KRATIE DECLARATION ON THE CONSERVATION OF THE MEKONG RIVER IRRAWADDY DOLPHINS

January 12, 2012

Kratie Town, Cambodia

1. We, the Commission for Dolphin Conservation and Development of Mekong River Dolphin Ecotourism Zone, the Fisheries Administration of the Ministry of Agriculture, Forestry and Fisheries, and the World Wide Fund for Nature, jointly declare our commitment to work together to conserve Irrawaddy dolphins in the Mekong River of Cambodia including the transboundary dolphin group shared with Lao PDR.
2. We recognize:
   - Irrawaddy dolphins are an important part of Cambodia's magnificent natural heritage that must be protected for the enjoyment and benefit of future generations;
   - the global importance of Irrawaddy dolphins as one of only seven species of freshwater dolphin in the world;
   - the Mekong River sub-population of Irrawaddy dolphins is red-listed as Critically Endangered, the highest International level of concern, by the International Union for Conservation of Nature (IUCN);
   - the Irrawaddy dolphin is one of 58 endangered aquatic species in Cambodia and fully protected under Cambodian Law; and
   - that despite strong efforts to conserve this sub-population by the Commission for Dolphin Conservation and Development of Mekong River Dolphin Ecotourism Zone, the Fisheries Administration, and the World Wide Fund for Nature, and a possible decline in the mortality rate in recent years, the population is small and in imminent danger of extinction.
3. We acknowledge:
   - the importance of Irrawaddy dolphins as a principal tourist attraction in North-Eastern Cambodia, and the importance of dolphins to the economies of Kratie and Stung Treng provinces;
   - the urgent need for coordinated and sustained efforts from multiple agencies of government at all levels to ensure effective implementation of dolphin conservation strategies, and
   - the need for the participation and support of local communities with due consideration of their rights and opinions.
4. We recognize and endorse the findings and recommendations of the Mekong Irrawaddy Dolphin Conservation Workshop held in Kratie on January 10-12, 2012 and commit to developing a strategy for collaborative implementation of these recommendations by April 30, 2012. The findings and recommendations from the workshop are attached to this document as Appendix 1, based on the full findings and recommendations from working group reports in Appendices 2 and 3.
5. We commit to a partnership to implement these recommendations that includes: information sharing, mutually supportive fundraising, policy review and development, effective law enforcement, peer-reviewed scientific investigation, support for alternative livelihoods, and collaboration with relevant stakeholders.
6. We request the continued support of national and international experts and development partners to achieve this aim and agree to re-convene in January 2013 to review progress on implementing the key workshop recommendations.

Prepared and signed on this, the 12th day of January, 2012 in Kratie, Cambodia.

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Attachments:

Appendix 1: Recommendations from the Mekong Irrawaddy Dolphin Conservation Workshop

Appendix 2: Findings and recommendations from Group 1 (Veterinary pathology and mortality)

Appendix 3: Findings and Recommendations from Group 2 (populations dynamics, demography, behavior, ecology and management)

APPENDIX 1

Kratie, 12-01-2011

Recommendations summary

Mortality

1. *Necropsy examinations should be conducted as swiftly as possible by expert marine mammal veterinarians pathologists and biologists, and attended by local Cambodians working with management and fishing communities.*

2. *Necropsy sessions should be led by expert marine mammal veterinarians pathologists and biologists, and attended by local Cambodians working with management and fishing communities. Whenever possible, sessions should be attended by a Cambodian veterinarian to create national expertise. Hold necropsy training workshops within 6 months.*

3. *When river guards find a carcass they will photograph it where it is found, photographing the body from both sides and taking detailed photographs of the neck area. Training should be provided on this. The carcass will be then transported to the WWF freezer facility to ensure swift high quality investigation.*

4. *Samples should be shipped to appropriate laboratories as soon as possible and ensure samples are maintained in high quality condition; permits for export, including CITES, should be kept in place for efficient export to supporting laboratories.*

5. *Freezers should have back-up generators to ensure safety of carcass storage. Use of liquid nitrogen should be considered to enhance sample storage capabilities.*

6. *Necropsy studies , data collected to date and sample archiving should coordinated and synthesized by a coordinator dedicated to this work.*

7. *Samples collected to date, including bones, teeth, and paraffin embedded and frozen tissues should be inventoried and stored in safe archiving sites.*

8. *The necropsy protocol should be reviewed and updated. Attention to asepsis and minimizing cross contamination of samples should be undertaken during post mortem examinations, and broader samples retained.*

9. *Live animal studies should be integrated with necropsy studies to determine if a mother of a dead calf is still alive.*

Neck Marks

10. *Thoroughly photo-document cervical area (neck) over time from the moment the animal is first found to necropsy.*

11. *Determine the association between characteristics of neck mark and stage of decomposition by reviewing photographs and coding both.*

12. *Continue detailed necropsy examinations of perinatal animals to further characterize developmental stage and nutritional status of calves, and other lesions.*

Contaminants

13. *Samples should continue to be collected and archived from stranded animals for toxicological analyses.*

14. *Samples that have already been analysed should be inventoried and preserved rather than disposed of by collaborating with institutions that can archive them for no cost.*

Population Dynamics & Demography

15. *Current photo-ID surveys should be continued to provide data which can be used to estimate abundance and vital rates.*

16. *The Beasley photo-ID catalog (2003-2007) should be combined with the WWF catalog, explicitly to look at recruitment to and losses from the population over a longer historical time period.*

17. *Estimate ages from all specimens for which teeth are available to generate an age and sex distribution of dead animals and develop and age-length curve.*

18. *Use laser photogrammetry of live animals in the field to obtain information on the distribution of size (age) classes in the population.*

19. *Use remote biopsy sampling of live animals to obtain population-level information on: sex ratio; genetics; contaminant levels; reproductive hormones; stress hormones; and lipid levels.*

20. *An individual-based demographic model should be constructed to guide future management efforts.*

Behaviour & Ecology

21. *Future field research should pay particular attention to the identity of females accompanied by calves, so that reproductive histories of individual females can be constructed.*

22. *A behavioral study should be conducted during the calving season to describe interactions between mothers and calves.*

23. *Although there is no published evidence that electro-fishing is a lethal threat to dolphins in the Mekong, this type of fishing cannot be ruled out as a source of calf mortality (either fetal or newborn). Concerted enforcement to reduce illegal electro-fishing is required as a precautionary measure, even while further efforts are made to understand the frequency with which this technique is used in the Mekong, how (and if) it affects dolphins, and whether the practice is increasing in extent or frequency.*

Management

24. *To better understand the status of the very small transboundary group of dolphins at the border of Cambodia and Lao PDR, all available data and information should be examined to describe and evaluate this group's current abundance and demography.*

25. *The Dolphin Commission, the Fisheries Administration and WWF should work together:*

    - *to compile basic scientific, conservation, and management information on Irrawaddy dolphins and use that material to prepare outreach materials in Khmer, English, and other languages for both Cambodian and international tourists,*

    - *provide support to review existing regulations and develop new regulations to eliminate gillnet entanglement,*

    - *to minimize or eliminate gillnet entanglement related mortality through effective law enforcement and monitoring, and*

    - *to train and equip national staff and local communities to implement the recommendations of this workshop.*

Appendices list

Appendix 2: Group 1 report, findings & recommendations

Appendix 3: Group 2 report, findings & recommendations

APPENDIX 2: Findings and recommendations from Group 1 (veterinary pathology and mortality)

Sections

I: Group 1 Break out session report: Review of Causes of Dolphin Mortality

II: Necropsy report summary (Ref number: CID11-005)

I: Group 1 Break out session report: Review of Causes of Dolphin Mortality

Adult mortality

Review of records from 46 adult carcasses identified human interaction as the cause of death (primary diagnosis) in 17 cases. Fifteen of these cases were attributed to gill net entanglement. Causes of death could not be determined in 27 cases, sometimes because no necropsy had been performed. One animal was severely malnourished and had severe dental attrition, and one animal had an abdominal abscess.

Mortality of Calves/Newborns/Fetuses

Review of records from 66 perinatal carcasses indicated the cause of death in 4 cases may have been human interaction: 3 potentially died due to gill net entanglement, 1 died in a bamboo fence (as reported in the data sheet, details not available). Cause of death in 61 cases could not be determined.

Plot of weight to length ratios for stranded animals suggests a focus of mortality at animals between 90 and 110 cm. Half of the carcasses were in this range, representing perinatal animals. Two animals were shorter than 40 cm and weighed less than 2 kg, indicating they were premature (fetal) animals.

There was interannual variation in documented calf mortality, which increased from 2001 to 2006, peaked in 2006-2007, then declined again. Such changes in numbers of reported animals could reflect changes in effort, reporting, effects of management, birth rates or true changes in mortality rate amongst years.

Conclusion and Recommendations

Based on post mortem examinations, gill net entanglement is the main cause of death of adult Mekong dolphins. In contrast, cause of death for the majority of dolphins that died around the time of birth could not be determined.

To improve understanding of the causes of mortality, all carcasses need to be initially examined as soon as possible after death (when at least decomposed as possible) and as thoroughly as possible by experts in marine mammal necropsy procedures. Necropsy should not only focus on disease processes, but also on life history parameters (age,

reproductive stage etc). Sessions should be used as educational and outreach opportunities.

Necropsy sessions should be led by expert marine mammal veterinarians and pathologists, and attended by local Cambodians working with management and fishing communities. Whenever possible, sessions should be attended by a Cambodian veterinarian to create national expertise. Such sessions would ensure the highest quality necropsy, provide training of local people and outreach opportunities. They would also ensure two-way flow of information, from local people about the animals and the environment in which they were found to the prosector, and about the necropsy findings to the local authorities and communities.

Specifically, when river guards find a carcass they will photograph it where it is found, photographing the body from both sides and taking detailed photographs of the neck area. The carcass will be then transported to the WWF freezer facility and maintained at -20 C until the next necropsy workshop. The first necropsy training workshops should be held at about 6 months from now, and results evaluated to determine the frequency of future training workshops. Once necropsies have been performed, export of samples for further analyses should be expedited, and attention paid to ensure sample quality is maintained during transport.

Permits for export, including CITES, should be kept in place for efficient export to support laboratories.

Freezers should have back-up generators to ensure safety of carcass storage. Use of liquid nitrogen should be considered to enhance sample storage capabilities.

Necropsy studies, carcass recovery, data synthesis and sample archiving should be coordinated by a coordinator dedicated to this work.

Samples collected to date, including bones, teeth, and paraffin embedded and frozen tissues should be inventoried and stored in safe archiving sites.

The necropsy protocol should be reviewed and updated. Attention to asepsis and minimizing cross contamination of samples should be undertaken during post mortem examinations.

To better understand causes of perinatal mortality, there should be increased effort specifically dedicated to observation of live adult female-calf pairs.

Live animal studies should be integrated with necropsy studies to determine if a mother of a dead calf is still alive.

Neck Marks

Many dolphin carcasses have variable marks around the neck area, the cause of which has been debated. In some adults, neck lesions have been determined to be caused by gill net entanglement when other lesions consistent with gill net entanglement are observed on the rest of the body. However, neck marks vary in characteristics, typically

being a diffuse purple color in the ventral cervical area of varying size and shape. Here we discuss those not clearly resulting from gill net entanglement.

Potential causes of neck marks are:

1. Normal species-specific feature that results in post mortem artifact
2. Lesion
    a. Traumatic
        i. Dystocia (abnormal birth process)
        ii. Entanglement (nets, monofilament, trap)
        iii. Intraspecific interaction
    b. Infectious

To differentiate these, the group discussed characteristics that would be expected in association with each potential cause of the mark.

1. A neck mark in the same region but differing in color (appears as a fold, not discoloured) is present in live animals.
   Post mortem neck mark varies considerably amongst animals, is not a specific, characteristic mark.
   Neck mark is mainly in code 3-5 animals
   One photo series by Dove shows neck mark appears as animal decomposes.

2. a)Trauma

   Histological examination should reveal hemorrhage in underlying tissues

   -Need to determine life stage of perinate: premature, full-term still birth, full-term breathed not suckled, full term suckled,
   -A feature of dystocia in other species is subcutaneous hemorrhage over the skull, which was not documented to date in neonates in the Mekong.

   b)Infectious:

   -Lack of histological evidence of inflammation indicates that bacteria, such as *Aeromonas hydrophila*, are post mortem invaders

Conclusion and Recommendations

In some adults, neck lesions are caused by gill net entanglement. An area of skin discoloration exists in the ventral cervical area (neck area) of some dolphin carcasses that varies in precise location, shape, extent, uniformity and color and is not clearly associated with gill net entanglement. Changes in tissues of the neck area occur post mortem, so discoloration should be interpreted in light of the stage of decomposition and presence of other marks and lesions. To date, for the animals examined histologically, the lack of evidence of inflammation and the difficulty in determining the exact stage of development of the perinate, suggest that the marks observed are post mortem changes. However, causes of trauma that may predispose to post mortem change in the neck area should be considered, e.g : traumatic death. Furthermore, post

mortem changes may resemble lesions from a variety of causes, so care must be taken to examine the whole animal when interpreting photographs of the neck area.

Specific actions to clarify the etiology of the cervical marks are:

1. Thoroughly photo-document cervical area over time from the moment the animal is first found to necropsy.
    a. Ensure real time, efficient, effective carcass recovery
    b. Train and equip river guards to photograph animals immediately in the location of first contact.
2. Determine the association between characteristics of neck mark and stage of decomposition by reviewing photographs and coding both.
3. Increase observations of live adult females during the calving season to determine if there is normal birth and nursing occurring. Abnormalities during birth or trauma to the calf that could cause the neck marks could be observed.
4. Continue detailed necropsy examinations of perinatal animals to further characterize developmental stage and nutritional status of calves, and other lesions.

Contaminants

A comparison of contaminant data from Mekong dolphins with data from other species of marine mammals indicates that levels of blubber sum PCBs, dioxins, DDTs and heavy metals are low compared to values in other studies. However, data are overdispersed (a few animals very different from the mean), with two animals with sum DDTs values that are relatively high compared to the mean. Apart from these animals, the group concluded that levels were not likely to be associated with acute mortality as they were low compared to values in blubber of other marine mammal species not suffering high mortality rates. The group examined the available data for the four animals with the highest sumDDT levels in detail to attempt to determine if contaminant exposure could have contributed to their deaths. These are summarized below:

> CID 09-001: code 3 juvenile female 127 cms, bacterial pneumonia associated with beta hemolytic streptococcus, missing flukes. Cause of death considered to be the severe bacterial infection, potentially associated with fluke removal during life.
>
> OBRE 05-06/01: adult male, no necropsy data available.
>
> OBRE 05-16/12: 106 cm female calf, no necropsy data available.
>
> CID 07-010: 224 cm female, large uterus, no further necropsy information available.

The data from these four animals were too limited to contribute to understanding whether or not contaminants played a role in mortality of these animals.

As high levels of legacy compounds in blubber of young animals are likely due to maternal transfer, perinatal blubber values might be used to determine whether or not an animal has suckled.

Although current values of contaminants are not of immediate concern, historical levels of contaminant exposure, especially to DDTs, could have played a role in dolphin population declines. The potential for gold mining and dredging to alter contaminant exposure in the future indicates samples from stranded animals should continue to be archived for potential future analyses.

Decomposition alters blubber lipid levels, and thus contaminant levels in blubber.

Conclusions and Recommendations

Levels of sum PCBs, dioxins, DDTs and heavy metals in Mekong dolphins are relatively low, except for DDTs in few individuals, and not likely to be associated with acute mortality.

Samples should continue to be collected and archived from stranded animals for toxicological analyses.

Samples that have already been analysed should be inventoried and preserved rather than disposed of by collaborating with institutions that can archive them for no cost.

II: Necropsy report summary (Ref number: CID11-005)

Yesterday afternoon Group 1 took the bus to see the Mekong dolphin located at the HAB21 building, Kratie. The dolphin was found wrapped in a large section of gillnet on 7th Dec 2011 at Samba Commune, Samba District. All the members of Group 1 examined the dolphin externally and a sub-group including Drs. Antonio Fernandez, Paul Jepson, Yuko Tajima and Professor Yamada conducted the necropsy collectively with four colleagues from Cambodia and two from Japan. The animal was a (sub-)adult male (body-length = 190cm) in code 4 (advanced condition). The dolphin was found to be in good nutritive condition and still completely wrapped in a large section of gillnet (net mesh diameter = 13-14cm). The skin was severely sloughed but there were numerous cutaneous depressions on the head and anterior thorax associated with the gillnet. The animal had a large bruise in the melon (deep in the mid-ventral part) and the stomach was full with recently ingested fish of different sizes. Despite the state of decomposition the dolphin appeared free of parasites or any other significant lesions. The cause of death was confirmed as human interaction (gillnet bycatch).

APPENDIX 3: Findings and recommendations from Group 2 (population dynamics, demography, behavior, ecology and management)

Sections

I: Mekong Dolphin Conservation Workshop Group 2 Report
II: Field report from 11 January

I: Mekong Dolphin Conservation Workshop Group 2 Report

Abundance

The Workshop reviewed Ryan *et al*. (2011) and strongly supported the conclusions of this paper regarding the number of marked individuals in the Mekong dolphin population. During discussion, however, workshop participants questioned how a population of 85 individuals was able to produce such a relatively large number of calves (*e.g*. 16 and 12 stranded perinatal animals in 2006 and 2007, respectively). Two possibilities were considered:

(1) The proportion of unmarked animals used to generate the population estimate was negatively biased;

or

(2) The age structure is highly skewed to adult animals.

The first possibility seems unlikely. Ryan and colleagues worked with independent researchers to validate the methods used to identify individual dolphins. Furthermore, Ryan met with Beasley to cross-match individuals from their respective photo-identification catalogs. A bias could exist with respect to differential capture probabilities of very young animals, but such a bias is very unlikely to account for the exceptionally high proportion of marked animals (0.91 – 0.96). Another possibility is that a portion of the population in tributary rivers was not sampled and thus not included in the surveys. However, local researchers considered this unlikely due to the small size of the tributaries and the fact that the dolphins there likely would have been reported by local people.

Workshop participants concluded that it was more likely that the age structure of the population is skewed to older individuals as a result of very low rates of recruitment in recent years. This is consistent with the findings of Ryan et al. (2011) with respect to recruitment rates. Such a skewed age structure would have serious implications for the viability of the population of dolphins in the Mekong River. To address this hypothesis, therefore, the Workshop recommended the following suite of research approaches:

1. Current photo-ID surveys (as described in Ryan et al. 2011) should be continued to provide data which can be used to estimate abundance, vital rates, and temporary movements into and out of the study area.

2. The Beasley catalog (2003-2007) should be combined with the WWF catalog, explicitly to look at recruitment to and losses from the population over a longer historical time period (including photographic identification of dead individuals). Rates of loss of identified individuals should be compared to current estimates of loss as a further test of the current thinking about population trend. It would be useful to explore an additional analysis of abundance over this time series, although this might require an alternative modeling approach.

3. Estimate ages of all specimens for which teeth are available to generate an age and sex distribution of dead animals and to develop an age-length curve for application to field studies. Some specimens may have already been processed at the Southwest Fisheries Science Center in La Jolla, USA, and the Workshop recommended that future teeth be processed at that Laboratory.

4. In addition, reproductive tissues should be sampled (testes) or collected whole (ovaries) and analyzed to determine maturity, assess reproductive seasonality, evaluate corpora for estimating reproductive rates, and generate estimates of age at maturation from necropsy material and from the age analysis of teeth mentioned above.

4. Use laser photogrammetry of live animals in the field to obtain information on the distribution of size (age) classes in the population. This sampling could occur during photo-ID surveys (see Appendix 1).

5. Use remote biopsy sampling of live animals to obtain population-level information on: sex ratio; genetics; contaminant levels; reproductive hormones; stress hormones; and lipid levels. This sampling should be conducted by trained personnel, with routine photo-ID of the biopsied animals (see Appendix 1). A short pilot program (perhaps several weeks) should be conducted with a few animals in a readily accessible area in order to confirm that there are no adverse health effects of this sampling technique. This effort should be accompanied by an outreach program designed to inform local people and tourists of the value of the sampling.

6. An individual-based demographic model should be constructed to guide future management efforts (e.g. Thompson et al. 2000). The data on age and stage structure of the population obtained from the research techniques described in these recommendations should be used as input to this model.

Behavior & Ecology

1. Future field research should pay particular attention to the identity of females accompanied by calves, so that reproductive histories of individual females can be constructed. Dolphin-watch guides, river guards and tourists could also be encouraged to contribute data, for example in the form of photographs of individual dolphins. An ancillary benefit of this is that it would assist awareness raising efforts.

2. A behavioral study should be conducted during the calving season to describe interactions between mothers and calves. Systematic focal animal behavioral observations combined with concurrent acoustic recordings would allow assessment of maternal behavior. This study would help determine whether the mortality of calves is due to: social factors such as infanticide or mobbing; human disturbance; or other factors. The photo-ID surveys could be used, as could reports from river guards and tourboat operators, to guide behavioral research efforts to areas where calves are present. Attempts should be made to observe nocturnal behavior and evaluate the potential for disturbance due to electrofishing or other factors.

3. Although there is no published evidence that electro-fishing is a lethal threat to dolphins in the Mekong, this type of fishing cannot be ruled out as a source of calf mortality (either fetal or newborn). Concerted enforcement to reduce illegal electro- fishing is required as a precautionary measure, even while further efforts are made to understand the frequency with which this technique is used in the Mekong, how (and if) it affects dolphins, and whether the practice is increasing in extent or frequency. In addition, reports on impacts of electro-fishing on dolphins in other areas (e.g. Myanmar) should be reviewed and evaluated.

Management

1. To better understand the status of the very small transboundary group of dolphins at the border of Cambodia and Laos, all available data and information should be examined to describe and evaluate this group's current abundance and demography.

2. The Dolphin Commission, the Fisheries Department, and WWF should work together to compile basic scientific, conservation, and management information on Irrawaddy dolphins and use that material to prepare outreach materials in Khmer, English, and other languages for both Cambodian and international tourists. This outreach effort would be expected to help build support both within Cambodia and internationally for strengthened conservation of the dolphins.

The Working Group recognized the value of having a presence on the water, both to help raise the profile of the dolphins and to detect and deter illegal activity.

References

Ryan, G.E., Dove, V., Trujillo, F. and Doherty, P.F. Jr. 2011. Irrawaddy dolphin demography in the Mekong River: an application of mark-resight models. Ecosphere 2(5) (Article 58), p 1-15.

Thompson, E.M., Wilson, B., Grellier, K. and Hammond, P.S. 2000. Combining power analysis and population viability analysis to compare traditional and precautionary approaches to conservation of coastal cetaceans. Conservation Biology 14(5):1253-1263.1

II: Field report from 11 January

On the afternoon of 11 January Wells, Smith, and Read accompanied Ryan and Chanveasna in the field and spent two hours with dolphins at the deep pool in Kampi. The purpose of the trip was to evaluate the feasibility of three field methods discussed earlier that day by the participants of Group 2: laser photogrammetry, remote biopsy sampling with photo-identification, and focal behavioral sampling of mothers and calves. The team also deployed a hydrophone briefly to listen for dolphin vocalizations and ambient sounds. The field team encountered a number of dolphins, including at least one dependent calf, a juvenile and two or three identifiable adults, including two identified in the same area on 9 January.

The field team concluded that all three sampling methods were feasible in this field setting. On at least 18 occasions during the two hours dolphins approached closely enough (within 25 m) to allow biopsy attempts; on at least four of these encounters animals approached closely enough (within 15 m) and were oriented perpendicular to the observer so that laser photogrammetry could have been used. Group structure was quite fluid, complicating focal animal sampling, but the field team concluded that the method was feasible, especially if a calf was chosen as the focal animal, the researchers are familiar with the identity of the dolphins (which will take some time), and the vessel operator is responsive to the instructions of the researchers for optimal positioning relative to the animals. The Kampi location also affords excellent opportunities for land-based observation, such as theodolite tracking of individual movements and spacing. Finally, echolocation was heard frequently during the brief listening period, concurrent with surface observations of repeated spitting by one of the large animals identified first on 9 January. Fish calls were also heard, likely from the smallscale croaker *Boesemania microlepis* (Baird *et al*. 2001).

Reference

Baird, I.G., B. Phylavanh, B. Vongenesouk, and K. Xaiyamanivong. 2001. The ecology of the smallscale croaker *Boesemania microlepis* (Bleaker 1858-59) in the mainstream Mekong River, southern Laos. Nat. Hist. Bull. Siam Soc. 49:161-76.