Science, Service, Stewardship

Change to Alaska's Marine Fisheries

As Simply As Possible

NOAA FISHERIES SERVICE

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- NOAA Fisheries, Alaska Region, Habitat Conservation Division

Essential Fish Habitat (EFH): An Ecosystem Approach

Essential Fish Habitat (EFH) is defined as the physical, biological and chemical characteristics necessary to support fish for feeding, spawning, breeding, and growth to maturity. Many key Ecosystem Processes (EFH Attributes) interact in water to support our fisheries. EFH is not just hard substrate and structure, such as coral, rocks, kelps, and seagrasses. While substrates influence the physical characteristics of seafloors, watersheds, and associated vegetation, ecosystem processes influence the physical characteristics of the water and habitat (e.g. water quality, quantity, temperature; dissolved gases; and bio-chemical interactions) that support food chains and fish survival, and promote sustainable fisheries.

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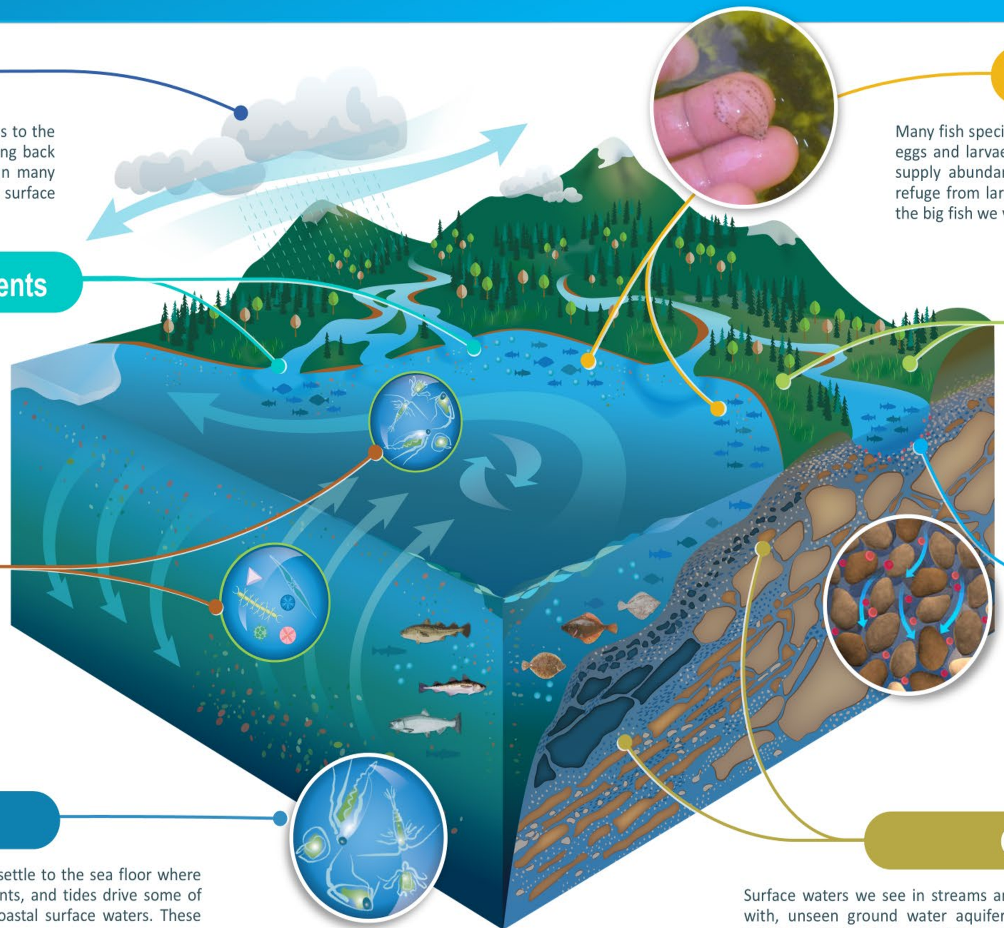

Water Cycle

Water enters the atmosphere through evaporation and returns to the land as rain or snow, contributing to surface waters or leaching back into the ground water regimes through wetland processes. In many regions, the abundant ground water regimes directly support surface waters and instream flows.

Outwelling Nutrients and Sediments

Terrestrial vegetation decomposes, providing nutrient-rich detritus to stream bottoms, substrates and soils. Wind and water constantly erode the land. Over time, waterways move detritus and sediments downstream to estuaries and nearshore coastal zones. Sediments resupply substrates and provide a foundation for vegetation and habitat for fish and invertebrates. Detritus provides nutrients to marine food chains, and larval and juvenile fish.

Food and Nutrients

One of the most important, though often overlooked, EFH Attribute is nutrition. Plentiful appropriate-size, nutrient-rich foods increase the chance of survival for larval and juvenile fish and invertebrates. Abundant food sources allow fish and invertebrates to survive harsh winter conditions and reach spawning maturity sooner.

Upwelling Nutrients

Marine plants, animal life, and terrestrial detritus eventually settle to the sea floor where they are converted to other forms of nutrients. Winds, currents, and tides drive some of these nutrients, sometimes referred to as old nutrient, to coastal surface waters. These nutrients provide a key foundation for marine food chains.

Near Shore Fish Nurseries

Many fish species spawn off shore. Coastal currents and tides transport their eggs and larvae to settle in shallow nearshore waters. These coastal zones supply abundant "tiny" food for small fish and invertebrates and provide refuge from larger predators. Small fish in nearshore fish nurseries become the big fish we value in our subsistence, sport, and commercial fisheries.

Wetlands and Riparian Zones

Wetlands and riparian zones function differently depending on local geology and hydrology. Generally, wetlands collect, store, and redistribute water over surface or ground aquifers. Wetlands act as filtration systems, regulating water temperature, quality, and quantity. Riparian vegetation provides shade to cool waters and organic nutrients to feed invertebrates and fish.

Hyporheic Zone

The hyporheic zone is the unseen water moving through gravel substrates in stream bottoms, between ground and surface waters, and surrounding riparian zones. This water regulates temperature and dissolved gas exchange, circulates organic nutrients, removes wastes, and provides habitat for countless aquatic flora and fauna. Pacific salmon, in their most sensitive embryonic phase, survive freezing winter conditions in the hyporheic zone.

Ground Water

Surface waters we see in streams and lakes are often closely connected to, and readily interact with, unseen ground water aquifers. Where surface and ground waters closely connect and interact, withdrawing water from aquifers alters surface waters, changing instream flows and river discharges, and in coastal areas may create saltwater intrusion.

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References: Limpinsel, D. E., Eagleton, M. P., and Hanson, J. L,. 2017. Impacts to Essential Fish Habitat from Non-Fishing Activities in Alaska. EFH 5 Year Review: 2010 through 2015. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-F/AKR-14, 229p.

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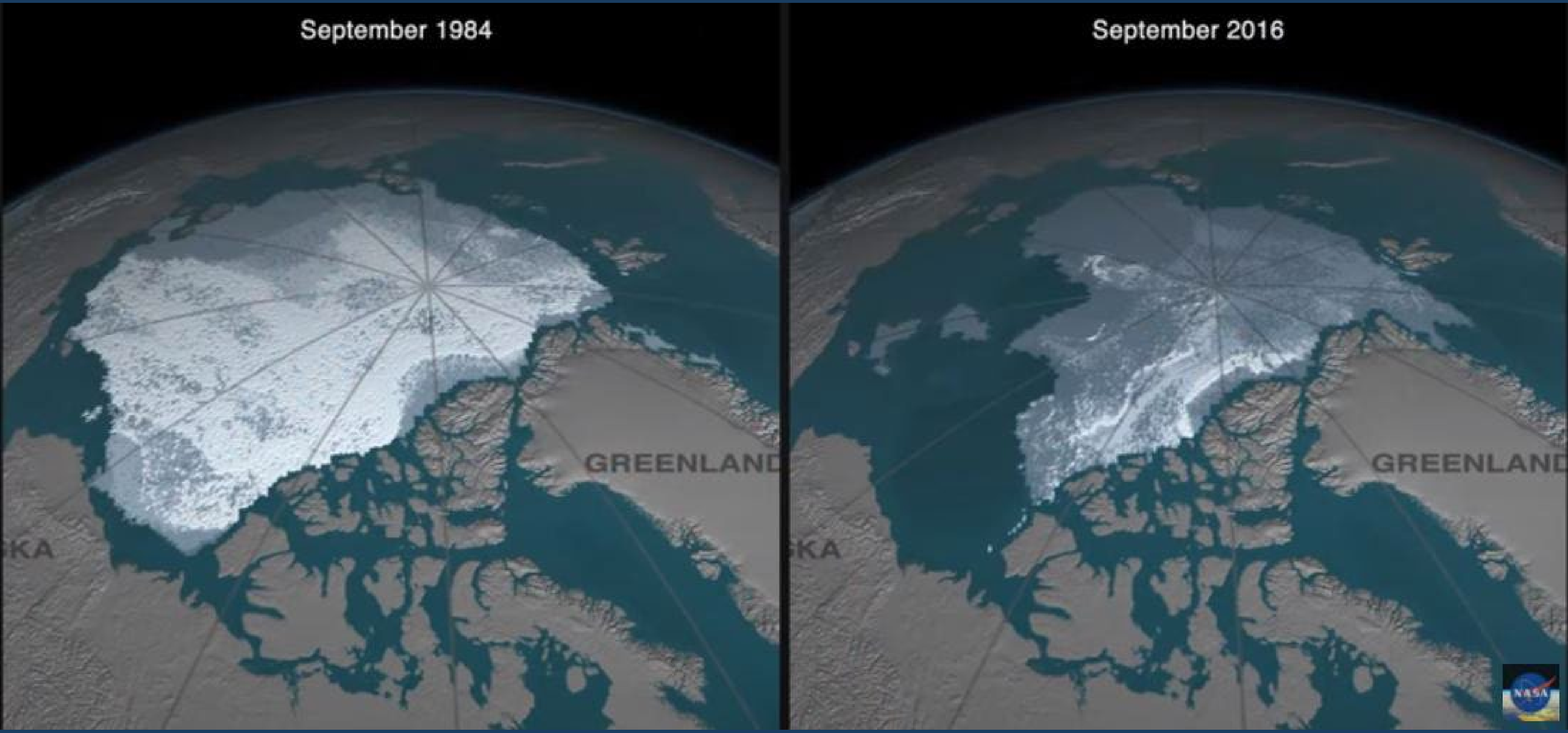
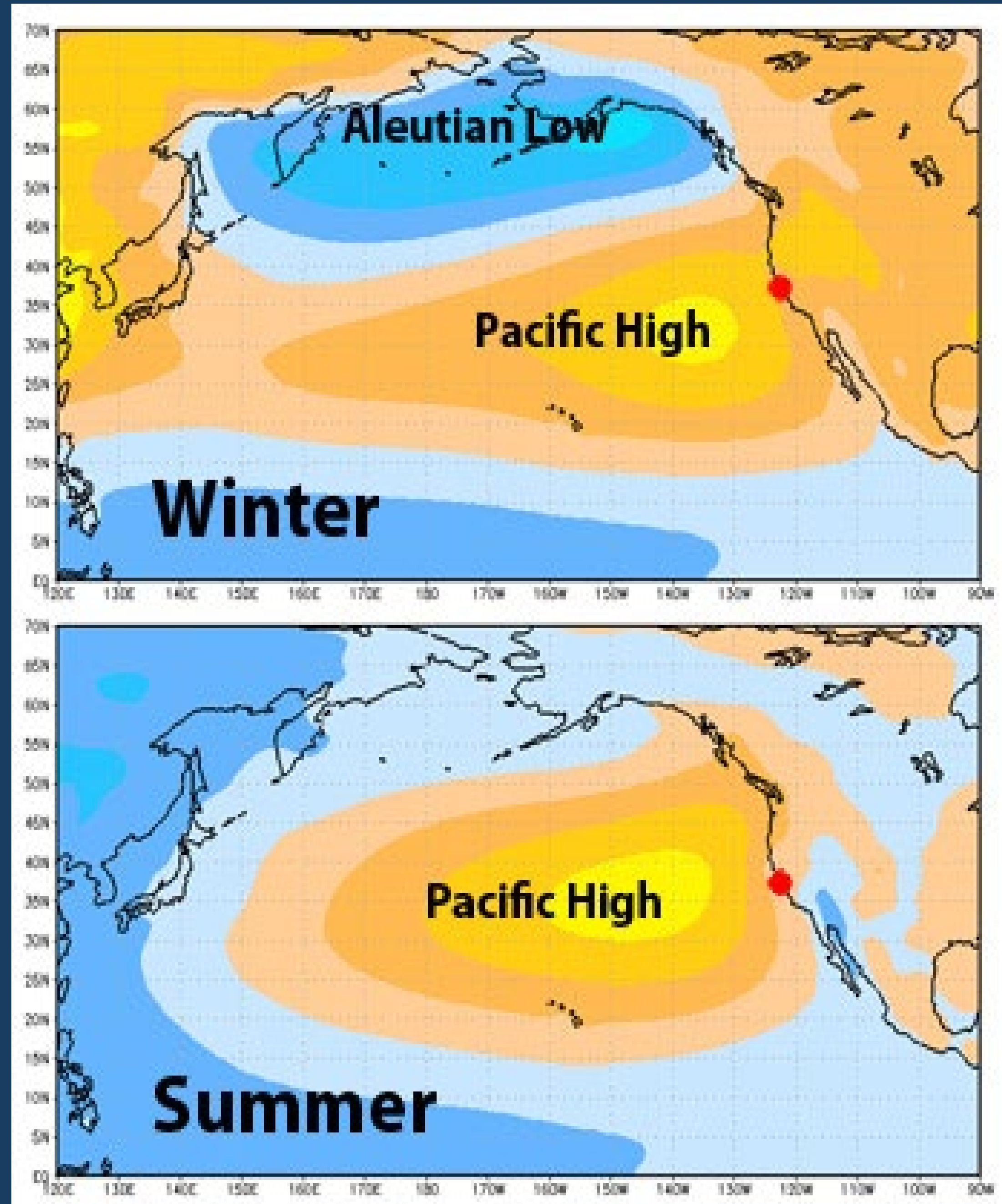


Bristol Bay

NASA Earth Observations

Atmospheric Forcing

Aleutian Low
North Pacific High



Seasons of the Sea
https://www.seasonsinthesea.com/may/phys.shtml

Sea Surface Ice Extent

Sea Ice Algae Induced Bloom, Species Spawn Timing, Advection and Transport of Larval Fish

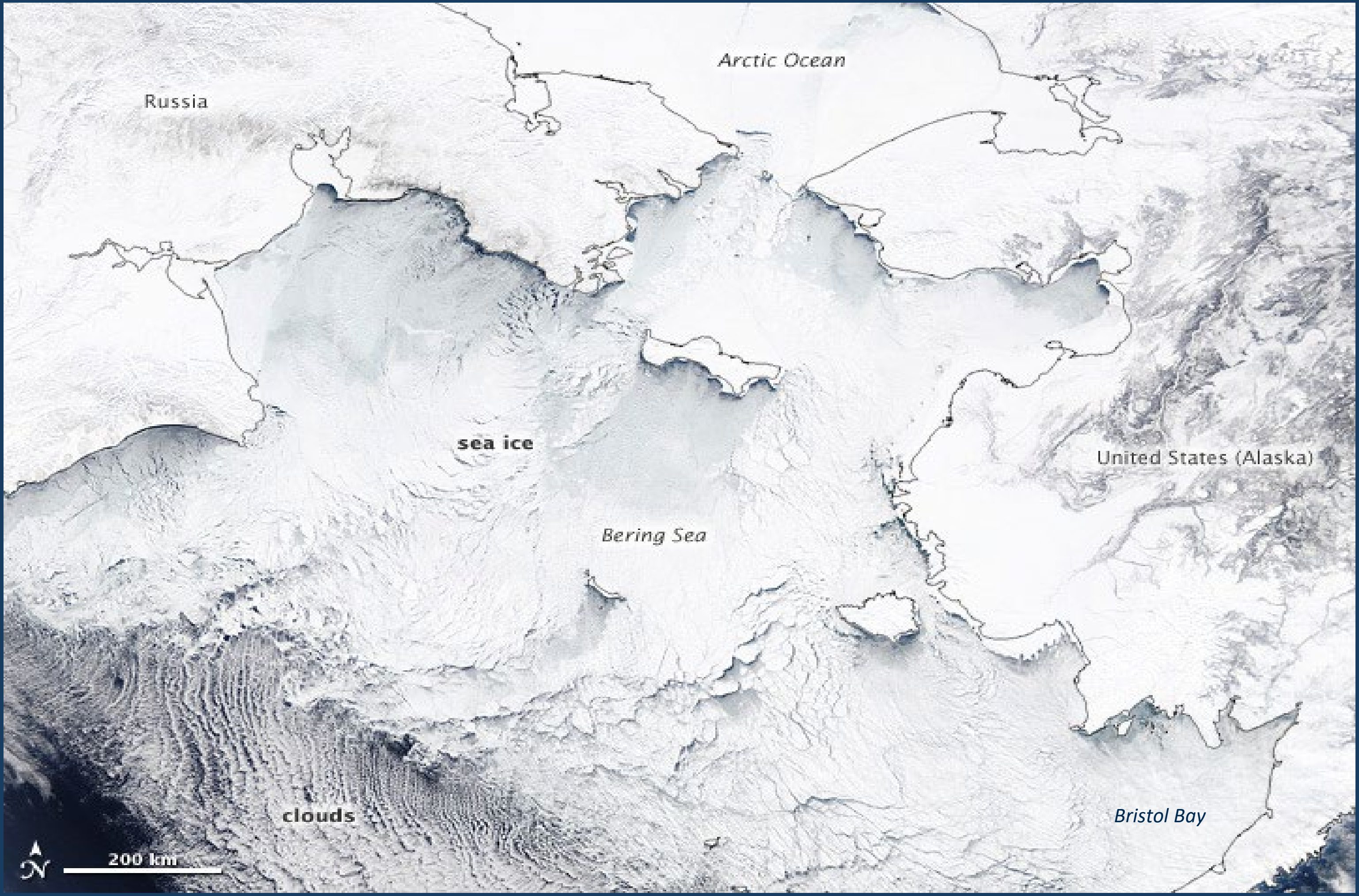


Image courtesy of Jeff Schmaltz, NASA Earth Observatory

Hunt et al. 2021, How will diminishing sea ice impact Commercial fishing in the Bering Sea?

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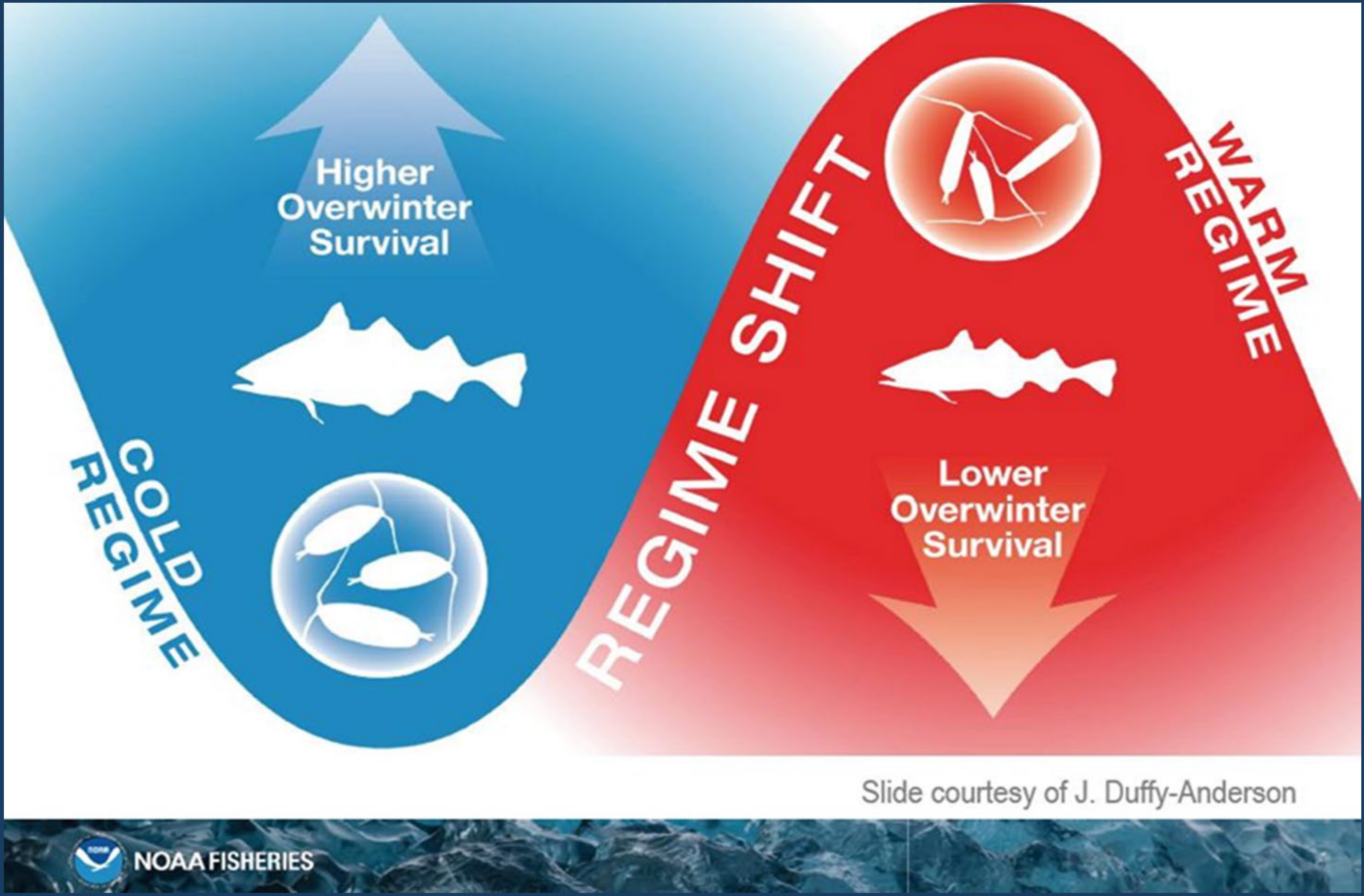

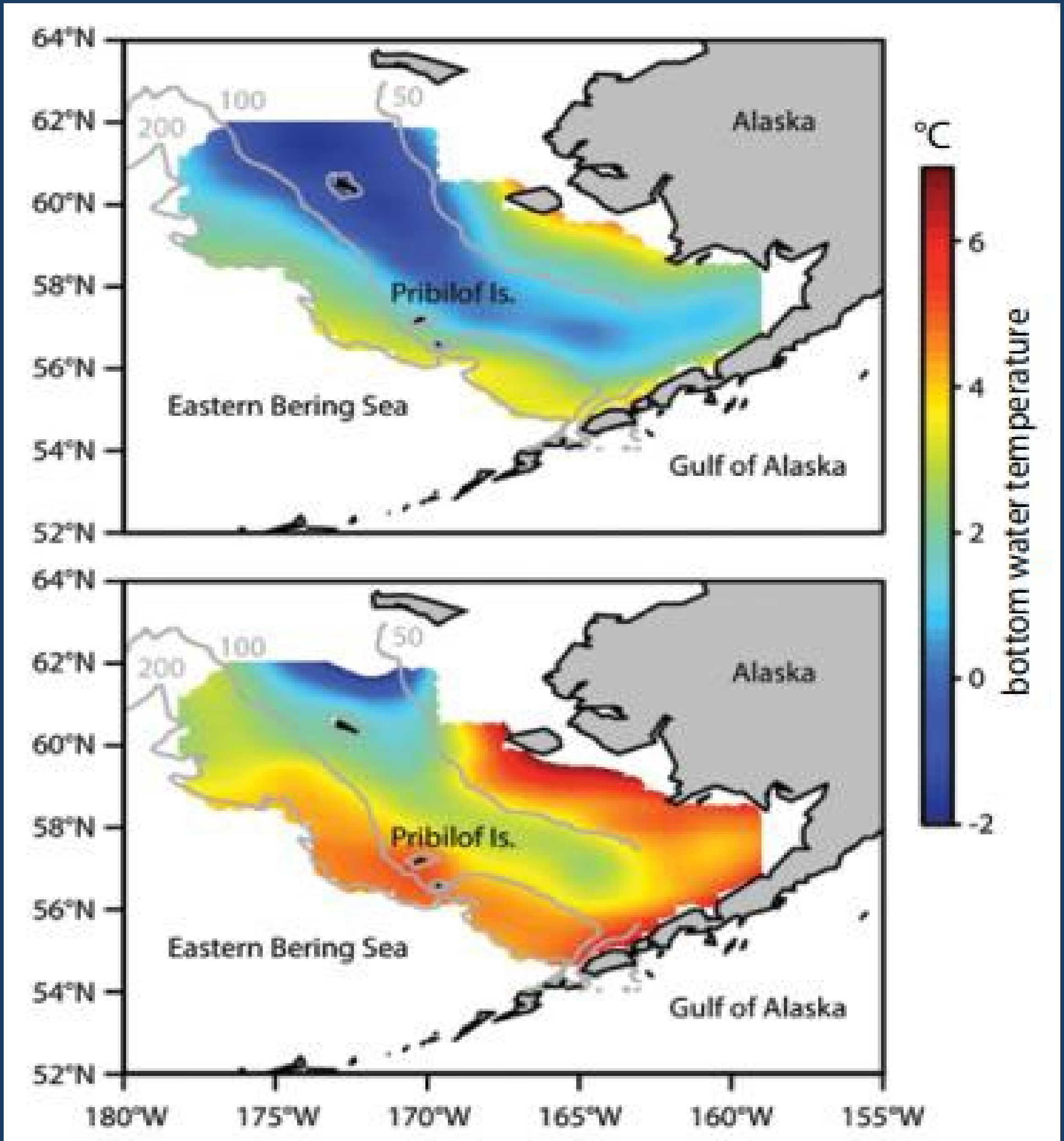

Van Pelt, T.I. (Ed.), 2015, The Bering Sea Project: NPRB

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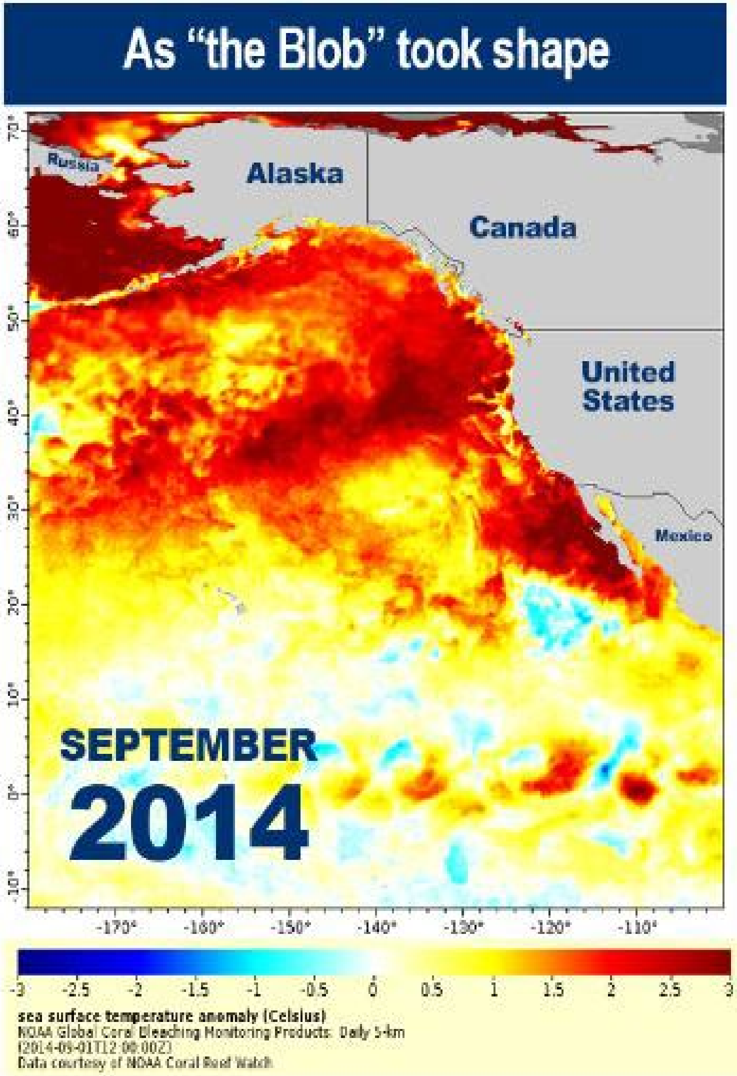
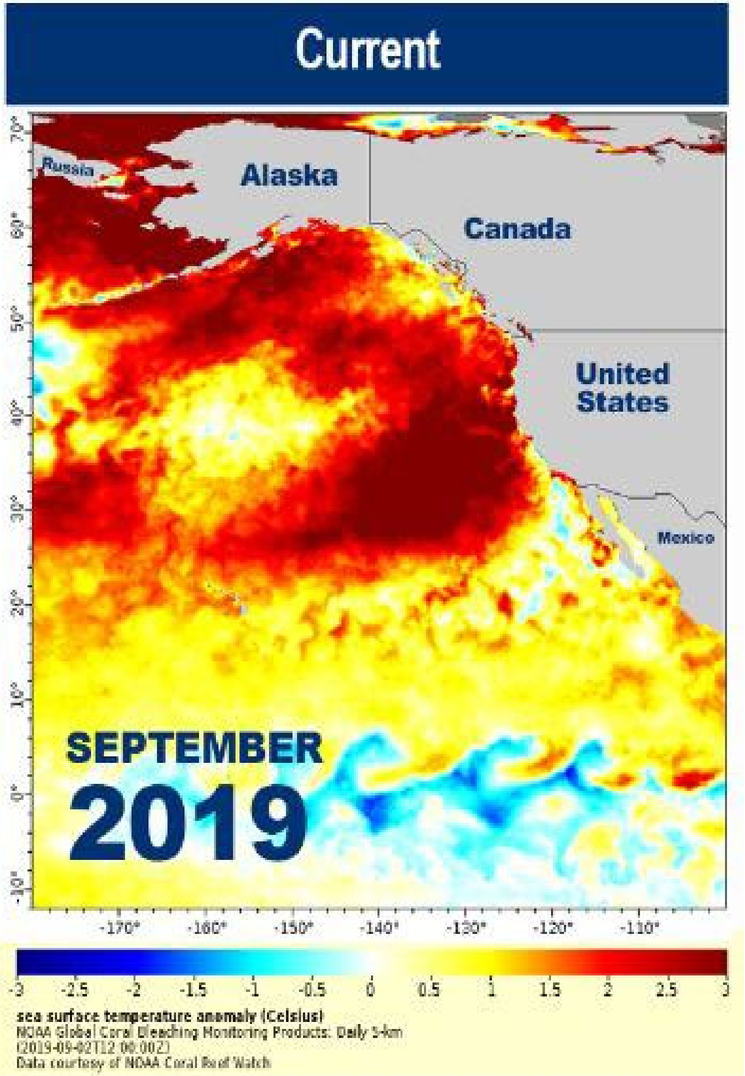
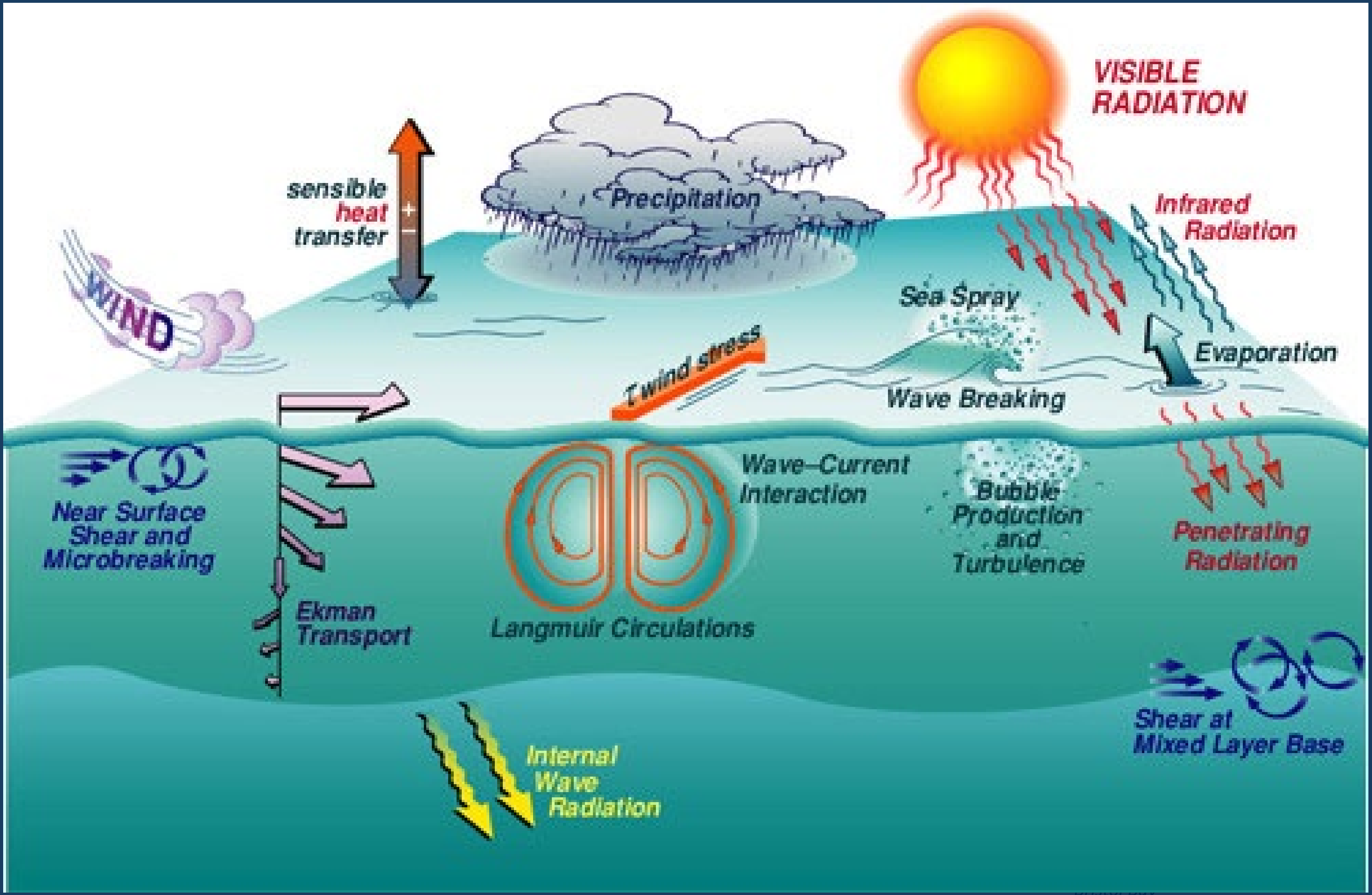
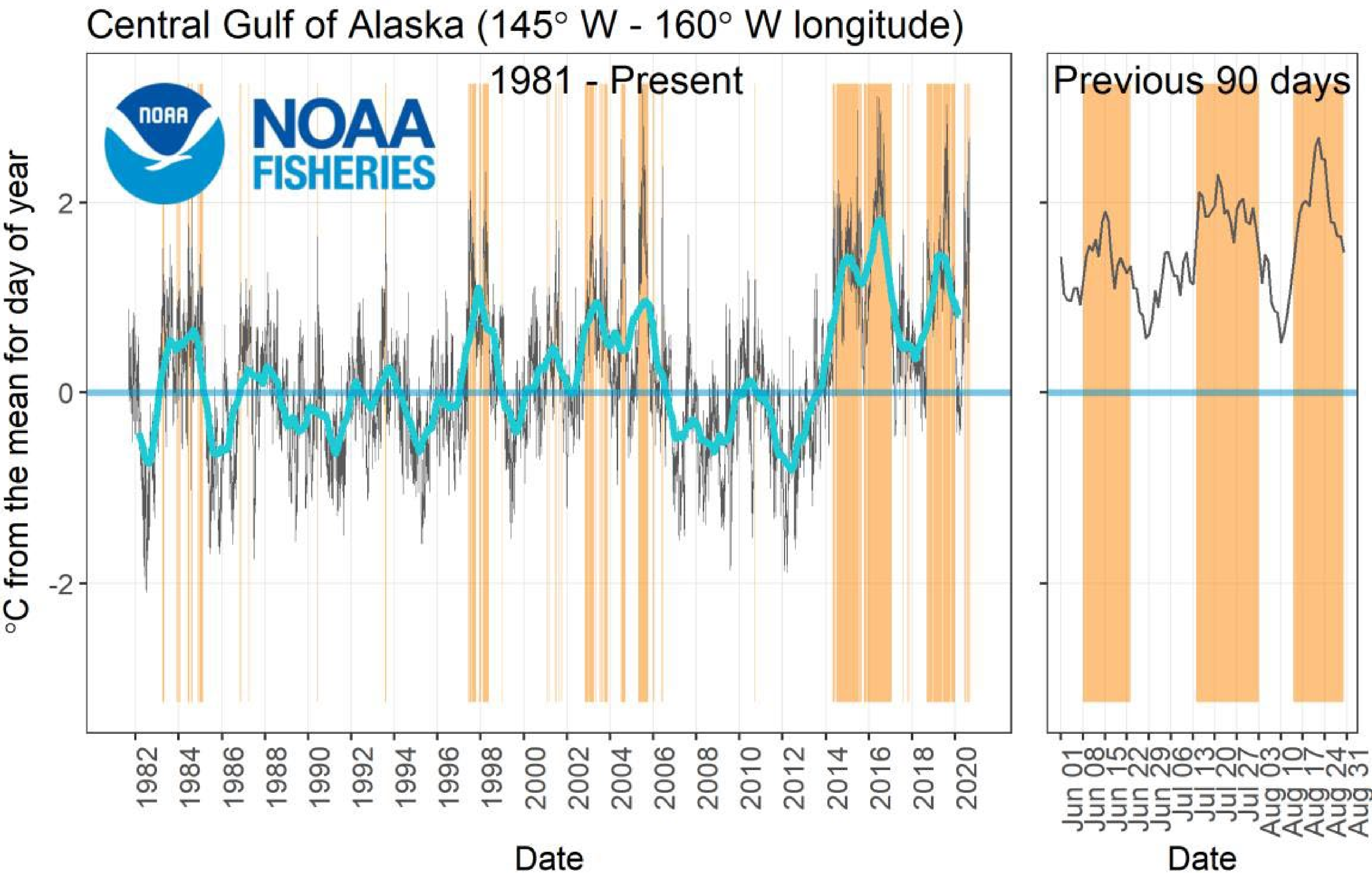
EFH Indicator - Sea Surface and Benthic Temperatures





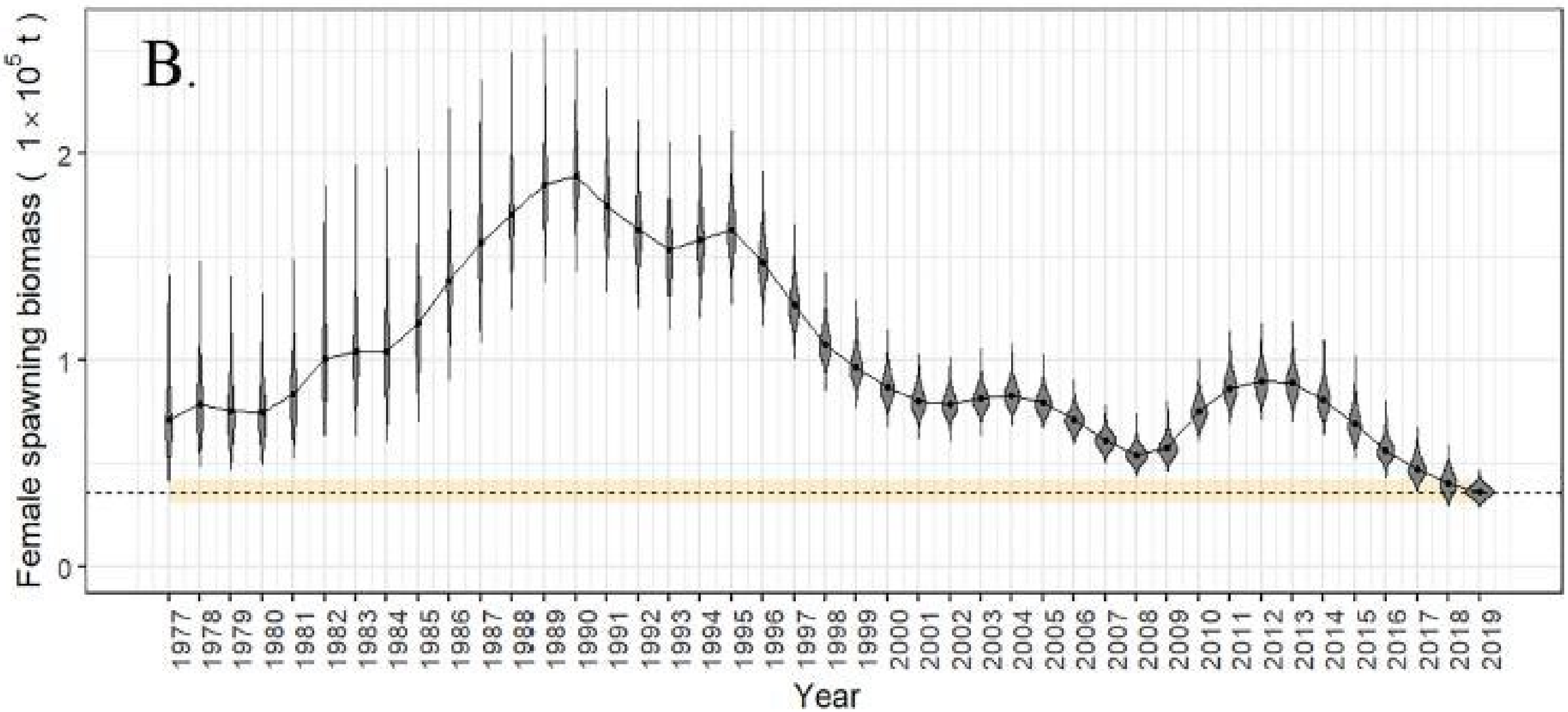


WHOI - Applied Ocean Physics & Engineering



Developed by Steven J. Barbeaux, Alaska Fisheries Science Center, E-mail: Steve.Barbeaux@noaa.gov
Sea surface temperatures from NOAA High-resolution Blended Analysis Data
Central GOA 145 W-160 W longitude <300 M depth and baseline 1982-2012

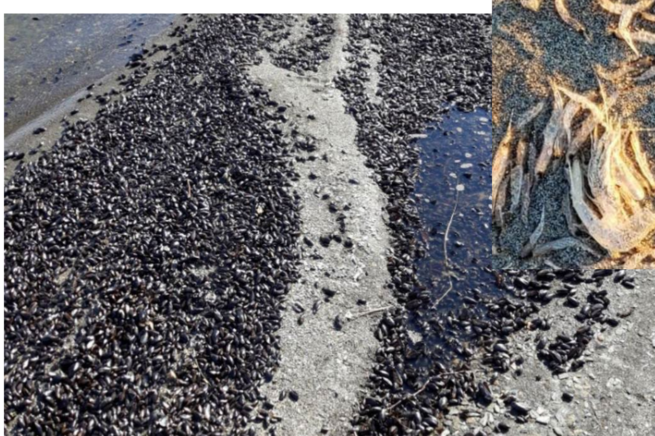
Gulf of Alaska, Pacific Cod, Female Spawning Biomass



Barbeaux, S.J., Holsman, K. and Zador, S., 2020. Marine heatwave stress test of ecosystem-based fisheries management in the Gulf of Alaska Pacific cod fishery. *Frontiers in Marine Science*, *7*, p.703.





Nome
8/16/19
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Rapid change is altering once understood ecosystem processes decreasing the precision needed to implement sustainable marine fisheries management measures.

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