

Annual Progress Report

Results of Humpback Whale Monitoring in Glacier Bay and Adjacent Waters: 2009



Three adult humpback whales dive together in Icy Strait, June 2009.

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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 2009, the twenty-fifth 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 2009 are outlined below.

Vessel Surveys

We conducted surveys in Glacier Bay and Icy Strait from May 1 through November 10, 2009. We searched for, observed and photographed humpback whales from the *Sand Lance*, a 5.8-meter motorboat based in Bartlett Cove and equipped with a four-stroke Johnson 140 HP outboard engine. 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.

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), focusing the day's effort in a

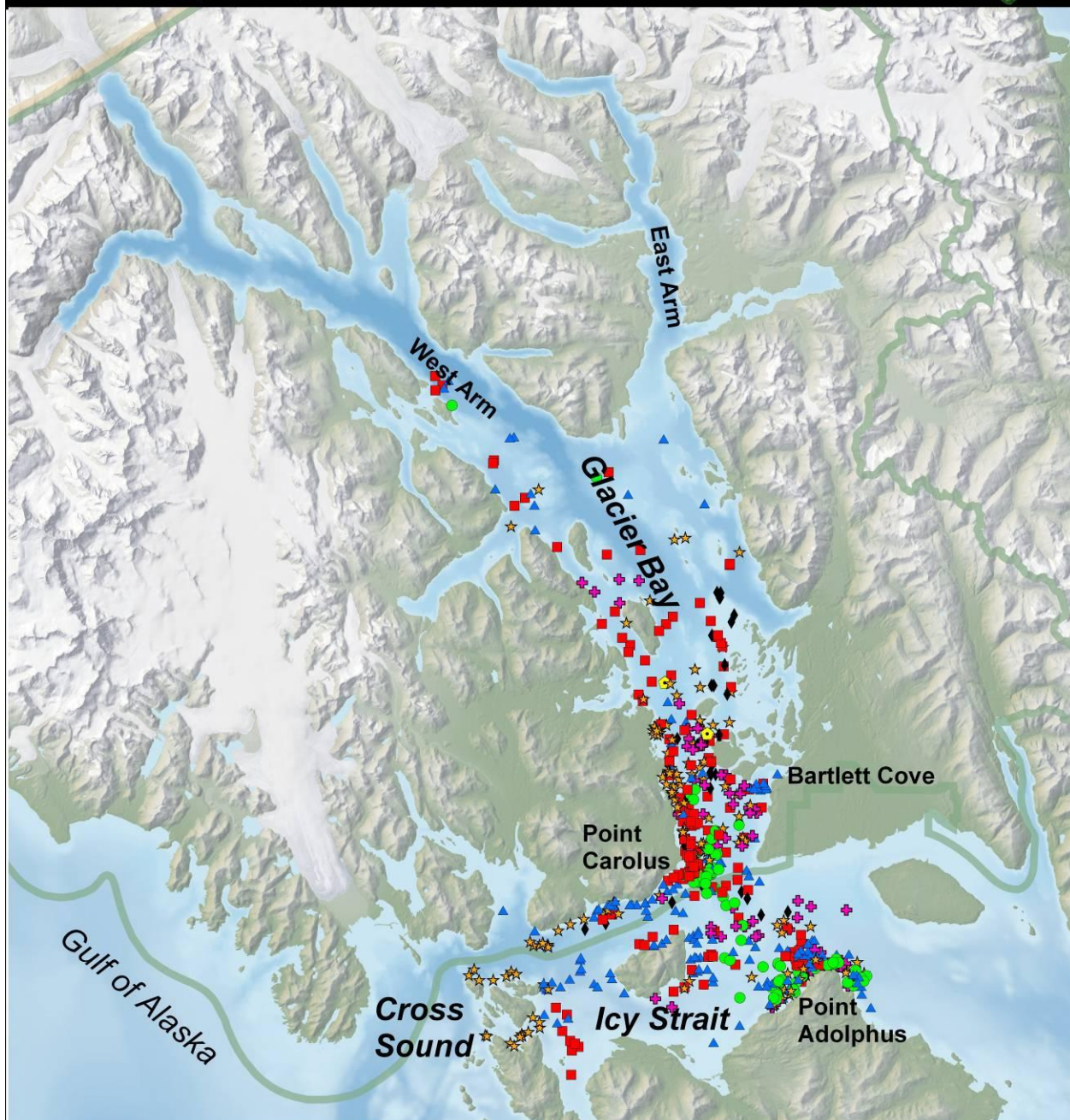
particular part of the study area. We surveyed the East and West Arms of Glacier Bay (to the mouth of Tarr Inlet) infrequently. We surveyed Icy Strait approximately once per week, with the greatest survey effort focused along the shoreline of Chichagof Island from Pinta Cove to Mud Bay and in Park waters around Point Carolus. We surveyed northeastern Cross Sound, including North and South Passes, on one trip in August due to the high number of whales in that area. Glacier Bay is the main area of NPS management concern with regard to whales, but descriptions of the whales' use of Icy Strait and Cross Sound provide essential context for the Glacier Bay results because whales frequently move between these areas and because Park waters include portions of Icy Strait and Cross Sound. Several Icy Strait surveys included Lemesurier & Pleasant Islands and the mouths of Dundas Bay and Idaho Inlet.

We defined survey effort hours as only those hours that we spent actively surveying for whales (*i.e.*, transit time to/from Bartlett Cove was not counted.) We defined a survey "day" as any day with survey effort hours in Glacier Bay or Icy Strait, thus we counted days in which there was survey effort in both Glacier Bay and Icy Strait as one Glacier Bay day and one Icy Strait day. In 2009, we lumped the one Cross Sound survey with Icy Strait survey effort.

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 depth sounder. If the whales were feeding we categorized their feeding behavior as subsurface, vertical lunge, lateral lunge, bubblenet, other bubble, flick or unknown.

Humpback Whale Distribution

Glacier Bay and Icy Strait 2009



Humpback Whale Pod Locations by Month

- May (n=81)
- ▲ June (n=180)
- July (n=165)
- ★ August (n=164)
- ✚ September (n=86)
- ◆ October (n=36)
- ⬡ November (n=2)



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0 2.5 5 10 Nautical Miles

Figure 1. Study area in Glacier Bay and Icy Strait showing distribution of humpback whale pods in 2009. Each symbol represents a pod containing one or more whales.

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 a Nikon D90 digital camera equipped with a 100-300 mm zoom lens. We compared fluke and dorsal fin photographs to previous NPS photographs and to photographs of other humpback whales from southeastern Alaska (University of Alaska Southeast, unpublished data) 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. 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 2009. We also printed and catalogued the best 2009 identification photograph (fluke or dorsal fin) of each individual.

Whale Counts

We examined the 2009 photographs to determine 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 later years (Gabriele *et al.* 1995).

We defined the following age classes: calves (less than one year old), juveniles (age 1 – 4 years, as determined by prior sighting history) and adults (age ≥ 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 (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.

RESULTS AND DISCUSSION

Vessel Surveys: We searched for, observed and photographed humpback whales for a total of 286 hours in the combined Glacier Bay/Icy Strait study area (Table 1). This is lower than the level of survey effort in 2007 and 2008, but higher than the level of survey effort in 2005 and 2006. 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, 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 – 2009.

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					
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	16	5	17	3	12	3	4	3	45	11	216	56	272
2006	2	2	14	6	15	7	16	7	5	1	45	20	197	85	282
2007	4	2	15	10	14	7	14	6	5	2	43	23	206	117	323
2008	4	1	16	10	14	8	12	9	3	1	42	27	187	117	304
2009	6	5	12	10	16	9	10	5	5	4	38	24	179	107	286
2005-2008 average survey effort:											43.8	20.3	201.5	93.8	295.3

The dashed line highlights a change in the way survey effort was calculated beginning in 2005.
Total # survey hours are not available for 1986 & 1987

Whale Counts

We documented a record number of whales in the study area as a whole ($n = 176$, Fig. 2, Appendix 1), which represents an 11% increase over 2008 (Neilson and Gabriele 2008). The total number of whales in Glacier Bay ($n = 105$) was higher than in recent years but lower than the high count of 111 whales in 2004. In Icy Strait, the number of whales ($n = 158$) was at a record high for the fifth year in a row with a total count 14% higher than in 2008 ($n = 138$). An unusually high number of whales ($n = 18$) were observed in Glacier Bay and Icy Strait only outside of the regular June through August

monitoring period, for a grand total of 194 individual whales documented in 2009. Overall the humpback whale population in southeastern Alaska is growing and the current rate of increase for humpback whales in the North Pacific is estimated to be approximately 5% per year (Calambokidis *et al.* 2008).

Eighteen (10%) of the whales that we documented in the study area in June, July and August had not been sighted previously in Glacier Bay or Icy Strait. The percentage of “new” whales in the study area (10%) was similar to the 1985 – 2008 average (12%).

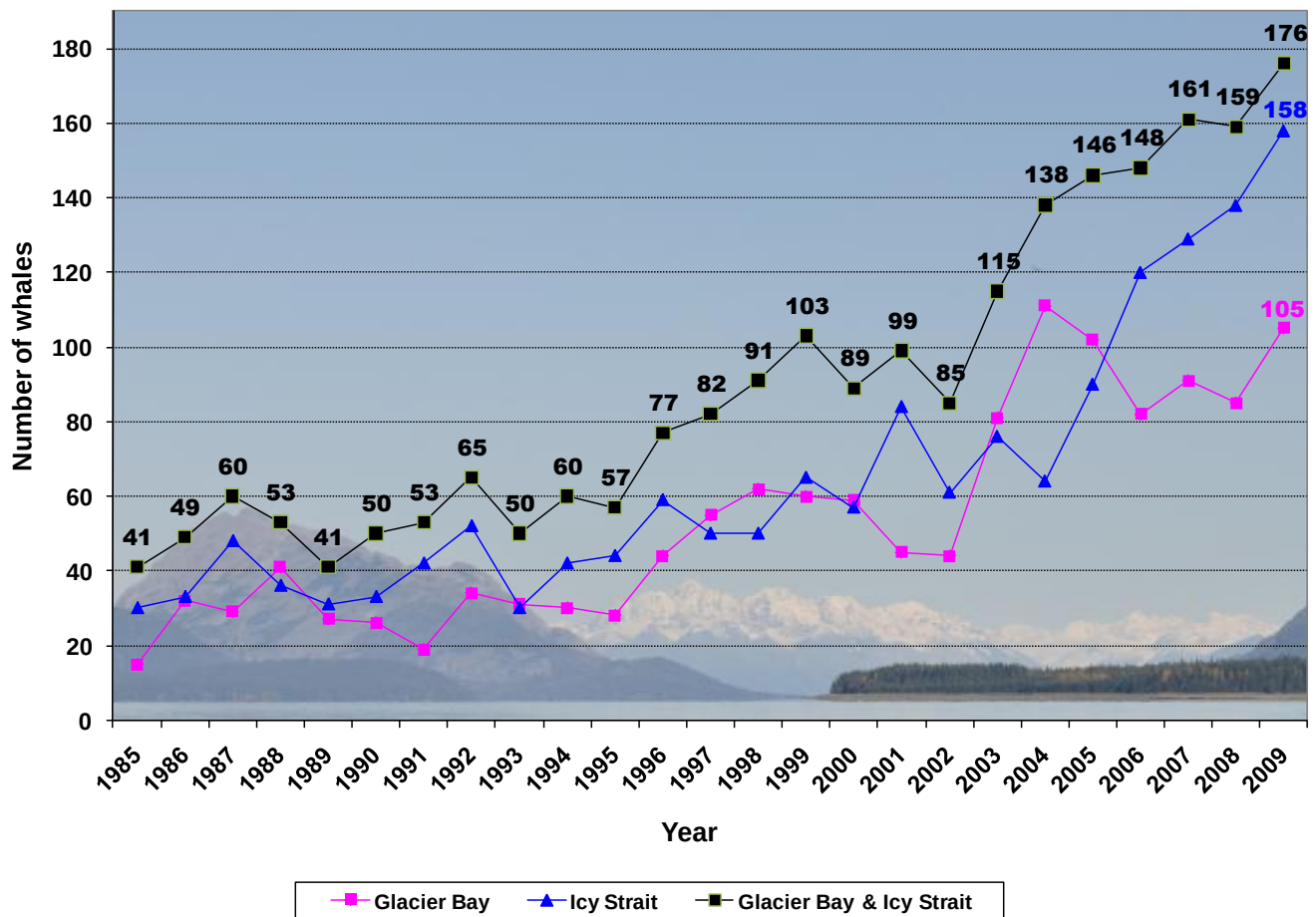


Figure 2. Number of individual whales documented in Glacier Bay & Icy Strait from June 1 through August 31, 1985 – 2009.

Nine more new whales were observed in Glacier Bay or Icy Strait only outside of the June through August monitoring period, for a grand total of 27 new (non-calf) whales in 2009. Interestingly, approximately half of all the new whales ($n = 13$) were small to medium in body size which indicates that they may have been juveniles. Five of the 27 whales had been sighted elsewhere in southeastern Alaska, while 22 whales had never been documented in southeastern Alaska. These 22 unknown whales were compared to a catalog of humpback whales from Kodiak but no matches were found (B. Witteveen, pers. comm.).

Whale Waters

In 2009, whale waters vessel speed restrictions in lower Glacier Bay were in place for 124 days,

compared to 137 days in 2008. The duration of these speed restrictions varies greatly from year to year depending on whale use in this area, with a significantly shorter duration in 2006 (22 days) but similar durations in 2005 (124 days) and 2007 (125 days). For the fifth year in a row, a large aggregation of whales centered around Point Carolus in Park waters in Icy Strait, resulting in a prolonged 13-knot speed limit in that area from May 15 – November 3 (173 days). Temporary whale waters were also designated at the entrance to the West Arm from June 25 – July 16 (22 days).

Residency

Sixteen (15%) of the 105 whales that entered Glacier Bay between June 1 and August 31, including one mother/calf pair, remained 20 or

more days, meeting our definition of ‘resident’ (Appendix 2). The proportion of Glacier Bay residents in 2009 was the lowest on record (1990 – 2008 average = 44%). Sixty-seven (42%) of the 158 whales that we identified in Icy Strait, including six mother/calf pairs, remained long enough to be considered resident. The proportion of Icy Strait residents in 2009 was similar to the historic average (1990 – 2008 average = 41%). Similar to recent years, 22 (13%) of the 176 whales that we sighted in Glacier Bay/Icy Strait, including one mother/calf pair, were resident in the combined Glacier Bay/Icy Strait study area. An additional 11 whales (6%), including one mother/calf pair, were resident in more than one area (*e.g.*, resident in Icy Strait and then resident in the combined Glacier Bay/Icy Strait area). Overall, 116 whales (66%) were resident in Glacier Bay, Icy Strait or the combined area between June 1 and August 31. This proportion is similar to recent years and highlights the importance of the Glacier Bay-Icy Strait region as a summer feeding ground for many humpback whales.

Twenty-five (14%) of the whales that we documented between June 1 and August 31, including one mother/calf pair, were identified on just one day: 10 in Glacier Bay and 15 in Icy Strait. Three of these whales were documented on the one day (August 5) that we surveyed Cross Sound, otherwise the sightings occurred over a broad range of dates, indicating that it was not a single pulse of whales arriving in the area. The proportion of whales sighted on one day varies widely each year, with a range of 12% – 43% since 1994. We documented 10 more whales on just one day outside of the June 1 – August 31 monitoring period, bringing the grand total of whales identified on one day to 35 individuals (18%). Three of these whales were identified on a single day (May 13).

Reproduction and Juvenile Survival

We documented 12 mother/calf pairs in 2009 (Table 2) with a crude birth rate (6.8%) somewhat lower than the historic average (10.2%) (Table 3) but well within the documented range of values for this extremely

Table 2. Mother-calf pairs, 2009.

	Mother ID#	Calf ID#	Documented in:
1.	235	2158	GB & IS
2.	353	2159	IS
3.	1014	2160	GB & IS
4.	1046	1046_calf_2009	GB & IS
5.	1079	2161	GB & IS
6.	1302	2162	GB & IS
7.	1428	1428_calf_2009	IS
8.	1432	2163	GB & IS
9.	1486	2164	GB & IS
10.	1531*	1531_calf_2009*	GB
11.	1593	2165	GB & IS
12.	1849	2166	IS

GB = Glacier Bay; IS = Icy Strait

Only calves whose flukes were photographed received an identification number

* Indicates mother/calf pair documented outside of the June 1 – August 31 study period

Table 3. Reproduction and known age whales in Glacier Bay and Icy Strait, 1982 – 2009.

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	8.8	18	91
1999	9	5	56	8.7	25	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
2007	17	12	71	10.6	39	161
2008	15	12	80	9.4	48	159
2009	12	10	83	6.8	51	176
1982-2008 average:	7.9	5.5	67.1	10.2	20.0	88.0

Only includes whales documented during the June 1 – August 31 study period. Crude Birth Rate (CBR) is 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.

variable parameter. One mother/calf pair (#1531 and calf) was present only in October and November, outside of the regular monitoring period. Female #1531 and her calf were also the only mother/calf pair documented exclusively in

Glacier Bay, all of the other mother/calf pairs were documented at least once, if not exclusively, in Icy Strait.

Female #1486 (age 10 with a complete annual

sighting history since age 4), female #1531 (age 13 with an incomplete annual sighting history) and female #1849 (age unknown) were documented with their first known calves. The mean age at first calving for female humpback whales in southeastern Alaska is 11.8 years (Gabriele *et al.* 2007). Whale #1486's sex was previously known from genetic analysis of sloughed skin, but the other two first-time mothers' sexes were unknown.

The value of the longevity of this study is highlighted by the fact that 29% (n = 56) of the 194 whales that we identified in 2009 were of known age. The proportion of known age whales in the population has increased annually as we continue to accumulate long-term sighting histories of the whales in the study area.

Genetics

We collected sloughed skin samples from nine unique individuals, including one calf. Since 1996, we have collected a total of 205 sloughed skin samples in the study area. Genetic analysis of these samples allows sex determination, definition of mitochondrial DNA haplotype and nuclear DNA genotyping. The only other practical ways we determine a whale's sex are if the whale returns to the study area with a calf (in which case we know that the mother is female) or in the infrequent event that we obtain photographs of the whale's urogenital area.

Feeding Behavior and Prey Identification

The only species of prey that we positively identified in association with feeding humpback whales was capelin (*Mallotus villosus*). On July 15 we collected a sample of capelin with a dipnet near several whales that were feeding off Point Carolus. On October 6 we observed widespread areas where small schooling fish were boiling at the sea surface near Flapjack Island (Fig. 3). We used a dipnet to collect a sample of the fish, which we identified as capelin and an unknown species of larval fish. At least nine humpback whales, including two mother/calf pairs, a minimum of 50 Steller sea lions (*Eumetopias jubatus*) and several species of gulls were feeding in the area.

We received numerous reports from other observers of small schooling fish in the study area in 2009. On April 26, a local boater took photographs of small schooling fish in Adam's Inlet that were identified as spawning capelin (B. Eichenlaub, pers. comm.; Y. Arimitsu, pers. comm.). In mid-June, two private fishermen reported that the stomachs of the halibut and king salmon they had caught in Bartlett Cove were full of "needlefish" (common name sand lance, (*Ammodytes hexapterus*) (C. Murdoch, pers. comm.; D. Waguespack, pers. comm.). In late June, a local charter fishing captain reported that to date, capelin were widely abundant in almost all of the fish stomachs they had



Figure 3. Surface swarms of capelin and larval fish (unknown spp.) near Flapjack Island on October 6, 2009.

examined from Icy Strait and Cross Sound (M. Halbert, pers. comm.). In late June, a GBNPP biologist conducting aerial surveys reported seeing numerous unidentified forage fish comm.). In mid-July, a local charter fishing captain reported more herring (*Clupea harengus pallasii*) off Gull Cove (at the mouth of Idaho Inlet) than he had seen in a number of years (P. Johnson, pers. comm.). Around the same time, a commercial fisherman reported that the salmon in Cross Sound were feeding primarily on herring (B. Stroeker, pers. comm.).

Whale/Human Interactions

In 2009 there were two confirmed and two unconfirmed reports of humpback whale/vessel collisions in Alaska; all of these incidents occurred in the study area. On June 5th a humpback whale surfaced underneath a rigid hull Zodiac that was anchored while fishing in Icy Passage near the Gustavus dock (D. Richards, pers. comm.). The whale lifted the boat several feet out of the water but did not capsize it. When the whale dove, the occupants' three sport halibut fishing lines "whizzed out", indicating that the whale was entangled, and they quickly cut the lines. The whale surfaced about 200 m away and then dove. The fate of this whale is unknown but there were no indications of any life threatening injuries.

On July 3rd a 10-meter commercial salmon troller transiting at 7 knots near the Inian Islands reported striking a humpback whale (L. Ply, pers. comm.). The captain did not see the whale prior to the collision but he heard a metallic thump and then heard a wheezing whale surface behind the vessel. Later he discovered a fist-sized-chunk of whale tissue stuck in his anchor chain 1.2 m off the water at the bow of the vessel (Fig. 4). We sent tissue samples to the National Marine Fisheries Service Southwest Fisheries Science Center and to Oregon State University for genetic analysis. The fate of this whale is unknown and no injured whales were reported or observed in the area following the collision.

The two unconfirmed reports of possible humpback whale/vessel collisions in the study area involved a skiff (August 4th at Point Adolphus) and a charter fishing vessel (early to mid September, exact location unknown).

In 2009 there were two confirmed and one unconfirmed report of dead humpback whales in Alaska; all of these incidents occurred outside the study area. On August 18th a crew member on the cruise ship *Westerdam* reported seeing a dead humpback whale floating in Chatham Strait but this report was never confirmed. On



Figure 4. Black and white whale skin and pink tissue stuck on anchor chain after whale collision with a fishing vessel on July 3, 2009.

November 28th a humpback whale calf was found dead on the beach at Grand Island in Stephens Passage. A full necropsy was not conducted but some samples were collected. On December 10th the carcass of a humpback whale calf was reported floating near Morris Reef in Chatham Strait. The carcass eventually washed ashore on Admiralty Island but no necropsy was conducted (NOAA unpublished data).

In 2009 there were seven confirmed humpback whale entanglements in fishing gear in Alaska; all of these incidents occurred in southeastern Alaska, including one incident in the study area. On September 21st we received a report from park visitors of an entangled humpback whale in Beardslee Entrance in lower Glacier Bay (M/V *Klondike Dream*, pers. comm.). The Park's trained whale disentanglement team responded and assessed the entanglement as potentially life threatening. As the whale traveled rapidly out of Glacier Bay towards western Icy Strait (Fig. 5), we attached a satellite tag to the entangling line trailing behind it. The next day, satellite data indicated that the buoy was stationary near the Inian Islands, approximately 12 miles east of where the whale was tagged. Local residents retrieved the telemetry and fishing gear, indicating that the whale had self-released from the entanglement. The gear was identified as a sport shrimp pot set in Howard Bay near Point Couverden in lower Lynn Canal on September 19th. We identified the whale as #1184, an adult male first documented in southeastern Alaska in 1991.

Outside the study area, on July 14th a humpback whale calf was reported entangled in gillnet near Juneau but the entanglement was assessed to be not life threatening and no disentanglement effort was mounted. On July 20th a sub-adult humpback whale was reported entangled in king crab pot gear near Skagway but later self-released. On September 22nd an adult humpback whale was documented entangled in sport shrimp pot gear but the whale was not resighted. The remaining reports (May 13th near Wrangell, September 12th in lower Lynn Canal and November 7th near Haines) involved humpback whales that were not resighted and the fishing gear type is unknown (NOAA unpublished data).

We are aware of a minimum of 32 “close call” incidents in which humpback whales nearly collided with vessels in Glacier Bay proper in 2009 (GBNP unpublished data). One incident involved a tourboat, one incident involved the high-speed catamaran that conducts daily tours of Glacier Bay and the remaining 30 incidents involved cruise ships. Three of the cruise ship encounters involved mother-calf pairs. At least five more “close calls” with cruise ships were documented in Icy Strait in 2009 (GBNP unpublished data). We defined a close call as a whale surfacing within 300 m in the path of a vessel, on the basis that there is some likelihood that the whale would still be at or near the surface 30 – 60 seconds later when the vessel arrived at the whale's location if the vessel is travelling 10 – 20 knots.



Figure 5. Humpback whale #1184 trailing orange buoy attached to sport shrimp pot on September 21, 2009.

The frequency of close calls varies annually based on the distribution of whales in the study area and has increased rapidly in recent years, with a previous high of 11 close calls reported in 2008 (Neilson and Gabriele 2008) and seven close call reports in 2007 (Neilson and Gabriele 2007). It is likely that the increase in reports in recent years is largely attributable to an increase in the reporting rate with NPS marine mammal observers stationed onboard cruise ships as part of a study initiated in 2006 and expanded in 2007.

Notable Behavioral Observations

On August 4th we observed whale #353 and her calf sleeping near Point Adolphus in Icy Strait. The pair appeared to awaken when a large non-breaking wake from a passing cruise ship rolled past them. It is unusual for us to observe sleeping whales noticeably reacting to boat wakes but on two occasions in 1998, we observed the same adult whale (pregnant female #1018) appear to be startled awake due to nearby wakes from cruise ships in Glacier Bay (Gabriele and Doherty 1998).

On at least three different occasions we documented adult whale #1532 (sex and age unknown) making loud in-air exhalations that sounded like honking. During all of these encounters #1532 was in a group of whales (3 – 14+ whales per group). Although we occasionally hear whales “honking”, it is unusual to document the same individual doing it repeatedly over time. We are aware of at least one other encounter in which #1532 was heard honking (June 2004).

In the fall, we saw several instances of apparently mating-related whale behavior consistent with behavior usually observed on their winter breeding grounds. The most notable of these are described below.

On September 9th, we observed 21-year-old female #1014 and her calf resting quietly at the surface with mature male #351 in a way that resembled the mate guarding behavior of

mother-calf-escort pods in the winter breeding season.

On September 29th we observed a known mature male (#1065, age 18) rapidly pursuing a known mature female (#1019, age 22) around a wide area in Icy Strait. These particular individuals are not frequently observed together, and they did not appear to be feeding, as they were traveling rapidly and the male was head-lunging, fluke-flicking and displaying s-shaped posture. A short time later, we made an audio recording of social sounds before and after #1019 did a vertical feeding lunge. Whale #1065 did not lunge but remained stationary nearby. The whales immediately resumed traveling, and were submerged within 300 m of the research vessel when social sounds were heard again, followed by several sharp, loud “slaps”. No other whales in the area were breaching or engaged in surface activity normally associated with percussive sounds, so we concluded that these loud sounds originated from this male-female pair. Similar sounds recorded in competitive groups in Hawaii have been attributed to underwater collisions or strikes between whales (Silber 1986), although the somewhat similar “gunshot” sounds made by male right whales (*Eubalaena glacialis*) in mating groups are known to be vocalizations (Parks and Tyack 2005). The exact source of the sound we recorded from this male-female pair is not known.

On October 19th we observed a surface active group of three whales just outside Glacier Bay near Point Carolus. The whales were engaged in highly energetic behaviors including head lunges and explosive surfacings. At the center of the activity was 12-year-old whale #1470 (sex unknown). One whale appeared to maintain its position within a body length of #1470 and performed repeated head lunges (likely male #937, though this whale’s identity could not be confirmed with certainty). The third whale (adult male #1083) was nearby and appeared to move around rapidly jockeying for position. This group’s behavior resembled competitive group behavior often observed on

wintering grounds and believed to have a mating-related function.

In 2009 we photographically identified two suspected and two confirmed singing humpback whales in the study area. On August 13 we deployed a portable hydrophone off the whale survey vessel *Sand Lance* near Mud Bay in Icy Strait. By correlating the timing and loudness of the song with our observations of a nearby whale, we suspect that the singer was adult male #1083 who was also documented as a suspected singer in October 2005. On September 9 we deployed the hydrophone at the entrance to Bartlett Cove and positively identified the singer as whale #352, a 25-year-old male who was also documented singing in Glacier Bay in 2007 (Neilson and Gabriele 2007). On September 14 we deployed the hydrophone near Willoughby Island and positively identified the singer as whale #516, a 35-year-old male who has not been documented singing in the study area before. On October 4 we deployed the hydrophone in Sitakaday Narrows and identified whale #159 nearby who we suspect may have been the singer. Whale #159 is a male (age unknown) who has not been documented singing in the study area before.

Singing humpback whales were heard on the anchored hydrophone in Bartlett Cove on numerous occasions between August 11th and November 23rd. Daily monitoring of the hydrophone continued through December. Song is a male display related to mating, and was previously not believed to be common in Alaska waters (McSweeney et al 1989, Gabriele and Frankel 2002).

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APPENDIX 1

STANDARDIZED (July 9 – August 16) and TOTAL (June 1 – August 31) Humpback Whale Counts, 1985-2009

	GLACIER BAY		ICY STRAIT		GLACIER BAY & ICY STRAIT	
Year:	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	23	27	23	31	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	27	50	69	91
1999	36	60	39	65	68	103
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	90	95	146
2006	66	82	98	120	130	148
2007	76	91	98	129	132	161
2008	55	85	97	138	125	159
2009	59	105	121	158	141	176
average:	37.16	53.52	45.00	64.88	68.60	89.92
stdev:	21.09	28.95	28.34	36.07	35.63	42.36

APPENDIX 2

Sighting Histories of Individually Identified Whales: 2009

[GB = Glacier Bay; IS = Icy Strait; green cells = Jun 1 – Aug 31 surveys (total period); blue cells = Jul 9 – Aug 16 surveys (standardized period)]

[illegible]

APPENDIX 2 (cont'd.)

Sighting Histories of Individually Identified Whales: 2009

[GB = Glacier Bay; IS = Icy Strait; green cells = Jun 1 – Aug 31 surveys (total period); blue cells = Jul 9 – Aug 16 surveys (standardized period)]

[illegible]

APPENDIX 2 (cont'd.)

Sighting Histories of Individually Identified Whales: 2009

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APPENDIX 2 (cont'd.)

Sighting Histories of Individually Identified Whales: 2009

[GB = Glacier Bay; IS = Icy Strait; green cells = Jun 1 – Aug 31 surveys (total period); blue cells = Jul 9 – Aug 16 surveys (standardized period)]

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