Glacier Bay & Icy Strait Humpback Whale Population Monitoring: 2024 Update

National Park Service
U.S. Department of the Interior

Glacier Bay National Park & Preserve

Female #2589, one of 24 mothers documented in the study area in 2024, surfaces with her calf at the mouth of Adam's Inlet on June 10th.

Background

Migratory humpback whales (*Megaptera novaeangliae*) use the waters in and around Glacier Bay National Park and Preserve (GBNPP) in southeastern Alaska (SEAK) as spring, summer, and fall feeding habitat. The majority spend the winter breeding season in Hawai'i but at least 10% migrate to Mexico. Commercial whaling decimated these populations until the mid-1970s. Most whales return to the same feeding areas where their mother brought them as a calf. This strong maternally directed site fidelity drove population growth until the unprecedented 2014-2016 NE Pacific marine heatwave (PMH) caused an abrupt crash in the SEAK population (Gabriele *et al.* 2022) and throughout the North Pacific (Cheeseman *et al.* 2024) and highlighted that climate change is a growing threat to this species.

This report summarizes results from 2024, the 40th consecutive year of GBNPP's humpback whale monitoring program in Glacier Bay and Icy Strait. The initial impetus for this program stemmed from concern in the 1970s that increased vessel traffic in Glacier Bay may have caused many whales to abandon the bay (Jurasz and Palmer 1981). Understanding the condition of the whale population is essential to making informed management decisions. GBNPP's decades-long annual monitoring program is unique within Alaska and has produced one of the world's longest and most complete time-series of data on a baleen whale population.

Key Findings from 2024

- Whale abundance in Glacier Bay-Icy Strait increased after a four-year period (2020-2023) in which abundance had remained relatively flat, however numbers remain ~30% lower than before the 2014-2016 NE Pacific marine heatwave (PMH).
- We documented a "baby boom" with a record-high number of mother/calf pairs (n = 24). This year's crude birth rate (12.8%) was one of the highest on record; not only reaching, but exceeding, the pre-PMH mean (9.2%).
- Several of this year's mothers had unusually long calving intervals (9-11 years) and seven females had their first known calves at ages much older than the average for this population. These delays are likely attributable to the PMH and its aftermath.
- For the second year in a row, we received several reports of killer whales "attacking" or "harassing" humpback whales and in June a humpback calf acquired injuries consistent with a killer whale predation attempt, which is extremely rare in Southeast Alaska.
- An unusually high number of whale-vessel collisions were reported in Icy Strait. In addition, two humpback whales were found dead: 1) an unidentified juvenile male near Elfin Cove had injuries consistent with a vessel collision and 2) 23-year-old pregnant female #1731 had injuries suggestive of blunt force trauma but her cause of death could not be confirmed.

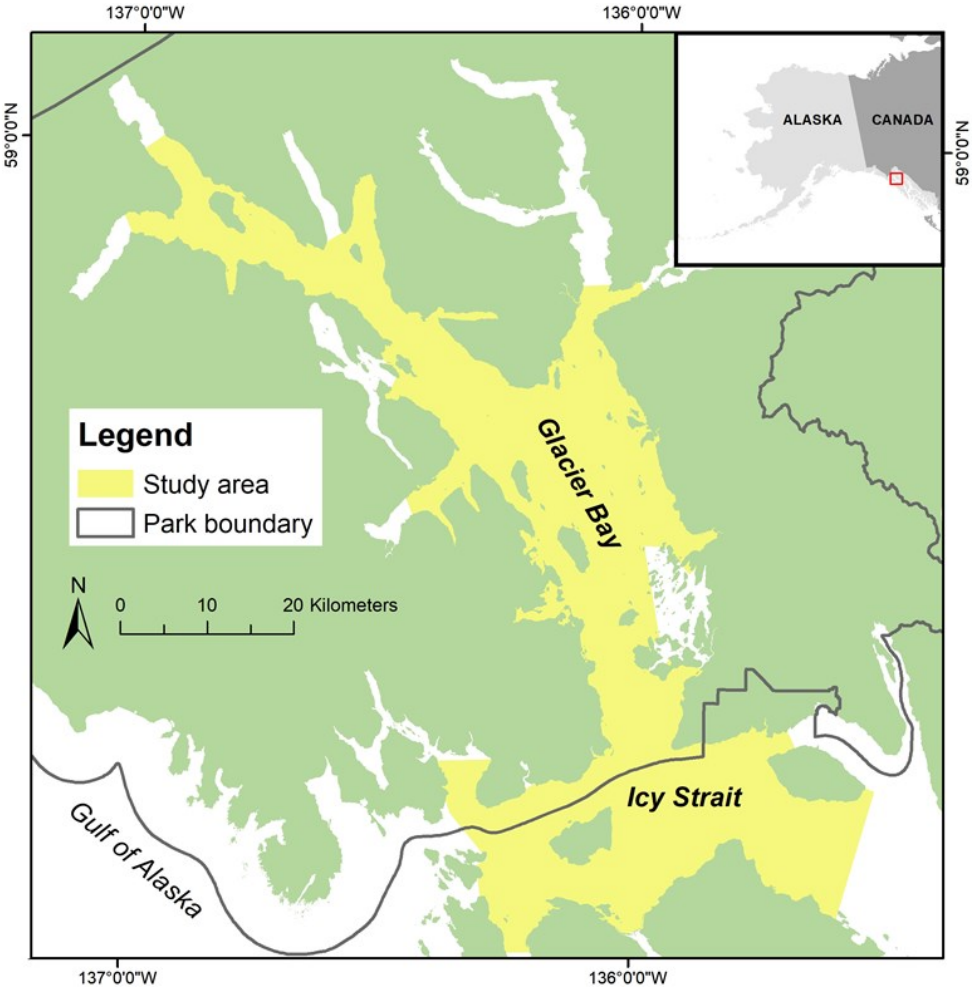


Figure 1. Study area in Glacier Bay and Icy Strait, Alaska.

Figure 2. The stable, distinct coloration and shape of a whale's flukes allow researchers to track individuals over time. Each whale receives a unique identification number. For example, the whale with black flukes is adult female #1834 (left) and the whale with white flukes is 30-year-old male #1293 (right).

Figure 3. R/V *Sand Lance* underway with research team. (Photo © UNESCO /Mark Kelley)

Where & How Do We Gather Data?

Every year since 1985, GBNPP biologists have conducted small boat-based photo-identification surveys in GB-IS (Figs. 1, 2) 4-5 days per week from June 1 – August 31 (core period) with less frequent surveys in the spring and fall (see Gabriele *et al.* 2017 and Neilson *et al.* 2018 for detailed methods). Our primary goal is to describe the distribution and abundance of humpback whales in a way that is comparable between years. We use a mixed approach in which we target 'hotspots' where whales have been reported or are known to frequent, while also surveying areas where whales may or may not be present.

Between May 1-October 4, 2024, we searched for and photographed humpback whales from the 5.8-m *R/V Sand Lance* (Fig. 3).

We took photographs of each whale's flukes and dorsal fin with a Nikon D7200 digital camera equipped with a 80-400mm zoom lens.

We compared these photos to previous GBNPP photos to determine the identity and past sighting history of each whale. We used the Happywhale.com automatic matching system to identify whales that had not been sighted before in GB-IS. We entered sighting data, including group composition and behavior state, in a database shared with the University of Alaska Southeast in Sitka. We calculated the crude birth rate (CBR) as # calves/total # whales identified during the core monitoring period.

Other information that we collected opportunistically included: 1) sloughed whale skin for genetic analysis and 2) opportunistic observations of whales' body condition (*e.g.,* emaciation), body size (*e.g.,* small), and probable whale prey. Whale distribution data from surveys form the basis of recommendations to the GBNPP superintendent on where and when 'whale waters' vessel speed and/or course restrictions should be implemented to protect humpback whales from vessel collisions and disturbance.

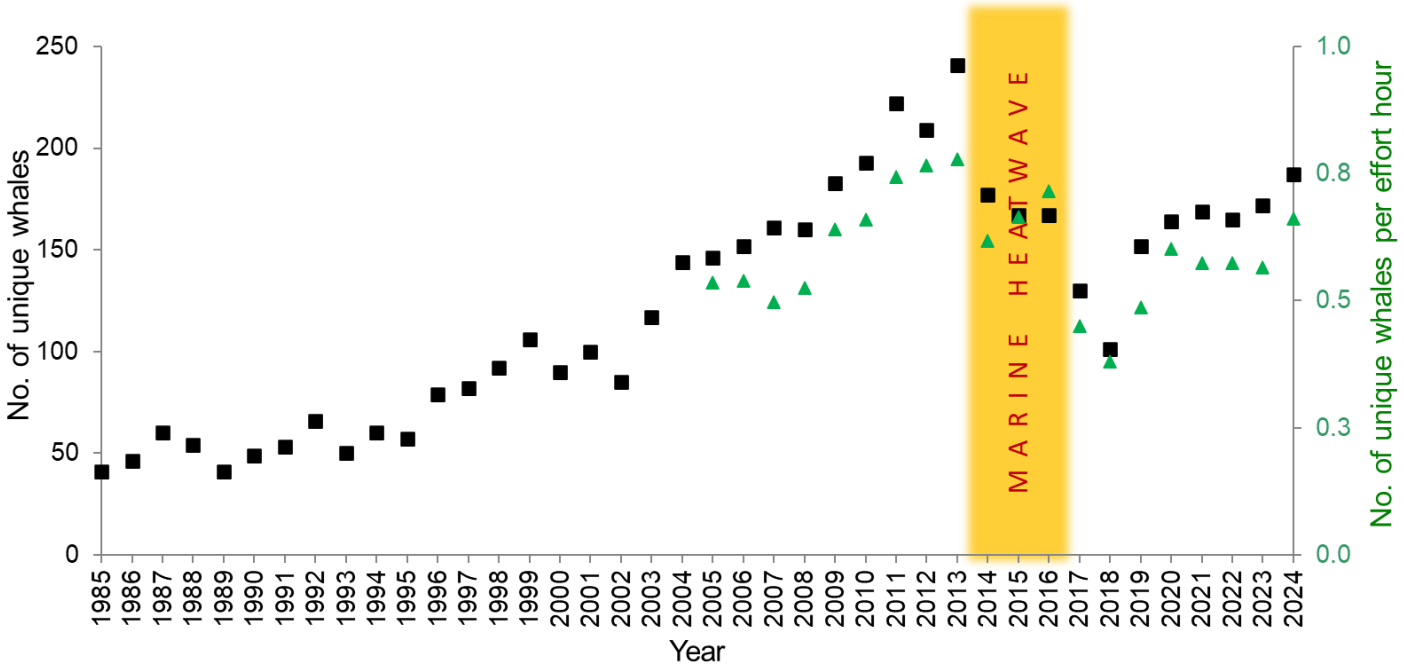


Figure 4. Relative abundance metrics for Glacier Bay & Icy Strait. Annual whale counts (black squares) and annual whale counts corrected for survey effort (green triangles) from June 1 – August 31, 1985–2024. A marine heatwave dominated the NE Pacific Ocean during the period highlighted in orange. Whales/effort hour is not available for 1985–2004.

What Did We Find in 2024?

Survey Effort

Our survey effort during the June 1 – August 31, 2024 core period (283 h) was slightly below average compared to 2005–2023 (mean 286.2 h, SD = 21.8 h) but within the range for survey effort in these years (233–323 h). We strive to maintain consistent survey effort each year but it inevitably fluctuates as a result of factors such as weather, staff availability, and unexpected events (*e.g.,* mechanical issues and marine mammal strandings).

Whale Counts

Between June 1 and August 31, we documented 187 unique humpback whales (Fig. 4, black squares) in GB–IS. This raw count represents a 8.7% increase compared to 2023. Correcting the count for survey effort reveals a 16.9% increase compared to 2023 (Fig. 4, green triangles). These increases are encouraging after a four-year period (2020–2023) in which total abundance in GB–IS remained relatively flat and depressed following the 2014–2016 Northeast Pacific marine heatwave (PMH). The PMH caused widespread and prolonged ecological disruption (Arimitsu *et al.* 2021, Suryan *et al.* 2021) and a significant decline in the North Pacific humpback whale population (Cheeseman *et al.* 2024).

While our 2024 counts indicate an upward trend in whale abundance, the population has not recovered to pre-PMH levels. In Glacier Bay, both the raw and effort-corrected counts increased compared to 2023. However, effort-corrected abundance (0.64 whales/effort hr) remains 26.3% lower than before the PMH, when it peaked at 0.87 whales/effort hr in 2012. In Icy Strait, the raw count decreased compared to 2023, however the effort-corrected count reveals a 6.1% increase. Similar to GB, effort-corrected abundance in IS (1.33 whales/effort hr) remains 33.6% lower than before the PMH, when it peaked at 2.01 whales/effort hr in 2013.

Outside of the core monitoring period, we documented five more whales in IS for a grand total of 192 unique whales in 2024. Across all dates and not including calves, four whales were new to the study (one in GB, three in IS).

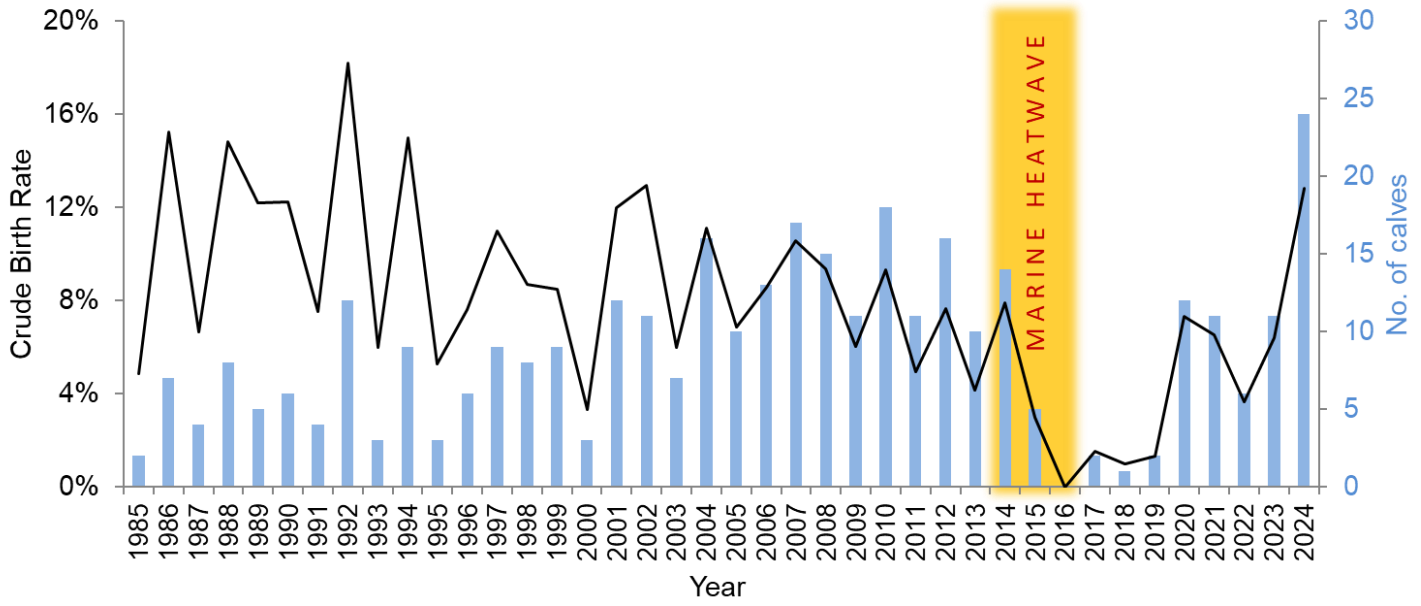


Figure 5. Crude birth rate (black line; # calves/total # whales) and annual number of calves (blue bars) in GB-IS from 1985-2024.

Reproduction & Juvenile Survival

We documented 24 mother/calf pairs, the highest number since the monitoring program began in 1985, yielding a crude birth rate (CBR) of 12.8% (Fig. 5). For the first time in many years, this year's CBR not only reached, but exceeded, the pre-PMH mean (9.2%). The CBR has only exceeded 10% in a handful of years during the study. The high CBR also reflects that the total whale count is about 30% lower than it would have been pre-PMH.

Research suggests that a high humpback whale calving rate in a given year reflects oceanographic conditions in the prior two feeding seasons (Frankel *et al.* 2021). Thus, this year's high CBR likely reflects favorable feeding conditions in 2022 and 2023 (Moran *et al.* 2025) that allowed many females to regain body condition sufficient to calve successfully. This year's cohort of mothers contained several adult females with unusually long calving intervals (9-11 years). These are much longer than the typical 2-3 year calving interval for this population (Baker *et al.* 1987; Gabriele *et al.* 2017). The long intervals documented since the PMH are likely to be a response to physiological stress (Kraus *et al.* 2007, Kershaw *et. al.* 2021), insufficient prey resources to support conception or pregnancy, or may indicate increased neonatal mortality before or during the migration to Alaska.

Seven females had their first known calf in 2024 at ages much greater than the average of 12.1 years documented for this population using data from 1985-2014 (Gabriele *et al.* 2017). One first-time mother was age 16, two were age 17, and the others were at least 12-20 years old. This suggests that female age at first calving may have increased due to the PMH and its aftermath.

Most of the 2024 calves appeared to be in relatively good body condition with a healthy amount of nuchal fat, but several had questionable skin conditions of unknown etiology (Fig. 6A). Two calves had dorsal fins that appeared to have been damaged/severed (possibly from vessel collisions) (Fig. 6B).

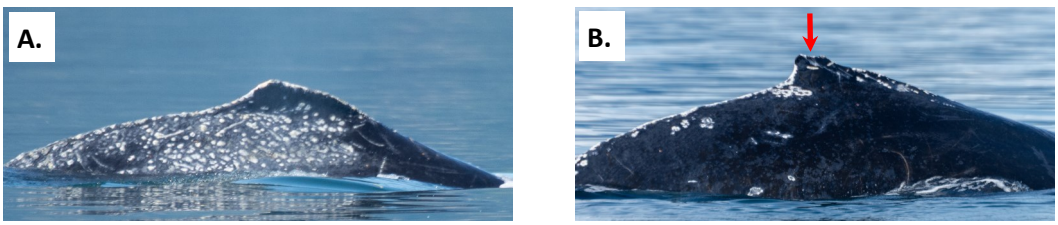


Figure 6. (A) #2157's calf with an unusual skin condition; (B) #1832's calf with a damaged dorsal fin, possibly from a vessel collision.

Figure 7. #2589's calf: (A) June 10th before injury; (B) July 23rd with fresh propeller injury; (C) September 10th with visible healing.

On June 30th, #1421's calf struck the hull of a whale watching vessel near Mud Bay while the vessel was drifting with its engine off (D. Gray, pers. comm.). The calf did not appear to be injured and when we documented it on July 24th it appeared healthy with no visible injuries. #2589's calf, which frequented lower Glacier Bay, acquired a superficial vessel propeller injury on its flank in June or July (Fig. 7).

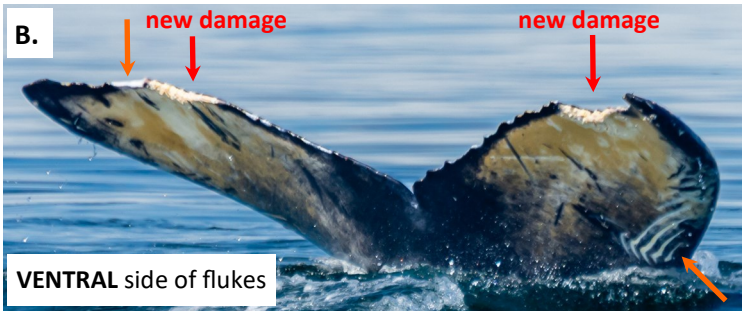
Although calf and juvenile survival have improved following abrupt declines, two of the 24 calves were not with their mothers on our final observations for the season. Female #1990 was sighted without her calf in a 10-minute observation on September 9th and female #1846 was sighted without her calf in a 35-minute observation on September 26th. In the fall, an absent calf could indicate weaning or temporary separation rather than calf mortality. Several calves born between 2019-2023 have been re-sighted in subsequent years in the study area or elsewhere, indicating increased juvenile survival. In contrast, only one calf born in 2014-2018 is known to have survived past its calf year (Gabriele *et al.* 2024).

For the second year in a row, we received several reports of killer whales "attacking", "harassing", and/or interacting with humpback whales in the study area. We are unaware of any successful killer whale predation attempts on humpback whales in SE Alaska and observations of attempted predation are extremely rare, therefore the sudden increase in these types of reports in 2023 and 2024 is notable.

In mid-July, a charter fishing captain reported that a group of approximately six killer whales attacked a humpback whale mother/calf pair in Mud Bay in Icy Strait. He observed the mother holding the calf at the surface on her head and the calf looked "pretty roughed up" (M. Pattison, pers. comm.). He did not see any blood and the outcome of this interaction is unknown. No photos or video were taken.

In addition, we received two reports that did not involve calves: 1) In July, an off-duty park ranger reported that a group of at least four killer whales appeared to attack a single humpback whale in Beardslee Entrance in Glacier Bay. The interaction went on for hours, however the observer was too far away to see details and no photos or video were taken (N. Tate, pers. comm.); 2) On Sept 18th, we received a report that a group of killer whales near Pinta Cove in Icy Strait appeared to be "attempting to drown or kill" a humpback whale. The killer whales were "practically jumping on top of it" and there was another humpback "trying to defend it with its tail" (T. Nelson and J. Proctor, pers. comm.). No blood was observed and the outcome of this interaction is unknown.

Whale #397's calf (#2791), which frequented Icy Strait, acquired new fluke injuries in June that appear likely to have been from a killer whale attack. On June 13th, a whale watching captain documented #2791 with healed tooth rake marks on its ventral right fluke typical of a failed killer whale predation attempt (Fig. 8A) (B. Pettie, pers. comm.). These types of scars are not unusual and in most cases, are thought to be acquired at or near the wintering areas when calves are younger (Steiger *et al.* 2008). The calf also had a chunk of tissue missing from the trailing edge of its left fluke that may have been from the same interaction (Fig. 8A). By June 28th, #2791 had acquired new injuries to the trailing edges of both flukes (Fig. 8B). A July 16th photo of the right dorsal fluke shows killer whale tooth rakes near the margin of the new injury, indicating that it was nearly a clean bite (Fig. 8C).



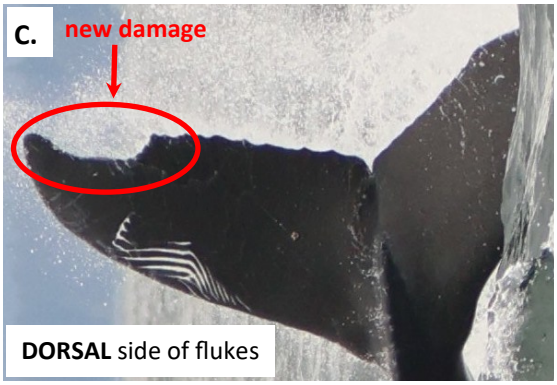


Figure 8. #397's calf (#2791)

(A) **June 13th** showing healed killer whale tooth rakes on ventral right fluke and tissue missing from trailing edge left fluke (photo courtesy B. Pettie);

(B) **June 28th** showing new damage to the trailing edges of both flukes (J. Neilson/NPS);

(C) **July 16th** showing dorsal side of right fluke—note killer whale tooth marks near the margin of the new injury (photo courtesy B. Pettie).

Site Fidelity

Between June 1 and August 31, 74% (n = 138) of whales were resighted over a span of ≥20 days (range 21–88 days) and 16% (n = 30) were considered 'transient' (sighted one day only). During and after the PMH, we documented a general trend of low residency (2014–2018: mean = 51%) and high transience (2014–2018: mean = 33%). However, since 2019 the residency and transience rates have been more similar to before the PMH (2005–2013: mean residency = 68%; mean transience = 22%). The resumption of a pattern of high residency and low transience presumably reflects the return of favorable feeding conditions in GB–IS since the PMH. Five of the 24 mother/calf pairs (21%) were transient and one of the mothers (#1783) had not been documented previously in the study area.

Adult male #159 (age unknown) returned to the study area for the 38th consecutive summer, giving him the longest unbroken sighting record of any whale in this study. Furthermore, #159's earliest known sighting was in GB in 1974 (Sea Search Ltd., unpublished data) and his 51-year sighting history (1974–2024) is the longest known span for any living whale in GB–IS (Fig. 9).

Tissue Samples

We collected 10 sloughed skin samples from 10 unique individuals, including four calves. Since 1996, we have collected 411 sloughed skin samples which are analyzed by the Cetacean Conservation and Genomics Lab at Oregon State University for sex determination, mitochondrial DNA haplotype, and nuclear DNA genotyping.

Figure 9. (A) #159 in 1974 (photo courtesy C. Jurasz/Sea Search Ltd; (B) #159 in 2024 (C. Gabriele/NPS photo).

Physical Condition

Twenty (11%) of the 187 whales we observed during the core monitoring period appeared to be "skinny" based on physical indicators such as visible scapulae, an overall "angular" appearance, and/or the presence of a post-cranial depression. Over half (n = 12) were lactating females which is not surprising given the high energetic cost of lactation (van Aswegen *et al.* 2025). Although our observations are opportunistic, fewer whales were judged as emaciated compared to 2017–2023 and this year's rate was similar to 2016 (Fig. 8), when we first started to notice whales in poor body condition in the summer following the PMH. Fewer skinny whales observed in recent years presumably reflects that whales regained their body condition and are finding sufficient feeding conditions.

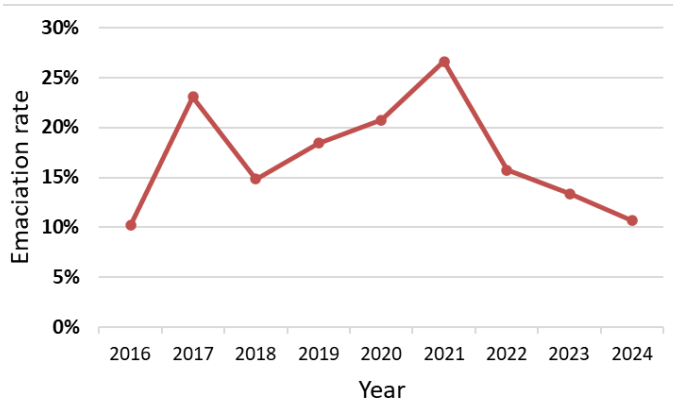


Figure 8. Rate of emaciation (number of "skinny" whales observed June 1–August 31 divided by the total number of whales during this period) in GB-IS whales in 2016–2024.

Adult female #250 (age ≥45) was emaciated as a mother in 2022, not documented in GB-IS in 2023, and then extremely emaciated in 2024 through our last observation on August 16th (Fig. 10). Van Aswegen *et al.* (2025) found that females may require more than one feeding season to recover their body condition; however in #250's case, it is unclear why she remains so emaciated three years after calving.

Figure 10. Emaciated adult female #250 on July 16, 2024; the bulge on her right side is her rib cage and she has an overall "bowed" appearance due to a lack of body fat.

Whale Prey and Feeding Behavior

Whales in GB-IS predominantly feed on forage fish, although krill may be targeted in parts of Glacier Bay. Opportunistic observations of near-surface forage fish in 2024 documented the presence of capelin, sand lance, and herring (*e.g.,* Fig. 11) near feeding humpback whales in the study area.

Figure 11. (A) Adult male #1816 feeding on herring at the mouth of Idaho Inlet on August 1, 2024. He repeatedly laid at the surface for several seconds while sculling his pectoral fins back and forth, followed each time by a sudden lunge (B).

Sand lance may have been more abundant in Glacier Bay than in recent years based on numerous observations of exceptionally large schools in GB, especially in the Lower Bay in early to mid August. GBNPP began a forage fish monitoring project in 2024 which should illuminate trends in future years.

We suspect that herring were relatively abundant in Icy Strait for the second year in a row, which is consistent with the higher effort-corrected whale count there in 2024. On five occasions between June 14–August 1, we heard the distinctive underwater humpback whale "feeding call" through the research vessel hull while near whales feeding in IS. This call is typically associated with whales feeding on herring. There were also several observations of humpback whales group bubblenet feeding in IS in 2024, a behavior typically associated with whales that are feeding on herring, however we received fewer reports of this behavior than in 2023.

On July 10th, while surface lunge feeding, adult female #1470 opened her mouth and released two seabirds that appeared to be mergansers based on a photo of the incident (N. Drumheller, pers. comm.). We have

previously documented gulls and murrelets being spit out and/or ingested by humpback whales but this was our first detection of mergansers.

On July 17th, we observed adult male #1808 near Strawberry Island in GB holding his mouth open for 15+ secs at the surface (Fig. 12), a behavior known as "trap-feeding" (McMillan *et al.* 2018) that we have only documented a few times in the study area.

We collected four opportunistic samples of forage fish near feeding whales (August 10: capelin near Finger's Bay; August 9: sand lance in Bartlett Cove (two separate samples); August 14: capelin near Garforth Island.) These opportunistic samples, along with additional samples collected by the newly formed GBNPP Forage Fish Monitoring Program, are analyzed by our collaborators at the U.S. Geological Survey for body condition and algal toxins (which when consumed, can bioaccumulate in apex predators like humpback whales and seabirds).

Whale/Human Interactions

No vessel collisions were reported in Glacier Bay in 2024 but an unusually high number (n = 5) were self-reported in Icy Strait (NOAA Alaska Region unpublished data). In recent summers, 0-2 collisions per year have been reported in IS, therefore the sharp increase in reports in 2024 is concerning, though we commend the operators for reporting the incidents. All five reports occurred over a ~2 week window between June 13-July 1. Two collisions involved whale watching boats that were shut down or idling while observing bubblenetting whales when they were struck by whales. In another case, a 5.8-m (19') cruise-ship tender inadvertently transited through a bubble-net at ~8-13 kts. One whale was struck by the vessel and another immediately breached, then the whales left the area. None of these incidents appeared to cause injuries to the whales or vessel damage.

On June 17th, a 16.5-m (54') catamaran transiting at 24 kts through Icy Strait struck an adult-sized humpback whale near Point Adolphus. The whale surfaced directly in front of the vessel and the captain immediately shifted into neutral and turned sharply. The vessel was estimated to be going ~15 kts at the time of impact, which was described as "violent". The whale resurfaced and swam away with no visible injuries, however its fate is unknown.

On June 26th, a 6.7-m (22') private vessel struck an unknown marine mammal (that we presume was a humpback whale) while transiting at ~22 kts in South Inian Pass. The collision caused minor propeller damage and the fate of the animal is unknown.

Under-reporting of collisions is a known problem (Neilson *et al.* 2011) and therefore the actual number of collisions in the study area in 2024 was probably higher; for example, based on frequent sightings of #2589 and her calf in GB in June and July, the calf's fresh propeller on July 23rd (Fig. 7) clearly resulted

Figure 12. Whale #1808 trap-feeds near Strawberry Island in Glacier Bay on July 17, 2024.

from a collision consistent with a small or medium sized vessel, most likely an unreported strike in GB.

In early July a juvenile male humpback whale was found dead near Elfin Cove in Cross Sound (just west of Icy Strait) and a necropsy revealed skull and spinal injuries consistent with a vessel collision (Fig. 11). The timing and location of this mortality could not be correlated with any of the reported collisions, therefore it is presumed to be from an unreported strike. We were unable to match the whale's flukes to any known individuals.

On July 22nd, 23-year-old pregnant female #1731 was found floating dead in Icy Strait west of Point Adolphus. A necropsy found evidence that suggested blunt force trauma injuries, however it was not possible to confirm the cause of death. Again, the timing and location of this mortality could not be correlated with any reported collision, therefore if this whale was struck it was unreported.

We continue to witness rapid growth in the number of commercial whale watching vessels in non-park waters in Icy Strait, especially around Point Adolphus and the Pleasant Island reef. Near Juneau, the whale watching fleet has also grown rapidly in recent years. Strengthening whale watching regulations and encouraging operator participation in voluntary best practices were recommended to ensure the sustainability of the industry (Schuler *et al.* 2019). In 2024, the park increased our outreach efforts to help prevent whale strikes (*e.g.,* Glacier Bay Supports Efforts to Prevent Whale Strikes) and met with Hoonah whale watching operators to discuss best practices.

Two entanglements in fishing gear were reported in or near the study area in 2024. On May 22nd, an adult humpback whale became entangled and anchored in commercial longline shrimp pot gear near Pelican. On May 23rd, the fisher cut off most of the gear and no entangled whales were subsequently reported in the area. An estimated 37-m (120') length of line was not recovered and was assumed to still be in the whale's mouth, but no resights of this whale were received (NOAA Alaska Region unpublished data).

On September 8th, one animal from a presumed mother/calf pair snagged a sport halibut fishing gear monofilament line in Beardslee Entrance. As the entangled whale started to swim away from the skiff, the fisher cut the line and then a whale was seen rising rapidly to the surface nearby. On September 9th we surveyed this area and did not observe any entangled whales and no other reports of an entangled whale were received.

Whale Waters

Three temporary whale waters areas with 13-knot vessel speed limits were designated in 2024 to protect shifting distributions of whales. All three areas were located on the east side of mid GB and around the entrance to the East Arm. From June 28 – September 10, whales concentrated on the east side of lower GB and a 13-knot vessel speed limit was implemented. Whale numbers on the west side of lower GB were not as high and a higher speed limit (20-knots) was maintained through September 30th. It is unusual for whale distribution in lower GB to be so consistently different between the east and west sides.

Figure 11. A dead juvenile humpback whale near Elfin Cove. A necropsy revealed broken bones consistent with a vessel collision. (NOAA Fisheries' Marine Mammal Health & Stranding Response Program Permit No. 24359).

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