

Annual Progress Report

**Results of Humpback Whale Monitoring in Glacier Bay and
Adjacent Waters: 2008**



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Glacier Bay National Park & Preserve
Division of Resource Management

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This report contains preliminary data and should not be cited without permission of the authors.

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Cover photo: Yearling whale #2029 breaches near Willoughby Island in Glacier Bay (NPS photo).

INTRODUCTION

This report summarizes the findings of the National Park Service's (NPS) humpback whale monitoring program during the summer of 2008, the twenty-fourth 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 2008 are outlined below.

Vessel Surveys

We conducted surveys in Glacier Bay and Icy Strait from May 13 through October 9, 2008. We also photographed whales opportunistically in April on one trip from Bartlett Cove to Hoonah, and on one trip to Adams Inlet. We primarily 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. In addition, we conducted seven surveys from the *Boomer*, a 6.7-meter motorboat equipped with a single two-stroke Yamaha 150 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.

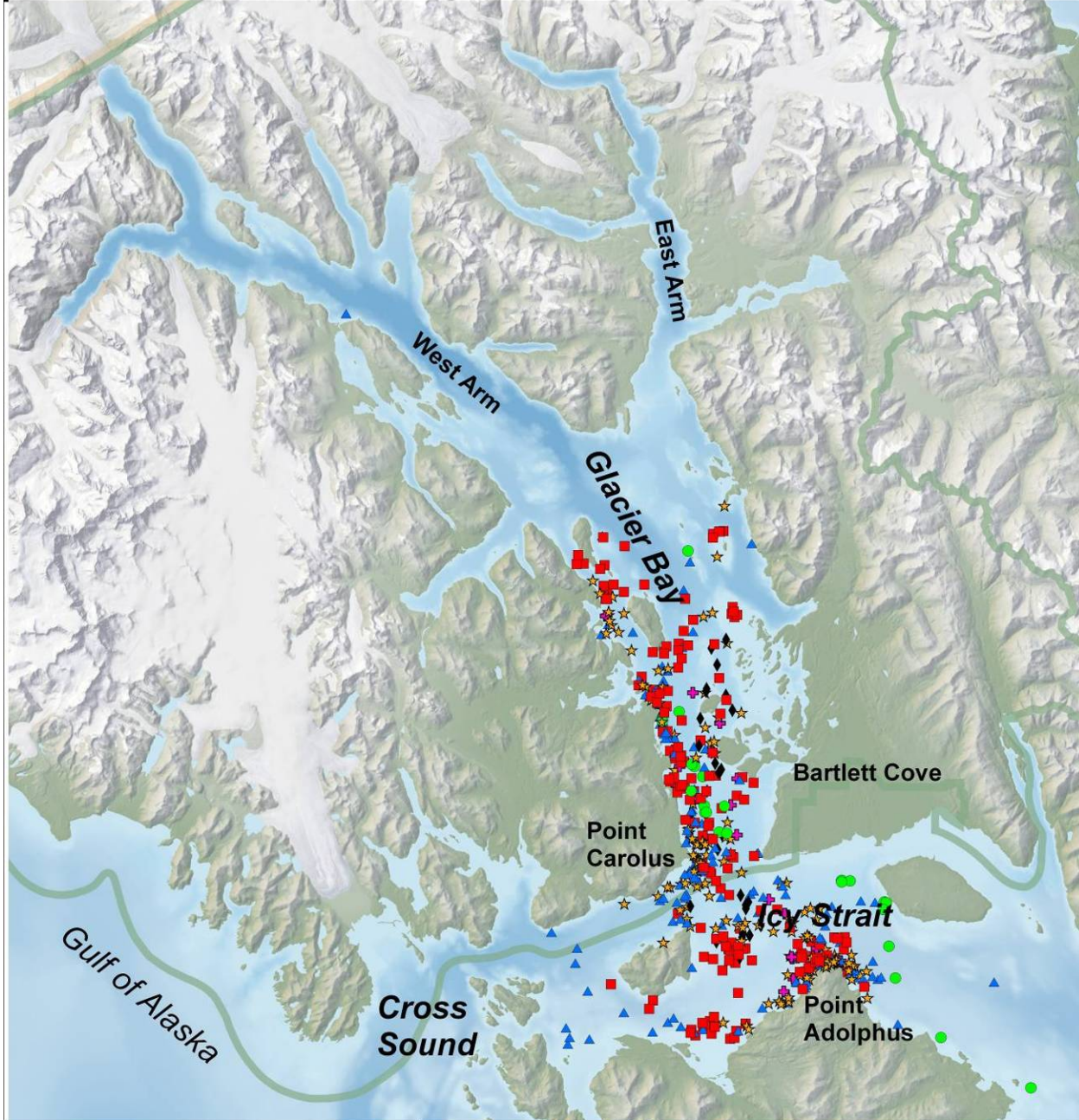
Between June 1 and August 31 we surveyed the main body of Glacier Bay (a rectangle defined by four corners: Bartlett Cove, Point Carolus, Geikie Inlet and Garforth Island) 3 – 4 days per week (Fig. 1), focusing the day's effort in a particular part of the study area. We surveyed the East and West Arms 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. 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 Glacier Bay results because whales frequently move between these areas and because Park waters include portions of Icy Strait. Several Icy Strait surveys included Dundas Bay, Idaho Inlet, Lemesurier Island and Pleasant Island.

We defined survey effort hours as only those hours that we spent actively surveying for whales (*i.e.*, transit time to and 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.

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

Humpback Whale Distribution

Glacier Bay and Icy Strait 2008



Humpback Whale Pod Locations by Month

- May (n=27)
- ▲ June (n=166)
- July (n=186)
- ★ August (n=168)
- ◆ September (n=23)
- ◆ October (n=29)



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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 2008. Each symbol represents a pod containing one or more whales.

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 a Nikon D100 digital camera equipped with a 100-300 mm zoom lens. 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 3). 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 2008. We also printed and catalogued the best 2008 identification photograph (fluke or dorsal fin) of each individual.

Whale Counts

We analyzed the 2008 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, 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 (in DMSO or frozen at -80o 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. We also biopsied known-age whales with a crossbow on five survey days, to help calibrate an age-determination method for humpback whales that uses fatty acid ratios in the blubber (Herman *et al.* 2008).

RESULTS AND DISCUSSION

Vessel Surveys: We searched for, observed and photographed humpback whales for a total of 304 hours in the combined Glacier Bay/Icy Strait study area (Table 1). This is slightly lower

Table 1. Monthly & Annual Survey Effort, 1985 – 2008.

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
2005-2007 average survey effort:											44.3	18.0	206.3	86.0	292.3

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

than the level of survey effort in 2007 but higher than the 2005 through 2007 average. 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).

Whale Counts

The number of whales in the study area as a whole ($n = 157$, Fig. 2, Appendix 2), was similar to recent years but slightly lower than the record high count in 2007 ($n = 161$). Likewise, in Glacier Bay, the number of whales ($n = 85$) was similar to recent years but slightly

lower than the total count in 2007 ($n = 91$). In Icy Strait, the number of whales ($n = 136$) was at a record high for the fourth year in a row with a total count 5% higher than in 2007 ($n = 129$). Nine more whales were observed in Glacier Bay and Icy Strait outside of the regular June through August monitoring period. 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).

Fifteen (10%) of the whales that we documented in the study area in 2008 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 – 2007 average

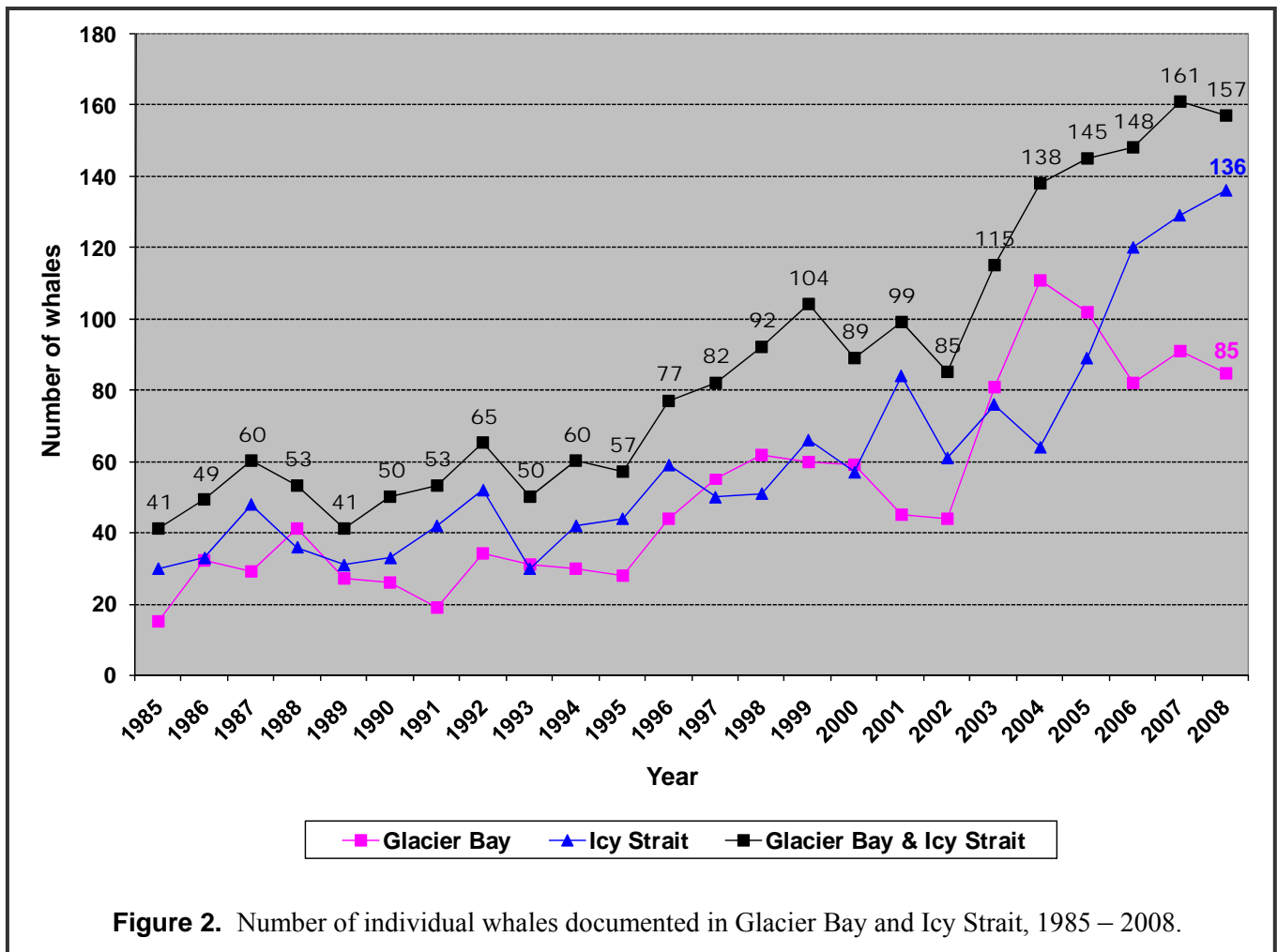


Figure 2. Number of individual whales documented in Glacier Bay and Icy Strait, 1985 – 2008.

(12%). One more new whale was observed in Glacier Bay outside of the June through August monitoring period. At least four of the new whales were small in size and two resembled calves that we had documented in recent years but we could not confirm these matches. Seven of the whales had been sighted elsewhere in southeastern Alaska, while eight whales had never been documented in southeastern Alaska.

Seasonal Distribution

The first 2008 sighting of a Glacier Bay whale took place in Hawaii on March 4th, when male #564 was sighted by the Hawaii Marine Mammal Consortium as a singer off the west coast of the Big Island (<http://www.nps.gov/glba/parknews/upload/Glacier-Bay-Whale-in-Hawaii.pdf>). Incidentally, #564 was first sighted in Alaska in Icy Strait on June 6th. The first whale sightings in the study

area in 2008 occurred in mid-March when the R/V *Thomas G. Thompson* reported two humpback whale sightings in lower Glacier Bay (L. Sharman, pers. comm.) On April 24th, during a trip to Hoonah to get the *Sand Lance* bottom-painted, most of Icy Strait was too rough to spot for whales, but we did sight a few at the mouth of Glacier Bay and two at the mouth of Port Frederick. The return trip from Hoonah on May 13th was the first official whale survey of 2008 and revealed a mother/calf pair in Port Frederick and at least 10 whales in the middle of Icy Strait, southwest of Pleasant Island. The number of whales in Icy Strait increased dramatically in June and remained stable through July and August. Even in September and October, there were at least 10 whales spread out across Icy Strait. Whale hotspots in Icy Strait in 2008 included Point Adolphus, central Icy Strait throughout the season, and the

area between Mud Bay and Lemesurier Island in mid-July and early August.

Glacier Bay whale distribution was unusual in 2008 in the relative rarity of sightings in the mid-bay, aside from an aggregation in and around Whidbey Passage from early July to early August. In April and May whales were reported a few times at the mouth of Adams Inlet. Sightings on the east side of the bay, from Garforth Island to Flapjack Island were particularly sparse. West and East Arm sightings were similarly sparse. Despite our low survey effort in the West Arm in 2008, consistent but low numbers of sightings from marine mammal observer Nat Drumheller aboard numerous cruise ships this summer indicated low whale abundance there. Whale sightings in the West Arm occurred regularly at the following locations: Gloomy Knob/Tidal Inlet, Hugh Miller Inlet, Scidmore Cut and Russell Island and occurred occasionally at Composite Island, Blue Mouse Cove, Reid Inlet, Jackie Point, Lamplugh Glacier, inside Tidal Inlet and at the head of Geikie Inlet.

The predominant Glacier Bay whale hotspots this season were the west shore of the lower bay as far north as the entrance to Berg Bay, and the Point Carolus area. On some surveys in these areas, more than 20 individual whales were sighted. Lower Bay whale numbers peaked in July, but whales were commonly sighted there throughout the season. Conversely, July whale numbers at the entrance to Glacier Bay were low compared to earlier and later in the season, perhaps indicating that these individuals moved up into Glacier Bay during July. At least five whales were still using the Point Carolus area during our final survey in mid-October. We received reports of whale sightings in November at Mud Bay and in Whidbey Passage. On November 21, visitors reported 15 whales at the mouth of Geikie Inlet and regular whale sightings at the back of Geikie Inlet throughout November (*Mad Dog Voyager* crew, pers. comm.).

Whale Waters

The length of whale waters vessel speed restrictions in lower Glacier Bay (137 days) was the longest since 1985. 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 similarly long durations in 2003 (134 days), 2005 (124 days) and 2007 (125 days). For the fourth year in a row, a large aggregation of whales centered around Point Carolus in Park waters in Icy Strait, resulting in a 13-knot speed limit in that area from July 18 – October 20 (95 days). Temporary whale waters were also designated between Willoughby and Flapjack Islands from July 9 – July 26 (18 days) and in Whidbey Passage from July 26 – August 15 (21 days).

Residency

Twenty-two (26%) of the 85 whales that entered Glacier Bay between June 1 and August 31, including two mother/calf pairs, remained 20 or more days, or long enough to be considered resident (Appendix 3). This proportion is lower than the historic average for Glacier Bay (1990 – 2007 average = 45%). Sixty (44%) of the 136 whales that we identified in Icy Strait, including 10 mother/calf pairs, remained long enough to be considered resident. The proportion of Icy Strait residents in 2008 was lower than in 2007 (51%) but higher than the historic average (1990 – 2007 average = 41%). Similar to recent years, 29 (18%) of the 157 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 10 whales (6%) 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, 121 whales (77%) were resident in Glacier Bay, Icy Strait or the combined area. 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.

We identified 19 (12%) of the whales in the study area on just one day: four in Glacier Bay and 15 in Icy Strait. These single 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 16% – 43% since 1994. We documented seven more whales, including a mother/calf pair, on just one day outside of the June 1 – August 31 monitoring period. Six of these whales were identified on a single day (May 13).

Reproduction and Juvenile Survival

We documented 15 mother/calf pairs in 2008 (Table 2) with a crude birth rate (9.6%) similar to the historic average (10.2%) (Table 3). One mother/calf pair (#1235 and calf) was present only in May, outside of the regular monitoring period. The number of mother/calf pairs that we documented in Glacier Bay was low compared to previous years. We know of only two mothers (#1018 and #161) who spent extended

periods of time in Glacier Bay. Interestingly, female #1018, who historically exhibits strong site fidelity to the West Arm of Glacier Bay, regularly frequented lower and middle Glacier Bay with her calf in 2008. It is notable that #1018 returned with a calf in 2008 given that we suspect she was struck by a 13 m jet boat traveling approximately 28 knots while she was pregnant in July 2007 (Neilson and Gabriele 2007).

Females #1235, #1658 and #1907 (all ages unknown) were documented with their first known calves; previously their sex was unknown. Female #1031 (age 20) and her mother (#219, age unknown but first sighted in 1982 and known to be a grandmother) both returned with calves in 2008. The value of the longevity of this study is highlighted by the fact that 29% (n = 46) of the whales that we identified in 2008 were of known age. The proportion of known age whales in the population has increased annually as we

Table 2. Mother-Calf Pairs, 2008

	Mother ID#	Calf ID#	Documented in:
1.	161	2057	GB & IS
2.	219	2058	IS
3.	232	2059	GB & IS
4.	397	2060	IS
5.	573	2150	IS
6.	941	2151	IS
7.	1018	2051	GB
8.	1019	2052	IS
9.	1031	2053	IS
10.	1042	2054	IS
11.	1057	2055	IS
12.	1235*	1235_calf_2008*	IS
13.	1298	2056	GB & IS
14.	1658	1658_calf_2008	IS
15.	1907	1907_calf_2008	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 – 2008.

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
2007	17	12	71	10.6	38	161
2008	15	12	80	9.6	46	157
1982-2007 average:	7.6	5.2	66.6	10.2	18.5	81.4

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.

continue to accumulate long-term sighting histories of the whales in the study area. Interestingly, we identified a record high number of yearlings in 2008 (n = 5). These yearlings were predominantly found in Glacier Bay, which is also where most of them spent their time as calves in 2007. We also identified

two four-year-old whales (#1842 and #2046) that had not been documented in southeastern Alaska since they were calves.

Yearling #2034 returned to the study area in 2008 with a significant injury to its right fluke blade (Fig. 3) that had occurred since our



Figure 3. Whale #2034 as a calf in 2007 (left) and with a healed injury to the right fluke blade in 2008 (right).

previous sighting in late August 2007. The origin of the injury, which appeared to be healed, is unknown. However, we speculate that it was not caused by a toothed predator (*e.g.*, killer whale, *Orcinus orca*, or false killer whale, *Pseudorca crassidens*) because there were no recent tooth rake marks on either side of the flukes. Furthermore, caudal peduncle photographs did not reveal any scars or injuries that would indicate #2034 had been entangled in fishing gear. Whales with significant portions of their flukes missing are rare in southeastern Alaska (Straley and Gabriele 2000) and this is the first time that we have documented this type of serious injury in the study area.

On July 29th we documented injuries to the calf of #1907's back and dorsal fin (Fig. 4) that were not there during our previous sighting on June 18, 2008. The calf had a swath of skin missing that extended along the dorsal side of its right flank from its dorsal fin to its caudal peduncle

exposing an underlying layer of red bloody tissue. In addition, the trailing edge of the calf's dorsal fin was damaged with some tissue missing. Overall, the injuries appeared to be fresh but not life threatening and the calf's behavior was normal. At the time of this sighting, the calf and its mother were in the core group at Point Adolphus in Icy Strait. Later we learned that three days earlier, on July 26th, a 18 m (58 ft) commercial seine fishing vessel reported striking a whale off the west side of Point Adolphus. The operator reported that he did not see the whale prior to the collision and that the ship was transiting at 10 knots when the ship's bow made impact. The collision lifted the ship's bow several feet out of the water and then he observed the whale surface approximately 30 m (100 ft) away but he saw no apparent signs of injury or blood in the water. He also noted that approximately 10 whales surfaced right after the collision, which strongly suggests that the whale that was hit was in the core group. Based on the



Figure 4. Calf of #1907 with fresh injuries likely caused by a vessel collision.

timing and location of this collision and the presence of #1907 and her injured calf in the core group on July 29th, we strongly suspect that #1907's calf was struck on July 26th. Despite our efforts to locate #1907 and her calf on subsequent surveys, we had no further encounters with the pair after July 29th. However the crew of a whale watching vessel reported seeing the injured calf at Point Adolphus on August 9, 2008 (K. Boesser, pers. comm.). Since 1987, we are aware of at least three other collisions that have occurred between humpback whales and vessels at Point Adolphus (Neilson and Gabriele 2005, NPS unpublished data).

We observed unusually high concentrations of barnacles growing on #941 and her calf (#2151) when we observed them in July and August (Fig. 5). As the calf rolled at the surface, we could see dense patches of barnacles and circular barnacle scars covering its head, back, flanks, pectoral fins and flukes. We were unable to observe #941 as closely as her calf, but she appeared to have fewer barnacles, with dense concentrations only apparent on her head and ventral flukes. Archived photographs show that #941 was not carrying this barnacle load in the summer of 2007. Humpback whales are known to carry barnacles of the genera *Coronula* and *Conchoderma* in a relationship of obligate commensalism (Scarff 1986). Based on the

external morphology of the barnacles we observed, we speculate that they were *Coronula* spp., also known as acorn barnacles. It is not uncommon for us to see barnacles growing on whales in the study area, but the number of barnacles on this mother/calf pair was unusual.

Genetics

We collected 23 sloughed skin samples from 20 unique individuals, including four calves. Since 1996, we have collected 196 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 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. The latter happens infrequently, but in 2008 we took photographs of calf #2057's ventrum as the calf rolled at the surface that revealed that this whale is a male.

Skin and blubber biopsies were obtained from known-age whales #186, #516, #1014, #1046, #1295, #1840, and unknown age whale #1809. Age estimates will be calculated for the known age whales using blubber fatty acids (Herman *et al.* 2008) and chromosome telomeres (Dennis



Figure 5. Female #941 and her calf showing unusually high concentrations of barnacles on both animals.

2006). Portions of the blubber samples will also be used in a NOAA Auke Bay Lab study to determine the dietary fatty acid signatures for whales that were presumed to be feeding on capelin, herring or both. The blubber sample from #1809 is of particular interest in determining the whale's nutritional status and the presence of any evident pathology, given its persistent emaciated appearance since its first sighting in 2003 (Doherty and Gabriele 2004).

Feeding Behavior and Prey Identification

The only species of prey that we positively identified in association with feeding humpback whales was a myctophid (most likely the northern lampfish (*Stenobrachius leucopsarus*)) (Table 4). We collected this specimen on June 2nd near three whales that were feeding south of Point Gustavus in Icy Strait. Interestingly, the next day (June 3), a dead fish reported to be a myctophid was reported washed up on the beach at Point Adolphus (M. Becker, pers. comm.). Previous studies in Icy Strait have found myctophids to be relatively rare compared to more typical humpback whale prey species such as capelin (*Mallotus villosus*) and walleye

pollock (*Theragra chalcogramma*) (Abookire *et al.* 2002). However, this is the third time that we have identified myctophids as the likely prey of humpback whales in Icy Strait (Doherty and Gabriele 2002, Neilson and Gabriele 2006).

On June 5th we observed extensive patches of prey on the echo-sounder in Icy Strait that we suspect were capelin after a local charter fishing captain reported that capelin were widely abundant in Icy Strait (based on the stomach contents of the fish they were catching) (M. Halbert, pers. comm.). In addition, on three occasions between late June and late July we noted a distinctive cucumber smell near feeding whales that likely indicated the presence of capelin. On two occasions we observed forage fish near feeding whales but we were unable to confirm the species; however we believe they were capelin and sand lance (*Ammodytes hexapterus*).

Whale/Human Interactions

On October 1st we documented a propeller scar (Fig. 6) on the dorsal side of adult whale #1832

Table 4. Humpback whale prey type determinations.			
METHOD:	PREY SPECIES (# of cases):		
	<i>myctophid</i>	<i>capelin?</i>	<i>sand lance?</i>
Collected specimen with dip net	1		
'Cucumber' smell in air		3	
Fish observed near surface			1
Seabirds & sea lions observed eating fish		1	

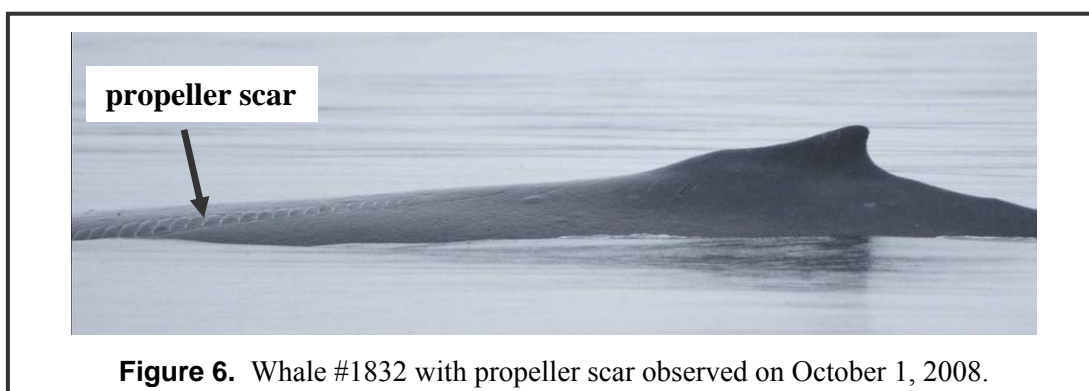


Figure 6. Whale #1832 with propeller scar observed on October 1, 2008.

(sex unknown, first documented in 2004) that was not there in photos taken August 13, 2007. This is the fourth whale that we have documented with a propeller scar in the study area since 1985.

Although we do not systematically solicit or track reports of vessels harassing whales in the study area, we occasionally receive reports of harassment. In 2008 we received two reports of vessels pursuing/harassing humpback whales; one incident occurred in Glacier Bay and the other occurred outside the study area in Cross Sound (Appendix 4, NOAA unpublished data).

We are aware of a minimum of 11 “close call” incidents in which humpback whales nearly collided with vessels in Glacier Bay in 2008 (Appendix 4, NOAA unpublished data). All of these incidents involved cruise ships. 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 the surface when the vessel arrived at the whale's location if the vessel is travelling 10 – 20 knots. 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 seven close calls reported in 2007 (Neilson and Gabriele 2007). It is likely that the increase in reports in 2007 and 2008 is partially 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.

In 2008 there was one confirmed whale/vessel collision (see p. 9) and one possible whale/vessel collision reported at Point Adolphus (Appendix 4, NOAA unpublished data). Four more collisions were reported outside the study area in southeastern Alaska (Appendix 4, NOAA unpublished data), two collisions were reported near Kodiak and one collision was reported near Seward (NOAA unpublished data).

On July 20th we received a report of an entangled whale near Lemesurier Island in Icy Strait (Appendix 5, NOAA unpublished data) but the animal was not resighted. Five more entangled whales were reported in 2008 outside the study area in southeastern Alaska (Appendix 5, NOAA unpublished data), one whale was disentangled from line near Kodiak, at least one dead entangled humpback was reported on Unalaska Island and one dead, entangled whale (possibly humpback) was reported near Kodiak (NOAA unpublished data).

In addition, at least 19 dead humpbacks were reported either beach cast or floating in Cook Inlet, the Bering Sea and around Kodiak Island and the Aleutian Islands (NOAA unpublished data). None of these animals was necropsied, therefore the cause of death was not confirmed in any of these cases. Overall, the number of dead humpback whales reported in Alaska in 2008 was exceptionally high compared to previous years (NOAA unpublished data).

Notable Behavioral Observations

On August 28th, in the middle of Icy Strait, we observed a lunge feeding whale (adult female #1428) surface underneath a flock of about 30 floating glaucous-winged gulls (*Larus glaucescens*) and engulf three juveniles (Fig. 7). After lunging, the whale remained motionless and vertical in the water, with its rostrum above the surface. It awkwardly and slowly opened and closed its mouth a few times, and shortly thereafter, we observed three drenched juvenile gulls at the surface. The whale slowly submerged and then continued milling and lunge feeding in the area. The gulls attempted to take off and rejoin their nearby flock, but they were unsuccessful because their feathers were saturated. After only a few minutes, the gulls were visibly trembling from hypothermia. One of them swam up to the research vessel and tried to climb aboard. We took it onboard so it could dry out. It was completely debilitated at first, but within 25 minutes it had visibly recovered after drying its feathers and getting warm in the sun, only to take off prematurely from the research vessel and land back in the water. We



Figure 7. Whale #1428 moments after releasing a juvenile glaucous-winged gull from its mouth.

presume that all three gulls died of exposure as a result of their encounter with the whale although there is a chance that their feathers dried and they were eventually able to fly away.

On October 1st, we observed a pair of whales (male #351 and female #600) in Beardslee Entrance that was absolutely stationary and making 21 – 23 minute dives. Dive lengths greater than 12 minutes are extremely unusual in Alaska, although long-dives in winter breeding areas are fairly common (Darling 2001, Chu 1988, NPS unpublished data). Listening with a portable hydrophone revealed no whale song or other vocalizations from these whales or other nearby pods. Their behavior at the surface was slow and measured. Given the male-female pairing and the onset of migration to the winter breeding grounds, it seems possible that this pair's behavior had a mating-related function.

Singing humpback whales were heard on the anchored hydrophone in Bartlett Cove on at least 41 occasions beginning on August 24th. A whale song was audible on the morning of October 25th just prior to the time when the hydrophone system stopped working. This unusually high number of singers is probably best explained by the concentration of whales in the lower Glacier Bay in late summer, where their vocalizations were audible on the hydrophone.

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APPENDIX 1

Humpback Whale Fluke Catalogs Used for Matching

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APPENDIX 2

STANDARDIZED (July 9 – August 16) and TOTAL (June 1 – August 31) Humpback Whale Counts, 1985-2008

Year:	GLACIER BAY		ICY STRAIT		GLACIER BAY & ICY STRAIT	
	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	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
2007	76	91	98	129	132	161
2008	55	85	96	136	124	157
average:	36.25	51.38	41.88	60.96	65.58	86.29

APPENDIX 4

SE Alaska Humpback Whale/Vessel Interactions, 2008

(Reports located in the study area are highlighted in yellow)

Date	Vessel type	Vessel speed	Location	Type of incident	Description of incident	Follow-up
2/10/08	28 ft. private vessel	19 kts	Eastern Channel, Sitka	collision	Vessel was transiting and struck whale with lower unit of the engine. Afterwards, observed a whale breathing 50 ft behind vessel.	
May 2008	cruise ship	unk	Glacier Bay	close call(s)	At least one close call occurred in late May in Glacier Bay. No further details obtained.	
5/19/08	3 Zodiacs from tourboat	unk	Granite Cove (near Elfin Cove), Cross Sound	harassment	Zodiacs observed repeatedly accelerating towards 12+ humpback whales including a few mother/calf pairs with at least one approach within 100 yards.	NOAA Enforcement investigated and Zodiac drivers denied there were within 100 yards. Captain re-emphasized regulations to crew.
6/1/08	cruise ship	unk	Sitakaday Narrows, Glacier Bay (just north of whale waters)	close call	Whale observed 2+ km ahead of ship, then dove heading away from ship's path. Whale surfaced 112 m off the ship's port bow swimming in same direction as the ship, slightly away from the ship.	
6/8/08	cruise ship	unk	Sitakaday Narrows, Glacier Bay	close call	Whale dove ~100 m in front of the ship heading towards it.	
6/16/08	24 ft fiberglass boat	30 kts	a few miles west of Point Adolphus, Icy Strait	<i>possible</i> collision	Operator reported possible collision with whale, though not confirmed. Vessel took on water and started to sink. Outdrive was damaged, no whale tissue on propeller.	GBNP surveyed for injured whales on 6/18/08 and 7/1/08 and found no injured whales. Later someone said the vessel hit a rock, not a whale, but this was never confirmed.
6/23/08	34 ft. aluminum tourboat	25 kts	Auke Bay, Juneau	collision	Vessel was transiting and hit whale on its dorsal side. Whale not seen again.	NOAA Protected Resources surveyed and found no whales in distress on 6/23/08. They sighted the whale that was allegedly hit and it was behaving normally.
6/30/08	cruise ship	unk	North of Rush Point, Glacier Bay (in whale waters)	close call/harassment	Ship was within 1 nm of shore in whale waters. Ship observed altering course towards a group of humpbacks, then transited directly through the group.	

APPENDIX 4 (cont'd.)

SE Alaska Humpback Whale/Vessel Interactions, 2008

(Reports located in the study area are highlighted in yellow)

Date	Vessel type	Vessel speed	Location	Type of incident	Description of incident	Follow-up
7/7/08	cruise ship	~13 kts	just north of Strawberry Island, Glacier Bay (in whale waters)	close call/possible collision	Whale observed 145 m off ship's port bow traveling parallel to and against ship's path. Whale was visible swimming below the surface. Lost sight of whale ~40 m from port bow. NPS rangers heard a loud thunk on port side of ship. Immediately afterwards, visitors observed a whale swimming below the surface off the port side of the ship.	GBNP whale biologists surveyed on 7/7/08 and found no injured whales. Further investigation led to conclusion that the thud heard by NPS rangers was likely the cruise ship tender being lowered for a transfer and that the whale was not hit.
7/26/08	58 ft. commercial seiner	10 kts	west side of Point Adolphus, Icy Strait	collision	Collision lifted the bow several feet out of the water, then observed the whale surface ~100 ft off the boat. No apparent signs of injury nor blood in the water.	On 7/29/08 GBNP observed #1907's calf with fresh injuries at Point Adolphus. Injuries appeared non-life threatening.
7/27/08	23 ft. skiff with 90 hp outboard engine	15 kts	North Pass, Juneau	collision	Force of the collision threw one passenger into the water. Observed a humpback ~20 ft off stern. No sign of external injuries to whale. Vessel's propeller and transom damaged.	NOAA Enforcement surveyed and found no whales in distress on 7/28/08.
7/28/08	cruise ship	8 kts	Point Carolus, Glacier Bay (in whale waters)	close call	Whale observed ~800 m off ship's port bow traveling perpendicular to and towards ship's path, then surfaced 371 m from port bow still traveling perpendicular to and toward the ship's path. Heard whale blow again close to the port bow and saw footprint ~30 m from port bow.	
7/28/08	cruise ship	5 kts	East of Secret Bay entrance, Sitakaday Narrows, Glacier Bay (in whale waters)	close call	Whale observed 50-100 m off ship's starboard bow and was then visible below the surface, heading slightly away. A few minutes later a whale surfaced 50-150 m ahead off ship's port bow, heading directly for the ship, then dove. Moments later more whales surfaced off starboard bow at 200-300 m, heading away. Pilot ordered "radical" steering changes to avoid collision(s).	
8/9/08	cruise ship	unk	Sitakaday Narrows, Glacier Bay (in whale waters)	close call	Whale observed sleeping ahead of ship's port bow. Ship transited past whale (still sleeping) ~100-200 m off port side. Captain did not see whale.	

APPENDIX 4 (cont'd.)

SE Alaska Humpback Whale/Vessel Interactions, 2008

(Reports located in the study area are highlighted in yellow)

Date	Vessel type	Vessel speed	Location	Type of incident	Description of incident	Follow-up
8/9/08	cruise ship	unk - "full speed"	near Lone Island, Glacier Bay	close call	Whale observed ~5 km directly ahead of ship, heading in same direction as ship, then dove. Whale next observed at 356 m slightly off starboard bow, still heading in same direction as ship, then dove. Whale then surfaced 182 m ahead and slightly to port, then observed under the port bow going with and parallel to the ship. Lost sight of whale ~90 m off port bow.	
9/6/08	cruise ship	unk	north end of Strawberry Island, Glacier Bay (heading out of whale waters)	close call	Whale observed ~5 km ahead of ship, heading perpendicular towards ship's path. Whale next observed almost directly ahead at 290 m, heading in the same direction as the ship. Whale surfaced again 151 m off port bow still going in the same direction. Lost sight of whale under port bow.	
9/12/08	32 ft. jet boat	37 kts	Breezy Bay, Craig	collision	Saw a mother/calf pair and headed towards them. Unclear which whale was struck. Collision launched vessel into the air and injured crew members. No information on injuries to whale(s).	Case is under investigation by NOAA Enforcement
9/19/08	cruise ship	unk	northern Sitakaday Narrows, Glacier Bay (in whale waters)	close call	Whale dove ~90 m off ship's port bow heading parallel to and against ship's path.	

APPENDIX 5

SE Alaska Humpback Whale Entanglements, 2008

(Reports located in the study area are highlighted in yellow)

Date	Location	Gear type	Description of incident	Follow-up
3/25/08	Sitka Sound	herring purse seine	Medium-sized whale reported entangled in herring purse seine. Whale likely entangled from the outside of the net after it closed. Unclear how long animal was entangled, reports ranged from 20 mins - 2 hours.	Whale released from net by fisherman with damage to net. Believed to be free of all gear. Jan Straley and others searched area after the whale was released. Saw no whales trailing gear or with obvious signs of recent entanglement. They did observe an agitated whale that fit the description of the entangled whale but could not confirm with 100% certainty.
7/7/08	3.5 nm NW of Benjamin Island, Lynn Canal	drift gillnet	Subadult (30-35 ft) humpback reported entangled in gillnet by commercial gillnetter.	With assistance from fishermen, animal able to free itself of main net and is likely free of all gear.
7/15/08	Peril Strait	2-3 ft. yellow polyball	Entangled humpback mother with calf reported by the charter vessel TRUE BLUE. Trailing gear along left side at level of pectoral flipper. Origin and nature of entanglement unknown.	7/16/08 - animal resighted from USFS helicopter. 7/17/08 - animal resighted from fixed-wing aircraft. Response mounted but animal not found after extensive surface and aerial effort.
7/20/08	Lemesurier Island, Icy Strait	single yellow & white buoy	Entangled adult humpback reported by the vessel MEDICINE MAN. Single buoy tight against the animal's dorsal surface. Shape of buoy unclear - one person thought it was basketball-sized and shaped, another person thought it was the size and shape of typical crab pot buoy.	GBNP searched the area but animal was not resighted.
8/14/08	Peril Strait	"net or clump of plastic"	Entangled adult humpback reported in a pod of three adults by the tourboat SPIRIT OF ALASKA. Trailing "net or clump of plastic", no buoys visible. Observers thought the whale might be entangled from its mouth or pec flipper, but how gear is secure is uncertain.	No response mounted. From passengers' fluke photos, the three whales were ID'd as 1295, 496 and 206 but it is unclear which whale was entangled. GBNP observed 1295 on 10/6/08 in Glacier Bay and cannot say with 100% certainty that this whale was not entangled.
8/28/08	Pt. Davison, southern Clarence Strait, Metlakatla	drift gillnet	Entangled whale reported in gillnet. Animal was completely wrapped in web and lead line, still attached to gillnetter. Entanglement was at the end of the net, right at buoy.	Whale disentangled by trained responder and others. Some gear remains on animal. Prognosis good. No longer life threatening.