Alaska Marine Conservation Council
CELEBRATING 20 YEARS

December 1, 2015

North Pacific Fishery Management Council
605 West 4th Avenue, Suite 306
Anchorage, AK 99501

RE: Agenda item C-7 Bering Sea Fishery Ecosystem Plan

Dear Chairman Hull and Council members:

We appreciate the opportunity to express support for the continued development of a fishery ecosystem plan (FEP) for the Bering Sea. The Alaska Marine Conservation Council (AMCC) is grateful of the efforts made by the North Pacific Fishery Management Council (Council), the Ecosystem Committee, and the Alaska Fisheries Science Center. This hard work has culminated in a thoughtful approach to ecosystem-based management (EBFM) that builds on the Council's legacy as a leader in developing and implementing EBFM approaches to fishery management. Accordingly, we ask that the Council formally initiate the development of the Bering Sea FEP, using the approach and format outlined by the Ecosystem Committee.

The Council already successfully employs EBFM principles throughout its Fishery Management Plans (FMPs); however, the Bering Sea FEP represents an opportunity to codify that effort into a discrete, transparent plan, which adds value to the Council's ongoing management practices. Among other things, the Bering Sea FEP will provide a mechanism for the Council to articulate its vision for the Bering Sea to the National Marine Fisheries Service, the Alaska Fisheries Science Center, and the public; it will serve as a coordinating function that enhances decision-making across FMPs; and it will also identify and prioritize research needs address gaps in ecosystem knowledge and FMP policies.

AMCC also sees particular value in how an EBFM approach would enhance the public process. For example, an FEP would allow the Council to explicitly evaluate how it analyzes tradeoffs in its decision-making process, providing not only greater transparency in the Council process, but also additional opportunities for stakeholder input. Such transparency has benefits that flow both ways: transparent, long-term planning on an ecosystem-level basis provides guidance for stakeholders, allowing for them to anticipate management decisions. This, in turn, minimizes the likelihood that the Council will have to engage in crisis management decision-making. The FEP could also provide a formal mechanism for the Council to incorporate local and traditional knowledge into its management decisions.

PO Box 101145 • Anchorage, AK 99501 T 907.277.5357 E fish@akmarine.org W www.akmarine.org

In summary, the Council has always led the nation in implementing EBFM concepts into its fishery management process. The FEP approach outlined by the Ecosystem Committee is an opportunity to continue that legacy. More than that, an FEP will also enhance the Council's decision-making processes by providing additional tools to Council and increased public input for stakeholders. We appreciate your collective effort on this issue and look forward to continued participation in this process.

Thank you for your consideration of these comments.

Sincerely,

Shannon Carroll
Fisheries Policy Director

December 1, 2015

Dan Hull, Chairman
North Pacific Fishery Management Council
605 West 4th Avenue, #306
Anchorage, AK 99501

RE: Bering Sea Fishery Ecosystem Plan (C-7 BS FEP)

Dear Chairman Hull and Council Members,

On behalf of the National Audubon Society in the Pacific Flyway, including state offices in Alaska and Washington, we write to convey Audubon's support for the North Pacific Fishery Management Council's (Council) development of a fishery ecosystem plan (FEP) for the Bering Sea. We understand that the Council will consider a decision to formally initiate development of the Bering Sea FEP at its December meeting. We encourage the Council to make an affirmative decision and move ahead along the lines of what was outlined in the November 2015 Discussion Paper, "Development of Bering Sea Fishery Ecosystem Plan."

The Council has long been recognized as a leader for its responsiveness to ecosystem concerns, and development of a Bering Sea FEP would be another manifestation of that leadership and a significant step forward in promoting the conservation, management and sustainable use of the Bering Sea ecosystem and resources. We greatly appreciate the thought and effort on the part of the Council's Ecosystem Committee and staff in drafting the Discussion Paper and FEP strategic document (Attachment 4).

Audubon looks forward to participation as a stakeholder in development of the Bering Sea, and we offer Audubon's support and expertise to assist in that process. Audubon first opened an office in Alaska in 1977, and the Bering Sea ecosystem has long been a concern and priority. In 2004, Audubon worked with BirdLife International's Asia Council and the Russian Bird Conservation Union to identify Important Bird Areas (IBAs) in the Bering Sea ecoregion[1], and in 2014, Audubon updated its analysis and identification of IBAs in the U.S. part of the Bering

[1] Audubon Alaska, Birdlife International Asia Council, and Russian Union for Bird Conservation. 2004. Important Bird Areas of the Bering Sea Ecoregion. Audubon Alaska, Anchorage, Alaska. 40 pp.

Sea[2]. In addition, Audubon maintains the Alaska WatchList[3], highlighting declining and vulnerable bird species, including 15 species of loons, cormorants, seaducks, and seabirds that regularly use the Bering Sea. Last published in 2010, the Alaska WatchList is currently being updated.

Finally, in 2010, Audubon published its Arctic Marine Synthesis[4], which synthesizes and maps ecosystem data in the Beaufort and Chukchi seas, but extends south into the northern Bering Sea. With support from the Gordon and Betty Moore Foundation, the Arctic Marine Synthesis is now being updated and extended to include the entire U.S. Bering Sea region. This revised and expanded atlas will gather and map the best available peer-reviewed information on a range of selected subjects from physical oceanography to seabirds and marine mammals and human uses, such as vessel traffic. The Arctic Marine Synthesis is intended as a planning and decision-support tool, and we will be pleased to consult with the Council staff and Ecosystem Committee, as well as with staff at the Alaska Fisheries Science Center, as we move forward. Please advise us if there are data layers that will be of special interest in development of the Bering Sea FEP.

Specific Comments

As the Council considers whether and how to move forward with a Bering Sea FEP, Audubon has two specific comments and suggestions:

Cumulative Effects

We encourage explicit consideration of how the Council will evaluate and consider the cumulative and interactive effects of environmental change and human activities in the Bering Sea ecosystem in relation to ecosystem-based fishery management. This is especially important in order to address "tradeoff issues" and ensure that "management is flexible, responsive, and resilient…" as described at the bottom of page 4 of the Discussion Paper.

The Discussion Paper (p. 25) on the Bering Sea FEP describes a possible action module on conceptual models of the Bering Sea ecosystem and human system focal points. Conceptual models are essential as a foundation for evaluation of cumulative and interactive effects, but the Council may want to consider an action module specifically on cumulative and interactive effects. Such a module could, for example, address questions like these: How will cumulative and interactive effects be identified and assessed on an on-going basis? What is the process for considering whether and how management practices will be adapted in response?

[2]Smith, M.A., N.J. Walker, C.M. Free, M.J. Kirchhoff, G.S. Drew, N.Warnock and I.J. Stenhouse. 2014. Identifying marine Important Bird Areas using at-sea data. Biological Conservation 172:180-189.

[3] Audubon Alaska. 2010. Alaska WatchList. Audubon Alaska, Anchorage. 8 pp. Accessed at: http://ak.audubon.org/sites/default/files/documents/ak-watchlist-2010.pdf

[4] Smith, M.A. 2010. Arctic marine synthesis: atlas of the Chukchi and Beaufort seas. Audubon Alaska, Anchorage, AK. Accessed at: http://ak.audubon.org/arctic-marine-synthesis-atlas-chukchi-and-beaufort-seas

Seabirds

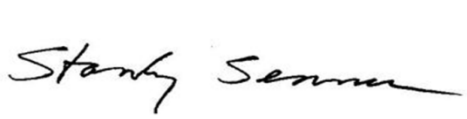
Seabirds are abundant, ecologically significant, and highly visible parts of the Bering Sea ecosystem, and their populations can be affected by fisheries activities (e.g., through incidental take and competition for prey species). When the Council developed the Aleutian Islands FEP in 2007, Audubon provided information on IBAs and WatchList species in the Aleutians and this information was recognized and (to some degree) incorporated into the FEP. We encourage the Council to give strong consideration to seabirds in development of the Bering Sea FEP. It may or may not be necessary to develop an action module on seabirds at this time, but we encourage the Council to include seabirds among the conceptual models to be developed as part of the Bering Sea FEP. Such a model would be helpful in a number of respects, including in the assessment of cumulative and interactive effects as mentioned above.

Conclusion

Audubon supports development of a Bering Sea FEP along the lines of what was outlined in the November 2015 Discussion Paper and encourages the Council to formally initiate that process. Development of the FEP would continue the Council's leadership in ecosystem-based management nationally and globally, and it will substantially advance an integrated approach to management decisions in the Bering Sea ecosystem. Audubon will be pleased to assist in this process, and we are eager to share our expertise and resources to that end.

Thank you for your time and consideration.

Sincerely,



Stanley Senner
Vice President for Bird Conservation
Pacific Flyway

Gail Gatton
Vice President & Executive Director
Audubon Washington

Nils Warnock
Vice President & Executive Director
Audubon Alaska

111 SW Columbia Street, Suite 200
Portland, OR 97201

Ocean Conservancy

503.505.6575 Telephone
503.230.0903 Facsimile
www.oceanconservancy.org

November 30, 2015

North Pacific Fishery Management Council
605 West 4th Avenue, Suite 306
Anchorage, AK 99501

RE: Agenda item C-7 Bering Sea Fishery Ecosystem Plan

Dear Chairman Hull and Council members:

Ocean Conservancy[1] is writing today to express our support for development of the Bering Sea Fishery Ecosystem Plan (FEP). We commend the North Pacific Fishery Management Council (the Council), your Ecosystem Committee, and the Alaska Fisheries Science Center for your interest and hard work in developing a framework for a Bering Sea FEP. **We ask the Council to take action at this meeting to initiate development of an FEP for the Bering Sea.**

Ecosystem-based management as an approach to fisheries management has been recommended by numerous experts for more than a decade.[2] Ecosystem-based fisheries management (EBFM) continues to be a national priority, as evidenced by the National Marine Fisheries Service's recent publication of an Ecosystem-based Management Policy.[3] The North Pacific Fishery Management Council has long been recognized as a leader in the development and implementation of ecosystem-based fishery management.[4] By developing an FEP for the Bering Sea, the Council can continue to lead in the development of EBFM implementation, setting the bar for how to implement EBFM. As recognized in the Council's Ecosystem Approach, the Bering Sea ecosystem is among "some of the most biologically productive and unique marine ecosystems in the world, supporting globally significant populations of marine mammals, seabirds, fish and shellfish."[5] This ecosystem supports tremendously valuable commercial fisheries, strong fishing communities and the subsistence way of

[1] Ocean Conservancy educates and empowers citizens to take action on behalf of the ocean. From the Arctic to the Gulf of Mexico to the halls of Congress, Ocean Conservancy brings people together to find solutions for our water planet. Informed by science, our work guides policy and engages people in protecting the ocean and its wildlife for future generations.

[2] Pew Oceans Commission, *America's Living Oceans: Charting a Course for Sea Change*, *A Report to the Nation* (2003); U.S. Commission on Ocean Policy, *An Ocean Blueprint for the 21st Century* (2004); White House Council on Environmental Quality, *Final Recommendations of the Interagency Ocean Policy Task Force* (2010).

[3] National Marine Fisheries Service Policy Directive, Ecosystem-Based Fisheries Management Policy, Discussion Draft (Sept. 9, 2015), *available at* http://www.st.nmfs.noaa.gov/Assets/ecosystems/ebfm/Draft_EBFM_Policy_9.9.2015_for_release.pdf.

[4] NOAA Science Advisory Board Report, *Exploration of Ecosystem Based Fishery Management* 30 (July 2014).

[5] North Pacific Fishery Management Council, *Discussion Paper: Development of a Bering Sea Fishery Ecosystem Plan* 2 (Nov. 2015).

life. As the Council is well aware, the Bering Sea faces significant and numerous stressors, particularly in the face of climate change. Impacts of climate change, ocean acidification, invasive species, oil and shipping contaminants and increased threats from shipping and oil and gas development all represent significant changes to the Bering Sea ecosystem with potentially huge impacts on fisheries. By developing a Bering Sea FEP, the Council will have an approach to management which can take into account the changing conditions and ensure ocean ecosystems can support healthy fish populations into the future.

The Council's current process of decision-making already incorporates many aspects of ecosystem-based management, and we commend the Council for this groundbreaking work. An FEP provides an opportunity to compile and communicate this existing work, creating a clear and transparent record of the Council's consideration of ecosystem impacts. Moving beyond the Council's existing work, the FEP provides an opportunity to advance further down the path of EBFM, allowing Alaska to continue to lead in this arena.

More specifically, an FEP will provide concrete tools to advance management and understanding of the Bering Sea ecosystem. We see significant value in the Bering Sea FEP as a tool to help the Council with the challenging job of managing fisheries in an ever changing climate. The FEP can provide a mechanism for balancing tradeoffs, opportunities and risks beyond single species management. An ecosystem-based approach will provide a formal means to incorporate ecosystem information and traditional knowledge into the Council's decision-making framework. As other non-fisheries sectors, particularly shipping, increase as Arctic ice melts, an FEP can provide a basis for the Council to assess risks to fisheries and to be able to respond to ensure sustainable fisheries management is not impacted.

In conclusion, an FEP is a valuable tool which can assist the Council in facing management challenges posed by a changing climate and other stressors. Developing an FEP will allow the Council to continue to lead internationally in the implementation of ecosystem-based fisheries management practices. We commend the Council for your foresight in considering an FEP for the Bering Sea and urge you to take action at this meeting to formally initiate development of the FEP.

Thank you for your continued dedication to this important work and we look forward to working with you to further develop the FEP.

Sincerely,

Rebecca Robbins Gisclair
Arctic Policy Manager

OCEANA Protecting the World's Oceans

175 South Franklin Street, Suite 418
Juneau, Alaska 99801 USA

+907.586.4050
OCEANA.ORG

December 1, 2015

Mr. Dan Hull, Chair
North Pacific Fishery Management Council
605 W. Fourth Avenue, Suite 306
Anchorage, AK 99501-2252

Dr. Jim Balsiger, Regional Administrator
NOAA Fisheries, Alaska Region
709 West Ninth Street
Juneau, AK 99802-1668

RE: Agenda item C-7 Bering Sea Fishery Ecosystem Plan

Dear Mr. Hull, Dr. Balsiger, and Council Members:

We support development of a Bering Sea Fishery Ecosystem Plan (BS-FEP). The North Pacific Fishery Management Council (NPFMC) has been considering developing a Bering Sea FEP since June 2013 and this November 2015 discussion paper provides a good framework and rationale for a Bering Sea FEP. We request the NPFMC take action at this meeting to initiate development of a Bering Sea Fishery Ecosystem Plan.

A BS-FEP would formalize the process for identifying and evaluating ecosystem concerns, and would provide an agreed process for integrating measures taken in response to these concerns into NPFMC decision making. At present, the NPFMC considers ecosystem concerns through the ecosystem considerations sections of the stock assessment and fishery evaluation (SAFE) reports, and has earned well-deserved praise for doing so. However, the process for identifying and evaluating these concerns is currently informal, and the allocation of limited agency resources to address new concerns is ad hoc. The proposed BS-FEP would formalize these processes and efforts, and would also provide a clear process for considering the results in the Council's formal deliberations. This formalization is the most straightforward example of what an FEP would provide that the Council does not already do. These objectives are very worthwhile for advancing conservation goals within the NPFMC, and deserve strong support.

The process for evaluating particular ecosystem concerns involves formulation and execution of "action modules", which currently provide the central focus of the proposed FEP process. These action modules specify agencies, resources, motivations and strategies for how each particular ecosystem concern would be addressed, and how the results of these efforts would be incorporated into decision making. By laying out a clear, concrete process for addressing these concerns, the discussion paper again illustrates the utility of a BS-FEP. The example action models are a good start, and we request that a climate change model should include the effects of ocean acidification.

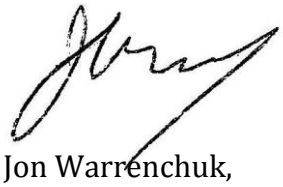
OCEANA Protecting the World's Oceans

175 South Franklin Street, Suite 418
Juneau, Alaska 99801 USA

+907.586.4050
OCEANA.ORG

Thank you for your continued work on this issue.

Sincerely,



Jon Warrenchuk,
Senior Scientist and Campaign Manager,
Oceana

THE PEW CHARITABLE TRUSTS

111 SW Columbia St, Suite 200
Portland, OR 97201

December 1, 2015

Dan Hull, Chairman
North Pacific Fishery Management Council
605 West 4th Avenue, #306
Anchorage, AK 99501

RE: Bering Sea Fishery Ecosystem Plan

Dear Chairman Hull and Council Members,

We write to express our strong support for the North Pacific Fishery Management Council's (Council) development of a fishery ecosystem plan (FEP) for the Bering Sea. Specifically, we ask that the Council take action at its December meeting to formally initiate development of the Bering Sea FEP and to endorse the general approach and format as outlined in the Ecosystem Committee's draft FEP strategic document. We greatly appreciate the careful thought and hard work of the Ecosystem Committee as well as Alaska Fisheries Science Center and Council staff in drafting both the discussion paper and the draft FEP strategic document. We believe the scoping and analysis done so far provide a solid foundation for developing a strong FEP that helps the Council achieve its vision of sustainable fisheries maintained by healthy marine ecosystems.[1]

In addition to expressing support for the Council initiating development of an FEP, we'd also like to reference some recent efforts at the federal level that build on the work that the Council has already done to implement ecosystem-based fishery management (EBFM), and that we feel complement its efforts to develop a Bering Sea FEP. Last, we offer two suggestions for Council consideration as it moves forward with development of an FEP.

National EBFM Guidance

Earlier this year, the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA Fisheries) released an EBFM policy directive that defines EBFM and provides a general framework for implementation.[2] (We expect the release of an "EBFM Road Map" this spring, which will provide more detailed guidance on how NOAA Fisheries and councils should implement EBFM.) In addition to this policy directive, two senior NOAA Fisheries officials, Dr. Jason Link and Dr. Wes Patrick, published a scientific paper suggesting that optimum yield - as defined in the Magnuson-Stevens Act - provides a policy framework to operationalize EBFM.[3] Both of these documents speak to many of the management approaches currently embraced by the Council, such as using ecosystem indicators to monitor ecosystem status and advance understanding of biological, chemical and physical processes. The Patrick and Link paper also cites specific management actions from the North Pacific as good examples

[1] NPFMC. Februrary, 2014. Ecosystem Approach Vision Statement.
[2] NMFS. September, 2015. Ecosystem-Based Fisheries Management Policy. Department of Commerce, National Oceanic & Atmospheric Administration, National Marine Fisheries Service.
[3] Patrick, W. and Link, J. August, 2015. Hidden in plain sight: Using optimum yield as a policy framework to operationalize ecosystem-based fisheries management. Marine Policy 62 (2015) pp. 74 - 81

for other councils to follow, such as the setting of an optimum yield cap on total removals in the North Pacific groundfish fisheries.

Building on the scientific efforts and management approaches employed in the North Pacific, both documents go on to suggest that FEPs provide an opportunity for councils to implement long-term ecosystem level planning as a further step toward operationalizing EBFM. In these documents, FEPs are described as providing a framework for councils to establish goals and objectives for their respective ecosystems, and for regularly assessing progress towards achieving those goals and objectives. We believe that this strategic planning and performance management concept is a central component of EBFM and should be a focus of the development of an FEP for the Bering Sea. To this end, we wholeheartedly agree with the Ecosystem Committee's discussion document that describes a primary benefit of the FEP as the creation of "a transparent public process for the Council to identify ecosystem goals and management responses."[4]

Suggestions for Consideration

As the Council considers whether and how to move forward with a Bering Sea FEP, we would like to offer the following thoughts and suggestions relative to the FEP strategic document, the plan development process, and the identification and development of FEP action modules:

- Incorporate the groundfish fishery management plan (FMP) objectives developed through the Programmatic Supplemental Environmental Impact Statement (PSEIS) process.[5]
- Ensure robust representation of traditional knowledge and subsistence expertise in membership of, and terms of reference for, the Bering Sea FEP Plan Development Team

These suggestions are discussed in more detail below.

FEP Ecosystem Goals & Groundfish FMP Management Objectives

Section 6 of the draft FEP strategic document lists six goals for the Bering Sea ecosystem and calls for the FEP to incorporate principles, policies and guidelines for meeting these ecosystem goals.[6] In general, these goals include protection of ecosystem structure and function, maintaining healthy levels of fish stocks, conserving habitat, providing for multiple uses of marine resources, and avoiding adverse impacts. While it's laudable that all six goals call for the protection and conservation of the marine ecosystem, the fact that they lack corresponding ecosystem objectives or metrics opens them up to subjective interpretation.

We believe this section of the draft strategic document would be strengthened by incorporating, either explicitly or by reference, the EBFM objectives specified in the Bering Sea / Aleutian

[4] NPFMC. November, 2015. Development of a Bering Sea Fishery Ecosystem Plan. Discussion Paper. Agenda Item C-7 BS FEP. p. 3
[5] NPFMC. August, 2015. Fishery Management Plan for Groundfish of the Bering Sea and Aleutian Islands Management Area. pp. 4 - 7
[6] NPFMC. November, 2015. Development of a Bering Sea Fishery Ecosystem Plan. Discussion Paper. Agenda Item C-7 BS FEP. p. 22

Islands groundfish FMP. The groundfish FMP management objectives were developed through the PSEIS process and include specific and measurable objectives that essentially operationalize the six goals listed in the draft FEP strategic document. In its April 2015 report, the Council's Scientific and Statistical Committee recommended incorporating these management objectives into the FEP as they could be easily mapped to the draft goals proposed at the time, and would be preferable to developing a second suite of very similar goals.[7] Additionally, the Ecosystem Committee's discussion document speaks to the value of having a clear statement of ecosystem goals[8], and suggests that the FEP "provide specific, actionable objectives."[9]

Integrating the ecosystem-based groundfish FMP management objectives into the FEP would add clarity and specificity to the six goals listed in the draft strategic document, and would create a clear linkage between the FEP's goals for the ecosystem and management of the groundfish fishery in the Bering Sea. To the extent that these management objectives are specific and measurable, they can better enable the Council to provide targeted guidance for identification and development of action modules, analogous to what is currently done in the Council's groundfish workplan where individual action items are grouped according to specific FMP management objectives.[10]

Traditional Knowledge & Subsistence

Both the Ecosystem Committee's discussion document and the draft FEP strategic document speak to the need for the FEP to establish processes and/or mechanisms for incorporating traditional knowledge into the Council's decision making process. Human communities are essential components of ecosystems, and the traditional knowledge held by indigenous communities should inform the Council's decision making process. To that point, the draft strategic document states traditional knowledge "is especially useful to supplement or validate local, small-scale ecosystem observations, in combination with large-scale scientific efforts."[11]

Additionally, Example Action Module 4 calls for the development of a protocol for using subsistence information in management. In particular, the description of that module states:

> *A Bering Sea Fishery Ecosystem Plan provides opportunity for the Council to prescribe how subsistence use and other traditional data will be used to describe and understand the potential impacts of commercial fisheries on subsistence resources and use and, if appropriate, mitigate those potential impacts to ensure that subsistence use of marine resources continues unabated in the Bering Sea.*[12]

---

[7] NPFMC. April, 2015. Final Report. Scientific and Statistical Committee to the North Pacific Fishery Management Council. p. 11
[8] NPFMC. November, 2015. Development of a Bering Sea Fishery Ecosystem Plan. Discussion Paper. Agenda Item C-7 BS FEP. p. 4
[9] *Ibid.* p.5
[10] NPFMC. February, 2008. Groundfish Policy Workplan.
[11] NPFMC. November, 2015. Development of a Bering Sea Fishery Ecosystem Plan. Discussion Paper. Agenda Item C-7 BS FEP. p. 22
[12] NPFMC. November, 2015. Development of a Bering Sea Fishery Ecosystem Plan. Discussion Paper. Agenda Item C-7 BS FEP. p. 30

We are greatly supportive of the incorporation of both traditional knowledge and subsistence usage information and data into the fishery management process. To ensure robust representation of these knowledge sources into the development process of the FEP, we believe that membership of the Plan Development Team should extend beyond federal and state agency personnel to include experts on the traditional knowledge, and/or subsistence uses of indigenous communities along the Bering Sea. In particular, we are aware of traditional knowledge experts associated with indigenous organizations in the Bering Sea region and we suggest that such expertise would be a positive addition to the prospective FEP Plan Development Team.

Conclusion

The availability and utility of tools and approaches to aid in EBFM is growing rapidly. In the Bering Sea many of these tools are currently being applied. Yet more will be needed to steward this ecosystem in the years ahead. The Council has and will continue to face difficult fishery issues where the decisions it makes will have significant implications for the broader ecosystem. These discussions can and should be informed by an FEP that clearly explicates the Council's goals and objectives for the Bering Sea ecosystem and puts in place a comprehensive plan to achieve them.

This Council is recognized as a global leader in the management of sustainable fisheries, utilizing a precautionary approach, and incorporating ecosystem considerations into many of its decision-making processes. By developing a comprehensive FEP for the Bering Sea, the Council can further cement its leadership role by establishing a transparent, science-based plan for continuing to implement ecosystem-based fishery management practices and maintaining a healthy and productive ocean ecosystem for all who depend on it.

We look forward to continuing to participate in this process, and we appreciate all that you do to maintain sustainable fisheries and healthy, productive marine ecosystems.

Thank you for your time and consideration.

Sincerely,

Steve Marx
Officer, U.S. Oceans, Pacific
The Pew Charitable Trusts
smarx@pewtrusts.org

St. George Island Institute

P.O. Box 940, St. George Island, AK 99591 (907) 859-2205
http://www.stgeorgeislandinstitute.com

November 19, 2015

Dan Hull, Chairman
North Pacific Fishery Management Council
605 West 4th Street, Suite 306
Anchorage, AK 99501-2252

Dear Chairman Hull:

It has come to my attention that the Council will be discussing a Bering Sea Fishery Ecosystem Plan, (agenda item C7.) I would like to request that as a part of this plan you ask your SSC and council staff to do an extensive evaluation of the status of the northern fur seal population, specifically as it relates to the Pribilof Islands. I have lived on the Pribilof's for twenty years and have watched this population of northern fur seals decline to a point below the 1911 level, which was the imputes to enact an International Treaty. I am wondering how long we are going allow this population to decline before constructive measures are taken to stop the decline. If a top predator in the ecosystem is declining, that is a sign that the whole ecosystem in out of balance, as NMML scientist Dr. Charles W. Fowler has so well illustrated in **Systemic Management: Sustainable Human Interactions with Ecosystems and the Biosphere,** Oxford University Press, 2009.

A Bering Sea Fisheries Ecosystem plan should also look closely at the lack of recovery of the Pribilof blue king crab. It seems to me that the Habitat Conservation Area must not include all the needed habitat for this species to recover, and maybe we should be looking at including the most important features of the Pribilof Domain - the Pribilof Canyon and the shelf edge. So, maybe extending the boundary to what was originally proposed would actually allow the species to recover. And also to truly make it a no-trawl zone with NMFS stopping trawling over the nursery grounds. This would make a great scientific experiment, since you now have twenty years of no recovery.

I also hope that your ecosystem plan will be looking at the seabirds that nest on our islands. They all had a very poor year last summer and this is first time that I know of that we saw all the species that FWS monitors fail.

Enclosed is a time line showing the long history of recognition of the importance of the Pribilof Domain to the Bering Sea ecosystem and I hope your plan will reflect this too.

Sincerely,

Karin Holser
Coordinator

cc: Dr. Kathryn Sullivan, Under Secretary of Commerce for Oceans and Atmosphere and NOAA Administrator
Dr. Richard Merrick, Director, Scientific Programs and Chief Science Advisor
Dr. Rebecca Lent, Marine Mammal Commission (rlent@mmc.gov)

Pribilof Conservation Timeline

1868 – President Ulysses S. Grant declared the Pribilof Islands as a reserve for the northern fur seals

1870 – The Act to Prevent the Extermination of the Fur Seals – to protect the seals, it established the Pribilof Islands as a permanent government reservation,(the country's first National Wildlife Refuge) and provide for the Aleuts comfort, maintenance, education, and protection

1910 – The Fur Seal Act – ended private lease system and assigned sole responsibility for the Pribilof Program to Department of Commerce and Labor

1911 – The North Pacific Fur Seal Convention – the first international conservation treated signed by the United States, Great Britain (on behalf of Canada), Russia, and Japan, abolished sealing on the high seas for fifteen years and was continued until 1983

1912 – Congress declared a five-year moratorium on sealing in the Pribilof Islands, except for seals needed for food by the Aleuts (The seals had decreased from an estimated 2 million in 1870 to only about 133,000 in 1910, but by 1918 the population was healthy enough to resume harvesting with low quotas that gradually increased to the peak of about 95,000 in 1941. By the 1950 the population was estimated at over 2 million once again)

1972 – The North Pacific Fur Seal convention established St. George Island as seal research station and prohibited all seal killing

1972 – Marine Mammal Protection Act

1989 - Central Bering Sea Fishermen Association proposes a no-trawl zone around the Pribilof Island to protect blue king crab, seabirds and marine mammals

1996- North Pacific Fisheries Management Council established the Pribilof Habitat Conservation Zone, which is much smaller then what was proposed by CBSFA

1999- Steller Sea Lion critical habitat status removed from St. George by the Steller Sea Lion Recovery committee. No consultation with St. George Islanders to verify that sea lions were no longer hauling.

2004 - St. George Traditional Council starts photo documentation of Steller sea lions hauling out at Dalnoi Point, Tolstoi, South Rookery, and others beaches on the island

2005 - St. George Traditional Council request NMFS as their Co-Management partner to reestablish Dalnoi Point as critical habitat for Steller sea lions, since over 400 sea lions are routinely documented hauled out. Request denied and told to present it to the NPFMC

2006 - NPFMC denied request for Dalnoi Point to be CH for Steller sea lions

2007 - St. George presents at the Steller sea lion mitigation committee showing ample evidence of use by Steller sea lions of Dalnoi Point by not just males, but females with pups, and tagged animals from Russia, Southeast Alaska, and all sites in between.

2011- NO Action by NMFS to conserve and protect either the Steller sea lion or the northern fur seal, so the St. George Traditional Councils nominates the 60 mile protected zone around the Pribilof Islands to be the first tribally nominated Marine Protected Area - The Pribilof Domain Cultural Heritage Zone.

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

INSTITUTE OF MARINE SCIENCES

3431 ARENDELL STREET
MOREHEAD CITY, NC 28557

T 252.726.6841
F 252.726.2426

23 November 2015

Dan Hull, Chairman
North Pacific Fishery Management Council
605 West 4th, Suite 306
Anchorage, AK 99501-2252
npfmc.comments@noaa.gov

Dear Chairman Hull, Fellow Council Members, Advisory Panel, and SSC Members:

I prepare this document to offer professional advice to support the Council's well-founded efforts to prepare a BS FEP and thereby finalize ecosystem-based fishery management plans (EBFMPs) for the Bering Sea. My own background in the conceptual core of ecosystem-based management, fisheries science, the ecology of Alaskan ecosystems, conservation of threatened and endangered species, and fisheries management is diverse, but I will describe here the highlights so as to indicate how those experiences help shape my advice to the Council. My letter and the accompanying document I prepared and attach are explicitly directed towards the Council's consideration at the upcoming December 2015 meeting of "Item 7: Bering Sea Fishery Ecosystem Plan-Discussion Paper" and respond to the November 2015 Council Discussion Paper entitled "Development of a Bering Sea Fishery Ecosystem Plan."

I first feel compelled to introduce myself to those who don't know me or my work and to identify the experiences I have had that motivate me to presume that I have suggestions of value that may inform your work on management of fisheries in the Bering Sea. I offer my comments in the spirit of transparency and inclusiveness that has characterized the open approach of all the work done by the North Pacific Fishery Management Council.

I served for four years from 1989-92 as the founding Chair of GLOBEC - the first US-originated global change research program on impacts of global climate change on ocean biology and fisheries ecosystems. That program grew to become international in scope, ultimately generating hundreds of millions of dollars for research worldwide and producing critical insights into how climate-driven changes in ocean physics modify critical processes affecting fish production of the world's oceans. Simultaneously from 1987-1992, I represented the US on the Shellfish and the Mariculture Committees of ICES. I also served two terms on the North Carolina Marine Fisheries Commission covering the years of 1985-87 and 1993-97. Subsequently, from 2001-2013, I chaired the Steering Committee for the North Carolina Coastal Habitat Protection Plan. This innovative CHPP is essentially an ecosystem-based management

plan for the State's fisheries that brings water quality regulators, coastal habitat managers, forestry departments, and soil erosion-protection program officials to the same table to develop viable, conceptually sound management plans that serve to enhance and sustain fisheries. I am unaware of any other state-run fisheries management plan that involves an ecosystem-based approach to the degree achieved by North Carolina's CHPP.

In Alaska, I have worked and continue to work for about 1-3 months annually from 1989-2015 on the Scientific Advisory Panel of the Exxon Valdez Oil Spill (EVOS) Trustees. My role has commonly been one of promoting syntheses among scientific studies so that understanding of broader ecosystem effects grows to the point where management interventions are more likely to successfully restore key fishery resources as well as enhance recovery of at-risk marine mammal and seabird populations. From 1993-95, I also served on the National Academy of Sciences NRC Bering Sea Ecosystem Panel and played a major role in the preparation of the report. The synthesis book that emerged in 1995 from this NRC panel work has served to guide many advances in management of Bering Sea fish stocks, successful wildlife recoveries, and growth in ecosystem services to human inhabitants of the land areas abutting the Bering Sea. Although my knowledge of Northern Gulf of Alaska, Prince William Sound and Kenai Peninsula, and Bering Sea fisheries and their ecosystem contexts has grown over my 26 years of work in Alaska, I readily admit that I am still learning and retain an open mind receptive to new learning, especially in the arena of how global climate change is affecting important fish stocks, fish habitats, and biological entities important to sustainability of key fisheries.

In studying the November 15 NPFMC document entitled "Development of a Bering Sea Fishery Ecosystem Plan", I note several issues that could benefit from more explicit elaboration during FEP development for the Bering Sea.

First, I note that while an effective FEP that meets criteria to qualify as an EBFMP can lead to management implications for ecosystem parameters, such as promoting recovery of threatened and endangered marine mammals and seabirds, the main intent, however, of ecosystem-based fisheries management is to use the knowledge of ecosystem structure and dynamic interactions among components to filter and modify impacts of fishing and other ecosystem drivers as they influence specific fish stocks of concern, their critical habitats, and their resistance and then resilience to external stressors. In other words, the ecosystem processes introduce interactions among ecosystem components that must be considered in fisheries population and fish habitat management.

Second, there is an urgent need to include in EBFM planning for the Bering Sea the various important drivers associated with climate change: water temperatures (now indicative a substantial possible regime shift towards warmer waters in the Bering Sea), declining extent of ice cover, greater water column stratification, and modifications of ocean currents, especially buoyancy-driven flows originating from ice and glacier melt and run-off.

Third, because of the extensive ice retreat, other external stressors of the ecosystem caused by human activities are escalating – shipping where ice historically inhibited it, the disturbance of minerals mining on the sea floor, materials extraction like sand mining for construction use on land, and energy development. These changing drivers can be and should be

incorporated into the Bering Sea ecosystem models because their influence on fish stocks and fish habitat may be substantial.

Fourth, there are indeed some ecosystem-level management objectives that can only be approached by having a relatively complete ecosystem model. For example, it is increasingly clear that explicit attention must be paid to preservation and even enhancement of forage fish populations and production in a time when the search for exploitable protein in the sea has been evolving towards smaller and smaller organisms, sometimes species providing critical forage for larger fishes, marine mammals, and seabirds. Industrial fishing, larger piscivorous fishes, marine mammals, and seabirds share demand for these smaller forage fishes, requiring informed fishery management to allocate available production among competing demands and thereby serve wildlife conservation and well as people reliant on fisheries catching forage species and on those targeting larger fishes higher up the food chain. Striking a fair balance among alternative demands for forage fish requires a substantial web of interactions be accurately depicted in the ecosystem models supporting EBFM.

Fifth, the need for international cooperation in science and management of the Bering Sea fisheries and potentially of other human activities, such as shipping, mining, and oil-and-gas extraction, exceeds those analogous needs in other marine ecosystems in the US. In particular, the Northern Bering Sea offers opportunities for monitoring, observation, and research where there is tremendous value in marine life, benthic habitats, and ongoing subsistence ways of life with little to no industrial fishing. To cover the entire Bering Sea with some level of regulatory protection for fish stocks important to US-based fisheries has required international agreements over what has been called the "Donut Hole", which is comprised of the Bering Sea waters beyond the traditional management authority of any one country. Five countries combine to influence fishing and other perturbations in the Arctic Donut Hole: the US, Russia, Denmark, Norway, and Canada. As global climate change continues, and, as a consequence, other drivers of fish abundance, fish habitat condition, fish distribution, and ecosystem structure and dynamics also change, existing international agreements will require close re-examination and may need formal reconsideration. The North Pacific Fishery Management Council may need to turn to the US State Department to act in the international arena on behalf of establishing effective ecosystem-based science and management for critical components of the Bering Sea ecosystem. Alternatively, PISCES may serve as a forum in which to discuss the science and management barriers, but that organization seems unlikely to generate the diplomacy required to resolve international conflicts. Denmark and Norway are engaged in Arctic waters of the Atlantic Ocean basin, so the PISCES authority may not extend to their territorial claims. Nevertheless, this issue of the Donut Hole and international co-management needs to be addressed by the Council in appropriate forums with knowledgeable representatives so as to close the political gaps that are not recognized by the fish and other living components of the Bering Sea/Arctic ecosystem.

Interactions within other US management authorities also exist and can result in further productive cooperation between the NPFMC and those entities. For example, the NPFMC, the North Pacific Research Board, and federal research entities within NOAA share many interests and concerns, such that convergence to a set of similar and effective science-based EBFM plans between the NPFMC and the Arctic Council could arise and produce a level of consistency in management approach and methods across adjacent high-latitude ocean basins.

I hope you find my observations and suggestions useful in the conduct of your Bering Sea management obligations. Along with my lengthy experience with the EVOS Trustee Council in guiding restoration of oil spill injuries, and my own academic research on developing practical lists of the components that must be included in an effective ecosystem-based management plan, I also have also worked with Native corporations, villages, towns, and groups of fishermen in Alaska to help rebuild Alaskan fisheries, including establishing effective mariculture of shoreline clams. Both my academic experience and my personal friendships with so many Alaskans who suffered losses from the Exxon Valdez oil spill lead me to encourage this Council to proceed with the contemplated BS FEP and through effective use of its action module approach, thereby producing informed and practical ecosystem-based fisheries management plans for the valuable Bering Sea.

I append a subsequent document in which I provide a list of the attributes that qualify a management regime as "ecosystem-based" for your consideration and possible inclusion in the BS FEP so as to better define differences between classic fisheries management and ecosystem-based fisheries management. I also provide short summaries of several recent studies that highlight the advantages of ecosystem-based fisheries management, largely by illustrating how climate-change impacts to fish populations, fish distributions, fish habitat functions, and newly intensified human activities may interact in ways that management must respond in order to offer sustainability and to maximize ecosystem services to humans who benefit now in so many ways from the resources of the Bering Sea.

Sincerely,

Charles H. Peterson
Professor of Marine Sciences, Biology, and Ecology

Services provided by developing a Bering Sea FEP (Fisheries Ecosystem Plan) that qualifies as Ecosystem-Based Fisheries Management

by

Dr. Charles H. Peterson[1], University of North Carolina at Chapel Hill, Institute of Marine Sciences, 3431 Arendell Street, Morehead City, NC 28557: cpeters@email.unc.edu

EBFM: A process to highlight critical space-based challenges of natural and human-induced changes in climate, ocean physics, ocean acidity, conflicting stakeholder preferences, needs of all stakeholders, dynamics of living natural resources, and goals of building ecosystem resilience to support a sustainable, productive ecosystem balancing fisheries extraction with wildlife conservation and subsistence rights.

In response to a mandate from the Ecological Society of America, Christensen et al. (1996) identified and explained the salient characteristics of the then newly developing methodologies of ecosystem-based management (EBM), which together justify adoption of this approach to management of any living resource, from board feet of Douglas fir to kg of walleye pollock. In brief, EBM injects the complexity of multiple ecosystem forcing functions and the important interactions among environmental variables, component species, and humans into process-driven models that are designed to inform and guide sustainable management (Table 1). In the context of fisheries management, EBFM (Ecosystem-Based Fisheries Management) approaches have evolved to move fisheries management away from quantitative modeling based largely on dynamics and yields of individual target fish populations and toward more holistic models that meld food web dynamics and implications of alternative management scenarios as well as other multi-species interactions with physical forcing functions. In brief, EBFM integrates fisheries management into the process-oriented models that constitute the core principles and methodologies of EBM.

[1]*Dr. Peterson is Distinguished Professor of Marine Sciences, Biology, and Ecology at the University of North Carolina at Chapel Hill. He was a member of the Bering Sea Ecosystem NRC study team and one of the authors of the published 1996 NRC Report. He has served on the Science Advisory Panel for the Exxon Valdez Oil Spill Trustees for 26 years since 1989. He has been a Contributing Editor for Marine Ecology Progress Series for 20 years and edits Oecologia for his 30th year, 12 of which as an Editor-in-Chief. Dr. Peterson was the founding Chair of the Science Advisory Panel for GLOBEC, the first federal government study of ecosystem impacts of global climate change on ocean ecosystems and fish, a program that became international and invested hundreds of millions of dollars into basic ecosystem, climate change, and fisheries research.*

The North Pacific Fishery Management Council has long earned a reputation for appropriate and effective application of EBFM principles in pursuit of their management obligations. The Council's commitment to EBFM approaches is especially well justified by unique aspects of the Bering Sea Ecosystem, in which environmental changes including temperature and sea ice extent and dynamics, the high biomass and high value of commercial fishery catches, the prominence of higher-trophic level seabirds and marine mammals of conservation concern, the impacts of international fishing on joint stocks of ecological and commercial importance, and the scope of subsistence by Native Americans within the Bering Sea can be formally considered within ecosystem-based models created to help guide management. Progress to date in preparing a Bering Sea FEP (Fishery Ecosystem Plan) strongly suggests that the final version of this document will achieve the status of effective EBFM.

The successful recent completion of a broadly praised FEP for the Aleutian Islands (AI) and the wide participation of so many different individuals and interested parties in that FEP process appropriately motivate a Council commitment to finalize an analogous Bering Sea FEP. The preparation of an FEP can play an important role of first informing stakeholders of the components and issues that are considered important enough to receive explicit attention in this ecosystem-based management plan because of their known or suspected prominence with the ecosystem in question. Reactions to what is included and what may be missing from the FEP perhaps then can now be considered by the Council as the FEP is finalized. This process can lead to inclusion of more detailed concerns of special emphasis in management of fishery resources in the geographically specified target BS ecosystem and catalyze development of the conceptual, then subsequently explicit, models needed to incorporate known drivers of ecosystem dynamics as applied to response variables of acknowledged importance for multiple fisheries.

Several aspects of the AI FEP experience seem likely to be repeated if the Bering Sea FEP is finalized. Like the AI FEP, a complete FEP for the Bering Sea fisheries, ecosystem, and communities would serve to establish a common repository for guidance to Bering Sea ecosystem knowledge, fisheries, and presumed critical dynamic forcing processes of relevance to everyone involved in fisheries management within that system. Furthermore, such a compilation of fisheries and ecosystem knowledge carries with it the implication that completing the formal overview of what is known to finalize the FEP will simultaneously reveal any serious gaps in knowledge that may challenge its effectiveness. These recognized gaps in knowledge are presumably prioritized during the early FEP creation and then those gaps of highest priority highlighted by inclusion in the FEP by action modules. Four such action modules are specified in the newly released BS FEP Discussion Paper. By identifying such gaps and the context in which that knowledge would be used to improved holistic ecosystem knowledge and outcomes of alternative fishery management actions, the spotlight on these gaps is bright. Inclusion in an action module probably leads to research to fill the void more quickly than if the concept of action modules had not been developed for inclusion in the FEP. Publication, wide dissemination, and open public discussion of the plan with its component action modules and their potential implications for management all can serve to put stakeholders on notice of possible new management approaches and initiatives. On the other hand, the experience of the Aleutian Islands FEP reveals that there can also develop confusion among stakeholders over what the FEP and the action modules are, the extent to which they drive details of the subsequent

EBFM plans, and how they may be used in management decisions. Whether continued inclusion of any specific action module is up for reconsideration or substantial modification is a question of importance. Hence, the Council should take steps to clarify the nature of any Bering Sea FEP and the processes whereby component action modules and emergent management actions may be modified or replaced.

According to the recent BS FEP Discussion Paper, with its 4 action modules, each module defines a separate, broad research project within the FEP. The Council can prioritize the modules, but apparently did not as yet for the 4 presented in the BS FEP Discussion Paper. Each module would include answers to a series of explicit and implicit questions, all of which are relevant to the information needs that motivate establishment of that specific action module. These questions that each action module must address are:

(1) Synopsis of the task and how it will be accomplished;
(2) Estimate of time and staff resources needed and level and type of public involvement;
(3) Purpose it will achieve (in relationship to FEP objectives);
(4) How it will affect Council decision making and management; and
(5) How it will be applied in Council management process.

Additionally, the FEP will then prioritize the action modules, assess the progress on each and review findings of previously completed action modules. Some action modules may be largely synthetic – like compilation of information relevant to the issues in question. Others may be less well evaluated previously, so information for a synthesis is more limited and, thus, the main task intrinsic to such an action module may be establishment of novel, quantitative process-oriented studies as the appropriate methodology to employ. Some action modules may apply specifically to compiling and interpreting all information necessary for the Council's NEPA analysis of an important contemplated action or set of actions.

Four "example" action modules have been released in the BS FEP Discussion Paper to illustrate their nature and this new process in the ultimate development of BS EBFM plans:

(1) Comprehensive review of fishery management with respect to EBFM best practices with recommendations;
(2) Define conceptual models for the BS based on key ecosystem processes and human focal points (e.g., groundfish, crabs, Norton Sound communities);
(3) Evaluate vulnerability of key species and fisheries to climate change so as to build resilience; and
(4) Develop protocols for use of subsistence information in management.

Benefits provided by developing first an FEP with action plans that can include EBFM models for the Bering Sea and its multiple fisheries can probably be best illustrated and communicated by describing the novel understanding and management implications of potentially broad applicability that have been developed by using rigorous EBM-compatible approaches in response to particular sets of emergent challenges to management of fishes and other living resources in multiple ocean ecosystems worldwide. Such published studies constitute a virtual treasure chest of questions and methodologies that have important counterparts in the Bering Sea as well. I choose to review recent studies and insights of basic applicability to addressing one of the newly released action modules for the Bering Sea FEP: namely action plan #3 ("Evaluate vulnerability of key species and fisheries to climate change to build resilience".) These study results reported here that are responsive to this topic constitute a particularly rich set

of insights into the processes triggered by human-induced and natural climate change – an especially critical challenge in the Bering Sea, where changes in water temperature, sea ice cover, freshwater run-off during warm seasons, geographic distributions of component fishes and wildlife, and physical dynamics are increasingly evident.

Select landmark ecosystem-based studies of climate change impacts on fish and fisheries – responsive to the conceptual issues intrinsic to BS FEP action module #3:

Hollowed, A.B. et al. (21 co-authors). 2013. Projected impacts of climate change on marine fish and fisheries. ICES J.Mar.Sci., doi.: 10.1093/icesjms/fst 081.

Hollowed et al. (2013) review available studies that utilize modeling based on IPCC (2007) climate change projections for T, S, pH, precipitation, currents, sea-level rise, and storms to project their likely impacts on marine fish, their fisheries, and fisheries-dependent communities in the northern hemisphere. The studies reveal: (a) changes in ecosystem productivity, habitat quantity and quality; (b) species-specific changes in fish and shellfish production and habitat; (c) impacts on prosecution of fisheries; (d) declines in food security; and (e) need for characterization of uncertainty in modeling and applying climate change consequences.

Pinsky, M.L., and Mantua, N.J. 2014. Summaries of recent studies revealing implications for fisheries management and sustainability under a warming climate. Oceanography 27:146–159. http://dx.doi.org/10.5670/

Pinsky and (Mantua 2014) review how several aspects of present-day industrial fisheries management need to be modified and repurposed in response to global climate change. Changes are already evident in water temperatures and salinity, but the magnitude and scope of these progressive modifications of fish habitat will be far larger by 2100, a year commonly targeted for GCM (Global Circulation Model) modeling of longer-term environmental change associated with global change. Although climate changes interact with many other processes in ways not fully understood, it is clear that methods have now been developed for integrating climate change and variability into monitoring, vulnerability assessments, stock assessments, spatial management, annual harvest limits, international agreements, and management of newly emerging fisheries. Human responses to manifestations of climate change are likely to have impacts on fisheries as great as or greater than climate change itself (Turner et al. 2010). The recognition of great heterogeneity in manifestation of climate change in the ocean implies that more regionally and spatially explicit approaches may need to be employed in fisheries management. Cumulative effects from multiple stressors increasingly impact fish and their distributions, with climate change interacting with by-catch, habitat destruction, targeted fishing, and other factors. It follows that this will further reduce resilience of fisheries to climate change and induce greater fluctuations in fish abundances (e.g., Hilborn et al. 2003). Impacts of climate change on fisheries yields cannot begin to be anticipated without due attention to the social, economic, and regulatory factors: the bio-sociological network represents the context in which complex interactions must be sorted out (e.g., McCay 2012). Climate change effects on fisheries act at short and long time scales, and can become mismatched to socio-economic processes. An

ecosystem-based approach to fisheries management can serve to address the full range of stressors, a response to climate change challenges that may be necessary to mediate damage to fisheries (McLeod and Leslie 2009). Finally, we must increase socio-economic resilience to respond effectively to climate change impacts on fisheries and fishing (Sumaila et al., 2011).

Mueter, F.J., and Litzow, M.A. 2008. Sea ice retreat alters the biogeography of the Bering Sea Continental Shelf. Ecol. Appl. 18: 309-320. http://dx.doi.org/10.1890/070564.1

Since the early 1980s to circa 2007, the southern edge of the pool of cold water produced by overlying seasonal ice cover in the Bering Sea retreated about 230 km northwards. Surveys from bottom trawls in the southeastern Bring Sea exhibit in large changes in community composition with latitude as sub-Artic fauna migrated northwards into habitat not previously suitable for their occupation. Now the bottom area formerly covered by the cold water pool exhibits increases in total biomass, species richness, and average trophic level of the largely demersal fishes and crustaceans that are sampled by bottom trawls, indicative of invasion of new bottom habitat with previously un- or underexploited resources. The application of scientific understanding of the factors involved in the redistribution of fishes and crustaceans as the ocean temperatures warm and ice cover decreases is extremely important to fisheries management. Snow crab catch data, for example, reveal that now 57% of catch variability is explained by winter sea ice extent. Although several metrics of community distribution and structure show linear relationships to bottom temperature, implying that warming climate has driven the patterns of biogeographic change, the residuals from these regression fits also exhibit a strong temporal trend – best explained by as yet undetermined processes of re-organization of community dynamics that also contribute to biogeographic re-organization of demersal fishes and crustaceans on the Southeast Bering Sea shelf. In other words, major patterns involved in poleward shifts in fish distributions can be explained by species-specific physiology and ecological adaptations, but interactions among species in the community also play a substantial role, which will be more challenging to understand and harder to predict in other ecosystems.

Boyce, D.G., and Worm, B. 2015. Patterns and ecological implications of historic marine phytoplankton change. Mar. Ecol. Prog. Ser. 534: 251-272.

Analyses of 115 published phytoplankton trend estimates from 1889 to 2010 reveal patterns of major change. Phytoplankton concentrations increased through time in nearshore and decreased in offshore open-ocean waters. Causes of these changes appear to be enhanced nutrient runoff from land into nearshore waters and elevated stratification of open ocean surface waters in response to elevated surface temperatures and the resulting greater stratification of the water column. Potential ecosystem responses to these trends include modified species composition and abundance across multiple trophic levels, changing fisheries yields, and changing export of production. The magnitude of these trends over longer time frames is uncertain, but modifications of bottom-up production forcing in ocean ecosystems have capacity to influence production in all fish stocks.

Britten, G.L., Dowd, M., and Worm, B. 2015. Changing recruitment capacity in global fish stocks. Proc. Nat. Acad. Sci.: in press.

This study evaluates time-varying trends from 1952 to 2003 in biological productivity parameters across 262 fish stocks from 127 species in 39 LMEs (Large Marine Ecosystems) and high seas areas. Widespread changes are revealed in the relationships between spawning stock size and recruitment of juveniles, implying basic changes in fish productivity in early juvenile life stages. Across all LMEs, average recruitment capacity varied by a rate equal to about 3% of the historical maximum per decade. The extent of biological change was significantly associated with changes, largely negative, in phytoplankton chl concentration and the history of overfishing of the stock. Highly negative changes in recruitment occurred in the North Atlantic, while the North Pacific changes reveal a more balanced pattern. When standardized Ricker stock recruitment models are fitted to observed data, the residuals around the predicted stock-recruitment curve often exhibit systematic errors, including: (1) progressive declines; (2) abrupt threshold change dynamics; and (3) reversing regime shifts. The observed regime shift exhibited by many northern Pacific Ocean stocks occurred in 1977, coinciding with the reversal in the Pacific Decadal Oscillation, which apparently triggered a dramatic shift from shrimps and crabs (crustaceans) to finfishes in the demersal system of the northern Gulf of Alaska sampled for decades off Kodiak Island by a small-mesh trawl survey (Anderson and Piatt 1999). These results of changing stock-recruitment relationships imply need to establish new baselines of potential production and yield for numerous fish stocks, including lowering expectations of maximum food production for most, and many important, fisheries.

Fulton, E.A., and Gorton, R. 2014. Adaptive Future for SE Australia Fisheries & Aquaculture: Climate Change Simulations. Fisheries Research and Development Corp. and CSIRO, 324 pp.

I devote more space to describing the nature and outcome of this study than any other for several reasons. First, this is the pre-eminent, most rigorous, and most all-encompassing, spatially explicit ecosystem-based fishery management study of direct and indirect consequences of quantitative direct and indirect effects of global climate-change drivers on ocean dynamics, fish stocks, and fisheries management interventions ever done. Second, this response done in response to fisheries management needs identified by CSIRO in Australia represents a perfect template for what the North Pacific Fisheries Management Council needs to facilitate to complete the studies explicitly identified under action module #3 “Evaluate vulnerability of key species and fisheries to climate change to build resilience.” Third, I not only endorse the urgency of this action module for the BS, I also argue that this should be the highest priority among those 4 modules publicized in the recently released BS FEP Discussion Paper. These issues fundamentally challenge all of our present models of fish stock dynamics, physical and chemical forcing of ocean ecosystems, trophic and other biological interactions among fishes, outcomes and impacts of explicit management interventions, and quite simply the present status quo of the basis for EBFM as we know it. Fortunately, the ecosystem-based modeling tools necessary to incorporate climate change effects are already present in our arsenal of EBFM methods. Unfortunately, the scope of modeling work needed is wide and the results are needed now: hence, my recommendation for assigning this action module the top priority for the BS. Additionally, the project may need to be tackled by a large number of staff including those with both relevant expertise in such fisheries modeling but also with species-specific knowledge in hand to parameterize the models. This is no simple task. I urge Council members and others to

read the Fulton and Gorton paper, which speaks volumes to the importance of this exercise for not only SE Australia but for LMEs worldwide.

Fulton and Gorton (2014) employed the most powerful and elaborate fisheries based ecosystem model in the world (the most current version of ATLANTIS) to run simulations of direct and indirect effects of global climate change variables on ocean ecosystem dynamics, distributions and productivity of fish stocks, and interacting impacts of current and alternative fishery management interventions. Fulton is the principal creator of the ATLANTIS software and is probably the most facile user of it. By having written the code that runs the climate-forced ecosystem-based model, she has the capacity also to make ready adjustments to the model that may be necessary for changing system processes responding to climate parameters. Key insights presented in this publication include the following:

(1) Modeling of climate change impacts faces several uncertainties that must be incorporated by choosing a range of potential scenarios to bracket outcomes. Among these uncertainties is ignorance of the numbers of people occupying the Earth into the future, so emissions levels of greenhouse gases are uncertain. This uncertainty drives managers toward adaptive management and governance based on what is being termed resilience thinking.

(2) Another modeling challenge arises from the non-stationarity of system drivers under climate change because our management approaches largely depend on equilibrium concepts and approaches. Hence, more non-stationary assumptions and processes must be incorporated into stock assessments that feed the ecosystem modeling, such as recognizing regime shifts. Dynamic forms of what are now stationary management levers are needed, such as closure areas for MPAs should not be fixed but rather changeable and idiosyncratic in response to resolving space-time heterogeneity in protection needs as they arise from dynamic modeling.

(3) The substantial body of climate change predictions already available from modeling studies around the world reveal the very likely prospect that both frequency and intensity of extreme events that help drive ecosystem and stock dynamics are changing. Coping with gradually trending change in modeling critical dynamics is hard enough technically, but inclusion of sudden large-magnitude change in forcing functions raises the already high challenge bar for computational novelty and accuracy.

(4) For SE Australia, the success of salmon aquaculture and abalone dive fisheries proved to be at great risk to all but the most modest scenarios of surface-water temperature increase.

(5) Building resiliency to climate change does not merely demand adjusting catches to sustain targeted populations but also recognizing how to sustain system cohesiveness. For example, the high value targets like sea urchins, abalone, and sharks are economically valuable themselves but also represent key drivers of trophic cascades in natural systems so climate change impacts can ramify beyond those stocks that are fished directly. Changing urchin populations not only induce impacts on biological parameters but as structural foundation species, they modify the physical environment in ways that must be considered in modeling and management responses to climate-dependent variables.

(6) Cephalopods, both squid and octopus, were discovered to respond in antagonistic directions to how the fishes and other members of the food web react to the directions of climate change. Functionally then, these cephalopods buffer the biological systems against even larger climate

change impacts, giving cephalopods a larger role in ecosystem dynamics prompting their explicit inclusion in the food web modeling in cases where they are now overlooked when fishery yields are not relatively high.

(7) The robustness generally revealed in climate change ecosystem models of shark, ray, and large mammal populations in ocean food webs may be a misleading consequence of ignorance of their true susceptibility to climate-sensitive drivers. Because of the important role of these groups in trophic cascades, more information on their climate resilience is badly needed. This coincides with needs for conserving these organisms, many of which have been and are still suffering from over-harvesting.

(8) Mesopelagic fishes and cephalopods represent a grossly understudied group of organisms of huge system importance because as prey they have the greatest number of connective direct linkages to predators and transmit negative climate stress responses both directly to predator species and by indirect interactions. It seems unlikely that this group will remain largely unexploited because it always receives recognition as the largest unharvested biomass of protein in any group of ocean fishes. When these species are depleted in models of future exploitation, other species fail to move into the niche and adopt the functions of this group, with such huge connectivity to predators sharing depth levels and those of shallower and deeper waters.

(9) In virtually all the modeling runs, demersal food webs prove to be more likely to decline with global climate change than pelagic food webs.

(10) For those species of fish that respond to climate change largely by distributional shifts, they run a high risk of running out of suitable habitat as they shift poleward or to deeper waters with warming temperatures.

Literature Cited

Anderson, P.J., and Piatt, J.F. 1999. Community organization in the Gulf of Alaska following ocean climate regime shift. Mar. Ecol. Prog. Ser. 189: 117-123.

Christensen, NL, Bartuska, AM, Brown, JH, Carpenter, S, D'Antonio, C, Francis, R, Franklin, JF, MacMahon JA, Noss, RF, Parsons, DJ, Peterson, CH, Turner, MG, and Woodmansee RG. 1996. The Report of the Ecological Society of America Committee on the Scientific Basis for Ecosystem Management. Ecol Appl. 6: 665-691.

Hilborn, R.W., Quinn, T.P., Schindler, D.E., and Rogers, D.E. 2003. Biocomplexity and fisheries sustainability. Proc. Nat. Acad. Sci. 100:6,564-6,568. pnas.1037274100.

McCay, B.J. 2012. Shifts in fishing grounds. Nature Climate Change 2:840–841. http://dx.doi.org/10.1038/nclimate1765.

McLeod, K.L., and Leslie, H.M.(eds). 2009. Ecosystem-Based Management for the Oceans. Island Press, Washington, DC, 392 pp.

Sumaila, U.R., Cheung, W.W.L., Lam, V.W.Y., Pauly, D., and Herrick, S. 2011. Climate change impacts on the biophysics and economics of world fisheries. Nature Climate Change 1:449–456. http://dx.doi.org/10.1038/nclimate1301.

Turner, W.R., Bradley, B.A., Estes, L.D., Hole D.G., Oppenheimer, M., and Wilcove, D.S. 2010. Climate change: Helping nature survive the human response. Conservation Letters 3:304–312., http://dx.doi.org/10.1111/j.1755-263X.2010.00128.x.

Table 1. Components of Ecosystem-Based Management (from Christensen et al. 1996).

(1) Sustainability through resilience
(2) Measurable, explicit goals
(3) Sound ecological models and understanding at all levels of organization
(4) Complexity and connectedness
(5) Inclusion of dynamics, change, and uncertainty
(6) Incorporation of appropriate ranges of temporal and spatial scales
(7) Humans as explicit ecosystem components and drivers
(8) Adaptability and accountability – consider management approaches as hypotheses to be tested

Association of Village Council Presidents

Kawerak, Inc.

Tanana Chiefs Conference

YUKON RIVER DRAINAGE FISHERIES ASSOCIATION

December 1, 2015

North Pacific Fishery Management Council
605 West 4th Avenue, Suite 306
Anchorage, AK 99501

RE: Agenda item C-7 Bering Sea Fishery Ecosystem Plan

Dear Chairman Hull and Council members:

We are submitting these comments on behalf of the Association of Village Council Presidents (AVCP), Bering Sea Fishermen's Association, Kawerak Inc., Tanana Chiefs Conference (TCC) and the Yukon River Drainage Fisheries Association (YRDFA). AVCP is an ANCSA regional non-profit and tribal consortium of the 56 tribes of the Yukon-Kuskokwim Delta region. Bering Sea Fishermen's Association is a non-profit fisheries association serving the needs of Western Alaska commercial and subsistence fishermen. Kawerak is an ANCSA regional non-profit and the tribal consortium in the Bering Strait region of Alaska, where there are 20 federally recognized tribes. Tanana Chiefs Conference (TCC) is ANCSA regional non-profit and tribal consortium of the 42 villages of Interior Alaska in the Yukon and Kuskokwim watersheds. YRDFA is an association of commercial and subsistence fishers on the Yukon River.

The Bering Sea is one of the most biologically productive marine ecosystems on the planet, and the marine resources of the Bering Sea support the subsistence way of life and the cultures, economies and spiritual and physical well-being of our peoples across Western Alaska. Ecosystem-based management provides a critical tool for protecting these resources, particularly in a rapidly changing climate. **We ask the Council to take action at this meeting to initiate development of a Fishery Ecosystem Plan (FEP) for the Bering Sea as outlined in the discussion paper**.

Ecosystem-based fishery management is a way to sustain the health of marine ecosystems by accounting for the interconnections between fisheries and fishing communities, marine life of all kinds, and an ocean that is constantly changing. Bering Sea communities are experiencing great changes including species moving into new areas and increased Arctic shipping going through the Bering Strait which impacts the environment, economy, infrastructure, safety/security and natural resources in the ocean. These changes are rapid and primarily caused by climate change. The current single-species approach to management does not always consider the complex changes occurring in the ecosystem, or interconnections among marine organisms. Initiating an FEP which moves us toward ecosystem based management will enable federal fishery managers to make decisions that sustain our oceans, our fisheries and our cultures.

An FEP can serve many important purposes for the Council and for stakeholders. The FEP provides a mechanism for implementing the Council's Ecosystem Approach in a clear and transparent manner. The FEP can also provide a place for balancing decisions beyond single species management and optimum yield. An FEP may inform decisions on bycatch, conserve important habitat, protect marine food webs, monitor ecosystem health, and evaluate the long-term impacts of management actions on our fisheries and communities. This process can offer a formal mechanism and process for bringing ecosystem information and traditional knowledge into the current decision-making framework. An FEP also provides an opportunity to incorporate subsistence information and account for subsistence needs. An FEP framework would communicate the Council's ecosystem goals and objectives in a way that is transparent and provides for public accountability.

The framework and structure for an FEP outlined in the discussion paper represents a well thought out and novel approach to implementing ecosystem-based management in the Bering Sea. Overall, we support this approach. We continue to encourage inclusion of traditional knowledge within the FEP. Indigenous peoples in the Bering Sea region have a historic and ongoing connection that has spanned millennia and have accumulated a wealth of traditional knowledge about this region. Traditional knowledge is a way of understanding which indigenous people have about the environment, natural resources and biology of local species. The Bering Sea FEP represents a unique and appropriate place to incorporate traditional knowledge into fisheries management in the North Pacific. **To ensure that traditional knowledge is included in the FEP, it is critical that a Traditional Knowledge Expert be included on the Core FEP Team, expanding membership beyond agency staff.**

We appreciate the extensive work the Ecosystem Committee, the Council and NMFS staff have undertaken to develop the framework for an FEP which is now before you, and we applaud the Council's interest in implementing Ecosystem-Based Management. We urge you to move forward at this time with development of a Fishery Ecosystem Plan (FEP) for the Bering Sea and look forward to working with you on this project.

Sincerely,

Myron P. Naneng, Sr., President
Association of Village Council Presidents

Melanie Bahnke, President
Kawerak

Victor Joseph, President
Tanana Chiefs Conference

Wayne Jenkins, Executive Director
Yukon River Drainage Fisheries Association