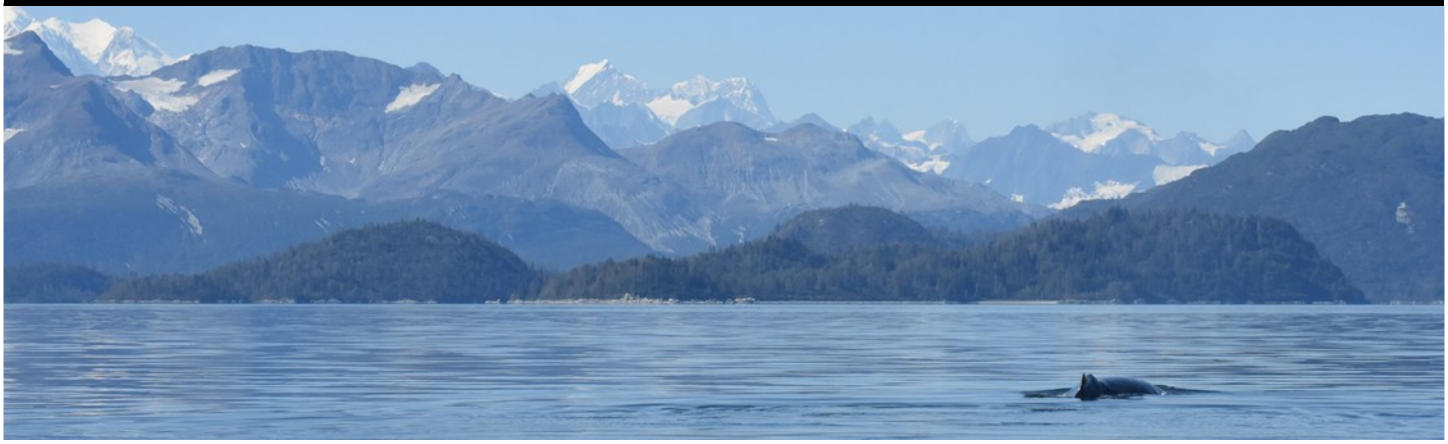
Glacier Bay & Icy Strait Humpback Whale Population Monitoring: 2019 Update

National Park Service
U.S. Department of the Interior

Glacier Bay National Park & Preserve



Twelve-year-old whale #2034 surfaces in Glacier Bay, September 2019.

Background

Migratory humpback whales (*Megaptera novaeangliae*) use the waters in and around Glacier Bay National Park and Preserve (GBNPP) in southeastern Alaska as spring, summer, and fall feeding habitat. The majority of these whales spend the winter breeding season in Hawaii, although a small proportion migrates to Mexico. By the mid-20th century, commercial whaling had decimated these populations but they have since recovered to the point that only the Mexico population remains listed as threatened under the Endangered Species Act. Individual whales return year after year to the same feeding areas where their mother brought them as a calf and this strong maternally directed site fidelity has driven population growth over time.

This document summarizes results from GBNPP's humpback whale monitoring program in Glacier Bay and Icy Strait (GB-IS) in 2019, our 35th consecutive year of consistent data collection in June-August. 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 & Palmer 1981). Understanding the condition of park resources is essential to making informed management decisions. GBNPP's 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 2019

- Following a period of dramatic decline in whale abundance in 2014-2018, we documented 149 humpback whales, a 48% increase compared to 2018.
- Correcting our whale counts for survey effort (slightly above average in 2019 at 312 hours) reveals a 25% increase in abundance compared to 2018.
- With or without effort correction, whale abundance remains almost 40% lower than at its peak in 2013.
- In Glacier Bay proper, the number of whales increased more than threefold (167%) from 45 whales in 2018 to 120 whales in 2019. In Icy Strait, the number of whales increased only slightly (6%) from 72 to 76 whales.
- These increases are partially due to the return of 12 well-known whales that had been missing in 2018, but 29 of 66 whales with a history of strong site fidelity to Glacier Bay and Icy Strait remain missing.
- Only two mother/calf pairs were documented (crude birth rate CBR = 1.3%) making 2019 the sixth consecutive year of low reproductive success compared to 1985-2013 (average CBR 9.3%).
- Forage fish, especially capelin in Glacier Bay, appeared more abundant than in recent years. Favorable foraging conditions are likely responsible for the comparatively long whale residence times we observed in 2019.
- The GB-IS humpback whale population appears to be beginning to rebound following a 5-year period (2014-2018) of ecological disruption attributed to the 2014-2016 Northeast Pacific Ocean marine heatwave.

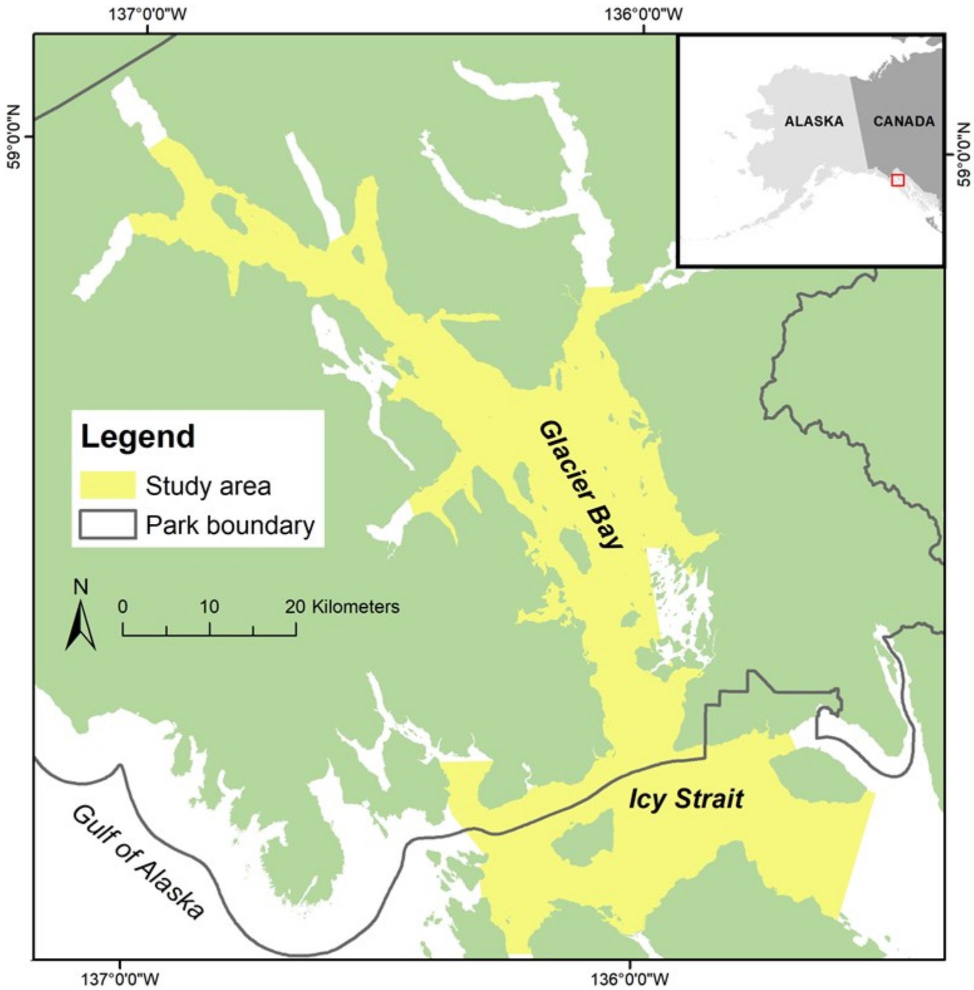


Figure 1. Study area in Glacier Bay and Icy Strait, Alaska.

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 24-year-old male #1293 (right).

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

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 whale sightings have been reported or are known to frequent, while also surveying outlying areas where whales may or may not be present.

Between April 29 and October 22, 2019, we searched for and photographed humpback whales from the *Sand Lance*, a 5.8-m motorboat (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 and to fluke photos from other areas in SE Alaska to determine the identity and past sighting history of each whale. For the first time, we used the Happywhale.com matching system to identify whales that had not been sighted before in GB-IS. We entered sighting data in a database shared with the University of Alaska Southeast in Sitka, Alaska. 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. We also recommended to the GBNPP superintendent where and when 'whale waters' vessel speed and/or course restrictions should be implemented to protect humpback whales from collision and disturbance.

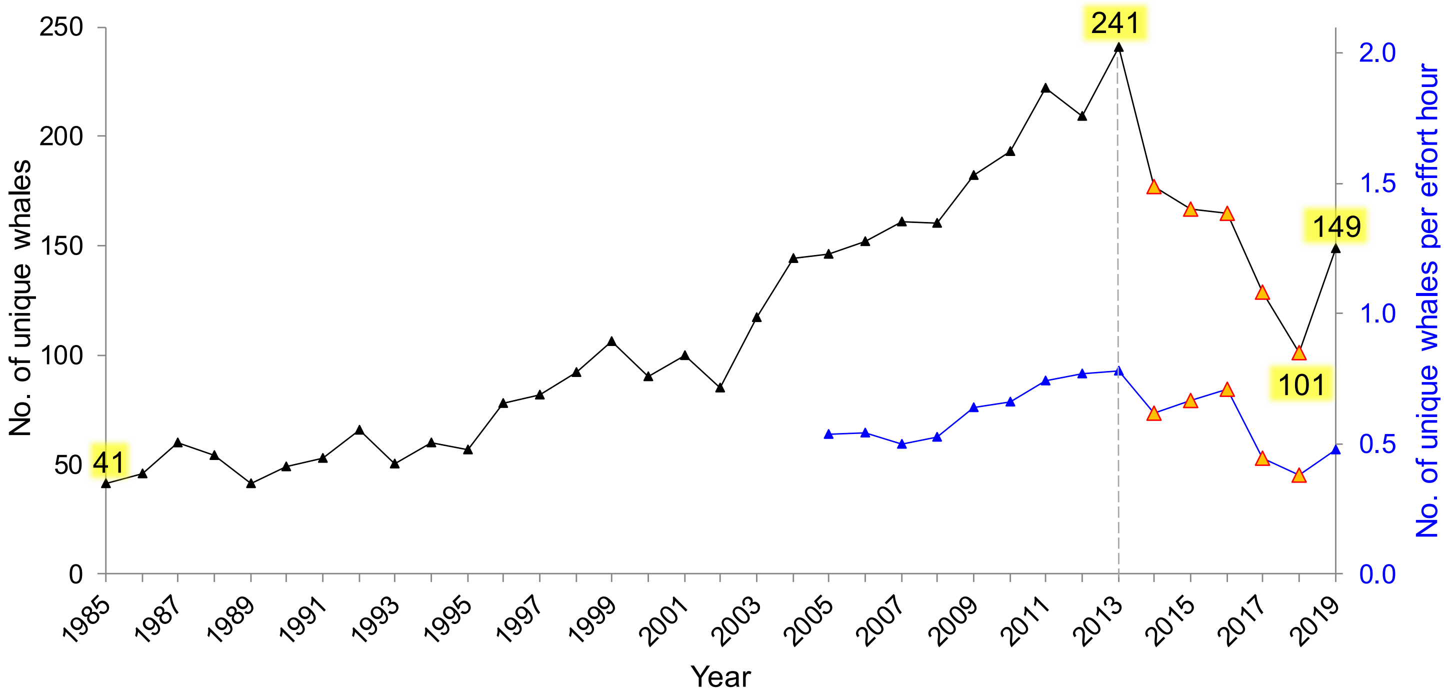


Figure 4. Relative abundance metrics for Glacier Bay & Icy Strait. Annual whale counts (black) and annual whale counts corrected for survey effort (blue) from June 1 – August 31, 1985–2018. Abundance increased through 2013 (dashed line), then abruptly declined in 2014–2018 (orange), followed by an uptick in 2019. Whales/effort hour is not available for 1985–2004.

What Did We Find in 2019?

Survey Effort

Our survey effort during the June 1 – August 31, 2019 core period (312 h) was above average compared to 2005–2018 (mean 283 h, SD = 23.5 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 difficulties and marine mammal strandings).

Whale Counts

Between June 1 and August 31, we documented 149 unique humpback whales in the study area (Fig. 4), a 48% increase compared to 2018. Correcting this count for survey effort reveals a 25% increase in abundance compared to 2018. However, the 2019 counts and effort-corrected counts remain 38.2% and 38.7% lower, respectively, than when abundance peaked in 2013. In Glacier Bay proper, the number of whales increased more than threefold (167%) from 45 whales in 2018 to 120 whales in 2019. In Icy Strait, the number of whales increased only slightly (6%) from 72 to 76 whales. Outside of the core monitoring period, we documented six additional whales (a typical amount for the non-core period), for a grand total of 155 unique whales in 2019.

Reproduction & Juvenile Survival

We documented two mother/calf pairs and a crude birth rate (CBR) of 1.3%. Both mothers (#219 and #1906) appeared to be in sub-optimal body condition (#1906 at least through late July and #219 through mid-September) with visible scapulae and/or postcranial depressions (Fig. 5). This was the sixth consecutive year of anomalously low reproductive success in GB-IS compared to 1985–2013 when the average CBR was 9.3% (Fig. 6).

We did not document any known juveniles (age 1-4 years) and we observed only two unfamiliar small whales, which is not unexpected given very low calf production in recent years. To the best of our knowledge, none of the 23 GB-IS calves born in 2014–2018 have returned or been documented elsewhere.

Figure 5. Female #1906 with her calf in Glacier Bay on June 17, 2019. Note the mother's postcranial depression, an indication of emaciation.

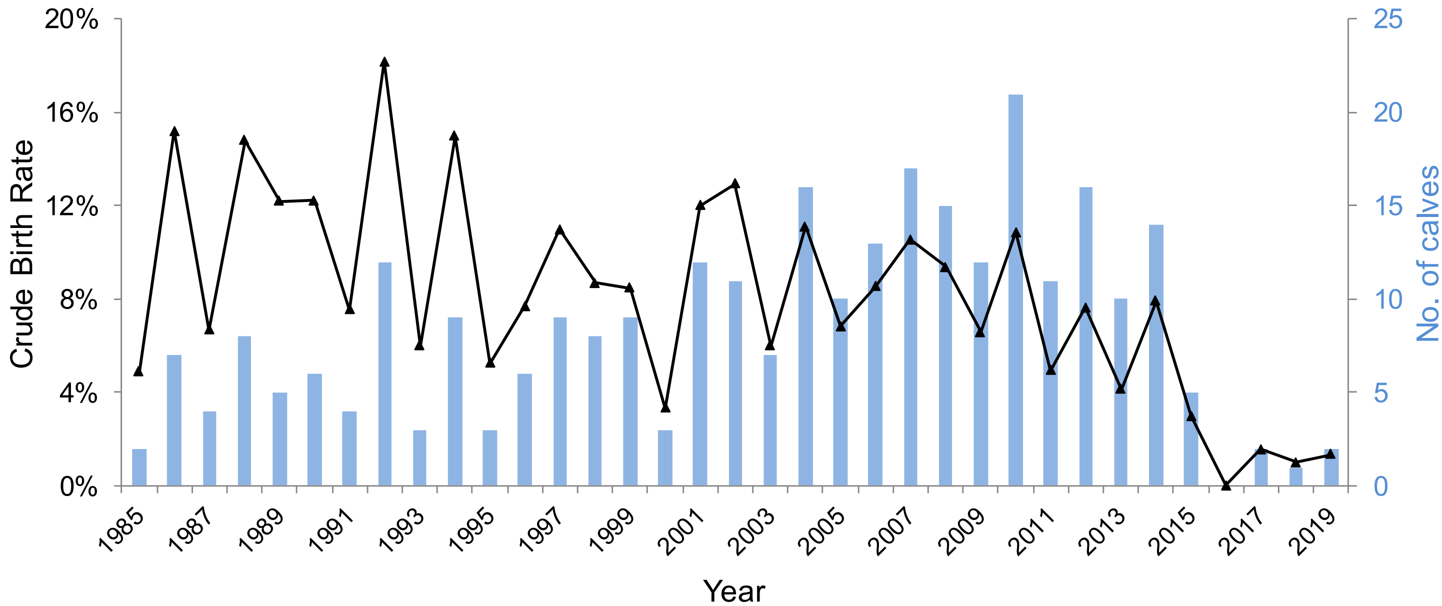


Figure 6. Crude birth rate (black line; # calves/total # whales) and annual number of calves (blue bars) in GB-IS from 1985-2019.

Site Fidelity

We documented high residency in GB-IS compared to recent years. A record high proportion of whales (n = 115, 77%) were 'resident' to the study area (resighted over a span of ≥20 days) (1985-2018 mean = 61%, SD = 9%), while a record low proportion (16%) were 'transitory' (sighted one day only) (1985-2018 mean = 27%, SD = 7%). This breaks a pattern of generally low residency and high transience that began in 2014 and peaked in 2018. In other words, in 2019 the humpback whales that came to GB-IS tended to stay. This change presumably reflects markedly improved feeding conditions in 2019 compared to 2014-2018.

In 2019 (44%, n = 29) of 66 whales with a long-term pattern of site fidelity to GB-IS (annually observed 2004-2013) were missing from the study area (13 females and 16 males with an age range of 20-45+ years old). Although this remains a high proportion, it breaks a pattern of increasing absences of these GB-IS 'regulars' that began in 2014 and peaked in 2018. It also affirms that at least some GB-IS whales temporarily shifted their summer distribution but have now returned. Notably, five reproductive females (females sighted with a calf in previous years) returned who had been missing in recent years (#250, #1046, #1088, #1246, #1421). However, two regularly reproductive females that were present in 2018 (#161, #581) were not sighted in GB-IS in 2019.

Collaboration with Happywhale.com has enabled us to search for GB-IS's missing whales in other feeding and breeding areas of the North Pacific. Through this effort, the survival of one of the 29 missing whales (#235) is known based on 2019 sightings elsewhere in SE Alaska (Scott Ranger and Dennis Rogers/ www.Happywhale.com unpublished data) but the fate of the remaining 28 missing whales is unknown.

Notably, Happywhale matching of the entire GBNPP fluke catalog to photos from around the North Pacific has confirmed the survival of 17 GB-IS calves (born 1992-2013) that have been sighted elsewhere as adults but have not returned to our study area. Automated matching technology will likely continue to shed light on the movement and dispersal patterns of individual whales.

Genetic Samples

We collected 15 sloughed skin samples from 13 individuals. Since 1996, we have collected 350 sloughed skin samples which are analyzed by our collaborators at Oregon State University for sex determination, mitochondrial DNA haplotype, and nuclear DNA genotyping.

Physical Condition

For the fourth year in a row, we observed numerous abnormally thin whales. We were surprised to find that the incidence of emaciation appeared to increase after declining in 2018 (2016 = 13%; 2017 = 24%; 2018 = 17%; 2019 = 23%), although these data are not collected systematically. Emaciation is most likely attributable to lack of food but may also indicate illness or disease. We hope to begin gathering more systematic body condition assessments by collecting photogrammetric data using unoccupied aerial systems (drones).

Only 3% of whales (n = 3) were noted to have abnormal skin (e.g., gray blotchy and/or heavily pocked in appearance) which is an improvement over 2018, when 17% of whales (n = 17) appeared this way.

Whale Prey

It appeared that forage fish were more abundant in GB in 2019 than in recent years, which likely explains the marked increase in whale abundance that we documented. Overall, the species that we detected near feeding whales (Table 1) were similar to what we have observed in past years. Capelin detections in GB (*e.g.,* Fig 7), which began to rebound in 2018 after notable declines for several years, increased in 2019 to levels not seen since before 2014.

Table 1. Species identified near feeding humpback whales in GB-IS in 2019 (n = number of detections).

Species	n
Capelin (*Mallotus villosus*)	9
Likely capelin	14
Pacific herring (*Clupea pallasii*)	2
Likely Pacific herring	2
Unidentified lanternfish (Myctophidae spp.)	1
Pacific sand lance (*Ammodytes personatus*)	1
Likely Pacific sand lance	1
Eulachon (*Thaleichthys pacificus*)	1
Likely Pacific sandfish (*Trichodon trichodon*)	1
Euphausiids	1
Unidentified forage fish	16

Figure 7. Gull carrying capelin in Glacier Bay.

On July 15 we saw a group of up to six whales perform a synchronized surface lunge approximately 4 km west of Composite Island. We were too far away to see if there was a bubblenet. Capelin have a distinctive cucumber-like smell (Johnson *et al.* 2015) that we detected at the lunge site. To our knowledge, this is the first time that synchronized surface lunging by >3 whales has been documented in GB; and if the prey was capelin, the first case of synchronized group lunge feeding on capelin anywhere in the world.

Whale/Human Interactions

No entanglements or dead whales were reported in the study area to GBNPP or to the National Marine Fisheries Service in 2019. However, on July 19 we documented entanglement injuries and scars on female #1593's caudal peduncle that appeared fresh (pink). Photographic comparison revealed these wounds had been acquired since August 8, 2017.

We documented several whales that had been struck by vessels. On July 5 we documented healed propeller scars on male #1061's head (Fig. 8) that photographic comparison revealed were not there on July 24, 2018.

Figure 8. Healed propeller scar on whale #1061's head.

On July 10 we documented superficial propeller scars on female #250's right flank (Fig. 9). On the same day, the crew of a 24-m (78 ft) commercial whale-watching catamaran reported striking a humpback whale near Point Adolphus while transiting at 22 kt (NOAA Alaska Region unpublished data), however these two events are unrelated based on timing/geography. The cata-maran captain "felt a thud", slowed down, and

Figure 9. Superficial propeller scar on whale #250's flank.

observed a whale surface behind the vessel. Two days later, we documented fresh injuries on adult female #1907's head (Fig. 10) that we presume were caused by the catamaran collision because they appeared fresh and because #1907 frequents Point Adolphus. During the encounter and subsequent sightings of #1907 through August 19, the wounds appeared to be superficial and her behavior appeared to be normal.

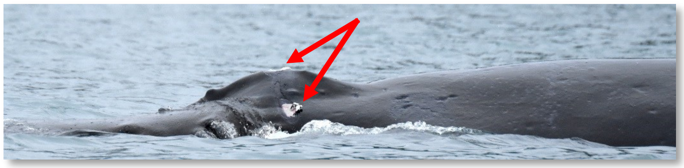


Figure 10. Fresh injuries on whale #1907's head likely caused by a vessel collision at Point Adolphus on July 10, 2019.

Whale Waters

After two years (2017-2018) in which a 13 kt vessel speed limit was not implemented in lower GB due to low whale use of this area, 2019 was more typical with whales feeding regularly there. Therefore, the 13 kt speed limit was implemented from June 1 - July 23. In addition, between June 26 and September 26, shifting high concentrations of whales in the middle of GB, lower West Arm, and entrance to the East Arm led to the designation of five temporary whale waters areas with 13 knot vessel speed limits of varying durations (10-50 days).

Conclusions

Our results from 2019 indicate that humpback whales in Glacier Bay and Icy Strait may be beginning to rebound following significant declines attributed to the 2014-2016 marine heatwave (*e.g.,* Walsh *et al.* 2018). The return of some whales that historically frequented GB-IS demonstrates that some whales survived by temporarily shifting their distribution, but the continued absence of many GB-IS 'regulars' and the continued high rate of emaciation indicates that the population has not yet fully recovered and that at least some whales have likely died. The survival and return of five reproductive females, along with the production and survival of two calves, are the first visible steps toward rebuilding a whale population with a more typical rate of calf production and survival, but only if oceanographic conditions support a prey base that promotes whale health and reproduction.

Literature Cited

Gabriele, C.M., J.L. Neilson, J.M. Straley, C.S. Baker, J.A. Cedarleaf, and J.F. Saracco. 2017. Natural history, population dynamics, and habitat use of humpback whales over 30 years at an Alaska feeding ground. Ecosphere 8: 1-18 (doi:10.1002/ecs2.1641)

Johnson, S.W., A.D. Neff, and M.R. Lindeberg. 2015. A handy field guide to the nearshore marine fishes of Alaska. NOAA Technical Memorandum NMFS-AFSC-293, Juneau, Alaska.

Jurasz, C.M., and V.P. Palmer. 1981. Censusing and establishing age composition of humpback whales (*Megaptera novaeangliae*), employing photodocumentation in Glacier Bay National Monument, Alaska. National Park Service Unpublished Report, Anchorage, Alaska.

Neilson, J.L., C.M. Gabriele, and L.F. Taylor-Thomas. 2018. Humpback whale monitoring in Glacier Bay and adjacent waters 2017: Annual progress report. Natural Resource Report NPS/GLBA/NRR-2018/1660. National Park Service, Fort Collins, Colorado.

Walsh, J.E., R.L. Thoman, U.S. Bhatt, P.A. Bieniek, B. Brettschneider, M. Brubaker, S. Danielson, R. Lader, F. Fetterer, K. Holderied, K. Iken, A. Mahoney, M. McCammon, and J. Partain. 2018. The high latitude marine heat wave of 2016 and its impacts on Alaska. Pages S39-S43 in Herring, S.C., N. Christidis, A. Hoell, J.P. Kossin, C.J. Schreck III, and P.A. Stott, editors. Explaining Extreme Events of 2016 from a Climate Perspective. Bulletin of the American Meteorological Society 99: S1-S157.

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