



## **Bering Sea FEP Climate Change Task Force REPORT**

November 1-2, 2023, AFSC Building 4 Seattle, WA

The Climate Change Task Force (CCTF) held their fall meeting over two days November 1-2, 2023, in person at the Alaska Fisheries Science Center and with hybrid access.

### **CCTF Members (in person and on-line) in attendance:**

Diana Stram, NPFMC (**co-chair**)

Kirstin Holsman, AFSC REFM (**co-chair**)

Lauren Divine, City of Saint Paul

Jason Gasper, NMFS AKRO

Scott Goodman, NRC INC

Mike LeVine, Ocean Conservancy

Todd Loomis, Ocean Peace LLC

Steve Martell, SeaState

Brenden Raymond-Yakoubian, Sandhill.Culture.Craft

Jeremy Sterling, AFSC MML

Members of the public participating online included the following: Steve Marx, Megan Williams, Mateo Paz Soldan, Stephanie Madsen, Mary Martinez, Maktuayaq Johnson, Jamie Goen, Maggie Nelson, Sarah La Belle, Maria Davis, Theresa Peterson, Chris Tran, Rose Bennett, Diana Evans, Kalei Shotwell, Chris Siddon, Nicole Watson, Caren Braby, Loretta Brown

The eAgenda for the meeting containing all the in-meeting work products and presentations is available at: <https://meetings.npfmc.org/Meeting/Details/3016>

### **Introductions and Overview of meeting objectives**

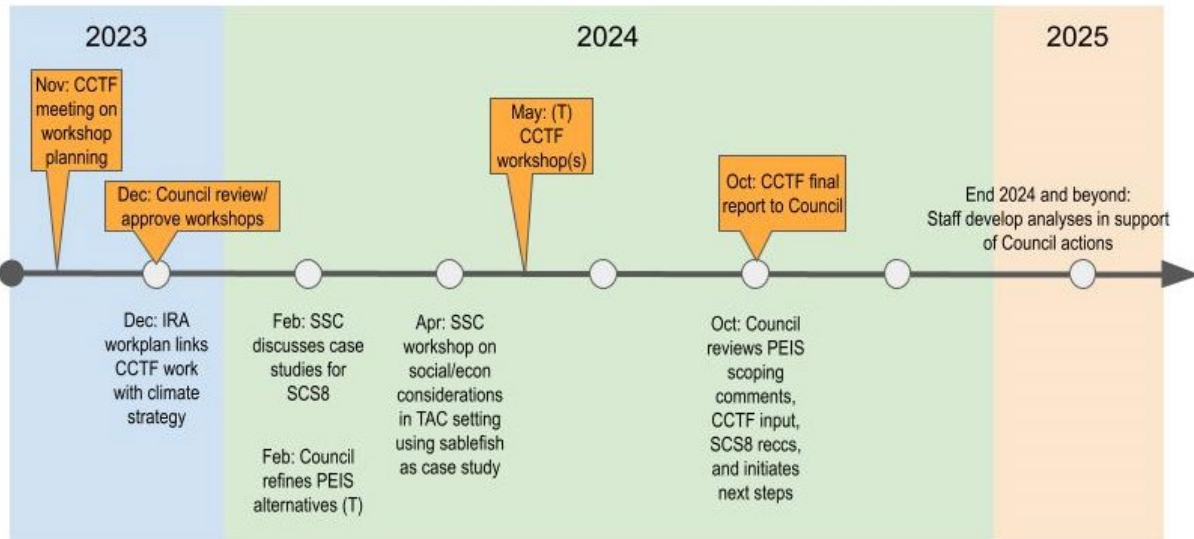
Kirstin Holsman provided an overview of the agenda for the meeting and the overarching objectives of outlining the forthcoming 2024 Climate Scenarios Workshop and planning for that endeavor. Additional items as noted for discussion to assist in this overarching objective included overviews of AFSC and NOAA efforts, Council consideration of Inflation Reduction Act funding and plans, a Climate resilience document put together by the Alaska Bering Sea Crabbers (ABSC's draft resilient fishery action plan) and potential on-ramps for climate information within the continuing development of Ecosystem and SocioEconomic profiles. Additionally, the taskforce intended to review new and existing climate research priorities to forward their input for the FEP team to consider at their meeting in January 2024. It was noted that, where possible, public comment would be taken during each agenda item in a less formalized manner. Several members of the public participated virtually and provided feedback throughout the meeting. All presentations were appended to the [eAgenda](#) including on-going work and where applicable are linked within the agenda topics in this report.

### **Climate Ecosystem and Fishery Initiative (CEFI overview) and update on ACLIM3 and ADAPT (Alaska Dashboard Adaptation Planning Tools)**

Kirstin Holsman provided an overview of NOAA National efforts under CEFI, coordination with the Alaska Fishery Science initiatives and an update on operational plans for the ACLIM 3 efforts, timeline and available and developing dashboard planning tools.

## Overview of October 2023 Council discussions and recommendations on use of IRA funding by NPFMC

Diana Stram provided an update on Council staff draft plans for the use of IRA funding in 2024 and plans for moving forward over the time frame 2024-2027 for which the money is to be utilized. She also provided a draft staff outline (below) of a potential timeline for coordination amongst separate but related Council actions and future plans between 2023-2025.



Taskforce members requested clarification on the planning for the PEIS and the timing and outcomes of the CCTF Climate Scenario Planning Workshop. She explained that the draft timeframe represented in the table was a Council staff endeavor to show where these different Council (and National SSC) initiatives and workshops are occurring and what products would be available when to inform future Council actions. Specifically, the timing of the Climate Scenarios workshop (CSW) would ideally be scheduled in the Spring of 2024 with the workshop report completed and available over the summer of 2024. This would allow for consideration of the outcomes to be available both during the scoping period for the PEIS and align with the CSW being a potential case study to be considered at the SCS8 in late August with the results of both workshops (and therefore the final report of the CCTF) available for the October 2024 Council meeting. This would allow outcomes of the CCTF work to be considered in conjunction with a range of potential Council future actions including the PEIS.

### Summary of CCTF member survey feedback on climate scenario planning workshop plans

Diana Stram provided an overview of results from a summer survey of CCTF members on expectations, locations, timing and engagement for the forthcoming CSW. This provided additional background information in conjunction with the extensive discussions of the recommended approach, which is discussed further below. These results are included on the eAgenda for the meeting and formed the basis of the discussions for the decision points on the Climate Scenario Planning Workshop discussion.

### Recommended approach for Climate Scenario Planning Workshop(s):

The CCTF is planning a 3-day public workshop that will occur in Anchorage May 2024 to allow for inclusion of other planned activities that are relevant to the objectives of the workshop (e.g., SSC workshop, etc). We plan to discuss ‘scenarios’ within a series of plenary discussions and facilitated

breakout groups, repeated over multiple days, aimed at synthesizing and summarizing the critical needs, resources, and process. By the end of the workshop, the participants will have developed a robust and inclusive decision making process and provide recommendations for tools the Council may consider in the future. Additional details on the scope of the workshop and draft scenario development from the CCTF during the meeting are included below.

## **CCTF 2024 Climate Change Scenarios Workshop**

### **When**

Mid-may 2024 (3 days); Anchorage Alaska (tentatively)

### **Who**

NPFMC Climate Change Task Force, Council members, members of the public, community members, fishery participants, managers, and climate and fisheries researchers

### **Goal**

The overarching objective of this workshop is to synthesize and summarize the critical needs, resources, and process to develop and maintain a robust and inclusive decision-making process to respond to climate change effects in the North Pacific. The workshop will be focused on regional management process and would invite attendees and participants to:

- Think broadly about potential solutions and tools within the existing process (incremental) but also beyond existing approaches (transformational); and
- Identify the bigger picture changes that could be effective to address large climate impacts and changes.

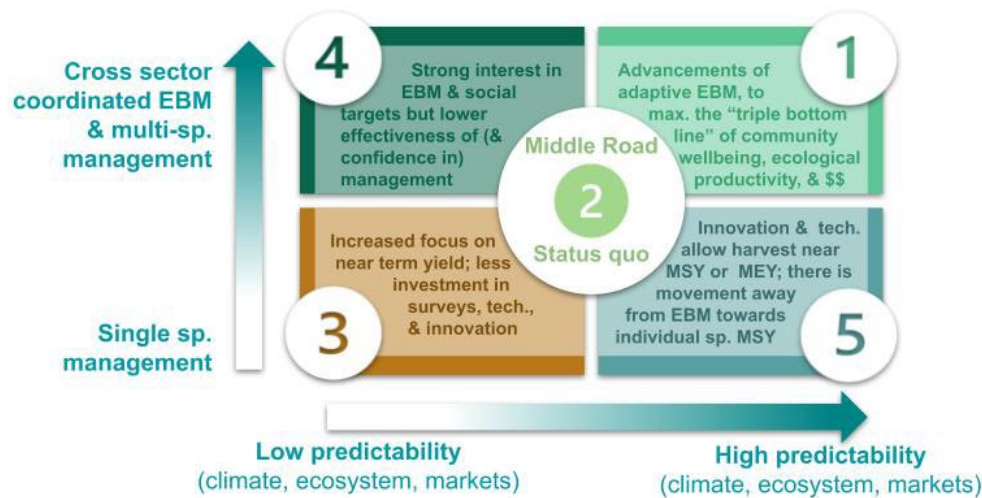
The workshop format will include: (a) a combination of interactive breakout sessions with scenario planning exercises designed to explore a suite of potential and plausible ‘what if’s’ in order to identify key needs, tools, information sources, opportunities and risks; (b) facilitated discussion sessions designed to support meaningful information exchange between attendees; and (c) structured format that enables cross-pollination of expertise, experiences, and perspectives in solution explorations.

### **Scenario planning & case studies**

We will use a suite of illustrative future “what if” scenarios and case studies to help inform climate change planning and response. The focus of future scenarios would be for planning rather than predicting, i.e., they will provide the scope for potential future changes that may occur next year, ten years from now, or 20+ years from now. Discussions around these changes and potential future scenarios will help identify near term actions, step-by-step approaches, and long-term investments in information, tools, and management innovations needed to increase resilience to climate change for different fisheries and marine dependent communities of place and practice.

- Case studies will help anchor discussions for what if scenarios and provide concrete examples of gaps and needs as well as successes in weathering climate driven changes to Alaskan marine ecosystems and resources.
- Use of personal experience or recent case studies will also help work through each scenario.

## Draft Climate Change planning Scenarios



### Note

- Scenario planning is used to help prepare for the possible futures and potential challenges that may arise
- Scenarios are intended to be plausible descriptions of possible future states, useful for exploring 'what if's'
- Scenarios are not policy prescriptive regarding desired future states

Figure 1. Draft example scenarios similar to those that may be used for the 2024 Climate Scenarios Workshop (scenarios will be developed and refined during workshop planning Jan-Feb, 2024)

### Outcomes & deliverables may include but are not limited to:

1. Identification of existing and potential climate change-related adaptations and responses, and key risks, barriers, and traps, as well as potential solutions across financial, social, and policy realms.
2. Synthesis of potential tools and resources to support resilient fisheries, fishing communities, and fisheries management through the Council process, such as:
  - Tactical and strategic measures/actions, both near-term and long-term,
  - Feasible tools, incremental changes as well as larger/long-term recommendations and potential innovations,
  - Climate-informed tools and approaches, needs, and limits.
3. Identification of the critical gaps in the information, tools, and processes to support effective responses and robust planning.
4. Summary of recommendations and opportunities that may inform ongoing and future Council actions and policies under a changing climate.

### Topics /themes/activities

- Climate Readiness Synthesis (CRS) results and implications
- Rapid response; emergency planning
- Near-term actions to influence longer-term scenarios
- Models, plans, and concepts for climate adaptation and resilience (e.g. Agency, Tribal, stakeholder driven models)

## Review of climate-related research priorities

Nicole Watson (NPFMC staff) provided the CCTF with a compilation of new submissions to the NPFMC research priorities based on a request for information posted to the Council's website for several months to solicit public ideas. She indicated which submissions had self-identified as being climate related. The CCTF had also compiled a list of existing research priorities from the database that were climate related.

The CCTF reviewed these priorities and indicated which were considered ‘important’. In the interest of agenda time the CCTF was not able to come to consensus on these priorities, nor vote in prioritization thereof and instead provided (attached) a list of priorities for which at least one CCTF member had indicated that it was important. These priorities will be submitted to the Bering Sea FEP team for their consideration at their meeting in January 2024. The CCTF notes that their consideration of specific climate-related indices was a one-time endeavor given the timeline of the completion of the CCTF and that another group needs to be tasked to focus on them in the future.

## **Long-term on ramps to Council: ESP integration of climate indices as on-ramp**

Kalei Shotwell (NMFS AFSC) provided the CCTF an overview of the current ESP development nationally and within Alaska and identified specific on-ramps that would meet the CCTF goals for incorporation of climate-related information into stock assessments and management. The CCTF discussed the indicated wishlist ideas for developing ESPs and the selection of climate indices for characterizing climate readiness by stocks. Some data access issues were noted as well as the indication that CEFI should help overcome the current data access issues. Discussion centered around identification and validation of indices. The validation aspect of some indices (e.g. ROMs) is a critical consideration by area and this makes it difficult to use the data product in ESPs if it is not validated for each region. There is a critical need to acquire information on the areas currently validated and plans for those to be validated and the priority thereof to continue to consider them as relevant indicators for climate in ESPs. Data validation resources are available but should be prioritized based on indices available and needs. The CCTF could possibly identify in conjunction with the workshop which information sources need to be A) robustly predictive in a forecast sense vs B) plausible and realistic. This could be a useful topic of feasibility and investment moving forward.

The CCTF discussed that ESPs are a feasible on-ramp for continued climate information into the Council process. One of the CCTF’s charges from the Council was to recommend process for integration of climate information to the management process and the ESPs appear to show great potential for this to be an on-going on-ramp, Kalei noted that in early 2024(January/February) there would be a request for information for crab and groundfish ESPs, and this could also be sent to the CCTF for their review of priorities and data requests and provide an opportunity to review what additional climate information should go out in this RFP. While the CCTF is not meeting during that time the CCTF could provide some review and recommendation via email on ESPs.

## **Future plans**

The CCTF plans to meet virtually February 26th, 2024, to review plans and finalize the agenda for the Spring (May TBD) Climate Change Workshop. The report from this workshop will represent the final output from the CCTF and is intended to be presented to the Council in October 2024.

## Climate Change Task Force Research Priorities November 2023

CCTF of interest?	CCTF Notes (from one or more members)	researchID	Description
		N001	What is causing the average size/weight of Cook Inlet halibut to decline?
		N002	Operational, multiple cameras/satcams on all fishing vessels at all times, with observers monitoring
Of high interest to one or more CCTF members	SDMs underway as part of ACLIM2 (Goodman et al. in prep)	N003	Crab spatial-temporal distribution relative to life history events, life stage, fishing, habitat.
Of high interest to one or more CCTF members		N004	Pacific cod predation on commercially important crab species
		N005	Satellite tagging for Pacific cod in the GOA, AI, EBS, and NBS
Of high interest to one or more CCTF members	need to identify climate refugia	N006	identify EFH by crab life stage and consider habitat protections by localized stock management unit
		N007	Improved age determination methods for Pacific cod
		N008	Maturity estimates for BSAI crab stocks - The availability of maturity data from male and female crab are incomplete for use in stock assessment models. Key parameters defining size at maturity, proportion mature at size, and the potential for biennial reproductive cycles are currently uncertain for many stocks. Methods for determining spatial and temporal variability of these quantities are needed to adequately characterize mature biomass and for evaluations of size limits.
		N009	Age structure of commercially harvested Pacific cod
		N010	Maximum age for Pacific cod in the GOA, AI, and BS
		N011	Spatial distribution and movement of crabs relative to life history events and fishing - Seasonal BSAI king and Tanner crab distributions across juvenile and adult life stages are poorly understood. The development and further refinement of seasonal monitoring and sampling methods to fill gaps in temporal and spatial extent is critical. Pairing smart tag deployment on crabs during new and existing survey opportunities is yielding relevant new information and should continue to be a high priority during the continuing depressed crab stock period.
		N012	Continue efforts to reduce crab bycatch and improve understanding of fishing impacts on crab stocks through different times of year and during molting/mating using existing information and including use of technology.

CCTF of interest?	CCTF Notes (from one or more members)	researchID	Description
Of high interest to one or more CCTF members	Somewhat underway but needs additional support; ACLIM2 has post-doc support to help develop this out; CEFI may also help contribute to MSEs regarding climate informed advice;	N013	Development of crab explicit management strategy evaluation (MSE) options - Management strategy evaluation (MSE) is a powerful simulation tool that models an ecological system to evaluate management approaches, such as harvest control rules. MSEs are evaluated using performance metrics determined cooperatively by managers, stakeholders, and scientists that guide decision-makers when considering alternative management approaches. Several crab stocks are presently depressed in the BSAI, partly due to ecosystem changes, and prioritizing MSE options is essential for exploring management strategies suitable for crab when existing options are limited.
Of high interest to one or more CCTF members	Seems related to N039d?	N014	Continued efforts to reduce bycatch and impacts on crab from fishing gear - Bycatch impacts on BSAI crab stocks should continue to be a high priority research topic across a number of topics: directed fishery research to modify gear and fishing practices to reduce incidence of females and small male discards, non-directed fixed and mobile gear experiments to evaluate fishing gear impacts on seafloor habitats and crab species - including estimation of unobserved mortality, evaluation of existing protection/regulatory areas for efficacy - including consideration of dynamic boundaries relative to updated and new information, update and evaluate procedures for discards, and estimation of discard and handling mortality.
	Seems related to N039d?	N015	Artificial propagation of BSAI crab stocks - Artificial propagation of BSAI crab stocks offers a promising avenue for stock enhancement, and there are cooperative industry efforts to fully support and build out the options for artificial propagation of stocks through the AKKCRAB program. Building on the successes of AKKCRAB, there's a need to scale efforts towards hatching, rearing, and releasing crabs into the wild. This scaling process is complex, requiring significant capital, coordination, planning, and cooperation with industry and managers. Research efforts should continue to address gaps in life history and habitat knowledge while also focusing on the development of necessary infrastructure and stocking implementation strategies.
		N016	Crab predation - Crab are known prey for groundfish, notably Pacific cod. Understanding the magnitude of predation impacts on crab populations in the BSAI is critical for ecosystem-level management considerations. Expanding cod stomach data collection and analysis is crucial, especially during times when crab are molting and most vulnerable to predation. Specifically, the effects of predation in shallow nearshore areas occupied by juvenile red king crab are poorly understood. Modeling exercises to explore assumptions of species interactions, consumption rates, and how these factors relate to natural mortality are high priority, given the depressed status of crab stocks.

CCTF of interest?	CCTF Notes (from one or more members)	researchID	Description
		N017	Cooperative research efforts to supplement existing at-sea surveys for increased spatio-temporal coverage - Continued focus on collaborating with the crab industry including chartering industry boats and their availability to support surveys (e.g., crab pot survey efforts for RKC and snow crab, juvenile surveys using modified pots or trawls, etc.). Prioritizing using industry vessels allows for other objectives to be built into or added to sampling plans (tagging, etc.). Specific priorities should include skipper survey efforts and collection of other information that may not typically occur (e.g., potential nursery hot spots for king and snow crab).
		N018	Quantification of unobserved fishing mortality on crab across all gear types and evaluate fishing gear impacts on crab and crab habitat during different times of the year and during molting/mating.
Of high interest to one or more CCTF members	Eoccast is a good model for this (west coast); high priority; currently not supported or underway	N019	Evaluate the efficacy of existing crab protection/regulatory areas, including consideration of dynamic boundaries for crab protections relative to updated and new information regarding movement and life stage and static boundaries for crab habitat protections.
Of high interest to one or more CCTF members	High Priority; high priority and applicable to multiple stocks and fisheries; i some work started (more support needed) via GOACLIM; additional support needed but might be avail via CEFI/ ACLIM3	N020	Identify pathways and other opportunities for fishermen and communities to diversify and adapt in the face of climate-driven changes to fisheries (e.g., Bering Sea crab crashes).
		N021	Develop appropriate crab PSC limits and trawl performance standards in groundfish fisheries to provide stronger incentives to minimize crab bycatch.
		N022	Expand routine fish, crab, and oceanographic surveys in the adjacent areas to the north (northern Bering Sea, Chukchi Sea, and Beaufort Sea) - Monitoring shifts in groundfish and shellfish distributions related to ecosystem changes and responses to climate change is important for ecosystem-based management considerations. Part of this research should build on prioritizing ongoing sampling in the northern Bering Sea (NBS) as further expansion of a future climate-ready survey strategy. As stocks show evidence of range expansion or retraction, likely driven by climate change, additional areas should be built into expanded survey strategies to understand spatial stock connectivity of species in the NBS and Arctic and assess probable climate-driven changes.
		N023	Crab growth rates - Seasonal BSAI growth data for crab species has been influential and variable in stock assessment models. Because crab cannot be aged, the stock assessment models are size-structured and are sensitive to molt increment data. Growth data has been collected in recent years and implemented into assessment models, but continued research is urgently needed to increase sample sizes, and fill gaps in specific size classes of crab (notably the pre-terminal molt sizes in snow and Tanner crab). This research involves collecting pre-molt crab and holding them until they molt to quantify their growth rates.



CCTF of interest?	CCTF Notes (from one or more members)	researchID	Description
	At least one member indicated high priority; but whole CCTF did not review this one	N024	Increased research attention towards the goal of rapid implementation of real-time salmon bycatch genetics data in the pollock fleet's fishing seasons.
Of high interest to one or more CCTF members	SAME OR SIMILAR TO N028 ; Important; limited if any support yet? member involved in submission	N025	Research on the cumulative impacts of bycatch and habitat damage, including in the context of climate change (e.g. effects to genetic diversity and resilience within species, effects across species, cumulative impacts from updated understandings of bottom contact from pollock trawling, etc.). This should also include the impacts of unobserved mortality, conceptualized either as bycatch or fully incorporated via some other metric/mechanism.
		N026	Retrospective analysis of whether and how social science is or is not used regarding predictions of changed fishing behavior in light of proposed changes to management structures.
Of high interest to one or more CCTF members	SAME OR SIMILAR TO N032; multiple support noted; member was involved in submission	N027	Retrospective and meta- analysis regarding whether, how, when and why objectives and goals of fishery management plans are or are not achieved over time. In light of the PEIS discussion, a fruitful first focus would be the existing BSAI groundfish FMP.
Of high interest to one or more CCTF members	CCTF note: member was involved in submission	N028	On behalf of Aleut Community of St. Paul Island Tribal government. Research on the cumulative impacts of bycatch and habitat damage, including in the context of climate change (e.g. effects to genetic diversity and resilience within species, effects across species, cumulative impacts from updated understandings of bottom contact from pollock trawling, etc.). This should also include the impacts of unobserved mortality, conceptualized either a bycatch or fully incorporated via some other metric/mechanism.
	RELATED TO N024	N029	Development of new genetic tools to improve delineation of chum salmon stocks in western Alaska would provide for improved management of Chum salmon bycatch in the BSAI pollock fishery. Whole genome resequencing would increase the number of genetic markers used to differentiate stocks by orders of magnitude compared to current approaches, but these methods have not been applied to Alaska salmon. Successful development and implementation of these new tools would have immediate impact on fisheries management but also provide the means to conserve Western Alaska salmon biodiversity over the long-term.
	At least one member indicated high priority; but whole CCTF did not review this one	N030	Evaluation of the potential efficacy of various forms of real-time sensory instruments on/for pelagic trawl nets for understanding and avoiding bottom contact.
		N031	To support development of a chum cap to reduce bycatch of Coastal Western Alaska chum salmon in the BSAI pollock fishery we recommend research to develop a marine-based juvenile chum index to be combined with a Western Alaska rivers three area index (as is used in the W. AK Chinook bycatch measures). Aim would be to build a time series of oceanographic variables and juvenile abundance indices for CWAK chum salmon, similar to NOAA's Southeast Alaska Coastal Monitoring program, which assesses the status of juvenile salmon in the coastal waters of the Gulf of Alaska ecosystem.

CCTF of interest?	CCTF Notes (from one or more members)	researchID	Description
	SAME AS N027	N032	Retrospective analysis of whether and how social science is or is not used regarding predictions of changed fishing behavior in light of proposed changes to management structures.
	SAME AS N030	N033	Evaluation of the potential efficacy of various forms of real-time sensory instruments on/for pelagic trawl nets for understanding and avoiding bottom contact
		N034	Recommend undertaking adult equivalency analysis (AEQ) of Coastal Western Alaska chum salmon taken as bycatch in the BSAI pollock fishery. The essential missing data necessary to undertake this AEQ analysis is the collection of Coastal Western Alaska chum salmon age composition data. We recommend that this data be collected from BSAI bycatch through observer and short-side sampling program as well as from sample in the South Alaska Peninsula June salmon fishery.
Of high interest to one or more CCTF members	Same as existing 536? High priority but combine?	N035a	Emphasize the ongoing urgency of priority #189 from the 2021 review: "Develop stock-specific ecosystem indicators and incorporate into stock assessments." This work should include precautionary responses to climate change factors.
	RELATED TO EXISTING #148	N035b	Research providing baseline data, and the ability to track change, for crab life cycles, movement patterns, and associated ecosystem characteristics. Emphasized in previous review under priority #148.
	SIMILAR OR SAME AS N024 AND N029	N035c	Improved genetic information and sampling processes for salmon PSC.
	Seems duplicative of other unobserved mortality topics	N035d	Improved mechanisms for estimating unobserved fishing mortality.
	SEEMS SIMILAR TO OTHER BENTHIC HABITAT AND TRAWLING IMPACTS TOPICS	N035e	Assessment of habitat and ecosystem impacts from fishing effort, including the cumulative impact of repeated effort over time. This should include benthic structures, habitat damage and disturbance, and "ecosystem component" fauna.
	At least one member indicated high priority; but whole CCTF did not review this one	N035f	Post-release mortality studies for discarded species, in which lack of existing research (i.e. crab), or emergence of additional mortality factors (i.e. halibut), indicate that current DMRs may be inaccurately capturing mortality estimates.
Of high interest to one or more CCTF members	Could be combined with N039g? ; also 733 and high priority ; multiple members indicated high	N035g	Strategies for precautionary management addressing climate change impacts.

CCTF of interest?	CCTF Notes (from one or more members)	researchID	Description
		N036a	<p>What is the role pinniped predation has had in recent fishery collapses across Alaska? There is strong correlation between the eastern population growth of Stellar Sea lions and the decline of Chinook ocean survival rates across Alaska. This is of particular concern because of what has been observed in British Columbia and the lower 48. Based on a large body of evidence, a significant source of Chinook decline in BC and the lower 48 is understood to be the unchecked growth of sea lion populations. Supporting this claim is the published works done by the Washington Academy of Sciences on pinniped predation on salmonoids. Further, in a 2021 lecture given by University of British Columbia Dr. Carl Walters, citing published work by Dr. Peter Olesiuk, Dr. Walters pointed out that the current BC pinniped population in 2021 had consumed 300,000 metric tones of prey, <b><i>a harvest greater than all sport take, commercial take and aqua culture production in BC during 2021.</i></b> Please, take a moment and let that fact sink in.</p>
		N036b	<p>Southern Resident Killer Whale(SRKW) prey increase. Simply put, I am embarrassed by the weak ESA mitigation plan for the SRKW prey increase that almost cost us Trollers in SE our season. So, a handful of us trollers came up with our own SRKW prey increase plan that we are not ashamed of and would like the council to consider researching the viability of this draft plan. <i>(See comment provided as an additional attachment)</i></p>
		N037a	<p><b>Electronic Monitoring (EM):</b> 2021 Research ID 712 identified the need for a “Gap analyses of loss of biological samples due to the implementation of EM.” In addition to the loss of biological samples, EM implementation has resulted in numerous unintended consequences that should be addressed as Urgent Priorities.</p>
	<p>At least one member indicated high priority; but whole CCTF did not review this one</p>	N037b	<p><b>Marine Mammals:</b> The limited number of 2021 Research Priorities addressing marine mammals discounts the important ecological role marine mammals play as well as the risks associated with direct and indirect fishery interactions. We urge the Council and associated bodies to review the attached Appendix 1 that includes Research Priorities recommendations from the <a href="#">Alaska Scientific Review Group for Marine Mammal Stock Assessments</a> in their <a href="#">2022 letter to NMFS</a>. In addition, 2021 Research ID 215 should be prioritized and extended to explicitly address impacts of direct and indirect fishery interactions.</p>
	<p>At least one member indicated high priority; but whole CCTF did not review this one</p>	N037c	<p><b>Ecosystem Indicators:</b> Using indicator species as a proxy for overall ecosystem health and function can be both a cost- and time-efficient measure (Carignan &amp; Villard 2002). This is particularly relevant in biodiverse, species-rich systems like the Eastern Bering Sea, where it is not possible to monitor all taxa (Lindenmayer 1999). The use of indicator species can be used to achieve specific management objectives including assessing the efficacy of management measures and detecting both early stage and long term ecological changes or shifts (Siddig et al. 2016).</p>

CCTF of interest?	CCTF Notes (from one or more members)	researchID	Description
		N037d	<b>Traditional Knowledge:</b> There are numerous ways Traditional Knowledge will strengthen all Research Priorities, including offering new frameworks for analysis; fostering relationships between Indigenous and Western scientific researchers and communities; and filling gaps in existing ecological and social scientific research.
Of high interest to one or more CCTF members	Somewhat underway but needs additional support; ACLIM2 has post-doc support to help develop this out; CEFI may also help contribute to MSEs regarding climate informed advice.	N037e	<b>Bycatch Impacts:</b> In an increasingly unpredictable and warming climate, anthropogenic activities like bycatch that suppress life-history diversity could have serious consequences, particularly for depressed populations persisting at ecological and physiological limits such as salmon (Sturrock et al. 2019). When considering impacts to communities and climate-vulnerable species, the Council must think more broadly about ecosystem impacts associated with target harvest and bycatch removals from the system.
		N038	Stop or reduce waste of halibut and other species of fish. Cost per pound (at store, restaurant, etc.) is too expensive. 1.Place watchers and or cameras on board all boats fishing for halibut in Alaska waters. 2.Provide an incentive for license holders to institute a percentage of bycatch to food banks and reduced cost to grocers who are limited to the price per pound plus cost of handling only. Require licensee's to be present if fishing in Alaska waters or their direct representative, not subleasing their license. More enforcement of existing regulations and improved legislation to protect the interest of Alaskans who should have access, including maximum benefit for our resources, including halibut, salmon, trout and other species.
		N039a	AMCC strongly encourages the completion of the existing research priority: #148: Spatial distribution and movement relative to life history events and fishing: Advisory bodies including the SSC and CPT have elevated this need for years and has been made particularly urgent by crab declines
		N039b	AMCC strongly encourages the completion of the existing research priority: #246: Cooperative research efforts to supplement existing at-sea surveys that provide seasonal, species specific information on upper trophic levels: In conjunction with #189, onramps should be evaluated for the consideration of predator health in determining the impacts of prey removals in the groundfish specifications process; we encourage urgent consideration of this due to fisheries impacts on species protected through the Marine Mammal Protection Act
		N039c	AMCC strongly encourages the completion of the existing research priority: #611: Collection of socio-economic information: A) This should be expanded to include subsistence fisheries as well, utilizing information through the Subsistence Division of the Alaska Department of Fish and Game, as well as information shared through Tribal Consultation and other informal means, to support the development of Social Impact Assessments expected in a variety of upcoming actions; and B)To the extent possible, economic information and analysis regarding the landings values and harvest values of single species harvested through various gear types, i.e. trawl/HAL sablefish, trawl/POT/JIG cod, trawl/gillnet salmon

CCTF of interest?	CCTF Notes (from one or more members)	researchID	Description
		N039d	AMCC underscores the urgency of: #164: Effects of trawling on crab and benthic communities: A) Quantification of unobserved mortality must be developed and considered retrospectively, in accordance with National Standard 9; and B) Species identified as benthic habitat in the Essential Fish Habitat review are considered with susceptibility and recovery rates that are arbitrary and do not reflect BSIA; some species named do not exist in the North Pacific, highlighting the problematic nature of borrowing models from a different (i.e. warmer and more fast-growing) ecosystem without diligent and precautionary adjustments; octocorals are evaluated differently from corals that attach to hard substrates, despite having similar susceptibility and recovery rates from disturbance
	At least one member indicated high priority; but whole CCTF did not review this one	N039e	AMCC underscores the urgency of: #244: Collect and maintain time-series data on the community composition, production and biomass of benthic invertebrate and vertebrate fauna: This should be expanded to include sedentary megafauna, which contribute substantially to ecosystem health and are particularly vulnerable to disturbance
		N039f	AMCC underscores the urgency of: #615: Evaluate the interactions between fisheries and killer whales and sperm whales: Guidance from Groundfish Plan Teams has underscored the need to update DMRs; we are concerned
Of high interest to one or more CCTF members	CEFI to start building these operational tools for AK; ACLIM and GOACLIM framework can test these; more investment needed to expand the suite; similar to existing 733	N039g	AMCC underscores the urgency of: #733: Climate change: Develop predictive tools to inform management options related to resilience and adaptation: As evidenced by climate-related challenges for marine species and fisheries managers, this priority should also include precautionary tools in addition to predictive tools, and be elevated from Strategic to Urgent

## Climate Change Task Force *Existing* Research Priorities

CCTF of interest?	CCTF Notes (from one or more members)	Research ID	Title	Description
Of high interest to one or more CCTF members	This is a high priority over next decade	191	Assess whether changes in pH and temperature would affect managed species, upper level predators, and lower trophic levels.	Assess whether changes in pH and temperature would affect managed species, upper level predators, and lower trophic levels. Laboratory studies are needed to assess the synergistic effects of ocean acidification and changes in temperature on productivity of marine species.
Of high interest to one or more CCTF members	This is underway via REEM and forms the basis for ecosystem models	192	Collect, analyze, and monitor diet information	Collect, analyze, and monitor diet information (species, biomass, energetics), from seasons in addition to summer, to assess spatial and temporal changes in predator-prey interactions, including marine mammals and seabirds. The diet information should be collected on the appropriate spatial scales for key predators and prey to determine how food webs may be changing in response to shifts in the range of crab and groundfish.
		197	Develop methodologies to monitor for new/emerging diseases and/or parasites among exploited species and higher trophic levels	Develop methodologies to monitor for new/emerging diseases and/or parasites among exploited species and higher trophic levels.
Of high interest to one or more CCTF members		200	Monitor contaminant flux and loads in lower and higher trophic levels, and assess potential for impact on vital rates.	Monitor contaminant flux and loads in lower and higher trophic levels, and assess potential for impact on vital rates. Laboratory studies are needed to assess the effects of oil dispersants on the productivity of marine species.
Of high interest to one or more CCTF members		217	Impact of fisheries on benthic habitat and trophic interactions	Conduct studies to assess the impact of bottom trawl fisheries on invertebrate abundance and species composition in benthic habitats. This is especially relevant to direct impacts on Bristol Bay red king crab. Indirect impacts are important to the foraging ecology of walrus (candidate species for listing under ESA), bearded seals, and gray whales.

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Of high interest to one or more CCTF members	This is underway as part of ACLIM2 and GOACLIM and CEFI	223	Develop and evaluate global climate change models (GCM) or down-scaled climate variability scenarios to assess impacts to recruitment, growth, spatial distributions, and benthic productivity.	Quantify the effects of historical climate variability and climate change on recruitment, growth, spatial distribution, and benthic productivity. Develop standard environmental scenarios (e.g., from GCMs) for present and future variability based on observed patterns. This is important for fisheries that target benthic species such as crab for which management may be structured on an assumption of stable stock distribution.
Of high interest to one or more CCTF members	This is being evaluated via ACLIM and CEFI but needs further work for non-summer, non core EBS areas; validation still needed in GOA(via GOACLIM) and Arctic (TBD)	224	Climate and oceanographic information covering a wider range of seasons	There is a need for climate and oceanographic information that covers a wider range of seasons than is presently available.
Of high interest to one or more CCTF members	This is being evaluated via ACLIM and GOACLIM and CEFI and CCTF	225	Develop projection models to evaluate management strategies under varying climate, ecological, and economic conditions and evaluate impacts to managed resources and coastal communities.	There is a need to develop projection models that evaluate the robustness and resilience of different management strategies under varying climate, ecological, and economic conditions. Projection models should forecast seasonal and climate related shifts in the spatial distribution and abundance of commercial fish and shellfish, and impacts to communities.
Of high interest to one or more CCTF members	Complete - see Hermann et al. 2019, 2022	240	Develop a multivariate index of the climate forcing of the Bering Sea shelf	Develop a multivariate index of the climate forcing of the Bering Sea shelf . Three biologically significant avenues for climate index predictions include advection, setup for primary production, and partitioning of habitat with oceanographic fronts and temperature preferences.
		245	Assess the impact of increases in recovering whale populations on lower trophic level energy pathways	Assess the impact of increases in recovering whale populations (e.g., gray, humpback and fin) on lower trophic level energy pathways.
Of high interest to one or more CCTF members		250	Conduct ecosystem structure studies	Studies are needed to evaluate the effects of global warming, ocean acidification, and selective fishing on food webs. For instance, studies are needed to evaluate differential exploitation of some components of the ecosystem (e.g., Pacific cod, pollock, and crab) relative to others (e.g., arrowtooth flounder).
Of high interest to one or more CCTF members	this sounds like the ESP efforts underway; ACLIM2 and ESP coordination is starting this; high priority as on-ramp;	536	Evaluate incorporation of climate change impacts into stock assessments	Climate change impacts are becoming an increasingly important consideration for long term planning and should be included in projections of exploitable fish stocks and associated ecosystem components. Incorporation of climate-based parameters into fish stock assessments will allow for exploration of harvest scenarios in the context of evolving climate conditions. Research is needed to explore how these parameters can be integrated into fishery stock assessments.

CCTF of interest?	CCTF Notes (from one or more members)	Research ID	Title	Description
Of high interest to one or more CCTF members	high priority, top 5	671	Characterize expected changes in benthic production due to climate change	Investigations are needed to address the impacts of global climate change on spatial patterns of benthic productivity. This is important for fisheries that target benthic species such as crab for which management may be structured on an assumption of stable stock distribution.
Of high interest to one or more CCTF members		715	Physiological responses of crab to climate stressors	Investigate how observed environmental changes (temperature, OA, etc.) affect crab physiological condition & survival of multiple life stages and reproductive output. Consider interactions among multiple stressors
Of high interest to one or more CCTF members	[LD] high priority, top 5; [KH] high priority; [ML] ; JG High	733	Climate change: Develop predictive tools to inform management options related to resilience and adaptation.	This research priority supports the work of the Climate Change Taskforce to identify and map out climate and environment change drivers and their likely response within fishery management, and specifically work on management options that provide a management response. Might support with groundfish specifications risk tables, and can also use these predictive tools to be able to evaluate the potential risk of different management responses related to potential scenarios.