CLP PROJECT ID: 03234115

CONSERVATION OF CETACEANS IN KIEN GIANG BIOSPHERE RESERVE
KIEN GIANG PROVINCE, VIETNAM

Viet Nam Marine Mammal Network
Southern Institute of Ecology
Ho Chi Minh University of Sciences

Aquiring baseline for cetacean conservation in Kien Giang Biosphere Reserve

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SECTION 1

SUMMARY

This project was the first scientifically-based conservation initiative cetacean in Kien Giang Biosphere Reserve (KGBR). Our project provides the critical baseline for cetacean conservation in KGBR, an UNESCO designated protected area in Vietnam, where unsustainable fishery is threatening the few remain cetaceans. Without a baseline on distribution, abundance and fishery's pressures on local cetacean, no further conservation efforts have ever been mobilized to protect those species in KGBR.

So far, we have achieved all our proposed objectives through a variety of activities, including boat-based surveys, semi-structures interviews, awareness raising activities, stakeholder meetings and workshops. The key outcome from our project is the first baseline for cetacean conservation in KGBR. Our baseline consists critical information on cetacean diversity, abundance, distribution as well at the emerging threats they are facing. Prior to the project, the KGBR management broad and local communities have participated in our project, where they provide important information for us, and in return significantly improved their awareness on cetacean conservation. Our baseline has set into motion new conservation initiative which will target the by-catch of cetaceans in KGBR.

INTRODUCTION

Conflicts between cetacean conservation and fisheries always befall when of those animals' habitat overlaps with fishing zones (Reeves et al. 2003a). To resolve this conflict, it is critical to know how many cetaceans are there and where they like to be (Reeves et al. 2003b). Accordingly, any conservation action that aim to protect cetacean need to begin with building a baseline on the distribution and abundance of the animals.

Kien Giang Biosphere Reserve (KGBR), an UNESCO designated (UNESCO, 2007), is the only location in Vietnam where several vulnerable cetacean species such as the Irrawaddy dolphins (*Orcaella brevirostris*) and the Indo-Pacific humpback dolphin (*Sousa chinensis*) are still being observed in their natural habitat (Long et al. 2015). Prior to this report, no new records of Irrawaddy dolphins have been made elsewhere in Vietnam. There is a high probability that Kien Giang's Irrawaddy dolphins are the last population in Vietnamese water. Unfortunately, unsustainable fishery in this area is threatening the few remained cetaceans. Conservation efforts could not be being implemented because the lack of understanding on those animal's distributions and abundances.

Such gaps of data has been identified by the IUCN/SSC Cetacean Specialist Group in its 2002-2010 Conservation Action Plan for the World's Cetaceans, which endorsed research initiatives in areas of "cetacean abundance and distribution" in the Gulf of Thailand where the KGBR is located (Reeves et al. 2003b). However, the cetaceans in KGBR have generated little research and conservation interest because of the infant stage of marine mammal science in Vietnam and low awareness of relevant stakeholders, namely the KGBR management staff, Kien Giang Fishery Department, Kien Giang Environmental Department and local fishery communities. As the result, cetacean in KGBR are generally excluded from local and regional conservation effort. Being excluded from conservation actions, together with rapidly increasing of fishery in KGBR may lead to local extinction of many cetacean species that inhabit this area.

The vanishing of cetaceans will affect the whole marine ecosystem of KGBR. As the apex predators, cetaceans generally maintain the ecosystem balance (Hoyt 2005; Moore 2013). They also play an important role in nutrient transportation in marine environment (Michael Gross 2016; Doughty et al. 2016). Moreover, cetacean extinction in KGBR may also impact the socio-economy of KGBR and possibly Vietnam. Starting from 2016, stricter implementation of the United States Marine Mammal Protection Act and Magnuson-Stevens Fisheries Act forces Vietnam to minimize cetacean-fishery conflict to maintain multibillion-dollar annual seafood importation in US market. Kien Giang, one of main fishing zone in the country, will likely to suffer economic consequences if its fishery industry cause declining in local cetacean population. Therefore, cetacean in KGBR need to be protected by scientifically-based conservation initiatives.

Our project aims to provide the first robust data on species composition, distribution and abundance of cetaceans, as well as raise awareness of stakeholders (local fishing communities, fishery agencies…) in KGBR on cetacean conservation. This provided our key partner, the KGBR management staff the necessary baseline for their future activities to protect cetacean habitat in KGBR.

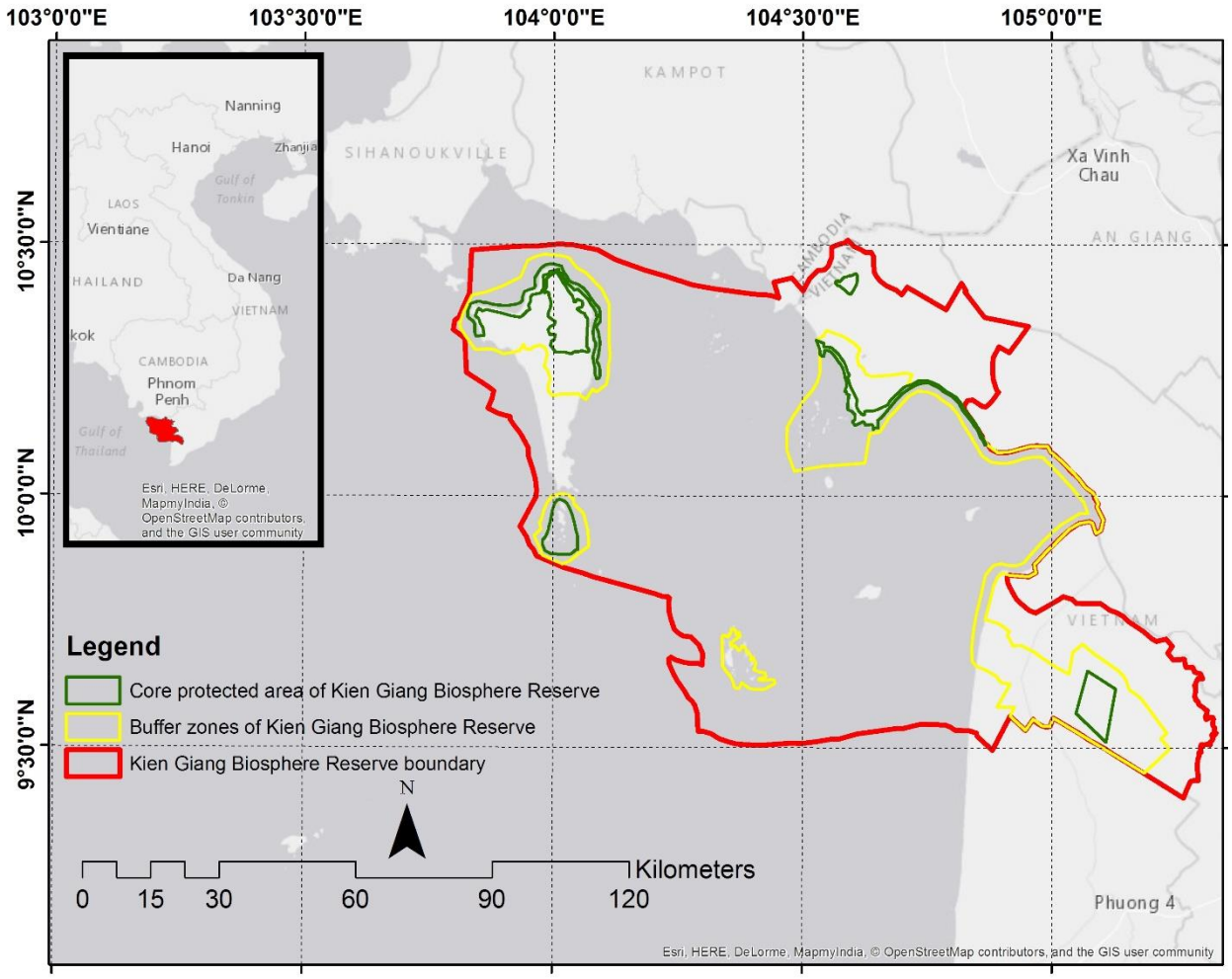


Figure 1: Map of the Kien Giang Biosphere Reserve and its location in Vietnam.

PROJECT MEMBERS

1. Project leader: VU LONG

   Nationality: Vietnamese

   Age group: 25-30

   Email: long.vu.192@gmail.com

   Highest level of education achieved: Master of Sciences

   Background: Vu Long has graduated from Ecology and Evolutionary Biology department of Ho Chi Minh University of Science. He has strong background in mammal ecology and has been involved in Conservation since he 2007 as volunteer for several local NGOs. Since 2012, he has been working as researcher of Southern Institute of Ecology. He has experience working with marine mammals in Kien Giang Biosphere reserve as well as in Trat province, Thailand. In 2014, he received funding from Rufford Small to conduct the first systematic survey on cetacean in KGBR. Since September 2014, he has established Vietnam Marine Mammal network and dedicate his career for marine mammal conservation.

   Current job title: researcher /coordinator of Vietnam Marine Mammal Network, Vietnam. Chevening Scholar in Bangor University.

   Relevant skills and experience brought to the project: Experience working with marine mammals in Kien Giang Biosphere; Cetacean survey skills; GIS skills; Relationship with other marine mammals researchers in Southeast Asia, America and Europe; Analysis skills; Planning skills; Experience working with local government

2. Team member: TRUONG ANH THO

   Nationality: Vietnamese

   Age group: 25-30

   Email: truonganhtho@gmail.com

   Highest level of education achieved: Bachelor

   Background: Truong Anh Tho has graduated from Ecology and Evolutionary Biology department of Ho Chi Minh University of Science. She has strong background in community-based conservation. She also has experiences in social studies and using multimedia tools to raise awareness of local communities.

   Current job title: researcher Organization: Ho Chi Minh city University of Sciences, Vietnam

   Relevant skills and experience brought to the project: Social study experiences; Interview skills; Raising awareness skills; Communication skills; Design skills

3. Team member: NGUYEN NGOC HUNG

   Nationality: Vietnamese

   Age group: 30-35

   Email: nguyen.hung.uns@gmail.com

   Highest level of education achieved: Doctoral degree

   Background: Nguyen Ngoc Hung has graduated from Ecology and Evolutionary Biology department of Ho Chi Minh University of Science. He has good background on ecology, wildlife survey and conservation. He has spent 2 years after graduated working as Environmental police officer. After that, he left law enforcement force and started working for Southern Institute of Ecology as a researcher to follow his conservation passion.

   Current job title: researcher Organization: Southern Institute of Ecology, Vietnam

   Relevant skills and experience brought to the project: Knowledge in Vietnamese laws and policies; Experiences working with local agencies; Wildlife survey skill ; Analysis skills ; Computer skills ; Interview skills

4. Team member: LE DUY

   Nationality: Vietnamese

   Age group: 30-35

   Email: leduy04h@gmail.com

   Highest level of education achieved: Master

   Background: Like the rest of the team, Le Duy has also graduated from Ecology and Evolutionary Biology department of Ho Chi Minh University of Science. He also has good background on ecology, wildlife survey and conservation. Besides that, Le Duy has very good background in photography.

   Relevant skills and experience brought to the project: Photography skills; Wildlife survey skills

SECTION 2

AIM AND OBJECTIVES

The overall goal of our project is to implement long term, multidiscipline approached conservation programs to protect cetaceans and their habitat in KGBR with collaboration of local communities and relevant governmental agencies. As the first cetacean conservation project in KGBR, our project need to start by building robust baseline on cetacean in KGBR, including their distribution, abundance, and their interaction with local communities. Such baseline allowed reliable recommendations towards management and conservation to related governmental agencies. Our specific objectives are:

- The abundance of Cetacean in Kien Giang BR is scientifically estimated
- Distribution of cetacean in Kien Giang BR is systematically mapped
- The habitat preference of cetacean in Kien Giang BR are scientifically predicted
- Threats from fishery to cetacean in Kien Giang BR are clearly identified
- Kien Giang governmental agencies, especially Kien Giang Biosphere Reserve management broad, Kien Giang fisheries department and local media fully aware of the needs for cetacean conservation in their province.
- Fishermen aware of effects of fishing gears on cetacean

METHODOLOGY

Survey parallel line transects were designed to cover areas of cetacean habitat, over a variety of depths intervals (in-shore and off-shore stratum). ArcGIS 10.1 and Distance 6.0 were used to randomly generate start points of each transects. Transect were designed based on recommendations in (Dawson et al. 2008). Surveys following Distance sampling protocols suggested by (Buckland et al. 2001). Minimum of two observers were stationed at port and starboard sides of survey vessel to look for cetacean's cues (e.g. splashing, blow, fluke…). Cetacean encountered when research vessel followed predetermined line transects (referred as on-effort sighting) and when it transited between areas (referred as off-effort sighting) were all recorded. Search speed was maintained between 15km/h to 19 km/h, depending on sea conditions. Data on position, group composition (e.g. the presence of calves) and behaviour will be recorded for all encountered cetacean species. Cetacean presence-absence data were also calculated for each 30-minutes sampling time.

Photo-identification/Mark-recapture surveys was also conducted during boat surveys. When a group of dolphins have been encountered, efforts were made to photograph the left and right sides of the dorsal fin and the back of each individual within the group. These photographs were

uploaded into a custom-made database (catalogue) for analysis and comparison. All qualified photo (e.g. clear, in good light, show clear distinguish mark) were manually compared to identified "recapture" animals. Recapture rates and population estimation were calculated by software Mark version 8.0 (Cooch & White 2007)

Depth, sea surface temperature, salinity and dissolved oxygen measurements were collected along transect line each thirty minute or when cetacean were encountered. Those environmental data were later related to cetacean presence-absence data collected along transect by generalized addictive model (GAM) (Hastie et al. 2006; Zuur et al. 2007). GAM models that consisted different sets of environmental variables were fit to cetacean presence-absence data using mgcv package (Wood 2013) in R 3.2.3. Top model, which chosen by AIC score (Pan 2004), was used to generated predictive map of cetacean detection in KGBR.

Semi-structured interview met hod will be used to collect standardized information on socioeconomic and cultural aspects of local coastal communities associated with local ecological knowledge and threats to cetaceans. Team member interviewed local people directly using prepared question list. Additional questions were used to clarify sensitive information such as by-catching, hunting.

To improve awareness of local communities on cetacean, we organized ten meetings in fishing villages in KGBR. During those meeting, we also integrated cetacean conservation issues and distributed awareness raising materials (sticker, leaflet, brochures, poster). Depend on each village characteristic, our awareness raising activities might range from interview and distributing posters to interactive games about marine conservation with sections that highlight on cetacean. For media coverage, we invited VTV2 channel of Vietnamese Central TV to join us for one survey to film documentary movie about our project and cetacean conservation. We also run two workshops with the KGBR management board to discuss about the project findings and connect the board with international partners who work on cetacean conservation.

OUTPUTS AND RESULTS

Total 51 line transects were conducted to survey an area of approximated 5000km^2. Four on-effort sightings of Irrawaddy dolphin (*Orcaella brevirostris*), two on-effort sightings of Finless porpoise *(Neophocaena phocaenoides*) and one on-effort sighting of Indo-Paciffic Humpback dolphin (*Sousa chinensis*) were made during systematic boat-base survey periods. Small number of sighting resulted in inadequate data which could not be analysis by standardized Distance software. Consequently, relative abundance of encountered cetacean species were calculated by sampling effort units (Table 1)

For Distance sampling required at least 40 sightings to provide accurate estimation (Buckland et al. 2001), current small number of sightings of cetaceans is un-suitable for accurate population estimations using Distance software.

Table 1: Encounter rates of cetaceans sighted on-effort in surveyed areas. EGh = groups sighted per hour of search effort, EIh = individuals sighted per hour of search effort, EG100km = groups sighted per 100km of search effort, EI100km = individuals sighted per 100km of search effort

Species	**EG100km**	**EGh**	**EI100km**	**EGh**
N. phocaenoides	0.54	0.042	0.27	0.197
O. brevirostris	0.27	0.021	2.56	0.021
S. chinensis	0.13	0.010	0.40	0.031

During this project, 536 photographs of Irrawaddy dolphin were taken. In combination with 2460 photographs of Irrawaddy acquired during opportunistic surveys before this project, a first photographic database for Irrawaddy dolphin in Kien Giang BR was established. From this database, total 42 individuals were recognized. Mark-recapture analysis suggest there were 153 Irrawaddy dolphins in surveyed area ((Table 2)

Table2: Estimation for Irrawaddy dolphin population using MARK software

MARK software, model M(o)	
Number of trapping occasions	4
Number of animals captured M(t+1)	42
Total number of captures, n	47
Estimated probability of capture, p-hat	0.0767
Population estimate	153 individuals
standard error	59.1627
CV	0.3866
Approximate 95 percent confidence interval	84 to 337 individuals

Current data only allowed limited inferring on the distribution pattern of cetacean in KGBR. Overall, cetaceans in KGBR appear to have very restricted distribution range in the east of the reserve and north of Phu Quoc Island (Figure 2). Additionally, different species appeared to have favoured habitats. The Irrawady dolphin were only found in the coastal area to Ba Lua archipelago (Figure). Only one group of Indo-Pacific humpback dolphin was recorded in North of Phu Quoc Island. Direct observations of Finless porpoise were made in Ba Lua archipelago only. However, we found three carcasses of this species in different location in Phu Quoc, which implied that porpoise can inhabiting this region.

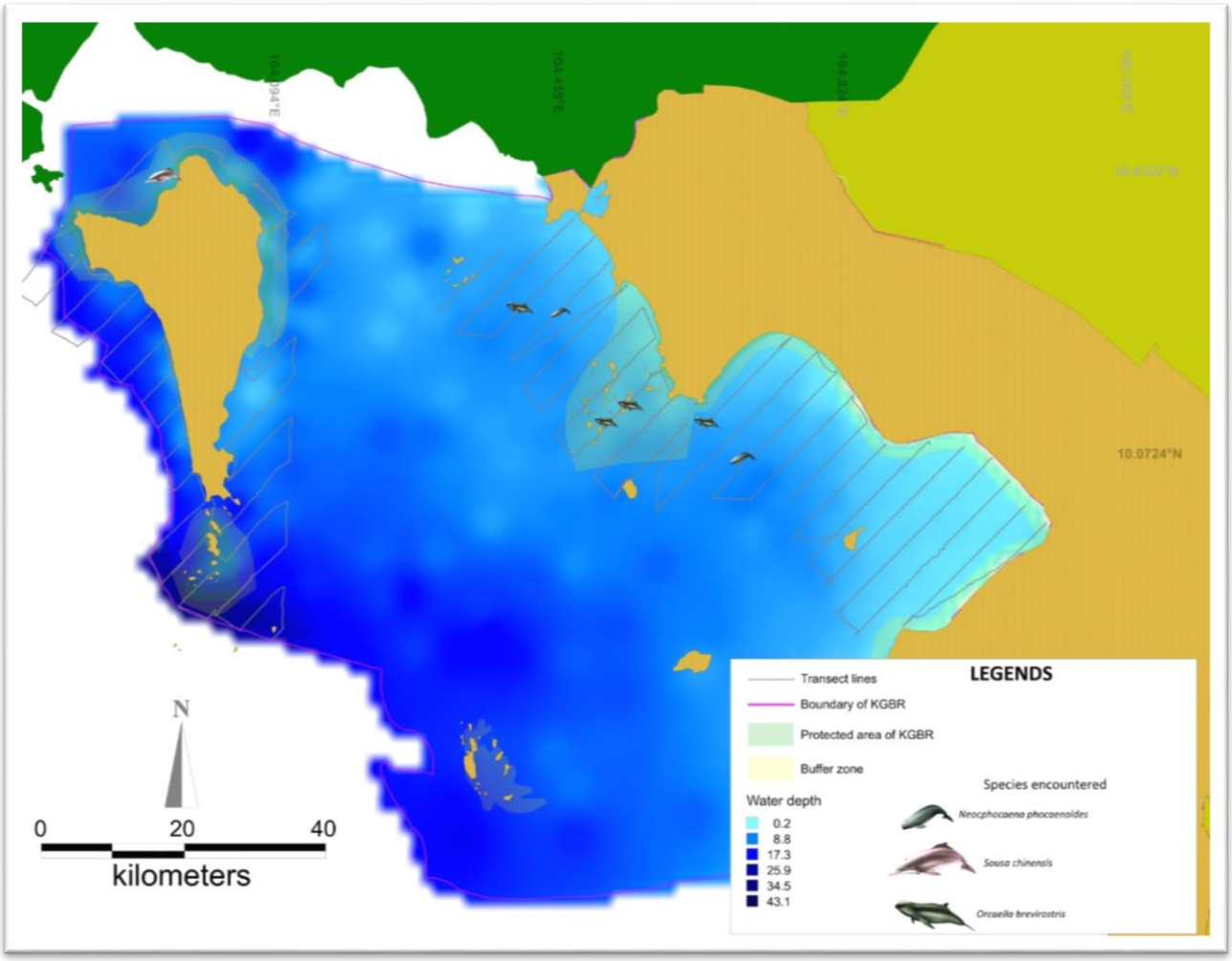


Figure 2: Survey transects and the location where cetaceans were encountered.

Total 254 locations were samples for environmental data. Among those, there were 07 locations where cetaceans were observed. The best fitted model for current data was the GAM model that included UTM coordinate X and Y, depth and distance to the nearest shore (Table 3). Based on this model, predicted probability of cetacean detection was plot for KGBR (Figure 3)

Table 3: Summary of best performance GAM model for cetacean presence-absence data.

Variable	df/edf	X^2	p-value
s(X_UTM)	1.78	6.277	0.046
s(X_UTM)	1.00	4.74	0.029
s(depth)	2.11	8.302	0.029
s(distance to the shore)	1.00	2.833	0.092

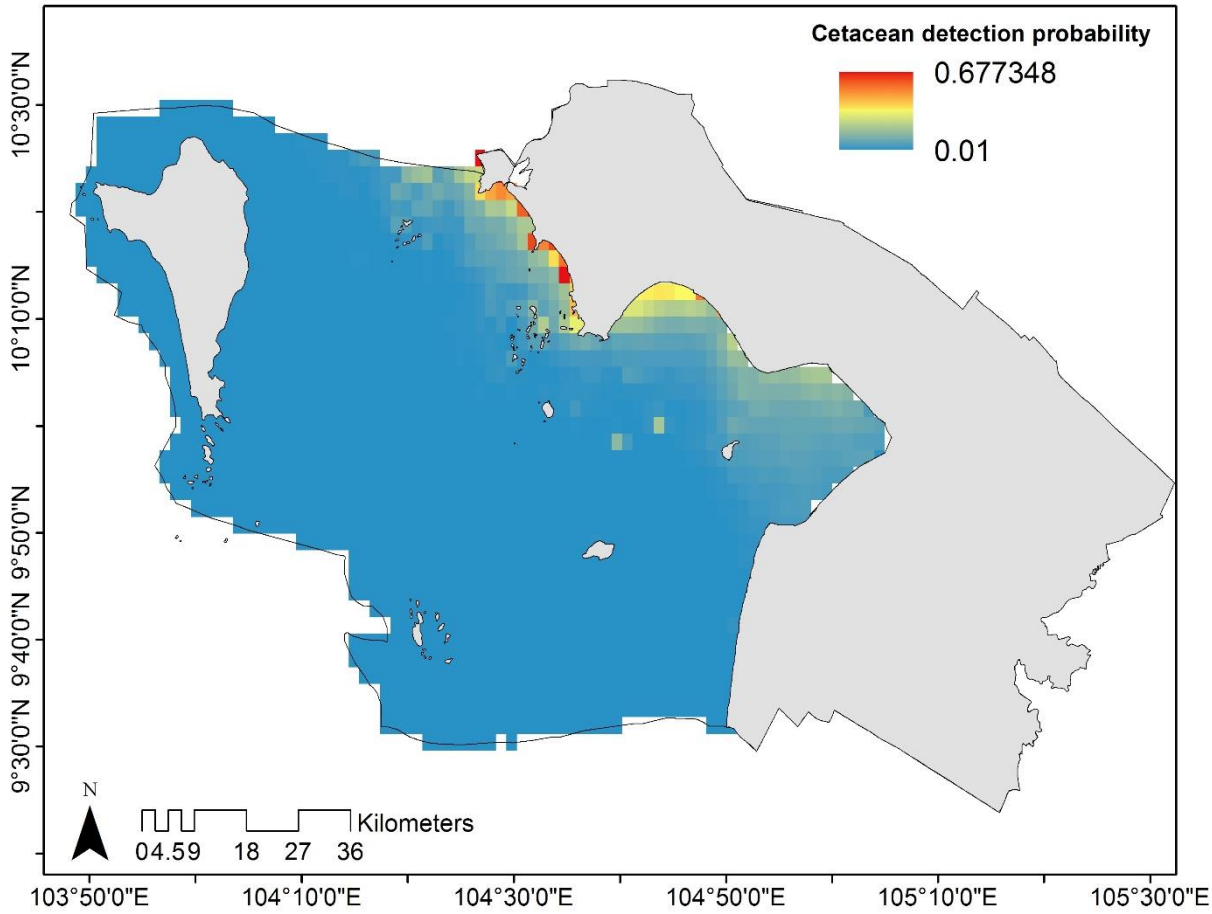


Figure 3: Predictive map of cetacean detection probability resulted from top GAM model. The area that have high predicted probability of encountering cetacean was Northeast coast of the reserve.

Semi-structure interview revealed that local fishermen went fishing all year. Fishing activities took place regardless marine conservation or already existed marine protected areas. All of 58 responders confirmed that they had accidentally catch different species of cetacean in their gears within last 5 years. We also recorded that local fishermen hold traditional respects for cetacean from the common of whale temples in this region. Interview survey also led to the discovery of previously unrecorded Omura's whale (*Balaenoptera omurai)* for KGBR.

Ten meetings with local communities in KGBR were organised during this project. In all meetings, local people shared their knowledge on cetacean in KGBR by participating in our interviews and games. During those meeting, we distributed 200 posters, 20 T-shirts and 2000 stickers that carried awareness raising messages on local cetacean conservation to local people.

For media coverage, VTV2 channel of Vietnamese Central TV joined us for one survey to film documentary movie about local cetacean conservation (Figure 4). The film, however, is still under development. We also run two workshops with the KGBR management board to deliver our

project's findings, as well as connecting the board with international cetacean researcher to develop detail conservation action based on our baseline results (Figure 4).

A

B

C

D

E

F

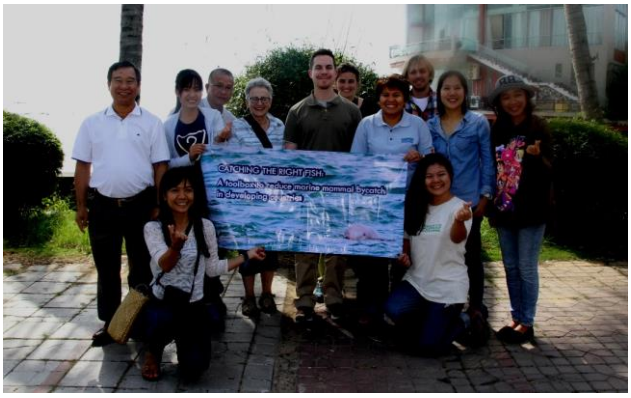


Figure 4: (A) Local communities meeting and interview. (B)Interactive game for fishermen's children, with cetacean poster as prices. (C) The local whale temple where Omura's whale skeleton was recorded. (D) National television staffs filming our project. (E) Handing picture of Irrawaddy dolphin to KGBR management staff during one of our workshop. (F) Workshop group pictures between KGBR staff, remain CLP team member, Ms. Truong Anh Tho and international collaborators who are working with KGBR to develop other marine conservation programme.

ACHIEVEMENT AND IMPACT

Our project carried out the first systematic and standardised boat-based survey to study cetacean in Vietnam. Our sampling methods (Distance, photo ID, habitat modelling), which were traditional techniques to study cetacean in developed countries, have never been used in Vietnam before. Our results provided comparable baseline data on cetacean abundance and distribution in KGBR, where no similar study had ever been done. Beyond its scientific values, our project added an important component into marine conservation schemes of KGBR management broad. First, our results allowed KGBR staff to use cetacean as the indicator species to monitor marine ecosystem in the reserve with reasonable costs and efforts. Before our project, KGBR management board were looking for indicator species that can indicate marine ecosystem health in this area. They had not considered cetacean since few information available for those species in this reserve. By participating in our project, the broad now understand the crucial role of cetacean in marine ecosystem as high-trophic-level predators, and they are commonly used as indicator species for many aspect in marine conservations, from system's health to recovery of marine fish stocks (Bowen 1997; Mast et al. 2014). More importantly, through working with us in this project, KGBR management broad was also exposed to reliable and practical methodologies that allow them to monitoring cetacean themselves, thus enable them to utilize cetacean as indicator species in their activities.

Our project also promoted cetacean as a necessary focal point for marine conservancy in this area. Around the world, many species of cetacean were used as flagships or symbols to attract sympathies, attentions and imagination of general public (Mast et al. 2014). In KGBR, we found that local fishermen have little regards on marine conservation in general. Many still fish inside marine protected area. Their intense fishing practices, which took place all year around, put stress on marine productivities in stress. However, local fishermen still hold high regards for cetacean, particularly whales and Irrawaddy dolphins. Whales temples, where local fishermen keep cetacean carcass for worshiping, were commonly found in this region. Our project made sure that this fact was well-aware by KGBR staff, national and international conservation organizations, thus made cetacean become much more compelling option for flagship species.

Cetacean by-catch happened commonly in the reserve as all fishermen we interviewed admitted t they had at least one cetacean by-catch within past five years. This finding clarified the anticipated threat for local cetacean populations. By-catch, refer to incidentally catch as non-target species in fishery, was recognized as the most significant threat not only to cetaceans but also to large marine vertebrate worldwide (Reeves et al. 2003b; Young & Iudicello 2007). Determition to solve cetacean by-catch issue in the United States also resulted in Marine Mammal Protection Act and Magnuson-Stevens Fisheries Act, which obligates all American fishing industry as well as

contries that import fishes to the United States to come up with by-catch mitigation measures (Johnson et al. 2017). In this context, our project had connected local fishermen communities with global conservation situation. We pointed out that involved into reducing cetacean by-catch in their hometown is for own benefits, as it will help secure fishery exportation to USA.

By conducting the first comprehended cetacean project in KGBR, we have also raised awareness for cetacean conservation on national scale level. We attracted the interest of National television channel (VTV2), and had them join us during survey. Although the expected product (cetacean documentary movie that carry our conservation message) could not be finished during this project time frames, our project has ignited the media interest on cetacean. We firmly believe because of our project, local media become more sensitive and positive to cetacean conservation issue. Prior to our project, there was one dolphin hunting cased took place in Kien Giang. The case of dolphin killing in KGBR, which have been reported by our informant and addressed by KGBR management board and Kien Giang Fishery department. The media was actively in condemning such action, which they had never done before.

We also spent great effort to communicate with international researcher and supporter. Our project main findings were 21th Biennial Conference of Society for Marine Mammalogy (December 2015 in San Francisco, USA) (Figure 5), an at the Second Regional South East Asia Marine Mammal Stranding Network Symposium (November 2016 in Pattaya, Thailand). Before us, no Vietnamese presentative had ever participated in those events. Many researchers and relevant organization considered Vietnam as a “black site” for cetacean studies. With our study in KGBR, we provided an example for difficulties, challenges and real situations of marine mammal conservation in the country. We believe our work has provide a “starting point” for other conservation initiatives that focus on cetacean and sustainable fishery in KGBR. For example, our project contributed to the development of the NOAA funded programme "Catching the Right Fish: A toolbox to reduce marine mammal bycatch in developing countries."

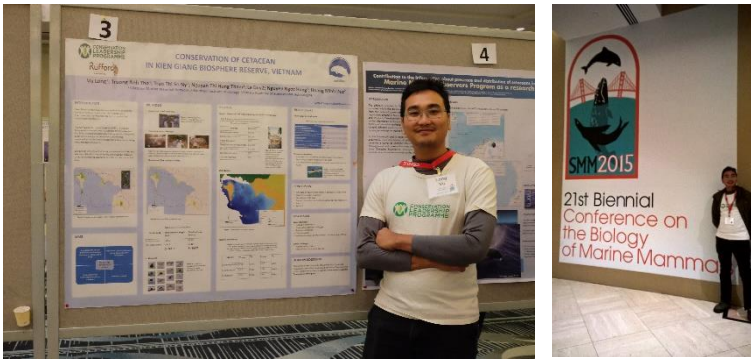


Figure 5: Project team leader presented this project preliminary results during Society for Marine Mammalogy’s Biannual Symposium, San Francisco, USA

SECTION 3

CONCLUSION

Our project established the first ecological baseline for cetacean conservation in KGBR. It provided a great amount of new information on those taxa, including new recorded species, their relative abundance, their possible distribution, local communities' perception toward cetacean and by-catch threat to the KGBR management broad. Our findings have inspired the board focus on cetacean in their marine conservation schemes. Possibly approaches include using cetacean as indicator species in monitoring marine ecosystem health or as flagship species to attract public supports.

This baseline also provided a "starting point" for other conservation organizations that interest on cetacean, sustainable fishery and marine issue in KGBR. Prior to this report, NOAA funded programme "Catching the Right Fish: A toolbox to reduce marine mammal bycatch in developing countries" had taken place in Southeast Asian region. Because of our findings, experts from this project had visited KGBR to discuss collaboration with the reserve management broad.

This project had also raise awareness of local communities and media on cetacean conservation issue. For local fishermen, through interview, meeting and education materials, our project had link interest of local communities with conservation issue, particularly the US requirement for importing fish. We also documented local fishermen's high regards toward cetacean, which allow conservation actions to take advantage on. For media, our project started to attract media coverages, which contribute to raise awareness on cetacean conservation national-wide.

PROBLEMS ENCOUNTERED AND POTENTIAL SOLUTIONS

Preparation for boat-based survey went well with the help of Dr. Louisa Ponnampalam, MARECET Malaysia. As the team has limited experience in marine mammal survey, the presence of highly experienced marine mammal observer such Dr. Louisa during first boat-based survey help our team to improve. Other preparing activities such as designing and producing education material also went well, thank to the abilities and relationships of one team member, Ms. Truong Anh Tho. Our interview survey also went accordingly to our plan, as the local communities had traditional interests in cetacean.

In the other hand, there were several problems with our project. Firstly, the boat-based survey recorded fewer cetacean sightings than we expected. Thus, we had to change to calculate relative abundance of cetacean in KGBR instead of estimating exactly abundance. In the end of the project, we had to applied more complicated modelling technique to make "education guess" on cetacean distribution pattern in KGBR. Also because of this issue, the VTV2 documentary about cetacean in

KGBR could not be finished within the time frame of this project. The limited number of encounter provided insufficient footages for the filming crew to compose a compelling story. This issue gave us a lesson on the imperfect nature of ecological/conservation study, and inspired us to improve our method in future project.

We also faced a significant challenge since the middle of our project, when the team leader and another member went to study aboard. Working remotely appeared to be less effective, and had prolonged our project beyond our planned timeframe. The team leader was indeed overconfident about his abilities to lead the team from different country while studying in a very intensive programme. As the results, many activates were delayed because of miscoordination. To address this problem, we recruited several volunteers to help on remain activities. This adjustment helped finishing interview and workshop activities. However, the report writing process was still delayed because of miss-communication between team members. The lesson we learnt from this setback was the importance of time management. We learnt that each team member need to manage their own time well, and effectively communicate with others to ensure the project meet its timelines. Commitment of team members to the project should also be addressed from the recruitment stage to avoid irresponsibility.

Adding to the missing team member, our team had faced a gender equality issue while working with local stakeholders. As the team leader was not in the country to directly work with KGBR and other relevant agencies, leading role was passed to the next committing and qualified member, which happen to be female. We realized that several collaborators in KGBR management broad have lesser regards for a female leader despite of her qualities. This caused delaying in responds for paper works and organizing workshops. As this is a sensitive issue, we can only resolve the problem by being patience. We also learnt that patience is critical when working with local stakeholders.

CAPACITY DEVELOPMENT AND LEADERSHIP CAPABILITY

This project is a crucial milestone in the chosen career paths of all team members. Starting from the team leader, Long Vu is among very few conservation scientists who work on marine mammal in Vietnam. He developed this project from his academic interest and conservation passion for cetacean in Vietnam. It is clear that Long have greatly developed his academic skills when he (on the behalf of the team) presented findings of this project in several scientific/conservation conferences. In the end, Long gained much more than academic abilities. This project challenged his recently developed leadership skills. By going through common problems of leading a conservation project such as team recruitment, project planning, organizing and executing, the team

leader gradually learnt to be conservation leader. More importantly, the team leader learnt a great lesson on team coordinating through his mistakes, which will help him in future projects. For the team leader, the CLP award provided him advantages when he applied for the highly competitive Chevening scholarship to persuade his master degree in United Kingdom. This degree greatly affected his performance in the project, but necessary for his career as a pioneer researcher in cetacean in Vietnam.

For the other team members, they participated in this project because of their passion for marine conservation. For Nguyen Ngoc Hung and Le Duy, although their study subjects are not cetacean, they have developed significant amount of surveying techniques (e.g distance sampling, photo-ID, interview…) which they will used in their future works. Nguyen Ngoc Hung is currently persuading his PhD degree on population genetic in Taiwan National University, where the modelling skill he gained from this project help his work. Le Duy used the GIS/mapping and interview skills he learnt from this project to finish his Master degree on bird ecology in Ho Chi Minh city University of Science. Truong Anh Tho, the acting leader of the project when the main team leader was unavailable, have greatly develop her skill in project coordinating, networking and workshop organizing, which all useful for her career in conservation. In summary, all team member greatly improved their capacities after this project.

IN THE FUTURE

We keep motivating the staff from KGBR to continue our work on cetacean conservation in this area. Keeping the management broad interest and motivated is not only crucial in sustaining our project results beyond it timeframe, but also benefit for the reserve's staff as they can access to more opportunities to improve their capacities or communicating with potential sponsors. We also maintain relationship with our interviewees who had provided us valuable information. By frequently communicating with those responders, we have established a network of informants who keep us updated on relevant issues in KGBR remotely.

This project can be considered as a pilot study where gained experiences will contribute for developing better projects. We understand more ecological data on cetacean are needed to address cetacean by-catch problem which was identified in this project. One important aspect that we want to investigate is how cetacean in this area used utilizing their habitats. Do they have specific foraging ground or just opportunistically feeding? This question can be answered by application of passive acoustic monitoring techniques, which we consider to applied in our future studies. Beside ecological interest, we always aim to address the cetacean by-catch issue in this region in future projects.

Figure 6: Mr. Ly Minh Tai (far left, green shirt) from KGBR management staff attended to a international workshop on marine mammal by-catch in Thailand with Ms. Truong Anh Tho (third from the right). We tried our best to encourage the staff to work with international expert regards to cetacean conservation in KGBR. More information can be found at KGBR website, available at the link in the end of this report.

SECTION 4

Appendices 1: Full account of income and expenditure

Date	Phase	Budget line	Unit cost (local currency)	Quantity	Total USD ($)
08/20/2015	A-Phase 1 Project preparation	Communications (telephone/internet/postage)	100000	20	88.00
08/22/2015	A-Phase 1 Project preparation	Communications (telephone/internet/postage)	500000	1	22.00
02/23/2015	A-Phase 1 Project preparation	Visas and permits	2272800	1	100.00
09/01/2015	A-Phase 1 Project preparation	Team training	500000	1	22.00
08/25/2015	A-Phase 1 Project preparation	Reconnaissance	180000	2	15.84
08/25/2015	A-Phase 1 Project preparation	Reconnaissance	120000	2	10.56
08/26/2015	A-Phase 1 Project preparation	Reconnaissance	120000	2	10.56
08/26/2015	A-Phase 1 Project preparation	Reconnaissance	300000	1	13.20
08/26/2015	A-Phase 1 Project preparation	Reconnaissance	500000	2	44.00
08/26/2015	A-Phase 1 Project preparation	Reconnaissance	2000000	1	88.00
08/26/2015	A-Phase 1 Project preparation	Reconnaissance	200000	2	17.60
09/30/2015	A-Phase 1 Project preparation	Field guide books, maps, journal articles and other printed materials	20000	4	3.52
10/01/2015	A-Phase 1 Project preparation	Field guide books, maps, journal articles and other printed materials	10000	20	8.80

Date	Phase	Budget line	Unit cost (local currency)	Quantity	Total USD ($)
10/05/2015	A-Phase 1 Project preparation	Field guide books, maps, journal articles and other printed materials	10000	200	88.00
11/12/2015	A-Phase 1 Project preparation	Insurance	250000	10	110.00
09/03/2015	B-Equipment	Scientific/field equipment and supplies	34500000	1	1518.00
11/12/2015	C-Phase 2 Project implementation	Outreach/Education activities and materials (brochures, posters, video, t-shirts, etc.)	60000	200	528.00
11/12/2015	C-Phase 2 Project implementation	Outreach/Education activities and materials (brochures, posters, video, t-shirts, etc.)	9000	200	79.20
11/12/2015	C-Phase 2 Project implementation	Outreach/Education activities and materials (brochures, posters, video, t-shirts, etc.)	200000	50	440.00
11/12/2015	C-Phase 2 Project implementation	Outreach/Education activities and materials (brochures, posters, video, t-shirts, etc.)	1000	2000	88.00
11/16/2015	C-Phase 2 Project implementation	Travel and local transportation (including fuel)	180000	8	63.36
11/16/2015	C-Phase 2 Project implementation	Travel and local transportation (including fuel)	100000	1	4.40
11/16/2015	C-Phase 2 Project implementation	Accommodation for team members and local guides	370000	6	97.68
11/17/2015	C-Phase 2 Project implementation	Food for team members and local guides	120000	6	31.68
11/18/2015	C-Phase 2 Project implementation	Food for team members and local guides	120000	6	31.68
11/18/2015	C-Phase 2 Project implementation	Travel and local transportation (including fuel)	200000	1	8.80
11/18/2015	C-Phase 2 Project implementation	Accommodation for team members and local guides	300000	24	316.80
11/19/2015	C-Phase 2 Project implementation	Food for team members and local guides	352000	1	15.49
11/20/2015	C-Phase 2 Project implementation	Food for team members and local guides	130000	1	5.72
11/21/2015	C-Phase 2 Project implementation	Food for team members and local guides	420000	1	18.48
11/22/2015	C-Phase 2 Project implementation	Food for team members and local guides	180000	1	7.92
11/23/2015	C-Phase 2 Project implementation	Food for team members and local guides	720000	1	31.68
11/24/2015	C-Phase 2 Project implementation	Food for team members and local guides	300000	1	13.20
11/25/2015	C-Phase 2 Project implementation	Food for team members and local guides	720000	1	31.68
11/26/2015	C-Phase 2 Project implementation	Food for team members and local guides	300000	1	13.20
11/27/2015	C-Phase 2 Project implementation	Food for team members and local guides	300000	1	13.20
11/28/2015	C-Phase 2 Project implementation	Food for team members and local guides	1400000	1	61.60
11/27/2015	B-Equipment	Boat/engine/truck (including car hire)	3900000	10	1716.00
11/28/2015	C-Phase 2 Project implementation	Travel and local transportation (including fuel)	200000	1	8.80
11/28/2015	C-Phase 2 Project implementation	Travel and local transportation (including fuel)	180000	8	63.36
02/10/2016	C-Phase 2 Project implementation	Travel and local transportation (including fuel)	180000	4	31.68
03/02/2016	C-Phase 2 Project implementation	Accommodation for team members and local guides	300000	40	528.00

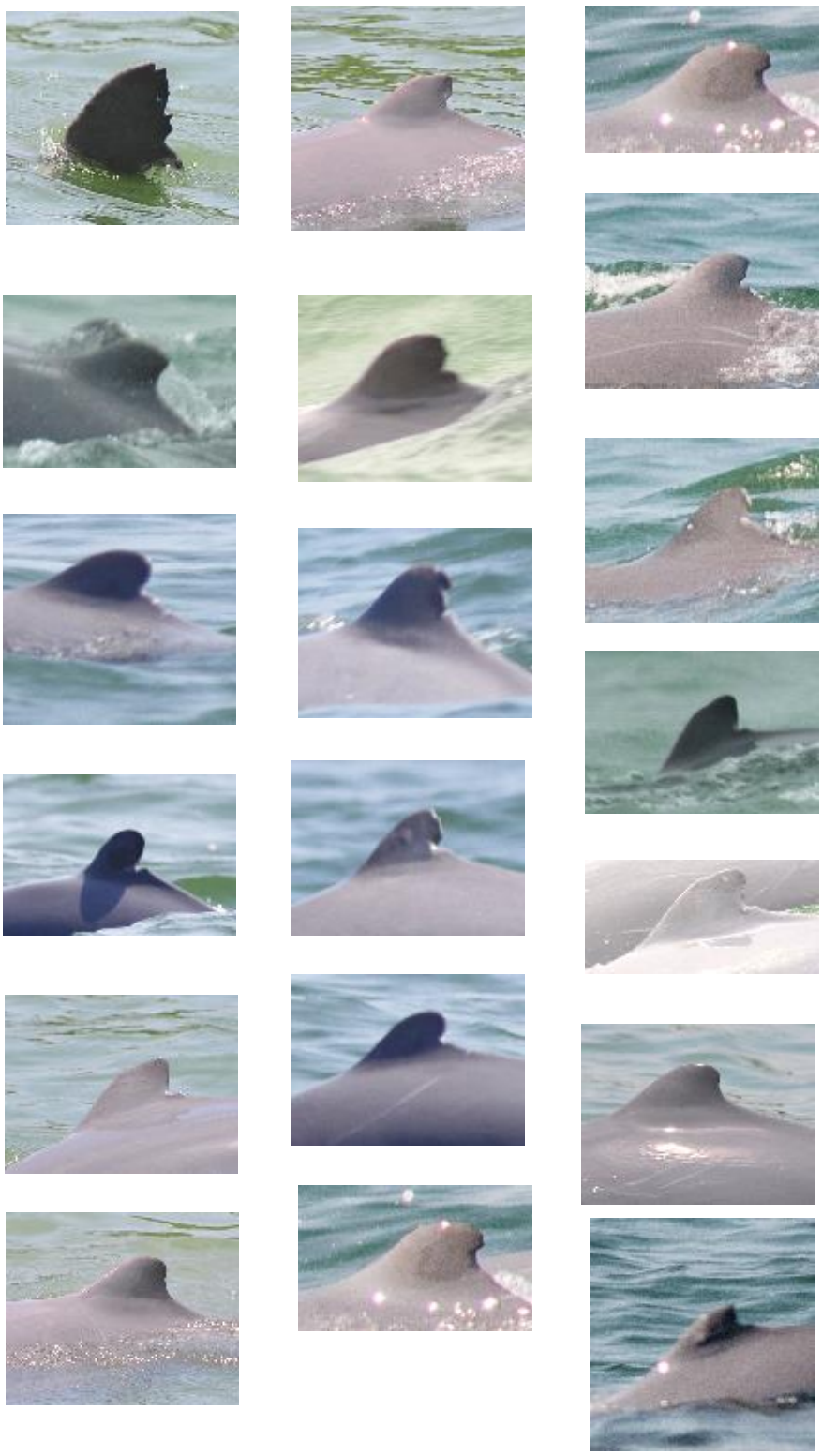
Date	Phase	Budget line	Unit cost (local currency)	Quantity	Total USD ($)
03/02/2016	C-Phase 2 Project implementation	Food for team members and local guides	120000	30	158.40
03/02/2016	B-Equipment	Boat/engine/truck (including car hire)	3000000	15	1980.00
03/02/2016	C-Phase 2 Project implementation	Travel and local transportation (including fuel)	180000	4	31.68
08/05/2016	C-Phase 2 Project implementation	Travel and local transportation (including fuel)	180000	2	15.84
08/15/2016	C-Phase 2 Project implementation	Accommodation for team members and local guides	300000	10	132.00
08/15/2016	C-Phase 2 Project implementation	Food for team members and local guides	120000	30	158.40
08/15/2016	B-Equipment	Boat/engine/truck (including car hire)	3000000	9	1188.00
08/15/2016	C-Phase 2 Project implementation	Travel and local transportation (including fuel)	180000	2	15.84

Appendices 2: Summary of cetacean sighting and zone map of KGBR

Sighting number	Date	Time	Zone	Transect name	Transect length	Species	Observed group size
1	16-Apr-14	12:03	1	I3O3	18.9	*O. brevirostris*	10
2	16-Apr-14	12:30	1	I3O3	18.9	*O. brevirostris*	4
3	17-Apr-14	10:38	1	I3O3	18.9	*O. brevirostris*	2
4	20-Apr-14	14:41	1	O9I9	23.3	*N. phocaenoides*	1
5	1-Jun-14	10:22	2	OO10II10	25.9	*O. brevirostris*	3
6	1-Jun-14	13:14	2	II11OO11	32.5	*N. phocaenoides*	1
7	25-11-15	14:32	7	NA	NA	*S. chinensis*	2

Appendices 3: Example of our photo catalogue

Some pictures of Irrawaddy dolphins' dorsal fin in our photo catalogue. These pictures were used to identified individual dolphins, thus enable the population estimation through Mark-recapture analysis. Some pictures were taken before this project took places in our opportunistic survey in KGBR during 2013 and 2014



Appendices 4: Pictures of cetacean recorded in KGBR during this project

(A) Irrawaddy dolphin *Orcaella brevirostris*; (B)Indo-Pacific Humpback dolphin *Sousa chinensis*; (C) carcass of Finless porpoise *Neophocaena phocaenoides*; (D) carcass of Pantropical spotted dolphin *Stenella attenuata*; (E)Skull of Omura's whale *Balaenoptera omurai*

A

B

C

D

E

Appendices 5: Accumulated species checklist of cetacean in KGBR

Species	English name	Information source
Balaenoptera edeni	Bryde's whale	Recorded from pictures interviewee provided. Also from three different skulls stored in whale temples in Rach Gia city
Balaenoptera omurai	Omura's whale	Recorded based on single skull stored in whale temple in Phu Quoc island. This skull belongs to a animal died in 2010.
Kogia breviceps	Pygmy sperm whale	Recorded based on single skull stored in whale temple in Hon Tre island.
Neophocaena phocaenoides	Finless porpoise	Recorded by 02 direct sighting during boat-based survey, plus multiple carcass and skulls provided by informants
Orcaella brevirostris	Irrawaddy dolphin	Recorded by 04 direct sighting during boat-based survey, plus multiple carcass and skulls provided by informants
Sousa chinensis	Indo-Pacific Humpback dolphin	Recorded by 01 direct sighting during boat-based survey
Stenella attenuata	Pantropical spotted dolphin	Recorded based on single reserved carcass stored in Bai Duong, Phu Quoc island
Tursiops aduncus	Indo-Pacific bottlenose dolphin	Recorded based on 04 skulls stored in whale temple in Rach Gia city and pictures from informants

Appendices 6: List of questions used during semi-structured interview

	Question (Eng)	Code	Group	Note
1	Name of interviewee	A1	A	**info**
2	Year of Birth	A2	A	**info**
3	Sex	A3	A	**multi-choice**
4	Phone number	A4	A	**info**
5	Ethic	A5	A	**info/(treated as multi-choice in analysis)**
6	Religion	A6	A	**info/(treated as multi-choice in analysis)**
7	Education	A7	A	**info/(treated as multi-choice in analysis)**
8	Number of people in family	A8	A	**numeric/ male/ female**
9	Time of residence in KGBR	A9	A	**multi-choice**
10	Economical status	A10	A	**multi-choice (evaluate by the interviewers through additional question)**
11	Number of people at working age in family	A11	A	**numeric/ male/ female**
12	Number of people at early age in family	A12	A	**numeric/ male/ female**
13	Main income of family comes from	A13	A	**multi-choice with additional info**
14	Fishery experience	B14	B	**numeric(years)**
15	Name fishing location	B15	B	**info**
16	Identify Fishing location on map	B16	B	**multi-choice (see attached map)**
17	Type of fishery/fishing object	B17	B	**info**
18	Size of boat	B18	B	**multi-choice (evaluate by the interviewers through additional questions)**
19	Main used fishing gear	B19	B	multi-choice (identify by the interviewers through additional questions)
20	Scale of fishing gear	B20	B	info
21	Seasonal fishing calendar in year	B21	B	info/ treat as multi-choice
22	Name 10 of fishes/sea creatures which you target	B22		info, name of fishes/creature in Vietnamese
23	"Do you know any marine mammals?"	C23		**multi-choice (evaluate by the interviewers through additional questions, with support of clear pictures of 15 marine mammals which recorded or may occur in this area)**
24	"Have you ever accidentallycatch these animals?"	C24		**multi-choice (evaluate by the interviewers through additional questions, with support of clear pictures of 15 marine mammals which recorded or may occur in this area) -also record additional info about catching incident**
25	"How frequently those by-catches happen?"	C25		**Multi-choice**

	Question (Eng)	Code	Group	Note
26	"What did you do when you by-catch these animals?"	C26		**info (treated as multi-choice in analysis); evaluate by the interviewers through additional questions**
27.1	"Do you purposely catch these animals?"	C27.1		**multi-choice (evaluate by the interviewers through additional questions)**
27.2	"Why do you catch these animal?"	C28		**multi-choice (evaluate by the interviewers through additional questions)**
28	"Is there any religion/belief/worship relate to these animal?"	C29		**multi-choice (evaluate by the interviewers through additional questions)**
29	"Name some whale temples that you know?"	C30		**info (record name, location of whale temple; which whale temple preserve marine mammal's bones)**
30	"In past 5 years, how frequently you see live marine mammals?"	C31		**multi-choice (evaluate by the interviewers through additional questions)**
31	"In past 5 years, how frequently you see dead marine mammals?"	C32		**multi-choice (evaluate by the interviewers through additional questions)**
32	Additional info on marine mammals which you know	C33		
33	"According to you, do we need to protect marine mammals?"	C34		**_multi-choice _also record the explanations for interviewee's answer**
34.1	"According to you, what should we do when marine mammals get tangled in fishing net/fishing gear?"	D34.1		**info**
34.2	"According to you, what should we do when marine mammals stranded?"	D34.2		**info**
35	"Do you contact local authorities when you see stranded or tangled marine mammals?"	D35		**multi-choice**
36	"According to you, what should we do if we want to protect marine mammals?"	D36		**multi-choice**
37	"Why do you think that we should do that?"	D37		**info**
38	"If we start doing marine mammals conservation in here, and our work may interfere with your fishery, what is your attitude toward marine mammal's conservation?"	D38		**multi-choice (evaluate by the interviewers through additional questions)**
39	"If you interest in marine mammals conservation, What is your refer source for further information?"	D39		**multi-choice**
40	"Do you know any folklore/story/legend which relate to marine mammals in this area?	D40		**info**
41	Interviewees'attitude during the interview	D41		**_multi-choice _answer by the interviewers**

Appendices 7: Awareness raising activities for local communities

(A) and (B) distributing poster during interview; (C) Provide poster for fishermen's children when conducted community meeting; (D)Our poster was displayed in local family's house

A

B

C

D

Appendices 8: Media condemned a case of dolphin killing in KGBR

The event happened during November 2016, when a group of local fishermen kill an Indo-Pacific bottlenose dolphin and post the picture on Facebook. Our informant, who is also a friend of on fishermen in this group send us the pictures. We let the KGBR staff know about the event. Normally, such event will not make into the news (published onTuoitre.vn, Link: http://tuoitre.vn/tin/ban-doc/tieu-diem/20161115/giet-ca-heo-co-the-bi-xu-nghiem/1218244.html)

TUỔI TRẺ CUỐI TUẦN | TRUYỀN HÌNH TUỔI TRẺ | TUOITRENEWS

Thứ 5, Ngày 24.08.2017

tuổi trẻ online

CHÍNH TRỊ - XÃ HỘI | THẾ GIỚI | PHÁP LUẬT | KINH TẾ | SỐNG KHỎE | GIÁO DỤC | ITUYỂN SINH | TH

Bạn đọc | Cùng làm báo | Phản hồi | Đường dây nóng | Tâm sự | Tiêu điểm

Tuyển nữ VN đua bàn thắng với Thái Lan

Giết cá heo có thể bị xử nghiêm

15/11/2016 06:28 GMT+7

TTO - Chưa rõ mục đích giết cá heo của nhóm ngư dân trẻ là gì, tuy nhiên hành vi này đã bị nhiều người phản ứng dữ dội vì "ngư dân sao lại giết loài động vật được mệnh danh là vị cứu tinh trên biển cả này?"

Cá heo tội nghiệp bị bắt và sau đó bị cắt đầu, mổ bụng - Ảnh: Facebook NPQ

Appendices 9: An article published in Science related to our project

This short letter summary the difficulties that fishermen in developing country will face in correspond with stricter implementation of the United States Marine Mammal Protection Act and Magnuson-Stevens Fisheries Act. This project team leader contributed to this paper using data and example of KGBR.

LETTERS

A fisherman casts his net on a lake in Thailand.

PHOTO: AKEILSOBI/ISTOCKPHOTO

Edited by **Jennifer Sills**

Poor fisheries struggle with U.S. import rule

IN THEIR POLICY Forum "U.S. seafood import restriction presents opportunity and risk" (16 December, p. 1372), R. Williams *et al.* describe some possible effects of the U.S. National Oceanic and Atmospheric Administration (NOAA) rule requiring that seafood imported into the United States must come from fisheries that comply with the U.S. Marine Mammal Protection Act (MMPA). Williams *et al.* point out that if fisheries are not adequately supported as they try to comply with the regulations, the rule could exacerbate difficulties experienced in poor fishing communities. We are an international group of marine mammal and fisheries scientists funded by NOAA's Office of International Affairs to assess the risk of marine mammal bycatch in small-scale fisheries in Southeast Asia (*1*). Based on our recent research trip to marine fisheries and research institutes in Thailand, Vietnam, and Malaysia, we believe that exporting nations will have trouble achieving and documenting compliance with the MMPA within the 5-year grace period.

From our work with local authorities, scientists, and fishing communities in these developing nations, we believe that the first hurdle will be galvanizing action from government agencies, fishery managers, and fishers. Conservation-driven policies will likely hold little weight with these constituents, given the intense economic needs in these countries. Because top-down management approaches may be met with resistance, the United States needs to work closely with regional partners to ensure that the benefits of MMPA rule compliance are understood across all levels, from management through to single fish suppliers and fishers.

The second hurdle relates to the considerable data requirements needed within the 5-year grace period to fulfill MMPA standards, such as the calculation of the Potential Biological Removal of species at risk. To our knowledge, this has only been reported for one marine mammal species in Southeast Asia (*2*). This knowledge gap is compounded by the largely unreported nature of marine mammal bycatches and marine mammal population distributions (*3*). A lack of robust quantitative data should not, however, mean that management (*4*) and data collection cannot begin now. Local capacity strengthening should guide regional monitoring programs and the identification of at-risk locations over the next 5 years.

Most of the countries exporting to the United States are dominated by a small number of fish products (*5*), which does generate hope for future compliance. Whether this compliance happens before 2022 remains questionable, given that clear product identifications, certifications, and traceability are also still widely lacking.

Low MMPA compliance after the grace period could mean economic losses for these exporting fisheries and an overall increase in fishing effort to compensate for new trades with less lucrative markets than the United States. This will have clear negative impacts on both marine mammal and fish populations. Greater collaboration between government fisheries and conservation departments will be essential to codevelop locally supported strategies that regulate fisheries, specifically to design a suite of approaches to measure and mitigate bycatch of marine mammals.

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Bathy metric chart of KGBR. Chart number 93300 of Region 9(NOAA, 2014) available at (http://www.charts.noaa.gov/NGAViewer/93300.shtml)

UNESCO page of Kien Giang Biosphere reserve

http://www.unesco.org/new/en/natural-sciences/environment/ecological-sciences/biosphere-reserves/asia-and-the-pacific/vietnam/kien-giang/

Kien Giang Biosphere Reserve website

http://www.kiengiangbiosphererereserve.com.vn/

Kien Giang Biosphere Reserve website showed the news on their staff participated in an international workshop on marine mammal by-catch for the first time

http://www.kiengiangbiosphererereserve.com.vn/index.php?detail/2/3/148/&H%E1%BB%98I-THAO-QU%E1%BB%90C-T%E1%BA%BE-V%E1%BB%80-NGHIEN-C%E1%BB%A8U-XAY-D%E1%BB%B0NG-H%E1%BB%86-TH%EF%BF%BD

DISTRIBUTION

A copy of this report is available at Kien Giang Biosphere Reserve management broad office. Address: 320 Ngo Quyen street, Vinh Lac ward, Rach Gia city, Kien Giang province, Vietnam

A copy of this report is available at Vietnam marine Mammal Network office. Address: 541 Nguyen Duy Trinh street, Binh Trung Dong ward , District 2, Ho Chi Minh city, Vietnam