MARINE RECREATIONAL INFORMATION PROGRAM

FINAL REPORT

WEST COAST RECREATIONAL FOR-HIRE SECTOR DATA NEEDS AND DATA COLLECTION PLANNING: CPUE INDEX OF ABUNDANCE FOR NORTH PACIFIC ALBACORE TUNA

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ABSTRACT

North Pacific albacore tuna, *Thunnus alalunga*, is greatly sought by the West Coast Recreational For-Hire Sector fishing from Washington south to the waters of Mexico. Both the Marine Recreational Information Program (MRIP) and the International Scientific Committee for Tuna and Tuna-Like Species in the North Pacific Ocean (ISC) have identified the need to develop a CPUE index of abundance that can be applied to North Pacific albacore tuna stock assessment. Recent trends toward increased use of recreational fishery data to complement commercial data may improve stock assessments. The West Coast recreational fishery for North Pacific albacore is relatively small in comparison to the U.S. commercial fishery for this stock. However, the recreational component may be critical for providing stock assessment information that is lacking in current data collected from monitoring the North Pacific commercial fisheries, because it covers areas of the species geographic range (with different temporal patterns) that are not usually fished commercially, and recreational data can be combined with commercial data for a more comprehensive assessment.

This report examines existing data sources in the albacore for-hire sector, including the Washington, Oregon and California State programs, and identifies data needs to develop a CPUE index of abundance. These needs fall into seven broad categories: I. Increased observer coverage, II. Biological sampling, III. More length data, IV. Refined discard or bycatch data: identification of target species, V. Refined fishing method data, VI. Refined vessel stratification data, and VII. Improved logbook data. The report outlines a five month pilot program, designed to address identified needs, for monitoring the West Coast recreational for-hire albacore fishery including increased observer coverage with additional dockside coverage for Washington and Oregon and supplemental dedicated Highly Migratory Species albacore observers for California (at the 10% level). Increased biological sampling and collection of length measurements are planned for all regions. Data collection will build upon existing state data protocols and include measures that can account for factors that may affect efficiency of the fleet, (vessel characteristics, bait, gear) species targeting (advanced declaration of target, delineation of fishing stops), the environment (temperature, habitat, depth) and dynamics of the population or of the fishing fleet (particularly by encompassing the entire geographic scope of the fishery).

INTRODUCTION

The United States West Coast Recreational Fishery is estimated to contribute nearly two billion dollars annually to the local economy (Pendleton and Rooke, 2006; TCW Economics, 2008; TRG, 2009), and plays an important role, regarding both fisheries management decisions (see Hannah, 2008) and population biology (*e.g.* groundfish species; Love *et al.*, 1998) for various fish species occurring in the region. The West Coast Recreational For-Hire Sector[1] of the fishery, consisting of charter vessels operating out of ports in Washington, Oregon, and California, represents a significant portion of this economic contribution. For example, in California, the for-hire fleet incurs the largest fishing effort of all sectors of the recreational fishery (CDFG, 2006, 2008).

Highly migratory species (HMS), seasonally distributed species such as billfish, sharks, and tunas, are frequently targeted by the for-hire sector. Among these species, North Pacific Albacore tuna, *Thunnus alalunga*, is greatly sought by recreational anglers fishing on for-hire (and private) vessels along the North American west coast from the Puget Sound, Washington to south of Guadalupe Island, Mexico (see Holts, 1985; Hill and Schneider, 1999). Annual albacore catch by for-hire anglers is variable due to the pulse nature of the fishery (Holts, 1985; Hill and Schneider, 1999). Laurs and Powers (2010) have recently provided a concise review of this specie's biology, habitat, and ecosystem. Distribution of this highly migratory pelagic species is influenced by climatic variability, and large-scale changes in oceanographic conditions can have major (and potentially long-term) impact on albacore movement and other biological factors such as growth, thus affecting availability, as well as vulnerability, to the fishery (Clark *et al.*, 1975; Laurs and Lynn, 1977, 1991).

[1] Also known as the Commercial Passenger Fishing Vessel, CPFV, industry (see Holts, 1985).

Table 1. West Coast Recreational Albacore Catch (numbers of fish) 2004 - 2007.

Year	Mexico	California		Oregon		Washington		Total ALB	Total HMS	ALB-US/	ALB-MX/
	For-Hire[1]	For-Hire	Private	For-Hire	Private	For-Hire	Private	US EEZ	US EEZ[2]	HMS-US	ALB-WC[3]
2004	165,570	20,197	31,018	5,119	12,421	13,046	1,172	82,973	122,004	68%	67%
2005	84,657	16,426	6,677	2,053	3,008	11,061	1,122	40,347	51,882	78%	68%
2006	17,691	3,365	8,115	2,649	9,026	21,437	3,483	48,075	85,346	56%	27%
2007	64,385	35,823	27,197	11,175	47,753	15,976	9,165	147,089	152,505	96%	30%

[1] Data for for-hire catch in CA and Mexico waters are from CDFG CPFV logbooks. All other data represent catch from RecFin.
[2] Data for total US EEZ HMS catch is all RecFin data except CA for-hire data. CA for-hire data are from CDFG CPFV logbooks.
[3] WC = Total West Coast-based U.S. catch (MX, CA, OR and WA)

Holts (1985) and Hill and Schneider (1999) estimated historical catch in the for-hire sector, and recent catch (since the inception of the RecFIN program in 2004) is listed in Table 1. The recreational fishery for albacore is relatively small in comparison to the commercial fishery for this species, which accounts for the vast majority of the catch[2]. Share of overall catch for the main gear types used by commercial fisheries over the last five years was longline, 35.5%, pole-and-line, 34.0%, and troll, 22.9% (ISC, 2008a). Additional fishing operations include purse seine, gill net, recreational, and unspecified gears, accounting for 7.6% of the total catch of albacore from the North Pacific Ocean. Commercial fisheries, and resource viability, for North Pacific albacore are closely monitored internationally by the Inter-American Tropical Tuna Association (IATTC), and by the Western and Central Pacific Fisheries Commission (WCPFC), and are also governed by the U.S. - Canada Albacore Tuna Treaty (see PFMC, 2009; Laurs and Powers, 2010). Recent estimates for total commercial albacore catch in the North Pacific were at a record high of 127,376 mt in 1999, but have declined to average approximately 86,000 mt since 2000 (ISC, 2008a). While the albacore resource is not considered overexploited, there is some concern that high levels of fishing capacity may be resulting

[2] Estimates regarding the contribution of the recreational albacore fishery to the total North Pacific Albacore catch vary from about 1 to 3.6 percent (Holts, 1985; Dotson and Charter, 2003). We suggest that these numbers, although anticipated to remain small relative to the commercial contribution, warrant evaluation based upon current recreational catch and better data specific to albacore.

in fishing effort greater than a level that will provide sustainable harvests over the long-term. As a result, IATTC and WCPFC have adopted resolutions to cap fishing effort on North Pacific albacore.

Uncertainty in the current North Pacific albacore stock assessment has been attributed to a lack of accurate fishery and biological information which will be required to improve reliability of stock status estimates (ISC, 2008a, and b). Similar concerns were recognized even in the early 1980s, when Bartoo and Kume (1982) summarized stock assessment needs for albacore in relation to the international commercial fishery, noting that better measurement of effective effort was necessary, that improvements may be difficult to achieve given the pulse nature of the fishery and the variability in oceanographic processes and weather conditions that strongly influence availability and catchability of North Pacific albacore. Recently, the ISC Albacore Working Group (AWG) has flagged Catch Per Unit Effort (CPUE) indices of abundance, all of which are currently derived from commercial logbook catch and effort data, as the primary limitation on accuracy of current stock assessment (ISC, 2008a). Likewise, PFMC (2009) had included development of new indices of abundance a highest priority issue for North Pacific albacore. In addition, uncertainties about the biology of North Pacific albacore (particularly stock structure, growth, age and maturity) remain and are an area of critical concern for stock assessment (PFMC, 2009).

The West Coast Recreational albacore fishery has the potential to provide information for stock assessment that cannot be obtained from data collected by monitoring the North Pacific commercial fisheries. First, the recreational albacore fishery operates in areas of the species' geographic range (northern coastal areas and extending southward into waters off Baja California, Mexico) that may not be fished by commercial vessels (to fill in data gaps). Second, it will be useful to combine commercial data with recreational data for a more comprehensive statement of stock status (a CPUE index of abundance, as discussed below, from recreational data is useful as an index that is independent from the commercial troll fishery, which represents only the eastern Pacific). Such information from the recreational fishery may be an important contribution to evaluating potential management options for the commercial U.S. West Coast Albacore Fishery, as described by Laurs and Powers (2010).

Concomitant with research needs identified by the ISC - AWG, the Marine Recreational Information Program (MRIP) Rare Event Species Work Group[3] has been charged with assessing management and stock assessment needs for catch and effort statistics from rare event and other (such as HMS) species. Such species may require unconventional sampling approaches, and expansion of data collection programs to meet identified needs (see NRC, 2006; PFMC, 2009). One identified need, coinciding with those of the ISC, is to develop a CPUE index of abundance the can be applied to stock assessment for North Pacific albacore tuna.

This report is intended to initiate the development of a sampling regime to contribute to a CPUE index of abundance for the West Coast Recreational For-Hire Sector albacore fishery. In early 2010, MRIP conducted a workshop to evaluate the potential for development of a West Coast Recreational For-Hire Sector based index of abundance for North Pacific albacore (Appendix 1). Workshop presentations and discussions involving West Coast Recreational For-Hire Sector representatives, fisheries managers, and scientists contributed to the contents of this report, including identification of data needs and data collection planning, as well as logistical and scientific insights that might otherwise have gone unrecognized.

The report begins with a brief description of the types of information required to produce a CPUE index of abundance and then provides background information regarding current data available from the West Coast Recreational For-Hire Sector albacore fishery, including available databases and the existing state and federally managed sampling programs. Data needs are identified, based on current sampling methodologies, observer coverage, and types of available data. The potential usefulness of modifying and/or augmenting existing sampling programs is considered. Based on these considerations, the report outlines a sampling design for a pilot test program to monitor the West Coast Recreational for-hire sector albacore fishery. Recommendations regarding future data collection for the West Coast Recreational for-hire sector albacore fishery provided at the conclusion of this report were developed, in part, as a result of the MRIP workshop (see Appendix 1).

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[3] The Rare Event Species Work Group was formerly known as the Highly Migratory Species Work Group (HMSWG).

INDEX OF ABUNDANCE DATA REQUIREMENTS

Three main data categories must be collected to construct a viable population assessment model (see NRC, 2006). These categories are: 1) total catch, 2) size and age composition of the population, and 3) CPUE indices of relative abundance (indices based on catch rates). A comprehensive data assessment model, that can accurately capture all segments of the population, will include all fisheries and gear types. For albacore these fisheries include the commercial fishery using longline, pole and line, troll, and other gear types, as well as the recreational fishery using rod and reel.

CPUE Index of Abundance

As described by Maunder *et al.* (2006), CPUE as an index of abundance is based on a fundamental relationship, relating catch to abundance and effort, often used in quantitative fisheries analysis:

$$C_t = qE_t N_t$$

where C_t is catch at time t, E_t is the effort expended at time t, N_t is abundance at time t, and q is the portion of the stock captured by one unit of effort (catchability coefficient).

The relationship between CPUE and abundance becomes:

$$C_t/E_t = qN_t$$

Whereby, catch is assumed to be proportional to abundance ($CPUE_t \propto N_t$) if the catchability coefficient, q, is constant over the exploitation history of the fishery; a state that is rarely true as fishery efficiency and other parameters affecting that efficiency change (Maunder *et al.*, 2006).

Catchability

Catchability, the fraction of a fish stock caught by a defined unit of fishing effort, is strongly tied to effort (and abundance), and is important for understanding fisheries dynamics relative to CPUE (Gulland, 1969; Hilborn and Walters, 1992; Hansen *et al.*, 2000) and for application to stock assessment models (Punt and Hilborn, 1997). Some of the factors that commonly cause ***q*** to change over time include changes in the efficiency of the fleet, species targeting, the environment, and dynamics of the population or of the fishing fleet (Maunder *et al.*, 2006). Data collected for factors that affect albacore catchability can be critically important to CPUE indices.

Although the West Coast Recreational For-Hire Sector albacore fishery takes only a small portion of the overall catch in the North Pacific, this does not diminish the potential value of a CPUE index derived from these data. A fisheries survey may capture a limited number of fish in comparison to the entire fishery, but still constitute a critical part of a stock assessment. This can be attributed to the fact that ***q*** of a properly conducted survey is less variable, or at least better understood, and thus, corrected for in the applied methodology. Logistical elements of the for-hire fishery, such as limited season, well defined geographic area, and opportunity for high levels of observer coverage with detailed data collection, offer a great opportunity to examine catchability using a rigorous, systematic approach. For this reason it is important to examine the sources of variability in the catchability of albacore by the recreational for-hire fishery and provide ways to correct for it so that the associated CPUE index can be applied to stock assessment models for North Pacific albacore.

Standardization of Effort

Hinton and Maunder (2004) emphasized that because CPUE is assumed to be proportional to abundance, and because CPUE is often the input data most heavily relied upon for population assessment models, it is important that any factors that may influence CPUE be removed from (or accounted for in) the index. Factors that might influence CPUE could include variation in fishing gear, changes in geographic and temporal patterns, and changes in the behavior of the fishery (as those described by Maunder *et al.*,

2006 and noted above). Methods for reducing the effects of these factors, or standardizing CPUE in assessment models (*e.g.* general linear models, Allen and Pusly, 1984; delta-lognormal method, Lo *et al.*, 1992; habitat standardization method, Bigelow *et al.*, 2002) have been reviewed in detail by Hinton and Maunder (2004).

To achieve standardization of effort and address the issue of changes in $\boldsymbol{q}$ over time, in addition to application of the most suitable modeling methods, it is imperative to collect all possible data associated with the fishing process. This includes obvious, and relatively easy to collect data, such as date, time, fishing location, vessel length, etc., and less readily accessible data such as bait and gear used (see Hinton and Nakano, 1996). As an example of the effects of these factors on fishing efficiency, we note that Laurs *et al.* (1976) analyzed logbook data for 1961 to 1970, found 10-foot length classes among jig vessels strongly affected the power of commercial albacore fishing. The research was applied to standardize CPUE data for the fishery by adjusting effort and CPUE values based on relative fishing power estimates for each year.

Brill *et al.* (1998) observed that accurate population assessments, particularly for highly migratory pelagic species, require the ability to differentiate changes in abundance from changes in vulnerability to capture resulting from variability in oceanographic conditions. Catch and effort data used to develop stock assessment models are often aggregated by fishing area, month or trips. Such aggregated data create difficulties in standardization of effort by virtue of the fact that one cannot detect changes in targeting strategy that occur during a given fishing trip, and cannot extract the influence of such changes from changes related to abundance or environmental factors (Hazin *et al*., 2007). Catch and effort data separated by stop with detailed information on the target species can provide accuracy in estimation of abundance indices (Fréon and Misund, 1999; Hazin *et al.*, 2007).

In addition, it has been demonstrated that other factors, such as habitat preference and environmental parameters may influence CPUE (Kleiber and Perrin 1991; Hinton and Maunder, 2004). Kleiber and Perrin (1991) examined the concepts of effort standardization and calculation of CPUE for the albacore fishery, and found that even with standardization of fishing power there was high variability in CPUE, suggesting that CPUE trends are unrelated to those in the population available to the fishery. This is

considered to be due to patchy distribution of albacore and improved methods by fishermen for locating favorable fishing areas. Basic research on individual species, fishing technology, and the environment will be useful to identify factors that are most influential in determining CPUE (Hinton and Maunder, 2004). In some cases, such as research regarding fishing technology, these data can best be obtained concomitant with fisheries monitoring for catch and effort studies (see NRC, 2006).

CURRENT DATA AND EXISTING SAMPLING PROGRAMS

Most recreational fisheries surveys are designed with two separate components that can be combined to estimate total catch. One survey, often a telephone intercept, is used to estimate angler effort, and a separate survey, dockside or onboard sampling survey is used to provide data for estimating catch and CPUE (see NRC, 2006).

While existing recreational fisheries sampling program designs for Washington, Oregon, and California regions have been developed to collect data for fisheries catch and effort that are similar among regions, programs necessarily differ from one another for multiple reasons. Each of these programs are managed and legislated by separate state entities. Laws pertaining to licenses and permitting, fishing quotas, and other aspects of the recreational fishery that can affect availability of catch and effort data and/or biological samples differ among states. Albacore distribution in relation to port, and fisheries activities differ among areas as well. In Washington, Oregon, and northern California, for example, for-hire fishing trips target albacore exclusively, while in southern California, where other HMS can be readily targeted, trips are much more diversified. Vessels based in the northern ports often are smaller, holding fewer passengers, with less likely space available to potential onboard observers. It is, at least in part, for these reasons, that Washington and Oregon rely on dockside intercept surveys, while in California onboard samplers are used to monitor recreational catch of for-hire vessels.

Below, databases housing West Coast recreational catch and effort data and related information are listed. Next, each of the three West Coast regions is described. A regional profile of the recreational for-hire fleets and general characteristics of the local

albacore fishery is briefly noted for each (and see PFMC, 2009). State sampling programs and collection methods are then summarized. Methodologies refer to the for-hire sector specifically (unless noted otherwise), but may also apply to other sectors (private vessels and shore-based fishing) of the recreational fishery.

Available Databases

Data for the West Coast recreational albacore fishery are housed in multiple accessible databases. Currently, the Pacific States Marine Fisheries Commission (PSMFC) manages the federally based Recreational Fisheries Information Network (RecFIN; http://www.recfin.org) to maintain data on recreational fishing. The RecFIN database includes data collected by state agencies for the Washington (Washington State Department of Fish and Wildlife, WSFW, Washington Ocean Sampling Program, OSP), Oregon (Oregon Department of Fish and Wildlife, ODFW, Ocean Recreational Boat Survey, ORBS), and California (California Department of Fish and Game, CDFG, California Recreational Fisheries Survey, CRFS) components of the West Coast albacore recreational fishery. The Marine Recreational Fisheries Statistics Survey (MRFSS) maintains a database for recreational fisheries data collected from 1980-2003. Beginning in 2004 state programs substituted for MRFSS.

In addition, there are two relatively extensive sources of historical data for the California component of the albacore recreational fishery. First, California for-hire vessel logbook data have been collected from 1936 to present as discussed below. Data from 1936 to 1997 have been standardized and summarized to provide readily accessible information on historical catch for the for-hire sector of the California recreational fishery (Hill and Schneider, 1999). These data are currently maintained by CDFG. Second, a database containing information on southern California recreational fisheries for-hire vessels extracted from daily fish reports in the Los Angeles Times (1959 to 1998), was constructed by Dotson and Charter (2003), and is maintained by the National Marine Fisheries Service, Southwest Fisheries Science Center (NMFS, SWFSC).

Washington Region

Albacore For-Hire Regional Profile

The importance of albacore to the Washington for-hire sector has generally risen in the last several decades as other fishery opportunities (salmon and rockfish) have declined. During the early part of this period, from 1992 to 1998, albacore catch increased in proportion to the number of anglers - from about 1,300 tons to about 3,000 tons (PFMC, 2003; PFMC, 2009).

Hanan and Campbell (2005) reported a total 19 Washington based for-hire vessels fishing for albacore (Table 2). The major for-hire port in Washington is Westport, which has seven charter offices with an average of 15 vessels that routinely fish for albacore from July through September. For-hire albacore vessels usually leave port before dawn , returning late in the day, or early the following day. An estimated 90% of the for-hire trips in Westport, for example, are 1 and a half to two days in duration (very few are as short as one day, or as long as three).

Also of note, since 2005 a mandatory for-hire vessel tuna logbook program has been in place to obtain information on location and effort in the for-hire albacore fishery (this information is not used in OSP estimates; see PFMC, 2009).

Table 2. Recent estimates of Washington (Port Zone C) and Oregon (Port Zone B) based albacore for-hire vessels. SR, Short range vessel; SP, Six pack vessel (from Hanan and Campbell, 2005).

Zone	State	Location	Operator	Number of CPFVs	Percentage of Fleet	Vessel Class	Albacore Fishing Season	Vessel Capacity (# anglers)
B	OR	Newport	Sea Gull Charters	1	1%	SR	Jul-Oct	10
B	OR	Newport	Tradewind Sportfishing	5	5%	SR	Aug-Oct	10
B	OR	Newport	Black Rocket Charters	1	1%	SP	Aug-Oct	3
B	OR	Brookings	Tidewind Sportfishing	2	2%	SR	Jul-Oct	10
B	OR	Winchester Bay	Pacific Pioneer Charters	1	1%	SR	Jul-Oct	10
Zone B Total				10	**10%**			
C	WA	Westport	Advantage Charters	1	1%	SR	Aug-Sep	7-10
C	WA	Westport	Cachalot Charters	1	1%	SP	Aug-Sep	6
C	WA	Westport	Coho Charters	2	2%	SR	Sep-Oct	7-10
C	WA	Westport	Deep Sea Charters	7	7%	1SR/6 SP	Aug-Oct	6-10
C	WA	Westport	Ocean Charters	4	4%	1SR/3 SP	Aug-Oct	6-10
C	WA	Westport	Westport Charters	4	4%	SR	Aug-Sep	7-10
Zone C Total				19	**19%**			

WDFW, Ocean Sampling Program

The WDFW, OSP collects data to estimate catch and effort of fish species by the for-hire sector from four major ports (Ilwaco Complex, Westport, La Push, and Neah Bay; see WDFW, 2008). Westport and Ilwaco represent most of the albacore for-hire effort. The Westport for-hire fleet accounts for more than 50% of albacore taken in Washington waters. However, Westport is a particularly difficult area to sample albacore, and albacore is filleted before it can be sampled in that port. This is typical for other ports as well, making fish counts and weight/length information difficult or impossible to obtain.

OSP sampling methods have been summarized in a brief report (see WDFW, 2008; http://www.recfin.org/WA-OSP.html). Effort estimates are obtained from vessel-port entrance/exit counts. Catch is estimated based on dockside intercept survey. Data collected include date, port, vessel, target species, number of anglers, primary fishing location, retained catch (catch is counted and identified to species by sampler), released catch (and see WDFW overview of sampling program in Appendix 2). Albacore length and weight are not measured.

Oregon Region

Albacore For-Hire Sector Regional Profile

The albacore recreational fishery off Oregon has increased during the past decade (PFMC, 2009). Peak catch was 58,928 fish in 2007, but catch has remained relatively high over the last two years. Both albacore distribution and weather affect recreational effort. Recreational access to albacore in Oregon waters is highly variable depending upon geographic distribution of albacore and weather. During 2007, for example, albacore were often less than 30 km off shore along much of the Oregon Coast, and weather conditions were suitable for vessel transit, allowing for a good fishing season (see PFMC, 2009).

The majority of for-hire albacore catch and effort is concentrated along the central part of the Oregon coast with Newport serving as the major port for the albacore for-hire fleet. Hanan and Campbell (2005) reported ten Oregon based for-hire vessels fishing

albacore (see Table 2). Most trips leave early, return mid-day (but albacore trips return much later in the day - overnight trips are rare). Private vessels land an estimated 74% of albacore taken in Oregon, while the for-hire sector accounts for the remaining 26%. Albacore trips comprise six percent of total recreational trips. The fleet often accesses moorage areas that are separate from private vessel mooring. The number of for-hire angler passengers varies widely among Oregon vessels.

ODFW, Oregon Recreational Boat Survey

The Oregon Department of Fish and Wildlife (ODFW), Oregon Recreational Boat Survey (ORBS) collects data to estimate catch and effort of marine fish species by the for-hire sector from at least ten to twelve major access points coast-wide (Schindler *et al.*, 2008; and see http://www.recfin.org/seb.html). ORBS methods, including a detailed summarization of data collected, have recently been reported by Schindler *et al.* (2008). For effort estimates, ORBS contacts for-hire vessels to determine number of trips and target species. These effort and catch data include port, catch area, week, season type, trip time, and boat type. Effort estimates can also be obtained from, or cross referenced with, vessel-port entrance/exit counts. To determine catch, ORBS uses dockside sampling and interviews. Data on number of anglers fishing is obtained from dockside intercept interviews. Dockside interviews are used to collect data regarding date, port, vessel, trip departure time, return time, duration of trip, primary fishing location, retained catch, and released catch. Dockside biological sampling includes length and weight measurements. Anglers are required to return with fish whole (although fish may be eviscerated), and sampling compliance is mandatory. Each port sampler has a goal of obtaining 15 length measurements weekly (ORBS reports a preliminary estimate of over 40,000 albacore recreationally caught off Oregon for 2009 – both private and for-hire vessels – and that length measurements were collected from more than 1400 of these fish).

California Region

Regional Profile

The California for-hire fleet is considered to be among the largest "party boat" fleets in the world, targeting approximately 266 fish species including albacore tuna (Hill and Schneider, 1999; and see Baxter and Young, 1953; Roedel and Frey, 1968; Young, 1969). The California for-hire fleet includes approximately 250 to 300 vessels ranging in length from 45 to 120 feet (Tables 3 and 4). California logbook data indicate that in 2008, 98 vessels fished HMS over an estimated 2,900 days at sea (and see PFMC, 2009). The fleet consistently carries approximately 620,000 passengers annually to Southern California and Mexico fishing grounds (Dotson and Charter, 2003; Hanan and Campbell, 2005). Hanan and Campbell (2005) subdivided the fleet into three classes based on passenger load, trip distance and duration. Smaller and faster HMS sport fishing vessels, designed to carry six passengers or less, are known as "six-packs." Six-pack vessels target tunas, billfish and other pelagic species on one or two day trips. Larger for-hire vessels often carry 20 to 40 or more passengers and target albacore, bluefin, *T. thynnus*, yellowfin, *T. albacares*, bigeye, *T. obesus*, and skipjack tuna, *Euthynnus pelamis*, on two types of trips: 1) short one or two day trips in the southern California Bight and northern Baja California waters, and 2) long-range, multiple day trips into Mexico waters. Short-range trips can be further subdivided into half day, full day, and night anchored fishing. Long-range vessels based out of Southern California ports typically conduct most, if not all, fishing activities in Mexican waters. San Diego Bay serves as the major hub for long-range HMS fishing in waters off Mexico with a subset of the fleet numbering more than 50 long-range vessels.

The recreational albacore fishing season off California and Mexico generally runs from July to September. Currently, the State of California enforces two different quotas or bag limits for albacore. North of Point Conception, the bag limit is 25, south of the Point, the limit is ten (there are fewer days to fish north of Point Conception).

Table 3. Recent estimates of southern and central California based albacore for-hire vessels. Ports are divided into port groups (Zones 1-4) by geographic location. LR, Long range vessels; SR, short range vessels; SP, Six pack vessels; CH = Charter only vessels (from Hanan and Campbell, 2005).

Zone	Location	Operator	Number of CPFVs	Vessel Class	Number of LR Vesels	Number of SR Vessels	Number of SP Vessels	Number of CH Vessels***
1	San Diego	Lee Palm's Sportfishing	1	LR*	1			
1	San Diego	Fisherman's Landing	20	SR, CH, LR*	7	3		10
1	San Diego	Point Loma Sportfishing	18	SR, LR*	5	13		
1	San Diego	H&M Landing	23	SR, CH, LR*	3	5		15
1	Mission Bay	Seaforth Sportfishing	14	SR, SP, LR*	8	4	2	
1	Mission Bay	Islandia Sportfishing	6	SR, SP, LR*	2	3	1	
1	Oceanside	Helgren's Sportfishing	7	SR, LR*	3	4		
2	Dana Point	Dana Wharf Sportfishing	12	SR, SP		10	2	
2	Newport Beach	Davey's Locker	5	SR, SP		4	1	
2	Newport Beach	Newport Landing	5	SR		5		
2	Seal Beach	Big Fish Sportfishing	1	SR		1		
2	Long Beach	Marina Sportfishing	3	SR		3		
2	Long Beach	Belmont Pier Sportfishing	2	SR		2		
2	Long Beach	Pierpoint Landing	9	SR, SP		5	4	
2	Long Beach	Long Beach Sportfishing	7	SR		7		
2	San Pedro	L.A. Harbor Sportfishing	6	SR		6		
2	San Pedro	22nd Street Landing	5	SR		5		
3	Redondo Beach	Redondo Sportfishing	5	SR		5		
3	Redondo Beach	Rocky Point	2	SP			2	
3	Marina Del Rey	Del Rey Sportfishing	4	SR		4		
3	Port Hueneme	Port Hueneme Sportfishing	3	SR		3		
3	Oxnard	Captain Hook's Sportfishing	8	SR, SP		7	1	
3	Oxnard	CISCO Landing	11	SR		11		
3	Ventura	Harbor Village Sportfishing						
3	Santa Barbara	Wave Walker Charters	1	SP			1	
3	Santa Barbara	Sea Landing	2	SR		2		
4	Avila Beach	Patriot Sportfishing	3	SR, LR**	1	2		
4	Morro Bay	Virg's Landing	7	SR, LR**	1	6		

*Long Range Baja California HMS Fishing
**Long Range Central California Albacore Fishing
***Short Range and Long Range Fishing

Table 4. Recent estimates of northern California (Port Zone A) based albacore for-hire vessels. SR, Short range vessels; SP, Six pack vessels (from Hanan and Campbell, 2005).

Zone	State	Location	Operator	Number of CPFVs	Percentage of Fleet	Vessel Class	Albacore Fishing Season	Vessel Capacity (# anglers)	Trip Duration (days)
A	CA	Crescent City	Tidewind Sportfishing	1	1%	SR	Aug-Sep	10	1
A	CA	Eureka	Eureka Fishing Ltd.	1	1%	SR	Aug-Sep	10-15	1
A	CA	Fort Bragg	Noyo Fishing Center	7	7%	3 SR/4 SP	Aug-Sep	6-12	1
A	CA	Fort Bragg	Telstar Charters	1	1%	SR	Aug-Sep	10	1
A	CA	Shelter Cove	Shelter Cove Sportfishing	1	1%	SP	Aug-Sep	6	1
A	CA	Bodega Bay	Bodega Bay Sportfishing	2	2%	SP	Aug-Sep	6	1
A	CA	Bodega Bay	Bodega Bay Charters	1	1%	SR	Aug-Sep	10	1
A	CA	Bodega Bay	Agressor Adventures	1	1%	SP	Aug-Sep	6	1
A	CA	San Francisco	Fisherman's Wharf	9	9%	8 SR/1 SP	Aug-Oct	6-20	1
A	CA	San Francisco Bay	Sausalito	7	7%	6 SR/1 SP	Aug-Oct	6-20	1
A	CA	San Francisco Bay	Emeryville Marina	7	7%	SR	Aug-Oct	10-15	1
A	CA	San Francisco Bay	Berkeley Marina	7	7%	SR	Aug-Oct	10-15	1
A	CA	San Francisco Bay	Point San Pablo	1	1%	SR	Aug-Oct	15	1
A	CA	San Francisco Bay	San Rafael	1	1%	SP	Aug-Oct	6	1
A	CA	San Francisco Bay	Richmond	1	1%	SP	Aug-Oct	6	1
A	CA	Half Moon Bay	Pillar Point Harbor	7	7%	SR	Aug-Oct	10-15	1
A	CA	Santa Cruz	Chartle Charters	1	1%	SP	Jul-Oct	6	1
A	CA	Santa Cruz	Stagnaro's Sportfishing	1	1%	SR	Jul-Oct	10	1
A	CA	Santa Cruz	Santa Cruz Sportfishing	1	1%	SP	Jul-Oct	6	1
A	CA	Santa Cruz	Shamrock Charters	1	1%	SR	Jul-Oct	10-15	1
A	CA	Santa Cruz	Suntan Charters	1	1%	SP	Jul-Oct	6	1
A	CA	Santa Cruz	Reel Sportfishing	1	1%	SP	Jul-Oct	6	1
A	CA	Monterey	Chris's Fishing	4	4%	SR	Jul-Oct	20	1
A	CA	Monterey	Park Place Excursions	1	1%	SP	Jul-Oct	6	1
A	CA	Monterey	Randy's Sportfishing	2	2%	SR	Jul-Oct	20	1
A	CA	Moss Landing	Tom's Sportfishing	1	1%	SR	Jul-Oct	12	1
Zone A Total				68	**70%**				

CDFG, California Recreational Fisheries Survey

The CDFG CRFS program is designed as a comprehensive survey to provide catch estimates for all marine fish species targeted by the recreational fishery (see http://www.dfg.ca.gov/marine/crfs.asp; 2010 CRFS Sampler Manual, http://www.recfin.org/lib/2010/CRFS_Sampler_Manual_2010.pdf). More than 400 ports are covered, and all samples are taken within daylight hours (multi-day trips are occasionally sampled).

The CRFS methods are summarized in two recent documents (PSMFC, 2006). To estimate effort, CRFS conducts an angler directory telephone intercept survey (angler license frame). The telephone survey is conducted monthly and samples two license frames, California recreational for-hire operators and licensed anglers. Data collected include date, port, trips, trip duration, type of trip, number of anglers, primary fishing location, and total wet gear hours.

Dockside intercept and onboard for-hire vessel surveys are used to estimate catch. Data are collected throughout the year, generally during daylight hours (overnight trips are sampled very infrequently, trips of duration greater than two days are not sampled),

and are reported monthly. Data include date, port, vessel, trip duration, target species, primary fishing location, depth, retained catch, released catch, length, weight, sex, number of anglers, and total wet gear hours (see PSMFC, 2006).

California state law allows for albacore to be filleted at sea. CRFS onboard samplers are able to collect length data before fish are filleted.

California Onboard Sampling

Onboard sampling is strongly important to the California CRFS sampling program – among other reasons, for attaining sufficient sample size and attempting to estimate discarded fish – to the extent that cooperation of for-hire vessels is required by law. The following passage is from the CDFG website:

"The cooperation of owners and operators of commercial passenger fishing vessels (CPFVs) has been critical to the success of the CRFS since its inception in 2004. Onboard and dockside sampling of CPFVs by CRFS samplers will continue. CPFV operators and anglers are reminded that accurate catch and effort estimates depend on the catch and discard data collected by CRFS samplers while onboard CPFVs. In addition, the CRFS samplers must observe both open and charter trips, and must gather effort data to ensure the best possible estimates.

Anglers are reminded that, by law (Section 105.5, Title 14, California Code of Regulations), owners or operators of CPFVs must carry and accommodate CRFS samplers on fishing trips when asked. CRFS samplers will ask to observe both charter and open fishing trips. If observer coverage of a trip is denied by the owner or operator of the vessel, the Department may request a written explanation for the denial, and CPFV owners or operators who deny observer coverage of a trip may have their fishing permits or licenses revoked".

California For-Hire Sector Logbook Data

As noted above, since 1936, operators have been required by California State law to possess a for-hire vessel license, maintain a daily logbook of anglers intending to fish and catch, and report the log data to CDFG. Current logbook data should include date, port, vessel, trip duration, target species, number of anglers, primary fishing location, species caught, species released, fishing method, bait, trip type, bottom depth, and sea surface temperature (and see PSMFC, 2006). Using logbook data, effort can be estimated from trip duration, number of anglers, and total wet gear hours.

Ally *et al*. (1991) suggested that logbook data, and level of compliance by for-hire captains, may be inadequate for fishery management purposes. Karpov *et al.*, 1995 analyzed catch statistics for central and northern California, and found that for-hire log

data under-reported catch and effort. In addition, the authors noted inter-annual variation in percentage of catch and effort reported by for-hire logs can vary widely from year to year. Catch was considered to be over-reported relative to effort (see Ally *et al.*, 1991, Karpov *et al*., (1995). However, Karpov *et al.*, (1995) suggested for-hire log data are of potential value for indicating long-term trends and total effort.

Hill and Schneider (1999) used logbook data to estimate historical catch in the for-hire sector. The authors reported that albacore catch off southern California, was highest in the 1950s and 1960s, and peaked at approximately 175,000 fish taken in 1952 and 180,000 fish taken in 1962. Highest catch off Baja California was taken from 1962 to 1986, with a peak of more than 190,000 fish in 1984. Catch remained relatively low since the mid-1980s, with a minor increase in 1997 that has been attributed to El Niño conditions (see Hill and Schneider, 1999; and see Table 1). Albacore are also caught on for-hire trips originating out of San Francisco and Monterey, but catch off central California has been low in comparison to southern California and Mexico. Of note, Dotson and Charter (2003) reported a high correlation between data extracted from daily fish records in the Los Angeles Times and CDFG logbook data analyzed by Hill and Schneider (1999).

DATA NEEDS

Recently, there has been a trend toward increased use of recreational fishery data to complement commercial fishery related time series, which have typically been the main source of fishery dependent data included in fish stock assessments (NRC, 2006). The West Coast Recreational For-Hire Sector represents an important additional data source that merits consideration as a potential input to the North Pacific albacore assessment. Data collected from the recreational for-hire albacore fishery will benefit commercial fisheries of the North Pacific Ocean and related management efforts, in part because most nations targeting the albacore harvest other highly migratory species during different times of any given year.

There is strong potential of recreational for-hire data to address stock assessment needs for North Pacific albacore. Examination of the existing sampling programs for

Washington, Oregon, and California has identified specific data types, listed below within seven general categories lacking for albacore within each of the three regions.

Evaluation of Data Needs: Examination of Effort Relative to Existing Sampling Levels

To assess data gaps for developing a CPUE index of abundance (based on sampling the for-hire albacore fishery) in the existing state programs, and to evaluate data needs for an albacore sampling program (determine spatial-temporal distribution of albacore fishing effort), several types of information were examined. Areas of albacore fishing effort relative to sampling effort for Washington were assessed based upon best available OSP information. Monthly, regional albacore fishing and sampling effort data for 2007 and 2008, provided by ORBS, were examined to assess potential gaps in dockside albacore sampling for Oregon. Monthly, regional albacore fishing effort (number of for-hire trips), and number of fish retained, for California and Mexico waters was extracted from CDFG logbook data from 1980 to 2008, and examined relative to current levels of overall CRFS sampling as estimated by CDFG. Using the five "management districts" implemented by CDFG (see 2010 CRFS Sampling Manual; CDFG, 2006), spatial and temporal patterns were examined (from CDFG logbook data) to better understand the distribution of for-hire albacore fishing effort in California and Mexico. Because of the highly migratory nature of albacore, the timing and geographical distribution of the albacore fishery is expected to vary among years based upon seasonal/annual oceanographic features and are anticipated to be influenced by other factors (*e.g.* socioeconomic factors).

Data Gaps

-Washington and Oregon Dockside Sampling

Washington albacore for-hire vessels typically leave port prior to, and return to port after, state sampling hours and are generally missed in both fish sampling and vessel entrance/exit counts. The overall annual monitoring rate for Washington, coastwide, is

reported by OSP to be over 50% of the for-hire vessel trips recorded in vessel effort counts. However, OSP reports that the Westport accounts for the majority of for-hire albacore catch in Washington, and that this port may be under sampled. Many albacore trips are not included in the vessel counts due to departure and return times.

Information provided by ORBS indicates dockside sampling of for-hire vessels is approximately 20%. Astoria, Garibaldi, Depoe Bay, Newport, and Brandon may be among the highest for for-hire albacore fishing effort. However, both temporal and geographic patterns of effort in this fishery will be influenced by the changes in albacore seasonal distribution, and are also expected to be influenced by other factors.

ORBS sampling for albacore is low due to early departure and late return of trips outside of sampling hours. However, for ports with recognized non-salmon fishing activity, ORBS begins sampling in early March and continues through October, accounting for approximately 96% non-salmon fishing effort in those ports. Remaining ports have sampling start dates in early May or June, ending in September. This sampling period accounts for 60%-90% of the activity occurring in these locations (see Schindler *et al*., 2008).

-CRFS Dockside and Onboard Sampling

CRFS telephone intercept survey is reported to cover 10 - 50% of for-hire operators weekly, with dockside intercept survey information used to validate information. CRFS onboard samplers currently sample less than five percent of all recreational for-hire trips.

CRFS data are collected for only a small portion of for-hire trips that fish in waters off Mexico (in part, because most of the trips that fish in this area are overnight). For example, in 2008, approximately 10% of the 12,000 anglers that fished in Mexico waters were monitored. Shipboard sampling for Mexico waters is estimated to be approximately 1%. Currently, catch from trips into Mexico is not estimated for any species. For CPUE estimates, CRFS reports that onboard monitoring currently samples at a frequency of less than 5% of the statewide recreational for-hire catch.

As expected, the temporal pattern of for-hire albacore fishing effort in Mexico waters and each of the six CDFG management areas varies amongst months and years

over the 18 year period from 1980 to 2008, and likely has been influenced by oceanographic patterns such as El Niño events, and by socioeconomic factors. Nonetheless, a general pattern of albacore season emerges. The California-Mexico Recreational For-Hire Sector albacore fishing season can be characterized as extending primarily from April to November (although the greater effort may generally be May to October), with peak periods mainly in June to August. In addition, low levels (less than 10) of albacore for-hire trips have begun as early as January (especially in Mexico and Southern California) and trips have occurred as late as December.

During the 18 year period examined, the majority of for-hire albacore trips within California waters occurred in southern California (from the Mexico border to Point Conception). Overall, most frequently, the number of for-hire albacore trips to Mexico waters is generally more than 10 times greater by month, than for southern California and the remainder of California trips.

Comparison of recent years (2004-2007 - since the inception of RecFIN) is demonstrative of these overall trends, and is instructive for evaluating both temporal and spatial patterns of for-hire albacore trips. See Figures 1 to 4.

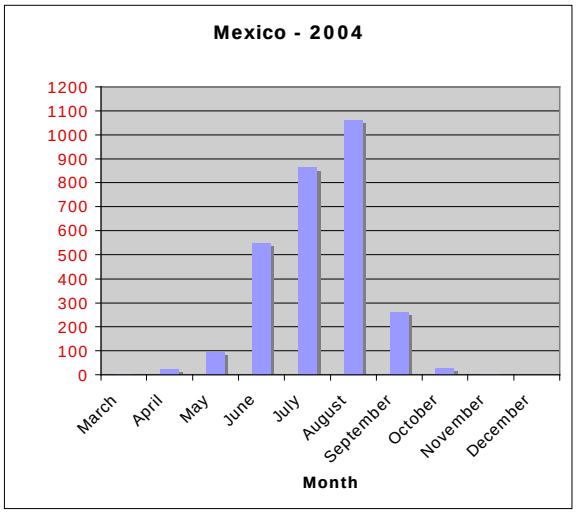
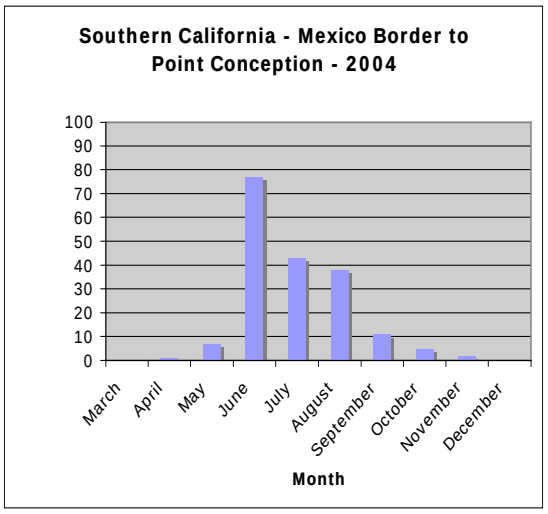


Figure 1a. Region 1.



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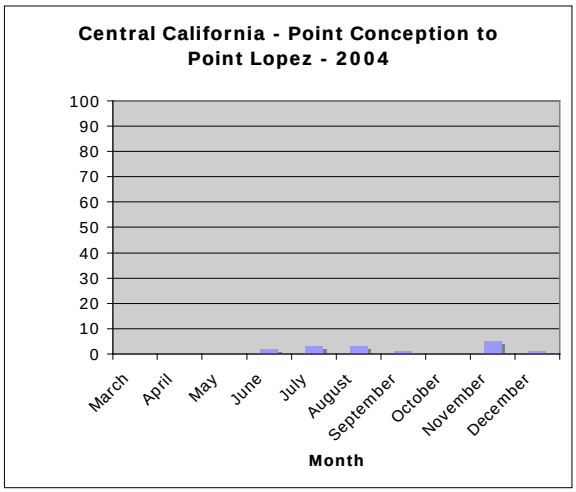


Figure 1c. Region 3.

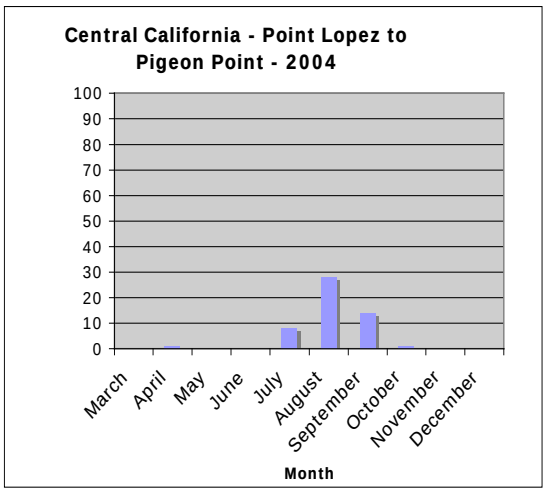


Figure 1d. Region 4.

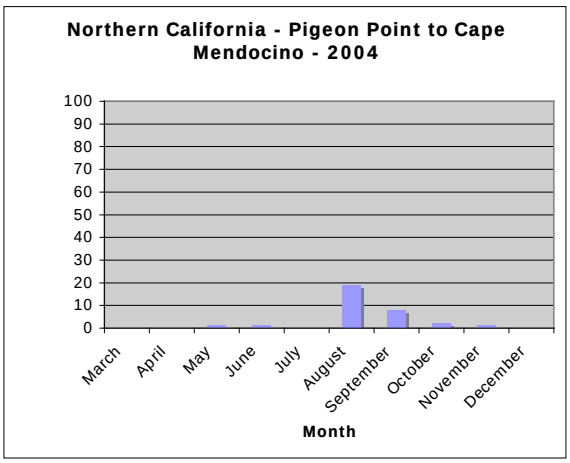


Figure 1e. Region 5.

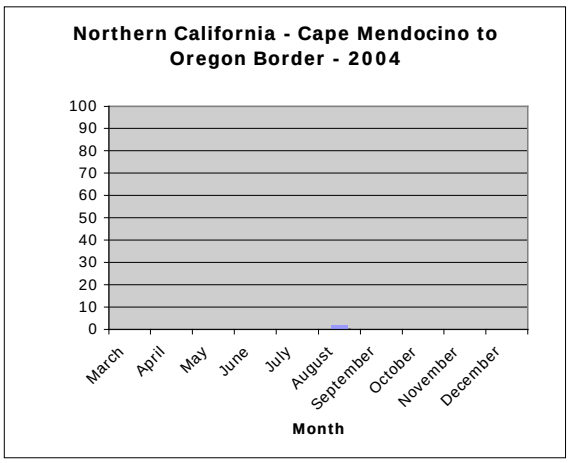


Figure 1f. Region 6.

Figure 1 (a-f). Temporal and geographic distribution of albacore for-hire trips by month (2004 calendar year) within Mexico waters and five CDFG management areas. Extracted from CDFG California for-hire logbook data.

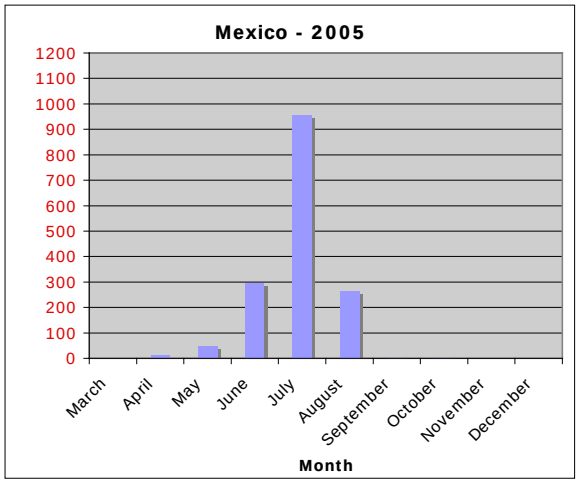
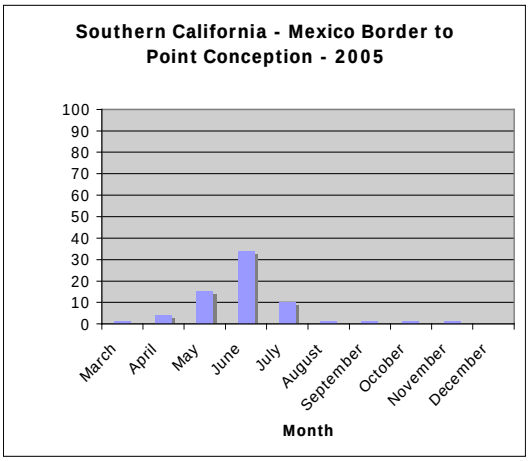


Figure 2a.



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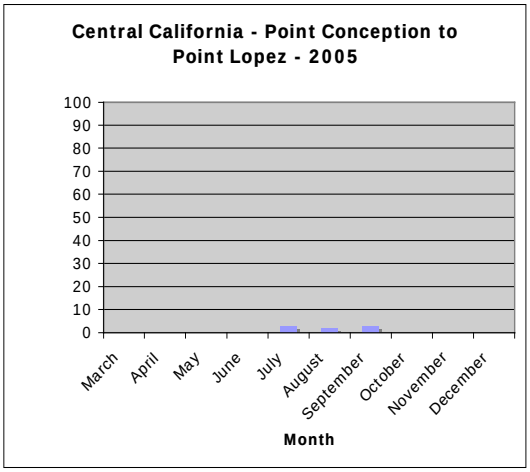

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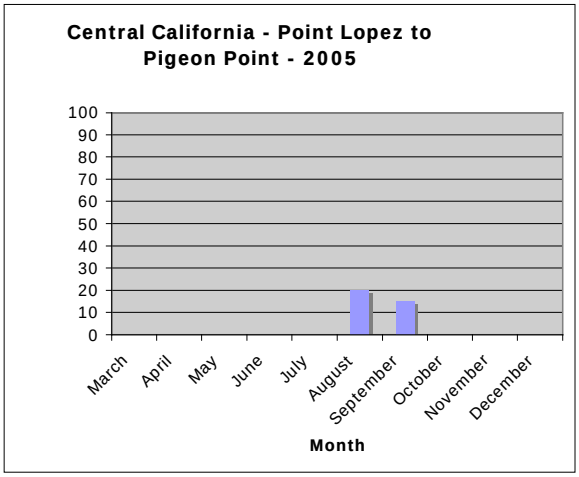

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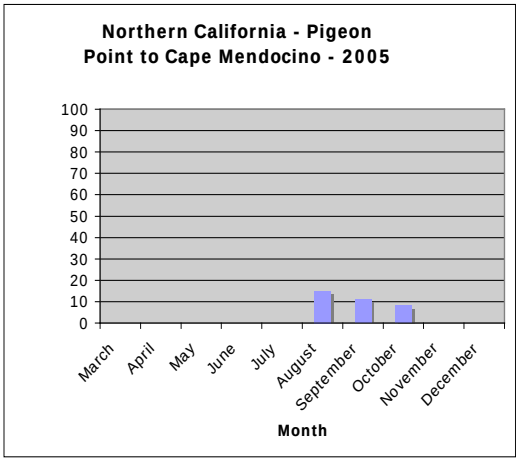

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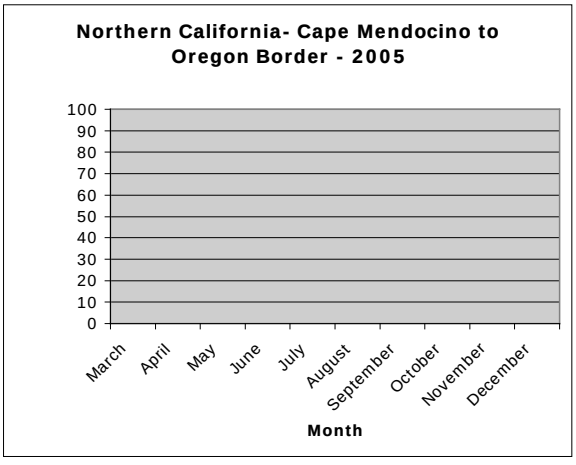


Figure 2f.

Figure 2 (a-f). Temporal and geographic distribution of albacore for-hire trips by month (2005 calendar year) within Mexico waters and five CDFG management areas. Extracted from CDFG California for-hire logbook data.

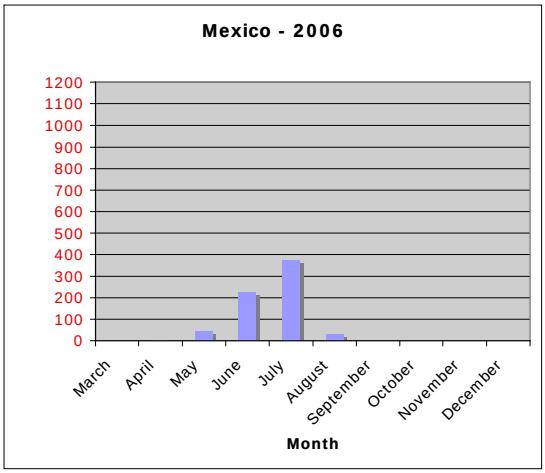
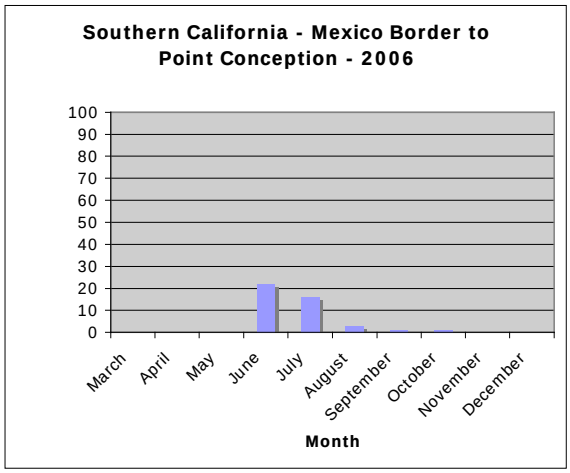


Figure 3a.



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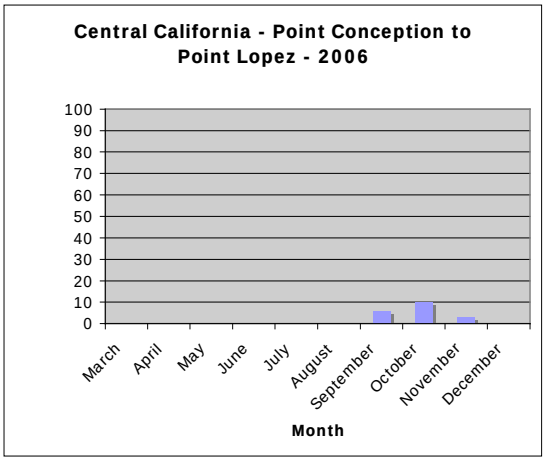

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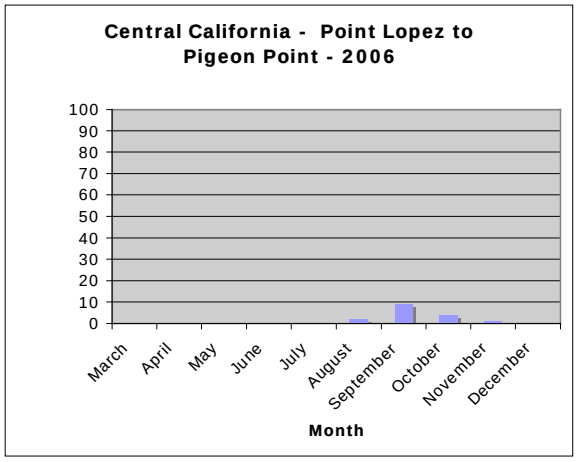

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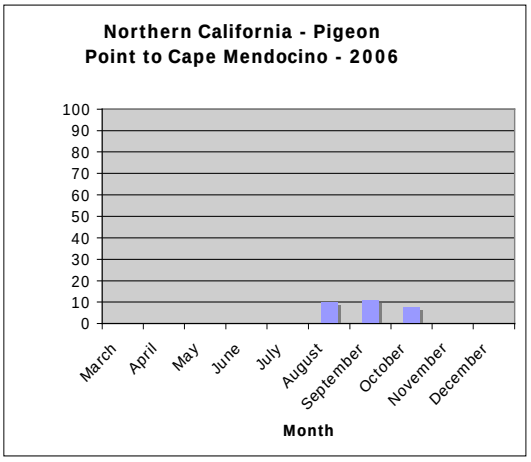

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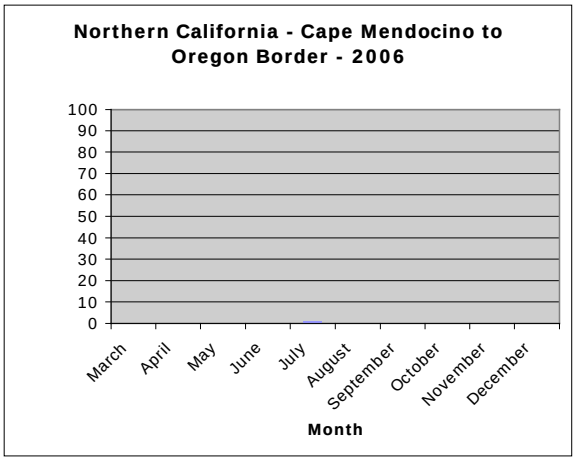


Figure 3f.

Figure 3 (a-f). Temporal and geographic distribution of albacore for-hire trips by month (2006 calendar year) within Mexico waters and five CDFG management areas. Extracted from CDFG California for-hire logbook data.

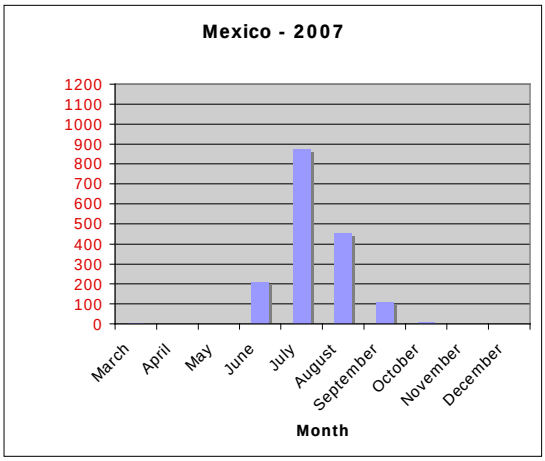


Figure 4a.

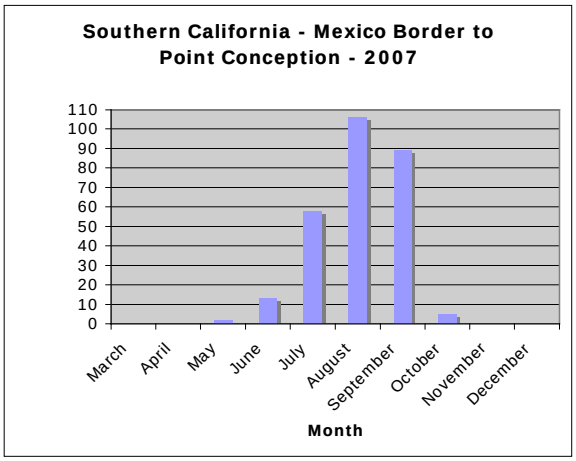
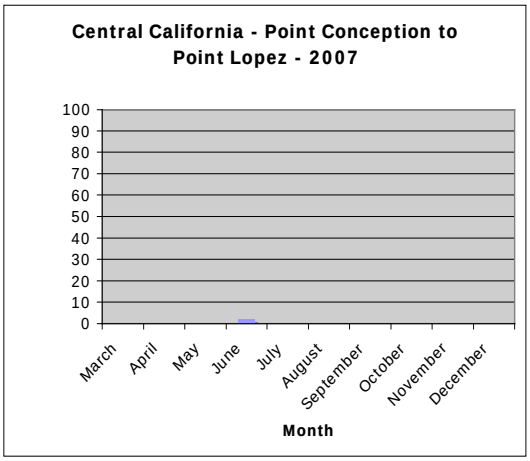


Figure 4b.



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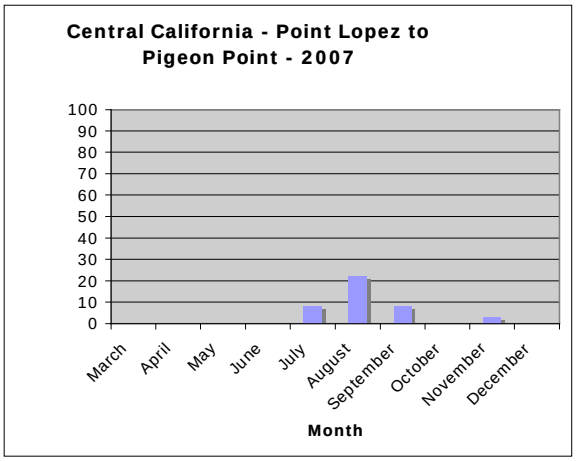

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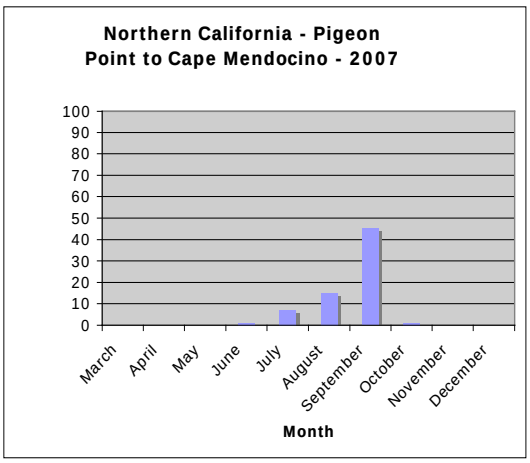

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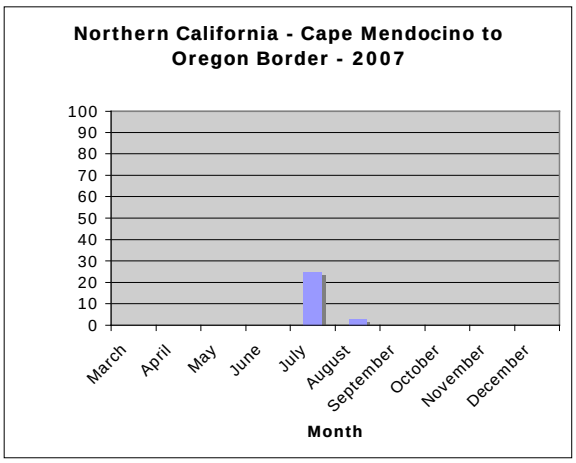

Figure 4f.

Figure 4 (a-f). Temporal and geographic distribution of albacore for-hire trips by month (2007 calendar year) within Mexico waters and five CDFG management areas. Extracted from CDFG California for-hire logbook data.

In addition, these trends in effort highlight the gap in albacore sampling for Mexico waters (where potentially important information can be collected for the North Pacific albacore CPUE index of abundance – the emphasis of the fishery is in these waters – and for stock assessment of this species). In particular, better coverage of for-hire trips to Mexico waters is needed. Approximately 50% of albacore catch occurs in Mexico water (see Hill and Schneider, 1999; PFMC 2009; and see Table 1), and Mexico trips are currently under sampled. For-hire operators note that in southern California, where Mexico is often an albacore fishing destination, approximately 90% of trips targeting albacore are overnight (these are trips that are not generally covered by CRFS onboard samplers; Table 5).

Table 5. Percent West Coast Recreational For-Hire Sector albacore fishery effort (number of HMS albacore trips) for Mexico and California waters from 2004 to 2007. Based on data extracted from CDFG for-hire logbook database.

		PERCENT ALBACORE TRIPS					
YEAR	TOTAL NUMBER OF ALBACORE TRIPS	MEXICO	MEXICO BORDER to POINT CONCEPTION	POINT CONCEPTION to POINT LOPEZ	POINT LOPEZ to PIGEON POINT	PIGEON POINT to CAPE MENDOCINO	CAPE MENDOCINO to OREGON BORDER
2004	3161	90.98%	5.82%	0.47%	1.65%	1.02%	0.06%
2005	1720	91.69%	3.84%	0.46%	2.04%	1.97%	0%
2006	780	86.15%	5.51%	2.44%	2.05%	3.72%	0.13%
2007	2068	80.03%	13.20%	0.10%	1.98%	3.34%	1.35%
AVERAGE PERCENT TRIPS		87.21%	7.09%	0.87%	1.93%	2.51%	0.39%

Data Needs

I. Observer Coverage

Increased Level of Overall Observer Coverage

Overall better geographic coverage of West Coast Recreational catch for albacore is needed. In general, existing Washington, Oregon, and California state surveys, while obtaining large amounts of data for a wide variety of marine fish species, are not designed in such a way that they can estimate catch and effort for HMS at the same level of accuracy as are obtained for other recreational species owing to logistical constraints. Fishing trips targeting HMS are longer in duration (in some cases - especially trips into

Mexico waters - including overnights) and depart, as well as return, outside of traditional sampling hours.

Observer Coverage of For-Hire Sector Albacore Fishery Southern Area

The geographic scope of the recreational for-hire albacore fishery includes the U.S. West Coast exclusive economic zone and nearby waters of Mexico where for-hire fishing trips originate from U.S. West Coast ports target albacore. Current sampling is conducted primarily among for-hire vessels in Washington, Oregon, and California waters. However, the overall value of sampling the West Coast Recreational albacore for-hire sector can be greatly enhanced by sampling southern areas off Mexico that are routinely fished by the southern California segment of the for-hire fishery, but are rarely fished by commercial vessels. Data for this region are thereby lacking (there is little observer coverage in the recreational fishery as described above), but are necessary for comprehensive abundance estimates. Data from the region are also needed for a better understanding of albacore seasonal distribution in the North Pacific. For-hire vessels provide a means of obtaining catch and effort data, as well as, biological samples for this area of albacore distribution. Length data and biological samples relating to age, growth and stock structure, can be a very cost efficient and important contribution of a recreational for-hire albacore program.

Increased Onboard Observer Coverage - California

As has been demonstrated by the CRFS sampling program, onboard observers enhance the programs ability to collect data in the recreational fishery. Onboard sampling will also be an important component of data collection for an albacore for-hire CPUE index of abundance. This is primarily because a greater sample size of albacore will be available to onboard observers (relative to dockside, where fewer anglers are likely to be interviewed due to time constraints and angler departure). Shipboard observers also allow for more data, greater accuracy of data, more detailed data necessary to CPUE index, including accurate delineation of target species, as described below (and in Index of Abundance Data Requirements), and more of the length data that are essential to stock assessments.

Better data is needed for characterization of effort. The CPUE index of abundance must be characterized by sampling albacore or HMS specific targeting for-hire trips. These trips are currently monitored by state sampling programs, but coverage is low, distributed at less than 5% overall coverage. In California (and occasionally Mexico) waters, samplers collect data onboard vessels. To clearly and accurately measure albacore effort, effort for the various species targeted during an albacore fishing trip (albacore, yellowfin, bluefin, bigeye, and skipjack tunas) must be carefully defined and distinguished among specific fishing stops and based on advanced angler declaration of target. This level of detail can be labor intensive for onboard samplers and will require refined data collection procedures.

Additionally, it is useful to have onboard samplers in California, as is a part of the CRFS program, because fish can legally be filleted by anglers on the vessel, before returning to port. Onboard samplers can better measure fish and collect biological samples.

Also, observers can make close observations of the gear and bait type used among fishing stops and collect data that can allow determination of fish sizes caught within specific gear and bait categories.

II. Biological Sampling

Biological study of North Pacific albacore has been identified by PFMC as a ***highest priority*** issue, central to enhancing scientific understanding and management of HMS species – in particular North Pacific albacore (PFMC, 2009). Studies listed by PFMC (2009), include (among others): age and growth, reproductive, and albacore length data. Biological samples can be collected at no additional cost[4], and are valuable to scientific research to the point that it would be a regrettable oversight not to collect them given the opportunity.

[4] It is anticipated that supplies and equipment for biological sampling will be provided by interested researchers and agencies (as is often the case marine fisheries field study). Observers are expected to have opportunities to collect biological samples during periods outside of direct catch and effort monitoring.

Improvements to the current North Pacific albacore stock assessment can be made with updated information on stock structure, age, growth and maturity. Because of the wide geographic range of the fleet fishing in waters off Washington, Oregon, California and northern Mexico, the recreational HMS for-hire fleet provides an ideal platform upon which to collect albacore biological samples such as otoliths, vertebral spines, reproductive organs, and tissue samples for genetic analysis. Biological sampling can be accomplished as an opportunistic, but nonetheless scientifically valuable, component of an albacore CPUE index of abundance sampling program.

Age data can be of primary importance to stock assessment modeling for North Pacific albacore. In addition, there is some indication of at least two separate albacore stocks in the North Pacific (see Laurs and Lynn, 1977). Data from tag recapture, size frequency, and age and growth studies support the hypothesis that there are multiple stocks that overlap at certain times based on phylogenetic relationships and geographic conditions. Stock structure of North Pacific albacore is a priority need for future research (see PFMC, 2009), and biological data collected from recreational for-hire vessels can contribute to such work. Length data, necessary by virtue of standardization of effort, for CPUE indices of abundance, can also contribute to research delineating stock structure.

There is also very little knowledge regarding the potential occurrence of albacore spawning in the waters off Baja California, even though there is some indication of spawning in the region. The recreational fishery targets large albacore found deeper in the water column, particularly in the southeast area in the vicinity of Guadalupe Island. These are the fish that are likely to be spawning and will present valuable biological samples. Spawning data can contribute to calculation of absolute indices of abundance.

III. More Length Data

As noted above, there is a need for increased sampling of length distributions to provide a refined understanding of growth and age structure of the population for more reliable stock assessment. In a recent population analysis of North Pacific albacore, Crone *et al.* (2006) constructed an age-based assessment model using available length at

age (and weight at age) data to develop the model, and discussed the potential value of an length-based age structured model.

Additional length at age data will allow for more refined determination of growth, age at maturity, distribution, and harvest rate of size classes. The for-hire sector has potential to produce an extremely informative index of abundance because it consistently encounters a limited, but potentially informative, size range of juvenile fish, ages two through five that can provide information on recent recruitment and future abundance of the population. However, preliminary analyses demonstrate that current size sampling of the recreational albacore fishery may be inadequate to address area-specific differences in catch rates, or biological parameters such as growth rates and seasonal distribution. Further, in California, most length distribution data has been obtained from the northern area of the fishery, and better information is needed for the southern areas. For example, from 2004-2007, less than 1% of fish were measured, with even fewer fish being measured for trips in Mexico waters. For albacore caught by the recreational fishery in Washington, length data are not obtained. In Oregon, roughly 3.5% of recreationally caught albacore were measured via dockside sampling.

IV. Refined Discard or Bycatch Data: Identification of Target Species

Discard data, obtained from onboard observer data collection, may be important in the southern California area where anglers may reach albacore bag limits sooner. It is possible that angler adjustments (release of catch) for bag limits may cause a downward bias in CPUE. These data can be obtained by onboard observers who will be able to delineate among fishing stops and record targets declared in advance of fishing.

Current sources of data for the southern California for-hire fleet (CRFS information and CDFG logbook data from CPFV captains) are designed primarily to characterize catch and are not sufficient to assess incidental catch, because they do not indicate changes in target species within a fishing trip (distinguishing between each fishing stop). It could be advantageous for future data collected to include target species by fishing stop (specific location). Thus, data collected could allow for distinguishing between fishing stops, as well as, changes in target species. Also, catch data could be sufficiently

segregated by fishing mode (trolling, stationary drift, free drift, anchored, gear, bait type) as well as, by target species. These data could provide for recording sufficient segregation of fishing activities to identify explicit techniques that might lower rates of incidental catch.

V. Refined Vessel Stratification Data

Additional and more accurate data is needed to categorize all for-hire vessels based on their fishing patterns, and to develop of vessel categories representing a proportional cross section of vessel strata that can be assessed for potential effects on fishing effort used for random selection related to observer coverage.

VI. Logbook Data

Albacore for-hire vessel logbook data may be useful to evaluate survey estimates (perhaps especially for corroboration between vessel and observer obtained catch estimates). Currently, survey methods appear to underestimate albacore catch - although this may be due in part to a lack of observer and geographic coverage as discussed above. However, the accuracy of logbook data is uncertain. Logbook data may not always be fully provided, and can potentially leading to downward bias in catch estimates. Logbook data are a primary limitation on accuracy of current stock estimates.

In addition, examination of historical logbook data may be useful for assessing factors related to effort and catchability. Size composition is not currently a required component of for-hire logbook records. Currently there is no method of compliance checking for for-hire vessels as exists for commercial vessels.

There may be a need for logbook compliance checking, such as that already in place for the commercial fishery, to improve logbook data (see PFMC, 2009).

SAMPLING DESIGN – Pilot Program

The primary goal of the pilot program for supplemental monitoring of the West Coast Recreational for-hire sector albacore fishery is to produce timely data that can be used to develop a recreational albacore CPUE index of abundance. The pilot study has been developed based on the seven general categories of data needs for developing a CPUE index of abundance based on the recreational for-hire albacore fishery, as outlined above. The pilot program is intended to allow determination of appropriate sample size, and best approaches to obtaining that sample over time and geographically. Specifically (and especially by expanding the sample range to the more southern fishing grounds), the pilot study will document the spatial-temporal characteristics of the current fishery and determine accuracy of current data collection (logbook, shipboard, dockside). The pilot program is anticipated to indicate the potential usefulness for improved and additional data, field testing, data evaluation and comparison to existing data, and recommendations for new methods that can be used to supplement existing data collection programs.

In particular, the pilot study will allow substantiation, and/or more accurate expansion of data currently collected for developing population models of: 1) total catch (or total removals if including bycatch); 2) effort; and 3) demographic information on the size, age, and taxonomic composition of the fish removed (see NRC, 2006 for recreational survey recommendations). Collectively, pilot program results will enable scientists and managers involved to produce a reliable albacore index of abundance by improving long-term albacore data collection from the West Coast Recreational For-Hire Sector.

Costs of initiating an entirely separate recreational for-hire program far outweigh the benefits when compared to supplementing the existing programs, thus the five month pilot program (ideally May to September - perhaps extending into October - during the albacore fishing season) is designed to increase the existing overall level of observer coverage, particularly in the southern region of the West Coast for-hire albacore fishery. Currently HMS is not a specialized priority for state sampling programs. It will be useful

to supplement the work of these already burdened programs with a dedicated focus on HMS albacore data, which will provide better data collection for albacore and other HMS species. For the pilot program it is prudent to augment coverage for the entire geographic range of the West Coast recreational albacore fishery.

The potential benefits of onboard sampling vary amongst regions (Washington, Oregon, California) and among trip types. Onboard sampling does not appear to be as logistically feasible in Washington and Oregon, as it is in California. In California, onboard sampling is so important to CRFS sampling capabilities, compliance is required by law. Because this is a voluntary program on the part of the recreational for-hire fleet, we cannot currently require for-hire vessels to carry observers, and representatives of the for-hire fleet in Oregon and Washington, while having indicated willingness to participation in the study, have also indicated that onboard space is often limited. As part of the proposed pilot sampling project, we plan at-sea observations off Mexico and California on the for-hire fleet operating out of California ports where representatives of the fleet have indicated a willingness to participate. Thus, the pilot program will increase current observer coverage of the California for-hire albacore recreational fishery by placing dedicated albacore (HMS) observers onboard vessels. The pilot program will also increase coverage level of dockside sampling of this sector in Oregon and Washington. This dockside sampling is intended to collect data from the for-hire fleet that leave or return during the night hours when state personnel are not sampling. Thus, geographic coverage will be increased in the southern California region, and temporal coverage will be increased in all regions.

Additionally the opportunity for increased biological sampling will exist in all regions. In all three regions, supplemental sampling will provide for increased albacore data. For vessels originating in California, the placement of additional coverage in the form of dedicated onboard albacore (HMS) observers will increase sampling power.

Also, we have developed a mechanism for obtaining albacore length measurements from for-hire vessels by providing operators with a means and incentive for making at sea length measurements (see Data Collection, below).

Supplementary Dockside Sampling/Interviews – Washington and Oregon

Two dockside samplers will be used to augment existing sampling and intercept survey interviews in these regions (one each Oregon and Washington). As a part of the planned pilot program, ORBS and OSP will receive funds to employ personnel that can augment albacore data collection. Washington and Oregon may deem that dockside samplers will sample for-hire albacore vessels during hours outside of regular state sampling (when many of the albacore trips depart and return to moorage areas), and at ports that are currently under sampled.

Observer Coverage - Dedicated Observers on California for-hire vessels

The selection of an appropriate observer coverage level is linked to finding a suitable balance between cost efficiency, increased albacore sampling and increase in geographic coverage of for-hire vessel activities. Because the California for-hire fleet is comprised of more than 300 vessels that conduct a large number of annual trips, high levels of coverage are not currently feasible (current CRFS coverage of the California recreational species for all marine species is at approximately less than 5% of fishing trips). Observer coverage at the 10% level is likely to provide the largest feasible sample from albacore recreational fishery, and to reduce large sample variance associated with very low levels of coverage. However, the pilot program should be used to assess the potential for a future program to approach the 20% level of observer coverage.

To this end, dedicated albacore observers will be placed onboard California for-hire vessels to increase coverage of albacore fishing to the 10% level. There were an estimated 2,900 days at sea amongst California for-hire albacore vessels in 2008. Based on this estimate, at least 290 dedicated albacore observer days at sea are required during approximately five months of the fishing season (ideally May to September).

Personnel

Sampling oversight, is instrumental to smooth and seamless implementation, and integration, of this type of sampling program. Considerable planning, training, and scheduling are necessary. Landings must to be contacted regarding availability of for-hire

vessels and trips to sample (and changes occur daily). Samplers must be randomly assigned trips based on their own availability and schedules. Sampling hours and overtime need to be recorded, and for payroll accomplished every 2 weeks. Data sheets must be collected and information entered into a database.

A pool of experienced biological observers will be drawn upon for the pilot program. Prior to field assignments, observer training sessions will be conducted to promote consistency and accuracy in monitoring. Observers will be trained in all aspects of data collection, and familiarized with scientific protocols and the data collection sheet (to be developed based on the existing "CRFS on-board sampling form" and refined in collaboration with all program participants prior to pilot testing). Observers will also be familiarized with fishing gear, bait, and angler techniques. In addition, observers will be instructed in onboard conduct and safety.

Number and Placement of Onboard Dedicated Albacore Observers

Observers are anticipated to be at sea one day or less when in California waters and two to three days in Mexico waters. This approximates an average 10 hours per day at sea for the onboard program.

A total of up to approximately 11 observers will be deployed to sample the California for-hire sector of the albacore recreational fishery. This includes an anticipated seven observers in the San Diego area, one in Los Angeles, one in Ventura/Santa Barbara, one to two in Monterey/San Francisco, and one for the remaining northern California area (Fort Bragg, Eureka, and Crescent City).

Stratification of Observer Coverage

The planned observer coverage stratification scheme is based on balancing the desire to cover the breadth of all potential albacore catch with the need for a reasonably high level of coverage within each time, area and gear category. Potential differences in catch characteristics relative to port, vessel class, fishing area, fishing season and fishing gear were examined to determine which, if any, of these factors could be stratified. Based on the specific characteristics of the southern California for-hire fleet, we developed an observer coverage stratification model that provides the ten percent of

observer coverage allocated to each stratified factor. Details on the number of days and trips allotted to the levels of each stratified factor are provided for the suggested 10% observation/coverage level.

Port and Vessel Stratification

Because vessels constituting the albacore for-hire fleet are based at numerous ports along the West Coast, there is a need for port stratification of observer coverage (as above). Based on usage by albacore for-hire vessels, California ports can be logically divided into five port groups by geographic location (San Diego region, Los Angeles region, Ventura/Santa Barbara region, Monterey/San Francisco region, and the remaining northern California region (Fort Bragg, Eureka, Crescent City).

Vessels will be selected on a random basis from a complete list of albacore for-hire vessels operating in the various geographic regions. Once the resulting list of randomly selected vessels is developed, for-hire operators will be telephoned to determine their fishing trip schedule. If a selected vessel is not active during the given sampling period, successive vessels on the list will be contacted until the desired number of trips (level of coverage) has been secured.

Randomization software (algorithm applied to Microsoft Excel) will be used to assign observer trips. Observers, trip-type (¾ day, full day, overnight, multi-day, or long range) and ports/landings will be assigned numbers (randomly assigned to days of the month to assure non-biased scheduling). Total fishing effort and total number of landings in each region will proportionately factored into observer assignments. Dedicated albacore samplers will intentionally be scheduled on trips that CDFG, CRFS "samplers" are not likely to board (extended trips, out of California waters). However, CRFS samplers will be given priority in all cases; observers for the current study will be instructed to abort a trip if CDFG, CRFS personnel plan to board the vessel.

Fishing Area Stratification

Stratification for Mexico and regions within California waters is based on patterns of albacore recreational for-hire fishing effort estimated from CDFG logbook data (see

Table 5 for recent estimates). Regional stratification may be distributed as follows: Region 1: Mexico – 80%; Region 2: Southern California – 14%, Regions 3&4: Central California 3%, Regions 5&6: Northern California 3% (Figure 5). Spatial patterns were examined to better understand the distribution of for-hire albacore fishing effort in California and Mexico. Nonetheless, because of the highly migratory nature of albacore, the timing and geographical distribution of the albacore fishery is expected to vary among years based upon seasonal/annual oceanographic features and are likely to also be influenced by other factors.

The California for-hire fleet consists of numerous vessels operating from ports along the coastline. Albacore catch levels, species composition, and share of catch from different fishing areas such as coastal regions versus offshore islands likely differ to some extent; thus vessels that utilize different geographic areas need to be monitored independently. This monitoring goal will be accomplished through the above port stratification design.

Seasonal Stratification

The California for-hire fleet operates year round, although fishing for highly migratory species is concentrated from April through November, with peak albacore season running summer to fall months. For pilot testing, observer coverage will be stratified into three periods, and the proportion of observer effort for the pilot program will be allocated to each of the three strata as follows: 1) May – 8%, 2) June and July – 46%, 3) August and September – 46% (see Figure 5). The levels of observer effort are based upon the percentage of overall angler effort that occurred during each bimonthly period from 1985-2003 (SWFSC *Los Angeles Times* landings reports database 1985-2003), and more recently from additional CDFG logbook data and CRFS data (RecFIN; http://www.recfin.org; and see Figures 1-4). Applied to a long-term program, this stratification scheme could be useful for detecting any seasonal shifts in catch levels that may occur as a result of variations in current systems, water temperatures and other oceanographic conditions, and could also allow for analysis of potential changes in albacore seasonal distribution and abundance relative to ENSO events. It will ensure that observation effort will not be concentrated in any particular portion of the fishing season.

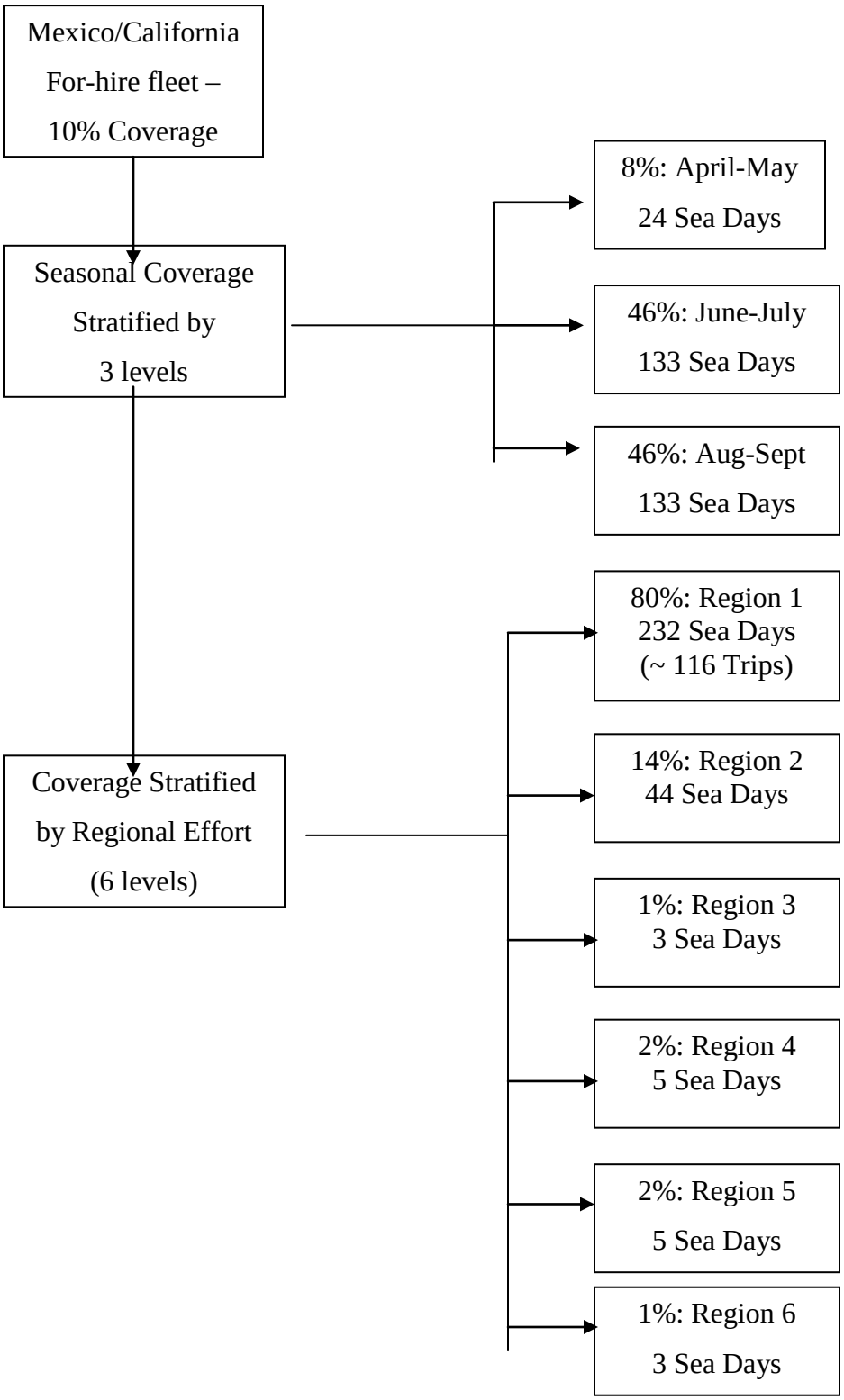

Figure 5. Alternative regional and seasonal stratification of observer effort for West Coast Recreational For-Hire albacore fishery.

Data Collection

In addition to data currently collected by onboard CRFS observers, it will be critical for dedicated HMS albacore observers to collect information on declared target species at each fishing stop, thus providing more accurate effort information and accurate estimates of targeted and non-targeted catch. Observations and data collected for fishing technique and gear will provide information potentially useful for standardization of CPUE and understanding catchability. Combined with the existing CRFS onboard sampling form (Appendix 3), the data sheet contained in Appendix 4, designed for a study of incidental catch in the southern California Recreational For-Hire Sector (Hanan and Curry, 2009), provides a useful starting point from which to design a dedicated HMS albacore data sheet.

Observers will watch only as many anglers at a time as they can carefully monitor. In addition observers will monitor anglers fishing in a similar manner, with similar targets, to allow sufficient observations of detail and completion of data sheets. There are many instances where the catch of albacore becomes so great that an observer cannot keep up with the pace of landing; there will be in place a protocol for limiting number of anglers observed and a hierarchy of sampling. There is also a subsampling plan to randomly sample a portion of the catch that was not sampled as fish were being landed during period of high catch rates. These fish can be tagged with an ID number corresponding to catch recorded on the dedicated HMS albacore data sheet. In this manner, data can be collected as the observer has time available during periods when there is no fishing.

For standardization of effort, and assessment of discard, it will be useful to differentiate among fishing stops and targets. To clearly identify target and non-target catch from for-hire anglers, target species (which often vary within a recreational fishing trip) must be identified with accuracy throughout a fishing trip. To enable determination of shifts in target species and angler hours observed, the data sheet should be developed to clearly delineate between vessel stops, including collection of information such as time of day, length of stop (start and end times), location (latitude and longitude). In addition, fishing type (drift, stationary, anchor, and troll), fishing mode (habitat), depth, and temperature were recorded. As possible, observers identified fish caught to the species

level. Observers must record "declared targets," which are determined by for-hire operators (in some cases by crew member in proxy), angler, or observer and recorded at the beginning of each stop.

Factors such as bait, hook size, weight of line, affect fishing power. For-hire operators share information on successful bait, gear and location to enhance fishing power within a port or amongst members of the fleet. Holts (1985) presented a description of recreational albacore fishing technique. Also, as demonstrated in the commercial fishery (Laurs *et al.*, 1976), vessel length may affect fishing power and these data are important to understanding CPUE. Specific habitat, sea surface temperature, and other oceanographic data will also be useful to understanding influences in CPUE.

Biological data collected will include tissue samples for genetic analysis, vertebral spines, otoliths; reproductive organs (*e.g.* Ramon and Bartoo, 1997; Vinas *et al.* 2004; Santiago and Arrizabalaga, 2005; Farley and Clear, 2008).

Length data can be obtained over a significantly increased sampling area and for a greatly increased number of fish by providing means and incentives to for-hire operators for at sea measurements. Polyurethane sheets and markers can be provided to operators, and at little cost to the program and little inconvenience to anglers, the amount of available albacore length data may be greatly enhanced.

Analysis Methods

Throughout this report, the importance of collecting data that will allow for understanding of catchability over time and facilitate standardization of CPUE have been emphasized. As noted by Stephens and MacCall (2004), CPUE has often been calculated using ratio estimators (see Turner, 1960; Tin, 1965; Hutchison, 1971), which require complex analysis to address issues of fishing power and catchability. More recently, General Linear Modeling (GLM) has been used to develop indices of abundance more directly from catch and effort data (see MacCall and Stephens, 2004). Once data have been obtained, they can be plotted to assess the variance and the relationship between catch and effort, and determinations can be made regarding the most feasible analysis methods.

Ideally, increased sample size, combined with more at sea observations and refined sampling regimes of the pilot program will increase precision. The proposed pilot program data collection methods (see Appendix 4 and data collection above) will allow for discretion in defining units of effort partitioned at desired levels (per trip, per stop, per angler, per hour). Data will clearly identify declared target and discard (bycatch), thus identifying total removal. In addition, the delineation of fishing stops (and stop duration) will facilitate collection of accurate catch and effort information and allow examination of potential for downward bias from angler release to adjust for bag limits.

Some data obtained from the pilot project will be collected from direct at-sea observations of catch (and effort). These data will provide a more precise estimate of the error component of catch and effort for better calculation of the sample sizes required for desired levels of precision in future at-sea sampling projects. These data will also provide details for comparison of data being gathered in the three state programs, including logbook information, and can provide a basis for clarifying discrepancies in those data. Finally, these data will be evaluated and tested for possible inclusion in stock assessment models describing North Pacific albacore.

Program Costs

Details of cost estimates for the five month pilot program are briefly presented in Appendix 5. Costs are based on the estimated 2,900 days at sea in the California for-hire-albacore fleet in 2008 (see PFMC, 2009), and observer coverage at the 10 % level in California, as well as, Mexico waters (290+ days at sea over a five month period; see Table 1, Appendix 5). Dockside sampling in Washington and Oregon will be limited to three peak months of the fishing season.

CONCLUSIONS

Although the West Coast Recreational For-Hire Sector albacore fishery takes only a small portion of the overall catch in the North Pacific, this does not diminish the potential value of a CPUE index derived from these data. A fisheries survey may capture a limited number of fish in comparison to the entire fishery, but still constitute a critical

part of a stock assessment. The West Coast Recreational albacore fishery has the potential to provide information for stock assessment that cannot be obtained from data collected by monitoring the North Pacific commercial fisheries.

The ISC AWG has recognized CPUE indices of abundance as the primary limitation on accuracy of current stock assessment (ISC, 2008a), and PFMC (2009) considers development of new indices of abundance a ***highest priority*** issue for North Pacific albacore. Biological study of North Pacific albacore has also been identified by PFMC as a ***highest priority*** issue, central to enhancing scientific understanding and management of HMS species – in particular North Pacific albacore (PFMC, 2009). Uncertainties regarding the biology of North Pacific albacore (especially stock structure, growth, age and maturity) are an area of critical concern for stock assessment (PFMC, 2009).

Often, recreational fisheries monitoring of HMS species may require unconventional sampling approaches, and expansion of data collection programs to meet identified needs (see NRC, 2006; PFMC, 2009). In developing a pilot program for monitoring of the for-hire albacore fishery, several gaps in albacore sampling were identified. Primary data gaps may include vessels missed by dockside samplers in Washington and Oregon. In addition, for California coverage of albacore for-hire vessels is likely less that 5%, and for Mexico waters (where potentially important information can be collected for the North Pacific albacore CPUE index of abundance – the emphasis of the fishery is in these waters), coverage is likely to be less than 1%. Approximately 87% of albacore trips out of California are in Mexico waters.

The pilot program presented here was designed to augment current sampling programs, and to address these data gaps. In addition, the program was developed to and to collect the most accurate data for understanding catchability and standardizing CPUE to produce a reliable albacore index of abundance that is applicable to stock assessment needs for North Pacific Albacore.

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Appendix 1. MRIP workshop Agenda: Index of abundance for North Pacific albacore tuna.

An MRIP-funded workshop was held from February 1-2, 2010 which brought together albacore biologists, stock assessment scientists, West Coast state recreational sampling program managers, industry representatives for the West Coast recreational for-hire albacore fishery, and other interested individuals to discuss the potential to develop a recreational for-hire based CPUE index of abundance for North Pacific albacore tuna.

The first day of the workshop featured a series of informative background presentations on North Pacific albacore biology, data needs for stock assessment, highly migratory species management context and existing West Coast recreational data collection programs. The second day of the workshop was structured as a plenary session to discuss what sampling to supplement existing recreational data collection programs would be needed to support production of a CPUE index of abundance for North Pacific albacore, and what elements should be included in a pilot project to test ideas for collecting this data. Input from workshop participants is embodied in the information and the recommendations provided in this report. A copy of the workshop agenda is included below.

AGENDA
MARINE RECREATIONAL INFORMATION PROGRAM

Highly Migratory Species Management Team Project to Evaluate the Potential to Develop a Recreational For-hire Based Index of Abundance for North Pacific Albacore Tuna

February 1-2, 2010
Martin Johnson House (T-29 Building)
Scripps Institution of Oceanography
La Jolla, California 92037

Dial-in Information for Conference Call Participants

Hosted by the Southwest Fisheries Science Center (858) 334-2800

MONDAY, FEBRUARY 1, 8:30 AM

A. *Call to Order*
1. Welcoming introductions
2. Key objectives

Stephen Stohs, HMSMT Chair

B. *Presentations of Relevant Background Information*

9:00 AM: Project overview, tasks and goals

Doyle Hanan, Project Lead

9:30 AM: North Pacific Albacore Fisheries in the HMS Fishery Management Plan

Craig Heberer, Lead Biologist—HMS Fishery Management Plan

10:00 AM: MRIP overview

Ron Salz, MRIP Rare Events Species Work Group Chair

10:30 AM: Pacific Albacore Stock Assessment 101: Models, Biology, and Data

Steve Teo, Southwest Fisheries Science Center

Lunch break (11:30 AM – 12:30 PM)

12:30 PM: Relevant Aspects of North Pacific Albacore Biology for Developing a Recreational For-hire Based Index of Abundance

Mike Laurs, Albacore Biologist

1:30 PM: Information Exchange with West Coast Recreational Charter Boat Industry Representatives Regarding Project Goals and Objectives

Mr. Buzz Brizendine, Charter Boat Operator, San Diego
Mr. Mick and Ms. Linda Buell. Garibaldi Charters
Mr. Mark Cedergreen, Westport Charterboat Association

2:30 PM: State Recreational Data Collection Program Overviews

Connie Ryan, CDFG
Eric Schindler, ODFW
Wendy Beeghley, WDFW
Gordon Kubota, President, CIC Research, Inc.

A barbecue for participants in attendance will be held the evening of February 1 from 5PM- 8PM on the Martin Johnson House patio.

TUESDAY, FEBRUARY 2, 9:00 AM

C. *Next Steps*

1. Review of key objectives
2. Timeline for completion
3. Assignment of tasks
4. Plans for a pilot project to test sampling methodology

3:00 PM: ADJOURN

Appendix 2. Overview of Washington (OSP) marine recreational sampling program.

Washington Ocean Sampling Program (OSP) Overview
Washington State Department of Fish and Wildlife

2010

Program Goals
Catch estimates
•Weekly in-season catch estimates for quota fisheries
•Monthly in-season groundfish catch estimates for RecFin database
•Post-season catch estimates for all species by February 1, with a goal of CV's < 10% in most ports on high volume species

Program Goals
Biodata
–Minimum 20% sample of landed coho and chinook for coded wire tags (CWTs)
–Scale samples for age analysis from a minimum 4% of chinook landed
–DNA samples from chinook
–Halibut lengths for conversion to biomass
–Halibut PIT tags
–Sturgeon lengths and tags
–Lengths and weights from groundfish for conversion to biomass

Program Goals
Onboard observation (selective salmon fisheries)
•Coho and chinook release rates
•Coho and chinook mark rates
•Salmon drop-off rates
•Legal:sublegal size salmon encounter rates
Major Washington Coastal Ports
Areas and Time Frames Sampled
Fisheries Sampled
•Recreational
– Halibut (in-season quota management)
– Salmon (in-season quota management)
– Bottomfish
– Tuna
– Sturgeon
•Commercial
– Non-treaty salmon troll (in-season quota management)
– Treaty salmon troll
– Albacore troll (Ilwaco and Westport only)

Recreational Sampling Methods

•Exit/entrance count - boats are counted (by boat type) either leaving the port (4:30AM-end of the day) or entering the port (approximately 8:00AM through dusk) to give total counts of charter and private boats for the day.

•Interview - boats are encountered systematically as they return to port; anglers are interviewed for target species, number of anglers, area fished, released fish by species. (Non-fishing trips are recorded as such and expanded.)

•Examination of catch - catch is counted and speciated by the sampler. Salmon are electronically checked for CWTs, other biodata is collected.

Recreational Sampling Methods

•Sampling rates - vary by port and boat type. Generally, at boat counts less than 30, the goal is 100% coverage. The sampling rate goal decreases as boat count increases.
–eg. At exit count of 100, sample rate goal is 30%; over 300, sample rate goal is 20%.
–Overall sampling rates average approximately 50% coastwide through the season;

•Sampling schedules - weekdays/weekend days are stratified in all ports except the Columbia River north jetty. Usually, both weekend days and a random 3 of 5 weekdays are sampled.

Project Facts

Personnel

–Two permanent biologists coordinating data collection

–One permanent scientific technician generating monthly in-season groundfish catch estimates

–Approximately 22 seasonal port samplers

–Three seasonal on-board selective salmon fishery observers

–One data entry operator

Project Facts

Volume of recreational data

•Between 16,000 and 28,000 boat interviews completed per season coastwide
•2009 recreational sample statistics:
•24,516 recreational boats sampled
•87,212 angler interviews
•5,795 sampled chinook (47% of total estimated catch)
•64,395 sampled coho (47% of total estimated catch)
•11,036 sampled albacore
•165,076 total sampled bottomfish, including
•119,767 black rockfish
•5,585 halibut
•13,618 lingcod

Project Facts

Budget

– Approximately $675,000 spent in 2009
– Approximately $640,000 average per year during the last 5 years

Data Expansion
Algorithm for expanding sampled days:

$$\frac{\text{Exit Count}}{\text{Total boats sampled}} * P_s \text{ sampled} = P_t$$

Where P_s = any parameter (anglers, fish retained, fish released) within a stratum
And P_t = total any parameter within stratum for the sample day

Data Expansion
Algorithm for expanding for non-sampled days:

Total Weekday Catch =

$$\frac{\Sigma(P_t) \text{ on sampled weekdays}}{\text{number weekdays sampled}} * \text{no. of weekdays in stratum}$$

Total Weekend Catch =

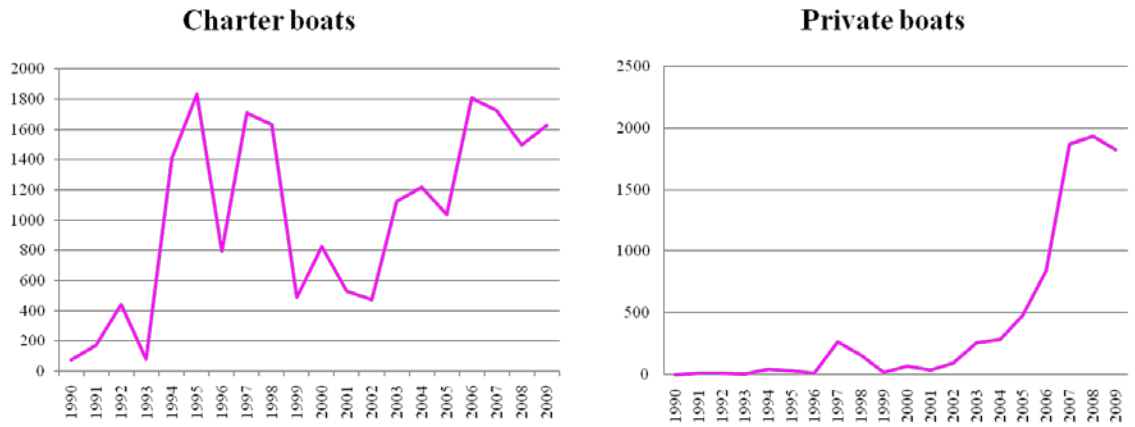
$$\frac{\Sigma(P_t) \text{ on sampled weekend days}}{\text{number weekend days sampled}} * \text{no. weekend days in stratum}$$

Total weekend catch + total weekday catch = total catch in stratum

Notes on Data Expansion
- Weekend days include holidays
- Salmon and halibut catch are stratified by week, all other species are stratified by month.
- All post-season expansions are stratified by boat type (charter, private, jetty), trip type (target species), port, area.

Timing of Catch Estimates
- In-season halibut and salmon estimates weekly for quota management.
- Post-season final estimates usually available by late January.
- In 2009, in-season bottomfish estimates were made available to RecFin database on a monthly basis, and all final estimates were available before February 1.

WASHINGTON RECREATIONAL ALBACORE EFFORT (numbers of angler trips), 1990-2009



WASHINGTON RECREATIONAL ALBACORE CATCH PER ANGLER TRIP, 1990-2009

RECREATIONAL ALBACORE SAMPLING CHALLENGES

- Charter vessels frequently leave prior to 4:30AM, so they may not appear on the exit count
- Charter vessels frequently return to port after the normal sampling period, so they don't get included in the systematic sample or included on an entrance count

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- Charter boats – especially in Westport – typically have their albacore loined by the time they are sampled, making counts by samplers impossible

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- Charter boats – especially in Westport – typically have their albacore loined by the time they are sampled, making counts by samplers impossible
- Time/funding constraints limit our ability to collect biological data (lengths)

Contacts:

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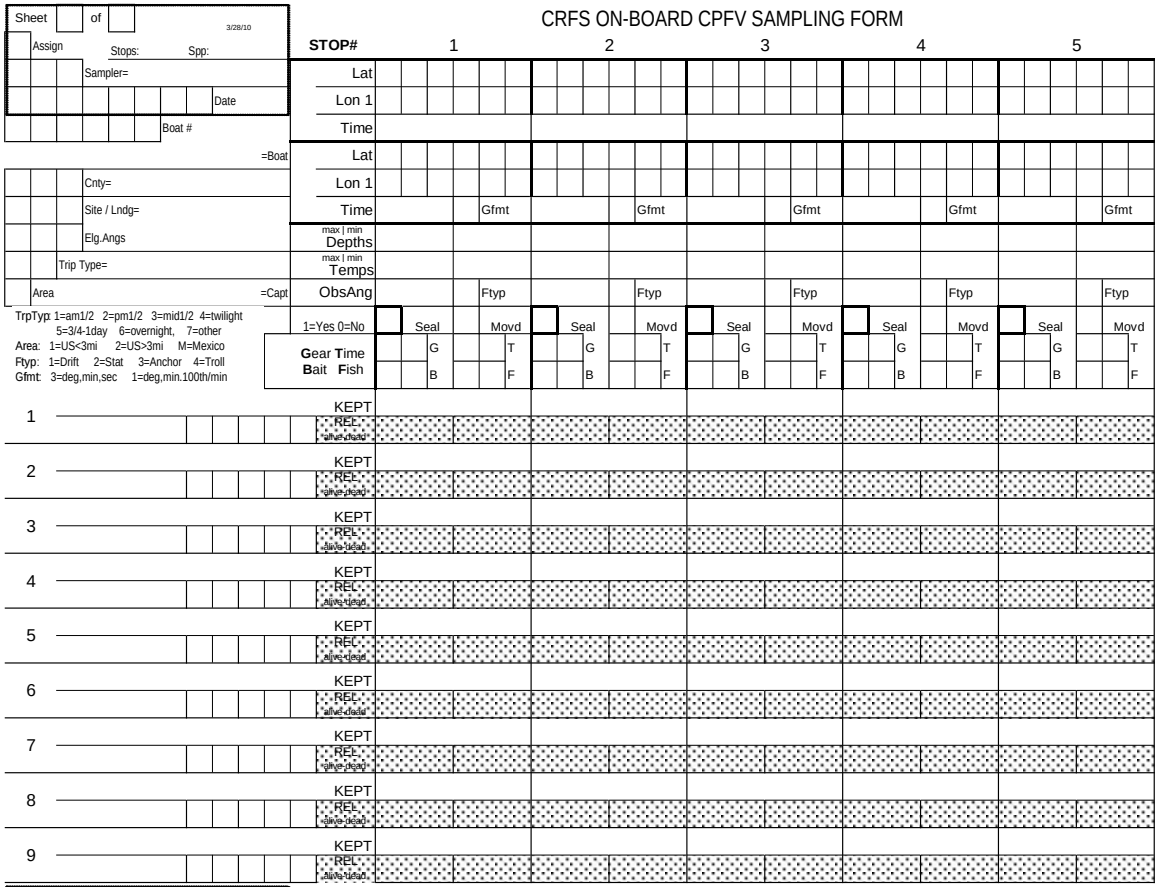
Doug Milward, milwadam@dfw.wa.gov, (360)902-2739

Appendix 3. California Recreational Fisheries Survey, CRFS, 2007 On-Board CPFV (For-Hire) data sheet.



BACK OF FORM

dot-line system	
1	6
2	7
3	8

Ftyp: 1=Drift 2=Stat
3=Anchor
4=Troll

Gfmt: 3=deg,min,sec
1=deg,min,100th/min

STOP#	6		7		8		9		10	
Lat										
Lon 1										
Time										
Lat										
Lon 1										
Time		Gfmt		Gfmt		Gfmt		Gfmt		Gfmt
max | min Depths										
max | min Temps										
ObsAng		Ftyp		Ftyp		Ftyp		Ftyp		Ftyp
1=Yes 0=No	Seal	Movd	Seal	Movd	Seal	Movd	Seal	Movd	Seal	Movd
Gear **T**ime	G	T	G	T	G	T	G	T	G	T
Bait **F**ish	B	F	B	F	B	F	B	F	B	F

SPECIES		6		7		8		9		10	
1	KEPT										
	REL alive dead										
2	KEPT										
	REL alive dead										
3	KEPT										
	REL alive dead										
4	KEPT										
	REL alive dead										
5	KEPT										
	REL alive dead										
6	KEPT										
	REL alive dead										
7	KEPT										
	REL alive dead										
8	KEPT										
	REL alive dead										
9	KEPT										
	REL alive dead										

Appendix 4. Data sheet for incidental catch in the southern California Recreational For-Hire Sector (Hanan and Curry, 2009).

Sheet ☐ of ☐

Total # Stops =

Observer=

Date

Boat #

Boat Name=

Cnty=

Lndg=

Total Anglers

Trp typ Capt=

TrpTyp :1=am1/2 2=pm1/2 3=mid1/2 4=twilight 5=3/4-1day 6=overnight, 7=other

Ftyp : 1=Drift 2=Stat 3=Anchor 4=Troll

Gfmt : 3=deg,min,sec 1=deg,min.100th/min

Mode :1=Surface 2=Kelp bed 3=kelp paddy 4=Reef 5=rockand boutler 6=Sand 7=wreck 8=HardBottm

Targets: SurfaceFh BottomFh RkFh RedsWhtSB CalcoLing HabutKelpB SandB YelTailScorp Boc etc

PSO ON-BOARD SAMPLING FORM 1

	STOP#	1 Mode=	2 Mode=	3 Mode=	4 Mode=
START	Lat				
	Long 1				
	Time/Site				
END	Lat				
	Long 1				
	Time	Gfmt	Gfmt	Gfmt	Gfmt
	Depths	max min	max min	max min	max min
	Temps	max min	max min	max min	max min
	#Obs Ang	Ftyp	Ftyp	Ftyp	Ftyp
	Bait/Lure and/or sard squid live/strips				
	Target 1				
	Target 2				
	Target 3				

Target Fish	#Kept	# Released Dead	# Released Alive	#Kept	# Released Dead	# Released Alive	#Kept	# Released Dead	# Released Alive	#Kept	# Released Dead	# Released Alive
Fish Name												
Name												
Name												
Name												
Name												
Name												
Name												
Name												
Name												
Name												
Name												

Non Target Fish	#Kept	# Released Dead	# Released Alive	#Kept	# Released Dead	# Released Alive	#Kept	# Released Dead	# Released Alive	#Kept	# Released Dead	# Released Alive
Name												
Name												
Name												
Name												
Name												
Name												
Name												
Name												
Name												
Name												
Name												

STOP# 5 Mode= 6 Mode= 7 Mode= 8 Mode=

dot-line system

1		6		START	Lat				
2		7			Long 1				
3		8			Time/Site				
4		9		END	Lat				
5		10			Long 1				
					Time	Gfmt	Gfmt	Gfmt	Gfmt
					Depths	max min	max min	max min	max min
					Temps	max min	max min	max min	max min
					#Obs/Ang	Ftyp	Ftyp	Ftyp	Ftyp
					Bait/Lure and sz/d				
					Target 1				
					Target 2				
					Target 3				

Ftyp :1=Drft 2=Stat 3=Anchor 4=Trol
Gfmt :3=deg,min,sec 1=deg,min,100th/min
Mode :1=Surface 2=Kelp bed 3=kelp paddy 4=Reef 5=rock and boulder 6=Sand 7=wreck 8=Hard Bottom
Targets :Surface Fish Bottom Fish Rkfish Reds Whts Blks Cabo Ling Halibut Kelp Blue Sand Bass Yellowtail Scorpion Bocaetc

Target Fish	#Kept	# Released Dead	# Released Alive	#Kept	# Released Dead	# Released Alive	#Kept	# Released Dead	# Released Alive	#Kept	# Released Dead	# Released Alive
Fish Name												
Name												
Name												
Name												
Name												
Name												
Name												
Name												
Name												
Name												

Non Target Fish	#Kept	# Released Dead	# Released Alive	#Kept	# Released Dead	# Released Alive	#Kept	# Released Dead	# Released Alive	#Kept	# Released Dead	# Released Alive
Name												
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Appendix 5. Pilot program cost estimates.

We assume that observers will be at sea one day or less when in California waters and two to three + days when at sea in Mexico waters. We also estimate that observers will average 10 hours per day at sea. They will be paid straight time up to eight hours, time and one-half up to 10 hours, and double time above 10 hours in a working day (per California labor laws). They will get paid time off for breaks and lunch also specified by the state of California. We do not plan to pay them for after hours when not working. If samplers get more fishing trips than expected into Mexico, we will need to scale back the total number of planned trips/days-at-sea as there would be more overtime required; conversely if we schedule fewer trips to Mexico and more trips in California, we will increase the total number of trips because there will be less overtime required.

We also recommend hiring two part-time dock samplers for Oregon and Washington. Washington has presented an estimated cost of $12,500 and Oregon $15,750 for this purpose. Dockside samplers will be scheduled at discretion of state programs to sample for-hire albacore boats (potentially during the off-hours when other state samplers are unavailable.

A productive recreational fisheries program requires of planning, training, and scheduling. For example, landings must be contacted regarding availability of fishing boats and trips to sample (this changes daily). Samplers will be randomly assigned trips based on their own availability and schedules. Sampling hours and overtime must to be tracked to execute payroll every 2 weeks. In addition data sheets must be collected, edited, and forwarded for data entry, and entries must be verified and edited.

Table 1. MRIP pilot program for supplemental monitoring of West Coast Recreational For-Hire Sector albacore fishery. Costs estimates are developed for a five month period during the albacore season from May to September.

PROJECT NEED	ESTIMATED COST	TOTAL
California		
Onboard Observers (11 observers: 290 days at 10 hours/day base rate – 12 hour/ day overtime rate; Federal and State fees; Worker's Compensation; ($1,543/observer/month) Harbor & Longshoreman's Insurance)	**$16,770/month**	**$83,850**
Washington		
Dockside Observer (single observer)	**$3,150/month**	**$12,500**
Oregon		
Dockside Observer (single observer)	**$2,500/month**	**$15,750**
Expendable Equipment (safety, data collection, printing supplies, etc.)	**$7,500**	**$7,500**
Program Coordination (training, assignments, timekeeping, collection of recorded data; data entry)	**$3,100/month**	**$15,500**
Preliminary Statistical Analysis and Reporting	**$14,500**	**$14,500**
Total		**$149,600**