

## Final Workshop Report:

# Establishing protected areas for Asian freshwater cetaceans Penetapan kawasan perlindungan cetacean air tawar Asia

*"Freshwater cetaceans as flagship species for integrated river conservation management"*  
*"Cetacean air tawar sebagai simbol spesies dalam manajemen konservasi sungai terpadu"*

Samarinda, 19-24 October 2009

Edited by Daniëlle Krebs, Randall R. Reeves, Peter O. Thomas,  
Gillian T. Braulik and Brian D. Smith



Published by Yayasan Konservasi RASI/  
Conservation Foundation for Rare Aquatic Species of Indonesia

2010

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*Citation:*

Kreb, D., Reeves, R.R., Thomas, P.O., Braulik, G.T. and Smith, B.D. (Editors). 2010. *Establishing protected areas for Asian freshwater cetaceans: Freshwater cetaceans as flagship species for integrated river conservation management, Samarinda, 19-24 October 2009*. Final Workshop Report. Yayasan Konservasi RASI, Samarinda, Indonesia, 166 pp. ISBN: 978-602-97677-0-4

*Yayasan Konservasi RASI* or the *Conservation Foundation for Rare Aquatic Species of Indonesia*, is a local NGO established in 2000, based in Samarinda, East Kalimantan. One of its first and ongoing conservation programs deals with the conservation of the freshwater Irrawaddy dolphin or Pesut Mahakam. The goal of this program is the conservation of the critically endangered freshwater dolphin population in the Mahakam River and its habitat through establishment of scientifically justified and community/ government-supported protected areas. Objectives include raising environmental awareness, establishing sustainable fisheries and facilitating community-supported establishment of river dolphin protected areas. Among the activities that have been and are being conducted are population monitoring and socio-economic assessment surveys; workshops at community, (sub)district, provincial, and (inter)national level; developing and implementing environmental education courses for high schools and elementary schools; awareness campaigns mainly with schoolchildren and fishermen; facilitating sustainable eco-tourism; and setting up sustainable aqua-culture fisheries with fishermen cooperations.

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## ACKNOWLEDGEMENTS

First of all, we are very grateful to the East Kalimantan Provincial Government, especially the Governor of East Kalimantan, the Mayor of Samarinda and the heads of Central and West Kutai Districts, for hosting the workshop in their respective areas.

We thank all sponsors, which funded this event, namely the Marine Mammal Commission, Ocean Park Conservation Foundation Hong Kong, People's Trust for Endangered Species, West Kutai District Government and Mining Department, PT. Pupuk Kaltim, the Provincial Public Works, and individual donors.

We are also grateful for the assistance provided by the Environmental Department of East Kalimantan (BLH), the Forestry Faculty of Mulawarman University, the Technical Executive Unit of the Preservation and Conservancy Agency of East Kalimantan (UPTD PPA), and other organizations. We also thank members of the steering committee and members of the local and international organizing committees for their help with logistics, fundraising, selection of participants, and development of a suitable workshop format.

Finally, we thank all participants for their input and active participation as well as the co-editors of this report.

Yayasan konservasi RASI

## UCAPAN TERIMA KASIH

Pertama-tama, kami sangat berterima kasih kepada Pemerintah Provinsi Kalimantan Timur, khususnya Gubernur Kalimantan Timur, Walikota Samarinda dan Bupati Kutai Kartanegara dan Kutai Barat, selaku tuan rumah lokakarya di daerah masing-masing.

Kami berterima kasih kepada seluruh sponsor yang mendanai lokakarya ini, yaitu Marine Mammal Commission, Ocean Park Conservation Foundation Hong Kong, People's Trust for Endangered Species, Pemerintah Kabupaten Kutai Barat dan Dinas Pertambangan Kutai Barat, PT. Pupuk Kaltim, Dinas Pekerjaan Umum Propinsi Kalimantan Timur, dan donor perorangan.

Kami juga berterima kasih atas bantuan yang diberikan oleh Badan Lingkungan Hidup Propinsi Kalimantan Timur (BLH), Fakultas Kehutanan Universitas Mulawarman, Unit Pelaksana Teknis dari Perlindungan dan Pelestarian Alam Dinas Kehutanan Propinsi Kalimantan Timur (UPTD PPA), dan organisasi lainnya. Kami juga mengucapkan terima kasih kepada anggota komite pengarah dan anggota komite penyelenggara lokal dan internasional atas bantuan mereka di bidang logistik, dana, seleksi peserta, dan pengembangan format lokakarya.

Akhirnya, kami mengucapkan terima kasih kepada semua peserta atas masukan dan partisipasi aktif serta penyusunan laporan ini.

Yayasan Konservasi RASI

## FOREWORD GOVERNOR

In my capacity as Governor of East Kalimantan Province as well as on behalf of the Republic of Indonesia, I supported the workshop event that was conducted between 19-24th October 2009 in Samarinda dealing with the establishment of protected areas for freshwater cetaceans in Asia. In this workshop both international and national scientists, policymakers and NGO representatives participated. Based on the observations by Yayasan Konservasi RASI, the status of Pesut Mahakam is considered very rare and only 90 individuals are estimated to remain alive. Their decline in numbers has been caused by the degradation of their habitat as a result of human activities and heavy transport. Furthermore, their food resources in the lakes and river have declined because of the increasing degradation of the Mahakam River system and lakes.

I regret the current situation and the discrepancy between the admiration we all feel for the symbol species of East Kalimantan Province and our insufficiency to provide a safe habitat for them.

The workshop results provide the provincial and local government with clear recommendations for protection of Pesut Mahakam, which hopefully will be implemented. Not only will this contribute to freshwater dolphin conservation but also it will help protect other unique wildlife that depends on the riverine ecosystem. In the middle Mahakam area alone at least 298 bird species, 24 mammal species, 16 species of reptiles and amphibians, 300 tree species, and 86 freshwater fish species have been identified. Besides the large biodiversity, the Mahakam also functions as a source of drinking water installations, as a transportation corridor, and as a focus of tourism with its characteristic river bends, providing beautiful scenery. There are also three large connected lakes (Semayang, Melintang and Jempang) with a total surface area of 39.000 ha. These three lakes function as buffer zones or natural flood control systems for downstream and upstream settlements. They also provide habitat for the Pesut Mahakam and are breeding sites for many fish species, which are the main food sources for the dolphins.

Given the complexity of factors that affect the dolphins and the entire river ecosystem, a comprehensive understanding and a strong commitment are required on the part of all stakeholders. A broad-based and sustained dialogue

## SAMBUTAN GUBERNUR

Dalam kapasitas saya sebagai Gubernur Propinsi Kalimantan Timur serta atas nama Republik Indonesia, saya mendukung acara lokakarya yang dilaksanakan tanggal 19 - 24 Oktober 2009 di Samarinda mengenai Penetapan Kawasan Perlindungan Cetacea Air Tawar di Asia. Dalam lokakarya ini telah ikut berpartisipasi para ilmuwan baik nasional maupun internasional, pengambil kebijakan dan perwakilan LSM. Berdasarkan hasil observasi Yayasan Konservasi RASI, status Pesut Mahakam dianggap sangat langka dan diperkirakan jumlahnya hanya 90 ekor. Penurunan jumlahnya disebabkan oleh degradasi habitat mereka sebagai akibat dari aktivitas manusia dan alat transportasi perusahaan. Selain itu, sumber makanan mereka di danau dan sungai telah jauh berkurang akibat peningkatan tekanan terhadap sistem Sungai Mahakam dan danau-danau.

Saya menyesal atas situasi saat ini dan ketidaksesuaian antara kekaguman kita semua terhadap simbol Provinsi Kalimantan Timur ini dan kekurangmampuan kami untuk menyediakan habitat yang aman bagi mereka.

Hasil lokakarya akan memberikan rekomendasi kepada pemerintah daerah dan provinsi untuk perlindungan Pesut Mahakam, yang diharapkan akan dilakukan. Tidak hanya akan memberikan kontribusi untuk konservasi lumba-lumba air tawar, tetapi juga akan membantu melindungi satwa liar unik lainnya yang tergantung pada ekosistem sungai. Di daerah Mahakam Tengah saja setidaknya terdapat 298 jenis burung, 24 jenis mamalia, 16 jenis reptil dan amfibi, 300 jenis pohon, dan 86 jenis ikan air tawar telah teridentifikasi. Selain keanekaragaman hayati yang besar, Mahakam juga berfungsi sebagai sumber instalasi air minum, koridor transportasi, dan sebagai fokus pariwisata dengan karakteristik tikungan sungai, yang memberikan pemandangan indah. Ada juga tiga danau besar (Semayang, Melintang dan Jempang) dengan total luas permukaan 39.000 ha. Ketiga danau berfungsi sebagai zona penyangga atau mengatur sistem paparan banjir secara alami untuk permukiman di bagian hulu dan hilir. Daerah tersebut merupakan habitat bagi Pesut Mahakam dan perkembangbiakan bagi banyak spesies ikan, yang merupakan sumber makanan utama bagi lumba-lumba.

will be needed in order to obtain the agreement and approval of all stakeholders. Their full support and commitment to their respective tasks and roles will be essential for successful implementation.

I conclude by expressing my hope that the workshop has achieved its goal of producing practical conclusions and decisions that will be implemented without delay and thereby add to our efforts to protect the freshwater dolphins and their habitat in Asia and other parts of the world. One of my own immediate commitments will be to announce the celebration of the 24th of October as the provincial Mahakam Dolphin Day, to coincide with the International Freshwater Dolphin Day.

H. Awang Faroek Ishak,

Governor of East Kalimantan Province

Mengingat kompleksnya faktor-faktor yang mempengaruhi lumba-lumba dan ekosistem sungai secara keseluruhan, pemahaman komprehensif dan komitmen yang kuat diperlukan bagi semua stakeholder. Pembicaraan yang luas dan berkelanjutan sangat dibutuhkan untuk memperoleh kesepakatan dan persetujuan dari seluruh stakeholder. Dukungan penuh dan komitmen mereka dengan tugas masing-masing akan berperan penting bagi keberhasilan pelaksanaannya.

Saya menyimpulkan dengan harapan bahwa lokakarya ini telah mencapai tujuannya menghasilkan kesimpulan praktis dan keputusan yang akan dilaksanakan tanpa penundaan akan meningkatkan upaya kami untuk melindungi lumba-lumba air tawar dan habitatnya di Asia dan bagian dunia lainnya. Salah satu komitmen saya sendiri akan mengumumkan peringatan tanggal 24 Oktober sebagai Hari Lumba-lumba Mahakam Propinsi, bertepatan dengan Hari Lumba-lumba Air Tawar Sedunia.

H. Awang Faroek Ishak,

Gubernur Propinsi Kalimantan Timur

## FOREWORD ORGANIZER

Indonesia is fortunate to have the presence of one freshwater dolphin species that we named Pesut Mahakam or Irrawaddy Dolphin in English and *Orcaella brevirostris* in Latin. Pesut Mahakam and many other freshwater dolphin species or populations are highly endangered or threatened with extinction. Multiple factors are responsible for this, including rapid increases in human populations, economic development, and the unsustainable use of natural resources. The dolphins' habitat is being lost or degraded, and they are being forced to compete with humans for food. Unselective fishing methods, pollution, and fast-moving vessels may even cause the deaths of individual dolphins.

To reduce the stress from those threats, we need to identify preventive and integrated actions that can be carefully implemented by the government, the private sector, and non-governmental organizations (NGOs). In order to develop more effective, socially and environmentally equitable conservation strategies, we wished to learn from the experiences and expertise in other countries, and thus grew the idea of convening an international workshop that would focus on the conservation of freshwater cetacean populations in Asia in particular and on the establishment of protected areas. To this end we brought together experts from academic institutions, government agencies, and NGOs both inside and outside of Asia.

The "International workshop on establishing protected areas for Asian freshwater cetaceans" was held between the 19<sup>th</sup> and 24<sup>th</sup> of October 2009 in Samarinda, East Kalimantan Province, Indonesia, and was organized by the Provincial Government, Mulawarman University, and the local NGO Yayasan Konservasi RASI. The aims of the workshop were to exchange knowledge and experiences on conservation management of freshwater cetaceans in established or proposed riverine protected areas in Asia, to evaluate the effectiveness of established protected areas in meeting their conservation goals, and to identify ways to improve conservation management of cetaceans in these areas and establish new protected areas.

Workshop participants provided us with overviews from countries that already have protected areas. These overviews summarized

## SAMBUTAN PANITIA

Indonesia sangat beruntung memiliki satu-satunya spesies lumba-lumba air tawar bernama Pesut Mahakam atau Irrawaddy Dolphin dalam bahasa Inggris dan dalam bahasa Latin *Orcaella brevirostris*. Pesut Mahakam dan lumba-lumba air tawar lainnya umumnya berstatus sangat terancam punah atau diambang kepunahan. Beragam faktor yang mempengaruhinya, termasuk peningkatan populasi manusia, pembangunan ekonomi, dan penggunaan sumber daya alam yang tidak berkelanjutan. Habitat satwa ini mengalami penurunan dan cenderung berkurang, dan selalu bersaing dengan manusia untuk memperoleh makanan. Metode penangkapan ikan yang tidak selektif, polusi, dan speedboat bahkan dapat menyebabkan kematian lumba-lumba.

Untuk mengurangi stres dari ancaman tersebut, kita perlu mengidentifikasi tindakan pencegahan dan terintegrasi yang dapat diimplementasikan dengan hati-hati oleh pemerintah, sektor swasta, dan organisasi non-pemerintah (LSM). Dalam rangka untuk mengembangkan strategi lebih efektif, sosial dan konservasi lingkungan yang adil, kami berharap dapat belajar dari pengalaman dan keahlian di negara-negara lain, sehingga muncullah gagasan untuk mengadakan sebuah lokakarya internasional yang akan difokuskan pada konservasi populasi cetacea air tawar di Asia pada khususnya dan pembentukan kawasan lindungnya. Untuk itulah kami membawa para pakar dari lembaga akademis, lembaga pemerintah, dan LSM baik dari dalam dan luar Asia.

"Lokakarya Internasional Penetapan Kawasan Perlindungan Cetacea Air Tawar Asia" diselenggarakan sejak tanggal 19 - 24 Oktober 2009 di Samarinda, Propinsi Kalimantan Timur, Indonesia, dan diselenggarakan oleh Pemerintah Propinsi, Universitas Mulawarman, dan LSM lokal Yayasan Konservasi RASI. Tujuan lokakarya ini adalah untuk pertukaran pengetahuan dan pengalaman mengenai pengelolaan konservasi cetacea air tawar pada kawasan perlindungan sungai yang sudah ada atau yang sedang diusulkan di Asia, untuk mengevaluasi efektivitas kawasan lindung yang ditetapkan dalam memenuhi tujuan konservasi mereka, dan mengidentifikasi cara meningkatkan pengelolaan konservasi cetacean di daerah-daerah dan



challenges and successes in management, and the benefits brought by protected areas to other species, ecosystems, and the social economy of local communities.

In addition, we hope that the workshop enabled us all to provide some inputs for the decision makers so that before policies are approved and implemented, the conservation implications can be considered more thoroughly, with the ultimate aim of protecting our freshwater cetaceans and other threatened species while at the same time supporting sustainable community development.

Budiono,

Executive Director  
Yayasan Konservasi RASI

menetapkan kawasan lindung baru.

Peserta Lokakarya memberikan kita beragam informasi dari negara-negara yang sudah memiliki kawasan lindung. Gambaran ini menghasilkan tantangan dan keberhasilan dalam pengelolaan, dan kawasan perlindungan akan memberikan manfaat untuk spesies langka lainnya, ekosistem, dan sosial ekonomi masyarakat setempat.

Selain itu, kami berharap bahwa lokakarya ini memungkinkan kita semua untuk memberikan beberapa masukan bagi para pengambil keputusan sehingga sebelum kebijakan tersebut disetujui dan dilaksanakan, implikasi konservasi dapat dipertimbangkan lebih teliti, dengan tujuan utama untuk melindungi cetacea air tawar kita dan spesies langka lainnya sementara pada saat yang sama mendukung pembangunan masyarakat yang berkelanjutan.

Budiono,

Direktur Eksekutif  
Yayasan Konservasi RASI

## 1. INTRODUCTION

The Workshop on Establishing Protected Areas for Asian Freshwater Cetaceans took place in Samarinda, East Kalimantan, Indonesia from the 19th to 24th of October 2009. The workshop provided an international platform for intensive exchanges of knowledge and experience on the conservation management of established or planned protected areas for freshwater cetaceans in Asian rivers. The focus was on seven Asian countries: Indonesia, China, Cambodia, Bangladesh, Myanmar, India, and Pakistan. The workshop provided an opportunity for participants to benefit from the knowledge and experience of several international experts who gave presentations on biodiversity conservation and sustainable community development in freshwater protected areas. The event as a whole consisted of one and a half days of sessions open to the general public, two and a half days of sessions limited to invited participants, and a two-day field trip. About 115 local and international participants from governments, NGOs, and academic institutions attended the seminar, while 40 people participated in the closed sessions and field trip. The main body of this report consists of notes on the workshop sessions highlighting the top-priority recommendations for conservation action, followed by the summary reports prepared by national representatives reviewing the conservation status of freshwater cetaceans and the management of existing or planned protected areas in their respective countries. In addition, annexes to the report contain the meeting agenda (Annex 1), the list of participants (Annex 2), the background presentations by international experts (Annex 3) and a table with all identified existing and proposed protected areas for freshwater cetaceans in each country (Annex 4).

The workshop was initiated and convened by Danielle Krebs and Budiono of the Conservation Foundation for Rare Aquatic Species of Indonesia (RASI), and they were assisted in planning and organizing the substantive aspects by a steering group that included B.C. Choudhury, Brian D. Smith, and Randall Reeves. Funding for the workshop came from international sponsors, namely the Ocean Park Conservation Foundation of Hong Kong, the U.S. Marine Mammal Commission, and People's Trust for

## 1. PENDAHULUAN

Lokakarya Penetapan Kawasan Perlindungan Cetacea Air Tawar Asia diadakan di Samarinda, Kalimantan Timur, Indonesia dari tanggal 19 hingga 24 Oktober 2009. Lokakarya tersebut menyediakan sebuah landasan internasional bagi pertukaran pengetahuan dan pengalaman secara intensif tentang manajemen dalam kawasan perlindungan cetacea air tawar yang telah dibentuk maupun yang direncanakan di sungai-sungai Asia. Lokakarya difokuskan pada tujuh negara di Asia meliputi: Indonesia, Cina, Kamboja, Bangladesh, Myanmar, India, dan Pakistan. Lokakarya memberikan kesempatan berharga bagi para peserta untuk memperoleh pengetahuan dan pengalaman dari beberapa ahli internasional yang memberikan informasi mengenai konservasi keanekaragaman hayati dan pembangunan masyarakat berkelanjutan di kawasan-kawasan perlindungan air tawar. Acara tersebut secara keseluruhan terdiri atas satu setengah hari sesi terbuka bagi masyarakat umum, dua setengah hari sesi terbatas bagi para undangan, dan dua hari kunjungan lapangan. Seminar dihadiri oleh kurang lebih 115 peserta lokal dan internasional dari instansi pemerintah, LSM, dan kalangan akademis, sedangkan sesi tertutup dan kunjungan lapangan diikuti oleh 40 peserta. Isi utama laporan ini terdiri atas catatan mengenai sesi tertutup (workshop) yang menyoroti rekomendasi utama untuk aksi konservasi, dilanjutkan dengan laporan singkat yang disiapkan oleh para peserta mengenai status konservasi cetacea air tawar dan manajemen dari kawasan-kawasan perlindungan yang telah ada maupun yang direncanakan di negara mereka masing-masing. Lampiran-lampiran berisikan tentang agenda pertemuan (Lampiran 1), daftar peserta (Lampiran 2), presentasi para ahli internasional (Lampiran 3) dan tabel seluruh kawasan perlindungan cetacea air tawar yang telah ada maupun yang diusulkan di masing-masing negara (Lampiran 4).

Lokakarya diprakarsai dan diselenggarakan oleh Danielle Krebs dan Budiono dari Yayasan Konservasi RASI (Rare Aquatic Species of Indonesia), dalam merencanakan dan mengatur berbagai aspek penting mereka dibantu oleh sebuah dewan penasehat yang beranggotakan B.C. Choudhury, Brian D. Smith, dan Randall Reeves. Dana untuk lokakarya diperoleh dari para sponsor internasional

Endangered Species, and from local sponsors in East Kalimantan, Indonesia, namely the Government of West Kutai, P.T. Pupuk Kaltim (PKT), and Provincial Public Works. It was hosted by the East Kalimantan Provincial Government, in cooperation with Mulawarman University and RASI. The hard work of numerous RASI staff members and volunteers was indispensable in making the workshop a success, and all participants gave them heartfelt thanks.

### *What are river dolphins?*

Freshwater cetaceans (including six dolphin species and a porpoise) are among the world's most threatened mammals (Reeves *et al.*, 2000, 2003). Four out of the six or seven (depending how the status of *Sotalia* in the Orinoco River is resolved) currently recognized cetacean species with freshwater populations occur in Asia, and all are Endangered or Critically Endangered according to the IUCN Red List. After inhabiting China's Yangtze River for an estimated 20 million years, the baiji, or Yangtze River dolphin, *Lipotes vexillifer*, appears to have been driven to extinction by human activities within the past few decades (Turvey *et al.*, 2007). Sympatric with the baiji, the Yangtze River finless porpoise, *Neophocaena phocaenoides asiaeorientalis*, is also Endangered with an estimated total population of about 1,800 individuals (Zhao *et al.*, 2008). The susu or Ganges River dolphin, *Platanista gangetica gangetica*, is found in the Ganges-Brahmaputra-Megna and Karnaphuli- Sangu river systems of Bangladesh, India, and Nepal. The bhulan or Indus River dolphin, *Platanista gangetica minor*, is found primarily in the Indus River of Pakistan and a small population is present in the Beas River in Punjab, India. Both *Platanista* sub-species are listed as Endangered (Smith *et al.*, 2004; Braulik *et al.*, 2004). The Irrawaddy dolphin, *Orcaella brevirostris*, is a marine and freshwater species with populations in three major Asian river systems, the Mahakam of Indonesia, the Ayeyarwady of Myanmar, and the Mekong of Cambodia and Lao PDR (Smith *et al.*, 2007). All freshwater populations of Irrawaddy dolphins are listed as Critically Endangered. Additional isolated or at least semi-isolated populations inhabit the brackish waters of Chilika Lagoon, eastern India, and Songkhla Lake, eastern Thailand, although the latter population has been severely depleted by incidental mortality in fishing gear and may no longer be viable (Kittiwattanawong *et al.*, 2007).

seperti Ocean Park Conservation Foundation Hong Kong, U.S. Marine Mammal Commission, People's Trust for Endangered Species, dan dari sponsor lokal di Kalimantan Timur, Indonesia, seperti Pemerintah Kabupaten Kutai Barat, P.T. Pupuk Kaltim (PKT) dan Dinas Pekerjaan Umum Propinsi. Bertindak sebagai tuan rumah adalah Pemerintah Propinsi Kalimantan Timur, bekerjasama dengan Universitas Mulawarman dan RASI. Keberhasilan pelaksanaan lokakarya tidak terlepas dari kerja keras para staf Rasi dan sukarelawan, bahkan para peserta pun menyampaikan rasa terima kasih yang tulus kepada seluruh panitia.

### *Apa lumba-lumba sungai itu?*

Cetacea air tawar (termasuk enam jenis lumba-lumba dan sejenis porpoise) merupakan salah satu mamalia yang paling terancam punah di dunia (Reeves *et al.*, 2000, 2003). Empat dari enam atau tujuh (tergantung bagaimana status taksonomi *Sotalia* di Sungai Orinoco akan diputuskan) jenis cetacea yang baru dikenal belakangan ini dengan populasi air tawarnya terdapat di Asia, dan semua termasuk dalam kategori Terancam Punah atau Sangat Terancam Punah menurut Daftar Merah IUCN. Bahkan baiji, atau lumba-lumba Sungai Yangtze, *Lipotes vexillifer*, yang telah mendiami Sungai Yangtze Cina selama kurang lebih 20 juta tahun, tampaknya telah menuju ambang kepunahan hanya dalam waktu beberapa dekade akibat dampak negatif kegiatan manusia (Turvey *et al.*, 2007). Finless porpoise Sungai Yangtze, *Neophocaena phocaenoides asiaeorientalis*, yang berbagi habitat dengan baiji, juga Terancam Punah dengan perkiraan jumlah populasi 1.800 ekor (Zhao *et al.*, 2008). Susu atau lumba-lumba Sungai Ganga, *Platanista gangetica gangetica*, terdapat di sistem sungai Ganga-Brahmaputra-Megna, dan Karnaphuli- Sangu di Bangladesh, India, dan Nepal. Bhulan atau lumba-lumba Sungai Indus, *Platanista gangetica minor*, terutama ditemukan di Sungai Indus Pakistan dan sebuah suppopulasi kecil terdapat di Sungai Beas di Punjab, India. Kedua sub-spesies *Platanista* termasuk dalam kategori Terancam Punah (Smith *et al.*, 2004; Braulik *et al.*, 2004). Lumba-lumba Irrawaddy, *Orcaella brevirostris*, adalah jenis laut dan air tawar dengan populasi yang terdapat pada tiga sistem sungai besar Asia, Mahakam Indonesia, Ayeyarwady Mianmar, dan Mekong Kamboja, serta Laos PDR (Smith *et al.*, 2007). Semua populasi lumba-lumba Irrawaddy air tawar termasuk dalam kategori Sangat

### *Antecedents of this workshop*

The first in a series of international workshops and meetings on Asian river dolphins took place in Wuhan, China, in 1986 (Perrin and Brownell, 1989; see Reeves background paper in Annex 3). Numerous recommendations concerning research and conservation have been made over the years since 1986, including several referring to the need for more effective protected areas for freshwater cetaceans. At its second meeting in 1997 in Rajendrapur, Bangladesh, the Asian River Dolphin Committee developed guidelines for the management of such protected areas (Smith and Reeves, 2000). Those guidelines still appear relevant and are summarized as follows:

1. Encourage local people to participate in planning and management.
2. Ensure that any exploitation of aquatic and riparian resources is sustainable and benefits local people.
3. Prohibit and enforce regulations restricting the use of non-selective fishing methods, including gillnets, rolling hooks, explosives, poisons, and electricity.
4. Implement environmental education programs, highlighting aquatic species and explaining the rationale for having the protected area.
5. Ensure enforcement of laws and regulations protecting the cetaceans (and other fauna) for which the protected area was created.
6. Monitor water quality and enforce legal standards.
7. Control the use of motorized vessels, even for enforcement and monitoring activities, as they can be hazardous for cetaceans and other aquatic fauna."

A workshop specifically focusing on freshwater populations of Irrawaddy dolphins was held in 2005 in Phnom Penh, Cambodia (Smith *et al.*, 2007), and it generated another statement regarding protected areas that bears repeating, as follows:

"Emphasizing that protected areas and core conservation zones within these areas will play an important role for conserving freshwater populations of Irrawaddy dolphins, we call attention to the need for the location, size and configuration of these areas to be based on sound biological knowledge of the populations they are intended to

Terancam Punah. Di samping itu terdapat populasi terisolasi yang hidup dalam air payau di Laguna Chilika, bagian timur India, dan Danau Songkhla, bagian timur Thailand, namun kematian yang tidak disengaja akibat alat penangkap ikan telah menurunkan jumlah populasi di Danau Songkhla secara drastis, bahkan diperkirakan tidak ada lagi individu yang tersisa (Kittiwattanawong *et al.*, 2007).

### *Peristiwa sebelum lokakarya ini*

Pertama adalah rangkaian lokakarya dan pertemuan internasional mengenai lumba-lumba sungai Asia yang diadakan di Wuhan, Cina, pada 1986 (Perrin and Brownell, 1989; lihat latar belakang naskah Reeves di Lampiran 3). Berbagai rekomendasi mengenai penelitian dan konservasi telah dibuat selama beberapa tahun sejak 1986, termasuk yang menyebutkan tentang perlunya kawasan-kawasan perlindungan cetacea air tawar yang lebih efektif. Pada pertemuan kedua, tahun 1997 di Rajendrapur, Bangladesh, Asian River Dolphin Committee mengembangkan panduan manajemen kawasan perlindungan (Smith and Reeves, 2000). Panduan tersebut masih relevan hingga kini dan diringkas sebagai berikut:

1. Mendorong masyarakat setempat untuk berpartisipasi dalam perencanaan dan pengelolaan.
2. Memastikan agar pemanfaatan sumber daya perairan dan hutan tepian sungai berkelanjutan dan menguntungkan bagi masyarakat setempat.
3. Melarang dan menerapkan peraturan pelarangan penggunaan metode penangkapan ikan yang tidak selektif, termasuk rengge, rawai, bom ikan, racun, dan setrum.
4. Melaksanakan program pendidikan lingkungan, dengan fokus utama pada jenis perairan dan menjelaskan alasan pembentukan kawasan perlindungan.
5. Memastikan pelaksanaan undang-undang dan peraturan perlindungan cetacea (dan satwa lain) yang menjadi tujuan pembentukan kawasan perlindungan.
6. Pemantauan kualitas air dan menerapkan standar resmi.
7. Mengatur penggunaan kapal bermotor, bahkan untuk kegiatan pelaksanaan undang-undang dan monitoring, karena dapat membahayakan cetacea dan satwa perairan lainnya."

protect, and for strong and appropriate management structures to be put in place so intended conservation benefits can be realized.”

Thus, in its historical context, the Samarinda workshop was seen as an opportunity to evaluate progress made towards implementing previous recommendations, to reconsider earlier formulations of objectives and methods in the light of new experience and knowledge, and to strengthen efforts for providing meaningful protection to Asian freshwater cetaceans and their habitat.

### *Why this workshop was convened*

The Workshop on Establishing Protected Areas for Asian Freshwater Cetaceans was convened, in large part, to broaden and deepen the channels of communication among scientists and managers concerned with Asian freshwater cetaceans. The central theme was the role of protected areas as a means of conserving freshwater cetaceans. The workshop was designed to provide scientists and policy makers in Asia with an opportunity to (1) evaluate the effectiveness of existing protected areas in achieving their conservation objectives, (2) identify ways to improve protected area management, and (3) develop guidance for improving protection in habitat that lacks official protected status. The workshop was also expected to produce an overview of existing freshwater protected areas, including an assessment of (1) the regulatory framework in each of the range states for establishing and maintaining such areas, and (2) the potential benefits of protected areas for other species, for freshwater ecosystems more generally, and for local human communities.

The agenda highlighted the conservation challenges facing the Pesut Mahakam, or the Mahakam River population of Irrawaddy dolphins. The Pesut Mahakam is the only freshwater dolphin population in Indonesia and is the mascot for the province of East Kalimantan. Detailed presentations and the field trip to observe the dolphins and their environment highlighted local, regional, and national efforts on behalf of the Pesut Mahakam. Given the overall focus on protected areas, local efforts to develop and improve management plans for two freshwater dolphin protected areas in the Mahakam River in Central and West Kutai Districts, and information on one freshwater-dependent population of Irrawaddy dolphins in the Sesayap

Sebuah lokakarya yang khusus membahas populasi air tawar lumba-lumba Irrawaddy dilaksanakan pada tahun 2005 di Phnom Penh, Kamboja (Smith *et al.*, 2007), dan menghasilkan sebuah pernyataan tentang kawasan perlindungan yang patut digarisbawahi, sebagai berikut:

“Menegaskan bahwa karena kawasan perlindungan dan daerah pusat konservasi yang ada di dalamnya akan memainkan peran vital untuk melestarikan populasi lumba-lumba Irrawaddy air tawar, maka penting agar lokasi, ukuran dan tatanan dari kawasan ini dibuat berdasarkan pengetahuan biologis yang memadai mengenai populasi yang akan dilindungi, selain itu harus dibentuk struktur manajemen yang kuat dan tepat agar tujuan konservasi dapat terwujud.”

Berdasarkan berbagai peristiwa di atas, lokakarya Samarinda dapat dilihat sebagai satu kesempatan untuk mengevaluasi sejauh mana kemajuan pelaksanaan rekomendasi terdahulu, agar tujuan dan metode dapat kembali dirumuskan berdasarkan pengalaman dan pengetahuan baru, serta memperkuat usaha untuk memberikan perlindungan yang berarti bagi cetacea air tawar Asia dan habitatnya.

### *Mengapa lokakarya ini diselenggarakan*

Secara umum, Lokakarya Penetapan Kawasan Perlindungan Cetacea Air Tawar Asia diselenggarakan untuk memperluas dan memperdalam jalur komunikasi diantara para ilmuwan dan pengelola yang peduli terhadap cetacea air tawar Asia. Tema pokok adalah peranan kawasan perlindungan bagi cetacea air tawar dengan pengertian mutlak bahwa pembentukan dan manajemen kawasan perlindungan merupakan salah satu bentuk campur tangan yang diperlukan untuk memastikan kelangsungan hidup jenis ini. Lokakarya dimaksudkan untuk memberikan kesempatan bagi para ilmuwan dan pengambil keputusan di Asia agar dapat (1) mengevaluasi efektifitas dari kawasan perlindungan yang ada dalam pencapaian tujuan konservasinya, (2) mengidentifikasi berbagai cara untuk memperbaiki manajemen kawasan perlindungan, dan (3) menghasilkan panduan untuk meningkatkan perlindungan habitat yang tidak memiliki status perlindungan resmi. Lokakarya juga diharapkan dapat menghasilkan suatu gambaran dari kawasan-kawasan perlindungan yang ada, termasuk

River Delta, Malinau District, provided case studies for conference participants.

### *Threats to freshwater cetaceans*

Freshwater cetaceans have declined dramatically in numbers and range, especially in Asia (Reeves *et al.*, 2000; Jefferson & Smith, 2002). The threats are diverse, longstanding, and very difficult to assess or manage. For most populations, bycatch (entanglement or entrapment, usually leading to death) in fishing gear is the most serious and immediate problem, and gillnets are the greatest cause of human-induced mortality. Freshwater cetaceans are also vulnerable to habitat modification and degradation (e.g. from noise and chemical pollution), and they compete with humans for fish and other resources (e.g. water). Injury or death can also be caused by vessel strikes, underwater explosions, electrocution (in electro-fishing), and entrapment in water management structures, notably irrigation canals. Some of these factors kill animals outright, while others impair their health or undermine their reproductive capabilities and social behavior.

Unlike coastal and pelagic cetaceans, many freshwater species live in environments where the very availability of water can be in doubt. All freshwater cetaceans require adequate water flow and water quality within their range; these are the basic elements of suitable habitat and are needed by the animals to support their physical health, mobility, and ability to forage efficiently and find prey. In freshwater (and estuarine) ecosystems, unlike in coastal or oceanic systems, such basic elements are finite and can be completely regulated. They can also be despoiled or entirely cut off by human activities. The constricted nature of riverine habitat, and the inescapable need to share that habitat with humans, increases the vulnerability of these dolphins to bycatch in fisheries, overfishing of their prey, disturbance by noise, and being struck or displaced by vessels.

While most of the identified threats are widespread in Asian river systems, and most freshwater cetacean populations face multiple threats, the overall riverine ecology and the types and intensity of human activities vary among the different river systems. However, in all cases the impacts of humans on those systems and on the dolphin and porpoise populations themselves are significant. In some cases the operative or limiting

penilaian terhadap (1) kerangka kerja yang mengatur pembentukan dan pengelolaan kawasan-kawasan tersebut di setiap negara, dan (2) potensi keuntungan kawasan perlindungan bagi jenis lain, bagi ekosistem air tawar secara keseluruhan, dan bagi masyarakat setempat.

Agenda utama lokakarya membahas tentang tantangan konservasi yang dihadapi Pesut Mahakam, atau populasi lumba-lumba Irrawaddy Sungai Mahakam. Pesut Mahakam adalah satu-satunya populasi lumba-lumba air tawar di Indonesia dan merupakan satwa lambang Propinsi Kalimantan Timur. Seluruh presentasi dan kunjungan lapangan untuk mengamati lumba-lumba dan lingkungannya terutama menyoroti usaha yang dilakukan di tingkat lokal, regional dan nasional untuk kepentingan Pesut Mahakam. Penyampaian fokus keseluruhan mengenai kawasan perlindungan, usaha lokal untuk menyusun dan memperbaiki rencana manajemen dua kawasan perlindungan lumba-lumba air tawar di Sungai Mahakam di Kabupaten Kutai Kartanegara dan Kutai Barat, serta informasi mengenai sebuah populasi lumba-lumba Irrawaddy yang tergantung pada air tawar di Muara Sungai Sesayap, Kabupaten Malinau, memberikan studi kasus bagi para peserta lokakarya.

### *Ancaman bagi cetacea air tawar*

Jumlah dan wilayah jelajah cetacea air tawar, terutama di Asia, telah berkurang secara dramatis (Reeves *et al.*, 2000; Jefferson & Smith, 2002). Ancaman terhadap mereka sangat beragam, berlangsung terus-menerus, dan sangat sulit untuk dinilai atau diatasi. Bagi sebagian besar populasi, terperangkap (terjerat atau terbelit alat tangkap ikan, yang biasanya berakibat kematian) merupakan masalah yang paling serius dan langsung, dan rengge adalah penyebab kematian terbesar akibat aktivitas manusia. Cetacea air tawar juga rentan terhadap perubahan dan penurunan kualitas habitat (misalnya polusi suara dan bahan kimia), dan mereka bersaing dengan manusia untuk memperoleh ikan dan sumber daya lain (misalnya air). Luka atau kematian juga dapat disebabkan oleh tabrakan kapal, ledakan bom di dalam air, sengatan listrik (penangkapan ikan dengan setrum), dan terperangkap dalam bangunan pengelolaan air, khususnya saluran irigasi. Sebagian dari faktor-faktor tersebut langsung mengakibatkan kematian lumba-lumba, sedangkan sebagian lain mengganggu kondisi kesehatan atau menurunkan

threats are obvious (e.g., bycatch, entrapment in canals), while in others it is not clear if one threat is having more impact than another, or if a given population's decline is due to the cumulative effects of several factors.

### *Why protected areas?*

The distribution of freshwater cetaceans and the populations of fish and other prey organisms they depend on is not uniform within rivers. While dolphins and porpoises range widely (or ranged widely historically) in all river systems they inhabit, they tend to be found more often and in higher density in certain areas (Hua *et al.*, 1989; Leatherwood *et al.*, 2000; Martin *et al.*, 2004; Krebs & Budiono, 2005; Beasley *et al.*, 2007; Smith, 1993). The management of essential habitat (e.g., for foraging, calving, nursing young) within a protected area framework can be an effective tool for conservation. As illustrated in the country reports below, efforts have been made to establish protected areas for freshwater cetaceans in most of the range states. In some instances, such areas have already been designated, and in others designation is still in the planning stages.

A suite of challenges faces anyone trying to establish protected areas in any habitat, whether terrestrial, aquatic, or marine. These include defining and gazetted an area, establishing its regulatory or legal status, controlling human activities within it, reducing detrimental impacts from external activities and processes, setting up and supporting appropriate levels of public education and law enforcement, developing and maintaining community acceptance and support, managing critical ecosystem elements, and monitoring the effectiveness of management interventions.

Perhaps even more than terrestrial protected areas, aquatic protected areas are vulnerable to impacts from activities outside their boundaries, usually upstream (e.g., water flow, water quality, regional and national land use and water policies) but also downstream, as in the case of population fragmentation and interference with spawning migrations of fish prey caused by downstream water regulation structures. Given the flow-through nature of riverine ecosystems, aquatic protected areas are dependent on large-scale environmental management which is often controlled by the central government, and sometimes even by governments in other countries.

kemampuan reproduksi dan mengubah perilaku sosial mereka.

Tidak seperti cetacea yang hidup di daerah pesisir atau laut yang dalam, kebanyakan jenis air tawar hidup di lingkungan dimana ketersediaan air kadang tidak menentu. Semua cetacea air tawar membutuhkan jumlah aliran dan kualitas air yang mencukupi sepanjang wilayah jelajah mereka; ini merupakan unsur dasar dari habitat yang sesuai dan dibutuhkan oleh mereka untuk menunjang kesehatan, mobilitas, serta kemampuan untuk mencari makan secara efisien. Pada ekosistem air tawar (dan muara), tidak seperti di pesisir atau laut, unsur-unsur dasar tersebut terbatas dan dapat diatur. Mereka juga dapat terganggu atau terputus seluruhnya oleh aktivitas manusia. Habitat sungai yang terbatas, dan kenyataan yang tidak dapat dihindari untuk berbagi habitat tersebut dengan manusia, peningkatan resiko lumba-lumba yang terperangkap, penangkapan ikan secara berlebihan, gangguan suara, dan tabrakan kapal.

Kebanyakan ancaman-ancaman yang telah teridentifikasi tersebar di sistem sungai Asia, dan sebagian besar populasi lumba-lumba air tawar menghadapi lebih dari satu ancaman, dengan variasi berbeda di berbagai daerah. Ekologi sungai serta tipe dan intensitas kegiatan manusia di setiap sungai tentu tidak sama, namun dampaknya terhadap sistem sungai dan lumba-lumba air tawar sama-sama besar. Dalam beberapa kasus, ancaman yang paling dominan sangat jelas terlihat (seperti terjerat, terperangkap dalam kanal), sedangkan dalam kasus lain tidak jelas apakah suatu ancaman berdampak lebih besar daripada ancaman lainnya, atau apakah penurunan populasi merupakan akibat kumulatif dari beberapa faktor.

### *Mengapa kawasan perlindungan?*

Penyebaran cetacea air tawar serta populasi ikan dan mangsa mereka yang lain, berbeda di setiap bagian sungai. Sehingga walaupun lumba-lumba (dahulu) memiliki wilayah jelajah yang luas di semua sistem sungai yang mereka huni, mereka cenderung lebih sering ditemukan di daerah-daerah tertentu (Hua *et al.*, 1989; Leatherwood *et al.*, 2000; Martin *et al.*, 2004; Krebs & Budiono, 2005; Beasley *et al.*, 2007; Smith, 1993). Manajemen habitat terpenting tersebut (untuk mencari makan, melahirkan, merawat anak) dalam sebuah kerangka kerja kawasan perlindungan dapat menjadi alat efektif untuk konservasi. Usaha pembentukan kawasan

Therefore, the long-term viability of freshwater cetacean populations requires management of entire ecosystems and watersheds, including significant, concrete measures outside of protected areas. Watershed management, especially in upstream sections, is required to reduce sedimentation from agriculture, forestry, and land conversion, to limit water removal and dramatic changes in flow regimes by dams and barrages, to ensure adequate water and sustain essential geomorphic features in cetacean habitat, and to reduce toxic effluents and chemical pollution from agriculture, industry, industrial transport, and human settlements.

It is fundamentally important to recognize that fresh water is essential to all forms of life inhabiting a riverine or lacustrine ecosystem. Protected areas can play a major role in the conservation of freshwater cetaceans, especially when they are part of a river basin approach that balances the use of aquatic resources by humans with the need to protect biodiversity.

### *Proceedings of the workshop*

The workshop was opened by Vice Governor Dr. H. Farid Wadjudy and Chief Organizer and RASI Director Ir. Budiono. The first presentations involved general introductory lectures on the Indonesian National Conservation Strategy for the Pesut Mahakam and national policy regarding habitat quality and habitat quality monitoring to preserve the Pesut Mahakam by Dr. Ir. Harry Santoso, Director of the Directorate General of Forest Protection and Nature Conservation, Forestry Department and Ir. Sugeng Harmono, staff of the Ministry of Environment for Biodiversity Conservation. Provincial officials from the Forestry and Environmental Departments, Dr. Ir. H. Ahmad Delmi and Ir. H. Tuparman, then discussed reforestation efforts and the impacts of industrial development on water quality of the Mahakam River and the habitat of the Pesut Mahakam. Dr. Randall Reeves gave an historical overview of international involvement in efforts to conserve Asian freshwater cetaceans and the role of the IUCN Species Survival Commission's Cetacean Specialist Group. Dr. H. M. Sumaryono introduced integrated spatial river management in the Mahakam River, and Professor Wang Ding presented lessons learned from the baiji's likely extinction.

In the next portion of the workshop, participants from Indonesia, India, Myanmar,

perlindungan untuk cetacea air tawar telah dilakukan di sebagian besar negara, sebagaimana dijelaskan dalam laporan-laporan negara di bawah. Sebagian kawasan telah dibentuk, sebagian lainnya masih dalam tahap perencanaan.

Pembentukan kawasan perlindungan di habitat apa pun, darat, perairan, atau laut, umumnya akan menemui sejumlah tantangan. Hal ini termasuk menetapkan wilayah, membuat peraturan atau status resminya, mengawasi kegiatan manusia dalam kawasan tersebut, mengurangi dampak merugikan dari aktivitas di luar kawasan, menyiapkan dan membantu pendidikan yang sesuai bagi masyarakat dan pelaksanaan undang-undang, membangun dan mempertahankan penerimaan dan dukungan dari masyarakat, mengelola unsur-unsur ekosistem yang kritis, dan mengawasi efektivitas pengelolaan.

Mungkin dibanding dengan kawasan perlindungan darat, kawasan perlindungan perairan lebih rentan terhadap kegiatan di luar perbatasan, khususnya di daerah hulu (misalnya jumlah aliran air, kualitas air, penggunaan lahan dan kebijakan perairan di tingkat regional dan nasional), walaupun pemecahan populasi dan gangguan terhadap migrasi perkembangbiakan ikan akibat bangunan pengatur air di daerah hilir juga dapat mempengaruhi populasi di kawasan perlindungan bagian hulu. Meskipun ekosistem sungai telah memiliki aliran air yang alami, kadang kawasan perlindungan di beberapa negara tergantung pada manajemen lingkungan berskala lebih luas yang dikontrol oleh pemerintah.

Karena itulah, kelangsungan hidup jangka panjang dari populasi cetacea ini memerlukan manajemen seluruh ekosistem dan wilayah perairan, dengan tetap memperhitungkan faktor-faktor di luar kawasan perlindungan. Manajemen wilayah perairan, terutama di bagian hulu, dibutuhkan untuk mengurangi sedimentasi dari kegiatan pertanian, kehutanan, dan alih fungsi lahan; membatasi penggunaan air dan perubahan aliran akibat pembangunan waduk dan bendungan; memastikan ketersediaan air yang memadai dan mempertahankan habitat cetacea sebagaimana aslinya; serta mengurangi limbah dan polusi bahan kimia dari pertanian, industri, transportasi industri, dan pemukiman manusia.

Pemahaman umum bahwa air tawar mendukung semua kehidupan yang menghuni ekosistem sungai dan air payau sangatlah penting. Kawasan perlindungan dapat memainkan peran penting dalam konservasi cetacea air tawar dan



Cambodia, Pakistan, China, and Bangladesh gave presentations on existing and planned protected areas for wild populations of freshwater cetaceans in their respective countries. Each of these presentations, which formed a major portion of the workshop (Section 5, Country Reports), considered the following topics.

- Introduction of each river system, human population, industrial, agricultural and other human activities, wildlife
- Description of current cetacean population status: e.g. abundance, trends, and distribution patterns, including identification of core areas
- Past and ongoing conservation initiatives and programs for cetacean conservation
- Location, size, and management (goal and objectives, regulations, policies, enforcement, monitoring design) of planned or existing protected areas or special conservation areas
- Information on threats to freshwater cetaceans in planned or existing protected areas or special conservation areas
- Trends in dolphin abundance, reproduction, or mortality due to conservation measures taken in planned or existing protected areas or special conservation areas
- Needs for establishing new protected areas
- Besides cetaceans, which other wildlife species will benefit, and in which ways, from planned or existing protected areas or special conservation areas?
- What are the benefits for local communities from the planned or existing protected areas or special conservation areas?

After completion of the country presentations, the closed workshop sessions focused on four primary themes. Discussion of these themes guided the development of workshop conclusions and recommendations, where the general recommendations represent points of general consensus among the meeting participants (Section 2) and the country priority recommendations (Section 3) and workshop session recommendations (Section 4) reflect the views of the country representatives who were present.

- Theme 1: To what extent have protected areas and cetacean conservation programs been designed and proven effective in providing

merupakan salah satu langkah yang harus diambil dalam sebuah pendekatan wilayah sungai yang akan menyeimbangkan pemanfaatan sumber daya air oleh manusia dengan kebutuhan untuk melindungi keanekaragaman hayati secara umum.

### *Laporan lokakarya*

Lokakarya dibuka oleh Wakil Gubernur Propinsi Kalimantan Timur, Drs. H. Farid Wadjdy serta Ketua Panitia dan Direktur Yayasan Konservasi RASI, Ir. Budiono. Presentasi awal berisikan penyampaian umum mengenai Strategi Konservasi Nasional Indonesia untuk Pesut Mahakam serta kebijakan national tentang kualitas habitat dan monitoring kualitas habitat untuk melestarikan Pesut Mahakam oleh Dr. Ir. Harry Santoso, Direktur Konservasi Keanekaragaman Hayati, Direktorat Jenderal Perlindungan Hutan dan Konservasi Alam, Departemen Kehutanan dan Ir. Sugeng Harmono, staf Kementerian Lingkungan Hidup bidang Konservasi Keanekaragaman Hayati. Dilanjutkan dengan diskusi oleh Dr. Ir. H. Ahmad Delmi dan Ir. H. Tuparman dari Dinas Kehutanan dan Badan Lingkungan Hidup Propinsi, mengenai usaha rehabilitasi hutan dan dampak pembangunan industri terhadap kualitas air Sungai Mahakam dan habitat Pesut Mahakam. Dr. Randall Reeves memberikan gambaran sejarah keterlibatan dunia internasional dalam usaha pelestarian cetacea air tawar Asia dan peranan IUCN Species Survival Commission's Cetacean Specialist Group. Dr. H. M. Sumaryono memperkenalkan integrasi manajemen tata ruang sungai di Sungai Mahakam, dan Professor Wang Ding mempresentasikan pelajaran yang bisa dipetik dari baiji yang mungkin telah punah.

Pada bagian berikut, peserta lokakarya dari Indonesia, India, Mianmar, Kamboja, Pakistan, Cina, dan Bangladesh memberikan presentasi mengenai kawasan perlindungan yang telah ada maupun yang direncanakan untuk populasi alam dari cetacea air tawar di masing-masing negara. Presentasi-presentasi ini, yang mengisi sebagian besar acara lokakarya (Bagian 5), membahas topik-topik berikut.

- Gambaran umum mengenai masing-masing sistem sungai, demografi penduduk, perindustrian, pertanian dan kegiatan manusia lainnya, satwalial
- Gambaran mengenai status populasi lumba-lumba yang terbaru; antara lain jumlah

integrated conservation of the cetaceans and other freshwater-dependent species, maintaining ecosystem health, and bringing economic (or other) benefits to local human communities?

- Theme 2: Community involvement in protected area management and sustainable development projects
- Theme 3: The importance of using consistent methods to monitor freshwater cetacean populations and the need to undertake other types of monitoring to evaluate the effectiveness of protected area and conservation management
- Theme 4: Improving conservation management in core areas for freshwater cetaceans and in aquatic protected areas.

It is the conveners' hope that the workshop inspired participants to reflect on what has been achieved and what still remains to be done for the conservation of freshwater cetaceans, thus setting the course for strengthened conservation actions through the improved management of existing protected areas and the identification and establishment of new protected areas. The challenge is to manage such areas so that they provide real protection to the cetaceans and other threatened species while at the same time contribute to the sustainable development of human communities that share and depend on the same resources as the wild animal populations.

perkembangan, pola penyebaran termasuk identifikasi habitat utama

- Usaha-usaha konservasi yang telah dan sedang dilakukan serta program untuk konservasi cetacea
- Lokasi, luas dan pengelolaan (tujuan, peraturan, kebijakan, penegakan hukum, pola pengawasan) dari kawasan perlindungan yang telah ada maupun yang direncanakan atau kawasan konservasi khusus
- Informasi mengenai ancaman-ancaman terhadap cetacea air tawar dalam kawasan perlindungan yang telah ada maupun yang direncanakan atau kawasan konservasi khusus
- Perubahan dalam jumlah populasi, reproduksi, atau angka kematian sejak tindakan konservasi dilakukan dalam kawasan perlindungan yang telah ada maupun yang direncanakan atau kawasan konservasi khusus
- Kebutuhan untuk membentuk kawasan perlindungan baru
- Selain cetacea, jenis satwaliar lain apa yang akan mendapatkan keuntungan, dan dengan cara apa, dari kawasan perlindungan yang telah ada maupun yang direncanakan atau kawasan konservasi khusus
- Apakah keuntungan yang dapat diperoleh masyarakat setempat dari kawasan perlindungan yang telah ada maupun yang direncanakan atau kawasan konservasi khusus?

Setelah presentasi negara selesai, sesi tertutup lokakarya terfokus pada empat tema utama. Hasil diskusi dari tema-tema ini dijadikan dasar penyusunan kesimpulan dan rekomendasi lokakarya, dimanarekomendasi umum merupakan konsensus antara peserta lokakarya (bagian 2) dan rekomendasi utama masing-masing negara (bagian 3) serta rekomendasi pada setiap sesi lokakarnya (bagian 4) merupakan pendapat para perwakilan masing-masing negara.

- Tema 1: Sejauh mana kawasan perlindungan dan program konservasi lumba-lumba telah dirancang dan terbukti efektif dalam memadukan konservasi lumba-lumba sungai dengan satwa perairan lain, mempertahankan kualitas ekosistem dan memberi manfaat ekonomi (atau lainnya) bagi masyarakat lokal?
- Tema 2: Keterlibatan masyarakat dalam pengelolaan kawasan perlindungan dan proyek pengembangan masyarakat berkelanjutan.

- Tema 3: Pentingnya metode monitoring populasi lumba-lumba yang konsisten dan tipe monitoring lain untuk mengevaluasi efektifitas dari kawasan perlindungan dan manajemen konservasi.
- Tema 4: Perbaikan manajemen konservasi di dalam habitat utama lumba-lumba dan kawasan perlindungan.

Merupakan harapan pihak penyelenggara agar lokakarya dapat memberi inspirasi bagi para peserta untuk melihat dengan lebih jelas pada apa yang telah dicapai dan apa yang masih harus dilakukan untuk konservasi cetacea air tawar, sehingga dapat mengambil langkah untuk memperkuat aksi konservasi melalui perbaikan manajemen dari kawasan perlindungan yang telah ada serta identifikasi dan pembentukan kawasan perlindungan baru. Tantangannya adalah bagaimana mengelola kawasan-kawasan tersebut agar selain dapat memberikan perlindungan bagi lumba-lumba dan satwa terancam punah lain, juga dapat memberi kontribusi bagi pembangunan berkelanjutan dari masyarakat, yang berbagi dan tergantung pada sumber daya yang sama dengan lumba-lumba.

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## 2. WORKSHOP SESSION NOTES\*

Workshop Session 1: "To what extent have protected areas (PAs) and cetacean conservation programs been designed to provide and proven effective in providing integrated conservation of the cetaceans and other freshwater-dependent species, maintaining ecosystem health, and bringing economic (or other) benefits to local human communities?"

### Objectives of existing and planned protected areas or cetacean conservation programs:

#### *Indonesia*

For both identified dolphin core areas in the Mahakam (in Central and West Kutai), the general objectives are to:

1. Establish community-supported PAs for the Pesut Mahakam. Management should include measures to reduce chemical and noise pollution and the risks of gillnet entanglement and vessel strikes.
2. Protect fish resources through sustainable fishing methods and enforcement of fishing regulations. This should help conserve the prey resources of the Pesut Mahakam and provide economic benefits to local fishing communities.
3. Protect and rehabilitate riparian forest within the PAs. This will reduce erosion and sedimentation, protect fish spawning areas, enhance fisheries (tree seeds and fruits provide food for fish), benefit other protected species, and increase tourism potential.
4. Raise environmental awareness of local communities, government officials, and other stakeholders. The message should focus on sustainable use of the natural environment and its resources and on the need for efforts to conserve the freshwater dolphin population.

#### *China*

The goal is to strengthen the Yangtze cetacean conservation network. Members of this network come from the PA sites and each site is represented. The Minister of Agriculture is the head of the network. The Institute of Hydrobiology (IHB) is a scientific research body and provides technical support to the network. The main objectives of the network are to:

1. Standardize survey methods and management through systematic staff training by IHB.
2. Provide a platform for information exchange. Each reserve submits an annual summary. IHB compares the results and submits a report to the

Minister of Agriculture meant to guide conservation work in each reserve.

3. Provide platforms for public and fisherman education as well as promote cetacean conservation to the central government.
4. Provide a mechanism for organizing and standardizing responses in cases of stranded animals.

#### *Cambodia*

WWF and the Fisheries Administration have worked together since 2005 to conserve the dolphins in the Mekong River between Kratie and the Lao border. This effort follows previous work by James Cook University, the Wildlife Conservation Society, and the Cambodia Department of Fisheries (currently called Fisheries Administration). The Cambodian Mekong Dolphin Conservation Plan (CMDCP) includes population monitoring, mortality investigation, community awareness and outreach, and the development of alternative livelihoods.

The Commission for Conservation and Development of Mekong River Dolphin Ecotourism Zone (Dolphin Commission) was created in February 2006 by the Cambodian Royal Government to conserve the Mekong dolphins and develop tourism based on dolphin watching. The Dolphin Commission was given extensive powers that enabled it to override existing authorities and previous laws related to dolphin conservation and to direct ministries to follow procedures and activities set down by the Commission.

The Dolphin Commission has used this extensive authority to establish 16 ranger stations along the Mekong and to employ 64 river guards to protect dolphins. The Dolphin Commission claimed that the Royal Government of Cambodia imposed a gillnet ban on the Mekong from Kampi to the Lao border through the order of the Prime Minister.

However meetings between WWF, the Dolphin Commission, and government attorneys in March 2010 revealed that the Dolphin Commission has no

\* "This chapter presents summary notes from the presentations and discussions of the four primary workshop sessions. 17

These notes, which have not been extensively edited, provide background for the General Workshop Conclusions and Recommendations in Section 3 and Priority Recommendations on Protected Areas for Freshwater Cetaceans in Individual Range Countries in Section 4. More detail on the specific situation in each country can be found in the Country Reports in Section 5."

authority to ban gill nets in the Mekong. The order from the Prime Minister was not legally binding because it is not part of adopted fishery law. Fishery law does specify that gill nets must have a mesh size greater than 1.5 cm and less than 15 cm, but there are no other laws that would regulate or ban the use of gill nets in the Mekong.

Efforts are now underway to use the Fishery Law to establish conservation areas around the core habitat areas used by dolphins.

There are also ongoing efforts to improve the management of the dolphin pool at Cheuteal on the Cambodia-Lao border area. There is a need here for consistent regulations to protect dolphins on both sides of the border.

### *Myanmar*

Objectives of the conservation program since 2005 have been to:

1. Protect the dolphin population,
2. Significantly reduce or eliminate illegal fishing activities,
3. Promote sustainability of the human-dolphin cooperative cast-net fishery,
4. Protect aquatic habitat,
5. Develop a management team and infrastructure for implementing the Ayeyarwady Dolphin Protected Area Management Plan
6. Monitor the status of the dolphin population.

### *Bangladesh*

The Third Schedule of the Bangladesh Wildlife (Preservation) (Amendment) Act, 1974, specifies five cetaceans, including the Ganges River dolphin, among "Protected Animals" which shall not be hunted, killed, or captured. Bangladesh has a total of 19 notified PAs to date. The Act provides a legal framework for PAs in Bangladesh. Bangladeshi legislation and policies also provide firm commitments to protection of the country's rich biological heritage. PAs for freshwater cetaceans have not yet been established in Bangladesh. A proposal has been submitted to the Government to establish a PA network for Ganges and Irrawaddy dolphins in mangrove channel "hotspots" in the Eastern Sundarbans Reserved Forest. The objectives of the proposal are to protect areas of key biological importance for freshwater dolphins, develop and implement a management plan that balances needs of dolphins and local communities, and build capacity of local scientists and government officials

and NGOs for implementing measures for dolphin conservation and sustainable fisheries. Specific policies and regulations needed to implement these objectives are being developed according to ecological studies and community consultations.

### *India*

There is a broad program objective of establishing a network of aquatic (wetland) PA's, with sub-networks to be species-focused in all river basins including the Ganges, Brahmaputra and Indus tributaries. Such a network will help both to conserve endangered and threatened aquatic species and to develop a sustainable fisheries model. An action plan is in place to identify reserves where the maintenance of ecological flows in rivers is a major issue.

In the Ganges, Vikramshila Dolphin Sanctuary, Narora Ramsar Site, and National Chambal Sanctuary have been effective in protecting river dolphins and achieving some degree of community involvement. The latter is particularly in the form of tourism and annual surveys, where hiring of boats gives some local economic benefit through wages. In Chilika Ramsar Site, a fisher-folk community organization has taken up dolphin tourism, with much of the economic benefit going to the communities. In the Brahmaputra, local villages are involved through a network that helps monitor dolphin mortality and population status. Communities are actively involved in annual dolphin population surveys.

### *Pakistan*

The Sindh Dolphin Reserve designated in 1972 has the general objective to conserve wild populations of Indus dolphins by preventing hunting and killing. There was no community consultation when this reserve was created, but now there is. There is also a program to monitor and rescue animals trapped or stranded in irrigation canals. The Sindh Dolphin Reserve is managed specifically for dolphins, however it contains relatively pristine and good habitat for many other species. Chasma and Taunsa Wildlife Sanctuaries are designated for migratory bird species, and as they are small there are few dolphins in these areas at any one time. However, dolphins may receive some indirect benefits from the protective measures implemented for waterfowl in these sanctuaries, and the national ban on dolphin killing is more actively enforced.

## **Concrete benefits for cetaceans, other species, river ecosystems, and human communities**

### *Indonesia*

Conservation awareness activities since 2000 have led to a decrease in dolphin mortality from gillnet entanglement. This has been achieved by sharing information on how to release entangled dolphins safely and by providing compensation for nets that have to be cut to save entangled animals. Benefits to the communities arise from community development projects (sustainable aquaculture) that directly improve livelihoods. One example is the project started in early 2009 in the dolphin PA in West Kutai. Other community benefits accrue from the environmental education program that started in 2009 in 25 high schools and 31 elementary schools in the main area of dolphin distribution area. This program is intended to increase care for and knowledge about the natural environment, natural resources, and wildlife on the part of young people. Government replanting of lakeshore vegetation has probably contributed to recent increases in some populations of small fishes.

### *China*

A seasonal fishing ban in the Yangtze mainstem has been in place since 2002, partly to benefit freshwater cetaceans. Although this worked pretty well, it resulted in the fishermen simply putting in more effort and time during the open season. Recently, a decision was made to extend the closed season from 3 months to 4. This change was implemented by the Ministry of Agriculture in 2009.

Another effort to help freshwater cetaceans involves efforts by the local government to find alternative livelihoods for fishermen in Tian-e-zhou semi-natural reserve. This reserve originally had 500 fishermen, and the fish resources were decreasing with the growth in the porpoise population and the use of more efficient fishing techniques. Joint efforts by IHB and WWF convinced the local government to provide relocation alternatives for most of the fishermen, and their incomes have increased by average of 30 percent. Additionally, the reserve staff is now trying to train the rest of the fishermen to work for the reserve, which has benefitted both the conservation work for cetaceans and the local communities bordering the reserve.

### *Cambodia*

Efforts by the Dolphin Commission to reduce gill net use has caused an apparent reduction in gillnet mortality since 2006. However, it is not clear whether the reduction is real or is due to local people being afraid to report entanglements and instead burying the dead dolphins. The last reported gillnet entanglement was in 2005. The gillnet ban is assumed to have had a beneficial effect on fish stocks and to have led to more development of alternative livelihoods in farming and aquaculture around the deep pools. Also, sanitation in these areas has improved.

Unfortunately, the number of dolphins has continued to decline in spite of the decrease in reported mortality in nets. In 1994, the photo-identified population was estimated to be 95 (86-111, CI = 95%, figures from Isabel Beasley). In 2008 the population was estimated to be 70 (69-91, CI = 95%, figures from WWF Cambodia) based on mark-recapture analysis of photo-identified dorsal fins. The methods used in 1994 and 2008 were not exactly the same, but these are the best numbers we have for comparison.

Benefits of the dolphin pools (PAs) to local communities include employment from tourism. Boat owners also benefit directly from tourism in dolphin areas, and tourism has a positive effect on fundraising for the dolphin project.

Proposed hydropower dam construction at Stung Treng and Sambor may prove to be the greatest threat to the survival of dolphins in the Mekong.

### *Myanmar*

The presence of a local NGO such as Wildlife Conservation Society (WCS) is important for PA management. Joint patrols are conducted to obtain information on illegal activities. During the patrols, WCS tries to educate the local people and the Department of Fisheries deals with enforcement and confiscates gear after giving first warnings. It is now rare to see electro-fishing and small-mesh nets in the PA. This should benefit both fisheries and dolphins. The system of rules and regulations for tourism provides employment because local guides and boats are used on every trip. Tour guides must report to the local fishery officer before they go into the Ayeyarwady Dolphin Protected Area.

### *Bangladesh*

There is no experience on what will happen after the establishment of a PA for freshwater cetaceans in Bangladesh. However, regulations are already in place in the reserved forest, such as bans on major wood harvest, fishing in rivers narrower than 30 m, and shrimp fry collection (which results in enormous bycatch), and a seasonal ban on crab and sardine fishing. All of these measures are intended to benefit local people and ensure the sustainable management of natural resources. Conservation priorities will be determined after close consultation with local stakeholders, but actions could include designation of no-fishing zones to protect freshwater cetaceans and replenish fish stocks in adjoining waters, requiring fishermen to tend their nets and release cetaceans that become entangled in them, patrolling PA sites with Forest Department staff, collaborating with local NGOs, the Coast Guard and Navy to reduce the number of mosquito set bag nets operating in PA sites, encouraging the Mongla Port Authority to reduce discharge of harmful effluents, and raising awareness among tour operators and providing appropriate guidelines for dolphin watching. Benefits of ongoing conservation and research efforts include the widespread educational outreach concerning freshwater dolphin conservation and improved understanding of the ecology of the dolphins and the threats they face.

### *India*

Recently, more stretches of rivers have been added to the PA network and the benefits are the following: (1) In many river-based PAs, local people seem to have benefited from exclusion of commercial and mafia fishermen. (2) Some community-based dolphin tourism has developed (e.g. Chilika and Chambal). (3) Biologists have been able to initiate more research projects. (4) Front-line staff training has taken place (capacity building). (5) There has been some degree of pollution abatement, and markers are being developed. Dolphin populations in almost all designated riverine PAs in India have been increasing.

In the Brahmaputra, several conservation activities have been associated with the program initiated in the early 2000s. For example, surveys have been conducted regularly and habitat assessment has been facilitated through establishment of a riverside village dolphin monitoring network. As a result, the dolphin population appears stable and estimates of mortality are more accurate. The river dolphin was declared

as the state aquatic animal in Assam in 2008, and this has helped delay a planned seismic survey for hydrocarbon exploration in the Brahmaputra River. Local communities get some monetary support during annual surveys and other research activity through hiring of boats and employment of young people as support staff.

### *Pakistan*

Implementation of the Sindh Dolphin Reserve has meant that the deliberate hunting of dolphins for food and oil has stopped. It is now illegal to kill Indus dolphins in Pakistan, and this prohibition is enforced by government officials, with offenders brought to court. The dolphin population has increased since the reserve was established, and the mortality caused by stranding in canals has been reduced considerably. In some small test areas, agricultural techniques have been improved, including reductions in the use of chemicals and water. Awareness of dolphins has increased significantly, demonstrated by the fact the canal rescue program is sponsored by local companies.

## **Shortcomings**

### *Indonesia*

There has been a lack of coordination among departments and between district and national governments, and this has made it difficult to achieve an integrated conservation program. Law enforcement has been inadequate to protect fish spawning areas and prevent illegal fishing. Illegal fishing gear has sometimes been confiscated by local people themselves, only to be released by the police. The emphasis of government is on business development (e.g. coal mining and oilpalm industries) rather than on environmental protection and restoration. There has been a chronic lack of funds to support conservation activities.

### *China*

The greatest problem is the lack of enforcement. Reserves have been established but enforcement within them is a huge problem. Electricity, rolling hooks, and other illegal fishing gear or methods are still being used, even in some reserves.



### *Cambodia*

Shortcomings in Cambodia include:

- Poor collaboration among the Dolphin Commission, Fisheries Administration, and WWF.
- Benefits from dolphin eco-tourism activities are not equitably shared.
- There is currently no legal way to reduce or eliminate the use of gill nets in core dolphin habitat.

### *Myanmar*

The main shortcomings are the lack of a budget to ensure sustainability of the PA program and the shortage of trained manpower.

### *Bangladesh*

PAs in Bangladesh suffer from poor law enforcement due to shortages of manpower, vessels, and budget. The Forest Department works on separate management plans for the PAs, though they are rarely implemented because of lack of resources and proper management. Policymakers at the ministry level need to be better attuned to freshwater dolphin conservation. Due to difficulties obtaining a local budget for wildlife conservation, such work must depend on external assistance. Currently, US AID and EU projects focusing on PA management are ongoing. Although knowledge on the population biology and ecology of freshwater cetaceans has increased considerably in recent years, there is still insufficient information on the human element, which is essential for science-based, community-informed management of proposed PA sites.

### *India*

In areas outside PAs, it has been difficult to address river dolphin conservation issues. Inside the PAs, there is a lack of coordination among government departments and inadequate capacity for determining the causes of dolphin mortality. The lack of community involvement during planning and the lack of funds from federal and state governments for focused dolphin conservation activities are common problems in both the Ganges and Brahmaputra regions. In the floodplains of the Brahmaputra system, the preferred management focus is on other charismatic species such as the rhinoceros, tiger, and elephant, and this makes it difficult to mount a sustained research and management program for dolphins. Finally, even in designated riverine PAs, there is a dialogue gap

regarding fishing practices between fishermen and the conservation management authorities.

### *Pakistan*

The Sindh Dolphin Reserve has been very successful and there are few shortcomings. However, there are potential problems with pollution because the dolphins occur mostly in downstream sections that receive inputs of contaminants from upstream sources. Moreover, there is a pressing need to maintain sufficient river flow to support a healthy aquatic ecosystem for dolphins, other aquatic species, and humans. Other shortcomings include the lack of coordinated effort to locate dolphins that die in the reserve and the inadequate coordination between government departments, especially Irrigation, Wildlife, and Fisheries.

## **Recommendations for improved integration of dolphin conservation, protection of other wildlife, and community development**

### *Indonesia*

- 1) Improve coordination among relevant departments;
- 2) Create a multi-stakeholder management team (including district and national departments and community and company representatives) that meets on a regular basis with secure funding.
- 3) Integrate and give higher priority to prioritize Forestry Department reforestation schemes in the PAs.
- 4) Establish a community-based monitoring system, with money to support patrol teams;
- 5) Educate the government officials on the importance of conserving dolphins and their habitat and urge greater consideration for the environment and for community benefits in business development (e.g. coal mining, oil palm industries).

### *China*

- 1) Improve the capacity of reserve staff for management;
- 2) Improve the coordination among provinces with regard to management responsibilities, e.g. in the case of managing fisheries in the reserve that is divided between Hunan and Hubei provinces;
- 3) Urge the central government to implement regulations enabling the reserves to function more actively and efficiently;

- 4) Give reserve staff fishery management authority to eliminate conflicts with other jurisdictions, which make things dysfunctional;
- 5) Involve local communities in conservation management schemes and give due consideration to the fact that biodiversity conservation often requires local sacrifice to meet a national (shared) responsibility.

#### *Cambodia*

- 1) Improve collaboration among the Dolphin Commission, Fisheries Administration, and WWF.
- 2) Communicate the Critically Endangered status and population size of dolphins in the Mekong to the public and the highest levels of government.
- 3) Expand alternative livelihood development to additional villages around and near core dolphin habitats.
- 4) Implement fair and equitable sharing of benefits from dolphin eco-tourism activities.
- 5) Make sure that dolphin eco-tourism activities are well managed to prevent stress on dolphin populations.
- 6) Establish protected areas around dolphin deep pools to maintain fish stocks and reduce incidence of dolphin entanglement in nets
- 7) Establish formal legislation that would allow the regulation and or banning of gill nets in designated areas.
- 8) Establish transboundary management agreement between Cambodia and Lao PDR to protect dolphins.

#### *Myanmar*

- 1) Establish additional PAs in upstream segments of the Ayeyarwady system;
- 2) Seek to improve the funding base for dolphin conservation and research;
- 3) Increase capacity for all aspects of river dolphin conservation.

#### *Bangladesh*

- 1) Develop a dolphin conservation action plan through collaboration by key parties, i.e. the Bangladesh Cetacean Diversity Project, the Forest and Fisheries Department, local community leaders, and NGOs;
- 2) Once a PA has been established, strengthen monitoring of dolphin numbers and threats.

#### *India*

- 1) Improve diagnostic capacity to determine causes of dolphin mortality, e.g. get more veterinarians involved;
- 2) Improve links between government agencies and other stakeholders in riverine PA situations;
- 3) Involve local communities in planning stages of PA management;
- 4) Obtain more funding for dolphin conservation activities the federal government and state governments.
- 5) Create and implement a national dolphin Action Plan commensurate with adoption of the river dolphin as the national aquatic animal;
- 6) Identify gap areas that have not been surveyed for river dolphins;
- 7) Address transboundary management issues in riverine PAs bordering Bangladesh, Nepal, and Pakistan;
- 8) Initiate joint river dolphin patrols involving wildlife, fisheries, civil society, research organizations, and police, both inside and outside PAs.
- 9) Develop alternative livelihood options for fisherfolks and others who have lost theirs due to creation of riverine PAs.

#### *Pakistan*

- 1) Develop a pollution disaster management plan;
- 2) Reduce pollution from industries and ensure that rigorous environmental impact assessments are conducted before industrial projects that could affect the quality of river dolphin habitat are approved, both inside and outside the Sindh Dolphin Reserve;
- 3) Improve fisheries laws, e.g. by preventing fishermen from leaving entangling gear in the water overnight and by requiring appropriate fish passage devices (such as "ladders") at barrages;
- 4) Expand the network for detecting, reporting, and responding to dolphin entrapments/strandings in canals, and at the same time, pursue plans to prevent dolphins from entering canals;
- 5) Quantify movement by dolphins into and out of the reserve through barrages;
- 6) Ensure that Sindh Wildlife Department has adequate, stable funding to maintain and, if possible, improve its river dolphin conservation work.

## Workshop Session 2: "Community involvement in protected area management and sustainable development projects"

### How were communities involved in decision making and the socialization processes for establishment of PAs, and what is their current involvement?

#### *Indonesia*

Prior to the establishment of PAs, extensive interview surveys were conducted with local communities to assess opinions and attitudes toward the protected area itself and toward each suggested regulation or policy. In addition, several meetings were organized in the villages with local people and representatives of RASI and local governments. Signed community agreements were obtained. The final policies and regulations submitted for approval followed the communities' aspirations and will be subject to evaluation by community district representatives before they become legally binding. According to the representative of Pela village, who participated in this workshop session, the villagers are aware of the dolphins and know that the numbers are decreasing. This level of awareness is a result, at least in part, of the educational efforts by RASI and government officials. The people of Pela are eager to provide further help.

For further community involvement, RASI has proposed that regular patrols be carried out by local teams as part of the *perangkat desa*, a kind of civil task force appointed by the head of the village for several tasks. The *perangkat desa* has the authority to detain and bring people engaged in illegal activities to the local police. These teams may consist of 3-4 people who would perform weekly night patrols to prevent illegal fishing practices. The teams would also constitute coordination points for local fishermen to report unusual events, such as the setting of gillnets in locations where dolphins are at high risk of becoming entangled.

#### *China*

WWF, working closely with reserve management, IHB, and the local government, has carried out consultations with all the community stakeholders including the 500 fishermen in Tian-e-zhou Reserve. The chief objective was to plan alternative livelihoods and relocation. Such planning was a lengthy process. Most of the fishermen were given

land by the county government. However, 30 fishermen are still working in the area as employees and part-time guards in the reserve.

Fishermen also maintain a monitoring network for cetaceans in each reserve. Regular meetings are held so that the fishermen can report to the reserve and to IHB.

#### *Cambodia*

Along the Mekong, there are in total 469 fishermen communities and the government recommends that each community should have one PA for fish-stock spawning. The PA is based on agreements with local communities where communities may raise proposals and the government has some budget available. Around the dolphin deep pools there are 15 community associations, which report dead dolphins. There are also consultations planned with communities at the border with Laos on how to stop gillnetting, create the conservation zone for dolphins and the fish protected areas. An MoU between the Department of Livestock and the Fisheries of Lao PDR and Fisheries Administration of Cambodia on the management of fisheries and aquatic resources in the trans-boundary area is being developed. In the dolphin pools there are 65 river guards, composed of members of the community and government. They receive 13USD income (on top of their regular salary) from the government, a house and a boat as remuneration for their work. In addition, there are 18 dolphin rangers who are unsalaried but receive some status because of their position.

#### *Myanmar*

Prior to the establishment of a PA for Irrawaddy dolphins in Myanmar, there was discussion with the local community to assess their needs and opinions and make them part of the planning process. The government provides identification cards to cast-net fishermen who cooperate with Irrawaddy dolphins that allow them to fish with the dolphins throughout the PA. A team from the Department of Fisheries and the Wildlife Conservation Society spends about 10 days per month patrolling in the PA and these visits are used to discuss and respond to the needs of local fishermen.

### *Bangladesh*

Local community involvement is still being established. Stakeholder consultation and cooperative management will be key considerations. Work in this direction is a primary focus of collaboration between the Forest Department and the Bangladesh Cetacean Diversity Project (BCDP). In general, local people are interested to learn more about the dolphins and support efforts to conserve them. Recently, co-management with people's participation has been introduced to protect biodiversity of PAs. This has increased stakeholders' sense of ownership of resource management.

### *India*

It is standard practice in India that, before beginning establishment of a PA, the intent to do so is expressed through media and official notification by relevant provincial governments, seeking expressions of consent or objections within a specified timeframe. Based on the response, efforts are made prior to final notification to settle the major issues, such as traditional rights to exploit the resources in aquatic habitat, navigation rights, and traditional or legal land holdings, either through compensation or some other mechanism.

In recent years, meetings with stakeholders, elected representatives, and NGOs have become mandatory aspects of the PA designation process. There are national guidelines under the India-Ecodevelopment Programme for setting up village Ecodevelopment Committees and Forest Development Committees around PAs. This helps to ensure the participation of local communities as well as the development of alternative livelihood mechanisms to compensate for the loss of traditional rights. In National Parks and Sanctuaries, the requirements for involvement of stakeholders are not as stringent as in other categories of PAs such as conservation reserves, community reserves, and Ramsar sites. Traditional rights of tribals and other community rights such as fishing, navigation, and resource harvesting are assessed and permitted after review of the possible impacts.

### *Pakistan*

When the Indus dolphin reserve was established in Sindh in the early 1970s, there was no community involvement in the decision. Local people involved in hunting dolphins were simply evicted. Because they belong to a small minority tribe, there was no large-scale resistance to or resentment toward this

approach. More recently, meetings have been held to make sure fishing communities understand fisheries law and regulations.

## **Which programs were or are focusing directly on community sustainable development, and how?**

### *Indonesia*

Until recently, governmental community development schemes and aid focused more on economic development than on environmental protection. Currently, there are more government aid programs to address lost livelihoods that formerly depended on natural resources, which have been reduced due to a number of factors. In the dolphin PA, aid for aquaculture has been provided both by the government and RASI, with the difference that the latter supported a sustainable aquaculture project that started in 2009 and involved 60 fishermen that depend on direct fishing and subsisting on very meager incomes. They are provided with floating cages, spawn of fish species that can be fed on pellets and vegetables, and pellets until the first harvest. They are also being monitored and provided with technical assistance to increase the sustainability of the program. The government support on the other hand supplies fish spawn of species that mostly are being fed on small fish from the river and does not include poverty criteria for selection of fishermen nor is technical assistance being supplied. Also, through environmental education in 25 high schools in the main distribution area of the dolphins, knowledge is being transferred on sustainable resource use.

### *China*

WWF, working closely with reserve management, IHB, and local government, has been helping the fishermen in the community around Tian-e-zhou Reserve to plan alternative livelihoods and relocation.

### *Cambodia*

The Cambodian Rural Development Team works closely with WWF to develop alternative livelihoods around the nine dolphin pools. WWF and other donors fund their work. The Dolphin Commission also has provided funds and equipment to promote alternative livelihoods. The alternative livelihood work is an important component of the dolphin conservation effort on the Mekong

### *Myanmar*

Local communities receive some small benefits from dolphin-watching tourism. Cast-net fishermen receive a portion of the fees from visitors who come to see the dolphins but the number of visitors is low. Under the current fish contracting system for cast-net fishermen cooperating with the dolphins, licence holders purchase large river segments with gear regulations, and each cast-net fisherman pays 10 dollars/ year to the license holder. Some fishermen may have agreements with the contractors and may fish for free. In the PA more than 100 cast-net fishermen regularly fish cooperatively with Irrawaddy dolphins.

### *Bangladesh*

In areas surrounding the Sundarbans, the government provided plantations to 81,000 families and US\$7.5 million has been distributed to beneficiaries. Government plans involve the development of alternative income generation activities. Support for infrastructure will be provided to local communities for sanitary systems, roads, bridges, and bio-gas installations. Fisheries management must balance the needs of humans and cetaceans. This is a developing stakeholder process in Bangladesh. The BCDP has been working with a local network of NGOs to conduct educational outreach in local communities, using innovative and culturally appropriate media.

### *India*

Programs for sustainable development in supporting Ramsar sites where river dolphins occur, such as Narora and Chilika Lake, have involved fishermen and farmers in their management. In other programs, local celebrities and traditional folk communicators have been used in awareness raising efforts, e.g. at Vikramshila Sanctuary. Moreover, there are training programs for alternative livelihoods and tourism, and programs to increase local capacity in science, "Water schools" involve local students to monitor water quality. All of these programs focus on strengthening community support for dolphin conservation.

The federal and state governments support various village development schemes, e.g. fisheries and rural development under the National Rural Employment Guarantee Act meant to local village communities get a minimum number of unskilled jobs. These funds have been used by dolphin PA managers to supporting nearby village communities.

The India ECO development program specifies that every PA is entitled to seek funding to initiate community development schemes. However, most PAs with dolphins have failed to take advantage of this opportunity, the Chilika Ramsar site being a notable exception.

Under a new initiative, the management body of a PA can use income generated in its area directly for activities and community development. Previously, such funds were deposited in the state revenue collection. Another recent development is that politicians are investing in environmental issues and including an environmental agenda in their election manifestos. Until recently, local and state legislation for rural development was rarely used for environmental concerns, but it is starting to focus more often on environmental rural initiatives. Within the PAs, there are initiatives to reduce pollution and soil erosion. Every region receives government funding for riverside improvements, e.g. production of vermi-compost for sale or for direct use on crops. Loans are provided to communities for small-scale industries. In some areas, commercial fishing is prohibited. Fishing fees have been eliminated in PAs such as Ramsar sites and community reserves and fishermen are now free to fish using "environment-friendly" fishing gear in these designated areas. However, no fishing is allowed in PA such as Sanctuaries and National Parks

For all of the programs mentioned, there is insufficient extension and outreach.

### *Pakistan*

Since the first river PA was established in 1974, various projects have been initiated to benefit communities. For example, local boats have been used for research and monitoring expeditions, and community-based game watchers have been employed in the reserve. Some programs within the PA seek to enhance local capacity for producing marketable natural products, particularly ones produced by women. There have been training programs in organic agriculture for farmers along the riverbanks, helping them improve techniques and reduce pollution. Small-scale loans have been provided to local communities and scholarships have been provided to students involved in aquatic research.

The Pakistan government has been practicing wildlife conservation through community participation since 1972, but these activities have become more visible since 1980. Now, the programs

not only focus on dolphins but also on people and other natural resources. Activities involve installing signboards, dolphin education programs, lectures, and school visits. Programs are sustained in part by the income generated from the PAs, e.g. selling locally made products.

## Shortcomings

### *Indonesia*

There is not enough government operational money available to provide long-term economically and environmentally sustainable community development, and this applies to the entire Mahakam River area. Also, some government-sponsored projects run counter to the idea of sustainable fisheries because they supply fishermen with fish spawn of species that feed on other small fish that are native to the Mahakam and that would otherwise be available for fisheries and natural fish predators (including dolphins). Also, too often aid is not combined with technical assistance or monitoring, so the success rate is either low or indeterminate. Moreover, aid is not always directed to those groups that are in most need of it.

The aquaculture project set up by RASI in the PA of West Kutai has limited financial resources and will not be able to involve more community members than the 60 fishermen; it was, after all, intended as a pilot or demonstration project. There is no stable funding to support local patrol teams, which would benefit local communities directly and indirectly. According to the local community representative of Pela village present for this session of the workshop, 95 % of the local people are having difficulty making a living but they get little attention from the government. The lake is being degraded by the use of pesticides for agriculture around it.

### *China*

It appears impossible to slow down the development processes along the Yangtze River creating major conflicts with conservation objectives.

### *Cambodia*

The lack of coordination and cooperation between WWF and the Dolphin Commission has led to confusion among some community members. A united and consistent community outreach program is needed. Some people are afraid to report dead dolphins and some such animals have been

deliberately hidden. The failure to report dolphin deaths and to make the carcasses available for necropsies makes it impossible for WWF and the Fisheries Administration to investigate the cause(s) of mortality.

### *Myanmar*

Illegal fishing is the main problem and fishermen want more patrols to keep illegal fishermen away.

### *Bangladesh*

Regulations need to be more flexible to support community needs.

### *India*

There is insufficient coordination among the government departments responsible for working in the river systems, such as the departments of Irrigation, Fisheries, Forest and Wildlife, tourism, and revenue. This gets in the way of implementing various government schemes that are environmentally "friendly." There is also a lack of local skill development, education, and awareness of the importance of biodiversity. Actual program implementation, as envisaged in the planning processes, too often does not occur. Socio-cultural, socio-economic, and socio-political situations hinder PA management activities from time to time.

### *Pakistan*

There is a lack of funding and little political will for conservation. Because people in remote areas generally have little awareness of dolphins, have low levels of education, and pay little attention to environmental protection, conservation programs often are not as effective as they could be.

## Recommendations for improved community involvement

### *Indonesia*

- 1) Ensure that stable funding is available to support the local patrol teams.
- 2) Make community development projects more sustainable and minimize their footprint on the natural environment. For example, when the government provides support for aquaculture, the fish provided should be non-piscivorous. Also, poverty criteria should be included when selecting the beneficiaries of government help

and providing technical assistance to inexperienced fishermen.

- 3) Focus on generating alternative livelihoods generation for Mahakam communities.
- 4) Improved fish products and technologies,
- 5) Reduce dependence on fishing by encouraging and supporting sustainable aquaculture.

#### *China*

- 1) Approach communities and try to use a bottom-up approach for conservation.
- 2) Make sure there is strong support from the local government.
- 3) Ensure there is good cooperation between the government and the different levels of a community. For example, in relocation projects, it became apparent that local people had difficulty finding or creating new jobs on their own. They needed government help. At the same time, the government needs to involve the community in a meaningful way so that affected people can participate in decision-making.
- 4) Invite fishermen into the conservation network.

#### *Cambodia*

- 1) WWF and the Fisheries Administration are working with the Cambodian Rural Development Team (CRDT), a local NGO, to develop alternative livelihoods around dolphin pools that have been proposed as protective areas.
- 2) Benefits from dolphin based ecotourism should be more equitably distributed.
- 3) Community Fisheries, an approach to fisheries co-management promoted by the government is a good way to increase community involvement. This co-management approach must be carefully designed and monitored to make sure that the conservation benefits to dolphins and fisheries are real and lasting.

#### *Myanmar*

- 1) Enhance program sustainability. For example, the patrol boat used by the program is provided by the government but its operational costs are covered by WCS. It is expected that government staff will learn from the project and take over responsibility for its continuation once stable funding is available.

#### *Bangladesh*

- 1) Increase development support and low-credit access at banks for local communities in support

of sustainable development initiatives related to PA management.

- 2) Increase cooperation between conservation NGOs (with limited funds) and social development NGOs, which spend more time in local communities. During village visits the community NGO staff can educate about the dolphins.
- 3) Improve enforcement of the fisheries law that forbids certain fishing gear, which has been in effect since 1950.

#### *India*

- 1) Seek to involve fisherfolk in sustainable, ecologically compatible fishing practices and elicit their support for setting up aquatic PAs.
- 2) Increase involvement of researchers, local communities, and media in consultations on dolphin conservation action plans at the national, state, and PA site levels, from the planning stages so that community involvement becomes an integral part of the entire process.
- 3) Make education and awareness programs for all targeted stakeholders a regular activity by including them in national and state generic action plans and in the management plans of individual PAs.
- 4) Create networks of community groups around dolphin PAs and involve them in dolphin conservation activities and target them in capacity building programs.
- 5) With the river dolphin now designated as the national aquatic animal, establish a national program for river dolphin conservation similar to those that already exist for the tiger, snow leopard, elephant, Asiatic lion, rhinoceros, marine turtle, etc. This will help ensure continued funding and sustain conservation management activities.

#### *Pakistan*

- 1) Empower riverbank communities by raising awareness.
- 2) Expand the currently small scale of nature-oriented tourism. This is a challenge because of the security situation, but it is possible.

Workshop Session 3: "The importance of using consistent methods to monitor freshwater cetacean populations and the need to undertake other types of monitoring to evaluate the effectiveness of protected area and conservation management"

**For each PA, or for conservation management of non-protected cetacean core areas, what monitoring methods have been used and on what schedule?**

*Indonesia*

**ABUNDANCE SURVEYS:** In 1997 and from 1999 to 2002, strip-transect and direct-count surveys were conducted. Photo-identification was initiated in 2001 using slide film, which yields a lower identification rate than digital imagery, which has been employed from 2005 onwards. Abundance was estimated in 2001 as 55 (CV = 6%; 95% CL=44-76) using the Petersen estimator.

Photo-identification work revealed that visual group size estimation in direct-count surveys tends to be negatively biased, leading to underestimation of abundance. In 2005 and 2007, the increased efficiency of photo-identification from digital imagery led to considerably higher estimates of population size (again using the Petersen estimator) – 2005: =89 (CV=15%; 95% CL=72-121); 2007 = 87; CV=9%; 95% CL = 75-105).

**OTHER MONITORING:** Land-based observation surveys were conducted in 2000, 2001, and 2005 to estimate the time spent daily by dolphins in the confluence area of Muara Pahu, in different water level conditions.

*China*

**ABUNDANCE SURVEYS:** Direct counts were attempted periodically over the past 30 years, but different methods were used each time and the results are not comparable. In 2006, an international collaborative survey was conducted in the entire range of the baiji and Yangtze finless porpoise in the mainstem of the Yangtze River using modified line-transect methods and two independent observation vessels. The estimate of Yangtze finless porpoises from this survey was approximately 1,800. Acoustic surveys were trialed in 1998 and worked well, and they were used during the 2006 range-wide survey. Detection probability was higher in the acoustic mode than in the visual mode.

**OTHER MONITORING:** Passive acoustic monitoring (PAM) has been used since 2005 to investigate movement patterns of Yangtze finless porpoises at the junction of Poyang Lake and the Yangtze River. Historically, this site was heavily used by finless porpoises to move into and out of the lake. The PAM showed that animals still move back and forth between the river and lake, but now primarily during the night and on a much smaller scale. Acoustic surveys from cargo ships and fishing boats are carried out continually in the mainstem of the Yangtze River and the adjoining lakes. Behavioral and acoustic data loggers have been used to study the underwater behavior and communication of finless porpoises.

*Cambodia*

**ABUNDANCE SURVEYS:** Photo-identification surveys have been conducted annually from 2001 to the present, except in 2006. Three or four surveys were conducted each year in 2007, 2008, and 2009. In 2007, abundance was estimated at 71 (66-86, CI = 95%) and in 2008 at 70 (69-91, CI = 95%) using mark-recapture analysis of marked animals.

**OTHER MONITORING:** Water, sediment, and dolphin prey samples were collected from the Mekong River between Kratie and Stung Treng and from the Sre Pok and Se San rivers, both major tributaries of the Mekong, in 2008 and these have been analyzed for PCBs and DDTs. Data on dolphin behavior are routinely collected during photo-identification surveys. Dolphin mortality monitoring is opportunistic and relies on local villagers to notify the scientific team when they find a dead animal. Necropsies of dead dolphins are always conducted when carcasses become available. Monitoring for gillnets in dolphin core areas is conducted about once a month by the WWF awareness and outreach team. The team logs the numbers and locations of any gillnets found.

*Myanmar*

**ABUNDANCE MONITORING:** Direct-count surveys have been conducted periodically since 2002. The best available information indicates a total population size of 59-72 dolphins in the Ayeyarwady



from Bhamo to Mingun as recorded in December 2003 and 2004.

**OTHER MONITORING:** Most research and management activities in the PA are undertaken during twice-monthly patrols. Activities conducted during patrols include (1) educational outreach on dolphin conservation and the importance of sustainable fisheries, (2) enforcement of the rules and regulations of the Department of Fisheries prohibiting destructive fishing practices, (3) consulting with fishermen, fish contractors, and local Department of Fisheries staff to better understand their problems and solicit their views on potential solutions, (4) monitoring the status of the dolphins and numbers and distribution of fishing gears and gold mining operations according to type, (5) following up on reports of dolphin deaths, and (6) conducting research on dolphin behavior and ranging patterns and on gillnet, beach-seine, and cast-net fisheries.

During 2006-2009, 40 patrols were conducted, covering a total of 6,116 km in the PA. During these patrols, there were 75 dolphin sightings (mean group size = 5.9, SD = 3.7, range = 1-13) and the number of individuals in the PA was estimated at 16-18.

### *Bangladesh*

**ABUNDANCE MONITORING:** Little information is available on the rangewide status of Ganges River dolphins in Bangladesh but anecdotal reports and personal observations suggest that the species is still fairly widespread in most major rivers and their tributaries. Sighting rates include 0.13 groups/km (mean group size = 1.8) in the Jamuna River between the divergence of the Old Brahmaputra River and the confluence of the Padma River, 0.08 groups/km (mean group size = 3.8) in the Kushiara River between the Bangladesh-India border and the confluence of the Korangi River, and 0.76 dolphins/km in the Karnaphuli and Sangu system in southeastern Bangladesh, with a higher encounter rate of 1.36 dolphins/km recorded in the lower Sangu. The status of freshwater dolphins is best known in the Sundarbans mangrove forest where a Huggins conditional likelihood model of concurrent counts made by independent teams generated population estimates of 225 Ganges River dolphins (CV = 12.7%) and 451 Irrawaddy dolphins (CV = 9.6%).

Regular dolphin monitoring has been conducted in the Sundarbans since 2002. Between

March 2002 and March 2005, captains of three nature tourism vessels operating in waterways of the Sundarbans mangrove forest in Bangladesh surveyed a total of 26,208 linear km covering 80 five-km delimited channel segments in the eastern Sundarbans. The captains recorded 1,005 sightings of groups of Ganges River dolphins (1,993 individuals, 11.8% calves) and 281 sightings of groups of Irrawaddy dolphins (566 individuals; 5.7% calves). These data were used to investigate channel-type preferences and identify cetacean 'hotspots' according to a scoring system based on group, individual, and calf encounter rates, the co-occurrence of the two species, and encounter rates in neighboring segments recorded during monsoon, post-monsoon, and dry seasons.

**OTHER MONITORING:** A mortality monitoring network has been established in the Sundarbans. From a total of 16 deaths (10 Ganges River dolphins, 4 Irrawaddy dolphins, 2 finless porpoises) reported inside or close to the Sundarbans Reserved Forest between November 2007 and June 2009, 12 were examined and biological samples collected by the BCDP. The cause of death was undetermined for 7 of the examined carcasses. Based on the nature of visible wounds and reports from local people, 2 of the Ganges dolphins were suspected to have been killed deliberately, probably for their oil. One Ganges dolphin and one Irrawaddy dolphin died from entanglement in gillnets and one Ganges dolphin from entanglement in a longline.

Thirteen direct-count surveys have been conducted by the University of Chittagong during low-water seasons from May 1998 to July 2005 in the lower Sangu river and the connecting Sikalbaha-Chandkhali canal of the Karnaphuli-Sangu system. Ecological parameters such as water depth, water temperature, pH, and salinity, along with fisheries data on numbers and types of deployed fishing gears are monitored during these surveys.

### *India*

**ABUNDANCE MONITORING:** Since 1981, a systematic census of river dolphins has been conducted annually in the National Chambal Sanctuary. Both Patna and Bhagalpur universities have monitored the dolphin population in the Vikramshila Gangetic Dolphin Sanctuary on an annual basis in the past; this monitoring is now carried out primarily by Bhagalpur University. The dolphin population in Katarniya Ghat Sanctuary near the Nepal border has

been monitored by several agencies over the years, including WWF-India, Gharial Conservation Alliance, and the PA management agencies. In Narora Ramsar site, the dolphin population is monitored by WWF-India using direct counts and acoustic surveys in collaboration with Japanese scientists. Irrawaddy dolphins in the Chilika Ramsar site are monitored by the Chilika Development Authority and other stakeholders. Some surveys are on a monthly basis but the majority are annual. In the Brahmaputra, Aranayak and other NGOs have been conducting dolphin abundance surveys every 3 years. Currently, there is land-based monitoring of dolphin hotspots, and Aranayak has proposed boat-based monitoring of these areas in the future.

#### *Pakistan*

**ABUNDANCE MONITORING:** Sindh: Direct-count surveys have been conducted regularly since 1974 by the provincial wildlife department. Punjab: Direct counts were made by the provincial wildlife department in the late 1980s and early 1990s but are no longer conducted. NWFP: Direct counts by the provincial government began in 2001 and now are conducted annually. Range-wide surveys were conducted by WWF collaborating with all three provincial wildlife departments in 2001 and again in 2006.

In 2001, based on direct counts the metapopulation of Indus dolphins was estimated as 1200. Eighty-four individuals were recorded between Chashma and Taunsa barrages, 259 between Taunsa and Guddu, and 725 between Guddu and Sukkur. In 2006, tandem direct counts conducted by independent teams were analysed using Huggins conditional likelihood capture-recapture models to generate an estimate of Indus dolphin absolute abundance that accounted for individuals missed due to perception or availability bias. Abundance between Chashma and Taunsa was 121 (CI=101-271, CV=19%), between Taunsa barrage and Ghazi ghat 52 (CI=50-118, CV=19.0) and between Guddu and Sukkur 1293 (CI=1279-3022, CV=22.5). Due to security concerns the lower 300km of the Taunsa to Guddu subpopulation could not be surveyed. Annual monitoring is conducted for dolphins trapped in canals near Sukkur barrage.

## **Have the methods used been consistent over time?**

#### *Indonesia*

In the Mahakam, consistent strip-transect and direct counts methods were used between 1999 and 2002 but these were judged to be inferior to photo-identification methods. The photo-identification surveys in 2005, 2006, and 2007 were conducted using consistent methods. However, the differences in methods used from 1999-2002 and from 2005-2007 mean that the two sets of results cannot be used to assess trends in abundance. Future surveys will follow methods similar to those used in 2005-2007.

For land-based observations, consistent methods have been used. The work schedule is for observations to be made between 07.00-18.00 hr on five consecutive days during different seasons.

#### *China*

Methods have changed periodically. Only since 2006 a consistent modified line-transect methodology has been adopted. This methodology will be used in the future. Passive acoustic monitoring was first attempted in 1998, and the methodology for this type of monitoring has been improved since then.

#### *Cambodia*

Photo-identification is the method that is the most effective and this has been used consistently since surveys began. The actual methodology has changed over time. Since 2007 WWF has been using a methodology devised by Dr. Fernando Trujillo.

#### *Myanmar*

Rigorous direct counts are conducted and they are consistent over time.

#### *Bangladesh*

Consistent survey methods have generally been used.

#### *India*

Consistent direct-count methods have been used to monitor river dolphins in the Ganges, Brahmaputra, Indus, and Chilika systems. Recently, acoustic methods have been tried as well in some areas.

### *Pakistan*

The methods used by provincial wildlife departments have not always been clearly recorded, but they are believed to have been consistent over time and the results can give an indication of the current situation and of trends. The rigorous direct counts conducted during the range-wide surveys in 2001 and 2006 used the same methods and are comparable, but they are not comparable with the provincial wildlife department counts because they involved slightly different methods and were consistently higher. In the future, capture-recapture analyses with data from tandem vessels (such as that used in 2006) will be used to generate a more robust abundance estimates, with confidence intervals and a CV.

### **Which method has been found to be most reliable for estimating dolphin abundance?**

#### *Indonesia*

Photo-identification, because group sizes from visual counts are usually underestimated.

#### *China*

Modified line-transect.

#### *Cambodia*

Photo-identification.

#### *Myanmar*

Direct count, because photo-identification is not feasible due to the lack of identifying marks on the dorsal fins of dolphins in the Ayeyarwady population.

#### *Bangladesh*

Direct counts corrected for missed animals using concurrent counts from independent teams.

#### *India*

Direct counts. However, more robust and detailed population estimation methods are being planned for Brahmaputra, Chilika, and select PAs in the Ganges system.

#### *Pakistan*

Direct counts collected by independent observer teams operating from two vessels travelling in tandem, and corrected for missed animals using capture-recapture models. Photo-identification is not possible due to the rapid surfacing behavior and lack of identifying features.

### **Concrete results of changes (positive or negative) in local abundance, natality, and mortality in PAs or cetacean core areas**

#### *Indonesia*

There have been significant changes in local distribution patterns. For example, the local sub-population in the Kedang Rantau River, which has abundant fish resources, has increased, probably due to immigration from downstream reaches where dolphin habitat has been degraded. No trends in total population size or natality have been detected.

Mortality has been decreasing, a trend that may be linked to the increased awareness and information on how to release entangled dolphins. Regression analysis showed a significant decrease in minimum mortality detected over time between 1995 and 2009 ( $b = -0.410$ ,  $df = 14$ ,  $t = -3.89$ ,  $p < 0.001$ ). The mean number of deaths documented annually was 5.6 between 1995 and 2000 and 2.1 between 2001 and 2009.

#### *China*

Except for the confined population in the Tian-e-Zhou semi-natural reserve, the number of finless porpoises in the Yangtze system is thought to be declining rapidly. The baiji is probably extinct.

#### *Cambodia*

Workshop participants representing Cambodia indicated that adult mortality had declined due to a gillnet ban but that juvenile mortality remained high.

#### *Myanmar*

No trends have been identified due to the low number of surveys and limited time series of data from direct counts.

#### *Bangladesh*

No trends have been detected but the ability to detect trends should improve in the future as the time series of observations since 2002 increases and is fully analyzed. Current emphasis is on evaluating biases in the sighting rates of the captains, using concurrent counts made by independent observer teams of students from local universities.

#### *India*

Dolphin counts have been increasing in several PAs as follows: National Chambal Sanctuary from 45 in 1985 to around 90 in 2002; Ghagra River from 45 in 2002 to 115 in 2009; Katarniaghat from 38 in 2006 to

48 in 2009; Narora (upper Ganga) from around 20 in 1994 to 56 in 2009; Vikaramshila Sanctuary (lower Ganga) from around 95-98 in 1998 to around 150 in 2009.

Detailed assessments of natality and mortality have not been made for dolphins in either the Ganges or the Brahmaputra.

WWF-India produced a report on the distribution and abundance of river dolphins in the Ganges and Brahmaputra River system) in February 2000 giving a rough estimate of the total number of Ganges dolphins and an overall summary of their distribution in India. The Irrawaddy dolphin population in Chilika Lake has been monitored for the last decade by the Chilika Development Authority and is considered to be declining slowly.

#### *Pakistan*

There has been a significant increase in abundance between Guddu and Sukkur barrages since establishment of the dolphin reserve in 1974. The average rate of increase over a 35-year period was 5.75% per year. Surveys of two independent groups (WWF/provincial wildlife department; separate surveys by the wildlife department) showed an increase in abundance of approximately 60% between 2001 and 2006. More limited data appear to show that abundance has been stable in other parts of the dolphins' range. Although there are no baseline data on canal mortality, large numbers of dolphins have been rescued from canals, and due to these activities, the mortality from that factor has been reduced.

### **What other kinds of monitoring are in place to evaluate the achievement of set objectives?**

#### *Indonesia*

Socio-economic monitoring of fishermen engaged in sustainable aquaculture; initial monitoring of water chemistry and macro-invertebrates in Kedang Pahu River; monitoring sedimentation. In addition, in 2010 a start has been made with patrols covering the entire protected dolphin area (ten per month) conducted by RASI to monitor illegal or hazardous activities and dolphin occurrence, as well as conduct water quality sampling for a six-months period.

#### *China*

Monitoring baiji and finless porpoises' sightings in the Yangtze and adjoining lake systems via a network of fishermen and cetacean reserve staff.

#### *Cambodia*

Interview surveys to detect changes in attitudes.

#### *Myanmar*

A joint team from the Department of Fisheries and WCS are conducting studies to establish a baseline for long-term monitoring. The team is (1) investigating sizes and composition of catches by gill-net, beach-seine, and cast-net fisheries in the Ayeyarwady Dolphin Protected Area; (2) investigating the socioeconomics of gill-net, beach-seine, and cast-net fishermen and their communities; and (3) providing science-based knowledge for the sustainable management of gill-net, purse-seine, and cast-net fisheries. While searching for dolphins during patrols, the team records fishing and gold mining operations according to type and systematically interviews gill-net, beach-seine, and cast-net fishermen to document fishing effort and catch. A study of dolphin ranging and behavior is being conducted for use as a baseline. Movements are tracked during group follows and behavioral states are sampled to develop an activity budget.

#### *Bangladesh*

Two mechanisms are being developed for long-term monitoring: (1) a sighting network among the captains of three nature tourism vessels operating in the Sundarbans and (2) a community-based dolphin mortality monitoring network.

#### *India*

WWF-India has been working in the upper Ganga (Bijnor to Narora stretch) for the last 15 years, regularly monitoring dolphin populations as well as changes in the riverine habitat. This includes working with local communities to improve the habitat. WWF has developed a database on dolphin abundance and movements. State Forest and Wildlife departments monitor dolphin populations in different parts of the Ganges including Geruwa, Chambal, and Ghaghra. The Chilika Development Authority is carrying out a socio-economic survey of local communities and tourism operators. Several universities, including Jiwaji, Manipal, Utkal, and Dibrugarh, are conducting bio-monitoring and environmental quality assessment in dolphin PAs.

#### *Pakistan*

Environmental monitoring between Guddu to Sukkur includes water quality, dolphin prey, and animals

stranded in canals. There is no routine environmental or socio-economic monitoring in other parts of the Indus dolphin's range.

## What are the shortcomings of current monitoring programs?

### *Indonesia*

There is no stable funding for regular dolphin monitoring. There is no regular water quality monitoring in the (proposed) PAs.

### *China*

More effort is needed to run the networks.

### *Cambodia*

The biggest shortcoming has been the lack of communication between WWF and the Dolphin Commission, hence each organization has different estimates for the dolphin population. Efforts are underway that should lead to better communication between the two parties and hence more accurate estimates.

### *Myanmar*

Manpower shortage and fuel costs limit the frequency and duration of patrols.

### *Bangladesh*

Funds are in short supply for compiling and analyzing data from the captains' sighting network and for fielding and supervising mortality response teams.

### *India*

There is no national or statewide program to coordinate conservation and research on Gangetic and other river dolphins. There is no national organisation to maintain a database and coordinate activities. However, the recent declaration of the river dolphin as the national aquatic animal has prompted the establishment of a group to develop a comprehensive action plan for river dolphin conservation in India with support from the Ganga River Basin Authority.

### *Pakistan*

There is no mortality monitoring. It is difficult to conduct large-scale rangewide surveys due to problems with security. Such surveys are also very time-consuming and expensive. Discrepancies

between the results of surveys by different agencies cause confusion. There is also a shortage of boats and equipment and a lack of training for wildlife department staff.

## Recommendations for improved monitoring tools

### *Indonesia*

1. Ensure at least biannual monitoring of dolphin abundance, distribution, and threats.
2. Increase capacity of governmental organizations to conduct monitoring surveys in the future.
3. Ensure regular water quality monitoring.

### *China*

1. Obtain sufficient funding for more regular surveys.

### *Cambodia*

1. Assess socio-economic benefits.
2. Determine if acoustic monitoring can be helpful.

### *Myanmar*

1. Increase frequency of rigorous rangewide surveys.

### *Bangladesh*

1. Obtain information on freshwater cetaceans in the Indian Sundarbans. There is a need for cross-border research on the status and ecology of freshwater cetaceans on the Indian side of the Sundarbans so that conservation efforts can focus on an entire biological population rather than on only the animals within national borders.

### *India*

1. In order to increase capacity of field researchers, managers, veterinarians, and village communities, organize training programs and exchanges with established dolphin conservation programs in the region.
2. Initiate health and mortality assessment.
3. Improve communication and coordination among national institutions such as those involved with fisheries, tourism, and hydrology.
4. Conduct a socio-economic survey of people's dependence on river resources and apply the results to dolphin conservation programs.
5. Assess and maintain critical minimum (environmental) flow regimes in dolphin habitat.

6. Establish cross-border collaborations between nations with shared populations of freshwater cetaceans, e.g. India and Bangladesh (Sundarbans), India and Nepal (Katarniaghat, Gandak), India and Pakistan (Indus River basin).

*Pakistan*

1. Establish a mortality monitoring network.
2. Increase capacity for conducting surveys.
3. Study the health of dolphins rescued from canals.
4. Tag rescued dolphins before release.
5. Make greater efforts to publish or otherwise disseminate survey results in a timely manner.

## Workshop session 4: "Improving conservation management in dolphin core areas/PAs"

### Which regulations and management policies apply or are proposed in the existing or planned protected areas?

#### *Indonesia*

Besides regulations that apply anywhere, such as a ban on electro-fishing and gillnets must have a mesh size of 4 to 10 cm, additional regulations proposed for the PAs include gillnets must be set parallel to the shore and not set at night. Current policies include reimbursement to fishermen if a dolphin is captured and safely released for any damage to their net. The other regulation is related to coal-barge tugboat traffic, which is proposed to be forbidden in PA tributaries, whereas oceanic coal-carrying tankers are proposed to be eliminated from the entire river. A very important management policy proposed is to increase the patrol for illegal activities and regular water quality checks in the PA.

#### *Bangladesh*

None at present. However, policies could include time-area fishing closures, gear restrictions for fisheries, and regulations for dolphin-watching tourism (e.g., limits on approach distance and duration), vessel traffic (e.g., speed restrictions), and upstream industries (e.g., pollution abatement).

#### *Cambodia*

In 2005 the Mekong dolphin conservation strategy was adopted as government policy. High dolphin mortality led to the creation of the Commission for Conservation and Development of Mekong River Dolphin Eco-tourism Zone (Dolphin Commission) in 2006. The Dolphin Commission declared a gillnet ban between Kampi and the Lao border. Mortality from gillnet entanglement appears to have been reduced, but the observed mortality is still too high. In recent years, many of the deaths have been of calves and the cause of this high calf mortality is not clear.

#### *China*

Yangtze Cetaceans are protected under China's Wildlife Protection Act, 1989. This means that it is illegal to capture, hunt, or kill them by any means. National policies with regard to environmental standards and fisheries laws apply to the river in general. China currently has a fishing ban in the

Yangtze River, its tributaries and appended lakes for three months each year, and is planning to extend to four months from next year.

#### *Myanmar*

Current regulations in the Ayeyarwady include (1) requiring fishermen to immediately release dolphins found alive and entangled in their nets, (2) prohibiting the catching, killing, or trading of dolphins (and dolphin parts in the case of trade), and (3) prohibiting the use of electricity to catch fish. In the PA, it is prohibited to use gill nets that obstruct the water-course, are more than 300 feet (91.4 m) long, or are spaced less than 600 feet (183.9) apart.

#### *India*

Ganges dolphins are protected under Schedule I of the Wildlife Protection Act, 1972. This means it is illegal to capture, hunt, or kill them by any means.

#### *Pakistan*

Dolphins are protected under the wildlife law and hunting them is not allowed. National policies with regard to environmental standards and fisheries laws apply to the river in general.

### Current shortcomings in the implementation of regulations and management policies

#### *Indonesia*

1. Lack of law enforcement
2. Lack of routine water quality monitoring and effective pollution control measures (in particular, as pertains to the coal mining and oil palm plantation industries)
3. Conversion of swamp forest for oil palm plantations, which reduces fish spawning habitat
4. Lack of buffer zones between industrial activities and the natural ecosystem.

#### *Bangladesh*

Bangladesh is a country of rivers, so it is important to identify additional areas needing special protection measures for freshwater cetaceans. Shortcomings include the lack of funds, law enforcement, and trained manpower.

### *Cambodia*

The ban on fishing was declared without community consultation, causing resentment in local communities. PAs are not legally designated and may lose support if the government changes.

### *China*

There are great difficulties enforcing the protection laws.

### *Myanmar*

Additional government ministries, notably the departments of Home Affairs and Forests, need to be involved in the PA. Law enforcement needs to be strengthened to address illegal fishing, especially electro-fishing.

### *India*

There is a lack of federal and state support for coordinated monitoring of river dolphin populations, including assessment of mortality and natality, during different seasons. Chilika Lake and the Harike Ramsar site (Beas River) have very small, vulnerable populations of dolphins, and these areas need more attention. Existing Indian wildlife legislation is adequate.

### *Pakistan*

There is no national water policy, but such a policy is vital given that so much water is removed from the rivers. Fisheries law is weak and fisheries monitoring is poor. Greater collaboration among the fisheries, wildlife, and irrigation departments would be highly beneficial for dolphin conservation, especially in Sindh.

## **Recommendations to improve PA management**

### *Indonesia*

1. Limit coal barge transport in tributaries
2. Restrict vessel speed at confluences, which are favored dolphin habitat
3. Restore riparian areas and protect fish spawning areas
4. Intensify (and randomise) patrols by a local task force to detect illegal activities
5. Monitor water quality regularly
6. Enforce pollution prevention measures for companies that are connected with the river system

7. Create buffer zones around PAs and between industries and the natural ecosystem
8. Hold regular meetings with multiple stakeholders to discuss problems
9. Seek stable government funding to support the above activities.

### *Bangladesh*

1. Conduct a comprehensive assessment of the activities and socio-economic status of local human communities in fringe villages of the proposed PA network for freshwater cetaceans in the Eastern Sundarbans Reserved Forest.
2. Use the results of that study, in combination with information from ecological studies, to develop management policies for the proposed PA in close consultation with local stakeholders.
3. Identify additional hotspots for conserving freshwater cetaceans, especially Irrawaddy dolphins in the Western Sundarbans Reserved Forest, and Ganges dolphins in upstream waterways of the Ganges-Brahmaputra-Meghna system and in the Karnaphuli-Sangu system.

### *China*

1. Ban commercial fishing in all reserves year-round.
2. Enforce the laws, which already exist consistently throughout the dolphins' range in order to reduce mortality.

### *Cambodia*

1. Make greater efforts to ensure that WWF, the Dolphin Commission, and the Fishery Administration have a coordinated approach to dolphin conservation in the Mekong.
2. Implement laws that clearly ban gillnets and enforce the laws consistently throughout the dolphins' range in order to reduce mortality.
3. Continue and expand research to determine the cause(s) of the high rate of calf mortality.

### *Myanmar*

1. Seek to involve additional government ministries, notably the departments of Home Affairs and Forests, in management of the Ayeyarwady River Dolphin Protected Area.
2. Strengthen law enforcement to address the problem of illegal fishing.

### *India*

1. Establish a national river dolphin project with sustainable funding and a coordinated approach.



2. Amend fisheries act to include sustainable fisheries in freshwater systems.
3. Monitor mortality to identify causes.
4. Collaborate with and involve fisherfolk in dolphin conservation efforts in order to encourage a sense of "ownership."
5. Monitor dolphin populations and habitat on a regular basis, similar to the monitoring of tigers and elephants.

#### *Pakistan*

1. Create a national water policy.
2. Amend fisheries laws.
3. Increase collaboration among fisheries, wildlife, and irrigation agencies.

### **Are existing PAs providing adequate protection for freshwater cetaceans?**

#### *Indonesia*

There is presently only one PA and its proposed regulations have not yet been legalized, so the protection provided by the PA is currently inadequate.

#### *Bangladesh*

There are no PAs for freshwater cetaceans in Bangladesh yet, but the government is currently considering a proposal to establish a network of three protected waterway segments (5, 12, and 15 km long, respectively) in the Eastern Sundarbans Reserved Forest.

#### *Cambodia*

The answer must be "no," because dolphins continue to die at an unsustainable rate. Deaths due to gillnets appear to have declined, but better enforcement of the gillnet ban is needed. At the same time, the Fisheries Administration needs to develop clear laws protecting both dolphins and fishery species. At present, there is no formal protection for dolphins in Fishery law. Also, all sources of mortality need to be identified and addressed.

#### *China*

There are presently three national and four provincial or local PAs for freshwater cetaceans. All of them can provide some degree protection to

cetaceans, but there are severe conflicts between economic development and conservation.

#### *Myanmar*

The Ayeyarwady Dolphin Protected Area includes only about one-quarter of the Irrawaddy dolphin population estimated at 59-74 individuals. There is a need for PAs in two other river segments: (1) from the Taping river confluence at Bhamo to the upstream end of the second river defile at Sinkan (36 km) and (2) from the downstream end of the second river defile to Tagaung (165 km).

#### *India*

Cetaceans are protected from deliberate harm in all designated PAs under the Wildlife Protection Act, 1972. However, incidental mortality in fisheries and the continuation of some degree of illegal fishing in almost all riverine PAs are problems that need to be addressed by changes in fisheries legislation or in how existing laws are implemented. Some areas may need to be closed entirely to fisheries. Establishment of fisheries cooperatives may help. In Chilika Lake, unplanned and excessive tourism has become a major problem for the local Irrawaddy dolphin population. A proper tourism plan needs to be developed.

#### *Pakistan*

The existing PA in Sindh appears to be effective since dolphin abundance is increasing. PAs are needed in NWFP and Punjab where the dolphin populations are smaller and more threatened.

### **New PAs to be established**

#### *Indonesia*

To maintain the dolphin population, the proposed natural reserve in Central Kutai needs to be established. Semayang, Melintang, and Jempang Lakes need to become special integrated natural reserve areas managed by multiple stakeholders. These are the principal source areas for fisheries in the Mahakam and for the Pesut's prey populations.

#### *Bangladesh*

In addition to the network of protected waterway segments for freshwater cetaceans proposed for the Eastern Sundarbans Reserved Forest, the lower Sangu River in southeastern Bangladesh has been

identified as an area of particular biological importance for a relatively small population of Ganges dolphins. The animals in the Karnaphuli-Sangu system are probably demographically isolated from the dolphins in the Ganges-Brahmaputra-Meghna system. There is also a need to establish one or more PAs in the Western Sundarbans Reserved Forest in Bangladesh, especially for Irrawaddy dolphins.

### *Cambodia*

WWF, the Dolphin Commission, and the Fisheries Administration are currently trying to form specific legislation to ban gillnet use in the dolphins' range. At the same time, the Fisheries Administration is trying to develop PAs around deep pools in the Mekong to protect fisheries. This could provide additional protection for dolphins.

### *China*

Most hotspots in the Yangtze River and adjoining lakes are already covered by a national and provincial PA network. The second semi-natural reserve is being established within Honghu Reserve. A feasibility study is underway for another semi-natural (i.e. ex-situ) reserve for finless porpoises in the reservoir above the Three Gorges Dam.

### *Myanmar*

As indicated earlier, there is a need to establish additional PAs: (1) from the Taping river confluence at Bhamo to the upstream end of the second river defile at Sinkan (36 km) and (2) from the downstream end of the second river defile to Tagaung (165 km).

### *India*

Several freshwater PAs and conservation reserves have been identified and proposed but they need considerable work at the federal and provincial levels before they can be designated. In the Brahmaputra, there are 5 new proposed PAs, some of which adjoin existing National Parks and Sanctuaries and require only the boundary to be extended to include the riverine stretches.

### *Pakistan*

Two new PAs have been proposed, one in NWFP and one in Punjab. The one in NWFP is in a more advanced stage of planning and hopefully will be designated in the coming year.

### 3. General Workshop Conclusions and Recommendations

Freshwater cetaceans are among the most critically endangered groups of animals on the planet. This reflects the fact that natural freshwater systems have been badly degraded by human use globally, and nowhere more than in southern Asia. The recent likely extinction of the baiji in the Yangtze River of China is emblematic and instructive: time is running out to save these animals and their ecosystems.

Much progress has been made over the last decade towards making the public and governments in range states aware of the existence of Asian freshwater cetaceans and of the threats facing these animals. Nonetheless, in most areas, populations of freshwater cetaceans have continued to decline and their habitat has continued to deteriorate. Economic and social development priorities have consistently taken precedence over concerns about biodiversity conservation.

#### *General Status*

The situation for each cetacean population in the range states represented at the workshop can be summarized as follows:

- In **Indonesia**, the Pesut Mahakam (Irrawaddy dolphin) population in the Mahakam River numbers only about 90 individuals mainly occupying some 270 kilometers in the middle part of the river. The decline in numbers and range apparently has continued in spite of the species' fully protected status.
- In **India**, the population of Ganges dolphins in the Brahmaputra River, which numbers about 300, appears to be relatively stable. The situation for Ganges dolphins elsewhere in India is mixed; some populations are increasing and others are decreasing. However, there is no rigorous estimate of total numbers (only a guesstimate of about 1,800) and no clear evidence of recent overall trends in abundance. The general consensus among Indian researchers is that overall numbers are stable. The recent discovery of a small population of Indus dolphins in the Beas River in the state of Punjab (at least 10 individuals) is encouraging.

### 3. Kesimpulan dan Rekomendasi Umum

Cetacean air tawar merupakan kelompok mamalia yang paling kritis dan terancam punah di planet ini. Gambaran ini merupakan fakta bahwa ekosistem sungai telah mengalami degradasi yang sangat buruk akibat aktivitas manusia, terlebih lagi di Asia Selatan. Fakta terbaru punahnya baiji, lumba-lumba Sungai Yangtze di China mengandung pembelajaran: jangan menunggu waktu untuk menyelamatkan satwa ini dan ekosistemnya.

Sudah banyak kemajuan yang dilakukan dalam beberapa dekade terakhir dalam upaya meningkatkan kesadaran masyarakat dan pemerintah akan keberadaan cetacean air tawar di Asia dan ancaman-ancaman terhadap satwa ini. Perlu diketahui bahwa hampir di semua daerah, populasi lumba-lumba air tawar dan kualitas habitat mereka terus mengalami penurunan. Prioritas pembangunan sosial dan ekonomi secara konsisten lebih diutamakan dibanding perlindungan keanekaragaman hayati.

#### *Status Umum*

Kondisi populasi cetacean yang telah disampaikan dalam lokakarya dapat disimpulkan sebagai berikut:

- **Indonesia**, populasi Pesut (Irrawaddy dolphin) di Sungai Mahakam hanya berjumlah 90 ekor terutama yang tersebar di bagian tengah sungai sepanjang 270 km. Penurunan jumlah dan luas penyebaran terus terjadi dari spesies dilindungi ini.
- **India**, populasi lumba-lumba Ganges di Sungai Brahmaputra berjumlah 300 ekor dan relatif stabil. Sedangkan pada daerah-daerah lainnya di India relatif bervariasi: beberapa populasi mengalami peningkatan dan lainnya mengalami penurunan. Belum ada perkiraan terbaik dari jumlah keseluruhan (sebuah perkiraan sekitar 1800 ekor) dan belum ada hasil penelitian terbaru mengenai jumlah keseluruhan. Perkiraan jumlah keseluruhan oleh para peneliti di India relatif sama. Hasil terbaru telah diketemukan sebuah kelompok kecil Lumba-lumba Indus di Sungai Beas, Punjab dengan jumlah sedikitnya 10 ekor.

- In **Myanmar**, the estimated number of Irrawaddy dolphins in the Ayeyarwady River is only about 72, with no sign of either an increase or a decrease in recent years.
- In **Cambodia**, the Mekong River population of possibly as few as 70 Irrawaddy dolphins appears to be declining rapidly. The causes of the decline are not fully understood, but by-catch in gillnets is a known threat and efforts to identify and reduce other possible threats continue.
- **Pakistan** is a bright spot among the Asian river cetacean range states, with evidence that the population of Indus dolphins has been increasing for more than 30 years and now numbers over 1,500.
- In **Bangladesh**, there are only about 125 Ganges dolphins in the Karnaphuli/Sangu River system, and there is no recent information on whether this population is increasing or decreasing. There has been no recent monitoring in the portion of the Brahmaputra River in Bangladesh, but ongoing work in the Sundarbans indicates populations of about 225 Ganges dolphins and 450 Irrawaddy dolphins there.
- In **China**, the baiji is likely extinct. The finless porpoise population in the Yangtze River declined by at least 30% from the late 1980s to 2006, and this decline continues. There are probably now only between 1,000 and 2,000 porpoises in the entire Yangtze system.
- **Myanmar**, perkiraan jumlah lumba-lumba Irrawaddy di Sungai Ayeyarwady hanya 72 ekor, belum ada tanda peningkatan atau penurunan jumlah dalam beberapa tahun terakhir.
- **Cambodia**, populasi lumba-lumba Irrawaddy di Sungai Mekong hanya 70 ekor dengan tingkat penurunan jumlah yang cepat sekali. Meskipun penyebab penurunan jumlah ini tidak sepenuhnya dipahami, namun kematian karena terperangkap rengge adalah ancaman yang nyata dan usaha dilakukan untuk identifikasi dan menurunkan ancaman potensial lainnya.
- **Pakistan** merupakan daerah yang baik dalam penyebaran cetacean sungai di Asia dengan bukti bahwa populasi Lumba-lumba Indus mengalami peningkatan dalam waktu lebih dari 30 tahun dan saat ini berjumlah 1.500 ekor.
- **Bangladesh**, terdapat sekitar 125 lumba-lumba Ganges dalam DAS Karnaphuli/Sangu dan belum memiliki informasi terbaru apakah mengalami peningkatan atau penurunan. Belum ada hasil monitoring terbaru di Sungai Brahmaputra, Bangladesh, namun hasil kerja yang sedang berjalan di Sundarbans teridentifikasi populasi lumba-lumba Ganges sebanyak 225 ekor dan lumba-lumba Irrawaddy 450 ekor.
- **China**, baiji sudah punah. Populasi finless porpoise di Sungai Yangtze mengalami penurunan sedikitnya 30% sejak tahun 1980 – 2006, dan terus mengalami penurunan. Kemungkinan saat ini hanya antara 1000 – 2000 ekor porpoise di sepanjang Sungai Yangtze.

### *Models of Protected Area Design*

A number of models of Asian river cetacean protected area (PA) design are available, all involving coordinated efforts by relevant government agencies and at least one major NGO partner. For example:

- The Mahakam, where identification of focus areas for conservation and PAs was based on high concentrations of dolphins, high rates of human-caused mortality, high numbers of calves observed, and fish spawning areas where dolphins do not necessarily occur.
- The science-based, community-informed effort in Myanmar that focuses on “hotspots”, efforts to eliminate fishing with electricity, and

### *Beberapa Rancangan Kawasan Perlindungan*

Sejumlah model/desain Kawasan Perlindungan (KP) cetacean sungai Asia telah tersedia, semuanya dapat diusahakan dengan koordinasi antara pemerintah dan sedikitnya satu mitra LSM. Sebagai contoh:

- Di Mahakam, identifikasi daerah untuk konservasi dan kawasan perlindungan berdasarkan tingkat kerapatan populasi, angka kematian yang tinggi disebabkan oleh kegiatan manusia dan tingginya jumlah anak lumba-lumba serta daerah perkembangbiakan ikan.
- Upaya di Myanmar lebih difokuskan pada daerah-daerah tertentu dan hubungan kerjasama

incorporation of a human-dolphin cooperative cast-net fishery

- The semi-natural reserve (Swan Oxbow) in China where finless porpoises have been translocated from the wild and are now closely monitored and given relatively good protection
- The pool-by-pool conservation strategy in Cambodia that provides special enforcement and monitoring in a series of dolphin “hotspots”
- The Bangladesh Sundarbans where researchers have identified “hotspots” for PA planning and partnered with ‘social development’ NGOs in areas fringing the proposed PA, to collect information from and disseminate materials to local communities in the course of their other work
- The Indus Dolphin Reserve in Sindh, Pakistan, declared in 1974 and covering the entire river stretch between Sukkur and Guddu Barrages, specifically to enforce a ban on deliberate taking and now managed as a more broad-reaching PA for dolphins and other species such as migratory birds and freshwater turtles.

### *General Conclusions and Recommendations on Protected Areas for Freshwater Cetaceans in Asia*

- Protected areas need to be designed and managed so that the protective measures they provide will be sustainable (and financed) in the long run. In most instances, this means that they need to be **adopted and implemented by governmental programs or agencies, as well as being accepted and supported by local communities.**
- No PA can be effective without a management plan that is accepted and supported by relevant authorities. All such management plans need to be **adaptable** – meaning that they are re-evaluated and amended periodically as new information becomes available on effectiveness, threats etc. Moreover, the plans need to include **timelines and deadlines for achieving milestones.**
- It is essential to gain a good understanding of threats and their severity in order to design appropriate conservation measures. Also, the effectiveness of conservation measures needs to be assessed. This means **research and monitoring must be supported at a level that can provide such understanding.**

manusia dan lumba-lumba dalam penangkapan ikan

- Daerah perlindungan semi-natural (Angsa Oxbow) di China, dimana finless porpoise dipindahkan dari alam, diawasi seksama dan memberikan perlindungan yang relatif baik
- Strategi konservasi “kolam-kolam” di Kamboja menyediakan penyelenggaraan khusus dan monitoring pada daerah-daerah khusus lumba-lumba
- Sundarbans di Bangladesh, dimana para peneliti telah mengidentifikasi daerah-daerah khusus untuk rencana KP dan bekerjasama dengan LSM yang bergerak dalam bidang pengembangan sosial dekat daerah KP untuk KP, untuk mengumpulkan informasi dan menyebarluaskan kepada masyarakat setempat
- Daerah perlindungan Lumba-lumba Indus di Sindh, Pakistan ditetapkan pada tahun 1974 meliputi sungai yang terbentang antara Bendungan Sukkur dan Guddu, khususnya untuk menerapkan pelarangan pemburuan satwa tersebut dan saat ini jangkauan pengelolaan diperluas pada KP bagi lumba-lumba dan spesies lainnya seperti jenis burung migrasi dan kura-kura air tawar.

### *Kesimpulan dan Rekomendasi Umum mengenai Kawasan Perlindungan Cetacean Air Tawar di Asia*

- Kawasan perlindungan perlu dirancang dan diatur sedemikian sehingga tindakan perlindungan yang dilakukan dapat berjalan secara terus menerus (termasuk di dalamnya dalam hal pendanaan). Dalam hal ini, rancangan tersebut perlu **diadopsi dan diterapkan dalam program pemerintah atau organisasi, serta dapat diterima dan didukung oleh masyarakat setempat.**

Kawasan perlindungan tidak dapat berjalan efektif tanpa rencana pengelolaan yang dapat diterima dan didukung oleh pemerintah. Seluruh desain rencana pengelolaan dapat **disesuaikan**, yang berarti dapat dievaluasi ulang dan diperbaiki secara berkala berdasarkan informasi terbaru tentang efektifitas, ancaman-ancaman dan lainnya. Lebih daripada itu, perencanaan harus mencakup **jangka waktu dan batas waktu untuk mencapai objektif-objektif.**

- Sangatlah penting untuk mencapai sebuah pemahaman yang baik dari ancaman-ancaman

- The conservation of other wild species as well as the welfare of nearby human communities need to be taken into account when designing and implementing cetacean PAs. Ideally, the protection given to cetaceans will benefit other species in the ecosystem (i.e. the cetaceans will function as umbrella species), but also **it is essential to consider that measures tailored for cetacean conservation might actually harm other wild species** – e.g., displacement of non-selective fishing effort from one area with dolphins to an area with no dolphins but other vulnerable species, development of unmanaged dolphin-oriented tourism. Therefore, management of cetacean PAs should **avoid unnecessary and unintended negative effects on other species and human communities**.
- An essential element of protected areas is to maintain a consistent conservation presence on the water. This can consist of researchers, government enforcers, or tour operators (often a mix of all three). **Such a presence should be built into all PA designs and management plans**.
- **Basic cetacean conservation measures in ‘non-protected’ (buffer) areas used by the animals are essential**. In other words, legally protected status and broad-based conservation measures (e.g. enforcement against some particularly destructive fishing practices such as electrocution and poisoning) should be implemented both inside and outside PAs, while value-added, targeted measures for enhanced protection are implemented inside PAs.
- River-basin level measures are in one category where policy at the national and often multinational level is required; other measures are in another category where PA-type management is more feasible and appropriate. Particularly in river systems where there is great demand for fresh water for human use, *critical minimum flow* and the maintenance of natural flow variability is of overarching importance. **This national, and often multilateral, issue must be addressed** if there is to be any hope of protected areas and other efforts being effective in the long term.
- A theme of the workshop was the importance of encouraging and facilitating more sustainable fishing methods or ‘alternative livelihoods’ for fishermen. Law-enforcement of illegal fishing, seasonal and/ or area fishing bans,
- Sangatlah penting untuk mencapai sebuah pemahaman yang baik dari ancaman-ancaman dan tingkat parahnya untuk dapat merancang tindakan konservasi yang tepat. Selain itu tindakan konservasi tersebut perlu dinilai. Artinya bahwa dibutuhkan **penelitian/ kajian dan pemantauan untuk menghasilkan pemahaman tersebut**.
- Pertimbangan integrasi konservasi terhadap spesies lainnya dan kesejahteraan masyarakat setempat sangat diperlukan dalam merancang dan melaksanakan perlindungan habitat cetacean. Sebaiknya, perlindungan terhadap cetacean air tawar dapat memberikan keuntungan juga bagi spesies lainnya di dalam ekosistem (cetacean berfungsi sebagai “payung spesies”), namun **hal ini perlu dipertimbangkan ketika tindakan konservasi cetacean dapat menimbulkan kerugian bagi spesies lainnya** (misalnya upaya pemindahan daerah penangkapan ikan tanpa seleksi dari suatu daerah, yang merupakan habitat lumba-lumba ke daerah lain yang bukan habitat lumba-lumba, namun habitat spesies lain yang mudah terancam, perkembangan pariwisata berorientasi lumba-lumba yang berlebihan). Oleh karena itu, pengelolaan KP Cetacean harus **menghindari timbulnya pengaruh negatif terhadap spesies lainnya dan masyarakat setempat**.
- Unsur yang diperlukan dalam KP adalah mempertahankan ketersediaan tim konservasi di sungai secara terus menerus. Hal ini dapat dilakukan oleh para peneliti, pemerintah atau operator perjalanan wisata (seringkali gabungan dari ketiganya). **Peran seperti itu haruslah disertakan ke dalam semua desain KP dan perencanaan pengelolaan**.
- **Tindakan dasar untuk pelestarian cetacean tersebut di luar kawasan perlindungan (bufferzone) tapi tetap merupakan habitat satwa tersebut** adalah penting. Dengan kata lain, perlindungan satwa dan habitatnya serta peraturan konservasi dasar (penegakan hukum terhadap penangkapan ikan yang tidak berkelanjutan seperti penyetroman dan racun) harus diterapkan di dalam dan juga diluar KP, sedangkan peraturan yang lebih spesifik diterapkan dalam KP. Ada juga tipe tindak perlindungan yang lebih tepat dan dimungkinkan dilaksanakan di tingkat KP. Untuk kebijakan nasional dan sering juga di tingkat multinasional

environmentally 'friendly' forms of aquaculture, conversion to farming, tourism, and other types of livelihoods were assumed to be of less risk to cetaceans while securing their prey resources. However, fishery management is complicated and challenging. Both law enforcement and fisheries knowledge are inadequate in many cases, but they are crucial to freshwater cetacean conservation. Fishery management (e.g. controls on gear types, conservation of brood stocks, limitations on entry) is essential for cetacean conservation generally and **it must be a central element of conservation efforts for Asian freshwater species in all areas, and especially within PAs.**

- It is important to acknowledge when designing PAs in freshwater systems, that the **success or failure of a PA may depend on what happens outside its boundaries.** Although it may not be possible to address all river basin-wide issues in a PA management plan, it is necessary to target some of the most important issues outside of the PA to ensure protection of wildlife inside it.
  - PAs of some kind already exist in all the river cetacean range states. Some of these protect terrestrial habitat, and some are designed to protect aquatic species such as crocodiles in river and lake systems. **Expanding the size and scope of current PAs to include river cetacean habitat** can be an effective and cost-effective means of providing protection for dolphins and porpoises and it is often less challenging than attempting to establish new PAs.
  - As a way of raising awareness and to encourage conservation, **an international Day of Freshwater Dolphins and Porpoises should be designated.** 24<sup>th</sup> of October is suggested as a date, and WWF as a group proposed to take the lead in promoting this gesture.
  - Considering the significance of agriculture and the dependence of livelihoods on it in this region, it is important that each country **develops a sound water policy and promotes improved agricultural practices,** e.g. both water and agrochemicals are used efficiently. Water policy should be comprehensive, covering all aspects (e.g. quality, distribution between states/provinces within a country). Water quality issues have serious implications for freshwater cetacean populations. Because of the increasing
- sangat diperlukan; Terutama sekali di dalam sistem sungai dimana terdapat permintaan air bersih untuk manusia, *arus kritis minimum*, dan pemeliharaan variabilitas arus alami. **Secara nasional dan sering juga multinasional, isu tersebut harus ditampilkan** bila ada harapan dari kawasan perlindungan dan upaya lainnya untuk menjadi efektif dalam jangka panjang.
- Sebuah tema dari lokakarya ini adalah pentingnya untuk mendorong dan memfasilitasi lebih banyak metode perikanan yang berkelanjutan atau "mata pencaharian alternatif" untuk nelayan. Penegakan hukum penangkapan ikan ilegal, musiman dan/atau daerah yang dilarang, teknik keramba ramah lingkungan atau beralih ke pertanian, jasa wisata dan tipe mata pencaharian lainnya diasumsikan kurang berisiko terhadap lumba-lumba dan sumber daya makanannya. Bagaimanapun juga, pengelolaan perikanan sangat rumit dan terbatas oleh kurangnya pelaksanaan hukum dan pengetahuan perikanan dalam beberapa kasus, tetapi krusial terhadap upaya konservasi lumba-lumba air tawar. Pengelolaan perikanan (seperti pengaturan tipe alat tangkap, konservasi reservat perikanan, batasan jumlah alat tangkap) adalah penting bagi konservasi cetacean dan **hal tersebut harus menjadi unsur terpenting dalam upaya konservasi lumba-lumba air tawar Asia dalam semua wilayah dan terutama di dalam KP.**
  - Sangat penting untuk menyadari sewaktu mendesain KP di dalam sistem daerah aliran sungai, bahwa **keberhasilan ataupun kegagalan dari KP dapat tergantung dari apa yang terjadi di luar kawasan tersebut.** Walaupun tidak mungkin mengganggu semua isu-isu sepanjang kawasan sungai ke dalam rencana pengelolaan KP, namun diperlukan memperhatikan isu-isu terpenting diluar Kawasan Perlindungan guna memastikan perlindungan lingkungan satwa liar di dalam KP.
  - Telah ada beberapa KP untuk lumba-lumba air tawar di seluruh negara mereka berada. beberapa diperuntukkan untuk melindungi kawasan darat, dan beberapa lainnya didesain untuk perlindungan spesies satwa perairan seperti buaya di sungai atau danau. **Perluasan wilayah dan lingkup KP ke dalam habitat lumba-lumba air tawar** merupakan upaya perlindungan yang efektif dan hemat biaya dan tantangannya lebih kecil dibanding dengan upaya menetapkan sebuah KP yang baru.

trend of building dams, particularly in South Asia and in the Mekong, it is important that the decision-making process considers environmental and social as well as financial aspects and follows the **guidelines of the World Commission on Dams**.

- PAs for freshwater cetaceans already exist in some systems but management structures are generally weak and as a result, the value of these areas for conservation is often limited. Efforts to establish new PAs should be balanced against the need to **strengthen management in existing ones**.
- It is self-evident that strengthening the management of existing PAs and establishing new PAs for freshwater cetaceans requires a motivated and empowered management team. **Capacity building should therefore be considered a key element of protected area planning**. This should include intensive training and long-term mentoring as well as the provision of appropriate equipment and supplies.
- Climate change is likely to have dramatic impacts on the riverine and estuarine environments where freshwater cetaceans live; however, the nature of the change, including how it will affect human activities, is little understood. This makes it impossible to advocate adaptive strategies for establishing new PAs or managing existing ones. **A study is needed on the implications of climate change for freshwater cetaceans that includes consideration of habitat resilience**. As part of such a study, specific areas that are less vulnerable to both the direct and indirect impacts of climate change may be identified for site-based protection. Also, it may prove possible to develop long-term management strategies to cope with predicted changes to the environments inhabited by freshwater cetaceans.
- Sebagai langkah dalam meningkatkan kepedulian dan mendorong upaya konservasi, disepakati pada setiap tanggal 24 Oktober untuk diperingati sebagai "**Hari Lumba-lumba dan Porpoise Air Tawar Sedunia**" dan WWF sebagai organisasi "leader" yang akan mempromosikan langkah tersebut.
- Pertimbangan bahwa pertanian merupakan kegiatan cukup luas dan ketergantungan mata pencaharian dari pertanian sangat signifikan di Asia, setiap negara perlu **mengembangkan kebijakan air dan mempromosikan cara pertanian** yang lebih baik melalui penggunaan air dan bahan-bahan kimia pertanian secara efisien. Kebijakan air haruslah dapat mencakup segala aspek air (kualitas, distribusi di antara kota/propinsi dalam suatu negara). Isu-isu kualitas air sangat berdampak bagi populasi lumba-lumba air tawar. Dikarenakan terjadi peningkatan pembangunan bendungan, terutama di Asia Selatan, maka sangatlah penting pada proses konstruksi bendungan selalu mempertimbangkan aspek lingkungan, sosial dan pembiayaan serta mengikuti **Aturan Komisi Pengawas Bendungan Dunia**.
- Kawasan perlindungan di beberapa sungai telah terbentuk namun struktur manajemen umumnya lemah mengakibatkan nilai konservasi sangat terbatas. Upaya penetapan kawasan perlindungan baru seharusnya jalan bersama dengan kebutuhan **penguatan manajemen pada kawasan perlindungan yang sudah ada**.
- Penguatan pengelolaan kawasan perlindungan yang sudah ada dan penetapan kawasan perlindungan baru bagi cetacean air tawar memerlukan motivasi dari tim pengelola yang telah dikuatkan. **Peningkatan kapasitas harus dipertimbangkan sebagai kunci dalam perencanaan daerah perlindungan** dan meliputi pelatihan secara intensif dan pendampingan jangka panjang dengan jumlah peralatan dan persediaan yang lengkap.
- Perubahan iklim nampaknya memiliki dampak terhadap lingkungan sungai dan daerah sekitarnya dimana cetacea air tawar hidup, namun, perubahan pada umumnya, termasuk bagaimana hal ini mempengaruhi kegiatan manusia, kurang dimengerti. Hal ini menyebabkan strategi yang adaptif tidak dapat diterapkan untuk membentuk daerah perlindungan yang baru maupun pengelolaan



yang sudah ada. **Suatu penelitian diperlukan pada akibat perubahan iklim terhadap cetacea air tawar termasuk pertimbangan terhadap resilience habitat.** Sebagai bagian dalam suatu penelitian, daerah tertentu yang kurang rawan terhadap dampak perubahan iklim baik langsung maupun tidak dapat digunakan sebagai daerah lindung berbasis lokasi. Juga untuk membuktikan bahwa strategi pengelolaan jangka panjang memungkinkan untuk dikembangkan dalam menghadapi perubahan yang telah diperkirakan sebelumnya terhadap lingkungan hidup cetacea air tawar.

#### 4. Priority Recommendations on Protected Areas for Freshwater Cetaceans in Individual Range States

##### MAHAKAM RIVER, INDONESIA

1. Establishing protected areas (PAs) in Central Kutai District; Legalizing regulations and prepare binding policies in West and Central Kutai Districts
2. Set up a management body of collaborative stakeholders (incl. community, government, NGOs, companies) that meet on a regular basis to discuss problems and for coordinated action
3. Having base funding yearly made available by the government for implementation of policies and regulations
4. Habitat rehabilitation including riparian reforestation (focusing reforestation programs to reserve areas) and enforcing regulations for coal-transport (a ban of coal-barge transport in tributaries and a ban on oceanic coal-tanker ships in the Mahakam)
5. Help local communities to engage in sustainable fisheries (such as aqua-culture using fish, which is not derived from the river and can be fed on a combination of pellets and vegetables) and other alternative income generation and livelihoods to reduce pressure on natural fish resources
6. Weekly monitoring of illegal activities (such as electro-fishing) and dolphin occurrence by using trained, local patrol teams. In addition, there should be 3-monthly monitoring of water quality and bi-annual monitoring of dolphin population abundance in the entire river
7. Establish the 24<sup>th</sup> October as "Provincial Day to Care for Pesut Mahakam"

#### 4. Rekomendasi Prioritas pada Kawasan Perlindungan Cetacea Air Tawar di Masing-masing Negara

##### SUNGAI MAHAKAM, INDONESIA

1. Menetapkan kawasan perlindungan (KP) di Kabupaten Kutai Kartanegara; Mensahkan peraturan dan menyiapkan kebijakan yang akan diterapkan di Kabupaten Kutai Barat dan Kutai Kartanegara
2. Membentuk badan pengelolaan kolaboratif stakeholder (termasuk masyarakat, pemerintah, LSM, perusahaan) yang bertemu secara berkala untuk membahas masalah dan tindakan terkoordinasi
3. Memiliki dasar pendanaan tahunan yang disediakan oleh pemerintah untuk pelaksanaan kebijakan dan peraturan
4. Rehabilitasi habitat termasuk reboisasi riparian (fokus program reboisasi ke daerah konservasi) dan menegakkan peraturan untuk transportasi batubara (larangan transportasi batubara di anak sungai dan larangan kapal tanker untuk batubara di Sungai Mahakam)
5. Membantu masyarakat lokal untuk terlibat dalam perikanan yang berkelanjutan (seperti keramba yang menggunakan ikan yang tidak berasal dari sungai dan pakan berupa kombinasi pelet dan sayuran) dan pendapatan dan mata pencaharian alternatif untuk mengurangi tekanan terhadap sumberdaya perikanan
6. Pemantauan aktivitas ilegal mingguan (seperti penyetruman) dan monitoring lumba-lumba oleh tim patroli lokal. Selain itu, harus ada pemantauan 3 bulanan terhadap kualitas air dan pemantauan dua tahunan bagi populasi lumba-lumba di sepanjang sungai.
7. Menetapkan tanggal 24 Oktober sebagai "Hari Propinsi Peduli untuk Pesut Mahakam"

## YANGTZE RIVER, CHINA

1. The central government should put more efforts on conservation of aquatic bio-diversity, to use river dolphins as flagship species, and river dolphin protected areas as demonstration sites of aquatic conservation efforts.
2. Capacity building of PAs, including staff training, capability of enforcing laws, and so on.
3. Efficiently use the PA network that has already been set up as a platform of river dolphin conservation.
4. To strictly ban fishing in PAs year-round.
5. To upgrade two PAs in two lakes to national level; Put more efforts on the protection of the Yangtze finless porpoise there.
6. To establish more ex-situ PAs; such as connecting Tian-e-zhou Oxbow and Hei-wa-wu Oxbow to expand water area of the PA, and re-link the mainstem of the Yangtze River and the oxbows; Set up Lao-wan Oxbow as another off-site PA if feasibility study confirms that the oxbow meets the requirements of being a PA.

## MEKONG RIVER, CAMBODIA

Development of a plan for dolphin conservation coordinated by WWF Cambodia, Commission for Conservation and Development of Mekong River Dolphin Eco-tourism Zone (Dolphin Commission) and Fisheries Administration (FiA) that includes the following six components:

1. Research focusing on abundance estimation and causes of mortality.
2. Strengthening enforcement of the gillnet ban in dolphin deep pool areas between Kampi Pool (Kratie Town, Kratie Province of Cambodia) and the Lao border. Consistent and regular patrolling, including at night, is needed to reduce gillnet use and other types of illegal fishing.
3. Development of clear, consistent, and enforceable regulations and an action plan to protect dolphins in the Mekong by the Cambodian government. Currently the Dolphin Commission attempts to enforce a gillnet ban that is not supported by fishery law.
4. Official designation of conservation areas around deep pools that will help to sustain fishery resources and help protect dolphins. A priority

## SUNGAI YANGTZE, CINA

1. Pemerintah pusat harus berupaya lebih lanjut tentang konservasi keragaman hayati perairan, menggunakan lumba-lumba sungai sebagai spesies unggulan, dan KP lumba-lumba sungai sebagai lokasi demonstrasi dari upaya konservasi perairan.
2. Penguatan kapasitas KP, termasuk pelatihan staf, kemampuan penegakkan hukum, dan sebagainya.
3. Efisiensi menggunakan jaringan KP yang telah ditetapkan sebagai platform konservasi lumba-lumba sungai.
4. Memperketat larangan penangkapan ikan di KP sepanjang tahun.
5. Menetapkan dua KP di dua danau secara nasional; meningkatkan upaya perlindungan finless porpoise Sungai Yangtze di sana.
6. Menetapkan lebih banyak KP eks-situ; seperti KP yang akan menghubungkan sungai-sungai mati Tian-e-zhou dan Hei-wa-wu untuk memperluas wilayah perairan KP, dan menghubungkan sungai mati dengan aliran Sungai Yangtze dengan; Mengatur sungai mati Lao-wan sebagai KP eks-situ baru jika studi kelayakan menegaskan bahwa daerah tersebut memenuhi persyaratan sebagai sebuah kawasan lindung.

## SUNGAI MEKONG, KAMBOJA

Pengembangan perencanaan konservasi lumba-lumba dikoordinasikan oleh WWF Kamboja, Commission for Conservation and Development of Mekong River Dolphin Eco-tourism Zone (Dolphin Commission) and Fisheries Administration (FiA) yang meliputi enam komponen-komponen berikut:

1. Penelitian terfokus pada perkiraan jumlah dan penyebab kematian.
2. Penguatan penegakan larangan rengge di daerah perairan dalam lumba-lumba antara Kampi Pool (Kota Kratie, Propinsi Kratié, Kamboja) dan perbatasan Laos. Patroli secara rutin dan konsisten, termasuk pada malam hari, diperlukan untuk mengurangi penggunaan rengge dan jenis-jenis alat penangkapan ikan ilegal.
3. Pengembangan peraturan yang jelas, konsisten, dan terlaksana dan rencana aksi untuk melindungi lumba-lumba di Mekong oleh pemerintah Kamboja. Saat ini Dolphin Commission

should be the development and implementation of a transboundary agreement by the Cambodian and Lao governments to eliminate gillnet use at the Cheuteal pool on the border of Cambodia and Laos.

5. Education and outreach activities with villagers and government entities that will clearly explain the rationale for conservation of fisheries and dolphins and why regulations are needed to achieve this. Village meetings, presentations and messages on local, regional, and national media should be used. One of the most urgent messages to be made clear to the people of Cambodia by those involved in dolphin conservation is that the proposed construction of hydropower dams at Stung Treng and Sambor would have severe effects on the dolphin population, and possibly cause the extinction of the species in the Mekong.
6. Identify target areas for alternative livelihood development and support these activities with funds from the Cambodian government, and development partners. CRDT, Oxfam Australia, and other NGOs have the capacity to implement alternative livelihood projects. Also explore cost-effective alternative energy sources to improve the quality of life for local people, including biogas and solar power.

## AYEYARWADY RIVER, MYANMAR

1. Using existing PA management as a tool, expand to two other segments on the Ayeyarwady River that support Irrawaddy dolphin.
2. Strengthen existing fisheries rules and regulations in protected areas and use as a model throughout the country
3. Strengthen collaboration with other ministries to participate in Irrawaddy Dolphin Conservation Program such as Tourism.

berupaya menegakkan larangan gillnet yang tidak didukung oleh peraturan perikanan.

4. Legalisasi resmi kawasan konservasi di sekitar kolam yang dalam akan membantu untuk mempertahankan sumber daya perikanan dan membantu melindungi lumba-lumba. Prioritas seharusnya dikembangkan dan diimplementasikan sebuah perjanjian lintas batas oleh pemerintah Laos dan Kamboja untuk menghapus penggunaan gillnet di kolam Cheuteal di perbatasan Kamboja dan Laos.
5. Aktivitas pendidikan dan pendekatan penduduk desa dan instansi pemerintah diperlukan untuk menjelaskan alasan perlunya konservasi perikanan dan lumba-lumba dan mengapa peraturan yang diperlukan untuk mencapai hal tersebut. Pertemuan di desa-desa, presentasi dan penyampaian pesan melalui media lokal, regional, dan nasional perlu digunakan. Satu pesan yang paling mendesak harus dibuat jelas bagi rakyat Kamboja oleh mereka yang terlibat dalam konservasi lumba-lumba adalah bahwa pembangunan bendungan tenaga air yang diusulkan di Stung Treng dan Sambor akan memiliki efek besar pada populasi lumba-lumba, dan mungkin menyebabkan kepunahan spesies di Mekong.
6. Mengidentifikasi wilayah-wilayah sasaran untuk pengembangan mata pencaharian alternatif dan mendukung kegiatan ini dengan dana dari pemerintah Kamboja, dan mitra pembangunan. CRDT, Oxfam Australia, dan LSM lainnya memiliki kapasitas untuk melaksanakan proyek-proyek pengembangan mata pencaharian alternatif. Juga melakukan penyelidikan sumber energi alternatif hemat biaya untuk meningkatkan kualitas hidup masyarakat setempat, termasuk biogas dan tenaga surya.

## SUNGAI AYEYARWADY, MYANMAR

1. Menggunakan pengelolaan KP yang sudah ada sebagai sarana untuk memperluas di dua segmen lainnya di Sungai Ayeyarwady bagi lumba-lumba Irrawaddy.
2. Penguatan peraturan-peraturan perikanan yang telah ada di dalam kawasan perlindungan dan menerapkannya secara nasional.

## SUNDARBANS, BANGLADESH

1. A protected area network be declared under provision of the Bangladesh Wildlife Protection Act in channel segments of the Eastern Sundarbans Reserved Forest that are of particular biological importance, according to existing scientific assessments, for the Ganges dolphin. After similar scientific assessments have been undertaken, additional channel segments should be added to the network in the Western Sundarbans Reserved Forest that focus especially on protecting the Irrawaddy dolphin.
2. Based on ecological and socio-economic studies and in collaboration with local human communities and stakeholders, a comprehensive management plan be developed by the Bangladesh Forest Department, with technical assistance from relevant experts, for proposed protected area segments in the Eastern and Western Sundarbans Reserved Forests.
3. Management capacity be developed within the Forest Department for developing regulatory policies and implementing interventions, including monitoring and enforcement, in support of freshwater cetacean conservation within the proposed protected area network.
4. Efforts be made to include a larger assemblage of aquatic species (e.g., estuarine crocodile, oriental small-clawed otter) in protection efforts for freshwater cetaceans in the proposed protected area segments.
5. Recognizing that financial assistance will be needed to achieve effective conservation of freshwater cetaceans in the proposed protected area network for the Sundarbans, it is suggested that the Government of Bangladesh engage with international conservation organizations and multilaterals to raise funds in support of conservation management.
6. Acknowledging that the Sundarbans includes only a small portion of aquatic habitat in Bangladesh, additional waterways should be assessed (including dolphin surveys, ecological studies and investigations of human use) for possible future designation as protected areas for freshwater cetaceans.

3. Penguatan kerjasama dengan kementerian lainnya untuk berpartisipasi dalam Program Konservasi Lumba-lumba Irrawaddy seperti Kementerian Pariwisata.

## SUNDARBANS, BANGLADESH

1. Sebuah jaringan KP telah dinyatakan sesuai dengan ketentuan Undang-undang Perlindungan Satwa Liar Bangladesh di segmen saluran Hutan Lindung Sundarbans bagian Timur yang penting untuk biologis tertentu, menurut penilaian ilmiah yang ada, untuk lumba-lumba Gangga. Setelah penilaian ilmiah yang serupa dilakukan, segmen saluran tambahan harus diperluas di Hutan Lindung Sundarbans Barat yang difokuskan terutama untuk melindungi lumba-lumba Irrawaddy.
2. Berdasarkan studi ekologi dan sosial-ekonomi dan bekerjasama dengan masyarakat lokal dan stakeholders, rencana manajemen yang komprehensif dikembangkan oleh Departemen Kehutanan Bangladesh, dengan bantuan teknis dari pakar yang relevan, untuk diusulkan segmen kawasan lindung di Hutan Lindung Sundarbans Timur dan Barat.
3. Dikembangkan kapasitas pengelolaan oleh Departemen Kehutanan untuk mengembangkan kebijakan peraturan dan menerapkan intervensi, termasuk pemantauan dan penegakan, dalam mendukung konservasi cetacea air tawar dalam jaringan kawasan lindung yang sedang diusulkan.
4. Upaya dilakukan untuk mencakup kelompok yang lebih besar dari spesies air (misalnya, buaya muara, berang-berang kecil-bercakar oriental) dalam upaya perlindungan bagi cetacea air tawar di segmen daerah perlindungan yang diusulkan.
5. Menyadari bahwa bantuan pendanaan akan dibutuhkan untuk mencapai konservasi yang efektif bagi cetacea air tawar di jaringan area perlindungan yang diusulkan untuk Sundarbans, disarankan bahwa Pemerintah Bangladesh ikut terlibat dengan organisasi konservasi internasional dan multilateral untuk meningkatkan pendanaan guna mendukung pengelolaan konservasi.
6. Diketahui bahwa Sundarbans hanya mencakup sebagian kecil habitat perairan di Bangladesh, jalur perairan tambahan harus dinilai (termasuk

## INDIAN RIVER AND COASTAL LAGOON SYSTEMS

1. Having declared the river dolphin (meaning *Platanista gangetica*) as the National Aquatic Animal, the Indian government should complement this commendable action by setting up a national network of protected/conservation areas for river dolphins and associated aquatic fauna and consider initiating a National River Dolphin Project along the lines of Project Tiger, Project Elephant, Project Snow Leopard and Project Rhino. In doing so, the project should identify their present pattern of distribution and status in the context of their historical distribution in the Ganges and Brahmaputra systems, Indus tributaries, and coastal waters of India (including Sundarbans).
2. Develop a Species specific conservation/ Recovery Program (SRP) for river dolphins through a consultative process involving biologists, wildlife managers and other stakeholders.
3. Given that fishery interactions are the primary cause of river dolphin mortality, the Inland Fisheries Act needs to be reviewed and amended so that rules and regulations are in place making fisheries sustainable and reducing risks to dolphins and other aquatic wildlife.
4. Facilitate and support a range of research programs targeted at river dolphins in order to provide a scientific basis for conservation and management actions and capacity building.
5. Review existing management plans for dolphin supporting aquatic protected areas with the objective of including sub-plans specifically focusing on conservation action for river dolphins.
6. Consider the development of community-based river dolphin conservation areas where sustainable fisheries and dolphin conservation measures are promoted in an integrated manner with possible model planning, design and implement ecotourism projects focused on dolphin watching, with appropriate safeguards against disturbance (harassment). Such projects should incorporate education and awareness efforts and they should be promoted as a preferable alternative to dolphinariums.

survei lumba-lumba, studi ekologi dan investigasi penggunaan manusia) untuk penunjukan di masa depan sebagai kawasan lindung untuk cetacea air tawar.

## SUNGAI INDIA DAN SISTEM LAGOON PESISIR

1. Setelah menyatakan lumba-lumba sungai (berarti *Platanista gangetica*) sebagai Hewan Akuatik Nasional, pemerintah India harus melengkapi tindakan terpuji dengan mendirikan jaringan nasional kawasan perlindungan/konservasi untuk lumba-lumba sungai dan fauna akuatik terkait dan mulai mempertimbangkan sebuah Proyek Nasional Lumba-lumba Sungai seperti halnya Proyek Harimau, Proyek Gajah, Proyek Macan Putih dan Badak. Dengan demikian, proyek tersebut harus mengidentifikasi pola distribusi saat ini dan status dalam konteks historis distribusimereka di sistem Sungai Gangga dan Brahmaputra, anak sungai Indus, dan perairan pesisir India (termasuk Sundarbans).
2. Mengembangkan Program Konservasi Jenis Spesifik / Pemulihan (SRP) untuk lumba-lumba sungai melalui proses konsultasi yang melibatkan ahli biologi, pengelola satwa liar dan stakeholders lainnya.
3. Mengingat bahwa interaksi perikanan adalah penyebab utama kematian lumba-lumba sungai, UU Perikanan perlu ditinjau ulang dan diubah sehingga kebijakan dan peraturan berada pada tempat dimana pengelolaan perikanan akan berkelanjutan dan mengurangi risiko terhadap lumba-lumba dan satwa air lainnya.
4. Memfasilitasi dan mendukung berbagai program penelitian yang ditargetkan pada lumba-lumba sungai dalam rangka memberikan landasan ilmiah untuk konservasi, tindakan pengelolaan dan pembangunan kapasitas.
5. Peninjauan rencana pengelolaan yang ada guna mendukung tujuan kawasan lindung lumba-lumba air termasuk sub-perencanaan khusus terfokus pada tindakan konservasi untuk lumba-lumba sungai.
6. Pertimbangkan pembangunan berbasis masyarakat pada daerah konservasi lumba-lumba sungai di mana perikanan yang berkelanjutan dan tindakan konservasi lumba-lumba dipromosikan secara terpadu dengan kemungkinan model perencanaan, merancang dan melaksanakan

7. Design and implement a national awareness campaign on river dolphins through innovative media programs and establishment of interpretation and information centers in dolphin conservation/protected areas.

## INDUS RIVER, PAKISTAN

1. Establish PAs of the most threatened, potentially viable sub-populations of the Indus River Dolphin in Punjab and NWFP. Strengthen the management of all PAs through effective, integrated and multi stakeholder approach.
2. Strengthen the existing fisheries laws to support sustainable fisheries / dolphin conservation
3. Complete an approved management plan/ species section plan at the national level (Ministry of Environment), agreed upon by the provincial governments.

proyek ekowisata terfokus pada pengamatan lumba-lumba, dengan pengamanan yang tepat untuk mengatasi gangguan (pelecehan). Proyek tersebut harus mencakup upaya pendidikan dan kesadaran dan mereka harus dipromosikan sebagai alternatif yang lebih baik daripada dolphinariums.

7. Merancang dan melaksanakan kampanye kesadaran nasional pada lumba-lumba sungai melalui program media inovatif dan pembentukan interpretasi dan pusat-pusat informasi di kawasan lindung/ konservasi lumba-lumba.

## SUNGAI INDUS, PAKISTAN

1. Penetapan KP pada daerah-daerah yang memiliki sub populasi Lumba-lumba Sungai Indus yang paling terancam tapi kemungkinan tetap bisa bertahan di Punjab dan NWFP. Penguatan manajemen dari seluruh KP dilaksanakan melalui pendekatan yang efektif, terintegrasi dan multi stakeholder.
2. Penguatan peraturan perikanan yang sudah ada guna mendukung pengelolaan perikanan berkelanjutan / konservasi lumba-lumba
3. Legalisasi rencana pengelolaan / rencana aksi konservasi Lumba-lumba pada tingkat nasional (Menteri Lingkungan), disepakati oleh Pemerintah Propinsi.

## **5. INDIVIDUAL COUNTRY REPORTS**

### **REVIEW OF THE CONSERVATION STATUS AND ESTABLISHMENT OF PROTECTED AREAS FOR FRESHWATER CETACEANS IN ASIA**



# REVIEW OF THE CONSERVATION STATUS AND ESTABLISHMENT OF PROTECTED AREAS FOR THE IRRAWADDY DOLPHINS IN THE MAHAKAM RIVER, EAST KALIMANTAN, INDONESIA

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## Abstract

The freshwater Irrawaddy dolphin population or 'Pesut' in the Mahakam River is isolated from coastal populations through evolutionary separation events. This symbol species for East Kalimantan Province is protected in Indonesia and has been classified as "Critically Endangered" in 2000. Most recent population estimates from 2007 based on Petersen Mark-Recapture Analysis indicate a population size of 87 individuals (CV=9%; 95% CL = 75-105) and 91 individuals based on the total number of individuals identified during that year. The major threat involved direct mortality, which was largely caused by gillnet entanglement (64% of all deaths). Mean annual mortality between 1995 and 2009 was 3.5 dead dolphins per year. Other threats are habitat degradation through sedimentation, which is reducing the depth of lakes and reducing fish resources; noise pollution because of high-frequency boat propellers and high decibel producing tugboats and barges for coal transport; chemical pollution, mainly from coal and gold-cleaning waste; prey depletion due to illegal and unsustainable fishing methods (electro-fishing, poison and trawl, non-sustainable aqua-culture practices using fish breeds that feed on other fish). Dolphin core areas include the "Muara Pahu – Penyinggahan area" where 57% of the total number of 91 identified dolphins in 2007 were observed in this area, whereas in the second largest core area "the Pela/ Semayang –Muara Kaman area" 46% of the total identified dolphins was observed. The first core area obtained official protected status at district level in 2009 and encompasses 4100 ha of river, tributary and freshwater swamp habitat. Regulations still need to be legalized. Multi-stakeholder workshops and community assessment surveys were conducted several times in the core areas to assess community opinions towards area and dolphin protection and community needs. Environmental education courses were implemented at a combined total of fifty-five high- and elementary schools in the Middle Mahakam. Sustainable aqua-culture (using herbivorous fish species) support is being provided to sixty fishermen in the protected area that subsist on gillnetting to reduce fish pressure and dolphin entanglements. Mitigation of unsustainable fishing techniques and pollution reduction (due to chemical waste and boat noise) remains an important component for the survival of this critically endangered freshwater dolphin population.

## Abstrak

Populasi lumba-lumba Irrawaddy atau 'Pesut' di Sungai Mahakam terisolasi dari populasi pesisir melalui peristiwa pemisahan secara evolusi. Satwa lambang Propinsi Kalimantan Timur ini dilindungi di Indonesia dan telah dikategorikan sebagai "Sangat Terancam Punah" pada tahun 2000. Perkiraan jumlah populasi terakhir pada tahun 2007 berdasarkan Analisa Penandaan-Penangkapan Ulang Petersen adalah 87 individu (CV=9%; 95% CL=75-105) dan 91 individu berdasarkan jumlah total individu yang berhasil diidentifikasi selama tahun tersebut. Ancaman terbesar adalah kematian langsung, yang sebagian besar disebabkan terjerat rengege (64% dari seluruh kematian). Rata-rata angka kematian tahunan antara 1995 dan 2007 adalah 3.5 ekor lumba-lumba per tahun. Ancaman lain berupa penurunan kualitas habitat akibat sedimentasi, yang mengurangi kedalaman danau dan sumber daya ikan; polusi suara dari baling-baling kapal yang berkecepatan tinggi serta kapal penarik ponton yang mengeluarkan suara berdesibel tinggi; polusi bahan kimia, terutama dari limbah pencucian batubara dan emas serta perkebunan dalam skala besar seperti kelapa sawit; penurunan jumlah ikan karena metode penangkapan yang ilegal dan tidak berkelanjutan (setrum, racun dan trawl, praktek keramba ikan predator). Habitat inti lumba-lumba adalah "daerah Muara Pahu – Penyinggahan" dimana 57% dari jumlah total 91 lumba-lumba yang teridentifikasi pada tahun 2007 terlihat di daerah ini, sedangkan di habitat inti kedua "daerah Pela/ Semayang –Muara Kaman" terlihat 46% dari jumlah total lumba-lumba yang teridentifikasi. Habitat inti pertama yang mencakup habitat sungai, anak sungai dan rawa air tawar seluas 4100 ha, telah memperoleh status perlindungan resmi dari tingkat kabupaten pada tahun 2009. Peraturan untuk kawasan ini masih dalam proses legalisasi. Lokakarya berbagai pihak stakeholder dan survei wawancara dilakukan beberapa kali di habitat inti untuk mengetahui pendapat masyarakat mengenai perlindungan lumba-lumba dan daerah yang bersangkutan serta kebutuhan dari masyarakat. Pendidikan lingkungan dilaksanakan di lima puluh lima sekolah dasar dan lanjutan di Daerah Mahakam Tengah. Program keramba lestari (menggunakan jenis ikan herbivora) diberikan kepada enam puluh nelayan dalam kawasan perlindungan yang biasanya mencari nafkah dengan merengge, untuk mengurangi tekanan terhadap perikanan dan kematian lumba-lumba karena terjerat rengege. Mencegah teknik penangkapan ikan yang tidak berkelanjutan dan mengurangi polusi (akibat limbah bahan kimia dan suara kapal), merupakan komponen penting bagi kelangsungan hidup populasi Pesut Mahakam.

## Overview of the Mahakam River system

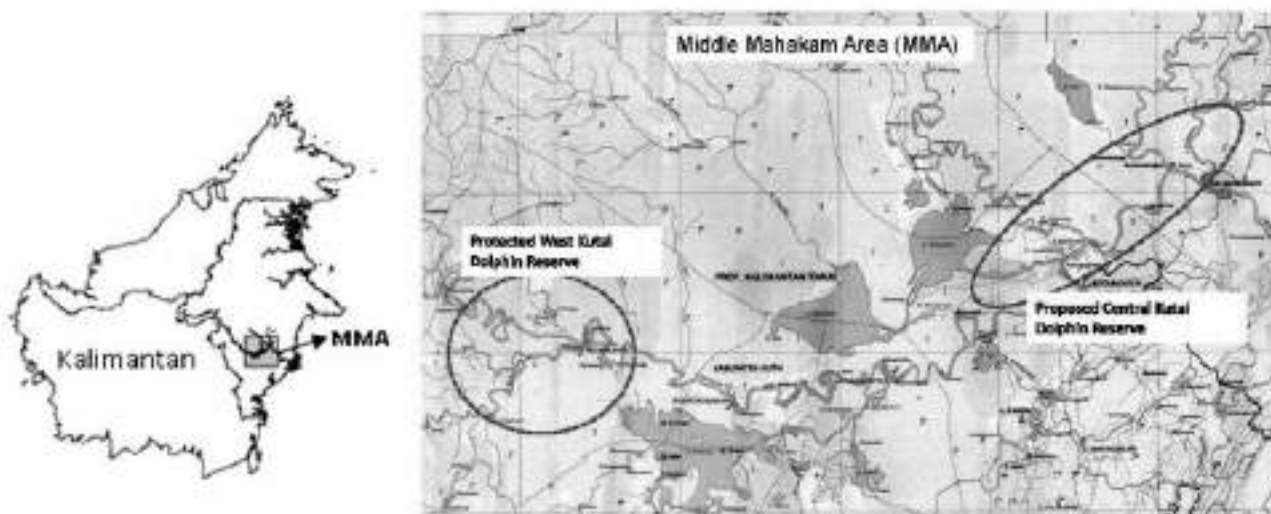
The Mahakam River is one of the major river systems of Indonesia and is located in East Kalimantan in the Sundaland ecoregion. The river is 910 km in length and can be up to 30 m deep. It originates in the Müller Mountains on the border of West Kalimantan. The total catchment area is 9,700,000 ha. The Middle Mahakam Area (MMA), which is situated between 180 and 350 km from the mouth, encompasses an average area size of 8,100 km<sup>2</sup> and represents the main dolphin distribution area (Figure 1). It is one of Kalimantan's largest wetland areas, is a natural floodplain and includes three major lakes, Jempang (averaging 150 km<sup>2</sup>), Semayang (averaging 130 km<sup>2</sup>) and Melintang (averaging 110 km<sup>2</sup>) with a maximum total water surface for the three lakes combined reaching 600 km<sup>2</sup> at high water levels, and c. 32 minor lakes (each varying between 0.1 – 20 km<sup>2</sup> in size), and extensive peat and freshwater swamps. The large lakes have both in and outwards water flow from and to the Mahakam and its connecting freshwater swamps and tributaries. Due to seasonal fluctuations in water levels, water depth in these lakes can reach zero except for a few deeper passages (Gönner, 2000). The lakes are surrounded by freshwater swamp forests, peat swamp forests and lowland dipterocarp rain forests. Vast swamp forests were severely affected by forest fires in 1998. On a landscape level, the wetland areas play an important role in the natural water regulation of the Mahakam River. The lakes and freshwater swamps

are very important fish-spawning grounds, seasonally replenishing fish stocks in the main river.

In 2005, the human population of East Kalimantan Province consisted of slightly less than 3 million inhabitants with a density of 11 residents per km<sup>2</sup> (2008, BPS). The Mahakam River flows through two districts: West Kutai (157,847 inhabitants) and Central Kutai (518,722 inhabitants). Major cultural ethnic groups include Kutai, Banjarese, Bugis, Java and Dayak, whereas the latter tribe is most prevalent in West Kutai District.

Industrial and agricultural activities in the MMA include fisheries, small-scale agriculture (wet and dry paddy, crops, forest products gathering) but also large-scale oil-palm industries, coal- and gold mining, and forestry. The area is intensively fished in Central Kutai district, to which most of the MMA belongs, with a 2006 annual catch of at least 12,000 metric tons of fish. In addition, about 8,000 tons of fish are harvested annually from floating cages (aqua-culture) for domestic and international trade (Fisheries Department, 2007). In 2002, fish catch was as high as 16,500 tons and breeding cage production was about 11,000 tons (Fisheries Department, 2003), indicating a recent decrease of about 1,000 tons/year and 1,500 tons/year, respectively. In the lake villages there are about 6,700 year-round fishermen and about 2,600 seasonal fishermen (Fisheries Department, 2002). During the dry season the seasonal fishermen alternate fishing with agricultural activities.

**Figure 1:** Proposed and protected dolphin areas in the Middle Mahakam Area in East Kalimantan, Indonesia



The MMA is a crucial breeding and migration site for 90 waterbird species, including important breeding populations of various herons and the lesser adjutant stork (*Leptoptilos javanicus*). A total of 298 bird species have been identified in this area of which 70 are protected by national law (UU RI No. 5, 1990) and five are endemic to Kalimantan (Budiono *et al.*, 2007). In addition, high fish diversity, the occurrence of false gavia and Siamese crocodiles, and the presence of rare and/or endangered species including proboscis monkeys, hairy-nosed otters, wild banteng, false gavials and Siamese crocodiles, and a critically endangered population of Irrawaddy dolphins, highlight the conservation significance and the importance of protecting habitat and species in this area.

### **Summary of population status and distribution of Irrawaddy dolphins in the Mahakam River**

The Irrawaddy dolphin population in the Mahakam River is the only obligate or true freshwater dolphin population in Indonesia. An analysis of tissues samples from 6 individuals indicated that the population has two unique genetic haplo-types compared to the coastal Irrawaddy dolphins in Northeast Kalimantan (Malinau), Thailand and Philippines (Robertson, 2009). The species is protected in Indonesia under national law (UU RI No. 5, 1990) and has been adopted as the symbol of East Kalimantan. Based on the results of the ongoing research program (Pesut Mahakam Conservation Program) it has been classified as "Critically Endangered" on the Red List since 2000 (Hilton-Taylor, 2000; Jefferson *et al.*, 2008).

Based on the most recent 2007 surveys, the Mahakam population was estimated at 87 individuals (CV=9%; 95% CL = 75-105). This estimate was determined using Petersen Mark-Recapture Analysis of photo-identified individuals (Kreb, *et al.*, 2007). Direct counts based on the total number of dolphins identified during both abundance monitoring surveys as well as opportunistic photo-identification of dolphins during site visits in 2007 estimated the population in 2007 at 91 individuals.

Their main distribution is in a section of c. 200 km in length, beginning at c. 180 km from the mouth until c. 380 km from the mouth. Dolphins show a preference for confluence areas where channels or tributaries intersect in the main river, and they are also found in lakes and tributaries.

Their total maximum range extends from 90 km upstream of the coast to c. 600 km upstream at rapids in Ratah River and major rapids upstream of Long Bagun.

Their long-term persistence is very uncertain due to the low number of dolphins in the Mahakam River and demographic data which shows a precarious balance of mortality and birth rates. Mean annual mortality based on interviews, reports and own observations between 1995 and 2009 was four (3.5) deaths per year (= 4% of a total estimated population of 87 dolphins), with 53 dolphins dying in this period. Most dead dolphins involved adults (76%), then juveniles (14%) and newborn calves (10%).

Between 1999 and 2002, 5-6 calves were born per year based on actual observations of three-monthly recurring surveys (Kreb and Budiono, 2005). However, abundance surveys conducted in 2005 and 2007 were only performed during the dry season and not spread throughout the year, so the number of newborns per year for 2005 and 2007 are not known. If the numbers would be more or less similar, then this would imply a birth rate of c. 6-7% of the total estimated population of 87 dolphins.

No obvious trend in abundance was found between the 2005 and 2007 survey, whereas these surveys cannot be compared to the 1999-2002 surveys because of differences in survey methods. Nevertheless, during the 2007 survey there were some shifts in relative occupancy of the core areas within the range. Both core areas identified between 1999 and 2002 maintained its importance over years or even became increasingly important. In the "Muara Pahu – Penyinggahan sub-districts area" 57% (52 dolphins) of the total number of 91 identified dolphins were still encountered in 2007. In the second largest core area "the Pela/ Semayang – Muara Kaman area" 46% (42 dolphins) of the total identified dolphins were observed in 2007. This area even became more important than before since the percentage of the total population found in this sub-population was substantially larger than in 2005, when only 28% of the total identified population occurred in this section.

### **Past and ongoing conservation initiatives/ programs for dolphin conservation**

Significant data on Irrawaddy dolphins in the Mahakam were collected during a two-month

preliminary study in 1997 and during a 3.5 years intensive Ph.D. research effort from early 1999 until mid 2002. Prior to this work there was an almost total absence of knowledge on the status of the freshwater Irrawaddy dolphin population in the Mahakam River and of the coastal Irrawaddy dolphins in East Kalimantan, Indonesia. Follow-up monitoring surveys were repeated in 2005 and 2007 by Yayasan Konservasi RASI in cooperation with the East Kalimantan Nature Conservancy Agency (BKSDA) to estimate total abundance and investigate mortality and threats. The research focused in particular on their abundance, population dynamics, and threats and a comparison of their social structures, acoustic behaviours and the degree of separation was made between coastal and freshwater Irrawaddy dolphins (Kreb, 2004; Kreb and Budiono, 2005).

Conservation work started as soon as research data on estimated and preferred dolphin areas became available. In 1999, a first effort, in cooperation with the East Kalimantan Nature Conservation Agency (Forestry department), involved raising public awareness of the protected status of the dolphins over the entire length of the river through information by disseminating information to all the heads of villages. In 2000, a local NGO, Yayasan Konservasi RASI (Conservation Foundation for Rare Aquatic Species of Indonesia) was established with the initial aim of protecting the dolphins and their habitat. RASI activities to date include, 1) dolphin population monitoring; 2) delineation of important dolphin sites; 3) environmental awareness programs for the general public and target groups, i.e., elementary and high-school children, fishermen, government officials, and companies; 4) developing environmental education school packages for junior and senior high schools and elementary schools in regular or extra-curricular courses; 5) socio-economic surveys and assessment of attitudes towards dolphin conservation in fishing communities; 6) workshops to train fishermen in safe techniques to release dolphins from fishing nets and in sustainable fishing techniques; 7) familiarizing fishermen with sustainable aqua-culture and establishing sustainable fishermen cooperatives which are financially supported to engage in sustainable aqua-culture; 8) establishment of a Mahakam Information Center in the major dolphin core area of Muara Pahu to inform residents and tourists about the importance of this dolphin site and to build local (governmental) interest; and 9)

multi-stakeholder workshops to discuss and endorse the establishment of two protected areas for dolphins and important fish spawning areas in West and Central Kutai and to develop regulations;

In addition, the Environmental Departments (BLH) in both West and Central Kutai districts conducted workshops to build the awareness of communities in the proposed dolphin protected areas of the dolphins and with new conservation measures.

### **Locations, size and management of planned or existing protected areas**

The first officially protected area for the Mahakam dolphins is the 'Kawasan Pelestarian Alam Habitat Pesut Mahakam, Muara Pahu, Kutai Barat' or the 'Natural Reserve Habitat Pesut Mahakam, Muara Pahu, West Kutai District'. A formal decision on the establishment and protected status was taken by the regent of West Kutai: SK: 522.5.51/ K. 471/2009. The Government Department assigned to coordinate management and work with the communities is the Environmental Department (Badan Lingkungan Hidup) of West Kutai District and Yayasan Konservasi RASI is the collaborating NGO. Detailed district regulations for the PA are still being finalized.

This protected area encompasses core dolphin habitat in a 36-km section of the main river between Tepian Ulak and Rambayan and c. 22 km of the Kedang Pahu River between Muara Pahu and Muara Jelau. The area also includes 23 km of protected tributary systems (Baroh and Beloan) and freshwater and peat swamp forest habitat (with between 150-500m wide protected riparian forest strips), that is not frequented by dolphins but represents important fish spawning habitat and directly supports the fish stock for the dolphin area. The total size of the PA is 4,100 ha. A 27 km buffer zone downstream of Tepian Ulak until Penyinggahan was proposed by the local government and supported by the local community but this is not yet officially designated.

The second proposed protected area is the 'Natural Reserve Habitat Pesut Mahakam in Central Kutai District', which comprises the following: a 27-km section of the main river between Pela and Muara Kaman, a section 17 km upstream of the Kedang Rantau River to Sebintulung, a section of 7 km upstream of the Kedang Kepala River to Muara Siran, the 4-km long Pela tributary and its connecting

confluence with Semayang Lake (2 km radius), and the 12.5 km long, deep-water channel (200 m width) in southern Semayang lake, that leads to Melintang Lake.

For both PAs, the general objectives are the following:

1. Establishment of community-supported protected areas for the freshwater dolphin Pesut Mahakam, *Orcaella brevirostris* to provide efficient habitat protection by implementing habitat quality improving measures by reducing chemical and noise pollution and reducing mortality risks caused by gillnet entanglement and vessel strikes.
2. Protection of fish resources through sustainable fishing methods and law enforcement of illegal fishing practices with the aim to protect prey resources of the Pesut Mahakam and sustain economic livelihoods of local fishing communities.
3. Riparian forest protection and rehabilitation within the protected area with the aim to reduce erosion and sedimentation, to protect fish spawning areas, fishery sources (tree seeds and fruits providing food for fishes), other protected species, and ecotourism potential.
4. Raising environmental awareness of local communities, government and other stakeholders for sustainable use of its natural environment and its resources and commitment for freshwater dolphin conservation.

The proposed regulations and policies for both areas focus on sustainable fisheries (no electro-fishing or poison-fishing, facilitating sustainable aqua-culture forms and establishing gillnet regulations to reduce the risk of dolphin entanglement (nets must be set parallel to shore in locations near and visible to residents, not set at night and regular net checks required, net mesh size >4cm <10 cm, and, and reimbursement for net damage when dolphins are safely removed after gillnet entanglement). The regulations and policies address the mitigation of noise and chemical pollution by restricting coal barge transport in narrow tributaries, requiring reduced speed in confluence areas (max. 15 km/hr), promoting monitoring of water quality and safe disposal of company waste products. There is provision under the regulations for riparian forest protection and rehabilitation, protection of fish spawning areas,

active law-enforcement, and monitoring of the dolphin population and the threats to it.

With regards to law enforcement and monitoring, RASI envisions that weekly night patrols will be carried out by local task force teams as part of the *perangkat desa*, a kind of civil task force appointed by village heads who have the authority to detain people engaged in illegal activities and bring them to the local police. These teams may consist of 3-4 people who police illegal fishing activities and will be the coordination point for local fishermen to report unusual events and potentially dangerous situations for the dolphins (i.e., dangerously placed gillnets). They could provide updates of dolphin occurrence throughout the range, including in flooded swamp lakes where animals have been trapped in the past when lakes have dried out.

### **Threats to freshwater cetaceans in planned or existing protected areas or project conservation areas**

#### *Direct mortality*

The major threat to Mahakam Irrawaddy dolphins is direct mortality from gillnet entanglement (64% of deaths with known causes (N=48) documented through interviews and direct observations between 1995 and 2009. Mean and median annual mortality is 3.5 and 3 dolphins per year. The majority of dead dolphins were adults (74%), 14% were juveniles and 10% were newborn calves. Most dolphins died as a result of entanglement in gillnets with mesh sizes of 10 –17.5 cm. The close association of fishermen and dolphins increases the potential for entanglement. Dolphins are often observed feeding in close proximity to nets and many fishermen use the dolphins' feeding patterns as indicators of the location and time to set gillnets. Dolphins are reported to aid fishermen by guiding fish into their nets. In turn, fishermen reported that on several occasions they had successfully released dolphins from gillnets. But at least five dolphins accidentally killed in gillnets were eaten and the skin of two of them were used as skin allergy medicine.

Vessel strikes, all, except for one adult, involving juvenile dolphins, accounted for 9% of mortalities. Neonatal mortality and deliberate kills each accounted for 6% of the documented deaths, the latter occurring mostly in isolated areas where the dolphins were rarely found. Four percent of

deaths occurred after being trapped in shallow water, whereas electro-fishing and long-line fishing (*rawai*) accounted each for 2% of deaths.

Factors that degrade dolphin habitat and thereby present an indirect threat to the animals include 1) sedimentation that is reducing the depth of lakes and reducing fish resources, 2) high frequency noise pollution generated by boat propellers and high decibel noise from tugboats and barges used for coal transport, 3) chemical pollution, mainly from coal and gold-cleaning waste, and 4) prey depletion from illegal and unsustainable fishing methods (electro-fishing, poison and trawl) and over-fishing to support unsustainable aquaculture practices (breeding of fish that feed on other fish). These are detailed below:

#### *Sedimentation*

A recent range decline involves the disappearance of the dolphin from Jempang Lake since the mid-1990's, probably due to a reduction in the depth of the lake from sedimentation caused by deforestation of the watershed. High densities of gillnets and sedimentation have also restricted the possibility of movements into the other two lakes, Melintang and Semayang. Except during high water levels dolphins are now confined to a narrow boat channel between the lakes where there is a high risk of vessel collision and noise pollution impacts.

#### *Noise pollution*

The main source of noise pollution is high-speed vessels (40-200 hp) (mean = 4.6 boats/ h in dolphin habitat). Dolphins dive for significantly longer periods when the boats are within 300 m of them (Kreb & Rahadi, 2004). In addition, frequent passing of fast moving motorized canoes with long propeller sticks (max 26 hp) also caused dolphins in the Pela River to dive longer. Container barges pass daily (mean = 8.4 boats per day) through primary dolphin habitat on the Kedang Pahu River, a narrow tributary of the Mahakam. These vessels take up over two-thirds of the width of the river and over half the depth of the tributary during the dry season. Dolphins always changed their direction (if swimming upstream) when they encountered loaded container barges. During low water periods they actively avoided the tributary, whereas before the presence of container barges dolphins entered the tributary while moving upstream to the Bolowan confluence (c. 10 km from the Kedang Pahu mouth) at all water levels according to information from

local fishermen. A new type of self-propelled oceanic carrier ship is now also being used to carry coal directly from the mining company at Muara Bunyut (near Melak). This raises considerable concern about the tremendous amount of underwater noise pollution produced by these ships in such a restricted water body, as well as the effect of these ships in increasing the channelization of the river bed.

#### *Chemical pollution*

Mercury and cyanide are introduced into the river from leaks in dams that retain wastes from large-scale gold mining operations and from small-scale illegal operations operating along the river. Accidental dumping of coal dust occurs frequently and this may have caused changes in the skin pigment of dolphins in this area observed in 2002 and 2007. In other areas such pigmentation changes have never been observed. In addition, coal cleaning waste enters the larger tributaries and lakes through the connecting narrow streams at high water periods. Pesticides from oilpalm plantations along river systems also form an unmonitored threat.

#### *Prey depletion*

Intensive fishing with gillnets, electricity, trawls (especially in the lakes), poison (Dupon/Lamet, Deses, Gadong's root) and aqua-culture of fish that are being fed with small fishes, which are directly caught from the lakes or river, has probably contributed to the significant decline of natural fish resources (Fisheries Department, 2007). This prey depletion may also be affecting the time and energy the dolphins have to spend finding prey. Logging of riparian forest also reduces fish resources. It increases water temperature and sedimentation and reduces the amount of detritus, which is food for fish. Decreased fish densities may increase dolphin presence at gillnets. Conversion of swamp forests to oil palm concessions, a widespread practice in the region, also severely reduces fish spawning areas.

### **Trends in dolphin abundance, natality or mortality due to conservation measures taken in planned or existing or existing protected areas or special conservation areas**

In Central Kutai, in the area of Muara Kaman-Kedang Rantau River, dolphin abundance has increased and unprecedented large group sizes were observed in

August and September of 2007. Because of the presence of a patrolling post at the confluence of main river and the Rantau River electro-fishing and illegal logging is reduced and it is possible fish resources may have increased attracting more dolphins.

With regards to mortality, regression analysis showed a significant decrease in minimum mortality detected in time ( $b = -0.410$ ,  $df = 13$ ,  $t = -3.89$ ,  $p < 0.001$ ) (Figure 2). Mean mortality between 1995 and 2001 was five (5.4) dolphins per year, whereas between 2002 and 2009 mean annual mortality was two (2.1) dolphins per year. This may represent a real reduction because there is no reason to expect a change in detection of dead animals. Dead dolphins are not usually buried and stranded animals are easily detected by villagers along the river. In addition, information about dolphins that have died in one area, especially due to human activities such as gillnetting, rarely remain a secret as the information spreads quickly by word of mouth and is picked up during the informal interviews held in most villages along the study area. Dead calves may possibly be less conspicuous than adults. This may explain the low number of calf mortalities detected in all years since 1995. Two new causes of death have recently been added to the list of threats; electro-fishing and long-line-fishing. Although these practices are still sporadic, a strong effort is needed to raise awareness of, and alleviate the threat of these new threats.

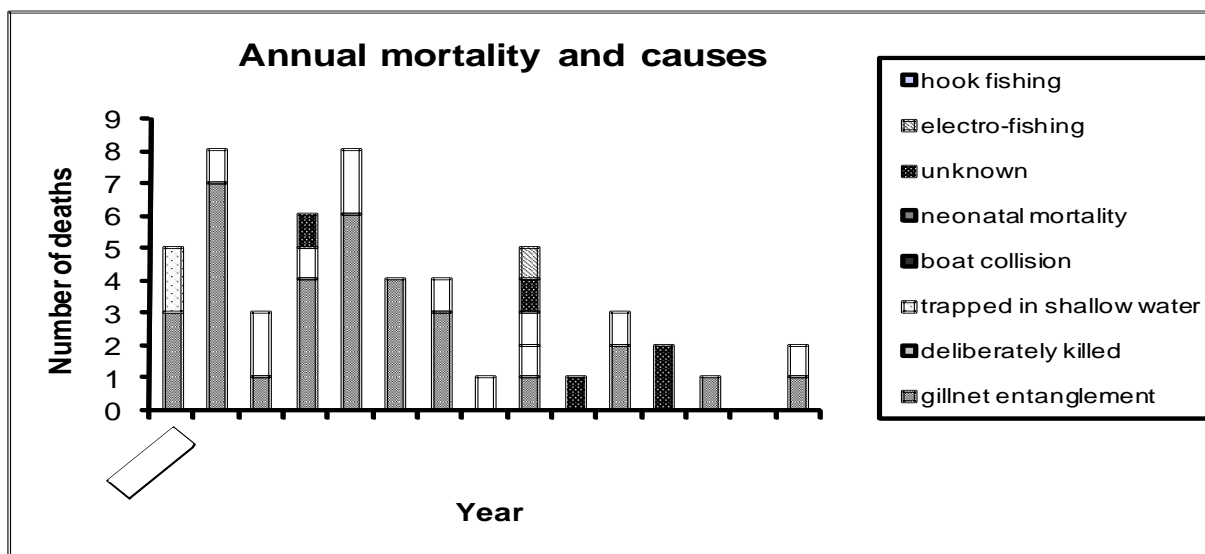
### Needs for establishing new protected areas

In addition to the currently protected and proposed dolphin protected areas in West and Central Kutai districts, there is a need to identify, demarcate and protect fish spawning areas. Existing fish reserves such as Loa Kang and Batu Bumbun (Central Kutai) should be more intensively patrolled. Proposed fish spawning areas include the Sebintulung River and swamp area in Central Kutai.

### Other species that will benefit from planned or existing protected areas or special conservation areas?

In the Muara Pahu PA sub-district, at least 37 bird species occur in the riparian forest. Seventeen of these are protected. In addition, proboscis monkey, long-tailed macaque, silvered and maroon langurs, smooth-coated and hairy-nosed otters, and the endemic Bornean monitor lizard also share the river or riparian forest habitat and will benefit from protection. Most significantly, protecting the fish spawning areas and riparian forest in the dolphin protected areas will benefit fish resources used by the dolphins, other wildlife species, and human communities along the river.

Figure 2. Recorded mortalities and causes shown in time



## What are the benefits for local communities in the planned or existing protected areas or special conservation areas?

The following benefits for local communities are being and will be derived from conservation efforts within the PAs:

- Income benefits through introduction of sustainable aqua-culture techniques. At least 60 fishermen in Muara Pahu sub-district are directly benefiting from two fish cages, 800 fish spawn and 240 kg of pellets provided by RASI to implement a pilot aquaculture project. The costs for the cages, which are provided rent free, are to be returned after two years by which time it is hoped that the users will have learned and earned some profit to continue with sustainable aqua-culture. If the project is successful, it is hoped that more fishermen will implement sustainable aqua-culture practices and that similar support will be provided by the local government.
- Preservation of natural fish resources through sustainable fishing methods; protection of fish spawning areas to increase fish resources; improved water quality through reduced sedimentation and pollution; and reforestation of riparian shade trees increasing fish resources.
- Preservation of local communities' cultural/natural heritage. The pesut in general is well-liked by the local communities and local legends on their origin exist as well as numerous anecdotes on human-dolphin interactions. Interviews (n=258) conducted in the PA indicated that 41% of the local people mentioned 'entertainment' as derived benefit from the dolphin's presence. Also, at the provincial and national level much interest exists to preserve the Mahakam dolphins and regular local and national media articles have been released on their decline. Most recently, concerned youngsters in Kalimantan have set up an internet site to share their concern on the pesut with others and the total number of members has now reached over 14,500.
- Other derived benefits from the dolphins' presence, experienced by 38% of fishermen (n =258) that have been interviewed, include the fact that dolphins aid them with fishing by indicating fish seasons and locations, indicating prolonged low and high water levels and drive fish into fishermen's nets.

## Acknowledgements

We would like to thank all sponsors of the workshop, i.e. the Marine Mammal Commission, Ocean Park Conservation Foundation Hong Kong, the People's Trust for Endangered Species, West Kutai District Government and Mining Department, PT. Pupuk Kaltim, the Provincial Public Works and all individual donators, for their contribution that allowed us to participate in the workshop and present the results in this paper. We also thank all sponsors, who have contributed to research on the Mahakam dolphins since 1999 and in particular the Ursula Merz Foundation and Global Nature Fund, which funded the 2007 survey of which most results are presented here.

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# REVIEW OF THE CONSERVATION AND PROTECTED AREAS ESTABLISHED FOR THE BAIJI, *LIPOTES VEXILLIFER*, AND THE FINLESS PORPOISE, *NEOPHOCAENA PHOCAENOIDES*, IN THE YANGTZE RIVER, CHINA

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## Abstract

The Yangtze River is home to two endemic cetaceans, the baiji or Yangtze River dolphin (*Lipotes vexillifer*) and Yangtze finless porpoise (*Neophocaena phocaenoides asiaeorientalis*). Both cetaceans have suffered great declines in abundance and range contractions during at least the last three decades. The baiji was declared likely extinct in 2006 because an extensive survey conducted by an international team of scientists throughout its range failed to sight a single animal. The present abundance estimate of the Yangtze finless porpoise, based on the data collected in the 2006 survey, is approximately 1,800. When compared to historical estimates, this indicates that more than half of the population has vanished since 1991 in the main river. The main threats to both species include over- and illegal fishing, heavy boat traffic, water development, and pollution. We provide an analysis of the effectiveness of our conservation efforts (*in situ*, *ex situ* and captive breeding) over the last three decades and make suggestions for the future protection of Yangtze finless porpoises (and baiji if any individuals of the species survive). The latter include effective enforcement of a ban on fishing in the river or at least in the current reserves, expansion of the current Tian-e-Zhou Oxbow Reserve, establishment of new similar *ex situ* reserves, and an intensified captive breeding program.

## Abstrak

Sungai Yangtze merupakan tempat tinggal bagi dua cetacea endemik, baiji atau lumba-lumba Sungai Yangtze (*Lipotes vexillifer*) dan finless porpoise Yangtze (*Neophocaena phocaenoides asiaeorientalis*). Kedua jenis cetacea tersebut telah mengalami penurunan populasi yang drastis dan penyusutan wilayah jelajah paling tidak selama tiga dekade terakhir. Baiji dinyatakan kemungkinan besar telah punah pada 2006 karena tidak terlihat seekor lumba-lumba pun selama survei ekstensif yang dilaksanakan oleh tim ilmuwan internasional di seluruh wilayah jelajahnya. Jumlah populasi finless porpoise Yangtze terakhir, berdasarkan data yang dikumpulkan selama survei pada 2006, diperkirakan 1.800 ekor. Dibandingkan dengan perkiraan jumlah populasi terdahulu, lebih dari setengah populasi di sungai utama telah menghilang sejak 1991. Ancaman utama bagi kedua jenis mencakup penangkapan ikan secara berlebihan dan ilegal, lalu lintas kapal yang padat, pembangunan bendungan, dan polusi. Kami membuat analisa mengenai efektivitas usaha konservasi yang kami lakukan (*in situ*, *ex situ* dan penangkaran) selama tiga dekade terakhir dan berbagai saran untuk perlindungan yang akan datang untuk finless porpoise Yangtze (dan baiji jika ada individu yang masih bertahan). Saran-saran tersebut antara lain pelaksanaan pelarangan penangkapan ikan di sungai atau paling tidak di kawasan perlindungan yang ada saat ini, perluasan Kawasan Perlindungan Oxbow Tian-e-Zhou, pembentukan kawasan perlindungan *ex situ* baru yang sama, dan sebuah program penangkaran yang intensif.

## Overview of the Yangtze River system

The Yangtze River is approximately 6,300 km long with about 700 tributaries and it passes through 11 provinces along its course. It is the largest river in China and the third largest river worldwide, called *Chang Jiang*, the long river, by most Chinese. The river rises in the far west of China and flows through the heart of the country before discharging its water into the East China Sea at Shanghai. The Yangtze is regarded as the geographical and cultural dividing line between the north and south of China. It is divided into three sections according to its geographic features: the upper reaches from the source in Qinghai Province to Yichang in Hubei Province (c. 4,400 km), the middle reaches from Yichang to Hukou at the mouth of Poyang Lake in Jiangxi Province (c. 1,000 km), and the lower reaches from Hukou to the estuary at Shanghai (c. 900 km).

The Yangtze River basin, according to current statistics, produces 40 % of the national grain production (including 70 % of rice), 33% of the cotton, 48 % of the freshwater fish, and 40 % of the gross value of the country's industrial output. The system's hydroelectric energy potential is enormous; the Three Gorges Dam is the largest hydroelectric project in the world. Because of the richness of its natural resources, the Yangtze River basin is the most densely populated area in China, accommodating approximately 40% of the human population. More than 1,100 aquatic species used to be found in the Yangtze, including more than 370 fish species, 200 benthic animals, and hundreds of aquatic plants (Li, 2008). There is one endemic cetacean species in the Yangtze River, the baiji or Yangtze River dolphin (*Lipotes vexillifer*), although it may be extinct, and another endemic subspecies, the Yangtze finless porpoise (*Neophocaena phocaenoides asiaeorientalis*) (Wang *et al.*, 2000). The Yangtze River has the highest biodiversity of any freshwater ecosystem in China. However, due to the intensifying impacts of human activities, such as hydro-project construction, pollution, transportation, and over-fishing, the diversity of aquatic wildlife in the river has declined significantly in the past several decades.

## Summary of population status and distribution of the Yangtze cetaceans

Both the baiji and the Yangtze finless porpoise live (or lived in the case of the baiji) in the middle and lower reaches of the river from Yichang to Shanghai and in two appended lakes, Poyang and Dongting (Fig. 1). The baiji was also once found in the Qiantang River but disappeared from there in the 1950s (Zhou *et al.*, 1977) (Fig. 1). As both species are at the top of the food web, their survival depends on habitat stability and food resource availability. However, the Yangtze River, the so called "Golden Channel of the Country," has been heavily used and explored for all kinds of human activities, and this has led to the likely extinction of the baiji (Turvey *et al.*, 2007). Meanwhile, the Yangtze finless porpoise has suffered a rapid decline and is listed in the Second Order of Protected Animals in China. It has been redlisted by IUCN as an endangered subpopulation since 1996 (Baillie and Groombridge, 1996).

As the sole living representative of the Lipotidae, a family that diverged from other cetaceans more than 20 million years ago (mya) (Nikaido *et al.*, 2001), the baiji has long been considered "Critically Endangered" (Reeves *et al.*, 2003; Dudgeon, 2005). The first systematic modern surveys of baiji were carried out during the late 1970s and early 1980s, and provided the first estimate of population size, c. 300-400 throughout the range (Zhou, 1982; Lin *et al.*, 1985; Chen and Hua 1987, 1989), with about 100 in the downstream section from Hukou to Shanghai (Zhou and Li, 1989) in 1980s (Fig. 1). Subsequent surveys described a consistent and rapid decline: c. 200 in 1990 (Chen *et al.*, 1993), fewer than 100 in 1995 (Liu *et al.*, 1996) and none in 2006 (Turvey *et al.*, 2007). It is now concluded that the baiji is functionally extinct (Turvey *et al.*, 2007). At least two unsubstantiated baiji sightings were reported in the Tongling section of the Yangtze since the 2006 survey, one in 2007 and another in 2009. Although there is still a small possibility that one or a few baiji remain somewhere in the Yangtze, there may be no hope of saving this species.

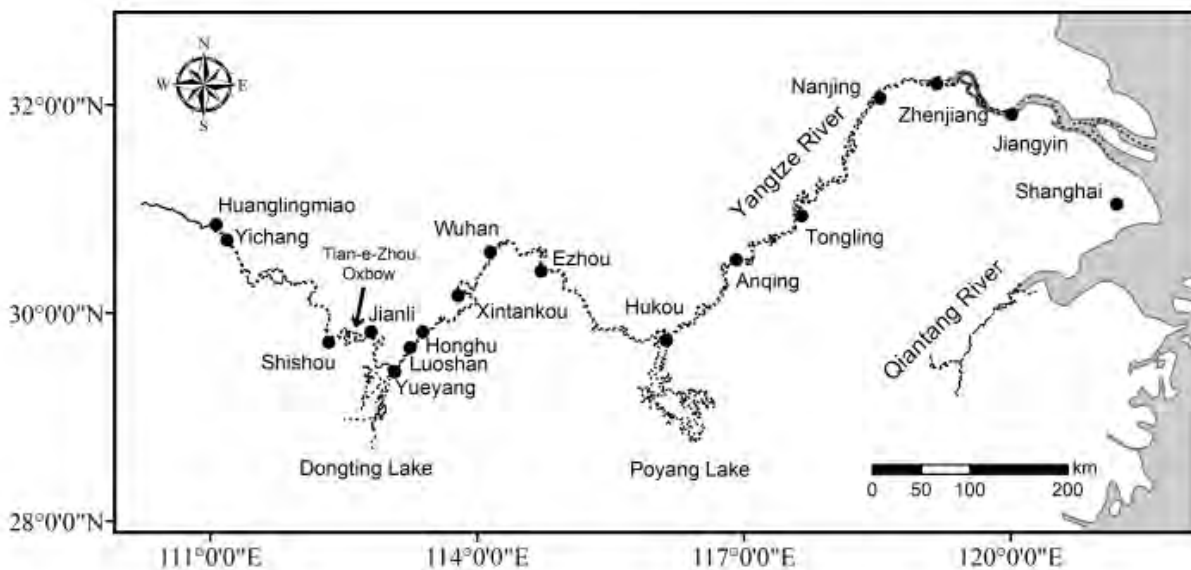
As mentioned above, the historical distribution of baiji in the Yangtze River was documented from the estuary near Shanghai to the lower Three Gorges region c. 1,800 km upstream, as well as in two large appended lake systems (Dongting and, at least transiently, Poyang) and the

neighbouring Qiantang River (Zhou *et al.*, 1977). It disappeared from the Qiantang River following construction of a high dam in 1957 (Zhou *et al.*, 1977; Liu *et al.*, 2000), and it was apparently no longer present in either Dongting or Poyang Lake by the late 1970s (Zhou *et al.*, 1977; Chen 1981, 1986; Yang *et al.*, 2000; Fang *et al.*, 2006). The baiji's occurrence along the middle-lower Yangtze channel decreased markedly in the decades before its extinction. Zhou *et al.* (1977) and Chen (1986) reported that it had disappeared from the region around Yichang, and the 1990s survey data were interpreted to suggest that the range had contracted further and that the species' upstream limit was around Jingzhou and its downstream limit near either Jiangyin or Wuhu (Chen *et al.*, 1997; Zhang *et al.*, 2003). At the beginning of this century, small groups or individuals may have persisted in only the three isolated "hotspot" sections of Honghu, Bali Jiangkou (a small river section near Hukou) and Tongling (Fig. 1; Braulik *et al.*, 2006).

The finless porpoise is widely distributed in Chinese waters, with two marine subpopulations and the freshwater subspecies in the Yangtze. The Yangtze subspecies may be the most threatened subpopulation of finless porpoises due to the human influences on the Yangtze ecosystem. The first range-wide estimate of finless porpoise numbers in the Yangtze system (c. 2700 porpoises) was based on

many small-scale, non-systematic surveys conducted between 1984 and 1991 (Zhang *et al.*, 1993). Thereafter, surveys in different sections of the river were carried out by various researchers using essentially the same survey methods (Wang *et al.*, 1998, 2000; Zhou *et al.*, 1998; Yang *et al.*, 2000; Yu *et al.*, 2001). From 1997 to 1999, a series of so-called "synchronous surveys," one in each year, were conducted by the Ministry of Agriculture and the Institute of Hydrobiology, Chinese Academy of Sciences (IHB). Preliminary analyses indicated that there were approximately 2,000 porpoises left in the river in the late 1990s (D. Wang, unpublished data; for the design of the surveys, see Zhang *et al.*, 2003). The same November-December 2006 survey that failed to find any baiji systematically covered the entire current range of porpoises in the mainstem of the river (not lakes Poyang and Dongting) using a modified line-transect survey method. This extensive survey indicated there were c. 1,000-1,200 finless porpoises in the mainstem. When estimates for the two lakes are included, the overall estimate of the population is approximately 1,800 (Zhao *et al.*, 2008). This means that the current population size in the river is less than half of what it was between 1984 and 1991 (2,550) (Zhang *et al.*, 1993), implying an annual rate of decline of at least 5% for the whole population in the mainstem (Zhao *et al.*, 2008).

**Figure 1.** Historical distribution of the baiji (dashed line and area in Yangtze and Qiantang Rivers and two lakes) and Yangtze finless porpoise (dashed line and area only in Yangtze River and two lakes). Extant reserves for Yangtze cetaceans are located in Shishou including Tian-e-Zhou Oxbow, Dongting Lake, Honghu, Poyang Lake, Anqing, Tongling, and Zhenjiang



Finless porpoises occasionally occurred in some large tributaries of the Yangtze River and in some adjacent lakes, but they have been extirpated from most of those areas (Zhang *et al.*, 1993; Yang *et al.*, 2000; Xiao and Zhang, 2002). They now occur primarily in the main river channel and its two largest appended lakes (Poyang and Dongting) (Figure 1). According to the 2006 survey, most porpoises are in the middle and lower reaches from Ezhou to Jiangyin (Figure 1), with the lowest densities in the upper region and in the estuary of the Yangtze River (Zhao *et al.*, 2008). The current distribution pattern is almost the same as that reported by Zhang *et al.* in 1993. The porpoises in the upper region from Yichang to Ezhou (Figure 1) (c. 130 porpoises in 716.4 km) appear to be at the highest risk of local extirpation (Zhao *et al.*, 2008). Moreover, there appear to be significant distribution gaps in this section, since no porpoises were detected during either the upstream or the downstream passes by the two survey-boats in the 150 km subsection between Yueyang and Shishou in 2006 (Figure 1) (Zhao *et al.*, 2008). If the porpoises in this subsection are extirpated, the linear extent of the recent historical range of this subspecies on the river will have shrunk by c. 400 km, or by about 24% of the whole range in the mainstem of the river (Zhao *et al.*, 2008). It is noteworthy that this is also the first river section from which the baiji was eliminated (Zhou *et al.*, 1977; Chen *et al.*, 1997;

Zhang *et al.*, 2003). Unless the current trend is reversed, there is a high probability that finless porpoises will disappear permanently from that area. The distribution of finless porpoises in the middle and lower regions between Wuhan and Jiangyin was still continuous (Figure 1), even though their abundance in this region had decreased significantly (Zhao *et al.*, 2008).

### Past and ongoing conservation initiatives/ programs for dolphin conservation

Three types of measures for conserving the baiji were proposed in 1986 by Chen and Hua (1989): 1) *in situ* conservation, 2) *ex situ* conservation, and 3) intensified captive breeding and research. These three approaches were reiterated and discussed in numerous subsequent workshops and meetings. Even though originally proposed primarily for the baiji, they have also been applied to finless porpoises in the Yangtze (Reeves *et al.*, 2000; Wang *et al.*, 2000). Since the early 1990s, several areas of high animal density or high-value habitat (“hot spots”) have been selected as protected areas for Yangtze cetaceans (Figure 1; see next chapter in this paper and Table 1).

**Table 1.** Overview of the natural reserves for Yangtze cetacean in China

Name of the PA	Category	Year established	Size and location of the PA	Comments
Honghu Xin-Luo National Baiji Natural Reserve	National reserve	1992	135 km, between Xintankou and Luoshan in Honghu section	
Shishou Tian-e-Zhou National Baiji Natural Reserve	National reserve	1992	89 km, in Shishou section and a 21 km long oxbow, Tian-e-Zhou	The oxbow is also an <i>ex-situ</i> conservation area for the animals
Tongling National Freshwater Cetacean Natural Reserve	Provincial Reserve-National reserve	2000 2006	58 km, in Tongling section	It also covers a 1.6 km long semi-natural protected channel between two sandbars
Zhenjiang Provincial Yangtze Cetacean Natural Reserve	Provincial reserve	2003	15 km, a side channel in Zhenjiang section	
Poyang Lake Provincial Yangtze Finless Porpoise Reserve	Provincial reserve	2004	8,600 ha area in the Poyang Lake from Hukou to Duchang	The protected area changes with the water level
Yueyang Yangtze Finless Porpoise Reserve	City reserve	2004	In the mouth area of East Dongting Lake	
Anqing Yangtze Finless Porpoise Reserve	City reserve	2007	243 km, in Anqing section	

Although some hotspots have been designated as reserves since the early 1990s, the natural environment of the Yangtze River has not improved due to unstoppable water construction- and industrial development projects, increased transportation and a lack of enforcement of fisheries regulations. The Yangtze Cetacean Conservation Network, which includes relevant government agencies, natural reserves, and research institutions, was established by the Ministry of Agriculture and the Institute of Hydrobiology (IHB) in 2008 to improve the effectiveness of the protected areas. This network aims to: 1) unify and integrate the work of established cetacean reserves, 2) ensure that appropriate scientific analyses are applied to the annual survey data, 3) provide technical support for the reserve staff, and 4) standardize and synchronize the conservation activities of all reserves.

Noteworthy among the *ex situ* conservation measures is the captive breeding program carried out by the IHB. This program has greatly increased our understanding of the animals, particularly their reproductive biology. A seriously wounded baiji, named "Qi-Qi," was rescued from the mouth of Dongting Lake in 1980 and lived in captivity for nearly 23 years. A female, "Zhen-Zhen," was introduced into the dolphinarium for a captive breeding attempt, but she unfortunately died of a serious disease two and half years later. Although the attempt at captive breeding of baiji failed, we learned a lot from Qi-Qi. The Baiji Dolphinarium is the only aquarium built for conservation and research on Yangtze River cetaceans. It was completed in 1992, and Yangtze finless porpoises were first introduced in 1996. At present, 6 porpoises, including 3 males and 3 females, are living in the aquarium. The individual born in the aquarium on 5 July 2005 was the first Yangtze finless porpoise to be born in captivity (Wang *et al.*, 2005). This small captive population is the only one of its kind in the world.

### Location, size and management of planned or existing protected areas

In total, 7 natural reserves have been established to protect the natural habitat and population of Yangtze cetaceans in the Yangtze River. Of those, 3 are national reserves, 2 are provincial reserves, and 2 are local (city) reserves (Table 1). Most of the reserves are managed by management bureaus or

local fishery bureaus, and they can only supervise fishing activities to a limited extent. All of the reserves conduct surveys each year to monitor the porpoise populations. Most Yangtze cetacean reserves were established in the main channel of the Yangtze River or in lakes, and they are quite different from the natural reserves for terrestrial animals. Unlike terrestrial reserves, there is no way to regulate the passage of vessels through them, or to limit industries and agriculture on the banks of the river or lakes. Although there is a requirement that newly planned construction work near or in the reserves needs to pass environmental impacts assessments, the release of pollutants from industrial and agricultural activities is hardly controlled by the reserve designation. As a consequence of this lack of real protection, the environment in these nominally protected reserves has continued to degrade over the past several decades.

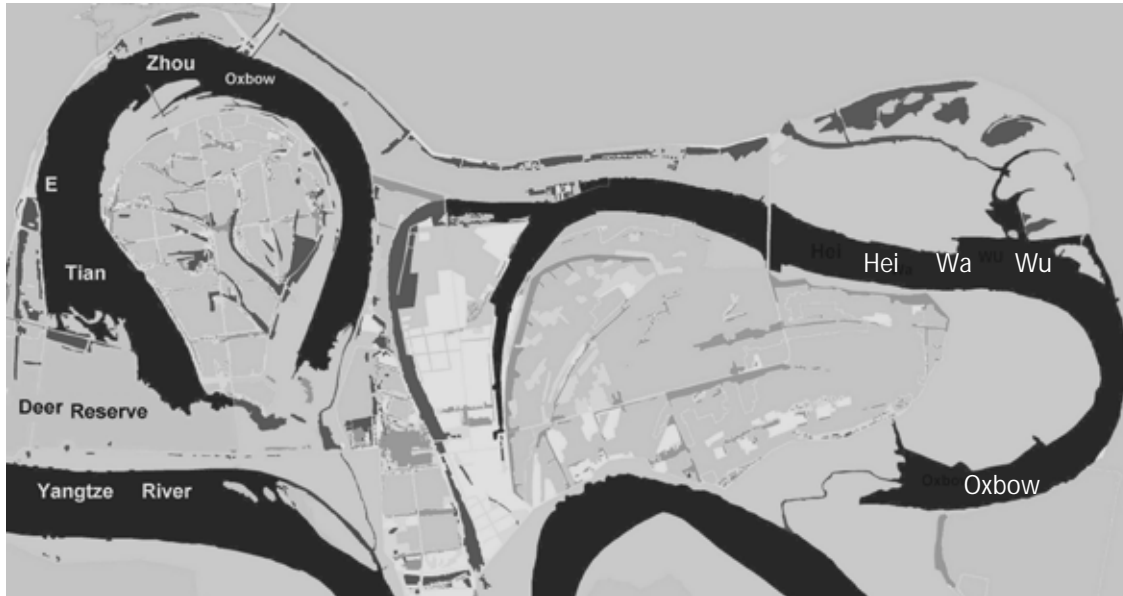
Two semi-natural reserves, the Tian-e-Zhou Oxbow and Tongling Reserve, have been established. Tian-e-Zhou Oxbow, which was an old course of the Yangtze River (Fig. 2), was identified as an eligible site after careful pilot surveys (Zhang *et al.*, 1995). The first group of 5 finless porpoises, including 3 females and 2 males, were introduced into the oxbow in 1990. Since then, several additional groups have been captured or rescued from the river and translocated into the oxbow. The population has increased steadily and the present population consists of about 30 individuals, with 3 or 4 calves born in the reserve each year (Wang *et al.*, 2005, 2006, 2009). This is the first successful *ex-situ* breeding effort of its kind, involving cetaceans, in the world. The other semi-natural reserve was set up in Tongling in Anhui Province in 1994. This smaller reserve is located in a small channel (1.6 km long and 80-220 m wide) between two sandbars of the Yangtze River. It contains about 10 porpoises.

In principle, all harmful human activities should be eliminated, or at least mitigated, in an *ex-situ* conservation area. The Tian-E-Zhou Reserve is nearly closed and there is no river transportation in this area. Moreover, the oxbow is located far from industrial development and its water quality is much better than the main channel of the Yangtze. There were some fishermen fishing in the oxbow two years ago, but the local government gave them some land around the oxbow in 2007 and fishing activity has been tightly regulated by the reserve administration. Thus, the effects of human activities have been well

controlled. Nevertheless, the reserve is relatively small for maintenance of aquatic mammals and it is estimated that the fish resources in the reserve can only sustain about 80 finless porpoises (Hao *et al.*,

2005). There are plans to extend the reserve boundaries and the area available to finless porpoises by including the adjacent oxbow, Hei-wa-Wu Oxbow (Fig. 2).

**Figure 2.** Tian-e-Zhou Oxbow (and Hei-wa-Wu Oxbow) in Shishou County, Hubei, China. There are two reserves in this area – the baiji reserve and the Pere David’s deer reserve.



### Threats to freshwater cetaceans in planned or existing protected or conservation areas

A number of anthropogenic factors are known or suspected to be responsible for the population decline and range contraction of Yangtze cetaceans, e.g. mortality in harmful fishing gear, boat collisions, water pollution and water development (e.g. dam construction). Turvey *et al.* (2007) concluded that entanglement in gear used in unregulated and unselective fishing (rolling hooks, electro-fishing, and gillnets) was the main factor responsible for the probable extinction of the baiji. This same factor explains much of the ongoing decline of the Yangtze finless porpoise (D. Wang *et al.*, 1998, 2000, 2005, 2009; K. Wang *et al.*, 2006). Boat traffic, which is increasing rapidly in the Yangtze River and lakes, also causes mortality of cetaceans (from hull impacts or propeller strikes), and boat noise may mask their social communication and affect their ability to forage efficiently (D. Wang *et al.*, 1998, 2000; K. Wang *et al.*, 2006). Widespread sand mining, much of it illegal, in the rivers and lakes and along the banks has been destroying important prey habitat and adversely affecting productivity. This problem is especially serious in Poyang Lake, where there is

currently a population of around 400 finless porpoises (Xiao and Zhang, 2000; Wang *et al.*, 2006; Zhao *et al.*, 2008). Compared with cetaceans that live in marine habitat, freshwater cetaceans may be at a higher risk from pollution, since the pollutants in the freshwater system are not as easily and quickly diluted as in the marine environment, but are easily deposited in the ecosystem, e.g. we found that T-Hg concentrations in various tissues of the Yangtze finless porpoises found in Eastern Dongting Lake were much higher than those reported in their marine counterparts (Dong *et al.*, 2006). Indeed, cetaceans in rivers generally occur in and near the world’s most densely populated human environments (Reeves *et al.*, 2000). Finally, water development projects, especially dams, have major effects on river ecology. In the Yangtze River system, structures can block porpoise movements between the river and adjoining lakes or tributaries (Liu *et al.*, 2000; Smith and Reeves, 2000), as well as the movements of their prey (Xie and Chen, 1996). The Three Gorges Dam in particular has changed, and will continue to alter, the downstream hydrologic conditions in the Yangtze River (Tong *et al.*, 2008), adversely affecting

the habitat of the baiji and finless porpoises in the river.

Although the relative importance of each of the above threats has not been quantified, all have contributed to the decline of the Yangtze finless porpoise. Despite the fact that for many years these same factors were also known to be pushing the baiji toward extinction, none has been addressed by effective conservation intervention. Instead, the seriousness of these threats has continued to escalate dramatically over the past two decades. We reiterate that immediate and effective action is urgently needed to reduce the threats, with highest priority given to areas with the greatest abundance of the animals in all regions.

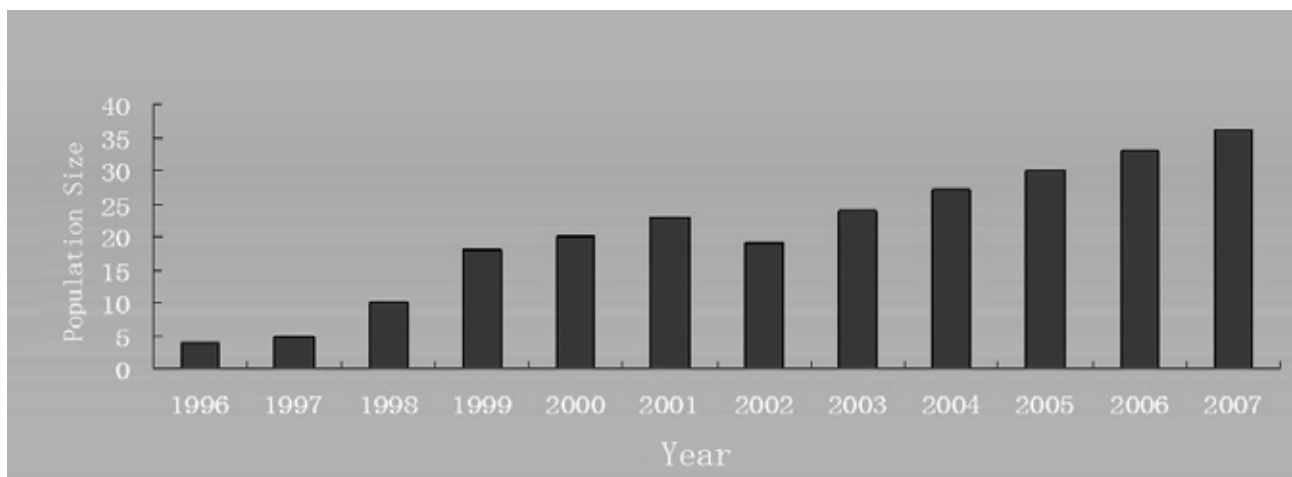
### Trends in dolphin abundance, natality or mortality due to conservation measures taken in planned or existing protected areas or special conservation areas

The population dynamics of the animals have not been well documented in most protected areas due to the technical and financial problems that exist in most of the reserves. According to the results of the 2006 Yangtze survey, the population of animals in all of the natural protected areas had decreased significantly in the past 15 years (Zhao *et al.*, 2008), which means that conservation measures in the natural PAs had failed to stop the population decline. According to survey data collected through the newly established Yangtze Cetacean Conservation Network, more than ten finless porpoises died in

2009, of which one was in the Shishou River section, three in the Honghu River section, two in Dongting Lake, four in Poyang Lake, and three in the Nanjing section. This was the first time that the information was collected through this network. Doubtless some missing information on porpoise mortality is still missing because not all areas were accessible to the network.

We are confident that the natality of the wild population of Yangtze finless porpoises remains relatively high. This conclusion is based on information obtained in February 2009 when a total of 29 porpoises were captured for physical examination in the Duchang section of the Poyang Lake. All 5 of the mature females porpoises captured were confirmed as pregnant through B-mode ultrasound diagnosis. In Tian-e-Zhou oxbow, all of the animals were captured for physical examination and medical treatment after an exceptional freezing event in southern China in April 2008; encouragingly, all five females over six years examined at that time were found to be pregnant. The high mortality of immature animals in the wild population is the most likely cause of severe population declines. Of the dead porpoises documented in 2009, 70% were juveniles (with body length less than 120 cm). Even though the causes of death were not all diagnosed, it is clear that most deaths were caused by human activities and not disease. The population dynamics of the porpoises in the Tian-e-Zhou reserve have been relatively well documented (Figure 3). Low mortality and stable natality are the main factors responsible for the steady population increase.

Figure 3. The population trend of Yangtze finless porpoises in the Tian-e-Zhou Reserve from 1996 to 2007.





## Need for establishing new protected areas

At present, we think it is unnecessary to establish new natural reserves and that instead effort should focus on adjusting the boundaries of the existing protected areas based on the results of the 2006 survey and the regular annual hotspot surveys.

As mentioned earlier, there is an urgent need to establish more semi-natural reserves. Two are being planned and will be established in the next year. One is in the Honghu area, named Laowan Oxbow, a 10 km long side-channel of the Yangtze. Although it is small, the natural situation is quite similar to the Tian-e-Zhou Oxbow. The other one is located in the Anqing area, named Xijiang River, a tributary of the Yangtze. The projects for establishing the two semi-natural reserves have been approved by the Ministry of Agriculture. Another potential site for *ex-situ* conservation of the Yangtze finless porpoise is the reservoir above the Three-Gorges Dam. The hydrological situation of this area has changed dramatically since the construction of the dam. The water flow velocity has slowed and the fish community structure has changed with a greater diversity of small fish resources (K. Wang, unpublished data). Furthermore, the transportation, pollution, and fishing activities in the reservoir could be controlled and managed. The IHB and the China Three-Gorges Company are working together to study the feasibility for establishing a new reserve in this idea.

## Other species that will benefit from planned or existing protected areas or special conservation areas?

Most of the protected areas for Yangtze cetaceans are also hotspots or suitable habitat for other aquatic animals, such as fishes, water birds, and even other wetland mammal species. More than 370 fish species once inhabited the Yangtze River. However, some, such as the Chinese paddle fish (*Psephurus gladius*) and reeves shad (*Hilsa reevesii*), are already extinct or nearly so. The declines of these species were also the result of several types of human activity, particularly those leading to or involving overfishing, pollution, and water development (Yue, 1995). Therefore, it is likely that at least some of the conservation actions taken on behalf of Yangtze cetaceans will also benefit endangered fishes.

Water birds, as symbolic animals of the wetlands, also stand to benefit from the conservation measures taken on behalf of cetaceans. For example, Poyang and Dongting Lakes are the most important habitats for winter migrating birds in China. Efforts to protect water resources and fish populations in the protected areas will also benefit birds.

There is also a unique example of conservation efforts for cetaceans benefiting a terrestrial mammal. Another national reserve, the Tan-e-Zhou Pere David's Deer National Reserve, is adjacent to the Tian-e-Zhou Oxbow (Figure 2). It is one of three reserves established for the Pere David's deer (*Elaphurus davidianus*) reintroduction project in China. The deer population in this region increased quickly due to the favorable grass beach along the oxbow (Hao *et al.*, 2005). The water resources are vital components of both the cetacean reserve and the deer reserve and measures taken to protect the water resources for the cetaceans significantly influenced the growth of the grass on the beach of the oxbow, benefiting the deer population.

## What are the benefits for local communities in the planned or existing protected areas or special conservation areas?

In the long run, all of the measures taken for the conservation of Yangtze cetaceans will benefit local human communities by improving the environment and increasing biodiversity. However, acute conflicts between biodiversity conservation and economic development of the local communities remain in most of the cetacean protected areas. For example, thousands of fishermen still live in and around Poyang Lake. The fishermen have been living on and fishing in the lake for generations. They have no land and no other means to make a living, therefore, fishing could not be banned totally and immediately. The local economic situation of people living in the cities around the lake is not very good. Their livelihoods rely extensively on exploitation of natural resources in the lake, such as through the sand dredging industry. Sand is an indispensable material for construction of buildings, and therefore is considered a god-given natural resource for the local communities. Sand dredging is a big business and a major income source for the local county economy around the lake, but it is chiefly responsible for the deterioration of the lake's environment and

biodiversity. Bans on fishing and sand-dredging are the main measures required for conservation of porpoises in the lake, but such measures would obviously affect the income of local communities in the short term and meet intense resistance. We do not know if porpoises can persist in the lake while these issues are resolved. For the baiji, it is obviously already too late.

There is one encouraging example of harmony between porpoise conservation and the interests of a local human community. The conflicts between fishermen and porpoises in the Tian-e-Zhou reserve have been solved after a decade of negotiations and efforts. The local government of Shishou County provided land for the fishermen in the oxbow in 2007, and the fishermen now have successfully converted to farming and stopped the fishing activities on which they had relied for generations. They are beginning to benefit from their new work and to realize that their farm production is closely dependent on the health of the oxbow and, indeed, the oxbow is the soul of the wetlands they live on. The measures needed to protect the oxbow wetland have been understood and support for them is gradually building among the local communities. The success of this example provides hope for the future conservation of Yangtze finless porpoises.

## Acknowledgements

The writing of this paper was supported by the National Basic Research Program of China (2007CB411600), National Natural Science Foundation of China (30730018), and President's Fund of the Chinese Academy of Sciences.

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# REVIEW OF THE CONSERVATION AND ESTABLISHMENT OF PROTECTED AREAS FOR THE IRRAWADDY DOLPHIN, *ORCAELLA BREVIROSTRIS* IN THE MEKONG RIVER, CAMBODIA

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## Abstract

The Mekong River originates in the Tibetan Plateau and runs for 4300 km through China, Myanmar, Laos, Cambodia, Thailand, and Vietnam, where it empties into the South China Sea. The 200 km stretch of the Mekong between the Lao border and Kratie town in Cambodia is the last refuge for the Irrawaddy dolphin in the Mekong. Dolphins were once found in the Mekong from Khone Falls on the Laos-Cambodia border to the Mekong delta in Vietnam and into Tonle Sap, the great Cambodian lake that is connected to the Mekong. It appears that most of the dolphins in Tonle Sap were killed during the Khmer Rouge era (1975-1979). In 2008 the World Wide Fund for Nature – Cambodia (WWF) and the Cambodian Department of Fisheries estimated that the population of Mekong dolphins was 70 (95 % C.I. 69 – 91) based on photo-identified animals analyzed using the Lincoln-Peterson mark-recapture model. This estimate did not include a correction for the percentage of unidentifiable individuals, predominantly calves and juveniles. This number is substantially lower than a 2004 estimate by Beasley of 95 identifiable individuals. This apparent decline is consistent with mortality records that show at least 92 dolphins have died in the period 2003-2009. Approximately 63% of these animals were calves. The causes for the high mortality rate, especially among calves, are not clear. It is known that both adults and calves have died in gill nets, but there may be other unidentified sources of mortality as well. There are currently no protected areas for dolphin in Cambodia and no regulations that prevent the use of gill nets, as long as the nets have a mesh size between 1.5 and 15 cm. The Dolphin Commission has attempted to reduce the use of gill nets, but has no authority to do so. WWF and the Fisheries Administration are working to establish protected areas around the nine main dolphin pools that would prevent the use of gill nets and reduce fishing pressure in these areas. Alternative livelihood programs are also being developed to diversify food sources and incomes for local people while at the same time reducing fishing pressure and dolphin bycatch in the Mekong.

## Abstrak

Sungai Mekong berasal dari Dataran Tibet dan mengalir sepanjang 4300 km melewati Cina, Mianmar, Laos, Kamboja, Thailand, dan Vietnam, hingga akhirnya bermuara di Laut Cina Selatan. Daerah sungai sepanjang 200 km antara perbatasan Lao dan kota Kratie di Kamboja adalah tempat perlindungan terakhir bagi lumba-lumba Irrawaddy di Sungai Mekong. Dahulu lumba-lumba dapat ditemukan mulai dari Khone Falls di perbatasan Laos-Kamboja hingga ke delta Mekong di Vietnam dan hingga Tonle Sap, danau besar di Kamboja yang berhubungan dengan Mekong. Tampaknya sebagian besar lumba-lumba di Tonle Sap terbunuh pada masa Khmer Merah (1975-1979). Pada 2008, World Wide Fund for Nature – Kamboja (WWF) dan Departemen Perikanan Kamboja memperkirakan jumlah populasi lumba-lumba Mekong adalah 70 ekor (95 % C.I. 69 – 91) berdasarkan foto-identifikasi yang dianalisa menggunakan metode penandaan-penangkapan ulang Lincoln-Peterson. Perkiraan ini tidak termasuk faktor koreksi dari individu yang tidak teridentifikasi, terutama anakan dan remaja. Jumlah ini jauh lebih rendah dari perkiraan Beasley tahun 2004 yaitu 95 individu. Penurunan yang nyata ini sesuai dengan jumlah kematian dimana tercatat sedikitnya 92 lumba-lumba mati antara tahun 2003-2009. Kurang lebih 63% dari seluruh jumlah kematian adalah anakan. Penyebab tingginya angka kematian, khususnya pada anakan, masih belum jelas. Diketahui bahwa lumba-lumba dewasa dan anakan mati karena terjatuh rengege, namun mungkin masih ada penyebab kematian lain yang belum teridentifikasi. Saat ini tidak ada kawasan perlindungan lumba-lumba di Kamboja dan tidak ada peraturan yang membatasi penggunaan rengege, selama mata jaringnya berukuran antara 1,5 hingga 15 cm. Dolphin Commission telah mencoba untuk mengurangi penggunaan rengege, namun tidak memiliki wewenang untuk melakukannya. WWF dan Fisheries Administration sedang berusaha membuat kawasan-kawasan perlindungan di sekitar sembilan habitat utama lumba-lumba yang akan mencegah penggunaan rengege dan mengurangi tekanan terhadap perikanan di daerah-daerah ini. Program mata pencaharian alternatif juga sedang dikembangkan untuk memperoleh variasi sumber makanan dan pendapatan masyarakat setempat, disamping mengurangi tekanan terhadap perikanan dan tangkapan samping (bycatch) lumba-lumba di Mekong.

## Overview of the Mekong River system

By catchment size, the Mekong River Basin is the most biodiverse river system on earth. It is home to hundreds of species of fish and it has the world's most productive inland fishery, underpinning the economies of all the countries in the Greater Mekong Subregion<sup>1</sup>. Originating in the Tibetan Plateau, the Mekong River winds for 4300 km through China, Myanmar, Laos, Cambodia, Thailand, and Vietnam. At least 60 million people in the lower basin depend directly on the Mekong's resources for their food and livelihoods.

The Mekong experiences large, seasonal fluctuations in flow volume and a 15+ m range in water level between the dry and wet seasons. It is an ecosystem that consists of seasonally flooded riverine forests, wide, braided channels, sandbars, deep pools, and rocky rapids. This stretch of the river is used for migration and breeding by many fish species, the majority of which are exploited in commercially important capture fisheries. Its deep pools provide critical refugia to giant fish species, such as the Mekong giant catfish.

## Summary of population status and distribution of Irrawaddy dolphins in the Mekong River

### *Historical distribution*

Mekong dolphins were once distributed throughout the lower Mekong from southern Lao PDR through to the delta in Vietnam, and many of its tributaries including the Tonle Sap (Figure 1). Mouhot (1966, *in* Beasley, 2007) made the earliest known reports to science of animals near Phnom Penh in the 1860's. In the late 1960's, Lloze (1973, *in* Stacey, 1996 *and* Beasley, 2007) found animals around Kratie, in the Tonle Sap, and around Banam toward the Vietnamese border. He reported the animals inhabited the delta area in Vietnam. Surveys by Smith and colleagues (Smith *et al.*, 1997, *in* Smith and Jefferson, 2002) in 1996 and Beasley (2007) in 2005 found no sign of any live Irrawaddy dolphins in

Vietnam. Additionally, a strong majority of Vietnamese people interviewed by Beasley (2007) who reported seeing dolphins said it was more than ten years since the last sighting. The only recent records of dolphins in Vietnam are of animals trapped in gillnets near the Cambodian border in 2002 and 2005 (Beasley, 2007), which may have been animals traveling downstream from Cambodia. The weight of evidence suggests freshwater Irrawaddy dolphins are now effectively extirpated from the Mekong in Vietnam. Similarly the Tonle Sap Lake was reported to be home to seasonally large numbers of dolphins, (Beasley, 2007; Lloze, 1973). There are no confirmed records since the 1960's of the species in Tonle Sap, and Beasley (2007) found very few respondents who reported seeing them there at all, let alone in the previous decade. It is reported that large numbers of dolphins were slaughtered in the Tonle Sap in the late 1970's by Khmer Rouge soldiers (Beasley, 2007; Smith and Jefferson, 2002). The species is now considered extirpated from the Tonle Sap.

At the northern extent of their range, Baird and various collaborators conducted a number of surveys into the species occurrence in southern Lao PDR and north eastern Cambodia in the 1990s (Baird and Mounsouphom, 1997). They confirmed that Khone Falls are the upstream limit of dolphin habitat, though one reported dolphin sighting above there is noted by Stacey (1996). The Khone Falls complex spans around 8 km wide in the far south of Lao PDR and is the largest waterfall by volume in the world (Encyclopaedia Britannica, 2009) and possibly the widest. These falls are a distinct geophysical barrier to dolphin movement upstream.

The Sekong River is large a tributary connected to the Mekong via the Sesan River, splitting from the Sesan in Steung Treng Province, Cambodia, to run roughly parallel to the Mekong northwards into Lao PDR (Figure 1). Irrawaddy dolphins have been reported by locals and recorded to have been historically present in many of the Sekong's larger tributaries below the complex of basalt waterfalls which dominate much of this area in southern Lao. No sightings have been confirmed since the late 1980's, though two dead animals were found near Sekong town in 1990 (Baird and Mounsouphom, 1997). As a survey by Baird in 1997 found no dolphins (Baird and Beasley, 2005) and fisheries officers do not report ever seeing the species there, it is presumed to be now extirpated

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<sup>1</sup> The Greater Mekong Subregion (GMS) is a transboundary economic agreement between the governments of China, Myanmar, Laos, Thailand, Cambodia and Vietnam. It is an intra-regional plan designed to enable the development and free trade of resources and goods across these six countries.

from this river. Local villagers in Cambodia reported to Baird that historically dolphins were only ever found in the Sekong during the high water of the wet season. In the Sesan River itself, the only records come from villager reports of historic sightings in a few deep pools (Baird and Beasley, 2005). The Srepok River is another large tributary to

the Mekong via the Sesan (Figure 2). This river has never been surveyed specifically for dolphins and anecdotal evidence suggests the species was rare in this area several decades ago. The only confirmed record from this river was in Monduliri Province, Cambodia of an adult female killed by explosive fishing in January 2005 (Gilbert and Beasley, 2006).

**Figure 1:** Estimated former extent of Mekong Dolphin distribution from Beasley (2007) based on historic records and interviews. Map courtesy of I. Beasley.

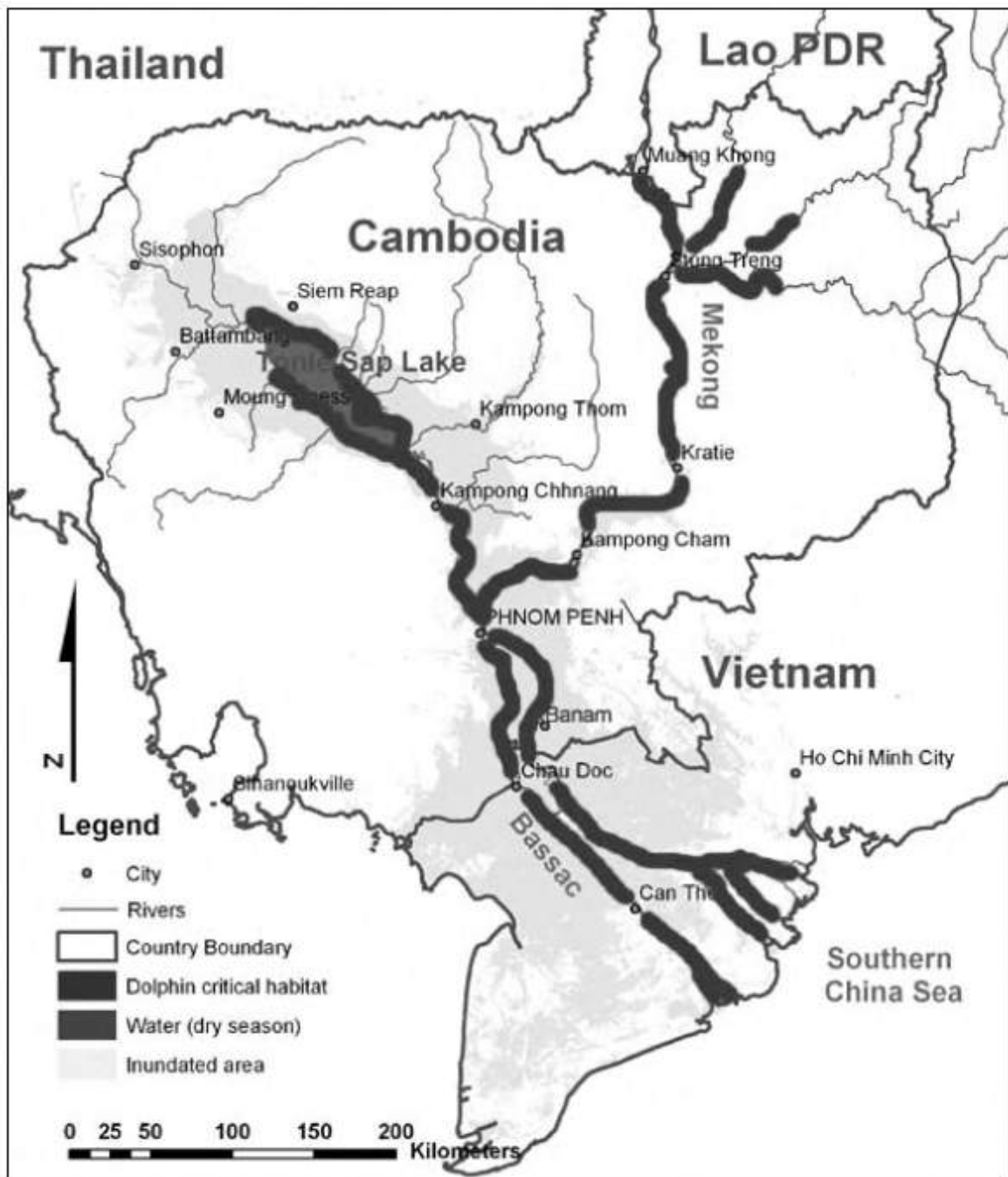
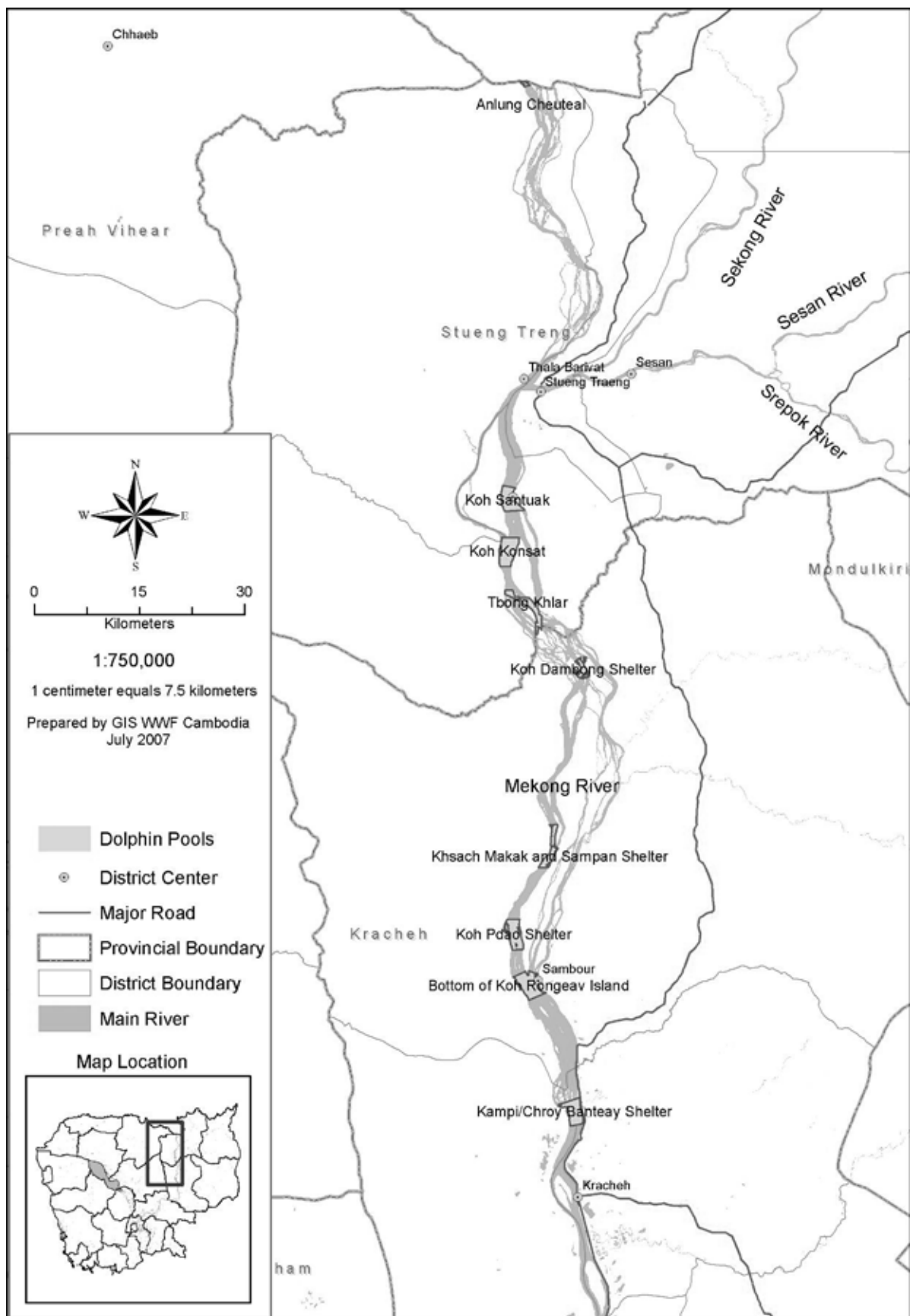
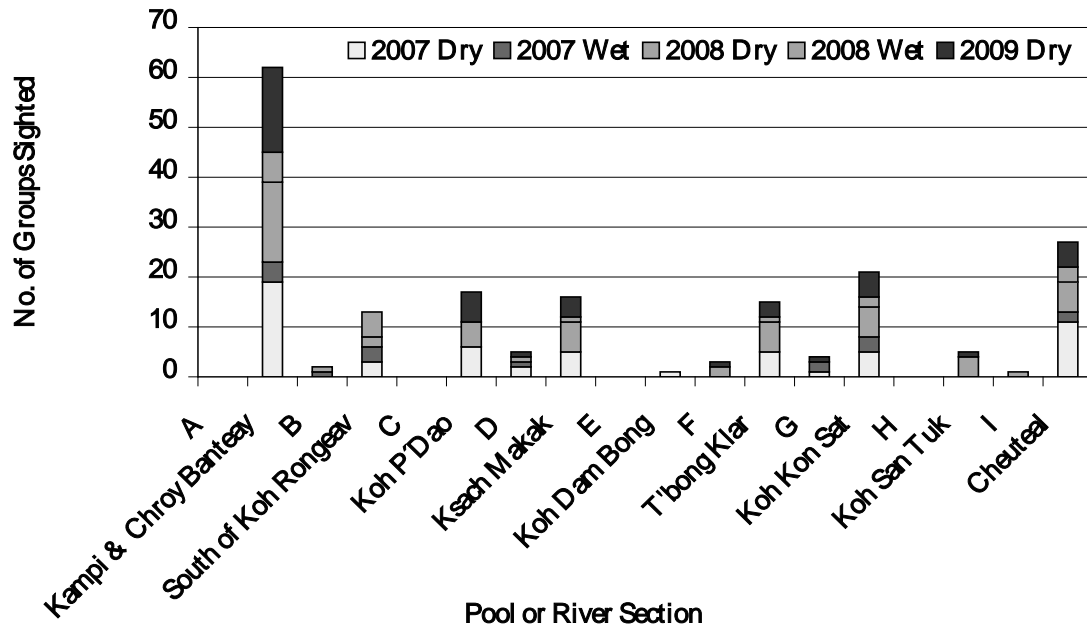


Figure 2. Current range of the Irrawaddy dolphin in the Mekong River





**Figure 3:** Sightings of dolphin groups in deep pools and intervening river sections in the Cambodian mainstream Mekong by CMDCP in wet and dry season surveys from 2007-2009. For the location of pools, refer to Fig. 2. Letters represent the intervening river sections between the preceding and succeeding pools. *NB:* 2-3 surveys are done each dry season, whereas only a single wet season survey is done annually, skewing superficial comparisons between the frequencies of seasonal occurrences.



**Table 1:** Estimates of Population Size for Irrawaddy Dolphins in the Mekong River

Year	Month	Number	Range (95% CI)	Method
1997	May	100-150*		Direct count and extrapolation
2004	December	95**	86-111**	Capture-Mark-Recapture
2007	April-May	71***	66-86	Capture-Mark-Recapture
2008	April-May	70****	69-91	Capture-Mark-Recapture

\* Data from Baird and Beasley (*Oryx* 39(3):301-310, 2005)

\*\* Data from Isabel Beasley (Case Study of Monitoring Methods of Irrawaddy Dolphins in the Mekong River, Draft presentation for Kalimantan Dolphin Workshop, October 2009). 95 is the number of identified animals. This report also includes a higher estimate that includes the estimated number of unidentifiable animals. The number 95 is used in this table because it most closely corresponds to the methodology used by CMDCP in 2007 and 2008

\*\*\* Dove *et al.*, 2008

\*\*\*\* Unpublished data, CMDCP 2009, analysis of 2007 and 2008 data

### *Current distribution*

The current home range for Mekong dolphins is a 200 km stretch of the Mekong mainstem between Kratie (Kracheh), Cambodia and the Anlung-Cheuteal deep pool, which straddles the Cambodia/Lao PDR border in Stung Treng and Champasak Provinces respectively (Figure 2) (Ryan and Kluskens, 2009). The 9 deep pools shown in Figure 2 represent the dry-season range of Mekong dolphins, with the majority of individuals found in these relatively restricted areas. See Figure 3 for data showing the use of these 9 deep pool areas.

The reason for the clumped distribution of dolphins is probably a combination of the high-quality habitat in deep pools and the fact that low water levels prevent dolphin movement outside the pools (Ryan and Kluskens, 2009).

In the wet season, dolphins disperse more widely and are found more frequently in sections of river outside the critical deep pools. Two animals were reported in August 2009 as far south as Kampong Cham town, around 120 km downstream from Kratie town. There are no recent reports of animals in tributaries in any season; however, this may be at least partly due to the lack of rigorous survey effort.

Over the last decade there have been sporadic reports of dolphins occurring outside the core 200 km area, such as an animal killed in the Srepok area in 2005 and occasional sightings and carcasses from the Kampong Cham area. Beasley (2007) reported two dolphins trapped in an irrigation canal in 2001 near Phnom Penh, and two caught in gillnets in Vietnam near the Cambodia border in 2002 and 2005. The carcasses found in Phnom Penh and Kampong Cham were all of individuals previously photo-identified in the home range as described above.

The Cambodian Mekong Dolphin Conservation Project (CMDCP) consists of WWF Cambodia and the Fisheries Administration of Cambodia. The CMDCP has conducted photo-identification studies from 2007-2009, and there is no evidence to suggest that dolphins move into or away from the Anlung-Cheuteal pool at the Cambodia-Lao border (Ryan and Kluskens, 2009). Dolphins have been sighted only once in the long river section between Koh Santuk and Cheuteal, and these were individuals previously photo-identified in the lower river section south of Stung Treng town. On the basis of CMDCP studies and Beasley (2007), the Cheuteal sub-population is thought to be isolated from the main population,

and it is unlikely that dolphins occur often north of Stung Treng town, except for individuals from the Cheuteal sub-population. While this northern section of river has much less human development than other areas, it may be less suitable as habitat because it is shallow and rocky, especially in the dry season. The CMDCP has observed large numbers of gill-nets stretching hundreds of meters across the river in the Stung Treng town area. In some places, the nets occur at sufficiently high densities that they would constitute a physical barrier to dolphin movement.

In 2007 the CMDCP began using photo-ID and the Lincoln-Peterson mark-recapture model to estimate the population of Mekong dolphins. Based on surveys in April and May of 2007 CMDCP estimated that the population of Mekong dolphins was 71 (95% C.I. 66-86) (Dove *et al.*, 2008). In 2008 the CMDCP analyzed 2007 and 2008 data and estimated that the population of Mekong dolphins was 70 (95 % C.I. 69 – 91) (CMDCP unpublished data). These estimates did not include a correction for the percentage of unidentifiable individuals, predominantly calves and juveniles. Previous estimates of the Mekong dolphin population are shown in Table 1 below. While the methods used to estimate abundance have not been consistent (see the notes below the table), the authors consider that the decline from an estimated 95 animals in 2004 to 70 animals in 2008 is real, and cause for concern.

### *Mortality rates*

Mortality rates for Mekong dolphins have been well documented since 2003 (Gilbert and Beasley, 2006; Dove, 2009). Data in Table 2 show that 92 dolphins have died from 2003-2009. The actual number may be higher because some animals may not have been recovered. Of the 92 recorded deaths, 58 (63%) have been calves. The reasons for the high rate of calf mortality are unknown. WWF issued a report in 2009 (Dove, 2009) that suggested some calves may be dying from disease because their immune systems were suppressed by environmental contaminants such as DDTs, PCBs, and mercury and by inbreeding.

An expert group, including members of the IUCN Cetacean Specialist Group, convened by WWF-Cambodia met in Phnom Penh in October 2009 and concluded that the environmental contamination hypothesis was doubtful and that gill nets were the more likely cause of dolphin mortality in the Mekong. The CMDCP, in cooperation with international experts, is continuing to investigate all

deaths and reviewing previous records with the goal of obtaining a better understanding of the causes of mortality in the Mekong. Everyone agrees that the

mortality rate is not sustainable and the Mekong population faces extinction if the mortality rate cannot be reduced.

**Table 2.** Dolphin Mortalities in the Mekong

Year	Adult	Juvenile	Calf	Total
2003	9	-	5	14
2004	5	-	11	16
2005	5	-	9	14
2006	3	1	15	19
2007	3	-	10	13
2008	2	-	4	6
2009	4	2	4	10
<b>Total</b>	<b>31</b>	<b>3</b>	<b>58</b>	<b>92</b>

Data from Gilbert and Beasley, 2006; Dove, 2009

### **Past and ongoing conservation initiatives/ programs for dolphin conservation**

Irrawaddy dolphin conservation programs in the Mekong River began in 2001 when Isabel Beasley, then a PhD student at James Cook University in Australia, began studying dolphins in the Mekong in collaboration with the Cambodia Department of Fisheries (currently called Fisheries Administration, or FiA). Research during 2001-2005 focused on documentation of population size, distribution, and threats. This resulted in 1) development of the Cambodian Mekong Dolphin Conservation Strategy published by the Ministry of Agriculture Forestry and Fisheries (MAFF) in 2005 and 2) establishment of the Cambodian Mekong Dolphin Conservation Project (CMDCP) in 2005 to implement that strategy. The Wildlife Conservation Society (WCS), WWF, and the FiA were founding members of the CMDCP (MAFF, 2005). Management of the CMDCP was handed over to WWF towards the end of 2005. The Cambodian Rural Development Team (CRDT) became a key partner of the CMDCP in 2006 in order to promote alternative livelihood development along the Mekong. Since 2006, the CMDCP has conducted research to estimate population size and to

document the range and movements of dolphins in the Mekong. The CMDCP has also investigated the causes of mortality by conducting necropsies and by collecting as much information as possible on the locations and causes of deaths.

The Commission for Conservation and Development of Mekong River Dolphin Eco-tourism Zone (Dolphin Commission) was established in February 2006 by the Cambodian Royal Government out of concern about the high dolphin mortality rate and interest in the development of “ecotourism” in Cambodia. The Commission’s board includes Secretaries of State of the Ministry of Tourism, Ministry of Agriculture, Forestry and Fisheries (MAFF), Governor of Kratie province, First Deputy Governor of Stung Treng Province, Lawyer of Government, Director of Fisheries Administration, Deputy General Secretary of Economic, Social and Cultural Observation Unit, Inspector of Kratie Provincial Kratie and Stung Treng Police, Commander of Military-Police of Provincial Kratie and Stung Treng Provinces and Chief of Cabinet of Ministry of Industry, Mine and Energy. The Commission sits within the Council of Ministers, which supervises all ministries and reviews and approves all proposed legislation from ministries prior to submission to

Parliament. The Dolphin Commission was given extensive powers that enabled it to override existing authorities and previous laws related to dolphin conservation and to direct ministries to follow procedures and activities set down by the Commission.

The Dolphin Commission has used this extensive authority to establish 16 ranger stations along the Mekong and to employ 64 river guards to protect dolphins. It has also been instrumental in getting the Royal Government of Cambodia to impose a gillnet ban on the Mekong from Kampi to the Lao border through the order of the Prime Minister in March 2005. The Dolphin Commission claimed this order gave them the authority to ban the use of gill nets, but meetings between WWF, the Dolphin Commission, and government attorneys in March 2010 revealed that the Dolphin Commission has no authority to ban gill nets in the Mekong. The order from the Prime Minister was not legally binding because it is not part of adopted fishery law. Fishery law does specify that gill nets must have a mesh size greater than 1.5 cm and less than 15 cm, but there are no other laws that would regulate or ban the use of gill nets in the Mekong.

### **Locations, size and management of planned or existing protected areas**

There are no formally protected areas for dolphins, but efforts are underway in the Fisheries Administration to establish conservation areas around the nine deep pools at the upper part of Mekong in Kratie and Stung Treng provinces. This designation would prevent all fishing in the conservation areas. This law was designed to protect fisheries, but would likely reduce dolphin bycatch as well. The Irrawaddy dolphin was recently declared by sub-decree No. 132, endorsed by the Prime Minister on 12 August 2009, to be one of 58 endangered species in Cambodia. As such, it is subject to full protection by the Cambodian government. As yet, no specific protective measures have been legislated for the species, but the government is working to establish protection measures for all 58 fisheries endangered species.

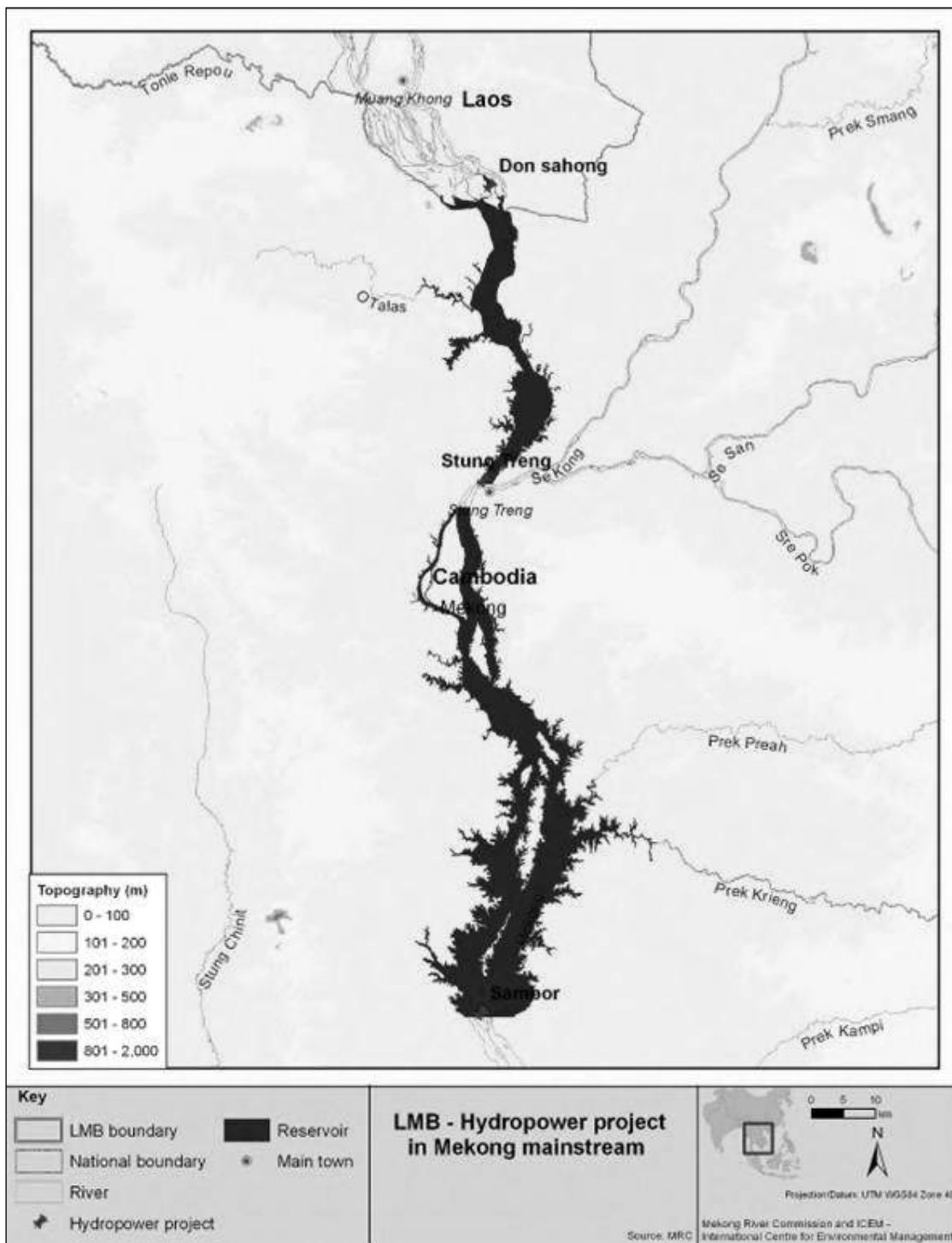
### **Threats to freshwater cetaceans in planned or existing protected areas or conservation areas**

Gillnets have long been identified as a significant cause of dolphin mortality in the Mekong. Between 2003 and 2005 all diagnosed deaths were caused by large-mesh gillnet entanglement, except for one animal killed, possibly deliberately, by fishermen with explosives in the Srepok (Gilbert and Beasley, 2006). Efforts by the Dolphin Commission to eliminate gillnet use has apparently reduced mortality. Since 2005 there have been no recorded gill net deaths (Ryan and Kluskens, 2009). Mortalities have been reduced but continue to be high and the causes of death have not been clearly identified (Table 2).

Other potential threats to Mekong dolphins include depletion of fish stocks, general degradation of the aquatic and riparian ecosystems, and proposed hydropower dams at Don Sahong in Lao PDR near the Cambodia border and at Stung Treng and Sambor in Cambodia. The proposed dam at Sambor is particularly worrisome because it would isolate the dolphins in the Kampi pool from the rest of the population and cause major changes in the hydrology and ecology of the river. The proposed dam at Sambor would be 56 meters high, 18 km long, and inundate an area of 620 sq. km. This includes most of the remaining dolphin habitat in the Mekong, with the exception of the area north of Stung Treng, but this section of river is threatened by proposed dams at Stung Treng and one at Khone Falls in the Don Sahong Channel (Mekong River Commission, 2009) (Figure 4).

A report released in March 2010 by the Mekong River Commission states that if both Don Sahong Dam (at Khone Falls on the Cambodia/Lao border) and Sambor Dam are built this would have immediate and detrimental impacts and disastrous consequences for the Mekong River dolphin population. In the MRC 20 year scenario, Irrawaddy dolphins are predicted to go extinct in the Mekong. (Mekong River Commission, 2010).

Figure 4. Area inundated by proposed dam a Sambor and Stung Treng (Mekong River Commission, 2009)



## **Trends in dolphin abundance, natality or mortality due to conservation measures taken in planned or existing protected areas or special conservation areas**

There are no formal protected areas, but the efforts by the Dolphin Commission to reduce the use of gillnets may have reduced the number of incidental kills due to entanglement. The Dolphin Commission began their work in 2006 and by 2007 had established a significant presence on the river. From 2007-2009 there were 29 reported mortalities, which is down from the 44 mortalities the previous three years. Unfortunately, the mortality rate is still unsustainably high and it appears the population is in serious decline (Table 2).

## **Needs for establishing new protected areas**

As stated above, there is clearly a need to establish protected areas or to establish regulations that would protect dolphins throughout their range in the Mekong. Such areas could be centered around the 9 deep water pools which form the core habitat of the dolphins' dry season range. Establishment of these areas could significantly reduce dolphin bycatch in gill nets. They could also assist in the control and monitoring of ecotourism operations centered on viewing the Mekong River dolphins.

## **Other species that will benefit from planned or existing protected areas or special conservation areas?**

Fish stocks could greatly benefit from the designation of protected areas around deep pools in the Mekong. These deep pools serve as a refuge for many fish species in the dry season, so efforts to reduce or prohibit fishing in these areas would benefit dolphins and fish.

## **What are the benefits for local communities in the planned or existing protected areas or special conservation areas?**

Protected areas have the potential to improve the management of fishery and other resources in the

Mekong River. Establishing conservation areas around the deep pools should help sustain fisheries for local communities and protect dolphins. Dolphin watching is a significant source of revenue for local communities, especially at Kampi and Cheuteal. Local communities are not always happy about conservation efforts initially. Restricting the use of gillnets or restricting the places where people can fish often means reduced income for fishermen. That is why a component of the CMDCP is to work with local communities to develop alternative livelihoods such as aquaculture, diversification of agriculture, animal husbandry, and tourism.

## **Acknowledgements**

We would like to thank the following individuals and organizations for their help and support in preparing this paper: Phay Somany (Fisheries Administration /WWF Cambodia), Gerry Ryan (WWF Cambodia), Bart Kluskens (WWF Cambodia)

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# REVIEW OF THE CONSERVATION STATUS AND ESTABLISHMENT OF PROTECTED AREAS FOR THE IRRAWADDY DOLPHIN IN THE AYEYARWADY RIVER

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## Abstract

The Union of Myanmar (formally Burma) is an extensive country bordering the Bay of Bengal and Andaman Sea. The country has four large river systems, namely the Ayeyarwady (formerly Irrawaddy) (2170 km long), the Chindwin (960 km), the Sittaung (298 km) and the Thanlwin (1274 km) and all these rivers flow from the north to the south and empty in the Andaman Sea. Irrawaddy Dolphins, *Orcaella brevirostris*, are patchily distributed in shallow, nearshore waters and are often associated with estuaries and mangrove forests. They also occur far upstream in the Ayeyarwady River system of Myanmar. The earliest reference to dolphins in the Irrawaddy River is from the New T'ang History about 800 A.D., which mentions trade in 'river pigs' among the Pyu people. Anderson (1879) observed Irrawaddy dolphins in the Ayeyarwady River and found that they occur no further downstream than Prome (Pyay), which is about 360 km from the sea. The first systematic and scientific survey conducted in 2002, provided a best population size estimate of 37 individuals. The second and third survey conducted in 2003 and 2004, provided estimates of 59 and 72 individuals. Additionally, during three years of surveys, threats and distribution patterns were mapped in the river segment between Mandalay to Bhamo. Destructive fishing techniques using voltage power, gillnets, dynamite, and poison were identified as main threats to the dolphins. In December 2005, the Ministry of Livestock and Fisheries of the Department of Fisheries announced the dolphin protected area between Mingun and Kyauk Myaung of 74 kilometres length where the unique culture of cooperative fishing with dolphin and cast net fishermen is being practiced. The Irrawaddy Dolphin Protected Area Management Plan was developed after conducting extensive meetings, workshops and a series of discussions to obtain input from local government officials, fish contractors, fishermen, village leaders and Buddhist monks. This input was carefully considered, incorporated into the plan and used to ensure that it would address the needs of wildlife protection as well as human livelihoods and welfare. This management plan was agreed by the meeting of the Management Committee (MC) of the Ministry of Livestock and Fisheries, which was held on the 7<sup>th</sup> of July, 2009.

## Abstrak

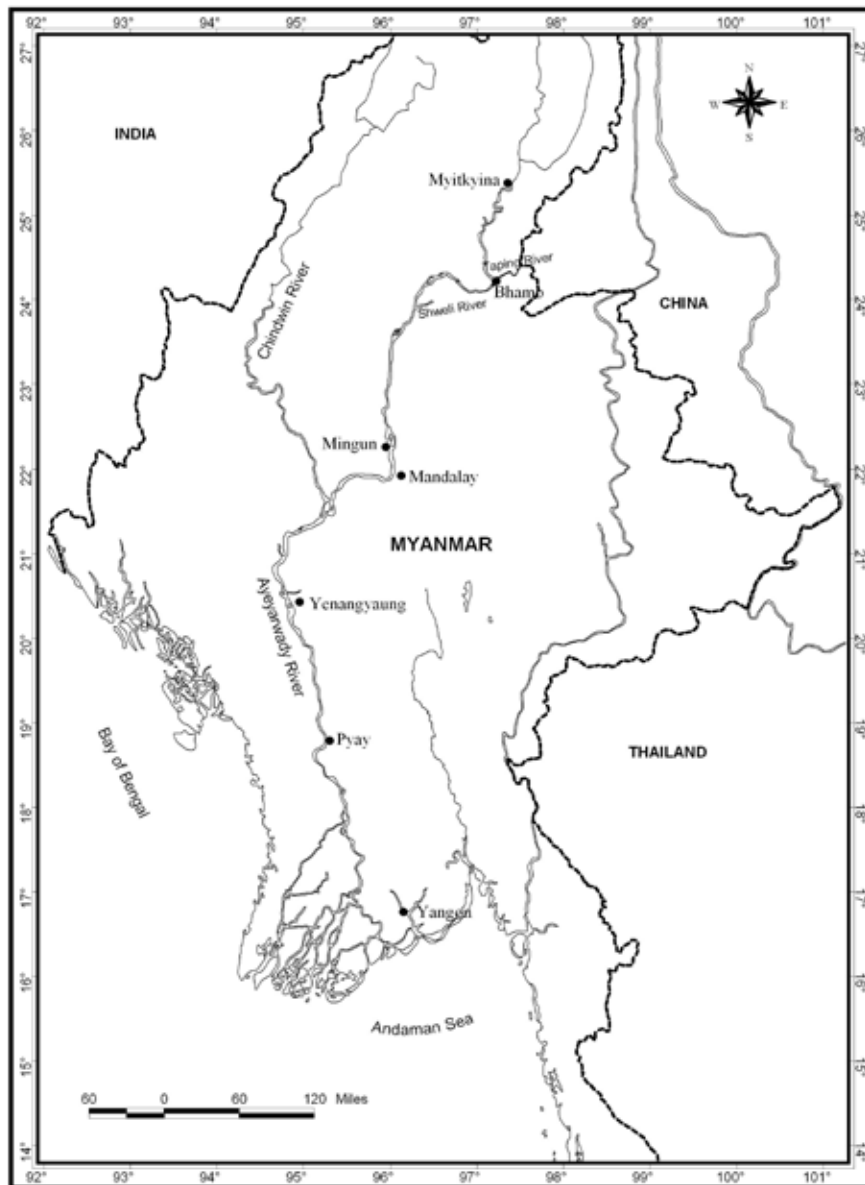
Myanmar (dahulu Burma) adalah sebuah negara luas yang dibatasi oleh Teluk Bengal dan Laut Andaman. Negara ini memiliki empat sistem sungai besar, yaitu Ayeyarwady (dahulu Irrawaddy) (2170 km), Chindwin (960 km), Sittaung (298 km) dan Thanlwin (1274 km), semua sungai ini mengalir dari utara ke selatan dan bermuara di Laut Andaman. Lumba-lumba Irrawaddy, *Orcaella brevirostris*, tersebar di perairan dangkal dekat pantai dan sering terlihat di daerah muara dan hutan bakau. Mereka juga tampak hingga jauh ke bagian hulu Sungai Ayeyarwady Myanmar. Catatan paling tua mengenai lumba-lumba di Sungai Irrawaddy berasal dari Sejarah T'ang Baru sekitar tahun 800 M, yang menyebutkan tentang perdagangan 'babi sungai' ('river pigs') diantara orang-orang Pyu. Anderson (1879) mengamati lumba-lumba Irrawaddy di Sungai Ayeyarwady dan mendapati bahwa mereka tidak pernah tampak lebih ke hilir dari Prome (Pyay), sekitar 360 km dari laut. Survei sistematis dan ilmiah yang pertama kali dilaksanakan pada tahun 2002, menghasilkan taksiran terbaik jumlah populasi sebanyak 37 individu. Perkiraan pada survei kedua dan ketiga tahun 2003 dan 2004 adalah 59 dan 72 individu. Di samping itu, selama tiga tahun survei, ancaman dan pola distribusi di bagian sungai antara Mandalay hingga Bhamo dicatat. Ancaman utama bagi lumba-lumba adalah teknik penangkapan ikan yang merusak dengan menggunakan setrum, rengge, bom, dan racun. Pada Desember 2005, Kementerian Peternakan dan Perikanan dari Departemen Perikanan meresmikan kawasan perlindungan lumba-lumba antara Mingun dan Kyauk Myaung sepanjang 74 km dimana terdapat kerjasama penangkapan ikan yang unik antara lumba-lumba dan para nelayan jala lempar. Rencana Pengelolaan Kawasan Perlindungan Lumba-lumba Irrawaddy disusun setelah diadakan serangkaian pertemuan, lokakarya dan diskusi untuk memperoleh masukan dari pemerintah daerah, pengusaha perikanan, nelayan, tokoh masyarakat dan biarawan Buddha. Masukan tersebut dipertimbangkan dengan hati-hati, dimasukkan ke dalam rencana dan digunakan untuk memastikan agar semua kebutuhan perlindungan satwaliar serta matapencaharian dan kesejahteraan manusia terpenuhi. Rencana pengelolaan ini disetujui dalam pertemuan Komite Pengelolaan dari Kementerian Peternakan dan Perikanan, pada 7 Juli 2009.

## Overview of the Ayeyarwady River system

The Union of Myanmar is located in Southeast Asia between latitudes 09° 32' N and 28° 31' N and longitudes 92° 10' E and 101° 11' E. Myanmar is a large country, with extensive coastlines that border the Bay of Bengal and Andaman Sea. Three parallel forested mountain ranges run north to south, the Rakhine Yoma range, the Bago Yoma range and the Shan Plateau. These surrounding mountain ranges

serve as the country's natural barriers. The country has four large rivers systems, namely, the Ayeyarwady (2,170 km long), the Chindwin (960 km long), the Sittaung (298 km long) and the Thanlwin (1,274 km long). All four of these rivers flow from north to south before entering the Andaman Sea. The Ayeyarwady River is the largest river in Myanmar and it is the only one in the country that supports a freshwater population of Irrawaddy dolphins.

Figure 1. Map of Myanmar and the Ayeyarwady River System.



## Summary of population status and distribution of Irrawaddy dolphins in the Ayeyarwady River

As mentioned in Smith *et al.* (1997), the earliest reference to dolphins in the Irrawaddy River is from the New T'ang History (Chinese text from 'about 800 A.D.' as cited in Luce 1966), which mentions trade in 'river pigs' among the Pyu people. Anderson (1879) observed Irrawaddy dolphins in the Ayeyarwady (Irrawaddy) River and he also found that the dolphins do not occur further downstream than Prome (Pyay, which is about 360 km upstream from the mouth) during the low-water season and Yenangyoung (about 540 km upstream from the mouth) during the high-water season. Regarding the upstream habitat limit, the local Shan people reported to Anderson (1879) that the dolphins were never found upstream of a point 30 km above Bhamo, where the course of the river was interrupted by rocks. They called the site Labine, or "Dolphin Point." Anderson (1879) also reported that the dolphins ascended larger tributaries, such as the Taping, Chindwin and Shweli, when these were in flood.

The first systematic, range-wide survey of Irrawaddy dolphins in the Ayeyarwady River was conducted from 25<sup>th</sup> November to 20<sup>th</sup> December 2002 by a team comprised of staff from the Wildlife Conservation Society (WCS) and four government institutions, namely: Ministry of Forestry, Ministry of Livestock and Fisheries, Ministry of Information and Ministry of Education (Mya, 2002). This visual boat-based survey started at the confluence of the Maykha and Maylikha Rivers and proceeded downstream to the delta along 1,788 km of river length in the main channel and 202 km in the tributaries. The team observed eight dolphin groups in the main channel for a total of 37 individuals. All sightings were in a 373-km river segment between the Taping River confluence at Bhamo and Mingun (located upstream of Mandalay; Figure 1) (Smith and Mya, 2007).

Based on information on dolphin occurrence obtained during the 2002 survey, a second survey was conducted in December 2003 between Mandalay and Bhamo (Mya, 2003). Scientists from the Ministry of Forestry, Ministry of Livestock and Fisheries and WCS collaborated as observers. A large vessel was used to survey the main channel and a small vessel was used to survey side-channels. At all times, two observers stood watch in front and on

each side of the survey track. The upstream survey covered 420 km. Ten dolphin groups were observed, and the total best estimate was 59 individuals including four calves (Smith and Mya, 2007).

In December 2004, upstream and downstream surveys were conducted between the Sagaing Bridge, located slightly downstream of Mandalay, to Bhamo (Figure 2) (Mya, 2004). Fourteen dolphin groups were observed during the upstream survey and 10 dolphin groups were observed during the downstream survey. During the upstream survey a total of 72 individuals were counted including 9 calves (Smith and Mya, 2007). Surveys conducted in 2007-2008 and 2008-2009 were combined with educational outreach activities and selling dried fish, which compromised searching effort, and the observer team recorded only 32 and 56 individuals, respectively.

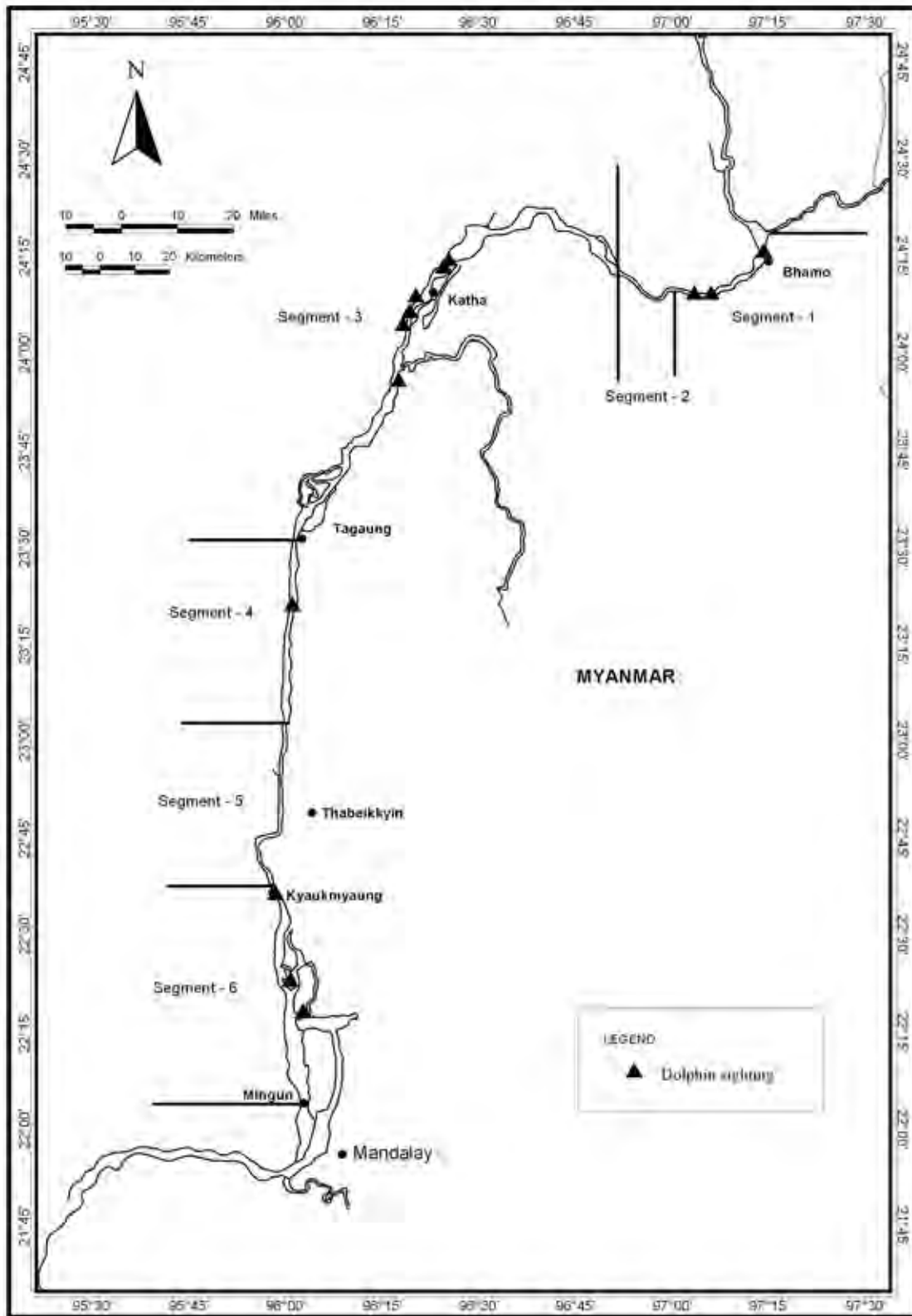
## Past and ongoing conservation initiatives/ programs for dolphin conservation

Past conservation initiatives involved three years of information gathering from visual boat-based surveys and investigations conducted by the Department of Fishery (DoF) and WCS on the status of Irrawaddy dolphins and threats to their survival in the Mandalay to Bhamo river segment. In December 2005, the DoF announced the establishment of a protected area for dolphins and the human-dolphin cooperative cast-net fishery in the Mingun to Kyaukmyaung river segment. The current conservation program focuses on enforcing fishing regulations, raising awareness, monitoring and implementation of the management plan in the protected area (Appendix 1).

### *Education and awareness program*

During twice-monthly patrols in the protected area, the DoF and WCS conduct educational outreach in local villages. The main purpose of this program is to raise awareness among local people about the Irrawaddy dolphin. Educational talks and workshops are held at schools, Buddhist monasteries, offices of local authorities, and houses of fish contractors. According to information collected from local people, electric fishing is the main threat to the dolphins, together with gill net, dynamite and poison fishing.

Figure 2. Map of Irrawaddy dolphin sightings in the Ayeyarwady River made during a survey in 2004 between Bhamo and Mandalay by DoF and WCS.



The educational team addresses these problems with the fishermen and local authorities. Awareness raising activities include the distribution of posters, banners and pamphlets, which were developed especially for conservation purposes. An educational video about the Irrawaddy dolphin, the cooperative fishing practice and sustainable fishing is frequently shown in the evenings at monasteries and schools. Awareness-raising banners about the Irrawaddy dolphin are also placed at jetties, schools, village markets, tea shops, and offices of village authorities and in villages, where cooperative-fishing is being practiced.

#### *Monitoring, research and surveillance program*

The team from DoF and WCS purchased and renovated a 62 ft long, 13 ft wide wooden vessel with a four-stroke diesel engine to be used as the main patrol boat. A small, long-tailed wooden boat, 20 ft long and with an 18 hp diesel engine, was also purchased for patrolling and surveying tributaries.

Twice-monthly patrols are conducted in the protected area except during June and July when high water levels make navigation unsafe. Information is provided to local villagers and fishermen about fishery laws and regulations. During the fish spawning season, the team announces fishery regulations to local villagers over a loud speaker. Law enforcement is conducted jointly by local DoF staff and local authorities. Workshops and meetings are held frequently with the local authorities, DoF officers and the local fishing communities. Visual monitoring of Irrawaddy dolphin habitat and studies of dolphin behavior are conducted during regular patrolling activities.

#### *Development, implementation and official agreement of the management plan*

The Irrawaddy Dolphin Protected Area Management Plan was developed after conducting extensive meetings, workshops and discussions to obtain input from local government officials, fish contractors, fishermen, village leaders and Buddhist monks. Their input was carefully considered and incorporated into the plan to ensure that it addresses the needs of wildlife protection as well as human livelihoods and welfare.

The protected area is managed under the Memorandum of Understanding between the Department of Fisheries, Ministry of Livestock and Fisheries, Union of Myanmar, and the Wildlife Conservation Society, New York, on Cooperation in

the Fields of Marine and Riverine Biodiversity Conservation in Myanmar, signed on 6 February 2007. The Department of Fisheries, Myanmar, is responsible for implementing the regulations and directives in support of the management plan, establishing a core management team for the protected area, providing staff support, maintaining liaisons with the local communities and other relevant departments and ministries, and facilitating the participation of international advisors from WCS. Within internal financial, logistical and legal constraints, WCS provides technical training and advice, and financial assistance for research, surveys, patrolling, educational outreach and training activities.

The Management Plan for the Ayeyarwady Dolphin Protected Area was adopted during a meeting of the Management Committee of the Ministry of Livestock and Fisheries, held on 7 July 2009. The management plan and its objectives and activities are presented in Appendix 1.

#### **Locations, size and management of planned or existing protected areas**

After three years of gathering information from investigations on the status of Irrawaddy dolphins and threats to their survival in the Mandalay to Bhamo river segment, it was determined that the animals occur mainly in three river segments, 1) between Bhamo harbour and the entrance of the second defile at Sinkhan village, 2) between Moda village and the entrance of the third defile at Male' village, and 3) from the end of the third defile at Kyaukmyaung to the Mingun jetty (Smith and Mya 2007). A human-dolphin cooperative cast-net fishery, which involves 47 cast-net fishing teams, is situated in the river segment between Kyaukmyaung and the Mingun jetty. These sites constitute the upstream and downstream demarcation points, respectively, of the 74-km long Ayeyarwady Dolphin Protected Area. The Ministry of Livestock and Fisheries and the Department of Fisheries announced Notification No.11/2005 on 28 December 2005, in accordance with the power under section 22, sub-section (c) of the Freshwater Fisheries Law, which states that: "The Director General of the Department of Fisheries prohibits the catching of fish using the under mentioned fishing implements in the Ayeyarwady River in order to safeguard and prevent the extinction of Irrawaddy dolphins. The catching or

killing of Ayeyarwady dolphins and trade in whole or parts of them is also prohibited. In the case of accidentally caught by fishing net, fishermen shall release them alive without delay." Also in December 2005, Fisheries Notification No. 10/2005 was announced which states that: "In accordance with the power under section 22 sub-section (c) of the Freshwater Fisheries Law, the Director General of the Department of Fisheries prohibits electric and shocking with battery in order to prevent the extinction of fish."

*Protected area*

In Ayeyarwady River, starting from the points of Sagaing Division, Shwebo District, Kyaukmyaung Township, in front of Yae-daw Pagoda (Lat 22.60903° N; Long 95.94280° E) and Mandalay Division, Pyinoolwin District, Singu Township; (Lat 22.61039° N; Long 95.94774° E) to the points of Sagaing Division, Mingun mountain range, in front of Baw-di-ta-htaung Pagoda (Lat 22 03937° N; Long 96 02235°E) and Mandalay Division, Mandalay city,

Nan-daw-kyun point (Lat 22 03831° N; Long 96 03477° E).

*Prohibited fishing implement*

1. Gill-net obstructed in water-course;
2. Gill-net obstructed from bank to bank of the river;
3. Drift-net longer than 300 feet;
4. Fishing implements and fishing methods that are prohibited by the Department of Fisheries from time to time.

**Threats to freshwater cetaceans in planned or existing protected or conservation areas**

According to information collected from the local people and fishermen, electric fishing is the main threat to the dolphins, together with gill net, dynamite, and poison fishing. A total of 13 dolphin deaths were documented between 2002 and 2009 (Table 1).

**Table 1.** Dolphin deaths documented since 2002.

Year	Place	No. of Carcasses	Cause of death
2002	Singu, Mandalay	1	Electric fishing
2004	Myay Zun, Mandalay	2	Gillnet entanglement
2005	Mandalay, Jetty	1	Unknown (carcass was damaged)
2005	Indown, Sagaing	2	Unknown
2006	Sink khaing	2	Unknown
2008	Shwe gu, Kachin State	2	Electric-fishing (calf) based on information from fisheries officer
2009	Bhamo, Kachin State	1	Gillnet (calf) information from fisheries officer
2009	Sethe, Mandalay	1	Gillnet entanglement (juvenile)
2009	Sagaing	1	Found dead by a fisherman who collected the oil

**Trends in dolphin abundance, natality or mortality due to conservation measures taken in planned or existing protected areas or special conservation areas**

Although concrete data on trends are not available, it is expected that the threats to the dolphins will be reduced and that the population will increase. Four new-born calves were detected in March, September and November 2009 in the protected area, and two calves were detected in December 2009 near Bhamo (Aung 2009).

**Needs for establishing new protected areas**

We propose to extend the protected area to include a 36 linear-km river segment between the Taping and Ayeyarwady confluence near Bhamo and the beginning of the river defile at Sinkan. This river segment supports the highest density of Irrawaddy dolphins in the Ayeyarwady River and it is easily accessible from Bhamo, where suitable infrastructure exists for implementing management interventions. Based on the results of a range-wide survey for Irrawaddy dolphins in January 2010, this

segment currently supports the highest encounter rates within the range of the population (0.58 dolphins/km) and 20.7% of the total population (Aung 2010).

### **Other species that will benefit from planned or existing protected areas or special conservation areas?**

In addition to the Irrawaddy dolphin, many fish species will benefit from establishment of the protected area and the implementation of restrictions on destructive fishing practices.

### **Benefits for local communities in the planned or existing protected areas or special conservation areas?**

The benefits for local communities are: 1) further development and promotion of cooperative fishing activities, 2) education programs that will increase the interest of local people, 3) increased tourism to view the cooperative fishing practice, which should provide employment income to local people; and 4) a protected area tax levied against tourism activities, with at least part of the revenue dedicated to development in local fishing villages.

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## **Appendix 1. MANAGEMENT PLAN FOR THE AYEYARWADY DOLPHIN PROTECTED AREA**

### **Objective 1 : Significantly reduce or eliminate illegal fishing activities.**

#### Action 1: Implement patrolling, educational outreach and enforcement activities.

##### *Activities*

1. Villagers will be educated about freshwater fisheries laws and regulations through meetings and discussions, distribution of printed media and showing education videos during all patrolling activities. (DoF)
2. Twice-monthly patrols will be conducted in the Ayeyarwady Dolphin Protected Area during non-monsoon season months. (DoF/WCS)
3. Patrols during the fish spawning season in June and July will be conducted jointly with the DoF in Singu and Mattaya Districts to educate and enforce the fishery closure for protecting fish stocks. (DoF/WCS)
4. The project vessels will be maintained for safe operation during patrols and surveys. (DoF/WCS)

#### Action 2: Educate local villagers, fishery lease holders, and fishers on the negative impacts of illegal fishing practices on sustainable fisheries.

##### *Activities*

1. Workshops will be frequently convened with fishers and fishery lease holders in local villages in collaboration with the DoF in Singu and Mattaya Districts. (DoF/WCS)
2. Educational pamphlets and posters will be developed and distributed. (DoF/WCS)
3. Permanent signboards will be placed in all riverine villages. (DoF/WCS)

#### Action 3: Collaborate with local authorities and the DoF to enforce fishery regulations that prohibit destructive fishing methods, such as those using electricity, poisons and explosives, and restrict the use of gill-nets and seine-nets.

##### *Activities*

1. Frequent meetings will be held with local authorities and DoF to monitor the activities of the management plan. (DoF)

2. Twice-monthly patrols (as per Action 1, Activity 2 above) will be routinely conducted in collaboration with local authorities. (DoF)

#### Action 4: Empower local DoF staff to enforce existing fisheries laws and regulations prohibiting illegal fishing techniques.

##### *Activities*

1. Educate fishery lease holders about their responsibility for ensuring that illegal fishing techniques are not used in their licensed river segments. (DoF)
2. Conduct twice-monthly monitoring patrols (as per Action 1, Activity 2 and Action 3, Activity 2 above) and hold frequent discussions with fishers and local DoF staff. (DoF)
3. Examine fish in local markets of the Ayeyarwady Dolphin Protected Area for evidence of being caught by electric fishing (mushy appearance and feel) for gathering information. (DoF)
4. Report illegal fisheries taking place in licensed segments for further action by the DoF according to existing fisheries laws and regulations. (DoF)

### **Objective 2: Promote the sustainability of the human-dolphin cooperative cast-net fishery.**

#### Action 1: Implement regulations to protect the human-dolphin cooperative cast-net fishery.

##### *Activities*

1. Accurate documentation will be maintained of co-operative cast-net fishers and they will be issued identity cards which give them special rights and responsibilities in the protected area (see below). (DoF)
2. Notify fishery license holders that co-operative cast-net fishers holding identity cards should be allowed to fish with dolphins throughout the protected area. (DoF)
3. Notify co-operative cast-net fishers that their identity cards will be revoked if they are found using other fishing gears while following or fishing cooperatively with dolphins. (DoF)
4. Frequent discussions will be held and visual monitoring will be conducted during regular patrols to monitor compliance of fishery lease holders and the co-operative cast-net fishers. (DoF)



Action 2: Provide support for ensuring that cast-net fishers cooperating with dolphins receive economic benefits from dolphin-watching activities

*Activities*

1. Seek opportunities to collaborate with relevant government agencies, such as the Ministry of Hotels and Tourism, to (a) organize the cast-net fishers into cooperatives and promote agreements among them to share fees charged to tourists who come to observe the dolphins and the human-dolphin cooperative fishing practice, (b) provide training to cast-net fishers and tourist guides on Irrawaddy Dolphin Watching Guidelines for Tourists and Tourism Operators to ensure that the dolphins are not harmed by the activity, and (c) establish appropriate fees for tourists visiting the Ayeyarwady Dolphin Protected Area for dolphin watching activities and share the funds with the cooperative cast-net fishing communities. (DoF/WCS)

Action 3: Provide support to ensure that dolphin watching activities are conducted in a manner that does not harm the animals and provides direct benefits to the human-dolphin cooperative cast-net fishers.

*Activities*

1. Conduct training courses on the biology and conservation of Irrawaddy dolphins and on safe practices for the dolphins and tourists during dolphin watching activities. (DoF/WCS)
2. Establish clear guidelines for dolphin-watching activities. (DoF)
3. Monitor dolphin watching activities during patrols and gather information from tourists and local stakeholders. (DoF/WCS)

**Objective 3: Protect aquatic habitat.**

Action 1: Investigate illegal gold mining operations.

*Activities*

1. Record information and inform relevant government authorities, such as the Ministry of Mines and Ministry of Transport, about all observations of gold mining activities made during patrols and surveys. (DoF/WCS)

Action 2: Monitor mercury concentrations in fish muscle tissues

*Activities*

1. Obtain muscle tissue samples of *Ompok* and *Wallago attu* fish species throughout the entire Ayeyarwady River. (DoF/WCS)
2. Analyze the tissue samples for mercury concentrations and interpret the biological implications of measured levels. (WCS)
3. Include information on mercury concentrations in reports submitted to the DoF. (WCS)
4. Highlight information on mercury concentrations during meetings and workshops. (DoF/WCS)

Action 3: Monitor additional sources of habitat degradation including dredging operations, disposal of industrial and municipal wastes, and disturbance of natural water flow.

*Activities*

1. Document and report on waste outfalls and other potential sources of habitat degradation recorded during surveys and patrols. (DoF/WCS)
2. Share information with relevant government authorities, such as the Ministries of Transport, Industry, Energy and Mines, about potential developments in the Ayeyarwady Dolphin Protected Area. (DoF)

**Objective 4: Promote sustainable fisheries**

Action 1: Investigate fishing techniques in the protected area

*Activities*

1. Investigate and record fish catches, the number of gears, and their locations and operation in the protected area. (DoF/WCS)
2. Develop better management for floodplain fisheries in the protected area. (DoF/WCS)

Action 2: Incorporate recommendations to implement for better fishery management.

*Activities*

1. Make science-based recommendations to manage fisheries for sustainable catches and maintaining sufficient prey for dolphins. (DoF/WCS)

2. Communicate fisheries management recommendations in reports and meetings. (DoF/WCS)

Action 3: Conduct educational outreach on sustainable fishing practices.

*Activities*

1. Incorporate information on sustainable fishing practices into educational outreach activities including workshops, meetings, and the development and dissemination of media materials. (DoF/WCS)
2. Conduct training courses on sustainable fisheries and opportunities for alternative livelihoods for fishers currently using illegal techniques. (DoF/WCS)

**Objective 5: Develop a core management team and capacity for implementing the Ayeyarwady Dolphin Protected Area Management Plan.**

Action 1: Develop a core management team composed of DoF and WCS staff, local fishers, community leaders and Fisheries Federation Officers

*Activities*

1. Develop a list of members for the core management team for approval by the DoF.
2. Convene meetings of the core management team to advise on and delegate responsibilities for implementing the management plan.

Action 2: Provide technical training on dolphin survey, patrolling and mortality monitoring techniques.

*Activities*

1. Conduct yearly training courses on survey, patrolling, and mortality monitoring techniques. (WCS/DoF)
2. Provide field experience and incorporate the participation of local DoF staff in surveys and patrols. (WCS)

# REVIEW OF THE CONSERVATION STATUS AND PROTECTED AREAS FOR GANGES RIVER DOLPHINS *PLATANISTA GANGETICA* AND IRRAWADDY DOLPHINS *ORCAELLA BREVIROSTRIS* IN THE RIVER SYSTEMS OF BANGLADESH

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## Abstract

Little information is available on the range-wide status of the Ganges River dolphin in Bangladesh but anecdotal reports and personal observations suggest that the species is still fairly widespread in most major rivers and their tributaries. Sighting rates include 0.13 groups/km (mean group size = 1.8) in the Jamuna River, 0.08 groups/km (mean group size = 3.8) in the Kushiyara River, and 0.76 dolphins/km in the Karnaphuli and Sangu system in southeast Bangladesh, with a higher encounter rate of 1.36 dolphins/km recorded in the lower Sangu. The status of freshwater dolphins is best known in the Sundarbans mangrove forest where a Huggins conditional likelihood model of concurrent counts made by independent teams generated population estimates of 225 Ganges River dolphins (CV = 12.7%) and 451 Irrawaddy dolphins (CV = 9.6%). Fisheries interactions represent the greatest immediate threat to freshwater dolphins in Bangladesh. Directed hunting of Ganges River dolphins for their oil has been reported to supply oil for medicinal purposes and as a fish attractant. A large proportion of the dolphin carcasses used for oil are obtained from animals that become entangled in nylon gillnets and are then killed by local fishermen. Riverine and estuarine waters in Bangladesh are already experiencing the ecological impacts of declining freshwater supplies and climate change. The dependence of Ganges and Irrawaddy dolphins on abundant freshwater flow makes them particularly vulnerable to habitat loss due to upstream water abstraction and sea-level rise. Three waterway segments have been identified in the Sundarbans for focal protection using a "hotspot" scoring system of encounter rates recorded by captains of three nature tourism vessels. A proposed protected area network including these segments will provide a platform for understanding the ecological effects of declining freshwater supplies and climate change and a basis for developing adaptive management responses that benefit both fishermen and freshwater dolphins. The proposed network in the Sundarbans covers only a small fraction of the total freshwater dolphin habitat in Bangladesh. A priority area for future consideration as a protected area is the lower Sangu River.

## Abstrak

Hanya sedikit informasi yang tersedia mengenai status wilayah jelajah lumba-lumba Sungai Ganga di Bangladesh, namun beberapa laporan singkat dan hasil pengamatan pribadi menyebutkan bahwa jenis tersebut masih cukup tersebar luas di banyak sungai-sungai besar dan anak sungainya. Rata-rata penemuan kelompok adalah 0,13 kelompok/km di Sungai Jamuna, 0,08 kelompok/km di Sungai Kushiyara, serta 0,76 lumba-lumba/km di sistem Karnaphuli dan Sangu di tenggara Bangladesh, dengan rata-rata penemuan individu yang lebih tinggi yaitu 1,36 lumba-lumba/km di bagian hilir Sangu. Status lumba-lumba air tawar paling diketahui di hutan bakau Sundarbans dimana tim independen membuat perhitungan secara bersamaan dengan menggunakan model kemungkinan bersyarat Huggins dan memperoleh hasil perkiraan populasi sejumlah 225 lumba-lumba Sungai Ganga (CV=12,7%) dan 451 lumba-lumba Irrawaddy (CV=9,6%). Kegiatan perikanan menimbulkan ancaman langsung terbesar bagi lumba-lumba air tawar di Bangladesh. Menurut laporan, lumba-lumba Sungai Ganga diburu untuk diambil minyaknya dan digunakan sebagai obat dan umpan ikan. Minyak kebanyakan diambil dari lumba-lumba yang terjatuh ke jaring dan kemudian dibunuh oleh nelayan setempat. Wilayah perairan sungai dan muara di Bangladesh telah mengalami dampak ekologi dari berkurangnya suplai air tawar dan perubahan iklim. Ketergantungan lumba-lumba Ganga dan Irrawaddy terhadap ketersediaan air tawar, membuat mereka rentan terhadap kerusakan habitat akibat berkurangnya aliran air dari hulu dan kenaikan permukaan air laut. Tiga bagian terusan di Sundarbans yang akan dijadikan kawasan perlindungan (KP) telah diidentifikasi menggunakan sistem penilaian "hotspot" dari rata-rata penemuan individu yang dicatat oleh tiga kapten kapal wisata alam. Sebuah usulan jaringan KP termasuk ketiga bagian terusan ini akan memberikan suatu landasan bagi pemahaman efek ekologi dari berkurangnya suplai air tawar dan perubahan iklim global serta menjadi dasar untuk mengembangkan pola manajemen yang sesuai sehingga akan menguntungkan bagi nelayan maupun lumba-lumba air tawar. Jaringan yang diusulkan di Sundarbans hanya mencakup sebagian kecil dari total habitat lumba-lumba air tawar di Bangladesh dan bagian hilir Sungai Sangu termasuk KP yang akan diusulkan berikutnya.

## Overview of the Ganges-Brahmaputra-Meghna and Karnaphuli-Sangu River systems in Bangladesh

Bangladesh has a population of about 160 million people largely dependent on agriculture and freshwater fisheries. The country contains one of the world's largest river networks. About 700 rivers flow over a total length of about 24,000 km. All of these are under intense pressure from human activities including shrimp fry collection, unselective fishing, and industrial and agricultural pollution (Figure 1).

In Bangladesh, Ganges River dolphins, locally called *shushuk*, range throughout most major channels and tributaries of the Jamuna (Brahmaputra in India)/Padma (Ganges in India)/Meghna river system to the the Meghna River mouth and the Sundarbans mangrove forest. They also occur in the much smaller Karnaphuli-Sangu River system. The distribution of these freshwater dolphins tends to be clumped in deep counter-current pools created by channel confluences, mid-channel islands, and sharp meanders.

In Bangladesh, Irrawaddy dolphins range from freshwater channels of the Sundarbans mangrove forest to the open estuarine waters in the Bay of Bengal. Similar to Ganges River dolphins, Irrawaddy dolphins prefer counter-current habitat but they are generally found in higher salinity areas of the Sundarbans with a seasonally moving zone of overlap in the distribution of both species (Figure 2).

The alluvial channels and adjacent floodplains of the Jamuna-Padma-Meghna river system occupy approximately 80% of the geographical area of Bangladesh and support three quarters of the country's human population (Dalal-Clayton, 1990). High productivity within these environments is maintained by dynamic hydrologic and sediment transport regimes. During normal years, the annual flood cycle provides a nutrient and water supply essential for supporting productive floodplain agriculture and fisheries (Smith *et al.* 1998).

The Jamuna River is one of the largest in the world and accounts for more than 50% of the total water flow arriving to Bangladesh (BWDB 1992). During the dry season, from November to March, flows in the Jamuna range from 3500 m<sup>3</sup>/sec to 6500 m<sup>3</sup>/sec. Beginning in April, the melting snows of the northern slope of the Himalayas and Tibetan plateau, reinforced by monsoon rains in northeastern India, cause discharge in the river to

increase rapidly, sometimes peaking at over 100,000 m<sup>3</sup>/sec (BWDB 1992). Large fluctuations in streamflow and non-cohesive silty bank and bed materials create extensive networks of braided channels and frequently cause dramatic erosion events.

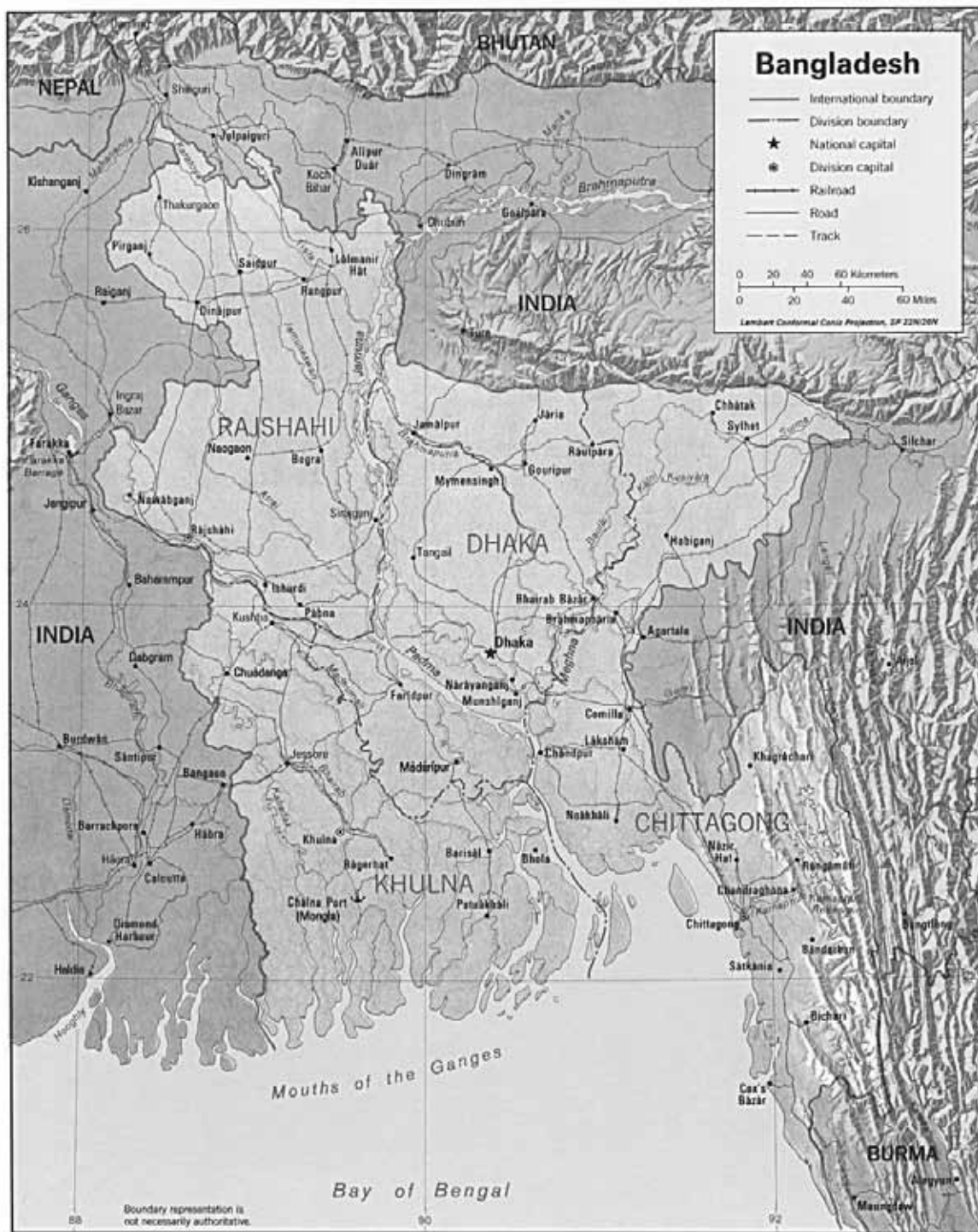
The Padma River drains the southern slopes of the Himalayas. Dry season flows in the Padma are greatly reduced by the Farakka Barrage, located 18 km upstream from the India-Bangladesh border. Water flow is depleted to such an extent that the main channel often turns into a series of small pools. Flows from the Padma feed most of the Sundarbans except for the far eastern edge which receives water from the Baleswar River (which is also a distributary of the Padma but after it has joined the Jamuna) (Smith *et al.*, 1998).

The headwaters of the Meghna River enter Bangladesh as the Surma and Kushiara distributaries of the Barak River, which drains the northeastern hills of India. Together these rain-fed rivers have an annual discharge of approximately 3515 m<sup>3</sup>/sec (Chowdhury and Bhuiya, 1990) with peak discharge reaching 20,000 m<sup>3</sup>/sec (World Bank 1990).

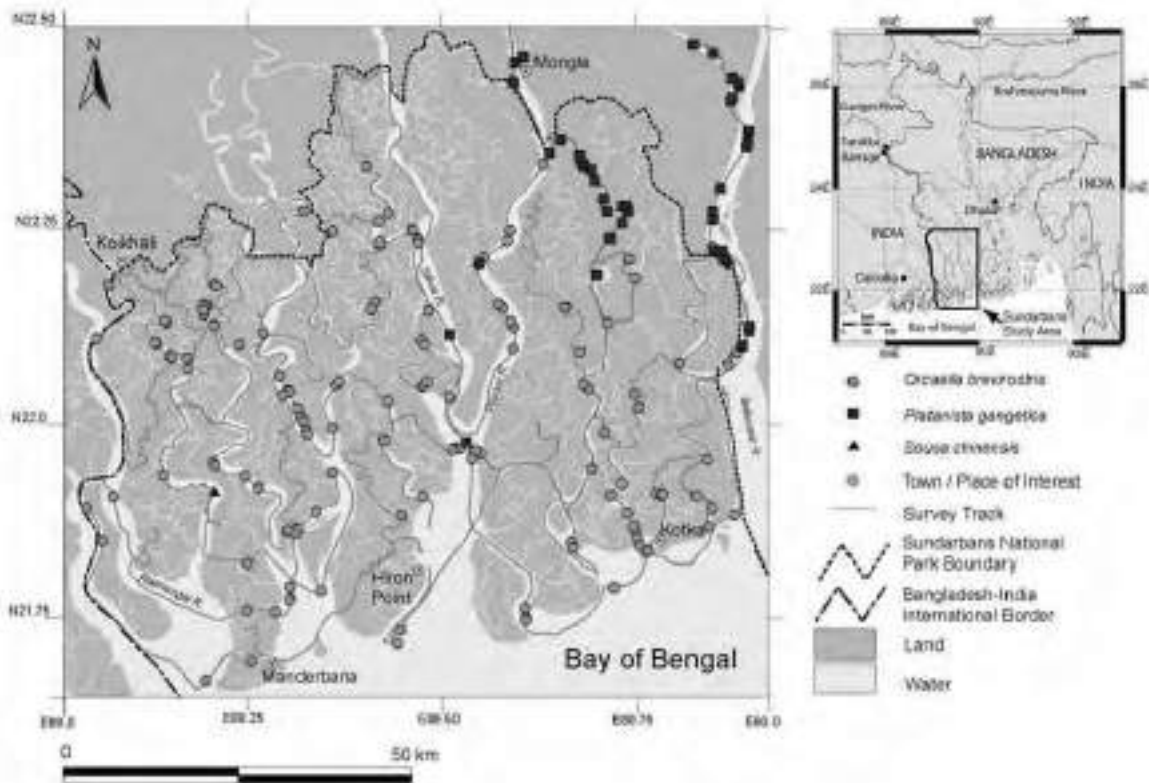
The Sundarbans is the world's largest continuous mangrove forest encompassing almost 600,000 ha. About 30% of the area is composed of a complex network of tidal waterways (Hussain and , 1994). The world's third largest river system, the Ganges-Brahmaputra-Meghna (Padma-Jamuna-Meghna), passes an enormous sediment load to the delta, supplying the physical elements for the world's largest undersea sediment fan. Salinity levels in the Sundarbans are determined primarily by freshwater flows and tides. Since construction of the Farakka Barrage (Ganges, India) in 1975, salinity in the Sundarbans has increased significantly. Increased sediment deposition due to reduced river discharges has led to the gradual drying up of distributaries that previously helped prevent salinity encroachment.

The Chittagong hills in the southeast of the country are drained by the comparatively small Karnaphuli, Sangu, and Matamuhari rivers. A high dam was constructed on the Karnaphuli River in 1962, creating the Kaptai reservoir, one of the largest in Asia, flooding over 76,600 ha of forest (Akonda, 1989) and altering ecological conditions in the 89-km stretch of river below the dam before it meets the sea. Although different watersheds feed the Karnaphuli and Sangu, the Sikalbaha-Chandkhali Canal connects them in their lower reaches (Figure3)

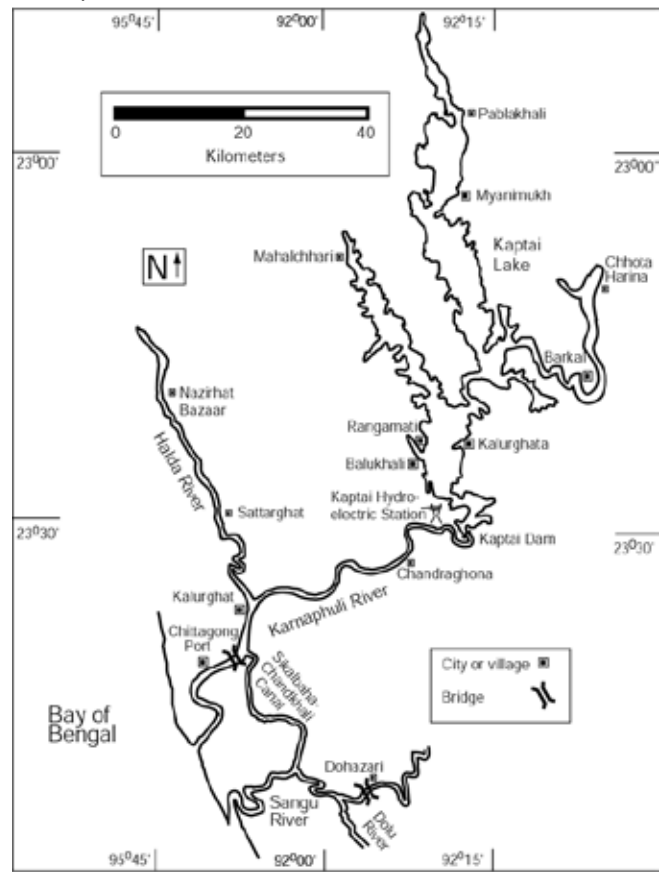
Figure 1. Map of Bangladesh showing the Jamuna-Padma-Meghna River system and the Karnaphuli River in the far southeast of the country.



**Figure 2.** Map of the Sundarbans Reserve Forest showing the March 2002 survey trackline and the locations of dolphin sightings, and an insert indicating the study area. Note that the Sundarbans image was derived from satellite imagery. It therefore shows numerous channels that do not contain water during the dry season and others that are too small to support dolphins. Map from Smith *et al.* (2006).



**Figure 3.** Map of Kaptai Lake and the Karnaphuli and Sangu Rivers and connecting Sikalbaha-Chandkhali Canal in Southeastern Bangladesh. Map from Smith *et al.* (2001).



## Summary of population status and distribution of Ganges River and Irrawaddy dolphins in freshwater systems in Bangladesh

Few abundance estimates exist for Ganges River dolphins outside the Sundarbans mangrove forest but anecdotal reports and personal observations of the authors suggest that the species still occurs fairly widespread in most major rivers and their tributaries in Bangladesh.

Direct counts of Ganges River dolphins in April 1996 in the Jamuna River between the divergence of the Old Brahmaputra River and the confluence of the Padma River indicated at least 38–58 dolphins in 25 groups (sighting rate = 0.13 sightings/km; mean group size taken from best estimates = 1.8, SD = 1.4, range = 1–7) (Smith *et al.*, 1998).

Direct counts of Ganges River dolphins in October 1995 in the section of the Kushiara River between the Bangladesh–India border and the confluence of the Korangi River indicated at least 34–43 dolphins in 9 groups (sighting rate = 0.08 sightings/km; mean group size taken from best estimates = 3.8, SD = 2.8, range = 1–8) (Smith *et al.*, 1998).

Direct counts of Ganges River dolphins made from January to April 1999 in the southern rivers of Bangladesh and Kaptai Lake indicate a population of at least 125 dolphins in the Karnaphuli and Sangu rivers and connecting canal, and that the species has almost certainly disappeared from Kaptai Lake. The overall encounter rate was 0.76 dolphins/km with the highest rate, 1.36 dolphins/km, in the lower reaches of the Sangu (Smith *et al.*, 2001).

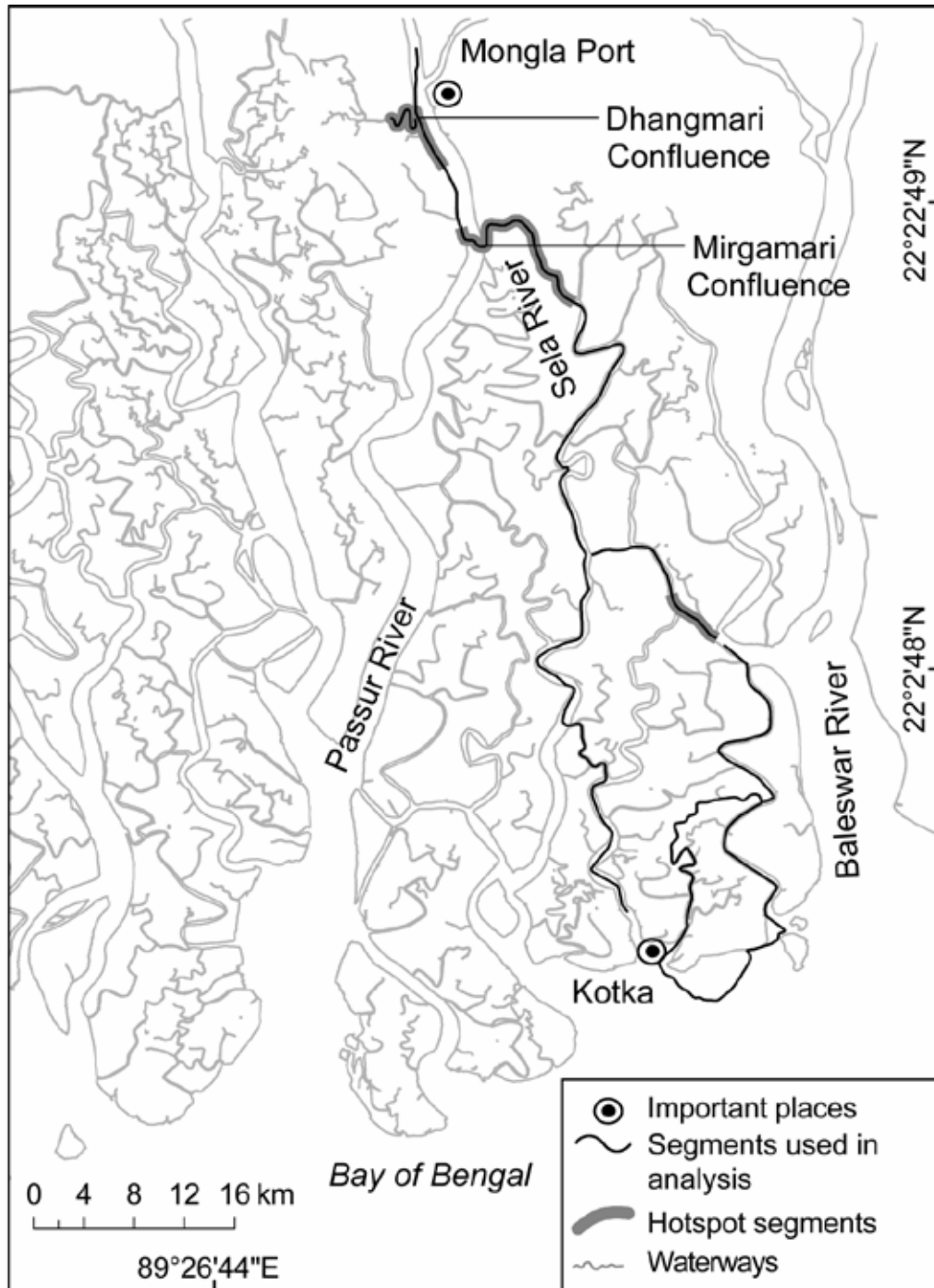
Assessments of Ganges River and Irrawaddy dolphins in waterways of the Sundarbans mangrove forest began with a comprehensive, dry-season survey in March 2002. Two independent observer teams made concurrent counts that were then corrected for missed groups using mark-recapture models (Smith *et al.*, 2006). For Irrawaddy dolphins, a stratified Lincoln-Petersen model, which incorporated group size and sighting conditions as covariates, and a Huggins conditional likelihood model, which averaged models that individually incorporated group size, sighting conditions and channel width as covariates, generated abundance estimates of 397 (CV = 10.2%) and 451 (CV = 9.6%), respectively (Smith *et al.*, 2006). For Ganges River dolphins, a stratified Lincoln-Petersen model, which incorporated group size as a covariate, and a Huggins

conditional likelihood model, which averaged the same models described above, generated abundance estimates of 196 (CV = 12.7%) and 225 (CV = 12.6%), respectively (Smith *et al.*, 2006). Overall the survey found that the waterways of the Sundarbans support significant numbers of Irrawaddy and Ganges River dolphins, especially compared to other areas where the species have been surveyed.

Habitat selection of Ganges River and Irrawaddy dolphins was investigated using data collected from visual boat-based surveys in the Sundarbans during the pre-monsoon season, when freshwater flow was approaching its lowest, and during the early post-monsoon season, when freshwater flow was still close to peak levels (Smith *et al.*, 2009). Generalized Additive Models indicated that Ganges River dolphins selected channel segments characterized by low salinity, high turbidity and moderate depth, while Irrawaddy dolphins were dependent on relatively deep, warm, and clear waters with a relatively high frequency of large and small confluences. However, during the high-water season Irrawaddy dolphins selected deep channels, extreme ranges of turbidity, and low salinity. Also, both species exhibited a preference for wide, sinuous channels with more than two small confluences or at least one large confluence and wide, sinuous channels with one or two small confluences (Smith *et al.*, 2009).

Between March 2002 and March 2005, captains of three nature tourism vessels operating in the Sundarbans mangrove forest in Bangladesh surveyed a total of 26,208 linear km covering 80 5-km long track lines in channel segments of the eastern Sundarbans. The captains recorded 1,005 sightings of Ganges River dolphin groups (1,993 individuals, 11.8% calves) and 281 sightings of Irrawaddy dolphin groups (566 individuals; 5.7% calves). These data were used to investigate channel-type preferences and identify cetacean 'hotspots' according to a scoring system based on group, individual and calf encounter rates, the co-occurrence of both species, and encounter rates in neighboring segments recorded during monsoon, post-monsoon, and dry seasons. Six 5-km segments were identified for priority conservation attention (three and two of these segments were contiguous; Figure 4) from a total of 38 that were transited (surveyed) on at least three occasions during each season (Smith *et al.*, 2010).

**Figure 4.** Area of nature tourism sighting network in the eastern Sundarbans showing the 38 segments surveyed on at least three occasions during the monsoon, post-monsoon and dry seasons during 2002–2005 and the six identified hotspot segments. Note that two hotspot segments, located in the far north of the study area and inclusive of the Dhangmari confluence and the Passur River near Mongla Port, are contiguous; and three hotspot segments, located slightly to the south and inclusive of the Mirgamari confluence and beginning of the Sela River, are also contiguous. Map from Smith *et al.* (2010).





## **Past and ongoing conservation initiatives/programs for dolphin conservation**

Since July 2006 the Bangladesh Cetacean Diversity Project (BCDP) has convened an extensive series of training courses to provide government officials, university students, and local scientists the skills and knowledge to conduct scientific research and educational outreach in support of cetacean conservation. In almost all cases, training courses were directly connected to research and educational outreach activities such that the participants obtained intensive, practical field experience reinforcing the lessons communicated during the training. All training courses emphasized interactive learning techniques, and all participants were provided with training handbooks as easy-to-understand references for the topics covered and additional background material.

Educational outreach is a high priority for the BCDP. One of the most effective approaches was an intensive, interactive training course for educators from local NGOs that were already working in community development projects in fringe villages of the Sundarbans (Prodipan, Coastal Development Project, Rupantar, Caritas, Learning Care for Oppressed Society, Let-us-Progress, and Dhoritry). The course provided them with illustrated media materials (including locally produced film documentaries and booklets in Bengali language) on cetaceans and encouraged them to incorporate cetacean conservation messages into their ongoing work. Based on an evaluation process, the BCDP estimated that the NGO educational outreach network reached over 20,000 people living in close proximity to critical dolphin habitat.

On 9-12 October 2008, the BCDP convened a cetacean exhibit (*Shushuk Mela*) at the Shishu (Children's) Academy in Dhaka. Inside the exhibition hall were (1) life-sized models of the seven small cetacean species inhabiting Bangladesh waters; (2) colorfully illustrated placards with information about cetaceans in English and Bengali; (3) interactive games including "Am I a Mammal?", "Cetacean Body Parts", and "Fin Matching;" (4) video presentations of a live birth of a cetacean and BCDP documentary films; (5) gallery-quality photographs of cetaceans in Bangladesh; and (6) an exhibit of cetacean skulls and bones. Throughout the exhibit, volunteer interpreters actively engaged visitors to play the games, ask questions, and discuss the presentations.

At least 10,000 people attended the exhibition. Entries in the guestbook were overwhelmingly positive and the exhibit received extensive media coverage in Bangladesh and a television segment on BBC World.

The BCDP established a mortality monitoring network among the Forest Department (FD) and NGO partners, distributing educational materials to 50 guard posts in the Sundarbans Reserve Forest and encouraging FD staff to report cetacean deaths to the "Dolphin Hotline". During the training workshop for NGO partners, BCDP requested that participants encourage community members to report cetacean deaths to the BCDP Dolphin Hotline number. Educational materials were also distributed among local tour operators and local villagers during field visits. If a cetacean carcass is reported to be in good or fair condition, the BCDP Coordinator organizes a Mortality Response Team composed of volunteer students from local universities who have been trained in sample collection following the Cetacean Carcass Examination and Sampling Protocol prepared by the BCDP.

## **Location, size and management of planned or existing protected areas**

Three waterway segments in the Eastern Sundarbans Reserve Forest (ESRF) have been identified for focal protection of freshwater cetaceans in a proposed protected area network according to the "hotspot" scoring system (see above; Figure 4). These are

1. A 12-km channel in northwest corner of the Eastern Sundarbans Reserve Forest (ESRF) starting at the Ghagramari Forest Department (FD) Patrol Post heading east on the Dhangmari Khal (creek) past the Dhangmari FD Station to the Passur River confluence and proceeding south on the Passur to the Karamjal FD Patrol Post.
2. A 15-km channel segment in the north of the ESRF starting at the Jongra FD Patrol Post on the Passur River heading south to the Nandabala FD Patrol Post and east to Mirgamari FD Patrol Post inclusive of Chandpai FD Range Office and southeast on the Mirgamari to the Andharmanik FD Patrol Post.
3. A 5 km segment in the mid-eastern part of the Eastern Sundarbans Reserve Forest starting two km north of the Dudhmukhi FD Patrol Post

heading south on the Betmar Khal to the Barashiala Khal and Southeast to the Bhola river confluence near Supoti.

The proposed network in the Sundarbans covers only a small fraction of cetacean habitat in Bangladesh. Another priority area for consideration as a protected area is the lower Sangu River, which supports a substantial portion of the Ganges River dolphin population in the Karnaphuli-Sangu system. Ganges River dolphins in the lower Sangu deserve particular conservation attention because they may be demographically isolated and the relatively pristine conditions in the lower Sangu make this river segment an ideal candidate for a protected area. These animals have been intensively studied by researchers from the Chittagong University. Thirteen direct count surveys for Ganges River dolphins in the lower Sangu River (~ 50.0 linear km) during 2003-2004 recorded 27-64 individuals (Benazir Ahmed, unpublished).

### **Threats to freshwater cetaceans in planned or existing protected areas or conservation areas**

Very little information is available on threats to freshwater cetaceans in Bangladesh, but fisheries interactions almost certainly represent the greatest immediate threat. Directed hunting for Ganges River dolphins has also been reported in northern Bangladesh to supply the demand for dolphin oil but much of this demand is probably also met by dolphins that become entangled in nylon gillnets and then are killed by fishermen. In India, Sinha (2002) noted that this 'assisted incidental capture' is difficult to distinguish from genuine and much rarer cases in which dolphins drown in gillnets unnoticed and cannot be released by the fishermen.

Dolphin oil is used as a liniment, claimed to be effective for treating rheumatism, burns, and nervous disorders, as a tonic for treating impotence and asthma, and as a drink for pregnant women who believe it will ensure a healthy baby. The oil is also mixed with banana leaves and fed to cows to fatten them before being taken to market (Haque, 1982; Pelletier and Pelletier, 1980; Smith *et al.*, 1998). In the Buriganga and Meghna rivers near Dhaka, in the Jamuna River near Sirajganj, and probably in other large river channels of Bangladesh, dolphin meat, entrails, and oil are also used as an attractant for the schilbeid fish *Clupisoma garua*. While drifting

downstream, fishermen in small boats trail bound pieces of dolphin body parts off the side while sprinkling the water with a mixture of oil and minced dolphin flesh. Small unbaited hooks are then used to catch fish that rise to the surface within the oil slick (Smith *et al.*, 1998). This fishing technique is also commonly practiced in large channels of the Ganges and Brahmaputra upstream in India (Motwani and Srivastava, 1961; Sinha, 2002)

Out of a total of 16 deaths (10 Ganges River dolphins, 4 Irrawaddy dolphins, 2 finless porpoise) reported inside or close to the Sundarbans Reserved Forest between November 2007 and June 2009, the BCDP collected and examined biological samples for 12 specimens. The cause of death could not be determined for seven of the examined carcasses. Based on the nature of visible wounds and reports from local people, two Ganges River dolphins were suspected to have been killed deliberately, probably for the oil. One Ganges River dolphin and one Irrawaddy dolphin died from entanglement in gillnets and one Ganges River dolphin from entanglement in a longline.

Water development projects in Bangladesh are largely for flood protection and irrigation. Most of the country is unsuitable for large dams or barrages because of the flat topography and the migratory behavior of the river channels. A notable exception is the Kaptai Dam, built in 1961 in the Karnaphuli River about 80 km upstream of its mouth (Figure 3). This dam entrapped a small number of Ganges River dolphins in the Kaptai Lake which survived in isolation for some time. However, the last record of the species in the reservoir was a carcass found in October 2004 and photographed with a fishing rope around its body (Ahmed, 2000). No dolphins were observed during a survey of Kaptai Lake in February 1999 covering all major arms of the reservoir (Smith *et al.*, 2001).

A partial inventory of water development projects in Bangladesh affecting rivers that historically supported or currently support dolphins included 16 projects: one high dam, six closure dams, two barrages, five embankment projects, and two dredging projects. In addition, upstream in India, the Padma (Ganges River in India) has also been greatly affected by the Farakka Barrage, and the Kalni/Kushiyara and Surma rivers will be affected if plans proceed to construct a high dam on the Barak River (Smith *et al.*, 2000).

Water is removed from the Ganges basin by an extensive network of at least 20 high dams and 21

low-gated dams (barrages). Water is also lost to evaporation from reservoirs and open canals, and seepage to recharge declining groundwater (Smith and Reeves 2000, Smith *et al.*, 2000). In terms of significance to Ganges River dolphins, the most notable flow regulation structure is the Farakka Barrage which diverts flow from the Ganges to the Hooghly River for the purpose of reducing sedimentation in Calcutta Port (Haque, 1976). If future plans proceed for a group of large-scale, inter-basin water transfer projects (see Ghosh *et al.*, 2003; Patkar, 2004), which will involve additional dam construction and diversion of water from rivers within the Ganges-Brahmaputra-Meghna system, declining freshwater flow to the Sundarbans will become a much greater threat to dolphins and other aquatic fauna.

Rising sea-levels from global climate change will profoundly affect the ecology of waters in the Sundarbans with strong interactive effects with declining freshwater flows. According to simulation models reported by the Intergovernmental Panel on Climate Change (IPCC) average sea-surface temperature will increase by 1.1-6.4°C resulting in a globally averaged sea-level rise of 18-59cm in 2090-2099 (IPCC, 2007). However, these figures could potentially be much higher because the models do not incorporate indirect factors such as carbon-cycle feedback.

Ganges and Irrawaddy dolphins in the Sundarbans show distinct distributional responses to salinity and turbidity gradients, providing a predictor of their distributional response to sea-level rise (Smith *et al.* 2009). The dependence of both Ganges River and Irrawaddy dolphins in the Sundarbans on environmental characteristics associated with abundant freshwater flow, including low salinity and the availability of confluences, makes them particularly vulnerable to habitat loss due to upstream water removal and sea-level rise (Smith *et al.*, 2009).

### **Trends in dolphin abundance, natality or mortality due to conservation measures taken in planned or existing protected areas or special conservation areas**

No information is available on trends in dolphin abundance, natality, or mortality due to conservation measures taken in protected areas;

however, mechanisms are being put into place through the captains' sighting and mortality monitoring networks (see above) to obtain this information in the long term. A key challenge will be to obtain large enough sample sizes to detect significant trends in these population parameters.

### **Needs for establishing new protected areas**

Bangladesh has a rich faunal diversity with at least 260 freshwater species and 475 marine species identified to date. Of these, eight are cetaceans including two freshwater-dependent species: the Ganges River dolphin and the Irrawaddy dolphin. The Bangladesh Wildlife Preservation Ordinance of 1973 was aimed at achieving better management of protected areas and preservation of biodiversity. The Wildlife Protection Act 1974 (Preservation Amendment) provides the legal framework for protected areas in Bangladesh. Today Bangladesh has a total of 19 legally recognized protected areas covering a total area of 241,913 ha, which represents 10% of the total area managed by the Forest Department. The area dedicated for protected areas in Bangladesh represents only 0.5% of the total country which is one of the lowest percentages in the world. These 19 protected areas have been designated in 3 legally recognized categories: wildlife sanctuaries (8), national parks (10), and a game reserve (1). The Forest Department has completed management plans for these protected areas; however, they generally have not been fully implemented because of lack of resources and management capacity.

The Forest Department is trying to protect the country's natural resources, but it lacks manpower and funding. To address these deficiencies, the Forest Department started an innovative forest co-management program with local communities. Co-management is a new concept in Bangladesh. The "Nishorgo" support project of the Forest Department is an example of protected area co-management implemented in five forest patches in the southeast and northeast regions (greater Sylhet and Chittagong hilltracts). Management agreements were completed between the Forest Department, local communities, and other key partners, and the co-management rules and policies were communicated to the stakeholders. A similar approach is anticipated in the case of the proposed protected area network for

freshwater dolphins, where local people and other resource users will be actively involved in the habitat management.

What is needed from a Bangladeshi perspective is to encourage in-situ conservation and to bring representative ecosystems into the protected area system. Biological corridors should be identified and protected as a matter of priority. Reforms of existing governance are needed to accommodate the participation and uphold the interests of local stakeholders in co-management. Documenting indigenous and traditional knowledge is a challenge in co-management but it can serve to involve local people in the conservation of biodiversity. It is also important that current users and surrounding communities benefit from the establishment of protected areas. Taking their needs and concerns and their future livelihoods into account helps develop trust and respectful relationships with the local stakeholders, and is a vital element of biodiversity conservation.

The Sundarbans provides habitat for many wildlife species, including the Bengal tiger (*Panthera tigris tigris*). Among the 8 notified Sanctuaries, three are situated in the southern part of the Sundarbans covering an area of 139,698 ha. A proposal for establishing a multi-use protected area for conserving the freshwater dolphins in the Eastern Sundarbans is now in the Forest Department planning process. The Forest Department is reviewing the issue and will take the necessary steps for implementation of the proposal in collaboration with the Wildlife Conservation Society's BCDP under close consultation with local stakeholders and related experts.

### **Other species that will benefit from planned or existing protected areas or special conservation areas?**

A variety of other species stand to benefit from the conservation of aquatic habitat in a protected area network for freshwater cetaceans including fish and crustacean diversity, the estuarine/Indo-Pacific crocodile (*Crocodylus porosus*), oriental small-clawed otter (*Amblonyx cinereus*), osprey (*Pandion haliaetus*), grey-headed fish eagle (*Ichthyophaga ichthyaetus*), Pallas's fish eagle (*Haliaeetus leucoryphus*), and white-bellied sea eagle (*Haliaeetus leucogaster*), brown-winged kingfisher (*Pelargopsis*

*amauropterus*), lesser adjutant stork (*Leptoptilos javanicus*), and masked finfoot (*Heliopais personata*).

### **What are the benefits for local communities in the planned or existing protected areas or special conservation areas?**

The proposed protected area network in the Sundarbans will provide a platform to improve understanding of the ecological effects of declining freshwater supplies and global climate change at the boundary of marine and fresh water. This will in turn serve as a basis for developing adaptive management that supports the well-being and welfare of human populations, especially fishermen, as well as the health of species such as freshwater cetaceans. It will support the development of sustainable strategies for local fisheries and other extractive and non-extractive uses of the Sundarbans ecosystem. An emphasis will be on promoting alternative fishing gears and sustainable practices such as time-area closures, which reduce threats to threatened freshwater cetaceans, while bolstering the sustainability of fisheries vital to the local and national economy and the food security of local communities.

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# A REVIEW OF THE CONSERVATION STATUS AND PROTECTED AREAS FOR THE SUSU *PLATANISTA GANGETICA GANGETICA*, BHULAN *PLATANISTA GANGETICA MINOR* AND IRRAWADDY DOLPHIN *ORCAELLA BREVIROSTRIS* IN THE GANGES, BRAHMAPUTRA AND BEAS RIVERS, AND CHILIKA LAGOON, INDIA

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## Abstract

The Ganges and Brahmaputra River systems, the Beas River (a tributary of the Indus River), and Chilika Lagoon are home to the Ganges dolphin (*Platanista gangetica gangetica*), Indus dolphin (*Platanista gangetica minor*) and Irrawaddy dolphin (*Orcaella brevirostris*), respectively. All river dolphins in India have undergone range reductions and decreases in abundance over the last century. Two significant recent developments are the discovery of Indus dolphins in the Beas River in the state of Punjab and the declaration of the Ganges dolphin as the National Aquatic Animal by the Government of India. The present abundance estimate of Ganges dolphins in the Ganges and Brahmaputra systems in India, based on surveys conducted in 2008, is around 2000 individuals. The population of Irrawaddy dolphins in Chilika lagoon is estimated between 109 and 158 individuals following different methods and that of the Indus dolphin in the Beas River around 10. The main threats to river dolphins in India continue to be gillnet entanglements and unsustainable fisheries depleting prey resources, boat strikes, alteration of riverine habitat and pollution. This paper provides information on the current distribution and abundance of these dolphins, on conservation efforts in existing protected areas and on planning of new conservation areas. Several innovative approaches to cetacean conservation undertaken by non-governmental organizations are summarized. The paper identifies the obstacles to conservation efforts and emphasizes the need to enhance conservation measures and protected areas for river dolphins in India.

## Abstrak

Sistem Sungai Gangga dan Sungai Brahmaputra, Sungai Beas (anak sungai dari Sungai Indus), dan Chilika Lagoon adalah habitat bagi lumba-lumba Gangga (*Platanista gangetica gangetica*), lumba-lumba Indus (*Platanista gangetica minor*) dan lumba-lumba Irrawaddy (*Orcaella brevirostris*). Seluruh lumba-lumba di India telah mengalami penurunan luas habitat dan penurunan jumlah selama abad terakhir. Dua perkembangan terakhir yang signifikan adalah penemuan lumba-lumba Indus di Sungai Beas di negara bagian Punjab dan deklarasi lumba-lumba Gangga sebagai Hewan Akuatik Nasional oleh Pemerintah India. Estimasi jumlah populasi saat ini dari lumba-lumba Gangga di sistem Sungai Gangga dan Brahmaputra di India, berdasarkan survei yang dilakukan pada tahun 2008, adalah sekitar 2000 individu. Populasi lumba-lumba Irrawaddy di laguna Chilika diperkirakan antara 109 sampai 158 ekor menurut metode yang berbeda dan bahwa dari lumba-lumba Indus di Sungai Beas sekitar 10. Ancaman utama untuk lumba-lumba sungai di India rengge (jaring insang) dan menurunnya makanan karena penangkapan ikan berlebih, tabrakan dengan kapal, perubahan habitat sungai dan polusi. Tulisan ini memberikan informasi mengenai distribusi dan jumlah lumba-lumba saat ini, pada upaya konservasi di kawasan lindung yang ada dan perencanaan kawasan konservasi baru. Ringkasan beberapa pendekatan inovatif untuk konservasi cetacea yang dilakukan oleh organisasi-organisasi non-pemerintah. Makalah ini mengidentifikasi hambatan untuk upaya konservasi dan menekankan pentingnya untuk meningkatkan tindakan konservasi dan kawasan lindung untuk lumba-lumba sungai di India.

## Overview of the Ganges, Brahmaputra and Beas Rivers and Chilika Lagoon

### Ganges River

The Ganges is a perennial river that originates as a stream called "Bhagirathi" from Gaumukh in the Gangotri glacier at 30°55'N, 79°7'E, some 4100 m above mean sea level. The Ganges river basin is the largest in India and the fourth largest in the world, with a catchment area of 861,404 km<sup>2</sup>. It drains nine states of India (Figure 1) and has a total length of 2,525 km of which 1,425 km is in Uttaranchal and Uttar Pradesh states, 475 km in Bihar and 625 km in West Bengal. Half a billion people live within the river basin, at an average density of more than 500 per km<sup>2</sup>. This population is projected to increase to over a billion by the year 2030.

Nearly all the sewage, industrial effluents, runoff of chemical fertilizers and pesticides, and large quantities of solid waste, including thousands of animal carcasses and hundreds of human corpses, are dumped into the Ganges every day. The inevitable result of this onslaught on the river's capacity to receive and assimilate waste has been deterioration of river water quality to the extent that by the 1970s, large stretches (over 600 km) of the river were virtually ecologically dead and posed a considerable public health threat to the religious bathers using the river every day.

The problem of river pollution is further aggravated by the over-extraction and diversion of the river water at various points. About 47 percent of the country's irrigated land is in the Ganges basin. The large number of people living along the river use Ganges water for drinking and other household purposes and the occupations of various people (e.g., fishermen, boatmen, priests etc.) are linked with the condition of the river (Behera, 1995; Behera and Rao, 1999; Sinha *et al.*, 2001; Smakhtin *et al.*, 2007; Bashir *et al.*, 2007).

### Brahmaputra River

The Brahmaputra River is one of the longest rivers in the world. It is known as the Tsangpo in Tibet, as the Siang or Dihang in Arunachal Pradesh (India) and the Luit or Brahmaputra in Assam (India). As it enters Bangladesh, it is known as the Jamuna, and further downstream, the Padma.

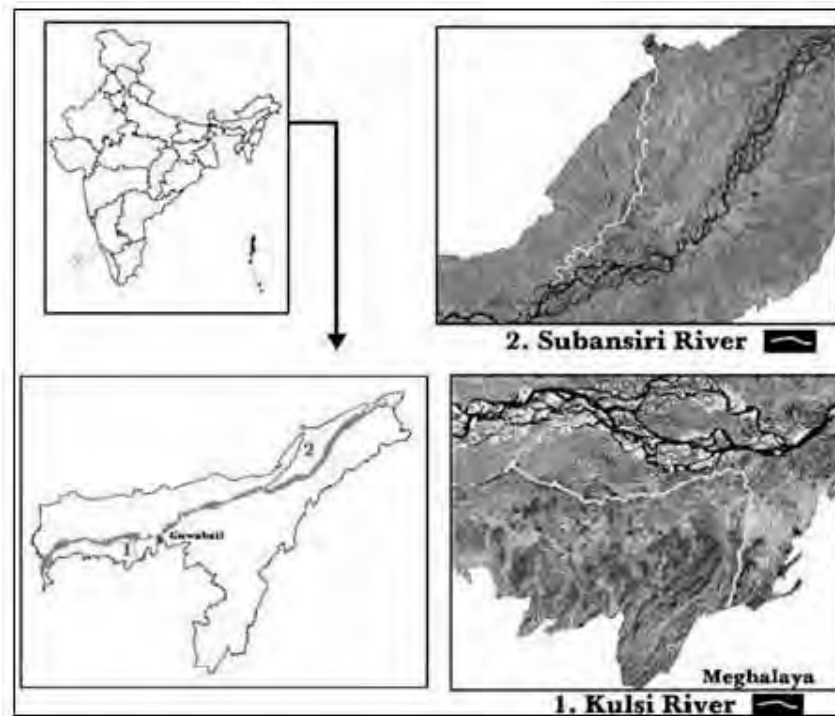
The 2880 km long Brahmaputra is larger than the Ganges in length and volume. Its first 1625 km are in Tibet, the next 918 km in India and the remaining 337 km in Bangladesh, where it converges with the Ganges (Figure 2). After entering India, the river flows as the Siang or Dihang River, travels about 52 km from Pasighat at the foothills of the Himalayas before two other major rivers, the Dibang and the Lohit, join it.

Figure 1. Map of India showing the flow of the Ganges River through different states





**Figure 2.** Location map of Brahmaputra River and two significant tributaries (Kulsi and Subansiri River) in terms of dolphin occurrence in Assam, India



From this 3-way junction, the river is known as Brahmaputra. Here the river enters the narrow flat valley known as the Assam or Brahmaputra Valley (Figure 2). The average width of this valley is about 86 km and the river is 15–18 km wide. In the state of Assam, 103 significant tributaries join the river from both sides, 65 from the north bank and 38 from the south bank. In the north, the principal tributaries are Subansiri, Jia Bharali, Dhansiri (North), Puthimari, Pagladiya, Manas, Champawati and Sankosh. On the south bank, the main tributaries are Burhi Dihing, Disang, Dikhow, Dhansiri (South) and Kopili. The locations of the Brahmaputra tributary confluences are constantly changing due to bank erosion.

The north bank tributaries originate in the Himalayas and have a high gradient; they carry a heavy sediment load of coarse material such as gravel and cobbles. The lower reaches of the northern tributaries are braided streams. The south bank tributaries have a lower gradient and their sediment load is relatively low with finer grain size; they are meandering rivers with deeper cross-sections (Wakid, 2009).

Among all of these tributaries of Brahmaputra River, dolphins are present in Kulsi River of Kamrup district and Subansiri River of Lakhimpur district (Figure 2).

#### *Beas River*

The Beas River originates in the Rohtang pass of the Himalayas at an altitude of 3978 m in the central Himachal Pradesh in India and flows 470 km before uniting with the Sutlej River at Harike Pattan south of Amritsar in Punjab, India, and then entering into Pakistan (Figure 3). The main channel of the river is broad and dotted with islands and wide pools. The depth of water varies from about 1.5 m during the dry seasons to about 4.5 m during the rainy seasons. Figure 3 indicates where dolphins have been sighted on the Beas River (Behera *et al.*, 2008a).

#### *Chilika coastal lagoon*

Chilika lagoon is the largest brackish water body in Asia. It is located on the east coast of India between 19°28'-19°54'N and 85°28'-85°54'E (Figure 4). The average area of the lagoon is 1065 km<sup>2</sup> and 906 km<sup>2</sup> during peak monsoon and dry season, respectively. The maximum north-south length of the lagoon is 64 km and the maximum width is 20 km. The water depth of the lagoon varies from 0.65- 4.5 m becoming gradually deeper from north to south and the greatest depth is near the Sipakuda sea mouth. Fifty-two rivers and rivulets drain into the lagoon and discharge 10,390 million m<sup>3</sup> of fresh water during the monsoon season, thereby reducing the salinity of the lake from July to December every year.

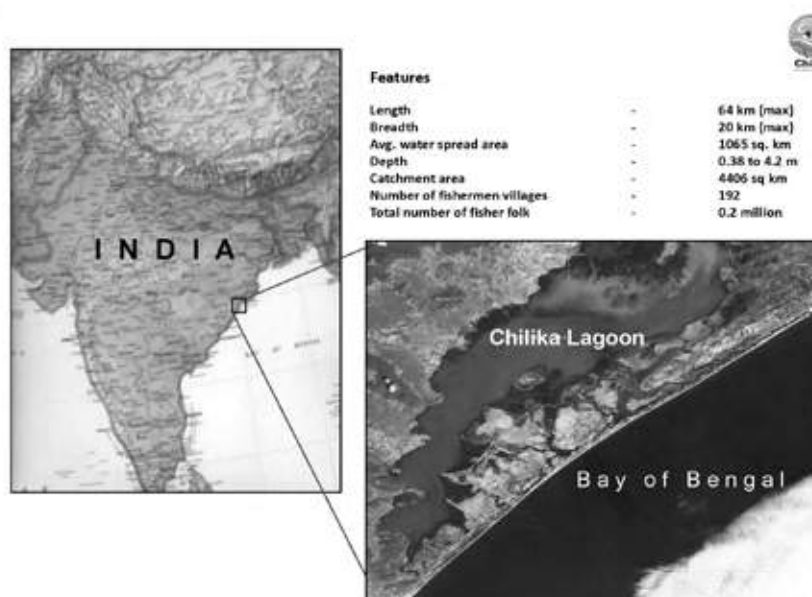
**Figure 3.** The Beas River in Punjab, India with location of Indus dolphin sightings



The lagoon is divided into four ecological zones: North, South, Central Sectors and an Outer channel. The total area of islands found in the lagoon is 223 km<sup>2</sup>. Saltwater enters the lagoon from the Bay of Bengal through the two openings, or sea mouths. Most of the lagoon is estuarine, but overall it harbors a unique assemblage of marine, brackish, and freshwater ecosystems. Over a million migratory and resident birds winter in the lagoon every year. Chilika supports some of the largest aggregations of migratory birds in the country, particularly during the winter. Flocks of migratory waterfowl arrive from as far away as the Caspian Sea, Lake Baikal, the Aral Sea, remote parts of Russia, the Kirghiz steppes of Mongolia, Central and Southeast Asia, Ladakh, and the Himalayas, to feed and breed in its fertile waters.

In 1989-90 an estimated 2 million birds visited the lagoon. Recently, based on a survey by the Bombay Natural History Society in 2002, 205 species of birds were listed as occurring in the lagoon (Dhandapani, 1992; Dhandapani, 1997; Muntaz *et al.*, 2006). On account of its rich biodiversity as a major source of local livelihoods, Chilika was designated as a "Ramsar Site," i.e., a wetland of international importance, in 1981. Nalaban Island within the lagoon has been designated as a Bird Sanctuary under the Wildlife (Protection) Act since 1987. The 'National Wetlands, Mangroves and Coral Reefs Committee' of the Indian Ministry of Environment and Forests has also identified the lagoon as a priority site for conservation and management. Fishing, the only form of natural resource use allowed in the lagoon, supports 150,000 fishermen.

**Figure 4.** The Chilika coastal lagoon in Orissa along the Bay of Bengal, which supports a population of Irrawaddy dolphins



## Summary of population status of Ganges River dolphins in India

### *Historic range of Ganges River dolphins*

Anderson (1879) recorded the distribution of the Ganges dolphin in the Ganges as falling between 77°E and 89°E. In the Brahmaputra, he mapped it as occurring throughout the main river to as far east as longitude 95°E and as far north as 27°30'N. He also reported that, even in the month of May when the Ganges was very low, the distribution extended up the Yamuna River as far as Delhi. Anderson emphasized that the upstream range of this dolphin was limited only by insufficiency of water and by rocky barriers.

### *Present status of Ganges River dolphins in the Ganges*

The northern states of Uttar Pradesh, Madhya Pradesh, Rajasthan, and Bihar comprise a large proportion of the present-day distribution of this species. These dolphins occur in several large rivers flowing through these states, the Ganges, Yamuna, Chambal, Ghagra, Gandak, Kosi, and Son. Some dolphins have also been recorded in the rivers of West Bengal.

Surveys were conducted during 2001-2005 in Madhya Pradesh, Rajasthan, and Uttar Pradesh with the cooperation and collaboration of state forest departments, universities, local NGOs, and experts. Similar surveys were conducted in Bihar and Jharkhand by R. K. Sinha and associates and in West Bengal by B. C. Choudhary and associates. Together, these surveys included 34 segments of 16 Ganges tributaries in seven states, covering a total of around 5244 linear km. The overall estimate of dolphin abundance was approximately 1800 (Behera, 2006; Behera *et al.*, 2008b). Table 1 presents a detailed accounting of the number of dolphins observed in each segment of river in the 2001-2005 surveys.

### *Present status of the Ganges dolphins in the Brahmaputra River system*

The first status survey of Ganges River Dolphin in Brahmaputra River was conducted in 1993 (Mohan *et al.*, 1997), which estimated a total population of the species as about 400 in the entire river. However, detailed range-wide surveys of the species in the entire Brahmaputra river system (means Brahmaputra mainstream and its tributaries) from Assam-Arunachal Pradesh border to India-

Bangladesh border were conducted in 2005 (Wakid, 2005 and Wakid, 2009) and 2008 (Wakid and Braulik, 2009).

In the survey conducted in February-April, 2005 a best estimate of 250 dolphins was recorded in Brahmaputra river system with 197 in Brahmaputra mainstream, 27 dolphins in Kushi River and 26 in Subansiri River. Out of the 197 dolphins in Brahmaputra mainstream, 21 dolphins were recorded in Assam-Arunachal Border to Balijan, 16 dolphins from Balijan to Dikhowmukh, 28 dolphins in between Dikhowmukh to Dhansirimukh, 40 dolphins in between Dhansirimukh to Gabhorumukh, 16 dolphins from Gabhorumukh to Guwahati, 29 dolphins from Guwahati to Pancharatna and 47 dolphins were recorded in between Pancharatna to India-Bangladesh border (Wakid, 2009).

In another population estimate survey conducted in February-April of 2008, following the same survey method of Wakid (2005 and 2009), Wakid and Braulik (2009) recorded a best estimate of 264 dolphins in the same river stretches of Brahmaputra river system with 212 dolphins in the Brahmaputra mainstream, 29 in Kushi River and 23 in Subansiri River. Out of recorded 212 dolphins in Brahmaputra mainstream, a best estimate of 25 dolphins were recorded in the Brahmaputra river stretch from Tenganimukh-Oiramghat (Assam - Arunachal Pradesh border) to Balijan, 22 dolphins from Balijan to Dikhowmukh, 28 dolphins from Dikhowmukh to Dhansirimukh, 42 dolphins from Dhansirimukh to Tezpur, 24 dolphins from Tezpur to Guwahati, 36 dolphins from Guwahati to Jugighopa and 35 dolphins from Jugighopa to Dhubri.

The total count of Gangetic dolphin in the Brahmaputra river system increased from 250 in 2005 to 264 in 2008 (Wakid and Braulik, 2009). At about the time of this survey, an additional six dolphins were sighted in the Barak River in Assam (Paulan Singh, pers. comm.).

**Table 1.** Numbers of dolphins encountered in the Ganges River or its tributaries, by segment, during surveys from 2001-2010 (Behera, 2006; Behera *et al.*, 2008, Behera, 2010). Additional information and supplementary surveys are noted.

Segment of Ganges or tributary	From	To	Kilometers	No. of dolphins observed	References	Comments
<b>Ganges mainstem</b>						
Upper reaches	Bijnor	Narora	165	56		
	Kanpur	Allahabad	200	78		WWF-India survey, Jan-Feb 2010
Middle reaches	Allahabad	Buxar	425	172		
	Buxar	Manihari ghat	500	>808		
Lower reaches		Farakka Barrage	100	24		Sinha <i>et al.</i> (2000) recorded 21 dolphins in the 38 km Farakka feeder canal
Bhagirathi River	Jangipur	Triveni Ghat	320	119		
	Triveni	Kolkata		32		
	Kolkata	Sagar Island		1		
<b>Northern tributaries</b>						
River Hooghly	Triveni	Sagar Island	190	97	S. Behera pers. comm.; Sinha <i>et al.</i> , 2010; G. Sharma pers. comm.	
Yamuna River	Yamuna-Chambal confluence	Allahabad	350	60		
River Kosi	Birpur barrage	Kursela		85		
Gandak River	Gandak barrage	Patna	320	290		
River Ghaghara (Giruwa)	Amba village Katarniaghat WLS	Girijapuri Barrage	20 22 22	23 39 49	Smith, 1993	Largest tributary of Ganges WWF India Dec 2006  WWF India Dec 2009
<b>Southern tributaries</b>						
Chambal River	Pali	Barahi	370	29		Up to 60 in recent surveys of National Chambal Sanctuary; R.K. Sharma, pers. comm.
River Ken			30	8		
River Betwa			84	6		
River Sind			110	5		
River Sone			130	10		

### *Present Status of Irrawaddy Dolphins in Chilika*

Dolphins are found in the south and central sectors and the Outer Channel of the lagoon, ranging from the high salinity lagoon mouth to the much less saline regions of the main lagoon with freshwater input (Muntaz *et al.*, 2006., Sutaria 2009). The population has been surveyed by Chilika Development Authority every February since 2005 using 18 boats doing concurrent counts in a single day. The most recent estimate from February 2010 by the CDA is of approximately 158 dolphins, whereas in 2007 an estimate of 135 was provided.

Photo-identification based on mark-recapture methods was used by Sutaria (2009) during the dry season (November to April) between 2004 and 2006, to estimate population size. The study estimated the total population size of Irrawaddy dolphins in Chilika in 2006 between 109-112 individuals at a CV=0.07 using open population models.

### *Present Status of Indus River dolphins in Beas*

The Indus River dolphin, *Platanista gangetica minor*, was believed to have become extinct in India after 1930 and was considered to survive only in the Indus River system in Pakistan. During surveys between 20-22 December 2007 and 28-30 April 2009 two separate dolphin groups of six and four individuals, respectively, were sighted, one in the Harike wetland area near the Harike barrage and the other 25 km upstream along the Beas River (Behera *et al.*, 2008b) (Figure 3). This subspecies is classified as endangered by IUCN. Informal interviews with locals revealed that the dolphins, which are locally called Bhulan, have been present in the Beas River for at least the past few decades (Behera *et al.*, 2008b).

## **Past and ongoing conservation initiatives and programs for dolphin conservation**

### *Historical initiatives*

In the early 1980's, L. A. K. Singh, R. J. Rao, and R. K. Sharma conducted research on various aquatic animals, including Ganges dolphins, in the Chambal River and other southern tributaries of the Ganges.

The Ganges Action Plan (GAP) was launched in 1985 by then Prime Minister Sri Rajiv Gandhi, and several universities located on the banks of the Ganges became involved in various dolphin research

projects included the GAP, e.g. R.K. Sinha's work from Patna and R.J. Rao's work from Jiwaji University which began in the early 1990s. Under the same initiative, Behera carried out his PhD work on dolphins in the upper Ganges (Bijnor to Kanpur) and determined that their upstream limit is at the Bijnor barrage. His was the first PhD thesis on the Ganges River dolphin in India. During the late 1990's, Sunil Choudhary initiated work in the Vikramshila River Dolphin Sanctuary in the state of Bihar, the only river dolphin sanctuary in India.

In the Brahmaputra River, R.S. Lal Mohan along with S. C. Dey, S. P Biswas, S. Roy and S. Bairagi conducted studies of dolphins in the early 1990's. This was followed by the Ph. D. work of Abdul Wakid in the late 1990's under the supervision of S. P Biswas.

In 1997 WWF-India established the Indian River Dolphin Committee, which was to involve all researchers working for the conservation of river dolphins in India. Several surveys were conducted in the Ganges and most of its tributaries in India and Nepal to assess status and threats. During 2001 and 2005, WWF-India conducted detailed surveys of dolphin distribution and range in all the rivers and estimated that the total population in the country was less than 1800.

In Chilika, dolphin conservation was initiated in the late 1990's by the Chilika Development Agency (CDA). Regular census and research work has been carried out by various workers, including Dipani Sutaria, Isabel Beasley, Muntaz Khan, and Bishnu Behera.

In 1997, Behera and Asghar Nawab from WWF-India rediscovered the Indus River dolphins in the Beas River, Punjab, and have been working in support of their conservation ever since.

### *Recent and ongoing initiatives*

The National Ganges River Basin Authority (NGRBA) was constituted by the Government of India under the chairmanship of the Prime Minister on 20 February 2009. The first meeting of the NGRBA was on 5 October 2009. At this meeting the Prime Minister declared the Ganges River dolphin as the National Aquatic Animal, recognizing it as one of the major bio-indicators of the ecological health of the Ganges. The Ministry of Environment and Forests listed the Ganges River dolphin as the National Aquatic Animal on 18 May 2010.

The National River Conservation Directorate of the Ministry of Environment and Forests, Government of India has set up a six member working group under the chairmanship of Dr. R.K.Sinha in October 2009 to prepare an action plan for the Ganges River dolphin in the Ganges River system. Only a draft action plan has been prepared and submitted and it is still under review.

Presently, several universities, including Gwalior, Patna, Bhagalpur, Dibrugarh, Guwahati, Aligarh, North Orissa, Utkal, Amritsar, and Jadavpur, are working on various aspects of river dolphins. The Wildlife Institute of India is working to increase the capacity of wildlife managers for river dolphin conservation work. The Indian Institute of Technology in Delhi and researchers from the University of Tokyo have recently joined river dolphin research in India.

Several innovative conservation initiatives have been developed include the following:

- **Community-based conservation integrated river basin management (WWF-India)**

WWF-India and its partners have worked to establish a new 'social approach' for the conservation of the Ganges River's aquatic biodiversity and its ecosystem functioning. This approach involves informing and motivating local people through advisory work and education/awareness programs. It targets rural communities whose activities contribute directly or indirectly to the degradation of the river system. This work was initiated in 2000 in the upper Ganges River in 165 km of river stretch and covering all the villages (21 in total) that are present along the riverbank of this stretch. The central government nominated an 82-km stretch from Brijghat to Narora as the first riverine Ramsar site in India in November 2005. Currently, the activities have been extended to many river stretches such as the Geruwa River, Katernia Ghat, main Ganges (Narora to Varanasi), and in 2010 similar work has started in the Beas River in Punjab.

- **River Watch (WWF-India and partner organization)**

The River Watch program was established in 2006 to make river conservation a priority around the country. It began with conservation initiatives for aquatic species such as gharial, dolphins, otters, and freshwater turtles. The program attempts to

harness the enthusiasm and knowledge of local groups and citizens and to combine this with technical expertise, policy knowledge, and political savvy to protect India's rivers. This initiative has led to closer co-operation among the Forest Department, NGOs, and researchers.

- **Community-based dolphin tourism in Chilika**

Dolphin-based tourism was developed by the local people in late 1980's and has slowly developed into an alternate source of income for fishers, especially during times when fish catches have fallen. The CDA and State Forest Department supports and helps maintain this locally developed industry while also raising awareness of boat driving guidelines, amongst boat drivers to reduce threats from boat strikes.

- **Gangetic Dolphin Research and Conservation Programme (Aaranyak)**

The Gangetic Dolphin Research and Conservation Programme (GDRCP) was established in 2005, aiming to conserve the species in Brahmaputra river system of North Eastern India, by Aaranyak, a society for biodiversity conservation of north-eastern India and a recognized scientific and industrial research organisation. Within the last 5 years, GDRCP has undertaken a variety of conservation efforts for Ganges river dolphins in Brahmaputra river system (Wakid 2005, 2006a, 2006b, 2007a, 2007b, 2009a, 2009b, 2010; Wakid and Braulik, 2009). These are credited with having helped reduce the reported dolphin mortality rate in the Brahmaputra by 60% and arresting the population's decline.

One of the initiatives undertaken by GDRCP to conserve the Brahmaputra dolphin is the development of a community-based Dolphin Conservation Network (DCN). The DCN encourages riverine communities living around important dolphin habitats to actively participate in conservation of the species of their localities. Since 2008 DCN have been monitoring the 30 most important dolphin habitats across the Brahmaputra Valley. In addition, within the last two years (Jan 08-Dec 09), with the help of the DCN, GDRCP has conducted over a thousand awareness campaigns or other events among riverine communities. Increased reports of sightings of young calves in the monitoring sites are a hopeful sign that things are improving.

GDRCP took a major role in forcing Oil India Ltd to postpone a planned seismic survey in the

Brahmaputra. GDRCP is also working closely with fishermen and fisheries societies, to reduce and manage the fishing pressure in and around identified dolphin habitats. GDRCP has also made a significant contribution of declaring the Ganges dolphin to be the State Aquatic Animal of Assam by the Government of Assam in 2008.

- **Community involvement and awareness (Bhagalpur University and WWF-India)**

The Vikramshila Gangetic Dolphin Sanctuary in Bihar is a legally protected area in a human-dominated floodplain river system. However, management effectiveness and active legal enforcement are minimal both inside and outside this PA. Local NGOs have been involved in monitoring, and awareness programs for fishermen within the Vikramshila sanctuary are said to have helped reduce the deliberate killing of dolphins.

The sanctuary has a relatively high density of dolphins and is under heavy fishing pressure. Thus, it offers the potential for developing multi-objective management of fisheries and river dolphins. Management is being undertaken on the premise that freshwater biodiversity conservation and economically viable fisheries can coexist (Kelkar *et al.*, 2010).

- **Studies of behavior using acoustics (WWF-India/Tokyo University/IIT Delhi)**

WWF-India, the University of Tokyo, and the Indian Institute of Technology, Delhi are working collaboratively on studies of Ganges dolphin behavior using passive acoustics. Traditional methods of studying dolphin behavior involve primarily visual observation. The technology being developed by this collaboration relies on a specially designed hydrophone for passive monitoring of dolphin clicks. The system is automated to allow 24 hr acoustic "observation" of underwater behavior in turbid waters without causing any disturbance to the animals.

- **Generic management plan for riverine sanctuaries (WII, WWF-India, M.P, U.P and Rajasthan Forest Departments)**

A model management plan for the National Chambal Sanctuary is being prepared, with a special focus on the Ganges dolphin. This model management plan is expected to be used in capacity building programs for other dolphin PAs.

## **Locations, size, and management of existing or planned protected areas**

Eleven existing PAs in India include habitat for river dolphins and there are two additional proposed PAs along the Brahmaputra River. Three additional areas are being proposed as conservation reserves where local communities can proactively participate in conservation-related activities (Annex 4, table 1). It must be noted, however, that except for the Vikramshila Gangetic Dolphin Sanctuary, the PAs have not been set up specifically for river dolphins. National Chambal Sanctuary, Katerniaghat Gharial Sanctuary, Bhitarkanika Wildlife Sanctuary, and Varanasi Turtle Sanctuary were all established primarily to protect other aquatic animals. Of the 11 existing PAs, systematic population assessment of river dolphins is being carried out in five, namely National Chambal Sanctuary, Chilika Lake Ramsar Site (Nalaban designated sanctuary), Narora Ramsar Site, Vikramshila Dolphin Sanctuary, and Katerniaghat Wildlife Sanctuary. In total, about 1000 km of the Ganges River and its tributaries is under this formal, legal protection. Although there are no PAs specifically for river dolphins in the Brahmaputra River system, around 1300 km of the Brahmaputra mainstream is protected (as a part of 6<sup>th</sup> edition of Kaziranga National Park), and this probably benefits dolphins to some extent.

In the Chilika Ramsar Site, the Narora Ramsar Site and Hastinapur Wildlife Sanctuary, there has been an increased focus on river dolphin conservation and management with the involvement of government organizations such as the Chilika Development Authority and WWF-India and non-government organisations like Nature Conservation Foundation and James Cook University. The Gharial Conservation Alliance, the primary focus of which is the critically endangered gharial, is now placing additional focus on the Ganges River dolphin at the National Chambal Sanctuary and the Katerniaghat Gharial Sanctuary.

The proposed Kushi Conservation Reserve in the Brahmaputra River system has been the focus of dolphin research, conservation, and management efforts by Aaranyak. The Aaranyak program is being viewed as a model to be extended to other proposed conservation areas in the Brahmaputra system.

In spite of their legally protected status and their occurrence in PAs, river dolphins continue to be subject to incidental capture in fishing nets in almost all PAs. Also, the recent upsurge of interest in

dolphin-oriented tourism has created problems of disturbance for the Irrawaddy dolphins in the Chilika Ramsar Site.

Community-based protection, management, and monitoring programs are still in their infancy in all PAs where river dolphins occur. The absence of well-conceived management plans and the lack of stable funding for management are chronic problems that require attention, both inside and outside PAs.

While the network of riverine PAs provides much-needed protection to some of the best-known populations of river dolphins, the recent declaration by the Government of India of the Ganges River dolphin as the National Aquatic Animal will raise this species' profile. It will now be included in a special program of the Ministry of Environment and Forests focusing on conservation and management of wildlife outside PAs, particularly through encouraging community involvement in conservation. The designation will also provide opportunities to expand and improve the PA network through inclusion of more river dolphin habitat in conservation reserves (Annex 4, table 1).

### **Threats to freshwater cetaceans in planned and existing protected areas or conservation areas**

The following threats to river dolphins have been documented in existing and planned protected areas or conservation areas in India:

- **Mortality from entanglement in fishing nets**

Incidental capture of river dolphins has been a problem in both existing and planned PAs in India. Even though fishing is banned in the riverine PAs, subsistence fishing as well as illegal commercial fishing continues to occur. Mortality of one to two individuals per year has been recorded in the National Chambal Sanctuary (R.K. Sharma, pers. comm.). Wakid (2010) recorded the deaths of 21 Ganges dolphins in the Brahmaputra River system in 2008 and 2009, of which 95% were a result of fishing net entanglement. All these deaths occurred outside PAs. A total of 67 deaths of Irrawaddy dolphins were reported in the Chilika Ramsar Site by the Chilika Development Authority between 2003 and 2009. Most entanglements were in gill nets and boat seine nets mainly occurring in the outer

channel. Vessel strikes are also a major cause of Irrawaddy dolphin mortality in Chilika.

- **Poaching for dolphin oil**

Ganges dolphins are killed deliberately in some areas of the Brahmaputra River to obtain oil for use as fish attractant (Bairagi, 1999). Wakid (2010) reported that 12% of active fisherfolk in the Brahmaputra use dolphin oil as fish attractant, and this use is most common in the Goalpara–Dhubri district of Assam.

- **Entrapment in canals**

Ganges dolphins occasionally enter irrigation canals where they become trapped and eventually die if they are not rescued. Such entrapment has been recorded in the Ganges at Farakka Barrage in West Bengal and in the Ghagra River, a tributary of the Ganges in Uttar Pradesh.

- **Dams and barrages**

In the Ganges basin, the Ganges mainstem and most of its tributaries have been fragmented by numerous dams and barrages, which restrict the movements of dolphins and degrade their habitat (e.g. by diverting water out of the river).

- **Habitat degradation due to siltation and decreased flow**

The WWF-India dolphin surveys conducted from 2001 to 2005 identified siltation-related habitat degradation to be a major threat to dolphins in the Brahmaputra River (Behera, 2006). Reduced flow volume was noted as a major threat to dolphins in the Ghagra, Kosi, Son, Punpun, and Chambal Rivers in the Ganges basin (Behera, 2006). Siltation of the northern sector of the Chilika lagoon and the required maintenance dredging of the main channels, which dolphins use, are matters of concern in Chilika.

- **Pollution**

Effluent discharge from several industrial towns into the Ganges River near Kanpur and Agra, pesticide runoff from agricultural activities along the banks of the Ganges and its tributaries, and pesticide runoff from tea gardens in Assam, have contributed to the contamination of the rivers and their fish and invertebrate resources on which dolphins depend.

- **Depletion of fish resources**

Unselective fishing reduces the abundance and variety of prey available to aquatic wildlife, including dolphins. Fishermen take all sizes and classes of fish, thereby endangering the brood stock, and this can lead to the collapse of previously productive fisheries. The use of



'Kaptajal' (mosquito net cloth) to capture small, swarming prey (e.g. fish fry, prawn larvae) in the Ganges and Brahmaputra is playing havoc with the riverine ecosystem and probably further depletes potential dolphin prey.

### **Trends in dolphin abundance, natality, or mortality due to conservation measures taken in existing or planned protected areas or special conservation areas**

In several PAs, river dolphins have benefited because of the protection and awareness created. Those in the National Chambal Sanctuary increased from 45-50 in the early 1980's to 70-75 in 2010 (R.K. Sharma, pers. comm.). In the Vikramshila Dolphin Sanctuary in Bihar there were thought to be 95-98 dolphins in the mid 1990s (Sinha *et al.*, 2000) and about 120 in 2001-2003 (Choudhary *et al.*, 2006). The present estimate of abundance in the sanctuary is around 170 (Sunil Choudhary, pers. comm.). There were estimated to be 158 Irrawaddy dolphins in Chilika in 2010, compared with around 135 in the year 2007 (Chilika Development Authority, pers. comm.). Increasing trends have been reported in the Upper Ganges Ramsar Site and the Katernia Ghat Wildlife Sanctuary in Uttar Pradesh. Both populations are limited by barrages and monitoring in the first stretch has shown an increase of 22 individuals recorded in 1990-1992 (Behera, 1995) to 56 individuals recorded in 2009-2010 (Behera, 2010). The Katernia Ghat – Geruwa River stretch is 22 km long and is surveyed annually by WWF. The Giruwa River is one of the best habitats for dolphins in India. The 'best' population estimate of 49 dolphins, for the most recent survey in December 2009 was found greater than the one conducted in December 2006, i.e. 39 dolphins (. The dolphins were sighted frequently in Katerniaghat to Amba region.

### **Needs for establishing new protected areas**

The recent surveys by WWF-India throughout the Ganges basin and Aaranyak in the Brahmaputra basin identified several stronghold breeding populations of river dolphins. These populations need to be brought under some kind of protection and management. Some important areas in the Ghagra River and Gandak River have recently been identified by the Gharial Conservation Alliance (D.

Basu, pers. comm.). However, these sites have not yet been proposed as PAs, pending detailed surveys. The currently recommended new PAs for river dolphins are in the Ganges River upstream of Farakka barrage in West Bengal and in the Kulsri and Subansiri Rivers, both tributaries of the Brahmaputra in Assam. There is detailed information about the status of dolphins in these areas. Several other areas that may meet the criteria for consideration as PAs include the parts of the Brahmaputra River adjoining the Orang National Park and Dibru-Saikhowa National Park in Assam. Other sites such as the Rupnarayan and Hoogly confluence in West Bengal may also be considered as future dolphin PAs.

### **Other species that will benefit from planned or existing protected areas or special conservation areas**

The riverine habitat of the Ganges and Indus dolphins also harbors several threatened chelonian, crocodylian, and bird species. The foremost amongst these are the Ganges gharial, the freshwater soft- and hard-shell turtles, and several species of wetland birds. In addition, the sympatric mahseer (a prized game fish), and the river otter should benefit from conservation and management programs for river dolphins.

### **What are the benefits for local communities in the planned or existing protected areas or special conservation areas?**

Establishment of aquatic PAs is included under the provisions of the Wildlife (Protection) Act, 1972. Although the Act prohibits any kind of resource exploitation for human use or livelihoods in PAs, local communities in and near PAs that have dolphins may benefit through nature-oriented tourism and education and awareness programs. Examples are the National Chambal Sanctuary and the Chilika and Narora Ramsar sites. Some of the local people who traditionally used their boats for travel and work on the river are now being hired to assist in reserve protection or research activities. Particularly in the Ramsar sites, community involvement in all spheres of conservation and management is encouraged. Local young people

with sufficient education are trained to assist in monitoring work, act as tour guides, and serve on river patrols.

However, further community involvement will only be possible in India if this is made part of the management plans of the riverine PAs due to the restriction of the Wildlife Act earlier mentioned. However, there is a provision in this act, which says that, if these activities are included in the management plan of the PA's with proper justification, they may be allowed by the authority. Therefore, it is recommended to include community involvement in research activities and awareness programs for river dolphins in the management plan of a PA to facilitate their participation. Outside the PA's there is no restriction of any kind of activity by the community except disturbing or hunting of protected species like river dolphin as there are no management plans outside a PA. Along rivers outside the PAs, plans are afoot to involve the fishing communities in dolphin protection as well as in ecologically "friendly" sustainable fisheries.

## Acknowledgements

The preparation of this report was facilitated and supported by the Wildlife Institute of India, WWF-India and Aaranyak, the organizations for which the authors work. The authors also acknowledge the benefits gained from interactions with the participants of the Samarinda river dolphin workshop.

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# REVIEW OF THE CONSERVATION AND ESTABLISHMENT OF PROTECTED AREAS FOR THE INDUS RIVER DOLPHIN, *PLATANISTA GANGETICA MINOR* IN PAKISTAN

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## Abstract

The Indus River is the longest river in Pakistan and is critical to the economy of the country. About 130 years ago, the Indus dolphin was found throughout approximately 3,400 km of the Indus River and its tributaries. The subspecies has undergone an 80% reduction in range, and is now restricted to only the Indus River mainstem in five subpopulations between six barrages. Radio tracking of a single dolphin showed that it was able to move across the barrage in both upstream and downstream directions. The subpopulations increase in size and density in a downstream direction to Sukkur barrage. A range-wide collaborative survey in 2006 used direct counts conducted by independent teams on tandem vessels, and Huggins conditional likelihood capture-recapture models, to generate an estimate of absolute abundance. Abundance was estimated as 121 (CI=101-271; CV=19.0%) between Chashma and Taunsa barrages, 52 (CI=50-118; CV=19.0%) between Taunsa barrage and Ghazi Ghat, and 1293 (CI=1279-3022; CV=22.5%) between Guddu and Sukkur barrages. Due to security concerns, approximately 300 km of river between Ghazi Ghat and Guddu barrage could not be surveyed, however, including an estimate for this area based on knowledge from previous surveys, abundance for the whole Indus dolphin subspecies was estimated to be 1600-1750 (95% CI=1559-3691; CV=19.9%) in 2006. Indus dolphins are threatened by population fragmentation, water diversion for agriculture, pollution, unsustainable fishing practices, and accidental mortality. The high-density Guddu-Sukkur section of the Indus River is a protected area and a designated Ramsar site. Conservation initiatives include rescue of dolphins trapped in irrigation canals, improving agricultural practices by reducing the use of agrochemicals and water, monitoring water quality, and policy work for water security. Efforts are underway to enhance protection of the Indus dolphin by notifying additional protected areas such as in Dera Ismail Khan, NWFP, and in Punjab.

## Abstrak

Sungai Indus adalah sungai terpanjang di Pakistan dan memegang peranan penting dalam perekonomian negara. Sekitar 130 tahun yang lalu, lumba-lumba Indus dapat ditemukan di seluruh bagian Sungai Indus dan anak sungainya sepanjang kurang lebih 3.400 km. Namun, sekarang enam buah bendungan di Sungai Indus membagi jenis ini menjadi lima sub populasi, dan hanya tiga populasi diantaranya yang cukup besar untuk bertahan hidup. Pelacakan radio dari seekor lumba-lumba menunjukkan bahwa ia mampu melintasi bendungan di sebelah hulu maupun hilirnya. Ukuran dan kepadatan sub populasi di bagian hilir meningkat, pada 2001 diperkirakan berjumlah 84 (Chashma – Taunsa), 259 (Taunsa-Guddu) dan 725 (Guddu-Sukkur) (Braulik, 2006). Survei tahun 2006 menunjukkan bahwa jumlah masing-masing sub populasi ternyata sama seperti 2001 kecuali yang berada di bagian Guddu hingga Sukkur jumlah perkiraannya meningkat menjadi 1275 (1111-1469) individu. Populasi total jenis ini sekarang diperkirakan 1600 – 1700. Hal ini disebabkan oleh peningkatan jumlah sub populasi Guddu-Sukkur dimana rata-rata encounter yang tercatat dalam satu segmen adalah 10,35 lumba-lumba/km. Ancaman yang dihadapi lumba-lumba Indus antara lain adalah fragmentasi lahan yang menyebabkan degradasi habitat, pemanfaatan air untuk pengairan, polusi, praktek penangkapan ikan yang tidak berkelanjutan, dan kematian akibat kecelakaan. Daerah Guddu Sukkur dari Sungai Indus, yang memiliki kepadatan lumba-lumba tertinggi, merupakan sebuah Kawasan Perlindungan dan dicalonkan sebagai situs Ramsar. Inisiatif konservasi inter institusi dan multi segi mencakup: mencari matapencaharian alternatif untuk mengurangi ketergantungan terhadap habitat lumba-lumba, menyelamatkan lumba-lumba yang terjebak dalam saluran irigasi, meningkatkan tindakan pengawasan dan cegah-tangkal dengan melibatkan masyarakat, memperbaiki praktek pertanian dengan mengurangi pemakaian bahan-bahan kimia dan air, monitoring kualitas air serta menyusun kebijakan yang mengatur pemanfaatan air dan perikanan yang berkelanjutan. Berbagai upaya sedang dilakukan untuk memperkuat perlindungan terhadap Lumba-lumba Indus dengan menjadikan lebih banyak wilayah yang penting bagi lumba-lumba sebagai Kawasan Perlindungan seperti di Dera Ismail Khan dan Punjab.

## Overview of the Indus River System

The Indus River is the longest river in Pakistan and the twenty-first largest river in the world in terms of annual flow. It rises in Tibet, flows through Ladakh in India and then flows south through the entire length of Pakistan to the Arabian Sea near Karachi. The total length of the river is 3,180 km (1,976 mi), its total drainage area exceeds 1,165,000 km<sup>2</sup> (450,000 mi<sup>2</sup>) and its estimated annual flow is about 207 km<sup>3</sup>.

The Indus flows through the Karakoram and Himalayas before entering the plains at Kalabagh. It then flows for approximately 2,000 km through the Provinces of Punjab, North-West Frontier Province (NWFP) and Sindh before reaching the sea. The only major cities on the lower Indus are Dera Ismail Khan and Sukkur and generally the river runs through rural areas. There are five major tributaries of the Indus: the Jhelum, Chenab, Ravi, Sutlej and Beas which join the Indus as the Panjnad River. The Panjnad has a discharge approximately equal to the Indus farther upstream. The five tributaries drain the densely populated, industrialized region of Punjab, flow through many major cities and receive high pollutant loads.

The Indus is the largest and most important water resource for the people and economy of Pakistan. It provides the main source of potable water, irrigates the majority of the nation's agricultural lands and supports many industries. River water is especially important in the plains as rainfall there is meagre and population density high. Modern irrigation was introduced in the 1800s and the Indus irrigation system is one of the largest and most complex networks in the world. It includes 18 barrages, several high dams, and thousands of kilometers of canals. Inter-river link canals have helped spread water resources across the region and provide the basis for the large production of crops such as cotton, sugarcane and wheat. The dams also generate electricity for industries and urban centres.

## Summary of population status and distribution of Indus dolphins

Some 130 years ago, the Indus dolphin was found throughout approximately 3,400 km of the Indus River and its tributaries from the estuary to the foothills at the base of the mountains (Anderson, 1879). In 2001 a comprehensive survey of the entire range of the dolphin was conducted. The total

population size was estimated as 1,100 in approximately 1,000 km of river (Braulik, 2006). Nearly the entire population (99% of the animals) occurred in only 690 linear km, which implies roughly an 80% reduction in the area of occupancy since the 1870's (Braulik *et al.*, 2004).

Dolphins occur primarily in three subpopulations between the Chashma-Taunsa, Taunsa-Guddu, and Guddu-Sukkur barrages. Remnant subpopulations also occur up- and downstream of this range. The subpopulations increase in size and density in a downstream direction and in 2001 were estimated by direct counts as 84 (Chashma – Taunsa), 259 (Taunsa-Guddu) and 725 (Guddu-Sukkur) (Braulik, 2006). A survey conducted in 2006 used direct counts conducted by independent teams on tandem vessels, and Huggins conditional likelihood capture-recapture models to generate an estimate of absolute abundance. Sighting probability was high; 75.3% of groups were seen by both survey teams. Missed groups were primarily single animals or groups of two, and were due to perception rather than availability bias. Including group size and sighting conditions as covariates, abundance was estimated as 121 (CI=101-271; CV=19.0%) between Chashma and Taunsa barrages, 52 (CI=50-118; CV=19.0%) between Taunsa barrage and Ghazi Ghat and 1293 (CI=1279-3022; CV=22.5%) between Guddu and Sukkur barrages. Due to security concerns approximately 300km of river between Ghazi Ghat and Guddu barrage could not be surveyed, however in 2001, approximately 200 individuals were recorded in the unsurveyed portion (Braulik 2006) and assuming that there were approximately 125 to 275 individuals in this area in 2006, abundance for the whole Indus dolphin subspecies is estimated to be 1600-1750 (95% CI=1559-3691; CV=19.9%) individuals (Braulik *et al.*, 2010).

The highest encounter rate was recorded approximately two-thirds of the distance between Guddu and Sukkur barrages. In this 80km high density area, an average of 10.35 dolphins/linear km was recorded in 2006. This is the highest encounter rate reported for any Asian river dolphin.

Management of Indus dolphins is the responsibility of provincial wildlife authorities. The Guddu-Sukkur subpopulation is under the management of Sindh Wildlife Department and the Taunsa-Guddu subpopulation falls almost entirely under the Punjab Wildlife Department. The upper

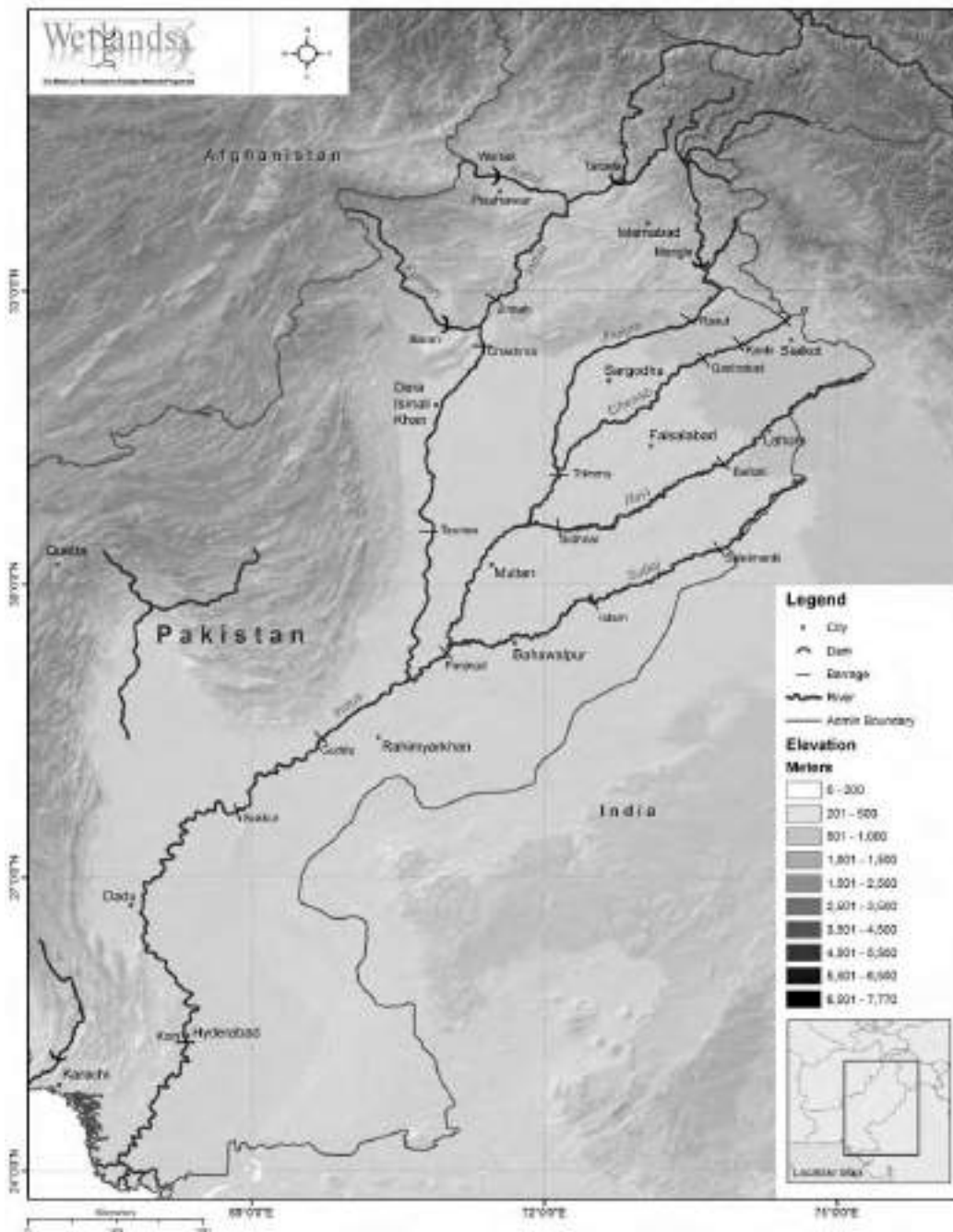
two-thirds of the Chashma-Taunsa subpopulation are in NWFP and the lower third is in Punjab.

Counts of dolphins in Sindh, Punjab and NWFP have been conducted over a 30-year period and are summarized in Table 1. Dolphin counts conducted by the Sindh Wildlife Department in collaboration with other agencies have been conducted between Guddu and Sukkur Barrages since the early 1970's. Results show a statistically significant average increase of 5.75% per year over 35 years. Reasons for this increase include population recovery following a ban on hunting,

combined with insecurity of the area restricting human activities, possibly supplemented by immigration from other subpopulations (Braulik et al. 2010).

Repeated surveys in NWFP over the last 10 years have shown that the exact locations of groups change from year to year but that there is some consistency in broader scale distribution, with peak densities reliably occurring between Rangpur Spur #18 to Samoki Walla Band (NWFP Wildlife Department, unpublished).

Figure 1- The Indus River System



## Past and ongoing conservation initiatives/ programs for dolphin conservation

### *Rescue of Indus Dolphins*

In January 2000, WWF-Pakistan conducted a dolphin rescue operation and trained the staff of Sindh Wildlife Department in dolphin rescue methods. WWF-Pakistan then initiated a project to rescue the dolphins that become trapped in the irrigation canals and, to date, 80 dolphins have been rescued from the canals. This number represents a significant proportion of the overall population. Morphometric data have been collected and maintained. Initially, the rescued dolphins were translocated to the mainstem of the Indus in 4x4 trucks that were opened at the back to accommodate the dolphin on a stretcher. Now there is a sound-proof ambulance with adequate space for the stretcher and the required equipment. Translocated dolphins are now microchipped to assist in identification if a rescued animal is trapped again or found dead later. In January 2009, a rescued dolphin was placed with a radio transmitter when all the gates in Sukkur Barrage were open, this animal was recorded moving through Sukkur Barrage three times in both upstream and downstream directions (Toosy *et al.*, 2009)

### *Capacity building and training*

WWF-Pakistan is establishing partnerships with local institutions to involve them in analyses of dolphin tissue samples and build a database for future reference. A post-mortem/necropsy facility has also been set up in Sukkur. WWF – Pakistan and Sindh Wildlife Department conducted training sessions for fishermen in how to rescue and release trapped dolphins safely from canals and fishing gear, respectively. An illustrated rescue manual was also developed for field staff and fishermen (Khan, 2005).

### *Dolphin distribution and abundance survey*

Comprehensive surveys of the entire current range of Indus dolphins in Pakistan were conducted in 2001 and again in 2006 by Pakistan Wetlands Programme/WWF-Pakistan, in collaboration with the provincial wildlife departments. In 2001 direct counts were conducted and these were corrected by a simply derived correction factor to account for missed groups. In 2006 tandem vessel surveys were conducted and capture-recapture analysis used to derive a correction factor for each subpopulation

incorporating sighting covariates, group size and 'river' state (surface turbulence).

### *Awareness*

WWF-Pakistan developed and disseminated Indus dolphin rescue posters in Urdu, the national language, and Sindhi, a regional language. The aim of this initiative was to encourage local communities to report dolphins trapped in the canals and also to educate them about the species, and in particular to instill in people the understanding that dolphins pose no threat to them or their livestock. This initiative improved the reporting of animals trapped in canals. Further, the rescues have received widespread media coverage.

Sindh Wildlife Department and WWF-Pakistan developed education centres to promote awareness about the Indus dolphin. The two centres are strategically located, one at each end of the Indus Dolphin Reserve in Sindh. Indus dolphin replicas have also been displayed at various institutions in the country, e.g. Lahore Zoo, Margalla Conservation and Information Centre, Wildlife Department NWFP in Peshawar, Sindh Wildlife Department in Karachi and the Indus Dolphin Conservation Centre in Sukkur. Information signs are displayed with the replicas; the one at the Lahore Zoo particularly highlights why this species cannot be maintained in captivity.

An awareness and tourism component was launched which includes free boat safaris for under-privileged school groups. Interactive Indus dolphin education materials were developed in both Urdu and English and these are already being used in Sukkur area schools.

### *Environmental impact studies*

One of the greatest threats to Indus dolphins is the large-scale diversion of river water. Much of the river is only approximately 1 m deep and there is evidence that in the dry season, dolphins are concentrated in deep pools. A number of large-scale habitat studies are underway to determine the dry-season habitat preferences of dolphins where they are most rare (in NWFP), to examine the depth preferences of Indus dolphins, and to determine which river features can be used to predict dolphin presence. It is important to understand which types of fluvial habitat river dolphins make the most use of during the dry season, when water is limited. Such an understanding is fundamental for government deliberations in order to ensure that sufficient water

flow is maintained to sustain a river dolphin population in the lower Indus River.

A detailed study is also underway to evaluate whether and under what circumstances Indus dolphins may move through irrigation barrages and thus improve our understanding of population fragmentation caused by such structures. This study includes mapping depth and velocity within the gates of Guddu barrage and in the adjacent river, examination of the engineering design plans, evaluating the operational cycle of the barrages over a 10-year period, and deployment of T-POD passive acoustic monitoring devices within barrage gates to detect dolphins acoustically. The role played by barrages (due to fragmentation and water diversion) in the extinction of nine dolphin subpopulations in the Indus tributaries is also being evaluated.

### *Water quality monitoring*

WWF–Pakistan is also monitoring the quality of Indus dolphin habitat between Guddu and Sukkur. The research team, composed of key stakeholders, collects samples of water, sediments and dolphin prey species to assess the presence of heavy metals and pesticide residues. Preliminary results indicate that high levels of heavy metals accumulate in the dolphin prey species. These findings will eventually lead to advocacy to implement National Environment Quality Standards (NEQS, 2000) to control the toxic load in the river and to develop river water standards in Pakistan.

In addition to work specifically focused on the Indus dolphin, WWF has been undertaking a range of freshwater conservation activities in Pakistan. The recently initiated “Indus Water Security Programme,” for example, focuses on water security and environmental flows for the Indus.

WWF intends to scale-up its efforts from a traditional emphasis on projects to a greater engagement on key national and provincial policies affecting water security and thus habitat security for species such as the Indus dolphin. This will require a review of the broader water management framework. WWF-Pakistan is also conducting stakeholder consultations to contribute to the development and refinement of water policy reform objectives. The scope of consideration includes:

1. National and provincial water resources management policy and institutional framework;
2. Policies related to allocation of water, in particular in the agricultural sector;

3. Water infrastructure development and management policy;

4. Maintenance of minimum flows (environmental flows).

### *Development of better management practices in agriculture*

WWF–Pakistan participates in the global Better Cotton Initiative (BCI) and launched a project entitled ‘Pakistan Sustainable Cotton Initiative’ (PSCI) which promotes the adoption of Better Management Practices (BMPs) in cotton cultivation areas. The aim is to achieve measurable reductions in key environmental indices, e.g. water consumption and water quality, while improving social and economic benefits for cotton farmers. BMPs for growing cotton are being advocated to reduce excessive use of irrigation water and pesticides. These practices can improve the livelihoods of cotton farmers by reducing their production costs.

The project trains agriculture officers in BMPs and those officers, in turn, train farmers through Farmer Field Schools (FFS) and Farmer Training of Facilitators (FTOF). The FFS program is an innovative approach that uses “learning by doing” to build the capacity for informed decision-making and encourage more sustainable practices in farming communities. Since 2004, BMPs in cotton cultivation areas are being adopted by the participating farmers in Bahawalpur and Sukkur/Ghotki. To evaluate the BMP project, it is important that the benefits of the adoption of these practices on the water quality and quantity, soil and biodiversity be assessed in a scientific manner through comparison of BMP and non-BMP sites. The current assessment process will span four years from July 2007 to June 2011. The key water quality measurements are pesticide residues and nitrate and phosphorus levels in the ground and surface water. Nematode species identification helps to determine soil quality as some nematodes are crop parasites and others are beneficial for the soil. Biodiversity, including birds, small mammals, amphibians, reptiles, and insects is also being studied. This assessment involves three studies per year, reflecting the complete cycle of cotton farming; May (pre-sowing), August (mid-season) and November (post-picking).

In NWFP, 11 Village Conservation Committees have been established to conserve biodiversity in the Indus River, including the Indus dolphin. Also, two Conservancy Management



Committees and a hog deer rehabilitation committee are functioning in the province.

### **Locations, size and management of planned or existing protected areas**

#### *Indus Dolphin Reserve, Sindh*

The Indus Dolphin Reserve is a game reserve covering an area of 44,200 ha. As the name suggests, this area has been given protected status particularly because of the Indus dolphin. According to the Sindh Wildlife Protection Ordinance, 1972 (amended 2001), hunting is allowed in a game reserve only by a special permit which may specify the species and the number of animals to be hunted. The Indus dolphin is a totally protected animal (no hunting permitted) under the second schedule of this ordinance.

#### *Taunsa Barrage Reserve, Punjab*

Taunsa Barrage was constructed across the Indus River in 1932. It is situated 20 km northwest of Kot Addu. The barrage derives its name from the town of Taunsa Sharif, situated on the right bank of the Indus River about 30 km upstream. In 1972 the Taunsa Barrage Reserve was first declared by Punjab Wildlife Department. It originally covered 7,682 ha or 19,205 acres. However, on 24 March 1999 a significant portion of the sanctuary area was denotified (taken out of reserve status) on the request of the irrigation department. The sanctuary has been reduced to 2,800 ha or 7,000 acres (Source: Punjab Wildlife and Parks Department). An area of 6,576 ha was declared as a Ramsar site in March 1996 (Ramsar site database).

#### *Chashma Barrage Game Reserve, Punjab*

The Chashma Wildlife Sanctuary is located upstream of Chashma Barrage in the Punjab Province and its total area is 34,099 ha. It was declared a wildlife sanctuary in 1974. The Sanctuary was renotified in July 1984 (Ramsar Directory accessed online in May 2007), in May 1999 and most recently in December 2004. The most recent notification specifies an area of 33,083 ha (81,750 acres) protected (Government of Punjab, Forest, Wildlife and Fisheries Department Notification). The land of the barrage and reservoir is owned by the provincial Irrigation Department. Surrounding areas of the wetland are partly state owned and partly privately owned. Administratively most of the wetland lies in Mianwali district and a small area lies in Dera Ismail Khan district. The main

purposes of the Chashma Barrage are flood control, storage of water for irrigation, generation of electricity, and fisheries production. Some 636 t of fish was harvested from the Ramsar Site in 1984 and the fishing is not sustainable.

Both Chashma and Taunsa Wildlife Sanctuaries are protected under the Punjab Wildlife Act 1974, which specifies that in a wildlife sanctuary no person shall:

- i. Enter or reside,
- ii. Cultivate any land, damage or destroy any vegetation,
- iii. Hunt, kill or capture any wild animal or fire any gun or other firearm within one mile of the boundaries,
- iv. Introduce any exotic species of plant or animal,
- v. Introduce any domestic animal or allow it to stray,
- vi. Cause any fire,
- vii. Pollute water

In addition, to ensure sustainable fishing the Punjab Fisheries Department has set gill net specifications for the Punjab Province. These gill net size specifications 1.5 inch each side of the mesh or total of all the sides of a mesh should not be less than 6 inches sq.

### **Threats to freshwater cetaceans in planned or existing protected areas or conservation areas**

The following threats to Indus dolphins have been documented, ordered from the most to least severe:

- Reduced river flow - The diversion of river water for irrigation results in seriously depleted and degraded dolphin habitat, especially during the winter dry season. Much former habitat is now completely dry for much of the year and dolphins have been extirpated from these areas. Problems of pollution are exacerbated by the reduced discharge and as the size of the river declines it is easier for fishermen to span the entire river with their nets.
- Fragmentation – Dolphin habitat is fragmented by the construction of barrages to irrigate and provide power to the surrounding farmland. For the majority of the year this hinders the movement of dolphins.

- Pollution – Water quality is poor and continues to deteriorate due to increasing organic pollution from cities, runoff from agricultural lands, and effluent from heavy industries, many of which do not meet National Environmental Quality Standards (NEQS, 2000). There is almost no sewage treatment in Pakistan and an increasing human population results in high and increasing levels of human waste entering water courses.
- Bycatch – Dolphins are accidentally captured and die in fishing nets.
- Entrapment in canals – Dolphins enter irrigation canals where they are trapped and eventually die due to lack of water unless rescued.
- Unsustainable resource use – Sub-contracting by influential fishing contract holders means less regulatory control and facilitates the proliferation of illegal fishing practices such as poison fishing and the use of illegal nets. The extraction and burning of reeds, which results in overall degradation of the riverine and wetlands ecosystem, is also common.

### **Trends in dolphin abundance, natality or mortality due to conservation measures taken in planned or existing protected areas or special conservation areas**

The only information on Indus dolphin natality is documentation that approximately 11% of individuals recorded in 2006 between Guddu and Sukkur barrages were calves (Braulik *et al.*, 2010). There is no information on dolphin mortality rates anywhere in the Indus River. For information on abundance and trends in abundance in the Indus River see section 'Summary of most recent population status of Indus dolphins' above.

### **Needs for establishing new protected areas**

The largest Indus dolphin subpopulation is well protected in the Sindh dolphin reserve, but there is a great need to protect the smaller, more vulnerable subpopulations upstream.

The governments of both Punjab and NWFP have expressed interest in establishing protected areas for river dolphins. WWF–Pakistan has been monitoring the dolphin population in Taunsa Wildlife

Sanctuary and its adjacent buffer areas and has recommended to the Punjab Wildlife and Parks Department and Irrigation Department that the area downstream of the barrage be declared a Protected Area specifically for dolphins (Khan, 2006). In this connection, WWF–Pakistan arranged for senior government officials to visit the proposed reserve site. Arrangements for a signed agreement are in the final stages.

The NWFP Wildlife Department has invested a great deal in surveys of Indus dolphins in the last 10 years and has documented the consistent presence of dolphin groups in several specific areas. The proposed protected area extends from Dera Ismail Khan to the Punjab border a section of river approximately 80km in length. Given the importance of involving local communities in any protected area designation, Conservancy Management Committees, Village Conservation Committees, and District Conservation Committees will be established.

### **Other species that will benefit from planned or existing protected areas or special conservation areas?**

Existing and planned reserves to protect the habitat of Indus dolphins can be expected to benefit a wide range of other species. Some reserves were initially established to protect resident and migratory birds, especially waterfowl, and new reserves will also bring benefits to these species. Larger mammals found in existing or proposed protected areas include the hog deer, the small-clawed Indian otter, and the fishing cat. There are eight species of freshwater turtles in the Indus River, including two endangered soft-shelled species, *Chitra indica* and *Trionyx gangeticus*. The Punjab Wildlife and Parks Department plans to supplement the existing population of hog deer in Taunsa and to hire game watchers to control illegal hunting of migratory waterfowl and trapping of freshwater turtles in the area.

### **What are the benefits for local communities in the planned or existing protected areas or special conservation areas?**

As the largest threats to the Indus dolphin appear to be related to diversion of dry season river flow and population fragmentation by dams, there has been

less focus on community involvement in conservation than for some other river dolphins. Community projects have been fairly small-scale and have been located primarily between Guddu and Sukkur barrages. However, community involvement is a key to protected area management of the Indus dolphin in Pakistan. Implementation of limits on fishing, resource extraction, and other activities which provide for local livelihoods requires consultation with local communities and strong public awareness efforts. Many measures and future initiatives which benefit the Indus dolphin and the health of the River Indus ecosystem can also reinforce the sustainability of current human activities, or, when those activities are found to be detrimental, foster the adoption of alternative practices and livelihoods.

#### *Indus Dolphin Reserve, Sindh*

The conservation of Indus Dolphins in the Indus Dolphin Reserve has a long history. Conservation programmes provide employment opportunities including four full-time community-based game watchers. Their main responsibility is to check for dolphins in canals and to interact with the local communities to encourage and receive reports of entrapments. Dolphin rescue operations involve the fishing communities; nets and boats are rented from them and rewards are given for reporting trapped dolphins. Local fishermen are also engaged to operate dolphin-watching boat tours. The project involving Better Management Practices in agriculture has increased the incomes of participating farmers. The farmers spend fewer resources on pesticides and fertilizers because they use them more sparingly and only as needed.

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**Table 1.** Published and unpublished counts of Indus River dolphins between Chashma, Taunsa, Guddu and Sukkur Barrages

Guddu – Sukkur Subpopulation			Taunsa – Guddu Subpopulation			Chashma – Taunsa Subpopulation		
<i>Date</i>	<i>Count</i>	<i>Reference</i>	<i>Date</i>	<i>Count</i>	<i>Reference</i>	<i>Date</i>	<i>Count</i>	<i>Reference</i>
Jan 1974	138	Pillari & Zbinden, 1973-74	Apr 1979	36	Pillari & Bhatti, 1980	Oct-Nov	39	Niazi & Azam, 1988
Dec 1974	182	Kasuya & Nishiwaki, 1975	Dec 1983	72	Chaudhry & Khalid, 1989	Winter 1987	47	Chaudhry <i>et al.</i> , 1999
Feb 1977	171	Pillari & Bhatti, 1978	Apr 1985	61	Khan & Niazi, 1989	Mar 1989	15	Chaudhry & Khalid, 1989
Apr-May 1977	187	Pillari & Bhatti, 1978	Aug 1985	71	Chaudhry & Khalid, 1989	April 1990	20	Chaudhry <i>et al.</i> , 1999
May 1977	198	Pillari, 1977	Sept-Oct 1985	62	Khan & Niazi, 1989	Nov 1991	35	Chaudhry <i>et al.</i> , 1999
Oct 1977	168	Pillari & Bhatti, 1978	Oct-Nov 1987	62	Niazi & Azam, 1988	Nov 1992	49	Chaudhry <i>et al.</i> , 1999
Feb-Mar 1978	191	Pillari & Bhatti, 1978	Mar 1989	83	Chaudhry & Khalid, 1989	Nov 1993	51	Chaudhry <i>et al.</i> , 1999
May 1978	241	Pillari & Bhatti, 1978	Apr 1990	107	Chaudhry <i>et al.</i> , 1999	Mar 1994	34	Chaudhry <i>et al.</i> , 1999
Apr 1979	240	Pillari & Bhatti, 1982	Nov 1991	108	Chaudhry <i>et al.</i> , 1999	Nov 1994	62	Reeves & Chaudhry, 1998
June 1979	292	Pillari & Bhatti, 1982	Nov 1992	124	Chaudhry <i>et al.</i> , 1999	Apr 1995	38	Chaudhry <i>et al.</i> , 1999
Sept 1979	291	Pillari & Bhatti, 1982	Nov 1993	111	Chaudhry <i>et al.</i> , 1999	Apr 1996	43	Chaudhry <i>et al.</i> , 1999
Feb 1980	291	Bhatti & Pillari, 1982	Mar 1994	128	Chaudhry <i>et al.</i> , 1999	Winter 1997	39	Chaudhry <i>et al.</i> , 1999
Apr 1980	346	Bhatti & Pillari, 1982	Nov 1994	100	Reeves & Chaudhry 1998	Winter 1998	31	Chaudhry <i>et al.</i> , 1999
Mar-Apr 1982	360	Bhaagat, 1999	Apr 1995	117	Chaudhry <i>et al.</i> , 1999	March 2001	84	Braulik, 2006
Mar 1986	429	Khan & Niazi, 1989	Apr 1996	124	Chaudhry <i>et al.</i> , 1999	March 2006	121	Braulik <i>et al.</i> , 2010
March 1987	450	Reeves & Chaudhry, 1998	Dec 1996	143	Reeves & Chaudhry,			
Apr-May 1989	368	Bhaagat, 1999	Winter 1997	90	Chaudhry <i>et al.</i> , 1999	<b>NWFP portion only</b>		
Mar-Apr 1990	387	Bhaagat, 1999	Winter 1998	100	Chaudhry <i>et al.</i> , 1999	2001	43	NWFP Unpublished
Mar-Apr 1991	398	Bhaagat, 1999	March 2001	259	Braulik, 2006	2002	41	NWFP Unpublished
Mar-Apr 1992	410	Bhaagat, 1999				2005	43	NWFP Unpublished
1992	439	Reeves & Chaudhry, 1998				2006	40	NWFP Unpublished
Mar-Apr 1993	426	Bhaagat, 1999				2007	47	NWFP Unpublished
Mar-Apr 1994	435	Bhaagat, 1999				2008	41	NWFP Unpublished
Mar-Apr 1995	447	Bhaagat, 1999				2009	29	NWFP Unpublished
Apr-May 1996	458	Mirza & Khurshid, 1996						
Apr 2001	725	Braulik <i>et al.</i> , 2010						
Apr 2006	1293	Braulik <i>et al.</i> , 2010						
2009	922	Sindh Wildlife Dpt. Unpub.						

## ANNEX 1. WORKSHOP AGENDA

<b>MONDAY, 19 October 2009 – Seminar Day 1</b>	
	<i>Delegates and open public</i> <span style="float: right;"><i>Seminar location: Governor's office</i></span>
7:45-8:30	On-site registration for local participants at seminar hall
08:30-9:15	<p><b>Official opening of the conference</b></p> <p><b>Official welcome/opening statements:</b></p> <ul style="list-style-type: none"> <li>• Ir Budiono, Director Yayasan Konservasi RASI</li> <li>• Drs. H. Farid Wadjdy, Vice-Governor of East Kalimantan</li> </ul>
09:15-10:15	<p><b>General introduction lectures (15 min each &amp; 5 min questions)</b></p> <p><i>Moderator: Ir. Ali Suhardiman</i></p> <ul style="list-style-type: none"> <li>• Dr. Ir. Harry Santoso, Director Biodiversity Conservation, Directorate General of Forest Protection and Natural Conservation, Forestry Department "<i>National conservation strategy of the Pesut Mahakam</i>"</li> <li>• Ir. Sugeng Harmono, Staff Ministry of Environment for Biodiversity Conservation, "<i>National policy regarding habitat protection and habitat quality monitoring to preserve the Pesut Mahakam</i>"</li> <li>• Dr. Ir. H. Ahmad Delmi, Head of Provincial Forestry Department, "<i>Reforestation of Mahakam watershed as an effort to protect the habitat and food resources of Pesut Mahakam</i>"</li> </ul>
10.15-10.45	Coffee break
10.45- 12.15	<p><b>General introduction lectures (continued)</b></p> <ul style="list-style-type: none"> <li>• Ir. H. Tuparman, Head of the Provincial Environmental Department, "<i>Impact from industrial development on water quality of the Mahakam and habitat of Pesut Mahakam</i>".</li> <li>• Dr. Randall R. Reeves, Chair of IUCN Species Survival Commission Cetacean Specialist Group "<i>The role of IUCN/SSC/CSG and its action plan for conservation of freshwater dolphins in Asia</i>"</li> <li>• Dr. H. M. Sumaryono, Lecturer at Forestry Management, University of Mulawarman "<i>Integrated spatial river management in the Mahakam</i>"</li> <li>• Prof. Wang Ding, Institute of Hydrobiology, The Chinese Academy of Sciences "<i>Learning lessons from Baiji's likely extinction: what we should do next?</i>"</li> </ul>
12.15-13.25	Lunch
	<b>Country presentations on existing and planned protected areas for wild populations of freshwater (dependent) cetaceans</b>

13.25-14.35	<b>Indonesia, Mahakam River-</b> Presentations by Dr Danielle Krebs & Ir. Syachraini (Yayasan Konservasi RASI) (30 min); BKSDA (10 min); BLH West Kutai (10 min); BLH Central Kutai (10 min) , 10 min questions
14.35-15.45	<b>India-</b> Presentations by Prof. BC Choudhury, Chair, Indian River Dolphin Committee; Wildlife Institute of India (10 min), Dr Sandeep Behera, WWF India, RAMSAR site Ganges (20 min); Dr. Wakid, Bhramaputra Ganges dolphin researcher (20 min); questions 10 min questions
15.45-16.15	Coffee/ Tea break
16.15-17.15	<b>Myanmar-</b> Presentations by Aung Myo Chit, Local Project Manager for WCS for the Ayeyarwady Dolphin Protected Area; Mya Than Tun, Government (30 min), film (15 min) + 10 min questions
<b>TUESDAY, 20 October 2009 – Seminar Day 2</b>	
	<i>Delegates and open public</i> <i>Seminar location: Governor's office</i>
08.30-09.10	<b>Country presentations on existing and planned protected areas for wild populations of freshwater cetaceans (cont.)</b> <i>Moderator: Ir. Ali Suhardiman</i> <b>Cambodia-</b> Presentations by Mr Ouk Vibol, Director of the Fisheries Administration Conservation Office and Dr Verné Dove, veterinarian (30 min), 10 min questions
09.10-09.50	<b>Pakistan-</b> Presentations by Gill Braulik, PhD researcher Indus dolphins; Mrs. Uzma Khan, Manager Conservation Programme, WWF-Pakistan, Mr Abdul Haleem Khan, District Forest Officer, NWFP Wildlife Department, Mr Hussain Bux Bhagat, Conservator, Sindh Wildlife Department (30 min), 10 min questions
09.50-10.20	Coffee/ tea break
10.20-11.00	<b>China-</b> Presentations by Prof. Wang Ding, Institute of Hydrobiology, The Chinese Academy of Sciences and Gang Lei, Head of WWF Wuhan Office, WWF HSBC Yangtze Programme (30 min), 10 min questions
11.00-11.40	<b>Bangladesh-</b> Presentations by Brian D Smith, WCS Asia Freshwater and Coastal Cetacean Program; Ishtiaq Rahman, Conservator of Forests, Department of Forests; Zahangir Alom, Bangladesh Cetacean Diversity Project Coordinator and Researcher; Prof. Benazir Ahmed, Chittagong University (30 min), 10 min questions

11.45-13.00	Lunch
13.00-13.30	<b>Indonesia, Sesayap River Delta-</b> Presentation by Dodi Rukman, Project Leader WWF Indonesia (20 min), 10 min questions
13.30-13.45	<b>Seminar Closure</b> by Ir. H. Tuparman, Head of the Provincial Environmental Department
13.45-14.30	<b>Transport to Workshop location</b>
<b>TUESDAY, 20 October 2009 – Workshop Session 1</b>	
	<i>Delegates and invited participants only Workshop location: Mancong Room, Hotel Mesra</i>
	<b>Theme 1: "To what extent have protected areas and cetacean conservation programs been designed and proven effective in providing integrated conservation of the cetaceans and other freshwater-dependent species, maintaining ecosystem health, and bringing economic (or other) benefits to local human communities"</b>
14.30-14.50	• Introductory presentation by Marcela Portocarrero Aya, Ph.D. researcher of Amazonian river dolphins- " <i>Using river dolphins as flagship species to maintain the goods and services of aquatic ecosystems</i> " (15 min + 5 min questions)
14.50-17.35	<b>Discussion:</b>  • Refer to objectives stated for each PA and/ or dolphin conservation program • Concrete results of measured benefits sofar for dolphins, other species, river ecosystem and human communities • Shortcomings • Recommendations for improved integration (recommended action activities)  <i>Moderator: Danielle Kreb</i>  <i>Rapporteur: Randall Reeves</i>
16.00-16.15	Coffee/Tea break
<b>Wednesday, 21 October 2009 – Workshop Session 2 &amp; 3</b>	
	<i>Delegates and invited participants only Workshop location: Mancong Room, Hotel Mesra</i>
6:00-8:15	Breakfast at Hotel
	<b>Theme 2: " Community involvement in protected area management and sustainable development projects"</b>
08:30-08:50	• Introductory presentation by Adriyani Samad, Forestry Department Central Kutai (15 min+ 5 min questions) – " <i>Community reforestation in Semayang Lakes reducing pressure on fisheries</i> "



08:50-11:50	<p><b>Discussion:</b></p> <ul style="list-style-type: none"> <li>• How were communities involved in decision making, socialization processes for establishment of PAs and what is their current involvement?</li> <li>• Which programs were/ are directly focusing on sustainable community development and how?</li> <li>• Shortcomings</li> <li>• Recommendations for improved community involvement</li> </ul> <p><i>Moderator: BC Choudhury</i></p> <p><i>Rapporteur: Danielle Krebs</i></p>
10:00-10:30	Coffee/ tea break
11:50-13:15	Lunch
13:15-14:10	<p><b>Theme 3: "The importance of using consistent methods to monitor freshwater cetacean populations and the need to undertake other types of monitoring to evaluate the effectiveness of protected area and conservation management"</b></p> <ul style="list-style-type: none"> <li>• Introductory presentation Dr Verné Dove, veterinarian - "<i>Population monitoring of the Mekong River Irrawaddy dolphin</i>" (30 min + 5 min questions)</li> <li>• Introductory presentation by Dr. Sandeep Behera, WWF India (15 min + 5 min questions) - "<i>Acoustic Technology used in Dolphin Surveys</i>"</li> </ul>
14:10-17:10	<p><b>Discussion:</b></p> <ul style="list-style-type: none"> <li>• For each PA since its establishment, or conservation management for dolphin core areas, what kind of dolphin monitoring methods has been in place and on which periodical time basis?</li> <li>• Are consistently similar methods used in time?</li> <li>• Which method is found most reliable for estimating dolphin abundance?</li> <li>• Concrete results of changes (positive or negative) in local abundance, natality, mortality in PAs or dolphin core areas?</li> <li>• What other kinds of monitoring are in place to evaluate the achievement of set objectives</li> <li>• Shortcomings</li> <li>• Recommendations for improved monitoring tools</li> </ul> <p><i>Moderator: Brian Smith</i></p> <p><i>Rapporteur: Gill Braulik</i></p>
<b>Thursday, 22 &amp; 23 October 2009 – Fieldtrip</b>	
<b>Saturday, 24 October 2009 – Workshop Session 4</b>	
	<i>Delegates and invited participants only      Workshop location: Mancong Room, Hotel Mesra</i>
6:00-8:30	Breakfast at Hotel

08:45	<b>Theme 4: "Improving conservation management in dolphin core areas/ PAs"</b>
08:45-09:05	<ul style="list-style-type: none"> <li>• Introductory presentation by BC Choudhury (15 min + 5 min questions)- "<i>Improving conservation management in protected areas in India</i>"</li> </ul>
9:05-12:05	<p><b>Discussion:</b></p> <ul style="list-style-type: none"> <li>• Short-comings of current conservation management implementation in dolphin core areas/ PAs and/ or discrepancies in management goals and actual implementation in PAs</li> <li>• Which new PAs need to be established?</li> <li>• Recommendations for improved/ strengthening of conservation management</li> </ul> <p><i>Moderator: M. Sumaryono</i></p> <p><i>Rapporteur: Gill Braulik</i></p>
10.00-10.30	Coffee/Tea break
12.10-13.25	Lunch
13.25-14.25	<p><b>Summarizing sessions 1-4: General Conclusions</b></p> <p><i>Moderator: Randall Reeves, presenting general conclusion notes + discussion</i></p> <p><i>Rapporteur: Danielle Krebs</i></p>
14.25-15.45	<p><b>Brainstorm session: Ideas and suggestions by delegates based on field observations for Mahakam protected areas with particular reference to sustainable ecotourism development</b></p> <p><i>Moderator: Budiono</i></p> <p><i>Rapporteur: Ali Suhardiman</i></p>
15.45-16.00	<b>Closing Ceremony by H. Sutarnyoto, SKM., M.Si, Assistant III of the Governor of East Kalimantan.</b>

## ANNEX 2. List of seminar & workshop participants

### Seminar participants:

No.	Country	Name	Organization
1	Bangladesh	Benazir Ahmed	Professor, University of Chittagong
2	Bangladesh	Ishtiaq U. Ahmad	Deputy Chief Conservator of Forests, Forest Department
3	Bangladesh	Md. Zahangir Alom	Bangladesh Cetacean Diversity Project Coordinator and Researcher
4	Cambodia	Ouk Vibol	Director of the Fisheries Administration Conservation Office
5	Cambodia/ Australia	Dr Verné Dove	Veterinarian, WWF-Cambodia
6	China	Gang Lei	Head Wuhan Office, WWF HSBC Yangtze Programme
7	China	Prof. Wang Ding	Head Lab, Institute of Hydrobiology, Chinese Academy of Sciences
8	India	Dr. Abdul Wakid	Head Program, Aaranyak, Gangetic Dolphin Research and Conservation Programme
9	India	B.C. Choudhury	Chair, Indian River Dolphin Committee; Wildlife Institute of India.
10	India	Nalini Choudhury	Independent participant
11	India	Sandeep Kumar Behera	Senior coordinator, WWF-India
12	Myanmar	Aung Myo Chit	Coordinator WCS, Irrawaddy Dolphin Project
13	Myanmar	Mya Than Tun	Director Assistant, Department of Fisheries
14	Pakistan	Abdul Haleem Khan	Staff Divisional Forest Wildlife, NWFP-Wildlife Department
15	Pakistan	Uzma Khan	Manager Conservation Program, WWF-Pakistan
16	UK	Gill Braulik	University St. Andrews, UK & Pakistan Wetlands Programme
17	US	Brian Smith	WCS Asia Freshwater and Coastal Cetacean Program
18	US	Peter Thomas	Director International and Policy Program, US Marine Mammal Commission
19	Canada	Randall Reeves	Chair, IUCN/SSC/ Cetacean Specialist Group
20	Colombia	Marcela Portocarrero	Foundation Omacha & Ph. D. Student, Hull International Fisheries Institute, The University of Hull
21	Czech Republic	Dr. Petr Obrdlik	Senior staff, WWF Germany, Freshwater Programme
22	Czech Republic	Libuse Obrdlik	Independent participant
23	Indonesia	Drs. H. Farid Wadjdy	Vice Governor Kalimantan Timur
24	Indonesia	H. Didik Effendi, S.Sos, M.Si	Vice-Regent Kutai Barat
25	Indonesia	Letkol Inf. Andi M. Surya	Area Army VI Tanjungpura
26	Indonesia	Mayor Inf. Baharuddin	District Army 0901 Samarinda
27	Indonesia	A. Kamil Razak	Head Police Department Samarinda
28	Indonesia	F. Kuleh	Police Department
29	Indonesia	Karyanto	Police Department
30	Indonesia	Kurdi	Intelligence Police Department
31	Indonesia	Dr. Ir. Harry Santoso	Director, General Directorate Conservation of Nature Department, Forestry Department
32	Indonesia	Mimi Murdiah	Director, General Directorate Conservation of Nature Department, Forestry Department
33	Indonesia	Sugeng Harmono	Staff Ministry for Environment,
34	Indonesia	Dr. Ir. Achmad Delmy	Head of Provincial Forestry Department East Kalimantan
35	Indonesia	Drs. Tuparman, MM	Head of Provincial Environmental department East Kalimantan
36	Indonesia	Budiono	Director, Yayasan Konservasi RASI
37	Indonesia	Danielle Kreb	Program Advisor, Yayasan Konservasi RASI
38	Indonesia	Syachraini	Program Coordinator, Yayasan Konservasi RASI

39	Indonesia	Imelda Susanti	Education and Research Officer, Yayasan Konservasi RASI
40	Indonesia	Sumaryono	Forestry Faculty, Mulawarman University (UNMUL)
41	Indonesia	Paulus Matius	Head, West Kutai District Forestry Department
42	Indonesia	Adriyani S.	Central Kutai District Forestry Department
43	Indonesia	H. Sukarni Gamin	Central Kutai District Forestry Department
44	Indonesia	Eddy Yudjar	Nature Protection Department, Provincial Forestry Department
45	Indonesia	Enny Endharpuri	Nature Protection Department, Provincial Forestry Department
46	Indonesia	Wahyu Widhi Heranata	Head, Nature Protection Department, Provincial Forestry Department
47	Indonesia	Fatimah Alwi	Provincial Environmental Department
48	Indonesia	Feny Deliana	Provincial Environmental Department
49	Indonesia	Indah Eliana	Provincial Environmental Department
50	Indonesia	Lenny Dianawati	Provincial Environmental Department
51	Indonesia	Nurdin S.	Provincial Environmental Department
52	Indonesia	Edial Noor	West Kutai District Environment Department
53	Indonesia	Petrus	West Kutai District Environment Department
54	Indonesia	Fahrud Rizali	Central Kutai District Environment Department
55	Indonesia	Sri Rahmi	Central Kutai District Environment Department
56	Indonesia	Ahmad Ripai	East Kalimantan Conservation Agency for Protection of Nature
57	Indonesia	Kuspriyadi S.	Head, East Kalimantan Conservation Agency for Protection of Nature
58	Indonesia	Ulfa R.	East Kalimantan Conservation Agency for Protection of Nature
58	Indonesia	Dody Rukman	WWF Indonesia
60	Indonesia	Edo Surya	National Park Authority, Kayan Mentarang, Malinau
61	Indonesia	Hendriadi Dasra	National Park Authority, Kayan Mentarang, Malinau
62	Indonesia	M. Aradh	Provincial Fisheries Department
63	Indonesia	Rusdiansyah I.	Provincial Fisheries Department
64	Indonesia	Zainal A.	Provincial Fisheries Department
65	Indonesia	M. Syahrhan	Head, Central Kutai District Fisheries Department
66	Indonesia	Suhendro	Provincial Agriculture Department
67	Indonesia	Drh. Gunawan NDB	Central Kutai Livestock and Health Department
68	Indonesia	Drh. Harjanto	Central Kutai Livestock and Health Department
69	Indonesia	M. Arifin Mustika	Fisheries and Livestock Department Samarinda
70	Indonesia	Agus S.	Provincial Mining and Energy Department
71	Indonesia	Rusdie HD	Provincial Transport Department
72	Indonesia	Soebowo Hadi	Transport Department
73	Indonesia	Zainul Arifin	Provincial Department of Culture and Tourism
74	Indonesia	Ayonius	Head, West Kutai Department of Culture and Tourism
75	Indonesia	Syachrumayah A.	Head, Provincial Research and Development Department
76	Indonesia	Burhansyah, SE, MM	Provincial Representatives Office
77	Indonesia	Hapida Sy	West Kutai Representatives Office
78	Indonesia	Arief Budiman	Gadjah Mada University
79	Indonesia	Djuwantoko	Gadjah Mada University
80	Indonesia	Soeprapto Mangoendihardjo	Professor Emeritus, Gadjah Mada University
81	Indonesia	RA Yudi Aningtyas	Gadjah Mada University
82	Indonesia	Heru Herlambang	Forestry Faculty, UNMUL
83	Indonesia	Himawan Nugroho	Forestry Faculty, UNMUL
84	Indonesia	Nani Husien	Forestry Faculty, UNMUL
85	Indonesia	Paula Mariana Kustiawan	Forestry Faculty, UNMUL
86	Indonesia	Sukartiningsih	Forestry Faculty, UNMUL

87	Indonesia	Ir. H. Abdunnur, M.Si	Fisheries Department UNMUL
88	Indonesia	Dr. Samson	Fisheries Department UNMUL
89	Indonesia	Komsanah Sukardi	Fisheries Department UNMUL
90	Indonesia	Mahmud N.	Mathematics and Science Department UNMUL
91	Indonesia	Norholis Majid	Mulawarman University
92	Indonesia	Lambang Subagiyo	Master Program, Environment Science, UNMUL
93	Indonesia	M. Fadli Noor	Master Program, Environment Science, UNMUL
94	Indonesia	M. Zainuri	Master Program, Environment Science, UNMUL
95	Indonesia	Roffi Meidisawarman	Master Program, Environment Science, UNMUL
96	Indonesia	Warsudi	Tropical Forest Research Center UNMUL
97	Indonesia	Adi Wijaya	Executive Student Organization Sylva, Forestry Faculty, UNMUL
98	Indonesia	Agil Amirul Rosyiddin	Executive Student Organization Sylva, Forestry Faculty, UNMUL
99	Indonesia	Budi Agung Nugrahanto	Executive Student Organization Sylva, Forestry Faculty, UNMUL
100	Indonesia	Megita Aditiyanto	Executive Student Organization Sylva, Forestry Faculty, UNMUL
101	Indonesia	M. Wahyu Agung	Executive Student Organization Sylva, Forestry Faculty, UNMUL
102	Indonesia	Sugimin	Executive Student Organization Sylva, Forestry Faculty, UNMUL
103	Indonesia	Ardi Rumengan	Higher Education Communication Forum East Kalimantan
104	Indonesia	M. Syoim	NGO BEBSIC
105	Indonesia	Sundari Rahmawati	NGO Walhi KEast Kalimantan
106	Indonesia	Warsono	NGO Pencinta Lingkungan Hidup
107	Indonesia	Sudirman, Spi	KRUS (Zoo)
108	Indonesia	Amy	Kaltim TV
109	Indonesia	Kemas A.	Kepala TVRI Kaltim
110	Indonesia	Khaidir	NGO SKH Tribun Kaltim
111	Indonesia	Syaiful	RRI (Radio)
112	Indonesia	Umar	Pos Kota
113	Indonesia	Wiwid M.	vivaborneo.com
114	Indonesia	Ir. Artha Mulya	Independent participant
115	Indonesia	Tjetjep Prasetya	KTI / CEO

## Workshop participants:

No.	Country	Name	Organization
1	Bangladesh	Benazir Ahmed	Professor, Universitas Chittagong
2	Bangladesh	Ishtiaq U. Ahmad	Deputy Chief Conservator of Forests, Forest Department
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6	China	Gang Lei	Head Wuhan Office, WWF HSBC Yangtze Programme
7	China	Prof. Wang Ding	Head Lab, Institute of Hydrobiology, Chinese Academy of Sciences
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15	Pakistan	Uzma Khan	Manager Conservation Program, WWF-Pakistan
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22	Czech Republic	Libuse Obrdlik	Independent participant
23	Indonesia	Budiono	Director, Yayasan Konservasi RASI
24	Indonesia/ Netherlands	Danielle Kreb	Program Advisor, Yayasan Konservasi RASI
25	Indonesia	Syachraini	Program Coordinator, Yayasan Konservasi RASI
26	Indonesia	Imelda Susanti	Education and Research Officer, Yayasan Konservasi RASI
27	Indonesia	Sumaryono	Forestry Faculty, Mulawarman University (UNMUL)
28	Indonesia	Adriyani S	Central Kutai District Forestry Department
29	Indonesia	H. Sukarni Gamin	Central Kutai District Forestry Department
30	Indonesia	Indah Eliana	Provincial Environmental Department
31	Indonesia	Petrus	West Kutai District Environment Department
32	Indonesia	Fahrud Rizali	Central Kutai District Environment Department
33	Indonesia	Danang Anggoro	East Kalimantan Agency for Protection of Nature
34	Indonesia	Hendriadi Dasra	National Park Authority Kayan Mentarang
35	Indonesia	Muslik	Central Kutai Fisheries Department
36	Indonesia	Arief Budiman	Lecturer, Gadjah Mada University
37	Indonesia	Alm. Djuwantoko	Lecturer, Gadjah Mada University
38	Indonesia	Soeprapto Mangoendihardjo	Professor Emeritus, Gadjah Mada University
39	Indonesia	RA Yudi Aningtyas	Gadjah Mada University
40	Indonesia	Ardi Rumengan	Higher Education Communication Forum East Kalimantan

## ANNEX 3. GENERAL INTRODUCTION LECTURES

### International Involvement in Conservation of Asian Freshwater Cetaceans: A 23-year Retrospective

Randall R. Reeves

Chair, IUCN/SSC/ Cetacean Specialist Group

#### Early Efforts

International interest in the conservation of freshwater cetaceans in Asia (hereafter 'Asian river dolphins', including *Platanista*, *Lipotes*, *Orcaella* and *Neophocaena*) was greatly influenced by the efforts of the Swiss anatomist Georgio Pilleri, who visited the South Asian subcontinent in the late 1960s and 1970s to collect specimens. He was particularly instrumental in getting government agencies in Pakistan to give protection to Indus dolphins (see Pilleri 1980; Khan and Niazi 1989). Also, his numerous publications on these and other river dolphins, many of them published in his own journal *Investigations on Cetacea*, helped stimulate scientific study and raise awareness internationally (e.g. Pilleri 1970; Pilleri and Zbinden 1974; Pilleri and Bhatti 1978, 1980; Pilleri and Pilleri 1979). Another scientist of that era from outside the region who contributed to knowledge of Asian river dolphins was Masaharu Nishiwaki at the University of Tokyo, Japan. Also, his student, Toshio Kasuya, continued through the 1970s, 1980s and 1990s to be involved in research on and conservation of these animals (Kasuya 1972, 1997; Kasuya and Haque 1972; Kasuya and Nishiwaki 1975; Reeves *et al.* 2000).

#### Wuhan Workshop in 1986

The most significant milestone in the emergence of international interest and involvement was a workshop organized collaboratively by W.F. Perrin and R.L. Brownell, Jr., of the United States with Zhou Kaiya and Liu Jiankang of China. Held in Wuhan in October 1986, the workshop was attended by 48 scientists and managers from 8 countries. Besides the plenary sessions, subgroups met to consider two key topics: (1) Dams and Dolphins and (2) Sighting

Methods. Also, considerable attention was devoted to the subject of 'semi-natural reserves' for the baiji. When the proceedings of the workshop were published in 1989, the volume contained, in addition to species reviews, 13 contributed papers on baijis, 1 on Indus dolphins and 2 on Ganges dolphins, as well as more general papers on captive breeding of river dolphins and on relevant international agreements and national legislation (Perrin *et al.* 1989). The convenors stated in their Introduction to the volume, "The river dolphins are in trouble around the world. The riverine habitat is highly vulnerable to degradation and is under heavy pressure nearly everywhere as human populations burgeon and as the economies of the developing nations expand." It concluded, "If present trends continue, there may be little time to do anything to save several of the river dolphins; some regional populations are already extinct." At the time, the baiji was considered the most endangered cetacean species in the world.

#### Next Steps by Cetacean Specialist Group

The Wuhan workshop was regarded by the IUCN/SSC Cetacean Specialist Group (CSG) as 'the first step in a campaign to promote, organize and support conservation action' (Perrin *et al.* 1989:iv). Perrin and his successor, Steve Leatherwood, pursued this campaign for the next two decades, with financial support from many non-governmental organizations, especially the Whale and Dolphin Conservation Society and Ocean Park Conservation Foundation. Much of the work consisted of organizing and conducting meetings with scientists and conservationists in the range countries, sharing information and skills, identifying priorities for

research and conservation, and raising the profile of river dolphins and their habitat both within the range countries and internationally. Under the aegis of the CSG, the Seminar on the Conservation of River Dolphins in the Indian Subcontinent was held in Delhi in August 1992 (Reeves *et al.* 1993), followed by meetings of the Asian River Dolphin Committee, one in Hong Kong in December 1994 (Reeves and Leatherwood 1993) and another in Rajendrapur, Bangladesh, in February 1997 (Smith and Reeves 2000a). In the same month, and also in Rajendrapur, the CSG organized and conducted the Workshop on Effects of Water Development on River Cetaceans (Smith and Reeves 2000b).

Notable among the recommendations of those meetings (particularly in the context of the present workshop) were that governments should designate protected areas specifically to conserve river dolphins, and also that they should, where appropriate and feasible, extend the boundaries of existing terrestrial protected areas to include adjacent stretches of river inhabited by dolphins.

Also during the late 1980s and 1990s, largely in response to the concerns and proposals tabled at the Wuhan workshop, a number of foreign scientists and conservationists collaborated with Chinese colleagues in efforts to study and conserve the baiji as well as the Yangtze population of finless porpoises. Most noteworthy was the work of Bernd Würsig and his group (Würsig *et al.* 2000a, b; Zhou *et al.* 1998) and later that of Steve Leatherwood (Leatherwood and Reeves 1994; Mraz and Genthe 1996). In 1993, an international workshop in Nanjing, China, carried out a formal baiji population and habitat viability assessment, concluding that the species could not survive without human intervention, including establishment of at least one *ex situ* population in a 'semi-natural reserve' (Ellis *et al.* 1993). In 1997, an international workshop in Hong Kong reviewed the status of Yangtze finless porpoises and made recommendations for research and conservation action, both *in situ* and *ex situ* (Reeves *et al.* 2000).

Leatherwood, using his position as both chairman of the CSG and director of the Ocean Park Conservation Foundation, raised funds and worked tirelessly (until his death in 1997) to support Chinese groups and individuals as they tried, unsuccessfully, to implement an effective baiji conservation strategy. Additional workshops and meetings, jointly organized by the CSG and the Wuhan Institute of Hydrobiology and funded primarily by baiji.org, were

held in the early to mid 2000s (Braulik *et al.* 2005; Turvey 2008). Although considerable progress was made in preparing the National Baiji Reserve at Tian-e-Zhou oxbow to hold cetaceans under 'semi-natural' conditions and a population of several tens of finless porpoises was successfully established there (Wei *et al.* 2002), the anticipated capture and introduction of baijis did not occur. A range-wide survey in 2006 determined that the baiji is likely extinct (Turvey *et al.* 2007) and that Yangtze finless porpoises have been declining rapidly (Zhao *et al.* 2008).

### IUCN/SSC Cetacean Action Plans

The IUCN Species Survival Commission, of which the CSG is a part, has a long tradition of publishing status reports and action plans on species, groups of species and conservation issues. In that tradition, from the late 1980s to early 2000s, the CSG produced a series of action plans that included numerous proposed actions and recommendations regarding Asian (and other) river dolphins. These were distributed widely with the intention of helping government agencies, nongovernmental organizations, international conventions and individuals set priorities and develop research, monitoring and mitigation programs.

The 1988-1992 plan (Perrin 1988) described 12 priority projects (out of 45 in total for the world) specifically related to freshwater cetaceans. Of the 12, five concerned Asian dolphins only (4 baijis and 1 Indus dolphins) while several others concerned tasks relevant to Asian dolphins (a workshop on survey methods, increased consideration of river faunas in internationally funded development, a workshop on "disturbance"). In addition, the plan cited the habitat of *Orcaella brevirostris* in Indonesia as something that should be 'monitored'.

The 1994-1998 action plan included 6 baiji projects and 8 *Platanista* projects (Reeves & Leatherwood 1994). It also called for a global review of the finless porpoises and described two priority projects on freshwater populations of *O. brevirostris* – one to investigate status and establish protected areas in Indonesia and one to investigate status and conservation of the species in the southern Asia mainland, with specific reference to populations in the Mekong, Sekong and Sesan rivers of Laos and Cambodia and in Chilika Lagoon, India. Several more generally topical projects were described, calling for



(a) a symposium on the impacts of dams on river dolphins, (b) testing the validity of folk beliefs about the properties of cetacean products and finding suitable substitutes, (c) a workshop on methods for surveying populations of coastal and riverine cetaceans and (d) promotion of consideration of river faunas in internationally funded development projects.

The most recent plan, intended to span the period 2002-2010, contains elaboration of previous projects and recommendations as well as new initiatives (Reeves *et al.* 2003). With regard to *O. brevirostris*, continued and expanded effort on the Mahakam River population is recommended, including monitoring threats, protection from all kinds of direct removals, and improved management of fishing, logging and vessel traffic. Further study and development of management plans are recommended for the dolphins in the Mekong River, and a specific workshop on all freshwater populations of *O. brevirostris* is proposed. Attention is drawn specifically to the dolphins in the Sundarbans (including both *Platanista gangetica* and *O. brevirostris* if not also finless porpoises) and the need to protect them and their habitat through, for example, nature tourism and by strengthening the technical capacity of local researchers and managers. The issue of capacity building in South and Southeast Asia is highlighted more generally as a priority, and intensive training courses are recommended as one approach to achieve it. In the early 2000s when the 2003 action plan was being developed, the troubling implications of global warming for river cetaceans were only beginning to be recognized. From today's vantage point, the project to 'assess the impacts of reduced water levels on river dolphins in the Ganges and Indus rivers' seems, if anything, too narrow. Finally, the plan identified the need to study and monitor finless porpoises in the Yangtze River and to establish protected areas for them in and near Dongting and Poyang Lakes.

Several foreign scientists, in addition to those mentioned earlier, have played major roles in implementing the relatively long lists of actions proposed by the CSG over the last two decades. Brian Smith (USA), Danielle Krebs (Netherlands), Isabel Beasley (New Zealand), Gill Braulik (UK) and Tom Akamatsu (Japan) have distinguished themselves in projects in Nepal (Smith *et al.* 1994), Myanmar (Smith and Hobbs 2002; Smith and Tun 2008), Pakistan (Braulik 2006), Thailand (Beasley *et al.* 2002), Cambodia (Beasley 2007), Indonesia (Krebs

2002; Krebs *et al.* 2007), Bangladesh (Smith *et al.* 1998, 2001, 2006) and China (Akamatsu *et al.* 2008). Smith has also implemented several of the cross-cutting projects, including the workshop on freshwater populations of *O. brevirostris* (Smith *et al.* 2007), the study of impacts of reduced freshwater supplies and sea-level rise (Smith *et al.* 2009) and conducting training courses on cetacean research techniques for scientists in South and Southeast Asia.

## International Whaling Commission

Members of the International Whaling Commission (IWC) are divided on the question of whether it has competence to 'manage' small cetaceans. Nevertheless, the IWC Scientific Committee has a standing sub-committee on small cetaceans that meets annually to consider new information on any species as well as one or two priority topics. Freshwater cetaceans were the priority topic at the 2000 meeting in Adelaide, Australia (IWC 2001). In addition to brief species summaries of distribution and stock structure, abundance, directed takes, incidental takes, habitat degradation, life history, ecology and status, the sub-committee generated numerous recommendations for both research and conservation action. Besides calling for studies of various kinds on freshwater populations of *O. brevirostris*, the sub-committee recommended 'an immediate cessation of live captures until affected populations have been assessed using accepted scientific practices (p. 266). For both subspecies of *Platanista*, various studies were recommended in relation to populations, habitat and threats. For Yangtze finless porpoises, the sub-committee recognized the 'unique nature' of the population (it is the only freshwater population of the species) and recommended an assessment of variation in the density of porpoises within the Yangtze system, with the goal of identifying areas of high abundance (e.g. Poyang Lake) 'that may deserve special protection'. Finally, for the baiji, the sub-committee was unable to reach consensus on a clear way forward to prevent extinction.

In its general conclusions and recommendations, the sub-committee recognized the potential value of protected areas but emphasized that they need to be well designed and well managed, and that measures to eliminate or greatly reduce threats need to be implemented and

enforced. Bycatch, particularly in gillnets, was identified as a widespread threat to freshwater cetaceans. The sub-committee also stressed the importance of obtaining robust estimates of abundance and noted that this can only be achieved if scientists with relevant analytical skills become involved and transfer knowledge and know-how to researchers in the range states.

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# Learning lessons from Baiji's likely extinction: what we should do next?

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Baiji only survives in the middle and lower reaches of the Yangtze River, even it once occurred in the Qiantang River but disappeared in the 1950s (Zhou *et al.*, 1977). As a member of the true river dolphins, a particularly rare group on this planet, baiji was considered to be the most threatened cetacean (Reeves *et al.*, 2003), and probably the rarest animal within the category of large mammals (Dudgeon, 2005). This species, as the sole representative of the Lipotidae family lineage diverging from other cetaceans more than 20 million years ago (mya) (Nikaido *et al.*, 2001), has long been listed as "Critically Endangered" by IUCN (Reeves, *et al.* 2003) until very recently when it was announced to be possibly extinct after an intensive range-wide survey concluded without a single sighting in 2006 (Turvey *et al.*, 2007). This would mean, although a few individuals might still survive somewhere in the wild outside of detection limits, presumably, there is only a slim chance of reversing its upcoming extinction. This will be the first aquatic mammal species to be extinct since the demise of the Japanese Sea Lion (*Zalophus japonicus*) and the West Indian Monk Seal (*Monachus tropicalis*) in the 1950s, as well the first cetacean species to be extinguished as a result of human activity (Turvey *et al.*, 2007).

There are occasional records on baiji in the historical Chinese literature dating back to 200 B.C. (~2,200 years ago, Guo, 200 B.C.). However, the international scientific community didn't know this species until its scientific nomination by Miller in 1918 (Miller, 1918). No data was available on the abundance of baiji before the late 1970s, but we

speculate that baiji had at one time been quite abundant in the Yangtze River as evidenced by its description in ancient books, e.g., Er-Ya (Guo, 200 B.C.) and Ru-Fan (Li, 1874). The first systematic modern surveys of baiji were carried out during the late 1970s and early 1980s, and provided the first population abundance estimate. Approximately 300-400 individuals were observed across their whole range (Zhou, 1982; Lin *et al.*, 1985, Chen and Hu, 1987, 1989) with about 100 individuals in the downstream section (Zhou and Li, 1989) in the 1980s. Then the subsequent landmark surveys described a consistent rapid decline: ~200 individuals in 1990 (Chen *et al.*, 1993), less than 100 individuals in 1995 (Liu *et al.*, 1996) and zero individuals in 2006 and thus likely to be extinct (Turvey *et al.*, 2007). Additional surveys (more regular) were conducted to monitor their abundance and look into their major threats (Akamatsu *et al.*, 1998; D. Wang, *et al.*, 1998, 2000, 2006; Zhou *et al.*, 1998; Zhang *et al.*, 2003; K. Wang *et al.*, 2006).

A number of anthropogenic factors are known or suspected to be responsible for the population decline and range contraction of the Yangtze cetaceans (D. Wang *et al.*, 1998, 2005; K. Wang *et al.*, 2006). Turvey *et al.* (2007) concluded that harmful fishing, in combination with some other threats such as boat collisions, water pollution and construction activities, collectively pushed the baiji to likely extinction. Actually, the above threats have long been recognized, and scientists addressed three remedial measures to cope with these problems, i.e. *in situ*, *ex situ* and captive breeding. All these

measures have been reiterated in many international meetings (Chen and Hua, 1989; D. Wang, 2000; Reeves *et al.* 2000) and addressed consequently. For example, several natural and so called semi-natural reserves were established since 1992, with a fine coverage of the hot spots of the Yangtze cetaceans along the Yangtze River (D. Wang, *in press*). In addition, people made profound progress on captive breeding techniques by rearing a male baiji for almost 23 years since 1980. This individual, named "QiQi", was stranded in January of 1980, and heavily injured by fishing hooks when a fisherman tried to catch him in the mouth of Dongting Lake. It was then translocated into the aquarium of Institute of Hydrobiology of the Chinese Academy of Sciences and recovered gradually four months later after careful therapy (Chen *et al.*, 1997). Much of the knowledge on baiji was acquired from this individual, which made it a shining star in China.

We have to point out that most of the measures we proposed have been called for many times in workshops, published papers and reports to the government, but they have received little attention and little progress has been made in carrying them out. Most of the threats are still present and at least some of them are getting worse. Under the pressure of rapid economic development, perhaps the best thing for the government to do could be to seek a balance between development and conservation. But, development almost always comes as a priority when there is conflict between them in a developing country like China. In this type of situation, no matter what research-based conservation suggestions are put forward, conservation results will likely be limited and most likely will be nothing more than "conservation on paper" (for example, please see Bearzi, 2007). The will of governments and the involvement and support of the public are the two keys for any possible success of any conservation program. Eventually, we have to ask ourselves if we are prepared to lose one more mammal species in the Yangtze River. The Yangtze finless porpoise (*Neophocaena phocaenoides asiaeorientalis*) may be the only one left in the river since we may have

already lost the baiji. Can we really afford the cost of losing them and eventually the whole biodiversity of the river? Our hope is that the international community has learned a lesson from the baiji tragedy and will react accordingly to remediate the Yangtze River, save and improve its biodiversity, and protect the finless porpoise.

### Acknowledgements

The writing of this paper is supported by National Basic Research Program of China (2007CB411600), National Natural Science Foundation of China (30730018), and the President's Fund of the Chinese Academy of Sciences.

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# Is it possible to consider river dolphins as flagship species to maintain the goods and services of aquatic ecosystems?

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River dolphins are one of the most threatened cetacean and freshwater species in the world (Reeves & Leatherwood, 1994). Dolphin populations in Asia are critically endangered, with the baiji (*Lipotes vexillifer*) considered functionally extinct. These species inhabit the major river basins of South America (Amazon and Orinoco) and Asia (Indus, Ganges, Brahmaputra and Yangtze), and these river systems and river dolphins are in serious risk.

River dolphins in Asia and South America share many social and environmental realities. Both continents have vast tropical river systems, supporting the largest biological diversity of aquatic species in the world. The high levels of biodiversity that have been maintained by freshwater ecosystems over thousands of years, clearly demonstrate the importance of maintaining these processes. Freshwater habitats cover less than 1% of the earth and provide refuge for 7% (126,000 species) of the estimated 1.8 million discovered species (Gleick 1996; Balian *et al.*, 2008).

Tropical rivers provide a source of income to millions of families in developing countries and ensure food security. However, these ecosystems are currently experiencing an alarming decline in biodiversity. This decline results in a deterioration of ecological processes that maintain vital goods and services, such as, food supply, building materials, water filtration, flood or erosion control, the storage and provision of clean water for human use. Currently, the use of these goods and services are contributing further towards the deterioration of the environment and threatening the existence of river dolphins and other aquatic species.

For the last few years, it has been a debated whether the requirements of a single species should provide the basis for defining conservation requirements, or whether it is best to analyze habitat patterns and ecological processes (Lambeck, 1997). It is not possible to conserve every species in

the world as there are so many still unknown, therefore, the selection of a single species with particular traits should provide a suitable bases for identifying habitat elements that must be present, if an ecosystem is able to support that species and/or others. This also will lead to the identification of key conservation areas where both species and ecosystems are represented.

Dolphins have the ability to use a wide range of habitats to conduct activities vital to their survival, these habitats include; flooded forests, lakes, river banks, river mainstream, beaches, confluences and low current areas; they are therefore directly affected by any changes in the ecosystem. River dolphins can move and migrate long distances based on changes to river level, or the creation and destruction of available habitats. As aquatic mammals they spend their entire life cycle in the water and depend exclusively on the good health of the ecosystem, fish stocks, aquatic vegetation and water quality. They are therefore highly dependent on the reliability of the ecosystems' natural processes that ensure the preservation of these environmental aspects. This behaviour makes the species perfect indicators of the status of the habitats as well as the human activities that are altering them.

With River dolphins considered as conservation targets, we can conduct conservation programmes that are focused not only on the protection of these species, but on the identification of key conservation areas and the protection of freshwater biodiversity. For several years, research into river dolphins has provided us with valuable information about their environmental, ecological and ecosystemic needs, as well as identifying human activities that have directly or indirectly altered the ecosystems and harmed river dolphins and other aquatic species. River dolphins have been a vital element to the understanding of the social and economic problems

that occur in these areas, where the lives of millions are closely attached to the dynamics of the rivers.

Freshwater ecosystems are not only crucial to the survival of a huge number and variety of wildlife, but they also provide active elements used to develop drugs and cures for illness and disease, and supply building materials for local people to build houses and boats. More importantly, these river systems support one of the most important activities to human survival: inland fisheries. People from tropical countries such as those in Asia, Africa and South America depend largely on fishing in rivers and lakes.

The freshwater dolphins share territory and resources with local communities. The wide diversity of freshwater habitats such as lakes, creeks, tributaries, flooded forests, channels and confluences, allow for flow regulation, flood and erosion control. The two distinct hydrological seasons each year in Asia and South America, are controlled by ecological processes which depend on the maintenance of healthy aquatic and terrestrial ecosystems. It is well known that human activities such as fishing are partly responsible for the decline in river dolphin populations. The use of dolphin meat as bait, their entanglement in fishing nets, the competition with fishermen for the same resource, illegal hunting, collision with boats, the use of their organs and fat in magical/religious activities, are some of the perils to the survival of these species. Indirect threats such as water pollution, gold mining, changes in land use, construction of dams, climate change, and the growth of local population are also threats to river dolphin conservation.

Due to these major issues, it is a priority to implement new and improved conservation initiatives to ensure the mitigation of previous harm and prevention of future threats that could harm river dolphin populations. It is also important to incorporate habitat quality requirements into conservation plans and introduce an appropriate plan for the utilisation of freshwater resources. Currently, the identification of conservation objectives, or targets, to identify key conservation areas, is one of the methods that has been demonstrated to be effective in terrestrial and marine conservation programmes. In freshwater terms, this initiative is still in its preliminary stages, however, it is proving to be the inspiration needed for the conservation of freshwater biodiversity.

River dolphins have many endearing features that make them the ideal species to help promote the conservation of ecological processes, supporting the goods and services that freshwater ecosystems provide to human populations. The fact that river dolphins are a part of local communities because of cultural myths and legends, means that they can be seen as charismatic species, gaining the attention of local people and making them a great key species in the development of conservation programmes. These will attract funding to new regions, generating a new source of income for these local communities. This income can be focused on tourism activities and manufacturing hand crafts, which if conducted properly will achieve very good results.

River dolphins are perfect examples of flagship species to maintain the goods and services provided by freshwater ecosystems. This means they are perfect for conservation, and for the identification and implementation of Protected Areas. However, it cannot be forgotten that the implementation of new Protected Areas alone will not bring the complete solution for the conservation of river dolphin and freshwater biodiversity. Neither will it contribute to improve the livelihood for local communities, especially if it is not accompanied by other conservation strategies where local people's interests are involved and where environmental education is used as a key tool to achieve changes and success.

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## ANNEX 4. PROTECTED AREAS TABLE

**Table 1.** Details of existing and proposed protected areas (PAs) for river dolphins in Asia including sites that receive nominal protection due to their inclusion in national parks, reserved forests, or sanctuaries established to protect other taxa or features.

Name and location	Status	Species and estimates of abundance	Geographical description	Main threats	Management authorities and supporting NGOs	References
<b>Bangladesh</b>						
Sundarbans Dolphin Protected Area Network, Eastern Sundarbans Reserve Forest	Proposal for PA network submitted to Bangladesh government and endorsed by Forestry Department in October 2008. Proposed sites in the Sundarbans currently receive nominal protection by their inclusion in the Eastern Sundarbans Reserve Forest.	OB - 451 (CV = 9.6%), PG- 225 (CV=12.6%), both from mark-recapture analysis of concurrent counts using independent teams in 2002.	Three channel segments in the eastern Sundarbans Protected Forest including a 12-km segment in the northwest corner, a 15-km channel segment in the north end, and a 5-km segment in the southeast corner.	Incidental mortality in gillnets and fishing lines, declining freshwater supplies, climate change.	WCS has collaborated with the Bangladesh MoEF on a program of cetacean research and educational outreach in the Sundarbans since 2006.	Smith <i>et al.</i> , 2006; 2009; 2010
Sangu River Dolphin Sanctuary	Proposed in 2003 but no additional progress made for its establishment.	PG - Minimum of 52-71 from direct counts in 1999.	50-km river segment below Dohzari Bridge to river mouth. Sangu occupies a separate watershed from the nearby Karnaphuli River but it is connected by the Sikalbaha-Chandkhali Canal.	Incidental mortality in gillnets and possibly overfishing of prey.	WDSCS has collaborated with Chittagong University on supporting conservation efforts in the lower Sangu.	Smith <i>et al.</i> , 2001
<b>Cambodia</b>						
	No PAs yet, but the Fisheries Administration is proposing PAs around dolphin pools. Dolphin conservation possibly incorporated within community fisheries areas.	OB - As at May 2007 estimated abundance of 71 (95% CI 66-76) using mark-recapture and photo ID. 2010 report pending (October 2010)	190km of Mekong River from Kratie to Lao Border	Known threats: by-catch, Possible threats: disease, pollution, disturbance from dolphin-watching boats Future threat: dams	Fisheries Administration, Dolphin Commission, WWF, WCS and the Cambodian Rural Development Team	Beasley, 2007; Beasley <i>et al.</i> , 2009
<b>India</b>						
National Chambal	415 km segment of Chambal River, a southern	In addition to critically endangered gharial	Central India, forms boundary between Rajasthan and Madhya	Occasional incidental captures in illegal fishing nets and	Wildlife agencies of Uttar Pradesh,	MP Forest Department

Sanctuary, states of Uttar Pradesh, Rajasthan, Madhya Pradesh	tributary of the Ganges, established in 1978-79 for conservation of the 2 crocodilians – gharial and mugger.	and several species of threatened and endangered freshwater turtles, this PA supports a population of 60-80 Ganges dolphins. Counts conducted annually by research wing of Madhya Pradesh Forest Department.	Pradesh. Chambal joins Yamuna, which ultimately joins Ganges. Upper reaches of Chambal within sanctuary are rocky and do not support dolphins. Lower two-thirds of sanctuary is largely sandy, deep, and slow-flowing and thus supports dolphins.	increasing water extraction that depletes flow.	Rajasthan, Madhya Pradesh. Wildlife wardens based at Kota (Rajasthan), Agra (Uttar Pradesh), Morena (Madhya Pradesh). Wildlife Institute of India, Dehradun, WWF-India, New Delhi, Gwalior University, Gwalior, Madras Crocodile Bank and TSA all involved in aquatic species research and monitoring.	survey reports; Management Plan of National Chambal Sanctuary, Morena; Sharma <i>et al.</i> , 1995; Sharma and Behera, 1999; Behera and Sharma, 2005.
Name and location	Status	Species and estimates of abundance	Geographical Description	Main Threats	Management Authorities and supporting NGOs	References
Chilika Lake RAMSAR site	Nominated as first of 6 RAMSAR sites in India. A 15 km <sup>2</sup> island in southern part of the 1,000 km <sup>2</sup> lake has also been declared a wild bird sanctuary.	OB: 100-125. Also an important wintering ground for > 1 million migratory waterfowl.	Largest brackish lagoon along the Bay of Bengal (east) coast of India.	Livelihoods of 120,000 fisherfolk depend on resources of Chilika lake. They use mechanized fishing vessels and prawn culture pens along the banks of the lake. Outboard motor strikes and incidental capture in fishing nets are major threats.	Chilika Development Authority and Wildlife Warden, Nalban Wildlife Sanctuary. WWF-India, WII, Wetlands International, local universities provide research support.	Reports from CDA, WDCCS, WCS, WWF-India, Wetlands International; Pattnaik <i>et al.</i> , 2006
Katerniya Ghat Gharial Sanctuary	Declared as a riverine wetland sanctuary for conservation of gharial, mugger, turtles, and dolphin in 1977.	PG: approx. 25-30 based on direct counts conducted annually by UP Wildlife Management authority.	A 15-20 km stretch of Girwa River along the India-Nepal border district of Baharaich, Uttar Pradesh includes head pond of downstream barrage.	Fluctuating water level and fishery interactions. Also, forced isolation of dolphins as they may be unable to move either upstream or downstream of the barrages.	Sanctuary wildlife warden. MCBT – Gharial Conservation Alliance and WWF-India conduct monitoring exercises.	Behera, 2006; Ramesh Pande, pers. comm.
Narora RAMSAR site	Declared in 2005.	PG: 52. Also present: otter <i>Lutra lutra</i> , gharial <i>Gavialis gangeticus</i> , <i>Crocodylus</i>	82 km segment of upper Ganga in Uttar Pradesh, from Garmukteswar to Narora. After passing Bijnor district, the Ganga	Shallowness due to water diversion (obstructs movements of dolphins). Although industrial pollution is	Uttar Pradesh Forest Department. WWF-India involved in conservation of this	Behera and Mohan 2005; RAMSAR Fact Sheet; Behera,

		<i>palustris</i> , 12 species of turtles, 6 of which are endangered, including Indian softshell <i>Aspideretes gangeticus</i> .	enters Meerut and Moradabad districts, on right and left bank, respectively. Brijghat, a religious ghat (or jetty), is situated on the right bank. The river flows about 82 km to reach Narora from Brijghat. This entire stretch is shallow with only small, intermittent stretches of deep pools and reservoirs upstream of barrages. The banks are sandy and muddy.	comparatively minor, domestic sewage discharge and pesticide (e.g. DDT, Alderin, dieldrin) and fertilizer runoff are problems, as are mass bathing during festivals and post-cremation rituals. Large-scale fishing in some areas.	river stretch along with local communities.	1995; Rao, 1995
Name and location	Status	Species and estimates of abundance	Geographical Description	Main Threats	Management Authorities and supporting NGOs	References
Hastinapur Wildlife Sanctuary	Declared in 1986 for conservation of swamp deer.	PG: 30. Otters, gharial, turtles (as above) also present.	2073 km <sup>2</sup> along both banks of upper Ganga in Meerut District, Uttar Pradesh. Altitude ranges between 130-150 m above sea level.	Agriculture, fishing, industrial pollution, forestry (minor).	Uttar Pradesh Forest Department and WWF-India.	Behera and Mohan, 2005; RAMSAR Fact Sheet; Behera and Rao, 1995, 1999; Nawab, 2008
Vikramshila Gangetic Dolphin Sanctuary	Designated in 1991, primarily for the Ganges dolphin.	PG: best estimate in the range of 60-80 based on direct count methods.	A 50 km stretch of the Middle Ganga, Bhagalpur District, Bihar, from Sultanganj to Kahalgaon.	Incidental killing in fishing nets and possibly targeted killing to extract oil.	Divisional Forest Officers and Wildlife Warden, Banka Forest Division, Bihar; Bhagalpur University Dolphin Conservation Programme	Sinha <i>et al.</i> , 2000 ; Choudhury <i>et al.</i> , 2006; Kelkar <i>et al.</i> , 2010
Sundarbans Tiger Reserve & World Heritage site	Sundarbans Tiger Reserve, created in 1973, was the part of the then 24-Pargans Division. The present tiger reserve area was constituted as Reserve Forest in 1978.	Both PG and OB have been reported in the Tiger Reserve but there are no population estimates.	Total area of Sunderbans is 9630 km <sup>2</sup> of which 4264 contains mangrove forest. The Reserve encompasses 2585 km <sup>2</sup> of which 1600 km <sup>2</sup> is island and > 985 km <sup>2</sup> is water. Within this area, 1330 km <sup>2</sup> is designated as core area,	Incidental mortality in fishing nets.	Field Director, Project Tiger, West Bengal Forest Department. Prakruti Sansad & WWF-India.	

	Considering the importance of the biogeographic region of Bengalian River Forests and its unique biodiversity, the National Park area of the Reserve was included in the list of World Heritage Sites in 1985. The whole Sundarbans area was declared a Biosphere Reserve in 1989.		and this was declared as Sundarbans National Park in 1984. A 124.4 km <sup>2</sup> portion of the core area is preserved as a primitive zone to protect gene pools. Within the buffer zone, Sajnekhali Wildlife Sanctuary was created in 1976 covering an area of 362 km <sup>2</sup> .			
Name and location	Status	Species and estimates of abundance	Geographical Description	Main Threats	Management Authorities and supporting NGOs	References
Kaziranga National Park, Assam	Declared as a National Park in 1974, principally to protect the Indian one-horned rhinoceros.	In the 92 km segment of Brahmaputra adjoining and included within the northern boundary of the Kaziranga National Park, PG: 40-45 based on 2008 direct count survey.	Total area of Kaziranga National Park approx. 430 km <sup>2</sup> . Dolphin habitat includes the river segment between Dhansirimukh and Silghat on the northern boundary of the park.	Minimal compared to the other areas of Brahmaputra incidental capture in fishing gear and targeted killing for oil are reported occasionally.	Director, Kaziranga National Park & Tiger Reserve, District Golaghat, Assam; Aaranyak, Guwahati.	Mohan, <i>et al.</i> , 1997; Wakid, 2009; Wakid and Braulik, 2009
Bhitarkanika Wildlife Sanctuary & RAMSAR site	Nesting site for olive ridley sea turtles. Declared a sanctuary in 1975 to protect estuarine crocodile, marine turtles, and migratory and resident birds in mangrove habitat. Sanctuary also reportedly has the largest known mangroves.	OB reported from coastal creeks and rivers of Sanctuary. There are no population estimates.	The 115 km <sup>2</sup> Sanctuary includes numerous creeks and rivers joining the Bay of Bengal. Dist. Kendrapara, Orissa.	Incidental killing in fishing nets.	Divisional Forest Officer, Mangrove Forest Division, Rajnagar, Orissa Forest Department.	Chada and Kar, 1999
Varanasi Turtle Sanctuary	Given permanent status as a turtle sanctuary per the Wild Life Protection Act	PG: Approx. 6-10 in transit.	A 7 km segment of Ganges from Rajghat to Ramnagar Fort near Varanasi, Uttar Pradesh.	Area greatly disturbed by heavy use by religious pilgrims.	Sanctuary wildlife warden, Sarnath, Varanasi, UP Forest	Basu and Sharma, 2000; Sharma and

	1972. Sanctuary created in 1989 as part of the Clean Ganga Plan.				Department.	Behera, 1999
Name and location	Status	Species and estimates of abundance	Geographical Description	Main Threats	Management Authorities and supporting NGOs	References
Kulsi Conservation Reserve	Proposed as conservation reserve for Ganges dolphin.	PG: 27 counted in 2005 survey and 29 counted in 2008 survey.	Meandering, deep pools, sand-bottomed 56 km segment of Kulsi River, a Brahmaputra tributary, between Borpit and Malibari, in Kamrup district of Assam.	Sand mining, accidental killing through fishing net entanglement, irrigation	Assam Forest Department & Aaranyak, Guwahati.	Wakid, 2005; 2007; 2009; Wakid & Braulik, 2009
Subansiri Conservation Reserve	Subansiri River is proposed to be declared as a conservation reserve for the river dolphin and other riverine fauna.	PG: 16 counted in 2008 survey in the proposed PA. Total count was 26 in 2005 and 23 in 2008 survey in the entire Subansiri River.	40 km segment of Subansiri River, a Brahmaputra tributary, between Adihuti and Badati of Lakhimpur District, Assam.	Incidental capture in fishing nets, ongoing hydro power project in Subansiri River.	Assam Forest Department & Aaranyak.	Wakid, 2005; Wakid & Braulik, 2009;
Farakka Barrage Conservation Reserve. West Bengal	Proposed as a conservation reserve in 2002.	PG: 15 counted in March 2002 survey.	13 km segment of Ganges mainstem between Raj Nagar and Farakka Barrage and 38 km of Feeder Canal below the barrage.	Anthropogenic pressure and fishing.	Farakka Authority and West Bengal Forest department; Centre for Environment and Development, Calcutta.	Behera <i>et al.</i> , 2008
Harike Wildlife Sanctuary and Ramsar site.	Declared as water bird sanctuary and designated as a RAMSAR site in 1990	PG: Discovered in 2007, 6-10 counted in WWF-India and Punjab Forest Department survey.	Beas River above confluence with Sutlej, 50 km of river (86 km <sup>2</sup> head pond above barrage). Dist. Firozpur, Kapurthala and Amritsar, Punjab.	Anthropogenic disturbances and water abstraction.	Wildlife Warden, Punjab Forest Department & WWF-India	Behera <i>et al.</i> , 2008
Dibru-Saikhowa Wildlife Sanctuary	Portion of Brahmaputra adjoining southern boundary of Dibru-Saikhowa National Park, proposed to be included in the Protected Area.	PG: 15 counted in 2008 survey.	58 km segment of mainstem of Brahmaputra with braided streams and deep pools between Saikhowa and Balijan, Assam.	Incidental capture in fishing nets and direct killing for oil.	Divisional Forest Officer, Tinsukia Wildlife Division of Assam Forest Department and Aaranyak	Wakid, 2009; Wakid & Braulik, 2009
Orang	Proposed to be included	PG: Approx. 20.	32 km segment of Brahmaputra,	Incidental capture in fishing	Divisional Forest	Wakid, 2009;

National Park	within National Park boundaries.		southern boundary of Orang National Park, Darang District, Assam	nets and direct killing for oil.	Officer, Mongoldoi Wildlife Disivision of Assam Forest Department; Aaranyak	Wakid & Braulik, 2009
Name and location	Status	Species and estimates of abundance	Geographical Description	Main Threats	Management Authorities and supporting NGOs	References
<b>Indonesia</b>						
Kawasan Pelestarian Alam Habitat Pesut Mahakam, Muara Pahu, Kutai Barat- (= Natural Reserve Habitat Pesut Mahakam, Muara Pahu, West Kutai District)	Formal decision on establishment and protected status taken by regent: SK: 522.5.51/ K. 471/2009. Plans exist to raise status at provincial level. Detailed district regulations still being finalized. 27 km buffer zone downstream of Tepian Ulak until Penyinggahan also proposed by local government and accepted by local community but not yet officially designed.	OB: For entire Mahakam, 87 (CV=9%; 95% CL = 75-105) estimated in 2007. Count of 91 in 2007 from extensive and intensive monitoring surveys;. 57% (52 dolphins) of the count was in "Muara Pahu – Penyinggahan sub-districts area".	A 36 km section of Mahakam mainstem between Tepian Ulak and Rambayan and c. 22 km of Kedang Pahu River between Muara Pahu and Muara Jelau, which is the main dolphin habitat. The area also includes 23 km of tributary systems (Baroh and Beloan) and swamp forest (with 150-500 m wide protected riparian forest strips) which constitutes important fish spawning habitat. Total size is 4100 ha.	Mortality from gillnet entanglement (74% of all documented deaths). Mean annual observed mortality 1995-2007 was 4. Habitat degradation/loss from noise, chemical pollution, container barge traffic, and sedimentation. Prey depletion by unsustainable fishing (electro-fishing, poison, trawling). Emergent threat from oceanic coal-carrier ships moving through major dolphin habitat and producing tremendous amounts of noise underwater.	Environmental Department of West Kutai, Badan Lingkungan Hidup, to coordinate management and socialization. Yayasan Konservasi RASI is the collaborating NGO.	Kreb, D. and Budiono, 2005; Kreb, Budiono and Syachraini, 2007; Kreb <i>et al.</i> , 2007
Natural Reserve Habitat Pesut Mahakam, Central Kutai District	Proposed to local authorities and being processed.	OB: Totals in Mahakam, as above. In "Pela/ Semayang– Muara Kaman area," 46% (42 dolphins) of total identified in were present (up from 28% in 2005).	A 27 km section of Mahakam mainstem between Pela and Muara Kaman, including 17 km between Kedang Rantau River and Sebintulung, 7km between Kedang Kepala River and Muara Siran, the confluence of Belayan River and the Pela tributary, and the southern part of Semayang Lake.	Same as above.	Environmental Department of Central Kutai, Badan Lingkungan Hidup. Yayasan Konservasi RASI is the collaborating NGO.	Same as above



Name and location	Status	Species and estimates of abundance	Geographical Description	Main Threats	Management Authorities and supporting NGOs	References
<b>Myanmar</b>						
Ayeyarwady Dolphin Protected Area	Established by Department of Fisheries in December 2006. Management plan submitted to government in October 2008. Currently awaiting approval.	OB – 72 from direct counts in 2004.	74 km segment of braided channels in the Ayeyarwady River upstream from Mingun and downstream of a river defile at Kyaukmyaung.	Mortality from electric fishing and entanglement in gillnets. Potential threat from dam construction.	WCS has collaborated with DoF to implement a wide range of research and conservation activities.	Smith and Mya Than Tun, 2007
<b>Nepal</b>						
Karnali River portion in Bardia National Park	No specific protection for dolphins, but they are nominally protected by inclusion of a portion of their habitat in the national park.	PG – 5-6 in 1990 and 1998 based on upstream and downstream direct counts; 4 in 2005 based on simultaneous direct counts at selected sites.	Braided channels below the Chisapani Gorge. Relatively clear, cool water during dry season compared to other parts of species' range.	Mortality in gillnets. Potential future dam construction.	Nepal Department of National Parks and Wildlife Conservation manages national park. WWF Nepal Freshwater Program conducted study in 1999.	Smith 1990; Sinha <i>et al.</i> , 2000; WWF Nepal Program, 2006.
Koshi River in Koshi Tappu Wildlife Reserve	Koshi Tappu Wildlife Reserve was established in 1976 to conserve wild water buffalo and birds. It was Nepal's first RAMSAR site, enlisted as such in 1987.	There are no population estimates of dolphins. Four were sighted opportunistically in 2009.	Lies in Terai lowlands of Nepal. A 14 km segment of Koshi River is inside the reserve and is potential dolphin habitat.	Dam construction in Koshi River.	Department of National Parks and Wildlife Conservation/Ministry of Forests and Soil Conservation. WWF Nepal and Wetland Project give support.	DNPWC Nepal, 2009
Narayani River in Chitwan National Park	Chitwan National Park was established in 1973. It was the first National Park of Nepal to be listed as a World Heritage Site.	No dolphin surveys have been conducted. One dolphin was sighted in 2008. Contains second largest population (408) of one-horned rhinoceros and largest population (41) of gharial in Nepal.	Most of Narayani River lies inside the park.	Anthropogenic pressure and fishing.	Department of National Parks and Wildlife Conservation/Ministry of Forests and Soil Conservation. WWF Nepal and National Trust for Nature Conservation give support.	DNPWC Nepal, 2009

Name and location	Status	Species and estimates of abundance	Geographical Description	Main Threats	Management Authorities and supporting NGOs	References
<b>Pakistan</b>						
Sindh Indus Dolphin Reserve	Established in 1974 by Sindh Wildlife Department specifically to protect Indus dolphins.	Direct counts corrected for missed groups recorded approximately 725 in 2001 and 1293 (CI=1279-3022; CV=22.5) in 2006. Surveys by Sindh Wildlife Department have recorded steadily increasing numbers since establishment of the reserve.	Indus mainstem between Guddu and Sukkur barrages, Sindh Province. Approx. 180 km.	Entanglement in gillnets. Entrapment in irrigation canals. Pollution.	Sindh Wildlife Department manages the reserve and conducts canal rescues. WWF-Pakistan supports the department, helps with the rescue program, and works with river communities, tourism, and education projects; also monitors fisheries and water quality.	Bhagaat, 2002; Braulik, 2006; Sindh Wildlife Department, unpublished data; Braulik <i>et al.</i> , 2010.
Chashma Wildlife Sanctuary	Established in 1974 by Punjab Wildlife Department for a variety of wildlife, especially migratory waterfowl.	A small PA so no dolphin surveys are conducted. Abundance likely < 5.	33,083 ha of Indus River head pond above Chashma barrage, 5 appended lakes and adjacent wetlands.	Bycatch, pollution, commercial fishing.	Punjab Wildlife Department and NWFP Wildlife Department.	Khan and Ali, 2007
Taunsa Wildlife Sanctuary	Established in 1972 by Punjab Wildlife Department for a variety of wildlife especially migratory waterfowl and hog deer	A small PA so no surveys of dolphins specifically are routinely conducted here. Abundance is likely to be less than 10.	2,800 ha (after renotification in 1999) of the Indus River head pond above Taunsa barrage and some adjacent wetlands	Bycatch, pollution, occasional canal entrapment.	Punjab Wildlife Department.	Khan, 2006
Punjab Indus Dolphin Reserve (Taunsa – Guddu)	Proposed in 2006.	River segment with second largest subpopulation of Indus Dolphins.	Approx. 340 km of Indus mainstem between Taunsa and Guddu barrages.	Bycatch, pollution, canal entrapment.	Punjab Wildlife Department, WWF – Pakistan, Punjab Irrigation and Power	Khan, 2006
NWFP Indus Dolphin Sanctuary	Proposed in 2008. Boundaries and detailed management plans	Direct counts by WWF, NWFP Wildlife Department, Pakistan	About 60 km of Indus mainstem from Dera Ismail Khan in NWFP to the Punjab border.	Still being identified but include bycatch and pollution.	NWFP Wildlife Department supported by Pakistan Wetlands	Braulik, 2006; NWFP Wildlife Department,

	currently being drafted.	Wetlands Programme: in 2001, 37; 2006, 34; 2007, 54; 2008, 31.			Programme.	unpublished data; Braulik, <i>et al.</i> , 2010
Name and location	Status	Species and estimates of abundance	Geographical Description	Main Threats	Management Authorities and supporting NGOs	References
<b>China</b>						
Honghu Xin-Luo National Natural Reserve	Established in 1992 to protect the baiji and Yangtze finless porpoise.	BJ – functionally extinct. YFP – around 1200 in the entire river and ~1800 total including those in Poyang and Dongting lakes. There is no estimate specifically for the reserve	A 135-km section of the Yangtze River between Xintankou and Luoshan located in Honghu City of Hubei Province.	Bycatch in unregulated and unselective fishing, habitat degradation through dredging, pollution and noise, vessel strikes and water development.	Ministry of Agriculture and local fishery departments are in charge of PA management; Institute of Hydrobiology of Chinese Academy of Sciences collaborates with WWF, OPCF and Baiji.org etc. to implement a range of research and conservation activities.	Turvey <i>et al.</i> , 2007; Zhao <i>et al.</i> , 2008.
Shishou Tian-e-Zhou National Natural Reserve	Established in 1992 to protect the baiji and Yangtze finless porpoise.	Same as above	An 89-km section of the Yangtze River in Shishou and a 21-km long Tian-e-Zhou Oxbow connected to this section.	Same as above	Same as above	Same as above
Five protection stations: Jianli, Chenglingji, Hukou, Anqing, and Zhenjiang	Established after Workshop on Conservation Measures of Baiji and Yangtze Finless Porpoise in 1996 organized by Ministry of Agriculture, to protect the baiji and Yangtze finless porpoise.	Same as above	Mainly responsible for rescuing stranded cetaceans found near the stations.	Same as above	Same as above	Same as above
Yueyang Municipal Dongting Lake Reserve	Established in 1996 to protect the Yangtze finless porpoise.	Same as above	A local reserve covering 66,700 ha of the lake.	Same as above	Same as above	Same as above

Name and location	Status	Species and estimates of abundance	Geographical Description	Main Threats	Management Authorities and supporting NGOs	References
Tongling National Natural Reserve	Established in 2000, upgraded to national reserve status in 2006, to protect the baiji and Yangtze finless porpoise.	Same as above	A 58-km section in the Tongling section of the river, Anhui Province.	Same as above	Same as above	Same as above
Zhenjiang Provincial Reserve	Zhenjiang Protection Station (mentioned above) was upgraded to a provincial reserve in 2003 to protect the baiji and Yangtze finless porpoise.	Same as above	Covers approximately a 15-km section of the river located in a side channel at Zhenjiang.	Same as above	Same as above	Same as above
Poyang Lake Provincial Reserve	Established in 2004 to protect the Yangtze finless porpoise.	Same as above	Covers an 8600-ha area of the lake.	Same as above	Same as above	Same as above
Anqing Municipal Reserve	Anqing Protection Station (mentioned above) was upgraded to a provincial reserve in 2007 to protect the baiji and Yangtze finless porpoise.	Same as above	Covers a 243-km section of the river near Anqing.	Same as above	Same as above	Same as above
Yangtze Cetacean Conservation Network	Established in 2008, led by MOA, consists of all reserves (national, provincial or municipal), monitoring stations and fishery bureaus along Yangtze River, technically supported by IHB.	Same as above	All cetacean hotspots, e.g. sections near Shishou, Honghu, Hukou, Tongling, Nanjing and Zhenjiang, and the two lakes, Poyang and Dongting .	Same as above	Same as above	Same as above

**Abbreviations:** BJ – baiji, or Yangtze River Dolphin *Lipotes vexillifer*; DoF – Department of Fisheries; FD – Forest Department; MOA – Ministry of Agriculture; MoEF – Ministry of Environment and Forests; OB – Irrawaddy dolphin *Orcaella brevirostris*; OPCF – Ocean Park Conservation Foundation HongKong; PG – Ganges or Indus River dolphin *Platanista gangetica*; WCS – Wildlife Conservation Society; WWF – Worldwide Fund for Nature; YFP – Yangtze finless porpoise *Neophocaena phocaenoides asiaeorientalis*.

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## ANNEX 5- Workshop pictures



Figure 1. Governor's speech presented by the vice governor of East Kalimantan, Drs. H. Farid Wadjudy



Figure 2. Presentation by the Chief Organizer, Ir. Budiono Director of Yayasan Konservasi RASI



Figure 3. Introduction lectures by the national and provincial forestry and environmental departments



Figure 4. Introduction lecture by Randall Reeves, Chair of IUCN Cetacean Specialist Group



Figure 5. General introduction lecture by Prof. Wang Ding from China, about the baiji dolphin in the Yangtze River, which is assumed to be functionally extinct now.



Figure 6. Country presentation from Indonesia on the Pesut Mahakam by Ir. Syachraini, Yayasan Konservasi RASI.



Figure 7. Country presentation from Pakistan by Ms Uzma Khan, WWF-Pakistan.



Figure 8. Presentation on the Irrawaddy dolphin in Myanmar by Aung Myo Chit, WCS



Figure 9. Presentation by Prof Choudhury from India on the Ganges dolphin and Irrawaddy dolphin.



Figure 10. Presentation by Ishtiaq Ahmad from Forestry Department, Bangladesh



Figure 11. Presentation by Dr Verne Dove, WWF-Cambodia on Irrawaddy dolphins in the Mekong River



Figure 12. International and national seminar participants joining the first two seminar days





Figure 13. Picture together with some of the seminar participants.



Figure 14. Workshop discussions regarding protected areas was held in Mesra Hotel, Samarinda.



Figure 15. Workshop sessions lasted from early morning until late afternoon on three days.



Figure 16. Fieldtrip to see the habitat and existing and proposed protected areas of Pesut Mahakam in West and Central Kutai.



Figure 17. Visit to the fishing village of Pela, where dolphins occur in the river on a daily basis. Lunch was prepared by local residents with local traditional food. The visiting of so many foreign guests has been a great honor for the residents of this village, which is very supportive towards dolphin conservation.



Figure 18. Passing the speed sign board in the protected area of Muara Pahu.



Figure 19. Two groups of Irrawaddy dolphins were encountered. Picture made by one of the participants, Abdul Haleem Khan from Pakistan



Figure 20. Picture taken after a dance performance in the aula of the regent office in West Kutai, Sendawar.



Figure 21. A gift of appreciation was handed during the last day of the workshop to the provincial government and was received by H. Sutarnyoto, SKM., M.Si, Assistant III of the governor of East Kalimantan.



Figure 20. Picture together with the workshop participants.



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