Biodiversity assessment of cetaceans and mantas near the Berau Islands, East Kalimantan, Indonesia

PROVISIONAL FINAL REPORT

FOR INDONESIAN INSTITUTE OF SCIENCES (LIPI)

FIELDWORK PERIOD: OCTOBER 2003

Long-snouted spinner dolphins. *Photograph by Budiono*.

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February 2004

PREFACE AND ACKNOWLEDGEMENTS

This preliminary survey was conducted in close collaboration with the local NGO, RASI Conservation Foundation together with the Indonesian partner scientist, Ir. Budiono. The official collaboration was with the Indonesian Institute of Sciences (LIPI). Field surveys were conducted by Ir. Budiono, Ir. Bambang Yanupuspita, Ir. Syachraini and Dr. Matthijs Couwelaar. We would like to thank the field observers and boat drivers Pak Kasino and Pak Anto. We would like to thank the following persons for their hospitality: Pak Djamhari and villagers at Derawan Island; conservation staff of Turtle Foundation at Sangalaki Island; villagers at Kaniungan Island. Finally, we owe a great deal of gratitude to the teamleaders of the project, Dr. Bert W. Hoeksema and Dr. Annelies Pierrot-Bults for giving us the opportunity to conduct this survey and for their support.

Samarinda, 11 February 2004

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INTRODUCTION

The coastal waters of East Kalimantan probably form the western part of the Indo-West Pacific centre of maximum marine biodiversity. Historical and ecological explanations support this working hypothesis. During the last ice age (17,000 yrs ago) sea levels and river mouths were situated 120 m lower than now (Voris 2000). Shelf seas (e.g. the Java Sea) had disappeared and Kalimantan was part of the SE Asian continental mainland. East off Kalimantan, the Indonesian throughflow (Gordon & Fine 1996), continued to pass east off Kalimantan, through the Sulu-Sulawesi Seas and the Makassar Strait, carrying larvae and plankton from the Pacific to the Indian Ocean. Similarly, these seas most likely represent a migratory pathway for oceanic whales and dolphins. East Kalimantan has a wide range of habitats, such as major river (deltas), mangroves, island/ reefs and deepwater offshore habitat, which are all inhabited by cetaceans. It will be tested whether East Kalimantan is part of the centre of marine biodiversity, and whether this is predominantly related to ecological or historical-biogeographical factors. Cetaceans and mantas are the taxa used in this preliminary study.

The Indonesian Archipelago contains some 5 million km^2 of territory (including water and land), of which 62% consists of seas within the 12-mile limit (Polunin, 1983). At least 29 species of cetaceans are reported to occur in the seas of the Indonesian Archipelago (Rudolph *et al.* 1997). However, only few dedicated studies have been conducted on the abundance, distribution and conservation of cetaceans in Indonesia, although very badly needed. Cetaceans are threatened with extinction in many parts of the world, but nowhere more obviously than in Asia. Growing human populations are putting an increasing pressure on natural resources, including the stocks of wild fish and crustaceans, supplies of freshwater and even coastal landscapes themselves (e.g. through 'reclamation' projects, harbour constructions, mariculture and oil spills). Rivers, estuaries and coastal marine waters are becoming increasingly unhealthy ecosystems for wildlife stock. Modifications and degradations of the habitat of dolphins and porpoises have often resulted in dramatic declines in their abundance and range (Reeves *et al.*, 1997).

The present survey involves a preliminary assessment of the cetacean diversity in the northeastern waters of East Kalimantan and provides the basis for future conservation-orientated research on cetaceans in this area.

OBJECTIVES

The objectives of the preliminary survey were to assess the diversity and occurrence of higher vertebrate organisms such as cetaceans and manta rays along the coast of East Kalimantan and relate this to ecological or historical-biogeographical factors. Diversity of these target species will be studied in different habitats varying in distance offshore (salinity, turbidity, nutrient load, sedimentation), land- and seaward position, depth and nearness to islands. A comparison of the species richness for cetaceans will be made with other areas, which have already been defined as center areas for cetacean diversity (in Indonesia: Komodo Islands). Finally, high density areas of biodiversity will be identified and related to geographical factors.

METHODOLOGY

Survey area

The Berau Archipelago contains a wide spectrum of aquatic habitats; delta (mangrove); near shore; near reefs/ islands; deepwater habitat (Figure 1). The area offers ecological conditions for a potentially high number of marine species and is most suitable for representing East Kalimantan in biodiversity studies. The southern peninsula Mangkalihat forms an interesting habitat as it narrows the passage between Sulawesi Island and Borneo Island and a shallow shelf is absent. This area was confirmed to be a major deepwater habitat for oceanic dolphins and sperm whales (Budiono, *in verbis*).

Field methods

A two-weeks rapid diversity assessment was conducted for cetaceans and mantas in near shore, offshore and near-islands habitats in the waters of the Berau district in Northeast Kalimantan in October 2003. Pre-determined survey transects were designed to provide representative survey coverage of various habitats. Searches were conducted alternatively from 2 wooden boats of varying length, *i.e.* 16m and 12m and varying horsepower, *i.e*. 16 hp and 26 hp, respectively. The 3 person-observers team followed a routine survey protocol for observation and data recording, in which the first observer scanned the continuously with 7x50 binoculars, second observer searched for dolphins with naked eyes, and records all sighting effort data and environmental and geographical conditions using a GPS every 30 minutes. The third observer searched at the rear and occasionally used binoculars. Positions changed every 30 minutes. One transect was surveyed in one day and double sightings on the same transect avoided. Upon sighting the

distance to the dolphins, compass bearing of the boat and of the dolphins, and coordinates of the sighting location were recorded. Species were identified and if more than one species was observed, it was recorded whether the species would mix and if not, what was the mean distance between the species. Minimum, maximum and best estimates were made of group sizes and the number of calves and juveniles. Further, a general behaviour description was made and whether the groups avoided, approached or behaved neutral to the observation vessel. It was attempted to photograph each species and individuals with distinctive dorsal fins. Depth at sighting locations was traced back from an official seamap of the area with depths.

RESULTS

Searches for cetaceans were conducted for a total of 715 km (49.8 h) during 12 survey days. Search effort was equally distributed over 3 different habitat types, i.e. near shore, off-shore and near offshore islands (Table 1). A total number of 11 independent sightings were made that consisted of one up to 4 different species. Most sightings (64%) were made near islands and reefs (within 5 km off the islands) and secondly (36%) in off-shore habitat, but still within 10 km off the islands). No sightings were made in near shore habitat. Also most species were encountered near reefs and islands (88% of *n* = 9 species) compared to off shore sightings (55%). Minimum and maximum depths for all sighting locations were 30 m and 400 m.

Table 1. Number of sightings and cetacean species encountered in different habitats.

Habitat	Survey effort (km)	No. of independent sightings	No. of cetacean species	% of total no. species (*n* = 9)
Off-shore [1]	248	4	5	55%
Near shore [2]	246	0	0	0
Islands/ reefs [3]	221	7	7	88%
Total	715	11	8	

[1] = > 20 m depth coastal contour line, > 5 km distance off islands and reefs
[2] = < 20 m depth coastal contour line, > 5 km distance off islands and reefs
[3] = < 5 km distance of islands and reefs

Nine different cetacean species were encountered in both mixed species groups and groups consisting of only one species (Table 2 & 3), which is 0.011 species/ km search effort. Sightings of mixed species composition involved 55% (*n* = 6) of all sightings. However, the percentage of sightings that

existed of groups, which actually mixed was 36% (*n* = 4). The remaining 19% (*n* = 2) involved dependent sightings of groups, which did not mix (minimum distance range = 30m & 100m).

Table 2. Identified species and habitat characteristics per independent sighting location

No. independent sightings[1]	Species	Best estimates of group size	Habitat	Depth (m)	Mixed groups
1	*Tursiops truncatus*	13	Island/ reefs [2]	200-300	-
2	*Tursiops aduncus* *Tursiops truncatus* *Stenella longirostris* *Stenella l. roseiventris*	7 40 55 8	Offshore (10 km off island)	300-400	All mixing
3	*Manta birostris*	65	Island/ reefs	30	-
4	*Tursiops truncatus*	2	Island/ reefs	100-180	-
5	*Tursiops truncatus* *Stenella longirostris* sp.[3] *Stenella l. roseiventris*	18 45 15	Offshore (7 km off island)	50	Not mixing, > 100m dist.
6	*Tursiops truncatus*	8	i.d. above	80	-
7	*Stenella longirostris* sp.	45	Island/ reefs	100-130	-
8	*Tursiops truncatus*	1	Island/ reefs	30	-
9	*Stenella longirostris* sp. *Stenellal. roseiventris* *Stenella attenuata*	11 8 4	Island/ reefs	35	All mixing
10	*Pseudorca crassidens* *Peponocephala electra*	7 4	Island/ reefs	400	Mixing
11	*Globicephala macrorhynchus* *Stenella attenuata*	4 55	Island/ reefs	200-360	Not mixing, >30m dist.
12	*Stenella longirostris* *Stenella l. roseiventris*	35 9	Offshore (10 km off island)	360-400	Mixing

[1] = Numbers corresponding with numbers in Fig.1.
[2] = < 5 km off reefs and islands
[3] =Tentative identification of possible sub-species of *Stenella longirostris* with short beak.

Most sightings were made of *Tursiops truncatus* and the genus *Stenella* including a dwarf form subspecies *Stenella l. roseiventris* (Plate 4). This last species represents the first official record of its occurrence in Indonesia. Although individual sightings for bottlenose dolphins, *Tursiops truncatus* are more numerous than for other species, highest total numbers of dolphins encountered in the study area are the long-snouted spinner dolphins, *Stenella longirostris* (Plate on title page) and a short beaked form of *Stenella longirostris* sp. These two species including the spotted dolphin, *Stenella attenuata*, occurred in the largest group sizes (Plate 1). The three whales species, false killer whale, *Pseudorca crassidens* (Plate 3); melon-headed whale, *Peponocephala electra* and short-finned pilot whale, *Globicephala macrorhynchus* were all recorded in low numbers and only during one sighting. All identified species were seen in mixed groups, except for the short-finned pilot whale. Only bottlenose dolphins and short-snouted spinner dolphins were also observed in single species groups. Calves and juveniles were also observed for some species and one neonate spotted dolphin was observed.

Table 3. Cetacean species group sizes, encounter rates, sighting frequency and conservation status. Sorted in decreasing sighting frequency order.

Species name	Mean groupsize	Groupsize range	Encounter rate Dolphins/ km	Number of sightings	Conservation Status[1]
Tursiops truncatus	14	1-40	0.11	6	DD
Stenella l. roseiventris	10	8-15	0.06	4	DD
Stenella longirostris sp.	34	11-45	0.14	3	DD
Stenella longirostris	37	35-38	0.10	2	LR (cd)
Stenella attenuata	30	4-55	0.08	2	LR(cd)
Tursiops aduncus	7	7	0.01	1	DD
Pseudorca crassidens	7	7	0.009	1	LC
Peponocephala electra	4	4	0.005	1	LC
Globicephala macrorhynchus	4	4	0.005	1	LR(cd)

[1] = Red List designation: DD = Data Deficient; LR (cd) = Lower Risk (conservation dependent); LC = Least concern.

One ray species was encountered, i.e. manta ray, *Manta birostris* in a large group size (*n* = 65) near an offshore island, Sangalaki (Plate 6).

The Berau islands are characterized by high species richness and the minimum area size within which all 9 species and tentatively identified sub-species were found was 421km^2. Eight species out of 9 species occurred in an area of only *ca.* 170km^2, doubling the number of species per area size, i.e. 0.046 species/ km^2. Three species had a conservation dependent status. The status of the dwarf spinner dolphin has not been evaluated but it has the most restricted range of occurrence being confined to shallow inner waters of South East Asia (Rudolph & Smeenk, 2002) although in this study the species also occured in deepwater habitat.

DISCUSSION

Methodological constraints

The month October was characterized by a transition of southern wind domination (July – September) to northern wind domination (November – January). This caused variable weather conditions with occasional mirror-like sea surfaces, but also often high waves and changing winds. Due to the high waves, the eastern offshore habitats off the islands could not be surveyed, narrowing the originally planned survey area. Supposedly best months for surveying in this area are the months March until July.

Conservation

Based on the relatively high species richness and presence of species with a restricted range and a globally conservation dependent status, the waters near the Berau Islands have both a local and global biodiversity importance. For comparison, 14 species of cetaceans were identified in Komodo (identified as one of the richest marine diversity sites in the Indo-Pacific) National Park waters (1.214 km^2 surface waters) (Kahn *et al.* 2000), whereas in the Berau study area alone, 8 species were encountered in an area of only *ca.* 170 km^2. Although there are undoubtedly other areas of high cetacean diversity in Indonesia, such as reported for Solor and Lembata Island in eastern Indonesia (Weber 1923, Barnes 1980, Hembree 1980), there are no comparative data on local species richness available. Most likely only a proportion of the actual number of species which occur in the Berau Archipelago seasonally or year round were observed in this preliminary survey, so the species richness may be even higher. For example, sperm whales, *Physeter macrocephalus*; common dolphins, *Delphinus delphis*, killer whales, *Orcinus orca* and Irrawaddy dolphins, *Orcaella brevirostris* were also observed to occur in the study area during earlier visits to the area (Budiono, *in verbis*). The fact that one neonate spotted dolphin was detected indicates that this area may also be of significance in terms of breeding area.

Based on the preliminary sighting data, we found that most sightings and species occurred within 5km distance off islands and reefs and all sightings were within 10km distance, so a 10km radius protection zone off islands and major reefs may be one of the conservation recommendations. Otherwise, the restricted range within which 8 of the 9 identified cetacean species and manta rays were observed has a good conservation potential to become a marine vertebrates sanctuary. The area also included 4 islands, which are frequently visited by tourists, so the area also has a high eco-tourism potential. However, any possible dolphin/ whale watching should be controlled and guided by instructed and responsible boats drivers.

Future planning

Conitinue investigating areas of high cetacean diversity but also include other marine vertebrates, i.e. the dugong, *Dugong dugon* and manta ray abundance; Prepare a species diversity index and compare with other areas that are defined as center areas of cetacean diversity; Investigate which areas have a year-round or seasonal importance for all target species and relate this to ecological and biogeographical

factors; Investigate the presence of different cetacean species and dugongs in terms of active migration or historical/ geographical factors. Asses the species abundance status (occasional, common, very common and abundant) and their habitat in terms of conservation; Prepare a conservation action plan for all threatened target species and their habitats if degraded, possibly through establishment of protected marine parks and local education/ awareness campaigns.

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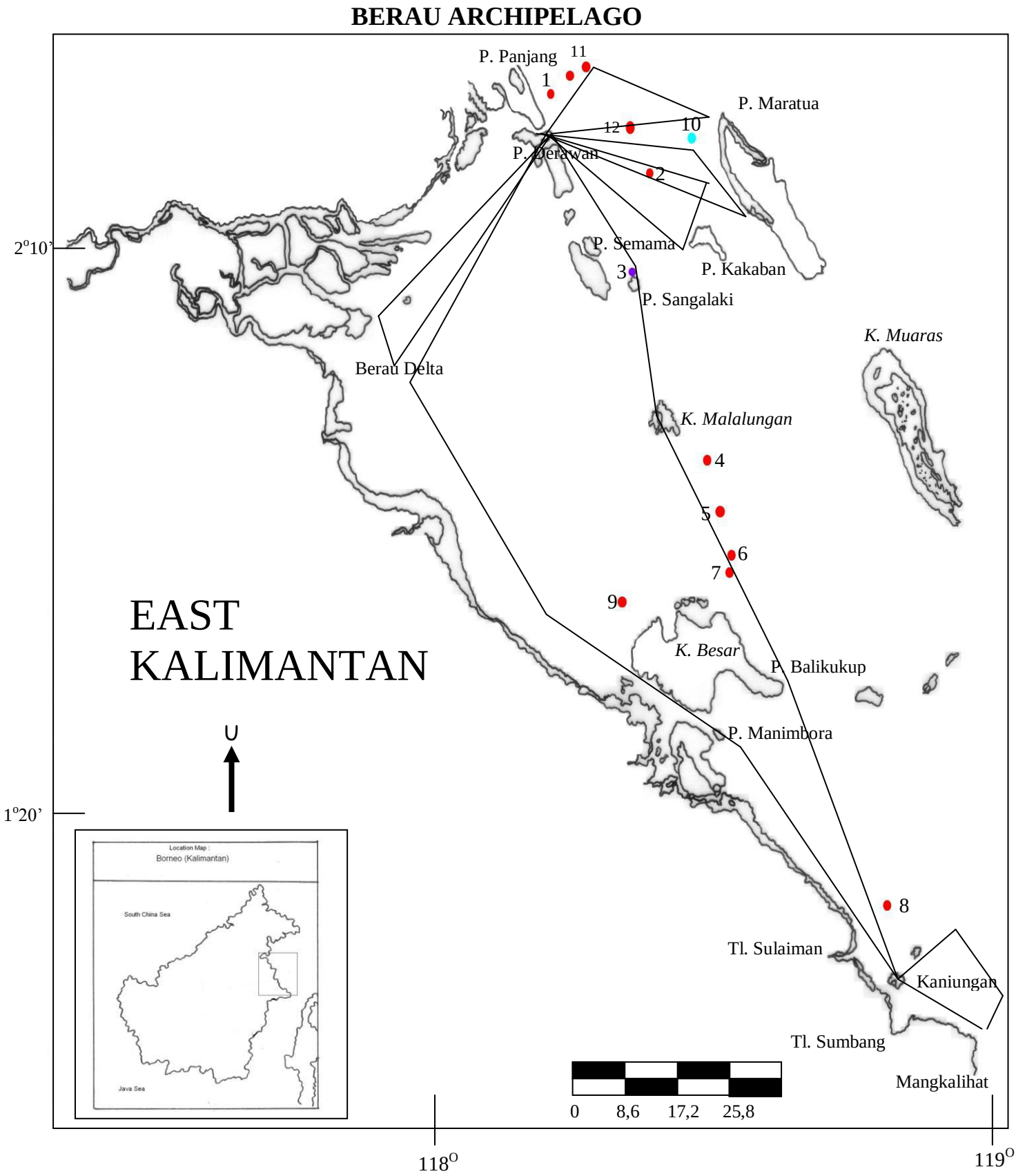

Figure 1. Map of cetacean and manta ray occurrence in the Berau archipelago, East Kalimantan. Numbers correspond with numbers of independent sightings in Table 2.

PLATES

Plate 1. Spotted dolphin, *Stenella attenuata.*
By Budiono/ YK-RASI

Plate 2. Belly-up swim by a long-snouted spinner dolphin, *Stenella longirostri*s. By Budiono/ YK-RASI

Plate 3. False killer whale. By Budiono/ YK-RASI

Plate 4. Dwarf spinner dolphin, *Stenella l. roseiventris.*
By Budiono/ YK-RASI

Plate 5. Bottlenose dolphins' bubble-trailing. By Budiono/ YK-RASI

Plate 6. Manta Ray. *Manta birostris*. By Budiono/ YK-RASI