

West Africa Regional Scientific Observer Training Manual



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1 Introduction

1.1 Learning objectives

- Explain the linkages and separate tasks of Monitoring, Control and Surveillance.
- List three management issues facing global fisheries.

1.2 Manual Organization

The purpose of this **Scientific Observer Sampling Manual** is to have a resource for training and at-sea field deployment of scientific observers on commercial fishing vessels in the east Atlantic Ocean including the Gulf of Guinea (Figure 1-1). The manual contains four main sections focusing on background information (Chapters 1-3) and the different aspects of Monitoring, Control and Surveillance (Chapters 4-16, 17 and 20, and 18, respectively). Chapters are organized around specific gear types and target fisheries. Country-specific information developed by individual observer programs is included as in Appendices 1-3. There is an extensive index of topics and a glossary of terms and acronyms. Each chapter begins with explicit learning objectives for the chapter that parallel the training modules. The objectives are followed by a brief introduction, a list of sampling priorities (where appropriate) and detailed form instructions.

WEST AFRICA



Figure 1-1 West Africa and the Gulf of Guinea.

1.3 Overview of MCS

1.3.1 What is MCS?

In the most basic form, monitoring, control and surveillance or MCS is an integrated information gathering, rule-making and enforcement system used to manage fisheries. Everett (2005-2009) and Flewwelling et al. (2002) define each component more specifically as follows:

- **Monitoring** consists of the collection, measurement and analysis of fishing activity. The monitoring component of MCS should receive, integrate and verify information from the licensing unit, sea-going units (sightings and inspections), observers, vessel monitoring systems (VMS) and satellite imagery, radar, port inspection, regular dockside monitoring of landings, fishing logbooks, production logbooks, and air sightings for vessel identification, activity and location. This information is the primary data used by fisheries managers to arrive at management decisions. If this information is unavailable, inaccurate or incomplete, managers will be handicapped in developing and implementing management measures.
- **Control** involves the specification of the enforceable terms and conditions under which resources can be harvested. These specifications are normally contained in national fisheries legislation and other arrangements that might be nationally, sub-regionally, or regionally agreed. The legislation provides the basis for which fisheries management arrangements, via MCS, are implemented.
- **Surveillance** involves the regulation and supervision of fishing activity to ensure that national legislation, conditions of access, and management measures are observed. The surveillance component of MCS will require fisheries personnel who not only collect data for the monitoring aspect of MCS during their surveillance duties, but can also communicate with and educate stakeholders involved in participatory conservation activities. These personnel must have the appropriate equipment and facilities, operating funds and training both to encourage voluntary compliance and to enforce laws where necessary. Surveillance is usually the largest and most expensive component to fund. This activity is critical to ensure that resources are not over exploited, poaching is minimized and management arrangements are implemented.

MCS has land, sea and air components. The land component entails port inspections, dockside monitoring, and the monitoring of transshipments and trade in fish products to ensure compliance with relevant rules. The sea component patrols national waters, employs no-force methods such as on board observers and technology (radar, sonar). The aerial component patrols using aircraft or satellite technology (e.g., VMS).

MCS utilizes both preventive and deterrent approaches to regulatory compliance. Preventive approaches enhance awareness by disseminating information to the fishers and the public to educate them on the rules or other issues. The deterrent approach implements fines or revokes fishing privileges if the rules are not followed.

1.3.2 Why have MCS?

The goal of fisheries management is to maximize the economic opportunities and benefits from a State's waters within sustainable harvesting limits (Flewwelling et al. 2002). Various management schemes have been applied in different fisheries, but most are based on limiting entry licenses and include vessel and gear restrictions. Regardless of the management scheme, this goal cannot be achieved without MCS.

1.3.3 How is data utilized?

Data collected through MCS are utilized for stock assessment (e.g., how many fish can be removed while maintaining a healthy stock), fisheries management (e.g., decisions made to balance biological needs of the stock and economic and social needs of the humans dependent on the stock) and enforcement (e.g., the intervention of the government to control a fishery; (Davies and Lesch 1998, Wallace and Fletcher 2000, Cooper 2006)).

Each of these user groups has different information needs. For instance, stock assessment modelers may require total catch estimates by species (weight and numbers), length-weight or length-age relationships of catch and size at maturity (to determine breeding grounds and timing, recruitment) depending on the model used.

1.4 Global fisheries – Gear, Issues & Management Instruments

1.4.1 Commercial fishing gear

Commercial fishing gear can be categorized as either passive whereby fish move to the gear (e.g., longline, traps, gillnet) or active where gear moves to the fish (e.g., trawl, purse seine). There are more than 60 gear types classified by the International Standard Statistical Classification of Fishing Gear and these are grouped into 11 categories (Appendix 6); however, the majority of global catch is taken by five gear types: purse seine, mid-water trawl, bottom trawl, gillnet and hook and line (based on 1950-2001 data; Watson et al. 2006). In general, purse seine nets catch fish by surrounding fish from all sides as well as underneath. Both mid-water and bottom trawl nets are towed nets consisting of a wide opening with wings that herd fish into a cone-shaped body and are collected in the terminal end or codend. Gillnets consist of a wall of nearly invisible net in which fish become gilled or entangled. Hook and line gear consists of natural or artificial bait placed on a hook fixed to the end of a line. Hook and line gear can be configured with a single hook up to tens of thousands of hooks (Nedelec and Prado 1990, FAO 2005-2009).

1.4.2 Issues

The primary issues constraining global marine capture fisheries in the last decade and facing fisheries in the future include:

1. **Illegal, Unreported and Unregulated (IUU)** fishing constitutes a serious threat to: (i) fisheries, especially those of high-value that are already overfished (e.g. cod, tuna, redfish and swordfish); (ii) marine habitats, including vulnerable marine ecosystems; and (iii) food security and the economies of developing countries (FAO 2009b). IUU is considered an environmental crime involving theft of resources. There is an international initiative in progress to implement binding port state measures. IUU is discussed in more detail in Chapter 18;
2. **Bycatch and discards** can have significant consequences for populations, food webs and ecosystems. The most recent estimate of annual global discards was 7.3 million tons (1992-200; Kelleher 2005). Several international initiatives (e.g., the development of International Plans of Action or IPOAs) which focused on reducing the catch of specific taxonomic groups have been successful in raising awareness of the issue and reducing global catch. Bycatch reduction devices (BRDs) are discussed further in Chapters 6-7;
3. **Overfishing and overcapacity** of fishing fleets (Beddington et al. 2007);
4. **Trade and trade subsidies** as they relate to overfishing and overcapacity; and
5. **Climate change** impacts on fish distribution and the frequency of extreme weather events.

1.4.3 International Management Instruments

International law is the system of rules governing the relationship among States (and between States and international organizations). The rules of international law are reflected primarily in treaties which generally create obligations only for those States party to the treaty (i.e., treaties do not bind countries that did not sign the treaty). Other rules of international law arise from general international practice accepted as law (so-called “customary international law”), although it is sometimes difficult to determine whether a particular practice has become accepted as law by States.

Flewwelling et al. (2002) summarizes the major international laws and treaties pertaining to fisheries as follows:

1. The 1982 *United Nations Convention on the Law of the Sea* (UNCLOS), which entered into force in 1994, forms the backbone of the international legal framework for fisheries management. UNCLOS is the umbrella instrument to all of the others. It sets out the rights and duties of coastal, port and flag States with respect to each of the principal maritime zones recognized by international law. These zones include the territorial sea, the exclusive economic zone and the high seas. It also deals with a range of other important issues that are related, including the legal regimes applicable to internal waters, archipelagic waters, the contiguous zone, the continental shelf, and the right of innocent passage and passage through international straits.
2. The *FAO Compliance Agreement* (1994) seeks to strengthen the provisions in UNCLOS relating to high seas fishing. This treaty has two primary objectives: 1) to require all States whose vessels fish on the high seas to take a range of steps to ensure that those vessels do not undermine measures to conserve and manage the living resources of the high seas; and 2) to increase the transparency of all high seas fishing operations through the collection and dissemination of data.
3. The *FAO Code of Conduct for Responsible Fisheries* (CCRF; 1995) is a broad and comprehensive but non-binding document which prescribes principles and standards for the conservation and management of all fisheries, as well as for fish processing, trade in fish and fishery products, fishing operations, aquaculture, fisheries research and the integration of fisheries into coastal area management. A fundamental objective of CCRF is “to serve as an instrument of reference to help States to establish or to improve the legal and institutional framework required for the exercise of responsible fisheries and in the formulation and implementation of appropriate measures.”
4. The *UN Fish Stocks Agreement*, relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, sets forth a broad range of obligations designed to create greater control over fisheries for certain valuable stocks, including the strengthening of MCS capabilities. This treaty builds on several general provisions of UNCLOS in an effort to strengthen cooperation for the conservation and management of certain fish stocks that occur both within national Exclusive Economic Zones (EEZs) and on the high seas. Entered into force on 11 December 2001.
5. To date, four IPOAs have been developed within the framework of the Code of Conduct (CCRF). FAO adopted three of these instruments in 1999 to deal with the incidental catch of seabirds in longline fisheries, the conservation and management of sharks and the

management of fishing capacity. The fourth IPOA is designed to prevent, deter and eliminate illegal, unreported and unregulated (IUU) fishing.

6. *Convention on International Trade in Endangered Species of Wild Fauna and Flora*, or CITES, is an international agreement among governments to ensure that international trade in specimens of wild animals and plants does not threaten their survival. The Convention entered into force on 1 July 1975 and currently has a membership of 173 countries. Many marine mammal and all turtles are listed. Appendix 15 contains a more detailed list of marine species covered by CITES.

International law primarily regulates the relationship among States whereas domestic (or national) law regulates the relationships between persons (including legal persons such as companies) within a particular State. Domestic law extends to territorial waters (12 nmi), national EEZs (to 200 nmi) and continental shelf waters (when sedentary species extend beyond 200 nmi). Flag states are responsible for controlling the fishing activities of a vessel, no matter where the vessel operates (including the high seas).

1.5 Regional Fisheries Bodies

Regional Fishery Bodies (RFB) and Regional Fishery Management Organizations (RFMO) consist of groups of states or organizations that have agreed to a set of rules in order to work together towards the conservation and management of fish stocks. Six RFBs operate in the eastern central Atlantic. Each RFB focuses on a specific group of species (e.g. tuna) or covers multiple targets and fisheries on the high seas and within national waters. The coverage of several of these RFBs overlap (Figure 1-2).

The oldest and largest RFB in the Atlantic is the International Commission for the Conservation of Tuna (ICCAT). Data collected by observers on tuna vessels will be passed on to ICCAT for the management of tunas and tuna-like species.

The Convention on the Conservation and Management of Fisheries Resources in the South East Atlantic Ocean established the Southeast Atlantic Fisheries Organization (SEAFO). This convention covers a sizeable part of the high seas of the South East Atlantic Ocean and includes sedentary / discrete and straddling species such as alfonso, orange roughy, oreo dories, armourhead, sharks, deepwater hake and red crab.

The Fishery Committee for the Eastern Central Atlantic (CECAF) covers a large portion of the Eastern Central Atlantic between Cape Sparte (Morocco) and the Congo River. The Committee covers all living marine resources within its area of competence. There are currently 34 member countries. Within the CECAF zone, there are three additional committees that include the national waters of the following countries:

- Sub-Regional Fisheries Commission (SRFC) - Cape Verde, Gambia, Guinea Bissau, Guinea, Mauritania, Senegal and Sierra Leone;
- Regional Fisheries Committee for the Gulf of Guinea (COREP) – Cameroon, Republic of Congo, Democratic Republic of Congo, Gabon, Sao Tome and Principe;
- Fishery Committee for the West Central Gulf of Guinea (FCWC) - Benin, Cote d'Ivoire, Ghana, Liberia, Nigeria and Togo.

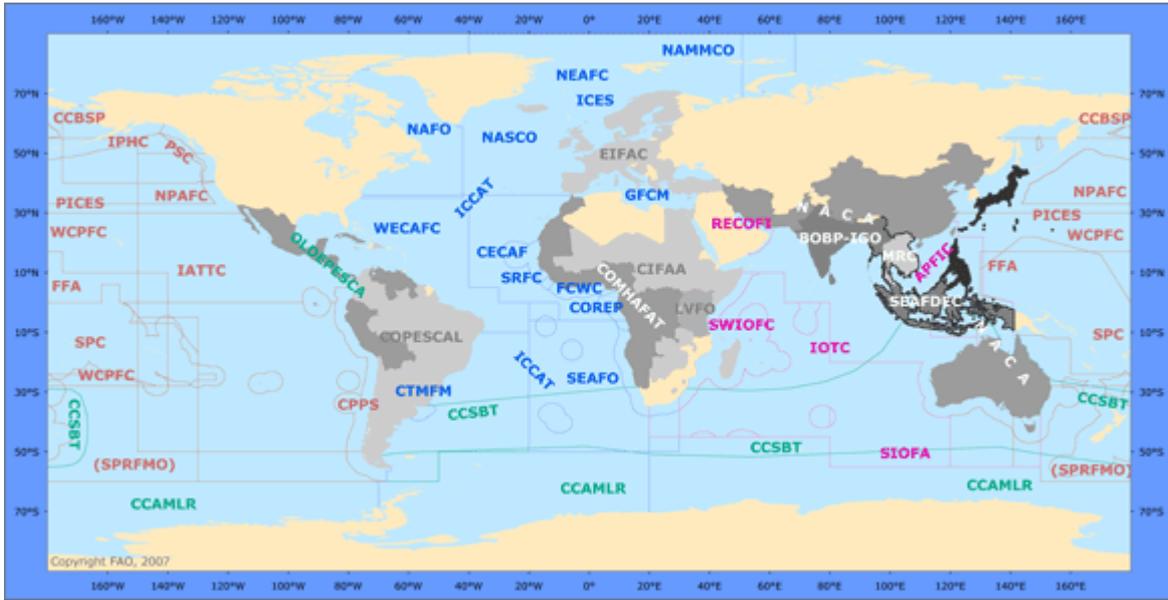


Figure 1-2 Approximate boundaries of Regional Fisheries Bodies (FAO 2001-2010a).

2 Scientific Observer Program – Objectives, Rights and Responsibilities

2.1 Learning objectives

- Describe at least 5 objectives of Scientific Observer Programs
- Discuss the importance of professional conduct with industry and other personnel

2.2 Introduction

This chapter describes the goal and objectives of Scientific Observer Programs (SOPs). In order to achieve the goal and objectives, all stakeholders (i.e., government agencies, the fishing industry) have significant roles to play. This chapter explains in great detail the responsibilities and expectations of each group. Laubstein (1999), Davies and Reynolds (2002), WCPFC (2003), NWFSC (2006), AFSC (2007), Kranz (2007) and WCPFC (2009) were valuable resources when compiling the list of responsibilities and duties.

2.3 SOP Goal & Objectives

The overarching goal of an SOP is to collect independent, reliable and accurate data on fishing operations, catches and interactions with the environment by the vessel and its fishing gear to ensure long-term conservation and sustainable use of living aquatic resources and ecosystems in the east Atlantic Ocean. To achieve this goal, the SOP has the following specific objectives:

- Estimate total fishing effort (i.e., position, time, total catch) for all hauls;
- Estimate weight and/or numbers of all species caught (catch composition) and establish disposition (e.g., retained, discarded, dead or alive) on a subsample of hauls;
- Collect biological information (e.g. lengths) on target and non-target species on a subsample of hauls;
- Collect catch and biological data on marine mammals and sea turtles (including sightings);
- Monitor fish or fish product offloads and transshipments;
- Monitor IUU activity;
- Document types of vessel equipment utilized (e.g. gear characteristics, electronics) and record vessel characteristics (e.g. registration numbers, licenses, etc);
- Document the presence of marine debris.

Additional objectives, depending on the country, may include:

- Evaluate the effectiveness of bycatch reduction devices (BRDs; including turtle excluder devices or TEDs);
- Educate fishers regarding BRDs, careful release techniques for sea turtles, seabirds and marine mammals and other relevant rules/regulations;
- Collect economic data;
- Provide input to future regulatory changes utilizing observer data;
- Monitor fish quality.

2.4 Rights and Responsibilities

2.4.1 Management Agency Responsibilities

The agency controlling the SOP is responsible for the following:

- Set observer coverage levels for each fishery/gear type on an annual basis.
- Develop an observer placement plan (for fisheries with <100% coverage) including how vessels will be selected, time observed, etc.
- Ensure that the vessel owners, permit holders and captains are fully aware of all fishing and observer requirements and obligations that the vessel may be under (including assessment of fees for observer coverage, safety, accommodation, etc). This can be accomplished during the permit process via a letter of intent explaining SOP objectives and/or meetings in ports with industry groups and individual fishers.
- Coordinate a briefing of the observer and the vessel captain before departure to review the obligations regarding the observer and vessel before the observer departs. This meeting should include a review of the observer data collection priorities and duties, observer and vessel responsibilities, adequate accommodation, vessel insurance, vessel compliance with required safety standards and review emergency procedures, access to bridge equipment needed to carry out observer duties (i.e. GPS, communications), ensure sampling area is safe, etc.
- Development of policies relating to the Observer Code of Conduct
- Promote national regulations needed to avoid sampling interference or any other interference on the observer duties, and harassment on the part of the crew;
- Supply all relevant equipment and forms to the observer for carrying out their duties, including the collection of data and biological sampling;
- Inform observers about 1) trip requirements and expectations, 2) sampling regimes, 3) data collection priorities if different than this manual, and 4) any alleged questionable issues recorded in previous observer trips on the same vessel;
- Assist with the procurement of observer visas, entry permits, waivers and any travel documents required to transport the observer to the vessel's departure port or from their arrival port;
- Organize all travel arrangements including air, bus, or ferry as necessary;
- Coordinate communication schedule with the observers; and
- Establish data confidentiality policies.

2.4.2 Vessel Rights and Responsibilities

The rights of vessel captains and crew shall include:

- Expectation that a reasonable period of prior notice of the placement or replacement of an observer shall be given.
- Opportunity to review and comment on the observer's data forms, including the right to include additional information deemed relevant or a personal statement.
- Ability to conduct lawful fishing operations with minimum interference due to the observer's presence and performance of required duties.
- Reasonable expectation of privacy in crew personal areas.

The duties and responsibilities of vessel captains and crew shall include:

- Accepting an approved observer if required by the SOP.
- Inform the SOP 24 hours prior to landing or departing any port.

- Assisting the observer to safely embark and disembark the vessel at an agreed place and time.
- Assisting the observer to carry out all duties safely.
- Providing the observer with food, accommodations, medical facilities, and sanitary facilities of a reasonable standard equivalent to those normally available to an officer on board the vessel.
- Facilitating access by the observer to all areas and facilities of the vessel necessary to conduct observer duties, including the bridge, communications equipment and personnel, deck, and areas used to process, weigh, and store fish, gear, and equipment.
- Provide access to certificate of registry, safety certificate and navigation and fishing log.
- Permitting the observer to remove samples from the catch and providing appropriate storage space for specimens collected and retained by the observer.
- Ensuring actions and equipment are consistent with fishing regulations and permit conditions.
- Ensuring that captain or crew do not obstruct, intimidate, influence, or interfere with the observer or impede or delay observer duties. Observers may not act as vessel crew.

2.4.3 Observer Rights and Responsibilities

The observer's rights include:

- Access to all areas and facilities of the vessel necessary to conduct observer duties, including the bridge, deck, areas used to process, weigh, and store fish, gear, and equipment..
- Access to the vessel's records including its logs and documentation for the purpose of records inspection, access to navigational equipment, charts and radios, and reasonable access to other information relating to fishing.
- Access to and use of communications equipment and personnel, upon request, for entry, transmission, and receipt of work related data or information.
- Access to additional equipment, if present, to facilitate the work of the observer while on board the vessel, such as binoculars, electronic means of communication, etc.
- Access to the working deck during net or line retrieval and to specimens (alive or dead) in order to collect samples.
- Notice of at least fifteen (15) minutes before fish are brought on board, unless the observer specifically requests not to be notified.
- Access to food, accommodations, medical facilities, and sanitary facilities of a reasonable standard equivalent to those normally available to an officer on board the vessel.
- The provision of adequate space on the bridge or galley for clerical work and adequate space on the deck for observer duties.
- Freedom to carry out their duties without interference, intimidation, or obstruction.

The observer's responsibilities include:

- Acceptance and compliance with agreed confidentiality rules and procedures with respect to the fishing operations of the vessels. Data, images and other information collected by the observer shall remain confidential and should be handled in a secure manner.
- Maintenance of independence and impartiality at all times while on board the fishing vessel.
- Documenting compliance with the laws and regulations set by the managing agency.
- Respecting the hierarchy and general rules of behavior that apply to all vessel personnel.
- Performance of duties in a manner that minimizes interference with fishing operations.

- Achieve a basic familiarity with the emergency procedures aboard the vessel, including the locations of life rafts, fire extinguishers, and first aid kits.
- Communicating regularly with the vessel captain and maintain open communication with vessel personnel.
- Observers may be required to embark or disembark in another country. Before departing for a trip, the observer must possess a valid passport with at least 6 months before the expiration date. Observer will obtain relevant visas and immunizations.
- Observers will be required to be medically fit.
- Observers must be on board and ready to depart at least 1-hour prior to the agreed boarding date/time. All pre-trip requirements should be completed by this time.
- Communicate with observer program daily or on a schedule determined by SOP.
- Maintain observer code of conduct (Section 2.5.1).
- Collect data according to the protocols described in the SOP manual. Observers are accountable for all data, issued equipment, and manuals. Loss of data can be grounds for dismissal.
- Data entry during off-vessel time.

2.5 Observer Sampling Priorities, Duties and Required Skills

Observers are responsible for a wide array of duties. Observers must be able to work under demanding conditions, both psychological and physical. There are times when you will not be able to complete all duties. Use the list below, ordered from most to least important, to prioritize when it is not possible to complete all duties. For each duty (left column), there is an associated list of required skills (right column).

Duties	Skills
1. For each gear deployment, record total fishing effort (e.g., position, time) and make an independent estimate of total catch on a random subset of gear deployments (Forms: Trawl Effort-Catch; Pelagic Longline-Set-Haul Information; Demersal Longline – Set-Haul Information; Purse Seine-Daily Activity Log; Trap Effort & Total Catch)	<ul style="list-style-type: none"> • Understand navigational and position information • Convert position into appropriate format • Be able to review the vessel’s fishing log, assess validity and transfer information correctly • Select appropriate random sample table (RST) and use RST correctly • Apply mathematical formulas to calculate total catch weight
2. Estimate weight and/or numbers of all species caught (catch composition) and establish disposition (e.g. retained, discarded) on random subset of hauls (Catch composition forms)	<ul style="list-style-type: none"> • Understand random sampling concepts, correctly apply different sampling strategies depending on situation and accurately record sampling methods • Accurately identify target species and common bycatch species • Become familiar with vessel operations so that percent retained can be assessed using the observer’s random catch composition sample (not

	<p>applicable to shrimp trawl)</p> <ul style="list-style-type: none"> • Be familiar with product types and weights
3. Collect biological information (e.g. sexed lengths) from target on all (Pelagic Longline Catch Composition) or a subset of hauls (generic Length form);	<ul style="list-style-type: none"> • Apply appropriate sampling strategy to collect random subsample of lengths • Be able to determine gender of target species
4. Collect biological information (e.g. lengths) from non-target species on a subsample of hauls (Length form);	<ul style="list-style-type: none"> • Same as #3
5. Collect catch and biological data on marine mammals and sea turtles (Marine mammal or sea turtle catch form).	<ul style="list-style-type: none"> • Accurately identify species
6. Record information on sightings of marine mammals and sea turtles in the vicinity of the fishing vessel (Marine mammal and sea turtle sighting form).	<ul style="list-style-type: none"> • Accurately identify species
7. Monitor fish or fish product offloads and transshipments (likely performed by land-based fisheries inspector)	<ul style="list-style-type: none"> • Be familiar with vessel's product labels
8. Document vessel sightings including vessel name, type, IUU activity, location (Vessel and Aircraft Sighting Form);	<ul style="list-style-type: none"> • Understand navigational and position information • Coordinate assistance from captain/crew
9. Document types of vessel equipment utilized (e.g. gear characteristics, electronics) and record vessel characteristics (e.g. registration numbers, licenses, etc) (Gear Description, Vessel and Trip forms).	<ul style="list-style-type: none"> • Be familiar with the type and construction of fishing gear used • Measure and otherwise take note of any special meshes or attachments to the gear which may affect its performance
10. Accurately record all data on relevant forms or in the observer logbook.	<ul style="list-style-type: none"> • Attention to detail • Effective communication • Understand how the forms and different elements of information are inter-related
11. Document any instances of gear loss in the observer logbook.	<ul style="list-style-type: none"> • Coordinate with captain or deck crew
12. Document suspected violations (including permit conditions) – see Chapter 17 for documentation protocol;	<ul style="list-style-type: none"> • Understand the permit conditions and be familiar with fishing regulations • Be able to bring any issue or discrepancy to the attention of the

	Master in simple language and if necessary report the issue or discrepancy to the SOP
13. Preparing reports and providing the vessel captain with an opportunity to include any information or statements deemed relevant.	<ul style="list-style-type: none"> • Attention to detail
14. Report to SOP according to communications schedule.	<ul style="list-style-type: none"> • Ability to use vessel's communication equipment (radio, cell phone, email)

2.5.1 Code of conduct

Observers have an important image to maintain as professional data collectors. Observers must avoid behaving in a manner that could adversely affect the public confidence in the integrity of the SOP, the data provided or other observers. Observers should adhere to the following code of conduct:

1. Observers must perform their assigned duties as described in the Scientific Observer Sampling Manual.
2. Observers must accurately record their sampling data, write complete reports and report accurately any observations of suspected violations.
3. Observers must not disclose collected data or observations to any person other than the vessel owner or operator of the observed vessel or observer program or agency staff (e.g. fishing positions, catch). Observers shall ensure that data and information collected while on board are kept secure and confidential at all times.
4. Observers shall develop a diligent and professional working routine as soon as possible upon boarding vessel. Observers must maintain an unbiased and/or neutral approach to fisheries management issues while on the job.
5. Observers must maintain their independence at all times and must report any attempt to compromise or harass them.
6. Observers must refrain from engaging in any illegal / inappropriate actions. These includes, but are not limited to:
 - Engaging in the use, possession or distribution of illegal drugs;
 - Drinking alcohol on board the vessel;
 - Soliciting or accepting bribes in money or kind (e.g. gifts, favors, etc.) for neglect of duty or any other act deleterious to their proper duties;
 - Engaging in physical sexual contact with vessel personnel;
 - Falsification of data.
7. Observers shall not have a direct financial interest in the vessel s/he is deployed on. The interests of a spouse or minor child are considered those of the observer.
8. Observers shall ensure that they do not hinder or interfere with the proper functioning of the vessel for fishing or navigation purposes and shall respect the safety and sanitary rules of the ship.
9. Observers shall attempt at all times to have a professional and courteous relationship with the master and crew.

10. Observers will respect all property and equipment and living space on board the vessel, including documents, logbooks and plans of the vessel.
11. Observers are not law enforcement officers but will be firm, fair and tactful in giving official notice to the Master, captain and/or any member of the crew. Observers have no authority to apprehend or direct any fishing vessel or give operational advice.
12. Observers shall refrain from using bad language, exhibiting bad behavior and making public complaints about other persons on board the vessel or on shore.
13. Observers should attempt to walk away from arguments or confrontations.
14. Observers shall not smoke in areas where this is forbidden.
15. Observers will respect the various customs and cultures of the vessels and crew they are involved with.
16. Observers are not crew. While voluntarily helping out with day to day chores or fish sorting is perfectly acceptable (and encouraged), there are a few things to avoid: deploying/retrieving gear, standing watch or serving as the regular cook.

3 Essential Information

3.1 Learning Objectives

- Describe four types of data collected by fisheries observers
- List five components that must be completed in the Observer Logbook
- Explain the advantages and disadvantages of three types of communications equipment
- Demonstrate how to call another vessel on the VHF radio
- Calculate the distance between two points on a chart
- Explain how to convert between several formats of latitude and longitude
- Define random sampling and explain why it is important
- List at least three levels where sampling occurs
- Describe how to use the random sample and random number tables

3.2 Introduction

This chapter provides a brief overview of the types of data collected by the SOP and describes the Observer Logbook. Next, it reviews some basic components of at-sea life including nautical terminology, communication options and navigation equipment as well as fundamental statistical concepts. The chapter concludes with tips for the first day or two on board.

3.3 Data collection overview

The SOP is tasked with collecting an assortment of fisheries-dependent data from commercial fisheries. Each type of data serves a specific purpose relating to fisheries management or stock assessment science. There are five primary data types:

1. **Fishing Effort Information** – This data is used by managers to understand where fish are caught, what gear is used, which species are targeted and how much effort it takes to catch these fish. Effort may be expressed in units of time (hours, days), amount of gear deployed (# hooks/pots, meters of gillnet), number of times gear was deployed, retained catch or a combination of the above.
2. **Total Catch Estimation** – the amount of fish and other biological material removed is important for both management and stock assessment.
3. **Catch Composition** – Catch composition data is used to estimate relative abundance of each species in a haul. It includes the species specific weights and counts. Catch composition also includes an estimate of retained catch and reason for discards.
4. **Biological Data** – Biological data is used by stock assessors to gauge the age composition of the population, the length to age ratio, the potential spawning population, and the male to female ratio. It includes determining gender, measuring lengths, taking weights, and collecting age structures from individual fish.
5. **Economic Data** – Economic data is used by economists to determine profitability of the fisheries. Ideally, this information will be collected directly from vessel owners by the management agency.

Each of the data types above are collected at different times and frequencies throughout the trip. For instance,

- For each trip¹, you will complete the Safety and Compliance Checklists, Trip Summary, Vessel Information, and Gear Description forms as well as make entries in the Observer Logbook.
- For each gear deployment, there will be an entry on the Fishing Effort and Total Catch form.
- For each ‘sampled’ gear deployment, a Catch Composition and Length (if assigned) form should be completed.
- Additional forms will be completed as appropriate. These include sightings (animal & vessel), photo log, fish/invertebrate species identification, marine mammal/sea turtle/seabird catch forms and marine debris forms.

Prior to each trip, you should be briefed on any changes to protocol. In addition, if the vessel has previously taken an observer, you should read through the previous observer’s logbook and make note of the vessel diagram and how he or she sampled.

At the end of each trip (or trips), you will go through a debriefing process which includes an in-depth interview regarding how you sampled, data editing and data entry. This is also your opportunity to discuss sampling problems and ideas for making the sampling situation better.

3.4 Observer Logbook

You will be issued an Observer Logbook for each trip. The observer logbook is where all of the details of your deployment will be recorded. Record events as they occur. The following should be recorded on the cover page of the vessel logbook: observer name and code, trip number, vessel name and code, gear type and target species. Within the logbook, there are several forms you will need to complete for each trip: Safety Checklist (Chapter 20), Trip Summary form (Chapter 4), and Compliance Checklist (Chapter 17). Finally, there are specific sections for a vessel diagram (including measurements of the sample area), a written summary of sampling techniques, the random sample table, all calculations and formulas used, daily notes, and a photo log.

3.4.1 Calculations

All total catch calculations, must be recorded in your logbook. Average weight calculations (when used to calculate animal counts or catch composition sample weights) can be recorded on the catch composition form. Record and label your calculations so that another person could easily understand them without any interpretation. **Calculations may be in pencil, but all other logbook entries should be made in ink!**

3.4.2 Rounding Rules

When you are performing a calculation, carry the numbers out full field (on the calculator) until you have reached your *final product*. Do not round any numbers within the calculation! It is important for you to recognize what final product you are calculating when deciding when to round a number. For example, you may need to use an average weight to calculate the total number of fish within your sample (see box). In this calculation, you would not

¹ A **fishing trip** is defined as the time between one full or partial offload to the next full or partial offload.

round until you had calculated the total number of that species. It is a common mistake to round once the average weight is calculated. When you round a number to put on a form, round to the number of decimal places required by the column.

Bonga shad average weight:
 $14.7 \text{ kg} / 50 \text{ fish} = 0.294 \text{ kg per fish}$

Calculate the number of fish in 75.3 kg:
 $75.3 \text{ kg} / 0.294 \text{ kg per fish} = 256.122448 \approx \mathbf{256 \text{ fish}}$

Incorrect: $75.3 \text{ kg} / 0.29 \text{ kg per fish} = 259.655172$

To round your final product, look *only at the first digit* to the right of the number you are rounding. If the first digit to the right is ≥ 5 , round up and if its < 5 , round down. For example, the final total weight estimate on the Trawl Effort and Total Catch Form is recorded to two decimal places (hundredths). If your final calculation was 4.9258226, you would round up to 4.93 mt. If your final calculation was 4.9748226, you would round down to 4.97 mt.

3.5 Life at Sea Basics

3.5.1 Living Conditions

Cleanliness, upkeep, safety, comfort of quarters, quality of food, and general attitude of the vessel personnel vary widely from vessel to vessel. Observers must be flexible and function professionally under a wide variety of living conditions. Chapter 19 addresses health and safety aboard commercial fishing vessels in more detail.

General guidelines for being a good shipmate include:

- Show respect to others and it will be returned to you.
- Clean up after yourself and make a conscious effort to maintain a professional appearance.
- Adapt to the situation - observers with an easygoing attitude will likely receive more cooperation than those who criticize and make demands.

3.5.2 Nautical terminology

The maritime industry uses specialized terminology (see also the glossary; Appendix 16). For instance, aft, bow, port, starboard, and stern are all terms referring to directionality on a vessel (Figure 3-1).

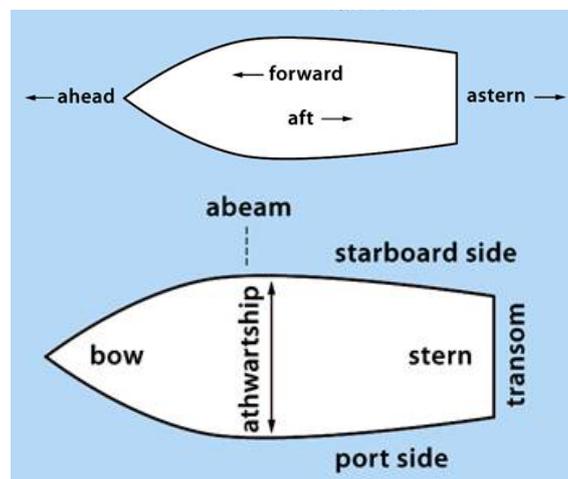


Figure 3-1 Terms for directionality on a vessel. Modified from (United States Coast Guard Auxiliary 2007).

Common nautical terms that may be useful for observers include:

BEAM – vessel width at its widest point.

BEARING - The direction of an object expressed either as a true bearing as shown on the chart, or as a bearing relative to the heading of the boat.

BIGHT - The part of the rope or line, between the end and the standing part, on which a knot is formed.

BILGE - The interior of the hull below the floor boards.

BRIDGE - The location from which a vessel is steered and its speed controlled; also called wheelhouse.

BULKHEAD - A vertical partition separating compartments (e.g., wall).

CABIN - A compartment for passengers or crew.

CAPSIZE - To turn over.

CHART - A map used by navigators.

COURSE - The direction in which a boat is steered.

CURRENT - The horizontal movement of water.

DECK - A permanent covering over a compartment, hull or any part thereof.

DRAFT - The vertical distance between the waterline and the bottom of the hull (keel), with the thickness of the hull included.

FOREPEAK - A compartment in the bow of a small boat.

GALLEY - The kitchen area of a boat.

HATCH - An opening in a boat's deck fitted with a watertight cover.

HEAD - A marine toilet.

HULL - The main body of a vessel.

LAZARETTE - A storage space in a boat's stern area.

LEE - The side sheltered from the wind.

LINE - Rope and cordage used aboard a vessel.

RUDDER - A vertical plate or board for steering a boat.

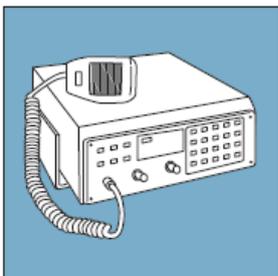
SCREW - A boat's propeller.

SCUPPERS - Drain holes on deck, in the toe rail, or in bulwarks.

3.5.3 Communication

3.5.3.1 Types of communication equipment

3.5.3.1.1 Radio



There are two types of radios used by fishing vessels - VHF and SSB. VHF stands for **V**ery **H**igh **F**requency. This band is divided into 71 channels with a frequency range of 156.000 to 163.000 MHz. Channel 16 is the International Distress Safety and Calling Channel. The transmission distance of VHF is a function of antennae height and in general, is slightly more than the distance one can see.

Figure 3-2 SSB Radio. Image from (Transport Canada 2003).

Radio communications over distances beyond twenty miles, will require you to use a high frequency radio commonly referred to as **S**ingle **S**ide **B**and or SSB or occasionally an HF radio (Figure 3-2). The frequency range is 2 to 26 MHz. Signal quality is inferior to VHF and

susceptible to slight atmospheric shifts. Lower frequencies are used for medium distances and higher frequencies for greater distances. All ship SSB radios must be capable of operating on 2182 KHz (the International Distress Safety and Calling Frequency) and at least two other frequencies. Depending on national telecommunications rules, you may be required to obtain a radio operators license to use the SSB.

General radio calling guidelines

Radios are different from telephones in that they cannot transmit and receive simultaneously. Keep in mind that people on other ships can also hear your conversations. Speak directly into the microphone; speaking loudly, slowly, and distinctly. Upon completing a transmission you must sign off by identifying your station and using the words "clear" or "out." If you expect to resume contact with the same station soon you may sign off using the phrase "standing by." Remember, in cases other than an emergency, when hailing another station on VHF channel 16 or SSB frequency 2182 you must switch to another working channel after initial contact is established. Finally, keep transmissions short and concise, giving the other station or person a chance to respond, ask questions, or confirm an unclear message. Radio transmissions should be short in duration except for emergency calls.

General calling procedures

1. Make sure radio is on and the appropriate channel is selected. Listen momentarily to verify the channel is not in use.
2. Background static from the radio speaker can be reduced with the squelch control. However, too much squelch can drown out incoming transmissions. Adjust the squelch so that a small amount of static is barely audible or to the point where the static first stops. Some models have an automatic squelch function which eliminates the need to adjust manually.
3. If there is no conversation, begin by depressing the button on the microphone and calling the name of the vessel or other station you are trying to contact three times, followed by your vessel name and call sign and the channel you are broadcasting on since most ships and stations listen simultaneously to several channels.

Example: "Delta I, Delta I, Delta I. This is the Bibamba TJAE on channel 16 over."

4. If there is no initial response to your call, wait two minutes before repeating the call. If there is no reply the hail may be repeated at two-minute intervals up to three times, after which you should sign off and wait at least 15 minutes before making another attempt.
5. If contact is established, you must switch to a working channel (VHF) or frequency (SSB) to continue your transmission.
6. When you have temporarily finished talking and are ready to listen, say "over," and release the button on the microphone. When the other party is ready to listen they will say "over."
7. After you have completed your message, end with the vessel name, call sign, and the word "out" to signal the end of your transmission. Example: "...Mungo TJBV out."

Distress calling procedures require very specific information to be communicated (see page 20-17 in Health & Safety chapter for more details).

3.5.3.1.2 Mobile phone

When vessels are in mobile or cellular service range, communications can occur via mobile phone. Appendix 2 contains the contact names / numbers of SOP staff.

3.5.3.1.3 Satellite

Some vessels may have satellite service for phone, email and fax. Ask the captain for specific instructions on your vessel.

3.5.3.2 Routine communication with the SOP

Observers will be expected to communicate with the SOP on a regular basis. Each country has its own requirements for the frequency of contact and what you need to report (Appendix 1). The observer will be able to receive/send radio calls using the radio of the vessel.

Remember, if you are using the radio, you may need to communicate some of the fishing information using codes provided by the SOP. Alternatively, the observers can send SMS from their cell phones when they are within service range.

3.5.3.3 Emergency communications

In case of a medical emergency, contact the SOP as soon as possible. Appendix 2 lists the contact names / numbers of SOP staff.

3.5.4 Navigation

Navigation is the act of determining a vessel's position, ascertaining speed and directing the course of a ship by using charts and electronic aids.

3.5.4.1 Geographic structure of the earth

The earth is almost spherical in shape with an axis of rotation around an imaginary line through the north and south poles. The equator (0°) is a circle around the earth's surface that is perpendicular to the rotational axis and it splits the earth into two sections – the northern and southern hemispheres (Figure 3-3). Lines of latitude, or parallels, run horizontally circling the globe like a belt. The poles at the furthest north and south locations are at 90° . Lines of longitude, or meridians, run vertically splitting the globe into two sections – east and west. There are 180° of longitude in each direction. When the two systems are combined, you get coordinates that define specific places on the planet.

A position can be expressed in degrees of latitude and longitude. Latitude is a measure of the angle between the plane of the equator and lines projected from the center of the Earth whereas longitude is a similar measure relative to the prime meridian. Degrees can be split into smaller units called minutes of arc (analogous to time but not the same). Each degree consists of 60 minutes of arc. Subunits of minutes are in seconds (60 seconds = 1 minute). Global Positioning System (GPS) readings can be in multiple formats (e.g., degrees, minutes, seconds- N $03^{\circ}25'30''$ or degrees, minutes and 10ths of minutes- N $03^{\circ}25.5'$ or decimal degrees- N 03.425°). Be aware of the format when recording position data from the vessel's GPS unit; Appendix 10 describes converting between formats.

3.5.4.2 Nautical measurements

A degree of latitude is equal to 60 nautical miles. One nautical mile equals 1,852 meters. Because the meridians of longitude get closer to one another as they approach the poles, distance between degrees of longitude decreases as you approach the poles. Vessel speed is

typically measured in knots (1 knot = 1 nautical mile per hour). Commercial fishing vessels rarely travel at more than 10 knots (18 km/hr).

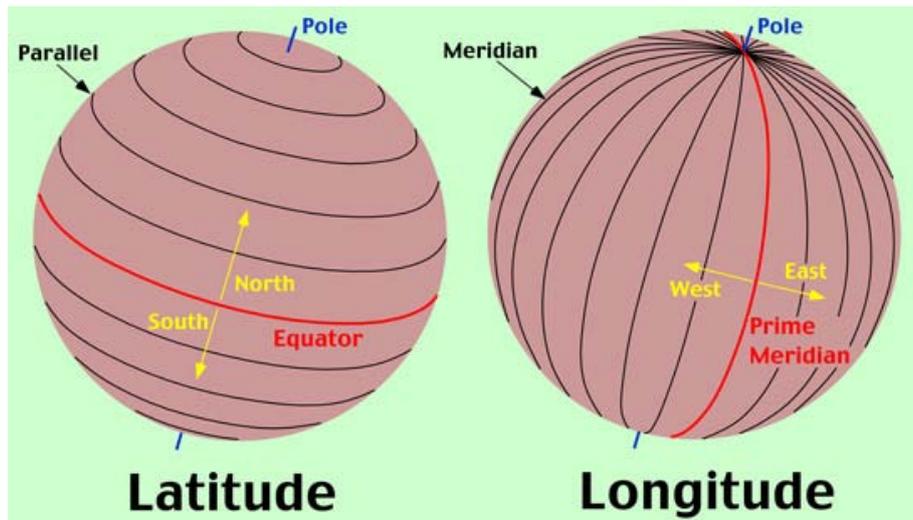


Figure 3-3 Globe with latitude (left) and longitude (right). Image from <http://www.physicalgeography.net/fundamentals/2b.html>.

3.5.4.3 Charts & other navigational aids

A **chart**, the nautical term for a map, is a reproduction of the earth's surface designed for convenient use in navigation. A chart is basically a projection of the earth's sphere onto a flat surface. Most industrial vessels use electronic nautical charts (or a chart plotter) that are linked to GPS, a gyrocompass and/or radar for navigation.

A **compass** is an instrument used to determine direction by means of a freely rotating magnetized needle that indicates magnetic north. Because a vessel is in constant motion, most vessels have a gyroscope which in simple terms is a sophisticated compass consisting of a rotating wheel mounted so that its axis can turn freely in all directions. This device may also be referred to as a gyrocompass or just a gyro. The gyro assists the vessel in maintaining the same absolute direction in space in spite of vessel movements.

GPS or a global positioning system is a system of satellites, computers, and receivers that is able to determine the latitude and longitude of a receiver on Earth by calculating the time difference for signals from different satellites to reach the receiver.



Radar uses an electromagnetic wave to detect solid objects (e.g., land or other vessels) day or night and regardless of weather. They may also be used to help find gear (e.g., longline) by detecting radar deflectors attached to the gear. The radar can estimate distance to a given object and determine the speed an object is moving.

A **radio direction finder** (RDF) shows the direction of a radio beacon, which may be situated at an entrance to a port, on top of a light house or on a marker buoy attached to a piece of fishing equipment (e.g., longline or Fish Aggregating Device (FAD)).

3.6 Fundamental statistical concepts

Sampling fish catch may sound simple but collecting a statistically representative sample of commercial catch is challenging. Each vessel and gear type poses unique sampling demands and hazards.

3.6.1 What is a “statistically representative sample”?

In general, it is a selection of individual observations intended to yield some knowledge about a population of concern. For fisheries managers/scientists, the population of concern is all commercial catch and other biological life caught (not just retained) by fishing vessels. When random sampling is used to sample (sometimes called a subsample), **every member of the population must have an equal probability of occurring in the sample.** If every member of the population is equally likely to occur in the sample and sampling is repeated over time, then the collection of samples can be used to draw conclusions about the population.

3.6.2 Why is random sampling important?

Random sampling removes subjectivity and allows managers, fishers and other end users to feel confident that observer data is unbiased. When data is collected randomly, scientists can justify using certain statistical methods to estimate population parameters based on the data collected. Sampling allows management agencies to estimate the total weight (or number) of fish removed from the ocean. Sampling may also allow scientists to determine the age of fish taken and a whole suite of other information for assessing the status of fish populations.

Sampling can occur at multiple levels including the fishery (which fisheries will be selected for observer coverage), vessel (which vessels take observers), trip (which trips within vessel), haul and/or net (which hauls are selected for catch composition), and species (which species and individual are selected for length, age structures and other biological sampling).

Observers will be most concerned with sampling at the haul and species level whereas the management agency must address sampling at the level of fishery, vessel and trip.

The Observer Logbook contains two different random sample tables (RSTs). RSTs prescribe which hauls to sample. Each RST is designed for a different number of hauls per day as follows:

<u>Hauls per day</u>	<u>RST</u>	<u>Target sample rate</u>
1-2	None	100%
3-4	#1	70-75%
5+	#2	65%-70%

General guidelines for haul-level sampling:

- Collect the sample before any sorting occurs (except some shrimp trawl sampling scenarios);
- Do not hand pick any part of the sample. There is a subconscious tendency to select large or otherwise obvious individuals;
- Collect sample from multiple points (on deck, from a bin or along a longline);
- Collect as large a sample as possible. Ideally, a minimum of 20% of the entire catch amount. However, it is better to take a smaller sample and be able to identify individuals to species rather than a larger sample with identification at a higher taxonomic level.

Document all sampling procedures including difficulties and why a set/haul wasn't sampled if it should have been in the Observer Logbook.

3.6.3 Steps for Taking a Random Sample

1. **Define the population.** The population is the total set of items that we wish to draw inferences about. Populations observers take samples from include:

- All individuals in a haul.
- All individuals of a given species in a catch composition sample.

2. **Define a sampling frame.** A sampling frame is a conceptual framework, which divides the population into in dependent, countable sampling units. There are two general categories of sampling frames: spatial and temporal.

Spatial – Based on a unit of space or a unit of gear. A spatial sampling frame is the predominate frame used by observers. Examples are:

- **Space** - Bin, Trawl Alley, or Baskets.
- **Gear** –Skate/basket, Tub, Pole, Stick, or Pot.

Temporal – Based on units of time. Examples are:

- Sample 20 minutes of a 60-minute set.
- Collect a sample at a pre-selected point in time.

3. **Define your sample units.** It must be possible to collect *all* individuals within a single unit. Be sure not to use sample units that are so large that it's impossible to collect all individuals. Examples:

- **Spatial** –
 - A trawl alley (or deck space) is divided into six sections of the same size. Each of the six sections is a sample unit.
 - All catch is shoveled into 10 baskets. Each basket becomes a sample unit.
- **Temporal** – A one-hour sort time is divided into six 10-minute sample units. Each 10-minute segment is a sample unit.

4. **Number all of the sample units in your sampling frame.** If your units are sections of deck or individual baskets, assign a number to each. If your units are time increments, number them consecutively. Gear segments on fixed gear vessels can also be numbered consecutively.

5. **Determine how many sample units you want in your sample.**

6. **Pick random numbers to choose which units to sample.** Generate random numbers between 1 and your maximum sample unit number (inclusive) to determine which sample

unit(s) to select. You will be issued a random number table with your gear and another can be found in Appendix 11 Random Number Tables. Other options for generating random numbers include dice, the second hand of a watch, or numbered pieces of paper.

7. **Select the sample units corresponding to the random numbers.** This is your sample.

- **Spatial** - Collect all of the individuals from each randomly selected deck section, gear unit or basket.
- **Temporal** - Collect all individuals during the time increment selected.

Example: There are 25 baskets of unsorted catch.

1. Define population – 25 baskets of catch.
2. Define sampling frame – Spatial Systematic, using baskets.
3. Define sample units – Individual baskets of fish.
4. Number all sample units – Baskets numbered as 1 – 25.
5. Determine how many sample units to sample – Decide to sample 5 baskets or 20%.
6. Choose 5 random numbers between 1 and 25 using random number table – Using random number table, numbers 1, 3, 5, 16, 17 were selected.
7. Count and weight all fish (by species) in baskets 1, 3, 5, 16, 17

3.6.4 Random Systematic Sampling

Another way to select a random sample is to set up a random systematic frame. Random systematic sampling can only be used when you know, or have a reasonable estimate of, the **total** number of sample units. Systematic sampling involves taking a sample during every “nth” defined sample unit. For a random systematic frame, randomize the selection of your first sample unit and then take every “nth” unit thereafter. The steps for taking a random systematic sample are the same as #1-5 above. Then,

6. Divide the total number of sample units by the number of units you want in your sample. This gives you your value for “n”.
7. Randomly select a number between 1 and n. This will be the first sample unit in your sample.
8. Sample every nth unit thereafter.

Example: There are 25 baskets of unsorted catch.

1. Define population – 25 baskets of catch.
2. Define sampling frame – Spatial Systematic, using baskets.
3. Define sample units – Individual baskets of fish.
4. Number all sample units – Baskets numbered as 1 – 25.
5. Determine how many sample units to sample – Decide to sample 5 baskets or 20%.
6. Calculate value of “n”: $25/5 = 5$.
7. Randomly select a number between 1 and “n” – For our example this = 2.
8. Sample baskets **2**, **7** (2+5), **12** (7+5), **18** (12+5) and **23** (18+5).

More examples for applying random sampling protocols to the specific gear types are in the following chapters. The same general principles apply to selecting individual fish for biological data collection (e.g., lengths, age structures).

3.6.5 Sample Bias

Samples can be biased in a number of ways and how you sample may increase or decrease this bias. For instance,

- Fish stratify within trawl nets while gear is fishing. Therefore, if a sample is collected from only one section, there's potential for bias.
- Different species may have preferred depth distributions. When sampling fixed gear such as longline, if samples are taken from the same depth strata all the time, then the overall sample may be biased.
- If crew sort retained and discard species by hand, these fish may end up being sorted out by size as well as species. Be aware of crew sorting bias when sampling discarded catch after they have sorted. This is not an ideal technique but sometimes the only way you can get a sample.
- Hand selecting fish should be avoided as the natural tendency is to select bigger or brighter specimen.
- Small sample size can influence the variation among the samples and sometimes this can have negative impacts on statistical analyses.

3.7 First day(s) on board

As soon as possible upon boarding a vessel, observers should present their identifications to the Master of the vessel and complete any formalities needed for joining the vessel (Davies and Reynolds 2002). You should coordinate a convenient time to meet with the captain and observer program representative (if possible) to get a vessel tour including assistance needed to complete the Safety Checklist. You should also discuss the quirks of vessel, stowage location for sampling and personal gear and sampling location options. Because the SOP is new for some gear groups, you will likely need to review the objectives of the SOP as well as the observer's role. You should also discuss the types of data collected (i.e. fishing positions, times, estimating total catch and sampling for catch composition, gear characteristics, monitoring of IUU vessels, regulations & violations), the equipment you need access to and discuss the types of information you will need from the captain. You should find out what areas of the vessel are off-limits to you and how best to minimize interference with fishing operations in performing your duties.

Before departing port, complete the Safety Checklist. While you're in port, it's also good to start on the vessel diagram (logbook) and Gear Description forms as well. If you think you will be doing volumetric estimates of total catch, measure the deck / bin prior to departing.

When choosing a sampling location, look for a location that will have:

- 1) minimal interference with vessel operations;
- 2) easy access to catch;
- 3) space to store data sheets and small sampling equipment;
- 4) a place to measure fish;
- 5) a place to hang scales;
- 6) sufficient lighting; and
- 7) is safe (ideally, not under warps or other cables under tension).

Once fishing begins, become familiar with how the crew sorts retained and discarded catch. What are the criteria for retaining each species (e.g., minimum or maximum lengths, certain

genders, etc)? Why are various fish/invertebrates discarded and will this be consistent throughout a trip? Make a sampling plan based on your observations of the first 1-2 retrievals.

Familiarize yourself with the species caught. Accurate species identification is a fundamental skill for scientific observers. Take some time the first day or two on board to complete species identification forms and learn the dominant species and species groups that are coming aboard. Start with the retained species and then move on to the discard species.

Finally, as you become familiar with species identification and your composition sampling procedures (1-2 days), practice determining sex for a variety of species before you begin collecting sexed length samples if this duty is assigned to you.

Your first days on board will be overwhelming. **Don't be discouraged – sampling gets easier with practice!**

4 Vessel and Trip Information

4.1 Learning objectives

- Describe two ways data from the Vessel Information form can be utilized.
- List the three primary sections that will be completed on every Vessel Information form.
- Describe two ways information from the Trip Summary form can be utilized.
- List the two primary components of the Trip Summary form.

4.2 Introduction

Information gathered on the Vessel Information form can be utilized to monitor changes in fishing capacity, fishing efficiency as well as processing capability. For instance, larger engines may increase towing power which can increase the size of a net towed by a vessel. If capacity is unknown, a problem with a fish stock may not be detected if catch remains constant while fishing capacity increases. Processing capability can have impacts on food quality. The primary sections of the Vessel Information form include: general vessel characteristics (e.g., length, ownership, flag, and engines), electronic equipment such as communications, refrigeration types and capacity and gear-specific sections for purse seine and trawl vessels. Depending on the country, this information may be collected directly by the SOP during the licencing process or by the relevant maritime authority during their inspections.

Information gathered on the Trip Summary form can be utilized to observe movement of key crew among the fleet and to simplify the debriefing process by providing a trip overview. The primary components of the Trip Summary form are: general trip characteristics (where & when you boarded, crew, gear type and target species), summary of forms completed and post-trip data tracking fields.

4.3 List of Priorities

1. Complete one Vessel Information form if instructed by the SOP.
2. Complete one Trip Summary form by the end of each trip.

4.4 Forms/Instructions

4.4.1 Vessel Information

Complete one Vessel Information form per year (or frequency requested by the Observer Program). You may need to check with the Observer Program to find out if this form is needed prior to each trip (example in Figure 4-1). Images from (Brogan et al. 2006). The asterisk (*) indicates priority fields.

Field	Definition
Observer Code:	Write the observer identification code assigned by the program.
Vessel Code:	Record the vessel code (Appendix 3). If your vessel is not on this list, contact the SOP immediately.
Trip ID	Enter the trip identification number assigned by the SOP.

*Vessel name	Record the vessel name.
*Country Registration No.	Identifying numbers (ie country registration number or Lloyd’s number). Use the registration number on the Certificate of Registry.
*Flag	Enter the 3-letter ISO3 country code for nation where vessel is flagged (Appendix 5).
Home port	Record the vessel’s home port city and country (use ISO3 country code). This may be listed on the stern or Certificate of Registry.
Previous vessel names	List previous vessel names (if known).
Previous flag	Record 3-letter ISO3 country code for nation(s) where vessel was previously flagged (if known).
Length overall	Record total length of the vessel in tenths of meters (to one place past decimal). Obtain from safety certificate, Certificate of Registry or fishing permit.
Draft	Record draft of vessel in meters (tenths).
Beam	Record beam of vessel in meters (tenths). Defined as vessel width at its widest point.
*IMO No.	Record the IMO (or IHS Fairplay, formerly Lloyd’s Register-Fairplay) number or “NA” if not available. The International Maritime Organization (IMO) number is seven digits and remains unchanged upon transfer of the ship's registration to another owner/country. Vessels used exclusively for fishing are exempt from mandatory assignment of IMO numbers (http://www.imo.org/TCD/mainframe.asp?topic_id=388).
MMSI No.	Record MMSI or enter “NA” if vessel does not have one. Currently, only vessels > 100 GRT are required to have a Maritime Mobile Service Identity (MMSI) number. It is a series of nine digits which are sent in digital form over a radio frequency channel in order to uniquely identify ship stations, ship earth stations, coast stations, coast earth stations, and group calls (http://en.wikipedia.org/wiki/Maritime_Mobile_Service_Identity).
*Int’l Radio Call Sign	International Radio Call Sign (IRCS) – issued by flag nation using standardized International Telecommunication Union prefixes (www.itu.int ; Appendix 5) provides list of country names and call sign prefixes. Note that the format varies by country.
Global Registry	Record Global Registry Identification or “NA” if vessel does not

ID	have one. Note: This registry to assign unique vessel identifiers (UVI) is currently under development (FAO 2008).
Hull material	Circle the appropriate construction material(s) for hull: wood, iron/steel, fiberglass. If material is different than these three, please circle other and write in the material type.
*Permit / license no.	Record the country-specific fishing permit number. All vessels observed by the SOP must have a fishing permit or license. If the vessel is targeting tuna, record the ICCAT Register number in the comments section.
*Permit expiration	Record the date of expiration of the country-specific permit/license.
Tonnage	Enter tonnage of vessel and circle tonnage type: GT – Gross tonnage, NT – Net tonnage, GRT – Gross Registered Tonnage, NRT – Net Registered Tonnage. Currently, GT and NT are the international standard units; however, record the unit recorded on the Certificate of Registry.
Owner name/address	Record the name and address of the vessel owner
Permit holder name/address	If permit holder is different than the owner, record the name and address of the permit holder. This may also be the ships agent or company representative.
Year built	Enter the year the vessel was built. Typically on the Certificate of Registry.
No. propellers & blades	Record the number of propellers and the number of blades per propeller.
Propeller pitch & diameter	Record the pitch (meters) and diameter (meters) of the propeller(s). Pitch is the displacement a propeller makes in a complete spin of 360° degrees. If unknown, record “unknown”
Ducted propeller?	Circle Yes if the vessel has a ducted propeller (also called a kort nozzle or rice nozzle) and No if it has regular propellers.
Bow thruster present?	Does the vessel have a bow thruster? Circle Yes or No
Engine (main & auxiliary)	Record the manufacturer and model for each engine as well as kilowatts (Kw) and RPMs. If unit of power is only known in horsepower, be sure to indicate a different unit.
Generator	Record the manufacturer and model as well as power (Kw).

Transmission	Record the manufacturer and model as well as gear ratio.
Winches	Record the manufacturer and model of the deck winches. Also note the type (electric, hydraulic, or other), how many, maximum hoisting weight.
Other	Record manufacturer and model of any other primary equipment not already specified.
Water capacity	Record the capacity for fresh water storage on board (cubic meters).
Fuel capacity	Record the fuel capacity and circle appropriate unit (cubic meters or tonnes).
Fuel consumption	Record the average daily fuel consumption while fishing (tonnes / day)

Electronics: For each device, circle **Yes** or **No** for whether the device was present on board. If present, record a usage code, manufacturer and model and provide additional information requested in the additional information column. Usage codes are defined as:

- | | | | |
|---|---|---|--------------------------|
| 1 | Used continuously during fishing | 5 | Rarely used |
| 2 | Used often during fishing | 6 | Used only during transit |
| 3 | Used sometimes during fishing | 7 | No longer used |
| 4 | Broken during this trip but used normally | 8 | Unknown |

Field	Definition
GPS	Global Positioning Satellite device to determine vessel position in latitude and longitude. Record the accuracy (or range) of GPS unit in meters. If range is unknown, record “unknown” in the additional information column.
VMS 	Vessel Monitoring System - A VMS in its basic form is essentially a global positioning system (GPS) linked to a satellite communications transponder, with a small processor to poll the vessel automatically and transmit information on the vessel position, course and speed (Flewwelling et al. 2002). Indicate in comment whether the VMS system had an internal or external GPS.
Radar	Device uses electromagnetic waves to locate solid objects. If vessel has more than one type, record secondary radar information in ‘other’ rows. If you are on a purse seine vessel and they have specialized bird radar, record information in purse seine section on back side of form.

Sonar

Device uses sound transmission to estimate bottom depth (also called a depth sounder or echo sounder) or fish in water column (also fish finder). Space is provided for 2 systems. If more than 2 devices are on board, record in 'other' rows.



ADCP (current profiler)



Acoustic Doppler Current Profiler – Specialized type of sonar used to detect direction and strength of currents at multiple depths. Record the frequency used in Comments column.

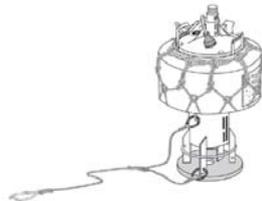
Radio beacon direction finder

Device used to find radio buoys.



Radio buoys / beacons

Include how many the vessel has on board and the frequencies they transmit on.



GPS buoys

Include how many the vessel has on board.



SST gauge



Temperature sensor to monitor sea surface temperature which can be important for finding some fish species.

XBT (bathythermograph)

An **expendable bathythermograph** is a specialized device used to collect a temperature profile at varying depths. The information is used to find thermoclines, ocean fronts or current eddies that will indicate the presence of fish especially tuna. Vessels may have automated or manually operated



XBTs. If an XBT is used by the vessel, a probe may be deployed regularly.

Other Complete for other devices as necessary.

Communications: Circle **Yes** or **No** and provide appropriate numbers/codes for the communication equipment on board.

Satellite Include the phone number and the provider of satellite service.



Fax Record the fax number if applicable

Email: Provide the email address if available

*VHF Record how many **V**ery **H**igh **F**requency radios are on board.

*SSB Record how many **S**ingle **S**ide **B**and (high frequency) radios are on board.

GMDSS The **G**lobal **M**aritime **D**istress **S**afety **S**ystem is an internationally agreed-upon set of safety procedures, types of equipment, and communication protocols used to increase safety and make it easier to rescue distressed ships, boats and aircraft.
(http://en.wikipedia.org/wiki/Global_Maritime_Distress_Safety_System)

AIS **A**utomatic **I**dentification **S**ystem is a short range coastal tracking system. If there is an AIS on board, note the class type (A or B).

Weather fax Does the vessel have a weather fax?

Other Provide information on any additional communications equipment on board.

Refrigeration: Circle **Yes** or **No** for the presence various refrigeration types on board and for all “Yes” responses, record the capacity.

Blast freeze? Blast freezers utilize cold air flow to quickly freeze product to extremely cold temperatures. Unit of capacity is tons /day. If applicable, record which gas is used for the freezing process (e.g., freon, ammonia).

Plate freeze?	Plate freezers are able to quickly freeze product to extremely cold temperatures. Unit of capacity is tons /day. If applicable, record which gas is used for the freezing process (e.g., freon, ammonia, CO ₂).
Freezer hold?	Unit of capacity is volume (e.g. cubic meters)
Ice?	Unit of capacity is volume (e.g. cubic meters)
RSW	Refrigerated sea (salt) water is typically used to transport small pelagic fish. Unit of capacity is a volume (e.g. cubic meters)
Brine	A super-saturated solution of salt water, commonly used for tuna. Unit of capacity is volume (e.g. cubic meters)
Other	If vessel uses some other form of refrigeration, please describe and include the capacity.

Waste Management: Check all methods of waste (rubbish, garbage) management used by the vessel and list types of materials for each. For example, plastics may be disposed on shore and galley food waste may be thrown overboard.

Purse Seine: Complete this section only if this trip was on board a purse seine vessel. For each device, circle **Yes** or **No** for whether the device was present on board, record a usage code (same definitions as Electronics section), and provide additional comments as necessary.

Ring stripper	Device that automatically feeds the purse rings onto a drum or other apparatus during gear retrieval. Also referred to as hairpin.
Speedboats	Record the number of functional speed boats on board and their engine power (e.g., 3: 45, 45, 65 hp).
Raft	Did the vessel have a raft or personal watercraft for assisting with the release of marine mammals or other large animals?
Bird radar	This may be in addition to radar above.
Net mensuration	Record the make/model of any net measuring equipment/sensors the vessel used to detect the shape of the net when deployed.
Diver / dive equipment	Ask the captain if there is a person on board who will act as a diver for the release of marine mammals. Was a diver ever used to rescue dolphins or other marine mammals from net?
High-intensity floodlight	Was the vessel equipped with a high-intensity floodlight and was it in operable condition. This is important if setting on

dolphins and retrieval extends into night.

Spotter aircraft Circle type: aircraft or helicopter or none. Also provide the manufacturer, model, registration number, and range (in kilometers) it can fly without returning to the vessel.

Trawl: Complete this section only if this trip was on board a shrimp or finfish trawl vessel. For each device, circle **Yes** or **No** for whether the device was present on board, record a usage code, manufacturer and model, and provide additional comments as necessary.

Bottom contact sensor Used to monitor footrope or door contact with bottom.

Catch sensors Used to monitor fullness of net

Net sensors Used to monitor the shape of the net opening (e.g. horizontal and vertical spread) as well as catch entering the net. Circle whether or not this system is hard **Wired** (via a third cable) or **wireless**.

Hydrophone Hull mounted receiver or towed hydrophone used to communicate with various net monitoring devices.

Other Record additional devices as necessary.

Comments: Use this space to provide further information regarding fields on this form.

Vessel Information

Observer code 00347	Vessel code GAB 75	Trip ID 21			
General Vessel Characteristics					
Vessel name Happy Sailer	Country Registration No. XYZ 3856	Flag SLE			
Home port (city, country) Freetown, SLE					
Previous vessel names	Previous flag	Length overall (LOA; m) 23.5			
		Draft (m) 5 Beam (m) 8			
IMO No.	Int'l radio call sign (IRCS) 9LC 27	Hull material (circle): Wood / <input checked="" type="radio"/> Steel / Fiberglass / Other _____			
MMSI No. 123456789	Global Registry ID:				
Permit/license No. SLE 27	Permit expiration (dd-mm-yy): 31-12-09	Tonnage: 187 <input type="radio"/> GT / <input type="radio"/> NT / <input type="radio"/> GRT / <input type="radio"/> NRT			
Owner Name/address Sailer Tom 7 Prawn Road Lungi, SLE	Permit holder name/address same as owner	Year built 1976			
		No. propellers: 1 No. blades: 3			
		Propeller pitch: _____ Diameter (m): 1.1			
		Ducted propeller? <input type="radio"/> Y / <input checked="" type="radio"/> N			
		Bow thruster present? <input checked="" type="radio"/> Y / <input type="radio"/> N			
	Manufacturer	Model			
Engine (main)	Caterpillar	C32			
		Kw: 1156 RPM: 2300			
Engine (auxiliary)	Caterpillar	C18 ACERT Aux			
		Kw: 372 RPM: 1800			
Generator	Caterpillar	C18 ACERT Genset			
		Power (Kw) 50 Hz - 275kw			
Transmission (gear box)	Renk	Ratio 1.5-4			
Winches (on deck)	TWG	Type: Electric / <input checked="" type="radio"/> Hydraulic / Other _____			
	How many? 2	Max hoisting weight 3800 kg			
Other:					
Other:					
Water capacity (m3): 2000	Fuel capacity: 75 m ³ / tonnes	Fuel consumptions (tonnes/day): 1.6			
Electronics					
	Present?	Usage	Manufacturer	Model	Additional Information
Plotter & GPS	GPS <input checked="" type="radio"/> Y / <input type="radio"/> N	1	SAMYUNG ENC	SGP-330	Accuracy (m) 15
	VMS <input checked="" type="radio"/> Y / <input type="radio"/> N	1	BlueTracker		GPS: <input checked="" type="radio"/> Internal / <input type="radio"/> external
	Radar <input checked="" type="radio"/> Y / <input type="radio"/> N	1	Samyung	SMR-3600	KHz: _____
	Sonar <input checked="" type="radio"/> Y / <input type="radio"/> N	1	Simrad	ES60 Single	KHz: 120
	Sonar <input type="radio"/> Y / <input checked="" type="radio"/> N				KHz: _____
	ADCP (current profiler) <input type="radio"/> Y / <input checked="" type="radio"/> N				KHz: _____
	Radio beacon direction finder <input type="radio"/> Y / <input checked="" type="radio"/> N				
	Radio buoys / beacons <input type="radio"/> Y / <input checked="" type="radio"/> N				How many? _____ Frequency: _____
	GPS buoys <input type="radio"/> Y / <input checked="" type="radio"/> N				How many? _____
	SST gauge <input type="radio"/> Y / <input checked="" type="radio"/> N				
	XBT (Bathymograph) <input type="radio"/> Y / <input checked="" type="radio"/> N				
Other:	<input type="radio"/> Y / <input checked="" type="radio"/> N				
Other:	<input type="radio"/> Y / <input checked="" type="radio"/> N				
Other:	<input type="radio"/> Y / <input checked="" type="radio"/> N				
Other:	<input type="radio"/> Y / <input checked="" type="radio"/> N				
Usage Codes					
1 Used continuously during fishing		5 Rarely used			
2 Used often during fishing		6 Used only during transit			
3 Used sometimes during fishing		7 No longer used			
4 Broken during this trip but used normally		8 Unknown			

4.4.2 Trip Summary

Complete one trip summary form for each trip on board a vessel (Figure 4-2).

Field	Definition
Embarkation, Departure, Return and Debarkation: enter dates, times and locations. Also make a note if the vessel made additional stops during the fishing trip.	
Date	Record date in day/month/year (dd/mm/yy) format
Time	Record time in 24-hr notation (e.g. 1:05 pm = 1305)
Time zone	Record the time zone in which the vessel operated and you recorded data. This must be consistent throughout the trip. Record the number (+/-) of hours in Coordinated Universal Time (UTC). See map in Appendix 9.
Port	Enter the city & country code (Error! Reference source not found.). If transfer to or from a vessel occurs at sea, also record vessel name, location for vessel transfers.

Make a note if there were stops in additional ports.

Captain, First Mate and Fish Master

Name/address	Record full name and address of each primary officer. This may be the company address.
Nationality	Record nationality for each person
Years in fishery	Enter the number of years each has worked in the fishery
Crew size	Record the total number of crew on board (excluding the observer)
Crew List?	Circle Yes or No . Ideally, the crew list would be a full manifest of all crew member names, position on board and nationality
Gear type	Circle appropriate gear type as defined below and if otter trawl, fill in appropriate number. If you are on a vessel that is using a different gear type, record most appropriate gear type based on the complete list in Appendix 6 and describe the gear more fully in the Observer Logbook.

TBB	Beam trawl
OTB-1	Otter trawl – bottom – side deployment
OTB-2	Otter trawl – bottom – stern deployment
OTM-1	Otter trawl – midwater – side deployment
OTM-2	Otter trawl – midwater – stern deployment

TBS	Shrimp trawl (use only if vessel is not using an otter trawl for shrimp)
PS	Purse seine – 1 vessel (Note: there’s a different code if using 2 vessels)
LLD	Drifting or pelagic longline
LLS	Set or demersal longline
FPO	Traps - pots
GND	Drifting gillnet

Primary and secondary target species Ask the captain what the primary and secondary target species are and record 3-letter species codes (Appendix 7). This field is reporting what the captain describes as his main target. If there is no secondary target, only report primary target.

Packaging Circle packaging types utilized: Boxed or bagged / Binned on ice / Loose.

Fish sales Record the location and buyer name if you are on board when fish are offloaded. Otherwise, note “not on board”

Products For each product type, list the record 3-letter species codes (Appendix 7) that were retained on board. Also include the approximate weight of each product type (e.g. 20kg or 25 kg) as marked on the packaging.

Debriefing Section

Forms Completed - Place an ‘X’ next to each form type that you completed during this trip.

Total sets/hauls Record the total number of sets/hauls made on this trip

sets/hauls sampled Record the number of sets/hauls sampled for catch composition during this trip

Mortality and Sightings Circle Yes or No for marine mammal, sea turtle or seabird mortality and sightings. Record species codes (Appendix 7) and record the number encountered for all Yes responses

Accommodations Circle Yes or No as appropriate.

crew assigned to room Record the number of people assigned to your room (including yourself)

Storage Did you have adequate storage for personal and sampling gear?

Food	Was a meal served on board at least twice per day?
Water	Was there fresh, clean drinking water on board?
Toilet	Was a toilet available on board? If no, describe what was used (ie, bucket, etc).
Sampling advice?	Do you have any advice for future observers regarding sampling on this vessel?

Debriefing & Data checking

Debriefing name	Enter debriefer name
Debriefing date / location	Record the date and location (city) of debriefing
Date data submitted	Record date data was submitted by the observer to the SOP
Date data finalized	Record date that data was finalized by the SOP
Date data entry	Record date that data was first entered into database
Date data entry verified	Record date that data was verified in database

Trip Summary				
Embarkation	Date (dd/mm/yy) 18-09-09	Time (24-hr clock) 1045	Time zone (+/- hrs) 0	Port (city, country) Conakry, GIN
Departure	Date (dd/mm/yy) 19-09-09	Time (24-hr clock) 0500	Port (city, country) Conakry, GIN	
Return	Date (dd/mm/yy) 27-11-09	Time (24-hr clock) 2300	Port (city, country) Freetown, SLE	
Debarkation	Date (dd/mm/yy) 28-11-09	Time (24-hr clock) 1530	Port (city, country) Freetown, SLE	
Additional stops?				
Captain name / address Finn Malulu, 100 Tuna Ave, Conakry, GIN			Nationality SLE	Years in fishery 12
Mate name / address Mac Diel, Accra, GHA			Nationality GHA	Years in fishery 7
Fish master name / address			Nationality	Years in fishery
Crew size (excl. observer)	17	Crew list attached?	Y / <input checked="" type="radio"/> N	
Gear type (circle one)	TBB / OTB-__ / OTM-__ / TBS / PS / <input checked="" type="radio"/> LLD / LLS / FPO / GND / Other: _____			
Primary target BET	Packaging (circle one)	Boxed or bagged / Binned on ice / <input checked="" type="radio"/> Loose / Other: _____		
Secondary target YFI				
Fish sales				
Location(s):		Freetown, SLE		
Buyer name(s):		Bigshot Bob		
Products (list species groups for each)				Product Wt (kg)
Whole: BSH				n/a
Tail off:				
Head off: SWO				n/a
Head & tail off:				
Head off & gutted:				
Fillet:				
Other: Gilled: L, gutted: BET, YFI, SKJ, ALB				n/a
Other:				

Debriefing					
Forms Completed (check all applicable)					
Observer Logbook	<input checked="" type="checkbox"/>	Compliance checklist	<input checked="" type="checkbox"/>	Vessel and aircraft sighting	<input checked="" type="checkbox"/>
Vessel Information	<input checked="" type="checkbox"/>	Safety checklist	<input checked="" type="checkbox"/>	Floatsam (PS only)	
Trip Summary	<input checked="" type="checkbox"/>	Species ID (new spp encountered)	<input checked="" type="checkbox"/>	Daily log (applies to PS only)	
Gear Description	<input checked="" type="checkbox"/>	Lengths		Marine Debris	<input checked="" type="checkbox"/>
Total catch & effort (set/haul)	<input checked="" type="checkbox"/>	Age structures		<i>Fish Health & Sanitation Audit</i>	<input checked="" type="checkbox"/>
Catch composition	<input checked="" type="checkbox"/>	Photo log	<input checked="" type="checkbox"/>		
Total sets/hauls	42	# sets/hauls sampled	40		
Mortality & sightings (circle Y or N for each)					
	Mortality	Species (code, #)	Sightings	Species (code, #)	
Marine mammal	Y <input checked="" type="checkbox"/> N		<input checked="" type="checkbox"/> / N	<i>DSA-2; PYW-1</i>	
Sea turtle	<input checked="" type="checkbox"/> / N	<i>TTL. 1</i>	Y / <input checked="" type="checkbox"/> N		
Seabirds	<input checked="" type="checkbox"/> / N	<i>PRX. 1</i>	Y <input checked="" type="checkbox"/> N		
	Y / N		Y / N		
Accommodations					
# crew assigned to room	3	Fresh water	<input checked="" type="checkbox"/> / N		
Adequate storage	<input checked="" type="checkbox"/> / N	Toilet	Y / <input checked="" type="checkbox"/> N	<i>used bucket on deck.</i>	
Food	<input checked="" type="checkbox"/> / N				
Sampling advice? <i>Bring extra snacks unless you like fish for every meal</i>					
Debriefing and data checking/tracking					
Debriefing name					
Debriefing date / location					
Date data submitted			Date data entry		
Date data finalized			Date data entry verified		
Debriefing Notes					

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Figure 4-2 Example Trip Summary form

5 Catch Composition Form

5.1 Learning objectives

- Describe the guidelines for selecting hauls for catch composition.
- List and define five of the eight primary elements of the catch composition form.

5.2 Introduction

Scientific observers will collect a random sample for catch composition from a subset of hauls. There are a few exceptions where each haul/set will be sampled (e.g., pelagic longline and tuna purse seine). Catch composition data is used to estimate relative abundance of each species in a haul. All catch within the catch composition sample should be identified to the species or lowest possible taxonomic level. Catch composition includes the species-specific weights and counts as well as an estimated quantity retained and reason for discards.

The term “haul” will be used throughout the gear-specific chapters; however, the terms haul, set, station or shot when used as nouns, refer to a fishing event from beginning to end. Since slightly different sampling procedures apply to the various gear types, more specific information on sampling procedures and expectations are described more fully in the gear-specific chapters.

The general guideline for selecting hauls for catch composition sampling is:

- If there are 1-2 hauls per day, sample all hauls;
- If there are 3-4 hauls per day, use Random Sample Table (RST) #1 to select hauls;
- If there are 5 or more hauls per day, use RST#2 to select hauls.

Both RSTs and more detailed instructions on their use are in the Observer Logbook.

5.3 List of Priorities

1. Randomly select hauls to sample for catch composition and document procedure in Observer Logbook.
2. Collect sample to determine catch composition from selected hauls.
3. Complete catch composition form for each sampled haul.

5.4 Forms/Instructions

5.4.1 Catch Composition Form

Complete one catch composition form for each sampled haul (see Figure 5-1).

Field	Definition
Observer Code:	Write the observer identification code assigned by the program.
Vessel Code:	Record the vessel code (Appendix 3). If your vessel is not on this list, contact the SOP immediately.
Trip ID	Enter the trip identification number assigned by the SOP.

Date	Record the date the haul was retrieved (dd/mm/yy).	
Haul	Record the haul number.	
Mixed?	Was this haul mixed with another haul prior to sampling? Circle Yes or No . This should not happen often.	
Species Name	Record the common or scientific name for the species or group. Note that if there are multiple sample types, there may be more than one entry (row) for some species. For example, shrimp species A may be part of the retained species sample (sample type 3A) and part of the discard sample (sample type 3C).	
Species Code	Record the 3-letter code for the species or species group (Appendix 7).	
ST	Record the appropriate code for Sample Type . Codes are defined as follows:	
	1	Whole haul The entire haul was monitored for this species and you are 100% confident that all individuals were seen.
	2	Unsorted random sample Used for trawl samples collected before crew does any sorting
	3A-C	Sorted sample Used for trawl samples collected after crew sorts retained from discards. This will be a common sample type on shrimp trawl vessels.
	3A	Retained (sorted by species) All retained fish that have been sorted to species should be weighed.
	3B	Retained (mixed species) Collect a random subsample of retained species that are mixed together (typically smaller sizes of several similar looking fish). Sort & weigh by species. Estimate total weight of the mixed species and record on page 2. If there are two types of retained mixed categories and you take a sample of each, be sure to estimate the total weight for each category.
	3C	Discard sample Collect a random subsample of

discards. Sort & weigh by species or species groups. Estimate total weight of the discards and record on page 2.

- 4 Longline, demersal
- 5 Gillnet
- 7 Pots/traps
- 8 Other Use for Marine Mammals and Sea Turtles if you are not 100% certain you saw all marine mammals or sea turtles. May also be used if an individual was sorted out of the catch before you could collect your sample (e.g., large shark).

Note: If code 3 is used, there must be an entry for 3A and 3C at a minimum. Pelagic longline and purse seine have their own catch composition forms.

Number Individuals	Record the count of animals for each species or species group in the sample. This may be a direct count or can be calculated by dividing the sample weight by an average weight. Record all calculations in the space provided at the bottom of the form (back side).
Weight (kg)	Record the weight of each species or species group in the sample.
Sample size (kg, hooks, or pots)	Record a unique sample size for each sample type. The sample size for a whole haul is the total catch weight from the total effort and catch form. For example, if one sea turtle was caught and you are certain it was the ONLY one caught, this would be considered a whole haul sample. The sample size for an unsorted random sample (ST=2) is the sum of all species weights from that sample. Sample size for demersal longline, traps and gillnet is the number of hooks, pots or net sections you tallied for catch composition.
% Ret.	Record the percentage of each species (species group) retained by weight for sale or onboard consumption.
Reason Discard	If % retained is <100, enter the most appropriate code describing the reason discard occurred.

- 1 Regulation (e.g., retention of species not allowed or there were size restrictions)
- 2 Market (e.g., there is currently no market to sell this species)
- 3 Damaged (e.g. fish was eaten by another species on line or in net)
- 4 Marketable but sorting error (common in shrimp trawl fishery)
- 5 Other – make notes in the comment section regarding other reasons for discard

Notes/
Calculations

Use this space for sampling notes and calculations (e.g., average weights).

For ST=3, use the worksheet at the right of this section to estimate the total weight of each sample type (3A, 3B & 3C). The sum of these is the Total estimated catch for ST=3.

There may be more than one sample type and associated sample weight for a given haul. For instance, a haul could contain a marine mammal (recorded as sample type “1” for whole haul) and a random sample of all other catch (recorded as sample type “2”).

Record “APL”, “X2” or “X1” for miscellaneous vegetation and plant material, plastic material and all other rubbish (excluding plastics), respectively. Leave the ‘Reason Discard’ column blank for species codes X1 and X2.

Catch Composition

Observer code <i>SL/E 0001</i>	Vessel code <i>12345</i>	Trip ID <i>75</i>	Date (dd/mm/yy) <i>24/03/10</i>	Haul <i>223</i>	Mixed? Y (N)		
Sample Type (ST) 1 Whole haul 2 Unsorted random	3A Trawl - retained by species 3B Trawl - retained mixed species 3C Trawl - discard sample	4 LL-demersal 5 Gillnet 7 Pots/traps 8 Other	Reason Discard 1 Regulation 4 Error 2 Market 5 Other 3 Damage				
Species Name	Species Code	ST	Number Individuals	Weight (kg)	Sample Size	% Ret.	Reason Discard
<i>Penaeus notialis</i>	<i>SOP</i>	<i>3A</i>	<i>700</i>	<i>35</i>	<i>113.78</i>	<i>100</i>	
<i>Caranx hippos</i>	<i>CVJ</i>	↓	<i>17</i>	<i>4.25</i>	↓	↓	
<i>Drepane africana</i>	<i>SIC</i>	↓	<i>2</i>	<i>1.04</i>	↓	↓	
<i>Galeoides decadactylus</i>	<i>GAL</i>	↓	<i>26</i>	<i>8.84</i>	↓	↓	
<i>Lutjanus goreensis</i>	<i>LJO</i>	↓	<i>3</i>	<i>3.15</i>	↓	↓	
<i>Pentanamus quinquarius</i>	<i>PET</i>	↓	<i>98</i>	<i>10.78</i>	↓	↓	
<i>Raja miraletus</i>	<i>JAI</i>	↓	<i>2</i>	<i>5.4</i>	↓	↓	
Crab, Unid	<i>CRA</i>	↓	<i>1</i>	<i>1.5</i>	↓	↓	
<i>Portunus validus</i>	<i>PVQ</i>	↓	<i>2</i>	<i>1.6</i>	↓	↓	
<i>Sepia officinalis</i>	<i>CIC</i>	↓	<i>4</i>	<i>2.2</i>	↓	↓	
<i>Pseudotolithus sp</i>	<i>CKW</i>	↓	<i>45</i>	<i>16.2</i>	↓	↓	
<i>Pomadourus jubelini</i>	<i>BUR</i>	↓	<i>9</i>	<i>2.07</i>	↓	↓	
<i>Trichiurus lepturus</i>	<i>LHI</i>	<i>3A</i>	<i>87</i>	<i>21.75</i>	<i>113.78</i>	↓	
<i>Drepane africana</i>	<i>SIC</i>	<i>3B</i>	<i>3</i>	<i>0.69</i>	<i>20.99</i>	↓	
<i>Galeoides decadactylus</i>	<i>GAL</i>	↓	<i>33</i>	<i>3.3</i>	↓	↓	
<i>Lutjanus goreensis</i>	<i>LJO</i>	↓	<i>7</i>	<i>4.2</i>	↓	↓	
<i>Pentanamus quinquarius</i>	<i>PET</i>	↓	<i>53</i>	<i>2.65</i>	↓	↓	
<i>lati</i>	<i>LLI</i>	<i>3B</i>	<i>29</i>	<i>10.15</i>	<i>20.99</i>	<i>100</i>	
Shrimps, unid	<i>DCP</i>	<i>3C</i>	<i>300</i>	<i>15</i>	<i>47.15</i>	<i>0</i>	<i>3/4</i>
Bivalves	<i>CLX</i>	↓	<i>19</i>	<i>0.95</i>	↓	↓	<i>2</i>
<i>Brachydontes auritus</i>	<i>GRB</i>	↓	<i>3</i>	<i>0.3</i>	↓	↓	<i>2</i>
<i>Galeoides decadactylus</i>	<i>GAL</i>	↓	<i>20</i>	<i>3.6</i>	↓	↓	<i>2</i>
<i>lati</i>	<i>LLI</i>	↓	<i>75</i>	<i>7.5</i>	↓	↓	<i>2</i>
<i>Raja miraletus</i>	<i>JAI</i>	↓	<i>5</i>	<i>1.75</i>	↓	↓	<i>1</i>
<i>Sardinella maderensis</i>	<i>SAE</i>	↓	<i>17</i>	<i>1.7</i>	↓	↓	<i>2</i>
Plant material	<i>APL</i>	↓	<i>1</i>	<i>10.5</i>	↓	↓	
Crab, Unid	<i>CRA</i>	↓	<i>17</i>	<i>0.85</i>	↓	↓	<i>1</i>
Elastic	<i>X2</i>	<i>3C</i>	<i>1</i>	<i>5</i>	<i>47.15</i>	<i>0</i>	

Notes / Calculations		Total weight	
Sampled 1 of 4 baskets of mixed species (sample type 3B) and 2 of 10 baskets of discard (sample type 3C):		3A	113.78
$SOP\ ave. = 2.5/50 = 0.05\ kg$	$LHI\ ave. = 6.25/25 = 0.25\ kg$	3B	80.75
$SOP\ no. = 35.0/0.05 = 700$	$LHI\ no. = 21.75/0.25 = 87$	3C	224.5
$lati\ ave. = 4.0/40 = 0.1\ kg$	$PET\ ave. = 3.85/35 = 0.11\ kg$	Total Catch Est	419.03
$lati\ no. = 7.5/0.1 = 75$	$PET\ no. = 7.5/0.11 = 98$		

Figure 5-1 Catch Composition example.

6 Trawl – Finfish

6.1 Learning objectives

- Explain the differences between beam and otter trawls.
- Describe two methods to estimate total catch.
- List the 3 forms that are specific to finfish trawlers
- List 4 things that may impact how you sample.

6.2 Introduction

Trawl fisheries targeting fish account for nearly 50% of global landings (Kelleher 2005). Demersal finfish trawling is second only to shrimp trawling in the quantity of global discards (1.7 million tons) but the global discard rate is substantially lower for demersal finfish trawling (9.6%, Kelleher 2005). The global average discard rate for pelagic trawling is 3.4%.

Observer data will be used to determine the status of fish stocks by complementing available survey data and to determine the extent of other bycatch.

6.3 List of Priorities

1. Collect information on fishing effort
2. Randomly sample catch for species composition
3. Record gear characteristics
4. Collect length-frequency data on target and non-target catch

6.4 Gear Description

Trawling is an active fishing method that involves pulling a cone-shaped net through the water behind one or more boats. Trawls can target fish and invertebrates on the bottom (demersal trawl) or in the water column (midwater or pelagic trawl; Figure 6-1). Trawl nets are designed and configured to accommodate specific target species and their unique behaviors; however, the two most common configurations hold the net open with either a rigid beam (beam trawl) or trawl doors (otter trawl; Figure 6-2). See Confusing Terminology inset for more on beam trawls. The doors (or otter boards) are hydrodynamically designed to open the net as it's pulled through the water.

As the trawl net is being towed (2-5 knots), fish are herded into the net opening by the net wings. Fish pass through the body and are retained in the codend (Figure 6-3). These generalized sections are highly variable among vessels and you will need the crew/captain's assistance for gathering measurements and other information about the gear.

Confusing Terminology

Configuration

- Pair trawl – 2 vessels
- Twin trawl – 2 nets
- Duplex (separator) trawl – 2 codends

Beam Trawl(er)

- Beam trawler – vessels which deploy nets from abeam; also outrigger trawler
- Beam trawl – type of net with rigid structure

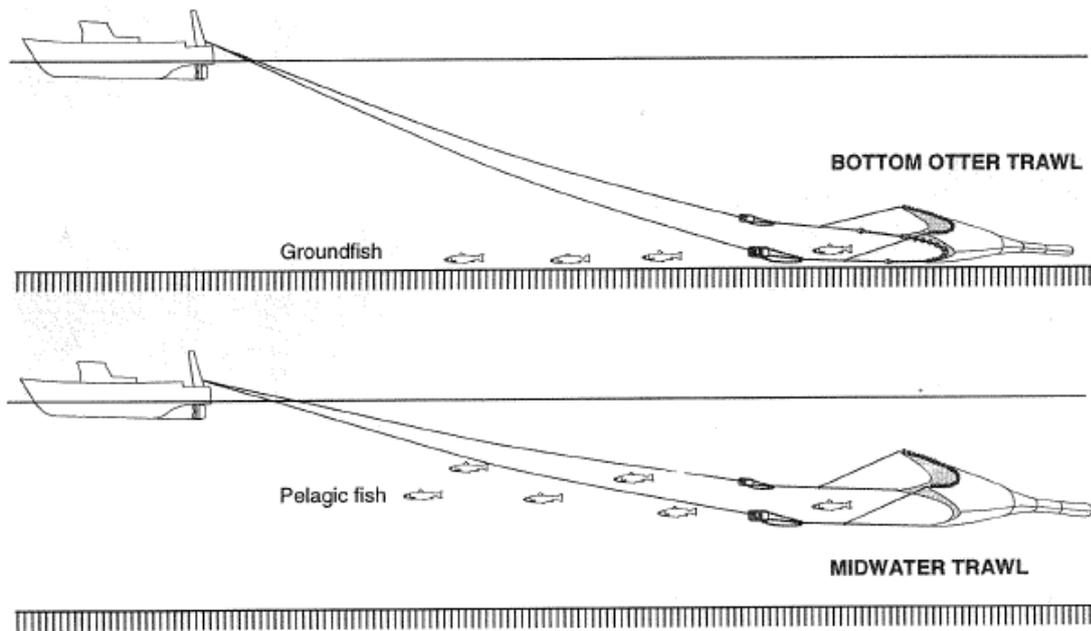
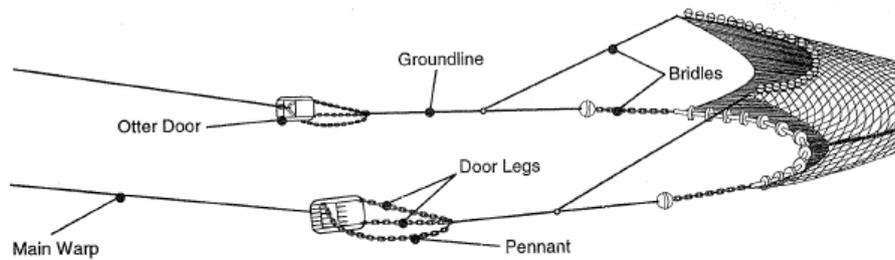


Figure 6-1 Bottom and midwater trawl nets target fish in different parts of the water column. Drawing from (Hanrahan et al. 1997).

A) Otter Trawl



B) Beam Trawl

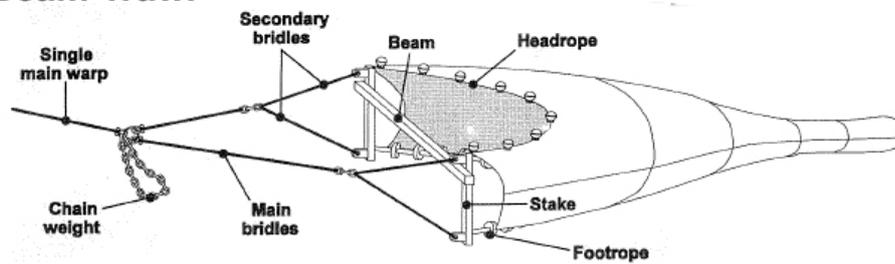


Figure 6-2 Otter (A) and beam (B) trawl configurations. The otter trawl in (A) is a bottom type trawl (note the rollers attached to the footrope). Drawing modified from (Hanrahan et al. 1997).

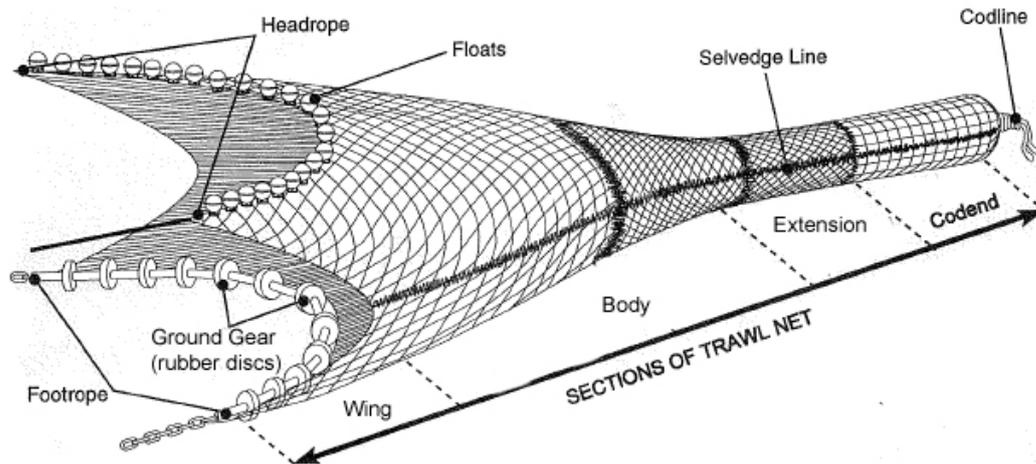


Figure 6-3 Generalized otter trawl net components. Net components are similar regardless of beam or otter trawl configuration. Drawing modified from (Hanrahan et al. 1997).

Gear deployment: The codend is lowered over the stern (or side) of the vessel and released into the water. Vessel speed is increased to create enough drag to pull the remainder of the net into the water. Bridles are then connected to the doors which are attached to the main warps or cables. The warps are set out until the trawl reaches the desired fishing depth. Once the trawl is deployed, the vessel is slowed to a preferred towing speed.

Gear retrieval: The haulback begins by winching in the main warps until the doors are at the stern. The pennants are disconnected from the doors and attached to the net reel transferring the strain from the warps to the net reel and groundline. The groundline and net are hauled back onto the net reel (Figure 6-4) until the ground gear is on board and the remainder of the net/codend is hoisted aboard in sections (side trawl) or all at once (stern trawl).

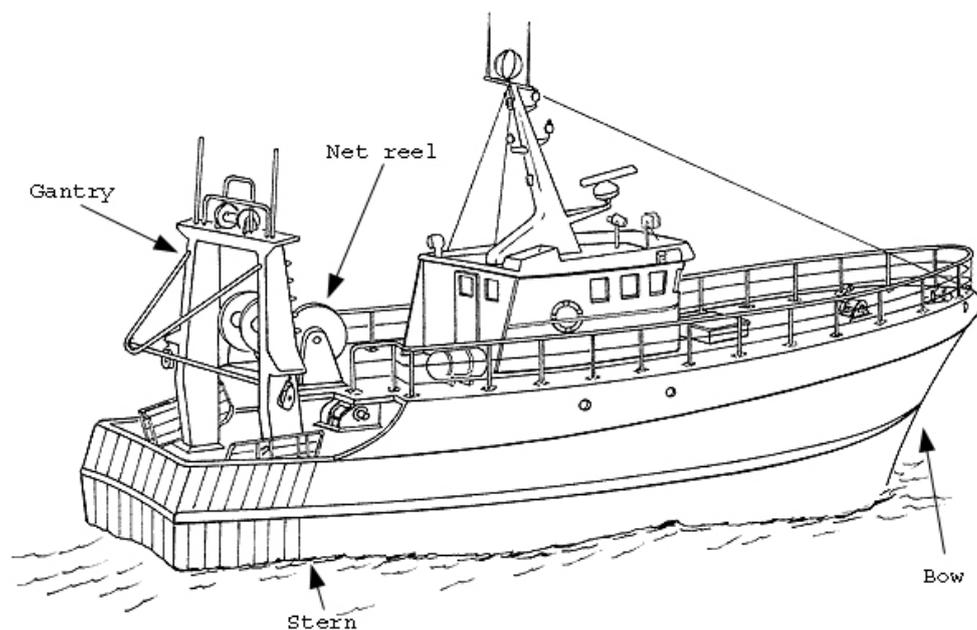


Figure 6-4 Mid-sized trawler configuration. Drawing modified from (FAO 1985).

6.5 Forms/Instructions

The asterisk (*) indicates priority fields.

6.5.1 Gear Description – Finfish Trawl

Complete one form for each unique net (see example in Figure 6-9). If possible, complete before departure. Total number of pages equals total number of unique nets fished. Write your name on the first page.

Field	Definition
Observer Code:	Record your observer program identification code.
Vessel Code:	Record the vessel code (Appendix 3). If your vessel is not on this list, call the SOP immediately.
Trip ID	Enter the trip identification number assigned by the SOP.
*Net type	Check the type of net: midwater (pelagic) or bottom (demersal)
Net #	Record information on each uniquely configured net on board. If there is only one net, enter '1' and only complete one form.
*Configuration	Check the type of trawl configuration: Otter trawl, beam trawl (Figure 6-2) or other. If other, draw diagram in comments section.
*Net deployment position	Check the position where the net is deployed from: stern, port side or starboard side. If the vessel is setting from both sides, check both 'Port' & 'Stbd'.
Net manufacturer / design name	Ask the captain for the name of the net manufacturer and model or design name. If vessel makes its own nets, write "vessel" and if unknown, write in "unknown".

Otter Trawl Section (Figure 6-2A)

Doors – Main & Dummy – The main doors may also be referred to as otter boards. The dummy door, or sledge, is used as a center door during twin trawl operations. If the vessel is fishing only 1 net, leave dummy door fields blank.

Material	Circle the construction material of the doors.
Length & height	Record the length and height of both door types in meters (Figure 6-5).

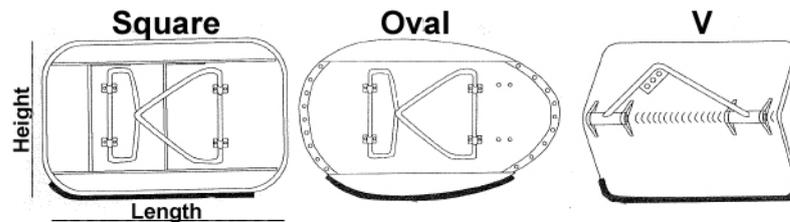


Figure 6-5 Door types and measurements. Drawing modified from (Hanrahan et al. 1997).

Weight Record the door weight in kilograms (from Captain).

Type Circle square, oval, V or other.

For each of the following components, record the length (meters), diameter (millimeters), material (e.g., iron chain for door legs and steel cable for bridle) and other information as necessary. For the various types of chain, record overall length (meters), diameter (mm; diagram below) and material.



Chain link diameter (Image from <http://www.mcmaster.com>).

Door legs Door legs, also known as back stops or back straps, connect the doors to the groundline. They also serve to keep the doors upright and stable during fishing operations.

Pennant The pennant is a loosely attached cable between the groundline and door which facilitates deployment and retrieval of the trawl. If absent, leave blank.

Groundline The groundline, or ground cable, connects the door legs to the bridle. If there is no groundline, leave blank.

Bridle The bridle connects the groundline to the net.

Beam Trawl Section (Figure 6-2B)

*Beam & stake Record the length (m), weight (kg) and material (e.g., steel, aluminum, wood) of the main beam and the stakes.

For bridles and chain weights, record the length (meters), diameter (millimeters), material and other information as necessary.

Bridle (main) The bridle connects the doors to the warp (main cable to vessel).

Bridle (secondary-top) The top length of the secondary bridle is measured from the point of main bridle attachment to the top of the stakes.

Bridle (secondary- bottom)	The bottom length of the secondary bridle is measured from the point of main bridle attachment to the bottom of the stakes.
Chain weight	A chain weight can be attached to the front of the main bridle. Leave blank if not present. Provide total weight in 'Other' column.

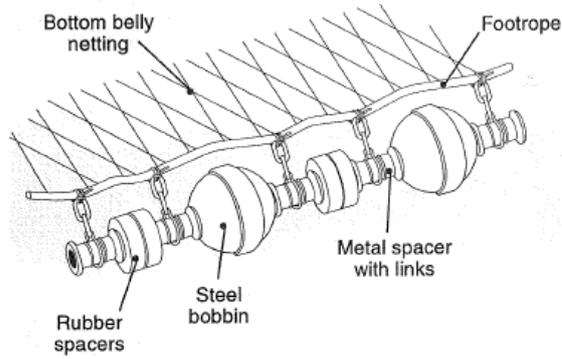
Beam and Otter Trawl Section

For each of the following components, record the length (meters), diameter (millimeters), type of material (e.g., steel, poly, Spectra, or nylon) and other information as necessary.

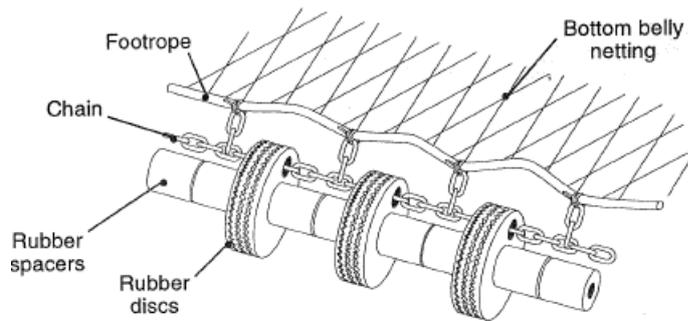
Warp	Warp (or main cable) connects the vessel to the otter trawl doors or beam trawl bridle. For otter trawl vessels, record the information for one side only (the assumption is both sides are the same).
3 rd wire	The 3 rd wire cable connects the vessel to specialized net sonar equipment. The 3 rd wire consists of a communications cable imbedded within an outer layer of steel cable. If absent, leave blank.
*Head rope	Also known as head line, float line, or float rope. Record number of floats or headline kites attached to head rope and describe in 'Other' column.
*Foot rope	Also known as lead line or ground rope.
Selvedge line	The seam along each side of the trawl that separates the top from the bottom.
Tickler chain or ticklers	The tickler chain or ticklers (smaller loops or strands of chain) functions to dislodge or lift fish off the bottom and into the net. These are more common on shrimp trawlers.

Complete the next 5 fields on bottom trawl vessels only. Depending on the target species and bottom type (e.g., mud, rock), a variety of ground gears (or footgear) may be attached to the foot rope. Ground gear ensures close contact with the bottom and enables fishing on rough bottoms without damage to the trawl net (Løkkeborg 2005). Provide width (cm), diameter (cm), material and a count of how many for each ground gear component present. Ground gear images below from Hanrahan et al. (1997).

Metal
bobbins &
spacers



Rubber discs
& spacers

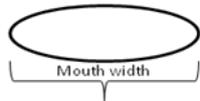


Net Characteristics Section

Most of the net specification will need to be obtained from the captain. Specifications indicated with a dagger (†) should be measured by the observer.

Total length Record the total net length in meters. You will likely need to ask the captain.

Mouth width Record the mouth width in meters.



Mouth height Record the mouth height in meters.



Record the material type (e.g., nylon, poly, sapphire, or spectra), line or twine diameter (mm), stretched mesh opening (tenths of cm), indicate if mesh opening measurement was made when the gear was wet (W) or dry (D). *Optional*: count the number of meshes on the long or horizontal axis and the number of meshes around the net (vertical axis). Use a wedge gauge to measure the stretched mesh opening. Insert gauge with manual force in a direction perpendicular to the plane of the net and measure at least 20 meshes. Measure from inner knot to inner knot (Figure 6-6). Mesh may be hung in either diamond or square configuration which impacts fish (and bycatch) catch rates (Figure 6-7); circle the diamond or square for how the codend mesh is hung.

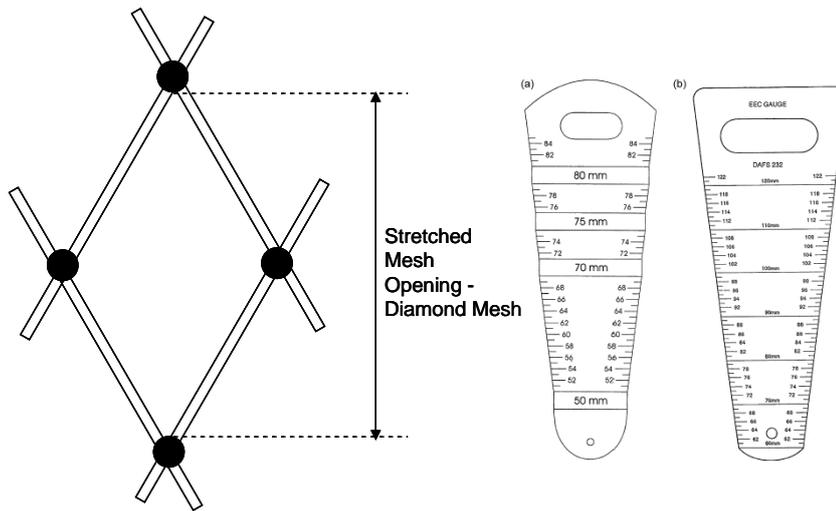


Figure 6-6 Measure stretched mesh opening from the inner edge of knots (upper left; modified from Ferro and Xu 1996) using a wedge gauge (upper right; Fonteyne et al. 2007). Bottom image supplied by S. Sei (Sierra Leone).

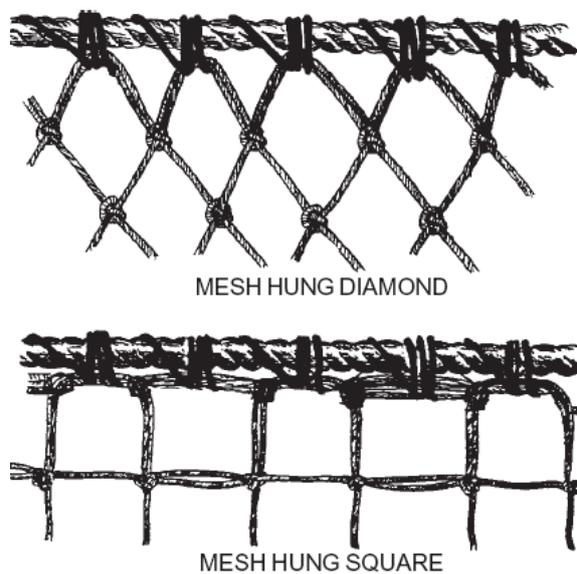


Figure 6-7 Mesh can be hung in diamond (top) and square (bottom) configuration. Drawing from (NMFS 2007b).

Wing	Sections of netting at the foremost part of the net which define the outer perimeter of the trawl opening. The wings maintain the shape of the trawl and herd fish into the net opening.
Trawl body	May be referred to as square and belly. If this section tapers, record the range of mesh sizes.
Extension	The extension, or lengthening piece, is a section between the body and the codend and is used to extend the overall length of the trawl. If extension isn't present, leave fields blank.
*Codend	<p>The codend (also sack or bag) is the section that collects the fish. Circle the diamond or square symbols for how the codend mesh is hung relative to the selvedge line (Figure 6-7).</p> <p>†Codend mesh opening should be measured independently using the wedge gauge issued. Push wedge into stretched mesh opening and apply consistent force (~5kg). Measure 10 meshes and record in the comments field. Calculate the average mesh opening size and record on the form.</p>
Other	Record any other types of mesh sections not already recorded (e.g., codend liners).
Other rigging present.	<p>Check each additional rigging component that is present on the net.</p> <p>Chaffing gear can be pieces of line or extra webbing attached to the codend to protect it from damage.</p> <p>Elephant ears are sewn to the end of the net in order to evenly distribute the lifted weight.</p> <p>Lazy line is used to lift and maneuver the net (Figure 6-8) and is sometimes attached to the elephant ears.</p> <p>Strengthening straps can be vertical (transverse) or horizontal (lastridges; Figure 6-8). Vertical straps encircle the codend to reinforce the mesh strength. These straps are not attached directly to the meshes but are fed through loops of twine at intervals around the net. Similarly, horizontal straps (parallel to the selvedge line) also serve to strengthen the codend.</p> <p>The splitting strap is used to bring consistent sized portions (splits) of catch on board, usually lifted from one side of the vessel.</p> <p>Add any other gear and make detailed comments in the comments field at the end of the form.</p>

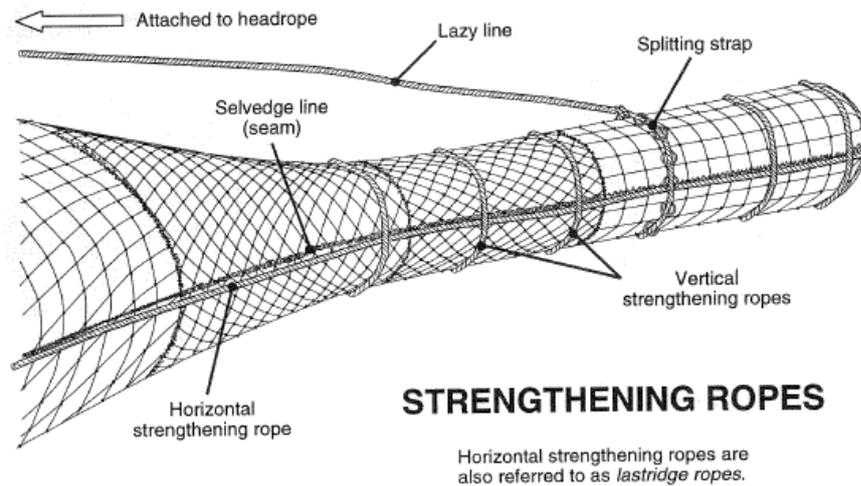


Figure 6-8 Types of strengthening ropes. Drawing from Hanrahan et al.(1997).

Photos? Circle **Yes**, if photos were taken of any gear component. Remember to provide copies to your debriefer and record detail in the Photo Log of the Observer Logbook.

Bycatch Reduction Device (BRD)

If there is no BRD, leave this section blank. A more detailed discussion of BRDs can be found in Chapter 7.

Type	Check boxes for BRD type used by the vessel. Fisheye, Radial escape section, Square-mesh window, Square-mesh codend, or other (specify in space provided).
Funnel	Check Yes or No for the presence of a herding funnel/cone.
Distance from escape opening to headrope	Measure in meters.
Distance from escape opening to tie off rings	Measure in meters.
Fisheye	
Offset	Number of meshes offset from top center. If located at top, enter "0"
Opening height & width	Measure in cm
Shape	Check appropriate opening shape: oval, diamond, square, halfmoon, rectangle, triangle, or specify if other.

Radial escape section

Opening width, height, length Measure applicable dimensions in cm

openings If the radial escape section isn't continuous around the codend, record the number of openings.

Square mesh window

Opening width, height, length Measure applicable dimensions in cm

BRD notes/drawing Provide additional notes and draw a diagram.

Comments Record any additional comments or make drawings about the gear here.

Gear Description - Finfish Trawl

Observer code 175		Vessel code XYZ 3856		Trip ID 00275	
Net type (check one): <input type="checkbox"/> Midwater <input checked="" type="checkbox"/> Bottom Net #: <input style="width:50px;" type="text"/> Configuration (check one): <input checked="" type="checkbox"/> Otter trawl <input type="checkbox"/> Beam trawl <input type="checkbox"/> Other _____ Net deployment position (check one): <input checked="" type="checkbox"/> Stern <input type="checkbox"/> Port <input type="checkbox"/> Stbd					
Net Manufacturer / design name: <u>Africa Net Systems / Flatfish Special</u>					
Otter Trawl					
Doors - Main			Doors - Dummy		
Material:	Aluminum / Steel / Wood / Other		Material:	Aluminum / Steel / Wood / Other	
Length (m)	1.4	Height (m)	1	Length (m)	
Weight (kg)	800	Type	Square Oval / / Other	Weight (kg)	
	Length (m)	Diameter (mm)	Material	Other	
Door legs - top	2.1	5	Chain		
Door legs - bottom	2	5	Chain		
Penant	3.2	5	Chain		
Groundline	4	12	Stainless steel		
Bridle (top leg)	5	12	Stainless steel		
Bridle (bottom leg)	4	12	Stainless steel		
Beam Trawl					
	Length (m)	Weight (kg)	Material	Other	
Beam					
Stake					
	Length (m)	Diameter (mm)	Material	Other	
Bridle (main)					
Bridle (secondary-top)					
Bridle (secondary-bottom)					
Chain weight				Weight:	
Otter and Beam Trawl					
	Length (m)	Diam (mm)	Material	Other	
Warp / main wire	500	12.5	Stainless steel		
3rd wire	600	5	Stainless steel		
Head rope	35	8	Polyethylene	# floats: 15	
Foot rope	30	8	Polyethylene		
Selvedge line					
Tickler chain				Weight:	
Other					

	Width (cm)	Diam (cm)	Material	Other			
Metal bobbins				How many?			
Metal spacers				How many?			
Rubber discs	5	20	Rubber	How many? 10			
Rubber spacer	5	12	Rubber	How many? 24			
Other							
Net Characteristics							
Total length (m):		Mouth width:			Mouth height:		
	Material	Diam. (mm)	Mesh open (cm)	W / D	# meshes long	# meshes around	Other
Wing	Poly	4	10	W	60	30	
Trawl body	Poly	4	6	W	80	40	
Extension	Ultra Cross® knotless	4	6	W	80	40	
Codend / sack	Ultra Cross® knotless	4	4.5	W	120	70	◇ □
Other							
Other							
Other rigging present? Check all that apply.							
<input checked="" type="checkbox"/> Chaffing gear		<input type="checkbox"/> Vert. Streng. Strap		<input type="checkbox"/> Lazy line		<input type="checkbox"/> Other:	
<input type="checkbox"/> Elephant ears		<input type="checkbox"/> Horiz. Streng. Strap		<input type="checkbox"/> Other:		<input type="checkbox"/> Other:	
		<input type="checkbox"/> Splitting Strap					
Photos? Y / <input checked="" type="radio"/> N							
Bycatch Reduction Device (BRD)							
Type: <input type="checkbox"/> Fisheye <input type="checkbox"/> Square-mesh window <input type="checkbox"/> Other:							
<input type="checkbox"/> Radial escape section <input type="checkbox"/> Square-mesh codend							
Funnel		<input type="checkbox"/> Yes		Distance of escape opening from headrope:		<input type="text"/> m	
		<input type="checkbox"/> No		Distance of escape opening from tie off rings:		<input type="text"/> m	
Fisheye		Offset		Radial escape section			
Opening (cm)		Width <input type="text"/>		Height <input type="text"/>		Opening (cm) Width <input type="text"/> Height <input type="text"/>	
Shape				Length <input type="text"/>			
<input type="checkbox"/> Oval		<input type="checkbox"/> Diamond		If not all the way around, #openings <input type="text"/>			
<input type="checkbox"/> Square		<input type="checkbox"/> Halfmoon					
<input type="checkbox"/> Rectangle		<input type="checkbox"/> Triangle					
<input type="checkbox"/> Other:				Square-mesh window			
				Opening (cm) Width <input type="text"/>		Height <input type="text"/>	
BRD notes/drawing							
Comments: <i>Codend mesh average: (4.5+4.55+4.45+4.5+4.5+4.45+4.4+4.5+4.6+4.55)/10 = 4.5 cm</i>							

Figure 6-9 Example Gear Description Form.

6.5.2 Trawl Effort / Total Catch Form

An entry is made on the Trawl Effort / Total Catch form for each non-fishing day and for each haul made during the trip regardless of whether the haul was sampled for species composition. Note that for a given haul, the fields for date/time, position and depth are split for start and end entries (Figure 6-12). Pages are numbered consecutively for each trip. For fields that remain the same over time, down arrows are acceptable.

Field	Definition
Observer Code:	Record your observer program identification code.
Vessel Code:	Record the vessel code (Appendix 3). If your vessel is not on this list, call the SOP immediately.
Trip ID	Enter the trip identification number (assigned by the program prior to each trip).
Haul	Record haul numbers sequentially for the trip. You can start at “1” or use the same numbering system as the captain but you must include hauls with zero catch. Enter “0” for all non-fishing days and enter a time and position for this day.
Total nets	Record the how many nets were fished (e.g., 1, 2 or 4) during a haul. For shrimp this excludes the try net. For finfish, this will typically be “1”.
Gear Perf	Record the appropriate code for gear performance: <ol style="list-style-type: none"> 1. No problem 2. Door- and warp-related problems 3. Net not fishing (bogged, obstructed, bag untied, torn, etc) 4. Net lost 5. Other <p>For performance #2-5, document details about the problem in the Observer Logbook.</p>
Sampled?	Check box if a catch composition sample was collected for this haul
Target	Record the intended target species: S – Shrimp F – Fish
Substrate	Record the dominant substrate using the following categories modified from Longhurst (1965): M – Mud S – Sand R – Rocky C – Corals

CM – Corals and mud
 CMS – Corals, mud and sand

Ask the captain for assistance.

Date Record start and end date for each haul (note that start and end are recorded on separate rows). There is a separate column for day, month and year. Record 2-digits in each column. If non-fishing day, enter date in the start row only.

Time (24-hr) Record fishing start and end time for each haul using 24-hr notation (e.g., 8:45 a.m. = 0845 and 2:12 p.m. = 1412). Do not include the colon in the time field. Start time is defined as the time winches are locked into place and gear is 'on bottom' fishing (Figure 6-10). End time begins when gear is lifted off bottom and is on its way up. If non-fishing day, record the time that the position was recorded for this day.

If the vessel does not maintain a detailed fishing log, you may need to coordinate the recording of time and position with the captain for hauls when you are sleeping. If the times or positions are unavailable, leave the fields blank.

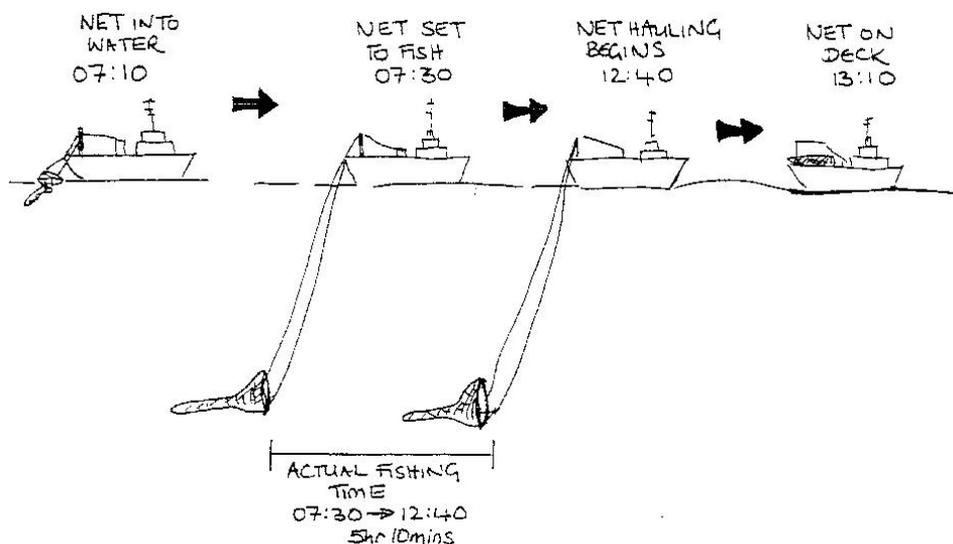


Figure 6-10 Diagram of fishing times. Figure from Davies and Lesch (1998).

Lat-Deg Record degrees of latitude (2-digits) for start and end of each haul.

Lat-Min Record the minutes of latitude (to hundredths of a minute; 4-digits)

Lat-N/S Record **N** for all latitudes North of the equator and **S** for latitudes south of the equator.

Long-Deg Record degrees of longitude (3-digits) for start and end of each haul.

Long- Min	Record the minutes of longitude (to hundredths of a minute; 4-digits)
Long- E/W	Record W for all longitude West of the prime meridian (e.g., 0°) and E for longitudes east of the prime meridian.
Depth (bottom)	Record the bottom depth to the nearest whole number (meters; Figure 6-11) at the start and end of each haul.
Depth (fishing)	Record the fishing depth (meters; Figure 6-11) at the start and end of each haul. Fishing depth should be less than or equal to bottom depth. For demersal gear, record fishing depth as bottom depth (to nearest whole number).

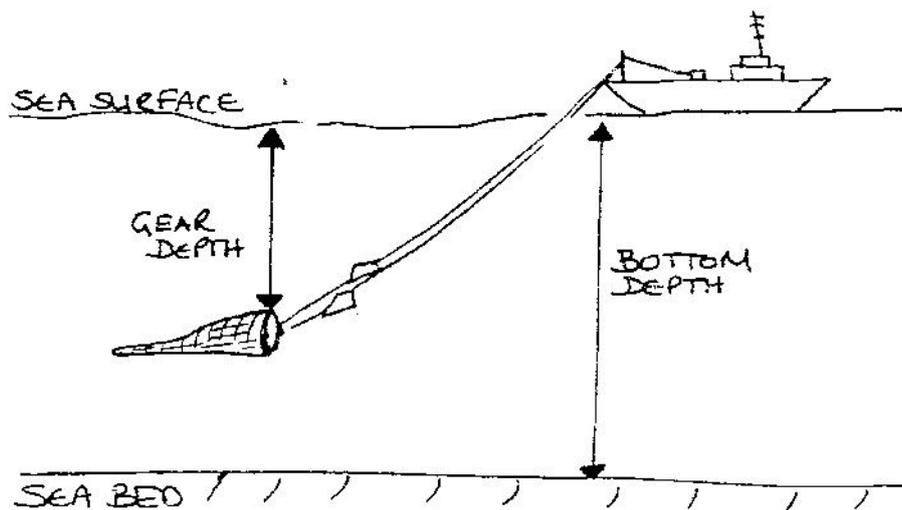


Figure 6-11 Diagram of gear and bottom depth. Figure from Davies and Lesch (1998).

V / O	Record O if the observer independently recorded time, position and depth information from the appropriate device. Record V if the information was obtained from a vessel's fishing log or the captain/crew.
Speed	Record the average towing speed (knots). Obtain from captain.
Retained Catch (mt)	Record the Retained catch estimate in metric tons. This may be an alternate to making a total catch estimate if you are not allowed access to the discarded catch for sampling. The method utilizes production information.
Total Catch Est. (mt)	Record the Total Catch Estimate in metric tons. See Section 6.6 for a more detailed explanation of catch estimation methods.
Method	Record code for the catch estimation method used: <ol style="list-style-type: none"> 1. Weigh entire catch 2. Weigh subsample and extrapolate to total count (basket, cartoon)

3. Volumetric estimate: bin or codend
4. Catch/effort ratio
5. Captain/Vessel estimate
6. Other method used. Document method in observer logbook.
10. Unable to obtain total catch estimate.

Trawl Effort / Total Catch

Page ____ of ____

Observer code		Vessel code		Trip ID																		
175		XYZ 3856		00275																		
Haul	Total nets	Gear Perf	Sampled?	Target	Substrate	Date/Time				Position				Depth, bottom (m)	Depth, fishing (m)	V/O	Speed (knots)	Retained catch (mt)	Total Catch Est. (mt)	Method		
						Day	Month	Year	Time (24-hr)	Lat-Deg	Lat-Min	Lat-N/S	Long-Deg								Long-Min	Long-E/W
0						Start	10	11	09	1110	8	29.0	N	13	14.0	W						
						End																
0						Start	11	11	09	1110	7	58.3	N	14	1.1	W						
						End																
1	1	1		F	S	Start	12	11	09	0010	7	34.1	N	14	14.0	W	30	29	O			
						End	12	11	09	0237	7	29.0	N	14	14.0	W	32	31	O	2.5	2.8	
2	1	1	x	F	S	Start	12	11	09	0315	7	29.0	N	14	14.0	W	34	33	O			
						End	12	11	09	0833	7	29.0	N	14	14.0	W	34	33	O	2.5	1.8	
3	1	1	x	F	M	Start	12	11	09	1005	7	29.0	N	14	14.0	W	37	36	O			
						End	13	11	09	1444	7	29.0	N	14	14.0	W	34	33	V	2.5		
0						Start	13	11	09	1200	7	0.0	N	14	14.0	W						
						End																
4	1	1	x	F	M	Start	13	11	09	2257	6	58.3	N	14	14.0	W	44	43	O			
						End	14	11	09	0140	6	58.4	N	14	14.0	W	50	49	V	2.5		
5	1	3	x	F	M	Start	14	11	09	0325	6	58.3	N	14	14.0	W	45	44	O			
						End	14	11	09	0635	6	58.6	N	14	14.0	W	44	43	O	2.5		
6	1	1		F	M	Start	14	11	09	1008	6	57.8	N	14	14.0	W	68	67	V			
						End	14	11	09	1320	6	58.3	N	14	14.0	W	65	64	V	2.5		
						Start																
						End																

Gear performance codes: 1. No problem 2. Door- and warp-related problems 3. Net not fishing (bogged, obstructed, bag untied, torn, etc) 4. Net lost 5. Other	Target: S – Shrimp F – Fish Substrate: M – Mud S – Sand R – Rocky C – Corals CM – Corals & mud CMS – Corals, mud & sand	Total Catch method: 1. Weigh entire catch 2. Weigh subsample & extrapolate to total count (basket, cartoon) 3. Volumetric estimate: Bin or codend 4. Catch / effort ratio 5. Captain / Vessel estimate 9. Other 10. Unable to obtain Total Catch estimate
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Figure 6-12 Example Trawl Effort / Total Catch form.

6.6 Total Catch Estimation

6.6.1 Methods of Total Catch Weight Estimation on Trawl Vessels

NOTE: This section is written assuming a basket weight of ~25kg. If actual basket weights are different, you will need to modify the basket numbers discussed below accordingly.

The method employed to estimate total catch on finfish and shrimp trawl vessels depends on total catch size. There are five options:

1. Weigh entire catch (small catch, ~400 kg, <16 baskets) before or after sorting. This will be a common method for shrimp trawl where total catch will equal retained plus discard weight;
2. Weigh subsample of catch, tally total baskets (cartoons or other container) and extrapolate to total catch using average basket weight (moderate catch, ~400-750kg, 16-30 baskets). For large shrimp catches, you may use this method for estimating total discard weight;
3. Volumetric estimate: Bin or codend (large catch and unable to fill baskets and tally);

4. Catch/effort ratio – At times you will be unable to be on deck when a net comes on board. Use the ratio of catch and effort from similar hauls to estimate total catch.
5. Captain/vessel estimate – this is the least desirable method.
6. Other – if you use a method other than 1-5 above, contact the observer program with details on method. Document the method in the Observer Logbook.

Each option is discussed in more detail below and follows the numbered steps in the flow chart for total catch estimation (Figure 6-13). When the observer is not on deck (e.g., you may be asleep), there are two choices for estimating total catch.

1. Have similar tows been made? ‘Similar’ can be defined as having the same depth strata in the same area and similar retained composition.

1A. If yes, calculate a catch/effort ratio using the following formula.

$(\Sigma \text{ Total weight of similar hauls} / \Sigma \text{ Haul duration of similar hauls}) * \text{Haul duration of unknown haul} = \text{Estimated weight of unknown haul}$

For example, given the following haul info and assuming haul 4 is ‘similar’ to hauls 1-3:

<i>Haul</i>	<i>Total weight</i>	<i>Start time</i>	<i>End time</i>	<i>Haul duration</i>
1	1.32	0025	0340	195
2	2.35	0400	0812	252
3	1.89	0842	1205	203
4	X	1228	1545	197

*Then X = ((1.32+2.35+1.89)/(195+252+203)) * 197*

*X = (5.56/650) * 197 = 0.008554 * 197 = 1.685108 ≈ 1.69 MT*

1B. If no, use the captain’s estimate of total catch and document why this method was used in the Observer Logbook (e.g., used captain’s estimate for the first 3 tows made during this trip).

When the observer is on deck, there are three choices for estimating total catch. Depending on the situation (i.e., sorting retained from discards may occur first), you may need to combine one or more of the methods described below.

2. Determine approximate size of catch and categorize into one of the three options. This is a rough estimate of how many 25-kg baskets the total catch will fill.

2A. **Method #1:** Catch is small (<400 kg or < 16 baskets) - weigh entire catch. Catch may be sorted in advance or sorted after weighing.

- i. Shovel all catch into baskets.
- ii. Weigh each basket and record weights.
- iii. Sum all weights & record total weight estimate on Trawl Effort / Total Catch form. Record all weights and calculations in the Observer Logbook. Go to #3 on flowchart.

2B. **Method #2:** Catch is moderate size (400-750kg or 16-30 baskets).

Steps if catch is not sorted:

- i. Shovel unsorted catch into baskets. Fill each basket to approximately the same height.
- ii. Weigh 10 baskets and record weights. Count remaining baskets.
- iii. Calculate average weight from weighed baskets (i.e., sum all weights/total # baskets weighed). Multiply the total count of baskets by the average weight & record total weight estimate on Trawl Effort / Total Catch form. Record all calculations in the observer logbook. Go to #3 on flowchart.

Steps if catch is sorted:

- i. Monitor retained catch as it is being put into pans prior to freezing. Keep counts separated by species or lowest taxonomic group possible (this will be useful if you are sampling for catch composition).
- ii. Weigh (or monitor the weighing of) 10 pans and record weights. If there are multiple pan sizes, weigh at least 10 pans for each pan type.
- iii. Calculate average weight from weighed pans (i.e., sum all weights/total # pans weighed). Multiply the total count of pans by the average weight. Save this number until step vi. Record all calculations in the observer logbook.
- iv. Shovel discards into baskets. Fill each basket to approximately the same height.
- v. Weigh 10 baskets and record weights. Count remaining baskets.
- vi. Calculate average weight from weighed baskets (i.e., sum all weights/total # baskets weighed). Multiply the total count of baskets by the average weight to calculate total weight of discards. Add total retained (step iii) and total discard weights & record total weight estimate on Trawl Effort / Total Catch form. Record all calculations in the observer logbook. Go to #3 on flowchart

2C. **Method #3:** Catch is large (>750 kg or >30 baskets). Volumetric estimate may be most appropriate (more details on volumetric estimation in section 6.6.1.1). Multiply total volume by density. Go to #3.

3. Are you taking a catch composition sample for this haul?

3A. If no, this haul is complete.

3B. If yes, go to #4 on flowchart (see Catch Composition section - Figure 6-18).

Potential issues to be aware of when estimating total catch and sampling catch composition (Pauly 1984):

- Dangerous or other 'protected species' may be removed prior to sorting. Record number, species, estimated weight and any other relevant information. If a sea turtle is caught, you may need to quickly collect your catch composition sample (set aside), process the turtle and then process the catch composition sample.
- Inorganic debris & plant material may be removed prior to total catch estimate. Record the type and weight of material removed.
- Large fish may be removed by crew prior to making total catch estimate. Try to identify, count how many were removed and estimate weight. Remember to include this weight in

total weight estimate and on catch composition form as sample type ‘1’ for Whole haul sampling or sample type “8” for ‘Other’ when you are unsure if you saw all of a given species/group in the sample.

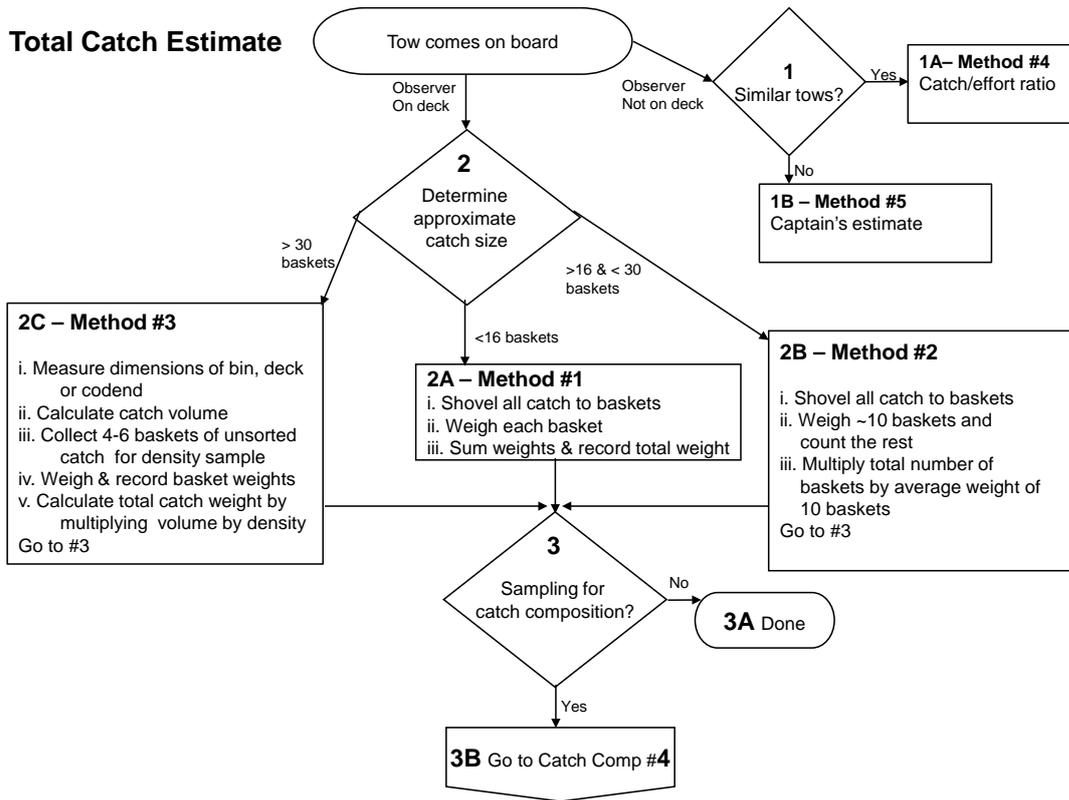


Figure 6-13 Flow chart of total catch estimation procedure.

6.6.1.1 Bin Volumes

Total catch is estimated by bin volume when all of the catch is dumped into one or more measurable areas on the deck or within holding bins (tanks) below deck. Volumes are calculated using the measurements (length, width, and height) of those bins. Multiply bin volume by density (Section 6.6.1.3) to calculate total weight estimate. Bin volumes become problematic when the bin is full of water.

Steps and tips for calculating bin volumes:

- **Determine the appropriate volume formula for each area of the bins and/or trawl alley.** Many bins and trawl alleys will be rectangular (Figure 6-14); however, some will have odd shaped areas (Figure 6-15). Common formulas are listed in Appendix 10.
- **Measure the area of the empty bins and trawl alley in meters.** It is easiest to measure the area of the bins and trawl alley prior to leaving the dock. If the bins and trawl alley have easily definable sections, measure them independently. Often, a catch only fills up a portion of the total area. **Draw the trawl alley and bins in the Observer Logbook and document the measurements of each area.** From these measurements, the total area of the bin will be available.

- **Measure the height of the catch in the bin in meters.** The height of the fish in the bin provides the final dimension needed to obtain the volume of the catch. Height is measured by placing a calibrated stick into the bin to measure the depth of fish at one or several points. If the height of fish varies throughout the bin, multiple height measurements should be taken and an average height calculated:

$$\text{Average Height} = (\text{Height A} + \text{Height B} + \text{Height C} \dots) / \# \text{ height measurements}$$

- **Calculate and record catch volume.** Record measurements on your deck sheet. Make sure that all of the measurements are as precise as possible. Calculations will be recorded in the Observer Logbook. To obtain volume of the catch:

$$\text{Volume of catch} = \text{total area of bin} * \text{average height}$$

- **Calculate total catch estimate.** Multiply the volume by the density to calculate the Total catch weight estimate:

$$\text{Total weight estimate} = \text{volume of catch} * \text{density}$$

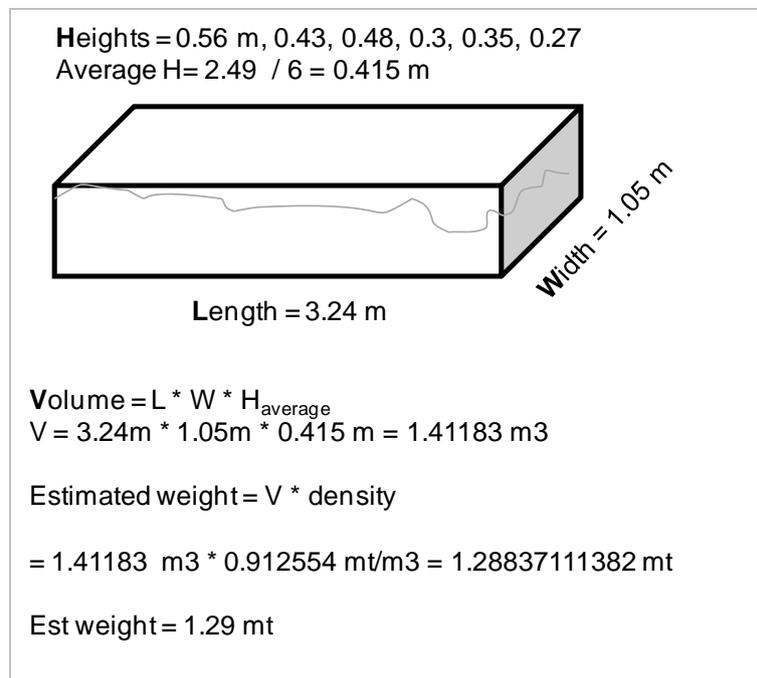


Figure 6-14 Bin volume calculation using six heights – light grey line is approximate height of fish in bin.

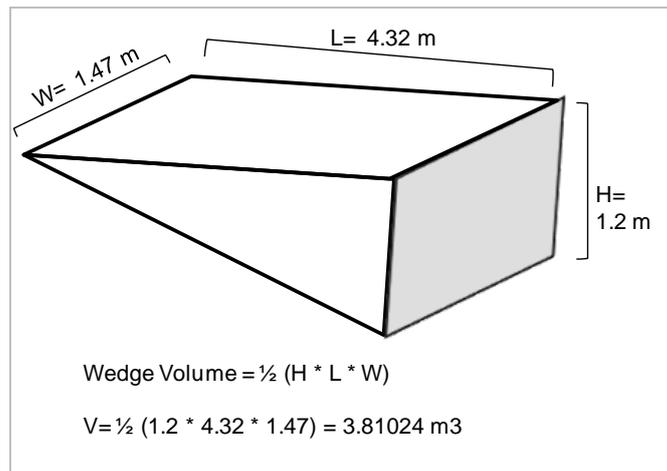


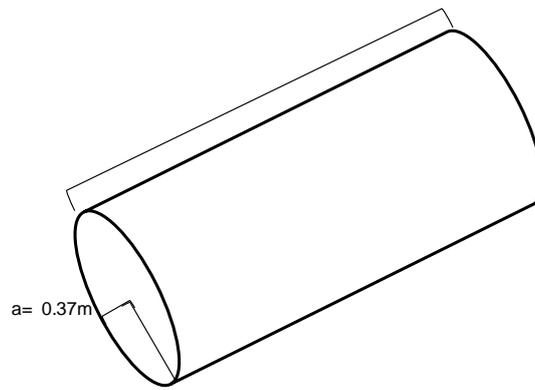
Figure 6-15 Volume calculation example for wedge volume.

6.6.1.2 Codend Volume

Similar to bin volume, codend measurements (length, width, and height) are made to calculate a volume of the codend. Codend volume is sometimes more difficult to calculate due to very complex shapes. Multiply volume by density to calculate total weight estimate.

When measuring a codend, always remember that safety is the first concern. Nets can slide and roll. Be careful not to get caught between the net and the trawl alley bin boards. Ask crew members for assistance; their help will make the task easier and safer. Follow the steps below to take an accurate codend measurement.

- **Determine the appropriate geometric shape(s) and decide on the appropriate formula(s) to use.** Using the formula, determine which dimensions will be measured in order to obtain a volume. Refer to Appendix 10 for the formulas required to calculate the various volumetric shapes.
- **Measure the various dimensions of the codend using actual measurements and/or reference points.** Take height and width measurements from several segments to obtain an average height and width for the net. It may be necessary to acquire a long stick, or a similar item, and mark it for use as a height gauge. When sighting across the net for a height, the observer's eyes should be level with the top of the net.
- **On the deck sheet, record the method and dimensions. In the Observer Logbook, record the formulas and calculations used in obtaining the volumetric estimate.** Most measurable codends require the use of the ellipsoidal formula (Figure 6-16).



Ellipsoidal Solid
 $V = \pi * \text{short radius} * \text{long radius} * \text{length}$
 $V = \pi * a * b * L$
 $V = \pi * .37 \text{ m} * 1.53 \text{ m} * 4.2 \text{ m}$
 $V = 7.469513 \text{ m}^3$

Figure 6-16 Volume calculation for ellipsoidal solid. Pi (π) is a mathematical constant = 3.14159.

- **Calculate total catch estimate.** Multiply the volume by the density to calculate the Total catch weight estimate:

Total weight estimate = volume of catch * density

Measuring Large Codends

Occasionally, a full codend is larger than the trawl deck and must be brought on board and emptied in several sections. To determine the codend volume in this situation, measure the codend sections as they are brought on-board. Use the reinforcing cables, or “expansion straps”, around the circumference to divide the codend into sections. Determine a volume for each segment of the net measured and add them together for a total volume of the codend. **Do not** apply a predetermined or constant volume to the number of codend segments to calculate the total catch estimate.

6.6.1.3 Density sampling

The density of fish can be calculated using a small container/sampling basket. Density is calculated by dividing the basket weight by the volume of the fish in the basket. If more than one basket is collected for a density sample (highly recommended for larger catches), divide the sum of basket weights by the sum of basket volumes to calculate density. If you use the same basket type, you will save time by filling to the same height so that the basket volume is standardized. Then all you need to do is collect the weights (Figure 6-17).

Density = Weight (mt) / volume (m³) = Σ basket weights / Σ basket volumes



Basket weights (with handle): 24.3 kg, 22.9 kg, 22.7 kg

Basket volume =

$$V = 0.41 \times 0.26 \times$$

$$V = 0.023452 \text{ m}^3$$

Density (ρ) = $\frac{m}{V}$

$$\rho = \frac{.1346 \text{ mt}}{(0.023452 \text{ m}^3 \times 6)}$$

$$\rho = \frac{.1346 \text{ mt}}{(0.140712 \text{ m}^3)}$$

$$\rho = 0.95656376 \text{ mt/m}^3$$

Types of crew sorting on trawl vessels:

1. Crew sorts retained into bins or baskets while leaving discard on deck.
2. Crew sorts out a scupper-retained fish are taken out of the flow of fish while discards are flushed directly off the vessel.
3. Crew sorts retained into bins or baskets and tosses or scoops discard overboard.
4. Crew presorts certain species.
5. Crew sorts from chute that discards

Figure 6-17 Density calculation example.

6.7 Catch Composition Sampling

6.7.1 Diversity of Fleet and Effects on Sampling

Sampling protocols are fairly consistent for all trawl vessels. However, there are a number of vessel characteristics that influence catch sampling:

Vessel size – The size and layout of a vessel can be a limiting factor when sampling. A vessel with a small deck may not have enough deck space to hold all discards.

Trawl vessels range from 15 to 100 meters

Therefore, the vessel may sort the discard directly out a scupper, over the side or down the stern ramp. On small vessels, observers may not have a designated sample area or a sample area with much space.

Duration of tow – Tow duration can vary greatly. If a vessel is making long tows, over 3 hours, observers will have plenty of time to sort and weigh samples. Observers on vessels that haul every hour have a limited amount of time to complete sampling duties.

Tow duration ranges from 3 to 5 hours for shrimp & 1 to 6 hours for finfish.

Size of total catch – Vessel size and size of total catch are related. Problems are created when a small vessel has a large tow because there is very little room for the work up of samples. It can also create a dangerous working environment.

Total catch ranges from 200 to 800 kg for shrimp and from 500 to 5000 kg for finfish.

Composition of tows – Most tows encountered will have a large diversity of species. This is not necessarily a problem for experienced observers that are able to identify species easily. However, the species composition of the tow will affect the sample size. If the vessel has a codend full of tiny juvenile fish, it may be necessary to reduce the sample size.

Trawl tows can have as few as 20 to >50 species.

Sorting technique of crew – Each vessel will have a unique sorting method. Talk with the crew prior to the first haul to discuss how they sort and the best way to collect the samples.

All of the factors above are interrelated and how the combinations of these factors affect sampling options needs to be considered.

Once your sample is in hand, follow the steps below (and Figure 6-18) to process the catch composition sample (This list continues from steps listed under Total Catch Estimation methods):

4. Was total catch estimated using 2A/2B or 2C?

4A. If 2A/2B and unsorted,

- i. Randomly select 1-2 baskets.
- ii. Sort the species composition sample into smaller baskets by species or species group. Go to #5

4B. If 2A/2B and sorted,

- i. Set aside all retained catch. The crew may have put the retained in pans. You should have a count of pans per species (or higher taxonomic group).
- ii. Count the individuals in 1-2 pans (depending on the species) in order to calculate an average count per pan of retained catch.
- ii. Randomly select 1-2 baskets of discards for species composition of discards.
- iii. Sort the species composition sample into smaller baskets by species or species group. Go to #5.

4C. If 2C & have unsorted sample,

- i. Select a minimum of 4 unsorted baskets for a density sample;
- ii. Select all or part of the density sample for species composition sample;
- iii. Sort the species composition sample into smaller baskets by species or species group. Go to #5.

5. Is this a species on the length collection list? It's a good idea to process the target species first so that you are not delaying the crew.

5A. Yes

- i. Count and weigh each species.
- ii. Estimate the proportion retained for each spp.
- iii. Randomly collect fish and determine gender & measure lengths. Priority species will vary among countries.
- iv. Return target species to crew for processing & discard non-retained species. Go to #6

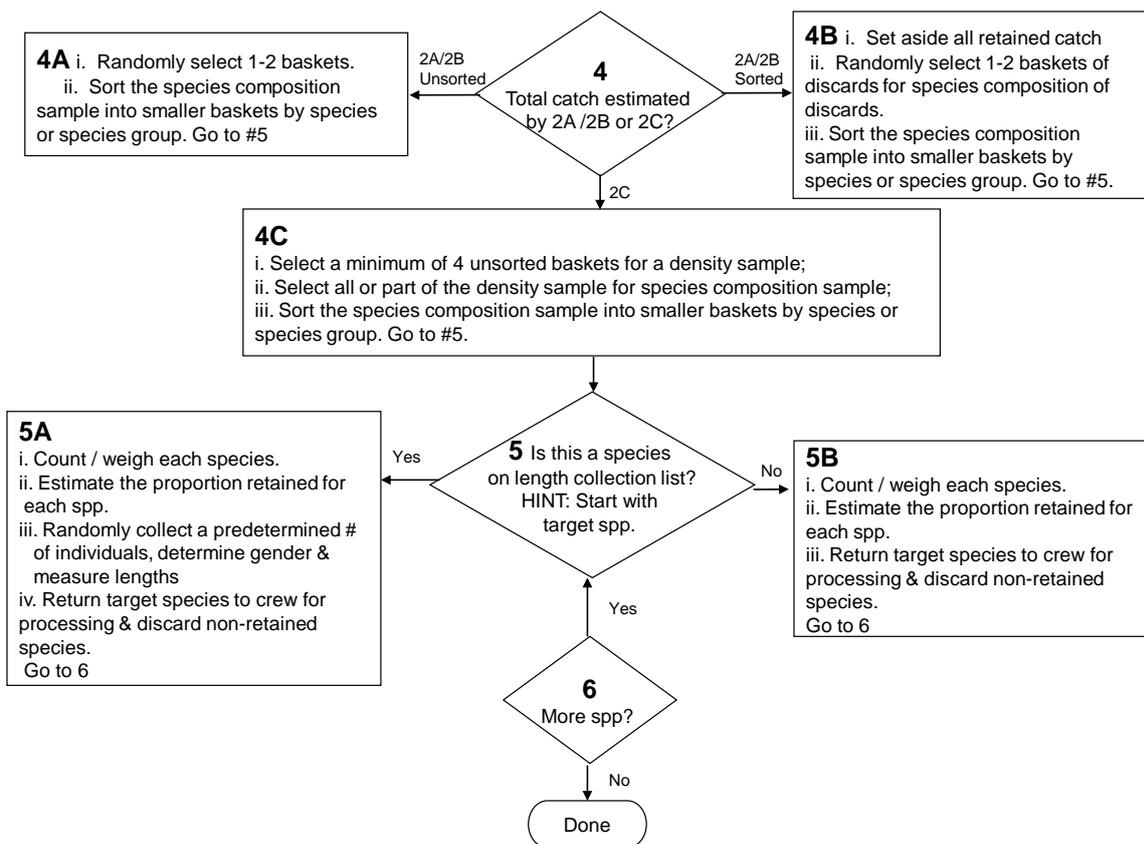
5B No

- i. Count and weigh each species.
- ii. Estimate the proportion retained for each spp.
- iii. Return target species to crew for processing & discard non-retained species. Go to #6

6. Do you have more species left to sample?

6A Yes, return to #5

6B No, DONE!



Species Composition

Figure 6-18 Flow chart of species composition sampling procedure.

Helpful hints:

- Remember to include any items or specimen removed prior to taking the catch composition sample on the catch composition form as sample type '1'.
- If the vessel is changing nets throughout a trip, it may be helpful to mark nets for easy identification
- If nets are normally mixed, establish a plan for separating catch from each net early in the trip. You may be able to work with the crew to keep the hauls separated.

6.7.2 Haul Selection

Depending on the number of hauls made per day, it may be physically impossible to sample all hauls. Therefore, random sample tables (RST) have been developed so that hauls are selected at random. There are two RSTs set up for different situations (Table 6-1). RST#1 is set up to sample 2 or 3 hauls in a row followed by one 'off' or unsampled haul. The haul sampling rate for RST#1 is ~70-72%. RST#2 is set up to sample 2 to 4 hauls in a row with one or two 'off' or unsampled hauls between. The haul sampling rate for RST#2 is ~65-70%.

Catch composition is recorded on the generic Catch Composition form described in Chapter 5.

Table 6-1 Guidelines for choosing a Random Sample Table

Hauls/day	Random sample table
1-2	None – Sample all hauls
3-4	RST#1
5+	RST#2

6.8 *Biological Data*

If assigned length collection, follow protocol provided at that time.

7 Trawl – Shrimp

7.1 Learning objectives

- Describe the difference between a pair trawl and a twin trawl
- Describe two methods to estimate total catch.
- List the 3 forms that are specific to shrimp trawlers
- Explain why BRDs are used.

7.2 Introduction

Shrimp trawling is one of the most important fisheries in the Gulf of Guinea system. However, tropical shrimp trawling accounts for about 27% (1.9 million tonnes) of all global discards with an average discard rate of 62.3% (Kelleher 2005). Shrimp trawling is generally regarded as one of the least selective fishing methods not only because of the quantity of discard but also the wide diversity of species caught. In addition, several nationally and internationally protected species occur in global shrimp trawl bycatch including sea turtles, sharks, dugongs, sea snakes, sea horses, coral and some fish species (Eayrs 2007).

Observer data will be used to determine the status of shrimp stocks by complementing survey data, assess the impact of juvenile fish catch on the finfish stocks and determine the extent of sea turtle bycatch in Eastern Atlantic waters.

7.3 List of Priorities

1. Collect information on fishing effort
2. Randomly sample catch for catch composition
3. Record gear characteristics
4. Collect length-frequency data on target and non-target catch

7.4 Gear description

Industrial shrimp trawl vessels employ a variety of otter trawl configurations (Vendeville 1990; Figure 7-1). Some vessels tow one or two nets from the stern (Figure 7-1A-B) whereas most shrimp vessels in West Africa tow either two or four nets simultaneously at the extremities of two outriggers (Figure 7-1C-D). Occasionally, these vessels may tow a smaller, separate net (or try net) which is towed to test for shrimp concentrations or to determine other fishing conditions. You may also observe pair trawl operations (two vessels towing one net; Figure 7-2).

Net configurations are also variable but in general a warp (cable) is connected to a bridle attached to two doors (or otter boards). The net is connected to the doors by two lines – the bottom and top leg lines (Figure 7-3). The net has three main sections: wings, body and codend. The codend lies at end of the net and is where the catch accumulates. Some nets have a fourth extension section that extends the overall length of the trawl.

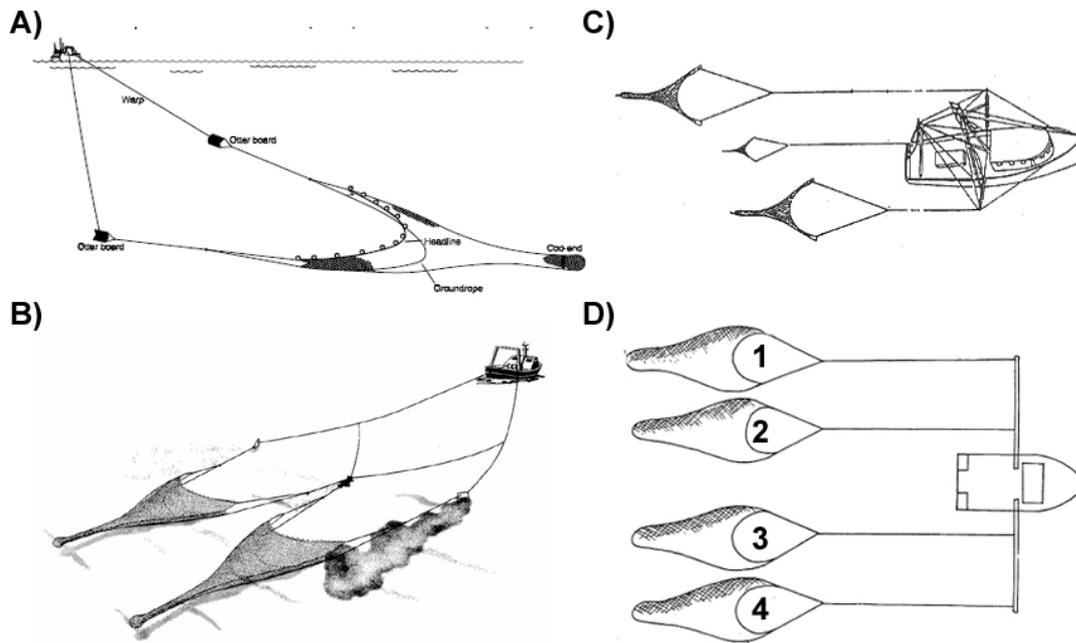


Figure 7-1 Shrimp trawler net configurations: A) stern trawler with single net, B) stern trawler with twin trawl, C) outrigger trawler with two single nets and a try net, D) outrigger trawler with twin trawl. Images modified from FAO (2001b), Lokkeborg (2005) and <http://www.crimond.com>.

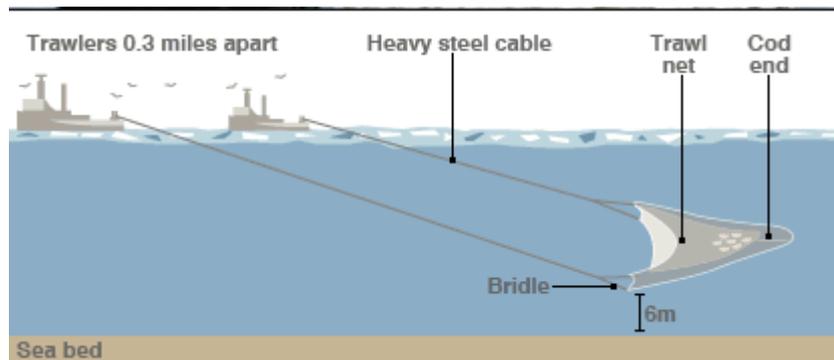


Figure 7-2 Pair trawl – one net pulled by two vessels. Image from http://news.bbc.co.uk/2/low/uk_news/7097257.stm.

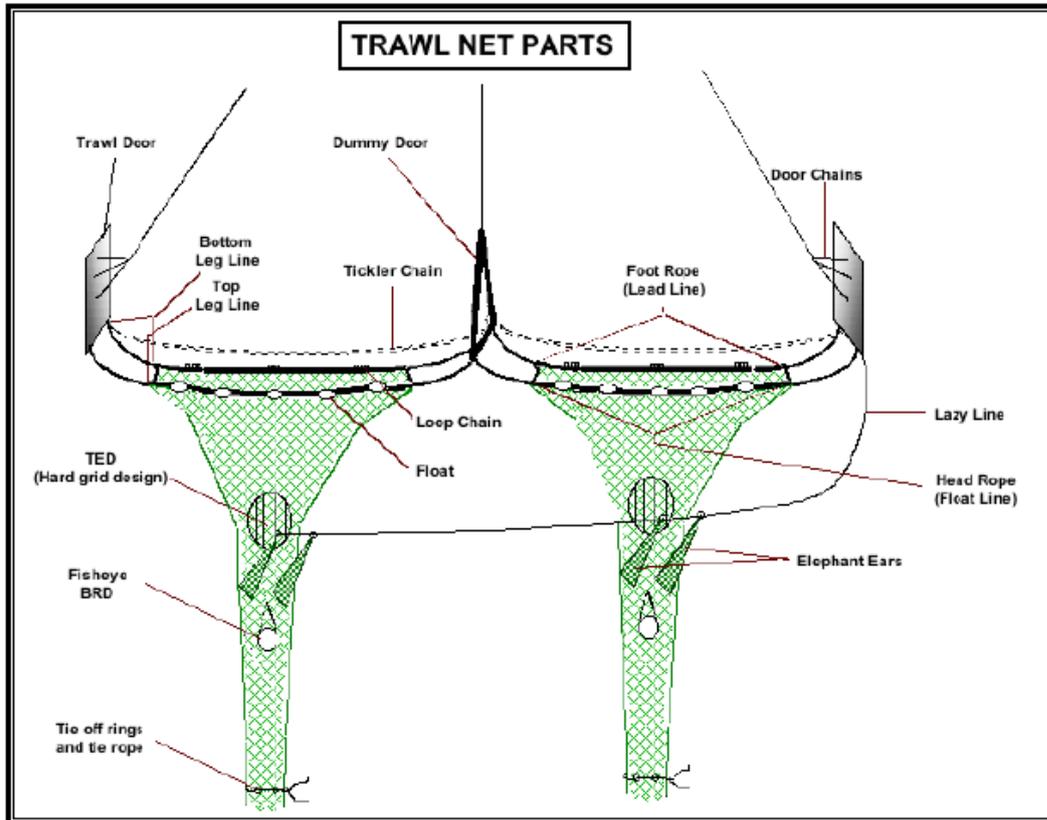


Figure 7-3 Generalized shrimp net diagram modified from NMFS (2008b). For locations of wing, body, extension, and codend see Figure 6-3.

Bycatch reduction devices (BRDs) include a variety of gear modifications for reducing the catch of unwanted juvenile fish or other species. BRDs may also be called a trash fish or junk fish excluder (JTED) device. **Trawl or turtle excluder devices (TEDs)** are specific BRDs designed to minimize turtle and other large species catch. BRDs are categorized by how they function. They either separate the catch by size or exploit behavioural differences of certain species to exclude them from the catch. Figure 7-4 and Figure 7-5 illustrate a few types of BRDs and TEDs, respectively. Some countries (namely the U.S.) have TED requirements for shrimp catch destined for import.

Shrimp are typically packaged in units of number of individuals per kilogram (or pound). They can be packaged with the head on or off, peeled or unpeeled, cooked or uncooked or any combination these. If shrimp are frozen at sea, you may hear the term glazing (a protective coating of ice on a frozen product that prevents dehydration). Sometimes the glazing contains preservatives. For market, shrimp are also classified by color including white, brown, pink, red, tiger (striped) and other categories.

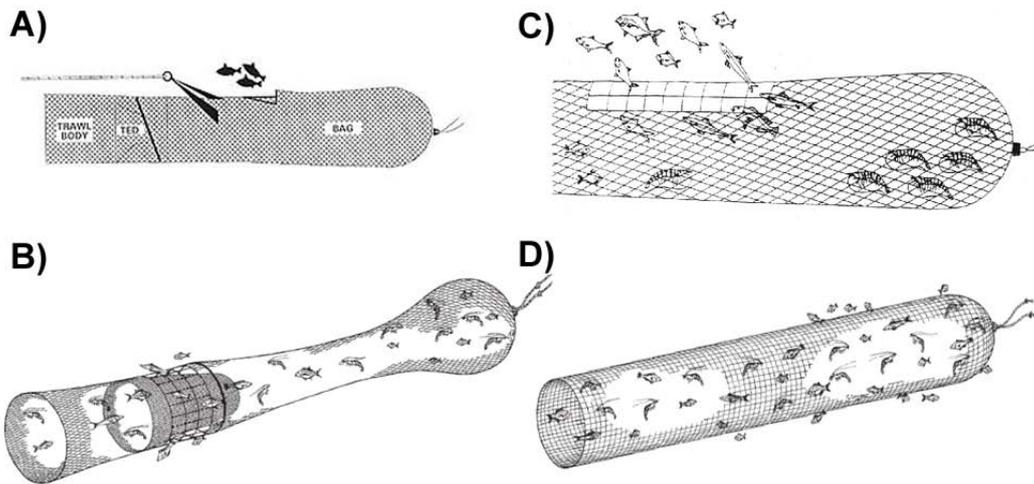


Figure 7-4 Examples of BRDs: A) Fish eye, B) Radial escape section, C) Square mesh window and D) Square mesh codend. Drawings modified from Crespi and Prado (2002-2009) and Eayrs (2007).

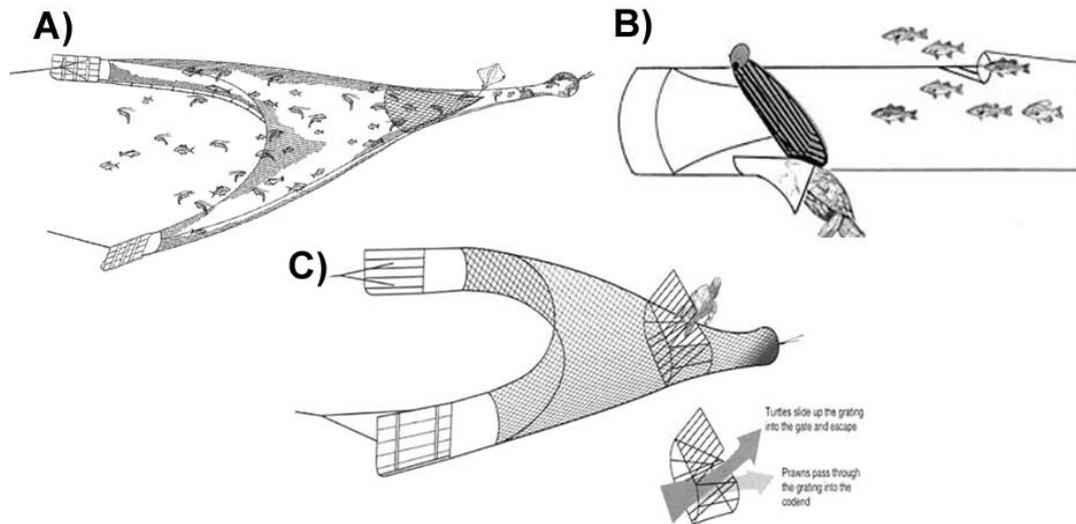


Figure 7-5 Examples of TEDs: A) Soft TED, top release, B) Hard TED, bottom release and C) Hard TED, top release. Drawings modified from <http://www.arbec.com.my/sea-turtles/art34julysept01.htm>, <http://www.seagrantfish.lsu.edu/management/TEDs&BRDs/index.htm> and Eayrs (2007).

7.5 Forms/Instructions

7.5.1 Gear Description – Shrimp Trawl

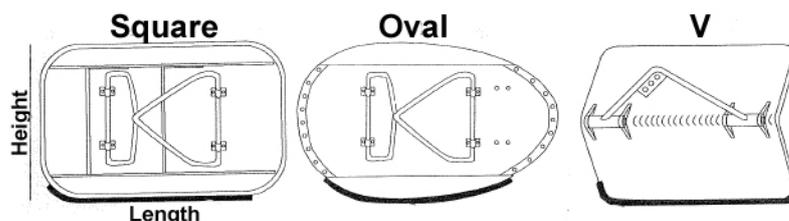
Complete one form for each unique net configuration (including try net). If possible, complete before departure. Total number of pages equals total number of different nets. Example shown in Figure 7-7.

Field	Definition
Observer Code:	Record your observer program identification code.
Vessel Code:	Record the vessel code (Appendix 3). If your vessel is not on this list, contact the SOP immediately.

Trip ID	Enter the trip identification number assigned by the program.
Total # nets	Record the total number of nets fished (including try net).
Vessel configuration	Check whether vessel is rigged with outriggers. Leave blank if outriggers are absent.
Net # / position	Check the appropriate box (boxes) for the position of the net you are describing (1 to 4 as illustrated in Figure 7-1D) or “try” for try net specifications. If any or all of the nets are identical, you should check multiple positions. Net position 1 denotes the outside port net and number 4 denotes the outside starboard net on a quad-rigged vessel (i.e., 4 nets). On a two-net vessel, the port net is number 2 and starboard is number 3. Note the location of the try net relative to main nets (e.g., in front of net #3 or off stern between nets 2 & 3).
Net manufacturer / design name	Ask the captain for the name of the net manufacturer and model or design name if available. If vessel makes its own nets, write “vessel” and if unknown, write in “unknown”.

Doors – Main & Dummy – The main doors are also referred to otter boards. The dummy door, or sledge, is used as a center door during twin trawl operations. If the vessel is fishing only 1 net or individual nets on each side, leave dummy door section blank.

Material	Circle the construction material for both door types.
Length & height	Record the length and height of both door types in meters.



Drawing modified from Hanrahan et al. (1997)

Weight	Record the door weight in kilograms (from Captain).
Type	Circle square, oval, V or other.

For each of the following components, record the length (meters), diameter (millimeters), material (e.g., steel for leg lines and poly, Spectra, or nylon for head/foot ropes) and other information as necessary. For the various types of chain, record overall length (meters), diameter (mm; diagram below) and material.



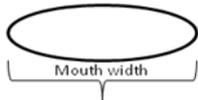
Chain link diameter (Image from <http://www.mcmaster.com>).

Warp	Warp (or main cable) connects the vessel to the trawl doors.
Bridle (door chain)	The bridle connects the doors to the warps (main cables to vessel).
Top leg line	On the main door, the top leg line length is measured from the point of cable attachment at the door to the attachment point on the top of the net.
Bottom leg line	On the main door, the bottom leg line length is measured from the point of cable attachment at the door to the attachment point on the bottom of the net.
Top & bottom leg line - dummy	Complete for vessels towing a twin trawl (e.g. two main doors plus a middle dummy door; Figure 7-1B).
Head rope	Also known as float line, float rope. Record number of floats or kites attached to head rope and describe in 'Other' column.
Foot rope	Also known as lead line.
Tickler chain & loop chains	The tickler chain is a continuous piece of chain attached in front of the foot rope whereas loop chains are smaller sections or strands of chain attached to the footrope. Their function is to dislodge shrimp from the bottom and into the net. Record a total weight for the tickler chain and a weight and count of the loop chains.

Net Characteristics Section

Most of the net specification will need to be obtained from the captain. Specifications indicated with a dagger (†) should be measured by the observer.

Total length	Record the total net length in meters. You will likely need to ask the captain.
Mouth width	Record the mouth width in meters.



Mouth height Record the mouth height in meters.



Record the material type (e.g., nylon, poly, sapphire, or spectra), line or twine diameter (mm), mesh opening (cm; stretched mesh opening measured from inner knot to inner knot; Figure 6-6), indicate if mesh opening measurement was made when the gear was wet (W) or dry (D). *Optional*: count the number of meshes on the long or horizontal axis and the number of meshes around the net (vertical axis).

Wing Sections of netting at the foremost part of the net which define the outer perimeter of the trawl opening. The wings maintain the shape of the trawl and herd fish into the net opening.

Trawl body May be referred to as square and belly. If this section tapers, record the range of mesh sizes.

Extension The extension, or lengthening piece, is a section between the body and the codend and is used to extend the overall length of the trawl. If extension isn't present, leave fields blank.

***Codend** The codend (bag or sack) is the section that collects the fish. Circle the diamond or square symbol for how the codend mesh is hung relative to the selvedge line (Figure 6-7).

†Codend mesh opening should be measured independently using the wedge gauge issued. Push wedge into stretched mesh opening and apply consistent force (~5kg). Measure 10 meshes and record in the comments field. Calculate the average mesh opening size and record on the form.

Other Record any other types of mesh sections not already recorded (e.g., codend liners).

Other rigging present. Check each additional rigging component that is present on the net.

Elephant ears are sewn to the end of the net in order to evenly distribute the lifted weight.

Lazy line used to lift and maneuver the net and is attached to the elephant ears.

Chaffing gear can be pieces of line or extra webbing attached to the codend to protect it from damage.

Add any other gear and make detailed comments in the comments field at the end of the form.

Comments Record any additional comments or make drawings about the gear here.

Bycatch Reduction Device (BRD)

If there is no BRD, leave this section blank.

Type Check box for BRD type. Fisheye, Radial escape section, Square-mesh window, Square-mesh codend, or other (specify in space provided).

Funnel Check Yes or No for the presence of a herding funnel/cone.

Distance from escape opening to headrope Measure in meters.

Distance from escape opening to tie off rings Measure in meters.

Fisheye

Offset Number of meshes offset from top center. If located at top, enter "0"

Opening height & width Measure in cm

Shape Check appropriate opening shape: oval, diamond, square, halfmoon, rectangle, triangle, or specify if other.

Radial escape section

Opening width, height, length Measure applicable dimensions in cm

openings If the radial escape section isn't continuous around the codend, record the number of openings.

Square mesh window

Opening width, height, length Measure applicable dimensions in cm

BRD notes/drawing Provide additional notes and draw a diagram.

Turtle Excluder Device (TED)

If there is no TED, leave this section blank.

- Name Record the common name of the TED design (e.g., Nordmore grid, Morrison). Ask captain. If unknown, write 'unknown'.
- Type Circle whether the TED is Hard or Soft. Hard TEDs are typically rigid and made of aluminum, steel or plastic. Soft TEDs use a non-rigid incline of mesh (Eayrs 2007).
- Opening Circle location for opening: Top or Bottom
- Funnel The guiding panel or funnel is located forward of the TED and is used to accelerate the catch through the TED and toward the codend. Circle Yes if present and No if absent
- Flap The escape cover or flap is an extension of mesh behind farthest part of TED opening. Circle Yes if present and No if absent
- Material Enter the material type used in TED construction (e.g., aluminum for hard TED or polypropylene mesh for a soft TED).
- Shape Circle whether grid shape is rectangular, oval or other (describe).
- Angle Use a protractor (angle finder) to obtain the angle (θ in Figure 7-6) of the TED (with respect to the plane of the net) while the nets are hanging freely. Typical angles range between 45-60°. If you are not issued a protractor, estimate the angle yourself and make a note that this is an estimate.

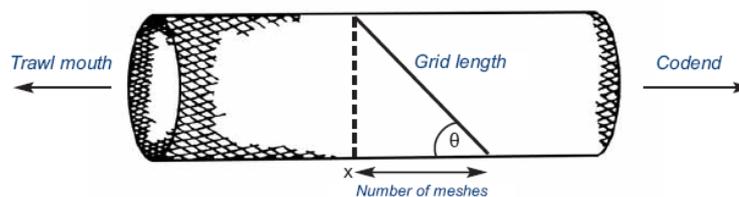


Figure 7-6 Grid angle diagram (Eayrs 2007).

- Design Circle whether bars are curved, straight or other (describe).
- Dimensions Enter the total length and width of the TED grid as well as bar spacing in centimeters.
- Distance from headrope Record the distance of TED from the headrope in meters.
- Floataion Record number of floats attached to TED and circle the material type and shape.

TED
notes/drawing

Provide additional notes and draw a diagram.

Photos?

Circle Y, if photos were taken. Remember to record in Observer Logbook (Photo Log) and to provide copies to your debriefer.

Gear Description - Shrimp Trawl

Observer code 175		Vessel code XYZ 3856		Trip ID 00275			
Total # nets: 4		Vessel configuration: <input checked="" type="checkbox"/> Outrigger <input type="checkbox"/> Stern trawler					
Net # / position (check one or more if nets are identical; see manual for position diagram)							
<input checked="" type="checkbox"/> Port - outside (1)		<input checked="" type="checkbox"/> Stbd - inside (3)		<input type="checkbox"/> Try net (5)			
<input checked="" type="checkbox"/> Port - inside (2)		<input checked="" type="checkbox"/> Stbd - outside (4)		Location:			
Net Manufacturer / design name: Africa Net Systems / Jumbo Shrimp Special							
Doors - Main			Doors - Dummy				
Material:	Aluminum / Steel / Wood		Material:	Aluminum / Steel / Wood			
Other:							
Length (m)	1.35	Width (m)	1	Length (m)	1.2		
Weight (kg)	300	Type	Square / Oval / Other	Weight (kg)	200		
		Type	Square / Oval / Other	Type	Square / Oval / Other		
	Length (m)	Diameter (mm)	Material	Other			
Bridle (door chain)							
Top leg line	1.5	5	Spectra				
Bottom leg line	1.5	5	Spectra				
Top leg line-dummy	1.5	5	Spectra				
Bottom leg line - dummy	1.5	5	Spectra				
Warp / Main wire	150	7	Stainless				
Head rope	4	8	Nylon	# floats: 5			
Foot rope	4	8	Nylon				
Tickler chain	4.1	3.5	Chain	Weight: 50			
Loop chain							
Net Characteristics							
Total length (m): 4.3		Mouth width: 1.8		Mouth height: 1.4			
	Material	Diameter (mm)	Mesh open (cm)	W / D	# meshes horiz	# meshes vert	Other
Wing	Poly	4	10	W	60	30	
Trawl body	Poly	3	5	W	80	40	
Extension	Poly	3	5	W	80	40	
Codend	Poly	2	3.5	W	120	70	⊙ / □
Other							
Other							
Other rigging present? Check all that apply.							
<input type="checkbox"/> Elephant ears		<input type="checkbox"/> Choke rings		<input checked="" type="checkbox"/> Lazy line		<input type="checkbox"/> Other:	
<input checked="" type="checkbox"/> Chafing gear						<input type="checkbox"/> Other:	
Comments:							

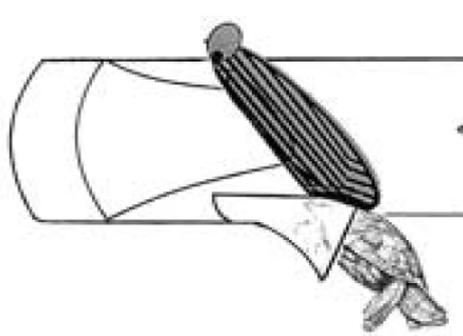
Bycatch Reduction Device (BRD)			
Type: <input type="checkbox"/> Fisheye <input type="checkbox"/> Square-mesh window <input type="checkbox"/> Other: <input type="checkbox"/> Radial escape section <input type="checkbox"/> Square-mesh codend			
Funnel <input type="checkbox"/> Yes <input type="checkbox"/> No		Distance of escape opening from headrope: <input type="text"/> m Distance of escape opening from tie off rings: <input type="text"/> m	
Fisheye Offset <input type="text"/> <input type="text"/> Opening (cm) Width <input type="text"/> Height <input type="text"/> Shape <input type="checkbox"/> Oval <input type="checkbox"/> Diamond <input type="checkbox"/> Square <input type="checkbox"/> Halfmoon <input type="checkbox"/> Rectangle <input type="checkbox"/> Triangle <input type="checkbox"/> Other:		Radial escape section Opening (cm) Width <input type="text"/> Height <input type="text"/> Length <input type="text"/> If not all the way around, #openings <input type="text"/>	
		Square-mesh window Opening (cm) Width <input type="text"/> Height <input type="text"/>	
BRD notes/drawing			
Turtle Excluder Device (TED)			
Name: <i>Unknown</i>		Type: <input checked="" type="radio"/> Hard / <input type="radio"/> Soft	
Opening: Top / <input checked="" type="radio"/> Bottom	Funnel <input checked="" type="radio"/> Yes / <input type="radio"/> No	Flap <input checked="" type="radio"/> Yes / <input type="radio"/> No	
Material: <i>Hard PVC Pipe</i>		Shape Rectangle / <input checked="" type="radio"/> Oval / Other:	
Angle (°): <i>Est. 35</i>	Design: Curved bar / Straight bar / Other: <i>Mostly straight w/curve at bottom</i>		
Dimensions		Distance of TED from headrope: <input type="text"/> <i>1.5</i> m	
Length: <i>150</i> cm	# TED Floats: <i>5</i>		
Width: <i>125</i> cm	Float material Sponge / Foam / <input checked="" type="radio"/> Plastic / Other:		
Bar Spacing: <i>8</i> cm	Float shape Round / Cylinder / <input checked="" type="radio"/> Bullet / Ellipsoid		
TED notes/drawing			
			
Photos? <input checked="" type="radio"/> Yes <input type="radio"/> No			
Version 1.2 6/2011			

Figure 7-7 Example Gear Description form for Shrimp Trawl.

7.5.2 Trawl Effort / Total Catch Form

This form is the same for finfish and shrimp trawl. Refer to Section 6.5.2 (page 6-14) for detailed instructions.

7.6 Catch Composition Sampling

Depending on the number of hauls made per day, it may be physically impossible to sample all hauls. Therefore, random sample tables (RST) have been developed so that hauls are selected at random. There are two RSTs set up for different situations (Table 6-1). RST#1 is set up to sample 2 or 3 hauls in a row followed by one 'off' or unsampled haul. The haul sampling rate for RST#1 is ~70-72%. RST#2 is set up to sample 2 to 4 hauls in a row with one or two 'off' or unsampled hauls between. The haul sampling rate for RST#2 is ~65-70%.

Once a haul is selected for sampling, follow steps in Section 6.7 and Figure 6-18. Catch composition is recorded on the generic Catch Composition form described in Chapter 5.

7.7 Biological Data

If assigned length collection, follow protocol provided at that time.

8 Demersal and Semi-Pelagic Longline

8.1 Learning objectives

- Describe 4 components of demersal longline gear
- List the 2 forms that must be completed that are specific to demersal longline vessels
- List 3 pieces of information that must be collected from each organism

8.2 Introduction

Longline gear is one form of hook and line gear that uses baited hooks to attract and catch fish. Demersal longlines (also known as bottom, set or anchored longlines) are similar to pelagic longlines except the gear typically fishes on or near the bottom (Figure 8-1) and targets bottom-dwelling fish such as the gadoids (cod, hake) and some shark species. You may also encounter vertical longlines although these typically target reef fish or are fished near FADs ((Preston et al. 1998); see Chapters 9 - 12 for information on other fixed gears). Hook and line gear of all types accounts for approximately 10% of global fisheries catch (Watson et al. 2006).

In general, longlining is considered to be selective in the size of fish captured (e.g., larger hooks catch larger fish). Many fish species remain alive and can be returned to sea with a high survival rate; however, there is potentially a higher impact on bycaught fish with swim bladders due to the effects of barotrauma and the habitat effects on the ocean floor. There are also concerns regarding the bycatch of sharks and seabirds in a few demersal longline fisheries (FAO 1999).

8.3 List of Priorities

1. Estimate effort and total catch for each gear deployment;
2. Identify every individual caught on each randomly selected set (or subsample within the set) and estimate percent retained;
3. Collect biological information on target and other identified species as requested;
4. Record all sightings and interactions with marine mammals and sea turtles;
5. Record vessel and fishing gear characteristics.

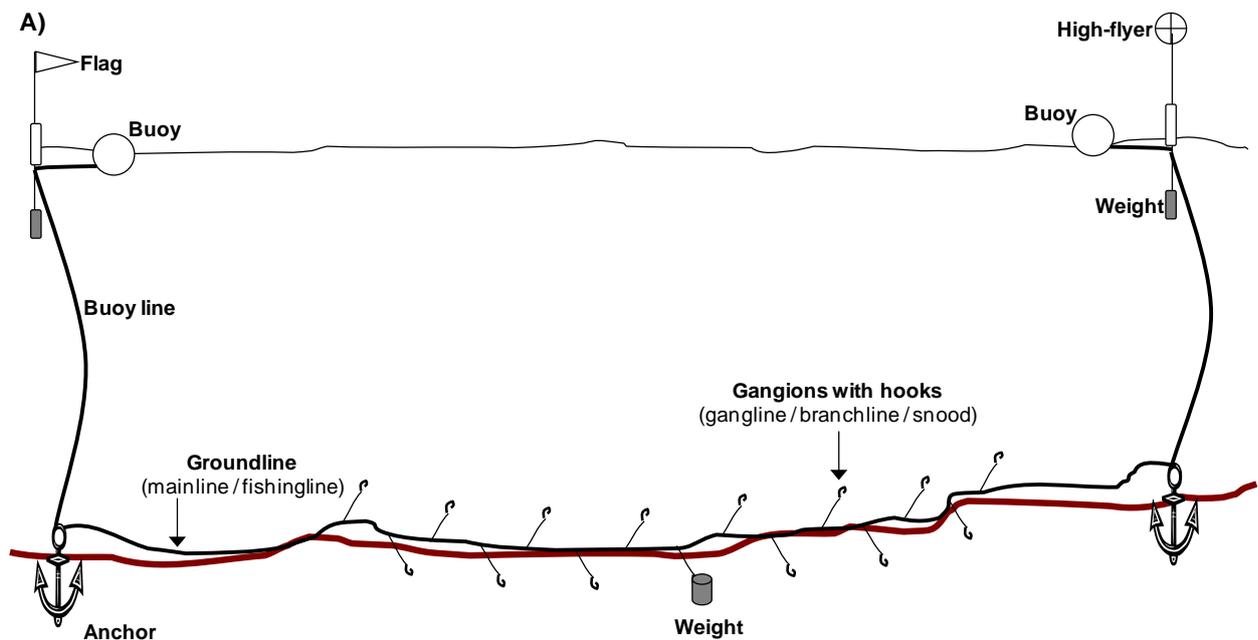
8.4 Gear Description

Demersal longline gear can have a multitude of configurations (Figure 8-1). The most common is the single-line system which consists of a single groundline with hooks attached by smaller lines called gangions. The double-line system (sometimes called the “Spanish” longline system) has a floating line (or hauling line) which runs parallel to a groundline and is connected to the groundline using several dropper (or joining) lines (Robertson et al. 2008, CCAMLR 2011). Both the single and double-line systems are configured with evenly spaced baited hooks attached by gangions and can be fished completely on- or off-bottom. The latter is also known as a semi-pelagic longline and the groundline is brought off-bottom by attaching regularly spaced floats. These gear subtleties will be differentiated on the Gear Description and Set and Haul Information forms but sampling is functionally the same so they’ve been combined for the purpose of this manual. Demersal longline length ranges from

a few hundred meters (small-vessel fisheries) to as long as 50 km in the larger vessel, industrial fisheries (FAO 2001-2010b).

The main components of a demersal longline are the groundline (also known as the mainline or fishing line), gangions (gangline, branchlines or snoods), hooks, floats, anchors and gear markers (Figure 8-1). The double-line configuration also includes a mainline (topline or motherline; Figure 8-1C). The groundline is the backbone of the gear and is typically a synthetic multifilament line. Gear may be stored in discrete sections called baskets (tubs or skates/magazines) which have 20 to 1,200 hooks or the groundline may be wound directly onto a single drum (snap system). Gangions are typically short, ranging from 1-5 m, and may be permanently attached to the groundline (direct splice or swivel) or attached to the groundline during each gear deployment using snaps (or clip; Figure 8-2). In general, gangions consist of one type of line material between the groundline and the hook. Hooks are attached to the lower end of the gangion and there are a variety of shapes and sizes although the most common are the tuna, circle and J-hook styles (Figure 8-3). Hooks may be baited manually or by using an automatic baiting machine. Line shooting machines that pull the gear off the vessel at a consistent speed may also be used. Modern vessels are equipped with a hydraulic line hauler for gear retrieval.

Gear markers are used to mark the location of the fishing gear and may include buoys (floats), radar reflectors (highflyers), radio beacons, GPS beacons and lights (Figure 8-4). Smaller floats may also be attached to the groundline in order to float it above the bottom (Figure 8-1B).



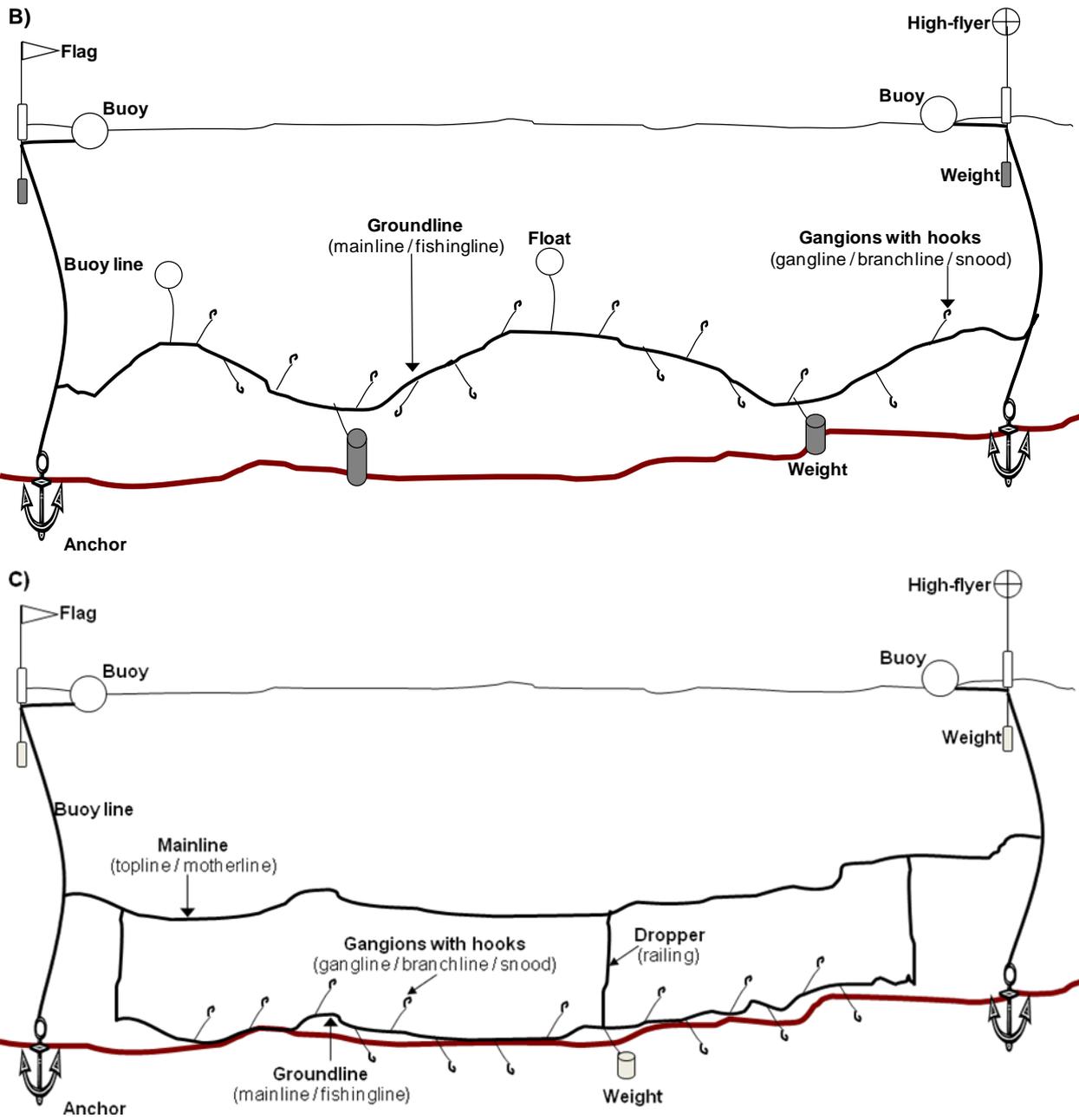


Figure 8-1 Demersal longline gear configurations and components: A) single-line, on bottom; B) single-line, off bottom; C) double-line, on bottom. Figures created using terminology from Hanrahan et al. (1997), Bjordal and Lokkeborg (1996), Brothers et al. (1999), and CCAMLR (2011)

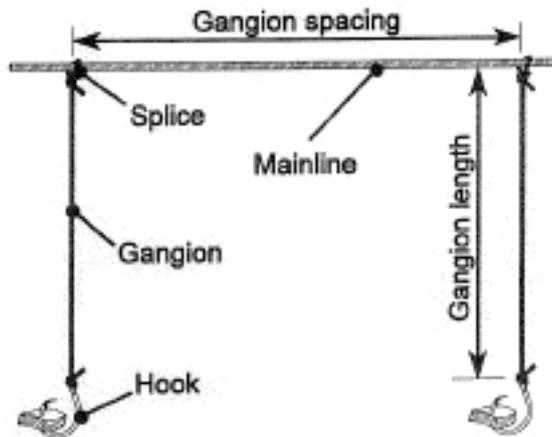


Figure 8-2 Gangion configuration. Gangions can be spliced directly to the mainline or be connected with a swivel or snap. The braided (multifilament) line and monofilament are two examples of gangion materials. Figure from Hanrahan et al. (1997).

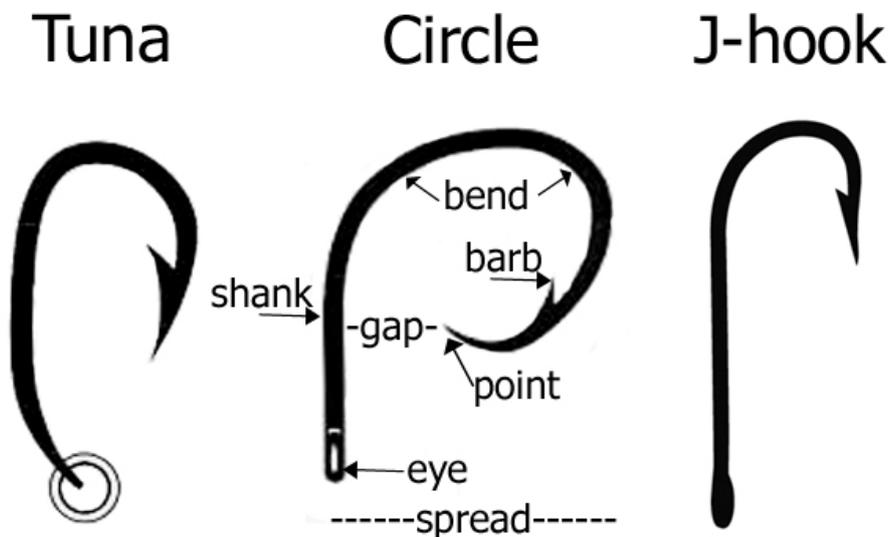


Figure 8-3 Basic hook types and terminology. The J-hook shank is parallel to the point and is shaped like the letter "J". Circle hooks have a point that bends in at approximately 90° and the tuna hook has a bent shank. Modified from Beverly (2006, 2009).

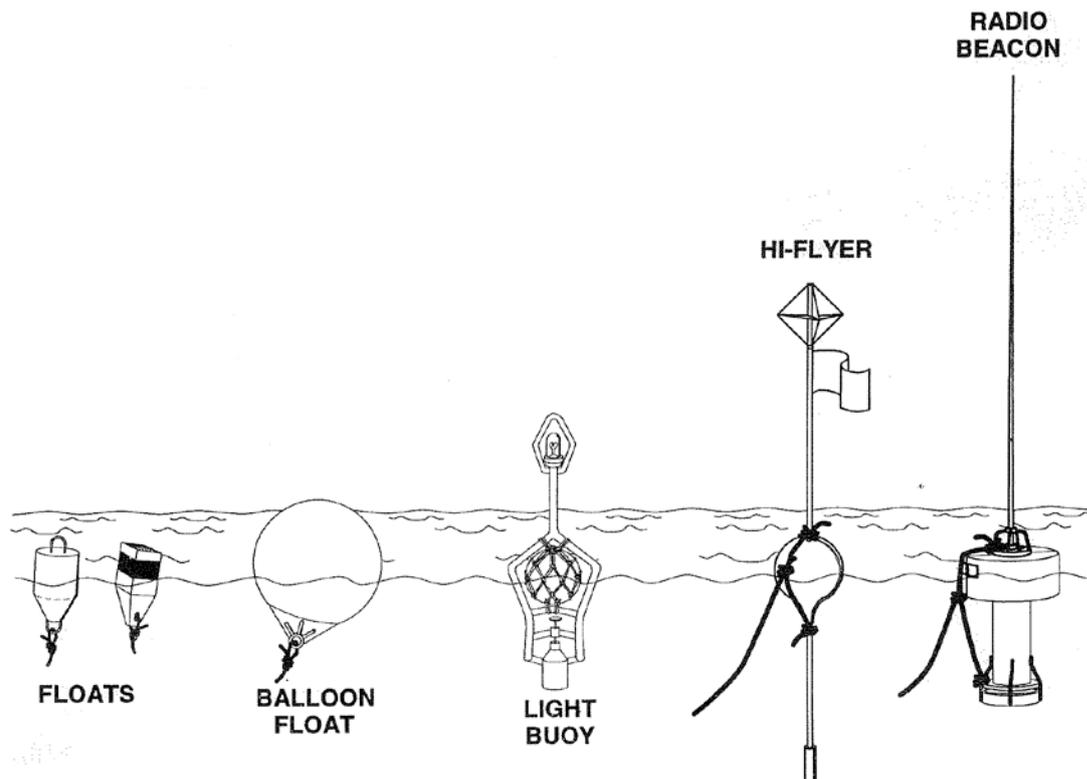


Figure 8-4 Types of gear markers. Modified from Hanrahan et al. (1997).

8.5 Fishing Description

Gear deployment: Demersal longlines are typically deployed from the stern of the vessel (Figure 8-5) and this process may also be referred to as setting or shooting. An end buoy with a gear marker is deployed first followed by buoy line and an anchor. The horizontal section may start with some running line (without hooks) and then the groundline (with hooks). As the vessel steams away from the end buoy, gear is pulled from the vessel. Crew may attach gangions, weights and floats at desired intervals as the groundline is payed out similar to pelagic longline deployment or pre-baited hooks already attached to the groundline may be pulled from the vessel through a setting chute. A set terminates when the last anchor and end marker buoy is deployed. The vessel travels at 2-10 knots while gear is being deployed. The length of the groundline, ideal fishing depth and number of hooks per gear unit varies with the intended target. Fishing depth is a function of the number of floats and their spacing or dropline length (double-line configuration).

Gear retrieval: Longlines are left in the water from several hours to a day. Gear retrieval begins by locating the gear marker at one end of the groundline, then hauling it and the buoyline onboard. The groundline could be hauled by hand but more typically it is fed into a hydraulic line hauler (block) and the gear is pulled in mechanically. Commercial fish are brought on board using gaffs whereas bycatch is typically discarded as the gear comes on board. The groundline can be stored in a coil that gets tied together, coiled into containers (tubs, baskets) or stored on metal racks (autoline systems). If gangions/hooks were deployed manually, these snaps are removed individually as the gear comes back aboard. The rate at which hooks come on board depends on weather, fishing depth, hook spacing and crew experience; however, in general, demersal longline hooks come up every few seconds.

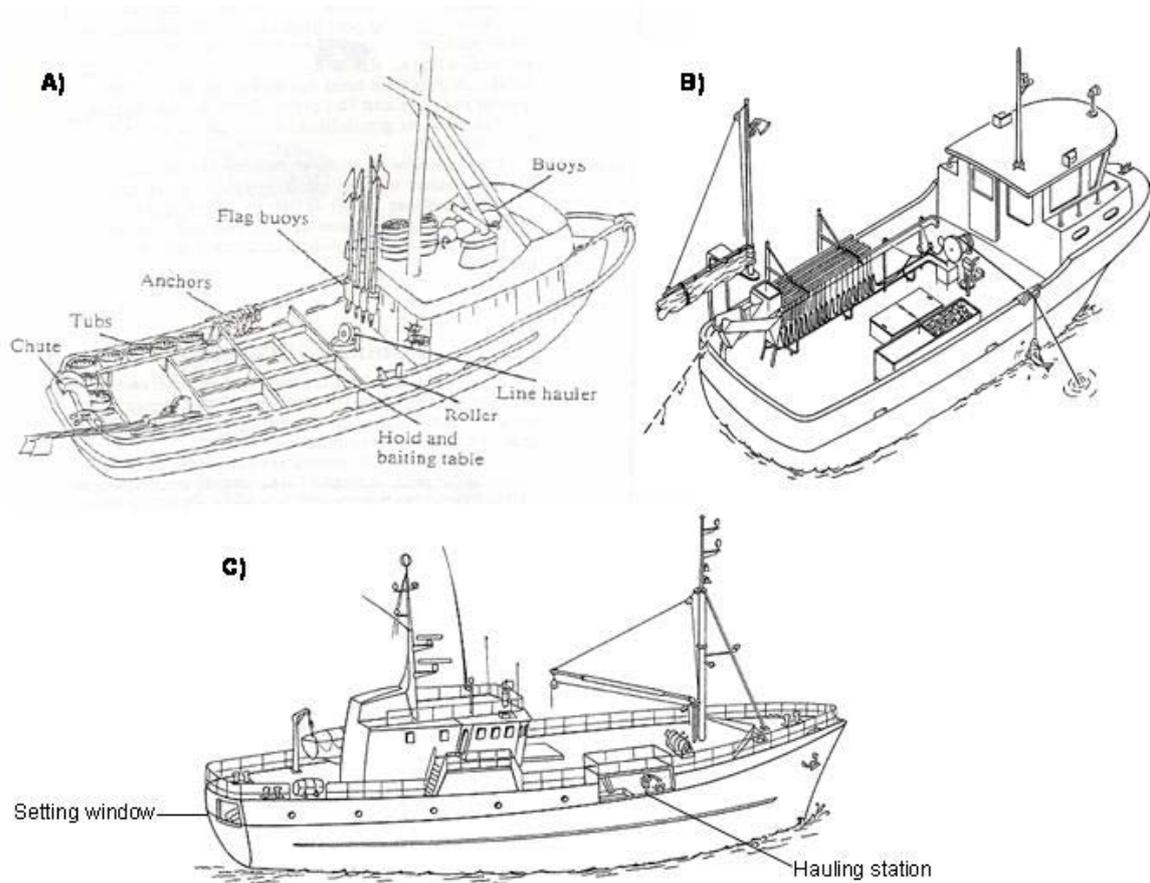


Figure 8-5 Generalized layout of small (A, B) and large (C) demersal longline vessels. Images from (NWFSC 2006) and (FAO 1985).

8.6 Forms/Instructions

8.6.1 Gear Description Form – Demersal Longline

Complete once per trip (see **Figure 8-7** for an example). Most gear information can be obtained from the captain or deck boss.

Field	Definition
Observer Code:	Record your observer identification code.
Vessel Code:	Record the vessel code (Appendix 3). If your vessel is not on this list, contact the SOP immediately.
Trip ID	Enter the trip identification number assigned by the SOP.
Lines	For each type of line used for the fishing process, record the material code, diameter (millimeters), breaking strength (or test; kg), number of strands and color code. It is normal for there to be only one groundline and one gangion type. If the vessel uses multiple gangion materials, gangion lengths or gangions constructed with two or three types of material, record the additional line types under type 2 and add

additional gangion types as necessary.

If the vessel is using the double-line system, use the additional rows provided to record the materials for the mainline (topline).

Material codes include:

- 1 – Monofilament
- 2 – Multifilament / synthetic fiber
- 3 – Cotton or other natural fiber
- 4 – Steel wire
- 5 – Other (please specify, e.g. tarred red polyester, Kuralon™)

Color codes

- | | | |
|-----------|------------|------------------|
| 1 – White | 5 – Blue | 9 – Yellow |
| 2 – Pink | 6 – Red | 10 – Other |
| 3 – Black | 7 – Clear | 11 – Multi-color |
| 4 – Green | 8 – Orange | |

Record any additional information about each line in the comments box.

Hooks

For each type of hook used by the vessel, record the manufacturer, model/pattern, size, material, and degrees of offset. The common model/patterns include the tuna hook, J-hook and circle hook (Figure 12-3). If the shank's crosssection is flat (rather than round), make a note of this in the comment section.

Hook sizes are not standardized among manufacturers. They may be in a metric unit or another convention that uses a slash (e.g., 9/0). Record what is on the manufacturer's box. If no information is available, either bring a sample back or take a photo including a side and front view with a ruler for scale.

Hooks may be stainless steel (shiny) or galvanized (dull) but verify the hook material with the captain (Beverly 2009).

Offset is measured in degrees. A hook is offset if the point does not line up exactly with the shank when the point-side is facing you (Figure 8-6). Offset hooks do not lay flat.

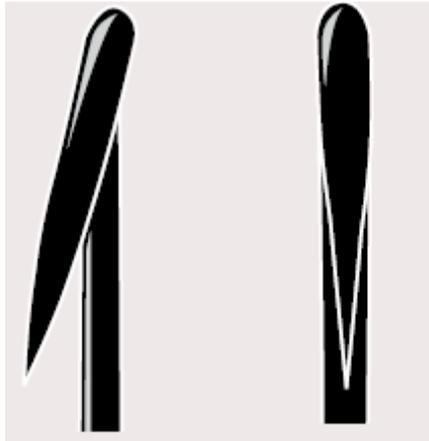


Figure 8-6 Offset (left) and non-offset hooks. Image from Beverly (2009).

Floats Excluding end buoys at the surface, describe the types of floats attached to the groundline. Floats may be used to keep the gear slightly off bottom (Figure 8-1B). Include the shape descriptor, approximate dimensions and material (e.g. foam, hard plastic, etc.).

Weights Excluding anchors attached to the ends, describe the types of weights attached to the groundline including material and average weight. For example, a vessel may use 5-kg lead cannonballs (spheres) or 8-kg concrete cylinders.

Gear Deployment Location Check appropriate box for whether longline gear was deployed from the stern, starboard or port of the vessel. If from the side, also record the distance from the stern (in meters).

Check appropriate box for whether the gear was deployed into the propeller up- or down-wash.

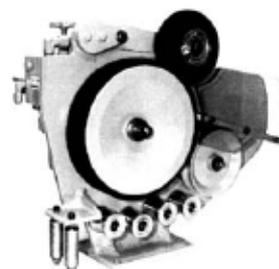
Other equipment For each device, circle **Yes** or **No** for whether the device was present on board and record a usage code defined as:

- | | | | |
|---|---|---|--------------------------|
| 1 | Used continuously during fishing | 5 | Rarely used |
| 2 | Used often during fishing | 6 | Used only during transit |
| 3 | Used sometimes during fishing | 7 | No longer used |
| 4 | Broken during this trip but used normally | 8 | Unknown |

Mainline hauler – uses hydraulic motor to assist with pulling gear on board.



Line setter / shooter – used to pull mainline from drum or deploy mainline at a consistent speed during setting



Automatic baiting machine – bait is fed into a slot where it is automatically cut and as gear is deployed, bait is applied to the hook automatically.



Image: <http://www.mustad-autoline.com>

Setting tube – gear deployed slightly subsurface through a tube.

Image:
<http://www.mustad-autoline.com>



Seabird Mitigation: Describe all techniques and equipment used to deter birds from hooks during the set and haul (e.g. bird curtain). Include diagrams with measurements of streamer lines and other equipment as necessary.

Gear Description - Demersal Longline

Observer code 33760	Vessel code ABC 0001	Trip ID 43
--	---	---

Lines	Type		Diameter	Breaking	# strands	Color	Comments
	Material	(mm)	strength (kg)				
Groundline	1	2	5	700	3	10	color=grey
Gangion	1	2	1	200	3	5	
Gangion	2						
Dropper	1						

Material Codes		Color codes				
1 Monofilament	4 Steel wire	1 White	4 Green	7 Clear	10 Other	
2 Multifilament / -stran	5 Other: _____	2 Pink	5 Blue	8 Orange	11 Multi-color	
3 Cotton / natural fiber		3 Black	6 Red	9 Yellow		

Hooks	Type	Manufacturer	Model/pattern	Size	Material	Offset
	1	Abe's hooks	J-hook	See photo	S	0
	2					
	3					

Model/pattern types

Tuna  J-hook  Circle  Other (describe):

Floats (attached to groundline)

Type	Shape	Dimensions	Material
1			
2			
3			

Float shapes

Bullet  Cylinder  Oval  Round  Cigar  Other (describe):

Weights (attached to groundline)

Type	Material	Weight (kg)
1	Concrete block	4.2
2		
3		

Gear Deployment Location

Stern
 Starboard, distance from stern _____ m
 Port, distance from stern _____ m
 Propeller up-wash
 Propeller down-wash

Other Equipment			Usage
Mainline hauler	Y / N		1
Line shooter	Y / N		
Autobaiting machine	Y / N		
Setting tube	Y / N		
Weighing scales	Y / N		
Other:	Y / N		
Other:	Y / N		
Other:	Y / N		
Other:	Y / N		
Other:	Y / N		

Usage Codes

- 1 Used continuously during fishing
- 2 Used often during fishing
- 3 Used sometimes during fishing
- 4 Broken during this trip but used normally
- 5 Rarely used
- 6 Used only during transit
- 7 No longer used
- 8 Unknown

Seabird Mitigation

Describe all techniques and equipment to deter birds from hooks during the set (e.g. streamer lines) and haul (e.g. bird curtain). Include diagrams with measurements of streamer lines and other equipment as necessary.

Set

Haul

No seabird mitigation was used but the crew occasionally hit the side of the hull with a gaff to scare the birds from the immediate area temporarily

Comments

Vessel stored gear in plastic tubs. Baiting was done on board during gear retrieval.

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Figure 8-7 Example Gear Description for Demersal Longline.

8.6.2 Set and Haul Information Form – Demersal Longline

The Set and Haul form is used to record the basic fishing effort parameters of all longline sets during observed trips (Figure 8-8 contains an example). The information necessary to complete this form is obtained through direct observations and crew input. If an element is not available or

applicable, leave the field(s) blank and describe the situation in the Comment section. Fields indicated with an asterisk (*) relate to fields on Gear Description form.

Field	Definition
Observer Code:	Record your observer identification code.
Vessel Code:	Record the vessel code (Appendix 3).
Trip ID	Enter the trip identification number assigned by the program.
Set No.	Record the set number (unique and consecutive for each trip).
Target	Ask the captain for the intended target species for each set. Record using 3-digit FAO code (Appendix 7). This will likely remain constant for a trip.
Page ___ of ___	Number pages consecutively throughout the trip and fill in the total number of pages at the end of the trip (e.g., Page 5 of 37).

Several fields must be collected at the beginning and ending of each deployment and retrieval (set and haul) period. It may take more than two hours to deploy gear and over six hours to retrieve a set. For each gear deployment, you will record four dates / times and two positions.

Date	There are separate columns for day, month and year. Record 2-digits in each column.
Time (24-hr)	Record time for each component using 24-hr notation (e.g., 8:45 a.m. = 0845 and 2:12 p.m. = 1412). Begin and end deployment times are defined when the first and last hooks go in the water, respectively. Begin and end retrieval times are when the first and last hooks come back on board, respectively.
Lat-Deg	Record degrees of latitude (2-digits) for begin and end of the deployment. Begin is where the first hook enters the water and end is where the last hook is deployed.
Lat-Min	Record the minutes of latitude (to hundredths of a minute; 4-digits)
Lat-N/S	Record N for all latitudes North of the equator and S for latitudes south of the equator.
Long-Deg	Record degrees of longitude (3-digits).
Long-Min	Record the minutes of longitude (to hundredths of a minute; 4-digits)
Long-E/W	Record W for all longitude West of the prime meridian (e.g., 0°)

and **E** for longitudes east of the prime meridian.

V / O	Record O if the observer independently recorded times and positions for gear deployment. Record V if the information was obtained from a vessel's fishing log or the captain.
Set Speed	Obtain the average setting speed (tenths of knots) from captain or GPS during gear deployment.
Bottom depth (m)	Record average bottom depth in meters. Ask the captain or record from depth sounder. If you need to convert units (e.g., feet to meters), record conversion calculation in comments section.
Fishing depth (m)	If the gear is not set on bottom, ask the captain to estimate how far off bottom he is targeting or what he thinks his fishing depth is. If you need to convert units, record conversion calculation in comments section.
Seabird mitigation (set)	Enter code for any mitigation used during gear deployment. Options include: 0 - None 1 - Bird scaring line - single 2 - Bird scaring line - double 3 - Weighted branchline/gangion 4 - Weighted groundline 5 - Underwater setting tube/chute 6 - Moon pool 10 - Other - explain in comments. Use this code if more than one of the techniques was used and explain in comments.
Retained Catch (mt)	Record the Retained catch estimate in metric tons. This may be an alternate to making a total catch estimate if you are not allowed access to the fish for sampling. The method utilizes production information.
Total Catch (mt)	Record total catch to nearest hundredth of a metric ton. Record detailed calculations in the Observer Logbook.
Estimation Method	Record the code for total catch estimation method used for this set. Section 8.7 describes these more fully. Options include: 1 - Weigh entire catch 5 - Captain / vessel estimate 6 - Catch / effort ratio (not sampled) 7 - Catch / effort ratio (tally sample) 9 - Other - explain in comments 10 - Unable to obtain Total Catch estimate
Haul Dir.	Circle F or R for the haul direction. Forward is defined as the

same direction gear was deployed and reverse is the opposite direction as gear was deployed.

Seabird mitigation (haul) Check box if seabird mitigation was used during gear hauling.

Hooks
Type*

Record the dominant hook type deployed for the set. Hook type should relate to the type number on the Gear Description-Demersal Longline form. If more than one hook type is deployed in a set, record the dominant hook type and make a note in the comments section about the approximate percentage of each hook type. For instance, “80% hook type 1 and 20% hook type 2 were deployed.”

Hooks/section Record the mean number of hooks attached per gear section. See “**Determining Amount of Gear in a Set**” for more information (Section 8.8.1.2).

Total sections Record the total number of sections deployed. Ask the captain or crew. You will need to periodically verify this count yourself.

Deployed Record the total number of hooks deployed. Calculate using the formula:

$$(\text{Hooks/section} * \text{total sections})$$

Retrieved Record the total number of hooks retrieved. If the vessel loses gear (i.e., gear is caught on bottom and parts), subtract the approximate number lost from total hooks deployed.

Tended Record the number of hooks tended while gear is soaking prior to hauling the gear. This practice may be called ‘hotlining’ and is more common on vessels fishing with pelagic longline gear and using live bait. Record zero if no hooks were tended.

Rebaited Record the number of hooks rebaited prior to hauling the gear.

Monitored Record the number of hooks monitored. See catch composition tally sampling below (Section 8.8.1.4). This number should match the sample size on the Catch Composition form.

Gangion
Type* and
Length

Record the dominant gangion type deployed for the set. Record gangion length (**Figure 8-2**). For demersal longline, this will likely be consistent throughout a trip.

Distance Record the distance between gangions (in meters). You may need

between	to measure the hook spacing for 20-30 hooks to calculate an average. It is likely that this will remain consistent throughout a trip unless the crew is snapping gangions/hooks on and off each set.
Weight (g) and weight placement	Record the full weight of any weight attached to each gangion. This may be incorporated into the swivel(s) or added separately. Make a note where the weights are located (e.g., 30g swivel attached 5cm above hook). If no weights are added, leave blank.
Floats	Record the type of floats attached to the groundline and note the approximate distance between them in meters.
Weights	Record the type of weights attached to the groundline and note the approximate distance between them in meters.
Bait – species and kg	Record the approximate weight of each species of bait used for the set. Ask the crew or pay attention to number of boxes/bags of bait used by species. Record to lowest taxonomic level possible.
Gear condition?	Indicate the condition of the gear at the completion of the haul by recording the most appropriate code defined as follows: <ul style="list-style-type: none"> 0 No problems (<10% hooks lost and/or minor gear damage) 1 Minor problems – 10-25% hooks lost and less than 50% of gear fouled due to weather/oceanic conditions. Gear tangled, spun up affecting gear fishability 2 Major problems – >25% of hooks lost and > 50% of gear fouled due to weather/oceanic conditions 3 Gear completely damaged or lost 4 Gear conflicts (with another fisher). Record details in comments including the other vessels name and relevant identifying features. If IUU fishing is suspected, be sure to fill in the Vessel and Aircraft Sighting form (Chapter18). 5 Other – explain in comments
Gear parted?	Did the groundline part (or break) during gear retrieval? Circle Yes or No . If yes, make notes in comments regarding parting time and when gear retrieval resumed.
Gear lost?	Was any gear lost during this set? Circle Yes or No . If yes, make notes in the comment section.

Light Devices

Type	Circle the predominant type of light device attached to gear. If more than one type, make a note in the comments.
How many?	Record the total number of light devices attached to the gear. If type=none, leave the remaining Light Device fields blank.
Placement	Record where the majority of the light devices were attached to the gear.
Color code & percent	Record the color code and approximate percentage of each color deployed. For example, Code 2 – 50% and Code 8 – 50%. Note that percent recorded must sum to 100%.
	Color codes:
	1 – White 5 – Blue 9 – Yellow
	2 – Pink 6 – Red 10 – Other
	3 – Black 7 – Clear
	4 – Green 8 - Orange
Other devices	Check appropriate boxes if temperature-depth recorders (TDRs), hook timers, or any other devices that may impact fishing effectiveness were deployed. If Other is checked, describe more fully in the comments section.
Comments	Use this section to describe any particulars that could not be codified from the available data element choices. If you run out of space, indicate that there are notes elsewhere (e.g., page X in Observer Logbook).

Set and Haul Information - Demersal Longline

Observer code		Vessel code			Trip ID		Set No.			
33760		ABC 0001			43		198		LJA	

Date/Time					Position					E / W	V / O	Set Speed (kts)	Bottom depth (m)	Fishing depth (m)	Seabird Mitigation
Day	Month	Year	Time (24-hr)	Lat-Deg	Lat-Min	N / S	Long-Deg	Long-Min							
Begin	01	11	10	535	08	21.39	N	014	9.89	W	O	4.7	97	97	0
End	01	11	10	618	08	19.06	N	014	10.23	W	V				

					Retained Catch (mt)	Total Catch (mt)	Est. Method	Haul Dir.	Seabird Mitigation
						0.61	7	F	
								R	

Seabird mitigation codes (deployment)

- 0 - None
- 1 - Bird scaring line - single
- 2 - Bird scaring line - double
- 3 - Weighted branchline/gangion
- 4 - Weighted groundline
- 5 - Underwater setting tube/chute
- 6 - Moon pool
- 10 - Other - explain in comments

Hooks

Type* 1

Hooks / section 150

Total sections 32

Deployed 4800

Retrieved 4800

Tended

Rebaited

Monitored 1800

*relate to Types described on Gear Description - Demersal Longline form

Total Catch Estimation Methods

- 1 - Weigh entire catch
- 5 - Captain / vessel estimate
- 6 - Catch / effort ratio (not sampled)
- 7 - Catch / effort ratio (tally sample)
- 9 - Other - explain in comments
- 10 - Unable to obtain

Gangion

Type*	Length	Distance between (m)
<u>1</u>	<u>0.65</u>	<u>1</u>

Weight (g)	Weight placement

Floats

Type*	Distance between (m)

Weights

Type*	Distance between (m)
<u>1</u>	<u>75</u>

Bait

Species	<u>FIN</u>				
kg	<u>700</u>				

Light devices

Type codes (circle one) 0 None 3 Glow bead

1 Chemical light stick 4 Other

2 Battery light

How many?

Placement

Color Code	%

Color Codes

- 1 - White6 - Red
- 2 - Pink7 - Clear
- 3 - Black8 - Orange
- 4 - Green9 - Yellow
- 5 - Blue10 - Other

Gear condition 0

Gear parted Y N

Gear lost? Y N

Gear Condition Codes

- 0 - No problems (<10% lost)
- 1 - Minor problems (<10-25% lost)
- 2 - Major problems (>25% lost)
- 3 - Gear completely damaged/lost.
- 4 - Gear conflicts
- 5 - Other - explain in comments

Other devices? TDRs Hook timers Other

Comments

Bait was a variety of mixed unidentified fish

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Figure 8-8 Example of completed Set and Haul Information form.

8.7 Total Catch Estimation

Total catch must be estimated for every set. There are four options on demersal longline vessels:

- Weigh entire catch (**method 1**) – If catch is extremely small, you may be able to weigh the entire catch. This is unusual.
- Captain / vessel estimate (**method 5**) – Use the captain’s estimate only if you are unable to use methods 1, 6 or 7.
- Catch / effort ratio (similar sets; **method 6**) – Use this method when you are unable to tally sample a set. Use the tally sample from similar sets (i.e., similar area, depth strata, time) to estimated the total catch in an unsampled set.



$(\Sigma \text{ Sample weights from similar sets} / \Sigma \text{ Tallyed hooks from similar sets}) * \text{ Total hooks in unsampled set}$

Set	Tally sample weight (kg)	Sample size	Total hooks in set	Total Catch estimate (kg)
5	434.75	840	2100	1086.875
6	583.27	960	2400	1458.175
7	398.15	840	2100	995.375
8			2400	1287.427273

$$\begin{aligned} \text{Set 8 total catch} &= ((434.75 + 583.27 + 398.15) / (840+960+840)) * 2400 \\ &= (1416.17 / 2640) * 2400 = 1287.427273 \text{ kg or } 1.29 \text{ mt} \end{aligned}$$

- Catch / effort ratio (tally sample; **method 7**) – Divide the sample weight by number of hooks sampled and multiply by total hooks in the set



$(\text{Sample weight} / \text{Tallyed hooks}) * \text{ Total hooks in set} = \text{Total catch}$

Example:

$$(229.67 \text{ kg} / 1800) * 4800 = 612.4533333 \text{ kg or } 0.61 \text{ mt}$$

If a method other than the above is used, record as method 9 and explain in comments.

8.8 Catch Composition and Biological Data

Demersal longline vessels may make multiple sets per day. Section 3.6.3 and the Observer Logbook fully describe how to use the Random Sample Table to select sets to sample for species catch composition.

Section 3.6 described random sampling but the next section will provide more detailed examples regarding how to subsample hooks within each set. During the selected tally sample, all fish will be counted (tallyed) to the lowest taxonomic level. You will also collect

fish to obtain weights and estimate the percent retained. Demersal longline catch composition data is recorded on the generic catch composition form described in Section 5.4 and an example specific to demersal longlining is at the end of this section (Figure 8-9).

Catch Composition

Observer code 33760	Vessel code ABC 0001	Trip ID 43	Date (dd/mm/yy) 01/11/10	Haul 198	Mixed? Y <input checked="" type="radio"/> N		
Sample Type (ST) 1 Whole haul 2 Unsorted random	3A Trawl - retained by species 3B Trawl - retained mixed species 3C Trawl - discard sample	4 LL-demersal 5 Gillnet 7 Pots/traps 8 Other	Reason Discard 1 Regulation 2 Market 3 Damage 4 Error 5 Other				
Species Name	Species Code	ST	Number Individuals	Weight (kg)	Sample Size	% Ret.	Reason Discard
<i>Afr. Red Snapper</i>	<i>LJA</i>	4	73	129.58	1800	97	4
<i>Afr Br. Snapper</i>	<i>LJE</i>		12	22.80		100	
<i>Snapper unid</i>	<i>SNX</i>		5	9.01		0	4
<i>Smoothmouth catfish</i>	<i>SMC</i>		2	6.85		100	
<i>Roughtail stingray</i>	<i>RDC</i>		4	33.50		0	2
<i>Blacktip shark</i>	<i>CCL</i>		1	20.60		0	1
<i>BF swimcrab</i>	<i>KLM</i>		3	0.89		100	
<i>Sponge Unid</i>	<i>SPO</i>		13	2.60		0	2
<i>Invert Unid</i>	<i>INV</i>		2	0.10		0	2
<i>Snail Unid</i>	<i>GAS</i>	4	75	3.75	1800	0	2
<i>Ave wt calculation</i>							
<i>Red snapper</i>	<i>78.1</i>	<i>44</i>	<i>1.775</i>				
<i>Red/brown</i>	<i>100.9</i>	<i>56</i>	<i>1.801785714</i>				
Notes / Calculations					Total weight		
<i>Sampled 3 of 8 sections 2,5 & 8. Each section had 4 gear units. Hooks sampled= 150 hooks/gear unit * (3*4) gear units = 1800</i>					3A		
<i>2 Red snapper dropped off - % ret= 71/73=0.9726 use combination of red/brown snapper for snapper unid weight estimate</i>					3B		
					3C		

Figure 8-9 Example of completed Catch Composition form for demersal longline.

8.8.1 Tally sampling

The standard catch composition sample type for demersal longline gear is the tally sample (ST=4) since the catch comes on board individually and the number of fish may be easily counted. When tally sampling, observers count all individuals by species (or species group) as they are brought out of the water. The count (tally) is then multiplied by the average weight of fish (determined through weight sampling) to obtain the estimated weight of each species in your sample (Flewellling et al. 2002). For bycatch species, where you weighed the actual number tallied in the sample, the weight recorded on the catch composition form is the actual weight. However, before you begin sampling you need to define a set, determine the amount of gear in a set, determine how much and which sections of the set you will sample (tally) and determine where you will tally and weigh fish.

8.8.1.1 Defining a Set

Defining a set of conventional demersal longline is straightforward. A set begins at a buoy and ends at a buoy. The set includes all of the hooks in between the two buoys. All the hooks set together in a string, **even those lost prior to retrieval**, are included in the set.

8.8.1.2 Determining Amount of Gear in a Set

In order to devise an appropriate sampling frame, you must determine the amount of gear in the set. This is fairly easy to determine when gear is stored in discrete units but there are some gear configurations without discrete units (e.g., snap gear). Vessels fishing with discrete units of gear can vary how many hooks are fished in each set by increasing or decreasing the number of units deployed. Interview your captain to determine whether or not the gear is divisible into consistent (or fairly consistent) units. Determining the number of hooks in a set is different for these two situations.

8.8.1.2.1 Pot, snap longline or other gear that is not divided into discrete units.

To determine the number of hooks deployed, you will need to count all of the hooks or pots in the set. The options for counting hooks, in order of preference, are:

1. Count hooks/pots while the gear is stored on the vessel;
2. Count hooks/pots while they are being baited;
3. Count hooks/pots during gear deployment;
4. Count hooks/pots while gear is being retrieved on sampled hauls and ask skipper if any gear was lost. This can be extremely difficult, especially when you need to sample for species composition at the same time. Also, counting hooks in the evening, morning, and night can be difficult due to available light;
5. Counting hooks/pots while gear is being retrieved on unsampled hauls. If you do not believe you can obtain an accurate hook/pot count while sampling, then you can take one haul off per day to count hooks/pots. **This only works if all sets have the same number of hooks/pots.**

8.8.1.2.2 Gear that is divided into discrete units

Determining the number of hooks deployed is easier with gear divided into discrete units. There are two things you must determine:

- Average number of hooks per unit
- Number of units deployed in a set

Average number of hooks per gear unit:

Vessels generally have a consistent number of hooks per unit of gear. Document in the Observer Logbook when average hook counts were done and why that time was chosen.

1. Count the number of hooks on a gear unit for at least **1/5** of the gear being used **each trip**. It is usually possible to count hooks while gear is being baited, stored or deployed.
2. Sum the hook counts for all the gear units counted and divide by the number of gear units counted to determine average number of hooks per skate.



$$\text{Average \# Hooks per gear unit} = \frac{\sum \text{Hook Counts}}{\# \text{ of units counted}}$$

Number of units in a set:

Count the number of units in a set:

1. During deployment of gear;
2. During retrieval of gear. If gear unit counts are done during retrieval of gear, ask skipper if any gear was lost. It can be difficult to count the number of gear units during retrieval, as section markers are sometimes hard to distinguish;
3. After gear retrieval.

If you cannot get an accurate count of the total number of gear units deployed, ask the captain for an estimate. If you need to rely on the captain's estimate, a verification of gear units per set must be done once each day. This can be accomplished by counting skates during one of the following times:

1. While gear is being deployed.
2. After a set is completed and all gear is on board vessel.
3. While gear is being retrieved.

Determining the Total Number of Hooks in a Set



$$\text{Total Hook Count} = \text{Total \# of sections} * \text{Average \# Hooks per section}$$

8.8.1.3 Determining which sets to sample

If you are unable to tally sample every set, use RST#1 to select which sets to sample. See further instructions in Section 6.7.2 and the Observer Logbook.

8.8.1.4 Determining the Amount of Gear to Sample

At minimum, **1/3** of a set must be tallied, **1/2** would be ideal. There should only be one sample size for the tally sample (e.g., tally all species caught, including retained and discarded, during the tally sample).

8.8.1.5 Randomly Selecting Gear to Tally Sample

If less than 100% of a set is going to be tallied, a random sampling frame must be designed (see also section 3.6). There are four choices for designing a random sample frame:

- Systematic spatial with a random start (preferred)
- Random (Non-systematic) spatial

- Systematic Temporal
- Random (Non-systematic) Temporal

Fixed-gear vessels routinely set over of a depth gradient or across different bottom types. This means the catch can vary significantly along a set. The best way to account for the variability caused by setting across a depth gradient or different bottom types is to use a systematic sampling frame.

8.8.1.5.1 Spatial Sampling

Spatial sampling is gear-based and involves randomly selecting sample units from the set to tally. Spatial sampling is ideal when gear consists of discrete sections.

Systematic Spatial Sampling with Random Start (preferred method)

Instructions - *Example in italics*

1. Define population to be sampled - *A longline set of 100 gear units.*
2. Define your sample frame - *Systematic spatial with random start based on gear unit.*
3. Define your sample units (# of gear segments in a sample unit may vary from haul to haul) - *Blocks of 5 gear units.*
4. Number all the sample units in your sampling frame - *Sample units numbered as 1-20 (100 gear units in 5 unit increments: (1-5), (6-10), (11-15)...(96-100))*

1	11	21	31	41	51	61	71	81	91
1	3	5	7	9	11	13	15	17	19
4	14	24	34	44	54	64	74	84	94
5	15	25	35	45	55	65	75	85	95
6	16	26	36	46	56	66	76	86	96
2	4	6	8	10	12	14	16	18	20
9	19	29	39	49	59	69	79	89	99
10	20	30	40	50	60	70	80	90	100

5. Determine how many of the sample units you want in your sample (minimum of 1/3 of set). *Decide you want to sample 1/2 of the set, so need to tally 10 sample units.*
6. Divide the total number of sample units by the number of units you want in your sample. This gives you your value for "n". $n = 20/10 = 2$
7. Randomly select a number between 1 and n. This will be the first sample unit in your sample. *Use random number table to select a number between 1 and 2. Randomly select 2.*
8. Sample every nth unit thereafter. *In this example the 'sample units' tallied would be 2, (2+2)... (18+2), so the gear sampled would be units (6-10), (16-20),(96-100).*

1	11	21	31	41	51	61	71	81	91
1	3	5	7	9	11	13	15	17	19
4	14	24	34	44	54	64	74	84	94
5	15	25	35	45	55	65	75	85	95
6	16	26	36	46	56	66	76	86	96
2	4	6	8	10	12	14	16	18	20
9	19	29	39	49	59	69	79	89	99
10	20	30	40	50	60	70	80	90	100

Random Spatial Sampling (Non-systematic)

Instructions - *Example in italics*

1. Define population to be sampled - *A longline set of 30 gear units.*
2. Define your sample frame - *Spatial, based on gear unit.*
3. Define your sample units (# of gear segments in a sample unit may vary from haul to haul) - *Blocks of 3 gear units*
4. Number all the sample units in your sampling frame - *Sample units numbered as 1-10 (30 gear units / 3 unit increments = 10; (1-3), (3-6), (7-9), (28-30))*

1	7	13	19	25
1	3	5	7	9
2	8	14	20	26
3	9	15	21	27
4	10	16	22	28
2	4	6	8	10
5	11	17	23	29
6	12	18	24	30

5. Determine how many of the sample units you want in your sample (minimum of 1/3 of set). *Decide want to sample 4 of the 10 sample units.*
6. Pick random numbers to choose which units to sample. *In this example generate 4 random numbers between 1 and 10 (the maximum sample unit number) to determine which sample units to tally. Number 3, 7, 9 and 10 are randomly selected.*
7. Tally sample the randomly selected sample units - *Tally sample gear units 7-9, 19-21, and 25-30. (Since 2 consecutive sample units, 9 and 10, were randomly selected, the last tally period includes 6 gear units).*

1	7	13	19	25
1	3	5	7	9
2	8	14	20	26
3	9	15	21	27
4	10	16	22	28
2	4	6	8	10
5	11	17	23	29
6	12	18	24	30

****Always start the sample at the beginning of a gear segment.** (For longline gear, begin at a gear unit knot!) Never start sampling in the middle of a gear segment. If you miss the start of the gear segment, start at the beginning of the next gear segment and make notes that this occurred.

8.8.1.5.2 Temporal Sampling

Temporal sampling is time based. In order to use this type of sample system you must know the approximate length of time it will take to haul a set. Temporal sampling may be more appropriate when gear units are not divided into discrete sections. Examples of both systematic and non-systematic temporal sampling follow:

Systematic Temporal Sampling with Random Start

Instructions - *Example in italics*

1. Verify the length of time needed to haul the set by asking the skipper or a crew member - *Captain tells you it will take 6 hours to haul a string.*
2. Define population to be sampled - *All hooks on the string.*

3. Define your sampling frame – *Systematic temporal, based on units of time.*
4. Define your sample units – *1/2-hour blocks of time* (length of time that defines a sample unit may vary from string to string).
5. Number all the sample units in your sampling frame – *Sample units numbered 1 – 12* (6 hours in 1/2 hour blocks; 1-30 min., 31-60 min.331-360 min.)
6. Determine how many of the sample units you want in your sample (minimum of 1/3 of set). *Decide to sample 1/2 of the string = 6 sample units.*
7. Divide the total number of sample units by the number of units you want in your sample. This gives you your value for “n”. $n = 12/6 = 2$
8. Randomly select a number between 1 and n. This will be the first sample unit in your sample. *Use random number table to select a number between 1 and 2. Randomly select 1.*
9. Tally sample the first gear segment that begins in the randomly selected time period and continue tally sampling until the time period has ended **and** you have reached the end of a gear segment. *Begin tally sampling when crew starts hauling the set and sample until 30 minutes have passed and you come to the end of a skate.*
10. Note how many gear units were tally sampled in each tally period so that you can calculate the total number hooks sampled for the set. *(This number will vary depending on length of gear units and the speed at which gear is hauled.)*
11. Sample every nth unit thereafter. *In this example the ‘sample units’ tallied would be 1, (1+2)... (9+2), so the time segments sampled would be minutes (1-30), (61-90),...(301-330).*

Random Temporal Sampling (Non-systematic)

1. Verify the length of time needed to haul the set by asking the skipper or a crew member – *Captain tells you it will take 4 hours to haul a string.*
2. Define population to be sampled -*All hooks on the string.*
3. Define your sample frame – *Non-Systematic Temporal, based on units of time.*
4. Define your sample units (length of time that defines a sample unit may vary from string to string) – *20-minute blocks of time*
5. Number all the sample units in your sampling frame – *Sample units numbered as 1-12* (4 hours in 20minute blocks; (1-20 min.), (21-40 min.)(221-240 min))
6. Determine how many of the sample units you want in your sample (minimum of 1/3 of set). *Decide want to sample 5 of the 12 sample units.*
7. Pick random numbers to choose which units to sample. *In this example generate 5 random numbers between 1 and 12 (the maximum sample unit number) to determine which sample units to tally. The numbers 3, 6, 8, 10 and 11 are randomly selected.*
8. Tally sample the first gear segment that begins in the randomly selected time period and continue tally sampling until the time period has ended **and** you have reached the end of a gear unit. *Begin tally sampling at the start of the first unit that begins after the crew has been hauling the set for 40 minutes, and sample until an additional 20 minutes have passed and you come to the end of a gear unit.*
9. Note how many gear units were tally sampled in each tally period so that you can calculate the total number hooks sampled for the set. *(This number will vary depending on length of gear units and the speed at which gear is hauled.)*
10. Sample all randomly selected time periods. *In this example the time segments sampled would be minutes (41-60), (101-120), (141-160) and (181-220). (Since 2 consecutive sample units, 10 and 11, were selected, the last tally period is 40 minutes long.)*

Observers should have their random sample frame designed prior to the start of gear retrieval.

8.8.1.6 Where to Tally Sample

The tally station is where the observer stands to count organisms as the groundline is being retrieved. The tally station should be no more than six meters from where the fish are landed and the observer should have an unobstructed view of the fish as they come out of the water and are brought aboard. From the tally station, observers must be able to clearly identify fish and other species as they come aboard as well as be able to identify drop-offs.

Equipment Needed

A deck form, three to six thumb counters, a pencil and a clipboard will be needed for tally sampling. Prior observers have devised many innovative techniques to make using multiple thumb counters easier. The most common is to use duct tape to attach multiple thumb counters to a clipboard. Other observers have used duct tape and line to create thumb counter belts that fit around the waist. Observers should be creative, experiment, and find out what works best. You will also need scales and several hooks for weighing fish.

8.8.2 Sample weights

Set up a location to safely weight fish during the non-tally periods. Coordinate with the crew in advance how bycatch species will be stored while you are tallying. During the tally sample, ask the crew to set aside bycatch for you to be weighed. Weigh target catch during the non-tally periods. Randomly select and weigh 40-50 individuals of each target in order to calculate an average weight. Attempt to spread out the collection across multiple non-tally periods. For example, if there are five non-tally periods, collect approximately 10 fish in each period for average weight sampling.

9 Traps / Pots

9.1 Learning objectives

- Describe 3 components of trap gear
- List the 2 forms that must be completed that are specific to vessels using traps
- List 3 pieces of information that must be collected from each species or species group

9.2 Introduction

Traps, also known as pots, are another form of fixed gear that uses bait to attract and catch fish. Traps are used to catch fish and invertebrates such as grouper, crab and octopus. Traps can be set individually or in lines (longlines, strings or trawls) that connect a series of traps. Traps account for less than 5% of global marine fish catch (Watson et al. 2004). In general, traps are designed to catch a very specific target and size range so there is minimal bycatch (ICES - International Bottom Trawl Survey Working Group 2010); however, the buoy lines pose an entanglement hazard for cetaceans.

9.3 List of Priorities

1. Estimate effort and total catch for each gear deployment;
2. Identify every individual caught on each randomly selected set (or subsample within the set) and estimate percent retained;
3. Collect biological information on target and other species as requested;
4. Record all sightings and interactions with marine mammals and sea turtles;
5. Record vessel and fishing gear characteristics.

9.4 Gear Description

The main components of trap gear are the buoy, buoy line and trap (**Figure 9-1**). If they are set in lines, then there will also be a groundline (or mainline). Traps consist of a rigid frame covered with netting or other enclosing material, have an opening with a funnel and sometimes have an escape mechanism for unwanted catch. Traps may also include a biodegradable section so that it stops fishing once the panel degrades. Bait is placed inside a bag or container inside the trap. Traps can be an infinite number of shapes but rectangular, conical or pyramidal are the most common (**Figure 9-2**). Vessels are typically equipped with a hydraulic line hauler for gear retrieval. Gear markers are used to mark the location of the traps and may include buoys (floats), radar reflectors (highflyers), radio beacons, GPS beacons and lights (**Figure 9-3**).

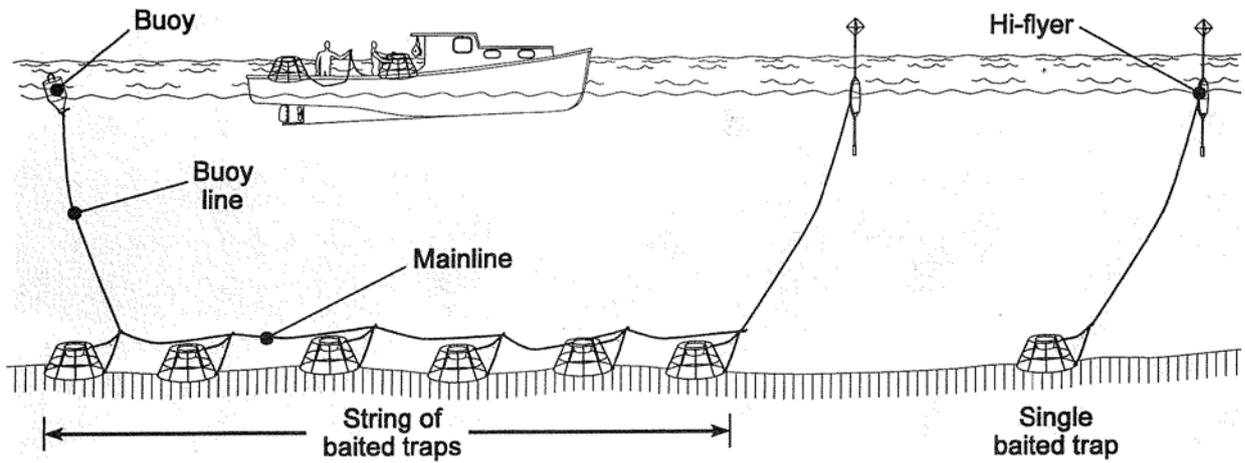


Figure 9-1 Trap configurations and components. Image from Hanrahan et al. (1997).

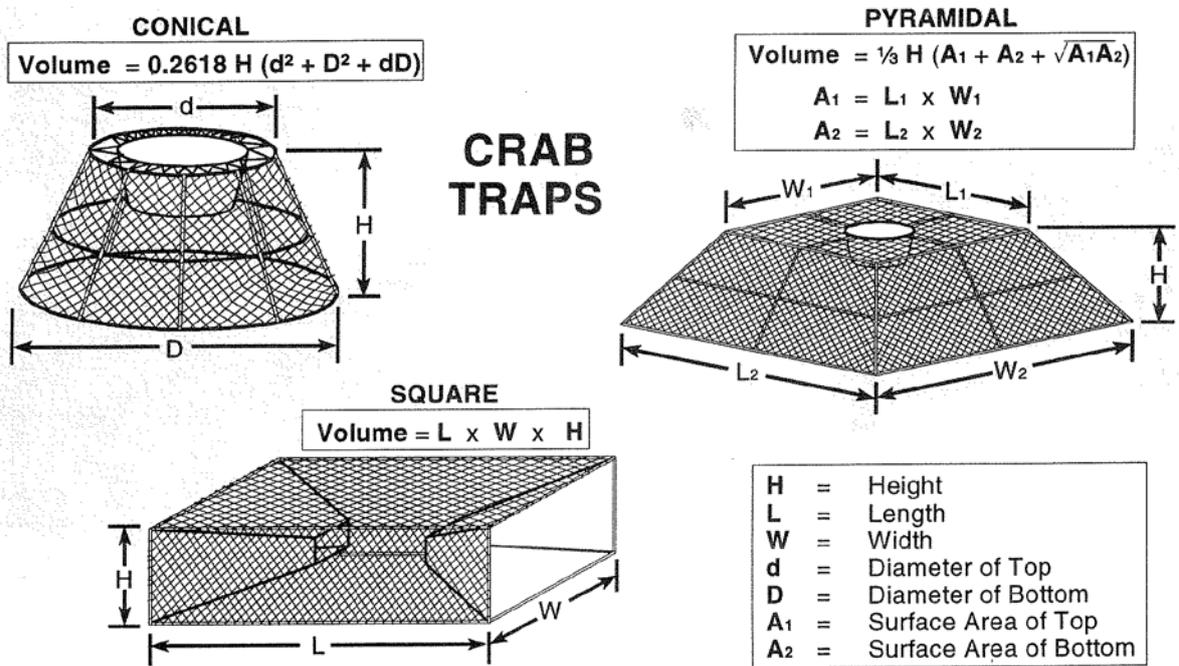


Figure 9-2 Trap shapes and dimensions. Figure from Hanrahan et al. (1997).

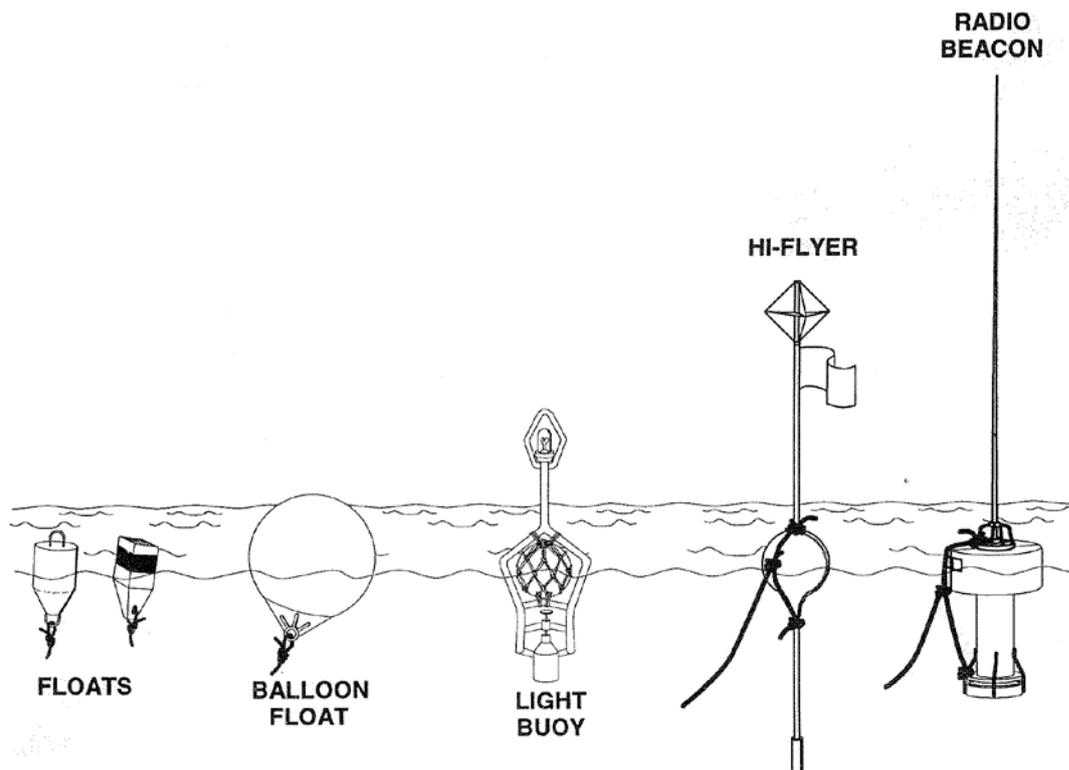


Figure 9-3 Types of gear markers. Modified from Hanrahan et al. (1997).

9.5 Fishing Description

Gear deployment: The gear deployment sequence depends on whether the traps are set in a line or individually. If in a line, deployment is similar to demersal longline gear starting with some sort of gear marker and buoy line followed by groundline and periodic traps. If individually, the trap is typically deployed first, then the buoy line and buoy.

Gear retrieval: Traps are left in the water from several hours to a day. Gear retrieval begins by locating the gear marker at one end of the set (if deployed in a line), then hauling it and the buoyline onboard. The groundline could be hauled by hand but more typically it is fed into a line hauler (block; Figure 9-4) and the gear is pulled in mechanically. The rate at which traps come on board depends on weather, fishing depth, trap spacing and crew experience.

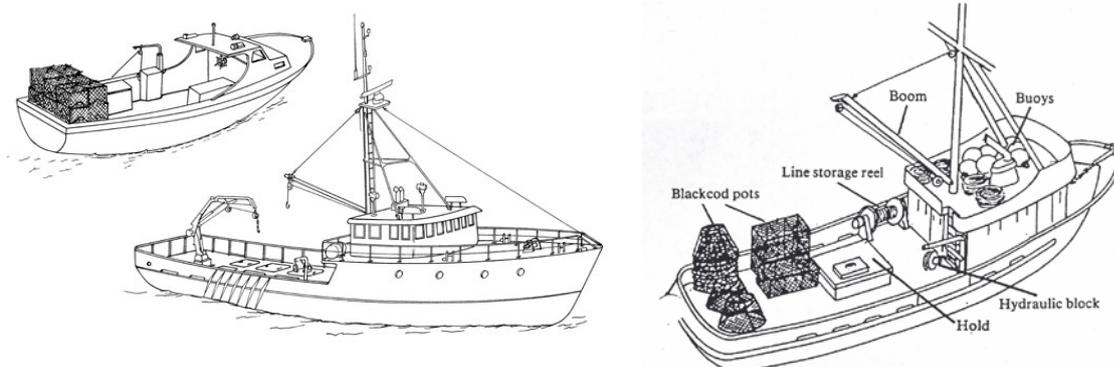


Figure 9-4 Generalized layout of trap vessels. Images from (FAO 1985) and (Watson et al. 2006).

9.6 Forms/Instructions

9.6.1 Gear Description Form – Traps

Complete once per trip (see **Figure 9-5** for an example) for each type of trap on board. If your vessel uses multiple types of traps, you will need to keep track of how many of each type are deployed per set. If you're on a vessel deploying multiple trap types in a set, contact the observer program for further instructions.

Field	Definition
Observer Code:	Record your observer identification code.
Vessel Code:	Record the vessel code (Appendix 3). If your vessel is not on this list, contact the SOP immediately.
Trip ID	Enter the trip identification number assigned by the SOP.
Traps deployed	Check appropriate box indicating whether traps were deployed individually or in lines. If the latter, also record more information on the groundline material (e.g., synthetic fiber, cotton or other natural fiber) and diameter.
Trap shape	Check the box that best approximates the shape of the traps used by your vessel. If possible, measure a few traps to get an idea of their dimensions. Record dimensions to nearest tenth of a meter.
Trap materials	Check boxes for the construction materials of the frame and covering
Funnel dimensions	Measure the funnel dimensions and record to nearest hundredth of a meter
Escape panel	Circle Yes or No for the presence of an escape panel
Biodegradable panel	Circle Yes or No for the presence of a biodegradable panel
Comments	Include any additional comments about the pots in this section

is obtained through direct observations and crew input. If an element is not available or applicable, leave the field(s) blank and describe the situation in the Comment section. Make an entry for each non-fishing day.

Field Definition

Observer Code: Record your observer identification code.

Vessel Code: Record the vessel code (Appendix 3).

Trip ID Enter the trip identification number assigned by the program.

Page ___ of ___ Number pages consecutively throughout the trip.

Set No. Record the set number (unique and consecutive for each trip).
Record zero (0) for all non-fishing days.

Several fields must be collected at the beginning and ending of each deployment and retrieval period. See section 9.8 for more information on defining a set. It may take more than two hours to deploy and over six hours to haul (retrieve) a set. For each gear deployment, you will record four dates / times and two positions.

Date There are separate columns for day, month and year. Record 2-digits in each column.

Time (24-hr) Record time for each component using 24-hr notation (e.g., 8:45 a.m. = 0845 and 2:12 p.m. = 1412). Start and end setting times are defined when the first and last trap goes in the water, respectively. Start and end hauling times are when the first and last trap comes back on board, respectively.

Lat-Deg Record degrees of latitude (2-digits) for start and end of the gear deployment. Start is where the first trap enters the water and end is where the last trap is deployed.

Lat-Min Record the minutes of latitude (to hundredths of a minute; 4-digits)

Lat-N/S Record **N** for all latitudes North of the equator and **S** for latitudes south of the equator.

Long-Deg Record degrees of longitude (3-digits).

Long-Min Record the minutes of longitude (to hundredths of a minute; 4-digits)

Long-E/W Record **W** for all longitude West of the prime meridian (e.g., 0°) and **E** for longitudes east of the prime meridian.

Bottom depth Record average bottom depth in meters. Ask the captain or record

(m)	from depth sounder. If you need to convert units (e.g., feet to meters), record conversion calculation in comments section or in the space below lat/long.
V / O	Record O if the observer independently recorded times and positions for gear deployment. Record V if the information was obtained from a vessel's fishing log or the captain.
# Deployed	Record the number of traps deployed.
# Retrieved	Record the number of traps retrieved. Sometimes traps are lost due to a gear malfunction or they simply could not be found.
Retained Catch (mt)	Record the Retained catch estimate in metric tons. This may be an alternate to making a total catch estimate if you are not allowed access to the fish for sampling. The method utilizes production information.
Total Catch Estimate	Record total catch to nearest hundredth of a metric ton. Record detailed calculations in the Observer Logbook.
Method	Record the code for total catch estimation method used for this set. Section 9.7 describes these more fully. Options include: 1 – Weigh entire catch 5 – Captain / vessel estimate 6 – Catch / effort ratio (not sampled) 7 – Catch / effort ratio (tally sample) 9 – Other – explain in comments 10 – Unable to obtain Total Catch Estimate
Sampled?	Check box if this set was sampled for catch composition. Otherwise, leave blank.
Comments	Use this section to describe any information that could not be codified from the available data element choices. If you run out of space, indicate that there are notes elsewhere (e.g., page X in Observer Logbook).

Observer code 175					Vessel code XYZ 388						Trip ID 00279								
Set	Start	Date/Time			Position						Pots/traps		Retained Catch (mt)	Total Catch Estimate (mt)	Method	Sampled?			
		Day	Month	Year	Time (24-hr)	Lat-Deg	Lat-Min	Lat-N/S	Long-Deg	Long-Min	Long-E/W	Depth (bottom; (m))					V/O	# Deployed	# Retrieved
0	Start	05	04	11	1200	06	18.03	N	010	47.1	W	in port							
	End																		
1	Start	06	04	11	1340	05	02.33	N	010	01.00	W	50	O						
	End	06	04	11	1505	05	03.09	N	010	01.20	W	63	V	30	30		1.3	5	
	Start	07	04	11	0424														
	End	07	04	11	0845														
2	Start	06	04	11	1737	05	03.12	N	010	01.50	W	65	O						
	End	06	04	11	1801	05	03.20	N	010	01.75	W	90	O	36	35		2.23	7	x
	Start	07	04	11	1012														
	End	07	04	11	1400														
3	Start	07	04	11	0500	05	02.38	N	010	00.48	W	47	V						
	End	07	04	11	0850	05	03.25	N	009	59.20	W	58	V	32	32		1.98	7	x
	Start	07	04	11	1337														
	End	07	04	11	1820														
4	Start	07	04	11	1029	05	03.20	N	010	01.05	W	86	V						
	End	07	04	11	1415	05	03.42	N	010	01.15	W	84	O	33	33		1.34	7	x
	Start	07	04	11	1958														
	End	08	04	11	0136														
Comments:											Total Catch method: 1 - Weigh entire catch 5 - Captain / vessel estimate 6 - Catch / effort ratio (not sampled) 7 - Catch / effort ratio (tally sample) 9 - Other - explain in comments 10 - Unable to obtain Total Catch estimate								

Figure 9-6 Example of completed Set and Haul Information form.

9.7 Total Catch Estimation

Total catch must be estimated for every set. There are four options on trap vessels:

- Weigh entire catch (**method 1**) – If catch is extremely small, you may be able to weigh the entire catch. This is unusual.
- Captain / vessel estimate (**method 5**) – Use the captain’s estimate only if you are unable to use methods 1, 6 or 7.
- Catch / effort ratio (similar sets; **method 6**) – Use this method when you are unable to sample a set. Use the tally sample from similar sets (i.e., similar area, depth strata, time) to estimated the total catch in an unsampled set.



$$(\sum \text{Sample weights from similar sets} / \sum \text{Tallied traps from similar sets}) * \text{Total traps in unsampled set}$$

Set	Tally sample weight (kg)	Sample size	Total pots in set	Total Catch estimate (kg)
5	234.75	15	40	626.00
6	383.27	20	40	766.54
7	298.15	25	50	596.30
8			45	687.13

$$\begin{aligned} \text{Set 8 total catch} &= ((234.75+383.27+298.15) / (15+20+25)) * 45 \\ &= (916.17 / 60) * 45 = 687.1275 \text{ kg or } 0.69 \text{ mt} \end{aligned}$$

- Catch / effort ratio (tally sample; **method 7**) – Divide the sample weight by number of traps sampled and multiply by total traps in the set



$$(\text{Sample weight} / \text{Tallied traps}) * \text{Total traps in set} = \text{Total catch}$$

Example: (234.75 kg / 15 traps) * 40 traps = 626.00000 kg or 0.63 mt

If a method other than the above is used, record as method 9 and explain in comments.

9.8 Catch Composition and Biological Data

Trap vessels may make multiple sets per day. Section 5.2 and the Observer Logbook fully describe how to use the Random Sample Table to select sets to sample for species composition.

Section 3.6 described random sampling but the next section will provide more detailed examples regarding how to subsample traps within each set. During the selected tally sample, all fish will be counted (tallied) to the lowest taxonomic level. You will also collect fish to obtain weights and estimate the percent retained. Trap catch composition data is recorded on the generic catch composition form described in Section 5.4 and an example specific to traps is at the end of this section (**Figure 9-7**).

9.8.1 Tally sampling

The standard catch composition sample type for trap gear is the tally sample for traps (ST=7) since the traps come on board individually and the number of fish may be easily counted. When sampling, observers should count all individuals by species (or species group) in each trap you sample. The count is then multiplied by the average weight of fish (determined through weight sampling) to obtain the estimated weight of each species in your sample (Flewwelling et al. 2002). For bycatch species, where you weighed the actual number tallied in the sample, the weight recorded is the actual weight. However, before you begin sampling you need to define a set, determine the amount of gear in a set, determine how much and which sections of the set you will sample (tally) and determine where you will tally and weigh fish.

9.8.1.1 Defining a Set

Regardless of whether gear is deployed as individual traps or in lines of connected traps, a set can be defined as a group of traps deployed at a similar time and in close proximity. For example, if your vessel deploys four lines of 10 traps each within a two hour time frame, you can declare this a set for purposes of your effort and sampling forms. All the traps set together in a string, **even those lost prior to retrieval**, are included in the set.

Catch Composition

Observer code 33760	Vessel code ABC 0001	Trip ID 43	Date (dd/mm/yy) 01/11/10	Haul 75	Mixed? Y <input checked="" type="radio"/> N		
Sample Type (ST) 1 Whole haul 2 Unsorted random	3A Trawl - retained by species 3B Trawl - retained mixed species 3C Trawl - discard sample	4 LL-demersal 5 Gillnet 7 Pots/traps 8 Other	Reason Discard 1 Regulation 2 Market 3 Damage 4 Error 5 Other				
Species Name	Species Code	ST	Number Individuals	Weight (kg)	Sample Size	% Ret.	Reason Discard
<i>Afr. Red Snapper</i>	<i>LJA</i>	7	73	129.58	10	100	4
<i>Afr Br. Snapper</i>	<i>LJE</i>		12	22.80		100	
<i>Snapper unid</i>	<i>SNX</i>		5	9.01		100	4
<i>Smoothmouth catfish</i>	<i>SMC</i>		2	6.85		100	
<i>Roughtail stingray</i>	<i>RDC</i>		4	33.50		0	2
<i>Blacktip shark</i>	<i>CCL</i>		1	20.60		0	1
<i>BF swimcrab</i>	<i>KLM</i>		3	0.89		100	
<i>Invert Unid</i>	<i>INV</i>		2	0.10		0	2
<i>Snail Unid</i>	<i>GAS</i>	7	75	3.75	10	0	2
<i>Ave wt calculation</i>							
<i>Red snapper</i>	<i>78.1</i>	<i>44</i>	<i>1.775</i>				
<i>Red/brown</i>	<i>100.9</i>	<i>56</i>	<i>1.801785714</i>				
Notes / Calculations <i>Sampled 10 of 50 traps; Sampled every 5th part with a random start of #4</i>					Total weight		
					3A		
					3B		
					3C		

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Figure 9-7 Example of completed Catch Composition form for demersal longline.

9.8.1.2 Determining Amount of Gear in a Set

In order to devise an appropriate sampling frame, you must determine the amount of gear in the set. Options include:

1. Count traps while the gear is stored on the vessel.
2. Count traps during gear deployment (the setting of gear).

3. Count traps while gear is being retrieved on sampled hauls and ask skipper if any gear was lost. This can be extremely difficult, especially when you need to sample for species composition at the same time.

You may need to coordinate with the deck boss and/or captain to determine an accurate number.

9.8.1.3 Determining which sets to sample

If you are unable to sample every set for catch composition, use RST#1 to select which sets to sample. See further instructions in Section 6.7.2 and the Observer Logbook.

9.8.1.4 Determining the Amount of Gear to Sample

At minimum, $\frac{1}{3}$ of a set must be tallied, $\frac{1}{2}$ would be ideal. There should only be one sample size for the tally sample (e.g., tally all species, retained and discarded, during the tally sample).

9.8.1.5 Randomly Selecting Gear to Tally Sample

If less than 100% of a set is going to be tallied, a random sampling frame must be designed (see also section 3.6). There are four choices for designing a random sample frame:

- Systematic spatial with a random start (preferred)
- Random (Non-systematic) spatial
- Systematic Temporal
- Random (Non-systematic) Temporal

Fixed-gear vessels routinely set over of a depth gradient or across different bottom types. This means the catch can vary significantly along a set. The best way to account for the variability caused by setting across a depth gradient or different bottom types is to use a systematic sampling frame.

9.8.1.5.1 Spatial Sampling

Spatial sampling is gear-based and involves randomly selecting sample units from the set to tally. Spatial sampling is ideal when gear consists of discrete units. A single trap makes an ideal gear unit.

Systematic Spatial Sampling with Random Start (preferred method)

Instructions - *Example in italics*

9. Define population to be sampled - *A set of 100 traps.*
10. Define your sample frame - *Systematic spatial with random start based on individual traps.*
11. Define your sample units - *a single trap.*
12. Number all the sample units in your sampling frame - *Sample units (traps) numbered as 1-100*

1	11	21	31	41	51	61	71	81	91
2	12	22	32	42	52	62	72	82	92
3	13	23	33	43	53	63	73	83	93
4	14	24	34	44	54	64	74	84	94
5	15	25	35	45	55	65	75	85	95
6	16	26	36	46	56	66	76	86	96
7	17	27	37	47	57	67	77	87	97
8	18	28	38	48	58	68	78	88	98
9	19	29	39	49	59	69	79	89	99
10	20	30	40	50	60	70	80	90	100

13. Determine how many of the sample units you want in your sample (minimum of 1/3 of set). *Decide you want to sample 1/3, so need to tally 33 or 34 traps.*
14. Divide the total number of sample units by the number of units you want in your sample. This gives you your value for “n”. *$n = 100/33.3 = 3$*
15. Randomly select a number between 1 and n. This will be the first sample unit in your sample. *Use random number table to select a number between 1 and 3. Randomly select 2.*
16. Sample every nth unit thereafter. *In this example the ‘sample units’ tallied would be 2, (2+3)... (96+3). Traps sampled are indicated with the grey highlight below.*

1	11	21	31	41	51	61	71	81	91
2	12	22	32	42	52	62	72	82	92
3	13	23	33	43	53	63	73	83	93
4	14	24	34	44	54	64	74	84	94
5	15	25	35	45	55	65	75	85	95
6	16	26	36	46	56	66	76	86	96
7	17	27	37	47	57	67	77	87	97
8	18	28	38	48	58	68	78	88	98
9	19	29	39	49	59	69	79	89	99
10	20	30	40	50	60	70	80	90	100

Random Spatial Sampling (Non-systematic)

Instructions - *Example in italics*

8. Define population to be sampled - *A set of 100 traps*
9. Define your sample frame - *Spatial, based on a single trap as sampling unit.*
10. Define your sample units (# of gear segments in a sample unit may vary from haul to haul) - *a single trap*
11. Number all the sample units in your sampling frame - *Sample units numbered as 1-100*
12. Determine how many of the sample units you want in your sample (minimum of 1/3 of set). *Decide want to sample 1/3 (33 traps).*
13. Pick random numbers to choose which units to sample. *In this example we used the random number table to select 33 random 2-digit numbers between 0 and 99. If zero is one of the selected numbers, sample trap #100.*
14. Tally all fish in the randomly selected traps - *Traps to sample highlighted below*

1	11	21	31	41	51	61	71	81	91
2	12	22	32	42	52	62	72	82	92
3	13	23	33	43	53	63	73	83	93
4	14	24	34	44	54	64	74	84	94
5	15	25	35	45	55	65	75	85	95
6	16	26	36	46	56	66	76	86	96
7	17	27	37	47	57	67	77	87	97
8	18	28	38	48	58	68	78	88	98
9	19	29	39	49	59	69	79	89	99
10	20	30	40	50	60	70	80	90	100

9.8.1.5.2 Temporal Sampling

Temporal sampling is time based. In order to use this type of sample system you must know the approximate length of time it will take to retrieve a set. Temporal sampling may be more appropriate when gear units are not discrete sections. Examples of both systematic and non-systematic temporal sampling follow:

Systematic Temporal Sampling with Random Start

Instructions - *Example in italics*

1. Verify the length of time needed to haul the set by asking the skipper or a crew member – *Captain tells you it will take 6 hours to haul a string.*
2. Define population to be sampled – *All traps on the string.*
3. Define your sampling frame – *Systematic temporal, based on units of time.*
4. Define your sample units – *1/2-hour blocks of time (length of time that defines a sample unit may vary from string to string).*
5. Number all the sample units in your sampling frame – *Sample units numbered as 1 – 12 (6 hours in 1/2 hour blocks; 1-30 min., 31-60 min.331-360 min.)*
6. Determine how many of the sample units you want in your sample (minimum of 1/3 of set). *Decide to sample 1/2 of the string = 6 sample units.*
7. Divide the total number of sample units by the number of units you want in your sample. This gives you your value for “n”. $n = 12/6 = 2$
8. Randomly select a number between 1 and n. This will be the first sample unit in your sample. *Use random number table to select a number between 1 and 2. Randomly select 1.*
9. Tally sample the first trap that is retrieved in the randomly selected time period and continue tallying each trap until the time period has ended. *Begin tally sampling when crew starts hauling the set and sample until 30 minutes have passed and you come to the end of a skate.*
10. Note how many traps were tally sampled in each period so that you can calculate the total number of traps sampled for the set. *(This number will vary.)*
11. Sample every nth unit thereafter. *In this example the ‘sample units’ tallied would be 1, (1+2),... (9+2), so the time segments sampled would be minutes (1-30), (61-90),... (301-330).*

Random Temporal Sampling (Non-systematic)

1. Verify the length of time needed to haul the set by asking the skipper or a crew member – *Captain tells you it will take 4 hours to haul a string.*
2. Define population to be sampled – *All traps in the set.*

3. Define your sample frame – *Non-Systematic Temporal, based on units of time.*
4. Define your sample units (length of time that defines a sample unit may vary from string to string) – *20-minute blocks of time*
5. Number all the sample units in your sampling frame – *Sample units numbered as 1-12 (4 hours in 20-minute blocks; (1-20 min.), (21-40 min.)(221-240 min))*
6. Determine how many of the sample units you want in your sample (minimum of 1/3 of set). *Decide want to sample 5 of the 12 sample units.*
7. Pick random numbers to choose which units to sample. *In this example generate 5 random numbers between 1 and 12 (the maximum sample unit number) to determine which sample units to tally. The numbers 3, 6, 8, 10 and 11 are randomly selected.*
8. Tally sample the first gear segment that begins in the randomly selected time period and continue tally sampling until the time period has ended **and** you have reached the end of a gear unit. *Begin tally sampling at the start of the first trap that begins after the crew has been hauling the set for 40 minutes, and sample all traps until an additional 20 minutes have passed.*
9. Note how many traps were sampled in each tally period so that you can calculate the total number of traps sampled for the set. *(This number will vary.)*
10. Sample all randomly selected time periods. *In this example the time segments sampled would be minutes (41-60), (101-120), (141-160) and (181-220). (Since 2 consecutive sample units, 10 and 11, were selected, the last tally period is 40 minutes long.)*

Observer should have their random sample frame designed prior to the start of gear retrieval.

Equipment Needed

A deck sheet, three to six thumb counters, a pencil and a clipboard will be needed for tally sampling. Prior observers have devised many innovative techniques to make using multiple thumb counters easier. The most common is to use duct tape to attach multiple thumb counters to a clipboard. Other observers have used duct tape and line to create thumb counter belts that fit around the waist. Observers should be creative, experiment, and find out what works best. You will also need scales and several hooks for weighing fish.

9.8.2 Sample weights

Set up a location to safely weigh fish. Weight all uncommon species. For catch that occurs in high numbers, randomly select and weigh 40-50 individuals of each in order to get an average weight. Attempt to spread out the collection across multiple traps. For example, if you tally 25 traps, you could collect 2 fish per trap or 10 fish every 5th sampled trap.

10 Pole & Line

This chapter is under development.

11 Gillnet

This chapter is under development.

12 Pelagic Longline

12.1 Learning objectives

- Describe 4 components of pelagic longline gear
- List the 3 forms that must be completed that are specific to pelagic longline vessels
- List 3 pieces of information that must be collected from each organism
- List 2 scenarios for reducing sampling duties and explain how sampling may be modified

12.2 Introduction

Longline gear is one form of hook and line gear that uses baited hooks to attract and catch fish. Pelagic longlines are also known as drifting longlines because the gear typically drifts with the ocean currents while fishing (Figure 12-1). Pelagic longlines target fish at or near the surface such as tuna, swordfish and some shark species. Although hook and line gear of all types only accounts for approximately 10% of global fisheries catch (Watson et al. 2006), nearly 16% of global tuna catch is harvested with pelagic longline gear (FAO 2009a).

In general, longlining is considered to be selective in the size of fish captured (e.g., large hooks catch large fish). Many fish remain alive and can be returned to sea with a high survival rate. However, pelagic longlining, especially while targeting swordfish, has had a significant impact on sea turtle populations. There are also concerns regarding sharks and seabirds in some fisheries (FAO 1999).

12.3 List of Priorities

1. Estimate effort for each gear deployment;
2. Identify every individual caught on each set and assess catch condition and fate;
3. Collect biological information on target and other identified species as requested;
4. Record all sightings and interactions with marine mammals and sea turtles;
5. Record vessel and fishing gear characteristics.

12.4 Gear Description

A pelagic longline consists of a mainline held near the surface or at a certain depth by means of regularly spaced floats and has evenly spaced baited hooks attached by branchlines (also known as snoods or gangions; Figure 12-1). Pelagic longlines may be of considerable length (20-120 km). Some pelagic longlines are set vertically, each line hanging from a float at the surface.

The main components of a pelagic longline are the mainline, branchlines, hooks, floats and gear markers (Figure 12-1). Mainline materials are typically a thick monofilament line and may be stored on a drum or, if in smaller sections, in a large bin. Pelagic longline gear is deployed in sections called baskets (or skates/magazines) which have 6 to 40 branchlines attached between floats (buoys). Branchlines can be more than 30m in length and are attached to the mainline with a snap (or clip; Figure 12-2). Branchlines can be simple with one type of line material between the snap and the hook or they can be more complex with multiple types of line and swivels attached. Hooks are attached to the lower end of the

branchline and also come in a variety of shapes and sizes although the most common are the tuna, circle and J-hook styles (Figure 12-3). The baiting of hooks may be manual or by a machine (baiting machine). Line shooting and bait casting machines are also often used to deploy pelagic longlines. Vessels are equipped with a hydraulic line hauler for gear retrieval and a sometimes a branchline coiler to wind and store the branchlines.

Gear markers are used to mark the location of the fishing gear and may include buoys (floats), radar reflectors (highflyers), radio beacons, GPS beacons and lights (Figure 12-4). Floats (buoys) are also deployed between baskets.

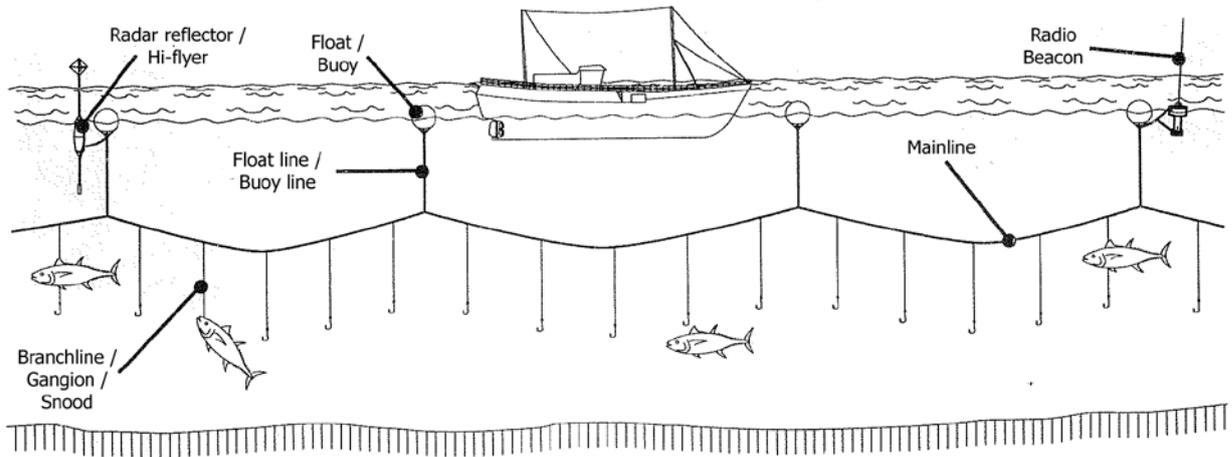


Figure 12-1 Pelagic longline gear components. Modified from Hanrahan et al. (1997).

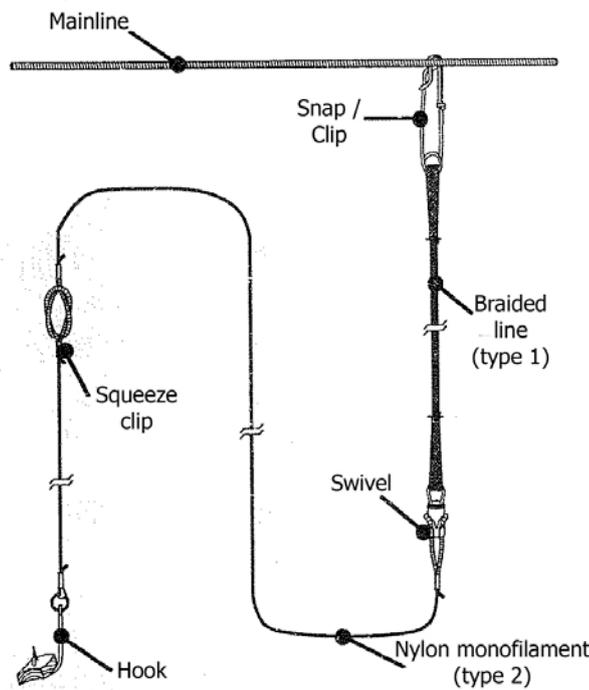


Figure 12-2 Branchline configuration. The braided line and monofilament are two examples of material branchlines can be made of. Modified from Hanrahan et al. (1997).

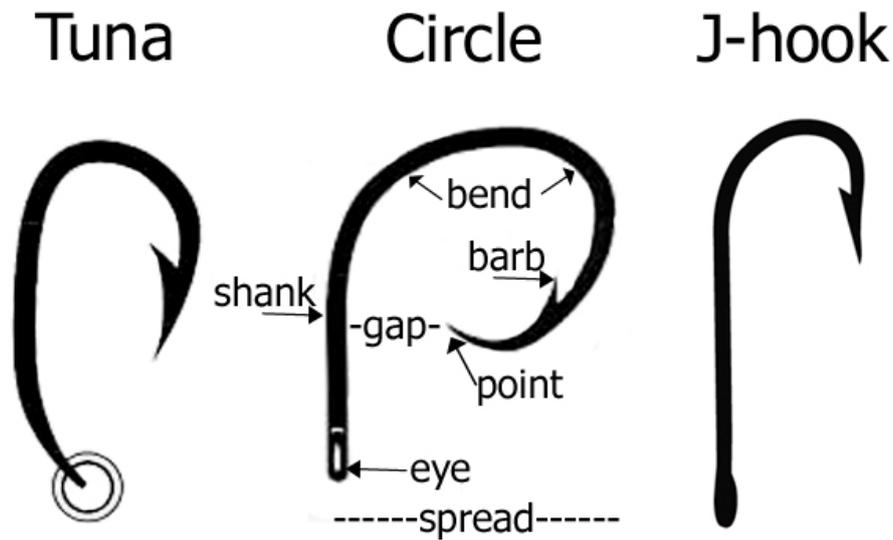


Figure 12-3 Hook types and terminology. The J-hook shank is parallel to the point and is shaped like the letter “J”. Circle hooks have a point that bends in at approximately 90° and the tuna hook has a bent shank. Modified from Beverly (2006, 2009).

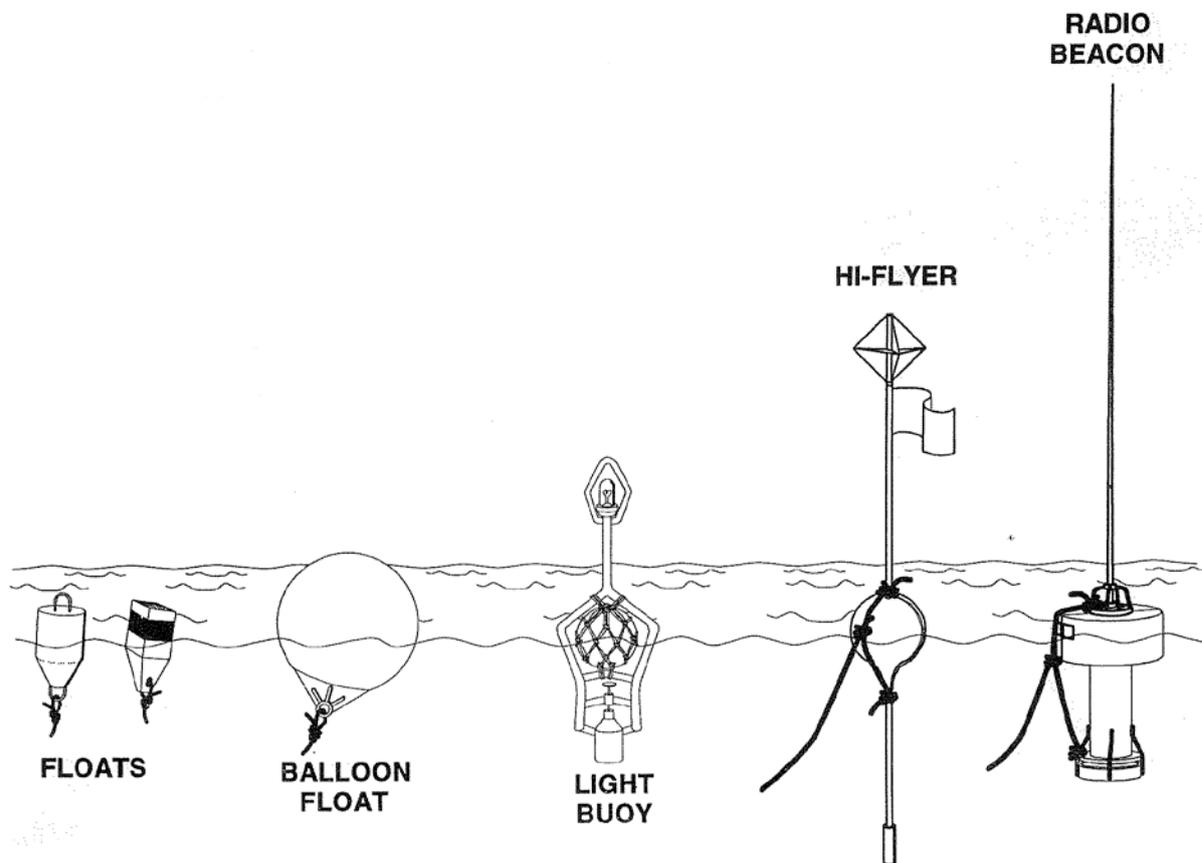


Figure 12-4 Types of floats and buoys. Modified from Hanrahan et al. (1997).

12.5 Fishing Description

Gear deployment: The longline is typically deployed from the stern of the vessel. This may also be called setting or shooting. An end buoy with a gear marker is deployed first and

baited branchlines (snoods) and floats are attached at desired intervals as the main line is payed out. A synchronous series of beeps may indicate when crew should attach the next branchline. The vessel travels at 6-12 knots while gear is being deployed. The length of the mainline, ideal fishing depth and number of hooks per basket varies with the intended target. Fishing depth is a function of floatline length, branchline length, currents, tides and amount of sag in the mainline (or distance between floats/buoys; Bigelow et al. 2006).

Gear retrieval: Longlines are left in the water from several hours to a day. Gear retrieval begins by locating the gear marker at one end of the mainline, then hauling it and the buoyline onboard. The main line is fed into a line hauler and the gear is pulled in. Hooked fish are brought on board using long gaff hooks. The mainline can be coiled and stored in containers or may be wound directly onto a drum. Snaps are removed individually and branchlines are wound up for storage either by hand or with a branchline coiler. The rate at which hooks come on board depends on weather, fishing depth, and hook spacing; however, in general, a hook should come up every 3-6 minutes.

12.6 Forms/Instructions

12.6.1 Gear Description Form – Pelagic Longline

Complete once per trip (see Figure 12-6 for an example). Most gear information can be obtained from the captain or deck boss.

Field	Definition
Observer Code:	Record your observer identification code.
Vessel Code:	Record the vessel code (Appendix 3). If your vessel is not on this list, contact the SOP immediately.
Trip ID	Enter the trip identification number assigned by the SOP.
Lines	<p>For each type of line found on board (including each component of a branchline), record the material code, diameter (millimeters), breaking strength (or test; kg), number of strands and color code. It is normal for there to be only one mainline type. If this is the case, then complete the row for “Mainline Type 1” only. Branchlines are frequently constructed with two or three types of material.</p> <p>If there are more than two types of mainline or floatline or if branchlines consist of more than 4 material types, use additional rows and number types accordingly.</p> <p>Material codes include:</p> <ul style="list-style-type: none"> 1 – Monofilament 2 – Multifilament / synthetic fiber 3 – Cotton or other natural fiber 4 – Steel wire 5 – Other (please specify, e.g. tarred red polyester)

Color codes

1 – White	5 – Blue	9 – Yellow
2 – Pink	6 – Red	10 – Other
3 – Black	7 – Clear	11 – Multi-color
4 – Green	8 – Orange	

Record any additional information about each line in the comments box.

Hooks

For each type of hook used by the vessel, record the manufacturer, model/pattern, size, material, and degrees of offset. The common model/patterns include the tuna hook, J-hook and circle hook (Figure 12-3). If the shank is flat, make a note of this in the comment section.

Hook sizes are not standardized among manufacturers. They may be in a metric unit or another convention that uses a slash (e.g., 9/0). Record what is on the box. If no information is available from the manufacturer, try to bring a sample back or take a photo including a side and front view with a ruler for scale.

Hooks are typically stainless steel (shiny) or galvanized (dull) but verify the material with the captain (Beverly 2009).

Offset is measured in degrees. A hook is offset if the point does not line up exactly with the shank when the point-side is facing you (Figure 12-5). Offset hooks do not lay flat.



Figure 12-5 Offset (left) and non-offset hooks. Image from Beverly (2009).

Gear Deployment Location Check appropriate box for whether longline gear was deployed from the stern, starboard or port of the vessel. If from the side, also record how far from the stern (in meters).

Check appropriate box for whether the gear was deployed into the propeller up- or down-wash.

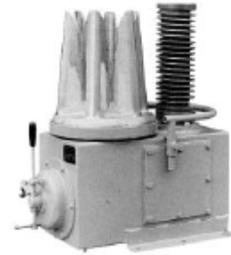
Other equipment For each device, circle **Yes** or **No** for whether the device was present on board and record a usage code defined as:

- | | | | |
|---|---|---|--------------------------|
| 1 | Used continuously during fishing | 5 | Rarely used |
| 2 | Used often during fishing | 6 | Used only during transit |
| 3 | Used sometimes during fishing | 7 | No longer used |
| 4 | Broken during this trip but used normally | 8 | Unknown |

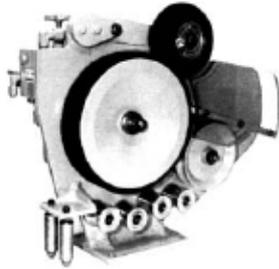
Mainline hauler – hydraulic motor used to assist with pulling gear on board.



Branchline hauler/coiler – winds branchlines into tight, consistent coils



Line setter / shooter – used to pull mainline from drum or deploy mainline at a consistent speed during gear deployment



Bait caster (catapult / thrower) – used to place bait away from the vessel outside of wake zone or within protection of streamers.

Seabird Mitigation: Describe all techniques and equipment used to deter birds from hooks during the set deployment and retrieval (e.g. bird curtain). Include diagrams with measurements of streamer lines and other equipment as necessary.

Gear Description - Pelagic Longline

Observer code <i>SLE 0001</i>	Vessel code <i>12345</i>	Trip ID <i>1</i>
----------------------------------	-----------------------------	---------------------

Lines	Type	Material	Diameter (mm)	Breaking strength (kg)	# strands	Color	Comments
	Mainline	1	1	4	600	1	5
Mainline	2						
Floatline	1	5	5.5	400	3	9	<i>Material=Polypropylene</i>
Floatline	2						
Branchline	1	3	2	800	3	4	
Branchline	2	1	2	800	1	7	
Branchline	3	4	1.8	265	7x7	10	<i>Color=metal (coated stainless steel)</i>
Branchline	4						

Material Codes		Color codes			
1 Monofilament	4 Steel wire	1 White	4 Green	7 Clear	10 Other
2 Multifilament / -strand	5 Other: _____	2 Pink	5 Blue	8 Orange	11 Multi-color
3 Cotton / natural fiber		3 Black	6 Red	9 Yellow	

Hooks	Type	Manufacturer	Model/pattern	Size	Material	Offset
	1	<i>Mustad</i>	<i>tuna</i>	<i>3.8</i>	<i>stainless</i>	<i>0</i>
	2	<i>Eagle claw</i>	<i>circle</i>	<i>16/0</i>	<i>high carbon steel</i>	<i>10°</i>
	3					
	4					

Model/pattern types



Tuna



J-hook



Circle

Other (describe):

Gear Deployment Location

- | | |
|--|---|
| <input type="checkbox"/> Stern | <input type="checkbox"/> Propeller up-wash |
| <input checked="" type="checkbox"/> Stbd, distance from stern <u>5</u> m | <input checked="" type="checkbox"/> Propeller down-wash |
| <input type="checkbox"/> Port, distance from stern _____ m | |

Other Equipment			Usage
Mainline hauler	Y / N	<input checked="" type="radio"/> Y	1
Branchline hauler / coiler	Y / N	<input checked="" type="radio"/> Y	1
Line shooter	Y / N	<input checked="" type="radio"/> Y	1
Bait caster	Y / N	<input checked="" type="radio"/> Y	4
Weighing scales	Y / N	<input checked="" type="radio"/> N	
Other:	Y / N		
Other:	Y / N		
Other:	Y / N		
Other:	Y / N		
Other:	Y / N		

Usage Codes

- 1 Used continuously during fishing
- 2 Used often during fishing
- 3 Used sometimes during fishing
- 4 Broken during this trip but used normally
- 5 Rarely used
- 6 Used only during transit
- 7 No longer used
- 8 Unknown

Seabird Mitigation

Describe all techniques and equipment to deter birds from hooks during the set (e.g. streamer lines) and haul (e.g. bird curtain). Include diagrams with measurements of streamer lines and other equipment as necessary.

Set *One streamer line deployed from stbd side; mainline made of 6mm ploy line; packing straps were white or yellow*

~80m ~50m

Haul

Used a water pump to create a "water curtain" on port, aft quarter of vessel to deter birds from hooks during haul

Comments

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Figure 12-6 Example Gear Description for Pelagic Longline.

12.6.2 Set and Haul Information Form

The Set and Haul form is used to record the basic fishing effort parameters of all longline sets during observed trips (Figure 12-8 contains an example). The information necessary to complete this form is obtained through direct observations. If an element is not available or applicable, leave the field(s) blank and describe the situation in the Comment section. Fields indicated with an asterisk (*) relate to fields on Gear Description form.

Field	Definition
Observer Code:	Record your observer identification code.
Vessel Code:	Record the vessel code (Appendix 3).
Trip ID	Enter the trip identification number assigned by the program.
Set No.	Record the set number (unique and consecutive for each trip).
Target	Ask the captain for the intended target species for each set. Record using 3-digit FAO code (Appendix 7). This will likely remain constant for a trip.

Page ___ of ___ Number pages consecutively throughout the trip.

Several fields must be collected at the beginning and ending of each deployment and retrieval (set and haul) period. It may take more than four hours to deploy gear and over 12 hours to retrieve a set. For each set, you will record four dates, times, positions, SSTs and sea states.

Date	There is a separate column for day, month and year. Record 2-digits in each column.
Time (24-hr)	Record time for each component using 24-hr notation (e.g., 8:45 a.m. = 0845 and 2:12 p.m. = 1412). Start and end setting times are defined when the first and last hooks go in the water, respectively. Start and end hauling times are when the first and last hooks come back on board, respectively.
Lat-Deg	Record degrees of latitude (2-digits) for start and end of the set and haul periods.
Lat-Min	Record the minutes of latitude (to hundredths of a minute; 4-digits)
Lat-N/S	Record N for all latitudes North of the equator and S for latitudes south of the equator.
Long-Deg	Record degrees of longitude (3-digits).
Long-Min	Record the minutes of longitude (to hundredths of a minute; 4-digits)

Long-E/W Record **W** for all longitude West of the prime meridian (e.g., 0°) and **E** for longitudes east of the prime meridian.

SST Record the sea surface temperature as a 3-digit number to the nearest 0.1 degree Celsius. Use the vessel's thermistor (thermometer probe). If the vessel does not have a working thermistor and you were issued a thermometer, use the issued thermometer to collect a temperature reading using the following steps:

1. Cast the water-collecting container overboard into water which is least affected by external heating from the vessel (i.e., away from engine cooling water discharges). Avoid sampling near overboard discharges. This is dangerous if the vessel is moving so make sure vessel has stopped before putting anything overboard yourself.
2. Collect enough water to fill the well and insert the thermometer.
3. Allow roughly 15 seconds for the thermometer to equilibrate before recording the temperature.

If neither you nor the vessel has an operable thermometer, leave this column blank and make a note in the comments section.

Sea state Record the dominant sea state using definitions in Appendix 12.

V / O Record **O** if the observer independently recorded time, position and environmental conditions. Record **V** if the information was obtained from a vessel's fishing log or the captain.

Set Speed Obtain the average setting speed (tenths of knots) from captain.

Max depth Ask the captain how deep he wants the deepest part of the gear to fish. Record maximum depth in meters. If you need to convert units, record conversion calculation in comments section.

Seabird mitigation Enter code for any mitigation used during gear deployment. Options include:

- 0 - None
- 1 - Bird scaring line - single
- 2 - Bird scaring line - double
- 3 - Weighted branchline/gangion
- 4 - Weighted groundline
- 5 - Underwater setting tube/chute
- 6 - Moon pool
- 10 - Other - explain in comments. Use this code if more than one of the techniques was used and explain in comments.

Haul Dir. Circle **F** or **R** for the haul direction. Forward is defined as the same direction gear was deployed and reverse is the opposite direction as gear was deployed.

Hooks

Type* Record the dominant hook type deployed for the set. Hook type should relate to the type number on the Gear Description- Pelagic Longline form. If more than one hook type is deployed in a set, record the dominant hook type and make a note in the comments section about the approximate percentage of each hook type. For instance, “80% hook type 1 and 20% hook type 2 were deployed.”

Hooks/basket Record the mean number of hooks attached per basket (may also be referred to as hooks per float). Count a minimum of 10 baskets during gear deployment and calculate an average.

Total Baskets Record the total number of baskets deployed. Ask the captain or crew.

Deployed Record the total number of hooks deployed including shark hooks that were attached to the floats. Calculate using the formula:

$$(\text{Hooks/basket} * \text{total baskets}) + \text{total shark hooks}$$

Retrieved Record the total number of hooks retrieved. Tally missing hooks as gear is hauled and subtract the number missing from total hooks set.

Tended Record the number of hooks tended while gear is soaking prior to hauling the gear. This practice may be called ‘hotlining’ and is more common on vessels using live bait.

Rebaited Record the number of hooks rebaited prior to hauling the gear.

Monitored Record the number of hooks monitored. Ideally, this will equal the number of hooks hauled. However, sometimes weather or your health may limit your ability to monitor all catch coming on board (see also Section 12.7).

Branchline

Type* and Length Record the dominant branchline configuration deployed for the set. Record lengths of each component by material type as described on the Gear Description-Pelagic Longline form. The length of the first component starts at the top of the snap. The sum of these lengths should equal the total branchline length (Figure 12-7).

If there are multiple branchline configurations, make a note in the comments section regarding the other configurations and approximate proportion of each configuration deployed.

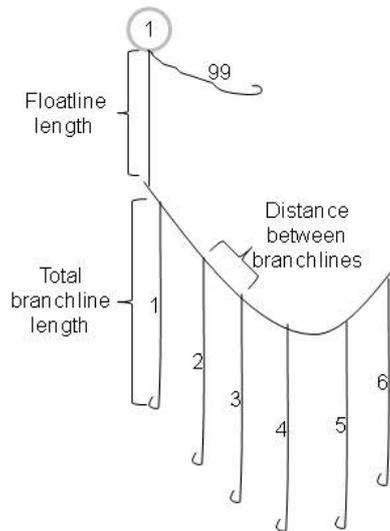


Figure 12-7 Branchline and floatline measurements.

Branchline set interval	Record the setting interval (in seconds) that the crew is targeting for branchline attachment. You can also time this yourself.
Distance between	Record the distance between branchlines (in meters) that the crew is targeting for branchline attachment. This can be calculated using vessel setting speed and the branchline attachment interval (above)
Weight (g) and weight placement	Record the total weight of any weight attached to the branchline. This may be incorporated into the swivel(s) or added separately. Make a note where the weights are located (e.g., 30g swivel between material type 2 and 3 and 30g weight attached 20cm above hook).
Floats	Record the total number of floats (including end buoys) deployed.
Float line Type*	Record the dominant floatline type (as described on Gear Description-Pelagic Longline form).
Floatline length	Record the average floatline length (Figure 12-7). Measure several to calculate the average.
Weights	Record the amount of weight (in grams) attached to floatline. If no weights were added, record "0".
Sharkline on floats?	If a sharkline was deployed at the float, record the hook type (from Gear Description-Pelagic Longline form) and total number of

sharklines deployed.

- Bait – species and kg Record the approximate weight of each species of bait used for the set. Ask the crew or pay attention to number of boxes of bait used by species.
- Bait – Hook No. If more than one bait species is used, they will typically be put on the same hook numbers within each basket. If this is the case, record the hook position within basket that each bait species was placed. For instance, Squid might go on hooks 4 and 5 while sardines on hooks 1-3 and 6-8 for an 8 hook basket. If this was not the case, leave Hook No. blank.
- Mainline length Ask the skipper for the estimate of the length of mainline deployed. Record in to nearest tenth of a nautical mile.
- Gear condition? Indicate the condition of the gear at the completion of the haul by recording the most appropriate code:
- 0 No problems (<10% hooks lost and/or minor gear damage)
 - 1 Minor problems – 10-25% hooks lost and less than 50% of gear fouled due to weather/oceanic conditions. Gear tangled, spun up effecting gear fishability
 - 2 Major problems – >25% of hooks lost and > 50% of gear fouled due to weather/oceanic conditions
 - 3 Gear completely damaged or lost
 - 4 Gear conflicts (with another fisher)
 - 5 Other – explain in comments
- Gear parted? Did the mainline part (or break) during gear retrieval? Circle **Yes** or **No**. If yes, make notes in comments regarding parting time and when gear hauling resumed.
- Gear lost? Was any gear lost during this set? Circle **Yes** or **No**. If yes, make notes in the comment section.
- Light Devices - Type Circle the predominant type of light device attached to gear. If more than one type, make a note in the comments.
- Light Devices – How many? Record the total number of light devices attached to the gear.
- Light Devices – Placement Record where the majority of the light devices were attached to the gear.

Color code & percent

Record the color code and approximate percentage of each color deployed. For example, Code 2 – 50% and Code 8 – 50%. The percent recorded must sum to 100%.

Color codes:

- 1 – White
- 2 – Pink
- 3 – Black
- 4 – Green
- 5 – Blue
- 6 – Red
- 7 – Clear
- 8 - Orange
- 9 – Yellow
- 10 – Other

Other devices

Check appropriate boxes if temperature-depth recorders (TDRs), hook timers, surface lights or any other devices that may impact fishing effectiveness were deployed. If Other is checked, make notes in comments section.

Comments

Use this section to describe any particulars that could not be codified from the available data element choices. If any data elements were left blank, record what was left blank and why the information could not be collected, in this section. If you run out of room, indicate that there are notes elsewhere (e.g., Observer Logbook).

Set and Haul Information - Pelagic Longline

Observer code SLE 0001	Vessel code 12345	Trip ID 1	Set No. 1	Target BET
----------------------------------	-----------------------------	---------------------	---------------------	----------------------

Page ___ of ___

		Date/Time				Position						SST (°C)	Sea state	V/O	Set Speed (kts)	Max Depth (m)	Seabird Mitigation	Haul Dir.
		Day	Month	Year	Time (24-hr)	Lat-Deg	Lat-Min	N/S	Long-Deg	Long-Min	E/W							
D e p l o y	Begin	22	12	09	0655	10	10.52	N	025	17.30	W	27.3	4	Ø	8.5	90	3	
	End	22	12	09	1112	10	20.75	N	024	40.91	W	27.4	4	V				
t r i e v e	Begin	22	12	09	1540	10	12.22	N	025	13.95	W	27.2	5	0			R	Ⓡ
	End	23	12	09	0311	10	21.87	N	025	47.32	W	27.2	6	0				

Hooks	
Type*	1
Hooks / basket	8
Total baskets	200
Deployed	1650
Retrieved	1609
Tended	0
Rebaited	0
Monitored	1523

Branchline		
Type*	Length	Branchline set interval (s)
1	10.0	
2	10.5	
3	1.0	Distance between (m)
		30
Weight (g)	Weight placement	
40	<i>Two 20g swivels at each junction b/w materials</i>	

Floats	
#	201
Float line	
Type*	1
Measured length	25.1
Weight (g)	5000
Shark line on floats?	
Hook type*	2
Total set	50

Seabird mitigation codes (deployment)	
0 - None	
1 - Bird scaring line - single	
2 - Bird scaring line - double	
3 - Weighted branchline/gangion	
4 - Weighted groundline	
5 - Underwater setting tube/chute	
6 - Moon pool	
10 - Other - explain in comments	

*relate to Types described on Gear Description - Pelagic Longline form

Bait				
Species	SQU			
kg	800			
Hook No.				

Light devices	
Type codes (circle one)	0 None 1 Chemical light stick 2 Battery light 3 Glow bead 4 Other
How many?	300
Placement	junction b/w branchline types 2 & 3
Color Code	%
2	75
4	25

Gear Condition Codes	
0	No problems (<10% lost)
1	Minor problems (<10-25% lost)
2	Major problems (>25% lost)
3	Gear completely damaged/lost.

Color Codes	
1 - White	6 - Red
2 - Pink	7 - Clear
3 - Black	8 - Orange
4 - Green	9 - Yellow
5 - Blue	10 - Other

Other devices? TDRs Hook timers Surface lights Other

Comments

*1636 - line parts but vessel finds the next float (radar deflector attached) and resume hauling by 1700

*2300 - line parts again and we end up steaming to other end to haul from that side. Resume hauling by ~0115. By the end of the haul it appears there were ~5 baskets of gear missing (including 1 float w/ a shark hook).

*Random break #4 - took 15 minutes to eat at 1620 - missed 37 hooks. If I had known the gear was going to part I would have delayed until we were steaming.

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Figure 12-8 Example of completed Set and Haul Information form.

12.6.3 Catch Composition Sampling

Because there are few fish and they come up individually, all fish will be identified, assessed for condition (when caught and released), sexed (if possible) and measured (Figure 12-9).

Observers must monitor the entire haul back, or gear retrieval process.

Field Definition

Observer Code: Record your observer identification code.

Vessel Code: Record the vessel code (Appendix 3).

Trip ID: Enter the trip identification number assigned by the program.

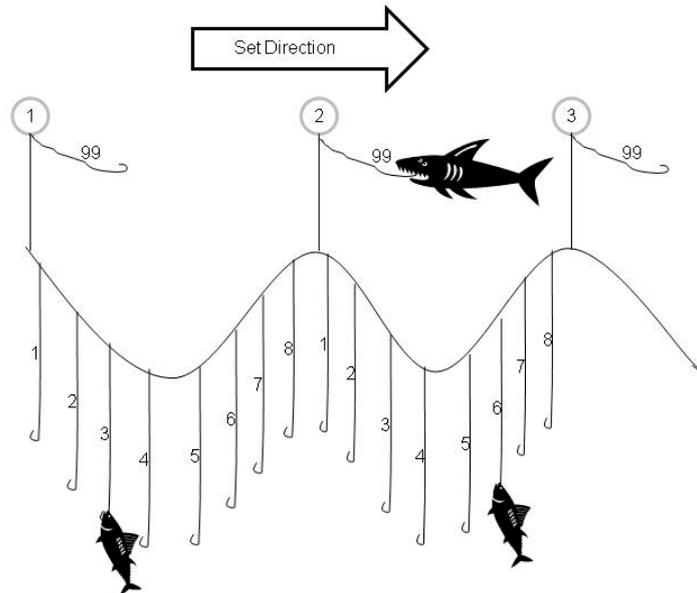
Set No.: Record the set number.

Page ___ of ___: Number pages consecutively throughout the trip.

Blank: First column left blank intentionally.

Hook No.: Record the hook numbers for each animal caught, including those that 'escaped' before being brought on board or were released outboard. For instance, given the diagram below and gear being hauled in the same direction set, the first fish would be recorded as Hook No. 3, the second fish (on the shark hook) as Hook No. 99

and the 3rd fish as Hook No. 6. All sharklines are indicated with hook number 99. If more than one fish is caught on a hook, record both with the same hook number.



Species name Record species name to lowest taxonomic level. If animal was not boarded, a higher taxonomic level is acceptable (for example, a shark breaks the surface & then the branchline parts and you didn't see it well enough to identify it to species, record this as 'Elasmobranch, unidentified, code=SKX')

Species code Record 3-letter species code (Appendix 7)

Caught condition code Record the condition in which the animal was caught using the following codes:

- A1** Active, not bleeding, no obvious injury
- A2** Active, bleeding, obvious injury
- X** Inactive / unresponsive / dead
- U** Unknown. Record unknown if you do not see animal as it's brought on board or it escapes prior to boarding.

There are some additional codes that apply specifically to marine mammals and sea turtles and link to their respective catch/carcass forms (Chapter 16).

- A3** Active, unknown condition
- X2** Previously dead (marine mammals, turtles only)
- O** Other

Kept / return Indicate whether the animal was kept or returned using the

code	<p>following codes:</p> <p>K Kept all or part of animal (excluding finned sharks - use code F)</p> <p>A1 Active, not bleeding</p> <p>A2 Active, bleeding, obvious injury</p> <p>X Inactive / unresponsive / dead</p> <p>F Finned</p> <p>U Unknown. Record unknown if you do not observe what happens to the animal.</p>
Damage code	<p>Record any damage an animal has when it comes on board. Only record recent damage. Take photos when possible.</p> <p>Blank No obvious damage</p> <p>NI Did not inspect</p> <p>C Cookie cutter shark – damage appears as a circular or oval-shaped cut out of the body.</p> <p>M Marine mammal – damage will usually result in nearly all of the fish’s body being removed often leaving only the fish’s head or mouthparts on the hook. The bite will often look jagged with strips of skin and tendons. You may be able to see more widely spaced tooth marks, or strips of flesh removed, in comparison to shark damage.</p> <p>S Shark –damage will usually appear as fairly sharp, defined edges of flesh removed as if cut from the body. May see teeth puncture marks, or slashes in the flesh.</p> <p>U Unknown source of damage. Describe in comments and take a photo.</p>
Sex	<p>If it is possible to collect the sex of the fish (possibly when crew is processing), record the sex using the following codes:</p> <p>M Male F Female</p> <p>I Indeterminate – use when you inspect the gonads but are unable to decide which sex</p> <p>U Unknown – gonads were not inspected</p> <p>For fish that will be returned to sea alive and cannot be sexed using external characteristics, record “U”.</p>
Length types	<p>Record the length type using definitions from Chapter 14. Unless</p>

and
measurements

given a special length project, record only one length in the “Length 1” type and measurement columns.

For tuna fisheries you will add a letter code after the numeric length type code defined as follows:

C – Curved –taken in a line tracing the contour of the body

S – Straight –measuring device remains flat (usually under the animal)

E – Estimated – try to estimate lengths of animals not brought on board to the nearest 10 cm.

The following list provides a general rule of thumb for measurement types:

- Swordfish and billfish – lower jaw to fork length, curved (type 05C)
- Tunas, sharks & most other fish – straight fork length (type 01S)
- Rays – disc width (type 11S)

Weight types
and
measurements

If the vessel is weighing fish, ask to access their weight information.

Weight type is also recorded as an alpha-numeric code (e.g. 01A) using the following definitions:

Blank - no weight

A Actual

01 Whole

E Estimated

02 Gilled & gutted

03 Gilled & headed

04 Headed & gutted

99 Other, describe in comment

Tag / specimen /
carcass no.

Record the tag, specimen or carcass number as appropriate. Complete the appropriate form as well.

Photos

Check box if photos were taken and make notes in comments field.

Comment
column

Number comments consecutively within each set.

Comments box

There is a comment box at the bottom of each 2nd page. Make any comments about individual animals or the haul here. Refer to individuals by their comment number.

Catch Composition - Pelagic Longline

Observer code SLE 0001 Vessel code 12345 Trip ID 1 Set No. 1 Page 1 of

Hook No.	Species name	Species code	Caught condition code	Kept / return code	Damage code	Sex (M, F, I, U)	Length 1		Length 2		Length 3		Weight		Tag / specimen / carcass no.	Photos	Comment
							Type	Measurement	Type	Measurement	Type	Measurement	Type	Measurement			
3	<i>albacore</i>	ALB	A1	K		I	01S	88								<input type="checkbox"/>	
5	<i>bigeye</i>	BET	A2	K	S	M	01S	101								<input type="checkbox"/>	
1	<i>albacore</i>	ALB	X	K		M	01S	98								<input type="checkbox"/>	
5	<i>albacore</i>	ALB	A2	K		F	01S	107								<input type="checkbox"/>	
2	<i>blue shark</i>	BSH	X	K		M	01S	193								<input type="checkbox"/>	
4	<i>blue marlin</i>	BUM	A1	A1		U	05E	175								<input type="checkbox"/>	1
7	<i>bigeye</i>	BET	A1	K		M	01S	129								<input type="checkbox"/>	
4	<i>albacore</i>	ALB	X	K		F	01S	111								<input type="checkbox"/>	
6	<i>yellowfin</i>	YFT	X	X	M	U										<input checked="" type="checkbox"/>	2
1	<i>bigeye</i>	BET	X	K		F	01S	136								<input type="checkbox"/>	

Common Species SKJ Skjopsk tuna YFT Yellowfin tuna BET Bigeye tuna ALB Albacore tuna SWO Swordfish BSH Blue shark SMA Shortfin mako shark	Caught condition A1 Active, not bleeding A2 Active, bleeding/obvious injury X Inactive U Unknown *More codes for MM & turtles	Kept/return codes K Kept A1 Active, not bleeding A2 Active, bleeding/obvious injury X Dead, inactive F Fined U Unknown	Damage codes Blank No damage NI Did not inspect C Cookie cutter shark M Marine mammal S Shark U Unknown source	Length types (combine # & letter) 01 Fork C Curved 02 Total S Straight 03 Standard E Estimated 04 Eye to fork 05 Lower jaw to fork 11 Disc width	Weight types (combine # & letter) Blank - no weight A Actual 01 Whole E Estimated 02 Gilled & gutted 03 Gilled & headed 04 Headed & gutted 99 Other, describe in comment
Sex codes M Male F Female I Indeterminate U Unknown (not inspected)					

Hook No.	Species name	Species code	Caught condition (A, D, I, U)	Kept / return code (K, A, D, F, I, U)	Damage code	Sex (M, F, I, U)	Length 1		Length 2		Length 3		Weight		Tag / specimen / carcass no.	Photos	Comment
							Type	Measurement	Type	Measurement	Type	Measurement	Type	Measurement			
7	<i>Atl. sailfish</i>	SAI	A2	K		F	05C	187								<input type="checkbox"/>	
2	<i>Blue shark</i>	BSH	X	K		F	01S	244								<input type="checkbox"/>	
8	<i>albacore</i>	ALB	X	K		M	01S	117								<input type="checkbox"/>	
3	<i>shortfin mako</i>	SMA	X	I		F	01S	143								<input type="checkbox"/>	
3	<i>bigeye</i>	BET	X	K		F	01S	121								<input type="checkbox"/>	
4	<i>yellowfin</i>	YFT	U	K	C	F	01S	107								<input checked="" type="checkbox"/>	
5	<i>yellowfin</i>	YFT	X	K		F	01S	108								<input type="checkbox"/>	
1	<i>Loggerhead</i>	TTL	A1	A1		U								1		<input checked="" type="checkbox"/>	
7	<i>bigeye</i>	BET	A2	K		M	01S	103								<input type="checkbox"/>	
8	<i>swordfish</i>	SWO	A2	K		M	05C	126								<input type="checkbox"/>	

Comments (reference by number in comments box):

Comments:
 1 - blue marlin broke branchline & escaped before boarding
 2 - no measure/sex because most of body missing (took photos of damage)

Figure 12-9 Example of completed Catch Composition form for pelagic longline.

12.7 Catch Composition and Biological Data

You are expected to monitor the entire retrieval for catch composition; however, occasionally this is not feasible. Use the following summary of problems/solutions to determine sampling modifications:

Fishing is too heavy to keep up without seriously impacting the vessel: If you are unable to keep up with the catch rate, reduce the number of sexed lengths collected to those indicated with the grey highlighted lines on the Catch Composition form for Pelagic Longline. This is approximately every third fish. The identification, catch condition and discard condition should still be collected for all individuals.

Rough seas / seasickness: If sea conditions make the deck too dangerous to work on, or if sea-sickness becomes severe, cease collecting measurements, but continue to monitor all hooks and record species caught. If sea conditions are too dangerous to remain on deck, you should make every effort to see each hook that comes up from a position of relative safety. These conditions are rare and impact your data quality. You should always document these situations in your Observer Logbook.

I need to use the toilet or eat a meal: If the haul time is more than 8 hours and the crew doesn't break at all, establish a random break system in order to take a meal or use the toilet. For instance, pick a random number between 1 and 12 which represent 5 minute increments on the clock. Every second hour during the randomly selected time, decide whether you need a break. Breaks should not exceed 15 minutes and should be limited to two per haul. You also need to devise a way to count hooks while on break in order to account for 'unmonitored hooks'. Most of the time, you should be able to take care of your needs without missing any sampling.

Example: The haul begins at 1145 and is expected to take 10 hours. The random number is 4. At 1320, 1520, 1720, 1920, 2120, you could take a 15-minute break. During the break, you ask the crew to put all branchlines retrieved in a separate basket so that you can count them upon your return.

13 Purse Seine – Large Pelagics

13.1 Learning objectives

- Describe how purse seine gear works and how marine mammals can be released safely
- List the 4 forms that must be completed that are specific to purse seine vessels
- Describe the ‘preferred’ method for estimating total catch
- List 5 species that are a priority for length-frequency collection.

13.2 Introduction

In general, seining (including purse seine) accounts for about 30% of global fisheries catch (Watson et al. 2006). Purse seining is a method of fishing that uses a wall of net to encircle a school of pelagic fish. In most cases the purse seines are surface gears used in both coastal and high-seas waters. Aggregated resources in shallow depths are most common, but fish at depths up to 300 m can be targeted. Purse seines are also used in inland areas when there is enough room for the deployment of a large net. The purse seine can be operated by a large range of vessel sizes as well as by one or two boats. A wide range of pelagic fish sizes can be targeted ranging from sardines to tuna. This chapter will focus on purse seine sampling for large pelagic targets. Purse seiners are also used to fill aquaculture pens with bluefin tuna in joint fishing-aquaculture operations.

Because the target species are typically pelagic, there is virtually no impact on the bottom habitat (except when the water depth is less than the height of the seine during the fishing operations and that the lower edge of the gear wipes the sea bottom). The main negative impact of tuna purse seining is the incidental capture of dolphins in certain fishing areas (especially the eastern Pacific). Special techniques have been developed to reduce bycatch of dolphins (e.g., the Medina or dolphin safe panel and "back down" operation), which allow encircled dolphins to escape alive. When small purse seines are used with light attraction, there may be incidental catch/bycatch (including small fish, juveniles or endangered species). The practice of encircling floating objects, including man-made fish aggregating devices (FADs) increases the capture of small sized and immature fishes aggregating around such devices (FAO 2001-2009).

Data collection protocols for this chapter were compiled using observer manuals from established observer programs and papers published by observer data users (IATTC 1999-2005, Itano 2003, 2007, SPC 2007, Delgado de Molina et al. No date, Gaertner No date).

13.3 List of Priorities

1. Record vessel activity continuously each day on board;
2. Estimate total catch for each gear deployment;
3. Collect random samples within each set for catch composition and document species retained and discarded;
4. Describe all floating objects sighted, especially those involved in a fishing set;
5. Subsample catch for lengths;

6. Record all sightings and interactions with marine mammals and sea turtles;
7. Record fishing gear characteristics.

13.4 Gear Description

A purse seine is made of a wall of netting framed with a float line at the top and lead line toward the bottom (usually, of equal or longer length than the float line). The float line is held aloft by hundreds of small floats. The leadline is a weighted line used to pull the net vertical and has purse rings hanging from the lower edge, through which runs a purse line made from steel wire or rope which allow the pursing (closing) of the net from below (Figure 13-1). Tuna purse seine nets can be more than 1km in length and 200m in depth (National Research Council Committee on Reducing Porpoise Mortality from Tuna Fishing 1992).

The basic equipment employed by industrial purse seine fisheries includes a net hauling system (e.g., single power block, duplex or triplex system, double block), a purse line winch (or capstan), a number of derricks or cranes, a brailer or a fish pump, small winches, several auxiliary boats and sometimes, an helicopter. Catch can exceed 100 MT. Net hauling systems come in a variety of styles and configurations. Auxiliary boats for tuna fisheries include a tow boat or net skiff used to pull the net from the vessel, speed boats used to herd tuna and/or dolphins and to prevent the net from collapsing during retrieval and a raft or personal watercraft used to assist with dolphin release.

The backdown procedure is the principal marine mammal release maneuver. The vessel starts to reverse after approximately one half to two-thirds of the net has been rolled aboard and is tied down. This creates a channel and causes the corkline at the apex (section furthest from the ship) to sink, thus allowing captured marine mammals to escape without losing the tuna catch (Figure 13-2). Occasionally, rafts and swimmers are deployed to herd marine mammals toward the release area.

The dolphin safety panel consists of a small-mesh net strip installed in place of the standard mesh. When correctly installed and aligned, it covers the perimeter of the backdown channel created by the backdown procedure, and reduces the likelihood of marine mammal entanglement.

13.4.1.1 Floating Objects and Fish Aggregating Devices

Tuna are sometimes associated with floating objects or flotsam of natural (e.g., trees) or human (e.g., fish aggregating device or garbage) origin. Floating objects can be drifting with the ocean currents or anchored to one location. Detailed information will be collected on sightings of and vessel interactions with floating objects (Floating Object Record form) in order to quantify this association and determine the distribution and abundance of the objects in the East Atlantic Ocean. Nets can be deployed near these floating objects as well.

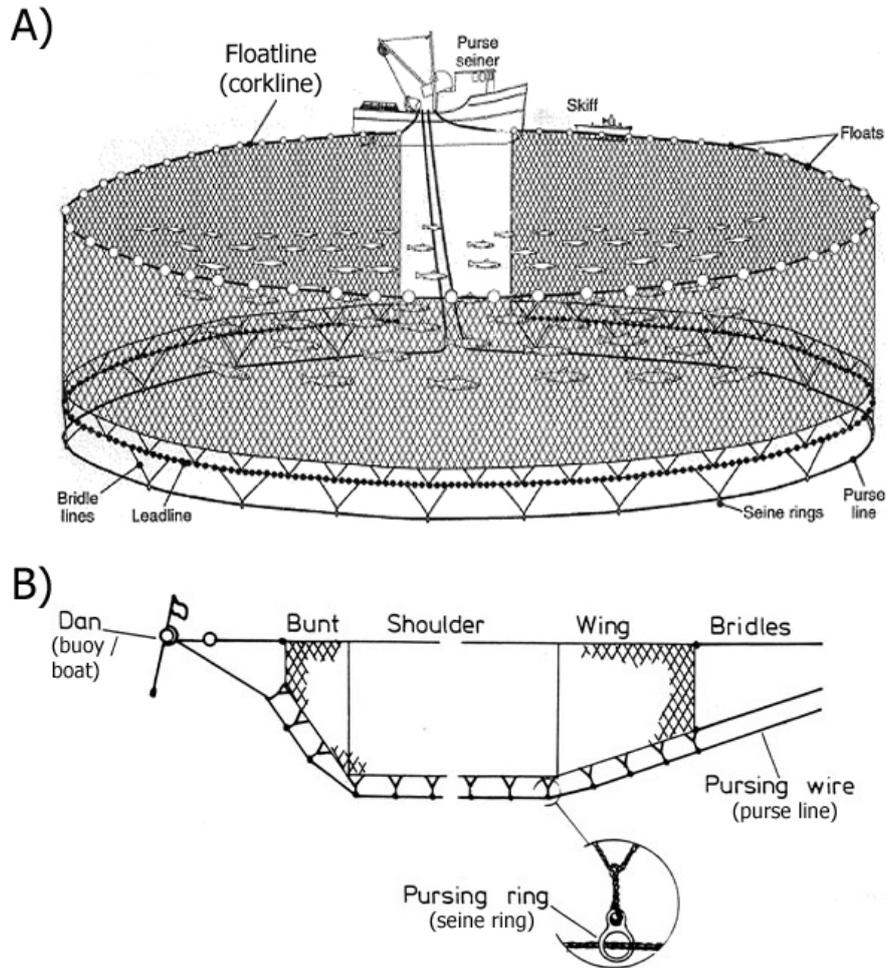


Figure 13-1 Generalized purse seine configuration without (A) and with (B) tapered ends. Images modified from (Hanrahan et al. 1997, FAO 2001-2009).

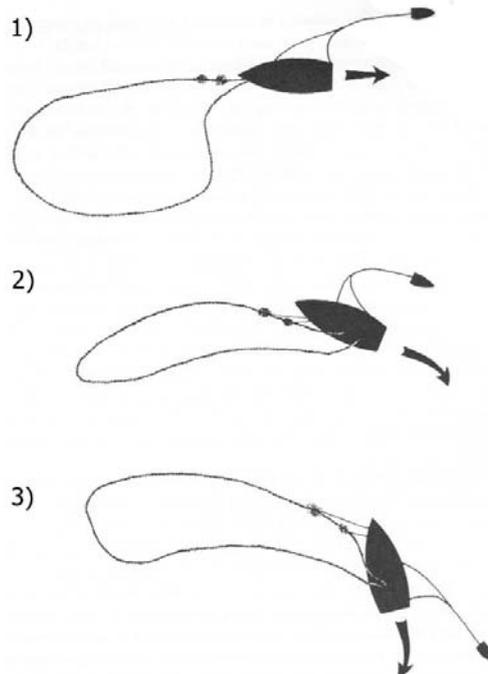


Figure 13-2 Diagram of backdown procedure to release dolphins. Modified from (National Research Council Committee on Reducing Porpoise Mortality from Tuna Fishing 1992).

13.5 Fishing Description

Locating Fish: Searching for fish is an important component of purse seine fishing effort. Tuna purse seiners utilize a number of methods to locate fish including aircraft (land-based planes or ship-based helicopters), high powered binoculars (20X) from the bridge or crow's nest, or radar to search the sea for cues of fish presence. Cues may include schools of tuna (breezers, boilers and black spots), schools of small fish, flocks of birds, ruffling of the water surface and presence of groups of dolphins or whales. Prior to deploying a net, vessels must evaluate school size and catchability (National Research Council Committee on Reducing Porpoise Mortality from Tuna Fishing 1992). Speedboats may be used to herd fish or marine mammals prior to gear deployment.

Gear Deployment: Another type of small motorized boat (tow boat or net skiff) is deployed first. One end of the net is then lowered and attached to the skiff. The seiner and skiff then proceed to encircle the fish with the net (also called casting). Casting is fairly quick, 5-15 minutes. When fully deployed, the seine hangs in the water similar to a gillnet. The mesh size is generally small enough that fish do not become entangled in the net, rather they are contained by the encircling net.

Gear Retrieval: Once the netting has totally encircled the fish, the purse line is winched in, closing the bottom of the seine (also called pursing). The seine is pulled aboard the seiner by the purse line and headline, reducing space inside the net and concentrating the fish in one section of the net (sometimes called the sack or bunt). Pursing may take 15-25 minutes. The catch is winched aboard with brailers (or dip nets) or sucked aboard with a hydraulic pump (small pelagic fish only). Getting all of the fish on board may take 4-5 hours depending on catch size (Kim et al. 2005).

13.6 Forms/Instructions

13.6.1 Gear Description Form

Complete one gear description form for each unique net used during your trip (Figure 13-6).

Page ___ of ___ Insert the page number and total number of pages. This will be "1 of 1" if there is only one net.

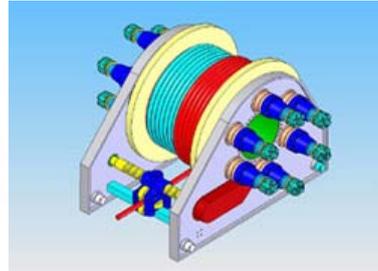
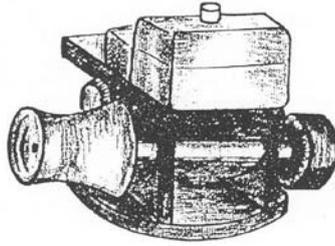
Observer Code: Record your observer identification code (assigned by the SOP).

Vessel Code: Record the vessel code (Appendix 3).

Trip ID Enter the trip identification number assigned by the SOP.

Net hauling system Make a brief description and record the manufacturer and model of the net hauling system including any power blocks.

Purse line winch Record the make and model of the power winch or capstan used to bring in the purse line.



Capstan (left) and purple line winch (right; <http://www.cmtwinches.com>)

Brail capacity Record the capacity (in metric tons) of each brailer used to transfer fish from the net onto the vessel. Ask the captain for the capacity. The capacity can be used for one method of total catch estimation.

Net Characteristics

Net # Enter “1” if only one net or identical nets are used. If more than one net is used and they are not identical, complete a second form and complete the relevant sections for Net #2.

Total length Record the total length of the net to the nearest whole meter. To determine the length of the net, count the number of handholds in the corkline from end to end during 3 gear deployments, using a hand counter to keep tally. Handholds are the spaces between groups of corks in the floatline, and are generally ~ 2 meters apart. Ask to measure a few to get an idea of this distance. Total length = total count of hand holds * average distance between handholds. If there are no obvious sections or if sections are too long to measure, ask captain for the net dimensions.

Total depth Net depth can be determined by counting the number of net strips (at the center line if possible). Each strip is approximately 2 meters (stretched mesh) deep, and the join between strips can be identified by the line of lacings holding the edges together. Calculate the net depth in meters by multiplying the number of strips by the height of one strip.

Float line length Record the length of the float line in meters. Captain can provide this measurement.

Lead line length Record the length of the lead line in meters. Captain can provide this measurement.

Mesh size & type Record mesh size in centimeters. Calculate using the average of 20 stretched meshes (the distance between opposite mesh knots when the mesh is stretched tight; Figure 13-3). Record the average mesh size to the nearest tenth of a centimeter.

Circle appropriate letter for whether the mesh size was measured **W**et or **D**ry. Ideally, this measurement should be made when the net is wet.

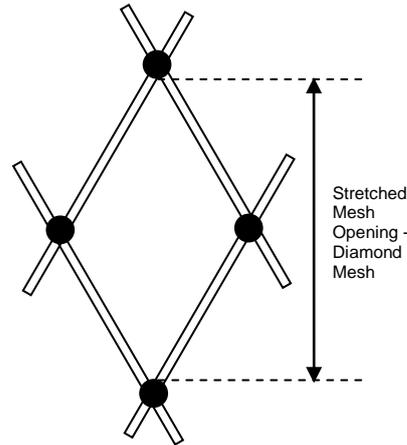


Figure 13-3 Measure stretched mesh opening from the inner edge of knots (modified from (Ferro and Xu 1996)).

Circle whether the mesh type was knotted or knotless (Figure 13-4).



Figure 13-4 Knotted (left; <http://www.battingtonets.com/analysis>) and knotless (right; <http://www.nguinternational.com/fishing/nets.htm>) mesh.

Hanging ratio Ratio of float line length to netting length (typically ~0.8). There may be different ratios for the float and lead lines. Ask captain.

Purse line material Record the material of the purse line (e.g., steel cable, Spectra™)

Purse line diameter (mm) Record the diameter of the purse line in millimeters. Ask the captain or crew.

Dolphin Safety Panel – Complete this section only if the net is equipped with this panel.

Length Measure this on three separate occasions, using the same method as described for determining total net length (see above). You can combine one measurement with your total net length measurement if you make a note of where the safety panel begins and ends while measuring the entire net. The ends of the safety panel may be marked with paint or buoys.

Depth Determine the depth of the safety panel by counting the number of fine mesh strips, as for total net depth. Usually 2-3 strips.

Mesh size Measure and record the mesh size of the netting in the safety panel, as

for net mesh size (above).

Net Diagram

Make a generalized sketch of the net, indicating the approximate dimensions and location of the principal components. Net shapes are highly variable (Figure 13-5). Include the overall dimensions of the net and safety panel, the approximate positions of bunch lines, and the position of markers on the corkline identifying tie-down points, the ends of the safety panel, and/or the apex of the backdown channel.

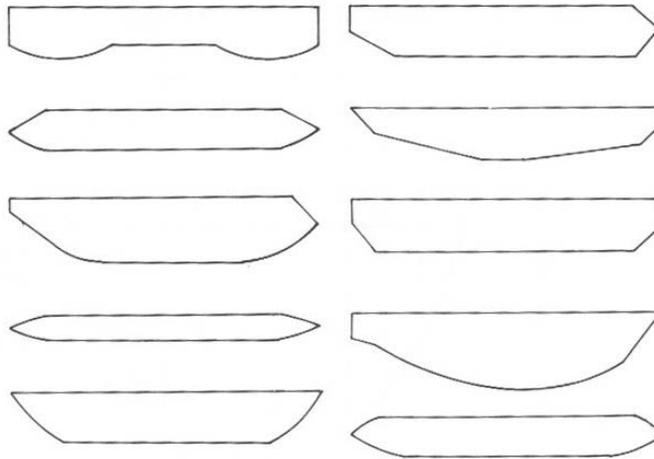


Figure 13-5 Purse seine shapes. Modified from Ben-Yami (1994)

Comments

Note the general condition of the net and safety panel including any details such as holes or tears in the webbing, loose corkline hangings, and any other information pertinent to the operation of the net or fishing efficiency.

Describe the brailing operation. This should include: how the mouth of the net was held open (i.e. with the skiff or by a boom); design of the actual brail (long or short handle, no handle, x-shaped, etc.); is the brail linked to a boom or the purse davit; etc.

Gear Description - Purse Seine

Observer code 175	Vessel code XYZ 388	Trip ID 00279	Page <u>1</u> of <u>1</u>		
	Description	Manufacturer	Model	Brail capacity (MT)	
Net Hauling system	<i>double block</i>	<i>Fiorentino</i>	<i>Wide Shell 56inch</i>	Primary	0.75
				Secondary	0.5
Purse line winch		<i>Westec</i>	<i>TW-8063</i>	Secondary	
Net Characteristics					
Net #: 1		Total length (m): 160		Total depth (m): 40	
Float line length (m): 170		Lead line length (m): 170			
Mesh	Size (cm)	7.2 W / D		Hanging Ratios	
	Type (circle one)	Knotted / Knotless		Float line: 0.85	Lead line: 0.85
Purse line material	<i>Duralon</i>		Purse line diameter (mm)	25	
Dolphin Safety Panel					
Total length (m):		Total depth (m):			
Mesh size (cm)	W / D				
Net diagram					
Comments					
<p><i>Net was well maintained (no obvious holes/tears); Net was held open by the skiff and fish were brailed on board with a few exceptions. Brailer had a handle to aid maneuverability. Brailer was attached to a knuckle crane. Fish were brailed directly onto the tender vessel on two occasions (see logbook pages 37 and 55).</i></p>					
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Figure 13-6 Example of Gear Description form for purse seine.

13.6.2 Daily Activity Log

All of the vessel's activities are accounted for on the Daily Activity Log (DAL). These activities include fishing, searching effort, and marine mammal sightings. The majority of the observer's non-fishing time on a tuna purse seine vessel will be on the bridge documenting activities and monitoring for marine mammals. The information recorded on this form is primarily used for estimating fishing effort and for analyzing the distribution of marine mammals.

The DAL should be filled out **continuously** throughout the entire trip. Fourteen event codes define specific vessel activities as well as documenting an assortment of sighting cues for tunas. Each event code requires you to complete a different set of fields (columns; Figure 13-7). Events are described more fully in the DAL instructions to follow.

A new entry must be made on the DAL for each new event, or whenever one of the following changes occurs; in such cases enter the same event code as before, followed by the relevant data items (Figure 13-7 and Figure 13-8):

- Change in the observer's effort status (e.g., you break for lunch or leave observation post for >5 minutes);
- Change of one knot or more in vessel speed;
- Change in the number of high-powered binoculars in use;
- Change in sea-state conditions (Beaufort) during a SEARCH event;
- Recording a position at least every **two** hours while the vessel is underway (SEARCH or RUN);
- Recording a water temperature at least every **four** hours while the vessel is underway (SEARCH or RUN).

On Effort?	Event	Date/Time				Position					Beaufort	Weather	Obs. Condition	Water Temp	Speed	No X20	Aerial Assist	MM Sight No.	Set No.	Float Object No.
		Day	Month	Year	Time (24-hr)	Lat-Deg	Lat-Min	Lat-N/S	Long-Deg	Long-Min										
	Port																			
	Run																			
	Search																			
	Cue-all types																			
	Heli Depart																			
	Heli Return																			
	Mammal																			
	Chase																			
	Start set																			
	Net cleaning set																			
	Investigate-free school																			
	Float object-investigate, deploy or retrieve																			
	Drift - Break down, night, or lights																			
	Drift - floating object																			
	Bad weather																			
	Transship/bunkering																			
	Other Fishing																			

Figure 13-7 Complete the highlighted data fields for each event type. Light grey indicates fields that are only necessary if a marine mammal sighting or floating object are associated with a setting event.

The DAL fields are defined as follows:

Field	Definition
Observer Code:	Record your observer identification code assigned by the SOP.
Vessel Code:	Record the vessel code (Appendix 3).
Trip ID	Enter the trip identification number assigned by the SOP.
On Effort?	<p>This column quantifies your effort in watching for and recording vessel activity and marine mammal sightings; it is not meant to act as a time card, but as a measure of when high quality data is being collected. You are ON EFFORT when you are on or near the bridge in order to observe the vessel's operations and to collect data on marine mammal sightings; you are not ON EFFORT if you are away from your observation post for more than five minutes. Record Y (Yes) or N (No) in the ON EFFORT? Column each time you make a SEARCH or RUN event entry. If the vessel is not searching or running, this column is left blank. If you change your effort status while the vessel is in either SEARCH or RUN, re-enter the event code with the appropriate ON EFFORT? status.</p> <p>For example, suppose the vessel began searching at 0600, but you did not go to the bridge until 0630. You would enter the DATE, code "3" in the EVENT column, "N" in the ON EFFORT? column, "0600" in the TIME column, and any other required data items in their respective columns. You then enter "3", Y, 0630, and any other required data items, to indicate that you were on the bridge and able to collect accurate sighting data. Later on, if the vessel is still searching and you leave your observation post at 1200 hours and return at 1300 hours, you would enter the following:</p> <ol style="list-style-type: none">1) "3", N, 1200, plus any other required data; and2) "3", Y, 1300, plus any other required data.
Event	<p>Record the appropriate event code for each event. There are 25 event types defined as follows:</p> <ol style="list-style-type: none">1. PORT – record "1" any time your vessel is in a port (anchored or at a dock). In addition to date, time and position, write the name of the port city or location to the right of position. Only RUN or SEARCH events can follow the PORT event code.2. RUN - Enter code "2" if the vessel is under way for at least 5 minutes, is following a set course, and no crew member is looking for signs of fish with binoculars and/or the bird radar is not monitored.

3. **SEARCH** - Enter code “3” if the vessel is under way, following a set course for at least 5 minutes and any crew member is looking for signs of tuna with binoculars and/or bird radar. Enter “3” if no crew members are using binoculars but someone is manning the bird radar; do not enter SEARCH if the helicopter is airborne but no crew member is stationed on the binoculars and/or bird radar. If in SEARCH mode for >2 hours, record a new position, weather conditions, water temp and speed.

- 4A-E. **CUES:** There are five cues that may indicate the potential for tuna:
 - 4A. **BIRDS** – a flock of birds is either sighted by eye or via the bird radar;
 - 4B. **SPLASHES** – splashing at the surface can precede a marine mammal sighting or fish at the surface
 - 4C. **BREEZER** – fish subsurface have the effect of making water look like a breeze is blowing
 - 4D. **FLOATING OBJECT** – the initial sighting of a floating object may lead to investigating a floating object
 - 4E. **OTHER** –can include cues of any kind reported by another vessel. Record the circumstances at the bottom of the page. If another vessel reports the presence of marine mammals, enter OTHER until the MM can be sighted from your vessel. Then record as MM sighting.

- 5A. **Heli Depart** - Record time and position when helicopter departs to search for fish.

- 5B. **Heli Return** - Record the time and position when helicopter returns from search.

- 6A. **MAMMAL** - Enter code “6A” every time you or any crew member, on the vessel or from the helicopter, first sights marine mammals, with or without the aid of a cue. There should be a separate mammal sighting form for each species sighted (Section 16.4.1).

- 6B. **CHASE** - Enter code “6B” when the first speedboat hits the water to pursue marine mammals or whenever the vessel itself begins herding marine mammals (the latter is more common when pursuing a whale).

7. **START SET** - Start set begins when net skiff is deployed into the water and begins pulling purse seine from the vessel.

8. **Net cleaning set** - If the net is set for any other reason other than to catch tuna (trial set, net cleaning), enter "8".

9. **Investigate free school** of tuna

10 A-C. **Floating object** – there are three types of floating object events. Enter the time and position for all types and also complete a Floating Object Record.

10A. **Floating object – Investigate.** If a vessel approaches a floating object within 250m, record as “10A”.

10B. **Floating object – Deploy** – Use “10B” when your vessel deploys a floating object.

10C. **Floating object - Retrieve** – Use “10C” when your vessel retrieves a floating object.

11A. **Drift - Break down** – Use “11A” when a vessel is drifting due to a mechanical problem.

11B. **Drift – night** – Use “11B” when a vessel drifts at night.

11C. **Drift – with floating object** – Use “11C” when a vessel is drifting with a floating object. You must also complete a Floating Object Record for this event.

11D. **Drift – with fish aggregating lights** – Use “11D” when a vessel is adrift and is using lights to attract fish to the vessel.

12. **Bad weather** – Record “12” if vessel is drifting or hove to due to bad weather.

13. **Transship/bunkering** - Stops to transfer fuel or supplies with another vessel. If your vessel receives fish from another boat while at sea or offloads its catch to another vessel, record the vessel name, registration number, IRCS, and amount of fish received or offloaded by species in the Daily Notes section of the Observer Logbook.

14. **Other fishing** - Make notes in Observer Logbook if the vessel uses fishing gear other than a purse seine.

Date	Record date for the first event of each day including the day you board. There is a separate column for day, month and year. Record 2-digits in each column (e.g. 01.05.10 for Day.Month.Year).
Time (24-hr)	Record time using 24-hr notation (e.g., 8:45 a.m. = 0845 and twelve minutes past two in the afternoon = 1412).
Lat-Deg	Record degrees of latitude (2-digits).

Lat-Min	Record the minutes of latitude (to tenths of a minute; 3-digits e.g. 47.6)
Lat-N/S	Record N for all latitudes North of the equator and S for latitudes south of the equator.
Long-Deg	Record degrees of longitude (3-digits) for start and end of each haul.
Long-Min	Record the minutes of longitude (to tenths of a minute; 3-digits e.g. 24.4)
Long-E/W	Record W for all longitude West of the prime meridian (i.e., 0°) and E for longitudes east of the prime meridian.
Beaufort	The Beaufort system uses sea state as a criterion for measuring wind speed (Appendix 12). If the sea state changes while the vessel is searching, re-enter SEARCH, a position, the new Beaufort state, and the other required data items. If the vessel is running, you need only record a change in Beaufort number, a position, and the other required data if you are ON EFFORT.
Weather	Weather codes: 0 - <50% Clouds 1 - >50% Clouds 2 - patchy fog 3 - solid fog 4 - mist / light rain 5 - med / heavy rain 6 - fog & rain 7 - snow
Obs. Cond.	Record the Observation Condition of the view 180° ahead of the vessel. This code is a combination of one letter and one number relating to visibility (letters) and glare (numbers) defined below: Visibility E Excellent: visibility is completely clear to the horizon; calm conditions; would easily detect a bird >300m from vessel G Good: sighting conditions may be affected by glare, sea state, weather or distance; a small bird would be detected to 300m and a mammal at >1 km F Fair: conditions affected by a combination of problems such as heavy seas, poor weather or distance; a small bird would be detected to 200m

P Poor: severely limited visibility (<200m) due to high seas, weather such as fog.

Glare

- 0 None
- 1 Slight / grey (light)
- 2 Bright / 1 side (moderate)
- 3 Bright / forward (harsh/reduces visibility significantly)

Observation Condition codes modified from Kuletz et al.(2008).

Water Temp Enter the surface water temperature, in Celsius, to the nearest tenth of a degree, or half a degree, depending on the type of thermometer used. Record the water temperature for every set, and at least once every four hours during the day when the vessel is running or searching. You are not required to record water temperature during drifts.

NOTE: When taking a temperature reading, be careful not to strike the thermometer against the side of the hull. Avoid taking the temperature near the warm water outlets from the engine cooling system.

If you are not issued a thermometer, use the ships thermometer for this data field.

Speed Record the speed of the vessel in knots (tenths) with every SEARCH event and with RUN events when: 1) the RUN event is the first event of the day, or 2) the speed changes by one knot or more.

No. X20 Record the number of pairs of high-powered binoculars (20X or stronger), low power binoculars and bird radar in use and in this order of priority. Enter **P1** if one pair is in use, **P2** for two pairs, and so on. If only low-powered binoculars (less than 20X) are being used, enter **P0** in this column. If only the bird radar (no binoculars) is being used to look for fish, enter **RAD**. If one pair of high-powered binoculars are used in addition to radar, the code is still P1. If the number of high-powered binoculars in use changes, re-enter SEARCH event code, the time, and the new No.X20 code.



Binocular power: Binoculars usually have two numbers associated with them in an A x B format (e.g., 7x56 or 25x100). The first number refers to the magnification and is the number used for determining high-powered status for this data field. The second number refers to the objective lens diameter and is a proxy for the amount of light coming through the lens.

- Aerial Assist** If a helicopter or plane aided the vessel at any time during the chase and/or set, enter **Y** (Yes), even if your vessel does not carry a helicopter. Enter **N** (No) if an aircraft was not used at any point during the chase and/or set.
- To ascertain whether the helicopter is being used to chase or herd marine mammals, listen to the radio transmissions between the boat and the helicopter, or ask the pilot or spotter after the set.
- MM Sight No.** Each marine mammal sighting is assigned a consecutive number starting with "1" for the first marine mammal sighted during the trip. This number identifies the sighting, the "CUE" which led to the sighting and the subsequent chase and set (if applicable) made on the marine mammals.
- Set No.** Enter a new consecutive set number every time the vessel makes a set with the intent to catch fish.
- Float Object No.** Enter a new consecutive floating object number for each unique floating object sighted, investigated, deployed and retrieved. This object number should match the Floating Object Record. If you encounter the same floating object, use the floating object number already used but complete a new floating object record form for each additional sighting with this object.

Daily Activity Log - Purse Seine - Large Pelagics

Observer code **175** Vessel code **XYZ 388** Trip ID **00279**

Page 1 of

On Effort?	Event	Date/Time				Position						Beaufort	Weather	Obs. Cond.	Water Temp (°C)	Speed (kn)	No X20	Aerial Assist	MM Sight No	Set No.	Float Object / Sighting No.	
		Day	Month	Year	Time (24-hr)	Lat-Deg	Lat-Min	Lat-N/S	Long-Deg	Long-Min	Long-E/W											
	1	13	12	09	0600	08	29.9	N	013	12.5	W	Board vessel in Freeport (SLE) harbor										/
N	2				0805	08	29.9	N	013	12.5	W	1	0	E0	28.1	9.2						/
N	2				1005	08	27.6	N	013	30.6	W											/
Y	2				1205	08	25.8	N	013	47.9	W	2	0	E0		9.0						/
Y	3				1345	08	21.2	N	013	58.9	W	2	0	E0	27.9	9.0	P1					/
Y	3				1545	08	15.5	N	014	20.1	W											/
Y	3				1735	08	13.5	N	014	30.7	W	2	0	E1	27.6	9.0	P1					/
	4A				1802			N			W						P1					/
	7				1830	08	12.9	N	014	47.5	W	2	0	E0	27.6			N		1		/
	11B				2135	08	13.1	N	014	47.5	W											/
								N			W											/
								N			W											/

Event Codes

7 Start set
 1 Port 8 Net cleaning set
 2 Run 9 Investigate-free school
 3 Search 10A Float object-investigate
 4A Cue-birds 10B Float object-deploy
 4B Cue-splash 10C Float object-retrieve
 4C Cue-breezer 11A Drift - Break down
 4D Cue-Floating object 11B Drift - Night
 4E Cue-Other 11C Drift - floating object
 5A Hell Depart 11D Drift - lights
 5B Hell Return 12 Bad weather
 6A Mammal 13 Transship/bunkering

Weather Codes

0 <50% Clouds
 1 >50% Clouds
 2 patchy fog
 3 solid fog
 4 mist / light rain
 5 med / heavy rain
 6 fog & rain
 7 snow

Observation Condition

Visibility
 E Excellent
 G Good
 F Fair
 P Poor

Glare
 0 None
 1 Slight / grey (light)
 2 Bright / 1 side (moderate)

No. X20 Codes

RAD Bird radar only P0
 <20x binocs
 P1 120x binocs
 P2 220x binocs
 P3 320x binocs

Page of

On Effort?	Event	Date/Time				Position						Beaufort	Weather	Obs. Cond.	Water Temp (°C)	Speed (kn)	No X20	Aerial Assist	MM Sight No	Set No.	Float Object / Sighting No.	
		Day	Month	Year	Time (24-hr)	Lat-Deg	Lat-Min	Lat-N/S	Long-Deg	Long-Min	Long-E/W											
N	3	14	12	09	0600	08	12.9	N	014	47.5	W											/
Y	3				0635	08	12.1	N	014	47.6	W	2	1	G1	27.5	9.2	P2					/
Y	3				0835	08	11.5	N	014	48.7	W	2	1	G1		9.2	P2					/
Y	3				1035	08	8.4	N	014	51.1	W	3	1	F1	27.5							/
	6A				1102	08	8.0	N	014	51.2	W						P2	N	1			/
Y	3				1235	08	6.8	N	014	52.2	W	3	1	F1		9.2	P2					/
Y	3				1430	08	5.3	N	014	52.3	W	3	1	F1	27.5	9.2	P1					/
	10A				1440	08	5.3	N	014	52.3	W											1/1
	7				1500	08	5.3	N	014	52.3	W				27.5			N		2		1/1
	11C				1700	08	5.4	N	014	52.3	W											1/1
								N			W											/
								N			W											/
								N			W											/
								N			W											/
								N			W											/
								N			W											/
								N			W											/

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Figure 13-8 Daily Activity Log example.

13.6.3 Floating Object Record

Complete the Floating Object Record (FOR) each time a floating object is investigated, deployed, retrieved or a set is made within 250 meters of a floating object (Figure 13-9).

A very important feature of the FOR is that it enables an object to be tracked throughout a trip, by means of the Object No. and Sighting No. recorded in the form header. When an object is sighted for the first time during a trip, it is assigned a unique number, the Object No., which is used for that object throughout the trip; the Sighting No. is a sequential number used to track each visit to a particular object during the trip. A new sighting number should be assigned if your vessel has left and returned to the same object. If the vessel drifts near an object overnight and a new FOR was completed the night before, continue with the same sighting number the next day.

Field	Definition
Observer Code:	Record your observer identification code.
Vessel Code:	Record the vessel code (Appendix 3).
Trip ID	Enter the trip identification number assigned by the SOP.
Object No.	Record a new Object No. for each unique floating object encountered.
Sighting No.	Record consecutive Sighting No. for additional sightings of the same object. If the vessel has not left the object, do not start a new sighting no.
Set No.	If a set is made on the floating object, record the associated set number.
Components	<p>This section is used to record the components that make up a floating object, and to track any changes in these components. The most common materials which make up the majority of floating objects are listed, and two columns, 'As found' and 'As left', are used to record the components which make up the object when the vessel encounters it ('As found') and when it leaves it adrift ('As left'). If a dead animal is intentionally attached to the object to attract prey, write its species code in the space provided. If the object has a component not included in the list, check Other and provide a description in the space provided.</p> <p>If net material is one of the components, try to estimate the dimensions and predominant mesh size.</p>
Locating equipment	Check all types of locating equipment present at the floating object when you found it (As found) and when you leave (As left).
Object origin	This section is used to document the origin of the object prior to

the current encounter.

Deployed -The object is either (a) being placed in the water for the first time, or (b) returned to the water after being taken aboard the vessel and moved to another area.

Your vessel – this trip - The object was encountered by your vessel previously during this trip.

Your vessel – previous trip - The object was set adrift **by your vessel** during a previous fishing trip. This information must be obtained from the crew.

Other vessel – with owner consent - The object belongs to another vessel, and its location has been given to your vessel with the owner's permission.

Other vessel – without owner consent - The object belongs to another vessel, and has been found by your vessel without the permission or collaboration of the owner.

Drifting object found - The object was not previously involved in fishing activity. If the object has signs of previous fishing activity, such as a flag or beeper attached, record it as Other vessel – no owner consent.

Unknown - You cannot determine the prior origin of the object.

Other - Check this box if you can determine the origin of the object, and none of the other options in this section apply. Record the origin in the space provided, and note any details in COMMENTS.

Locating method Check the **primary** method used to locate the object. If the object is a FAD being deployed, check Not applicable, since it was not located.

Radar - The object or associated birds were detected using radar equipment.

Direction finder - The object was located using a directional beeper signal.

Satellite - The position of the object was determined via satellite (GPS).

Visual – the object itself - The object was sighted directly or with X20 binoculars.

Visual – birds- Birds sighted directly or with X20 binoculars led to the detection of the object.

Not applicable - The object was transported to the area and placed in the water (deployed).

Unknown - You were unable to determine the method used to find the object.

Other - If none of the above is applicable, describe the method used to find the object in the space provided.

Other Data

Bait container attached?

If the vessel attached a bait container, check **Yes**. If no bait container was attached, check **No**. If you are not sure, check **Unk** and note any details in COMMENTS.

Bait container refilled?

If the object has a bait container when found, check **Yes** if it is refilled, **No** if it is not. If you are not sure, check **Unk** and note any details in COMMENTS. If the object has no bait container, check **NA** (not applicable).

Fauna entangled?

Check **Yes** if any fauna, dead or alive, is entangled in the object. Write the name or species codes of the entangled fauna in the space provided. If you are not sure because you could not see entire object, check **Unk**.

Check the appropriate box for whether the floating object was **Anchored** or **Drifting**.

Water clarity

Check the box which most closely describes the clarity of the water (Clear, Turbid or Very turbid) using the following definitions:

Clear - object can be seen at >3m depth;

Turbid object is visible to 3m; and

Very turbid - object disappears from sight beyond 1 m depth.

% biota

Record your estimate of the percentage of the object which is covered in living material (e.g. invertebrates or algae). If you cannot see the object well enough to estimate, leave blank.

Tag number

If the object carries a tag attached as part of a tracking program

(**NOT** a marker or identifier placed by a fishing vessel), record the identification number of the tag in the space provided, and note any details in COMMENTS. **Do not remove the tag from the object.**

Moved object

If the vessel moved the object, check the box and record the new position.

Overhead &
Side view
diagrams

Use this space to make two sketches of the object. One should be a bird's-eye view of the object, with dimensions (in meters), and shaded to show the extent and density of epibiota or other organic material. The other should be a side view of the object, similarly shaded, showing the angle at which it is floating in the water, with dimensions both above and below the waterline. If the object is irregularly shaped, draw an imaginary box around it, and give the length, width, and height of the box. If the object is submerged, record the depth at which it is floating. If you cannot see enough of the object to draw a side view, draw as much as you can and make a note.

Comments

Record any other information not included in the previous sections. Use this space, and a separate sheet of paper if necessary, for notes on additional species of flora or fauna not included on the form due to lack of space or lack of a suitable code. Also include notes on previous fishing activity (e.g., beeper or flag attached) and any other information which would help trace previous sightings of this log.

Birds associated with floating object?

Floating Object Record

Page 1 of _____

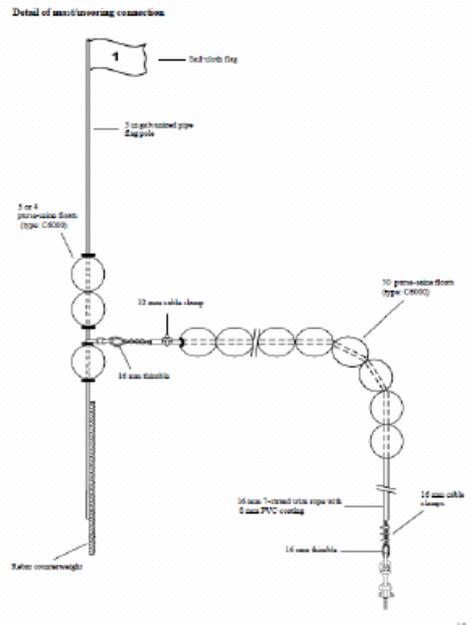
Observer code 175	Vessel code XYZ 388	Trip ID 00279	Object No. 1	Sighting No. 1	Set No. 2
-----------------------------	-------------------------------	-------------------------	------------------------	--------------------------	---------------------

Components (check all that are applicable)			Object origin (check one)		
	As found	As left			
Tree			Your vessel - deployed		
Dead animal _____			Your vessel - deployed earlier this trip		
Chain/cable/rings/weights	x	x	Your vessel - deployed previous trip		
Cane/bamboo			Other vessel - with owner consent		
Bait container / bait			Other vessel - without owner consent	x	
Cord / rope	x	x	Drifting object found		
Floats / corks	x	x	Unknown		
Artificial light for attracting fish			Other _____		
Netting material					
Sacks / bags			Locating method (check one)		
Planks / pallets / plywood / spools			Radar		
Metal drum / plastic drum			Direction finder		
PVC or other plastic tubes			Satellite		
Plastic sheeting			Visual - the object itself	x	
Unknown			Visual - birds		
Other _____			Not applicable		
			Unknown		
			Other _____		
If there's netting....			Other data		
Estimated area of hanging netting (m2)				Y	N
Predominant mesh size (cm)			Bait container attached	x	NA
			Bait container refilled		x
			Fauna entangled	x	Unk
Locating equipment (check all applicable)					
	As found	As left			
Flag	x	x	Check one: <input checked="" type="checkbox"/> Anchored <input type="checkbox"/> Drifting		
Satellite buoy			Water clarity: Clear / Turbid / Very turbid		
Buoy, corks, etc	x	x	% biota	<5%	Tag Number
Lights					
Radio transmitter / beeper / beacon			<input type="checkbox"/> Moved object to:		
Radar reflector			Lat:		Long:
Unknown					
Other _____					

Overhead view (include dimensions)



Side view



Comments

Figure 13-9 Example of floating object record.

13.6.4 Set Information & Catch Composition Form

Fill out a Set Information and Catch Composition form for all sets (including those that were not completed and sets without any catch; Figure 13-10).

Field	Definition
Observer Code:	Record your observer identification code.
Vessel Code:	Record the vessel code (Appendix 3).
Trip ID	Enter the trip identification number assigned by the SOP.
Set No.	Record set number.
Float Object / Sighting No.	If the set was associated with a floating object, record the appropriate Floating Object No. and Floating Object Sighting No. (e.g. 4 / 2).
MM Sighting No.	If set was associated with a marine mammal sighting(s), record the appropriate marine mammal sighting numbers.

Set Information

School Association	Check one box for the primary association of the tuna school. If other, use space to specify more detail.
How Detected	Check one box for how the school was detected. If other, use space to record more information.
Set Sequence Times	Record the times for the following: Start set – Start set begins when net skiff is deployed into the water and begins pulling purse seine from the vessel. This time should be the same as on the DAL. Begin pursing – Record time when winches begin to bring the purse line back on board. End pursing – Record time when all of the purse line is back on board and all rings are up. Begin brail – Record time when the first brailer brings fish on board. End brail – Record time when the last brail (even if this is the net) comes on board. End set – Record time when net skiff is brought on board.
Brailer Tally	As fish are brailed, tally each brailer according to its estimated fullness (to the nearest eighth).

Calculate the TOTAL brailers using the following table

Tally of Full	*	1	=	A
Tally of 7/8	*	0.875	=	B
Tally of 3/4	*	0.75	=	C
Tally of 2/3	*	0.667	=	D
Tally of 1/2	*	0.5	=	E
Tally of 1/3	*	0.333	=	F
Tally of 1/4	*	0.25	=	G
Tally of 1/8	*	0.125	=	H
Total = A+B+C+D+E+F+G+H				

If you are unable to tally, leave blank and make a note in the comments section.

If fish are brailed directly onto another vessel, attempt to tally brailer's while estimating fullness as well and use that brailers capacity to calculate total catch. You may not be able to take a catch composition sample if this occurs.

Total Catch (mt)

Total Catch Estimate Record the total catch estimate to nearest metric ton. This includes both retained and discarded catch brought on board. If no fish are caught (skunk set), enter 0 (zero). See section 13.7 for information regarding total catch estimation methods.

Method Total Catch method options for tuna purse seine:

1. Weigh entire catch
5. Captain/Vessel estimate
8. Brailer capacity * brail tally
9. Other. Document method in observer logbook.

Section 13.7 explains each in more detail.

Vessel Estimate Record the captain or vessel estimate of total catch. Leave blank if one is not made.

Problems Check all problems that occurred during this set that may have affected the net's fishing ability or the catchability of tuna.

No problems – check if there were no problems.

Interaction with other vessel – check if net was fouled by another vessel.

Tide – check if the tide/current impacted the net.

Unfavorable SST

Breakdown – check if set was aborted or delayed due to a breakdown.

Tangle – check if net was tangled in any way (e.g., with a FAD or collapsed into itself due to current).

Missed mark – check if vessel missed the school it was targeting.

Other – record other problems not indicated above (e.g. fish moving too fast or move too deep).

Catch Composition

Species Name	Record the common or scientific name for the species. Note that if there are multiple sample types, there may be more than one entry (row) for some species.
Species Code	Record the 3-letter code for the species or species group (Appendix 7).
ST	Record the appropriate code for Sample Type . Codes are defined as follows: 6A – Whole brail – all fish in the randomly selected brails are identified, counted and weighed (if possible). 6B – Partial brail – a subset of fish in the randomly selected brails are identified, counted and weighed (if possible). 1-Whole haul. If haul is small (e.g. <1 brailer), attempt to identify and count all fish. 8 – Other. Use for Marine Mammals and Sea Turtles. Record the number of individuals and leave species weight and sample weight blank.
Number individuals	Record the total count of animals by species or species group in the sample.
Weight (kg)	If no scale is available, leave this column blank. If a scale is available, try to weigh the fish by species or collect an average weight of each species and tally the rest. Collect 20-50 individuals per set for average weight calculations. If you use an average weight, document your calculations in the comments/calculations box.
Sample weight	Record a sample weight for each sample type.

If ST=6A, record the estimated weight of brails sampled. Calculate this sample weight using the same methods as the brailer method for estimate of total catch (code 8). Alternatively, if the vessel had a scale, sum the individual species weights to calculate the sample weight.

If ST=6B, use actual weights or collect 20-50 individuals per haul for average weight calculations. If you use an average weight, document your calculations in the comments/calculations box.

If ST=1, sample weight equals total catch estimate.

If ST=8, leave sample weight blank. Make notes on appropriate marine mammal or sea turtle carcass form.

Ret % Record the percentage of each species (species group) retained by weight for sale or onboard consumption.

Reason Discard If % retained is <100, enter the most appropriate code describing the reason discard occurred.

- 1 Regulation (e.g., retention of species not allowed or size restrictions)
- 2 Market (e.g., there is currently no market to sell this species)
- 3 Damaged (e.g. fish was eaten by another species on line or in net)
- 4 Marketable but sorting error (common in shrimp trawl fishery)
- 5 Other – make notes regarding other reasons for discard

Set Information & Catch Composition - Purse Seine - Large Pelagics

Observer code <i>175</i>	Vessel code <i>XYZ 388</i>	Trip ID <i>00279</i>	Set No. <i>2</i>	Float.Object / Sighting No. <i>1 / 1</i>	MM Sighting No.																												
Set Information																																	
School Association (check one) <input type="checkbox"/> 1 Unassociated <input type="checkbox"/> 4 Marine mammal <input type="checkbox"/> 2 Feeding - baitfish <input type="checkbox"/> 5 Other: <input checked="" type="checkbox"/> 3 Floating Object			How Detected (check one) <input type="checkbox"/> 1 Vessel sighting <input type="checkbox"/> 5 Sonar/depth sounder <input type="checkbox"/> 2 Helicopter sighting <input type="checkbox"/> 6 Other vessel <input type="checkbox"/> 3 Floating object <input type="checkbox"/> 7 Other: <input checked="" type="checkbox"/> 4 Birds/bird radar																														
Set Sequence Times																																	
Start set	Begin pursing (winch on)	End pursing (rings up)	Begin brail	End brail	End set (skiff on board)																												
<i>1500</i>	<i>1515</i>	<i>1534</i>	<i>1538</i>	<i>1709</i>	<i>1720</i>																												
Brailer tally																																	
Full	7/8ths	3/4th	2/3rd	Half	1/3rd	1/4th	1/8th	TOTAL																									
<i>I</i>	<i>IIII</i>	<i>IIII</i>	<i>IIII</i>	<i>IIII</i>	<i>II</i>	<i>I</i>	<i>I</i>	<i>29.375</i>																									
Total Catch (mt)			Problems (check all that apply)																														
Total Catch Estimate	Method	Vessel Estimate	<input checked="" type="checkbox"/> No problems <input type="checkbox"/> Unfavourable SST <input type="checkbox"/> Missed mark <input type="checkbox"/> Interaction w/ other vessel <input type="checkbox"/> Breakdown <input type="checkbox"/> Other: <input type="checkbox"/> Tide <input type="checkbox"/> Tangle																														
<i>22.03</i>	<i>8</i>	<i>20.0</i>																															
Catch Composition																																	
Sample Type (ST) 6A Whole Brail 1 Whole haul 6B Partial Brail 8 Other				Reason Discard 1 Regulation 4 Error 2 Market 5 Other 3 Damage																													
Species Name	Species Code	ST	Number Individuals	Weight (kg)	Sample Weight	% Ret.	Reason Discard																										
<i>yellowfin tuna</i>	<i>YFT</i>	<i>6A</i>	<i>97</i>	<i>1658.7</i>	<i>2079.54</i>	<i>99</i>	<i>2</i>																										
<i>bigeye tuna</i>	<i>BET</i>	↓	<i>5</i>	<i>170</i>	↓	<i>100</i>																											
<i>skipjack</i>	<i>SKJ</i>	↓	<i>23</i>	<i>85.79</i>	↓	<i>0</i>	<i>2</i>																										
<i>little tunny</i>	<i>LTA</i>	↓	<i>12</i>	<i>91.2</i>	↓	<i>0</i>	<i>2</i>																										
<i>Blue marlin</i>	<i>BUM</i>	↓	<i>1</i>	<i>58.8</i>	↓	<i>0</i>	<i>1</i>																										
<i>silky shark</i>	<i>FAL</i>	↓	<i>2</i>	<i>12.75</i>	↓	<i>80</i>	<i>2</i>																										
<i>triggerfish, unid</i>	<i>TRI</i>	<i>6A</i>	<i>1</i>	<i>2.3</i>	<i>2079.54</i>	<i>0</i>	<i>2</i>																										
Comments / calculations: <i>Estimate 30 brailers. want to sample 3 full brails. Random number b/w 1 and 10 was 6. Sampled brail lift #6, 16 and 26. Collected all fish from brail #16 for tuna lengths and collected lengths of all non-target species from all 3 brails</i> <i>Ave wt - YFT = 342.0/20=17.1</i>						Brail tally Total catch																											
						<table border="1" style="width:100%; border-collapse: collapse;"> <tr><td style="text-align:center;">6</td><td style="text-align:center;">1</td><td style="text-align:center;">6</td></tr> <tr><td style="text-align:center;">10</td><td style="text-align:center;">0.875</td><td style="text-align:center;">8.75</td></tr> <tr><td style="text-align:center;">12</td><td style="text-align:center;">0.75</td><td style="text-align:center;">9</td></tr> <tr><td style="text-align:center;">5</td><td style="text-align:center;">0.6667</td><td style="text-align:center;">3.3333</td></tr> <tr><td style="text-align:center;">3</td><td style="text-align:center;">0.5</td><td style="text-align:center;">1.5</td></tr> <tr><td style="text-align:center;">2</td><td style="text-align:center;">0.3333</td><td style="text-align:center;">0.6667</td></tr> <tr><td style="text-align:center;">0</td><td style="text-align:center;">0.25</td><td style="text-align:center;">0</td></tr> <tr><td style="text-align:center;">1</td><td style="text-align:center;">0.125</td><td style="text-align:center;">0.125</td></tr> <tr><td colspan="2"></td><td style="text-align:center;">29.375</td></tr> </table>	6	1	6	10	0.875	8.75	12	0.75	9	5	0.6667	3.3333	3	0.5	1.5	2	0.3333	0.6667	0	0.25	0	1	0.125	0.125			29.375
6	1	6																															
10	0.875	8.75																															
12	0.75	9																															
5	0.6667	3.3333																															
3	0.5	1.5																															
2	0.3333	0.6667																															
0	0.25	0																															
1	0.125	0.125																															
		29.375																															
Version 1.2 6/2011																																	

Figure 13-10 Example of Set Information & Catch Composition form for purse seine vessels.

13.7 Total Catch Estimation

There are three methods for estimating total catch on a tuna purse seine vessel and the brail tally method (#8) is the one you will use most frequently.

1. Weigh entire catch – if the vessel has a scale on the brailer, verify the weights as they are being recorded by the crew. Sum the brail weights to obtain a total weight estimate.
5. Captain/Vessel estimate – if you are unable to make an independent estimate, record the vessel estimate for total catch.
8. Brail tally – Multiply the brailer capacity (mt) by the brail tally to obtain the estimated catch weight. Round to the nearest whole metric ton.
9. Other - Document any other method used in Observer Logbook.

NOTE: Live tuna escaping from the net due to sinkage of the corkline, due to a rip in the sack or mammal release are not included in the total catch estimation. However, if this occurs, make a note in the Comments field.

13.8 Catch Composition Sampling

Sampling whole brails (ST=6A) - randomly select two or three brailers of fish per set for your catch composition sample. At first, you will need to ask the captain or crew to estimate how many brails of fish they think they've caught. With time and experience, you will be able to assess this for yourself. Ideally, you should use a systematic sampling frame with a random start point. Document your method of brailer selection in the Observer Logbook including whether or not you are sampling whole or partial brails.

For example, the crew estimates the net is holding about 30 brails of fish. In order to sample ~ 3 brails (or 10%), you would sample every 10th brail (30/3) and use the Random Number Table (Appendix 11) to determine which brail to begin with. If the random number between 1 and 10 was 4, you would sample the 4th, 14th and 24th brails to come on board. If 30 brails was an underestimate and there were really 40 in total, then you would sample the 34th brail as well.

Identify and count all fish in each selected brailer. Length sampling is prioritized by species (Table 13-1).

Weights may be determined in one of three ways:

- Actual weights – use actual weights if all fish are weighed on board. It is unlikely the vessels will have this type of equipment.
- Average weight multiplied by total count. If you can weigh 20-50 individuals of each species, use these weights to calculate an average.
- Use a length-weight table to calculate weights of fish measured. Sum the weights from the table for each species. If all fish of a given species were not all measured, use the length sample to calculate an average weight and multiply the average by the total count.

Sampling partial brails (ST=6B) - Depending on the brailer capacity, you may need to take partial brails or a ‘spill’ sample in order to sample more evenly through the haul. Selection of brailers to sample is similar to the procedure described above.

Example, the brailer holds 1,000 kg and you do not have enough space on deck to ‘hold’ an entire brail. You decide to take partial brails (one quarter of the randomly selected brails or ~250kg) for your samples. You estimate this haul is ~40 brails total and you want to sample from 8 brails. Select a random number between 1 and 5 (40/8) and pull your sample from every 5th brail thereafter. If the random number was 2, you would sample from the 2nd, 7th, 12th, 17th, 22nd, 27th, 32nd and 37th brail that was brought on board. If 40 was an underestimate, you would also sample from the 42nd and every 5th until the end.

13.9 Biological Data

Randomly select and measure individual fish each set according to the prioritized list in Table 13-1. If possible, attempt to determine sex of each individual; however, if this impacts product quality, you may record sex as unknown. Record lengths on generic length form described in Section 15.7.1.

Table 13-1 List of species for length-frequency collection on tuna purse seine vessels.

How many?	Common Name	Scientific Name
Tunas		
All	Atlantic bluefin tuna	<i>Thunnus thynnus</i>
Subsample 20-50	Bigeye tuna	<i>Thunnus obesus</i>
Subsample 20-50	Albacore tuna	<i>Thunnus alalunga</i>
Subsample 20-50	Yellowfin tuna	<i>Thunnus albacores</i>
All	Little tunny	<i>Euthynnus alletteratus</i>
All	Skipjack tuna	<i>Katsuwonus pelamis</i>
All	Frigate tuna	<i>Auxis thazard</i>
All	Bullet tuna	<i>Auxis rochi</i>
Billfish		
All	Swordfish	<i>Xiphias gladius</i>
All	Atlantic sailfish	<i>Istiophorus albicans</i>
All	Atlantic blue marlin	<i>Makaira nigricans</i>
All	Black marlin	<i>Makaira indica</i>
All	Atlantic white marlin	<i>Tetrapturus albidus</i>
All	Shortbill spearfish	<i>Tetrapturus angustirostris</i>
Other Finfish		
All	Atlantic bonito	<i>Sarda sarda</i>
All	If catch <15 of any finfish	
Subsample 15-20	If catch >15 of any finfish	

Sharks

All	Bigeye thresher shark	<i>Alopias superciliosus</i>
All	Silky shark	<i>Carcharhinus falciformis</i>
All	Oceanic whitetip shark	<i>Carcharhinus longimanus</i>
All	Scalloped hammerhead	<i>Sphyrna zygaena</i>
All	Smooth hammerhead	<i>Sphyrna lewini</i>
All	Shortfin mako	<i>Isurus oxyrinchus</i>
All	Porbeagle	<i>Lamna nasus</i>

14 Purse Seine – Small Pelagics

This chapter is under development.

15 Biological Data & Specimen Collection

15.1 Learning objectives

- Explain how length frequency data are utilized.
- List the species to be measured for a given target fishery.
- How many and which measurements should be made?
- Determine maturity stages of fish and select invertebrates
- List the types of age structures collected

15.2 Introduction

Biological data, including sex, lengths, weights, and age structures and other specimen, may be collected on a subset of individual fish and invertebrates. This data is used by fisheries stock assessment scientists to gauge the age composition of the population, the length to age ratio, the potential spawning population, the male to female ratio and much more.

If you are assigned length frequencies, they should be collected on the primary target and a subset of other species on each sampled haul. If you are assigned length sampling, a more detailed species list will be provided at that time. The type of length measurement depends on the species being measured. Table 15-1 and Table 15-4 provide diagrams and definitions for each length type of fish and invertebrates, respectively, and summarize which measurements should be made for each species group.

Length and other measurements of marine mammals, sea turtles, and seabirds are recorded on separate forms (see Chapter 16) – do not record these groups on the Fish/Invertebrate Length Frequency Form.

15.3 List of Priorities

1. Identify and process all live marine mammals and sea turtles immediately. If a marine mammal is obviously dead, you can delay collecting data on it until after you complete #2-3.
2. Randomly collect, determine gender and measure a subsample of the primary target species from each sampled haul. The quantity of measurements depends on the target fishery.
3. Randomly collect, determine gender and measure a subsample from a minimum of 5 additional species from each sampled haul.
4. Complete a species identification form for each new species encountered.
5. Complete a Tag Encounter and Recovery form for any tags you encounter.
6. Identify and enumerate all seabirds caught; seabirds have a separate form.

15.4 Length Measurements

Length measurements will be **rounded down** to the nearest whole centimeter (fish) or millimeter (invertebrates). For instance, if you have three fish lengths of 44.2, 44.5 and 44.8 cm, all are recorded as 44 cm – see also Figure 15-1. Do not measure damaged individuals (e.g., missing tail or rostrum). However, these individuals should be recorded with a length of “0”.

The snout should be resting gently against the head piece of the measuring board or other vertical surface (e.g. a bulkhead). Always be sure to keep your eye directly above the tail of the fish to ensure the correct measurement is recorded. If the measurement is taken when your eye is not directly above the tail of the fish, the measurement will be read at an angle, possibly giving an incorrect result.

When an individual is larger than the measuring device provided, measure it by taking two or more measurements. One method is to first measure as much of the fish as possible, make a light mark on the fish at the point where the measurement stops, and then take a second measurement from that point. Adding the two measurements together gives the length of the fish. Another method is to take the first measurement at 100 cm, lightly mark the fish at this point, and then take a second measurement from the point. It is then easy to add the two measurements together to get the full length.

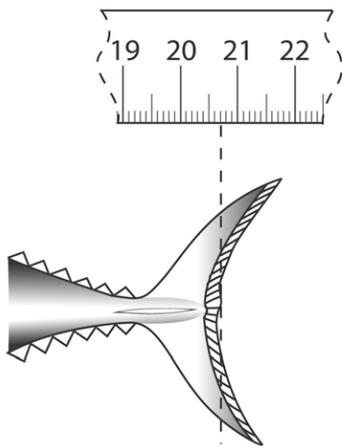


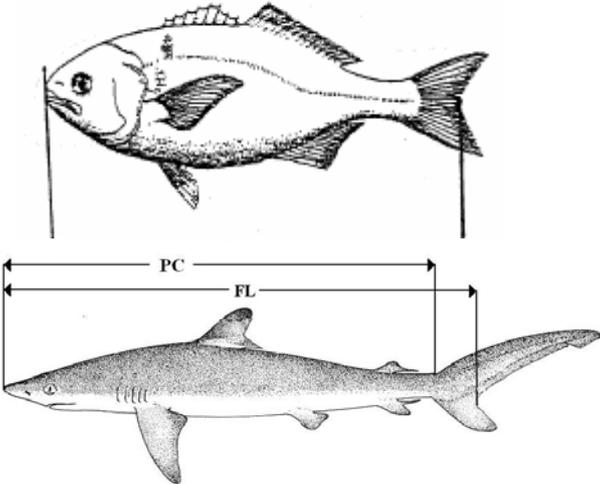
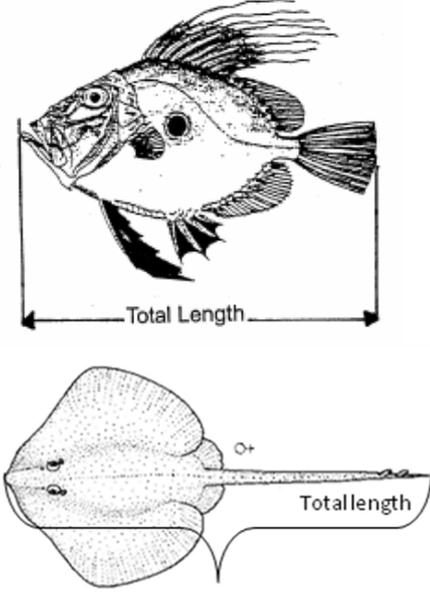
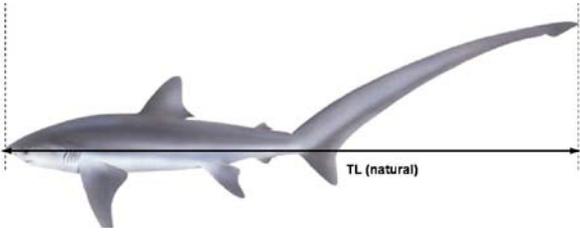
Figure 15-1 The fork length of this fish would be recorded as 20cm whereas the total length would be 21cm. Image from Brogan et al. (2006)

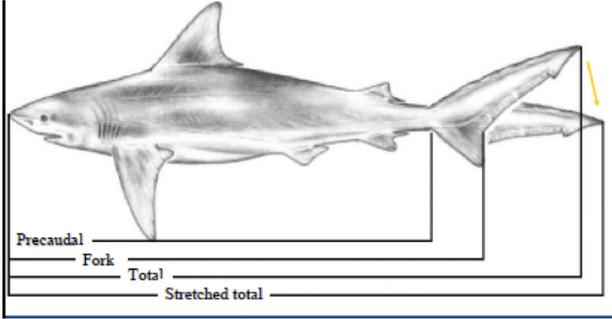
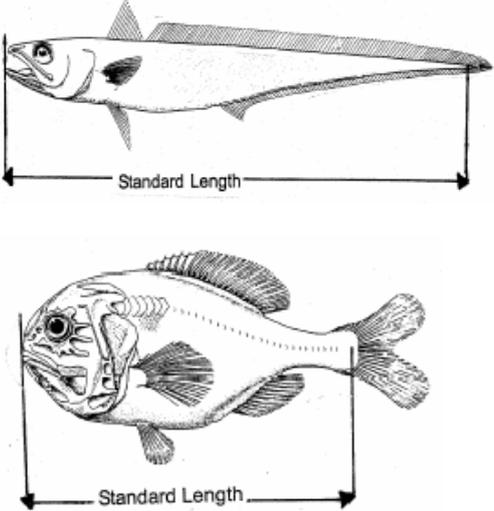
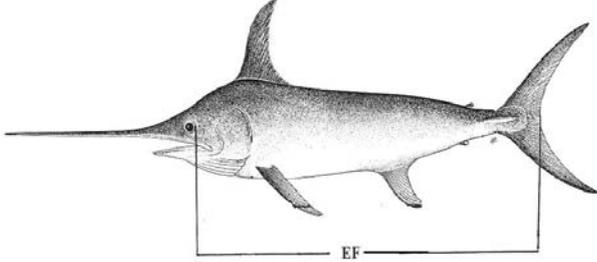
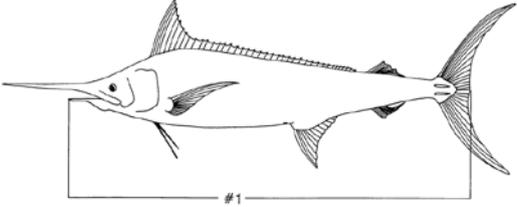
15.4.1 Fish (bony & cartilaginous)

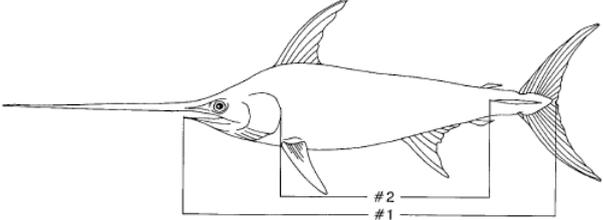
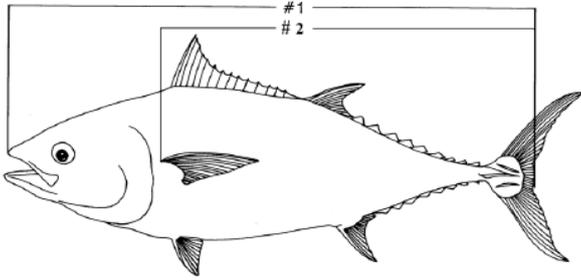
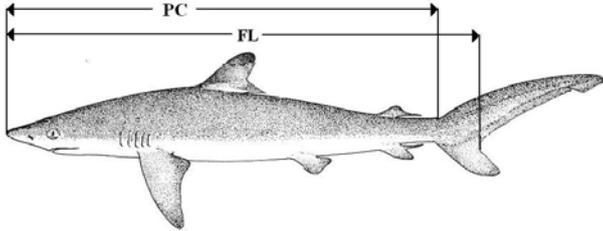
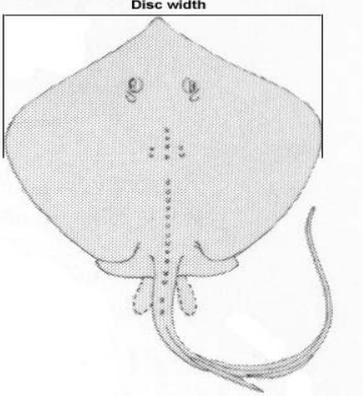
15.4.1.1 Standard measurements

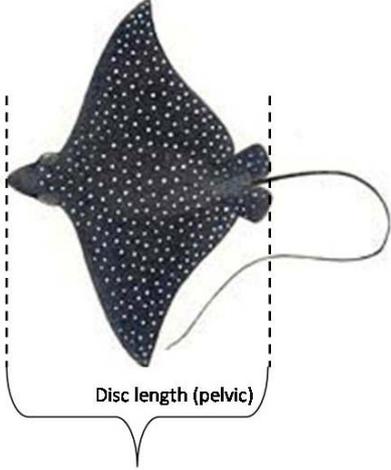
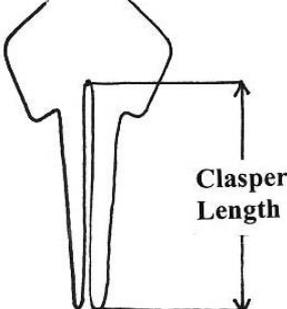
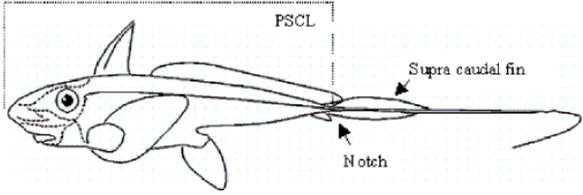
In general, fish measurements are taken along the longest longitudinal axis. Straight-line measurements are preferred to measurements over the curve of the body. The most common measurement used for fish is fork length although there are many other length types. Table 15-1 contains definitions for the various measurement types and lists the typical groups for each measurement type.

Table 15-1 Standard measurements for bony and cartilaginous fish. Images and definition from (Anderson and Gutreuter 1983, Francis 2006, Kranz 2007, Southeast Fisheries Science Center 2007, NMFS 2008a, ICES - International Bottom Trawl Survey Working Group 2010)

Measurement name-abbreviation (length code)	Measured from (typical species / groups)	Figure
Fork length- FL (01)	Snout tip to center of fork in caudal fin (straight). Mouth should be closed (Bony fish with concave (forked) tails; Sharks with distinct fork).	 <p>The figure illustrates two types of fish. The top fish is a bony fish with a forked tail. A horizontal line with arrows at both ends is drawn from the snout tip to the center of the fork in the caudal fin. This line is labeled 'FL'. A shorter horizontal line is drawn from the snout tip to the start of the tail, labeled 'PC'. The bottom fish is a shark with a distinct fork. A horizontal line with arrows at both ends is drawn from the snout tip to the center of the fork in the caudal fin, labeled 'FL'.</p>
Total length- TL (02)	Snout tip to furthest tip of tail (Bony fish with convex or tapered tails; Primary measurement for batoids excluding suborder Myliobatoidei). Tail should not be compressed to spread to its extreme when measured.	 <p>The figure shows two fish. The top fish is a bony fish with a convex tail. A vertical line with arrows at both ends is drawn from the snout tip to the furthest tip of the tail, labeled 'Total Length'. The bottom fish is a batoid (ray). A horizontal line with arrows at both ends is drawn from the snout tip to the furthest tip of the tail, labeled 'Total length'.</p>
Natural total length-TL _{nat} (02)	Like TL above, tip of the snout to the posterior tip of the tail with the tail in the natural position. Taken along the body midline to a point intersected by a perpendicular line dropped from the posterior tip of the	 <p>The figure shows a shark. A horizontal line with arrows at both ends is drawn along the body midline from the snout tip to the posterior tip of the tail. A vertical dashed line is dropped from the posterior tip of the tail to the horizontal line. The horizontal line is labeled 'TL (natural)'.</p>

	upper lobe of the tail (Sharks – 2 nd option)	
Stretched total length- TL _{stretch} (13)	Tip of the snout to the posterior tip of the tail with the tail flexed down so that the upper lobe lies along the body midline. Also commonly called flexed total length (Sharks-primary measurement)	
Standard length-SL (03)	Snout tip to last caudal vertebrae (usually marked by a shallow vertical groove near the extremity of the fleshy part of the tail).	
Eye to fork length (04)	Straight-line measurement from the posterior margin of eye orbit to the fork in tail. (Billfish - secondary)	
Lower jaw to fork length- LFL (05)	Length from tip of lower jaw to caudal fork length (Billfish; swordfish - primary)	
Cleithrum to fork (06)	Straight-line measurement from the inside leading edge of the cleithrum to the fork in tail. The cleithrum is the bony structure which anchors the pectoral girdle. It is the bony anterior margin of the body after head removal, and is light in color and slightly concave. Measurement sometimes used if measured collected after dressing (swordfish).	

<p>Cleithrum to caudal keel (07)</p>	<p>Cleithral arch to caudal anterior origin of caudal keel. This is a curved length (swordfish-#2 in figure & secondary measurement)</p>	
<p>Pre-anal fin length-PAFL (08)</p>	<p>Measured from the tip of the snout to the insertion of the first anal fin ray, immediately posterior to the anus (Grenadier - primary). Taken on fish that commonly have damaged caudal fins or tails.</p>	
<p>Pectoral fin to fork (09)</p>	<p>Anterior insertion of pectoral fin to fork of tail (straight; tunas #2 in figure- secondary)</p>	
<p>Pre-caudal length-PC (10)</p>	<p>Snout tip to the pre-caudal pit (small crease) at the end of the caudal peduncle. If the shark does not have a pre-caudal pit, use the point where the front edge of the upper tail lobe meets the caudal peduncle. (shark -secondary)</p>	
<p>Disc width (11)</p>	<p>Distance between the furthest opposite points of the wings (2nd for skates, rays)</p>	

<p>Disc length pelvic-DL_{pel} (14)</p>	<p>Tip of the snout to the posterior edge of the pelvic fins, excluding the anterior pelvic lobes or 'legs' (which sometimes project beyond the posterior pelvic lobes) and claspers (suborder Myliobatoidei - primary).</p>	
<p>Clasper inner length (12)</p>	<p>Tip of the clasper to the center of the angle between the claspers. (3rd shark, 2nd skate measurement)</p>	
<p>Chimaera length -CL (15)</p>	<p>Tip of the snout to the posterior edge of the supracaudal fin, excluding the caudal filament. (Chimaeras - primary)</p>	

15.4.1.2 Sex determination

Because males and females of certain species grow at different rates, fisheries biologists are especially interested in having length frequencies separated by sex so they can better monitor such growth patterns (Van Helvoort 1986). Sex can be determined using either external or internal characteristics.

15.4.1.2.1 External differentiation

A few species (mostly the cartilaginous fishes) can be sexed based on external features. Male sharks, skates and rays have external claspers emerging from their pelvic fins (Figure 15-2). Opah and dolphinfish are also sexually dimorphic (Figure 15-3 and Figure 15-4, respectively)

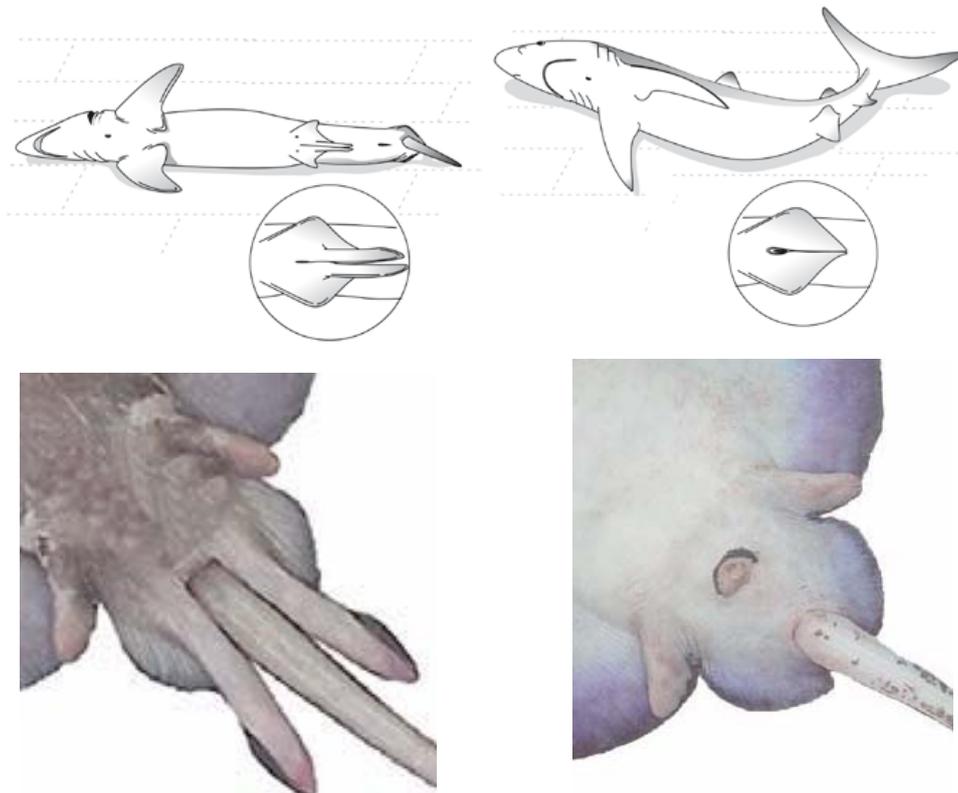


Figure 15-2 Male sharks and other elasmobranchs have claspers (left) emerging from the ventral section of their pelvic fins whereas females do not have this feature (right). Images from Brogan et al. (2006) and Alaska Fisheries Science Center (2009).



Figure 15-3 Male opah (*Lampris guttatus*; left) have distinct double edged (concave) breastplate that is somewhat sharp and angular whereas the female opah (right) chestplate is convex with a more gentle slope. Image credit: D. Itano in McAuliffe et al. (2007).



Figure 15-4 The male dolphinfish (*Coryphaena hippurus*; top) has a pronounced bony crest on its ‘forehead’ whereas the female (bottom) forehead slopes gently. Image from NMFS (2008a).

15.4.1.2.2 Internal differentiation

Most bony fish lack external sex differentiation features and must be cut open to evaluate internal reproductive organs or gonads. Gonads are typically located in the posterior portion of the cut cavity near the back bone. The easiest way to access the gonads is to slit the belly 4-8cm parallel to the spine and slightly ahead of the anal opening (vent). You may need to reach in to move the intestines and/or fatty tissue aside. Each group of species is slightly different but in general, males have solid gonads that may be smooth or highly crenulated whereas female ovaries are paired sacs. Immature male gonads are frequently string-like. If asked to collect sexed length-frequencies, you will have additional training specific to the species/fishery although Table 15-2 describes a few species groups that you are likely to encounter. If the vessel’s product is whole fish, you may also need to negotiate with the captain to cut open a few fish for the length sample.

15.4.1.2.3 Sex codes

There are four codes recorded for sex (M, F, I and U) defined as follows:

- M Record for all fish determined to be **male**.
- F Record for all fish determined to be **female**.
- I **Indeterminate.** If the gonad is checked but is too small or immature to confidently determine the sex, the observer should record I. Both immature male and female gonads are likely to be string-like and thin and some of the features outlined above may not be obvious when the gonad is examined.
- U **Unknown.** Use this code when you were unable to check the sex due to lack of time or damage to product.

Table 15-2 Summary of sex differentiation for common species groups. Compiled from (AFSC 1997, Brogan et al. 2006, NMFS 2007b).

Male	Female
TUNAS <i>Euthynnus</i> , <i>Thunnus</i> sp.	
<p>The testes are usually elongated and uniform in shape throughout. They are flatter and thinner when compared to the swordfish testes. Generally, there is more fatty or connective tissue associated with the tuna testes than with the swordfish testes.</p>	<p>Same characteristics as swordfish ovaries.</p>
SWORDFISH <i>Xiphias gladius</i>	
<p>The most prominent characteristics of male swordfish gonads are:</p> <ul style="list-style-type: none"> • triangular in shape (cross section) & smooth exterior • in cross section, contains a small opening (lumen) with smooth edges • no granules visible <p>Color: white to pink</p> 	<p>The most prominent characteristics of female swordfish gonads are:</p> <ul style="list-style-type: none"> • oval/circular shape (cigar or sausage shaped) • rough (striated) external appearance • in a cross section, the presence of a lumen (opening) near the center with somewhat rough edges • small granules (eggs) frequently present <p>Color: variable, ranges from gray (indicating immature egg production) to orange (indicating near spawning). Generally, swordfish and tuna over 250 pounds are female.</p> 
<p>Cross section (top) and whole (bottom) views of male swordfish gonads. Courtesy of U.S. National Marine Fisheries Service, Southeast Fisheries Science Center.</p>	



Cross section (top) and whole (bottom) views of female swordfish gonads. Courtesy of U.S. National Marine Fisheries Service, Southeast Fisheries Science Center.

Flatfish: The gonads of flatfish are found posterior to the visceral cavity and may extend underneath the flesh of the body (esp. females). To find the gonads it is usually easiest to cut backward from the vent on the blind side following the curvature of the gut cavity (Alaska Fisheries Science Center 2009).

The testis is tapered at the anterior edge, is triangular in shape, and does not extend as far back as the ovary. It extends back toward the caudal fin about twice the distance of the width of the front edge. Depending on maturity stage, the testis will appear clear and transparent (immature) to opaque and white (ripe) in color.



The anterior edge of the ovary is rounded, and extends back toward the caudal fin, forming a balloon or sac-like structure. In mature fish the ovary extends back to a minimum of one half of the body cavity. Depending on maturity stage, the ovaries will appear light pink (immature) to bright orange (ripe) in color.



15.4.1.3 Maturity

In general, maturity is grouped into several stages for each gender. You will be provided with additional training if asked to determine maturity.

15.4.1.4 Age structures

Certain structures, or parts, of fish can be used to determine age. These are used to study a fish population by estimating the age composition of fish that are caught from an age-length relationship. **If you are instructed to collect age structures, you will be provided with additional training.** Age structure data is recorded on the Specimen Collection Form.

15.4.1.4.1 Scales

Scales are small, thin, overlapping structures protecting the skin of fish. Scales produce annual rings (similar to trees) that can be used to estimate a fish's age. The following steps outline the scale collection procedure for most fish:

1. Rinse the fish with water and rub the body lightly from head to tail. This removes loose scales and mucus that may be from another fish.
2. Choose scales from immediately above or below the lateral line (Figure 15-5). Note: depending on the species, you may be provided with alternate locations.
3. Use forceps to loosen and remove a few scales. You will feel a slight resistance if the scale is embedded in the sample fish
4. If possible, clean by dipping in water and rub them between your fingers.
5. Place in envelope and label appropriately.

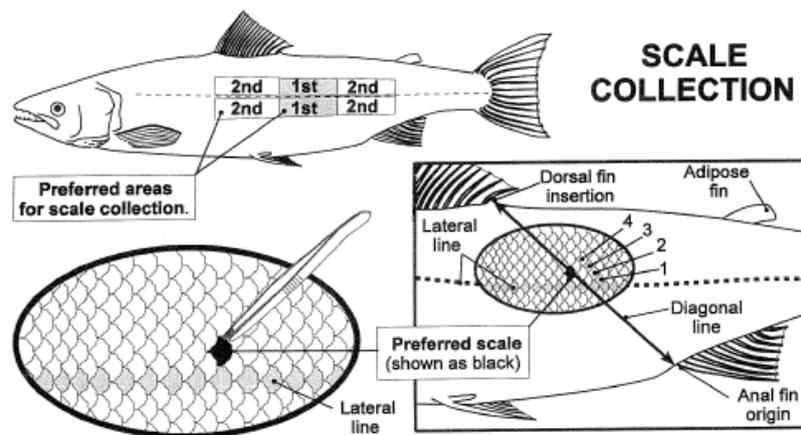


Figure 15-5 Scale collection areas. Image from Hanrahan et al.(1997).

15.4.1.4.2 Spines/Rays

Fins are composed of rays (and/or spines) connected by a fleshy membrane. The rays or spines of some species have growth rings that can be used to age individual fish. Collecting a fin ray sample involves cutting the fin away from the body and storing in an appropriately labeled envelope or scintillation vial.

15.4.1.4.3 Otoliths

Otoliths are small, bony structures made of calcium carbonate. There are three pairs of uniquely sized and shaped otoliths for most species although only the largest pair (sagitta) is typically collected for aging purposes. They are located in the otic cavity of the inner ear of bony fishes and aid in positioning the fish relative to gravity and in sound detection. Otoliths grow in size with the fish and display their growth in annual rings, or annuli. In flatfish,

because the head is twisted during early development, the otoliths are positioned one on top the other directly behind the brain whereas in roundfish, they are positioned side-by-side.

Methods of extraction vary by species. The otic cavity can be accessed from the top of the head with a perpendicular or a parallel cut as well as from below (Figure 15-6 and Table 15-3). Carefully remove the otoliths with forceps. Clean/dry the otolith by rubbing it gently between the thumb and forefinger. Otoliths may be placed in envelopes or scintillation vials.

If otoliths are stored in envelopes, they should be labeled with the following information: observer code, vessel code, trip number, haul, date, species code, specimen number, length, weight, and sex. In addition, otoliths stored in envelopes should be stored carefully to prevent unnecessary damage (otoliths are very brittle).

If otoliths are stored in vials, be sure to add appropriate solution (e.g., glycerine) for storage.

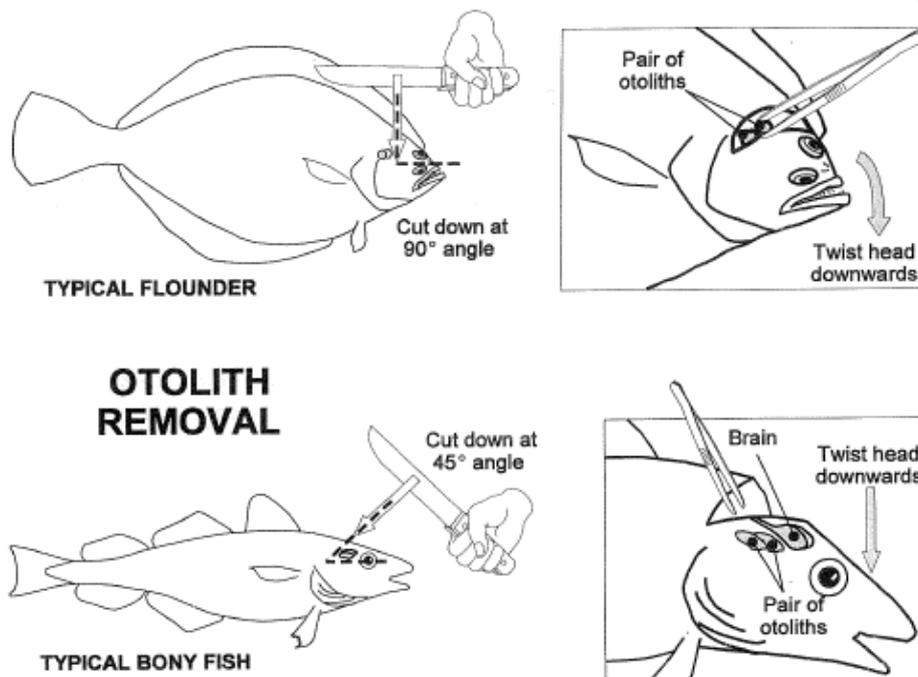
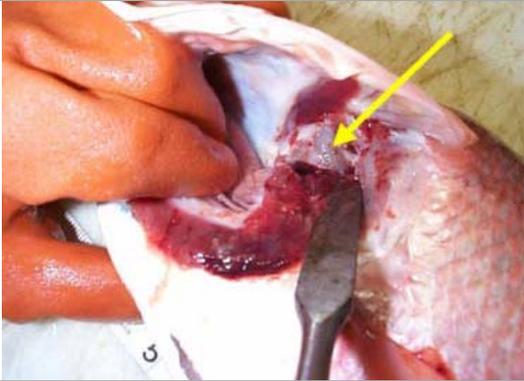
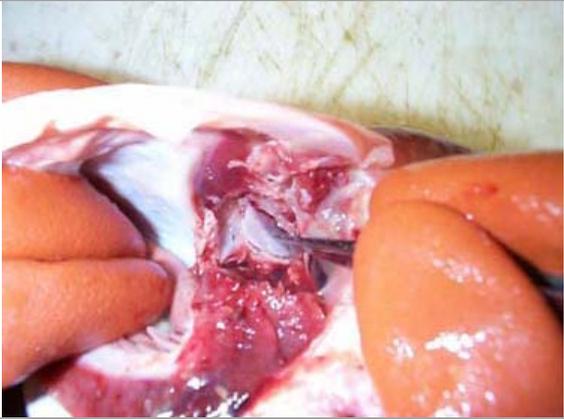


Figure 15-6 Otolith position and removal for flat (upper) and round (lower) fish. Image from Hanrahan et al. (1997). Some roundfish otoliths are more easily accessed with the 90° cut.

Table 15-3 Steps for removing otolith from below otic cavity. Photos and protocol extracted from (NOAA Fisheries Service 2009).

<p>1. Lift opercle and expose gill.</p>	
<p>2. Cut away the gill arches at their insertion.</p>	
<p>3. Use a chisel to scrape away tissue from the otolith capsule, the capsule will feel like a large knob or protrusion</p>	
<p>4. Open the capsule with a chisel, the large sagittal otoliths can be easily removed with forceps.</p>	

15.4.1.4.4 Thorns and Vertebrae

Thorns may be collected to age skates/rays and vertebrae can be used to age skates/rays, sharks and some fish.

15.4.1.5 Food habits

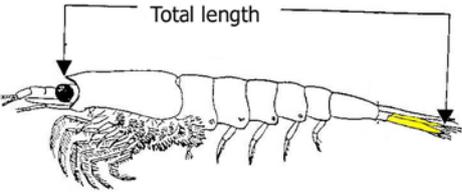
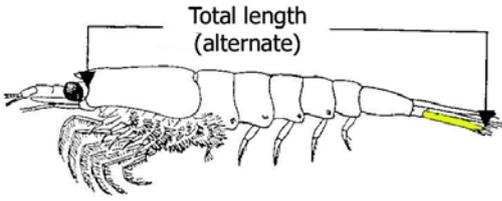
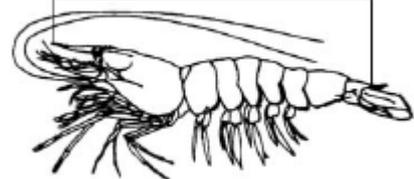
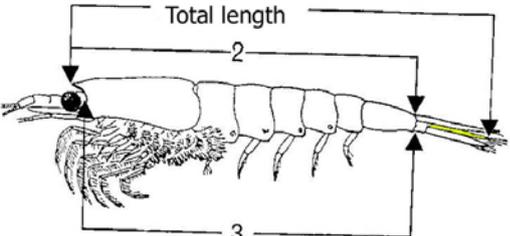
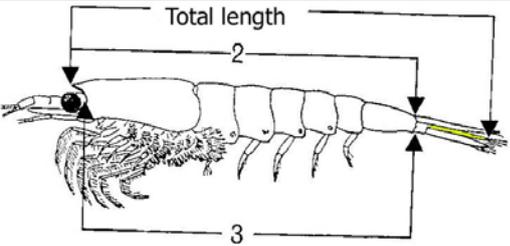
Stomach scans or stomach collection may be added to observer protocols at a later date.

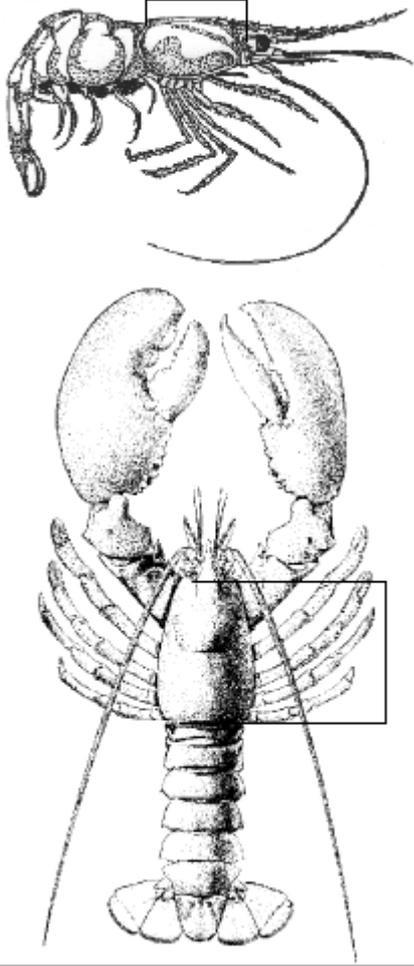
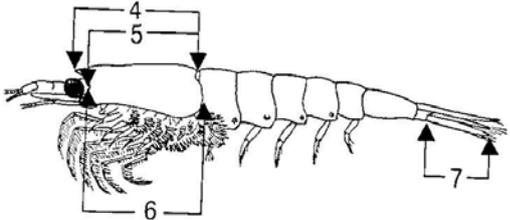
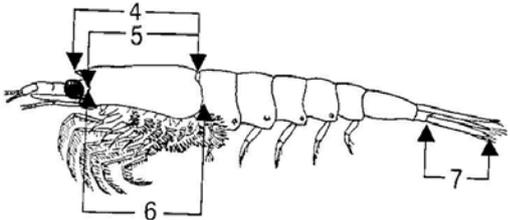
15.4.2 Invertebrates

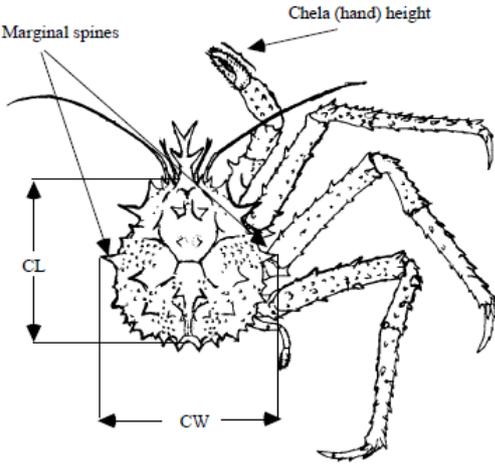
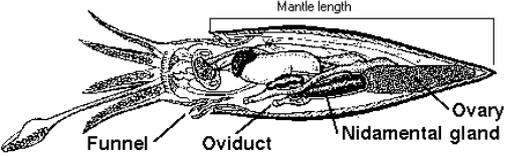
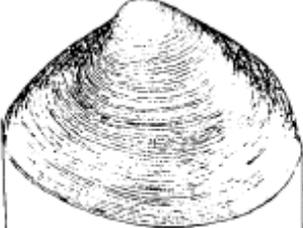
15.4.2.1 Standard measurements

The most common measurement used for shrimp is total length and for crab is carapace width although there are many other measurement options. Table 15-4 contains definitions for the various measurement types and lists the typical groups for each measurement type.

Table 15-4 Standard measurements for various invertebrates. Images and definitions from (Mauchline 1980, ACCSP 2004, CCAMLR 2006, NMFS 2007a)

Measurement (length code)	Measurement description (typical species)	Figure
Total length (02)	Tip of rostrum to posterior tip of uropods (excluding terminal setae). Uropod shaded yellow. (Preferred length for shrimps)	
Total length – alternate (30)	Distance between the base of the eye-stalk to posterior tip of uropods (excluding terminal setae). Uropod shaded yellow.	
Total length – alternate (31)	Tip of rostrum to tip of telson	 ACCSP - Atlantic Coastal Cooperative Statistics Program
Body length (32)	Tip of rostrum to posterior margin of last abdominal segment (#2 in image). Uropod shaded yellow.	
Body length (33)	Distance between the base of the eye-stalk to posterior margin of last abdominal segment (#3 in image)	

<p>Carapace length (34)</p>	<p>Distance along the dorsal surface of the carapace from the rear margin of the eye to the back edge of the carapace. See also #5 in next image. (prawns, preferred length for lobsters)</p>	
<p>Carapace length (35)</p>	<p>Dorsal distance between the anterior tip of the rostrum and the mid-dorsal posterior edge of the carapace (#4 in image)</p>	
<p>Carapace length (36)</p>	<p>Distance between the base of the eye-stalk and the posterior lateral edge of the carapace (#6 in image)</p>	

Carapace length CL (37)	Posterior edge of the eye socket to median posterior carapace (crab)	
Carapace width CW (38)	Largest width across the carapace including marginal spines (crab)	
Mantle length (45)	Straight line measurement from the tip of the fin to the base of mantle (squid)	
Shell height (46)	Distance from hinge to bill edge (scallops)	
Shell width (47)	(clams)	

15.4.2.2 Sex determination

Sex determination of the invertebrates varies by group.

15.4.2.2.1 Shrimp

On the first pair of swimming legs (pleopods), male endopods are notched whereas female endopods are pointed (Figure 15-7). You will not need to separate shrimp by sex unless specifically assigned a special project.

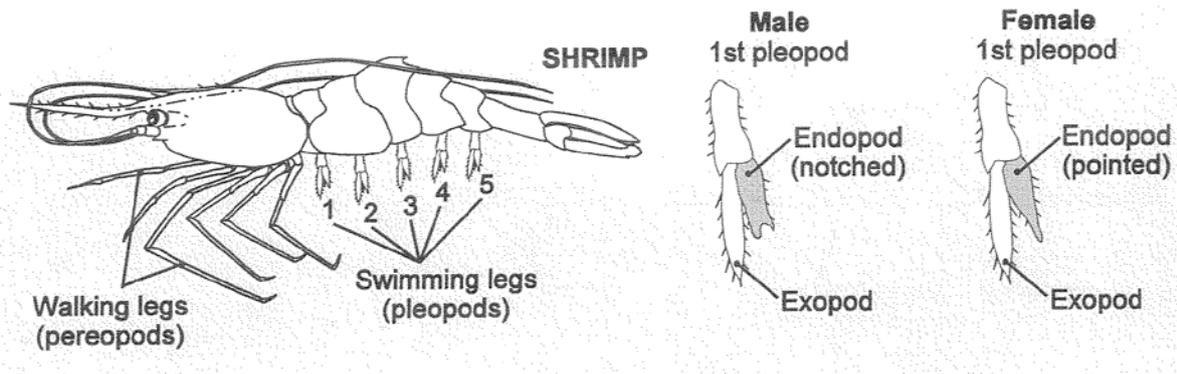


Figure 15-7 Sex differences in shrimp. Image from Hanrahan et al.(1997).

15.4.2.2.2 Crab

For crab, the main difference between the sexes is the shape of the abdominal flap. Females tend to have larger, rounder flaps whereas males are smaller and more triangular in shape (Figure 15-8).

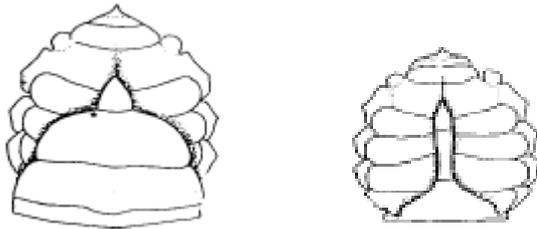


Figure 15-8 Sex differences in crab. Image from (NMFS 2007a)

15.4.2.2.3 Lobster

The primary difference between male and female lobsters is the size of the first pair of swimmerets: females are thin and filament-like whereas males are thick in shape and firm in texture (Figure 15-9). Females also have a relatively large genital opening between the third pair of walking legs whereas males have a small genital opening on the fifth pair of walking legs.

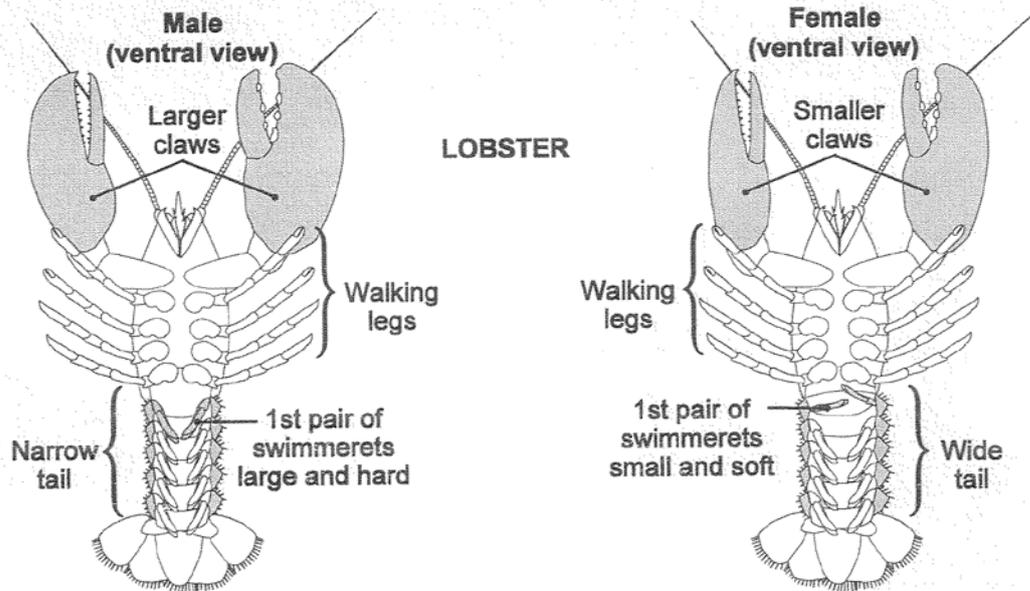


Figure 15-9 Sex differences in lobster. Image from Hanrahan et al. (1997).

15.4.2.3 Crab and Lobster Maturity

For male crab and lobster, leave maturity blank. For female crab and lobster, maturity definitions are as follows:

- 1-no eggs visible
- 2-eggs visible (no eyes)
- 3-eggs visible (eyes visible)
- 4-eggs visible (eyes unknown)

Crab and lobster bearing eggs are also called “gravid” or “berried”.

15.5 Additional Collections

15.5.1 Collection of whole fish / invertebrates

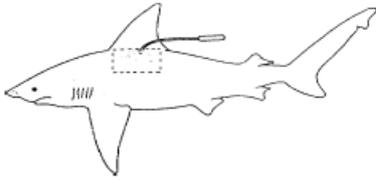
Whole animals may be collected at the request of the SOP. You may be asked to collect unidentifiable species or rare species as well. When it’s not feasible to return specimen to shore, attempt to take a photograph and document distinguishing features by completing a species identification form. Complete a Specimen Collection form for all collected specimen.

Collected specimen must be preserved in some way. There are four primary preservation methods: salt, ice, freezing or chemicals.

- **Salt:** Insert salt into the gill chamber and body cavity. The whole body can then be rolled in salt and placed in a waterproof plastic bag or container. This method is meant for short term preservation.
- **Ice & Freezing:** Place specimen and a specimen label in a waterproof bag or container. Store on ice or in freezer hold and transfer to the SOP immediately upon debarkation.
- **Chemicals:** Not applicable to scientific observers at this time.

Insert a specimen collection tag with each specimen collected. At a minimum, this tag should include a specimen number if you are collecting many individuals of the same species, your observer code, vessel code, date, haul number, and species name/code. It is also useful to include the sex, length and weight.

15.5.2 Tagged Animals



Fish and other marine animals are tagged to obtain information about their movements, migrations, stock structure, growth, population size, mortality, schooling behavior, and physiology and to investigate the effects of various patterns of fishing on the fish and the fisheries.

There are an assortment of tag types which can be grouped into two categories: conventional and electronic. Conventional tags (streamers, spaghetti tags, dart or discs/buttons) are attached externally. The tags have a serial number and an address for returning the tag if found on a fish (Figure 15-10).

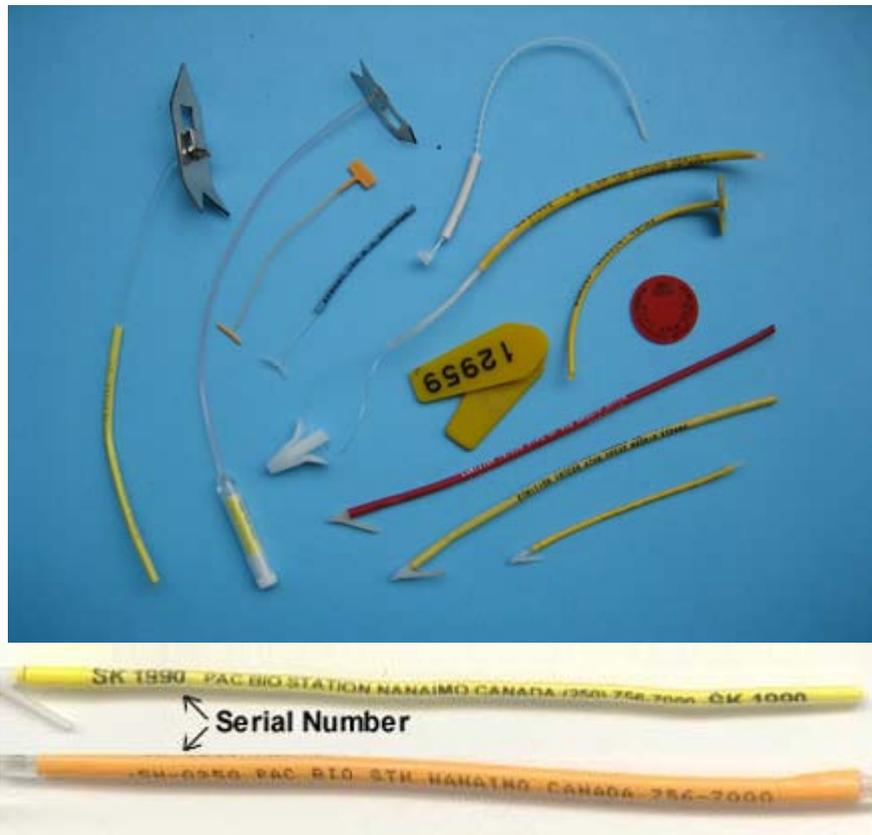


Figure 15-10 Conventional tags (top) and close-up of spaghetti tag (bottom). Images from ICCAT and Pacific Biological Station, Department of Fisheries and Oceans, Canada.

Electronic tags, while more expensive, can provide more detailed information. Animals with electronic tags are also marked externally with a conventional tag (e.g., if electronic tag is implanted) or with the electronic tag itself. Examples of electronic tags include:

- Archival tags - implanted internally and can measure pressure (for depth of dives), ambient light (to estimate location), internal and external body temperature, and, in some cases, speed of travel. A green or green and white conventional tag typically indicates the presence of an archival tag.
- Acoustic tags - small sound-emitting devices that allow the detection and/or remote tracking of fish in three dimensions.
- Pop-up tags - attached externally. After a pre-determined time, they detach from the fish, float to the surface and transmit information via satellite.

Tags can be attached nearly anywhere although the muscle below the dorsal fin and behind the pectoral fin are common tag locations for fish.

What to do if you encounter a tagged animal?

Fill out the Tag Encounter and Recovery form for each tag you encounter on any fish or invertebrate. Tag information from marine mammals, sea turtles and seabirds should be recorded on the appropriate carcass form. If a tagged fish is dead or will be retained, collect the tag, length, weight, sex and aging structures. If the animal is alive and will be released, leave the tag on the fish, measure (or estimate) length and carefully release as quickly as possible.

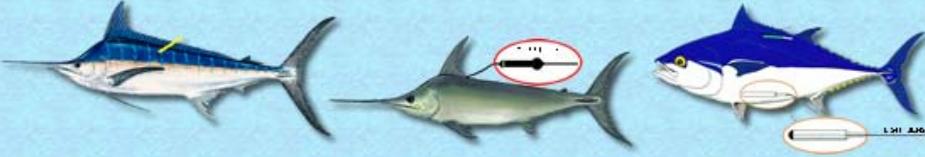
Tag Rewards

There are many entities deploying tags in the Atlantic Ocean. Each program employs different methods for rewarding tag recovery. More information regarding tuna and billfish can be found in Figure 15-11 and <http://www.iccat.int/en/Tag-Program.htm>.

REWARD

for the recapture of a tagged fish





If you find a tagged fish don't pull out the tag until the specimen is measured or weighed. If you can save the fish for examination, do so.

The following information needs to be reported (as detailed as possible):
Tag code (letters and numbers), colour and address printed in the tag
Species, sex (if possible) and length or weight (specify type & units of measurements)
Date and place where the fish was caught and the fishing gear used

Please provide any additional information, such as water temperature, fish condition, wounds, etc.



1



2



3

> Tags implanted on fish are used to learn about fish behaviour and migrations and to estimate important population parameters, such as abundance, mortality and growth. There are three main types of tags: (1) Conventional, (2) Pop-up Satellite Archival, and (3) Internal Archival.

> Pop-up Satellite Archival Tags are electronic data-logging devices that provide location estimates, swimming depth and water temperature. This information is collected and stored in the tag's memory. A summary of these data is then transmitted to the Argos satellite system after the tag pops off at a predetermined time. Pop-up tags are valuable even when found on a beach years later because their memory still maintains the data accurately.

> Internal Archival Tags are implanted in the abdomen of the fish and only the sensor can be seen protruding from the belly. These are electronic data-logging devices that provide the same information as pop-up tags, as well as the fish body temperature. This information is stored in the tag until the fish is recovered. **Please avoid pulling the sensor when removing the tag from the fish.** To remove the tag make an incision on the fish's belly.

Acoustic tags are also electronic tags placed inside the body cavity and are not visible from the outside.





To claim your reward please contact or send information together with the tag and your address to:
ICCAT, E-mail: info@iccat.int, Address: C.P. 542, Madrid, Spain

Closest Local Fishing Agency **Recovery form available in www.iccat.int**



INTERNATIONAL COMMISSION FOR THE CONSERVATION OF ATLANTIC TUNAS

Figure 15-11 ICCAT tag reward poster.

15.6 Species Identification

More than 500 species of fish and invertebrates occur in the Gulf of Guinea and Eastern Atlantic Ocean. In each catch composition sample, the primary commercial species should be identified to the species level. Other species can be identified to the family or even phylum level (Table 15-5)

Table 15-5 Generic guide to levels of species identification.

Genus / Species	Family	Phylum / Class / Order
<ul style="list-style-type: none"> • Marine mammals • Sea turtles • Sharks & rays • Bony fish: Tunas & tuna-like fishes, see also country specific list in Appendix 1 • Shrimp: <i>Penaeus notialis</i>, <i>Penaeus kerathurus</i>, <i>Parapenaeopsis atlantica</i>, <i>Parapenaeus longirostris</i> • Crab: <i>Callinectes amnicola</i>, <i>C. pallidulus</i>, <i>Portinus validus</i>, <i>Callapa robroguttata</i> • Lobsters: <i>Panulirus regius</i>, <i>P. argus</i> • Cuttlefish, octopus and squids: <i>Sepia officinalis hieredda</i>, <i>Sepia bertheloti</i>, <i>Octopus vulgaris</i>, <i>Illex coindettii</i>, <i>Alloteutis africana</i>, <i>Loligo vulgari</i> 	<ul style="list-style-type: none"> • Seabirds • Fish: all except those listed in Species column and country specific list 	<p>Phyla</p> <ul style="list-style-type: none"> • Porifera –sponges; <p>Classes</p> <ul style="list-style-type: none"> • Scyphozoa – jellyfish • Polycheata • Gastropoda – snails, limpets, nudibranchs • Pycnogonida – sea spiders • Crinoidea – feather stars • Stelleroidea – starfishes • Echinoidea – sea urchins, sand dollars • Holothuroidea – sea cucumbers <p>Order</p> <ul style="list-style-type: none"> • Actinaria – sea anemones • Scleractinia – corals • Pennatula & Gorgonacea – sea pens, sea whips, sea fans

Species identification forms allow the SOP to verify that the identification of species seen during a deployment is correct. ***Species identification forms are required for all fish, invertebrates and dead seabird species that are new to you.*** There are separate forms for marine mammals and sea turtles. The first trip in a new target fishery or area may require several of these forms to be completed.

During debriefing, you may be asked to provide a verbal description of a fish if you don't have an ID form, or if the form is incomplete. If you are not able to provide an accurate description of a species recorded in your samples, the SOP may change the data to a higher taxonomic grouping and you may need to take another fish ID test in the future. It is advisable to complete multiple ID forms on species that you do not encounter frequently, so that you have a written record to refer to.

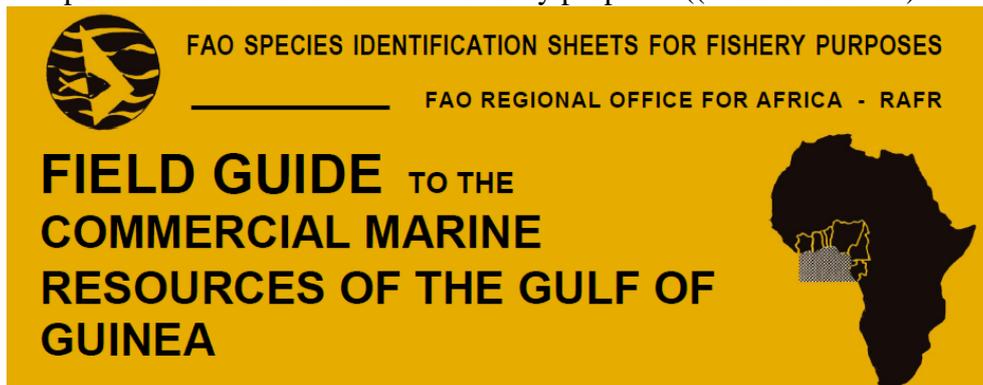
Unidentified Fish

Never guess the identification of a species. If you encounter an individual animal that you cannot identify, fill out a species description form with as much information as possible. You may find a more identifiable specimen of the same species later, so organize your unidentified fish descriptions with names such as “unidentified shrimp #1,” or “unid fish #5.” Record all form heading information, so that the data can be changed if the fish is identified later. ***Ideally, you should bring the specimen back to the SOP.*** If you are unable to bring the fish back, attempt to take photographs of the specimen for identification purposes.

Record unidentified fish on your Catch Composition form with the most appropriate group code. For example, an “unidentified Penaeid shrimp” should be recorded using the “Penaeid shrimp unidentified” group code of PEZ.

Standard Species Identification Guides

Observers will be provided with some guides for quick reference and guides that are more comprehensive. An important species identification guide for West African Atlantic Region is the FAO Species identification sheets for fishery purposes ((Schneider 1990) shown below)



It is mandatory that all Observers carry with them fish identification guides. On your species identification forms, it's a good habit to include scientific names to minimize confusion. Common names for a fish are highly variable among fishermen and sometimes the same common name is used for entirely different fish. It is advisable however that all Observers commit to memory and be able to identify most of their common species, as there will be no time onboard to follow long identification keys.

15.7 Fish and Invertebrate Forms/Instructions

15.7.1 Fish / Invertebrate Length Frequencies

Complete the Fish/Invertebrate Length Frequency Form for each sampled haul if length measurements of fish or invertebrates were collected (Figure 15-12).

Observer Code:	Record your observer program identification code.
Vessel Code:	Record the vessel code (full list in Appendix 3).
Trip ID	Enter the trip identification number assigned by the SOP.
Date	Record the date haul was retrieved (dd/mm/yy).
Haul	Record the haul or set number.
Species name	Record the common or scientific name of the measured fish / invertebrate.
Code	Record the 3-letter code (Appendix 7)
Sex	Enter M, F, I or U for Male, Female, Indeterminate or Unknown. Record Indeterminate when you inspect gonads but are unsure of sex and unknown when gonads are not inspected.
Mat.	For female crab and lobster, maturity definitions are as follows:

- 1-no eggs visible
- 2-eggs visible (no eyes)
- 3-eggs visible (eyes visible)
- 4-eggs visible (eyes unknown)

Maturity protocols for other species may be added to sampling protocol at a later date.

LType

Length type codes are recorded as a number and letter combination (e.g. 01S) made up of length type (definitions in Table 15-1 and **Table 15-4**) and whether the measurement was straight or curved:

- 01 Fork
- 02 Total (fish & crustaceans; natural total length of sharks)
- 03 Standard
- 04 Eye to fork
- 05 Lower jaw to fork
- 06 Cleithrum to fork
- 07 Cleithrum to caudal keel
- 08 Pre-anal fin length
- 09 Pectoral fin to fork
- 10 Pre-caudal length
- 11 Disc width
- 12 Clasper inner length
- 13 Stretched total length
- 14 Disc length pelvic (Myliobatoidei)
- 15 Chimaera length

- 30 Crustacean total length –alternate
- 31 Crustacean total length –alternate
- 32 Crustacean body length
- 33 Crustacean body length
- 34 Crustacean carapace length
- 35 Crustacean carapace length
- 36 Crustacean carapace length
- 37 Crustacean carapace length
- 38 Crustacean carapace width
- 45 Squid mantle length
- 46 Shell height (scallops)
- 47 Shell width (other bivalves)

- S Straight
- C Curved (over the body)

KPC

Key punch check – Add the lengths and counts for each row and record the sum in the KPC column. This will be used as a quality control check during data entry.

- Length Record each length in ascending order to nearest whole centimeter (fish) or millimeter (invertebrates).
- # Record the number of individuals for each length encountered. Record the number of unmeasurable individuals for each species as length=0.
- Comments There is space at the bottom of the page for comments regarding unusual observations or sampling difficulties.

Fish / Invertebrate Length Frequencies

Page ____ of ____

Observer code	SLE 0001		Vessel code	12737		Trip ID	33		Date (dd/mm/yy)	01/07/10		Haul set	78		
Species Name	Code	Sex	Mat.	LType	KPC	Length	#	Length	#	Length	#	Length	#	Length	#
<i>Yfin tuna</i>	YFT	M		O1S	449	77	1	85	1	92	3	93	1	94	2
<i>Yfin tuna</i>	YFT	M		O1S	207	95	6	105	1						
<i>Yfin tuna</i>	YFT	F		O1S	484	80	1	92	1	99	1	100	3	106	1
<i>Yfin tuna</i>	YFT	F		O1S	263	110	2	150	1						
<i>Frigate tuna</i>	FRI	M		O1S	206	35	2	36	1	38	1	44	1	47	1
<i>Frigate tuna</i>	FRI	F		O1S	113	28	1	37	1	45	1				
<i>bigeye thresher</i>	BTH	M		O2S	289	288	1								
<i>swordfish</i>	SWO	F		O5C	286	85	1	199	1						
<i>com. Stingray</i>	JDP	M		14S	68	67	1								
<i>com. Stingray</i>	JDP	F		14S	90	89	1								
Comments:			Sex: M - Male F - Female I - Indeterminate U - Unknown			Common length types (record as number & letter combination): 01 - Fork 11 - Disc width S - Straight 02 - Total 34 - Carapace length (lobster) C - Curved 03 - Standard 37 - Carapace length (crab) 05 - Lower jaw to fork 38 - Carapace width (crab)									

Figure 15-12 Example Fish/Invertebrate Length Frequency form.

15.7.2 Specimen Collection

Complete the Specimen Collection Form for each specimen (whole fish, age structures, etc) collected (Figure 15-13).

-
- Observer Code: Record your observer program identification code.
- Vessel Code: Record the vessel code (full list in Appendix 3).
- Trip ID: Enter the trip identification number assigned by the SOP.
- Date: Record the date haul was retrieved (dd/mm/yy).
- Haul: Record the haul or set number.

Species name	Record the common or scientific name of the measured fish / invertebrate.
Species Code	Record the 3-letter code (Appendix 7)
Specimen Type	Record the code for the type of specimen collected 1 - whole animal 2a - scales 2b - spine/ray 2c - otoliths 2d – thorn 2e - vertebrae 3 - stomachs
Specimen #	Record the specimen number for this collection. If you are not issued pre-numbered labels, vials or envelopes, start with “1” for each trip and number sequentially throughout the trip. Otherwise, use the number listed on the label, envelop or vial you are issued.
Sex	Enter M, F, I or U for Male, Female, Indeterminate or Unknown. Record Indeterminate when you inspect gonads but are unsure of sex and unknown when gonads are not inspected.
Mat.	Leave maturity column blank – To be added to sampling protocol at a later date.
Length	Record each length to nearest whole centimeter (fish) or millimeter (invertebrates).
Weight (kg)	Record the whole weight of each species to the nearest tenth of a kilogram.
Comments	Make notes in the comment section as needed.

15.7.3 Tag Encounter and Recovery

Complete the Tag Encounter and Recovery form for all tags encountered regardless of whether the animal was retained or returned to the sea (example in Figure 15-14).

Observer Code:	Record your observer program identification code.
Vessel Code:	Record the vessel code (Appendix 3).
Trip ID	Enter the trip identification number assigned by the SOP.
Set No.	Record the set or haul number. If not found during fishing, leave this field blank.

Tag Information

Tag number	Record any number or code on the tag and check ONE box for whether this tag was applied (by the observer), was a recapture & the animal was released alive or the tag was removed because the animal was retained or dead.
Tag type	Check the appropriate tag type.
Tag location	Check box for where the tag was attached to the animal's body.
Tag color	Check the color of the tag
Who found the tag?	Record the contact information for the person who found the tag.
Where was tag found?	Check box for whether the tag was found during fishing or during offload. If tag was found during the offload, include the date and location of the offload.

Fish & Invertebrate Information Sections

Species code	Record the species code to the lowest taxonomic level possible.
Length	Record the length in cm (fish) or mm (invertebrates).
Length type	Circle the appropriate codes for length type and whether the measurement was straight, curved or estimated. Common codes are listed on the form; the full list and definitions are in Table 15-1 (fish) and Table 15-4 (invertebrates).
Weight	Record the weight in kg.
Weight type	Circle the appropriate codes for weight type and whether the weight is actual weight or estimated weight
Sex	Record the sex of the animal – M ale, F emale, I ndeterminate or U nknown.

Structures collected?

Check appropriate box for any additional structures collected. It is routine to collect otoliths from fish with tags if they are not returned alive.

Comments

Use this space for any additional comments (e.g. unusual injuries or markings, etc).

Tag Encounter and Recovery			
Observer code <i>SLE 0001</i>	Vessel code <i>12737</i>	Trip ID <i>33</i>	Haul / Set <i>175</i>
Tag Information			
Tag Number <i>NOAA BET00376</i>		Check one: <input type="checkbox"/> Applied <input type="checkbox"/> Recaptured & released alive <input type="checkbox"/> Removed	
Tag type	Tag location	Tag color	
<input checked="" type="checkbox"/> Conventional <input type="checkbox"/> Archival (implanted) <input type="checkbox"/> Electronic (other) <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Below 1st dorsal fin <input type="checkbox"/> Behind pectoral <input type="checkbox"/> Opercle <input type="checkbox"/> Belly	<input type="checkbox"/> Carapace <input type="checkbox"/> Other <input type="checkbox"/> Blue <input type="checkbox"/> Green <input type="checkbox"/> Pink <input type="checkbox"/> White <input type="checkbox"/> Other	
		<input type="checkbox"/> Yellow <input checked="" type="checkbox"/> Red <input type="checkbox"/> Orange <input type="checkbox"/> Metal	
Who found tag?		When was tag found?	
Name: <i>Mr. Sanusi Minah</i>		<input checked="" type="checkbox"/> While fishing	
Address: <i>1001 34th St, Freetown</i>		<input type="checkbox"/> During offload	
Phone/email: <i>232 - 22 - 101 202</i>		Date:	
		Location:	
Fish Information			
Species name <i>bigeye tuna</i>	Species code <i>BET</i>	Length (cm) <i>88</i>	Weight (kg) <i>14.5</i>
			Sex (M,F,I,U) <i>U</i>
Structures collected?	Length types (Circle # and letter)	Weight types (Circle # and letter)	
<input type="checkbox"/> Otoliths <input type="checkbox"/> Scales <input type="checkbox"/> Other: _____ <input type="checkbox"/> None	<input checked="" type="radio"/> 01 Fork <input type="radio"/> 02 Total <input type="radio"/> 03 Standard <input type="radio"/> 04 Eye to fork <input type="radio"/> 05 Lower jaw to fork <input type="radio"/> 11 Disc width	<input checked="" type="radio"/> A Actual <input type="radio"/> E Estimated <input type="radio"/> 01 Whole <input type="radio"/> 02 Gilled & gutted <input type="radio"/> 03 Gilled & headed <input type="radio"/> 04 Headed & gutted <input type="radio"/> 99 Other, describe in comment	
	<input type="radio"/> C Curved <input checked="" type="radio"/> S Straight <input type="radio"/> E Estimated		
Invertebrate Information			
Species name	Species code	Length (cm)	Weight (kg)
			Sex (M,F,I,U)
Structures collected?	Length types (Circle one)	Weight types (Circle # and letter)	
<input type="checkbox"/> Carapace <input type="checkbox"/> Eggs <input type="checkbox"/> Other: _____ <input type="checkbox"/> None	<input type="radio"/> 02 Total <input type="radio"/> 32 Body <input type="radio"/> 34 Carapace length (lobster) <input type="radio"/> 37 Carapace length (crab) <input type="radio"/> 38 Carapace width (crab)	<input type="radio"/> Blank - no weight <input type="radio"/> 01 Whole <input type="radio"/> 99 Other, describe in comment <input type="radio"/> A Actual <input type="radio"/> E Estimated	
Comments			
<i>Fish was frozen whole - I was unable to collect sex or an otolith</i>			

Figure 15-14 Example Tag Encounter and Recovery form.

15.7.4 Species Identification forms

There are specific forms for a few groups (billfish, sharks, skates/rays, flatfish/tonguefish, shrimps, scorpionidae and sparidae). Marine mammals, sea turtles and seabirds have their own forms (see next chapter). Most of the forms for fish and invertebrates are self explanatory and ask for counts of various parts and may require some drawing of various anatomical parts (Figure 15-15 and Figure 15-16). The generic rules for filling out these forms are:

- Species ID forms are required for all animals identified to species and for animals identified to the family or phylum level. If there isn't a group specific form, use the miscellaneous species form.
- If you further identify an organism that only needs to be keyed to family, you must fill out a new form for the identified species (e.g., mantis shrimp unidentified).
- Species ID forms ***must be filled out with the animal in hand!***
- Species ID forms must describe in detail what you observed from your specimen. Do not copy information verbatim from the key or field guide.

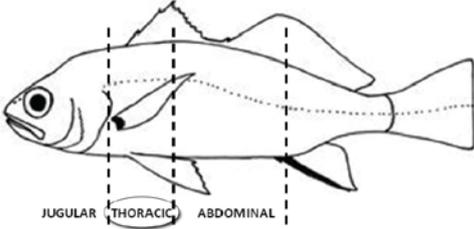
Misc. Fish Species Description

Observer code: A732 Vessel Code: LIB 732 Trip ID: 91
 Common name / code: Swallowtail sea perch / AHN
 Haul: 3 Specimen collected? (Y) / N Total length (cm): 19 Fork length (cm): 16
 Date: 01/05/11 Photos? Y / (N) Weight (kg): 0.4
 Sex: M / F / I / (U)

Check box for presence/absence

	Present	Absent
Adipose fin	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Pelvic fins	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Chin barbel	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Pelvic fin position (circle one)



Describe color: reddish orange w/ yellow blotches on back & stripes on opercle

How many?	Spines	Rays
Dorsal fins	<u>1</u>	<u>10</u>
Anal	<u>1</u>	<u>8</u>

	Upper	Lower
Gill rakers	<u>10</u>	<u>13</u>

Draw the animal and include the following:

1. Shape of dorsal fin -fill in spine heights
2. Caudal fin shape
3. Pectoral fin shape
4. Anal fin shape
5. Pelvic fin position
6. Lateral line(s)
7. Position of any spines, cirri, barbells, etc.

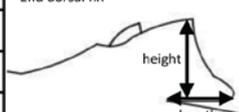


Additional field characteristics used to identify this species:

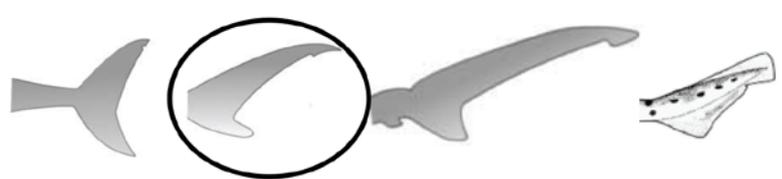
Figure 15-15 Sample Misc. Fish Species Description form.

Shark Species Description

Observer code: <u>9872</u>	Vessel Code: <u>BC3-L24</u>	Trip ID: <u>287</u>	
Common name / code: <u>Pigeye shark (<i>Carcharhinus amoinensis</i>) / CCF</u> Weight (kg): <u>28.6 kg</u>			
Haul: <u>5</u>	Specimen collected? Y <input type="radio"/> N <input checked="" type="radio"/>	Stretched Total length (cm): <u>167</u>	Fork length: _____
Date: <u>24/03/11</u>	Photos? Y <input type="radio"/> N <input checked="" type="radio"/>	Interdorsal length: <u>54</u>	Internal clasper length: <u>18</u>
Sex: M <input checked="" type="radio"/> F <input type="radio"/> I <input type="radio"/> U <input type="radio"/>		Precaudal length: <u>139</u>	

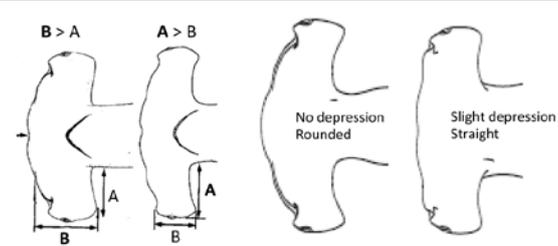
Check box for presence/absence	Present	Absent	Ratio of 2nd dorsal length to height (check one)
Head with lateral, bladelike expansions	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Length 2 or more times height <input type="checkbox"/>  Length < 2 times height <input type="checkbox"/> Length equal to height <input type="checkbox"/> Length less than height <input type="checkbox"/> N/A <input type="checkbox"/>
Anterior nasal flaps formed into barbels	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Long snout	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Eyes visible from top of head	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Dorsal fin spines	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Interdorsal ridge	<input type="checkbox"/>	<input checked="" type="checkbox"/>	How many? Dorsal fin: <input type="text" value="2"/> Gill slits: <input type="text" value="5"/>
Anal fin	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Caudal keel	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Precaudal pit	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Flank color (circle one) <input checked="" type="radio"/> Light / <input type="radio"/> Dark

Caudal fin (tail) shape (circle one)

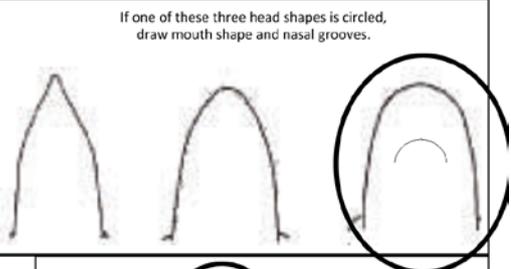


Other (draw shape):

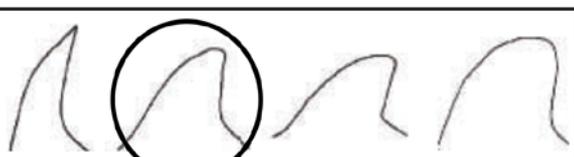
Head shape (circle one)



If one of these three head shapes is circled, draw mouth shape and nasal grooves.



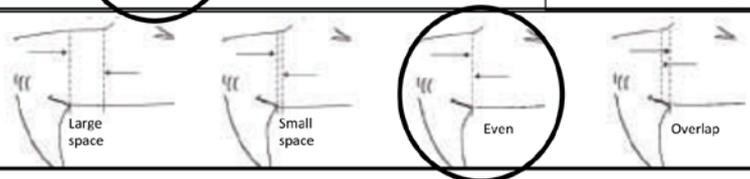
First dorsal fin shape (circle one)



Pectoral fin color (circle one)



Pectoral fin placement relative to 1st dorsal fin (circle one)



Comments:

Grayish in color, white below; fins with dusky tips

V1.2 8/2011

Figure 15-16 Sample Shark Description form.

16 Marine Mammals, Sea Turtles & Seabirds –Sightings, Interactions & Catch

16.1 Learning objectives

- Describe three features to pay attention to when identifying marine mammals
- Describe three features to pay attention to when identifying sea turtles
- Describe three features to pay attention to when identifying seabirds
- List the main sections of the forms you must complete if you catch a marine mammal or sea turtle

16.2 Introduction

All sea turtles and many marine mammals and seabirds are globally threatened or endangered (IUCN 2008). In order to assess fishery impacts on these species, sightings and fishery interactions need to be reliably quantified.

16.3 List of Priorities

1. Identify all marine mammals, sea turtles and seabirds caught to the lowest taxonomic level possible and complete appropriate forms for the species caught
2. Complete a Marine Mammal and Turtle Sighting and Interaction form for all sightings and interactions

16.3.1 Marine Mammals

Marine mammal interactions with fishing gear can be active or passive. Marine mammals have been documented actively feeding on discards and on longline- or gillnet-caught fish. Fishers may attempt to deter marine mammals from their gear as well. These are typically not fatal interactions and are recorded on the Marine Mammal & Sea Turtle Sighting and Interaction form. Marine mammals are rarely, but occasionally, caught by fishing gear. When this does occur, it needs to be documented thoroughly on the Marine Mammal Capture and Carcass Examination forms.

16.3.2 Sea Turtles

Like marine mammals, sea turtle sightings are recorded on the Marine Mammal & Sea Turtle Sighting and Interaction form. If a sea turtle is caught incidentally there are specific protocols that should be followed when handling it. These protocols and guidelines have been developed to reduce the risk of further injury to the turtle and to the people handling it. When a turtle is caught, work with the crew to get the turtle on board safely or alongside the vessel if it is too large to bring aboard.

Once a sea turtle has been safely brought onboard or alongside the vessel, your job is to document the catch on the Sea Turtle Accidental Capture form (section 16.4.4), take photographs and measurements, retrieve tag information from previously tagged turtles, and assist with removing as much gear as possible from live turtles.

16.3.2.1 Landing and Handling

Upon sighting a turtle caught in gear, the crew should bring the turtle alongside the vessel by slowly and gently retrieving the gear. Gaffs or any other sharp devices should not be used to retrieve the turtle. Turtles less than 90cm in carapace length can generally be brought aboard safely. If the crew is unable to land the turtle due to size or safety considerations, take photos and samples. Ask crew to remove any gear while the turtle remains in the water. The turtle may need a short time to calm down.

16.3.2.2 Dehooking - Longline

Special dehooking equipment has been developed to safely remove longline gear from hooked and/or entangled sea turtles and has been demonstrated to be effective at increasing the post-hooking survival of sea turtles. A 3-year study in the Northeast Distant waters off the East Coast of the U.S. showed that dehooking increased survival for both loggerheads and leatherback turtles.

What are dehookers and what are the incentives for using the equipment?

The most important purpose of the dehooker is to reduce the mortality of turtles by removing the hook from the turtle. Turtle post-hooking survival can be increased when the hook is removed with minimum injury. Fishers assist in sea turtle conservation, retain their hooks (which can be costly), and reduce their re-rigging time. Dehooking a turtle, especially one that is too large to bring aboard, requires cooperation among the crew. This is not a one person operation. Cooperation will result in the best possible release of the turtle.

What if removing the hook may cause more damage?

Deciding whether or not to remove a hook is a judgment call; however, almost all external hooks should be able to be removed. If the hook is in a place where removal may cause further damage to a live turtle, then the hook should be left alone. For example, a hook embedded in the brain or glottis might be best left alone. Remove hooks where the insertion point is visible. Bolt cutters may be more efficient than using a dehooker. Cut the eye or barb of the hook (or flatten the barb) and pull out the other end using longnose pliers. If the hook cannot be removed, cut off as much of the visible part of the hook as possible. Always cut away as much gear as possible on live turtles.

What equipment might you encounter?

There is a wide range of sea turtle handling and dehooking equipment. Some items you may encounter include:

1. Long-handled pigtail dehooker for both external and ingested hooks on turtles that are not boarded (Figure 16-1).
2. Short-handled pigtail dehooker with bite block for both external and ingested hooks. Used on turtles that are boarded (Figure 16-2).
3. Device for pulling an “inverted V”- either the long-handled dehooker for external hooks (J-style) or a gaff
4. PVC pipe – is used to protect the turtle’s beak from becoming damaged from the metal of the dehooker. It also serves to shield the barb of the hook to prevent re-engagement once the hook has been released. The J-style and Scotty’s dehookers are also shown (Figure 16-2) and are used to remove external hooks that are not too deep.
5. Mouth gags and openers (Figure 16-3)
6. Dip net
7. Bolt cutters

8. Line cutter: a long-handled line cutter can be used to cut the lines from turtles that are released while they remain in the water.



Figure 16-1 Long handled equipment: Line cutter (top), pigtail dehooker (middle) and J-style dehooker (bottom). Images from PIRO (2009).

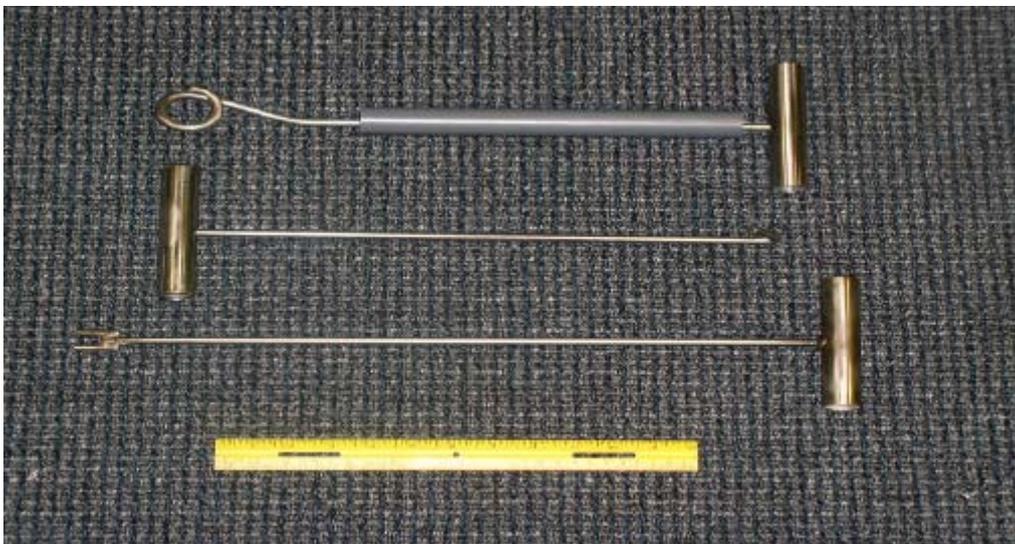


Figure 16-2 Short-handled equipment: pigtail dehooker (top), J-style dehooker (middle), Scotty's dehooker (bottom). Images from PIRO (2009).



Figure 16-3 Examples of mouth openers and gags. Images from PIRO (2009).

How to use a long-handled pigtail dehooker:

1. The person holding the line attached to the turtle should try to stay to the left of the dehooking person while keeping the line taut. The dehooking person should have the line to the left, and the dehooker to the right. Make sure to stay clear of being in between the branchline and the dehooking device because if the line snaps it could be dangerous.
2. The person dehooking will place the dehooker on the line (perpendicular, at a 90-degree angle) with the opening of the pigtail facing up.
3. Pull the device toward you as you would a bow and arrow, until you engage the line.
4. Turn the dehooker a 1/4-turn clockwise, putting the line in the center of the curl.
5. Slide the dehooking device down the line until it engages the shank of the hook and bottoms out. You may have to rotate and move the device back and forth until the top portion of the pigtail is resting on the shank of the hook. This is the proper engagement on the hook.
6. Once engaged, bring the line and the device together making sure the line is tight and parallel with the hooking device.
7. Communicate with the second person so you know when to give slack and when to pull taut and prevent injury. Give a thrust downward until the hook disengages, then gently pull the dehooker upwards, with the hook holding the line taut so the hook is not too loose and does not re-engage.

How to use a short-handled pigtail dehooker:

1. The dehooking person should hold the branchline in the left hand, and the dehooker in the right holding the PVC pipe towards you up against the handle.
2. Place the dehooker on the line (perpendicular / at a 90-degree angle) with the opening of the pigtail facing up.
3. Pull the device toward you as you would pull back on a bow and arrow, until you engage the line.
4. Turn the dehooker a 1/4-turn clockwise, putting the mono in the center of the curl.
5. Release the PVC and slide the dehooking device down the branchline, holding until it engages the shank of the hook and bottoms out. You may have to rotate and move the device back and forth until the top portion of the pigtail is resting on the shank of the hook. Drop the PVC pipe down. This is the proper engagement on the hook
6. Once engaged, bring the line and the device together making sure the branchline is tight and parallel with the hooking device.
7. Give a thrust downward until the hook disengages, then pull up the dehooker holding the PVC down. Hold the line taut so the hook is not loose and can't possibly re-engage.

16.3.2.3 Resuscitation

All turtles that appear dead or comatose (unconscious) should be brought on board to attempt to revive the animal when practical. Turtles can withstand lengthy periods without breathing; a comatose sea turtle will not move, breathe voluntarily or show reflex responses or other signs of life. In other cases, an unresponsive turtle may show shallow breathing or reflexes such as eyelid or tail movement when touched. The following resuscitation techniques should be implemented:

1. Place the turtle on its bottom shell (plastron) so that the turtle is right side up and elevate its hind quarters at least 15cm for a period of 4 to 24 hours. The amount of the elevation depends on the size of the turtle; greater elevations are needed for larger turtles. A board, tire or float can be used for elevation. Periodically rock the turtle gently left to right and right to left by holding the outer edges of the shell (carapace) and lifting one side about 7 cm, then alternate to the other side. Gently touch the corner of the eye or eyelid and pinch the tail (reflex test) periodically to monitor consciousness (Figure 16-4). DO NOT put the turtle on its carapace (back) and try to compress the plastron. This may harm the turtle.



Figure 16-4 Elevate a comatose turtle with its head down (left) and periodically pinch the tail to see if there is a reflex response (right). Images from PIRO (2009).

2. Sea turtles being resuscitated must be shaded and the skin kept damp or moist, but under no circumstances should the turtle be placed into a container holding water. A water-soaked towel placed over the head, carapace, and flippers is the most effective method of keeping a turtle moist, but do not cover its nostrils. Sea turtles may take some time to revive; do not give up too quickly. Turtles that are successfully resuscitated benefit from being held on deck as long as possible (up to 24 hours) to fully recover from the stress of accidental forced submergence.



Figure 16-5 Wet towel placed over turtle to keep turtle cool. Images from PIRO (2009).

3. Sea turtles that revive and become active must be released from the area of the boat that is closest to the water only when fishing or scientific collection gear is not in use, when the engine gears are in a neutral position, and in areas where they are unlikely to be recaptured or injured by vessels. A turtle that has shown no sign of life after 24 hours on deck may be considered dead and returned to the water.

16.3.2.4 Tissue Collection Protocol for Observers

This protocol was adapted from: Dr. Angela Formia, Università di Firenze, 50125 Firenze, Italy; and Wildlife Conservation Society, BP 7847, Libreville, Gabon. Email: aformia@seaturtle.org.

List of materials:

- Tubes with saturated salt solution
- Disposable blades
- Alcohol swabs (or 80% ethanol and cotton balls)
- Cigarette lighter to sterilize the forceps
- Small forceps
- Disposable gloves (recommended)
- Permanent marker pen to write on tubes
- Parafilm

Methods:

- Very small tissue samples may be collected without risk to an adult or juvenile sea turtle, provided that sterile techniques are observed. Unnecessary disturbance, handling and noise should be kept to a minimum during all sampling procedures.
- In the case of hard-shelled turtles, samples should be taken preferably from the skin of the dorsal surface of the front flipper close to the “shoulder” or alternatively from the neck region. Leatherbacks should be sampled in the area of loose skin between the tail and the rear flippers.
- The biopsy site should be wiped with alcohol before and after the procedure.
- Disposable equipment should be used whenever possible to avoid DNA crosscontamination: **Use a new blade when collecting from each different individual.**
- **Any equipment reused should be cleaned carefully with the alcohol provided and the alcohol burned off.**
- Gloves should be worn.
- The recommended tissue sample size for an adult turtle is approximately 6 mm of diameter and 2 mm in depth.
- Pinch the skin with the forceps, pulling outward slightly, and slicing a thin layer with a sharp blade about one square cm in size and 2mm in depth.
- Store in a clearly labelled and sealed tube (wrap parafilm around the top to avoid leaks) at room temperature, avoiding exposure to heat and sunlight. An alternative method of preservation for pieces of tissue of a small size is plain salt or even 70-95% ethanol. **DO NOT use formalin.**
- Tag the turtle following standard procedures and release as soon as possible near the point of capture. Do not tag or sample live hatchlings.
- Tagging the turtle will ensure that the same individual is not sampled twice. **Be sure to record tag number as well as the number on the sample tube.**

- Samples should be obtained from both living or dead turtles. **Be sure not to sample the same individual more than once.**
- Label each tube using the permanent pen with the species, location, date, and field ID number.
- Write the numbers/information on the tube on your corresponding datasheet.

NOTE: Though samples can be stored at room temperature for several months, they should be kept at 4°C or -20°C wherever possible (provided they are not subsequently exposed to too many freeze-thaw cycles).

16.3.3 Seabirds

Protocols for seabird sightings and interactions with gear may be developed in the future. The only seabird duty is completing the Seabird Identification form for each new species of seabird encountered in the catch.

16.4 Forms/Instructions

16.4.1 Marine Mammal and Turtle Sighting and Interaction Form

Use this form for marine mammal and sea turtle **sightings** and **interactions**: Fill out one form for each time you SEE one or more marine mammals or turtles at sea AND record whether they interact with the fishing gear. Use one form for each sighting or interaction with one or more animals of the same species (examples are shown in Figure 16-6 and Figure 16-7).

If the fishery interaction involves catching the animal, you will also fill out a Marine Mammal Capture Form or Sea Turtle Accidental Capture Form.

Field	Definition
Observer Code	Record your observer code.
Vessel Code	Record the vessel code (Appendix 3).
Trip ID	Enter the trip identification number assigned by the program.
Date / Time	Enter the date when you saw the animal as day/month/yr Enter the time when you first saw the animal (use 24hr notation)
Haul / Set #	Record the Haul or set number if the sighting occurred during active fishing. Otherwise leave blank.
Sighting #	Record the sighting number. Number consecutively as marine mammal and sea turtle sightings are made throughout a trip.
Assoc. Sight. #	Record the sighting number(s) if multiple species are sighted concurrently. For example, if the first group of marine mammals you see contains one Risso's dolphin and two false killer whales, you would complete two sightings forms. One for the Risso's dolphin (sighting #1) and one for the false killer whales (Sighting #2). On the form you would record #2 and #1,

respectively, for the Assoc. Sight #.

Sighting
Conditions

Circle the relative condition that relates to your view of the animal as affected by ambient lighting, sea state, your position, precipitation, weather, etc. Use the following guidelines:

Excellent: visibility clear to the horizon; calm conditions; would easily detect a bird >300m from vessel and a mammal at > 3 km

Good: sighting conditions may be affected by glare, sea state, weather or distance; a small bird would be detected to 300m and a mammal at >1 km

Fair: conditions affected by a combination of problems such as heavy seas, poor weather or distance; a small bird would be detected to 200m

Poor: severely limited visibility (<200m) due to high seas, weather such as fog, etc.

Location

Latitude: enter degrees and decimal-minutes. Circle **North** or **South**

Longitude: enter degrees and decimal-minutes. Circle **East** or **West**

If on a purse seine vessel, the time and position should match the Daily Activity Log.

Wind

Estimate the wind speed at the time of observation; record it in **knots**.

Wave HT

Estimate Wave Height; record it in **meters**

Water Temp

Record most recently reported surface water temperature (°Celsius)

Species

Enter the common name of the species observed. If more than one species is seen, fill out a separate form for each species and note the association in the Note Box at bottom of form and include Associated Sighting numbers in the Assoc.Sight.# box above.

Species code

Debriefers will enter the 3-letter species code.

Confidence

How certain are you of the species' identification? Circle one of 3 levels of confidence

Body length

Circle the size range that represents the approximate length of

the animal seen. Use clues like its size relative to the vessel's length, wave height, or birds nearby.

- Photos taken: Photographs can help confirm the species' identification and document fishery interactions. If you take photographs, please record the frame number (**Frame #**) involved.
- Video? Did you take video footage of the observation or interaction? If so, circle **Y** (yes). Otherwise, circle **N** (no)
- Closest Approach How close did the animal get to the vessel? Record the shortest distance in **meters**
- Initial Sight Distance Record the initial sighting distance in **meters**
- Number Sighted Estimating the number of animals in a large group can be difficult. Please provide your **BEST** estimate of the total group size. If you are uncertain, record the minimum (**Min**) and maximum (**Max**) number of individuals you believe were in the group.
- Initial sighting cue Circle the initial sighting cue that lead to the sighting
- Initial sighting by: Circle who (or what) made the initial sighting.
- Vessel Activity Circle the appropriate vessel activity when you sighted the marine mammal.
- Notes & Identifying Characteristics Use the large box to provide written and drawn descriptions of the appearance of the animal you saw, the circumstances of its interaction with the gear or vessel, the presence of numbered tags, or to indicate areas of visible injuries
- Behaviors Circle all the behaviors or activities that pertain to the animal(s) you observed (definitions in Table 16-1). There may be many behaviors recorded for each observation reported.
- Fishing Interactions Marine mammals may interact with fishing vessels and gear in many ways. Check **all** the situations that apply to this observation. Most of the main categories (bold on left side of form) have sub-categories (non-bold on right).
- Feeding on catch** – also check whether the animal was taking fish off hooks or from the net, feeding on discards or on fish from outside the net (trawl).
- Deterrence used** – check which type of deterrents were used. Check “Skiff” if a skiff was used to run along the gear (often used in gillnet

fisheries).

Boarded vessel – check if the animal came on board the vessel on its own.

Vessel collision – check whether the animal was hit by the hull, propeller or both.

Chased by speedboat – check if MM were chased or herded by speed boat on purse seine

Deployed PS around MM – check purse seine net was deployed around marine mammals

Deployed PS within 100m – check if purse seine net was deployed within 100m of marine mammals

Entangled/captured in gear - Check if marine mammal or turtle is entangled or captured and record a Capture #. **If a marine mammal or sea turtle is CAPTURED, complete a Marine Mammal Capture Form or Sea Turtle Accidental Capture Form**

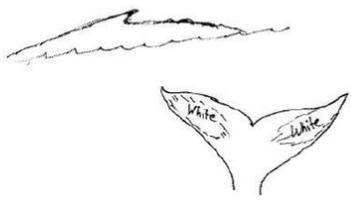
Table 16-1 Marine mammal and sea turtle behavioral descriptions. Modified from (IATTC 1999-2005, AFSC 2007).

Small Cetaceans	Large Cetaceans
<p>Bow riding – Animals swim beside the bow or in the bow wave of a moving vessel.</p> <p>Leaping entirely out of the water – Animal jumps fully clear of the surface of the water (as opposed to merely breaking the surface of the water), not for forward locomotion but for other reasons.</p> <p>Porpoising – Animal raises its body to be nearly or fully out of the water while traveling forward at a fast rate of speed, usually in a fluid, arching motion.</p> <p>Slow rolling – Animal comes to the surface to breathe, with the blowhole and dorsal area usually showing, and then rolls back underwater.</p>	<p>Blow visible for a distance – Blow can be seen from more than 500 m away.</p> <p>Breaching – Animal accelerates forward underwater and then jumps free of the water, sometimes fully clearing the water’s surface and then lands on the surface of the water, creating large splash.</p> <p>Flipper slapping – Whale floats or swims at the surface, turns on its side and slaps one pectoral fin against the water, either once or several times in quick succession.</p> <p>Group feeding – Seen primarily in humpback whales, when they coordinate feeding by lunging out of the water with their mouths open, engulfing prey and water.</p> <p>Lob-tailing – Whale raises its tail flukes up out of the water and slaps them down against the surface with great force. This may occur once or be repeated many times.</p> <p>Spy-hopping – Whale is vertical or upright in the water and raises its head up out of the water, usually with its eye showing.</p> <p>Tail raised on dive – When diving the whale’s entire tail lifts completely above the water before going underwater.</p> <p>Side & stern wake riding – Whale is riding in the wake created midships along the side of the vessel or the wake created by the stern.</p>

Sea Turtles	Pinnipeds
<p>Still: floating in the water without apparent movement.</p> <p>Swimming, but not in reaction to the presence of the vessel. If the turtle appears to be swimming to avoid the vessel, circle Other.</p> <p>Feeding: enter this code only if you are sure that the turtle is consuming food.</p> <p>Other/Unknown: any activity that cannot be described with listed behaviors</p> <p>Dead: the turtle was already dead when it was sighted</p>	<p>Jug handle – Seal or sea lion floats on its side with one front flipper and one rear flipper above the water, creating what looks like a handle.</p> <p>Porpoising – Swimming fast & jumping at least partially out of the water in a fluid, arching motion. This swimming pattern resembles that of dolphins seen at a distance.</p> <p>Rafting – A group of pinnipeds resting at the surface together.</p> <p>Spooked from haulout – Pinnipeds which had been resting on beach or rocks dove into the water during to your vessels approach.</p> <p>Vocalizing – Pinniped making direct noises at you or at another pinniped.</p>

Marine Mammal / Sea Turtle Sightings and Interactions

Complete one form for each sighting or interaction with one or more animals of same species

Observer code SLE 0001		Vessel code 12737		Trip ID 33	
Sightings					
Date(dd/mm/yy) 02/08/10	Time (24-hr) 1438	Haul/Set # 01	Sighting # 3	Assoc.Sight. # 9	Sighting Condition: (Circle one) Excellent <input type="radio"/> Fair <input type="radio"/> Good <input checked="" type="radio"/> Poor <input type="radio"/>
Latitude 0 8 °	0 1 °	9 N	2 E	W	Wind Speed (kn): 20 Wave Ht (m): 2
Longitude 0 1 8 °	1 5 °	2 E	W		Water Temp: 29.1 °C
Species: Humpback Whale			Confidence: (circle one) Sure <input type="radio"/> Likely <input checked="" type="radio"/> Unsure <input type="radio"/>		
Species Code: _____					
Body Length: (circle one) <3 m (<10') 3-8 m (10-25') 8-16 m (25-50') 16-26 m (50-80') >26 m (>80')					
Photos: Frame #		Video? Y <input checked="" type="radio"/> N <input type="radio"/>			
Closest Approach 7 5	Initial Sight Distance 1 5 0	Number Sighted (Best) 3	Number (Min) 4	Number (Max) 4	
Initial sighting cue: <input checked="" type="checkbox"/> Splashes/blow <input type="checkbox"/> Birds <input type="checkbox"/> Tuna <input type="checkbox"/> FAD <input type="checkbox"/> Other		Initial sighting by: <input checked="" type="checkbox"/> Aircraft <input checked="" type="checkbox"/> Crew <input type="checkbox"/> Observer		Vessel activity (circle one): <input checked="" type="checkbox"/> Transit/searching <input type="checkbox"/> Drifting <input type="checkbox"/> Deploying fishing gear <input type="checkbox"/> Other <input type="checkbox"/> Retrieving fishing gear	
Notes & Identifying Characteristics Include description and drawing of body features, tags, markings, coloration and associated organisms			Behaviors Circle behaviors observed below & describe in "Notes" box		
<p>Captain alerted me to whales-1430. I went to wheelhouse but it didn't resurface until 1438. We got 2 blows, a couple of views of the dorsal fins and then they sounded. Fluke was deeply forked and had white patches. Body completely dark.</p> 			Small Cetaceans <input type="checkbox"/> Bow riding <input type="checkbox"/> Leaping entirely out of water <input type="checkbox"/> Porpoising <input type="checkbox"/> Slow rolling		Pinnipeds <input type="checkbox"/> Jug handle <input type="checkbox"/> Porpoising <input type="checkbox"/> Rafting <input type="checkbox"/> Spooked from haulout
			Large Cetaceans <input checked="" type="checkbox"/> Lob-tailing <input checked="" type="checkbox"/> Blow visible at distance <input type="checkbox"/> Breaching <input type="checkbox"/> Spy-hopping <input type="checkbox"/> Tail raised on dive <input type="checkbox"/> Flipper slapping <input type="checkbox"/> Side wake riding		Sea Turtles <input type="checkbox"/> Dead <input type="checkbox"/> Still <input type="checkbox"/> Swimming <input type="checkbox"/> Feeding <input type="checkbox"/> Other/Unknown
Fishing Interactions (check all that apply)					
<input type="checkbox"/> Feeding on catch	<input type="checkbox"/> Off hooks or from net	<input type="checkbox"/> Fish from outside net (trawl)	<input type="checkbox"/> Discards		
<input type="checkbox"/> Deterrence used	<input type="checkbox"/> Seal bomb (or other explosive)	<input type="checkbox"/> Acoustic device (pingers)	<input type="checkbox"/> Yelling		
<input type="checkbox"/> Towed on gear	<input type="checkbox"/> Other types of noise	<input type="checkbox"/> Skiff	<input type="checkbox"/> Pole gaff		
<input type="checkbox"/> TED	Other: _____				
<input type="checkbox"/> Boarded vessel					
<input type="checkbox"/> Vessel collision	<input type="checkbox"/> Hit by hull	<input type="checkbox"/> Hit by propeller	<input type="checkbox"/> Hit by hull & propeller		
<input type="checkbox"/> Chased by speedboat	<input type="checkbox"/> Deployed PS around MM	<input type="checkbox"/> Deployed PS within 100m			
<input type="checkbox"/> Entangled/ captured in gear	If yes,  fill out Sea Turtle or Marine Mammal Capture Form				
	Capture # _____				

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Figure 16-6 Example of a Marine Mammal/Sea Turtle Sightings and Interaction Form that records a sighting only, with no fishery interaction.

Marine Mammal / Sea Turtle Sightings and Interactions

Complete one form for each sighting or interaction with one or more animals of same species

Observer code SLE 0001		Vessel code 12737		Trip ID 33	
Sightings					
Date(dd/mm/yy) 02/08/10	Time (24-hr) 0038	Haul/Set # 46	Sighting # 4	Assoc.Sight. #	Sighting Condition: (Circle one) Excellent Fair Good Poor
Latitude 0 8 °	0 3 .	2	N S	Wind Speed (kn): 30	Wave Ht (m): 3
Longitude 0 2 0 °	3 5 .	5	E W	Water Temp: 28.3 °C	
Species: Atlantic humpback dolphin			Confidence: (circle one) Sure Likely Unsure		
Species Code:					
Body Length: (circle one) <3 m (<10') 3-8 m (10-25') 8-16 m (25-50') 16-26 m (50-80') >26 m (>80')					
Photos: Frame # 7-10			Video? Y N		
Closest Approach	Initial Sight Distance	Number Sighted (Best)		Number (Min)	Number (Max)
0		1		1	1
Initial sighting cue: *Splashes/blow *Birds *Tuna *FAD *Other		Initial sighting by: *Aircraft *Crew *Observer		Vessel activity (circle one): *Transit/searching *Drifting *Deploying fishing gear *Other *Retrieving fishing gear	
Notes & Identifying Characteristics Include description and drawing of body features, tags, markings, coloration and associated organisms			Behaviors Circle behaviors observed below & describe in "Notes" box		
<p>as we were hauling net, I saw something big inside. The crew dumped the entire net contents on the deck and the dolphin was inside - appears slightly decomposed. Animal is mostly grey, has a medium beak and a puffy hump forward of dorsal fin. It also had what look like gillnet mesh cuts across its face</p> 			Small Cetaceans *Bow riding *Leaping entirely out of water *Porpoising *Slow rolling		Pinnipeds *Jug handle *Porpoising *Rafting *Spooked from haulout
			Large Cetaceans *Blow visible at distance *Spy-hopping *Flipper slapping		*Lob-tailing *Breaching *Tail raised on dive *Side wake riding
Sea Turtles *Still *Feeding			*Dead *Swimming *Other/Unknown		
Fishing Interactions (check all that apply)					
<input type="checkbox"/> Feeding on catch	<input type="checkbox"/> Off hooks or from net	<input type="checkbox"/> Fish from outside net (trawl)	<input type="checkbox"/> Discards		
<input type="checkbox"/> Deterrence used	<input type="checkbox"/> Seal bomb (or other explosive)	<input type="checkbox"/> Acoustic device (pingers)	<input type="checkbox"/> Yelling		
<input type="checkbox"/>	<input type="checkbox"/> Towed on gear	<input type="checkbox"/> Other types of noise	<input type="checkbox"/> Skiff	<input type="checkbox"/> Pole gaff	
<input type="checkbox"/>	<input type="checkbox"/> TED	<input type="checkbox"/> Other: _____			
<input type="checkbox"/> Boarded vessel					
<input type="checkbox"/> Vessel collision	<input type="checkbox"/> Hit by hull	<input type="checkbox"/> Hit by propeller	<input type="checkbox"/> Hit by hull & propeller		
<input type="checkbox"/> Chased by speedboat	<input type="checkbox"/> Deployed PS around MM	<input type="checkbox"/> Deployed PS within 100m			
<input checked="" type="checkbox"/> Entangled/ captured in gear	If yes,  fill out Sea Turtle or Marine Mammal Capture Form				
		2	Capture #		

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Figure 16-7 Example of a Marine Mammal/Sea Turtle Sighting and Interaction Form that records a sighting in which there is a fishery interaction.

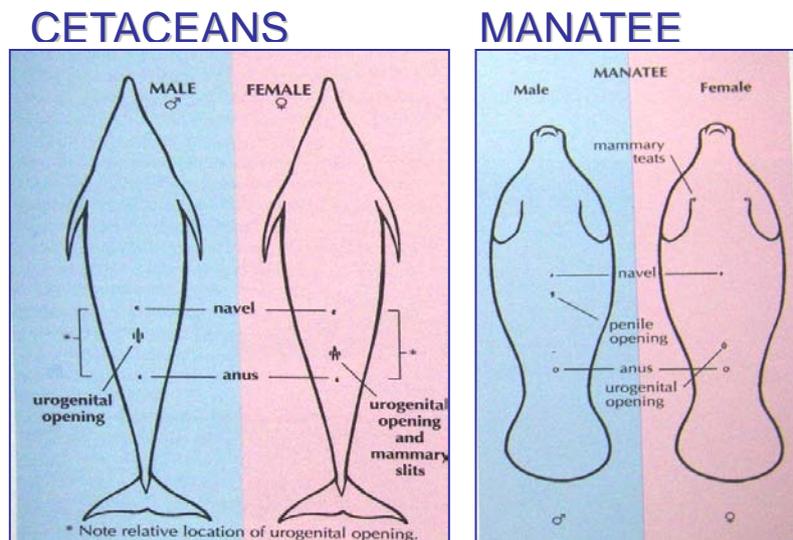
16.4.2 Marine Mammal Capture Form

Use this form if a marine mammal is accidentally caught in the gear. Use one form for each individual marine mammal (MM) whether it is DEAD or ALIVE.

IF THE ANIMAL IS ALIVE, RETURN IT TO THE WATER AS SOON AS POSSIBLE! Take photos if possible

Field	Definition
Observer Code	Record your observer code.
Vessel Code	Record the vessel code.
Trip ID	Enter the trip identification number assigned by the program.
Haul / Set #	Record the Haul or set number.
Date / Time	Fill in the date of release (dd/mm/yy). Fill in the time of release. If whole animal was collected, leave blank.
Capture #	Give each marine mammal captured on this trip a separate and consecutive number, whether it is dead or alive. Number consecutively throughout the trip.
Location	Describe the area or region where the carcass was found if latitude / longitude are unavailable.
Latitude / longitude	Latitude: enter degrees and decimal-minutes. Circle N or S Longitude: enter degrees and decimal-minutes. Circle E or W
Species / code	Record the species common or scientific name and 3-letter species code

Gender



Determine the animal's gender and circle **M** for male, **F** for female, or **U** if the gender is unknown or cannot be determined.

Photos Taken	Did you take photographs of the animal? Yes or No ? If yes, record the number of the Frame where it can be found on your camera.
External Injuries	Examine the animal for injuries around the head, body, flippers, and flukes. Is the animal bleeding? Describe injuries or blood observed.
<u>Condition when captured:</u>	For each individual, record its condition at the time of capture.
Was mammal brought on board?	Check Yes , No or Unknown for whether the MM was brought on board.
Did mammal escape?	Check Yes , No or Unknown for whether the MM escaped or slid out of gear prior to boarding.
Carcass #	If MM was dead and a MM Carcass Form was completed, record the carcass # in the space provided.
<u>Condition when released:</u>	For each individual, record its condition at the time of release: Released – swam away - animal actively swims away and has no obvious injury Released – blood visible – animal may swim away but has an obvious injury Released – sank – animal is not active and sinks upon release Note: the three ‘Released’ options are heirarchical – record the worst case scenario. For example, if an animal is bleeding AND swims away, the observer should check “Released-blood visible” or if an animal is bleeding and it sank upon release, the observer should record “Released-sank”. Dead -Treated as Catch: The marine mammal was not previously dead and was sacrificed for market, table, or other use. Dead- examined/sampled – indicate if carcass was examined, sampled, or collected whole. If so, FILL OUT A MARINE MAMMAL CARCASS FORM. Discarded dead, marked – You may be provided further instructions for marking carcasses. If not, record as unmarked. Discarded dead, unmarked – Carcass returned to sea unmarked. Unknown – provide additoinal comments in the comment field.

Was there any gear attached to mammal upon release? Record whether any netting or line was left on the animal when it was released and describe more fully in the space provided.

Comments Record any additional notes requested in previous fields and any other information related to this capture.

**Entangling Gear
Details:**

Complete the gear-specific sections as appropriate.

Trawl

Location relative to TED

Note where the MM was caught relative to the TED. Options include No TED, Forward of the TED and Went through the TED

Gillnet

Section caught

Record a rough estimate of where the MM was caught in the gillnet. Options include the top 1/3 of the net, the middle 1/3 of the net and the bottom 1/3 of the net.

Animal was able to surface?

Check if the animal was able to surface to breathe while caught in the gillnet.

Hook & line

Hook type

Check the type of hook that the MM was caught on: J, circle or other. If other, make a note regarding the type.

Hook size

Record the hook size (usually in ##/# format, 16/0)

Bait

If possible, note the bait type that caught the MM.

Hook #

Record the hook number from the gear description form. We can link the manufacturer and other information using this field.

Was a light stick on the hook?

Check yes or no.

Light stick color

If there was a light stick, circle the appropriate color.

gangions to next float

Record the number of gangions to the next float.

Hook location

Check one as appropriate. If hooked in the jaw/mouth, also note the location in the jaw.

Was the animal entangled in the gear?

Circle **Yes**, **No** or **Unknown**.

Was hook removed?

Circle **Yes**, **No** or **Unknown**

Purse Seine

Release procedures

Circle **Yes**, **No** or **Unknown** for any attempts to release marine

mammals from purse seine gear.

If animal was entangled, describe...

If an animal was entangled in the net, describe in detail which section it was caught in. Include mesh size and any other features that may be important in developing mitigation to reduce catch in the future.

The following two pages show examples of how Marine Mammal Capture Forms would be completed for (A) capture of a DEAD animal (Figure 16-8) and (B) capture of a LIVE animal that was released alive (Figure 16-9).

A) A Marine Mammal Carcass Form was also completed for this dead animal (Figure 16-11).

B) This dolphin was alive and healthy when it was released from the gear. Fortunately the observer was able to determine the species and gender and take photographs before it fell out of the net. No MM Carcass Form was needed.

(A)

Marine Mammal Capture Form

Complete ONE FORM for each Marine Mammal captured, whether DEAD or ALIVE

Observer name / code SLE 0001	Vessel code 12737	Trip ID 33	Haul/Set # 46	Date (dd/mm/yy) 02/08/10	Time (24-hr) 0038	Capture # 2
Location: Offshore W. Africa		Latitude 0 8 °		0 3 .		2 (N) / S
		Longitude 0 2 0 °		3 5 .		5 E / (W)
Species Atlantic humpback dolphin		Gender: (M) F U	Photos taken: (Y) / N	External injuries: line cuts in head		
		Frame #: 7 - 10				
Marine Mammal CONDITION WHEN CAPTURED						
<input type="checkbox"/>	Alive, active, not bleeding, no obvious injury			Y	N	U
<input type="checkbox"/>	Alive, active, bleeding, obvious injury	Was mammal brought on board?		X		
<input type="checkbox"/>	Alive, active, unknown condition	Did mammal slide out or escape from gear?			X	
<input type="checkbox"/>	Dead (fresh)/ inactive / unresponsive					
X	Previously dead- odor, rotten	IF dead and examined, list CARCASS # :		1	(# should match Marine Mammal Carcass Form)	
<input type="checkbox"/>	Unknown					
Marine Mammal CONDITION WHEN RELEASED						
<input type="checkbox"/>	Released-swam away	<input type="checkbox"/>	Dead- Examined/sampled	Was any gear attached to mammal upon release? Y (N) U		
<input type="checkbox"/>	Released- blood visible	<input type="checkbox"/>	Dead - marked	If Yes, describe:		
<input type="checkbox"/>	Released - sank	X	Dead - unmarked			
<input type="checkbox"/>	Dead- Treated as catch	<input type="checkbox"/>	Unknown			
Comments:						
Entangling Gear Details						
Trawl			Gillnet			
Location relative to TED			Section caught:			
X	No TED		<input type="checkbox"/>	Top 1/3		Was animal able to surface ? Y N U
<input type="checkbox"/>	Forward of TED		<input type="checkbox"/>	Middle		
<input type="checkbox"/>	Went through TED (in codend)		<input type="checkbox"/>	Bottom 1/3		
Hook & line						
Hook type:	<input type="checkbox"/>	"J"	<input type="checkbox"/>	Circle	<input type="checkbox"/>	Other _____
Bait:	<input type="checkbox"/>	Squid	<input type="checkbox"/>	Mackerel	<input type="checkbox"/>	Other _____
Was light stick on hook?	<input type="checkbox"/>	Yes	<input type="checkbox"/>	No	# gangions to next float	
Light stick color (circle): White, Pink, Blue, Green, Red, Yellow, Purple, Other, Unknown						
Hook location:	<input type="checkbox"/>	Not hooked	<input type="checkbox"/>	Not known if hooked	<input type="checkbox"/>	Hooked but location unknown
Internal:	<input type="checkbox"/>	Unknown, internal	<input type="checkbox"/>	Swallowed (esophagus)		
External:	<input type="checkbox"/>	Unknown, external	<input type="checkbox"/>	Head/neck	<input type="checkbox"/>	Rear flipper region
<input type="checkbox"/>	Front flipper region					
Was animal entangled in line?	Y	N	U	Was hook removed?	Y	N U
Purse Seine						
Was backdown procedure used to assist with marine mammal release?				Y	N	U
Were divers or a raft used to attempt marine mammal release?				Y	N	U
If animal was entangled in net, describe which section (including mesh size, etc.):						

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Figure 16-8 Marine Mammal Capture Form completed for animal reported on the Marine Mammal/Turtle Sighting and Interaction form in Figure 16-7.

(B)

Marine Mammal Capture Form

Complete ONE FORM for each Marine Mammal captured, whether DEAD or ALIVE

Observer name / code SLE 0001	Vessel code 12737	Trip ID 33	Haul/Set # 47	Date (dd/mm/yy) 02/08/10	Time (24-hr) 1432	Capture # 3
Location: Offshore W. Africa			Latitude 0 8 °	0 4 .	7	(N) / S
			Longitude 0 2 0 °	3 3 .	9	E / (W)
Species Common dolphin	Gender: M (F) U	Photos taken: Y / N	Frame #: 12 -15	External injuries: minor scrape on left side near dorsal fin		
Marine Mammal CONDITION WHEN CAPTURED						
<input checked="" type="checkbox"/>	Alive, active, not bleeding, no obvious injury			Y	N	U
<input type="checkbox"/>	Alive, active, bleeding, obvious injury	Was mammal brought on board?			X	
<input type="checkbox"/>	Alive, active, unknown condition	Did mammal slide out or escape from gear?		X		
<input type="checkbox"/>	Dead (fresh)/ inactive / unresponsive					
<input type="checkbox"/>	Previously dead- odor, rotten	IF dead and examined, list CARCASS # :			(# should match Marine Mammal Carcass Form)	
<input type="checkbox"/>	Unknown					
Marine Mammal CONDITION WHEN RELEASED						
<input checked="" type="checkbox"/>	Released-swam away	<input type="checkbox"/>	Dead- Examined/sampled	Was any gear attached to mammal upon release? Y (N) U		
<input type="checkbox"/>	Released- blood visible	<input type="checkbox"/>	Dead - marked			
<input type="checkbox"/>	Released - sank	<input type="checkbox"/>	Dead - unmarked	If Yes, describe:		
<input type="checkbox"/>	Dead- Treated as catch	<input type="checkbox"/>	Unknown			
Comments:						
Entangling Gear Details						
Trawl			Gillnet			
Location relative to TED			Section caught:			
<input checked="" type="checkbox"/>	No TED		<input type="checkbox"/>	Top 1/3		
<input type="checkbox"/>	Forward of TED		<input type="checkbox"/>	Middle		
<input type="checkbox"/>	Went through TED (in codend)		<input type="checkbox"/>	Bottom 1/3		
Was animal able to surface? Y N U						
Hook & line						
Hook type:	<input type="checkbox"/>	"J"	<input type="checkbox"/>	Circle	<input type="checkbox"/>	Other _____
Bait:	<input type="checkbox"/>	Squid	<input type="checkbox"/>	Mackerel	<input type="checkbox"/>	Other _____
Was light stick on hook?	<input type="checkbox"/>	Yes	<input type="checkbox"/>	No	# gangions to next float	
Light stick color (circle): White, Pink, Blue, Green, Red, Yellow, Purple, Other, Unknown						
Hook location:	<input type="checkbox"/>	Not hooked	<input type="checkbox"/>	Not known if hooked	<input type="checkbox"/>	Hooked but location unknown
Internal:	<input type="checkbox"/>	Unknown, internal	<input type="checkbox"/>	Swallowed (esophagus)		
External:	<input type="checkbox"/>	Unknown, external	<input type="checkbox"/>	Head/neck	<input type="checkbox"/>	Rear flipper region
<input type="checkbox"/>	Front flipper region					
Was animal entangled in line?	Y	N	U	Was hook removed?	Y	N U
Purse Seine						
Was backdown procedure used to assist with marine mammal release?				Y	N	U
Were divers or a raft used to attempt marine mammal release?				Y	N	U
If animal was entangled in net, describe which section (including mesh size, etc.):						

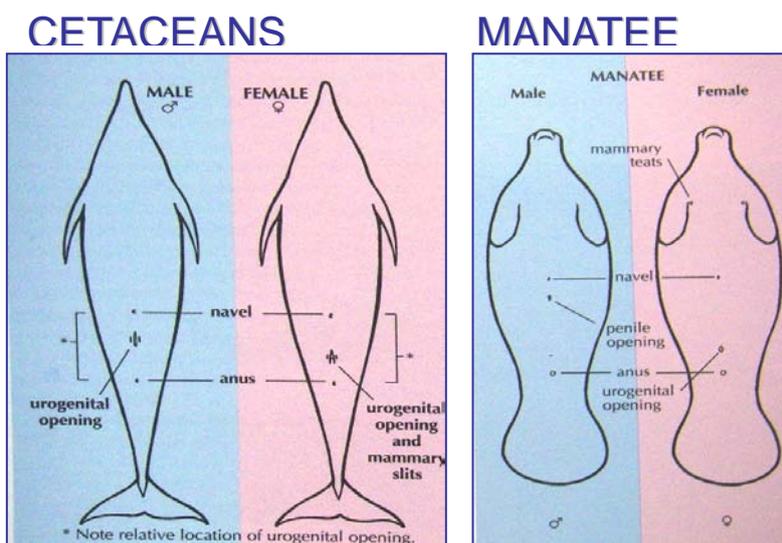
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Figure 16-9 Example of Marine Mammal Capture Form that would be completed for a dolphin caught alive and released from the trawl later the same day.

16.4.3 Marine Mammal Carcass Form

Complete this form to describe each dead marine mammal examined, using one form per carcass.

Field	Description
Observer code	For observer trips, record observer code. If this is a beached carcass, record your name.
Vessel code	Record the vessel code.
Trip ID	Record Trip ID assigned by the SOP.
Haul/Set #	Record the Haul or set number.
Date examined	Record the day/month/year the carcass was examined
Carcass #	Assign consecutive carcass numbers as they are encountered and should not be repeated on the same trip. It is the same Carcass # listed on the Capture Form.
Species / code	Record the species common or scientific name and 3-letter species code
Gender	



Determine the animal's gender and circle **M** for male, **F** for female, or **U** if the gender is unknown or cannot be determined.

Tooth count	The number of teeth in each jaw can be used to verify the identity of many species. Starting at the front midline of the jaw, count the number of teeth in the Upper Left , Upper Right , Lower Left and Lower Right jaws
Location	Describe the area or region where the carcass was found.

Record the Latitude and Longitude of the location if possible, using the reading from a GPS or calculated from a map. Record degrees and minutes (to nearest 1/10th minute)

External Injuries

Examine the animal for injuries around the head, body, flippers, and flukes. Is the animal bleeding? Describe injuries or blood observed.

Photos Taken

Take photos of the carcass if possible, using the camera provided.

- Take a photo of the whole animal and any samples collected from it.
- Use the Photo Label at the bottom of the datasheet, as explained below

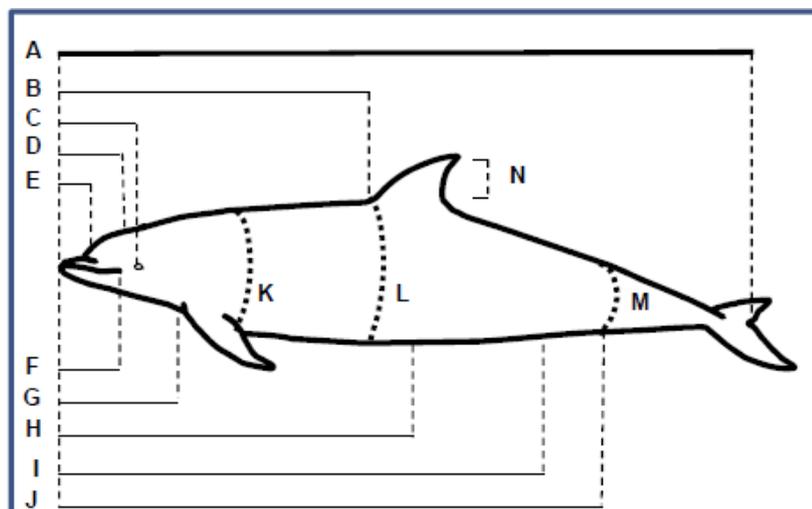
Did you take photographs of the animal? **Yes** or **No**? If yes, record the number of the Frame where it can be found on your camera.

Measurements
Lengths (A-J):

Place the animal on its belly and stretch it as straight as possible. Place the tape measure flat on the surface next to the animal. Place the Zero End of the tape measure at the tip of the snout. Measure and record the distance from the tip of the snout to each of the body parts shown on the data form, measured to the closest 1/10th centimeter.

*** IF YOU ARE ABLE TO TAKE ONLY ONE LENGTH MEASUREMENT*...it is most important to measure and record the TOTAL LENGTH (A).**

- On a cetacean or manatee, this is the distance from the tip of the snout to the notch on the trailing edge of the flukes (or greatest length on manatee).
- On a pinniped, this is the distance from the tip of the snout to the end of the tail (not flippers).



Girths (K-M):

Girths are measurements made around the circumference of the animal's body at various points along its length. Slide the tape

measure under the animal's body, assuring it doesn't twist or fold over itself. With one hand, hold the Zero End of the tape measure tight to the body. With the other hand, pull the tape around the animal until it overlaps the Zero End of the tape. Hold snugly and read the girth as the measurement where the Zero End meets the tape, to the nearest 1/10th of a centimeter.

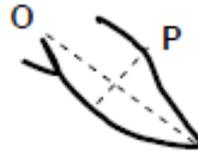
*** IF YOU ARE ABLE TO TAKE ONLY ONE GIRTH MEASUREMENT*...** it is most important to measure and record the **AXILLARY GIRTH (K)** this is measured around the body just aft of the animal's pectoral fin or flipper

**Appendages
(N-Q):**

Dorsal fin height: On cetaceans, measure the distance from the top of the dorsal fin to its base on the animal's back. Sometimes the fin will flex here when pulled sideways.

Front flipper: Flex the flipper forward. Measure the

- 1. flipper's length (O)** from its tip to the point of its anterior insertion
- 2. flipper's maximum width (P)** by holding the measure perpendicular to this line and recording the greatest width across the flipper



Fluke width: Measure the width of the flukes from tip to tip along the trailing edge. If the flukes are curled, hold the tape along the edge and follow the curve.



Samples collected

A carcass may be collected whole or parts may be sampled. Place a mark next to each sample collected from this animal. If unlisted samples are collected, mark OTHER and use the blank space to describe those samples.

**Photo & Sample
Label
(Bottom of form)**

- 1) Fill in the information at the bottom of the page, using information from the top of the form.**
- 2) After SAMPLE/PHOTO LABEL is complete, cut it from the bottom of the form and PLACE IT IN ANY PHOTOS TAKEN WITH THIS CARCASS OR RELATED SAMPLES.**
- 3) When all photos are complete, insert this SAMPLE/PHOTO**

LABEL into a large clear sample bag along with all samples collected.

To **COLLECT** skin for a DNA SAMPLE, follow procedure illustrated in Figure 16-10.

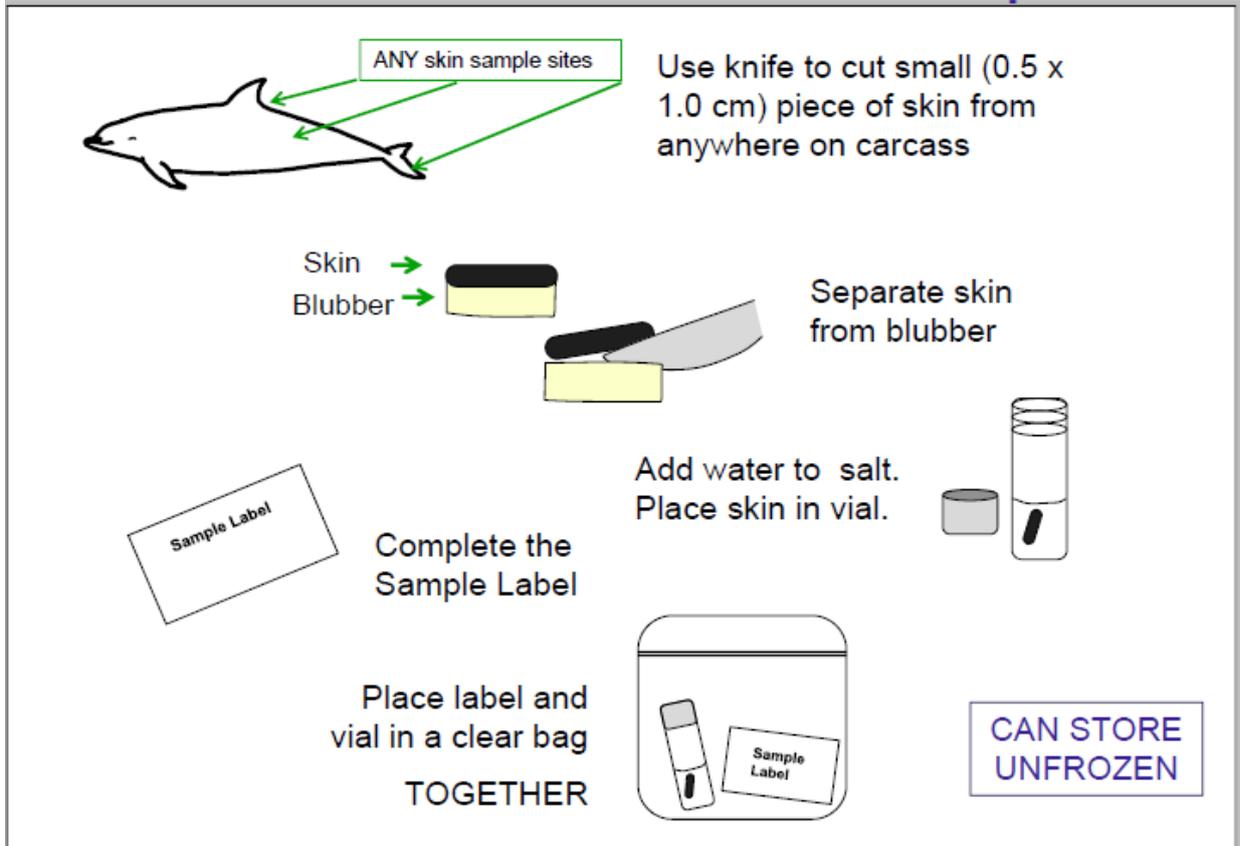


Figure 16-10 Procedure for collecting a skin sample FROM A DEAD CETACEAN for DNA analysis.

Marine Mammal Carcass Form

Complete one form for each MARINE MAMMAL examined.

Observer code SLE 0001	Vessel code 12737	Trip ID 33	Haul/Set # 46	Date Examined (dd/mm/yy) 02/08/10	Carcass #. 1
Species Atlantic Humpback dolphin		Gender: <input checked="" type="radio"/> M <input type="radio"/> F <input type="radio"/> U	Tooth Count:	Upper Left: 29 Lower Left: 27	Upper Rt: 28 Lower Rt: 27
Location: Atlantic Ocean, offshore W. Africa			Latitude 08 03.2	N / S <input checked="" type="radio"/>	
External Injuries: Previous gillnet injury on head			Longitude 020 35.6	E / W <input checked="" type="radio"/>	
Photos taken: <input checked="" type="radio"/> Y / <input type="radio"/> N			Frame # 7-10		
Measurements					
Straight line from SNOUT to...					
A notch (Total Length)	196.6 cm				
B dorsal fin (ant. Insertion)	. cm				
C eye (center)	. cm				
D blowhole (center)	. cm				
E melon	. cm				
F mouth (corner)	. cm				
G flipper (ant. Insertion)	. cm				
H umbilicus	. cm				
I genital slit (center)	. cm				
J anus	. cm				
Girths					
K at axilla	64.8 cm				
L at dorsal fin insertion	. cm				
M at anus	. cm				
Appendages					
N dorsal fin height	13.2 cm				
O flipper length	. cm				
P flipper max width	. cm				
Q fluke width	. cm				
Samples Collected (check all that apply)					
Whole carcass <input type="radio"/>	Jaw <input type="radio"/>	Stomach <input type="radio"/>	Baleen <input type="radio"/>	None: <input type="radio"/>	
Head only <input type="radio"/>	Teeth only <input type="radio"/>	Reproductive tract <input type="radio"/>	Skin <input checked="" type="radio"/>	Other: <input type="radio"/>	
** Complete and remove label below. Place in all photos taken and then in sample bag with samples**					
Marine Mammal PHOTO and SAMPLE Label					
Observer code SLE 0001	Vessel code 12737	Trip ID 33	Date (dd/mm/yy) 02/08/10	Carcass #. 1	
Species Atl humpback dolphin	Gender M	Total Length (cm) 196.6	Location: 08 03.2 N / 020 35.6 W		

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Figure 16-11 Example of Marine Mammal Carcass form completed for the dolphin described on the Capture Form in **Figure 16-8**. The bottom of this form would be cut off at the dotted line and be used as the label for the DNA sample. It should be put inside the bag with the vial that contains the skin sample.

16.4.4 Sea Turtle Accidental Capture form

The Sea Turtle Accidental Capture form is used for recording identification features and capture information (Figure 16-12). A separate form should be completed for every turtle caught in fishing gear regardless of whether the turtle was brought on board. Sea turtle sightings (without gear interactions) are recorded on the Marine Mammal and Sea Turtle Sighting form (above).

The Sea Turtle Capture form is designed to be completed quickly with minimal writing so that the turtle can be worked up and returned to the water as soon as possible..

- **Observer code:** record your observer program identification code;
 - **Vessel code:** record vessel code (Appendix 3);
 - **Trip ID:** Enter the trip identification number assigned by the program;
 - **Haul/Set # :** note the haul or set number (in increasing order);
 - **Turtle #:** record turtle capture #;
-
- **Date:** note date of capture of the turtle (dd/mm/yy);
 - **Time:** note time of capture of the turtle in hours (24 h) and minutes (hh:mm);
 - **Location of capture:**
 - **Latitude:** note the latitude of capture (degrees, tenths of minutes and N or S);
 - **Longitude:** note the longitude of capture (degrees, tenths of minutes and E or W);
 - **Fishing gear:** note the type of fishing (e.g., trawl, longline, purse seine, gill net etc.);
 - **Distance to shore(km):** note the distance of the location of capture from shore in km (000.0 km); ask the captain for this information;
-
- **Name of Observer(s):** note the first name and last name (surname) of the observer(s);
-
- **Species:** check the sea turtle species identified; check “unknown” if the species is not identified or if you are unable to identify it;
 - **Camera # :** note the number written on the camera;
 - **Photo #(s):** note the number of the photo taken; **Photos:** 2 photos should be taken per turtle ; the **1st photo** should be from directly above so that it clearly captures the scutes on the carapace and the head of the turtle ; the **2nd photo** should also be taken from directly above and should include the head and front end of the carapace ; take additional photos of any other interesting observations;
 - **Tissue sample : tube #:** note the number on the tube;
-
- the **carapace length** is noted in cm (000.0 cm) ; the curved carapace length is measured from the middle of the nuchal scute (nuchal notch) to the longest posterior scute ; in a **leatherback** the measurement is taken from the middle of the nuchal notch to the very end of the caudal peduncle and the measuring tape should not follow the crest of the ridge;
 - the **carapace width** is noted in cm (000.0 cm) and is measured at the broadest point of the carapace ; in a **leatherback** the measurement is taken over the top of the longitudinal ridges ;
 - **Tag # :** check and note tag numbers on the left (L) and right (R) front and back flippers; left is defined by the observer standing behind a turtle resting on its plastron;
 - **Tag position:** note the position of the tag on the left flippers (Left Front (LF) or Left Rear (LR)); note the position of the tag on the right flippers (Right Front (RF) or Right Rear (RR)); left is defined by the observer standing behind a turtle resting on its plastron;
 - **Nuchal in contact with first costal :** if the nuchal scute is touching the 1st costal scute, note “yes;” if there is no contact note “no”
 - **# of costals :** note the number of costals on the left (L) and right (R) sides of the carapace; left is defined by the observer standing behind a turtle resting on its plastron;

- **# of Vertebrales/Prefrontals** : note the number of vertebral scutes (V); note the number of prefrontals (P);
- **Condition** : note if the turtle is alive, dead or comatose when captured ; if the turtle is comatosed, please follow the instructions on the « how to resuscitate a turtle » guide before release ;
- **Obvious injury**: note ‘yes’ if there is any big or serious injury on the turtle and describe in the “other observations” section; if there is no injury, write ‘no’;
- **Attempted resuscitation**: indicate ‘yes’ if an attempt was made to revive a comatose turtle; indicate ‘no’ if no attempt was made to revive a comatose turtle;
- **Resuscitation successful**: indicate ‘yes’ if the resuscitation successful; indicate ‘no’ if the resuscitation was not successful;
- **Future** : if the turtle was noted as alive or comatose at the time of capture, please note if it was released alive or if it died or if it was not released ;
- **Other observations**: note any additional interesting observations.

SEA TURTLE ACCIDENTAL CAPTURES				
Observer code	Vessel code	Trip ID	Haul/set #	Turtle#
<i>SLE001</i>	<i>12737</i>	<i>33</i>	<i>321</i>	<i>4</i>
Date of capture (dd/mm/yy)	Location of capture		Fishing gear	
<i>24/08/11</i>	LATITUDE		<i>trawl</i>	
	<i>07° 34.1 N</i>			
Time of capture hours (24-hr) and minutes (hh:mm)	LONGITUDE		Distance from shore (km)	
<i>SLE001</i>	<i>14° 14.0 W</i>		<i>unknown</i>	
Name of observer(s): <i>Jo Observer</i>				

SPECIES (check one) LEATHERBACK ✓ OLIVE RIDLEY GREEN TURTLE HAWKSBILL LOGGERHEAD UNKNOWN Camera # : <i>digital</i> Photo #(s): <i>3</i> Tissue sample : tube #	Curved carapace length (cm)	<i>72</i>		
	Curved carapace width (cm)	<i>43</i>		
	Tag # : Left /Right	L: <i>USA399</i>	R:	
	Tag position; LF/LR/RF/RR	<i>LF</i>		
	Nuchal in contact with first costal : yes/no	<i>Yes</i>		
	# of costals : Left/Right	L: <i>5</i>	R: <i>5</i>	
	# of Vertebrales / Prefrontals :	V: <i>5</i>	P: <i>4</i>	
	Condition: live/dead/comatose	<i>live</i>		
	Obvious injury: yes/no	<i>Yes</i>		
	Attempted resuscitation: yes/no	<i>no</i>		
	Resuscitation successful: yes/no			
	Future : released alive/ dead/ other	<i>Released alive</i>		

OTHER OBSERVATIONS: *(if caught on hook & line, indicate hook location: flipper/jaw/swallowed)*
Carapace color – dark brown/red; turtle released alive but bleeding from right rear flipper which looks like it was torn by the trawl mesh

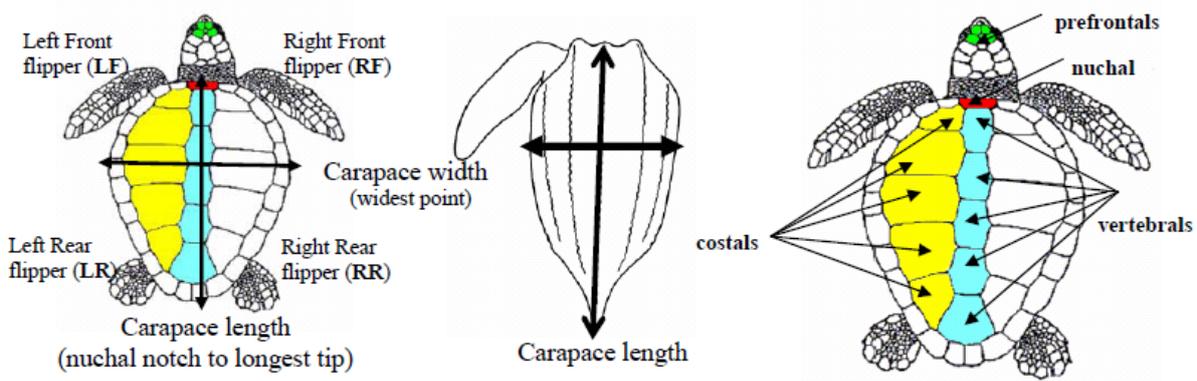


Figure 16-12 Example of Sea Turtle Accidental Capture form.

16.4.5 Seabird Species Identification Form

Currently, seabird data collection duties are minimal but may increase in the future. Complete one Seabird Species Identification form (front and back; Figure 16-14) for each new species of seabird caught. Complete header information, circle appropriate foot and bill types and measure total length, tarsus, bill and wing chord to nearest centimeter. If bird is alive, note the foot and bill types and any coloring and release the bird quickly.

If you encounter a dead seabird with a leg band (Figure 16-13) or any other type of tag, make every attempt to retain the bird but definitely the tag.



Figure 16-13 Leg bands. Photo: Patuxent Wildlife Research Center, U.S. Geological Survey.

Seabird Common name: _____ Observer ID: _____

Date: _____ Haul/Set #: _____ Vessel: _____

Specimen collected? **Y** **N** Tag #: _____ Photos taken? **Y** **N**

Length of bird - measure straight line from the tip of bill to longest tail feather: _____ cm

Foot type: (Circle one or describe)

			
3 webbed toes	3 webbed toes, 4th toe minute, flat heel	3 webbed toes; 4th toe free, with fleshy flap	4 webbed toes

Other foot type, describe and draw: _____

Foot color: _____

Tarsus measurement: (For all tubenoses and unidentified birds) _____

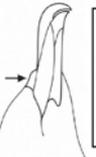
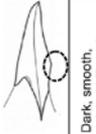
The tarsus or leg measurement is the long bone connecting the ankle to the foot. It is measured diagonally across the bone from the middle groove of the ankle joint to the top edge of the foot.

Tarsus length: _____ mm

Leg Placement: _____

All images © COASST 2002. General form structure North Pacific Groundfish Observer Program.

Bill shape: (Circle one or describe)

		
Hooked bill, Nasal tubes on side	Hooked bill, Arch on lower mandible	Dark, smooth, pointed bill; arch on lower mandible

Other bill shape, describe and draw: _____

		
Orange, with grooves, horn or bump	Duck-like bill with knob	Duck-like bill with feathers

Bill measurement: (All birds)

Bill length or exposed culmen, is the straight-line distance between the tip of the bill and the point where the bill meets the skin or feathers of the forehead. Place one end of the dividers at the tip of the bill and measure the diagonal distance to the forehead feathers.

Bill length: _____ mm

Bill color: _____

Wing chord measurement: (All birds)

In a relaxed folded wing, the wing chord is the distance between the wrist bend and the tip of the longest primary feather. Do not stretch out the wing. For accuracy, gently lay the wing against the ruler (do not flatten) and line the end of the ruler up with the wrist.

Wing chord length: _____ cm

Additional identifying characteristics or notes:

All images © COASST 2002. General form structure North Pacific Groundfish Observer Program.

Figure 16-14 Example Seabird Identification form.

17 Regulations and Compliance

Monitoring

17.1 Learning objectives

- Describe the observer's primary role in compliance monitoring including how observer duties fit within the management framework
- Cite the primary fishing regulations
- Enable observers to make correct decisions for communicating problems
- List the six elements for documenting suspected violations

17.2 Introduction

The observer's role in compliance monitoring is to observe, inform and document (Alaska Fisheries Science Center 2007). The observer's course of action depends on the type of suspected violation and circumstances under which it occurred as well as the actions and demeanor of vessel personnel. Gathering facts and documenting a suspected violation in the observer logbook should be done as part of your routine duties. Remember, **you are not on board to enforce any laws** but if you witness a possible violation, you are expected to document the activities you observe.

17.2.1 Observe

A routine observation of all activities aboard a vessel is your first step in recognizing possible infractions. A violation may be obvious such as using illegal fishing methods like dynamite, but other violations may need further investigation. Observers need to validate their own calculations, measurements and methods prior to documenting a suspected violation. Ask the vessel personnel to clarify any questions you have. By asking these questions you may determine that no violation has occurred.

17.2.2 Inform

If you think a violation has occurred, notify the vessel's captain as soon as possible. Informing the captain is expected unless the captain has failed to respond to previous reports or you feel that it may lead to a potential harassment situation. In these cases, document your reasons for not reporting an incident to the captain in the Daily Notes of the observer logbook. Informing the captain provides him with an opportunity to correct the problem and prevent violations from occurring. Effective communication with vessel personnel requires familiarity with the regulations, good judgment and tact. Organize the facts and approach the captain in a calm and reasonable manner.

The captain's response will shape how the violation is eventually handled. In many cases, the problem will be remedied immediately. If the captain ignores your statements and the violation continues, continue to document each instance. If the problem continues and interferes with your ability to perform your duties, contact the SOP immediately (Appendix 2).

17.2.3 Document

Fully document any suspected violation in the daily notes of the observer logbook (Figure 17-1). Your documentation may be used as evidence; therefore it must be thorough and factual. Omit any subjective or unprofessional commentary. All Daily Notes should be in ink and in chronological order. All entries for suspected violations should contain the following basic elements:

Who: Identify the vessel by name, permit number and vessel type.

- Identify the individuals and witnesses involved by first and last name, position on the vessel and function/duties. Utilize the crew list compiled for the Trip Summary Form.
- Identify who was notified and the nature of their reaction.

What: Describe the event(s) and circumstances in narrative form.

- Include what made you suspicious.
- Detail what was discovered when you looked into the matter
- Describe what occurred (or didn't occur) as a result of your discussions with the captain and crew.
- Use direct quotes whenever possible.
- Record each instance of a suspected violation

When: Identify the exact or approximate time of the suspected violation (i.e., time and date). Include the haul or delivery number if appropriate.

Where: Record the vessel's position (latitude/longitude) or the plant location at the time of the suspected violation. Describe where on the vessel the suspected violation occurred. Draw a diagram if applicable.

Why: Attempt to determine why the suspected violation occurred. Include your own observations and conversations with the crew members that substantiate why the violation may have occurred. Be as objective as possible and cite factors which may provide mitigating or aggravating information.

How: describe the effect the possible violation had on your ability to perform your observer duties. If harassment or intimidation is involved, describe how these actions made you feel.

17.3 Summary of Regulations

For a brief summary of regulations that will impact your next cruise see Appendix 1 (country specific information).

The International Convention for the Prevention of Pollution from Ships (MARPOL) is an international agreement (technically two treaties) adopted in 1973 and 1978 (http://www.imo.org/TCD/contents.asp?doc_id=678&topic_id=258). The purpose of MARPOL is to prevent pollution of the marine environment due to operational or accidental causes. There

On July 30, 2010 I witnessed the shrimp trawler, f/v Blue Moon (permit STP03475), fishing in the inshore water area closed to industrial vessels off of Principe Island. Our position was 01° 43' 51.2N and 007°21' 31.24E. I entered the wheelhouse to get some information from the logbook, ~0645 and it seemed like we were closer to land than seemed safe so I glanced at the radar. Land was ~3 nautical miles away and there were 2-3 artisanal vessels between our vessel and land. No vessel names were decipherable on the small vessels. I informed the mate that I thought we might be fishing within the exclusion zone and continued to take down information from the previous day's hauls for my data forms. The mate said thanks for noticing and stated "he must have fallen asleep for a while". By 0655 the vessel had changed course. I took a photo of the radar at ~0700 after the vessel had changed course.

Figure 17-1 Example of suspected violation documentation in Observer Logbook. What is missing?

are six Annexes covering oil pollution (Annex I), noxious liquids (II), harmful substances in packaged form (III), sewage (IV), garbage (V) and air pollution from ships (VI). There are 151 signatories to Annex I/II and 140 to Annex V (Appendix 14).

If you are on a tuna vessel, the following ICCAT resolutions may apply:

Species / Resolution No.

Bigeye (BET)

04-01 Purse seine and baitboat closure from 1 November to 30 November between 0°S, 5°N, 20°W and 10°W.

Bluefin (BFT)

*Longline closure in east Atlantic between 1 June to 31 December except area delimited by West of 10°W and North of 42°N.

*Purse seine closure from 1 July to 31 December.

06-05 *Baitboat & trawl closure from 15 November to 15 May.

*Use of aircraft to search for BFT is prohibited.

*Cannot catch/sell BFT <30kg with a few exceptions.

*20% observer coverage requirements.

Billfish (BIL)

06-09 Maintain daily records of disposition/fate for all blue & white marlin caught.

Bycatch (BYC)

04-10 *Vessels may not have onboard fins that total more than 5% of the weight of sharks onboard, up to the first point of landing.

*In fisheries that are not directed at sharks, CPCs shall encourage the

- release of live sharks, especially juveniles, to the extent possible, that are caught incidentally and are not used for food and/or subsistence
- 07-06 Minimize mortality of porbeagle and shortfin mako sharks.
- 07-07 All vessels fishing south of 20°S must carry and use bird scaring lines.
- 08-07 Bigeye thresher sharks shall be released.

General (GEN)

- 94-09 Sightings of IUU tuna fishing must be documented & reported.
- 05-08 Encourage the use of circle hooks and dehooking devices to reduce mortality of sea turtles in pelagic longline fisheries.

This is not a complete list and vessels are responsible for fishing within whatever catch limits and rules that have been imposed on them by their flag state or state under which they have a fishing agreement. For more information see ICCAT (2009).

17.4 Forms/Instructions

17.4.1 Observer Logbook

Fully document any suspected violation in the daily notes of the observer logbook as per instructions above.

MARPOL – Regardless of whether a flag country or country granting fishing access is a signatory to MARPOL, observers are expected to document instances of oil or plastic disposal events for information purposes. Describe the type and quantity of plastic disposed. For oil spillages, describe the visual appearance (colour, thickness, depth) and estimate the area covered and quantity of the spill.

17.4.2 Compliance Checklist

The Compliance Checklist found in the Observer Logbook must be completed at the **end** of every trip. It is important to ensure the information you collect is kept confidential from the vessel and anyone else except SOP staff. If unsure that a violation has been committed but suspect a vessel has violated its license/permit condition or other fishing regulation, write a full account of the incident, including all evidence that aroused suspicion. The SOP staff will determine if your suspicions are valid and may request further investigation by the Fisheries Patrol or relevant enforcement agency. Although gut feelings on board are often correct, these, unfortunately are not enough to prosecute a vessel. There must be some incident or evidence to back up any suspicions.

Be friendly on board and have a harmonious trip if possible, but remember an observer must put new friendships aside when reporting on vessel compliance. Any attempt by the vessel to corrupt an observer is illegal and should be noted and reported. Both offering or providing money or gifts are considered bribery. If a vessel is caught fishing illegally and an observer has accepted gifts from that vessel then the observer could be accused of taking a bribe to not report the illegal fishing, which could land them in prison. Connivance, tacit encouragement or assent (without participation) to wrongdoing by another, is also a punishable offence.

Circle **Yes**, **No** or **Unknown** for each of the following (e.g., Figure 17-2). If you answer yes, provide further comments at the end of the form.

Fishing Regulations

- Did the vessel trawl within any inshore exclusion zone or marine protected area?
- Did the vessel possess any fishing nets whose mesh sizes do not conform to prescribed standards and ensure the protection of species?
- Did the vessel use any sort of liner or device to obstruct mesh in trawl nets or purse seine gear?
- Was there respiratory equipment, a harpoon or dangerous fishing weapon (except as a safety precaution) on board?
- Did vessel personnel use explosives, chemicals, poisons or other noxious substances, electrical currents or headlamps, fire-arms, light or automatic traps or any other devices likely to destroy aquatic fauna and the aquatic environment?

Permit/License Conditions

- Did the vessel target any species other than those they are licensed to target? Target species are mentioned on vessels' fishing permits. Codend mesh size can also be used as a guide for target species.
- Did the vessel use a fishing method other than the method they are licensed to use?
- Did the vessel retain sublegal size fish?
- Did the vessel sell or possess any protected fishery resources such as sea turtles or marine mammals?
- Did the vessel sell or trade fish at sea?
- Did the vessel not display or present a valid and current license document onboard?
- Did the vessel not display appropriate vessel markings?

MARPOL

- Did you witness the vessel dumping industrial, agricultural or domestic waste?
- Did you witness the vessel dumping plastic?
- Did you witness the vessel discharge oil?
- Did you witness any of the above dumping/discharge by another vessel?

Observer/Vessel Personnel Interactions

- Did the vessel personnel request that an event not be reported?
- Did the vessel personnel offer you a bribe to modify your data?
- Did vessel personnel hinder the observer in the carrying out of their duties?
- Did vessel personnel intimidate or harass you at any time?

Compliance Checklist

During the trip, did you witness or did the master or crew attempt or do any of the following:

Fishing Regulations	
Fish within any inshore exclusion zone	Y / <input checked="" type="radio"/> N / U
Fish within any marine protected area	Y / <input checked="" type="radio"/> N / U
Presence on board a fishing vessel of any fishing nets, whose mesh sizes do not conform to prescribed standards	Y / <input checked="" type="radio"/> N / U
Use any sort of liner or device to obstruct mesh (trawl and other net fisheries)	Y / <input checked="" type="radio"/> N / U
Presence on aboard of respiratory equipment (e.g. scuba), harpoon or dangerous fishing weapon (except as a safety precaution)	Y / <input checked="" type="radio"/> N / U
Use of explosives, chemicals, poisons or other noxious substances, electrical currents or headlamps, fire-arms, light or automatic traps or any other devices likely to destroy aquatic fauna and the aquatic environment	Y / <input checked="" type="radio"/> N / U
Permit/licence conditions	
Target species other than those they are licenced to target	Y / <input checked="" type="radio"/> N / U
Use a fishing method other than the method they are licensed to use	Y / <input checked="" type="radio"/> N / U
Retain sublegal size fish (varies by species)	Y / <input checked="" type="radio"/> N / U
Sell or possess of any protected fishery resources (e.g., turtles, mammals)	Y / <input checked="" type="radio"/> N / U
Sell / trade fish at sea	<input checked="" type="radio"/> Y / N / U
Not display or present a valid (and current) licence document onboard	Y / <input checked="" type="radio"/> N / U
Not display appropriate vessel markings	Y / <input checked="" type="radio"/> N / U
MARPOL	
Dumping of industrial, agricultural or domestic waste	<input checked="" type="radio"/> Y / N / U
Dumping of plastic	<input checked="" type="radio"/> Y / N / U
Discharge of oil	Y / <input checked="" type="radio"/> N / U
Dumping of any of the above by another vessel	Y / <input checked="" type="radio"/> N / U
Observer/Vessel personnel Interactions	
Request that an event not be reported	Y / <input checked="" type="radio"/> N / U
Offered a bribe to modify your data	Y / <input checked="" type="radio"/> N / U
Hinder the observer in the carrying out of their duties	Y / <input checked="" type="radio"/> N / U
Intimidated or harassed at any time	Y / <input checked="" type="radio"/> N / U

If you answered yes to any of the above, please provide more detail on the event and indicate the logbook page(s) where the event is documented more thoroughly.

Date / Explanation	<i>July 30, 2010 - vessel possibly fishing in inshore exclusion zone. near Principe Is. Documented event on page 32 of observer logbook. Mate moved from area immediately after I notified him</i>
Date / Explanation	<i>July 23, 2010 - vessel trades ~50kg of tuna with an artisanal vessel for ~50kg of whitefish</i>
Date / Explanation	<i>Multiple dates- vessel discarded all rubbish overboard (paper & plastics). See pages 35, 38, 42 and 47 for more detailed description of dumping. I only recorded when I observed but this probably occurred on several occasions that</i>
Observer signature / Date	<i>K. S. Dutton</i> August 27, 2010

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Figure 17-2 Example of a completed Compliance Checklist

18 Surveillance

18.1 Learning objectives

- Define IUU and describe the impacts of IUU fishing.
- List seven types of information to record if an IUU vessel is sighted.

18.2 Introduction

Vessel and aircraft sightings, especially of vessels fishing illegally, are the primary surveillance duty of observers. The extent and impact of illegal, unreported and unregulated (IUU) fishing is extremely difficult to quantify but it is recognized as both a global fisheries conservation as well as food security concern (FAO 2001a). There has been a steady increase in illegal fishing in the Eastern Central Atlantic Ocean where estimated illegal and unreported catch ranged between 294,000-562,000 tonnes using data from 2000-2003 (Agnew et al. 2009).

18.3 IUU Fishing – What is it?

The FAO International Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (IPOA-IUU; FAO 2001a) defines IUU as follows:

Illegal fishing refers to activities:

- conducted by national or foreign vessels in waters under the jurisdiction of a State, without the permission of that State, or in contravention of its laws and regulations;
- conducted by vessels flying the flag of States that are parties to a relevant regional fisheries management organization (RFMO) but operate in contravention of the conservation and management measures adopted by that organization and by which the States are bound, or relevant provisions of the applicable international law; or
- in violation of national laws or international obligations, including those undertaken by cooperating States to a relevant RFMO.

Unreported fishing refers to fishing activities:

- which have not been reported, or have been misreported, to the relevant national authority, in contravention of national laws and regulations; or
- undertaken in the area of competence of a relevant RFMO which have not been reported or have been misreported, in contravention of the reporting procedures of that organization.

Unregulated fishing refers to fishing activities:

- in the area of application of a relevant RFMO that are conducted by vessels without nationality, or by those flying the flag of a State not party to that organization, or by a fishing entity, in a manner that is not consistent with or contravenes the conservation and management measures of that organization; or
- in areas or for fish stocks in relation to which there are no applicable conservation or management measures and where such fishing activities are conducted in a manner inconsistent with State responsibilities for the conservation of living marine resources under international law.

The FAO IPOA-IUU requests nations to voluntarily implement effective MCS in fisheries including:

1. developing an integrated scheme for access to waters and resources;
2. maintaining records of all vessel ownership;
3. implementing VMS where appropriate;
4. implementing observer programs where appropriate;
5. providing training and education to all persons involved in MCS operations;
6. promoting industry knowledge and understanding of the need for MCS and MSC issues within national jurisdictions;
7. establishing and maintaining MCS data; and
8. ensuring effective implementation of national and, where appropriate, internationally agreed boarding and inspection regimes consistent with international law, recognizing the rights and obligations of masters and of inspection officers, and noting that such regimes are provided for in certain international agreements, such as the 1995 UN Fish Stocks Agreement, and only apply to the parties to those agreements.

The IPOA-IUU also calls on States to coordinate their activities and cooperate directly, and as appropriate through relevant RFMOs, in preventing, deterring and eliminating IUU fishing. In particular, States should:

1. exchange data or information, preferably in standardized format, from records of vessels authorized by them to fish, in a manner consistent with any applicable confidentiality requirements;
2. cooperate in effective acquisition, management and verification of all relevant data and information from fishing;
3. allow and enable their respective MCS practitioners or enforcement personnel to cooperate in the investigation of IUU fishing, and to this end States should collect and maintain data and information relating to such fishing;
4. cooperate in transferring expertise and technology;
5. cooperate to make policies and measures compatible;
6. develop cooperative mechanisms that allow, *inter alia*, rapid responses to IUU fishing; and
7. cooperate in monitoring, control and surveillance, including through international agreements.

Surveillance activities depend on rapid identification of fishing vessels. In the mid-1980s, FAO proposed international standard specifications for a vessel identification and marking system (Flewwelling et al. 2002). The system proposed based its markings on the International Telecommunications Union (ITU) Radio Call Signs (IRCS) that are unique for each vessel. The size and spacing of each character is dependent upon the length of the vessel. The markings must be in visible locations on the sides of the vessel, and the top of the wheelhouse for air identification. Advantages are for both control mechanisms and rapid identification for aerial patrol efforts and safety-at-sea. International marking standards and a comprehensive global record of vessels is still under development (FAO 2008).

Observer vessel sighting data will be used to quantify IUU fishing in West African waters and provide information to the relevant enforcement agency. Observers will also be documenting gear conflicts with artisanal fisheries.

18.4 List of Priorities

1. Make an entry on the Vessel and Aircraft Sighting form for each suspicious fishing vessel or fishing-related aircraft sighted during your trip.

18.5 Forms/Instructions

18.5.1 Vessel and Aircraft Sightings

The sighting of vessels and aircraft is a very important surveillance role of observers. If vessels are seen that could possibly be fishing illegally, record as much detail as possible on the Vessel and Aircraft Sighting form (Figure 18-1). If the vessel you are on has an AIS system, check it to see if the sighted vessel is recognized. Sightings of currently permitted vessels (Appendix 3) do not need to be recorded unless they are fishing illegally. Appendix 4 is a compilation of known IUU vessels.

Don't hesitate to contact the SOP by cell phone, email or radio, immediately when you see such activity. Include as much information about the vessel and its activities as possible.

Field	Definition
Page ___ of ___	Number pages consecutively for trip and fill in the total pages at the end of the trip.
Observer Code:	Record your observer program identification code.
Vessel Code:	Record the vessel code (Appendix 3) of the vessel you are on.
Trip ID	Enter the trip identification number.
Date	Record date in dd/mm/yy format
Time	Record the time the vessel or aircraft was first sighted
Latitude / Longitude	Record the position of the vessel you are on (unit is degrees and minutes to the hundredths of a minute) and include whether it is North or South latitude and East or West longitude.
Direction & Distance	Check the compass and radar for the direction (bearing) and distance from the vessel you are on. If no radar is available, record an estimated distance.
Name	Record the name of the sighted vessel (or as much as you can see or enter 'obscured'). For airplanes and helicopters, record 'aircraft'
Visible numbers	Record any visible numbers or other markings. These could be IMO or other vessel identifier.
Flag	Enter the flag or port – the stern is typically marked with a port city
Type	Record the vessel/aircraft type using codes listed on the bottom of the

form.

Activity Record the vessel activity using codes listed on the bottom of the form. Leave blank for aircraft.

Speed Record other vessel's speed in knots. The captain may be able to use the radar to determine the other vessel's speed.

Hull Material Record hull material: steel, wood, fiberglass, other.

Comments Include any additional information not already included on the form. For example, distinguishing features such, color, design or shape, bridge position, etc. Were there any dents? Were booms up or down? On PS, was chase boat in the water? Was a photo taken? If so, record the frame number.

Vessel and Aircraft Sightings								
Observer code 175			Vessel code XYZ 388			Trip ID 00279		
1	Date (dd/mm/yy)	Time (24-hr)	Latitude (dd mm.mm)	N/S	Longitude (ddd mm.mm)	E/W	Direction (deg.)	Dist. (nmi)
	28/07/10	0835	05 47.62	N	015 18.97	W	265	0.8
	Name Biaerve	Visible numbers	Flag Unknown	Type 2	Activity 2	Speed (kts) 4	Hull material steel	
Comments <i>Vessel appears to be hauling longline gear. Captain tried hailing on Ch 16 but they did not respond.</i>								
2	Date (dd/mm/yy)	Time (24-hr)	Latitude (dd mm.mm)	N/S	Longitude (ddd mm.mm)	E/W	Direction (deg.)	Dist. (nmi)
	01/08/10	1412	05 50.02	N	014 23.75	W	85	2.5
	Name	Visible numbers	Flag Unknown	Type 9	Activity 6	Speed (kts)	Hull material	
Comments <i>Helicopter sighted. No information available regarding it's origin/activity.</i>								
3	Date (dd/mm/yy)	Time (24-hr)	Latitude (dd mm.mm)	N/S	Longitude (ddd mm.mm)	E/W	Direction (deg.)	Dist. (nmi)
	Name	Visible numbers	Flag	Type	Activity	Speed (kts)	Hull material	
Comments								

Figure 18-1 Example Vessel and Aircraft Sighting form

19 Marine Debris

19.1 Learning Objectives

- Describe three scenarios that would require a Marine Debris Encounter form.

19.2 Introduction

Marine debris, including derelict fishing gear, can impact fishers through fishing gear entanglement, vessel interactions (e.g., with propeller) or catch interaction. Collecting data on marine debris encounters will allow the managing agency to assess the quantity of marine debris in the east Atlantic Ocean.

What is marine debris?

Marine debris is any persistent solid material that is manufactured or processed by humans and directly or indirectly, intentionally or unintentionally, disposed of or abandoned into the marine environment.

19.3 List of Priorities

1. Complete a Marine Debris Encounter form for all vessel interactions and gear interactions on longline, gillnet and purse seine vessels.

19.4 Forms/Instructions

19.4.1 Marine Debris Encounter

If you are on a pelagic longline, gillnet or purse seine fishing vessel, fill out the Marine Debris Encounter form for each encounter with marine debris (Figure 19-1). If you are on a trawl vessel, only complete the form for **vessel** interactions with marine debris. You may be assigned a special project to document gear interactions on trawl vessels.

Field	Definition
Observer Code:	Record your observer program identification code.
Vessel Code:	Record the vessel code.
Trip ID	Enter the trip identification number (assigned by the program prior to each trip).
Haul	Record haul (or set) number if interaction occurred during a haul. Otherwise, leave blank.
Date	Record the date of the encounter.
Time (24-hr)	Record encounter time using 24-hr notation.
Lat-Deg	Record degrees of latitude (2-digits).

Lat-Min	Record the minutes of latitude (to hundredths of a minute; 4-digits)
Lat-N/S	Circle N for all latitudes North of the equator and S for latitudes south of the equator.
Long-Deg	Record degrees of longitude (3-digits) for start and end of each haul.
Long-Min	Record the minutes of longitude (to hundredths of a minute; 4-digits)
Long-E/W	Circle W for all longitude West of the prime meridian (e.g., 0°) and E for longitudes east of the prime meridian.
Incident Type	<p>Check the appropriate box(es) for the type of incident(s).</p> <p>Gear interactions include any encounter with pieces of fishing gear or other equipment put over the side by the vessel.</p> <p>Vessel interactions are with the vessel itself (e.g., line is caught in prop).</p> <p>Entangled species may occur with gear and vessel interactions.</p>
Debris Type	<p>Check the appropriate box(es) for the type of debris.</p> <p>Record the type of net, if possible. For example, gillnet, trawl net, etc.</p> <p>Plastic sheeting only includes tarp-like plastic. If the debris encountered doesn't fit into any of the listed categories, check other and describe in detail.</p> <p>For purse seine vessels, fish aggregating devices (FADs) do not count as marine debris. FADs have their own form when on a purse seine vessel.</p>
Biota Type	Check one or more biota types and list species names if known.
Description	Describe the type of incident in more detail, diameter or width, length, colors of line and biota living on the debris.
Weight	Estimate the weight of the marine debris.
Photos	Circle Yes if you took photos and No if not.
Brought aboard	Was marine debris brought on board and retained for disposal? Circle Yes or No .
Length of downtime	Estimate the amount of time the vessel was unable to work due to this interaction. If the interaction did not cause any delay to fishing

operations, enter "0".

Downtime / cost Describe what was done during downtime (e.g. propeller disentangled by divers) and estimate the cost to the vessel. Be sure to include the unit of currency.

Marine Debris Encounter

This information is being used to help determine the economic cost of marine debris impacts.

Observer code <i>SLE 0001</i>	Vessel code <i>12737</i>	Trip ID <i>33</i>	Haul No. <i>132</i>
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Time & Position of Encounter with Debris (includes vessel, gear and animals)

Date (dd/mm/yy) <i>18/07/10</i>	Time (24-hr) <i>0420</i>	Lat-Deg <i>09</i>	Lat-Min <i>47.32</i>	N / S	Long-Deg <i>020</i>	Long-Min <i>34.59</i>	E / W
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Incident Type (check one or more):

- Gear Interaction
 Vessel Interaction
 Entangled Species Caught (e.g., entangled fish)

Debris Type (check one or more):

- Net: *gillnet*
 Cloth
 Plastic packing straps
 Rope
 Plastic sheeting
 Floats / buoys
 Monofilament line
 Plastic bags
 FAD (fish aggregating device)
 Metal (describe): _____
 Other (describe): _____

Biota Type (check one or more and list species names if known):

- Fish
 Crustaceans
 Encrusting organisms
 No biota/organisms present

Description of incident type and debris object/material (describe the type of incident in more detail, diameter or width, length, colors and biota living on the debris):

Vessel runs over derelict gillnet and gets it wrapped in prop. Gillnet has 14cm mesh and appears to be monofilament (~1m x 1.5m). There are remains of ~10 sharks and bony fish in the net but none are identifiable.

Weight (kg): 75 Photos: **Y** N Brought onboard for disposal: **Y** N

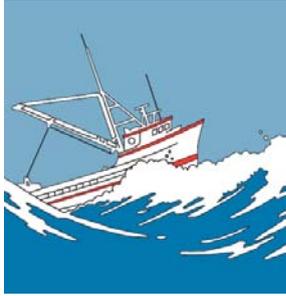
Length of downtime (hrs): 3

Description of downtime and cost (describe what was done during downtime (e.g. propeller disentangled by divers) and details of cost):

Two crew sent overboard to cut line from prop. Estimated cost unknown.

Figure 19-1 Example Marine Debris Encounter form.

20 Health & Safety Information



20.1 Learning objectives

- List three dangers inherent to working at sea
- List at least 4 basic competencies required for all personnel (including the observer) on the vessel
- Explain how to deal with a variety of health issues including seasickness
- Describe each of the seven steps to survival
- List essential elements of a personal survival kit
- Demonstrate use of the following safety equipment: EPIRBs, PFDs, VHF and SSB radios, liferafts, hydrostatic release, and fire extinguisher (types, how to use)
- Respond appropriately if a person falls overboard, fire or smoke is detected, or the fire or abandon ship alarm is sounded
- Describe the advantages and disadvantages of 3 types of visual distress signals and include when each is most appropriate to use.

20.2 Introduction

Fishing is one of the most dangerous occupations in the world (ILO 2000). Constant motion, heavy equipment and an inhospitable environment are inherent dangers on a fishing vessel. Thousands of people have died because they weren't familiar with emergency procedures or their safety equipment. Awareness and preparedness should be your main objective. As the observer, you may be the most knowledgeable person on board. Regardless of how cautious the crew is, you are ultimately responsible for your own safety and how you react in an emergency situation could save your life!

20.3 List of Priorities

1. Know your responsibilities regarding safety
2. Complete a Safety Checklist form for each vessel prior to departure
3. Participate in drills when they occur

20.4 Your Safety Responsibilities

There are several international conventions that address fishing vessel safety standards and requirements. The International Convention on Standards of Training, Certification and Watchkeeping for Seafarers was adopted by the IMO in 1978 and was revised in 1995 (STCW-95). A second convention, the International Convention on Standards of Training, Certification and Watch-keeping for Fishing Vessel Personnel (STCW-F), was drafted in 1995 and specifically addresses issues of fishing vessels. STCW-F is not currently in force (www.imo.org). Most West African countries are a signatory to STCW-95 but very few have adopted STCW-F (Appendix 14). Regardless, both documents provide excellent guidelines for minimum requirements for all personnel on board a fishing vessel. Davis and Reynolds (2002) summarize these conventions stating that "All personnel must perform the following basic competencies:

- i. communicate with other persons on board on elementary safety matters and understand safety information symbols, signs and alarm signals;
- ii. respond appropriately if a person falls overboard, fire or smoke is detected, or the fire or abandon ship alarm is sounded;
- iii. identify muster and embarkation stations and emergency escape routes;
- iv. locate and don life jackets (personal flotation devices or PFDs);
- v. raise the alarm and have basic knowledge of the use of portable fire extinguishers;
- vi. take immediate action upon encountering an accident or other medical emergency before seeking further medical assistance onboard; and
- vii. close and open fire/weather-tight and watertight doors fitted on the particular ship other than those for hull openings.”

Before departure from the dock, observers must complete the Safety Checklist. In order to complete this form, you may need to request a tour of the vessel which can be conducted by the vessel operator or appropriate crew. You should become familiar with:

- i. general safety procedures for that vessel;
- ii. alarm signals used for each type of emergency and alarm locations;
- iii. location and operation of all safety equipment, including fire extinguishers, first-aid kits, life vests, life raft, and communications equipment;
- iv. escape routes from accommodations and/or work areas; Visualize how you would evacuate and retrieve your safety gear from wherever you may be on the vessel. Visualize your evacuation routes with the vessel in different orientations (i.e. on its side, upside down).
- v. where to report (muster stations) and procedures; and
- vi. identification of the person in charge of medical treatment.

If the vessel does not have a life raft with enough capacity for all crew, call the SOP immediately.

20.5 Vessel Hazards

20.5.1 Safety on deck

Fishing vessels have many potentially dangerous areas but the deck typically poses the most hazards. Be aware of your surroundings at all times and keep eyes and ears tuned to vessel activities. The hours, the environment, the food, and the work may be quite different from what your body is accustomed to on land. Slipping, tripping, and falling are the most common causes of injury. Watch out for slick spots where the deck is wet, slimy or oily, step carefully over the half-foot combing rising from the bottom of metal latch doors and passageways, and look out for low overheads in vessel stairwells and watertight doors. Be cautious of line stored on deck – never step into the bight of a line.

Beware of trawl warps under strain. Whenever a cable is subjected to tension, stand out of the way of backlash. Explain to the crew that codend and/or bin/trawl alley measurements may need to be made once the winches have stopped. When nets are being hoisted off the deck, stand clear. Like the trawl warps, these hoisting cables are under great tension. Ask the skipper and crew where they want you to stand when deploying and retrieving gear.

Talk with the crew about safe places to sample when on deck. Ask where previous observers have sampled. Don't be afraid to voice concerns regarding the sampling area, or to ask for help in making a sampling area safer.

Use proper lifting technique (more on this later)! When lifting, get as close as possible to the object, keep the back straight while using your legs. On a moving vessel, this is critical because unexpected movements can cause back strain. Don't be afraid to ask for assistance in moving heavy baskets or objects.

When outside, remain in full view of a second party at all times. If the weather conditions are too bad for the crew, they're too bad for you as well.

General Deck Safety Tips

- **Always wear a personal flotation device** and appropriate footwear (e.g., boots, close toed shoes) when on deck.
- **Be aware of cables under strain.**
- **Wear protective eyewear** (longline vessels). This will help protect your eyes in the case of a mainline break, sinkers flying back at the vessel after a line break, or any other potential eye hazard.
- Don't run aboard ships, particularly up stairwells.
- Always hold handrails in stairwells and on ladders.
- Always keep a hand free to hang on to the vessel.
- Wear appropriate gear when on deck sampling, rain gear, gloves, hat, etc. Try to stay as warm and dry as possible. Always wear gloves when handling fish.
- Do not stay outside on the deck during rough seas. It is recommended that observers do not go out on the deck alone, especially in rough weather. If you feel that you must go out on deck by yourself make sure you tell someone you are going out on deck.
- Use proper lifting technique.
- Avoid clothes with loose strings or tabs and jewelry such as rings as these might become caught in the equipment or moving belts. Long hair should be tied back.

Safety comes first. If you are unable to collect data due to safety concerns (not only weather), document the particular details of the situation in the Observer Logbook. The report should include a description of the problem, the attempted solutions and the final resolution.

You may encounter a "near miss" (*i.e.* an accident that almost happened) or a specific safety concern during your trip. Documentation of near misses is important. Make sure to notify the debriefer and describe any incidents during our debriefing. Thorough documentation of the incident (what, where, when, and any fixes) can provide valuable information for improving safety training and protection for observers.

20.5.2 Boarding vessels

Vessels at the dock should have a gang plank for safe boarding. If this is not the case, at the very least, a safety net should be attached to the vessel and the dock so that if you slip during boarding, the net will catch you. Be especially aware of wet, slippery surfaces when stepping on to a vessel and be sure of your footing on each step when using a boarding ladder.

20.5.3 Vessel transfers

Transfers between vessels are potentially hazardous, especially in rough weather (NMFS 2008b). You are responsible for deciding whether or not to transfer based upon your evaluation of the transfer conditions. Conditions such as mode of transfer, vessel size, distance to shore, swells versus waves, current and impending weather affect the decision to transfer. Observers must use their best judgment. Be cautious, not foolhardy. Do not be forced into transferring against your better judgment by an anxious or impatient captain. Usually the captain will determine conditions are too rough for transfer before an observer thinks it is too rough. In these cases, the observer must follow the recommendation of the captain who is responsible for the safety of the vessel and personnel aboard (including the observer).

Several methods are available for transfers between larger vessels (>50m). Transfers between vessels may involve using a swing rope or a personnel basket. Given a choice, select the personnel basket for transfers. The swing rope can be potentially hazardous in anything but flat calm seas. Whenever possible, be preceded by an experienced crewman. Stepping, climbing, or jumping from one vessel to another must be executed with extreme caution and proper timing. The following general guidelines should be followed during all transfers:

1. Observers will wear PFD's, during all transfers.
2. Observers will not encumber themselves with baggage when transferring. Balance is critical and both hands must be free during transfers especially to canoes. Baggage should be handed across after the transfer is completed or sent across by basket or cargo net.
3. If a personnel basket is to be used, make sure a guide line is attached to the basket and manned for greater control and to reduce swinging when landing the basket on deck. Baggage should be securely stowed in the center of the personnel basket. The following procedures should be used during personnel basket transfers:
 - a. Stand with one foot on the outer ring of the basket, the other on the deck and both hands securely holding the netting.
 - b. As the basket lifts off the deck, bring your foot off the deck and place it on the outer ring of the basket next to your other foot (already on the basket ring).
 - c. Stand firmly on the outer ring with knees slightly bent as opposed to locking your knees to avoid leg or back injury in the event of a hard landing. Carefully step off the basket when it has landed firmly on the deck.

20.5.4 Bacteria and Fungus

Bacteria from fish may lead to infection in cuts, scrapes, or punctures. To prevent “fish poisoning” always wear gloves when handling fish and wash your hands thoroughly with soap and water after sampling. Change gloves often to keep them dry and discard any torn gloves. Treat *all* minor cuts, especially those on your hands, with antiseptic to avoid infection from fish slime.

Be cautious whenever wading through fish on deck. Fish spines, especially on the Ariidae and stingrays, can penetrate rubber boots and cause painful puncture wounds to the feet. Spines often carry bacteria and can lead to fish poisoning.

If a wound gets red or swollen, soak it for ½ hour in very hot, soapy water at least three times a day. Dry and bandage the wound. Antibiotics are commonly prescribed for fish poisoning.

The vessel may have some on board. Never leave an infection untreated--the threat to your health can become much more far-reaching than simply a pair of inoperative hands.

Take extra precautions against infection when collecting specimens from marine mammals. “Seal finger” is a fungal infection of the hands that can easily be contracted by a scratch or bite.

20.5.5 Heavy lifting and repetitive motion issues

The duties of an observer are physically demanding. The job requires not only heavy lifting but also repetitive motions. Serious back injuries can occur due to improper lifting technique (see text box for Heavy lifting tips) and carpal tunnel syndrome can occur from repetitive motions of the hands and arms.

Carpal-tunnel syndrome can occur from by any abnormal strain on the tendons caused by repetitive motion. This may cause chaffing or swelling which creates pressure on the median nerve as it passes through the tight carpal tunnel in the wrist. Symptoms include numbness or tingling in your hand, pain in your wrist, palm or forearm, trouble gripping objects and more pain at night. You can prevent carpal tunnel by doing arm, wrist and hand exercise prior to being deployed.



20.5.6 Radar

Radar emits radiation that can cause injury. Do not stand near the radar when it is turned on.

20.6 Personal health & safety

In addition to the hazards already discussed, vessels pose a variety of personal health and safety risks ranging from illness and accidents to harassment. Report any injuries, accidents or illnesses that occur at sea to the captain immediately and to the SOP upon return to port.

General tips

- Avoid drugs and alcohol aboard fishing vessels. Stay sober at all times.
- Drink plenty of water and eat regularly.
- Wash hands frequently with hot soapy water and/or sanitizer to avoid illness and infections. Treat all cuts, burns and other wounds seriously and apply appropriate first aid to avoid infections.
- When you are not feeling well, use extra caution and reduce the time spent working.
- Be aware of confined spaces, such as sleeping quarters that contain chemicals. Fumes can build up in confined spaces and make people ill or even kill them.
- Bring things from home that comfort you and can occupy your time during slow periods. Books, magazines, games, favorite articles of clothing, pleasant smells, are examples of things you could bring along. These will help you mentally deal with the sometimes psychologically straining effect of life at sea on a fishing vessel.

Heavy lifting tips

1. Plan ahead before lifting – Knowing what you're doing and where you're going will prevent you from making awkward movements while holding something heavy. Clear a path, and if lifting something with another person, make sure both of you agree on the plan.
2. Lift close to your body – You will be a stronger and more stable lifter if the object is held close to your body rather than at the end of your reach. Make sure you have a firm hold on the object you are lifting, and keep it balanced close to your body.
3. Feet shoulder width apart – A solid base of support is important while lifting. Holding your feet too close together will be unstable, too far apart will hinder movement. Keep the feet about shoulder width apart and take short steps.
4. Bend your knees and keep your back straight – Practice the lifting motion before you lift the object, and think about your motion before you lift. Focus on keeping your spine straight--raise and lower to the ground by bending your knees.
5. Tighten your stomach muscles – Tightening your abdominal muscles will hold your back in a good lifting position and will help prevent excessive force on the spine.
6. Lift with your legs – Your legs are many times stronger than your back muscles--let your strength work in your favor. Again, lower to the ground by bending your knees, not your back. Keeping your eyes focused upwards helps to keep your back straight.
7. If you're straining, get help – If an object is too heavy, or awkward in shape, make sure you have someone around who can help you lift.
8. Never jerk or twist



Figure 20-1 How to lift by Jonathan Cluett, <http://orthopedics.about.com/cs/backpain/ht/lift.htm>, February 25, 2007.

20.6.1 Hydration

Drinking plenty of water and eating enough food are two critically important factors in maintaining health in this new environment. Adults require a minimum of 2 liters of water per day and water needs increase in the tropics and with physical exertion (Jensen and Dzigan 2005). If urine is dark or you have a headache, you may be dehydrated.

20.6.2 Hyperthermia & Hypothermia

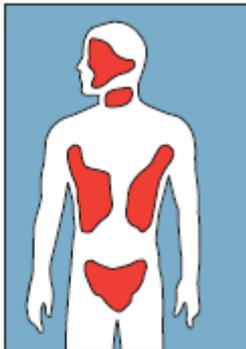


Figure 20-2 High heat loss/gain areas – head, neck, sides of chest and groin region. (Image from (Transport Canada 2003)).

Hyperthermia, or heat exhaustion, is an acute condition which occurs when the body produces or absorbs more heat than it can dissipate. Early symptoms include weakness, pale skin, headache and profuse sweating. The next phase involves the skin becoming hot and bright red. If not treated, hyperthermia may lead to heat stroke. Heat stroke occurs when the victim stops sweating and loses consciousness. Additional symptoms include confusion, headache, hostile behavior, the appearance of intoxication, and dizziness due to a drop in blood pressure. Dehydration plays a large role in hyperthermia because the body may not be able to sweat, a major source of heat loss. The primary treatment is cooling the person down by moving indoors (or shade), remove clothing, place in cool water, and cool compresses applied to the torso, head, neck and groin (Figure 20-2). Rehydration is also critical for treating hyperthermia.

Hypothermia occurs when the body's core temperature drops. It can occur when submerged in water less than 33°C and in air less than 27°C. Although the water temperatures off of West Africa range from 22-30°C, hypothermia can still occur. Water conducts heat away from the body 25 times faster than air at the same temperature (Jensen and Dzugan 2005). The Man Overboard section of this chapter discusses appropriate action to take if you find yourself in the water.

20.6.3 Fatigue and sleep deprivation

Fatigue and sleep deprivation suffered by the crew and by the Observer are threats to everyone's safety. Be aware of the physical state of other people on the vessel—whether the person on watch or in control of the gear. Fatigued individuals make mistakes. Monotonous work is difficult to do accurately and safely when tired. Try to “catch up” on sleep when there are breaks in fishing.



20.6.4 Noise

Engine noise is not only annoying—it keeps boat operators from hearing voices, signals, and danger warnings. If you're around a loud noise for a long time, the noise can make you tired and lower your reaction time.

20.6.5 Seasickness



One of the least pleasant aspects of going to sea is the possibility of seasickness. An individual's susceptibility to seasickness is highly variable. Individuals that have experienced motion sickness in cars or buses may experience seasickness during their trips. The symptoms of motion sickness include nausea, vomiting, and dizziness. Other common signs are sweating and a general feeling of discomfort and not feeling well (malaise). Most people feel some level of discomfort when they first go to sea.

Seasickness is a result of a conflict in the inner ear (where the human balance mechanism resides) caused by the erratic motion of the ship through the water. Inside the cabin of a

rocking boat, for example, the inner ear detects changes in linear and angular acceleration as the body bobs with the boat. But since the cabin moves with the passenger, the eyes register a relatively stable scene. Agitated by this perceptual incongruity, the brain responds with stress-related hormones that can lead to nausea and vomiting. Its effect can be magnified by strong smells (like diesel fumes or fish, which are part of daily life at sea). Seasickness usually occurs in the first 12-24 hours after sailing. For most people, seasickness dissipates when the body becomes acclimated to the ship's motion (getting one's "sea-legs"). In rare cases, an individual may stay ill beyond the first couple of days at sea, regardless of sea state. If this occurs, dehydration can become life threatening if it leads to shock.

You may choose to take seasickness medication before going to sea. There are several over-the-counter and prescription medications available to minimize seasickness. Acupressure wristbands and eating crystallized ginger are other remedies used with varying success. Seasick medications must be taken before the symptoms begin. Most medications take several hours to be absorbed into the body. If you are vomiting and cannot keep anything in your stomach taking medication at sea will not be an option. Even if you doubt that you will get seasick, you might want to take the medication before you board as a precaution. If you should get seasick, take comfort in the fact that recovery is only a matter of time. All that is usually required for a complete recovery is some patience.

Seasickness tips:

- Keep drinking fluids. Seasickness and related medications cause dehydration and headaches. Try to drink juices low in acidity, clear soups, or water, and stay away from milk or coffee.
- Continue eating items like crackers, dry toast, dry cereal, etc. (avoid anything greasy, sweet, or hard to digest). Keeping something in your stomach suppresses nausea, or, when vomiting, eliminates painful "dry heaves".
- Focus on the horizon to eliminate the visual conflict in your brain.
- The vessel's motion is generally less pronounced the further astern you go. Try to stay as far back from the bow and on lower decks, if possible.
- Keep working. Most people find that being busy on deck keeps their minds off their temporary discomfort. Also, the fresh air out on deck is often enough to speed recovery.
- Carry a plastic bag. This simple trick allows some peace of mind and eliminates some of the panic of getting sick. When vomiting over the side, be aware of which way the wind and waves are coming. Going to the leeward side will ensure that an unpleasant experience doesn't become any more unpleasant.
- Don't be embarrassed or discouraged. When Observers are seasick, chances are that others people on board are seasick too! No one is immune to seasickness.

Modified from (NWFSC 2006).

20.6.6 Harassment

Observers can be subject to negative attention, comments, or actions because vessels often see them as unwelcome government agents or even "fish cops".

20.6.6.1 Identifying Harassment

Harassment can take many forms such as:

- Repeatedly waking an observer during sleep periods.
- Providing substandard accommodations and food.
- Criticizing or interfering with an observer's sampling techniques or reporting practices.
- Excessive/inappropriate teasing or ribbing.
- Intentionally throwing discarded species over that are requested by the observer.
- Tampering with an observer's gear or sample.

- Intimidating an observer.
- Barring an observer from areas they need access to do their job

In all cases, harassment is defined as when the observer feels threatened or feels that their work or living environment is being compromised.

20.6.6.2 Sexual Harassment

Sexual harassment is unwelcome behavior of a sexual nature. Privacy is greatly reduced onboard a vessel, and interactions can become intense very quickly. Sexual harassment may include sexist remarks or behavior, or sexual advances which result in a tense and unproductive work environment. Examples of sexual harassment include:

- Suggestive sounds or gestures
- Sexual remarks about ones clothing, body or sexual orientation
- Leering or ogling
- Persistent sexual comments and jokes
- Constant brushing against or touching a person's body

Sexual harassment is unwanted attention in a nonreciprocal relationship (relationships with vessel personnel are prohibited under observer standards of conduct). In most normal interpersonal relationships, an individual can exercise free choice in deciding to develop a relationship based on mutual caring and respect. These elements are absent in sexual harassment. If you feel sexually harassed remember that it is not your fault! Take the appropriate steps to address the situation, contact help, and document thoroughly.

20.6.6.3 What to Do if Observers Experience Harassment

Observers who experience harassment in any form should confront it directly and document it completely. By reporting harassment, you protect future observers as well as yourself. Please report any cases of harassment to the SOP as soon as possible. The SOP is unable to help with problems if they are unaware of them.

Tip* Observers should not feel embarrassed to report harassment or worry that they did something to provoke the unwanted behavior. Remember, unreported harassment not only affects your ability to do your job but it will set a precedent for the treatment of future observers on that vessel.

Follow these steps when you experience harassment:

Tip* Remember that you are the judge of whether another person's actions negatively affect you.

1. The **FIRST** time an observer feels uncomfortable or feels that a crew member has crossed a line, tell the offender to **STOP**. In this conversation the harasser should be told that his/her comments, actions or advances are unwanted and that they should stop.
2. Don't fight fire with fire. Observers should behave professionally at all times. Make sure that verbal and non-verbal body language exhibit a clear message to the harasser to stop.
3. Document all harassment incidents from the very beginning in the observer logbook. Record the details of the event assuming that the harassment could escalate. It is easier to do it initially than to come back and reconstruct it weeks later. In the logbook, describe the situation, including who, what, where, when, why and how (see page 17-2). Be as detailed as possible. Use direct quotes, accurate times and dates, any witnesses present, circumstances surrounding the event and any other important details. Detail the attempts made to end the harassment and the response that was received.

4. If the initial harassment is egregious or if the problem continues after clearly asking the harasser to stop, report it to the skipper. Tell the skipper the full story, explain that it is affecting your work, and request that he take steps to end the problem. Most skippers do not want trouble on the boat. If the skipper is informed that trouble is brewing, he should take appropriate action. Document any further incidents and the skipper's actions.
5. If the harassment is not taken care of by the skipper, if the issue is with the skipper, or if there are other problems with the skipper, report the offense to the SOP at the first opportunity, use your cell phone at sea if necessary. If there is no resolution, the SOP will make arrangements for you to leave the vessel.

20.6.6.4 Advise to Observers (adapted from "Advise to women" in NMFS 2008b)

Sexual harassment, ranging from verbal harassment to assault and rape, can affect both women and men. Such incidents are frequently not reported, for reasons ranging from a desire to be a good sport in minor cases to embarrassment and shame in more serious cases. This section is intended to alert you to the different nature of social conditions at sea, and to suggest some actions you should take if you feel uncomfortable or harassed.

Social conditions are different from those on land. Privacy is greatly reduced, and as a result, interactions can become more intense and feelings of intimacy are more quickly established. Small incidents, both pleasant and unpleasant, can quickly take on exaggerated importance, due to the close quarters, the prevalence of gossip, and the sense of isolation from "the real world" back on shore. Furthermore, staffing on a ship brings together people with very diverse backgrounds and value systems. While some of the men are accustomed to the concept of women as professionals, others are familiar with more traditional views of women. For some men, sexual remarks or actions may be considered an acceptable mode of behavior regardless of location. Also, the value systems of many men change somewhat during the period of time that they are at sea. Homosexual behavior at sea may be socially acceptable by some cultures that reject these actions on land.

The crew has usually established a workable interaction among themselves, while observers, who come aboard for a single trip, are not part of that system.

Sexual awareness and tensions can be heightened at sea, due to the unusual social closeness and deprivation of normal outlets. Behavior and attire that are acceptable on shore can be viewed as provocative at sea and close relationships between people can strongly affect the atmosphere in which everyone must work and live. Observers, especially women, are therefore particularly apt to draw attention, comment, and speculation. While some of the attention may be pleasant and even flattering, some of it is not.

In consequence, it is necessary to be aware of the different social situation, to consider the consequences on some situations and to modify your normal behavior if necessary. Below are some examples of the sort of actions you might adopt or avoid:

1. Strictly obey the rules regarding drinking, which can lead to poor judgment, lack of control, and alertness, and hasty actions. At sea you must be prepared for any emergency. Consider yourself on duty 24 hours a day.

2. Refrain from wearing potentially provocative clothing such as sleeveless tops, short shorts, and tight clothing.
3. Be aware that if you show more attention to one crewman, it may be misinterpreted by him or by others.
4. Do not invite crew to your cabin if you are alone, or accept an invitation to be alone with him for a "friendly chat" or "little drink". Women should go to a public area if a man comes to talk to you without your invitation.
5. Activities such as flirting, joking about sex, or touching may be misinterpreted by the persons involved or by others. Unwanted approaches such as these should be responded to politely but very firmly. You yourself should avoid flirtatious behavior.
6. Do not engage in sexual affairs. These distract you and your partner from doing your work, can breed resentment and jealousy and will subject other observers to increased sexual pressure, both on your trip and on subsequent trips. Physical involvement is a violation of the programs code of conduct.
7. Make it clear that your interests in companionship are elsewhere or that you are "not available".
8. If you are experiencing unwelcome advances or are in any tense situations, do not stand around on deck or other deserted areas alone at night.
9. In general, be very sensitive to the altered social conditions and their possible implications. Be very conservative. Use common sense.

An assault often occurs with warning signs of milder behavior. If you act firmly and decisively during the early stages, you may reduce the chances of future harassment. Some warning signs to watch for are:

- Frequent attempts to detain you, to be in your company, or to visit you in your cabin.
- Mild or casual sexual remarks become more frequent, pointed and/or objectionable.
- Any physical contact, even if it appears innocent.
- Other people warn you about a man who begins to harass you.
- A person whom you have repeatedly attempted to discourage continues or escalates the advances.

The definition of harassment is subjective (see Chapter 17), making it difficult to identify. Sexual harassment can be defined as "unwelcome sexual advances, requests for sexual favors, and other verbal or physical conduct of a sexual nature." Thus, it is your decision at what point you will draw the line.

Many women and men feel uncomfortable with milder forms of harassment, but tolerate it, not wanting to cause trouble, or appear to be oversensitive or bad sports. The unfortunate result of this passivity is that harassment may continue or increase until it becomes serious. At that point, the observer is open to the charge that s/he allowed or encouraged the previous actions. It is best to take action at the time you first feel uncomfortable. There are a variety of actions you may adopt, which must depend on your judgment. In general, the best sequence to follow is:

1. Indicate to the harasser that you do not enjoy or appreciate his actions. Do not make a joke of his behavior. Speak firmly and coldly, or pointedly avoid him. Do not make the mistake of pretending to ignore it; this invites continuation at a higher level. Losing your temper may be effective in some cases but usually is not, and may even encourage the harasser.

2. If the above measures are not immediately effective in stopping the harassment, bring the matter to the attention of the captain and ask him to immediately solve the problem or you will request to be removed from the vessel.
3. If the problem continues, call your supervisor and report the incident. Inform the captain he will need to make immediate arrangements to return you to port. If arrangements are not immediately made, inform your supervisor.
4. If the harassment advances to the point of assault, it becomes a crime. You should immediately report the offense to the captain and your supervisor. Have your supervisor make arrangements for you to leave the vessel immediately or get yourself off of the vessel and inform your supervisor of your actions. Make sure the incident is not ignored.

Sexual assault and rape have occurred on vessels at sea. These serious offenses might be prevented if appropriate action is taken in the early stages. Never believe that the problem is trivial or that you are over-reacting. If you feel harassed, then it has gone too far. By reporting harassment, you are protecting others as well as yourself. The captain does not want trouble on his boat nor face a costly delay. If you inform them that trouble is brewing, they should take appropriate action.

20.7 Survival at Sea

20.7.1 Life saving equipment

Most people arrive in a survival situation with only the clothing they are wearing and the things in their pockets. Survival equipment is useless unless it's with you. At all times, you should have on your person clothing appropriate for the outside environment, a knife and your personal survival kit.

Regulations require vessels to carry a variety of equipment for use in emergencies. Make sure you know where the common equipment shown in Figure 20-3 is stored, and how to use it.

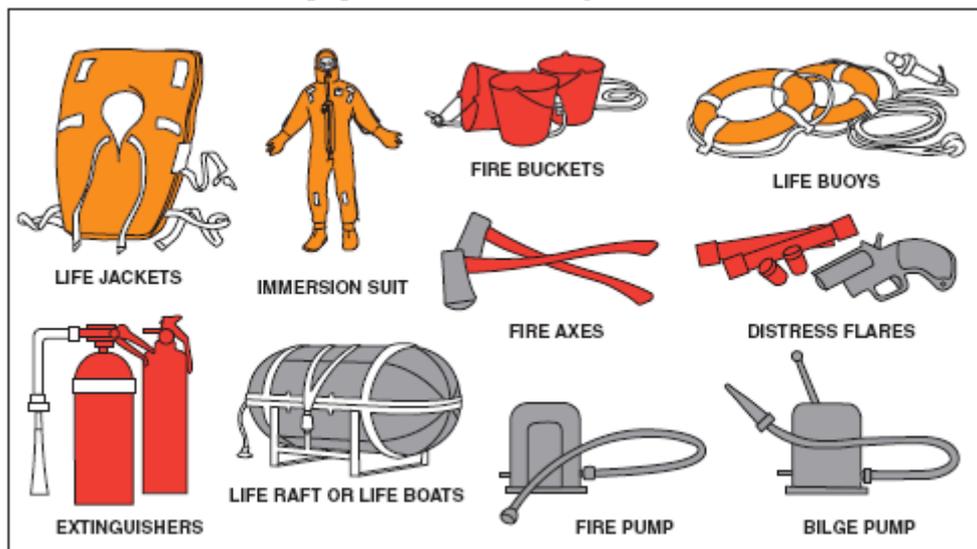


Figure 20-3 Typical life saving equipment. Image from Transport Canada (2003). Immersion suits may not be required in tropical areas.

20.7.1.1 Survival craft

Life rafts and **life boats** are both examples of survival craft (Figure 20-4). Life boats typically need to be manually deployed whereas most life rafts can either be manually deployed or will self-deploy once a vessel sinks beyond a given depth (if configured with a hydrostatic release). Life rafts should be repacked each year. The canister will have a decal with a service date. Life rafts should also be mounted in a location so it will float free if a vessel sinks (e.g., not directly under a bunch of rigging). Survival craft can be packed with varying degrees of additional survival equipment (e.g., Survival of Life at Sea or SOLAS) packs). There are three types of SOLAS packs – A, B and Coastal – and their contents vary (Table 20-1). Prior to boarding, you should be familiar with the major components of a life raft (Figure 20-5).

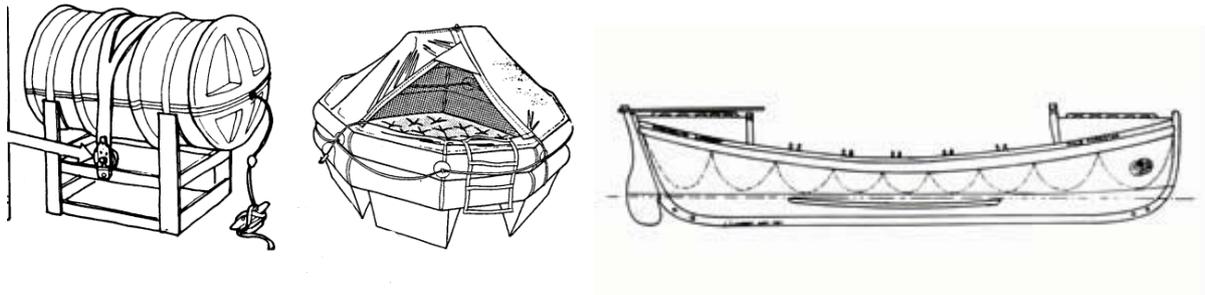


Figure 20-4 Examples of survival craft: life raft canister (left), life raft (center) and life boat (right).

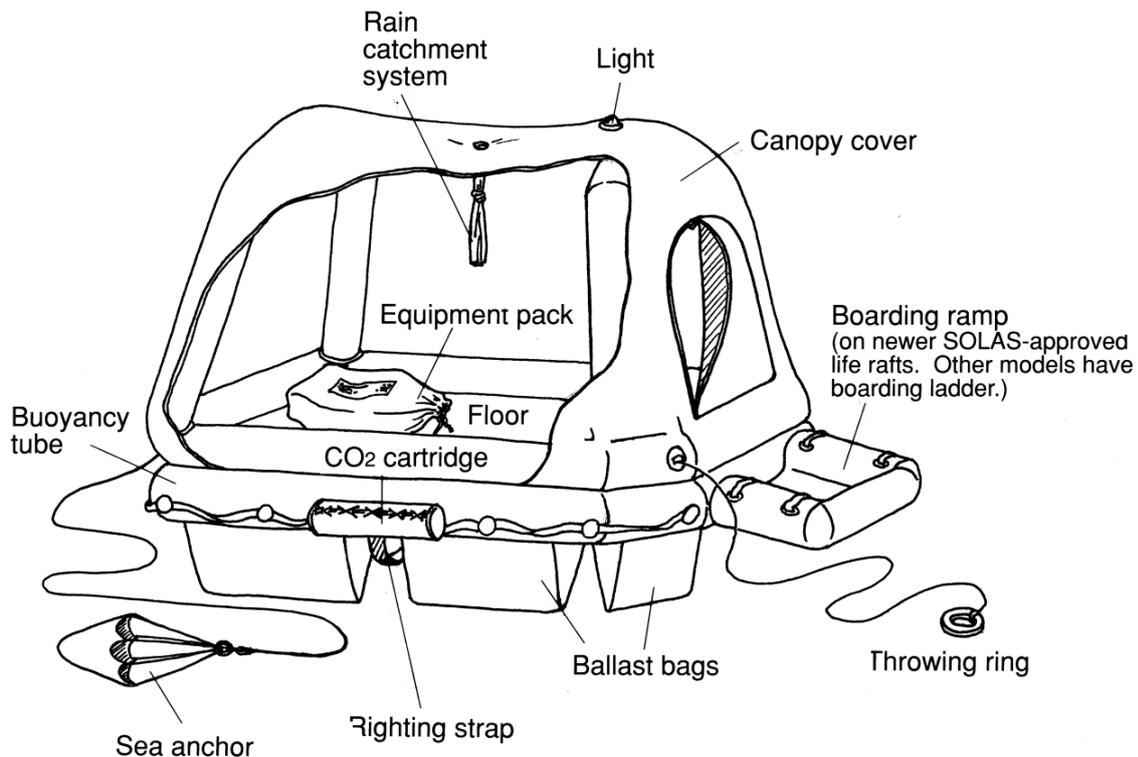
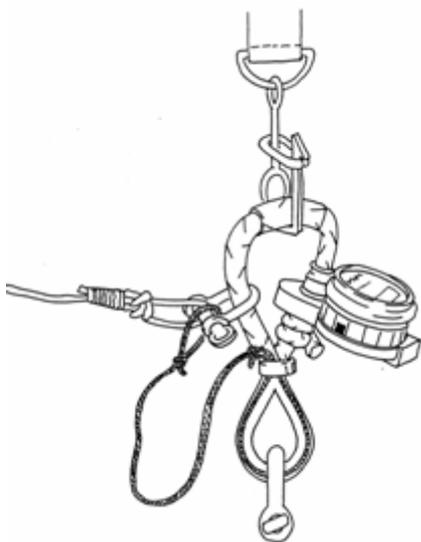


Figure 20-5 Important components of a life raft. Image courtesy of AMSEA.

Table 20-1 Comparison of SOLAS kit contents.

Equipment	Coastal pack	Solas B	Solas A
Quoit & heaving line	1	1	1
Knife	1	1	1
Bailer	1	1	1
Sponge	1	1	1
Sea anchor (drogue)	1	2	2
Paddles	2	2	2
Whistle	1	1	1
Flashlight with spare batteries & bulb	1	1	1
Signal mirror	1	1	1
Survival instructions	1	1	1
Immediate action instructions	1	1	1
Repair kit (1 set sealing clamps or plugs)	1	1	1
Pump or bellows	1	1	1
Tin openers	0	0	3
First aid kit in waterproof case	0	1	1
Rocket parachute flares	0	2	4
Hand held flares	0	3	6
Buoyant smoke signals	0	1	2
Copy of Life Saving Signals	0	1	1
Fishing tackle	0	0	1
Food ration	0	0	2,378 calories/person
Water	0	0	1.5 l/person
Rustproof, graduated drinking vessel	0	0	1
Anti-seasickness pills	0	6/person	6/person
Seasickness bag	0	1/person	1/person
Thermal protective aid	0	Enough for 10% of persons or 2, whichever is greater	Enough for 10% of persons or 2, whichever is greater

20.7.1.2 Hydrostatic release



Some, but not all, vessels may have a hydrostatic release attached to their liferaft canisters. This allows the liferaft to automatically deploy once a vessel sinks below a given depth (~4m). The basic setup includes a strong rope secured to the deck or liferaft cradle and attached to the liferaft lashing with a sliphook (aka pelican hook). There is a weak link (weaker line) that attaches the painter to the deck. If the ship sinks, the water pressure will activate a knife inside the release which cuts the rope and the liferaft will float free. As the ship sinks, the liferaft painter line will be stretched and the liferaft starts to inflate. Once the weak link breaks, survivors can board the floating liferaft.

Figure 20-6 Hydrostatic release. Image from AMSEA.



20.7.1.3 Personal flotation devices & other flotation

There is an assortment of personal flotation device (PFD) types ranging from vests to collar-like PFDs (Figure 20-7). Each type has advantages and disadvantages. The best PFD or life jacket is one that you wear and that fits properly. You should also attach a whistle and a strobe light if possible. The human voice doesn't carry well and a whistle can assist with gaining attention of rescue crew.

Tips for keeping your PFD in good condition:

- Don't put heavy objects on your PFD or use it for a kneeling pad. PFDs lose buoyancy when crushed.
- Let your PFD drip dry thoroughly before putting it away. Always stow it in a well-ventilated place.
- Never dry your PFD on a direct heat source.
- Monitor for rips, mold, torn seams and missing reflective tape. Fix and replace as necessary.

Vessels may carry additional emergency floatation devices such as a life ring, cushion, or life sling. If you are fishing in cool water, you may also encounter immersion (survival) suits on board.

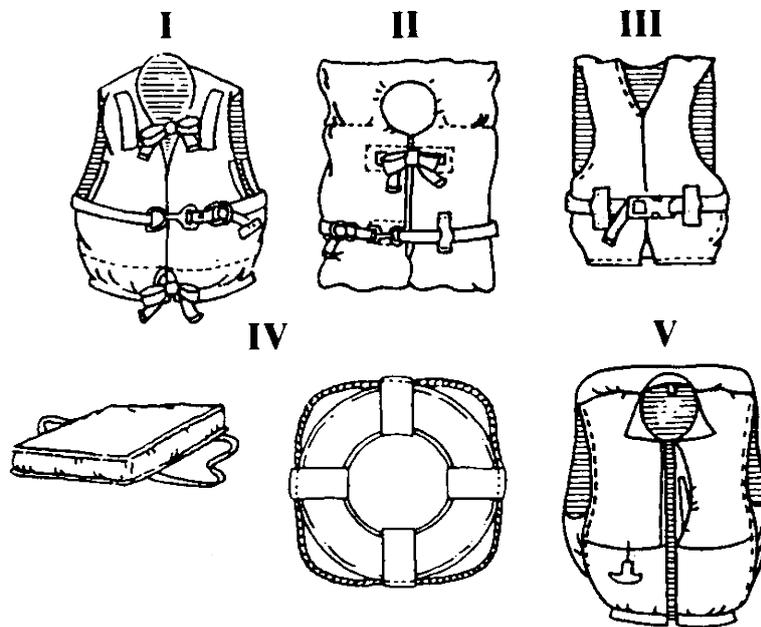


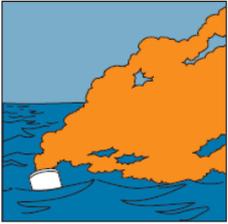
Figure 20-7 Types of PFDs (Image from <http://fwp.mt.gov/images/fishing/floatjacket.gif>).

20.7.1.4 Visual Distress Signals

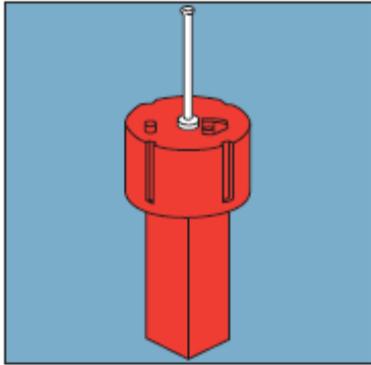
Visual distress signals include pyrotechnics (or flares), flashlights, portable strobe lights, mirrors and distress flags. All have advantages and disadvantages and are only of value if used in the appropriate situation (Table 20-2).

Pyrotechnics or **flares** range in type and purpose. All flares should be stored in a watertight container, in a cool dry location. **Flares are valid for four years from date of manufacture**, and should be disposed of after that time. Flares get very hot – read all instructions in advance so that you are not accidentally injured in a real emergency.

Table 20-2 Advantages and disadvantages of visual distress signals (Images from (Transport Canada 2003) and California Department of Boating and Waterways).

Signal type	Use when...	Advantages	Disadvantages
Parachute signal 	<ul style="list-style-type: none"> • Day or night • You have reason to believe it will be seen from a rescue ship or from shore • You can see the mast top of a vessel on the horizon 	<ul style="list-style-type: none"> • Pistol-projected or hand-held rocket-propelled • Long burn time (40s) • Sighted from long distance 	
Handheld flare 	<ul style="list-style-type: none"> • Day or night • You can see lights from shore or a ship or an aircraft 		<ul style="list-style-type: none"> • Fairly short sighting distance • Hot molten metal droppings
Smoke 	<ul style="list-style-type: none"> • Day only • Low or moderate wind conditions 	Hand held and floating canister format	<ul style="list-style-type: none"> • Fairly short sighting distance
Dye 	<ul style="list-style-type: none"> • Day only 	<ul style="list-style-type: none"> • Fairly short sighting distance & best from above 	
Lights 	<ul style="list-style-type: none"> • Night only 		<ul style="list-style-type: none"> • Fairly short sighting distance
Flags 	<ul style="list-style-type: none"> • Day only 		<ul style="list-style-type: none"> • Short sighting distance
Signal mirror 	<ul style="list-style-type: none"> • Day only 	<ul style="list-style-type: none"> • Can be seen for long distances 	

20.7.1.5 Emergency Communication Equipment



20.7.1.5.1 EPIRBs

An Emergency Position Indicating Radio Beacon (**EPIRB**; Figure 20-8) is mandatory on many vessels. Even if it is not mandatory, it is highly recommended. When activated, the battery operated EPIRB transmits a signal that is recognized as a positive indication of distress by Search and Rescue forces throughout the world. EPIRBs should be mounted in a float free position. Never attach the lanyard to the vessel. EPIRBs should be tested regularly in accordance with regulations and the manufacturer's instructions.

Figure 20-8 Example of EPIRBs. Image from Transport Canada (2003).

20.7.1.5.2 Radios

Radio operation was discussed more fully in Chapter 3; however, everyone on board should know how to make an emergency distress call.

20.7.1.5.2.1 Distress calling procedures

Normally, the captain of the vessel will decide if and when a distress call is required. However, depending on the nature of the emergency you may be the only one able to get to the radio to make the call, therefore, you should be familiar with the procedure. Ideally, this information is posted near the radio. A distress call is used only when a life or vessel is in immediate danger. The procedure is as follows (Jensen and Dzugan 2005):

1. Make sure radio is on and select channel 16 if using a VHF radio or frequency 2182 kHz if using a SSB radio.
2. Press the transmit button and speak slowly, clearly, and calmly and say, "MAYDAY - MAYDAY - MAYDAY."
3. Say, "This is (your vessel name and call sign)" and repeat 3 times.
4. Give your present position (latitude and longitude) if you know it, or describe any navigational aids or landmarks you are near.
5. State the nature of your distress (e.g., fire, grounding, medical emergency, etc.).
6. Give the number of persons aboard and condition of any injured.
7. Describe the amount and type of survival gear on board (PFDs, liferaft, etc)
8. Briefly describe your vessel providing length, type, hull, and colors.
9. End your message by saying, "This is (vessel name and call sign) over."
10. Release the microphone and listen: Someone should answer. If you do not receive an answer, repeat the above procedure. If there is still no answer, try another channel and begin again.

If your situation permits, stand by your radio to provide information as requested (e.g., closest landmarks, water depth, etc.).

20.7.1.6 Other Equipment

Watertight and weather tight enclosures - Be sure you know the location of all watertight and weather tight closures (e.g. port holes/port lights), and how to use them. Both watertight

and weather tight closures should be inspected regularly. Report any defects to the master or operator immediately. Gaskets should never be painted.

Personal survival kit - The personal survival kit must be light and small enough so it's always with you (e.g., attached to your PFD). Personal survival kit contents depend on the individual, environment and activity. However, the four essential elements of a survival kit are something to provide **shelter** (e.g., building aids such as string), **signals**, items to meet **personal health** needs (e.g., medications) and a **fire-starter**.

Comfort kit (also known as a ditch or abandon ship kit) – Includes extra items that would be “nice to have” such as extra water, extra food, additional signaling devices, Radios, flashlight, etc. The Comfort Kit should be accessible. Ideally, this would be in a float free position and be waterproof and sturdy. However, don't count on it being there when you need it; this is not a personal survival kit.

20.8 Seven Steps to Survival

The United States Coast Guard assembled the Seven Steps to Survival from the personal experiences of those who survived emergency situations. Committing the seven steps to survival to memory should be one of the goals of every observer learning how to survive at sea (Jensen and Dzugan 2005). Every time the situation changes (e.g., boarding a raft, reaching land, etc.), the seven steps begin again.

1. **Recognition** - You must quickly recognize the seriousness of the situation and that your life is in danger. Hesitation or denial may cost your life.
2. **Inventory** - Stop and assess the situation. Decide what you have that will help you survive and what are the hindrances. Inventory people including skills, injuries and mental state as well as equipment and the environment (e.g., weather, currents). Doing so will help you to make good decisions that will help you survive.
3. **Shelter** – Effective shelters provide insulation (or shade in the tropics) and protection from the elements. Clothes are your primary shelter. Shelter can also be an immersion suit, a raft, or an overturned vessel—anything that protects you against the loss (or gain) of body heat. Water can take heat away from your body much quicker than air, so shelter also helps you keep as dry as possible. High heat loss areas, including the head and neck, need to be protected most. The added buoyancy of a PFD helps to keep your head and neck out of water, therefore conserving heat. In a shore survival situation, the seven steps to survival start over again and shelter is your first priority after you inventory the situation. It takes hours to construct adequate shelter on shore and you must do so as soon as possible.
4. **Signals** - Signals must attract attention and convey a message is a signal. Radios, EPIRBs, and flares are signals carried by vessels. Immersion suits and PFDs sometimes have lights attached. You may have a signal mirror in your personal survival kit. If abandoning ship, anything buoyant that can be tossed overboard may help an aircraft spot your position. **Anything that makes you bigger, brighter, or different from your surroundings is a signal**, so an attempt to gather items that float from a sinking ship should be made. In a shore survival situation, three of anything (fires, buoys, immersions suits on the beach) is an internationally recognized distress signal. Additional features may include hard angles and contrast to the background. Ground signals should be three times as high as wide.

5. **Water** – Water needs increase with any activity. Life rafts have limited rations of water, so it is advised to gather as much as possible before abandoning ship, if time permits. Have a strategy for gathering extra water in an emergency. In a survival situation, there are only three safe sources of water: boiled, packaged or filtered. *Never drink seawater or urine.*
6. **Food** - A person can go without food much longer than without water. Never eat food without water—your body requires water to digest food. Life rafts are supplied with limited food rations. In a shore survival situation, many types of edibles can be found near shore. Almost any animal or green plant in the inter-tidal zone are edible, but avoid mussels or clams—they may cause paralytic shellfish poisoning.
7. **Play** - Studies have shown that mental attitude makes a positive difference in a survival situation. Play is anything that keeps you occupied and prevents your mind from dwelling on the difficulties you are facing. Play could be reading, telling jokes or stories, completing a task, improving your shelter—anything that keeps your mind active and focused.

20.9 Types of emergencies

Emergencies can be split into two types: immediate onset and delayed onset (AMSEA 2006). Immediate onset emergencies, as the name implies, happen suddenly with little or no warning. Examples include explosions, collision, capsizing, or person overboard. Delayed onset emergencies start out slowly and accumulate until the situation becomes life threatening. Regardless of whether an emergency happens quickly or is delayed, human emotions such as fear, panic and depression can be life threatening. For instance, in studies of human responses to emergencies 25% act effectively, 50% are unresponsive, and as many as 25% panic. Fear is a normal reaction in an emergency and has a useful function in keeping us aware in dangerous situations. Panic, however, prevents clear thinking, wastes energy and is an obstacle in setting priorities. Depression can also be a problem when it destroys the will to survive. There are several ways to minimize or eliminate panic, fear, and depression:

- Accept the fact that an emergency situation can happen to you
- Make contingency plans
- Acquire relevant training. It will give you procedures to follow that will increase confidence. Practice reduces panic and drills are the best way to practice.
- Recognize your ability to be creative, innovative, and resourceful in a survival situation
- Develop a positive mental attitude. Think like a survivor, not a victim!
- Do something to improve your situation.

The four primary emergencies that occur on board are person overboard, fire, flooding and abandon ship. Each will be discussed individually.

20.9.1 Person Overboard

First thing to remember is to take steps to never fall overboard by avoiding unsafe deck behavior and working on deck when it is not safe.

If you are the one overboard:

1. Attract attention, yell, whistle, etc.
2. Assume the H.E.L.P. position (Figure 20-9). The **H**eat **E**scape **L**essening **P**osition protects the critical body areas and slows down the loss of heat. If two or more people are in the water together, form a **HUDDLE** (Figure 20-9) so that the sides of your bodies are close together.
3. Keep clothes and boots on. They will increase insulation and will not pull you down.
4. Grab any floating objects that will make you more buoyant and more visible.
5. Stay as still as you can.

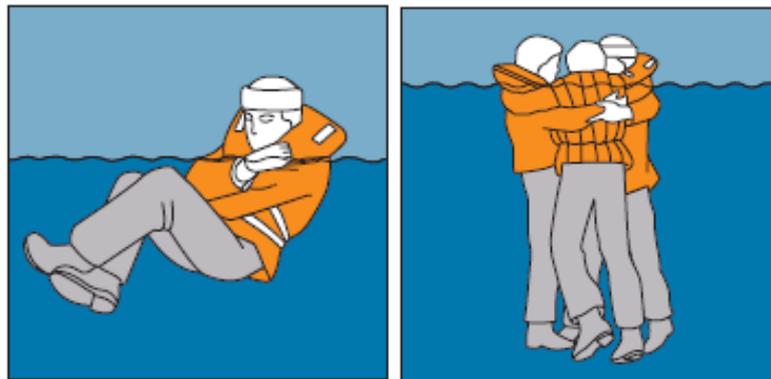


Figure 20-9 H.E.L.P. (left) and HUDDLE (right) positions. (Images from (Transport Canada 2003)).

If you are aboard a vessel and someone goes overboard:

1. Mark position with anything that floats and mark waypoint on GPS if possible. (Many vessels have a man overboard (M.O.B.) button especially for these situations)
2. Sound the alarm (typically 3 blasts for the letter “O” (morse code) repeated at least 4 times)
3. Post a lookout. Eyes and pointing hand should **never** leave victim.
4. Maneuver vessel to return to victim.
5. Rescue swimmer dons immersion suit with rescue line attached. Prepare to launch rescue craft if needed.
6. Recover victim. Bring aboard (horizontally if it takes no more time) over the side or up the stern ramp of the vessel.
7. Treat victim. Look for signs of hypothermia and hyperthermia as well as any other injuries.
8. Contact the Port Authority, Navy, Merchant Marine unit or any vessels in area if victim is not found immediately, or medical advice/attention is needed.

20.9.2 Fire

It is wise to know where fire extinguishers and exits are located in every area of the vessel—especially those areas in which you spend time. Each fire extinguisher has a small quantity of fire retardant, so back-up extinguishers should be located and brought to the fire as soon as the fire is discovered. To effectively use a fire extinguisher, fire in short bursts in a low, sweeping motion (Figure 20-10). Keep your body low to avoid smoke inhalation and heat. Do not attempt to fight any fire alone (except a small fire e.g. a wastebasket fire).

Procedures include:

1. Sound Alarm: notify wheelhouse and signal alarm (typically 1 long continuous blast 10 seconds or more)
2. De-energize electrical system to area.

3. Close doors to stop the spread of fire and smoke.
4. Fight fire.
 - Smother, cut off air supply*
 - Cool*
 - Interrupt chain reaction*
 - Jettison*
5. Account for personnel.
6. Establish boundary perimeter.
 - Visualize area as a box*
 - Know what is on all **six** sides of the box!*
7. Prepare in case of abandon ship.
8. Ensure everyone knows how to use fire extinguishers.
 - Proper type for fire*
 - Locations*
 - Ensure extinguishers can be found in the dark*

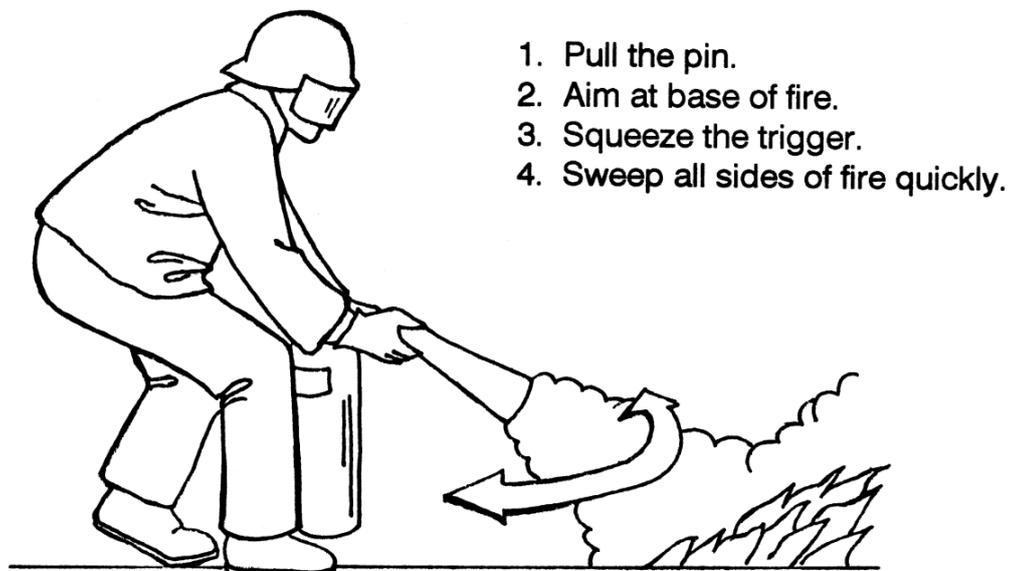


Figure 20-10 The four steps for using a fire extinguisher (P.A.S.S.). Image courtesy of AMSEA.

20.9.3 Flooding

When a vessel is taking on water, usually the crew has time to try and solve the problem. Malfunctioning pumps or leaks in through-hull fittings are not uncommon, and can usually be fixed with equipment on board. If the flooding condition worsens, pumps can sometimes be delivered to a vessel via aircraft (area dependent). Observers have limited roles in these types of vessel emergencies but should be prepared to assist if needed.

Procedures:

1. Sound alarm (typically 1 long continuous last 10 seconds or more)
2. Close all watertight hatches, doors and air vents
3. Plug holes.
4. Use pumps and buckets of water.
5. Check lines, through-hull fittings and hull for leakage.

6. Maintain stability of vessel
7. Prepare in case of abandon ship.

Remember: **PCP -- PLUG! CLOSE! PUMP!**

20.9.4 Abandon Ship

The worst possible emergency requires a person to give up their shelter—the vessel. Never abandon the ship unless it is certain that being on board the vessel is more dangerous than being in the water. Lives have been lost because ships have been abandoned too soon during fires or flooding. Knowing the nearest exits, mustering areas, life raft locations, immersion suit locations, EPIRB locations, and the emergency equipment available become critical factors in helping you survive an abandon ship emergency.

General Abandon Ship procedures are as follows:

1. Sound Alarm (at least 7 short blasts followed by 1 long blast 10 seconds or more)
2. Send Mayday.
3. Don immersion suits/PFDs. Put on or bring extra warm clothing if possible.
4. Prepare to launch life raft. Attach painter line to vessel.
5. Assemble signal devices to take into life raft. These include EPIRBs, flares, smoke signals, flashlights, handheld radios, etc.
6. Get first aid kit, water, food, and abandon ship (survival) kit.
7. Muster at embarkation station.
8. When sinking is imminent or remaining on board is inappropriate, launch and board life raft.
9. Keep painter attached to vessel. Be prepared to cut painter immediately if there is risk to life raft or vessel sinks
10. Activate EPIRB and commence 7 Steps to Survival.

Boarding the life raft: Ideally, you will want to board the raft from the vessel without entering the water. Enter raft one person at a time and assist the next person boarding.

Sometimes the life raft inflates upside down (Figure 20-11). In this case, someone will need to enter the water and follow these steps:

1. Go to side with CO₂ cartridge and orient life raft so that you are facing the wind.
2. Climb the righting strap (looks like a ladder or rope with loops) with your back arched and pull raft back.
3. You want to land on your back. If you do not clear the raft as it comes down, don't panic – either continue to pull yourself from under the raft or if you know you aren't going to clear, put a hand up as it falls to make an air space between the floor and you. Take a breath and calmly pull yourself out from under the raft.



Figure 20-11 Righting the life raft. Wind direction represented by the arrows. Image from (Transport Canada 2003).

Implement the STAY Rules for Surviving an Emergency

Stay afloat – wear your PFD at all times and stay on top of floating objects.

Stay dry – if possible stay with the vessel or board life raft directly.

Stay still – conserve heat loss.

Stay warm – get out of the water and protect the high heat loss areas.

Stay with the boat – the boat can keep you afloat and makes you easier to find.

Stay together – makes you easier to find, improves morale & if in HUDDLE position, increases warmth.

Stay sober – alcohol increases heat loss while decreasing judgment and coordination.

20.10 Psychology of Survival

Often the reason some people survive emergencies and others don't is simply the “will to live” or the “will to survive”. Maintaining a positive attitude in an emergency situation and trying to regain a sense of control over your situation is very important to survive.

Some common themes that run through the stories of survivors:

- Accept your situation, but don't give in to it.
- Act like a survivor, not like a victim.
- Don't give up.
- Be positive.
- Have a plan.
- Pray
- Play. Keep a positive attitude, and find the will to live!

20.11 Forms/Instructions

20.11.1 Safety Checklist

The Safety Checklist is in the Observer Logbook and is designed to aid in familiarizing observers with safety procedures and equipment **before** departing the dock for your first trip. The Safety Checklist must be completed upon boarding (Figure 20-12).

Field	Definition
Pre-Departure questions	
Were you informed of the general safety procedures for the vessel?	Circle Yes or No
Were alarm signals demonstrated for each type of emergency?	Circle Yes or No
Did you examine escape routes from accommodations and work areas?	Circle Yes or No
Where is your muster station in case of an emergency?	Examples include wheelhouse, back deck, etc.
Who is the person in charge of medical treatment?	E.g. captain, mate
Were you shown the location of radios and provided with instructions for use?	Circle Yes or No
Were you shown the location of navigation equipment and provided with instructions for use?	Circle Yes or No
Liferafts / Lifeboats	
Model	Record the brand and/or model of the liferaft or life boat. For each liferaft, note the capacity (# of persons the raft is rated to carry), the last inspection date, note the mounting location and whether its mounted in a position where it will float free (circle Yes or No). Is a hydrostatic release present and if present, is it attached correctly?
Was there adequate life raft capacity for all on board?	Circle Yes or No
Was survival craft packed with a SOLAS kit?	Circle Type A, Type B, Other or No
EPIRBs	
Model	Record the brand and/or model of the EPIRB. For each EPIRB, record the battery expiration date, note the mounting location, is it a category I or II model, and whether its mounted in a position where it will float free (circle Yes or No).
Station bill	Check whether a station bill is present or absent. A station bill indicates where to muster and which crew are responsible for various activities in case of an emergency.
Fire extinguishers	Check whether present or absent. Are fire extinguishers located in all main areas and corridors? Circle yes or no.

- First aid equipment Check whether present or absent.
- High water alarm Check whether present or absent.
- Watertight doors Check whether present or absent. Circle yes or no for whether they close properly (i.e., they form a seal).
- Distress flares For each flare type (parachute, smoke and hand), not the number on board, whether or not they are expired, and their storage location.
- Floation devices Record the number of each type (PFDs, life rings/slings and immersion suits) that are on board.
- Were there adequate PFDs for all crew on board? Circle Yes or No
- Drills Circle Yes or No for each type of drill (fire, man overboard, abandon ship and flooding) and not the date the drill occurred. This section is completed at the end of the trip.
- Did you participate in the drills? Circle Yes or No
- Other comments Provide additional comments for future observers or any other safety concerns you had on this vessel.

Safety Checklist

Pre-Departure (Complete before you leave port)							
Were you informed of the general safety procedures for the vessel?							<input checked="" type="radio"/> Yes / <input type="radio"/> No
Were alarm signals demonstrated for each type of emergency?							<input checked="" type="radio"/> Yes / <input type="radio"/> No
Did you examine escape routes from accommodations and work areas?							<input checked="" type="radio"/> Yes / <input type="radio"/> No
Where is your muster station in case of an emergency?				<i>wheelhouse</i>			
Who is the person in charge of medical treatment?				<i>2nd mate</i>			
Where you shown the location of radios and provided with instructions for use?							<input checked="" type="radio"/> Yes <input type="radio"/> No
Where you shown the location of navigation equipment and provided with instructions on use?							<input checked="" type="radio"/> Yes <input type="radio"/> No
Survival craft		Capacity (#persons)	Last inspection date	Location	Float free?	Hydrostatic release	
Model						Present	Attach properly
<i>Youlong KHD</i>	<i>12</i>	<i>01/01/09</i>	<i>above wheelhouse</i>	<input checked="" type="radio"/> Y / <input type="radio"/> N	<input type="radio"/> Y / <input checked="" type="radio"/> N	<input type="radio"/> Y / <input checked="" type="radio"/> N	
Model				Y / N	Y / N	Y / N	
Was there adequate life raft capacity for all on board? Yes <input checked="" type="radio"/> No <input type="radio"/>							
Was survival craft packed with a SOLAS kit? A / B <input checked="" type="radio"/> Other <input type="radio"/> No <input type="radio"/>							
EPIRBs		Battery expire date	Location	Category I / II	Float free?		
<i>McMurdo Smartfind (406)</i>	<i>01/01/11</i>	<i>Outside, 1-level above wheelhouse</i>	<i>II</i>	<input type="radio"/> Y / <input checked="" type="radio"/> N			
Model				Y / N			
Check if Present or Absent		Present	Absent	Unknown			
Station bill		<input checked="" type="checkbox"/>			In main areas/corridors? <input checked="" type="radio"/> Yes / <input type="radio"/> No		
Fire extinguishers		<input checked="" type="checkbox"/>					
First aid equipment		<input checked="" type="checkbox"/>					
High water alarm				<input checked="" type="checkbox"/>	Do they close properly? <input checked="" type="radio"/> Yes / <input type="radio"/> No		
Watertight doors		<input checked="" type="checkbox"/>					
Distress flares		#	Expired?	Location	Flotation devices		
Parachute	<i>3</i>	<input type="radio"/> Y / <input checked="" type="radio"/> N	<i>Wheelhouse (waterproof box)</i>	# Life rings / slings		<i>2</i>	
Smoke	<i>5</i>	<input type="radio"/> Y / <input checked="" type="radio"/> N	<i>Wheelhouse (waterproof box)</i>	# PFDs		<i>10</i>	
Hand	<i>9</i>	<input type="radio"/> Y / <input checked="" type="radio"/> N	<i>Wheelhouse (waterproof box)</i>	# Immersion suits		<i>0</i>	
		Y / N					
Were there adequate PFDs for all on board? Yes <input checked="" type="radio"/> No <input type="radio"/>							
Drills (Complete post-trip)							
	Fire	Man overboard	Abandon ship	Flooding	Other?		
Performed?	<input type="radio"/> Y / <input checked="" type="radio"/> N	<input checked="" type="radio"/> Y / <input type="radio"/> N	<input checked="" type="radio"/> Y / <input type="radio"/> N	<input type="radio"/> Y / <input checked="" type="radio"/> N			
Date (dd/mm/yy)	<i>22/12/09</i>	<i>29/12/09</i>	<i>22/12/09</i>	<i>29/12/09</i>			
Did you participate in drills? <input checked="" type="radio"/> Yes / <input type="radio"/> No							
Other Comments: <i>There was an extra engineer on board so liferaft capacity was be exceeded by 1; life raft packed w/ a vessel packed kit (sounded similar to Solas B based on description; did not participate other than going to muster station for fire & flooding drills;</i>							

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Figure 20-12 Example of completed Safety Checklist

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Appendix 1. Country-Specific Information

Appendix 2. Country-Specific Contacts

Appendix 3. Country-Specific Vessel Names / Codes

Appendix 4. List of Known IUU Vessels

Last updated June 29, 2010.

CCAMLR	ICCAT	NEAFC	NAFO	Name	Previous Names	IMO Number	IRCS	Flag	Previous Flag
	x			Abdi Baba 1	Erol Bulbul	Unknown	Unknown	Bolivia	Turkey
		x	x	Alboran II	White Enterprise	7306570	4VPO	St. Kitts & Nevis	Panama
x				Aldabra		Unknown	5VAA2	Togo	
x				Amorinn	Noemi, Lome, Iceberg II	7036345	5VAN9	Togo	Belize, Togo
x				Bigaro	Lugalpesca, Hoking, Sargo	Unknown	5VBO3	Unknown	Uruguay, Togo
	x			Bigeye		Unknown	FN 003883	Unknown	
	x			Bravo		Unknown	T8AN3	Unknown	
x				Carmela	Mare, Notre Dame, Golden Sun, Gold Dragon	6803961	Unknown	Unknown	Namibia, Bolivia, Equatorial Guinea, Togo
	x			Cevahir	Salih Bayraktar	Unknown	Unknown	Bolivia	Turkey
x				Challenge	Mila, Perseverance	6622642	HO5381	Panama	UK, Equatorial Guinea
x				Chu Lim	Piscis, South Bay, Gale, Ulyses, Thor 33, Ying Peng	8713392	Unknown	Unknown	Uruguay, Equatorial Guinea, Dem. People's Rep. Korea, Togo
			x	Cliff	Ice Bay, Reefer Bay	8028424	XUVV9	Cambodia	
x				Constant	Isla Graciosa, Tropic	6607666	3CM2191	Equatorial Guinea	South Africa, Equatorial Guinea
x				Corvus	Dorita, Magnus, Thule, Eolo, Red Moon, Black Moon, Ina Maka, Galaxy	7322897	3ESP3	Panama	Uruguay, St. Vincent & Grenadines, Equatorial Guinea, Dem. People's Rep. Korea
	x			Daniaa	Carlos	Unknown	Unknown	Unknown	Guinée Rep
		x	x	Dolphin	Ognevka	8422852	UCHF	Russian Federation	Georgia
x				Draco-1	Carran, Hammer, Chilbo San 33, Liberty	9042001	XUUG8	Cambodia	Uruguay, Togo, Dem. People's Republic Korea, Panama
		x		Eros Dos	Furabolos	8604668	HO-5115	Panama	
			x	Furabolos		8604668		Unknown	

	x			Gala 1	MANARA II, ROAGAN	Unknown	Unknown	Unknown	Libya
x				Good Hope	Sea Ranger V, Toto	7020126	5NMU	Nigeria	Belize
		x	x	Gorilero	Gran Sol	6719419	9LYF36	Sierra Leone	Panama
x				Heavy Sea	Serpa Uno, Keta, Duero	7322926	3ENF8	Panama	Uruguay, Panama
		x	x	Iannis 1		7332218	H03374	Panama	
	x			Lila No. 10		Unknown	Unknown	Unknown	Panama
x				Limpopo	Lena, Alos, Ross	7388267	Unknown	Unknown	Seychelles, Ghana, Togo
	x			Madura 2		Unknown	Unknown	Unknown	
	x			Madura 3		Unknown	Unknown	Unknown	
		x	x	Maine		8707240	3XLU	Guinea Conakry	
	x			Maria		Unknown	FN 003882	Unknown	
	x			Melilla No. 101		Unknown	Unknown	Unknown	Panama
	x			Melilla No. 103		Unknown	Unknown	Unknown	Panama
		x	x	Murtosa		7385174	ZDBLI	Togo	
		x	x	Nemanskiy		8721595	Unknown	Unknown	
			x	Nicolay Chudotvoretz	Santa Nikolas	8421937	UDIB	Russian Federation	Honduras
	x			No 2 Choyo		Unknown	Unknown	Unknown	Honduras
	x			No. 101 Gloria	Golden Lake	Unknown	Unknown	Unknown	Panama
x				North Ocean	Boston, Boston-1, Jian Yuan	9230658	BZZW5	China	Bolivia, Russia, Georgia
	x			Ocean Diamond		Unknown	Unknown	Unknown	
	x			Oriente No. 7		Unknown	Unknown	Unknown	Honduras
		x	x	Red	Kabou	6706084	3EJ13	Panama	Guinea Conakry
x				Rex	Cisne Azul, Viking, Inca, Condor	6818930	Unknown	Unknown	Belize, Seychelles, Togo
	x			Sharon 1	Manara I, Poseidon	Unknown	Unknown	Unknown	Libya
	x			Southern Star 136		Unknown	Unknown	Unknown	St. Vincent and Grenadines
		x	x	Sunny Jane		7347407	V3KG2	Unknown	Belize
x				Trosky	Paloma V	9319856	Unknown	Cambodia	Uruguay, Namibia
x				Typhoon-1	Arctic Ranger, Rubin	6905408	5VTN6	Togo	UK, Seychelles
x				West Ocean	Darwin, Darwin-1, Kiev	9230672	BZTX8	China	Bolivia, Russia, Georgia
		x	x	Yucatan Basin	Enxembre, Fonte Nova, Jawhara	7321374	3EGV5	Panama	Morocco
x				Zeus	Kinsho Maru, No.18, Triton-1	9037537	Unknown	Unknown	Japan, Sierra Leone, Togo

Appendix 5. Country & IRCS Codes

FAO ISO list of 3-letter country codes (<http://www.fao.org/countryprofiles/iso3list.asp>) and International Radio Call Sign prefixes (<http://www.smeter.net/stations/call-prefixes-by-country.php>) issued to each country.

Country or Organization	Country Code	Call Sign Series	Country or Organization	Country Code	Call Sign Series	Country or Organization	Country Code	Call Sign Series
Afghanistan	AFG	T6A-T6Z	Comoros	COM	D6A-D6Z	Guinea-Bissau	GNB	J5A-J5Z
Albania	ALB	YAA-YAZ	Congo (DRC)	COD	90A-9TZ	Guyana	GUY	8RA-8RZ
Algeria	DZA	ZAA-ZAZ	Congo	COG	TNA-TNZ	Haiti	HTI	HHA-HHZ
		7RA-7RZ	Cook Islands	COK	E5A-E5Z			4VA-4VZ
Andorra	AND	7TA-7YZ	Costa Rica	CRI	TEA-TEZ	Honduras	HND	HQA-HRZ
Angola	AGO	C3A-C3Z	Côte d'Ivoire	CIV	TIA-TIZ	Hong Kong	HKG	VRA-VRZ
Antigua and Barbuda	ATG	D2A-D3Z	Croatia	HRV	TUA-TUZ	Hungary	HUN	HAA-HAZ
Argentine Republic	ARG	V2A-V2Z	Cuba	CUB	9AA-9AZ			ICeland
		AYA-AZZ			CLA-CMZ	India	IND	ATA-AWZ
		LOA-LWZ			COA-COZ			VTA-VWZ
L2A-L9Z	T4A-T4Z	8TA-8YZ						
Armenia	ARM	EKA-EKZ	Cyprus	CYP	C4A-C4Z	Indonesia	IDN	JZA-JZZ
Australia	AUS	AXA-AXZ			H2A-H2Z			PKA-POZ
		VHA-VNZ			P3A-P3Z			YBA-YHZ
Austria	AUT	VZA-VZZ	Czech Republic	CZE	OKA-OLZ			7AA-7IZ
Azerbaijani Republic	AZE	OEA-OEZ	Denmark	DNK	OUA-OZZ	International Civil Aviation Organization		8AA-8IZ
Bahamas	BHS	4JA-4KZ			XPA-XPZ		4YA-4YZ	
Bahrain	BHR	C6A-C6Z			5PA-5OZ	Iran	IRN	EPA-EQZ
Bangladesh	BGD	A9A-A9Z	Djibouti	DJI	J2A-J2Z			9BA-9DZ
Barbados	BRB	S2A-S3Z	Dominica	DMA	J7A-J7Z	Iraq	IRQ	HNA-HNZ
Belarus	BLR	8PA-8PZ	Dominican Republic	DOM	HIA-HIZ	Ireland	IRL	YIA-YIZ
Belgium	BEL	EUA-EWZ	Ecuador	ECU	HCA-HDZ	Israel	ISR	4XA-4XZ
Belize	BLZ	ONA-OTZ	Egypt	EGY	SSA-SSM	Italy	ITA	4ZA-4ZZ
Benin	BEN	V3A-V3Z			SUA-SUZ	6AA-6BZ	Jamaica	JAM
Bhutan	BTN	TYA-TYZ	El Salvador	SLV	HUA-HUZ	Japan	JPN	JAA-JSZ
Bolivia	BOL	A5A-A5Z			YSA-YSZ			JAA-JSZ
Bosnia and Herzegovina	BIH	CPA-CPZ	Equatorial Guinea	GNQ	3CA-3CZ			8JA-8NZ
Botswana	BWA	A2A-A2Z	Eritrea	ERI	E3A-E3Z	Jordan	JOR	JYA-JYZ
Brazil	BRA	8OA-8OZ	Estonia	EST	ESA-ESZ	Kazakhstan	KAZ	UNA-UOZ
		PPA-PYZ	Ethiopia	ETH	9EA-9FZ	Kenya	KEN	5YA-5ZZ
ZVA-ZZZ	Fiji	FJI			3DN-3DZ	Kiribati	KIR	T3A-T3Z
Brunei Darussalam	BRN	V8A-V8Z	Finland	FIN	OFA-OJZ	Dem People's Rep of Korea	PRK	HMA-HMZ
Bulgaria	BGR	LZA-LZZ	France	FRA	FAA-FZZ	Republic of Korea	KOR	P5A-P9Z
Burkina Faso	BFA	XTA-XTZ			HWA-HYZ			DSA-DTZ
Burundi	BDI	9UA-9UZ	Gabonese Republic	GAB	THA-THZ	Kuwait	KWT	D7A-D9Z
Cambodia	KHM	XUA-XUZ			CYA-CZZ			TKA-TKZ
Canada	CAN	TJA-TJZ	Gambia	GMB	TMA-TMZ	Kyrgyz Republic	KGZ	6KA-6NZ
		CFA-CKZ			TRA-TRZ			9KA-9KZ
		CYA-CZZ			C5A-C5Z			XWA-XWZ
		VAA-VGZ			4LA-4LZ			EXA-EXZ
		VOA-VOZ	Georgia	GEO	4LA-4LZ	Laos	LAO	9KA-9KZ
		VXA-VYZ			TVA-TXZ	Latvia	LVA	EXA-EXZ
Cape Verde	CPV	XJA-XOZ			TRA-TRZ	Lebanon	LBN	EXA-EXZ
Central African Republic	CAF	D4A-D4Z			Y2A-Y9Z	Lesotho	LSO	EXA-EXZ
Chad	TCD	TLA-TLZ	Germany	DEU	DAA-DRZ	Liberia	LBR	7PA-7PZ
		TTA-TTZ			Y2A-Y9Z			A8A-A8Z
Chile	CHL	CAA-CEZ	Ghana	GHA	9GA-9GZ			D5A-D5Z
		XQA-XRZ	Greece	GRC	J4A-J4Z			ELA-ELZ
		3GA-3GZ	Grenada	GRD	SVA-SZZ			5LA-5MZ
China	CHN	BAA-BZZ	Guatemala	GTM	J3A-J3Z	Libya	LBY	6ZA-6ZZ
		XSA-XSZ	Guinea	GIN	TDA-TDZ			5AA-5AZ
Colombia	COL	3HA-3UZ			TGA-TGZ	Lithuania	LTU	LYA-LYZ
		HJA-HKZ			3XA-3XZ	Luxembourg	LUX	LXA-LXZ
		5JA-5KZ						

Country or Organization	Country Code	Call Sign Series	Country or Organization	Country Code	Call Sign Series	Country or Organization	Country Code	Call Sign Series
Macedonia Former	MKD	Z3A-Z3Z	Paraguay	PRY	ZPA-ZPZ	Switzerland	CHE	HBA-HBZ
Madagascar	MDG	5RA-5SZ	Peru	PER	OAA-OCZ			HEA-HEZ
		6XA-6XZ			4TA-4TZ	Syrian Arab Republic	SYR	YKA-YKZ
Malawi	MWI	7QA-7QZ	Philippines	PHL	DUA-DZZ		6CA-6CZ	
Malaysia	MYS	9MA-9MZ			4DA-4IZ	Tajikistan	TJK	EYA-EYZ
		9WA-9WZ	HFA-HFZ	Tanzania	TZA	5HA-5IZ		
Maldives	MDV	8QA-8QZ	Poland	POL	SNA-SRZ	Thailand	THA	E2A-E2Z
Mali	MLI	TZA-TZZ			3ZA-3ZZ			HSA-HSZ
Malta	MLT	9HA-9HZ	Portugal	PRT	CQA-CUZ	Timor - Leste	TLS	4WA-4WZ
Marshall Islands	MHL	V7A-V7Z	Qatar	QAT	A7A-A7Z	Togolese Republic	TGO	5VA-5VZ
Mauritania	MRT	5TA-5TZ	Romania	ROU	YOA-YRZ	Tonga	TON	A3A-A3Z
Mauritius	MUS	3BA-3BZ	Russian Federation	RUS	RAA-RZZ	Trinidad and Tobago	TTO	9YA-9YZ
		XAA-XIZ			UAA-UIZ			TSA-TSZ
Mexico	MEX	4AA-4CZ	Rwandese Republic	RWA	9XA-9XZ	Tunisia	TUN	3VA-3VZ
		6DA-6JZ	Saint Kitts and Nevis	KNA	V4A-V4Z			TAA-TCZ
Micronesia	FSM	V6A-V6Z	Saint Lucia	LCA	J6A-J6Z	Turkey	TUR	YMA-YMZ
Moldova	MDA	ERA-ERZ	Saint Vincent and the Grenadines	VCT	J8A-J8Z	Turkmenistan	TKM	EZA-EZZ
Monaco	MCO	3AA-3AZ	Samoa	WSM	5WA-5WZ	Tuvalu	TUV	T2A-T2Z
Mongolia	MNG	JTA-JVZ	San Marino	SMR	T7A-T7Z	Uganda	UGA	5XA-5XZ
Morocco	MAR	CNA-CNZ	Sao Tome and Principe	STP	S9A-S9Z	Ukraine	UKR	EMA-EOZ
		5CA-5GZ			HZA-HZZ			URA-UZZ
Mozambique	MOZ	C8A-C9Z	Saudi Arabia	SAU	7ZA-7ZZ	United Arab Emirates	ARE	A6A-A6Z
Myanmar	MMR	XYA-XZZ			8ZA-8ZZ			GAA-GZZ
Namibia	NAM	V5A-V5Z	Senegal	SEN	6VA-6WZ	United Kingdom of Great Britain and Northern Ireland	GBR	MAA-MZZ
Nauru	NRU	C2A-C2Z	Serbia & Montenegro	SRB & MNE	YTA-YUZ			VPA-VQZ
Nepal	NPL	9NA-9NZ			YZA-YZZ			VSA-VSZ
Netherlands	NLD	PAA-PIZ	4NA-4OZ	ZBA-ZJZ				
Netherlands - Aruba	ABW	P4A-P4Z	Seychelles	SYC	S7A-S7Z			ZNA-ZOZ
Netherlands - Netherlands Antilles	ANT	PJA-PJZ	Sierra Leone	SLE	9LA-9LZ			ZQA-ZQZ
New Zealand	NZL	ZKA-ZMZ	Singapore	SGP	S6A-S6Z			2AA-2ZZ
Nicaragua	NIC	HTA-HTZ			9VA-9VZ			United Nations
		H6A-H7Z	OMA-OMZ	United States of America	USA			AAA-ALZ
		YNA-YNZ	S5A-S5Z					NAA-NZZ
Niger	NER	5UA-5UZ	H4A-H4Z			WAA-WZZ		
Nigeria	NGA	5NA-5OZ	Solomon Islands	SLB	T5A-T5Z	KAA-KZZ		
Norway	NOR	JWA-JXZ	Somali Democratic Republic	SOM	6OA-6OZ	Uruguay	URY	CVA-CXZ
		LAA-LNZ	South Africa	ZAF	S8A-S8Z	Uzbekistan	UZB	UJA-UMZ
		3YA-3YZ			ZRA-ZUZ	Vanuatu	VUT	YJA-YJZ
Oman	OMN	A4A-A4Z	Spain	ESP	AMA-AOZ	Vatican City State		HVA-HVZ
Pakistan	PAK	APA-ASZ			EAA-EHZ	Venezuela	VEN	YVA-YYZ
		6PA-6SZ	Sri Lanka	LKA	4PA-4SZ	4MA-4MZ		
Palau	PLW	T8A-T8Z	Sudan	SDN	SSN-STZ	Viet Nam	VNM	XVA-XVZ
Palestinian Authority		E4A-E4Z			6TA-6UZ			3WA-3WZ
Panama	PAN	HOA-HPZ	Suriname	SUR	PZA-PZZ	World Meteorological Organization		C7A-C7Z
		H3A-H3Z	Swaziland	SWZ	3DA-3DM	Yemen	YEM	7OA-7OZ
		H8A-H9Z	Sweden	SWE	SAA-SMZ	Zambia	ZMB	9IA-9JZ
		3EA-3FZ			7SA-7SZ	Zimbabwe	ZWE	Z2A-Z2Z
Papua New Guinea	PNG	P2A-P2Z			8SA-8SZ			

Appendix 6. Fishing Gear Codes

Full list of International Standard Statistical Classification Of Fishing Gear (ISSCFG; 29 July 1980) codes (FAO 1995).

Gear Categories	Standard Abbreviation	ISSCFG
SURROUNDING NETS		01.0.0
With purse lines (purse seines)	PS	01.1.0
- one boat operated purse seines	PS1	01.1.1
- two boats operated purse seines	PS2	01.1.2
Without purse lines (lampara)	LA	01.2.0
SEINE NETS		02.0.0
Beach seines	SB	02.1.0
Boat or vessel seines	SV	02.2.0
- Danish seines	SDN	02.2.1
- Scottish seines	SSC	02.2.2
- pair seines	SPR	02.2.3
Seine nets (not specified)	SX	02.9.0
TRAWLS		03.0.0
Bottom trawls		03.1.0
- beam trawls	TBB	03.1.1
- otter trawls ¹	OTB/OTM	03.1.2
- pair trawls	PTB	03.1.3
- nephrops trawls	TBN	03.1.4
- shrimp trawls	TBS	03.1.5
- bottom trawls (not specified)	TB	03.1.9
Midwater trawls		03.2.0
- otter trawls ¹	OTM	03.2.1
- pair trawls	PTM	03.2.2
- shrimp trawls	TMS	03.2.3
- midwater trawls (not specified)	TM	03.2.9
Otter twin trawls	OTT	03.3.0
Otter trawls (not specified)	OT	03.4.9
Pair trawls (not specified)	PT	03.5.9
Other trawls (not specified)	TX	03.9.0
DREDGES		04.0.0
Boat dredges	DRB	04.1.0
Hand dredges	DRH	04.2.0
LIFT NETS		05.0.0
Portable lift nets	LNP	05.1.0
Boat-operated lift nets	LNB	05.2.0
Shore-operated stationary lift nets	LNS	05.3.0
Lift nets (not specified)	LN	05.9.0

Gear Categories	Standard Abbreviation	ISSCFG
FALLING GEAR		06.0.0
Cast nets	FCN	06.1.0
Falling gear (not specified)	FG	06.9.0
GILLNETS AND ENTANGLING NETS		07.0.0
Set gillnets (anchored)	GNS	07.1.0
Driftnets	GND	07.2.0
Encircling gillnets	GNC	07.3.0
Fixed gillnets (on stakes)	GNF	07.4.0
Trammel nets	GTR	07.5.0
Combined gillnets-trammel nets	GTN	07.6.0
Gillnets and entangling nets (not specified)	GEN	07.9.0
Gillnets (not specified)	GN	07.9.1
TRAPS		08.0.0
Stationary uncovered pound nets	FPN	08.1.0
Pots	FPO	08.2.0
Fyke nets	FYK	08.3.0
Stow nets	FSN	08.4.0
Barriers, fences, weirs, etc.	FWR	08.5.0
Aerial traps	FAR	08.6.0
Traps (not specified)	FIX	08.9.0
HOOKS AND LINES		09.0.0
Handlines and pole-lines (hand-operated) ²	LHP	09.1.0
Handlines and pole-lines (mechanized) ²	LHM	09.2.0
Set longlines	LLS	09.3.0
Drifting longlines	LLD	09.4.0
Longlines (not specified)	LL	09.5.0
Trolling lines	LTL	09.6.0
Hooks and lines (not specified) ³	LX	09.9.0
GRAPPLING AND WOUNDING		10.0.0
Harpoons	HAR	10.1.0
HARVESTING MACHINES		11.0.0
Pumps	HMP	11.1.0
Mechanized dredges	HMD	11.2.0
Harvesting machines (not specified)	HMX	11.9.0
MISCELLANEOUS GEAR⁴	MIS	20.0.0
RECREATIONAL FISHING GEAR	RG	25.0.0
GEAR NOT KNOWN OR NOT SPECIFIED	NK	99.9.0

¹ Fishery agencies may indicate side and stern bottom, and side and stern midwater trawls, as OTB-1 and OTB-2, and OTM-1 and OTM-2, respectively; ² Including jigging lines; ³ Code LDV for dory-operated line gears will be maintained for historical data purposes; ⁴ This item includes: hand and landing nets, drive-in-nets, gathering by hand with simple hand implements with or without diving equipment, poisons and explosives, trained animals, electrical fishing

Appendix 7. Species Names and Codes

Bony fish are sorted by Family then scientific name. The remaining species are sorted by order, family and scientific name. Species may be listed multiple times for cross-referencing. There are separate tables for fish (including sharks and rays), invertebrates (includes plants and rubbish), marine mammals, marine reptiles and sea birds. Source: (Garibaldi and Busilacchi 2009). Nei, nca and nep = unidentified or unclassified. If code is blank, leave the code blank on your forms but record the species name.

Fish (bony)

Code	Scientific name	English name	French name	Spanish name	Family	Order
FIN	Osteichthyes	Finfishes nei	Poissons téléostéens nca	Peces de escama nep		PISCES MISCELLANEA
MZZ	Osteichthyes	Marine fishes nei	Poissons marins nca	Peces marinos nep		PISCES MISCELLANEA
PRC	Percoidei	Percoids nei	Percoides nca	Percoideos nep		PERCOIDEI
SUR	Acanthuridae	Surgeonfishes nei	Chirurgiens nca	Navajones nep	Acanthuridae	ACANTHUROIDEI
AQH	Acanthurus chirurgus	Doctorfish			Acanthuridae	ACANTHUROIDEI
MDO	Acanthurus monroviae	Monrovia doctorfish	Chirurgien chas-chas	Navajón caniveta	Acanthuridae	ACANTHUROIDEI
NUF	Prionurus biafraensis	Biafra doctorfish			Acanthuridae	ACANTHUROIDEI
ACR	Acropomatidae	Glow-bellies, splitfins nei	Macondes, etc. nca	Farolitos nep	Acropomatidae	PERCOIDEI
	Synagrops bellus	Blackmouth bass	Macondes nca	Macondas, dentiños nep	Acropomatidae	Perciformes
	Synagrops microlepis	Thinlip splitfin	Macondes nca	Macondas, dentiños nep	Acropomatidae	PERCOIDEI
SYS	Synagrops spp	Splitfins nei	Macondes nca	Macondas, dentiños nep	Acropomatidae	PERCOIDEI
BOF	Albula vulpes	Bonefish	Banane de mer	Macabí	Albulidae	ALBULIFORMES
ALU	Albulidae	Bonefishes nei	Albulidés nca	Macabíes nep	Albulidae	ALBULIFORMES
BNF	Pterothrissus belloci	Longfin bonefish	Banane gisu	Macabí badejo	Albulidae	ALBULIFORMES
SLX	Salmonoidei	Salmonoids nei	Salmonoidés nca	Salmonoideos nep		SALMONIFORMES
PZC	Alepocephalidae				Alepocephalidae	SALMONIFORMES
AVS	Alepocephalus australis	small scaled borwn slickhead			Alepocephalidae	SALMONIFORMES
PHO	Alepocephalus rostratus	Risso's smooth-head		Talisman	Alepocephalidae	SALMONIFORMES
ALH	Alepocephalus spp	Slickheads nei		Talismanes	Alepocephalidae	SALMONIFORMES
AQC	Asquamiceps caeruleus				Alepocephalidae	SALMONIFORMES
	Bathytroctes michaelisarsii	Michael Sars smooth-head			Alepocephalidae	SALMONIFORMES

Code	Scientific name	English name	French name	Spanish name	Family	Order
AYM	Bathytroctes microlepis	Smallscale smooth-head			Alepocephalidae	SALMONIFORMES
	Conocara macropterum	Longfin smooth-head			Alepocephalidae	Osmeriformes
	Einara macrolepis	Loosescale smooth-head			Alepocephalidae	Osmeriformes
AEK	Herwigia krefftii	Krefft's smooth-head			Alepocephalidae	SALMONIFORMES
	Leptoderma macrops	Grenadier smooth-head			Alepocephalidae	Osmeriformes
PHP	Photostylus pycnopterus	Starry smooth-head			Alepocephalidae	SALMONIFORMES
	Rouleina maderensis	Madeiran smooth-head			Alepocephalidae	Osmeriformes
	Talismania antillarum	Antillean smooth-head			Alepocephalidae	Osmeriformes
	Talismania homoptera	Hairfin smooth-head			Alepocephalidae	Osmeriformes
	Talismania longifilis	Longtail slickhead			Alepocephalidae	Osmeriformes
	Talismania mekistonema	Threadfin smooth-head			Alepocephalidae	Osmeriformes
AXC	Xenodermichthys copei	Bluntnout smooth-head			Alepocephalidae	SALMONIFORMES
	Alestiidae				Alestiidae	CHARACIFORMES
AEB	Alestes baremoze	Silversides			Alestiidae	CHARACIFORMES
AED	Alestes dentex	Characin			Alestiidae	CHARACIFORMES
ZGC	Gymnammodytes cicereus	Mediterranean sand eel	Cicerelle de Méditerranée	Barrinaire	Ammodytidae	Perciformes
	Phractura fasciata				Amphiliidae	SILURIFORMES
	Antennarius pardalis				Antennariidae	LOPHIIFORMES
	Antennarius striatus	striated frogfish			Antennariidae	LOPHIIFORMES
OGT	Apogon imberbis	Cardinalfish	Coq	Salmonete real	Apogonidae	PERCOIDEI
APO	Apogonidae	Cardinalfishes, etc. nei	Apogonidés nca	Peces cardenal, etc. nep	Apogonidae	PERCOIDEI
	Glossanodon polli		Argentina du Pacifique	Argentina del Pacífico	Argentinidae	Osmeriformes
CAX	Ariidae	Sea catfishes nei	Mâchoirons nca	Bagres marinos nep	Ariidae	SILURIFORMES
AUG	Arius gigas	Giant sea catfish	Mâchoiron géant	Bagre gigante	Ariidae	SILURIFORMES
SMC	Arius heudelotii	Smoothmouth sea catfish	Mâchoiron banderille	Bagre bocalisa	Ariidae	SILURIFORMES
AUR	Arius laticutatus	Rough-head sea catfish			Ariidae	SILURIFORMES
	Arius parkii	Guinean sea catfish			Ariidae	SILURIFORMES
AWX	Arius spp				Ariidae	SILURIFORMES
IMB	Ariomma bondi	Silver-rag driftfish			Ariommatidae	STROMATEOIDEI, ANABANTOIDEI
	Ariomma melanum	Brown driftfish			Ariommatidae	STROMATEOIDEI, ANABANTOIDEI

Code	Scientific name	English name	French name	Spanish name	Family	Order
DRK	Ariomma spp	Driftfishes nei	Ariommes nca	Ariomas nep	Ariommatidae	STROMATEOIDEI, ANABANTOIDEI
AGA	Guentherus altivela	Jellynose; Highfin tadpole fish			Ateleopodidae	LAMPRIFORMES
	Ijimaia loppei	Loppe's tadpole fish			Ateleopodidae	LAMPRIFORMES
	Atherina lopeziana				Atherinidae	ATHERINIFORMES
	Aulopus cadenati	Guinean flagfin			Aulopidae	AULOPIFORMES
ULF	Aulopus filamentosus	Royal flagfin			Aulopidae	AULOPIFORMES
	Balistes capriscus				Balistidae	TETRAODONTIFORMES
TRG	Balistes carolinensis	Grey triggerfish	Baliste cabri	Pejepuerco blanco	Balistidae	TETRAODONTIFORMES
BVP	Balistes punctatus	Blue spotted triggerfish	Baliste à taches bleues	Pejepuerco moteado	Balistidae	TETRAODONTIFORMES
BLV	Balistes vetula	Queen triggerfish			Balistidae	TETRAODONTIFORMES
BIX	Balistes spp				Balistidae	TETRAODONTIFORMES
TRI	Balistidae	Triggerfishes, durgons nei	Balistes nca	Peces-ballesta nep	Balistidae	TETRAODONTIFORMES
CNT	Canthidermis maculatus	Ocean triggerfish			Balistidae	TETRAODONTIFORMES
HJC	Rhinecanthus aculeatus	White-banded triggerfish			Balistidae	TETRAODONTIFORMES
BVY	Bathylagidae	Deep-sea smelts nei			Bathylagidae	Osmeriformes
	Bathylagoides argyrogaster	Silver deepsea smelt			Bathylagidae	Osmeriformes
BBL	Batrachoides liberiensis	Hairy toadfish			Batrachoididae	BATRACHOIDIFORMES
TDF	Batrachoides spp	Toadfishes nei	Crapauds nca	Sapos nep	Batrachoididae	BATRACHOIDIFORMES
TFD	Batrachoididae	Toadfishes, etc. nei	Crapauds, etc. nca	Sapos, etc. nep	Batrachoididae	BATRACHOIDIFORMES
BHD	Halobatrachus didactylus	Lusitanian toadfish	Crapaud-lusitanien	Sapo lusitánico	Batrachoididae	BATRACHOIDIFORMES
BPE	Perulibatrachus elminensis	Guinean toadfish			Batrachoididae	BATRACHOIDIFORMES
	Perulibatrachus rosignoli	Rosignol toadfish			Batrachoididae	BATRACHOIDIFORMES
BAF	Ablennes hians	Flat needlefish	Orphie plate	Agujón sable	Belonidae	BELONIFORMES
BEN	Belonidae	Needlefishes, etc. nei	Aiguilles, orphies nca	Agujones, maraos nep	Belonidae	BELONIFORMES
	Strongylura senegalensis	Senegal needlefish			Belonidae	BELONIFORMES
AND	Tylosurus acus	Agujon needlefish	Aiguille voyeuse	Marao ojón (=Aguja imperial)	Belonidae	BELONIFORMES
BTS	Tylosurus crocodilus crocodilus	Hound needlefish	Aiguille crocodile	Marao lisero	Belonidae	BELONIFORMES
NED	Tylosurus spp	Needlefishes nei	Aiguilles nca	Maraos nep	Belonidae	BELONIFORMES

Code	Scientific name	English name	French name	Spanish name	Family	Order
BLE	Blenniidae	Combtooth blennies	Blennies(=Baveuses)	Babosas	Blenniidae	Perciformes
	<i>Blennius normani</i>				Blenniidae	Perciformes
EOC	<i>Entomacrodus cadenati</i>	West African rockhopper			Blenniidae	Perciformes
HYQ	<i>Hypoleurochilus aequipinnis</i>	Oyster blenny			Blenniidae	Perciformes
	<i>Hypoleurochilus langi</i>				Blenniidae	Perciformes
	<i>Microlipophrys bauchotae</i>				Blenniidae	Perciformes
	<i>Lipophrys velifer</i>				Blenniidae	Perciformes
	<i>Parablennius dialloi</i>				Blenniidae	Perciformes
	<i>Parablennius goreensis</i>				Blenniidae	Perciformes
	<i>Parablennius incognitus</i>				Blenniidae	Perciformes
	<i>Parablennius parvicornis</i>	Rock-pool blenny			Blenniidae	Perciformes
	<i>Parablennius tentacularis</i>	Tentacled blenny			Blenniidae	Perciformes
	<i>Parablennius verryckeni</i>				Blenniidae	Perciformes
YST	<i>Paralipophrys (Lipophrys) trigloides</i>				Blenniidae	Perciformes
LLR	<i>Scartella cristata</i>	Molly miller			Blenniidae	Perciformes
	<i>Spaniblennius clandestinus</i>				Blenniidae	Perciformes
FLX	Pleuronectiformes	Flatfishes nei	Poissons plats nca	Peces planos nep		PLEURONECTIFORMES
RGK	<i>Arnoglossus capensis</i>	Cape scaldfish			Bothidae	PLEURONECTIFORMES
RLI	<i>Arnoglossus imperialis</i>	Imperial scaldfish			Bothidae	PLEURONECTIFORMES
MSF	<i>Arnoglossus laterna</i>	Mediterranean scaldfish	Arnoglosse de Méditerranée	Serrandell	Bothidae	PLEURONECTIFORMES
RNH	<i>Arnoglossus thori</i>	Thor's scaldfish			Bothidae	PLEURONECTIFORMES
LEF	Bothidae	Lefteye flounders nei	Arnoglosses, rombous nca	Rodaballos, rombos, etc. nep	Bothidae	PLEURONECTIFORMES
OUB	<i>Bothus podas</i>	Wide-eyed flounder			Bothidae	PLEURONECTIFORMES
	<i>Monolene mertensi</i>	Merten's moonflounder			Bothidae	PLEURONECTIFORMES
TIS	Branchiostegidae	Tilefishes nei	Tiles nca	Blanquillos, paletas nep	Branchiostegidae	PERCOIDEI
BMA	<i>Bregmaceros atlanticus</i>	Antenna codlet			Bregmacerotidae	GADIFORMES
	<i>Bregmaceros nectabanus</i>	Smallscale codlet			Bregmacerotidae	GADIFORMES
	<i>Cataetyx bruuni</i>				Bythitidae	OPHIDIIFORMES
	<i>Draculo shango</i>				Callionymidae	Perciformes

Code	Scientific name	English name	French name	Spanish name	Family	Order
	<i>Synchiropus phaeton</i>				Callionymidae	Perciformes
ZAC	<i>Antigonia capros</i>	Deepbody boarfish			Caproidae	ZEIFORMES
BOR	Caproidae	Boarfishes nei	Sangliers nca	Ochavos nep	Caproidae	ZEIFORMES
BOC	<i>Capros aper</i>	Boarfish	Sanglier	Ochavo	Caproidae	ZEIFORMES
ALA	<i>Alectis alexandrinus</i>	Alexandria pompano / African theadfish	Cordonnier bossu	Jurel de Alejandría	Carangidae	PERCOIDEI
LIJ	<i>Alectis ciliaris</i>	African pompano	Cordonnier fil	Pámpano de hebra	Carangidae	PERCOIDEI
VAD	<i>Campogramma glaycos</i>	Vadigo	Liche lirio	Lirio	Carangidae	PERCOIDEI
CGX	Carangidae	Carangids nei	Carangidés nca	Carángidos nep	Carangidae	PERCOIDEI
RUB	<i>Caranx crysos</i>	Blue runner	Carangue coubali	Cojinúa negra	Carangidae	PERCOIDEI
WFF	<i>Caranx fischeri</i>	Longfin crevalle jack	Carangue de Fischer	Jurel de Fischer	Carangidae	PERCOIDEI
CVJ	<i>Caranx hippos</i>	Crevalle jack	Carangue crevalle	Jurel común	Carangidae	PERCOIDEI
NXU	<i>Caranx lugubris</i>	Black jack			Carangidae	PERCOIDEI
HMY	<i>Caranx rhonchus</i>	False scad	Comète coussut	Macarela real	Carangidae	PERCOIDEI
NXS	<i>Caranx senegallus</i>	Senegal jack			Carangidae	PERCOIDEI
TRE	<i>Caranx spp</i>	Jacks, crevalles nei	Chinchards, carangues nca	Jureles, pámpanos nep	Carangidae	PERCOIDEI
BUA	<i>Chloroscombrus chrysurus</i>	Atlantic bumper	Sapater	Casabe	Carangidae	PERCOIDEI
BUZ	<i>Chloroscombrus spp</i>	Bumpers nei	Sapaters nca	Casabes nep	Carangidae	PERCOIDEI
WEC	<i>Decapterus punctatus</i>	Round scad	Comète quiaquia	Macarela chuparaco(=Surela)	Carangidae	PERCOIDEI
SDX	<i>Decapterus spp</i>	Scads nei	Comètes nca	Macarelas nep	Carangidae	PERCOIDEI
RRU	<i>Elagatis bipinnulata</i>	Rainbow runner	Comète saumon	Macarela salmón	Carangidae	PERCOIDEI
HXB	<i>Hemicaranx bicolor</i>	Bicolor jack	Carangue bicolore	Casabe bicolor	Carangidae	PERCOIDEI
LEE	<i>Lichia amia</i>	Leerfish	Liche	Palometón	Carangidae	PERCOIDEI
NAU	<i>Naucrates ductor</i>	Pilotfish	Poisson pilote	Pez piloto	Carangidae	PERCOIDEI
BIS	<i>Selar crumenophthalmus</i>	Bigeye scad	Sélar coulisou	Chicharro oión	Carangidae	PERCOIDEI
LUK	<i>Selene dorsalis</i>	African moonfish	Musso africain	Jorobado africano	Carangidae	PERCOIDEI
RLR	<i>Seriola carpenteri</i>	Guinean amberjack	Sériole guinéenne	Medregal de Guinea	Carangidae	PERCOIDEI
AMB	<i>Seriola dumerili</i>	Greater amberjack	Sériole couronnée	Pez de limón	Carangidae	PERCOIDEI
YTL	<i>Seriola rivoliana</i>	Longfin yellowtail	Sériole limon	Medregal limón	Carangidae	PERCOIDEI
AMX	<i>Seriola spp</i>	Amberjacks nei	Sérioles nca	Medregales nep	Carangidae	PERCOIDEI

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TOG	<i>Trachinotus goreensis</i>	Longfin pompano	Pompaneau tacheté	Pámpano cojonovo	Carangidae	PERCOIDEI
TOO	<i>Trachinotus maxillosus</i>	Guinean pompano	Pompaneau chévron	Pámpano galonero	Carangidae	PERCOIDEI
POP	<i>Trachinotus ovatus</i>	Pompano	Palomine	Pámpano blanco	Carangidae	PERCOIDEI
POX	<i>Trachinotus</i> spp	Pompanos nei	Pompaneaux nca	Pámpanos(=Palometas) nep	Carangidae	PERCOIDEI
TIE	<i>Trachinotus teraia</i>	Shortfin pompano	Pompaneau né-bé	Pámpano terayo	Carangidae	PERCOIDEI
HMC	<i>Trachurus capensis</i>	Cape horse mackerel	Chinchard du Cap	Jurel del Cabo	Carangidae	PERCOIDEI
JAX	<i>Trachurus</i> spp	Jack and horse mackerels nei	Chinchards noirs nca	Jureles nep	Carangidae	PERCOIDEI
HOM	<i>Trachurus trachurus</i>	Atlantic horse mackerel	Chinchard d'Europe	Jurel	Carangidae	PERCOIDEI
HMZ	<i>Trachurus trecae</i>	Cunene horse mackerel	Chinchard du Cunène	Jurel de Cunene	Carangidae	PERCOIDEI
USE	<i>Uraspis secunda</i>	Cottonmouth jack	Carangue coton	Jurel volantín	Carangidae	PERCOIDEI
SNB	<i>Snyderidia canina</i>				Carapidae	OPHIDIIFORMES
CEZ	Centracanthidae	Picarels, etc. nei	Picarels, etc. nca	Picareles, etc. nep	Centracanthidae	PERCOIDEI
	<i>Spicara alta</i>	Bigeye picarel	Mendoles, picarels nca	Chuclas, carameles nep	Centracanthidae	PERCOIDEI
TAC	<i>Spicara melanurus</i>	Blackspot picarel	Picarel de l'Atlantique sud-es	Sucla	Centracanthidae	PERCOIDEI
PIC	<i>Spicara</i> spp	Picarels nei	Mendoles, picarels nca	Chuclas, carameles nep	Centracanthidae	PERCOIDEI
HDW	<i>Schedophilus pamarco</i>	Pamarco blackfish	Rouffe rayé	Rufo pamarco	Centrolophidae	STROMATEOIDEI, ANABANTOIDEI
CBC	<i>Cepola macrophthalmia</i>	Red bandfish	Cépole commune	Cepola	Cepolidae	PERCOIDEI
	<i>Cepola pauciradiata</i>				Cepolidae	PERCOIDEI
HTH	<i>Chaetodon hoefleri</i>	Four-banded butterflyfish			Chaetodontidae	PERCOIDEI
BUS	Chaetodontidae	Butterflyfishes	Papillons	Pescados mariposa	Chaetodontidae	PERCOIDEI
	<i>Prognathodes marcellae</i>				Chaetodontidae	Perciformes
	<i>Chlopsis olokun</i>				Chlopsidae	ANGUILLIFORMES
	<i>Chlorophthalmus agassizi</i>	Shortnose greeneye			Chlorophthalmidae	AULOPIFORMES
PFS	<i>Parasudis fraserbrunneri</i>				Chlorophthalmidae	AULOPIFORMES
TLR	<i>Tilapia rendalli</i>	Redbreast tilapia			Cichlidae	PERCOIDEI
CIT	Citharidae	Citharids nei	Feuilles nca	Solletas nep	Citharidae	PLEURONECTIFORMES
CIL	<i>Citharus linguatula</i>	Spotted flounder	Feuille	Solleta	Citharidae	PLEURONECTIFORMES
CLU	Clupeoidei	Clupeoids nei	Clupéoidés nca	Clupeoideos nep		CLUPEIFORMES
CLP	Clupeidae	Herrings, sardines nei	Harengs, sardines nca	Arenques, sardinas nep	Clupeidae	CLUPEIFORMES
BOA	<i>Ethmalosa fimbriata</i>	Bonga shad	Ethmalose d'Afrique	Sábalo africano	Clupeidae	CLUPEIFORMES

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PLO	Pellonula leonensis	Smalltoothed pellonula	Spratelle de Guinée	Sardinita guineana	Clupeidae	CLUPEIFORMES
	Pellonula vorax	Bigtoothed pellonula	Spratelle de Guinée	Sardinita guineana	Clupeidae	CLUPEIFORMES
PIL	Sardina pilchardus	European pilchard(=Sardine)	Sardine commune	Sardina europea	Clupeidae	CLUPEIFORMES
SAA	Sardinella aurita	Round sardinella	Allache	Alacha	Clupeidae	CLUPEIFORMES
SAE	Sardinella maderensis	Madeiran sardinella	Grande allache	Machuelo	Clupeidae	CLUPEIFORMES
	Sardinella rouxi	Yellowtail sardinella	Sardinelle miyako	Sardinela sinda	Clupeidae	CLUPEIFORMES
SIX	Sardinella spp	Sardinellas nei	Sardinelles nca	Sardinelas nep	Clupeidae	CLUPEIFORMES
	Coloconger cadenati				Colocongridae	ANGUILLIFORMES
	Ariosoma anale	Longtrunk conger			Congridae	ANGUILLIFORMES
ARB	Ariosoma balearicum	Bandtooth conger			Congridae	ANGUILLIFORMES
CBV	Bathuroconger vicinus	Large-toothed conger			Congridae	ANGUILLIFORMES
COE	Conger conger	European conger	Congre d'Europe	Congrio común	Congridae	ANGUILLIFORMES
COS	Conger orbignyanus	Argentine conger	Congre argentin	Congrio argentino	Congridae	ANGUILLIFORMES
CGZ	Conger spp	Conger eels nei	Congres nca	Congrios nep	Congridae	ANGUILLIFORMES
COX	Congridae	Conger eels, etc. nei	Congres, etc. nca	Congrios, etc. nep	Congridae	ANGUILLIFORMES
ACL	Heteroconger longissimus	Brown garden eel			Congridae	ANGUILLIFORMES
ACJ	Japonoconger africanus				Congridae	ANGUILLIFORMES
	Paraconger notialis	Guinean conger			Congridae	ANGUILLIFORMES
RCH	Rhechias bertini				Congridae	ANGUILLIFORMES
	Uroconger syringinus	Threadtail conger			Congridae	ANGUILLIFORMES
CFW	Coryphaena equiselis	Pompano dolphinfish			Coryphaenidae	PERCOIDEI
DOL	Coryphaena hippurus	Common dolphinfish	Coryphène commune	Lampuga	Coryphaenidae	PERCOIDEI
DOX	Coryphaenidae	Dolphinfishes nei	Coryphènes nca	Dorados nep	Coryphaenidae	PERCOIDEI
TOX	Cynoglossidae	Tonguefishes	Cynoglossidés	Cinoglósidos	Cynoglossidae	PLEURONECTIFORMES
YOW	Cynoglossus browni	Nigerian tonguesole	Sole-langue nigérienne	Lengua nigeriana	Cynoglossidae	PLEURONECTIFORMES
	Cynoglossus cadenati	Ghanian tonguesole			Cynoglossidae	PLEURONECTIFORMES
YOI	Cynoglossus canariensis	Canary tonguesole	Sole-langue canarienne	Lengua de Canarias	Cynoglossidae	PLEURONECTIFORMES
	Cynoglossus monodi	Guinean tonguesole			Cynoglossidae	PLEURONECTIFORMES
YOE	Cynoglossus senegalensis	Senegalese tonguesole	Sole-langue sénégalaise	Lengua del Senegal	Cynoglossidae	PLEURONECTIFORMES
YOX	Cynoglossus spp	Tonguesole nei	Sole-langues nca	Lenguas nep	Cynoglossidae	PLEURONECTIFORMES
YFU	Symphurus ligulatus	Elongate tonguesole			Cynoglossidae	PLEURONECTIFORMES

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	<i>Symphurus vanmelleae</i>				Cynoglossidae	PLEURONECTIFORMES
DYX	Dactylopteridae	Flying gurnards nei	Grondins volants nca	Dactilópteros nep	Dactylopteridae	SCORPAENIFORMES
DYL	<i>Dactylopterus volitans</i>	Flying gurnard	Grondin volant	Alón volador	Dactylopteridae	SCORPAENIFORMES
DIY	<i>Diodon hystrix</i>	Spot-fin porcupinefish			Diodontidae	TETRAODONTIFORMES
DIO	Diodontidae	Globefish, porcupine fish	Porcs-epics	Pejerizos, puercoespines	Diodontidae	TETRAODONTIFORMES
SFN	<i>Diretmichthys parini</i>	Parin's spinyfish	Dirette de Parin	Malcarado de Parin	Diretmidae	BERYCIFORMES
	<i>Diretmoides pauciradiatus</i>	Longwing spinyfin	Dirette de Parin	Malcarado de Parin	Diretmidae	BERYCIFORMES
DUU	<i>Diretmus argenteus</i>	Silver spinyfin			Diretmidae	BERYCIFORMES
SIC	<i>Drepane africana</i>	African sicklefish	Forgeron ailé	Catemo africano	Drepanidae	PERCOIDEI
ECN	Echeneidae	Suckerfishes, remoras nei	Rémoras nca	Remoras, pegas nep	Echeneidae	PERCOIDEI
EHN	<i>Echeneis naucrates</i>	Live sharksucker	Rémora commun	Pegatimón	Echeneidae	PERCOIDEI
REO	<i>Remora remora</i>	Shark sucker			Echeneidae	PERCOIDEI
	<i>Bostrychus africanus</i>				Eleotridae	GOBIOIDEI
	<i>Dormitator lebretonis</i>			Camote del Pacífico	Eleotridae	GOBIOIDEI
FGB	Eleotridae	Gudgeons, sleepers nei	Gudgeons, dormeurs nca	Durmientes nep	Eleotridae	GOBIOIDEI
	<i>Eleotris senegalensis</i>				Eleotridae	GOBIOIDEI
EOV	<i>Eleotris vittata</i>				Eleotridae	GOBIOIDEI
CEC	<i>Elops lacerta</i>	West African ladyfish	Guinée d'Afrique occidentale	Malacho de Africa occidental	Elopidae	ELOPIFORMES
CEG	<i>Elops senegalensis</i>	Senegalese ladyfish	Guinée du Sénégal	Malacho senegalés	Elopidae	ELOPIFORMES
EMT	Emmelichthyidae	Bonnetmouths, rubyfishes nei	Andorrèves, poissons rubis nca	Andorreros, peces rubí nep	Emmelichthyidae	PERCOIDEI
EYO	<i>Erythrocles monodi</i>	Atlantic rubyfish			Emmelichthyidae	PERCOIDEI
ANX	Engraulidae	Anchovies, etc. nei	Anchois, etc. nca	Anchoas, etc. nep	Engraulidae	CLUPEIFORMES
ANE	<i>Engraulis encrasicolus</i>	European anchovy	Anchois	Boquerón	Engraulidae	CLUPEIFORMES
HRL	<i>Chaetodipterus lippei</i>	West African spadefish			Ephippidae	ACANTHUROIDEI
SPA	Ephippidae	Spadefishes nei	Chèvres, disques nca	Pagalas nep	Ephippidae	ACANTHUROIDEI
HUO	<i>Ephippus goreensis</i>	East Atlantic African spadefish			Ephippidae	ACANTHUROIDEI
EVO	<i>Evermannella balbo</i>	Balbo sabretooth			Evermannellidae	AULOPIFORMES
ODM	<i>Odontostomops normalops</i>	Undistinguished sabretooth			Evermannellidae	AULOPIFORMES
	<i>Cheilopogon cyanopterus</i>	Margined flyingfish			Exocoetidae	BELONIFORMES

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	Cheilopogon melanurus	Atlantic flyingfish			Exocoetidae	BELONIFORMES
	Cheilopogon milleri	Guinean flyingfish			Exocoetidae	BELONIFORMES
ECG	Cheilopogon nigricans	Blacksail flyingfish			Exocoetidae	BELONIFORMES
	Cheilopogon pinnatibarbus pinnatibarbus	Bennett's flyingfish			Exocoetidae	BELONIFORMES
FLY	Exocoetidae	Flyingfishes nei	Exocets nca	Voladores nep	Exocoetidae	BELONIFORMES
FOA	Fodiator acutus	Sharpchin flyingfish			Exocoetidae	BELONIFORMES
FFV	Hirundichthys affinis	Fourwing flyingfish	Exocet hirondelle	Volador golondrina	Exocoetidae	BELONIFORMES
PXB	Parexocoetus brachypterus	Sailfin flyingfish			Exocoetidae	BELONIFORMES
	Prognichthys gibbifrons	Bluntnose flyingfish			Exocoetidae	BELONIFORMES
FIP	Fistularia petimba	Red cornetfish	Cornette rouge	Corneta colorada	Fistulariidae	SYNGNATHIFORMES
FIT	Fistularia spp	Flutemouth			Fistulariidae	SYNGNATHIFORMES
FUT	Fistularia tabacaria	Cornetfish	Cornette tachetée	Corneta	Fistulariidae	SYNGNATHIFORMES
TUX	Scombroidei	Tuna-like fishes nei	Poissons type thon nca	Peces parec. a los atunes nep		SCOMBROIDEI
DLT	Diplospinus multistriatus	Striped escolar	Escolier rayé	Escolar rayado	Gempylidae	SCOMBROIDEI
GEP	Gempylidae	Snake mackerels, escolars nei	Escoliers, rouvets nca	Escolares, sierras nep	Gempylidae	SCOMBROIDEI
GES	Gempylus serpens	Snake mackerel	Escolier serpent	Escolar de canal	Gempylidae	SCOMBROIDEI
LEC	Lepidocybium flavobrunneum	Escolar	Escolier noir	Escolar negro	Gempylidae	SCOMBROIDEI
NLT	Nealotus tripes	Black snake mackerel	Escolier reptile	Escolar oscuro	Gempylidae	SCOMBROIDEI
NEN	Nesiarchus nasutus	Black gemfish	Escolier long nez	Escolar narigudo	Gempylidae	SCOMBROIDEI
PRP	Promethichthys prometheus	Roudi escolar	Escolier clair	Escolar prometeo	Gempylidae	SCOMBROIDEI
OIL	Ruvettus pretiosus	Oilfish	Rouvet	Escolar clavo	Gempylidae	SCOMBROIDEI
MFF	Eucinostomus melanopterus	Flagfin mojarra	Blanche drapeau	Mojarrita de ley	Gerreidae	PERCOIDEI
GDJ	Gerreidae	Mojarras, etc. nei	Blanches, etc. nca	Mojarras, etc. nep	Gerreidae	PERCOIDEI
GEZ	Gerres nigri	Guinean striped mojarra	Friture rayée	Mojarra guineana	Gerreidae	PERCOIDEI
MOJ	Gerres spp	Mojarras(=Silver-biddies) nei	Blanches nca	Mojarras nep	Gerreidae	PERCOIDEI

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	<i>Apletodon pellegrini</i>	Chubby clingfish			Gobiesocidae	GOBIESOCIFORMES
	<i>Lepadogaster purpurea</i>	Cornish sucker			Gobiesocidae	GOBIESOCIFORMES
GOC	<i>Opeatogenys cadenati</i>				Gobiesocidae	GOBIESOCIFORMES
	<i>Awaous lateristriga</i>	West African freshwater goby			Gobiidae	GOBIOIDEI
	<i>Bathygobius burtoni</i>				Gobiidae	Perciformes
	<i>Bathygobius casamancus</i>				Gobiidae	Perciformes
BJO	<i>Bathygobius soporator</i>	Frillfin goby			Gobiidae	Perciformes
	<i>Ctenogobius lepturus</i>				Gobiidae	Perciformes
EBG	<i>Ebomegobius goodi</i>				Gobiidae	GOBIOIDEI
GPA	Gobiidae	Gobies nei	Gobies nca	Góbidos nep	Gobiidae	GOBIOIDEI
	<i>Gobioides africanus</i>				Gobiidae	GOBIOIDEI
	<i>Gobioides sagitta</i>				Gobiidae	GOBIOIDEI
	<i>Gobionellus occidentalis</i>				Gobiidae	GOBIOIDEI
GCR	<i>Gobius cruentatus</i>	Red-mouthed goby			Gobiidae	GOBIOIDEI
	<i>Gobius rubropunctatus</i>		Gobies de l'Atlantique nca	Góbidos, chaparrudos nep	Gobiidae	Perciformes
GOB	<i>Gobius spp</i>	Atlantic gobies nei	Gobies de l'Atlantique nca	Góbidos, chaparrudos nep	Gobiidae	GOBIOIDEI
GOJ	<i>Gorogobius nigricinctus</i>				Gobiidae	GOBIOIDEI
	<i>Lesueurigobius koumansi</i>				Gobiidae	Perciformes
	<i>Mauligobius nigri</i>				Gobiidae	GOBIOIDEI
NMI	<i>Nematogobius ansorgii</i>				Gobiidae	GOBIOIDEI
	<i>Nematogobius brachynemus</i>				Gobiidae	Perciformes
	<i>Nematogobius maindroni</i>				Gobiidae	GOBIOIDEI
	<i>Periophthalmus barbarus</i>	Atlantic mudskipper			Gobiidae	GOBIOIDEI
OGH	<i>Porogobius schlegelii</i>				Gobiidae	GOBIOIDEI
TGN	<i>Thorogobius angolensis</i>				Gobiidae	GOBIOIDEI
	<i>Thorogobius rofeni</i>				Gobiidae	GOBIOIDEI
WHZ	<i>Wheelerigobius maltzani</i>				Gobiidae	GOBIOIDEI
	<i>Wheelerigobius wirtzi</i>	Cameroon goby			Gobiidae	GOBIOIDEI
	<i>Yongeichthys thomasi</i>				Gobiidae	GOBIOIDEI
BPO	<i>Bonapartia pedaliota</i>	Longray fangjaw			Gonostomatidae	STOMIIFORMES

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YTB	<i>Cyclothone alba</i>	Bristlemouth			Gonostomatidae	STOMIIFORMES
YTU	<i>Cyclothone braueri</i>	Garrick			Gonostomatidae	STOMIIFORMES
YTV	<i>Cyclothone livida</i>				Gonostomatidae	STOMIIFORMES
YTM	<i>Cyclothone microdon</i>	Veiled anglemouth			Gonostomatidae	STOMIIFORMES
	<i>Cyclothone obscura</i>	Hidden bristlemouth			Gonostomatidae	STOMIIFORMES
YTP	<i>Cyclothone pallida</i>	Tan bristlemouth			Gonostomatidae	STOMIIFORMES
YTX	<i>Cyclothone</i> spp				Gonostomatidae	STOMIIFORMES
DPT	<i>Diplophos taenia</i>	Pacific portholefish			Gonostomatidae	STOMIIFORMES
	<i>Gonostoma atlanticum</i>	Atlantic fangjaw			Gonostomatidae	STOMIIFORMES
GSD	<i>Gonostoma denudatum</i>				Gonostomatidae	STOMIIFORMES
GSL	<i>Gonostoma elongatum</i>	Elongated bristlemouth fish			Gonostomatidae	STOMIIFORMES
BRI	Gonostomatidae	Bristlemouths	Brossés	Moritos	Gonostomatidae	STOMIIFORMES
GSY	<i>Sigmops bathyphilus</i>	Spark anglemouth			Gonostomatidae	STOMIIFORMES
	<i>Manducus maderensis</i>				Gonostomatidae	STOMIIFORMES
GMG	<i>Grammicolepis brachiusculus</i>	Thorny tinsel fish			Grammicolepididae	ZEIFORMES
XED	<i>Xenolepidichthys dalgleishi</i>	Spotted tinsel fish			Grammicolepididae	ZEIFORMES
GRB	<i>Brachydeuterus auritus</i>	Bigeye grunt	Lippu pelon	Burro ojón	Haemulidae	PERCOIDEI
GRX	Haemulidae (=Pomadasyidae)	Grunts, sweetlips nei	Grondeurs, diagrammes nca	Burros, roncós nep	Haemulidae	PERCOIDEI
PKC	<i>Parakuhlia macrophthalmus</i>	Dara			Haemulidae	PERCOIDEI
GBL	<i>Plectorhinchus macrolepis</i>	Biglip grunt	Diagramme à grosses lèvres	Burro labiogruoso	Haemulidae	PERCOIDEI
GBR	<i>Plectorhinchus mediterraneus</i>	Rubberlip grunt	Diagramme gris	Burro chiclero	Haemulidae	PERCOIDEI
PBX	<i>Plectorhinchus</i> spp	Sweetlips, rubberlips nei			Haemulidae	PERCOIDEI
BGR	<i>Pomadasyus incisus</i>	Bastard grunt	Grondeur métis	Ronco mestizo	Haemulidae	PERCOIDEI
BUR	<i>Pomadasyus jubelini</i>	Sompat grunt	Grondeur sompat	Ronco sompat	Haemulidae	PERCOIDEI
PKE	<i>Pomadasyus perotaei</i>	Parrot grunt			Haemulidae	PERCOIDEI
BGZ	<i>Pomadasyus rogerii</i>	Pignout grunt	Grondeur nez de cochon	Ronco trompudo	Haemulidae	PERCOIDEI
BGX	<i>Pomadasyus</i> spp				Haemulidae	PERCOIDEI
PKK	<i>Pomadasyus suillus</i>				Haemulidae	PERCOIDEI

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	<i>Aldrovandia gracilis</i>				Halosauridae	NOTACANTHIFORMES
	<i>Aldrovandia phalacra</i>	Hawaiian halosaurid fish			Halosauridae	NOTACANTHIFORMES
NHU	<i>Halosaurus ovenii</i>				Halosauridae	NOTACANTHIFORMES
BHA	<i>Hemiramphus balao</i>	Balao halfbeak	Demi-bec balaou	Agujeta balaju	Hemiramphidae	BELONIFORMES
BAL	<i>Hemiramphus brasiliensis</i>	Ballyhoo halfbeak	Demi-bec brésilien	Agujeta brasileña	Hemiramphidae	BELONIFORMES
HAX	<i>Hemiramphus</i> spp	Halfbeaks nei	Demi-becs nca	Agujetas nep	Hemiramphidae	BELONIFORMES
	<i>Hyporhamphus picarti</i>	African halfbeak			Hemiramphidae	BELONIFORMES
	<i>Oxyporhamphus micropterus similis</i>	False halfbeak			Hemiramphidae	BELONIFORMES
	Heterenchelyidae	Mud eels nei			Heterenchelyidae	ANGUILLIFORMES
AHP	<i>Panturichthys isognathus</i>				Heterenchelyidae	ANGUILLIFORMES
	<i>Panturichthys longus</i>				Heterenchelyidae	ANGUILLIFORMES
	<i>Panturichthys mauritanicus</i>	Mauritanian shortface eel			Heterenchelyidae	ANGUILLIFORMES
	<i>Pythonichthys macrurus</i>				Heterenchelyidae	ANGUILLIFORMES
	<i>Pythonichthys microphthalmus</i>				Heterenchelyidae	ANGUILLIFORMES
HCZ	Holocentridae	Squirrelfishes nei	Marignons nca	Candiles nep	Holocentridae	BERYCIFORMES
HOO	<i>Holocentrus ascensionis</i>	Squirrelfish			Holocentridae	BERYCIFORMES
	<i>Sargocentron hastatum</i>	Red squirrelfish	Marignan sabre	Candil sable	Holocentridae	BERYCIFORMES
	Ipnopidae				Ipnopidae	AULOPIFORMES
	<i>Bathymicrops regis</i>				Ipnopidae	AULOPIFORMES
BDU	<i>Bathypterois dubius</i>	Spiderfish			Ipnopidae	AULOPIFORMES
	<i>Bathypterois grallator</i>	Tripodfish			Ipnopidae	AULOPIFORMES
	<i>Bathypterois quadrifilis</i>				Ipnopidae	AULOPIFORMES
	<i>Bathytrophops sewelli</i>				Ipnopidae	AULOPIFORMES
BIL	Istiophoridae	Marlins, sailfishes, etc. nei	Makaires, marlins, voiliers nca	Agujas, marlines, peces vela nep	Istiophoridae	SCOMBROIDEI
SAI	<i>Istiophorus albicans</i>	Atlantic sailfish	Voilier de l'Atlantique	Pez vela del Atlántico	Istiophoridae	SCOMBROIDEI
BLM	<i>Makaira indica</i>	Black marlin	Makaire noir	Aguja negra	Istiophoridae	SCOMBROIDEI
BUM	<i>Makaira nigricans</i>	Blue marlin	Makaire bleu	Aguja azul	Istiophoridae	SCOMBROIDEI
WHM	<i>Tetrapturus albidus</i>	Atlantic white marlin	Makaire blanc de l'Atlantique	Aguja blanca del Atlántico	Istiophoridae	SCOMBROIDEI
SSP	<i>Tetrapturus angustirostris</i>	Shortbill spearfish	Makaire à rostre court	Marlín trompa corta	Istiophoridae	SCOMBROIDEI

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SPF	Tetrapturus pfluegeri	Longbill spearfish	Makaire bécune	Aguja picuda	Istiophoridae	SCOMBROIDEI
KYX	Kyphosidae	Sea chubs nei	Calicagères nca	Chopas nep	Kyphosidae	PERCOIDEI
KYP	Kyphosus spp	Kyphosus sea chubs nei	Kyphosus calicagères nca	Kyphosus chopas nep	Kyphosidae	PERCOIDEI
BZD	Bodianus speciosus	Blackbar hogfish	Porceau dos noir	Vieja lomonegro	Labridae	PERCOIDEI
WRA	Labridae	Wrasses, hogfishes, etc. nei	Pourceaux, donzelles, etc. nca	Lábridos(=Tordos,maragotas)nep	Labridae	PERCOIDEI
	Labrus mixtus	Cuckoo wrasse	Merle	Merlo	Labridae	Perciformes
XYN	Xyrichtys novacula	Pearly razorfish	Donzelle lame	Rao	Labridae	PERCOIDEI
	Labrisomus nuchipinnis	Hairy blenny			Labrisomidae	OTHER PERCIFORMES
MTF	Malacoctenus africanus				Labrisomidae	OTHER PERCIFORMES
LAG	Lampris guttatus	Opah	Opah	Opa	Lampridae	LAMPRIIFORMES
LLG	Leptochilichthys agassizii	Agassiz' smooth-head			Leptochilichthyidae	SALMONIFORMES
EMP	Lethrinidae	Emperors(=Scavengers) nei	Empereurs nca	Emperadores nep	Lethrinidae	PERCOIDEI
LTN	Lethrinus atlanticus	Atlantic emperor	Empereur atlantique	Emperador atlántico	Lethrinidae	PERCOIDEI
LPX	Liparidae	Snailfishes nei	Limaces de mer nca	Babosos nep	Liparidae	SCORPAENIFORMES
PCJ	Paraliparis copei				Liparidae	SCORPAENIFORMES
LOB	Lobotes surinamensis	Tripletail	Croupia roche	Dormilona	Lobotidae	PERCOIDEI
ANF	Lophiidae	Anglerfishes nei	Baudroies, etc. nca	Rapes, etc. nep	Lophiidae	LOPHIIFORMES
	Lophiodes kempfi	Longspine African angler			Lophiidae	LOPHIIFORMES
ANK	Lophius budegassa	Blackbellied angler	Baudroie rousse	Rape negro	Lophiidae	LOPHIIFORMES
MNZ	Lophius spp	Monkfishes nei	Baudroies nca	Rapes nep	Lophiidae	LOPHIIFORMES
MVA	Lophius vaillanti	Shortspine African angler	Baudroie africaine	Rape africano	Lophiidae	LOPHIIFORMES
AFK	Apsilus fuscus	African forktail snapper	Vivaneau fourche d'Afrique	Pargo tijera	Lutjanidae	PERCOIDEI
SNX	Lutjanidae	Snappers, jobfishes nei	Lutianidés nca	Lutjánidos nep	Lutjanidae	PERCOIDEI
LJA	Lutjanus agennes	African red snapper	Vivaneau africain rouge	Pargo colorado africano	Lutjanidae	PERCOIDEI
LJE	Lutjanus dentatus	African brown snapper	Vivaneau brun d'Afrique	Pargo marrón africano	Lutjanidae	PERCOIDEI
	Lutjanus endecacanthus	Guinea snapper	Vivaneaux nca	Pargos tropicales nep	Lutjanidae	PERCOIDEI
LVN	Lutjanus fulgens	Golden African snapper	Vivaneau doré	Pargo dorado africano	Lutjanidae	PERCOIDEI
LJO	Lutjanus goreensis	Gorean snapper	Vivaneau de Gorée	Pargo de Gorea	Lutjanidae	PERCOIDEI
SNA	Lutjanus spp	Snappers nei	Vivaneaux nca	Pargos tropicales nep	Lutjanidae	PERCOIDEI
GAD	Gadiformes (Order)	Gadiformes nei	Gadiformes nca	Gadiformes nep		GADIFORMES

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	<i>Bathygadus favosus</i>				Macrouridae	GADIFORMES
BGO	<i>Bathygadus macrops</i>	Bullseye grenadier			Macrouridae	GADIFORMES
BGN	<i>Bathygadus melanobranchus</i>	Vaillant's grenadier			Macrouridae	GADIFORMES
CKP	<i>Cetonurus globiceps</i>	Globehead grenadier			Macrouridae	GADIFORMES
	<i>Coelorinchus geronimo</i>	Hollowsnout grenadier			Macrouridae	GADIFORMES
HYS	<i>Hymenocephalus italicus</i>	Glasshead grenadier			Macrouridae	GADIFORMES
RTX	Macrouridae	Grenadiers, rattails nei		Granaderos, colas de ratón nep	Macrouridae	GADIFORMES
MLL	<i>Malacocephalus laevis</i>	Softhead grenadier			Macrouridae	GADIFORMES
MLO	<i>Malacocephalus occidentalis</i>	Western softhead grenadier			Macrouridae	GADIFORMES
NZA	<i>Nezumia aequalis</i>	Common Atlantic grenadier	Grenadier lisse	Granadero liso	Macrouridae	GADIFORMES
NZD	<i>Nezumia duodecim</i>	Twelve-rayed grenadier			Macrouridae	GADIFORMES
NZM	<i>Nezumia micronychodon</i>	Smalltooth grenadier			Macrouridae	GADIFORMES
NZS	<i>Nezumia sclerorhynchus</i>	Roughtip grenadier			Macrouridae	GADIFORMES
SUQ	<i>Squalogadus modificatus</i>	Tadpole whiptail			Macrouridae	GADIFORMES
	<i>Branchiostegus semifasciatus</i>	Zebra tilefish			Malacanthidae	Perciformes
TAR	<i>Megalops atlanticus</i>	Tarpon	Tarpon argenté	Tarpón	Megalopidae	ELOPIFORMES
	<i>Melamphaes leprus</i>				Melamphidae	Stephanoberyciformes
PMC	<i>Poromitra crassiceps</i>	Crested bigscale			Melamphidae	Stephanoberyciformes
HKB	<i>Merluccius polli</i>	Benguela hake	Merlu d'Afrique tropicale	Merluza de Benguela	Merlucciidae	GADIFORMES
HKM	<i>Merluccius senegalensis</i>	Senegalese hake	Merlu du Sénégal	Merluza del Senegal	Merlucciidae	GADIFORMES
HKX	<i>Merluccius spp</i>	Hakes nei	Merlus nca	Merluzas nep	Merlucciidae	GADIFORMES
MDH	<i>Microdesmus aethiopicus</i>				Microdesmidae	GOBIOIDEI
MRW	<i>Masturus lanceolatus</i>	Sharptail mola			Molidae	TETRAODONTIFORMES
MOX	<i>Mola mola</i>	Ocean sunfish	Poisson lune	Pez luna	Molidae	TETRAODONTIFORMES
MOP	<i>Mola spp</i>	Sunfish			Molidae	TETRAODONTIFORMES
RZV	<i>Ranzania laevis</i>	Slender sunfish			Molidae	TETRAODONTIFORMES
ALM	<i>Aluterus monoceros</i>	Unicorn leatherjacket filefish			Monacanthidae	TETRAODONTIFORMES
AWI	<i>Aluterus schoepfii</i>	Orange filefishes	Bourse orange	Lija naranja	Monacanthidae	TETRAODONTIFORMES
ALN	<i>Aluterus scriptus</i>	Scribbled leatherjacket filefi			Monacanthidae	TETRAODONTIFORMES

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ALT	Aluterus spp	Leatherjacket filefishes			Monacanthidae	TETRAODONTIFORMES
FFX	Monacanthidae	Filefishes, leatherjackets nei	Poissons-bourses nca	Cachúas, lijas nep	Monacanthidae	TETRAODONTIFORMES
FIK	Stephanolepis hispidus	Planehead filefish		Lija áspera	Monacanthidae	TETRAODONTIFORMES
	Monodactylus sebae	African moony			Monodactylidae	PERCOIDEI
LML	Laemonema laureysi	Guinean codling			Moridae	GADIFORMES
	Laemonema yarrellii				Moridae	GADIFORMES
MOR	Moridae	Moras, codlings, nei	Mores nca	Moras nep	Moridae	GADIFORMES
	Physiculus huloti				Moridae	GADIFORMES
PQO	Physiculus spp				Moridae	GADIFORMES
BSS	Dicentrarchus labrax	European seabass	Bar européen	Lubina	Moronidae	PERCOIDEI
MLR	Chelon labrosus	Thicklip grey mullet			Mugilidae	MUGILIFORMES
	Liza falcipinnis	Sicklefin mullet			Mugilidae	MUGILIFORMES
	Liza grandisquamis	Largescaled mullet			Mugilidae	MUGILIFORMES
LZD	Liza dumerili	Grooved mullet			Mugilidae	MUGILIFORMES
LZZ	Liza spp				Mugilidae	MUGILIFORMES
	Mugil bananensis	Banana mullet	Mulet sauteur d'Afrique	Galúa africana	Mugilidae	MUGILIFORMES
MUO	Mugil capurrii	Leaping African mullet	Mulet sauteur d'Afrique	Galúa africana	Mugilidae	MUGILIFORMES
MUF	Mugil cephalus	Flathead grey mullet	Mulet à grosse tête	Pardete	Mugilidae	MUGILIFORMES
MGU	Mugil curema	White mullet	Mulet blanc	Lisa blanca	Mugilidae	MUGILIFORMES
MGS	Mugil spp				Mugilidae	MUGILIFORMES
MUL	Mugilidae	Mulletts nei	Mulets nca	Lizas nep	Mugilidae	MUGILIFORMES
MUM	Mullidae	Goatfishes, red mullets nei	Rougets, etc. nca	Salmonetes, etc. nep	Mullidae	PERCOIDEI
MUT	Mullus barbatus	Red mullet	Rouget de vase	Salmonete de fango	Mullidae	PERCOIDEI
MUX	Mullus spp	Surmulletts(=Red mullets) nei	Rougets nca	Salmonetes nep	Mullidae	PERCOIDEI
MUR	Mullus surmuletus	Surmullet	Rouget de roche	Salmonete de roca	Mullidae	PERCOIDEI
GOA	Pseudupeneus prayensis	West African goatfish	Rouget du Sénégal	Salmonete barbudo	Mullidae	PERCOIDEI
GPC	Cynoponticus ferox	Guinean pike conger	Murénésoco de Guinée	Morenocio de Guinea	Muraenesocidae	ANGUILLIFORMES
AMP	Echidna peli	Pebbletooth moray			Muraenidae	ANGUILLIFORMES
	Enchelycore nigricans	Mulatto conger			Muraenidae	ANGUILLIFORMES
AWG	Gymnothorax afer	Dark moray	Murène obscure	Morena oscura	Muraenidae	ANGUILLIFORMES
	Gymnothorax mareei	Spotjaw moray			Muraenidae	ANGUILLIFORMES

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MMH	<i>Muraena helena</i>	Mediterranean moray			Muraenidae	ANGUILLIFORMES
MME	<i>Muraena melanotis</i>	Honeycomb moray			Muraenidae	ANGUILLIFORMES
MMO	<i>Muraena robusta</i>	Stout moray			Muraenidae	ANGUILLIFORMES
MUI	Muraenidae	Morays	Murènes	Morenas	Muraenidae	ANGUILLIFORMES
	<i>Uropterygius wheeleri</i>				Muraenidae	ANGUILLIFORMES
BHG	<i>Benthoosema glaciale</i>	Glacier lantern fish	Lanterne glaciale	Linterna oscura	Myctophidae	MYCTOPHIFORMES
BNS	<i>Benthoosema suborbitale</i>	Smallfin lanternfish			Myctophidae	MYCTOPHIFORMES
	<i>Bolinichthys photothorax</i>	Spurcheek lanternfish			Myctophidae	MYCTOPHIFORMES
	<i>Bolinichthys supralateralis</i>	Stubby lanternfish			Myctophidae	MYCTOPHIFORMES
	<i>Centrobranchus nigroocellatus</i>	Roundnose lanternfish			Myctophidae	MYCTOPHIFORMES
	<i>Ceratoscopelus warmingii</i>	Warming's lantern fish	Lanterne de Madère	Carpintero	Myctophidae	MYCTOPHIFORMES
DPB	<i>Diaphus bertelseni</i>				Myctophidae	MYCTOPHIFORMES
DPY	<i>Diaphus brachycephalus</i>	Short-headed lantern fish			Myctophidae	MYCTOPHIFORMES
	<i>Diaphus garmani</i>	Garman's lanternfish			Myctophidae	MYCTOPHIFORMES
DPO	<i>Diaphus holti</i>	Small lantern fish	Lanterne courte	Rafino corto	Myctophidae	MYCTOPHIFORMES
DPL	<i>Diaphus lucidus</i>	Spotlight lanternfish			Myctophidae	MYCTOPHIFORMES
DPI	<i>Diaphus mollis</i>	Soft lanternfish			Myctophidae	MYCTOPHIFORMES
	<i>Diaphus perspicillatus</i>	Transparent lantern fish			Myctophidae	MYCTOPHIFORMES
	<i>Diaphus splendidus</i>	Horned lanternfish			Myctophidae	MYCTOPHIFORMES
	<i>Diaphus taaningi</i>				Myctophidae	MYCTOPHIFORMES
DGA	<i>Diogenichthys atlanticus</i>	Longfin lanternfish			Myctophidae	MYCTOPHIFORMES
ELR	<i>Electrona risso</i>	Electric lantern fish	Étincelle	Chispa	Myctophidae	MYCTOPHIFORMES
	<i>Gonichthys cocco</i>				Myctophidae	MYCTOPHIFORMES
	<i>Hygophum reinhardtii</i>	Reinhardt's lantern fish	Lanterne des Bermudes	Benet negro	Myctophidae	MYCTOPHIFORMES
	<i>Hygophum taaningi</i>		Lanterne des Bermudes	Benet negro	Myctophidae	MYCTOPHIFORMES
	<i>Lampadena anomala</i>				Myctophidae	MYCTOPHIFORMES
LDC	<i>Lampadena chavesi</i>				Myctophidae	MYCTOPHIFORMES
	<i>Lampadena luminosa</i>	Luminous lanternfish			Myctophidae	MYCTOPHIFORMES
LPL	<i>Lampanyctus alatus</i>	Winged lanternfish			Myctophidae	MYCTOPHIFORMES
	<i>Lampanyctus nobilis</i>	Noble lampfish			Myctophidae	MYCTOPHIFORMES
	<i>Lampanyctus tenuiformis</i>				Myctophidae	MYCTOPHIFORMES

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	<i>Lepidophanes guentheri</i>				Myctophidae	MYCTOPHIFORMES
LNF	<i>Lobianchia dofleini</i>	Dofleini's lantern fish	Lanterne de Dofleini	Japonés	Myctophidae	MYCTOPHIFORMES
	<i>Lobianchia gemellarii</i>	Cocco's lantern fish	Lanterne de Dofleini	Japonés	Myctophidae	MYCTOPHIFORMES
LXX	Myctophidae	Lanternfishes nei	Lanternules nca	Peces linterna nep	Myctophidae	MYCTOPHIFORMES
	<i>Myctophum affine</i>	Metallic lantern fish			Myctophidae	MYCTOPHIFORMES
	<i>Myctophum asperum</i>	Prickly lanternfish			Myctophidae	MYCTOPHIFORMES
MCU	<i>Myctophum nitidulum</i>				Myctophidae	MYCTOPHIFORMES
	<i>Myctophum obtusirostre</i>	Bluntsnout lanternfish			Myctophidae	MYCTOPHIFORMES
MTP	<i>Myctophum punctatum</i>	Spotted lanternfish			Myctophidae	MYCTOPHIFORMES
LYL	<i>Nannobranchium lineatum</i>				Myctophidae	MYCTOPHIFORMES
NOV	<i>Notolychnus valdiviae</i>	Topside lampfish			Myctophidae	MYCTOPHIFORMES
	<i>Notoscopelus caudispinosus</i>	Lobisomem			Myctophidae	MYCTOPHIFORMES
	<i>Notoscopelus resplendens</i>	Patchwork lampfish			Myctophidae	MYCTOPHIFORMES
LAX	<i>Notoscopelus</i> spp	Patchwork lampfishes			Myctophidae	MYCTOPHIFORMES
	<i>Taaningichthys minimus</i>				Myctophidae	MYCTOPHIFORMES
AMC	<i>Myroconger compressus</i>	Red eel			Myrocongridae	ANGUILLIFORMES
ANV	<i>Avocettina infans</i>	Avocet snipe eel			Nemichthyidae	ANGUILLIFORMES
ANU	<i>Nemichthys curvirostris</i>	Boxer snipe eel			Nemichthyidae	ANGUILLIFORMES
	Nemichthyidae				Nemichthyidae	ANGUILLIFORMES
ANM	<i>Nemichthys scolopaceus</i>	Slender snipe eel			Nemichthyidae	ANGUILLIFORMES
SYJ	<i>Scopelengys tristis</i>	Pacific blackchin			Neoscopelidae	MYCTOPHIFORMES
	<i>Facciolella oxyrhyncha</i>	Facciola's sorcerer			Nettastomatidae	ANGUILLIFORMES
	<i>Hoplunnis punctata</i>				Nettastomatidae	ANGUILLIFORMES
NVP	<i>Venefica proboscidea</i>	Whipsnout sorcerer			Nettastomatidae	ANGUILLIFORMES
AIY	<i>Ahliesaurus berryi</i>				Notosudidae	AULOPIFORMES
	<i>Scopelosaurus argenteus</i>	Waryfish			Notosudidae	AULOPIFORMES
	<i>Scopelosaurus lepidus</i>	Blackfin waryfish			Notosudidae	AULOPIFORMES
VSH	<i>Scopelosaurus</i> spp				Notosudidae	AULOPIFORMES
DBA	<i>Dibranchius atlanticus</i>	Atlantic batfish			Ogcocephalidae	LOPHIIFORMES
	<i>Apterichtus gracilis</i>				Ophichthidae	ANGUILLIFORMES

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	<i>Apterichtus monodi</i>				Ophichthidae	ANGUILLIFORMES
	<i>Bascanichthys ceciliae</i>				Ophichthidae	ANGUILLIFORMES
	<i>Brachysomophis atlanticus</i>				Ophichthidae	ANGUILLIFORMES
	<i>Callechelys guineensis</i>	Shorttail snake eel			Ophichthidae	ANGUILLIFORMES
	<i>Callechelys leucoptera</i>				Ophichthidae	ANGUILLIFORMES
	<i>Dalophis boulengeri</i>				Ophichthidae	ANGUILLIFORMES
	<i>Dalophis cephalopeltis</i>				Ophichthidae	ANGUILLIFORMES
	<i>Dalophis multidentatus</i>				Ophichthidae	ANGUILLIFORMES
AOD	<i>Dalophis obtusirostris</i>				Ophichthidae	ANGUILLIFORMES
AOM	<i>Echelus myrus</i>	Painted eel			Ophichthidae	ANGUILLIFORMES
	<i>Echelus pachyrhynchus</i>				Ophichthidae	ANGUILLIFORMES
	<i>Echiophis creutzbergi</i>	Spoon-nose eel			Ophichthidae	ANGUILLIFORMES
	<i>Ethadophis epinepheli</i>				Ophichthidae	ANGUILLIFORMES
AOH	<i>Hemerorhinus opici</i>				Ophichthidae	ANGUILLIFORMES
	<i>Myrichthys pardalis</i>	Leopard eel			Ophichthidae	ANGUILLIFORMES
	<i>Myrophis plumbeus</i>	Leaden worm eel			Ophichthidae	ANGUILLIFORMES
	<i>Mystriophis crosnieri</i>				Ophichthidae	ANGUILLIFORMES
	<i>Mystriophis rostellatus</i>	African spoon-nose eel			Ophichthidae	ANGUILLIFORMES
OWX	Ophichthidae	Snake eels nei	Serpentons nca	Tiesos, serpentones nep	Ophichthidae	ANGUILLIFORMES
	<i>Ophichthus ophis</i>	Spotted snake eel			Ophichthidae	ANGUILLIFORMES
	<i>Ophichthus regius</i>	Ornate Snake Eel			Ophichthidae	ANGUILLIFORMES
OOS	<i>Ophisurus serpens</i>	Serpent eel			Ophichthidae	ANGUILLIFORMES
	<i>Pisodonophis semicinctus</i>				Ophichthidae	ANGUILLIFORMES
OPS	<i>Pseudomyrophis atlanticus</i>				Ophichthidae	ANGUILLIFORMES
BRD	<i>Brotula barbata</i>	Bearded brotula	Brotule barbée	Brótula de barbas	Ophidiidae	OPHIDIIFORMES
OLB	<i>Lamprogrammus brunswigi</i>				Ophidiidae	OPHIDIIFORMES
	<i>Lamprogrammus exutus</i>	Legless cuskeel			Ophidiidae	OPHIDIIFORMES
	<i>Monomitopus metriostoma</i>				Ophidiidae	OPHIDIIFORMES
OPH	Ophidiidae	Cusk-eels, brotulas nei	Abadèches, brotules nca	Brótulas, congribadejos nep	Ophidiidae	OPHIDIIFORMES
OOA	<i>Ophidion barbatum</i>	Snake blenny			Ophidiidae	OPHIDIIFORMES

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	Ophidion lozanoi				Ophidiidae	OPHIDIIFORMES
ODB	Dolichopteryx binocularis				Opisthoproctidae	SALMONIFORMES
OOL	Opisthoproctus soleatus	Barrel-eye			Opisthoproctidae	SALMONIFORMES
OWT	Winteria telescopa	Binocular fish			Opisthoproctidae	SALMONIFORMES
	Alloctytus guineensis				Oreosomatidae	ZEIFORMES
ORD	Oreosomatidae	Oreo dories nei	Oréos nca	Oreós nep	Oreosomatidae	ZEIFORMES
DLF	Dolichosudis fuliginosa				Paralepididae	AULOPIFORMES
	Lestidiops cadenati				Paralepididae	AULOPIFORMES
	Lestidiops sphyrenoides				Paralepididae	AULOPIFORMES
IYT	Citharichthys stampflii	Smooth flounder			Paralichthyidae	PLEURONECTIFORMES
	Syacium guineensis				Paralichthyidae	PLEURONECTIFORMES
	Cyttopsis rosea	Rosy dory			Parazenidae	ZEIFORMES
	Bembrops greyi	Roundtail duckbill			Percophidae	TRACHINOIDEI
	Bembrops heterurus	Squaretail duckbill			Percophidae	TRACHINOIDEI
PJC	Peristedion cataphractum	African armoured searobin			Peristediidae	SCORPAENIFORMES
	Phosichthyidae				Phosichthyidae	STOMIIFORMES
OLM	Pollichthys maui	Stareye lightfish			Phosichthyidae	STOMIIFORMES
OLC	Polymetme corythaeola	Rendezvous fish			Phosichthyidae	STOMIIFORMES
VIA	Vinciguerria attenuata	Slender lightfish			Phosichthyidae	STOMIIFORMES
VII	Vinciguerria nimbaria	Oceanic lightfish			Phosichthyidae	STOMIIFORMES
VIP	Vinciguerria poweriae	Power's deep-water bristle-mou			Phosichthyidae	STOMIIFORMES
YAB	Yarella blackfordi				Phosichthyidae	STOMIIFORMES
FLH	Platycephalidae	Flatheads nei	Platycéphalidés nca	Platicefálidos nep	Platycephalidae	SCORPAENIFORMES
	Solitas gruveli	Guinea flathead			Platycephalidae	SCORPAENIFORMES
PBC	Barbantus curvifrons	Palebelly searsid			Platyroctidae	Osmeriformes
PHN	Holtbyrnia anomala	Bighead searsid			Platyroctidae	Osmeriformes
	Holtbyrnia innesi	Teardrop tubeshoulder			Platyroctidae	Osmeriformes
	Holtbyrnia macrops	Bigeye searsid			Platyroctidae	Osmeriformes
	Maulisia maui	Maul's searsid			Platyroctidae	Osmeriformes
	Maulisia microlepis	Smallscale searsid			Platyroctidae	Osmeriformes
PMO	Normichthys operosus	Multipore searsid			Platyroctidae	Osmeriformes

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PYA	Platyroctes apus	Legless searsid			Platyroctidae	Osmeriformes
	Platyroctidae				Platyroctidae	Osmeriformes
	Sagamichthys schnakenbecki	Schnakenbeck's searsid			Platyroctidae	Osmeriformes
PSO	Searsia koefoedi	Koefoed's searsid			Platyroctidae	Osmeriformes
GAL	Galeoides decadactylus	Lesser African threadfin	Petit capitaine	Barbudo enano africano	Polynemidae	PERCOIDEI
PET	Pentanemus quinquarius	Royal threadfin	Capitaine royal	Barbudo real	Polynemidae	PERCOIDEI
TGA	Polydactylus quadrifilis	Giant African threadfin	Gros capitaine	Barbudo gigante africano	Polynemidae	PERCOIDEI
	Polydactylus spp				Polynemidae	PERCIFORMES
THF	Polynemidae	Threadfins, tasselfishes nei	Barbures, capitaines nca	Barbudos nep	Polynemidae	PERCOIDEI
WRF	Polyprion americanus	Wreckfish	Cernier commun	Cherna	Polyprionidae	PERCOIDEI
	Holacanthus africanus	Guinean angelfish			Pomacanthidae	PERCOIDEI
ANW	Pomacanthidae	Angelfishes nei	Demoiselles nca	Angeles nep	Pomacanthidae	PERCOIDEI
AUU	Abudefduf luridus	Canary damsel			Pomacentridae	PERCOIDEI
ABU	Abudefduf saxatilis	Sergeant-major			Pomacentridae	PERCOIDEI
	Abudefduf taurus	Night sergeant			Pomacentridae	PERCOIDEI
	Chromis cadenati	Cadenat's chromis			Pomacentridae	Perciformes
CMK	Chromis chromis	Damsel fish			Pomacentridae	Perciformes
HZL	Chromis limbata	Azores chromis	Castagnole à queue rayée	Fula blanca	Pomacentridae	Perciformes
	Microspathodon frontatus	Guinean damselfish			Pomacentridae	PERCOIDEI
	Stegastes imbricatus	Cape Verde gregory			Pomacentridae	PERCOIDEI
TGE	Stegastes leucostictus	Beaugregory			Pomacentridae	PERCOIDEI
GRX	Haemulidae (=Pomadasyidae)	Grunts, sweetlips nei	Grondeurs, diagrammes nca	Burros, roncós nep	Pomadasyidae (see Haemulidae)	PERCOIDEI
POT	Pomatomidae	Bluefishes nei	Tassergals nca	Anchovas nep	Pomatomidae	PERCOIDEI
BLU	Pomatomus saltatrix	Bluefish	Tassergal	Anjova	Pomatomidae	PERCOIDEI
PRI	Priacanthidae	Bigeyes, glasseyes, bulleyes nei	Beauclaires, etc. nca	Catalufas, etc. nep	Priacanthidae	PERCOIDEI
PQR	Priacanthus arenatus	Atlantic bigeye			Priacanthidae	PERCOIDEI
ILI	Ilisha africana	West African ilisha	Alose rasoir	Sardineta africana	Pristigasteridae	CLUPEIFORMES
SOT	Psettodes belcheri	Spottail spiny turbot	Turbot épineux tacheté	Perro	Psettodidae	PLEURONECTIFORMES
PSB	Psettodes bennettii	Spiny turbot	Turbot épineux	Lenguado espinudo	Psettodidae	PLEURONECTIFORMES
CBA	Rachycentron canadum	Cobia	Mafou	Cobia	Rachycentridae	PERCOIDEI

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LRE	Radiicephalus elongatus	Tapertail			Radiicephalidae	LAMPRIFORMES
REL	Regalecus glesne	King of herrings	Roi des harengs	Rey de los arenques	Regalecidae	LAMPRIFORMES
	Nicholsina usta collettei				Scaridae	Perciformes
PWT	Scaridae	Parrotfishes nei	Perroquets nca	Loros nep	Scaridae	PERCOIDEI
UVB	Scarus hoefleri	Guinean parrotfish	Perroquet de Guinée	Loro de Guinea	Scaridae	PERCOIDEI
PRR	Sparisoma cretense	Parrotfish	Perroquet vieillard	Loro viejo	Scaridae	PERCOIDEI
	Sparisoma rubripinne	Redfin parrotfish	Perroquet vieillard	Loro viejo	Scaridae	Perciformes
MGR	Argyrosomus regius	Meagre	Maigre commun	Corvina	Sciaenidae	PERCOIDEI
MIV	Miracorvina angolensis	Angola croaker			Sciaenidae	PERCOIDEI
THZ	Pentheroscion mbizi	Blackmouth croaker			Sciaenidae	PERCOIDEI
CKL	Pseudotolithus brachygnathus	Law croaker	Otolithe gabo	Corvina reina	Sciaenidae	PERCOIDEI
PSE	Pseudotolithus elongatus	Bobo croaker	Otolithe bobo	Corvina bobo	Sciaenidae	PERCOIDEI
	Pseudotolithus epipercus	Guinea croaker			Sciaenidae	PERCIFORMES
UDM	Pseudotolithus moorii	Cameroon croaker			Sciaenidae	PERCOIDEI
PSS	Pseudotolithus senegalensis	Cassava croaker	Otolithe sénégalais	Corvina casava	Sciaenidae	PERCOIDEI
	Pseudotolithus senegallus	Law croaker			Sciaenidae	PERCIFORMES
CKW	Pseudotolithus spp	West African croakers nei	Otolithes nca	Corvinas africanas nep	Sciaenidae	PERCOIDEI
PTY	Pseudotolithus typus	Longneck croaker	Otolithe nanka	Corvina bosoro	Sciaenidae	PERCOIDEI
DRS	Pteroscion peli	Boe drum	Courbine pélin	Bombache boe	Sciaenidae	PERCOIDEI
CBM	Sciaena umbra	Brown meagre	Corb commun	Corvallo	Sciaenidae	PERCOIDEI
CDX	Sciaenidae	Croakers, drums nei	Sciaenidés nca	Esciénidos nep	Sciaenidae	PERCOIDEI
UCA	Umbrina canariensis	Canary drum (=Baardman)	Ombrine bronze	Verrugato de Canarias	Sciaenidae	PERCOIDEI
UMO	Umbrina ronchus	Fusca drum			Sciaenidae	PERCOIDEI
UBS	Umbrina spp	Drums nei	Ombrines nca	Verrugatos nep	Sciaenidae	PERCOIDEI
SAX	Scomberesocidae	Sauries nei	Balaous, bananes de mer nca	Papardas nep	Scomberesocidae	BELONIFORMES
SAU	Scomberesox saurus	Atlantic saury	Balaou atlantique	Paparda del Atlántico	Scomberesocidae	BELONIFORMES
	Scomberesox simulans	Dwarf saury	Balaou atlantique	Paparda del Atlántico	Scomberesocidae	BELONIFORMES
WAH	Acanthocybium solandri	Wahoo	Thazard-bâtard	Peto	Scombridae	SCOMBROIDEI
BLT	Auxis rochei	Bullet tuna	Bonitou	Melva(=Melvera)	Scombridae	SCOMBROIDEI
FRI	Auxis thazard	Frigate tuna	Auxide	Melva	Scombridae	SCOMBROIDEI

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FRZ	Auxis thazard, A. rochei	Frigate and bullet tunas	Auxide et bonitou	Melva y melvera	Scombridae	SCOMBROIDEI
LTA	Euthynnus alletteratus	Little tunny(=Atl.black skipj)	Thonine commune	Bacoreta	Scombridae	SCOMBROIDEI
SKJ	Katsuwonus pelamis	Skipjack tuna	Listao	Listado	Scombridae	SCOMBROIDEI
BOP	Orcynopsis unicolor	Plain bonito	Palomette	Tasarte	Scombridae	SCOMBROIDEI
BON	Sarda sarda	Atlantic bonito	Bonite à dos rayé	Bonito del Atlántico	Scombridae	SCOMBROIDEI
BZX	Sarda spp	Bonitos nei	Bonites nca	Bonitos nep	Scombridae	SCOMBROIDEI
MAS	Scomber japonicus	Chub mackerel	Maquereau espagnol	Estornino	Scombridae	SCOMBROIDEI
MAZ	Scomber spp	Scomber mackerels nei	Maquereaux scomber nca	Caballas scomber nep	Scombridae	SCOMBROIDEI
KGX	Scomberomorus spp	Seerfishes nei	Thazards nca	Carites nep	Scombridae	SCOMBROIDEI
MAW	Scomberomorus tritor	West African Spanish mackerel	Thazard blanc	Carite lusitánico	Scombridae	SCOMBROIDEI
MAX	Scombridae	Mackerels nei	Maquereaux nca	Caballas nep	Scombridae	SCOMBROIDEI
ALB	Thunnus alalunga	Albacore	Germon	Atún blanco	Scombridae	SCOMBROIDEI
YFT	Thunnus albacares	Yellowfin tuna	Albacore	Rabil	Scombridae	SCOMBROIDEI
BET	Thunnus obesus	Bigeye tuna	Thon obèse(=Patudo)	Patudo	Scombridae	SCOMBROIDEI
TUS	Thunnus spp	True tunas nei	Thons Thunnus nca	Atunes verdaderos nep	Scombridae	SCOMBROIDEI
BFT	Thunnus thynnus	Atlantic bluefin tuna	Thon rouge de l'Atlantique	Atún rojo del Atlántico	Scombridae	SCOMBROIDEI
	Benthalbella infans	Zugmayer's pearleye			Scopelarchidae	AULOPIFORMES
OUA	Scopelarchus analis	Short fin pearleye			Scopelarchidae	AULOPIFORMES
PIS	Pontinus accraensis	Ghanean rockfish			Scorpaenidae	SCORPAENIFORMES
	Pontinus leda	Speckled deepwater scorpionfish			Scorpaenidae	SCORPAENIFORMES
SSW	Scorpaena angolensis	Angola rockfish			Scorpaenidae	SCORPAENIFORMES
EZS	Scorpaena elongata	Slender rockfish	Rascasse rose	Gallineta rosada	Scorpaenidae	SCORPAENIFORMES
SLQ	Scorpaena laevis	Senegalese rockfish			Scorpaenidae	SCORPAENIFORMES
MZS	Scorpaena maderensis	Madeira rockfish	Rascasse de Madère	Rascacio de Madeira	Scorpaenidae	SCORPAENIFORMES
SCS	Scorpaena normani	Norman's rockfish	Rascasses nca	Rascacios, cabrachos nep	Scorpaenidae	SCORPAENIFORMES
SNQ	Scorpaena notata	Small red scorpionfish			Scorpaenidae	SCORPAENIFORMES
RSE	Scorpaena scrofa	Red scorpionfish	Rascasse rouge	Cabracho	Scorpaenidae	SCORPAENIFORMES
SCS	Scorpaena spp	Scorpionfishes, rockfishes nei	Rascasses nca	Rascacios, cabrachos nep	Scorpaenidae	SCORPAENIFORMES
SCS	Scorpaena stephanica	Spotted-fin rockfish	Rascasses nca	Rascacios, cabrachos nep	Scorpaenidae	SCORPAENIFORMES
SCO	Scorpaenidae	Scorpionfishes nei	Rascasses, etc. nca	Rascacios, gallinetas nep	Scorpaenidae	SCORPAENIFORMES

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SOF	Scorpaenodes africanus				Scorpaenidae	SCORPAENIFORMES
	Scorpaenodes elongatus				Scorpaenidae	SCORPAENIFORMES
TZY	Trachyscorpia cristulata echinata	Spiny scorpionfish	Rascasse épineuse	Rascacio espinoso	Scorpaenidae	SCORPAENIFORMES
BRF	Helicolenus dactylopterus	Blackbelly rosefish	Sébaste chèvre	Gallineta	Sebastidae	SCORPAENIFORMES
AHN	Anthias anthias	Swallowtail seaperch			Serranidae	PERCOIDEI
CFQ	Cephalopholis nigri	Niger hind	Mérou du Niger	Cherna del Niger	Serranidae	PERCOIDEI
EFA	Cephalopholis taeniops	Bluespotted seabass; African hind	Mérou à points bleus	Cherna colorada	Serranidae	PERCOIDEI
GPW	Epinephelus aeneus	White grouper	Mérou blanc	Cherna de ley	Serranidae	PERCOIDEI
EFJ	Epinephelus caninus	Dogtooth grouper	Mérou gris	Mero dentón	Serranidae	PERCOIDEI
EPK	Epinephelus costae	Goldblotch grouper	Mérou badèche	Falso abadejo	Serranidae	PERCOIDEI
EEG	Epinephelus goreensis	Dungat grouper	Mérou de Gorée	Mero de Gorea	Serranidae	PERCOIDEI
EEL	Epinephelus haifensis	Haifa grouper	Mérou d'Haifa	Mero de Haifa	Serranidae	PERCOIDEI
EET	Epinephelus itajara	Jewfish	Mérou géant	Mero guasa	Serranidae	PERCOIDEI
GPD	Epinephelus marginatus	Dusky grouper	Mérou noir	Mero moreno	Serranidae	PERCOIDEI
GPX	Epinephelus spp	Groupers nei	Mérous nca	Meros nep	Serranidae	PERCOIDEI
MKU	Mycteroperca rubra	Mottled grouper	Badèche rouge	Gitano	Serranidae	PERCOIDEI
RYC	Rypticus saponaceus	Greater soapfish			Serranidae	PERCOIDEI
	Rypticus subbifrenatus	Spotted soapfish			Serranidae	PERCOIDEI
BSX	Serranidae	Groupers, seabasses nei	Serranidés nca	Meros, chernas, nep	Serranidae	PERCOIDEI
	Serranus accraensis	Ghanean comber	Serran-chèvre	Cabrilla	Serranidae	PERCOIDEI
	Serranus africanus		Serran-chèvre	Cabrilla	Serranidae	PERCOIDEI
CBR	Serranus cabrilla	Comber	Serran-chèvre	Cabrilla	Serranidae	PERCOIDEI
BAS	Serranus spp	Combers nei	Serrans nca	Serranos nep	Serranidae	PERCOIDEI
ASB	Serrivomer beani	Bean's sawtooth eel			Serrivomeridae	ANGUILLIFORMES
AWK	Serrivomer spp	Sawtooth eels nei			Serrivomeridae	ANGUILLIFORMES
SVG	Setarches guentheri	Channeled rockfish; deepwater scorpionfish			Setarchidae	SCORPAENIFORMES
	Bathysolea polli				Soleidae	PLEURONECTIFORMES
	Bathysolea profundicola	Deepwater sole			Soleidae	PLEURONECTIFORMES
GSM	Buglossidium luteum	Solenette			Soleidae	PLEURONECTIFORMES
DHZ	Dicologlossa hexophthalma	Ocellated wedge sole	Céteau ocellé	Acedía ocelada	Soleidae	PLEURONECTIFORMES

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	<i>Heteromycteris proboscideus</i>	True sole			Soleidae	PLEURONECTIFORMES
	<i>Microchirus boscanion</i>	Lusitanian sole			Soleidae	PLEURONECTIFORMES
	<i>Microchirus frechkopi</i>	Frechkop's sole			Soleidae	PLEURONECTIFORMES
MRK	<i>Microchirus ocellatus</i>	Foureyed sole			Soleidae	PLEURONECTIFORMES
THS	<i>Microchirus</i> spp	Thickback soles	Soles-perdix	Golletas	Soleidae	PLEURONECTIFORMES
MZT	<i>Microchirus theophila</i>	Bastard sole	Sole-perdrix juive	Acevía senegalesa	Soleidae	PLEURONECTIFORMES
MKG	<i>Microchirus variegatus</i>	Thickback sole			Soleidae	PLEURONECTIFORMES
	<i>Microchirus wittei</i>	Banded sole			Soleidae	PLEURONECTIFORMES
MHH	<i>Monochirus hispidus</i>	Whiskered sole			Soleidae	PLEURONECTIFORMES
SOS	<i>Pegusa lascaris</i>	Sand sole	Sole-pole	Lenguado de arena	Soleidae	PLEURONECTIFORMES
OAL	<i>Solea senegalensis</i>	Senegalese sole	Sole du Sénégal	Lenguado senegalés	Soleidae	PLEURONECTIFORMES
SOL	<i>Solea solea</i>	Common sole	Sole commune	Lenguado común	Soleidae	PLEURONECTIFORMES
SOO	<i>Solea</i> spp				Soleidae	PLEURONECTIFORMES
SOX	Soleidae	Soles nei	Soles nca	Lenguados nep	Soleidae	PLEURONECTIFORMES
YNY	<i>Synaptura cadenati</i>	Guinean sole	Sole-ruardon du Golfe	Lenguado de Guinea	Soleidae	PLEURONECTIFORMES
YNU	<i>Synaptura lusitanica</i>	Portuguese sole			Soleidae	PLEURONECTIFORMES
VNC	<i>Vanstraelenia chirophthalmus</i>	African solenette			Soleidae	PLEURONECTIFORMES
	<i>Pegusa triophthalma</i>	Cyclope sole			Soleidae	PLEURONECTIFORMES
BOG	<i>Boops boops</i>	Bogue	Bogue	Boga	Sparidae	PERCOIDEI
DEA	<i>Dentex angolensis</i>	Angolan dentex	Denté angolais	Dentón angoleño	Sparidae	PERCOIDEI
	<i>Dentex barnardi</i>	Barnard's dentex	Denté à tache rouge	Chacaron de Canarias	Sparidae	PERCOIDEI
DEN	<i>Dentex canariensis</i>	Canary dentex	Denté à tache rouge	Chacaron de Canarias	Sparidae	PERCOIDEI
DNC	<i>Dentex congoensis</i>	Congo dentex	Denté congolais	Dentón congolés	Sparidae	PERCOIDEI
DEC	<i>Dentex dentex</i>	Common dentex	Denté commun	Dentón	Sparidae	PERCOIDEI
DEP	<i>Dentex gibbosus</i>	Pink dentex	Gros denté rose	Sama de pluma	Sparidae	PERCOIDEI
DEL	<i>Dentex macrophthalmus</i>	Large-eye dentex	Denté à gros yeux	Cachucho	Sparidae	PERCOIDEI
DEM	<i>Dentex maroccanus</i>	Morocco dentex	Denté du Maroc	Sama marroquí	Sparidae	PERCOIDEI
DEX	<i>Dentex</i> spp	Dentex nei	Dentés nca	Dentones, samas, etc. nep	Sparidae	PERCOIDEI
SBZ	<i>Diplodus cervinus</i>	Zebra seabream	Sar à grosses lèvres	Sargo breado	Sparidae	PERCOIDEI
SHR	<i>Diplodus puntazzo</i>	Sharpsnout seabream	Sar à museau pointu	Sargo picudo	Sparidae	PERCOIDEI
	<i>Diplodus sargus cadenati</i>	Moroccan white seabream	Sar commun	Sargo	Sparidae	Perciformes
	<i>Diplodus sargus sargus</i>	White seabream	Sar commun	Sargo	Sparidae	Perciformes

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SRG	Diplodus spp	Sargo breams nei	Sars, sparailions nca	Sargos, raspallones nep	Sparidae	PERCOIDEI
CTB	Diplodus vulgaris	Common two-banded seabream	Sar à tête noire	Sargo mojarra	Sparidae	PERCOIDEI
SSB	Lithognathus mormyrus	Sand steenbras	Marbré	Herrera	Sparidae	PERCOIDEI
SBS	Oblada melanura	Saddled seabream	Oblade	Oblada	Sparidae	PERCOIDEI
SBA	Pagellus acarne	Axillary seabream	Pageot acarne	Aligote	Sparidae	PERCOIDEI
PAR	Pagellus bellottii	Red pandora	Pageot à tache rouge	Breca chata	Sparidae	PERCOIDEI
PAC	Pagellus erythrinus	Common pandora	Pageot commun	Breca	Sparidae	PERCOIDEI
PAX	Pagellus spp	Pandoras nei	Pageots nca	Brecas nep	Sparidae	PERCOIDEI
	Pagrus africanus	Southern common seabream	Pagre rayé	Pargo sémola	Sparidae	PERCOIDEI
REA	Pagrus auriga	Redbanded seabream	Pagre rayé	Pargo sémola	Sparidae	PERCOIDEI
BSC	Pagrus caeruleostictus	Bluespotted seabream	Pagre à points bleus	Hurta(=Zapata)	Sparidae	PERCOIDEI
RPG	Pagrus pagrus	Red porgy	Pagre rouge	Pargo	Sparidae	PERCOIDEI
SBP	Pagrus spp	Pargo breams nei	Dorades nca	Pargos nep	Sparidae	PERCOIDEI
SLM	Sarpa salpa	Salema	Saupe	Salema	Sparidae	PERCOIDEI
SBX	Sparidae	Porgies, seabreams nei	Dentés, spares nca	Dentones, sargos nep	Sparidae	PERCOIDEI
SBG	Sparus aurata	Gilthead seabream	Dorade royale	Dorada	Sparidae	PERCOIDEI
BRB	Spondyliosoma cantharus	Black seabream	Dorade grise	Chopa	Sparidae	PERCOIDEI
BAG	Sphyraena afra	Guinean barracuda	Bécune guinéenne	Espetón de Guinea	Sphyraenidae	OTHER PERCIFORMES
GBA	Sphyraena barracuda	Great barracuda	Barracuda	Picuda barracuda	Sphyraenidae	OTHER PERCIFORMES
YRU	Sphyraena guachancho	Guachanche barracuda			Sphyraenidae	OTHER PERCIFORMES
YRS	Sphyraena sphyraena	European barracuda	Bécune européenne	Espetón	Sphyraenidae	OTHER PERCIFORMES
BAR	Sphyraena spp	Barracudas nei	Bécunes nca	Picudas nep	Sphyraenidae	OTHER PERCIFORMES
BAZ	Sphyraenidae	Barracudas, etc. nei	Bécunes, barracudas, nca	Barracudas, picudas, nep	Sphyraenidae	OTHER PERCIFORMES
	Argyropelecus affinis	Pacific hatchet fish			Sternoptychidae	STOMIIFORMES
	Argyropelecus gigus	hatchetfish			Sternoptychidae	STOMIIFORMES
	Argyropelecus hemigymnus	Half-naked hatchetfish			Sternoptychidae	STOMIIFORMES
	Argyropelecus sladeni	Sladen's hatchetfish			Sternoptychidae	STOMIIFORMES
MAV	Maurolicus muelleri	Silvery lightfish			Sternoptychidae	STOMIIFORMES
	Maurolicus weitzmani	Atlantic pearlside			Sternoptychidae	STOMIIFORMES
	Polyipnus polli				Sternoptychidae	STOMIIFORMES

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HAF	Sternoptychidae	Hatchetfishes nei	Haches d'argent nca	Hachas de plata nep	Sternoptychidae	STOMIIFORMES
SXD	<i>Sternoptyx diaphana</i>	Diaphanous hatchet fish			Sternoptychidae	STOMIIFORMES
SXP	<i>Sternoptyx pseudobscura</i>	Highlight hatchetfish			Sternoptychidae	STOMIIFORMES
VAT	<i>Valenciennellus tripunctulatus</i>	Constellationfish			Sternoptychidae	STOMIIFORMES
	<i>Aristostomias polydactylus</i>				Stomiidae	STOMIIFORMES
	<i>Aristostomias xenostoma</i>				Stomiidae	STOMIIFORMES
	<i>Astronesthes caulophorus</i>				Stomiidae	STOMIIFORMES
AEG	<i>Astronesthes gemmifer</i>	Snaggletooth			Stomiidae	STOMIIFORMES
AEO	<i>Astronesthes leucopogon</i>				Stomiidae	STOMIIFORMES
	<i>Astronesthes macropogon</i>				Stomiidae	STOMIIFORMES
	<i>Astronesthes micropogon</i>				Stomiidae	STOMIIFORMES
AHR	<i>Astronesthes niger</i>				Stomiidae	STOMIIFORMES
	<i>Astronesthes richardsoni</i>	Richardson's snaggletooth			Stomiidae	STOMIIFORMES
	<i>Bathophilus brevis</i>				Stomiidae	STOMIIFORMES
BTU	<i>Bathophilus digitatus</i>				Stomiidae	STOMIIFORMES
BTN	<i>Bathophilus nigerrimus</i>	Scaleless dragonfish			Stomiidae	STOMIIFORMES
	<i>Bathophilus pawneeii</i>	Pawnee dragonfish			Stomiidae	STOMIIFORMES
	<i>Borostomias elucens</i>				Stomiidae	STOMIIFORMES
BRM	<i>Borostomias mononema</i>	Sickle snaggletooth			Stomiidae	STOMIIFORMES
CUD	<i>Chauliodus danae</i>	Dana viperfish			Stomiidae	STOMIIFORMES
CVS	<i>Chauliodus schmidti</i>				Stomiidae	STOMIIFORMES
CDN	<i>Chauliodus sloani</i>	Sloane's viperfish			Stomiidae	STOMIIFORMES
ECR	<i>Echiostoma barbatum</i>	Threadfin dragonfish			Stomiidae	STOMIIFORMES
	<i>Eustomias achirus</i>	Proud dragonfish			Stomiidae	STOMIIFORMES
	<i>Eustomias dendriticus</i>				Stomiidae	STOMIIFORMES
	<i>Eustomias en barbatus</i>	Barbate dragonfish			Stomiidae	STOMIIFORMES
	<i>Eustomias filifer</i>				Stomiidae	STOMIIFORMES
	<i>Eustomias lipochirus</i>				Stomiidae	STOMIIFORMES
	<i>Eustomias melanonema</i>				Stomiidae	STOMIIFORMES

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	<i>Eustomias melanostigma</i>				Stomiidae	STOMIIFORMES
	<i>Eustomias obscurus</i>				Stomiidae	STOMIIFORMES
FGU	<i>Flagellostomias boureei</i>	Longbarb dragonfish			Stomiidae	STOMIIFORMES
HTO	<i>Heterophotus ophistoma</i>	Wingfin snaggletooth			Stomiidae	STOMIIFORMES
	<i>Leptostomias longibarba</i>				Stomiidae	STOMIIFORMES
MCN	<i>Malacosteus niger</i>	Stoplight loosejaw			Stomiidae	STOMIIFORMES
	<i>Melanostomias bartonbeani</i>	Scaleless black dragonfish			Stomiidae	STOMIIFORMES
MNB	<i>Melanostomias biseriatus</i>				Stomiidae	STOMIIFORMES
MNE	<i>Melanostomias tentaculatus</i>	Tentacle dragonfish			Stomiidae	STOMIIFORMES
	<i>Odontostomias micropogon</i>				Stomiidae	STOMIIFORMES
SCW	<i>Pachystomias microdon</i>	Smalltooth dragonfish			Stomiidae	STOMIIFORMES
	<i>Photonectes dinema</i>				Stomiidae	STOMIIFORMES
	<i>Photonectes leucospilus</i>				Stomiidae	STOMIIFORMES
	<i>Photonectes margarita</i>				Stomiidae	STOMIIFORMES
	<i>Stomias affinis</i>	Günther's boafish			Stomiidae	STOMIIFORMES
	<i>Stomias lampropeltis</i>				Stomiidae	STOMIIFORMES
	<i>Stomias longibarbatus</i>	Longbarb scaly dragonfish			Stomiidae	STOMIIFORMES
SWK	<i>Stomias</i> spp				Stomiidae	STOMIIFORMES
	Stomiidae				Stomiidae	STOMIIFORMES
BLB	<i>Stromateus fiatola</i>	Blue butterfish	Fiatole	Palometa fiatola	Stromateidae	STROMATEOIDEI, ANABANTOIDEI
LSC	<i>Stylephorus chordatus</i>	Tube-eye			Stylephoridae	LAMPRIIFORMES
	<i>Dysomma brevirostre</i>	Pignosed arrowtooth eel			Synaphobranchidae	ANGUILLIFORMES
SVY	Synaphobranchidae	Cutthroat eels nei			Synaphobranchidae	ANGUILLIFORMES
	<i>Synaphobranchus affinis</i>	Grey cutthroat			Synaphobranchidae	ANGUILLIFORMES
	<i>Cosmocampus retropinnis</i>				Syngnathidae	SYNGNATHIFORMES
	<i>Hippocampus algiricus</i>	West African seahorse			Syngnathidae	SYNGNATHIFORMES
HPI	<i>Hippocampus guttulatus</i>	Long-snouted seahorse	Hippocampe à long bec	Caballito de mar	Syngnathidae	SYNGNATHIFORMES
HPH	<i>Hippocampus hippocampus</i>	Short snouted seahorse			Syngnathidae	SYNGNATHIFORMES

Code	Scientific name	English name	French name	Spanish name	Family	Order
HIC	Hippocampus spp	Seahorses nei			Syngnathidae	SYNGNATHIFORMES
	Microphis brachyurus aculeatus				Syngnathidae	SYNGNATHIFORMES
	Microphis brachyurus brachyurus	Short-tailed pipefish			Syngnathidae	SYNGNATHIFORMES
SGQ	Syngnathus acus	Greater pipefish			Syngnathidae	SYNGNATHIFORMES
SWY	Syngnathus spp	Pipefishes nei			Syngnathidae	SYNGNATHIFORMES
BHF	Bathysaurus ferrox	Deep-sea lizardfish			Synodontidae	AULOPIFORMES
	Bathysaurus mollis	Highfin lizardfish			Synodontidae	AULOPIFORMES
	Saurida brasiliensis	Brazilian lizardfish			Synodontidae	AULOPIFORMES
TCY	Trachinocephalus myops	Snakefish			Synodontidae	AULOPIFORMES
EFG	Ephippion guttifer	Prickly puffer			Tetraodontidae	TETRAODONTIFORMES
LFL	Lagocephalus laevigatus	Smooth puffer			Tetraodontidae	TETRAODONTIFORMES
LGH	Lagocephalus lagocephalus	Oceanic puffer			Tetraodontidae	TETRAODONTIFORMES
TSP	Sphoeroides pachygaster	Blunthead puffer			Tetraodontidae	TETRAODONTIFORMES
	Sphoeroides spengleri	Bandtail puffer	Compères de l'Atlantique nca	Tamboriles del Atlántico nep	Tetraodontidae	TETRAODONTIFORMES
PUX	Tetraodontidae	Puffers nei	Compères nca	Tamboriles nep	Tetraodontidae	TETRAODONTIFORMES
GXW	Gephyroberyx darwinii	Darwin's slimehead			Trachichthyidae	BERYCIFORMES
HPR	Hoplostethus mediterraneus	Mediterranean slimehead	Hoplostète argenté	Reloj mediterráneo	Trachichthyidae	BERYCIFORMES
TRC	Trachichthyidae	Slimeheads nei	Poissons-montres nca	Relojes nep	Trachichthyidae	BERYCIFORMES
TRA	Trachinidae	Weeverfishes nei	Vives, etc. nca	Arañas, escorpiones nep	Trachinidae	TRACHINOIDEI
	Trachinus armatus	Guinean weever			Trachinidae	Perciformes
	Trachinus collignoni	Sailfin weever			Trachinidae	Perciformes
	Trachinus lineolatus	Striped weever			Trachinidae	Perciformes
	Trachinus pellegrini	Cape Verde weever			Trachinidae	Perciformes
TZR	Trachinus radiatus	Starry weever	Vive à tête rayonnée	Víbora	Trachinidae	Perciformes
WEX	Trachinus spp	Weevers nei	Vives nca	Arañas nep	Trachinidae	TRACHINOIDEI
DSM	Desmodema polystictum	Polka-dot ribbonfish			Trachipteridae	LAMPRIFORMES
TRX	Trachipteridae	Ribbonfishes	Trachyptères, poissons-rubans	Peces cinta	Trachipteridae	LAMPRIFORMES

Code	Scientific name	English name	French name	Spanish name	Family	Order
TRQ	Trachipterus trachipterus	Mediterranean dealfish; ribbonfish	Poisson ruban	Traquíptero	Trachipteridae	LAMPRIFORMES
BEH	Benthodesmus spp	Frostfishes			Trichiuridae	SCOMBROIDEI
	Benthodesmus tenuis	Slender frostfish			Trichiuridae	SCOMBROIDEI
SFS	Lepidopus caudatus	Silver scabbardfish	Sabre argenté	Pez cinto	Trichiuridae	SCOMBROIDEI
	Lepidopus dubius	Doubtful scabbardfish	Sabre argenté	Pez cinto	Trichiuridae	SCOMBROIDEI
CUT	Trichiuridae	Hairtails, scabbardfishes nei	Poissons-sabres, sabres nca	Peces sable, cintos nep	Trichiuridae	SCOMBROIDEI
LHT	Trichiurus lepturus	Largehead hairtail	Poisson-sabre commun	Pez sable	Trichiuridae	SCOMBROIDEI
CGY	Chelidonichthys gabonensis	Gabon gurnard			Triglidae	SCORPAENIFORMES
	Lepidotrigla cadmani	Scalebreast gurnard			Triglidae	SCORPAENIFORMES
LDR	Lepidotrigla carolae	Carol's gurnard			Triglidae	SCORPAENIFORMES
GUX	Triglidae	Gurnards, searobins nei	Grondins, cavillones nca	Cabetes, rubios nep	Triglidae	SCORPAENIFORMES
CTZ	Trigloporus lastoviza	Streaked gurnard			Triglidae	SCORPAENIFORMES
TDA	Tripterygion delaisi	Black-faced blenny			Tripterygiidae	OTHER PERCIFORMES
	Uranoscopus albesca	Longspine stargazer	Uranoscopes	Miracielos(=Ratas)	Uranoscopidae	TRACHINOIDEI
	Uranoscopus cadenati	West African stargazer	Uranoscopes	Miracielos(=Ratas)	Uranoscopidae	TRACHINOIDEI
	Uranoscopus polli	Whitespotted stargazer	Uranoscopes	Miracielos(=Ratas)	Uranoscopidae	TRACHINOIDEI
URA	Uranoscopus spp	Stargazers	Uranoscopes	Miracielos(=Ratas)	Uranoscopidae	TRACHINOIDEI
SWO	Xiphias gladius	Swordfish	Espadon	Pez espada	Xiphiidae	SCOMBROIDEI
ZEX	Zeidae	Dories nei	Saint Pierres nca	Peces de San Pedro nep	Zeidae	ZEIFORMES
JOS	Zenopsis conchifer	Silvery John dory	Saint Pierre argenté	San Pedro plateado	Zeidae	ZEIFORMES
JOD	Zeus faber	John dory	Saint Pierre	Pez de San Pedro	Zeidae	ZEIFORMES
	Zenion hololepis				Zenionidae	ZEIFORMES
	Zenion longipinnis				Zenionidae	ZEIFORMES
	Pachycara crassiceps				Zoarcidae	Perciformes
	Pachycara crossacanthum				Zoarcidae	Perciformes
PWR	Pachycara spp				Zoarcidae	Perciformes
LVD	Zoarcidae	Eelpouts nei	Loquettes nca	Loquetas nep	Zoarcidae	Perciformes

Fish (cartilaginous)

Code	Scientific name	English name	French name	Spanish name	Family	Order
CAR	Chondrichthyes	Cartilaginous fishes nei	Poissons cartilagineux nca	Peces cartilaginosos nep		PISCES MISCELLANEA
SKX	Elasmobranchii	Sharks, rays, skates, etc. nei	Requins, raies, etc. nca	Tiburones, rayas, etc. nep		PISCES MISCELLANEA
CYH	Hydrolagus mirabilis	Large-eyed rabbitfish			Chimaeridae	CHIMAERIFORMES
HYD	Hydrolagus spp	Ratfishes nei	Chimères nca	Quimeras nep	Chimaeridae	CHIMAERIFORMES
CNN	Neoharriotta pinnata	Sicklefin chimaera			Rhinochimaeridae	CHIMAERIFORMES
HOL	Chimaeriformes	Chimaeras, etc. nei	Chimères, etc. nca	Quimeras, etc. nep		CHIMAERIFORMES
THR	Alopias spp	Thresher sharks nei	Renards de mer nca	Zorros nep	Alopiidae	LAMNIFORMES
BTH	Alopias superciliosus	Bigeye thresher	Renard à gros yeux	Zorro oñón	Alopiidae	LAMNIFORMES
ALV	Alopias vulpinus	Thresher	Renard	Zorro	Alopiidae	LAMNIFORMES
RSK	Carcharhinidae	Requiem sharks nei	Requins nca	Cazones picudos, tintoreras nep	Carcharhinidae	CARCHARHINIFORMES
CCA	Carcharhinus altimus	Bignose shark	Requin babosse	Tiburón baboso	Carcharhinidae	CARCHARHINIFORMES
CCF	Carcharhinus amboinensis	Pigeye shark	Requin balestrine	Tiburón baleta	Carcharhinidae	CARCHARHINIFORMES
BRO	Carcharhinus brachyurus	Copper shark	Requin cuivre	Tiburón cobrizo	Carcharhinidae	CARCHARHINIFORMES
CCB	Carcharhinus brevipinna	Spinner shark	Requin tisserand	Tiburón aleta negra	Carcharhinidae	CARCHARHINIFORMES
FAL	Carcharhinus falciformis	Silky shark	Requin soyeux	Tiburón jaquetón	Carcharhinidae	CARCHARHINIFORMES
CCE	Carcharhinus leucas	Bull shark	Requin bouledogue	Tiburón sarda	Carcharhinidae	CARCHARHINIFORMES
CCL	Carcharhinus limbatus	Blacktip shark	Requin bordé	Tiburón macuira	Carcharhinidae	CARCHARHINIFORMES
OCS	Carcharhinus longimanus	Oceanic whitetip shark	Requin océanique	Tiburón océánico	Carcharhinidae	CARCHARHINIFORMES
DUS	Carcharhinus obscurus	Dusky shark	Requin de sable	Tiburón arenero	Carcharhinidae	CARCHARHINIFORMES
CCP	Carcharhinus plumbeus	Sandbar shark	Requin gris	Tiburón trozo	Carcharhinidae	CARCHARHINIFORMES
CCS	Carcharhinus signatus	Night shark	Requin de nuit	Tiburón de noche	Carcharhinidae	CARCHARHINIFORMES
CWZ	Carcharhinus spp	Carcharhinus sharks nei	Requins Carcharhinus nca	Cazones Carcharhinus nep	Carcharhinidae	CARCHARHINIFORMES
TIG	Galeocerdo cuvier	Tiger shark	Requin tigre commun	Tintorera tigre	Carcharhinidae	CARCHARHINIFORMES
NGB	Negaprion brevirostris	Lemon shark	Requin citron	Tiburón galano	Carcharhinidae	CARCHARHINIFORMES
BSH	Prionace glauca	Blue shark	Peau bleue	Tiburón azul	Carcharhinidae	CARCHARHINIFORMES
RHA	Rhizoprionodon acutus	Milk shark	Requin à museau pointu	Cazón lechoso	Carcharhinidae	CARCHARHINIFORMES
DCA	Deania calcea	Birdbeak dogfish	Squale savate	Tollo pajarito	Centrophoridae	SQUALIFORMES
SDU	Deania profundorum	Arrowhead dogfish	Squale-savate lutin	Tollo flecha	Centrophoridae	SQUALIFORMES

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BSK	Cetorhinus maximus	Basking shark	Pèlerin	Peregrino	Cetorhinidae	LAMNIFORMES
SCK	Dalatias licha	Kitefin shark	Squale liche	Carocho	Dalatiidae	SQUALIFORMES
SHB	Echinorhinus brucus	Bramble shark	Squale bouclé	Tiburón de clavos	Echinorhinidae	SQUALIFORMES
GNC	Ginglymostoma cirratum	Nurse shark	Requin-nourrice	Gata nodriza	Ginglymostomatidae	ORECTOLOBIFORMES
HEI	Paragaleus pectoralis	Atlantic weasel shark	Milandre jaune	Tiburón comadiza	Hemigaleidae	CARCHARHINIFORMES
HXT	Hepranchias perlo	Sharpnose sevengill shark	Requin perlon	Cañabota bocadulce	Hexanchidae	HEXANCHIFORMES
SBL	Hexanchus griseus	Bluntnose sixgill shark	Requin grisét	Cañabota gris	Hexanchidae	HEXANCHIFORMES
WSH	Carcharodon carcharias	Great white shark	Grand requin blanc	Jaquetón blanco	Lamnidae	LAMNIFORMES
SMA	Isurus oxyrinchus	Shortfin mako	Taupe bleue	Marrajo dientuso	Lamnidae	LAMNIFORMES
MAK	Isurus spp	Mako sharks	Taupes	Marrajos	Lamnidae	LAMNIFORMES
POR	Lamna nasus	Porbeagle	Requin-taupe commun	Marrajo sardiner	Lamnidae	LAMNIFORMES
MSK	Lamnidae	Mackerel sharks,porbeagles nei	Requins taupe nca	Jaquetones,marrajos nep	Lamnidae	LAMNIFORMES
CLL	Leptocharias smithii	Barbeled houndshark	Émissole barbue	Tiburón barbudo	Leptochariidae	CARCHARHINIFORMES
LMP	Megachasma pelagios	Megamouth shark	Requin grande guele	Tiburón bocudo	Megachasmidae	LAMNIFORMES
LMO	Mitsukurina owstoni	Goblin shark	Requin lutin	Tiburón duende	Mitsukurinidae	LAMNIFORMES
CCT	Carcharias taurus	Sand tiger shark	Requin taureau	Toro bacota	Odontaspidae	LAMNIFORMES
OXY	Oxynotus centrina	Angular roughshark	Centrine commune	Cerdo marino	Oxynotidae	SQUALIFORMES
OXN	Oxynotus paradoxus	Sailfin roughshark	Humantin	Cerdo marino velero	Oxynotidae	SQUALIFORMES
PTM	Pseudotriakis microdon	False catshark	Requin à longue dorsale	Musolón de aleta larga	Pseudotriakidae	CARCHARHINIFORMES
RHN	Rhincodon typus	Whale shark	Requin baleine	Tiburón ballena	Rhincodontidae	ORECTOLOBIFORMES
SHO	Galeus melastomus	Blackmouth catshark	Chien espagnol	Pintarroja bocanegra	Scyliorhinidae	CARCHARHINIFORMES
GAQ	Galeus polli	African sawtail catshark	Chien râpe	Pintarroja africana	Scyliorhinidae	CARCHARHINIFORMES
GAU	Galeus spp	Crest-tail catsharks nei	Chiens galeus nca	Pintarrojas nep	Scyliorhinidae	CARCHARHINIFORMES
SYX	Scyliorhinidae	Catsharks, etc. nei	Chiens,holbiches,rousset. nca	Alitanes,pejegatos,pintar. nep	Scyliorhinidae	CARCHARHINIFORMES
SYC	Scyliorhinus canicula	Small-spotted catshark	Petite roussette	Pintarroja	Scyliorhinidae	CARCHARHINIFORMES
SYE	Scyliorhinus cervigoni	West African catshark	Roussette thalassa	Alitán africano	Scyliorhinidae	CARCHARHINIFORMES
SCL	Scyliorhinus spp	Catsharks, nursehounds nei	Roussettes nca	Alitanes, pintarrojas nep	Scyliorhinidae	CARCHARHINIFORMES
SYT	Scyliorhinus stellaris	Nursehound	Grande roussette	Alitán	Scyliorhinidae	CARCHARHINIFORMES
SYO	Scymnodon obscurus	Smallmouth knifetooth dogfish	Squale-grogneur à queue échan.	Bruja bocachica	Somniosidae	SQUALIFORMES
SYR	Scymnodon ringens	Knifetooth dogfish	Squale-grogneur commun	Bruja	Somniosidae	SQUALIFORMES

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SPV	<i>Sphyrna couardi</i>	Whitefin hammerhead	Requin-marteau aile blanche	Cornuda aliblanca	Sphyrnidae	CARCHARHINIFORMES
SPL	<i>Sphyrna lewini</i>	Scalloped hammerhead	Requin-marteau halicorne	Cornuda común	Sphyrnidae	CARCHARHINIFORMES
SPK	<i>Sphyrna mokarran</i>	Great hammerhead	Grand requin marteau	Cornuda gigante	Sphyrnidae	CARCHARHINIFORMES
SPN	<i>Sphyrna spp</i>	Hammerhead sharks nei	Requins marteau nca	Cornudas (Peces martillo) nep	Sphyrnidae	CARCHARHINIFORMES
SPZ	<i>Sphyrna zygaena</i>	Smooth hammerhead	Requin-marteau commun	Cornuda cruz(=Pez martillo)	Sphyrnidae	CARCHARHINIFORMES
SPY	Sphyrnidae	Hammerhead sharks, etc. nei	Requins marteau, etc. nca	Cornudas, etc. nep	Sphyrnidae	CARCHARHINIFORMES
GUP	<i>Centrophorus granulosus</i>	Gulper shark	Squale-chagrin commun	Quelvacho	Squalidae	SQUALIFORMES
CPL	<i>Centrophorus lusitanicus</i>	Lowfin gulper shark	Squale-chagrin longue dorsale	Quelvacho lusitánico	Squalidae	SQUALIFORMES
CWO	<i>Centrophorus spp</i>	Gulper sharks nei	Squales-chagrins nca	Quelvachos nep	Squalidae	SQUALIFORMES
GUQ	<i>Centrophorus squamosus</i>	Leafscale gulper shark	Squale-chagrin de l'Atlantique	Quelvacho negro	Squalidae	SQUALIFORMES
CFB	<i>Centroscyllium fabricii</i>	Black dogfish	Aiguillat noir	Tollo negro merga	Squalidae	SQUALIFORMES
CYO	<i>Centrosymnus coelolepis</i>	Portuguese dogfish	Pailona commun	Pailona	Squalidae	SQUALIFORMES
CYY	<i>Centrosymnus cryptacanthus</i>	Shortnose velvet dogfish	Pailona sans épine	Pailona ñata	Squalidae	SQUALIFORMES
CZI	<i>Centrosymnus spp</i>				Squalidae	SQUALIFORMES
DNA	<i>Deania spp</i>	Deania dogfishes nei	Squales-savates nca	Tollos deania nep	Squalidae	SQUALIFORMES
ETT	<i>Etmopterus polli</i>	African lanternshark	Sagre à menton lisse	Tollo lucero africano	Squalidae	SQUALIFORMES
ETP	<i>Etmopterus pusillus</i>	Smooth lanternshark	Sagre nain	Tollo lucero liso	Squalidae	SQUALIFORMES
ETX	<i>Etmopterus spinax</i>	Velvet belly	Sagre commun	Negrito	Squalidae	SQUALIFORMES
SHL	<i>Etmopterus spp</i>	Lanternsharks nei	Sagres nca	Tollos lucero nep	Squalidae	SQUALIFORMES
DGX	Squalidae	Dogfish sharks nei	Squales nca	Galludos, tollos, nep	Squalidae	SQUALIFORMES
DGS	<i>Squalus acanthias</i>	Picked dogfish	Aiguillat commun	Mielga	Squalidae	SQUALIFORMES
QUB	<i>Squalus blainvillei</i>	Longnose spurdog	Aiguillat coq	Galludo	Squalidae	SQUALIFORMES
DOP	<i>Squalus megalops</i>	Shortnose spurdog	Aiguillat nez court	Galludo ñato	Squalidae	SQUALIFORMES
QUK	<i>Squalus mitsukurii</i>	Shortspine spurdog	Aiguillat épinette	Galludo espinilla	Squalidae	SQUALIFORMES
DGZ	<i>Squalus spp</i>	Dogfishes nei	Aiguillats nca	Mielgas nep	Squalidae	SQUALIFORMES
CPU	<i>Squalus uyato</i>	Little gulper shark	Petit squale-chagrin	Galludito	Squalidae	SQUALIFORMES
SUA	<i>Squatina aculeata</i>	Sawback angelshark	Ange de mer épineux	Angelote espinudo	Squatinae	SQUALIFORMES

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SUT	<i>Squatina oculata</i>	Smoothback angelshark	Ange de mer ocellé	Pez ángel	Squatinae	SQUALIFORMES
ASK	Squatinae	Angelsharks, sand devils nei	Anges de mer nca	Angelotes, peces ángel nep	Squatinae	SQUALIFORMES
GAG	<i>Galeorhinus galeus</i>	Tope shark	Requin-hâ	Cazón	Triakidae	CARCHARHINIFORMES
SMD	<i>Mustelus mustelus</i>	Smooth-hound	Émissole lisse	Musola	Triakidae	CARCHARHINIFORMES
TRK	Triakidae	Houndsharks, smoothhounds nei	Émissoles, requins-hâ nca	Cazones, tollos nep	Triakidae	CARCHARHINIFORMES
CVX	Carcharhiniformes	Ground sharks				CARCHARHINIFORMES
HXW	Hexanchiformes	Filled and cow sharks				HEXANCHIFORMES
LMZ	Lamniformes	Mackerel sharks				LAMNIFORMES
SHX	Squaliformes	Dogfish sharks, etc. nei	Squaliformes nca	Squaliformes nep		SQUALIFORMES
STT	Dasyatidae	Stingrays, butterfly rays nei	Pastenagues, etc. nca	Pastinacas, etc. nep	Dasyatidae	RAJIFORMES
RDC	<i>Dasyatis centroura</i>	Roughtail stingray			Dasyatidae	RAJIFORMES
RDS	<i>Dasyatis margarita</i>	Daisy stingray			Dasyatidae	RAJIFORMES
RDE	<i>Dasyatis margaritella</i>	Pearl stingray			Dasyatidae	RAJIFORMES
RDQ	<i>Dasyatis marmorata</i>	Marbled stingray			Dasyatidae	RAJIFORMES
JDP	<i>Dasyatis pastinaca</i>	Common stingray	Pastenague commune	Raya látigo común	Dasyatidae	RAJIFORMES
RTB	<i>Taeniura grabata</i>	Round stingray			Dasyatidae	RAJIFORMES
RUA	<i>Urogymnus asperrimus</i>	Porcupine ray			Dasyatidae	RAJIFORMES
RGL	<i>Gymnura altavela</i>	Spiny butterfly ray	Raie-papillon épineuse	Raya mariposa	Gymnuridae	RAJIFORMES
RGI	<i>Gymnura micrura</i>	Smooth butterfly ray			Gymnuridae	RAJIFORMES
RBY	<i>Gymnura spp</i>	Butterfly rays nei	Raies-papillon nca	Rayas mariposa nep	Gymnuridae	RAJIFORMES
RMC	<i>Mobula coilloti</i>				Mobulidae	RAJIFORMES
RMM	<i>Mobula mobular</i>	Devil fish		Manta mobula	Mobulidae	RAJIFORMES
RMN	<i>Mobula rochebrunei</i>	Lesser Guinean devil ray	Petit diable de Guinée	Diablito de Guinea	Mobulidae	RAJIFORMES
RMV	<i>Mobula spp</i>	Mobula nei			Mobulidae	RAJIFORMES
RMO	<i>Mobula thurstoni</i>	Smoothtail mobula			Mobulidae	RAJIFORMES
MAN	Mobulidae	Mantas, devil rays nei	Mantes, diables de mer nca	Mantas, diablos nep	Mobulidae	RAJIFORMES
MAF	<i>Aetobatus flagellum</i>	Longheaded eagle ray			Myliobatidae	RAJIFORMES
MAE	<i>Aetobatus narinari</i>	Spotted eagle ray	Aigle de mer léopard	Chucho pintado	Myliobatidae	RAJIFORMES
AQX	<i>Aetobatus spp</i>				Myliobatidae	RAJIFORMES
EAG	Myliobatidae	Eagle rays nei	Aigles de mer nca	Aguilas de mar nep	Myliobatidae	RAJIFORMES

Code	Scientific name	English name	French name	Spanish name	Family	Order
MYL	Myliobatis aquila	Common eagle ray	Aigle commun	Aguila marina	Myliobatidae	RAJIFORMES
MWX	Myliobatis spp				Myliobatidae	RAJIFORMES
MPO	Pteromylaeus bovinus	Bull ray			Myliobatidae	RAJIFORMES
MRB	Rhinoptera bonasus	Cownose ray			Myliobatidae	RAJIFORMES
MRM	Rhinoptera marginata	Lusitanian cownose ray			Myliobatidae	RAJIFORMES
	Rhinoptera spp.				Myliobatidae	RAJIFORMES
RMB	Manta birostris	Giant manta			Myliobatidae	RAJIFORMES
SAW	Pristidae	Sawfishes	Poissons-scies	Peces sierra	Pristidae	RAJIFORMES
RPM	Pristis microdon	Largetooth sawfish			Pristidae	RAJIFORMES
RPP	Pristis pectinata	Smalltooth sawfish			Pristidae	RAJIFORMES
RPR	Pristis pristis	Common sawfish			Pristidae	RAJIFORMES
BYH	Bathyrāja hesperāfricana	West African skate			Rajidae	RAJIFORMES
BHY	Bathyrāja spp	Bathyrāja rays nei	Raies bathyrāja nca	Rayas bathyrāja nep	Rajidae	RAJIFORMES
RJB	Dipturus batis	Blue skate	Pocheteau gris	Noriega	Rajidae	RAJIFORMES
JFD	Dipturus doutrei	Violet skate			Rajidae	RAJIFORMES
RJO	Dipturus oxyrinchus	Longnosed skate	Pocheteau noir	Raya picuda	Rajidae	RAJIFORMES
JFX	Leucoraja leucosticta	Whitedappled skate			Rajidae	RAJIFORMES
RJN	Leucoraja naevus	Cuckoo ray	Raie fleurie	Raya santiguesa	Rajidae	RAJIFORMES
RNA	Neoraja africana	West African pygmy skate			Rajidae	RAJIFORMES
RJC	Raja clavata	Thornback ray	Raie bouclée	Raya de clavos	Rajidae	RAJIFORMES
JAI	Raja miraletus	Brown ray	Raie miroir	Raya de espejos	Rajidae	RAJIFORMES
JAR	Raja radula	Rough ray			Rajidae	RAJIFORMES
RFX	Raja rouxi				Rajidae	RAJIFORMES
SKA	Raja spp	Raja rays nei	Pocheteaux et raies raja nca	Rayas raja nep	Rajidae	RAJIFORMES
RFL	Raja straeleni	Spotted skate			Rajidae	RAJIFORMES
RJU	Raja undulata	Undulate ray	Raie Brunette	Raya mosaica	Rajidae	RAJIFORMES
JFV	Rajella leopardus	Leopard skate			Rajidae	RAJIFORMES
RAJ	Rajidae	Rays and skates nei	Rajidés nca	Rayidos nep	Rajidae	RAJIFORMES
RJA	Rostroraja alba	White skate; bottlenose skate	Raie blanche	Raya bramante	Rajidae	RAJIFORMES
GTF	Rhinobatidae	Guitarfishes, etc. nei	Guitares, etc. nca	Guitarras, etc. nep	Rhinobatidae	RAJIFORMES

Code	Scientific name	English name	French name	Spanish name	Family	Order
GUB	Rhinobatos albomaculatus	Whitespotted guitarfish	Poisson-guitare à lunaires	Guitarra pecosa	Rhinobatidae	RAJIFORMES
RHH	Rhinobatos blochii	Bluntnose guitarfish			Rhinobatidae	RAJIFORMES
RBC	Rhinobatos cemiculus	Blackchin guitarfish			Rhinobatidae	RAJIFORMES
RBI	Rhinobatos irvinei	Spineback guitarfish			Rhinobatidae	RAJIFORMES
RBX	Rhinobatos rhinobatos	Common guitarfish			Rhinobatidae	RAJIFORMES
GUZ	Rhinobatos spp	Guitarfishes nei	Guitares nca	Guitarras nep	Rhinobatidae	RAJIFORMES
RCL	Rhynchobatus luebberti	African wedgefish			Rhinobatidae	RAJIFORMES
RZS	Zanobatus schoenleinii	Striped panray			Rhinobatidae	RAJIFORMES
TOD	Torpedinidae	Electric rays nei	Torpilles, raies électriq. nca	Tremielgas, torpedos nep	Torpedinidae	TORPEDINIFORMES
TTB	Torpedo bauchotae	Rosette torpedo			Torpedinidae	TORPEDINIFORMES
TTN	Torpedo mackayana	Ringed torpedo			Torpedinidae	TORPEDINIFORMES
TTR	Torpedo marmorata	Marbled electric ray; spotted torpedo;	Torpille marbrée	Tremolina mármol	Torpedinidae	TORPEDINIFORMES
TTO	Torpedo nobiliana	Electric ray	Torpille noire	Tremolina negra	Torpedinidae	TORPEDINIFORMES
TOE	Torpedo spp	Torpedo rays	Torpilles	Tremolinas	Torpedinidae	TORPEDINIFORMES
TTV	Torpedo torpedo	Common torpedo	Torpille ocellée	Tremolina	Torpedinidae	TORPEDINIFORMES
BAI	Batoidimorpha(Hypotremata)	Batoid fishes nei	Batoïdes nca	Peces batoideos nep		PISCES MISCELLANEA
SRX	Rajiformes	Rays, stingrays, mantas nei	Raies, pastenagues, mantes nca	Rayas, pastinacas, mantas nep		RAJIFORMES
RMJ	Mobula japonica	Spinetail mobula			Mobulidae	RAJIFORMES

Invertebrates (includes plants & garbage)

Code	Scientific name	English name	French name	Spanish name	Family	Order
X1		Garbage - everything except plastic	Déchets - Tous types de déchets y compris le plastique			Garbage - everything except plastic
X1		Rubbish - everything except plastic	Déchets - Tous types de déchets y compris le plastique			Rubbish - everything except plastic
X2		Garbage - Plastic material	Déchets – matière plastique			Garbage - Plastic material

Code	Scientific name	English name	French name	Spanish name	Family	Order
X2		<i>Rubbish - Plastic material</i>	<i>Déchets – matière plastique</i>			<i>Rubbish - Plastic material</i>
X2		<i>Plastic material</i>	<i>Matière plastique</i>			<i>Plastic material</i>
APL		Aquatic plants nei	Plantes aquatiques nca	Plantas acuáticas nep		PLANTAE AQUATICAE MISCELLANEA
NUQ	Anomura	Anomuran decapods nei	Décapodes anomura nca	Decápodos anomura nep		ANOMURA
GGW	Gorgoniidae	Gorgonians			Gorgoniidae	ANTHOZOA
ATX	Actiniaria	Sea anemones	Actinies	Anémonas de mar		ANTHOZOA
AJZ	Alcyonacea	Soft corals	Corails mous	Corales muelles		ANTHOZOA
AJH	Anthozoa	Corals, anemones, nei				ANTHOZOA
CBL	Non-Scleractinia	Soft corals nei	Corails mous nca	Corales muelles nep		ANTHOZOA
NTW	Pennatulacea	Sea pens				ANTHOZOA
CSS	Scleractinia	Hard corals, madrepores nei	Madrépores nca	Madréporas nep		ANTHOZOA
SSX	Ascidiacea	Sea squirts nei	Asciéens nca	Ascidias nep		ASCIDIACEA
STF	Asteroidea	Starfishes nei	Astéridés nca	Estrellas nep		ASTEROIDEA
CLX	Bivalvia	Clams, etc. nei	Clams, etc. nca	Almejas, etc. nep		BIVALVIA
KAR	Calappa rubroguttata	Spotted box crab	Migraine maculée	Calapa manchada	Calappidae	BRACHYURA
SCR	Maja squinado	Spinous spider crab	Araignée européenne	Centolla europea	Majidae	BRACHYURA
UCG	Uca tangeri	West african fiddler crab	Gelasime africain	Violinista africano	Ocypodidae	BRACHYURA
KLM	Callinectes amnicola	Bigfisted swimcrab	Crabe bicorne	Cangrejo tijeron	Portunidae	BRACHYURA
KLG	Callinectes marginatus	Marbled swimcrab	Crabe marbré	Cangrejo jaspeado	Portunidae	BRACHYURA
KLP	Callinectes pallidus	Gladiator swimcrab	Crabe gladiateur	Cagrejo gladiator	Portunidae	BRACHYURA
CAL	Callinectes spp	Swimcrabs nei	Crabes nca	Jaibas nep	Portunidae	BRACHYURA
KNR	Cronius ruber	Red swimcrab	Crabe rouge	Cangrejo colorado	Portunidae	BRACHYURA
SWM	Portunidae	Swimming crabs, etc. nei	Crabes, étrilles nca	Jaibas, etc. nep	Portunidae	BRACHYURA
OSQ	Portunus hastatus	Lancer swimcrab	Étrille nageuse	Jaiba cornuda	Portunidae	BRACHYURA
CRS	Portunus spp	Portunus swimcrabs nei	Étrilles nca	Jaibas, nécoras nep	Portunidae	BRACHYURA
PVQ	Portunus validus	Senegalese smooth swimcrab	Étrille lisse du Sénégal	Jaiba satinada	Portunidae	BRACHYURA
CRA	Brachyura	Marine crabs nei	Crabes de mer nca	Cangrejos de mar nep		BRACHYURA

Code	Scientific name	English name	French name	Spanish name	Family	Order
OJK	Alloteuthis africana	African squid	Casseron africain	Calamarín africano	Loliginidae	CEPHALOPODA
OCT	Octopodidae	Octopuses, etc. nei	Pieuvres, poulpes nca	Pulpos, pulpos nep	Octopodidae	CEPHALOPODA
OQD	Octopus defilippi	Lilliput longarm octopus	Poulpe à longs bras	Pulpito patilargo	Octopodidae	CEPHALOPODA
OCN	Octopus macropus	White-spotted octopus	Poulpe tacheté	Pulpo patudo	Octopodidae	CEPHALOPODA
OCC	Octopus vulgaris	Common octopus	Pieuvre	Pulpo común	Octopodidae	CEPHALOPODA
SQM	Illex coindetii	Broadtail shortfin squid	Encornet rouge	Pota voladora	Ommastrephidae	CEPHALOPODA
EJB	Sepia bertheloti	African cuttlefish	Seiche africaine	Sepia africana	Sepiidae	CEPHALOPODA
EJE	Sepia elegans	Elegant cuttlefish	Seiche élégante	Sepia elegante	Sepiidae	CEPHALOPODA
EJL	Sepia elobyana	Guinean cuttlefish	Seiche de Guinée	Sepia guineana	Sepiidae	CEPHALOPODA
CTC	Sepia officinalis	Common cuttlefish	Seiche commune	Sepia común	Sepiidae	CEPHALOPODA
IAR	Sepia orbignyana	Pink cuttlefish	Seiche rosée	Sepia con punta	Sepiidae	CEPHALOPODA
IAX	Sepia spp	Cuttlefishes nei	Seiches nca	Sepias nep	Sepiidae	CEPHALOPODA
IEO	Sepiella ornata	Ornate cuttlefish	Sépie ornée	Sepia ornada	Sepiidae	CEPHALOPODA
HHP	Heteroteuthis dispar	Odd bobtail squid	Sépiole différente	Globito aberrante	Sepiolidae	CEPHALOPODA
CEP	Cephalopoda	Cephalopods nei	Céphalopodes nca	Cefalópodos nep		CEPHALOPODA
CTL	Sepiidae, Sepiolidae	Cuttlefish, bobtail squids nei	Seiches, sépioles nca	Sepias, choquitos, globitos nep		CEPHALOPODA
CWD	Crinoidea	Feather stars and sea lilies	Crinoïdes	Crinoideos		CRINOIDEA
CRU	Crustacea	Marine crustaceans nei	Crustacés marins nca	Crustáceos marinos nep		CRUSTACEA MISCELLANEA
SPO	Spongidae	Sponges	Éponges	Esponjas	Spongidae	DEMOSPONGIAE
ECH	Echinodermata	Echinoderms	Oursins, bèches-de-mer	Erizos, cohombros de mar		ECHINODERMATA
URX	Echinoidea	Sea urchins, sand dollars, etc. nei	Oursins, etc. nca	Erizos, etc. nep		ECHINOIDEA
YBC	Cymbium cymbium	Pig's snout volute	Volute trompe de cochon	Voluta trompa de cerdo	Volutidae	GASTROPODA
YBG	Cymbium glans	Elephant's snout volute	Volute trompe d'éléphant	Voluta trompa de elephante	Volutidae	GASTROPODA
YBP	Cymbium pepo	Neptune's volute	Volute Neptune	Voluta de Nepruno	Volutidae	GASTROPODA
CXY	Cymbium spp	Volutes nei	Volutes nca	Volutas nep	Volutidae	GASTROPODA
GAS	Gastropoda	Gastropods (snails)	Gastropodes nca	Gasterópodos nep		GASTROPODA
CUX	Holothurioidea	Sea cucumbers nei	Bèches-de-mer nca	Cohombros de mar nep		HOLOTHURIOIDEA
HQZ	Hydrozoa	Hydrozoans	Hydrozoaires	Hidrozoos		HYDROZOA
CNI	Cnidaria	Cnidarians nei	Cnidaires nca	Cnidarios nep		INVERTEBRATA AQUATICA MISCELL.

Code	Scientific name	English name	French name	Spanish name	Family	Order
INV	Invertebrata	Aquatic invertebrates nei	Invertébrés aquatiques nca	Invertebrados acuáticos nep		INVERTEBRATA AQUATICA MISCELL.
ISH	Isopoda	Isopods, pillbugs, sowbugs				ISOPODA
MSH	Ex Mollusca	Marine shells nei	Coquilles marines nca	Conchas marinas nep		MOLLUSCA MISCELLANEA
MOL	Mollusca	Marine molluscs nei	Mollusques marins nca	Moluscos marinos nep		MOLLUSCA MISCELLANEA
ARV	<i>Aristeus varidens</i>	Striped red shrimp	Gambon rayé	Gamba listada	Aristaeidae	NATANTIA
SSH	<i>Plesiopenaeus edwardsianus</i>	Scarlet shrimp	Gambon écarlate	Gamba carabinero	Aristaeidae	NATANTIA
CRN	Crangonidae	Crangonid shrimps nei	Crevettes crangonidés nca	Camarones crangónidos nep	Crangonidae	NATANTIA
ONZ	<i>Pontocaris lacazei</i>	Hardshell shrimp	Crevette crâne	Camaron de casco	Crangonidae	NATANTIA
XHH	<i>Exhippolysmata hastadoides</i>	Companion shrimp	Bouc compagnon	Camaron compañero	Hippolytidae	NATANTIA
NCF	<i>Nematocarcinus africanus</i>	African spider shrimp	Crevette araignée d'Afrique	Camaron araña africano	Nematocarcinidae	NATANTIA
NLH	<i>Nematopalaemon hastatus</i>	West African estuarine prawn	Bouquet étier	Camaron estuarino africano	Palaemonidae	NATANTIA
PAL	Palaemonidae	Palaemonid shrimps nei	Crevettes palémonides nca	Camarones palemónidos nep	Palaemonidae	NATANTIA
HKF	<i>Heterocarpus ensifer</i>	Armed nylon shrimp	Crevette nylon armée	Camaron nylon armado	Pandalidae	NATANTIA
PDZ	Pandalidae	Pandalid shrimps nei	Crevettes pandalides nca	Camarones pandálidos nep	Pandalidae	NATANTIA
PVJ	<i>Parapandalus narval</i>	Narwal shrimp	Crevette narval	Camaron narval	Pandalidae	NATANTIA
LKT	<i>Plesionika martia</i>	Golden shrimp	Crevette dorée	Camaron de oro	Pandalidae	NATANTIA
GFU	<i>Glyphus marsupialis</i>	Kangaroo shrimp	Sivade kangourou	Camaron canguro	Pasiphaeidae	NATANTIA
GUS	<i>Parapenaeopsis atlantica</i>	Guinea shrimp	Crevette guinéenne	Camaron guineo	Penaeidae	NATANTIA
DPS	<i>Parapenaeus longirostris</i>	Deep-water rose shrimp	Crevette rose du large	Gamba de altura	Penaeidae	NATANTIA
PEZ	Penaeidae	Penaeid shrimps nei	Crevettes pénéidés nca	Camarones peneídos nep	Penaeidae	NATANTIA
TGS	<i>Penaeus kerathurus</i>	Caramote prawn	Caramote	Langostino	Penaeidae	NATANTIA
SOP	<i>Penaeus notialis</i>	Southern pink shrimp	Crevette rose du Sud	Camaron rosado sureño	Penaeidae	NATANTIA
YIA	<i>Sicyonia carinata</i>	Mediterranean rock shrimp	Boucot méditerranéen	Camaron de piedra méditerranéo	Sicyoniidae	NATANTIA
YIG	<i>Sicyonia galeata</i>	Tufted rock shrimp	Sicyonie huppée	Camaron penachudo	Sicyoniidae	NATANTIA
SKF	<i>Solenocera africana</i>	African mud shrimp	Solenocère d'Afrique	Camaron fanguero africano	Solenoceridae	NATANTIA

Code	Scientific name	English name	French name	Spanish name	Family	Order
SOZ	Solenoceridae	Solenocerid shrimps nei	Salicoques, solénocères nca	Camarones solenoceros nep	Solenoceridae	NATANTIA
DCP	Natantia	Natantian decapods (shrimp, unid)	Décapodes natantia nca	Decápodos natantia nep		NATANTIA
OWP	Ophiuroidea	Basket and brittle stars	Ophiures	Ofiuroideos		OPHIUROIDEA
WOR	Polychaeta	Marine worms	Vers marins	Poliquetos		POLYCHAETA
PWJ	Pycnogonida	Sea spiders				PYCNOGONIDA
CZP	Callianassa spp	Ghost shrimps			Callianassidae	REPTANTIA
NEX	Nephropidae	True lobsters, lobsterettes nei	Homards, langoustines nca	Bogavantes, cigalas nep	Nephropidae	REPTANTIA
VLO	Palinuridae	Spiny lobsters nei	Langoustes diverses nca	Langostas diversas nep	Palinuridae	REPTANTIA
SLC	Panulirus argus	Caribbean spiny lobster	Langouste blanche	Langosta común del Caribe	Palinuridae	REPTANTIA
LOY	Panulirus regius	Royal spiny lobster	Langouste royale	Langosta real	Palinuridae	REPTANTIA
SLV	Panulirus spp	Tropical spiny lobsters nei	Langoustes tropicales nca	Langostas tropicales nep	Palinuridae	REPTANTIA
LOS	Scyllaridae	Slipper lobsters nei	Cigales nca	Cigarros nep	Scyllaridae	REPTANTIA
YLK	Scyllarides herklotsii	Red slipper lobster	Cigale rouge	Cigarro rojo	Scyllaridae	REPTANTIA
LOX	Reptantia	Lobsters nei	Langoustes, homards nca	Langostas nep		REPTANTIA
LQH	Lysiosquilla hoevenii	Lizard mantis	Squille lézard géante	Galera gigante	Lysiosquillidae	STOMATOPODA
QLA	Squilla aculeata	Kicking mantis shrimp	Squille frappeuse	Galera pateadora	Squillidae	STOMATOPODA
QLC	Squilla cadenati	Angolan mantis shrimp	Squille angolaise	Galera de Angola	Squillidae	STOMATOPODA
MTS	Squilla mantis	Spottail mantis squillid	Squille ocellée	Galera ocelada	Squillidae	STOMATOPODA
SQY	Squillidae	Squillids nei	Squilles nca	Galeras nep	Squillidae	STOMATOPODA
SVX	Stomatopoda	Stomatopods (mantis shrimp, unid)	Stomatopodes nca	Estomatopodos nep		STOMATOPODA

Marine Mammals

CODE	Scientific name	English name	French name	Spanish name	Family	Order
MAM	Mammalia	Aquatic mammals unid.	Mammifères aquatiques nca	Mamíferos acuáticos nep		MAMMALIA Unid.
EUA	Eubalaena australis	Southern right whale	Baleine australe	Ballena franca austral	Balaenidae	MYSTICETI
MIW	Balaenoptera acutorostrata	Minke whale	Petit rorqual	Rorcual enano	Balaenopteridae	MYSTICETI
BFW	Balaenoptera bonaerensis	Antarctic minke whale	Petit rorqual antarctique	Rorcual antártico	Balaenopteridae	MYSTICETI
SIW	Balaenoptera borealis	Sei whale	Rorqual de Rudolphi	Rorcual del Norte	Balaenopteridae	MYSTICETI

CODE	Scientific name	English name	French name	Spanish name	Family	Order
BRW	<i>Balaenoptera brydei</i> (also <i>B. edeni</i>)	Bryde's whale	Rorqual de Bryde	Rorcual tropical	Balaenopteridae	MYSTICETI
BRW	<i>Balaenoptera edeni</i> (see <i>B. brydei</i>)	Bryde's whale	Rorqual de Bryde	Rorcual tropical	Balaenopteridae	MYSTICETI
BLW	<i>Balaenoptera musculus</i>	Blue whale	Rorqual bleu	Ballena azul	Balaenopteridae	MYSTICETI
FIW	<i>Balaenoptera physalus</i>	Fin whale	Rorqual comun	Rorcual común	Balaenopteridae	MYSTICETI
BAE	Balaenopteridae	Balaenoptid whales unid.		Rorcuales nep	Balaenopteridae	MYSTICETI
HUW	<i>Megaptera novaeangliae</i>	Humpback whale	Baleine à bosse	Rorcual jorobado	Balaenopteridae	MYSTICETI
CPM	<i>Caperea marginata</i>	Pygmy right whale	Baleine pygmée	Ballena franca pigmea	Neobalaenidae	MYSTICETI
MYS	Mysticeti	Baleen whales unid.	Baleines mysticètes nca	Ballenas mysticetas nep		MYSTICETI
HVD	<i>Cephalorhynchus heavisidii</i>	Heaviside's dolphin	Dauphin d'Heaviside	Delfín de Heaviside	Delphinidae	ODONTOCETI
DLP	Delphinidae	Dolphins unid.	Dauphins nca	Delfínidos nep	Delphinidae	ODONTOCETI
DCZ	<i>Delphinus capensis</i>	Long-beaked common dolphin	Dauphin commun a bec large	Delfín común a pico largo	Delphinidae	ODONTOCETI
DCO	<i>Delphinus delphis</i>	Common dolphin	Dauphin commun	Delfín común	Delphinidae	ODONTOCETI
KPW	<i>Feresa attenuata</i>	Pygmy killer whale	Orque pygmée	Orca pigmea	Delphinidae	ODONTOCETI
SHW	<i>Globicephala macrorhynchus</i>	Short-finned pilot whale	Globicéphale tropical	Calderón de aletas cortas	Delphinidae	ODONTOCETI
PIW	<i>Globicephala melas</i>	Long-finned pilot whale	Globicéphale commun	Calderón común	Delphinidae	ODONTOCETI
GLO	<i>Globicephala</i> spp	Pilot whales unid.			Delphinidae	ODONTOCETI
DRR	<i>Grampus griseus</i>	Risso's dolphin	Grampus	Delfín de Risso	Delphinidae	ODONTOCETI
FRD	<i>Lagenodelphis hosei</i>	Fraser's dolphin	Dauphin de Fraser	Delfín de Fraser	Delphinidae	ODONTOCETI
DDU	<i>Lagenorhynchus obscurus</i>	Dusky dolphin	Dauphin sombre	Delfín obscuro	Delphinidae	ODONTOCETI
RSW	<i>Lissodelphis peronii</i>	Southern right whale dolphin	Dauphin aptère austral	Delfín liso austral	Delphinidae	ODONTOCETI
KIW	<i>Orcinus orca</i>	Killer whale	Orque	Orca	Delphinidae	ODONTOCETI
MEW	<i>Peponocephala electra</i>	Melon-headed whale	Péponocéphale	Calderón pequeño	Delphinidae	ODONTOCETI
FAW	<i>Pseudorca crassidens</i>	False killer whale	Faux-orque	Orca falsa	Delphinidae	ODONTOCETI
DHA	<i>Sousa teuszii</i>	Atlantic hump-backed dolphin	Dauphin à bosse de l'Atlantiq.	Delfín jorobado del Atlántico	Delphinidae	ODONTOCETI
DPN	<i>Stenella attenuata</i>	Pantropical spotted dolphin	Dauphin tacheté pantropical	Estenela moteada	Delphinidae	ODONTOCETI
DCL	<i>Stenella clymene</i>	Clymene dolphin	Dauphin de Clyméné	Delfín clymene	Delphinidae	ODONTOCETI
DST	<i>Stenella coeruleoalba</i>	Striped dolphin	Dauphin bleu et blanc	Estenela listada	Delphinidae	ODONTOCETI
DSA	<i>Stenella frontalis</i>	Atlantic spotted dolphin	Dauphin tacheté de l'Atlantiq.	Delfín pintado	Delphinidae	ODONTOCETI
DSI	<i>Stenella longirostris</i>	Spinner dolphin	Dauphin longirostre	Estenela giradora	Delphinidae	ODONTOCETI
DSP	<i>Stenella</i> spp	Spotted dolphins unid.	Dauphins tachetés nca	Estenelas nep	Delphinidae	ODONTOCETI
RTD	<i>Steno bredanensis</i>	Rough-toothed dolphin	Sténo	Esteno	Delphinidae	ODONTOCETI

CODE	Scientific name	English name	French name	Spanish name	Family	Order
DBO	<i>Tursiops truncatus</i>	Bottlenose dolphin	Grand dauphin	Tursion	Delphinidae	ODONTOCETI
PYW	<i>Kogia breviceps</i>	Pygmy sperm whale	Cachalot pygmée	Cachalote pigmeo	Kogiidae	ODONTOCETI
DWW	<i>Kogia sima</i>	Dwarf sperm whale	Cachalot nain	Cachalote enano	Kogiidae	ODONTOCETI
SPW	<i>Physeter catodon</i> (P. macrocephalus)	Sperm whale	Cachalot	Cachalote	Physeteridae	ODONTOCETI
BAW	<i>Berardius arnuxii</i>	Arnoux's beaked whale	Béradien d'Arnoux	Ballenato de Arnoux	Ziphiidae	ODONTOCETI
SRW	<i>Hyperoodon planifrons</i>	Southern bottlenose whale	Hyperoodon austral	Ballena nariz de botella sur	Ziphiidae	ODONTOCETI
BBW	<i>Mesoplodon densirostris</i>	Blainville's beaked whale	Baleine à bec de Blainville	Zifio de Blainville	Ziphiidae	ODONTOCETI
BGW	<i>Mesoplodon europaeus</i>	Gervais' beaked whale	Baleine à bec de Gervais	Zifio de Gervais	Ziphiidae	ODONTOCETI
BYW	<i>Mesoplodon grayi</i>	Gray's beaked whale	Baleine à bec de Gray	Zifio de Gray	Ziphiidae	ODONTOCETI
BHW	<i>Mesoplodon hectori</i>	Hector's beaked whale	Baleine à bec d'Hector	Zifio de Hector	Ziphiidae	ODONTOCETI
TSW	<i>Mesoplodon layardii</i>	Strap-toothed whale	Baleine à bec de Layard	Zifio de Layard	Ziphiidae	ODONTOCETI
BTW	<i>Mesoplodon mirus</i>	True's beaked whale	Baleine à bec de True	Zifio de True	Ziphiidae	ODONTOCETI
MEP	<i>Mesoplodon spp</i>	Beaked whales unid.			Ziphiidae	ODONTOCETI
BSW	<i>Tasmacetus shepherdi</i>	Sherpherd's beaked whale	Tasmacète	Ballena picuda de Shepherd	Ziphiidae	ODONTOCETI
BCW	<i>Ziphius cavirostris</i>	Cuvier's beaked whale	Ziphius	Zifio de Cuvier	Ziphiidae	ODONTOCETI
ODN	Odontoceti	Toothed whales unid.	Baleines odontocètes nca	Ballenas odontocetas nep		ODONTOCETI
SEF	<i>Arctocephalus australis</i>	South American fur seal	Otarie d'Amérique du Sud	Lobo fino austral	Otariidae	PINNIPEDIA
SEK	<i>Arctocephalus pusillus</i>	South African fur seal	Otarie du Cap	Lobo marino de dos pelos	Otariidae	PINNIPEDIA
SSF	<i>Arctocephalus tropicalis</i>	Subantarctic fur seal	Otarie sub-antarctique	Lobo fino de subantarctico	Otariidae	PINNIPEDIA
SEL	<i>Otaria byronia</i>	South American sea lion	Lion de mer d'Amérique du Sud	Lobo común	Otariidae	PINNIPEDIA
SMM	<i>Monachus monachus</i>	Mediterranean monk seal	Phoque moine de Méditerranée	Foca monje del Mediterráneo	Phocidae	PINNIPEDIA
SXX	Otariidae, Phocidae	Seals unid.	Phoques nca	Focas nep		PINNIPEDIA
WAM	<i>Trichechus senegalensis</i>	West African manatee	Lamantin d'Afrique	Vaca marina del Africa	Trichechidae	SIRENIA

Marine Turtles

CODE	Scientific name	English name	French name	Spanish name	Family	Order
TTL	<i>Caretta caretta</i>	Loggerhead turtle	Caouane	Caguama	Cheloniidae	TESTUDINES
TUG	<i>Chelonia mydas</i>	Green turtle	Tortue verte	Tortuga verde	Cheloniidae	TESTUDINES
TTH	<i>Eretmochelys imbricata</i>	Hawksbill turtle	Tortue caret	Tortuga carey	Cheloniidae	TESTUDINES
LKV	<i>Lepidochelys olivacea</i>	Olive ridley turtle	Tortue olivatre	Tortuga golfina	Cheloniidae	TESTUDINES

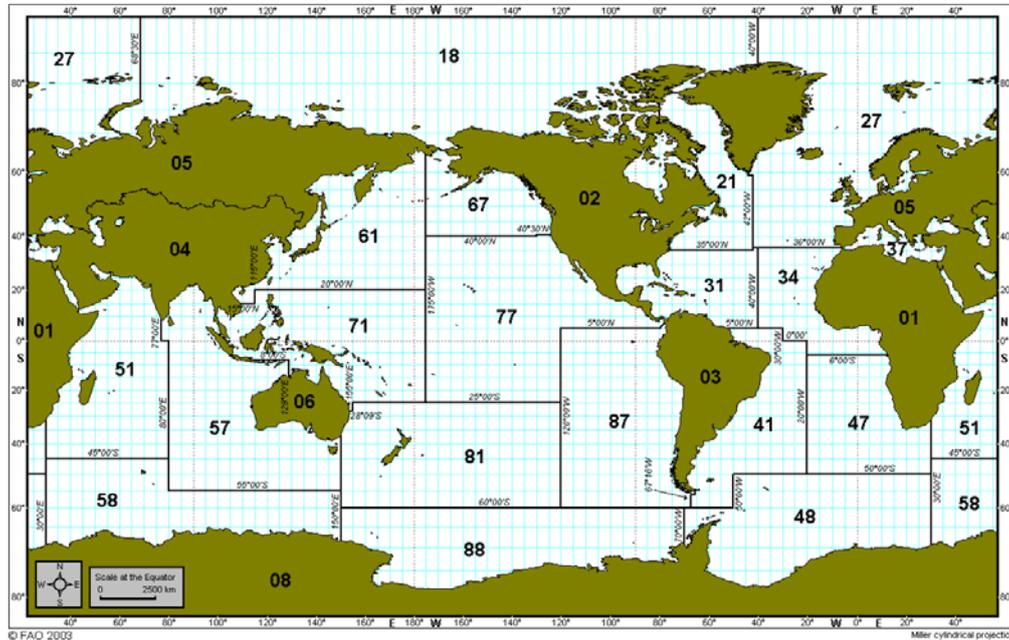
DKK	<i>Dermochelys coriacea</i>	Leatherback turtle	Tortue luth	Tortuga laud	Dermochelyidae	TESTUDINES
TTX	Testudinata	Marine turtles nei	Tortues de mer nca	Tortugas de mar nep		TESTUDINES

Seabirds

CODE	Scientific name	English name	French name	Spanish name	Family	Order
LRD	Laridae	Gulls nei	Laridae nei		Laridae	CHARADRIIFORMES
SVZ	<i>Sterna</i> spp	Terns nei	Sternae nei		Laridae	CHARADRIIFORMES
SZV	Sulidae	Boobies and gannets nei	Sulas et Morus nei		Sulidae	CICONIIFORMES
PRX	Procellariidae	Petrels and shearwaters nei	Pétrels et Pufins nei		Procellariidae	PROCELLARIIFORMES

Appendix 8. International and National Fishing Boundaries – Gulf of Guinea

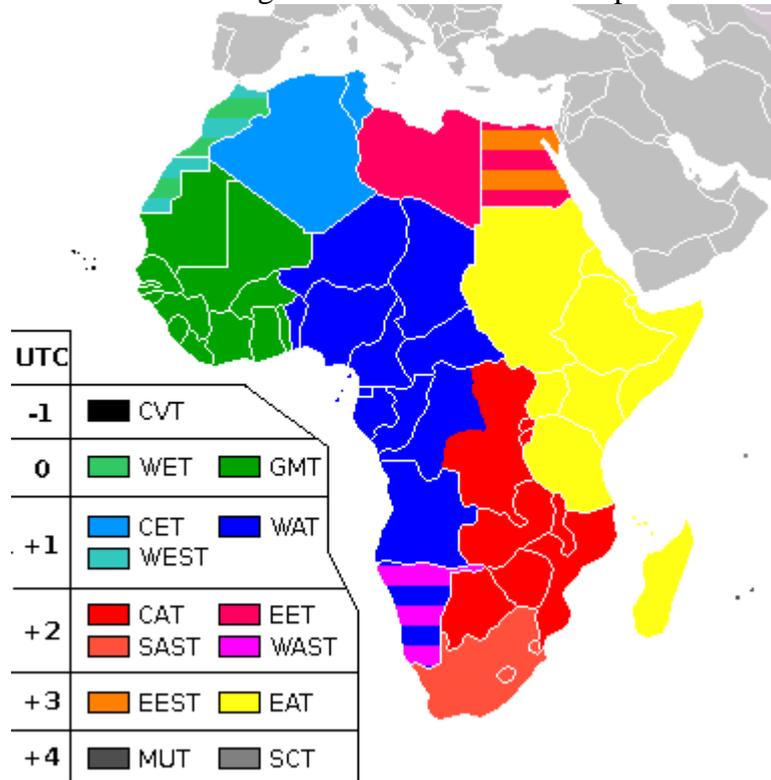
Incomplete
National EEZs



FAO Statistical Areas

Appendix 9. Map of African Time Zones

Map of African time zones indicating difference from UTC. Map from www.wikipedia.org.



Appendix 10. Common Formulas & Conversion Factors

Abbreviations

Feet	ft	Liter	L	Latitude	lat
Fathoms	f			Longitude	long
Nautical miles	Nm	Pounds	lbs		
Miles	mi	Metric ton	mt	Fahrenheit	°F
Kilometer	km	Kilogram	kg	Celsius	°C
Meter	m	Gram	g		
Centimeter	cm			Knot	Kn
Millimeter	mm	Hour	hr	Meters/second	m/s
		Minute	min		
Radius	r				
Diameter	d				

Common Conversions

Speed

1 knot = 1 nautical mile per hour = 1.852
km/hr = 0.514 m/s

Distance / length

1 nautical mile = 1 min lat = 1.852 km =
1.15 miles = 1,012.6859 fathoms
1 degree (latitude) = 60 nautical miles
1 fathom = 1.829 meter = 6 feet
1 meter = 100 cm = 3.28 feet
1 cm = 10 mm = 0.3937 inches
1000 m = 1 km = 0.62 miles

Weight

1 mt = 1,000 kg
1 kg = 1000 g = 2.2046 lbs

Volume

1 L = 1.0567 U.S. qt

Temperature

$F^{\circ} = (1.8 \times C^{\circ}) + 32C^{\circ} = 5/9(F^{\circ} - 32)$
 $C^{\circ} = (F^{\circ} - 32) * .555$

Latitude / Longitude Conversion

From: Degrees, minutes, seconds
To: degrees, minutes & 10ths of minutes

Divide seconds by 60 and add to minutes.

Example: $6^{\circ} 22' 45'' = 6^{\circ} 22.75'$

From: Decimal degrees to degrees
To: degrees, minutes & 10ths of minutes

Temporarily drop the degrees. Multiply the decimal value by 60.

Example: $6.425^{\circ} = 6^{\circ} 25.5'$

Area and Volume Formulas

Area of a circle = πr^2 ($\pi = 3.1416$)

Circumference = $2 \pi r$

Area of a square or rectangle = length * width

Area of a triangle = $\frac{1}{2} * \text{base} * \text{height}$

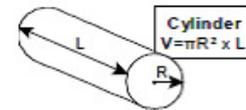
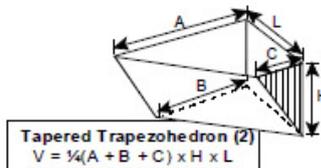
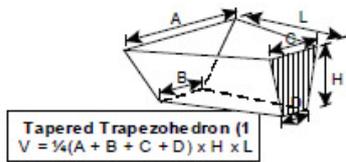
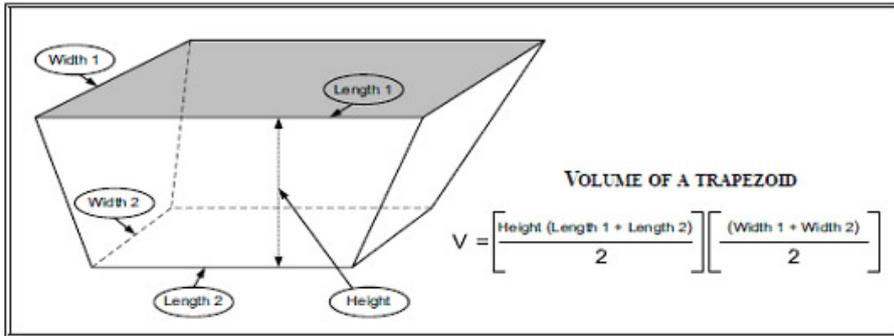
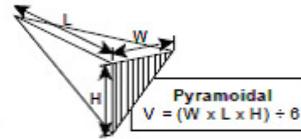
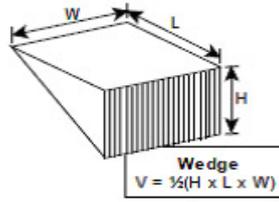
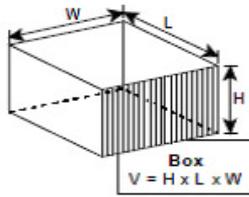
Volume of a right angle cone = $\frac{1}{3} * \pi r^2 h$

Volume of a Sphere = $\frac{4}{3} * \pi * r^3$

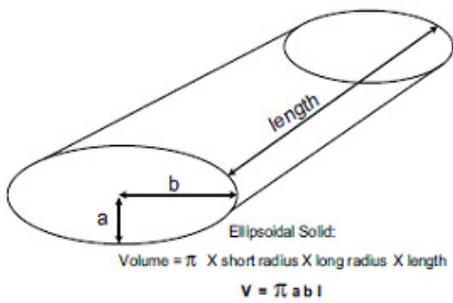
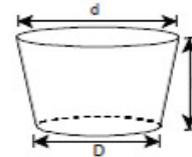
Length of the triangle hypotenuse "C" where A and B equal the length of the opposite two sides: $a^2 + b^2 = c^2$ and $\sqrt{c} = c$

Volumetric Formulas:

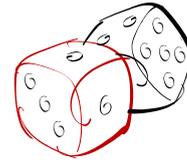
V = Volume
 H = Height
 L = Length
 W = Width
 $\pi = 3.1416$
 D = Diameter
 d = diameter
 R = Radius



Tapered Cylinder
 $V = 0.2818 H (d^2 + D^2 + dD)$



Appendix 11. Random Number Tables



How to Use the Random Number Table

To use the random number table, enter the table at a random point. The easiest way to do this is by closing your eyes and placing your finger on the table. The column and row nearest your finger is the starting point. Determine how many digits you are using: if you need numbers between 1 and 250, use three digits in the row. If you need numbers between 1 and 25, use two digits in the row, and so on. Decide in which direction you will move through the table in advance. Then proceed in any direction through the table (even diagonally), recording appropriate numbers and skipping numbers too high or repeated, until you have enough random numbers. You should decide on a direction and enter the table at a different random starting point every time you use it.

For example, if you need to choose 3 numbers between 1 and 25, you could enter the table by placing your finger on the table to choose a column and row. Your criterion is two digit numbers between 01 and 25 (inclusive). For this example, you decided to work up the column from your starting point. As you move up the column, the first number you encounter is 14. This is a two-digit number between 01 and 25; it fits the criterion, so you write it down. The next number is 09; it also fits the criterion, so you write it down. The next number is 58 and does not fit the criterion so you skip this number. Keep moving up the column, skipping the numbers that do not fit the criterion, until you choose the all the numbers you need.

Random Number Table

9 1 5 1 9	5 6 2 7 0	5 3 2 5 6	2 1 4 8 5	5 2 1 3 7
0 2 4 9 3	4 7 0 8 8	6 8 1 7 1	2 9 2 3 2	3 8 9 6 5
4 5 4 6 5	2 5 1 1 4	3 9 4 9 3	5 9 0 0 4	1 9 9 1 2
3 5 6 8 3	7 2 9 3 3	4 1 8 3 9	0 1 9 6 3	4 9 7 9 6
6 0 3 8 0	4 8 2 8 2	0 2 2 5 5	9 3 6 8 9	7 0 6 3 5
9 7 4 3 4	5 5 6 4 1	0 1 0 6 2	2 8 5 0 0	1 5 6 3 0
0 8 7 6 8	9 2 0 4 2	2 2 2 3 3	7 0 1 4 3	3 8 8 7 1
4 8 5 2 0	1 4 3 5 4	9 1 1 5 8	1 2 3 3 8	3 7 2 1 1
8 9 7 2 1	8 5 1 6 4	1 7 3 1 3	3 1 9 4 6	5 2 7 7 4
5 6 7 0 3	8 0 5 0 1	9 0 9 7 2	9 9 3 4 2	3 9 7 4 9
8 5 3 4 8	3 4 6 0 6	0 8 4 0 6	7 1 3 6 6	6 1 1 2 3
3 2 5 1 8	1 9 8 1 5	1 1 0 5 7	7 6 0 9 7	0 0 3 3 4
3 6 5 3 5	1 1 8 0 0	6 8 3 1 0	8 5 4 7 6	3 3 2 2 5
4 6 8 9 6	5 5 2 2 5	0 5 2 5 0	5 2 0 1 9	8 7 1 1 9
4 2 1 4 4	5 0 4 3 1	2 1 9 4 8	6 9 5 9 6	7 1 1 1 3
4 0 7 2 8	8 3 6 3 0	6 9 9 3 0	5 6 9 2 8	7 5 3 9 0
3 6 5 6 1	8 2 7 4 1	6 7 5 6 1	4 6 7 7 4	5 1 7 4 2
0 2 4 1 9	4 5 9 9 5	0 2 5 8 1	5 0 0 3 2	1 4 1 6 8
9 6 4 7 2	5 5 1 9 0	4 6 1 9 4	2 3 6 5 5	9 2 7 9 9
2 3 6 3 5	1 5 2 5 8	9 7 8 0 9	1 0 2 3 5	4 7 8 1 2
4 1 5 5 7	0 7 6 2 5	6 2 3 4 6	9 6 2 3 9	9 2 9 6 9
6 0 4 6 4	9 4 0 5 5	3 5 3 8 1	2 9 0 9 2	3 7 1 0 2
6 0 6 4 3	2 3 2 3 0	6 7 5 9 7	2 0 1 6 9	4 9 8 3 2
2 6 2 2 6	3 3 4 7 4	2 4 6 7 8	3 8 5 2 0	9 9 4 7 5
2 5 5 0 7	9 4 3 4 5	1 3 6 7 0	8 7 1 1 2	9 8 9 5 8
3 3 9 4 9	7 4 0 9 0	6 6 9 7 0	5 4 6 6 6	7 3 1 9 2
2 4 3 7 4	8 5 5 7 8	1 9 5 8 7	1 9 2 2 0	1 5 5 4 7
8 7 4 0 9	4 5 4 8 5	1 4 3 4 7	8 1 4 0 6	1 2 7 2 6
5 6 5 7 8	9 4 4 7 8	2 1 9 9 7	3 9 6 9 6	2 0 8 7 3
8 0 4 4 2	9 7 4 0 5	4 6 4 0 3	8 8 3 5 1	6 0 9 5 6
4 9 5 3 3	9 8 0 1 6	1 8 6 3 5	7 3 7 4 6	2 2 9 2 5
4 4 6 6 5	5 5 9 2 1	6 4 4 3 3	8 1 7 4 6	8 0 0 8 8
6 2 7 0 0	1 6 5 4 2	7 7 5 4 0	0 4 8 4 7	9 1 8 7 6
3 4 8 4 8	8 7 3 4 0	7 2 0 4 0	9 0 1 6 5	3 0 9 4 1
6 5 4 0 3	8 1 0 2 2	1 3 3 6 1	8 1 8 7 9	8 1 4 7 0
8 5 0 9 3	8 9 1 0 7	7 2 8 1 7	8 1 0 2 9	7 1 5 9 2
3 0 3 2 1	3 0 5 7 1	0 1 1 8 8	6 1 3 4 0	5 0 6 6 5
5 3 6 9 9	0 5 8 2 3	9 2 0 2 3	1 5 0 8 1	5 6 6 5 7
5 6 3 3 5	8 1 9 5 7	1 1 7 5 6	0 8 8 3 1	1 6 4 2 9
5 8 8 8 1	2 5 4 4 3	2 1 3 8 2	4 8 0 5 3	1 6 7 8 8
1 8 7 7 4	8 4 1 3 8	0 0 6 8 2	5 4 7 2 6	3 3 8 3 9
1 3 2 3 4	2 8 6 9 5	7 6 2 4 3	4 6 5 0 5	8 3 8 5 4
2 4 8 6 6	3 0 7 5 0	9 7 2 6 2	2 0 4 2 7	8 0 2 3 5
7 3 9 4 8	5 7 6 5 9	0 6 0 7 6	7 8 2 2 4	8 9 8 9 1
9 7 2 2 7	1 6 7 3 2	9 5 1 5 3	1 6 7 7 3	5 1 9 4 0

Appendix 12. Sea State

Beau- fort	Wind Speed (kn)	Wave Height (m)	Description	SPECIFICATIONS FOR USE AT SEA
0	0-1	0	Calm	Sea like a mirror
1	1-3	.1	Light Air	Ripples with the appearance of scales are formed, but without foam crests.
2	4-6	.2	Light Breeze	Small wavelets, still short, but more pronounced. Crests have a glassy appearance and do not break.
3	7-10	.6	Gentle Breeze	Large wavelets. Crests begin to break. Foam of glassy appearance. Perhaps scattered white horses.
4	11-16	1	Moderate Breeze	Small waves, becoming larger; fairly frequent white horses.
5	17-21	2	Fresh Breeze	Moderate waves, taking a more pronounced long form; many white horses are formed. Chance of some spray.
6	22-27	3	Strong Breeze	Large waves begin to form; the white foam crests are more extensive everywhere. Probably some spray.
7	28-33	4	Near Gale	Sea heaps up and white foam from breaking waves begins to be blown in streaks along the direction of the wind.
8	34-40	5.5	Gale	Moderately high waves of greater length; edges of crests begin to break into spindrift. The foam is blown in well-marked streaks along the direction of the wind.
9	41-47	7	Severe Gale	High waves. Dense streaks of foam along the direction of the wind. Crests of waves begin to topple, tumble and roll over. Spray may affect visibility.
10	48-55	9	Storm	Very high waves with long over-hanging crests. The resulting foam, in great patches, is blown in dense white streaks along the direction of the wind. On the whole the surface of the sea takes on a white appearance. The 'tumbling' of the sea becomes heavy and shock-like. Visibility affected.
11	56-63	11.5	Violent Storm	Exceptionally high waves (small and medium-size ships might be for a time lost to view behind the waves). The sea is completely covered with long white patches of foam lying along the direction of the wind. Everywhere the edges of the wave crests are blown into froth. Visibility affected.
12	64-71	14+	Hurricane	The air is filled with foam and spray. Sea completely white with driving spray; visibility very seriously affected.

Appendix 13. Standard Phonetic Alphabet

Letter	Word	Pronunciation
A	Alfa	AL FAH
B	Bravo	BRAH VOH
C	Charlie	CHAR LEE
D	Delta	DELL TAH
E	Echo	ECK OH
F	Foxtrot	FOKS TROT
G	Golf	GOLF
H	Hotel	HOH TELL
I	India	IN DEE AH
J	Juliet	JOO LEE ETT
K	Kilo	KEY LOW
L	Lima	LEE MAH
M	Mike	MIKE
N	November	NO VEM BER
O	Oscar	OSS CAR
P	Papa	PA PAH
Q	Quebec	KWE BECK
R	Romeo	ROW ME OH
S	Sierra	SEE AIR RAH
T	Tango	TANG GO
U	Uniform	YOU NEE FORM
V	Victor	VIK TUR
W	Whiskey	WISS KEY
X	X-ray	ECKS RAY
Y	Yankee	YANG KEY
Z	Zulu	ZOO LOO

Appendix 14. International Conventions Signed by West African Nations

(Source: International Maritime Organization, Status of Conventions by Country, downloaded August 15, 2009)

	IMO Convention 48	IMO amendments 91	IMO amendments 93	SOLAS Convention 74	SOLAS Protocol 78	SOLAS Protocol 88	Stockholm Agreement 96	LOAD LINES Convention 66	LOAD LINES Protocol 88	TONNAGE Convention 69	COLREG Convention 72	CSC Convention 72	CSC amendments 93	SFV Protocol 93	STCW Convention 78	STCW-F Convention 95	SAR Convention 79	STP Agreement 71	STP Protocol 73	INMARSAT Convention 76	INMARSAT OA 76	INMARSAT amendments 94	INMARSAT amendments 98	IMSO amendments 2006	FACILITATION Convention 65	MARPOL 73/78 (Annex I/II)	MARPOL 73/78 (Annex III)	MARPOL 73/78 (Annex IV)	MARPOL 73/78 (Annex V)	MARPOL Protocol 97 (Annex VI)	London Convention 72	London Convention Protocol 96	INTERVENTION Convention 69			
Angola	X			X	X			X		X	X	X			X		X									X	X	X	X	X		X	X			
Benin	X	X		X	X			X		X	X	X			X											X	X	X	X	X			X	X		
Burkina Faso																																				
Cameroon	X	X		X				X			X				X		X			X	X					X								X		
Cape Verde	X		X	X				X		X	X	X			X		X									X	X	X	X	X		X				
Chad																																				
Congo	X	X	X	X				X		X	X				X		X									X	X	X	X	X						
Cote d'Ivoire	X	X	X	X	X			X		X	X				X		X									X	X	X	X	X		X			X	
Dem. Rep. of the Congo	X			X				X		X					X																	X				
Equatorial Guinea	X			X	X	X		X	X	X	X				X												X	X	X	X	X		X		X	
Gabon	X	X		X				X		X	X				X						X	X				X	X	X	X	X		X			X	
Gambia	X	X	X	X				X		X	X				X		X									X	X	X	X	X						
Guinea	X			X	X			X		X	X	X			X											X	X	X	X	X						
Guinea-Bissau	X																																			
Liberia	X	X	X	X	X	X		X	X	X	X	X		X	X		X			X	X			X	X	X	X	X	X	X					X	
Mali																										X										
Mauritania	X			X	X			X		X	X				X	X											X	X	X	X						X
Namibia	X	X	X	X	X			X	X	X	X				X	X	X										X	X	X	X						X
Niger																																				
Nigeria	X	X	X	X				X		X	X	X			X		X			X	X			X		X	X	X	X	X		X			X	
Senegal	X	X		X	X			X		X	X				X		X			X	X			X		X	X	X	X	X					X	
Sierra Leone	X	X	X	X	X	X		X	X	X	X				X	X										X	X	X	X	X	X	X	X	X	X	X
Togo	X	X		X	X			X		X	X				X											X	X	X	X	X						

	INTERVENTION Protocol 73	CLC Convention 69	CLC Protocol 76	CLC Protocol 92	FUND Convention 71	FUND Protocol 76	FUND Protocol 92	FUND Protocol 2003	NUCLEAR Convention 71	PAL Convention 74	PAL Protocol 76	PAL Protocol 90	PAL Protocol 02	LLMC Convention 76	LLMC Protocol 96	SUA Convention 88	SUA Protocol 88	SUA Convention 2005	SUA Protocol 2005	SALVAGE Convention 89	OPRC Convention 90	HNS Convention 96	OPRC/HNS 2000	BUNKERS CONVENTION 01	ANTI FOULING 01	BALLASTWATER 2004	NAIROBI WRC 2007	HONG KONG SRC 2009
Angola				X		X								X		X	X				X	X						
Benin		X			X									X		X	X											
Burkina Faso																X	X											
Cameroon		d	X	X	X		X									X	X											
Cape Verde				X			X									X	X				X							
Chad																												
Congo				X			X							X							X	X						
Cote d'Ivoire		X			X																X	X						
Dem. Rep. of the Congo																												
Equatorial Guinea		X							X					X		X	X											
Gabon		d		X	X		X		X													X						
Gambia		X			X											X												
Guinea				X			X									X	X				X	X						
Guinea-Bissau																X	X				X	X						
Liberia	X	d	X	X	d	X	X		X	X	X			X	X	X	X			X	X	X	X	X	X	X	X	
Mali																X	X											
Mauritania	X	X	X		X											X	X				X							
Namibia	X			X			X									X	X				X							
Niger																X	X											
Nigeria		d		X	X		X		X					X		X					X	X			X	X		
Senegal		X														X	X				X							
Sierra Leone		d		X	d		X							X	X						X	X	X	X	X	X		
Togo																X	X											

Appendix 15. CITES Listed Marine Vertebrates – Southern & West Africa

Compiled from <http://www.cites.org/eng/app/appendices.shtml>. Accessed January 15, 2010.

Appendix I – Most endangered. Trade in specimens of Appendix I species is normally prohibited, and may be allowed in exceptional circumstances when the purpose of the import is not commercial, for instance, for scientific research.

Marine Mammals

Southern right whale	<i>Eubalaena australis</i>
Minke whale	<i>Balaenoptera acutorostrata</i>
Antarctic minke whale	<i>Balaenoptera bonaerensis</i>
Sei whale	<i>Balaenoptera borealis</i>
Bryde's whale	<i>Balaenoptera byrdei (edeni)</i>
Blue whale	<i>Balaenoptera musculus</i>
Fin whale	<i>Balaenoptera physalus</i>
Humpback whale	<i>Megaptera novaeangliae</i>
Pygmy right whale	<i>Caperea marginata</i>
Atlantic hump-backed dolphin	<i>Sousa teuszii</i>
Sperm whale	<i>Physeter catodon (P. macrocephalus)</i>
Arnoux's beaked whale	<i>Berardius arnuxii</i>
Southern bottlenose whale	<i>Hyperoodon planifrons</i>
Mediterranean monk seal	<i>Monachus monachus</i>

Sea turtles

Leatherback turtle	<i>Dermochelys coriacea</i>
Loggerhead turtle	<i>Caretta caretta</i>
Green turtle	<i>Chelonia mydas</i>
Hawksbill turtle	<i>Eretmochelys imbricata</i>
Olive ridley turtle	<i>Lepidochelys olivacea</i>

Fish

Sturgeon	<i>Acipenser sturio</i>
Smalltooth sawfish	<i>Pristis pectinata</i>
Common sawfish	<i>Pristis pristis</i>

Appendix II – At serious risk. Includes species that are not necessarily threatened with extinction now but may become so unless trade is closely controlled. It also includes so-called “look-alike” species, i.e. species similar in appearance to the species listed for conservation reasons. Trade in Appendix II specimens is only allowed if certain conditions are met, above all that the trade level will not be detrimental to the survival of the species in the wild.

Marine Mammals

Short-finned pilot whale	<i>Globicephala macrorhynchus</i>
Long-finned pilot whale	<i>Globicephala melas</i>
Risso's dolphin	<i>Grampus griseus</i>
Fraser's dolphin	<i>Lagenodelphis hosei</i>
Dusky dolphin	<i>Lagenorhynchus obscurus</i>
Southern right whale dolphin	<i>Lissodelphis peronii</i>
Killer whale	<i>Orcinus orca</i>
Melon-headed whale	<i>Peponocephala electra</i>

False killer whale	<i>Pseudorca crassidens</i>
Pantropical spotted dolphin	<i>Stenella attenuata</i>
Clymene dolphin	<i>Stenella clymene</i>
Striped dolphin	<i>Stenella coeruleoalba</i>
Atlantic spotted dolphin	<i>Stenella frontalis</i>
Spinner dolphin	<i>Stenella longirostris</i>
Rough-toothed dolphin	<i>Steno bredanensis</i>
Bottlenose dolphin	<i>Tursiops truncatus</i>
Pygmy sperm whale	<i>Kogia breviceps</i>
Dwarf sperm whale	<i>Kogia sima</i>
Blainville's beaked whale	<i>Mesoplodon densirostris</i>
Gervais' beaked whale	<i>Mesoplodon europaeus</i>
Gray's beaked whale	<i>Mesoplodon grayi</i>
Hector's beaked whale	<i>Mesoplodon hectori</i>
Strap-toothed whale	<i>Mesoplodon layardii</i>
True's beaked whale	<i>Mesoplodon mirus</i>
Beaked whales nei	<i>Mesoplodon spp</i>
Sherpherd's beaked whale	<i>Tasmacetus shepherdi</i>
Cuvier's beaked whale	<i>Ziphius cavirostris</i>
South American fur seal	<i>Arctocephalus australis</i>
South African fur seal	<i>Arctocephalus pusillus</i>
Subantarctic fur seal	<i>Arctocephalus tropicalis</i>
West African manatee	<i>Trichechus senegalensis</i>
Fish (incl. sharks)	
Great white shark	<i>Carcharodon carcharias</i>
Basking shark	<i>Cetorhinus maximus</i>
Whale shark	<i>Rhincodon typus</i>
Seahorses	<i>Hippocampus spp.</i>

Appendix III - includes species that are protected in at least one country, which has asked other CITES Parties for assistance in controlling the trade.

Appendix 16. Glossary / Acronyms

Abeam – at right angles to the keel of the boat, but not on the boat.

Acoustic Doppler Current Profiler¹ (ADCP or ADP) - sonar that produces a record of water current velocities for a range of depths.

Aft - Toward the stern of the boat (on the boat); opposite of forward.

Ahead – In front of the boat; opposite of astern

AIS – see Automatic Identification System

Apex⁴ - The section of the backdown channel during a purse seine set furthest from the ship, where the corkline sinks during backdown to allow marine mammals to escape.

Argos system - Satellite-based location and data collection system dedicated to studying the environment, developed as a result of French-American cooperation between the Centre National d'Etudes Spatiales (CNES, the French space agency), the National Aeronautics and Space Administration (NASA, USA) and the National Oceanic and Atmospheric Administration (NOAA, USA). See also: <http://www.argos-system.org>.

Artisanal Fisheries - Small-scale and local fisheries carried out by people who rely on fishing to support their families and communities. Generally subsistence and/or only partly commercial in nature.

Astern - Behind of the boat, opposite of ahead.

Athwartship – across or at right angles to the center line of a boat.

Automatic Identification System¹ (AIS) - a short range coastal tracking system used on ships and by Vessel Traffic Services (VTS) for identifying and locating vessels by electronically exchanging data with other nearby ships and VTS stations. IMO SOLAS requires on vessels > 300 GRT and all passenger vessels regardless of size.

Backdown⁴ - The principal marine mammal release maneuver. The vessel starts to reverse after approximately two-thirds of the net has been rolled aboard and is tied down. This causes the corkline at the apex of the channel formed by the net to sink, thus allowing captured marine mammals to escape without losing the tuna catch.

Barotrauma - an injury caused by changes in atmospheric or barometric pressure

Batten down - Secure hatches and loose objects both within the hull and on deck.

Beam - vessel width at its widest point.

Bearing - The direction of an object expressed either as a true bearing as shown on the chart, or as a bearing relative to the heading of the boat.

Bight - The part of the rope or line, between the end and the standing part, on which a knot is formed.

Bilge - The interior of the hull below the floor boards.

Bird radar⁴ - A very sensitive, high-resolution radar capable of detecting flocks of birds at distances of up to 15 miles.

Bow - The forward part of a boat.

Brailer³ - net used for transferring the catch of a deep sea seine after it has been brought alongside. It is operated either entirely by hand or partly by hand and partly by power.

BRD – see bycatch reduction device

Branchline – Line connecting a hook to mainline of longline gear.

Breezer – school of fish (yellowtail or tuna usually) swimming close enough to surface to cause what looks like a breeze on the water.

Bridge - The location from which a vessel is steered and its speed controlled.

Bridle - a Y-shaped cable, rope, or chain, used for holding, towing, etc

Bulkhead - A vertical partition separating compartments (a wall).

Bycatch - The parts of a fishery catch containing non-targeted species (including fish, birds or marine mammals) and often discarded at sea.

Bycatch reduction device (BRD) - A device used to allow live escapement of unwanted species or individuals (juveniles) or endangered species.

Bunt – see Sack

Cabin - A compartment for passengers or crew.

Catch Documentation Scheme (CDS) – formal protocol to document fisheries catch and sometimes products

CECAF - FAO Fishery Committee for the Eastern Central Atlantic

Capsize - To turn over.

Capstan³ –consists of one vertically-mounted warping head. Used for hauling ropes, it has the advantage that it can take ropes coming from any horizontal direction without the need for guiding blocks and other rope leading systems, provided that the rope is perpendicular to the capstan shaft and approximately on the same horizontal plane as the warping head.

CDS – see Catch Documentation Scheme

Chart - A map for use by navigators.

Chase⁴ - Pursuing marine mammals with the intention of herding them and setting around them. A chase commences when the first speedboat is launched. Occasionally the seiner will do the chasing, usually in sets on whales.

CSW - Circulating Sea Water; See RSW

Codend – terminal end of a trawl net used to hold fish; sometimes called a sack.

Course - The direction in which a boat is steered.

Current - The horizontal movement of water.

Davit - any of various crane-like devices used singly or in pairs for supporting, raising, and lowering esp. boats, anchors, and cargo over a hatchway or side of a ship

Deck - A permanent covering over a compartment, hull or any part thereof.

Demersal – Living / found at or near the bottom of a body of water: e.g. a demersal fish

Derrick¹ – a lifting device composed of one mast or pole which is hinged freely at the bottom. It is controlled by lines (usually four of them) powered by some means such as man-hauling or motors, so that the pole can move in all four directions. A line runs up it and over its top with a hook on the end.

Dolphin Safety Panel (system)⁴ - A small-mesh net strip installed in place of the standard 4¹/₄"-mesh strip on a purse seiner, beginning 75 to 100 fathoms from the bow ortza and extending towards the stern end of the net. When correctly installed and aligned, it covers the perimeter of the backdown channel, and reduces the likelihood of marine mammal entanglement. Safety panels were originally made of 2" mesh webbing (Medina panel), but are now made of 1¹/₄" mesh webbing (fine-mesh panel).

DWFN – Distant Water Fishing Nations

Draft¹ (or **draught**) - the vertical distance between the waterline and the bottom of the hull (keel), with the thickness of the hull included.

Ducted propeller – see Kort nozzle

Echo sounder¹ - the technique of using sound pulses directed from the surface or from a submarine vertically down to measure the distance to the bottom by means of sound waves. Device may also be referred to as a depth sounder.

EEZ – see Exclusive Economic Zone

Emergency Position-Indicating Radio Beacon (EPIRB) – One component of a GMDSS.

Exclusive Economic Zone³ (EEZ) - A zone under national jurisdiction (up to 200-nautical miles wide) declared in line with the provisions of 1982 United Nations Convention of the

Law of the Sea, within which the coastal State has the right to explore and exploit, and the responsibility to conserve and manage, the living and non-living resources.

eXpendable BathyThermograph (XBT) - a temperature and depth probe that is launched from the bridge wing of a ship using a hand launcher.

FAD – see fish aggregating device

FAO - Food and Agriculture Organization of the United Nations

Fender - A cushion, placed between boats, or between a boat and a pier, to prevent damage.

Fish-Aggregating Device⁴ - There are two types of FAD: those designed and deployed with the sole purpose of attracting fish, or those improvised by fishermen from natural flotsam (a tree trunk, for instance) to which they attach anything that will make it more attractive to the fish.

Flags of Convenience (FoC) - Vessels use the flags of states that either cannot or do not apply and enforce regulations. Countries such as Panama operate an open registry, and make a business from granting flags to foreign owned vessels.

Forepeak - A compartment in the bow of a small boat.

Forward – Toward the front of the boat (on the boat); opposite aft.

Galley - The kitchen area of a boat.

Gangion – see branchline

GCLME - Guinea Current Large Marine Ecosystem

GDP - Gross Domestic Product

Global Maritime Distress Safety System¹ (GMDSS) - an internationally agreed-upon set of safety procedures, types of equipment, and communication protocols used to increase safety and make it easier to rescue distressed ships, boats and aircraft.

Global Positioning System¹ (GPS) – a space-based global navigation satellite system that provides reliable location and time information in all weather and at all times and anywhere on or near the Earth when and where there is an unobstructed line of sight to four or more GPS satellites.

GMDSS – see Global Maritime Distress Safety System

GPS –see Global Positioning System

Gross register tonnage¹ (GRT; also **grt**, **g.r.t.**) represents the total internal volume of a vessel, with some exemptions for non-productive spaces. A gross register ton is equal to a volume of 100 cubic feet (~2.83 m³).

Gross tonnage¹ - (**GT**; also **G.T.**, **gt**) is a unitless index related to a ship's overall internal volume. Gross Tonnage is different from Gross Register Tonnage. Neither Gross Tonnage nor Gross Register Tonnage are measures of the ship's displacement (mass) and should not be confused with terms such as deadweight tonnage, net tonnage, or displacement. Gross Tonnage is calculated by measuring a ship's volume (from keel to funnel, to the outside of the hull framing) and applying a mathematical formula.

GT – see gross tonnage

GRT – see gross register tonnage

Hatch - An opening in a boat's deck fitted with a watertight cover.

Hanging ratio - the length of a rope on which a net panel is mounted divided by the actual length of stretched netting on the rope

Head - A marine toilet.

High frequency (HF) radio – see single side band

Hull - The main body of a vessel.

IPOA - International Plan of Action

IRCS - International Radio Call Sign issued by the International Telecommunications Union

IMO - International Maritime Organization of the United Nations

IUU - Illegal, Unreported and Unregulated Fishing

Kort nozzle¹ – a propeller fitted with a non-rotating nozzle. It may be fixed, with directional control coming from a rudder set in the water flow, or pivoting, where their flow controls the vessel's steering.

Lazarette - A storage space in a boat's stern area.

Lee - The side sheltered from the wind.

Length overall¹ (**LOA**; also **o/a**, **o.a.** or **oa**) - the maximum length of a vessel from the two points on the hull most distant from each other, measured perpendicular to the waterline.

Line - Rope and cordage used aboard a vessel.

LOA – see length overall

Maximum Sustainable Yield³ (**MSY**) - The highest theoretical equilibrium yield that can be continuously taken (on average) from a stock under existing (average) environmental conditions without affecting significantly the reproduction process.

MCS - Monitoring, Control and Surveillance

MSY – see Maximum Sustainable Yield

Muster – to gather or assemble

Net drum³ or reel - a wide, powered spool (usually hydraulic) on which a trawl, gillnet or purse seine net is wound when hauling.

Net Register Tonnage¹ (NRT) is the volume of cargo the vessel can carry; ie. the Gross Register Tonnage less the volume of spaces that will not hold cargo (e.g. engine compartment, helm station, crew spaces, etc., again with differences depending on which port or country is doing the calculations). No longer a standard measure.

Net tonnage¹ - (NT; also N.T., nt) is a calculated representation of a the internal volume of a ship's cargo holds but has a different formula from Gross Register tonnage. It is expressed in "tons", which are units of volume defined as 100 cubic feet (~2.83 m³). The "ton" as a unit of volume should not be confused with the far more common "ton" as a unit of weight or mass.

NGO - Non-governmental Organization

NT – see net tonnage

NRT – see net register tonnage

Ortza⁴ -A metal triangle to which the end of the net is attached. A typical seine net tapers up gradually from its maximum depth (generally 12-18 strips) to the ortzas. The bow ortza is at the sack end of the net, while the stern ortza is at the end first hauled aboard during a set.

Outrigger¹ - part of a boat's rigging which is rigid and extends beyond the side of a boat.

Pair trawl – two vessels towing one net; may also be called the sweeping net in the Limbe area of Cameroon.

Pitch² –the theoretical distance a prop moves forward in one revolution.

Port - The left side of a boat looking forward. A harbor is also called a port.

Ports of Convenience (PoC) - Where a port State is unwilling or unable to exercise measures to combat IUU fishing activities, such as inspections to detect IUU-caught fish, and prohibitions on landing of illegal catches.

Port state measures - port States can help prevent IUU catches from reaching international markets through denial of access to ports, port inspections, prohibition of landing, and even detention or sanctions, an important disincentive to Illegal, Unreported and Unregulated (IUU) fishing.

Power block³ - a mechanized pulley used to haul in nets, purse seine, etc. Also referred to as a **Puretic power block**.

Pursing - the process of retrieving the purse cable in order to draw in and close the bottom of the net.

Radar¹ is an object detection system that uses electromagnetic waves (e.g., microwaves or radio waves) to identify the range, altitude, direction, or speed of both moving and fixed objects such as aircraft, ships, motor vehicles, weather formations, and terrain. The term *RADAR* was coined in 1941 as an acronym for *radio detection and ranging*.

REC - Regional Economic Communities

RFMO - Regional Fishery Management Organizations

RFB – Regional Fishery Bodies

RSW – Refrigerated sea water; also sometimes CSW.

Rudder - A vertical plate or board for steering a boat.

Sack (bunt) - a portion of the purse seine net that is used to concentrate the catch and raise it to the surface for loading. It is situated towards the bow end, and is constructed of heavier and stronger twine in order to withstand the weight of large catches. Sack may also refer to the codend on a trawler.

SAR - Synthetic Aperture Radar

Screw - A boat's propeller.

Scuppers - Drain holes on deck, in the toe rail, or in bulwarks.

Sexual dimorphism - differences in appearance between the males and females of a species

Single Side Band Radio (SSB) – High frequency (HF) radio with a long calling range (thousands of kilometers).

Snood – see branchline

SOLAS - International Convention for the Safety of Life at Sea

Sonar¹ - (**sound navigation and ranging**) is a technique that uses sound propagation (usually underwater) to navigate, communicate with or detect other vessels or objects.

SRFC - Subregional Fisheries Commission (Northwest Africa)

SSB – see single side band

Starboard - The right side of a boat when looking forward.

Streamer line – Seabird mitigation device designed to deter birds from an area around the vessel, especially the stern. Also referred to as a bird line or tori line.

Stern - The after part of the boat; opposite of bow.

Stock³ - A group of individuals in a species occupying a well defined spatial range independent of other stocks of the same species.

TAC - see Total Allowable Catch

Tail bag – see codend

TED – see Turtle excluder device

Tonnage¹ - a measure of the size or cargo capacity of a ship. There are a variety of measurements (see gross tonnage, gross register tonnage, net register tonnage and net tonnage).

Tori line – see Streamer line

Total Allowable Catch³ (TAC) - total catch allowed to be taken from a resource in a specified period (usually a year), as defined in the management plan.

Trawl³ – A cone or funnel-shaped net that is towed through the water by one or more vessels.

Trip – the period of time from when a vessel departs to go fishing and returns to a port (dock to dock).

Try net – a smaller, separate net towed by shrimp trawl vessels which is pulled continuously or for brief periods to test for shrimp concentrations or determine other fishing conditions

Turtle Excluder Device (TED) – is any modification to a trawl designed to reduce the capture of turtles. May also be referred to as a **trawl efficiency device** as other large animals may also be excluded.

Twin trawl – two nets towed side by side (i.e., when shrimp trawler is towing 4 nets, there is a twin trawl off each outrigger)

Very Small Aperture Terminal (VSAT) – a two-way satellite ground station with a dish antenna that is smaller than 3 meters

Very High Frequency Radio (VHF) - The VHF band is divided into 71 channels with a frequency range of 156.000 to 163.000 MHz. Calling range is slightly more than line of sight.

Vessel monitoring systems¹ (VMS) are used in commercial fishing to allow environmental and fisheries regulatory organizations to monitor via satellite and in real time, the position, time at a position, and course and speed of fishing vessels (Flewwelling 2002).

VHF – see Very High Frequency

VMS - Vessel Monitoring System

VSAT – see Very Small Aperture Terminal

Warp – main cable on a trawler

Winch¹ - a mechanical device that is used to pull in (wind up) or let out (wind out) or otherwise adjust the "tension" of a rope or wire rope (also called "cable" or "wire cable").

XBT – see expendable bathythermograph

¹Definition from *www.Wikipedia.org*

²<http://www.caravelleboats.com/propeller%20info.htm>

³<http://www.fao.org/fi/glossary/>

⁴IATTC definition