Gulf Watch Alaska: Long-term research and monitoring in the Gulf of Alaska

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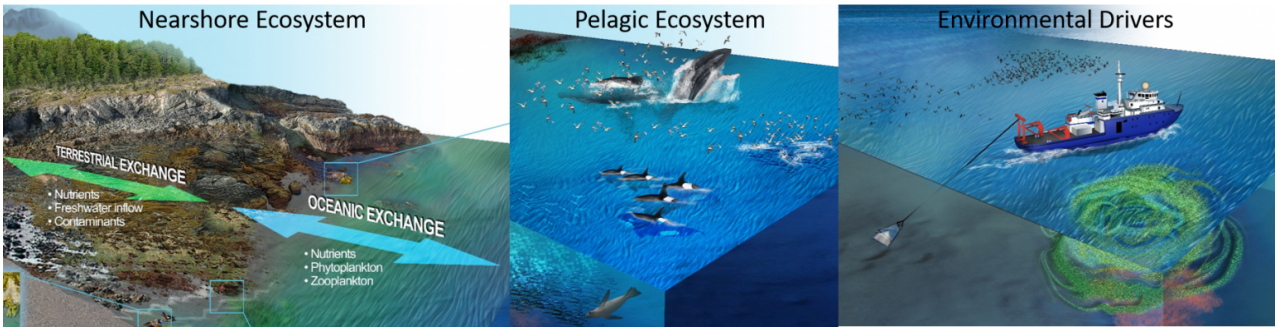

Figure 1

Within the Gulf of Alaska, in the North Pacific Ocean, three major events – both natural and human-caused – resulted in large-scale ecosystem changes during the last 50 years

The first event was a naturally occurring ecosystem regime shift in the late 1970s in which altered ocean conditions resulted in dramatic changes in marine communities. This event caused long-term declines in many shrimp, crab, seabird, and marine mammal populations over the subsequent decades (Anderson and Piatt 1999). As a result, some fisheries were closed, and a population of sea lions was listed as endangered, while some other species and fisheries thrived.

A decade after the regime shift, the tanker vessel Exxon Valdez ran aground in Prince William Sound due to human error, spilling 42 million litres of oil into the ocean Wolfe et al. 1994. Not only did the oil spill cause the immediate mortality of many species of intertidal organisms, fish, birds, and mammals but many fisheries closed, and effects lasted much longer than anticipated Esler et al. 2018.

Two and a half decades after the oil spill, the Gulf of Alaska experienced the most prolonged marine heatwave recorded globally Hobday et al. 2018. This large heatwave (also known as “The Blob”) and a subsequent smaller heatwave caused major species distribution shifts, drastic declines in some populations with dramatic increases in others, and multiple fisheries collapses Walsh et al. 2018; Barbeaux et al. 2020. Each of the three events offers insight into ecosystem response and resilience. They also highlight the importance of having reliable ecosystem monitoring data to understand the causes and consequences of ecosystem perturbations and to forecast ecosystem responses to other sources of variation, including climate change.

A lack of comprehensive and consistently collected ecosystem data

After the *Exxon Valdez oil spill*, it became clear that lack of comprehensive and consistently-collected ecosystem data significantly hampered our understanding of spill effects Peterson et al. 2003. This affected both natural resource management and legal proceedings related to distinguishing natural variability versus oil spill effects in potentially limiting species recovery. The assessment was further complicated in that some populations were in decline prior to the spill. The challenge was determining recovery potential given naturally changing conditions for those species clearly injured by the spill. After funding many relatively shorter-term (1- 6 year) individual or integrated projects, scientists, managers, and the *Exxon Valdez* Oil Spill Trustee Council created a large-scale, long-term research and monitoring program, Gulf Watch Alaska. The program was designed to provide coherent, long-term data about marine ecosystems in the Gulf of Alaska, to identify factors limiting the recovery of species still injured by the oil spill and document the drivers and effects of other changes observed in the North Pacific, including those related to climate change.

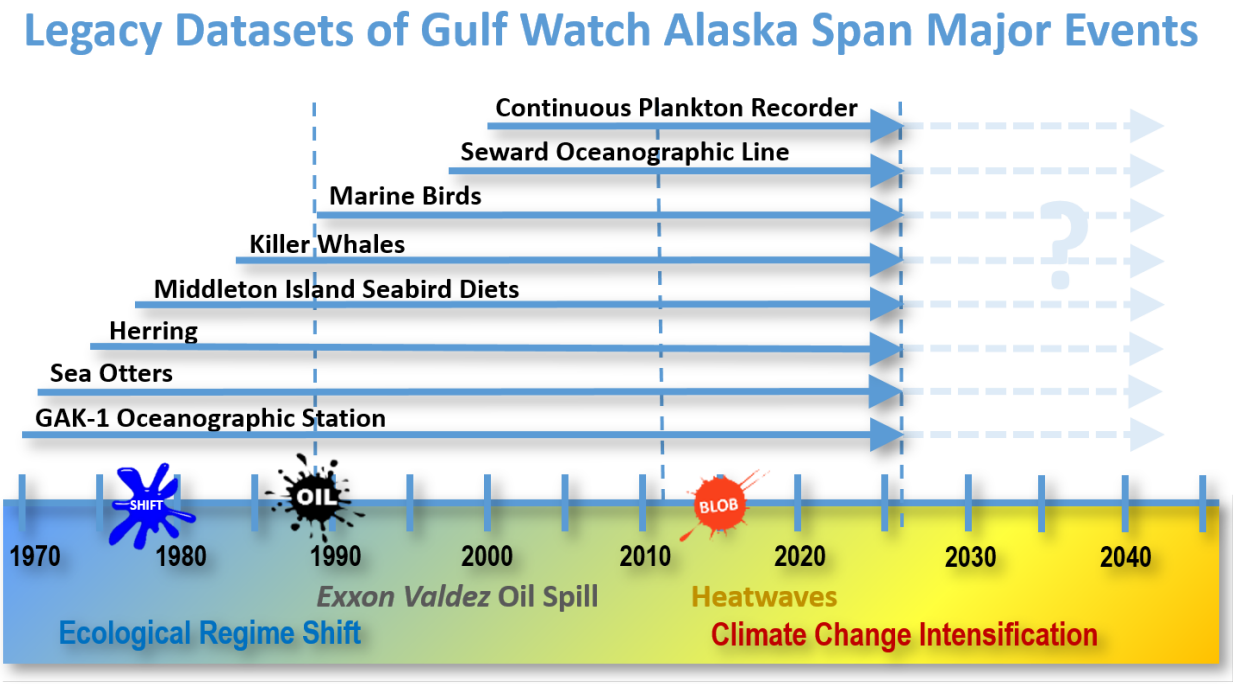

Figure 2

What is Gulf Watch Alaska?

Gulf Watch Alaska is a collaboration among 14 agencies, universities, and non-governmental organizations. It includes 35 principal investigators with broad expertise in marine science.

Three overarching research and monitoring themes focus on Environmental Drivers (physical and biological oceanography), Nearshore Ecosystems (subtidal and intertidal systems), and Pelagic Ecosystems (prey and upper trophic-level predators) (Fig. 1).

There is an additional focus on Pacific herring research and monitoring because this important forage fish species is still far below pre-oil spill levels and no longer supports a commercial fishery.

The final components of the program are science synthesis and outreach to ensure integration throughout the program and provide relevant products to resource managers and other stakeholders, including the general public. A particularly important aspect of Gulf Watch Alaska is the legacy studies that form the foundation of the long-term monitoring program. Some of these projects started before the oil spill, spanning 50 years and all three major events in the Gulf of Alaska (Fig. 2). Within Gulf Watch Alaska, these legacy projects are integrated with new studies to help understand why some species have not yet recovered over 30 years since the oil spill and what other factors are driving ecosystem change over time.

The recent marine heatwaves in the North Pacific Ocean occurred during the first decade of Gulf Watch Alaska. Whereas long-term warming of the North Pacific Ocean was predicted by climate forecasts, the amount of warming that occurred was not expected until future decades. These unanticipated climate events that appear to have exceeded natural variability Litzow et al. 2020 serve as a test and example of the value of Gulf Watch Alaska monitoring data for detecting, understanding, and interpreting ecosystem responses to climate variability.

Gulf Watch Alaska documents ecosystem response

Gulf Watch Alaska produced four synthesis publications that documented the response of the marine ecosystem to the heatwaves Arimitsu et al. 2021, Suryan et al. 2021, Weitzman et al. 2021, Danielson et al. 2022 and were cited in the most recent Intergovernmental Panel on Climate Change report (2022).

In the 8 years since the onset of the first heatwave, some species have returned to pre-heatwave levels, but others have not. Four species – Pacific herring (a commercially and ecologically important fish), killer whales (iconic apex predators), pigeon guillemots and marbled murrelets (ecologically unique marine birds) – whose populations have not recovered since the oil spill are in similar or worse states of recovery post-heatwaves.

Heatwaves – an eye-watering glimpse into the future

Recent heatwaves are likely windows into the future, given global climate change projections. Over the past 120 years in the Gulf of Alaska, six of the ten warmest years have occurred since 2015 (Alaska Center for Climate Assessment and Policy). Ecosystems are resilient but have limits and tipping points Dakos et al. 2019. Long-term research and monitoring is the only way to identify these boundaries, determine consequences, and allow us to respond to climate change effectively.

Please Note: This is a Commercial Profile

More About Stakeholder

Gulf Watch Alaska

Providing sound scientific data about environmental changes related to the Exxon Valdez oil spill to understand the recovery.