

# 2021 Aleutian Islands Ecosystem Status Report:

## IN BRIEF

### Current Conditions

Sea surface temperatures during August and September 2021 in the western and central Aleutians were the highest since the satellite record began in 2003. In the eastern Aleutians, temperatures were mostly cooler relative to last year and closer to the long-term average. Low sea level pressure caused a stormier winter than usual. This was followed by westerly winds in spring, which suppressed transport through eastern passes. Slightly stormier conditions returned in summer in the western and central Aleutians. In general, environmental conditions were near average over much of the year, continuing the largely more favorable conditions for the biota in 2020 relative to recent years. Overall, sea surface temperatures are expected to decrease to average levels through winter 2021 and early spring 2022.

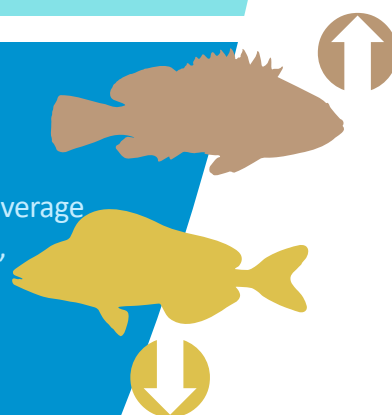
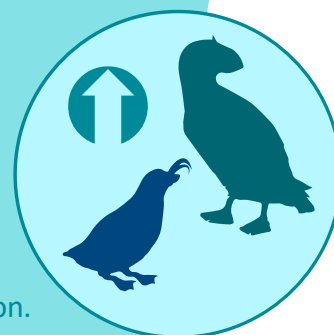
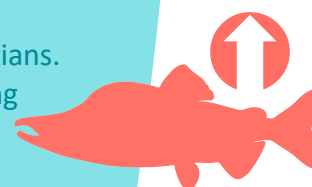
Both planktivorous and piscivorous seabirds had reproductive success above the long-term average, suggesting wide availability of prey. The abundance of Eastern Kamchatka pink salmon was the second highest on record. This may be expected to have ecosystem impacts, as increased competition for prey and 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

Multi-year patterns observed across the Aleutians include:

- 1) Sustained environmental conditions since 2013, which include above-average water temperatures, weaker eddies and lower flow through the passes, and below-average abundance of large diatoms and biomass of meso-zooplankton
- 2) Increased abundance of Eastern Kamchatka pink salmon in odd years
- 3) The groundfish pelagic foraging guild continuing to be dominated by rockfish, with the combined biomass of Pacific ocean perch and northern rockfish being higher than Atka mackerel and walleye pollock combined

Potential cumulative effects include lower productivity across the system with increased bioenergetic needs for fish, faster growth rates for zooplankton, increased competition for prey, and changes in prey field timing, availability, quality, and composition.



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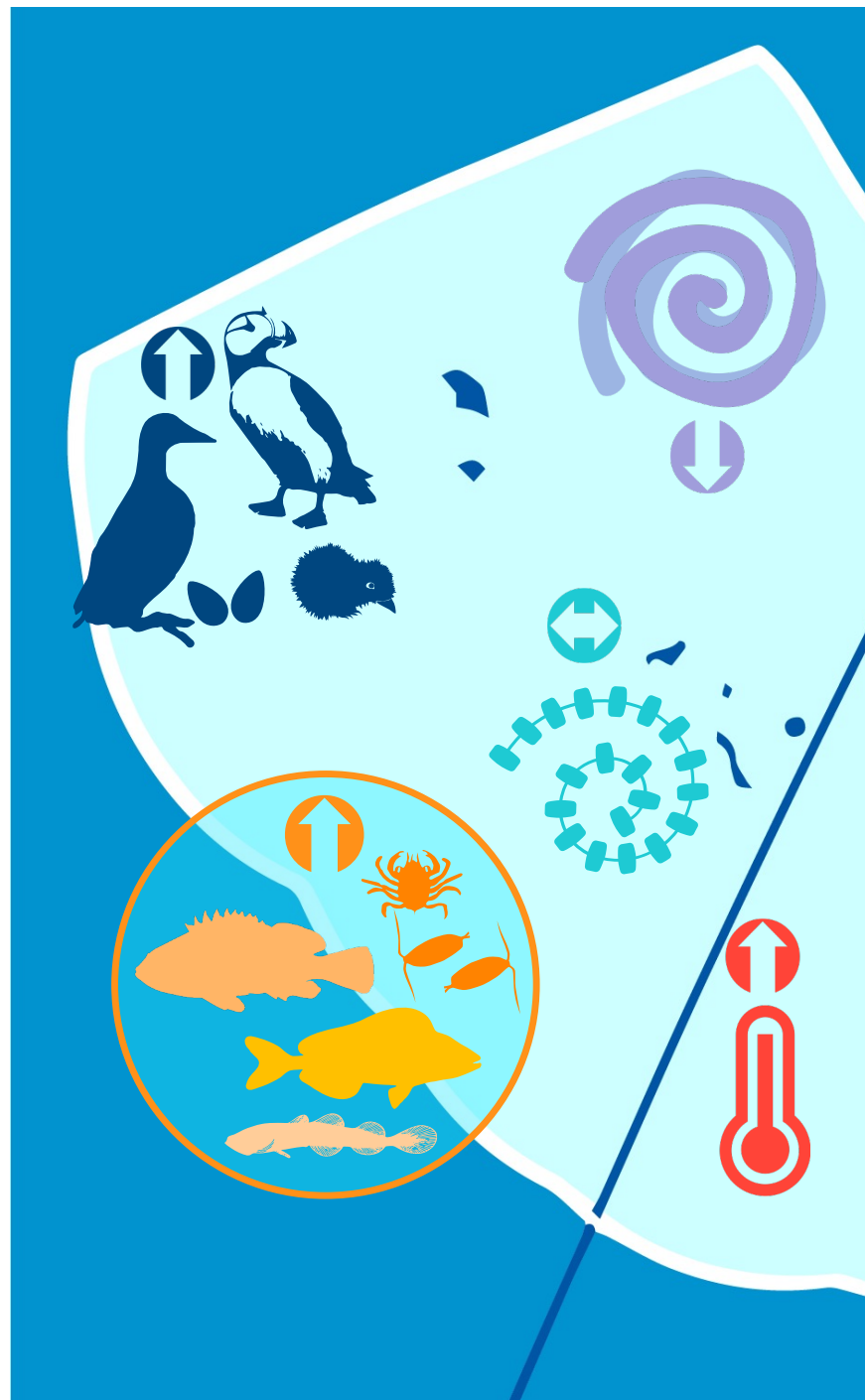
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## Regional Highlights

The **western Aleutians** experienced enhanced storminess during summer due to negative sea level pressure anomalies. During August and September, the **highest sea surface temperatures** since observations began in 2003 exceeded the threshold for a moderate heatwave. Temperatures quickly 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 temperatures. **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, and thick-billed murres). Conditions have continued to improve since 2019, when birds experienced poor reproductive success.

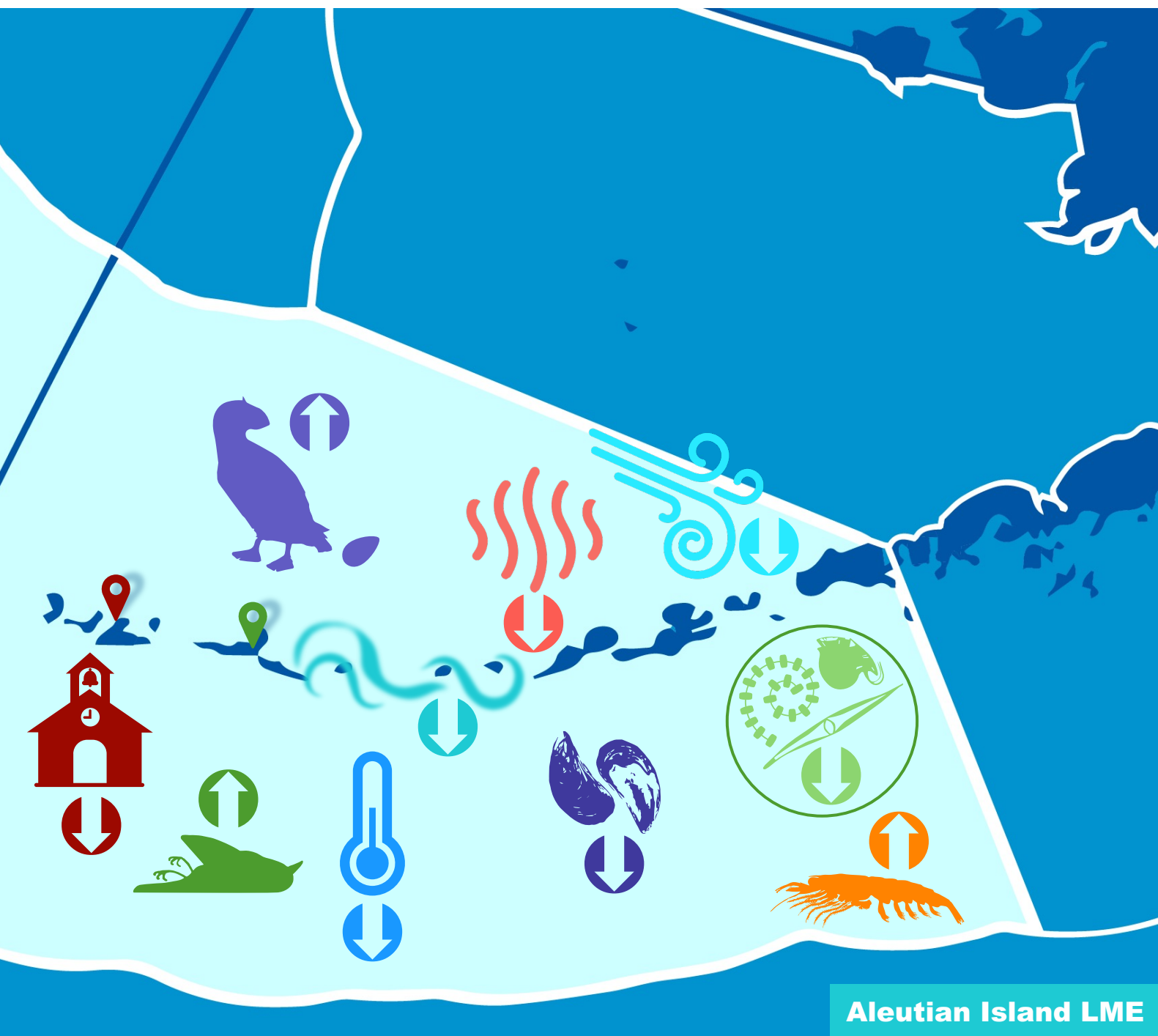
The above-average reproductive success of fish-eating seabirds and zooplankton-eating seabirds at Buldir Island suggests that a **wide variety of prey** was available. Their average hatch dates fall between mid-June to late July and average chick-rearing periods last 30 to 42 days, suggesting prey were available throughout the summer. Chick diets included age-0 commercial groundfish species. Atka mackerel comprise 14% of tufted puffin and 56% of horned puffin chick diet composition in 2021. There was an increase in the proportion of gadids in chick diets relative to previous years. Rockfish have also remained present in the chick diets of both tufted (25%) and horned puffins (8%) at Buldir Island. The presence of **rockfish** in seabird diets suggests they are more available to seabirds as prey, potentially reflecting the increasing trend in Pacific ocean perch and northern rockfish biomass.

The **central Aleutians** experienced the same pattern of enhanced storminess during summer and **high sea surface temperatures** during August and September as in the western Aleutians. Eddy kinetic energy was average in the region this year, meaning there was likely an average flux of nutrients and heat across the passes. Eddy kinetic energy north of the central Aleutian 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 this area. Phytoplankton biomass, as represented by chlorophyll-a concentration, was slightly above average offshore from the islands, but slightly below average on the south side of the islands during June.



The central Aleutians 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 this summer. A late-summer, single collection of a suite of other species also occurred as part of Knik Tribe's monitoring efforts. While results are not yet available, toxin levels have been within regulatory limits in past years.

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



**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 exceeded the moderate marine heatwave threshold. Mid-water temperatures also seem to have cooled compared to 2019 and previous years. Temperatures were similar to those recorded last year by the longline survey at depths between 100-300 m. **Winds** blowing from the west to the east in the eastern Aleutians caused low flows through Unimak Pass. Eddy kinetic energy, which is typically driven by intense pulse eddies in this areas, remained below average. Chlorophyll-a concentration suggested that spring **phytoplankton biomass** was also below average.

**Fish eating seabirds**, such as murres and puffins, had mostly high reproductive success, although gulls had average

reproductive success. These indicators suggest good availability of forage fish to rear chicks and potentially for fish-eating groundfish. No auklets, which are primarily zooplankton-eaters, were monitored for reproductive success in the region. However, the **euphausiids** in tufted puffins chick meals (34% of diet composition by number) suggest zooplankton were available to predators. There were a few reports of dead seabirds (20-50 birds) in Cold Bay and Unalaska.

Monitoring of **harmful algal blooms** indicates that peak toxin levels occurred during June. This year toxins in **blue mussels** were 75x above the regulatory level. 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 appears much higher while the females are pregnant rather than during the nursing period. 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 with a rate of increase of 3.7% per year. Higher THg in the western compared to 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.



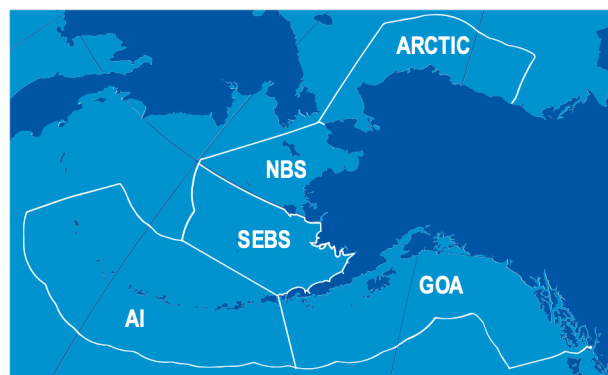
### Plastics in Seabirds

Phthalates, a type of plastics-derived contaminant, was found in seabirds across the Aleutians in a study conducted from 2009 to 2015. Concentrations in the Aleutians did not vary geographically but did vary depending on feeding ecology, with the highest concentrations in diving plankton-feeders (crested auklets). Studies in other countries have shown that seabirds that ingest plastic may experience various sublethal effects such as 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 seabirds' feeding ecology and the area where they forage.

### Management Uses

Ecosystem information was formally considered in seven groundfish stock assessments for the Bering Sea/Aleutian Islands region, and one statewide stock (sablefish) in 2021. Four of these assessments classified ecosystem dynamics at risk level 2 (out of 4) noting substantially increased concerns: AI Pacific cod, yellowfin sole, EBS pollock and EBS Pacific cod. For the AI Pacific cod, the author recommended Tier 5 allowable biological catch (ABC) as a reduction from Tier 3 due to assessment and ecosystem concerns. As the Tier 5 model was retained, the Scientific and Statistical Committee (SSC) supported the BSAI Groundfish Plan Team (PT) decision that no additional reduction was needed.

For yellowfin sole, the SSC agreed that some concern existed but did not warrant the reduction recommended by the author and PT. For EBS pollock the ABC was reduced 11% from Tier 1 to Tier 2 maximum permissible noting fishery performance, assessment, and ecosystem concerns. For the rest of the stocks, precautionary measures already incorporated into setting catch levels were considered sufficient to address uncertainty about current ecosystem dynamics.



**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 can be found at  
<https://www.fisheries.noaa.gov/resource/data/alaska-marine-ecosystem-status-reports-interactive-overview>.



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