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SUMMARY

Facultative river dolphins: Conservation and social ecology of freshwater and coastal Irrawaddy dolphins in Indonesia

Irrawaddy dolphins *Orcaella brevirostris* are facultative river dolphins, of which both coastal as well as freshwater populations exist. These separate populations are most likely to have evolved during a historical, evolutionary process and possibly through allopatric speciation during the last glacial maximum. The species is found in shallow, coastal waters of the tropical and subtropical Indo-Pacific from eastern India to southern Philippines and northern Australia, including most of the Indonesian Archipel. The dolphins also occur in three major river systems: the Mahakam in Indonesia, the Ayeyarwady in Myanmar (former Burma), and the Mekong crossing through Vietnam, Cambodia and Laos. Since 1990 the species has been fully protected by law in Indonesia and is adopted as a symbol of East Kalimantan Province. Prior to the present study, no systematic data had been collected before on the Mahakam population or “pesut” as they are referred to locally. In order to fill in the gap of knowledge on the population’s status, dynamics and threats, as well as on the species’ biology, data were collected during a two-month preliminary study in 1997 and during 3.5 years intensive research from early 1999 until mid 2002.

The research basically exists of a fundamental and applied part. The more applied, conservation part of the study attempted to identify and monitor the population status, dynamics, and threats thoroughly and set a rationale for conservation action of the riverine population. The more fundamental part of the study involves the study of the impacts of habitat on the social structures and acoustic behaviour of coastal and freshwater dolphin populations.

Survey techniques, which were used to obtain data to fulfil these objectives involved: direct counting, density sampling techniques (strip-transects and line-transects), photo- and video-identification study, focal group-follows, boat-based and land-based observations, collection of skin (cells) samples for genetic analysis, semi-structured and formal interviews, and collection of random, environmental samples. During the fieldwork we always opted for a minimum invasive approach.

Results of the applied part of the study of direct importance to conservation are the following: In the Mahakam River, best estimates of total population size varied between 33 and 55 dolphins (95% confidence limits: 31-76 individuals) based on direct counts, strip-transect analysis, and Petersen and Jolly-Seber mark-recapture analyses of photo-identified dolphins. These abundance estimates have a narrow range considering the wide-range of methods that were used. Precision of estimates of population size of direct counts and Petersen mark-recapture analysis was highest and nearly similar but the latter method is preferred since it is less biased and potential
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Biases may be calculated. Mean, minimum annual birth- and mortality rates were nearly similar, i.e., 13.6% and 11.4% and no changes in abundance > 8% were detected over 2.5 years. Smaller changes could not be detected due to the limitation of the study period. Dolphins primarily died after gillnet entanglement (73% of deaths). Dolphins’ main habitat includes confluence areas between the main river and tributaries or lakes. Dolphins daily intensively use small areas mostly including confluences, moving up and downstream over an average length of 10 km of river strip and within a $1.1 \text{ km}^2$ - area size, and exhibit a high degree of individual site-fidelity. These areas are also primary fishing grounds for fishermen and subject to intensive motorized vessel traffic. Sixty-four percent of deaths (from 1995-2001) with known location ($n = 36$) occurred in these areas. River dolphins surfaced significantly less in the presence of motorized canoes ($< 40 \text{ hp}$), speedboats (40-200 hp), and container barges ($>1000 \text{ hp}$) and they actively avoided container barges. Formal interviews with local residents revealed a generally positive attitude towards the establishment of protected dolphin areas in small, manageable sites. Because of the dolphins’ dependence on areas that are also used intensively by people, primary conservation strategies in these sites should be to increase local awareness, to introduce alternative fishing techniques, set gillnet restrictions, promote increased frequency of checking nets, compensating fishermen for damaged nets in the process of releasing entangled dolphins. Without any conservation action, the population has a 1% to 4% chance of survival to the next century based on population viability analysis. Key to survival lies in mortality reductions: Preventing the deaths of 2 individuals yearly may help to set this population back on the road to recovery and prevent the dolphins from extinction with a 50% to 75% probability, whereas saving 3 individuals yearly causes a survival probability of near 100%. Since 73% of deaths occur through gillnet-entanglement, conservation efforts should primarily focus on finding ways to prevent death through entanglement following measures stated above.

Based on data collected during 1999 and 2000, the IUCN (International Union for Conservation of Nature and Natural Resources) Red List of Threatened Animals status of this freshwater population was raised from ‘Insufficiently Known’ to ‘Critically Endangered’. Irrawaddy dolphin populations in the Mekong River and Ayeyarwady River fare no better as the populations consisted of less than 100 individuals based on preliminary studies, and they faced ongoing and pervasive threats to their long-term persistence. Their status may follow that of the Mahakam population after enough data is collected on their abundance and threats.

The following results were obtained during the more fundamental part of the research related to the differences in social structures and social communication of freshwater and coastal dolphin populations: Based on individual recognition through photo-identification, it appeared that different groups of individual dolphins congregated in two major core areas in the river, one more downstream and one more upstream with a high site fidelity, particularly of females. Based on differences in sizes of neck crests, males and females could be identified in the field (although this sexual dimorphism was less pronounced for coastal dolphins) and it appeared that only
(some) males were found to move in between these two areas. Breeding occurred through the year, this in contrast with the Irrawaddy dolphins in Balikapan Bay, which bred seasonally. Both coastal and freshwater populations are hypothesized to have polyandrous mating systems, although mating strategies of riverine dolphins may exist of both open competitors with a high site fidelity and roving males, which attempt to mate before estrous females are detected by other males. Coastal dolphins were less social in that they interacted less often with other groups than river dolphins and their interactions were mostly functional in term of feeding together, whereas river dolphin inter-group interactions were of varying nature and feeding, travelling and socializing were the most prevailing. Agonistic and avoidance encounters were also relatively common. River dolphins associated with each other relatively intensively and had long-term preferred companionships. Environmental factors thought to impact social structures and explain differences between coastal and riverine dolphins are the differences in degree of restrictedness of habitat shape, seasonality of food abundance, and clumping or scattering of food resources.

Habitat differences, but also social structures and genetic relatedness also impacted on acoustic behaviour of coastal and freshwater populations. Vocalizations were most varied and frequent in one core area of dolphins in the river in which a well-identified sub-population with a high site-fidelity occurred and with the highest degree of social exchange among groups in comparison to two other areas in the river and the coastal bay population. Pod-specific whistle-dialects exist not only among coastal and riverine populations, but also within sub-pods within the river, which differ in the number of modulations, duration, and minimum and maximum frequencies. There is also evidence for individual “signature” whistles and “contact” whistles. Vocal repertoire (sound types) was more similar between the likely more genetically related, coastal and freshwater populations in East Kalimantan than between coastal populations of East Kalimantan and Australia (see chapter 10). Vocal repertoire was less varied for coastal Irrawaddy dolphin populations in East Kalimantan and Australia compared with the Mahakam River, which may be determined by ecological conditions. Food resources and dolphins are more scattered in the coastal habitat causing a lesser degree of sociality, which influences their vocal repertoire. The whistles and vocalizations rates (numbers per time unit) seem to be determined by social structures. Larger groups with (more) calves whistled less often than smaller groups, which may be caused by the fact that there is less need for contact whistles. Whistle frequencies were significantly higher upon approach of (speed) boats of > 40 hp and they lasted longer than in their absence. Conclusively, acoustic behaviour may help to define stocks as separate management units.

Research recommendations involve continuing to collect genetic sample tissues to assess the genetic variation of the riverine population and the time of separation between coastal and riverine populations. Additionally, monitoring should be continued to detect any trends in abundance, to update the photo-identification catalogue, to assess the stability of preferences of core areas, and obtain the latest information on threats and on mortality rates.