

# RESULTS OF HUMPBACK WHALE POPULATION MONITORING IN GLACIER BAY AND ADJACENT WATERS: 2006

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## INTRODUCTION

This report summarizes the findings of the National Park Service's (NPS) humpback whale monitoring program during the summer of 2006, the twenty-second consecutive year of consistent data collection in Glacier Bay and Icy Strait. Each summer, Glacier Bay National Park & Preserve (GBNPP) biologists document the number of individual humpback whales in Glacier Bay and Icy Strait, as well as their residence times, spatial and temporal distribution, reproductive parameters and feeding behavior. These data are used to monitor long-term trends in the population's abundance, distribution and reproductive parameters. Photographic identification data are also shared with other researchers studying North Pacific humpback whales. In addition, Park biologists use whale distribution data on a daily basis to make recommendations regarding when and where GBNPP "whale waters" vessel course and speed restrictions should be implemented in Glacier Bay.

## METHODS

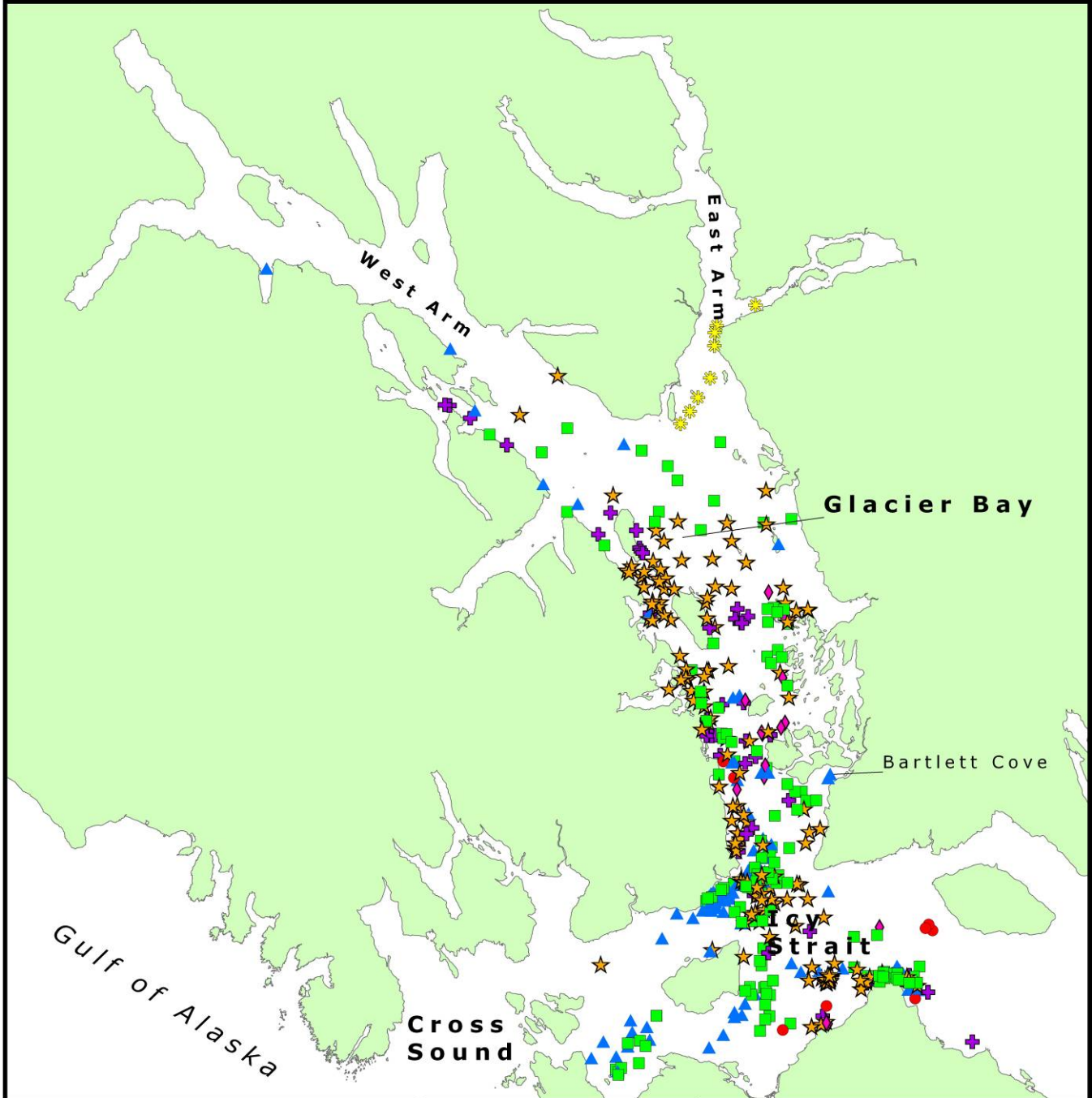
The methods used for population monitoring have been described in previous reports. The primary techniques have not changed significantly since 1985, allowing for comparison of data between years. The specific methods used in 2006 are outlined below.

**Vessel Surveys:** We conducted surveys in Glacier Bay and Icy Strait from April 25 through October 24, 2006. We searched for, observed and photographed humpback whales from the *Sand Lance*, a 5.8-meter motorboat equipped with a single four-stroke Johnson 140 HP outboard engine and based in Bartlett Cove. To minimize the potential impact that monitoring efforts might have on whales, we typically did not conduct surveys in the same area on consecutive days. Survey hours include our transit time to and from Bartlett Cove.

Between June 1 and August 31 we surveyed the main body of Glacier Bay (a rectangle defined by four corners: Bartlett Cove, Point Carolus, Geikie Inlet and Garforth Island) 3 – 4 days per week (Fig. 1). We surveyed the West Arm of Glacier Bay (to the mouth of Tarr Inlet) a few times per summer and the East Arm of Glacier Bay infrequently. We surveyed Icy Strait approximately once per week, with the greatest survey effort focused along the shoreline of Chichagof Island from Pinta Cove to Mud Bay and in Park waters around Point Carolus. Several Icy Strait surveys included Dundas Bay, Idaho Inlet, Lemesurier Island and Pleasant Island. Glacier Bay is the main area of NPS management concern with regard to whales, but descriptions of the whales' use of Icy Strait provide essential context for the

# Humpback Whale Distribution Glacier Bay & Icy Strait 2006

National Park Service  
U.S. Department of the Interior



### Humpback Whale Pod Locations by Month

- ☀ April (n=8)      ★ August (n=164)
- May (n=15)    ✚ September (n=47)
- ▲ June (n=120)    ◆ October (n=16)
- July (n=141)



### Glacier Bay National Park Resource Management

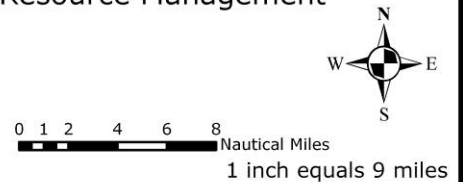


Figure 1. Study area in Glacier Bay and Icy Strait showing distribution of humpback whale pods in 2006.

Glacier Bay results because whales frequently move between these areas and because Park waters include portions of Icy Strait.

We defined a pod of whales as one or more whales within five body lengths of each other, surfacing and diving in unison. Upon locating a pod, we recorded the latitude and longitude coordinates of their initial location, determined with a GPS. We recorded on field datasheets all information pertaining to the pod, including the number of whales, their activity (feed, travel, surface active, rest, sleep, unknown), sketches of the markings on their tail flukes and dorsal fin, photographs taken, whale identity (if known), water depth, temperature and any prey patches observed on the echo-sounder. If the whales were feeding we categorized their feeding behavior as sub-surface, vertical lunge, lateral lunge, bubble-net, other bubble, flick or unknown.

**Individual Identification:** The ventral surface of each whale's flukes has a distinct, stable black and white pigment pattern that allows for individual identification (Jurasz and Palmer 1981; Katona *et al.* 1979). For some whales, the shape and scarification of the dorsal fin also serve as unique identifiers (Blackmer *et al.* 2000). We took photographs of each whale's flukes and dorsal fin with film and digital cameras. We compared fluke and dorsal fin photographs to previous NPS photographs and to other available fluke catalogs (Appendix 1) to determine the identity and past sighting history of each whale.

We referred to many whales by a permanent identification number common to the combined catalogs of Glacier Bay National Park & Preserve and University of Alaska Southeast researcher Jan Straley (Straley and Gabriele 2000). We also referred to those whales first photo-identified by Jurasz and Palmer (1981) by their nicknames (Appendix 2). We only assigned calves a permanent identification number if we obtained adequate photographs of the calf's flukes and the calf was sighted on more than one day. For whales that had not been previously identified in Glacier Bay and Icy Strait, we assigned temporary identification numbers. We replaced these temporary numbers with permanent identification numbers if we identified the whale on more than one day or if the whale was identified elsewhere by another researcher. Photographic and sighting data were added to a relational database containing Glacier Bay and Icy Strait whale sighting histories from 1977 to 2006. We also printed and catalogued the best 2006 identification photograph (fluke or dorsal fin) of each individual.

**Whale Counts:** We analyzed the 2006 photographs and then counted the number of distinct individual whales in the sample. We made separate counts of Glacier Bay and Icy Strait for the dedicated

monitoring period (June 1 – August 31) and for a 'standardized period' (July 9 – August 16) (after Perry *et al.* 1985). Although the standardized period is substantially shorter than the current NPS monitoring period and the beginning and ending dates have no particular biological significance, we continue to use the standardized period because it provides the only valid means of comparing whale counts in 1982 – 1984 to subsequent years (Gabriele *et al.* 1995).

We defined the following age classes: calves (less than one year old), juveniles (age 1 – 4 years) and adults (age  $\geq$  5 years). We also determined the number of whales that were 'resident' in Glacier Bay, Icy Strait and the combined area. We defined a whale as resident if it was photographically identified in the study area over a span of 20 or more days (after Baker 1986).

**Genetics:** We opportunistically collected sloughed skin on the sea surface with a small dip net when whales breached or performed other surface active behavior. We stored these sloughed skin samples in plastic canisters filled with dry table salt (NaCl). We archived half of each skin sample at GBNPP (in dry salt) and sent the other half to be archived (in DMSO or frozen at -80° F) at the National Marine Fisheries Service Southwest Fisheries Science Center where they are available on request to other scientists studying a variety of topics.

**Prey Identification:** We used field guides (Hart 1988; Mecklenburg *et al.* 2002; Pearse *et al.* 1987; Smith and Johnson 1977) to taxonomically identify sample prey items that we collected opportunistically at the surface.

## **RESULTS AND DISCUSSION**

**Vessel Surveys:** We searched for, observed and photographed humpback whales for a total of 355 hours in the combined Glacier Bay/Icy Strait study area (Table 1). This total is comparable to the overall average for the study area for the period 1985 – 2005. Although we strive to maintain a comparable level of survey effort each year, it inevitably fluctuates as a result of inter-annual variability in uncontrollable factors such as weather, distance of whale aggregations from Bartlett Cove, availability of staff and the frequency of unexpected events that detract from our ability to conduct surveys (*e.g.*, mechanical difficulties and marine mammal strandings).

Table 1. Monthly & Annual Survey Effort, 1985 – 2006.

YEAR	MAY		JUNE		JULY		AUG		SEPT		TOTAL # SURVEY DAYS (June 1 - August 31)		TOTAL # SURVEY HOURS (June 1 - August 31)		
	# survey days		# survey days		# survey days		# survey days		# survey days		GB	IS	GB	IS	GB + IS
	GB	IS	GB	IS	GB	IS	GB	IS	GB	IS	GB	IS	GB	IS	GB + IS
1985	0	0	10	7	11	4	10	3	0	1	31	14	234	92	326
1986	0	0	13	5	17	3	6	6	0	2	36	14	-	-	-
1987	3	2	12	5	12	7	5	7	1	2	29	19	-	-	-
1988	0	0	11	5	12	7	12	5	7	3	35	17	199	108	307
1989	3	1	17	6	14	6	16	7	1	4	47	19	231	123	354
1990	6	4	16	5	18	6	14	8	0	0	48	19	215	115	330
1991	7	3	14	7	17	6	13	4	6	3	44	17	256	100	356
1992	3	2	19	4	17	5	12	4	7	1	48	13	248	71	319
1993	2	1	10	3	13	3	7	5	1	1	30	11	192	62	254
1994	1	0	9	5	10	4	13	8	1	1	32	17	169	92	261
1995	3	2	10	4	11	4	10	7	2	2	31	15	167	90	258
1996	4	2	11	5	17	10	16	3	3	1	44	18	259	116	374
1997	5	2	17	4	21	7	19	6	9	4	57	17	327	90	417
1998	10	4	20	3	23	6	12	4	5	2	55	13	344	64	408
1999	4	1	16	4	18	6	18	3	5	1	52	13	318	64	382
2000	1	0	21	8	21	5	23	6	5	1	65	19	321	84	405
2001	3	1	17	6	14	5	20	5	6	2	51	16	236	76	312
2002	3	1	19	6	19	4	18	2	4	2	56	12	297	68	365
2003	5	0	20	7	19	5	16	5	3	1	55	17	283	101	384
2004	6	2	21	3	19	5	21	5	8	2	61	13	373	74	447
2005	1	0	19	5	19	3	15	3	5	3	53	11	293	57	349
2006	2	2	18	7	18	7	18	7	5	1	54	21	256	99	355
<b>1985-2005 average survey effort:</b>											45.7	15.4	261.1	86.7	347.8

Note: Total # survey hours are not available for 1986 & 1987

Two main factors contributed to the 2006 levels of survey effort in Glacier Bay and Icy Strait. First, an unprecedented number of whales in Icy Strait, including a prolonged aggregation of whales centered around Point Carolus, necessitated extra survey effort in this part of the study area for us to stay abreast of where whales were concentrated so that we could provide up-to-date whale waters management recommendations. Second, frequent poor weather conditions, especially fog, hampered our ability to conduct surveys in Glacier Bay throughout the summer.

**Whale Counts:** For the fourth year in a row we documented a record number of whales in the study area as a whole (Fig. 2, Appendix 3). The number of whales in Icy Strait (n = 120) was 35% higher than the previous record high (n = 89 in 2005), while the number of whales in Glacier Bay (n = 82) was the third highest count on record after 2004 and 2005. Overall the humpback whale population in southeastern Alaska is growing and the current rate of increase in the Central North Pacific stock of humpback whales is estimated to be 7% per year (Mobley *et al.* 2001).

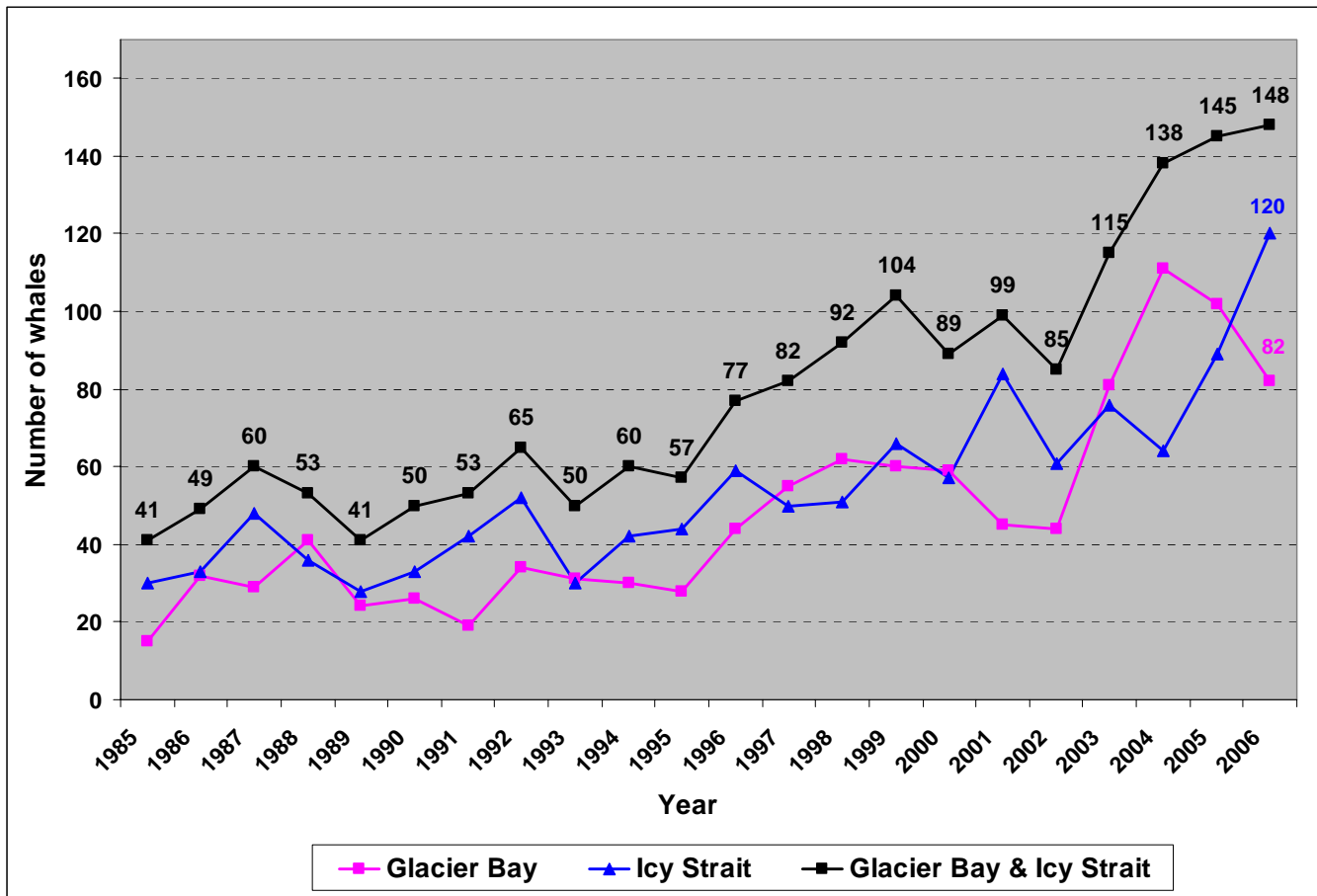


Figure 2. Number of individual whales documented in Glacier Bay and Icy Strait, 1985 – 2006.

Fourteen of the whales that we documented in the study area in 2006 had not been sighted previously in Glacier Bay or Icy Strait. The percentage of “new” whales in the study area (9%) was slightly below the 1985 – 2005 average (12%). Two of the whales had been sighted elsewhere in southeastern Alaska and 12 whales had never been documented in southeastern Alaska, however one individual (whale #2027, also known as X-141) had been documented in Prince William Sound. This is only the second time we have documented the movement of a whale between the study area and Prince William Sound. Eleven of the new whales appeared to be small to medium-sized and are presumed to be juveniles. Four of the new whales were observed outside of the regular monitoring period (June 1 – August 31).

**Seasonal Distribution:** Beginning in late April and continuing throughout the summer we observed whales throughout Glacier Bay (Fig. 1). We received the first report of a humpback whale sighting on March 29 near Sebree Island (J. de la Bruere, pers. comm.). In April we received several reports of whales at the entrance to the East Arm and we documented nine individuals there on April 25. Beginning in mid-May, NPS rangers began regularly reporting at least three whales, including a

cow/calf pair, in the West Arm. Several of these sightings were notable in that they were near the face of tidewater glaciers, including Lamplugh, Johns Hopkins and Margerie Glaciers. Elsewhere in Glacier Bay the number of whale sightings in May and June was atypical with only a few animals scattered widely and many whales regularly seen in Glacier Bay identified in Icy Strait instead. By late June, whale numbers in the lower bay began to increase slowly but it was not until early August that activity was sustained at consistent levels. Approximately 10 – 15 whales frequented the lower bay in August but activity tapered off by the end of the month. Whale numbers in Whidbey Passage were low until mid-August, followed by an increase in activity that lasted until late September and included the waters off the east side of Willoughby and Drake Islands. Following this pulse, there was an increase in activity in Hugh Miller Inlet in late September. For the second year in a row, the amount of whale activity on the east side of the mid-bay was below average, with the exception of 2 – 3 whales (mostly small animals presumed to be juveniles) observed consistently in the Flapjack Island reefs in late July and August.

From late May until early-mid September, a large aggregation of up to approximately 30 whales were present in Park waters in Icy Strait between Point Gustavus and Point Dundas, with most of the activity centered around Point Carolus. Twice before (in mid-July 2001 and mid-July 2005) we have observed large aggregations of 14 – 18 whales concentrated around Point Carolus but these groupings were short-lived compared to the sustained levels of activity that we observed in this area in 2006. In the beginning of June, whale activity was low around Point Adolphus but high in western Icy Strait, especially off the west side of Lemesurier Island and at the mouth of Idaho Inlet. By mid-June most of the activity began to shift towards eastern Icy Strait. Between late June and the middle of August, there was an unusually large aggregation of whales feeding in the middle of Icy Strait off the east side of Lemesurier Island and Mud Bay. In late July there was a second pulse of activity in western Icy Strait at the mouth of Idaho Inlet with 10 – 15 whales sighted there on July 27. By late August, the large aggregation of whales in the middle of Icy Strait dispersed and many of these same whales were seen in Glacier Bay.

**Whale Waters:** The length of whale waters vessel speed restrictions in lower Glacier Bay (22 days) was the third shortest since 1985. However, an unusually large aggregation of whales in Park waters in Icy Strait between Point Gustavus and Point Dundas (centered around Point Carolus) warranted temporary vessel speed restrictions in this area from June 6 – September 19 (106 days). In addition, a high number of whales in Whidbey Passage necessitated temporary whale waters there from August 16 – September 27 (43 days).



**Residency:** Twenty (24%) of the 82 whales that entered Glacier Bay between June 1 and August 31 remained 20 or more days, long enough to be considered resident (Appendix 2). This proportion is below average for Glacier Bay (1990 – 2005 average = 47%) and several whales that have been resident in Glacier Bay in previous years (*e.g.*, #235, #564, #1298, #1432) were resident in Icy Strait in 2006. Seventy (58%) of the 120 whales that we identified in Icy Strait, including six cow/calf pairs, remained long enough to be considered resident, which is above average for Icy Strait (1990 – 2005 average = 39%). Twenty-five (17%) of the 148 whales that we sighted in Glacier Bay/Icy Strait, were resident in the combined Glacier Bay/Icy Strait study area. Eight whales were resident in more than one area (*e.g.*, resident in Icy Strait and then resident in Glacier Bay). Six of these whales started out as residents in Icy Strait and then moved into Glacier Bay later in the summer to become Glacier Bay or Glacier Bay/Icy Strait residents. Overall, 107 whales (72%) were resident in Glacier Bay, Icy Strait or the combined area.

We identified 28 (19%) of the whales that entered the study area, including three mother/calf pairs, on just one day: 9 in Glacier Bay and 19 in Icy Strait. However, we documented three of these 28 whales on additional days outside of the June 1 – August 31 monitoring period. The proportion of whales sighted only once in the study area is comparable to the proportion from 2003 and 2004 (16% – 18%) but lower than the proportion in 1994 – 2002 (23% – 43%) and 2005 (28%).

**Reproduction and Juvenile Survival:** We documented 13 mother/calf pairs in the study area (Table 2). The crude birth rate of 8.8% in 2006 is slightly lower than average for previous years (Table 3) but well within the documented range of values for this extremely variable parameter.

One female whale already known to be a grandmother (#235) returned to the study area with a new calf. We identified three whales (#1480, born 2000; #1844, born 2004; and #1891, born 2005) that had not been sighted in the study area since they were calves.

For the second year in a row we documented a record high number of known-age juveniles ( $n = 7$ ) compared to the 1985-2004 average of 2.6 known-age juveniles per year. The most likely reason for this increase is that the high number of calves documented in the study area in recent years (Table 3) has increased our potential for sighting juveniles in subsequent years. Southeastern Alaska juveniles tend to return to the areas where they were brought by their mother in their calf year (Straley 1994). It is also possible that changes in prey availability or other habitat characteristics of the Glacier Bay area have

Table 2. Mother-Calf Pairs, 2006.

	<b>Mother ID#</b>	<b>Calf ID#</b>	<b>Documented in:</b>
1.	193	193_calf_2006	IS
2.	225	225_calf_2006	GB
3.	235	2020	GB & IS
4.	353	1909	IS
5.	397	397_calf_2006	IS
6.	541	2021	IS
7.	573	1910	IS
8.	600	600_calf_2006	IS
9.	1011	2025	GB
10.	1018	2023	GB
11.	1031	1031_calf_2006	IS
12.	1079	2022	GB
13.	1432	2024	GB & IS

**Notes:**

- GB = Glacier Bay; IS = Icy Strait
- Only calves whose flukes were photographed received an identification number.

made the habitat increasingly attractive to juvenile whales. In the future, we may attempt to use photogrammetry to collect quantitative measurements of whales' body lengths (Jaquet 2006) to examine the spatial and temporal distribution of different size whales (*i.e.*, age classes) in the study area.

**Genetics:** We collected 23 sloughed skin samples from 17 unique individuals, including four calves. Since 1996, we have collected 161 sloughed skin samples from humpback whales in Glacier Bay and Icy Strait. Genetic analysis of these samples allows sex determination, definition of mitochondrial DNA haplotype and nuclear DNA genotyping. The only other practical ways we are able to determine a whale's sex are if the whale returns to the study area with a calf (in which case we assume that the mother is female) or in the infrequent event that we obtain photographs of the whale's genital area.

**Feeding Behavior and Prey Identification:** We positively identified four types of prey in association with feeding humpback whales in 2006: Pacific herring (*Clupea harengus pallasii*), capelin (*Mallotus villosus*), sand lance (*Ammodytes hexapterus*) and euphausiids (*Thysanoessa* sp. or *Euphausia* sp.) (Table 4). The prey type most commonly identified was capelin, with multiple observations of this species from late June through late September, although the majority of our observations were based

Table 3. Reproduction and known age whales in Glacier Bay and Icy Strait, 1982 – 2006.

Year:	# Calves	# Calves Photo ID'd	% Calves Photo ID'd	Crude Birth Rate (%)	# Known Age Whales	Total # Whales
1982	6	3	50	-	-	-
1983	0	0	0	-	-	-
1984	7	5	71	17.9	-	39
1985	2	1	50	4.9	3	41
1986	8	5	63	16.3	2	49
1987	4	3	75	6.7	5	60
1988	8	5	63	15.1	4	53
1989	5	3	60	12.2	5	41
1990	6	6	100	12.0	7	50
1991	4	4	100	7.5	8	53
1992	12	10	83	18.5	7	65
1993	3	3	100	6.0	12	50
1994	9	5	56	15.0	10	60
1995	3	2	67	5.3	9	57
1996	6	3	50	7.8	18	77
1997	9	7	78	11.0	17	82
1998	8	7	88	8.7	18	92
1999	9	5	56	8.7	24	104
2000	3	2	67	3.4	23	89
2001	12	9	75	12.1	26	99
2002	11	6	55	12.9	23	85
2003	7	5	71	6.1	27	115
2004	16	12	75	11.6	36	138
2005	10	5	50	6.9	35	145
2006	13	8	62	8.8	41	148
<b>1982-2005 average:</b>	7.0	4.8	66.7	10.3	15.2	74.7

**Notes:**

- Only includes whales documented during the June 1 – August 31 study period.
- Crude Birth Rate (CBR) = a percentage computed by # calves / total whale count.
- CBR's for 1982 & 1983 could not be calculated because total whale counts for these years are not available.
- Number of known age whales does not include calves of the year. These data are not available for 1982 – 1984.

Table 4. Humpback whale prey type determinations.

METHOD:	PREY SPECIES (# of cases):				
	<i>herring</i>	<i>capelin</i>	<i>sand lance</i>	<i>euphausiids</i>	<i>larval fish (unk. sp.)</i>
Collected specimen with dip net	1	1	1	1	1
'Cucumber' smell in air		15			
Fish observed near surface	1?	2			

solely on a cucumber smell that is characteristic of capelin. On August 21 we observed eight-year-old male whale #1438 lunge feeding in the middle of Icy Strait along a strong tiderip where dense prey patches were concentrated. The patches were composed primarily of euphausiids, translucent larval fish (unknown species) and larger schooling fishes that were likely herring. We collected a sample of the euphausiids and larval fish but were unable to catch any of the larger fish for positive identification.

In mid-July we received a report of several small forage fish floating at the surface near Point Adolphus that were barely alive, losing scales and appeared to be dazed. The observers speculated that the fish, later identified from a specimen as northern lampfish (*Stenobranchius leucopsarus*) (J. Jacobsen, pers. comm.), were left behind by nearby feeding humpback whales (A. Jensen, pers. comm.). On November 21, 2002 we collected fish scales floating in the vicinity of a whale feeding at Point Adolphus that were later identified as being from a myctophid, most likely the northern lampfish (Doherty and Gabriele 2002). Previous studies in Icy Strait have found this mesopelagic species to be relatively rare compared to more typical humpback whale prey species such as capelin and walleye pollock (*Theragra chalcogramma*) (Abookire *et al.* 2002).

**Whale/Human Interactions:** Overall, the number of whale/human interactions that we documented in the study area in 2006 was lower than in recent years. It is unlikely that this decrease is attributable to a decline in the reporting rate within Glacier Bay, where NPS rangers are aware that such incidents should be reported. However, it is possible that part of this decrease is attributable to a decline in the reporting rate in Icy Strait.

On many occasions throughout the summer we observed vessels in Park waters in Icy Strait around Point Carolus in close proximity to whales (within 100 meters) but in most cases the vessels were anchored or drifting while fishing. Due to the large number of whales frequenting this area, a 13-knot vessel speed limit was in place throughout the summer, which we suspect reduced the probability of whale-vessel collisions from occurring in this high use area.

In late May we received a report of an injured humpback whale calf at Point Adolphus in Icy Strait. The calf, though not bleeding at the time it was observed, had a significant injury to its dorsal fin that caused the dorsal fin to appear to be “flapped in half” and it had propeller scars down its back (K. Owen, pers.

comm.). We did not observe any injured calves in 2006 and did not receive any further reports of this animal.

On August 3, while surveying in Icy Strait, we documented an injury to female #250's back that she did not have during our previous sighting of her in the same area on July 5, 2006 (Figs. 3 and 4). We speculate that her injury, which was several inches deep, was most likely caused by a vessel strike. The injury did not appear to be life-threatening and she was actively lunge feeding near several other whales.



Figure 3. Whale #250 prior to injury.



Figure 4. Whale #250 with injury, August 3, 2006.

The only incident of which we are aware in which a humpback whale nearly collided with a vessel in the study area in 2006 occurred on the morning of July 3 with the whale monitoring vessel *Sand Lance*. We were transiting southwest through Sitakaday Narrows at a speed of approximately 18 knots when a single humpback whale (#1905) suddenly surfaced approximately one body length (~12 meters) off the starboard side of the vessel, crossing the bow. We immediately reduced the vessel's speed by putting the engine into neutral, thus avoiding what appeared to be an imminent collision. A few seconds later the whale surfaced on the same heading as before, raised its flukes and dove. We drifted with the engine in neutral and observed the whale's behavior from a distance. The whale's dives were approximately six minutes long and it surfaced erratically (*i.e.*, at unpredictable locations, separated by hundreds of meters), which may help explain why we had not spotted it prior to the near collision. Another contributing factor may have been the lighting; although sea conditions were calm and visibility was generally excellent, the whale approached the vessel from the west, where its blows were more difficult to see than to the east, where the morning light would have illuminated them with back-light. Whale #1905, first documented in the study area in 2004, is presumed to be a juvenile based on its body size.

Elsewhere in southeastern Alaska, on August 15 a humpback whale surfaced underneath the 12.8-meter commercial whale watching jet boat, *Awesome Orca*, in North Pass near Juneau and struck the vessel. The incident occurred as the vessel's engine was idling and the passengers were watching a group of whales nearby. When the whales began to approach the vessel, the captain put the engine into reverse to avoid the whales, but one of the whales surfaced underneath the vessel and the whale's flukes made contact with the starboard side of the hull. The force of the impact was enough to cause one of the passengers to lose her balance and hit her head onboard, causing a minor head injury that required hospital treatment. As far as those involved could ascertain, the whale was not injured in the incident (Keeker 2006).

On June 6 a yearling humpback whale (#1891) became entangled in sport Dungeness crab (*Cancer magister*) pot gear in Bartlett Cove. The whale was observed thrashing at the surface, entangled in line and towing a single crab pot buoy around its tailstock (J. Johnson and W. Clark, pers. comm.). Efforts by the Park's trained whale disentanglement team to remove the gear (Fig. 5) from the erratically-moving whale were unsuccessful; however, on June 8 all of the gear was recovered near Geikie Inlet, indicating that the whale had freed itself. On June 13 and several more times throughout the summer we documented whale #1891 feeding near Point Carolus. Despite some superficial wounds (Fig. 6) the whale appeared healthy and behaved normally as it fed near several other whales. This is the first time of which we are aware that a whale has become entangled in fishing gear in Glacier Bay, except for a very minor entanglement of a whale in 80 lb test fishing line in Bartlett Cove in 2005 (Neilson and Gabriele 2005).



Figure 5. The park's trained whale disentanglement team attempting to remove crab pot gear from whale #1891.



Figure 6. Raw (pink) wounds and white scuff marks show where line had been wrapped around the whale's tailstock after the whale was free of gear.

On July 25 we received a report from kayakers who observed 2 – 3 buoys circling and moving against the current near the Gustavus dock and suspected that perhaps a whale might be entangled in them, although they did not see any whales in the area. Sea conditions were glassy and they noted that none of the other buoys in the area appeared to be moving in a similar way. They investigated the moving buoys up close and the buoys submerged and disappeared from sight (C. Long and P. Provost, pers. comm.).

Elsewhere in southeastern Alaska, in early January a humpback whale was reported trailing a buoy near Sitka but the whale was not sighted again. Between early June and late August, six humpback whales were reported entangled in line and buoys in various locations around southeastern Alaska, but due to a lack of details accompanying the reports it is possible that some of them were repeat sightings. In late August a dead, bloated humpback whale was reported floating in Frederick Sound near Pybus Bay. Aerial photos taken by the U.S. Coast Guard showed that the animal was entangled in yellow line. Unfortunately, the carcass was not secured and could not be relocated, thus a necropsy was not performed to confirm the cause of death (NOAA Fisheries Alaska Region, unpublished data). Between May and September, members of the Alaska Marine Mammal Stranding Network responded to three separate incidents in which humpbacks were entangled in gillnets. In late May a humpback whale became entangled in a gillnet near Petersburg and was fully disentangled later the same day (NOAA Fisheries Alaska Region, unpublished data). In late August a humpback whale was reported entangled in a gillnet in lower Stephen's Passage and was fully disentangled nine days later (NOAA Fisheries Alaska Region, unpublished data). Finally, in mid-September, a humpback whale became entangled in a gillnet near Petersburg but on the following day shed the gear on its own (NOAA Fisheries Alaska Region, unpublished data). Also in September, Glacier Bay National Park increased the roster of Park staff trained in whale disentanglement by hosting an advanced course on whale disentanglement taught by Ed Lyman of the Hawaiian Islands Humpback Whale National Marine Sanctuary.

**Notable Behavioral Observations:**

For the fourth year in a row we observed whale #1809, a small to medium-sized animal of unknown age that has appeared unhealthy since we first documented it in the study area in 2003. Whale #1809's breathing continues to have a hollow/wheezing quality as first noted in 2005 (Neilson and Gabriele 2005) but otherwise the whale appears to feed and behave normally.

In 2006, two separate incidents were reported in which killer whales (*Orcinus orca*) apparently harassed humpback whale calves in Icy Strait. In the first incident on July 1, observers reported seeing a group of

approximately 20 killer whales off southwest Pleasant Island and then approximately six adult females and immature killer whales began milling around a humpback whale cow/calf pair. The killer whales leaped over the calf and temporarily separated it from its mother. The mother slashed her flukes and produced wheeze blows when the killer whales were close and her entire body shook when she surfaced. Eventually, the killer whales appeared to lose interest and departed the area, at which time the observers believed that the humpback whale mother and calf reunited (S. Anna via D. Matkin, pers. comm.).

In the second incident on July 22, two male killer whales were seen traveling rapidly approximately 200 meters from Point Adolphus and then approached what appeared to be a humpback whale cow/calf pair. Shore-based observers reported that the “adult humpback began tail lobbing quite violently for two to three minutes. Shortly after this, it appeared that the humpback was holding the calf out of the water with her head/back for about 30 seconds. The [killer whales] were visible one more time then vanished. The humpback and calf traveled west...and appeared to be swimming and diving normally.” (J. Williams, pers. comm.).

These are the only such incidents of harassment by killer whales of humpback whale calves that we are aware of in the study area, however a handful of similar incidents have been reported elsewhere in southeastern Alaska (Jefferson *et al.* 1991, Matkin *et al.* 2006, V. Deecke, pers. comm., F. Sharpe, pers. comm.) and we have documented killer whale harassment of adult humpbacks (NPS, unpublished data).



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## LITERATURE CITED:

- Abookire, A. A., J. F. Piatt and S.G. Speckman (2002). A nearsurface, daytime occurrence of two mesopelagic fish species (*Stenobrachius leucopsarus* and *Leuroglossus schmidtii*) in a glacial fjord." Fishery Bulletin 100(2):376-380.
- Baker, C. S. (1986). Population characteristics of humpback whales in Glacier Bay and adjacent waters: Summer 1986. Report to the National Park Service, Gustavus, AK, 30 pp.
- Blackmer, A. L., S. K. Anderson and M. T. Weinrich (2000). Temporal variability in features used to photo-identify humpback whales (*Megaptera novaeangliae*). Marine Mammal Science 16:338-354.
- Doherty, J. L. and C. M. Gabriele (2002). Results of humpback whale population monitoring in Glacier Bay and adjacent waters: 2002. Report to the National Park Service, Glacier Bay National Park and Preserve, Gustavus, AK. 33 pp.
- Gabriele, C. M., J. M. Straley and C. S. Baker (1995). The Variability of Humpback Whale Counts in Glacier Bay and Icy Strait. Proceedings of the Third Glacier Bay Science Symposium, 1993, edited by D. R. Engstrom, p. 239-245.
- Hart, J. L. (1988). Pacific Fishes of Canada. Fisheries Research Board of Canada, Ottawa, Canada K1A 0S9.
- Jaquet, N. (2006). A simple photogrammetric technique to measure sperm whales at sea. Marine Mammal Science 22(4):862-879.

- Jefferson, T. A., P. J. Stacey and R. W. Baird (1991). A review of killer whale interactions with other marine mammals: predation to co-existence. *Mammal Review* 21:151-180.
- 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. Report to the National Park Service, Anchorage, AK, 42 pp.
- Katona, S. K., B. Baxter, O. Brazier, S. Kraus, J. Perkins and H. Whitehead (1979). Identification of Humpback whales by Fluke Photographs. In: *Behavior of Marine Animals*, vol. 3: Cetaceans. Edited by H. E. Winn and B. L. Olla, Plenum Press, p. 33-44.
- Keeker, K. 2006. Woman hurt by whale under boat. *Juneau Empire*, August 18, 2006. Juneau, AK.
- Matkin, D. R., J. M. Straley and C. M. Gabriele (in press). Killer whale feeding ecology and non-predatory interactions with other marine mammals in the Glacier Bay region of Alaska. *In Proceedings of the Fourth Glacier Bay Science Symposium, 2004*, edited by J. F. Piatt and S. M. Gende. U.S. Geological Survey/Information and Technology Report. USGS/BRD/ITR-2006-00XX. Washington, D.C.
- Mecklenburg, C. W., T. A. Mecklenburg, and L. K. Thorsteinson (2002). *Fishes of Alaska*. American Fisheries Society, Bethesda, MD, 1037 pp.
- Mobley, J. M., S. Spitz, R. Grotefendt, P. Forestell, A. Frankel and G. Bauer (2001). Abundance of humpback whales in Hawaiian waters: Results of 1993-2000 aerial surveys. Report to the Hawaiian Islands Humpback Whale National Marine Sanctuary. 16 pp.
- Neilson, J. L., and C. M. Gabriele (2005). Results of humpback whale population monitoring in Glacier Bay and adjacent waters: 2005. Report to the National Park Service, Glacier Bay National Park and Preserve, Gustavus, AK. 24 pp.
- Pearse, V., J. Pearse, M. Buchsbaum, and R. Buchsbaum (1987). *Living invertebrates*. Blackwell Scientific Publications, Boston, MA.
- Perry, A., C. S. Baker, and L. M. Herman (1985). The natural history of humpback whales (*Megaptera novaeangliae*) in Glacier Bay. Final Report to the National Park Service, Alaska Regional Office, Anchorage, AK, 41 pp.
- Smith, D. L. and K. B. Johnson (1977). A guide to marine coastal plankton and marine invertebrate larvae. Kendall/Hunt, Dubuque, IA, 221 pp.
- Straley, J. M. and C. M. Gabriele (2000). Humpback Whales of Southeastern Alaska. Humpback whale fluke identification catalog (3<sup>rd</sup> printing), National Park Service, P.O. Box 140, Gustavus, Alaska, 150 pp.

## APPENDIX 1

### Humpback Whale Fluke Catalogs Used for Matching

Cartwright, R. Unpublished data. Keiki Kohola Project. Department of Biology, California State University – Channel Islands, One University Dr., Camarillo, CA 93012.

Darling, J. D. 1991. Humpback Whales in Japanese Waters (Ogasawara and Okinawa) Fluke Identification Catalogue 1987-1990. World Wide Fund for Nature Japan, Minato-ku, Tokyo, Japan. 56 pp.

Jacobsen, J. Unpublished data. Department of Biological Sciences, Humboldt State University, PO Box 4492, Arcata, CA 95518.

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. Report to the National Park Service, Anchorage, AK, 42 pp.

Pacific Biological Station. Photographic Catalogue of Humpback Whales in British Columbia ([http://www-sci.pac.dfo-mpo.gc.ca/sa/cetacean/humpbackwhale/default\\_e.htm](http://www-sci.pac.dfo-mpo.gc.ca/sa/cetacean/humpbackwhale/default_e.htm)), Cetacean Research Program, Pacific Biological Station, 3190 Hammond Bay Rd., Nanaimo, BC V9T 6N7.

Perry, A., C. S. Baker, and L. M. Herman. 1985. The natural history of humpback whales (*Megaptera novaeangliae*) in Glacier Bay. Final Report to the National Park Service, Alaska Regional Office, Anchorage, AK, 41 pp.

Perry, A., J. R. Mobley, Jr., C. S. Baker and L. M. Herman. 1988. Humpback whales of the central and eastern North Pacific. University of Hawaii Sea Grant Miscellaneous Report, UNIHI-SEAGRANT-MR-88-02, 236 pp.

Sharpe, F. Unpublished data. Alaska Whale Foundation, 4739 University Way NE #1239, Seattle, WA 98105.

Straley, J. M., and C. M. Gabriele. 2000. Humpback Whales of Southeastern Alaska. Humpback whale fluke identification catalog (3<sup>rd</sup> printing), National Park Service, PO Box 140, Gustavus, AK. 151 pp.

Uchida, S., and N. Higashi. 1995. Fluke Identification Catalogue of Humpback Whales in Japanese Waters off Okinawa 1991-1995. Okinawa Expo Aquarium, Motobu-Cho, Okinawa, Japan 905-03. 18 pp.

von Ziegesar, O., B. Goodwin and R. DeVito. 2004. A catalog of humpback whales in Prince William Sound Alaska 1977-2001, Eye of the Whale Research, PO Box 15191, Homer, AK 99603. 49 pp.







**APPENDIX 3**

**STANDARDIZED (July 9 – August 16) and TOTAL (June 1 – August 31)  
Humpback Whale Counts, 1985-2006**

<b>Year:</b>	<b>GLACIER BAY</b>		<b>ICY STRAIT</b>		<b>GLACIER BAY &amp; ICY STRAIT</b>	
	standardized whale count	total whale count	standardized whale count	total whale count	standardized whale count	total whale count
1985	7	15	19	30	24	41
1986	26	32	24	33	39	49
1987	18	29	33	48	40	60
1988	19	41	29	36	40	53
1989	20	24	20	28	33	41
1990	16	26	24	33	33	50
1991	17	19	33	42	44	53
1992	27	34	38	52	48	65
1993	24	31	24	30	40	50
1994	17	30	29	42	44	60
1995	18	28	26	44	37	57
1996	37	44	43	59	65	77
1997	41	55	33	50	66	82
1998	45	62	28	51	69	92
1999	36	60	40	66	69	104
2000	44	59	26	57	62	89
2001	26	45	58	84	72	99
2002	28	44	34	61	56	85
2003	53	81	61	76	102	115
2004	85	111	38	64	110	138
2005	66	102	50	89	95	145
2006	66	82	98	120	130	148
<b>average:</b>	<b>33.45</b>	<b>47.91</b>	<b>36.73</b>	<b>54.32</b>	<b>59.91</b>	<b>79.68</b>