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Chapter 8

Oceanic Cetaceans & Associated Habitats

Solomon Islands Marine Assessment

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APEX Environmental

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Executive Summary

The Solomon Islands Marine Assessment – Oceanic Cetaceans and Associated Habitats was conducted from 10 May to 16 June 2004. Because of the broad and multi-faceted nature of the Solomon Island Marine Assessment's activities and goals, this program was not designed as a dedicated cetacean survey. As such the Solomon Island Marine Assessment could not address certain species- or habitat-specific conservation and management issues for cetaceans – such as the estimation of relative abundances (which can only be estimated through more structured and periodic surveys). Instead, this program was structured as a Rapid Ecological Assessment on Solomon Islands' oceanic cetaceans and associated habitats (the SI Cetacean REA) and included the following activities:

1. To conduct a visual and acoustic survey on Solomon Islands' whale and dolphin species diversity, distribution, ranking of total individual count and their associated habitats (near shore, yet deep-water);
2. To canvass community knowledge on local cetacean sighting patterns, strandings and cetaceans' role in cultural heritage and folklore;
3. To conduct an on-board capacity building program on cetaceans for local scientists and marine conservationists;
4. To assist with the identification of migratory corridors of national and regional importance, as well as other critical cetacean habitats;
5. To strengthen national conservation policies for large cetaceans and marine bio-diversity in general;
6. To evaluate the potential for sustainable and responsible (sperm) whale and dolphin watch activities.

The SI Cetacean REA was conducted during 36 survey days in the central and western provinces of the Solomon Islands and included 160.0 hours of visual survey time, covering 1228.1 nautical miles. Cetaceans were sighted on 52 separate encounters in which 815 animals were counted, belonging to 10 species. The species sighted include (ranked by sighting frequency): Spinner dolphin (*Stenella longirostris*); Pantropical spotted dolphin (*Stenella attenuata*); Common bottlenose dolphin (*Tursiops truncatus*); and single sightings for the Indo-Pacific bottlenose dolphin (*Tursiops aduncus*); Orca or killer whale (*Orcinus orca*); Risso's dolphin (*Grampus griseus*); Rough-toothed dolphin (*Steno bredanensis*); Short-finned pilot whale (*Globicephala macrorhynchus*); Mesoplodon beaked whale (*Mesoplodon sp.*); Rorqual baleen whale (*Balaenoptera sp.* – either the common Bryde's or Sei whale; *B. brydei* or *B. borealis* respectively).

Acoustic surveys included 49 offshore listening stations. In total, cetacean presence was acoustically detected on 51% of all listening stations. Sperm whales (*Physeter macrocephalus*) were positively identified acoustically, bringing the total of species for the SI Cetacean REA to 11. Acoustic contacts were dominated by oceanic dolphins, followed by sperm whales. Both sighting frequencies and counts of individuals were dominated (>95%) by the same 3 species: spinner dolphins, common bottlenose dolphins and spotted dolphins. Sighting and acoustic results were corrected for survey effort and an initial comparison with similar REAs in other regions was made. There were unfavourable sighting conditions during a substantial number of days. These were spread evenly over all SI Cetacean REA Legs.

The SI Cetacean REA visual and acoustic results strongly indicate a relatively low cetacean species diversity and relative low abundance throughout most of the western Solomon Islands' provinces, at least during the SI Cetacean REA period. In several areas, however, spinner and spotted dolphins were locally abundant. This outcome needs to be further investigated, as – when confirmed by additional dedicated cetacean surveys - it has significance for management of cetacean use and fisheries interactions. Issues highly relevant to the Solomon Islands are the traditional dolphin drives, the licensed live dolphin captures

for tourism ventures (for local 'swim with the dolphins' programs and trade/international export), and possibly the large-scale tuna purse-seine tuna fisheries in Solomon Islands' waters.

Throughout the survey, local knowledge on cetaceans proved very valuable. Many coastal communities, such as the Shortlands and Savo Island, have important spinner dolphin resting areas at their local reef lagoons. These preferred dolphin habitats seem stable for exceptional long periods and often have been known to villagers for over five generations. Responsible, well regulated, wild cetacean watching may be feasible in these locations (and presumably in many more similar areas and communities not visited by the Marine Assessment.

Traditional dolphin hunting villages of Fanalei and Bita 'Ama were also visited. In Fanalei, elders explained that the traditional dolphin drive is practiced with strong cultural heritage and minimal modernisation in fishery methods. Essentially, dolphins are driven from the ocean into the local reef lagoon by creating an "acoustic net" through strategic placement of canoes around the pod and well-timed banging of rocks underwater. The aftermath of a recent capture of spotted dolphins for a live-display facility did cause significant disturbance amongst the village and this modern influence may not be easily integrated within an otherwise largely traditional community.

Although the traditional dolphin drives in Fanalei are largely non-modernized, several aspects raise serious concerns. The long-term disappearance of the valued melonheaded whales (robo au) in local waters, the increased effort due to population growth and new market forces clearly indicate that depletion of SI marine mammal resources can and does happen. Hence, additional dedicated cetacean surveys need to be conducted by the SI Government to determine the sustainability of the traditional dolphin drives, and ultimately, to ensure the preservation of the unique cultural heritage of the SI.

The Bita' Ama community (a second village with a history of traditional dolphin drives) has not hunted dolphins for numerous years. All dolphin hunting canoes – which are different in wood type and design from fishing canoes - are in a state of deterioration. Preparations are being made by elders to build new canoes and resume traditional dolphin hunting in the northern Indispensable Strait within 2 years.

Important cetacean habitats that have been identified are reef lagoons, especially for spinner dolphins, and the northern Indispensable Strait region, where, according to community knowledge, large baleen whales are common seasonally. After detailed interviews with elders from Bita 'Ama it seems that the most likely species involved are blue whales. Other anecdotal sighting information also strongly indicates that blue whales are present in these waters. If confirmed, the Indispensable Strait region, as well as several other narrow yet deep island passages in the western Solomon Seas, are likely to function as marine migratory corridors for large cetaceans. Such corridors (also called migratory bottlenecks) are often used by multiple species of large migratory marine vertebrates - including cetaceans, marine turtles, sharks, billfish and tuna - and have already been recognised to be of regional conservation importance in several other nations of the Indo-Pacific.

Marine corridor conservation can be effectively achieved via habitat-based management frameworks including multi-use Marine Protected Areas. Key issues for corridor conservation in the Indo-Pacific include fisheries interactions; especially gill and/or drift netting practices in or near corridors which may effectively cordon off a passage. Because of the seasonal migrations of whales, dolphins and other migratory marine life, even short periods of intensive fishing with gillnets in the vicinity of corridors can result in very significant by-catch and entanglement rates. Overall, management measures may vary substantially between corridor sites and ideally are incorporated within long-term management plans.

On several occasions during the SI Marine Assessment specific reef lagoon areas were identified where spinner dolphins were known to 'rest'. These sites were often known by local communities for many generations, indicating long-term site fidelity. In these locations community-based marine management approaches, in collaboration with provincial and national government agencies, may be an effective management framework to ensure these important dolphin habitats are conserved, and where feasible, regulate any economic opportunities such as local dolphin watching activities.

At the Arnavon Islands Marine Protected Area, the complete skeleton of a previously stranded false killer whale, *Pseudorca crassidens*, was located on a remote beach. With help of the Conservation Officers, the bones and skull were transported to the Arnavon research station. The 6m skeleton was assembled into an educational display at the station's entrance. Furthermore, the Arnavons central location in the Manning Strait (one of the major marine corridors of the Solomon Islands), in combination with on-going marine conservation projects and trained staff which are permanently on-site, mean that conservation activities (i.e. monitoring) on whales and other large migratory marine life could be implemented relatively cost-effectively.

The Gavutu live-capture dolphin facility was visited, and included a detailed tour and inspection. The main business of the facility is a local 'swim-with-dolphin tourism' venture and international export of dolphins. The recommendations of a recent IUCN Species Survival Commission report on the facility and dolphin trade were brought forward during discussions with staff. In addition, an indirect – and unintended - effect of the facility may be over-exploitation of local fish stocks due to high daily food requirements for the dolphins, as well as price incentives to local fishermen.

Key recommendations focus on additional cetacean surveys, ecological research, training and policy. In particular, SI would benefit from additional cetacean surveys to estimate relative abundance for cetacean species of interest and to further identify and confirm high priority areas for conservation. In order to address the knowledge gap on SI cetaceans, it is vital to improve the local expertise and build capacity for long-term cetacean survey and ecological research programs in the Solomon Seas. A national cetacean workshop with field-oriented training components has been agreed upon by Marine Assessment stakeholders as an effective tool to address this. Areas of interest for possible follow-up cetacean training, survey and research activities include: The Gizo/New Georgia Group, Malaita, Indispensable Strait, Florida Islands, Fauro (Shortlands), and the St. Cruz Islands – the latter being the vast eastern-most province of the SI. St. Cruz province has exceptional oceanic habitat diversity and consistent anecdotal sightings of large whales (including sperm whales and orcas). Due to logistical constraints St. Cruz was not part of the area of interest for the Solomon Islands Marine Assessment.

Lastly, SI would benefit from becoming a signature state of the Convention of International Trade of Endangered Species (CITES). CITES is an internationally recognized mechanism to sustainably manage wildlife trade in endangered species, including cetaceans. By joining CITES the Solomon Islands would improve CITES coverage and effectiveness and in doing so would be welcomed by the wider international community. In addition, Solomon Islands export a considerable quantity of fauna. While most SI species as reported by CITES may sustain such a trade, there are several cases where CITES has recommended a ban on imports of several species from the Solomon Islands. By not being a CITES member, the Solomon Islands has no mechanism to officially oppose such trade restrictions.

The Solomon Islands Marine Assessment provided a good basis for these recommendations. In addition to the significant collection of cetacean data, it increased awareness and active participation amongst key government and non-government stakeholders, and assisted with

the development of local capacity that may be involved in future projects on Solomon Islands' diverse whale and dolphin species and habitats.

Introduction

The Cetaceans of the Solomon Islands

The limited scientific literature, in combination with traditional knowledge and anecdotal records, suggests that cetaceans are relatively frequently observed in Solomon Islands' waters. Based on combined sighting information reported for the Solomon Islands, Papua New Guinea, wider Melanesia and eastern Indonesia, it is likely that over 30 species of whales and dolphins inhabit the waters under Solomon Islands' national jurisdiction (Table 1). This means that more than one third of all known whale and dolphin species worldwide can be found in the Solomon Island Seas, including residential, migratory and endangered cetacean species (IUCN 2003).

However, despite the numerous and major advances in marine science for the tropical Indo-Pacific region, the lack of information on the ecology and conservation status of whales and dolphins – and their associated coastal and offshore habitats - is one of the largest 'knowledge gaps' concerning the marine biology of this exceptionally diverse part of the world's oceans. This is especially so for the waters of the Solomon Islands. According to the IUCN Species Survival Commission – Cetacean Specialist Group (CSG), numerous whale and dolphin species which occur in the Solomon Islands are considered data-deficient on the taxonomic, species, stock and population level (Ross et al. 2003, R. Reeves pers. comm.).

The Solomon Islands have a narrow continental shelf, and as a result its overall length of the 200m isobath (4600 km) is only marginally longer than its coastline. This means that oceanic cetaceans and their associated pelagic and deep-sea habitats (>2000m) are often located relatively close to shore. This combination of coastal-oceanic habitat diversity and proximity to shore creates opportunities for marine (mammal) resource conservation and management (Hyrenbach et al. 2000, Kahn and Pet 2003, Kahn 2001a, 2003, Fortes et al. 2003, Malakoff 2004, Hoyt 2004).

Several whale species that are known or suspected to occur in the Solomon Seas are IUCN listed as vulnerable (humpback, sperm, 'Pacific' blue whales) or endangered species (i.e. fin, 'Antarctic' blue whales, sei whales). Vital information for management such as stock structure and population estimates and dynamics are virtually non-existent. A similar situation exists for local species diversity and distribution and ecology. A very limited number of scientific studies have been done in these waters on cetacean species diversity, distribution and relative abundance (the latter can only be estimated through structured and periodic surveys), and none on species-specific cetacean ecology and habitat use (see Appendix 1 for a shortlist of relevant references).

Cetaceans in the Asia-Pacific are thought to be vulnerable to the region's ever-increasing coastal and marine resource usage (IUCN 2003). These range from broad region-wide issues such as:

- fisheries by-catch,
- chemical pollution and
- habitat destruction (including impacts of deforestation on coastal cetacean habitats, and presumably to a lesser extent, noise pollution from seismic oil and gas exploration, military/navy activities involving sonar, shipping)

to more specific Solomon Islands issues such as:

- The licensed live-capture trade of catching and exporting bottlenose dolphins (T. aduncus) in SI waters for local and international cetacean displays and 'swim-with-the dolphins' tourism venues. The Solomon Islands policy to develop a sustainable export industry for SI's cetacean resources has been detailed in government statements (Kile and Watah 2003). A recent export in 2003 to Mexico received wide-spread attention from international regulatory bodies such as CITES as well as the scientific and civil community. To avoid any misunderstandings on this complex issue, the IUCN's Species Survival Commission – Cetacean Specialist Group and Veterinary Specialist Group deployed a joint fact-finding team in late 2003, with the assistance of the SI government, and its report is publicly available (Ross et al. 2003). This SI Cetacean REA was not designed nor conducted to address any of these issues specifically (see section: Limitations of the SI Cetacean REA), and this paper will report on the SI Cetacean REA's field activities and outcomes. However, it is important to note that in early 2005, the government of the Solomon Islands announced a complete ban on further exports of dolphins. A joint declaration by the Minister for Fisheries and Marine Resources and the Minister for Forests, Environment and Conservation detailed that this new policy is effective immediately (see Appendix 5).
- The status of the traditional dolphin drives on Malaita and Makira Islands (see Section C for a detailed account).

The preparations for the Solomon Islands Marine Assessment – Oceanic Cetaceans and Associated Habitats component (the SI Cetacean REA) included the sourcing and review of numerous papers and technical reports related to the survey area (Appendix 1). These documents were further analysed to produce a preliminary species list for the Solomon Islands and (where possible) to shortlist potential cetacean habitats and other points of interest during the Solomon Islands Marine Assessment. However, a more detailed literature review was beyond the scope of this project.

SOLOMON ISLANDS CETACEAN SPECIES AND HABITATS

A preliminary cetacean species list for the Solomon Islands includes resident and migratory species; several rare, vulnerable and/or endangered whale species - including blue, Bryde's, sperm, and beaked whales; as well as numerous coastal and oceanic dolphin species (Fam. Balaenopteridae, Physeteridae, Kogiidae, Ziphiidae and Delphinidae respectively – Table 1). The preliminary cetacean species list for the Solomon Islands is very similar to that of Indonesia (Rudolph et al. 1997). This may be expected as both nations are tropical Asia-Pacific archipelagos with similar coastal and oceanic cetacean habitats.

It seems likely that cetaceans are an important component of coastal and oceanic ecosystems in the national and EEZ waters of the Solomon Islands (Reeves et al. 1999). Cetacean habitats may include Solomon Islands' major rivers (although no riverine species are known to occur in the SI at this date), mangroves as well as its diverse coastal habitats. Open ocean environments include many oceanic islands, oceanic fronts and upwellings, seamounts, guyots, canyons, deep-sea trenches and the water column itself. These diverse habitats are often in close proximity to one another because of the Solomon Islands' narrow continental shelf, abundant oceanic islands and extreme depth gradients. Examples of cetacean habitats within the Solomon Islands Marine Assessment (SI MA) survey route included coastal 'hotspots' for whales and dolphins, local communities engaged in traditional dolphin drive fisheries and narrow yet deep island passages that are known or suspected to function as migratory corridors of regional significance (WWF 2003).

Solomon Islands Marine Corridors

From a broader – and regional - marine conservation perspective, data on cetacean species diversity, distribution, relative abundance, species-specific sighting frequencies, total individual counts and ecology is also crucial when considering the location and complex oceanography of the survey area. The Solomon Islands are one of the few equatorial regions worldwide where hemispherical oceanic exchange of a wide variety of marine life occurs. Cetacean movements between the South Pacific and North Pacific are known or suspected (depending on the species) to occur through the major island passages of the Solomon Islands' archipelago, such as Indispensable Strait, Bougainville Strait - separating the Solomon Islands from Papua New Guinea (PNG), Manning Strait and New Georgia Sound (also known as The Slot). The ecological significance of these passages as migration corridors for whales and dolphins (and other large migratory marine life) remains poorly understood (but see Kahn et al. 2000, Kahn 2002a and 2003, Kahn and Pet 2003 for more on marine corridors in the Indo-Pacific).

Yet Solomon Islands' cetaceans which include these passages in their local or long-range movements may be increasingly vulnerable to numerous regional and local environmental impacts such as habitat destruction, subsurface noise disturbances, net entanglement, marine pollution and over-fishing of marine resources (Hofman 1995, Fair and Becker 2000, Gordon and Moscrop 1998). At least some of these impacts on cetaceans are known to occur in the waters of the Solomon Islands (IUCN 2003, Local government officials, pers. comm.). These impacts would affect residential whale and dolphin populations as well as several endangered migratory species (such as the sperm, blue and fin whale - *Physeter macrocephalus*, *Balaenoptera musculus* and *B. physalus* respectively) which may include these passages in their long-range movements.

This is of special concern in the Solomon Islands, where a strictly limited number of deep inter-island channels are suspected to function as migration corridors for cetaceans. These passages have considerable ecological significance and conservation value:

1. The Solomon Islands' (SI) straits and passages may form an important migration corridor network for large cetaceans travelling from the southern and northern parts of the Pacific Ocean, and may even travel to the Indian Ocean via the eastern Indonesian Seas, and vice versa. In addition, residential whale and dolphin populations are also likely to use these corridors as part of their home range.

2. The SI straits and passages are also likely to function as sensitive bottlenecks to numerous other species of large migratory marine life such as green, hawksbill and leatherback sea turtles, tuna and billfishes, as well as elasmobranchs such as manta rays and (whale) sharks.

Local activities such as destructive fishing practices and gill/drift netting near these straits can result in regional environmental impacts on cetacean populations and affect large marine ecosystem dynamics (Agardy 1997, Kahn et al. 2000, Kahn 2003, Perrin et al. in press).

The Solomon Islands Marine Assessment's Contribution to the 'Cetacean Data Gap'

To better understand and manage the Solomon Islands' (SI) cetaceans, scientists and managers need to obtain information about their diversity and distribution, life histories - including their feeding and breeding habits, long and short-term movements, the locations of their critical habitats, how they use each habitat, when they travel between them and the routes the various species take - as well as current and emerging threats.

This data is difficult and costly to obtain for most marine mammals, even for developed nations with ample resources, let alone for the Solomon Islands. Therefore, the Solomon Islands Marine Assessment presented a valuable opportunity to make a significant contribution to address this knowledge gap and increase the understanding of the diverse assemblage of cetacean species in these remote waters of the tropical western Pacific. Importantly, the Solomon Islands Marine Assessment – Oceanic Cetaceans and Associated Habitats (the SI Cetacean REA) component included the involvement of the Marine Assessment's community team, as the local communities were a key data source. Through the informal on-board capacity building of local scientists and conservationists, the SI Cetacean REA also contributed to improved local cetacean expertise and promoted the possible establishment of long-term cetacean conservation programs in the Solomon Islands (see *Recommendations*, below).

LIMITATIONS OF THE SI CETACEAN REA

It must be noted that because of the broad and multi-faceted nature of the Solomon Islands Marine Assessment's activities and goals[1], this program could not be designed as a dedicated cetacean survey. As such the SI Cetacean REA could not address species- or habitat-specific conservation and management issues – such as the estimation of relative abundances - which can only be estimated through more structured and periodic cetacean surveys. The SI Cetacean REA's modus operandi had to be adjusted to accommodate for the complex day-to-day schedule of various site visits as well as logistical limitations. Another factor limiting species-specific outcomes of the SI Cetacean REA was the relatively short time scale of the project. Hence, certain key issues (i.e. regarding tourism and traditional dolphin drives) need to be further investigated. For example, management of the export trade of dolphins for the live-display and 'swim-with-captive-dolphins' tourism programs must rely on accurate estimates of stock boundaries and population abundance of the species targeted. This type of data can best be obtained through multiple dedicated surveys and longer-term ecological research on particular cetacean populations. A similar situation may apply to the traditional dolphin drives – a unique cultural heritage for the SI (see also Sections C and D of this chapter). The SI Cetacean REA provided a good basis for such work: in addition to the significant biological data, it has increased awareness and active participation amongst key government and non-government stakeholders, promoted the establishment of long-term cetacean survey and research programs, and assisted with the development of local capacity that may be involved in future projects.

THE GOALS FOR THE SI CETACEAN REA

The SI Cetacean REA goals were to:

1. Conduct visual and acoustic surveys of the Solomon Islands' whale and dolphin species diversity, distribution, ranking of species-specific sighting frequencies and total individual count and their associated habitats;
2. Assist with the identification of near-shore yet deepwater habitats that may be of significance to oceanic cetaceans and associated pelagic deep-sea species (i.e. canyons, knolls, seamounts, trenches, upwelling zones);
3. Assist with the identification of migratory corridors of national and regional importance, as well as other critical habitats;
4. Identify, and assess, wherever possible, interactions with coastal and pelagic fisheries (small and large scale);
5. Assist with the identification, and assessment of current or emerging threats to cetaceans;

[1] see *Solomon Islands Marine Assessment*, this report

6. Use visits to coastal villages to canvass community knowledge on local cetacean sighting patterns, strandings, and cetaceans' role in cultural heritage and folklore;
7. Conduct an on-board capacity building program on cetaceans for local scientists and marine conservationists and improve awareness through participatory field work and hands-on training (i.e. research techniques; cetacean species identification at sea; ecology, conservation and management issues);
8. Assist with the identification of opportunities for national cetacean conservation and management strategies; SI Cetacean REA outcomes may be incorporated in national programs, regional initiatives and international conventions of relevance to cetaceans.[2]
9. Assist with the identification of potential sites with economic opportunities for responsible cetacean watching. The development of possible sperm whale watching has already been indicated to be of national interest by the SI government.

Survey Methods

The visual and acoustic cetacean survey component during the SI Cetacean REA was carried out from 10 May[3] – 16 June 2004 on the live-aboard the MV FeBrina, a purpose build 22m dive vessel with long range live-aboard capacity. The field work was conducted for a total of 36 sea days.

Visual Cetacean Assessment

While underway between daytime anchorages or longer-range passages, an expert cetacean observer (BK) conducted visual surveys of the surrounding waters. The sighting efforts by the observer were further assisted by the vessel's captain and to a lesser extent the other Solomon Islands Marine Assessment participants. The majority of sighting efforts were made from the bridge deck area, which increased observer height to approximately 5m above sea level.

Regular scanning of the surrounding seas with marine binoculars (35x8 Steiner Commander) further increased the visual survey range. Once cetaceans were sighted or a possible cue observed more than once, the vessel's course and speed was adjusted to allow for a discreet approach and close observation.

For each sighting, a positive species identification (ID) was made whenever conditions and animal behaviour allowed this to be done safely and with minimal disturbance. Other standard data recorded for each sighting included: Date and time; GPS location and area description; species identified and any cetacean species associations, group size(s) and composition - including the presence of newborn calves; distance from vessel; direction of travel when first sighted; any natural markings; occurrence of 10 behavioural categories – including feeding, resting, bow riding, aerials, avoidance and data on other behaviours observed; surface interval and dive durations whenever possible; photo; video data whenever

[2] Programs and organizations include the SI's National Biodiversity Strategic Action Plan (NBSAP), South Pacific Regional Environment Programme (SPREP), South Pacific Commission (SPC) and IUCN Species Survival Commission (SSC) Cetacean Action Plans, as well as various international treaties such as the Conventions on Biodiversity and Migratory Species – CBD and CMS);

[3] These dates include two additional cetacean survey days, as counted from the Papua New Guinea – Solomon Islands (PNG-SI) border to Honiara, Guadalcanal during the relocation passage of the survey vessel FeBrina, prior to the start of other Solomon Islands Marine Assessment activities.

possible; and sighting condition (a 1-5 ranking of the overall visual conditions for spotting cetaceans, incorporating sea state, ambient light, rain and other weather factors).

A Canon 300 Rebel Digital EOS, equipped with a 70-300mm optically stabilized lens, was used to obtain photo-identifications of individual animals with distinctive colourations, marks or scars. Photographs were used to 'mark' individuals during most sightings and for the majority of cetacean species encountered. These photographic data are crucial for longer-term ecological focus research including studies on local movements/site fidelity and population/stock assessments. In addition, a Panasonic CCD MZ-350 professional digital video camera was also frequently used to record the diversity of cetacean species and surface behaviours.

Acoustic Cetacean Assessment

During off-shore routes the visual surveys were complimented by periodical acoustic listening stations using either omni-directional or directional custom VHLF hydrophones (20Hz-20kHz) connected to a custom-made amplifier equipped with multi-channel high/low pass filters. Detection range for sperm whales was estimated to be 8-10 nm in good conditions, whereas the detection range for smaller cetaceans was estimated to be 2-3 nm. In order to minimise any coastal interference, the acoustic assessment was conducted once the vessel was located 4 or more nautical miles offshore. Listening stations were conducted at least 8 nautical miles apart, depending on daily schedules and offshore conditions. Digital audio recordings of cetacean vocalizations were recorded with a Sony Portable MiniDisc Recorder (MZ-R70) during several stations.

Each listening station was conducted for at least five minutes, after which the following data was recorded: Date and time, GPS location and area description; position of high and low pass audio filters; any acoustic contact with cetaceans[4]; direction of contact (priority species only); species identification (when applicable), abundance estimate (when applicable); listening conditions (a 1-5 ranking of the overall audio quality of listening station incorporating sea state, vessel and ambient noise); and the recording's segment numbers.

The acoustic survey component is especially valuable to locate priority cetaceans such as sperm whales and other deep-diving oceanic cetaceans. These animals spend the majority of time underwater, and thus while present in the surveyed area, are not often seen at the surface. However, these same species routinely echolocate and/or communicate underwater during foraging dives and the hydrophones are able to detect (and locate) the clicks and other vocalizations from most odontocete (toothed whales and dolphins) cetacean species.

In addition to data on presence/absence of cetaceans within the estimated listening range, the acoustic assessment can also provide more detailed data for each listening station including: species identification; group size estimates; indications of foraging and/or social behaviours; and determination of local (underwater) movement patterns by conducting acoustic tracking activities. The acoustic survey results are important for comparative analysis between and within sites over time. However, during the SI Cetacean REA the collection of species-specific data was restricted due to operational constraints.

After the visual and acoustic data collection was completed for each cetacean encounter and listening station, the vessel would depart from the area slowly and return to the predetermined route. Routes were occasionally adjusted to allow for all Solomon Islands Marine Assessment activities to be conducted at maximum effectiveness, as well as environmental

[4] Depending on the species heard, positive identifications can be made and abundance categories estimated from these acoustic assessments of cetacean presence in the proximity of the vessel.

factors such as unfavourable currents and/or winds. A more extensive description of methodologies and data analysis has been described elsewhere (Whitehead and Kahn 1992; Kahn et al. 1993; Kahn et al. 2000; Kahn and Pet 2003).

CETACEAN ACTIVITIES AND OTHER SOLOMON ISLANDS MARINE ASSESSMENT COMPONENTS – coral diversity and health status, reef fish, sea grass, commercial species, community interviews

The majority of cetacean activities were conducted when the vessel was underway. Transit time is usually 'down-time' for coastal (reef and sea grass) field assessments and 'up-time' for cetacean surveys. Thus interference with other (mostly site-based) activities was minimal. Some additional travel distance was necessary during longer periods in transit (i.e. passages) to identify any cetacean species seen or pass closer to associated habitats (i.e. canyons, seamounts) that were located nearby the original route. While on-site, the cetacean component of the Solomon Islands Marine Assessment also had strong links with the community-based activities (see below). The surveying and boat-handling techniques were especially designed to cause minimal disturbance to cetaceans while allowing for discrete and close observations.

PASSAGES BETWEEN SITES – VISUAL CETACEAN SURVEY

During these relatively short inter-site transfers a visual cetacean survey was conducted.

The Solomon Islands Marine Assessment travelled along large sections of the Solomon Islands' coastline that lack a significant continental shelf and include diverse deep-sea habitats close to shore (i.e. canyons, knolls, seamounts, trenches). This route presented a clear opportunity to do cetacean work, as such extreme habitat proximity from coastal to oceanic ecosystems, has yielded substantial whale and dolphin sightings in other comparable areas of the Asia-Pacific region where cetacean surveys have been conducted. During the Solomon Islands Marine Assessment, both coastal as well as more oceanic cetacean species were encountered relatively close to shore.

LONG PASSAGES BETWEEN SITES AND ISLANDS – VISUAL AND ACOUSTIC CETACEAN SURVEY

The passages between the major islands of the Solomon Islands are known or suspected migratory corridors for oceanic cetaceans as well as other large migratory marine life. Constant visual surveys from the upper deck and opportunistic acoustic 'listening stations' were conducted to assess this key habitat. During listening stations an easily deployed directional hydrophone was lowered in the water. The stations took approximately 5-10 minutes and were usually spaced 2-3 hours apart depending on vessel speed and travel schedule. Acoustic contacts with cetaceans were digitally recorded, depending on sea conditions.

Because of logistical restraints it was not possible to switch from survey mode to tracking mode. Priority species such as sperm whales may be tracked acoustically once detected (usually during a deep foraging dive of approximately 45 min). This would result in close range observations during their surface intervals (approx. 8-10 min, a pod usually consists of 4-12 individuals who may all surface in the same general area). Once sperm whales are heard on the hydrophone, it routinely takes 1-2 hours before close observations (<50m) of sperm whales can be made - depending on initial distance, swimming speed and dive cycle. However, it is *not necessary* to actually see or track sperm whales to: a) positively identify this species or b) obtain an estimate of their total individual count. A positive identification can be inferred acoustically due to the characteristics of their clicks (Whitehead and Weilgart

1990). Thus, the routine listening stations provided valuable data for the SI Cetacean REA on sperm whales and other species; whether or not acoustic contacts are followed-up by tracking and/or subsequent sightings.

Anchored on Site – Canvassing of Local Community Knowledge on Cetaceans

The SI Cetacean REA included a strong linkage with the Solomon Islands Marine Assessment community team when making landfall during site visits. The team assisted with efforts to canvass local knowledge on cetaceans for the majority of coastal SI communities visited. This was done with relative ease by incorporating several questions on cetaceans during the routine request to the village elders to be allowed to conduct marine assessment activities in local waters. Six questions were of particular interest to a) fill the data gap on cetaceans and b) assist with the identification of conservation issues and strategies:

1. Are there any areas of consistent whale and/or dolphin sightings known in the local area, and if so are these seasonal?
2. What are the local names for the species seen, and how would the local community rank these according to perceived local abundance category for each species (i.e. from common to rare)?
3. Is there any information available on whale strandings (live or dead, single or group) in the local area? When, where and what ultimately happened to the animal(s)?
4. Are there any fisheries interactions with cetaceans in local waters? This includes positive interactions such as fishermen using schools of dolphins as a proxy for tuna and other large pelagics, as well as (by-)catch and depredation (stolen catch) by cetaceans.
5. Is there significant historical, traditional or modern usage of cetacean products in the community or local area?
6. Do cetaceans feature in the community's cultural heritage (i.e. storytelling, legends, and myths)?

Depending on such information on cetaceans, the proximity of deepwater habitats nearby and availability of tenders, a quick assessment of local waters was conducted from the tender at a limited number of sites. In addition, assistance with the in-water survey activities of the coral, reef fish and commercial species teams was given, including underwater photo and video recordings of species and activities of interest.

Other Activities - Large Marine Life Sightings (Non-Cetacean)

While underway, sighting details for other large (and often migratory) marine life were recorded on a separate 'non-cetacean' data sheet (i.e. all marine turtles, manta rays, [whale] sharks, mola mola, all large billfish and tuna sightings).

Results and Discussion

Visual Survey Results

Visual Survey Effort

The SI Cetacean REA was conducted over 36 field days and covered an estimated 1228.1 nautical miles (nm) and included 7 of Solomon Islands' 9 provinces (Figs 1-4, Table 2). The survey included 160.0 active visual survey hours, spread over 3 habitat zones – coastal,

oceanic and straits/corridors (Fig 5a). Daily survey distances ranged between 22.0 and 91.3 nm. The majority of survey days covered between 21-40 nm (Fig 5b).

Cetaceans where sighted during the majority of the 36 survey days (72.2%, Fig 5c). Sighting frequencies ranged between1-4 separate encounters per day, totalling 1-3 separate species. A routine survey day included 1-2 sightings per day (52.8% of survey days), consisting of 1-2 species (63.9% of survey days; Figs 5c-d resp.).

During the SI Cetacean REA survey period a total of 10 cetacean species were identified visually in 52 sightings. In addition, sperm whales (*Physeter macrocephalus*) were identified acoustically on 4 occasions (operational restraints restricted the time needed to make subsequent visual contact), bringing the total species positively identified during the SI Cetacean REA to 11. All cetacean sighting coordinates were transcribed to a GIS format and assigned species-specific colour-coded data points (Figure 3). Cetaceans were assigned the following general symbols according to taxonomic classification, or occasionally, broader cetacean categories depending on the resolution of the field data.

Cetacean species category	Symbol
Sub-order Mysticeti – baleen whales	●
Families Physeteridea and Kogiidae - sperm whales	■
Family Ziphiidae - beaked whales	◈
Family Delphinidae –dolphins (mostly oceanic species)	▲
Globicephalinae - a Delphinidae subfamily of six species[5], similar to the historical 'blackfish' grouping.	✚
Unidentified small cetacean (< 6 metre)	△
Unidentified large cetacean – toothed whale (> 6 metre)	□
Unidentified large cetacean – baleen whale (> 6 metre)	○
Unidentified beaked whale (Fam. Ziphiidae)	◇

The species identified included toothed whales and dolphins (Suborder Odontoceti), baleen whales (Suborder Mysticeti) as well as the rare and relatively unknown beaked whales (Fam. Ziphiidae). In total, the cetacean species sighted belong to 4 taxonomic families, 9 genera and 11 different species:

1. Spinner dolphin (*Stenella longirostris*)
2. Pantropical spotted dolphin (*Stenella attenuata*)
3. Common bottlenose dolphin (*Tursiops truncatus*)
4. Indo-Pacific bottlenose dolphin (*Tursiops aduncus*)
5. Orca (*Orcinus orca*)
6. Risso's dolphin (*Grampus griseus*)

[5] The Globicephalinae subfamily is based on a systematic revision of the Delphinidae and includes six species: *Feresa attenuata*, *Peponocephala electra*, *Globicephala macrorhynchus* and *G. melas*, *Pseudorca crassidens* and *Griseus grampus* (LeDuc *et al*. 1999). It replaces the historical blackfish category that includes the majority of these species as well. Globicephalinae sightings are recorded when sightings of members of the subfamily can not be identified to species. This occurs infrequently and is mostly due to the similarities of *P. electra*, *F. attenuata* and juvenile or subadult *G. griseus*, in particular during unfavourable sighting conditions.

7. Rough-toothed dolphin (*Steno bredanensis*)
8. Short-finned pilot whale (*Globicephala macrorhynchus*)
9. Mesoplodon beaked whale (*Mesoplodon sp.*)
10. Rorqual baleen whale (*Balaenoptera sp.* – either the common Bryde's or Sei whale; *B. brydei* or *B. borealis* respectively)
11. Sperm whale (*Physeter macrocephalus* – acoustic identification only).

An estimated total of 815 individual cetaceans were counted during the 52 separate species sightings (Table 2). This cetacean count is a known underestimate as only minimal counts of individual cetaceans at the surface per sighting were used in the calculation. Because of the new survey routes each day and significant distances covered each day, the likelihood of 'double counts' (observing and recording the same dolphins or pods more than once) was considered negligible. The limited photographic identification efforts supported this, as no individuals were matched between encounters. Comparisons were carried out in near real-time due to the high-quality digital cameras, equipped with powerful tele-lenses.

Sightings were dominated by two species, the spinner dolphin and to a lesser extend the common bottlenose dolphin. The sighting frequency (Figure 6) shows that over 80% of all sightings consist of 3 species:

Spinner dolphin - *Stenella longirostris* (55.8 %)
Common bottlenose dolphin – *Tursiops truncatus (17.31 %)*
Pan-tropical spotted dolphin - *Stenella attenuata (9.62 %)*

Figure 7 shows that over 90% of the total individual count is due to the same 3 species, albeit in different ranking:

Spinner dolphin - *Stenella longirostris* (68.83 %)
Pan-tropical spotted dolphin - *Stenella attenuata (12.27 %)*
Common bottlenose dolphin – *Tursiops truncatus (9.20 %)*

These ranked species-specific sighting frequencies and total individual count results imply a relatively low species diversity and abundance in these waters during the SI Cetacean REA when corrected for survey effort (Table 2). In most other Asia-Pacific regions where comparable studies have been conducted, the species composition accounting for such a high percentage routinely consists of at least 5-6 species (Kahn et al. 2000, Kahn 2002a, Kahn and Pet 2003, Kahn 2004). It is interesting to note that several oceanic odontocetes known to occur in the deep-water habitats of the Solomon Seas - and often assumed to be relatively common here - were not sighted at all during the SI Cetacean REA:

Melon-headed whale – *Peponocephala electra*
Fraser's dolphin – *Lagenodelphis hosei*
Pygmy killer whale – *Feresa attenuata*
False killer whale – *Pseudorca crassidens*
Sperm whale – *Physeter macrocephalus* (although present in the survey area, as identified through acoustic contacts)
Pygmy and Dwarf sperm whales – *Kogia sp.*

These oceanic odontocetes are either exclusively teuthophagous cephalopod specialists – squid, cuttlefish and octopus - or rely on cephalopods for a substantial part of their diet. Other species with a similar feeding ecology that were sighted include the:

Short-finned pilot whales - *Globicephala macrorhynchus* (n=1)
Risso's dolphin - *Grampus griseus* (n=1).

This relatively low species diversity and abundance for these oceanic odontocetes may indicate that the deep-sea waters and habitats surveyed during the SI Cetacean REA period did not include pelagic cephalopod prey in high abundance.

Interestingly, several cetacean species were sighted during the SI Cetacean REA which are considered to be relatively rare in tropical Indo-Pacific waters (as based on the limited survey efforts in this region):

Orcas - *Orcinus orca* (n=1)
Rorqual whales *Balaenoptera brydei* or *B. borealis sp.* (n=1)
Beaked whales - *Mesoplodon sp.* (n=1)
Rough-toothed dolphins - *Steno bredanensis* (n=1).

Bryde's and Blue Whales in the Solomon Seas

In addition to the whale species visually or acoustically identified above, several reports from Japanese research and scientific whaling expeditions indicate that SI waters include important habitats for Bryde's (see Appendix 1) and possibly pygmy Bryde's whales especially (*Balaenoptera brydei* and *B. edeni* resp.). Although blue whales (*B. musculus*) were not encountered during the SI Cetacean REA effort reported here, anecdotal evidence from local communities and reported sightings indicate that blue whales inhabit the Solomon Seas and its western waters may include important (seasonal) habitats for this endangered whale species.

Interviews with Bita 'Ama community elders on Malaita Island revealed the presence of 'very large whales' in the northern section of the Indispensable Strait. Community interviews identical to those conducted in Fanalei (positive species identification using a process of elimination, assisted by illustrated cetacean identification handbooks) strongly suggest that these sightings are blue whales (see also Section C). Secondly, FeBrina's crew reportedly sighted a blue whale 'mother and calf' (15:30; 18 June 2004; 9^{o} 01.6S and 159^{o} 29.4E, R. Slater, pers. comm.) in The Slot, just west of the Russell Islands, which are mid-way between Guadalcanal and New Georgia province. These sightings were made outside the SI Marine Assessment, during the vessel's passage back to Papua New Guinea.

It is important to note that in this case the observers had a full 6-weeks of informal cetacean field training at that stage and were familiar with species identification procedures at sea (i.e. the process of elimination according to species-specific features and behaviours). The observers also had identification experiences with both humpback whales and sperm whales – the only two other species of large whales with tropical ranges to routinely fluke-up upon diving – and these two species were ruled out from the start of their observations.

The whales were sighted in windy conditions but in close proximity to the vessel (25 + knots, less than 100m from vessel's bow) and were clearly visible. Identification features described include an extremely large body size (>23m), tall straight blow, even in the rough conditions and fluking behaviour upon diving. These and several other reported features all indicated a blue whale mother/calf pair were sighted. In addition, some hours earlier that same day another 'very large whale' was sighted in the distance and no location or species data could be recorded due to rough sea conditions. The observed travel direction for the whales in both observations was estimated to be due south.

SI Cetacean REA Results Corrected for Active Survey Effort – Time and Distance.

Visual cetacean results were corrected for survey effort - time and distance actively surveyed. Both corrections produced very similar results, thus only distance (nautical miles 'on-survey') will be included here for most parameters. Cetacean sightings per survey day and cetacean species positively identified per survey day averaged 1.44 and 1.14 respectively. Comparable surveys of priority cetacean areas in eastern Indonesia resulted in maximum values of 8.8 and 4.6 resp. (Kahn 2001b, 2002b, 2003, Kahn and Pet 2003, for corrected results from other regions). The average cetacean sighting rate was 1 sighting per 25 nautical mile surveyed (0.04 sightings/nm). Comparable surveys of priority cetacean areas in eastern Indonesia resulted in maximum values of 0.17 sightings/nm. Total individual count estimates were also corrected for survey effort. An average of 22.64 individual cetaceans were counted per survey day, and an average of 0.66 cetaceans per nautical mile surveyed (Table 2). Comparable surveys of priority cetacean areas in eastern Indonesia resulted in maximum values of 385.4 individual cetaceans per survey day, and an average of 7.60 cetaceans per nautical mile surveyed. These regional comparisons must be viewed with caution as seasonal and environmental differences between survey areas and years must be taken into account. In addition, even when observers and methods are identical, several other factors are not (i.e. different vessels - and average vessel speed -, unexpected logistical constraints due to working in remote areas).

However, the SI Cetacean REA results strongly indicate that the waters assessed in the Solomon Islands may have a relatively low cetacean species diversity and low total individual count when compared to REAs conducted in eastern Indonesia and northern Papua New Guinea (i.e. an order of magnitudes less, at least during the SI Cetacean REA period; Kahn *et al*. 2000, Kahn 1999, 2001b, Kahn 2002b, Kahn and Pet 2003, Kahn unpubl. data for PNG).

Visual Survey Results per SI Cetacean REA Leg

The effort and summary results of the visual surveys were also compared by survey legs (1-5). Survey legs usually comprised of an area that was covered within a single week and have a similar visual survey effort. (Table 3, Figure 8a-f). The variability between REA legs was relatively low for visual survey effort, number of species identified and to a lesser extent visual conditions (Figure 8a, b and f resp.). Substantial variability between REA legs was recorded for species diversity index, sightings/nm and abundance/nm (Figs 8 c, d and e resp.). The latter three parameters all have maximum values in REA leg 4, indicating this leg included relatively important cetacean habitats for several species.

Acoustic Cetacean Survey Results

A total of 49 listening stations were conducted during the survey, the majority while the vessel was making passage at night to new islands (Fig 2, 4). Acoustic contact with cetaceans was recorded during 51.02 % of all the listening stations. Sperm whales were heard on 8.16 % of all listening stations with acoustic contacts (Table 4). Acoustic detection range was estimated in the field at 6.0 nautical mile (nm) for sperm whales and 2.5 nm for small odontocetes. Total acoustic coverage was calculated to be 5541.8 nm2 for sperm whales and 962.1 nm2 for small cetaceans respectively (Table 4).

All coordinates of acoustic contacts with cetaceans during the SI Cetacean REA were transcribed to a GIS format and assigned symbols according to species categories (Fig 4). Acoustic contacts with cetaceans were analysed in situ for vocalization characteristics and assigned a particular 'cetacean category', ranging from a single species which can be clearly distinguished in the field (such as sperm whales, orcas) to broader species assemblages (i.e.

small oceanic dolphins from the Fam. Delphinidae, such as spotted, spinner and bottlenose dolphins), which have relatively similar vocalizations and may group together (see species associations). Cetacean categories were assigned when vocalizations could not be confidently separated to the species level in the field (or during subsequent on-board analysis of recordings).

A total of 53 categories[6] were assigned to the 49 listening stations (4 stations included 2 categories, as more than 1 species was detected; sperm whales and oceanic dolphins). Acoustic categories were dominated by 'oceanic dolphins' and 'no contact' (both 45.3%), and followed by 'sperm whales' (7.5%) and 'blackfish' (1.9%) categories. (Figure 9). When selecting only those listening stations on which cetaceans were heard, oceanic dolphins were again the most frequently heard (82.76% of all cetacean categories, followed by sperm whales (13.8 %) and blackfish (3.5 %) (Figure 10).

The highly distinctive vocalizations or 'clangs' (Weilgart 1988) of sexually and socially mature sperm whale males were not heard (so-called sperm whale bulls, which grow to 18m and are thus much larger than 10-11m females; Table 4). Sperm whale bulls are highly migratory and prefer cold, high latitude waters, and only infrequently venture into tropical seas in order to breed (Rice 1989). Frequent acoustic or visual contact with sperm whale bulls in low latitudes may indicate the vicinity of a tropical breeding ground, such as recently observed off Komodo National Park and the Solor-Alor Islands in eastern Indonesia (i.e. Kahn 2002b, Kahn and Pet 2003, Kahn 2004).

These acoustic survey results for cetaceans in general, and sperm whales in particular, are relatively low when compared to more extensive survey efforts conducted in East Indonesia and the Bismarck Sea, northern Papua New Guinea (Kahn et al. 2000, Kahn 1999, 2001b, Kahn 2002b, Kahn and Pet 2003, Kahn unpubl. data). Hence, the overall acoustic results are in accordance with the results of the visual surveys (due to the long dive cycles of many oceanic species acoustic and visual survey results may differ substantially). These combined results strongly indicate that the cetacean diversity and abundance in the coastal and off-shore habitats surveyed in the western provinces of the Solomon Islands are both relatively low, at least for the limited number of survey days reported here.

Acoustic Survey Results per SI Cetacean REA Leg

The effort and summary results of the acoustic surveys were also analysed by separate survey legs (1-5). Survey legs usually comprised of an area that was covered within a single week of the SI Cetacean REA (Table 4, Figure 11a-d). Both acoustic conditions as well as acoustic contact with all species display relatively low variance between SI Cetacean REA legs. Both the number of listening stations as well as the acoustic contact with sperm whales displayed more variability between SI Cetacean REA legs. In the latter case, this is to be expected as the relatively low abundance of sperm whales, combined with the known social organization into clusters of this species, resulted in zero values for the majority of SI Cetacean REA legs. The high value for the PNG-SI leg (50% of all acoustic contacts) is most likely due to the extremely low sample size of that leg (n=2). The low number of listening stations during leg 3 is due to a combination of extreme visual and acoustic conditions in completely open water passages (see also the sections below on environmental conditions). This caused operational difficulties for the Marine Assessment as a whole.

[6] Acoustic cetacean categories reflect the best possible identification outcome (ultimately a species) through a process of elimination. As such they are not mutually exclusive. Thus, while all 'blackfish' are indeed part of the oceanic dolphin family Delphinidae, this does not hold for vice versa. To maximize data resolution, when specific vocalizations allowed for the identification of this subfamily it was recorded.

Cetacean Species Associations – Multi-Species or Mixed Groups

The SI Cetacean REA cetacean survey also recorded the cetacean species association rate. This rate was defined as the simultaneous observation of two or more cetacean species in mixed groups or in close proximity (<10 body lengths) to one another. Mixed-species groups of cetaceans were observed routinely during the SI Cetacean REA. Overall, 10 occurrences of species association were recorded (19.2 % of all sightings; Figure 12). Cetacean species associations predominantly involved interactions between spinner dolphins (n=4) and bottlenose dolphins (n=3), and to a lesser extend spotted dolphins (n=2) and pilot whales (n=1).

The ecological significance and possible function(s) of cetacean species associations is still poorly understood (e.g. Mann et al. 2000). However, such associations may be an indication of preferred cetacean habitat, especially if there are oceanic species involved. Ideally, periodic dedicated surveys should be conducted to determine whether cetacean associations are consistently observed in such areas. Cetacean REAs can be conducted in new areas of interest. The logistical constraints of the multi-task SI Cetacean REA format did not allow for long observation times (i.e. hours-days) to estimate the duration of each association or conduct ecological/behavioural focus studies.

Environmental Conditions During the SI Cetacean REA

Sighting Conditions

Each sighting was allocated a visual condition on a 1-5 scale, ranging from perfectly calm and clear weather to extremely unfavourable conditions such as strong winds and high seas combined with heavy rainfall. In the absence of any cetacean observations for long periods, sighting conditions were recorded every 2 hours. All recorded sighting conditions were then averaged for each survey day. The visual surveys were halted in sighting conditions greater than 5.

During the SI Cetacean REA conditions varied widely and ranged from 1.5 to 5. Ideal conditions (1-1.5) were recorded for a total of 3 survey days only. The majority of surveying was done in mediocre conditions of 2-3 (53% of survey days). Unfavourable sighting conditions of >3-5 were recorded for a substantial number of days (39% of survey days; Figure 13a). The seaworthy and stable vessel (even up to conditions 4) and the high position of the sighting platform ensured that the effect of these less than ideal survey conditions on detection rates was kept to a minimum.

Acoustic Listening Conditions

Listening stations were ranked according a 1-5 scale, depending on ambient noise and interference from the ship and tenders. Sighting conditions of less or equal to 4 were not considered a major factor influencing acoustic survey efforts. In general, acoustic conditions were more favourable in May than in June, when the seasonal southeasterly trade winds became more frequent and increased in strength.

Acoustic listening conditions varied widely during the SI Cetacean REA and were less than optimal for a significant part of the survey. Most listening stations (63.3%) were conducted on

survey days with overall conditions of 2-3 (10-15 knots wind, building seas in open waters). Over 8.1 % of all stations was conducted in category 4 or 5 (20-25 knots wind, high seas in open waters) and 2.0 % of stations were conducted in near perfect acoustic conditions (Figure 13b). Several planned listening stations had to be cancelled altogether during 5 survey days (including several passages) due to extreme weather conditions (Figure 13c, condition >5).

Importantly, the acoustic detection of most odontocete (toothed) cetaceans can be optimized for each acoustic condition, by selecting different (or no) low and high 'pass filters' within the amplifier for each station. Such filters can minimize wave, wind and boat noise when need be, allowing overall volume to be increased. Appropriate adjustment of (any) filters to prevalent conditions may take 1-2 minutes and ensures that any reduction in the detection range remains minimal (according to our field tests with cetaceans and ships detected at known distances and a gradient of conditions (Kahn unpubl. data). High/low pass filter settings were recorded for each station.

The Arnavon Islands: Cetacean Educational Display and Manning Strait Corridor Site

At the Arnavon Island Marine Protected Area, a recent whale stranding was reported by the local Conservation Officers. The stranded whale was initially noticed on a remote beach on 22 Jan 2004, and was already heavily decomposed at that stage. After 2 hours searching by speedboat the complete skeleton of a false killer whale *Pseudorca crassidens* was found. Its bones and skull were carefully collected and then transported to the Arnavon research station. Here the false killer whale skeleton was re-assembled into a 6m educational display at the entrance to the research station (see Figure 15).

Furthermore, the Arnavon's central location in the Manning Strait (one of the major marine corridors of the Solomon Islands), in combination with on-going marine conservation projects and trained staff which are permanently on-site, mean that conservation activities (i.e. monitoring) on whales, dolphins and other large migratory marine life could be implemented relatively quickly and cost-effectively.

Cetacean strandings reported by communities during the SI Cetacean REA

Several strandings of large cetacean were reported by local communities while the SI Cetacean REA was in New Georgia waters (Leg 3, Table 4), but no more details were given that could assist in species identification. The remote locations of strandings on exposed coasts (Vangunu) and windy conditions during this period prevented site visits. Thus the species and number of animals involved in these strandings could not be determined.

Non-Cetacean Sightings

Non-cetacean sightings during the survey included surface observations during active survey effort unless otherwise specified. Sightings include the following species or categories (number of sightings + estimated abundance; comments);

- Billfish - marlin or sailfish (3+3);
- Marlin - *Makaira* or *Tetrapturus* sp.(2+2)
- Sailfish - *Istiophorus platypterus* (1+1)
- Mantas - *Manta sp*. (1 + 12)
- Sharks (no data)
- Marine turtles (no data)

- Leatherback turtles - *Dermochelys coriacea* (1+1)
- Leatherback nesting beaches (n=3) – as reported by Fanalei community and other assessment teams; no data;
    - SE Malaita (Mabo beach, just to the S of Fanalei – no further data)
    - Central S coast of St Isabel (approx. 28 turtles/night in season, P. Ramohia, pers. comm.);
    - Rendova – Tetepare S and coast (more information available from WWF Solomon Islands)
- Large yellowfin tuna (1+1)
- Dugong - Dugong dugon, as sighted on survey and reported by other assessment teams (2 +3 [including 1 calf])
- Dugong feeding grounds – as reported by Fanalei community – 1 + 20-50; SE Malaita; 'regular afternoon sightings with high tide' in coastal bays of NW Fanalei/Walande reef lagoon).
- Saltwater crocodiles - *Crocodylus porosus* – as sighted and reported upon by sea grass assessment team (3+3).

Traditional Dolphin Hunters of Malaita.

The Fanalei and Bita 'Ama Communities

The Solomon Islands Marine Assessment route in Malaita was specifically planned to include visits to two traditional dolphin hunting villages:

- Fanalei on SE Malaita with hunting grounds in the coastal and open waters adjoining the western Pacific and
- Bita 'Ama on NW Malaita, with (currently inactive) hunting grounds in the coastal and open waters of the northern parts of Indispensable Strait, connecting the Solomon Seas to the western Pacific.

The practices and cultural heritage of the dolphin hunters of Malaita are relatively well documented in the scientific literature and other more anecdotal reports. Numerous background papers were analysed prior to the Solomon Islands Marine Assessment and the community interviews. A literature review of these papers would be valuable, yet is beyond the scope of the Solomon Islands Marine Assessment report (see Appendix 1 for short listed references).

Community Interviews

Community members of these two unique coastal communities were interviewed to record their traditional knowledge in, and experience with, the traditional Solomon Islands' dolphin hunt. In addition, an assessment of the degree of modernisation was made whenever possible.

Interviews were not focused on other national and international issues and conservation concerns associated with this fishery. Thus questions where geared towards community knowledge, traditional values and changes in historical catch per unit effort (H-CPUE). In addition, extensive interview experience with another community of traditional sea hunters in Lembata, east Indonesia - who target sperm whales (see Barnes 1996, Kahn 2002b, 2003) - was used to ensure a neutral demeanour was given to all questions and traditional values were honoured.

The Traditional Dolphin Drives off Fanalei

In Fanalei, elders explained that the traditional dolphin drive is practiced with strong cultural heritage and minimal modernisation in the fishery. Essentially, the fishery is based on an acoustic drive technique. Dolphins are driven from the ocean into the local reef lagoon by creating an "acoustic net", through strategic placement of canoes around the pod and well-timed banging of rocks underwater. Certain species of small cetaceans can thus be controlled - primarily spotted dolphins and to a lesser extend spinner dolphins - and driven towards a relatively narrow (approximately 100m), yet deep channel between the outer islands of the reef lagoon (Figure 15 c-d).

The traditional methods as practiced in Fanalei seemed completely intact. Canoes are dug-out without outriggers, and are fully traditional with no modern influences or modifications. In addition, communication at sea during the hunt has not been modernised. A traditional system of flags and hand signals continues to be used at sea to signal when and where dolphins have been sighted and to coordinate the hunt. This coordination of the dolphin drive is crucial and requires exceptional skills, leadership and teamwork of all involved, often for long periods (6-12 hours) and under difficult conditions. While at sea, the canoes' distance

from land is measured according to landmarks that are just visible – beach, palm trees, land, open sea – and each distance category has a specific term in the local language.

Outboards are not used as the noise under water alarms the dolphins and gives the boats' position away, thereby reducing the element of surprise used to startle the dolphins when clapping the stones underwater. Outboard engines are also not used for any scouting trips. The dolphin school is driven from open ocean through a narrow reef passage and into the lagoon. Then the dolphins are further herded towards a sheltered mangrove bay, which is closed off with a net once the dolphins have entered. The dolphins are then pulled into the canoes one by one, killed with knives and transported by canoe to the village for further processing. The teeth especially are considered essential for wedding dowries and are also a highly valuable commodity (teeth function as money in the village, throughout Malaita and in other selected parts of the Solomon Islands), as is the meat for local consumption. As this practice is fairly well-documented (i.e. Takekawa 1996 a-c, see Appendix 1), the drive methods and cultural significance of the hunt are not discussed in further detail in this report.

Both villages were informed prior to arrival of the survey vessel by the community liaison team and outreach programs. Because of time constraints of the Solomon Islands Marine Assessment, only several hours were spend in each village. Not all village elders were present as most people were on the Malaita mainland tending to farmlands. Six senior persons with extensive knowledge (often passed on for generations) and long-term experience in traditional dolphin drives were available for the interview:

- Mr. Ernest Afia – Elder of the Malaqualo tribe who were the 'original founders of the Fanalei dolphin hunt more than 100 years ago' (The Fanalei community is made up of six separate tribes).
- Mrs. Elisabeth Au (wife of Fanalei village leader Mr. Joseph Au).
- Unnamed elders (2) and community members (2) with extensive experience in the drive.

The interview was predominantly held with Mr. Afia and Mrs. Au with frequent input and agreement from the other community members present. The interview was structured in 4 components.

1. Catch and effort data, which included questions on:
2. Species diversity and group abundance in the hunting grounds.
    - Species targeted as well as others that are not easily controlled by traditional driving methods.
    - Key behaviours of target and non-target species.
    - Successful drives per season.
    - Catch composition.
    - Group sizes per catch ('normal' and 'maximum').
    - Seasonal or/and annual trends in these components.
    - Trends in whale and dolphin sightings and behaviours (with an emphasis on behaviours indicative of feeding and migration).

3. Dolphin hunt techniques
    - Equipment and manpower involved.
    - Activities prior, during and after the hunt.
    - Securing of the catch in lagoon waters.

4. Use of dolphin products– teeth and meat.
    - Catch processing.
    - Market values.

- Distribution and role of teeth in community traditions.
- Area of trading (village, island or/and inter-island scales).
- Other sources of teeth.
- Strandings.
- Trade with commercial fishers.

5. Indications of modernisation of traditional techniques.

Key Outcomes of the Interview with Fanalei Elders and Other Community Members

As mentioned above, the practices and cultural heritage of the dolphin hunters of Malaita are relatively well documented in the scientific literature and other more anecdotal reports. Thus this section focuses on outcomes of the interviews without providing much context. Detailed background papers can be found in Appendix 1.

Traditional names of Fanalei cetaceans

Traditional names for numerous cetacean species were recorded and then assigned to a particular species by using illustrated cetacean reference and identification books (Fig 15d). The majority of traditional names mentioned during the interview were identical to those recorded by previous researchers (Table 1).

Dolphins – Kirio
Spinner dolphin – Raa
Spinner dolphin (offshore small body) – Raa matakwa
Spinner dolphin (offshore, robust body) – Subo raa
Pantropical spotted dolphin – Unbulu
Striped dolphin – Robo tetefa
Common dolphin (Dephinus sp.) – Rabo manole
Melonheaded dolphin - Robo au/ Robo tafungai
Fraser's dolphin – not known (Takekawa 1996b in Appendix 1 notes that the name robo au may also apply to Fraser's dolphin teeth but this could not be verified).
Bottlenose dolphin - Olo folosi
False killer whale – Ga ia robo
Risso's dolphin – Gwon mudu
Beaked whales – Sao
Large whale – Busu asi
Dugong – Ia tekwa

Hunting season and effort

The Fanalei dolphin hunting season is from January – April and coincides with seasonal periods of calm weather. During these months the men of the village go out in their small wooden canoes (without outriggers) every day. The season is sometimes extended into May depending on fair weather. During the remainder of the year no hunting is done and the main activity of the men and women is tending to their crops on small parcels of farmland on mainland Malaita.

An average season would include 8-10 successful drives. The number of animals that can be controlled during the acoustic drive is highly variable between days and seasons. Dolphin groups of 20-40 animals are routinely caught. Groups of 200-300 animals are caught with some regularity and occasionally a group may consist of an estimated 700 individual dolphins. On these rare occasions that such a large group can be successfully controlled and caught, it takes the villagers all night to kill and process the dolphins. Estimated numbers of

dolphin catches for each Jan.-April hunting season were given by Fanalei elders as 'mixed' species - spinner and spotted dolphins (Raa and unbulu, respectively):

2004 - 600
2003 - 1200
2002 - 700
2001 - no data
2000 - 800
1999 - 700
1965 - 2000 (mentioned as a record year for this generation)

Cetacean sightings off Fanalei

The local names, occurrence and relative frequency of cetaceans sighted during the Fanalei dolphin drive season is given in Table 1. As expected – and in accordance with the SI Cetacean REA visual survey results - the most common sightings are of spinner, spotted and bottlenose dolphins. Various other species of oceanic odontocetes are sighted but infrequently. Comments by elders and other community members on key species for Fanalei included:

- Unbulu (spotted dolphins) – easy to control, reacts predictably to the noise made during the hunt, often playful. Groups often include 200 animals; groups of 700 individuals occur infrequently (1-2 sightings/season).
- Raa (spinner dolphins) – much more difficult to hunt than unbulu, a large pod would consist of approximately 200-300 individuals, but routinely a group would include 50 animals.
- Robo teta or tetefa (striped dolphins) – similar in group size to unbulu, but have been sighted much less frequent in the area for many years.
- Robo au (melon-headed whales) – has not been sighted in the area ('finished') for many decades. The last generation who hunted Robo au were the grandfathers of the elders interviewed. As the elders interviewed approached or exceeded 50 years of age, it seems reasonable to assume the period of Robo au drives was approximately 100-125 years ago. They were considered common then and catches of 1000/drive were achieved, albeit occasionally. It appears this species is now exceptionally rare or even extirpated from Fanalei waters (and possibly populations are significantly reduced throughout the Solomon Seas).
- Gwon mudu (Risso's dolphins) – occasionally sighted and sometimes targeted for the drive fishery with success. However, this is rarely done. A large group would consist of 14 animals but more often a group would consist of 3-5 animals.
- Ga ia robo (false killer whales) – sighted occasionally, but never hunted as they do not react to the noise and dive under the canoes to open sea.
- Pilot whales are not seen (or possibly wrongly identified as false killer whales).
- Orcas – infrequently sighted. Interestingly, a single large male has been seen during 3 consecutive seasons and it is thought to be the same animal. This orca is said to 'harass people' and approaches the canoes and dives under them. The hunters are afraid of this behaviour and will scatter when the orca is sighted, even if that means heading out further to sea. The appearance of the orca will disrupt and halt any drive activities for as long as the animal is in the general area.
- Sao (beaked whales) - sighted sporadically, but are never hunted.
- 'Whales' are sighted with regularity and often include periods of whale sightings 'for several days at a time', followed by periods of no whale sightings in the hunting grounds. Interestingly, the hunters do not differentiate between different baleen whale species.

- The sperm whale does not seem to be known and has not been sighted at all in the Fanalei area – despite the relatively deep water nearshore, and its distinctive and easily recognizable blow, body shape and diving behaviours.

The elders explained that the Fanalei and Walande people originated from northern Malaita – where dolphin drives were practiced at the time – and later migrated to the Sa'a region of Malaita. Here they continued the dolphin drive practice. Their skills were especially valuable as the land in the Sa'a area was already owned and occupied by other tribes, so the 'newcomers' had to settle on the relatively barren islands without much freshwater. The islands were also harder to approach and lessened the chance of attack by the other tribes. These islands proved an ideal base for traditional dolphin drives.

The nearby Walande village has a similar cultural heritage to Fanalei and also conducts dolphin drives. Effort is similar to Fanalei, with 30-40 canoes involved during the same season. However, it seems that the success of these drives is minimal. This is thought to be due to problems with coordination of the drive. As a result Fanalei produced all teeth for sale this year.

Significance and value of dolphin teeth

The teeth of the Raa (spinner dolphin) is used for necklaces only. It has no value for dowry or trade. The teeth of the Unbulu are used for both dowry and trade. Unbulu teeth are essential for weddings, as practiced throughout Malaita. At least 1000 teeth are needed as a dowry (a spotted dolphin produces approximately 100 teeth). These teeth are also used for day-to-day trade (i.e. 12 teeth for a large tobacco stick) as well as land purchases and leases. Again, these activities have been documented (see Appendix 1), so this report will not go into further detail on what is locally considered 'standard practice'. It is noteworthy that Unbulu tooth have become more valuable over the last 4 years. While in 2001 the price for a single tooth was S$0.30 in 2003 that increased to S$0.50 and doubled to S$1.00/tooth in 2004. During the interviews it was explained that dolphin teeth always 'sold out' and that it was getting 'a bit hard to catch dolphins'. This was thought to be caused by natural variation in seasons rather than any effect of overexploitation. The sale of dolphin teeth is considered essential to the well-being of the community. In particular school fees for the village children are seen as a major financial burden that can be met, at least in part, by the sale of dolphin teeth. The 'high price' did not affect demand and all teeth caught in the 2004 season (which ended in May, one month prior to our visit) were sold to buyers 'from all over Malaita'.

Use and value of dolphin meat

The meat is either consumed locally or fried with numerous spices and sold quickly in local markets for approximately S$5.00 per 1/4th of a strip (approx S$5.00/kg). Increasingly during the last years, dolphin meat has also been sold outside Malaita. This occurs mostly at markets in Honiara where prices can be doubled.

Modern Influence on Traditional Dolphin Drive Activities

Although the traditional dolphin drive activities were assessed to have minimal modern influences overall (see above), there are some factors that were recorded during the interviews with village elders and other community members:

Increased effort – annual seasons

According to Mr. Afia, the original hunting season was not practiced every single year by past generations. The annual season became routine once the practice was adopted by the local church 'several generations ago', and annual blessings for the seasons were incorporated in church services.

Expanded community involvement

The village elders decided 'several generations ago' that women and children would be allowed to assist with the final capture of the dolphins in the sheltered lagoon and the transport to the village. This was originally prohibited and in some villages remains so to this day (i.e. nearby Walande).

Increased effort – population growth

A more recent factor affecting hunting effort has been the population growth of Fanalei. More people participate in the drive. Fanalei elders estimated that in 2004 between 40-60 canoes participated in the season. Three generations ago the estimated number of canoes involved in the drive was estimated to be 10-16. This equates to roughly a doubling of canoes per generation.

The interviews were unable to quantify the effect this may have had on success rates and increases in catch, but the consensus was that it made the drive more effective – but only if it was coordinated and lead by a strong and knowledgeable frontman. Population growth would also further increase the financial responsibilities of the community – especially school fees - and may thus be a major driving force for increased efforts in the future.

Use of gillnet in final moments of the drive

One aspect of the actual drive modernised. During the final moments of the drive, a long nylon gillnet is used to cordon off the final escape route of the dolphin catch. This occurs once the dolphin group has been successfully driven from open ocean through the narrow lagoon passage and well into the local mangrove bay. The impact of this equipment on the traditional methods of the drive effort seems minimal as the net is solely used at the very last stage of the capture. No other modern equipment such as ropes or radios are used during the drive itself.

The use of a gillnet does free up the men and women who otherwise may have been preoccupied with controlling the dolphins. However, at this stage of the hunt the dolphins are almost without exception 'tired and calm'. Any escapes of individual dolphins at this stage have been very rare at best, according to the elders. So, although the introduction of a modern gillnet may have allowed more people to be involved to get the dolphins into the canoes and transported, it seems unlikely that this would have increased the overall success or the historical catch per unit effort (H-CPUE) of the traditional dolphin hunt.

New markets forces

Increasingly, the meat is taken to the market in Honiara, Guadalcanal by ferry and sold for better prices (often double the local Malaita price/kg).

Commercialisation of the drive activities

Dolphins caught with traditional drive methods for intended use in local and international live-display facilities and 'swim-with-the-dolphin' tourism projects.

One issue of concern is that the Fanalei community has sold live dolphins caught during traditional drives. According to the interviews, in 2002-2003 a local company with a dolphin facility near Honiara requested a total of 45-55 spotted dolphins to be kept alive and penned in the local bay. Of these, 12 animals were transported by a big vessel or barge to the display facility in the Florida islands, near Honiara. The spotted dolphins proved sensitive to such relocations and during the transport 10 animals died. Another animal died in the holding pen some time after arrival.

The aftermath of the 2003 capture of spotted dolphins for a live-display facility did cause significant disturbance amongst the village. One of the main issues was the distribution of the revenue of the sale of live dolphins (an unprecedented event in Fanalei) amongst community members. Apparently this did not proceed according to traditional regulations. Hence the elders officially decided that specific captures of live dolphins for sale will not occur in the 2004 season and will most likely remain prohibited for subsequent seasons. The acoustic drives and traditional use of dolphins' teeth and meat will continue.

Overall, the sale of live dolphins caused significant social tension within the Fanalei village and its surroundings. The export/display facility involved has indicated that the survival rate of the species in transport and captivity is regrettable and that the species will not be considered again as a candidate for display and/or export. Its main species of commercial interest is the Indo-Pacific bottlenose dolphin (Tursiops aduncus). Apart from significant national and international legal aspects of displaying and/or exporting live dolphins, this modern influence may not be easily integrated within an otherwise largely traditional Fanalei community.

In conclusion, although the traditional dolphin drives in Fanalei are largely non-modernized, several aspects raise serious concerns. The long-term disappearance of the valued melonheaded whales (robo au) in local waters, the increased effort due to population growth and new market forces clearly indicate that depletion of SI marine mammal resources can and does happen. Hence, additional dedicated cetacean surveys need to be conducted by the SI Government to determine the sustainability of the traditional dolphin drives, and ultimately, to ensure the preservation of the unique cultural heritage of the SI.

The Traditional Dolphin Drives off Bita 'Ama

Bita 'Ama is located on the NW side of Malaita. The interviews with the Bita 'Ama community were conducted at night and the information obtained was limited due to logistical constraints. Information was provided by an anonymous elder, who had been active as a hunter himself and was well informed. The interview was structured as described above for the Fanalei community.

Bita 'Ama dolphin hunting traditions are older than the Fanalei community (whose families migrated there from N Malaita). However, the Bita 'Ama community has not been hunting for numerous years. The reason(s) for this are not clear. All dolphin hunting canoes – which are different in wood type and design from fishing canoes - are in a state of deterioration. Preparations are being made by elders to build new canoes. The actual trees that have already been earmarked for this use were shown. Hunting techniques and catch composition are largely identical to Fanalei (although the time limits of the interview meant some differences could have been missed). The species predominantly hunted is the Pantropical spotted dolphin. According to the Bita 'Ama elder interviewed, traditional dolphin hunting will resume in the hunting grounds of the northern Indispensable Strait within 2 years.

Interestingly, from April to August the Bita 'Ama community routinely have close encounters with 'very large whales' while fishing offshore in the Indispensable Strait. After detailed

questioning on a) ecological, morphological and behavioural aspects (e.g. group size estimates, blow angle and height, colour patterns, fluke-ups, other attributes), and b) an independent species identification by the elder through illustrations of 'very large whales' in cetacean field handbooks, it seems most likely that the whales sighted are blue whales (Balaenoptera musculus). Other anecdotal sighting information also strongly indicates that blue whales are present in these waters. If confirmed, the Indispensable Strait region, as well as several other narrow yet deep islands passages in the western Solomon Seas are likely to function as marine migratory corridors for large cetaceans.

Local knowledge of cetaceans during the Solomon Island Marine Assessment

Throughout the survey, local knowledge on cetaceans proved very valuable. Many coastal communities have shown us important spinner dolphin resting areas at their local reef lagoons. These preferred dolphin habitats are highly site-specific and seem stable for exceptional long periods. Certainly the village knowledge of the significance of certain reef lagoon areas to spinner dolphins spans over five generations.

In places such as the Shortlands and Savo Islands, an inspection of dolphin habitat as pointed out by the respective communities, could be conducted. The Shortlands resident local group consisted of an estimated 85 animals. These dolphins were accustomed to speedboats and would approach nearby speedboats in order to bow ride and perform spectacular leaps, often jumping just in front and above the observers in the bow. In Savu, the estimated 50 spinner dolphins were again exactly where the local community had predicted. In this case, the dolphins also approached the speedboat to bow ride, but this behaviour was quickly followed by resting and socializing. An attempt was made on SCUBA to inspect an underwater cave that was locally thought to be the main reason for the dolphin's frequent occurrence in this particular area. However, no cave was found and no dolphins were sighted during this 25-min. dive, although dolphins were heard close by.

It is interesting to note that spinner dolphins where often observed near lagoon entrances – both by local communities (long-term knowledge) and during our visual surveys (single passes through a previously unknown area). These sightings are consistent with the view that spinner dolphins use local reef lagoons habitat as resting and socializing areas during the day. Here spinner dolphins are relatively safe from large predators such as sharks, as the clear waters and sandy bottom (light background) would allow early visual predator detection. For the mostly nocturnal species, this is especially important during periods of daytime rest and acoustic inactivity (no echolocation information on surroundings). TNC – Solomon Islands Program's on-going socio-economic survey will further solicit input from local communities through a cetacean questionnaire (W. Atu, pers. comm.).

Other SI Cetacean REA Activities

SI Cetacean REA visit to the Gavutu captive dolphin facility

Background and recommendations for the dolphin facility, husbandry practices, dolphin health and export can be found in a fact-finding paper by the IUCN's Species Survival Commission – Cetacean Specialist Group (CSG) and the Veterinary Specialist Group (Ross et al. 2003). This report focuses on several related issues and concerns, as discussed on-site with the facility's manager, M. Schultz, who offered the Solomon Islands Marine Assessment cetacean team a tour, organized a demonstration/training session and answered many questions on dolphin capture, husbandry, training and trade.

Potential Impact on Local Fish Stocks and Marine Environment of the Florida Bay Islands

A substantial proportion of the captive dolphins' diet consists of locally captured fish (as well as frozen fish specifically imported for this purpose). While this increased demand on local fish resources has a positive effect on the local economy, it may result in overexploitation of local fish stocks. The Gavutu facility offers a higher price per kilo for larger transactions (S$8/kg for > 25 kg vs. S$7/kg for <25kg of local fish). This measure minimizes operational time spend on processing many transactions of small quantities of fish at the facility.

However, such incentives to local fishermen (i.e. a 14% increase in price/kg for more than 25kg fish/transaction) may unintentionally increase the fishing pressure to higher levels. It may also unintentionally lead to a local increase in destructive fishing practices such as reef bombing – a common fishing technique for schooling and reef fish in SE Asia. Unconfirmed reports of reef bombing have been noted by the SI Fisheries Department. In addition to devastating effects on the marine habitats and fish stock, reef bombing is likely to impact directly on wild cetaceans in the vicinity of the underwater explosion as well. This may include lethal as well as sub-lethal tissue damage and can result in severe acoustic habitat degradation (Ketten 1998, Kahn et al. 2000). Because of these and other concerns, the impacts of the increased pressure on local fish stocks due to the captive dolphin food requirements should be further evaluated.

INTERNATIONAL LIVE DOLPHIN EXPORT TRADE

While acknowledging that the absence of data on population estimates in the near term will hinder any scientific assessment of the current dolphin export situation in the SI, a recent IUCN report specifically notes that:

> *'the Indo-Pacific bottlenose dolphin* [Tursiops aduncus – Fig 15e] *is a coastal species in most of its range and large-scale removals such as the captures to date in the Solomon Islands could have serious impacts on local island populations'* (Ross et al. 2003).

Currently the local price for a 'swim-with-the-dolphins' experience in the SI is S$200/swim/pp. (approx. U$27.-). According to the facilities manager, these 'swim-with programs' are increasingly popular worldwide and Asia in particular, where prices for such activities can be up to 3-4 times higher than charged at Gavutu. The rise in demand for captive dolphins has been described as an 'explosive expansion' by the industry. As mentioned above, meeting such market demand is likely to result in unsustainable levels of dolphin catches. Clearly, additional data is needed on SI dolphin resources (on local species population estimates and ecology) to ensure that any export will not cause detrimental effects to SI dolphins. In the meantime the precautionary principle may need to be applied by government licensing agencies.

Another, related issue is the negative view of the international press on dolphin exports. The protesting (and occasionally misinformed) news articles that surround SI dolphin exports to date may substantially decrease the overall tourism potential of the Solomon Islands. This 'negative press' effect should not be underestimated and could be viewed as a potential economic loss – especially as marine/nature-based tourism (diving, recreational fishing, birding, trekking, in combination with SI rich cultural heritage) is widely regarded by government as a major contributor to the national economy in the future. Responsible wild cetacean watching ventures may be a viable component of such an industry, even in developing, remote island nations (Hoyt 2001, Kahn 2002c).

However, such tourism ventures are difficult to reconcile with live-dolphin captures that are often perceived by foreign tourists as high-impact and unsustainable. Hence, it is important to note that in early 2005, the government of the Solomon Islands announced a complete ban on further exports of dolphins. A joint declaration by the Minister for Fisheries and Marine Resources and the Minister for Forests, Environment and Conservation detailed that this new policy is effective immediately (see Appendix 5).

POTENTIALLY SIGNIFICANT CETACEAN-FISHERIES INTERACTIONS: THE SI PURSE SEINE TUNA FISHERY

The western and central Pacific Ocean currently supports the largest industrial tuna fishery in the world (Bailey et al. 1996). Within this vast region, the Solomon Islands is one of the most productive waters for skipjack and yellow-fin tuna in the tropical Pacific Ocean (Fig 14). Because of the diversity of oceanic cetaceans known or suspected to inhabit SI waters (Table 1), and the intense pelagic fishing pressures, such interactions may be significant.

Although no reliable data exists on any significant oceanic cetacean-tuna fisheries interactions - such as potential entanglement and (by) catch, or depredation - the region's tuna fisheries management agency, The Secretariat of the Pacific Community (SPC), notes that

'While we remain largely ignorant about the impacts of tuna fisheries on by-catch species and pelagic ecosystems, it is obvious that these impacts have increased very significantly over the last 50 years as tuna fisheries worldwide have expanded their catches and effort by orders of magnitude. However, we have little or no information on the relative abundances or biomasses of many components of the pelagic ecosystem' (see also Appendix 4).

Many national and indeed regional stakeholders agree that a cetacean by-catch assessment is urgently needed for the western Pacific (see www.cetaceanbycatch.org for a Call to Action by the world's leading cetacean by-catch experts). A SPC report by (Bailey et al. 1996) includes one of the few relevant references on cetacean by-catch for the Solomon Islands' marine fisheries. The report lists by-catch in the tropical western Pacific for each gear type (purse-seine, longline, others). It notes that the number of marine mammal landings in these fisheries is 'minor'. Thus it seems that cetacean by-catch for pelagic tuna fisheries in this region does not warrant concern.

However, this report was based on log sheet data as recorded by the fishermen themselves and this may have underestimated such occurrences. It would be interesting to confirm the minimal cetacean by-catch with data from the SPC independent observer program. Unfortunately, such independent data is limited as the observer program in the Solomon Islands was initiated in 1998 and there was minimal data collection during most of 2001 due to the civil unrest (D. Brogan, SPC Secretariat, pers comm. in Sept 2004).

Hence, observer data is only available until the end of 2002. The 2003 observer sheets are currently being processed. Observer data collected during the 1998 - 2002 period included mandatory reporting of all marine mammal landings but there were no official guidelines to record cetacean-fisheries interactions or sightings. This situation is currently being addressed by SCP, through implementation of several key recommendations of an expert workshop on cetacean-tuna fisheries interactions. SCP has provided additional training of observers and introduced specific data forms to record cetacean landings, fisheries interactions and sightings. Improved data on cetaceans should be available from 2003 onwards (D. Brogan, pers. comm.). SCP has been helpful with further inquiries and noted that additional - and up to the most recent - data will be released upon request from officials of the Solomon Islands Ministry of Fisheries. Such a request is currently being completed.

The potential for cetacean-tuna fisheries interactions in the SI may warrant further investigation, especially as the SI Cetacean REA indicated an apparent low total individual count or absence of many oceanic dolphin species. Thus, a comprehensive assessment of cetacean-pelagic fisheries is needed for SI. As pelagic fisheries data is often pooled for large sections of the South Pacific, such a study may need to include adjacent fishing grounds such as Papua New Guinea. More detailed statistics on the pelagic tuna fishery in SI waters, and other small scale, in-shore marine fisheries of the SI are provided in Appendices 3 and 4, including a summary of discard and by-catch.

Potential for Cetacean Watching in the Solomon Islands

The SI Cetacean REA's activities included an initial assessment of the potential for local cetacean watch opportunities, especially for sperm whales and coastal dolphins. Whale- and dolphin watching in the wild is a fast-growing industry with world-wide revenue of over 1.5 billion US$ dollars each year, and practiced in over 87 countries (Hoyt 2001). Many coastal nations have benefited from the development of well-managed whale watching operations. Interestingly, this potential can be realised fairly quickly (< 5 years) if conditions are right and the activities are regulated properly (Hoyt 2001, see also Kahn 2002c for a review on cetacean watch development options in Indonesia, which faces similar challenges to SI for assessing and realizing its cetacean-watch potential).

Cetacean watching may be a valuable new marine tourism industry to developing archipelagic nations such as the Solomon Islands. Consistent sightings of cetaceans in local waters may provide coastal communities with a valuable opportunity to establish new eco-ventures such as responsible cetacean watching. From this socio-economic perspective, there is also a need to evaluate the ecological significance of SI's waters for cetaceans. In particular, an assessment of the role cetaceans can play in regional eco-tourism development and economic diversification in remote regions of SI was an important aspect of the SI Cetacean REA (ecotourism is broadly defined here as: responsible nature-based tourism which causes minimal environmental impacts, as guided and/or regulated by best industry practices which are periodically reviewed).

The SI government has already expressed keen interest in developing responsible sperm whale watching in the archipelago, as part of a national marine tourism strategy. No substantial work has been conducted yet to attempt to assess the feasibility (i.e. identify possible species and promising areas) for such marine tourism ventures in SI waters. It is a noteworthy trend that increased protective measures for cetaceans have often 'kick started' or accelerated the development of a whale and/or dolphin watching industry in new locales and nations. In addition, benign research and monitoring of living whales and dolphins have been incorporated at most, if not all, highly successful and responsible cetacean watch industries. Outcomes of these programs help to evaluate the potential impacts of tourism activities on cetaceans over time and fine-tune the regulations (Hoyt 2001).

The SI Cetacean REA determined that several coastal communities, such as the Shortlands and Savo Island, have important spinner dolphin resting areas at their local reef lagoons. These preferred dolphin habitats seem stable for exceptional long periods and often have been known to villagers for over five generations. Responsible, well regulated, wild cetacean watching may be feasible in these locations. The passage between Honiara, Guadalcanal and the Florida Islands is also locally known for its frequent dolphin sighting, as well as the occasional whale. Indeed in this area the SI Cetacean REA sighted a large rorqual baleen whale. It seems that this area has wild dolphin tourism potential (but see the section on International dolphin export trade). Presumably, similar accessible and reliable dolphin

habitats can be found in other areas and communities not visited by the Solomon Islands Marine Assessment, such as the eastern provinces.

Judging from reports of frequent sightings of large whales close to shore, the St. Cruz area may hold significant potential for (sperm) whale watching. Additional feasibility studies in all these areas are needed to evaluate the economic viability and sustainability of such ventures. Importantly, any developments in cetacean watching should be coupled with operator-endorsed codes of conduct and appropriate regulatory frameworks, including the establishment of Marine Protected Areas.

Overall, responsible wild cetacean watching may have considerable potential in the Solomon Islands. However, the development of such a tourism industry will be hard to reconcile with the Solomon Islands' dolphin export trade, which often generates considerable negative, high-profile, international (and occasionally misinformed) press coverage for the SI – and is likely to influence visitation numbers and thus hamper national tourism growth.

Recommendations

Capacity Building for Improved National and Local Cetacean Expertise

SI needs to build local capacity for cetacean monitoring and research programs by additional training of government and NGO personnel, as well as interested resort dive staff and community groups. In particular, a national workshop is needed to build capacity for improved local expertise on cetacean conservation and management. The workshop would target key stakeholders (government officials, NGOs, community groups) and provide an introduction to:

- The diversity and ecology of Solomon Islands' whale and dolphin species.
- Cetacean identification at sea (resident and migratory species), methods for dedicated surveys (i.e. line transect, photographic mark-recapture studies) and basic cetacean REAs (new areas of interest, limited funds), standardized data collection and data management.
- Government and community-based sighting/stranding networks (incl. rescue and data collection techniques from live and dead strandings; raise awareness with management agencies and the general public).
- Responsible whale watching – international guidelines.
- Conservation and management issues that are particularly relevant to SI's cetaceans.

Ideally, such a workshop would be coupled with a small field component (1-2 days). This field activity would focus on practicing skills learned during the workshop, while at the same time addressing an important data gap for local waters. Overall the workshop would build on the outcomes of the SI Cetacean REA and a) greatly improve cetacean awareness and b) promote the establishment of, and active involvement in, cetacean conservation and management programs amongst SI stakeholders.

In addition to these expected outcomes, the workshop is also an important tool to share existing information and increase high-quality data gathering on SI cetacean diversity, distribution and ranking of species-specific sighting frequencies and total individual counts.

ADDRESSING THE KNOWLEDGE GAP ON SI CETACEANS – A NATIONAL APPROACH

The waters of the Solomon Islands are expected to inhabit an exceptional cetacean diversity (at least 33 species, Table 1), yet there has been minimal survey effort and ecological research to date. Currently, there exists a major knowledge gap on the diversity, abundance and distribution of whales and dolphins in Solomon Islands' territorial waters.

The SI Cetacean REA has started to fill this nation-wide data-deficiency, and has provided initial information for the ecosystem-based management of the marine (mammal) resources of the Solomon Islands. To build on this baseline REA, there is a need to develop a national cetacean program with national and site-specific components:

1. Cetacean biodiversity mapping – Cetacean surveys (line-transect; photographic mark-recapture) as well as visual and acoustic REAs (especially in large data-deficient areas), and dedicated surveys rapid assessments and surveys.
2. Focus research on priority whale and dolphin species, including work on population estimates and stock boundaries for commercially exploited species (such as the Indo-Pacific bottlenose dolphin, as well as the major species targeted in the traditional drives) and ecology (i.e. breeding, feeding, migration).
3. Education, outreach and local capacity building.
4. Policy development for marine mammal conservation and management, for both national and provincial governments.

The multi-disciplinary approach of such a national cetacean program for SI will address the need for:

1. Additional data on whales and dolphins in national waters for improved, ecosystem-based management – including responsible wild cetacean watch development.
2. A framework to guide consistent national policy on cetacean management and conservation.
3. Broadened environmental awareness, institutional capacity and marine resource management perspectives.

The policy development aspect of the program is of importance as the Solomon Island Seas are comprised of international (EEZ), national and provincial waters which may have different jurisdictions, affecting different species assemblages and habitats. Thus, SI legislation may include different and potentially conflicting, legal frameworks of direct relevance to the management and conservation of cetaceans.

Therefore, a multi-pronged cetacean program - with both provincial and national components - will provide Solomon Islands with the initial ecological know-how, educational initiatives and policy advice. It will assist with the identification of management and conservation measures – both species and habitat specific - that may be considered for the diverse assemblage of whales and dolphins inhabiting the waters of the Solomon Islands.

This current knowledge gap for SI's cetaceans should be addressed in the near future to assist both government and conservation organizations in their decision making on (often shared) marine resource management decisions of national and regional importance, and to meet responsibilities for various international conventions and treaties of which the SI is a signatory or member state.

SHORT-TERM PROJECTS TO ADDRESS THE KNOWLEDGE GAP

There are clear and practical opportunities in the SI to maximize the amount of information available for such a national management approach. Several projects can be implemented in the short term which are both cost-effective and of high management value (Kahn 2003c) and would improve the protective management of the SI's residential and migratory cetaceans:

a) Existing information (past and present) on SI cetacean and large migratory marine life sightings needs to be canvassed and consolidated by seeking further input from provincial and national government agencies, coastal communities, local NGOs, dive shops, dive resorts and other knowledgeable stakeholders.
b) A local cetacean sighting and stranding network for each province needs to be established, and coordinated as part of a national Solomon Islands Marine Mammal Network (reporting of sightings and strandings - including tissue sampling of dead animals - and rescues).
c) New sightings and human-interactions (fisheries, tourism) need to be recorded nation wide on standardized data sheets, preferably identical to those used by APEX Environmental in other Asia-Pacific nations or other appropriate format.
    - Include detailed behavioural and habitat use data whenever possible (i.e. indications of feeding, diving, migrating, mating, resting, active avoidance behaviours).
d) Periodic and dedicated cetacean REAs should be conducted in areas of interest, as well as population estimate surveys and ecological research on priority species. Fieldwork should be implemented by an expert team including local members from marine resource management government agencies, coastal communities and NGOs.
e) Innovative ways for opportunistic cetacean surveys should be explored (i.e. during other marine monitoring projects or related field activities; 'ships of opportunity').
f) Investigate the sustainability of the SI traditional dolphin drives (see also Section C).
g) Investigate and record all other reported interactions of cetaceans with
    - Fisheries – by-catch and targeted catch; coastal and pelagic, artisanal, small and large scale fisheries.
    - Marine tourism – surface observations and 'swim-with-cetacean' encounters.
    - Other commercial uses of marine mammals including the captive-dolphin export trade.

IDENTIFYING IMPORTANT CETACEAN HABITATS FOR PROTECTIVE MANAGEMENT

As mentioned above, the cetaceans of the Solomon Islands are extremely data-deficient, and the Solomon Islands would benefit from additional cetacean work in most of its provinces. Therefore, it is not possible to prioritize areas for protection on a national level at present, as habitats such as preferred breeding, feeding, resting areas, migratory routes and corridors are not known for most whale and dolphin in the Solomon Islands.

However, best available information suggests that the following areas may be important cetacean habitats in the SI, and further studies are required to confirm their status. Thus, this shortlist should be regarded as preliminary and is likely to change and become more specific once more data becomes available.

a) N Guadalcanal – Florida Islands waters and inter-island passages (consistent sightings of small cetaceans, extremely large schools of dolphins reportedly 'passing through', as well as occasional 'whale' sightings).

b) New Georgia Group, especially the wider Gizo – Kolombangara – Simbo Isl. area (diverse deep water habitats, reportedly frequent sightings of pilot whales, unidentified large whales).
c) Malaita, especially the waters around Fanalei and Bita 'Ama.
d) Fauro Islands - Shortlands Island Group ('resident' spinner dolphin groups, population and ecology research – reef lagoon habitat use).
e) Russell Islands - diverse deep water habitats, reportedly frequent sightings of orcas, and to a lesser extend sperm whales.
f) Southern oceanic waters off New Georgia – frequent Bryde's whale sightings, major target area for tuna fisheries (purse seine fleet).
g) All deep, yet relatively narrow passages separating the main islands of the Solomon Islands from the South Pacific Ocean or the Solomon Sea, which are known or suspected multi-species migratory corridors.
    - Indispensable Strait – Bita 'Ama – large baleen whales (possibly blue whales),
    - Manning Strait including the Arnavon Islands.
    - Iron Bottom Sound
    - Gizo Strait and Vella Gulf
    - Blanche Channel
    - Bougainville Strait.

h) St. Cruz Province (diverse deep water habitats, reportedly frequent sightings of sperm whales and to a lesser extend orcas) – all waters of the eastern and southern provinces of SI have not been covered by the REA.

Conservation Options – Marine Corridors and Local Dolphin Resting Lagoons

Marine Corridors

Marine corridors are site-specific habitats (as opposed to the much more dynamic off-shore habitats for these wide ranging species) which are critical to numerous species of large migratory marine life, including oceanic cetaceans such as sperm whales, (whale) sharks and mantas, marine turtles, sunfish, as well as straddling fish stocks such as billfish and tuna. We also know that these passages are often located within the Indo-Pacific region's many archipelagic nations - such as Indonesia, Philippines, Solomon Islands and Papua New Guinea, Maldives, Seychelles (Kahn 2003, 2002a. Here they play an important role in ensuring the integrity and functionality of Large Marine Ecosystems (LMEs). Yet these very same passage areas are increasingly vulnerable to local disturbances. Such localized impacts can have major regional ramifications for marine conservation and sustainable fisheries initiatives (Agardi 1997). Marine corridors are usually coastal habitats and offer an important opportunity to improve migratory species conservation. They are relatively easy to include in coastal resource management programs (again, when compared to habitats in EEZ waters or high seas; Kahn 2003).

Corridor conservation can be effectively achieved via habitat-based management frameworks including multi-use Marine Protected Areas. Key issues for corridor conservation in the Solomon Islands include fisheries interactions; especially gill and/or drift netting practices in or near corridors which may effectively cordon off a passage. Because of the seasonal migrations of whales and other migratory marine life, even short periods of intensive fishing with gillnets in the vicinity of corridors can result in very significant by-catch and entanglement rates. Whale entanglements in gillnets are a lose-lose situation: the whale often loses its life, the fishermen often lose their expensive nets.

A destructive fishing practice (DFP) known as reef blasting is common and widespread throughout Indonesia and the Philippines. It is not known whether this practice is used in the Solomon Islands, but unconfirmed reports suggest it may occur in certain locations. Numerous direct lethal and sub-lethal effects, as well as indirect impacts, of the pressure wave of an underwater blast on cetaceans have been described (i.e. Ketten 1998, see Kahn et al. 2000 for a summary on potential impacts of reef bombing on corridor habitat in Indonesia).

Reef bombing in or near corridors may be a potentially significant threat to cetaceans as underwater explosions may cause a) direct harm to animals close by and b) substantial acoustic habitat degradation which may lead to corridor avoidance. Long-term sources of noise pollution such as shipping and off-shore oil and gas activities near corridors may also contribute to acoustic habitat degradation; although the impact of such increased under sea noise levels on whales and dolphins may differ greatly between species and remains poorly understood. Overall, management measures may vary substantially between corridor sites and ideally are incorporated within long-term management plans (i.e. Kahn 2002a, 2003). For example, Komodo National Park World Heritage and Biosphere Reserve includes two major corridor passages for whales and other migratory marine life. Providing better protection for these habitats was an important factor to justify and gather local support to establish a complete ban on gillnetting in Park waters through new district-level legislation (Kahn and Pet 2003).

Dolphin Resting Lagoons

On several occasions during the SI Marine Assessment the local community knowledge on cetaceans included information on specific reef lagoon areas where spinner dolphins were known to 'rest'. Other species such as bottlenose dolphins may have similar preferred reef habitats but this could not be verified. Community interviews showed that pods of spinner dolphins used the same area every day and these sites where often known for many generations, indicating long-term site fidelity.

These reef habitats have been identified as resting areas for spinner dolphins in other regions of the tropical Pacific (i.e. Hawaii, Tahiti) and it is likely that the several populations of spinner dolphins use Solomon Island lagoons in a similar fashion. Reef lagoons may function as safe daytime resting areas for this mostly nocturnal species. Its clear, sheltered waters and sandy bottoms provide an effective environment for early predator detection and avoidance (such as sharks).

From a management perspective two issues may be of importance:

1. The opportunity to work with local communities to ensure these reef habitats are not degraded. Indeed it seems that the coastal communities we encountered regard these areas as special and provide them de facto protection by excluding some fishing activities for example and
2. The dolphin watch tourism potential in local waters - such as dolphin resting lagoons (see Section D).

In these locations community-based marine management approaches, in collaboration with provincial and national government agencies, may be an effective management framework to ensure these important dolphin habitats are conserved, and where feasible, regulate any economic opportunities such as local dolphin watching activities.

TRADITIONAL DOLPHIN DRIVES – FANALEI

Dedicated Cetacean Surveys to Assess Relative Abundance for Species of Special Interest

Although the traditional dolphin drives in Fanalei are largely non-modernized, several aspects raise serious concerns. The long-term disappearance of the valued melonheaded whales (robo au) in local waters; increased effort due to population growth; and new market forces all clearly indicate that depletion of SI marine mammal resources can and does happen.

These aspects of the dolphin drives clearly indicate that depletion of SI marine mammal resources can and does happen. Clearly more work is needed to determine the sustainability of the traditional dolphin drives, and ultimately, to ensure the preservation of the unique cultural heritage of the SI. The SI Government may consider the following activities in particular:

Dedicated cetacean surveys in Fanalei waters to determine bio-diversity in local waters, estimate relative abundances of target species, habitat use as well as more socio-economic factors of the drives (incl. cultural heritage and aspirations of this community).

Such surveys would also be required to address the sustainability of the live-dolphin capture and international export trade.

Genetic analysis of samples from teeth included in Fanalei wedding dowries and other cultural artefacts (designed to incorporate a time-series, spanning >100 years) may be a cost-effective and realistic option to obtain information on the long-term population trends of target cetacean species in Fanalei.

Finally, it must be noted that just because the traditional dolphin drives are a highly visible impact on local spotted dolphin populations, this activity may not be the only or even the greatest impact on the population status of this and other target species (i.e. other factors acting throughout the populations' home range may include habitat degradation, potential effects of pelagic and coastal fisheries).

Canvassing of Community Knowledge on Local Cetacean Species and Habitats

TNC– Solomon Islands Program's on-going socio-economic survey will further solicit input from local communities through a cetacean questionnaire (W. Atu, pers. comm.).

Gavutu Captive Dolphin Facility

In addition to the recommendations of the IUCN Species Survival Commission report, the effect of the increased pressure on local fish stocks due to the captive dolphin food requirements should be further evaluated.

Potentially Significant Cetacean-Fisheries Interactions: the SI Purse Seine Tuna Fishery

The potential for cetacean-tuna fisheries interactions in the SI may warrant further investigation, especially as the SI Cetacean REA indicated an apparent low total individual count or absence of many oceanic dolphin species. Thus, a comprehensive assessment of cetacean-pelagic fisheries is needed for SI.

As pelagic fisheries data is often pooled for large sections of the South Pacific, such a study may need to include adjacent fishing grounds such as Papua New Guinea. More detailed statistics on the pelagic tuna fishery in SI waters, and other small scale, in-shore marine fisheries of the SI are provided in Appendices 3 and 4, including a summary of discard and by-catch.

THE CASE FOR SI TO BECOME A SIGNATORY STATE OF CITES[7].

CITES, the Convention of International Trade of Endangered Species, (see Appendix 2 for convention details) is an internationally recognized mechanism to sustainably manage wildlife trade in endangered species, including cetaceans. In order to strengthen the management and conservation of the relatively high level of endemic species and endangered species (both terrestrial and marine), the SI government should seriously consider to become a member of CITES.

CITES is widely recognized and respected as an effective conservation agreement with broad membership – 167 parties to date. It regulates trade in species between contracting parties, and to a lesser extent between Parties and non-Parties, but countries who stay outside the convention reduce the effectiveness of the regulations: CITES is only as effective as its coverage.

By joining CITES the Solomon Islands would improve CITES coverage and effectiveness and in doing so would be welcomed by the wider international community. In addition, Solomon Islands export a considerable quantity of fauna. While most SI species as reported by CITES may sustain such a trade, these are several cases where CITES has recommended a ban on imports of several species from the Solomon Islands. By not being a CITES member, the Solomon Islands has no mechanism to defend this commercial trade or officially oppose any trade restrictions.

The process of joining CITES is relatively straightforward and assistance can be provided through its Secretariat. Key obligations as a Party include:

1. The annual payment of a minimal fee based on GNP (i.e. less than $50- in the case of Palau),
2. Designating a Management Authority and a Scientific Authority to manage the trade of endangered species.
3. Adopt the provisions of CITES into its national legislation so that it can fully implement and enforce the provisions of the treaty.
4. Maintain records of all trade in CITES listed species,
5. Submit annual reports on trade to the World Conservation Monitoring Unit, a department of the United Nations Environment Programme (UNEP) and biennial reports on all measures taken to enforce the CITES provisions.

CITES may provide financial assistance to these National Authorities. Some of the other obligations do include a significant workload (i.e. points 4 and 5). However, developing nations routinely recover administration costs through the issuance of CITES permits.

The CITES treaty requires a country that wishes to join, to formally affirm its intent to be bound by the treaty. To join CITES, the Solomon Islands would have to deposit an appropriate legal instrument with the Swiss Government (the Depository Government). What

[7] Including technical advice on CITES obligations as kindly provided by Sue Miller, Whale and Dolphin Conservation Society (WDCS), UK.

constitutes an appropriate legal instrument for the Solomon Islands will be defined by its national law (e.g. ratification of the treaty by the Head of State or otherwise).

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Tables

Table 1. Preliminary marine mammal species list for Solomon Islands waters, with positive identifications during SI Cetacean REA and Fanalei names and relative catch frequency.

Generic identification (ID)	Scientific ID (Order Cetacea)	SI REA	Other reports[1]	Fanalei ID[2]	Targeted catch[3]	Relative frequency of catch[4]	Comments
Dolphins	*Fam. Delphinidae*	•	All	kirio	Yes		Highly diverse coastal and oceanic species (incl. the largest dolphin, the orca or killer whale), no riverine species known.
Beaked whales	*Fam. Ziphiidae*	•		Sao	No		At least 3 genera likely to inhabit SI waters.
Large whales	*Fam. Balaenopteridae; Physeter macrocephalus*	•	14	Busu asi	No		Rorqual baleen whales, sperm whale.
Dugong	*Dugong dugon (Order Sirenia)*	•	5, 14	Ia tekwa	No		Locally common but not extensively hunted. Highly data-deficient and thought to be at risk of extirpation throughout much of its range (Marsh et al. 2001).
Sperm whale	*Physeter macrocephalus*	•	8, 7, 12		No	(acoustic ID only)	
Dwarf sperm whale	*Kogia simus*				No		
Pygmy sperm whale	*Kogia breviceps*		9		No		
Short-finned pilot whale	*Globicephala macrorhynchus*	•	7,9		No		
Orca	*Orcinus orca*	•	8, 9		No		Avoided when sighted, same individual male seen in separate years

Species identification (ID)	Scientific ID	SI REA	Other reports[1]	Fanalei ID[2]	Targeted catch[3]	Relative frequency of catch[4]	Comments
False killer whale5	*Pseudorca crassidens*	•	8, 9, 7, 11, 14	Ga ia robo	No		Sometimes sighted
Pygmy killer whale	*Feresa attenuata*		7		No		Sometimes sighted
Melon-headed whale	*Peponocephala electra*		8, 9, 11, 16, 14 (teeth, no recent sightings)	Robo au/ Robo tafungai	Yes		Teeth are considered the most valuable, yet this species has not been caught (or seen) for many decades, and indeed, many generations (>100 years).
Spinner dolphin	*Stenella longirostris*	•	8, 6, 7, 9, 11, 14,16	Raa	Yes	Almost every year	
Spinner dolphin (offshore small body)				Raa matakwa	Yes	Almost every year	
Spinner dolphin (offshore, robust body)				Subo raa	Yes	Almost every year	
Pan-tropical spotted dolphin	*Stenella attenuata*	•	8, 7, 9, 6, 11, 14,16	Unbulu	Yes	Every year, main target species	
Striped dolphin	*Stenella coeruleoalba*		8, 7, 9, 14	Robo tetefa	No		
Rough-toothed dolphin	*Steno bredanensis*	•	8, 7, 9, 6		No		
Risso's dolphin	*Grampus griseus*	•	7, 9, 6, 14	Gwon mudu	No		
Bottlenose dolphin	*Tursiops truncatus*	•	8, 9, 14	Olo folosi	No		Do not react to noise of clapping stones

Species identification (ID)	Scientific ID	SI REA	Other reports[1]	Fanalei ID[2]	Targeted catch[3]	Relative frequency of catch[4]	Comments
Indo-Pacific Bottlenose dolphin	*Tursiops aduncus*	•			No		Do not react to noise of clapping stones
Short-beaked common dolphin	*Delphinus delphis*		5, 14	Rabo manole	No		
Long-beaked common dolphin	*Delphinus capensis*			Rabo manole	No		
Fraser's dolphin	*Lagenodelphis hosei*		14	Not known[6]	Yes	Every year	
Indo-Pacific Humpback dolphin	*Sousa chinensis*				No		Likely but no record found
Irrawaddy dolphin	*Orcaella brevirostris*		9		No		
Beaked whales	*Mesoplodon sp.*				No		
Blainville's beaked whale	*Mesoplodon densirostris*		7				
Gingko-toothed beaked whale	*Mesoplodon ginkgodens*						Likely but no record found
Indo-Pacific beaked whale	*Indopacetus pacificus*						Likely but no record found
Cuvier's beaked whale	*Ziphius cavirostris*		8		Yes	Sometimes	
Bottlenose whales	*Hyperoodon sp.*				No		
Common minke whale	*Balaenoptera acutorostrata*		12		No		
Antarctic minke whale	*Balaenoptera bonaerensis*						Likely but no record found

Species identification (ID)	Scientific ID	SI REA	Other reports[1]	Fanalei ID[2]	Targeted catch[3]	Relative frequency of catch[4]	Comments
Bryde's whale	*Balaenoptera brydei*		8, 12		No		
Pygmy Bryde's whale	*Balaenoptera edeni*				No		Highly likely but no record found (see Kahn et al. 2001)
Omurai's whale	*Balaenoptera omurai*						Reported recently as new baleen whale species from SI waters (Wada et al. 2001), but uncertainty remains on similarities with *B. edeni*, and the overall taxonomic status of the sei-bryde's whale complex
Sei whale	*Balaenoptera borealis*				No		Highly likely but no record found
Fin whale	*Balaenoptera physalus*				No		Likely but no record found
Blue whale	*Balaenoptera musculus*				No		Highly likely but no record found , see Bita 'Ama community interviews, sightings reported from experienced dive industry operators (to be verified)
Humpback whale	*Megaptera novaeangliae*				No		Highly likely but no record found, sightings reported from experienced dive industry operators (to be verified)

1 - As listed in Appendix 1.
2- Fanalei ID as reported during SI Cetacean REA interviews and literature (Takekawa 1996a,b in Appendix 1).
3- Targeted catch was assessed through SI Cetacean REA interviews.
4- Relative catch frequencies were assessed through SI Cetacean REA interviews.
5 -Identified species from the Arnavon Isl. Stranding and interviews with Conservation Officers.
6 -Takekawa notes that the name robo au may also apply to the Fraser's dolphin (*Lagenodephis hosei*) . This could not be verified during the SI Cetacean REA.

Table 2. Visual survey summary for the SI Cetacean REA May-June 2004.

Solomon Islands Cetacean REA	**May 10 – June 16 2004**
Survey effort	
Total days surveyed	36
Estimated survey distance (nm)	1228.1
Active visual survey effort (hr)[8]	160.0
Oceanic habitat zone (hr)	60.0
Coastal habitat zone (hr)	67.5
Straits and corridors habitat zone (hr)	32.5
Survey results	
Cetacean sightings	52
Cetacean total individual count [9]	815
Cetacean species diversity (total includes one acoustic species identification – the sperm whale)	11
Survey results corrected for effort	(average)
Species identified/survey day	1.14
Sightings/survey day	1.44
Total individual count /survey day	22.64
Sightings/survey distance (nm)	0.04
Total individual count /survey distance (nm)	0.66

[8] Active visual survey effort = Total hours - hours spend off effort (due to sea time spend on species identification and/or tracking and ecological research on priority species, logistical constraints).
[9] Cetacean total individual count = Direct count of cetaceans surveyed (total of *minimal* abundance estimates of cetaceans at the surface/sighting). See methods for more details.

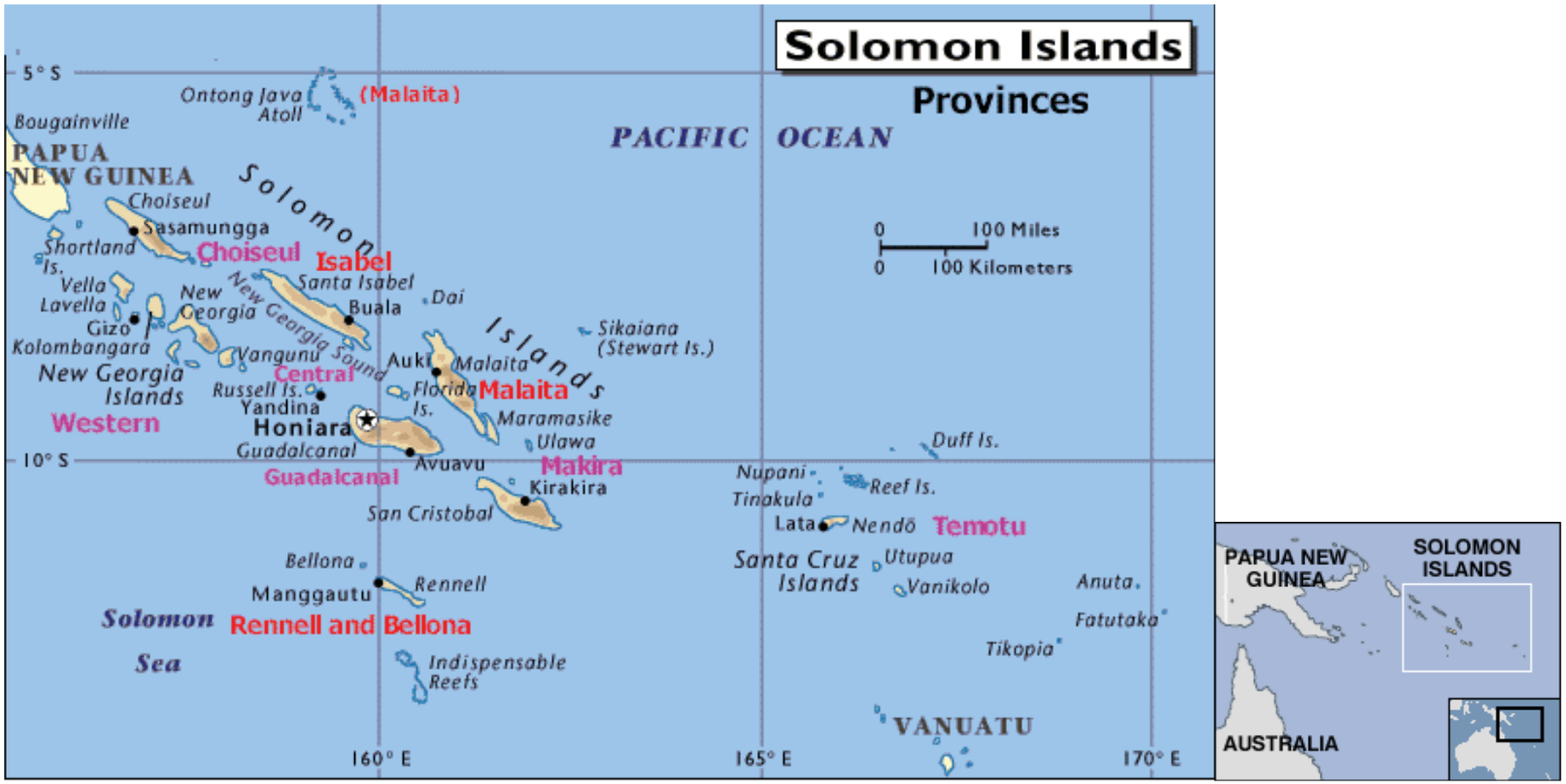
Table 3. The SI Cetacean REA legs, including key parameters.

REA Leg No.	Area Description	Days	Distance
			(nm)
1	Guadalcanal - Florida Isl. - St. Isabel	7	204.30
2	Arnavon Isl. - Choiseul – Shortland Isl. - Mono Isl.	8	261.60
3	New Georgia Group – Russell Isl. - Guadalcanal	7	232.40
4	Guadalcanal - Makira - Florida Isl. - Savo	6	159.60
5	3 Sisters - Malaita - N Indispensable Strait	6	210.20
All - SI	All Solomon Islands Legs	34	1068.10
PNG-SI	SE Bougainville – Guadalcanal, Honiara	2	160.00
TOTAL	All Solomon Island Cetacean REA Legs	36	1228.10

Table 4. Acoustic survey summary for the SI Cetacean REA May-June 2004.

Solomon Islands Cetacean REA	May 10 – June 16 2004
Listening stations	49
Acoustic encounter rate (% of contacts/stations) – all cetacean species.	51.0
Acoustic encounter rate (%) – sperm whales	8.2
Estimated acoustic coverage (nm^2) -sperm whales (6.0 nm detection radius/station)	5541.8
Estimated acoustic coverage (nm^2) -oceanic dolphins (2.5 nm detection radius/station)	962.11

Figure 1. Solomon Islands' provinces and main islands (including eastern provinces not included in this Marine Assessment) and geographic location of the Solomon Islands in the Pacific (insert).



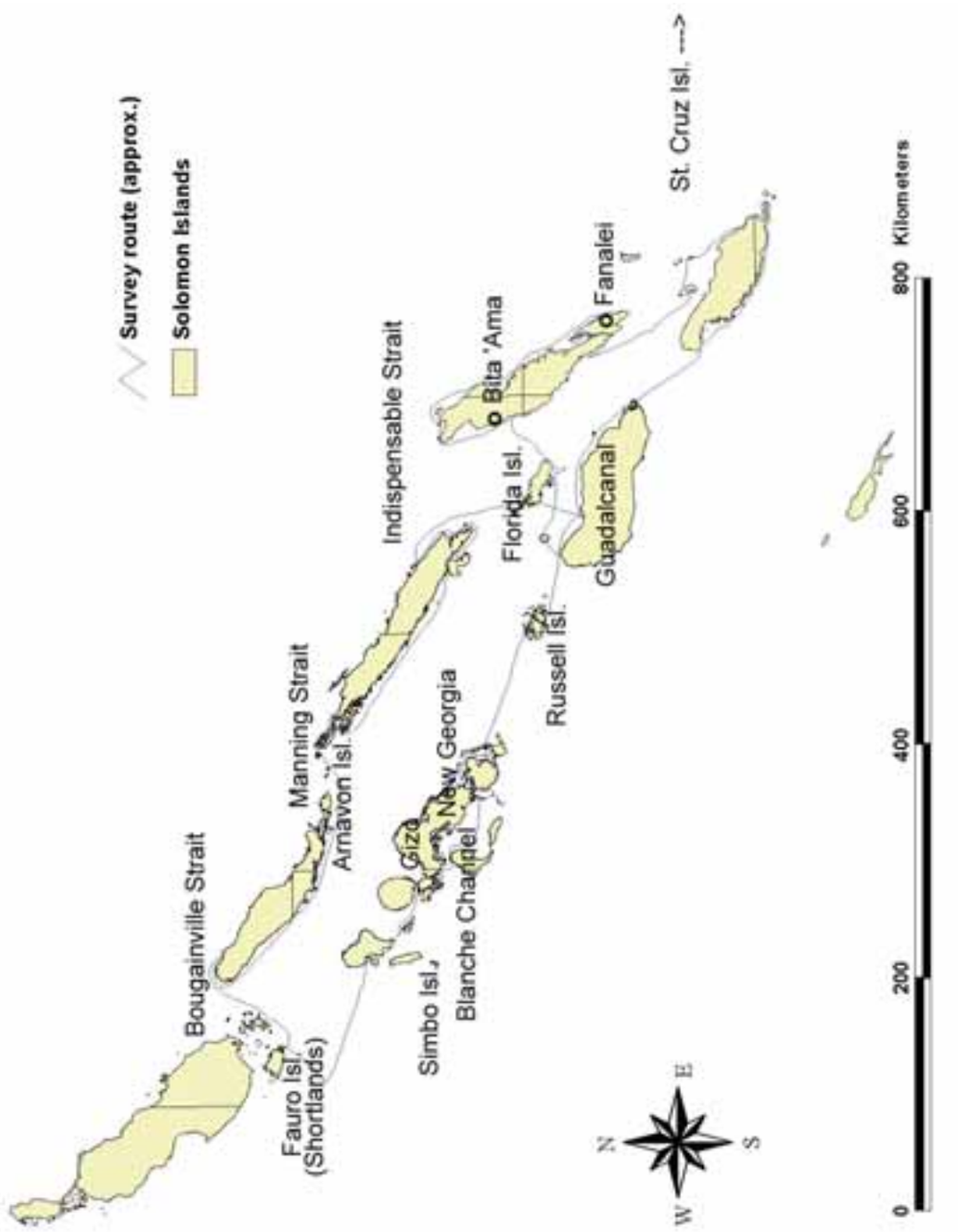
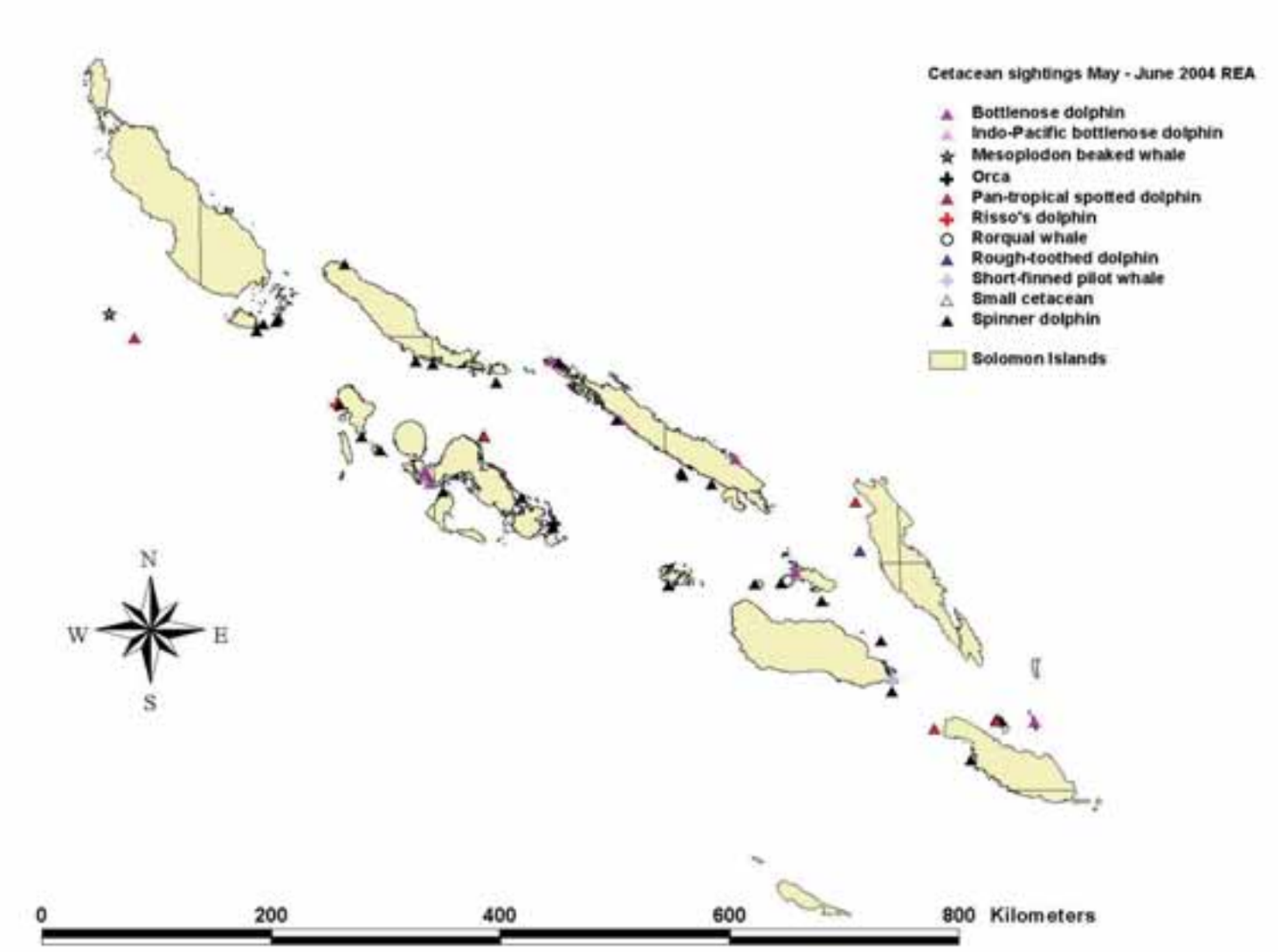


Figure 2. Approximate track of vessel FeBrina during the SI Cetacean REA (as digitized from the passage charts), not including the passages to/from Papua New Guinea.

Figure 3. Cetacean species diversity and distribution in the SI Cetacean REA: May – June 2004 (n=52).



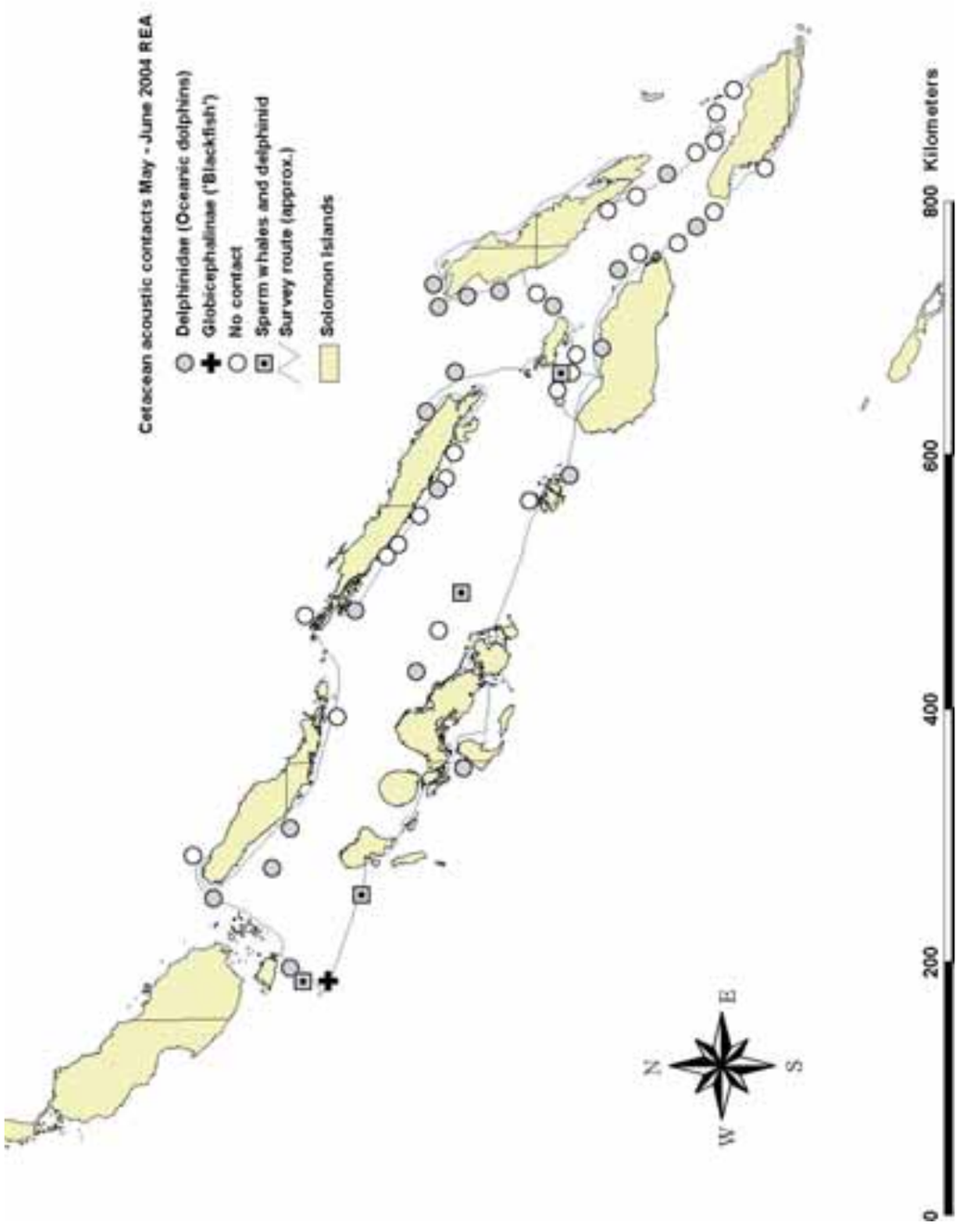


Figure 4. Distribution and diversity of acoustic contacts recorded on listening stations conducted during the SI Cetacean REA: May – June 2004. (n=49). Note: track does not include PNG-SI passage during which 3 listening stations were made on the Mono Isl. – Guadalcanal leg – in The Slot to the N of New Georgia.

Figure 5a-d. Summary of visual survey effort for the SSI Cetacean REA: May – June 2004

Figure 5a. Active visual survey time per habitat zone (n = 160.0 survey hours)

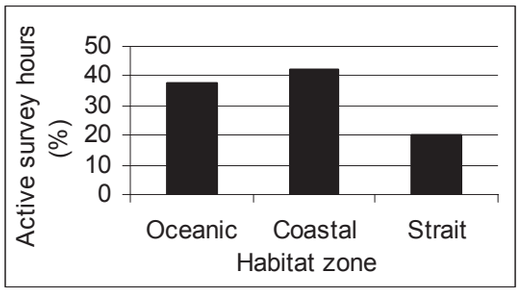


Figure 5b. Visual survey distance ranges (n = 1228.1 nautical mile) for each survey day (n=36 days).

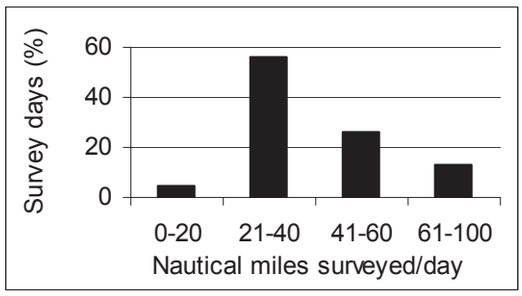


Figure 5c. Number of cetacean sightings per survey day (total survey days n=36).

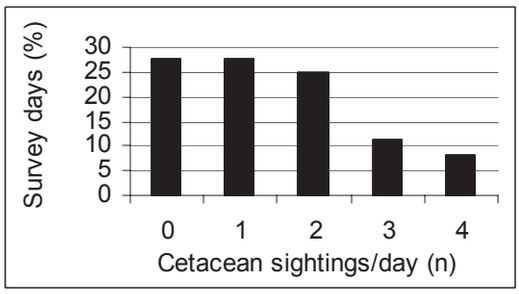


Figure 5d. Number of species identified per survey day (total survey days n=36).

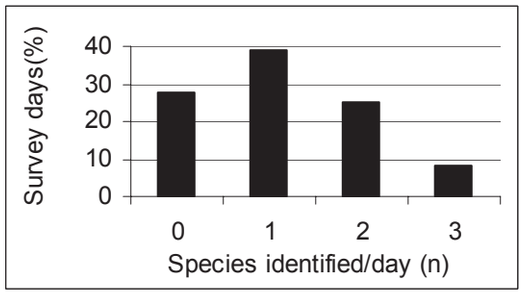


Figure 6. Species-specific sighting frequencies for the SI Cetacean REA: May – June 2004 (% of total sightings, n=52).

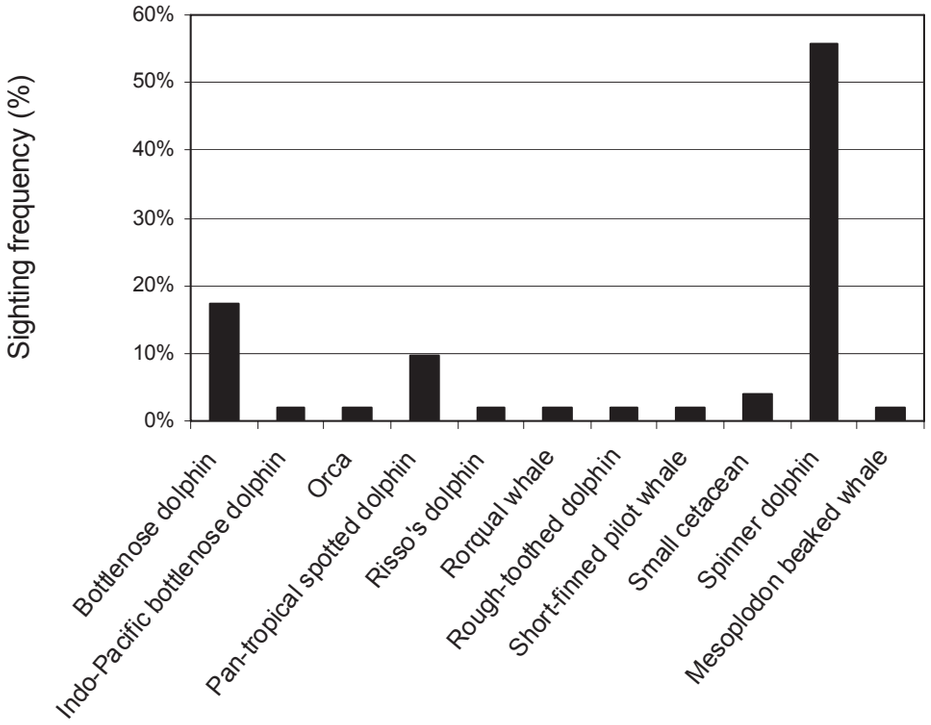


Figure 7. Species-specific frequency of total individual count (n=815) for the SI Cetacean REA: May – June 2004.

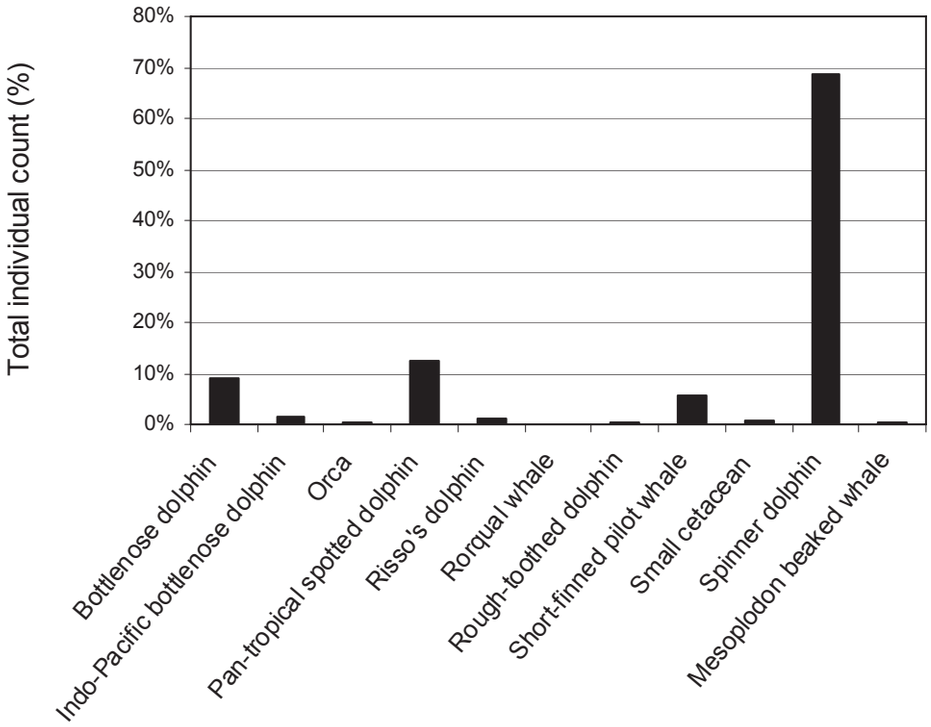


Figure 8a-f. Summary of visual survey effort and results for each SI Cetacean REA leg.

Figure 8a. Visual survey effort per SI Cetacean REA leg

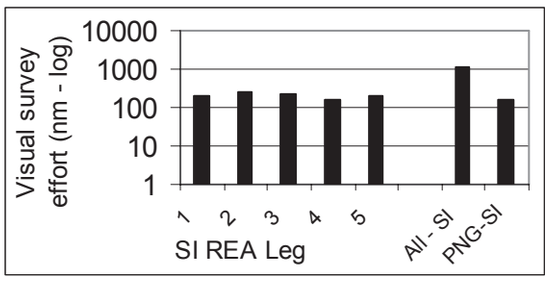


Figure 8b. Number of cetacean species positively identified per SI Cetacean REA leg.

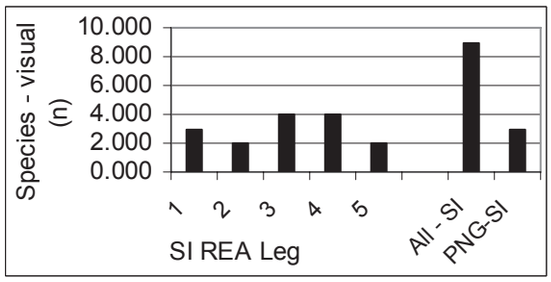


Figure 8c. Species diversity index (species identified/nm) per SI Cetacean REA leg.

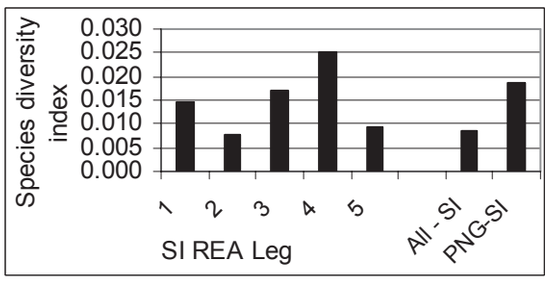


Figure 8d. Sightings index (sightings/nm) per SI Cetacean REA leg.

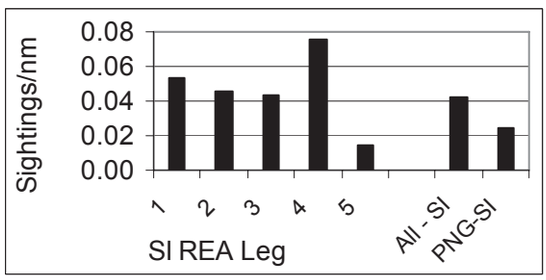


Figure 8e. Total individual count index (count/nm) per SI Cetacean REA leg.

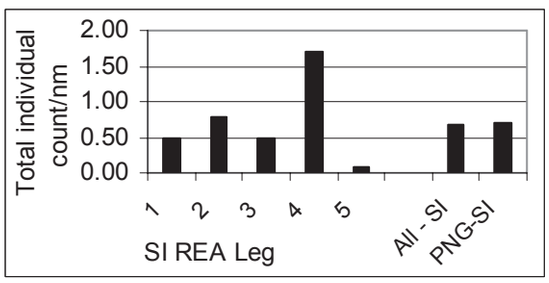


Figure 8f. Average visual conditions per SI Cetacean REA leg.

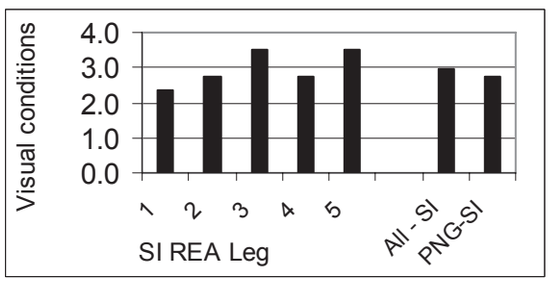


Figure 9. Acoustic survey categories for all listening stations conducted during the SI Cetacean REA: May – June 2004.

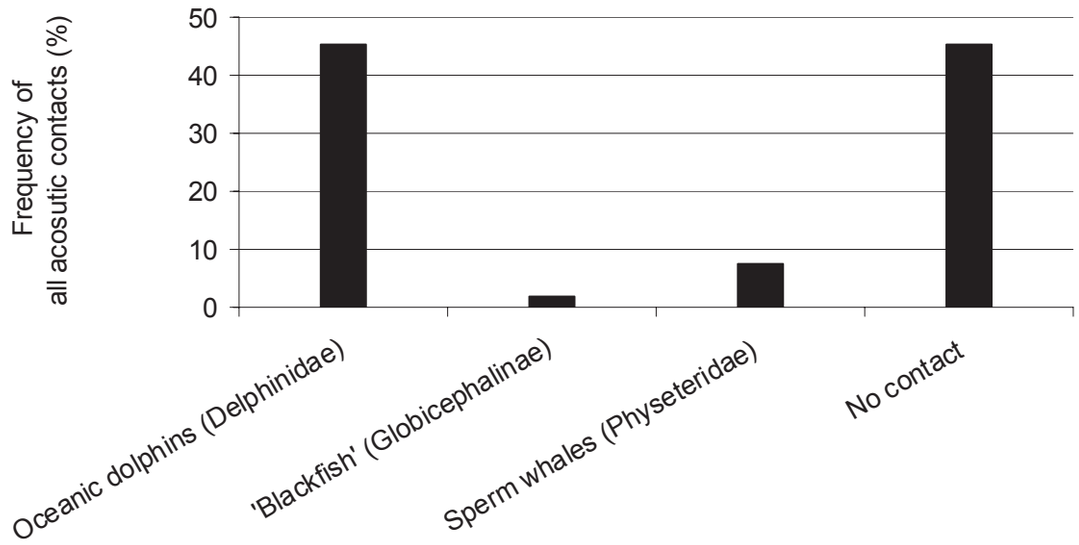


Figure 10. Acoustic survey categories for positive cetacean contacts only.

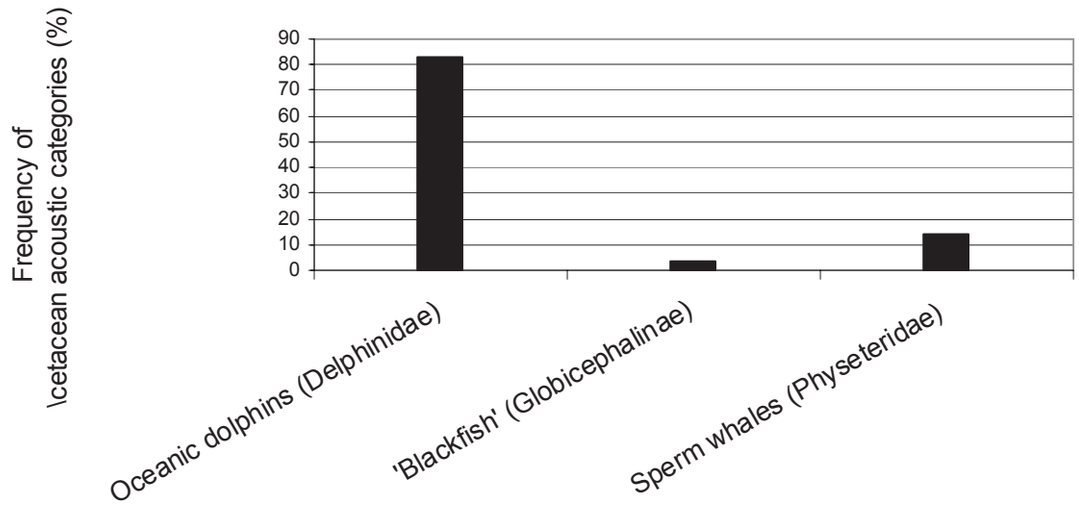


Figure 11a-d. Summary of acoustic survey effort and results for the SI Cetacean REA legs, including the PNG-SI passage.

Figure 11a. Hydrophone listening stations (passive bio-acoustic monitoring) conducted for each leg.

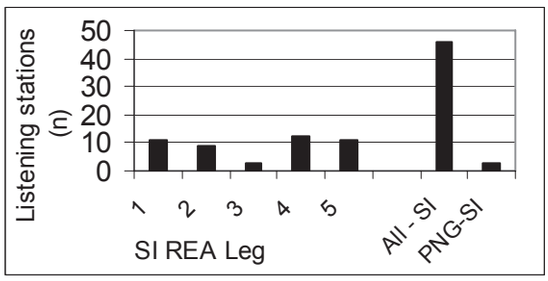


Figure 11b. Percentage of acoustic contact with cetaceans during the hydrophone listening stations conducted each leg.

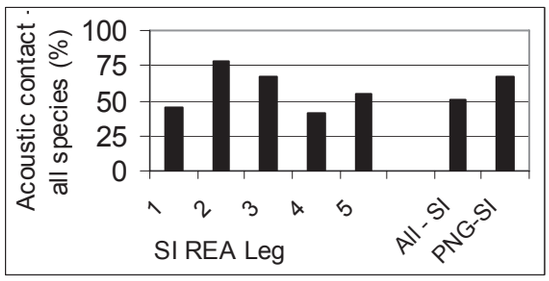


Figure 11c. Ratio of acoustic contact with sperm whales over all acoustic contacts for each leg.

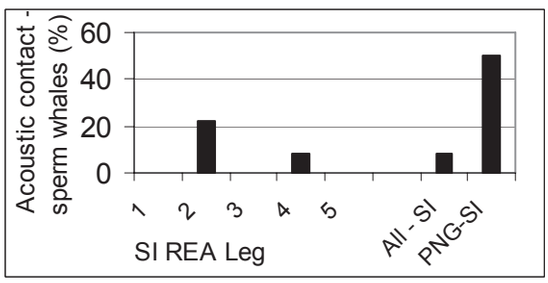


Figure 11d. Average acoustic conditions during each leg.

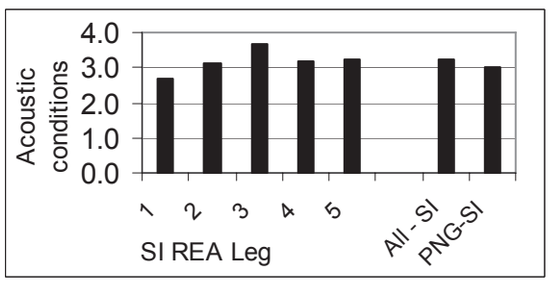


Figure 12. Frequencies of cetacean species associations (% of total sightings) recorded during the SI Cetacean REA: May – June 2004.

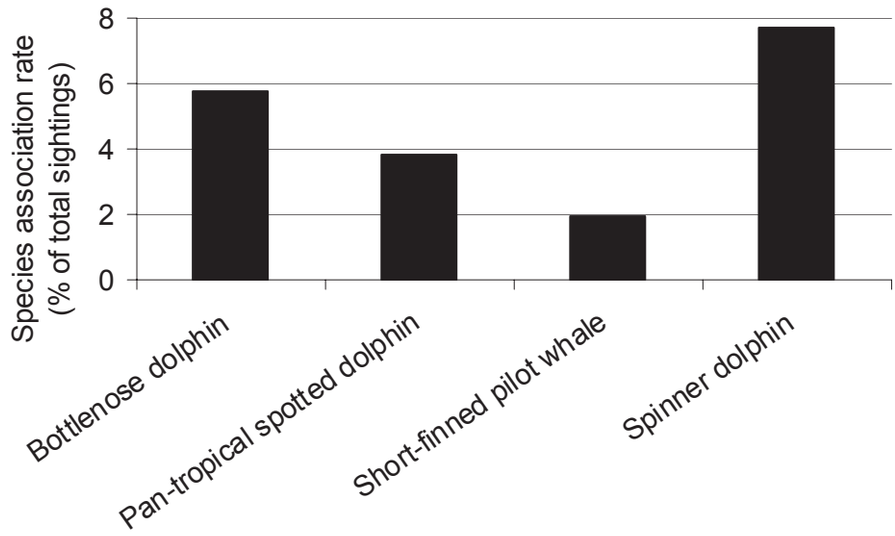


Figure 13a-b. Environmental conditions – visual and acoustic – during the SI Cetacean REA.

Figure 13a. Frequency of sighting conditions during the SI Cetacean REA.

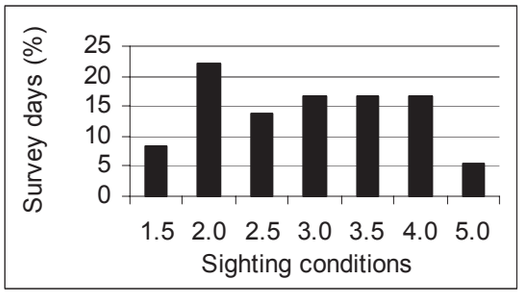


Figure 13b. Frequency of acoustic conditions/listening station during the SI Cetacean REA.

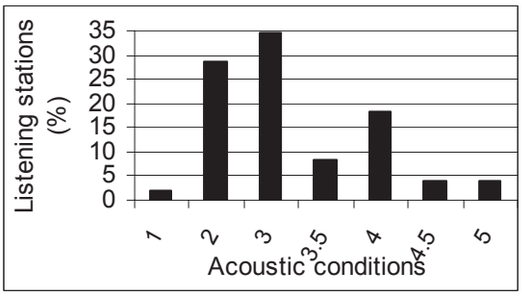
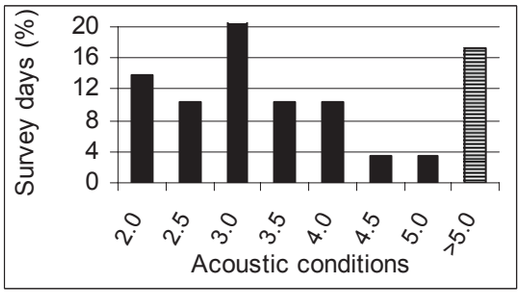
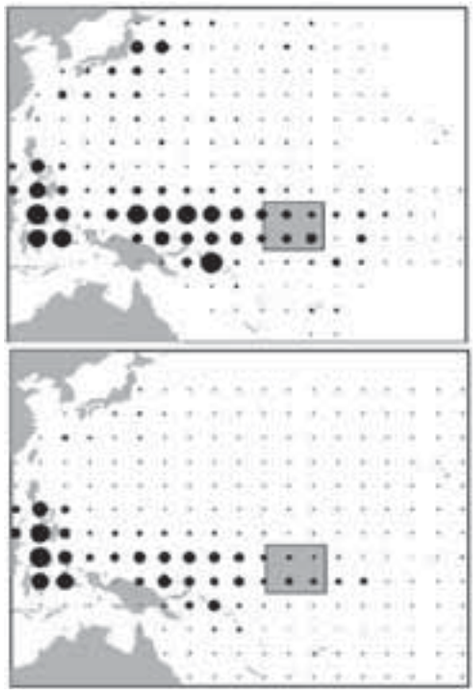


Figure 13c. Frequency of acoustic conditions/survey day during the SI Cetacean REA.



Please refer to relevant sections for more details.

Figure 14. Distribution of skipjack (top) and yellowfin (bottom) average catch in the western Pacific Ocean, 1988-1992.



The maximum circle size represents annual catches of 39,200 mt for skipjack and 26,000 mt for yellowfin. The rectangle indicates the Gilbert Islands area (from Hampton and Sibert 1995, as reproduced and quoted in Hampton et al. 1995).

Figure 15: Photos of several cetacean species and activities during the Solomon Islands Marine Assessment.

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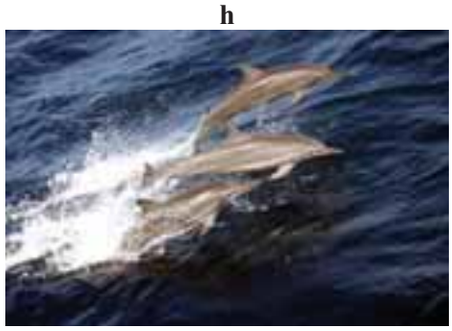

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a) A sperm whale (*Physeter macrocephalus*) commences a deep a foraging dive, Sulawesi Sea, Indonesia (acoustic identification only during the Solomon Islands Marine Assesment).
b) Fauro Island residents (Shortland Islands) 'call' spinner dolphins (*Stenella longirostris*) to bow ride with their speedboat, by banging a paddle against the inside of the hull.
c) The narrow reef lagoon entrance of Fanalei village, part of the most difficult phase of the traditional dolphin hunt.
d) Interviews canvassing information on local cetaceans and traditional dolphin hunting with Fanalei elders and community members (photo by D. Wachenfeld).
e) Indo-Pacific bottlenose dolphins (*Tursiops aduncus*), Gavutu live-capture and dolphin display facility, Florida Islands.
f) Members of a Makira village paddle out to greet the survey vessel. Such encounters were routine in most anchorages and an opportunity to ask for local knowledge on cetaceans.
g) Short-finned pilot whales (*Globicephala macrorhynchus*) log (rest) and spy hop (head rising vertically above the surface) near a reef lagoon entrance.
h) Spinner dolphins (*Stenella longirostris*) approach the survey vessel to bow ride.
i) Pantropical spotted dolphins (*Stenella attenuata*) travelling at high speed.
j) Traditional Solomon Islands bamboo band and dances.
k) Orcas (*Orcinus orca*) traveling along coral reef drop-off (photo by W.Atu).
l) Stranded false killer whale (*Pseudorca crassidens*) skeleton reassembled as an educational display – Arnavon Island research station.

Appendices

Appendix 1. Shortlisted references and historical records relating to Solomon Islands cetaceans and traditional dolphin drives of Malaita[10].

1. Akimichi. 1992. The surviving whale-tooth: Cultural significances of whale products in Oceania. Bull. National Mus. Ethnol. 17:121-142.
2. Akin, D. 1981. Porpoise teeth in East Kwaio Artwork Journal of the traditional money association Vol. 2(1).
   Akin, D. (1993). Negotiating culture in East Kwaio, Malaita Appendix 2: Kwaio shell money making and use of porpoise teeth. PhD dissertation. Dept. of Anthropology, Univ. of Hawaii, USA.
3. Boyd, D (date uncertain). Introduction to porpoise hunting on Fanifi, Solomon Islands. Columbia University (typescript manuscript, 40pp).
4. British Solomon Islands Protectorate – Special Duties Fisheries). 1973. Dried porpoise meat. Government Memorandum No. 443/4/10 (currently the Fisheries Department of the Solomon Islands).
5. British Solomon Islands Protectorate – Office of the District Commissioner. 1965. Background paper: Malaita porpoise hunting. Government Memorandum No. M/22/7/1 from Pepys-Cockerell J.L., former District Officer Of North Malaita.
6. Dawbin, W.H. (1966). Porpoise and porpoise hunting in Malaita. Australian Natural History 15(7): 207-211.
7. Dawbin, W.H. 1974 Cetacea of the south western Pacific Ocean. Background paper to FAO/ACMRR, La Jolla, USA.
8. Goto, M. Nagatome, I. and Shimada, H. Cruise report of the cetacean sighting survey in waters off the Solomon Islands in 1994. Paper presented to the International Whaling Commission - IWC SC/47/SH12 (survey conducted between September 17th and October 5th, 1994).
9. Hill, L 1989. Traditional Porpoise Harvest in the Solomon Islands. A preliminary report from the University of Papua New Guinea, Port Moresby, PNG.
10. Ivens Rev. W.G. 1902. Porpoise hunting. The Southern Cross Log July 1: 21-22. (letter and notes on Malaita dolphin hunting).
11. Leatherwood. S. (date uncertain) Introduction to porpoise hunting of Fanifi, Solomon Islands. Colombia University. Report F/10/13 and Appendix 6 from unpublished M.Sc. thesis.
12. Miyashita, T. Kato, H and T. Kasuya, eds. 1995. Worldwide map of cetacean distribution based on Japanese sighting ata (Volume 1). National Research Institute of Far Seas Fisheries, Shizuoka, Japan. 140pp.
13. Miyazaki, N. and Wada, S. (1978). Observations of cetacea during whale marking cruise in the western tropical Pacific, 1976. Scientific Reports of the Whales Research Institute, Tokyo 30: 179-195.
14. Takekawa, D. (1996a). Ecological knowledge of Fanalei villagers about dolphins: dolphin hunting in Solomon Islands 1. Senri Ethnological Studies No. 42. Osaka: National Museum of Ethnology, 5565. Japan.
15. Takekawa, D. (1996b). The method of dolphin hunting and the distribution of teeth and meat: dolphin hunting in Solomon Islands 2. Senri Ethnological Studies No. 42. Osaka: National Museum of Ethnology, 6780. Japan.
16. Takekawa, D. (1996c). Hunting method and the ecological knowledge of dolphins among the Fanalei villagers of Malaita, Solomon Islands. South Pacific Commission (SPC) Traditional Marine Resource Management and Knowledge Information Bulletin #12.

[10] These papers were kindly made available by R. Reeves, Chair IUCN SSC – Cetacean Specialist Group.

Appendix 2. Brief summary of CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora).

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is an international agreement between Governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival. States (countries) adhere voluntarily to CITES. States that have agreed to be bound by the Convention ('joined' CITES) are known as Parties. Although CITES is legally binding on the Parties - in other words they have to implement the Convention - it does not take the place of national laws. Rather it provides a framework to be respected by each Party, which has to adopt its own domestic legislation to make sure that CITES is implemented at the national level.

CITES works by subjecting international trade in specimens of selected species to certain controls. These require that all import, export, re-export and introduction from the sea of species covered by the Convention has to be authorized through a licensing system. ('Re-export' means export of a specimen that was imported.) The species covered by CITES are listed in three Appendices, according to the degree of protection they need. Appendix I includes species threatened with extinction (most whale species and some dolphin species are listed).

Trade in specimens of these species is permitted only in exceptional circumstances. Appendix II includes species not necessarily threatened with extinction (all cetacean species not listed under Appendix I are listed here), but in which trade must be controlled in order to avoid utilization incompatible with their survival. An export permit may be issued only if the specimen was legally obtained; the trade will not be detrimental to the survival of the species; and in case of an Appendix I-listed species, an import permit has already been issued. Appendix III contains species that are protected in at least one country, which has asked other CITES Parties for assistance in controlling the trade (Further information on www.cites.org).

Appendix 3. Summary of marine fisheries in the Solomon Islands.

The tuna purse seine fleet of the Solomon Islands is currently made up of three domestic vessels and up to 80 vessels in the licensed foreign fleet (P. Ramohia – Senior Fisheries Officer, SI Fisheries Department, pers. comm. in June 2004). The latter includes vessels from the USA (the largest foreign flag fleet operating in the SI with up to 40 vessels licensed), Japan, Korea, Taiwan and other nations. Tuna purse seiners catch tuna all over the Pacific, and are not restricted to SI waters. Typically, the USA vessels have bilateral agreements with up to 30 Pacific nations (P. Ramohia, pers. comm.). Most ships are licensed for 500 tonnes.

The vessel's captain decides in which nation/port the catch is landed and processed.
There are two landing and refueling ports in SI: Honiara (Guadalcanal) and Noro (Gizo area, New Georgia). Honiara is the main longline port as sashimi is landed and flown overseas 2-3 times a week. Noro is the preferred port for processing tuna through its cannery. The civil unrest (2000-2002) has had a major impact on this component of the industry especially. There are 40 trained Solomon Islands observers on the fleet, as part of the Pacific observer program. Total Allowable Catch (TAC) is monitored via this observer program (P. Ramohia, pers. comm.).

The fisheries situation of the Solomon Islands is characterized by (from FAO and SCP sources - http://www.fao.org/fi/fcp/en/SLB/profile.htm):

A. The large importance of both subsistence fisheries and the offshore industrial fisheries for tuna;
'Solomon Islands coastal and offshore waters are rich tuna grounds and have traditionally been exploited by distant-water fishing fleets. Japanese long liners have fished in the zone since at least 1962 and annual catches have ranged up to 9,500 t (1978), but have been around 3,000 - 4,000 t in the late 1990s. Catches are dominated by yellowfin tuna (typically 60%) with albacore and bigeye making up the balance. Effort is directed to more northern and western areas. Domestically-based fishing operations commenced in 1971. The domestic pole-and-line fleet has also operated since 1971 with catches approaching 40,000 t in 1986, a peak year. Effort is concentrated around the Main Group Archipelago where baitfish supplies are most readily available. The fishery shows strong cyclical variation, with peaks every three or four years, a feature which seems to be linked to El Niño events (Lehodey 2001). Initially the domestic tuna fishery was primarily a pole-and-line fishery, but group seining was commenced in 1984 and later single-seining was undertaken using two government-owned vessels as well as vessels chartered from Australia, Taiwan and Japan. In the late 1990s the purse seine fishery was basically comprised of three domestic vessels which caught around 11,000 t per year. Operations are concentrated around the Main Group Archipelago. Other vessels have been licensed in recent years, but little information on their activities is available. US purse seine vessels also have access to a small part of the zone under the Multi-lateral Treaty, but in recent years the US fleet has fished to the east of the Solomon Islands zone. Since 1995 several joint-venture tuna long lining enterprises have operated from shore-bases in the Solomon Islands. The total catch of tunas in the Solomon Islands EEZ in 1999 was 73,493 t. The local industrial tuna fleet in that year consisted of 20 long liners, 5 purse seiners, and 30 pole/line boats. The catches by country in the Solomon zone in 1999 were:

Fishing Nation	Fiji	FSM	Japan	Kiribati	Korea	PNG	Solomon	Taiwan	USA	TOTAL
Metric tonne	1	49	4	85	909	18	69,092	2,228	1,107	73,493

(Units: metric tonnes, Source: SPC Catch and Effort Log sheet Database with adjustments)

Since 1999 the tuna fishing situation has deteriorated due to the social unrest. Catches in 2000 have been estimated to be less than half of the 1999 level.

B. Lesser important small-scale commercial fisheries near the urban centres:

About 90% of the Solomon Islands' population is living in rural areas, so subsistence and artisanal fishing activities are widespread and of great importance. These fisheries are concentrated on coastal and nearshore reefs and lagoons. The target resources are reef associated finfish, beche de mer, trochus, giant clam, lobster, and turbo. About 180 species of reef finfish, from 30 families, are caught by the small-scale rural fisheries. The catch is comprised, mostly, of Lutjanids (snappers), Serranids (groupers and rock cods), Lethrinids (emperors), Scombrids (mackerels) and Carangids (trevallies). The small-scale commercial fisheries are mainly located near the main urban area of Honiara, and to a much lesser extent, around the towns of Auki on Malaita Island and Gizo in the west. These fisheries are oriented to providing primarily finfish to wage-earning residents. The other common form of small-scale commercial fishing is that for non-perishable fishery products for export. The most important of these items are trochus shells, beche-de-mer, and shark fins. These commodities are an important source of cash for Solomon Islanders, especially in the isolated villages since the demise of the copra industry. With an average production of about 400 t per year of trochus, the Solomon Islands is the largest producer in the Pacific Islands region.'

Appendix 4. By-catch and discard in western Pacific tuna fisheries.

(Source: The Secretariat of the Pacific Community (SPC) – Oceanic Fisheries Programme reports - http://www.spc.int/oceanfish/Html/TEB/Bill&Bycatch/index.htm).

'The Western and Central Pacific Ocean (WCPO) currently supports the largest industrial tuna fishery in the world, with an estimated catch in 1992 of 1,089,607 mt in the SPC statistical area alone. Skipjack is the most important of the four major tuna species in the fishery, accounting for 67 per cent of the catch by weight in 1992, followed by yellowfin (24.5%), bigeye (5%) and albacore (3%). Purse seine gear was responsible for 80 per cent of the total catch, with pole-and-line gear accounting for 7 per cent, longline gear 12 per cent and troll gear 1 per cent. All of these fisheries invariably have some level of catch of non-target species (termed 'by-catch'). A portion of this by-catch is discarded because it has little or no economic value, and, if retained, would take up storage capacity best used for the more valuable tuna species. A portion of the target catch is also often discarded for economic reasons, or because it is damaged, physically too small for efficient processing, or lost because of gear failures during fishing operations.

Billfish and by-catch growth studies.

While we remain largely ignorant about the impacts of tuna fisheries on by-catch species and pelagic ecosystems, it is obvious that these impacts have increased very significantly over the last 50 years as tuna fisheries worldwide have expanded their catches and efforts by orders of magnitude. However, we have little or no information on the relative abundances or biomasses of many components of the pelagic ecosystem.

Observer programs, conducted by regional and national organizations, have developed over the last two to three decades. In general, these observer programs were created to monitor activities such as compliance with licensing agreements and restrictions on incidental catches. In addition to providing information required for meeting those objectives, observer programs provide essentially the only reliable, detailed information on catches discarded at sea. Based on such observer programs in the WCPO the main by-catch species of tuna fisheries are billfish, sharks, escolar, wahoo, mahi-mahi, rainbow runner, and opah.'

Appendix 5. Media Statement from Solomon Island Government Communications Unit on new policy banning dolphin export trade

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SOLOMON ISLANDS GOVERNMENT SLAPS BAN ON DOLPHIN EXPORT

The Government of Solomon Islands today announced a ban on dolphin export, saying its action is to ensure Solomon Islands maintains its good standing in the international community. The Minister for Fisheries and Marine Resources, Hon Paul Maenu and the Minister for Forests, Environment and Conservation, Hon David Holosivi jointly announced in Honiara today that the ban is immediate.

Hon Maenu and Hon Holosivi said the measure was taken to address concerns raised by members of the international community following export of dolphins from Solomon Islands last year. "As a responsible member of the international community, Solomon Islands has a duty to ensure concerns regarding its conduct are given due consideration. In this regard, we are pleased to announce that the Solomon Islands Government, through Cabinet has approved a new policy on further exports of dolphins from Solomon Islands," the Ministers said.

"Under this new policy which Cabinet approved yesterday, no dolphins would be exported from Solomon Islands".

Appropriate regulations to bring this policy into effect are being developed and would be implemented jointly by the Department of Fisheries and Marine Resources and the Department of Forestry, Environment and Conservation. The Ministers said the new policy initiative does not and will not affect the domestic use of dolphins inherent in Solomon Islands traditional practices.

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Alfred Maesulia
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Please attribute all press releases to *Government Communications Unit,*
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