

2021 Aleutian Islands Ecosystem Status Report:

IN BRIEF

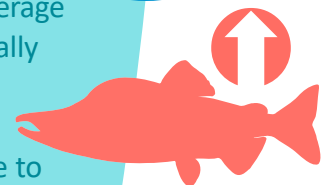
Current Conditions

In 2021 sea surface temperatures in August and September were the highest on record since 2003 in the western and central Aleutians. In the eastern, they were mostly cooler relative to last year and closer to the long-term average. Low sea level pressure caused a stormier winter than the long-term average. This was followed by westerly winds in Spring, which suppressed transport through eastern passes. Slightly stormier conditions than average returned in summer in the western and central Aleutians. This may have created potentially slightly less favorable environmental conditions for foraging. So, it might explain delayed hatching of piscivorous seabirds. In general, conditions were near average over much of the year, continuing the more favorable conditions for the biota observed in 2020 relative to recent years. Overall, sea surface temperatures are expected to decrease to average levels through winter 2021 and early spring 2022.

Both planktivorous and piscivorous seabirds had reproductive success above the long-term average, suggesting wide availability of prey. The abundance of Eastern Kamchatka pink salmon was the second highest on record; increased competition for prey and trophic cascades have been shown in years of high abundance of pink salmon. Lastly, paralytic shellfish toxins were reported to be 75x above the regulatory limit in Unalaska. This continues to pose a risk to human health and food webs in the region.

Multi-year Patterns

There appear to be three major drivers of the multi-year patterns observed across the chain: i) sustained environmental conditions since 2013. This includes above average water temperatures, weaker eddies and lower flow through the passes, which might decrease the volume of heat, nutrients and salinity through them, and below average abundance of large diatoms and biomass of meso-zooplankton; ii) increased abundance of Eastern Kamchatka pink salmon in odd years; and iii) pelagic foragers that are dominated by rockfish, with the combined biomass of Pacific ocean perch and northern rockfish being higher than that of Atka mackerel and walleye pollock combined. Potential cumulative effects include lower productivity across the system with increased bioenergetic needs for fish and faster growth rates for zooplankton, increased competition for prey, and changes in prey field timing, availability, quality, and composition. Potential lower prey availability and quality would also affect apex predators.



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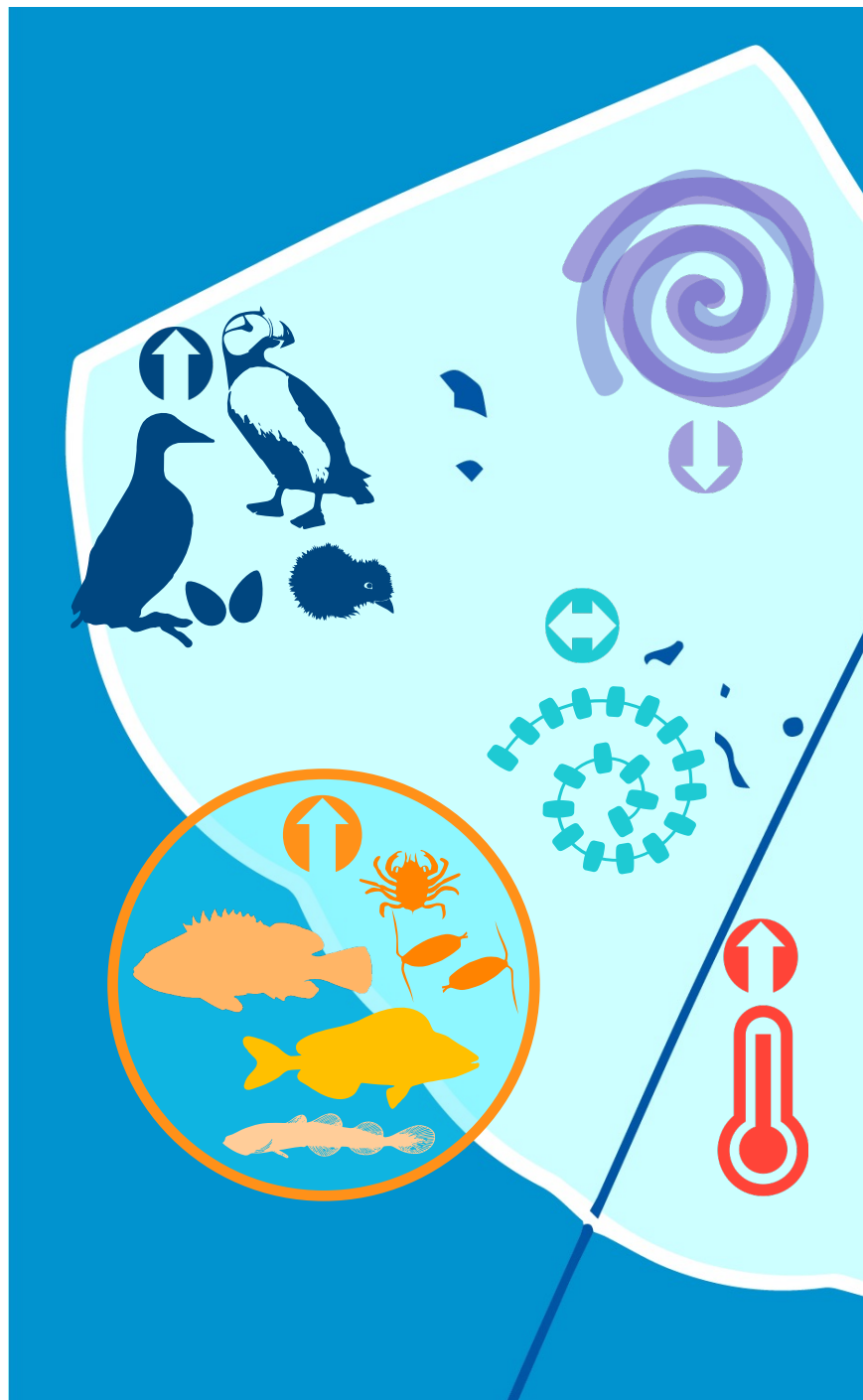
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Regional Highlights

The western Aleutians experienced enhanced storminess during summer due to negative sea level pressure anomalies. This includes **record high sea surface temperatures** since 2003 in August and September resulting in a two month long moderate heat wave. There was also a short-lived strong heat wave during peak sea surface temperatures. Temperatures quickly dropped and returned to near normal by October. This heatwave coincided with the start of the spawning season of Atka mackerel when they nest at depths between 32 - 144m. As a result, nests in the shallower areas may have experienced warm temperatures close to 10-11°C, or near the upper limit of historical spawning temperature. **Eddy kinetic energy** was below average, suggesting low fluxes of nutrients, heat and salt through the passes. Satellite-derived chlorophyll concentration, often a proxy for **phytoplankton biomass**, was near average during early spring, and above average in June, particularly north of the western Aleutian islands. It was an exceptionally successful season for **fish-eating seabirds** (tufted and horned puffins, thick-billed murres). Conditions have continued to improve since 2019. Prior to that birds experienced poor reproductive success.

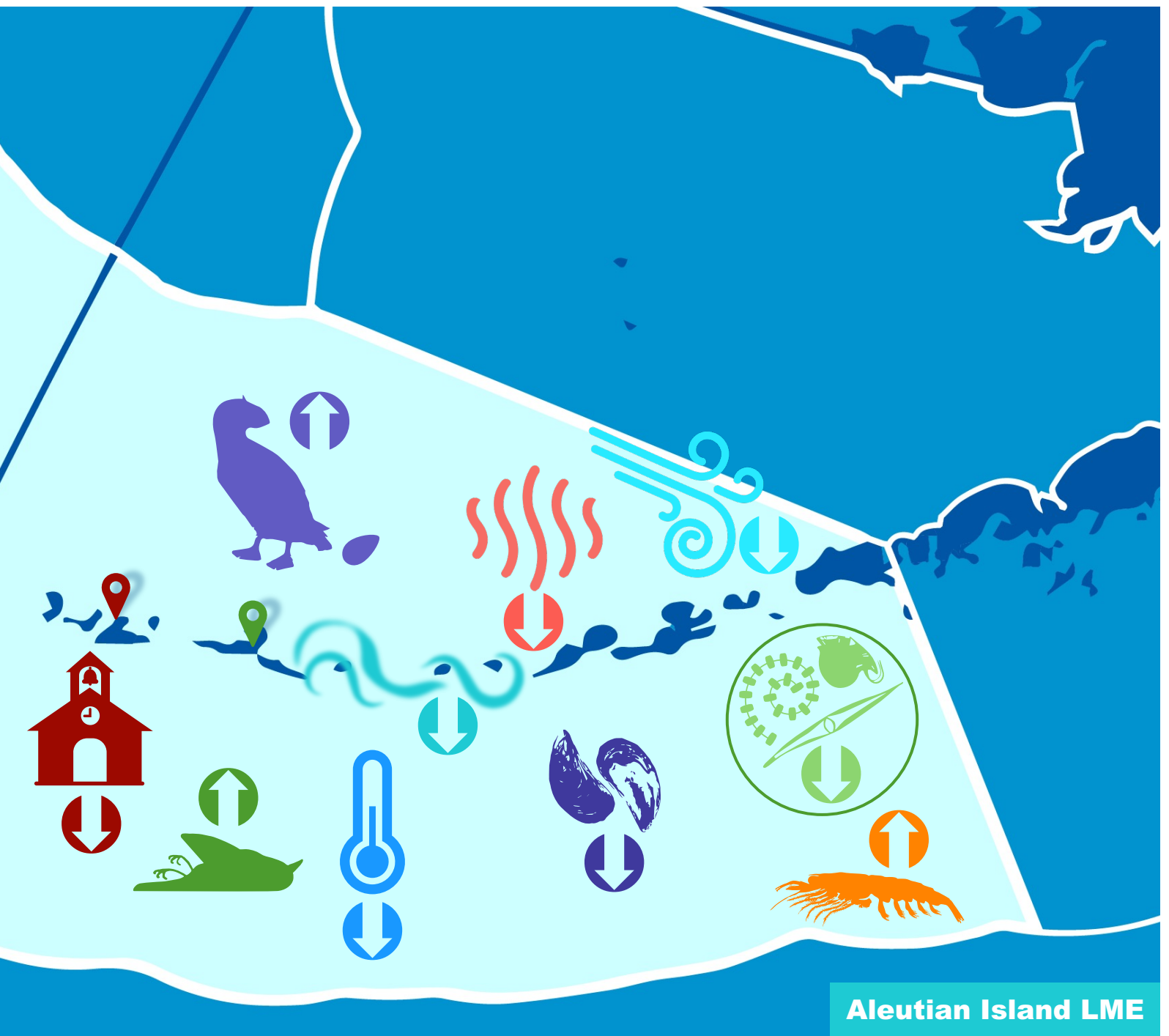
The above average reproductive success of fish-eating seabirds and zooplankton-eating seabirds at Buldir Island suggests that a **wide variety of prey** were available. Their long-term average hatch dates fall between mid-June to late July. Average hatching periods were 30 to 42 days, suggesting prey were available throughout the summer for chick rearing. There also was likely benefit to commercial groundfish as well. Tufted puffins consumed Atka mackerel (14% of diet composition), as did horned puffins (56% diet composition). There was an increase in the proportion of gadids in chick diets; rockfish have also increased in the diets of both tufted (25%) and horned puffins (8%) at Buldir. The increase of **rockfish** in seabird diets suggests they are more available to seabirds as prey, potentially because they have displaced Atka mackerel and pollock in some areas.

In the central Aleutians there was enhanced storminess during summer due to negative sea level pressure anomalies. Record (since 2003) **high sea surface temperatures** were seen in August and September. As in the western Aleutians, there was a two month long moderate marine heatwave. This was followed by a strong short-lived marine heat wave in September. Quickly thereafter conditions returned to near average levels. Eddy kinetic energy north of the islands is usually the lowest in magnitude compared to that in the western and eastern Aleutians. Events are characterized either by multiyear or continuous eddies of low intensity in the area. This year was average in the region, meaning there was likely an average flux of nutrients and heat across the passes. Phytoplankton biomass, as represented by chlorophyll a concentration, was slightly above average offshore from the islands, but slightly below on the south side of the islands during June.



The area had the highest number of reports of beach-cast dead seabirds, particularly **shearwaters** in Atka (200 birds). Bycatch estimates of shearwaters seem to be low during low (even) pink salmon abundance years and higher in high (odd) pink salmon abundance years. This suggests increased competition between shearwaters and pink salmon. Weekly mussel collections for Paralytic Shellfish Toxin were taken at Adak. A late-summer single collection of a suite of other species for the Knik Tribe's monitoring efforts also occurred. While results are not available yet, in the past, toxin levels have been within regulatory limits.

School enrollment in 2020-21 was slightly lower, driven by fewer students in Adak.



Aleutian Island LME

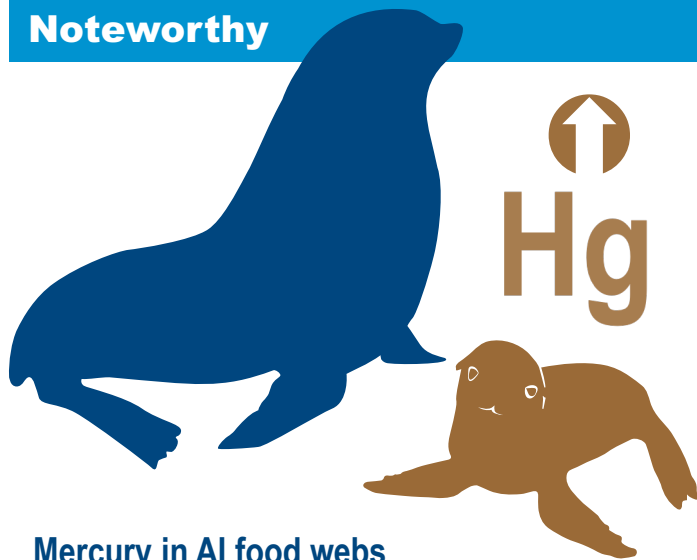
In the eastern Aleutians, sea surface **temperatures** were not as high as in the western and central Aleutians. Temperatures were higher in September than last year, but only a few days were under moderate marine heat wave conditions. Mid-water temperatures also seem to have cooled compared to 2019 and previous years. They are similar to those recorded last year by the longline survey at depths between between 100-300 m. **Winds** blowing from the west to the east in the area caused low flows through Unimak Pass, and eddy kinetic energy - typically driven by intense pulse eddies remained at speeds below average. Spring **phytoplankton biomass** was also below average, as suggested by chlorophyll concentration.

Fish eating seabirds had mostly high reproductive success. This includes murres and puffins, with gulls having an average year. No auklets (primarily zooplankton eaters)

were surveyed in the region. There were a few reports of dead seabirds (20-50 birds) in Cold Bay and Unalaska. While indicators suggest good availability of forage fish to rear chicks and potentially for fish-eating groundfish, there was no data collected on planktivorous seabirds. The **euphausiids** in tufted puffins chick meals (34%) suggest zooplankton was available. This suggests it would also be available for planktivorous commercial groundfish.

Monitoring of **harmful algal blooms** indicate that peak toxin levels occurred during June. This year, as in 2020, toxins in **blue mussels** were above the regulatory level, 75x. This level is much lower than in the reported shellfish that caused a fatality last year (140x above the regulatory level). Public awareness efforts have increased in the area to minimize impacts on human health.

Noteworthy



Mercury in AI food webs

Relatively high total mercury concentration (THg) has been observed in 25% of the Steller sea lion pups sampled to date in western and central Aleutians. The pups' exposure to mercury is much higher while the females are pregnant rather than during the nursing. High THg can decrease immune function as well as cause muscle and organ tissue damage during active breath-hold diving. The percent of pups with THg > 20 µg/g in natal hair doubled in 8 years at Agattu (20.6% in 2011 to 46.4% in 2019); rate of increase 3.7% per year. Higher THg in the western than in the central Aleutians was also observed in several fish and seabirds. Differences in the amount of mercury present originate at the base of the food chain and are amplified by feeding ecology.



Plastics in Seabirds

Phthalates, a type of plastics derived contaminant, was found in seabirds across the Aleutians. Its presence did not vary geographically. Concentrations varied depending on feeding ecology, with the highest concentrations in diving plankton-feeders (crested auklets). Other studies have shown seabirds that have ingested plastic may experience various sublethal effects including: lower weight and higher concentrations of uric acid and cholesterol in their blood. Studies also found that while ingestion of plastics may not drive mortality, it does increase their chance of dying. The amount of plastic ingested depends on the seabird's feeding ecology and the area where they forage.

Management Uses

In 2021, ecosystem information was formally considered in seven full stock assessments for Bering Sea/ Aleutian Islands groundfish stocks as well as the Alaska wide sablefish stock assessment.

The remainder of this section will be completed following the December 2021 North Pacific Fishery Council Meeting.



Reference: Ortiz, I. and Zador, S., 2021. Ecosystem Status Report 2021: Aleutian Islands, Stock Assessment and Fishery Evaluation Report. North Pacific Fishery Management Council, 1007 West Third, Suite 400, Anchorage, AK 99501.

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More information on these and other topics can be found on the Ecosystem Status Report website.



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