Range-Wide Gray Whale Science Symposium

September 9-10, 2026

Hatfield Marine Science Center, Newport, Oregon

Oregon State University
Marine Mammal Institute

Range-wide Gray Whale Science Symposium

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Presentations and Panel Discussions

Wednesday, 9 September 2026

Carmen Ford Phillips Auditorium + Zoom

Agenda

8:00 - 9:00 AM	**Arrival & Check-in for In-Person Attendees**
9:00 AM	**Welcome, and Opening Remarks** *Lisa Ballance, Oregon State University* *Frances Gulland, Marine Mammal Commission*
9:10 AM	**Session 1: Eastern and Western North Pacific Gray Whale Population Overview** *Moderator: Aimée Lang, NOAA Fisheries, Southwest Fisheries Science Center* The ebb and flow of gray whales in the eastern North Pacific: from whaling to warming and a bumpy ride in between *Dave Weller, NOAA Fisheries, Southwest Fisheries Science Center* *Josh Stewart, Marine Mammal Institute, Oregon State University* Monitoring gray whale status in the wintering lagoons of Baja California Sur, Mexico *Jorge Urbán Ramírez, Gray Whale Research in Mexico and Marine Mammal Research Program, Universidad Autónoma de Baja California Sur* *Steven Swartz, Gray Whale Research in Mexico and The Ocean Foundation* Western North Pacific gray whales: status and trends (virtual, pre-recorded) *Alexander Burdin, Kamchatka Branch of Pacific Geographical Institute, Russian Academy of Sciences* Atlantic gray whales: Then and now (virtual) *Randy Reeves, Marine Mammal Commission* Session 1 Discussion
10:20 AM	**Break**
	Session 2: Changing Ecology of Eastern North Pacific Gray Whales and the Pacific Coast Feeding Group *Moderator: Dave Weller, NOAA Fisheries, Southwest Fisheries Science Center*

Presentations and Panel Discussions

Panel discussion: Eastern North Pacific gray whale regional ecology
This panel builds on a virtual Eastern North Pacific Gray Whale Ecology Meeting held in May 2026. For more information, see the Meeting Summary and Presentation Slides.

Gulf of Alaska:
KC Bierlich, Marine Mammal Institute, Oregon State University
Lauren Wild, University of Alaska Southeast
Andy Szabo, Alaska Whale Foundation
Offshore Vancouver Island:
Jim Darling, Whale Trust
Erin Foster, Fisheries and Oceans Canada
Offshore Washington:
John Calambokidis, Cascadia Research Collective
Southern California Bight:
Alisa Schulman-Janiger, American Cetacean Society-Los Angeles Chapter and the Natural History Museum of Los Angeles County
Baja California Peninsula, Mexico*:*
Jorge Urbán Ramírez, Gray Whale Research in Mexico and Marine Mammal Research Program, Universidad Autónoma de Baja California Sur
Steven Swartz, Gray Whale Research in Mexico and The Ocean Foundation

Connectivity, and lack of connectivity, of PCFG and other ENP gray whales
Jonathan Scordino, Makah Fisheries Management, Makah Tribe

Gray whale adaptation and resilience in a changing ocean with insights from the Pacific Coast Feeding Group
Leigh Torres, Marine Mammal Institute, Oregon State University

Session 2 Discussion

12:15 PM **Lunch**

1:45 PM **Session 3: Ecosystem Changes Impacting Gray Whales**
Moderator: Jason Baker, Marine Mammal Commission

North Pacific marine ecosystems: Eastern North Pacific, California Current, and Gulf of Alaska seasonal patterns and marine heat events (virtual)
Nate Mantua, NOAA Fisheries, Southwest Fisheries Science Center

Pacific Arctic ecosystems: North Bering and Chukchi sea ice loss and ecosystem transformation
Kate Stafford, Marine Mammal Institute, Oregon State University

Presentations and Panel Discussions

	Time series trends in benthic prey populations in the northern Bering and Chukchi Seas *Jackie Grebmeier, Chesapeake Biological Laboratory, University of Maryland Center for Environmental Science*
	Exposure risks and impacts of harmful algal bloom (HAB) toxins in marine mammals *Kathi Lefebvre, NOAA Fisheries, Northwest Fisheries Science Center, Wildlife Algal-toxins Research and Research and Response Network (WARRN-West)*
	Session 3 Discussion
3:20 PM	**Break**
3:35 PM	**Session 4: Overview of Lethal and Sublethal Threats to Health and Survival** *Moderator: Lori Schwacke, Marine Mammal Commission*
	Strandings: UME and post-UME update, including cause of death findings *Deb Fauquier, NOAA Fisheries, Office of Protected Resources*
	Range-wide assessment of gray whale nutritional status via drone-based photogrammetry *KC Bierlich, Marine Mammal Institute, Oregon State University*
	Insights from the Pacific Northwest on alternate feeding areas and nutritional status *John Calambokidis, Cascadia Research Collective*
	Biomarkers of gray whale physiological status: assessing stress, reproduction, and metabolic state via hormones and novel biomarkers *Kathleen Hunt, Marine Mammal Institute, Oregon State University*
	Gray whale ecological responses to environmental change during a prolonged mortality event revealed by baleen stable isotopes: What can stable isotopes tell us, and what are their limitations? *Geraldine Busquets-Vass, Centro de Investigación Científica y de Educación Superior de Ensenada, Unidad Académica La Paz*
	Session 4 Discussion
5:20 PM	**Day 1 Wrap-Up and Prep for Day 2** *Peter Thomas, Marine Mammal Commission*
5:30 PM	**Poster Session (Gladys Valley Marine Studies Building – Lobby)**

Facilitated Discussions

Thursday, 10 September 2026

9:00 AM	**Welcome, and Introduction to Breakout Discussions (Carmen Ford Phillips Auditorium)** *Peter Thomas, Marine Mammal Commission*
9:15 AM	**Discussion Groups Session 1** Mixed-topic groups will identify key scientific questions and knowledge gaps across gray whale population dynamics, feeding ecology, and health monitoring. Outcome: Develop priority questions to be considered in Discussion Group Session 2.
10:30 AM	**Break**
11:00 AM	**Discussion Groups Session 2** Topic-specific groups will discuss priority questions from Discussion Group Session 1 within the areas of gray whale population dynamics, feeding ecology, and health monitoring. Outcome: Identify research needs and potential next steps to address the priority questions.
12:15 PM	**Lunch**
1:45 PM	**Discussion Group Report Out (Carmen Ford Phillips Auditorium)** *Moderator: Frances Gulland & Peter Thomas, Marine Mammal Commission*
3:00 PM	**Future Directions and Next Steps (Carmen Ford Phillips Auditorium)** *Moderator: Frances Gulland & Peter Thomas, Marine Mammal Commission*
4:00 PM	**Meeting Adjourn**

Poster Presentations

Tuesday, 9 September 2026 5:30-7:00 PM

TITLE	LEAD PRESENTER	FOCAL REGION
Utilizing stable isotope analysis to characterize dietary contributions of foraging gray whales in response to the changing Arctic preyscape	Taylor Azizeh	Arctic
Decline in area coverage and trends in the energy density of benthic amphipods in the northern Bering and Chukchi Seas from 1970-2021: a preferred prey source for Eastern North Pacific gray whales	Jacqueline Grebmeier	Arctic
Increasing springtime occurrence of gray whales in Sitka Sound, Alaska	Lauren Wild	Southeast Alaska
Gray whale sightings and strandings in Washington State reveal the Eastern North Pacific population is in trouble and the ways gray whales are adapting	John Calambokidis	Washington
It can pay to stray: Pacific stopover habitats critical for gray whale energetics and conservation	Hannah Clayton	Washington
Using non-invasive drone-based research to assess the health of “Sounders” gray whales in WA, USA	Mitchell McCartney	Washington
Individual variation and temporal progression of epidermal Condition in PCFG gray whales	Natalie Chazal	Pacific Coast Feeding Group
Migratory characteristics of Pacific Coast Feeding Group gray whales (*Eschrichtius robustus*) described from satellite tags	Ladd Irvine	Pacific Coast Feeding Group
Non-invasive assessment of reproductive status in gray whales	Jen Jelencic	Pacific Coast Feeding Group
A gut feeling: DNA metabarcoding reveals prey diversity and community structure in the diets of gray whales	Charles Nye	Pacific Coast Feeding Group
Integrating a DNA register with satellite telemetry records of Pacific Coast Feeding Group (PCFG) gray whales	Daniel Palacios	Pacific Coast Feeding Group
Pacific Coast Feeding Group gray whale research by the Makah Tribe	Jonathan Scordino	Pacific Coast Feeding Group
Morphological and genetic characterization of gray whales from the Pacific Coast Feeding Group (PCFG) using photogrammetry and “blow samples” collected by drones	Debbie Steel	Pacific Coast Feeding Group
Understanding migratory behavior of the Pacific Coast Feeding Group gray whales through barnacle morphology	Ryan Walsh	Pacific Coast Feeding Group
Whale smart and whale safe: Reducing gray whale vessel strike risk in San Francisco Bay	Moe Flannery	California

Poster Presentations

Tuesday, 9 September 2026 5:30-7:00 PM

TITLE	LEAD PRESENTER	FOCAL REGION
Successful pilot deployment of LIMPET (SPLASH10-292A) biologging tags on gray whales (*Eschrichtius robustus*) in San Francisco Bay	Kathi George	California
Gray whale prey consumed during migratory stopovers in San Francisco Bay	William Keener	California
Widespread mortality and malnutrition linked to anomalous presence of gray whales within San Francisco Bay	Julia O'Hern	California
Quantifying gray whale (*Eschrichtius robustus*) migratory movement behavior and respiration rate using focal tracking data from uncrewed aerial systems	Naomi Scott	California
Gray whales (*Eschrichtius robustus*) in San Francisco Bay experience high mortality and have limited affiliation to known foraging groups	Josephine Slaathaug	California
A baleen-based multi-biomarker framework for assessing gray whale ecology and physiology	Alejandro Fernández Ajó	Range-wide
Improving confidence in vessel strike diagnosis through standardized lesion assessment of gray whales (*Eschrichtius robustus)*	Brittany Dolan	Range-wide
Advances in the development and implementation of artificial intelligence reidentification tools for gray whale (*Eschrichtius robustus*) photo-identification matching	Trevor Joyce	Range-wide
From connectivity science to corridor-scale conservation: Advancing collaborative protection of a North American Eastern Pacific Blue Corridor	Elisabeth Krueger	Range-wide
Habitat suitability modeling for gray whales along the US West Coast	Anna Nisi	Range-wide

Utilizing stable isotope analysis to characterize dietary contributions of foraging gray whales in response to the changing Arctic preyscape

Presenter: Taylor R. Azizeh, Oregon State University, taylor.azizeh@oregonstate.edu;
John Calambokidis, Cascadia Research Collective;
Kerri Danil, NOAA/NMFS Southwest Fisheries Science Center;
Barbie Halaska, Central California Marine Animal Response Team;
John Hyde, NOAA/NMFS Southwest Fisheries Science Center;
Jeff Jacobsen, VE Enterprises;
Nick Kellar, NOAA/NMFS Southwest Fisheries Science Center;
Kathryn Sherman, NOAA/NMFS Southwest Fisheries Science Center;
Jorge Velez-Juarbe, Natural History Museum of Los Angeles County;
Dave Weller, NOAA/NMFS Southwest Fisheries Science Center;
Joshua D. Stewart, Oregon State University;

Gray whales (GW) have experienced a series of major mortality events (and subsequent recoveries) over the last 50 years, and studies from the past 20 years have associated these significant population fluctuations with foraging conditions in the Arctic. And while they have evolved to target benthic prey, there are numerous examples of GW (Eastern North Pacific (ENP) and Pacific Coast Feeding Group) targeting epibenthic and pelagic prey. Pelagic feeding and feeding outside of the traditional Arctic foraging hotspots are observed more frequently during periods of high mortality, suggesting that benthic prey shortages lead to foraging plasticity. Predicting how GW may respond to rapid environmental change requires a better understanding of the prevalence and fitness benefits of foraging plasticity. To estimate the proportion of the ENP population engaging in pelagic feeding during acute benthic prey shortages, we are using stable isotope analysis (SIA) of skin tissue from GW collected in the Arctic and during the southbound migration. Carbon ($\delta^{13}C$) can be used to distinguish benthic versus pelagic prey sources, and nitrogen ($\delta^{15}N$) provides information on trophic position. We will present preliminary results on the prevalence of pelagic feeding signatures during years of high and low Arctic benthic biomass based on samples collected in November – February 1997 – 2026 from live and stranded GW off the coasts of Washington, Oregon, and California. Additionally, we will present results of samples collected from ten individuals with paired photogrammetry data collected during a pilot study in 2026, with the goal of relating pelagic diet contributions to individual fitness. We will analyze an additional 250+ samples this year, and welcome supplementary collaborative sample contributions to the initiative. This work will provide a better understanding of how GW may buffer in changing Arctic conditions, and how much resilience the population may have to continued benthic prey declines.

Decline in area coverage and trends in the energy density of benthic amphipods in the Northern Bering and Chukchi Seas from 1970-2021: a preferred prey source for Eastern North Pacific gray whales

Brian P. Marx, University of Maryland;
Presenter: Jacqueline M. Grebmeier, University of Maryland, jgrebmei@umces.edu;
Lee W. Cooper, University of Washington;
Thomas J. Miller, University of Maryland;
Sue E. Moore, University of Washington;

In the shallow seas of the Pacific Arctic Region (PAR), contractions of the spatial extent and biomass of tube-building benthic amphipods since the 1980s, particularly in the Chirikov Basin in the northern Bering Sea, have significant implications for the marine food web. The Eastern North Pacific (ENP) population of gray whales (*Eschrichtius robustus*) are top predators that historically relied on dense aggregations of benthic amphipods in the PAR as a preferred prey source. Two Unusual Mortality Events (1999-2000; 2019-2023) declared by the US National Oceanic and Atmospheric Administration for the ENP population, as well as elevated mortalities that are recurring in 2026, have focused concerns on prey availability for these benthivores in their Arctic foraging grounds. To assess trends in amphipod prey availability, amphipods were collected in 2023 to determine energy contents (kJ g^{-1}) of the dominant taxa. These values were then used to develop a conversion factor between formalin-preserved and frozen samples to look at multidecadal values of amphipod prey. The goal was to produce a standardized time series of amphipod energy density (ED, kJ m^{-2}) in the PAR using 51 years of formalin-preserved amphipod wet weight biomass. The Chirikov Basin exhibited a large decline in the mean energy density of the dominant ampeliscids (Family Ampeliscidae), from a maximum of 347.08±156.38 kJ m^{-2} in 1984 to a minimum of 31.07±17.49 kJ m^{-2} in 2010, a 91% reduction. By comparison, the SE Chukchi Sea, a current region of high gray whale feeding, exhibited a range of 167.67±13.73 (2005) to 1.55±1.48 (2009) in the mean energy density of the dominant pontoporeiid amphipods (Family Pontoporeiidae), with higher densities in the early 2000s declining sharply by 2021. In addition, evaluation of the overall station biomass in the Chirikov Basin indicates a dramatic decline in the amphipod spatial bed size over the last 4 decades, further suggesting a reduced prey field energy source for benthic feeding gray whales. These findings indicate that the previously extensive and dense sources of energy of benthic amphipods (both caloric and overall biomass) to the ENP population are greatly diminished. This represents a significant shift of ecosystem structure that has implications of food limitations for ENP gray whales that migrate to the PAR annually to forage and replenish energy reserves.

Increasing springtime occurrence of gray whales in Sitka Sound, Alaska

Presenter: Lauren Wild, University of Alaska Southeast, lawild@alaska.edu;
Ellen Chenoweth, University of Alaska Fairbanks;
Willa Johnson, University of Alaska Fairbanks;
Jan Straley, University of Alaska Southeast;
Mike Miller, Sitka Tribe of Alaska;

Beginning in late March, Sitka Sound, Alaska is home to a spawning aggregation of Pacific herring (*Clupea pallasii*). This herring population has been of cultural importance to Łingít people in Sheet'ká Aaní (Sitka) for over 10,000 years. It is also subject to a lucrative commercial sac roe fishery. Since the 1950s, Sitka residents have reported small numbers (<20) of gray whales (*Eschrichtius robustus*) feeding on herring eggs post-spawn. University of Alaska Southeast researchers have cataloged individuals opportunistically since the late 1980s. In 2019, the numbers of gray whales increased suddenly and dramatically to over 150 individuals, coinciding with an Unusual Mortality Event (2019-2023) and overall decline of the Eastern North Pacific population (>50% from 2016-2025). Spring whale numbers remained high and in 2023 we began a dedicated study to understand why there is a local increase in gray whales in Sitka Sound concurrent with a population decline, and what the implications are of this influx on the herring resource and users of herring/herring eggs. We have built a Sitka Sound gray whale photo-identification catalog with sightings from the 1980s through 2025, uploaded the catalog to Happywhale, and are comparing with other catalogs along their range. We have a minimum of 23 individuals in the catalog prior to 2019, and a minimum of 222 individuals in the current 2025 catalog. The longest within-season re-sight is 47 days; the longest re-sight of an individual across seasons is 17 years (2007-2023). Genetic data has revealed a skewed sex ratio, with nearly 2:1 males-to-females; additional samples from 2026 field season will be incorporated. Overall, this study confirms that gray whale numbers in Sitka Sound have drastically increased in the springtime, and that whales are targeting ecologically and culturally important herring eggs. These results will be vital for ecosystem-based management in Sitka Sound.

Poster Presentation | Washington

Gray whale sightings and strandings in Washington State reveal the Eastern North Pacific population is in trouble and the ways gray whales are adapting

Presenter: John Calambokidis, Cascadia Research Collective, calambokidis@CascadiaResearch.org;
Jessie Huggins, Cascadia Research Collective;
Hannah Clayton, Cascadia Research Collective, Stanford University;
Alie Perez, Cascadia Research Collective;
Alex Vanderzee, Cascadia Research Collective, SeaLife Response, Rehab, and Research;
Elana Dobson, Cascadia Research Collective;
Jeff Harris, NOAA/NMFS Marine Mammal Laboratory;
Peter Mahoney, NOAA/NMFS Marine Mammal Laboratory;
Holly Fearnbach, SeaLife Response, Rehab, and Research;

Eastern North Pacific (ENP) gray whales have experienced elevated mortality, declining abundance, and low calf production since 2019. We present some of the ways sightings and strandings in Washington can offer insight into the nature, timing, and potential cause of this crisis, as well as how gray whales are attempting to adapt. Almost 50 years of gray whale stranding records in Washington provides one of best long-term indicators of increased mortality, with elevated number of deaths recorded in 1990-1991, 1999-2000, and 2019-2026. The recent decline has been the most protracted and has involved the largest number of whales, with no sign of recovery. One long-studied subgroup, the “Sounders”, have returned annually to northern Puget Sound since 1990, typically staying for 2-3 months each spring. Their numbers increased from an initial 6 individuals to 12 individuals during the 1999-2000 unusual mortality event (UME), and to 18 in recent years. Sounders showed very little mortality over the first 30 years of monitoring, including through the 1999-2000 UME. In each of the last 5 years, 3-5 whales (8 individuals) have arrived in late December/early January and stayed through late spring, foregoing the migration to winter breeding grounds in Mexico. Another subgroup, the Pacific Coast Feeding Group (PCFG), feeds through the summer/fall in the Pacific Northwest (foregoing migrating to the Arctic), and similar to the Sounders, has not shown comparable declines. The primary or supplemental feeding in the Pacific Northwest further supports findings that the declines are related to changes in their Arctic feeding grounds. Gray whale sightings in Washington in 2025/2026 have also been unusual; with several concentrations observed in areas they are not typically seen. Our observations indicate gray whales are seeking alternate feeding areas to supplement prey loss in the Arctic, sometimes successfully and other times not.

Poster Presentation | Washington

It can pay to stray: Pacific stopover habitats critical for gray whale energetics and conservation

Presenter: Hannah Clayton, Stanford University, hclayton1@stanford.edu;
David Cade, Stanford University;
Ashley Blawas, Stanford University;
Samantha Leander, Sealife Response, Rehab, and Research;
James Fahlbusch, Cascadia Research Collective;
John Durban, New England Aquarium;
Holly Fearnbach, Sealife Response, Rehab, and Research;
John Calambokidis, Cascadia Research Collective;
Jeremy Goldbogen, Stanford University;

Climate-linked changes in prey resources are causing severe declines in Eastern North Pacific gray whales, whose energetic ecology remains relatively unknown. A small group (~24 individuals) of ENP gray whales seem to be faring better than the broader population by making detours into the northern Puget Sound, Washington ("NPS"), each year to feed on ghost shrimp in the shallow (mean depth 2.5m) intertidal. We performed a multi-year study integrating biologging data, intertidal prey sampling efforts, and drone photogrammetry to estimate the foraging efficiency of gray whales on a stopover foraging ground in the NPS, producing some of the highest resolution estimates of energy consumption and field metabolic rates in a baleen whale system to date. We further modeled the energetic outcomes of foraging in the NPS compared to foraging on traditional foraging grounds (TFGs) in the Arctic, finding that the net energetic benefit of stopover foraging in this region outweighs, on average, the benefits of feeding exclusively on TFGs even in the most ideal ecological and foraging contexts. Our results highlight the urgent need to identify, and conserve, key foraging habitats along the Pacific coast that may enable gray whale resilience in the face of changing climates.

Poster Presentation | Washington

Using non-invasive drone-based research to assess the health of "Sounders" gray whales in WA, USA

Presenter: Mitchell M. McCartney, University of California, Davis, mmmccartney@ucdavis.edu;
Holly Fearnbach, Sealife Response, Rehab, and Research;
Kerri Danil, Sealife Response, Rehab, and Research;
Alex W. Vanderzee, Sealife Response, Rehab, and Research;
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Samantha G. M. Leander, Sealife Response, Rehab, and Research;
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Jonathan A. Eisen, University of California, Davis;
Alie Perez, Cascadia Research Collective;
John Calambokidis, Cascadia Research Collective;

An elevated number of Eastern North Pacific gray whales (*Eschrichtius robustus*) have stranded along the west coast of North America since 2019, leading to the declaration of an Unusual Mortality Event (UME) that lasted between 2019-2023. Although the UME was declared over in 2023, the number of dead stranded whales has continued to be high, with more than 100 total strandings in the US and Mexico already in 2026. Estimates of gray whale abundance have declined by more than 50% since 2016 and many of the stranded whales have been found to be in emaciated body condition. Our drone-based research has shown that: 1) aerial photogrammetry can be used to detect changes in individual body condition over time and 2) whale blow exhalate can be used to assess respiratory health, highlighting the utility of this non-invasive research to give free-ranging whales a "health check." Here, we present results from a pilot study in April and May, 2026 that involved the collection of a unique suite of health metrics to assess the health of a small aggregation of gray whales, known as the "Sounders", that have an annual feeding stopover in Puget Sound, WA on their way to their Arctic feeding grounds. We were able to collect 51 blow samples from 11 individuals to explore metabolite composition, 17 blow samples from nine of these individuals to describe respiratory microbiomes, and aerial photogrammetry images of eight of these individuals to explore the relationship between physiological health and body condition. Repeat blow samples and photogrammetry images were collected both within and between efforts, allowing for an evaluation of short-term physiological changes; body condition will also be interpreted in the context of our longer time-series (2020-2026). This timely study provides an important evaluation of gray whale health during this period of extreme population decline.

Poster Presentation | Pacific Coast Feeding Group

Individual variation and temporal progression of epidermal condition in PCFG gray whales

Presenter: Natalie Chazal, Oregon State University, chazaln@oregonstate.edu;
Sonora Van Diest, Oregon State University;
Kathleen Hunt, Oregon State University;
Enrico Pirotta, University of St. Andrews;
KC Bierlich, Oregon State University;
Alejandro Fernández Ajó, Oregon State University;
Jeanine Peters-Kennedy, Cornell University;
Leigh Torres, Oregon State University;

Longitudinal assessments of epidermal health in gray whales provide a unique and valuable opportunity to evaluate how visible skin condition expression changes through time and relates to broader indicators of physiological stress. Recent observations within the Pacific Coast Feeding Group (PCFG) of gray whales indicate an increasing number of individuals exhibiting a skin condition of unknown origin characterized by irregular white, raised, and variably distributed lesions. Evaluation of repeated observations of the same individuals can reveal progression, remission, persistence, and potential drivers of disease expression, and be compared to other health metrics. This study focuses on eight PCFG gray whales with extensive photographic histories spanning multiple years (2016-2025). Using longitudinal lateral imagery, epidermal condition was scored through a qualitative framework that characterizes lesion pattern, activity state (active, latent, or inactive), lesion coverage, border definition, and directional change relative to prior sightings (increasing or decreasing severity). Images were categorized by body region and photo quality to ensure scoring consistency. This high-resolution time series reconstructs individual trajectories of epidermal condition. To better understand the mechanistic drivers or impacts of this skin condition, epidermal assessments will be assessed relative to multiple non-invasive biomarkers of whale health, including body condition, growth metrics, hormone profiles, scarring history, and fine-scale behavioral and environmental data. Histological analyses of the skin, performed on two whales, was conducted in collaboration with veterinary anatomic pathologists from The Marine Mammal Center and Cornell University College of Veterinary Medicine. Histopathology showed evidence of neutrophilic leukocytoclastic vasculitis characterized by karyorrhectic debris and erythrocytes within capillary walls, variable degrees of intracellular edema in epidermal keratinocytes, and smudging of superficial dermal collagen. By combining longitudinal photographic analysis with complementary health metrics, this study aims to evaluate epidermal disease as a visible indicator of cumulative stress and overall whale health in a changing coastal ecosystem.

Migratory characteristics of Pacific Coast Feeding Group gray whales (*Eschrichtius robustus*) described from satellite tags

Presenter: Ladd M. Irvine, Oregon State University, ladd.irvine@oregonstate.edu;
Barbara A. Lagerquist, Oregon State University;
Taylor R. Azizeh, Oregon State University;
Bruce R. Mate, Oregon State University;

Understanding individual migratory behavior is critical for interpreting population dynamics and managing wide-ranging marine mammals. We used satellite telemetry data from 33 tagged Pacific Coast Feeding Group gray whales (2009, 2012–2013) to quantify migratory timing, routes, travel rates, and winter habitat use. Complete southward migration was identified for 18 individuals, with all but two departures starting off northern California, USA (NorCal), ranging from 28 November to 13 February. One whale did not migrate south, remaining in NorCal throughout winter. Mean migration duration was 18.7 days (range: 14–26 days), with mean travel speeds of 4.9 km h^{-1} (SD = 2.1). Most whales followed nearshore routes, although some crossed the California Bight offshore. All tracked migrants converged on Laguna Ojo de Liebre (Baja California Sur, MX), with limited use of other breeding lagoon areas by two individuals. Mean time spent in the wintering grounds was 26.1 days with substantial individual variability (range = 7–68.5 days). Notably, most whales spent considerable time outside lagoon boundaries, and eight individuals did not enter the lagoon at all. Twelve whales were tracked through northward migration, which was longer in duration (mean = 32 days; range = 19–49 days), with mean travel speeds of 4.1 km/h (SD = 1.9) and had endpoints ranging from NorCal to Vancouver Island, CA. Lunar illumination was not a significant predictor of migratory departure timing in both southward or northward directions and the common departure point, and temporal spread of departure, limited investigation of other migratory cues. The observed variability in migration timing, duration of winter residency, and lagoon use has important implications for abundance estimation, exposure to anthropogenic risks, and management of these, and other, migratory whales.

Poster Presentation | Pacific Coast Feeding Group

Non-invasive assessment of reproductive status in gray whales

Alejandro Fernández Ajó, Oregon State University;
Enrico Pirotta, University of St. Andrews;
KC Bierlich, Oregon State University;
Lisa Hildebrand, Oregon State University;
Clara N. Bird, Oregon State University;
Kathleen E. Hunt, Oregon State University;
C. Loren Buck, University of Arizona;
Leslie New, Ursinus College;
Danielle Dillon, New England Aquarium;
Presenter: Jen Jelincic, Oregon State University, jen.jelincic@oregonstate.edu;
Leigh G. Torres, Oregon State University;

Understanding reproductive dynamics is critical for evaluating the health and recovery potential of large whale populations. However, assessing reproductive status in free-ranging whales remains challenging due to the logistical constraints of studying these large marine mammals. Non-invasive approaches offer valuable opportunities to monitor reproductive physiology and demographic processes while minimizing disturbance to individuals. Here, we present complementary studies conducted on Pacific Coast Feeding Group (PCFG) gray whales that evaluate non-invasive methods for assessing reproductive status in both females and males. First, we examined the utility of drone-based photogrammetry and fecal progesterone metabolite concentrations to identify pregnancy in female gray whales. Morphometric measurements derived from unoccupied aerial systems successfully distinguished pregnant from non-pregnant females, while progesterone metabolite concentrations exhibited substantial overlap among reproductive states. These findings highlight the value of body morphometrics as indicators of pregnancy in free-ranging whales. Second, we investigated seasonal variation in fecal testosterone concentrations of male gray whales. Mature males exhibited increasing testosterone levels toward the end of the feeding season, whereas juvenile males did not show similar patterns. These results suggest that reproductive physiological activation begins prior to southbound migration and demonstrates the potential of fecal hormone analyses to characterize reproductive maturity and reproductive seasonality in males. Together, these studies illustrate how integrating physiological and morphological assessments can improve our understanding of reproductive status in gray whales. Ongoing work is evaluating additional endocrine and molecular biomarkers that may further enhance pregnancy detection and reproductive monitoring. Developing robust, non-invasive tools for reproductive assessment will strengthen population monitoring efforts and provide valuable insights into the factors influencing gray whale health, reproduction, and population dynamics.

Poster Presentation | Pacific Coast Feeding Group

A gut feeling: DNA metabarcoding reveals prey diversity and community structure in the diets of gray whales

Presenter: Charles Nye, Oregon State University, charles.nye@oregonstate.edu;
Leigh Torres, Oregon State University;
Alejandro Fernández Ajó, Oregon State University;
Natalie Chazal, Oregon State University;
Lisa Hildebrand, Oregon State University;
Hali Peterson, Oregon State University;
Sarah Henkel, Oregon State University;
Debbie Steel, Oregon State University;
C. Scott Baker, Oregon State University;

Gray whales (*Eschrichtius robustus*), like other mysticetes, exhibit strong migratory site fidelity. Within gray whales, distinct subunits or migratory herds have been identified, with each group exhibiting unique dietary preferences within their range. Gray whales in the Pacific Coast Feeding Group (PCFG) forage along nearshore waters of the Pacific Northwest (41°N to 52°N). Observations of feeding PCFG whales indicate a diverse prey base consisting of mysids, crab larvae, and amphipods. Here, we present the first description of diet items from PCFG whales using DNA metabarcoding and community analyses to quantify variation in beta diversity. Fecal samples (n = 173) from PCFG whales were collected during the foraging season off the Oregon Coast from 2016-2023. Sequence variants from high-throughput sequencing of the COI barcode gene were matched to diet taxa using sequence repositories and novel prey DNA vouchers. We identified 287 species-level taxa in PCFG fecal samples from 22 taxonomic phyla, 14 of which have not been reported previously in gray whale diets. Copepods (91%) and crustaceans (86.7%) held the highest percent-occurrences of broad diet item groups. Fecal DNA samples were found to comprise three distinct diet composition clusters, with the youngest juvenile whales falling into the most distinct grouping. Results of species analysis (ISA) show mysids (*Neomysis rayii*), crabs (*Petrolisthes eriomerus*, *Metacarcinus magister*), and several phytoplankton species have significant associations with PCFG diet clusters (mean IndVal = 0.45, $p < 0.05$). This gradient in community / diet composition may reflect the habitats and depth stratified foraging tactics used by gray whales in the PCFG range, driven by distinct foraging patterns among age groups. Recent trends in gray whale foraging behavior may reflect greater environmental changes, and high-resolution diet data may provide a baseline for foraging comparisons within and between migratory groups of this species.

Poster Presentation | Pacific Coast Feeding Group

Integrating a DNA register with satellite telemetry records of Pacific Coast Feeding Group (PCFG) gray whales

Presenter: Daniel M. Palacios, Oregon State University, Center for Coastal Studies, dpalacios@coastalstudies.org, daniel.palacios@oregonstate.edu;
Debbie Steel, Oregon State University;
Scott Baker, Oregon State University;

The Pacific Coast Feeding Group (PCFG) is a small aggregation of gray whales (*Eschrichtius robustus*) that feeds in nearshore waters from northern California to southeastern Alaska during summer and autumn. Between 2009 and 2013, 35 PCFG gray whales were satellite tagged off Oregon and northern California, including 25 individuals from which biopsy samples were collected. To facilitate future studies of movement ecology, population structure, and connectivity, we generated complete genetic profiles for all 25 tagged whales and integrate these data with existing telemetry and photo-identification records. Genetic analyses included sex determination, mitochondrial DNA (mtDNA) haplotyping based on a 522-bp control-region sequence, and microsatellite genotyping at 13 loci. The resulting DNA Register comprises 25 individually identified whales, including 13 males and 12 females. Mitochondrial analyses identified 12 distinct haplotypes, with haplotype frequencies ranging from one to four individuals. Haplotype diversity was high (h = 0.940), indicating broad representation of maternal lineages within the tagged sample. Microsatellite analyses revealed substantial nuclear genetic diversity, with mean expected heterozygosity of 0.745, and an average of 8.1 alleles per locus (range: 4–15). No duplicate multilocus genotypes were detected, confirming that all samples represented individuals. The project produced the first integrated genetic database for satellite-tagged PCFG gray whales, linking sex, mtDNA haplotypes, microsatellite genotypes, photo-identification histories, and telemetry records (https://mmi.oregonstate.edu/whet/dna-register-tagged-gray-whales-pacific-coast-feeding-group). The resulting dataset is compatible with larger regional genetic datasets and provides a foundation for future investigations of genetic diversity, kinship, movement strategies, habitat use, and population connectivity in this distinctive feeding aggregation.

Funding: The biopsy samples analyzed in this study were collected during satellite-tagging projects conducted by Bruce R. Mate and colleagues between 2009 and 2013. These efforts were part of the *Offshore Gray Whale Satellite Tagging in the Northwest Training Range Complex (NWTRC)* project, funded by the U.S. Navy, Commander, Pacific Fleet, through the Navy's Marine Species Monitoring Program under an agreement with HDR, Inc. (Contract No. N62470-10-D-3011) administered by Naval Facilities Engineering Command (NAVFAC) Northwest. The genetic analyses presented here were funded by the Oregon State University Marine Mammal Institute through Oregon Gray Whale License Plate Program (Award No. AMM103-AW14).

Pacific coast feeding group gray whale research by the Makah Tribe

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The Makah Tribe established a Marine Mammal Program (MMP) within its Fisheries Management Department during 2002 to manage the Makah Tribe's sealing and whaling rights that were reserved in the 1855 Treaty of Neah Bay. The MMP has conducted a number of studies to address data gaps on Pacific Coast Feeding Group (PCFG) gray whales both independently and in collaborations with partners. PCFG whales are a feeding group that shows interannual fidelity to the Pacific Coast between 41-52° (excluding Puget Sound) during the feeding season (June-November). The panels of this poster include key results from eight study topics; QR codes link to publications or presentations on each topic.

Poster Presentation | Pacific Coast Feeding Group

Morphological and genetic characterization of gray whales from the Pacific Coast Feeding Group (PCFG) using photogrammetry and “blow samples” collected by drones

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The Pacific Coast Feeding Group (PCFG) is a well studied subset of gray whales that forage along the Oregon coast, where many individuals show high site fidelity. Recent evidence shows that PCFG whales are morphologically shorter and have smaller heads and flukes compared to Eastern North Pacific (ENP) gray whales. Comparing the genetic profiles of individuals with these morphological differences could shed new light on the distinctiveness between PCFG and ENP whales. This project piloted and validated drone based methods for collecting and genotyping respiratory vapor (“blows”) from PCFG gray whales. Between May and October 2025, the team collected 32 blow samples from 24 individuals, paired with drone-based photogrammetry measurements of body length, condition, head size, and fluke span. Throughout the season, iterative refinement of both field and laboratory protocols led to major improvements in quality of genetic samples. By fall, 12 of the final 13 samples were rated “good”, driven by a revised flight technique that positioned the drone to intercept the blows more completely. Higher quality samples yielded improved genetic results, including successful sex identification for all 12 “good” samples and successful microsatellite genotyping for 9 of the 12 samples. This pilot season confirms that drone based blow sampling could be a reliable, noninvasive tool for genetic characterization of gray whales. In May 2026, we collected 19 blow samples paired with morphological measurements from ENP gray whales foraging along the coast of Kodiak Island, Alaska, presenting an opportunity to compare morphology and genetic characterization between ENP and PCFG whales.

Poster Presentation | Pacific Coast Feeding Group

Understanding migratory behavior of the Pacific Coast Feeding Group gray whales through barnacle morphology

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Recent tagging efforts and opportunistic sightings have provided evidence that some Eastern North Pacific (ENP) gray whales do not make their full migration from northern feeding grounds to their breeding lagoons of Baja California, Mexico. As a result, the abundance estimates for ENP gray whales may underestimate the size of the population given abundance estimates are heavily dependent on shore-based observations of gray whales as they pass Granite Canyon, California during their southbound migration. There is no current method to evaluate population-wide migratory behaviors to assess the impact of this potential bias on stock assessment. However, a species of barnacle, *Cryptolepas rhachianecti*, that is host-specific to gray whales, may help in evaluating the proportion of gray whales that migrate. The gray whale barnacle spawns and recruits to gray whales in the lagoons of Baja California, Mexico, and has morphologically distinct juvenile and adult forms. Here we present the preliminary development and application of methods that determine migratory behavior in Pacific Coast Feeding Group (PCFG) gray whales based on observations of their barnacle epibionts on the feeding grounds. We have used case studies of frequently observed PCFG gray whales to document the applications of these methods and barnacle growth progressions throughout multiple body regions of gray whales. We have also tested preliminary assumptions that juvenile barnacles do recruit to all gray whales that fully migrate south and only adult barnacles are observed on a gray whale that did not migrate during the previous breeding season. Juvenile barnacle presence may be useful for complementing existing telemetry data to understand patterns and drivers in migratory behavior and better inform population abundance estimates.

Whale smart and whale safe: Reducing gray whale vessel strike risk in San Francisco Bay

Presenter: Moe Flannery, California Academy of Sciences, mflannery@calacademy.org;
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San Francisco Bay (SF Bay) is a highly urbanized estuary with intense vessel traffic comprised of commercial ships, passenger vessels, fishing vessels, and recreational boats. In 1990,California enacted the Oil Spill Prevention and Response Act which created Harbor Safety Committees in the state's major ports to plan for safe navigation and operation of tankers and barges and reduce risk of accidents. Committee members include commercial fishers, ferry operators, pilots, pleasure boat operators, port authorities, state agencies, U.S. Coast Guard, and other stakeholders. These committees also provide a unique venue for sharing information about large whales that utilize the same areas as vessel traffic. Between 2018–2025, 43% (30 of 70)gray whales necropsied in SF Bay and adjacent coastal areas died due to suspected vessel interactions. Prompted by this mortality data, the SF Harbor Safety Committee created a Marine Mammals Subcommittee to proactively develop innovations, strategies, and best practices that reduce the risk of strikes to whales while maintaining navigational safety. In 2026, the subcommittee launched the Whale Smart program, a specialized training program that educates commercial vessel operators (such as passenger vessels) on how to identify and navigate safely around gray whales. Additionally, the team partnered with the Benioff Ocean Science Laboratory's Whale Safe program to install an advanced AI-powered network, including WhaleSpotter thermal cameras. This system scans bay waters up to two nautical miles away and automatically flags whale blows or heat signatures, providing real-time alerts that allow mariners to slow down or reroute. This collaboration balances conservation needs with safety imperatives and highlights the effectiveness of efforts to bring together diverse stakeholders to achieve conservation goals. The results in SF Bay can serve as a scalable model for balancing maritime safety and wildlife conservation in heavily urbanized waterways globally.

Poster Presentation | California

Successful pilot deployment of LIMPET (SPLASH10-292A) biologging tags on gray whales (*Eschrichtius robustus*) in San Francisco Bay

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Since 2018, gray whales have been seasonally documented with increasing frequency in San Francisco Bay (SF Bay), where they are exposed to intense commercial and recreational vessel traffic. Although vessel strike risk is considered a primary threat to gray whales in SF Bay, fine-scale information on whale behavior and habitat use has been limited. To address this knowledge gap, The Marine Mammal Center and the University of California, Santa Cruz conducted a pilot study in June 2026 to evaluate deploying multi-day biologging tags on gray whales in this urban environment. We successfully tagged two gray whales with LIMPET (SPLASH10-292A) tags from a 7-m research vessel (two of two deployment attempts). Tags remained attached for five and seven days, providing continuous movement and dive data. Concurrent drone operations provided photogrammetry and thermal imagery, while biopsy samples supported complementary health and ecological investigations. A veterinary pathologist provided expertise on wound assessment and animal welfare throughout the study. Analyses indicated that both whales spent approximately 90% of tagged time within the upper 20 m of the water column, and 39-62% of tag locations overlapped ferry lanes. These results suggest high risk of vessel strike while gray whales inhabit SF Bay. These deployments demonstrated the feasibility of conducting tagging operations in the challenging conditions of SF Bay and the value of biologging data for quantifying exposure to anthropogenic threats. Following tag deployment, we conducted focal follows and longer-term monitoring of both tagged whales. Successful tag shedding and normal skin healing provided insight into the short-term effects of subdermal tags. Lessons learned from this pilot will inform future tagging efforts designed to improve understanding of gray whale movement, behavior, habitat use, and vessel strike risk, ultimately supporting evidence-based mitigation strategies in one of North America's busiest urban estuaries.

Acknowledgements: Moe Flannery, Julia O'Hern, Cara Field

Poster Presentation | California

Gray whale prey consumed during migratory stopovers in San Francisco Bay

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Coincident with and subsequent to a recent NOAA-declared Unusual Mortality Event (2019-2023), multiple gray whales remained for extended periods in San Francisco Bay (SF Bay), California, USA during the spring northbound migration period. In 2025, the average length of stay was 25 days with a maximum of 67 days. Observational studies from research and whale watching vessels have recorded mud plumes produced by the whales in shallow portions of the central bay (depths < 38 m) during dives of approximately 5-8 min. To determine whether the whales were successfully foraging, stomach, esophageal and intestinal contents of 11 gray whales stranded in the SF Bay Area from 2018-2026 were collected during necropsies. Of these (5 females, 6 males), the cause of death for 7 was blunt force trauma consistent with vessel strike. Prey items were detected using two complementary methods: macroscopic analysis and DNA metabarcoding. Preliminary results found ingested invertebrate prey including crustaceans (amphipods, decapods, isopods), mollusks (gastropods and bivalves), and marine worms (annelids). Other contents included algae, hydrozoans, marine plants and debris such as plastic (5-10% by volume) and significant amounts of indigestible wood. A key finding was that some prey species identified were characteristic of the SF Bay benthic infaunal community. This is the first confirmation of gray whales consuming food within SF Bay, and it provides dietary data on gray whales during a period of broad population decline. The urbanized bay offers habitat for nutritionally stressed gray whales to forage but also increases the risk of lethal vessel interaction, as there is a high degree of overlap between whales and marine traffic. The distribution, biomass, and nutritional quality (calorie density) of potential prey in the bay warrant investigation.

Poster Presentation | California

Widespread mortality and malnutrition linked to anomalous presence of gray whales within San Francisco Bay

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Gray whales (*Eschrichtius robustus*) are a historically resilient species currently experiencing population decline. Despite a migration route that passes along the entrance to San Francisco Bay, CA, USA (SFB), few records exist of gray whales entering the estuary before 2018. One notable exception occurred during the Unusual Mortality Event (UME) of 1999-2000 when gray whales were reported inside SFB. The study described here documented the abruptly elevated presence of gray whales within SFB during a subsequent period of high mortality and broad nutritional stress between 2018 and 2025. Vessel-based surveys conducted within SFB described inter-annual and seasonal trends for the years of 2023-2025. The number of gray whales within SFB trended similarly with strandings along the California coast both seasonally and annually. Body condition was also assessed for 72 of the 114 identified individuals with suitable lateral, vessel-based photographs, revealing that 68% of whales scored were in a visually poor nutritional state upon first observation in the bay with just 1% of whales scored as 'good' body condition. In comparison, for a group of 33 northbound gray whales photographed between 2018-2024 off the Monterey Peninsula, approximately 80nm south of SFB, just 12% of the whales were scored in poor condition and 30% in good condition. This suggests that whales entering SFB may be in generally poorer condition than whales not entering the bay. This study highlights the importance of ongoing geographic comparisons of migrating gray whales and provides insight into the broader population ecology and emerging conservation challenges for this species.

Poster Presentation | California

Gray whales (*Eschrichtius robustus*) in San Francisco Bay experience high mortality and have limited affiliation to known foraging groups

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Terrestrial and marine species are exhibiting distributional shifts due to climate change and resource availability. As food webs are impacted, some species have moved into areas of increased human activity, encountering anthropogenic hazards. A coastal marine species that undertakes a long migration between breeding and foraging ranges, the Eastern North Pacific (ENP) population of gray whales (*Eschrichtius robustus*) is especially vulnerable to changes. Subgroups of ENP gray whales, including the Pacific Coast Feeding Group and the (Puget) Sounders, have adapted to exploit alternative feeding grounds as prey availability declines in the Arctic. Novel to known migration phenology, gray whales have been observed seasonally since 2018 in San Francisco Bay (SF Bay), California. We evaluated subgroup identity and mortality of gray whales in SF Bay from 2018–2025 using photo-identification. Data were collected through vessel-based surveys, opportunistic effort, and community submissions. We identified 114 individual whales of which eight were matched to a subgroup, indicating gray whales utilizing SF Bay are not merely a range extension by foraging subgroups. Only four gray whales were resighted within SF Bay between years. Using photographs, 21 individuals were successfully matched to carcasses and a minimum mortality rate of 18% was determined. Blunt and/or sharp force trauma consistent with vessel strike was determined to be the cause of death for 30 of 70 carcasses, and for nine of 11 matched animals where a cause of death was determined. Sounder and PCFG matched whales were more likely to survive SF Bay than ENP individuals, though minimum length of stay did not influence mortality. This work confirms that gray whales entering SF Bay are highly susceptible to vessel strike mortality and highlights a crucial need to identify and implement adaptive management strategies to mitigate injuries and mortality as whales continue to utilize novel habitat.

Poster Presentation | California

Quantifying gray whale (*Eschrichtius robustus*) migratory movement behavior and respiration rate using focal tracking data from uncrewed aerial systems

Presenter: Naomi Scott, NOAA/NMFS Southwest Fisheries Science Center, naomi.scott@noaa.gov; **Trevor Joyce**, NOAA/NMFS Southwest Fisheries Science Center;

Over the last three years, researchers at the NOAA Southwest Fisheries Science Center (SWFSC) have collected video focal tracking data over Eastern North Pacific gray whales (*Eschrichtius robustus*) using small uncrewed aerial systems (UAS) in conjunction with SWFSC's long-running Granite Canyon gray whale abundance survey. Although focal tracking was primarily conducted for purposes of group size estimation and body condition measurement, we are currently annotating the same video data to opportunistically quantify gray whale behavioral metrics, including: 1) migratory swimming speed and trajectory; 2) surfacing interval and respiration rate; and 3) visibility through the surface. These metrics, describing three-dimensional migratory movement patterns, will be used to: 1) help refine data collection tools in the Granite Canyon population survey; 2) parameterize vessel-strike risk assessment models; and 3) estimate availability bias and factors affecting detection probability and group size bias in aerial photographic surveys and high-resolution satellite imagery surveys. This will assist in determining the feasibility of using aerial and satellite imagery surveys in future population assessments.

Poster Presentation | Range-wide

A baleen-based multi-biomarker framework for assessing gray whale ecology and physiology

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Gray whales have experienced multiple unusual mortality events (UMEs) over the past decades, raising concerns about the environmental and physiological factors influencing both individual health and population dynamics. Identifying the drivers of mortality remains challenging because most assessments rely on observations collected near the time of death and provide only a limited snapshot of an animal's condition. Baleen offers a unique opportunity to overcome this limitation by preserving a continuous, multi-month record of an individual's physiology and ecology. Here, we present an integrated approach for reconstructing gray whale health trajectories using multiple biomarkers archived in baleen. Analyses demonstrate that hormone profiles preserved in baleen reveal long-term patterns of endocrine activity, while stable isotope records provide insight into foraging ecology and resource use through time. Together, these biomarkers allow retrospective examination of physiological and ecological changes occurring over several months prior to mortality. Building on this foundation, we present preliminary analyses of mercury (Hg) concentrations measured along baleen plates. Initial results indicate that Hg concentrations increase through time and are associated with seasonal patterns as well as baleen-derived physiological and ecological markers. Statistical analyses suggest relationships between mercury levels, stable isotope values, and thyroid hormone concentrations, supporting the potential for integrating contaminant exposure, nutritional ecology, and physiological condition within a single continuously growing tissue. Collectively, these findings demonstrate the value of baleen as a multi-proxy archive capable of capturing complementary information on endocrine function, foraging ecology, and contaminant exposure. By integrating these diverse biomarkers, baleen analyses provide a powerful framework for investigating the factors that influence individual health, contribute to mortality events, and ultimately shape gray whale population dynamics. Ongoing work is exploring additional biomarkers that may further expand the utility of baleen for assessing reproduction, stress physiology, health status, and environmental exposure in gray whales.

Poster Presentation | Range-wide

Improving confidence in vessel strike diagnosis through standardized lesion assessment of gray whales (*Eschrichtius robustus)*

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Identifying vessel strike lesions and determining their contribution to mortality remain significant challenges during large whale necropsies. These challenges are compounded in cases where animals are not accessible immediately after death, as autolysis and postmortem carcass trauma can obscure or mimic vessel-inflicted antemortem blunt and sharp force trauma. Consequently, confidence in cause of death determinations may be reduced, and variability among investigators may increase. To address these challenges, a multidisciplinary working group has been established to develop standardized criteria for evaluating and classifying vessel strike lesions in gray whales (*Eschrichtius robustus*). This working group brings together stranding responders, marine mammal biologists, invited experts, and veterinary pathologists from the Pacific coast of the United States and Canada. Through collaborative review of gross necropsy findings, histopathology, and case histories, this working group is identifying lesion characteristics that distinguish antemortem and perimortem sharp and blunt-force trauma from postmortem decomposition and artifacts caused by carcass displacement. Soft tissue hemorrhage and skeletal fractures are being evaluated across confirmed and suspected vessel strike cases to develop a standardized scoring rubric. For prospective gray whale necropsies along the Pacific coast, the resulting rubric will assist stranding network partners in improving diagnostic consistency, reducing observer variability, and strengthening the quality of data used to inform management and conservation actions.

Poster Presentation | Range-wide

Advances in the development and implementation of artificial intelligence reidentification tools for gray whale (*Eschrichtius robustus*) photo-identification matching

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Non-invasive photo-identification based on natural markings is a central tool in gray whale (*Eschrichtius robustus*) research and management, used in the estimation of abundance, the tracking of demographic and biological parameters, and studies of large- and small-scale movement patterns. Manual photo-identification matching is however a labor-intensive process that is challenging to scale within and across regional catalogs. This project represents a multi-year collaboration to develop and implement Artificial Intelligence and Machine Learning (AI/ML) reidentification tools for gray whales within the web-based www.flukebook.org platform. The development of this project has progressed through multiple phases, evolving from the training of pre-existing reidentification algorithms (*HotSpotter*, *PIE*, *CurvRank*) and the implementation of ensemble models, to the development of a gray whale-specific algorithm, *whaleridgeFindR*, focused on long-term stable features of the dorsal ridge. The current operational model, *MiewID*, leverages state-of-the-art deep learning, yielding increased computational efficiency and approximately 96% matching accuracy over the top-20 search results. Collaborators on this project have imported extensive datasets to www.flukebook.org covering the western North Pacific and eastern North Pacific gray whale populations, and the Pacific Coast Feeding Group, facilitating cross-catalog reconciliation and studies of population connectivity. While these tools have the potential to streamline workflows, challenges remain regarding human interpretability of deep learning outputs, and the possible overweighting of mutable features like pigmentation and scarring patterns over more stable long-term diagnostic markings. Future efforts will focus on expanding algorithmic matching to aerial drone imagery, while also maintaining the essential role of human expertise in ensuring catalog integrity.

Poster Presentation | Range-wide

From connectivity science to corridor-scale conservation: Advancing collaborative protection of a North American Eastern Pacific Blue Corridor

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Gray whales migrate annually between breeding grounds in Baja California, Mexico and feeding areas in the Arctic, along a nearshore pathway that exposes them to cumulative risks: entanglement in fishing gear, vessel strikes, underwater noise, and climate-driven shifts in prey and habitat. Despite decades of research documenting gray whale migration and the growing understanding of threats across their range, conservation and management actions remain fragmented across jurisdictions, sectors, and management frameworks. National marine mammal protection laws, marine protected areas, and voluntary industry measures provide an important foundation for protection but do not yet function as an ecologically connected network across the full migration route. As a result, conservation gains in one region may be offset by threats elsewhere.

Building on the collaborative reports Protecting Blue Corridors (2022) and Blue Corridors of the Eastern Pacific (2023), and the supporting platform BlueCorridors.org, WWF and more than 60 partners have transformed over three decades of data into decision support tools for conservation and policy. Developed with scientists, NGOs, governments, and technology experts, these tools visualize whale movements alongside threat layers, priority habitat, and existing protections.

This poster presents WWF's vision for a North American component of an Eastern Pacific Blue Corridor, encompassing the gray whale's full migratory route. The approach focuses on connecting habitats and reducing cumulative risk across the migratory cycle. We aim to complement and strengthen existing conservation efforts by identifying gaps; aligning with ongoing research, conservation, management, and advocacy; and supporting Indigenous leadership, community engagement, and private-sector solutions at the scale of whale migration. This poster explores how WWF is investing in and scaling these efforts through a regional approach and how lessons learned could inform co-designed, corridor-scale conservation of gray whales and baleen whales across the Northeast Pacific.

Poster Presentation | Range-wide

Habitat suitability modeling for gray whales along the US West Coast

Presenter: Anna Nisi, University of Washington, California Marine Sanctuary Foundation, nisianna@gmail.com, anisi@uw.edu;
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Understanding patterns of species distributions and habitat suitability is essential for conservation and management. For gray whales (*Eschrichtius robustus*), as well as all other highly migratory marine species, developing dynamic habitat suitability models can help characterize exposure to anthropogenic threats, such as vessel collisions and fishing gear entanglement, and can help inform spatially- and temporally-explicit management interventions, such as vessel speed reduction programs. Here, leveraging open datasets of gray whale locations and integrated species distribution models, we developed habitat suitability models for gray whales at 10km spatial resolution and weekly temporal resolution on the West Coast of the United States, from California to the Olympic Peninsula of Washington. These models were able to recreate patterns of gray whale migrations and performed well when predicting independent data. In this poster, we will present monthly map predictions for gray whales, highlight areas of high predicted overlap between gray whales and large vessels, compare our results, which combine data across feeding groups, with other modeling efforts for the Pacific Coast Feeding Group, and discuss the degree to which existing vessel speed reduction programs overlap in time and space with areas of high predicted gray whale habitat suitability.