Report of the

Scientific Committee

Annex L: Small Cetaceans

Annex M: Whale Watching

This Report is **CONFIDENTIAL** until

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International Whaling Commission, Anchorage 2007

Annex L

Report of the Sub-Committee on Small Cetaceans

Members: Aguilar, Almeida e Silva, Bass, Bejder, Bjørge, Bolaños-Jiménez, Borodin, Brandon, Brownell, Burdin, Cañadas, Chilvers, Cipriano, Cozzi, Dalla Rosa, de Stephanis, Deimer-Schuette, Di Guardo, Dinter, Ettyne, Fernandez, Fernholm, Foote, Fortuna, Gallego, Galletti, Hammond, Hoelzel, Hughes, Ilyashenko, Iñíguez, Ipatova, Kakuda, Kasuya, Kock, Krahn, Kuningas, Larsen, Lauriano, Lawrence, LeDuc, Lens, Lima, Litovka, Lucetti, Lusseau, Lyrholm, Magloire, Marcondes, Martin, Mate, Matkin, Mazzariol, Melnikov, Miasnikov, Mikhno, Miller, Morin, Newell, Northridge, Øien, Ottoy, Park, Parsons, Perrin, Pitman, Porter, Porter, Postma, Raverty, Rea, Read, Rebecca, Reeves, Reijnders, Ridoux, Ritter, Ritter, Rogan, Rojas-Bracho, Rose, Rosenbaum, Rowles, Senn, Simmonds, Straley, Strbenac, Suydam, Tajima, Tichotsky, Tiedemann, Urban, Van Waerebeek, Visser, Wade, Weinrich, Williams, Winship, Yamada, Yatabe, Young, Zelensky, Zerbini.

1. ELECTION OF CHAIR

Rogan was elected Chair.

2. ADOPTION OF AGENDA

The adopted Agenda is given in Appendix 1.

3. APPOINTMENT OF RAPPORTEURS

Reeves and Read acted as rapporteurs.

4. REVIEW OF AVAILABLE DOCUMENTS

Documents relevant to the work of the sub-committee were SC/59/SM1-29, SC/59/O16, SC/59/BC 2, 6, 8, 10 and Rojas-Bracho *et al*. (2006), Pitman *et al*. (2007), Joergensen (2007), Dalla Rosa and Secchi (2007), Bain *et al*. (in review), Caballero *et al*. (2007), Forney and Wade (2006), Matkin *et al*. (2007), Zerbini *et al*. (2007), McHugh *et al*. (in review), Krahn *et al*. (2007) and Herman *et al*. (2006).

5. POPULATION STRUCTURE, SYSTEMATICS AND STATUS OF KILLER WHALES

The sub-committee last reviewed the status of killer whales in 1983 (IWC 1984) and since that time a great deal of new information has become available on all aspects of their biology and status. Given the documentation available for this meeting, it was decided to organise the review on an ocean by ocean basis.

Killer whales in the North Pacific have been assigned to different ecotypes based on their foraging ecology, with three main ecotypes identified – residents (fish-eating), transients (marine mammal-eating) and offshores (prey type not known, but could include elasmobranchs). In the Antarctic, three ecotypes have also been described, based on morphometric characteristics from photographs and field observations (Pitman and Ensor, 2003). The ecotypes here were designated types A, B and C. Type A appears to feed mainly on Antarctic minke whales (Balaenoptera bonarensis), type B appears to specialise on pinnipeds while type C is thought to be mainly piscivorous and remain near the pack ice. More recently, it has been proposed that the Type C killer whale reported from the Ross Sea in eastern Antarctica is a dwarf form of killer whale (Pitman *et al*., 2007). Type C was found to be smaller that either of the other two forms, and, as had been hypothesised previously (e.g. Berzin and Vladimirov 1983), these authors suggest that multiple species of killer whale occur in the Southern Ocean.

5.1 Distribution and Abundance

The killer whale has the most extensive global distribution of any cetacean and occurs, or occurred historically, in all oceans and appended seas. In a worldwide review, Forney and Wade (2006) developed a table of the available information on killer whale density and abundance, by ocean basin and by regional sub-division within each basin. New information presented at this meeting was incorporated into an adapted version (Table 1). Forney and Wade were interested in identifying broad-scale patterns in density and abundance and they made no distinction among ecotypes or geographical/morphological forms.

Overall, the observed patterns of worldwide killer whale distribution are in general agreement with previous descriptions, which indicate that killer whales are more common at higher latitudes and in coastal areas. Killer whale occurrence also appears broadly tied to regions of higher ocean productivity, as indicated by remotely sensed chlorophyll levels, and the latitudinal and inshore/offshore patterns of abundance may simply be a reflection of the higher productivity in coastal and high-latitude areas (Forney and Wade, 2006). Regions of similar latitude exhibit differences in abundance that may be tied to patterns of productivity and prey availability; for example, killer whales are rare along the U. S. northeast coast although they are common along the coast of Oregon and Washington, at a similar latitude. Some of highest densities of killer whales in the world are in Alaska, Norway/Iceland and the Antarctic. Branch and Butterworth (2001) estimated that there were about 25,000 killer whales in the Southern Ocean south of 60ºS in the 1990s. Wade drew attention to the estimate of 8,500 (CV = 0.37) killer whales in the eastern tropical Pacific based on line transect surveys between 1986-90 (Wade and Gerrodette 1993). This high number indicates that even though densities in tropical waters may be generally low, the total number of whales can be substantial when the large size of the region is taken into account. Most tropical areas of world's oceans have not been well surveyed.

Forney and Wade (2006) concluded that there was sufficient evidence for a minimum worldwide abundance estimate of about 50,000 killer whales but that the true number is likely "considerably higher, because estimates are not available for many high-latitude areas of the northern hemisphere and for large areas of the South Pacific, South Atlantic, and Indian Oceans." In broad terms, it can be concluded that killer whales occur as different types and forms. High latitude and high productivity tend to define the presence of a fish-eating form whereas in lower latitudes where productivity tends to be less, it is hypothesised that killer whales tend to be generalists rather than specialists (e.g. Baird 2002).

North Pacific

Killer whales occur throughout the Russian Far East but have been little studied in most areas. During the Soviet whaling era, they were described as abundant in the entire Sea of Okhotsk but the first and only quantitative data for the region are from joint Russia-Japan ship surveys in the late 1990s and early 2000s. The sighting rate in the July-September 2003 survey was 0.73 groups (3.47 individuals) per 100nmi (SC/59/SM4). Several years of photo-identification work in Avacha Gulf, eastern Kamchatka, Russia, had resulted in the identification of 37 social units consisting of 277 different resident-type individuals through the summer of 2006 (SC/59/SM4). None of these whales have been observed with scars from bites of cookie-cutter sharks (Isistius brasiliensis) and therefore it is assumed that they do not migrate long distances to lower latitudes (e.g. Japan). Other whales bearing cookie-cutter shark bites, including transient- and resident-type animals, do appear in the Avacha Gulf area occasionally. Resident-type whales sampled in Kamchatka and the Kuril Islands had a Southern Resident haplotype shared with animals from south-western Alaska, the central Aleutians and inshore waters of British Columbia and Washington State. A male sampled near Sakhalin Island had the AT1 transient haplotype and its blubber had very high PCB and DDT levels (SC/59/SM4).

Zerbini summarised a recently published paper containing abundance estimates for killer whales in the nearshore waters of the Gulf of Alaska and Aleutian Islands in 2001-2003 (Zerbini *et al*., 2007). This area has some of the highest estimated densities of killer whales in the world. However, stock structure is poorly understood. The study by Zerbini *et al*. differed from previous killer whale line-transect ship surveys in that two estimates of group size were obtained. Once a sighting was made, observers went off-effort and the ship approached the group to collect biopsies, acoustic recordings, and photographic data. During the approach the observers and the data recorder made independent estimates of the number of whales in the group, which were averaged to produce an 'initial group size' (IGS) estimate. A 'post-encounter group size' (PEGS) estimate was obtained after time was spent making close approaches to photograph the whales. Separate estimates of abundance were calculated for the two categories of group size estimates. Also, separate abundance estimates were calculated for the two main ecotypes encountered – residents and transients, distinguished on the basis of morphological and genetic data. Abundance estimates of residents – 991 (95% CI = 379-2,585) [IGS] and 1,587 (95% CI = 608-4,140) [PEGS] – were at least four times higher than estimates of transients – 200 (95% CI= 81-488) [IGS] and 251 (95% CI = 97-644) [PEGS]. The authors concluded that the IGS estimate of abundance was better for resident killer whales though likely negatively biased, perhaps by ~20%. The PEGS estimate is more accurate for transients because the groups were smaller and after close approaches for photo-identification work, it was often possible to count marked individuals rather than just estimate a group size from the number of whales seen at the surface within a short period of time. In the case of the resident-type whales, the PEGS estimate may be positively biased to an unknown degree because resident whales commonly occurred in loose aggregations of numerous subgroups that often merged or split over time. Therefore, after several hours of photo-identification work it was not possible to be sure that all the whales counted were in visual range at the time of initial detection. This was not thought to be a problem for transient-type whales because their group size was, on average, smaller and they were usually seen in a single group that stayed in association throughout the period of observation.

In response to a question, Wade indicated that the same groups of resident-form individuals had been observed both east and west of Unimak Pass in the eastern Aleutians. Therefore the survey observations do not support the hypothesis of a stock boundary for residents in that vicinity. Wade also explained that analyses of the very large photo-identification catalogue of killer whales in the Aleutians are ongoing and that the initial focus was on transients rather than residents. It was noted that the estimates presented by Zerbini *et al*. (2007) were fairly imprecise (CVs > 0.40). Wade pointed out that though the line-transect estimates of abundance were relatively imprecise, a mark-recapture estimate for transients from photo-identification data from just those surveys would not have been much better. However, a larger dataset is currently being analyzed that will produce a much more precise mark-recapture estimate by combining those data with photo-identification data from a variety of other surveys. Initial results suggest that the new point estimates will be generally consistent with the findings of Zerbini *et al*. (2007).

A photographic catalogue of killer whales in the eastern tropical Pacific is being maintained at the Southwest Fisheries Science Center in La Jolla, California (SC/59/SM27). It presently includes 162 different individuals identified from photographs collected opportunistically during 14 surveys of cetacean abundance between 1977-2006. Only 11 of the 162 individuals have been re-sighted, with intervals between sightings ranging from 6 months to 14 years. The re-sightings indicate movement between the central outer coast of Baja California and the northern Gulf of California, and in one instance a group first seen in 1999 near the mainland coast of Mexico was resighted in 2006 far offshore in deep pelagic waters.

SC/59/SM15 summarised information on killer whales in the Gulf of California, Mexico, updating a previous review by Guerrero-Ruiz *et al*. (1998). The database includes 243 sightings from 1972-2006. A total of 236 different individuals have been photo-identified and 43 have been re-sighted at least once. The longest period between re-sightings was 16 years. The authors suggest that there are four communities of killer whales in the Gulf, with considerable movement into and out of the Gulf and some individuals being documented as far away as California to the north and Peru to the south. Although ecotypes and stock affinities of the whales in this region have not been studied, at least some animals are assumed to be transient types because they prey on marine mammals..

SC/59/SM1 presented information on 20 sightings of killer whales off the eastern and south-western coasts of Taiwan between 1996-2005. All observations were made between April – August, mainly from whale-watching boats. The infrequency of observations, small group sizes (2-10) and the fact that one individual was re-sighted in approximately the same location in successive years led the authors to conclude that only small numbers of killer whales occur around Taiwan. Although no genetic samples were available, it was inferred from external morphology that the animals around Taiwan most likely belong to the transient or offshore ecotype.

South Pacific

Research on killer whales in New Zealand has been ongoing since 1992 (SC/59/19). Photo-identification of individuals (n = 132) has been the basis for estimating abundance and making inferences concerning range and social structure. There is some evidence to suggest population structure, with North Island, South Island, and New Zealand-wide populations recognised provisionally. Also, both Type B and Type C Antarctic killer whales are observed to visit New Zealand waters. They bear wounds from cookie-cutter shark bites, which likely means they visit waters even farther north since New Zealand killer whales that remain in New Zealand waters do not get such bites.

SC/59/SM20 updated a published report on killer whales in Papua New Guinea (PNG) waters (Visser and Bonoccoso 2003). Surveys have been conducted only intermittently off West New Britain Province since 2002. Somewhat more than 100 sightings have been collated, most of them in the Kimbe Bay area. The data are biased towards areas where tourism facilities, especially dive resorts, are prevalent. Fourteen individual killer whales have been identified from photographs. Resightings were made of two animals, one of which was re-sighted after an interval of 16 months. The occurrence of calves appears to peak in April.

Miller provided a summary of records of killer whales in the Pacific Islands Region, defined in a recent CMS agreement as the marine areas under the jurisdiction of each State or Territory between the Tropic of Cancer and 60ºS latitude and between 130ºE and 120ºW longitude. Records of occurrence were found for 19 of the 22 Pacific Islands Countries and Territories (which does not include the Australian continent, the North and South Islands of New Zealand or Hawaii). Information on killer whales in the South Pacific is very patchy except for New Zealand.

Southern Ocean

Aerial photogrammetry was undertaken for 252 killer whales in the Ross Sea (Pitman *et al*. 2007). They were identified from the air as 'type C' whales by a distinctive cape and slanted eye patch. The length distribution of these whales (26 classified as calves, 33 as adult females, 64 as adult males and 97 as unknown) was at the low end of the broader distribution from Soviet Antarctic whaling data, and similar to the size distribution of killer whales in Norwegian coastal waters. The size distribution of the coastal Norwegian whales also was at the low end of the broader distribution from the North Atlantic and Norwegian waters that included offshore animals.

Gadamke presented SC/59/SM7, a compilation of information on killer whales in Australian territorial waters derived from Morrice (2004). In the absence of directed field studies of killer whales in Australia, most records have been opportunistic or incidental. Seventeen unpublished records of strandings, including two mass strandings involving 7-9 individuals, were collated from government agency databases. Although killer whales occur widely in Australia, 59% of the records came from Macquarie Island where the whales have been observed to prey on elephant seals and penguins.

De Stephanis summarised SC/59/SM23 on behalf of the authors. A long-term photo-identification database has been maintained for Possession Island, Crozet archipelago, since 1964, supplemented since 1998 by photographs obtained from longline fishing vessels working in the Crozet Exclusive Economic Zone. Preliminary analyses indicate that some whales exhibit strong site fidelity to near-shore waters while others seen offshore travel long distances as evidenced by one match between Crozet and the Kerguelen EEZ 1300 km distant. In discussion the sub-committee expressed interest in seeing the database expanded to include other sub-Antarctic island areas.

Kock pointed out that CCAMLR has observers on longline vessels who represent a potential source of data on killer whales in sub-Antarctic waters. The sub-committee recommends that CCAMLR compile data on killer whales from observer reports and supply those data for consideration by the IWC.

SC/59/SM8 reported the results of a pilot study of occurrence and distribution of cetaceans in Terra Nova Bay in the Ross Sea. The area is characterised by the Terra Nova polynya, which creates an area of enhanced productivity. Killer whales were the most common species of cetacean sighted during helicopter and vessel-based surveys of the region. A total of 39 sightings of killer whales were made; on 24 occasions it was possible to determine ecotype. In most (22) of these sightings, killer whales of Type C were present. On two occasions Type B killer whales were identified.

SC/59/SM10 presented the results of ship-based line transect surveys in the waters around the Antarctic Peninsula. Killer whales were the third most frequently encountered species of cetacean, after humpback and minke whales. A total of 70 killer whales sighting were recorded: nine sightings of Type A animals; 24 of Type B animals; and 37 sightings of undetermined killer whales. Type C killer whales were not observed during these surveys, supporting the conclusion of Pitman and Ensor (2003) that this ecotype does not occur in this region. The large number of undetermined sightings was due to the passing mode typically employed during these surveys. Preliminary analyses of photographs taken during these surveys have yielded 21 unique Type A killer whales and 52 Type B animals. Future work will compare these photographs with the Antarctic Killer Whale Identification Catalogue (AKWIC).

Given the paucity of information on the distribution and abundance of specific killer whale ecotypes in the Antarctic, the sub-committee welcomed these results and encouraged future dedicated surveys in this region.

The results of these dedicated surveys were augmented by a compilation of killer whale sightings made from eco-tour operations in Antarctic waters. SC/59/SM 21 described 108 killer whale sightings made from ecotourism vessels working in the Antarctic from 1981-2007. Eighty-seven of these sightings were documented in sufficient detail to assign animals to ecotype. Sightings of all three ecotypes were present: 36 sightings of Type A killer whales; 23 sightings of Type B killer whales; and 28 sightings of Type C killer whales. Photographs of distinctive individuals were contributed to the AKWIC and a small number (4) of matches have been made to date.

Ensor and Visser both noted records of an apparently different ecotype in Southern Ocean waters. These animals were black and white killer whales (similar to Type A), but they had extremely small eye-patches, smaller than those described for Type C killer whales (Pitman & Ensor, 2003), and more reminiscent of the small eye-patches seen on a group of killer whales which stranded on New Zealand shores in 1955 (Visser & Mäkeläinen, 2000; Visser, 2007).

Martin noted that very few killer whales have been observed in near-shore waters around South Georgia – despite the presence of abundant prey. Killer whales are more common further offshore in this area. As noted elsewhere, the distribution of killer whales in the Antarctic is patchy, but the factors responsible for this spatial variation in distribution are not understood.

Atlantic Ocean

SC/59/SM11 reviewed the available literature and presented new information on the occurrence, distribution and ecology of killer whales in Brazilian waters. The species has been recorded along the entire Brazilian coast, except for northern coastal waters. Most records are from the southern and south-eastern regions. A total of 118 sightings were recorded, distributed among all seasons. In the south-east, sightings occurred mainly during spring and summer months in coastal waters. In the south, however, most records were from winter and spring months and in offshore waters where killer whale interactions with longline fisheries are common. Twenty-two strandings of killer whales were registered, 16 of which occurred in Rio Grande do Sul State. The occurrence of killer whales in coastal waters of Rio de Janeiro, south-eastern Brazil, is seasonal (e.g. Siciliano *et al*., 1999). It was not possible to determine whether there is any degree of seasonality in their occurrence in southern Brazil since most sightings come from observers onboard fishing vessels and therefore there could be a bias associated with fishing effort. The higher proportion of sightings close to shore off Rio de Janeiro in comparison to other coastal areas is likely explained by the narrower continental shelf and the presence of seasonal upwelling. Dedicated studies are urged to determine the identity of killer whale populations in Brazilian waters, while broad surveys are required to estimate their abundance.

A dataset consisting of 3,787 killer whale sightings from across the north-eastern Atlantic between 1970-2007 was compared with the locations of 1,413 killer whale catches by Norwegian small-type whaling vessels between 1938-1967 (SC/59/SM5). The two datasets showed a similar overall distribution pattern despite the biases inherent in both of them and despite the fact that a large shift occurred during the late 1960s in the migration of the Norwegian spring spawning (NSS) herring (Clupea harengus) stock, a key prey population. This was interpreted by the authors of SC/59/SM5 to suggest that there are populations of killer whales in the north-eastern Atlantic that do not follow the NSS herring migration. Sightings from several large-scale line transect surveys (the North Atlantic Sighting Surveys, NASS) during the summer months in 1987, 1989, 1995 and 2001, which achieved fairly even coverage of the north-eastern Atlantic, suggested that killer whales were relatively evenly distributed across this range during this season. Estimates of total killer whale abundance from the NASS surveys ranged from 4,413 to 26,774. The variability in abundance estimates between surveys could be due to a number of factors, such as variation in platforms, sea states, observers and areas covered.

Foote called attention to the strong influence of herring spawning areas on killer whale distribution in the north-eastern Atlantic and also noted that some groups of killer whales associate with mackerel fisheries to feed on discards. Densities of killer whales in UK waters appear to be lower than farther north. Lyrholm pointed out that killer whales occur fairly regularly off the west coast of Sweden, coincident with mackerel migrations. Kock noted that killer whales occasionally enter the Baltic Sea; a group of about ten animals were seen recently near Bornholm.

In response to a question concerning possible biases in the abundance estimates summarised from the literature in SC/59/SM5, Foote acknowledged that no special adjustment had been made in the analyses to account for social factors – e.g. differences in group size between different ecotypes or populations. It was suggested that reanalyses using methods similar to those of Zerbini *et al*. (2007) might be worth considering.

SC/59/SM13 presented preliminary results of analyses of killer whale population dynamics off northern Norway. For at least 20 years, killer whales have been concentrating during October-January in northern Norwegian fjords, where their main prey – Norwegian spring spawning herring – has been overwintering. This has provided a unique opportunity to study killer whale behaviour and conduct long-term photo-identification work. The authors of SC/59/SM13 estimated the numbers and survival rates of identifiable animals in this population using photo-identification and mark-recapture techniques with data collected during 1986-1993 and 2002-2003. Population size was estimated using simple two-sample estimators on pairs of years and using closed capture models in program MARK within years. In the latter analyses, the best models were selected using AIC; how well the models fit the data was explored using Goodness of Fit tests in programs RELEASE and MARK. The highest annual estimate of the number of identifiable animals was obtained for 2003: 398 individuals (95% CI = 314-531). The proportion of identifiable individuals was estimated to be 0.556 (SE = 0.052) for 1992-1995 and 0.656 (SE = 0.041) for 2000-2003. Total population size for 2003 was estimated to be 606 individuals (95% CI = 460-800).

The sub-committee welcomed these preliminary results from the long-term study of killer whales in Norway. In response to a series of questions and suggestions from sub-committee members, Kuningas and Hammond stressed that the work presented in SC/59/SM13 was preliminary and that they planned to take into account a variety of recently developed methodological advances as they complete the work (e.g. incorporation of social structure into mark-recapture analyses as per Whitehead and Durban; use of robust designs; ways to account for differences in capture probability and estimation of proportions of identifiable individuals, etc.). Eventually it should be possible to do some modelling with these data in order to get an idea of population status. It was suggested that if these herring-eating killer whales were among those targeted by Norwegian whaling from 1938-81 (Øien 1988), that the population could have been much larger historically. The sub-committee encouraged completion of this valuable work and hoped the final results would be informed by the discussions at the present meeting.

SC/59/SM25 provided information of the status of killer whales around Spain using data from a 10-year research program. Two specific areas of regular occurrence were highlighted, one in the Gulf of Biscay and the other in the Strait of Gibraltar. Records of killer whales in the Gulf of Biscay, all in the south-eastern part, come mainly from reports by fishermen targeting bluefin tuna (Thunnus thynnus). In the Strait of Gibraltar, a population of 32 whales in three or four social groups is consistently present from March-October, and at least some individuals also have been recorded in the few surveys carried out in winter months. De Stephanis indicated that tuna fishing is carried out in many parts of the Gulf of Biscay and therefore he had no reason to believe that the apparent concentration of sightings in the south-eastern part was an artefact of sighting effort. Ridoux concurred, noting that there were fewer than ten records of killer whales stranding along the French coast over a period of 35 years and that no reports of sightings had been obtained from recent cetacean surveys conducted from 2003 to the present. The sub-committee encouraged continuation of this study, particularly concerning the killer whales in the Strait of Gibraltar.

5.2 Stock structure

North Pacific

Killer whales in the North Pacific have been assigned to putative populations based on their seasonal distribution (primarily summer) and foraging ecology, with three main ecotypes identified – residents (fish-eating), transients (marine mammal-eating) and offshores (prey type not known, but could include elasmobranchs). SC/59/SM6 presented the results of genetic analysis of seven putative populations in the North Pacific and one outgroup (40 samples from the south coast of Iceland). The North Pacific samples were from southern residents in Washington State waters, Southeast Alaskan residents, resident types from the Bering Sea/Aleutian Islands area, resident types from near the Kamchatka peninsula, 'offshores', transient types from Southeast Alaska and transient types from California.

Sixteen microsatellite loci and mtDNA sequence data for the complete mtDNA region were used in this study. These were analysed using the assignment method implemented in STRUCTURE as well as conventional F-statistics. A Mantel test was used to look for isolation by distance. Patterns of migration were investigated using methods assuming drift/migration equilibrium (private allele method, and the coalescent method implemented in MIGRATE) as well as a non-equilibrium assessment implemented in IM (isolation with migration). The latter method further enabled the assessment of effective population size, the time point at which putative populations began to diverge, and the ongoing rate of migration since then.

As reported previously, the authors of SC/59/SM6 found just four mtDNA haplotypes among the North Pacific sequences (six in total from 203 samples including the outgroup from Iceland), and these differed by 0.1% to 0.9% uncorrected difference. Whales within putative populations shared the same haplotype, and haplotypes also were shared between the Kamchatka and southern resident populations, between the Bering Sea and Alaskan resident populations, and between the Alaskan and Californian transients included in the study. All putative populations clustered as distinct groups using the assignment method implemented in STRUCTURE, except this method divided the Bering Sea sample between Kamchatka and Southeast Alaska resident population. F-statistics suggested significant differentiation between most pairwise comparisons, including between ecotypes in sympatry (e.g. Southeast Alaskan residents and transients). The Mantel test indicated a significant correlation between genetic and geographic distance within the resident ecotype. Measures of gene flow suggested similar, low rates among all putative populations, and the non-equilibrium assessment implemented in IM suggested ongoing gene flow among all putative populations, including between ecotypes. The effective sizes of resident populations were smaller than those of transient populations on average, and all division time-point estimates were more recent than the last glacial maximum.

The primary conclusions of SC/59/SM6 were as follows: Locally differentiated populations can be defined by both geographic distribution and ecotype.. Each of these populations shows a similar level of differentiation and should be considered separately for management and conservation measures. None of the data suggest the partitioning of populations into two groups defined by ecotypes, and instead suggest the need for multiple management units or stocks. MtDNA data are consistent with IM data suggesting the founding of regional populations along matrilines since the last glacial maximum.

Given the migration rates reported in SC/59/SM6 (relatively low numbers of migrants per generation), it was considered unlikely that exchange would be observed in demographic studies. The genetic data presented correspond well with, and thus can be viewed as reinforcing, the existing demographic/management unit designations. It was pointed out that much higher rates of gene flow are known to occur between populations of baleen whales yet they are treated as management stocks.

There was considerable discussion in the sub-committee of this paper, covering issues related to statistical analysis, models and software used. A question was raised regarding the consequences of relating the underlying assumption of IM that there are only two extant and one ancestral population in the model. These results should be interpreted cautiously until all populations can be incorporated into the analysis.

Nine carcasses were examined from a pod of 11-12 killer whales entrapped in sea ice off northern Japan in February 2005 (SC/59/SM 12). The nine examined whales consisted of one adult male, 5 adult females (3 of which were lactating) and 3 calves of which 2 were females. Based on mtDNA sequences, all the animals shared one mitochondrial sequence, which is clustered with the transient ecotype from the eastern North Pacific although the δ^{15} value given by stable isotope analyses placed them somewhere between the resident/offshore and transient ecotypes. Microsatellite analysis (7 loci) indicated that the adult male was not father of any of the other eight pod members sampled.

The sub-committee welcomed these new results and considered it likely that at least eight stocks occurred in the North Pacific, with more stocks likely to be determined.

Hoelzel summarised information on genetic studies of North Atlantic killer whales. His group has analysed 40 samples from Iceland (stranded and biopsied on the south coast – 10 from the south-eastern coast, all of which had one mtDNA haplotype; the rest from 100 km to the west near the island of Vestmannaeyjar, 80% of which had a second haplotype and 20% the same haplotype as the other 10 whales). Microsatellite data analysed using STRUCTURE showed just one population for the Iceland samples (see SC/59/SM6). Hoelzel cautioned against establishing populations on the basis of mtDNA alone for this species. Although some putative populations in the North Pacific apparently are defined by haplotype, others have multiple haplotypes, and some haplotypes are shared among distinct populations (e.g. including between samples from Iceland and New Zealand). Multiple haplotypes have been identified off Iceland, Norway and the UK, but analysis of nuclear DNA markers (such as microsatellites) will be required to define genetic stock structure among these samples. Hoelzel is collaborating with Lyrholm on a study of this kind. The sub-committee welcomed these results and encouraged more work on stock structure in this area.

Given the presence of at least three ecotypes in the Antarctic region, and the unresolved questions over the systematics of killer whales in this region, the sub-committee recommended that additional morphological and genetic studies be carried out in this region.

5.3 Life history

Pacific Ocean
Krahn presented SC/59/SM3 describing a non-lethal method for estimating ages of killer whales from measurements of specific fatty acids present in their outer blubber layer. Specific short-, branched-, and odd-chain fatty acids correlated moderately well with age for transient and resident killer whales of both sexes, but these single-parameter relationships were population-specific, moderately scattered and seemingly varied with long-term diet. In contrast, a simple multi-linear equation model derived from the combination of two specific fatty acid ratios enabled the ages of individual killer whales to be predicted with good precision ($\sigma = \pm 3.8$ years). This simple killer whale age/fatty acid ratio model appeared to be independent of individual diet and was therefore applicable to eastern North Pacific killer whale populations regardless of sex or ecotype. (In the absence of any known-age whales of the offshore ecotype, offshores were not included in the analysis). The authors were unable to offer a biological mechanism to explain the age/fatty acid ratio relationship. The model was applied to several less well-studied resident and transient killer whale populations to predict their age distributions from their blubber fatty acid compositions and these distributions were compared to a population of known age structure (i.e., West Coast Southern Residents). These results provide some evidence that adult male transient killer whales may have a lower life expectancy than their resident counterparts. Finally, the authors described the potential for extending this method to other cetacean species (e.g. humpback or bowhead whales), as well as for improving the precision of the age/fatty acid ratio model.

In discussion, Krahn suggested that the lower life expectancy of male transients might be explained by the fact that they are exposed to more risk of injury from interactions with large mammalian prey. Transients also carry much higher contaminant loads than residents and this may compromise their immune function and lead to earlier deaths from pathogens. In response to a question of whether male transients tend to be more solitary than male residents, and thus would have less chance of being biopsy-sampled, Wade noted that most transient groups are small (6 or fewer individuals) and the large adult male tends to be the first individual seen from a distance – sometimes from up to 5nmi away. In his view, even though fewer transients than residents are sampled, there should not be a bias against sampling adult male transients in a way that would affect the age distribution.

Krahn pointed out that Herman, the lead author of SC/59/SM3, was exploring the application of this technique not only to one or more baleen whale species, but also to the well-studied population of bottlenose dolphins in Sarasota Bay, Florida. He is also seeking to determine which part of the blubber gives the best signal. Based on work thus far, it appears that the portion nearest the skin is preferred, but limited access to fresh carcasses has meant that there are few opportunities to sample the deep blubber. Captive killer whales might offer opportunities to investigate turnover rates for different tissues and to carry out experimental studies of the mechanism underlying this new age-estimation method.

The sub-committee concluded that this paper has important implications for cetacean research and recommended that more effort be made to develop, test and, if appropriate, apply this non-lethal method in demographic studies to other cetacean species, including large whales.

Ages of the nine killer whales from northern Japan reported in SC/59/SM, estimated from GLGs in the dentine and cementum, ranged from 13 years (lactating female) to 59 years ('resting' female). The large male was estimated to be 34 years old. The calves had almost no dentine and were scored as zero age. Yamada noted that these animals possessed foetal folds and fringed tongues and that their dorsal fins and flukes were extended and that two of the three had milk in their stomachs. He guessed that they were all several months old. Corpora counts in the adult females increased linearly with age from 3-7 in whales 13-34 years old, which is generally consistent with what is known from elsewhere. The oldest female (59 years) had only eight corpora, suggesting that ovulation rate may decline with age.

In New Zealand the longest re-sighting period for a New Zealand female killer whale was 29 years (n = 27 re-sightings, 1977-2006) and this animal was still reproductively active at 40-42 years old (SC/59/SM19).

North Atlantic

In SC/59/SM13, survival was estimated for stage/sex-specific groups of killer whales in northern Norway – adult males, adult females, sub-adults, juveniles and calves – using Cormack-Jolly-Seber open recapture models in program MARK. Adult male and adult female survival were estimated as 0.958 (SE = 0.0096, 95% CI = 0.935-0.973) and 0.959 (SE = 0.0142, 95% CI = 0.929-0.980), respectively. Lowest survival was estimated for calves, 0.816 (SE = 0.167, 95% CI = 0.335-0.975). Calving intervals based on photo-identification data collected over a 14-year period (1989-2002) ranged from 3-14 years (mean = 5.93, SE = 3.087). So-called temporary emigration, when killer whales move relatively long distances inside and outside the fjords to keep track of their unpredictable prey source, can affect sighting probabilities and may introduce a downwards bias in estimates of some population parameters. The sub-committee welcomed these preliminary results from the long-term study of killer whales in Norway. It is the first time that demographic information has been available from outside the north-eastern Pacific. Although provisional, these life history parameters appear similar to those for north-eastern Pacific populations that have been studied over long timescales.

In general, little is known about the life history of killer whales and the sub-committee encourages the continuation, inter alia, of photo-identification programmes to obtain better demographic information from all regions.

5.4 Ecology

Information on feeding ecology has shown that killer whales forage on a wide variety of prey items throughout their range. Most information comes from direct observations of feeding activity, with less information from stranded or bycatch animals. More recently, information obtained from stable isotope analysis and fatty acid analysis has lead to an increase in our understanding of feeding strategies. Most of the information comes from the North East Pacific.

Pacific Ocean

SC/59/SM 12 reported on the stomach contents of all six adult killer whales off northern Japan that died as a result of ice entrapment, that had moderate to large quantities of material consisting mainly of seals (Phoca largha and Histriophoca fasciata) and squid. Claw counts were divided by 20 to estimate the minimum number of individual seals represented, with a maximum of 32 in the stomach of the adult male.

Resident-type killer whales off Kamchatka have been observed feeding on Atka mackerel (Pleurogrammus monopterygius), various salmon species (Oncorhynchus sp.) and cod (Gadus macrocephalus) (SC/59/SM4). There are also reports of killer whales hunting largha seals in the northern part of Avacha Gulf and northern fur seals on Medhny Island (SC/59/SM4).

Matkin summarised a recent paper on ecotypic variation and predatory behaviour of killer whales in the eastern Aleutian Islands, Alaska (Matkin *et al*. 2007). Killer whales were encountered 250 times during 421 days of surveys from 2001-2004. They were identified as transient, resident or offshore ecotype based on acoustic and genetic data. Residents were found 12 times more often than transients and offshores were encountered only once. Totals of photo-identified individuals were 165 mammal-eating transients and 901 residents. The transients were seen mainly in spring (May-June) when they were observed preying on gray whales (Eschrichtius robustus) migrating northward through Unimak Pass and later (late June to September) preying on northern fur seals (Callorhinus ursinus) west of Unimak Pass. In the three years of observations only one kill of a Steller sea lion (Eumetopias jubatus) was observed. Predation on minke whales (Balaenoptera acutorostrata) was seen more often than expected given the infrequency of minke sightings in the region. Killer whales were seen to harass a humpback whale (Megaptera novaeangliae) on one occasion but other humpbacks converged on the attackers and appeared to drive them away. Matkin noted that further observations since 2004 around Bogoslof Island, where there are rookeries of both fur seals and Steller sea lions, have confirmed that fur seals are taken much more often that sea lions. No observations have been made of predation on adult male fur seals.

From 1970 to 2006, West Coast Transient (WCT) killer whales in British Columbia and south-eastern Alaska were observed to make 208 kills of seven species of marine mammals (n=193) and five species of sea birds (n=15) (SC59/SM24). A kill was defined as an attack resulting in the death of an identified prey animal. All of the killer whales were individually photo-identified (n=184). The mammals killed were harbour seals (Phoca vitulina; 55% of the kills), harbour porpoises (Phocoena phocoena; 18%), Dall's porpoises (Phocoenoides dalli), Steller sea lions, California sea lions (Zalophus californianus), Pacific white-sided dolphins (Lagenorhynchus obliquidens) and common minke whales. No attempt was made to analyse the relationship between prey preference and prey availability in the area although it was suggested that sufficient survey data are available on marine mammal populations in the region to support such an analysis. In general, the more times an individual killer whale was observed making a successful kill, the greater was the cumulative number of different prey species that individual was known to have taken. This corroborated a similar trend found in an earlier study, which had included all predation data (kills and attacks), leading the author to conclude that most WCT killer whales are not prey specialists.

There was considerable discussion about the conclusiveness of the results in SC/59/SM24. It was suggested, for example, that some partitioning of foraging effort could occur without being detected in the observations and analysis. Also, individual whales might change their foraging behaviour with age, either broadening or narrowing their dietary emphasis. Little is known about foraging activity in winter and at night although tagging work has shown that killer whales do hunt seals at night as well as during the daytime. Straley acknowledged the difficulty of eliminating bias and stressed the provisional nature of the results presented. Matkin noted that in his experience, initial impressions of individual whales specialising on particular types of prey frequently fail to hold up over the long term. Killer whales appear to adapt to changes in prey availability and so he urged caution in jumping to conclusions on the generalist/specialist issue.

Nevertheless, results of stable isotope work in the Aleutians (by Peggy Krahn and colleagues) have been fairly consistent with what is inferred from observational studies.

It was noted that the killer whales that prey on pinnipeds along the beach at Punta Norte, Argentina, return year after year to the same place at the same time to prey on the same species, giving the impression that they are extremely specific in their predation behaviour and schedule. Visser noted that those same individuals prey on elephant seals and southern right whales (Eubalaena australis) at other times of the year. Straley noted that WCT killer whales from her study area travel as far as Hood Canal in Washington State where they continue to prey mainly on harbour seals for long periods.

Krahn summarised two recent papers (Herman *et al*. 2005; Krahn *et al*. 2007) that present information on chemical tracers that can be used to help establish trophic levels and point to areas where killer whales have been feeding. In this instance, fatty acid, stable isotope and organochlorine analyses of blubber biopsies represent a collaboration of laboratory chemists with field biologists because the results showed good concordance in assignment to the three recognised ecotypes of killer whales in the eastern North Pacific – residents, transients and offshores. The ecotype profiles exhibited broad similarity across geographical regions, suggesting that the dietary specialisation reported for resident and transient whales in the well-studied eastern North Pacific populations also extend to the less-studied whales in the western Gulf of Alaska and Aleutian Islands. Although the offshore population had blubber fatty acid profiles implicating fish as its primary prey, the contaminant and staple isotope results for these whales were equally congruent with predation on marine mammals.

Information on prey items of killer whales in the Gulf of California and along the Pacific coast of Mexico was summarised in SC/59/SM14. The database consisted of 274 records of observations from 1858-2006, 58 of which involved predatory interactions with other species including cetaceans, pinnipeds, sea turtles and fish. Based on observed feeding habits the authors inferred that killer whales in Mexican Pacific waters most likely are of the transient ecotype although no studies of morphology, acoustics or genetics have been carried out. Attacks on humpback whales in Banderas Bay were particularly noteworthy and Urbán-Ramirez indicated that these appear to have increased in frequency since the mid-1990s. Predation on elasmobranchs, turtles and a variety of fish species has also been documented (SC/59/SM 15)

Above-water and underwater observations of killer whale foraging in New Zealand (SC/59/SM19) have made it possible to identify 27 different prey species consisting of four main types: rays, sharks, fin-fish and cetaceans (pinnipeds have not been identified as killer whale prey in New Zealand). Based on observations of individual prey items caught, foraging appears to focus primarily on rays. On a single day one group of killer whales was observed to take 18 rays. Killer whales from Papua New Guinea waters have been observed feeding on four species of elasmobranchs and four species of fin-fish (SC/59/SM20).

Southern Ocean

SC/59/SM 8 reported foraging behaviour of killer whales in the Ross Sea. The Type C animals were observed exhaling under the ice, possibly to facilitate prey capture. Type B and C animals were observed harassing Adelie's penguins (Pygoscelis adeliae) (Ballard and Ainley 2005; Lauriano *et al*. 2007). In the Antarctic Peninsula, killer whales of both A and B ecotypes were observed harassing humpback and minke whales, but no confirmed incidences of predation were seen (SC/59/SM 20). Killer whales of both types were observed chasing and killing pinnipeds and Type B animals were observed killing gentoo penguins (Pygoscelis papua). Type B killer whales have been observed creating waves to wash pinnipeds off the ice (Smith *et al*., 2007).

Although killer whales occur widely in Australia, 59% of the records came from Macquarie Island where the whales have been observed to prey on elephant seals and penguins (SC/59/SM7). Along the southern and central coasts of mainland Australia killer whales have been seen preying on humpback whales, other large baleen whales, dugongs, dolphins, seals and pelagic fish (including caught fish on longlines).

Atlantic Ocean

Pitman *et al*. (2007) reviewed some of the morphological characteristics of north-eastern Atlantic killer whales based on whaling data and concluded: "It appears that in Norway there … is a smaller, fish-eating ecotype that frequents nearshore waters, and a larger, mammal-eating form that occurs offshore." Foote called attention to the strong influence of the herring migrations on the distribution of killer whales in the north-eastern Atlantic and he also noted that some groups of killer whales associate with mackerel fisheries to feed on discards. Foote speculated that animals feeding around mackerel vessels offshore in summer may be found preying on seals near the Shetlands at other seasons. With regard to the killer whales studied along the coast of Norway, it is likely that spring spawning herring stock are the main prey item at least for some of the year (SC/59/SM13). Kuningas explained that the herring are now wintering primarily in open waters outside the fjords. The spawning stock is currently estimated at 10 million tonnes and continues to increase (Toresen, 2007) and it is expected that by next winter most of the stock will be wintering in open waters. This may have implications for the autumn and winter distribution of killer whales in Norwegian fjords and coastal waters.

Rogan reported on a recent analysis carried out examining blubber contaminant levels (organochlorine compounds) and stable isotopes on a small number of killer whale samples from British and Irish waters (McHugh *et al*., in review). Elevated contaminant levels and enriched isotopic ratios were determined in one individual whale sampled in the Scottish Western Isles compared to the others suggesting marine mammal based dietary influences. These results are consistent with the hypothesis that at least two ecotypes exist in the North East Atlantic, one that feeds predominately on fish and a second on marine mammals.

De Stephanis reported that bluefin tuna are believed to be the principal prey of the small group of killer whales in the Strait of Gibraltar; they apparently catch tuna by using an endurance-exhaustion technique (Guinet *et al*., in press). During the summer months, they also interact with the long-line fishery for tuna that began in the Strait in 1995.

In the South Atlantic, a variety of prey items have been recorded, mostly from analysis of stomach contents, including bony fishes, stingrays, cetaceans, cephalopods and salps (SC/59/SM11). The available data are insufficient to speculate on whether killer whales in Brazilian waters exhibit any dietary specialisation. Both marine mammals and fish were recorded in the digestive tract of a stranded killer whale in southern Brazil (Dalla Rosa, 1995). This is consistent with reports from other areas of the Southern Hemisphere.

Dalla Rosa and Secchi (2007) evaluated depredation by killer whales on longline-caught tuna (Thunnus spp.) and swordfish (Xiphias gladius) in waters off southern and south-eastern Brazil and compared it to depredation by sharks. Data were obtained mainly from data sheets distributed to the captains of tuna vessels sailing from Santos, south-eastern Brazil, between 1993 and 1995. Data on the catch-per-unit-effort of tuna and swordfish and some records of interactions were obtained from fishing vessel logbooks. Dockside interviews with fishermen and with researchers who had been onboard tuna vessels provided additional information. Killer whale and shark interactions were analysed per longline set and per trip. Killer whale interactions occurred from June to February, mainly between June and October, while shark interactions occurred all the year round. The number of sets and trips involving shark interactions was significantly higher than the number of sets and trips involving killer whale interactions. However, when depredation occurred, the proportion of fish damaged by killer whales was significantly higher than that damaged by sharks. Furthermore, killer whales removed or damaged significantly more hooked swordfish than hooked tuna, whereas sharks damaged significantly more hooked tuna than swordfish.

Dalla Rosa commented that an ongoing project in Brazil to monitor cetacean interactions with the longline fishery includes onboard observers. Preliminary analyses suggest that only about 0.5% of the target fish species caught is lost to killer whale depredation and about 1% to shark depredation (Montero *et al*. 2006). It was noted that depredation rates can be difficult to interpret and compare since there is no standardisation of reporting units etc. Fishing effort in the longline fishery in Brazil varies seasonally within the study region and Dalla Rosa suspects that killer whale occurrence may not be seasonal in these offshore waters, which would mean that that they may simply be taking advantage of the facilitated foraging that is available seasonally due to the presence of the fishing operations.

5.5 Habitat

Habitat degradation or exclusion was viewed by Visser as the most important threat to killer whales around New Zealand (SC/59/SM 19). Their tendency to prey on rays brings them into estuaries and harbours, which puts them in direct conflict with certain kinds of development and the mariculture industry. Rays use structures in harbours as refuge from killer whales. There is an increasing number of proposals for marine turbines, including one that would place as many as 200 turbines in a narrow harbour entrance in 30 m of water. Killer whales already need to navigate large sand bars to enter and exit this harbour, and Visser anticipates that the presence of the turbines could make it almost impossible for the whales to carry on their normal foraging routine there. Concerns raised with the developers about the potential effects of electromagnetic fields on elasmobranchs led to a plan to sheathe and bury the cables in order to mitigate any such adverse effects.

Visser regards both marine renewable energy and increased marine tourism targeting killer whales as looming issues for killer whale conservation and management in New Zealand. Until recently, the PNG marine environment was under minimal stress from a small human population. Now, however, there are increasing signs of habitat degradation due to land-based activities and over-harvesting, particularly of sedentary marine resources (SC/59/SM 20)

5.6 Directed takes and incidental mortality

Live-captures for a dolphinarium in the Black Sea were attempted in the Russian Far East off Sakhalin Island and Kamchatka beginning in 2002 (SC/59/SM4). It is uncertain whether any whales were killed during capture efforts that year but in September 2003, a group of 32-37 resident-type whales was encircled by seine nets in Zhirovaya Bay, Avacha Gulf, eastern Kamchatka. At least one of two whales that became entangled in the netting died, and a third young female was transported to the Black Sea dolphinarium where she died after 3 weeks in captivity.

Burdin reported that an annual quota of 6-8 live-captured killer whales had been established by the Russian Federation over the last several years but he did not know the outcome of further capture attempts made in 2004, 2005 and 2006. No population assessment has been made to justify the removal quotas and therefore the sub-committee recommends that a scientifically valid assessment be conducted before further captures off Kamchatka are authorised. The implications of removals on the social behaviour of killer whales must be taken into account in any such assessment (Williams and Lusseau, 2006).

Depredation by killer whales on longlines in the Sea of Okhotsk is an increasingly serious problem. Burdin noted that fishing pressure in this sea is expanding rapidly and that many European as well as Asian countries are involved. There is concern about retaliatory efforts by fishermen, depletion of prey resources and the potential for incidental hooking or entanglement of the killer whales. Depredation is also reported from Brazil (Dalla Rosa and Secchi 2007) and although the impact of these interactions on the killer whales is uncertain, some cetacean by-catch is known to occur in the tuna and swordfish longline fishery in Brazilian waters.

As mentioned previously, during the summer months, killer whales in the Strait of Gibraltar also interact with the long-line fishery for tuna that began in the strait in 1995. Reportedly, two killer whales were killed in Morocco in 2004 and six more in September 2006, but this information has not been confirmed. It has been suggested that these mortalities may have been the result of fisheries interactions.

In discussion, Straley drew the sub-committee's attention to a recent workshop on cetacean interactions with longline fisheries hosted by the Vancouver Public Aquarium. Proceedings of the workshop are not yet available but are expected soon.

A neonate that live-stranded at San Blas, Nayarit, Mexico, in April 2007 (SC/59/SM15) may have been involved in a fishery interaction of some kind but this could not confirmed (or discounted) by photographs (Rojas-Bracho, pers. comm.). At the time of the meeting the calf was being rehabilitated at an oceanarium in Nuevo Vallarta.

Between 2000 and 2005, the annual reported take of killer whales in West Greenland ranged from 15 – 34 individuals (Anon., 2006). Further information is required on the population structure and abundance estimation of killer whales in this region.

5.7 Other

Bain *et al*. (submitted) studied the influence of whale watching vessels on southern resident killer whales off San Juan Island, Washington, from 2003 to 2005. The authors observed activity states of killer whale schools using scan sampling and collected information on the number of vessels present at various distances from the schools. Transitions between activity states were significantly affected by vessel traffic, indicating a reduction in time spent foraging as had been observed in Northern Resident killer whales in a previous study. The size of this vessel effect decreased as the distance between vessels and whales increased during interactions. There was no significant difference in the ways vessel interactions disrupted the behaviour of the three pods in this community. Each school was within 400m of a vessel most of the time during daylight hours from May through September. The high proportion of time spent by Southern Resident killer whales in proximity to vessels raises the possibility that the short-term changes in behaviour documented in this paper could have biologically significant consequences.

Rowles presented SC/59/SM18 on behalf of the authors. This was a retrospective global analysis of killer whale strandings with a focus on the North Pacific. Data were obtained on 222 stranded individuals from all continents except Africa and Antarctica, spanning the period 1944-2003. Most of the reports were from the North Pacific and especially Alaska and British Columbia. Fewer than 3% of the strandings were investigated with a complete post-mortem examination, and for more than 85% even the most basic gross necropsy was either not conducted or not reported. A crude analysis combining numbers of strandings reported from 1973-2003 and numbers of individuals 'known to have died' based on photo-identification data suggested carcass recover rates of 12% for southern residents and 3% for northern residents. Applying a 12% recovery rate to the annual global carcass reporting rate implied in SC/59/SM18 was interpreted by the authors as suggesting that at least 58 killer whales strand each year.

A recent case of a juvenile killer whale that died from laryngeal perforation by a halibut fishing hook was described in SC/59/DW10. To facilitate better use of opportunities to sample carcasses of stranded killer whales, the authors of SC/59/SM18 a standardised killer whale necropsy and disease testing protocol. This protocol can be downloaded free from [give website].

In discussion, it was pointed out that strandings in Mexico had not been included in the compilation of North Pacific records (but see SC/59/SM15). Straley suggested that, based on her experience using the protocol, a condensed version would be useful for situations where use of the full protocol is impractical.

Gallego called the sub-committee's attention to the recent deaths of several long-finned pilot whales in southern Spain with suspected morbillivirus infection. He cited disease as another potential threat to the Gibraltar population of killer whales.

Nematodes (all identified as Anisakis simplex) were found in the stomachs of the six adult killer whales stranded as part of a larger group, sampled off northern Japan (SC/59/SM 12). Some data on tissue concentrations of trace elements and organohalogen and organotin compounds were also provided in SC/59/SM12. It was noted that the body mass data accompanying the body length and other data in SC/59/SM12 were especially welcome.

Photographs in SC/59/SM1 showed killer whales off Taiwan with a missing dorsal fin and with numerous cut marks on the dorsal fin. This was interpretated as likely caused by contact with a boat propeller in one instance and some kind of fishery interaction in another. Kuningas reported that the number of marks on killer whales in Norway had increased a lot in Norway over the last few years, presumably because of the increasing number of interactions with fishing operations. This increased fishery interaction is a result of the resumption of the fishery of the recovered herring stock in the mid-1990s after 25 years of protection. A few individuals are observed with clear damage from propellers.

In general, mass strandings of killer whales (defined here as strandings of three or more animals) are quite rare. SC/59/SM22 described 22 mass-strandings of killer whales, augmented by four other records contributed during the meeting. Twelve of these events have occurred since 1984. A large proportion of these mass strandings occurred in New Zealand, where the foraging behaviour of killer whales in shallow water may be responsible, at least in part, for these events.

5.9 Consideration of Status

The sub-committee noted that the population structure of killer whales was complex and, except for a few areas of the North Pacific, very poorly understood. Furthermore, in many areas (such as most of the tropical oceans) there is very little information available on any aspect of killer whale biology. Such limitations hinder any assessment of the status of killer whales.

Several ecotypes of killer whales exist, sometimes in sympatry. These ecotypes vary in their patterns of social behaviour and foraging specialisations. Population structure exists within ecotypes, although the amount of gene flow between populations and ecotypes is poorly understood. Nevertheless, it is clear that some populations of killer whales are small, demographically closed and thus vulnerable to anthropogenic perturbation. Adverse human influences can impact these demographically independent populations in many ways, including direct removals, prey depletion, environmental contaminants, habitat degradation, disturbance and other factors.

Due to limitations of time and the absence from the meeting of a number of experts, the sub-committee was unable to fully review the status of all stocks of killer whales for which information exists. Nevertheless, the sub-committee drew attention to several stocks of killer whales for which there is clear reason for concern regarding status, including: (1) the southern resident killer whale population from the coasts of Washington State and British Columbia; (2) killer whales in Greenland; (3) killer whales found near the Strait of Gibraltar; and (4) killer whales of the Oyashio Current ecosystem.

The first of these is perhaps the best known; the small, demographically closed population of piscivorous southern residents that inhabit the inshore trans-boundary waters of Washington State and British Columbia. These killer whales have been studied continuously since 1974. As a result of long-term studies in both the U.S. and Canada there is an extraordinarily rich body of information on the abundance and demography of this population.

Between 48 and 58 animals were taken for public display from the southern resident population between 1962 and 1973. Since that time population size has fluctuated between 71 and 97 individuals. Southern resident killer whales feed primarily on Chinook salmon (Oncorhynchus tshawytscha) during the spring and summer months and on chum salmon (Oncorhynchus keta) during the fall. Current potential threats to the population include: declines in prey availability; high levels of environmental contaminants; disease; and then impacts of vessel traffic, particularly whale watching boats. Concerns regarding the status of this small population have led to its listing as endangered under the US Endangered Species Act and the Canadian Species at Risk Act.

Wade presented preliminary results of models that examined temporal variation in crude survival rates for the population as a whole and survival of the three component pods. In addition, covariates were used to examine the contribution of variation in prey availability, oceanography and vessel traffic to the observed variation in survival rates. Several methods were used to assess temporal variation in survival, including: constant survival over time; a single trend in survival over the 27-year period; different survival rates for each year; survival rates that remained constant for a period of four to seven years.

Crude survival rates for the entire population fluctuated throughout time in a roughly cyclical pattern that reflected changes in abundance. Periods of population decline were synchronous with periods of poor survival. All three pods exhibited cyclical variation in survival, although not necessarily in abundance. Models that include environmental covariates (particularly measures of prey abundance) consistently outperformed simple survival models. In particular, models that included measures of the at-sea abundance of Chinook salmon explained a high degree of variation in the survival of southern resident killer whales. None of the oceanographic indices performed well at predicting survival, but future research will re-assess the potential utility of these measures once appropriate time lags have been included. The number of commercial whale watching vessels in Haro Strait was not well correlated with temporal variation in survival and models including this covariate performed poorly. Wade concluded that the survival of southern resident killer whales has fluctuated dramatically through time and these fluctuations appear to be driven primarily by the abundance of their salmonid prey.

Wade speculated that declines in salmon abundance (many salmon runs within the range of southern residents are also listed endangered) may have made killer whales in this population more vulnerable and less resilient to normal variation in prey abundance. It is also possible that contaminants affect the health and survival of killer whales if individuals mobilise energy reserves (and contaminants) during periods of nutritional stress. Ross *et al*. (2000) suggest that levels of PCB concentrations in southern resident killer whales are high enough to cause immune suppression.

In discussion, Wade noted that there do not appear to be any lingering direct effects of the live capture removals in the recent demography of this population, although it is possible that there are effects mediated through the social behaviour of these long-lived animals. The sub-committee welcomed these preliminary results and encouraged Wade to complete this analysis.

The sub-committee also noted the takes of killer whales from West Greenland, including a recent take of 15 animals in 2005 (Anon., 2006). Further information is required on the population structure and abundance estimation of killer whales in this region. The sub-committee recommended that every effort should be made to obtain information and samples from killer whales hunted in Greenland.

The sub-committee drew attention to the status of killer whales near the Strait of Gibraltar, where approximately 30 animals feed on bluefin tuna (Thunnus thynnus). As noted in SC/59/SM25, these killer whales are threatened by depletion of their primary prey source, and from harassment and culling attempts by tuna fishermen in Morocco. Further information is required on the population structure of these killer whales, particularly to determine whether or not this is a demographically closed population. Nevertheless, there is reason for concern regarding the direct and indirect effects of fisheries activities on these animals. The sub-committee expressed concern about the status of the killer whales in the Strait of Gibraltar and urged that the relevant local and national agencies in Spain and Morocco cooperate to monitor their status and assess the need for conservation action. It further recommended that population structure be investigated on an urgent basis to determine this small group of whales' degree of isolation.

The sub-committee considered the potential effects of the past harvest of killer whales in the coastal waters of Japan, where more than 1,500 individuals were removed since 1948 (Ohsumi 1975). Removals of this number of killer whales would have caused major depletions and could have caused local or regional extirpation of killer whales in this ecosystem. Brownell drew the sub-committee's attention to the relatively low densities of killer whales in the Oyashio Current ecosystem, compared to the number in other productive, cold-water ecosystems, such as the Gulf of Alaska and California Current (Forney and Wade 2006). The sub-committee agreed that surveys and population assessments should be conducted to better understand the present status of killer whales in this region.

6. INFECTIOUS AND NON-INFECTIOUS DISEASES OF MARINE MAMMALS AND IMPACT ON CETACEANS

A pre-meeting workshop was held jointly with the Standing Working Group on Environmental Concerns on the topic of infectious and non-infectious diseases of marine mammals. Scientists from many disciplines presented information during the workshop, which covered topics such as epizootics, harmful algal blooms and parasitism and how these impacted on cetaceans. Much of the information currently available pertains to small cetaceans. It was agreed that an intersessional working group on Cetacean Emerging and Resurging Diseases (CERD) be established, co-chaired by Rowles and Van Bressem. The full report from the workshop, including the recommendations is presented as Appendix 2 of Annex K.

7. REVIEW UPDATES TO THE LIST OF RECOGNISED SPECIES OF CETACEANS

The sub-committee reviewed proposals to add two species of small cetaceans to the Scientific Committee's List of Recognised Species of Cetaceans (SC/59/O15).

Beasley *et al*. (2005) documented morphological and genetic discontinuities between the form of the Irrawaddy dolphin (Orcaella brevirostris) in the coastal waters of New Guinea and Australia and animals in the remainder of the species' range. The two forms differ significantly in several morphological features and are separated by 17 diagnostic sites in a 403 base-pair region of the mtDNA control region. This latter distinction is greater than the genetic distance between other pairs of recognised species, such as Stenella coeruleoalba and Delphinus delphis. Beasley *et al*. (2005) described the new Australasian form as the snubfin dolphin Orcaella heinsohni. The sub-committee endorsed this description and recommended that the Australian snubfin dolphin Orcaella heinsohni be added to the Scientific Committee's List of Recognised Species of Cetaceans.

The status of the nominal species in Sotalia has been debated for some time. In particular, there has been disagreement as to whether the marine and riverine forms are distinct at the species or sub-species level. In recent papers Monteiro-Filho *et al*. (2002), Cunha *et al*. (2005) and Caballero *et al*.

(2007) recommended separation of these two forms into discrete species: the riverine Sotalia fluviatilis and the coastal Sotalia guianensis. The two forms differ in morphological characters, and mtDNA and nuclear sequences. The sub-committee endorsed this classification and recommended that Sotalia guianensis be added to the Scientific Committee's List of Recognised Species of Cetaceans. The sub-committee further recommended that the common name not be assigned to this species until scientists in South America have reached a consensus.

8. Progress on previous recommendations

IWC Resolution 2001-13 (IWC, 2002, p.60) directs the Scientific Committee to review progress on previous recommendations relating to critically endangered stocks of small cetaceans on a regular basis.

8.1 Baiji

In recent years the sub-committee has expressed repeated concern over the dire conservation status of the baiji (Lipotes vexillifer). At this year's meeting Taylor reported the results of a recent survey (Turvey *et al*., submitted) that indicate that the baiji is likely extinct. This represents the first human-caused extinction of a cetacean species. A systematic visual and acoustic survey was conducted for baiji from Yichang to Shanghai between 6 November and 13 December 2006. Independent teams of expert observers worked aboard two survey vessels travelling at 15 km/hr and covered the in-channel distance from Yichang to Shanghai (1660 km) twice. Dongting and Poyang lakes were not covered because these lakes are regularly surveyed for finless porpoise and baiji have not been seen in the lakes since the 1970s. Survey participants concluded that the lack of any baiji sightings or acoustic recordings during this survey means that the species is now likely extinct. The sub-committee endorsed the methods used in this survey and agreed fully with the conclusions of the scientists who conducted the survey. The baiji is likely extinct.

The sub-committee noted that, despite extensive scientific discourse for more than two decades, little effort was made to implement any real conservation measures for this species. In hindsight, the extinction of this species is not surprising; species cannot be expected to save themselves. The extinction of this species also underscores the risk to other endangered species of small cetaceans and particularly to the vaquita (see below). Such highly endangered species require swift and decisive intervention before they are forever lost.

8.2 Vaquita

The sub-committee also reviewed the current status of the highly endangered vaquita (Phocoena sinus). In a recent paper Rojas-Bracho *et al*. (2006) provided a comprehensive review of the status of this species. The paper also reviews the recent (2005) establishment of a Vaquita Refuge in the northern Gulf of California by the Mexican Ministry of the Environment, an area that contains within its borders approximately 80% of all verified sightings of this species. In addition, the Government of Mexico established the Programme for the Protection of the Vaquita, also in 2005, in which $1 million is to be transferred to the state governments of Baja California and Sonora to support implementation. The authors of this paper conclude that the vaquita's survival does not depend on more science but on improved management and conservation efforts.

Taylor presented the results of a simple modelling exercise designed to estimate the likely current abundance of vaquitas and explore the time remaining until this species will reach a critically low level of abundance. The intent of this exercise was to underscore the immediate need to remove all entangling nets from the current range of the vaquita. This conservation measure has been recommended by CIRVA, the international recovery team for the vaquita convened by the Government of Mexico (Rojas-Bracho *et al*. 2006).

Data for this analysis came from two primary sources. D'Agrosa *et al*. (2000) monitored fishing activities and vaquita by-catch in three fishing villages in the Upper Gulf –Puerto Peñasco, San Felipe and El Golfo de Santa Clara from January 1993 to January 1995. A minimum of 39 vaquitas were killed per year in El Golfo de Santa Clara alone which, extrapolated to the Upper Gulf, yields 78 vaquita deaths annually. From a dedicated line transect survey conducted in 1997 Jaramillo *et al*. (1999) estimated that 567 CV = 0.51) vaquitas were present in the Upper Gulf at that time. There are no more recent estimates of the magnitude of either by-catch or abundance for the vaquita.

The likely rate of decline for the vaquita was estimated by assuming that the rate of animals killed in entangling nets has remained constant since the documentation of D'Agrosa *et al*. (2000) in the mid-1990s. The best estimate of the number of vaquitas killed divided by the best estimate of vaquita abundance in that same time period results in a removal rate of 13.8% per year (78/567). Assuming that the vaquita population is growing at its maximal rate of 4%/year (see Rojas-Bracho *et al*. 2006), the population is declining at an annual rate of 9.8%. Using this rate, and assuming no density depensation, the current population size of the vaquita is estimated as 213 animals. This exercise also suggests that the time remaining to a critical threshold, below which more extreme conservation actions would be necessary, is approximately 8 years.

Taylor also presented the results of analysis of the statistical power required to detect a 10% per annum decline. The precision of abundance estimates for this species is poor because of the small size of the animals, their inconspicuous surfacing behaviour, small group size (between 1 and 2 individuals) and their habit of avoiding boats. The results of this exercise indicate that future line-transect surveys will not be effective on any time-scale that might be useful for vaquita conservation. This reinforces the conclusions of Taylor and Gerrodette (1996), who estimated that by the time any decline in abundance could be detected, the vaquita could well be extinct. No new methodology has been developed since that paper was published to change this conclusion. In addition, the costs are high and would significantly reduce funds needed for direct conservation action.

The sub-committee concludes that the current number of vaquitas is likely in the low hundreds and that there is very little time remaining until the population becomes so small that it is vulnerable to depensation and ecological, genetic and demographic stochasticity. It is important to emphasise that conservation measures typically applied to other very small populations, such as captive breeding, are not a viable option for this species. The sub-committee further concludes that another survey cannot provide any information needed for the conservation of this critically endangered species. More science is not required to conserve this species. Instead, the sub-committee strongly recommended that resources be found to design and implement a comprehensive programme to eliminate entangling nets from the range of the vaquita through a buy-out programme or other system of compensation to affected fishing communities.

The extinction of the baiji serves as an urgent warning regarding the vulnerability of extremely small populations of cetaceans. The baiji was the first cetacean species driven to extinction by humans in modern times. If we do not act quickly and decisively, the vaquita, which was just described fifty years ago, will soon join the baiji.

8.3 Harbour Porpoise

SC/59/SM26 described a framework for estimating the growth rate of harbour porpoise populations (Phocoena phocoena) in the North Sea and European Atlantic using a population model. The model was simultaneously fit to data on abundance, life history (age at sexual maturity, pregnancy rate and mortality age structure) and by-catch rate (per unit fishing effort) with data on total fishing effort as input. The model fitting was accomplished in a Bayesian statistical framework, allowing explicit consideration of uncertainty. The performance of the framework was illustrated using data on harbour porpoise from the United Kingdom. The population model provided a useful method for assessing the consistency of information from different datasets. The framework will be further developed to consider population structure of harbour porpoises in the North Sea and data on by-catch and life history from other countries in the region.

Read briefly summarised SC/59/BC6, which presented a Bayesian approach for estimating demographic rates and impacts of by-catch on the population of harbour porpoises in the Gulf of Maine and Bay of Fundy. The approach combines mortality risk functions to estimate parameters that describe rates of both natural and by-catch mortality throughout life. The approach allows estimation of potential population growth rate and the rate realised under by-catch mortality. Furthermore, the approach takes into account multiple sources of uncertainty in data and process, and provides posterior distributions for a rich set of demographic rate parameters that are unknown for most cetaceans. Further refinement of the model is planned in the near future.

SC/59/SM2 presented the results of a trial using acoustic alarms (pingers) conducted in the Danish North Sea hake gill net fishery in July-September 2006. The goal of the trial was to determine whether the spacing of the Aquatec AQUAmark 100 pinger could be increased without reducing its effectiveness in reducing harbour porpoise by-catch. The trial was designed as a controlled experiment with complete observer coverage, where nets without pingers formed the control group and nets with pingers spaced at 455 m and 585 m, respectively, formed the two experimental groups. Control nets without pingers had a by-catch rate of 0.54, nets with pingers spaced at 455 m had a by-catch rate of 0.00 and nets with pingers spaced at 585 m had a by-catch rate of 0.12. The by-catch rates for the two experimental groups were both significantly different from that of the control group ($p < 0.0001$; 1 d.f.; $\alpha = 0.95$). The results of this experiment showed that pinger spacing can be increased considerably in this fishery, relative to current guidelines and regulation, without any loss of efficacy. The paper discussed factors influencing the general applicability of these results and recommended that further trials of pinger spacing be conducted in other gill net fisheries and with other pingers. Larsen noted that Denmark has now introduced a two-year trial period in which pingers may be spaced at distances greater than that required by EU Council Regulation 812/2004. Read noted that it would be useful to map the sound field produced by these pingers in situ and Larsen replied that some work had been undertaken in this regard and that more research was planned. The sub-committee welcomed the results of this experiment and looked forward to receiving updates of future work in this area.

SC/59/SM28 presented the results of a trial conducted to determine the efficacy of a new type of pinger in reducing harbour porpoise by-catch. It has been hypothesised that alerting sounds might stimulate porpoises to echolocate, which would enhance detection of the net. This concept was tested by deploying custom made alarms, called PAS (Porpoise Alerting Sound) pingers, in the Danish hake gill net fishery during July-August 2006. Alerting sounds were artificial porpoise-like click trains that simulated the clicks porpoises use when investigating targets. The PAS pingers produced a series of 110 kHz clicks, with a source level of 125-138 dB p-p re 1µPa @ 1 m, at 50-2500 clicks per second. Conventional gill nets were used with a mesh size of 130 mm, twine size of 0.57mm, 40.5 meshes high, an 8-mm head rope equipped with 100-mm elliptical floats, and a total length of 2000 knots. Half of the nets were equipped with PAS pingers and the other half with dummy (silent) pingers, all attached at intervals of 180 m. Observers collected data on fishing activity, fish catches and porpoise by-catch. There was a by-catch of 17 porpoises in the PAS nets and 15 in control nets. There was no significant difference in by-catch rates between the experimental and control nets ($p = 0.06$; 1 d.f.). These results indicate that the alerting sounds emitted by the PAS pingers do not reduce the by-catch of harbour porpoises.

Members of the sub-committee asked whether an artificial click train with a different center frequency (e.g. 140 kHz vs. 110 kHz) might produce a different result. Larsen replied that the signal used in the PAS pinger has been shown to stimulate echolocation in trials with captive porpoises. There were also questions regarding the use of this type of pingers with acoustically reflective gill nets. Larsen noted that detection of nets may not be a problem for free-swimming porpoises that should be able to detect nets at a range of 3 -5m and perhaps at much greater distances. The sub-committee welcomed this work and noted that the causes of entanglement of harbour porpoises (and other small odontocetes) are still poorly understood.

The sub-committee also received a report of the first photographed observation of a harbour porpoise in Svalbard, Norway (Joergensen 2007). This sighting (and one made in the same area in 2004) is approximately 1000 km north of the typical distributional limit of the species in Norway.

At its meeting in 2003, the sub-committee highlighted the endangered status of the population of Baltic harbour porpoises, especially in the 'Baltic proper' and the urgent need for immediate actions to prevent further anthropogenic mortality in this region. In addition, the sub-committee reiterated its strong endorsement of the measures outlined in the ASCOBANS recovery plan for porpoises in the Baltic (the 'Jastarnia Plan'). Since then, the sub-committee has reviewed the results of a 2002 aerial survey that produced two sightings of single porpoises, yielding an estimate of 93 groups (95% CI=10-460 groups) (SC/56/SM7), together with the results of aerial surveys in the German portion of the western Baltic in 2003 - 2006 that produced abundance estimates of 0 - 4,793 (SC/58/SM19). At the present meeting, some new information was presented from the Baltic. SC/59/ProgRep Germany referred to the deployment of porpoise detectors in the German sector from Kiel Bight to the Pomeranian Bay in 2006 (ongoing since 2003 fide Dinter) as part of the implementation of the Jastarnia Plan. SC/59/ProgRep Sweden reported that detectors were also deployed along the Swedish Baltic coast, with expected future expansion to Finland. The sub-committee was informed about an European Union Regulation on Fisheries (EU Regulation 812/2004) requiring the use of pingers on gill nets set by vessels 12m and longer and a ban on drift nets that will be effective in 2008. The sub-committee welcomed this new information and requested that it be informed at its next annual meeting of any other progress made towards implementation of the EU Regulation 812/2004 and the Jastarnia Plan, especially in regard to animals in the Baltic proper. The sub-committee also requested that ASCOBANS provides a written report describing what has (and has not) been accomplished in terms of plan implementation.

8.4 Sotalia

SM/59/29 reviewed the status of Sotalia guianensis in Venezuela. Throughout its range the main threats to this species are by-catch and habitat degradation. This is also true in Venezuela, where populations may be impacted by petroleum extraction activities, shipping traffic and fisheries by-catch. By-caught animals in Venezuela may be subject to some level of consumptive use. Recent efforts have focused on designing and implementing a plan to evaluate the status of this and other cetaceans in the Maracaibo system, including examination of the causes of stranding events (including by-catch).

The sub-committee welcomed this news and encouraged further research assessing the level and impact of by-catch of this species, in particular in the Maracaibo system and Orinoco river.

8.5 Other

Reeves informed the sub-committee of catches of small cetaceans in Greenland. As reported in IWC/59/4 Appendix E, the NAMMCO Scientific Committee met in November 2006 and reviewed recent research, together with catches and management of narwhals and belugas in Greenland. Aerial surveys and studies of stock structure are underway for both species in Greenland. The NAMMCO Scientific Committee expressed concern about the narwhal quotas set for West Greenland (260 animals in 2006/7) and Melville Bay (115 animals in 2006/7). The West Greenland quota exceeds the recommended level of 135 and the quota for Melville Bay 'might not be sustainable.' Beluga quotas have been reduced since their introduction in 2004 (140 animals for West Greenland and 20 for Qaanaaq in 2006/7), but the NAMMCO Scientific Committee 'remained concerned that the total removals for West Greenland were still above the recommended level of 100.' Noting this, the sub-committee reiterated is earlier recommendations that stocks of narwhals and belugas in West Greenland should remain the focus of major conservation concerns.

Reeves also provided information on the magnitude of harvests of other small cetaceans in Greenland for which no quotas exist. In 2005, the Greenland hunting statistics (Anon, 2006) reported harvests of 2,568 harbour porpoises, 15 killer whales (noted above) and 291 long-finned pilot whales (Globicephala melas). The sub-committee expressed concern regarding these harvests, particularly of the large numbers of harbour porpoises reportedly taken, as no assessment has been made of their sustainability, and recommended that formal assessments be made of these stocks.

The sub-committee received information from da Silva (INPA, Manaus, Brazil) on the large and growing illegal catch of botos (Inia geoffrensis) for use as bait in the central Brazilian Amazon (IWC, 2007, p. 317). Botos are captured by harpoon after tributaries or small lakes are blocked by nets. Some individuals are kept alive after capture, and live botos have been observed with both harpoon wounds and line around their peduncle, presumably after escaping. This illegal killing continues at levels that are very likely to be unsustainable. The effects of the hunt are shown by declining densities of botos in standardised visual surveys and the disappearance of marked individuals from the population. Martin and other sub-committee members noted that this practice likely originated elsewhere in the Amazon Basin (e.g. Columbia) and may continue in these areas today. There are no current attempts by local or national authorities to stem this illegal hunt and, as a result, it is likely to continue until either the boto or the target fish species are driven to such low levels that the fishery is no longer economically sustainable. The sub-committee expressed great concern regarding these illegal takes and recommended that the Government of Brazil make every effort to determine the number of individuals killed and the geographic extent of the hunt, and conduct an assessment of the impact of these removals on the dolphin population.

Wade, Bass, and Kasuya returned attention of the sub-committee to the hand-harpoon hunt for Dall's porpoise populations in the western North Pacific near Japan that targets a population of truei-type porpoise as well as a population of dalli-type porpoise found in the Sea of Japan and the southern Okhotsk Sea. The sub-committee has previously expressed concern for the status of these populations, for example, in IWC (1992), IWC (1993), and most recently in IWC (2002). Wade noted one development, referring to a summary of information about the hunt available on the website of the National Research Institute of Far Seas Fisheries (Iwasaki 2006, http://kokushi.job.affrc.go.jp), where it is stated that "in order to promote further rational and scientific resource management, it is sought to build a resource control model considering the species' ecology and the amount of the resources, and that if conditions are set carefully, it may be possible to apply the idea of PBR from Wade (1998)". The sub-committee encouraged the consideration of alternative methods to evaluate catch levels of these Dall's porpoise stocks. Therefore, Wade briefly reviewed alternative methods used for scientific evaluation of levels of catches of marine mammals, especially of small cetaceans, including methods of the sub-committee (IWC 2002), ASCOBANS (2000, 2006), PBR (Wade 1998), and the New Zealand MALFIRM (Gales 1995). He applied them for comparison to the populations of Dall's porpoise targeted in the hunts. For the southern Okhotsk Sea population (dalli-type), the alternative thresholds range from 596 to 4,520. For the truei-type population, the alternative thresholds range from 539 to 4,340. The subcommittee noted that catch levels remain high –for 2001-2005 it averaged 7,169 for dalli-type porpoise and 8,226 for truei-type porpoise (http://kokushi.job.affrc.go.jp). Wade noted this catch level was above the lowest alternative threshold by nearly a factor of 2, and was higher than some of the other alternative thresholds by a factor of 4 or more. He also noted that if the maximum annual population growth rate of Dall's porpoise is truly 4%, under the assumptions of a density-dependent model it should be understood that a catch of 4% will cause the population to decline to levels approaching zero, and will prevent future recovery.

The sub-committee reiterated its extreme concern for these stocks and repeated its previous recommendation that catches be reduced as soon as possible to sustainable levels. Given that the existing abundance estimates for these stocks are now 17 years old, the sub-committee strongly recommended that new abundance estimates be generated for Dall's porpoise stocks in the region and encouraged adjacent member states to facilitate such a survey. Such estimates should address potential biases from vessel avoidance or vessel attraction. The subcommittee repeated its recommendation for research on quantification of by-catches, investigation into the accuracy of estimates of catch, and research into population structure of Dall's porpoise in the Okhotsk Sea, further details of which can be found in IWC (2002). Finally, the sub-committee noted that a full assessment of the status of these stocks, as recommended in 2002, has not been undertaken, and the subcommittee repeated its recommendation that a full assessment of the status of each population be conducted as soon as possible.

9. TAKES OF SMALL CETACEANS

The sub-committee reviewed a table of incidental captures of small cetaceans (Appendix 1) and thanked the Secretariat for compiling these records. The sub-committee welcomed the information submitted by some member countries and encouraged others to contribute these data.

Several members of the sub-committee noted that live captures were planned in several parts of the world (e.g. Panama, Turkey and the Solomon Islands) for a variety of small cetaceans (killer whales, bottlenose dolphins, etc.) for display purposes. The sub-committee reiterated its long-standing recommendation that no removals (live capture or directed harvest) should be authorised until a full and complete assessment had been made of their sustainability.

10. OTHER

SC/59/BC3 compiled and reviewed existing information on the interactions between cetaceans and fishing operations in the Archipelago of the Azores. Information presented included unpublished data collected by two fisheries observer programmes as well as data collected opportunistically during short-term research projects. In addition, the paper included a brief synopsis of these fisheries and a presentation of past or ongoing monitoring projects. Over a nine-year period, the tuna fishing observer programme reported 57 dolphins incidentally hooked on the fishing line; all were released alive. Between 1998 and 2000, annual estimates of incidental capture of dolphins for the whole tuna fleet were <50 individuals. Capture rates declined in the following years. There was only one record of cetacean mortality associated with other fishing operations. Cetacean interference occurred in up to 15% and 2% of the observed sets for demersal and swordfish fisheries, respectively. The cost of this interference is difficult to assess but detectable losses occurred in only a small fraction of these cases. Overall, results suggested a low level of interaction between cetaceans and fisheries in the Azores and that the economic impact of cetacean interference was probably small. However, observer coverage of some fisheries was low and degree of interaction may be underestimated. The authors recommended that existing observer programmes be expanded to increase observer coverage of some fisheries and allow monitoring of other fisheries.

The sub-committee noted two papers that reported on by-catch mitigation research in the Mediterranean (SC/59/BC 8 and 10). Both papers were preliminary in nature and the sub-committee looked forward to receiving full reports of this research at next year's meeting. SC/59/SM16 summarised pathology in the skeletons of Peale's dolphins (Lagenorhynchus australis) from southern South America. The sub-committee welcomed this paper, but did not have time to review it in detail.

11. WORK PLAN

The sub-committee reviewed its schedule of priority topics. Those currently held by the sub-committee (IWC, 2007, p. 317) are as follows:

Systematics and population structure of Tursiops

Status of ziphiids in the Southern Ocean

Status of common dolphin (Delphinus spp.)

Status of small cetaceans of the eastern tropical Atlantic

Given that next year's meeting will be held in Santiago, Chile, the sub-committee agreed to adopt a review of conservation issues regarding small cetaceans in the south-eastern Pacific. The sub-committee also agreed to add another item to its list of future priority topics: fishery depredation by small cetaceans.

12. ADOPTION OF REPORT

The report was adopted at 12:39 on May 14th, 2007. On behalf of the sub-committee, Rogan thanked the invited participants for their contribution to the global review of status of killer whales and the rapporteurs for their assistance with the report.

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Table 1. Global overview of killer whale distribution and density. Adapted from Forney and Wade (2006) with information presented at this meeting added.

Region	Source of abundance information	Data Type	Years	Area size (km^2)	Effort (km)	No. Si	No. Ani	Si / 1000 km	Abund. Estimate	CV	Density (Animals per 100 km^2)	Catalog or Minimum count
ATLANTIC OCEAN AND ADJACENT SEAS												
Norwegian Sea	Øien 1990	LTR	1988	477,727	5,742	7	67	1.22	3,100	0.63	0.65	
Northern Norway - coastal	Similä *et al*. 1996	CAT	1990-1993	*67,000*								408
	SC/59/SM/13	CAT	1986-93 + 2002-2003						614		0.61	
Iceland & Faroe Islands	Gunnlaugsson and Sigurjónsson 1990; Sigurjónsson *et al*. 1989	LTR	1987	2,281,630	21,827	25	199	1.15	6,618	0.32	0.29	
NW Scotland	MacLeod *et al*. 2003	LTR	1998	104,000	2,157	0	0	0.00	0		0.00	
North Sea/West of Great Britain	Stone 1997	SURV	1996		7100 hrs	17	120					
North East Atlantic	SC/59/SM5	LTR	1987	2,285,353	26,545	21	88	0.79	8,260	0.45	0.36	
		LTR	1989	3,011,133	17,226	23	89	1.34	26,774	0.63	0.89	
		LTR	1995	2,428,812	12,648	5	33	0.40	4,413	1.21	0.18	
		LTR	2001	2,728,383	15,891	42	44	2.64	15,014	0.42	0.55	
Newfoundland/Labrador	Lien *et al* 1988	SURV	1979-1986		85,273	58		0.68				
Southeastern U.S. shelf/slope	Garrison *et al*. 2003	LTR	2002	263,564	3,744	0	0	0.00	0		0.00	
Western North Atlantic (SE U.S.)	Mullin and Fulling 2003	LTR	1998	573,000	4,163	0	0	0.00	0		0.00	
Gulf of Mexico (Oceanic Northern Gulf)	Derived from Mullin and Hoggard 2000	LTR	1991-1997	398,960					246	0.39	0.06	
Gulf of Mexico (Oceanic Northern Gulf)	Mullin and Fulling 2004	LTR	1996-2001	380,432	12,162	5	12	0.41	133	0.49	0.03	
Gulf of Mexico (GulfCet I area)	Derived from Mullin and Hoggard 2000	LTR	1991-1997	154,621					92	0.48	0.06	
Gulf of Mexico (aerial surveys)	Mullin and Hoggard 2000	LTR	1996-1998	82,796	4,101	0	0	0.00	0		0.00	
Gulf of Mexico (shelf waters)	Fulling *et al*. 2003	LTR	1998-2001	245,800	2,196	0	0	0.00	0		0.00	
Northern Spain	López *et al*. 2004	SURV	1998-1999	9,842	8,128	0	0	0.00	0		0.00	
Spain (Gibraltar area)	SC/59/SM25	CAT	1999-2006									32
Spain (Biscay area)	SC/59/SM25											
Mediterranean	Notarbartolo-di-Sciara 1987	OBS	1985									
Brazil	SC/59/SM11	OBS				118						
Southern Brazil	Pinedo *et al*. 2002	SURV			3,324	5	15	1.50				
Patagonia, Argentina	López and López 1985, Iñíguez 2001	CAT	1985-1997	*20,002*		408						30
SOUTHERN OCEAN												
Area II	Hammond 1984	LTR	1981-1982	1,830,660	11,810	13	301	1.10	12,367	0.69	0.68	
Area III	Hammond 1984	LTR	1979-1980	1,795,778	12,812	22	1,608	1.72	38,278	0.63	2.13	
Area IV	Hammond 1984	LTR	1978-1979	1,431,045	12,792	24	946	1.88	16,399	0.55	1.15	
Area V	Hammond 1984	LTR	1980-1981	1,868,464	10,014	24	6,014	2.40	136,500	0.69	7.31	
S of 60°S	Branch and Butterworth 2001	LTR	1978-1983	9,935,989	65,979	117	2,002	1.77	91,310	0.34	0.92	
S of 60°S	Branch and Butterworth 2001	LTR	1985-1990	11,655,723	67,550	114	817	1.69	27,168	0.26	0.23	

Region	Source of abundance information	Data Type	Years	Area size (km^2)	Effort (km)	No. Si	No. Ani	Si / 1000 km	Abund. Estimate	CV	Density (Animals per 100 km^2)	Catalog or Minimum count
S of 60°S	Branch and Butterworth 2001	LTR	1991-1997	10,922,924	52,334	68	836	1.30	24,790	0.23	0.23	
Southern Ocean	Kasamatsu & Joyce 1995	LTR	1976-1988	28,765,576	130,036	129	1,135	0.99	80,400	0.15	0.28	
Terra Nova Bay, Ross Sea	SC/59/SM8	SURV	Jan-Feb 2004	400	5,342	39		0.008			0.069	5
Antarctic Peninsula	SC/59/SM10	SURV	1997-2006			70					0.13 / NM	73
Antarctica	SC/59/SM21	OBS	1981-2007			108						87
Marion Island, Southern Ocean	Keith *et al*. 2001, Pistorius *et al*. 2002	OBS	1973-2000		5m							25-30
					PACIFIC OCEAN AND ADJACENT ARCTIC WATERS							
Central Bering Sea	derived from Waite *et al*. 2002	LTR	1999	196,885	1,761	2	10	1.14	121		0.06	
SE Bering Sea	Waite *et al*. 2002	LTR	2000	158,561	2,194	11	50	5.01	391	0.43	0.25	
Aleutian Islands	Forney (unpublished data)	LTR	1994	634,042	2,780	14	75	5.04	2,594	0.44	0.41	
Aleutian Islands, west of Unimak	Zerbini *et al*. 2006	LTR	2001-2003	109,933	3,560	16	113	4.49	584	0.51	0.54	
Gulf of Alaska, east of Unimak	Zerbini *et al*. 2006	LTR	2001-2003	107,680	5,494	14	192	2.55	655	0.54	0.61	
G of AK *transients*	Matkin *et al*. 1999	CAT		*214,307*					32		0.01	32
Western AK (excluding Kodiak)	Dahlheim 1997; Waite, pers. comm..	CAT		*94,998*					180		0.19	180
BC/Washington *residents*, summer	Ford *et al*. 2000; Carretta *et al*. 2002	CAT	1970-2003	129,889					295		0.23	295
Alaska Southeast to Kodiak *residents*	Matkin *et al* 1999; Dahlheim, pers. comm.., Angliss & Lodge 2002	CAT		150,515					440		0.29	440
U.S. West coast *transients*	Matkin *et al* 1999; Matkin, pers. comm.., Angliss & Lodge 2002	CAT		400,904					344		0.09	344
Oregon/Washington	Barlow 2003	LTR	1996-2001	325,018	7,482	7	52	0.94	898	0.35	0.28	
California	Barlow 2003	LTR	1991-2001	817,549	33,327	11	64	0.33	511	0.35	0.06	
California (aerial surveys)	Forney *et al*. 1995	LTR	1991-1992	264,270	13,042	2	2	0.15	65	0.69	0.02	
Mexico (Gulf of California)	Guerrero-Ruiz *et al*. 1998	CAT	1972-1997	*210,000*		156	843				0.04	86
Gulf of California	SC/59/SM15	CAT	1972-2006			243	1365					236
Eastern Tropical Pacific	Wade and Gerrodette 1993	LTR	1986-1990	19,148,000	135,300	57	308	0.42	8,500	0.37	0.04	
	SC/59/SM27	SURV	1977-2006									162
Mexico (Gulf of California)	Gerrodette and Palacios 1996	LTR	1986-1993	262,125	4,377	3	13	0.12	146		0.06	
Mexico (Pacific Coast EEZ)	Gerrodette and Palacios 1996	LTR	1986-1993	2,054,192	25,356	15	56	0.59	852		0.04	
Central America EEZ	Gerrodette and Palacios 1996	LTR	1986-1993	323,013	5,251	3	12	0.57	143		0.04	
Costa Rica EEZ	Gerrodette and Palacios 1996	LTR	1986-1993	475,737	8,465	4	14	0.47	153		0.03	
Panama EEZ	Gerrodette and Palacios 1996	LTR	1986-1993	188,045	3,692	1	1	0.27	10		0.01	
Columbia EEZ	Gerrodette and Palacios 1996	LTR	1986-1993	329,492	5,856	1	6	0.17	64		0.02	
Ecuador EEZ	Gerrodette and Palacios 1996	LTR	1986-1993	229,863	1,164	1	2	0.86	75		0.03	
Galapagos	Merlen 1999	OBS	1948-1997									
Eastern Temperate Pacific	NMFS, 1997 Sperm Whale Abundance and Population Structure Cruise, unpublished	LTR	1997	7,786,000	8,100	4	31	0.49				

Region	Source of abundance information	Data Type	Years	Area size (km²)	Effort (km)	No. Si	No. Ani	Si / 1000 km	Abund. Estimate	CV	Density (Animals per 100 km²)	Catalog or Minimum count
Hawaii	Barlow 2006	LTR	2002	2,452,916	17,050	2	13	0.12	349	0.98	0.01	
Sea of Okhotsk	Berzin and Vladimirov 1989	OBS	1979-1984									
Kamchatka and Commander Islands	Miranova *et al*. 2002	OBS	1992-200			274	1,619					700-800
Russian Far East,	SC/59/SM4 Burdin *et al* 2006	CAT	1996-2006		13,000, 213 days	188	789					450
Sakhalin Island Area, Russian Far East	SC/59/SM4	OBS			5 years	9						
	Razlivalov (2004) in SM4	OBS	2003		2 months	13	70					
Chukotka	SC/59/SM4	OBS	2005			1	68					
	Grachev *et al* (2002) in SM4	OBS	1983-2001				45-50					
	Melnikov & Zagrebin (2005) in SM4	OBS	1990-2000				788					
Sea of Okhotsk	SC/59/SM4	SURV	2003								3.47 /100 NM	
	Valdimirov *et al* (2004) in SM4	SURV	1998-1999								1.87 /100 NM	
Primorsky Krai	SC/59/SM4	OBS	2006		1 week	1						
Japan (aerial Surveys)	Kasuya 1971	SURV	1959-1970		318,190	26	151	0.08				
Western North Pacific	Miyashita *et al*. 1996	SURV	1993-1995		20,179	7	31	0.35				
Taiwan	SC/59/SM1	OBS	1996-2005			20						
Marquesas Islands/French Polynesia	Laran & Gannier 2001	SURV	1998-2000		4,896	1	-	0.20	0		0.00	
Society Islands/French Polynesia	Gannier 2000	SURV	1996-1999		6,452	0	-	0.00	0		0.00	
New Zealand	Visser 2000	CAT	1992-1997			3,269			119	0.20		115
	SC/59/SM19		1998-2006									132
Solomon Islands	Shimada & Pastene 1995	SURV	1993		3,704	1	5	0.27				
Pacific Islands Countries and Territories	SC/59/SM WP2	OBS										
Papua New Guinea	Visser & Bonaccorso (2003)	OBS +				94	14					14
	SC/59/SM20	CAT				8						
Eastern South Pacific (Chile to Easter Is)	Aguayo *et al*. 1998	OBS	1993-1995		*581 hrs*	3	8					
				INDIAN OCEAN AND ADJACENT SEAS								
Indian Ocean	Eyre 1995	SURV	1993		23,030	1	2	0.04				
Maldives	Ballance *et al*. 2001	SURV	1998		1,700	0	-	0.00	0		0.00	
South Australia	Ling 1991	OBS	1982-1990			26						
Australia	SC/59/SM7	OBS				933						
Komodos Island, Indonesia	Kahn and Pet 2003	SURV	1999-2001		8,716	2	-	0.23				
Crozet Archipelago	Poncelet *et al*. 2002	M-R	1977-2000									43-93
	SC/59/SM23	CAT	1987-2006									195

Appendix 1

AGENDA

1 Convenor's opening remarks
2 Election of Chair and appointment of rapporteurs
3 Adoption of Agenda
4 Review of available documents
5 Population structure, systematics and status of killer whales
  5.1 Distribution
  5.2 Abundance
  5.3 Stock structure
  5.4 Life history
  5.5 Ecology
  5.6 Habitat use
  5.7 Directed takes and incidental mortality
  5.8 Other consideration of status
6 Infectious and non-infectious diseases of marine mammals and impact on cetaceans (joint session (part) with E)
7 Review updates to list of recognised species of cetaceans
8 Review of previous recommendations
  8.1 baiji
  8.2 vaquita
  8.3 harbour porpoise
  8.4 tucuxi
  8.5 other
9 Takes of small cetaceans
10 Other
11 Work plan
12 Adoption of report

Appendix 2

SMALL CETACEAN CATCHES

DIRECT CATCHES OF SMALL CETACEANS FOR THE CALENDAR YEAR 2005

Data provided by Kathy Frost, ABWC (Alaska Beluga Whale Committee)

Species	Type of catch	Area/stock	Males	Females	Total landed	Struck and lost
White whale	Aboriginal	Beaufort Sea	-	-	20	-
White whale	Aboriginal	Chukchi Sea	-	-	43	-
White whale	Aboriginal	Eastern Bering Sea	-	-	132	-
White whale	Aboriginal	Kuskokwim	-	-	2	-
White whale	Aboriginal	Bristol Bay	-	-	19	-

Data from Alaska Marine Mammals Stock Assessments - 2006 (Angliss and Outlaw, 2007)

Species	Type of catch	Area/stock	Males	Females	Total landed	Struck and lost
White whale	Aboriginal	Cook Inlet			2	0

FISHERY BYCATCH OF SMALL CETACEANS FOR THE CALENDAR YEAR 2006

Dolphin species	Sex	No.	Year	Location	Cause	Det.	Source or contact
Argentina - AMMA							
Commerson's dolphin	1F, 10U	14	2006-07	North coast TF	Shore-based nets	RNP, LGB	RNP, LGB
Spectacled porpoise	1M, 1F	6	2006-07	North coast TF	Shore-based nets?	RNP, LGB	RNP, LGB
Burmeister's porpoise	U	1	2006-07	North coast TF	Shore-based nets?	RNP	RNP

Species	Sex	No.	Date	Location	Fate	Targeted fish species	Gear	How observed?	Source or contact
Argentina - AQUAMARINA									
Franciscana dolphin	F	49	Aug 06 to Feb 07	Bahia Samborombon, Cabo San Antonio	D	White croacker, weak fish	GN	F	P. Bordino, AquaMarina CECIM
Franciscana dolphin	M	31	Aug 06 to Feb 07	Bahia Samborombon, Cabo San Antonio	D	White croacker, weak fish	GN	F	P. Bordino/AquaMarina CECIM
Argentina - MACN – CONICET									
Franciscana	6 F, 3 M, 37 U		Oct. 06 – Mar. 07	Southern Buenos Aires Coast, Argentina	-	Shrimp, sharks, some fish species	GNS, TM	Reported	L. Cappozzo; M. F. Negri; M. V. Panebianco/MACN
Common dolphin	M			Southern Buenos Aires Coast, Argentina.	-	Sharks, some fish species	GNS	Reported	L. Cappozzo/MACN
Australia									
Australian snubfin dolphin	U	1	13 Oct. 06 (*1)	19°06.570'S, 146°50.593'E	R	Shark	NSC	F Shark contractor	B. Lane/DPI&F baden.lane@dpi.qld.gov.au
Australian snubfin dolphin	M &F	2	19 Nov. 06	-19.2550'S 146.8483'E	D	Shark	NSC	F Shark contractor	B. Lane/DPI&F baden.lane@dpi.qld.gov.au
Bottlenose dolphin	M	1	14 Sep. 06 (*2)	26°48.46'S 153°08.74'E	R	Shark	NSC	F Shark contractor	B. Lane/DPI&F baden.lane@dpi.qld.gov.au
Bottlenose dolphin	M	1	23 May 2006	-26.3939'S 153.0657'E	D	Shark	NSC	F Shark contractor	B. Lane/DPI&F baden.lane@dpi.qld.gov.au
Bottlenose dolphin	F	1	13 Jan. 2006	Noosa Beach shark net, Sunshine Coast	D	Shark	NSC	F Shark contractor	B. Lane/DPI&F baden.lane@dpi.qld.gov.au
Bottlenose dolphin	M	1	14 May 2006	-25.8987'S 153.0977'E	D	Shark	NSC	F Shark contractor	B. Lane/DPI&F baden.lane@dpi.qld.gov.au
Bottlenose dolphin	U	1	24 May 2006	-25.8941'S 153.0970'	D	Shark	NSC	F Shark contractor	B. Lane/DPI&F baden.lane@dpi.qld.gov.au
Bottlenose dolphin	U	1	24 Aug. 2006	North Stradbroke Island drum line, Moreton Bay	A	Shark	NSC	F Shark contractor	B. Lane/DPI&F baden.lane@dpi.qld.gov.au
Bottlenose dolphin	M	1	26 Jan. 2006	Noosa shark net, Sunshine Coast	D	Shark	NSC	F Shark contractor	B. Lane/DPI&F baden.lane@dpi.qld.gov.au
Bottlenose dolphin	U	1	4/01/06 (*3)	32°03'S; 115°45'E	R	Unknown	RG	F	Doug Coughran, DEC
Bottlenose dolphin	U	1	10/06	151 19' 45" E 33 38' 58" S	D	Sharks	NSC	F	Dennis Reid, NSW DPI
Bottlenose dolphin	F	1	11/06	151 19' 45" E 33 38' 58" S	D	Sharks	NSC	F	Dennis Reid, NSW DPI
Bottlenose dolphin	U	1	30/10	Evans Head	D			Stranded dead (*4)	Christine Fury, SCUWRC

Species	Sex	No.	Date	Location	Fate	Targeted fish species	Gear	How observed?	Source or contact
Bottlenose dolphin	7M/ 2F, 14U	23	01-06/06	~19-20°S, ~116-119°E	21D , 2A	Multiple	TX	F/DA	Commercial Fisheries Program Dept. of Fisheries (WA) 168-170 St Georges Terrace, Perth, WA, 6000
			(Bottlenose dolphin: 1st 2 quarters of 2006. 3rd & 4th quarters will be reported in next year's report)						
Common dolphin	F	1	3 Oct. 2006	Alexandra Headland, Sunshine Coast shark net	D	Shark	NSC	F -Shark contractor	B. Lane/DPI&F baden.lane@dpi.qld.gov.au
Common dolphin	U	1	1 Nov. 2006(*5)	Surfair Resort, Sunshine Coast shark drum line	R	Shark	NSC	F -Shark contractor	B. Lane/DPI&F baden.lane@dpi.qld.gov.au
Common dolphin	F	2	11 Oct. 2006	28^{0}8.067’S 153^{0}30.602’E	D	Shark	NSC	F -Shark contractor	B. Lane/DPI&F baden.lane@dpi.qld.gov.au
Common dolphin	F + U	2	7 Feb. 2006	-28.1583’S 153.5381’E	D	Shark	NSC	F -Shark contractor	B. Lane/DPI&F baden.lane@dpi.qld.gov.au
Common dolphin	U	1	8 Apr. 2006	27^{0}58.406’S 153^{0}26.161’E	D	Shark	NSC	F -Shark contractor	B. Lane/DPI&F baden.lane@dpi.qld.gov.au
Common dolphin	U	1	24 May 2006	-25.8941’ 153.0970’E	D	Shark	NSC	F -Shark contractor	B. Lane/DPI&F baden.lane@dpi.qld.gov.au
Common dolphin	F	1	28 Mar. 2006	Wurtulla shark net, Sunshine Coast	D	Shark	NSC	F -Shark contractor	B. Lane/DPI&F baden.lane@dpi.qld.gov.au
Common dolphin	U	1	8 Apr. 2006	Wurtulla shark net, Sunshine Coast	D	Shark	NSC	F -Shark contractor	B. Lane/DPI&F baden.lane@dpi.qld.gov.au
Common dolphin	F	1	29 May 2006	-26.3939’S 153.0657’E	D	Shark	NSC	F -Shark contractor	B. Lane/DPI&F baden.lane@dpi.qld.gov.au
Common dolphin	M	1	4 Jun. 2006	-26.3939’S 153.0657’E	D	Shark	NSC	F -Shark contractor	B. Lane/DPI&F baden.lane@dpi.qld.gov.au
Common dolphin	F	1	25 Jul. 2006	Bribie Island shark drumline	D	Shark	NSC	F -Shark contractor	B. Lane/DPI&F baden.lane@dpi.qld.gov.au
Common dolphin	M	1	11 Dec. 2006	Noosa shark net, Sunshine Coast	D	Shark	NSC	F -Shark contractor	B. Lane/DPI&F baden.lane@dpi.qld.gov.au
Common dolphin	U	1	10/06	151 17’ 53” E 33 43’ 11” S	D	Shark	NSC	F	Dennis Reid, NSW DPI
Common dolphin	U	1	26/3/06	Whale Beach-NSW	D	Shark	NSC		ORRCA
Indo-Pacific bottlenose dolphin	U	1	8/7/06	34 47 15 S 138 32 00 E	R	Unknown	MIS	M	C. Kemper/S.A. Museum
Indo-Pacific bottlenose dolphin	F	1	Found 10/9/06	32 59 40 S 137 46 30 E	K	Unknown	NK	S.A. Museum post mortem	C. Kemper/S.A. Museum
Pilot whale		1	6/06/2006	28°E 160°S	R	Large tuna and billfish species	LLD	V	T. Smith/AFMA PO Box 7051, Canberra Business Centre ACT 2610 (02) 6225 5322 *Tim.Smith@afma.gov.au*
Short-beaked common dolphin	U	5	2005/ 2006 (*6)	Spencer Gulf/Investigator Strait	D	Pilchard	PS1/PS2	M	SARDI Aquatic Sciences
Short-beaked common dolphin	U	1	Reported 15/6/06	32 56 17 S 137 45 54 E	D	Finfish	MIS (aqua-culture cage)	A	C. Kemper/S.A. Museum
Spinner dolphin	M	1	15 Mar. 2006	Kurrawa Beach shark net, Gold Coast -28.0265’S; 153.4411’E	D	Shark	NSC	F Shark contractor	B. Lane/DPI&F baden.lane@dpi.qld.gov.au
Striped dolphin		1	17/03/2006	27°E 154°S	R	Large tuna and billfish species	LLD	V	AFMA PO Box 7051, Canberra Business Centre ACT 2610
Unid. dolphin		1	13/10/2006	14°S 137°S	D	Prawns	TBS	V	(02) 6225 5322 Tim.Smith@afma.gov.au
Unid. toothed whale		1	12/01/2006	29°E 160°S	R	Large tuna and billfish species	LLD	V	
Unid. dolphin	U	1	Reported 4/9/06	32 56 12 S 137 45 54 E	D	*Kingfish*	MIS (aqua-culture cage)	A	C. Kemper/S.A. Museum
Belgium									
Harbour porpoise	_	3+	2005	IVc ICES area	D	Mixed fishery: sole, plaice, other species	Rec. beach fisheries, prob. gillnets; 1 animal ret. alive	Indirect & direct	J. Haelters
Harbour porpoise	_	3+	2005	IVc ICES area	D	Mixed fishery, predominantly Dover sole	Professional gillnet fisheries	Indirect	J. Haelters
Harbour porpoise	_	1	2005	IVc ICES area	D	Mixed fishery for demersal species	Bottom trawl (TBB)	Indirect	J. Haelters
Harbour porpoise	_	11-	2005	IVc ICES area	D	Unknown	Unk.	Indirect	J. Haelters

Species	Sex	No.	Date	Location	Fate	Targeted fish species	Gear	How observed?	Source or contact
		15+							
White-beaked dolphin	-	1	2005	IVc ICES area	D	Unknown	Unk.	Indirect	J. Haelters
Harbour porpoise	-	27-31 (+)	2006	IVc ICES area	D	Mixed fishery; bottom - demersal species	Both recreational and commercial fishermen mostly gillnets	Indirect	J. Haelters
White-beaked dolphin	-	1 (+)	2006	IVc ICES area	D	unknown	Unk.	Indirect	J. Haelters
Brazil									
Franciscana		235		Southern Brazil		croakers	GNS	Logbooks	LMM/FURG
Marine Tucuxi	F	1		São Paulo			gillnet		IPeC
Marine Tucuxi	M	1		São Paulo			gillnet		IPeC
Marine Tucuxi	M	1		São Paulo			gillnet		IPeC
Marine Tucuxi	M	1	Jul. 1st 2006	Rio de Janeiro				Fisherman called the Lab.	MAQUA
Marine Tucuxi	U	2		Praia deDiogo Lopes – RN (5º05’11’’S; 36º35’05’’W)				Entangled	Flávio J. Lima Silva *flaviogolfinho@yahoo.com.br*
Marine tucuxi	M	1		Bahia				Necropsy	IMA
Marine tucuxi	3M, 1F	4		Sergipe				Necropsy	IMA
Pantropical spotted dolphin	F	1		Bahia				Necropsy	IMA
Clymene dolphin			1	Bahia				Necropsy	IMA
Clymene dolphin			1	Sergipe				Necropsy	IMA
France									
Common dolphin	-	48	Feb/06	Bay of Biscay	D	*Dicentrarchus labrax*	PTM	M	O. Van Canneyt/ CRMM/ULR
Common dolphin	-	4	Jan-Feb-Mar/06	Bay of Biscay	D	Flat fish	GTR	V	O. Van Canneyt/ CRMM/ULR
Harbour porpoise	-	21	Jan-Feb-Mar/06	Bay of Biscay	D	Flat fish	GTR	V	O. Van Canneyt/ CRMM/ULR

Species	Area/stock	Incidental Mortality			Live capture
		Reported	Estim. total	Source	
Germany					
Harbour porpoise	North Sea	0	Unknown		
Harbour porpoise	Baltic Sea Schleswig-Holstein	3	Unknown	Gillnet	None
Harbour porpoise	Baltic Sea Mecklenburg-Prepomerania	6	Unknown	Gillnet	None

Species	Sex	No.	Date	Location	Fate	Targeted fish species	Gear	How observed?	Source or contact
Ireland									
Common dolphin	-	1	26/9/06	51.37N 8.01W	D	*Merluccius merluccius*	GNS	Scientific observer	BIM
Common dolphin	-	1	13/10/06	50.81N 8.63W	D	*Merluccius merluccius*	GNS	Scientific observer	BIM
Common dolphin	-	1	19/10/06	52.82N 10.50W	D	*Merluccius merluccius*	GNS	Scientific observer	BIM
Common dolphin	-	2	Oct. 06	NA	D	*Clupea harengus*	TM	Scientific observer	MI
Common dolphin	-	2	Oct. 06	NA	D	*Clupea harengus*	TM	Scientific observer	MI
Harbour porpoise	-	1	24/7/06	51.04N 8.94W	D	*Merluccius merluccius*	GNS	Scientific observer	BIM
Harbour porpoise	-	1	26/9/06	51.23N 8.24W	D	*Merluccius merluccius*	GNS	Scientific observer	BIM

Species	Sex	No.	Date	Location	Fate	Targeted fish species	Gear	How observed?	Source or contact
Harbour porpoise	-	1	26/9/06	51.25N 8.36W	D	*Merluccius merluccius*	GNS	Scientific observer	BIM
Striped dolphin	-	1	26/9/06	51.27N 8.23W	D	*Merluccius merluccius*	GNS	Scientific observer	BIM
Italy									
Cuvier's beaked whale	F	1	21/4/05	Manduria (Taranto)	D	NK	TBB	DA	Michela Podestà, CSC – MSNMI
Common bottlenose dolphin	M	1	17/12/05	(40º59N, 009º37E)	D	-	NSC*	M	B. Diaz Lopez, BDRI
Common bottlenose dolphin	M	1	21/12/05	(40º59N, 009º37E)	D	-	NSC*	Floating	*Same as above*
Common bottlenose dolphin	U	1	Jan. 06	(40º59N, 009º37E)	D	-	NSC*	DA	*Same as above*
Common bottlenose dolphin	F	1	15/2/05	Punta Ala (Groseto)	D	NK	TBB	DA	Michela Podestà, CSC – MSNMI
Common bottlenose dolphin	F	1	27/4/05	Chioggia (Venezia)	D	NK	NK	DA	*Same as above*
Common bottlenose dolphin	M	1	6/9/05	Pineto (Teramo)	D	NK	NK	DA	*Same as above*
Common bottlenose dolphin	M	1	26/9/05	Ortona (Chieti)	D	NK	GN	DA	*Same as above*
Common bottlenose dolphin	M	1	17/12/05	Golfo Aranci (Sassari)	D	NK	NK	DA	*Same as above*
Striped dolphin	?	1	29/5/07	Ischia (Napoli)	D	NK	NK	DA	*Same as above*
Striped dolphin	M	1	9/7/05	Castelvolturno (Caserta)	D	*NK*	NK	DA	*Same as above*
Striped dolphin	M	1	30/7/05	Castiadas (Cagliari)	D	NK	GND	DA	*Same as above*
Striped dolphin	M	1	30/8/05	Ischia (Napoli)	D	NK	NK	DA	*Same as above*
Korea									
False killer whale	U	1	1/9	N34 43.700; E128.35.181	D	Mullet, anchovy, shad	FYK	F	CRI/NFRDI
Common dolphin	M	1	5/1	N36.20.702 E129.24.286	D	Amberjack, herring, squid	FYK	F	CRI/NFRDI
Common dolphin	F	1	5/1	N36.20.540 E129.24.185	D	Amberjack, herring, squid	FYK	F	CRI/NFRDI
Common dolphin	F	1	8/1	N36.20.562 E129.30.032	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	U	1	8/1	N36.15.517 E129.24.466	D	Squid	LL	F	CRI/NFRDI
Common dolphin	M	1	9/1	N36.06.904 E129.45.353	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	11/1	N36.23.451 E129.25.123	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	F	1	12/1	N35.49.211 E129.33.664	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	12/1	N36.05.012 E129.37.181	D	mackerel, jack mackerel	TX	F	CRI/NFRDI
Common dolphin	U	1	24/1	N36.20.120 E129.24.357	D	Conger eel, crab, octopus	FPO	F	CRI/NFRDI
Common dolphin	F	1	25/1	N36.19.311 E129.26.893	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	U	1	6/2	N35.53.235 E129.33.094	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	F	1	14/2	N36.28.862 E129.27.078	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	18/2	N35.51.769 E129.33.633	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	F	1	18/2	N35.53.343 E129.35.526	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	U	1	19/2	N36.04.705 E129.35.740	D	Conger eel, crab, octopus	FPO	F	CRI/NFRDI
Common dolphin	U	1	20/2	N36.04.624 E129.36.780	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	22/2	N35.54.097 E129.35.259	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	U	1	24/2	N35.49.478 E129.35.126	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	U	1	28/2	N35.53.257 E129.32.548	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	U	1	2/3	N35.52.523 E129.34.777	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	2/3	N35.53.332 E129.35.366	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	U	1	3/3	N35.47.419 E129.30.554	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	3/3	N36.19.796 E129.24.083	D	Amberjack, herring, squid	FYK	F	CRI/NFRDI
Common dolphin	M	1	3/3	N35.53.278 E129.33.587	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	4/3	N35.47.969 E129.32.101	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	5/3	N35.48.044 E129.31.010	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	5/3	N36.04.640 E129.35.620	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	U	1	5/3	N35.52.394 E129.33.703	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	F	1	6/3	N35.48.082 E129.33.078	D	Mackerel, jack mackerel	SX	F	CRI/NFRDI
Common dolphin	U	1	6/3	N35.47.856 E129.32.938	D	As above	SX	F	CRI/NFRDI
Common dolphin	U	1	6/3	N35.48.120 E129.33.032	D	As above	SX	F	CRI/NFRDI
Common dolphin	F	1	6/3	N35.52.545 E129.33.330	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	F	1	6/3	N35.52.513 E129.33.197	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	6/3	N35.52.459 E129.33.716	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	6/3	N35.52.351 E129.33.796	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI

Species	Sex	No.	Date	Location	Fate	Targeted fish species	Gear	How observed?	Source or contact
Common dolphin	U	1	7/3	N36.21.753 E129.24.059	D	Amberjack, herring, squid	FYK	F	CRI/NFRDI
Common dolphin	F	1	8/3	N36.17.333 E129.26.588	D	Conger eel, crab, octopus	FPO	F	CRI/NFRDI
Common dolphin	U	1	9/3	N36.11.997 E129.29.498	D	As above	FPO	F	CRI/NFRDI
Common dolphin	M	1	10/3	N35.47.239 E129.30.065	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	F	1	10/3	N36.10.687 E129.30.289	D	Conger eel, crab, octopus	FPO	F	CRI/NFRDI
Common dolphin	F	1	11/3	N35.51.834 E129.33.114	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	11/3	N35.54.960 E129.34.102	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	15/3	N36.06.499 E129.31.039	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	F	1	16/3	N36.22.168 E129.25.227	D	Amberjack, herring, squid	FYK	F	CRI/NFRDI
Common dolphin	F	1	18/3	N36.04.543 E129.39.221	D	Conger eel, crab, octopus	FPO	F	CRI/NFRDI
Common dolphin	U	1	20/3	N36.20.001 E129.28.813	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	20/3	N36.26.835 E129.27.148	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	F	1	20/3	N36.04.656 E129.39.861	D	Conger eel, crab, octopus	FPO	F	CRI/NFRDI
Common dolphin	F	1	20/3	N36.14.913 E129.24.065	D	As above	FPO	F	CRI/NFRDI
Common dolphin	M	1	21/3	N35.47.969 E129.31.123	D	Mackerel, jack mackerel	SX	F	CRI/NFRDI
Common dolphin	F	1	21/3	N35.48.044 E129.30.983	D	As above	SX	F	CRI/NFRDI
Common dolphin	F	1	21/3	N35.59.158 E129.34.152	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	21/3	N36.06.063 E129.37.461	D	Conger eel, crab, octopus	FPO	F	CRI/NFRDI
Common dolphin	M	1	21/3	N35.51.780 E129.32.555	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	U	1	23/3	N36.22.028 E129.25.200	D	Amberjack, herring, squid	FYK	F	CRI/NFRDI
Common dolphin	F	1	23/3	N35.54.248 E129.33.676	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	U	1	24/3	N36.19.408 E129.25.100	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	U	1	24/3	N36.00.209 E129.35.231	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	U	1	25/3	N36.21.564 E129.24.661	D	Amberjack, herring, squid	FYK	F	CRI/NFRDI
Common dolphin	M	1	25/3	N36.21.537 E129.24.661	D	As above	FYK	F	CRI/NFRDI
Common dolphin	M	1	25/3	N36.23.688 E129.25.440	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	28/3	N36.20.702 E129.24.520	D	Amberjack, herring, squid	FYK	F	CRI/NFRDI
Common dolphin	M	1	28/3	N36.20.675 E129.24.453	D	As above	FYK	F	CRI/NFRDI
Common dolphin	F	1	28/3	N36.20.621 E129.24.420	D	As above	FYK	F	CRI/NFRDI
Common dolphin	M	1	28/3	N36.20.621 E129.24.386	D	As above	FYK	F	CRI/NFRDI
Common dolphin	M	1	28/3	N36.20.648 E129.24.587	D	As above	FYK	F	CRI/NFRDI
Common dolphin	F	1	28/3	N36.20.702 E129.24.554	D	As above	FYK	F	CRI/NFRDI
Common dolphin	M	1	28/3	N36.10.914 E129.26.063	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	U	1	31/3	N36.21.537 E129.24.561	D	Amberjack, herring, squid	FYK	F	CRI/NFRDI
Common dolphin	U	1	31/3	N36.20.621 E129.24.386	D	Amberjack, herring, squid	FYK	F	CRI/NFRDI
Common dolphin	F	1	31/3	N35.59.142 E129.36.510	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	31/3	N36.09.394 E129.26.359	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	1/4	N36.22.130 E129.24.594	D	Amberjack, herring, squid	FYK	F	CRI/NFRDI
Common dolphin	U	1	1/4	N36.22.103 E129.26.218	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	U	1	1/4	N36.19.883 E129.30.459	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	1/4	N36.03.799 E129.27.648	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	U	1	1/4	N36.09.890 E129.27.043	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	F	1	1/4	N36.08.531 E129.28.782	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	2/4	N35.48.007 E129.30.611	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	2/4	N35.57.962 E129.33.552	D	Conger eel, crab, octopus	FPO	F	CRI/NFRDI
Common dolphin	U	1	4/4	N36.20.001 E129.30.218	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	F	1	4/4	N36.10.105 E129.29.006	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	U	1	6/4	N35.48.724 E129.32.613	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	U	1	6/4	N36.05.416 E129.27.748	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	6/4	N36.08.456 E129.24.607	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	U	1	9/4	N36.06.128 E129.27.588	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	F	1	10/4	N36.12.304 E129.34.347	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	10/4	N36.11.819 E129.34.487	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	F	1	15/4	N36.19.990 E129.26.900	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	15/4	N36.19.441 E129.26.050	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI

Species	Sex	No.	Date	Location	Fate	Targeted fish species	Gear	How observed?	Source or contact
Common dolphin	U	1	15/4	N36.19.505 E129.25.983	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	U	1	15/4	N36.51.694 E129.26.996	D	Amberjack, herring, squid	FYK	F	CRI/NFRDI
Common dolphin	U	1	16/4	N36.12.240 E129.26.433	D	Conger eel, crab, octopus	FPO	F	CRI/NFRDI
Common dolphin	U	1	17/4	N36.28.797 E129.36.015	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	17/4	N36.02.991 E129.37.049	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	17/4	N36.04.333 E129.36.160	D	Conger eel, crab, octopus	FPO	F	CRI/NFRDI
Common dolphin	M	1	17/4	N36.12.563 E129.27.111	D	As above	FPO	F	CRI/NFRDI
Common dolphin	F	1	17/4	N36.12.595 E129.27.044	D	As above	FPO	F	CRI/NFRDI
Common dolphin	F	1	18/4	N37.24.569 E129.17.314	D	Amberjack, herring, squid	FYK	F	CRI/NFRDI
Common dolphin	F	1	18/4	N37.24.569 E129.17.314	D	As above	FYK	F	CRI/NFRDI
Common dolphin	M	1	18/4	N37.24.569 E129.17.314	D	As above	FYK	F	CRI/NFRDI
Common dolphin	M	1	18/4	N37.24.569 E129.17.314	D	As above	FYK	F	CRI/NFRDI
Common dolphin	M	1	18/4	N37.24.569 E129.17.314	D	As above	FYK	F	CRI/NFRDI
Common dolphin	M	1	18/4	N37.24.569 E129.17.314	D	As above	FYK	F	CRI/NFRDI
Common dolphin	F	1	18/4	N37.24.569 E129.17.314	D	As above	FYK	F	CRI/NFRDI
Common dolphin	U	1	18/4	N36.20.130 E129.26.886	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	F	1	19/4	N35.47.969 E129.30.963	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	22/4	N36.03.104 E129.37.729	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	F	1	22/4	N36.04.996 E129.35.900	D	Conger eel, crab, octopus	FPO	F	CRI/NFRDI
Common dolphin	M	1	22/4	N35.52.556 E129.32.772	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	23/4	N36.20.675 E129.24.453	D	Amberjack, herring, squid	FYK	F	CRI/NFRDI
Common dolphin	F	1	23/4	N36.20.594 E129.24.554	D	As above	FYK	F	CRI/NFRDI
Common dolphin	F	1	23/4	N36.20.648 E129.24.353	D	As above	FYK	F	CRI/NFRDI
Common dolphin	F	1	23/4	N36.20.621 E129.24.386	D	As above	FYK	F	CRI/NFRDI
Common dolphin	M	1	23/4	N36.20.729 E129.24.386	D	As above	FYK	F	CRI/NFRDI
Common dolphin	M	1	23/4	N36.19.376 E129.26.947	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	F	1	23/4	N36.04.656 E129.35.780	D	Mackerel, jack mackerel	SX	F	CRI/NFRDI
Common dolphin	M	1	23/4	N36.04.656 E129.35.800	D	As above	SX	F	CRI/NFRDI
Common dolphin	M	1	23/4	N36.04.769 E129.35.680	D	As above	SX	F	CRI/NFRDI
Common dolphin	M	1	23/4	N36.04.915 E129.35.760	D	As above	SX	F	CRI/NFRDI
Common dolphin	F	1	23/4	N36.04.866 E129.35.740	D	As above	SX	F	CRI/NFRDI
Common dolphin	F	1	23/4	N36.04.866 E129.35.760	D	As above	SX	F	CRI/NFRDI
Common dolphin	M	1	23/4	N36.04.931 E129.35.800	D	As above	SX	F	CRI/NFRDI
Common dolphin	M	1	23/4	N36.04.996 E129.35.740	D	As above	SX	F	CRI/NFRDI
Common dolphin	F	1	23/4	N36.04.721 E129.35.600	D	As above	SX	F	CRI/NFRDI
Common dolphin	M	1	23/4	N36.05.028 E129.35.840	D	As above	SX	F	CRI/NFRDI
Common dolphin	F	1	23/4	N36.04.996 E129.35.660	D	As above	SX	F	CRI/NFRDI
Common dolphin	M	1	23/4	N36.04.899 E129.35.720	D	As above	SX	F	CRI/NFRDI
Common dolphin	F	1	23/4	N36.12.078 E129.27.455	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	U	1	24/4	N36.19.538 E129.25.916	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	25/4	N36.21.591 E129.28.376	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	25/4	N36.22.130 E129.24.528	D	Amberjack, herring, squid	FYK	F	CRI/NFRDI
Common dolphin	M	1	25/4	N36.21.968 E129.24.494	D	As above	FYK	F	CRI/NFRDI
Common dolphin	M	1	25/4	N36.21.807 E129.24.293	D	As above	FYK	F	CRI/NFRDI
Common dolphin	M	1	25/4	N36.21.834 E129.24.561	D	As above	FYK	F	CRI/NFRDI
Common dolphin	M	1	25/4	N36.21.888 E129.24.561	D	As above	FYK	F	CRI/NFRDI
Common dolphin	F	1	25/4	N36.22.022 E129.24.494	D	As above	FYK	F	CRI/NFRDI
Common dolphin	M	1	25/4	N36.19.150 E129.25.782	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	F	1	25/4	N36.04.785 E129.37.661	D	Mackerel, jack mackerel	SX	F	CRI/NFRDI
Common dolphin	M	1	25/4	N36.04.737 E129.35.040	D	Conger eel, crab, octopus	FPO	F	CRI/NFRDI
Common dolphin	M	1	25/4	N36.13.889 E129.23.905	D	Amberjack, herring, squid	FYK	F	CRI/NFRDI
Common dolphin	F	1	25/4	N36.13.867 E129.23.919	D	As above	FYK	F	CRI/NFRDI
Common dolphin	U	1	25/4	N36.13.911 E129.23.865	D	As above	FYK	F	CRI/NFRDI
Common dolphin	F	1	25/4	N36.21.968 E129.24.327	D	As above	FYK	F	CRI/NFRDI
Common dolphin	U	1	26/4	N36.28.161 E129.27.423	D	As above	FYK	F	CRI/NFRDI
Common dolphin	U	1	26/4	N36.28.194 E129.27.423	D	As above	FYK	F	CRI/NFRDI
Common dolphin	U	1	26/4	N36.28.161 E129.27.531	D	As above	FYK	F	CRI/NFRDI
Common dolphin	U	1	26/4	N35.54.248 E129.33.090	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	U	1	26/4	N36.12.224 E129.29.358	D	Conger eel, crab,	FPO	F	CRI/NFRDI

Species	Sex	No.	Date	Location	Fate	Targeted fish species	Gear	How observed?	Source or contact
						octopus			
Common dolphin	U	1	27/4	N35.55.380 E129.36.643	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	F	1	28/4	N36.02.991 E129.36.709	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	F	1	28/4	N36.03.945 E129.26.548	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	F	1	29/4	N36.05.319 E129.40.232	D	Conger eel, crab, octopus	FPO	F	CRI/NFRDI
Common dolphin	F	1	3/5	N36.20.621 E129.24.420	D	Amberjack, herring, squid	FYK	F	CRI/NFRDI
Common dolphin	F	1	4/5	N36.51.586 E129.27.063	D	As above	FYK	F	CRI/NFRDI
Common dolphin	U	1	4/5	N36.51.618 E129.27.036	D	As above	FYK	F	CRI/NFRDI
Common dolphin	F	1	4/5	N36.51.144 E129.26.120	D	As above	FYK	F	CRI/NFRDI
Common dolphin	U	1	8/5	N36.53.516 E129.26.584	D	As above	FYK	F	CRI/NFRDI
Common dolphin	F	1	8/5	N35.59.191 E129.35.571	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	F	1	9/5	N38.24.303 E128.30.429	D	Amberjack, herring, squid	FYK	F	CRI/NFRDI
Common dolphin	F	1	9/5	N38.24.303 E128.30.429	D	As above	FYK	F	CRI/NFRDI
Common dolphin	M	1	9/5	N38.24.303 E128.30.429	D	As above	FYK	F	CRI/NFRDI
Common dolphin	F	1	9/5	N36.28.905 E129.27.001	D	As above	FYK	F	CRI/NFRDI
Common dolphin	M	1	9/5	N36.28.911 E129.27.149	D	As above	FYK	F	CRI/NFRDI
Common dolphin	M	1	9/5	N36.28.903 E129.27.028	D	As above	FYK	F	CRI/NFRDI
Common dolphin	U	1	9/5	N36.28.894 E129.27.018	D	As above	FYK	F	CRI/NFRDI
Common dolphin	U	1	9/5	N36.28.894 E129.27.169	D	As above	FYK	F	CRI/NFRDI
Common dolphin	F	1	10/5	N37.20.413 E129.16.419	D	As above	FYK	F	CRI/NFRDI
Common dolphin	M	1	10/5	N36.28.894 E129.27.189	D	As above	FYK	F	CRI/NFRDI
Common dolphin	M	1	10/5	N36.28.854 E129.27.008	D	As above	FYK	F	CRI/NFRDI
Common dolphin	M	1	10/5	N36.04.317 E129.39.881	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	U	1	10/5	N36.04.462 E129.39.741	D	Mackerel, jack mackerel	SX	F	CRI/NFRDI
Common dolphin	U	1	10/5	N36.04.608 E129.39.761	D	As above	SX	F	CRI/NFRDI
Common dolphin	M	1	10/5	N36.04.705 E129.39.821	D	As above	SX	F	CRI/NFRDI
Common dolphin	U	1	11/5	N36.19.106 E129.25.903	D	Conger eel, crab, octopus	FPO	F	CRI/NFRDI
Common dolphin	U	1	12/5	N37.20.413 E129.16.419	D	Amberjack, herring, squid	FYK	F	CRI/NFRDI
Common dolphin	M	1	12/5	N36.17.387 E129.25.184	D	Conger eel, crab, octopus	FPO	F	CRI/NFRDI
Common dolphin	U	1	12/5	N36.19.688 E129.25.869	D	As above	FPO	F	CRI/NFRDI
Common dolphin	M	1	12/5	N36.03.704 E129.25.706	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	F	1	13/5	N36.28.097 E129.27.490	D	Amberjack, herring, squid	FYK	F	CRI/NFRDI
Common dolphin	M	1	13/5	N36.28.194 E129.27.410	D	As above	FYK	F	CRI/NFRDI
Common dolphin	F	1	14/5	N36.28.129 E129.27.477	D	As above	FYK	F	CRI/NFRDI
Common dolphin	F	1	14/5	N36.28.172 E129.27.531	D	As above	FYK	F	CRI/NFRDI
Common dolphin	M	1	14/5	N36.25.095 E130.30.695	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	15/5	N35.53.267 E129.32.668	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	U	1	16/5	N36.19.484 E129.24.859	D	Amberjack, herring, squid	FYK	F	CRI/NFRDI
Common dolphin	U	1	16/5	N36.19.473 E129.24.873	D	As above	FYK	F	CRI/NFRDI
Common dolphin	U	1	16/5	N36.19.624 E129.24.873	D	As above	FYK	F	CRI/NFRDI
Common dolphin	U	1	16/5	N36.19.462 E129.24.832	D	As above	FYK	F	CRI/NFRDI
Common dolphin	F	1	16/5	N36.19.527 E129.24.873	D	As above	FYK	F	CRI/NFRDI
Common dolphin	U	1	16/5	N36.19.764 E129.23.882	D	As above	FYK	F	CRI/NFRDI
Common dolphin	U	1	16/5	N36.19.807 E129.23.789	D	As above	FYK	F	CRI/NFRDI
Common dolphin	U	1	16/5	N36.19.796 E129.23.909	D	As above	FYK	F	CRI/NFRDI
Common dolphin	F	1	16/5	N36.19.861 E129.23.856	D	As above	FYK	F	CRI/NFRDI
Common dolphin	F	1	16/5	N36.19.829 E129.23.842	D	As above	FYK	F	CRI/NFRDI
Common dolphin	F	1	16/5	N36.19.936 E129.23.856	D	As above	FYK	F	CRI/NFRDI
Common dolphin	M	1	16/5	N36.19.807 E129.23.842	D	As above	FYK	F	CRI/NFRDI
Common dolphin	U	1	16/5	N36.19.839 E129.23.896	D	As above	FYK	F	CRI/NFRDI
Common dolphin	M	1	17/5	N36.19.085 E129.24.789	D	Conger eel, crab, octopus	FPO	F	CRI/NFRDI
Common dolphin	M	1	17/5	N36.28.108 E129.27.464	D	Amberjack, herring, squid	FYK	F	CRI/NFRDI
Common dolphin	M	1	17/5	N36.28.129 E129.27.490	D	As above	FYK	F	CRI/NFRDI
Common dolphin	M	1	17/5	N35.53.310 E129.32.495	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	F	1	17/5	N35.55.165 E129.35.579	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	18/5	N36.28.870 E129.27.088	D	Amberjack, herring, squid	FYK	F	CRI/NFRDI
Common dolphin	M	1	18/5	N36.53.472 E129.26.564	D	Amberjack, herring, squid	FYK	F	CRI/NFRDI

Species	Sex	No.	Date	Location	Fate	Targeted fish species	Gear	How observed?	Source or contact
Common dolphin	M	1	18/5	N36.08.957 E129.24.547	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	F	1	18/5	N35.54.270 E129.34.701	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	F	1	18/5	N36.10.930 E129.26.103	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	F	1	18/5	N36.09.318 E129.29.003	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	20/5	N36.34.500 E129.38.239	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	U	1	20/5	N36.26.943 E129.26.786	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	U	1	21/5	N36.20.044 E129.23.889	D	Amberjack, herring, squid	FYK	F	CRI/NFRDI
Common dolphin	M	1	21/5	N36.03.831 E129.26.668	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	22/5	N36.05.853 E129.37.901	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	23/5	N36.03.233 E129.35.670	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	F	1	25/5	N36.07.098 E129.40.562	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	F	1	25/5	N36.15.980 E129.26.184	D	Conger eel, crab, octopus	FPO	F	CRI/NFRDI
Common dolphin	F	1	1/6	N36.28.108 E129.27.531	D	Amberjack, herring, squid	FYK	F	CRI/NFRDI
Common dolphin	F	1	1/6	N36.28.129 E129.27.397	D	As above	FYK	F	CRI/NFRDI
Common dolphin	M	1	4/6	N36.09.351 E129.28.055	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	5/6	N36.19.516 E129.23.909	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	F	1	5/6	N36.00.705 E129.28.046	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	6/6	N36.17.285 E129.28.548	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	U	1	9/6	N35.48.044 E129.31.170	D	Mackerel, jack mackerel	TX	F	CRI/NFRDI
Common dolphin	U	1	9/6	N36.04.349 E129.24.548	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	U	1	12/6	N36.03.993 E129.35.520	D	Conger eel, crab, octopus	FPO	F	CRI/NFRDI
Common dolphin	M	1	13/6	N36.05.853 E129.40.869	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	16/6	N36.10.898 E129.27.225	D	Conger eel, crab, octopus	FPO	F	CRI/NFRDI
Common dolphin	M	1	20/6	N36.07.082 E129.40.402	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	F	1	20/6	N36.07.162 E129.40.282	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	U	1	20/6	N36.09.308 E129.30.031	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	U	1	22/6	N36.14.945 E129.24.720	D	Conger eel, crab, octopus	FPO	F	CRI/NFRDI
Common dolphin	U	1	7/7	N36.15.290 E129.24.292	D	As above	FPO	F	CRI/NFRDI
Common dolphin	U	1	12/7	N36.11.108 E129.26.263	D	As above	FPO	F	CRI/NFRDI
Common dolphin	F	1	21/7	N36.12.455 E129.27.554	D	As above	FPO	F	CRI/NFRDI
Common dolphin	U	1	8/8	N36.02.991 E129.36.769	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	U	1	9/8	N35.53.580 E129.33.144	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	U	1	10/8	N36.13.727 E129.24.587	D	Conger eel, crab, octopus	FPO	F	CRI/NFRDI
Common dolphin	U	1	12/8	N36.19.839 E129.29.870	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	21/8	N36.03.185 E129.35.030	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	F	1	23/8	N36.04.090 E129.41.722	D	Conger eel, crab, octopus	FPO	F	CRI/NFRDI
Common dolphin	M	1	23/8	N35.52.513 E129.33.051	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	F	1	25/8	N36.12.520 E129.28.086	D	Conger eel, crab, octopus	FPO	F	CRI/NFRDI
Common dolphin	U	1	3/9	N36.53.710 E129.26.153	D	As above	FPO	F	CRI/NFRDI
Common dolphin	U	1	3/9	N36.00.193 E129.35.491	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	U	1	3/9	N36.00.209 E129.35.371	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	F	1	4/9	N35.59.223 E129.36.510	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	U	1	7/9	N36.13.889 E129.28.863	D	Conger eel, crab, octopus	FPO	F	CRI/NFRDI
Common dolphin	U	1	8/9	N37.38.631 E129.04.975	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	F	1	10/9	N36.28.690 E129.33.972	D	Conger eel, crab, octopus	FPO	F	CRI/NFRDI
Common dolphin	U	1	15/9	N37.38.477 E129.08.196	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	U	1	16/9	N37.38.623 E129.07.947	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	21/9	N37.19.751 E129.15.509	D	Amberjack, herring, squid	FYK	F	CRI/NFRDI
Common dolphin	U	1	22/9	N38.13.580 E128.36.051	D	As above	FYK	F	CRI/NFRDI
Common dolphin	U	1	23/9	N37.26.242 E129.13.178	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	26/9	N37.47.028 E128.57.562	D	Conger eel, crab, octopus	FPO	F	CRI/NFRDI
Common dolphin	M	1	26/9	N37.26.266 E129.14.626	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	U	1	28/9	N36.24.442 E129.28.897	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	29/9	N37.26.304 E129.14.086	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	F	1	2/10	N37.38.615 E129.05.128	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	3/10	N37.43.762 E128.59.566	D	Amberjack, herring,	FYK	F	CRI/NFRDI

Species	Sex	No.	Date	Location	Fate	Targeted fish species	Gear	How observed?	Source or contact
						squid			
Common dolphin	M	1	3/10	N37.41.791 E129.02.309	D	As above	FYK	F	CRI/NFRDI
Common dolphin	U	1	3/10	N37.41.791 E129.02.309	D	As above	FYK	F	CRI/NFRDI
Common dolphin	U	1	3/10	N37.41.791 E129.02.309	D	As above	FYK	F	CRI/NFRDI
Common dolphin	M	1	4/10	N37.58.872 E128.48.534	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	U	1	4/10	N36.40.658 E129.30.109	D	Conger eel, crab, octopus	FPO	F	CRI/NFRDI
Common dolphin	U	1	8/10	N36.53.526 E129.27.204	D	Amberjack, herring, squid	FYK	F	CRI/NFRDI
Common dolphin	U	1	8/10	N36.53.526 E129.27.110	D	As above	FYK	F	CRI/NFRDI
Common dolphin	F	1	10/10	N37.06.333 E129.24.587	D	As above	FYK	F	CRI/NFRDI
Common dolphin	M	1	10/10	N37.06.322 E129.24.492	D	As above	FYK	F	CRI/NFRDI
Common dolphin	F	1	10/10	N37.06.365 E129.24.465	D	As above	FYK	F	CRI/NFRDI
Common dolphin	U	1	11/10	N37.41.921 E129.01.968	D	As above	FYK	F	CRI/NFRDI
Common dolphin	U	1	11/10	N37.41.921 E129.01.968	D	As above	FYK	F	CRI/NFRDI
Common dolphin	F	1	11/10	N37.19.114 E129.16.990	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	U	1	14/10	N37.44.170 E129.00.014	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	U	1	14/10	N36.21.564 E129.28.309	D	Conger eel, crab, octopus	FPO	F	CRI/NFRDI
Common dolphin	U	1	15/10	N38.12.527 E128.38.271	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	U	1	15/10	N36.15.075 E129.28.530	D	Conger eel, crab, octopus	FPO	F	CRI/NFRDI
Common dolphin	U	1	16/10	N36.22.028 E129.28.762	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	F	1	17/10	N37.11.062 E129.22.064	D	Conger eel, crab, octopus	FPO	F	CRI/NFRDI
Common dolphin	U	1	17/10	N36.53.472 E129.26.631	D	Amberjack, herring, squid	FYK	F	CRI/NFRDI
Common dolphin	U	1	20/10	N36.28.894 E129.29.080	D	As above	FYK	F	CRI/NFRDI
Common dolphin	F	1	20/10	N36.28.814 E129.29.100	D	As above	FYK	F	CRI/NFRDI
Common dolphin	U	1	21/10	N36.20.023 E129.27.529	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	U	1	23/10	N36.05.982 E129.37.421	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	U	1	25/10	N36.55.084 E129.27.130	D	Amberjack, herring, squid	FYK	F	CRI/NFRDI
Common dolphin	U	1	27/10	N36.54.912 E129.28.006	D	Conger eel, crab, octopus	FPO	F	CRI/NFRDI
Common dolphin	U	1	30/10	N36.14.892 E129.26.552	D	As above	FPO	F	CRI/NFRDI
Common dolphin	U	1	2/11	N37.26.255 E129.12.639	D	Amberjack, herring, squid	FYK	F	CRI/NFRDI
Common dolphin	U	1	2/11	N37.26.221 E129.12.620	D	Amberjack, herring, squid	FYK	F	CRI/NFRDI
Common dolphin	F	1	2/11	N36.06.435 E129.38.681	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	U	1	3/11	N36.19.936 E129.28.920	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	U	1	3/11	N36.04.042 E129.36.801	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	8/11	N36.05.356 E129.29.764	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	10/11	N36.08.505 E129.26.047	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	U	1	10/11	N36.02.807 E129.28.902	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	13/11	N37.22.920 E129.16.114	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	13/11	N37.19.443 E129.17.588	D	Amberjack, herring, squid	FYK	F	CRI/NFRDI
Common dolphin	U	1	13/11	N36.26.749 E129.27.550	D	Conger eel, crab, octopus	FPO	F	CRI/NFRDI
Common dolphin	M	1	13/11	N36.05.060 E129.28.188	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	U	1	14/11	N36.09.308 E129.30.286	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	16/11	N37.20.607 E129.16.517	D	Conger eel, crab, octopus	FPO	F	CRI/NFRDI
Common dolphin	F	1	18/11	N36.22.092 E129.25.281	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	U	1	21/11	N37.19.443 E129.17.588	D	Amberjack, herring, squid	FYK	F	CRI/NFRDI
Common dolphin	M	1	22/11	N37.57.905 E128.52.197	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	22/11	N37.19.443 E129.17.588	D	Amberjack, herring, squid	FYK	F	CRI/NFRDI
Common dolphin	M	1	22/11	N37.00.124 E129.26.552	D	As above	FYK	F	CRI/NFRDI
Common dolphin	F	1	25/11	N37.21.173 E129.19.466	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	F	1	29/11	N37.20.446 E129.19.466	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	U	1	29/11	N36.21.737 E129.24.879	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	U	1	13/12	N37.19.443 E129.17.588	D	Amberjack, herring, squid	FYK	F	CRI/NFRDI
Common dolphin	U	1	15/12	N37.23.706 E129.18.127	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	16/12	N37.03.282 E129.28.621	D	Amberjack, herring, squid	FYK	F	CRI/NFRDI

Species	Sex	No.	Date	Location	Fate	Targeted fish species	Gear	How observed?	Source or contact
Common dolphin	U	1	16/12	N37.03.325 E129.28.594	D	As above	FYK	F	CRI/NFRDI
Common dolphin	U	1	16/12	N37.03.282 E129.28.594	D	As above	FYK	F	CRI/NFRDI
Common dolphin	M	1	17/12	N37.23.485 E129.17.386	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	F	1	17/12	N36.51.543 E129.27.090	D	Amberjack, herring, squid	FYK	F	CRI/NFRDI
Common dolphin	U	1	17/12	N36.51.532 E129.27.090	D	As above	FYK	F	CRI/NFRDI
Common dolphin	M	1	17/12	N37.00.188 E129.26.552	D	As above	FYK	F	CRI/NFRDI
Common dolphin	M	1	19/12	N37.23.485 E129.17.386	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	U	1	19/12	N37.21.254 E129.18.653	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	U	1	19/12	N36.20.023 E129.27.810	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	U	1	20/12	N37.47.285 E128.57.963	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	20/12	N37.23.814 E129.17.178	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	22/12	N36.21.510 E129.26.335	D	Conger eel, crab, octopus	FPO	F	CRI/NFRDI
Common dolphin	F	1	23/12	N36.29.013 E129.27.511	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	24/12	N37.24.569 E129.17.314	D	Amberjack, herring, squid	FYK	F	CRI/NFRDI
Common dolphin	F	1	24/12	N37.24.569 E129.17.314	D	As above	FYK	F	CRI/NFRDI
Common dolphin	M	1	24/12	N37.24.569 E129.17.314	D	As above	FYK	F	CRI/NFRDI
Common dolphin	F	1	24/12	N37.24.569 E129.17.314	D	As above	FYK	F	CRI/NFRDI
Common dolphin	M	1	24/12	N37.24.569 E129.17.314	D	As above	FYK	F	CRI/NFRDI
Common dolphin	F	1	24/12	N37.24.569 E129.17.314	D	As above	FYK	F	CRI/NFRDI
Common dolphin	M	1	24/12	N37.24.569 E129.17.314	D	As above	FYK	F	CRI/NFRDI
Common dolphin	F	1	24/12	N37.24.569 E129.17.314	D	As above	FYK	F	CRI/NFRDI
Common dolphin	M	1	24/12	N37.24.569 E129.17.314	D	As above	FYK	F	CRI/NFRDI
Common dolphin	M	1	24/12	N37.24.569 E129.17.314	D	As above	FYK	F	CRI/NFRDI
Common dolphin	U	1	25/12	N37.19.443 E129.17.588	D	As above	FYK	F	CRI/NFRDI
Common dolphin	M	1	25/12	N37.22.413 E129.16.229	D	As above	FYK	F	CRI/NFRDI
Common dolphin	M	1	25/12	N37.22.413 E129.16.229	D	As above	FYK	F	CRI/NFRDI
Common dolphin	F	1	25/12	N37.22.413 E129.16.229	D	As above	FYK	F	CRI/NFRDI
Common dolphin	M	1	26/12	N37.22.548 E129.23.533	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	M	1	26/12	N37.23.706 E129.18.127	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	U	1	26/12	N36.15.851 E129.25.596	D	Conger eel, crab, octopus	FPO	F	CRI/NFRDI
Common dolphin	M	1	31/12	N37.34.093 E129.07.784	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Common dolphin	U	1	31/12	N36.20.087 E129.25.910	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
P. w-s. dolphin	M	1	1/1	N37.21.060 E129.17.182	D	Amberjack, herring, squid	FYK	F	CRI/NFRDI
P. w-s. dolphin	F	1	1/1	N37.21.060 E129.17.182	D	As above	FYK	F	CRI/NFRDI
P. w-s. dolphin	M	1	2/1	N36.25.100 E129.26.331	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
P. w-s. dolphin	U	1	5/1	N36.35.740 E129.25.632	D	Amberjack, herring, squid	FYK	F	CRI/NFRDI
P. w-s. dolphin	F	1	8/1	N36.14.989 E129.23.116	D	As above	FYK	F	CRI/NFRDI
P. w-s. dolphin	M	1	15/3	N36.04.802 E129.34.560	D	As above	FYK	F	CRI/NFRDI
P. w-s. dolphin	F	1	26/3	N38.10.436 E128.38.217	D	As above	FYK	F	CRI/NFRDI
P. w-s. dolphin	M	1	7/6	N36.33.778 E129.28.752	D	Conger eel, crab, octopus	FPO	F	CRI/NFRDI
P. w-s. dolphin	F	1	30/6	N36.40.860 E129.30.099	D	As above	FPO	F	CRI/NFRDI
P. w-s. dolphin	U	1	3/7	N36.40.806 E129.43.042	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
P. w-s. dolphin	U	1	8/7	N36.41.458 E129.40.241	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
P. w-s. dolphin	F	1	12/8	N38.10.252 E128.38.408	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
P. w-s. dolphin	U	1	28/9	N38.12.648 E128.37.968	D	Amberjack, herring, squid	FYK	F	CRI/NFRDI
P. w-s. dolphin	M	1	11/12	N35.20.703 E129.36.700	D	Conger eel, crab, octopus	FPO	F	CRI/NFRDI
P. w-s. dolphin	M	1	14/12	N38.11.438 E128.37.355	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
P. w-s. dolphin	F	1	14/12	N35.34.673 E129.37.133	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
P. w-s. dolphin	F	1	16/12	N38.15.278 E128.35.522	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
P. w-s. dolphin	F	1	19/12	N37.53.184 E128.52.556	D	Conger eel, crab, octopus	FPO	F	CRI/NFRDI
P. w-s. dolphin	M	1	19/12	N35.15.688 E129.23.060	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
P. w-s. dolphin	M	1	22/12	N37.22.548 E129.23.533	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
P. w-s. dolphin	M	1	23/12	N38.20.376 E128.32.200	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
P. w-s. dolphin	U	1	27/12	N38.04.747 E128.41.347	D	Amberjack, herring, squid	FYK	F	CRI/NFRDI
P. w-s. dolphin	F	1	30/12	N37.22.891 E129.14.859	D	As above	FYK	F	CRI/NFRDI
P. w-s. dolphin	U	1	30/12	N37.22.891 E129.14.859	D	As above	FYK	F	CRI/NFRDI
P. w-s. dolphin	F	1	30/12	N36.20.066 E129.29.937	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
P. w-s. dolphin	M	1	31/12	N36.20.152 E129.25.321	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
P. w-s. dolphin	M	1	31/12	N36.20.023 E129.25.803	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI

Species	Sex	No.	Date	Location	Fate	Targeted fish species	Gear	How observed?	Source or contact
P. w-s. dolphin	U	1	31/12	N36.20.206 E129.31.001	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
P. w-s. dolphin	U	1	31/12	N36.20.152 E129.31.028	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Finless porpoise	U	1	4/1	N35.52.588 E129.33.752	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Finless porpoise	U	1	18/1	N35.47.931 E129.31.170	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Finless porpoise	U	1	25/2	N35.47.425 E129.30.268	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Finless porpoise	U	1	1/3	N35.47.462 E129.30.275	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Finless porpoise	U	1	1/3	N36.21.510 E129.24.059	D	Amberjack, herring, squid	FYK	F	CRI/NFRDI
Finless porpoise	U	1	8/3	N35.47.457 E129.30.643	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Finless porpoise	U	1	8/3	N35.53.731 E129.34.701	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Finless porpoise	F	1	9/3	N35.48.082 E129.31.149	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Finless porpoise	F	1	13/3	N35.47.392 E129.31.710	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Finless porpoise	U	1	21/3	N34 58.080 E129.17.780	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Finless porpoise	U	1	24/3	N35.47.433 E129.30.843	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Finless porpoise	F	1	27/3	N34 46.289 E128.23.230	D	Mullet, anchovy, shad	FYK	F	CRI/NFRDI
Finless porpoise	M	1	4/4	N35.15.534 E129.17.258	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Finless porpoise	F	1	11/4	N34 49.415 E128.21.130	D	Mullet, anchovy, shad	FYK	F	CRI/NFRDI
Finless porpoise	U	1	16/4	N35.47.481 E129.30.623	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Finless porpoise	U	1	24/4	N35.43.016 E129.30.243	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Finless porpoise	U	1	18/5	N34 34.226 E125.55.553	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Finless porpoise	M	1	31/5	N35.51.780 E129.32.662	D	Conger eel, crab, octopus	FPO	F	CRI/NFRDI
Finless porpoise	U	1	12/6	N35.43.010 E129.29.765	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Finless porpoise	F	1	18/6	N34 58.026 E128.44.356	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Finless porpoise	U	1	23/6	N34 39.775 E128.23.339	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Finless porpoise	F	1	1/7	N34 47.090 E128.44.094	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Finless porpoise	U	1	1/7	N34 47.090 E128.44.094	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Finless porpoise	U	1	6/7	N34 45.427 E128.28.056	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Finless porpoise	F	1	21/7	N35.38.085 E129.31.743	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Finless porpoise	U	1	13/11	N35.02.861 E128.42.254	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Finless porpoise	F	1	19/11	N36.00.662 E129.36.170	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Finless porpoise	U	1	5/12	N36.07.356 E129.26.508	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Finless porpoise	U	1	16/12	N36.08.553 E129.26.794	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Finless porpoise	U	1	30/12	N36.06.160 E129.38.621	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Harbour porpoise	U	1	6/1	N38.23.304 E128.30.001	D	Amberjack, herring, squid	FYK	F	CRI/NFRDI
Harbour porpoise	U	1	6/1	N38.23.309 E128.32.307	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Harbour porpoise	M	1	9/1	N38.30.549 E128.28.379	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Harbour porpoise	U	1	14/1	N38.30.001 E128.29.998	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Harbour porpoise	U	1	14/1	N38.09.350 E128.39.749	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Harbour porpoise	U	1	15/1	N38.28.002 E128.29.957	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Harbour porpoise	U	1	18/1	N38.30.002 E128.29.998	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Harbour porpoise	U	1	19/1	N38.24.401 E128.31.452	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Harbour porpoise	U	1	19/1	N38.24.353 E128.31.457	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Harbour porpoise	U	1	20/1	N38.24.401 E128.31.452	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Harbour porpoise	U	1	23/1	N38.22.202 E128.31.453	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Harbour porpoise	F	1	23/1	N38.28.362 E128.32.102	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Harbour porpoise	F	1	23/1	N37.25.975 E129.13.589	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Harbour porpoise	U	1	24/1	N38.29.567 E128.26.260	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Harbour porpoise	U	1	25/1	N38.24.006 E128.31.311	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Harbour porpoise	F	1	27/1	N38.30.039 E128.30.053	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Harbour porpoise	U	1	2/2	N37.43.703 E129.01.505	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Harbour porpoise	U	1	2/2	N38.29.004 E128.29.999	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Harbour porpoise	F	1	2/2	N38.23.270 E128.31.300	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Harbour porpoise	U	1	5/2	N37.43.687 E129.00.495	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Harbour porpoise	U	1	5/2	N38.24.289 E128.30.405	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Harbour porpoise	U	1	5/2	N38.24.302 E128.31.450	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Harbour porpoise	U	1	7/2	N38.24.303 E128.30.429	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Harbour porpoise	U	1	7/2	N38.24.353 E128.30.395	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Harbour porpoise	U	1	9/2	N38.27.005 E128.28.306	D	Amberjack, herring, squid	FYK	F	CRI/NFRDI
Harbour porpoise	U	1	9/2	N38.24.303 E128.30.429	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Harbour porpoise	U	1	9/2	N38.24.303 E128.30.429	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Harbour porpoise	U	1	9/2	N38.24.303 E128.30.429	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Harbour porpoise	U	1	9/2	N38.20.723 E128.32.489	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Harbour porpoise	U	1	10/2	N38.24.303 E128.30.429	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Harbour porpoise	U	1	10/2	N38.24.337 E128.30.427	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Harbour porpoise	U	1	10/2	N38.20.302 E128.32.348	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Harbour porpoise	U	1	10/2	N38.20.712 E128.32.324	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Harbour porpoise	U	1	10/2	N38.32.288 E128.32.283	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI

Species	Sex	No.	Date	Location	Fate	Targeted fish species	Gear	How observed?	Source or contact
Harbour porpoise	U	1	10/2	N38.30.288 E128.32.705	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Harbour porpoise	F	1	11/2	N38.21.155 E128.32.308	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Harbour porpoise	F	1	11/2	N38.21.102 E128.32.400	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Harbour porpoise	M	1	13/2	N38.10.423 E128.37.905	D	Amberjack, herring, squid	FYK	F	CRI/NFRDI
Harbour porpoise	M	1	15/2	N38.23.300 E128.31.209	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Harbour porpoise	M	1	15/2	N38.23.300 E128.31.209	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Harbour porpoise	M	1	15/2	N38.32.102 E128.27.200	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Harbour porpoise	M	1	16/2	N38.25.302 E128.32.006	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Harbour porpoise	U	1	18/2	N38.24.303 E128.30.429	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Harbour porpoise	M	1	19/2	N38.23.005 E128.32.005	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Harbour porpoise	F	1	20/2	N38.24.304 E128.31.006	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Harbour porpoise	M	1	21/2	N38.22.455 E128.31.454	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Harbour porpoise	M	1	24/2	N38.25.302 E128.32.006	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Harbour porpoise	F	1	3/3	N38.32.106 E128.30.208	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Harbour porpoise	M	1	10/3	N38.35.503 E128.29.303	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Harbour porpoise	F	1	11/3	N38.32.454 E128.28.509	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Harbour porpoise	F	1	20/3	N38.32.239 E128.28.304	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Harbour porpoise	U	1	27/3	N38.20.305 E128.33.305	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Harbour porpoise	U	1	1/4	N38.10.258 E128.39.003	D	Amberjack, herring, squid	FYK	F	CRI/NFRDI
Harbour porpoise	U	1	23/4	N38.24.008 E128.30.397	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Harbour porpoise	U	1	26/4	N38.30.589 E128.25.868	D	Amberjack, herring, squid	FYK	F	CRI/NFRDI
Unidentified	U	1	1/3	N35.47.446 E129.30.149	D	Flounder, plaice, porgy	GN	F	CRI/NFRDI
Netherlands									
Harbour porpoise*	F+M		2006	Dutch North Sea coast	D		GN	Found dead and autopsied	IMARES
Atlantic white- sided dolphin	M		2006	49.°40N; 11°05W	D	Scad; Mackerel	Pelagic trawl	Observer	IMARES
Common dolphin	M		2006	53°13N; 11°21W	D	Scad; Mackerel	Pelagic trawl	Reported by crew	IMARES
New Zealand									
Common dolphin	U	3	??/10/06	Taranaki	D	*Trachurus*	TM	F	S. Rowe/ DOC
Dusky dolphin	F	1	??/03/06	Banks Penla	D	*Trachurus*	TM	F	S. Baird/NIWA
Dusky dolphin	U	1	??/11/06	Marlborough	D	U	GNS	F	S. Rowe/ DOC
Hector's dolphin	M	1	06/12/06	Marlborough	D	U	GNS	F	H. McConnell/ DOC
Hector's dolphin	U	3	03/04/06	Marlborough	D	U	TBB/ TM	F	H. McConnell/ DOC
Norway									
Harbour porpoise	1			ICES area Ia	D	Angler fish, gadoids	GN	F	IMR (Arne Bjørge)
Harbour porpoise	134			ICES area IIia$_2$	D	Angler fish, gadoids	GN	F	IMR (Arne Bjørge)
Harbour porpoise	10			ICES area IIIa	D	Angler fish, gadoids	GN	F	IMR (Arne Bjørge)
Harbour porpoise	4			ICES area IVa	D	Angler fish, gadoids	GN	F	IMR (Arne Bjørge)
Portugal									
Harbour porpoise	F	1	24 Feb 2003	40°19'N; 8°51'W	D	*Trachurus trachurus*	SB	M	M. Ferreira, SPVS marisa.ferreira@socpvs.org
Harbour porpoise	M	1	13 Jun 2003	40°27'N; 8°48'W	D	*Trachurus trachurus*	SB	M	M. Ferreira, SPVS marisa.ferreira@socpvs.org
Common dolphin	M/F	1 M 1 F 23 ?	5 Aug 2003	40°33'N; 9°46'W	2 D 23 R	*Trachurus trachurus*	SB	M	M. Ferreira, SPVS marisa.ferreira@socpvs.org
Comments: At least 25 animals captured in a beach purse-seine net. 2 died and the others were released.									
Harbour porpoise	F	1	13 Jul 2004	40°03'N; 8°54'W	D	*Trachurus trachurus*	SB	M	M. Ferreira, SPVS marisa.ferreira@socpvs.org
Common dolphin	M/F	3 M 2 F 10 ?	16 Aug 2004	40°29'N; 8°48'W	5 D 10 R	*Trachurus trachurus*	SB	M	M. Ferreira, SPVS marisa.ferreira@socpvs.org
Comments: 15 animals captured in a beach purse-seine net. 10 released; 5 dead									
Common dolphin	?	8	26 Aug 2004	40°26'N; 8°53'W	R	*Sardina pilchardus*	SV	F	M. Ferreira, SPVS marisa.ferreira@socpvs.org
Harbour porpoise	F	2	14 Jun 2005	40°27'N; 8°48'W	D	*Trachurus trachurus*	SB	M	M. Ferreira, SPVS marisa.ferreira@socpvs.org
Harbour porpoise	F	1	25 Jul 2005	40°27'N; 8°48'W	D	*Trachurus trachurus*	SB	M	M. Ferreira, SPVS marisa.ferreira@socpvs.org
Spain									
Bottlenose dolphin	--	1	02/05/06	Mahon (39º52´N-4º18´E)	D		NK	DA	Cons. M. Ambiente
Common dolphin		1	21-7-06	36,44N-3,53W	D		NK	M	J. L. Mons, CREMA

Species	Sex	No.	Date	Location	Fate	Targeted fish species	Gear	How observed?	Source or contact
Common dolphin		1	21-7-06	36,44N-3,53W	D		NK	M	J. L. Mons, CREMA
Common dolphin		1	28-6-06	36,30N-4,54W	D		NK	M	J. L. Mons, CREMA
Common dolphin		1	28-6-06	36,30N-4,54W	D		NK	M	J. L. Mons, CREMA
Common dolphin		1	21-3-06	36,43N-4,25W	D		NK	M	J. L. Mons, CREMA
Common dolphin		1	1-3-06	3,66N-4,63W	D		NK	M	J. L. Mons, CREMA
Common dolphin		1	28-2-06	36,30N-4,54W	D		NK	M	J. L. Mons, CREMA
Common dolphin		1	27-2-06	36,30N-4,54W	D		NK	M	J. L. Mons, CREMA
Common dolphin		1	12-2-06	36,43N-4,25W	D		NK	M	J. L. Mons, CREMA
Botlenose dolphin		1	25-6-06	36,32N-6,18W	D		NK	M	J. L. Mons, CREMA
Unid. dolphin		1	25-3-06	36,32N-6,18W	D		NK	M	J. L. Mons, CREMA
Unid. dolphin		1	9-3-06	36,32N-6,18W	D		NK	M	J. L. Mons, CREMA
Striped dolphin		1	4-2-06	36,43N-4,25W	D		NK	M	J. L. Mons, CREMA
White beaked dolphin	F	1	30-1-06	45,00N-5,00W	D	*Various*	TX	F	S. Lens/IEO
Cuvier's beaked whale		1	28/5/07	36,72948N -4,10257W	D	Gear not knowon	NK	M	J. L. Mons, CREMA
Sweden									
Harbour porpoise		1	3/2	Prob. Skagerrak	D				anders.m.nilsson@vgregion.se
Harbour porpoise	F	1	16/1	Väderöarna islands, Skagerrak	D	Shrimp	TM		As above
UK									
Harbour porpoise	-	20	2006	SW UK	D	*Various*	GEN	M	SMRU
Common dolphin	-	25	2006	SW UK	D	*Sea Bass*	PTM	M	SMRU
Common dolphin	-	7	2006	SW UK	D	*Various*	GEN	M	SMRU

Notes:

Argentina AMMA: These numbers and those in former years represent specimens collected by us; the actual number of animals that died is much higher. In 2006-07 there were only two expeditions to the fishing areas.

France: Only data from observer programme coordinated by Ifremer are given; stranded animals with unequivocal by-catch marks are not included. The projects PETRACET and PROCET were aimed at estimating the removal of small cetaceans by EU pelagic trawl fisheries and testing the effect of several commercial pingers (Ifremer, CRMM/ULR). In the PETRACET project pelagic trawl fisheries of the UK, Denmark, Ireland, the Netherland and France were observed. A total of 89 common dolphins, 3 striped dolphins and 1 Risso's dophin were caught in 21 among the 952 observed hauls. Extrapolated to all the fisheries, this suggests that the total removal should be 1760-1930 dolphins per year according to the type of stratification that was tested (Northridge *et al.*, 2006). The impact of such a catch on the population will be analysed in the project NECESSITY due in 2007. In the PROCET project, available pingers tested in commercial operation failed to show any effect on the frequency of by-catch events or the number of dolphins caught (Fossecave *et al.*, 2006). Other by-catch events were opportunistically reported and included 21 harbour porpoises and 4 short-beaked common dolphins caught in bottom-set trammel net fisheries operating off Arcachon, Bay of Biscay in 2006.

FISHERY BYCATCH OF SMALL CETACEANS 2004

Species	Sex	No.	Date	Location	Fate	Targeted fish species	Gear	How observed?	Source or contact
USA – NEFSC									
Harbour porpoise	U	1	1/3/04	42.40°N, -70.35°W	D	Monkfish	GNS	F	NEFSC, 166 Water Street, Woods Hole, MA 02543. Dana Belden, 508-495-2136 *dbelden@wh sun1.wh.whoi.edu*
Harbour porpoise	U	1	1/3/04	42.45°N, -70.35°W	D	Monkfish	GNS	F	See above
Harbour porpoise	U	1	1/29/04	42.42°N, -70.35°W	D	Cod	GNS	F	See above
White-sided dolphin	M	1	2/4/04	42.48°N, -69.91°W	D	American plaice flounder	OTB	F	See above
Harbour porpoise	F	1	2/9/04	42.45°N, -70.40°W	D	Cod	GNS	F	See above
White-sided dolphin	U	1	2/13/04	41.87°N, -68.32°W	D	Monkfish	OTB	F	See above
Harbour porpoise	U	1	2/20/04	42.44°N, -70.38°W	R	Cod	GNS	F	See above
White-sided dolphin	M	1	2/25/04	42.59°N, -69.68°W	D	White hake	OTB	F	See above
White-sided dolphin	M	1	2/27/04	39.77°N, -72.48°W	D	Atlantic mackerel	PTM	F	See above
Harbour porpoise	U	1	2/27/04	42.48°N, -70.46°W	D	Cod	GNS	F	See above
Unknown dolphin	U	1	3/5/04	38.38°N, -74.25°W	D	Atlantic mackerel	TM	F	See above
White-sided dolphin	U	1	3/13/04	41.64°N, -69.12°W	D	Cod	OTB	F	See above
White-sided dolphin	M	1	3/16/04	42.84°N, -69.90°W	D	Unknown flounder	OTB	F	See above
White-sided dolphin	F	1	3/17/04	42.49°N, -69.47°W	D	Unknown groundfish	OTB	F	See above
White-sided dolphin	M	1	3/19/04	42.55°N, -69.66°W	R	Unknown groundfish	OTB	F	See above
White-sided dolphin	M	1	3/20/04	42.63°N, -69.53°W	D	Unknown groundfish	OTB	F	See above
White-sided dolphin	M	1	3/23/04	42.52°N, -69.60°W	D	Unknown groundfish	OTB	F	See above
White-sided dolphin	U	1	3/25/04	42.75°N, -69.35°W	D	White hake	OTB	F	See above
White-sided dolphin	U	1	3/25/04	41.80°N, -68.35°W	D	Witch flounder	OTB	F	See above
White-sided dolphin	F	1	3/27/04	41.79°N, -68.25°W	D	Winter skate	OTB	F	See above

Species	Sex	No.	Date	Location	Fate	Targeted fish species	Gear	How observed?	Source or contact
White-sided dolphin	F	1	4/5/04	41.54°N, -68.69°W	D	Witch flounder	OTB	F	See above
White-sided dolphin	M	1	4/6/04	41.72°N, -68.61°W	D	Monkfish	OTB	F	See above
White-sided dolphin	M	1	4/6/04	41.32°N, -69.24°W	D	Haddock	OTB	F	See above
Harbour porpoise	F	1	4/7/04	40.34°N, -71.00°W	D	Monkfish	GNS	F	See above
Harbour porpoise	F	1	4/7/04	40.34°N, -70.97°W	D	Monkfish	GNS	F	See above
Harbour porpoise	M	1	4/7/04	40.34°N, -70.93°W	D	Monkfish	GNS	F	See above
Harbour porpoise	M	1	4/7/04	40.36°N, -70.92°W	D	Monkfish	GNS	F	See above
Harbour porpoise	F	1	4/7/04	40.36°N, -70.92°W	D	Monkfish	GNS	F	See above
White-sided dolphin	U	1	4/7/04	41.98°N, -67.94°W	D	Monkfish	OTB	F	See above
White-sided dolphin	U	1	4/9/04	42.08°N, -67.63°W	D	Winter flounder	OTB	F	See above
White-sided dolphin	F	1	4/10/04	42.10°N, -67.71°W	D	Cod	OTB	F	See above
Unknown dolphin	U	1	4/18/04	39.94°N, -69.50°W	D	Monkfish	GNS	F	See above
Harbour porpoise	F	1	4/21/04	40.05°N, -70.06°W	D	Monkfish	GNS	F	See above
Harbour porpoise	M	1	4/21/04	39.65°N, -72.90°W	D	Sea scallop	DRB	F	See above
Harbour porpoise	F	1	4/25/04	40.58°N, -71.16°W	D	Monkfish	GNS	F	See above
Bottlenose dolphin	M	1	4/25/04	40.12°N, -70.22°W	D	Monkfish	GNS	F	See above
Unknown porpoise/dolphin	F	1	4/25/04	40.62°N, -71.17°W	U	Monkfish	GNS	F	See above
Harbour porpoise	M	1	4/27/04	37.95°N, -75.03°W	D	Monkfish	GNS	F	See above
Harbour porpoise	U	1	4/27/04		D	Monkfish	GNS	F	See above
Harbour porpoise	U	1	4/27/04		D	Monkfish	GNS	F	See above
Harbour porpoise	M	1	4/27/04	37.97°N, -75.03°W	D	Monkfish	GNS	F	See above
Unknown porpoise/dolphin	U	1	5/5/04	41.07°N, -71.34°W	D	Monkfish	GNS	F	See above
Unknown porpoise/dolphin	U	1	5/5/04	41.06°N, -71.39°W	D	Monkfish	GNS	F	See above
Unknown dolphin	U	1	5/11/04	37.75°N, -74.56°W	D	Sea scallop	DRB	F	See above
Harbour porpoise	U	1	5/22/04	40.71°N, -71.13°W	D	Monkfish	GNS	F	See above
Harbour porpoise	U	1	5/22/04	40.70°N, -71.10°W	D	Monkfish	GNS	F	See above
Common dolphin	F	1	7/3/04	38.23°N, -71.67°W	D	Short-fin squid	OTB	F	See above
Common dolphin	M	1	7/7/04	40.79°N, -66.86°W	D	Silver hake	OTB	F	See above
Common dolphin	F	1	7/8/04	40.46°N, -68.18°W	D	Silver hake	OTB	F	See above
Unknown porpoise/dolphin	U	1	7/14/04	41.81°N, -68.28°W	D	Monkfish	OTB	F	See above
Harbour porpoise	U	1	7/19/04	41.73°N, -68.38°W	D	Unknown flounder	OTB	F	See above
Minke whale	U	1	8/24/04	41.37°N, -67.32°W	D	Yellowtail flounder	OTB	F	See above
Long-fin pilot whale	F	1	9/17/04	41.70°N, -68.44°W	D	American lobster	OTB	F	See above
Long-fin pilot whale	U	1	9/24/04	41.72°N, -68.38°W	U	Atlantic herring	PTM	F	See above
Common dolphin	M	1	9/27/04	40.75°N, -66.99°W	D	Silver hake	OTB	F	See above
Harbour porpoise	M	1	10/6/04	42.72°N, -70.47°W	D	Cod	GNS	F	See above
White-sided dolphin	U	1	10/13/04	42.93°N, -70.38°W	D	Cod	GND	F	See above
Harbour porpoise	M	1	10/13/04	42.75°N, -70.29°W	D	Cod	GNS	F	See above
Harbour porpoise	M	1	10/13/04	42.76°N, -70.33°W	D	Cod	GNS	F	See above
Harbour porpoise	M	1	10/13/04	42.76°N, -70.33°W	D	Cod	GNS	F	See above
White-sided dolphin	U	1	10/29/04	39.95°N, -69.70°W	R	Long-fin squid	OTB	F	See above
Unknown baleen whale	U	1	10/29/04	41.73°N, -68.39°W	D	Monkfish	OTB	F	See above
Unknown whale	U	1	10/30/04	41.73°N, -68.38°W	D	Witch flounder	OTB	F	See above
Unknown whale	U	1	11/2/04	41.72°N, -68.38°W	D	Witch flounder	OTB	F	See above
Common dolphin	F	1	11/3/04	38.15°N, -73.78°W	D	Long-fin squid	OTB	F	See above
Common dolphin	F	1	11/3/04	38.15°N, -73.78°W	D	Long-fin squid	OTB	F	See above
Common dolphin	F	1	11/3/04	38.15°N, -73.78°W	D	Long-fin squid	OTB	F	See above
Harbour porpoise	U	1	11/7/04	42.522°N, -70.61°W	D	Cod	GNS	F	See above
White-sided dolphin	U	1	11/7/04	43.19°N, -70.27°W	D	Unknown groundfish	OTB	F	See above
Common dolphin	F	1	12/2/04	38.31°N, -73.62°W	D	Long-fin squid	OTB	F	See above
Unknown porpoise/ dolphin	U	1	12/3/04	41.04°N, -70.94°W	D	Monkfish	GNS	F	See above
Harbour porpoise	U	1	12/3/04	42.72°N, -70.47°W	D	Cod	GNS	F	See above
Common dolphin	F	1	12/4/04	38.38°N, -73.47°W	D	Long-fin squid	OTB	F	See above
Unknown whale	U	1	12/9/04	43.30°N, -70.06°W	D	Monkfish	OTB	F	See above
Unknown baleen whale	U	1	12/9/04	41.74°N, -68.37°W	R	Unknown flounder	OTB	F	See above
Unknown porpoise/ dolphin	U	1	12/16/04	40.84°N, -71.72°W	D	Monkfish	GNS	F	See above
Common dolphin	U	1	12/16/04	38.52°N, -73.28°W	D	Long-fin squid	OTB	F	See above
Common dolphin	U	1	12/16/04	38.52°N, -73.28°W	D	Long-fin squid	OTB	F	See above
Common dolphin	U	1	12/16/04	38.61°N, -73.24°W	D	Long-fin squid	OTB	F	See above
Long-fin pilot whale	M	1	12/17/04	41.91°N, -68.04°W	U	Monkfish	OTB	F	See above
Harbour porpoise	F	1	12/19/04	42.84°N, -70.25°W	D	Pollock	GNS	F	See above
Harbour porpoise	U	1	12/22/04	41.71°N, -69.82°W	D	Monkfish	GNS	F	See above
Harbour porpoise	U	1	12/30/04	40.78°N, -70.83°W	D	Monkfish	GNS	F	See above
USA - SEFSC									
Common dolphin	U	1	07/2004	44°49’N; 44°38’W	R	Swordfish/ tuna	LLD	F	L. Garrison, SEFSC
Pilot whale	U	1	01/2004	35°56’N; 74°43’W	D	Swordfish/ tuna	LLD	F	L. Garrison, SEFSC
Pilot whale	U	1	02/2004	20°30’N; 74°00’W	D	Swordfish/ tuna	LLD	F	L. Garrison, SEFSC
Pilot whale	U	1	2/2004	20°25’N; 73°49’W	D	Swordfish/ tuna	LLD	F	L. Garrison, SEFSC

Species	Sex	No.	Date	Location	Fate	Targeted fish species	Gear	How observed?	Source or contact
Pilot whale	U	1	07/2004	35°42'N; 74°43'W	R	Swordfish/ tuna	LLD	F	L. Garrison, SEFSC
Pilot whale	U	1	07/2004	35°42'N; 74°43'W	R	Swordfish/ tuna	LLD	F	L. Garrison, SEFSC
Pilot whale	U	1	09/2004	39°43'N; 71°43'W	D	Swordfish/ tuna	LLD	F	L. Garrison, SEFSC
Pilot whale	U	1	10/2004	39°41'N; 71°41'W	D	Swordfish/ tuna	LLD	F	L. Garrison, SEFSC
Pilot whale	U	1	10/2004	39°48'N; 71°00'W	D	Swordfish/ tuna	LLD	F	L. Garrison, SEFSC
Risso's dolphin	U	1	7/2004	39°55'N; 69°25'W	R	Swordfish/ tuna	LLD	F	L. Garrison, SEFSC
Risso's dolphin	U	1	10/2004	39°42'N; 71°43'W	D	Swordfish/ tuna	LLD	F	L. Garrison, SEFSC
Risso's dolphin	U	1	11/2004	38°14'N; 73°33'W	D	Swordfish/ tuna	LLD	F	L. Garrison, SEFSC
Afsc[1]									
Killer whale	U	2	2004	Bering Sea	D	Flatfish	TBB	F	M. Perez (AFSC)
Killer whale	U	1	2004	Bering Sea	R	Flatfish	TBB	F	M. Perez (AFSC)
Dall's porpoise	M	1	2004	Bering Sea	D	Pollock	TM	F	M. Perez (AFSC)
USA - SWFSC									
Northern right whale dolphin	F	1	16-Jan-2004	33° 09'N; 118° 15'W	D	*Swordfish*	GND	F	Jim.Carretta@noaa.gov NMFS SWFSC 858.546.7171
Short-beaked common dolphin	M	1	7-Nov-2004	32°30'N; 117°56'W	D	*Swordfish*	GND	F	As above
Short-beaked common dolphin	F	1	5-Jan-2004	32°37'N; 117°49'W	D	*Swordfish*	GND	F	As above
Short-beaked common dolphin	M	1	5-Jan-2004	32°37'N; 117°49'W	D	*Swordfish*	GND	F	As above
Short-beaked common dolphin	M	1	18-Nov-2004	32°29'N; 117°57'W	D	*Swordfish*	GND	F	As above
Short-beaked common dolphin	M	1	15-Jan-2004	33°00'N 118°08'W	D	*Swordfish*	GND	F	As above
Short-beaked common dolphin	M	1	7-Jan-2004	32°32'N 117°58'W	D	*Swordfish*	GND	F	As above
Short-beaked common dolphin	F	1	26-Oct-2004	32°44'N 117°45'W	D	*Swordfish*	GND	F	As above
Short-beaked common dolphin	F	1	16-Jan-2004	32°49'N 117°58'W	D	*Swordfish*	GND	F	As above
Long-beaked common dolphin	M	1	1-Aug-2004	34°17'N 119°28'W	D	*Swordfish*	GND	F	As above
USA – PIFSC									
False killer whale	U	1	25/1/04	Outside EEZ	R	Tuna	LL	F	NMFS/PIRO Observer Program
False killer whale	U	1	17/2/04	Inside EEZ	R	Tuna	LL	F	As above
False killer whale	U	1	22/3/04	Outside EEZ	R	Tuna	LL	F	As above
False killer whale	U	1	4/4/04	Outside EEZ	R	Tuna	LL	F	As above
False killer whale	U	1	9/9/04	Inside EEZ	D	Tuna	LL	F	As above
False killer whale	U	1	18/9/04	Inside EEZ	R	Tuna	LL	F	As above
Short-finned pilot whale	U	1	2/5/04	U	R	Tuna	LL	F	As above

Notes:

Argentina AQUAMARINA: Entangled in gear, cut off and sank. **MACN:** Entangled in gear.

Australia: (*1) The dolphin was released alive. The dolphin was not hooked, but had rope around the tail. The rope was removed without injury to the dolphin. (*2) Dolphin caught in the net by it's pectoral fin. It was released and sent to Sea World for rehabilitation. (*3) Entangled in fishing line. Disentangled. (*4) Fluke cut off by knife or sharp item. (*5) The dolphin was released alive. The hook was embedded in the pectoral fin. (*6) May have occurred in 2005.

Belgium: One of the bycaught porpoises in 2005 was voluntarily delivered to MUMM for research purposes. In order to continue the established cooperation with fishermen, reports of bycatches are not made available on MUMM's website. Stranded bycaught animals however, are reported as such in the online database.

Netherlands: *Estimated number minimally 250.

Italy: *Incidental capture in aquaculture antipredator nets (NSC).(Díaz López & Shirai 2007)

New Zealand: These bycatch reports represent only those individuals that were reported to DOC or the Ministry of Fisheries and were confirmed as fisheries bycatch from Government observers in fisheries or from autopsies of beach cast specimens. There is no estimate of total bycatch in NZ and the individuals reported here represent a minimum.

Spain: Entangled in gear.

Sweden: First porpoise was found in fish market.

USA: In addition to the fishery observer records above, a number of dead-stranded animals in the Southwest Region (California coast) were attributed to fishery interactions during 2004-2005: 1 bottlenose dolphin, 10 long-beaked common dolphin, 1 sperm whale, 1 Pacific white-sided dolphin, 1 short-beaked common dolphin, and 5 Harbour porpoise. Reference: Garrison (2005). [1] Data from Perez (2006)

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Annex M

Report of the Sub-Committee on Whalewatching

Members: Kato (Chair), An, Bolanos, Bejder, Carlson, Corkeron, De Stephanis, Dinter, Foote, Fortuna, Funahashi, Gabriele, Gallego, Galletti, Groch, Hucke-Gaete, Iñiguez, Lusseau, Mattila, Parsons, Panigada, Ponce, Prieto, Ritter, Robbins, Rojas-Bracho, Rose, Silva, Simmonds, M., Stachowitsch, Straley, Tominaga, Urban, Weinrich, Wilkin, Gallego, Williams, R., Yoshida.

1. CONVENOR'S OPENING REMARKS AND TERMS OF REFERENCE

Kato welcomed the members of the sub-committee and noted the priority items identified by the Scientific Committee: (1) assessing the biological impacts of whalewatching on cetaceans; (2) identifying data sources from platforms of opportunity of potential value to the Scientific Committee. In addition, the following items were identified: (1) reports from Intersessional Working Groups: (identifying data sources from platforms of opportunity of potential value to the Scientific Committee; further development of a questionnaire and improved methodologies to assess the extent and potential impact of swim-with-whale operations; improvement of data collection from whalewatching operations including further development of the DRS; and strategic planning of large-scale whalewatching research); (2) review of whalewatching guidelines and regulations; and (3) review of risks to cetaceans from whalewatching vessel collisions.

2. ELECTION OF CHAIR AND APPOINTMENT OF RAPPORTEURS

Kato was elected Chair and Carlson was appointed rapporteur with assistance from Rose and Lusseau.

3. ADOPTION OF AGENDA

The adopted Agenda is given as Appendix 1.

4. REVIEW OF AVAILABLE DOCUMENTS

The documents available to the sub-committee were identified as: SC/59/WW1-24; Ritter, 2007; Joergensen, 2007; Smith *et al.,* 2007; Bain *et al.*, 2007a,b; Bejder *et al.,* 2006a,b; Stockin *et al.,* 2001.

5. ASSESSING BIOLOGICAL IMPACTS OF WHALEWATCHING ON CETACEANS

5.1 Quantifying baselines

SC/59/WW2 presented a framework that was developed in response to results presented in last year's WW sub-committee (Bejder *et al.,* 2006a,b). An important goal of scientific inquiry into effects of anthropogenic activity (whalewatching activities or otherwise) on wildlife is to provide a sound foundation for wildlife conservation and management efforts. This objective, however, is often jeopardized by misinterpretation of the very science that professes to safeguard wildlife. The paper argues that imprecise or lax use of the terms habituation, sensitisation and tolerance can lead to misinterpretation of research findings, with unintended and potentially dire consequences for wildlife communities. The most noticeable example is colloquial use of the term behavioural habituation, to refer to any form of moderation in wildlife response to human disturbance. Because habituation is widely assumed to be a positive outcome for wildlife, such a misclassification can lead to inappropriate management decisions including an easing of conservation efforts. Therefore, this paper urges that classification of wildlife response as habituation should not be done without considerable scrutiny. This paper demonstrates that most cases of presumed habituation or sensitisation actually represent differences in the *tolerance levels* of wildlife to anthropogenic activity (Fig. 1). This distinction is important because there are various mechanisms by which different tolerance levels can arise and by which habituation- and sensitisation-type responses can be explained (Bejder *et al*., 2006b). By characterizing explanatory mechanisms as learning, physiology, selection or ecology, the paper shows that only one mechanism will result in true behavioural habituation (or sensitisation), while others likely will have detrimental outcomes for targeted animals. WW2 presents a framework for literal and standardised use of terminology and an empirical technique for discerning among explanatory mechanisms to detect true habituation and sensitisation responses.

The sub-committee welcomed the paper and emphasized that absence of response does not necessarily mean absence of impacts; i.e. there may be unseen population level impacts due to stress.

SC/59/WW4 established the theoretical and empirical contexts informing our current understanding of the impacts of boat-based tourist interactions with cetaceans. It then introduced the conceptual Levels of Acceptable Change (LAC) framework developed by Duffus and Dearden (1990) as a platform upon which to discuss management of tourism impacts on populations of wild animals. Bejder noted that this framework is a good companion to the PCAD model (National Research Council, 2005) that was introduced and agreed upon last year as useful for considering the potential for human activities to have population-level consequences for cetaceans. These elements then serve as a basis upon which to propose an integrated framework to address the long-term sustainability of visitor interactions with wild populations of marine mammals. The proposed conceptual framework was discussed in terms of the integration of four key stakeholder groups; the commercial tourism operator, the research community (both natural and social scientists), policy-makers and management agencies. In discussing this framework it was concluded that given the critical contribution of science to sustainability, rigorous research and comprehensive monitoring must become an integral part of sustainable management.

Lusseau presented Smith *et al.* (2007). The study assessed factors influencing tourist satisfaction and long-finned pilot whale reactions to boat interactions in Cape Breton Island, Nova Scotia, Canada. They found that whalewatchers were more satisfied when: they had more encounters with whales during a trip; these encounters lasted longer; and when there was less cloud cover. In contrast, whales were significantly less likely to move towards the whalewatching boat than they were to stay equivocal or move away from the boat as the encounter progressed. The authors suggested using results from both dimensions of this whalewatching system (whale biology and tourist sociology) to define an optimal trade-off in how long encounters should last, minimising the reaction of the whales to the whalewatching boat and maximising the satisfaction of tourists.

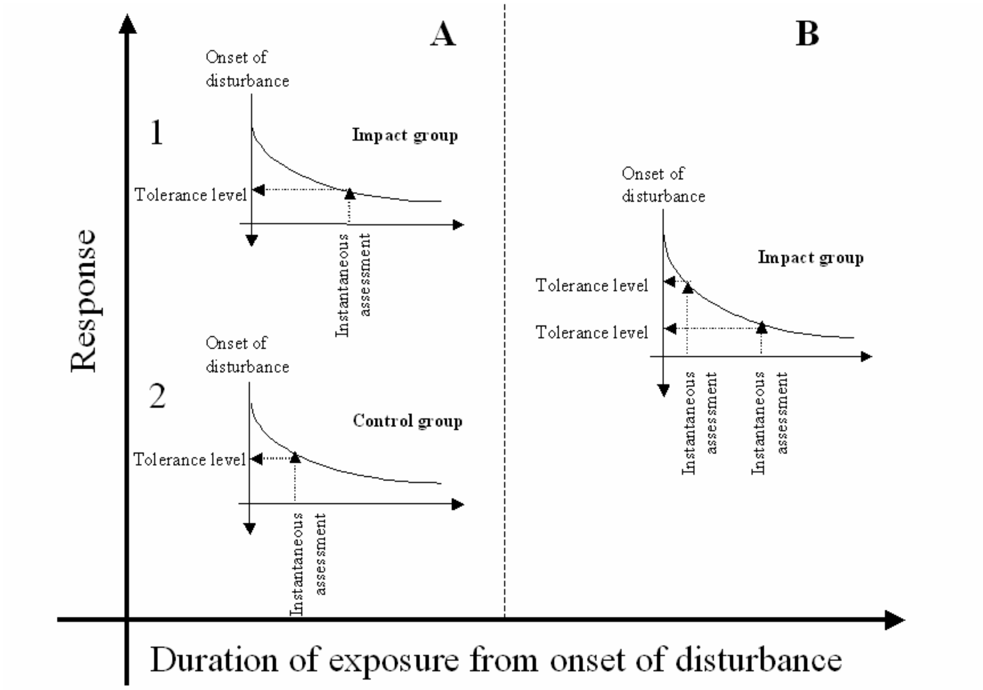

Fig. 1. Examples depicting two study designs typically used for assessment of anthropogenic impact on wildlife. The origin represents the time of onset of the disturbance factor; the x-axis denotes duration of exposure to the stimulus, and the y-axis represents corresponding levels of response to the stimulus. Figure 1a depicts an instantaneous comparison at one point in time of responses between an 'impact' (1a-1) and a 'control' (1b-2) group that have different durations of exposure. Figure 1b depicts a sequential comparison at two points in time of responses measured within one community at different exposure levels. Note direction of y-axis in small insert figures: tolerance levels increase as response levels decrease (large y-axis).

One member commented that it may be dangerous to use this approach to set regulations because it may not be taking into consideration minimal interaction quality needed for the whales. Lusseau replied that indeed in some instances the optimal trade-offs will not be considered sustainable. Lusseau provided an example of how LAC then become crucial in determining best practice (Figure 2). In this instance the LAC in the likelihood that the whales would abandon habitat was set at 15% prior to the industry starting. The optimal trade-off between visitor satisfaction and habitat disturbance is well below the LAC and therefore the LAC is retained to determine the maximum number of interactions that can occur within a whalewatching trip (11 interactions per trip).

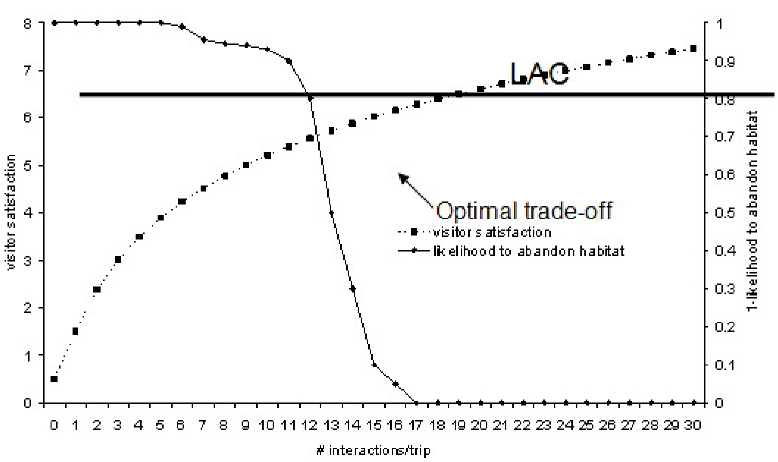

Fig. 2. The relationship between the number of interactions within a whalewatching trip and passenger satisfaction and the likelihood the whales will abandon the habitat in which whalewatching occurs (conceptual example).

Lusseau further commented that in real terms, optimal situations need to be defined as multi-dimensional systems (Figure 2 gives a simple example) in which multiple stationary states can be defined at the intersections between LACs (biological, economical, and sociological) and optimal trade-offs. This approach will allow defining and quantifying sustainable solutions, along with their resilience to ecological and socio-economical changes.

The discussion noted the value of a model-selection based approach to data analysis, as opposed to a hypothesis-testing approach, and suggested that further analyses of this nature be encouraged. When combined with the approaches outlined in Bejder's two previous papers (SC/59/WW2, SC/59/WW4), these approaches may help resolve some of the issues that people studying the influence of whalewatching on whale populations have been struggling to answer. It was also noted that the paper suggested that reducing interaction time might reduce impacts and several other studies on regulatory compliance show better adherence to delimited interaction durations; therefore, a regulatory decrease in encounter time might be beneficial. The sub-committee encouraged further modelling work of this kind.

5.2 Methods

SC/59/WW18 reported on spatial analysis of 'Southern Resident' killer whale habitat use. Among other factors, vessel traffic has been implicated in the decline of this population. Requiem or refuge reserves present an obvious impact mitigation option, but run the risk of tokenism if arbitrarily placed. Recent studies reported that both northern and southern resident killer whales were most vulnerable to vessel disturbance while feeding (Williams *et al*., 2006; Bain *et al*., 2007a). Consequently, protecting foraging 'hotspots' (by creating vessel exclusion zones there) should confer greater conservation benefit to whales than by protecting habitat generically. The authors presented results from two analyses, using classification trees and GAM-based spatial models, from data collected during May-September 2006 in the inshore waters near San Juan Island, Washington State (USA) and adjacent Canadian waters. The spatial resolution of the study's prediction grid was chosen based on interviews with on-the-water boater education coordinators. This yielded a practical grid cell size within which boats could feasibly be excluded with existing financial resources and reasonable boater compliance. The results showed that minor adjustments to the boundaries of existing vessel exclusion zones would encompass habitat that killer whales used preferentially for feeding. A recurring theme in the use of MPAs to protect cetaceans is the need to identify areas that are large enough to be biologically meaningful while being small enough to allow real management of human activities within those boundaries. The authors felt that their approach, identifying areas that whales use primarily for activities in which they are particularly sensitive to anthropogenic disturbance, balances pragmatism and conservation benefit by identifying small, but important areas to prioritise for protection.

The sub-committee welcomed the approach used by WW18. It was noted that foraging habitat for cetaceans may relate to dynamic oceanographic conditions and could be temporary, rather than in fixed geographic locations, and it may be hard to continually change regulatory areas in a management framework. The authors hope to expand their analyses using existing longer-term datasets to assess whether there is stability in the locations of preferred feeding areas over time. The sub-committee welcomed expansion of this study and encouraged the authors to report on results of future studies.

SC/59/WW20 summarised a study on the impact of tour boats on the behaviour and energetics of bottlenose dolphins off Choros Island (Chile). During field work, swimming speeds and movements of the dolphins were recorded via theodolite tracking. Group behaviour was recorded in a focal group sampling manner and all behavioural events in a group, such as leaps and tail slaps, were scored. Mean swim speeds for each activity and the proportion of time spent for a specific activity were determined to calculate the energy budget of the dolphins. The energy expenditure of leaps was determined on the basis of the assessed leap heights, which require a defined speed. These quantifications of metabolic rate were derived from the author's previous physiological studies from captivity, where the energy expenditure of two trained bottlenose dolphins via respirometry was determined; dolphins performed a variety of activities before surfacing in a metabolic hood to breathe. Based on oxygen consumption, the power requirements of dolphins during swimming at different speeds could be calculated. Results are presented under item 5.4.

One member noted that one of the most important ways in which energetic costs can be measured in animals is through oxygen consumption, which can be measured through collecting respiratory data. The sub-committee encouraged researchers to incorporate such information into their work in order to more accurately measure energetic costs of vessel responses, as an important method in determining the potential for long-term effects from short-term response studies. Another noted that one problem with physiological studies is the limited number of animals used in these studies. Some members noted that further studies to at least increase sample size for species already available in captivity would be useful.

SC/59/WW24 examined the effect of whalewatching on humpback whales in Witless Bay, Newfoundland. Among other things this paper looked at effects of tour boats on whales. The project used three different methods to study whale reactions: a one-month cliff-top study in 2000, where respiratory variables, whale behaviour, and boat presence were recorded remotely; examination of whale behaviour from aboard whalewatching boats, using laser-range finder binoculars to determine vessel approach distances to whales simultaneously with the behaviour of the whales in 2003; and time-depth recorder tags to implement a BACI (before/after, control/impact) study that looked at changes in surface behaviour, respiratory variables and dive profiles to determine if there was a vertical component to the response of whales to boats. While the first two of these methods have been used in previous impact studies, this work represents one of the few cases to date where tag data have been incorporated into such studies and where multiple methodologies were used to determine effects of vessel approaches. Results of this study are presented under item 5.4.

It was noted that this multi-faceted approach provided insights into different scales at which vessels impact cetacean behaviour and biology and further work of this nature was encouraged.

5.3 Population-level effects

SC/59/WW14 reported on movements of vessels and 'Northern Resident' killer whales (*Orcinus orca*) from July to September (1991-94) in Robson Bight (Michael Bigg) Ecological Reserve, British Columbia, Canada. Killer whales were seen in all parts of the Reserve, but spent significantly more time near gravel 'rubbing beaches' than anywhere else. Overall, killer whales partitioned their time in the Reserve among resting (12%), rubbing (25%) and other activities (63%). Vessels, primarily commercial fishing vessels, were observed entering the Reserve over 12,000 times during the 4-year study. Boats did not appear to have marked effects on the numbers of whales in the Reserve. However, vessels did appear to affect the movements of the whales in this near-shore habitat. Whales were more likely to move to another area of the Reserve or to leave the Reserve entirely when vessels were present than when they were absent, and were more sensitive to vessels near the rubbing beaches than anywhere else in the Reserve. The authors noted that boats can displace whales from an area that has been designated recently as critical habitat for the population. The authors note that all vessel traffic in the area, not only commercial whalewatching boats, contributed to this habitat degradation trend.

Discussions at the whalewatching sub-committee at SC/58 included analysis of the long-term effects of whalewatching on small cetaceans, especially bottlenose dolphins. As a result, the IWC asked the Scientific Committee to consider similar studies on large whales (IWC, 2007; p. 2).

SC/59/WW23 presented an analysis examining whether whalewatching vessel exposure affected either the calving rates or calf survival to age two in humpback whales (*Megaptera novaeangliae*) on their feeding grounds off southern New England. Whalewatching started here in 1976, and grew through the early 1980s. Since then it has been among the most intense in the world, with over 15 companies, many operating multiple boats with multiple trips per day. Exposure was considered as either the total time an individual was 'watched' or the total number of interactions each whale had. Neither variable showed correlation to the calving rate (# of calves per individual/total # of years the individual was sighted). Because the two exposure variables were highly correlated to each other, only minutes of exposure was used in subsequent analysis. Logistic regression analyses were conducted using whether a female had a calf in a particular year as the dependant variable, and the female's identity, her exposure the year before pregnancy, exposure the year before calving, total lifetime exposure, and the year of calving as informative variables. The results predicted that animals with higher levels of vessel exposure when pregnant were *more* likely to return with a calf. Calf survival to age two was examined by including information on the mother's exposure the year when pregnant and with the calf, exposure during year 1, and the year of calving as informative variables. Results showed that calves whose mothers had *higher* exposure levels during pregnancy and during their first independent year were *more* likely to survive to age two. The year in which a calf was born was a more important predictor of survivorship than measures of whalewatching exposure, which compliments other studies that have shown annual variability in prey availability and habitat use patterns in this population (Payne *et al*., 1986, 1990; Weinrich *et al*., 1997). The findings indicate that strong maternal fidelity to specific feeding sites supersedes any effect of displacement for humpback whales, and no evidence was found for negative effects of whalewatching on reproductive parameters. The findings further suggest that in large whales, levels of whalewatching exposure may not necessarily be indicative of more biologically meaningful detrimental effects on either individuals or populations.

In discussion, it was noted that the study was conducted in an area that has extensive additional vessel traffic beyond whalewatching boats. The official Traffic Separation Scheme of the International Maritime Organization for commercial vessels going into and out of Boston Harbour bisects Stellwagen Bank, and traffic coming and going from Canada and the northern Gulf of Maine traverses Jeffreys Ledge. The area is also extensively used by commercial and recreational fishing boats. Thus, the whales in the study could be affected by other vessel noise sources as well as whalewatching vessels, although recordings have shown that noise exposure is stronger when whalewatching vessels are present. Another member asked how representative exposure of animals in the study was of total whalewatching exposure, since observers were only on a small portion of whalewatching vessels in the area. Although exposure indices in the study were definitely under-representations of actual exposure of individuals, adding additional exposure data would only strengthen the conclusions unless there was an inherent bias in selecting the individuals exposed in the study, and there is no reason to think that this is likely. Lusseau noted that it would be advantageous to introduce a habitat selection term in the analysis to assess whether was an interaction between whalewatching exposure and habitat selection (through food availability on both banks).

There was a question about removing first reproductive events from the database. Weinrich clarified that such cases were only removed if the presence of a calf was used as an indication of maturity prior to the assumed onset of maturity (8 years), and most initial reproductive events were, in fact, included in the study. Bejder noted the large significant year effect shown by the logistic regressions in survival of calves to age one and two, which was likely due to some aspect of prey availability, and questioned whether the residuals in the models could be used to determine whether there was an underlying effect attributable to vessel exposure. He urged the authors to carry out an analysis looking at the influence of food availability on reproductive success and noted that there are databases on food availability to explore such analyses. Weinrich accepted that this would be a valuable addition to the analysis, but also added that the year affect was not found when looking at calving in females, but only in predicting calf survival. Further, the year effect in calf return analysis was driven largely by three aberrant years: 1994-5, and 2003. The 2003 effect may simply have been due to the shorter interval since birth during which a former calf could be re-sighted; the other two years were likely due to prey scarcity on Stellwagen Bank during that period, which had also been noted in previous papers about the population (Weinrich *et al*., 1997; Rosenbaum *et al*., 2002; Clapham *et al.,* 2003). Some members concluded that therefore food availability needed to be accounted for in this analysis.

Corkeron, acknowledging that no relationship was detected between the level of whalewatching experienced by humpback whales and reproductive success of the whales within the population of interest, noted that the North Atlantic humpback population has one of the lowest rates of increase known for humpback whale populations worldwide. Despite difficulties in making inferences between humpback populations across ocean basins (as they are perhaps best viewed as quasi-replicates rather than true replicates), this introduces a caveat in interpreting this analysis.

The sub-committee welcomed the paper and its analytical methods, and suggested that these would be appropriate to use in other areas where such data were available. The sub-committee agreed that long-term studies in areas where whalewatching activities are taking place, especially those studies measuring vital rates over time, are extremely helpful in assessing whether changes in individual fitness and/or population-level effects were caused by whalewatching. The sub-committee encouraged IWC contracting governments to consider long-term funding for longitudinal studies.

5.4 Short-term effects

SC/59/WW1, a compilation of whalewatching research studies published over the past year, summarised three studies on short-term impacts. Delfour (2007) evaluated the impact of human activities (boat activity, kayak and dolphin-swim activity) on Hawaiian spinner dolphins (*Stenella longirostris*) during three successive summers (2001-2003) at one dolphin resting location. The study monitored dolphin behaviour, group dynamics and composition, the number of boats present and their activity within 40m of dolphins. Results indicated that: the abundance of dolphins was significantly less in the last year of study; human activity significantly increased in 2003 as did the number of boats/kayaks that frequented the area; and the number of swimmers was not significantly different across the consecutive years. When the data were pooled across the study period, results demonstrated a significant inverse correlation between numbers of dolphins and swimmers.

Stensland and Berggren (2007) investigated the responses of Indo-Pacific bottlenose dolphins (*Tursiops aduncus*) to whalewatching traffic. The study found that small numbers (*n* =1 to 2) of whalewatching boats did not result in changes in dolphin swimming patterns but as the number of whalewatching vessels increased, so did the amount of non-directional movement. These non-directional movements also increased when swimmers were placed in the water. Other behaviours that increased in proportion to tourism activity included 'tail-out' dives and the degree to which female dolphins engaged in travelling behaviour. The study considered that female dolphins were subject to whalewatching activity approximately 45% of the time whereas males were less exposed (38%), which was attributed to the greater dispersal and larger territory size of male dolphins outside the main dolphin-watching area.

WW1 also summarised two studies from Pipa, Brazil (do Valle and Cunha Melo, 2006; Santos *et al*., 2006), describing changes in the 'costero' or estuarine dolphin (*Sotalia guianensis*) as the result of exposure to boat traffic, including whalewatching vessels. Dolphins demonstrated behavioural changes attributed to whalewatching vessel disturbance, including increased dive times and group cohesion when boats were deemed to be closer than 100m. Significant changes in behaviour were linked to the speed and direction at which boats approached dolphins (rather than distance), particularly in groups of dolphins with calves.

The sub-committee thanked Parsons for compiling this useful document and agreed that the work should continue for presentation at next year's meeting.

SC/59/WW9 presented a study to evaluate the appropriateness of distance limit regulations in the Azores. For that purpose, land-based observations using a theodolite were carried out south of Pico Island during the whalewatching high season. Sperm whales and bottlenose dolphins were the two target species of the study. Sperm whales were especially sensitive to boat distance, whereas bottlenose dolphins did not show a clear pattern of short-term responses. Intense whalewatching boat pressure was detected in the study area. Findings from this study suggest that distances defined in the regulations were appropriate, but particular concern arose due to the high whalewatching traffic observed in the study area.

SC/59/WW24 looked at the impact of whalewatching boats in Witless Bay, Newfoundland. A cliff-based study found that whale blow intervals increased with the number of whalewatching boats that approached the whales. Aerial behaviour was more common when boats were present than when they were not, and increased with the number of whalewatching boats. Operators had agreed on a code of conduct that included a 100m minimum approach distance. Studies on board the boats using laser range-finder binoculars suggested that while whale behaviour did not vary when the code was complied with or not, the whale's blow interval significantly increased with an increasing number of infractions per minute. The length of the interaction had no effect. Time-depth recorders were used to examine vertical and horizontal avoidance responses. Whales showed no difference in diving behaviour regardless of whether the code of conduct was followed; their index of linearity was lower during boat interactions as compared with control periods, and their travel speed increased in exposure and post-exposure phases. However, when the code was violated, numbers of trumpet blows (forceful exhalations) and tail slashes, implicated in many other studies as disturbance responses, increased during the exposure phase.

Although sample sizes were limited in each study, complimentary findings provide a picture of humpback whale response strategies. Whales could be using a two-step horizontal avoidance. In cases of low disturbance (*i.e*., one boat approach following the code), whales respond with increased speed and possibly a more irregular path. A circuitous escape-route could signify less distance travelled, therefore allowing whales to remain in the same area. This could be particularly important for whales that are engaged in important feeding activities in restricted areas where concentration of fish above a certain threshold makes it energetically convenient to feed (Piatt and Methven, 1992). In more intrusive interactions (*i.e*., more than two boats or a higher number of infractions), whales may abandon short-range avoidance mechanisms and start travelling. Due to methodological limitations, individuals could not be followed long enough to confirm this impression; however, similar responses have been found for other species in other locations (Williams *et al*., 2002; Jahoda *et al*., 2003; Lusseau, 2005). In these instances, the fact that boat traffic can force animals to swim away from food may carry consequences for fitness.

In discussion, it was noted that the results show consistency with other studies where responses incorporate changes in swimming speed, indices of linearity, and respiratory variables, suggesting that this commonality should be explored further. Weinrich replied that while it is true that the whales in WW24 showed these responses, the results showed a decrease in linearity, and an increase in blow rates, both of which are the opposite of the responses in many other studies. However, he noted a previously-detected common response across mysticetes to decrease their surface to dive time ratio in response to surface disturbances.

SC/59/WW20 examined how the activities and energetics of bottlenose dolphins are affected by boats. Another focus was the dolphins' strategies to avoid boats. The results of this study indicate that close boats (<100 m) affect the behaviour of bottlenose dolphins more strongly than boats further away (>100 m). Close boats induced a decrease of certain types of behaviours, such as feeding and resting, while other behaviours increased. Furthermore, dolphins left their preferred residence area, when many boats stayed for a longer time in their surroundings. Based on activity budget, average swim speeds, and leap frequencies, the mean energetic requirement of dolphins was shown to have increased. In light of these findings, a number of recommendations for dolphin-watching guidelines are presented, such as a limitation on boat numbers, the establishment of minimum distances, and conduct related to different types of behaviour.

While the sub-committee applauded the approach of combining metabolic rate measurements from captive studies with field observations, it noted that there were substantial flaws in the experimental and analytical design, including pseudo-replication and not accounting for auto correlation in behaviour, which meant that the data need to be revisited. Ritter noted that Yazdi would welcome comments from the sub-committee on these analyses.

Two companion papers (Bain *et al.,* 2007a,b) reported on a study examining the influence of boat traffic on Southern Resident killer whales conducted from 2003 to 2005 off San Juan Island, Washington. In this location, boat traffic is ubiquitous in the areas heavily used by whales, which eliminated the possibility of conducting experiments to assess the effects of boat traffic on whale behaviour or activity budgets. The first study used a variety of techniques to collect and analyse data across the widest possible range of traffic conditions (especially at the low-traffic end of the scale) for holding confounding effects statistically constant to measure the remaining effects of anthropogenic stimuli. Bain *et al.* (2007a) presented variations in activity states of killer whale groups using scan sampling, in relation to the number of vessels present at various distances from focal groups.

Vessel interactions lead to a reduction in time spent foraging as was observed in Northern Resident killer whales in a previous study (Williams *et al*., 2006). The size of this vessel effect decreased as the distance between vessels and whales increased. There was no significant difference in vessel effects observed among pods. Bain *et al.* (2007b) reported results from studies of fine-scale behaviour of individuals using theodolite tracking. Theodolite tracks were summarised in terms of swimming path directness and deviation indices, travel speed, and rates of respiration and surface active display behaviours. Vessel number and distance were used in a generalized additive model along with natural explanatory variables for differences in whale behaviour. Path directness varied with number of vessels and distance to vessels. Increased distance travelled in the presence of vessels could result in increased energy expenditure relative to whales that could rest while waiting for affected whales to catch up. The likelihood and rate of surface active behaviour varied with number of vessels. Number and proximity of vessels were also related to variability in respiratory intervals, path deviation index and swimming speed. Each killer whale group was within 400m of a vessel most of the time during daylight hours from May through September. The high proportion of time Southern Resident killer whales spend in proximity to vessels raises the possibility that the short-term behavioural changes reported here can lead to biologically significant consequences.

The sub-committee welcomed this new information, and noted that it illustrated the validity behind the sub-committee's oft-repeated recommendations that vessel interaction studies begin before whalewatching traffic reaches a saturation point. The sub-committee noted that while these studies provide evidence that habitat degradation is influencing whale behaviour and activity budgets, it is currently unclear whether this effect is driven by acoustics or boat behaviour.

The authors noted that acoustic impact assessments are ongoing. Some members asked whether vessel exclusion zones could help to increase the sample size of no-boat tracks and increase statistical power. The authors responded that this approach has been tried, and received good compliance from commercial operators. Private boaters, however, routinely disrupted 'control' observations. The authors noted that this approach would need to be thought through carefully because boat-free zones might represent a substantial departure from the current baseline conditions. In fact, it is currently unclear whether a new, boat-free zone would form an experimental treatment or a control.

It was suggested that the quantification of interactions between whalewatching effects and existing physiological and ecological factors be taken forward. Discrepancy in cost of transport between species with different body size means that horizontal avoidance of vessels will be relatively less costly for large-bodied species in comparison with smaller species. Therefore the relative energetic cost of short-term effects, and their long-term consequences, will vary with body size. Similarly, gregarious species have to take into consideration the costs and benefits of leaving their group if that group decides to avoid an interaction. The added cost of transport may then be expensive to them, but not expensive enough to supersede the benefits of group membership (decreased predation risk, for example). This may lead individuals to make decisions that will lower their overall fitness. The fitness decisions made by individuals will also affect the fitness of associates in social species. Unintentional changes to social bonds brought about by a segregation of individuals due to vessel disturbance may diminish the ability of individuals to rely upon long-term social networks, with unknown long-term repercussions.

It was noted that many studies have been produced in the past 10 years using similar behavioural proxies (for example, deviation index and respiration rate) to assess short-term effects. A meta-analysis of these studies will help exploring the influence of these factors on whalewatching effect size. It was proposed that such a meta-analysis be presented at the next meeting of the sub-committee. In discussion, it was noted that the intent was not to present an exhaustive list of the potential physiological and ecological factors that may affect the long-term consequences of short-term effects.

The sub-committee agreed to form an intersessional working group to:

1) prepare and carry out meta-analyses on published behavioural responses of cetaceans to vessel traffic.

These will include:

i) meta-analysing the effect size of vessel interactions on movement patterns (*e.g.*, deviation indices) and respiration rate; and

ii) assessing how the specific response (*e.g.*, altering animal movement indices such as path linearity, swimming speeds or respiration rate) and magnitude (*i.e.*, effect size) of responses vary with body size and across taxa.

Lusseau agreed to Chair the intersessional working group.

6. DATA SOURCES FROM PLATFORMS OF OPPORTUNITY OF POTENTIAL VALUE TO THE SCIENTIFIC COMMITTEE

SC/59/WW1 summarised an innovative study by Hauser *et al.* (2006) that investigated data gathered by whalewatching operators in British Columbia (Canada) and Washington State (USA) targeting resident killer whale populations. Data on sighting location and killer whale pod composition collected from a shore based survey was compared with data gathered from whalewatching boats. It was discovered that distributional data was accurate (91.7% correct). There are many species where sightings and distribution data are valuable and the accuracy with which these data were collected by whalewatching operators is encouraging. Hauser *et al.* noted that "…*in developing nations with expanding ecotourism endeavours, whalewatching platforms may present a cost-effective method to accumulate basic information*" and that on a wide scale "*it is proposed that data provided by commercial whalewatching operations can be applied to spatial analyses*", with appropriate consideration for some of the limitations of the data collected.

M. Simmonds introduced SC/59/WW11 on behalf of its author. The paper relates to the 'Dolphin Space Programme' (DSP), which is an accreditation scheme for wildlife tour boat operators in the Moray Firth, Scotland. Launched in 1995, the aim of the DSP is to encourage wildlife cruise operators and the public who go out to observe dolphins and other marine wildlife to 'watch how they watch' and respect the animal's need for space. The DSP aims to be a model of excellence for responsible wildlife tourism and to support the sustainable, positive development of marine wildlife watching in the Moray Firth, Scotland. It has amongst its stated objectives "reducing the potential impact that cetacean-watching boats can have on the status, distribution or behaviour of the Moray Firth bottlenose dolphins". Simmonds noted that a full time officer had been appointed to the DSP some 18 months ago and that this provided the opportunity for research to further investigate the impacts of whalewatching which was almost exclusively focused on the small resident bottlenose dolphin population. It was also noted that the long-term nature of ongoing research led by the University of Aberdeen in the Moray Firth could facilitate this. WW11 provided some background to ongoing research collaborations being facilitated by the DSP, including student placements and providing recording forms to operators. Simmonds suggested that the DSP team would be pleased to receive advice from the whalewatching working group and emphasised the potential importance of the Moray Firth in future dedicated studies.

SC/59/WW21 reported on cetacean sightings made during a journey on the North Atlantic Ocean on board a commercial cruise ship. Systematic data on sightings and effort were collected and the orientation of cetaceans in relation to the vessel was documented. Sixty-three sightings were made, comprising nine cetacean species. Ship time provided by cruise operators can constitute a cost-effective way to collect data, which otherwise might be difficult to obtain.

The sub-committee recommended that information about sampling effort and observational procedures be incorporated, to enable use of this type of information for density estimates and/or habitat use over time. Cruise ships may transit across poorly sampled areas and therefore provide a valuable platform of opportunity to collect information relevant to the Scientific Committee. The sub-committee referred to previously established procedures to implement this type of sampling, such as described in Williams *et al.* (2006).

Ritter (2007) summarised observations made during a long-term research programme on cetaceans off La Gomera, Canary Islands, conducted from whalewatching boats and reporting on behavioural responses of rough-toothed dolphins towards a dead newborn calf. The first sighting was made on 25 April 2001 when a group of 15–20 rough-toothed dolphins was spotted. An adult dolphin in the group was observed with a dead newborn calf, continuously pushing the carcass toward the surface. During the following five days, what appeared to be the same group was resighted five times, for a total observation time of 4 h 40 min. The observations here represent one of very few examples of this type of behaviour being documented over a period of several days. The recorded behaviour underlines the highly social nature of the species and the sub-committee noted the importance of platforms of opportunity to shed light on behaviours rarely observed in cetaceans.

Ritter presented Joergensen (2007), a report of the first photographed observation of a harbour porpoise in Svalbard in July 2006. The expedition leader of a cruise ship observed a single harbour porpoise in front of the Monaco glacier in Liefdefjord. The animal approached the boat and was photographed to confirm the identity of the species. The observation is significant, as the northern-most recorded observation for this species previously was in northern Norway, 525 nautical miles (975km) south. This single observation has therefore expanded the range for this species considerably. The sub-committee noted that rare sightings of this nature again demonstrate the value of platforms of opportunity.

It was noted in discussion that not every observation from every vessel can be considered valuable 'data'. However, since it is often true that vessels conduct repeated cruises along the same track lines across a season, rigorous standardized protocols may be used in such situations to obtain repeated sightings to measure density, seasonal changes in abundance, and other factors. Other studies using ferries as platforms of opportunity were noted as a source of valuable published data (*e.g*., Williams *et al.,* 2002; Weir *et al.*, 2004) and suggested that their methodologies should be applied whenever possible.

The sub-committee acknowledged the significance of the data presented in these studies as well as the value of photographic documentation of species and behaviours, particularly those rarely observed. They further noted the importance of publishing such information, even though it might not be collected by professional researchers. The sub-committee therefore agreed on the importance of data collection on board platforms of opportunity such as whalewatching boats, cruise ships, ferries and other types of vessels and recommended the documentation of cetacean sightings and behaviours via photography/video whenever possible. They further recommended the publication of new information based on such verified documentation of species and behaviours in peer-reviewed journals.

As an example of the type of data that can be collected from whalewatching vessels, Stockin *et al.* (2001) analysed common minke whale surfacing data in northeast Atlantic waters gathered over a period of three years on board whalewatching boats (1367 dive sequences in total) from a survey area covering 450km^2. The study showed significant changes in surfacing rates both throughout the season and during the day. Data collected during this study is the most substantial data set of minke whale surfacing rates in the northeast Atlantic and may have implications for calibrating line transect surveys and minke whale abundance estimates.

Robbins presented the work of the intersessional working group to identify data sources from platforms of opportunity of potential value to the Scientific Committee. The IWC already requests information about opportunistic data collection in Section 2.1.2 of the National Progress Reports. In response to a query, Robbins indicated that Progress Reports are being mined for this information, but that the ad hoc nature of these entries makes this somewhat difficult. She indicated that it could be helpful to provide additional guidance to compilers in that section of the report template. The sub-committee therefore encouraged modifications in the template instructions for opportunistic data reporting in the National Progress Reports requested by the IWC, as follows:

Opportunistic, platforms of opportunity. In 2004, the Committee agreed that details on the data collected by whalewatching vessels and other opportunistic platforms should be included (IWC, 2005b). Opportunistic platforms are those primarily engaged in non-research activities, such as whalewatching boats, cruise ships, ferries and Coast Guard vessels. Give brief details of work carried out, with references where appropriate. Please give the primary responsibility of the person collecting the data (*e.g*., vessel crew, naturalist or dedicated observer). Identify one or more types of data collected (separate by species, area and organisation). Types of data may include: sightings (*e.g*., count, time and location), survey effort, environmental data, photo-ID, animal behaviour or other (please specify). Use an asterisk to identify types of data contributed to a separate archive (such as a regional photo-ID catalogue), and provide the location of that archive in last column. Please make separate entries for each species, area and/or institution.

Robbins further noted that the database already compiled will be transferred to the Secretariat at SC/60 to facilitate queries by any member of the Scientific Committee.

The sub-committee welcomed the work of the intersessional working group and agreed it should continue to:

1) monitor and evaluate opportunistic data collection programs world-wide, particularly those using whalewatching platforms;

2) encourage scientifically sound and management relevant data collection methods; and

3) facilitate the Scientific Committee's access to opportunistic data sets that may be relevant to its work.

Robbins agreed to chair the intersessional working group.

7. OTHER ISSUES

7.1 Whalewatching in Alaska

Gabriele presented a report from the National Oceanic and Atmospheric Administration (NOAA), the United States agency responsible for most marine species, on whalewatching in Alaska. The Alaska whalewatching industry is highly seasonal, occurring mostly in the summer months, in coastal areas near major tourist hubs such as Frederick Sound, Icy Strait, Sitka Sound and Resurrection Bay. The main target species are humpback whales and killer whales. The whalewatching industry has developed in Alaska in the past two decades in parallel with the increase in the humpback whale populations. The high degree of site-fidelity of humpback whales to specific geographic areas yields reliable concentrations of whales from day to day and year to year, which are targeted by whalewatching vessels. Like many other areas, a variety of vessel types participate in whalewatching in Alaska, but the practice of whalewatching from large cruise ships (~300 m length) is probably unique to Alaska.

To minimize the potential for harassment and the possibility of collision, NOAA implemented regulations in 2001 that prohibit approaching humpback whales closer than 100 yards in Alaskan waters, prohibit disruption of normal behaviour and prescribe a slow, safe speed near whales. Whale protection regulations in Glacier Bay National Park include a minimum humpback whale approach distance in all park waters (1/4 mile) and vessel course and speed restrictions on an as-warranted basis in the specific areas of Glacier Bay where whales are concentrated.

Numerous incidents of vessel interactions with humpback whales have been documented in Alaska, including harassment and fatal and non-fatal collisions (see SC/59/BC16). Several studies of the effects of vessel traffic on whales have been conducted over the last several years.

At the present time, the Alaska office of NOAA does not advocate the use of whalewatching vessels as research platforms. Although whalewatching operators and passengers are often generous in contributing humpback whale and killer whale identification photos to researchers, the agency does not actively solicit or promote data collection from this industry. However, there is whale location data collected from state ferries and some whalewatching companies.

Humpback whale approach regulations and marine mammal viewing guidelines are widely circulated to the industry and available on the NOAA website. The agency regularly communicates with various stakeholders working to manage and monitor human impacts on whale populations in Alaska. Nationally, NOAA collaborates with Watchable Wildlife, Inc. to promote responsible whalewatching and marine mammal viewing. NOAA presented information on marine wildlife viewing issues at the annual Watchable Wildlife, Inc. conference in November 2006, held in Anchorage, Alaska. Additional outreach efforts are needed to address an increasing pool of visitors, as well as new operators, who may or may not be knowledgeable about local whale species and responsible viewing behaviour.

The sub-committee thanked Gabriele for presenting the information. It was noted that with organized outreach there could be buy-in by the operators for a data-collection program. If researchers then reported results back to operators they might feel they have an investment in the resource.

One member asked about whalewatching regulations in Glacier Bay and if there were any baseline data to support such rigorous regulation. Gabriele replied that there was a serious problem in the late 1970's and 1980's. Research was conducted and its results, along with some common sense, were used to develop regulations. In addition, acoustic measurements showed that slower moving vessels are quieter than faster moving ones. She further noted that most vessels are in transit to the glaciers and not whalewatching as such. One member questioned why there was regulation only for humpback whales and not other species. Gabriele replied that in the United States, humpback whales are a legally protected endangered species as well as a popular target for whalewatching. It was also noted that much of the whalewatching in Glacier Bay was from cruise ships, which can not manoeuvre around whales in the same manner as smaller boats, so a greater minimum approach distance was appropriate. Gabriele noted that the regulations apply to all vessels in the park.

Straley reported on a study design to use ferries to gather survey data and to help assess collision risk. However, the study was not carried out due to lack of funding. The sub-committee expressed interest in the study design for application in other situations and Straley agreed to submit a paper detailing the design for next year's meeting.

The sub-committee recommended that basic information about the size of the industry be collected in all regions in which cetacean-watching industries exist. This includes information about the number of companies operating dedicated whalewatching tours, as well as marine cruises that target cetaceans as part of their tours. Other information needed includes the number and type of vessels operating, routes used by the vessels and general socioeconomic information about the industry. This information is crucial to place short-term impacts in context when working to understand their biological relevance.

7.2 Discuss and organise a workshop on the strategic planning of large-scale whalewatching research

Last year the Scientific Committee agreed that it was necessary to concentrate research effort on understanding the interactions between whalewatching impacts on cetaceans and other anthropogenic disturbances and ecological factors. To do so, the sub-committee proposed that a dedicated workshop to develop a global scale research design would be very helpful to this process and recommended that such a workshop be held. SC/59/WW17, a report of the intersessional working group, proposed a programme for this workshop to design a study that will be replicated at different sites, and to select appropriate sites where it will be carried out. Participants will be asked to review pertinent pre-existing data before the workshop to present a review to the workshop participants. Teams will be set up before the workshop to tackle each broad data category (impacts, long-term study sites, whalewatching exposure). The goal of this exercise will be both to find study sites for which some relevant information, such as population biology or whalewatching information, is already existing and to draw attention to studies that have already highlighted interactions between whalewatching impact and other environmental factors (natural or anthropogenic). After reviewing the pre-existing information, a robust study design will be developed to detect biologically significant impacts of whalewatching on individuals and populations. This study will focus on: whether whalewatching can alter population biology parameters, whether whalewatching can act as an evolutionary selective force on targeted individuals and populations, and endeavour to detect the mechanisms involved in these impacts. A draft list of candidate species and the specific populations that would make ideal study subjects will be developed to maximise the precision and implications of the results while minimising the number of study sites involved. This list will then be compared with sites highlighted in the review and desirable sites will be selected. The working group proposed to hold this workshop for two days before next year's IWC meeting.

There was a discussion on the feasibility and logistics of the large-scale research project subsequent to the presentation. Potential participants will be contacted this year and, if willing, will be asked to provide papers providing significant contributions to agenda items described in the programme. These papers will then be circulated prior to the meeting. This will speed up the information process to save time for discussions during the workshop. In addition to participants, there will be observers, including stakeholders local to the potential research sites, present at the workshop.

Sub-committee members stressed the need to have participants that will have a good understanding of how to sample oceanographic and prey information in a wide variety of habitats. In addition, it will be necessary to have contributors who have experience running large-scale international research projects (cetacean or non-cetacean) and an in-depth knowledge of current field sites. One member commented that this project may be too inclusive and therefore may become practically unfeasible. However, the sub-committee felt that there was a need to shift the way that we approach the issue of whalewatching disturbance. *Ad-hoc* studies of whalewatching impact assessment have been carried out for more than 20 years and yet we still do not have a solid grasp on the general principles governing the disturbance created by boat interactions with cetaceans and their consequences. Only a coordinated large-scale and long-term project will be able to get at this issue. Another member noted that this project presents a unique opportunity to more widely understand how anthropogenic activities disturb and impact the lives of cetaceans.

The working group described ideas on how the project could be deployed feasibly. The project would be centrally coordinated by a full-time team. Field sites would be selected to allow for replication within a limited number of species and across a wide variety of environmental factors. This can be achieved with species such as humpback whales and bottlenose dolphins. In addition, other species would be selected to understand variations with life history processes. Once a set of measures is defined during the workshop, their relationships to boat interactions would be evaluated through experimental exposure at both control and impact sites within each field site. It is anticipated that a set of measures would be collected at every site and more in-depth studies would be carried out at specific sites. These experiments would be repeated through time to assess the interactions between those and other factors such as habitat quality (*e.g*., prey availability) and population biology parameters.

The sub-committee agreed that the intersessional working group should now be the workshop steering committee and should continue its work in preparation for a two-day pre-meeting workshop at SC/60 in Chile. Lusseau agreed to Chair the steering committee, which will outline terms of reference for the workshop.

7.3 Swim-with-whale operations

SC/59/WW6 was an update on the development of a questionnaire for swim-with-whale-tourism operators and researchers. The questionnaire is an attempt to get more in-depth data on operational procedures when people are placed in the water with large whales. A draft questionnaire was developed and given to two companies on the northern coast of the Dominican Republic, where humpback whales are regularly watched. However, no responses were received in time for SC/59. Efforts will continue and an update of the questionnaire and its reception by whalewatching companies will be submitted to the Scientific Committee as soon as possible. Rose invited members of the sub-committee to contribute suggestions for the questionnaire.

The paper also noted an incident during a swim-with-whale encounter that resulted in serious injuries to three tourists in the Dominican Republic. The incident occurred when the tourists, who were snorkelling from a whalewatching vessel and drifting with the current, were brought close to a resting mother and calf. The mother 'woke up' and reacted violently to their proximity, slashing with her tail and breaking one man's leg and knocking another snorkeller unconscious. This incident highlights that swim-with-whale guidelines that discourage active approaches to the animals are not sufficient to safeguard swimmer safety. Given the previous concern of the effect of swim-with programmes on mother-calf pairs, this was of interest to the sub-committee.

The sub-committee agreed that the intersessional working group should continue its work and report to next year's meeting. The focus of the intersessional work this coming year will be to:

1) identify local researchers who can serve as liaisons with whalewatching operators, to maximize the probability of questionnaires being accepted, filled out, and returned; and

2) distribute a sufficient number of questionnaires to ensure approximately a half dozen returns, whose results will be reported to the sub-committee at SC/60.

Rose agreed to chair the intersessional working group.

SC/59/WW12 reported on swim-with-dolphin activities in the Azores. Since boat-based whalewatching activities in the Azores began in the early 1990s, swim-with-dolphin activities have increased. Regulations permit two swimmers to be in the water at the same time during encounters up to a maximum duration of fifteen minutes. Five species of dolphins are targeted for in-water-encounters. There are currently six operators on two islands offering two types of trips: a) Same-day swim-with trips, lasting 3-4 hours with little or no instruction. Tourists are taken out to sea and, in the event of an encounter with dolphins, they are allowed to enter the water; b) Guided swim-with tours that offer natural history information and instruction for clients whilst trying to ensure the least possible disturbance to the dolphins. Swimming and snorkelling ability is checked and instruction given to clients on how to enter the water and move so as to eliminate as much noise as possible. During the excursions, dolphins are first observed from the boat; the skipper assesses the possibility of initiating a swim-with encounter.

Same-day trips can create non-compliance pressure on operators. These excursions take place in the North Atlantic Ocean, in deep offshore waters and sometimes in rough weather conditions where dolphins are not habituated to humans. Guided swim-with tours take the pressure off the companies and the skippers to produce 'instant' in-water encounters.

One member clarified the Regional Law in the Azores that regulates the whalewatching activity there. The law strictly forbids swimming with great whales and specifically states that swimming is only allowed with *Delphinus delphis, Stenella frontalis, Tursiops truncatus, Grampus griseus, S.*

coeruleoalba and Steno bredanensis. He further noted that swimming with dolphins is a product that is promoted only by a fraction of the enterprises. Concern was raised that WW12 could be misinterpreted regarding the number of boats engaged in the activity on the same occasion. In fact, at peak season, an average of two or three boats is typically engaged in swim-with activity simultaneously, normally in different geographical areas.

7.4 Review of whalewatching guidelines and regulations

Carlson reported that the compendium of whalewatching guidelines and regulations around the world has been updated and is available on the IWC's website.

SC/59/WW1 presented several recently published studies investigating compliance with whalewatching regulations. Whitt and Read (2006) studied the level of compliance with dolphin-watching regulations in Clearwater, Florida. From 1 to 11 boats were within 100 yards of encountered dolphin, 15% of which were other dolphin-watching vessels. A third of these vessels jet skis, which often approached closer than 50 yards. Dolphin-watching companies obeyed guidelines for approach distances on average 57% of the time. More than half of the instances when guidelines were flaunted involved close approaches and manoeuvres intended to entice the dolphins to bowride or jump over the wake of the boat. Conversely, none of the operators stayed with dolphins for more than 30 minutes, with most encounters with dolphins being less than 15 minutes. During approximately a quarter of the dolphin encounters, animals displayed behaviours associated with 'disturbance', mostly when boats were within 50 yards of dolphins or when calves were. None of the companies showed total compliance or obeisance to the guidelines and on average there was compliance only 60% of the time. Of the regulations, only the "duration with dolphins-guideline" was completely adhered to and the guideline least adhered to was the one "that requires knowledge of dolphin behaviour" (Whitt and Read, 2006).

Cunningham-Smith *et al*. (2006) conducted a study in Sarasota, Florida, to evaluate the level of human/wild dolphin interaction in a three phase study. The first and third phase involved land-based surveys. The second or 'docent program' phase when a well-marked vessel monitored behaviour of boaters near dolphins (and approached illegal actors). During the first phase, 20 human/dolphin interactions were observed on average per hour. Of these, 26% involved touching/trying to attract dolphins' attention and 10.9% involved feeding. During the second phase, 1.3% of boats that passed through the study area engaged in illegal interactions with dolphins, despite the presence of the clearly marked docent program vessel. Boats performing illegal interactions were approached and interestingly 61% of those approached were aware of regulations and had disregarded them. During the third phase, a single dolphin ('Beggar') was followed and 3.7% of vessels attempted to feed the dolphin and 2.6% attempting to touch the dolphin. It was noted that the dolphin was observed eating 84% of the items that it was offered, nearly half of which were non-natural human foodstuffs such as fruit, potato chips and nuts. This feeding is clearly a risk to the dolphins in the region.

Cunningham-Smith *et al*. (2006) reported that the number of illegal interactions, although still occurring, decreased significantly during the docent program phase, presumably due to the presence of a clearly marked vessel and enforcement personnel.

In discussion of this issue and previous papers (*e.g.*, SC/59/WW4), the usefulness of social science data for managing whalewatching impacts and regulatory compliance was noted.

SC/59/WW3 presented a series of recent events that collectively represent a paradigmatic shift in the way commercial tourism encounters with dolphins are managed. These events also represent a significant step towards sustainable dolphin-based tourism. These events coalesced around an Australian ministerial decision that is unprecedented in terms of proactive management of tourist interactions with cetaceans – namely a decision to reduce the number of commercial dolphin-watch licenses from two to one in Shark Bay as a necessary sacrifice for the long-term sustainability of the area. It represents a socio-political complement to a science programme in which a demonstrated negative impact on cetaceans was considered to be unacceptable – thus exceeding the Levels of Acceptable Change (see SC/59/WW4). The wider significance of this development became apparent at the 2nd National Wildlife Tourism Conference (Fremantle, Western Australia, 2006). The conference represented the intersection of three timely events: 1) the completion and reporting of a five year programme of research (which drew upon over fifteen years of data collection) monitoring the impacts of commercial tourism at Shark Bay, Western Australia (Bejder *et al*., 2006a,b); 2) the subsequent ministerial decision (Minister for the Environment, Western Australia) in response to the research; and 3) a resolution from delegates at the National Wildlife Tourism Conference supporting that ministerial decision. This paper summarises these developments and considers their significance in terms of the sustainable management of wildlife tourism, both in Australia and elsewhere. It also notes that Shark Bay, a well managed site of relatively low level commercial dolphin-watching activities, carries important insights that should not be ignored, particularly when extrapolated to the many high-intensity dolphin-tourism sites around the world.

Bejder noted that an important component behind the Western Australian ministerial decision was based on the IWC Scientific Committee's (2006) recommendation to the Government of Australia to ensure that appropriate action was taken to restore the abundance and breeding success of individuals in the exposed area in Shark Bay. The sub-committee commended the Australian government for its decision.

The sub-committee noted the lack of action by the Government of New Zealand in response to the recommendation of the Scientific Committee last year to increase protection for the Doubtful Sound, New Zealand dolphin population as a matter of urgency. The sub-committee reiterated this recommendation and urged the New Zealand Government take note of the Australian ministerial decision.

Groch reported on progress to establish Control Areas in the Right Whale Environmental Protection Area, Santa Catarina, Brazil. During last year's meeting, the sub-committee reviewed a proposal to improve monitoring of the effects of boat-based whalewatching in the Environmental Protection Area, to further improve knowledge about the short- and long-term effects of boat-based tourism on southern right whales in Brazil, as well as to improve the design and implementation of management measures to ensure both the species' survival and the sustainability of the whalewatching industry. The Scientific Committee's recommendation that the proposal be implemented by relevant authorities responsible for the Environmental Protection Area was brought forward to the Brazilian authorities and acted upon. The sub-committee commended the Brazilian government for taking action based on the Scientific Committee's recommendations.

SC/59/WW5 was a review of a multi-stakeholder effort in Peru to promote sustainable cetacean watching. A local non-governmental organization (NGO), international NGOs, Peruvian government agencies, and the U.S. State Department have sponsored a project to foster the development of sustainable cetacean watching in coastal communities, as a viable economic alternative to dolphin poaching and an incentive to protect coastal habitat. In 2006 and 2007, numerous workshops took place in various municipalities and an international conference was held in Lima, to address various aspects of cetacean watching and cetacean conservation. Two documents, one a national strategy for developing sustainable cetacean watching in Peru (Austermühle, 2007) and one a generic plan for developing sustainable cetacean watching world-wide (Hoyt, 2007), have been produced as part of this project. Base-line research on bottlenose dolphins is on-going and dolphin watching pilot projects will be undertaken in the near future. Cetacean watching guidelines and monitoring programs will be established as soon as possible.

The sub-committee welcomed this collaborative initiative. It was noted that a similar program, initiated four years ago between Fundacion Cethus, the Whale and Dolphin Conservation Society (WDCS) and recently the Argentine Cooperation Agency (FOAR), is developing whalewatching workshops in Panama, Nicaragua, Guatemala and Costa Rica. These cooperative efforts enhance the sharing of information and experiences to develop (or improve) whalewatching activity. The sub-committee encouraged such initiatives wherever whalewatching activities occur or are planned and noted that the collection of baseline data before an industry had developed to any significant degree was ideal (see below).

SC/59/WW22 reported on the use of voluntary approaches (VAs) to achieve conservation goals. While popular, there are limited studies that quantitatively evaluate their efficacy. In the northeast United States, a VA was established in 1998 by the whalewatching industry in cooperation with government agencies and NGOs. Its intent was to avoid collisions with and harassment of endangered whales by commercial and recreational whalewatching vessels. One important aspect of the VA is three speed zones within specific distances to whales. To measure speed zone compliance, inconspicuous observers were placed onboard 46 commercial whalewatching trips from 12 companies in 2003 (n=35) and 2004 (n=11). Compliance was evaluated by creating speed zone buffers around sighted whales and overlaying them with vessel track and speed data. Speeds in excess of the VA were considered non-compliant. Whalewatching companies were routinely non-compliant (mean non-compliance level 0.78; range 0.74–0.88), some companies were more compliant than others, non-compliance was significantly higher in zones farther from whales, and vessels approached their maximum speeds in all zones. These results indicated that the VA did not achieve the conservation goal of substantially limiting vessel speed near whales. The failure is troubling because the case study represented near-ideal conditions for success.

In the discussion of WW22, it was noted that the New England guidelines being considered were somewhat unusual, as the speed component was developed specifically in response to an increasing number of collisions between whales and whalewatching boats in 1998, the year before the suggested speed limitations were introduced, with full cooperation from the whalewatching industry. However, some whalewatching companies in the area have been operating for up to 30 years, with the same operators often captaining the boats for much, if not all, or that time. These operators may not be willing to modify what they perceive as benign behaviour, even if it does not comply with guidelines that were added after the industry developed and they started running whalewatching cruises. Despite this lack of compliance, it was pointed out that the target animals for these operations are the same population for which the analysis presented in WW23 failed to detect any long-term effects of whalewatching exposure on reproductive parameters.

Nevertheless, the sub-committee agreed that it was clear from a growing number of scientific studies testing lack of guideline compliance that voluntary guidelines are often not effective and statutory regulations are preferable. The sub-committee recommended that whalewatching activities should be monitored for compliance and regulations should be actively enforced. However, the sub-committee also noted the area- and species-specific nature of whalewatching and the importance of using results from appropriately conducted studies and of considering local conditions in developing whalewatching regulations. The sub-committee encouraged the enactment of regulations that are science-based, but recognized that in some cases, regulations based on best practice will be most precautionary. In such cases, however, such regulations must remain dynamic and should be amended as research progresses. Further, convenience of enforcement should not be the primary underlying factor in developing regulations in the absence of scientific data.

SC/59/WW24 presented data on compliance with the Code of Conduct in Witless Bay, Newfoundland, Canada. Compliance of five vessels was measured on 39 whalewatching trips in 2002. Overall the code was violated on 69% of the trips. The mean number of infractions per trip was 1.3 ± 1.4 (max = 7). Infractions when boats entered the 100m zone were observed on 49% of the trips, while infractions within the 100 m zone were observed on a third of the trips. In 91% of the trips, boats were within 100m of the whales at least once during the interaction. In 83% of such cases, it was because the operators had breached the 100m exclusion zone, while in 17% of the cases the whales had approached the vessel.

This lack of compliance was unexpected as operators voluntarily signed up for the Code of Conduct in the previous year, and some were strong advocates. The author believes that skippers who commit infractions were often unaware that they were violating the code. The presence of investigators on board should have provided additional incentive to be cautious and adhere to the codes. As estimating distances at sea is difficult, this could be a factor in the failure to adhere to the 100m rule (Baird and Burkhard, 2000). Other possible factors include a lack of peer pressure, or the operator's generally benign view of their own actions (close approaches to whales).

SC/59/WW15 presented recommendations for whalewatching guidelines in the blue whale feeding area of southern Chile. Currently, there is high pressure to develop whalewatching on a regular basis. Any possible negative impacts generated by whalewatching activities may be intensified as the population is already endangered due to past exploitation and therefore more vulnerable to anthropogenic disturbances and changes in ocean conditions. In the absence of scientific data on whalewatching operations, it is critical that this activity develop under the best practices currently in place, with a precautionary approach and flexible guidelines that allow for adaptation of the activity as new scientific information is collected.

The proposed guidelines are based on 1) scientific data collected since 2004 by Centro de Conservacion Cetacea under the Alfaguara (blue whale) Project, which has recorded feeding aggregations as well as social behaviours; 2) the collection of social information through cooperative work with several coastal communities and fishing associations from Isla de Chiloé; 3) a review of existing national regulations for marine activities; 4) consultations with national maritime authorities, and international whalewatching and blue whale specialists; and 5) a review of all existing regulations, codes of conduct and guidelines for whalewatching around the world. The proposed guidelines include activities such as observations from land, water and air, swimming, diving, feeding, touching and noise production in the vicinity of whales. They also refer to applications for permits. It is relevant to note for the purpose of the proposed guidelines that the term 'whalewatching' encompasses both commercial and non-commercial whalewatching activities. The intention of the proposed guidelines is to provide a framework that allows people to observe blue whales and other cetacean species in a way that does not represent a threat to the animals or their ecosystem and ensures that operators and visitors will act responsibly when observing the animals in the wild. They also seek to serve as a baseline to be discussed among governmental authorities and other stakeholders for agreeing a set of regulations for watching blue whales in Chilean waters.

The sub-committee welcomed this initiative and agreed to endorse the recommended guidelines. In addition, the sub-committee repeated its previous recommendations, agreeing that it is extremely important to obtain baseline data from areas where whalewatching has not yet developed but is likely to begin and recommending that such data be collected whenever possible. Further, the sub-committee recommended carefully designed studies to determine the effectiveness of the guidelines in minimizing disturbance responses in the target animals

SC/59/WW7 presented an updated review of Azorean whalewatching regulations. Azorean whalewatching started in 1993. This activity has been influenced to some degree by previous whaling activities and it is characterized by the special topography and biological features of the islands. The regulation process started in 1996. The first law order was created in 1999. In 2003, another law order appeared with several modifications and, one year later, a governmental law was created to regulate some aspects of the latter one. The main aim of whalewatching legislation is control of whalewatching activities, balancing the protection, conservation and management of cetaceans with regional tourist development.

7.5 Review of risk to cetaceans from colliding with whalewatching vessels

SC/59/BC11 presented information from a project where dedicated, trained observers were placed aboard a fast ferry between Boston, Massachusetts, and Cape Cod in southern New England. The vessel used was very similar (and in some cases identical to) whalewatching boats used in the same region, as well as in other areas. One of the whalewatching guidelines in New England is that observers should be posted whenever a vessel will come within two miles of any sighted whale, regardless of whether that whale is being targeted for whalewatching, in order to help sight any other 'unseen' nearby whales to minimize the risk of collision, as previously sighted whales have themselves rarely been struck by whalewatching boats (Weinrich, 2005). The study showed that observers were very helpful in initially sighting whales, especially those that were greater than 400m from the vessel. Similar efforts may also be helpful in minimizing the risk of collision to whales from whalewatching boats, wherever they operate. While whalewatching boats are often very attentive to whales in the 'sighting phase' of their cruises, they may be less attentive when leaving whales near the conclusion of their trip. Using attentive, trained observers at these times may be especially important.

In SC/59/BC14, the authors examined whale collision data, collected from a variety of sources, from the waters surrounding the Hawaiian Islands (USA). They noted a significant increase in reported collisions in the past decade (1997-2006), which could not be entirely explained by an assumed population increase or simply as a result of increased awareness. They also found that, especially in the most recent five years (2001-2006), the majority of reported collisions (69%) involved commercial whalewatching vessels, but noted that this could be due to their greater likelihood of reporting, given increased awareness and the numbers of 'eyewitnesses' on board. They may also be more likely to report a 'minor' collision when the whale seems to inadvertently 'bump' a stationary vessel. The authors noted the difficulty of quantifying the impact of increased awareness and concern resulting from local education campaigns.

SC/59/BC16 reported on 62 accounts of whale-vessel collisions in Alaska, gathered from a variety of sources since 1978. Several reported whale-vessel collisions (n=6) detailed in this paper were attributed to commercial whalewatching vessels. However, the authors note that other vessels are known to have been whalewatching prior to the collision (*i.e*., two of the cruise ships, at least one tour boat and probably some of the charter boats), making it difficult to assess whalewatching as a factor in whale-vessel collisions. Improvement in data collection about the activity of vessels involved in collisions with whales would correct this weakness in the reported vessel strike data. As noted during the presentation, several factors can affect the reporting rates of different vessel types so it is difficult to assess the relative importance of whalewatching vessels in the vessel strike issue in Alaska.

7.6 Other issues

SC/59/WW10 provided an update to an earlier paper on interactions with 'solitary, sociable' dolphins presented to the last meeting of the sub-committee (Simmonds *et al*., 2006). At least 70 sociable and solitary cetaceans have been recorded worldwide and they seem to be part of a growing phenomenon that relates to human-interactions with these animals. Such animals are particularly vulnerable to being injured or killed as a result of human actions. The conservation implications of this are not clear. However, the loss of such animals particularly from relatively small and isolated populations may be significant. It may, therefore, be important to better understand the factors that cause solitary sociable dolphins to develop, noting the stages identified by Wilke *et al*. (2005). WW10 details the life of a young female solitary sociable that took up residence on the coast of Cumbria in northwest England and died on the shore at Skinburness in 2006. A post-mortem showed that septicaemia caused by a bacterial infection (*Erysipelothrix rhusiopathiae*) was the ultimate cause of death. *E. rhusiopathiae* is zoonotic and usually enters its host through scratches or puncture wounds on the surface of the skin and is likely to be found in faecally-contaminated environments. Thus the dolphin's habit of living close inshore in polluted waters, combined with the wounds that she developed, are likely to have facilitated this infection and her death. It was noted that in 2006 another solitary bottlenose dolphin died in U.K. waters from a tug boat propeller in the entrance to Portsmouth Harbour. There are currently several other solitary sociable dolphins in European waters. The authors of WW10 support the need for more research and monitoring to be paid to these animals and for those who are involved in their monitoring and management to exchange information and insights.

SC/59/WW19 introduced the results of a study examining the perception tourists had of the whalewatching industry in northeast Venezuela. Guidelines established in this area allow for the presence of a dedicated observer on tour vessels. Most interviewed tourists did not perceive whalewatching as a potential threat to the conservation of the local dolphin population. These results will be incorporated in the local whalewatching guidelines to increase the awareness of tourists to potential conservation challenges the local dolphin populations are facing.

8. WORK PLAN

The sub-committee agreed to hold a workshop on the strategic planning of large-scale whalewatching research prior to SC/60. The workshop will include oral presentations by invited experts, including Scientific Committee participants and solicited papers on: research designs for species of varying taxa and life history strategies and exposed to different environmental factors; experimental studies with appropriate controls and use of innovative technology and analytical techniques, including modelling; and determining the availability of specific pre-existing data (*e.g*., local history of whalewatching activities, baseline data, longitudinal data on species in question, ecological data, human impacts including exploitation history). The workshop will be held in Santiago, Chile and a report will be presented at SC/60.

The work plan prioritised major items as listed below:

(1) review of the report of the workshop on strategic planning of large-scale whalewatching research;

(2) developing methodology of and assessing the biological impacts of whalewatching on cetaceans;

(3) identifying data sources from platforms of opportunity of potential value to the Scientific Committee.

In addition, the following items were recommended for the next meeting:

(4) review of whalewatching in South America;

(5) review of reports from Intersessional Working Groups specified below;

(6) review of whalewatching guidelines and regulations;

(7) review of risks to cetaceans from whalewatching vessel collisions.

The sub-committee discussed the work plan and prioritised as listed. It was also agreed that Intersessional Working groups be formed to:

(i) prepare and conduct a meta-analysis to assess the influence of cetacean biology and ecology on short-term impact effect size from whalewatching vessel traffic. Lusseau agreed to Chair the group and Bejder, Fortuna, Parsons, Weinrich, and Williams, R. to participate;

(ii) identify data sources from platforms of opportunity of potential value to the Scientific Committee. Robbins agreed to Chair the group and Bolanos, Carlson, Fortuna, Galletti, Mattila, Ritter, Parsons and Weinrich to participate;

(iii) further develop a questionnaire to assess the extent and potential impact of swim-with-whale operations; and to identify local researchers to distribute questionnaires to operators. Rose agreed to Chair the group and Panigada, Parsons, Ritter and Weinrich to participate.

9. ADOPTION OF THE REPORT

The report was adopted at 17:05 on May 14, 2007. The sub-committee thanked Kato for his wise guidance during the discussions and thanked Carlson and Rose (and other sub-committee members) for their efficient rapporteuring. Kato expressed his sincerely thanks to all of participants for their cooperation to smooth and efficient discussion at the sub-committee.

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Appendix 1

AGENDA

1. Opening Remarks
2. Election of Chair and Rapporteurs
3. Adoption of Agenda
4. Review of available documents and information
5. Assessing biological impacts of whalewatching on cetaceans
    - 5.1 Quantifying baseline
    - 5.2 Methods
    - 5.3 Population-level effects
    - 5.4 Short-term effects
6. Identify data sources from platforms of opportunity of potential value to the Scientific Committee
7. Other issues
    - 7.1 Whalewatching in Alaska
    - 7.2 Discuss and organize for a workshop on the strategic planning of large-scale whalewatching research
    - 7.3 Swim-with-whale operations
    - 7.4 Review of whalewatching guidelines and regulations
    - 7.5 Review of risk to cetaceans from colliding with whalewatching vessels
    - 7.6 Other issues
8. Work plan
9. Adoption of the report