

Winter observations of a group of female and immature sperm whales in the high-latitude waters near the Aleutian Islands, Alaska

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Sperm whales (Physeter macrocephalus) have one of the most extensive global distributions of any cetacean, but distribution and movement patterns vary significantly between sexes. Adult male sperm whales are predominantly solitary and have an expansive distribution, whereas females and their offspring typically form groups of both sexes, remaining in the tropics and sub-tropics throughout the year. Here we present observations and photographs from a rare winter sighting of a group of female and immature sperm whales near Koniuiji Island, in the Central Aleutians, in the high-latitude waters of the Bering Sea. This sighting is consistent with historic whaling catches of sperm whales of both sexes, including pregnant females, above 50°N in the North Pacific, but no groups of females and immatures have been observed in ten years of summer sighting surveys in the Aleutian Islands and Bering Sea region, despite regular sightings of adult males. We discuss possible reasons for the absence of recent sightings of these mixed schools.

Keywords: sperm whale, *Physeter macrocephalus*, females and immatures, distribution

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Sperm whales (*Physeter macrocephalus*) have one of the most extensive global distributions of any cetacean (Rice, 1989), but distribution and movement patterns vary significantly between sexes (Whitehead, 2003). Adult male sperm whales are predominantly solitary and have an extensive distribution (Best, 1979; Rice, 1989), typically feeding in higher latitudes and undertaking extensive north–south seasonal movements to tropical or sub-tropical waters to breed (Rice, 1989; Whitehead, 2003). In contrast, females and their offspring typically form stable groups, often comprised of matrilineally related whales of both sexes (Mesnick, 2001; Whitehead, 2003, 2008). These mixed groups of females and immatures appear to have a more restricted range, typically remaining in the tropics and sub-tropics throughout the year (Rice, 1989; Whitehead, 2003; Gero *et al.*, 2007). Based on photo-identification studies, however, some large scale movements (up to 3800 km) have been documented for female sperm whales (Jacquet *et al.*, 2003; Whitehead *et al.*, 2008).

In the North Pacific, adult male sperm whales are sighted during summer in the Gulf of Alaska, Bering Sea and waters around the Aleutian Islands (Angliss & Allen, 2010). Acoustic surveys have detected male sperm whales year round in the Gulf of Alaska, but they appear to be more

common in the summer months (Mellinger *et al.*, 2004), supporting the belief that they migrate to warmer waters in winter (Whitehead & Arnborn, 1987; Angliss & Allen, 2010). In contrast, females and their associated offspring are thought to be restricted below the sub-arctic boundary at approximately 42°N (Best, 1979; Rice, 1989; Whitehead, 2003). Here we present observations and photographs from a winter sighting of a group of female and immature sperm whales near Koniuiji Island, in the central Aleutian Islands, in the high-latitude waters of the Bering Sea. On 27 February 2008, we encountered a group of sperm whales just offshore of Koniuiji Island, on the Bering Sea side of the central Aleutian Islands, at 52°17.8'N and 174°55.9'W (Figure 1). The sighting occurred during an acoustic trawl survey of walleye pollock (*Theragra chalcogramma*); http://www.afsc.noaa.gov/REFM/Stocks/fit/PDFS/Cruise_Report_DY0802.pdf. (Logerwell, 2008) operating from the NOAA ship 'Oscar Dyson', a 63.8 m research vessel with a bridge observation height of 11.8 m. The characteristic slanted, puffy blows of the whales were first observed through hand-held 10 × 25 binoculars, several km from the ship, at 1119 Alaska Daylight Time. Weather and sighting conditions were extremely poor due to high winds (> 25 kts), but we were able to observe the whales for 52 minutes in total.

The group was estimated to comprise approximately 50 individuals, with three distinct subgroups of size 10–12, 20–30 and 10–12 animals, respectively. Photographs were taken from the ship using digital SLR cameras with resolution of at least 10 MP, and distinct differences in the sizes of the

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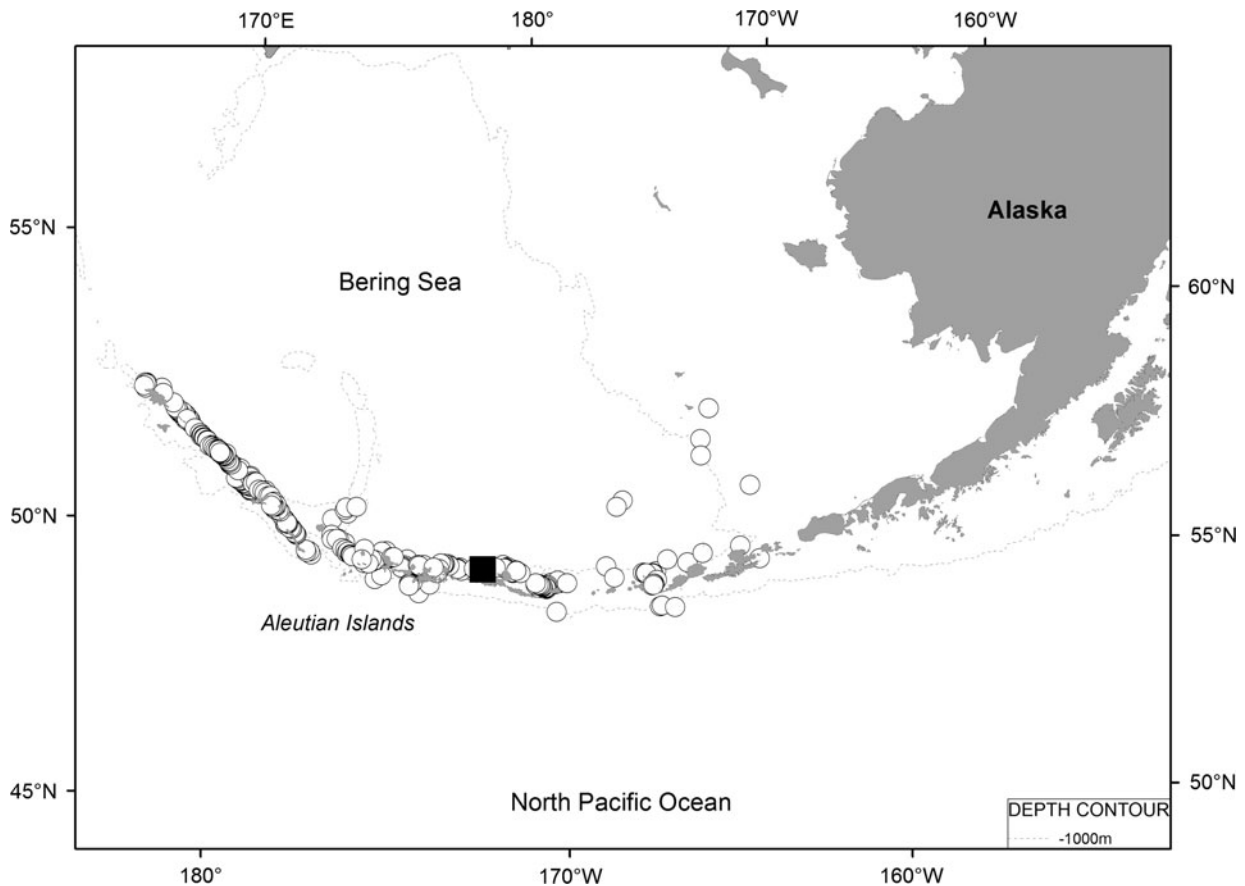


Fig. 1. Map displaying 393 sightings (open circles) of adult male sperm whales made during 12 cetacean sightings surveys along the Aleutian Islands in the summers of 2001–2007 and 2009–2010 (e.g. Zerbini *et al.*, 2007); summer surveys occurred between the months of June and August and only large adult male sperm whales were observed. Also shown is the winter sighting (closed square) of an apparent mixed group of female and immature sperm whales of varying size and age, all smaller than adult males.

animals were apparent from the photographs (Figure 2). Although we can present no genetic data or direct anatomical observations to confirm the sex of the observed animals, we believe that this sighting was a mixed group of female and immature sperm whales for the following reasons. The group comprised larger animals, which we assumed to be adult females, with closely-associated smaller animals, presumed to be immature whales. Adult males can easily be distinguished from both females and sub-adult males in the field due to substantial differences in size (16 m on average for males compared with 11 m for females; Rice, 1989) and a large crease on the top of the head at the transition between the nose and the trunk (Whitehead, 2003). We have extensive experience observing males during summer surveys around the Aleutian Islands (as well as females/immatures in tropical regions), and although whales of various sizes were present in all three subgroups we observed, none appeared large enough to be adult males. Furthermore, several acoustic targets that were detected by the survey's quantitative echosounding system (Simrad ER60), as the group dove in the vicinity of the ship were probably whales of varying sizes, including one measuring approximately 9 m and another measuring approximately 6 m. This is consistent with the size range of females and sub-adults (Best, 1979; Rice, 1989).

All three subgroups remained within a half to one km of each other and were rafting at the surface for most of the

encounter. Several tightly aggregated clusters of whales were observed within the subgroups, accompanied by a high degree of social contact. Sideways, partial fluking was observed in association with whales during apparent social behavior (e.g. rolling and body contact), but no high fluking for deep dives were recorded. Multiple dives of short duration were observed throughout the encounter (associated with shallow fluking), and only one dive of approximately 20 minutes duration was recorded when the whales were not observed at the surface. No directional travel was apparent as all subgroups resurfaced within several hundred metres of their initial dive location. All three subgroups appeared to alternate time spent at the surface, and several young animals (less than half the length of the accompanying adult) were observed logging by themselves at the surface for short periods while the adults were diving. In contrast, during extensive summer sighting surveys over ten years along the Aleutian Islands (e.g. Zerbini *et al.*, 2007), we have observed sperm whales on 393 occasions, all involving much larger adult males (Figure 1). In general, most of these sightings were of solitary individuals (median group size = 1), although whales were sometimes encountered at relatively high density in loose aggregations, and dive times were generally longer than 40 minutes. An additional five sperm whales were observed the following day, 28 February 2008, approximately 114 km away from the sighting of the females and immatures. The ship did not approach the whales, but the individuals were

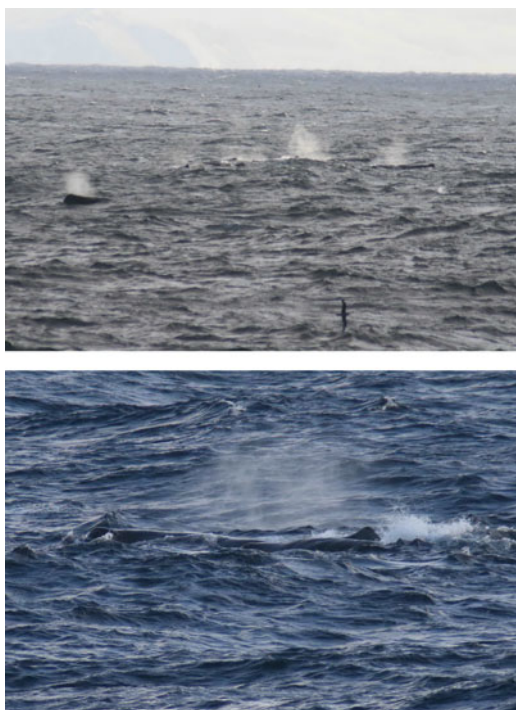


Fig. 2. Top: photograph of rafting members of a subgroup of sperm whales of varying size. Bottom: photograph of a cluster of two animals, a probable female and smaller immature sperm whale in tight association.

scattered in distribution (~ 1 km separation) and appeared to be large adult males.

This sighting represents rare winter observations of sperm whales from the Aleutian Islands, where poor weather typically constrains sighting surveys, but it is not the only record of female and immature sperm whales from this area. Both Berzin & Rovnin (1966) and Nishiwaki (1966) discussed seasonal distribution patterns of sperm whales on whaling grounds and reported that groups of females and immatures were observed along the Aleutian chain and in the Bering Sea, with several records of sperm whales (all age-classes and sexes) overwintering in the high-latitude waters of the western Aleutians. Berzin & Rovnin (1966) reported that sperm whales could be found regularly in high-latitudes during the winter, specifically mentioning an observation of 80–100 animals in the Aleutians in January 1964, and Berzin (1971) documented a mixed group of females and immatures in the Aleutians in early March. Together with these earlier reports, our recent sighting confirms that groups of female and immature sperm whales are not necessarily confined to lower-latitudes of the North Pacific.

The Aleutian Islands' ecosystem is extremely productive and supports one of the world's largest fisheries. Peak areas of productivity are found on the northern (Bering Sea) side of the Aleutian chain, where upwelling, a result of the northern movement of nutrient-rich water funnelling through the passes, enhances productivity (Ladd *et al.*, 2005). Sperm whale distribution in general has been found to be positively correlated with areas of upwelling (Jaquet, 1996) and steep topography (Berzin & Rovnin, 1966; Jaquet & Whitehead, 1996), which create a habitat that is extremely favourable for cephalopods, the primary prey item for female and immature sperm whales (Kawakami, 1980; Jaquet, 1996; Waring *et al.*, 2001; Jaquet & Gendron, 2002; Ruiz-Cooley *et al.*,

2004). This encounter occurred on the nutrient-rich northern side of the Aleutian chain, adjacent to a young volcano with steep associated topography. Depths at the start of the encounter were approximately 1300 m, quickly dropping to 1500 m before exceeding depths recorded by the depth-sounder (1500 m). The extremely productive area appears to offer suitable habitat for sperm whales, and adult males are regularly sighted in these areas during the summer (Figure 1).

However, it is notable that no groups of females and immatures have been observed during these recent summer sighting surveys, despite extensive survey effort and regular sightings of adult males. This contrasts with historic whaling data, which documented catches of sperm whales of both sexes, including pregnant females, in all months of whaling above 50° N (March–October) (Mizroch & Rice, 2006, appendix), in both the Gulf of Alaska and along the western Aleutians and off the coast of Kamchatka (S.A. Mizroch, unpublished data). This apparent change in the occurrence of mixed groups of females and immatures may represent a depletion due to whaling (e.g. Berzin, 2008); a re-distribution as a result of past whaling (e.g. Whitehead *et al.*, 1997); a response to changes in prey resources (e.g. Whitehead, 1996; Jaquet & Gendron, 2002; Jaquet *et al.*, 2003), possibly due to shifts in water temperature (Nishiwaki, 1966); or perhaps a response to increasing predation pressure by killer whales, *Orcinus orca* (e.g. Pitman *et al.*, 2001). The large group size observed in this encounter is a common trait for mammals occurring in areas of increased predation risk (Alexander, 1974), and risk of predation by killer whales has been suggested to be a major factor influencing group size for sperm whales (Jaquet & Gendron, 2009). A relatively high abundance of mammal-eating 'transient' killer whales regularly use the coastal waters of the Aleutian Islands during summer (Zerbini *et al.*, 2007; Durban *et al.*, 2010); although their relative winter abundance is unknown. Springer *et al.* (2003, 2008) have suggested an increase in killer whales in coastal waters of the far North Pacific in recent decades, similar to that which has been documented in the coastal north-eastern Pacific (Ford *et al.*, 2007), which may represent a strong selective force on the distribution of vulnerable sperm whale mixed schools (Pitman *et al.*, 2001). If this is the case, presumably adult males are large enough to avoid much predation risk, or have other social and feeding constraints against forming large groups.

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