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Sea Turtles of Macajalar and Gingoog Bays Mindanao, Philippines

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Abstract - There are 4 species of sea turtles recorded in Macajalar and Gingoog Bays in Northern Mindanao. The hawksbill and the green turtle have the highest occurrence while casual and accidental occurrences are recorded for the olive ridley and leatherback turtle. Sea turtles are recorded in 22 barangays (the smallest geopolitical unit in the Philippines) of 11 municipalities in both bays, but only the hawksbill and green turtles are observed in in-water and boat surveys. Only the hawksbill turtle is confirmed to nest in 9 barangays of 5 municipalities. Nesting is all year round with peaks during the 1st quarter of the year. 22% of the nests have not reached hatching due to poaching (14%) and natural causes (8%). Nesting activity is within the range recorded for the species. Sea turtle-human interactions are generally positive with majority of accidental captured turtles released although poaching of eggs and deaths of sea turtles directly or indirectly manmade are still documented.

Keywords - sea turtles, hawksbill turtle, green sea turtle, olive ridley turtle, leatherback turtle, conservation

INTRODUCTION

There are 7 species of sea turtles globally (Meylan & Meylan, 1999) with 5 found in Philippine waters, and 3 are known to nest in

Philippine beaches (Cruz, 2002). The green turtle, olive ridley turtle and loggerhead turtle are declared endangered while the hawksbill turtle and leatherback turtle are critically endangered (IUCN, 2011; Cruz, 2002; Baillie & Groombridge, 1996; De Veyra & Ramirez, 1994). As a highly migratory species, they are protected by international laws under the recommendation of the International Union for the Conservation of Nature and Natural Resources and locally by the Wildlife Resources and Conservation Act (RA 9147) and the DENR Administrative Order 2004-15.

Despite being declared a protected species, sea turtle populations are still declining as they are still being exploited for their meat and other derivatives (Torres et al., 2005; Groombridge & Luxmore, 1989; Alcala, 1980). Decline in numbers is well observed in some areas (Torres et al., 2005). Habitat loss from coastal development and urbanization bring about major changes in areas that used to be nesting grounds or foraging zones. Due to lack of research on the locations of nesting and foraging zones, these important areas where sea turtles converge are currently under threat from rapid urbanization.

In Northern Mindanao, sea turtles have been observed to be foraging and nesting, but there is a clear lack of data as to its location. Preliminary studies have confirmed the municipality of Magsaysay to be a nesting ground, but it is clear by the extent of the reports that they are not confined in only one location of the region but encompasses the 2 big bays of Region 10, and probably even the whole Northern Mindanao.

Unfortunately, this area of the Philippines has been poorly studied for sea turtle activities, and the interactions that might have occurred remain undocumented. Hence, this study aims to address the missing data on the status of sea turtles and their interactions with humans in the 2 bays in the hope that the information can further strengthen and improve conservation activities for Northern Mindanao.

OBJECTIVES OF THE STUDY

The general objective of this study is to identify sea turtles found in Macajalar and Gingoog Bays. Specific objectives include; (1) determining the location, pattern, and frequency of nesting and foraging of turtles; (2) determining the aspects of the nesting biology of turtles in the area; (3) establishing a GIS map to locate nesting sites and foraging zones; and (4) documenting the sea turtle-human interaction in the area.

MATERIALS AND METHODS

Study Area

Macajalar and Gingoog Bays are 2 adjacent bays situationally located in Northern Mindanao (Fig. 1). Nineteen geopolitical units make up Macajalar and Gingoog Bays, encompassing a combined coastline of approximately 180kms. The shorelines of both bays are mixed sandy beaches and rocky beaches with some outcroppings occurring intermittently. Numerous rivers and streams sporadically cut through the coastline. Industrialized zones, breakwaters, and barriers also cut across the beaches in both bays. Presence of sea turtles was documented at the barangay level of the municipalities/cities.

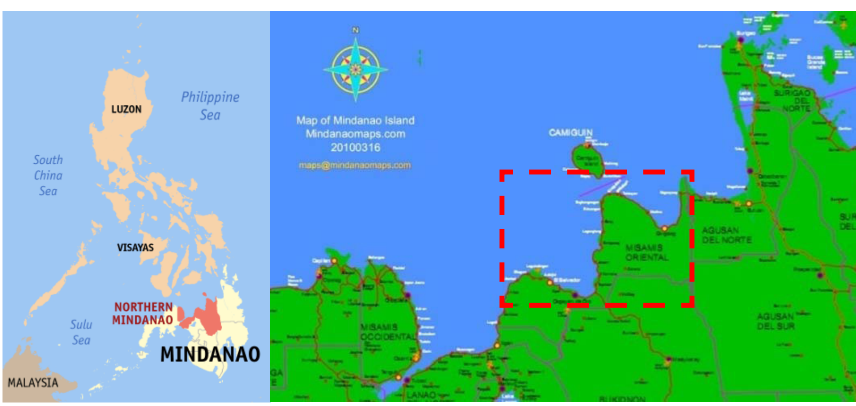

Fig. 1. Map of Northern Mindanao, Macajalar and Gingoog Bays in broken box

Data presented in this study covered a span of 6 years (June 2005-May 2011). Data gathered was based on primary and secondary information using 4 basic methods; interviews, ground surveys, opportunistic sightings, and in-water census. Primary information included actual observation of the sea turtle-human interactions, such as accidental capture and release, tagging of nesters, location of nests, death and burial of turtles, among others. Secondary information was based on reports from the local government units, the DENR, and anecdotes from key informants (e.g. nesting, foraging) during the semi structured interviews.

For the interviews, approach was made following protocol published by Tambiah (1999), where informants were shown photographs and a species identification field guide of the different species of sea turtles and were asked to point out species that they have encountered and the type of encounter. Whenever an informant reported a nesting beach or foraging ground in an accessible area, a nesting survey was then conducted.

For nesting beaches, a transect walk was conducted to locate turtle tracks and nests. Reported nests whose clutch had hatched already were dug up, and egg shells from the previous clutch were used to verify the presence of the nest. When the nesting beach had been verified, the location was then marked with a GPS and monthly surveys were conducted. Whenever a fresh nest was found, the nest was then enclosed and protected with a mesh cylinder (*sensu* Boulon, 1999) for a period of 55-75 days. When the hatchlings emerged, they were counted and released. The nests were then dug up to check for unhatched eggs, trapped hatchlings and dead hatchlings. Hatching and mortality rate were computed from data collected following method of Miller (1999).

For areas reported to be foraging zones, we developed our own in-water survey combining underwater survey using SCUBA diving, snorkeling and boat observation. Underwater census consisted of traversing a depth of 15-20 ft using a diver propulsion vehicle with an average speed of 2-3km/hr at an average time of 45-60mins. During surface intervals of the dives, snorkeling was conducted to cover more areas. Turtles seen during the census are identified up to species level (Pritchard & Mortimer, 1999), photographed and location marked by GPS. To confirm sites as foraging ground, repeated underwater surveys were conducted. Sea turtles that are documented during the coral reef surveys are also recorded in the in-water surveys.

Occurrence terminology was patterned after Isleib and Kessel (1973) as used in Wing and Hodge (2002) (Table 1). The terminology provided a scale for occurrences of the different species of sea turtles documented in the bays. The term is only applied on primary and verified secondary reports.

Table 1. Occurrence terminology for marine turtles (after Isleib and Kessel in Wing and Hodge, 2002).

Term	Definition
Accidental	Species has been recorded only a time or 2; it is so far from its usual range that further observations are considered unlikely.
Casual	Species that has been recorded no more than a few times, but irregular observations are likely over a period of years.
Rare	Species occurs, or probably occurs, regularly within the region but in very small numbers.
Uncommon	Species occurs regularly, but utilizes very little of the suitable habitat and/or the region regularly hosts relatively small numbers of the species; not observed regularly, even in appropriate habitat.
Fairly Common	Species occurs in only some of the proper habitat and large areas of presumed habitat are occupied sparsely or not at all and/or the region regularly hosts substantial numbers of the species.
Common	Species occurs in all or nearly all proper habitats, but some areas of presumed habitat are occupied sparsely or not at all and/or the region regularly hosts large number of the species.
Abundant	Species occurs repeatedly in proper habitats, with available habitat heavily utilized, and/or the region regularly hosts great numbers of species.

RESULTS AND DISCUSSION

Sea Turtle Species and Distribution

Four species of sea turtles were documented Macajalar and Gingoog Bays. The critically endangered hawksbill turtle, *Eretmochelys imbricata* Linnaeus, was fairly common having the highest occurrence of all the sea turtles and the only sea turtle documented to nest in both bays.

The green turtle, *Chelonia mydas* Linnaeus, was uncommon having the 2nd highest occurrence.

Occurrence of the olive ridley turtle, *Lepidochelys olivacea* Eschscholtz, was casual, while there was an accidental presence of the largest species of sea turtle, the leatherback, *Dermochelys coriacea* Vandelli, in Macajalar Bay.

The presence of the hawksbill turtle was fairly distributed across both bays, occurring in 22 barangays of 11 municipalities. Nine barangays of 5 municipalities were documented as nesting sites with concentration in the Municipality of Magsaysay. The green turtle was documented in 19 barangays of 10 municipalities through in-water surveys and accidental capture. Although low in number, the olive ridley turtle's range also cut across both bays, but most of its occurrences were mostly due to beaching. An unusual occurrence of the large leatherback turtle was recorded in Macajalar Bay. Fig. 2 shows the locations of the different sea turtle species in Macajalar and Gingoog Bays.

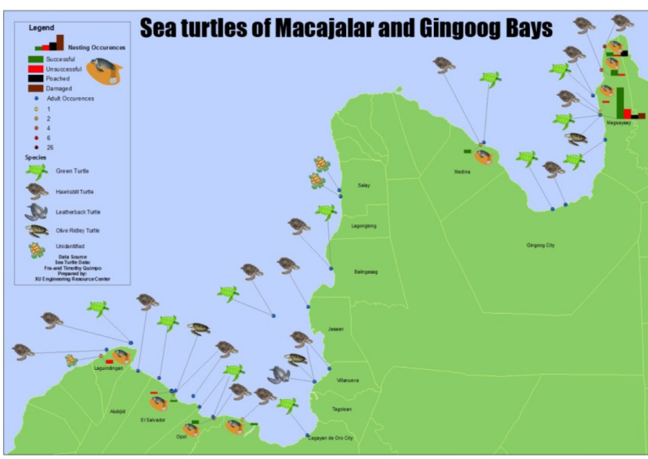

Fig. 2. GIS map of sea turtle distribution in Macajalar and Gingoog Bays.

Repetitive in-water and boat observation surveys in Laguindingan, Agutayan Island in Jasaan, Medina, and Magsaysay confirmed the use of the reef crests as foraging and resting areas of subadult and adult hawksbill turtles while an adult green turtle was observed to rest in Agutayan Island and Medina. Up to 2 subadult hawksbill turtles were observed foraging in Agutayan Island, Medina, and Magsaysay, while solitary hawksbill turtles were observed in Laguindingan. Surface breathing of hawksbill and green turtles were observed in Sta. Cruz, Magsaysay. Hawksbill and green turtles were also observed in 5 sites during coral reef surveys of Macajalar Bay.

Sea Turtle Nesting

Only the hawksbill turtle was documented to nest in 9 barangays of 5 municipalities in both bays (Fig. 2). Highest concentration of nesting incidences (37 of the total 46) were recorded in Magsaysay, Misamis Oriental, while nesting in other areas seemed sporadic. Average nesting annually was at 6 nests with the highest nesting incidence in 2007 at 14 and the lowest at 2010 with only 1 recorded nesting. Nesting occurred throughout the year with peaks generally during the 1st quarter of the year (Fig. 3). Twenty-two percent of the nests had been unsuccessful due to poaching (14%), and natural causes (8%).

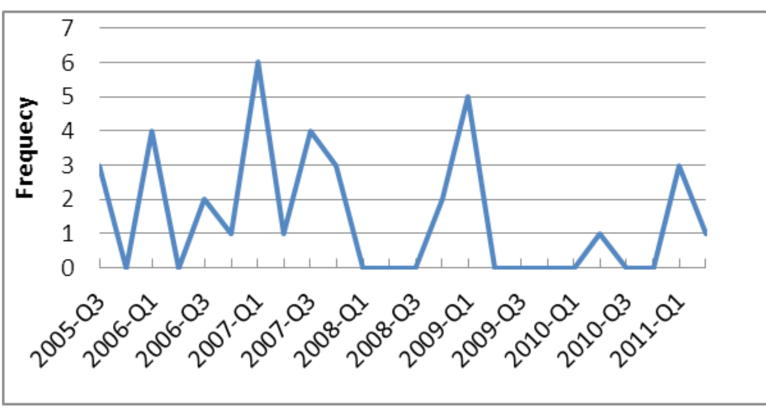

Fig. 3. Frequency of quarterly nesting incidences in Macajalar and Gingoog Bays.

Mean clutch size was at 158 (+28) eggs with a range of 105-208 eggs. Mean emergence period was at 63 (+8) days with the shortest period at 52 and longest emergence at 82 days. Hatching rate for successful nests was at 84% with 4% mortality rate in the newly hatched.

Sea turtle-human interactions

Majority of the reported interactions with sea turtles were due to accidental bycatch as turtles get trapped in fishing gears of fishermen. The green turtle was the most commonly accidentally caught species with 16 incidences, 15 of which resulted to the release of the turtle unharmed while 1 turtle was already dead during the retrieval of the net. Hawksbill turtles accidentally caught by fishermen numbered only 6, but there were 3 incidences were hawksbill hatchlings had been kept as pets and were surrendered to the researcher for release, and 2 incidences were a nesting female turtle got stranded in land and was rescued and returned to the sea. Only 1 incidence each of capture for the olive ridley and leatherback turtle were recorded, both of which were safely released.

There were 4 recorded deaths of green turtle, 1 died during rehabilitation, 2 beached with a mouthful of plastic, and 1 trapped in a net and drowned. There was only 1 recorded death of a hawksbill turtle, death of which was due to a damaged carapace, possible due to boat accident or a deliberate attempt to capture it. Two of the reported 3 incidences of olive ridley turtle were of beached and dead turtles, with 1 having ingested a hook-and-line that caused its death.

There were 4 incidences of poaching of turtles eggs in the Municipality of Magsaysay. Key informants also reported massive harvesting of eggs and butchering of sea turtle nesters a decade ago but no report on recent killings during the conduct of the study.

Hawksbill Turtle

The hawksbill turtle (Fig. 4) is the most circumtropical species of marine turtles. In the Pacific, it is known to occur from the Gulf of Thailand all the way to the Pacific Islands of French Polynesia (Marquez, 1990). Juveniles, subadult, and adult hawksbill turtles are typically associated with coral reefs where they feed on sessile and slow-moving invertebrates. This is posited as the reason why hawksbill turtles are still fairly common in Macajalar and Gingoog Bays. Coral cover in Macajalar Bay is still in fair condition, and in areas frequented by this species, coral cover ranges from fair to good (Quiaoit et al., 2008; Atrigenio et al., 1998), while coral cover in Duka, Medina is also

Fig. 4. Hawksbill Turtle (*Eretmochelys imbricata*)
in Agutayan Island, Jasaan, Macajalar Bay.

at fair (Alfeche, 2010).

In the Philippines, hawksbill turtles have no major nesting aggregations (Cruz, 2002; Palma, 1994), instead nesting in low densities covering large areas (Witzell, 1983) but exhibiting high site fixity (Garduno-Andrade, 1999; Dobbs, et al., 1999). This conforms to the observation of high site fixity of nesting in Magsaysay. Even in other nesting sites like, although nesting is observed to be temporally sporadic, it is nevertheless spatially constant. There are also other areas in both bays which are believed to be nesting sites based on characteristics of hawksbill turtle nesting areas, but the areas are data deficient or have no reported nesting's during the research period.

Regular sightings of juvenile, subadult, and adult hawksbill turtles in the coral reefs of Macajalar and Gingoog Bays are consistent with observations that immature hawksbill turtles tend to remain in the same developmental habitats for extended periods (Houghton et al., 2003; Meylan, 1999; De Veyra & Ramirez, 1994), while adult hawksbill turtles also exhibit site fidelity to their feeding grounds (Limpus, 1992). This high fidelity of hawksbill turtles to its nesting ground and foraging zones make conservation of the identified areas in Macajalar and Gingoog Bays critical to the survival for this population of hawksbill turtles.

Green Sea Turtle

The green turtle (Fig. 5) is widely distributed in tropical and subtropical. It is the most abundant sea turtle in the Western Pacific region with distributions from the Gulf of Thailand all the way to the French Polynesia. Adult green turtles are herbivorous, and one of the few marine animals to feed exclusively on seagrasses, thus playing an important role in the cycling of nutrients in seagrass meadows (Bjorndal, 1980). In this region, its major nesting ground is in the Turtle Islands of the Sulu-Sulawesi region of Southeast Asia (Cruz, 2002) but have been known to travel up to 800kms from their nesting site to foraging grounds (Sagun, 2004; Luschi et al., 1998; and De Veyra, 1994).

Fig. 5. Green Turtle (*Chelonia mydas*) in Duka Medina, Gingoog Bay.

Most of the green turtles documented in this study are a result of accidental capture by fishermen either in fish pens, fish corrals and bottom set gill nets in intertidal areas, or in driftnets in offshore areas. Fish pens and fish corrals are large modified fish traps in intertidal and seagrass areas with barriers designed to direct fishes into a certain where they are trapped. Feeding grounds of green turtles are protected shallow water areas (Bowen, et al., 1989), hence, putting them in direct contact with bottom set gill nets, fish corrals, and gill net fisheries (Cheng & Chen, 1997; Chan, et al., 1988). This accounts for the high accidental capture rate of the green turtle as compared with the hawksbill turtle even though the hawksbill turtles have a higher occurrence. One of the green turtles documented had a tag from Malaysia (tags MY59759, MY59760), showing a link with the sea turtle rookeries in the area. With this recapture of a Malaysian tagged turtle which was traced to be originally tagged in Sandakan, Sabah, Malaysia, it could be said that Macajalar and Gingoog Bay maybe a foraging zone of sea turtles nesting in the turtle islands.

Olive Ridley Turtle

The pantropical olive ridley turtle (Fig. 6) is the smallest, but most abundant sea turtle species (Pritchard, 1997). They occur mostly in the northern hemisphere and in the Philippines are known to nest in areas facing the South China Sea (Cruz, 2002). They are pelagic species, foraging kilometers away from mainland shores, hence, rarely seen in shallow coastal areas except when nesting (Swimmer, et al., 2006; Polovina et al., 2004; and Barbour et al., 1994).

Fig. 6. Carcass of an Olive Ridley Turtle (*Lepidochelys olivacea*) retrieved in Magsaysay, Gingoog Bay (photo courtesy of LandoPagara).

Olive ridley turtles are omnivores and generally bite baited hooks, which in turn causes their demise (Swimmer, et al., 2006; Hays, et al., 2003). In Macajalar and Gingoog Bay they are not observed during the in-water and boat observation surveys because of their epipelagic nature, and no nesting has been recorded here. They are minimally caught in coastal fishing gears, but a number of them are caught or maybe injured in deep sea hook and line fishing targeted for large pelagic fishes. This is posited as the reason why they are casually recorded in Macajalar and Gingoog Bays, and beachings are a result of death or injuries sustained in the deeper waters.

Leatherback Turtle

The largest sea turtle (Fig. 7), the leatherback turtle, is unique among the marine turtles in lacking a bony carapace, instead having a leathery skin with 7 distinct ridges that run from the anterior to the posterior part of the carapace as opposed to the traditional bony shell of the other marine turtles (Barbour et al., 1994).

Fig. 7. Beached Leatherback Turtle (*Dermochelys coriacea*) in Villanueva, Macajalar Bay (photo courtesy of DENR 10).

In the Philippines, leatherback turtles are documented throughout the archipelago and the majority of the captures occur in the Visayan Seas (Cruz, 2006). Leatherback turtles are the most pelagic of all marine turtle species, and feeding exclusively on gelatinous plankton; hence, sightings in coastal waters rarely occur (James et al., 2005). There are only 4 confirmed sightings of leatherback in the region within the last 2 decades and only 1 during the conduct of this study (Viloria A. pers comm.). All the four documented encounters are due to accidental capture in fishing gears, attesting to the rarity of this species in coastal waters.

Sea Turtle Nestings

Nesting of hawksbill turtles are documented in 9 barangays of 5 municipalities, but the number of nesting sites could be higher. Hawksbill turtles are solitary nesters and prefer nesting in isolation away from disturbance (Groombridge & Luxmore, 1989; Witzell, 1983). In both bays, there are a number of beaches that are characteristic nesting beaches of hawksbill turtles, but information is lacking due to the isolation of the beaches from coastal communities, or the low level of awareness of locals regarding turtle nesting. In Magsaysay, the high nesting incidences resulted from a combination of nesting incidences and high awareness of the communities to the presence of sea turtle nesting's in their sites, particularly in Brgy. Kandiis, Magsaysay. Higher awareness, results in higher reports being provided to the researcher or the DENR.

Nesting of hawksbill turtles globally and even in a regional level is highly variable, with clear seasonal patterns (Garduno-Andrade, 1999; Marcovaldi et al., 1999; Pilcher, 1999) or year round nesting's with no pattern (Pilcher & Ali, 1999; Mortimer & Bresson, 1999). In Macajalar and Gingoog Bay nesting is observed to be throughout the year with peaks during the 1st quarter and 3rd quarter of the year. Most of the nesting's occur in Magsaysay which has a type 2 climate pattern based on the Modified Coronas Classification of the climate map of the Philippines. A type 2 weather pattern has no dry season and a pronounced rainfall from November to January. Peaks in nesting are highly correlated with summer monsoon seasons (Mortimer &

Bresson, 1999; Dobbs et al., 1999), and this is posited as the probable reason of the 1st quarter peaks.

The recorded clutch size in Macajalar and Gingoog Bay is within the range of the species but is relatively high if compared to other records in the Philippines (Torres et al., 2004; Alcala, 1980) and Pacific hawksbill population reported by Witzell (1983). Other nesting characteristics recorded are within the range of what has been described by previous authors (Meylan, 1984; Witzell, 1983). Hatching rate is also high as a result of the enclosure of nests in a protective mesh during the incubation period.

Sea turtle-human interactions

Sea turtle-human interactions recorded during the conduct of the study have positive outcomes for the sea turtles. Majority of the interactions are a result of accidental capture in fish nets, but resulted in a successful release of the turtles. Only 1 incidence of death of a green sea turtle due to drowning from entanglement in the fishnet has been recorded. It is emphasized that the basis for these recorded interactions are reports to the researcher or the appropriate government agencies and might present a bias as poaching could have happened unreported. Although, it can be noted that there are no anecdotal reports of butchering of sea turtles during the research period and this absence could also serve as the basis for the positive statement.

Negative interactions with sea turtles are a result of accidents, by catch, indirect anthropogenic impact, and poaching of eggs. Poaching's of eggs are recorded in 2 barangays of Magsaysay. Poaching's of eggs represent a grave threat to the population of sea turtles as it completely wipes out a whole clutch of eggs. Other indirect anthropogenic impacts include death of turtles due to ingestion of fishing hooks, cellophane, and drowning due to entanglement in net. There are also incidences of weakened turtles that are released back to the sea due to lack of infrastructure to support rehabilitation of sick and weak turtles.

CONCLUSION

The presence of 4 species of sea turtles, with the critically endangered hawksbill turtle documented to be nesting, warrants robust conservation measures to prevent further decline of population in the 2 bays. Based on the distribution of the sightings, a bay wide approach is necessary to ensure the protection of the species. Increasing awareness of the ecological importance of sea turtles can provide a big contribution to its conservation success.

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