



# **Report of the International Workshop on the Conservation of Irrawaddy Dolphins in the Mekong River<sup>1</sup>**

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## Introduction

On 16-18 January 2017, the World Wide Fund for Nature (WWF) – Cambodia in collaboration with the FiA of MAFF convened the *International Workshop on the Conservation of Irrawaddy Dolphins in the Mekong River*. The Irrawaddy dolphin (*Orcaella brevirostris*) population in the Mekong River of Cambodia is listed by the IUCN as Critically Endangered. In 2012, the “*Kratie Declaration on the Conservation of the Mekong River Irrawaddy Dolphins*” (WWF et al. 2012) was signed and was a landmark for dolphin conservation in the Mekong, with the Commission for Conservation and Development of Mekong River Dolphin Eco-Tourism Zone, the FiA Administration, and WWF-Cambodia, all agreeing to work together on a joint strategy for dolphin conservation in the Mekong. The Declaration details a series of management and research recommendations which were reviewed and updated at the next *Workshop on the Conservation of Irrawaddy Dolphins in the Mekong River* held in Phnom Penh, Cambodia, 23-24 April 2014 (WWF et al. 2014). The goal of the 2017 workshop was to enhance Mekong River dolphin conservation in Cambodia and follow up on these recommendations by:

1. Providing support and guidance for pursuing the "Kratie Declaration" from regional and international experts, and international conservation bodies including the International Union for Conservation of Nature and the U.S. Marine Mammal Commission.
2. Reviewing current population status and trend and identifying high priority management and research needs.
3. Reviewing and enhancing photo-identification, census and necropsy programs.
4. Reviewing and enhancing the river guard SMART program for monitoring patrolling activities.
5. Developing strategies for continued financial support

The agenda included presentations on Irrawaddy dolphins in other areas of Southeast Asia and updates on progress with Mekong River dolphin conservation efforts (Appendix 1). The workshop brought together Cambodian national and provincial government officials, as well as WWF-Cambodia staff and experts on other Irrawaddy dolphin populations around South East Asia and on cetacean conservation and biology elsewhere in the world (Appendix 2).

This report presents the principal conclusions and the highest-priority recommendations of this 2017 Workshop for Mekong River dolphin conservation. It is expected that the Cambodian government and WWF-Cambodia will endeavor to implement immediately those recommendations within their expertise, responsibility, resources, and authority. It is also understood that some of the conclusions refer to concerns that go beyond the abilities of the Cambodian government and WWF to address on their own.

### Principal Conclusions

1. Progress on recommendations made at the 2014 workshop has been outstanding, with apparent increases in dolphin abundance and reductions in mortality since 2012, reflecting the commitment of the WWF-Cambodia team, the Kingdom of Cambodia’s FiA, the Kratie and Stung Treng provincial administrations and the local community to Mekong River Irrawaddy dolphin conservation.
2. Years of protection in Cambodia have made significant gains in conservation of the Mekong River dolphins, yet proposed hydropower dams covering the entire range of the species in the Mekong may completely nullify this achievement.
  - a. Since the construction of the Don Sahong dam began in 2014, the Laos/Cambodia transboundary population of Mekong River dolphins has declined from five to three

individuals and the animals have been driven away from their traditional range in the vicinity of the construction.

- b. If the proposed construction of large hydropower projects in the Mekong River in the provinces of Kratie (Sambor Dam) and Stung Treng (Stung Treng Dam) proceeds, the risk of extinction of the entire Mekong River dolphin population will be greatly increased risk and the dams will eliminate or modify almost their entire habitat.
3. Bycatch in gillnets remains a critical threat to Mekong River dolphins, thus effective enforcement of existing dolphin conservation laws and enhancement of the River Guard program is a conservation priority essential to the survival of Mekong River dolphins.

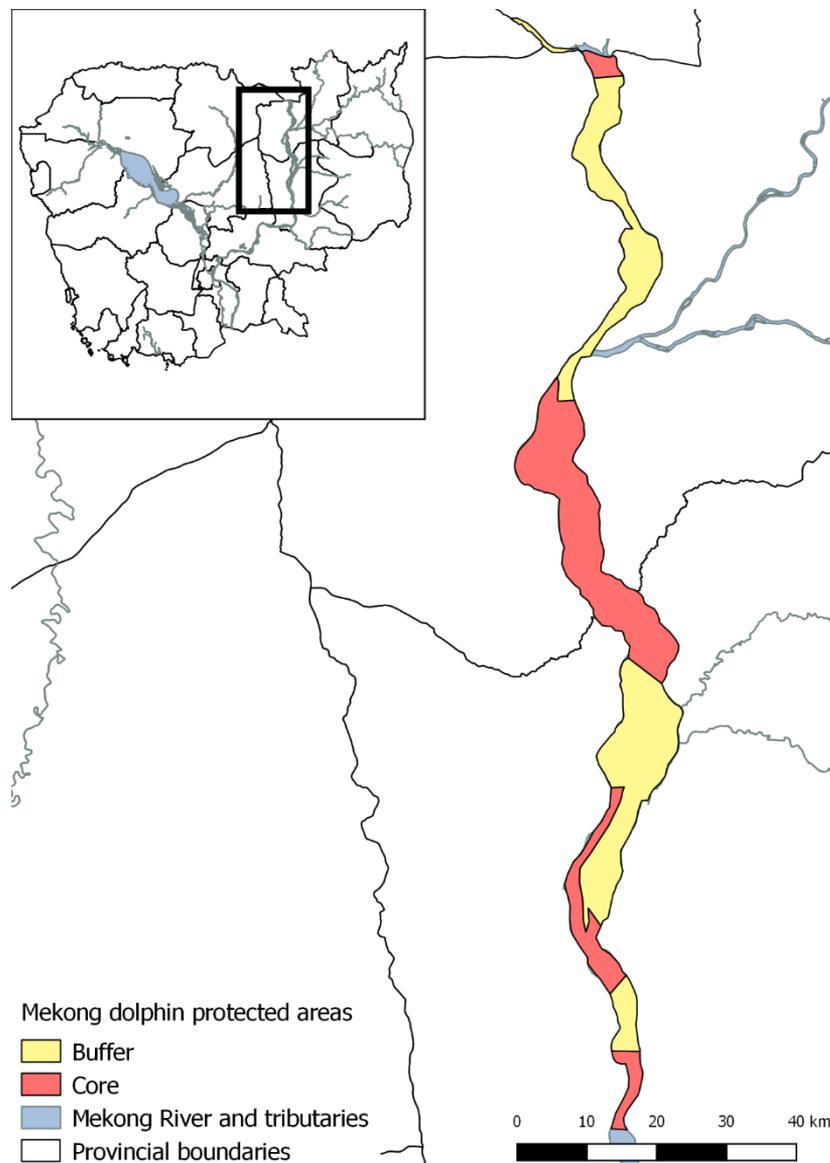


Fig. 1: Map of the range of the Mekong River population of Irrawaddy dolphins. Inset, location within Cambodia.

## Presentations

### *Overview of the conservation status of Irrawaddy dolphins (Brian Smith)*

Irrawaddy dolphins occur in relatively small populations of generally less than 200 individuals in nearshore coastal waters near river mouths, three large rivers, and three large lagoons or sounds of the Indo-Pacific. The species is considered “Vulnerable” in the IUCN Red List (Reeves et al. 2008) due to an estimated 30% or more reduction in the range-wide population. Five demographically isolated populations are considered “Critically Endangered” due to low population sizes (<50 mature individuals). These include all three riverine populations: the Ayeyarwady River in Myanmar, the Mahakam River in Indonesia, and the Mekong River in Cambodia and Laos, as well as populations in Songkhla Lagoon in Thailand and Malampaya Sound in the Philippines. Irrawaddy dolphins are also listed on Appendix I of the Convention of International Trade in Endangered Species, banning all commercial trade in the species.

Irrawaddy dolphins have an extremely patchy distribution. In rivers they occur almost exclusively in deep pools at confluences or above and below river rapids. In coastal waters, they occur almost exclusively in waters affected by freshwater inputs. The clumped distribution of dolphins has vital implications for their conservation since these areas are also the locations of the greatest human use. They are also the areas of the greatest fishing activity, vessel traffic, pollutant concentrations, and tourism activity.

Although the magnitude and nature of threats vary from area to area, entanglement in fishing gear particularly gillnets, is a common problem facing all Irrawaddy populations. This implies that regardless of other threatening factors, this immediate threat must be assertively addressed or populations will continue to decline, possibly to extinction, regardless of conservation actions implemented to address other threats. In the long term, the dolphins must have suitable habitat to survive. Local conservation efforts are vital. However, dam construction will have wide ranging impacts on dolphin habitat resulting in habitat loss and degradation. A critical lesson from the extinction of the baiji or Yangtze River dolphin is that fatal interactions with fishing gear combined with habitat loss, due to the construction of dams, is a recipe for species/population extinction.

Irrawaddy dolphins appear to be able to persist at low population sizes in the absence of intensive human threats. However, according to our understanding of genetics, there must be occasional demographic interaction with other groups for long term persistence. This has important implications because groups can become completely isolated if others located in between are extirpated with potential cascading conservation impacts for the species or populations.

Protected areas established in core habitat have been a key conservation strategy for saving Irrawaddy dolphins. These areas can serve as a platform for implementing conservation measures such as no gillnet fishing zones, regulating dolphin watching tourism, protecting habitat from local degradation due to human activities such as dredging, shoreline development, gold mining, etc. However, protected areas are only as effective as the conservation actions that are taken in them. A potential danger of establishing protected areas is that people will become complacent and consider that the job is done after the declaration. Protecting Irrawaddy dolphins is an ongoing process. It is unlikely that the job will ever be finished. This means that it is critical for governments, NGOs, local communities, and individuals to remain consistently engaged, especially in the field. It is also vital that governments, NGOs and local communities hold themselves accountable to biological results (i.e., increased survivorship of calves, stabilization or an increase in population size, no further decrease in the population). Conservation action must be the highest priority but research and monitoring are also vital tools to ensure that our efforts are actually saving dolphins and protecting them from extinction.

From a biological perspective, the Irrawaddy dolphins in the Mekong River appear in good condition (i.e., there no evidence of emaciation or weakness from disease). Although recruitment is still a major issue, females appear to be reproducing although neonate mortality is high. From an ecological perspective, there remain long stretches of river where their habitat is still in good shape. From a conservation perspective, the Government of Cambodia, WWF and the international conservation community have demonstrated a strong commitment towards saving the Mekong River dolphin. The dolphins are also generally popular among local people and there is an economic incentive to save them due to the benefits they provide as an attraction for tourism. Finally, there has been great international interest in conserving the Mekong River dolphin population which has generated funding and technical support for conservation efforts.

### ***Overview of previous workshops (Brian Smith)***

This is the fourth workshop convened by WWF and the FiA involving the international advisory group on conserving the Mekong River Dolphin population. At the first workshop in October 2009, the group rejected hypothesis that the principal cause of calf mortality was caused by bacterial infection promoted by immune suppression. They also recommended more aggressive efforts to address the threat of entanglement in gillnets; an independent analysis of a composite photo-catalog; and strengthened photo-identification and necropsy efforts.

At the second workshop in January 2012, the group conducted a thorough examination of necropsy results. They also made on-the-water observations of the dolphins to assess the potential for behavioral studies and collecting skin and blubber samples for genetic and pollutant analyses; of tour boat activity to evaluate possible impacts of dolphin watching activity; and of fishing operations to get a better idea of the potential for fatal entanglements. During this workshop the group also drafted the Kratie Declaration (WWF et al. 2012). This declaration was a commitment to develop partnerships within Cambodia and provide ongoing support from an international group.

At the third workshop in April 2014, the group concluded that entanglement in gillnets remains the most critical threat to Mekong River dolphins; effective enforcement of dolphin conservation laws is the highest conservation priority; and the construction of large hydropower projects in the Mekong basin, especially main-stem dams, will have very serious impacts on Mekong River dolphins (WWF et al. 2014).

### ***Irrawaddy dolphins in the Mahakam River, Indonesia. (Danielle Krebs)***

This population inhabits a 420 km stretch of the Mahakam River, Indonesia. Known as Pesut Mahakam, these dolphins are protected by Indonesian Law and are the official mascot of East Kalimantan Province. The population is listed as critically endangered (CR) by the IUCN and population abundance has been estimated between 69-81 (CV 7%) individuals. Abundance and distribution data have been collected during extensive monitoring surveys initiated in 1997. Abundance estimates from 2005 onwards show a declining trend (Fig. 2). At least 4-6 calves are born every year with a peak in calving in July-Sept (dry season). Between 2005 and 2016, on average four carcasses were recovered every year, 16% of which were calves: juveniles and adults represented 9% and 75% of carcasses recovered, respectively. The area of highest dolphin density is between 180km-450 km from the river mouth. The dolphins concentrate in areas of confluences and within tributaries where the major activities are feeding, playing and mating. Shifts in core habitat use been linked to the conversion of fish spawning areas into oil palm plantations and increases in vessel traffic, e.g., coal barges in narrow tributaries. The major threat to this population is mortality in gillnets (64%). Boat strikes pose another threat and account for 11% of recorded deaths. Other threats include increased underwater noise in restricted waterways,

unsustainable and illegal fishing methods, e.g., electro-fishing, poisoning, industrial pollution, plastic waste, and habitat alteration, (e.g., sedimentation, conversion of fish spawning areas).

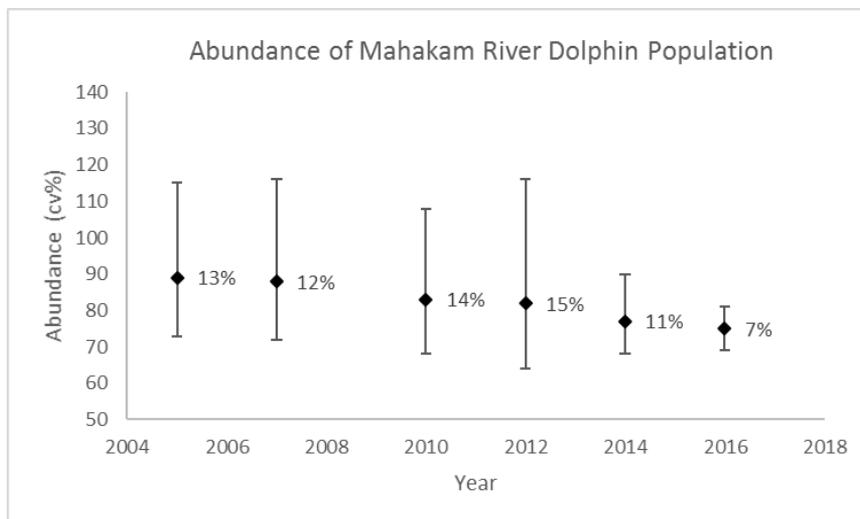


Fig. 2: Abundance of the Mahakam River population of Irrawaddy dolphins

Conservation efforts have focused on training fishermen to rescue dolphins when they are entangled in fishing nets, raising awareness amongst all stakeholders and communities, including government authorities and encouraging alternative livelihoods, e.g., sustainable aqua-culture and ecotourism. Since 2002, there have been eight successful releases of dolphins entangled in nets and three dolphins have been rescued from swamp areas. The designation of a protected area 24,000 ha core, 51,000 ha total) is currently in progress, which will include freshwater swamp areas and core dolphin habitat.

***Irrawaddy dolphins in the Ayeyarwady River, Myanmar (Naing Lin)***

Irrawaddy dolphins in Myanmar are found in the Ayeyarwady River, in three separated populations, estimated to total 60 to 70 individuals, from Mandalay to Bamaw. Coastal populations occur in the Rakhine State, the Ayeyarwady Delta and the Taninthari region. The Ayeyarwady is known for the unique culture of cooperative fishing between fishermen and dolphins. The main threats to Ayeyarwady dolphins are gold mining, gillnet fishing, and electric fishing.

Dolphin surveys were initiated in 2002 with surveys of the Sagaing and Mandalay regions, which produced a population estimate for that region of 20-25 individuals. Subsequent counts encompassing the entire range have encountered up to 72 animals.

Year	Count	Remarks
2002	37	First Experience for Range Wide Survey
2003	59	Winter Season (Water Level Low)
2004	72	Winter Season (Water Level Low)
2005	-	Education Period for Protected Area Nomination
2006	58	Winter Season (Water Level Low)
2007	31	Rainy Season ( Water Level Height/Wide)

2008	-	Education Program between Mandalay and Bamaw
2009	-	Education Program between Mandalay and Bamaw
2010	69	Winter Season (Water Level Low)
2011	72	Winter Season (Water Level Low)
2012	67	Winter Season (Water Level Low)
2013	51	Couldn't survey around Bamaw Area (Armed conflict)
2014	63	Winter Season (Water Level Low)
2015	58	Winter Season (Water Level Low)
2016	65	Winter Season (Water Level Low)

Fig. 3: History of counts of Ayeyarwady River population of Irrawaddy dolphins

The Management Plan for the Ayeyarwady Dolphin Protected Area (ADPA), prepared by the Department of Fisheries, Myanmar in collaboration with the Wildlife Conservation Society (WCS) has six major objectives. The first is to dramatically reduce or eliminate illegal fishing activities. Key activities include two regular SMART patrols per month and an education and awareness program. While SMART data is now routinely collected and cooperative patrols with community, police, townships and regions have been undertaken, numerous challenges remain. Enforcement was particularly weak from 2010-2014, there is poor inter-agency cooperation, funds and equipment are limited and there has been a surge in electric fishing.

To meet the second objective to promote the sustainability of the human-dolphin cooperative cast-net fishery a Committee for Cooperative Fishermen is leading a strong network of all cooperative fishers which is making inroads to maintain and stabilize the cooperative fishing culture. This is hampered by poor returns from fishing and the difficulty of maintaining community cohesion in the face of electric fishing. Tourism is increasing in Myanmar, and there is demand to see dolphins and cooperative fishing. Working with the communities, guidelines for dolphin watching have been established, a Visitors Centre set up, and training provided to guides and boat drivers. Conservation contracts with the community and significant national and international publicity for the dolphins are strengthening support, while the reality that dolphins are difficult to see in a short visit and that profits are largely going to tour operators' work against the program.

Gold mining has been eliminated inside the ADPA, a significant step to meeting the objective of protecting aquatic habitat. The difficult objective of promoting sustainable fisheries is being tackled in coordination with regional and township Fisheries Departments and through promoting of community fisheries. Work is ongoing with the Fisheries Department and WCS to strengthen the protected area management team and infrastructure through regular meetings and capacity building.

Efforts to monitor the status of dolphins continue with a scheduled 10-day range-wide survey every February that covers 445 km of river for a direct count of dolphins present. Photo-ID methods have been tested, but proved impractical for this population which has few natural markings. Between 2002 to 2016, 42 dolphin deaths (3 per year) have been recorded, 29 of these inside the ADPA. Births have been more difficult to detect. Eight calves have been recorded inside the ADPA from 2012-2016.

### ***Irrawaddy dolphins in Bangladesh (Zahangir Alom)***

The waterways of Sundarbans Reserved Forest in Bangladesh are the only place where Irrawaddy (*Orcaella brevirostris*) and Ganges River dolphins (*Platanista gangetica*) occur in the same habitat. In 2002, the abundance of Irrawaddy dolphins there was estimated at 451 (CV = 9.6%) individuals based on a double concurrent count survey of all navigable waterways in the Sundarbans (Smith et al. 2006). In 2004, the abundance of Irrawaddy dolphins in the coastal waters of Bangladesh was estimated at 5,383 (CV=39.5) individuals based on a distance sampling survey (Smith et al. 2008). Therefore Bangladesh supports the world's largest population of Irrawaddy dolphins of about 6,000 individuals. This is more than an order of magnitude greater than any other known population of the species.

A total of 49 Irrawaddy dolphin deaths were recorded in Bangladesh from February 2007 to December 2016. The cause of death for 67% of these was believed to be fisheries entanglement, mostly in gillnets, based on net and rope marks, entangled gear attached to the carcasses, and reports from fishermen. An interview survey conducted among 210 fishermen confirmed that gillnets, and occasionally set-bag nets and longlines, are responsible for the majority of dolphin deaths.

In 2012, the Government of Bangladesh declared three Wildlife Sanctuaries for the protection of freshwater dolphins in the eastern Sundarbans. These Wildlife Sanctuaries were identified as hotspots of dolphin occurrence on the basis of sighting data collected by three nature tourism captains during 26,000 km of search effort from 2002-2005. These areas are more geared to protecting Ganges River dolphins than Irrawaddy dolphins, but they are the areas where the two species co-occur most often. Additional hotspots for freshwater dolphins need to be identified and protected in the western Sundarbans, where Irrawaddy dolphins are more common. In 2014, the Government of Bangladesh declared a marine protected area (MPA) in the Swatch-of-No-Ground submarine canyon and adjacent estuarine waters. This MPA covers a total of 1,738 km<sup>2</sup> and includes 233 km<sup>2</sup> of priority habitat for Irrawaddy dolphins. Due to the relatively large population size of Irrawaddy dolphins in Bangladesh, the country could serve as global safety net for preventing species extinction if sufficient protection can be achieved.

### ***Irrawaddy dolphins in the Mekong River, Cambodia (Channa Phan)***

Historically Irrawaddy dolphins occurred from the Mekong River delta in Vietnam to Khone Falls, in Lao PDR, including into Tonle Sap Lake and into the Sekong, Sesan and Srepok Rivers in northeastern Cambodia. They are now found from Kampi pool (near Kratie) to Khone Falls in a range of <200 km. The population is designated critically endangered on the IUCN Red List (Smith and Beasley 2004). It is one of the 58 recognized "Fisheries Endangered Species" in Cambodia.

Their distribution is concentrated in nine deep pools where the dolphins reside in the dry season (Ryan et al., 2011), but they range more widely in the wet season (Beasley 2007). Mekong dolphins show high site-fidelity around these deep pools, and appear to keep regular home-ranges with little dispersal between core areas (Beasley, 2007; WWF unpublished data). One of these core areas, the transboundary pool at the Lao PDR/Cambodia border is separated from the nearest downstream pool by a complex 60 km stretch of river containing a large number of rapids. While there is evidence of limited exchange of individuals among the core areas downstream and dolphins are able to traverse rapids it appears those dolphins inhabiting the trans-boundary pool are now an isolated sub-population (Ryan 2012).

Year	1997	2007	2010	2013	2015
Estimate	≤200	95	85	70	80
Confidence Interval	-	86–101	78–91	62–80	64-100
Method	Direct observation and guess	Photo-ID Mark-Recapture	Photo-ID Mark-Resight	Photo-ID Mark-Resight	Photo-ID Mark-Resight
Reference:	(Baird & Beasley 2005)	(Beasley et al. 2013)	(Ryan et al. 2011)	(Ryan 2015)	Phan et al. 2016

Fig. 4: Abundance of the Mekong River population of Irrawaddy dolphins

Mekong River Irrawaddy dolphins are a living national treasure of Cambodia. Khmer and Lao folklore tell of human ancestry of dolphins which as the largest mammal in fresh water are a keystone or flagship species of the Mekong's biodiversity. They serve as an indicator of ecosystem health for aquatic fisheries and water quality and are a major tourist attraction that provides very important income to local communities.

The most significant threat to Mekong dolphins is entanglement in fishing nets, especially gillnets and destructive illegal fishing (e.g., explosives, electrofishing). Overfishing, environmental contamination and disturbance by boats and tourists are other lesser threats. Of particular concern is the construction of hydropower dams both upstream of their range, and soon, possibly, within it.

The Cambodian Mekong Dolphin Conservation Project was created in 2005 as a collaboration between the Kingdom of Cambodia's FiA and WWF-Cambodia with the aim to conserve the critically endangered Irrawaddy dolphin population in the Mekong River. The project consists of 5 main components: research, education and outreach, alternative livelihoods, policy development and implementation and transboundary collaboration and coordination.

The project focuses on population studies to understand the size and trend of the Mekong dolphin population, investigations into the cause of death of animals and observations of behaviour, with a focus on newborn calves and movements within the range. As part of education and outreach efforts, project staff meet with villagers and fishermen residing along the Mekong River, especially adjacent to main dolphin habitats and conduct school visits to raise awareness among students and teachers along the Mekong River. The program entered into a partnership with the 'Association of Buddhism for Environment' to raise awareness about dolphin and environmental protection, and with the 'Cambodian Rural Development Team' to support the development of alternative livelihoods.

A major focus is policy development and implementation, in particular working to support the FiA in developing relevant legislation and regulations regarding conservation of the Mekong dolphins. These include: 1). the sub-decree on the Creation of the Mekong Dolphins' Managerial Protection Area, 2). the sub-decree on the Determination of Types of Fisheries and Engendered Fisheries Products, and 3). the Proclamation on the Protection Measure of the Endangered Fisheries Species. Support to the River Guard program to assist them in enforcing the dolphin sub-decree and the law on fisheries to protect Mekong river dolphins is a very high priority. A series of training courses such as " Field Craft and Law Enforcement" were provided to the fisheries officials, the river guards and the rangers at Stung Treng Ramsar site and needed equipment was also provided to the river guards.

Finally, encouraging trans-boundary collaboration between Cambodia and the Lao PDR has been important for the management of threats to the dolphins in the trans-boundary pool. The program supported the implementation of the MoU between FiA of Cambodia and Department of Livestock and Fisheries of Lao PDR that led to creation of the trans-boundary fishery management committee and development of a trans-boundary fishery management plan. Unfortunately these efforts are in doubt due to the emerging impacts from the construction of the Don Sahong dam.

Fundamental lessons learned over the 12 year history of the program are the needs for the participation of local communities, for consensus and partnership to achieve common goals, for rigorous science behind complex problems, and for long-term commitment to make lasting change.

### ***Mortality summary (Sereyvuth Hang)***

Necropsies on all dolphin carcasses recovered since 2014 have been performed on frozen carcasses during necropsy training sessions. Two trainings in 2015 and 2016 were provided by Dr. Frances Gulland, and attended by WWF staff as well as government officials from the FiA, a veterinarian from Tamau Zoo and students from the Royal University of Phnom Penh. Every dead dolphin collected was photographed to determine identity and record skin lesions. Storage of carcasses is difficult due to size and need for consistent freezer availability, and also delays the feedback of information on cause of death to the community; thus in future performing necropsies on carcasses as they are found will be more expedient.

Carcass recovery since 2008 has declined, with six carcasses (4 adult, 2 neonates) recovered in 2016 (Fig. 5). Most calves are recovered in February and March each year, see Fig. 5a below (gray bars represent calves, black adults). Cause of death in many cases could not be determined due to decomposition, but in diagnosed adults, bycatch in gillnets was the most common cause of death. In calves, four of six calves examined had severe traumatic lesions that contributed to mortality.

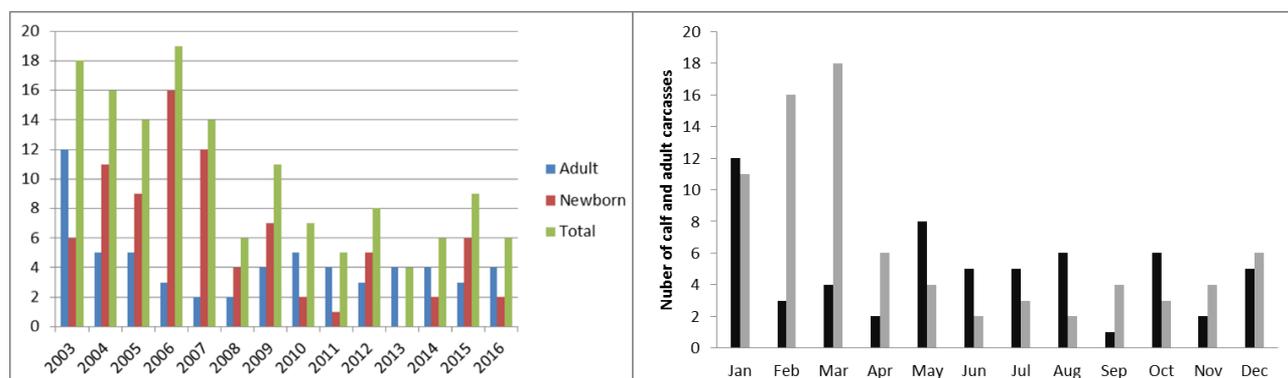


Fig. 5: Carcass recovery of Mekong River dolphins a) by age b) by month (gray calf, black adult)

### ***Evidence for infanticide (Lor Kimsan)***

Lor Kimsan presented recent photos of interactions between a mother and her neonate calf and other conspecifics. These interactions, which included apparent rushing and hitting at the calf and throwing the calf out of the water, fall in the category that has been described as potential infanticidal behaviour. Observations of this sort, which are rare but have been recorded anecdotally several times, along with evidence of trauma, likely inflicted by other dolphins, in several neonate calves necropsied by the program point to an urgent need for further investigation to document and understand this behaviour. Workshop participants familiar with dolphin behaviour in a number of

species were unable to conclusively evaluate the behaviour documented in the photographs but they were able to confirm that intraspecific aggression has been recorded in the literature for other species in various contexts, including toward neonates.

### ***River Guard program (Keo Samnang)***

The Mekong River Guard program was established, and is administered by the FiA cantonments in Stung Treng and Kratie provinces, with strong support from WWF-Cambodia. The Guards are government employees from the FiA, people from local communities and policemen who receive a per diem from WWF, and meet regularly with both WWF and FiA staff to coordinate project activities. There are currently 68 River Guards stationed at 16 different outposts along the Mekong from Kratie to the Laos border. They ensure a series of laws, declarations and sub-decrees by the Royal Government of Cambodia established to protect fisheries and dolphins in the Mekong River are upheld. Over the past year, the guards have had four capacity building training courses, including courses on enforcement tactics, navigation and reporting. In January 2016 more than 50 people from Kratie and Stung Treng provinces attended a formal ceremony with WWF and FiA officials to receive new uniforms and equipment (walkie-talkies, torches and headlights), essential for their work patrolling the Mekong River. The Guards use a tool known as "Spatial Monitoring and Reporting Tool (SMART) to monitor activities on the river and location of guards. The number of gillnet sets confiscated increased from 998 in 2014, 1,824 in 2015, to 2,596 in 2016. Over 140 kms of gillnet reported removed in 2016. There was a seasonal pattern to gillnet removal, with peak removal occurring in January and February each year. Hooked long lines and equipment for electric fishing (batteries, converters and electric wires) were also confiscated. People fishing illegally have been arrested and fined. More support from the courts is needed, however, as fishermen brought to trial have not been successfully prosecuted.

The Mekong River Guard Program has been tremendously successful in confiscating gillnets in the core dolphin zones in the Stung Treng – Kratie landscape of the Mekong River. This has reduced the threat of gillnet entanglement and may be a significant factor in the recent increase in calf survival and apparent stabilization of the Mekong dolphin population which had been subject to earlier steep declines. Despite this substantial progress, the river guards still face a number of obstacles in achieving their goal of zero dolphin mortality caused by illegal fishing activities. They also face personal risks that must be addressed to ensure their safety and the continued success of dolphin protection efforts.

### ***Hydropower development and dolphins (Gerry Ryan)***

Hydropower initiatives are developing rapidly in the Mekong River basin, including on the main-stem of the river. Hydropower developments are expected to have significant impacts on the Mekong's dolphins. In general, dams are of concern to dolphins for five broad reasons:

- fragmenting of populations by creating impassable barriers to interchange,
- loss of habitat and microhabitats, both through siting of structures and changes to the very specific conditions riverine dolphins use to survive in constant river flow,
- loss of prey through fish decline,
- disturbance, both short-term during construction, and long-term during operation, and
- direct mortality or debilitation from damage following exposure to seismic mapping, explosive or other excavation, and other sources of industrial noise, or through entrainment into turbines.

Four major hydropower projects are of extreme concern to dolphins in the Mekong River: the Don Sahong dam, currently under-construction in Lao PDR, and the proposed Sambor, Stung Treng, and Lower Sekong dams in Cambodia (See Fig. 6).

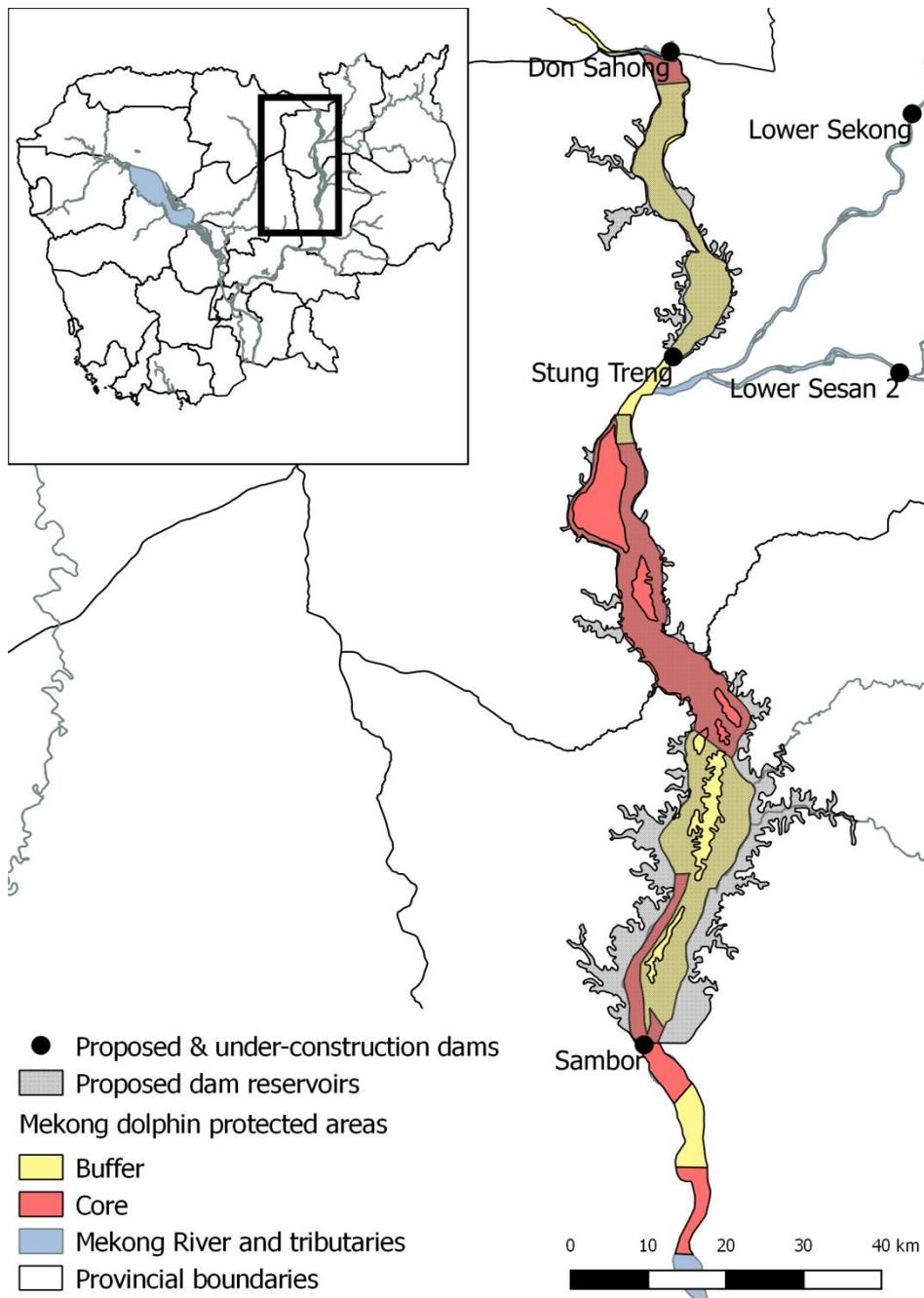


Fig. 6: Location of dolphin conservation zones, and hydropower dams and reservoirs under construction or proposed in the range of the Mekong River population of Irrawaddy dolphins. Inset, location within Cambodia

The 2014 workshop concluded that “if built, Don Sahong dam will lead to the extirpation of dolphins from the Cambodia/Lao PDR pool and will increase extinction risk for the entire Mekong dolphin population.” Despite opposition from Thailand, Cambodia, and Vietnam, the Don Sahong dam is now being built in a channel of the Khone-Phapeng Falls complex in Laos, several hundred meters upstream of the Lao-Cambodia border (Fig. 6). A 2014 report by WWF concluded that the Don Sahong dam posed a very high risk to the transboundary population of dolphins, the only

remaining dolphins in Laos. Since construction began in 2014, the dolphin group in the trans-boundary pool has declined from five to three animals, and the individuals remaining appear to have been displaced from very near the Don Sahong site where their presence has been recorded for decades at the Anlung Cheuteal deep pool, to an upstream location further away from the site.

The Sambor and Stung Treng dams are proposed to be built in Cambodia within the area of remaining dolphin distribution in the Mekong (Fig. 6). In particular, the Sambor site is of the highest concern. A recent USAID project compared two proposed alternatives for the Sambor dam: one at the originally proposed location, consisting of an 18 km wide dam across the entire Mekong River at Sambor (depicted in Fig 6); and another a smaller alternative at a site around 18 km upstream where the river has several channels. This smaller alternative would cut off only the main channel of the river and create an artificial fish passage channel across the island of Koh Rohngeav. The reservoir for the much larger original proposal would cover almost all remaining dolphin habitat outside the transboundary area (Fig. 6), with downstream effects on Kampi pool. The Sambor dam is certain to cause the loss of core habitat, with both proposed dam alternatives located directly in areas frequently used by dolphins. In addition, upstream reservoirs and downstream changes in hydrology will certainly drastically impact the dolphin's habitat. The originally proposed Sambor larger site will certainly fragment the population into two much smaller, disconnected populations. The alternative Sambor site also poses a high risk of fragmentation; although the proposal leaves side channels unobstructed, these remaining channels are much shallower than the main channel and dolphins are not known to use them. The proposed Stung Treng dam would inundate the entire "Middle Stretches of Mekong River North of Stoeng Treng" Ramsar site (Appendix 3, Fig. 6), and cut off the transboundary Mekong River dolphin population from any possibility of contact with downstream populations.

## **Progress on Recommendations from the 2014 Workshop**

Somany Phay presented a detailed review of progress on the recommendations from the 2014 workshop on the Conservation of Irrawaddy dolphins in the Mekong River. These recommendations have been followed since 2014 by the Kingdom of Cambodia's FiA with the assistance of the WWF-Cambodia to guide the strategy for the conservation of dolphins in the Mekong. The recommendations address the topics of:

1. Fisheries and law enforcement
2. Hydropower dam development
3. Population dynamics
4. Behavior and ecology
5. Mortality
6. Tourism

The tables on progress are included in each section below. The workshop participants considered progress in each area, except tourism, in detail. They concluded that progress on recommendations made at the 2014 workshop has been outstanding, reflecting the commitment of the FiA, the WWF-Cambodia team, Kratie and Stung Treng provincial administrations, and local communities to Mekong River Irrawaddy dolphin conservation. The workshop developed further recommendations for each of the areas considered which are detailed below.

## **Working Group Session Recommendations**

### **Fisheries and law enforcement**

Recognizing the constraints of limited funds and resources, the following recommendations have been prioritized according to high, medium and low.

#### High Priority

1. Faster (30-40 km)/safer vessels should be provided to the river guards and floating stations established during the dry season to decrease the response time of river guards to reports of illegal fishing activity.
2. Night patrols should be continued and potentially increased from the current number of seven per month per outpost. This may not be possible during the wet season due to safety considerations.
3. Feedback from SMART data collection should be provided to the river guards on a timely basis – ideally before the next patrol is conducted.
4. Better support is needed from the courts to ensure that illegal fishermen who are arrested are successfully prosecuted. This effort should be coordinated with the Provincial governor. One action that could be taken is to convene a workshop to sensitize the judiciary about the importance of prosecuting fishery laws.
5. The illegal fisheries reporting hotline should be better promoted among local communities and timely responses by the river guards should be strengthened.
6. To prevent gillnets from being set in the core dolphin zones, enforcement efforts conducted by the river guards should also concentrate on fish landing sites or depots.
7. Salaries should be increased and health and life insurance provided to ensure that the river guards are motivated and can devote their full time attention towards enforcing fishery laws.
8. The number of patrolling days for each outpost should be increased from 18 days per month to 20 to 25 days per month.
9. Clearly visible, weather resistant and informative signboards should be placed to demarcate the upstream and downstream ends of the dolphin core zones.

#### Medium

1. Large patrol boats should be used in all channels during the wet season and in large channels during the dry season. Smaller vessels should be used in small channels during the dry season.
2. Additional training is needed for the river guards on fisheries laws and relevant legislation for the protection and management of Mekong dolphins.
3. Three additional river guard stations should be established (two in Kratie and one in Stung Treng)
4. The number of river guards should be increased from 68 to 98.
5. Patrolling effort during the dry season should continue to be concentrated in the core dolphin zones. However, during the wet season, patrolling effort should be expanded according to the more wide ranging movements of the dolphins as water levels rise.
6. In addition to their current equipment, river guards should be provided with high quality life jackets, high-powered spotlights, hand-held radios, high quality rugged binoculars, rain jackets, and water resistant cameras.
7. The current system of collecting SMART data on paper should be replaced by data collection on a hand-held device (i.e., SMART phone or tablet) using CyberTracker software. This should be implemented on a step-by-step basis with the first phase consisting of training and implementation by WWF staff and then, after the SMART model is translated into Khmer, implemented at each of the patrolling outposts.
8. More efforts should be made to monitor, bring greater accountability, to and incentivize river guard performance based on evidence from the SMART database. One example is that net confiscation could be tracked using geotagged photographs of net confiscation after return from patrols and then burned or tagged and safely stored for evidence for prosecution.

9. Quarterly meetings should be convened to share information and plan joint fishery enforcement patrols with Community Fishery Committees.

Low

1. Support should be provided (e.g., food, fuel, equipment) to Community Fishery Committees, especially where stations are located far away from community fishery areas, to strengthen their capacity for conducting patrols on their own and to provide more effective intelligence to river guards.
2. A workshop should be convened on fishery law enforcement with experts to build on the existing *International Standard Enforcement Strategy for Kratie and Stung Treng* (Appendix 4) and to provide more specific guidance tailored the needs of the river guards.

In addition to the increase in pay and life and health insurance mentioned above, alternative livelihoods should be provided to the families of river guards. On a broader scale, work with communities should identify those individuals or elements most likely to engage in illegal gillnet fishing and consider targeted alternative livelihood options for them, thus increasing the effectiveness of community intervention efforts.

During the course of the workshop there was considerable technical exchange on implementation of the SMART data system between the Bangladeshi and Cambodian teams. As follow up the teams will be exploring a potential study tour of river guards in the Mekong to the Sundarbans in Bangladesh to participate in ongoing training for the Bangladesh Forest Department conducted by the Wildlife Conservation Society (WCS) on implementing SMART wildlife enforcement and monitoring patrols including in three wildlife sanctuaries for freshwater dolphins. Ongoing technical exchange will continue on the use of the SMART program and of CyberTracker technology between WCS Bangladesh and WWF-Cambodia. There was also discussion of holding an international workshop focused on enforcement and involving enforcement specialists from countries of the region. Appendix 6 presents a visual GIS-based log of a post-workshop trip along the entire range of Mekong River dolphins, demonstrating the real-time power available through SMART and other technologies to monitor the location of legal and illegal fishing and fishing gear, the presence of dolphins and other wildlife, and other significant human activities.

Table 1: Progress on Fisheries and Law Enforcement Recommendations

No.	Fisheries & Law Enforcement	Progress	Challenges
1	Assess the efficacy of current enforcement program, including training, detections, arrests, and successful prosecutions, in dealing with the problem of illegal gillnets. Is this enforcement occurring in the right places (core zones of dolphin distribution)? Are current levels of monitoring and enforcement effort (e.g. days on the water) sufficient?	<ul style="list-style-type: none"> <li>- A number of the enforcement patrols have met the enforcement Minimum Standard for Protected Area that suggests 15 days/month</li> <li>- The enforcement patrol activities were occurring in the both core and buffer zones of the dolphin protection area</li> <li>- 94,929 meters of illegal gillnets confiscated in 2015 and 140,683 meters confiscated in 2016</li> </ul>	<ul style="list-style-type: none"> <li>- Gillnet use still happens at both the dolphin core and buffer zones</li> <li>- Lack of evidence for successful prosecution</li> <li>- Poor participation of the provincial court regarding detention of the illegal fishers in the jails</li> </ul>
2	Assist community fishery committees to complete steps to become formally recognized by the Ministry of Agriculture, Forestry, and Fisheries (MAFF) and to empower these committees to enforce regulations, particularly with respect to illegal use of fishing gear. This may require additional funding, especially for those communities adjacent to core dolphin zones.	<p>10 community fisheries (CFi) have been supported both for establishment and implementation of the management plan.</p> <ul style="list-style-type: none"> <li>- 7 CFi have been formally recognized by MAFF</li> <li>- Three CFi are in step 8</li> <li>- Capacity of the 10 CFi committees was raised</li> <li>- Provision of the equipment to enforce the internal rules/regulations</li> <li>- Supported the 10 CFi committees for enforcing the regulations</li> </ul>	<ul style="list-style-type: none"> <li>- Lack of funding for CFis to do regular enforcement patrols</li> </ul>

3	Improve cooperation and relationships between river guards and community fishery committees. For example, fishery committees could participate in data collection, similar to that conducted in the SMART program for monitoring patrolling activities. Regular meetings should occur between river guards and local community fishery committees	<ul style="list-style-type: none"> <li>- Monthly meeting between CFI committees and the river guards whose outposts are adjacent to the CFI villages</li> <li>- Representatives of a few CFI committees who are the river guards, have been joining the data collection</li> </ul>	- CFI committees still do not have an appropriate mechanism and capacity for doing a data collection
4	At the provincial level, sensitize the judiciary to legal issues relevant to dolphin conservation	- No progress	
5	Continue and expand efforts to educate local communities on fishery laws and regulations, including in regard to gear types and protected areas	<ul style="list-style-type: none"> <li>- Education/outreach have been continued (Village meeting, pagoda visit, green school, night show, commune meeting, provincial workshop, radio broadcasting, installation of billboard and signboard)</li> <li>- As a result the assessment study on the local community people's perception, 85% of local people get understanding</li> </ul>	- It is still hard to change the local people's traditional behavior
6	Run-off from gold mining and sugar cane production in tributaries of the river is perceived as a problem. There should be improved engagement with the private sector to reduce the potential for pollution.	<ul style="list-style-type: none"> <li>- Five workshops to share green growth information with MFF Landscape were organized and 12 indicators of LIVES (Linked Indicators for Vital Eco-system Services) tool were also discussed</li> <li>- Currently, because of the current law enforcement, no single mining activity takes place within the core zone of the Mekong dolphins' managerial protection area</li> <li>- The sugar cane factory isn't operating anymore</li> </ul>	- Sand and gravel dredging activities are currently happening along the Mekong in front of Kratie town

## Hydropower dam development

The workshop concluded that years of protection of dolphins in Cambodia have made significant gains in conservation the species, yet proposed hydropower dams covering the entire range of the species in the Mekong River may completely nullify this achievement.

The Mekong River is the most fish-biodiverse river in Asia, and the construction of hydropower dams will have severe impact on the vast services it provides through livelihoods, food security, sediment transport for delta stability, and biodiversity (Stone 2016).

Don Sahong Dam is under construction and already appears to be affecting dolphins in the transboundary pool areas. It was brought to the attention of the meeting that the Royal Government of Cambodia has formally approved in principle the permission to allow the Royal Group Company of Ouknha Kith Meng to sign a Memorandum of Understanding (MoU) with the Ministry of Mines and Energy on the three projects that include 1) the 2,600 mw hydropower project in Sambo district of Kratie province 2) the 900 mw hydropower project in Stung Treng province and 3) the 190 mw hydropower project at lower Sekong in Stung Treng province with the total electricity capacity of 3,690 mw and allow to conduct a pre-feasibility and feasibility studies as well as environmental and social impact assessments The proposed Sambor and Stung Treng dams are of the most immediate concern. Sambor Dam in particular has the largest potential impact on Mekong dolphins of any dam on the Mekong River (Fig 6).

It is unclear whether the MoU has yet been entered into, but the group considered it imperative that the terms of any MoU and the implications of the proposed dams for the human population and biodiversity of the Mekong be made public as soon as possible. While the expertise of the current workshop is focussed on Mekong River dolphins, we highlight that a dam at Sambor is likely to have wide ranging impacts on the human population downstream including livelihood, disaster risk, food security, and land stability.

As noted above, a dam at Sambor would have very high risk or certain impacts on dolphins through:

- Fragmenting habitats

- Loss of habitat and microhabitat
- Loss of fisheries and therefore prey
- Short- and long-term disturbance from construction
- Direct mortality

To fully understand the potential impacts of these proposals, more details of proposed dams need to be made available, and appropriate research and environmental assessment carried out.

Nonetheless, the scale and location of these projects provides ample reason for immediate concern. Ongoing investigation of built and proposed hydropower projects in the Mekong basin, and the known impacts of hydropower developments world-wide, lead to the conclusion it is highly likely that a dam at Sambor would pose a severe and clearly unacceptable risk of extinction to dolphins in the Mekong River.

Despite environmental and food security concerns, dam developments are proceeding on the Mekong River. The Mekong River Commission’s Procedures for Notification, Prior Consultation and Agreement mechanism has failed to stop developments in Laos despite objections from the other signatory states. However there is still a good opportunity to ensure that any future development in Cambodia is sustainable and compatible with protecting the biodiversity of the Mekong River. Representatives of WWF-Cambodia reported that a groundswell of public concern has grown over hydropower development in Cambodia and the Greater Mekong sub-region. This has been fostered by campaigns and coalitions led by organizations such as WWF. Future activism should leverage this support and work with the large number of interested partners, from grassroots organizations to government departments.

Based on these considerations, we recommend:

- Organizing information to build the case for concern over the impacts of the Sambor and Stung Treng dams.
  - This should include collation of monitoring information on the emerging impacts of the Don Sahong Dam on the transboundary sub-population of dolphins.
- WWF work with appropriate coalition partners to prepare or update hydropower strategy in response to this development, including:
  - Focusing public attention on the Royal Group’s involvement on Sambor, Stung Treng, and the Lower Sekong dams as soon as possible.
  - Using lessons from hydropower advocacy to date, and leveraging community activism for hydropower advocacy.
  - Exploring the potential to use technical and economic information such as financing, cost-benefit analyses, food security, to explore the impacts of proposed dams
  - Using the international group assembled at the current Mekong River dolphin workshop to bring relevant international expertise to bear with respect to the threat of these proposed dams to Mekong River dolphins and their habitat.
- Use the FiA Technical Working Group’s hydropower sub-group as a mechanism to maintain a sustainable Mekong.
- Ensure rigorous scientific evaluation and transparency of any stages of development.

Table 2: Progress on Hydropower Development Recommendations

No.	Hydropower Development	Progress	Challenge
1	Cambodia, Vietnam, Thailand and Lao PDR should abide by the 10-year moratorium on the construction of dams in the mainstream of the Mekong River recommended in <i>the</i>	- Advocacy including petition collection and public gathering in Phnom Penh and at the border between Stung Treng and	- the Don Sahong and Xayaburi dams in Laos are under construction - Sambor dam has had Pre-feasibility study

<i>Strategic Environmental Assessment of Hydropower on the Mekong mainstream</i> ( ICEM 2010)	- Champassak provinces were made - The study on the impact of Don Sahong dam construction was produced and disseminated	- Construction of the Pak Beng (Laos) dam is scheduled to be started in 2017
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## Population dynamics, behavior and ecology

The workshop participants reviewed the recommendations of the 2012 and 2014 workshops, which generally remain relevant to further work. In addition to continued photo-identification surveys, determining the reproductive histories of individual females and gathering data on the fate of calves are high priorities.

Significant information is contained in the photo-ID record which spans from 2001 to the present day (and from 1993 for one individual). It is of the highest priority that the catalogues collected by Isabel Beasley during her PhD, and by WWF are integrated, and the long-term data therein are further reviewed and analyzed. In addition, the identity of stranded individuals, if discernible, must be incorporated into this database. It is recommended that this task be completed in one year. It is recognized that external support will be required to complete this task and a strategy must be developed to provide this. In addition, support for modeling abundance and vital rates analysis will also be required. (This recommendation incorporates previous recommendations from Population Dynamics 1, 2, and 4, and Behaviour 1, Ecology 2, 2014 report).

Ryan et al. 2011 paper used an analysis of existing photo-id data to inform a power analysis on the most suitable intensity of future survey effort. They found that the current effort of 3 surveys per year gave >90% power to detect a 3% decline in 3 years. Therefore, photo-identification surveys should continue at the present rate of effort (three times per year) to add to the long-term monitoring dataset.

Exchange between dolphin research projects in the Southeast Asian region will be encouraged to build and maintain field photo-identification methods and to explore the use of various photo-id analysis programs to ease analysis and ensure data are organized and archived effectively.

Others present in the pools should be equipped to collect opportunistic identification or behavioural data, (e.g., River Guards and tour operators), including using video for behavioural documentation. Following the recommendation that more time be spent at the pools, it was noted that monthly surveys of the pools have been initiated.

Table 3: Progress on Population Dynamics Recommendations

No.	Population Dynamics	Progress	Challenge
1	As a matter of highest priority, the combined catalogues of photographs collected by Isabel Beasley between 2004 and 2007 (Beasley et al. 2013) and by WWF from 2007 to the present (Ryan et al. 2011) should be used for an analysis of temporal trends in abundance and vital rates.	o No progress was made	Gerry Ryan had no time to do this
2	Future approaches to modeling vital rates should combine data on the identity of recovered carcasses with the mark-resight analysis.	- Dolphin carcasses were collected and identified but data wasn't yet combined	Limited capacity
3	Until a full analysis of existing data is completed, photo-identification surveys should continue at the present rate of effort (three times per year) to add to the long-term monitoring dataset. The results of this full analysis should be used to inform a power analysis and decide on the most suitable intensity of future survey effort.	- The estimation of the Mekong dolphin population was made in 2015 - Three Photo-identification surveys are annually conducted	

4	Future modeling work on abundance and vital rates will likely require analytical support from outside WWF-Cambodia	Ryan has provided support for such modeling work	Limited capacity and will. need others to provided needed support
5	All available samples of teeth and ovaries should be analyzed at the NOAA, Southwest Fisheries Science Center (La Jolla, California). Teeth collected from dolphins that died in late 2013 and 2014 need to be sent to La Jolla to be included in this analysis. The highest priority should be to estimate the maximum age of individuals, to assist in the choice of surrogate species for demographic modeling.	Teeth, ovaries and a number of other dolphin samples were shipped to NOAA, Southwest Fisheries Science Center (La Jolla, California, in March 2016)  - These analyses are in progress	SWFSC has not reported on progress or provided a timeline for this analysis
6	Efforts to obtain information on the distribution of size (age/stage) classes using laser photogrammetry have been unsuccessful but attempts to use this technique should be continued as part of the regular photo-identification surveys, especially since including the activity requires very little additional effort while the information gained could be valuable for modeling	No progress	The research team is not familiar with using this equipment
7	There is currently little justification for continuing efforts to remotely collect biopsies from live animals for obtaining population-level information on sex ratio, genetics, contaminant levels, reproductive hormones, and lipid levels. Six samples have been obtained, but the great effort and expense that would be required to obtain more such samples cannot be justified in view of the limited results (Ryan et al. 2012, Ryan 2013).	N/A	
8	An individual-based demographic model should be constructed, but this work is of a lower priority because the necessary data are not available and unlikely to become available in the near future.	N/A	
9	It would be useful to obtain and analyze tissue samples from Irrawaddy dolphin populations in nearby coastal waters to better understand the taxonomic status of the Mekong population	- Paper on genetics of the Mekong River dolphin population was reviewed	- Less capacity of local FiA cantonments along the coastal area to collect tissue sample from the marine dead animal

### Analysis of reproductive histories

It remains a high priority to continue systematic field research and conduct retrospective analysis of the photographs compiled over the history of studies on the Mekong to determine the reproductive histories of individual females including:

- Duration of the mother-calf association (period of dependency)
- Calving interval (time from one birth to the next)
- Age at first birth (a measure of age at sexual maturity)
- Age at last birth (reproductive senescence)
- Fecundity (number of births/number of mature females in the population)

These data would support population abundance assessment and demographic modeling of the population based on photo-identification and life history data to determine actual and predicted rates of population growth and assess the effectiveness of threat alleviation measures.

Workshop participants developed an in-depth approach and protocols for constructing reproductive histories from both current and retrospective data (Appendix 5). A working group was formed (Wells, Ryan, Porter, Smith, Channa, and Phay) to identify tasks and data sources as well as sources of expertise (e.g., graduate students, technicians to draw upon for specific tasks) to carry the retrospective analysis forward. They will meet by correspondence in February 2017 to establish initial timelines for this work.

### Enhance behavioural observations and improve understanding of reports of potential infanticide

Following reports of suspected aggression towards calves (as described above) the workshop recognized it is difficult to ensure the presence of observers at dolphin pools to record such rare behaviours. The following recommendations are intended to increase the likelihood of documenting events occurring around the time of birth of calves and compiling observations to date.

1. Increase observations in Kampi pool to 2 times per month, and when a newborn calf is reported, 5 to 7 days should be dedicated to observing it as soon as possible.
2. A modification of the data collection sheet used in the Mahakam will be developed and field training and assistance will be provided (Porter) for use during surveys in early 2017.
3. River Guards are regularly present on the water and can assist in reporting calves and other changes. Equipping River Guards to record video of mother/calf behaviour and interactions with conspecifics, such as “infanticide interactions” may provide a way to better understand rare behaviors. (Previous recommendation Behaviour 2)
4. Review existing data from previous focal survey studies (Beasley, Dove, Goss) to further investigate mother-infant behaviour and aggressive interactions with calves and activity budgets (Previous recommendations Behaviour 3 and 4)

Wells, Porter, Alom, Smith, Krebs, Phay, Channa will constitute a working group to identify opportunities for exchange and capacity building on research methodologies between regional dolphin projects and with established long-term studies (e.g., Sarasota Bay). Porter will work with the Cambodian team in March 2017 to refine behavioural methodologies.

### Ecology

The analysis of stomach analysis remains a high priority and it is recommended that a suitable person be identified to establish an otolith catalogue to use for fish identification. (previous Ecology recommendation 1 (Necropsy group Vuth, Gulland)).

It was noted that the collected teeth and ovary samples have been sent to NOAA, Southwest Fisheries Science Center (La Jolla, California, USA) for analysis of the maximum age of individuals to assist in demographic modelling. As yet, no analyses have been conducted on these samples and this remains a high priority (previous recommendation Population Dynamics 5).

Table 4: Progress on Behaviour and Ecology Recommendations

No.	Behaviour & Ecology	Progress	Challenge
1	Compile reproductive histories from photo-ID data for as far back in time as can be supported by available data, linking identifiable females with calves and determining the fates of the calves to the extent possible (behaviour)	<ul style="list-style-type: none"> <li>- Database has been developed. Relevant information includes location and the estimated date of calf record</li> <li>- 12 calves were recorded in 2015</li> <li>- 11 calves were recorded in 2016</li> </ul>	Did not have resources to monitor the past record
2	Implement more frequent (monthly if possible) photo-ID surveys of Kampi Pool, as an index site, to track females and calves (and other individuals) through time. The primary goals of these additional surveys would be to better understand the timing of events in the lives of the calves and the fates of mothers and calves, and to observe calves as they acquire marks so they can be identified once they have left their mothers. As warranted by findings from Kampi Pool, surveys may be expanded to other pools. Monthly surveys should begin as soon as possible to take advantage of the availability of calves observed in recent (early 2014) focal follows. (behaviour)	<ul style="list-style-type: none"> <li>- This type of survey used to be jointly conducted at Kampi by Ms. Goss, the student from the United State, and Mr. Seang Oun, the focal fellow from the Royal University of Phnom Penh and the dolphin team in 2014. Julia hasn't yet submitted a report to WWF-Cambodia</li> <li>- Beside the three Photo-ID surveys/year, the monthly calf monitoring has been conducted along the Mekong by the dolphin research team</li> </ul>	No standardized methodology or protocol to collect and analyze data

3	The group acknowledged the importance of the data collected during recent focal animal behavioral observations relative to the issue of infanticide. Preliminary findings indicate that infanticide is possible, but it is likely a rare event. The apparent recent reduction in calf strandings, and the lack of support for the infanticide hypothesis from necropsy data, suggest that while it would be desirable to continue detailed research on mother/calf behaviour and conduct it over multiple seasons, this is regarded as somewhat less of a priority at present than it was in 2012. It remains important to look for and report any evidence, whether direct observations of behaviour or inferences from necropsies, related to causes of calf mortality (behaviour)	<ul style="list-style-type: none"> <li>- New calves were recorded and photographed</li> <li>- A number of new calves couldn't be photographed</li> <li>- New calves were prevented from gillnet entanglement and potential infanticide by the river guards</li> <li>- Trauma in dead calf was found at necropsy and evidence in aggressive behavior was observed during the calf monitoring activity</li> </ul>	- No protocol for calf monitoring
4	Focal follow research for the remainder of the 2014 dry season should focus primarily on mother-calf follows in order to facilitate comparisons of mother and calf pairs by themselves vs. those with other animals, to see if they modify their behaviour in the presence of a potentially aggressive animal.	Not sure if data and information has been shared with Saber or other persons	
5	Information on the prey of the Mekong dolphins is lacking, but will be crucial relative to potential impacts of dam construction or for perspective relative to observations of dolphin body condition. Stomach content data from strandings and information from stable isotope studies of dolphin tissues can help to define feeding habits (ecology)	<ul style="list-style-type: none"> <li>- The stomach contents of the dead dolphins were collected from necropsies</li> <li>- Study on the impacts of the Don Sahong dam construction on aquatic fisheries resources, especially the trans-boundary Mekong dolphin</li> </ul>	No capacity in terms of skill and finance
6	Better information is needed on the connectivity between pools relative to dolphin movements. More detailed analyses of existing photo-ID data should be performed to examine site fidelity and connectivity between pools	<ul style="list-style-type: none"> <li>- Three Photo-ID surveys/year</li> <li>- Monthly calf monitoring</li> </ul>	No resources for studying the home range

### Education and Outreach

It is a priority to get existing data and analyses into peer reviewed journals to increase credibility and archive data.

Public awareness can be increased through the use of media, including social media, periodicals and media specific to fisheries that are targeted to fisheries agencies.

The idea of giving individual dolphins popular names to be used in raising public awareness should be explored.

### **Necropsy Program**

The workshop participants reviewed the results of necropsy efforts in the past two years and considered the personnel and facilities available to this ongoing program. Their recommendations were to:

1. Continue necropsies to determine cause of death, thus monitoring the efficacy of mitigation of gillnet mortality, and the frequency of calf mortality.
2. Continue training for Kratie WWF team to enable immediate necropsy of fresh animals rather than prolonged storage.

The approach of using periodic training workshops to necropsy frozen carcasses by an expert in marine mammal necropsy has worked well to date, but the team in Kratie is now sufficiently trained to perform necropsies. In addition, the number of carcasses has decreased, making storage of carcasses an inefficient approach. Immediate necropsy of dead

- animals by the Kratie team will allow more timely feedback to enforcement on gillnet associated mortalities.
3. Ensure laboratory equipment and supplies are maintained, including freezers. One new freezer is immediately required to replace one that has broken since 2014. (Funds to be sought immediately).
  4. Analyze samples and synthesize results from samples already collected
    - a) Age and genetics data from teeth sent to NOAA, Need report on results.
    - b) Develop partnership for microbiology with Institut Pasteur on frozen lung, liver samples to investigate potential for infectious cause of still births, e.g., Brucella
    - c) Ship samples in formalin for histology examination– require CITES permit (will require inventory of samples).
    - d) Analyze stomach contents for prey identification, and develop reference collection of otoliths.
  5. Match photographs of dead animals to photo ID catalogue to determine ID and sex and better integrate these results into efforts to better understand reproductive histories and individual survival. (see above).

Table 5: Progress on Mortality Recommendations

No.	Mortality	Progress	Challenges
1	<p>Continue detailed necropsy examinations by expert marine mammal veterinarians</p> <p>a. Hold dolphin necropsy workshops approximately every 6 months. These workshops should be led by experts in marine mammal pathology and should serve to train in-country veterinarians and technical staff, maintain the sample database, direct pathology research, and provide feedback on results to relevant communities. The recent carcass recovery rate indicates a frequency of twice-yearly workshops of 1-2 weeks duration would be adequate, although this should be re-evaluated regularly.</p> <p>b. Pathology findings to date indicate that a regular necropsy workshop approach is adequate, but this should be reviewed if there are novel necropsy findings</p> <p>c. Freezer capacity at Kratie must be increased to include a back-up freezer to ensure carcass preservation for workshops. Sectioning carcasses prior to freezing must be conducted with care to prevent destruction of organs or lesions.</p> <p>d. Dead dolphins must be photographed prior to storage for workshops, and information on history of carcass discovery and photographs stored with necropsy data.</p>	<p>-</p> <p>- Two trainings in 2015 and 2016 were provided by Dr. Frances Gulland, veterinarian from The Marine Mammal Center, Sausalito, California. The trainings were participated by the Government official from the FiA, a veterinarian from Tamau zoo and students from the Royal University of Phnom Penh</p> <p>- One new back-up freezer was brought to Kratie. One of the two freezers is now broken</p> <p>- Every dead dolphin collected was properly photographed. Report on each dead dolphin was attached with photographs of all aspect of appearance, particular for a dorsal fin</p>	<p>Need one more freezer</p>
2	<p>Maintain an inventory of samples and data and archive all samples securely</p> <p>e. Finding a long-term secure archive facility is a priority, with centralization of samples as much as possible</p> <p>f. Inventory of samples available for prey identification is a priority (e.g. stomach contents, blubber, and skin).</p>	<p>- The new freezer capacity could not properly store a big quantity of samples. For long-term secure archive, consideration should be made on better facility; the laboratory of NOAA should be the option</p> <p>- Samples taken from necropsies were properly recorded, packed and stored in the freezers. Types of samples were collected by using the existing necropsy protocol.</p>	<p>The electricity in Kratie is cut for almost every day in the dry season. Although the generator is available at the Kratie office, its capacity is still low</p> <p>Need a new freezer at least</p>

## Tourism

There was insufficient time to review progress on tourism since the 2014 workshops, but the progress table is presented here.

Table 6: Progress on Tourism Recommendations

No.	Tourism	Progress	Challenges
1	<p>Work with local community fisheries, village development committee, local NGOs, the tourism sector, and the provincial tourism department at each site to:</p> <ol style="list-style-type: none"> <li>Explore the need and options for regulating dolphin-watching operations, especially at Kampi, Anlung Cheuteal pools where tourist number are highest.</li> <li>Adapt best practice protocols for dolphin watching tourism appropriate to each site including land-base watching where it is viable</li> <li>Conduct discussion with provincial and fishery authorities about using a proportion of the revenue from dolphin-watching tourism to support enforcement and conservation</li> </ol>	<ul style="list-style-type: none"> <li>- Guideline for managing the dolphin watching activities was developed and displayed at Kampi. The guideline will be applied at other two sites including Koh Phdao and Trans-boundary Cheuteal pool</li> <li>- In addition to the guideline above, capacity of the boat drivers at Kampi and the provincial tourism department was built</li> <li>- \$500 was shared with the Kratie FiA cantonment for a few months only then stopped because the Kratie provincial administration would need all the revenue to spend for other priorities that included decoration and modernization of the Kampi site and road construction</li> </ul>	
2	Work closely with provincial tourism departments to strengthen the efforts of community tourism committees to (1) ensure that the benefits of dolphin-watching tourism are shared equitably among stakeholders and (2) provide information to stakeholders and domestic and international tourists	<ul style="list-style-type: none"> <li>- No progress</li> </ul>	
3	Develop a policy-oriented document that collates and interpret information on dolphin tourism in Cambodia and the trans-boundary pool to explain the benefits of nature oriented tourism to the economy and to people in the provinces	Data/information on the Mekong dolphin status was produced and will be finalized soon	
4	Update and extend implementation of Kratie Declaration recommendation that the FiA and WWF should work together. Specifically, there is still a need to combine basic scientific, conservation and management information on Irrawaddy dolphins and to use that information to produce outreach materials in Khmer, English and other languages for both Cambodian and international tourists.	A number of educational materials in English and Khmer were produced and have been disseminating widely in Cambodia	
5	Identify external funding and commission research into the “quadruple-bottom-line” sustainability (ecological, social, economic and managerial) of Mekong dolphin-watching tourism co-ordinated across all four sites. The research should include the feasibility of complementing dolphin watching with other attractions on the Mekong Discovery Trail.	No progress	

## Activation

Workshop participants began initial discussions of how WWF as a global conservation organization could best work globally on behalf of freshwater dolphins and their habitats. This was introduced in the context of exploring how best to work at both the global and local for example through working at the policy level through roundtables that would enable these leaders to exchange their successes around freshwater and dolphin conservation, as well as push each other to make bigger

commitments that benefit both people and nature. They could also work with the private sector to leverage the brand power of corporate partners to elevate awareness on river dolphins and inspire water stewardship, public engagement to engage members all around the world and introduce them to river dolphins, using them as ambassadors to talk about broader freshwater issues, and science to bring together river dolphin and water experts from each basin to exchange their research, best practices and lessons learned, and find a community to ask questions and share ideas.

Some informal networks of Irrawaddy dolphin researchers exist through previous Irrawaddy dolphin workshops in Phnom Penh in 2005 and Samarinda, Indonesia in 2009, as well as regional fora like the Southeast Asia Marine Mammal group (SEAMMAMS; last meeting held in 2013) and the Asian Marine Mammal Stranding Network (AMMSN) which bring together the larger community to share the results of research, conservation, education, and public awareness efforts. The working groups and collaborations established or strengthened at this workshop between regional and global experts represent the power of such global activation. These are targeted to address methodological, research, enforcement and conservation questions. The impact is more global: as an outcome of earlier Mekong workshops personnel from the Mekong River dolphin program were supported to attend the Biennial Conference of the Society for Marine Mammalogy in San Francisco in 2015. This international engagement and the long-term fundamental commitment by the government and WWF in Cambodia provide opportunities for capacity building exchange to support other populations in the region and a strong basis for awareness raising and fundraising for further conservation efforts.

The question of hydropower dams in particular is one facing riverine Irrawaddy dolphins in the Mahakam and Ayeyarwady Rivers, as well as the Mekong. This group of experts on cetacean biology and conservation recognizes the need for organizations such as WWF to activate broader coalitions founded on the breadth of environmental, social, and economic concerns over the impacts of mainstem dams on the Mekong River. Only the global power of such international organizations can counter the immense pressure to build such dams, and there may be synergies to be explored and gained from internationally coordinated efforts to consider the impacts of dams on dolphins and more broadly. Finally, the recommendations of this report, both the principal conclusions and those contained in the body of the report, provide the substantive foundation of campaigning on behalf of Mekong River dolphins in the immediate future at the local, regional, and global levels.

## **Acknowledgements**

Workshop organizers recognize the support of The Marine Mammal Center, the Marine Mammal Commission, WWF-US, WWF-Cambodia, Wendi Hutton and Matthew Naythons for supporting participants' travel to this meeting. Randall Reeves, Chair of the IUCN Cetacean Specialist Group, was a member of the international organizing team planning the meeting and his help was instrumental in securing support for participants. Finally, thanks to all WWF-Cambodia staff for their efficient organization of this meeting and associated field visits, and for their wonderful hospitality.

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## Appendix 1.

### Agenda

#### Day 1 January 16 2016

<b>From</b>	<b>To</b>	<b>Sessions</b>	<b>Speakers/facilitators</b>
8:00	8:30	Registration	All
8:30	8:45	National anthem, introduction and objectives of the workshop	Ms Bun Chanmeta
8:45	9:00	Welcoming remark by the Kratie Governor	H. E. Sor Chamrong
9:00	9:05	Remarks by International Workshop Committee, and Asia Coordinator of Cetacean Specialist Group, IUCN	Mr. Brian Smith
9:05	9:20	Remarks of WWF Country Director	Mr. Chhith Sam Ath
9:20	9:30	Remarks of WWF GMPO Director	Mr. Stuart Chapman
9:30	9:45	Opening speech of Director General of the FiA	H. E. Srun Limsong
10:15	10:30	Current Status of Irrawaddy Dolphin Conservation in Indonesia	Dr. Danielle Krebs
10:30	10:45	Current Status of Irrawaddy Dolphins Conservation in Myanmar	Naing Lin
10:45	11:05	Current Status of Irrawaddy Dolphin Conservation in Bangladesh	Zahangir Alom
11:05	11:25	Current status of Irrawaddy dolphins in the Mekong River	Mr. Phan Channa
11:25	12:00	Q & A on the presentations	Dr. Peter Thomas
13:30	13:55	Conclusions, recommendations and working group reports from the last workshop in 2014: The progress of implementation	Mr. Phay Somany
13:55	14:10	Population size and demography	Mr. Phan Channa
14:10	14:25	Dolphin mortality and necropsy programme	Mr. Sereyvuth
14:25	14:40	Dolphin behavior: Evidence for infanticide	Mr. Lor Kimsan
14:40	15:00	River Guard program	
15:00	15:15	Don Sahong dam construction, the trans-boundary dolphin sub-population and future dam construction management status	Mr. Phay Somany and Gerry Ryan
15:40	16:15	Q & A on the presentations	Dr. Peter Thomas
16:20	17:15	Divide into Working groups on 1). Fisheries and law enforcement, guard and SMART program, 2). Population dynamics, behavior & ecology, 3). Investigation of cause of death (mortality and necropsy) and 4). Hydro-power dam and tourism and update of the recommendations	1. Brian Smith 2. Randy Wells, Lindsay Porter 3. Frances Gulland 4. Peter Thomas
17:15	17:30	Working group session summary and thanks	Each Group lead
17:45	18:00	Closing remarks	H.E. Sor Chamrong

#### Day 2 January 17 2017

Field trip to Kampi pools to observe dolphin field research and river guard program

#### Day 3 January 18 2017

Review draft recommendations, develop final recommendations based on working group drafts, field visits and discussion with workshop attendees

## Appendix 2

### Participant List

1	H. E. Srun Limsong	Deputy Director General of FiA
2	Mr. Ouk Vibol	Director of De. of Fisheries Conservation (DFC)
3	Mr. Chab Siekheng	Inspector of the Mekong Fisheries Inspectorate
4	Mr. Sean Kin	Chief of the Kratie Fisheries Cantonment
5	Mr. Tym Nyro	Chief of the Stung Treng Fisheries Cantonment
6	Mr. Phay Somany	Vice head of the endangered fisheries office and Government Liaison with WWF
7	Mr. Hang Sereyvuth	Vice head of administrative office and Field Coordinator of the Cambodian Mekong Dolphin Conservation Project (CMDCP)
8	Mr. Tan Sametbunwath	Vice Chief of the Kratie Fisheries Cantonment
9	Mr. Mok Ponlork	Vice Chief of the Kratie Fisheries Cantonment and Chief of the river guards in Kratie
10	Mr. Sam Sreyvichet	Vice Chief of the Kratie Fisheries Cantonment and Chief of the river guards in Stung Treng
11	Mr. Chhith Sam Ath	Country Director WWF Cambodia
12	Mr. Horm Chandet	Mekong Flooded Forest Landscape Manager
13	Mr. Rin Narooun	Conservation Area Manager WWF Cambodia
14	Mr. Phan Channa	Senior Research Officer (Ministry of Environment/WWF)
15	Mr. Keo Samnang	Enforcement Officer WWF Cambodia
16	Mr. Lor Kimsan	Project Officer WWF Cambodia
17	Ms. Bun Chanmeta	Senior Project Officer WWF Cambodia
18	Mr. Leng Doeun	The Provincial Coordinator WWF Cambodia
19	Mr. So Socheat	Senior Community Officer
20	Miss Vong Puthkanha	Assistant to the Country Director
21	Mr. Man Sen	Driver WWF Cambodia
22	H. E. Khann Chamnan	The Deputy Governor of Kratie Province
23	Mr. Lieng Seng	The Stung Treng Agricultural Provincial Department
24	Mr. Stuart Chapman	WWF, Conservation Director, Greater Mekong Program Office (GMPO)
25	Mr. Seng Teak	WWF, Cambodia-Regional Conservation Director, GMPO
26	Mr. Jimmy Borah	WWF GMPO
27	Mr. Ek Chamroeun	FACT
28	Mr. Sonim Veth	IUCN Cambodia
29	Dr. Peter Thomas	Marine Mammal Commission (US MMC support and guidance, International organizing Team)
30	Mr. Brian Smith	Wildlife Conservation Society (Expertise on Asian river dolphin biology and conservation, International organizing Team) IUCN SSC CSG
31	Dr. Frances Gulland	The Marine Mammal Center (veterinary expertise, necropsy training, International organizing Team)
32	Dr. Lindsay Porter	SMRU Hong Kong, (regional expertise in photo identification, population monitoring)
33	Dr. Randall Wells	Chicago Zoological Society (expertise in dolphin biology, long term population monitoring, calf development)
34	Mr. Zahangir Alom	Wildlife Conservation Society, Bangladesh (expertise in freshwater dolphin research and enforcement)
35	Dr. Danielle Krebs	Yayasan Konservasi RASI, Regional IUCN SSC CSG, Indonesia

		(expertise in Irrawaddy dolphin research)
36	Mr. Naing Lin	Landscape Coordinator WCS Myanmar
37	Mr. Nop Vannarith	Provincial Coordinator NTFF-EP
38	Mr. Lou Vanny	Coordinator officer IUCN Cambodia
39	Miss Hean Reasmey	Finance Assistant WWF-Kratie
40	Mr. Uk Kimnich	Project Assistant WWF-Kratie
41	Mr. Phorn Sokmy	Driver WWF-Kratie
42	Miss Shruti Suresh	Internship WWF Cambodia
43	Mr. Gerry Ryan	Researcher University of Melbourne Australia
44	Mr. So Thy	Admin assistant WWF- MFF
45	Mr. Chheng Sambo	Communication Officer WWF Cambodia
46	Mr. Vithin	BTV Kratie

## Appendix 3

### Ramsar Site: Middle Stretches of Mekong River North of Stoeng Treng

- **Country: Cambodia**
- **Site number: 999**
- **Area: 14,600 ha**
- **Designation date: 23-06-1999**
- **Coordinates: 13°44'N 106°00'E**

Middle Stretches of the Mekong River north of Stoeng Treng. 23/06/99; Stoeng Treng; 14,600 ha; 13°44'04"N 106°00'00"E. National Protected Area. A 40km stretch of the Mekong River in the north of Cambodia characterized by strong turbulent flow with numerous channels between rocky and sandy islands that are completely inundated during high water, with higher alluvial islands that remain dry. It lies about 5km from the town of Stoeng Treng where the Se Kong river joins the Mekong river and 4 km south from the border with Laos. The site is home to a breeding population of the critically endangered White-shouldered Ibis (*Pseudibis davisoni*). The extensive and largely undisturbed channel islands provide important refuge and a food source for fish species during times of high flows, while the areas deep pools allow refuge for aquatic species, including the critically endangered Giant Mekong Catfish (*Pangasianodon gigas*) and the vulnerable Irrawaddy Dolphin (*Orcaella brevirostris*). The site faces a number of significant threats such as an expanding infrastructure network, a market-driven agricultural increase of cash crop and logging activities that are reducing the forest, and the omnipresent threat of dams, particularly those upstream, but seven dams have also been proposed for the mainstream of the Mekong within Cambodia. Ramsar site no. 999. Most recent RIS information: 2012

- **Administrative region: Stung Treng Province**

Source: <https://rsis.ramsar.org/ris/999>

## Appendix 4

### International Standard Enforcement Strategy For Siphandone –Stung Treng – Kratie (SSK) Landscape 2013

#### 1. Introduction

The common main threats to natural resources in the SSK Landscape along the Mekong River are:

1. Illegal and un-sustainable fishing practices
2. Illegal land encroachment, hunting & wildlife trade, arson, and logging practices
3. Uncontrolled use of protected areas by neighbouring villagers
4. Uncontrolled tourism activities
5. Economic Land Concessions
6. Hydropower dam
7. Illegal extraction of natural resource (mining, sand, gravel)
8. Water pollution

Within this context WWF is working with various stakeholders, and government agencies including Fisheries Administration (FiA), Forestry Administration (FA), and Ministry of Environment (MoE) with the implementation of a patrolling and enforcement plan along the Mekong River between Kratie and the Lao PDR border that will meet international standards for natural resource protection.

#### 2. Objectives of the Enforcement Strategy

1. Development and maintenance of the compliance and enforcement capacity of responsible agencies to mitigate the impacts of users, visitors (tourists) and illegal activities.
2. Staff training and capacity building on protection and enforcement activities for relevant stakeholders and government agencies.
3. The integration of the Protected areas into local and regional compliance and enforcement initiatives

#### 3. Methodology

**Protection** - Maintaining an effective enforcement and compliance capacity to mitigate the impacts of users, visitors and illegal activities

1. Vacancies; Ensure the filling of vacant staff posts in the approved organogram for the protected areas (PAs)
2. Equipment; Provide correctly located outposts and adequate equipment for enforcement and compliance activities.
3. Patrolling; Maintain regular enforcement patrols, particularly along the boundaries
4. Planning; Maintain and collate information on all incidents (patrol reports, SMART, and informant network) to enable effective planning for deployment of enforcement and compliance resources and capacity and to provide feedback for future management activities..
5. “Hot Spots”; Identify critical areas and concentrate the effective deployment of the protection and enforcement rangers towards controlling illegal activities, enforcing legislation and regulations
6. Reports for M&E; Maintain an incident's register and collate information on all illegal incidents in order to monitor effectiveness of enforcement activities.
7. Mapping; Map areas where illegal activities occur and maintain an inventory of incidents
8. Visitors; Direct field staff's protection, enforcement and compliance activities towards the mitigation of visitor impacts, and ensuring security of visitors
9. Erecting signage indicating risk of prosecution for illegal activities in particular on road access, public roads traversing the areas including signage placed at boat launch sites and the river guard posts.

**Training** - The development of the protection and enforcement ranger's skills base

1. Training courses; Ensure the provision of adequate protection and enforcement training for rangers.
2. Attend training; Ensure that managers & all enforcement rangers attend and then apply the training

**Co-operation** - The integration of the protected area into local and regional compliance and enforcement initiatives

1. Co-operation; Build and maintain synergies and good relations between WWF, FiA, FA, MoE, and provincial authorities including local police offices, local prosecutors, relevant NGOs and local communities.
2. Education; Communicate with and raise community awareness on the value of Dolphins, other species, PAs and reducing illegal activities in the landscape. Include the use of community patrol support.
3. Legal requirements; Confirm the activities in protected areas that specifically require compliance with legal requirements, and advising staff members accordingly to ensure compliance and adherence.
4. Legislation; Collating and maintaining a legal register on pertinent legislation for instance, the Dolphin Protection and Management Areas, the Ramsar Site, and the Mekong Fishery Biodiversity Management and Conservation Site between Kratie and Stung Treng and advising staff members on particulars

#### **4. Outputs**

1. Functioning law enforcement plan from FiA, FA, and MoE
2. Zero dolphin mortality caused by illegal fishing activities.
3. Zero wildlife and natural resources crimes including wildlife trade networks
4. Properly controlled protected areas
5. Formal guideline developed for tourism activities
6. Incident database maintained, updated, and reported monthly
7. Improved capacity and motivation of the enforcement staff

<b>Objective 1 – Protection: Maintain an effective compliance and enforcement capacity to mitigate the impacts of users, visitors and illegal activities</b>	<b>Performance Measure</b>	<b>Performance Indicator</b>
1	Ensure the filling of vacant staff posts in the approved organogram for the protected area	Motivation for critical post to be filled Motivation submitted. Post filled
2	Provide correctly located outposts and adequate equipment for enforcement and compliance activities.	Outposts constructed, and equipment acquired in a timeous manner Records of such purchased equipment on asset list. Outpost and equipment maintained regularly.
3	Maintain regular reserve patrols particularly along the boundaries	Regular patrols maintained per schedule. Patrols carried out (RBDC & SMART). Schedules available of field staff duties Nets and fish traps and animal snare removed and destroyed Fishing with explosives/poison/electricity, and illegal logging stopped Reduction in number of poaching incidents in the river
4	Maintain and collate information on all incidents (patrol reports, SMART, and informant network) to enable effective planning for deployment of enforcement and compliance resources and capacity and to provide feedback for future management activities.	Deployment of staff is appropriate Reports are used to collect data from the protected area for reporting purposes. RBDC Data sheets, SMART, and monthly reports Data collected in the field is collated onto maps and into reports. Information available and analysed
5	Ensure the effective deployment of the enforcement and compliance members towards controlling illegal activities, enforcing legislation and regulations	Identify hot spots and redeploy patrols in these areas. Critical areas identified and patrols focused on these areas (patrol reports). Annual decrease in poaching incidents & incursions.
6	Maintain an Incidents register and collate information on all illegal incidents in order to monitor effectiveness of enforcement activities.	Keep records for all incidents Patrol information available and analysed. Trends in number of incidents easily accessed Measure using PA-EMS, COPs, and ranger performance management.
7	Map areas where illegal activities occur and maintain an inventory of incidents	Maps compiled Maps completed and updated monthly
8	Direct field staff compliance and enforcement activities towards the mitigation of visitor (tourist) impacts, and ensuring security of visitors	Staff deployed Visitor impact mitigated Regular patrols at identified buildings/areas are conducted, and no untoward incidents reported
9	Erect signage indicating risk of prosecution for illegal activities within the zones, in particular on road access, public roads near the river, ranger posts, and boat launch sites	Signage in place on river launch sites, along roadsides, on approaches Illegal activities along public roads near the PAs reduced/ stopped

<b>Objective 2 – Training: The Development of the members skill base</b>		<b>Performance Measure</b>	<b>Performance Indicator</b>
1	Ensure the provision of adequate enforcement and compliance training for members.	Compile a list of training needs.	List submitted to training officer or equivalent, ensure training needs are met (One training course (minimum) per annum for each compliance/enforcement member)
2	Ensure that managers & all enforcement members attend, and then apply the training	Regular training courses	Training records to be kept Improvement in the application of the ranger duties.

<b>Objective 3 – Cooperation: The integration of the PA into local and regional compliance and enforcement initiatives</b>		<b>Performance Measure</b>	<b>Performance Indicator</b>
1	Build and maintain synergies and good relations between WWF, FiA, FA, MoE, and provincial authorities including local police offices, local prosecutors, relevant NGOs and local communities.	Relationship developed through meetings and assistance.	Minutes and records of such discussions and meetings. Co-operation agreement implemented.
2	Communicate with and raising community awareness on the value of PAs and of reducing illegal activities in SSK Landscape. Include the use of community patrol support.	Communication and meetings	Records of such discussions and meetings including assessment report and active community patrol.
3	Confirm the activities in PAs that specifically require compliance with legal requirements, and advise members accordingly to ensure compliance and adherence.	Identify legal requirements	Members advised Database of potential activities created.
4	Collate and maintain a legal register on pertinent legislation for Dolphin Protection and Management Areas, the RAMSAR site, and the Mekong Fishery Biodiversity Management and Conservation Site between Kratie and Stung Treng and advise staff members on particulars	Identify legislation	Register of legislation collated and maintained. Members advised.

## Appendix 5

### Constructing Reproductive Histories from Current and Retrospective Data

Steps toward constructing these reproductive histories from both current and retrospective data include:

- i) Identifying adult females in the population by observation of consistent close association with a calf or retrospectively from necropsy.
- ii) Determining when females are accompanied by calves believed to be their own.
- iii) Monitoring female-calf pairs through time to determine the duration of their association.
- iv) Determining the fate of each calf:
  - Identification of calf following separation (“weaning”) = success
  - Calf disappears during period of association with mother = failure
  - Calf disappears near the age when separation might be expected, but the calf’s fin is not distinctive = fate cannot be determined

#### *Approach and Protocols for determining reproductive histories*

##### *Definitions*

*Calf* = young dolphin from time of birth to time of separation from mother (end of period of dependency, defined as when the calf spends less than 50% time in close proximity to mother)

*Neonate* = a calf within the first few weeks of birth, when fetal folds are evident

*Young-of-the-year* = a calf during the first year of life, a period when most calves are lost

*Juvenile or subadult* = an immature dolphin following separation from mother (“weaning”)

*Adult* = sexually mature, evidenced for females when they are accompanied by their first calf

*Presumed mother* = adult-sized dolphin seen in close association with a young calf on at least three separate field days (consecutive sightings)

##### *Field Research*

- Thoroughly photograph all dolphins seen to document occurrence of calves in close proximity to other individuals. Rapid continuous photographs will be useful to document adult identifications.
- Develop identification catalog of adult females as subset of photo-identification catalog and take this catalog onto the boats.
- As they develop, document distinctive fin markings for calves.
- While on the water, compare real-time photos to the adult female catalog to determine if any adult females are present.
- If females are present, then spend whatever time is necessary to determine/confirm if they are accompanied by a calf.
- Note unusual behaviors or markings on calves.

- Monitoring - attempt to observe and photographically document mothers with calves as frequently as possible. The more often a team is in the field, the more precise the documentation of changes in a female's reproductive status (birth, loss).

### *Retrospective Compilation*

- Photo-ID Archives:
  - Develop reproductive histories for females from the beginning of photo-ID work to the present time through careful examination of photos to determine which adults are consistently in close proximity to calves. If a specific larger individual is seen close to a calf repeatedly on different field days, then tentatively consider this to be the mother unless other evidence refutes this.
  - Progress forward through time specifically looking for the identified mothers and noting when they are or are not seen with calves.
- Strandings:
  - Assign sex to dolphins in photo-ID catalog based on necropsy findings
  - Match stranded adult females and distinctive calves to the photo-ID catalog.
  - Track females back through time in photo-ID data to develop reproductive histories.
  - Examine ovaries and compare evidence of follicular activity to observed reproductive histories.
  - Determine age from examination of growth layer groups in teeth; relate to reproductive histories.
  - Conduct genetic analyses to determine if stranded calves may have belonged to stranded adult females.

### *Integration of Recent and Past Data*

- Develop a timeline for each adult female indicating when she was accompanied by a calf, when she was no longer accompanied by that calf, and when she was first seen with the next calf, etc.
- Indicate if calf was observed after separation from mother (or if it disappeared or was recovered as a carcass).
- Calculate/estimate reproductive parameters described above.
- Determine trends over time.
- Try to identify correlates of changes in reproductive parameters for the population (for example, implementation of River Guard system).

# Appendix 6

## Post Trip Field Trip Report

