Final Report March 20th 2023 for SMM Conservation Award
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Project Title: Developing a necropsy program to determine the efficacy of reducing Mekong River dolphin mortality with a River Guard enforcement and outreach program.

Project Summary: The Mekong River dolphin population in Cambodia is critically endangered, with a population of under 100 individuals, high calf mortality and minimal recruitment. This project aimed to determine the causes of Mekong River dolphin (MRD) mortality, and to assess the efficacy of an established River Guard program to reduce deaths of these animals. The project counted and collected dolphin carcasses and performed necropsies to determine the causes of death of these animals. The River Guard program conducted patrols using local guards who reported the location of dolphins and illegal fishing activities, confiscated gear and enforced dolphin protection. River Guards are police, fisheries officers and representatives from local communities who are trained, equipped and employed to enforce the ban on gillnetting within areas of the river designated as MRD habitat. Local outreach to the community living along the Mekong in dolphin habitat was conducted by River Guards and World Wildlife Fund (WWF) staff to inform villagers of laws banning gill nets and electric fishing, and to describe the natural history and needs of the Mekong River dolphin and its history in Cambodia. The project was led and conducted by Sam Un Eam and the WWF MRD team in Kratie, Cambodia, with necropsy support from F. Gulland through remote training and one on-hands workshop in Kratie, Cambodia. The necropsy program detected three dolphins that were determined to have died from entanglement over 10 days at the end of December 2022. This spate of deaths resulted in considerable media coverage, and heightened awareness of the plight of the dolphins. In January 2023, the prime Minister of Cambodia ordered strict protection of permanent and seasonal protection zones where fishing is to be limited and laws enforced to protect dolphins. This significant order has allowed the Ministry of Agriculture, Forestry and Fisheries to revise the existing sub-decree on the Mekong River Dolphin Management and Protection Zone.

This project enabled the government officers and local WWF staff to identify entanglement as the cause of dolphin deaths, exposed inadequacies in the existing River Guard program, and increased legal protection for dolphins in the Mekong River.

River Guard Program

The Mekong River Guard program was established and is administered by Cambodia's Fisheries Administration (FiA) of the Ministry of Agriculture, Forestry and Fisheries with strong support from WWF-Cambodia. The Guards include government employees, people from local communities and policemen who receive a per diem, and meet regularly with both WWF and FiA staff to coordinate project activities. There are currently 72 river guards stationed at 16 different outposts along the Mekong from Kratie to Stung Treng. 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. The Guards use a tool known as "Spatial Monitoring and Reporting Tool" (SMART) to monitor activities on the river and location of guards. Essential equipment such as boats, boat engines, personal flotation devices, and walkie-talkies have been provided in the past with support from multiple donors including the

Cambodian government and WWF. Over the year of this project, salary was provided to the WWF River Guard program coordinator. In January 2022, the River Guard program was expanded by the acquisition of one boat equipped with GPS. In January 2023, the River Guard program increased night patrols to increase enforcement and legal protection following the deaths of three dolphins in December 2022 detected by the necropsy program.

New long-tail boat engine bought by WWF on the Mekong, January 2023

Necropsy Program

Training

Due to the COVID pandemic, the work plan for this project was modified to accommodate the inability of personnel to travel to or within Cambodia in 2022. During 2022, a combination of online "zoom" meetings and email exchanges was used to conduct necropsy training for the team in Cambodia, and an in-person training workshop was held in January 2023. Due to circumstances on the river in 2020-2022 (disappearance of about 20 animals from specific pools, deaths of individually identified adult animals), the in-person necropsy training workshop was expanded to also include dolphin photo-identification on the river, and a review and update of the existing data in the dolphin identification database (Fin Base).

The in-person necropsy training was held in Kratie January 18-19 2023, following six days of on-water survey for dolphins. A series of lectures on necropsy aims and techniques, and detection of fishery interaction marks, was given by F. Gulland, then a dolphin carcass was dissected with the local team of dolphin researchers and members of the river guard program. Methods for sample collection and storage were explained and samples collected for genetics, toxicology and infectious disease diagnostics. The dolphin was diagnosed as having died following peduncle entanglement in a monofilament line (see photo below).



Necropsy training in Kratie, January 18 2023, and peduncle wound observed in the carcass.

Carcass collection and examination

Throughout 2022, WWF staff responded to any information on dead dolphins and collected carcasses for necropsy examination. Examination of these carcasses was conducted by Sam Un Eam and colleagues, with on line "zoom" support from Frances Gulland and colleagues including Dr. Andrew Brownlow, PhD, MRCVS, Director, Scottish Marine Animal Stranding Scheme, University of Glasgow, and Prof. Sandro Mazzariol, DVM, PhD from Università degli Studi di Padova, Italy (the latter two assisted due to time differences between Cambodia and USA during necropsies, so facilitating real-time suppport).

During 2022, 10 carcasses were examined as soon as possible, with remote assistance from Gulland via zoom. Photographs of the entire animals and close up images of lesions or attached gear were taken using a digital camera, and samples of skin, muscle and blubber were collected and archived in the freezer following a simplified calf mortality investigation protocol developed for this project.


Necropsy training conducted via zoom and cell phone between Cambodia and California during COVID pandemic 2022;
new freezer bought with SMM fund

One carcass was stored at -20°C for examination at a necropsy training workshop with Gulland in person held in Kratie January 2023. Carcass storage was in a new freezer bought with SMM grant funds. The necropsy training workshop was also used as a public outreach opportunity, with findings shared with the community.

Determination of cause of death

During 2022, necropsy training focussed on detecting signs of fisheries interactions on dolphin carcasses. Examples of cuts from monofilament, bruising at pressure points and differences between pre and post mortem bruising were reviewed both by zoom and in person. This training enhanced the local team's ability to detect fisheries interactions as causes of death.
Samples for infectious disease screening, age determination, genetic and toxicological studies were archived in Kratie during 2022, taken to the Institut Pasteur in Phnom Penh in January 2023, and transported to California in January 2023 following CITES and US MMPA regulations. Samples were tested for presence of Brucella *spp*. by polymerase chain reaction (PCR) testing of frozen tissue samples at the University of Illinois, USA, by Dr. K. Colegrove were all negative. Genetic diversity will be examined by Dr Michael McGowen at the Smithsonian Institution, and a broad toxin screen will be performed on blubber samples by Dr Eunah Hoh at San Diego State University.

Sample processing and cost change

Samples were sorted and hand carried by F. Gulland to the USA so no costs were incurred for sample shipping. We thus used these previously allocated funds to buy software to assist with photo-identification of live dolphins and storage capacity for MRD database.

Mortality Rate

From January to December 2022, 11 dolphins were found dead along the Mekong in Cambodia. When compared to annual mortality over the previous decade reported in the records at the WWF office in Kratie, Cambodia, the annual mortality rate had not declined in 2022.

	Cause of Death	Calf	Adult	Total
2022	Unknown	1	1	2
	Fishery associated	3	6	9
2021	Unknown	3	4	7
	Fishery associated	1	1	2
2020	Unknown	5	4	9
	Fishery associated			
2019	Unknown	4	2	6
	Fishery associated	0	2	2

Collection of dolphin carcasses by the river guards and/or WWF personnel

Outreach

Local: Local community people living in villages adjacent to the Mekong River dolphin conservation areas were recruited to the River Guards' law enforcement program, joining patrolling teams and explaining fisheries restrictions to local fishers.

International media: News on any dead dolphins that died due human activities was disseminated to the local newspaper, the Khmer Times, in order to attract more attention to the plight of these dolphins from the public, potential finders and the government. These stories were picked up by the international press, including the Malaysia Times, Aljazeera and the Washington Post. See

https://www.khmertimeskh.com/501208239/conservationist-group-says-10-rare-mekong-river-dolphin-recorded-dead-in-cambodia-in-2022/
and

https://www.aljazeera.com/news/2022/12/8/cambodias-mekong-dolphin-is-dying-despite-efforts-to-save-it

The new decree to protect dolphins was reported nationally see

https://www.khmertimeskh.com/501246824/royal-government-designates-mekong-river-dolphin-management-area/https://www.khmertimeskh.com/501246824/royal-government-designates-mekong-river-dolphin-management-area/

Uses of funds

PI Gulland's time for this project and travel were supported by the Marine Mammal Commission. Laboratory analyses of samples collected at necropsy are funded by "in kind" donations from the collaborating laboratories performing the analyses.

Funds from the SMM conservation fund were used to support the River Guard program coordinator, a boat and equipment, and the dolphin necropsy program manager in Kratie, see Table below. The remaining $ 3,000 at the time of this final report will be used for continued local travel for river guards to collect carcasses and local veterinary team support

Outcomes of the project

1. The WWF Mekong River dolphin research team in Kratie improved their necropsy technique using standard protocols, and are better able to identify entanglement as a cause of mortality when examining dolphin carcasses.
2. Identification of nine dolphin deaths due to fisheries interactions in December 2022 resulted in the development of a new Cambodian government sub-decree to restrict use of gill nets and monofilament line in the dolphins' range, increased coverage of the river by river guards, and raised considerable public awareness due to national and international press coverage.
3. Development of collaborations at multiple laboratories will further understanding of the contributions of genetics, toxin exposure and infectious diseases to dolphin mortality.
4. Local people living in villages adjacent to the Mekong River were made more aware of the negative impact of illegal and destructive fishing activities on dolphins, especially use of gillnets.
5. Night patrolling activities by the River Guards to eliminate illegal gillnet use, electric fishing and other destructive fishing practices were re-instated in 2023. The number of carcasses detected with entanglement lesions in 2022 highlighted the inadequacies in the river guard program that was overwhelmed by increased illegal fishing during COVID, presumably due to the hardships faced by local communities.

Budget Worksheet: SMM Conservation Fund Grant in USD

Budget Item	Unit		Proposed Expenditures from SMM	Actual Expenditures	Details and comments
Personnel		**$**	**12,500.00**	**$ 12,880.18**	Salaries paid by WWF
Primary Investigator					
Kratie Field Research Assistant	1	$	6,500.00	$ 12,880.18	
Stung Treng Field Research Assistant	1	$	6,000.00		
Veterinarian Gulland	8%	$	-		No charge for time
Equipment (>$1000 US)		**$**	**4,000.00**	**$ 3,856.96**	
Freezer	1	$	1,000.00	$ 675.00	
Boat for river guards	1	$	3,000.00	$ 3,181.96	
Supplies		**$**	**1,500.00**	**$ 1,381.06**	Used for necropsies
Laboratory supplies					
Computer software		$		1	
Travel		**$**	**1,500.00**	**$ 715.25**	Paid by WWF
Local travel (collection of dolphin carcass) x $150 per trip x 10 trips		$	1,500.00	$ 715.25	
Veterinarian travel to Cambodia (Round trip USA-Cambodia air ticket)		$	-		funded by Marine Mammal Commission
Rental office and lab space Kratie		**$**	**1,000.00**	**$ 204.56**	Paid by WWF
Sample processing fees		**$**	**2,000.00**	**$63.61**	Request to use for photo management software instead as Gulland hand carried samples so no cost
Shipment of samples to overseas laboratory		$	2,000.00	$63.61	
WWF Institutional indirect costs**	10%	**$**	**2,500.00**	**$ 2,500.00**	
WWF Institution		$	2,500.00		
TOTAL COST		**$**	**25,000.00**	**$ 21,901.62**	