Annual Progress Report

Results of Humpback Whale Monitoring in Glacier Bay and Adjacent Waters: 2011

Humpback whale #875 lunge feeds in Icy Strait, May 2011.

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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 2011, the twenty-seventh 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 2011 are outlined below.

Vessel Surveys

We conducted surveys in Glacier Bay and Icy Strait from May 17 through October 13, 2011. We searched for, observed and photographed humpback whales from the *Sand Lance*, a 5.8-meter motorboat based in Bartlett Cove and equipped with a two-stroke Evinrude E-TEC 150 HP outboard engine. To minimize the potential impact that monitoring efforts might have on whales, we typically did not conduct surveys in the same area on consecutive days.

Between June 1 and August 31 we surveyed the main body of Glacier Bay (a rectangle defined by four corners: Bartlett Cove, Point Carolus, Geikie Inlet and Garforth Island) 3 – 4 days per week (Fig. 1), focusing the day's effort in a particular part of the study area. We surveyed the East and West Arms of Glacier Bay (to the mouth of Tarr Inlet) infrequently. We surveyed Icy Strait approximately once per week, with the greatest survey effort focused along the shoreline of Chichagof Island from Pinta Cove to Mud Bay and in Park waters around Point Carolus. 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 Lemesurier and Pleasant Islands and the mouths of Dundas Bay and Idaho Inlet.

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

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

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

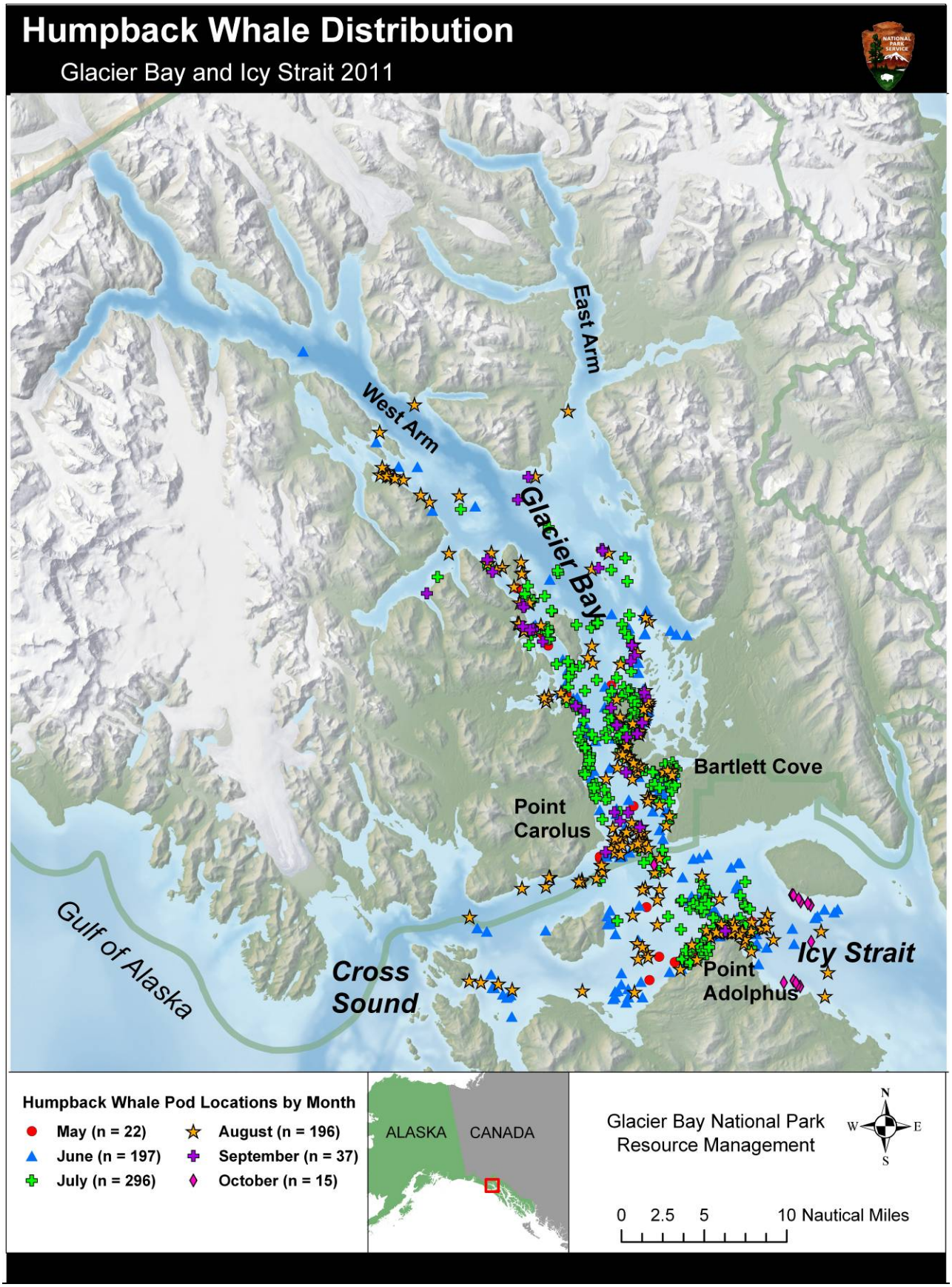

Figure 1. Study area in Glacier Bay and Icy Strait showing distribution of humpback whale pods in 2011. Each symbol represents a pod containing one or more whales.

and Palmer 1981; Katona *et al*. 1979). For some whales, the shape and scarification of the dorsal fin also serve as unique identifiers (Blackmer *et al*. 2000). We took photographs of each whale's flukes and dorsal fin with a Nikon D90 digital camera equipped with a 100-300 mm zoom lens. We compared fluke and dorsal fin photographs to previous NPS photographs and to photographs of other humpback whales from southeastern Alaska (University of Alaska Southeast, unpublished data) to determine the identity and past sighting history of each whale.

We referred to many whales by a permanent identification number common to the combined catalogs of GBNPP and University of Alaska Southeast researcher Jan Straley. We also referred to those whales first photo-identified by Jurasz and Palmer (1981) by their nicknames (Appendix 2). We only assigned calves a permanent identification number if we obtained adequate photographs of the calf's flukes and the calf was sighted on more than one day. For whales that had not been previously identified in Glacier Bay and Icy Strait, we assigned temporary identification numbers. We replaced these temporary numbers with permanent identification numbers if we identified the whale on more than one day or if the whale was identified elsewhere by another researcher. Photographic and sighting data were added to a relational database containing Glacier Bay and Icy Strait whale sighting histories from 1977 to 2011. We also printed and catalogued the best 2011 identification photograph (fluke or dorsal fin) of each individual.

Whale Counts

We examined the 2011 photographs to determine the number of distinct individual whales observed. We made separate counts of Glacier Bay and Icy Strait for the dedicated monitoring period (June 1 – August 31) and for a 'standardized period' (July 9 – August 16) (after Perry *et al*. 1985). Although the standardized period is substantially shorter than the current NPS monitoring period and the beginning and ending dates have no particular biological significance, we continue to use the standardized period because it provides the only valid means of comparing whale counts in 1982 –1984 to later years (Gabriele *et al*. 1995).

We defined the following age classes: calves (less than one year old), juveniles (age 1 – 4 years, as determined by prior sighting history) and adults (age ≥ 5 years). We also determined the number of whales that were 'resident' in Glacier Bay, Icy Strait and the combined area. We defined a whale as resident if it was photographically identified in the study area over a span of 20 or more days (after Baker 1986). Reliable tracking of residency statistics began in 1990 with the advent of our computerized whale database.

Genetics

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

RESULTS AND DISCUSSION

Vessel Surveys: We searched for, observed and photographed humpback whales for a total of 299 hours in the combined Glacier Bay/Icy Strait study area (Table 1). This level of survey effort is comparable to the average for 2005 – 2010. Although we strive to maintain a comparable level of survey effort each year, it inevitably fluctuates as a result of inter-annual variability in uncontrollable factors such as weather, availability of staff and the frequency of unexpected events that detract from our ability to conduct surveys (*e.g.*, mechanical difficulties and marine mammal strandings).

Table 1. Monthly & Annual Survey Effort, 1985 – 2011.

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***
2005	1	0	16	5	17	3	12	3	4	3	***45***	***11***	*216*	*56*	***272***
2006	2	2	14	6	15	7	16	7	5	1	***45***	***20***	*197*	*85*	***282***
2007	4	2	15	10	14	7	14	6	5	2	***43***	***23***	*206*	*117*	***323***
2008	4	1	16	10	14	8	12	9	3	1	***42***	***27***	*187*	*117*	***304***
2009	6	5	12	10	16	9	10	5	5	4	***38***	***24***	*179*	*107*	***286***
2010	5	3	14	9	11	11	17	8	3	5	***42***	***28***	*194*	*99*	***293***
2011	3	1	13	10	14	6	13	7	5	3	***40***	***23***	*189*	*110*	***299***
2005-2010 average survey effort:											42.5	22.2	196.5	96.8	293.3

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

Whale Counts

For the third year in a row, we documented a record high number of whales in the study area as a whole (n = 219), Fig. 2, Appendix 1). This represents a 14% increase over the previous high count of 192 whales in 2010 (Neilson and Gabriele 2010). The number of whales in Glacier Bay (n = 149) was also 14% higher than the previous high count of 131 whales in 2010. The number of whales in Icy Strait (n = 157) was the second highest count ever documented and approached the record high number of whales there in 2009 (n = 159) (Neilson and Gabriele 2009).

Similar to recent years, we observed a high number of whales (n = 14) in Glacier Bay and Icy Strait only outside of the regular June through August monitoring period, for a grand total and record high of 233 individual whales in 2011. Overall the humpback whale population in southeastern Alaska is growing with an estimated 6.8% annual growth rate between 1986 and 2008 (Hendrix *et al*. in press).

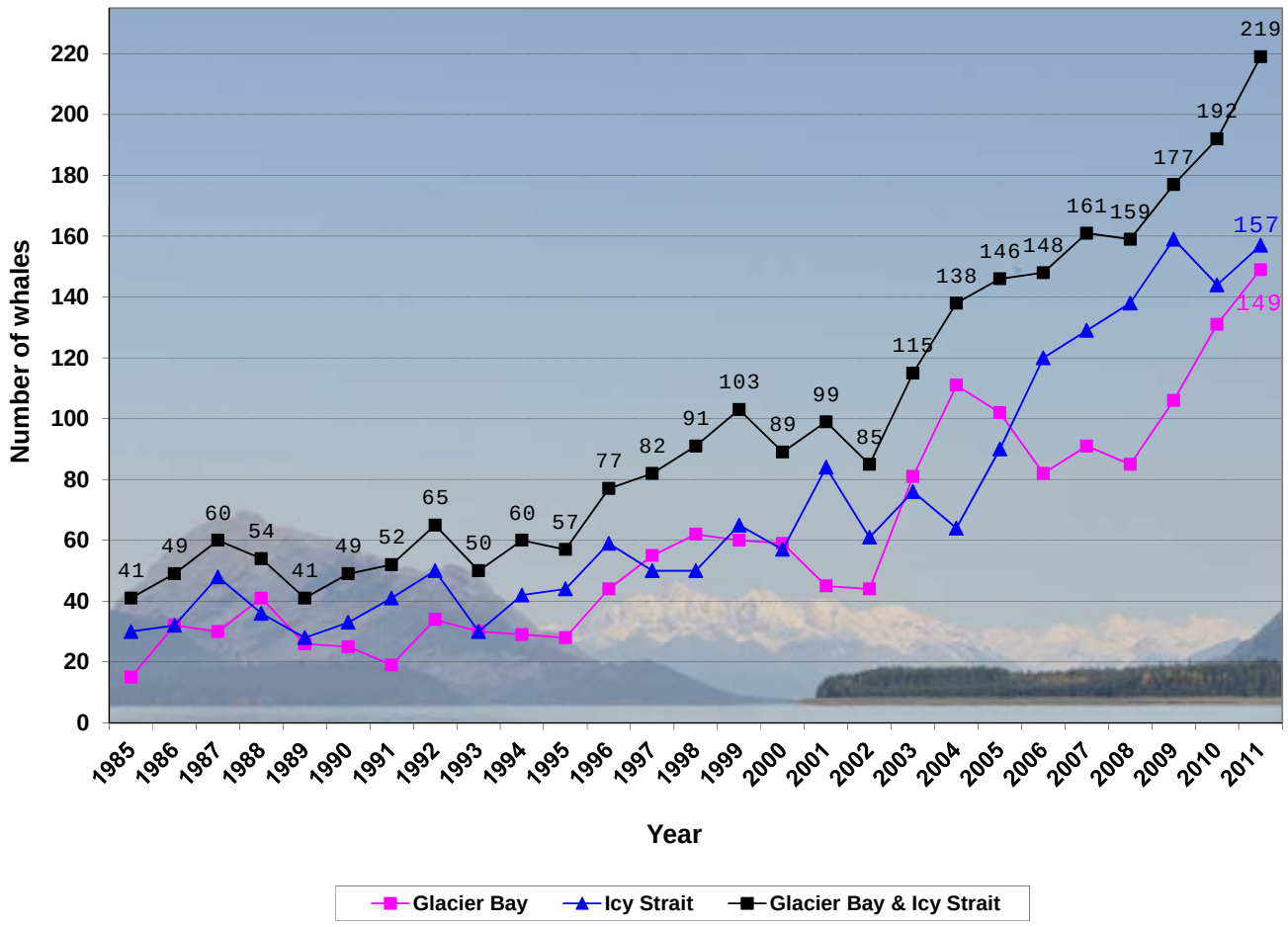

Figure 2. Number of individual whales documented in Glacier Bay & Icy Strait from June 1 through August 31, 1985 – 2011.

Twenty-seven of the whales that we documented in the study area in June, July and August had not been sighted previously in Glacier Bay or Icy Strait. The percentage of "new" whales in the study area (12%) matched the 1985 – 2010 average (12%). This suggests that immigration of new whales is not the primary cause of the growing whale population in the study area. Instead, recruitment of Glacier Bay-Icy Strait calves, plus increased use of the study area by previously documented Glacier Bay-Icy Strait whales, are more likely responsible for the trend.

Seven more new whales were observed in Glacier Bay or Icy Strait outside of the June through August monitoring period, for a grand total of 34 new (non-calf) whales in 2011. Approximately one-third of all the new whales (35%, n = 12) were small to medium in body size which indicates that they may have been juveniles. Eight of the 34 new whales were known to have been sighted elsewhere in southeastern Alaska; the remaining 26 animals did not match any of the whales in the southeastern Alaska fluke catalog (University of Alaska Southeast, unpublished data).

Whale Waters

Vessel course and speed restrictions have long been used to reduce whale disturbance and collision risk in Park waters (36 CFR Subpart N, 13.1174). In 2011, whale waters vessel speed restrictions in lower Glacier Bay were in place

for 100 days. Until recently, the duration of these speed restrictions has varied greatly from year to year depending on whale use in the lower bay, however, in recent years similarly long duration whale waters have become typical (2007-2010 range = 124 – 143 days).

For the seventh year in a row, a large aggregation of whales centered around Point Carolus in Park waters in Icy Strait. This resulted in a prolonged 13-knot speed limit from June 23 – September 30 (100 days). In 2011, temporary whale waters were also designated in lower Whidbey Passage from July 8 – September 1 (56 days).

Residency

Fifty-seven (38%) of the 149 whales that entered Glacier Bay between June 1 and August 31, including three mother/calf pairs, remained 20 or more days, meeting our definition of 'resident' (Appendix 2). The proportion of Glacier Bay residents in 2011 was within the documented range of values for this variable parameter since 1990 (15% - 67%) but higher than the past three years (15% - 27%) (Neilson and Gabriele 2008, 2009, 2010).

Thirty-nine (25%) of the 157 whales that we identified in Icy Strait, including two mother/calf pairs, remained long enough to be considered resident. This is the second lowest rate of Icy Strait residency we have documented since 1990.

Similar to recent years, 33 (15%) of the 219 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 12 whales (5%) were resident in more than one area (*e.g.*, resident in Glacier Bay and then resident in Icy Strait).

Overall, 141 whales (64%) were resident in Glacier Bay, Icy Strait or the combined area between June 1 and August 31. This proportion is similar to recent years and highlights the importance of the Glacier Bay-Icy Strait region as a summer feeding ground for many humpback whales.

Forty-one (19%) of the whales that we documented between June 1 and August 31 were identified on just one day: 16 in Glacier Bay and 25 in Icy Strait. Fourteen of these whales, including four mother/calf pairs, were documented in western Icy Strait on three different surveys (June 15, n = 3; June 29, n = 4; August 12, n = 7); otherwise the sightings occurred over a broad range of dates, indicating that it was not a single pulse of whales arriving in the area. The proportion of whales sighted on one day varies widely each year, with a range of 13% – 37% since 1985. We documented 13 more whales on just one day outside of the June 1 – August 31 monitoring period, bringing the grand total of whales identified on one day to 54 individuals (23%).

Reproduction and Juvenile Survival

We documented 11 mother/calf pairs in 2011 (Table 2) with a crude birth rate (5.0%) lower than the historic average (10.1%) (Table 3). We identified four mother/calf pairs exclusively in Glacier Bay, six pairs exclusively in Icy Strait and one pair in both areas. As previously mentioned, four of the mother/calf pairs in Icy Strait were identified on just one day (#1428 + calf on June 15; #1832 + calf on June 29; #1847 + calf on August 12; #1849 + calf on August 12).

We documented extensive killer whale (*Orcinus orca*) rake marks on whale #1847's calf's flukes (Fig. 3). There was a small area of unhealed (pink) tissue on the whale's left fluke tip. There were no other visible rake marks or injuries apparent on the calf's body. About 6% of whales in SEAK have killer whale rake marks on their flukes (Steiger *et al.* 2008). Adult sized humpbacks rarely obtain new killer whale rake marks from year to year (i.e. most attacks occur on calves) (Mehta *et al.* 2007).

Whales #1832, #1847 and #2461 (ages unknown) were documented with their first

Table 2. Mother-calf pairs documented in 2011.

	Mother ID#	Calf ID#	Documented in:
1.	219	2473	IS
2.	817	817_calf_2011	GB
3.	1018	2474	GB
4.	1042	2475	IS
5.	1295	2476	GB
6.	1428	1428_calf_2011	IS
7.	1593	2477	GB & IS
8.	1832	1832_calf_2011	IS
9.	1847	1847_calf_2011	IS
10.	1849	1849_calf_2011	IS
11.	2461	2461_calf_2011	GB

GB = Glacier Bay; IS = Icy Strait
Only calves who were observed more than once and whose flukes were photographed received an identification number

Figure 3. Whale #1847's calf with extensive killer whale rake marks on flukes on August 12, 2011. The arrow highlights unhealed (pink) tissue on the calf's left fluke tip.

Table 3. Reproduction and known age whales in Glacier Bay and Icy Strait, 1982 – 2011.

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	14.8	4	54
1989	5	3	60	12.2	5	41
1990	6	6	100	12.2	7	49
1991	4	4	100	7.7	8	52
1992	12	10	83	18.5	7	65
1993	3	3	100	6.0	12	50
1994	9	5	56	15.0	10	60
1995	3	2	67	5.3	9	57
1996	6	3	50	7.8	18	77
1997	9	7	78	11.0	17	82
1998	8	7	88	8.8	18	91
1999	9	5	56	8.7	25	103
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	6.8	35	146
2006	13	8	62	8.8	41	148
2007	17	12	71	10.6	39	161
2008	15	12	80	9.4	48	159
2009	12	10	83	6.8	51	177
2010	21	15	71	10.9	51	192
2011	11	8	73	5.0	60	219
1982-2010 average:	8.5	6.0	67.8	10.1	21.2	91.8

Only includes whales documented during the June 1 - August 31 study period. Number of calves photo ID'd is the number of calves with fluke photos (vs. dorsal fin only photos). Crude Birth Rate (CBR) is a percentage computed by # calves / total whale count. CBRs 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.

known calves. The sex of these three first-time mothers was previously unknown.

The value of the longevity of this study is highlighted by the fact that 27% (n = 60) of the whales that we identified in 2011 (n = 219) were of known age. This is similar to the proportion of known age whales in recent years. Overall. there has been an increasing annual trend in the proportion of known age whales as we accumulate long-term sighting histories of the whales in the study area.

Genetics

In 2011 we collected 15 sloughed skin samples, including three samples from individually identified calves. Since 1996, we have collected 241 sloughed skin samples in the study area. Genetic analysis of these samples allows sex determination, definition of mitochondrial DNA haplotype and nuclear DNA genotyping. The only other practical ways we determine a whale's sex are if the whale returns to the study area with a calf (in which case we know that the mother is female) or in the infrequent event that we obtain photographs of the whale's urogenital area.

Feeding Behavior and Prey Identification

In mid-July we documented an unprecedented high number of humpback whales in lower Glacier Bay since monitoring began in 1985. Whales were present throughout the lower bay with especially high densities on the east side of the lower bay between Bartlett Cove and Boulder Island. On July 18 we documented a minimum of 49 individual whales on a survey between Bartlett Cove and Strawberry Island, with 21 of these whales in Bartlett Cove or near Lester Point. Many of the whales were individuals who in previous years would typically be seen feeding in Icy Strait or elsewhere in Glacier Bay. At the same time, we observed unusually high numbers of harbor porpoise (*Phocoena phocoena*), gulls and murrelets feeding in the same areas as the whales. On several occasions, we observed dense schools of forage fish boiling at the water's surface and each time we dipnetted a sample, they were capelin (*Mallotus villosus*). This extraordinary concentration of whales, prey and other predators on the east side of the lower bay tapered off dramatically by July 20.

On August 9 we overheard several charter vessels and whale watching vessels talking on the radio about humpback whales group bubblenet feeding in Pinta Cove near Point Adolphus. One captain said that he had also observed group bubblenet feeding on the night of August 8 in the same general area. We arrived in Pinta Cove a short time later and from a distance observed one instance of group bubblenet lunge feeding, then the whales began traveling away from the area. We approached the pod and determined that it was composed of eight whales: adult female #587; adult males #516, #875, #933, #1474 and #1655; and adults #879 and #2042 (sex unknown). A few of these whales are typical Point Adolphus "core group" members but most of them are not. The core group is a stable group of whales known for subsurface feeding near Point Adolphus, but group bubblenet feeding is rarely observed. The last report of group bubblenet feeding we received occurred in 2003 (Doherty and Gabriele 2003).

In mid-May, spawning male capelin were documented on Strawberry Island (n = 1) and in Adam's Inlet (n = 1) (M. Becker and Y. Arimitsu, pers. comm.) On six occasions between late June and mid-August we positively identified capelin from samples we collected with a dipnet near whales that were feeding in lower Glacier Bay and Whidbey Passage (Table 4). On nine occasions between early June and late August we observed forage fish near feeding whales or we observed seabirds eating fish near whales that we suspect were capelin based on their size, color and shape. On five other occasions between mid-June and mid-August we noted a distinctive cucumber smell near feeding whales that likely indicated the presence of capelin. On ten occasions between late May and late July we observed small schooling fish near feeding whales but we were unable to identify the species.

Table 4. Humpback whale prey type determinations.

METHOD:	PREY SPECIES (# of cases):		
	capelin	***capelin?***	***herring***
Collected specimen with dip net	6		
Nearby vessel jigged fish			1
'Cucumber' smell in air		5	
Fish observed near surface		7	
Seabirds observed eating fish		2	

On July 29 we observed a vessel catch a Pacific herring (*Clupea pallasi*) with a jig near a large group of whales that was feeding in the middle of Icy Strait; however, in general, herring appeared to be scarce in Icy Strait, especially around Point Adolphus. A local charter fishing captain reported that the herring that were typically at Point Adolphus had moved over to the Pleasant Island reef and were laying close to the bottom there for most of the summer. He speculated that the herring were more difficult for the whales to catch when they were aggregated near the bottom. He reported near daily sightings of a whale feeding in this area. The whale was usually alone but occasionally it had a companion (M. Halbert, pers. comm.). On August 18 we overheard a charter fishing vessel captain say that "pollock bait" (presumably juvenile walleye pollock (*Theragra chalcogramma*)) were abundant at Point Adolphus.

In late June, a GBNPP biologist conducting aerial harbor seal surveys reported seeing numerous unidentified forage fish schools in Geikie Inlet between Tyndall Cove and Shag Cove but did not see any whales in this area (J. Womble, pers. comm.).

Whale/Human Interactions

Vessel Collisions

On July 6, near the entrance to Port Frederick in Icy Strait, a humpback whale surfaced unexpectedly underneath a 10-m fiberglass sailboat that was drifting with its engine off while the two people onboard watched a group of whales bubblenet feeding in the distance. The single whale struck the boat from below, lifting it more than 1 m out of the water and pushing it 3 m sideways. It is not clear if the whale was intending to breach or if it was surfacing to lunge feed or breathe, but the collision ripped the keel off the boat and the vessel sank within minutes. Both passengers ended up in the water, where they were rescued by another vessel in the area. An unknown observer reported seeing a whale breaching continuously nearby for the next couple of hours, however the fate of the whale that struck the vessel is unknown (NOAA Alaska Region unpublished data, Forgey 2011).

On July 17, a small humpback whale (likely a calf) surfaced underneath a double kayak in Bartlett Cove, lifting it very rapidly approximately 0.5 m out of the water and then suddenly dropping it. The kayak was not capsized. A larger whale that appeared to be the calf's mother surfaced nearby and "bellowed" in the air. Prior to the collision, the kayakers, who were with other paddlers in a group, had seen a whale close by and had lined up abreast and banged their paddles on their boats (K. Owen, pers. comm.).

On August 31, Glacier Bay Lodge's day tour boat, the 22-m catamaran *Baranof Wind*, struck a humpback whale while transiting at 13-14 knots in choppy seas between Willoughby and Strawberry Islands, outside of designated whale waters. The captain did not see the whale until it was directly in front of the vessel, still submerged underwater. He immediately pulled

back the throttle into neutral and felt a 'thud' as the vessel continued forward and struck the whale with the port bow of the catamaran. Passengers onboard the vessel reportedly did not feel the strike, although the vessel's rapid deceleration was noticed. The captain informed the passengers of what had occurred and called us on the *Sand Lance* to report the collision. The captain stayed with the whale to observe its behavior as we transited towards the site. He reported that immediately after the collision, the whale stayed at the surface, lifting its flukes just above the water and making a whistling sound as it exhaled. Eventually, it began diving for longer periods and lifting its flukes in a normal manner.

We arrived on the *Sand Lance* approximately 35 minutes after the collision and located the whale, at which time the *Baranof Wind* departed. We heard the whale make three audible "stress blows" and then it began traveling south through Sitakaday Narrows on 7-10 minutes dives. We assessed the whale for approximately one hour as it continued south at a sustained speed of 5-6 knots, continuing to stress blow. It appeared to be a small whale, likely 1-2 years old. We observed an area of gray pallor on the whale's left flank below its dorsal fin that appeared to be the site of the vessel impact (Fig. 4). We did not observe any blood or open wounds. We obtained fluke and dorsal fin photographs of the whale, which did not match any of the whales in our catalog. No further sightings of this whale (#GBNP-JLN-20110831-1-094) have been confirmed and its fate is unknown.

This is the second time that the Glacier Bay Lodge day tour boat has collided with a humpback whale. The first incident occurred on June 15, 1986 when the 20-m vessel *Thunder Bay*, transiting at 10 knots or less, struck adult female whale #535 near Garforth Island (NPS Case Incident Record 860034). Whale #535 survived the collision and continues to be sighted annually in Glacier Bay.

Elsewhere in Alaska in 2011, there were three other humpback whale-vessel collisions reported (two in southeastern Alaska and one near Kodiak). The fate and identity of these whales is unknown. In addition, a calf near Juneau was observed with propeller scars across its back, but it is unknown if this collision occurred in Alaska (NOAA Alaska Region unpublished data).

Dead whales

On September 1, a dead humpback whale calf was found beach-cast on Glass Peninsula on Admiralty Island. A limited necropsy was conducted, however it was not possible to confirm the cause of death. There was evidence that the calf may have suffocated after being entangled in line, although no gear was found on the animal. Other evidence pointed towards possible blunt trauma from a vessel collision (NOAA Alaska Region unpublished data).

Elsewhere in Alaska in 2011, there were six other reports of dead humpback whales (three in southeastern Alaska and three in other parts of the state). Four of the dead whales were floating and appeared to be fresh, while the other two were beach-cast and in an advanced state of decomposition. None of these dead whales were necropsied or closely examined (NOAA Alaska Region unpublished data).

Entangled whales

On October 29, adult female whale #541 was observed entangled in Tenakee Inlet. She was first sighted in southeastern Alaska in 1981 (University of Alaska Southeast unpublished data) and we have documented #541 in the study area nearly every year since 1998. We had seen her last on July 12 in Bartlett Cove, at which time she was not entangled. Responders assessed the entanglement but did not attempt to deploy a satellite tracking tag due to deteriorating weather conditions and the course and speed of the whale. The entanglement involved a line looped around her left fluke blade and trailing a small orange buoy. This line was deeply embedded in the leading edge of the left fluke blade (Fig. 5). There was also a

Figure 4. Humpback whale struck by the *M/V Baranof Wind* in Glacier Bay on August 31, 2011. The arrow highlights an area of gray pallor on the whale's flank that is presumed to be the site of impact from the vessel collision.

Figure 5. Humpback whale #541 observed entangled in shrimp pot gear in Tenakee Springs on October 29, 2011. The arrow highlights a deep injury on the leading edge of her left fluke blade from imbedded line (photo credit Tenakee Springs Stranding Network).

yellow buoy located close to the forward left side of her body, indicating a possible mouth or pectoral fin entanglement. The entangling gear was identified as shrimp pot gear with sinking line that had been lost in Farragut Bay in eastern Frederick Sound in July 2011 (NOAA Alaska Region unpublished data). No further sightings were made of #541 in 2011, however on two occasions in summer 2012, we documented #541 with a calf in Icy Strait. She was behaving normally and did not appear to be entangled. We observed no visible injuries, although it was not possible to assess the leading edge of her left fluke blade.

Elsewhere in Alaska in 2011, there were 12 other reports of entangled humpback whales (nine in southeastern Alaska and three in other parts of the state). These cases included a calf that was disentangled from pot gear by trained responders near Juneau and five cases in which fishermen and other mariners fully or partially disentangled whales in southeastern Alaska (NOAA Alaska Region unpublished data). The calf that was disentangled near Juneau was the same calf that had propeller scars across its back from an unrelated human interaction.

Notable Behavioral Observations

During a June 10 observation of female whale #1593 and her calf, the calf briefly rode on its mother's back. This behavior is unusual in the study area but commonly observed with younger calves on the breeding grounds (C. Gabriele, pers. obs.).

On July 18 we observed adult male whale #157 with an abnormal skin condition consisting of dense concentrations of small blister-like lesions covering the dorsal side of his body (Fig. 6).

Some of the blisters appeared to have ruptured, lending a scaly appearance to the whale's skin, but most of the blisters appeared intact. Prior to July 18, we documented #157 several times in 2011, however we did not obtain high quality dorsal fin photographs to determine if he had this skin condition earlier in the year. His skin appeared normal in high quality photographs from September 2010. We subsequently documented #157 in 2011 on August 12 and August 18 but it was not until September 7 that we obtained high quality photographs that showed his skin had healed (Fig. 7).

The etiology of whale #157's abnormal skin condition is unknown. Many whales in the study area have blister-like lesions that we refer to as "bumps". However, these bumps are typically larger and not as densely concentrated as what we observed on whale #157. Vesicular or blister lesions of unknown origin have been documented in North Atlantic right whales (*Eubalaena glacialis*) and in blue whales (*Balaenoptera musculus*) off southern Chile (Pettis *et al.* 2004, Brownell *et al.* 2008). Blister-type lesions have also been documented in blue whales, fin whales (*Balaenoptera physalus*) and sperm whales (*Physeter macrocephalus*) in Mexico, where they have been attributed to ultraviolet radiation damage (*i.e.*, sunburn) (Martinez-Levasseur *et al.* 2011), however we doubt that sunburn is a factor for whales in rainy southeastern Alaska.

On July 21 we found a freshly dead murrelet (*Brachyramphus* sp.) floating in the path of an adult female whale that had just breached. We speculated that the murrelet may have been killed by the whale's breach but we were unable to confirm its cause of death.

Throughout the summer, adult whale #1532 (sex and age unknown) continued to make frequent loud in-air exhalations that sounded like honking, as previously described in Neilson and Gabriele (2009)

Figure 6. Humpback whale #157 on July 18, 2011 showing abnormal skin condition.

Figure 7. Humpback whale #157 on September 7, 2011 showing healed skin condition.

Beginning in early August, we saw several instances of apparently mating-related whale behavior consistent with behavior usually observed on their winter breeding grounds. Compared to previous years, the onset of these behaviors in the season seemed early. The most notable of these behaviors are described below.

On August 5 we observed a group of three whales near North Marble Island engaged in rolling, head rises, head lunges, pectoral fin slaps and wheezing while traveling fast. It appeared that whales #1908 (sex and age unknown) and #1836 (age 7, sex unknown) were engaged in competitive behavior while adult female #1486 (age 12) stayed off to one side and did several rolling pectoral fin slaps. The behavior of this pod resembled competitive group behavior often observed on wintering grounds and believed to have a mating-related function.

On August 18 while observing whales #2038 (age 4, sex unknown) and #2462 (age and sex unknown) in Icy Strait, we heard song-like vocalizations after the whales dove. We also heard what sounded like low groans and underwater blows. No audio recordings were made.

On August 23 we observed a group of three whales near Strawberry Island that appeared to be engaged in mildly competitive behavior (head lunges, etc.) The group was comprised of adult female #235 (age unknown), adult male #351 (age unknown) and adult male #1299 (age 14).

On October 3 we deployed a portable hydrophone off the whale survey vessel *Sand Lance* near Point Gustavus in Icy Strait and positively identified male whale #1652 as a singer. The encounter was notable because the song was faintly audible through the hull of the vessel, even when the whale was approximately 100 m away. Whale #1652 (age unknown) had not been documented singing in the study area before.

On October 13 we observed adult male #516 (age 38) and adult female #501 (minimum age 25) near Eagle Point in Icy Strait. The pair was nearly stationary and making 10 minute dives. Their behavior resembled a similar pair of whales that we observed in 2008 (Neilson and Gabriele 2008) and attributed to a possible mating-related function. In winter breeding areas, long dives are fairly common (Chu 1988, Darling 2001), as are "breath-holders" (male-female pairs of whales that remain nearly stationary and submerge for 15-25 minutes) (Jones 2010).

ACKNOWLEDGEMENTS

Whale sightings, behavioral observations and enthusiasm from Park staff and volunteers continue to play an important role in this long term study. We thank Bill Eichenlaub for his efforts to further refine our shared regional database, and to Jen Cedarleaf, Ellen Chenoweth and Jan Straley for their continued diligence in merging our data into the new database. We extend our deepest thanks to Bruce McDonough for keeping the *Sand Lance* running smoothly for another productive season. We appreciate Park staff who reported whale sightings, and the Park's Visitor Information Station for recording them and passing them along to us. We especially appreciated the many sightings we received from Nat Drumheller, Justin Smith and Dena Matkin. We are grateful to Mike Halbert, Jamie Womble and Monika Becker for sharing their observations of whale prey and to Yumi Arimitsu for identifying the species of forage fish found in May. We thank Kimber Owen for sharing her kayaking story and we commend Captain Brendan Maier for his cooperative and professional response to the collision involving the *Baranof Wind*. We are grateful to Gordon Chew and the Tenakee Springs Stranding Network for sharing their account of #541's entanglement. Thanks to Kaili Jackson, Aleria Jensen and Ed Lyman (NOAA) for compiling and sharing data on humpback whale strandings and entanglements in Alaska. NPS data from 1988 to 1990 were collected by Jan Straley. NPS data from 1985 to

1988 were collected by C. Scott Baker. This work was carried out under NOAA Fisheries Permit #945-1776-01.

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APPENDIX 1

Standardized (July 9 – August 16) and Total (June 1 – August 31) Humpback Whale Counts, 1985 – 2011

	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	23	32	38	49
1987	18	30	33	48	40	60
1988	19	41	29	36	40	54
1989	22	26	20	28	33	41
1990	16	25	24	33	33	49
1991	17	19	34	41	45	52
1992	27	34	36	50	48	65
1993	23	30	24	30	40	50
1994	17	29	29	42	44	60
1995	18	28	26	44	37	57
1996	37	44	43	59	64	77
1997	41	55	33	50	66	82
1998	46	62	27	50	68	91
1999	36	60	39	65	68	103
2000	44	59	26	57	62	89
2001	26	45	58	84	72	99
2002	28	44	34	61	56	85
2003	53	81	61	76	102	115
2004	85	111	38	64	110	138
2005	66	102	50	90	95	146
2006	66	82	98	120	130	148
2007	76	91	98	129	132	161
2008	55	85	97	138	125	159
2009	59	106	122	159	142	177
2010	76	131	97	144	140	192
2011	132	149	82	157	174	219
average:	**42.07**	**59.85**	**48.15**	**71.00**	**75.11**	**98.48**
stdev:	**28.15**	**36.38**	**30.02**	**41.84**	**41.92**	**51.30**

APPENDIX 2

Sighting Histories of Individually Identified Whales: 2011

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

	Whale_ID	Nickname	5/17/2011	5/19/2011	5/23/2011	5/26/2011	6/1/2011	6/2/2011	6/3/2011	6/6/2011	6/9/2011	6/10/2011	6/13/2011	6/14/2011	6/15/2011	6/16/2011	6/17/2011	6/20/2011	6/21/2011	6/22/2011	6/23/2011	6/24/2011	6/27/2011	6/28/2011	6/29/2011	6/30/2011
1	1839		GB		IS				IS			IS												GB		
2	1896		GB							GB														GB		GB
3	1018			GB		GB		GB		GB																
4	2474	calf of 1018		GB		GB		GB		GB																
5	1014				IS													GB	GB							
6	1063				IS																					
7	1065				IS							IS								GB				GB		
8	1088				IS							IS									IS					
9	1652				IS							IS			IS					GB			GB			GB
10	166	Frenchie			IS				IS			IS									IS					
11	1784				IS											IS						GB		GB		
12	1803				IS										IS											
13	1842				IS		IS							GB		IS			IS	GB		GB				
14	186				IS																IS					
15	2038				IS																					
16	2317				IS											IS										
17	352				IS											IS						IS				
18	875				IS																					
19	937				IS										IS						IS					GB
20	1046					GB														GB						
21	1485					GB		GB								IS					IS					
22	351					GB		GB														IS				GB
23	1012						GB											GB	GB							
24	117	White Eyes					GB											GB		GB						
25	1432						GB				GB			GB					GB	GB						GB
26	1904						GB					IS									IS	IS		IS		
27	1816						IS												IS			IS				GB
28	1486							GB										GB	GB	GB			GB	GB		GB
29	1654							GB																		
30	2050							GB					GB													
31	1083								IS												IS					
32	1299								IS								IS		GB							
33	159								IS			IS					IS									
34	1657								IS												IS					
35	1809								IS		GB									GB		GB				
36	1834								IS			IS														
37	2155								IS												IS					
38	2349								IS						IS											
39	1838									GB			GB										GB			
40	1489										GB													GB		
41	1900										GB						IS									
42	118	Chop Suey										IS							GB					GB		
43	1273											IS			IS											
44	1292											IS									IS					
45	1293											IS		GB						GB	IS					GB
46	1298											IS			IS						IS					
47	1439											IS				IS										
48	1532											IS			IS			GB	GB							
49	1593											IS														GB
50	2477	calf of 1593										IS														GB

	Whale_ID	7/1/2011	7/5/2011	7/6/2011	7/7/2011	7/8/2011	7/11/2011	7/12/2011	7/13/2011	7/14/2011	7/15/2011	7/18/2011	7/20/2011	7/21/2011	7/22/2011	7/25/2011	7/26/2011	7/27/2011	7/28/2011	7/29/2011	8/3/2011
1	1839											GB	GB				GB				
2	1896					GB															
3	1018		GB				GB		GB							GB					
4	2474		GB				GB		GB							GB					
5	1014							GB	GB			GB									
6	1063		GB					GB				GB									
7	1065		GB				GB	GB	GB	GB		GB		GB		GB					
8	1088							GB	GB		GB	GB									
9	1652		GB			GB			GB			GB									
10	166	IS			IS						IS	GB			IS					IS	
11	1784								GB	GB		GB									
12	1803	IS			IS																
13	1842										GB										
14	186														IS						
15	2038	IS																		IS	
16	2317																GB				
17	352								GB												
18	875	IS	GB						GB											IS	
19	937					GB	GB	GB	GB		GB						GB				
20	1046							GB				GB					GB				
21	1485							GB			GB	GB									
22	351						GB						GB								
23	1012		GB																		
24	117	IS					GB					GB				GB					
25	1432					GB											GB				
26	1904																				
27	1816						GB			GB			GB						GB		
28	1486						GB		GB					GB		GB					GB
29	1654															GB					
30	2050			GB														GB			GB
31	1083				IS							GB			IS						
32	1299						GB					GB						GB			
33	159																				
34	1657																				
35	1809									GB	IS		GB	GB					GB		
36	1834																				
37	2155																GB				
38	2349																				
39	1838							GB													
40	1489		GB									GB				GB			GB		
41	1900																				
42	118	IS				GB			GB			GB					GB		GB		
43	1273																				
44	1292				IS																
45	1293		GB				GB		GB							GB					
46	1298	IS												GB					GB		
47	1439	IS				GB							GB								
48	1532						GB					GB	GB								
49	1593																				
50	2477																				

	Whale_ID	8/4/2011	8/5/2011	8/8/2011	8/9/2011	8/10/2011	8/11/2011	8/12/2011	8/17/2011	8/18/2011	8/2/2011	8/23/2011	8/24/2011	8/25/2011	8/29/2011	8/30/2011	8/31/2011	9/2/2011	9/7/2011	9/12/2011	9/15/2011	9/27/2011	10/3/2011	10/13/2011
1	1839																							
2	1896																							
3	1018					GB																		
4	2474					GB																		
5	1014	GB				GB				IS							GB		GB					
6	1063																							
7	1065																GB							
8	1088									IS					IS	IS								
9	1652							IS															IS	
10	166				IS					IS	IS										GB			
11	1784			IS												IS	GB							
12	1803			GB								GB												
13	1842					GB																		
14	186				IS					IS	IS													
15	2038									IS														
16	2317																							
17	352			IS						IS														
18	875				IS						IS													
19	937																							
20	1046					GB																		
21	1485			GB						IS						IS								
22	351	GB				GB	GB					GB		GB										
23	1012																GB							
24	117			GB		GB																		
25	1432									IS										GB				
26	1904			GB																				
27	1816					GB																		
28	1486		GB			GB											GB			GB		GB		
29	1654				IS																			
30	2050																							
31	1083			GB										GB					GB					
32	1299											GB								GB		GB		
33	159			IS													GB			GB				
34	1657																							
35	1809																							
36	1834			IS	GB																			IS
37	2155			GB		GB	GB							GB										
38	2349																							
39	1838																					GB		
40	1489					GB											GB							
41	1900								GB								GB							IS
42	118									IS						IS								
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44	1292																							
45	1293			IS											IS									
46	1298																							
47	1439																							
48	1532								GB	IS							GB							
49	1593																							
50	2477																							

APPENDIX 2 (cont'd.)

Sighting Histories of Individually Identified Whales: 2011

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

	Whale_ID	Nickname	5/17/2011	5/19/2011	5/23/2011	5/26/2011	6/1/2011	6/2/2011	6/3/2011	6/6/2011	6/9/2011	6/10/2011	6/13/2011	6/14/2011	6/15/2011	6/16/2011	6/17/2011	6/20/2011	6/21/2011	6/22/2011	6/23/2011	6/24/2011	6/27/2011	6/28/2011	6/29/2011	6/30/2011	7/1/2011	7/5/2011	7/6/2011	7/7/2011	7/8/2011	7/11/2011	7/12/2011	7/13/2011	7/14/2011	7/15/2011	7/18/2011	7/20/2011	7/21/2011	7/22/2011	7/25/2011	7/26/2011	7/27/2011	7/28/2011	7/29/2011	8/3/2011	8/4/2011	8/5/2011	8/8/2011	8/9/2011	8/10/2011	8/11/2011	8/12/2011	8/17/2011	8/18/2011	8/2/2011	8/23/2011	8/24/2011	8/25/2011	8/29/2011	8/30/2011	8/31/2011	9/2/2011	9/7/2011	9/12/2011	9/15/2011	9/27/2011	10/3/2011	10/13/2011
51	1805											IS						GB	GB					IS													GB																IS	GB										GB					
52	1821											IS																																																									
53	1850											IS				IS					IS																																																
54	2156											IS			IS			GB	GB		IS															IS																																
55	2314											IS									IS																																			IS													
56	232	Notchfin										IS			IS						IS						IS				GB			GB							GB								GB																				
57	573											IS			IS						IS						IS			IS										IS					IS					IS																			
58	587	Gertrude										IS			IS						IS						IS			IS							GB			IS					IS					IS					IS	IS					IS						GB		
59	GBNP-CMG-20110610-1-025											IS																																																									
60	1233												GB	GB		IS			GB	GB																														IS																			
61	1470												GB										GB	GB		GB								GB			GB													IS										GB									
62	221												GB								IS		GB										GB	GB	GB	GB				IS					IS										IS														
63	2346												GB										GB			GB												GB																															
64	235	Spot											GB					GB	GB	GB						GB																										GB					GB												
65	2348												GB																																							GB																	
66	GBNP-JLN-20110613-1-019												GB																																																								
67	1082													GB														GB																																									
68	1244	Dimple Dorsal												GB			IS					IS									GB		GB				GB		GB								GB		GB																GB				
69	1019														IS																																																					
70	1428														IS																																																						
71	1428_calf_2011	calf of 1428													IS																																																						
72	155	Freckle Fluke													IS						IS						IS			IS										IS					IS					IS											IS								
73	161	B.W.M.													IS						IS			GB							GB			GB		GB																																	
74	1731														IS										IS																												IS																IS
75	1807														IS	IS											IS							GB														GB						GB															
76	577	Scoper													IS						IS										GB			GB		GB	GB							GB						IS																			
77	616	Lesser													IS																																						IS																
78	2463														IS										IS																																												
79	2456														IS	IS									IS																									IS																			
80	1042															IS																				IS				IS					IS																								
81	2475	calf of 1042														IS																				IS				IS					IS																								
82	1302															IS				GB											GB		GB	GB																							GB					GB					GB		
83	1806															IS	IS																																																				
84	1898															IS											IS							GB		IS	GB																																
85	1905															IS					IS						IS									IS			GB		GB		GB	GB					GB																				
86	GBNP-CMG-20110616-1-029															IS																																																				
87	GBNP-CMG-20110616-1-072															IS																																																				
88	584																IS					IS												GB			GB																																
89	1817																IS				IS			GB									GB																																				
90	826																IS					IS			IS																																												
91	1507																IS																			IS																																
92	1461																	GB							IS									GB			GB	GB	GB								GB								IS										GB				
93	801																	GB																												GB																							
94	1313																		IS																																																		
95	1438																		IS																			GB						GB																									
96	2472																		IS																																											IS							
97	1090																				IS																																																IS
98	1246																				IS						IS						GB			GB						GB													IS														
99	1306																				IS									IS						IS				IS										IS						IS													
100	1474																				IS						IS									GB	GB							GB	IS					IS						IS													

APPENDIX 2 (cont'd.)

Sighting Histories of Individually Identified Whales: 2011

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

	Whale_ID	Nickname	5/17/2011	5/19/2011	5/23/2011	5/26/2011	6/1/2011	6/2/2011	6/3/2011	6/6/2011	6/9/2011	6/10/2011	6/13/2011	6/14/2011	6/15/2011	6/16/2011	6/17/2011	6/20/2011	6/21/2011	6/22/2011	6/23/2011	6/24/2011	6/27/2011	6/28/2011	6/29/2011	6/30/2011	7/1/2011	7/5/2011	7/6/2011	7/7/2011	7/8/2011	7/11/2011	7/12/2011	7/13/2011	7/14/2011	7/15/2011	7/18/2011	7/20/2011	7/21/2011	7/22/2011	7/25/2011	7/26/2011	7/27/2011	7/28/2011	7/29/2011	8/3/2011	8/4/2011	8/5/2011	8/8/2011	8/9/2011	8/10/2011	8/11/2011	8/12/2011	8/17/2011	8/18/2011	8/2/2011	8/23/2011	8/24/2011	8/25/2011	8/29/2011	8/30/2011	8/31/2011	9/2/2011	9/7/2011	9/12/2011	9/15/2011	9/27/2011	10/3/2011	10/13/2011
101	1655																				IS																GB													IS																					
102	1899																				IS	GB															GB	GB																																	
103	2055																				IS																																									IS								
104	2310																				IS														GB			GB			GB											GB		GB			GB							GB	GB				
105	397																				IS									IS										IS					IS										IS														
106	535	Quits																			IS										GB	GB	GB				GB					GB																											
107	541																				IS						IS						GB																																				
108	1304																					IS		IS													GB	GB				GB												GB							IS								IS
109	1505																					IS					IS									IS																																	
110	1815																					IS					IS			IS						IS																																	
111	1894																					GB															GB												GB			GB					GB						GB		GB				
112	157	M.D.																					GB			GB							GB	GB			GB																IS		IS									IS					
113	1836																						GB	GB																								GB				GB										GB							
114	2034																						GB															GB					GB							GB												GB					GB		
115	2161																						GB																													GB					GB					GB	GB				GB		
116	2311																						GB											GB	GB		GB	GB				GB									GB														GB				
117	2340																						GB											GB			GB																		IS														
118	2030																							GB										GB			GB							IS																									
119	2347																							GB									GB	GB																				GB															
120	2466																							IS																																											GB		
121	1658																								IS																																				IS										
122	1832																								IS																																														
123	1832_calf_2011	calf of 1832																							IS																																														
124	2315																								IS																																														
125	2336																								IS		IS			IS	GB									GB																													
126	2458																								IS											IS					GB																												
127	GBNP-JLN-20110629-1-064																								IS																																														
128	1539																										IS			IS						IS													GB	IS															GB				
129	1802																										IS										GB					GB								GB				GB							IS								
130	1907																										IS			IS										IS					IS					IS						IS													
131	219																										IS			IS						IS				IS					IS										IS														
132	2473	calf of 219																									IS			IS						IS				IS					IS										IS														
133	283																										IS			IS				GB													GB																						
134	1421																											GB													GB			GB																									IS
135	187																											GB																																									
136	1906																											GB				GB					GB												IS																				
137	2464																											GB				GB										GB																											
138	2465																											GB						GB								GB				GB					GB																		
139	2023																												GB														GB			GB																							
140	1480																													IS																																						
141	1628																													IS																																						
142	193																													IS										IS					IS																								
143	2042																													IS										IS					IS					IS																			
144	2047																													IS										IS									IS						IS														
145	933																													IS							GB	GB		IS					IS					IS																			
146	GBNP-CMG-20110707-1-067																													IS																																						
147	2339																														GB						GB															GB																	
148	1479																															GB		GB					GB																														
149	1811																															GB		GB		GB	GB	GB			GB																											
150	1295																																GB														GB							GB						GB				GB					

APPENDIX 2 (cont'd.)

Sighting Histories of Individually Identified Whales: 2011

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

	Whale_ID	Nickname	5/17/2011	5/19/2011	5/23/2011	5/26/2011	6/1/2011	6/2/2011	6/3/2011	6/6/2011	6/9/2011	6/10/2011	6/13/2011	6/14/2011	6/15/2011	6/16/2011	6/17/2011	6/20/2011	6/21/2011	6/22/2011	6/23/2011	6/24/2011	6/27/2011	6/28/2011	6/29/2011	6/30/2011	7/1/2011	7/5/2011	7/6/2011	7/7/2011	7/8/2011	7/11/2011	7/12/2011	7/13/2011	7/14/2011	7/15/2011	7/18/2011	7/20/2011	7/21/2011	7/22/2011	7/25/2011	7/26/2011	7/27/2011	7/28/2011	7/29/2011	8/3/2011	8/4/2011	8/5/2011	8/8/2011	8/9/2011	8/10/2011	8/11/2011	8/12/2011	8/17/2011	8/18/2011	8/2/2011	8/23/2011	8/24/2011	8/25/2011	8/29/2011	8/30/2011	8/31/2011	9/2/2011	9/7/2011	9/12/2011	9/15/2011	9/27/2011	10/3/2011	10/13/2011
151	1697																																GB				GB												IS																				
152	2037																																GB		GB	IS					GB		GB																											
153	2343																																GB																																						
154	2476	calf of 1295																														GB														GB							GB						GB				GB					
155	1901																																	GB	GB		GB																													GB	GB			
156	581																																	GB							IS																													
157	2457																																	GB		IS																																	
158	2460																																	GB																			IS																
159	1840																																		GB		GB					GB	GB						IS													GB				GB			
160	2028																																		GB		GB																									GB							
161	2312																																		GB														GB								GB												
162	817																																		GB		GB		GB					GB																									
163	817_calf_2011	calf of 817																																GB		GB		GB					GB																									
164	2455																																		GB																																		
165	1659																																			IS									IS																								
166	1948																																			IS	GB					GB																											
167	2029																																			IS													IS																				
168	2054																																			IS						GB								IS					IS														
169	2338																																			IS									IS											IS														
170	2470																																			IS					GB																			GB										
171	GBNP-CMG-20110715-1-094																																			IS																																
172	2279																																				GB																															
173	2320																																				GB										GB										GB								GB				
174	1908																																					GB			GB					GB		GB																					
175	2220																																					GB																														
176	2468																																					GB																		IS													
177	1846																																						GB					GB					IS																				
178	1049																																							IS					IS										IS														
179	1061																																							IS																													
180	GBNP-CMG-20110722-1-020																																							IS																													
181	2325																																							GB																						IS								
182	1813																																									GB							GB																				
183	2169																																									GB		GB																									
184	2461																																									GB	GB											GB															
185	2461_calf_2011	calf of 2461																																							GB	GB											GB															
186	465																																										GB																										
187	GBNP-JLN-20110727-1-065																																										GB																										
188	1472																																											GB					IS								GB												
189	1808																																											GB			GB					GB																	IS
190	944																																											GB					GB	IS				GB															
191	965																																												IS								IS																
192	2334																																													GB																							
193	250																																													GB																							
194	GBNP-CMG-20110804-1-043																																														GB																						
195	2459																																														GB												GB		IS								
196	GBNP-CMG-20110804-1-063																																														GB																						
197	2318																																																GB																				IS
198	2321																																																	GB								GB											
199	516	Garfunkle																																															IS					IS		GB		GB											IS
200	879																																																	IS																			

APPENDIX 2 (cont'd.)

Sighting Histories of Individually Identified Whales: 2011

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

	Whale_ID	Nickname	5/17/2011	5/19/2011	5/23/2011	5/26/2011	6/1/2011	6/2/2011	6/3/2011	6/6/2011	6/9/2011	6/10/2011	6/13/2011	6/14/2011	6/15/2011	6/16/2011	6/17/2011	6/20/2011	6/21/2011	6/22/2011	6/23/2011	6/24/2011	6/27/2011	6/28/2011	6/29/2011	6/30/2011	7/1/2011	7/5/2011	7/6/2011	7/7/2011	7/8/2011	7/11/2011	7/12/2011	7/13/2011	7/14/2011	7/15/2011	7/18/2011	7/20/2011	7/21/2011	7/22/2011	7/25/2011	7/26/2011	7/27/2011	7/28/2011	7/29/2011	8/3/2011	8/4/2011	8/5/2011	8/8/2011	8/9/2011	8/10/2011	8/11/2011	8/12/2011	8/17/2011	8/18/2011	8/2/2011	8/23/2011	8/24/2011	8/25/2011	8/29/2011	8/30/2011	8/31/2011	9/2/2011	9/7/2011	9/12/2011	9/15/2011	9/27/2011	10/3/2011	10/13/2011
201	1629																																															GB					GB														
202	2157																																															GB																												
203	1031																																																	IS																												
204	1847																																																	IS																												
205	1847_calf_2011	calf of 1847																																																	IS																												
206	1849																																																	IS																												
207	1849_calf_2011	calf of 1849																																																	IS																												
208	2316																																																	IS																												
209	2469																																																	IS																												
210	1057																																																		IS																												
211	2467																																																		IS																												
212	2462																																																		IS																												
213	2273																																																																													
214	GBNP-CMG-20110829-1-005																																																																													
215	2168																																																																													
216	1725																																																																													
217	2032																																																																													
218	2471																																																																													
219	GBNP-JLN-20110831-1-094																																																																													
220	2327																																																																													
221	GBNP-JLN-20110907-1-033																																																																												
222	GBNP-CMG-20110915-1-010																																																																												
223	GBNP-JLN-20110927-1-026																																																																												
224	1373																																																																												
225	1435																																																																												
226	156																																																																												
227	336																																																																												
228	501																																																																												
229	517																																																																												
230	GBNP-CMG-20111013-1-034																																																																												
231	GBNP-CMG-20111013-1-068																																																																												
232	GBNP-CMG-20111013-1-073																																																																												
233	2350																																																																												