

**Workshop Report:**  
**Addressing bycatch in artisanal gillnet fisheries**  
**Compiled by Mike Simpkins, NOAA Fisheries**

While most of the research and development of bycatch reduction methods is focused in developed nations and commercial fisheries, some of the most severe coastal gillnet bycatch challenges are likely to be found in artisanal gillnet fisheries in developing nations. Efforts to address challenges in these coastal regions are stymied by a lack of information on the extent of the bycatch problem and the status of the species affected, as well as by social, cultural and economic factors that can cause artisanal fishing communities to resist implementing mitigation measures. At the 2011 biennial meeting of the Society for Marine Mammalogy, the Consortium for Wildlife Bycatch Reduction and NOAA Fisheries hosted a workshop and included experts currently working on marine mammal or related bycatch issues in artisanal fisheries in developing nations. Workshop participants identified key informational needs and initial actions required to address marine mammal bycatch in artisanal gillnet fisheries; identified regions, fisheries, or situations that are ripe for action; and provided recommendations for a follow-on workshop to be held in late 2012 that will focus on catalyzing action to address bycatch in one or more artisanal gillnet fisheries.

**Workshop Report**

**Addressing bycatch in artisanal gillnet fisheries**

**26 November 2011, Tampa, Florida**

Fisheries bycatch is an immediate and major threat to many marine mammal populations. In some cases, bycatch reduction devices or practices have been shown to mitigate the bycatch of non-target species, but the problem is growing at a rate that outpaces progress in finding solutions. While most of the research and development of bycatch reduction methods has taken place in Europe, North America, Australia, and New Zealand and has focused on commercial fisheries, some of the most severe bycatch challenges involve artisanal or small-scale gillnet fisheries in Latin America, Asia, and Africa. Efforts to address the challenges in the coastal waters of those regions are stymied by a lack of information on the scale of the bycatch problem and the status of the species or populations affected, and often by a lack of understanding of the socio-economic drivers that lead to high-bycatch fishing practices.

On 17-21 October 2011, a group of experts on tools and approaches to marine mammal bycatch mitigation in gillnet fisheries was convened in Woods Hole to assess the state of the art and develop recommendations regarding best practices, including identification of research priorities for the future. A report of that workshop is currently being drafted, and the workshop organizers intend to publish its proceedings as a series of articles in a special issue of a peer-reviewed scientific journal, such as *Endangered Species Research*. Further information regarding the workshop is available online at: [http://www.bycatch.org/marine\\_mammal\\_gillnet\\_bycatch](http://www.bycatch.org/marine_mammal_gillnet_bycatch).

On 27 November 2011, we convened a group of experts with direct experience assessing and addressing bycatch of marine mammals in gillnet fisheries in many regions (see List of Participants in Appendix 1). The focus of this workshop was on artisanal or small-scale fisheries in the developing world.

The workshop began with a series of introductory presentations (see Agenda in Appendix 2). Mike Simpkins (NOAA Fisheries, US) welcomed participants, provided an overview of the goals of the workshop, and described how the workshop fit into the context of broader efforts to address the issue. Tim Werner (Consortium for Wildlife Bycatch Reduction, US) then presented a summary of the October workshop on gillnet bycatch mitigation tools and approaches. Grant Murray (Vancouver Island University, Canada) then provided an overarching social science perspective on ways to assess and address bycatch in small scale fisheries, with a particular focus on understanding the drivers of fishing behavior. Grant briefly described some methods for assessing bycatch in these types of fisheries, beginning with a focus on understanding overall fishing practices. He also discussed the need to understand the dynamics of the fishery from an operational standpoint, including the ecological conditions that influence fishing practices (that sometimes lead to bycatch), the economic conditions of the fishing communities and households, the socio-cultural context of the fishery – including values and attitudes about marine mammals and bycatch, the relevant governance regime, any relevant interactions with competing uses of marine resources, and available infrastructure and technology relevant to the fishery. With respect to addressing or mitigating bycatch, Grant described the need to design solutions that appropriately fit the problem and local context, with particular focus on ensuring that the solution addresses the underlying drivers of the behavior that leads to bycatch.

Following the introductory presentations, participants working in Latin America, Asia, Europe, Africa, and the Indian Ocean shared their experiences and identified key factors that had influenced the success

and failure of their efforts (see Appendix 3 for summaries). The group then discussed the full suite of summaries and identified several high priority topics to pursue via future workshops or other efforts.

### **High Priority Topics to Pursue as the “Next Step” in Addressing Gillnet Bycatch of Marine Mammals**

- Development and sharing of assessment tools
  - Where little or no information is available – develop and share methods to assess magnitude of bycatch (including assessing fishing effort)
  - Where some information is available – develop and share methods to assess the impact of bycatch (including characterizing fishing behavior and practices)
  - Where some mitigation tools exist or have been tested – develop and share approaches for “scaling up” mitigation efforts from pilot/experimental to fishery-wide (e.g., by engaging a broader range of stakeholders)
- How to address bycatch in illegal fisheries (e.g., Caspian seal bycatch in illegal sturgeon fishery)
- How to address bycatch of critically endangered species (where zero mortality is required)
- How to address intentional “bycatch” (e.g., for bait, household consumption, or bushmeat market)
- Identifying next steps and attracting funding for a given region/issue (i.e., workshop on next steps with funders invited)
- Engaging gear engineers (and fishermen) in developing alternative gears and/or switching to alternative gears

Eight participants volunteered to work with the steering committee to identify and prioritize actions related to the identified topics. We anticipate convening at least one regional or international workshop in 2012 to pursue one or more of the topics, and we likely will support efforts to incorporate gillnet bycatch assessment and mitigation discussions at other upcoming workshops and conferences in 2012 – such as the SOLAMAC (Sociedad Latinoamericana de Especialistas de Mamíferos Acuáticos) Conference in October 2012 and/or an Indian Ocean cetacean workshop that is currently being developed. Of particular interest would be workshops that bring together experts actively working in the field on gillnet bycatch issues and social scientists (e.g., anthropologists, geographers, economists) who have developed and tested tools for assessing and characterizing fisheries, bycatch, and the social and economic drivers that influence the behavior of fishermen engaged in these types of fisheries.

### **Acknowledgments**

Many thanks to the steering committee for their efforts in designing and carrying out this workshop – Mike Simpkins (Chair), Tim Werner, Grant Murray, Simon Northridge, Bill Perrin, Andy Read, and Randy Reeves. Thanks also to the Society of Marine Mammalogy and the many volunteers who assisted in facilitating this and other workshops alongside the Society’s conference. Funding and other support was provided by NOAA Fisheries Office of International Affairs and the New England Aquarium’s Consortium for Wildlife Bycatch Reduction. Most importantly, thank you to the participants and colleagues who provided the attached bycatch summaries and shared their expertise and experience in working on the

difficult problem of artisanal and other small-scale gillnet fishery bycatch of marine mammals.

## APPENDIX 1

### Addressing bycatch in artisanal gillnet fisheries – Participants

Jo Marie Acebes	Balyena.org, Philippines
Joanna Alfaro-Shigueto	ProDelphinus, Peru; University of Exeter, UK
Susana Cárdenas Alayza	Punta San Juan Project, University of British Columbia, Canada
Dr. Omar A. Amir	Ministry of Livestock and Fisheries, Tanzania
Elena Andrievskaya	Marine Mammal Rehabilitation Center, St. Petersburg, Russia
Isidore Ayissi	Cameroon Marine Biology Association (ACBM)
Carolina Bertozzi	Projeto Biopesca, Brazil
Pablo Bordino	Fundacion Aquamarina, CECIM, Argentina
Gill Braulik	University of St. Andrews, UK
Sal Cerchio	Wildlife Conservation Society, Madagascar
Lilia Dmitrieva	University of Leeds, UK
Louella Dolar	TMRC and Silliman University, Philippines
Leonardo Flach	Instituto Botocinza, Brazil
Simon Goodman	University of Leeds, UK
Jeremy Kiszca	Southwest Indian Ocean Fisheries Project (SWIOFP), France
Donna Kwan	UNEP, CMS, Abu Dhabi
Kristy Long	NOAA Fisheries, US
Jeffrey Mangel	ProDelphinus, Peru; University of Exeter, UK
Juliana Marigo	Projeto Biopesca, Brazil
Jeff Moore	NOAA Fisheries, US
Grant Murray	Vancouver Island University, Canada
Doris Oliva	Univesidad de Valparaiso, Chile
Alessandro Ponzo	Physalus, Philippines
Andy Read	Duke University, US
Randall Reeves	Okapi Wildlife Associates, Canada
Lorenzo Rojas-Bracho	Instituto Nacional de Ecologia, Mexico
Howard Rosenbaum	Wildlife Conservation Society, US
Enrique Sanjurjo	World Wildlife Fund, Mexico
Marcos Santos	Instituto Oceanografico, Universidade de Sao Paulo, Brazil
Eduardo Secchi	Universidade Federal do Rio Grande, Brazil
Mike Simpkins	NOAA Fisheries, US
Joanna Toole	World Society for the Protection of Animals, UK
John Wang	Formosa Cetus Research and Conservation Group, Canada
Tim Werner	Consortium for Wildlife Bycatch Reduction, US
Tara Wight	Rescan Environmental Services, Ltd., Canada
Nina Young	NOAA Fisheries, US

## APPENDIX 2

### Addressing bycatch in artisanal gillnet fisheries – Agenda Saturday 26 November 2011: 08:00-12:00

1. Introductory Presentations [40 min]
  - a. Greeting and Introduction to Workshop [Mike Simpkins – 10 min]
  - b. Synopsis of findings from October Gillnet Mitigation workshop [Tim Werner – 10 min]
  - c. Presentation on small-scale/artisanal fisheries from a social science perspective with a focus on the drivers of fishing behaviour and how they influence bycatch interactions and the likelihood of altering fishing practices [Grant Murray – 20 min]
2. Brainstorm/Round-Robin Discussion on Factors that Influence Success or Failure in Assessing or Addressing Gillnet Bycatch [90 min]

Workshop participants will share their experience on implementing bycatch assessment or mitigation projects in gillnet fisheries. These brief synopses should:

  - a. Provide a brief description of the fishery interaction —target catch, bycatch, political, social, and economic contexts.
  - b. Describe efforts to either assess/characterize or address the bycatch situation
  - c. Discuss the factors (Economic, Cultural, Social, Political, Technological, Funding, other) that have led to successes or failures in assessing or addressing the situation
3. Break [20 min]
4. Synthesis of round-robin in context of social drivers presentation [45 min]
  - a. Are there common themes in the factors that led to failures, or didn't lead to success?
  - b. What factors led to successes (i.e., what's different in those areas and situations from others where such successes have not occurred)?
  - c. What key factors should be the focus of the next efforts to address bycatch in these fisheries (e.g., challenges to overcome or opportunities to shift toward "successful" conditions)
5. Identify opportunities for a follow-on workshop to promote the "next step" for a region/situation [45 min]
  - a. Identify regions/situations that are ripe for intervention, discussion, and/or investment
    - i. Region/issue on brink of success?
    - ii. Region/issue with highest conservation concern?
  - b. Identify needs for help with addressing issue in the selected region(s) or situation(s)
  - c. Nominees for Local/regional chairman for follow-on workshop – other steering committee additions/modifications
  - d. Critical partners to engage in the workshop





## **APPENDIX 3**

### **Compilation of Bycatch Issue Summaries**

## Addressing bycatch in artisanal gillnet fisheries workshop

Dr. Eduardo R. Secchi, Laboratório de Tartarugas e Mamíferos Marinhos, Instituto de Oceanografia,  
Universidade Federal do Rio Grande, Brazil

### Synopsis of the bycatch issue – stepwise approach to assess the impact of franciscana bycatch:

I have been monitoring fishing-related mortality of franciscana dolphin in southern Brazil since the early 1990s. In 1992 I received from UNEP a small grant for doing a rapid assessment of the potential problem of cetaceans in the region. After interviewing fishermen from a large proportion of the fleet it was clear that coastal gillnetting was potentially responsible for a large bycatch of franciscana and deserved a detailed investigation. I then applied for funding from both national and international organizations aiming at estimating franciscana bycatch in this fishery. The estimates were in the order of several hundreds to more than one thousand dolphins being killed each year. Estimates were based on logbooks given to fishermen, who were also asked to bring carcasses back to port so biological data (for genetics, reproduction, diet, pollution, etc.) could be obtained. The real impact of this supposedly high mortality would only be determined after estimating abundance. However, it was necessary to identify the unit for which the abundance would be estimated. Then, the next step was to identify discrete units using all available data, including genetics morphology, population parameters, etc. Four Franciscana Management Areas (FMAs – *sensu* Secchi et al., 2003) were proposed. It was known that the magnitude of the impact and the intrinsic potential for population response varied regionally. Abundance was estimated for some of these FMAs and the magnitude of the bycatch could be evaluated. Stage structured matrix population models were used to assess the risk of population decline. Despite differences in data quality among areas and uncertainty in parameter models, results suggested that most populations (FMAs) had high risk of decline. I took me more than 15 years before the pieces of this complex puzzle could be put together and it was only possible through strong national and international collaboration with colleagues and, most importantly, with fishermen. We succeed in listing franciscana as Vulnerable in the IUCN Red List. Nevertheless, despite efforts to protect franciscana in Brazil (a species-specific National Action Plan was published by the Ministry of Environment based on a wide consultation with stakeholders), the political will is minimal and fishing effort instead of being reduced has increased. Conservation priorities are not necessarily priorities in the agendas of nations' governments with important health, education and other basic social needs. The Brazilian Government, for example, with its plan for accelerating development named PAC (*Plano para Aceleração do Crescimento*), has increased investment in development, including fisheries and cut allocation of its resources to conservation. This is the situation of franciscana. There are many fisheries (artisanal and industrial) along the large (ca. 8,000km long) Brazilian coast and fluvial environments yet to be monitored for assessing marine mammal bycatch. Several coastal and oceanic species are likely affected. Special attention should be given to small coastal populations of Guiana dolphins, bottlenose dolphins, Antillean Manatee as well as the Amazon river and tucuxi dolphins.

## Key factors influencing success/failure:

### Factors that slow progress:

- **Inflated number of fishing villages along the large Brazilian coast and, therefore, lack of adequate information of fishing effort, variability in fishing dynamics, and bycatch for most areas.**
- Small number of researchers involved in long-term monitoring of fishing villages to estimate bycatch due to both lack of human resources and funding.
- Lack of abundance estimates for most species or populations.
- Low or limited education level in many fishing communities.
- **Low or no compliance of fishermen to honestly inform bycatch (for different reasons which include improper media broadcast of bycatch issues; fear of being affected by fishing regulations, etc.).**
- Minimal onboard observer coverage limited to only few commercial fisheries.
- Wide variability in fishing practice and effort which make both assessment and regulation difficult.

### Factors that slow progress in terms of conservation measures:

- **Lack of political will (Government's agenda prioritizing development in detriment to conservation);**
- **Lack of assessment on the economical and social impacts of mitigation measures;**

### Factors that help progress (most important factors in **bold**):

- **Involvement of trustful community members as part of research and conservation team to assess bycatch. However, once good data become available and by assessing bycatch proves it is causing population decline, fishermen will fear mitigation measures and halt cooperation or trust will be affected;**
- Funding to address research questions necessary to proper evaluation of bycatch (population discreteness, abundance, fishing-related mortality).
- **Long-term persistence (and funding) for assessing bycatch.**

## Addressing bycatch in artisanal gillnet fisheries workshop

Leonardo Flach, Instituto Boto Cinza

### Bycatch issue synopsis - Bycatch on *Sotalia guianensis* from Sepetiba Bay- Brazil:

The IBC has been carried out an ongoing research of Guiana dolphin *Sotalia guianensis* population study. Since 2005, we started a stranding network and to recovery dolphin carcasses from monitoring surveys. From 2005 to October 2011 we have recovered 130 dolphin carcasses. During 2002, we made a quick fishery assessment survey to characterize the artisanal fishing activities. Initially, we had some indications that the bycatch may be large enough to impact the Guiana dolphin population, but we did not have sufficient data on fishing effort to be able to extrapolate our bycatch estimates.

In 2010 we confirmed that the dredging activity was increasing the bycatch rate. In 2011 we started a close work with fishermen in the communities to characterize the fishing gear that cause the bycatch.

These fishery communities are quite poor, have lower level of education and lack of basal instruction to work in other jobs. There is a possibility of an aquiculture development or improve the fishing fleet to fish outside the bay area.

We know that 130 dolphins carcasses recovered within the six year is only part of the dolphin mortality rate. The underestimated bycatch rate of more than 20 dolphins per year shows that more than 2% of the population (1,000 dolphins) has been killed and the mortality is not sustainable.

We have just addressed the fishery activity and fishing gears that are responsible for bycatch and are trying to start the awareness of possible mitigation strategies. There is some resistance in the some fishing communities or fisherman to any mitigation efforts, but we might have funding and have support from the regional, or national governments. To our knowledge, a pinger experiment has been developed for *Sotalia guianensis* with no effective reduction on bycatch.

### Key factors influencing success/failure:

Factors that slow progress (most important factors in **bold**):

- Lack of information on fishing effort to use in extrapolating bycatch estimates
- Local conflicts from industrial fishing activities and artisanal activities biasing bycatch information (artisanal blame industrial fishing to be responsible for bycatch)
- **Lack of infrastructure for collecting information on fishing effort and bycatch (e.g., isolated areas in island, most fishing activities occurs at night in small boats, lack of manpower of on-board observer, most fishermen work alone and barely know how to write)**
- **Most local communities initially not interested in determining whether there was a bycatch problem and generally tended to disbelieve any indications that there may be a problem**
- National governments not interested in determining whether there is a bycatch problem for not threatened species and generally disbelieve any indications that there may be a problem
- **Lack of positive results in bycatch reduction from pingers mitigation tool that have been used in northeastern Brazil fisheries, so we likely will have to develop and test new sound frequency sound.**

Factors that help progress (most important factors in **bold**):

- Part of the artisanal communities responsible for bycatch , have some interest in avoid it and to support efforts to estimate bycatch rates
- **The fishing community leaders have interest to reduce bycatch and to collaborate with experiences**
- **Funding from environmental government might be available and technical support from Bycatch Consortium can effectively implement an alternative bycatch reduction.**

## Addressing bycatch in artisanal gillnet fisheries workshop

Dr. Marcos César de Oliveira Santos, Laboratório de Biologia da Conservação de Mamíferos Aquáticos, Instituto Oceanográfico, Universidade de São Paulo, Brazil

### **Bycatch issue synopsis – Incidental captures of small cetaceans in southeastern Brazil: Lessons to be shared:**

I have been studying cetaceans in southeastern Brazil since 1994. In 1995 I started to conduct a long-term research in the Lagamar estuary, a 160-km long body of estuarine water which crosses two states of Brazil: São Paulo and Paraná, protected from outer waters by a huge mangrove area. The first focus was to invest on mortality in outer waters through beach surveys added to monitoring the local gillnet fishing fleet. The latter target was not successful at that time because since the 1960s the study area has been hosting several conservation units and, unfortunately, in the first 30 years the local community was not included in the whole processes. The main consequence was the lack of support of the local community up to the end of the 1990s in most scientific efforts. The 2000s came and an important change in the way environmental agencies started to reach their goals made a great difference as several community members got involved. In 2003 I decided it was time to invest again on the evaluation of incidental captures. A local community member was interested in our studies and asked a chance to get involved. Since then he has been working as the main bridge between academia and the local community. I got several funds to give him something back after his support to our goals. Also, we invested part of the funds in an undergraduate course on Biology in a University placed 100km far from his town. In 2004 we got funds to invest on the first evaluation on small cetacean incidental captures in gillnet fishing operations. We used the main port of a town named Cananéia (12,000 inhabitants), placed in southern São Paulo, and started the survey with 4 boats. We decided to survey gillnets and 12 to 14m long boats, with a crew of 4 to 5 members. After 6 months we had a fleet of 12 boats, and in a year up to 29. Based on the dynamics of the fishing operations, these numbers were always fluctuating. The strategy was the following: handle to the captain a logbook to be filled each day of efforts. Just a piece of paper per day with the following data: GPS position, net dimensions, water depth, length of time nets remained soaked, a question on incidental capture of cetaceans, an indication on the captured species (all boats had flyers with coloured pictures of local small cetaceans) and a list of fish to be checked if captured. Whenever they had room in the hull, captured cetaceans were kept frozen and brought to natural history studies. In 35 months, fishermen reported the incidental capture of 157 dolphins, from which 107 were landed (reported/landed): 122/87 franciscanas (*Pontoporia blainvillei*), 18/10 Guiana dolphins (*Sotalia guianensis*), 12/9 Atlantic spotted dolphins (*Stenella frontalis*), 2/0 bottlenoses (*Tursiops truncatus*) and (1/1) long-snouted-common-dolphin (*Delphinus capensis*). For the first time we got a complete description on the characteristics of small cetacean incidental captures in local coastal waters. In 2007 a TV show presented the issue of cetacean incidental captures in northern Brazil, the government implemented rough regulations and we lost the confidence on the local crews. Just after several years and after a huge discussion on how regulations must make sense, we restarted to survey those boats in early 2011. One important positive aspect: in a local meeting with fishermen and environmental agencies held in 2008, a decision was made to avoid shallow waters where up to 17% of all franciscanas were captured by those gillnet fishing boats. This local agreement may represent one important step to protect this vulnerable to extinction species.

## Key factors influencing success/failure:

### Factors that slow progress (most important factors in **bold**):

- Community members in/close to Conservation Units and not included in conservation issues/meetings/processes
- Establishment of fishing regulations w/o involving fishermen in previous discussions
- A few National laws/regulations that required or supported the collection of bycatch information
- Different ways/strategies local, regional and federal governments treat fishing issues
- The way bycatch is treated by media; fishermen are not killers/bad people
- Arrival of other research groups trying to invest in the same investigation with same (cetaceans) or other marine species (turtles, sharks)
- **Lack of other economic/job opportunities makes fishermen concerned about any possible mitigation actions that could impact their fish catch or profits**

### Factors that help progress (most important factors in **bold**):

- Local boat owners sometimes are interested in avoiding trouble with environmental agencies. Getting involved with a research group sometimes is a good strategy to reach this goal.
- **Community members are definitely the main ones to invest our efforts both at the local level and with regional governments**
- Funding directed towards environmental education is necessary, as well as someone to address info to the local community
- Log-book filled by captains works well after reaching their confidence
- **Giving feed-back to fishermen on collected data/material + reached results is deemed important**

### **Addressing bycatch in artisanal gillnet fisheries workshop**

Dr. Carolina Pacheco Bertozzi and Dr. Juliana Marigo, Projeto BioPesca, Brazil

#### **Bycatch issue synopsis - Bycatch on *Pontoporia blainvillei* from Praia Grande, SP, Brazil:**

Projeto BioPesca is a non-profit organization working with artisanal fisheries communities of the central coast of São Paulo State, Brazil, since 1998. The aim of our work is to monitor the incidental capture of small cetaceans and chelonians, as well as foster environmental education in order to encourage the development of sustainable fishing practices. Over the past 13 years, Projeto BioPesca developed benchmark studies about the artisanal fisheries in Praia Grande and in particular about the franciscana dolphins, *Pontoporia blainvillei*. The species is a small coastal dolphin threatened of extinction due to high by-catch numbers along its distribution. Animals incidentally captured by fisherman working with Projeto BioPesca are landed, necropsied and provide critical information about the health and biology of the species in the area.

Continuous monitoring of the fishing boats in Praia Grande County, from July 1999 to December 2008 allowed both the chronological evaluation of incidental catching and capture per unit effort. Five different types of gillnets and one of trawl net for shallow areas were used by the fishing boats in Praia Grande, of which four types of gillnets registered catching. A total number of 91 franciscana dolphins were accidentally captured and the values of catch per unit effort (CPUE) indicate that "boeira" surface nets and "bottom thick" demersal nets are responsible for the highest capture numbers during autumn and winter time. The use of drift nets was observed along the coast of the São Paulo State where a total of 1,192 boats have used such nets. Through the systematic monitoring of four fishing communities, the total fishing effort concerning drift nets, in the State of São Paulo, was 4,684,981 km per fishing day. This value was then multiplied by the catch per unit of average fishing (0.00008 Franciscana dolphins/km x fishing day), which resulted in an estimate mortality of 372 dolphins between June 2004 and April 2005. Estimated age of captured animals varied from 0 to 14 years, 80.0% ranged between 0 and 3 years. Microscopic analysis of 45 testicles showed that 33.3% of males were immature, 15.6% pubescent, and 51.1% mature. Microscopic analysis of 42 female ovaries showed that 54.8% of females were immature, 4.8% pubescent, and 40.5% mature. Nine out of the total mature females captured were pregnant. Both average length and average sexual maturity age for male individuals were estimated between 103.6 – 107.83 cm and 1.31 – 1.48 years, respectively. For female individuals these numbers were 119 cm and 1.2 – 1.83 years, depending on the method used. The results obtained in the State of São Paulo indicate that drift nets affect mainly immature individuals of both sexes, from 0 to 2 years old. However, a significant percentage of mature adults have also been captured. Besides, no latitude pattern in the variables studied was confirmed.

Another significant contribution of Projeto BioPesca's research has been the daily interaction between researchers and artisanal fisherman of Praia Grande, creating a powerful bond of trust. Mutual trust, built up over more than a decade, has allowed the development of many sustainable fishing practices, such as: the release of live captured marine turtles and other non target species (stingrays and crabs), ensuring that about half of the turtles caught are released alive back into the ocean; the recovery of dead by-caught animals for research; the proper collection of waste from fishing activities; compliance with existing fisheries' legislation (mesh size, closed seasons, minimum landing size) and the incentive not to waste the fish caught.



Currently, the fishermen of Praia Grande are participating, on a volunteer basis, in a unique project in Brazil. The goal of this project is to test reflective and stiff gillnets developed with the intention to reduce the incidental capture of cetaceans and chelonians. The project started in September this year and it is a partnership between Project BioPesca, Universidade Federal do Rio Grande (FURG) and the New England Aquarium.

The involvement and participation of fishermen and the local community with the research and education activities developed by Project BioPesca are essential for the development of sustainable practices that ensure the protection of the environment in medium and long term.

**Key factors influencing success/failure:**

Factors that slow progress (most important factors in **bold**):

- **The artisanal fleet is spread along the São Paulo coast in small fishing communities, making it difficult to monitor their activities.**
- **Lack of human resources for monitoring small-scale fishing activities**
- Lack of control of fishing activities, fishing effort, landed production and incidental captures. Lack of log-books filled by the artisanal fleet.

Aspects that help progress (most important factors in **bold**):

- **The artisanal fishermen are always in need of information and show interest in reducing the incidental capture of dolphins and turtles, since there is no economic value associated with bycatch.**
- Systematic monitoring is extremely important for the monitoring of small-scale activities.

**Addressing bycatch in artisanal gillnet fisheries workshop**  
Pablo Bordino, Fundacion AquaMarina CECIM, Buenos Aires, Argentina

**Bycatch issue synopsis – Assessing and addressing bycatch and bycatch mitigation of Franciscana dolphins in Argentina:**

Incidental mortalities of Franciscana dolphin *Pontoporia blainvillei* in the artisanal demersal gillnet fishery of Argentina, Uruguay and Brazil have occurred with the onset of nylon gillnet fisheries since several decades ago. Incidental capture represents the major threat to the species survival, and the species is currently considered the most threaten cetacean in the South Western Atlantic.

I have been studying marine mammals, and particularly cetaceans, since 1992. My main effort has been focused on Franciscana dolphins in Buenos Aires, where the development of artisanal fishery has been increasing since the 80's. Artisanal fisheries along several locations in coastal Buenos Aires are responsible for higher Franciscana dolphin incidental mortality in Argentina.

Since 2000, on board observers have recorded dolphin bycatch from gillnet fishermen (10-22% of the fleet size) at Cabo San Antonio and Bahia Samborombon, where two different population units have been identified. For both areas, the mean CPUE calculated as the number of dolphins captured per 1000 linear meters of gillnets per day was 0.54 (95% CI 0.33 to 0.91). The minimum annual incidental mortality is roughly estimated as 600 individuals in northern Buenos Aires. These fisheries consist of about 50 fishermen who mainly operate from September to April, although some boats fish throughout the year. The fisheries are conducted by small inflatable, fiberglass and wood vessels 5-8m in length operating between 0.2 to 7 km from the coast. The fishery mainly targets Sea trout (*Cynoscion striatus*), Whitemouth croaker (*Micropogonias furnieri*), Parona leatherjack (*Parona signata*), and Patagonian smooth-hound (*Mustelus* sp.). The nets are composed of mono or multifilament nylon and are set on the bottom anchored in position, placed in waters from 3 to 18 m. The nets are 50-75 m long and 2-6m deep with a stretched mesh size between 10 to 18 cm, although fishermen sometimes used 4 to up to 12 nets together in a string.

To date we have focused our effort on achieving two strongly linked main goals: a) to assess the basic aspects of the ecology and behavior of the species, and b) to reduce the bycatch of dolphins in coastal gillnets. By using satellite linked tags we have obtained information on how these animals use the water column and specific features in their habitat, and we are now able to investigate the overlap between the home ranges of individual animals and those areas with the highest fishing effort. This information will aid us in identifying ways in which interactions between dolphins and artisanal fishery may be minimized. In addition, discussions with local artisanal fishermen may lead to the identification of practical solutions to reduce dolphin bycatch. Since 2002, we have tested the effectiveness of pingers, the potential of alternative fishing gears, and recently evaluated the use of modified gillnets with barium sulphate to reduce cetacean bycatch rates. All these approaches present challenging situations to be implemented in a larger scale, and priority areas need to be defined. As gillnet fisheries will continue to operate in areas inhabited by the species, methods to reduce entanglement are urgently needed. We expect that our effort will be useful to approach other artisanal fisheries along the Argentinean coast where bycatch of Commerson's dolphins and Burmeister's porpoise are also recorded.

## Key factors influencing success/failure:

### Factors that slow progress (most important factors in **bold**):

- **Mostly local artisanal fishermen face a subsistence economy and limited job opportunities.**
- Fishermen will continue using gillnets for traditional and economic reasons.
- **Current overfishing situation leads to increase the gillnet fishing effort for competition with commercial fleet.**
- **Lack of continued funding to improve already established efforts to mitigate bycatch in a challenging situation**
- Concerns about bycatch mitigation tools affecting fisherman's income and profitability
- Limited involvement, regulation and enforcement from the government (it could be seen as a benefit for some people). As a consequence, there is no policy and incentives to establish sustainable artisanal fishing activities.
- Lack of established observers programs in other areas within the species distribution range to get reliable information about fishing effort, bycatch rates, and bycatch dynamic.
- One local Artisanal Fishermen Association (with political contacts) acting unethically, not allowing independent decisions of associated fishermen to collaborate in finding practical solutions to reduce dolphin bycatch.

### Aspects that help progress (most important factors in **bold**):

- **Previous funding made progress to get reliable information on bycatch rates as well as to test potential mitigation tools.**
- **Established independent observer program conducted by volunteer students.**
- Tends estimation in Franciscana dolphin bycatch from the last decade (2000-2010) in northern Buenos Aires in order to evaluate bycatch dynamic and evaluate priorities.
- **Established cooperation with the UAPA (Argentinean Artisanal Fishermen Union) that has allowed to conduct experiments to evaluate bycatch mitigation tools.**
- Real interest of some local fishermen and community leaders to reduce current wildlife bycatch.
- Knowledge of habitat use by franciscana dolphins and overlap with gillnet fishing activities.
- Some decisions taken in consensus with artisanal fishermen.
- **Socio economic evaluation of the fishery.**
- Proved bycatch mitigation tools, including short scale socio-economic assessment, that could be implemented for fishery management.
- Relative low cost- high benefit in terms of investments to produce a change in small scale fisheries.
- Priority conservation area established by the Federal Government.
- Contacts with government agencies and policy makers.
- National laws and regulations available, and recently interest of the Federal Government to develop an Action Plan for the Conservation of Marine Mammals.
- **Educational efforts in local schools showed a relative positive impact within artisanal fishing community in northern Buenos Aires (independent evaluation).**
- Cooperation with colleagues on a multidisciplinary approach.

**Addressing bycatch in artisanal gillnet fisheries workshop**  
Jeffrey C. Mangel, ProDelphinus, Peru and University of Exeter, UK

**Bycatch issue synopsis:**

The Peruvian non-profit group ProDelphinus has been conducting studies of marine fauna bycatch with Peruvian small-scale longline and gillnet fisheries since 2001. This work is conducted using a variety of methods. First we have onboard observers operating out of several ports and in several fisheries. These observers monitor fishing effort and the target and bycatch – including small cetaceans, sea turtles and seabirds. We also have shore-based observer reports to quantify fishing effort. We have also conducted large scale rapid assessment survey projects with fishermen along the Peru coast and in the Amazon basin to assess, at the national level, the levels of small cetacean bycatch occurring.

Our work has shown that despite the presence of national regulations since the mid-1990s banning the catch, landing or sale of small cetaceans, that small cetacean catch and bycatch still occurs regularly and is likely of the same magnitude as prior to the ban (on the order of 10-20,000 killed annually). Small cetacean bycatch remains common in the driftnet fishery. The main species affected are long-beaked common dolphins, dusky dolphins, bottlenose dolphins and Burmeister's porpoises. Also, gillnet vessels and longline vessels are known to harpoon dolphins and porpoises for use as bait in both nets and longlines. While there is some information available from government research cruises along the Peru coast, information on small cetacean populations and distributions is extremely limited. This makes difficult any assessment of the population level impacts associated with observed catch and bycatch. While pinniped bycatch appears limited, pinniped depredation of catch from fishing nets is a real source of concern among fishermen and has a large impact on their income.

Our work has now shifted to trying to find solutions to bycatch problems and we are now conducting trials of pingers in the driftnet fishery. These appear effective. We also promote other mitigation technologies such as the use of net cutters which could be helpful in releasing entangled small cetaceans from fishing nets.

**Key factors influencing success/failure:**

Factors that slow progress (most important factors in **bold**):

- Lack of information on small cetacean populations and distribution
- Limited access to government research cruise data and fisheries data
- Fractured nature of the fishery makes communication with fishermen difficult.
- **Fishermen have seen little incentive to change their practices because regulatory controls are non-existent**
- Lack of funding for onboard observer work or mitigation trials
- **Fishermen and vessel owners have no funds to invest in mitigation technologies so any efforts have to come with outside funding. This makes finding locally sustainable solutions difficult.**

Factors that help progress (most important factors in **bold**):

- **Finding motivated fishing captains, boat owners is essential in working at sea and trialing mitigation measures**
- **Consistent, repeat presence in fishing ports to build relationships, provide conservation workshops**
- Show how pro-actively dealing with bycatch issues can improve the fishery and potentially lead to improved efficiency or profitability
- If you can find things to do/try that actually help fishermen with their work (whether it's specifically related to small cetacean bycatch or not) it helps build trust
- **By showing that you are trying to work with fishermen, rather than shut them down**
- The fractured nature of the fishery actually makes it easier in some ways to work directly with individual fishermen to try things, as opposed to dealing with the politics of an RFMO

**Addressing bycatch in artisanal gillnet fisheries workshop**  
Joanna Alfaro-Shigueto, ProDelphinus and University of Exeter

**Bycatch issue synopsis:**

The starting point for our program was the previous work by CEPEC in Pucusana. We identified a need for using onboard observers to obtain accurate estimates of bycatch. That was implemented in ports with longlines and gillnets. Gillnets showed an impact on small cetaceans. Artisanal fishermen seemed open to having us working in their ports, shared information, agreed to take observers aboard and participated in talks and surveys in their home towns. Thus, our next step was to test pinger effectiveness. Funding has been always a challenge. Scaling up the impacts of small-scale fisheries on small cetaceans along the entire Peru coast is also necessary. Government authorities seem to be supportive but there is no official action to guarantee this yet.

As a separate issue from bycatch, we identified the use of dolphin fat as bait for longlines. Gillnetters will often sell bycatch or harpooned dolphins to longline boats. The main reason for this is the limited availability of traditional bait species (not in the market or expensive). We are uncertain of the scale of this issue.

**Key factors influencing success/failure:**

Factors that slow progress (most important in bold)

- **Poor current legislation for small-scale fisheries, and further enforcement**
- Limited involvement of government offices in small-scale issues (priority is industrial fisheries)
- Lack of economic incentives to small scale fisheries to operate within sustainable fisheries parameters
- **Challenges to implementing mitigation measures fleet-wide**
- Challenges in analysis of data gathered in small-scale fisheries

Factors that help progress (important ones in bold)

- **Identification of appropriate mitigation measures**
- Funding partly secured to maintain long term research program
- Identification of conservation priorities
- Certain fishing fleets keen to use mitigation measures are now identified

## Addressing bycatch in artisanal gillnet fisheries

Enrique Sanjurjo / WWF – Gulf of California

### Bycatch issue synopsis:

There are four main components that explain the context the vaquita, fisheries, fisheries management, and vaquita conservation plan

### Vaquita:

- Vaquita is the most endangered cetacean in the world. Only about 245 left.
- The only proven cause of non-natural death is by-catch in drifting gillnets
- According to population biologists the only real possibility for saving vaquita is zero by-catch.
- Modifications in gillnets, zoning, time closures could allow to reductions in by-catch, but not to zero.
- The only way of obtaining zero by-catch is eliminating gillnets.
- In the long run it seems that the only solution is eliminating gillnets, but in that does not seem to be feasible in the short run.

### Fisheries:

- There is an artisanal fleet of about 800 off-board engine small boats (pangas) and 80 industrial vessels fishing in the region.
- Industrial vessels just fish in the region during the shrimp season (September to March).
- Pangas work almost all the year: shrimp (sep-mar), finfish (feb-may), sharks and rays (may-jun). During summer most of the fleet stop working and a small number work on crabs and clams.
- There are three main fishing villages in the region: Santa Clara (400 pangas), San Felipe (300 pangas), Puerto Peñasco (100 pangas). There are not exact numbers, because the fishing census is always in progress and never completed.
- Only pangas interact with vaquita, there is no evidence that industrial vessels do.
- The main gear used by pangas are drifting gillnets (those that kill vaquita).

### Fisheries management:

- There is not a regional fisheries management.
- Single species are managed in aisle of the rest, and with diverse and not always coherent instruments.
- Fishermen do not comply with the maximum length of gillnets, and authorities let that happen.
- Fishing permits are given, mostly, for one single species; but fishermen fish all the year.
- Most (if not all) legal fishermen are working in illegality; some because of the length of gillnets, others fishing other species than the ones in the permit, and others fishing in no take zones. With “legal” fishermen working in illegality is hard combat what they call illegal fishing (people working with no permits at all).
- Fishing authorities care about target species biomass but they don’t care about fishing externalities (vaquita by catch for example)
- Environmental authorities are working for saving vaquita, but with poor coordination with fisheries authorities.

### **Vaquita conservation plan:**

- Mexican Government has invested 30 million dollar for saving vaquita, with insufficient results.
- Since 2005 there is a no-take-zone for protecting vaquita, the so called vaquita refuge.
- The program has four main components: gear swap outs, effort buy outs, compensation for not fishing in the refuge, and enforcement of the refuge.
- Fishing effort is 30% lower than it was before, and about 100 fishermen accepted compensation for switching gear.
- With this policies the probability for losing vaquita in the next decade are over 90%

### **Factors influencing success / failure**

- Environmental authorities are aware about vaquita and they are making actions, in 2012 Mexican government will change at federal level and there is a high risk of losing the momentum for vaquita.
- Fishing authorities do not care about vaquita or any other negative externality of fisheries.
- Single species fisheries management is an administrative fiction in a multispecies fishery context.
- Tolerance to illegality has created a vicious circle at which imposing new regulations will just reinforce the career into more and more illegality.
- Strict command and control regulations with high technologic specifications in fisheries standards disincentive technological innovations. This is in particular relevant for shrimp: the standard command the use of drifting gillnets and the use of new technologies could not be set up gradually.



## **Addressing bycatch in artisanal gillnet fisheries workshop**

J.Y. Wang, FormosaCetus Research and Conservation Group

### **Bycatch issue synopsis:**

My colleagues and I have worked for the past 15 years to try to get a preliminary understanding of the impact of coastal fisheries (of all kinds) on both species of finless porpoises (*Neophocaena phocaenoides* and *N. asiaeorientalis*) in east Asian waters. The numbers of carcasses collected (and reported) over short time periods with minimal effort and minimal sampling of the huge fishing fleet operating in these coastal waters (and considering the desire of fishermen not to report bycatch due to local marine mammal protection laws) suggests the impact of fisheries bycatch on finless porpoises may be great. We do not have any information on fishing effort or catch rates to attempt any meaningful extrapolation. With the exception of some populations in Japanese waters, there are no estimates of abundance for either species of finless porpoise species (partly due to a long history of taxonomic uncertainty and largely due to the difficulties of studying these species in situ). Our understanding of the alpha taxonomy of finless porpoises is far from complete or even sufficient and population structure information is lacking for most regions. Our initial efforts have focused on working in a few areas where local fishermen have been at least somewhat cooperative. In some areas, we can work and interact more closely and directly with fishermen but in other communities, we have government officials acting as the middlemen (a condition mainly set out by officials or due to logistical difficulties). The socio-economic statuses of the communities differ greatly. There is a possibility of ecotourism industry in some communities but government investment is needed (the amount of which will depend greatly amongst regions). Finless porpoises are not easily seen and avoid boats so much will be needed to increase the interest of a rarely-seen species. These are arguably the most difficult small cetacean species to study and appear to be especially easy to entangle in fishing nets being quite small in size. Both species were assessed as Vulnerable by the IUCN Red List of Threatened Species because of inferred declines in abundance due mainly to fisheries.

Since 2002, we have also been working on understanding the IUCN Red List's Critically Endangered population of Indo-Pacific humpback dolphins (*Sousa chinensis*) in the Eastern Taiwan Strait. One of the five main threats to this population is fisheries bycatch, particularly trammel nets, which are used by thousands of fishermen in the waters inhabited by these dolphins. With foreign NGO funding, we were able to better understand the distribution, distinctness of the population and estimate the abundance to be <100 individuals; with such a small population, every individual is important to the continued existence of these dolphins. Funding from NGOs (both foreign and local) have allowed us to continue to monitor this population at a marginally adequate level while government- and industry-funded research is being conducted to challenge and 'verify' our work.

2004/05: we undertook a mark-recapture type project on a representative number of fishing ports along eastern Taiwan in order to estimate the fishing effort for the coastal large-mesh pelagic driftnet fishery.

In the 1990s, we surveyed several Taiwanese ports for cetacean carcasses. Even though it was already illegal to kill, sell or possess cetaceans, many small cetaceans were still be caught and traded at several fishing ports in Taiwan. This work led to an initial ballpark estimate of the total number of cetaceans being killed by Taiwanese fisheries being between about 25,000 and 40,000 cetaceans per year.

In the early 1990s, I also worked on the groundfish gillnet and harbour porpoise bycatch issue. I established the first observer program to collect data on this issue and then as a result was hired to coordinate and act as an observer for the first government observer program. This led to the first annual estimate of the harbour porpoise bycatch by the fishery in the Bay of Fundy from direct observer data.

### **Key factors influencing success/failure:**

#### Factors that slow progress:

- Lack of funding has severely retarded our work on bycatch issues
- Lack of funding for abundance surveys (even with the ETS Sousa)
- Lack of international attention
- Lack of bycatch records (esp. for ETS Sousa)
- Lack of credible information on fishing effort to use in extrapolating bycatch estimates
- Lack of information on marine resources (i.e., stock assessments) for any species including cetaceans.
- Lack of credible catch/landings for any ports (also fishermen do not file income taxes so there is no tracking of fishermen salaries)
- Lack of fisheries management so small scale fishermen must compete with companies with high capital investment; in addition, special exclusive fishing rights have been given to companies for some regions
- Lack of local capable and unbiased marine mammal scientists that can conduct credible scientific studies.
- Permits are required for anyone wishing to go out to sea.
- Most local fishing communities believe cetaceans are breeding like rabbits and that a cull is needed because their (unmanaged) marine resources have declined greatly over the years even though the limited information suggests cetacean populations are decreasing (or likely so).
- Legal protection was implemented 'overnight' with no explanation or education of fishermen to allow them to understand the biology of cetaceans.
- Local, regional, and national governments also not interested in determining whether there is a bycatch problem, generally disbelieve any indications that there may be a problem and attempt to discredit any information that suggests bycatch may be a problem.
- Government funding is almost always provided to 'chosen' researchers rather than to researchers with the best scientific reputation.
- National laws/regulations that make it illegal to kill or possess cetaceans
- Lack of other economic/job opportunities makes fishermen concerned about any possible mitigation actions that could impact their fish catch or profits
- Local communities are very wary of researchers that are tied to government agencies as well as local academic researchers (and they have good reason).
- A lack of scientific credibility of the information that is made public about stranded cetaceans (including cause of death)
- Credible information is difficult to obtain for cetacean carcasses and access to carcasses are controlled and often denied.
- Organized criminal element involved in illegal black market for cetacean meat along with the lack of desire by local enforcement to deal with cetacean conservation and the criminal human elements (corruption and bribery may be an issue).

Factors that help progress:

- Threat of existing foreign laws (e.g., the Pelly Amendment) that, if applied, can result in economic consequences.
- Attention by international and local NGOs and lobby-pressure on the local government has resulted in more official recognition and attention towards issues (e.g., such as the ETS Sousa).
- Funding from international and local NGOs has made it possible to undertake initial work on high priority issues (e.g., ETS Sousa, finless porpoise carcass examination and estimating fishing effort for one fishery).
- Opportunities to increase the exposure of the issues to foreign audiences.
- Dedicated, independent and capable researchers (local and foreign) who are willing to make sacrifices and take on the many challenges with the issues.

## Addressing by-catch in artisanal gillnet fisheries workshop

Louella Dolar

### Bycatch issue synopsis:

**1.)** Cetacean by-catch in the eastern Sulu Sea- Done in early 1990's, this was the first cetacean by-catch assessment my colleagues and I carried out in the Philippines. It was done to determine the impact of the then existing fisheries on the population of cetaceans in the area. During this time cetaceans were not protected yet and one could see that the numbers being brought to the markets were increasing each month and cetacean meat was becoming more and more acceptable to the general public. The monitoring process was a combination of actual by-catch monitoring and interviews. The gears involved were drift gillnet, purse seine, ringnet (smaller version of purse seines), and surface set gillnets. The driftnet fishery had one major landing site and this was monitored each day during the peak fishing months for two years. Photos were taken (for species verification) and measurements and sex of individual by-caught dolphin were recorded. A proportion of purse seine and ring net boats were boarded to observe the fishing operation first hand, get an idea of the coverage of their fishing ground, obtain the fishing effort and estimated number of by-catch. By-catch was determined through interviews with crewmen focusing on the by-catch that week. Fish mongers were also interviewed. Not all boats were boarded but information on the number in the fleet was obtained and seasonality and duration of fishing activities in the area was obtained. In addition, fishing villages were visited wherein the number of gillnets were counted, fishing effort determined and by-catch estimates were obtained. Results from assessments of by-catch from the different types of fishing gears were then combined. At the same time, abundance of cetaceans were estimated using line-transect surveys. The by-catch rate proved to be beyond sustainable with removal rates ranging from 1.5 to 8 times more than the sustainable take of 1-2%. The monitoring helped pass the law protecting marine mammals in the Philippines. No mitigating actions were done.

**2.)** A rapid assessment of by-catch was carried out in Verde Island Passage in the Philippines in 2006. Verde Island Passage is a corridor with an area of about 4,500 km<sup>2</sup>. By-catch assessment was based mainly on interviews. Because of time and budgetary constraints effort was focused on the nine largest coastal villages with major fishing activities (there were 200 + coastal villages). Drift gillnets ranked number one in terms of threat followed by surface-set gillnets for pelagics (e.g. herring). Sixty-four driftnets (measuring 150m - 1,000m long and 25m deep) and 75-100 surface-set gillnets (measuring 200m long and 25m deep) were counted in these nine villages. Estimated cetacean by-catch was 5-15 cetaceans per year. A line transect survey conducted in the area at the same time yielded sightings of 5 cetacean species, with Risso's dolphins having the highest sighting rate. Rough population estimate for this species was 136 (based on 9 sightings and using the  $f(o)$  derived from another area/study using similar sighting platform and methodology). Abundance could not be estimated for the four other species (spinner, spotted, bottlenose and Fraser's dolphins) because of very low sighting rates.

**3.)** Dugongs-Dugongs were believed to have been extirpated in southern Visayan Sea until we obtained a photograph of a dugong blasted by dynamite (although dynamite fishing has been outlawed since the

'70's it is still used in many areas in the Philippines). A survey was then conducted in 2007 to verify and if possible estimate population size. Incidental catches were also determined with the use of interviews. Bottom-set gillnets for crabs and fish and surface set-gillnet for fish were found to be the main threat. An estimate of approximately 20 dugongs were caught in these gears from 2000-2007. Dugong abundance was difficult to estimate.

#### **Key factors influencing success/failure:**

##### Factors that slow progress (most important factors in **bold**):

- Lack of funding to carry out by-catch monitoring.
- **Too many villages and artisanal fishermen distributed in very long coastlines.**
- **There is no record of fishing gears and fishing effort, anywhere to help extrapolate by-catch. To get this information one has to visit each fishing village and collect the information himself.**
- Lack of funding and interest from the government to implement mitigation actions.

##### In addition for 2 & 3:

- Because fishermen are aware that cetaceans are protected, they hesitate to report by-catch. They are afraid of the implications of by-catch to their use of fishing gear.
- **The National law protecting cetaceans made by-catch data gathering extremely difficult. For example for driftnet fisheries, cetacean caught are butchered at sea and "smuggled" to inland villages.**
- Although there is a national law that requires stranded or by-caught animals be reported to local office of the Bureau of Fisheries, most of the reports indicate "stranding" and in many cases not mention whether the animal was caught in nets.
- **Lack of funding for abundance surveys to determine marine mammal population size and therefore determine impacts of by-catch on marine mammal populations.**

##### Factors that help progress (most important factors in **bold**):

###### For 1:

- **Fishermen were cooperative in sharing information about by-catch. Particularly, one family of fishermen, after being trained in data collection, helped us collect daily by-catch landings by driftnet fisheries as well as fishing effort by these driftnet boats.**
- There was sufficient funding to carry out abundance survey for the eastern Sulu Sea.
- There was great interest among students to be involved in cetacean survey and they volunteered as observers.
- Presence of technical assistance from foreign institutions/scientists.

###### For 2 & 3.

- Funding support from NGO's focusing on corridors and straits made the rapid assessment of Verde Island and the dugong study possible.
- Collaboration among the academes and local government.
- Perseverance, dedication and creativity on the part of the research assistants and researchers.

## Addressing bycatch in artisanal gillnet fisheries

Lilia Dmitrieva, University of Leeds

### Bycatch issue synopsis – Caspian seal bycatch in illegal fisheries:

The Caspian seal (*Pusa caspica*) has declined by more than 90% since 1900 and is listed as Endangered by IUCN. In order to estimate their potential impact on Caspian seal population dynamics and extinction risk we made the first quantitative minimum observed Caspian seal bycatch mortality in fisheries in the north-Caspian, by conducting semi-structured interviews in fishing communities along the coasts of Russia (Kalmykia, Dagestan), Kazakhstan and Turkmenistan. Our results show that there is a large Caspian seal bycatch which is directly linked with sturgeon poaching. We recorded a directly observed bycatch of 853 seals for the 2008-2009 fishing season, 93% of which occurred in illegal sturgeon fisheries. Considering high level of poaching in the Caspian the total minimum annual bycatch is suggested to be likely more than 10 times greater. The presence of high bycatch rates was supported independently by evidence of net entanglement from seal carcasses, during a mass stranding on the Kazakh coast in May 2009, where 30 of 312 carcasses were entangled in large mesh sturgeon net remnants.

Fishery bycatch is suggested as being the strongest driver of population decline since the 1990s, and may currently be the most important single threat to the species. The creation of properly resourced and enforced protected areas for the Caspian seal could reduce the risks of fisheries-related mortality. However, the social and political complexity of dealing with poaching means that the prospects for eliminating bycatch and stabilizing the future of the seal population in the short term are likely to be low without sustained action from the Caspian governments.

### Key factors influencing success/failure:

Factors that slow progress (most important factors in **bold**):

- The high profit-illegal nature of the sturgeon fishery means that **direct approaches to reducing bycatch such as working with fishermen to change fishing methods, altering gear used, or introducing technological solutions are likely to be unviable.**
- Caspian seal bycatch is directly linked with illegal sturgeon fisheries so mitigation measures for Caspian seal bycatch should be closely allied to the solution for sturgeon poaching
- Hidden nature of illegal fisheries does not allow to make reliable bycatch estimates
- **High level of surgeon poaching in four countries since early 1990s.**
- Difficult socio-economical situation in the region (lack of other job opportunities)
- High level of corruption facilitates illegal fisheries
- **Caspian seal is harvested in Russia**
- Black market seal products can be easily legalized
- **Lack of public awareness about high seal mortality related with fisheries**

Factors that help progress (most important factors in **bold**):

- Kazakhstan government has been developing protected areas for the Caspian seals
- Seal mortality events are investigated by Kazakh specialists
- Sturgeon poaching has declined after 2007 due to stricter fisheries rules, decrease of sturgeon abundance, increased risks to personal safety and higher operating costs for fishing
- Plans being discussed by Caspian governments to ban sturgeon fishing



## **Addressing bycatch in artisanal gillnet fisheries workshop**

P.K. Ofori-Danson, Department of Oceanography and Fisheries, University of Ghana, Legon, Ghana

### **Bycatch issue synopsis:**

Dear colleagues, I have jointly worked with two others (Dr. Van Waerebeek, K and Mr. Debrah, J.S.) since 1999 (i.e. past 11 and half years) to investigate fisheries interactions and population status of small cetaceans in the coastal waters of Ghana, West Africa. The surveys have provided an update on the catch composition and other aspects of cetacean population in Ghana. Our studies involved taking photographs of landed specimens to determine species composition of cetacean take at 3 ports in Ghana's artisanal fisheries in 1995 – 2010, possibly the most comprehensive sample documented in West Africa.

We used the data obtained to estimate catch rates of landed cetaceans per month (cpm) and landed cetaceans per day (cpd) for the 3 ports. Catch estimates ranged from 1.17 to 22.56 cpm. Mean daily landings rate was estimated as 0.74 cpd. The catches were dominated (24.5%) by Clymene dolphin (*Stenella clymene*). The major culprit for these bycatches is the drift gillnet (DGN) fisheries. There is evidence of use of cetacean meat as bait for catching sharks whose fins are exported to oriental countries for scarce foreign exchange earnings. While no quantifiable data exist to evaluate the extent cetaceans are used as bait in cetacean fisheries, most captured animals seem to be landed, butchered on land and sold for human consumption due to declining fish catches.

Bearing in mind that cetacean bycatches remain largely unreported in West Africa, such magnitude of confirmed fisheries-caused mortality of Clymene dolphins at a local level should be reason of great concern for its sustainability region-wide. There is urgent need for intensive biological sampling programme and nation-wide recording of cetacean captures to guide the formulation and implementation of effective management and conservation measures.

### **Key factors influencing success/failure:**

Factors that slow progress (most important factors in **bold**)

- **Lack of funding for mortality rate for cetacean bycatch and abundance surveys**
- Not clearly defined institutional structure information) for collecting information on fishing effort and bycatch (e.g. confusion on roles of the Directorate of Fisheries and Wildlife Division on collection of cetacean bycatch)
- Lack of observer programs
- **Declining fish catches which is gradually turning bycatch into targeted catch especially by drift gillnet (DGN) fisheries for human consumption and use as bait for shark finning trade**
- **Tallying of cetacean bycatches as a standard procedure for fisheries observers at the national level**
- **Training and support of field data collection personnel of the Directorate of Fisheries and Wildlife Division**
- Inadequate logistics for enforcement of national legislation that support the monitoring, control and surveillance of coastal fisheries

Factors that help progress (most important factors in bold)

- Provision of national legislature on cetacean and (other aquatic mammal) bycatch
- Entrepreneurial interest in promotion of dolphin-watching ecotourism
- The exploration for oil requiring environmental impact assessments
- **The recent discovery and export of oil from coastal waters of Ghana with growing national interest in conservation of marine resources.**

## **Addressing bycatch in artisanal gillnet fisheries workshop (Cameroon report)**

Isidore Ayissi, Kribi-Cameroon

### **Bycatch issue synopsis:**

Bycatch of marine mammals in fishing nets is a global concern. Yet, very little is known about bycatch in certain regions of the world e.g., Africa. A few areas have documented the serious consequences of bycatch. Recently, Specialised Research Center of Marine Ecosystems (CERECOMA) and Cameroon Marine Biology Association (ACBM) carried out rapid assessment of impact of gillnet on marine mammals. The survey was conducted from the Southern part of the Cameroon coast at River Ntem to the Northern part around Bakassi peninsula using questionnaires. The data collectors were supervised by one Biologist as Team Leader. Fishermen were selected at random and the survey was conducted particularly in afternoons and Sundays when fishermen were free in their homes but others were contacted at the landing sites during their arrival from the fishing trip. In certain areas where data was available, we collected certain information from government official service at The Ministry of Fisheries and Livestock, the manager of fishing activities. The data collection took various times to cover each port according to the size. Other took few hours while other took more than a week particularly in the big ports. The fact that most fishermen are illiterate made it difficult for us to interact with them. We used guides in certain areas to interact with fishermen in local languages particularly Nigerians foreigners. The communities were stratified by population size into at least 3 categories:

- (1) “major ports”;
- (2) “intermediate-sized ports”;
- (3) “small ports”.

The strata were selected according to the number of fishermen, boats and fishing activities in the port. For 30 ports planned during this survey, 23 were covered (making a percentage of 76.66%). The remaining 7 ports could not be covered due to the instability in Nigeria border which host conflict in the Bakassi peninsula.

From this survey, Cetaceans and sirenians are commonly caught by fishermen on the Cameroon coastline particularly in Douala area around the Wouri estuary. The results reveal that around 97 cetaceans (whale and dolphin) and 292 sirenians (manatee) are caught yearly in the fishing camps surveyed. These numbers would be much greater if all the ports (about 300 in number) were considered. Manatee meat is common in most restaurants in Cameroon, particularly in Sanaga estuary which can be considered as the sanctuary of this species. This species is either caught intentionally by nets, harpoons, traps and poison around lagoons and river estuaries in Douala area.

Other species were identified as sea turtles with 1241 individuals per year for 13 leatherback and others were green, hawksbill and olive species. Turtle’s meat is common in feeding habits of coastal people in Cameroon, but the majority of their catch is not internationally. However in certain cases, those reptiles are caught internationally as in Sandje where results present 400 individuals per year by traditional fishermen.

**Key factors influencing success/failure:**

Factors that slow progress (most important factors in **bold**):

- **Time constrain because this survey was carried out during few months and raining season when most fishermen were out;**
- **The survey was carried out in random sampling manner because for 300 fishing ports along Cameroon coast only 10% were covered;**
- **These totals may be low estimate because most fishermen know that the catch of these species is not allowed and are afraid to give the right information;**
- **Limited funds that could not permit the involvement more people and to cover all fishing camps;**
- Lack of baseline information and data base in fisheries services but in future it could be good to involve more permanent data collectors and these results must be feedback to official services for good monitoring;
- Illiteracy of most fishermen who were not able to identify many species.
- **Lack of boats to cover certain ports. We had obligation to walk at certain moments by foot;**
- Lack of alternative sources of incomes for local people as ecotourism which could be developed on marine mammals to save those species;
- **Limited implication of administrative services on bycatch issues because of the absence of scientific observers;**
- **Absence of marine protected areas along Cameroon coast for more than 400 km of distance;**
- Lack of the promotion of marine sciences in Cameroon Universities.

Factors that help progress (most important factors in **bold**):

- Funds from foreign partners permitted us to carry out this survey;
- **Local people from Bouandjo hamlet agree to carry small ecotourism project on marine mammals as whales and dolphin;**
- Implication of local fishermen for data collection, government's services and certain areas biologist's students.

## Addressing bycatch in artisanal gillnet fisheries workshop

Tim Collins, WCS

### Bycatch issue synopsis – Coastal dolphin bycatch in Gabon and Congo:

We (WCS) have worked on cetaceans in Gabon and Congo since 2000. The initial and primary focus was intensive and seasonal (July-October) research on migratory southern hemisphere humpback whales. In 2004, as a corollary (and very much secondary) effort we began conducting additional survey work on inshore dolphins, with a particular focus on Atlantic humpback dolphins. The success of this early effort was mixed (and questionable), with limited funding limiting effort. However survey coverage was wide, and sightings were recorded in 'atypical' exposed coastal habitats that has informed more recent work. Since late 2008 dolphin work has been directed, including dedicated funding that has facilitated a year round beach-based effort in Conkouati Douli National Park (Congo) that focuses principally on 1.) quantitative assessment of artisanal fish catches and 2.) shore based observations for dolphins. Surveys occur once a month over ~10 days during which 60km of coast are surveyed on foot, with researchers resting each night at a different landing site, with two sites selected for detailed assessment of catches. Recent effort in Gabon has been primarily limited by available equipment; traditionally Gabon has been the base of our efforts, but our vessels are in need of critical repairs, and field projects have recently been restructured leading to a loss of personnel capable of completing survey work. Both countries have marine protected areas, and Conkouati Douli (Congo) and Mayumba (Gabon) national parks share a common border at the international frontier. These two parks were the focus of a recent bilateral agreement (2010) that formalised the creation of the '*Parc Transfrontaliere de Mayumba-Conkouati*,' a first for the region. Nesting marine turtles (including the largest leatherback rookery in the world), the transboundary movement of Atlantic humpback dolphins and the protection of fisheries resources were all motivating factors.

Work with coastal fishers in Conkouati Douli National Park is financed by a donor (US Gov) whose prime motivations include conservation of natural resources and encouragement of sustainable resource use. However the work has also (deliberately, as an element of survey approach) provided an indirect window on the bycatch of marine megafauna. The latter includes turtles, bottlenose dolphins, occasional (and we hope) rare catches of humpback dolphins and very occasional captures of common dolphins (*Delphinus capensis*). The extent of these captures and their nature remains hazy given incomplete effort and anxieties typically associated with takes of protected species. However, although data remain sparse (less than 20 dolphin captures recorded since 2009) it is clear that its extent varies between villages, with more captures reported at landing sites closer to Pointe Noire, and a clear trade in dolphin meat (i.e. the behaviour of fishers and traders suggests that it is more than opportunistic).

Moving forward we will concentrate on developing an abundance estimate and habitat model (at worst improving our picture of when and where they occur, at best identifying candidate sites for protection) for Atlantic humpback dolphins in Gabon and Congo and reducing takes in coastal villages of Congo. The former will be facilitated through directed funding, and includes use of at least three methods (ZINB models with covariates using beach based observer data, mark recapture and some derivative of strip transects) that can be used for both cross validation and identification of the most cost-effective method for future monitoring work. Work in villages to date has been deliberately moderated (allowing relationships to develop) but moving forward we will more formally engage with fishers through a

focused observer effort in candidate villages and an outreach campaign effected through a local Congolese NGO comprised primarily of fishers.

**Key factors influencing success/failure:**

Factors that slow progress (most important factors in **bold**):

- **Although some funding has been secured it is both short term (i.e. sustainable funding is generally unavailable) and low apparent densities require lots of effort in a very challenging environment, which is wild and logistically challenging (there are no bus services, no roads, no slipways or harbours for much of 700km)**
- **Significant costs associated with infrastructure purchase and maintenance (boat repairs, ATV's for beaches)**
- Lack of information on the extent of the marine bushmeat trade in Congo and significant uncertainty on how to best progress
- Lack of capacity within local agencies of national institutions (demotivated fisheries officers, poor enforcement of bushmeat trade, complicity of enforcement officers etc)
- **Most local villagers are very poor, meat can provide a significant source of income. Alternative solutions (i.e. improving the return on traditional fisheries) are not simple to devise**
- No National laws/regulations that require or support the collection of bycatch information
- Lack of empathy (donors and institutions) - the Atlantic humpback dolphin is a cryptic and timid species of moderate habits. There may be fewer on the planet than there are tigers in the wild.

Factors that help progress (most important factors in **bold**):

- Funding and technical support from the IWC will greatly improve abundance estimation work
- **Strong institutional support in Gabon (national parks agency, ministry of environment)**
- Good potential for locally sourced financing in Gabon through AFD 'debt relief for conservation swaps' that will provide local agencies (both national and NGO) with conservation dollars
- **Low human pressure in Gabon, some pressure in Congo, but nothing like elsewhere in West Africa**
- **Strong International NGO support (WCS, WWF, IUCN) for the conservation of the 'Congo Basin Coast'**

## **Addressing bycatch in artisanal gillnet fisheries workshop (Tanzania report)**

Omar A. Amir, Ministry of Livestock and Fisheries, Zanzibar-Tanzania

### **Bycatch issue synopsis:**

In 2000 a project was launched in Zanzibar, Tanzania with the objective to assess the status of cetaceans and build the capacity for their conservation and management. This was facilitated through collaboration between the marine mammal research group at Stockholm University, Sweden, (between 1998 and 2010) and since 2010 by Newcastle University, UK, and researchers and students from the Institute of Marine Sciences, University of Dar es Salaam, based in Zanzibar, Tanzania the Ministry of Livestock and Fisheries of Zanzibar, Tanzania.

The activities have focused on two research areas; vessel based surveys to collect data for cetacean distribution, abundance, genetic population structure, ecology and behaviour and documentation of strandings and interactions with fisheries and tourism occurring in Tanzanian coastal waters. The interactions with fisheries have been coordinated by me (having long time working experience in artisanal fisheries in Zanzibar) in collaboration with Dr. Per Berggren (who has considerable experience from conducting bycatch investigations and pinger trials in European waters) and fisheries beach recorders from the Department of Fisheries Development of Zanzibar.

During the past twelve years we have built up a good collaboration with the fishermen, fisheries beach recorders and local authorities. We have access to the available fishery statistics and foresee no problems to acquire the necessary permits to conduct the bycatch assessment work. We have previous experience from arranging several workshops with fishermen to discuss the bycatch problem and also from promoting sustainable dolphin tourism.

In the study area (Menai Bay Conservation Area) there are two populations of Indo-Pacific bottlenose (*Tursiops aduncus*) and humpback dolphins (*Sousa chinensis*) that have been studied since 1998. Population sizes were estimated at 136 for Indo-Pacific bottlenose dolphins and 63 for humpback dolphins that inhabit the area.

Observer programmes conducted onboard fishing boats were used to estimate and assess bycatch of dolphins in drift- and bottom set gill net fisheries operating in Menai Bay, Zanzibar. We used those data to estimate overall bycatch rates, based on bycatch rates observed in the two of the most active fishing communities. Based on the results of an observer programme conducted on the drift- and bottom set gillnet fishery in the study area, 9.6% of the estimated number (136) of Indo-Pacific bottlenose dolphins and 6.3% of the estimated number (63) of humpback dolphins are bycaught annually in this area. These levels of anthropogenic mortalities are not considered sustainable. We therefore proposed to introduce pingers as a mitigation method to prevent the bycatch before it is too late for both the animal populations and the communities relying on them for the tourism. Based on the experience from pinger use in other geographical areas it was expected that pingers will result in a significant reduction in bycatch of the dolphin species.

## **Key factors influencing success/failure:**

### Factors that slow progress (most important factors in **bold**):

- **No National laws/regulations that require or support the collection of bycatch information;**
- Most local communities initially were little interested in determining whether there was a bycatch problem and generally tended to disbelieve any indications that there may be a problem;
- Concerns from fishermen about any possible mitigation actions that could impact their fish catch or profits;
- Need for continued funding to buy, replace and deploy pingers.

### Factors that help progress (most important factors in **bold**):

- **Funding and technical support from foreign partners and regional NGO made it possible to do the assessment work;**
- **Availability of baseline information and data base in fisheries services and involvement of officials from the government (ministry responsible for fisheries);**
- **Existence of alternative sources of incomes for local people as dolphin ecotourism is the main tourist attraction in the two communities where the work was conducted;**
- **Availability of abundance estimates for the two common populations in the area;**
- Two communities, Kizimkazi Mkunguni and Kizimkazi Dimbani, have strong interest in dolphin bycatch and supported efforts to estimate bycatch rates;
- Application of mitigation tools (pingers) that was used in gillnet fisheries.



### **Addressing bycatch in artisanal gillnet fisheries workshop**

Salvatore Cerchio and Norbert Andrianarivelo, Wildlife Conservation Society, Ocean Giants Program

#### **Bycatch issue synopsis – Bycatch and hunting on the West Coast of Madagascar:**

In the southwest of Madagascar, traditional Vezo fishermen opportunistically hunt coastal dolphins for local consumption and sale of meat. Interviews of fishermen from the village of Anakao in 2000 suggested that over 6,000 individuals were slaughtered between 1985 and 2000 by the one community, with 57% of takes occurring after 1995. There was also suggestion of a progression from incidental by-catch to directed by-catch to directed hunting, and an increase in impact associated with change in fishing technique from harpoon to monofilament nets. Species most impacted were spinner dolphins, Indo-Pacific bottlenose dolphins and Indo-Pacific humpback dolphins, all having a strong coastal distribution and thus vulnerable to traditional hunting. In 2005, a drive hunt of 100-200 spinner dolphins was reported, supporting the figures reported in the interviews. Between 2004 and 2009, boat-based surveys were conducted in this region to establish status of cetacean populations. Eleven species of dolphins and two species of baleen whales were observed, highlighting the diversity and ecological importance of the region. Distributions of the three species targeted by hunters were primarily coastal and encounter rates very low, making it impractical to assess abundance and trends through standardized surveys. By 2007 it was decided that conservation actions on the impacted populations should be taken in the absence of trend data. During 2008-2011, similar boat and interview surveys were conducted around Nosy Be and Nosy Mitsio in the northwest; Sakalava fishers in this region do not appear to actively hunt dolphins, but there is evidence of by-catch, some potentially directed. Group size of humpback dolphins was three-fold larger and individual encounter rate six-fold greater in northwest as compared to southwest. This dramatic difference suggests that the Nosy Be population is relatively healthy and provides further evidence for the depletion of southwest populations. Incidental by-catch in artisanal fisheries was reported in both regions, however the impact of by-catch appears to be far less than the impact of directed hunting, and thus our conservation activities have focused on the more critical of the threats.

In response to the hunt and apparent impact on dolphins in the southwest, we have initiated a program of education, awareness-raising and alternative livelihood development, starting with a series of stakeholder workshops in 2007-2008 to promote economic alternatives to dolphin hunting. This resulted in the creation of the local Association for the Protection of Whales and Dolphins (FMTF) formed of community stakeholders including fishers formally hunting dolphins. The FMTF charter states explicit goals of cetacean conservation, economic advancement and development of community-based ecotourism in a region with a rapidly developing tourism industry. WCS has worked with the FMTF to apply the strategies of: *alternative livelihoods*, through training fishers on cetacean biology and whale-watching; *social marketing*, through creation of culturally appropriate messages and avenues to raise awareness and promote conservation (e.g., through local music); *traditional legal mechanisms*, establishing local community-ratified 'DINA', local laws governing both cetacean protection and ecotourism management. In addition, we are currently exploring the design of community-based MPAs, or Locally Managed Marine Areas (LMMA). The FMTF board has reported no hunts have occurred since 2008, although this has not been independently validated; we will return to the region in future years to re-assess status and test whether encounter rate and group size of targeted populations has increased.

During 2010, WCS conducted a long-range survey across 1200 km of coastline from the SW to mid-west coast, conducting interview surveys of 211 fishers in 23 villages across eight locales. Active hunting was reported only in the southern portion of the range, from Morandava south, and incidental by-catch reported throughout the range. Perhaps most critical, four other Vezo villages were identified that engage in a drive hunt for coastal dolphin similar to that documented in Anakao. It appears that the Vezo drive hunt tradition is relatively widespread along the southwest coast, but apparently confined to a finite number of specific villages. Follow-up interview work in 2011 verified the location of hunts, and community workshops will commence in 2012, in an effort to repeat the community intervention model developed in Anakao. Without the developing tourist industry in these remote villages that provided a clear alternative livelihood opportunity in Anakao, we will be addressing new challenges in the effort to mitigate the impact of the hunts, likely relying more on social marketing techniques.

### **Key factors influencing success/failure:**

#### Factors that slow progress (most important factors in **bold**):

- Lack of funding, particularly for the community invention work
- Lack of capacity in the region, particularly for field assessment surveys, data analysis, reporting
- Small population sizes of coastal dolphins making it difficult to adequately assess status
- **Poverty and lack of education in communities**
- **Exploding human population and crashing natural resources (e.g., from over-fishing)**
- **Lack of clear economic alternative to hunting in some remote communities**
- **Ineffectiveness of 'top down' management in remote subsistence communities, due to lack of enforcement and motivation to abide by national or regional laws and regulations**
- Cultural resistance to intervention by western NGOs and institutions, coupled with the multitude of efforts with overlapping target populations and techniques (e.g., interview fatigue)
- Lack of communication/coordination among groups working in region resulting in duplication of effort

#### Factors that help progress (most important factors in **bold**):

- **Use of an entirely Malagasy team for community intervention work, importantly including regional and local community members (and being sensitive to tribal rivalries and tensions among Malagasy)**
- **In some regions (Anakao) co-occurrence of abundance of humpback whales and a substantial tourism industry, allowing the development of community-based ecotourism model**
- **Convergence of agendas between local community and conservation groups (i.e., fishers recognized opportunity to make money from ecotourism...), resulting in receptivity of local community to conservation intervention**
- **Existence of a local community management institution, the DINA, or traditional law that subsistence fishers are motivated to abide by after ratification by communities**
- Taking advantage of absence of hunting by ancestors and local Vezo pride as a social marketing technique, and communicating message through culturally effective medium
- Established infrastructure of conservation NGO (WCS) in the region

## Addressing bycatch in artisanal gillnet fisheries workshop

Jeremy Kiszka, University of La Rochelle/France and South-West Indian Ocean Fisheries Project/SWIOFP

### Bycatch issue synopsis – Bycatch issue in east Africa and western Indian Ocean islands:

I have worked on bycatch issues in the western Indian Ocean for the past 6 years, especially to review and assess the past and present extent of marine mammal, sea turtle and elasmobranch bycatch in coastal/artisanal fisheries in the western Indian Ocean. I have started my work on the island of Mayotte (French island in the Comoros archipelago) on dugongs and other marine mammals, and extended to other organisms and regions, in eastern Africa, especially through the South-West Indian Ocean Fisheries Project (funded by the World Bank and the FFEM, French Fund for the World Environment).

In 2006, a first regional workshop to review bycatch issues in the western Indian Ocean, involving 12 countries has been organized. Based on existing information (papers, grey literature), unpublished data and individual experiences, we concluded that bycatch in gillnets (including bottom-set and drift nets, mostly targeting large pelagic fish and sharks) was the most significant threat to marine mammals and sea turtles in the SW Indian Ocean. Bycatch in oceanic/pelagic fisheries has been considered as a minor threat to large baleenopterid whales (few bycatch in purse-seiners, as fishermen use rorqual whales to locate tuna aggregations) and large delphinids (especially depredating species). However, this needs to be further quantified using data collected by the Indian Ocean Tuna Commission.

Coastal cetaceans (*Tursiops aduncus*, *Sousa chinensis* and *Stenella longirostris*), the dugong (*Dugong dugon*) and the humpback whale (*Megaptera novaeangliae*) are the most commonly bycaught species, especially off Zanzibar (Tanzania), SW Madagascar and possibly Mozambique and Kenya (gillnets are extensively used in these countries). Bycatch around oceanic islands (Comoros, Seychelles, Mauritius) appears minimal (very limited use of gillnets). In the region, almost information on bycatch has been collected using questionnaire surveys, as no observer data exist. However, in Zanzibar, from onboard observers during 2003 and 2004, the annual bycatch rate represented 9.6% for *T. aduncus* and 6.3% for *S. chinensis*. Other bycatch rates are unavailable in the region, while some abundance estimates exist for some coastal species, including off southern Kenya, Maputo bay, Mayotte, western and NE Madagascar (using CMR analyses and aerial surveys). However, overall, information on (at least) coastal marine mammal abundance, habitat preference and population structure is very limited in the SW Indian Ocean. In addition to abundance estimates, there is a clear need to assess marine mammal (and other bycaught species) stock structure, and define management units.

In order to further investigate the interaction between marine megafauna and gillnet fisheries in the SW Indian Ocean, a regional-scale project is being conducted (2011-2012) using interview surveys that have been previously used and improved in developing nations (Rapid Bycatch Assessment, Moore *et al.* 2010). At least 1,300 interviews will be conducted in areas where bycatch data are lacking (Kenya, Mozambique, NW Madagascar, Mauritius). In addition, RBA will be conducted in Zanzibar to evaluate their representativeness, as bycatch information using observer data have been collected in this area. Future collaborative projects will be submitted in 2012 in the region, especially to provide more detailed information on the distribution, abundance and population structure of small cetaceans from the coastal waters of eastern Africa, especially for MPA design and the development of mitigation strategies.

## Key factors influencing success/failure:

### Factors that slow progress (most important factors in **bold**):

- Lack of funding and local capacities for abundance and habitat surveys
- Limited information on the geographical extent of populations (connectivity, population structure), and on the units to manage (at least for coastal species)
- Observer programs are not possible for most fisheries (except in Zanzibar)
- Mitigation measures have been successfully implemented in gillnet fisheries in Zanzibar, but need for continued funding to buy, replace and deploy pingers
- Management in very small fisheries are very difficult
- **The increasing use of interview surveys in the region during the past 10 years, and the existence of several independent initiatives, have an effect on the collaboration of fishermen**
- No national laws/regulations that require or support the collection of bycatch information
- **For some regions, lack of other economic/job opportunities makes fishermen concerned about any possible mitigation actions that could impact their fish catch or profits**

### Factors that help progress (most important factors in **bold**):

- **Availability of fishing effort information for most countries (number of boats, gears and fishers)**
- **Existence of alternatives/job opportunities for fishermen in areas where tourism is active (e.g. Zanzibar, Bazaruto archipelago, Nosy Be, Southern Kenya)**
- **Abundance estimates are available for a few locations (still in progress)**
- Some governments show a great interest in assessing the extent of bycatch in their countries, and are very keen to provide support (staff from local fisheries services)

## **Addressing bycatch in artisanal gillnet fisheries workshop**

Jeff Moore, NOAA Fisheries Service

### **Bycatch issue synopsis:**

Since 2006, I have participated in various fisheries bycatch research projects. These have collectively included several taxonomic groups (marine mammals, sea turtles, seabirds, and with some new work that includes elasmobranchs) and diverse fishery types (industrial and small-scale) in different regions of the world. My principal research interests involve assessing the population impacts of bycatch, which is necessary for understanding whether bycatch levels are sustainable; this can help prioritize use of limited conservation and management resources.

In data-rich fisheries (usually from industrial fisheries from the developed world), impact assessments can, at least sometimes, be conducted using appropriate statistical and modeling methods. However, small-scale fisheries of the developing world pose numerous obstacles to conventional bycatch estimation or impact analysis. Management infrastructure is lacking, and observer programs are generally non-existent and not feasible to conduct. Therefore, alternative approaches must be considered for quantifying mortality of long-lived late-maturing non-target species and assessing impact accurately enough to inform conservation prioritization.

Conservation prioritization efforts in the developing world must not only consider where the greatest biodiversity threats are, but also where the opportunities are for change and identification of what those opportunities might be. This requires that information be collected not only about the species of concern and their threats, but also about the nature of the fisheries and people that interact with these species. Questions we need to understand to ultimately effect change include: How do the people fish and why do they fish that way? How does management function (i.e., what are the pathways to change)? How do markets function? Ultimately – what are the alternatives to fishing as people do and how might those alternatives be realized?

To get at these questions, colleagues and I have been exploring interview-based methodologies by which we might accomplish several objectives:

- estimate bycatch of species of concern in some fashion
- quantify fishing effort
- characterize cultural and socio-economic facets of the fisheries
- gauge trends (in fishing practices, in species abundance, in interaction rates between fishermen and these species)

Ultimately, we hope that the methods we develop will be useful for rapidly assessing (e.g., over large spatial areas), the magnitude of bycatch problem throughout a region, where they appear most severe, and where there might be opportunities for conservation.

Our initial efforts included collaborators in multiple nations (Nigeria, Sierra Leone, Cameroon, Jamaica, Tanzania, Mayotte, Comoros, Malaysia) and resulted in the first published recommendations for studying bycatch in developing nations using interview-based methodologies (Moore et al. 2010; Biological Conservation). Follow-up research is ongoing in Nigeria, where we are testing improved interview methodologies that gather information on a broader scope of issues than in our first efforts.

**Key factors for success in implementing interview-based bycatch assessment in developing countries:**

- Studying the human component of the bycatch issue
- Extensive training (in-country workshops) and regular QA/QC measures during the progression of work
- Extensive efforts to enforce standardization of methodology, from how interviews are administered to how data are collected and entered into a database
- Nurturing collaborative relationships with in-country partners
- Achieving project support from local leaders

**Key challenges/obstacles to interview-based assessment in developing countries:**

- Limited in-country expertise on a variety of issues (species ID, scientific method) that compromises quality of experimental design and data collection
- Limited funding
- Obstacles (cultural, logistic) to conducting research in a timely fashion
- Safety issues (civil unrest, piracy, etc.)
- Fisheries policy (e.g., lack of mandate to address issues, or unenforced laws on paper that act as disincentives for fishermen to participate in research)

### **Addressing bycatch in artisanal gillnet fisheries workshop**

Donna Kwan, UNEP/CMS Dugong MOU Secretariat, UNEP/CMS Office – Abu Dhabi, UAE.

#### **Bycatch issue synopsis – Incidental capture of dugongs in gillnets - a global perspective:**

Incidental capture in small scale artisanal and subsistence net fisheries is the largest threat to dugong populations over most of its range in South West Indian Ocean, North West Indian Ocean, South Asia and South East Asia. Dugongs are caught in drift and bottom-set gill nets in 87-99% of the range (based on coastline). However there is little reliable quantitative information exists on the level of impact of gill nets on dugongs. In response to this situation, the Dugong MOU Secretariat with the assistance of a group of specialists has designed a standardised interview survey protocol based on the original method developed by the Duke/Project GLOBAL Rapid Bycatch Assessment. This protocol has been reviewed by a multi-disciplinary group of experts and has been developed to interview fishers and other key informants to identify 'dugong risk areas' or 'trouble spots', where the number of dugongs and the threats to their survival are high.

The UNEP/CMS Dugong Standardised Survey Tool currently contains a questionnaire, data upload file, project manual and data analyses protocols are currently being developed. The Tool is designed to be a low cost, low tech method to collect information on the spatial distribution of dugongs and their habitats as well as the key threats to dugong populations – it also contains similar survey questions on marine turtles and cetaceans. The Dugong Standardised Survey Tool may be an important tool for addressing shared conservation synergies across other marine wildlife species impacted by gill nets including West African manatees, marine turtles and inshore cetaceans. Since 2010, the Tool has been used to conduct over 2400 interviews in 16 dugong range states. This information will be used to put together national, regional and global picture of "hotspots" which require management interventions.

Three pilot projects have been selected to be developed on the basis of expression of interests submitted to the Dugong MOU Secretariat - these include Bazaruto Archipelago, Mozambique; Western Province, Papua New Guinea and Gulf of Mannar (India & Sri Lanka). The pilot projects will trial the application of a Management Tool Kit of advisory, financial incentive and conservation tools which includes include low technology, low cost rapid assessment questionnaires, financial incentives, gear modifications, and monitoring methodologies. Subject to available funding, the pilots will be extended to other range states.

The Secretariat is also actively fund-raising through a Global Environment Facility (GEF), a regional concept proposal for GEF-eligible range states with available STAR Biodiversity allocations, aimed to develop sustainable financing and market opportunities, while delivering livelihood improvement and economic opportunity in exchange for dugong and seagrass conservation. In addition, a Dugong, Seagrass and Coastal Communities Initiative aimed at private/industry donors will be launched in early 2012. Funds raised will be directed to implementation of the priority pilot projects described above as well as the extension/up-scaling to all interested Dugong MOU range states.

## **Key factors influencing success/failure:**

### Factors that slow progress:

- The widespread impact of gillnets on small isolated highly threatened populations across the global geographic range of dugongs.
- In developing countries, most dugongs caught incidentally are used for food; however, gillnets are also increasingly used to target dugongs.
- For low income communities, dugongs taste good and are worth more dead than alive – incidentally caught dugongs are sold as meat and other by-products.
- This problem is exacerbated when the target product is highly valuable eg. in Mozambique where shark fins fetch US\$200/kg (dugong meat \$2/kg)
- Link between incidental capture of dugongs and the illegal, unreported and unregulated shark fin trade is unlikely to be limited to Mozambique given wide spread concern about dugongs caught in shark nets and the Asian focus of the Shark fin trade.
- The incentive for fishers to kill dugongs caught incidentally is considerable.
- There is a chronic lack of capacity for monitoring, enforcement and compliance of any regulations, even in protected marine areas.

### Factors that help progress:

- Strong commitment from fisher communities, lead government agencies, NGOs and tourism industry to effectively address the incidental capture of dugongs in gillnets fisheries.
- Secretariat can facilitate a coordinated approach – to share resources (financial and human), technical expertise, lessons learnt especially with regards effective mitigation approaches.
- Opportunities to address impact of bycatch across different species by coordinating to share resources (financial and human), technical expertise, lessons learnt especially with regards effective mitigation approaches.
- Potential to take an incentive based approach to ask fishers ‘what would it take’ and work with them to develop a mitigation approach, e.g., pilot projects.