Study of the Irrawaddy dolphin population in Sesayap river, East Kalimantan and recommendations for its conservation

FINAL REPORT JULY, AUGUST & NOVEMBER SURVEYS 2009

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Irrawaddy dolphin surfacing in Sesayap delta by D. kreb

Project Executed by

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PREFACE AND ACKNOWLEDGEMENTS

The results presented in this technical final report are still preliminary and not to be cited without prior approval from the authors. This survey was initiated by WWF Indonesia and conducted in collaboration with by the NGO Yayasan Konservasi and BKSDA Kalimantan Timur. Field surveys were conducted by Dodi Rukman, M. Irfansyah Lubis, Suparjono, Arman (WWF), Ripai Ahmad, Yoyok Sugianto (BKSDA Kaltim), Hendriadi Dasra, Edo Dwi Surya (Balai Taman Nasional Kayang Mentarang) and Danielle Kreb (YK-RASI). We would like to thank every field observer gratefully and also our boat driver Pak Salim and his crew. We also thank Joni (WWF) for his great logistical support. We also thank Pter Orbdlik and WWF Germany as sponsors of the project.

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ABSTRACT

Marine mammal observation surveys were conducted in Sesayap River and Delta in East Kalimantan in 2009 in order to obtain information on cetacean diversity, total abundance, distribution patterns and threats. A total of 994 km of line-transects were surveyed in 14 days during three surveys in July, August and November 2009. Two cetacean species, i.e. Irrawaddy dolphin, *Orcaella brevirostris*, and Indo-Pacific humpback dolphin, *Sousa chinensis* were encountered. The most abundant species was the Irrawaddy dolphin, which is locally named as *lamud.* DNA analysis of a stranded Irrawaddy dolphin specimen in Malinau revealed a similar haplotype as those from Phillippines and Thailand (Songkla Lake) specimens. During both surveys, more sightings were made in the delta compared to the river and dolphins occurred in larger group sizes and with higher densities in the delta. The dolphins' distribution on the river is linked to tidal and seasonal patterns where the extent of saltwater intrusion determines the range of their distribution upstream the river. During 'normal years' without extreme drought dolphins' distribution is limited some 10 km below Malinau, some 90 km upstream of the Sesayap River. Threats include pollution from chemical cleaning of post-harvest shrimp-ponds and upstream coalmining activities as well as decreased fish resources due to increased sedimentation and unsustainable fishing techniques such as electro-fishing. Pollution preventive measures should be enforced to reduce pollution and sustainable fisheries facilitated such as aqua-culture of non-piscivorous fish species. School education should include environmental awareness issues and preserve cultural heritage including conservation of lamud.

INTRODUCTION

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 coastal limit (Polunin, 1983). However, in spite of this extensive water mass only few reports on cetaceans are available. The investigation of the status of cetaceans in the Indonesian archipelago is one of the research projects recommended in the 2002-2010 Action Plan by the IUCN/SSC/Cetacean Specialist Group (Reeves *et al*., 2003). Rudolph *et al.* (1997) reported at least 29 species of cetaceans to occur in the seas of the Indonesian Archipelago but only a few dedicated studies have been conducted on the abundance, distribution and conservation of cetaceans in Indonesia such as long-term research conducted on several cetacean species in Komodo National Park waters and on the Irrawaddy dolphin, *Orcaella brevirostris* in the Mahakam River and coastline in East Kalimantan (Kahn *et al.*, 2000; Kreb, 2004, Kreb & Budiono 2005, Kreb et al. 2008). The Irrawaddy dolphin is a unique freshwater and coastal dolphin species, which is found in shallow, coastal waters of the tropical and subtropical Indo-Pacific and in the Mahakam, Ayeyarwady and Mekong Rivers (Stacey & Arnold, 1999). The species is protected in Indonesia and adopted as symbol of East Kalimantan. The status of most coastal Irrawaddy dolphin populations are still data deficient.

Along the entire coast of East Kalimantan coastal population of Irrawaddy dolphins can be found, i.e. Balikpapan Bay, Mahakam delta, Sangkulirang Bay, Berau Delta (Kreb & Budiono, 2005; Kreb *et al.* 2008; Kreb & Lim 2009). Only for Balikpapan bay, abundance estimates were provided, i,e, best estimates of mean abundance in 2008 were between 67 and 140 individuals based on the Burnham & Overton mark-recapture- and line-transect density analysis, respectively (Kreb & Lim 2009). In addition, during surveys conducted by Kayan Mentarang National Park authorities, Irrawady dolphins were also found to occur in the Sesayap delta and River (Departemen Kehutanan 2007; Departemen Kehutanan 2008).

On 14/04/2005 a dead Irrawaddy dolphin was found stranded near Malinau. Measurements were taken and samples obtained for genetic analysis. Based on DNA analysis conducted by the National Marine Fisheries Service Southwest Fisheries Science Center In La Jolla, California, US, it was found that the haplo-type of this specimen was identical to specimens from the Philippines and Thailand (Robertson 2009) and evolutionary separated from the Mahakam population, for which two unique haplo-types were identified.

Three seasonal surveys are being conducted in 2009 to identify the distribution patterns and relative abundance of the Irrawaddy dolphins in the Sesayap Delta and River following different seasonal and tidal conditions in order to achieve a better understanding of their daily and seasonal ranging patterns. In addition information is being collected on existing or potential threats and the significance of the dolphins to the local community and their interactions. Finally recommendations for the conservation of this population will be handed to the local government and other stakeholders.

This project also fits within the action plans of the IUCN (i.e. IUCN 2002-2010 Conservation Action Plan for the World's Cetaceans) and UNEP/ CBD Regional Action Plan for SE Asia's Small Cetaceans and its Indonesia Country Report in particular.

FIELD METHODS AND ANALYSIS

Field methods

Three boat surveys were and are being conducted covering different types of water conditions (low, medium and high water levels). The first survey was conducted at high water level conditions between 20 until 25 July 2009 (6 days) with daily heavy rains at night and related strong currents in the river; the second at low water level conditions between 15 and 18 August 2009 (4 days) and the third survey was conducted during medium water level conditions between 2 and 5 November 2009 (4 days). The survey track is indicated in Appendix 1 and covers the districts of Tidung Pala and Malinau. During the first survey a total distance of 388 km was covered while traveling through at a mean speed of 9.8 km/hr, whereas during the second survey a total distance 298 km was searched on effort at a mean speed of 10.6 km/hr and total distance covered during the third survey was 308 km at mean speed of 10.1 km/hr.

Surveys were conducted from a wooden boat of 12 m length and 20 hp onboard diesel engine (Dong Feng). The survey team existed of three observers, which actively searched for dolphins while standing at c. 3 m eye-height above sea level on top of the boat and one data recorder, switching positions every 30 minutes. Two observers continuously scanned the sea surface within an 180^{o} angle from the beam by aid of binoculars (7x50) and the other observer searched with the unaided eye, occasionally using binoculars. The survey track-line and effort data were directly stored in the Garmin eTrex Vista CX. All sighting effort data, i.e. segment (river or delta), speed, channel type and width, cloud coverage, beaufort, tide and visibility (fog, rain, sun reflection) were recorded on a datasheet every 30 minutes. In addition, random samples were collected involving depth, salinity, turbidity and water samples to test for water quality and pollutants. During one survey day, one or two transects were surveyed covering one or two segments, whereas double sightings on the same transect were avoided. For delta segments with a width between 2 to 3 km, two parallel transects were surveyed with c. 500m distance from each shore with a 1 km strip width travelling in the thalweg (middle) part of the transect strip, which was also. For segments with width less than 1 km, the boat also travelled in the thalweg. For river segments with widths varying between 750m and 1.5 km, the boat travelled zig-zag in sections wider than 1 km and in the thalweg in sections of less than 1km width.

Upon making a sighting, firstly the radial distance between boat and dolphins was estimated and the sighting angle. Then, the dolphin group's position was directly marked on

the GPS. Distance estimation and 'calibration' among observers was exercised by comparing known width of channels (based on actual map scales) with own estimations. Effort was suspended long enough to photograph as many individuals as possible for mark-recapture analysis and also to identify species and group size. The total dolphin observation time of the three Sesayap surveys in 2009 was 11.6 h, and the mean observation time per sighting was 16 min. Minimum, maximum and best estimates of group size and of the number of calves and juveniles were recorded. In addition, video footage was made. Depth at sighting locations was measured using a depth-meter, turbidity with a sechi disk and salinity with a hand-held refracto meter and for measurements below 1 ppt a digital hand-held salinity meter was used for greater accuracy

Analysis

In the delta and river, a fixed strip width of 1 km was used (with 500m radial strip on each side of the boat) because the maximum obtained perpendicular sighting distance was 500m (max. linear sighting distance was 800m). Within this strip width distance a clear view could be obtained of objects near the riverbank. Also c.75% of all sightings were made of groups very near the river/delta shore banks providing evidence that our sighting abilities indeed covered this set transect strip-width.

Densities were calculated by dividing the total number of dolphins sighted per transect by search effort multiplied with strip width. Minimum estimated dolphin population within survey area was calculated by multiplying mean density with total study area:

$$D = n.G/(L.W) \quad \& \quad N = D * A$$

Where D= density; n = sightings; G = mean group size; L= search effort (km); W = strip width (km); N = population estimate; A = study area (length of transect* mean width of river/ delta arms.

Total abundance was estimated per segment and including only those transects were dolphins were actually observed during at least one of the surveys, excluding areas that were not surveyed and excluding surveyed areas were no dolphins were sighted.

RESULTS

Distribution and abundance

During all three surveys a total of 46 sightings of Irrawaddy dolphins, *Orcaella brevirostris* were made and two group sightings of Indo-Pacific humpback dolphins, *Sousa chinensis* (Table 1). During the surveys in July and November at medium to high water conditions with strong freshwater influx due to heavy rains for the July survey, sightings were concentrated in the delta area, whereas during the low water survey in August, dolphins were more spread throughout the entire survey area and were found both in the delta and river (Fig 2, Appendix 2). Also, during low water, dolphin densities were 1.5 times higher than in medium-high water level surveys and dolphins occurred in larger group sizes. During all surveys, more sightings were made in the delta compared to the river and dolphins occurred in larger group sizes and with higher densities in the delta (Table 1, Table 2).

Total population abundance estimates within the survey area for the high, low and medium water level surveys are 43, 96 and 41 dolphins, respectively.

Based on informal interviews in villages upstream of Malinau (i.e. Pulau Sapi and Setaban), we found that dolphins have never been sighted in these river segments, although freshwater sharks between 1 to 4 m do occur here. Only in 1984, during a prolonged drought period with much saltwater intrusion, dolphins moved as far as Malinau and the next nearby village Tanjung Lapang.

Table 1. Sightings, densities and abundance estimates per segment and survey period

Delta	n sightings	No dolphins sighted	Mean G	No transects	Survey effort-L (km)	Dolphins/ km2 survey	N estimate
Jul-09	12	29	2.4	3	165	0.22	41
Aug-09	10	49	4.9	2	130	0.37	72
Nov-09	13	28	2.2	2	142	0.20	39
River							
Jul-09	2	2	1	6	179	0.02	2
Aug-09	8	28	3.5	5	169	0.20	24
Nov-09	1	1	1	5	164	0.02	2

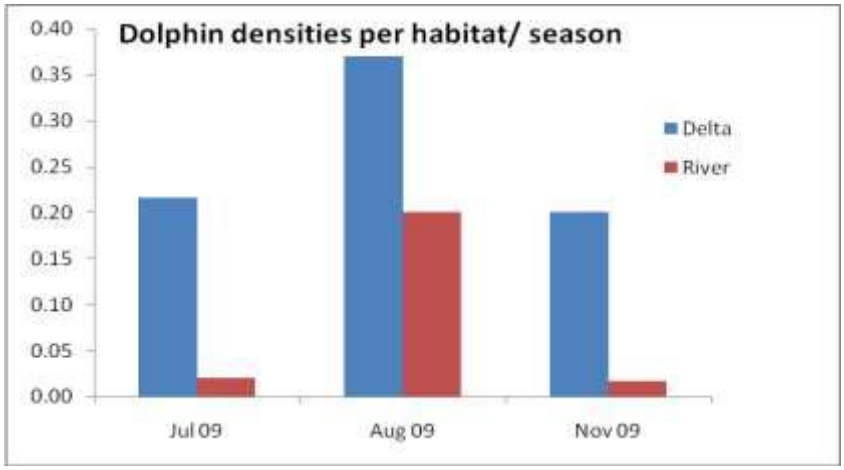

Fig. 1. Dolphin densities per habitat per season

Table 2. Sightings, densities and abundance estimates per transect an survey period

	Survey July 2009-HIGH				Survey August 2009-LOW				Survey November 2009-MEDIUM					
Transects	No dolphins sighted	Survey effort km	D= Dolphins/ km2	N*	No dolphins sighted	Survey effort km	D= Dolphins/ km2	N*	No dolphins sighted	Survey effort km	D= Dolphins/ km2	N*	Strip width (km)	A=Study Area (km2)
T. Juata-Muara Sesayap Selatan	17	54	0.31	30	34	71	0.48	46	15	78	0.19	18	1	96
T. Juata-Bangkudulis Kecil Utara-M. Seseyap	1	65	0.02	2	15	59	0.25	26	13	64	0.20	21	1	102
M. Sesayap-Bangkudulis Kecil Selatan-Tj. Juata	11	46	0.32	9	-	-	-	-	-	-	-	-	0.75	29
Muara Sesayap- Sesayap	2	37	0.05	2	6	25	0.24	11	1	20	0.05	2	1	45
Sesayap- Tidung Pala	0	67	0.00	0	8	64	0.13	6	0	64	0.00	0	1	48
Tidung Pala - Malinau	0	75	0.00	0	14	80	0.23	7	0	80	0.00	0	0.75	30
MEAN/TOTAL	31	344		**43**	77	179		**96**	28	169		**41**		123

*= Minimum estimated dolphin population within survey area = D*A

Table 3. Sampling at dolphin locations per segment and survey period

	Depth			Turbidity			Salinity		
Segment	Jul-09 mean; range m	Aug-09 mean; range (m)	Nov-09 mean; range (m)	Jul-09 mean; range cm	Aug-09 mean; range cm	Nov-09 mean; range cm	Jul-09 mean; range ppt	Aug-09 mean; range ppt	Nov-09 mean; range ppt
Delta	15.2 (4.1-37.8)	9.9 (7.7-14.2)	11.0 (3.4-19.2)	76.3 (20->200)	88.3 (52-165)	38 (7-92)	19.0 (0.64-35)	19.4 (10-27)	24 (18-30)
River	7	7 (2.5-11.5)	-	21	23.9 (21-29)	-	0.21	0.21 (0.03-0.52)	-

Depth at dolphin locations varied between 2.5m and 37.8m during all surveys combined; clarity/ turbidity between 20 cm and 200, whereas salinity ranged between 0.03-35 ppt. Mean salinities varying between 19 ppt and 24 ppt for the delta and 0.21 ppt for the river indicate the dolphin's preference for brackish water.

During the survey in July 2009, at least 11 Irrawaddy dolphins could be identified based on their distinctive dorsal fin shape. However, during the next surveys due to lack of available adequate camera equipment only 1 additional dolphin fin could be identified. Nevertheless, with the right equipment and sufficient training of local staff, photo-identification is well feasible through which a better understanding of their site-fidelity and migration patterns will be obtained.

Threats

Based on informal interviews with local fishermen and residents we found that water quality of Sesayap River has changed over time. Sedimentation has increased because of upstream logging. Fishermen from Sesayap complained that each time after shrimp farms in the delta have harvested their shrimps, the shrimp ponds or *tambak* are being cleaned with chemicals to kill diseases and that the waste water enters without filtering system into the delta waters and reaches upstream villages at high tide, causing fish kills at large scale. In addition, in the upstream rivers such as Malinau, villagers complained that the water since recent years feels sticky when they are washing and that the water, which used to be red at high water after rain, currently has a grey colour at high water and fish resources have decreased. In the upstream segments of the river two coalmining companies are operating, but at present no information is available on their wastewater treatments. On the other hand, the Mentarang river is still good condition.

During our survey we also observed in the afternoon one boat with fishermen engaged in electro-fishing near the village of Seputuk. Assuming that this is not a one-time incident, electro-fishing at large scale may cause a serious threat to the food resources of the dophins and local fishing communities. There are no direct catches of dolphins, and currently the main threat seems to be pollution through chemical pollutants, sedimentation (causing decreasing fish resources) and possibly overfishing.

DISCUSSION

Distribution

The water conditions during the first survey (uly 2009) were characterized by rising water levels after low water conditions, with daily heavy rains during the night, causing strong downstream currents and a lot of wooden debris in the river. These conditions were supposed to cause the absence of dolphins in the river during this survey. However, similarly during the medium water levels in November, the dolphins were also absent from the upstream river segments. During the low water survey saltwater intrusion was higher, which explains the higher encounter rates on the river in comparison to wet periods. Based on our observations it seems that the dolphin's distribution in the Sesayap River is very much influenced by the tidal pattern. Convergence areas between freshwater and brackish water present rich fish areas, where dolphins can easily prey on both salt or freshwater fish, because both freshwater and saltwater fish will experience an invisible barrier where salinity drops to zero and may concentrate on the freshwater or brackish side of this barrier, respectively. Dolphin presence is linked to high fish abundance and is more numerous in areas with high fish abundance. Here, fishermen communities in the villages Sesayap, Bebatu, Sengkong still live a marginal subsistence from fisheries. In the delta, dolphins are

also often seen entering the delta at high tide near Pulau Tibi confirming their daily distribution patterns following the tidal system.

Conservation

Based on informal interviews in the villages of Sesayap and Tidung Pala, dolphins are well liked in general by local communities who name the dolphins '*lamud'*. There is the following legend from the local Tidung tribe (Suku Tidoeng) about the dolphins such as was narrated by an elder healing woman (dukun) from Sesayap village: There once lived a king in this village who lost his golden wedding ring in the river. He ordered one of his subordinates to dive in the river to catch the ring. The poor men dived several times but couldn't find the ring and finally out of shame decided not to surface anymore and stay underwater. Finally the man transformed and became the lamud. Several other legends exist about sharks and the villages of the Tidung tribe themselves.

Some recommendations for conservation include:

- To preserve local legends as cultural heritage and encourage the care of the younger generation for the lamud, it is important to incorporate conservation of lamud into education material at both high- and elementary schools.
- To increase local awareness of local residents about the dolphins and sustainable resource use.
- To prevent further overfishing, it is important to provide fishermen with better livelihoods opportunities by introducing fish in breeding cages that are fed with pellets or vegetables, preventing fish that feed on other fish. In addition, active patrols and education for fishermen should put a halt to electro-fishing
- To prevent pollution from the chemical cleaning of post-harvest shrimp ponds in the delta, a filtering system should be introduced. All the more, since pollution occurs at large scale, where one owner may own hundreds of hectares of shrimp ponds, these owners should have enough capital to take pollution preventive measures.
- To prevent pollution from coal-cleaning waste entering the river system, site visits should be made to coalmining companies and preventive measures being taken.
- To continue population monitoring and photo-identification studies for a better understanding of their short-term and long-term migration patterns and core areas.

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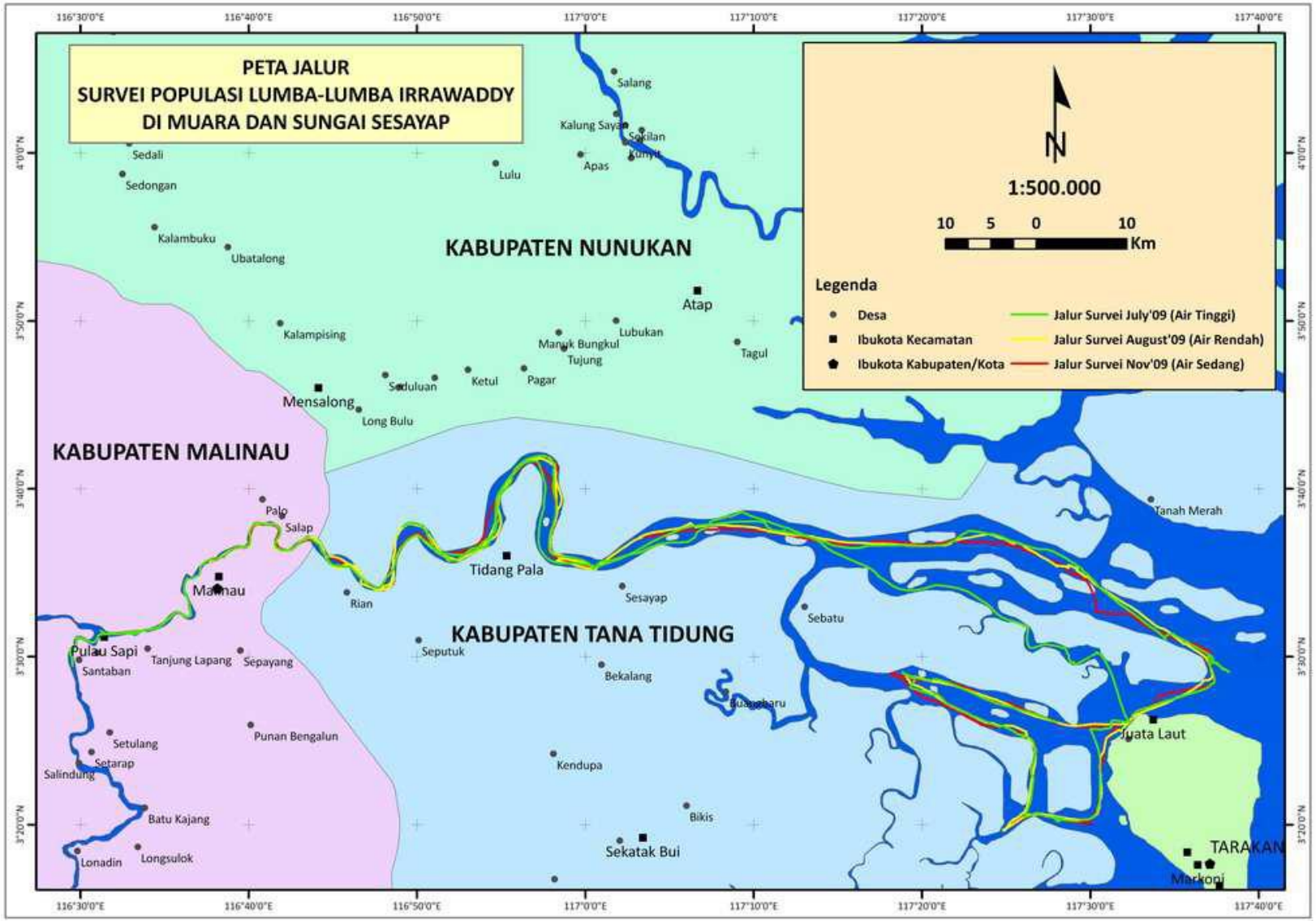
Appendix 1. Survey tracks followed during all three surveys conducted in July (green), August (red) and November (white) 2009



Appendix 2. Dolphin sightings made during the surveys in July (green), August (yellow) and November (red) 2009.

Pictures

Irrawaddy dolphins, *Orcaella brevirostris,* distribution pattern are influenced by tidal pattern and wet and dry seasons, where dolphins move upstream the river when saltwater intrusion is highest during the dry season. Photo: D. Kreb

Photo: D. Kreb

Indo-Pacific humpback dolphins,*Sousa chinensis*, were observed surfacing in a group of six individuals near Tanjung Tibi, muara Sabawang. Photo: D. Kreb

Indo-Pacific humpback dolphins either have a gray, speckled with pink, or entirely pink body colour pattern. Photo: D. Kreb

Survey team and boatmen

Front observers standing on top of boat to obtain a wide view

Interview held with Bapak Mantain Sulaiman in Pulau Sapi Village

After one-night's storm the survey boat was submerged with water. The next morning hard work was done to get the boat ready and after some hours, the survey could be continued. Photo: Hendriadi Dasra.