IRRAWADDY DOLPHIN CONSERVATION IN THE FISHERIES OF MALAMPAYA INNER SOUND, PALAWAN, PHILIPPINES

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Key words: Irrawaddy dolphins, Mortality, Malampaya Sound, Philippines

Abstract

The critically endangered population of Irrawaddy Dolphin (*Orcaella brevirostris*) in Malampaya Inner Sound is continuously threatened by the activities of the human population, especially fishing activities. It is predicted by experts of WWF that their local population will continue to decline and will be lost within seven years if current processes and fishing practices will continue to operate.

Twenty – nine mortalities of Irrawaddy Dolphins were recorded between year 2001 and 2006. The general objective of the study is to gather information to assess the fisheries activities affecting the mortality of the Irrawaddy dolphin. Specific objectives are: 1) to gather information on fishing gear-related mortality of Irrawaddy dolphins in the sound, 2) to determine the spatial and temporal characteristics of the above fishing gears in Malampaya Inner Sound, and 3) to give recommendations for the conservation and protection of Irrawaddy dolphins relative to fisheries activities in the Inner Malampaya Sound.

The high monthly fishing effort of shrimp gill net no. 9, crab trap, and fish gill net no. 12 is alarming, because there are reports of Irrawaddy dolphins entanglement in their joining lines. Similarly gill net numbers 9 and 12 likewise create additional risks of entanglement of Irrawaddy dolphins since they are soaked for longer periods, higher frequency and wider area, compared to other gears.

Crab gill net no. 4, crab pot, and shrimp gill net no. 9 have distinct overlap in their fishing areas at the northern portion of the Inner Sound. While skimming net and crab pots partly overlap at the southern end of the Sound. The distribution of fishing gears shows that almost all of the areas of the Inner Sound are occupied by the gears overlapping the frequent sighting locations of the dolphins. The result shows how narrow is the swimming path left for the dolphins to move around freely in the sound with out encountering a net/ gear. Fish gill net no. 9, shrimp gill net no. 9, crab gill net no. 4, and crab pot are the most likely gears to be encountered by the Irrawaddy Dolphins in their frequent sighting areas.

The current fisheries conditions regarding Irrawaddy conservation are the following: 1) increasing number of Irrawaddy dolphin mortality 2) increasing efforts of Irrawaddy mortality-associated fishing gears, and 3) co-occurrence of Irrawaddy mortality-associated fishing gears and identified Irrawaddy Dolphin sighting areas, 4) it is most likely that dolphins get entangled in the process of feeding or by passing through undetected nets and ropes, 5) the causes of Irrawaddy dolphins mortality are: net or rope entanglement, drowning under the net, hit by boat propeller, 6) Irrawaddy meat are consumed by the community members after accidental death, but not hunted for food, 7) the population of the critically endangered dolphin is too small in number, something has to be done urgently, and 8) due to their high fishing efforts, crab pots, shrimp gillnet, and fish gill net no. 9 are still threats to Irrawaddy dolphins in the sound.

Judging from the above, the future of the Irrawaddy Dolphin population is threatening. Recommendations for fisheries management and conservation of the Irrawaddy dolphin population in the Inner Sound are presented in this study.

INTRODUCTION

Fisheries is a rather wide and dynamic field for management. It involves socioeconomics, governance, and environment. More often, fisheries management is focused on the social welfare of the fishers and sustained use of the resources. The effect of fishing activities to mammals is not included in many management schemes and not usually address as main issue.

In Palawan, management of several semi-enclosed bodies of water as well as coastal zones are being initiated not only to conserve and protect the integrity of the resources therein, but also to uplift the socio-economic status of the local communities. Bay wide integrated approach is a popular known strategy used to manage the coastal resources of Puerto Princesa City, facilitated by different agencies and projects.[3,4]

The Malampaya Sound is located in the northern por-

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tion of the long and narrow island of Palawan, Philippines. It is compose of about 100 ha. of both marine and estuarine waters and another around 100 ha. of land surrounding the sound. The sound is a protected area under the management of the Department of Environment and Natural Resources (DENR), Philippines.

Furthermore, in Malampaya Sound, WWF-Philippines has introduced management protocols since 2001. Consequently, ecological studies were conducted by WWF-Philippines in the Sound in the same year. On the other hand, the Fishery Resource Management Plan of Malampaya sound was facilitated as part of the Sustainable Coastal Area Development Program of the Tambuyog Development Center, Palawan.[6]

The Malampaya Sound is the only home for the critically endangered Irrawaddy Dolphin (*Orcaella brevirostris*) in the Philippines, which is one of the tourism attractions of the Municipality of Taytay. Other population of this dolphin can be found in the rivers of Myanmar. Irrawaddy dolphins like to swim and play in shallow waters near the shores of Malampaya Inner Sound. This makes them very vulnerable to human activities, such as fishing.

Reports reveal that the population of Irrawaddy dolphin in the sound is continuously decreasing. Human actions are believed to be the main cause of the population decline of the dolphins. Experts predicted that their local population will continue to decline and will be lost within seven years if current processes and fishing practices will continue to operate. This makes the study on the interrelationships of fisheries and conservation of Irrawaddy dolphin important.

The general objective of the study is to gather information to assess the fisheries activities affecting the mortality of the Irrawaddy dolphin. Specific objectives are: 1) to gather information on fishing gear-related mortality of Irrawaddy dolphins in the sound, 2) to determine the spatial and temporal characteristics of the above fishing gears in Malampaya Inner Sound, and 3) to give recommendations for the conservation and protection of Irrawaddy dolphins relative to fisheries activities in the Inner Malampaya Sound.

MATERIALS AND METHODS

Information on fishing gears and history of mortality of dolphins was elicited from members of the community, fishermen, and NGOs long working in the Sound.

Fishing gear survey was conducted daily from August 2, 2006 to January 10, 2007 in the Inner Sound of Malampaya (Fig. 1), where the dolphin lives. Information on the monthly fishing efforts of the gears were used to determine the dominant and seasonality of the gears.

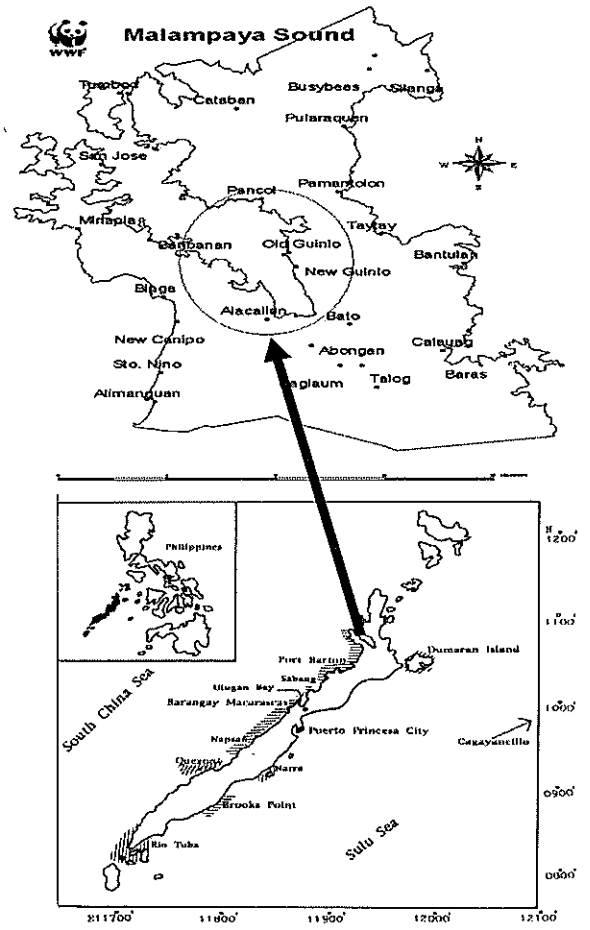

Fig. 1. Maps of the Philippines and Palawan Island, showing the study site in Inner Malampaya Sound.

Interview forms were developed to elicit data pertinent to the use of fishing gears in space and time. Interview forms used in this study were the same as those used in previous study by WWF in the sound.

Interview forms included a map where the respondent can easily locate and mark his fishing grounds and give information on type of gear used, date, time spent fishing per trip, number of fishing trips, number of fishers on

board, species of fish caught, volume and price per kilogram of catch, and dolphin sightings and other questions useful to the analysis of results. Information on locations of dolphin sightings was complimented by survey results done by dolphin experts of WWF.

Fish catches were identified using Gonzales [5] and references found in the Protected Area Superintendent (PASu) Office Malampaya Sound. Identification of some species caught by skimming net was based from Avillanosa *et al.*[1]

Initial results of the study were presented for verification to 25 Malampaya Sound fishers in the study site on February 5, 2007. Other information such as reasons for using gears at specific periods, fishing areas, change of gears etc. were also verified and validated with the fishers. Basing from their experience, fishers were also requested to graph the estimated catch and effort trends of selected gears for one whole year. The same study result was also presented to the Municipal Council Members (Policy Making Body) of Taytay for information and comments on February 26, 2007.

RESULTS

Fishing Gears and Fish Catch

A total of seven fishing gears were surveyed: 1) Gillnet no. 12; 2) Gillnet no.9 (multifilament); 3) Gill net no.9 (monoline); 4) Gillnet no. 4; 5) Crab Trap (Bukatot); 6) skimming net (Sudsud); and 7) Baby Purse Seine (Talakop). For the purpose of standardization and easy identification of these gears, especially the gill net variants, we assigned names for each of them, comprising their target species (Table 1). Gill net variations were named after their target species and mesh size. The catch compositions of these gears are listed in Table 1. This information was recorded as baseline to future studies on relationships of the species caught by the gear and the target food of the dolphin.

Table 1. Seven fishing gears surveyed with species caught

Name of Fishing Gear	Local Name Gear	Local Name of Fish Caught	Scientific Name of Fish
Crab gill net no. 4	Pante	Alimasag	*Portunus pelagicus*
Fish gill net no. 9 (mono-filament)	Pante Pantinga	Kabasi Kanduli Burao Tunsoy Ispada Salay Hasa-hasa Lapad Sapsap Malakapas Dumpelas	*Ambligaster leiogaster* *Arius maculates* *Rastrilliger kanagurta* *Sardinella gibbosa* *Trichiurus japonicus* *Alepe vari* *Rastrilliger brachysoma* *Sardinella brachysoma* *Leiognathus equulus* *Gerres ambreviatus* *Gerres filamentosus* *Chirocentrus dorab?*
Shrimp gill net no. 9 (multi-filament)	Pamo Pang Hipon	Hipon Suahe Sapsap	*Penaeus* spp. *Metapenaeus* spp. *Leiognathus* spp.
Fish gill net no. 12	Kurantay	Tunsoy Lapad Lupoy	*Sardinella gibbosa* *Sardinella brachysoma* *Sardinella* sp.
Skimming net	Sudsud	Alamang Suahe Parangan Hipon pan ilog Putian Ulang Malilit na mag hipon, isda at alimasag	*Acetes* spp. *Metapenaeus ensis* *Apogon* spp. River shrimp *Penaeus indicus; P. merguienses* *Macrobacrium* sp. Juvenile crustaceans and fishes
Ring net	Talakop	Tunggao Salay Talakitok Salinyasi Tanguigui Pak-an Hasa-hasa Lapad Sapsap Kalapato Lupoy	*Sphyraena obstusata* *Alepe vari* *Caranx sexfasciatus and Carangoides uii* *Sardinella fimbriata* *Scomberomorus commerson* *Megalaspis cordyla* *Rastrilliger brachysoma* *Sardinella brachysoma* *Leiognathus equulus* *Atule mate* (outer sound) *Sardinella* sp.
Crab Trap	Bukatot Alimasag	Alimasag	*Portunus pelagicus*

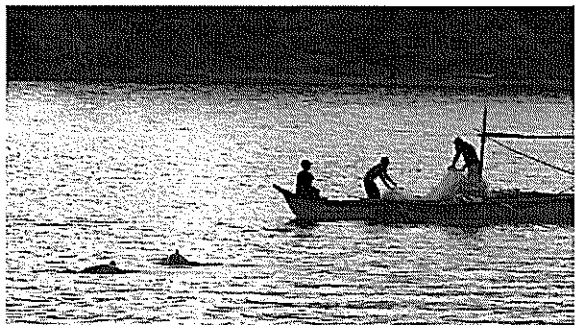

Plate 1. Gillnet and its variations are associated with death of Irrawaddy dolphin.

Of the seven fishing gears, four gears were not documented during the past study of WWF in Malampaya Sound:[9] shrimp gill net no. 9, fish gill net no. 12, skimming net, and crab trap. These gears were studied because of their relative influence to the feeding habits, food preference and mortality of Irrawaddy dolphins.

Fish gill net no. 12 is an encircling gillnet, which is a

longer and deeper gill net than usual. It has also smaller mesh size of 1 inch. It is locally known as kurantay (Plate 1) and also called likos, kayagkag[2] or palubog-sa-tamban.[10]

In some areas, kurantay is known to have net depth of 17.27 m, and reaches 420 m in length, while kurantay nets operated in Malampaya sound has similar depths, but with shorter length of around 200 m. The depth of this net usually extends through the surface to bottom of the water column, practically forming a vertical wall. Kurantay is an active gear, but used in municipal waters, operated by encircling the school of fish and catches small pelagic species.

The shrimp gillnet no. 9 is made up of a fine multifilament with 1.3 inches mesh size. It is a gill net set at the sea bottom to catch prawn and shrimps (Penaeids). Gill nets are supposed to be passive nets set vertically to block the passage of the fish to effect catching. However, fishermen in Malampaya sound have modified their fishing methods by occasionally dragging the net by the pump boat.

Fish gill net no.9 is made out of a mono-filament line with a mesh size of 1.3 inches forming a single wall at the surface portion of the sea. It is a surface gillnet intended to catch small pelagics, catching mainly salay, alumahan and kabasi (Table 1). In this report, the fish gillnet no. 9 includes the data of gill net no. 8 (a slight variation in mesh size of gill net no. 9).

Crab gillnet no. 4 is a monofilament bottom gill net with 3 inches mesh size. It is specifically used to catch swimming crabs, *Portunus pelagicus* (Table 1). However, this net is also known to entangle Irrawaddy Dolphins in the Inner Sound.

Crab trap (bukatot, Plate 2) pangal in Cebuano and Panak in Ilongo and Cuyuno[2] is a globular basket-like trap made out of woven rattan or buho strips, equipped with bait to catch swimming blue crabs. Numerous baskets are set with joining nylon lines stretching parallel to the coastlines. The joining lines of this gear are known to entangle Irrawaddy Dolphins.

Except for crab gill net no. 4, the above three trap are known as common fishing gears of Palawan.[4]

Skimming net, also known as scissor or push net (sudsud, hudhud, sakag or sapyaw; [1] is a gear for catching sergested shrimps (*Acetes* spp.), locally known as Alamang. This gear uses three types of nets: B-net, pamo red, and pamo white. The net is operated by pushing and raising it when its time to haul the catch.

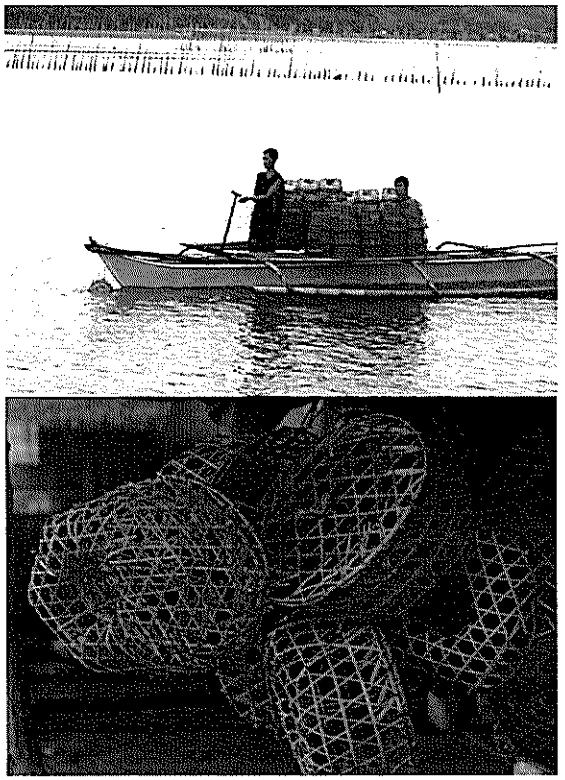

Plate 2. Crab traps on banca, above; close view of crab traps, below; a gear also associated with dolphin death.

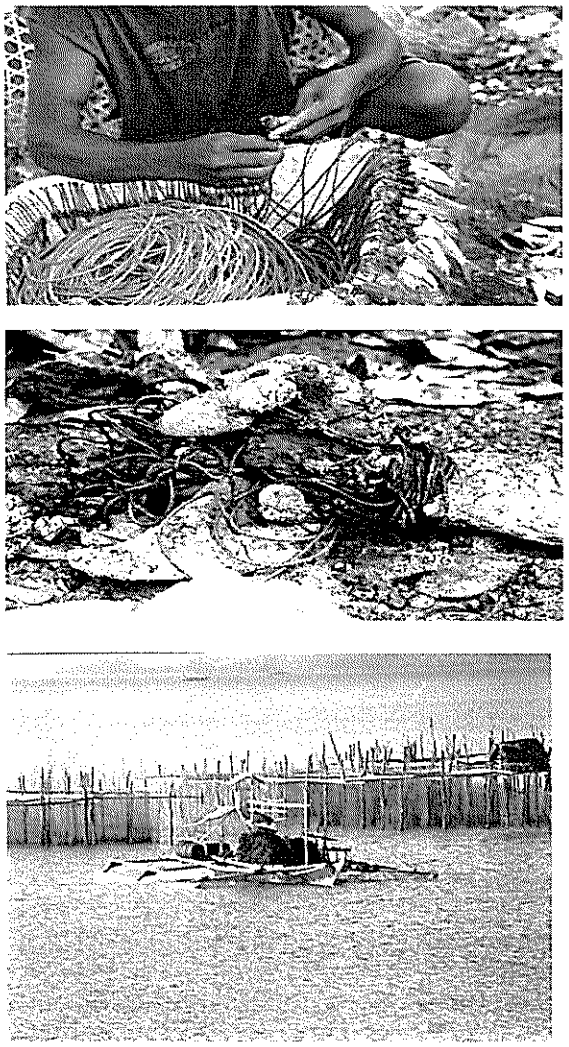

Plate 3. Baiting long line (above); flukes of dolphin entangled in a rope (middle); ringnet (below). All these gears are threat to dolphins in the sound.

Ring net (Talakop, Plate 3), locally known as pangulong in other parts of Palawan is a surrounding net operated by enclosing the school of fish and by pulling the purse rope inside the rings to close the bottom portion of the net. This net targets small pelagic fishes like anchovies, jacks, and sardines (Table 1). This is the only active and commercial gear operating in the inner sound of Malampaya, while skimming net is also an active gear, but not a commercial one.

Table 2 shows that fishing gears associated to mortalities of dolphins were not recorded in detailed before 2006. Information on what gear was known, but the specific dates and year were not noted. Interview and observations also indicated that dolphins are not hunted by coastal people, they are just consumed when found dead by other causes. The recent report of cause of death of Irrawaddy dolphins are the long line and ring net (Plate 3).

Table 2. Number of Irrawwaddy dolphin annual mortality from 2001 to 2006

Year	Number	Cause
2001	7	By-catch (gear to be named)
2002	4	By-catch (gear to be named)
2003	4	By-catch (gear to be named)
2004	4	By-catch (gear to be named)
2005	2	By-catch (gear to be named)
2006	8	By-catch, 4 by crab pots; 1 ringnet; 1 rope entanglement; 1 propeller; 1 unknown

Temporal and Spatial Changes of Fishing Gears

The mostly used gears between the survey periods were shrimp gill net no. 9, crab pot, and the fish gill net no. 9, with peak fishing trip/effort in August 2006.

The fish gill net no. 9 is widely used in the inner sound from August to December 2006, with highest effort in November 2006, while the shrimp gill net no. 9 and the crab pot were deployed in the Inner Sound from August to November 2006.

The fish gill net no. 9 dominated the number of fishing trip after the month of September when the number of trips of other gears begins to fall (Fig. 2). Crab gill net no. 4, fish gill net no. 12, and crab pot were used in the Inner Sound only between the months of August till October of 2006, while the baby purse seine was used in the Inner Sound from August 2006 to January 2007.

Only the baby purse seine and fish gill net no. 9 were operated after December, both of which are targeting small pelagics. Crab gill net no. 4, crab pot, and shrimp gill net no. 9 have distinct overlap in their fishing areas at the northern portion of the Inner Sound (Fig. 3). While skimming net and crab pots partly overlap at the southern end of the Sound.

Ring net, fish gill net no. 9, and shrimp gill net no. 9 are also operated at the Outer Sound. Ring net, fish gill net no. 12, and shrimp gill net no. 9 have scattered fishing areas, while the rest of the gears have generally congregated fishing grounds (Fig. 3).

Fish gill net nos. 9 and 12 are the only two gears fishing in the deepest portion of Inner Sound (7-10 fathoms).

Fish gill net no. 9, shrimp gill net no. 9, crab gill net no. 4, and crab pot are the most likely gears to be encountered by the Irrawaddy dolphins in their sighting areas (Fig. 3).

The graph drawn by the fishermen on catch trend during the validation meeting showed that the shrimp gill net no.9, fish gill net no. 9, crab gill net no. 4, and crab pot have high fishing activities during the months of June to October.

The two crab gears: crab trap, which is set near the shore, and crab gill net no. 4, which is set at deeper portions of the Inner Sound, exhibit contrast in volume of catch in certain periods (Fig. 2). The crab trap is expected to have high catches in the months of February – April and August – September, while the crab gill net no. 4 is expected to have low volume of catch in the same periods.

During the presentation of the initial results of this study with the *Sanguniang Bayan* (Municipal Council Members), Council Members suggested some topics to be verified or studies: the influence of *Amihan* and *Habagat* (Northeast and Southwest monsoons) to the fisheries activities in the sound, the observed high catch volume of crabs during dry season and their gravid period, the effects of agricultural pollution to the movements of crabs in the inner sound.

The group further suggested that the study result must also be presented to the Protected Area Management Board (PAMB); that PAMB must review all guidelines and policies regarding gear regulations in Malampaya Sound; and to produce a video footage of feeding Irrawaddy Dolphin.

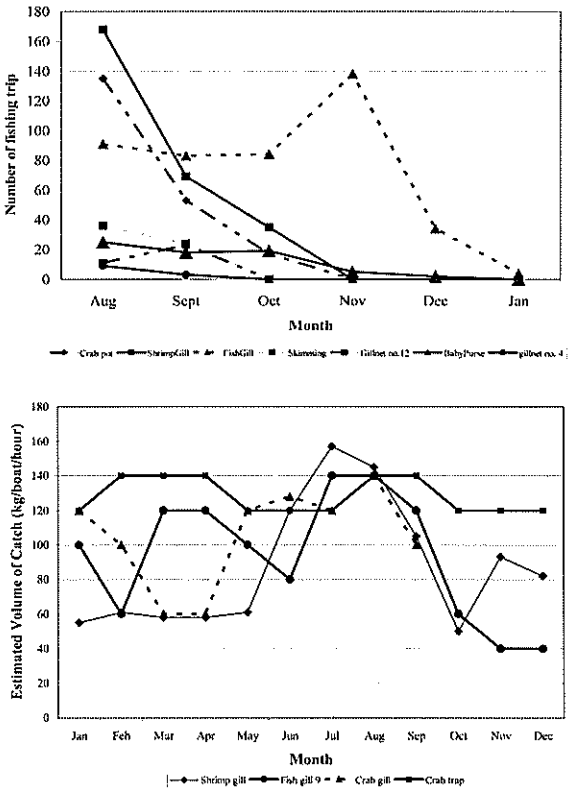

Fig. 2. Number of fishing trips made by selected fishing gear in Malampaya Inner Sound from August 2006 to January 2007 (above); year round estimated volume of catch of four gears by fishermen (below).

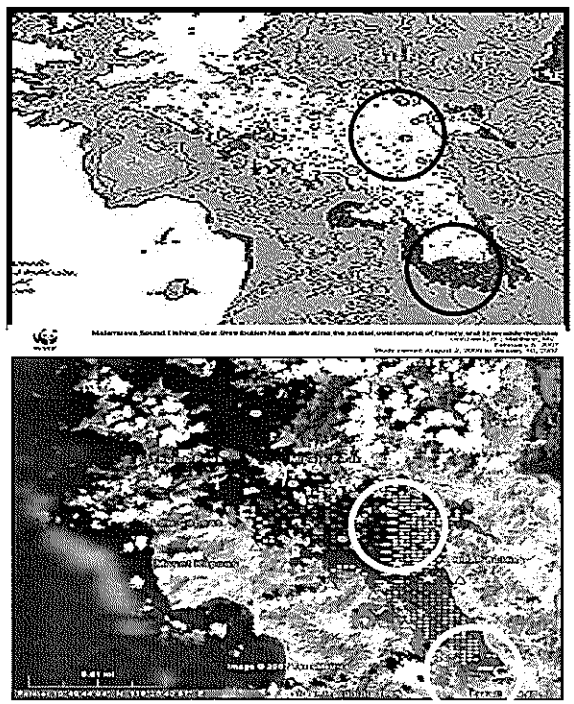

Fig. 3. Map of Malampaya Sound, showing remarkable increase in density of fishing gears in Irrawaddy dolphin frequented areas (encircled) in 2007 (map below), compared to that in 2001 (map above).

DISCUSSION

Fishing gears and Catch

Fisheries in Malampaya Sound is very dynamic, especially in the occurrence and diversity of species. This circumstance relates directly to the preference and use of fishing gears and other fisheries activities of the fishers and community around Malampaya Sound.

As the composition and abundance of target species in the bay fluctuates, the fishers tend to shift from one gear to another when their catch decreases in the former gear, while hoping to get better catches with the latter. This situation makes the gear and effort study complicated when a whole-year data for a certain gear is wanting. During the validation meeting of this study, fishers estimated that only 10% of the fisherman population can afford to acquire additional gears. However, this information has to be scientifically confirmed and validated.

The location of fishing grounds and type of gears used in the Inner Sound are dependent on the target species, Furthermore, the species depends on the habitat and type of environment. This is why the crab gill net no. 4, crab pot and shrimp gill net no. 9 have overlapping fishing grounds in pursuit of crustaceans (shrimp and crabs) who lives in a same habitat (Fig. 3). Similarly, the fish gill no.9, fish gill no. 12, and the baby purse seine have overlapping fishing grounds targeting the same group of fishes–small pelagic species. Expectedly, dolphins are also observed in these areas where they can easily search for their food.

Furthermore, most of the fishers in Malampaya Sound use different kinds of fishing gears at the same period of time. For example, a fisher sets his crab trap early in the morning, then sets his shrimp gill net no. 9 in the deeper waters of the sound, and while waiting to haul his gill net and traps, he uses a hook and line to catch other fishes. This fisherman could further own a Hilay (a bottom fish aggregating devise), which is harvested every six months and a live grouper fish pen, which is usually harvested every eight months.

In the study conducted April to September 2000[9] the ring net was reported to fish only in the Outer Sound, while it was observed to operate in the Inner Sound in this study. This situation suggests that the baby purse seine may operate in the inner sound only during the northeast monsoon.

The above situations demonstrate a part of the dynamic fisheries occurring in the Inner Sound, Malampaya. In order to manage a dynamic fisheries situation, it also requires a dynamic approach. As for fisheries management, it is basic to have a comprehensive data and information where action plans can be developed and policies can be based. Thus, a longer study that would cover the cyclic changes of the species and gears could get data and information that could better explain the dynamics of fisheries in this Sound, and its direct effects to the dolphins. The study might not only cover months, but years or even decades.

Fishing gears and Irrawaddy Dolphins

The distribution of fishing gears (Fig. 3) shows that almost all of the areas of the Inner Sound are occupied by the seven gears related to Irrawaddy Dolphin conservation. This map shows how narrow the swimming paths left for the dolphins to move around freely in the Inner Sound. There is only a slim chance that the dolphin could not encounter a net, while navigating in the water column.

Ring netters, which operate in the Inner Sound during northeast monsoon further heightens the threat to the Irrawaddy dolphins, because a ring netter was known for the death of an Irrawaddy dolphin in the past.[7] In this case, there was no entanglement instead the dolphin can be drawn or suffocated when trapped underwater under the net. In this instance, something has to be done to enable the ring net crew to detect the presence of dolphins caught in their net and able to release the said dolphin.

The domination of fish gill net no. 9 in number of fishing trips after the month of September 2006, while the number of trips of other gears decreases (Fig. 2) indicates that this gear could be a distinct gear common all through out the year, and should be given attention in terms of management and its association with dolphin mortalities.

Table 3. Irrawaddy Dolphin high risk fishing gears, their period (month) and location

Fishing gears	Months	Location (Fig. 3)
Fish gill net no. 9	Feb.-May July - Sep.	West of Pancol
Shrimp gill net no. 9	Jun-sep.	South southwest of Mypa and West of Old Guinlo
Crab gill net no. 4	May - Sep.	Southwest of Mypa, West of Old Guinlo, and Northeast of Pinagpala cutting across the Sound
Crab pots	Feb. - April Aug. - Sept.	South southwest of Mypa, stretching to west of Old Guinlo cutting the Sound further south in front of Pinagpala and Balimbing.

The high monthly fishing effort of shrimp gill net no. 9, crab trap, and fish gill net no. 12 (Fig. 2) is alarming. There are recent reports of Irrawaddy dolphin mortality due to entanglement in the joining lines of crab traps, long lines (kitang; Plate 3) and fish gill net no. 9. Thus the high fishing efforts of crab traps increases the probability of entanglement of Irrawaddy Dolphins to the joining lines of the traps. Similarly, gill nets number 9 and 12 likewise create an additional risk of entanglement of Irrawaddy dolphins when soaked in longer periods and higher frequency in the waters of the Inner Sound.

The high fishing efforts of crab gill net no. 4, fish gill net no. 9, shrimp gill net no. 9 and crab pots (Fig. 2), and their locations (Fig. 3), which are also within the sighting areas of the Irrawaddy Dolphin increase the probability of entanglement.

Crab gill net no. 4 has been identified as the gear causing the most Irrawaddy mortality in the inner sound.[9] Result of the same study also suggested that the dolphins may be targeting the same resource as that targeted by the gill net fishery. However, it was not established that swimming blue crab (target species of gill net no. 4) is also the preferred food of Irrawaddy dolphin. In the contrary, there are indicators that shrimps and fishes (target species of gill net no. 9), were observed in stomachs of dead Irrawaddy[9] and as observed by fishermen, are the target food of Irrawaddy dolphins.

The stomach content of a dead Irrawaddy Dolphin examined March 17, 2007 by the authors, revealed that the food composition were dominated by bottom fishes thriving in muddy substrate and squids, though the remaining fish bones have to be thoroughly examined for species identification. Thus, the cause of entanglement of Irrawaddy dolphins as by-catch in crab gill net no. 4 is not due to their attraction to the crab catch of the net, but they could be accidentally caught by the net while navigating for other purposes or destinations.

Although dolphins use highly developed echolocation signal to locate their prey,[8] this system may not be precise enough to detect the fine materials of gill net no. 4. It must be noted that crab gill net no. 4 has the largest mesh size of all nets nylon operated in the inner sound, combined with a fine 0.40mm mono-filament transparent twine material, may not be easily detected by the echolocation system of the dolphin.

Irrawaddy Dolphin mortality with fish gill net no. 9 could have happened when the dolphin was searching for fishes as food. On the other hand, it could be that dolphins are attracted by the thrashing and panicky movements of the captured fish in the net, and get entangled in the same net in the process of feeding.[4]

The degree of mortality incurred by the shrimp gill net no.9 to Irrawaddy dolphins should be studies, since the target catches of this net are also the known preferred food of the dolphin–Penaeids. Further study on this aspect could enable us to infer deeper and gain more understanding on the relationships among fishing gears, target species, feeding behavior, and food habits of Irrawaddy dolphins in the Inner Sound of Malampaya.

Spatial change of fishing gears in the sound has an influence in the mortality of the Irrawaddy population in the inner sound. The frequent change of location of gears could confuse the movement pattern of Irrawaddy while navigating or feeding in turbid waters, causing them to get entangled in nets or gears set in a random manner in new locations.

Although there are still limited scientific information on the trends of number and kinds of gears used in Malampaya Sound, the result of this study suggests that there are tendencies that Irrawaddy Dolphin will continue to decrease its population in the sound, if gear types and number used in the area continue to be uncontrolled.

The future of the Irrawaddy Dolphin population seemed threatening, while hope lingers, while fishermen are beginning to observe young Irrawady Dolphins wandering around the Inner Sound.

CONCLUSION

1. There is an increasing efforts and use of area of some fishing gears associated with the death of Irrawaddy dolphins.
2. There is co-occurrence of Irrawaddy mortality-associated fishing gears and frequent dolphin sighting areas.
3. It is most likely that dolphins get entangled in the process of feeding or by passing through undetected nets and ropes.
4. The causes of Irrawaddy dolphin's mortality are: net or rope entanglement, drowning under the net, hit by boat propeller.
5. Irrawaddy meat are consumed by the community members after accidental death, but not hunted for food.
6. The population of the critically endangered dolphin is too small in number, something has to be done urgently.
7. Due to their high fishing efforts, crab pots, shrimp gillnet, and fish gill net no. 9 are still threats to Irrawaddy dolphins in the sound.

RECOMMENDATION

1. More information is needed on the seasonality of fishers' target species vis-à-vis shifting and use of different gears in the Inner Sound. This study should be related to the conservation of Irrawaddy dolphin.
2. The feeding behavior and food habits of Irrawady dolphin should also be studied.
3. Study on long line fisheries.
4. Economic valuation of catches per gear in relation to gear preference of fishers is necessary.
5. Policies for decrease fishing effort should not only be limited to crab gill net no. 4, but also to crab traps, long lines, and other nets potential to dolphin entanglement.
6. Conservation policies for Irrawaddy should not only focus on regulating fishing efforts of the gears, but also exploit possibilities of enforcing close areas or close seasons.
7. Education, information, and communication campaigns regarding the interaction between fisheries and the Irrawaddy dolphin population should be continuous, focusing on how to deal with entanglement and entrapment of Irrawaddy dolphins.
8. Full implementation of Environmental Law Enforcement.
9. Full scale Environmental Law implementation for Malampaya Sound.
10. Breeding and reproduction of the dolphin must also be considered.

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