

Status of the Striped Dolphin, *Stenella coeruleoalba*, in Canada*

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The Striped Dolphin, *Stenella coeruleoalba*, is found in offshore waters throughout the world in warm-temperate and tropical seas. Large numbers are killed yearly in directed fisheries off Japan and they are also incidentally caught in fishing operations around the world. Published and previously unpublished records from Canadian waters include 11 from western and 17 from eastern Canada. The Striped Dolphin appears to be at the northern limits of its normal range in Canadian waters, and no serious threats to it exist here. No COSEWIC status designation is required.

Le présent rapport expose les caractéristiques biologiques du dauphin bleu (*Stenella coeruleoalba*), son statut mondial, et les mesures de gestion dont il fait l'objet et sa situation, particulièrement au Canada. L'espèce fréquente les eaux hautes des mers chaudes tempérées et des mers tropicales du globe. De grands nombres sont tués chaque année dans le cadre d'une pêche sélective au large du Japon, et ils sont aussi capturés accidentellement au cours d'opérations de pêche dans toutes les mers du globe. Des données publiées et inédites pour les eaux canadiennes font état de 11 observations dans les eaux du Pacifique et 17 observations dans les eaux de l'Atlantique. Les eaux canadiennes, où l'espèce n'est pas menacée, semblent représenter la limite septentrionale de l'aire de répartition courante du dauphin bleu. À ce titre, l'espèce ne requiert pas une intervention de la part du CSEMDC.

Key Words: Striped Dolphin, dauphin bleu, *Stenella coeruleoalba*, Canada, status, cetacean, North Pacific, North Atlantic.

This review summarizes the current state of knowledge of the Striped Dolphin, *Stenella coeruleoalba* (Meyen, 1833), with special reference to its status and management in Canadian waters. Striped Dolphins (Figure 1) reach maximum lengths of between 2.5 and 2.7 m; males are slightly larger than females (Leatherwood and Reeves 1983; Ross 1984). Leatherwood and Reeves (1983) and Ross (1984) summarize the physical description of Striped Dolphins. Striped Dolphins and Common Dolphins (*Delphinus delphis*) are superficially similar, and this may make it difficult to distinguish between them at sea. Detailed descriptions of the complex pigmentation pattern of the Striped Dolphin are given by Norris and Prescott (1961), Gahr and Pilleri (1969), Fraser (1974) and Ross (1984). Pigmentation patterns appear to be highly variable, though Fraser and Noble (1970) note that these variations do not appear to correlate with age, sex, or geographical distribution. Such variations have resulted in considerable taxonomic uncertainty. In his review of the taxonomic history of *Stenella coeruleoalba*, Hershkovitz (1966) lists 44 historical species designations. Common names attributed to this species include the Blue-white Dolphin, Long-beaked Dolphin, Gray's Dolphin, Gray's Long-snouted Porpoise, Streaker Porpoise, Meyen's Dolphin, and the Euphrosyne Dolphin.

Distribution

The Striped Dolphin is found in all warm-temperate and tropical waters and is the most widely distributed species of the genus *Stenella* (Wilson et al. 1987). In the eastern North Atlantic, the Striped Dolphin has been observed as far north as Britain and Denmark (Fraser 1974; Wilson et al. 1987). The species appears to become more common southward along coastal Europe (Brown 1975; Evans 1987; Collet and Duguay 1987; Duguay 1987, 1988), and is present in the Mediterranean (Morzer Bruyns 1974; Casinos and Vericad 1976; Duguay 1977; Di Natale 1983; Podesta and Notarbartolo-di-Sciara 1987). It has been recorded along the west coast of Africa, and its presence in the Indian Ocean is well documented (Ross 1984; Leatherwood et al. 1984; Alling 1986; Wilson et al. 1987).

In the Atlantic, van Bree (1973) reports a Striped Dolphin specimen that is thought to have originated from the waters of Greenland. The species has been recorded from Newfoundland, along the U.S. east coast (Mansfield 1967; Sergeant et al. 1970; Mercer 1973; Hain et al. 1985) to Florida, and in the Caribbean and the Gulf of Mexico (Odell and Chapman 1976; Perrin et al. 1981). There are also several records along the coast of South America from southern Brazil to northern Argentina (Brownell and Praderi 1976; Perrin et al. 1981; Wilson et al. 1987).

* Reviewed and approved by COSEWIC 15 April 1993, report accepted, no status designation required.

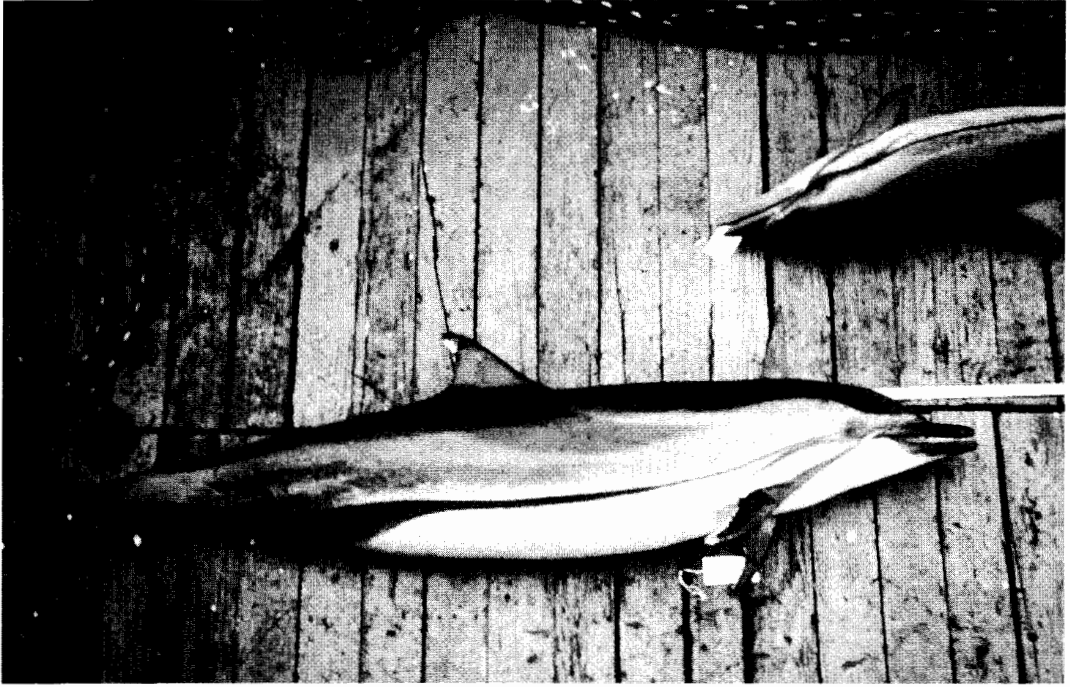


FIGURE 1. Striped Dolphin killed in a tuna purse-seine in the eastern tropical Pacific. Photo by O. Seth, courtesy National Marine Fisheries Service.

The Striped Dolphin is the most northerly distributed species of the genus *Stenella* in the North Pacific (Nishiwaki 1967). Watson (1981) notes that this species can be found as far north as the Bering Sea, but unfortunately presents no documentation. Considering this lack of documented records and the small number of records from northern parts of the North Pacific (Wilson et al. 1987), we believe it is unlikely they occur in the Bering Sea. In the eastern North Pacific, Striped Dolphins have been reported off the coast of North America from British Columbia to the equator, including the Gulf of California (Kellogg and Scheffer 1947; Cowan and Guiguet 1952; Sampson 1970; Hubbs et al. 1973; Wahl 1977; Aguayo-L. and Perdomo-V. 1985). Au et al. (1979) describe the distribution in the eastern tropical Pacific, which between the central Mexican and northern South American coast is known to reach to 153°W. Striped Dolphins are rarely seen in Hawaiian waters (Shallenberger 1981). There do not appear to be any records as far south as Peru (Perrin et al. 1983).

In the western North Pacific, Striped Dolphins are common off Japan (Nishiwaki 1967; Miyazaki et al. 1974). There are a few records north to the southern Sea of Okhotsk (Sleptsov 1961), and south through the South Pacific to New Zealand and Australia (Wilson et al. 1987).

Published records from within the Canadian 320 km (200 mi) extended economic zone (EEZ) are few (Cowan and Guiguet 1952; Mansfield 1967; Pike and MacAskie 1969; Sergeant et al. 1970; Mercer 1973; Wilson et al. 1987). Records are also found in unpublished reports by Hatler (1972), the Sea Education Association (1979) and Perkins et al. (1981). Jamieson and Heritage (1988) report an animal identified as *Stenella* sp. that was killed in an experimental fishery for Flying Squid (*Ommastrephes bartrami*) in offshore British Columbia waters. This animal was likely a Striped Dolphin, as other species in the genus *Stenella* found in the eastern North Pacific are typically more tropical (Leatherwood et al. 1988). A photograph of a dead Striped Dolphin on a wharf in Chester, Nova Scotia, from 1926, can be found in Reeves and Mitchell (1987), but there are no further details as to its origin. Katona et al. (1983) state that at least one record exists for Cape Breton Island, Nova Scotia, but this does not appear to match with any record compiled here. Mercer (1973) suggests that records from Quebec, and Halifax, Nova Scotia (Tomilin 1957; Miller and Kellogg 1955) are in error. Four unpublished records from the west coast, and eight unpublished records from the east coast, have also been compiled. In total, 11 records from the west coast,

TABLE 1. Records of the Striped Dolphin within the Canadian 320 km (200 mi) extended economic zone (V.I. = Vancouver Island). Specimens: UBC = University of British Columbia; BCPM = Royal British Columbia Museum, formerly BC Provincial Museum. See Figure 2 for locations.

Date	Location	Number	Type ^a	Source ^b	Temp ^c	Comments
Western Canada						
1948	Nootka Sound, V. I.	1	1	1	—	UBC 2886
18 March 1958	51°45'N, 133°45'W	5-10	2	2	—	
June 1960	Long Beach, V.I.	1	1	3	—	BCPM 6665
23 April 1961	Lawn Pt., Campbell River, V.I.	1	3	2	—	UBC 8011
23 April 1963	Kyuquot, V.I.	1	4	2	—	UBC 9236
05 March 1972	Wreck Bay, V.I.	1	1	4	—	UBC 9470
13 March 1972	Lovekin R., Long Beach, V.I.	1	1	4,5	—	BCPM 7525, male
1975	Victoria, V.I.	1	5	3	—	BCPM 8875 ^d
— March 1975	Cadboro Bay, Victoria, V.I.	1	5	6	—	mandible only ^d
17 February 1983	Long Beach, V.I.	1	1	3	—	BCPM 11394, male
10 August 1987	≈ 48°44.3'N, 131°7'W	1	4	7	—	listed as <i>Stenella</i> sp., killed in squid drift net
Eastern Canada						
1926	Chester, Nova Scotia	1	6	8	—	photo of a dead animal on wharf
14 February 1964	W spit Sable Island	1	1	9	—	identification not positive
summer 1964	N. beach Sable Island	3	7	10	—	
12 January 1968	Sable Island	3	1	10	—	
1968/1969	St. Pierre Bank	1	4	11	—	caught in trawl, St. Pierre Museum
29 June 1971	47°16'N, 53°58'W	1	4	11	—	caught in salmon net
31 July 1979	41°40'N, 62°30'W	—	2	12	—	
03 August 1979	43°50'N, 58°10'W	—	2	12	—	
August 1981	44°00'N, 59°00'W	25	2	13	—	
23 July 1989	43°51.9'N, 58°55.9'W	15	2	14	15.6	w/ <i>Lagenorhynchus acutus</i>
27 July 1989	43°33.1'N, 58°49.5'W	2	2	14	17.0	w/ <i>Delphinus delphis</i>
04 August 1989	43°49.4'N, 58°54.6'W	20	2	14	18.6	
11 August 1989	43°48.9'N, 58°59.6'W	15	2	14	18.5	w/ <i>L. acutus</i> , <i>D. delphis</i>
13 August 1989	43°50.4'N, 58°54.3'W	10	2	14	17.4	w/ <i>L. acutus</i> , <i>D. delphis</i>
04 August 1990	43°50.8'N, 58°57.4'W	8	2	14	15.0	w/ <i>D. delphis</i>
09 August 1990	43°50.8'N, 58°54.2'W	20	2	14	17.3	w/ <i>Hyperoodon ampullatus</i>
10 August 1990	43°45.1'N, 58°57.2'W	15	2	14	19.1	w/ <i>Globicephala melas</i>

^aType of Record: 1. Found dead on beach; 2. Sighting; 3. Skull collected, no details; 4. Caught in fishing gear, killed; 5. Skeletal parts found on beach; 6. Dead, no details; 7. Live stranded, died.

^bSource of Record: 1. Cowan and Guiguet 1952; 2. Pike and MacAskie 1969; 3. Royal British Columbia Museum, formerly the British Columbia Provincial Museum; 4. Hatler 1972; 5. Wilson et al. 1987; 6. University of Victoria; 7. Jamieson and Heritage 1988; 8. Reeves and Mitchell 1987; 9. Mansfield 1967; 10. Sergeant et al. 1970; 11. Mercer 1973; 12. Sea Education Association 1979; 13. Perkins et al. 1981; 14. H. Whitehead, unpublished data.

^cSea surface temperature in degrees celsius.

^dThese two records from the Victoria area in 1975 may be from the same individual, as the first is represented only by a skull, and the second by a single mandible, of approximately similar sizes. Further details on these collections are unavailable.

and 17 from the east coast records are presented in Table 1, with locations shown in Figure 2. Most records are of strandings or opportunistic sightings from one research area.

Protection

International

There is no international trade known in Striped Dolphin products. If such trade were to exist, it would be regulated by the Convention on International Trade in Endangered Species of Wild

Fauna and Flora (CITES). As Striped Dolphins are listed under Appendix II of the Convention, international trade requires export permits from the country of origin. There is no international protection for Striped Dolphins from direct or incidental takes.

National

Canada: Until they were repealed in 1993, the Cetacean Protection Regulations of the Fisheries Act of Canada of 1867 protected all cetacean species from "hunting". "Hunting" was defused as "to chase, shoot at, harpoon, take, kill, attempt to take or

kill, or to harass cetaceans in any manner", and could only be undertaken under licence. Aboriginal "hunting", however, could be undertaken without licences. The Cetacean Protection Regulations were replaced with the Marine Mammal Regulations of the Fisheries Act in early 1993. These regulations appear to provide no more or no less protection by stating only that "no person should disturb a marine mammal except when... under the authority of these regulations." However, no provisions for regulation of incidental catches in fishing operations exist.

United States: All cetaceans are protected under the Marine Mammal Protection Act of 1972, as well as by the Packwood-Magnuson Amendment of the Fisheries and Conservation Act and the Pelly Amendment of the Fisherman's Protective Act.

Population Size(s) and Trends

An estimated 2 300 000 Striped Dolphins are present in the eastern North Pacific (U.S. Department of Commerce 1987); the largest population estimate available for that area of any species of cetacean. Perrin (1975) notes that more than one stock may be present in the eastern tropical Pacific, with a distributional break between about 10° and 17°N latitude. Further research seems to support this population discontinuity, and Perrin et al. (1985) suggest that animals north and south of these latitudes be considered separate populations. Nishiwaki (1975) reported an estimate of 400 000 to 600 000 animals off Japan, while Kasuya and Miyazaki (1975; cited in Ellis 1989) note an estimate of between 130 000 and 180 000 for the same period and area. Kasuya (1985) concludes that the population off Japan has been declining since the mid-1940s. Forcada et al. (1990) note that the Striped and Common Dolphin are the most common small cetaceans in the offshore waters of the eastern North Atlantic.

Habitat

The Striped Dolphin's wide pelagic distribution in the eastern tropical Pacific is related to the distinctive oceanographic features of this region (Au et al. 1979). These authors note that all evidence points to a common preference among the pelagic dolphins, particularly the Striped and Common dolphins, for regimes of shallow thermocline, which is the major characteristic of the eastern tropical Pacific. Sightings off the northeast coast of the United States by CETAP (1982) were generally centred about the 1000 m depth contour. In a study in Japan, Miyazaki and Wada (1978) recorded Striped Dolphins in areas where sea surface temperatures ranged from 18.2 to 30.5°C. During research on Northern Bottlenose Whales (*Hyperoodon ampullatus*) off the Canadian east coast, Striped Dolphins were only recorded when water temperatures exceeded 15°C, during late July and August (Table 1), although field work in the area

has been undertaken during June, July, August, October and February (Whitehead, unpublished data).

General Biology

Reproduction

Striped Dolphins usually produce a single calf; only one pair of twin fetuses was found in a sample of about 30 000 dolphins examined in Japan (Tobayama et al. 1970). Gestation is thought to be 12 months (Kasuya 1972). Average length at birth is about 100 cm (Kasuya 1972; Miyazaki 1977). According to Miyazaki et al. (1981), Striped Dolphins weigh about 12 kg at birth, and grow rapidly in their first two years of life. Weaning takes place at an average estimated length of 174 cm and average age of 15 months (Kasuya 1972). Estimated lengths at attainment of sexual maturity in different areas are 195-220 cm for males and 216 cm for females, with a mean age of 9 years for both sexes (range of 7-12 years for males; 5-13 years for females; Perrin and Reilly 1984). Asymptotic body weight is attained at an age of about 15 years, when males average 157.5 kg and females 135.9 kg (Miyazaki et al. 1981). The mean and minimum ages at maturity have declined in the population off Japan, likely due to exploitation (Kasuya 1985). Physical maturity is reached at 235 cm in the male, and 225 cm in the female (Miyazaki 1977). Estimates of ovulation rates of animals from the western North Pacific range from 3 to 12 times per year (Perrin and Reilly 1984). Calving interval estimates range from 1.4 years to 4.2 years. Kasuya (1985) notes that the reproductive cycle in animals off Japan has also likely shortened because of exploitation of that stock. Using counts of cemental growth layers, assuming the deposition of one growth layer group per year, Kasuya (1976) has found that animals may reach 50 years of age. From a sample of over 1000 individuals aged using this technique, Kasuya (1985) noted one individual of each sex reaching an age of 57 years. In the same study, although sex ratio between different schools varied from about 22% females to about 73% females, the mean sex ratio of 12 schools totalling over 3000 individuals was about 1:1.

Species Movement

Off the coasts of Japan, Nishiwaki (1967) noted northerly movements in May through July, and southerly movements in October through December. Compared to most other species of cetaceans studied by CETAP (1982) off the NE coast of the United States, no strong seasonal changes in distribution were evident for the Striped Dolphin. As noted above, northern movements into waters off the Canadian east coast generally appear to be related to the warming of surface waters, although records from mid-winter do exist (Table 1).

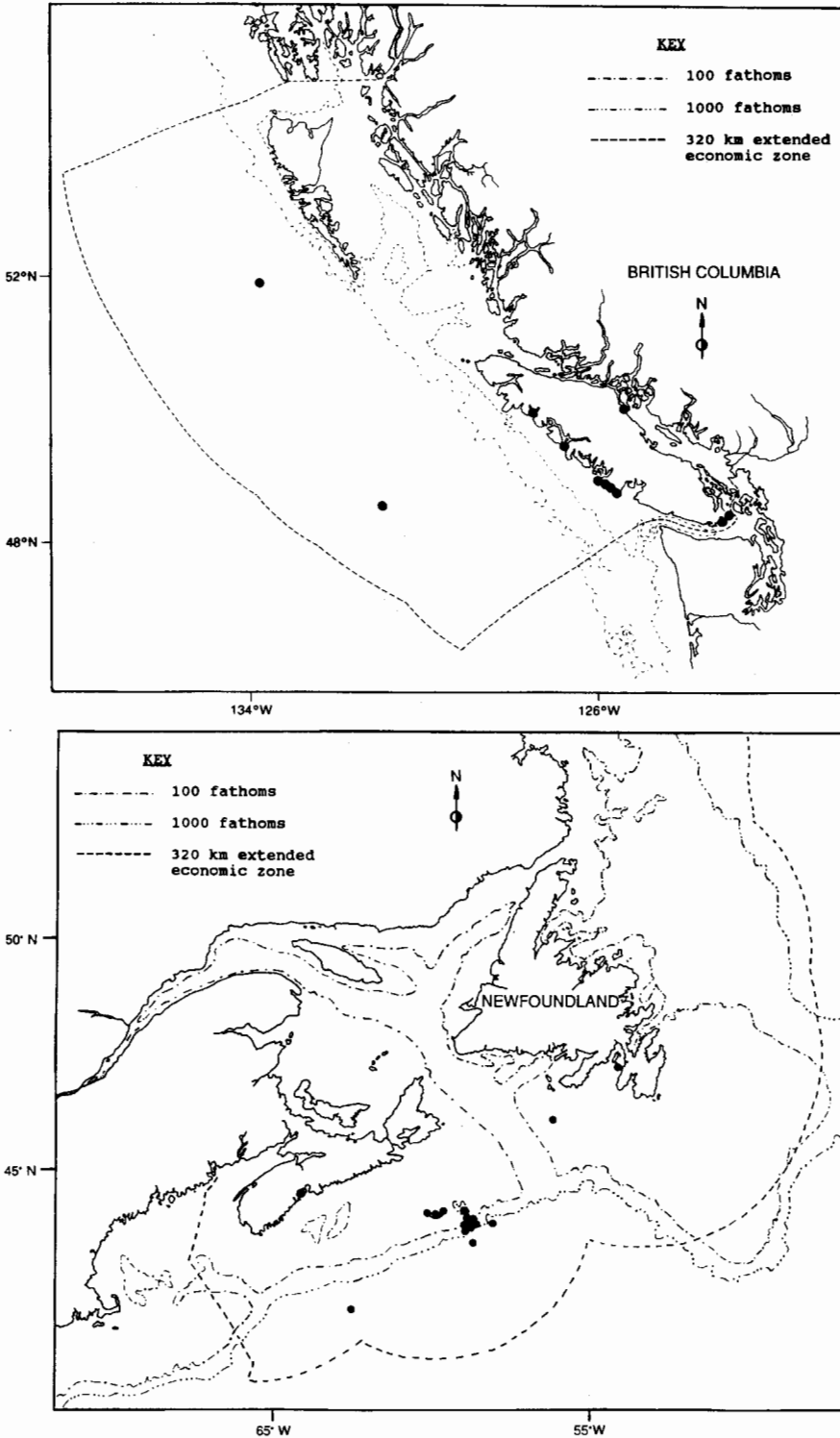


FIGURE 2. Locations of records from within the Canadian 320 km (200 mi) extended economic zone. Top: Pacific coast; bottom: Atlantic coast. See Table 1 for details of records.



FIGURE 3. Striped Dolphins porpoising in the Mediterranean. Photo courtesy S. Leatherwood.

Behaviour

Groups of up to 3000 individuals have been reported off the coast of Japan (Nishiwaki 1975). Miyazaki and Nishiwaki (1978) examined 45 schools of Striped Dolphins off the coast of Japan between 1963 and 1973 and found that 85.8% of schools had fewer than 500 individuals; the range was 8 to 2136 individuals. They also described three different types of schools, juvenile, adult, and mixed, to which Striped Dolphins belonged at different times according to their age and reproductive condition. The average size of schools taken in the Japanese drive fisheries was 360 individuals (Nishiwaki 1975). From 114 sightings from the northeast coast of the United States, the mean estimated group size was 64.9, with a mode of 20, and a range from 1 to 500 individuals. In this area, Striped Dolphins were observed in the largest groups of all small cetacean species observed (CETAP 1982).

Food items recorded include fish, squid, and shrimp; myctophid fishes and the shrimp *Bentheogennema borealis* were dominant in the stomach contents of 27 individuals taken off the coast of Japan (Miyazaki et al. 1973). Feeding on anchovies and sardines in the Mediterranean has been suggested (Di Natale 1979).

Associations with seabirds, and at least nine other species of marine mammals, have been noted. These

include Atlantic White-sided Dolphins (*Lagenorhynchus acutus*), Common Dolphins, Long-finned Pilot Whales (*Globicephala melas*), Risso's Dolphins (*Grampus griseus*), Bottlenose Dolphins (*Tursiops truncatus*), other species in the genus *Stenella*, Northern Bottlenose Whales, Sperm Whales (*Physeter macrocephalus*), and Minke Whales (*Balaenoptera acutorostrata*) (Table 1; CETAP 1982; Au and Pitman 1988). Au and Pitman (1988) note that associations with birds and other species of marine mammals occurred in seven and nine percent, respectively, of 139 schools observed in the eastern tropical Pacific.

Di Natale (1983) notes that Striped Dolphins have been recorded at swimming speeds up to 32 knots. Striped Dolphins are among the most acrobatic of dolphins (Figure 3), and have been reported to ride the bow waves of boats by many authors. However, Au and Perryman (1982) found that schools of *Stenella*, including the Striped Dolphin, exhibited an avoidance response to boats from as far away as six or more miles. It is possible that in certain areas, such as the eastern tropical Pacific where they have been pursued by tuna purse seine boats, they have learned to avoid vessels. In such areas this may result in a significant reduction in sighting probability by ship-board observers. Animals sighted off Nova Scotia in 1989 and 1990 came to the bow of



FIGURE 4. Striped Dolphin riding the bow wave on a research boat off Nova Scotia, 1989. Photo by H. Whitehead.

the research vessel (Figure 4) and did not appear to take avoidance action. Striped Dolphins have been maintained in captivity in Japan, but little appears to be known about their captive behaviour (Defran and Pryor 1980).

Limiting Factors

A shark attack on an ailing individual has been reported (Ross and Bass 1971). Predation by Killer Whales (*Orcinus orca*) has not been observed (Jefferson et al. 1991), but remains have been recovered from Killer Whale stomach contents (Nishiwaki and Handa 1958). Although predation by False Killer Whales (*Pseudorca crassidens*) has not been documented, it may occur in association with tuna purse seine operations in the eastern tropical Pacific, as has been reported for other species in the genus *Stenella* (Perryman and Foster 1980).

A variety of parasites have been reported from this species, including the nematodes *Halocercus lagenorhynchi*, *Halocercus delphini*, *Anisakis simplex*, *Anisakis typica*; the trematodes *Nasitrema* sp., *Pholetes gastrophilus*, *Campula rochebruni* and *Campula delphini*; the cestodes *Monorygma* spp., *Phyllobothrium delphini*, *Strobilocephalus triangularis* and *Tetrabothrius fosteri*; and the protozoan *Sarcocystis* sp. (Horning and Pilleri 1969; Ross and

Bass 1971; Zam et al. 1971; Dailey and Brownell 1972; Dollfus 1974; Dailey and Stroud 1978; Dailey and Walker 1978; Viale 1981; Gales et al. 1985). Although presumably not detrimental to individuals, the external parasitic barnacle *Xenobalanus globicipitis*, as well as cyamids, have been recorded from this species (Pilleri 1970; Pilleri and Knuckey 1969; Ross 1984). The role of most parasites in mortality is generally unknown, although *Nasitrema* sp. has been implicated in the death of one individual off Florida (O'Shea et al. 1991). Infection by the yeast *Cryptococcus neoformans* has been implicated in the cause of death in an animal off Australia (Gales et al. 1985). Howard et al. (1983) note that pathogenic bacteria are probably responsible for most diseases and deaths in marine mammals. A morbillivirus has recently been implicated in the deaths of at least 400 Striped Dolphins in the Mediterranean (Domingo et al. 1990). O'Shea et al. (1991) note a pneumonia associated with the bacteria *Vibrio damsela* contributing to the death of a Striped Dolphin off Florida. Mass strandings have been reported for Striped Dolphins (Duguay 1987), but only infrequently (Sergeant 1982).

Striped Dolphins have been involved in the Yellowfin Tuna (*Thunnus albacares*) purse seine fishery in the eastern Tropical Pacific (Perrin 1975;

Wahlen et al. 1988), where hundreds have been killed yearly (e.g., Chivers et al. 1990; Hall and Boyer 1990). Small numbers have also been captured in tuna purse nets and swordfish driftnets in the Mediterranean (Di Natale 1983; Notarbartolo-di-Sciara 1990), and killed incidentally in gill nets off France (Duguy and Husenot 1982). Jamieson and Heritage (1989) reported a single *Stenella* sp. taken in a Canadian experimental fishery for Flying Squid in British Columbia waters in 1987. The Striped Dolphin, along with other species of small cetaceans, have long been captured in Japan in both small type whaling and local fisheries (Ohsumi 1972). Up to 20 000 Striped Dolphins have been taken annually in drive fisheries off Japan (Nishiwaki 1975). Directed takes in Japanese coastal fisheries in recent years have been lower, ranging from 1225 to 2918 (IWC 1988, 1989, 1990, 1991), and the decline in catch may reflect a decrease in the population size, rather than a reduction in effort (Kasuya 1985). Aguayo-L. and Perdomo-V. (1985) report that Striped Dolphins may be taken for use as bait in a shark fishery in the Gulf of California.

The Striped Dolphin has been the subject of several detailed toxicological analyses (ie., Honda et al. 1982; Honda and Tatsukawa 1983; Honda et al. 1983; Honda et al. 1984a; Honda et al. 1984b; Tanabe et al. 1984). High levels of organochlorines have been detected in tissues taken from stranded and captured animals (Taruski et al. 1975; O'Shea et al. 1980). Significantly higher levels of mercury have been documented in Striped Dolphins compared with virtually all other species of cetaceans examined (Wagemann and Muir 1984). However, the role of contaminants in mortality is largely unknown.

Evaluation

This species appears to be only an uncommon visitor to Canadian waters. As such, it requires no COSEWIC status designation.

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Note added in proof:

An additional record of this species from western Canada, a single animal found dead on the west coast of Graham Island in 1990, has come to our attention. No other details as to precise date or location are available, but this record appears to represent the northern-most occurrence at this species in the eastern North Pacific. A photograph of this animal, apparently a male, is held in the files of the Marine Mammal Research Group (Stranded Whale and Dolphin Program of B.C. SWDP90-43).

Several additional records from eastern Canada have also come to our attention. In early November 1991, six Striped Dolphins were found dead ashore on a stretch of North beach, near Old Main, Sable Island. Two additional Striped Dolphins were found in an advanced state of decomposition about eight weeks later approximately 40 km from the six dolphins, on the north side of East Spit, Sable Island. These individuals may have come ashore during the same period as the six dolphins. Measurements, samples for genetic analyses, teeth for aging, and photographs were collected for most animals. Our thanks to Zoe Lucas for providing this information.

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