Phocoenoides dalli (True, 1885)

English: Dall's porpoise
German: Dall-Hafenschweinswal
Spanish: Marsopa de Dall
French: Marsouin de Dall

Family Phocoenidae

1. Description

Like the other members of the phocoenid family, Dall's porpoises have a stocky body with a short, wide-based, triangular dorsal fin. The beak is very short and poorly defined. The flippers and flukes are small. The colour pattern is very characteristic, the animals being largely dark grey to black with a large, ventrally continuous white patch which extends up about halfway on each flank. The upper part of the dorsal fin and the trailing edge of the flukes are light grey. Maximum body length is 239 cm and mass 200 kg (Jefferson, 2009).

Dall's porpoises are polymorphic in their pigmentation pattern. In *dalli* type animals, the flank patch extends to about the level of the dorsal fin whereas in *truei* type animals the patch extends to about the level of the flippers. Both colour morphs were variously considered as species or subspecies in the past (e.g. Rice, 1998), and genetic analysis confirms that they form separate populations: Pairwise comparisons indicate a low but significant difference between the Sea of Japan-Okhotsk *dalli*-type population on the one hand and the *truei*-type population and the standard *dalli*-type population in the northwestern North Pacific on the other hand (Escorza-Treviño and Dizon, 2000; Hayano et al. 2003; Amano and Hayano, 2007). Furthermore, there seems to be a demographic distinctiveness between Bering Sea and western North Pacific stocks (McMillan and Bermingham, 1996).

2. Distribution

http://www.iucnredlist.org/apps/redlist/details/17032/0/rangemap

Distribution of Phocoenoides dalli*: North Pacific (Hammond et al. 2008; © IUCN).*

The distribution of Dall's porpoise is confined to the North Pacific Ocean and adjacent seas. They range in subarctic waters from the Sea of Okhotsk, Bering Sea, and the northern Gulf of Alaska, south to the Sea of Japan, the Subarctic Boundary at about 63°N across the North Pacific, and in the California Current to about 32°N off Baja California Norte. Although mainly an offshore deepwater inhabitant, Dall's porpoise also occurs in narrow channels and fjords where the water is clear and relatively deep, such as those in Prince William Sound and around the Alexander Archipelago in Alaska (Jefferson, 2009).

There are records of the species as far south as 28°N, off the coast of Baja California (Mexico) although reported only during periods of exceptionally cold waters. At the northern end of the range, sightings are infrequent north of 62°N in the Bering Sea, but there have been occasional sightings in the Chukchi Sea (Reyes, 1991, and refs. therein).

3. Population size

Several stocks have been recognised, based largely on geographic variation in morphology and colour patterns, parasite loads, densities of mother/calf pairs, and genetic differences. Eight stocks (seven dalli-type and one truei-type) are recognised by the International Whaling Commission (Houck and Jefferson, 1999 and refs. therein). Nevertheless, most abundance estimates are geographically justified:

For Alaskan US EEZ waters, Angliss and Outlaw (2005) estimate population size from 1987-1991 data at 83,400 after correcting for vessel attraction behaviour.

In the inshore coastal waters of the Inside Passage, between British Columbia (BC)-Washington and the BC-Alaska borders surveys conducted in 2004 and 2005 yield an abundance estimate of 4,910 (CI = 2,700-8,940) (Williams and Thomas, 2007).

The most recent estimate of Dall's porpoise abundance in the eastern Pacific US EEZ is the geometric mean of estimates from 2001 (Barlow and Forney 2007) and 2005 (Forney 2007) summer/autumn vessel-based line transect surveys of California, Oregon, and Washington waters, or 48,376 (CV = 0.24) animals.

In 2007 new abundance estimates for Dall's porpoises were made available for Japanese waters, based on 2003 survey data. The new population estimates are 173,638 *dalli*-type porpoises and 178,157 truei porpoises (IWC, 2008), lower than the estimates of 1991 of 226,000 and 217,000 (IWC, 1998) respectively.

4. Biology and Behaviour

Habitat: Dall's porpoise is found in diverse habitats, including sounds, nearshore waters (near deep water canyons) as well as offshore waters more than 1,000 km from shore. Waters colder than 18°C are preferred, and the peak abundance is in waters colder than 13°C (Reyes, 1991 and refs. therein). It may routinely forage at depths of 500 m or more (Carwardine, 1995). It is not found in the southern extremes of its range during the summer or warm water months (Houck and Jefferson, 1999). Ferrero (1998) confirms, that sea surface temperature was the most important habitat parameter examined.

Behaviour: Almost hyperactive. Darts and zig-zags around at great speed, and may disappear suddenly. Swimming-speeds can reach 55 km/h. This is the only porpoise that will rush to a boat to bow-ride, but soon loses interest in anything that travels slower than 20 km/h. They do not porpoise like other small cetaceans, but produce a "rooster tail" (Carwardine, 1995).

Schooling: Dall's porpoises are found mostly in small groups of 2 to 12, although aggregations of up to several thousand have been reported. Groups appear to be fluid, often forming and breaking up for feeding and playing (Jefferson et al. 1993). They often associate with Pacific white-sided dolphins (*Lagenorhynchus obliquidens*; from 50°N southwards) and pilot whales (*Globicephala macrorhynchus*; from 40°N southwards) (Carwardine, 1995). Bowriding behaviour has been observed with gray (*Eschrichtius robustus*), fin (*Balaenoptera physalus*), blue (*Balaenoptera musculus*) and humpback whales (*Megaptera novaeangliae*) (Houck and Jefferson, 1999, and refs. therein).

Food: Stomach samples from Dall's porpoises collected in pelagic waters spanning most of their range in the North Pacific and the Bering Sea revealed a diet of myctophid fish in the

subarctic North Pacific and on gonatid squids as well as myctophid fish in the Bering Sea, with little prey selectivity. Most of the prey items were mesopelagic species that migrate vertically to shallower waters at night. Stomach content was greater during twilight hours, suggesting the porpoises foraged actively on myctophids at night in shallower waters. According to Ohizumi et al. (2003), the annual consumption by Dall's porpoises was estimated to be 2.0-2.8 million tons, or 4.7-6.5% of the biomass of mesopelagic fish in the subarctic North Pacific. Comparison of stomach contents and trawl samples shows crude consistency (Ohizumi and Watanabe, 2004).

Amano and Kuramochi (1998) suggest from their findings, that Dall's porpoises feed opportunistically, changing prey items and feeding times based on supply. The most common prey items in the Sea of Okhotsk were the Japanese pilchard (*Sardinops sagax*) and the squid (*Berryteuthis magister*) (Walker, 1996). Around Hokkaido in the Sea of Okhotsk and the Sea of Japan, the dominant prey species switched from the late 1980s to the early 1990s as the *Sardinops melanostictus* (Japanese pilchard) populations in both seas declined. In the Sea of Japan, Dall's porpoises switched to *Theragra chalcogramma* (walleye pollock), and in the Sea of Okhotsk, to *Engraulis japonicus* (Japanese anchovy) and *Berryteuthis magister* (magistrate armhook squid) (Ohizumi et al. 2000).

Reproduction: Most Dall's porpoise calves are born in spring and summer (Jefferson et al. 1993). Segregation of age and sex classes was determined in the western North Pacific population. Mother-calf pairs are sighted only north of 46°N. Data obtained from gillnet fishery confirm that pregnant and lactating females dominate in the northern Pacific area and that newborn calves are also present. These observations probably indicate a calving and breeding area for the population north of the USA Exclusive Economic Zone (EEZ). The percentage of mature males in this area is low, and most mature males are found south of the USA EEZ (Reyes, 1991 and refs. therein).

Besides the *truiei* and *dalli* types, there seems to be a frequent hybridization between free-ranging Dall's and harbour porpoises, *Phocoena phocoena.* All crosses examined had Dall's porpoise as the maternal parent, a directionality reflecting the indiscriminate pursuit of female porpoises by male harbour porpoises (Willis et al. 2004).

5. Migration

Although the species as such is present all year round in Prince William Sound, Alaska, a decrease in abundance of Dall's porpoises was observed from fall to winter, indicating a movement of a portion of that population out of the area. These seasonal migrations may also occur in the Gulf of Alaska and the Bering Sea (Reyes, 1991 and refs. therein). According to Forney and Barlow (1998) Dall's porpoises seem to shift their distribution southward during cooler water periods on both interannual and seasonal time scales. In southern California waters, Dall's porpoises were found only in the winter, generally when the water temperature was less than 15°C (Houck and Jefferson, 1999). Carretta et al. (2000) also found that Dall's porpoises were present off San Clemente Island, California, only during the cold-water months of November-April.

Houck and Jefferson (1999), suggest that this species is present year-round in central California, northern California, Puget Sound, Washington, and British Columbia. In these areas, waters remain cool (about 9–15°C) throughout the year. Inshore/offshore movements off southern California and British Columbia have also been postulated.

Although movements in the eastern Pacific also have a north/south component, there appear to be more distinct north/south movements in the western Pacific. These movements may be temperature-related or food-dependent. Truei-type porpoises and mixed schools are generally found in warmer waters, while dalli-types are found in both warmer and colder waters (Houck and Jefferson, 1999 and refs. therein). Porpoises of the truei-type winter off the Pacific coast of Japan, moving in summer towards the north, reaching the southern Kuril Islands. Migration of truei-type animals into the Okhotsk Sea was recently confirmed, and it has been suggested that this occurs through the Kuril Islands. The presence of a higher percentage of mother-calf pairs in the southern part of that sea suggests that the area represents a breeding ground for the truei-type. Up to 15,000 animals of the dalli-type are reported to migrate through the Tsugaru Strait to the Pacific coast of Japan (Reyes, 1991 and refs. therein).

6. Threats

Direct catch: A fishery for Dall's porpoises operates only in Japanese waters and dates back to early in the 20th century. While this fishery was developed primarily during winter months, it has spread to other seasons and areas, resulting in an increase in the annual catch and the inclusion of the dall's-type in the captures. A total of 40,000 were taken in 1988 from a population of about 105,000 porpoises migrating to the fishing grounds. The stock composition of the catches is not known. The effect of hunting at such a level on the populations is a matter of serious concern (Reyes, 1991 and refs. therein). In recent years, the catch has been reduced somewhat, but still remains too high, with 11,000 harpooned in 1998 (Houck and Jefferson, 1999 and refs. therein). The latest figure is 11,357 captured in 2007, of which 4,070 are of the Dalli and 7,287 of the truei type.
The Japanese hunt of Dall’s porpoise has been highlighted by the IWC SC several times as unlikely to be sustainable. However the Japanese government has ignored IWC SC recommendations to reduce quotas, claiming that IWC does not have competence over small cetaceans (WWF, 2009).

Incidental catch: In addition to the direct catch, Dall's porpoises are captured incidentally, mostly in drift net fisheries.

In the Being Sea and Gulf of Alaska as well as around the Alaska Peninsula and Aleutian Island salmon drift gillnet fishery results in an estimated annual incidental kill rate in observed fisheries of 33.9 porpoise per year from this stock (Angliss and Outlaw, 2005).

Dall’s porpoises are also by-caught in salmon gillnet fisheries in British Columbia, Canada waters. However, best estimates of bycatch mortality in 2004 and 2005 exceeds only the most precautionary limits for porpoise species (Williams et al. 2008).

Estimates of incidental marine mammal, sea turtle, and seabird mortality in the California drift gillnet fishery for broadbill swordfish, *Xiphias gladius*, and common thresher shark, *Alopias vulpinus*, for the 7-year period, 1996 to 2002 amount to 44 Dall's porpoises (Carretta et al. 2004). In the eastern Pacific US EEZ, current mean annual takes for all fisheries for which mortality data are available are 1.4 animals per year (Caretta et al. 2009).

Large numbers of Dall’s porpoises die in driftnets within national waters of Japan and Russia, where the UN ban on driftnets does not apply. The estimated bycatch in the Japanese salmon driftnet fishery operating in the Russian EEZ totaled close to 12,000 for the period 1993 to 1999, ranging from 643–3149 on an annual basis (IWC 2002). At its 60th annual meeting, the IWC in 2008 reiterated its concern for the stocks of Dall’s porpoise off Japan and repeated its

previous recommendation that catches should be reduced to sustainable levels, that the bycatch levels be quantified and that a full assessment of each of the affected populations be conducted as soon as possible.

Pollution: Organochlorine compounds (OCs) such as polychlorinated biphenyls (PCBs), dichlorodiphenyltrichloroethane and its metabolites (DDTs), chlordane related compounds, hexachlorocyclohexane isomers (HCHs), hexachlorobenzene (HCB) and tris-chlorophenyl methane (TCPMe) were found in the blubber samples of Dall's porpoises collected from Japanese coastal waters in 1998/1999. Concentrations and compositions of DDTs and HCHs showed significant differences between the truei-type population off the Pacific coast of northern Japan and dalli-type from the Sea of Japan/Okhotsk. OCs levels detected in truei-type porpoises collected in 1998/1999 were lower than those collected in 1984, except TCPMe. On the other hand, except DDTs, the residue levels of other organochlorines in dalli-type porpoises showed no significant decrease since 1984 (Kajiwara et al. 2002). High concentrations of organochlorines (especially DDT) were also reported in Dall's porpoises from southern California (Reyes, 1991 and refs. therein). Since females may transfer organochlorines to their offspring during gestation and especially through lactation, and testosterone levels in males may be reduced by high levels of PCBs and DDE, this may have detrimental effects on production and calf survival (Houck and Jefferson, 1999 and refs. therein; Jarman et al. 1996).

Concentrations and body burdens of 14 trace elements (Hg, Cr, Mn, Co, Cu, Zn, Sr, Ag, Cd, V, Se, Pb, Mo, and Fe) and butyltins (BTs) (tributyltin TBT, dibutyltin DBT, and monobutyltin MBT) were determined in various tissues of a porpoise collected off the Sanriku coast of Japan. Selective accumulation was observed for Hg, Mn, Cu, Ag, Mo, Fe, and total BTs (TBT, DBT, and MBT) in the liver, Cd in the kidney, Zn, Sr, V, Pb, and Co in the bone, and Se in the skin (Yang et al. 2006). A mother-fetus pair collected off the Sanriku coast, Japan was contaminated by phenyltin compounds (Yang et al. 2007).

Overfishing: It is unlikely that the fishery for salmon could directly affect the food supply of Dall's porpoises, since salmon is not their regular prey. However, other fisheries operating in the North Pacific take a variety of fish species that could include potential prey species. The development of the squid fishery in the region could eventually represent a potential threat by reducing food availability (Reyes, 1991 and refs. therein).

7. Remarks

Range states (Hammond et al. 2008) :
Canada; Japan; Korea, Democratic People's Republic of; Korea, Republic of; Mexico; Russian Federation; United States of America.

Phocoenoides dalli is included in CITES Appendix II . The species is considered as "Least Concern" by the IUCN (Hammond et al. 2008). It is included in Appendix II of CMS.

8. Sources

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