The Mekong River Dolphin (*Orcaella brevirostris*) under threat

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Introduction

The most recent survey of the Mekong population of *Orcaella brevirostris*, one of the three remaining river Irrawaddy dolphin populations, has produced an abundance estimate of 71 (95% CI range 66-86) remaining individuals (Dove et al., in prep, 2007). The populations in the Mekong, Ayeyarwady and Mahakam Rivers, and Songkhla Lake are listed as critically endangered (IUCN, 2006).

The known threats to the Mekong population are bycatch in gill nets and deliberate killing. Other potential threats include pollution - from industry, agriculture and towns; habitat change - as a result of dam construction and operation, and deforestation; competition for food from over-fishing; disease; and increased boat traffic - tourism and local activity related.

Research has been conducted on the Mekong dolphin population since 2001, initially as part of a PhD project with James Cook University of Australia, as well as the Cambodian Fisheries Administration (FiA), and the Wildlife Conservation Society (WCS). Subsequently in 2005 the Cambodian Mekong Dolphin Conservation Project (CMDCP) was formed as collaboration between WWF, WCS, FiA and the Cambodian Rural Development Team (CRDT). The project is managed by WWF Cambodia. CMDCP implements conservation programmes that include: threat reduction, awareness, research and regional co-ordination.

The present distribution and status of the population

The present distribution of the Mekong population is limited to a 190 km long stretch of the Mekong between Kratie (Kracheh) in N.E. Cambodia and the Khone Falls, just north of the Cambodian-Lao border (Fig. 1). In the dry season, when river levels are low (January–May), the population is mostly concentrated in and around nine deep pools, with recent research showing that there is movement between seven of the southern most pools (Dove et al., in prep, 2007). Once the wet season begins (June) and river levels increase dolphins follow prey through their habitat range north of Kratie, mostly on the Mekong but also occasionally the lower reaches of tributaries (in January 2005, one adult dolphin was found dead in the Srepok River), although the deep dolphin pools remain areas of greatest dolphin concentration. There appears to be less movement between the northern most group at the transboundary pool on the Laos/Cambodian border and other groups that are linked to deep pools 65-190km further south.

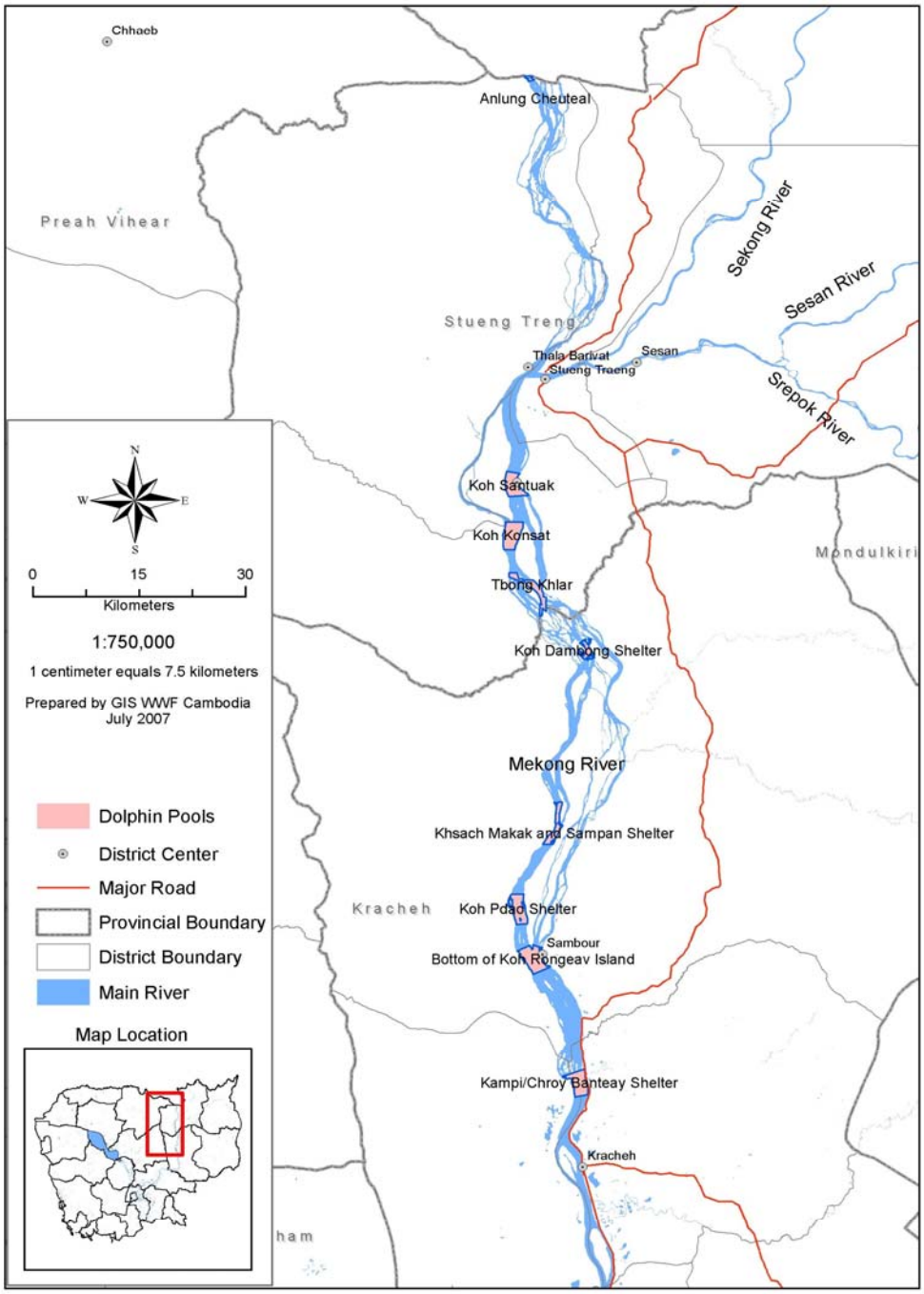

Figure 1: Present distribution map of *Orcaella brevirostris* in the Mekong River

The Cambodian Fisheries Administration´s strategy adopted by the Ministry of Agriculture Forestry and Fisheries (2005) estimates the Mekong Irrawaddy dolphin population to be between 80-100 individuals, based on direct counts in 2004. Beasley et al. (2007) report a minimal population estimate of 127 individuals (95% CI range 108-146) at April 2005 based on mark-recapture analysis. The most recent mark-recapture surveys carried out in April and May 2007 by WWF (Dove et al., in prep, 2007) resulted in an abundance estimate of 71 individuals (95% CI range 66-86).

Although a mortality monitoring program was begun by scientists in 2001, this only became effective in 2003 once a community reporting network had been established at key villages through the dolphin habitat range. Carcasses were recovered and necropsies undertaken, tissue samples were collected for diagnostic analysis where possible. A database was compiled including information on stranding location, date and status upon recovery; morphometric; gross pathology; and possible cause of death when evident.

For the years 2003 to 2006 the average number of mortalities per year has been 16.25, with the highest number of mortalities (n=19) occurring in 2006 (Table 1). For the first half of 2007 (up to August 26th) there have been 13 mortalities, of which 11 have been calves. Yearly mortality rates should not exceed 1-2% of the total population size with 1% being more applicable to very small populations that are already at high risk of extirpation due to demographic, genetic and other factors (Wade, 1998). The Mekong population of Irrawaddy dolphins (n=71) greatly exceeds this 1% acceptable mortality figure, with 19 confirmed mortalities in 2006 (16 calves).

Table 1: Confirmed mortalities since 2001 (Ca= calves, Ad=adults)

EAR	Jan		Feb		March		April		May		June		July		Aug		Sep		Oct		Nov		Dec		TOTALS		
	Ca	Ad	Ca	Ad	Ca	Ad	Ca	Ad	Ca	Ad	Ca	Ad	Ca	Ad	Ca	Ad	Ca	Ad	Ca	Ad	Ca	Ad	Ca	Ad	**Total**	Ca	A
01								2													1				**3**	1	
02							1										1	1						1	**4**	2	
03		1	1	1	2		1	1		1		1			1	1	1			3				1	**16**	6	1
04	2	1	1	1	3	1					1	1			1		1				2	1			**16**	11	
05	1	2	1		3				1	2													3	1	**14**	9	
06	5	1	8				1					1		1							1		1		**19**	16	
07 p to .8.07)	1		3		3		2			1		1	2												**13**	11	

Of additional concern is the high mortality rate of calves, contributing an increasing proportion of total mortalities each year. In 2005 six calf mortalities were reported, 37.5% of total mortalities that year, by 2006 calf mortalities had increased to 16, contributing to 84% of total mortalities that year. Clearly an alarming trend.

Anthropogenic factors were implicated in 17 (59%) of the 29 adult mortalities recovered since 2001. Of these 15 were due to entanglement in fishing gears, one was reported shot (in 2001) and one deliberately killed by explosives over concerns for access to fishing rights (in 2005). The two adult mortalities in 2007 were both geriatric female dolphins, with few or no teeth remaining. Both appeared to have died from pneumonia, with one confirmed with bacteriological culture. Such an event would be considered death of natural causes, with old age the underlying predisposing factor to disease.

To date gross pathology has been unable to determine the underlying cause of death of all but one calf mortality, the latter of which died of septicaemia and severe pneumonia, confirmed by microbiological testing. The calves are all neonatal calves usually less than three weeks of age. As the calves that are dying are extremely young, it has been hypothesised that one underlying cause could be man-made pollutants, and the transfer of these chemicals from lactating females, to the calves via the milk. As dolphins are top predators at the top of the food chain, they bioaccumulate toxins such as pesticides and polychlorinated biphenyls (PCB's) through the prey species that they consume, and store these chemicals in their blubber. When a female lactates, she uses up her blubber stores, and the chemicals stored pass into the milk, and thus into her calf.

There is sufficient scientific evidence that certain toxins can result in immunosuppression in cetaceans, which if it occurs in calves would render these young mammals susceptible to various opportunistic disease pathogens. Thus young calves with lowered immunity may not recover from a simple wound or minor infection. This could certainly account for such high calf mortality rates as is being seen in the Mekong River. Toxicological results are still pending, however it is no easy task trying to link specific contaminants with neonatal exposure and implicating it in the underlying cause for calf mortality

Viable tissue and organ samples from adult and calf mortalities collected since 2003 have been sent to North American laboratories for diagnostic analysis, including: polymerase chain reaction pathogen screen, histopathology, trace minerals, heavy metal, organic contaminant and dioxin analyses.

Three stranded calves recovered in 2007 were bacteriological tested at the Pasteur Institute in Phnom Penh. *Aeromonas hydrophila* was isolated from all three carcasses and *Morganella morganii* from one. Both bacteria species can cause gastroenteritis and septicaemia that could threaten the life of calves, however they are unlikely to be the primary cause of death as they are opportunistic and ubiquitous bacteria in the environment that overcome an individual with a suppressed immune system.

The combination of a high and unsustainable mortality rate and marginal recruitment due to the large proportion of calves dying, makes the Mekong population one of the most critically threatened populations of freshwater Irrawaddy dolphins. With this population in serious decline, it faces extirpation in the near future, if immediate conservation action is not taken.

Current and potential threats to the population

Intensification of fisheries through the introduction of nylon gillnets has been the most serious threat to the Mekong Irrawaddy population over the last 20 years. It has been the major cause of adult mortality and key contributor to the dramatic reduction in Mekong dolphin population and habitat range. The Mekong Irrawaddy dolphin population was previously distributed continuously in suitable habitat from below the Khone Falls in southern Lao, south to the Vietnamese delta, including the Tonle Sap River and Great Lake (Beasley et al 2005). Over the last six years gill nets continue to be the major cause of adult mortality (59% of reported strandings), though adult mortalities are now in decline due to a combination of NGO conservation programmes, including those of CMDCP, and the Cambodian Government's enforcement programme (since mid 2006) that focuses on a gill net ban in dolphin core areas. The difficulty of enforcing gill nets bans 24 hours a day throughout the Mekong dolphin's 190km range (this ban does not include the Laos area of the transboundary pool where there are a profusion of gillnets), combined with rapid population increase, poverty and the lack of alternative livelihoods will mean that gillnets will continue to be a threat to dolphins.

Intensification of fisheries is also resulting in increasing human competition for dolphin prey, which may make food increasingly scarce for dolphins (fishermen in the region report declining catches). In addition, fish traps and gill nets act as potential barriers that limit dolphin movement, particularly into and out of tributaries, posing additional stresses on natural dolphin feeding and social ecology and may culminate in increasing population fragmentation.

Deliberate killing of dolphins was historically (1975-1995) another major source of dolphin mortalities. Dolphins were hunted for food and oil during the reign of the Khmer Rouge and later shot for target practice by Khmer and Vietnamese soldiers (Beasley et al 2005). Wilful killing has been implicated in only two mortalities over the last six years. However, some conservationists are now concerned that the current extensive range of the Government gill net ban - with plans to extend it through the dolphin 190km range habitat by 2008, and lack of alternative livelihood provision, could result in future deliberate killings of dolphins by antagonised river communities. Gill net bans should be restricted to the core dry season deep pool habitat (nine identified pools see map in Figure 1) and efforts to provide alternative livelihoods and develop sustainable community fisheries intensified.

Pollution is another potential threat to the Mekong dolphin and requires investigation. The principal potential sources of dangerous pollutants and water quality deterioration in the region are mining activities and uncontrolled use of pesticides in agriculture

There are a number of small scale mines located within the basins of tributaries entering the Mekong at Stung Treng and lower down in Kratie province. These mines are poorly regulated with miners use acids,

cyanides and mercury to extract gold, without any protective measures for environment. Although cyanide is degradable and therefore likely to be less harmful to dolphins, mercury can be transformed by bacteria to the more toxic form organic mercury. Organic mercury is readily taken up by organisms in water, especially aquatic invertebrates, which can accumulate mercury to high concentrations. Top predators such as dolphins are therefore vulnerable. In response to this concern diagnostic work on samples from 10 calf and adult mortalities was undertaken in 2005 (Murphy et al., 2006), with only one individual found to have a high mercury concentration in the liver (67µg/g). Gilbert and Beasley (2005) conclude that "..given the absence of associated pathology or high concentrations there is currently no evidence to suggest that Mekong dolphins are suffering from the toxic effects of mercury". Further analysis for heavy metal contaminants within Mekong dolphin tissue samples is currently being undertaken in North America.

Increasing agricultural land use along the Mekong and the uncontrolled use of pesticides, including persistent organochlorine pesticides banned in neighbouring countries, is another pollution concern. CMDCP continues to collect tissue samples from dolphin necropsies for diagnostic analysis. .

Another form of environmental disturbance is siltation, mining and deforestation. This is a potential future threat with increasing development along the Mekong. Siltation can have a negative impact on the ecosystem impacting dolphin prey and potentially reducing the deep pool dry season habitat of Mekong the dolphin. CMDCP plans to undertake water quality monitoring later this year.

Increasing Mekong boat traffic and dolphin watching ecotourism on the Mekong is another potential threat. In Cambodia dolphin ecotourism is currently focussed at one dolphin pool and is reasonably regulated, in Laos dolphin ecotourism at the transboundary pool is poorly regulated. As the number of tourists and boat operators increase the possibility of dolphin harassment also increases, as well as general noise and disruption of natural behaviour, this culminates in stress to the dolphins. Stress can negatively affect dolphin's immunological system, as well as vital feeding and social behaviour.

Finally, a very serious new threat on the horizon is dam development, particularly on the lower Mekong mainstem. The number of dams proposed throughout the Mekong basin is increasing each year and the cumulative affect of these dams would have serious consequences for Mekong biodiversity. Dams can impact dolphins in a number of deleterious ways: change habitat quality and availability through both increased siltation, and reduced and disrupted water flows; block dolphin movements resulting in fragmented populations - increasing dolphin group vulnerability and reducing the gene pool; reduce the amount of available food - due to a dam's negative impacts on prey species caused by habitat change. There are currently two dams of primary concern going through feasibility studies: Don Sahong dam (240-360MW) and Samboh (Sambour) dam (3,300MW). Don Sahong dam is situated just north of the transboundary dolphin pool in S. Laos; and Samboh dam is situated within the dolphin habitat range, just north of the largest dolphin pool in Cambodia. The Mekong Dolphin population is already listed as critically endangered, and has an alarming mortality rate, that may see this population face extirpation within a few years. Both dams if constructed would have a detrimental impact on the already compromised Mekong dolphin population. The Samboh dam, given its proposed position and size, in particular would have disastrous consequences for the Mekong Irrawaddy River dolphin.

Conclusions

Gillnet entanglement has been proved to be a major cause of adult dolphin mortality. There has been a decline in the number of adult strandings in the last two years, most likely due to a combination of effective conservation measures that include programmes such as awareness and alternative livelihood development, as well as increased Government enforcement - largely through gillnet bans in core dolphin habitat. The reason for the high mortality of calves is still unclear.

The current rate of mortality for the Mekong population of *Orcaella brevirostris* is extremely high and unsustainable. This combined with an additional future threat due to the proposed construction of hydropower dam development on the lower Mekong mainstream, will result in fundamental deleterious changes to the dolphin habitat. Unless the causes of mortalities can be isolated, particularly calf mortalities, and appropriate conservation measures to reduce threats implemented the population faces extirpation in the near future. The support of the international scientific and nature conservation communities for the Mekong dolphin population is urgently needed.

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