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Killer whales of Atlantic Canada, with particular reference to the Newfoundland and Labrador Region

Les épaulards du Canada-Atlantique, et en particulier ceux de la région de Terre-Neuve et du Labrador

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ABSTRACT

We describe research results for studies of killer whales (*Orcinus orca*) in Atlantic Canada. Based on opportunistic sightings data and a multi-year photographic catalogue, there were 363 sighting events between 1864 and 2007, with most being recorded in the last seven years and during the June-September period in the Newfoundland/Labrador Region. This pattern is likely a reflection of observer effort and an increased public awareness for this species. While most sightings have been made relatively close to shore, there have also been killer whales sighted in offshore areas, and in water depths in excess of 3000 meters. In the Atlantic Canada, killer whales have been sighted both alone and in groups, with group sizes ranging from 2-60 whales. Most groups have been comprised of 3-7 individuals. Based on the photographic records analysed to date, there are at least 63 individual killer whales in Newfoundland and Labrador, although this is likely to be an underestimate. Relatively few killer whale sightings have been recorded on the Scotian Shelf or in the Gulf of St. Lawrence (the latter despite appreciable aerial and vessel-based cetacean survey effort in recent years). Efforts are planned to collect further imagery and begin biopsy sampling to examine stock structure and relationships with other north Atlantic populations such as Greenlandic killer whales.

RÉSUMÉ

Nous décrivons les résultats d'une étude scientifique concernant les épaulards (*Orcinus orca*) du Canada Atlantique. Selon des données issues d'observations anecdotiques et d'un catalogue photographique pluriannuel, 363 observations ont été rapportées entre 1864 et 2007, dont la plupart proviennent des sept dernières années et de la période de juin à septembre. Ce patron peut refléter l'effort d'observation et un accroissement de l'éveil public à l'existence de cette espèce. Bien que la plupart des observations ait été faite relativement près des côtes, des observations d'épaulards ont également eu lieu au large des côtes, dans des eaux de plus de 3000 mètres de profondeur. Dans la région de Terre-Neuve/Labrador, des épaulards ont été observés autant seuls qu'en groupes variant de 2 à 60 individus. La plupart des groupes étaient constitués de 3 à 7 individus. Selon les archives photographiques analysées jusqu'à maintenant, la région de Terre-Neuve et Labrador comporterait au moins 63 épaulards quoique cette estimation soit vraisemblablement minimale. Relativement peu d'observations d'épaulards ont été rapportées sur le plateau Néo-Écossais et dans le golfe du Saint-Laurent (et dans ce dernier cas, malgré des efforts appréciables d'inventaires à partir de plateformes aériennes ou d'embarcations au cours des dernières années). Des efforts sont planifiés afin d'acquérir des données photographiques supplémentaires et de débuter un échantillonnage par biopsies dans le but d'examiner la structure du/des stocks et ses relations d'autres populations d'Atlantique nord telles que des épaulards de Groenland.

INTRODUCTION

The killer whale (*Orcinus orca*) is the largest member of the dolphin family, with a characteristic black and white colouration and obvious dorsal fin. Behind the killer whale's dorsal fin is a grey area referred to as a saddle patch. The shape of the dorsal fin and the saddle patch, as well as natural scars, are unique to each whale and can be used to tell individual whales apart (Lien *et al.* 1988). Extensive studies on population structure, mortality, feeding and social behaviour have been carried out using individually-identified whales in other areas of the world (Ford 2002, Mitchell and Reeves 1988), making killer whales one of the most studied marine mammals.

Much of what is known about killer whale biology has come from studies in the northeastern Pacific. Relatively little research has been done on killer whales in the western Atlantic although they served as a subject for the art and rituals of the people who lived in Newfoundland and Labrador in the past (reviewed in Lien *et al.* 1988). Killer whales were hunted as competitors to whaling or fishing operations until 1972, and perhaps as a result, this species is sighted relatively rarely in the western Atlantic. Killer whales are most often sighted in temperate coastal waters (Ford 2002), and are known to occur from the Bay of Fundy, and Nova Scotia north to the Arctic (e.g., Lien et al. 1988, Reeves and Mitchell 1988, Sergeant and Fisher 1957, Whitehead and Glass 1985). Although suggested in the literature, there is no evidence of seasonal migratory movements for killer whale populations in the Atlantic (e.g., Mitchell and Reeves 1988, Reeves and Mitchell 1988, Sergeant and Fisher 1957). It is also unknown whether killer whales from populations in adjacent areas such as Greenland and Iceland mix with whales from eastern Canada.

Knowledge of killer whales in Atlantic Canada has been largely based on opportunistic encounters (discussed in Sergeant and Fisher 1957). Killer whales have been noted to occur regularly along the Canadian Atlantic coast, including the Gulf of St. Lawrence. Systematic monitoring of this species in Newfoundland and Labrador did not begin until 1979, and remains deficient in the region. DFO, Memorial University, and several NGOs began to collect more systematic sightings and behaviour data on killer whales in the Newfoundland and Labrador Region since the early 1980's. Until this study, D. Snow had created the largest photographic collection of nearshore killer whales in this region, some of which appear to exhibit a geographically-transitory lifestyle pattern. While the seasonal arrival of pack ice is suspected to preclude these cetaceans from maintaining a year-round presence on the Labrador coast, killer whale sightings are predictable there.[1] Recently, with the increased public awareness of this species due to public education efforts, and DFO interview surveys to collect data for SARA-listed species such as blue whales (*Balaenoptera musculus*) and leatherback turtles (*Dermochelys coriacea*), more reports of killer whales have been received.

To assess the status of killer whales in this region, and therefore their susceptibility to anthropogenic threats, we require information on their abundance, distribution, and lifestyles (e.g., how large is their home range and what are their movement patterns within

[1] Gill and Thiele observed a killer whale far into the area of Antarctic sea ice, suggesting that these whales may tolerate heavier ice than thought previously. For a number of years, killer whales have been reported swimming (and possibly hunting harp seals) within the pack ice off Newfoundland's north coast during March (W. Ledwell, Whale Release and Strandings, 244 Tolt Rd., Portugal Cove-St. Phillips, Newfoundland and Labrador, Canada A1M 1R2, pers. comm., Lawson unpubl. data).

it?). As it has in the northeast Pacific, this information for Atlantic Canada can be gained through a combination of photographic identification, directed and opportunistic sightings collection, and genetic and acoustic sampling.

This paper presents research results for studies of killer whales in the Newfoundland and Labrador Region, as well as other parts of Atlantic Canada. We describe what is known about the distribution and sighting pattern for this species here, and the growth of a photoidentification catalogue. We also discuss killer whale predation events, interactions with fisheries, sources of mortality, and proposed further research.

METHODS

For this report, we have used data from two sources. A large-scale marine mammal sightings database is maintained at the Department of Fisheries and Oceans in St. John's. It includes killer whale sightings, and is based on opportunistic and directed observer effort. These sightings were mapped using the MapInfo GIS programme.

Sightings records for killer whales sometimes included photographs of the whales. For this report we have taken the photographs gathered by DFO, Snow and others and collated them into a new catalogue using iView Media Pro image management software. We assigned membership to groups[2] based on locations where they were sighted and with whom whales were associated. As this catalogue grows we will be better able to compare and describe killer whales in Atlantic Canada. Since most of the highest-quality images in this new catalogue have come from the Newfoundland and Labrador Region, we cannot identify killer whales in other areas of Atlantic Canada.

RESULTS AND DISCUSSION

Killer Whale Sightings

There were 363 sighting events (n > 1,710 whales) reported in Atlantic Canada (not including the Arctic) between 1864 and 2007, with most records occurring since 1950, and a large portion (31.4%) being recorded in the last seven years and during the June–September period. Further, most of these sightings have occurred in the waters of Newfoundland and Labrador. This pattern is likely a reflection of observer effort and an increased awareness for this species (Figure 1). While most sightings have been made relatively close to shore (which may be a function of observer effort), there have also been lone and groups of killer whales sighted in offshore areas, and in water depths in excess of 3,000 meters. Mitchell (1975b) suggested that killer whale abundance is greatest within 800 km of shore in cold waters of both hemispheres.

[2]At this stage in the study of killer whales in Atlantic Canada we have decided to forego the use of the term "pod" when discussing killer whale groups. Groups of killer whales in this region may not be "pods" in the Pacific coast sense, in that they may be loose affiliations where animals exchange fairly freely. In the Pacific, the term "pod" is used to refer to the larger grouping of residents which are known to be structured matrilineally. The Pacific transients ecotypes don't normally live in equivalent kinds of associations so are called "groups" rather than "pods". Until more is known of the social structure and the genealogy of Atlantic Canadian killer whale groups, we will use the term "group" to refer to an affiliative group of killer whales.

Killer whales have been sighted in all months of the year, and for the last four years have been seen moving within the nearshore ice fields of northern Newfoundland in the vicinity of breeding harp seals (W. Ledwell, Whale Release and Strandings, 244 Tolt Rd., Portugal Cove-St. Phillips, Newfoundland and Labrador, Canada, A1M 1R2, pers. comm., Lawson unpubl. data). This accords with an Antarctic sighting of killer whales in pack ice by Gill and Thiele (1997).

In the Gulf of St. Lawrence, occasional sightings were reported along the western shelf of Newfoundland and St George's Bay, southwest Newfoundland (Lien *et al.* 1988). Ice-entrapments of killer whales in St George's Bay indicate that killer whales occur occasionally in the area to the west of the sightings in St. Pierre on the central south coast of Newfoundland (Figures 1 and 2) (Mitchell and Reeves 1988).

Killer whales have been reported rarely from coastal Nova Scotia, the Bay of Fundy, and the northeastern U.S.A. Despite many years of aerial and shipboard cetacean surveys conducted by the National Marine Fisheries Service, killer whales where seldom seen (D. Palka, National Marine Fisheries Service, 166 Water St., Woods Hole, Massachusetts 02543 U.S.A., pers. comm.).

Killer whales have been sighted both alone (25.7% of sighting events) and in groups (Table 1, Appendix A). Groups of two or more whales ranged in size from two to 60 whales, with the average being 5.1 whales per sighting (6.7 whales per group of two or more animals) and the mode being 3 whales per group. These group sizes are smaller than those that have been reported for northern and southern residents in British Columbia, who combined had an average group size of 12 individuals (range = 3-59)(Bigg *et al.* 1990) and correspond more closely with group sizes of British Columbia transients (average range = 2-6)(Ford and Ellis 1999).

We have no reports of killer whale group sizes in Atlantic Canada ranging to several hundreds as has been seen occasionally in other parts of the world (e.g., Luque et al. 2006, Perrin (Editor) 1982), although Vladykov (1944) reported groups of up to 40 killer whales in the St. Lawrence Estuary decades ago (such large groups have not been reported since).

On the other hand, as similarly reported by Baird and Dill (1996) for British Columbia transient whales, we have sighting reports for lone adult males and females. Whether these whales are actually lone animals, or temporarily out of observer range of a group of animals is not known.

Photographic Database

Killer Whale Groupings

In a preliminary analysis, we assigned killer whales to thirteen groups (Table 1, Appendix A). While we are currently re-evaluating the membership of individuals in these groups as we build the Atlantic catalogue, there are some evident and predictable affiliative patterns. It is possible that with further photographic analyses we will reduce or modify current group designations (Table 1).

Detailed descriptions of each group's size, members, and sightings history are included in Appendix A. The following paragraphs provide a condensation of this information.

Killer whales groups are not large in size relative to their counterparts in British Columbia (e.g., Bigg *et al.* 1990), and slightly less than half of the putative groups have contained young or calves.

Many of the groups have been sighted near St. Anthony, Newfoundland at least once, despite there being far more tourist and fishing operations (and hence potential observers) in places like the Avalon Peninsula near St. John's, and on the northeast coast of Newfoundland, and in the southern Gulf of St. Lawrence. This suggests that St. Anthony and the Strait of Belle Isle areas may be important for these whales. Few killer whales have been sighted in the Gulf of St. Lawrence, around P.E.I., Nova Scotia, or New Brunswick - despite a considerable number of potential observers aboard tourist and fishing vessels.

Some of the groups around Newfoundland and southern Labrador may represent temporary groupings as several animals have been photographed with more than one group on different occasions. Also, not all group members have been distinctly identified.

Minimum Number of Killer Whales in Atlantic Canada

Based on the photographic records, we have catalogued 63 killer whales in the waters of Newfoundland and Labrador. It is very likely that this abundance value is an underestimate as more than half of the photographs in our possession can not be classified as to group membership, and we have few good images from other areas in Atlantic Canada. Also, most study effort has been concentrated in a limited number of areas around Newfoundland, and rarely offshore. This species was not sighted during two previous nearshore aerial surveys in Newfoundland in 2002 and 2003, but several lone individuals were sighted during DFO's large-scale aerial survey of the northwest Atlantic coastline in the summer of 2007.

Relatively few killer whale sighting have been recorded in the rest of Atlantic Canada despite appreciable aerial and vessel-based cetacean survey effort in recent years. Few killer whale sightings have been made near the Labrador coast north of Battle Harbour, but this may be related to reduced observer effort in this area. Killer whales have been sighted by fisheries observers in offshore longline and gillnet fisheries off northern Labrador and in Davis Strait (see below).

From reports (reviewed in Mitchell and Reeves 1988, Wenzel and Sears 1988, and in Lesage et al. 2007, in review) killer whales may have been more abundant in the Gulf of St. Lawrence in the past. The apparent reduction in beluga whale numbers could be a factor in a killer whale decline if beluga were an important prey species. Despite considerable aerial and vessel survey effort by DFO in recent years, very few killer whale sightings have been made in the Gulf.

In summary, there exist no comprehensive estimates of killer whale abundance for Atlantic Canada.

Movement Patterns

We can only suggest killer whale movement patterns in the Canadian northwest Atlantic by documenting the locations of known individuals over time. An example is B, D and O groups which have been shown to move hundreds of kilometres between years (Table 2, Figure 2). Within any one year killer whales also appear to move many kilometres,

although the multiple sightings of A group along the Avalon Peninsula in one year suggest that they can exhibit site fidelity to one area for at least a few weeks.

There have been suggestions that killer whales might migrate seasonally (Mitchell and Reeves 1988, Sergeant and Fisher 1957), but this has yet to be documented.

Sources of Mortality

Killer whales have been reported bycaught in offshore fishing gear in Newfoundland, and there are 14 stranding records of adult killer whales in Atlantic Canada between 1955 and 2007. Nine are post-1967, all but one involving single whales and most along Newfoundland's south coast (Mitchell and Reeves 1988, W. Ledwell, pers. comm.). One killer whale was found stranded on Sable Island, Nova Scotia (Lucas and Hooker 2000). Four fatal entrapments in ice have been reported in the Newfoundland and Labrador Region (e.g., Dearden 1958, Lien et al. 1988). There are two records of killer whales being entrapped in gill nets in offshore Newfoundland (Lawson, unpubl. data), plus several found floating dead (W. Ledwell, pers. comm.). Killer whales were caught in the Atlantic to support aquarium collections. There have also been reports of killer whales being fired upon by military aircraft and vessels in the north Atlantic during the second world war.

In Atlantic Canada, killer whales are not hunted, although a calf photographed recently may have had a healed bullet wound on its head. This was not the case during the whaling period when a number of historical reports indicate that whalers either chased killer whales as a target species, or tried to kill them as competitors for the large whale carcasses being processed during whaling operations. For example, killer whales were shot frequently in waters around Prince Edward Island in the early 1900s (Prince 1905).

There is no information on the levels of contaminants in the tissues of killer whales in Atlantic Canada. Since killer whales are vulnerable to bioaccumulation as long-lived upper trophic level predators, it is possible that killer whales in Atlantic Canada may be at risk of biological effects of manmade contaminants that they consume in fish or mammal prey (Ford and Ellis 2006, Vladykov 1944). Fish-eating killer whales in British Columbia (both the southern and northern residents) exhibit significant pollutant contamination; the transient killer whales which appear to have a marine mammal diet are even more contaminated. It is not known if the same is true for killer whales in Atlantic Canada.

Predation Events

Killer whale groups have been seen approaching or attacking other marine mammals (Groups A, D, and G), seabirds (B-Group), seals, and various species of fish.

In the Newfoundland and Labrador region, whalers, tour vessel operators, whale researchers, and fishermen have reported killer whales killing or harassing minke (*Balaenoptera acutorostrata*), humpback (*Megaptera novaeangliae*) and other whales. On at least five occasions killer whale groups killed and ate a minke whale. They have also been seen attacking (or harassing) adult and young humpback whales (three cases), seals (three cases), and tuna (tuna remains found in the stomachs of two killer whales). In most areas of the province humpback whales exhibit a high rate of fluke and foreflipper tooth rakes that appear to be caused by killer whales, although it cannot be confirmed that these killer whales are producing these rake marks. There have been at least three reports of killer whales harassing and/or attacking and eating white-beaked dolphins

(*Lagenorhynchus albirostris*), and Vladykov (in Lien et al. 1988) reported large groups of killer whales in the Estuary during spring and fall, apparently attacking beluga whales.

These reports contrast with an anecdotal description of a single killer whale in Red Bay, Labrador and a single minke whale seeming to feed cooperatively by driving herring towards one another (e.g., Mitchell 1975a).

In addition to whales, killer whales have also been observed to harass and/or consume marine fish and seabirds. Killer whales have been sighted in all months of the year, and have been seen moving within the nearshore ice fields of northern Newfoundland in the vicinity of breeding harp seals; it is not known if they were hunting these seals, but a sealing captain in the area felt that the harp seals were very reluctant to enter the water when the whales were nearby.

Whether there are dietary specialist (e.g., Ford and Ellis 1999, 2006) whales or groups of whales in Atlantic Canada is not yet known. Further field observations and biopsy sampling (for dietary profiles) may assist in determining this.

Depredation on Commercial Fisheries

Since killer whales consume a number of fish species of commercial interest, there is worldwide and numerous interactions between fisheries and these marine mammals (1997).

This is true for Atlantic Canada as killer whales have been reported in association with a variety of vessel types. They have been observed near Greenland halibut longline fishing operations off northern Labrador and in the Davis Strait. While we do not yet have photographic documentation, observers have reported that groups of these whales have occasionally fed on discarded fish during these operations

Killer whales have also been reported to approach and remain near fishing vessels on occasion in offshore areas. In one case several whales rubbed along the sides of a Newfoundland crab vessel as it moved slowly through the water (Figure 3). In another incident, tuna longliners reported that a number of killer whales remained around their vessels as they fished, and when the lines were retrieved all that remained of the tuna were heads attached to the hooks. Killer whale groups have also been seen near nets of shrimp trawling operations as the full nets were being hauled aboard.

FUTURE RESEARCH

This summary of the information available for killer whales in Atlantic Canada demonstrates that this species deserves further study effort. In particular, completion and enlargement of the photographic catalogue to include more individuals, and Regions beyond Newfoundland and Labrador, will facilitate derivation of minimum abundance estimates and allow us to better understand their movement patterns. It is intended that biopsy sampling will begin in the Newfoundland and Labrador region in 2007, as well as autonomous acoustic recordings. These should allow us to describe stock structure and genetic relationships amongst individual whales here and in adjacent areas such as the Arctic and Greenland. This would help to answer questions about migratory patterns, and whether the “population” of killer whales we see here is comprised of a variety of groups that move over great distances (and perhaps between adjacent regions or countries).

SUMMARY

There were 363 sighting events in the Canadian northwest Atlantic between 1864 and 2007, with most recorded in the Newfoundland and Labrador Region over the last seven years (possibly a reflection of observer effort and an increased public awareness of this species) during the June-September period. While most sightings have been made relatively close to shore, there have also been killer whales sighted in offshore areas, and in water depths in excess of 3000 meters. Killer whales were sighted alone and in groups, with group sizes ranging from 2-60 whales, although we do not have sufficient data to determine if there are "resident-like" and "transient-like" ecotypes as there are in the Pacific northwest. Based on the photographic records analysed to date, there are at least 63 individual killer whales in this Region, although this is likely to be an underestimate.

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REFERENCES

Baird, R., and Dill, L.M. 1996. Ecological and social determinants of group size in transient killer whales. Behav. Ecol. **7(4)**: 408-416.

Bigg, M.A., Olesiuk, P.F., Ellis, G.M., Ford, J.K.B., and Balcomb III, K.C. 1990. Social organization and genealogy of resident killer whales (*Orcinus orca*) in the coastal waters of British Columbia and Washington State. Rep. int. Whal. Comm. **12**: 383-405.

Dearden, J.C. 1958. A stranding of killer whales in Newfoundland. Can. Field-Nat. **72**(166-167).

Ford, J.K.B. 2002. Killer whale. *In* Encyclopedia of marine mammals. *Edited by* W.F. Perrin, B.M. Wursig and J.G. Thewissen. Academic Press, New York, NY. pp. 669–674.

Ford, J.K.B., and Ellis, G.M. 1999. Transients: mammal-hunting killer whales of British Columbia, Washington, and southeastern Alaska. UBC Press, Vancouver, British Columbia.

Ford, J.K.B., and Ellis, G.M. 2006. Selective foraging by fish-eating killer whales *Orcinus orca* in British Columbia. Mar. Ecol. Prog. Ser. **316**: 185-199.

Gill, P.C., and Thiele, D. 1997. A winter sighting of killer whales (*Orcinus orca*) in Antarctic sea ice. Polar Biol. **17**(5): 401-404.

Lien, J., Stenson, G.B., and Jones, P.W. 1988. Killer whales (*Orcinus orca*) in waters off Newfoundland and Labrador, 1978-1986. Rit Fiskideildar **11**: 194-201.

Lucas, Z.L., and Hooker, S.H. 2000. Cetacean strandings on Sable Island, Nova Scotia, 1970-1998. Can. Field-Nat. **114(1)**: 45-61.

Luque, P.L., Davis, C.G., Reid, D.G., Wang, J., and Pierce, G.J. 2006. Opportunistic sightings of killer whales from Scottish pelagic trawlers fishing for mackerel and herring off North Scotland (UK) between 2000 and 2006. Aquatic Living Resources **19**: 403-410.

Mitchell, E., and Reeves, R.R. 1988. Records of killer whales in the western North Atlantic, with emphasis on eastern Canadian waters. Rit. Fiskideild **9**: 161-193.

Mitchell, E.D. 1975a. Porpoise, dolphin and small whale fisheries of the world. Status and problems. IUCN Monogr. **3**: 129.

Mitchell, E.D. 1975b. Review of biology and fisheries for smaller cetaceans. J. Fish. Res. Board Can. **32**: 891-895.

Perrin (Editor), W.F. 1982. Report of the workshop on identity, structure and vital rates of killer whale populations, Cambridge, England, June 23-25, 1981. Rep. int. Whal. Comm. **32**: 617-632.

Prince, E.E. 1905. The whaling industry and the Cetacea of Canada, Government Printing Bureau, Ottawa, Ontario.

Reeves, R.R., and Mitchell, E. 1988. Distribution and seasonality of killer whales in the eastern Canadian Arctic. Rit Fiskideildar **11**: 136-160.

Sergeant, D.E., and Fisher, H.D. 1957. The smaller Cetacea of eastern Canadian waters. J. Fish. Res. Board Can. **14**: 83-115.

Vladykov, V.-D. 1944. Études sur les mammifères aquatiques: III. Chasse, biologie et valeur économique du marsouin blanc ou béluga (*Delphinapterus leucas*) du fleuve et du golfe Saint- Laurent, Département des pêcheries, Province de Québec, Québec.

Wenzel, F., and Sears, R. 1988. A note on killer whales in the Gulf of St. Lawrence, including an account of an attack on a minke whale. Rit Fiskideildar **11**: 202-204.

Whitehead, H., and Glass, C. 1985. Orcas (killer whales) attack humpback whales. J. Mammal. **66**: 183-185.

Table 1. Descriptions of name, size, sightings history, and presence of young for killer whale groups sighted in Newfoundland and Labrador.

Group Name	Number of Unique Whales in Group	Sighting Locations	Sighting Dates	Calf in Group?
A	6	Eastern Avalon Peninsula	2002	No
B[a]	10	St. Anthony; Battle Harbour, Labrador; Hopeall, Trinity Bay; St. Pierre (France)	2004; 2005; 2006	Yes
C	2	St. Anthony		No
D[a]	6	Bonavista; Twillingate; Point Amour, Labrador; St. Anthony	1999; 2001; 2002; 2003; 2005	Yes
E	3	Bay Bulls	2005	No
G	5	St. Anthony	2005	No
H	6	St. Anthony; Conception Bay	2003	Yes
I	2	St. Anthony	2004	No
L	5	St. Anthony	2003	No
M	4	St. Anthony; Twillingate	2005	No
N	4	St. Anthony	2006	Yes
O[a]	6	St. Anthony; Battle Harbour, Labrador	2005; 2006	Yes
S[a]	4	St. Pierre (France)	2006	Yes

[a] Some B-, D-, O-, and S-Group individuals have been sighted with members of other groups, suggesting fluidity in group membership. Where possible, group size figures have been consolidated to account for individuals matched between groups.

Total identified whales: 63

Table 2. Designations and sightings history for members of several killer whale groups identified in Newfoundland and Labrador.

Individual	Bonavista 2001	Battle Harbour Sept. 2004	L'anse aux Meadows 09 Aug. 2005	St. Anthony 14 Aug. 2005	Battle Harbour Sept. 2005	St. Pierre Apr. 2006	Battle Harbour Jul. 2006	Battle Harbour Sept. 2006
B001 (♀)					X		X	
B002 (♀)		X			X	X	X	
B003 (J or ♀)					X	X		
B004 (J)					X			
B006 (♂)					X		X	
B007 (J)					X		X	
B008 (♂)		X						
B012 (J or ♀)					X			
B013 (J)		X						
B014 (J)		X						
O001 (♂)			X	X			X	X
O006 (J)							X	
O007 (J or ♀)							X	X
O008 (J)						X	X	
O009 (♀)			X	X				X
O010 (J)							X	X
D001 (♀)	X							
D002 (♂)	X							
D004 (♀)	X		X	X			X	X
D005 (♀)	X							
D006 (♀)	X							
D007 (♀)	X							
S001 (J or ♀)						X		
S002 (♀)						X		
S003 (J)						X		
S004 (J or ♀)						X		
Total reported group size	[NA]	6	[Min. 5]	5	7	10	10	[NA]
Individuals Identified:	6	4	3	3	7	7	10	5

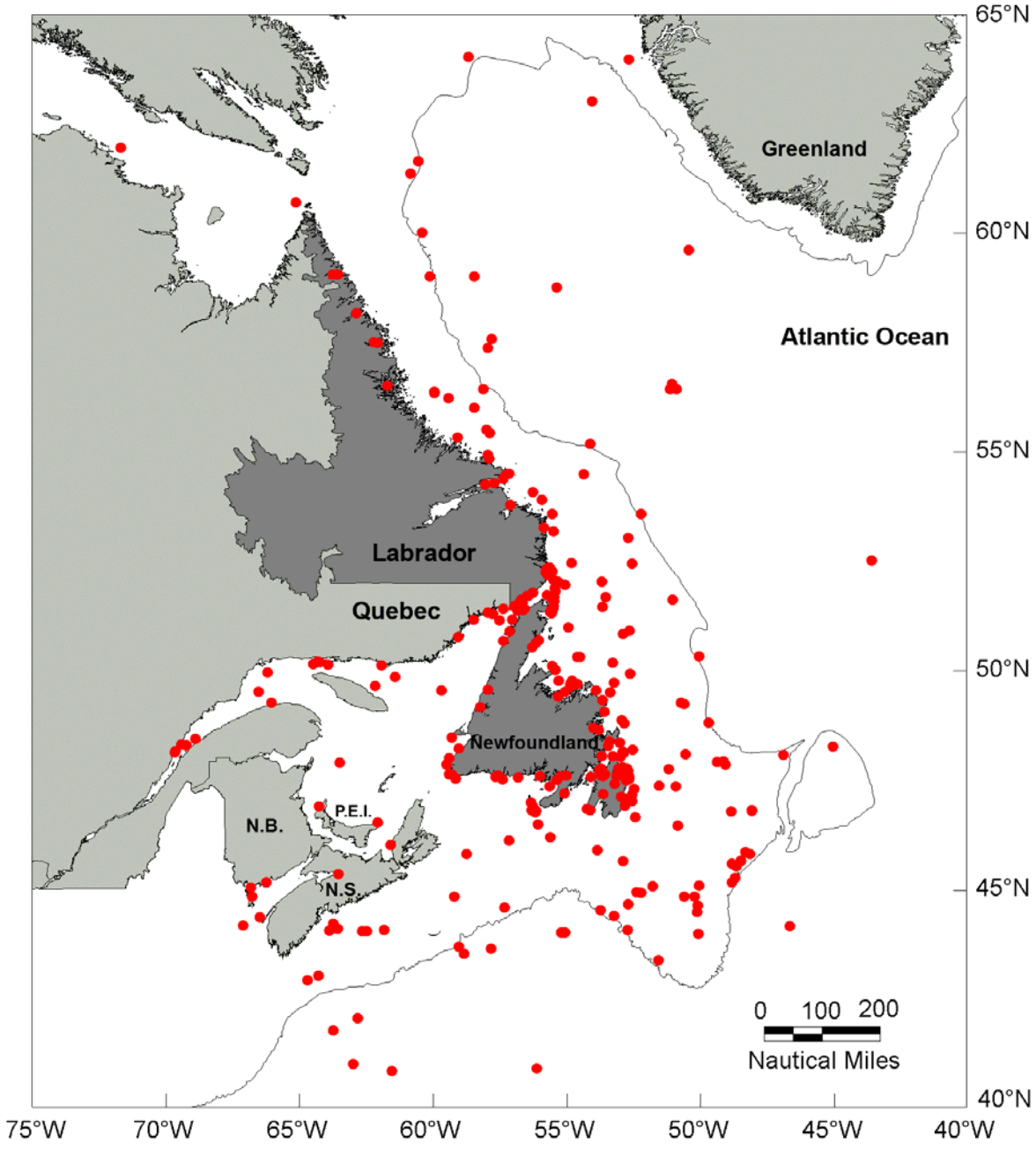

Figure 1. Map depicting most of the 363 sighting events for killer whales in the Canadian northwest Atlantic (shown in red). Bathymetry of 1000 meters is also indicated. Not shown are some of the sightings recorded further to the north, or the few in U.S. waters to the south.

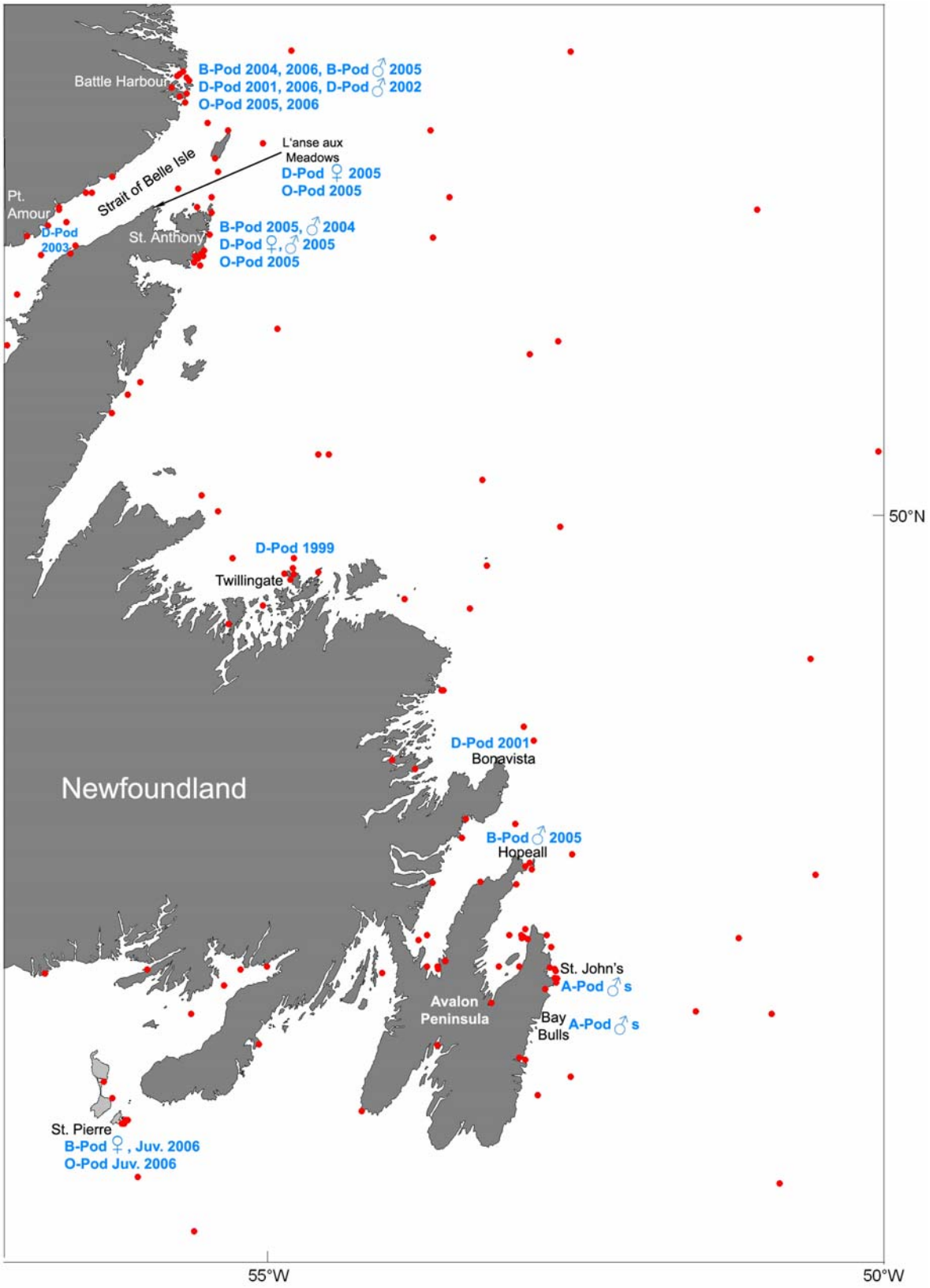

Figure 2. To illustrate the mobility of some of these killer whale groups, this map depicts the location and date of sightings for particular groups on separate occasions.

Figure 3. Four killer whales that approached an offshore vessel tending crab pots. Note the distinctive cut in the top rear margin of the dorsal fin of the nearest whale. Images from a VHS-format videotape (Seawatch observer programme, DFO, Newfoundland and Labrador Region).

APPENDIX A: DETAILED DESCRIPTIONS OF PUTATIVE KILLER WHALE GROUPS IN NEWFOUNDLAND AND LABRADOR

A Group

A-Group is an assemblage of six killer whales (two adult males, a juvenile male, and two smaller individuals) that spent much of July and August 2002 near the shore of the Avalon Peninsula of Newfoundland. During July 2002, Snow (Wildland Tours, St. John's, NL) noted interesting behaviour among the two dozen humpbacks in the vicinity of these killer whales: most of the humpbacks performed multiple breaches or loud lob-tailing displays just prior to the killer whales swimming into the area. Interestingly, two minke whales came within 100 meters of some of these killer whales. Attacks of killer whales on humpback whales off the east coast of Newfoundland, specifically on the Southeast Shoal of the Grand Banks have been documented previously.

B Group

Six killer whales were noted in this group during an encounter in 2004. The sighting included an adult male, an adult female, and a calf. They have been observed harassing seabirds (the adult female swam through a group of six razor billed auks, possibly eating four of them). Some of the females and juveniles sighted off Battle Harbour in August and September 2004 were observed in the same area during September 2005, July 2006, August 2006. Two B-Group individuals were also photographed off St. Pierre in April of 2006 (Figure 2). The large male killer whale of B-Group has been photographed alone near St. Anthony in July 2004, near Battle Harbour in September 2004, 2005, and 2006, and off Hopeall, Trinity Bay in July 2005.

The Wildland Tour's Northern Whale Study group encountered a group of seven killer whales in September 2005 off Battle Harbour, Labrador. They observed that two appeared to be mature females while four were juveniles and one was a young calf. Some matched previously sighted B-Group individuals. During their encounter 50 white beaked dolphins approached the study boat which was itself surrounded by the group of killer whales. At a distance of approximately 200 meters the dolphins apparently noticed the killer whales, turned, and fled the area.

The study group recorded these killer whales using a hydrophone later in the morning when they approached a group of three humpbacks including a juvenile that were feeding in the area. The humpbacks trumpeted and after being surrounded for approximately 30 seconds the water turned white with the frothing caused by the rapid movements of the killer whales and humpbacks. There was no evidence of contact between the two species and the killer whales left the area immediately after the encounter and were not seen again. The humpbacks all appeared uninjured. The hydrophone picked up the squeals and clicks of the killer whales during this encounter.

C Group

At least two whales are present in this group, with an adult male and an adult female. They have been sighted in close proximity to tour boats near St. Anthony in several recent summers.

D Group

The killer whales of D-Group include a distinctive male with a large, forward-sweeping dorsal fin and a female with a distinctive cut on the rear base of her dorsal fin. They have

been photographed in 2001 near Battle Harbour and Bonavista, and off Twillingate in July 1999. There is a photograph of the D-Group male from St. Lewis, Labrador in October 2002 and off Point Amour, Labrador in September 2003. In 2005, P. Alcock of Northland Discovery Tours in St. Anthony took a series of photographs that show this distinctive male and female are still associated with one another. One D-Group female has been photographed off L'Anse aux Meadows and St. Anthony in 2005 and off Battle Harbour in 2006 with other B- and O-Group members.

E Group

This group of three killer whales was sighted in Bay Bulls (just south of St. John's) on June 10, 2005. These killer whales stayed here for several weeks apparently harassing humpback whales in the area. A tourist photographed a humpback whale with bloody flesh hanging off its tail during this period.

G Group

This group contains an adult male and two adult females. They were sighted near St. Anthony in the summer of 2005 and were observed attacking a minke whale.

H Group

This group contains an adult male, two adult females and perhaps two juveniles. They have been sighted in near St. Anthony in July of 2003, and in Conception Bay in the fall of that year.

I Group

An adult male and female were photographed together near St. Anthony in July 2004.

K Group

This group of four whales includes an adult male, and three adult females. They were photographed together near St. Anthony in July 2005.

L Group

This group of three whales includes an adult male, and two adult females. They were photographed together near St. Anthony in July 2003.

N Group

There were four killer whales in this group: the large male with the irregular tip on the dorsal fin; a large female; and, two juveniles. Humpback whales were within visual range of boat-based observers, as were white-beaked dolphins. These killer whales were tolerant of the research vessel and area tour boat operators, and allowed close approaches in choppy seas. They were photographed near St. Anthony in July 2006.

O Group

These five individuals were photographed off L'Anse aux Meadows in early July 2005 and off St. Anthony in mid July 2005. These sightings contained an adult male, three adult females, and a calf. One of the adult females had been identified off Bonavista in 2001 with D-Group. Some of these O-Group individuals and the D-Group female were later photographed off Battle Harbour in July 2006 with two previously unidentified O-Group

killer whale and four B-Group members, including two adult males. Four O-Group members and the D-Group female were photographed off Battle Harbour later in September 2006.

S-Group

Ten killer whales were photographed near St. Pierre off the Newfoundland south coast in April 2006, containing four individuals previously unidentified (S-Group). A B-Group female and juvenile and an O-Group juvenile were associated with these killer whales during this sighting event.

Other Killer Whale Groups

Other killer whales have been photographed in St. Anthony, near St. Pierre, along the Quebec north shore, and in the Strait of Belle Isle. When these photographs are processed into the Regional catalogue we may be able to assign them to existing or new groups.