

**ASSESSMENT OF DUGONG (*Dugong dugon*)
OCCURRENCE AND DISTRIBUTION IN
AN EXTENDED AREA OFF THE RAKHINE COAST
OF WESTERN MYANAMAR**

Tint Tun and Anouk D. Ilangakoon



Report to the Society for Marine Mammalogy
July, 2007





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Cover

- A dugong bycatch in beach seine net at Ngwe saung in October 2004.
- A dolphin carcass found in Chaung tha in February 2007.
- Seagrass at Pho ka lar kyun.



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1. Introduction

Dugong (*Dugong dugon*) is known as "Ye-wet" (water pig) or "Ye-thu-ma" (mermaid) or "Lin-shu" in Myanmar. Dugong has been a protected animal by law since 1994 and it is listed in the "Completely Protected Animals" category in Myanmar.

The presence of dugong in Myanmar waters was documented as far back as the 1850's by Rev. S. Benjamin (Mason, 1882) from Tanintharyi coast (formerly known as Tenasserim coast) of southern Myanmar and one was captured alive in 1966 from Rakhine coast (formerly known as Arakan coast) in western Myanmar (Guardian, 1966; Yin, 1967). The 740 km long Rakhine coastal zone, stretching from Naff river in the north to Mordin point in the south, is situated in western Myanmar and it is bounded by the Bay of Bengal in the west (Figure 1).

Since 1966 there was a large gap in information about the dugong in Myanmar which is possibly the reason for the neglect of Myanmar in recent global assessments and action plans in which Myanmar was not listed (Marsh et al., 2002) as part of the dugongs range. After this gap of about four decades from 1966, Tun and Ilagakoon (2006) initiated a dugong survey in 2005. Rakhine coast became the focus of their initial survey as the last occurrence was documented from the Rakhine coast. Their preliminary survey succeeded in documenting the continued presence of the dugong in Myanmar (Ilagakoon and Tun, 2007).

Following their preliminary survey in 2005/2006, Tun and Ilagankoon conducted another extended survey along the Rakhine coast from Ngwe Saung resort town in Ayeyawady

Division to Hmawyone village in Rakhine State during the 2006/2007 field season (Figure 1). This report presents the results of this second phase of their survey.



2. Method

Based on a questionnaire already used in the Gulf of Mannar Sri Lanka and India by Ilangakoon *et. al.* in 2004, Tun and Ilangakoon (2006) developed a semi-structured interview survey technique for their preliminary dugong survey in Rakhine coast in western Myanmar. The technique was also used in the present extended survey. Both individual interviews and group discussions were carried out at the field sites visited along the Rakhine coastline.

2.1 Survey Area

The survey was conducted along a 160km stretch of coastline from Ngwe saung town to Hmawyone village during February to May 2007 (Figure 1). According to the administration, Ngwe saung is situated in Ayeyawady Division and Hmawyone is situated in Rakhine State although they are all located along the Rakhine coast (Figure 1). Minlan, Thazin, Phone maung kyain, Gyine le, Ka nyin kwin, Ye thoe, Pho kalar kyun, Chaung tha, Magyi, Tha baw kan, Shwe ya gyaing and Hmawyone villages were visited. Ngwe saung, Shwe thoung yan, Gwa and Kyein ta li towns were also visited during the survey (Figure 2).

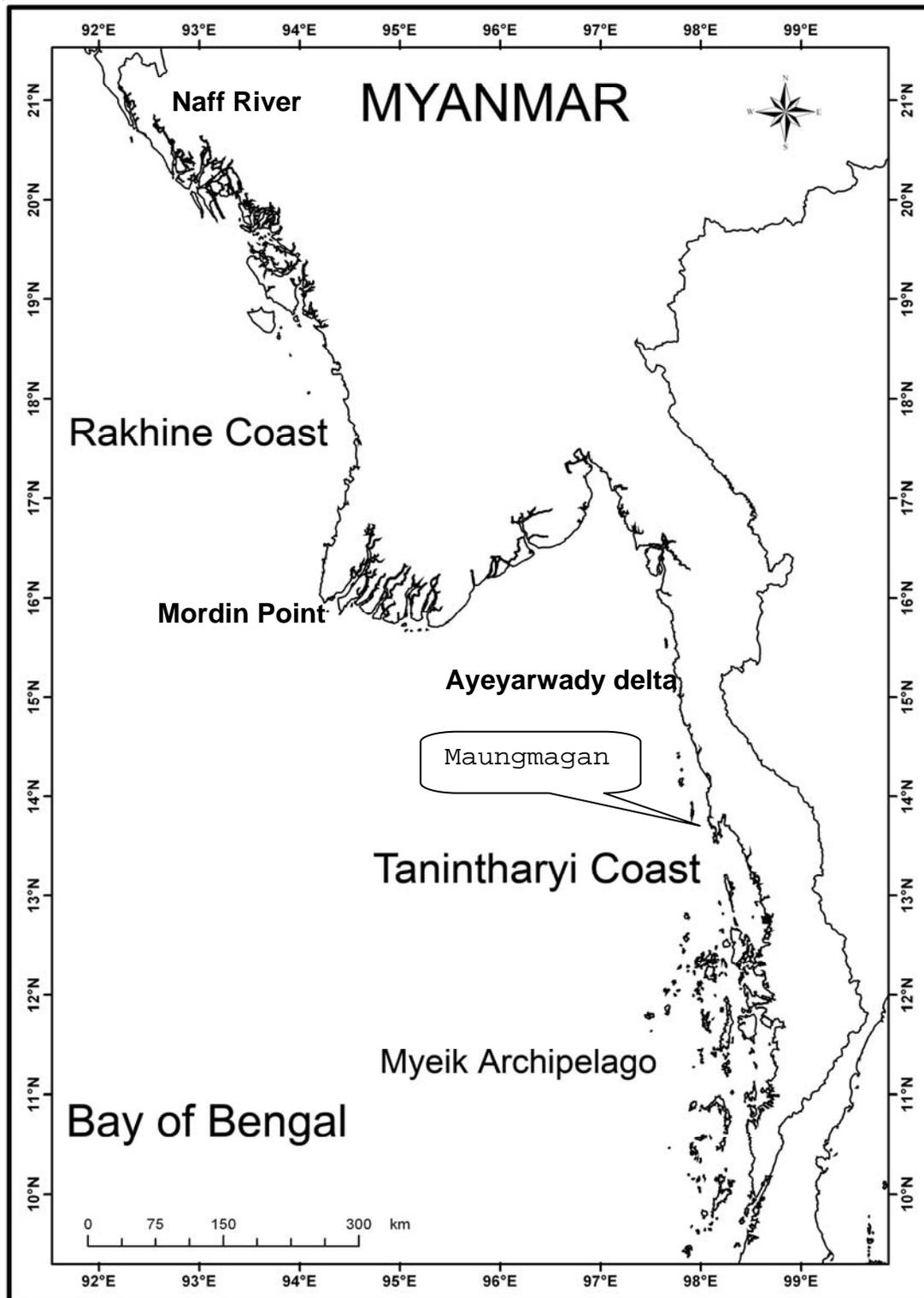


Figure 1. Map showing the Myanmar coastal area.



Figure 2. Map showing the study area.

2.2 Survey Respondents

The majority of respondents to the questionnaire and participants at group discussions at all sites were members of the fishing communities. Additionally discussions were also held with fisheries officials and other influential and knowledgeable persons within these communities (Figure 3 - 8). A total of 79 persons were interviewed during the survey.



Figure 3. An interview with a fisherman.



Figure 4. An interview with a fisherman.



Figure 5. An interview with villagers.



Figure 6. An interview with fishermen.



Figure 7. An interview with fishermen.



Figure 8. An interview with knowledgeable persons.



3. Results

3.1 Dugong

3.1.1 Stranding

Strandings of dugong were reported at Thazin and Phone maung kyaing villages. A dugong was stranded at Thazin in 2004 and another dugong was stranded about four years ago at Phone Maung Kyine village. Causes of death could not be identified by the villagers.

Dugong stranding was also reported by a fisherman at Hmawyone village, who reported that two dugongs with wounds and scratches were found stranded. Fishermen thought that they fought with each other and stranded with many wounds. One was dead and the other one was still alive when they were found but it was subsequently killed.

3.1.2 Sightings

Based on the information obtained during the survey, dugongs are sighted along the coast of the survey area. Dugongs were sighted by most of the respondent fishermen and some villagers. In the past, fishermen sighted dugongs occasionally at Hgnet taung kyun (also known as Hgnet kyun) which is located between Ngwe saung and Thazin. However, at present, dugong is rarely sighted in that area. A fisherman from Gyaing le village had sighted a dugong about two years ago.

At Hmawyone, dugongs can be found throughout the year but more frequently in the rainy season, from May to October. Almost all villagers at Hmawyone have seen the dugong. Fishermen said that the presence of a dugong can be noticed easily by its movement, ripples in the wake of its movement and surfacing to respire. They explained that it looks like a hull of a boat in upside down position. A dugongs head can also be seen when they are surfacing. Sometimes dugongs come close to the shore even just beyond a fishing rod and then it can be seen easily (Figure 9).



Figure 9. Hmawyone water where dugongs can be sighted just beyond the fishing rod.

Dugongs have not been found in big groups. Two to three dugongs were the biggest group size found in Hmawyone water. Two dugongs, one small and one big (possibly a mother-calf pair), were sighted in Hmawyone waters and weights were estimated to be 20-25 viss (33-41kg) and around 150 viss (app. 245kg) respectively. Big dugongs

were common in Hmawyone waters and the biggest ever seen was estimated to be about 300viss (490kg) in weight.

Dugong sightings are also common in Shwe ya gyaing and neighbouring villages. At Shwe ya gyaing, dugongs are sighted frequently almost throughout the whole rainy season. They are apparently so visible that villagers can see the animal even from the land. Shwe ya gyaing is also a good place with some rocks and seagrass and, therefore villagers assumed that it can provide not only sheltered areas but also an area for dugongs to forage in the monsoon season. The biggest dugong ever sighted in Shwe ya gyaing was estimated to be more than 200 viss (ca. 327kg) in weight and about 3m in length and animals of approximately more than 100 viss (163kg) are common. A dugong was found in Gwa kyun waters at about 3m depth. Dugongs were sighted frequently every monsoon season in Shwe ya gyaing but they are rarely sighted in summer. Fishermen think that Shwe ya gyaing and its neighbouring waters are a good habitat for dugongs as sightings and accidental catch of dugongs have been reported every year.

3.1.3 Bycatch

Dugong bycatches were also reported from the survey area. Various sizes of dugongs were killed accidentally in fishing nets. Many years ago, a dugong was even caught alive by a fisherman with a castnet on a beach in the Gwa area.

A dugong was accidentally caught in a beach seine net at Ngwe saung in October 2004 (Figure 10 & 11). It was about

3m in length and estimated to be about 50-60 viss (82-98kg) in weight.



Figure 10. A dugong accidentally killed at Ngwe saung in 2004.



Figure 11. A dugong accidentally killed at Ngwe saung in 2004.

Accidental killings of dugong were also reported at Shwe ya gyaing and its neighbouring villages. Two years ago, a dugong was accidentally caught in a beach seine and a

small dugong of about 25viss (41kg) was accidentally caught in a fishing net a few years ago at Shwe ya gyaing. Another dugong was killed accidentally in a gillnet nearby a few years ago.

Recent dugong bycatches in 2006 were also reported from the survey area. In 2006, a dugong weighing 40-50viss (ca. 65-82kg) was caught accidentally in a fishing net at Shwe ya gyaing. At the end of 2006, a dugong weighing more than 100 viss (163kg) was accidentally caught while beach seine fishing at Magyi. A small dugong was also caught accidentally in a gillnet at Hmawyone in 2006 weighing 20 viss (33kg).

Very recently in 2007, two dugongs, one was about 70 viss (114kg), were accidentally caught in seine nets in Shwe ya gyaing area within a few months of each other. Another



Figure 12. A flipper of an accidentally killed dugong at Hmawyone in April, 2007.

dugong was also killed accidentally in a fishing net weighing 80 viss (ca. 131kg) at Hmawyone in April 2007. The fishermen did not allow the dugong to be photographed but they allowed collection of its flipper as a specimen (Figure 12).

Generally, fishermen have no intention to hunt and kill dugongs but when one is sighted in the process of normal

fishing operations they try to kill it, most often using a harpoon. Sometimes, fishermen try to use their nets to catch a dugong but they are reluctant to use fishing nets because they know that dugongs are very strong animals and they can destroy their fishing nets.

Sometimes, dugongs are still alive when fishermen find them accidentally caught in fishing nets. However, they killed the dugong instead of releasing it as they can earn a good income even just from one dugong.

3.1.4 Local knowledge on dugong

The majority of respondents at all sites were aware that the dugong is a mammal. People in the survey area are very familiar with the dugong but almost all respondents did not know either the local or international legal status of the dugong. There is no superstition attached to the sighting of dugongs during their fishing. Fishermen are aware of dugongs and they do not fear them in any way. They are also aware that dugongs are clever because they manage to escape even when they are encircled with fishing nets. A fisherman observed a foraging dugong in Shwe ya gyaing water. The animal swam away when the fishermen try to go closer to the animal. They said that a dugong cannot swim away very swiftly as some fishes do because of its massive bulk but it builds up its momentum quickly after two or three strokes.

Fishermen have the belief that a dugong or dolphin can be killed accidentally in fisheries due to fate, when the animal's life span has ended and it is the due time for the animal to die. Tusks or teeth of dugongs are

collected as souvenirs by some villagers. Three teeth collected from a dugong stranded at Hmawyone were round in shape and about the size of a human thumb. Fishermen know that dugongs are mammals and the sex of dugongs can be distinguished by presence or absence of breasts.

Dugong rind (skin) is used as a traditional medicine for diarrhoea in Rakhine coast (Figure 13). It is obtained from dugongs and kept in dried form. Villagers usually keep the rind above a stove in the kitchen. A user grinds



Figure 13. Fresh dugong rinds at Hmawyone.

the rind with a little water on a stone slab and then drinks ground rind mixture as a traditional medicine. It was reported that it smells bad

when it is soaked in water. However, some people do not think that it can cure severe diarrhoea. But some have used it as a traditional medicine and sometimes they need to look for the rind at nearby villages if they cannot find one in their village.

Some people in the survey area have tried to eat dugong meat but said it is soft and not palatable. Dugong meat does not need to be boiled with water to make curry.

Dugongs living in Hmawyone water destroy rudders of the fishing boats which anchor in the bay. Some rudders make a noise due to movement of the shaft in wave action. Dugongs are said to selectively attack those rudders which make a noise but they do not attack a rudder which does not make a noise. The dugong apparently dives straight down under the boat, then it swims upwards forcefully and destroys the rudder with its head. Fishermen can see the attack from the boat very clearly and they think that the rudder is destroyed by smashing the rudder with its tusks. Dugongs usually attack rudders at night time and, sometimes, they continue to attack all night. This behaviour has also been found to occur in other nearby waters. Nowadays, most of the boats in the area are fixed with iron rudder to avoid dugong attack.



Figure 14. Boats anchored in Hmawyone water where dugong destroys the rudder with its head.

Dugongs can be seen during day or night, full moon or new moon, but they noticed that dugongs consume not only seagrass but also bivalves. Hmawyone and Shwe ya gyaing waters are abundant not only in seagrass but also in

bivalves. According to the descriptions and some broken samples shown by a fisherman, the bivalve looks like *Pinna* species (Figure 15).



Figure 15. A broken bivalve molluscs which is abundant in Hmawylene bay.

Hmawylene small bay is also known as a bay of bivalves among the villagers. These bivalves are also collected and eaten by the villagers.

Sometimes, fishermen from Shwe ya gyaing hear some noises while they are diving in the water. They believe that the noise comes from foraging dugongs as they have sighted dugongs in the water. They also found some toppled corals and stone slabs on the sea bottom. Fishermen believe that it does not look like it happened by wave action or other natural events because it looks selective. Fishermen think that if they are toppled by a natural event, all stones and/or corals must be in disorder. They can also distinguish between places which are altered by sharks, rays, groupers or dugongs.

Fishermen said that dugongs forage on the bottom and they also look for food under the stone or corals by removing them. Foraging tracks made by dugongs can also be seen while they are diving. Based on their experience, fishermen from Shwe ya gyaing had an opinion that the dugong prefers to live in rocky habitat rather than coral habitat.



Figure 16. A seagrass meadow at Pho ka lar kyun.

3.2 Seagrass

According to the respondents, many seagrass meadows are patchily distributed along the coast of the survey area and they are in pristine condition (Figure 16). They can



Figure 17. Stranded seagrass at Hmawyone.

be found at places with little silt. Stranded seagrasses were observed at all sites during the survey (Figure 17). Large seagrass meadows can be seen in almost all small bays in Gwa and

Shwe ya gyaing areas. A good seagrass meadow was observed at Pho ka lar kyun at low water and *Cymodocea serrulata*, *Cymodocea rotundata*, *Halodule pinifolia*, *Halophila ovalis*

and *Syringodium isotoefolium* species were observed (Figure 18 & 19). Hmawyone area also has many seagrass meadows and they are also in pristine condition.



Figure18. Seagrass at Pho ka lar kyun.



Figure 19. Seagrass at Pho ka lar kyun.

3.3 Other Marine Mammals

Dolphins are abundant in Rakhine coast and they can be sighted in various group sizes even in hundreds throughout the year. According to the fishermen from Shwe ya gyaing, they divide dolphins into two kinds - black and white. Because of the colour, white dolphins are called "Ah nu" at Myaybon area in northern Rakhine coast (Associate Professor San Tha Tun, pers. com). "Ah nu" means leprosy or leprosy patient and people are scared to be stained with some waters which were spewed during the dolphin surfacing.

Some fishermen have sighted whales during their fishing operations. They sighted the body and blow (water spout) of whales from a distance. They estimated the water spout was about four meters high. They are not superstitious about sighting a whale in the sea. Sometimes, dolphins are accidentally caught in fishing nets and fishing

lines. They are usually entangled by their flukes when they are accidentally caught in longline fishing.



Figure 20. A dolphin head observed at Thazin.

Very recent accidental dolphin bycatches in fishing gear were reported from Thazin and Chaung tha. A dolphin was accidentally killed in purse seine fishing off Thazin in January

2007. The dolphin's head was kept by the fishermen and they handed it over to the survey team (Figure 20). They do not collect oil from the dolphin but its meat was eaten by fishermen and villagers.



Figure 21. A dolphin carcass observed at Chaungtha.

Two dolphin carcasses were also observed at Chaung tha. They were accidentally killed in two separate fishing nets in 2007. Both dolphins were being sunned out by hanging from bamboo poles and oil from the dolphins was being collected by using a plastic bag and some enamel coated bowls when they were observed (Figure 21 & 22). Some villagers and visitors bought the oil to use as a lotion for muscles and tendons.



Figure 22. A dolphin parts observed at Chaungtha.

Sometimes, dolphins strand alive on the shore. A fisherman from Shwe ya gyaing found a dolphin stranded alive in the early morning about three months ago. It was lying on its side when it was found. The dolphin was killed and its flesh was sold. The fishermen kept the skin of the dolphin in dried form, hoping that someone would buy the skin at a good price (Figure 23).



Figure 23 A dried dolphin skin at Shwe ya gyaing.

Fishermen from Shwe ya gyaing said that many dolphins with human-like heads were observed at Ma gyi ngu in the past. They were told by their ancestors that such kinds of dolphins were called "labine" in Myanmar language. A villager from Ma gyi ngu was given a nick name as "labine gaung"

(dolphin head) because his head looked like a dolphin head. They call dolphins with a beak (elongated rostrum) as "Lin shu" and dolphins without a beak as "La bine".

3.4 Threats to Marine Mammals

Fishermen have no intention of deliberately killing dugongs in general but when they sight a dugong during their fishing trips, they take the opportunity and, usually, try to kill the dugong. Their greed is the main reason because of the animal's massive body which can yield much flesh and a single dugong can provide a good income. They usually use harpoons to kill the animal because the harpoon is a tool generally carried in their boat besides fishing nets. Fishing nets are also a threat

to the dugongs. Seine nets are the main threat in this area as the animals live in shallow water and near the shore.

New and disturbing information derived from this survey was that some shark fishermen look for dolphins and kill them to use as bait for their shark fishing. Fishermen from Shwe ya gyaing explained that they had no special purpose or specific interest in killing marine mammals but, as they were fishermen and they were living on their catch, they try to kill the marine mammals just as another aquatic animal in the sea when they are sighted.

However, it appears that marine mammals in the survey area are relatively safe because neither dugong nor dolphin meat was observed at markets in the survey area like Maungmagan market in Tanintharyi Division (Tun, 2006) (Figure 1).



4. Discussion

Although no systematic surveys have been carried out on the dugong in Myanmar and its occurrence had not been documented during the past four decades, Tun and Ilangakoon (2006) successfully proved the continued occurrence of a dugong population in Myanmar with their preliminary survey in Gwa area in the Rakhine coastal region.

Substantiating further their previous positive results, the present survey could verify the existence of a healthy and viable dugong population in the extended Rakhine coastal region stretching over a distance of

approximately 160km from Ngwe saung in Ayeyarwady division and Hmawzone in Rakhine state.

Having an average width of approximately 30-40 nm., the continental shelf off the Rakhine coast is narrow (People's Pearl and Fisheries Corporation, Rangoon, and Institute of Marine Research, Bergen, 1981), and, therefore, bathymetric conditions create opportunities for even near shore fishermen to encounter large whales during their fishing operations. Dugong and dolphin sightings are common in Rakhine coastal waters. It indicates that the waters off the Rakhine coastline have an abundance of cetaceans (both large and small) and dugong and the area may support high species diversity. Inclusion of some dugong juveniles in sightings and bycatch indicates that the dugong population in that area is still productive.

The accidental catch in fishing gear is the single major threat to dugongs on the Rakhine coast. Opportunistic killing by fishermen should also be considered as a potential anthropogenic threat to the dugong population in the area in future. So far, dugong meat is eaten locally by the people in that area although it is not considered to be particularly palatable. At the same time direct catch and bycatch is also a major threat to dolphin populations.

Fishermen releasing a marine mammal that is still alive in accidental bycatch or stranding is questionable and difficult to believe even if they sometimes state that they do so. In the light of information obtained through surveys along the Rakhine coast so far, a marine mammal captured accidentally whether dead or alive will not be

freed but, instead, it will certainly be killed for local sale and consumption just to provide some variety in relation to local food. It is normal practice for the people in the survey area to consume marine mammal meat whenever it is landed. However, it has not been landed on demand as yet.

Though dugong rind is kept and used as a traditional medicine, people have no other superstitious beliefs concerning the dugong. This is in sharp contrast to many parts of the dugong's worldwide range, especially in Asia, where they are generally hunted as food or for their body parts, bones and teeth which are used for medicinal purposes and are valued on the basis of superstitious beliefs. It is apparent that the dugongs off Myanmar's Rakhine coastline are not yet faced with serious direct hunting pressures or habitat fragmentation, degradation and destruction.

However, due to geographical advantages, the hotel and tourism trade is booming in the survey area. Chaung tha and Ngwe saung are, in fact, new resorts on the coast whereas Nga pa li beach which is situated a few kilometres north of Hmawyone has been a very famous tourist area in Myanmar for many decades. Another well known beach, Kan tha yar, is situated in Gwa township. Even at Gwa itself, an assessment and feasibility study has been done recently for hotel construction at the old Gwa airport.

According to the statistics, Chaung tha received more than seven times more visitors than Ngwe saung and Ngapali. Around, 165 thousand visitors went to Chaung tha in 2005-2006 tourist season, whereas Ngwe saung and

Ngapali received around nine thousand and 14 thousand visitors respectively (Living Colour, 2007).



Figure 24. A menu of a restaurant at
Chang tha.

In line with this booming hotel and tourism business, exploitation of marine living resources has also risen (Figure 24). However, dugong and dolphins have not been put on the menu so far. It is however necessary to take advantage of the enforcement of law and order in the hotel and tourism development area, and to launch an extensive public education program in a timely manner to assure conservation and sustainable use of the living marine resources.

Rakhine coastal area between Than dwe and Gwa is an ideal place for both terrestrial and marine environmental conservation because, parallel to the survey area in Rakhine division, a 678 sq. mile Rakhine Yoma Elephant Range is situated along the Rakhine Mountain Range. The Kyein ta li based local NGO, Rakhine Coastal Region Conservation Association (RCA) is also very interested in conservation and sustainable use of the natural resources in this region and it has already started its activities within its present capacity. In cooperation and collaboration with the RCA, awareness of conservation and sustainable use of their marine and coastal environment can be raised among the local people and authorities. Due to the strong base built by the RCA as an on-the-ground active NGO in the area, a marine

mammal network can be developed between Gwa and Than dwe areas.

Rakhine coastal region is the most tropical cyclone prone area of Myanmar and hydrographic conditions are influenced by the monsoons that prevail between May and October. Based on the information obtained during the survey, it can be assumed that seasonal occurrence of dugong at Hmawyone and Shwe ya gyaing depends mainly on geographic conditions and food supply.

Soe-Tun et. al. (2001) studied seagrass off the Myanmar coastline. Seagrass meadows are patchily distributed along the Rakhine coastal region and they are in very good, pristine condition (Soe Tun, Professor, Marine Science Dept., Mawlamyine University, pers. com.). Family Hydrocharitaceae represents the most dominant genera in both Rakhine and Taninthayi coasts and the family Cymodoceaceae occurs mainly on the Rakhine coastline. Meanwhile, the species *Halophila ovalis* found in the area is known to be a species preferred by dugongs (www.hans-rothauscher.de/dugong/sasia_e.htm).

Occurrence of dugong in Tanintharyi division in southern Myanmar was also documented by Rev. S. Benjamin (1983) and some recent dugong bycatch information were also reported from that division (Tint Tun, unpublished; Nang Mya Han, pers. comm.).



5. Conclusion

Occurrence of a healthy and viable dugong population in Rakhine coastal region of Myanmar has been verified by

the present extended survey. Seagrass beds are scattered and patchily distributed along the survey area and they are in undisturbed and pristine condition. The status of the dugong in the survey area on the Rakhine coast is also presently secure due to minimal direct hunting pressures, low rates of accidental bycatch and no habitat degradation or fragmentation. Therefore, in the light of these positive factors, it can be speculated that Myanmar is possibly one area remaining in south and south-east Asia where future survival prospects of the dugong are bright.

At present no information or data is available on the total extent of the dugong's range of occurrence and distribution, the extent of available habitat, size of the population, seasonal movement patterns and extent as well as effects of accidental and opportunistic killing in Myanmar waters. Therefore, more research on the species off Rakhine coastal area is both urgent and important. This also applies to small cetaceans.



6. Recommendation

6.1 Development and dissemination of public awareness materials.

There are no publications or any other awareness creating materials concerning the dugong in Myanmar so far. Production of printed bilingual (Rakhine and Myanmar), educational material is essential in order to initiate the public awareness programme in Rakhine State. These materials would be distributed to the local schools, NGOs, for display in public places and offices concerned,

through public awareness creation trips to the Rakhine coastal areas.

6.2 Launching of public awareness programm on conservation and sustainable use of marine living resources in Gwa amd Thandwe area in Rakhine coastal area.

A program for public awareness and education should also be done in order to give accurate information to the local people on status, conservation and bycatch reporting in order to make them aware of the important role they need to play in marine mammal research and conservation in the future. Gwa and Kyein ta li have the most convenient access at present and they are the nearest towns in Rakhine State to Yangon. Due to the willingness of the already existing Kyein ta li based local NGO to participate in the conservation of the coastal area between Gwa and Than dwe in Rakhine State, this should be designated as a base area for further development and extension of conservation and sustainable use of natural resources activities in the Rakhine coastal region.

6.3 A Short course on marine mammals to the fisheries officers.

Information on marine mammal strandings, sightings and bycatch have been reported from the coastal region of Myanmar every year. However, a standardized format to collect this information is an urgent need for local fisheries officers and people concerned. Capacity

building through conducting a short introductory course on marine mammals, targeting the fisheries officers would become a basis for setting up the necessary infrastructure for the development of a marine mammal information network. Illustrated handout material, digital cameras and computers should be made available at the fisheries training centre.

6.4 Occurrence and status of dugong off the whole Rakhine coast.

Building on baseline data already available through interview surveys along the Ngwe saung and Hmaw yone segment of the Rakhine coast (Ilangakoon and Tun, 2007, present survey), qualitative cost-effective interview surveys on the occurrence of dugong off the remaining segments of the Rakhine coast should be conducted. The same research protocol should be used as in the previous surveys.

It is also recommended that aerial surveys should be conducted along the Mynamar coastline as a matter of priority to collect quantitative data on dugong occurrence and distribution. This should also lead to the identification of areas where concentrations of dugongs occur, and as a result, efforts to minimizing threats, such as the use of gillnets, in such areas can be better focused.

6.5 Dugong habitat assessments in Rakhine Coast.

An assessment of the dugong habitats mainly on the abundance, quality and distribution of seagrass along the Rakhine coastline should be undertaken. Preferably, this should also be done using satellite images and aerial photographs, combined with local knowledge through consultation with fishermen in the area. This information should lead to development of a seagrass habitat map in Myanmar waters. The survey should be first conducted at some prioritized places as an initial phase of the study.

At present there is no data to show that there are any adverse anthropogenic impacts on seagrass habitats in Myanmar waters. However it is recommended that a specific assessment of human impacts on seagrass beds is carried out in order to detect any such yet unknown threats that may exist and may become a problem in the future.

6.6 Bycatch monitoring and fisheries interaction assessment.

Interview surveys in 2005, 2006 and 2007 (Tun and Ilangakoon, 2006, present survey) have shown that there is accidental bycatch and some level of interaction between dugongs and fisheries in Myanmar waters. Therefore it is important to systematically monitor this bycatch in order to assess its extent and determine the level of threat it poses to the long term survival of the dugong in Myanmar.

At present bycatch is not always reported to authorities and therefore much of it may go undocumented. Therefore

it is necessary to develop a system of reporting and documenting the bycatch in all coastal areas of the country.

In order to collect such quantitative data on bycatch it is essential to provide basic training to local fisheries and social sector officials. This data will also become vital in the future to minimise conflicts between the fishery and dugong conservation efforts.

6.7 Regional collaboration and cooperation with neighbouring countries.

Regional collaboration and co-operation with neighbouring countries, Thailand to the south and Bangladesh to the north, in terms of dugong research could be advantageous to all countries concerned. This is of importance in assessing if any cross border dugong migrations occur. At the same time Thailand already has a history of dugong research (Hines 2001, 2005) and therefore also has the necessary expertise and experience which is presently lacking in Myanmar. Collaboration and consultation with Thailand could help to build local capacity for research and conservation of the dugong.

Establishment of a dugong and marine mammal regional network is an option to be pursued, so as to share information and to take timely conservation action based on regionally significant information.



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