

**BUILDING CAPACITY OF THE
NMFS SCIENCE ENTERPRISE**

BY

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EXECUTIVE SUMMARY

The National Marine Fisheries Service (NMFS) asked us to ascertain the scope and frequency of current program reviews, develop a proposed framework for reviews, provide a list of priorities, recommend an oversight and documentation mechanism, and review the overall science enterprise and make recommendations on the science being undertaken, reported, and transitioning into management decisions. We broadly interpret our charge as advising NMFS Senior Management on scientific institution building. We considered programs, products and management of the science enterprise.

While NMFS has numerous outstanding scientists that conduct high quality research and provide sound scientific advice, our study found many problems. The National Marine Fisheries Service faces difficult challenges making some problems inevitable. Our findings are our opinions, but there may be other perspectives that merit consideration.

Our key findings are as follows:

1. NMFS Science Centers and Headquarters operate largely as independent entities in spite of National planning and coordination efforts.
2. The parallel organizational status for Science Centers and Regional Offices is appropriate, but it requires cooperation and coordination.
3. Management information is incomplete, piecemeal and hard to use.
4. There is too much program fragmentation, and investments in innovation are too small and/or subcritical mass.
5. There is insufficient scientific experience and leadership, focus on Science Centers, and follow-through, at Headquarters.
6. There are no functional program review policies.
7. The performance of stock assessment review processes is mixed, and needs to be improved in some regions.
8. Scientific Review Groups peer review marine mammal science.
9. Quality assurance processes for scientific input to the Endangered Species Act are evolving, but they are still incomplete, inconsistent, and lack adequate transparency.
10. Quality assurance of economic and social impact assessments and habitat science is largely left to internal review by the Science Centers and to Regional Fishery Management Council Scientific and Statistical Committees.
11. All Science Centers have internal review policies for documents and publications.
12. Too much faith is placed on independent peer review and the Center for Independent Experts.
13. The Federal Advisory Committee Act impedes science quality assurance.

We have four broad recommendations concerning a National framework for future program reviews, lessons learned from previous program reviews, all aspects of

management of the Agency's science enterprise, and processes to produce scientific advice to support management. Our recommends are to:

1. Implement a National process for program reviews- We think Programs should be defined and reviewed Nationally, rather Center by Center, to:
 - a. Improve or create integration.
 - b. Engage and make Headquarters responsible for the process.
 - c. Enhance consistency nationally and over time.
 - d. Assure follow-through on program review outcomes.

Therefore, we recommend a National program review process with the following elements:

- a. A National Program Review Panel comprised of external science leaders.
 - b. Five National Programs that include all of NMFS scientific activities regardless of organizational location.
 - c. Program Review Teams to conduct annual program review site visits.
 - d. A Program Information Database.
 - e. Program Review Staff to support the process.
2. Conduct a review of reviews- There have been numerous reviews and planning effort at the regional level and from a National perspective. They have been conducted under the auspice of NMFS, NOAA, Department of Commerce, and the National Research Council. The conclusions from all of these studies should be assembled and digested as a foundation for implementing our other recommendations.
 3. Reassess the organization and management of the Agency's science enterprise and make improvements as necessary- We believe improvements are necessary with respect to:
 - a. Coordination with Regional Offices (at least in some regions),
 - b. Some Science Center organizations,
 - c. Program integration at the National level and in some cases regionally,
 - d. Management information and its transmission both ways between the field and Headquarters,
 - e. Investments in innovation at or above the critical mass level,
 - f. Succession planning for future scientific leaders,
 - g. Headquarters capability, leadership and focus, when it comes to managing the Agency's science enterprise from a National perspective.
 4. Evaluate, redesign and complete, as necessary, processes for producing scientific advice for management. We recommend the following steps:
 - a. Each region should prepare a description of the processes used to quality assure MSFMCA, ESA and MMPA scientific advice.
 - b. National workshops should be conducted to review this information
 - c. A Headquarters lead team should prepare National guidelines for quality assurance processes for advice.
 - d. Regions should redesign processes, as appropriate, based on steps b-c.

- e. There should be further consultation with stakeholder before finalizing and implementing regional processes.

SECTION 1. INTRODUCTION

The National Marine Fisheries Service (NMFS) is the steward of the Nation's living marine resources and the ecosystems upon which they depend. Science plays a prominent role in the Agency's stewardship mission. Specifically, the Agency's mission statement calls for "... science-based conservation and management..." More than half of the budget of the NMFS is for science. It should be as relevant, responsive, credible and sound as it can be. Toward that end, NMFS Senior Management (SM) asked us to

1. Ascertain the scope and frequency of current programmatic reviews conducted by NMFS science,
2. Develop a proposed framework for programmatic reviews that is sensitive to the intersections among physical entities and the distribution of activities among them,
3. Provide a nominal list of priorities for laboratory and programmatic reviews and as well as a draft schedule for such reviews,
4. Recommend an oversight and documentation mechanism to track both the nature of the reviews and actions taken to address recommendations,
5. Review the overall NMFS scientific enterprise and select NMFS programs, as directed, and make recommendations on the science being undertaken, reported, and transitioning into management decisions.¹

We interpret our charge as advising SM on quality assurance of the science enterprise. Quality assurance includes program review. However, the structure and functioning of "review" needs to be placed in the context of existing and potential management structures and the way that these lead to institution building. The following issues are prominent:

1. Management of the Science Enterprise- Is it appropriately organized, is there sufficient management information, and is leadership experience and insightful enough, to set priorities and allocate assets effectively to support the Agency's mission?
2. Effectiveness of Programs- Are they relevant, do they have a good strategic design, are they properly resources, is there effective performance monitoring?
3. Utility of Products- Are scientific results (including advice on policies and management) responsive, defensible, robust to uncertainty, and fit for purpose.

The body of this report contains our findings (Section 2) and recommendations (Section 3). Appendices 1-6 respectively contain the following:

¹ From Statement of Work, see Appendix 2.

1. A description of our methodology,
2. A statement of work prepared by NMFS,
3. Ideas, observations and other considerations that supplement our findings and recommendations,
4. A description of a National Process for Program Reviews,
5. A draft Program Review Policy prepared by the NMFS Office of Science and Technology, and
6. Reports from our site visits to the six NMFS Science Centers.

SECTION 2. FINDINGS

This section of the report contains our most important findings. While we did not review the quality of NMFS research, we know of numerous outstanding scientists that conduct high quality research and provide sound scientific advice in support of the Agency's mission. The Agency is also fortunate to have an exciting mission supported by valuable assets including laboratories and ships. However, we found many problems. We recognize that some problems are inevitable given the Agency's challenging environment characterized by complex scientific issues (i.e., understand and predicting ecosystem dynamics), intense political interest, conflicting social objectives and ideologies, and multiple sometimes competing legal mandates and requirements. The problems we identified do not necessarily apply to all organizational units. Some Science Centers are doing better than others. Of course our findings are opinions based on our review, and there are probably other perspectives that merit consideration.

Our findings are divided into two categories: Program management, and program and product quality assurance processes. Our Terms of Reference highlighted program reviews, which are part of program quality assurance. However, program reviews are only useful if program management is capable of extracting program review signals from noise (i.e., reviewers are not always right) and implementing change. The ultimate measure of program quality is the quality of the products the programs produce (scientific publications, scientific advice to support the Agency's mission). Thus, programs, products and management are inseparable when it comes to assessing and advancing the capabilities of the NMFS science enterprise.

Program Management

NMFS Science Centers report to the Director of Scientific Programs and Chief Science Advisor. The Office of Science and Technology (S&T) also reports to the Director of Scientific Programs. S&T is the Director's headquarters staff to help manage programs carried out by regional Science Centers. It manages some of its own programs and serves as points of contact for many national-level and international activities (e.g., representation of LMR science on various boards and committees). Regional Science Centers have parallel organizational status with the Regional Offices that implement the Agency's resource management programs. Both report to Senior Managers (SM) in Headquarters.

The nominal purposes of organizations and management are to

- Increase capabilities so "teams" of personnel are appropriately and efficiently focused on results
- Efficiently Transmit information from field to HQ
- Efficiently Transmit information from HQ to field

The transmission of information is important for several reasons. These relate to tactical and strategic concerns. From the tactical point of view, are programs on track? Are short-term modifications required? Are their problems in the field with program budgets or constituents that need HQ attention? From a strategic point of view, are there needs or opportunities to develop a national critical mass to deal with major research problems or issues? How can programs be coordinated to span the regional responsibilities of Centers (e.g., California current)? How does national coordination make the parts greater than the whole?

We found that management of the Agency's science enterprise has some serious deficiencies. We reiterate that the topic of program reviews, and more broadly science quality assurance and the health of a science enterprise, cannot be separated from organization and management. Our findings with respect to the organization and management are given below.

1. NMFS Science Centers and Headquarters operate largely as independent entities in spite of National planning and coordination efforts- Overall we found that Senior Management (SM) is faced with major immediate choices regarding program management and its consequences for the science enterprise. Basically, we found the field and headquarters operate as largely independent entities, which impedes development of a critical mass for innovative research. At stake are opportunities to advance science by strategically designing programs from a National perspective utilizing the best and most appropriate scientific capabilities of each of the Science Centers. Such an approach will attract the resources and scientific talent (the best and the brightest) that NMFS needs. Strategically designed National programs are much more than today's efforts to coordinate regional activities.

To change, NMFS needs more National scientific leadership, and better management, information systems and organizational structures, to plan and implement National programs. We realize that this is a difficult challenge because of the decentralized culture of NMFS, which probably reflects inherent problems of building scientific capability in Headquarters. It is difficult to attract scientists to Headquarters and there is an increasing tendency for them to be consumed by NOAA, Department, interagency and Congressional demands instead of managing the Agency's science enterprise. SM needs to find a way of making Headquarters more attractive or find a way to manage science from a National perspective from another location or multiple locations.

2. The parallel organizational status for Science Centers and Regional Offices is appropriate, but it requires cooperation and coordination- While science programs ultimately support the Agency's management mission, they should report separately to a high level in the Agency to guard against local political pressures on advice and priority setting, and so there is the potential for science programs to benefit from strong scientific leadership with a national perspective and national responsibilities. However, for the organizational structure to be successful, there needs to be good coordination and cooperation between regional Science Centers and Regional Offices.

In most, but not all regions, Center staff and Regional staff (in the two regions where we visited Regional Offices) seemed satisfied with the relationship and positive about each other. Also, there seems to be a renewed interest in formalizing operating agreements between organization entities, including Science Centers and Regional Offices. While these are positive signs, we note that Regional Boards (composed of Science Directors, Regional Administrators, and senior staffs) no longer meet or meet irregularly.

Another issue is the recent build-up of science capacity in some Regional Offices and Headquarters Offices. In the early 2000s, there was an understanding that scientific capability should be placed in Science Centers and the Office of Science and Technology, not Regional Offices and HQ management offices. However, this no longer seems to be the case. We were told about science programs in some Regional Offices and Headquarters Offices (particularly the Protected Species Office and the Chesapeake Bay Office).

Was there a conscious change in policy? If so, why? If it reflects managers being dissatisfied with the scientific support they receive from Science Centers, the Agency should decide if the problem is the policy, lack of attention to coordination and cooperation, or some other type of performance problem. There is no inherently right or wrong policy concerning scientific capacity in Regional Offices, but there are important implications in terms of efficient use of scientific resources, integration of scientific activities, transition of research to operations, manager's access to relevant scientific support, scientific leadership, and science quality assurance, including an Agency policy for review of science programs.

3. **Management processes and organizational structures of some Science Centers need improvement.** Some Centers have Strategic Plans and other planning documents, but some Centers do not. Presumably all Centers will have a Strategic Plan as a section of the 2010-2015 NMFS Strategic Plan, which will identify priority activities. Also, Milestones are identified in electronic annual operating plans (eAOPs). However, these planning documents only seemed to play a significant role in the management of some Centers. For other Centers, these documents fulfill a headquarters requirement, but they are not used.
- There are also several National plans that include activities of regional Science Centers (Data Acquisition Plan, Stock Assessment Improvement Plan, Social Science Improvement Plan, Habitat Improvement Plan). These plans play a valuable role in formulation and justification of Executive Branch out year budgets, but they usually lack enough detail and scientifically rigorous analyses to be the basis of scientific activities implemented by the Science Centers Scientific programs should pass muster with critical scientists.
- Most Centers have a so called Board of Directors, made up of senior managers, but some of these groups meet infrequently (e.g., once a year). Their role and effectiveness varies between Centers, and in general, it is unclear. Some Science

Directors exercise reasonable control over programs through budget decisions, but other Center Directors leave it to Laboratories and Divisions. Minimal oversight probably means lost opportunities for reprogramming and innovation.

There is relatively little evidence of recent reprogramming from low priority programs to initiate new programs or invest in the future (although the NWFSC has a noteworthy program for funding small bottom up research initiatives). In an era of tight budgets and many operational priorities (implementing legal mandates), reprogramming is almost certainly necessary to fuel innovation. Most Science Centers seem to wait for new funding from HQ. Access to these funds usually requires some cost sharing (with Center base funds), which forces some degree of reprogramming, but not necessarily from low priority areas.

Organizational structures vary between Centers for no apparent reason. In some cases, activities that support particular functions or missions are consolidate and integrated within organizational entities, whereas in other Centers they are spread among several entities. Some or most Center organizations are a legacy of the past, without apparent rationale, and they are unlikely to facilitate integration, coordination, efficient application of resources, and teams of experts at or above the level of critical mass.

We think the organizational structure of the Science Centers should take account of the continuum of activities from long-term strategic research investments to operational science in the form of management advice. Ecosystem monitoring and fisheries data collection (i.e., an observing system) is part of the continuum, supporting both research and operational science. One of the strengths of this continuum is that it allows the rapid transition of research to operations (e.g., scientists involved in preparing advice, can draw on research experiences [their own and their colleagues'] as input to advice). Also, an institution that contains research along with operational science is likely to attract higher caliber scientists than an organization that has no research activity. However, unless there is some partitioning between research activities and operational science, the pressures for more near real time advice are likely to be met at the expense of research. Our conclusion is that Center Organizations and management needs to partition budgets and activities sufficiently to maintain balance along the continuum without impeding transition from research to operations. The Science Center Accreditation Program (discussed later in this report) addressed this issue.

4. **Management information is incomplete, piecemeal and hard to use-** We found that the transmission of meaningful information between Science Centers and Headquarters is inadequate. This has the effect of fortifying insularity among the six Science Centers as independent science enterprises rather than being part of an integrated National whole. A negative consequence of this insularity is that the good properties of Science Center are not diffused while the bad properties are fortified. It is inefficient to build the research establishment in consonance with the budget resources allocated to research in terms of six (or more considering HQ programs)

independent units. Likewise it is difficult to develop institutional excellence and to attract top-notch personal without organization.

As far as we can determine, the Agency has four main sources of management information about the Science Centers:

- a. *A national financial management system.* Budget staff in the Centers seemed generally satisfied with the system for tracking expenditures by budget tasks. This is an improvement over the situation of the early 2000s when the National system (either at the NOAA or DOC level) was considered a failure and most Centers found it necessary to maintain their own systems (so called cuff systems). However, the budget system does not relate expenditures to scientific programmatic activities by sorting budget information into user specified categories when multiple budget tasks are involved.
- b. *Electronic Annual Operating System (eAOP).* This seems to be an electronic version of the hardcopy Current Year Operating Plans (CYOPs) the Agency used for decades as a source of management information. However, these documents seem to be primarily a list of milestones for performance monitoring. Many of the milestones are essentially a description of planned activities (e.g., conduct a survey), but it is unclear if they cover all of the Centers activities and how the activities relate to each other or to the budget (what they cost- obviously a critical management question). Some of the Centers seem to take eAOP milestones seriously. For them they may be challenging and the Center may use eAOP milestones to monitor performance of the Center. Other Centers probably populate eAOPs to fulfill a Headquarters requirement, with milestones that are not challenging, and therefore they say little about the true performance of the Science Center.

We are not surprised that some Centers place little priority on eAOPs as a planning and management tool, because they perceive that only a few mid level Headquarters staff, who are assigned responsibility for the system, read or use eAOPs (mostly to fulfill the NMFS' requirement to report to NOAA and DOC). We have a similar impression since no one in Headquarters even mentioned eAOPs.

- c. *Data calls-* The Centers told us about frequent short turn around (sometimes a matter of hours) calls from Headquarters for information about Center programs, budgets, contracts, travel, facilities and assets (e.g., small vessels), cooperative arrangements (e.g., with universities), etc. These data calls come from all levels in Headquarters (from the Assistant Administrator to entry level employees such as Sea Grant Fellows) to all levels in the Centers. The same request may come from multiple Headquarters staff (sometimes it is not obvious it's the same request, which makes matters worse). Centers complain that it is common for them

to not know the reason information is needed or its importance. They could be more helpful and prioritize their efforts if they knew more about the requests. In some cases, the requested information may be in other management documents (such as eAOPs) or it should be. There's rarely feedback on the information provided. There may have been a similar request sometime in the past, but there is no guarantee that the answer can be reproduced.

- d. Headquarters staff's firsthand knowledge of field programs- Such knowledge can be invaluable, but with fewer HQ staff members having experience in the field, it is less common. It will never be sufficient to substitute for a comprehensive source of information. It is dangerous to infer too much in general about the Agency from firsthand knowledge of a specific program or region.

The frequency of data calls and the anxiety they create is evidence that the Agency needs a modern management information system (MIS). Such a system should be build on raw data of activity descriptions, personnel and budget tasks and object classes, in as much detail as exists (i.e., thus the reference to raw data). It should be a modern relational database that allows data to be extracted and reports assemble according to user specified. There should be the capability to add tags or flags to fields for classification (e.g., by program, location, legal mandate, etc) and to prorate (i.e., how much of a person's time is spend on a particular activity) data. Category assignments or prorations will usually require subjective judgments, but an MIS will at least document the judgments and make data extractions repeatable and consistent. Some Science Centers have or had management information systems along these lines. The Agency does not.

5. **There is too much program fragmentation, and investments in innovation are too small and/or subcritical mass-** We think the lengthy list of scientific activities we compiled for each Center is an indication of fragmentation. It would be easy to sort the activities into major program categories (some Centers do), but sorting is not the same thing as integration and creating programs that are greater than the sum of the parts. There is fragmentation within Science Centers, and between Centers, Centers and Regional Offices, and the field and Headquarters. There are several factors that lead to program fragmentation, small investments in innovation, and subcritical mass programs:
 - a. Center organizations that do not facilitate building integrated programs. This issue is discussed above.
 - b. Regionalization and a culture of doing everything in every region. Having regional Science Centers makes sense to investigate regional scale ecosystems and to serve the regional management of fisheries mandated by the MSFMCA. However, this does not mean that every type of scientific activity needs to be conducted by every Science Center. In some Centers,

program fragmentation is at the laboratory level (e.g., multiple laboratories with seemingly independent stock assessment or habitat research projects). There are some examples of one Center taking the lead for multiple regions, but there are more opportunities to integrate programs on a coast wide basis or nationally to gain efficiency and create programs that are large enough to be at or above critical mass. Also, there are probably too many laboratories and Centers, although we realize that this largely reflects political interests.

- c. A plethora of relatively small, independently funded programs (FATE, Aquaculture, Cooperative Research, Observers, Socioeconomics, Advance Technology, Ocean Acidification, etc, each with costly program managers trying to leverage their money) operated by Headquarters Offices. While these programs are usually competitive, there is a tendency to spread the money around to be fair. The amount of funding is usually small (subcritical mass) requiring Centers to redirect some of their base funds to the project. In fact, the goal of most of the managers of these programs is to use their funds to leverage Center funds. This results in sometimes inexperience usually mid level Headquarters staff subverting Center priorities and management. These programs may have a high overhead (e.g., cost of program managers) and high transaction costs (for proposal preparation and reviews for relatively small amounts of funding). Funds from these programs are often used to accrete sometimes stale research rather than reprogramming to develop real proof of concept ideas that could generate large amount of new money.

Another implication of these Headquarters run programs is that they place HQ Offices in competition with the field instead of being honest brokers oversee the entire science enterprise.

- d. Infrequent program terminations and/or reprogramming. We understand that terminating programs, closing laboratories, and reprogramming are difficult and unpleasant, but probably necessary to invest in innovation and to maintain or build programs above the critical mass level.
- e. Lack of timely recognition of opportunities for innovation. Not all investments in innovation are good investments. To make wise investments in innovation there need to be visionary scientific leaders and processes to build a consensus among scientists at all stage of their careers on priorities for investments in innovation. Leadership is discussed below. We are not aware of processes that truly tap the innovative juices of the science community (although there are a few local examples), and if they do exist, it is not clear how they can influence budgets. Program reviews could help to identify innovation opportunities.

6. **There is insufficient scientific experience and leadership, focus on Science Centers, and follow-through at Headquarters-** We remember a period not too long ago when many of the high level positions in Headquarters were filled by people with scientific experience (in laboratories, on ships, analyzing data, building computer models) and recognition (at the National and international level). They were leaders throughout the Agency, not only in positions with scientific responsibilities. There were also experienced scientists (people who conducted and published research, who had been on the frontline dealing with Fishery Management Councils and stakeholders) in mid level positions in Headquarters. The Science Center Director positions were widely considered as the most coveted and prestigious positions for fishery scientists nationwide. We feel that there has been decrease in the number of experienced scientists in Headquarters and in scientific leadership overall. There are many reasons the situation has changed. People are less mobile in general (because of two career families), Headquarters is not an attractive place for scientists and it is too often a dead end. Ironically, the apparent success of the Sea Grant Fellows Program exacerbates the problem. Over the last decade or two, the Agency has placed a large number of Sea Grant fellows in permanent positions (mostly in Headquarters), and several of them have advanced rapidly (e.g., to SES positions). Undoubtedly, they are excellent employees, smart and hard working, with an understanding of (or tolerance for) life “inside the Beltway,” but they usually lack hands on research experience and stature as scientists. The recent departure of the current Director of Scientific Programs and Chief Science Advisor makes the problem of too little experienced scientific leadership in Headquarters markedly worse.

This problem has ramifications with respect to:

- a. Understanding of the scientific activities that occur in the field,
- b. Credibility with field scientists, academics, NOAA Science Advisory Board, and many prestigious NOAA scientists that represent other Line Offices in NOAA level meetings,
- c. Vision, balanced with experience, to identify wise investments in innovations,
- d. Attracting the best and the brightest young scientists to the Agency,
- e. The science based roots of the Agency and science as the foundation for policy and management (e.g., an effective science conscience in HQ).

Another problem with Headquarters’ leadership and management of the Agency’s science enterprise is that the Headquarters focus seems to be on NOAA, DOC, Executive Branch Interagency Processes, and Congress. The focus is understandable because these higher level government processes are very demanding. They are also necessary for the Agency to be competitive in the Executive Branch Budget formulation process. In fact, because of the attention paid to these processes, including attention by some of the Agency’s most

experienced and credible scientific leaders, NMFS has been successful as evidenced by budget increases, including large investments in infrastructure such as ships and laboratories. Unfortunately, with limited scientific capability in Headquarters, this upward focus (in the sense of organizational hierarchy) has left little time and energy to lead and manage the Agency's science enterprise. While we respect the NOAA leadership's desire over the last decade to have "all one NOAA," it comes with a cost.

One Headquarters effort that focused on building and maintaining the capability of the Agency's science enterprise was the development of a Science Center Accreditation Program during the early 2000s. The program addressed all aspects of scientific institution building (e.g., staffing including promotions and session, facilities, training, libraries, product quality assurance). It considered the balance between data collection and observing systems, strategic research investments (i.e., innovation), and operational activities such as performing stock assessments and advising on management.

We requested documentation for the Science Center Accreditation Program, but none was provided. However, the Agency once thought it was important enough to highlight it in 2002 testimony to the US Oceans Commission, as follows:

"NOAA Fisheries is developing an accreditation program for its five fishery science centers and the collection of laboratories of which they are comprised. NOAA Fisheries recently adopted draft standards for the accreditation program and the fishery science centers are drafting implementation plans for approval later this year. The standards were developed by the NOAA Fisheries Science Board with the aid of a poll of the entire scientific, technical and administrative complements of the five NOAA Fisheries fishery science centers. The draft accreditation plan contemplates a five-year implementation period followed by external visiting committee assessments similar to that which is done in most academic scientific institutions."

We understand that implementation of the program began in about 2005-2006, but it was quickly dropped. During more than one of our Science Center visits, we heard complaints about Headquarters' failure to use or give feedback on the data (on the distribution of staff time spent on various activity categories) they had submitted.

It is likely that many of the issues raised in this report would have been addressed by the Science Center Accreditation Program, including a program review policy. There are other examples of Headquarters lack of follow through on decisions or plans to address issues raised in this report. We already mentioned that there was policy consideration about the distribution of scientific activities between Centers and Regions, the field and Headquarters, and S&T and other HQ Offices. However, those considerations seem to have been forgotten.

A more explicit example of the lack of follow through is the development of a modern Management Information System (MIS) along the lines described above. This involved a team of employees from throughout the Agency working over many months with professional facilitation. A comprehensive plan was developed and agreed by the Agency leadership during the late 1990s. As far as we can tell, only the eAOP has materialized, which falls far short of the MIS that was envisioned and is need, in our opinion.

There are probably many other examples of lack of follow-through. In the field, follow-through on the program reviews that have been conducted is mixed. In some cases, documents have been prepared giving responses to review recommendations, whereas in another cases, we were told that nothing has happen since a review that took place years ago.

Program Reviews and Product Quality Assurance

7. **There are no functional program review policies-** None of the Centers are functioning under a program review policy. A variety of program reviews have been conducted in the last decade, but most of the science enterprise has not been reviewed. In general, the program reviews that have been conducted appear have been well done, but the evidence that program review findings and recommendations were applied is mixed. At the current rate that reviews are being conducted, many programs will go un-reviewed for too long (a decade or longer).
8. **The performance of stock assessment review processes is mixed, and needs to be improved in some regions-** Each of the Centers has a stock assessment review process that is coordinated with or overseen by Regional Fishery Management Councils (RFMCs) and in some cases with Interstate Fisheries Commissions. To be successful, the processes need to have:
 - a. The capable to produce assessments at the rate (number per year) required by fishery managers.
 - b. A track record of giving advice that stands the test of time. That is:
 - i. errors are minimal,
 - ii. advice is consistent from one assessment to the next, and when it isn't, changes reflect real changes in stocks, not changes in methods, data or assumptions,
 - iii. assessments have predictive value
 - c. Credible with managers and stakeholders.

The processes that support the Pacific Fisheries Management Council and the North Pacific Fisheries Management Council seem to be performing reasonably well. The East Coast processes that support four RFMCs and two Interstate Commissions are struggling, at best, with respect to the frequency of assessments,

consistency of advice over time, and credibility. The process in the Western Pacific Region is new, but early experience has been problematic.

There are several factors that might explain the difference in performance between regions, such as:

- a. Data quality
- b. Number of scientists available to conduct assessments
- c. Capability of stock assessment scientists
- d. Difficulty of assessments. That is, some stocks are harder to assess than others because of life history characteristics, migratory processes, interactions with other species, or the complexity of fisheries.
- e. RFMCs and Interstate Commission's expectations about the frequency of assessments
- f. The culture of scientists, managers and stakeholders. That is, do they have a culture of respect and finding solutions or distrust and finding problems?

We have not critically evaluated the performance of the regional stock assessment processes in terms of factors a-f, but our impression is that an important factor behind the difference between the East and West coasts is the culture of scientists, managers, and stakeholders (factor f). We do not think that factor c explains the difference as all of the Science Centers have highly qualified stock assessment scientists. Arguably, factors a, b, and d are more challenging in the SEFSC than elsewhere, but factor e is more challenging on the West Coast (where assessments are conducted annually or every other year).

Some stock assessments are reviewed by the scientific committees of international fishery arrangements, such as the International Commission for Conservation of Atlantic Tuna (ICCAT) and International Scientific Committee (ISC) for Pacific tunas. These review processes seem to be satisfactory.

9. ***Scientific Review Groups peer review marine mammal science-*** SRGs are established under the authority of the Marine Mammal Protection Act. They are made up on non-Federal scientists. NMFS marine mammal science, such as population assessments and estimates of Potential Biological Removals (PBRs), are routinely reviewed by SRGs. NMFS marine mammal research is also reviewed by the US Marine Mammal Commission and international commissions (primarily the International Whaling Commission).

The Science Centers seemed to feel that the review of scientific products on marine mammals is satisfactory, although some concern was expressed by one of the Science Center. It occurs to us that the degree of independence of SRGs could be an issue. The marine mammal science community is relatively small. The community also depends on NMFS for research permits and in some cases funding (usually pass-through). We can envision situation which could have either a

positive and negative influence on SRG member's disposition toward NMFS. However, we have no evidence of problems.

10. Quality assurance processes for scientific input to Endangered Species Act are evolving, but they are still incomplete, inconsistent, and lack adequate transparency-

The ESA requires science information on listing determinations (i.e., on a petition to list a species as threatened or endangered), status reviews, biological opinions (i.e., on the impact of a proposed action on a listed species), distinct population segments and evolutionary significant units (i.e., population units that are candidates for ESA protection), designation of critical habitat and on mitigation measures. Various processes exist to provide the required scientific information for ESA, such as Biological Review Teams, Take Reduction Teams, and a Sea Turtle Expert Group on the East Coast. However, these processes have the following weaknesses:

- a. *They appear to be ad hoc and inconsistent.* There seems to be an emerging understanding that Biological Review Teams (or some equivalent structure) will be used to provide transparent (i.e., separable from policy or management decisions) scientific input into listing determinations. We were told that the NMFS Science Board is advocating this approach, but the Agency and the Office of Protected Resources have not fully agreed. NMFS scientists participate in other groups that compile scientific information in support of the ESA (e.g., Take Reduction Teams), but it is unclear if these groups are primarily performing a scientific or managerial function. Some, presumably science based decisions, are made by Protected Species programs (in Regional Offices and/or the Headquarters Office of Protected Species), apparently with little or no scientific input from Science Centers. Some types of decisions are so frequent or minor (e.g., many biological opinions) that input from the Science Centers on all decisions would be burdensome and impractical. However, there should be a consistent protocol for determining when the decisions merit input from Science Centers.
- b. *Lack of transparent and separable scientific input to many decisions.* While the Biological Review Teams mention above provide a record of the scientific input to listing determinations, and some Centers have other processes to document scientific input, this is not so for some other ESA decisions. For example, we could not locate an Alaska Fisheries Science Center document, or some other form of transparent scientific input, to the current status review of Steller Sea Lion distinct population segments off Alaska. None is cited in the Federal Register notice soliciting scientific input to the decision. Of course there are numerous reports on the Center's Steller Sea Lion research, including documents on population trends, but these are not the same as scientific advice tailor to scientific questions

(usually in the form of Terms of Reference, ToR) that should be answered to inform decisions.

- c. *Lack of operational criteria for making ESA decisions.* One of the reasons it is difficult to have transparent and separable scientific input to ESA decisions (b above) is the lack of operational criteria (analogous to overfishing definitions). It is noteworthy that this problem was recognized in the mid 2000s. Candidate protocols and criteria were formulated by a working group of Agency scientists and managers (NOAA 2004. Technical Memorandum NMFS-F/SPO-67, <http://spo.nmfs.noaa.gov/tm/tm67.pdf>). However, we understand that the working group's proposals were not adopted. We do not know if the proposals were deemed unsatisfactory (in which case, they might have been improved), the Agency decided it would rather not have criteria because they would be constraining, or there were other reasons.
- d. *Limited scientific input from non-federal scientists.* Non-federal scientists do not serve on some of the groups involved in providing scientific input to the ESA because the groups are not exempt from the Federal Advisory Committees Act (FACA) and they are not approved under FACA. This is more of an impediment to non-Federal scientific input to ESA than it is to fisheries management because the Magnuson Stevens Fishery Conservation and Management Act (MSFCMA) is FACA exempt.

11. Quality assurance of economic and social impact assessments and habitat science is largely left to internal review by the Science Centers and to Regional Fishery Management Council Scientific and Statistical Committees- This scientific information is also considered by RFMC plan development teams in some regions, but these teams primarily design management rather quality assuring scientific information. We do not know if the quality assurance provide by Science Centers and SSCs is sufficient. However, as this information gains importance in decision processes (as it should) and impacts stakeholders, it will be subjected to more scrutiny, and it may be necessary to put in place processes analogous to the processes used to produce stock assessment advice for fisheries management.

12. All Science Centers have internal review policies for documents and publications- All Centers have an internal review policy for publications, and it is being applied. All of the Centers were satisfied with the processes they have in place. They were able to produce records of published papers and other documents that had been through the process. We did not attempt to assess the performance of these processes or the quality of documents and publications.

13. Too much faith is place on independent peer review and the Center for Independent Experts²- At least one Science Center director referred to them as the “Holly Grail.” We are concerned about this notion.

There are three common forms of peer review. Sequential peer review (typically used by journals) has peers review scientific work, but the scientists that initially prepared the work retain ownership and responsibility. Integrated peer review engages independent scientists with Agency scientists to collectively agree on the final scientific product and advice, thus sharing ownership and responsibility. Independent scientific advice is a variation of integrated peer review where the independent peers have ownership of advice because they have sole responsibility for approving it. The Agency is increasingly using processes that produce independent scientific advice. We think it is a mistake.

We have several concerns about the Agency’s use of peer review and the CIE:

- a. Independent advice undercuts “carrot” and “stick” motives of Agency scientists involved in preparation of scientific advice. The carrot is recognition for their role in producing the advice (even without authorship) and the stick is accountability for mistakes. We are not suggesting that scientists should be punished for honest mistakes, but a sense of ownership and responsibility should be a greater incentive to do a good job than when responsibility is invisible.
- b. Science Centers, in particular Science Center Directors, are ultimately responsible for the scientific advice in support of the Agency’s mission. Independent advice undercuts, obscures and/or confuses this responsibility. There are examples of Science Center directors disagreeing with independent advice, but not knowing how to deal with. We hope it is not that they do not feeling responsible for it. With processes that involve senior level Agency scientists in approval of advice, the Science Center Director maintains a degree of control, which is necessary to fulfill the Center’s ultimately responsibility. It may be easier to surrender this responsibility to independent peer reviewers, but we think the collective capability of the scientists of a Science Center lead by an experienced Science Center Director is a better bet.
- c. Excessive dependence on independent peer reviewers leads to instabilities and inconsistencies in advice from year to year. The independent

² The Center for Independent Experts was established by NMFS (under a service contract) to provide a source of experts that are free from conflicts of interest. It is also a mechanism to compensate (i.e., pay) experts for their services. Experts are selected solely by the CIE without NMFS influence. The CIE is useful to increase the credibility of a process by assuring stakeholders that NMFS did not pick experts because the Agency believes they will give favorable reviews.

see <http://www.ciereviews.org/index.php>

scientists that the Agency uses as peer reviewers are excellent, but they usually lack local knowledge of data, stocks, fishery management context, and the basis for past advice. An integrated process allows local (mostly Agency) scientists to compensate for the lack of local knowledge of independent experts. However, when local scientists feel like servants of independent reviewers, instead of partners, valuable local knowledge is less available or under-valued in the formulation of advice.

- d. Use of CIE members for independent peer reviewers is sometimes viewed as necessary for advice to be credible. This is probably true in some circumstances, but the credibility of advice is probably more dependent on the performance of the process in the long term.
- e. The rationale for the CIE is that it provides an “arms length” mechanism for selecting independent peer reviewers (i.e., the Agency cannot be accused of selecting peer reviewers they expect to be favorable). It also provides a convenient mechanism for compensating disciplines in such high demand that consulting fees are the norm (e.g., stock assessment experts). However, we think the CIE is being commonly used when arms length selection of experts and consulting fees are not necessary. Our guess is the CIE is over used by the Science Centers because they want to get their share of a Headquarters pre-paid service, which is not an efficient use of funds. Overuse of the CIE also creates multiple classes of peer reviewers (those that are paid, and those that are not), tends to unnecessarily exclude US scientists that could make a valuable contribution, and it may undermine volunteer peer review.
- f. Apparently, the contract that establishes the CIE calls for CIE participants in workshops to file their own reports separate from workshop reports they approve. These reports sometimes have technical information that Agency scientists find useful, but they under cut or confuse consensus workshop reports. We have been told that these individual reports are required because of FACA and/or to maintain a record of an independent review.

It is interesting that while there seems to be a push for more independence of peer reviewers involved in the preparation of fisheries advice and for independent advice, the processes used by the Alaska Fisheries Science Center and the North Pacific Fishery Management Council have less independence than any other. Yet they are generally viewed as performing well with more buy in from managers and stakeholders than elsewhere.

14. The Federal Advisory Committee Act impedes Science Quality Assurance- We understand the positive reasons for FACA, but we doubt that Congress intended to prevent NMFS from using scientific peer review and consensus building processes in an objective and transparent manner to advise on research programs and to

produce the best science advice practicable. It is also our perception that the Agency's response to FACA varies between regions and circumstances. Legal advice on FACA probably guards the Agency against violations without full understanding of the balance between legal risks and costs of playing it safe.

SECTION 3. RECOMMENDATIONS

We have four broad recommendations. Our first recommendation is for a National framework for program reviews. Our second recommendation is for a review of reviews to maximize the benefit from past reviews (as well as this review) of the science enterprise. Our third recommendation concerns all aspects the management of the Agency's science enterprise. Our fourth recommendation addresses the processes used to produce scientific advice to support management. The recommendations are interdependent (e.g., the benefiting from program reviews depends on management capability), and all of the recommendations are important to build the capacity of the NMFS scientific enterprise.

1. **Implement a National process for program reviews-** NMFS drafted a framework for program reviews (Appendix 5). It is a typical approach leaving the specifics to regional Science Centers. They are to identify major programs and nominate one or two per year for review with an aim at a three to five year cycle for reviewing all programs. The only connection between reviews in each Center is that a Center Director from another Center or the Director of Scientific Programs will be a member of each program review panel.

We think more needs to be done to:

- a. Improve or create integrated National programs with due consideration of above critical mass investments in innovation,
- b. Engage and make Headquarters responsible for the process,
- c. Enhance consistency Nationally and over time,
- d. Assure follow-through on program review outcomes.

Therefore, we recommend a National program review process with the following elements:

- a. A National Program Review Panel comprised of external science leaders.
- b. Five National Programs that include all of NMFS scientific activities regardless of organization location.
- c. Program Review Teams to conduct site visits as part of Annual Program Reviews.
- d. A Program Information Database.
- e. Program Review Staff to support the process.

A National Program Review Panel and National Programs will ensure that reviews consider program areas from a National perspective. The membership of Program Review Teams should have overlap across the country and over time to enhance consistency. The number of programs should be defined so that all programs are covered on a five year cycle by Annual Program Reviews. A Program Review Database that is complete, consistent, and user friendly, will also improve

consistency and integration. It will document outcomes and follow-through. Staff will be necessary to support the process.

The process described above is for systematic rotating reviews of all Agency programs. We also expect that there will be a need for smaller “one off” reviews of particular topics (e.g., such as a national review of cooperative research). Such reviews could also be guided by the National Program Review Panel, although they should be separate from the multi-year cycle of reviews. There may be a need for one off reviews within regions. These should be left to Science Centers.

A process for National Program Reviews is described in more detail in Appendix 4. This process will be demanding in terms of the internal workload and costs, and the needed for participation of experienced independent scientific leaders. However, the demands are primarily driven by the size and complexity of the NMFS science enterprise and the expectation that it will be reviewed at a reasonable frequency (i.e., every five years). The demands may be less apparent if it is left to individual Centers to run program reviews, but the total workload and cost is likely to be similar if the reviews are undertaken as frequently and comprehensively as in our proposal.

2. **Conduct a review of reviews-** Although the Agency lacks an functional program review policy, dozens of reviews have been conducted during the last decade as indicated in our site visit reports (Appendix 6). Furthermore, our study is not the first one to consider the NMFS science enterprise from a National perspective. There have been studies conducted under the auspices of the Office of the NOAA Chief Scientist, NOAA Science Advisory Board, Office of the Inspector General, National Research Council, and other organizations. There are also many National planning documents on specific topics including a Congressionally mandated National research plan.

We think it would be useful to assemble and digest all of these documents so that common messages can be identified. What’s been the response to recommendations? What more should be done in response to these reviews and plans? A review of reviews should be the foundation for implementation of our other recommendations.

3. **Reassess the organization and management of the Agency’s science enterprise and make improvements as necessary-** We believe improvements are necessary with respect to:

- a. Coordination with Regional Offices (at least in some regions),
- b. Some Science Center organizations,
- c. Program integration at the National level and in some cases regionally,
- d. Management information and its transmission both ways between the field and Headquarters,

- e. Investments in innovation at or above the critical mass level,
- f. Succession planning for future scientific leaders,
- g. Headquarters capability, leadership and focus, when it comes to managing the Agency's science enterprise from a National perspective.

We recommend a phased process with internal and external phases. We suggest that the internal phase of about six to nine months. The external phase should be planned while the internal phase is underway. If the internal phase is done well (producing concise, well conceived plans), the external phase should take no more about six months, and it should be possible for the Agency to complete the entire process (e.g., adopt plans) within eighteen months.

Internal Phase- Headquarters and Science Centers should evaluate management and propose improvements. This phase should build on the review of reviews (Recommendation 2).

Are Center organizations conducive to program efficiency and integration? Do Centers have appropriate planning and management strategies with meaningful performance measures? Do they have sufficient internal management processes and coordination mechanisms with Regional Offices? What are they doing about succession planning?

At the National level, Headquarters should reassess management information. Is there enough of it? Is it being transmitted effectively? Is it being used, and if not, why not?

Headquarters should also assess its own capability to lead and manage the Science Centers. Does it have enough experienced scientists? Does it have scientific leaders with experience, vision and stature? It should consider needs to respond to demand upward (e.g., NOAA and DOC) and to manage the Centers. How can the workload be partitioned between upward demands and Center management so that neither one gets short changed? This assessment needs to be made from both a short and long-term perspective.

The internal phase should identify programmatic activities that would benefit from coast-wide or National integration and consolidation. A policy and processes for selecting and managing investments in innovation should be prepared. The implications of the numerous small programs managed out of Headquarters offices should be assessed.

Succession planning, including mobility of personnel, should also be reviewed. Ideally, leaders in HQ should have extensive field experience and vice versa.

Many of the activities in the Internal Phase are Headquarters responsibilities, but there should be input from the Science Centers.

All of the Centers should review their organizations and management procedures, but we think some of them have more problems than others. Proposals for change, or lack thereof, should be judged on merit, not a sense of “sharing the pain” equally among all the Centers.

External Phase- This phase should be conducted by an external panel including experienced managers of mission oriented government science programs. They should review the results of the internal phase. They should have the opportunity to meet with scientific staff, scientific leaders, managers that use scientific products, and stakeholders.

The purpose of the External Phase is to “peer review” the Internal Phase. Was it done well? Does the Panel endorse or advise against the plans and recommendations from the Internal Phase? Does the Panel have additional recommendations for follow-up?

4. **Evaluate, redesign and completion, as necessary, processes for producing scientific advice for management-** Our findings raise several issues about the processes used to assure the quality of scientific advice. These issues include performance of some stock assessment review processes, a potential issue with marine mammal Scientific Review Groups, lack of agreement on a complete set of processes in support of the Endangered Species Act, the nature of reviews of economics and social sciences, and habitat products, the Center for Independent Experts.

We recommend the following steps:

- a. Each region should prepare a description of the processes used to quality assure MSFMCA, ESA and MMPA scientific advice, including economics and social sciences, and habitat information.
- b. National workshops should be conducted to review this information. The workshops should include scientists, managers, and stakeholders. The workshops should compare notes on what works and what doesn't work. They should also consider if additional process, more consistency and/or more transparency, is needed for subject matter with less well developed processes than is typical of stock assessments.
- c. A Headquarters lead team (which will have to draw heavily on the field given the experience level in HQ) should prepare National guidelines for quality assurance processes for advice. The guidelines should seek completeness, consistency and transparency. With respect to consistency,

it should not be pushed so hard that regional differences are not taken into account, but there should be a logical basis for differences. At present, it is difficult to judge which differences are justified, and which ones are a legacy or a result of inertia.

The role of the CIE should also be reassessed. Undoubtedly, there are cases where it has a valuable role (one of us recalls specific examples), but it should not be overused.

- d. Regions should redesign processes, as appropriate, based on steps b-c.
- e. There should be further consultation with stakeholder before finalizing and implementing regional processes.

We presume a lot of documentation of processes for quality assurance of advice was prepared and approved as part of the implementation of the Agency's response to the Data Quality Act. We have not seen these documents. They may fulfill part of the need. There was probably National involvement, also partially fulfilling the need. However, we suspect that these processes were more a bureaucratic response to a legal mandate than a National process of sharing experiences, stakeholder consultations, and guidance, to achieve consistency where it is feasible and useful to improve advice.

As part of the evaluation of processes for providing scientific advice, we recommend that the Agency give high level attention to the implications of FACA and how to balance legal risks against benefits of engaging stakeholders and external experts in processes to formulate scientific advice. Our observation is that the way FACA is dealt with today ranges from ignoring it to totally excluding non-Federal participants. Neither extreme is desirable. In between, non-federal employees are sometimes required to submit separate reports even though the goal is consensus advice. In other cases, the MSFCMA exemption is presumably to apply, but we do not know how broadly this exemption actually applies, what's required for the exemption to be applied, and if the requirements are being met. In other cases, activities are presumed to occur under the auspice of FACA approved Committees (e.g., NOAA Science Advisory Board or Marine Fisheries Advisory Committee). Again, it is not clear how broadly these Committees can delegate, under what conditions, what is required. The Agency should also consider if it should be more willing to apply for FACA approval, or if it should pursue legal exemptions (such as with MSFCMA). We realize this is not a new topic, but it needs to be address in order to conduct program reviews.

Confusion or lack of understanding about FACA might be exemplified by our status. Are we advising as contract employees (in one case), under the auspices of the NOAA SAB, some other authority, or is FACA being ignored?