



SUMMARY MEETING REPORT & RECOMMENDATIONS

MARINE FISHERIES ADVISORY COMMITTEE San Diego, California · April 28-30, 2015

OVERVIEW

The spring 2015 Marine Fisheries Advisory Committee (MAFAC) meeting took place at the Andaz San Diego Hotel, in San Diego, California and spanned three days from April 28-30, 2015. Eileen Sobeck, Assistant Administrator of Fisheries; Paul Doremus, Deputy Assistant Administrator for Operations; Richard Merrick, Director of Scientific Programs and Chief Science Advisor to NOAA Fisheries; and Jennifer Lukens, Director of the Office of Policy and the Designated Federal Office to MAFAC represented NOAA Fisheries leadership at the meeting.

Julie Morris served as Acting Chair of MAFAC for the first day, and Chair Keith Rizzardi presided over the second and third day. The meeting opened by welcoming four new members to MAFAC, Terri Lei Beideman (NJ), Heather Brandon (AK), Michael Okoniewski (WA), and Peter Shelley (MA). Additionally, seven members were congratulated on their reappointment for a second 3-year term: Julie Bonney (AK), Dick Brame (NC), Michele Longo Eder (OR), Liz Hamilton (OR), Micah McCarty (WA), Bob Rheault (RI), and Pam Yochem (CA).

NOAA Fisheries Leaders discussed the NOAA Fisheries budget outlook for 2015; creation of two new task forces under MAFAC, as recommended at the fall 2014 meeting; and provided updates on several key priorities for NOAA and NOAA Fisheries. Eileen Sobeck highlighted NOAA and NOAA Fisheries' 2015 policy and programmatic priorities including the 15 recommendations and ambitious implementation Action Plan from the President's Task Force on Illegal Fishing and Seafood Fraud; current progress on Magnuson-Stevens Act reauthorization; current status of the rulemaking for offshore aquaculture in the Gulf of Mexico and other aquaculture updates; and the release of the 2015-2018 National Implementation Plan to the new National Saltwater Recreational Fisheries Policy.

Over the course of the three-day meeting, MAFAC engaged with the following NMFS staff to discuss these NOAA Fisheries priorities and activities:

- Cooperative research and cooperative management – Heather Sagar, Senior Policy Analyst, Office of Policy.
- Recovery of protected species – Therese Conant, Recovery Coordinator/Headquarters and Nora Berwick, Senior Natural Resource Specialist/West Coast Region, both with the Office of Protected Resources.
- Recreational fishing policy – Russ Dunn, Senior Recreational Fisheries Advisor and Craig Heberer, Recreational Fisheries Coordinator for the West Coast Region.
- Marine Recreational Information Program and its transition to a new survey – Dr. Richard Merrick, Chief Science Advisor.
- Climate change and its impacts on the west coast and Pacific region – Dr. Cisco Werner, Director of the Southwest Fisheries Science Center.

Additionally, the directors of the Gulf States and Pacific Marine Fisheries Commissions discussed their outlook for 2015 and a successful joint NMFS- State Directors meeting held earlier in the year; Dr. Don Kent, Director of Hubbs-Sea World Research Institute gave a

presentation on their offshore aquaculture enterprises; and MAFAC members toured NOAA Fisheries Southwest Fisheries Science Center in La Jolla to learn about their extensive science and research activities.

This report summarizes the major meeting discussions, action items, recommendations, and next steps for MAFAC. Recommendations on the Climate Science Strategy is included as Attachment A. Meeting materials, presentations, transcripts, and recommendations can be found on the MAFAC website [here](#).

DISCUSSIONS

DAY 1 – April 28, 2015

NOAA Fisheries Budget Outlook – Paul Doremus

The presentation reviewed the FY 2015 budget and an overview of the President's 2016 budget request. In December 2014, Congress appropriated \$958.2 million to NOAA Fisheries, which provided a modest increase over FY 2014 (1.6%). However, from FY 2010 – FY 2013 there was a 12.5% decrease. Reductions are in Protected Resources and Habitat and there is still a major gap compared to previous funding. Congress identified \$2 million to be targeted for electronic monitoring (EM) and electronic reporting (ER), with a special focus on the Gulf of Mexico, out of existing resources. NOAA Fisheries is partnering with NFWF who plan to augment that with \$2 million for a total of \$4 M for grants.

NOAA Fisheries combined the FY 2014 and FY 2015 appropriations for the Saltonstall-Kennedy (SK) competitive grant program. It will be as balanced as possible across priority areas: observations/EM; supply, quality, diversification of seafood; and improvements in quality/quantity of fisheries information in U.S. territories. Submissions numbered 285 proposals. NOAA is grateful for all the contributions of partners on this effort. Additionally, Coastal Resilience Grants are a priority of Dr. Sullivan. NOAA receive \$10 M, of which \$5 M is for fisheries grants. The Coastal Ecosystem Resilience Grants program will focus on habitat restoration, while NOS has slightly different focus on coastal protection.

NOAA is awaiting Congress' approval for FY 2016. NOAA's overall budget request increased by 9.8% over the FY 2015 enacted budget. For core programs, this includes a 7.8% increase for Fisheries, which is fairly substantial, but it's unlikely Fisheries will receive this. Any increases will be used to substantially improve Protected Resources capacity where there is a rapid growth in demand; for domestic fisheries management; and Illegal, Unreported, and Unregulated (IUU) fishing internationally. Fisheries remains optimistic that parts will be supported, but not sure where. Staff are briefing the Appropriations Committees and specific Members to explain the requested increases. Related to science needs, a NSF science group is doing a prioritization for OMB; Richard Merrick is involved. Fisheries has a need for about 15,000 days at sea, but only requested 8,000, due to staff limitations. Now, with existing budget, can only fund 5,000, one-third of needs.

Paul closed with a discussion that Fisheries is consolidating the 37 program, project, or activity lines (PPAs) in our budget to 10, which clarifies the work the agency does.

Reports from the State Directors Meeting and Fisheries Commissions – David Donaldson and Randy Fisher

Randy Fisher opened with a summary of the fall State Directors and Commissions meeting. In preparation, a survey was used to identify the most important topics to the directors. Based on input, discussions at the meeting focused on early involvement in budget preparation with

NOAA Fisheries, more early involvement in species listing processes, the new recreational fisheries policy, and the disconnect between science centers and regions (some perceived, some real). David Donaldson noted that overall, the meeting was considered very positive and they decided to meet every year rather than every two years. The next meeting is being targeted for early 2016 in New Orleans or somewhere in the Gulf of Mexico. NMFS committed to having the Science Directors at the meetings as well Regional Administrators.

The west coast is testing electronic reporting in the recreational sector to replace paper log books. The Commission is also changing its computer server, to improve how fast they can process data. They expect to be able to provide information 30 days from when surveys are complete. They are issuing a RFP for a fish identification program for cell phones to improve species identification, have handed out barotrauma devices to reduce mortality on rockfish, have deckhands taking lengths and weights on bluefin tuna, and developed identification cards to help tell species apart.

The Commission has an experimental fishing permit (EFP) to carry cameras on commercial boats (whiting, fixed gear, trawlers, and longline boats). Camera footage is being compared to observer data. Cameras are best used for compliance monitoring, and observers are needed to collect biological information. Observer coverage at 100% (i.e. for IFQ fisheries), which is far more expensive, should not be necessary if cameras are successful. Cost for observers is around \$500/day; the Commission reimburses fishermen about \$108/day. If they can go to cameras, it should cost about \$100/day. Overall, flat funding for the Commission is a big issue. A web based log book program is being implemented in California. In Oregon, 98% are using e-fish tickets. California and Washington are coming on line.

For the Gulf of Mexico region, David noted red snapper has dominated the discussion for years. There is frustration among the States, particularly as the population increases, and feel they need more flexibility to manage the resource. The five state directors recently got together, developed the Gulf States Red Snapper Authority, and are requesting authority to manage red snapper. Several bills have been introduced into Congress to give authority to the Commission, but under the states' plan, it would be the states, not Commission that has the management authority. However, the Commission would provide funding for data collection.

He noted that the five Gulf states submitted proposals for the EM/ER funds through NFWF, and they hope some will be funded. The Gulf Commissions data programs have been level funded for 10 years, and that has caused problems in terms of the amount of information they can collect. His last comment was that the Gulf and Atlantic Commission are meeting jointly in November in St. Augustine, FL.

Cooperative Research and Cooperative Management – Heather Sagar

Heather Sagar provided a presentation on the background of cooperative research and cooperative management and a white paper on the topic developed by a working group. Fisheries received a letter from stakeholders and NGOs on the topic focused on Section 318 of the Magnuson-Stevens Act and that Congress intended more effort in cooperative management. They believed it could enhance NOAA capabilities, improve stakeholder relations, and possibly bring new resources to fisheries management.

A working group looked at successes and failures of cooperative research and cooperative management efforts and lessons learned in fisheries, habitat, and protected resources efforts. They conducted internal and external interviews around the country, held a roundtable with the letter writers, and participated in the West Coast Forum.

The working group discussed definitions and reserved co-management to mean work between NOAA and States or Tribes. Cooperative management includes the regional fishery management process, cooperative research with stakeholders, take reduction team efforts, and bycatch studies, among others. Successful cooperative research and cooperative management efforts have a clear legal framework, organized stakeholder group, clear roles, and clear goals. Support from partners, trust, transparency, good communication, matching the scale of the cooperative management with the range of the species, use of the results in management decisions, and funding were all important. The resulting white paper summarizes the critical success factors, inventories examples, and made 18 recommendations on how to move forward.

Before breaking, Pam Yochem shared that there is very strong concern from the National Association of Marine Laboratories and Consortium of Ocean Leadership about the recommendation on statutory language to seek private donations. When federal funding is tight, external partners suffer the most. If agencies seek to attract funding from private sources, the competition hurts external partners even more. Another concern was potential conflicts of interest when taking funds from outside sources and "mission drift."

It was noted that NOAA is seeking authorities comparable to other Federal agencies to work as flexibly and with greatest reach as possibly across sectors. It is not viewed as a zero sum game, However, these concerns can be managed.

Members were surprised that much of the report focused on the fishery management council process as an example of cooperative management, and recommended reducing that focus in the white paper. There were also concerns that NMFS has been reluctant to use cooperative research data at times, considering it less reliable and accurate. This tradeoff should be addressed in the document. Finally, members noted that improving coordination and the relationship with the various Sea Grant programs could be very beneficial, and staff gave examples of new internal cooperative efforts, including staff exchanges to improve our understanding of Sea Grant programs.

Protected Resources – Recovery of Species – Theresa Conant and Nora Berwick

The session provided background and context to the Species Recovery Project of the Protected Resources Subcommittee, and specific details about the recovery plan and recovery actions of the Middle Columbia River (MCR) steelhead trout, one of seven species covered in the project, were provided. Therese Conant opened with a review how species recovery is defined, what the ESA requires regarding recovery, what factors are considered in recovery planning, recovery plan goals, how they are developed and used, and what is required of individual recovery actions.

Nora Berwick, the Recovery Coordinator for MCR steelhead trout. She emphasized that coordination of the actions of diverse private, local, tribal, state and Federal parties is critical to success. Steelhead management was divided into different management units based on river basins. Nora described recovery goals and biological criteria; the overall goal is for the viability of each major population group to be at low risk. A Washington Gorge Implementation Team was developed in an area of the Middle Columbia where no state recovery board exists. Nora described in detail the various partners involved; the implementation structure including a the forum, steering committee, science team, and othe technical teams; the processes they established; and provided examples of implementation achievements. Recovery actions number 964 in the Middle Columbia, of which 197 actions are contained in the Washington Gorge Region.

The Protected Resources Subcommittee met with Nora following the presentation to ask questions and test their interview design for fact gathering for their project.

Meetings of the following Subcommittees were held in the afternoon:

- Protected Resources
- Strategic Planning, Budget & Program Management
- Aquaculture Group of the Commerce Subcommittee

DAY 2 – April 29, 2015

Report from the Assistant Administrator – Eileen Sobeck

Eileen opened by welcoming the new members to the Committee as well as the seven members who were reappointed for a second term (see Overview, above). She noted that the Agency is pleased that the two new Task Forces on Aquaculture and Climate & Marine Resources received a lot of interest from high caliber candidates, were organized rapidly, and have accomplished several tasks so quickly.

She reviewed her main priorities for the year, and those of the agency:

- Supporting the Presidential Task Force on Combating IUU (Illegal, Unreported, and Unregulated) Fishing and Seafood Fraud, its priority actions and timelines, and in particular, putting limited resources where they will do the most good, focused on species at high risk of seafood fraud and IUU fishing.
- In the last session of Congress, both the House and Senate developed and introduced Magnuson-Stevens Act reauthorization bills, though neither chamber passed a bill. NMFS had informal discussions with both House and Senate staffs on their drafts, and is monitoring the recent bill introduced by Congressman Young, which is very similar to the House bill from last session.
- Marine aquaculture continues to be important to NOAA, it has grown 8% annually in recent years, and is considered a job creator. NOAA Fisheries and partner federal agencies will continue to work to make progress to streamline permitting for marine aquaculture, a directive under the Administration's National Ocean Policy.
- National Saltwater Recreational Fisheries Implementation Plan for 2015-2018 was released a couple of weeks ago, containing over 50 commitments to support NOAA Fisheries ongoing focus on recreational fisheries.

Recreational Fishing - Policy & Its Implementation – Russ Dunn and Craig Heberer

Russ Dunn reviewed the final Recreational Fisheries Policy, its goals, and six guiding principles. The policy of NMFS is to "...foster, support, and enhance a broadly accessible and diverse array of sustainable saltwater Recreational fisheries for the benefit and enjoyment of the nation." An Implementation Plan was developed, and it identifies over 50 actions to be taken over the next four years. In particular, regional implementation plans are to be developed over the coming year, and the members of MAFAC and the Recreational Fisheries Working Group are encouraged to engage in their regions.

Craig Heberer provided a recreational fisheries update for the West Coast Region. Saltwater recreational fishermen on the West Coast target a diversity of marine resources including highly migratory species, salmon, rockfish, and coastal pelagic species. In 2012, 1.6 million anglers completed 7.4 million fishing trips on the West Coast, spent \$1.8 billion in fishing trip and equipment expenditures, and supported over 18,800 jobs and \$2.5 billion in sales.

The Region's Rec Fish Team is working to update its Action Agenda for 2016-2018. Examples of regional issues include improving the management of Pacific bluefin tuna which are experiencing overfishing and considered overfished; commercial sardine closure and live bait fishery dynamics, since live bait availability impacts sportfishing; the impacts the growing sea lion population is having on on at-risk salmon and steelhead stocks, and potentially white sturgeon; and working with partners, including the PSMFC, fishing organizations, and state co-managers to increase the use of descender devices for increasing survivorship of rockfish released at depth through a "giveaway" program and targeted outreach.

MRIP and Transitioning to a New Survey – Richard Merrick

Richard Merrick provided an update on the Marine Recreational Improvement Program (MRIP) and how MRIP will manage the transition to new survey methodologies while maintaining the integrity of the historical time series. The new MRIP Fishing Effort Survey is the last recommendation of the 2006 National Research Council (NCR) report on how to improve NOAA Fisheries' recreational data collection programs to be implemented. Its goal is to generate a statistically robust, unbiased estimate about catches. Richard reviewed program milestones and the approach that the stakeholder-inclusive teams have taken for each new effort: design, review and certify new methods; implement the improvements in pilots; then scale up to enhance precision, timeliness, and coverage.

Over eight years, six MRIP pilot projects have been tested and two independent reviews have been conducted. Now, the new mail-based fishing effort survey has been validated, and a 3-year transition plan has been developed for its full implementation. During transition, the current coastal household telephone survey will run concurrently with the new mail-based survey for two years to provide enough data for calibration. The process will require continuing collaboration with partners and stakeholders, and it will involve benchmark changes, calibrating and revising catch histories. In the third year, the survey will completely switch over to the new time series, and it will be incorporated into reruns of the stock assessments and inserted into management decisions. Full transition will be completed by 2017.

Several statisticians on the original NRC panel have been involved through the whole design over the last two years. Additionally, NMFS is commissioning the NRC to conduct a second, independent external review to assess MRIP progress.

MAFAC members discussed issues that can affect catch estimates including compliance with the saltwater angler registries, data gaps (juveniles, retirees), using statistical multipliers, potential underreporting, selfreporting, accurate species identification by anglers, potential biases, and use of electronic monitoring in recreational fisheries.

National Standards – Proposed Revisions to National Standards 1, 3, and 7 – Wesley Patrick

The Agency released a proposed rule to revise National Standards (NS) 1,3, and 7 in January, and comments are being accepted until June 30. It primarily makes revisions to NS1, which is about achieving optimum yield on a continuing bases. Changes are also recommended for NS 3, managing fisheries as a unit throughout the range, and NS 7, which looks at the cost benefits of any measure recommended for amendment. These changes are being proposed, now that there has been some time to assess what is working and what is not in the implementation of annual catch limits (ACLs) and accountability measures (AMs) to end and prevent overfishing. The rule shows there is some flexibility in how ACL requirements can be met, and incorporates input from Councils, the public, an NRC report on rebuilding programs, MAFAC, and the Recreational Fisheries Working Group.

The proposed rule does not establish any new requirements or require Councils to revise current management plans, but adds additional clarity and potential flexibility on how we can meet the MSA mandates and addresses some of the topics being raised by Congress regarding MSA reauthorization.

Wesley discussed the five subtopics under NS1. The proposed revision: (1) provides two additional ways of calculating T-Max for rebuilding plans that are not so data intensive and can be used for more data-limited and data moderate stocks; (2) clarifies and provides guidance on what “adequate progress” is with respect to rebuilding, since it must be monitored every two years, and defines when adequate progress is not being made; (3) allows for a 180-day interim provision to be implemented when there is an unanticipated and significantly changed understanding of stock status that reduces fishing effort, but not necessarily require overfishing end; (4) does not require modify rebuilding plans to stay within a certain timeline, so long as fishing pressure remains below F-rebuild, unless adequate progress is not being made; (5) allows rebuilding plan to be discontinued if it is determined that both the stock was never overfished, as originally thought, and the biomass of the stock is above the MSST (it is not currently overfished). Other elements in the proposed rule clarify for data-poor stocks, where MSY cannot be estimated, that alternative approaches that promote sustainability may be used (this is already done in different councils); clarifies guidance on which stocks require conservation and management; enhances ecosystem approaches to management; provides more stability in annual catch limits; defines depleted stocks; and improves the routine review of management plans.

MAFAC members discussed potential economics impacts of underfishing in a given year, even if it helps rebuilding; taking recruitment overfishing into consideration; how to address protecting multiple spawning sites for certain species to enhance rebuilding; conservation group’s concerns that too much flexibility may not be a good thing when numerous stocks are overfished or undergoing overfishing, but possibly less a concern when fisheries are already generally in good condition; significant capital investments make it difficult for fishermen to adjust and provides incentives to minimize management; and working to make adjustments when biomass is starting to decline – not waiting for a stock to be overfished or overfishing occurring. Additionally, there was discussion on how the proposed rule related to proposed bills in Congress and MSA reauthorization.

Public Comment

Two local individuals were introduced to MAFAC. The first was Juan Carlos Padermo, from Conapesca, Mexico. He had recently opened an office in San Diego to facilitate U.S. citizens getting the licenses they need to visit and fish off Mexico. Mexico has instituted a new process for allowing Americans to visit by yacht or boat. Information about permits are accessible now on a new website. Mr. Padermo mentioned briefly that they are supporting the effort, along with the United States, to rescue and protect the remaining endangered vaquita porpoise off Baja California; that they are working to improve efficiency with respect and friendship rather than bureaucracy; and that they are working to improve fishing logs and electronic data collection through cooperatively by using the same new electronic ROGG System, that the U.S. fleet is using.

The second person introduced was Captain Louis Zimm. He is a member of the Pacific Fishery Management Council’s Groundfish Advisory Committee, a long standing captain with the San Diego recreational fleet, and a former captain for the Scripps Institution of Oceanography. Captian Zimm has been very involved in the descending device implementation and would be demonstrating its use on the trip on Friday.

Climate Change – Changing ocean conditions and its impacts on the West Coast and Pacific region – Cisco Werner.

This presentation covered current conditions in the Pacific, more specific conditions along the U.S. West Coast, the climate science strategy and why it's needed, and specific examples for the seven objectives that the climate strategy has identified. Detailed slides were provided.

Cisco described the various climate impacts affecting the Pacific Ocean and west coast. The arrival of El Niño was announced about a month earlier, but scientists are watching to see if it will actually strengthen. They arrive every two to seven years when there is a warming in the Pacific, last for one or two years, then disappear. The last big one was over 10 years ago. On longer time scales, the Pacific Decadal Oscillation brings a cool regime for about 10 years, then a warm regime for about 10 years, and it appears we are entering a warm phase. Different species of zooplankton, prey fish (anchovy, sardine) and larger fish (salmon, brownfish, rockfish) favor different phases due to the interrelationships between them. Additionally, the current unusual warming, the “warm blob” (in the ocean and on land) in the North Pacific and along the west coast, is affecting snow pack, water, species, and this El Niño. Trends are changing and these different signals point to the importance of the production and delivery of climate information to support future agency and decision-making processes.

This is why the Climate Science Strategy is important. Of the seven objectives in the strategy, the first three are management related and remaining four are science related. Real examples from the region for each objective were presented. For Objective 1, on the need to identify appropriate climate-informed reference points for managing living marine resources (LMRs), he discussed the sardine assessments. The Pacific Fisheries Management Council now uses the California Cooperative oceanic Fisheries Investigations (CalCOFI) as a new temperature index along with the temperature productivity relationship for establishing the overfishing level beginning in 2014. Related to Objective 2, identifying robust strategies for managing LMRs under changing climate conditions, Cisco discussed management strategy evaluations for Pacific albacore. The albacore is the first species that Southwest Fisheries Science Center scientists are conducting this evaluation on, with scientists from the International Scientific Committee on Tuna and Tuna-like Species, and PICES, which is the North Pacific Regional Marine Organization. Simulations are being used to compare the relative effectiveness of different management strategies that explicitly take spatial structure into account. Tagging work and catch data have shown that albacore follow very specific physical features in the environment. Simulations using this information are able to predict shifts in species diversity and distribution into the future. To implement the management strategy evaluation different components are evaluated to determine which strategy should be followed. It is the interface between science and decision making. Adaptive decision processes that can incorporate and respond to changing climate conditions is Objective 3. Last year, the West Coast Regional Office proposed closing the swordfish drift gill net fishery east of 120°W due to anticipating increased interaction with Pacific loggerhead turtles. The decision was based on the expectations of persistent warm waters (not on the possibility of a tropical El Niño coming).

Objective 4 concerns identifying future states of marine, coastal, and freshwater ecosystems, LMRs, and LMR-dependent human communities in a changing climate. Cisco discussed examples of work that has been going on for a number of years with colleagues from academia and NOAA's Geophysical Fluid Dynamics Laboratory to develop future scenarios for the California Current and steps toward earth systems models. This involves downscaling global models to be able look at more regional or local scales to get the kind of responses that are needed for forecasting. Similarly, it is important to get feedback from small scales to continually improve the larger scale models (upscaling) and to include a human dimension, such as with bioeconomic models.

In terms of identifying the mechanisms of climate effects on ecosystems, LMRs, and LMR dependent human communities, Objective 5, the difficulty in teasing out mechanisms due to climate change was emphasized. There was encouraging proof of concept of a multi-species climate-to-fishers model used to assess what drives the variability from physics and lower trophic levels to sardine, anchovy, and fishing fleets. The advantage of models is that one can investigate each part separately to tease discrete mechanism out. Slightly different temperature and diet preferences were found to lead to significantly different responses to environmental variability. Although there is a lot of on-going work on biological realism, alternative hypotheses, and climate projections, anchovy related more to local upwelling, while sardines had a more broad correlation.

Objective 6 deals with tracking trends in ecosystems, LMRs, and LMR-dependent human communities to provide early warning of change, and NOAA's California Current integrated ecosystem assessment (IEA) was discussed. IEAs provide information about trends and help assess what is expected in the future. In this case, cooler waters in the California Current support "northern" copepods which are rich in lipids and support fish production. When temperatures shift warmer, southern copepods are supported, and these have much less lipids and don't support fish as well, including rockfish, sanddabs, market squid and some salmon. Landings start to fall, and fishermen become vulnerable. If there is increased vulnerability of marine resources to expected climatic change, and reduced resilience or adaptive capacity of fishermen to shift away from these species (depending on fisheries diversification), human communities will have increased vulnerability.

Finally, Objective 7 concerns building and maintaining the science infrastructure needed to produce and deliver actionable information to fulfill NOAA Fisheries mandates under changing climate conditions. Cisco acknowledged we have a lot of what is needed, with respect to knowledge, instruments, what models can and cannot do, and how to take different signals and put something together that's meaningful. That's hardware and software. However, we do need to train the next group of people to do this work in an integrated way.

Expected results from the Strategy are better tracking of ecosystem changes providing early warnings of climate-related changes; increased understanding of the mechanisms of change and the vulnerability of fish stocks, communities; near and long term forecasts of ocean & resource conditions; climate sensitive stock assessments and biological reference points; and improved management scenarios.

Members discussed the importance of partnerships to get all the work needed done; how this work should unite, help integrate, and provide the applied context for all the work NOAA does at a higher level; and how this information should help predict what will happen in a fishery, short term and long term, 10, 20, 40 or more years from now.

Meetings of the following Subcommittees were held in the afternoon:

- Ecosystems Approach
- Recreational Fisheries
- Protected Resources

DAY 3 – April 30, 2015

Rose Canyon Fisheries – A Commercial-Scale Proposal to Define the Regulatory Pathway to Farming the U.S.A.'s Exclusive Economic Zone – Don Kent, Hubbs-SeaWorld Research Institute

Mr. Kent first provided a history and overview of California's and San Diego's fishing history and compared it to agriculture. Considering California's long coastline and large EEZ, there is a lot of potential for aquaculture. The Rose Canyon Fisheries project has been in preparation for several decades. The intention is to demonstrate the technologies that are available now, improve that technology over the years working with researchers and regulators, and grow out to a maximum of 5,000 metric tons per year of production, equal to an ex-vessel value between \$50 --\$80 million. In tons, that is five times the production of capture fisheries in San Diego now and will create new seafood jobs. Long term, they are interested in yellowtail jack (suitable for Hamachi trade), white sea bass, and striped bass, but will focus initially on yellowtail.

Mr. Kent described the location site and cages proposed, the permits being sought, the economic benefits, studies in marine spatial planning that has identified 500 sq km suitable for aquaculture, preventing marine mammal entanglements, novel feeds that can be used, ongoing research, sustainable practices in general, and the overall advantages of aquaculture. He emphasized the need for a better understanding of balance. There has been a lot of negative rhetoric about aquaculture. His organization is working to set the record straight that aquaculture needs to be both environmentally and economically viable, bring management agencies together, and conduct education and outreach to help make Rose Canyon Fisheries and other aquaculture enterprises a reality.

Subcommittee Reports

Aquaculture/ Commerce Subcommittee Report –John Corbin, Co-Chair

John provided a presentation on the formation and membership of the new Aquaculture Task Force (ATF), the tasks it was assigned, and its schedule for that work. Its first task was to review the draft priorities for the 2016-2020 Office of Aquaculture Strategic Plan. The Task Force recommendations were presented to the Commerce Subcommittee, that Committee had some revisions to the ATF submission, and finalized recommendations to present to the full MAFAC Committee.

MAFAC approved the following comments where noted. MAFAC agreed to submit consolidated comments from both the ATF and Aquaculture/Commerce Subcommittee:

Vision and Mission:

Vision Statement: "A vibrant U.S. marine aquaculture sector that creates jobs, provides sustainable seafood, and supports healthy oceans."

Task Force:

- See definition of vibrant – do you want to use this term?
- Insert "an expanding" before vibrant
- Insert "healthful" before sustainable
- Change "supports healthy oceans" to "restores ocean ecosystems"

Aquaculture Subcommittee:

- Robust instead of vibrant?
- Insert Economically viable/sustainable and environmentally responsible

Revised Vision Statement: A robust, economically viable, environmentally responsible US marine aquaculture sector that creates jobs, provides sustainable seafood, and supports healthy oceans. **ADOPTED**

Mission Statement: “To provide science, services, and policies to support significant growth of sustainable U.S. marine aquaculture, including commercial production and restoration.”

Task Force:

- To provide: 1) science, services, and policies to support significant growth of sustainable U.S. marine aquaculture, including commercial production and restoration and 2) interagency coordination in the development and implementation of a national marine aquaculture development program.
- What does significant mean? Needs to be measurable.

Aquaculture subcommittee:

- Change provide to enhance or advance
- Change significant to ongoing or increasing
- Insert habitat and stock before restoration to clarify

Revised Mission Statement: To enhance science, services, policies, and interagency coordination to support rapid growth of sustainable US marine aquaculture, including commercial production and habitat and stock restoration. **ADOPTED**

Goals and Measures:

Goal 1: Develop a clear and effective regulatory system for the marine aquaculture sector.

Task Force:

- Insert efficient before “regulatory”
- Insert commercial before “marine aquaculture sector” to clarify
- Insert “support expansion”
- Insert “that will allow, encourage and support the expansion of” after system.

Aquaculture Subcommittee:

- Replace “clear and effective” with “streamlined, coordinated and predictable”,
- Change system for process or environment

Revised Goal 1: Develop a streamlined, coordinated, and predictable regulatory process for commercial marine aquaculture. **ADOPTED**

Goal 2: Promote environmental stewardship and sustainability in the marine aquaculture sector

Task Force:

- Insert “for long-term growth” after sustainability
- Insert “and economic”

Aquaculture Subcommittee:

- Insert “using best available technologies” at the end of the statement.
- Change “stewardship” to “responsibility”

MAFAC:

- Keep original statement
- Add “using best available technologies” as suggested by the subcommittee

Revised Goal 2: Promote environmental stewardship and sustainability in the marine aquaculture sector using best available science and technologies. **ADOPTED**

Goal 3: Provide science-based tools, technologies, and services for the marine aquaculture sector

Aquaculture Subcommittee:

- Insert “extension” before “services”
- Change “Provide” to “Develop”

Revised Goal 3: Develop science-based tools, technologies and extension services for the marine aquaculture industry. **ADOPTED**

Goal 4: Increase public understanding of marine aquaculture

Task Force:

- Insert “to foster long-term growth”
- Insert “and appreciation for” after understanding
- Insert “and its benefits” after aquaculture

Aquaculture Subcommittee:

- Insert “education”
- Insert “outreach capacity”
- Change “increase” to “improve”

Revised Goal 4: Increase education and outreach capacity to improve public understanding of marine aquaculture. **ADOPTED**

Goal 5: Build internal support for marine aquaculture

Task Force:

- Remove this as a goal

Aquaculture Subcommittee:

- Remove this as a goal **ADOPTED**

General Task Force Comments:

- We need a plan from NOAA that provides less in the way of aspiration and more in the way of quantitative goals and projected timelines. That will allow MAFAC and others to comment on the plan’s reality and measure performance as things move forward.
- We strongly suggest that the goals 1) be related and in support of the on-going 10 year plan and 2) be of a specific, quantifiable nature. The general language is problematic in its lack of specificity. As examples, we created a new Goal 1 that mirrors the 10 year plan and is quantifiable. Problematic in its generality is Goal 2. It states that NOAA will create a clear and effective regulatory system for coastal aquaculture. Coastal aquaculture occurs in state waters and it is very unlikely NOAA is going to be successful in negotiating with states and for certain, very significant regions, local governments.
- The lack of a research-oriented goal needs to be addressed. Funding is always an issue; however, the federal aquaculture research plan was a product of joint agency effort and it would seem an obvious goal to implement that plan across the research oriented NOAA programs.
- With regard to the vision statement – a vibrant US marine aquaculture sector is what we all want to see. But there is a need for specifics. Will ‘vibrant’ be defined in terms of projected production volumes in the plan that follows? For example, the US consumes

about 5 million metric tons live weight of seafood per year of which 90% is imported. Would 'vibrant' be a reduction of 10 or 20% of imports?

With regard to Goal 1 – is there a clean distinction between coastal and offshore aquaculture, i.e. state vs federal waters? And what can NOAA do to change, improve or unify the different systems that have evolved in the states? For example, coastal finfish aquaculture is banned in Alaska. Will NOAA change that?

Suggested New Goal Statements (not adopted by MAFAC):

Suggested Goal: In cooperation with the private sector, develop and implement a National Marine Aquaculture Development Program designed to double domestic marine aquaculture in 10 year.

Suggested Goal: develop and implement an International Aquaculture Technology Transfer Program designed to send private entrepreneurs and farm managers to visit and work in other countries with more advanced aquaculture sectors.

Suggested Goal: Ensure that with the increasing regulation of wild stock fisheries and a concomitant growth in the aquaculture industry that there is no resulting net loss of seafood industry jobs but rather an increase in employment in the sector.

Suggested Goal: Increase the value of marine aquaculture production in US waters by 100% within 10 years.

Protected Resources Subcommittee Report – Julie Morris, Chair

Julie presented a summary of the Endangered Species Act Recovery Project that the Protected Resources Subcommittee is conducting. She submitted the following report:

Terms of Reference: Purpose

Conduct a retrospective analysis of a subset of NOAA Fisheries Endangered Species Act recovery actions by status category ('not started,' 'ongoing,' 'complete') to identify characteristics that may increase the likelihood of recovery action success and help inform development of future recovery actions. In a subset of recovery plans, review the 'not started' recovery actions, with an emphasis on recovery actions related to fisheries impacts and suggest potential partners, strategies, revisions and clarifications to help implement these recovery actions.

What we learned from presentations at this meeting:

- Our task will be a lot more complicated than we expected.
- For Steelhead, a strategy is needed to prioritize the actions that will most directly improve viability and these actions need to be completed in an effective sequence.
- It is unclear who is responsible for overall coordination of recovery actions being conducted by multiple entities.
- Positive and effective working relationships among the people/entities responsible for implementing the recovery actions are very important.

Our plans going forward:

- Develop a common set of questions for interviews and a template for summarizing our

interviews. We've compiled a list of draft questions based on committee discussions at this meeting and factors identified in preparation for this meeting.

- Convene a subcommittee conference call in late May 2015 to organize the process for conducting interviews with the Protected Resource lead on each of the 7 recovery plans.
- Conduct phone/skype interviews by Mid-August 2015.
- Draft a compilation of interviews with initial analyses of characteristics likely to increase the success of recovery actions by mid-September.
- Review this at the October 2015 MAFAC meeting.
- Draft final report on recovery actions by December 2015.

Strategic Planning, Budget & Program Management Subcommittee Report – Julie Bonney, Acting Chair

This subcommittee met to review the recommendations of the Cooperative Research and Cooperative Management White Paper. The following recommendations were developed, discussed with the whole Committee, and MAFAC approved the following:

Recommendation #1 (page3):

The Introduction discusses a letter from a broad set of stakeholders that was sent to Dr. Sullivan requesting that NOAA strengthen the use of co-management in fisheries management along with a suite of other issues. A copy of the letter should be included as an attachment to the white paper and a discussion of the broader efforts and working groups that are working on some of the other issues that are flagged in the letter from these constituents should be delineated.

Recommendation #2 (page 40 – 41):

Cooperative Management Policy #1-- Under Cooperative Management Policy (1) All three terms should be clearly defined and their individual application delineated. These are: (1) Co-Management, (2) Cooperative Management, (3) Cooperative Research to provide guidance to employees, partners and stakeholders. This is important as the terms are not interchangeable.

In addition, the following edit should be made for clarity:

Given the various definitions and understandings of “co-management,” this White Paper recommends use of the term “co-management” be reserved for the shared management with States and Tribes that have similar authorities. The working group recommends that a common definition of the term “cooperative management” be disseminated to differentiate the differences between “Cooperative management” and “Co-management” as well as “Cooperative research”.

Some ideas:

“Cooperative management” could refer generally to increased stakeholder engagement in the fishery management process – from data collection to development of management plans to addressing buy-in and accountability – to foster a shared understanding of the condition of and responsibility and task sharing for managing and protecting resources, consistent with conservation and management standards and legal requirements. This understanding would span NOAA’s responsibilities under the MSA, ESA, and MMPA.

Recommendation #3 (page 41):

Cooperative Management Policy #3-- NOAA Office of Communications and the Office of Policy should facilitate in-reach by training all appropriate NOAA Fisheries staff on the common understanding of co-management, cooperative management, and cooperative research and the suite of tools available to NOAA Fisheries under the MMPA, ESA and MSA. Facilitation and/or customer service training may be appropriate for specific staff to improve interactions between NOAA Fisheries staff and constituents. Training could take place through webinars, training videos, field training and publicized information NOAA Fisheries Policy Office on the NOAA Fisheries intranet. This recommendation may initially require additional funding resources but may be offset by gains in management efficiency.

Recommendation #4 (page 42):

Cooperative Management Policy #5-- NOAA Fisheries Leadership and NOAA Fisheries Management and Budget should continue to push for statutory language needed to accept private donations and determine the proper guidelines regarding the use of private funds.

Recommendation #5 (page 42):

Cooperative Research #3-- The Cooperative Research Program and other cooperative research activities (i.e. SK Grants and BREP) should ensure that both stakeholders and NOAA Fisheries are involved from start to finish to set goals and objectives to ensure results have the best chance to be used for management purposes. Because cooperative research may be important in providing data necessary for stock assessments, stock assessment scientists should be included in the design, implementation, and analysis of projects.

Recommendation #6 (page 43):

Metrics -- NOAA Fisheries Office of Science and Technology should review 2014 cooperative research program projects and determine how many, and which of them better informed, facilitated or led to improved management decisions or enriched scientific products.

Recommendation #7 (page 43):

Conclusion -- The November 25, 2013 letter recommended that NOAA support cooperative management and cooperative research as a means to bring new resources to fisheries management, enhance NOAA's capabilities, and improve stakeholder relationships.

Recommendation #8:

Finally, the document needs a synthesis conclusion, explaining when cooperative management and cooperative research are best used. For example:

“Cooperative management” allows aspects of NOAA’s responsibility to be delegated to stakeholders, but may require those stakeholders to incur the burden of investing additional resources or incurring additional costs. As a general rule, cooperative management should be pursued when NOAA and the stakeholders gain mutual benefits and when legal authority permits.

“Cooperative research” allows stakeholders to contribute to the overall base of knowledge enabling NOAA to make informed decisions. In general, NOAA should support stakeholder research and advise the stakeholder on how to best structure their research efforts. Also, NOAA may choose to confer with stakeholders where multiple overlapping research initiatives exist, in an effort to determine whether one or more of the research projects could

be modified to increase the overall knowledge. NOAA should consider how best to be a partner and facilitator to create a positive environment for cooperative research projects.

Ecosystems Approach Subcommittee Report – Pam Yochem, Chair

Pam Yochem submitted the following report:

Thanks to Keith Rizzardi and NOAA staff for doing the lion's share of work to date on coordinating the work of the Climate & Marine Resources Task Force of the Marine Fisheries Advisory Committee (MAFAC). This Task Force was created as a communication conduit for stakeholder input to MAFAC, and subsequently NOAA Leadership, **on the production, delivery, and use of climate-related information in fulfilling NOAA Fisheries mission activities.**

The first effort put to the new Task Force was to review the NOAA Fisheries National Climate Science Strategy

Task Force activities since last MAFAC Meeting:

- Selection of Task Force members
- Establishment of a Google site to facilitate the collaborative work of the task force
- Kick-off webinar and conference calls
- In-person meeting

Results to date:

- Task force produced their recommendations on the National Climate Science Strategy – this document was circulated and posted prior to this MAFAC meeting
- Yesterday, Ecosystems Approach Subcommittee met, reviewed and revised the draft recommendations developed by the Task Force. Heidi emailed that to MAFAC last night.

Subcommittee recommendation:

- Although we would like staff to take a final look at this for typos and perhaps some grammatical polishing, the version that Heidi sent reflects the Subcommittee's recommendation to MAFAC - that MAFAC adopt these comments and recommendations on the NOAA Fisheries National Climate Science Strategy

MAFAC considered this recommendation and approved the a detailed report to be submitted. It is attached as Appendix A.

Next Meetings

Potential dates for FY2015 meetings were shared. Dates generally avoid Fishery Management Council or Commission meetings and NOAA Fisheries Leadership Council meetings. Members voiced conflicts with several proposed dates, resulting in the best spring date of April 29 –May 1, 2015. Best fall dates are tentatively October 26 – 30 and November 2-6.

[End of Meeting]

ATTACHMENT A
Findings and Recommendations on the
NOAA Fisheries Draft Climate Science Strategy

Developed and Submitted by the Climate & Marine Resources Task Force
and Ecosystems Approach Subcommittee
Approved by MAFAC, April 30, 2015

Thank you to the writers of the *Draft NOAA Fisheries Climate Science Strategy*. It is a thoughtful and concise blueprint for capturing key components of assessing climate change on Living Marine Resource (LMR) marine and riverine environments.

The mandates on NOAA are significant to the entire world in terms of identifying and adapting to climate change. Beyond even the mandates is the responsibility we (as both commentators and world citizens) all have in helping NOAA do its work to effectively *gather and communicate* those findings to the sectors – whether federal, tribal, state or local – that will be most impacted by marine and riverine changes. The enormity of that responsibility is certainly overwhelming to anyone who really cares about how the world will adopt positive adaptive strategies to mitigating and living with climate change.

The Climate & Marine Resources Task Force of MAFAC met on March 11, 2014 to discuss the *Draft NOAA Fisheries Climate Science Strategy*. The following detailed comments were derived from that meeting, as well as subsequent work by Task Force members. We appreciate the opportunity to provide these comments to the Ecosystems Approach Subcommittee of MAFAC for review. We hope these will be adopted and approved by the entire MAFAC Committee at its April 2015 meeting.

The Climate & Marine Resources Task Force commends the NOAA Fisheries Service for undertaking the development of a climate science strategy. The need to focus scientific resources in the face of climate change and variability is urgent. Having a clear strategy to address scientific questions is paramount.

The Task Force had extensive discussions and questions for NOAA Fisheries staff on the development and content of the Strategy. They suggested that additions and clarifications be made in the NOAA Fisheries Climate Change Science Strategy to improve it to serve the needs of agency better.

The Task Force's comments are organized into three sections: (A) comments on the entire scope of the proposed strategy; (B) comments organized, as is the strategy in Chapter 2, by the objectives established by NOAA; and (C) specific comments on recommended socioeconomic research to meet strategic objectives.

A. Comments on the entire scope of the proposed Strategy

1. Urgency and risk

The document could be strengthened by emphasizing urgency upfront. Related to the urgency of the issue is the risk of inaction in moving climate science forward. There is a great degree of risk associated with not acting and in not preparing now for changes that are coming as a result of climate change. The reader needs a clear statement of this purpose and need, therefore a preface is recommended which highlights the urgency of the issue and the risk of inaction, such

as opportunity costs. However, there is also risk in premature action that impacts present seafood harvest before new approaches are understood and vetted.

2. Communicate climate science results

A high priority should be placed on developing new approaches to communicating the results of climate change-related research undertaken by NOAA Fisheries to the diverse community of expert and non-expert stakeholders with whom NOAA fisheries interacts, particularly sector and community leaders and managers. The best research will be inadequate if it does not lead to wider and deeper understanding of the challenges confronting fisheries and marine ecosystems. Related to communications, the text of the Strategy should also be written in clearer, plain(er) language. This will ensure that the public, if an intended audience, can easily understand it and its need.

3. Socioeconomic dimensions

Three of the seven objectives make reference to “LMR-dependent human communities.” As the old saying has it, one does not manage fish, one manages people who fish. There are, in other words, socioeconomic dimensions to be understood in meeting all seven objectives. The draft strategy offers somewhat less information about how socioeconomic objectives will be reached, so Section C of these comments provides suggestions to conduct some of the social science research that will be needed. Additionally, there are many communities of stakeholders that are not in the commercial sector. The *Strategy* should encompass these other sectors (recreational, sport, charter, subsistence and sustenance fishing) as these fisheries and their dependent communities will also be hugely impacted by climate change.

4. Link objectives to management questions and decisions

In the Executive Summary, the document should briefly describe how the seven objectives were identified and developed and their connection to mission priorities, management questions, and decision processes. The internal discussion and deliberation was explained by staff to the Task Force, however the reader does not have the same benefit and the link to management challenges is not clearly written. The document discusses new approaches and management strategy evaluation techniques, but these are difficult to understand. It's not clear how they will be integrated into existing decision-making processes. More discussion of strategies to provide a transition from current management processes to processes informed by climate science would strengthen the document.

Additionally, NOAA should not abandon current stock assessment and management processes and the data collection required to support these activities. Fisheries management depends on accurate and timely stock assessments. While climate modeling is important, it operates on larger time scales (e.g., decades to centuries) and it should not interfere with empirical data collection (e.g., fish surveys) needed for shorter time scales (e.g., 1-5 years).

5. Ensure the *Climate Science Strategy* provides a focus on spatial and temporal habitat issues

The document would benefit from clearer focus and greater relevance to habitat programs and assessments (e.g., EFH and ESA section 7 consultations). This should not diminish the importance on temporal climate-driven patterns that are the main focus.

6. Resilience and Risk

Understanding resilience and actions to reduce risks could use more focus in the document. For example, there are some actions that should provide climate mitigation benefits, but more scientific information is needed to fully understand the benefits. Additionally, how does NOAA Fisheries propose to better account for the interactions of climate and non-climate stressors in

all its program areas? Non-climate stressors may exist which combine or exacerbate climate change stressors. These points are mentioned in the document, however they are largely underrepresented.

In particular, the *Strategy* should address the scientific needs related to actions that would increase resilience of living marine resources (LMR) and LMR ecosystems to climate change risks and increasingly dynamic/chaotic system responses. Examples are provided in section B, Objective 2 of this document. A couple of additional examples include:

- Testing of alternative limits to harvest regimes within marine protected areas including no harvest, reduced harvest, periodic cessation of harvest (10-12 year cycles), and selective reduction in take of species (or guilds) determined to regulate marine biological communities, for example forage fish species, and top predator species (i.e., applied research into management of marine reserves to mitigate climate and non-climate stressors to whole ecosystem). With respect to this, the Marine Protected Area Federal Advisory Committee (MPA FAC) developed a thoughtful [white paper](#) that addresses the topic of resiliency and climate change and it should be consulted.
- Identification and understanding the mitigation of non-climate stressors that impact habitats, populations of species, and LMR ecosystems, and how reductions to non-climate stressors can be achieved in order to improve LMR resilience.

7. Tools to prioritize science needs

The lay reader may not understand the purpose of the examples included within this section without understanding that, depending on the types of climate impacts or issues being examined, these are all appropriate decision analysis tools to reduce or eliminate climate-related scientific or management uncertainties. The document needs to emphasize that the extra capabilities we are in need of are continual – because the process should be iterative over time. It is helpful to avoid “linear” models of science delivery if one wants to argue the case for consistent effort, stable programs, and continued funding.

The scientific needs are two types: 1) data needs, and 2) synthesis, incorporation, and modeling needs. Although only modeling is addressed here, it is important to advance and prioritize the empirical data collection that is necessary to support immediate and short term management needs, such as stock assessments (as noted in 4. above), and not have that completely overshadowed by robust climate change modeling.

NOAA Fisheries will need to acquire additional science and technical capacity for:

- modeling
- climate-based assessments
- vulnerability assessments
- decision analysis tools to reduce uncertainty

Each of these activities should be a relatively high priority for NOAA, NOAA Fisheries, and partners. Two areas that help in this regard (and could use additional highlighting and be expounded upon in the document) are 1) examples of tools to prioritize science information needs (i.e., identify critical research needs and data gaps); and 2) more explicit examples of tools to integrate analyses into and influence decision-making.

NOAA should consider a phased approach: what aspects of its science capacity must improve immediately, and what aspects can be improved over time (e.g. prioritization may link to a fish stock’s ecological or economic importance)? NOAA must accept limitations. Information will always be imperfect, and sometimes, imperfect information is acceptable. NOAA needs to think

about the costs and benefits of obtaining information and the utility of the data it gathers. Not every aspect of every ecosystem must be fully understood. Not every stock assessment has economic value. Moreover, the more data NOAA tries to assemble, the more likely there will be a time lag in the analysis of these data. Simply put, NOAA does not have the resources to analyze unlimited data. To the extent that partners can undertake work, NOAA should be willing to share the burden (see 8. below).

Three types of tools which help illustrate these points are:

- a. Decision tree or matrix (e.g. a simple four quadrant matrix to focus initially on NOAA Fisheries climate science management needs within areas of strong jurisdiction or authority; as well as to cultivate outside partnerships or to assist partners with their information needs).
- b. Models and process studies, with projections displayed as animations or “movies” (people easily understand these).
- c. Experimental approaches (shellfish/aragonite example – research in this area needs to be more robust; factors other than ocean acidification, such as changes in upwelling, rainfall, anthropogenic nutrient inputs, also contribute to changes in aragonite saturation.).

Other examples which could be added in the document:

- a. Adaptive Management (A/M) examples (show the process as circular rather than linear).
- b. Bayesian Belief Networks (BBN) or other structured decision-making/learning tools.
- c. Expert Elicitation/Delphi approaches. This could involve an A/M process with follow up research, monitoring, and adjustment. A key aspect of this approach is to document the process, expected outcomes, actual results, and lessons learned.

8. Partnerships

The *Climate Science Strategy* should acknowledge Federal partners (e.g. USGS, USFWS), as well as others (e.g. First Nations, academic researchers) to ensure these partners realize they are being asked to be on board with this strategy. Fortunately, NOAA does not need to do all the work by itself. NOAA funds or provides grants to cooperative institutes, academic institutions, and other non-governmental organizations. These entities should be consulted for their ongoing scientific climate enterprise and in the development of scientific priorities. New climate challenges will require a new way of working with partners. All of these entities should pursue new ways of information exchange, such as by developing shared databases. An inclusive approach to climate change information management will lead to more cost effective and more transparent results that may also be perceived as less biased. (See also Objective 7, Part B below.)

9. Link to the National Climate Adaptation Framework and its objectives

The *Strategy* could identify better linkages to the [National Fish, Wildlife & Plants Climate Adaptation Strategy](#) and its objectives¹. The objectives in this adaptation strategy are proactive and relate directly to management decisions. The document would be strengthened by mapping the seven NOAA Fisheries objectives onto the NCAS seven objectives in several areas that are discussed below. For instance, the NCAS seven objectives are consistent with NOAA Fisheries' EFH, ESA Section 7, and NEPA responsibilities and also address interactions of climate stressors, non-climate stressors, and habitat alterations, including loss of critical habitats and

¹ A concise Highlights document to the National Fish, Wildlife & Plants Climate Adaptation Strategy can be found here: <http://www.wildlifeadaptationstrategy.gov/pdf/Strategy-Highlights-Brochure.pdf>

habitat connectivity.

10. Make the science strategy operational not just aspirational

The document would be improved by relating overall objectives to operational guidance, rather than being limited to aspirations. The operational guidance could discuss how the strategy will be operationalized by stepping down to the regional (and partner) level in order to deliver clear results. The results should be focused on reducing climate risk and uncertainty. If including such operational guidance is not appropriate for this draft, then these steps should be outlined in a future implementation guidance which also outlines a clear time line for incorporation of objectives 1 to 7.

11. Capacity and Limitations

NOAA must understand its *capacity* to process the scientific information related to climate change. This requires an understanding of existing capabilities and a projection of future needs. For example, new data observation systems, laboratories, or computer modelling capabilities may be needed, and budgetary changes may be necessary. It should be noted that gathering climate change information now, is an investment that helps to avoid future expenses.

To assist with exercise, NOAA should review the *Strategy's* Chapter 3 actions, identify which actions involve investments and their specific budgetary requirements, develop timeframes for implementing the action, and tie each action clearly to one of the seven objectives. Also, as currently written, the *Draft Climate Science Strategy* seems to reflect the desires of the science team; NOAA managers and leaders need to engage in a review of this Draft Strategy to ensure the whole agency's perspective is reflected.

Unfortunately, in a climate changed world, the usefulness of historic data can vary. While it may be the best available data, it may be inadequate. Data need to be collected in ways that take advantage of new technologies and efficiencies, and is appropriate for the spatial and temporal extent of the problem. Existing data collection should be carefully evaluated and less frequent collection or analysis of data for one program might create opportunities to invest in new scientific information elsewhere. Internal and external peer review might help to identify appropriate changes in data collection and analysis. In addition, any redundancies in the data collection need to be eliminated. Finally, NOAA needs to remain open to the use of data collected by other public and private entities, even for regulatory decisions, if that information is the best available.

B. Comments organized by the objectives established by NOAA in the Strategy

Objective 1: Identify appropriate, climate-informed reference points for managing LMRs.

- Describe how the process of determining “biological reference points” actually works. Biological reference points are actually not points but rough estimates of system capabilities or limits. It may be better to think of them as “climate informed reference conditions.” Some of the most useful reference points may not be immediately linked to short term management objectives.
- Add “habitat” to the first bullet of this objective (“Identify ecosystem-based reference points that include climate change and ecosystem information for all LMR management plans and strategies”... and their habitats.)
- Identify appropriate reference points needed for international treaty requirements.
- Ensure current and any future reference points take into account both the common and distinct needs of commercial, subsistence, and recreational fisheries and

marine-dependent communities.

Objective 2: Identify robust strategies for managing LMRs under changing climate conditions.

- Climate stressors (ocean acidification, storm surges, alteration of upwelling, changes in ocean currents, etc.) are not happening at the same rate or with the same impact, and this has tremendous implications for LMRs and LMR ecosystems. This is alluded to at least twice in the document, but would be strengthened by incorporating follow-through on these matters, such as measuring of impacts, risk assessment prioritization and refinement, indicator development, and response strategies.
- Support the emphasis on the use of Management Strategy Evaluation as a way to identify robust management measures in the context of a changing climate.
- Identify strategies to include non-marine resource use and impacts in marine integrated ecosystem assessments (i.e., agriculture competition for fresh water; climate change is exacerbating old conflicts so a new paradigm must be created).
 - Encourage scientific strategies to identify and protect marine, coastal, estuarine, and riverine critical habitat, especially strategies which may also mitigate risks from climate change.
- Research aspects of population structure of fisheries to support strategies that distribute fishing effort across sub-stocks, age classes, and genetically distinct populations in an effort to preserve the potential for fish populations to adapt.
- Develop the capacity to critically examine the costs and benefits, including health and mitigation costs, incurred in substituting natural environments, i.e., wild stock vs. farmed stock and adaptations to climate fluctuations.
- Utilize modeling technology that can realistically illustrate cause and effect of shifting regimes.

Objective 3: Design adaptive decision processes that can incorporate and respond to changing climate conditions.

- Identify interim and long term strategies for sector/communities to get timely and adequate information for making adaptive changes.
- Accurately portray the adaptive management process. The current adaptive (management) framework in the document is portrayed as a linear process of altering biological reference points. This is not consistent with adaptive management process. AM is continual, circular, and evolving.
- Incorporate local and traditional knowledge (LTK) and traditional ecological knowledge (TEK) for adaptive and pre-emptive practices as well as identifying cumulative impacts:
 - Research existing oral and written histories.
 - Maintain continual dialogues with Native American tribes.
 - Increase LTK and TEK data collection.
 - Research adaptive measures from world history
- Research existing adaptive practices from around the world.
- Create greater dialogue on the significance of impacts of *marine* changes on *non-coastal* terrestrial ecosystems, i.e., how ecosystems integrate and what this means to in-land adaptive measures.
- Conversely, create greater dialogue on climate change impacts on marine systems to non-coastal terrestrial ecosystems.
- Enhance methods of data recording and transfer to real time information systems.
- Undertake “research on the research,” that is, actively investigate how the information generated by the research strategy is being used, including how

perceptions of risks are affected by improved measures of risk.

Objective 4: Identify future states of marine, coastal, and freshwater ecosystems, LMRs, and LMR -dependent human communities in a changing climate.

- Since this is the most critically needed outcome of research and analysis, the steps listed on page 36 as “important strategies” is an important start.
- Build on these strategies by identifying better ways to integrate with many systems throughout the world and translating to fisheries, marine, and community managers everywhere.
- Develop measures of vulnerability to change in communities and industries and extend to creating models of what the socioeconomic responses to the ecological and management changes may be.

Objective 5: Identify the mechanisms of climate effects on ecosystems, LMRs, and LMR-dependent human communities.

- On p. 39 of the draft *Strategy* it is noted, “NOAA Fisheries’ current capacity to conduct process-based research will not meet the demand for understanding how aquatic species, ecosystems, and LMR-dependent human communities may respond, acclimate or adapt to climate change.” This says it all and is the critical message for garnering necessary support for NOAA to increase its capacity.
- Particularly needed are the data and analysis of changes in LMR-dependent communities, including both coastal communities and fisheries related industries that will lead to improved understanding and prediction of social and economic changes resulting from the ecological effects of climate change.

Objective 6: Track trends in ecosystems, LMRs, and LMR-dependent human communities and provide early warning of change.

- Increase, establish, and invest in community-based or citizen science monitoring systems, with uniform protocols (e.g. Alaska Community Based Monitoring Systems, or CoCoRaHS, the Community Collaborative Rain, Hail, and Snow network), and identify key geographic areas (marine and riverine) to target their establishment.
- Develop uniform protocols for community-based monitoring to feed into integrated data sets.
- Identify key indicators to track and monitor (e.g. changes in occurrence or prevalence of diseases in wild fish populations; this might include working with USFWS and USDA to expand the National Wild Fish Health Survey). Identify key environmental indicators of change in important habitats and their impacts on marine environments.
- Integrate a model for identifying major signs of long-term change in distinct geographic socio-ecological systems combined with larger systems.

Objective 7: Build and maintain the science infrastructure needed to fulfill NOAA Fisheries mandates under changing climate conditions.

- NOAA should review the actions in Chapter 3 of the draft *Strategy*, identify specific budgetary requirements, timeframes for implementation, and prioritize them.
- Increase partnerships (as noted) with other federal agencies, state governments and agencies, coastal and riverine communities, environmental NGOs, tribal governments, universities, international organizations, etc., to integrate existing

- science.
- Increase the budget of NMFS's Social Science Branch and expand its National Standard 8 responsibilities to include social indicators relevant to climate change.
 - Identify *new* constructs for continual data collection, analysis and data sharing among sectors.
 - Use socio-economic data already collected and distributed by public agencies to track socio-economic changes.
 - Include research of resources use in subsistence communities. Subsistence resource use is essential to the discussion of *real economies* based on their extreme remoteness from straight cash economies.

C. Additional Comments on Socioeconomic Research to Meet Strategic Objectives

There is a variety of socioeconomic research strategies that should be considered to address the objectives described in Section B:

1. Vulnerability Analysis

Analysis of the vulnerability of LMR-dependent communities depends first on defining them. Landings data, combined with data on the regional economies such as contained in the NOAA Economics-National Ocean Watch (ENOW)/ National Ocean Economics Program and the social indicators developed by NMFS's Social Science Branch can provide first-order measures of fisheries dependence for most commercial fisheries.

These data can also be used to approximate measurement of recreational fishing dependent communities, though survey data on marine recreational fishing will be needed to provide additional detail.

National studies can be done using these data down to the county level to identify relative levels of LMR dependence. As the data used for these studies are regularly produced, the construction of vulnerability indexes along these lines will provide both a picture of current vulnerability but allow tracking of changes over time.

Subsistence fisheries in native and indigenous communities need to be included in this analysis. Data sources for these investigations, such as Census data, will have to be supplemented with field research. Subsistence fishing is a primary issue in Alaska, but subsistence fishing as an important part of the diet among native and indigenous communities is in fact common in the entire US and in the Pacific islands.

Subsistence fisheries are also not confined to native and indigenous communities. Low income people in U.S. coastal communities, particularly in urban areas, frequently supplement their diet with fish. These consumers are relatively under studied outside the public health field.

For proper vulnerability analysis we need a better understanding of organism-level impacts, especially the impact of ocean acidification on calcifiers.

2. Industry Analysis

Investigations of climate change impacts on fisheries focus on changes in the ecosystems that will affect possible levels of catch, but there will also be changes in the commercial fishing industry in response to the ecological and biological changes. The ecological and biological changes will interact with changes in the industry to create new economic structures in harvesting, processing, and distribution. Little is known about how these changes will take

place largely because the climate-induced changes are only recently beginning to show up in the economic systems. This raises two questions:

- a. What changes are occurring?

The strains on the commercial fishing industries resulting from overfishing and restrictions required for stock management have resulted in a variety of adaptations to changing conditions in timing of activity, gear and other technology, and markets. These changes point to possible directions of responses related to climate change and need to be more systematically understood. Given the variety of industrial organizations within U.S. fisheries, this research will need to be carried out over several years.

It should also be noted that many of these same questions about how adaptation will occur might apply to subsistence fisheries. Local and traditional knowledge is critical to understanding past changes and adaptation in subsistence societies that may help understand responses to climate change. Other more formal theoretical frameworks will have to replace industrial organization, such as community development, for this research.

- b. What changes should occur?

Changing fisheries response to climate change will raise the policy question: what should government's role be in assisting LMR-dependent communities and the fishing industry itself? Previous efforts have mostly focused on compensating losses and shifting people out of the fishing industry to reduce effort. Future changes may require more active intervention in reshaping industries and communities. A first step in such efforts will be identifying social preferences and values within fishing communities.

The most applicable economic framework for potential policy in this area is the work on innovation and economic networks, often called "cluster theory." This field moves beyond traditional impact analysis of the type that has typically been done in relation to management plans by focusing on how networks of industry, government, educational, and other institutions work to encourage a sustained level of innovation in economic activity through new technologies, products, and markets. Working with other government agencies that regularly operate in this space, such as the Economic Development Administration in DOC and the Rural Development Administration in USDA, NOAA should investigate how and where government (Federal, state, and local) policies can foster innovative adaptations in industries and communities.

3. Understanding perceptions and preferences for risk of decision makers and stakeholders in fisheries management.

The *Science Strategy* implicitly defines the problem of fisheries adaptation to climate change as a problem in risk management with the intention of greatly increasing the measurement and understanding of the risks from climate change and to the fisheries. This is an essential element in fulfilling NOAA Fisheries' missions, but improved measures of risk have been shown to be inadequate to assure effective responses. The example of climate change as a larger issue in society demonstrates this problem clearly.

To the extent that NOAA wishes to fully understand the challenges of climate change, the concept of risk needs to be extended to the perceptions of risk and to preferences for risk among the decision makers and stakeholders involved in the policy process. Developments in the understanding of how people perceive risks and how risks are communicated such as

prospect theory and status quo bias over the past two decades have altered understandings of the economics of risk and shown that even the best measurement of risk may not be sufficient.

Over time, NOAA should engage researchers with backgrounds in the social analysis of risk to monitor the development and communication of risk data within the fisheries management community (government, industry, and other stakeholders) to understand how different participants see the risks associated with different projections of climate change, impacts, and responses. The goals of this research will be to understand how people respond to changes in measured risks in order to improve communication of the risks and to identify gaps between the outputs of the research strategy as a whole and decisions incorporating the results of that research.