RESULTS OF HUMPBACK WHALE POPULATION MONITORING IN GLACIER BAY AND ADJACENT WATERS: 2003

Janet L. Doherty and Christine M. Gabriele

Glacier Bay National Park & Preserve
P.O. Box 140, Gustavus, AK 99826 USA

INTRODUCTION

This report summarizes the findings of the National Park Service's (NPS) humpback whale monitoring program during the summer of 2003, the nineteenth 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.

One of the primary goals of the monitoring program is to produce annual statistics from field data collected in a consistent fashion each year so that trends in whale numbers and distribution can be derived. The current report is brief in comparison to previous reports (Appendix 1) with the new goal of providing all the pertinent facts about the 2003 whale population with just enough narrative detail to characterize the year's events. The reason for this change is twofold. First, although the longer reports are a useful reference, we rarely refer back to them for the level of detail that they contain. Second, we annually spend several weeks producing a descriptive report that has become somewhat repetitive over the years; time that might be better spent conducting more focused analyses that would advance our understanding of humpback whale use of the Glacier Bay area. The new format is intended to be a concise report that emphasizes our research methods and summarizes the data in maps, figures and tables.

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 2003 are outlined below.

Vessel Surveys: We conducted surveys in Glacier Bay and Icy Strait from May 15 through November 4, 2003. 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 2003. We also printed and catalogued the best 2003 identification photograph (fluke or dorsal fin) of each individual.

Whale Counts: We analyzed the 2003 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.

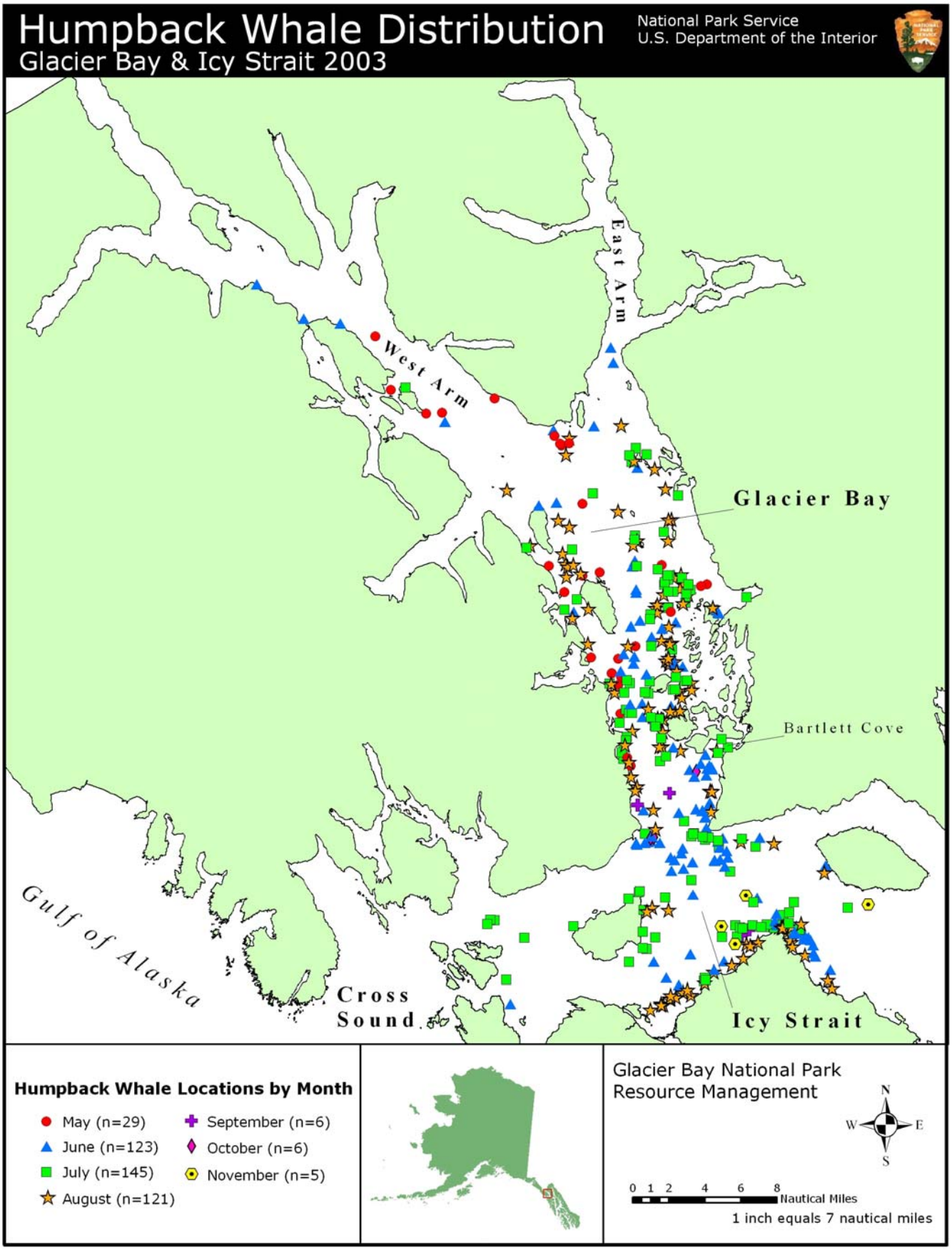

Figure 1. Study area in Glacier Bay and Icy Strait showing humpback whale distribution in 2003.

RESULTS AND DISCUSSION

Vessel Surveys: We searched for, observed and photographed humpback whales for a total of 384 hours in the combined Glacier Bay/Icy Strait study area (Table 1). Our level of survey effort in Glacier Bay was typical of recent years but somewhat above the multi-year average since 1985. Our level of survey effort in Icy Strait was above average, especially compared to recent years, and likely reflects frequent calm survey conditions there in 2003. Although we strive to maintain a comparable level of survey effort throughout the study area 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

Table 1. Monthly & Annual Survey Effort, 1985-2003

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***
									1985-2002 average survey effort:		43.9	15.7	250.8	88.4	339.3

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

staff and the frequency of unexpected events that detract from our ability to conduct surveys (*e.g.,* mechanical difficulties and marine mammal strandings). Another change that has occurred during the life of the monitoring program is that in 2001 we replaced the study's 5.2-meter Boston Whaler with a 5.8-meter SafeBoat which is capable of handling more inclement survey conditions. The new vessel has

enhanced our ability to navigate through localized poor conditions (*e.g.*, fog in Bartlett Cove) to reach areas with acceptable survey conditions, and as a result may have slightly increased our level of survey effort.

Whale Counts: We documented a record number of whales in Glacier Bay and the observed increase cannot be attributed to a shift in distribution away from Icy Strait because numbers were high there, too (Fig. 2, Appendix 4). Notably, 20 of the whales that we documented in the study area in 2003 had not been sighted previously in Glacier Bay or Icy Strait. Nine of the "new" whales had been sighted elsewhere in southeastern Alaska, one whale had been observed in British Columbia and ten whales had never been documented. This is the first time that we have documented the movement of a whale (#1847, also known as BCX30) between the study area and British Columbia.

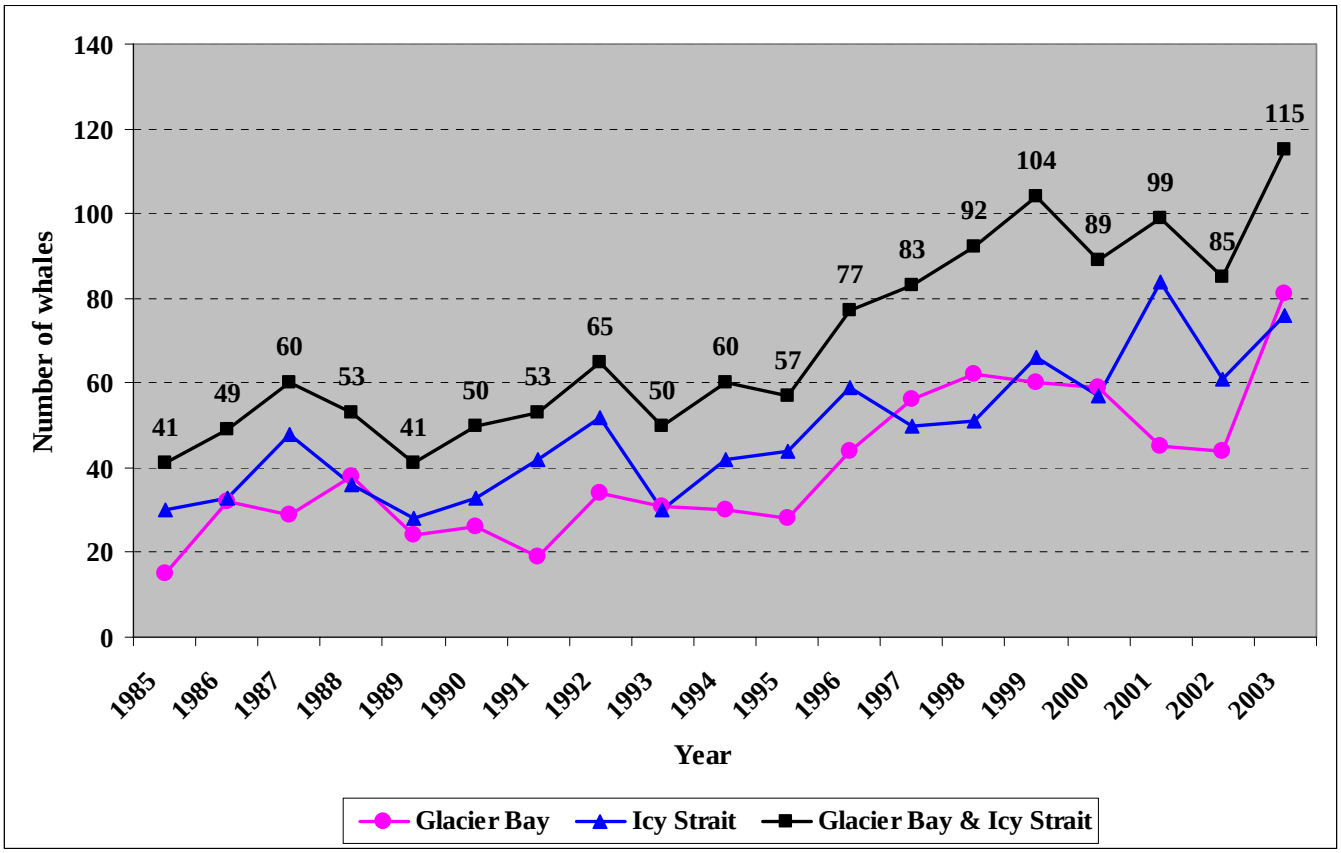

Figure 2. Number of individual whales documented in Glacier Bay and Icy Strait, 1985-2003.

Seasonal Distribution: Beginning in mid-May and continuing throughout the summer we observed many whales in Glacier Bay, with the highest numbers concentrating in the mid and lower bay (Fig. 1).

We documented the first humpback whale in Glacier Bay in 2003 on April 6 when we heard a whale vocalizing on the hydrophone anchored in outer Bartlett Cove. We received reports of a concentration of whales in Whidbey Passage for a few days in late May (R. Yerxa, pers. comm.) but these numbers were not sustained. Whale activity at Point Adolphus was high until mid-June, when many whale apparently moved toward the Gustavus Flats and Glacier Bay. On June 12 we documented as many as 30 whales at the entrance to Glacier Bay, including a number of Point Adolphus 'core group' members. Throughout June we received reports of at least 3-6 whales feeding near the Gustavus dock (W. Howell and P. Turner, pers. comm.). In mid-July we documented a large aggregation of whales around Lemesurier Island, but by the end of July most of the activity in Icy Strait had shifted towards Point Adolphus. Whale numbers in mid Glacier Bay increased in July and use of this area was sustained through August. Throughout the summer we only documented a few whales in the West Arm and we received few reports from other observers in this area.

Whale Waters: The protracted use of lower Glacier Bay by whales from mid-May through early October resulted in the longest implementation of a reduced vessel speed limit in this area since 1985 (Appendix 5). A vessel speed limit and course restriction was also designated in northern Sitakaday Narrows for the same extended time period. Unlike in some previous years, no temporary whale waters were designated in mid or upper Glacier Bay (Appendix 6).

Residency: Thirty-five (43%) of the 81 whales that entered Glacier Bay between June 1 and August 31, including two cow/calf pairs, remained 20 or more days, long enough to be considered resident (Appendix 3). Thirty (39%) of the 76 whales that we identified in Icy Strait, including four cow/calf pairs, remained long enough to be considered resident. An additional 17 (15%) of the 115 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. One whale (#118) was resident in Glacier Bay until August and then became resident in Icy Strait. These residency statistics are similar to what has been observed in the study area in previous years.

Reproduction and Juvenile Survival: We documented 7 mother/calf pairs in the study area in 2003 (Table 2). The crude birth rate of 6.1% in 2003 is somewhat lower than average for previous years (Table 3) but well within the documented range of values for this extremely variable parameter. Whale #1046, a female born in 1987, returned to the study area for the first time with a calf at age 16. Whale

#1046's sighting history is intermittent with no sightings documented in 1992 (at age 5) or 1995 (at age 8), so it is unclear if this was her first calf. Two female whales already known to be grandmothers (#219 and #581) returned to the study area with new calves. Three generations of whales are becoming fairly common in the study area, for example whale #581's 16-year-old daughter (#1042) also returned with a calf in 2003. Also, whale #219, her 15-year-old daughter (#1031), and #1031's 5-year-old offspring (#1475) all returned to the study area in 2003. Whale #1475 (born 1998) was one of two whales (also #1731, born 2001) that had not been sighted in the study area since they were calves.

Table 2. Mother-Calf Pairs, 2003

	Mother ID#	Calf ID#	Documented in:
1.	219	1803	IS
2.	235	1800	GB
3.	451	451_calf_2003	GB & IS
4.	541	541_calf_2003	IS
5.	581	1802	IS
6.	1042	1801	IS
7.	1046	1804	GB

Notes:

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

Genetics: We collected 18 sloughed skin samples from 15 unique individuals, including one calf. One of the skin samples had a live cyamid (whale louse) attached, which we also collected. Since 1996, we have collected 100 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. 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).

Feeding Behavior and Prey Identification: We positively identified three species of fish as potential whale prey in 2003: Pacific herring (*Clupea harengus pallasi*), capelin (*Mallotus villosus*) and sand lance (*Ammodytes hexapterus*) (Table 4). The unusually high number of whales and seabirds that we observed in mid and lower Glacier Bay are likely attributable to a comparatively high abundance of forage fish (probably primarily capelin) but the lack of systematic quantitative annual forage fish

Table 3. Reproduction and known age whales in Glacier Bay and Icy Strait, 1982-2003

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
AVG:	6.45	4.50	67.07	10.39	13.05	68.10

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.

abundance data prevents us from testing this hypothesis. On May 22 we documented a pair of adult whales 'echelon feeding' off the north end of Willoughby Island. This behavior, in which two or more whales lunge synchronously while swimming parallel and very close to each other at the water's surface, is rarely observed in the study area despite the fact that we systematically note details pertaining to feeding behavior. We documented the 'core group' of whales that consistently feed together near Point Adolphus on six occasions between June 4 and August 21. We received one report of the core

group engaged in group bubblenet feeding (M. Jarvis, pers. comm.). Typically this group uses subsurface feeding and is only observed infrequently using bubblenets (see Jurasz and Jurasz 1979 for definition of bubblenet).

Table 4. Humpback whale prey type determinations

	PREY SPECIES (# of cases):		
METHOD:	***herring***	***capelin***	***sand lance***
Collected specimen with dip net		2	
'Cucumber' smell in air		11	
Fish observed near surface	7	2	1
Seabirds observed carrying away fish	1		

Whale/Human Interactions: There were two incidents in Glacier Bay in which a humpback whale surfaced in very close proximity to a transiting cruise ship's bow, but neither close call resulted in a collision. In early July the operator of a 6.7 m Zodiac struck a single humpback whale in Icy Strait but the whale and the vessel operator survived. We documented a healed injury to whale #221's dorsal fin that had occurred since our last sighting of this whale on September 5, 2002 (Figs. 3, 4). This resembled injuries that we documented in 2001 to whale #166's dorsal fin and in 2002 to whale #118's dorsal fin (Doherty and Gabriele 2001). Unfortunately, we can not determine the origin of these injuries.

Figure 3. Whale #221's dorsal fin prior to damage.

Figure 4. Whale #221's dorsal fin, summer 2003.

Over the course of the summer we documented five incidents in which whales were harassed by aircraft circling or hovering at low altitude; one incident involved a commercial air taxi and four incidents involved U.S. Coast Guard helicopters. In early July USGS biologists reported a possible entangled

whale in upper Glacier Bay but we were unable to determine if this was an entangled whale or simply a loose piece of fishing gear.

Outside the study area, we are aware of two humpback whales that were struck by vessels. In mid-May an adult female humpback whale died after being struck by a large ship and was found floating near Yakutat. In mid-August a cruise ship transiting south of Sitka reportedly collided with a humpback whale but the fate of the whale is unknown.

The number of whale/vessel incidents (close calls and collisions) inside and outside the study area was above average in 2003, otherwise the overall number and type of whale/human interactions was typical of previous years. The increase in whale/vessel incidents may be partially attributable to the overall growth of the humpback whale population in southeastern Alaska and/or to an increase in the reporting rate of incidents.

Notable Behavioral Observations: Twice in fall 2003 we detected singing whales (Gabriele and Frankel 2002) on the computer listening station at GBNPP headquarters that transmits acoustic signals from a hydrophone anchored in Bartlett Cove. We immediately launched a whale survey equipped with a portable hydrophone to try to find the singer to determine its identity and observe its behavior. On the first attempt on 23 September the singing had stopped by the time we got out into Bartlett Cove, but there was only one whale in the area and it was traveling rapidly into Sitakaday Narrows. We presume that this individual, male whale #351, was the singer but we cannot be certain.

On 14 October, we heard singing on the listening station and we were able to go out and locate the singer, whale #1065, near Point Carolus. This is the first visual confirmation of the identity of a singing whale in Glacier Bay. There were several other humpbacks feeding in the area and after about 30 minutes of observation, whale #1244 joined the singer and the singing stopped. The whales remained very close together and engaged in graceful, languid surface behavior characterized by rolling and periodically extending their tails, heads or pectoral flippers out of the water. The whales seemed highly interested in one another and were physically in contact with each other almost continuously (see cover photo of this report). They also appeared to actively remain close to our drifting vessel. Although we left the area after an hour, these two whales remained together and continued this behavior for a total of at least two hours (observed from a distance). The sex of #1065 (born 1992) is unknown, but in 2004 we

collected a sloughed skin sample from this whale so genetic analysis will soon reveal its sex. Whale #1244 is known to be male from genetic analysis of a biopsy sample collected in 2002 (C.S. Baker, pers. comm.). The behavior of the singer and the whale that joined are similar to observations made in Hawai'i where singing is a common male activity (J. Darling, pers. comm.).

On 22 September, we observed two adult male humpbacks (#157 and #118) interact closely with a group of four killer whales (*Orcinus orca*) that were attacking a Steller sea lion (*Eumetopia jubatus*) in Icy Strait. The killer whales hit, leapt over and generally harassed the sea lion while it remained passive and stationary at the surface. The two humpbacks, which had been separate just prior to the start of the killer whale attack, joined together and stayed very close to the sea lion, especially when the killer whales were charging at or leaping over the sea lion. The humpbacks appeared agitated – wheeze-blowing, laterally swishing their tails and rolling on their sides near the sea lion – and stayed at the surface most of the time. Due to daylight limitations we had to leave before this multi-species interaction ended. The humpback whales' behavior is difficult to interpret, but is similar to previous anecdotal observations of humpback whales' apparent curiosity and excitement during killer whale attacks on a minke whale (*Balaenoptera acutorostrata*) (D. Matkin, pers. comm.) and a Steller sea lion (E. Mathews, pers. comm.) in southeastern Alaska.

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* and Jim de la Bruere on the USGS-BRD research vessel *Alaskan Gyre*. Special thanks to Dena Matkin for continuing to contribute supplementary whale photographs and to Bruce McDonough for keeping the *Sand Lance* running smoothly throughout the summer. Thanks to Mary Kralovec for her ongoing 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 #945-1499-00.

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APPENDIX 1

Previous GBNPP Humpback Whale Monitoring Annual Reports (in chronological order)

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

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APPENDIX 3

Sighting Histories of Individually Identified Whales: 2003
(GB = Glacier Bay, IS = Icy Strait)

	Whale ID	Nickname	05/15/2003	05/16/2003	05/20/2003	05/22/2003	05/27/2003	05/29/2003	06/02/2003	06/03/2003	06/04/2003	06/05/2003	06/09/2003	06/10/2003	06/12/2003	06/13/2003	06/16/2003	06/18/2003	06/19/2003	06/20/2003	06/23/2003	06/24/2003	06/25/2003	06/26/2003	06/27/2003	06/30/2003	07/02/2003	07/07/2003	07/09/2003	07/10/2003	07/11/2003	07/14/2003	07/16/2003	07/17/2003	07/18/2003	07/22/2003	07/23/2003	07/24/2003	07/25/2003	07/28/2003	07/30/2003	07/31/2003	08/01/2003	08/04/2003	08/05/2003	08/06/2003	08/07/2003	08/08/2003	08/11/2003	08/13/2003	08/14/2003	08/18/2003	08/19/2003	08/21/2003	08/22/2003	08/25/2003	08/27/2003	08/28/2003	09/16/2003	09/22/2003	09/23/2003	10/03/2003	10/14/2003	10/27/2003	11/04/2003
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62	1659														IS					IS												GB																																		
63	397																GB			GB				IS			IS				IS					IS								IS										IS											
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APPENDIX 3 (cont'd.)

Sighting Histories of Individually Identified Whales: 2003
(GB = Glacier Bay, IS = Icy Strait)

	Whale ID	Nickname	05/15/2003	05/16/2003	05/20/2003	05/22/2003	05/27/2003	05/29/2003	06/02/2003	06/03/2003	06/04/2003	06/05/2003	06/09/2003	06/10/2003	06/12/2003	06/13/2003	06/16/2003	06/18/2003	06/19/2003	06/20/2003	06/23/2003	06/24/2003	06/25/2003	06/26/2003	06/27/2003	06/30/2003	07/02/2003	07/07/2003	07/09/2003	07/10/2003	07/11/2003	07/14/2003	07/16/2003	07/17/2003	07/18/2003	07/22/2003	07/23/2003	07/24/2003	07/25/2003	07/28/2003	07/30/2003	07/31/2003	08/01/2003	08/04/2003	08/05/2003	08/06/2003	08/07/2003	08/08/2003	08/11/2003	08/13/2003	08/14/2003	08/18/2003	08/19/2003	08/21/2003	08/22/2003	08/25/2003	08/27/2003	08/28/2003	09/16/2003	09/22/2003	09/23/2003	10/03/2003	10/14/2003	10/27/2003	11/04/2003
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APPENDIX 4

STANDARDIZED (July 9 – August 16) and TOTAL (June 1 – August 31)
Humpback Whale Counts, 1985-2003

	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

APPENDIX 5

History of 'Lower Bay Whale Waters' Vessel Speed Limits in Glacier Bay, 1985-2003

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

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

*1996-2003	15-May	31-Aug	109	20 knot speed limit / mid-channel course restriction

APPENDIX 6

History of 'Temporary Whale Waters' Restrictions in Glacier Bay, 1985-2003

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

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

*1996-2003	Whidbey Passage, Russell Is. Passage, East Arm entrance	01-Jun	31-Aug	92	mid-channel course restriction