

Alaska Fisheries Science Center - updates on surveys and climate research

Robert Foy (+NMFS/AFSC/Partner PIs)
AFSC Research and Science Director

Presentation to North Pacific Fisheries Management Council
May, 2021



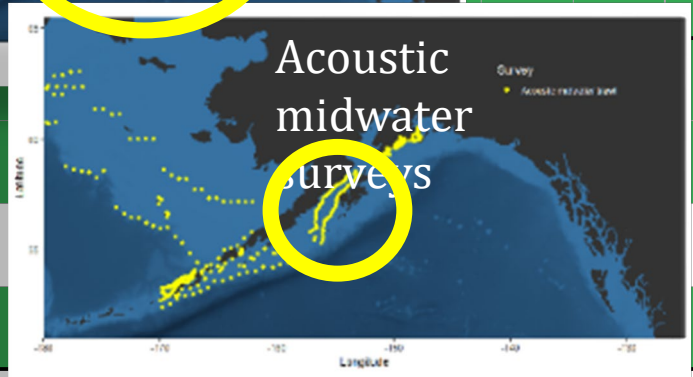
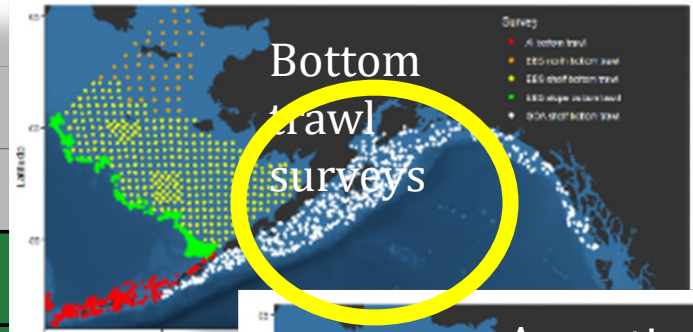
Alaska Fisheries Science Center

- 2021 Survey Update
- Execution of 2021 Executive Orders
 - AFSC **climate** informed science for management
 - AFSC and **environmental justice** in research



Gulf of Alaska fish/eco surveys

Survey	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
GOA BT vessel 1												
vessel 2												
vessel 3												
Deep shelf and slope groundfish longline												
Winter Acoustic-Trawl Shumagin/Sanak												
Winter Acoustic-Trawl Bogoslof												
Winter Acoustic-Trawl PWS/Kenai												X
Winter Acoustic-Trawl Shelikof												
Summer Acoustic-Trawl GOA												2/3
GOA larval												
Spring GOA Ichthyoplankton												
Summer GOA Age-0												X
Kodiak Pacific cod nursery habitat												
Large-Scale GOA Pacific cod nursery												
GulfWatch oceanography&forage												



• Limited coverage of GOA deep (>700 m) stations in favor of NBS

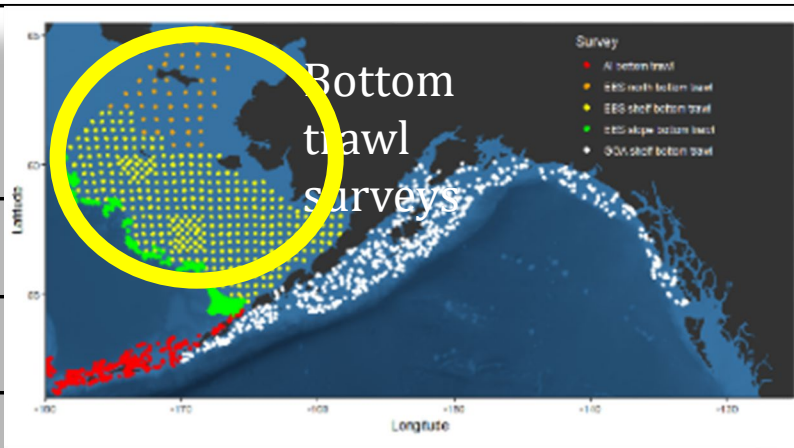
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Bering Sea fish/eco surveys

Survey	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Eastern Bering Sea vessel 1												
vessel 2												
Summer Acoustic-Trawl EBS											Drone	
Bering Sea Slope												
Northern Bering Sea vessel 1												
vessel 2												
Deep shelf and slope groundfish longline survey												
Spring EBS Ichthyoplankton												
Summer EBS Age-0 (Inc. BASIS)												
Spring EBS Ecosystem/Moorings												
Fall EBS Ecosystem/Moorings												
Northern Bering Sea juvenile salmon and age-0												
Distributed Biological Observatory (Ecosystem)	AE	AE	AE/RUSALCA A IES	AE EIS	AE RUSALCA	AE	AE	AIERP DBO	DBO AIERP	AIERP DBO	DBO	



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2021 Executive Orders associated with climate change

EO 14008 (2021): Tackling the Climate Crisis at Home and Abroad

Section 203. National Climate Task Force

Section 207: Renewable Energy (DOI led ...double offshore wind by 2030)

Section 208. Oil and Natural Gas (DOI led)

Section 215. Civilian Climate Corp (DOI led)

Section 216. Conserving Lands and Waters

Section 216(a) [conserve 30% by 2030].

Section 216(c).

Directs **DOC/NOAA** to ...”to collect input”...”on how to make fisheries and protected resources more resilient to climate change, including changes in management and conservation measures, and improvements in science, monitoring, and cooperative research.”

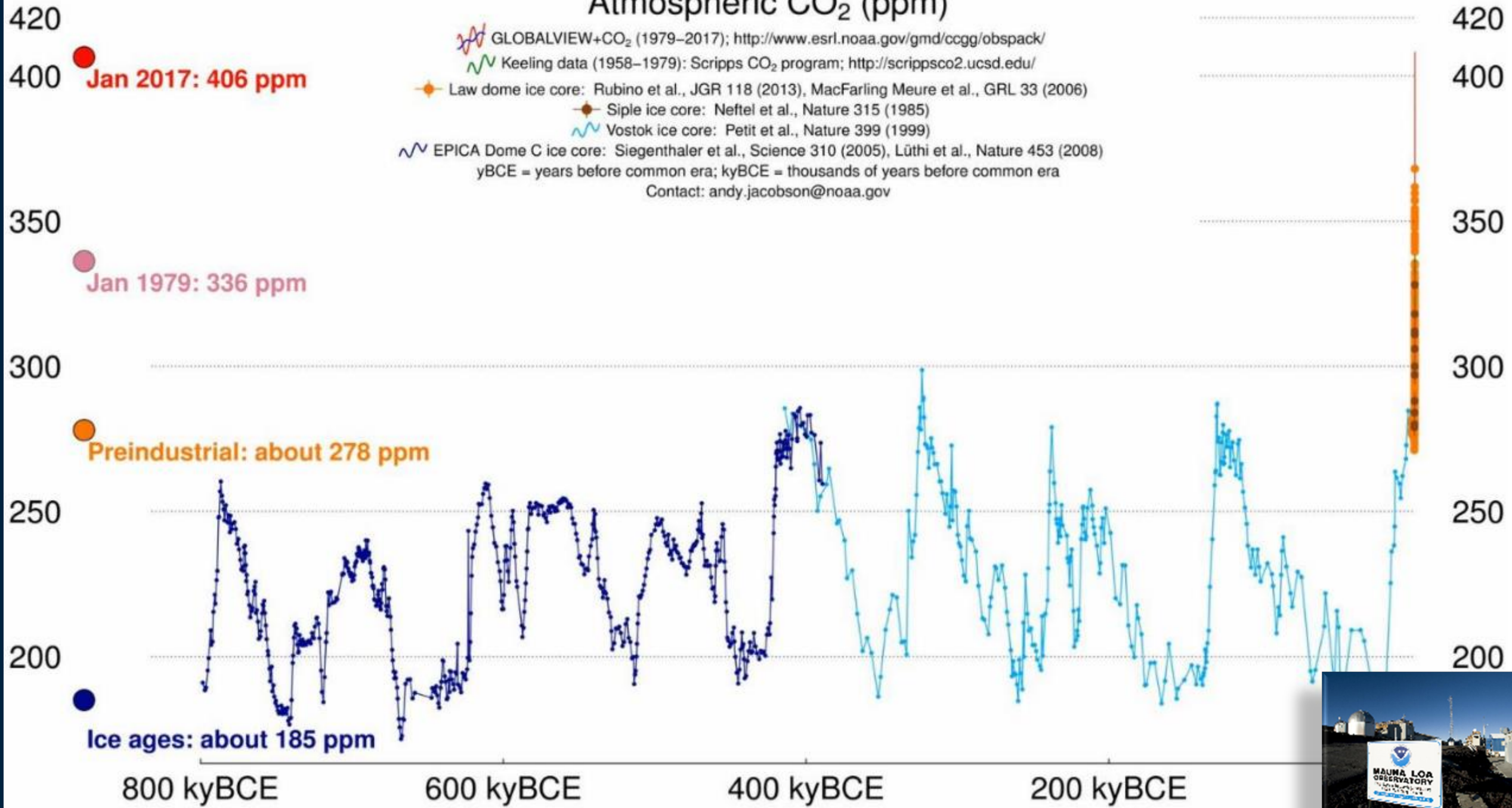
Climate considerations shall be an essential element of U.S. foreign policy and national security. The U.S. will move quickly to build resilience, both at home and abroad, against the impacts of climate change that are already manifest and will continue to intensify according to current trajectories.



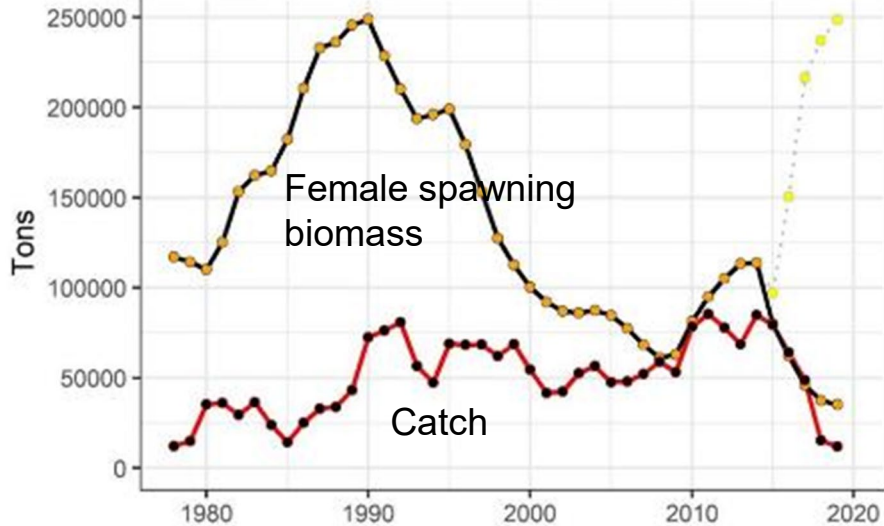
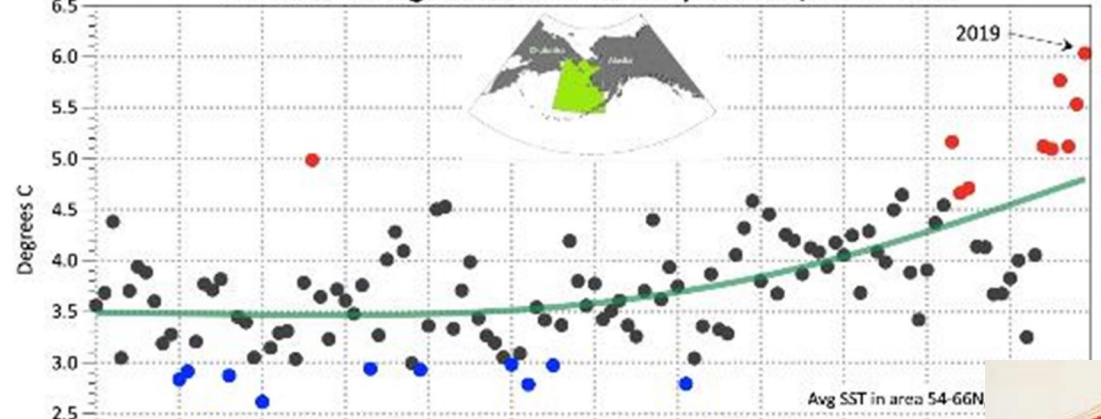
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Atmospheric CO₂ (ppm)

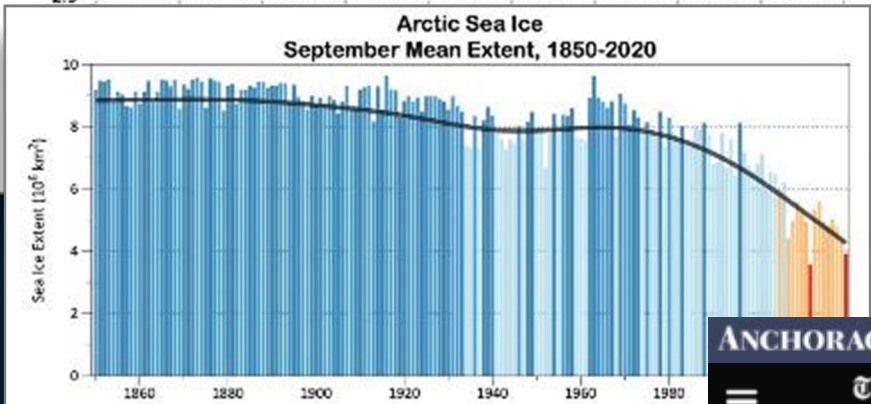
- GLOBALVIEW+CO₂ (1979–2017); <http://www.esrl.noaa.gov/gmd/ccgg/obspack/>
 - Keeling data (1958–1979): Scripps CO₂ program; <http://scrippsco2.ucsd.edu/>
 - Law dome ice core: Rubino et al., JGR 118 (2013), MacFarling Meure et al., GRL 33 (2006)
 - Siple ice core: Neftel et al., Nature 315 (1985)
 - Vostok ice core: Petit et al., Nature 399 (1999)
 - EPICA Dome C ice core: Siegenthaler et al., Science 310 (2005), Lüthi et al., Nature 453 (2008)
- yBCE = years before common era; kyBCE = thousands of years before common era
Contact: andy.jacobson@noaa.gov



Bering Sea (east of 180W)
Annual Average Sea Surface Temperature, 1900-2019

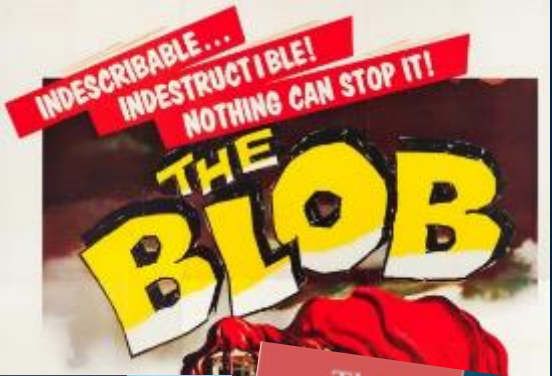


Gulf of Alaska Pacific cod recruitment



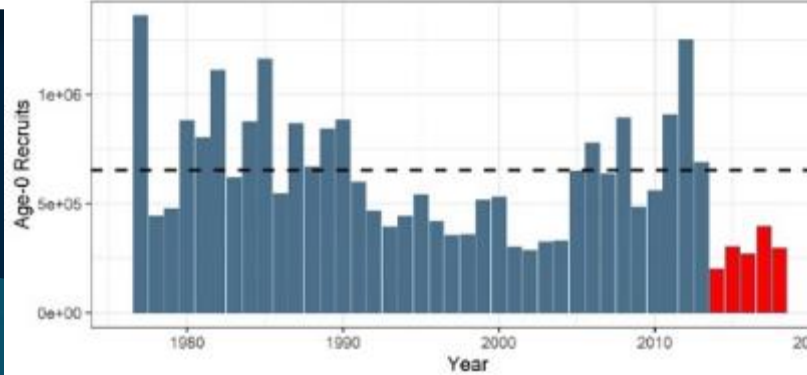
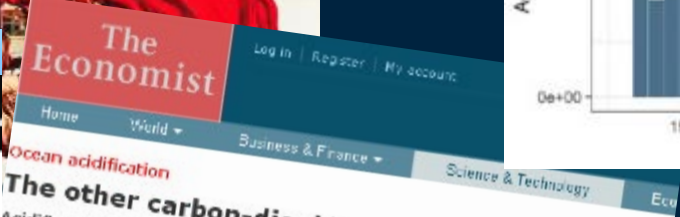
Arctic Sea Ice
September Mean Extent, 1850-2020

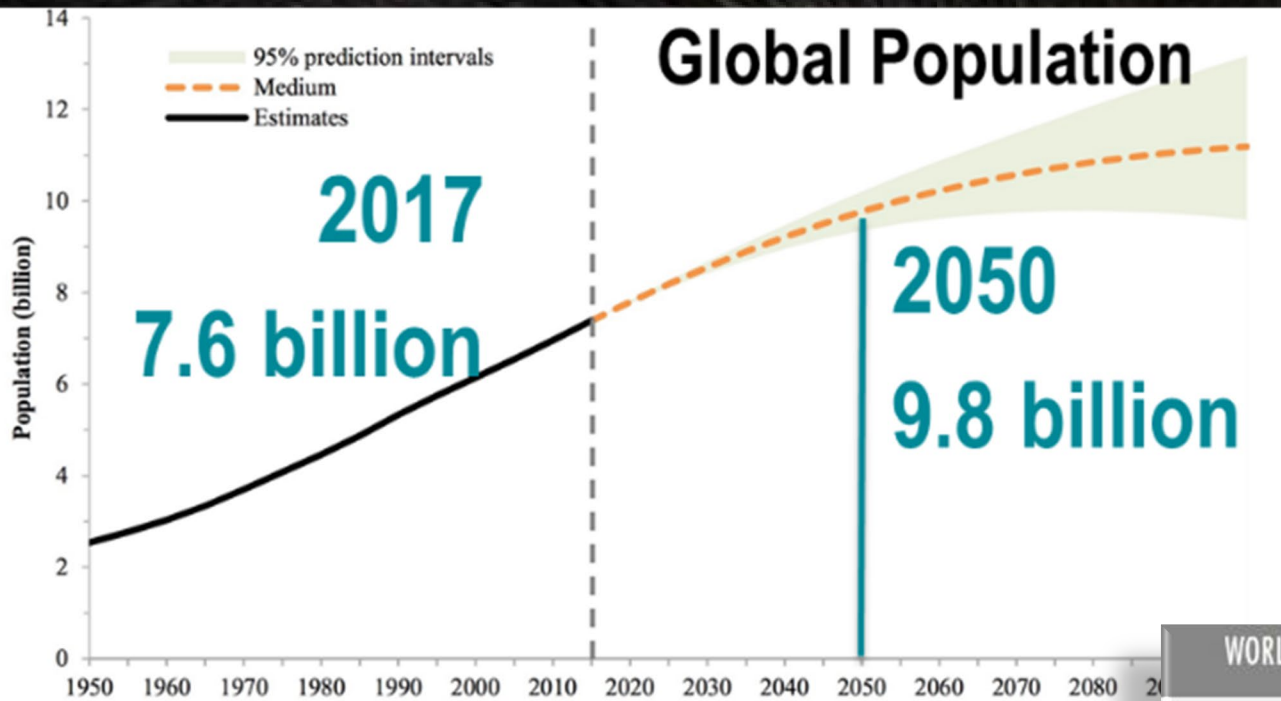
ACCAP
 September Arctic Ice Extent
 ■ Smoothed Average
 ■ 2-4 million km²
 ■ 4-6 million km²
 ■ 6-8 million km²
 ■ 8-10 million km²



**‘Fallen off a cliff’:
 Scientists have never
 observed so little ice in the
 Bering Sea in spring**

By Jason Samenow
 May 3





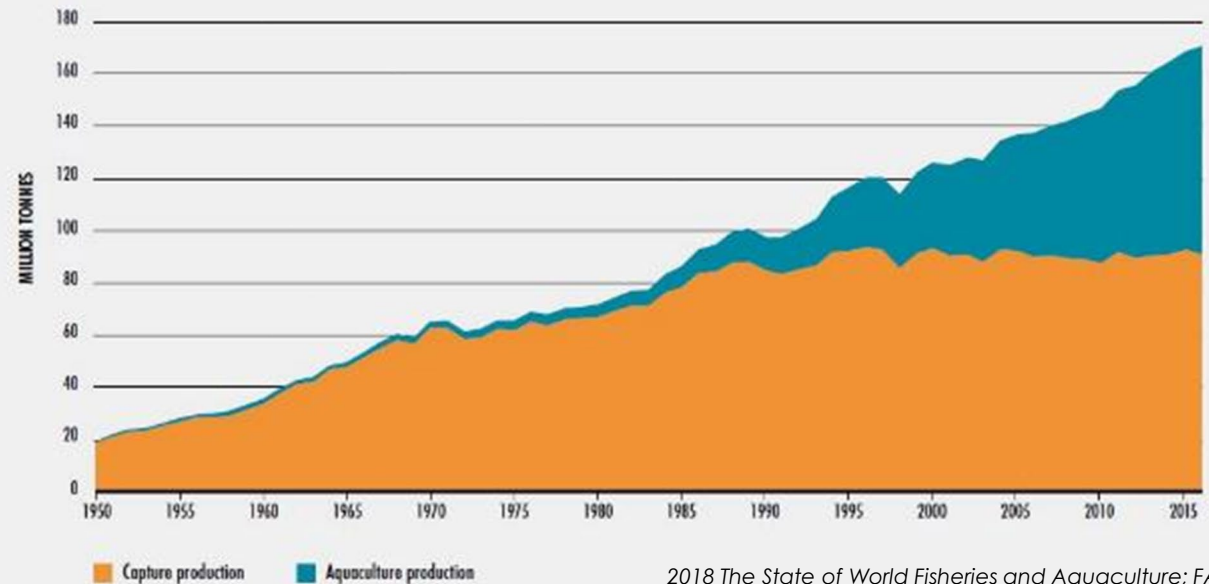
Source: United Nations, Department of Economic and Social Affairs, Population Division (2017).
World Population Prospects: The 2017 Revision. New York: United Nations.



Food security is a local, regional, national, and global issue

Food security is a local, regional, national, and global issue

WORLD CAPTURE FISHERIES AND AQUACULTURE PRODUCTION



2018 The State of World Fisheries and Aquaculture; FAO

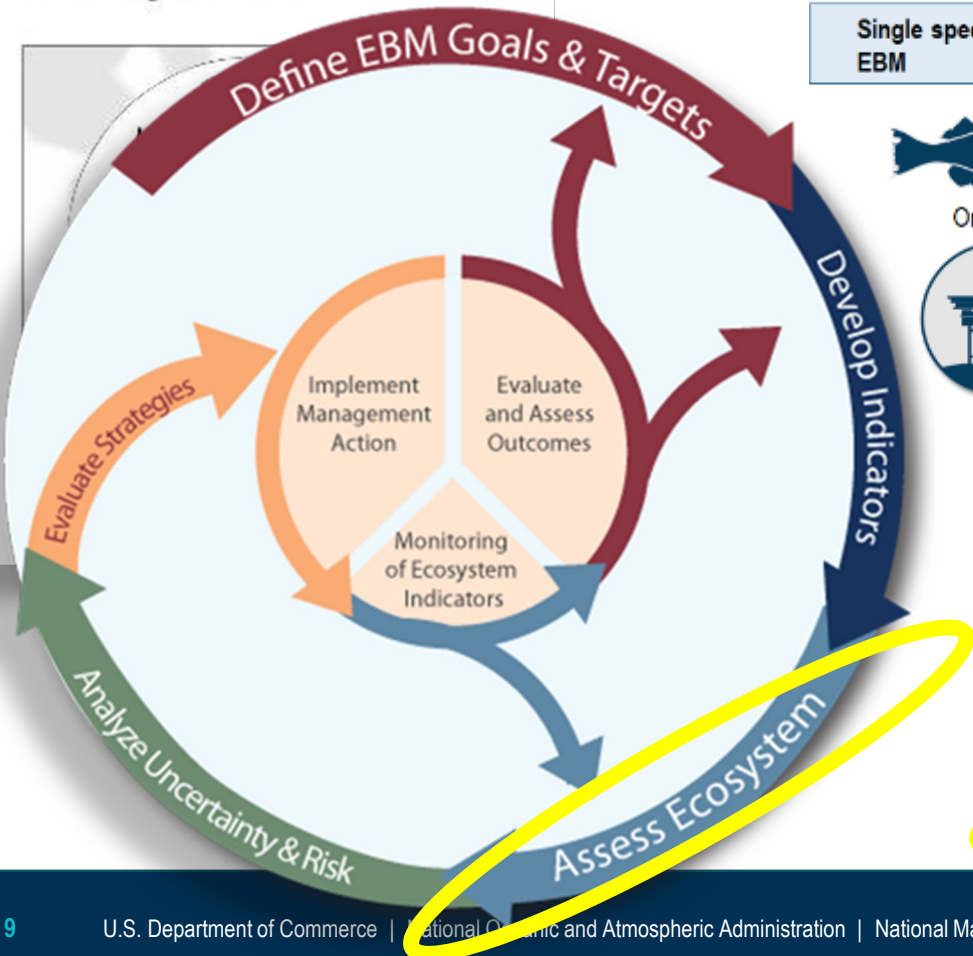
NOTE: Excludes aquatic mammals, crocodiles, alligators and caimans, seaweeds and other aquatic plants

NMFS Ecosystem Based Fishery Management

LEGAL AUTHORITIES AND MANDATES: MSA, MMPA, ESA, NEPA

Magnuson-Stevens
Fishery Conservation and
Management Act

2004, 2016-current (2014 NPFMC Ecosystem Vision)



Single species or sector
EBM



Or



Multiple species or
sectors EBM



Or



EBM of the entire system



Adapted from UNEP, 2011



EBFM Policy → **EBFM Road Map** (Plan, Advance, **Prioritize**, Explore trade-offs, Ecosystem management, Resilience/Community well being)

AFSC Ecosystem Based Fishery Management

AK Integrated Ecosystem Assessment (IEA) program

- ✓ Support development of early warning systems and ecological forecasts
- ✓ Support the Preview of Ecological and Economic Conditions (PEEC)
- ✓ Participatory science to support conceptual models and scenario planning (e.g. for use in **FEPs and support Climate Change Task Force**)...onramps to short and long term management advice...**ADAPTIVE and climate ready?**
- ✓ Leveraged support for Ecosystem Status Reports (ESR) development
- ✓ Maintain operational readiness of ecosystem models and risk frameworks
- ✓ Support ROMSNPZ virtual ocean predictions and forecasts
 - Data access, model webpage, R tools



AK IEA Steering Committee:
Kirstin Holsman, Kerim Aydin, Jamal Moss, Stephen Kasperski, Libby Loggerwell, and Phyllis Stabeno



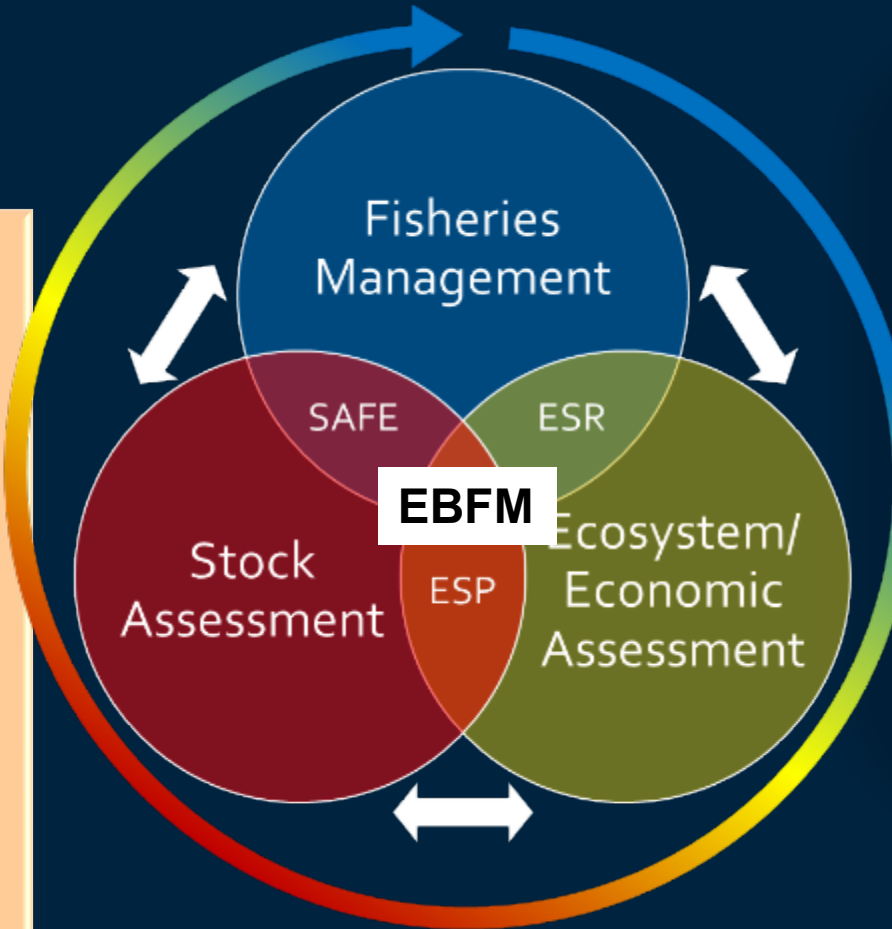
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AFSC Ecosystem Based Fishery Management

Ecosystem Status

Reports (~20 years)

- Indicator-based assessments by region
- Tailored to the North Pacific Fisheries Management Council
- Linked with annual stock assessment cycle
- Provide context for Ecosystem-Based Fisheries Management



Ecosystem

Socioeconomic Profiles

Category 1: Informs stock assessment model

Category 2: Used to inform the Allowable Biological Catches

Category 3: Indicators inform other Ecosystem Based Management Processes

Category 4: Exploratory



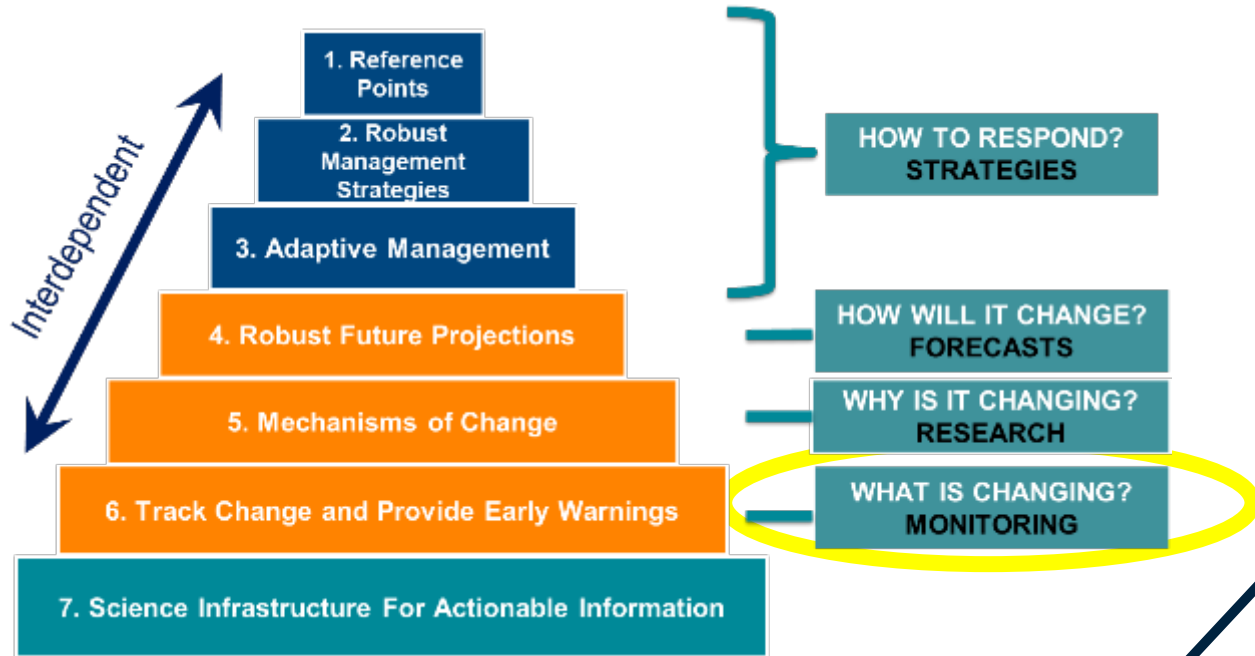
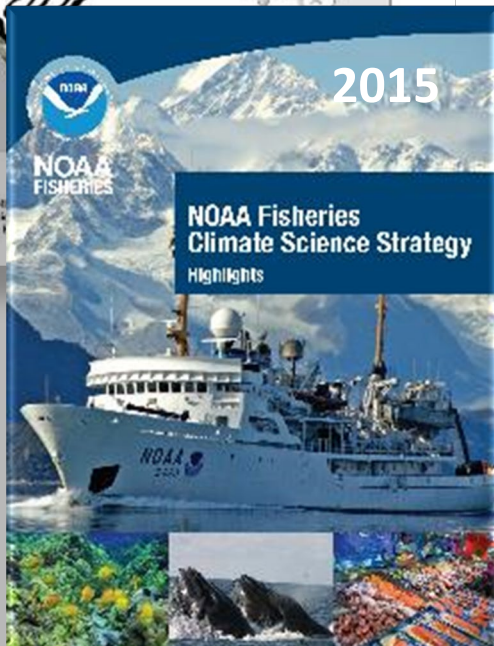
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NMFS climate informed science for management

Magnuson-Stevens
Fishery Conservation and
Management Act



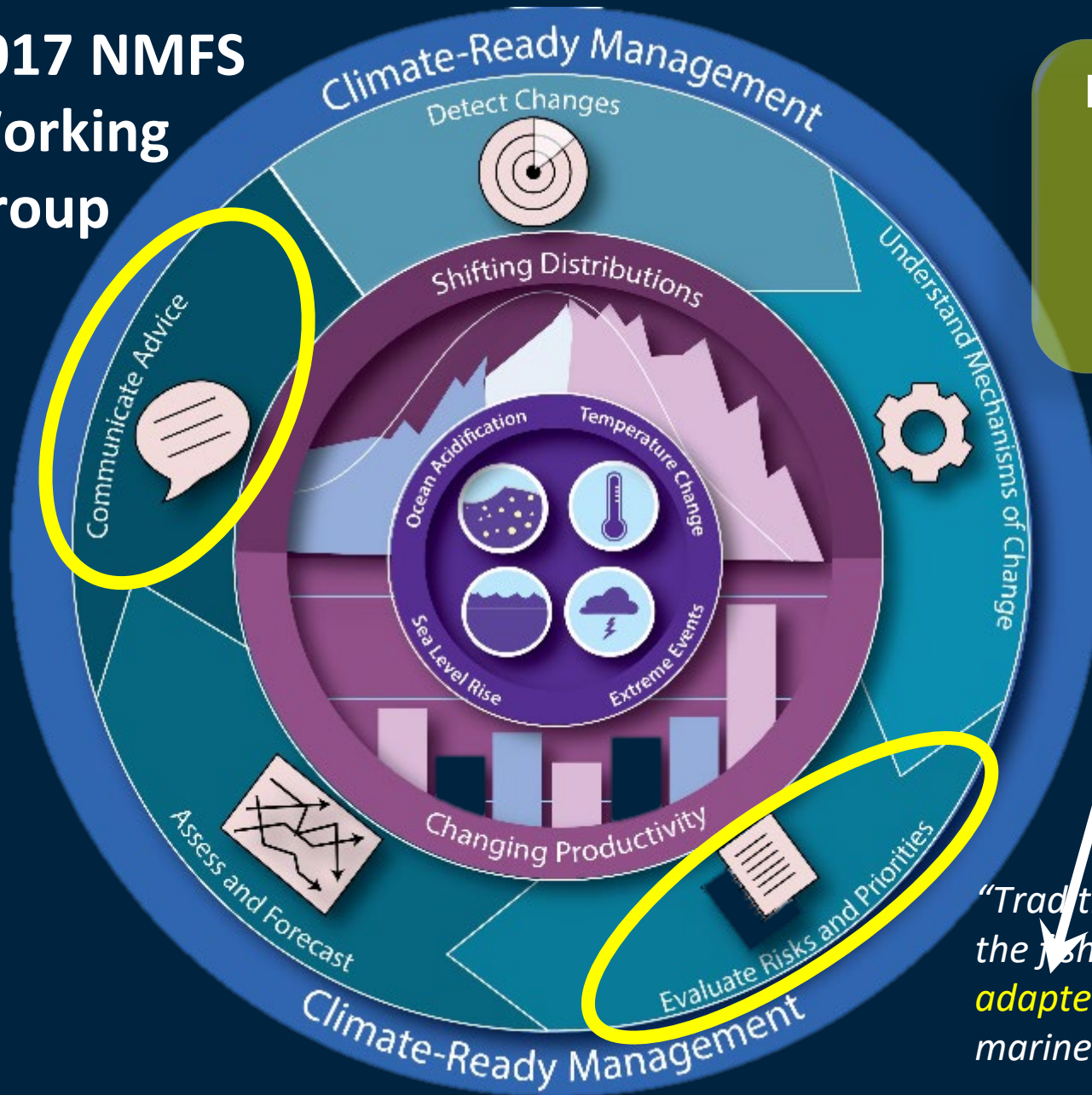
U.S. DEPARTMENT
National Oceanic
and Atmospheric Administration



- ✓ Science Capacity
- ✓ Climate-Ready Management
- ✓ Resilience and Adaptation



2017 NMFS Working Group



Potential fisheries management impacts

- Allocation issues
- Spatial & temporal management
- Estimates of spawning biomass, MSY, biological reference points

*“U.S. National Marine Fisheries Service has called for increasing the **production, delivery, and use of climate and environmental information** to fulfil its living marine resource stewardship mandates”*

Karp et al. 2019. Accounting for Shifting Distributions and Changing Productivity in the Development of Scientific Advice for Fishery Management. ICES JMS doi: 10.1093/icesjms/fsz048

*“Traditional methods and assumptions used in the fishery management process need to be **adapted** to ensure effective stewardship of living marine resources under changing conditions.”*



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AFSC climate informed science for management

EBS & GOA Regional Action Plans (2015-today)

- ✓ Climate-informed reference points
- ✓ Advance robust management strategies (e.g. FEP, ACCLIM, multi-spp.)
- ✓ Advance adaptive management processes (Ecosystem socio-Economic Profile-ESP, risk tables)
- ✓ Project Future Conditions (physical forecasts, projections, IBM)
- ✓ Mechanisms (lab, movement, heatwaves, place-based IEA, LKTK)
- ✓ Track and provide early warnings (Ecosystem Status Report-ESR)
- ✓ Build and maintain adequate science infrastructure (surveys, research [trophodynamics, aging], stock assessments)

EBS & GOA 2.0 and Arctic 1.0 -> October 2021

- Process Studies
- Monitoring
- Management Oriented Synthesis
- Socio-economic
- Marine Mammals



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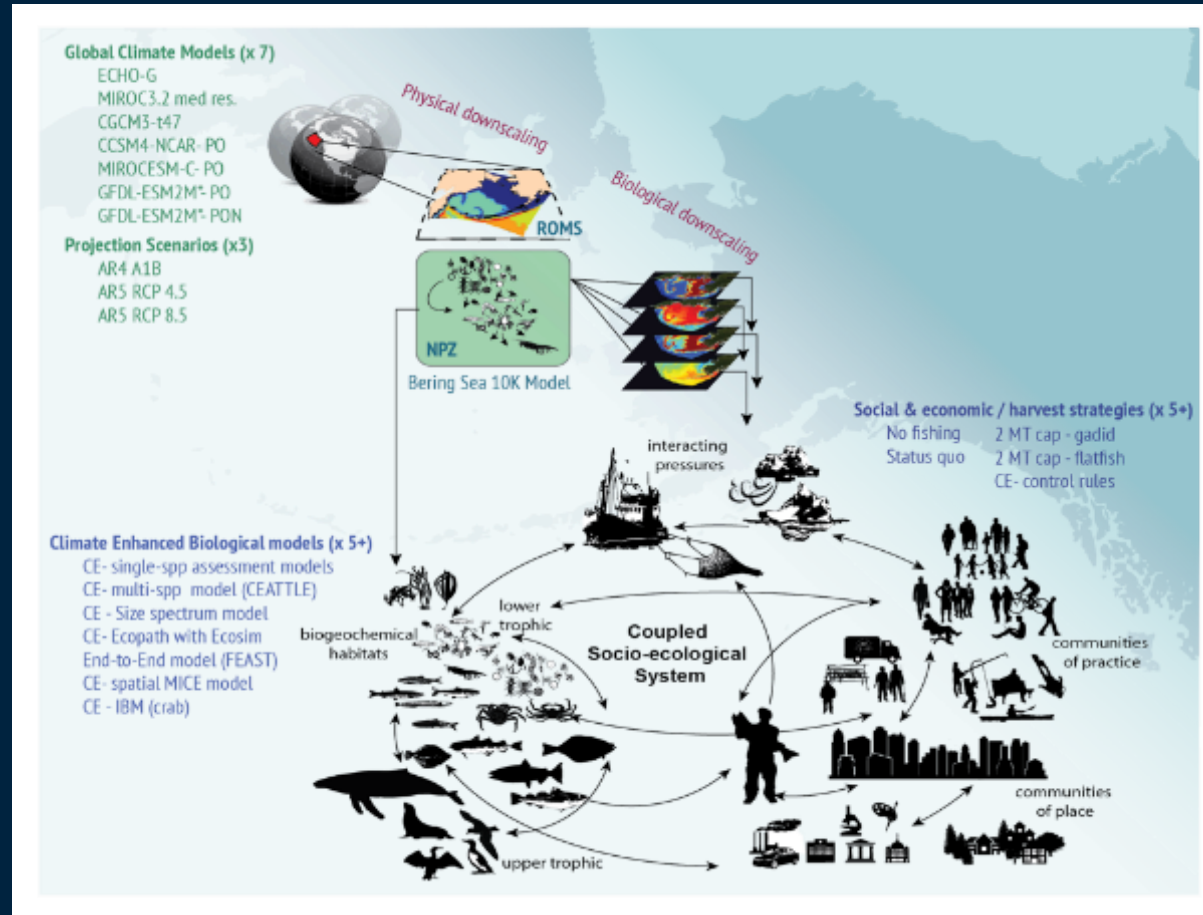
Alaska Climate Integrated Modeling Project

Operational suite of coupled socio-ecological models for climate fisheries hindcasts, forecasts, projections and Management Strategy Evaluation

Characterize and project climate-driven changes to the eastern Bering Sea (EBS) ecosystem, from physics to fishing communities.

EBFM can forestall climate declines and provide critical time to adapt

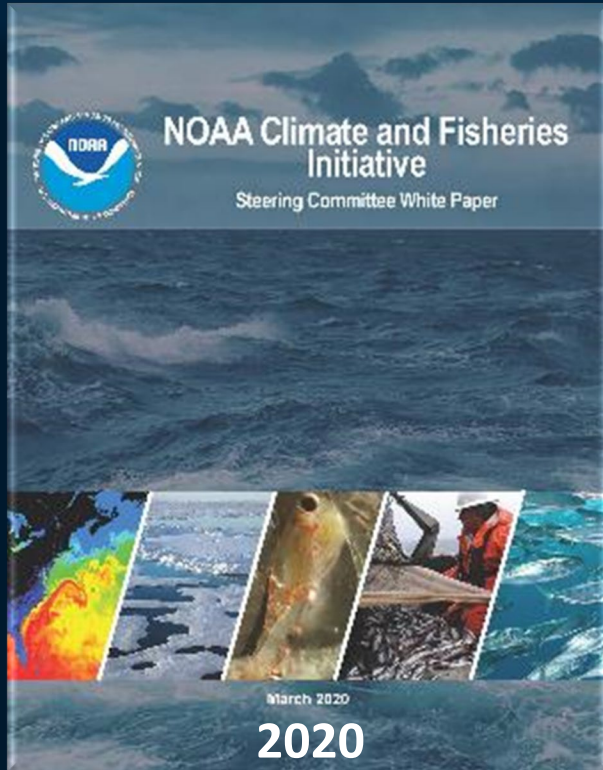
Holsman, K.K., Haynie, A.C., Hollowed, A.B. *et al. Nat Commun* 11, 4579 (2020). <https://doi.org/10.1038/s41467-020-18300-3>



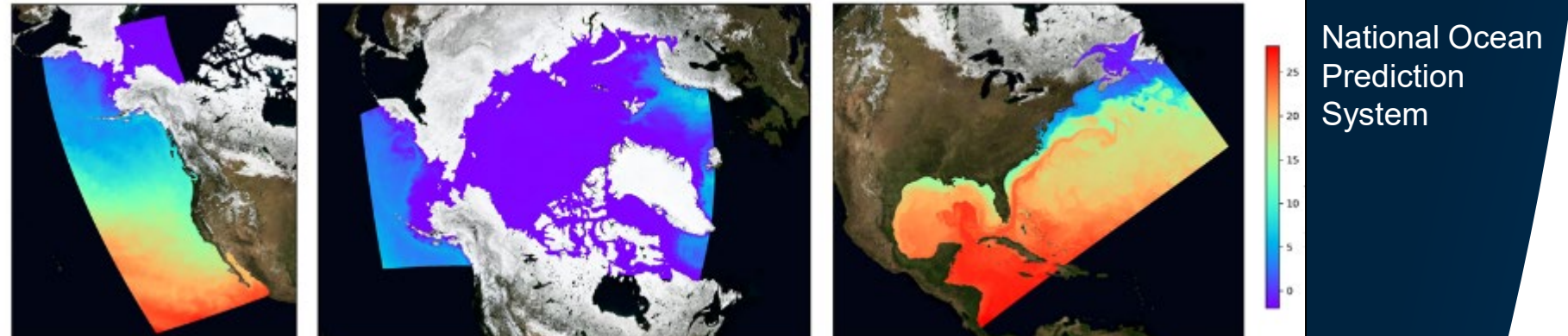
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Hollowed et al. 2020. *Frontiers in Mar. Sci.*
doi: 10.3389/fmars.2019.00775

NOAA Climate and Fisheries Initiative



end-to-end operational ocean modeling & decision support system



▶ Advancing Ocean, Ecosystem, and Climate Understanding

▶ Operational Ocean, Climate, and Ecosystem Prediction Systems

▶ Climate Ready Decision Making



- Habitat and distribution maps
- Spp. forecasts and projections
- Ecosystem-wide forecasts and projections
- Tipping points and thresholds

2021 Executive Orders associated with environmental justice (and climate)

EO 14008 (2021): Tackling the Climate Crisis at Home and Abroad

Section 219-223. SECURING ENVIRONMENTAL JUSTICE AND SPURRING ECONOMIC OPPORTUNITY

EO 13985: Advancing Racial Equity and Support for Underserved Communities Through the Federal Government

NOAA: “Advancing Equity for All Roadmap”

NMFS: [Equity and Environmental Justice Working group](#)

EO 13990: Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis

Section 1. Policy

- “....listen to the science;.....to bolster resilience to the impacts of climate change; to restore and expand our national treasures and monuments;....”

Section 3. Restoring National Monuments (DOI led)

Section 4 (b). Arctic Refuge

- [Reinstates EO 13754 \(December 9, 2016\) Northern Bering Sea Climate Resilience - to maintain existing prohibitions on commercial non-pelagic trawl gear in Bering Sea and Aleutian Islands FMP and Arctic FMP](#)

Presidential Memorandum: Tribal Consultation and Strengthening Nation-to-Nation Relationships (2021)

Executive Order 13175 (2000): Consultation and Coordination With Indian Tribal Governments



Source: White House
© 2016 The Pew Charitable Trusts



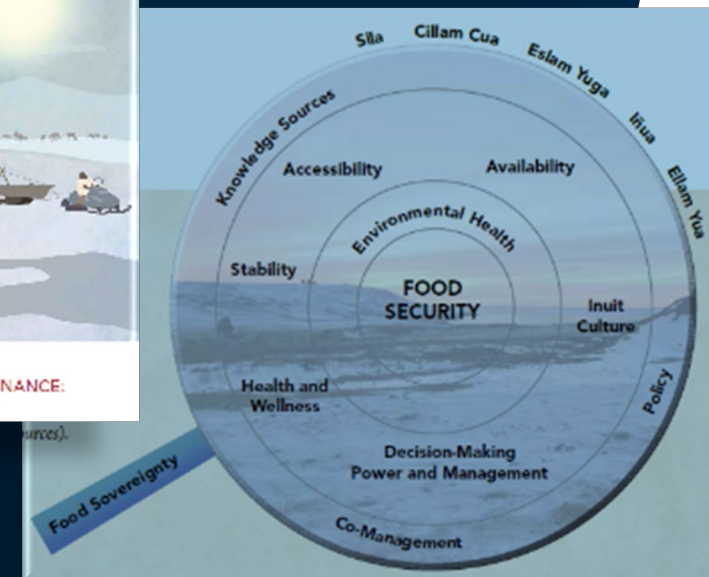
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AFSC and **environmental justice** in research

“Environmental justice is the **fair treatment and meaningful involvement** of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of **environmental laws, regulations, and policies.**”

Environmental Justice in Alaska includes Food Security

- Policy (subsistence, co-management, IWC, MSA-NPFMC)
- Data and knowledge collection/analysis
- Cooperation
- Collaboration
- **Communication**
- **Co-development**

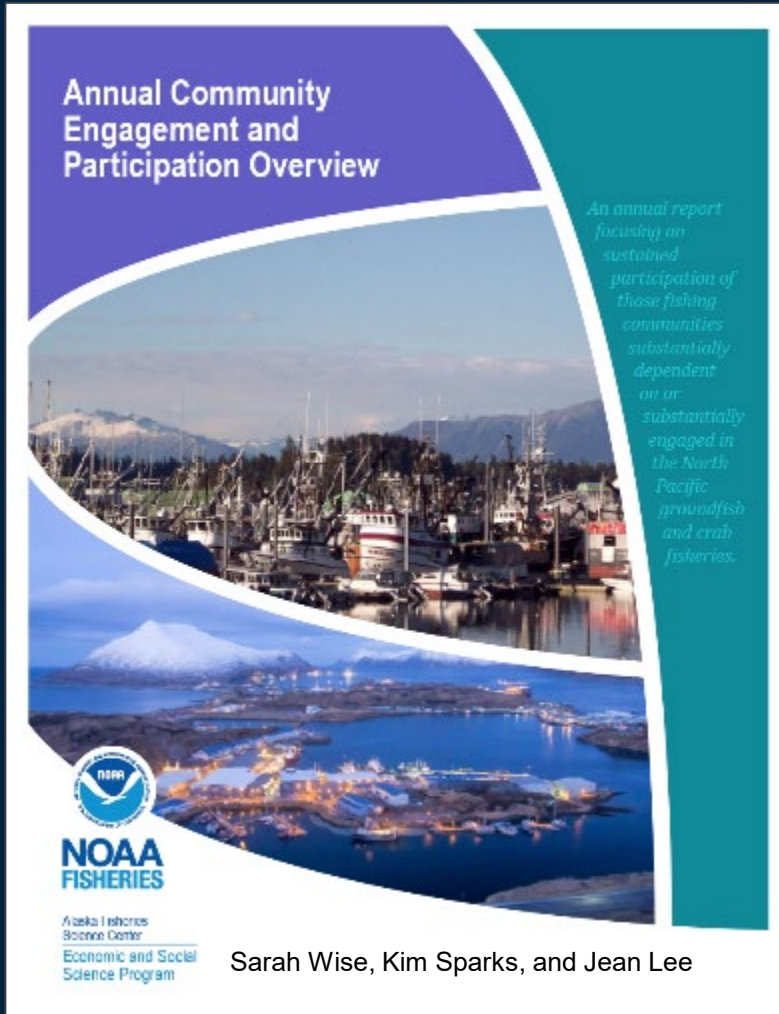


https://iccalaska.org/wp-icc/wp-content/uploads/2020/09/FSSG-Report_-LR.pdf



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AFSC and **environmental justice** in research



Engagement Indices - *A relative score (compared to all other AK communities in that fishery)*

Commercial Processing
Commercial Harvesting

Regional Quotient – *A relative share % of landings relative to all other AK communities in that fishery)*

Commercial Processing
Commercial Harvesting

Community Sketches

Community Vitality (by proxy)

- Deep dive into Highly Engaged communities
- school enrollment – direct metric
- Average pounds delivered and % of revenue landed
- Fish taxes

Community Sketches

- Demographics
- Area Description
- Social Indicators
- Infrastructure & Transportation
- School Enrollment
- Current Economy
- Fish Taxes
- Fishing History & Regulatory Background



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AFSC and environmental justice in research

Beluga whale



Commercial fishing permit holders



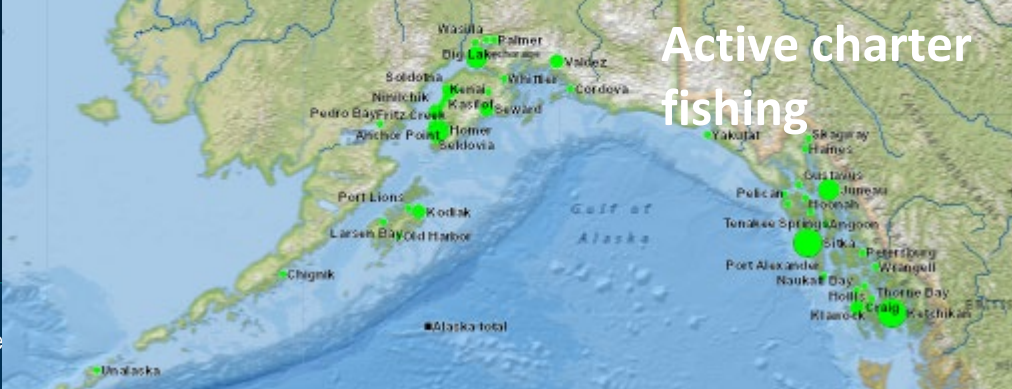
Halibut-residents



Seals and sea lions



Active charter fishing

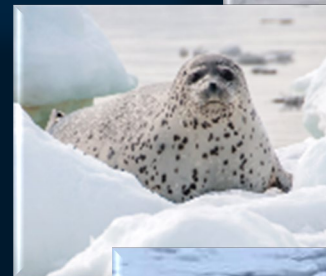
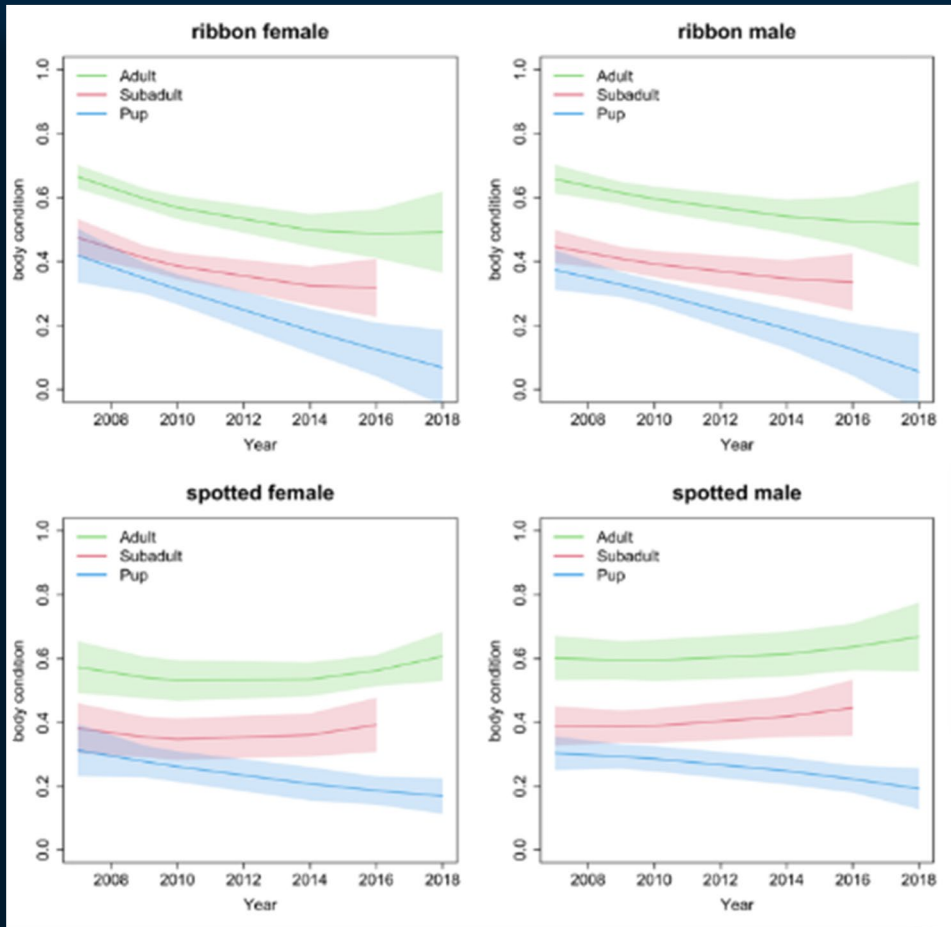


<https://www.fisheries.noaa.gov/alaska/commercial-fishing/alaska-fisheries-science-center-interactive-data-maps>



AFSC and environmental justice in research

Changing sea ice affecting ice seal biology



Boveng, P. L., H. L. Ziel, B. T. McClintock, and M. F. Cameron. 2020. Body condition of phocid seals during a period of rapid environmental change in the Bering Sea and Aleutian Islands, Alaska. *Deep Sea Research Part II: Topical Studies in Oceanography*:104904.



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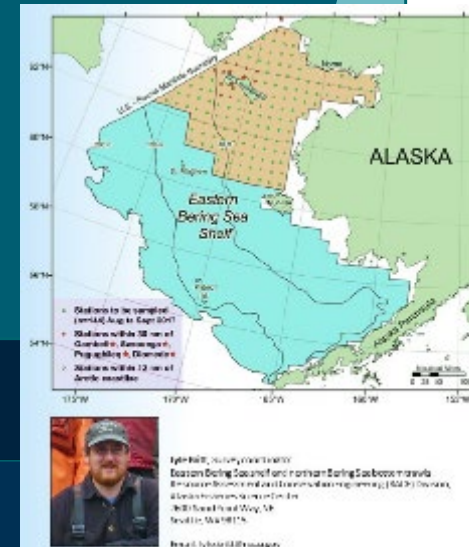
AFSC and **environmental justice** in research

Co-develop best practices for building relationships and partnerships with communities

- Communication and engagement (sharing information)
- Framework for identifying, prioritizing, and implementing research Cooperation
 - Data production: providing information.
 - Research project or data gathering that is a priority
 - Co-production of knowledge: development to implementation and communication of results.

Survey and research communication plan

- Provide clear and accessible information about AFSC scientific surveys and research activities and how they support science-based management
- Improve and increase dialogue and feedback mechanisms in target areas
- Facilitate cross-cultural learning opportunities for Alaska Native K-12 and college students



AFSC and **environmental justice** in research

Co-develop (in progress) white paper - 2022

Building relationships: co-development of knowledge through a dialogue between ocean hunters and western science researchers

Goal and Vision

To develop a framework to build relationships between and among Alaskan Indigenous communities and marine mammal researchers to improve **communication, coordination, collaboration**, and to create a framework for the co-development of knowledge through a dialogue between marine hunters and western science researchers.

Committing staff

- Interagency Arctic Research Policy Committee (IARPC)
Indigenous Engagement and Communications Specialist
- AFSC Tribal research coordinator



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Challenges for research informing management

Climate change

- Non-stationarity; is the change in productivity due to climate or fishing pressure? When do we change reference points? Will tipping points (thresholds) change?
- Limited resources
- Acceptable levels of uncertainty, risk
- Balance of management informed indicators and mechanisms
- How do we provide bookends and expect decisions?
- What don't we know?

Environmental justice

- Identifying community specific research needs and services within NOAA Fisheries mission scope
- Identifying and prioritizing co-developed research questions (threatened communities, sectors)
- Applying resources within the entire Alaska EEZ
- Assessing inequality in effects of environmental change (communities, fishing sectors)



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Thank You!

“We must listen to science — and act.”
[EO 14008 (2021)]

“Agencies shall make achieving environmental justice part of their missions by developing programs, policies, and activities to address the disproportionately high and adverse human health, environmental, climate-related and other cumulative impacts on disadvantaged communities, as well as the accompanying economic challenges of such impacts.”
[EO 14008 (2021)]

