RESULTS OF HUMPBACK WHALE POPULATION MONITORING IN GLACIER BAY AND ADJACENT WATERS: 2004

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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 2004, the twentieth consecutive year of consistent data collection in Glacier Bay and Icy Strait (Appendix 1). 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 2004 are outlined below.

Vessel Surveys: We conducted surveys in Glacier Bay and Icy Strait from May 11 through November 9, 2004. We searched for, observed and photographed humpback whales from the *Sand Lance*, a 5.8-meter motorboat 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). 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. 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 Glacier Bay results because whales frequently move between these areas.

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, as well as details pertaining to feeding behavior.

Individual Identification: The ventral surface of each whale's flukes have 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 2) 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 2004. We also printed and catalogued the best 2004 identification photograph (fluke or dorsal fin) of each individual.

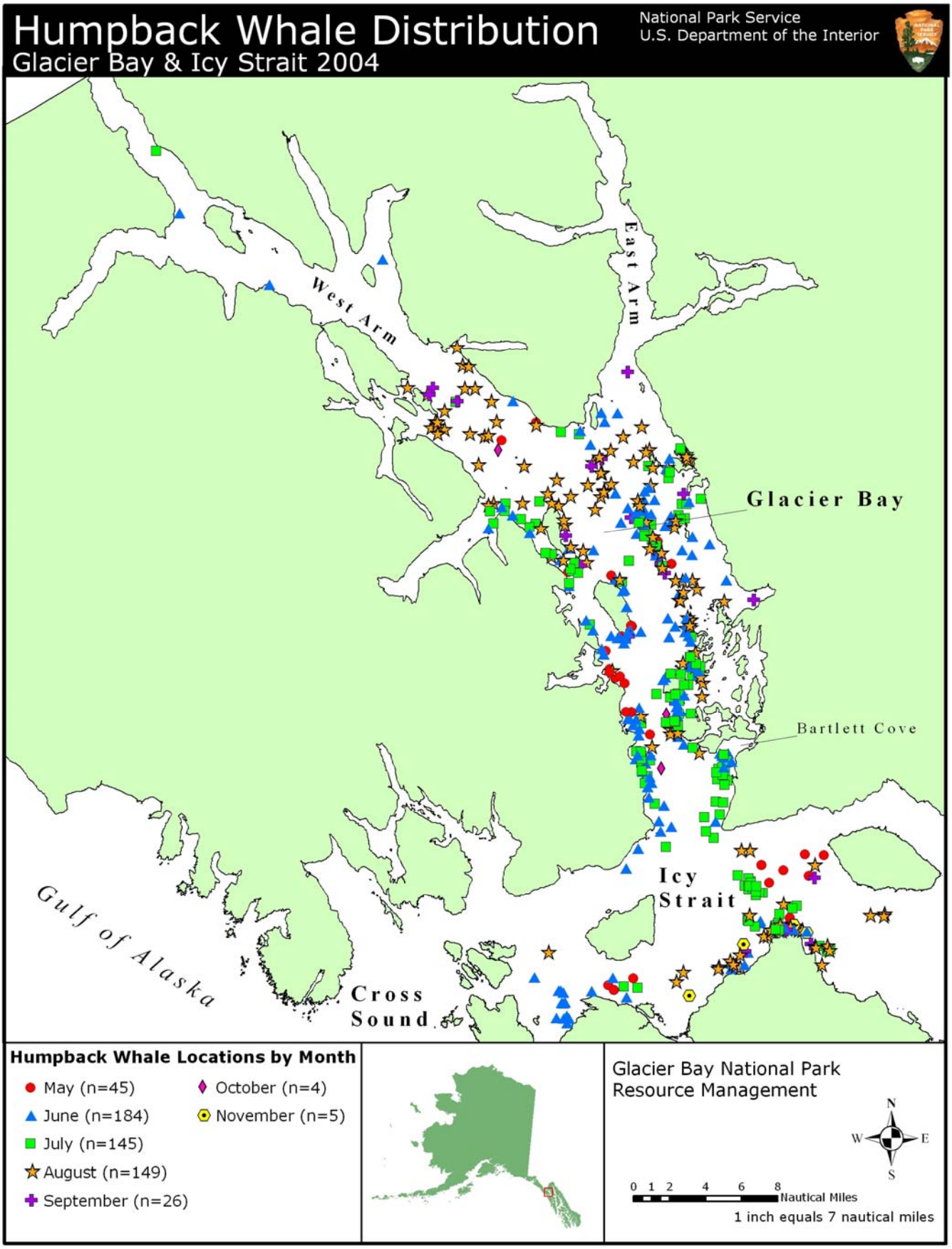

Figure 1. Study area in Glacier Bay and Icy Strait showing humpback whale distribution in 2004.

Whale Counts: We analyzed the 2004 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 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 and sent the other half to the National Marine Fisheries Service Southwest Fisheries Science Center (SWFSC) for DNA amplification and archiving. The SWFSC sends the DNA to the University of Auckland in New Zealand for mitochondrial DNA haplotyping and sex determination.

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 447 hours in the combined Glacier Bay/Icy Strait study area (Table 1). Our 2004 survey effort in Glacier Bay was above average and our survey effort in Icy Strait was below 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, 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). Specifically, three main factors

contributed to the 2004 levels of survey effort in Glacier Bay and Icy Strait. First, an unprecedented number of whales in park waters necessitated extra survey effort in Glacier Bay for us to stay abreast of where whales were concentrated so that we could make up-to-date whale waters management recommendations. Second, our survey effort includes time spent transiting to and from Bartlett Cove, and in 2004 unusually high numbers of whales in upper Glacier Bay increased the proportion of time that we spent in transit. Third, poor weather conditions hampered our ability to conduct surveys in Icy Strait, especially in June.

Table 1. Monthly & Annual Survey Effort, 1985-2004

YEAR	MAY # survey days		JUNE # survey days		JULY # survey days		AUG # survey days		SEPT # survey days		TOTAL # SURVEY DAYS (June 1 - August 31)		TOTAL # SURVEY HOURS (June 1 - August 31)		
	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***
1985-2003 average survey effort:											44.5	15.8	252.7	89.2	341.9

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

Whale Counts: For the second year in a row we documented a record number of whales in Glacier Bay and in the study area as a whole (Fig. 2, Appendix 4). This increase is only partially attributable to a record high number of calves (n = 17). Overall the humpback whale population in southeastern Alaska is growing. Between 1979 and 2000, the annual population growth rate in this region was estimated to be 8.8% (Angliss and Lodge 2004).

Fifteen of the whales that we documented in the study area in 2004 had not been sighted previously in Glacier Bay or Icy Strait. Six whales had been sighted elsewhere in southeastern Alaska and nine of the whales had never been documented. Five of the "new" whales were small and are presumed to be juveniles but we were unable to match their photographs to our catalog of past years' calves. For the second time we documented the movement of a whale between the study area and British Columbia. We have seen whale #1659 (also known as # BCX0631) in the study area every year since 2002, when we noted that it was a very small whale.

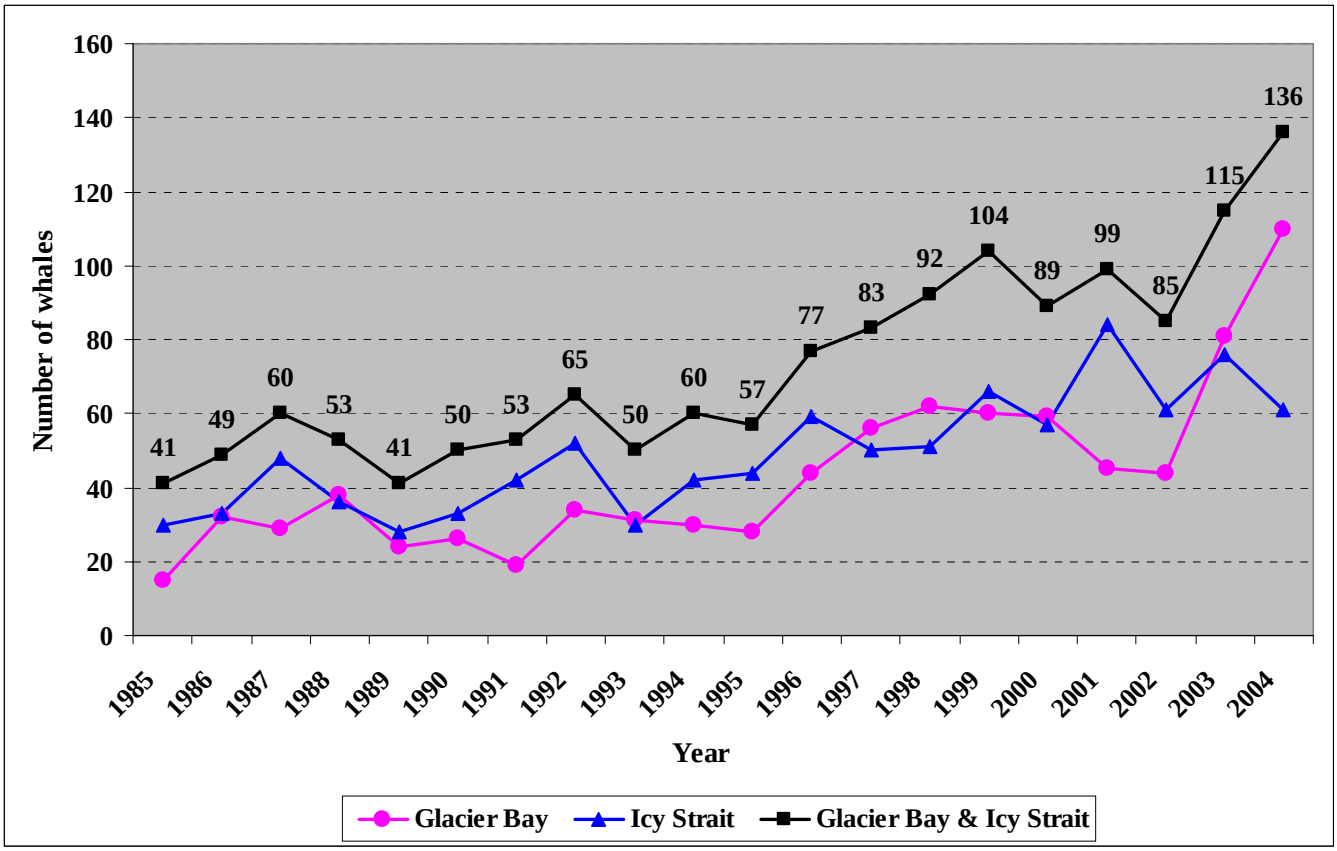

Figure 2. Number of individual whales documented in Glacier Bay and Icy Strait, 1985-2004.

Seasonal Distribution: Beginning in mid-May and continuing throughout the summer we observed an unprecedented number of whales in Glacier Bay (Fig. 1). We documented the first humpback whale in Glacier Bay in 2004 on March 26 when we heard a whale vocalizing on the hydrophone anchored in outer Bartlett Cove. The first sightings occurred in mid-April when the NPS vessel *Nunatak* reported six whales in Glacier Bay (K. Grant, pers. comm.). Beginning in mid-May, whale sightings were reported regularly in the upper West Arm near Margerie Glacier, Lamplugh Glacier and at the entrance to Johns Hopkins Inlet. West Arm sightings declined in mid-June, but in mid-August activity increased to even

higher levels at the entrance to the West Arm. Whales were frequent in this area until the beginning of October.

In late May we documented a brief, high level of activity between Rush Point and Fingers Bay, and whale numbers fluctuated in that area through mid-July. In late July we observed a large aggregation of whales in the northern half of Whidbey Passage. From mid-June to mid-August, whales concentrated in lower Glacier Bay and Beardslee Entrance. The whale aggregation then shifted to the Beardslee Entrance and Flapjack Island area where it remained until mid-September. Whale numbers were also high in the waters surrounding Sandy Cove from early August to early September. In mid-September we received a report of a humpback whale in upper Muir Inlet, approximately two miles from the face of Muir Glacier (B. Eichenlaub, pers. comm.). In general, the timing and distribution of whales in the lower and mid bay was similar to previous years, but the whales' heavy use of West Arm waters in 2004 was unprecedented. The late-season use of the Sandy Cove area was also somewhat unusual.

In mid- June and early July we documented a minimum of 12 whales near the mouth of Idaho Inlet in western Icy Strait. In mid-July we documented an aggregation of whales in the middle of Icy Strait, but otherwise whales in Icy Strait were consistently concentrated around Point Adolphus, which is typical of whale distribution in Icy Strait in previous years.

Whale Waters: The length of whale waters restrictions in lower Glacier Bay was typical of previous years (Appendix 5) but the unusually high number of whales in the mid and upper bay warranted numerous temporary whale waters designations (Appendix 6).

Residency: Seventy-four (67%) of the 110 whales that entered Glacier Bay between June 1 and August 31, including nine cow/calf pairs, remained 20 or more days, long enough to be considered resident (Appendix 3). The proportion of whales that were considered resident in Glacier Bay is the highest documented since 1985. Twenty-four (39%) of the 61 whales that we identified in Icy Strait, including four cow/calf pairs, remained long enough to be considered resident, which is a typical proportion for Icy Strait. An additional five (4%) of the 136 whales that we sighted in Glacier Bay/Icy Strait were resident in the combined Glacier Bay/Icy Strait study area but not in either specific sub-region. Whale #1083 was resident in Glacier Bay in June and then resident in Icy Strait in August. Whale #283 was resident in Icy Strait until mid-July and then resident in Glacier Bay until at least the middle of August.

We identified 22 of the whales (16%) that entered the study area, including two mother/calf pairs, on just one day: seven in Icy Strait and 15 in Glacier Bay. However, we documented seven of these whales on additional days outside of the June 1 – August 31 monitoring period.

Reproduction and Juvenile Survival: We documented a record high 17 mother/calf pairs in the study area in 2004 (Table 2). One mother/calf pair was present only in May, outside the regular monitoring period.

Table 2. Mother-Calf Pairs, 2004

	Mother ID#	Calf ID#	Documented in:
1.	155	155_calf_2004	IS
2.	353	1842	IS
3.	535	1843	GB
4.	573	1844	IS
5.	587	1845	GB & IS
6.	944	1846	GB
7.	1014	1835	GB
8.	1057	1057_calf_2004	IS
9.	1079	1836	GB
10.	1090*	1090_calf_2004*	IS
11.	1295	1295_calf_2004	GB
12.	1298	1837	GB
13.	1302	1838	GB
14.	1304	1839	GB
15.	1432	1432_calf_2004	GB
16.	1479	1840	GB
17.	1819	1841	GB

Notes:
- 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.

Despite the high number of mother/calf pairs in 2004, the crude birth rate (11.8%) was typical of previous years because the total number of whales in the study area was also high (Table 3). We documented the majority of the mother/calf pairs in Glacier Bay. Five of the mothers (#1057, age 13; #1295, age 12; #1298, age 12; #1302, age 12; and #1304, age 12) had never been previously documented with a calf. However, the age at first calving can only be confirmed for #1295 and #1298

because these 12-year-old females have been sighted every year in southeastern Alaska since age five without a calf. The other three females could have had a calf in previous years when they were not sighted in southeastern Alaska. A more detailed analysis of the age at first calving will be published in the proceedings of the October 2004 Glacier Bay Science Symposium (Gabriele et al. in press).

Table 3. Reproduction and known age whales in Glacier Bay and Icy Strait, 1982-2004

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	10.8	17	83
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	11.8	35	136
AVG:	6.87	4.83	67.41	10.46	14.15	71.33

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.

Whale #1432's calf died at the end of July from an apparent vessel strike. The details surrounding this incident are discussed under Whale-Human Interactions. We identified three whales (#1423, born 1997;

#1428, born 1997; and #1802, born 2003) that had not been sighted in the study area since they were calves. However, whale #1428, the 1997 calf of #965, was documented in Sitka Sound in 1998 and 1999 (J. Straley, unpublished data).

We observed whale #944's calf (#1846) several times this summer with extensive, healed killer whale rake marks all over its caudal peduncle and flukes (Fig. 3). Otherwise the calf appeared to be healthy and active. We do not know if the killer whale attack occurred in the study area.

Figure 3. Whale #944's calf with extensive scarring from killer whales.

Genetics: We collected 20 sloughed skin samples from 17 unique individuals, including three calves. Since 1996, we have collected 120 sloughed skin samples from humpback whales in Glacier Bay and Icy Strait. Genetic analysis of these samples allows sex determination and definition of mitochondrial DNA haplotype. 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 (then we assume it is female) or if we obtain photographs of the whale's genital area. The latter happens infrequently, but in 2004 we took photographs of calf #1841's genitals as the calf rolled at the surface and we determined that this whale is a female (D. Glockner-Ferrari, pers. comm.) Continued genetic analysis of sloughed skin samples from our study area will help elucidate the genetic relationships among whale populations worldwide (*e.g.,* Baker et al. 1998, Vant 2002).

Prey Identification: We positively identified four species of fish in association with feeding humpback whales in 2004: Pacific herring (*Clupea harengus pallasi*), capelin (*Mallotus villosus*) sand lance (*Ammodytes hexapterus*) and juvenile pink salmon (*Oncorhynchus gorbuscha*) (Table 4). The

unprecedented high number of whales in the study area apparently indicates high abundance of some or all of these forage fish species in the study area. Additional information may be forthcoming from seabird studies conducted in Glacier Bay in 2004 that entailed studies of forage fish distribution (Arimitsu et al., in prep).

Table 4. Humpback whale prey type determinations

	PREY SPECIES (# of cases):			
METHOD:	***herring***	***capelin***	***sand lance***	***juvi pink salmon***
Collected specimen with dip net		1	1	1
'Cucumber' smell in air		10		
Fish observed near surface	3			
Seabirds observed carrying away fish		2?	1?	

Whale/Human Interactions: We are aware of three incidents in Glacier Bay in which humpback whales surfaced in very close proximity to cruise ships, but none of these close calls resulted in a collision (M. Blakeslee, pers. comm., M. Fisher, pers. comm.). Interestingly, one of the whales, #1065, was involved in another close call with a cruise ship in Glacier Bay in 2003. There was also one incident in which a whale surfaced less than one body length (approximately 15 meters) in front of a tour vessel that was transiting at approximately 20 knots but the vessel did not strike the whale (S. Neilson, pers. comm.). On two separate occasions we documented a float plane and a private vessel harassing whales in Glacier Bay. We received a report of a charter vessel harassing whales at Point Adolphus (M. Braal, pers. comm.) and a report of an entangled humpback whale calf at Point Adolphus (G. Nelson, pers. comm.) but photographs revealed that it was an entangled gray whale, not a humpback whale. We received a report of a possible entangled whale in Beardslee Entrance (J. Speed, pers. comm.) but we were unable to determine if this was an entangled whale or simply a loose piece of fishing gear. However, in mid-August at least one, and possibly two, entangled humpback whales were documented in Icy Strait (NMFS Alaska Region stranding database, unpublished data).

On the morning of July 30 the tour vessel *Baranof Wind* reported a dead humpback whale in the intertidal zone on the south side of Strawberry Island (Fig. 4). Veterinarians from the Marine Mammal Center and the Alaska SeaLife Center led a detailed necropsy on August 1. The necropsy revealed that the whale was a nursing male calf that died after sustaining injuries caused by a blunt impact to the right

side of its body (Gulland and Tuomi 2004). Based on post-mortem dorsal fin photographs we identified the whale as the calf of whale #1432. Although it is possible that the calf was struck by something other than a vessel (for example a killer whale or another humpback whale), it seems more likely that it was hit by a vessel. We hypothesize that the collision took place sometime on July 29 within a few miles of where the whale was found. A 13 knot vessel speed limit was in place in lower bay whale waters at the

Figure 4. Dead humpback whale calf found on Strawberry Island, July 30, 2004.

time of the calf's death. Sea conditions in Glacier Bay were rough on July 29 and it is possible that a vessel struck the calf in heavy seas without realizing it. If the calf was struck by a vessel, this would be the second known whale fatality from a vessel strike in the study area. In July 2001 a pregnant female humpback whale was found dead near Point Gustavus after being hit by a large ship (Doherty and Gabriele 2001).

We left the calf's carcass on Strawberry Island to decompose but by August 7 several pieces of blubber removed from the carcass during the necropsy washed up in Pinta Cove (near Point Adolphus). The remainder of the carcass remained on Strawberry Island where we observed black bears feeding on it (Fig. 5). In early October a large portion of the decomposing carcass washed up on the beach just north of Lester Point. On October 16 we observed a minimum of 11 black bears feeding on the rotting remains.

Outside the study area, we received a report in mid-May of a humpback whale entangled in fishing gear near Point Couverden. In mid-August a humpback whale calf was found floating dead near Juneau. A detailed necropsy revealed that the whale was a nursing female calf with a severely fractured scapula (Tuomi 2004).

Figure 5. Black bear sow with three cubs feeding on the carcass of #1432's calf on Strawberry Island, August 30, 2004.

The number of whale-human interactions that we documented in 2004 was unusually high compared to previous years. The frequency of interactions is likely attributable in part to increases in the overall size of the southeastern Alaska whale population. Some of the observed increase in interactions may also be related to the high concentration of whales in Glacier Bay in 2004, where NPS staff and vessel operators are actively encouraged to report incidents.

Notable Behavioral Observations: The unusually high concentration of whales at the entrance to the West Arm was particularly difficult for vessel operators to detect because these whales made especially long dives. While typical dive times in the study area are 4-6 minutes, whales feeding at the entrance to the West Arm were regularly observed making dives of 10-12 minutes. This likely indicates that the whales were feeding at great depth on the deep layer of euphausiids (krill) first documented there in the 1980s (Krieger and Wing 1986). Although euphausiids sometimes swarm at the surface, in southeastern Alaska they are more typically found in the 'deep scattering layer' at 60-150 meters depth (Krieger 1990). We are not certain why so many whales concentrated at the entrance to the West Arm in 2004,

but special management actions to reduce the risk of whale-vessel collisions in this area may be warranted if the trend continues.

Whale #1809 is a small whale of unknown age that has appeared unhealthy since it was first documented in the study area on July 10, 2003. This whale's dorsal fin leans to the right, its rib cage is visible (Fig. 6) and color photographs reveal that it is carrying an unusually high concentration of whale lice (cyamids). In May 2004 we collected a sloughed skin sample with a live cyamid attached after whale #1809 breached. This whale also has scars around its caudal peduncle that clearly indicate it has been entangled (Doherty et al. in press).

Figure 6. Whale #1809 with bulge of ribcage evident.

On several occasions in past years we have suspected that we are observing behavioral changes in late summer and early fall related to the transition between summer feeding and winter breeding behavior (Baker and Herman 1984) prior to the whales' migration out of southeastern Alaska. On August 27 we observed male whale #516 (age 30) and whale #1088 (age 10, sex unknown) rolling together in close proximity at the surface. A nearby Steller sea lion confounded our ability to determine what was causing the interaction between the two whales because Steller sea lions sometimes precipitate humpback whale surface activity when they approach. On September 29 we observed male whale #351 (age unknown) and whale #1012 (age and sex unknown) rolling and turning in close proximity at the surface. The whales occasionally lifted their tails but did not dive. We observed similar behavior between two whales in October 2003 (Doherty and Gabriele 2003) after a male whale joined a whale that had been singing.

ACKNOWLEDGEMENTS

The whale monitoring study is vastly enriched by participation from Park staff and volunteers. We thank all of the enthusiastic staff at Glacier Bay National Park & Preserve for reporting whale sightings, and the Park's Visitor Information Station for recording them and passing them on to us. We especially appreciated receiving regular whale sighting reports from Justin Smith on the NPS vessel *Capelin*, Jim de la Bruere on the USGS-BRD research vessel *Alaskan Gyre* and Captains Deb Johnson, Jim Johnson and Blake Harper on the NPS concessionaire vessel *Baranof Wind*. Special thanks to Dena Matkin for continuing to contribute supplementary whale photographs and for assisting with the search for the entangled whale at Point Adolphus. We also thank Nick Rains for sharing his images of whale #1052 in front of Margerie Glacier. A big thanks to Bruce McDonough for doing his best to keep the *Sand Lance* running smoothly throughout the summer. We are grateful to the Glacier Bay law enforcement rangers for the use of their mighty Lund, the *Lituya*, when the *Sand Lance* was broken down. We also thank the RM staff for their understanding in accommodating our need for the *Alaria* during the *Sand Lance*'s unscheduled vacation. Last but not least, we thank Susan Boudreau and Mary Kralovec for their support of this research. National Park Service data from 1988 to 1990 were collected by Jan Straley. National Park Service data from 1985 to 1988 were collected by C. Scott Baker. This work was carried out under NOAA Fisheries Permit #945-1499-02.

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APPENDIX 1

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[Note: Many of these reports can be downloaded from the GBNPP public web site, www.nps.gov/glba]

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APPENDIX 2

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APPENDIX 3

Sighting Histories of Individually Identified Whales: 2004
(GB = Glacier Bay, IS = Icy Strait)

#	Whale ID	Nickname	05/11/2004	05/13/2004	05/18/2004	05/21/2004	05/27/2004	05/28/2004	06/01/2004	06/02/2004	06/03/2004	06/04/2004	06/07/2004	06/08/2004	06/09/2004	06/10/2004	06/11/2004	06/15/2004	06/16/2004	06/17/2004	06/18/2004	06/21/2004	06/22/2004	06/23/2004	06/24/2004	06/25/2004	06/28/2004	06/29/2004	06/30/2004	07/01/2004	07/02/2004	07/06/2004	07/07/2004	07/08/2004
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2	1246		GB		IS													IS					GB						GB					
3	1505		GB		IS		GB		GB													GB		GB										
4	1809		GB				GB																											
5	1485			GB		GB																												
6	1507			GB																														
7	1652			GB										GB														GB						
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12	161	B.W.M.			IS			IS		GB									GB			GB							GB					
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14	1660				IS																													
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APPENDIX 3 (cont'd.)

Sighting Histories of Individually Identified Whales: 2004
(GB = Glacier Bay, IS = Icy Strait)

	Whale ID	Nickname	05/11/2004	05/13/2004	05/18/2004	05/21/2004	05/27/2004	05/28/2004	06/01/2004	06/02/2004	06/03/2004	06/04/2004	06/07/2004	06/08/2004	06/09/2004	06/10/2004	06/11/2004	06/15/2004	06/16/2004	06/17/2004	06/18/2004	06/21/2004	06/22/2004	06/23/2004	06/24/2004	06/25/2004	06/28/2004	06/29/2004	06/30/2004	07/01/2004	07/02/2004	07/06/2004	07/07/2004	07/08/2004	07/09/2004	07/12/2004	07/13/2004	07/14/2004	07/15/2004	07/16/2004	07/19/2004	07/20/2004	07/21/2004	07/23/2004	07/26/2004	07/27/2004	07/28/2004	07/30/2004	08/02/2004	08/04/2004	08/05/2004	08/06/2004	08/09/2004	08/10/2004	08/11/2004	08/12/2004	08/13/2004	08/16/2004	08/18/2004	08/19/2004	08/21/2004	08/23/2004	08/24/2004	08/25/2004	08/26/2004	08/27/2004	08/30/2004	08/31/2004	09/01/2004	09/09/2004	09/10/2004	09/15/2004	09/16/2004	09/29/2004	10/05/2004	10/07/2004	10/15/2004	11/09/2004
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113	1042																													IS																																															
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115	1842	calf of 353																												IS	IS								IS										IS				IS																									
116	581																													IS																																																
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118	1533																																	GB				GB								GB							GB																	GB									
119	1802																																	GB							GB																																					
120	1832																																	GB											GB												GB								GB						GB							
121	1531																																		GB							GB																																GB				
122	GBNP-JLD-20040712-1-0011																																			GB																																										
123	1295																																				GB																																									
124	1295_calf_2004																																				GB																																									
125	1817																																				GB							GB								GB											IS															
126	933																																						IS										IS				IS																									
127	1472																																							IS			GB																																				
128	285																																							IS																							IS															
129	1441																																										IS						IS																													
130	944																																											GB				GB		GB	GB					GB			GB			GB				GB													
131	1846	calf of 944																																										GB				GB		GB	GB					GB			GB			GB				GB													
132	GBNP-JLD-20040726-1-0056																																												GB																																		
133	441	Festus																																													GB																															
134	1629																																																		GB										GB		GB						GB								
135	1805																																																		GB																	GB	GB								
136	1820																																																		GB					GB					GB			GB													
137	516	Garfunkle																																																		IS													IS									GB			
138	1833																																																							GB														GB							
139	1011	Wide White Eyes																																																								GB												IS					GB	
140	GBNP-JLD-20040823-1-0028																																																												GB																
141	879																																																																IS												
142	GBNP-CMG-20040827-1-0061																																																																IS												
143	1542																																																																												IS

APPENDIX 4

STANDARDIZED (July 9 – August 16) and TOTAL (June 1 – August 31)
Humpback Whale Counts, 1985-2004

	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	17	38	29	36	40	53
1989	20	24	20	28	32	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	42	56	33	50	67	83
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	84	110	34	61	109	136

APPENDIX 5

History of 'Lower Bay Whale Waters' Vessel Speed Limits in Glacier Bay, 1985-2004

YEAR	START DATE	END DATE	# DAYS	LOWER BAY SPEED LIMIT
1985	01-Jun	31-Aug	92	10 knots
1986	01-Jun	31-Aug	92	10 knots
1987	09-Jun	06-Aug	59	10 knots
1988	01-Jul	20-Jul	20	10 knots
1989	30-Jun	21-Aug	53	10 knots
1990	27-Jun	23-Aug	58	10 knots
1991	03-Jul	31-Aug	60	10 knots
1992	17-Jun	31-Aug	76	10 knots
1993	13-Jul	19-Aug	38	10 knots
1994	07-Jul	13-Aug	38	10 knots
1995	12-Jul	11-Aug	31	10 knots
1996	01-Jul	01-Sep	63	10 knots
1997	10-Jul	22-Aug	44	10 knot speed limit for vessels ? 80 ft. in length, all other vessels: 10 knot speed limit if within 1 mile of shore, otherwise 20 knot speed limit
1998	09-Jul	10-Sep	64	10 knots
1999	09-Jul	15-Sep	69	10 knots, and mid-channel course restriction extended until 15-Sept
2000	23-Jun	21-Sep	91	10 knots, and mid-channel course restriction extended until 21-Sept
2001	31-Aug	28-Sep	29	10 knots, and mid-channel course restriction extended until 28-Sep
2002	01-Aug	16-Aug	16	10 knots
2003	22-May	02-Oct	134	13 knots, and mid-channel course restriction extended until 02-Oct
2004	19-Jun	19-Aug	62	13 knots (*note:* speed limit reduced to 10 knots on 07-Aug)

In addition, the following regulations are in effect annually by default under the GBNPP Vessel Management Plan:

*1996-2004	15-May	31-Aug	109	20 knot speed limit / mid-channel course restriction

APPENDIX 6

History of 'Temporary Whale Waters' Restrictions in Glacier Bay, 1985-2004

YEAR	LOCATION	START DATE	END DATE	# DAYS	TYPE OF RESTRICTION
1985	*none*				
1986	Muir Point to south Leland Island	12-Jun	03-Jul	22	10 knot speed limit
1987	East Arm entrance	03-Jul	10-Jul	8	10 knot speed limit / mid-channel course
1987	East Arm entrance	10-Jul	29-Jul	20	mid-channel course
1987	lower Whidbey Passage	10-Jul	29-Jul	20	10 knot speed limit
1988	Russell Island Passage	20-Jul	06-Aug	18	10 knot speed limit
1989	*none*			0	
1990	southern Whidbey Passage	08-Jul	10-Aug	34	10 knot speed limit
1991	*none*			0	
1992	East Arm entrance	09-Jul	21-Jul	13	10 knot speed limit / mid-channel course
1993	Whidbey Passage	13-Jul	04-Aug	23	10 knot speed limit / mid-channel course
1994	Whidbey Passage	07-Jul	27-Jul	21	10 knot speed limit / mid-channel course
1995	Whidbey Passage	08-Jul	22-Jul	15	10 knot speed limit / mid-channel course
1996	*none**				
1997	Russell Is. Passage, East Arm entrance	10-Jul	22-Aug	44	10 knot speed limit for vessels ≥ 80 ft. in length, all other vessels: 10 knot speed limit if within 1 mile of shore, otherwise 20 knot speed limit
1997	Whidbey Passage	10-Jul	02-Oct	85	10 knot speed limit for vessels ≥ 80 ft. in length, all other vessels: 10 knot speed limit if within 1 mile of shore, otherwise 20 knot speed limit
1998	East Arm entrance	04-Jun	19-Jun	16	10 knot speed limit if within 1 mile of shore; 20 knot speed limit otherwise
1999	Marble Islands	23-Jun	15-Jul	23	10 knot speed limit
2000	Whidbey Passage	23-Jun	01-Jul	9	10 knot speed limit / mid-channel course
2001	Rush Point to lower Whidbey Passage	25-Aug	14-Sep	21	10 knot speed limit / mid-channel course
2002	Hugh Miller/Blue Mouse Cove	22-Jun	18-Jul	27	10 knot speed limit (+ mid-channel course when entering Blue Mouse Cove)
2002	Lower Whidbey Passage	26-Jun	16-Aug	52	10 knot speed limit
2003	northern Sitakaday Narrows	22-May	02-Oct	134	13 knot speed limit / mid-channel course
2004	Whidbey Passage	17-Jun	09-Jul	23	13 knot speed limit (*note:* from June 17-19, speed limit was 10 knots)
2004	Northern Beardslee Entrance	07-Aug	14-Sep	39	10 knot speed limit / mid-channel course
2004	Sandy Cove	07-Aug	08-Sep	33	10 knot speed limit / mid-channel course
2004	West Arm entrance	19-Aug	13-Oct	56	13 knot speed limit

In addition, the following regulations are in effect annually by default under the GBNPP Vessel Management Plan:

*1996-2004	Whidbey Passage, Russell Is. Passage, East Arm entrance	01-Jun	31-Aug	92	mid-channel course restriction