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STATE OF KACHEMAK BAY

2019 HIGHLIGHTS FROM LONG-TERM MONITORING IN KACHEMAK BAY, ALASKA

Kachemak Bay waters were warmer than average in 2019, especially in the summer. Increased harmful algal blooms were expected from the warmer temperatures, but did not materialize. The Bay also experienced a summer drought, low salmon returns, and hints of sea star recovery.

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Kachemak Bay is a rich, subarctic estuary in Southcentral Alaska, with all the estuarine and coastal habitats that are found in the Gulf of Alaska, which provide habitat for fish, shellfish, marine mammal and bird species. These support recreational, subsistence, and commercial fishing; marine transportation; and tourism. However, the Bay is affected by changing climate conditions, fish and shellfish population declines, harmful algal blooms and other hazards. This pilot report was developed as part of a NOAA Kachemak Bay Ecological Assessment and uses data from monitoring and research programs to highlight current conditions in the bay.

The State of Kachemak Bay is intended to be an annual report published each spring, providing a cross-disciplinary summary of recent findings for people working and living in the Kachemak Bay area. Future editions will continue to incorporate feedback from end-users, improving the usefulness and relevance of this report. More assessment tools can be found at the project website. *https://coastalscience.noaa.gov/project/ecological-assessment-for-kachemak-bay-alaska-science-tools-to-inform-management/*

PARTNERS & CONTRIBUTORS

The State of Kachemak Bay report is a product of the Kachemak Bay Ecological Assessment, conducted by the Kasitsna Bay Laboratory, National Centers for Coastal Ocean Science (NCCOS) aimed at bringing together Kachemak Bay science. This report was made possible by contributions from the Kachemak Bay National Estuarine Research Reserve, Alaska Department of Fish and Game, Center for Alaskan Coastal Studies, Natural Resources Conservation Service, Cook Inlet Aquaculture Association, US Fish and Wildlife Service, and the myriad partners within the Gulf Watch Alaska Long-term monitoring program, NOAA, the National Park Service, University of Alaska Fairbanks, U.S. Geological Survey, and the Exxon Valdez Oil Spill Trustee Council.

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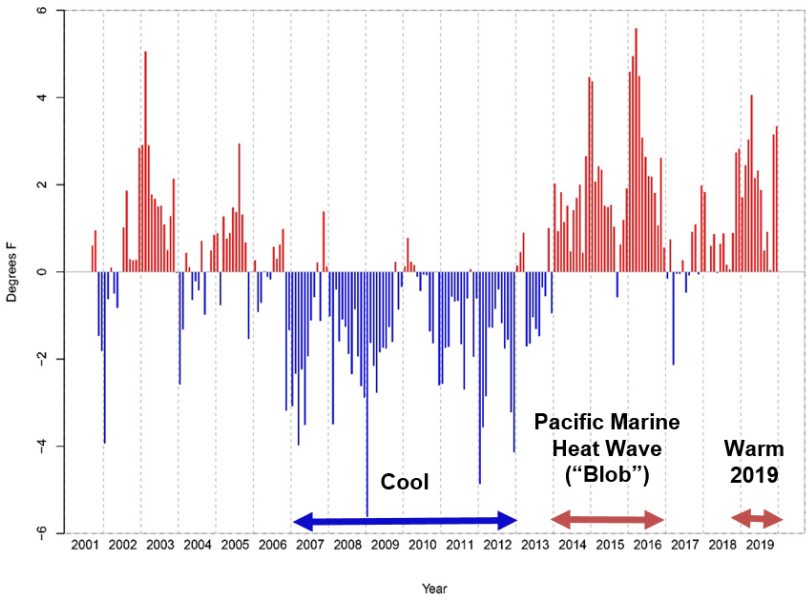
CAN WE TAKE THE HEAT?

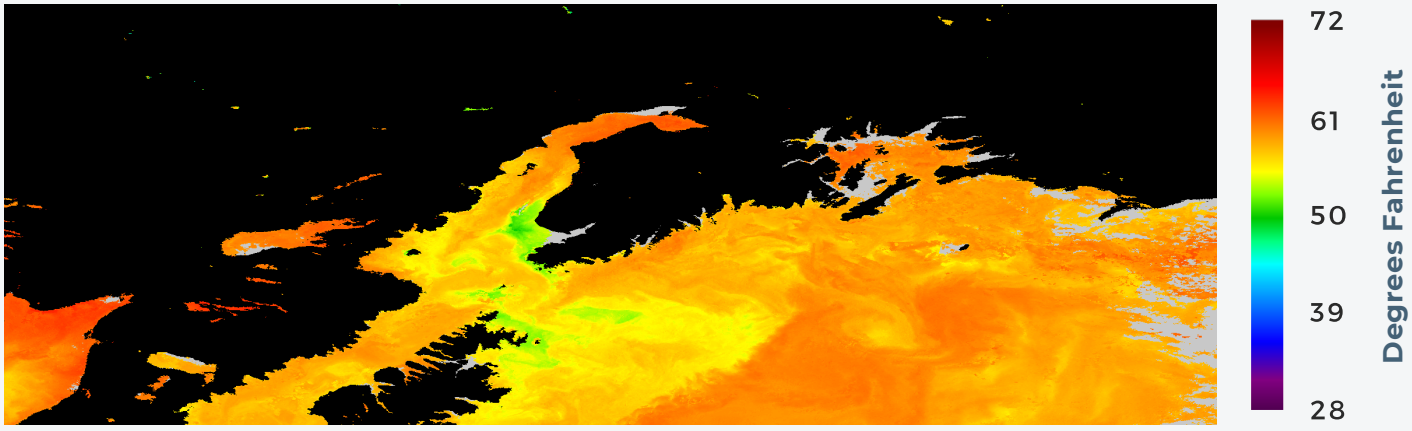
Water temperatures were unusually warm during summer 2019. Warming was similar to the 2014-2016 Pacific marine heat wave, but winter temperatures were cooler this year. Warm water can affect fish and increase harmful algal blooms, especially paralytic shellfish poisoning events in the Bay. *https://gulfwatchalaska.org/monitoring/environmental-drivers/*

Monthly Water Temp Anomalies, Homer Deep (compared to 2002-2018)



Anomaly plot showing difference from average over time. Red bars = warmer than average; Blue bars = cooler than average

Maximum sea surface temperatures, between August 23 and August 27, 2019



The entire Gulf of Alaska experienced high sea surface temperatures (SST) in summer 2019, but varied between sites (see cooler temperatures outside Kachemak Bay in image above). Check out the BIOMapper to see average monthly ocean temperatures in Kachemak Bay: *https://nccos-coastalsciencemaps-web-staging.azurewebsites.net/biomapper/biomapper.html?id=kbay*

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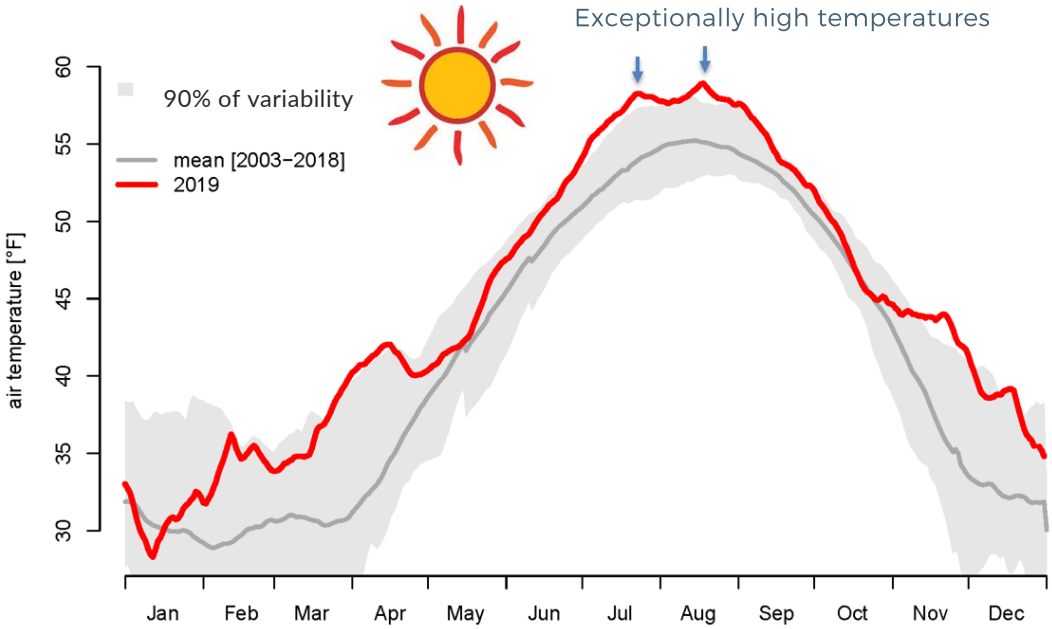
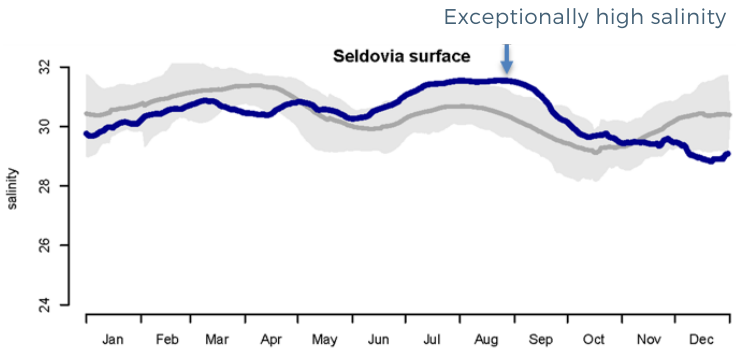


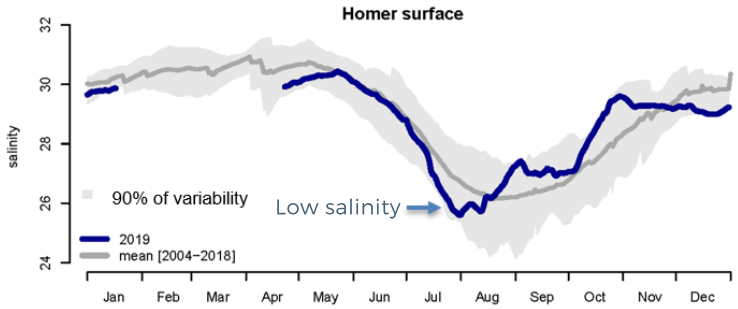
Warm 2019 summer air temperatures and relatively low precipitation in Southcentral Alaska led to drought conditions, water shortages, and wildfires.

FRESHWATER INTO THE BAY

Food webs in the Bay are affected by freshwater input from rivers, rain, snow and glacial melt. Low summer precipitation led to saltier surface water at Seldovia, but water near Homer Harbor had near normal or lower than average salinity (which means fresher). Glacial melt during the warm, sunny summer likely accounted for this difference between the inner and outer Bay. Inner Kachemak Bay has more freshwater runoff from glaciers than does the outer Bay and this fresher water flows along the north side of the Bay, around the spit, and back out into Cook Inlet.

https://accs.uaa.alaska.edu/kbnerr/oceanography/





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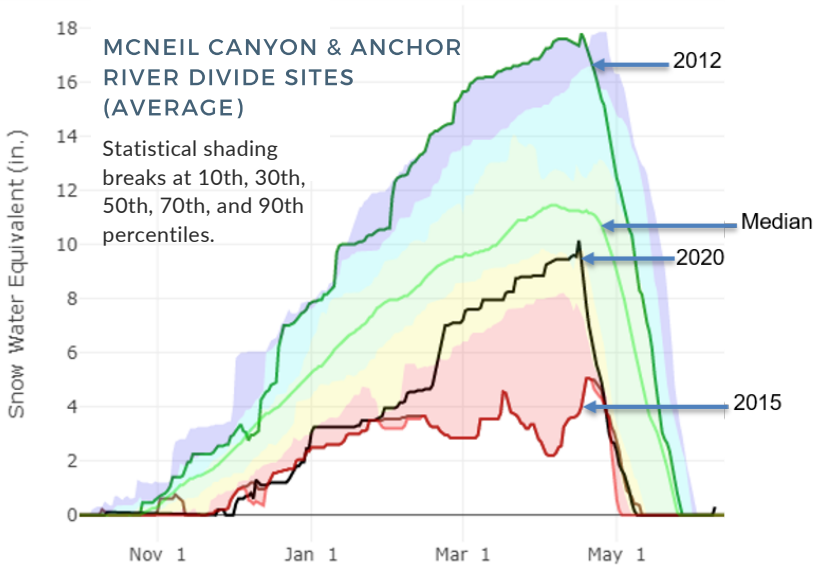
BELOW AVERAGE SNOWPACK FOR WINTER OF 2019/2020

Snowpack has been measured around Kachemak Bay since the 1970's by the Natural Resources Conservation Service (NRCS) and the Homer Soil and Water Conservation District (HSWCD). In the Kachemak Bay region, snowpack is becoming more variable. Snowpack affects wildlife, ground water, river flows, green-up dates, and wildfire hazard. The region has experienced both record highs and lows in the last ten years. Some years the amount of snowpack is mainly driven by the amount of precipitation during the winter. More recently, it has been temperature driven, as more winter precipitation has been coming as rain.



Data are displayed by water year, Oct 1-Sep 30, showing precipitation contributing to stream flow the following year. The 2020 water year is Oct 2019 - Sep 2020.
https://www.nrcs.usda.gov/wps/portal/nrcs/ak/snow/

USDA United States Department of Agriculture
Natural Resources Conservation Service

"FIRE AND ICE" PROJECT STUDIES THE EFFECTS OF CHANGES IN GLACIAL EXTENT ON THE MARINE ECOSYSTEM

Rain, snow, groundwater and glacial melt all contribute freshwater to Kachemak Bay – but how much from each source enters the Bay? UAA scientists with the Alaska Established Program to Stimulate Competitive Research (EPSCoR) "Fire and Ice" project, funded by the National Science Foundation, are working to find that answer. Measuring stream flow and chemistry is part of the "Ice" side of the 5-year project, based in Kachemak Bay and Lynn Canal in Southeast AK. UAF scientists are also measuring fish, clams, plankton, kelp and more, to see how glacial and non-glacial rivers affect nearshore ecosystems in the Bay. Stay tuned for results from this exciting project!
https://www.alaska.edu/epscor/files/pdfs/One-pager-CM-3.pdf

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Alaska EPSCoR

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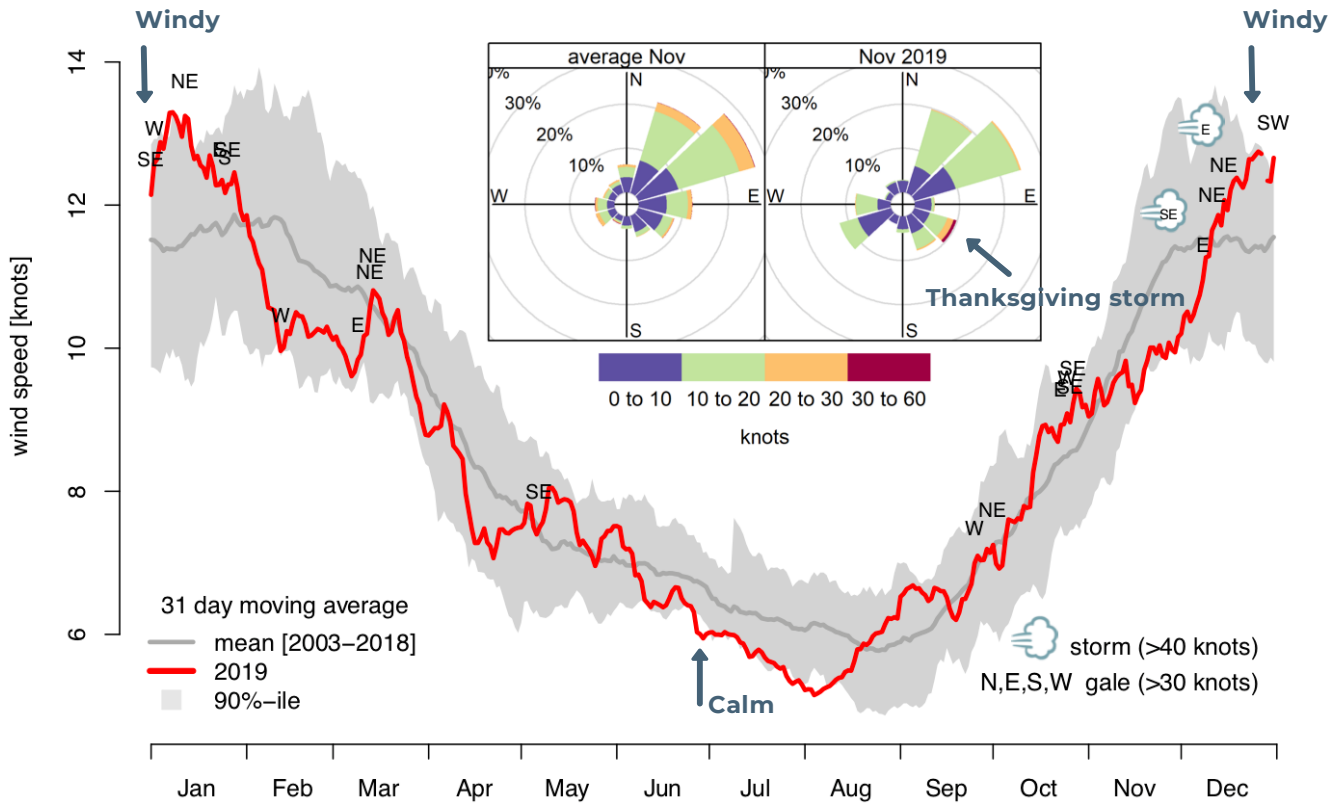
WINTER STORMS

2019 saw unusually persistent high winds in both January and December, which are already the windiest times of the year. Summer winds were very calm. Kachemak Bay winds are typically higher and from the northeast in the winter, and calmer in the summer, with southwesterly day breezes. Of the two large storm events in 2019, the Thanksgiving storm on 30 November was a rare southeasterly blow, and downed many large trees on the south side of the Bay.

https://accs.uaa.alaska.edu/kbnerr/oceanography/




Clearing trees after a Thanksgiving windstorm near Jakalof Bay


December waves along the shores of Homer, AK

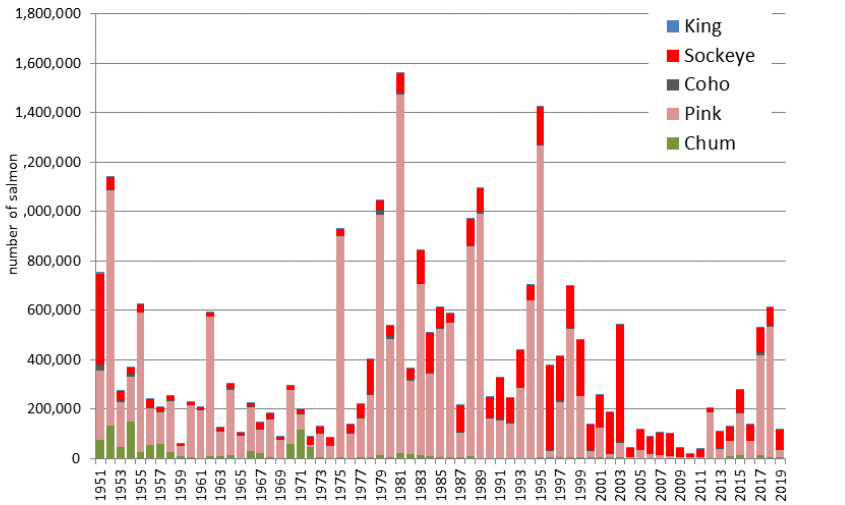
A HISTORICAL PERSPECTIVE: COMMERCIAL SALMON HARVEST IN THE SOUTHERN DISTRICT OF LOWER COOK INLET

Harvest in some years in the early 1950's saw high levels of sockeye and Chinook (king) salmon. This may be the result of drift gillnet and fish trap harvest in outer Kachemak Bay near Bluff Point. Harvests of pink and sockeye salmon increased in the mid-1970s with the start of hatchery releases.

https://www.adfg.alaska.gov/index.cfm?adfg=contacts.homer

Alaska Department of Fish & Game

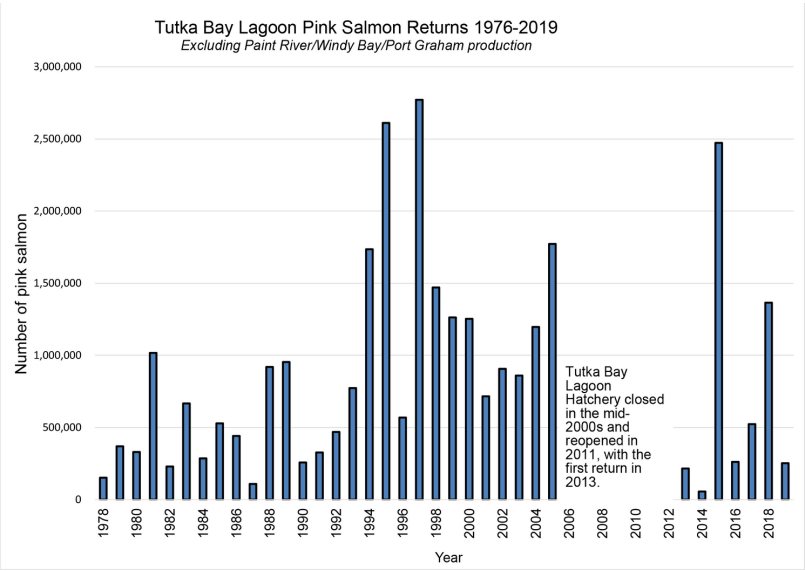
Southern District Commercial Salmon Harvest by species, 1951-2019

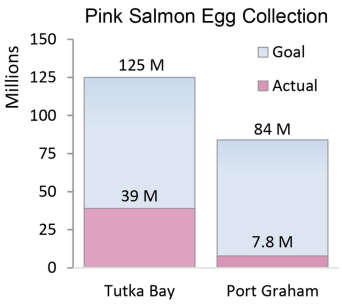


COOK INLET AQUACULTURE ASSOCIATION (CIAA) HATCHERIES EXPERIENCE WEAK PINK SALMON RETURNS

Alaska's salmon hatchery programs are designed to increase abundance and enhance fisheries, while protecting wild stocks. In 2019, hatcheries in Tutka Bay Lagoon and Port Graham experienced weak pink salmon returns, similar to a statewide trend. Only 17,500 pink salmon returned to Port Graham Hatchery, and egg collection numbers fell short of goals. Tutka Bay Lagoon Hatchery also dealt with extremely low water levels in Tutka Creek.

https://www.ciaanet.org/about/hatcheries/





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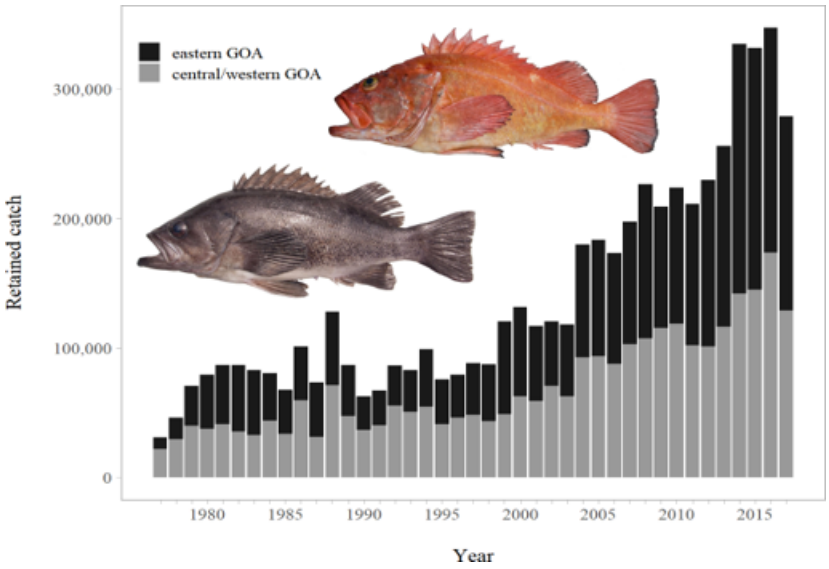
STATEWIDE ROCKFISH INITIATIVE DEVELOPING LONG-TERM MANAGEMENT STRATEGIES TO PREVENT OVERHARVEST

Rockfish harvest in the Gulf of Alaska is increasing as other popular fisheries become more restricted. Rockfish live up to 100 years, making them especially vulnerable to overharvest. Alaska Department of Fish and Game's (ADFG) Statewide Rockfish Initiative is developing long-term management strategies for sustainable black and yelloweye rockfish fisheries. Collaborative management will ensure spawning populations and fishing opportunities are maintained and all fisheries are managed under an appropriate harvest level. *http://www.adfg.alaska.gov/FedAidPDFs/RIR.5J.2019.05.pdf*



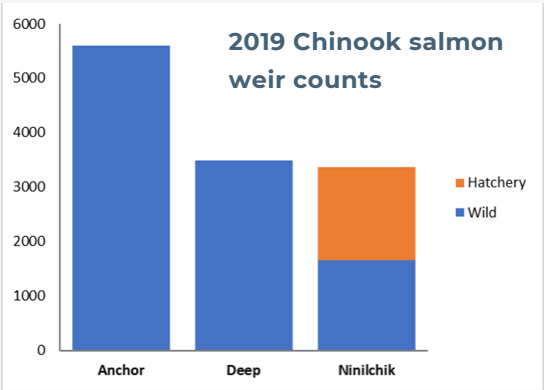
Sport rockfish (all species) harvest in numbers of fish from the Gulf of Alaska, 1977–2017.

Alaska Department of Fish & Game

ALASKA DEPARTMENT OF FISH & GAME DEPLOYS INNOVATIVE CHINOOK SALMON VIDEO MONITORING

Chinook salmon escapement has been monitored in lower Kenai Peninsula roadside streams since the 1950's. Salmon escapement is the number of adult fish that return to the spawning habitat. Historical monitoring used single aerial surveys during the run peak and were indexes of escapement rather than actual escapement. Monitoring transitioned to weir and sonar based methods in the late 90's and early 2000's. 2019 was the first year the Anchor River, Deep Creek, and Ninilchik River were all monitored with video for the entire run, providing run size differences between the three drainages. In-stream video monitoring allows species differentiation and identification of hatchery vs. wild fish. Daily counts inform in-season management of Chinook salmon sport fisheries in the streams and Cook Inlet, and are updated daily online: *https://www.adfg.alaska.gov/index.cfm?adfg=ByAreaSouthcentralLowerCookInlet.main*

Alaska Department of Fish & Game



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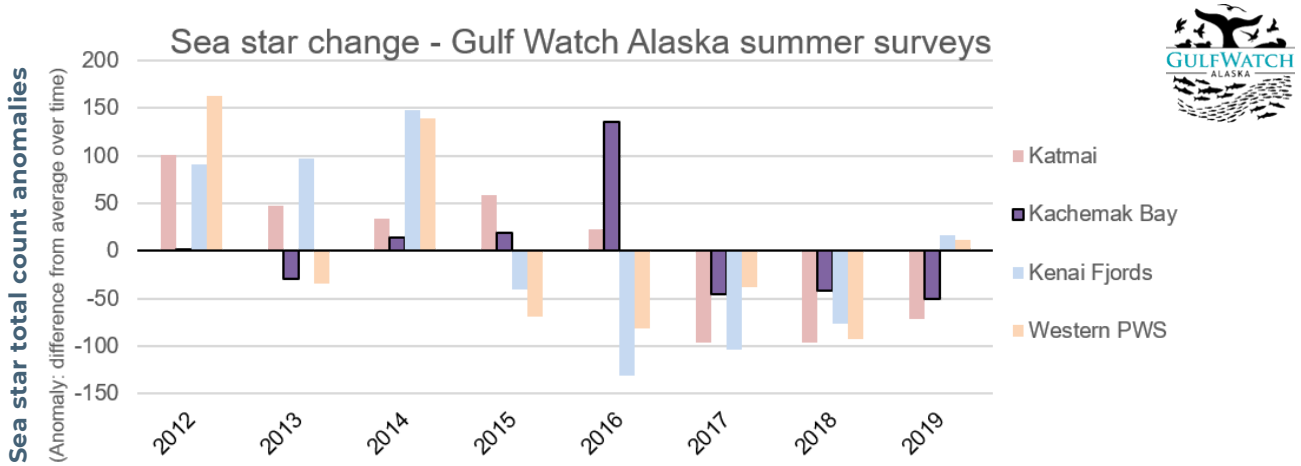
MONITORING SEA STAR WASTING & RECOVERY

Sea star wasting syndrome (SSWS) has decimated sea star populations from Mexico to Alaska. Sea star populations are patchy, making it hard to track change, and two types of intertidal monitoring are conducted in Kachemak Bay. Gulf Watch Alaska (GWA) program researchers monitor summer sea star numbers along the Gulf of Alaska, including 6 sites in the Bay. Center for Alaskan Coastal Studies (CACS) students & volunteers monitor SSWS during the year at 3 sites. SSWS has been found in Kachemak Bay and across the Gulf of Alaska, with varying disease severity and recovery rates observed at different sites. Learn more: *https://gulfwatchalaska.org/monitoring/nearshore-ecosystems-4/*. Find out how to volunteer here: *https://www.akcoastalstudies.org/*



Summer 2014: CACS surveys find mild to moderate symptoms in true stars *(Evasterias troschelii)* & sunflower stars *(Pycnopodia helianthoides)*. Severe symptoms rarely observed.

Summer 2016: Severe symptoms & die-offs in true stars, sunflower stars & other stars at the CACS sites. SSWS found at many GWA sites, but high numbers of true stars seen at Kachemak Bay sites (example of patchiness).

Fall 2016 to Spring 2017: No sea stars, except leather stars *(Dermasterias imbricate)* and blood stars, *(Henricia leviscula)* found at Kachemak Bay sites (CACS, GWA). At other Gulf sites, sea stars were absent or had extremely low counts.

2018-2019: Mixed signs of recovery. Except for leather & blood stars, sea star counts were low in Kachemak Bay. Sunflower & true stars returned at some, but not all, Gulf of Alaska sites.

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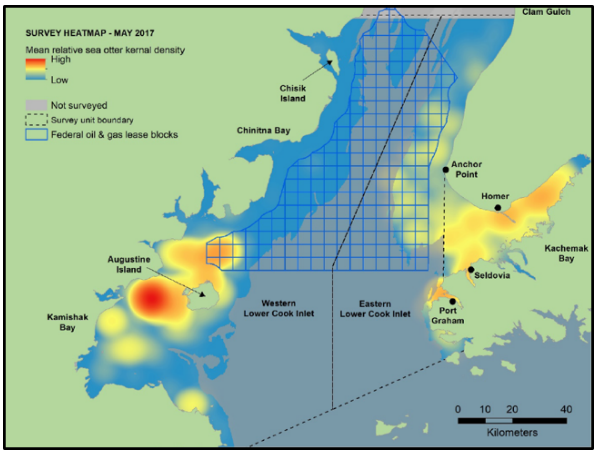
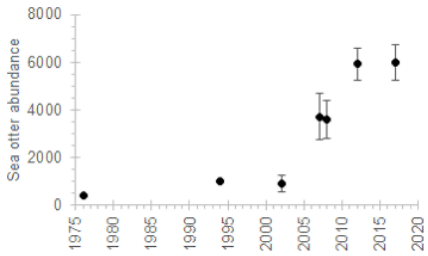
SEA OTTERS RETURN

USGS science for a changing world

After being hunted to near extinction, sea otters are repopulating nearshore habitats of Alaska. Population growth in Kachemak Bay was slow until the mid-2000's, when abundances increased exponentially for about ten years before leveling off. As of May 2017, sea otters were distributed throughout Kachemak Bay and may be approaching a stable density. More otters than expected were found between Anchor Point and Clam Gulch. Report with source data and imagery: *https://www.fws.gov/r7/fisheries/mmm/seaotters/pdf/2017_Cook_Inlet_Sea_Otter_Survey_Final_Report.pdf*





TEAMING UP: ALASKA HARMFUL ALGAL BLOOM NETWORK

Over 50 species of microscopic marine algae (or phytoplankton) are common in Kachemak Bay. Three species can produce toxins and, if abundant, can cause harmful algal blooms (HABs) and hurt or kill people, marine animals and seabirds.

35 Community Monitors trained by the Kachemak Bay National Estuarine Research Reserve (KBNERR) collected over 250 samples in 2019. Over 64% of Kachemak Bay phytoplankton samples had harmful species present. *https://accs.uaa.alaska.edu/wp-content/uploads/2019-KBNERR-HAB-Report.pdf*

NCCOS Kasitsna Bay Lab monitors *Alexandrium* species of phytoplankton, which can cause Paralytic Shellfish Poisoning (PSP). These phytoplankton increased enough during the Pacific Marine Heat Wave to make shellfish toxic and temporarily limit shellfish harvest. NCCOS research showed that *Alexandrium* cells increase with warmer sea water, but other factors are also important. Luckily, warm waters in 2019 did not produce PSP events in the bay. *https://coastalscience.noaa.gov/project/application-of-quantitative-molecular-methods-to-characterize-abundance-and-distribution-of-alexandrium-cysts-for-noaas-hab-forecasting/*

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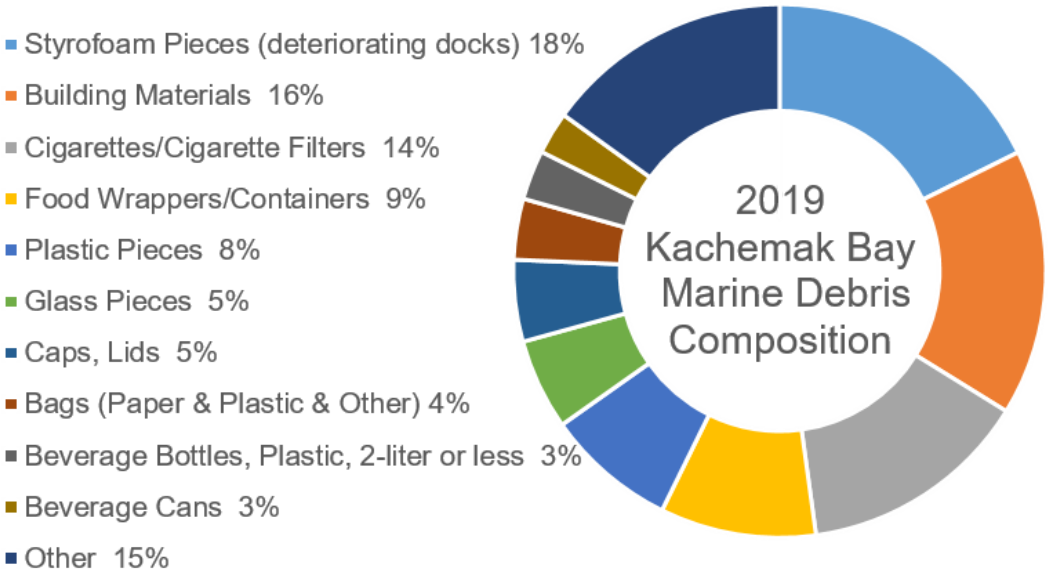
MARINE DEBRIS CLEANUP

On many Alaskan beaches, fishing debris is common. Kachemak Bay has less commercial fishing activity and favorable currents so drifting fishing debris is not directed to our beaches. Local single-use plastic consumer goods, including food wrappers, bags, and water bottles, make up much of our beach trash. Old docks breaking up also contribute a significant amount of marine debris.

https://www.akcoastalstudies.org/outreach/international-coastal-cleanup.html



331 individuals volunteered
600 hours
54 miles of beach covered
2,081 pounds of debris removed
1,479 items removed

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MONITORING INVASIVES: NO EUROPEAN GREEN CRAB (EGC)

EGC are an aggressive invasive species, known to be present as far north as British Columbia.

40 number of clams one EGC can eat in a day, competing with native crab, fish and bird species for food resources

23 monitoring events completed in Kachemak Bay during the summer of 2019 by 6 groups of volunteers and elementary students. No EGC were caught.

Early detection is the most effective way to remove invasive species and minimize harmful impacts.

https://accs.uaa.alaska.edu/kbnerr/community-monitoring/

EGC burrow into stream banks contributing to erosion and destroying juvenile salmon habitat.

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SCIENCE AND EDUCATION AT NOAA KASITSNA BAY LABORATORY

The NOAA Kasitsna Bay Laboratory is part of the National Centers for Coastal Ocean Science (NCCOS) under NOAA's National Ocean Service. NCCOS partners with the University of Alaska Fairbanks on lab operations and research. Lab research includes coastal impacts of climate change, marine spatial ecology, harmful algal blooms, and oil spills and hosts federal, state, Alaska Native and university researchers. NCCOS partners with the Center for Alaskan Coastal Studies, K-12 schools, universities and tribal groups to provide marine science education for K-12, undergraduate and graduate students.

Contact: Kris.Holderied@noaa.gov. Find out more about the lab online:
https://coastalscience.noaa.gov/about/facilities/
OR *https://www.uaf.edu/cfos/about-us/locations/kasitsna-bay/*