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The Restructured North Pacific Groundfish and Halibut Observer Program

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NOAA FISHERIES

The Restructured North Pacific Groundfish and Halibut Observer Program

Craig H. Faunce, FMA Division

New regulations governing how observers are deployed into the fisheries of Alaska became effective on 1 January 2013. Amendment 86 to the Fisheries Management Plan (FMP) of the Bering Sea and Aleutian Islands and Amendment 76 to the FMP of the Gulf of Alaska establish the new North Pacific Groundfish and Halibut Observer Program (Observer Program). The new regulations change how observer coverage is funded and the observer coverage requirements for vessels and processors. These changes will increase the statistical reliability of data collected by the program, address cost inequality among fishery participants, and expand observer coverage to previously unobserved fisheries. These changes are necessary to successfully manage Alaska's billion dollar fisheries industry.

Vessels less than sixty feet in length and those that fish for Pacific halibut are included in the new Observer Program.

The new Observer Program restructures and replaces what was originally considered an "interim program," which lasted for 23 years. Broadly speaking, under the interim program, vessels and plants paid for observers by the day at coverage rates specified in law based on *days in a calendar quarter* at-sea (not fishery as is often assumed) and on *tons processed* for shoreside processors. Under the interim program, catcher vessels between 60 and 125 ft in overall length were allowed to self-select which trips were to be observed. Because vessels less than 60 ft or those targeting Pacific halibut were not observed, the former static regulatory structure of observer coverage created not only an incentive for owners to change the length of their vessels (indeed a disproportionately high number of 124 ft and 58 ft vessels exist in the fleet), but also created a mechanism for owners, because of self-selected trips, to skew observer coverage towards trips with lower bycatch rates (e.g. pollock) and away from those with higher bycatch rates (e.g. most flatfish fisheries).

The 2013 Observer Program is the result of the third attempt by the National Marine Fisheries Service (NMFS) to restructure the interim program since 1990. This recent effort began with a 2008 Council problem statement, involved more than 53 individuals from five agencies, and took 5 years to accomplish. The new program places *all* vessels and processors in the groundfish *and halibut* fisheries off Alaska into either full or partial coverage categories. No operations are exempt from the new program. Vessels and processors in the full coverage category will continue to obtain observers by contracting directly with observer providers. Vessels and processors in the partial coverage category will obtain observers through NMFS, paying a fee on landings to cover costs.

The full-coverage category now includes:

- catcher/processors (CPs) (with two exceptions),
- motherships,
- catcher vessels while participating in American Fisheries Act (AFA) or Community Development Quota (CDQ) pollock fisheries,
- catcher vessels while participating in CDQ groundfish fisheries (except sablefish and pot or jig gear catcher vessels),
- catcher vessels while participating in the Central Gulf of Alaska Rockfish Program (RP), and
- inshore processors when receiving or processing Bering Sea pollock.

Vessels and processors now in the partial coverage category include:

- catcher vessels designated on a Federal Fisheries Permit (FFP) when directed fishing for groundfish in federally managed or parallel fisheries, except those in the full coverage category,
- catcher vessels when fishing for halibut IFQ or CDQ,
- catcher vessels when fishing for sablefish IFQ or fixed gear sablefish CDQ, and
- shoreside or stationary floating processors, except those in the full coverage category.

Halibut vessels such as this one will be subject to observer coverage in 2013.

The new Observer Program establishes greater coverage requirements for those vessels with the potential to take long trips (catcher/processors), compared to catcher vessels that cannot take long trips because of the potential for catch spoilage. Regulatory changes bring new catcher/processors less than 60 ft into the Observer Program because the full coverage requirement for catcher/processors and motherships is based on specific operating endorsements issued by NMFS on a vessel's FFP (and not its length). The full coverage requirements that remain for some catcher vessel operations represent those inherited from existing catch-share programs or required for detailed quota accounting (e.g. AFA, A80, RP, and CDQ). Catcher vessels greater than 125 ft that were previously fully observed can move to partial coverage under the new program if they participate in certain target fisheries such as pollock in the Gulf of Alaska.

How vessels in partial coverage attain their observers in the new program represents a major change from the previous program. Under the new Observer Program, coverage requirements for the partial coverage category are specified in an Annual Deployment Plan (ADP). The intent of the ADP is not to adjust policy, but rather to focus on science-driven deployment to reduce potential bias and meet NMFS's data needs. The allocation strategy used to deploy observers in the partial coverage category is the principal aspect of observer deployment that can be adjusted through the ADP. The ADP process is initiated as a science-based recommendation through committee that is vetted into an initial draft document by the Alaska Fisheries Science Center's Fisheries Monitoring and Analysis (FMA) Division and the Sustainable Fisheries Division of the NMFS Alaska Regional Office. The initial draft ADP is then presented to the North Pacific Fishery Management Council at its June meeting. NMFS will subsequently analyze Council recommendations and release a final draft ADP by 1 September. The final draft ADP is then presented to the Council's plan teams in September, the Council's Scientific and Statistical Committee (SSC), and the Council itself in October. Based on accepted minor Council recommendations to be made in October, a NMFS final ADP is then issued for the following year. Under a compressed implementation schedule, the 2013 ADP was first presented as a draft to the Council's observer advisory committee, plan teams, and SSC during September-October 2012, was updated following Council recommendations in November, was presented to the Council in December, and was finalized and released in January 2013.

The 2013 ADP defines three pools of vessels within the partial-coverage category by the way that observers are deployed. In the first, termed the *zero coverage pool*, NMFS has placed jig vessels and vessels less than 40 ft under the rationale that these vessels do not harvest large amounts of fish, and small vessels may be challenging to observe. In addition, state guideline harvest level (GHL) fisheries are outside of the jurisdiction of NMFS and the Observer Program. In the second partial coverage pool, termed the *vessel selection pool*, vessels greater than or equal to 40 ft and less than 57.5 ft are selected at random by the FMA Division every 2 months based on prior activity. This means that vessels with a history of fishing in multiple 2-month periods have the chance of being selected for observer coverage more than once during the year. Selected vessels are required to carry observers for all their trips during their selected 2-month period. The observer data from selected vessels should be representative of fishi ng by unobserved vessels because for the observed vessel, there is nothing to be gained by taking unrepresentative or shorter trips since observer coverage cannot be avoided for up to 8 weeks. Following Council recommendations, NMFS is targeting a sample size (number of vessels to be observed) in this pool for 2013 that is equivalent to 11% of the number of vessels that fished in the most recent full year at the time the draft ADP was written (i.e., 2011). Between 9 and 25 vessels are expected to be observed for each 2-month period in 2013. For the first 2 months of 2013, nine vessels were selected. Of these nine, two did not have FFPs, one vessel surrendered its FFP to avoid observer coverage, two vessels had not made landings, one vessel decided to fish in violation of its coverage requirements, and three vessels carried observers. The first observer in the vessel selection pool was deployed onto a 53-ft vessel on 3 January 2013. With better data and continued cooperation between the FMA Division and Alaska Regional Office's SF Division, the FFP issue has been corrected and the second draw of 29 vessels for the period of March-April 2013 has been made.

Vessels greater than 57.5 ft constitute the *trip selection pool* of partially covered vessels. These vessels must log each intended trip into an Observer Declare and Deploy System (ODDS, available online and by phone) to determine if they require an observer. Trips are randomly selected at a rate determined from simulations of past effort and anticipated funds in the Annual Deployment Plan. Following Council recommendations, NMFS is targeting a number of observed trips that is equivalent to 14%-15% of the number of trips logged into ODDS. Because trips are logged 72 hours in advance, the observer provider has time to deploy an observer to the vessel, but the vessel does not have a great deal of notice to manipulate trip coverage. Cancelling a trip that has been selected for observer coverage triggers the vessels' next logged trip to be selected for coverage. If a vessel cancels only "to be observed" trips and continues to log additional trips, it will quickly end up having only "to be observed trips" logged. To reduce the amount of uncertainty in the system, ODDS has a three open trip limit, meaning that after three trips logged, a vessel must update their logged trip with landing information.

On 4 January 2013, the first observer was deployed in the trip selection pool onto a 58-ft vessel. In the first 12 weeks of this year, more than 1,200 trips had been logged into the ODDS, and more than 230 trips were selected for observer coverage. Although both trawl and non-trawl trips are selected at the same rate, observer coverage rates of trips that have been realized (not cancelled or released from coverage) after the first 12 weeks of 2013 was near 17% for trawl compared to approximately 14% for non-trawl trips. This discrepancy was because early in the year some selected trips could not be observed and only non-trawl fisheries were open at the time. In the 3 months of operation, the combined rate among gear types for realized trips is near 16%.

FMA analysts are checking the performance of the new Observer Program. This effort enhances collaborative efforts among the FMA Division, the Alaska Regional Office, and NOAA's Office of Law Enforcement. The first check compares vessel landings in the vessel-selection pool made under federal authority with observer data. Any unobserved landings are referred to the Office of Law Enforcement. Another check is to verify that the ODDS system is working properly and that the random number generator is performing as expected for each trip. While these checks ensure that the scale of potential biases with respect to observer coverage are known, additional comparisons of actual vs. predicted coverage amounts are also carried out. These additional comparisons are conducted to inform NMFS about potential financial shortfalls that may occur if effort by the fleet or the selection rate is particularly high relative to years past. Plots of daily and cumulative selection rates help in these evaluations (Fig. 1).

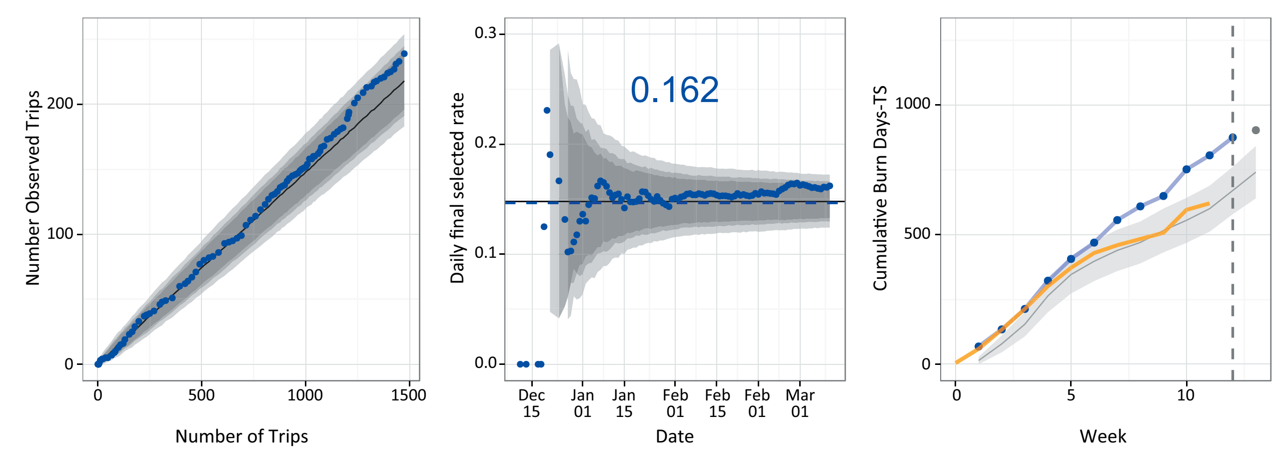


Figure 1. These plots are examples of how FMA analysts are tracking the new Observer Program. These plots are for the trip-selection pool of vessels. Panels depict the cumulative number (left panel) and rate (center panel) of selected trips logged in ODDS after cancelled and release-from-coverage trips are considered. Black lines depict expected values under perfect selection (selection = programmed rate) and shadows depict expected 90th, 95th, and 99th percentile bounds. The right panel depicts the cumulative number of days expected to be invoiced by calendar week in the trip-selection pool compared to projections made in the 2013 ADP (black line with gray 95th percentile bounds). Blue points in the right panel denote days in ODDS, whereas those in orange indicate days from observer data in the FMA database, which lags those in ODDS. As of week ten of 2013, the combination of a higher than expected selection rate and fleet effort has resulted in greater anticipated expenditures than was anticipated.

Observers work in a variety of conditions in close quarters with the crew. It is important that there is a good working relationship among people onboard.

Square peg, round hole

As the interim Observer Program's 23-year history will attest, it has been difficult for NMFS to gain control over where observers are deployed and to enact a new method for funding the Observer Program. An historic Council vote in October 2010 to restructure the Observer Program was unanimous, and the Council's support of the restructured program has continued through implementation. However, the Council did make some exceptions to the new program's general requirements in order to address constituent issues.

In the first exception, processing vessels that meet specific criteria may choose whether they wish to belong to the full or partial coverage category. The criteria for this exception is defined by the Council as "catcher/processors less than 60 ft. LOA with a history of catcher/processor and catcher vessel activity in a single year from January 1, 2003, through January 1, 2010 or any catcher/processor with an average daily groundfish production of less than 5,000 pounds round weight equivalent in the most recent full calendar year of operation from January 1, 2003, to January 1, 2010." Two vessels appear to meet the criteria under this exception. This exception creates unique challenges for NMFS in implementing the program. For example, both of these vessels have decided to be in partial coverage, meaning that special trip definitions are required for these vessels since the new regulations define a trip as ending when all harvested fish onboard have been delivered (Clearly, this regulatory definition does not fit well with vessels that process fish on-board).

Important dates of Restructure

1990

First year of fully domestic fishing operations in Alaska.

NMFS and Council establish an "interim" observer program.

First attempt to restructure the program is initiated (Research Plan). This plan proposed to collect ex-vessel revenue and deploy observers once enough funds had been collected.

1992

Council adopts the Research Plan

1994

NMFS implements Research Plan

1995

Council repeals the Research Plan and directs NMFS to refund collected fees ($5.5 million)

1996

Council adopts interim observer program requiring coverage through 1997

1997

NMFS begins to develop a joint partnership agreement (JPA) with the Pacific States Marine Fisheries Commission to procure observers.

Council supports JPA (to be effective in 1999) and votes to extend the interim observer program through 1998.

1998

JPA approach is abandoned. Council extends the interim program through 2000.

2000

Council extends interim program through 2002. NMFS works with Councils Observer Advisory Committee (OAC) to develop an alternative program during that time.

2002

Council extends interim observer program through 2007.

2006

Second attempt to restructure the program is initiated. NMFS presents a regulatory amendment package with alternatives to the interim program.

Council removes the sunset date of the interim observer program due to the cost and statutory issues raised by the 2006 proposed program.

2008

Third attempt to restructure the program is initiated. Council tasks NMFS to develop a discussion paper to reevaluate the issues that were raised in the 2006 observer restructuring analysis.

Council approves a problem statement for the restructuring of the observer program and adopts moving forward with the effort.

2009

OAC and Council review the NMFS implementation plan and ask for further revisions.

2010

OAC and Council review the NMFS revised implementation plan and initial review draft analysis. The analysis outlines various phases of any observer program development based on available funding and data.

Council unanimously adopts its preferred motion to restructure the observer program. Motion specifies a full and partial coverage category, what fishing operations belong in each, a 1.25% fee to fund the future program, outlines how prices will be established, and how NMFS will report on the progress of the new program.

Council requests NMFS for start-up funding for the first year of the new observer program.

NMFS begins outreach efforts in Seattle, Kodiak, Homer, Sitka, Petersburg, Juneau, and Sand Point.

2011

NMFS presents white paper on Electronic Monitoring to Council.

NMFS presents the proposed rule and regulations to restructure the observer program to the Council.

Council deems proposed final regulations to be necessary and appropriate.

Council again requests NMFS for start-up funding for the first year of the new observer program.

2012

NMFS presents its 2013 Annual Deployment Plan (ADP) and development plan for EM to the Council and their Plan Teams and Committees. The ADP specifies that observers will be deployed by NMFS among trips or vessels.

Industry members petition the Council to delay full implementation of human observers on previously unobserved boats.

Council reiterates its support for the new observer program and the 2013 ADP, but recommends NMFS prioritize coverage to vessels in trip-selection that are managed by Prohibited Species Caps (PSC), reduces the time required for vessels in vessel-selection to carry an observer by a third, and asks that voluntary coverage requirements be considered.

Council requests further clarification of EM in proposed rule.

After analysis, NMFS provides letter to Council specifying how coverage probabilities and durations have been altered between the trip- (>57.5 feet catcher vessels; CVs) and vessel-selection (40-57.5 feet CVs) pools in the partial-coverage category.

NMFS obtains approximately $4M to fund the new observer program for the first year.

NMFS selects an observer provider for the partial coverage category vessels from competitive bid.

NMFS makes first selection for which vessels in the vessel-selection pool will carry an observer during January-February 2013.

NMFS launches the web-based Observer Declare and Deploy System (ODDS) and initiates a contract to a phone bank to log trips and randomly assign observers within the trip-selection pool.

NMFS solicits volunteers for an EM pilot study to be conducted on boats in the vessel-selection pool.

NMFS initiates contract to deploy EM on voluntary vessels in 2013.

Proposed and Final rules are published in the Federal Register as BSAI Amendment 86/GOA Amendment 76. The observer program is restructured.

NMFS conducts outreach events in Seattle, Anchorage, Petersburg, Homer, Kodiak, and Newport (OR).

Fourteen fishing groups voice their lack of support for full implementation of the restructured program to the Alaska Congressional Delegation.

Alaska Congressional Delegation petitions Acting Secretary of Commerce to not place observers on vessels in the vessel-selection pool until an EM alternative is available.

A lawsuit is filed on the new observer program.

2013

The 2013 (restructured) Observer Program is launched. For the first time, observers are required on vessels less than 60 feet in length, including those that fish for Pacific halibut. Deployment under the NMFS contract is determined by random sampling vessels and trips. Over 450 trips are logged into ODDS in the first two weeks.

NMFS conducts outreach events in Ketchikan, Sitka and Juneau.

NMFS makes second selection for which vessels in the vessel-selection pool will carry an observer during March-April 2013.

A fishing association asks Council to have NMFS base the 2014 ADP on poundage, not effort.

In the second exception, catcher/processors that processed no more than 1 metric ton (t) round weight of groundfish on any day (up to a maximum of 365 t per year) in the previous calendar year are not required to carry full observer coverage. This exception was made by NMFS to facilitate small levels of processing which is a current practice on some boats.

A third exception was requested in October 2012—just prior to implementation of the new program. The Council requested and NMFS developed a mechanism to allow 100% observer coverage for the Bering Sea-Aleutian Islands Pacific cod catcher vessel trawl fleet during the 2013 season, with the additional costs to be borne by thae vessel owners. This exception was designed to avoid the vessels' uncertainty of potentially having to wait for an observer to be deployed, as well as to improve the fleet's own bycatch management efforts. While many vessels participated in this exception, some did not.

New opportunities and new challenges

One of the greatest benefits of the new Observer Program is that NMFS now has the ability to provide reliable estimates of catch of all species (including discards) from vessels less than 60 ft in length including vessels participating in the Pacific halibut fishery. However, some members of the fleet remain strongly opposed to implementing the new regulations despite the exceptions listed above. This opposition has posed the greatest challenge to implementing the new program. Before the close of the year 2012, 14 fishing groups petitioned the Alaska Congressional Delegation to urge NMFS to delay implementation of the new program on small boats until NMFS resolves outstanding deployment issues and implements electronic monitoring, specified as cameras. At the same time, The Boat Company (a charitable education foundation and Alaska non-profit corporation that engages in recreational fishing for salmon and halibut for their clients) filed suit against NMFS, citing that the new program fails to achieve minimum levels of coverage needed to generate statistically reliable estimates of bycatch in the Gulf of Alaska. A new group called the Fixed Gear Alliance filed a motion to intervene in the lawsuit and represent the interests of commercial longline, pot, and jig fishermen. Yet despite these pressures, the Council reiterated its support for the restructured Observer Program and the 2013 Annual Deployment Plan at its December 2012 meeting.

The direct contract between NMFS and an observer provider also brings new opportunities and challenges for the program. NMFS has awarded a competitive contract to A.I.S., Inc. to recruit, hire, and deploy observers onto partial-coverage vessels. Fortunately, A.I.S., Inc. has past experience deploying observers on smaller vessels and its staff is familiar with the process. However, the development and management of such a large-scale contract required that FMA provide additional contract training to staff. In addition, effectively managing the multiple components of the new Observer Program has proved to be challenging. For example, while the ADP provides a mechanism for the Agency and the Council to continuously update the Observer Program, changes to the plans or deployment rates that can impact the observer provider may require contract modifications, which in turn can incur additional costs in both time and dollars. The initial contract with A.I.S. Inc. will likely be rebid and refined in 2014. NMFS may consider a longer-term contract for observer providers in the partial-coverage category in the future.

Observers collect information on species that would otherwise not show up in catch reports.

Is it worth it?

Given the extensive time and resources required to restructure the Observer Program, it is reasonable to ask the question "is all of this worth it?" To address this question we need only to revisit the five issues listed in the Council's 2008 problem statement that was the basis for restructure of the Observer Program.

First, the Observer Program was restructured to reduce bias in observer data introduced through self-selection of coverage. Excluding behavior that cannot be legislated in a sampling design once an entity is observed, a reduction in observer data bias is enabled through new random-selection processes. In theory, observer data should be proportional to fishery effort, ensuring a representative sample, and in practice, this seems to be taking place. According to Mary Furuness, in-season manager at the Alaska Regional Office "Observer data this year seems to be spread more evenly among gear types and areas compared to last year, which helps to ensure that each gear type is getting their appropriate bycatch rate."

Second, the new program provides collection of observer data from sectors that previously had no observer coverage requirements, such as the Pacific halibut fishery. The Councils' joint plan teams have been advising stock assessment scientists for several years to include an independent estimate of the bycatch of groundfish in the Pacific halibut fishery. This estimate is partially derived from International Pacific Halibut Commission survey data and is provided to stock assessments in order to comply with Annual Catch Limit reporting requirements. New NMFS catch estimates derived from the 2013 Observer Program should replace the Halibut Fishery Incidental Catch Estimate.

Third, the structure of the new program allows fishery managers to provide observer coverage in response to the management needs and circumstances of individual fisheries. Such a process already was put in place when the Council asked NMFS between October and December 2012 to focus the at-sea sampling originating from the trip-selection pool within fisheries that have Prohibited Species Caps. Fourth, cost-inequities associated with the old program are now addressed by a broad-based fee (currently at 1.25% of ex-vessel value) for all partial-coverage participants which will fund observer coverage in future years.

Finally, the new program will continue to provide scientists with data critical for the conservation and management of fisheries and ecosystems in the North Pacific- none of which are currently experiencing overfishing or are overfished.

Alaskan groundfish have been considered among the most successfully managed fisheries in the world, and the new Observer Program represents an important, necessary, and long-overdue improvement to the quality of the data used to earn that distinction. Considering that Alaskan groundfish account for nearly half of the weight of total U.S. domestic landings and is valued at over $2 billion, it seems that all the effort to restructure the Observer Program was, and will continue to be- worth it. More information on the new Observer Program is provided on the Alaska Regional Office's website and within this summary poster.

Marine Ecology & Stock Assessment Program

Recompression Experiments on Rougheye Rockfish with Barotrauma

Because rockfish (*Sebastes* spp.) are physoclystic, i.e. their gas bladders are closed off from the gut, they often suffer internal barotrauma injuries from rapid air expansion in their tissues when brought up from depth. Many rockfish released at the surface do not survive, either because they cannot submerge due to excessive buoyancy or because of internal damage. There is some evidence that recompression may greatly increase the survival of barotrauma-injured rockfish. However, survival can be species-specific; therefore, it is important to gauge the impacts on each species of interest. Research completed during 2010-12 demonstrated that rougheye rockfish (*S. aleutianus*), caught at depths from 500 to 900 ft and exhibiting barotrauma, can survive if recompressed after capture. This result is noteworthy because it is the deepest known successful capture and recompression of any rockfish species, which suggests there is potential to conduct scientific tagging studies to track movements and behavior of deepwater rockfish species.

All fish brought to the surface exhibited some external signs of barotrauma including exophthalmia ("pop-eye"), an everted esophagus, and ocular emphysema (air bubble under the cornea). In 2011 and 2012, we tagged and released 130 fish at approximately 200 ft, and 46 others were recompressed in portable pressure tanks and slowly brought back to surface pressure. All but one fish were brought to surface pressure over approximately 48 hours. Using a 48-hr schedule, no fish larger than 54 cm survived. One large fish was given roughly 96 hours in the tanks and survived with the longer depressurization schedule. After repressurization in the tanks, fish no longer had exophthalmia or an everted esophagus. In many cases, ocular emphysema also disappeared. Of the 46 fish, 23 survived long-term and were monitored in the laboratory through January 2013.

In January 2013, 21 of the 23 surviving fish were sacrificed. Eyes and internal organs were observed for signs of previous barotrauma. In addition, gonads were sampled for histological slide preparations to examine maturation. As of this writing, slides are still being prepared, but to the naked eye gonads did not appear to be maturing, even though we would expect gonads to be maturing and enlarging in preparation for spawning in January. Many fish had repaired swim-bladders that were holding air (Fig. 1). Two of the larger surviving fish (54 and 65 cm) were fitted with non-functional satellite tags and held in the laboratory to determine if larger rougheye rockfish could tolerate these tags. After a duration of 2 months, both fish survived and were negatively buoyant (Fig. 2). One was sacrificed in March and the other is being displayed in an aquarium.

In 2013 plans are to sample in the same area that was sampled in 2011 and 2012 to look for tagged fish and to deploy satellite tags on additional rockfish captured with longline gear. The objectives are to determine if released fish can survive being caught, tagged, and returned to depth.

For more information, contact Cara Rodgveller at (907) 789-6052 or cara.rodgveller@noaa.gov.

By Cara Rodgveller

Figure 1. Photograph of an inflated rougheye rockfish swim bladder after capture, repressurization, and holding in the laboratory for 1.5 years. Note the herniated red area on the left side of the swim bladder, which is likely a healed barotrauma.

Figure 2. Rougheye rockfish that has been caught, repressurized, held in the laboratory for 1.5 years, and fitted with a satellite tag.

The Spiny Issue of Ageing Spiny Dogfish: Historical Dogma vs. New Methods

The dogma of using the dorsal fin spine to age spiny dogfish (*Squalus suckleyi*) has been in existence for over 30 years. With these well established methods, the species has a rather long history of published literature on age and growth. However, a problem with this method is that the dorsal fin spine, which protrudes from the body, is sometimes broken and often worn, thus creating lost or difficult-to-read annuli. Recent research on an Atlantic congener (*Squalus acanthias*) found that a technique using histological staining of vertebrae thin sections made it possible to count annuli, thus eliminating the sources of uncertainty associated with worn spines. However, this vertebral method has yet to be tested in the much longer-lived North Pacific spiny dogfish.

The North Pacific Research Board funded a study to examine both ageing methods and to determine the best for use for spiny dogfish. This is a collaborative effort between the Center's Auke Bay Laboratories, Age and Growth Lab, and the University of Alaska Fairbanks, with inter-agency participation from the Northwest Fisheries Science Center and Washington Department of Fish and Wildlife. Our study examines both age structures (Fig. 1) and compares inter- and intra-reader as well as inter-lab variability in reading annuli to determine which method produces the most precise ages for the North Pacific spiny dogfish. Results suggest a substantial decrease in intra- and inter-reader variability when the vertebrae method is compared to the dorsal fin spine method. Preliminary analyses also show that there are multiple sources of measurement error when using the spine method, sources that do not exist with the vertebrae method, and that inter-reader variance increases substantially more with increasing sample age with the spine method than with the vertebrae method. Future work will include completion of sectioning, staining and reading of vertebrae and spines (for a total of almost 400 samples of each), readings by at least one more reader, marginal increment analysis, and an inter-lab exchange.

By Cindy Tribuzio

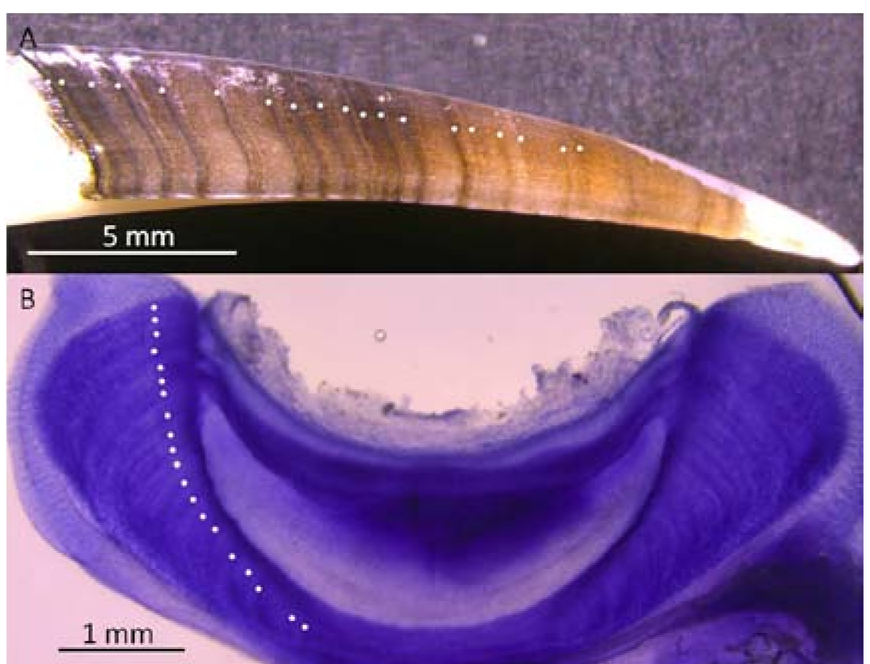


Figure 1. (A) Spine and (B) vertebrae thin section from the same animal. White dots denote annuli.

AFSC Survey and Fishery Data Available Through AKFIN

Fishery and survey data are now available online through *AKFIN* (Alaska Fisheries Information Network). Data sources include 1) the Auke Bay Laboratories (ABL) bottom-longline survey; 2) Fisheries Monitoring and Analysis (FMA) observer data; and 3) the NMFS Alaska Regional Office (AKRO) groundfish catch accounting data. AKFIN's mission is to consolidate multiple fishery data sources so that mangers and scientists can access data efficiently and in formats specific to their needs. In cooperation with ABL's Marine Ecology and Stock Assessment program (MESA), FMA, and the AKRO, AKFIN has developed reports that bring together in one location the data sources stock assessment scientists regularly use. These reports were developed specifically to fit staff data needs. New for 2013, reports that allow access to Resource Assessment and Conservation Engineering (RACE) trawl survey data are under construction and should be available in the near future.

As new needs arise, reports can easily be adapted and created. To create an account for accessing these reports, contact Robert Ryznar at Robert_Ryznar@psmfc.org. Contact Cara Rodgveller with questions about the web accessible reports (cara.rodgveller@noaa.gov, 907-789-6052).

By Cara Rodgveller.

FMA Prepares Observers for the 2013 Restructured Observer Program

The 2013 North Pacific Groundfish and Halibut Observer Program (Observer Program) implemented changes to how observers are deployed, how observer coverage is funded, and the observer coverage requirements for vessels and processors. These changes will increase the statistical reliability of data collected by the Observer Program, address cost inequality among fishery participants, and expand observer coverage to previously unobserved fishing sectors. The increased observer coverage will help ensure that the best available scientific data is provided to NMFS and the North Pacific Fishery Management Council to successfully manage our Alaskan fishery resources. Detailed information on the development and implementation of the 2013 Observer Program may be found at *http://www.fakr.noaa.gov/sustainablefisheries/observers/default.htm*; a summary of the changes is available in this issue's feature article.

The changes brought about by implementation of the 2013 Observer Program necessitated adjustments to many operations of the Fisheries Monitoring and Analysis Division (FMA), including new additions to our training curriculum in order to prepare observers for their work while deployed in Alaska. While the restructuring did not change the overall sampling work on a vessel, our efforts are now expanded to include smaller vessels and the Pacific halibut fishery. Our training needed to be revised to include preparation for work on small vessels that are new to observation.

The regulations implementing the new Observer Program became effective on 1 January 2013 and placed all vessels and processors participating in groundfish and halibut fisheries occurring in Alaskan waters into one of two observer coverage categories: 1) full coverage or 2) partial coverage.

The full coverage category is composed of the catcher-processor fleet, motherships, Bering Sea pollock vessels and processing plants, and the Gulf of Alaska rockfish fisheries. The partial coverage category is composed of catcher vessels fishing with a Federal Fisheries Permit for groundfish in federally managed or parallel fisheries (except those in the full coverage category), catcher vessels fishing for halibut Individual Fishing Quotas (IFQ) or Community Development Quotas (CDQ), catcher vessels fishing for sablefish IFQ or fixed gear sablefish CDQ, and shoreside or stationary floating processor (except those in the full coverage category).

The NMFS deployment plan for 2013 further established a zero coverage category. In 2013, the zero coverage category is composed of all vessels less than 40 ft. in length overall and vessels fishing with jig gear. This could change in future years.

Figure 1. Observers training with longline snap-gear.

The Observer Program provides all initial and recurrent training to prepare observers for their field deployments. All new observer candidates attend an initial 3-week training class which prepares them for work on full coverage assignments. An additional 4-day training session is then provided for those observers who are scheduled to be deployed on partial coverage assignments. We do have a large number of observers who are already trained and experienced who return for work each fishing year. These prior observers obtain new information needed for the job by attending an annual briefing designed to update them on changes.

Our Focus This Year: The Partial Coverage Fleet

While many of the vessels in the partial coverage fleet have taken observers before, many of the smaller vessels will be new to us. These new vessels can be more challenging for observers because of their smaller size, limited space available for sampling, and potentially short fishing sets which could reduce time for observers to complete their duties. Other challenges may include the quick pace of fishing effort, the lack of a NMFS logbook documenting fishing effort data, and fishing gear unique to vessels less than 58 ft length overall (LOA). While observers on full coverage vessels are typically deployed on a single vessel for several weeks, observers on partial coverage vessels are often on the vessel for only one 2-4 day trip. This shorter deployment results in less time for an observer to become familiar with the vessel and to accomplish all sampling duties such as collecting biological and fishing effort data. Last, the observer may be working with vessel personnel who are new to the program. To address these challenges, new training materials were developed by FMA staff to provide observers the tools and experience needed to collect data on these small vessels.

The new training material is designed to introduce partial coverage work protocols and issues to all observers who will board the new fleet. Our training utilizes new hands-on exercises that simulate sampling on a vessel in the field. The 4-day partial coverage class includes an additional 4-6 hours of training regarding all covered gear types (trawl, pot, longline) as well as 4 hours of training on a type of longline gear known as snap-gear (Figs. 1 and 2). Snap-gear is typically found only on vessels less than 58 ft LOA. Prior to 2013, observer coverage was not required for vessels less than 60 ft so this gear had not been encountered by observers. The new 4-day partial coverage training includes a suite of hands on exercises, reviews the sampling techniques covered in the 3-week training, highlights specific plant duties, highlights specific pollock catcher vessel duties, introduces longliners using snap-gear, and provides additional safety training with a focus on small vessels. The hands-on elements of the training are designed to simulate the observer's experience when faced with the challenge of collecting data on an unfamiliar vessel. An essential focus throughout the training is communication skills to facilitate data collections on vessels where the crew may not be familiar with observer duties. Role playing helps an observer learn how to communicate their data needs to the crew and prepares them for working in small quarters and tight work spaces on deck. Upon the new observers' completion of the 4-day partial coverage training, we believe that they are now ready to deploy and successfully collect the data essential to NMFS.

Figure 2. Observers practicing volumetric catch estimates.

Some of the Challenges in Partial Coverage

Catch and fishing effort data, species composition sampling, and biological samples form the foundation of observer data. Collecting some of this information on small boats can be more challenging. For example, vessels less than 60 ft LOA are not required to maintain a NMFS daily fishing logbook. Thus, the observer may need to obtain this key information directly from the captain or from the equipment on the boat. Successful data collection is dependent on the observer's ability to understand and communicate their needs to the captain of each vessel. To help facilitate sharing of data, FMA developed "fishing effort summary forms" which observers can provide to the vessel operator to facilitate data recording. These forms are designed to make it easy for the captain of a vessel to provide the haul data needed by the observer. Role-playing activities in class deal with the communications skills that are necessary to collect quality data in a diverse fishing fleet.

Our work to adapt our training to meet the new demands of partial coverage operations was challenging as it occurred in a short time period, with large numbers of observers being prepared for the new year. FMA staff and observers alike have adapted quickly to the new fleet and challenges it presents, and observers are just now returning from the first field deployments of 2013. Observers returning from the partial coverage vessels are providing our staff with important feedback to help us continue to improve our future training. As we move forward we will continue to adapt to meet the data collection needs for the Observer Program. It is an exciting and dynamic period for FMA.

By Paul McCluskey and Mike Vechter

Cetacean Assessment & Ecology Program

Genetic Evidence for Population Structure in Northern North Pacific Killer Whales

In accordance with the guidelines of the U.S. Marine Mammal Protection Act (MMPA), the National Marine Fisheries Service (NOAA Fisheries) consults annually with Scientific Review Groups to prepare assessment reports for marine mammal stocks in U.S. waters. These reports include a description of the stock's geographic range, estimates of population size and trends, and the current stock status. Stock Assessment Reports (SARs) are used to determine allowable levels of "takes" of marine mammals incidental to various anthropogenic activities and are also used to determine the scope and scale of necessary conservation measures. One critical element necessary to meet the objectives of the SARs is an accurate characterization of the stock being assessed, and for highly mobile cetaceans, such as killer whales, *Orcinus orca*, (Fig. 1) this can often be a difficult task.

To address data needs for killer whales in Alaska waters, the National Marine Mammal Laboratory's Cetacean Assessment and Ecology Program (CAEP) conducted annual vessel surveys throughout the Aleutian Islands and western Gulf of Alaska between 2001 and 2010. These surveys comprised part of CAEP's ongoing research to determine the distribution, abundance, stock structure, and diet of killer whales throughout western Alaska and the Aleutian Islands. Two of the primary objectives of the vessel surveys were to collect identification photographs and small tissue biopsy samples of individual killer whales encountered throughout the survey area. To maximize the geographic extent of the survey area and include killer whales from neighboring regions, samples collected by CAEP surveys were supplemented with biopsies contributed by other NOAA Fisheries and non-governmental research organizations within both Russian and Alaskan waters. Geospatially-referenced photographic data and genetic data acquired from tissue samples can then be incorporated in analyses designed to look for geographical or ecological boundaries that define killer whale subpopulations or stocks. The scope of this large collaborative project provides us with the opportunity to explore patterns of genetic subdivision among killer whales sampled across the northern North Pacific.

Despite killer whales' relatively ubiquitous distribution, data from photographic resightings, analysis of social associations among individual whales (Durban et al. 2010, Marine Biology; Fearnbach 2012, Ph.D. Thesis), and satellite telemetry data (J. Durban, SWFSC, unpublished data; Matkin et al. 2012, Fishery Bulletin) suggest that some individual killer whales and pods (matrilineally-related stable social groups) exhibit a high degree of site fidelity. However, estimates of gene flow and a quantitative assessment of genetic structure are lacking for killer whales in the northern North Pacific, and documented movements of individual whales between regions suggest a certain degree of connectedness. Reflecting the uncertainty surrounding population structuring and a lack of data for the westernmost reaches of the northern North Pacific, current stock designations encompass very broad areas. Currently, "resident" (fish-eating) killer whales are recognized as a single stock from Southeast Alaska through the Aleutian Islands and Bering Sea (Allen and Angliss 2011, NOAA Tech. Memo.). The U.S. MMPA stock designation for Bigg's (aka "transient" or mammal-eating) killer whales recognizes two stocks with overlapping geographic distributions, comprising the Gulf of Alaska, Aleutian Islands, and Bering Sea stock and the much smaller community of AT1 killer whales, whose range appears to be largely restricted to Prince William Sound and the Kenai Fjords (Allen and Angliss 2011; Matkin et al. 1999, Fishery Bulletin).

To address the question of population structure and provide much needed data for contemporary stock assessments, we used both mitochondrial (mtDNA) control region (CR) sequences and nuclear (nDNA) microsatellite genotypes to examine the genetic structure of both resident and Bigg's killer whales in the northern North Pacific and to test hypotheses based on mtDNA phylogeny and behavioral data. Molecular genetic analyses were applied to 462 killer whale biopsy samples collected between the northern Gulf of Alaska and the Sea of Okhotsk (Fig. 2). Estimates of genetic distance between the two predominant North Pacific ecotypes indicated negligible levels of gene flow between ecotypes, highlighting the genetic and demographic isolation of these two divergent evolutionary lineages in the North Pacific. A recent paper using mitogenome sequences estimated that transient killer whales diverged from all other killer whale lineages some 700,000 years ago (Morin et al. 2010, Genome Research); our recent finding of negligible gene flow in nuclear DNA further emphasizes a lack of contemporary male-mediated gene flow between ecotypes. Analysis of molecular genetic data also revealed significant levels of population genetic subdivision *within* the two *Orcinus* ecotypes using both mitochondrial control region sequences and nuclear microsatellite (26 loci) genotypes. Strong evidence of geographic patterns

Figure 1. Adult male Bigg's killer whale photographed in the western Aleutians during the 2010 CAEP survey. Photograph by Dave Ellifrit.

of genetic differentiation was supported by significant regions of genetic discontinuity, providing evidence of multiple subpopulations within the currently recognized stocks for both resident and transient killer whales. Interestingly, the resolved patterns of population genetic subdivision suggested some notable differences in the geographic structuring of subpopulations between the two ecotypes.

In the Aleutian Islands, subpopulations, or groups with significantly different mtDNA and microsatellite allele frequencies, were largely delimited by boundaries that coincided with major passes in the Aleutian Islands for the fish-eating resident-type killer whales (Fig. 3). A population subdivision for resident killer whales at Samalga Pass was supported by both a Bayesian cluster analysis of nDNA genotypic data and a striking shift in the frequency of mtDNA haplotypes. Samalga Pass has also been recognized as a physical and biogeographic boundary between the eastern and central Aleutians (Ladd et al. 2005, Fisheries Oceanography). While Amchitka Pass represented a major subdivision for Bigg's killer whales between the central and western Aleutian Islands, whales sampled around the eastern Aleutians appeared to be genetically differentiated from those sampled near the Pribilof Islands in the Bering Sea (Fig. 4). There was also significant support for a smaller sympatric subpopulation (UI) around Unimak Island that distinguished a small number of killer whales that have been observed intercepting and preying on northward-migrating gray whales in the waters around Unimak Island during the late spring and early summer (Barrett-Lennard et al. 2011, Marine Ecology Progress Series). In the western North Pacific, data for both nDNA and mtDNA suggested that killer whales in the western Aleutians are part of a population that includes Russia, with the boundaries between subpopulations occurring at Buldir Pass (residents) and Amchitka Pass (Bigg's killer whale).

The patterns of genetic structure resolved by the current study provide strong evidence for the existence of multiple subpopulations of killer whales across the northern North Pacific, highlighting the need to revisit current stock designations. This species is impacted through both direct and indirect interactions with commercial fisheries. Evidence of population differentiation in this highly mobile species is a critical component for evaluating the impacts of incidental bycatch and estimating predator-prey relationships for species such as the endangered Western stock of Steller sea lions (*Eumetopias jubatus*).

By Kim Parsons

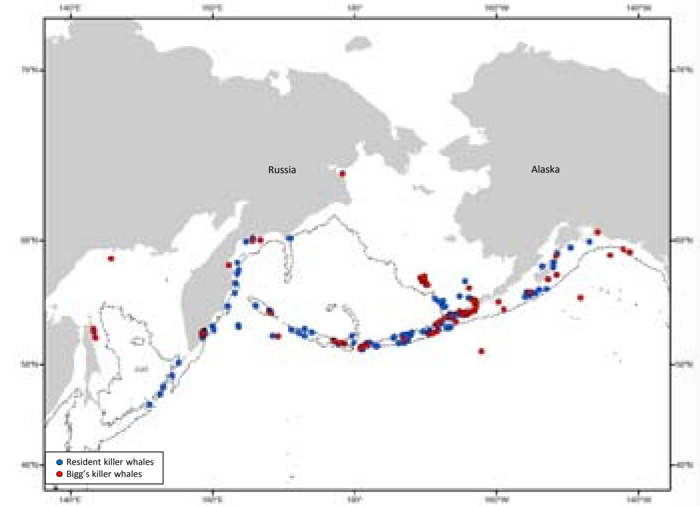


Figure 2. Map of killer whale biopsy sample locations included in the current study. Symbols indicate ≥1 individual sample.

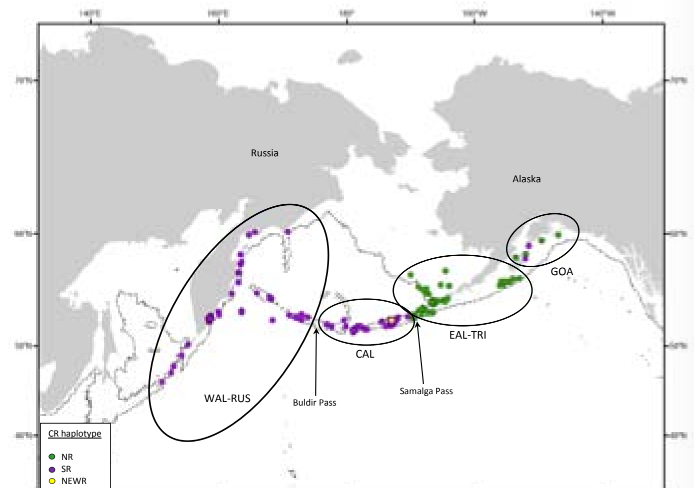


Figure 3. Resident killer whale biopsy samples included in the current study, plotted according to sample locations. Solid-line ellipses indicate the geographic extent of genetic subpopulations based on analysis of nDNA and mtDNA data. Individual samples are color coded according to mtDNA control region (CR) haplotype. The 1,000-m bathymetric depth contour is indicated by a thin broken line.

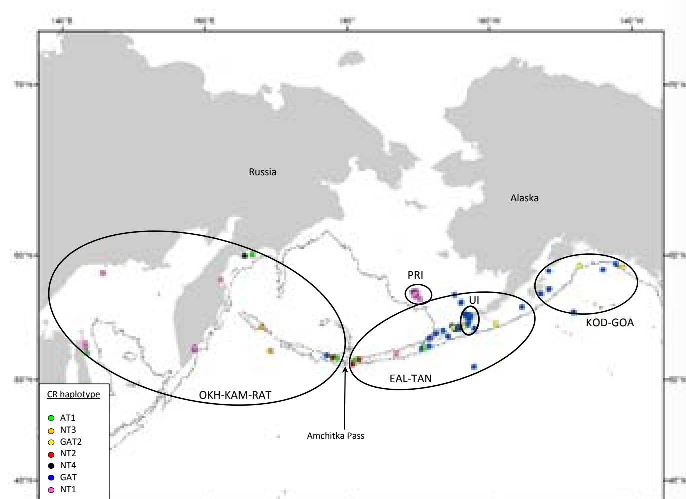


Figure 4. Bigg's killer whale biopsy samples included in the current study, plotted according to sample locations. Solid-line ellipses indicate the geographic extent of genetic subpopulations based on analysis of nDNA and mtDNA data. Individual samples are color coded according to mtDNA control region (CR) haplotype. The 1,000-m bathymetric depth contour is indicated by a thin broken line.

Resource Ecology & Ecosystem Modeling Program

Fish Stomach Collection and Lab Analysis

During the first quarter of 2013, Resource Ecology and Ecosystem Modeling (REEM) program staff analyzed the contents of 1,701 groundfish stomachs. The majority of these samples were from 26 species sampled from the Chukchi Sea, and 6 species were from the northern Bering Sea. Most of the small crustacean prey (e.g., euphausiids, hyperiid amphipods, gammarid amphipods, mysids, and calanoid copepods) were identified to species whenever their condition allowed. Stomach contents from four species of groundfish sampled in Marmot Bay, Alaska (Gulf of Alaska region) were also analyzed. In total, these stomach content analyses resulted in 1,703 records being added to the AFSC Groundfish Food Habits database. In preparation for stable isotope analysis, 55 muscle and liver tissue samples from Alaskan groundfish were ground, and 58 tissue samples were tinned in preparation for gas isotope-ratio mass spectroscopy. This ongoing project provides additional information on long-term integration of energy transfer in Alaska's marine foodwebs. Analysis of flatfish stomach contents and benthic grab samples for the Flatfish Essential Fish Habitat project are also ongoing.

Fisheries observers collected 1,179 stomach samples from three species collected in the eastern Bering Sea and from 14 arrowtooth flounder collected in the Aleutian Islands region. In preparation for future stomach sampling by fisheries observers, REEM staff assembled 46 stomach collection kits and delivered them to 23 commercial fishing vessels in the Seattle-Tacoma area. REEM personnel trained new fisheries observers on stomach sampling procedures and instructed them on how the samples are analyzed and the data are used.

REEM staff participated in several outreach activities this quarter. Activities in the lab included hosting a job-shadow for a local high school student and providing presentations and tours of the Food Habits Laboratory for a class of new fisheries observers and for the MIMSUP (Multicultural Initiative in the Marine Science Undergraduate Participation) program from the Western Washington University. Monthly presentations about marine life in Alaskan waters are given at the Sunshine Garden Senior Center. The Food Habits Laboratory display and hands-on activity were very popular with children, teens, and adults at the Pacific Science Center's Polar Science Weekend held 28 February through 3 March 2013.

By Troy Buckley, Geoff Lang, Mei-Sun Yang, Richard Hibpshman, Kimberly Sawyer, Caroline Robinson and Sean Rohan

Age & Growth Program

Age and Growth Program Production Numbers

Estimated production figures for 1 January – 31 March 2013.

Species	Specimens Aged
Arrowtooth flounder	955
Atka mackerel	428
Greenland turbot	360
Pacific cod	1,200
Rex sole	516
Sablefish (black cod)	396
Walleye pollock	558
Yellowfin sole	123

Total production figures were 4,536 with 1,005 test ages and 37 examined and determined to be unageable.

By Jon Short

Economics & Social Sciences Research Program

Using Indicators to Assess the Vulnerability and Resiliency of Alaskan Communities to Climate Change

Communities in Alaska that harvest marine and terrestrial resources are experiencing impacts from unexpected climate-related changes and unprecedented environmental conditions. Residents of rural Alaska are already reporting heretofore unseen changes in the geographic distribution and abundance of fish and marine mammals, increases in the frequency and ferocity of storm surges in the Bering Sea, changes in the distribution and thickness of sea ice, and increases in river and coastal erosion. When combined with ongoing social and economic change, changes in biological and physical systems such as food availability, weather and climate make life in rural Alaska extremely challenging.

We develop a framework of indicators to assess three basic forms of community vulnerability to climate change: 1) exposure to the biophysical effects of climate change, 2) dependence on resources that will be affected by climate change, and 3) a community's adaptive capacity to offset negative impacts of climate change. We conduct a principal components analysis on each of the three forms of vulnerability and then combine all three components together to determine each community's overall vulnerability to climate change for 315 communities throughout Alaska. The top five communities that rank the highest in overall vulnerability to climate change in descending order are Kivilina, Teller, Akutan, Brevig Mission, and Unalaska. Kivilina, Teller, and Brevig Mission are among the most vulnerable communities due to their high exposure to the biophysical effects of climate change, while Akutan is among the most vulnerable communities due to a low level of adaptive capacity. Unalsaka is among the most vulnerable communities due to its dependence on marine resources that will be affected by climate change. We hope that this research can be used to inform communities as to the ways in which their communities are vulnerable to climate change and to help them develop adaptation strategies.

By Amber Himes-Cornell and Stephen Kasperski

Productivity Growth of Catcher-Processors in the Bering Sea Pollock Fishery

Many fisheries worldwide have exhibited marked decreases in profitability and fish stock abundance during the last few decades as a result of overfishing. However, more conservative, science- and incentive-based management approaches have been practiced in the U.S. federally managed fisheries off Alaska since the mid 1990s. The Bering Sea pollock fishery is one such fishery and remains one of the world's largest in both value and volume of landings. In 1998, with the implementation of the American Fisheries Act (AFA) this fishery was converted from a limited access fishery to a rationalized fishery in which fishing quota were allocated to cooperatives who could transfer quotas, facilitate fleet consolidation, and maximize efficiency. The changes in efficiency and productivity growth arising from the change in management regime have been the subject of several studies, with a few focusing on the large vessels that both catch and process fish onboard (catcher-processors).

In this study we modify existing approaches to account for the unique decision-making process characterizing catcher-processor's production technologies. In particular, we focus on sequential decisions regarding what products to produce and the factors that influence productivity once those decisions are made using a multiproduct revenue function. The estimation procedure is based on a latent variable econometric model and departs from and advances previous studies since it deals with the mixed distribution nature of the data. Our productivity growth estimates are consistent with increasing productivity growth since rationalization of the fishery, even in light of large decreases in the pollock stock. These findings suggest that rationalizing fishery incentives can help foster improvements in economic productivity even during periods of diminished biological productivity. This manuscript is currently under internal review and will be submitted to a scientific journal for peer review in the coming months.

By Ron Felthoven and Marcelo Torres

Estimating Regional Economic Impacts of Changes in an Alaska Crab Stock Yields from Ocean Acidification

Fossil fuel emissions and deforestation have increased atmospheric CO^2 concentrations, which have led to corresponding increases in oceanic CO^2 concentrations, and hence, changes in carbonate chemistry of the oceans and decreases in ocean pH. Due to the increase in oceanic CO^2 concentrations, the surface ocean pH has decreased on average by 0.1 units compared to pre-industrial levels. This is equivalent to a 30% increase in acidity of the surface waters. As CO^2 levels continue to rise over the coming decades, the pH in the ocean will fall even further. A standard emissions scenario predicts that average pH in surface waters will fall from the current level of 8.1 to 7.8 before 2100.

This trend could have substantial physiological effects on marine organisms, affecting growth, survival, reproduction, and behavior. Calcifying organisms may be particularly affected because the reduction in pH makes it more difficult to excrete and sustain a calcified shell or exoskeleton. This will slow the growth of many marine fish species including crabs. As a result, the harvests of, and revenue from, harvests of fish species will decrease. The decrease in the revenue implies a reduction in the number of jobs in fish harvesting and processing sectors, and a decrease in the income of the stakeholders engaged in the fisheries. This will generate a wide range of economic impacts on the fishing-dependent communities.

A bioeconomic study by Dalton and Punt (2013) estimated the nonlinear effects of ocean acidification on survival parameters in stage structured pre-recruitment dynamics model; coupled the pre-recruitment dynamics model with a post-recruitment population dynamics model; and derived a sequence of Bristol Bay red king crab (RKC) yield curves for an ocean acidification scenario from 2009 to 2100, using the coupled model. Using the sequence of RKC yield curves, we calculated the temporal and cumulative regional economic impacts of the reduction in RKC yields on the Alaska economy using a recursive dynamic computable general equilibrium model. We also conducted some sensitivity analysis for an important parameter in the bioeconomic model to gauge robustness of our results.

By Chang Seung, Michael Dalton, André Punt

The 2012 Economic Survey of Alaska Saltwater Sport Fishing Charter Businesses: A Preliminary Look

A survey developed by AFSC economists over the last several years was administered in 2012 to collect economic and other information from charter boat operators. These data were collected to provide a baseline of information necessary to assess the effect of regulatory restrictions (currently in place or potential) on Alaska charter boat fishing operators and the economic contributions these businesses make in the Alaska communities in which they are located, as well as to the state and nation. Some information useful for this purpose is already collected from existing sources, such as from the Alaska Department of Fish and Game (ADF&G) logbook program. However, information on vessel and crew characteristics, services offered to clients, and costs and earnings information are generally not available from existing data sources and thus must be collected directly from the industry through voluntary surveys. Initial scoping and design of the survey was based on consultations with Alaska charter boat associations and staff from the NMFS Alaska Region, Alaska Department of Fish and Game, North Pacific Fishery Management Council, and International Pacific Halibut Commission. Several focus groups, interviews, and meetings with Alaska charter boat operators (the target population) were used to test and refine the survey questions.

The Alaska Saltwater Sport Fishing Charter Business Survey was administered between April and July 2012 by the Pacific States Marine Fisheries Commission (PSMFC). A total of 667 charter guide license holders (businesses) who participated in the charter logbook program and were active in 2011 were contacted by mail and asked to fill out a paper or on-line questionnaire. The survey asked questions about costs and earnings, revenues, employment, and services offered during 2011. Of those contacted, 191 participated in the paper or on-line survey. The overall response rate was 191/667 = 28.6%.

A preliminary analysis of the data from the 191 responding license holders/businesses (i.e., respondents) was conducted to summarize the data for 2011. The results primarily focus on summarizing the data for the sample of *item respondents*—those providing a non-zero response. Thus, the sample estimates ignore blanks, refusals, and cases where the question is not applicable to the individual respondent. The number of item respondents varies among questions.

Number of vessels: The total number of active vessels owned or leased by the sample during 2011 was 347. The median number of vessels operated by a single business was 1.0.

Expenditures: The sample reported a total of $2.9 million was paid to vessel operators and guides, $1.1 million was paid to on-board crew, and $3.7 million was paid to on-shore employees during 2011. The mean (median[1]) amount each respondent paid to vessel operators and guides was $22,178 ($272). The mean (median) amount paid to crew was $8,621 ($0) and to shore employees was $27,746 ($599). The much lower median amounts reflect the large number of respondents that did not employ additional workers. For non-labor expenses spent in 2011, see Table 1.

Employment: Figures 1 and 2 summarize the employment by season and number of the forms of payments to employees, respectively.

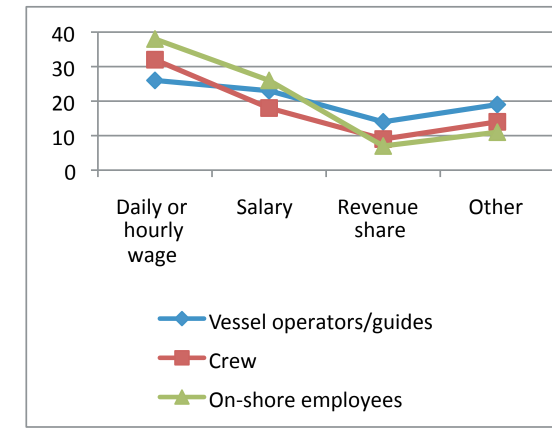


Figure 1. 2011 Employment by season (total full- and part-time employees) across sample.

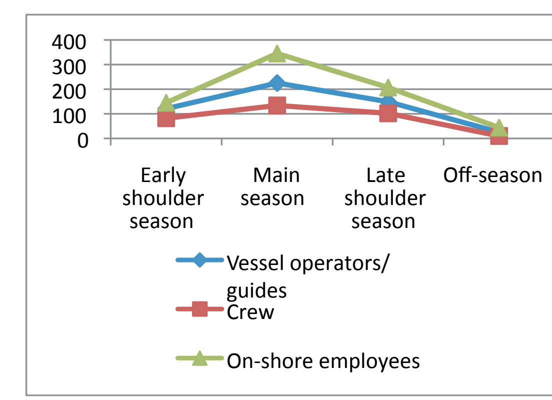


Figure 2. Number of businesses in sample by form of payment and type of employee.

Table 1. Summary of 2011 non-labor expenses across sample of item respondents

Expense category	Item respondents	Total (in millions)	Mean	Median	Standard deviation
Charter trip-related	153	$8.6	$56,263	$18,030	$166,372
General overhead	154	$10.6	$69,074	$18,992	$157,747
Vehicles, machinery, and equipment	129	$6.4	$49,500	$10,000	$165,280
Buildings, land, and other real estate	49	$2.3	$46,514	$25,000	$82,399

[1] *Median:* the middle value of a distribution; half the values are larger and half the values are smaller than it.

Table 2. Summary of 2011 revenue across sample of item respondents

Revenue category	Item respondents	Total (in millions)	Mean	Median	Standard deviation
Charter fishing trips – direct payments from clients	137	$23.0	$167,731	$46,900	$570,146
Charter fishing trips – payments from booking agent or service	82	$2.1	$25,887	$6,500	$41,048
Non-fishing charter trips	84	$2.2	$26,192	$1,993	$68,166
Client referrals/booking commissions	61	$0.48	$7,796	$0	$24,638
Federal charter halibut permit sales income	58	$0.96	$16,541	$0	$99,059
Federal charter halibut permit lease income	59	$0.02	$331	$0	$1,343

Revenue: Across the 145 item respondents to the revenue questions, the total revenue for 2011 was $28.8 million, with a mean (median) revenue of $198,321 ($71,904). The range of total revenues across these respondents was from $68 to $5.7 million. These revenues were divided into several categories based on the source of the revenue (see Table 2).

Clients: Respondents were asked questions about what proportion of their clients were return business, early bookers, and last minute bookers (see Figure 3).

Family participation in the business: Across the item respondents, the mean (median) number of family workers in the business was 2.5 (2.0). The mean (median) proportion of the business owned by the respondent's household was 93% (100%), while between 26% and 50% of the household income was generated from the business, indicating most respondents' households had other sources of income besides that from the charter business.

Next steps: Given a lower than expected response rate (~29%) to the survey, AFSC researchers are in the process of evaluating the representativeness of the sample before the sample results can be adjusted and extrapolated to the population. That evaluation is underway, and the results of that analysis will be made available at a later date. In addition, the survey is currently being re-fielded by PSMFC to collect information from Alaska charter boat business for the 2012 fishing season, which will provide information useful for identifying changes.

By Dan Lew, Brian Garber-Yonts, and Amber Himes-Cornell

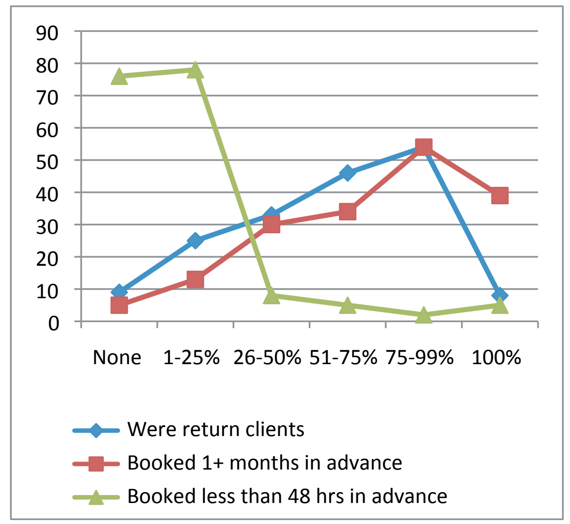


Figure 3. Percent of business' clients that are returning clients, early bookers, or last minute bookers across sample

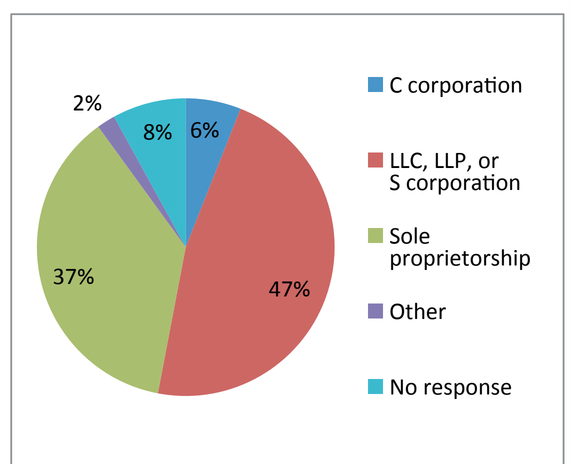


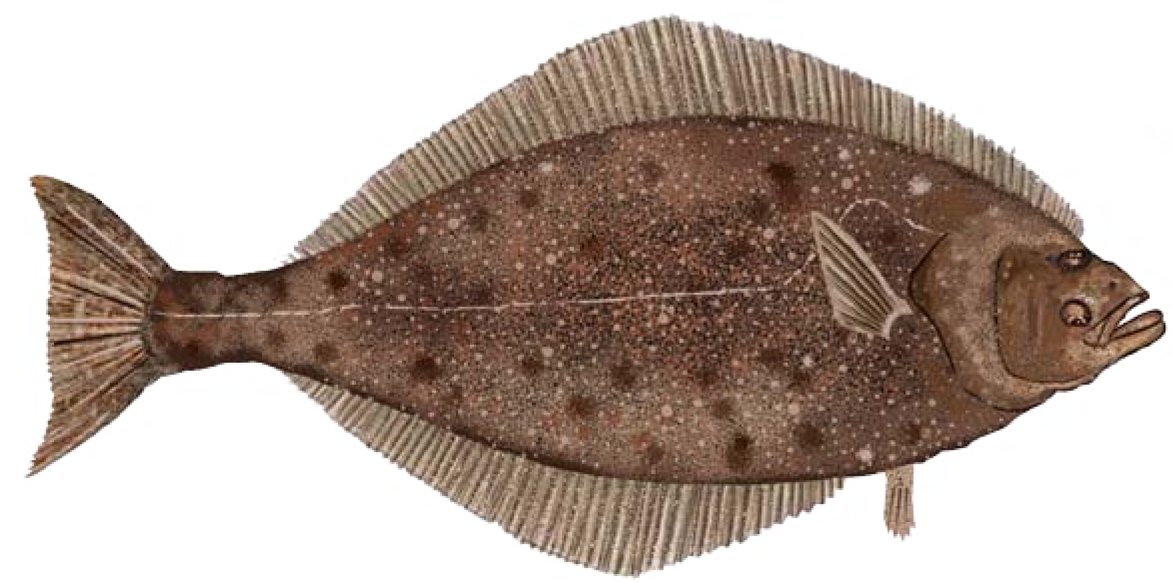
Figure 4. Distribution of types of business structures across sample

The Statistical Significance of Social Accounting Matrix Model-Based Economic Impacts from Recreational Fishing Harvest Limits in Southern Alaska

This research extends earlier work conducted by AFSC economists to assess the effects that accounting for two types of variations in inputs (shocks) of regional economic impact models have on the statistical significance of the model estimates. In this research, confidence intervals for regional economic impacts resulting from six changes in saltwater sportfishing harvest limits are calculated using a stated preference model of sportfishing participation and a social accounting matrix (SAM) for southern Alaska. Two important types of input variation are considered in calculating the economic impacts: sample variation in sportfishing-related expenditures and stochastic variation from parameters in the recreation participation model. Results indicate that the estimated confidence interval for the economic impacts (in terms of the change in total regional output) that accounts for both types of variations is significantly wider than the one estimated when considering only the sample variation. In fact, for the six policy scenarios considered, only the change in total regional output associated with a two-fish reduction in the Pacific halibut bag limit is statistically greater than zero when both types of variation are considered in the calculation of economic impacts. For the other five policy scenarios, the 95% confidence intervals contain zero, suggesting reductions in the bag limits are not statistically different from zero. Moreover, using the methods of convolutions to assess differences in estimated impacts between scenarios, we show there are only statistical differences between estimated economic impacts when sampling variation alone is accounted for, but none when stochastic variation is considered. This suggests that in some cases, decision makers may need to look beyond a simple comparison of the point estimates of economic impacts of alternatives as a basis for choosing a preferred alternative due to a lack of statistical differences in the results from regional economic impact models.

By Dan Lew and Chang Seung

Two important types of input variation are considered in calculating the economic impacts: sample variation in sportfishing-related expenditures and stochastic variation from parameters in the recreation participation model.



Alaska Marine Science Symposium

Several REEM staff and contractors attended and presented results at the North Pacific Research Board Alaska Marine Science Symposium held in Anchorage, Alaska on 21-25 January 2013.

Drs. Stephani Zador and Kirstin Holsman presented a poster titled "Identifying and comparing ecosystem stressors in the eastern Bering Sea and Gulf of Alaska." The poster describes a pilot study to develop metrics to represent the condition of marine ecosystems that can be used 1) to establish reference points useful for Alaska's Integrated Ecosystem Assessment (IEA) and 2) to enable comparisons across ecosystems. The authors modified recent ecosystem index approaches (e.g., the Ocean Health Index by Halpern et al. 2012) to reflect conditions and stressors that are particular to Alaska, applied the index assessment to data collected from surveys of Alaska marine ecosystem experts, and conducted comparative analyses between the eastern Bering Sea (EBS) and Gulf of Alaska (GOA) ecosystems.

Drs. Stephani Zador, Olav Ormseth, and Heather Renner (U.S. Fish and Wildlife Service Alaska Maritime National Wildlife Refuge) presented a poster titled "Red flags or red herrings? Using ecosystem indicators to detect anomalous conditions in the Gulf of Alaska in 2011." In this poster the authors presented the status of ecosystem indicators that cumulatively suggest that anomalous conditions occurred in the Gulf of Alaska during 2011. The first indications were noted in upper trophic organisms (seabirds and Pacific halibut) that experienced reproductive failures and potential nutrient deficiencies, respectively. Abundance indices of plankton and forage fish, halibut stomach contents, and ocean surface currents also indicated that anomalous conditions occurred during 2011. The authors compared multiple lines of evidence that suggested that changes in bottom-up forcing factors negatively influenced productivity at the lower trophic level, which in turn negatively influenced upper trophic organisms. They concluded that 1) synthesis of indicators' status across multiple trophic levels can reveal broad-scale changes in the environment that may have important biological and management implications, and 2) upper trophic organisms in particular serve as integrative indicators that provide near real-time cues of environmental state.

Drs. Ivonne Ortiz, Kerim Aydin and Al Hermann (NOAA's Pacific Marine Environmental Laboratory) presented the poster "FEAST Forage and Euphausiid Abundance in Space and Time: assumptions, knowledge, and gaps." The poster summarizes insights and capabilities of the fish component of an end-to-end vertically integrated model based on dynamic prey fields, bioenergetics, and a suite of fish species (e.g., walleye pollock, Pacific cod, and arrowtooth flounder, among others). Model parameters and assumptions are based on retrospective data analysis and also close collaboration between modelers and observational field researchers on zooplankton, bioenergetics and early fish development. Capabilities and gaps: i) the model fits observed temperatures and cold pool extension, but data is still required to evaluate non-shelf areas; ii) relative survival of age zero fish under different climate conditions can be evaluated but not predicted accurately; survival can be tuned for single years; iii) core output includes predicted fish distribution by length, iv) sudden bouts of growth are caused by zooplankton blooms in the model but variation in timing is critical to calibration and prediction, and v) euphausiids production and predation is still controversial, with acoustic abundance estimates an order of magnitude higher than simulated values and other field measurements.

Dr. Kirstin Holsman (JISAO/REEM) presented a talk titled "The influence of climate change and predation on biological reference points estimated from multispecies and single species stock assessment models" which focused on recent results of the multispecies stock assessment model (MSM) for three species of groundfish from the Bering Sea. In particular, she presented 1) methods to estimate annual mortality from temperature and size-specific bioenergetics-based consumption rates, 2) approaches to using model projections to derive multispecies biological reference points (BRPs), and 3) results of application of the model to pollock, Pacific cod, and arrowtooth flounder from the Bering Sea. Initial results indicate that climate-driven changes in water temperature may affect unfished biomass estimates (and concomitant target harvest rates) but various control rules for harvest have larger impacts on BRPs through changes in predator abundances. In general, both temperature and predator harvest rates have the largest effects on prey species with high rates of predation (i.e., pollock) whereas BRPs from MSM are approximately equal to those from single-species stock assessment models for species with low predation rates.

By Stephani Zador, Ivonne Ortiz, and Kirstin Holsman

Seabird Research

The Pacific Seabird Group (PSG) celebrated its 40th annual conference in Portland, Oregon, on 20- 23 February 2013. The annual conference is an important place for seabird biologists, scientists, and conservationists from many organizations to gather to discuss science, conservation, and policy issues related to seabirds in the Pacific Ocean. The conference is an opportunity for additional meetings to occur at the same time. The Alaska Fisheries Science Center sent two staff to this meeting, Dr. Stephani Zador and Shannon Fitzgerald, to represent the Center's important work on seabirds as ecosystem indicators and on seabird/fishery interactions. Dr. Zador presented the paper "Red flags or red herrings? Using ecosystem indicators to detect anomalous conditions in the Gulf of Alaska in 2011," by Stephani Zador, Olav Ormseth, and Heather Renner. Dr. Zador also chaired the session titled "Foraging ecology and distribution at sea."

Fitzgerald organized the various contractors and partners involved in the AFSC Coordinated Seabird Studies Group to present five posters at the meeting. These included "Demographics of albatrosses caught as bycatch in Hawaiian (2010-2012) and Alaskan longline fisheries (2007, 2009-2011)" by Jessie Beck, Michelle Hester, Hannahrose M. Nevins, Shannon Fitzgerald, and Erica Donnelly-Greenan; "Sight and salvage: preparing observers for seabird duties at sea" by Jane Dolliver, Shannon Fitzgerald, Charlie Wright, and Julia K. Parrish; "Estimates of seabird bycatch in Alaskan groundfish fisheries using the Alaska Region Catch Accounting System, 2007-2011" by Shannon Fitzgerald, Jennifer Cahalan, Jason Gaspar, and Jennifer Mondrogon; "Evaluating the recent distribution of albatross bycatch in Alaskan longline groundfish fisheries (2007 to 2011)" by Edward F. Melvin, Sarah L. Jennings, Troy J. Guy, and Shannon M. Fitzgerald; and "Diurnal occurrence of dead mesopelagic fish and squid at the sea surface and their importance as a previously unrecognized predictable food resource for oceanic marine birds" by William A. Walker, Robin W. Baird, Daniel L. Webster, Jessica M. Aschettino, Gregory S. Schorr, Daniel J. McSweeney, and Shannon Fitzgerald. Fitzgerald also chaired the session titled "Bycatch and birds at sea."

AFSC staff also attended and contributed to the Short-tailed Albatross Recovery Team meeting held on 20 February, the North Pacific Albatross Working Group meeting and the USFWS Birds of Conservation Concern briefing held on 21 February, and the PSG Conservation Committee held on 22 February. Partners helping to represent the AFSC Seabird Studies Group at the meeting included Washington Sea Grant, the University of Washington COASST Program, Oikonos Ecosystem Knowledge, the Marine Wildlife Veterinary Care and Research Center, the Alaska Regional Office, and others. Abstracts are available at: http://www.pacificseabirdgroup.org. The February 2014 conference is scheduled for Juneau, Alaska.

By Shannon Fitzgerald and Stephani Zador

Ecosystem Modeling

Dr. Kerim Aydin participated in a joint workshop of the National Science Foundation and North Pacific Research Board's Bering Sea Synthesis program in Friday Harbor, Washington, on 25-28 February 2013. Workshop participants presented results from Bering Sea studies of lower trophic level organisms, particularly focusing on production rates of mesozooplankton with respect to climate and fish populations from recent years of observations. Dr. Aydin presented results from the Forage and Euphausiid Abundance in Space and Time (FEAST) modeling effort that suggested key uncertainties in top-down and bottom-up control in the Bering Sea resulting from continued overall uncertainty in production rates and life cycles of euphausiids in the region.

By Kerim Aydin

Research Project Presented at the RACE Seminar Series

As part of the Resource Assessment and Conservation Engineering (RACE) seminar series, Dr. Matt Baker delivered a talk entitled "Synthesis of physical structure and community composition to inform spatial management." An abstract and select figures from the talk are included below.

Spatial and multispecies management of marine fisheries resources require robust methods to identify regional structure and determine relative impacts of environmental and biological drivers. Building on a recent Bering Sea Integrated Ecosystem Research Program (BSIERP) project, which synthesized expert opinion from oceanographers and biologists to delineate mesoscale heterogeneity in the eastern Bering Sea, we sought to develop an integrated statistical approach to define ecological regions with practical utility towards fishery management. We combined bottom trawl survey data and environmental indices to evaluate shifts in species distributions and abundance over time and space. Applying random forest methods, we quantified the relative influence of physical variables on abundance patterns for individual species and evaluated the relative importance and marginal effect of each physical variable to identify critical thresholds. We then integrated individual species trends to quantify threshold shifts in community composition (multispecies turnover) along environmental gradients. By integrating physical and biological data, we define spatially coherent regions partitioned along ecologically significant gradients. Species interactions are an important a driver of ecosystem functioning and organization. By identifying environmental thresholds for individual species we inform potential competitive and predatory interactions. These methods are applied to better inform understanding of potential competitive and predatory interactions and to characterize resource partitioning among species within functional diet-based guilds. Our current research applies these regional boundaries to explore the importance of spatial scale in multispecies autoregressive state-space model outputs. As one approach, we are applying dynamic factor analysis to identify common underlying trends in time series data of species abundance within functional guilds. This research is funded by the Comparative Analysis of Marine Ecosystem Organization and the Habitat Assessment Improvement Plan programs.

By Matthew Baker

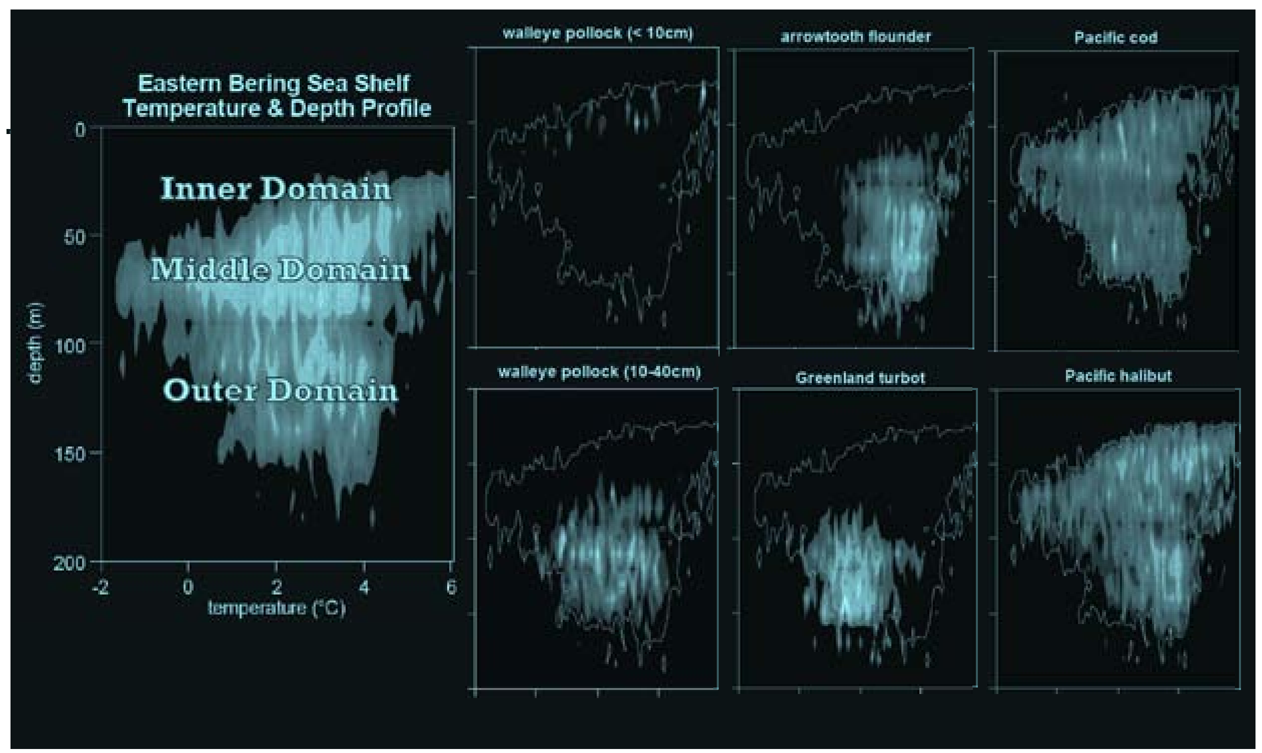


Figure 1. As shown by contour plots, habitat use differs markedly between functional guilds, species, and life stage. Plots display relative density (biomass) by temperature and depth (lighter areas indicate higher densities). The plot of the eastern Bering Sea shelf (left) is used to develop a system-wide footprint, superimposed on individual species graphs for reference.

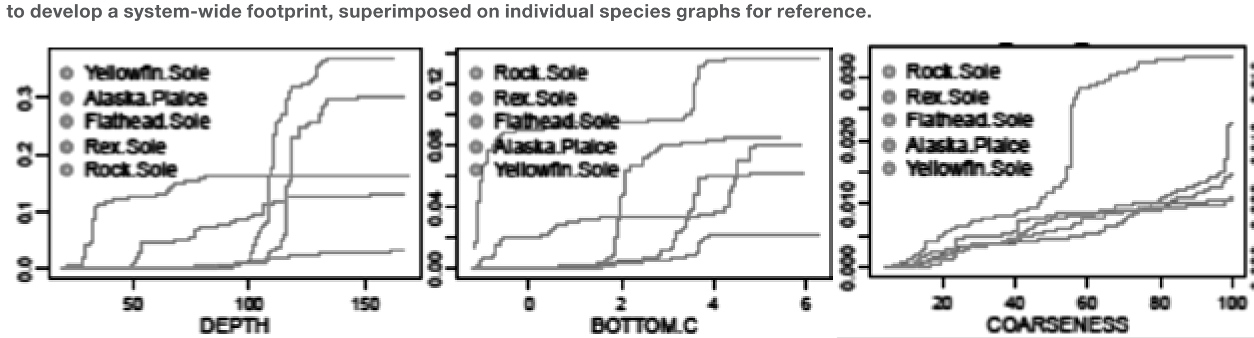


Figure 2. Cumulative importance plots (gradient forest output) display cumulative shifts (in R2 units) of individual species' abundance across various environmental predictors. The common scale enables comparisons across species within functional guilds (e.g. benthivore flatfishes above).

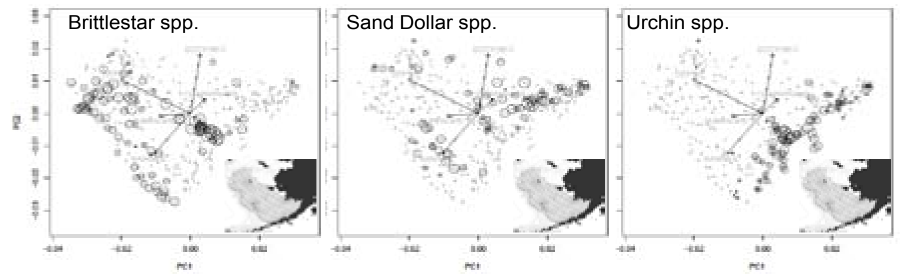


Figure 3. Overlay of weighted species abundance (e.g. echinoderms above) per station in the Bering Sea trawl survey. Coordinate position represents inferred biological composition associated with environmental predictors. Individual points represent sample stations in the survey (inset).

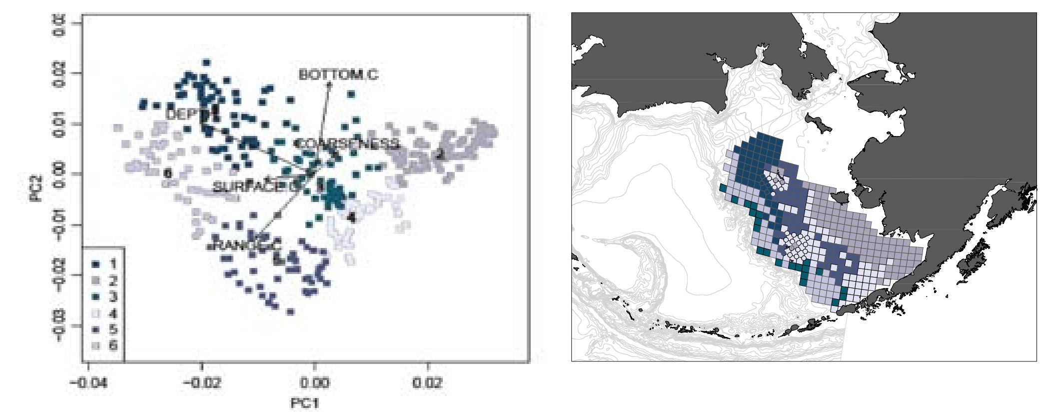


Figure 4. By applying clustering approaches, we are able to group survey stations according to inferred community assemblages (right) and map distinct ecological regions as an output of this analysis (left).

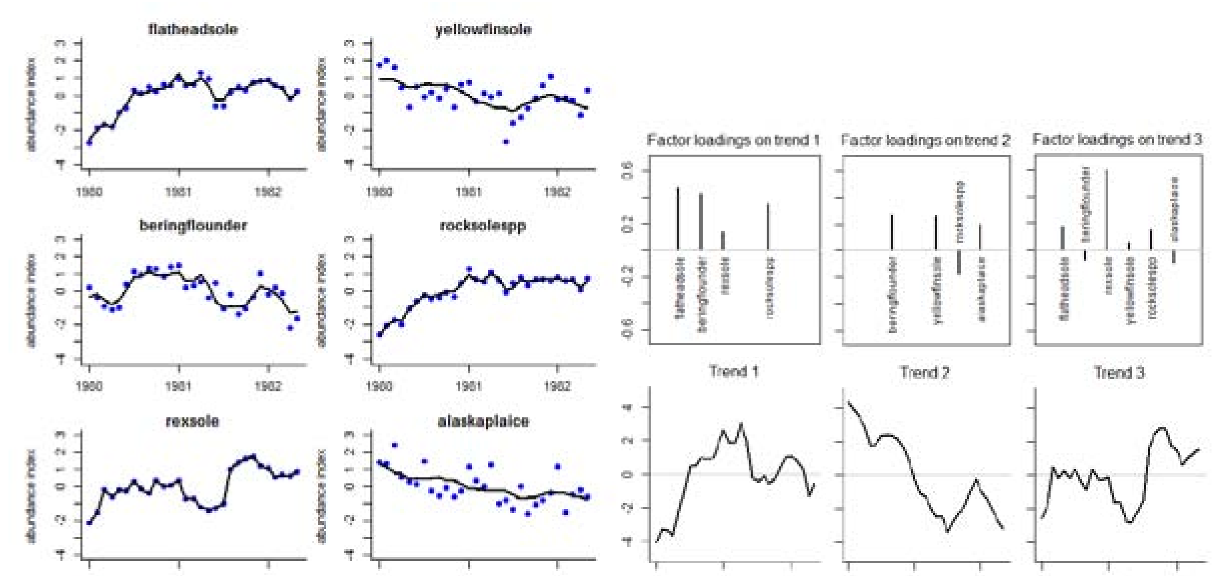


Figure 5. As a next step, we are applying dynamic factor analysis to identify a set of common underlying trends in time series data of species abundance for functional guilds (e.g. benthivore flatfishes above). Models use linear combinations of hidden random walks and compare multiple competing models. Environmental variables can be compared to trend outputs or incorporated directly into model analyses.

28th Lowell Wakefield Fisheries Symposium

Members of the Status of Stocks and Multispecies Assessment (SSMA) program participated in the 28th Lowell Wakefield Fisheries Symposium "Responses of Arctic Marine Ecosystems to Climate Change" which was held at the Hotel Captain Cook, Anchorage, Alaska, 26–29 March 2013. Franz Mueter of the University of Alaska Fairbanks, Juneau was Chair of the steering committee and is the symposium contact. A description of the symposium follows.

The Arctic Ocean and its adjacent seas are undergoing rapid environmental changes, most notably in the extent and duration of sea ice cover. The biological consequences of these changes and their impacts on humans are complicated and therefore difficult to predict. For example, larger areas and a longer season of open water are likely to increase primary production, while low nutrient availability and more storm events may limit any such increases. Changes in the abundance and spatial distribution of some fish, birds, and mammals have been documented, but whether subarctic species will expand into the Arctic and how arctic species will respond to an extended ice-free season is highly uncertain.

This symposium sought to advance our understanding of present and future responses of arctic marine ecosystems to climate change at all trophic levels from plankton to marine mammals to humans, by documenting and forecasting likely changes in environmental processes and the responses of species to those changes. We encouraged contributions that focused on collaborative approaches to understanding and managing living marine resources in a changing Arctic and to managing human responses—locally, regionally, and globally—to changing arctic marine ecosystems. We believe that important insight and innovation will come from residents of the affected arctic communities.

Dr. Libby Logerwell of the AFSC's Fisheries Interaction Team is a member of the steering committee and co-chaired a session on Marine Fish Resources of the Arctic in a Changing Climate. This session encompassed the biology and ecology of arctic fishes, distributional shifts of fishes into arctic waters, the capacity of local species to adapt to changing conditions, fisheries potential of the Arctic Ocean, and approaches to managing fisheries resources in the Arctic from local to pan-arctic scales. Anne Hollowed, Program Manager for SSMA, was an invited speaker for this session; Libby Logerwell also presented a talk within this session. The abstracts of their talks follow.

Potential Movement of Fish and Shellfish Stocks from the Subarctic to the Arctic Ocean

Anne B. Hollowed, Alaska Fisheries Science Center, Seattle, NMFS/NOAA,, Seattle, WA
Harald Loeng, Institute of Marine Research, Bergen, Norway,
Benjamin Planque, Institute of Marine Research, Tromsø, Norway

An assessment was conducted on the likelihood that 17 fish stocks, shellfish stocks, or stock groups will move from subarctic areas into the Arctic Ocean. We assess the vulnerability of fish and shellfish stocks to expected exposure to climate-induced environmental changes in arctic and subarctic ecosystems resulting from climate change. We assess the sensitivity and adaptability of 17 stocks from five ecosystems: Barents Sea, Eurasian shelves of the Arctic, Bering Sea, Chukchi Sea, and Beaufort Sea. These comparisons reveal that several species are considered candidates to migrate into the high Arctic in the future, but it is anticipated that only six stocks have a high probability of establishing viable resident populations in the region. The ability of species to survive in the Arctic depends on how they respond to the physical and biological conditions of the region. Marine fauna that currently reside in the area exhibit adaptations that make them well suited for the challenging conditions of the Arctic. Examples of these adaptations include: 1) capability of rapid growth to maximize the benefit of a short production season; 2) specific physiological characteristics to survive in cold conditions; 3) capability of inhabiting deep-ocean conditions to avoid ice in winter; 4) diversity of diets; 5) broad spawning range, with low site fidelity; 6) high migration/dispersal rates; and 7) phenotypic plasticity.

Oceanographic Characteristics of the Habitat of Benthic Fish and Invertebrates in the Beaufort Sea

Elizabeth Logerwell and Kimberly Rand, Alaska Fisheries Science Center, NMFS/NOAA, Seattle, WA
Thomas J. Weingartner, University of Alaska Fairbanks, School of Fisheries and Ocean Sciences, Institute of Marine Science, Fairbanks, Alaska

We relate the spatial variability in the distribution of benthic taxa of the Beaufort Sea to oceanographic characteristics of their habitat, with the goal of illustrating potential mechanisms linking climate change to arctic marine communities. Offshore fish of the Beaufort Sea have not been surveyed since 1977, and no synchronous measures of fish distribution and the oceanographic characteristics of their habitat have been made previously. A survey was conducted during August 2008 in the western Beaufort Sea, Alaska. The distribution and abundance of benthic fish and invertebrates were assessed with standard bottom trawl survey methods. Oceanographic data were collected at each trawl station and at several locations between stations. The dominant benthic taxa, polar cod (*Boreogadus saida*), eelpouts (*Lycodes sp.*), and snow crab (*Chionoecetes opilio*), were associated with cold (<–1.5°C), high salinity (>33) water found offshore of the shelf break, derived from the Chukchi Sea. These waters are expected to be high in secondary productivity, such that we hypothesize that the distribution of fish and crab was driven by conditions favorable for successful foraging. Predictions of the impacts of climate change require an understanding of the mechanisms linking the distribution and abundance of marine organisms to their oceanographic habitat. Our study documents the association of dominant benthic fish and invertebrates of the Beaufort Sea with specific water mass types and is thus a step toward this understanding.

The Program can be viewed at: *http://seagrant.uaf.edu/conferences/2013/wakefield-arctic-ecosystems/program.php*

The Abstract Book can be viewed at: *http://seagrant.uaf.edu/conferences/2013/wakefield-arctic-ecosystems/wakefield-2013-program.pdf*

By Libby Logerwell

SPICES in Chile

Dr. Anne Hollowed attended the international symposium and workshop on "Climate variability and change impacts on marine resources and Fisheries in the South Pacific: Toward a South Pacific Integrated Ecosystem Studies Program (SPICES)" which was held in Concepcion, Chile, on 7-10 January 2013. The meeting, attended by 91 scientists from 10 countries (Australia, Canada, Chile, England, Germany, Mexico, New Zealand, Peru, Uruguay, and the USA), featured six theme sessions:

- S1: Toward climate indices and regionalized models (dowscaling) to study climate variability and change in the South Pacific
- S2: Assessing species-specific responses to climate variability and change
- S3: Assessing ecosystem responses to climate variability and change
- S4: Climate variability and change: Impact on fisheries and coastal communities
- S5: Managing fisheries and ecosystems under a variable and changing climate
- S6: Marine and Antarctic Ecosystem programs: EBFM, MPA, policies and governance in a changing climate framework

The meeting concluded with the 1-day workshop "South Pacific Integrated eCosystEm Studies (SPICES) Program: Toward an International Program to study Climate Variability and Change on Marine Resources and Fisheries in the South Pacific," which served as a forum for discussing the formation of an international marine research program for the South Pacific.

Dr. Hollowed was the plenary speaker for Theme Session 5 . The title of her talk was "Managing fisheries and ecosystems under a variable and changing climate in the North Pacific". The following is the abstract from her talk.

Recent reviews of the global status of commercial fish and fisheries reveal several factors that contribute to the achievement of sustainable fisheries and the successful adoption of an ecosystem approach to management. These factors include leadership, social capital, incentives, as well as a commitment to the collection and assessment of high quality information on the fished populations and the environment. Adapting successful management strategies to sustain fish and fisheries under changing climate conditions requires new management tools and flexible frameworks. This paper will review the management systems of selected large marine ecosystems, assess how climate variability and change will alter these systems, and evaluate the capacity of the management system to adjust to expected effect of climate change on the distribution, abundance and species composition of target species. Projections are used to identify future bottlenecks that may emerge from the current governance structures that evolved to manage sustainable fisheries. This synthesis demonstrates the need for a coordinated global effort to evaluate future harvest strategies within the context of multiple stressors to adequately assess the implications of climate change on the global food supply.

Overall the symposium was a success. Workshop participants agreed that there is a need for an international marine science organization in the South Pacific, however, they recognized that it will take time to build support amongst member nations. In the interim, participants agreed to work together to utilize existing meeting venues to convene theme sessions focused on the impacts of climate variability and change on marine ecosystems. Selected papers from the symposium will be published as a special issue of a peer-reviewed journal. In addition, symposium organizers plan to publish the major findings and conclusions of the meeting in the journal *Biology Letters*.

By Anne Hollowed

North Pacific Regional Workshop to Facilitate the Description of Ecologically or Biologically Significant Marine Areas (EBSAs).

The Secretariat for the Convention on Biological Diversity (CBD) organized the workshop "North Pacific Regional Workshop to Facilitate the Description of Ecologically or Biologically Significant Marine Areas" held in Moscow, Russia, from 25 February to 1 March 2013. The workshop is the fifth in a series of regional workshops, with a primary objective to facilitate the description of ecologically or biologically significant marine areas (EBSAs) through the application of scientific criteria adopted by CBD. Two other regional workshops in the Pacific region were held prior to the North Pacific regional workshop; thus the southern boundary of the North Pacific region was pre-determined (Fig. 1.) Only two countries, the Russian Federation and Mexico, volunteered to include their EEZ waters for EBSA scientific evaluation by the CBD process. The rest of the countries have their own national process of defining marine protected areas or EBSAs.

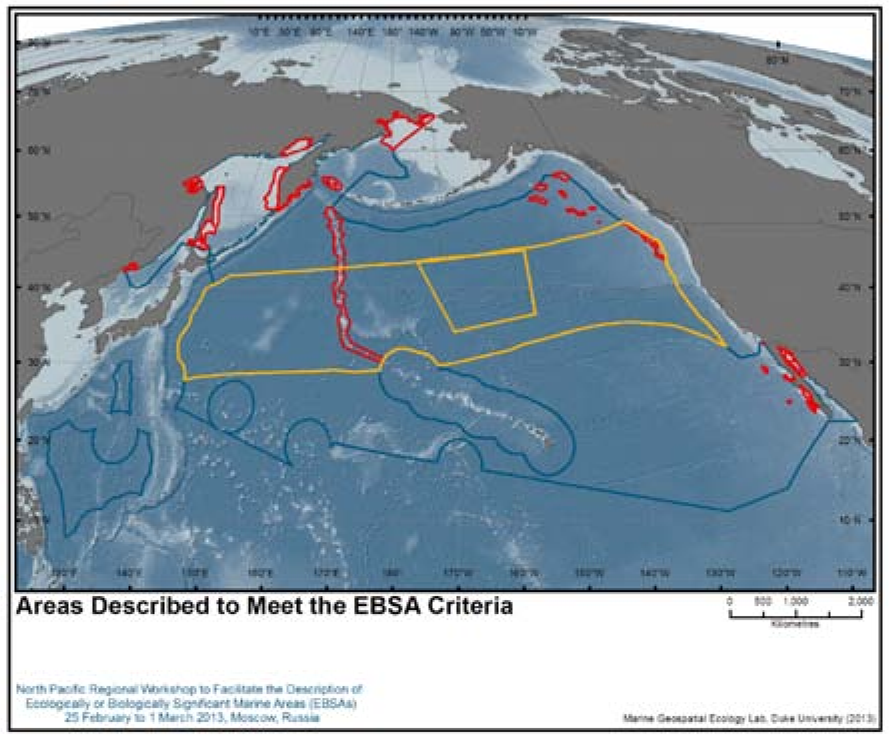


Figure 1. Areas described to meet the EBSA criteria. Blue line indicates the boundary of the area considered by the workshop. Polygons in red indicate those areas described against EBSA criteria by the workshop. Polygons in yellow indicate those features that are inherently not spatially fixed, and described against EBSA criteria by the workshop.

The seven major scientific criteria adopted by the CBD to identify EBSAs are as follows:

- Uniqueness or rarity
- Special importance for life history stages of species
- Importance for threatened, endangered, or declining species and/or habitats
- Vulnerability, fragility, sensitivity, or slow recovery
- Biological productivity
- Biological diversity
- Naturalness

The participants concluded that 20 areas in the North Pacific region met most of the scientific criteria for EBSAs. These EBSAs occur in the following zones (see Fig. 1.: the Russian EEZ (EBSAs #1-9), the Mexican EEZ (EBSAs #10-15) and the international Zone (EBSA #16 for the Juan de Fuca Ridge Hydrothermal Vents, EBSA #17 for the seamounts in the NE Pacific Rim outside the central Gulf of Alaska and Canada, EBSA #18 for the Emperor Seamount chain and seamounts north of Hawaii, EBSA #19 for the Central Pacific transition zone and bordering currents that also encompasses many important feeding areas for loggerhead turtles, leatherback turtles, and white sharks, and EBSA #20 for the Albatross Arc that covers important feeding areas for black-footed and Laysan albatrosses).

The results of the workshop will be submitted to forthcoming meetings of the Convention's Subsidiary Bodies and the 12th Conference of the Parties. The participants were from the CBD Secretariat and national representatives from Canada, North Korea, South Korea, Japan, Mexico, Philippines, and the Russian Federation. Other organizations that participated were from NOAA, the Food and Agriculture Organization of the United Nations, the Northwest Pacific Action Plan, the North Pacific Marine Science Organization, the North Pacific Fisheries Commission, and various Russian organizations including the Russian Academy of Sciences and World Wildlife Fund-Russia. China was invited but was unable to attend. Dr. Loh-Lee Low attended for NOAA as the United States is not yet a member of the Convention.

By Loh-Lee Low

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Alaska Fisheries Science Center
7600 Sand Point Way N.E.
Seattle, Washington 98115

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