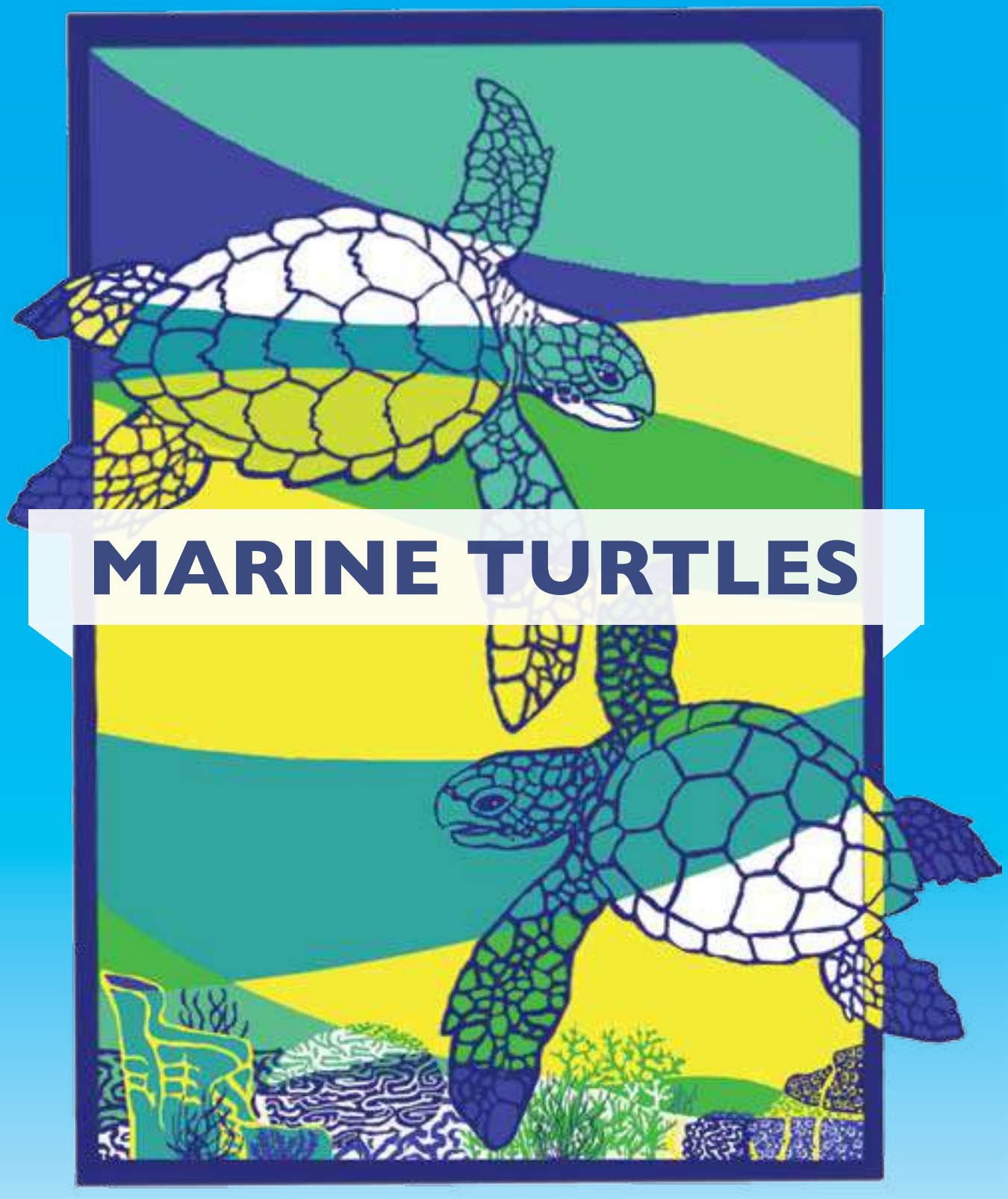
PHILIPPINE AQUATIC WILDLIFE
RESCUE AND RESPONSE MANUAL SERIES



MARINE TURTLES

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ACCCoast Adaptation to Climate Change in Coastal Areas
Marine Wildlife Watch of the Philippines

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Suggestions and comments are encouraged from users of this manual for the continued improvement of response protocols for protected species. Suggestions and comments may be sent to the Biodiversity Management Bureau (BMB) and the Marine Wildlife Watch of the Philippines (MWWP) at info@mwwphilippines.org.

Philippine Aquatic Wildlife Rescue and Response Manual Series:

Marine Turtles

A collaboration of the
Department of Environment and Natural Resources-Biodiversity Management Bureau (DENR-BMB)
Marine Wildlife Watch of the Philippines (MWWP)
and the
Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

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Foreword

Marine turtle conservation in the Philippines is challenging work. Spread unevenly across our country's five seas, thousands of islands and countless coastal indentations, these turtles encounter threats to their existence: hunting, pollution and damage to habitats, to name a few. Mandated by law, the DENR passionately spearheads the effort to counteract such threats.

Over the past decades, millions of hatchlings have been born under the protection of the Turtle Islands Wildlife Sanctuary. The DENR's Regional and Field Offices have successfully saved thousands of marine turtles from what may have been sure death in fishing gears. Of course, the DENR is not alone in this endeavor. The Biodiversity Management Bureau has welcomed fifty-three institutional conservation partners who actively assist in this gargantuan task. Along with the surge in environmentally aware citizens, our partnerships continue to grow in number. Together, we have learned much about dealing with the threats faced by our endangered marine wildlife.

With this welcome development, we have prepared a key element in the strategy to heighten our effectiveness. This Manual synthesizes thirty years of our best conservation practice, providing tried-and-tested methods culled from our experience and internationally accepted actions. This Manual serves as a toolkit of proven techniques even as we build new conservation skills using advances in this space age of digital technology and electronic connectivity.

Through thirty years of continuous effort, domestic pressures have lessened. Yet, the global dimensions of threats against our marine turtles have not abated, and may seemingly have intensified. Marine turtles travel thousands of kilometers in quest of food and mates. Many dangers lurk along the way. Our vigilant coast watchers have caught numerous foreign poachers red-handed with hundreds of slaughtered marine wildlife.

Clearly, much more work is needed. Together, we must increase our skills in the standard, prescribed ways of rescuing marine turtles from harm. Our effort today raises our hope that our children and children's children will still witness marine turtles nesting, swimming and living across our country's seas.

Read and learn from this Manual. Contribute to our common hope.

THERESA MUNDITA S. LIM
Director
Biodiversity Management Bureau
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Preface

Marine life is very diverse in the Philippine archipelago. Over 7,000 islands provide a variety of habitats, including a coastline which is approximately 37,000 km long, deep inner seas and trenches, off-shore waters, shallow coasts with reefs, seagrass beds, and mangrove forests. The Philippines lies within the Coral Triangle, the most biodiverse marine environment in the world. With this richness comes the responsibility to manage human activities around these resources to preserve ecological processes in order to maintain a healthy environment to sustain millions of Filipinos.

Out of the seven species of marine turtles worldwide, five species are found in almost all the seas in the Philippines: green, hawksbill, olive ridley, loggerhead, and leatherback turtles. They occupy nesting beaches, coastal feeding habitats, mating grounds, internesting, and developmental habitats utilized by the turtle for different stages of their life cycle. In each of these habitats, humans and turtles interact, mostly to the turtle's disadvantage. When turtles are encountered, certain procedures need to be followed since all marine turtles are protected in the country under the Wildlife Resources Conservation and Protection Act (Republic Act No. 9417) of 2001 or the Philippine Wildlife Act. Nesting turtles and hatchlings need not be rescued but the information from such incidents is important to gather. Stranded, caught accidentally, injured, and sick turtles would need to be rescued. They also give indications on the threats in their habitats and the condition of the environment. It is necessary, therefore, to know when to intervene in responding to marine turtle reports.

If no one responds to a stranding, the chance to release the animal to the wild is lost, along with the valuable information that could have added to our knowledge of marine turtles, their habitat, and possible underlying threats to both. Rescue as an intervention is also relevant for animal welfare, scientific, public health, and educational purposes. Any and all information from rescues could greatly contribute to the conservation of the population.

Releasing stranded and captured marine turtles back to their natural habitat is a priority especially since these species are endangered. Each individual released back to the wild could make a significant contribution to the stabilization of the existing population. Every marine turtle released back to its natural habitat is a major step towards its conservation.

This manual addresses the lack of information materials on how to deal with marine turtle encounters in the Philippine seas to ensure that the proper treatment and intervention is provided. The manual also responds to the Comprehensive Action Plan for Threatened, Charismatic, and Migratory Species of the Sulu-Sulawesi Marine Ecoregion (SSME), which has been identified as the first priority seascape the Coral Triangle Initiative (CTI). The Tri-National Committee of the SSME developed the Comprehensive Action Plans (CAP) that identified seven Key Result Areas (KRAs) to improve the status of marine turtles in the

SSME, as follows: (a) Identify best practices in minimizing threats to marine turtle populations and their habitats; (b) Develop and implement nesting habitats and management programs to maximize hatchling production and survival; (c) Provide recommendations on specific features or criteria in marine protected area (MPA) design and MPA network design in relation to the protection and management of marine turtles in SSME waters; (d) Undertake initiatives to promote reduction of incidental capture and mortality of marine turtles; (e) Conduct turtle population habitat research and monitoring protocols; (f) Develop guidelines for MPA network design for marine turtles; and (g) Publish information to promote best practices and successes for marine turtle conservation.

This manual is an important step to address gaps and issues on threatened marine wildlife in the Philippines to better protect and conserve marine biodiversity in the Coral Triangle.

Acknowledgment

This manual would not have been finished if not for the help of the following: Beterinaryo sa Fort Animal Clinic and Kirschner Travel Manila office for providing us with a free venue; Monica Manalansan for the assistance; Macky Lovina for the valuable comments; Dr. Nicholas Pilcher for reviewing the manuscript; Fara Policarpio, Cris Villarey, and Ms. Anna Oposa for editing; Jenica Dizon, for the layout, book design, and graphic work; Mike Yap for the artwork; and Emelinda Ramoso for the cover.

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List of Abbreviations

BFAR Bureau of Fisheries and Aquatic Resources
BMB Biodiversity Management Bureau
CBD Convention on Biological Diversity
CCL Curved Carapace Length
CCW Curved Carapace Width
CENRO Community Environment and Natural Resources Office
CEP Coastal Environment Program
CITES Convention on International Trade in Endangered Species of Wild Fauna and Flora
cm centimeter/s
CMMO Coastal and Marine Management Office
CMS Convention on Migratory Species
CS Clutch Size
CTI Coral Triangle Initiative
CTI-NPOA Coral Triangle Initiative - National Plan of Action
CWR Certificate of Wildlife Registration
DA Department of Agriculture
DAO DENR Administrative Order
DENR Department of Environment and Natural Resources
DIN Dead in Nest
dL deciliter
DNA deoxyribonucleic acid
DPE Dead hatchling in pipped egg
E Emerged
ECAN Environmentally Critical Areas Network
EDTA ethylenediaminetetraacetic acid
EO Executive Order
g gram/s
GiZ Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
ICRMP Integrated Coastal Resource Management Program
IU International Unit
IUCN International Union for the Conservation of Nature
IUCN-SSC IUCN Species Survival Commission
kg kilogram/s
L liter
LGU Local Government Unit
LIN Live in Nest
LPE Live hatchling in pipped egg
m meter/s
mg milligram
mmol millimole
mL milliliter
MT Marine Turtle Form
MWWP Marine Wildlife Watch of the Philippines
MoA Memorandum of Agreement
MPA Marine Protected Area
NGO Non-Government Organization
NIPAS National Integrated Protected Areas System
NSO No Significant Observations
OGA Other Government Agencies
P Predated
PASu Protected Area Superintendent
PAWB Protected Areas and Wildlife Bureau
PCP Pawikan Conservation Project
PCSD Palawan Council for Sustainable Development
PCV Packed Cell Volume
PENRO Provincial Environment and Natural Resources Office
PH Philippines
PO People's Organization
ppm parts per million
ppt parts per thousand
PVC Polyvinyl chloride
RBC red blood cell
S Shells (egg)
SEAFDEC Southeast Asian Fisheries Development Center
SEP Strategic Environmental Plan for Palawan
SSME Sulu-Sulawesi Marine Ecoregion
SSME-CAP Sulu-Sulawesi Marine Ecoregion- Comprehensive Action Plan
SU-IEMS Silliman University - Institute of Environmental and Marine Sciences
TFP Task Force Pawikan
TIHPA Turtle Islands Heritage Protected Area
TIWS Turtle Islands Wildlife Sanctuary
TRNP Tubbataha Reefs Natural Park
U units
UD Unhatched Undeveloped Egg
UH Unhatched Developed Egg
UHT Unhatched Full Term Egg
WBC white blood cell
WRC Wildlife Rescue Center
WRD Wildlife Resources Division
µg microgram
µmol micromole

List of Figures

Definition of Terms

Acclimatization - gradual, long-term response of an organism to changes in its environment.
Asphyxiation - suffocation from lack of air.
Austenitic – a metallic, non-magnetic allotrope of iron.
Benthic –pertains to the bottom of the sea.
Bycatch – accidental capture of a non-targeted species in fisheries whether retained and sold or discarded.
Cohort - a group of animals born in the same specified period within a population.
Coelom – refers to the body cavity of a marine turtle that holds the internal organs.
Cloaca - the posterior opening that serves as the only outlet for the intestinal, reproductive, and urinary tracts of certain animal species.
Dorsal – carapace side of a marine turtle.
Ectotherms - cold-blooded animal whose regulation of body temperature depends on external sources.
Emergence – the process wherein hatchlings find their way out of the egg chamber to the surface of the nest.
Epibiota - an organism that lives on the surface of another living organism.
Euthanasia - the act of killing an animal in the most humane manner to end further suffering and pain especially in chronically or terminally ill animals.
Ex situ – situated away from the natural setting.
Fibropapilloma - benign cauliflower-like tumors on the soft and hard tissues, both internally and externally, specific to marine turtle caused by a virus.
Fistulous – describes a narrow passage or duct formed by disease or injury, as one leading from an abscess to a free surface, or from one cavity to another.
Foraging - searching for wild food resources.
Headstarting - the method of keeping and growing hatchlings in captivity after emergence for a few months or years before they are released in the belief that the chance of survival of the animal is increased.
Hypothermia – body temperature below normal range.
Infantile frenzy – the hyperactivity seen in hatchlings soon after emergence that propels them quickly from land to sea to their pelagic habitat.
Imprinting – the process wherein hatchlings impress on the beach or coastal area where they were hatched for the purpose of remembering where to return when they become reproductively ready to breed.
In situ - situated in the original, natural, or existing place or position.
Natal homing – the ability of marine turtles to navigate and migrate back to the coastal area where they were hatched.
Orifice – a body opening.
Oviposition – the process of laying eggs.
Ovulation – the process of developing eggs.
Pipping - the breaking /opening of the egg shell by the hatchling from the inside of the egg.
Pelagic – pertains to the surface and water column in the sea (not benthic).
Prone – a body position in which one lies flat with the plastron down and carapace up.
Putrefaction - the anaerobic decomposition of organic matter by bacteria and fungi that results in obnoxiously odorous products.
Rehabilitation – an intervention whereby health-compromised animals are diagnosed, treated, and cared for under controlled conditions with a goal of nurturing the animal back to health and released to its natural habitat.
Release – the act of bringing an animal back to its natural habitat.
Rescue - to free or deliver an animal from confinement, danger, or a situation that is not normal.
Response - to act on a report of a marine wildlife incident.
Rostral - situated or occurring near the front end of the body.
Rostrum – beak of the marine turtle.
Stranding - a situation wherein marine turtles are washed ashore dead or alive but still weak, or seen floating at sea but are already dead or are still alive but weak.
Toxicosis - an abnormal condition produced by the action of a poison.
Ventral – plastron side of a marine turtle.

Overview of the Manual

Rationale

From 1999 till 2008 alone, the Wildlife Rescue Center (WRC) of the Biodiversity Management Bureau (BMB) of the Department of Environment and Natural Resources (DENR) responded to 28 incidents of rescued or retrieved marine turtles in Manila. Seven of the cases were turtles caught in fishing gears, four died while undergoing rehabilitation and twenty-four were successfully released back to the sea (DENR-BMB-Pawikan Conservation Project reports). Add to these the incidents that occurred in other parts of Luzon, Palawan, the Visayas, and Mindanao (both reported and unreported) and the numbers can be mind-boggling.

Marine turtles continue to strand and/or need rescue. As protected species in the Philippines, there is a need to ensure that each individual is treated as an important member of their population. Therefore, in cases when one strands or needs to be rescued, response effort should be made as soon as possible. This would contribute to reducing the decline of marine turtle populations in the Philippines.

The need for this manual came about to ensure that the proper response is carried out in marine turtle incidents. Having untrained people do a response can be as fatal to the marine turtle as not doing a response. This manual will serve as a guide to a response team where rescue of marine turtles are needed, increasing the animal's chance of survival. A proper response increases the information gathered on the incident, which serves as a baseline for conservation management programs.

Purpose

The purpose of this manual is to provide understandable, step-by-step instructions to coastal resource managers whenever they encounter a marine turtle. It will also serve as the official manual in support of capacity-building programs of the DENR.

Considering the species covered by this manual are threatened and protected, this publication will strengthen the implementation of relevant local and national policies and support to international commitments, such as the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), Convention on Migratory Species (CMS), and Convention on Biological Diversity (CBD). Furthermore, this manual serves as a tool that can add to the scientific knowledge on marine turtles in the country when properly documented. It also ensures that the response is carried out safely for both the marine turtle and the rescue team.

Scope

This manual attempts to provide users with a working knowledge needed for the conduct of a marine turtle incident response. Commonly required procedures related to rescues, such as tagging, handling, species identification, and documentation, are described in this manual. Hatchery management is also included. Illustrations are not drawn to scale except those indicated.

The last two chapters also deal with rehabilitation, euthanasia, and necropsy procedures. It is strongly advised that the users engage licensed veterinarians with a background on marine turtle anatomy and physiology when implementing euthanasia and necropsy.

Inset boxes are color-coded to signify: policy (blue), procedural emphasis (red), and biological explanations (yellow).

policy

procedural emphasis

biological explanations

Finally, this is a rescue/response manual and does not cover enforcement procedures and other legal protocols. It is best to contact law enforcers in matters involving enforcement issues.

Target Users

Only DENR personnel or conservation partners are authorized to conduct marine turtle rescues and/or tagging. This manual is primarily intended to help these authorities respond to a marine turtle report. Those who encounter marine turtles in need of rescue should immediately contact the nearest DENR Office first to seek assistance in handling the situation.

CHAPTER 1: MARINE TURTLES IN THE PHILIPPINES AND THEIR BIOLOGY

PHILIPPINE MARINE TURTLE SPECIES AND STATUS

There are seven species of marine turtles in the world. Six of these species are found in Southeast Asia. Five of these can be found in the Philippines, namely: green turtle (*Chelonia mydas*), hawksbill turtle (*Eretmochelys imbricata*), olive ridley turtle (*Lepidochelys olivacea*), leatherback turtle (*Dermochelys coriacea*), and loggerhead turtle (*Caretta caretta*). Guides to identify species of marine turtle as adults and hatchlings with biological information on the species are in Annexes 1, 2, and 3. All marine turtles in the Philippines are classified as endangered, except for the hawksbill turtle which is critically endangered.

The green, hawksbill, and olive ridley turtles are widely distributed throughout the country. High nesting aggregations of green turtles are found in Mindanao namely: Turtle Islands Wildlife Sanctuary (TIWS), Bancauan Island in Mapun (formerly Cagayan de Tawi-Tawi) and other islands in the province of Tawi-Tawi, and Panikian Island in Zamboanga del Sur. Tubbataha in Palawan is a significant developmental area for green turtles. Important nesting aggregations of olive ridley turtles are found in the provinces of Zambales, Bataan, and Batangas. Major aggregations of hawksbill turtle may be found in significant areas like Romblon Island, Magsaysay in Misamis Oriental, and the Davao Gulf. Distribution maps of the five species of marine turtles in the Philippines can be seen in Annex 3.

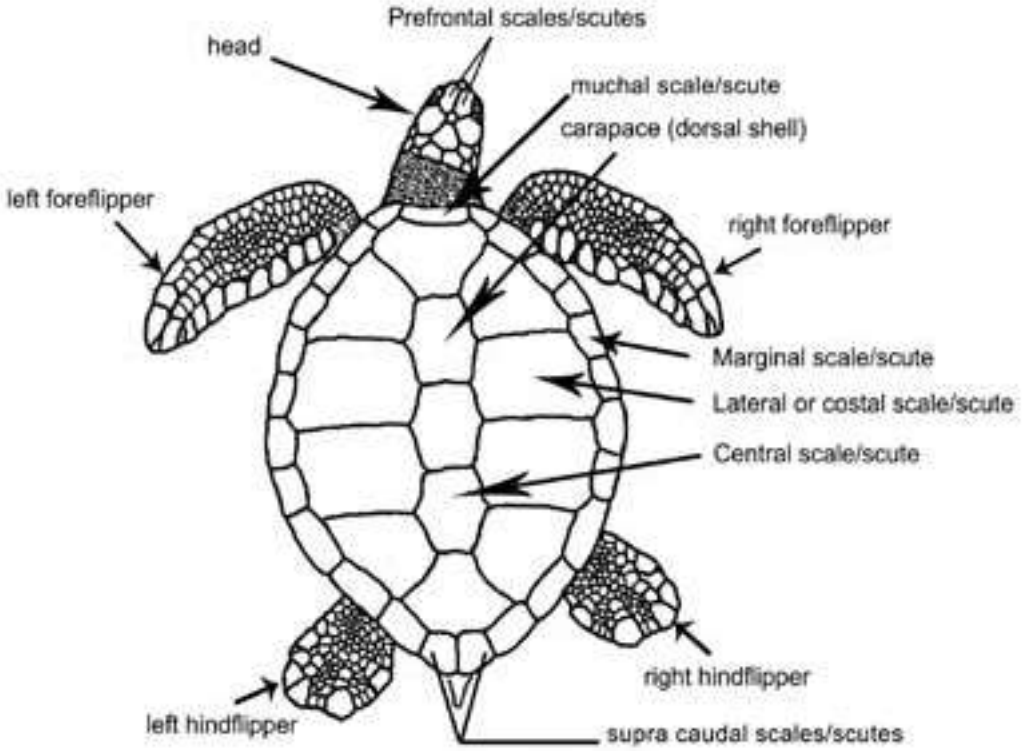
Leatherback turtles, which nest mostly in Peninsular Malaysia and Indonesia, often forage in the Philippines around Palawan, central Visayas, Bicol, and the Davao Gulf. For years, only the green, hawksbill, and olive ridley turtles were known to nest in Philippine beaches. It was only in 2013 when the first documentation of a nesting leatherback turtle was made in Barangay Rawis, Legazpi City, Albay in the Bicol Region.

Loggerhead turtles, which nest in Japan, come to the Philippines to forage in the waters of Basilan and the Bicol Region. They have yet to be observed nesting in the country.

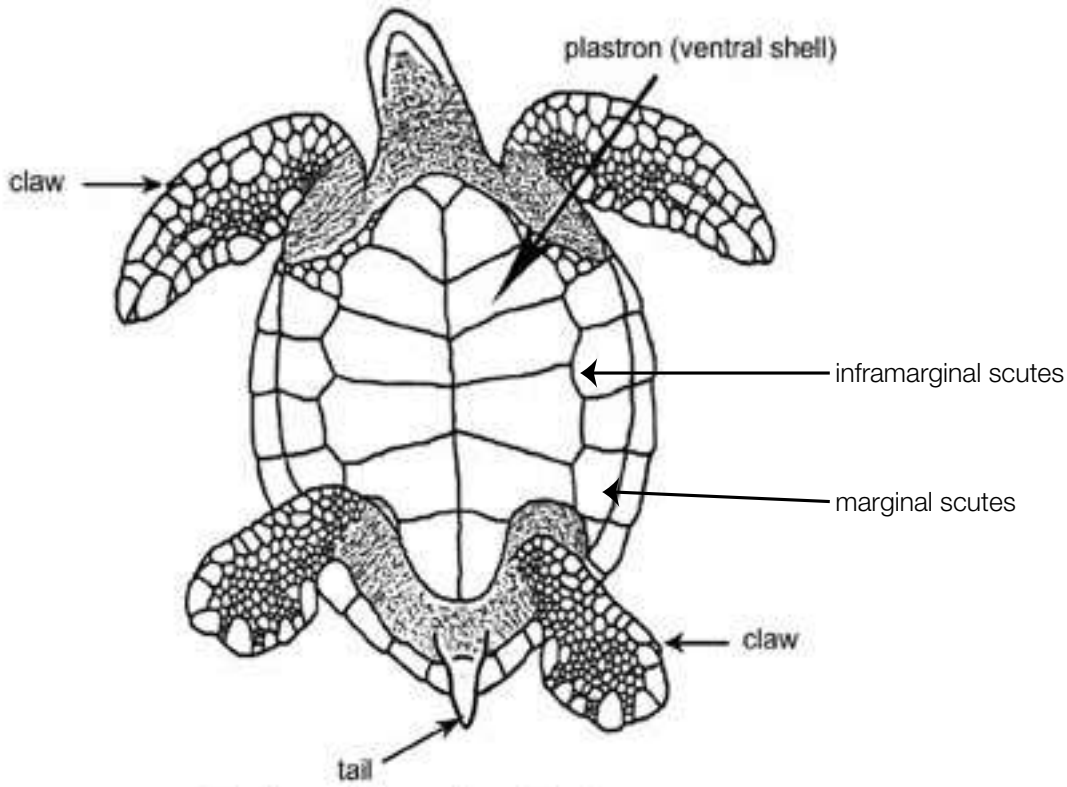
MARINE TURTLE BIOLOGY

Marine turtles are air-breathing reptiles that spend most of their time in the sea. They are differentiated from land turtles (tortoise) or freshwater turtles (terrapins) with the presence of long flippers for swimming instead of legs or webbed claws. The parts of the marine turtle could be found in Figure 1. They have a carapace or shell, that is actually evolved spine wings and serves to protect all the internal organs of the animal. The skin of a marine turtle is leathery with thickened scales mostly in the flipper part. The internal organs are also protected by the hard plastron on the bottom. The head is bony with scales and a beak. The scales on the head and carapace are also called scutes.

Figure 1 External parts of a marine turtle, dorsal (above) and ventral (below).



As viewed from the carapace



As viewed from the plastron

BREATHING

Marine turtles have lungs that necessitate breathing of air through their two nostrils. When marine turtles breathe, there is an audible rush of air, the neck is arched, the head is elevated, and a rapid, audible expiration occurs, followed promptly by a rapid inspiration, and finally a respiratory pause of variable duration held in the end-inspiratory position (Jackson, 1985). Marine turtles have adapted well to diving through the storage of oxygen, and the exchanges between the lungs and blood, and blood and tissue. The lungs function as the major oxygen storage and can supply sufficient oxygen for most routine dives for up to 20 minutes (Lutz, 1985). Marine turtles can stay as long as five hours submerged with oxygen retained in the blood.

SALT EXCRETION

Marine turtles need freshwater, which they get through their diet. Excess salts in the body are processed and excreted through the kidneys (out through the cloaca) and the salt glands in their head, which excretes the salt through the lacrimal duct. Hence, the excretion is visible as 'tears' when the animal is out of the water.

DIET AND ECOLOGICAL FUNCTIONS

The diet of marine turtles determines its ecological niche in the sea.

- Green turtles, along with dugongs, are the only large vertebrates that graze on seagrass and algae. Through grazing, they control the growth and community structure of seagrass beds, thus increasing their productivity and nutritional value. As mega-herbivores, they are important in the nutrient cycling of the seagrass ecosystem.
- Hawksbill turtles enhance coral growth when they graze on encrusting sponges on reefs, providing more suitable attachments for coral larvae to grow, thus enhancing coral reefs.
- Leatherback turtles feed on jellyfishes, thus controlling their population. Since jellyfish predates on small fish, their eggs, and larvae, fish survivability increases.
- Loggerheads and olive ridleys break up their food easily, especially crustacean shells, thus increasing the rate of nutrient cycling in the sea.

Ecologically, marine turtles contribute further as nutrient exporters by depositing their feces from their foraging habitats to other areas, including the terrestrial environment when nesting --while hatchlings are important seasonal food source for large populations of fish, seabirds, and crabs.

LIFE CYCLE OF SEA TURTLES

The generalized life cycle, as exemplified by the green turtle, is presented in Figure 2 (Lanyon et al., 1989). At the start of the breeding season, sexually mature males and females migrate thousands of kilometers from their feeding grounds to congregate and mate in coastal waters very near their nesting sites. Mature males can be differentiated from the female by their long and thick tails that extend far beyond the edge of the carapace, while the females' tails are short and does not extend much beyond the edge of the carapace. After mating, the males return to their foraging grounds while the females move to adjacent sites in preparation for nesting. The nesting activity begins when the female emerges from the sea to the beach of her choice, most often at night.

She digs to create a body pit using her foreflippers, after which she makes the egg pit using her hindflippers and deposits more than a hundred eggs. After each nesting, the female goes back to her internesting habitat to complete the next clutch of eggs. The entire process of ovulation to oviposition takes about two weeks. Therefore, in one season, she is expected to lay from 2 to 7 clutches of eggs at two weeks intervals before migrating back to her feeding ground. During the entire breeding migration, courtship, and residency within the internesting habitat, the adult turtles eat almost no food, being dependent on the stored fat reserves (Limpus, 1994).

The eggs incubate underneath the sand for about two months (45 – 75 days) where they develop into hatchlings. The temperature of incubation determines the sex of the hatchling and the rate of development. Higher temperatures shorten the incubation period and more female hatchlings are produced. Under cooler conditions, the eggs hatch longer and more males are produced.

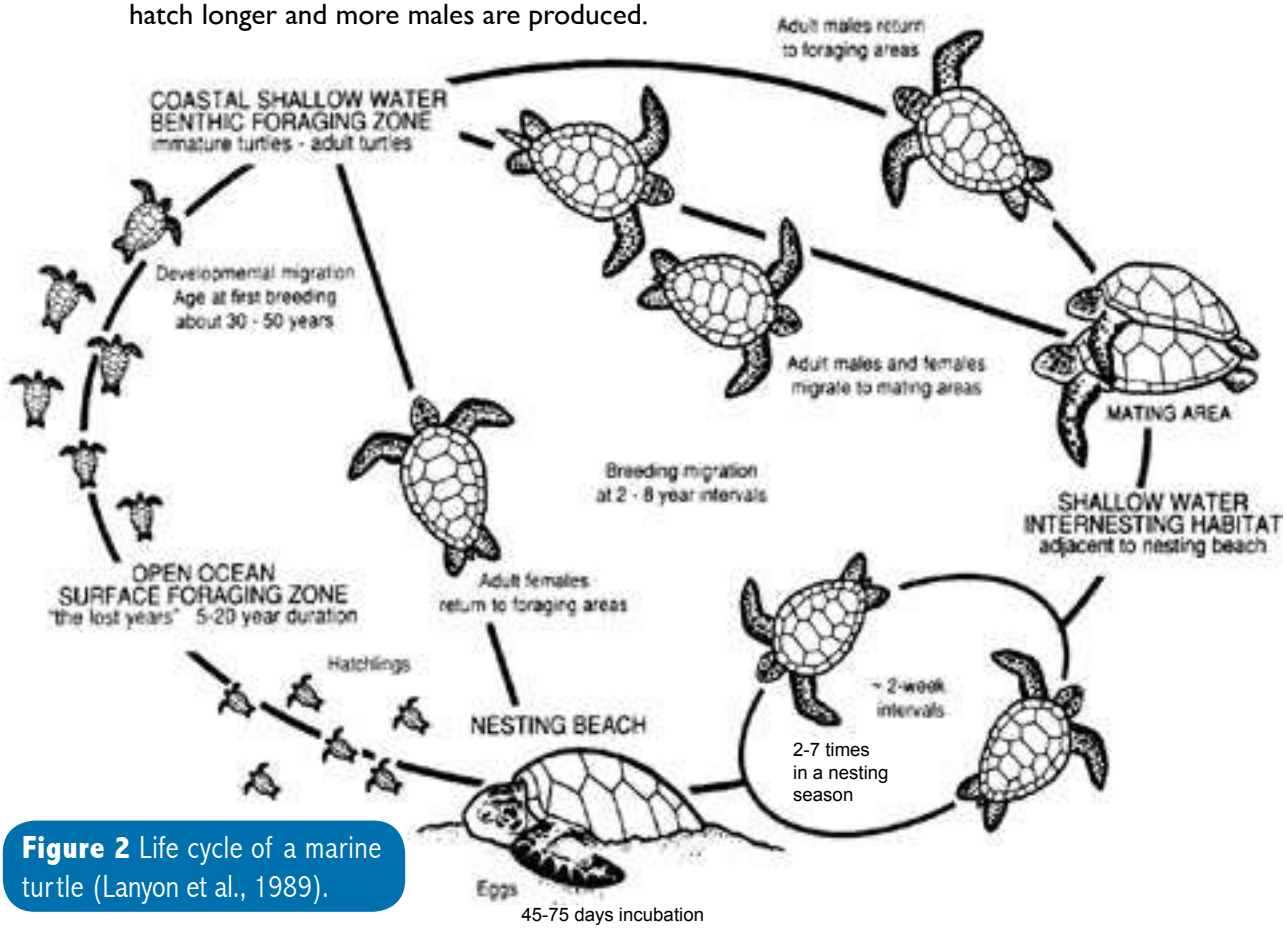


Figure 2 Life cycle of a marine turtle (Lanyon et al., 1989).

After hatching, the young turtles dig their way up from the nest column. This process is called emergence. They then rapidly make their way to the ocean by crawling on the sand. During the first few days after leaving the nest, the hatchlings use their reserved yolk to fuel the 'infantile frenzy' that will propel the hatchling from the shore to its pelagic, "lost years" habitat where they stay for up to 20 years. The hatchlings also imprint on the beach and while swimming from the shore. This process allows them to navigate back to the nesting sites, called natal homing, when they reach sexual maturity in 30-50 years. The survival rate for the eggs to adulthood is very low, estimated at around one or two individuals per thousand (Frazer, 1986). Some estimates go even lower, at one individual reaching adult for every 10,000 eggs.

Except for the leatherback which remains entirely pelagic, the young turtles in the pelagic habitat change their lifestyle at a carapace length of 30cm or more, taking residence in shallow waters and feeding principally on benthic organisms. Each individual remains associated with a restricted feeding area for many years and may shift to a different feeding area as it matures (Limpus, 1994).

When a turtle reaches sexual maturity, breeding migration takes place. Breeding occurs in the region of its birth. At the end of the season, the turtles return to the same feeding area from which it began its migration. This is repeated with each breeding season. In most species, the energy demands of long migrations and egg laying dictates that most females do not nest annually but, on the average, every 2 to 8 years. The males, on the other hand, breed more frequently at every 1-2 years (Limpus, 1994).

NESTING PROCESS

The sequential stages of marine turtle nesting from Carr & Ogren (1960) are given below. The whole process can take four to six hours.

1. Stranding, testing of stranding sites, and emergence from wave wash
2. Selecting of course and crawling from surf to nest site
3. Selecting of nest site
4. Clearing of nest site premises
5. Excavating of body pit
6. Excavating of nest hole or egg pit
7. Oviposition or egg laying
8. Filling, covering, and packing of nest hole or egg pit
9. Filling body pit and concealing of site of nesting (camouflaging)
10. Selecting of course and locomotion back to sea
11. Reentering of wave wash and traversal of surf

THREATS

Threats, whether man-made or not, impact sea turtles at all life-stages from eggs to adults. It is impossible to prevent natural predation, mortalities due to natural causes, or changes to the environment brought about by climate change. But reducing or even eliminating human-caused threats is possible.

• Harvesting of eggs, juveniles, and adults contribute greatly to the decline of the marine turtle population in the Philippines. Adults and juveniles are taken for their meat and their carapace for decorations.

There have been several reports of CHELONITOXICATION in the country, where consumers of turtle meat have been sent to the hospital due to poisoning which has led to serious sickness and even death (Aguirre et al., 2006).

• Bycatch is a major threat to turtles in the Philippines. The implicated fishing gears include fish corrals, drift nets, dynamite, and long-lines. Mortalities associated with fishing gear entanglement are responsible for causing asphyxiation or drowning of the animal. Fisheries bycatch still persists and is difficult to address.

• Egg collecting is also prevalent in unmanaged turtle nesting beaches in the Philippines. Even in areas where there are conservation programs, such as Bataan, poaching still persists in the community. The DENR stopped issuing permits to collect marine turtle eggs in the Turtle Islands, Tawi-tawi since 2002 due to the implementation of the Philippine Wildlife Act.

• Habitat degradation in the marine environment results from increased effluent and contamination from coastal development, construction of marinas, increased boat traffic, and harvest of near-shore marine algae resources. These have also affected marine turtle populations. For example, degradation of marine habitats (e.g., polluted coasts, with high human population density, agricultural runoff, and red tide events) has been implicated as a possible contributor to the increasing prevalence of the tumor-causing fibropapilloma disease in marine turtles (Balazs et al., 1998). Nesting habitat degradation can result from building and resort construction, beach armoring and re-nourishment, and/or sand extraction (Lutcavage et al., 1997). The presence of lights on or adjacent to nesting beaches alters the behavior of nesting adults and is often fatal to hatchlings as they are attracted to light which would draw them away from the water (Witherington and Bjorndal, 1991).

CLIMATE CHANGE IMPACTS

Marine turtles are highly susceptible to climate change at all stages of their lives. Potential impacts of global warming, such as projected sea level rise, can lead to shoreline erosion of small, low-lying tropical islands. Waves running up the shore during storms will wet the nests and increase egg mortalities at rookeries in these small islands, possibly decreasing the overall reproductive success of the marine turtle population (Poloczanska et al., 2009). With global warming, more icebergs in the poles are expected to melt, thereby causing an infusion of fresh water into the oceans and resulting in changes in the current when fresh water meets sea water. This change in current flow will directly impact the post-nesting migration of marine turtles as they follow these currents to go to their foraging habitats (Cheng and Wang, 2009).

Other effects of climate change, such as changes in the magnetic fields of the earth as a result of earthquakes and other natural cataclysms, can drastically affect the marine turtle. A marine turtle collects positional information from two magnetic elements (inclination angle and intensity) that vary across the globe, giving different geographic areas their unique magnetic signatures. It is hypothesized that marine turtles also

imprint on the magnetic field of their natal site and later use this information for natal homing. Thus the unusually rapid changes in the earth's field may affect ecological processes by disrupting natal homing, resulting in widespread colonization events and changes in population structure (Fuentes, Limpus, and Hamann, 2009).

Sex determination and hatching success in marine turtles are largely dependent on temperature. Modeling projections suggest complete feminization of hatchling output by 2070 under an extreme scenario of climate change (Fuentes, Hamann, and Limpus, 2009).

LEGAL FRAMEWORK FOR CONSERVATION

There are several laws, policies, and government programs that are important to consider in turtle conservation.

The government's initial response to the dwindling population of marine turtles is the creation of the Task Force Pawikan (TFP) by virtue of Executive Order No. 542, which was signed by then President Ferdinand E. Marcos on June 26, 1979. The TFP emanated from the Office of the President and was transferred to the DENR by virtue of Executive Order No. 708 dated July 27, 1981. The TFP was renamed as the Pawikan Conservation Project (PCP) in 1989 when it was transferred to the Protected Areas and Wildlife Bureau (PAWB). Recently, it was integrated into the conservation of threatened species of the Wildlife Resources Division (WRD) of the Biodiversity Management Bureau (BMB), formerly PAWB. PCP's existing activities include: (1) habitat surveys and and Information, Education, and Communication (IEC) activities; (2) rescue and rehabilitation of marine turtles and dugongs; (3) capacity building; and (4) establishment of partnerships, networking and monitoring of Memorandum of Agreement (MOA)-related activities.

Habitat surveys are continuously conducted to identify and manage other nesting sites in collaboration with conservation partners. Some of the identified nesting beaches have been declared as marine turtle sanctuaries, such as Bancauan in the San Miguel Group of Islands in Mapun and TIWS in Tawi-Tawi; Halog Island, Tanobon Island, Panata Cay and Kota Island (Spratlys) in Kalayaan, Palawan; and Panagatan in Antique.

Information and education campaigns are continuously conducted by the DENR, specifically in coastal communities, to create awareness on marine turtle conservation. The DENR continues to involve other Local Government Units (LGUs), Non-Government Organizations (NGOs), People's Organizations (POs), the private sector, academe, and other government agencies as partners in the conservation and protection of marine turtles.

The number of LGUs committed to the conservation and protection of the marine turtles is gradually increasing. As of 2014, twenty-one LGUs, twelve NGOs, four POs, seven academes, six private organizations, and three Other Government Agencies (OGAs) have formalized partnerships with the DENR through a MOA in conserving

and protecting marine turtles. Six other LGUs, three NGOs, and three companies representing the private sector have also signified their interests in becoming DENR's conservation partner.

The Integrated Coastal Resource Management Program (ICRMP)/Coastal Marine Management Office (CMMO) was designated as the National Coordinating Office for all activities under the Coastal Environment Program (CEP) of the DENR. All coastal marine management functions of the CMMO were transferred to the BMB in 2013.

Republic Act 9147 of 2001 (Wildlife Resources Conservation and Protection Act) aims to: (a) conserve and protect wildlife species and their habitats to promote ecological balance and enhance biological diversity; (b) regulate the collection and trade of wildlife; (c) pursue, with due regard to the national interest, the Philippine commitment to international conventions, protection of wildlife and their habitats; and (d) initiate or support scientific studies on the conservation of biological diversity.

The law is enforceable for all wildlife species found in all areas of the country, including protected areas under the National Integrated Protected Areas System (NIPAS) Act and critical habitats. The Wildlife Act grants jurisdiction over wildlife resources to the DENR, the Department of Agriculture (DA), and the Palawan Council for Sustainable Development (PCSD). The DENR has jurisdiction over all terrestrial plant and animal species, including all turtles and tortoises and wetland species - including but not limited to crocodiles, water birds, all amphibians, and dugongs. The DA exercises jurisdiction over all declared aquatic critical habitats, all aquatic resources including but not limited to all fishes, aquatic plants, invertebrates, and all marine mammals, except marine turtles and dugong. The PCSD has authority over all wildlife resources in the Province of Palawan pursuant to Republic Act No. 7611.

In 2004, as part of the implementing rules and regulations of R.A. 9147, DENR Administrative Order (DAO) 2004-58 required private individuals and entities possessing threatened and exotic species of wild fauna to have their collections registered with the DENR on or before 07 March 2005. Those who complied were issued the corresponding Certificate of Wildlife Registration (CWR), authorizing them to maintain wild fauna --which species and quantity are specified in the certificate. DAO 2004-55, especially Section 23, allows the collection of threatened wildlife, by-products, and derivatives only for scientific or breeding or propagation purposes, and only by accredited individuals, business, research, educational or scientific entities.

Sections 27 and 28 of RA 9147 prohibit and penalize certain acts. The punishable acts include unauthorized killing and destroying of wildlife; inflicting injury which cripples and/or impairs the reproductive system of wildlife species; trading of wildlife; collecting, hunting or possessing wildlife, their by- products or derivatives; gathering or destroying of active nests, nest trees, host plants and the like; maltreating and/or inflicting other injuries not covered by the preceding paragraph; transporting of wildlife; and, effecting any of the following acts in critical habitats: dumping of waste products detrimental to wildlife, squatting or otherwise occupying any portions of the critical habitats, mineral exploration and/or extraction, burning, logging, and quarrying.

Republic Act 8550 (Fisheries Code of the Philippines) injects the concept of conservation into the concerns of the state while attempting to ensure food security, which is the ultimate mandate of the Bureau of Fisheries and Aquatic Resources (BFAR). Chapter II, Section 11 of the law (Protection of Rare, Threatened and Endangered Species) mandates the DA through BFAR to create measures to conserve and protect marine resources, particularly those that are rare, threatened, and endangered. Chapter IV (Fisheries Reserves, Refuge and Sanctuaries) allows for the protection of marine habitats to this end. Chapter VI (Prohibited Acts), Section 97 (Fishing or Taking of Rare, Threatened, and Endangered Species) imposes penalties for the fishing or taking of these rare, threatened and endangered species. Section 105 (Obstruction of Defined Migration Paths) further enlarges the scope of protection for these species by acknowledging the significance of their migratory paths to the survival of these species. This particular section has a major impact on marine turtle conservation, given the highly migratory nature of the animal. This law, in effect, prohibits and penalizes the fishing or taking of rare, threatened or endangered species.

Marine turtles are also covered under the Philippine Animal Welfare Act of 1998 as amended in 2012. This is of particular importance for marine turtles undergoing rehabilitation as it states:

> "It is the purpose of this Act to protect and promote the welfare of all terrestrial, aquatic, and marine animals in the Philippines by supervising and regulating the establishment and operations of all facilities utilized for breeding, maintaining, keeping, treating or training of all animals."

Internationally, the Philippines is a signatory to agreements such as the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), Convention on Migratory Species (CMS), Convention on Biological Diversity (CBD), and the Convention on Wetlands. Programs such as the Coral Triangle Initiative (CTI), Sulu-Sulawesi Marine Ecoregion (SSME), and Turtle Island Heritage Protected Area (TIHPA) allow the Philippines to set targets in order to also meet the region's conservation goals.

CHAPTER 2: MARINE TURTLE HANDLING, TAGGING, AND RELEASE

HANDLING

A review of the proper handling and transport procedures is presented in this section to help responders conduct their activity while ensuring the safety of both the animal and the field personnel. Marine turtles can be rather large and bulky with their heavy shell, adding difficulty in its handling and restraint. While you need to protect marine turtles during any procedure, it is also important that responding personnel are protected from injury as well.

A live marine turtle needs to be handled in the following situations:

1. After nesting has been completed and animal needs to be tagged and measured;
2. During a rescue operation from captivity or from bycatch;
3. Prior to release of the animal;
4. When the animal needs to be transported;
5. When the animal needs to be rehabilitated;
6. Active capture of turtles for research.

When responding to a marine turtle report a minimum set of materials and supplies are needed to allow the personnel to conduct the response efficiently and collect data properly. The checklist given below includes the minimum items needed for a response.

GENERAL RESPONSE KIT CHECKLIST

Supplies

- Tape measure
- Pen/pencil
- Clipboard
- Foam cushion
- Towel
- 70% isopropyl/ ethyl alcohol
- 10% povidone-iodine solution
- Disposable gloves
- Cotton swabs

Data sheets

- Forms MT01, MT02, MT03, MT04, MT05, MT06
- Marine turtle response manual

Equipment

- Stretcher
- Camera
- Batteries
- Water dipper (*tabo*)
- Pail
- Scissors and knife
- Cellphone with credits (load)
- GPS (optional)
- DNA kit (Refer to p.16)
- Dissecting set
- Flashlights and batteries especially for night response
- Soft cloth (to cover the eyes of the turtle)

RESTRAINT

Restraint is necessary when procedures are needed to be done on the animal, particularly out of the water. Make sure that the animal is restrained in the shade. Avoid or minimize sound and light stimuli (at night) when handling marine turtles. Such stimuli can add to the already stressful handling procedure.

If the animal is on the beach/or land, the animal will have a tendency to crawl towards the water. If it needs to be restrained at this point, hold on to the carapace to

Figure 3 Cover the eyes of the marine turtle with a damp cloth to calm it down.

prevent the animal from moving forward. It helps to cover its eyes with a damp cloth as this calms the animal down (Fig. 3). Care should be given not to cover the nostrils with the cloth to allow the turtle to breathe.

Another way to restrain a turtle is to keep it in a container big enough to hold the animal without bending the neck and appendages. This will immobilize the animal. Make sure there is enough space for the flippers to sit on the bottom of the container comfortably and that the bottom of the container is cushioned with wet foam. If the confinement will take a few hours, it is best to put seawater in the container without submerging the head of the animal.

LIFTING

Lifting is necessary when the marine turtle needs to be assisted in moving from one place to another, which may be of short or long distance. The weight must always be considered before deciding in the method for lifting the marine turtle. Marine turtles are heavy, with juveniles at around 10kgs or lighter. An adult green turtle can weigh up to 160kgs and leatherback adults at 600kgs.

CARRYING BY HAND

If small enough, lifting the animal by its carapace is enough. Holding the carapace by the front and at the back is best if one person is doing the lifting (Fig. 4). If the turtle is heavier, up to four people can carry the animal with two people holding on to the sides of the carapace. NEVER CARRY THE TURTLE BY ITS FLIPPERS as this will not successfully restrain it and may even cause dislocation or fracture to the animal.

Figure 4 Proper way for one person to carry a marine turtle.

Figure 5 Carrying a marine turtle using a stretcher made from fishing net.

CARRYING WITH A STRETCHER

This is the recommended method even for smaller turtles as it is the most comfortable and safest way to lift a turtle (Fig.5). A stretcher made from fishing net will do as you can get the materials easily in a fishing village. You would need two (at both ends) or four (on each corner) people lifting the stretcher depending on how heavy the turtle is.

TRANSPORT

If the marine turtle needs to be moved to another location, the animal can be transported by simply carrying the animal or transporting it using a land vehicle or a boat. It is important to provide essential information about the specifics of the rescue and the condition and behavior of the turtle to the personnel transporting the turtle, including possible problems and complications of inappropriate care, especially when the medical facility is distant.

When transporting a turtle, follow this set of guidelines:

- Use a stretcher when moving the turtle from one place to another.
- Transport turtles in a plastron-down position; NEVER UPSIDE DOWN.
- Do not transport weak turtles in a tub with water because they could drown.
- Provide a cushion for the animal to lie on during transport. This will lessen the vibration felt by the animal from the vehicle's engine.
- KEEP THE ANIMAL WET at all times to prevent dehydration.
- Use a towel or cloth (as cover) soaked in seawater during transport. Make sure that the cloth is breathable and loose enough especially around the nostrils to allow the turtle to breathe.
- For long distances (more than an hour), use a tub of seawater to transport the marine turtle.
- Prevent a weakened turtle from crawling into a corner or straight wall that may obstruct breathing.
- Transport during the cooler times of the day.
- Use a covered transport vehicle to prevent exposure to excessive heat or cold.

TAGGING

Tagging refers to the attachment of prescribed metal tags on the flippers of a marine turtle as a means of identification. Marine turtles are tagged to identify specific individuals or cohorts for research purposes. Information on the population count, reproductive biology, movements, strandings, foraging, and growth rates of marine turtles can be obtained through tagging.

In the Philippines, the types of tags used in marine turtles are:

1. Inconel tag (an austenitic nickel-chromium-based super alloy), which is inscribed with numbers and/or letters (e.g., PH0663E), and is attached to the turtle's flippers using a tag applicator (Fig. 6). This is the most durable of all the materials used for tagging and is sourced only from the DENR offices, where the tag codes are encoded and used in their database.

Figure 6 An inconel tag with the Philippine serial number.

The first two letters in the tag number corresponds to the country where the turtle is tagged. PH is for the Philippines, MY is for Malaysia, FG for French Guiana, BR for Brazil, NC for New Caledonia, etc.

DENR-BMB-PCP has the sole authority to assign codes for marine turtle flipper tags, approved specifications for these tags and their applicators, including design and material and procedure. The DENR-BMB-PCP provides DENR Regional Offices, PENROs, CENROs, PASus, and conservation partners with metal flipper tags. The requesting partner has an assigned custodian of the tags and applicator.

2. Microchip or microprocessor, which is inserted into the body of the turtle and can be detected with an electronic reader. The equipment is more expensive, so the method is rarely used in the Philippines.

Only trained DENR personnel and conservation partners are allowed to attach the metal flipper tag on marine turtles as prescribed in this manual. The use of improvised tags, such as tin sheets, which are attached by boring a hole in the flippers or carapce of a turtle, is discouraged as these may endanger the life of the animal.

To determine if a marine turtle is to be tagged, the following characteristics should be present:

1. The curved carapace length (CCL) is 40cm or more;
2. The animal is in good or healthy condition;
3. The flippers are not impaired;
4. If there are no existing tags attached to the turtle;
5. If only one foreign or one PH tag is attached.

The timing of the tagging is also important. The following are recommended:

- Tag a marine turtle a few minutes before it is released back to the sea.
- In the case of a nester, allow the animal to finish laying her eggs before initiating the tagging procedure.
- Active capture of turtles for tagging is allowed only in specific research areas.

DOs and DON'Ts

- Wear safety gloves when handling sea turtles.
- Observe for and AVOID DIRECT CONTACT with tumors, fibropapillomas (warts), scars, broken skin, open wounds, bleeding, oozing pus, and other turtle fluids. Transmission of diseases while handling marine turtles is possible.
- Clean materials (e.g., tag applicator, tape measure, reusable rubber gloves, stretcher, and cloth) that came in contact with the sea turtle using soap and water, then disinfect using one part bleach to 9 parts water.
- Dispose all waste materials that came in contact with turtle fluids (e.g., cotton swabs, disposable gloves) as HAZARDOUS WASTE.

Figure 7 Tag applicator with tag.

BEFORE TAGGING

Prepare your materials and equipment together with the tagging form. Prepare the animal for tagging through restraint. The Marine Turtle Tagging Data Sheet/Form (Annex 3: Form MT01) should be used for this purpose. Make sure you have at least two tags per turtle and a tag applicator (Fig. 7).

Check the flippers for existing tags and/or tag scars. If there is a tag scar, note the position of the tag scar in the tagging data sheet.

If there is an existing Philippine tag, record the number in the data sheet, including the location of the tag. A properly tagged turtle should have a tag on both foreflippers. Check if the tag is still properly attached. There is no need to tag anew if the tags from the Philippines on both foreflippers are still firmly attached.

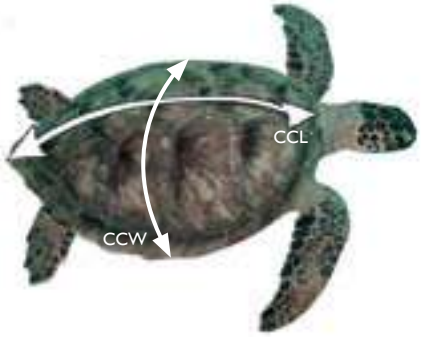


Figure 8 Curved Carapace Length (CCL) and Curved Carapace Width (CCW) measurement.

Check if the turtle has any external organisms such as barnacles, parasites, and other epibionts (an organism that lives on the surface of another living organism). If present, remove these by pouring fresh water into the barnacle and gently scrape them off. This would allow for better measurement and free the animal from parasites.

Measure the curved carapace length (CCL) and curve carapace width (CCW) in centimeters (Fig. 8). The curved carapace length is measured from the anterior point at the middle of the nuchal scute to the posterior tip of the supracaudal scales. The CCW is taken at the widest part of the carapace.

ATTACHING THE TAG

The DENR personnel, Provincial Environment and Natural Resources Offices (PENROs), Community Environment and Natural Resources Offices (CENROs), Protected Areas Superintendents (PASus), and conservation partners involved in the tagging should apply two tags per turtle, one on each foreflipper. This is now the standard procedure due to the high incidence of tag loss experienced in the past.

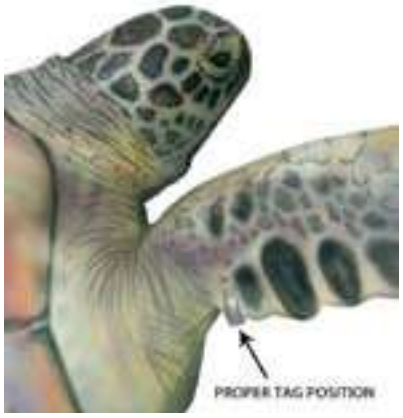


Figure 9 Proper placement of the tag on the foreflipper.

For green, hawksbill, olive ridley, and loggerhead turtles, attach the tag on both foreflippers. This is done before the first scale on the trailing edge of the foreflipper and NOT ON THE SCALE (Fig. 9).

For leatherback turtles, attach one tag on the hindflippers (Fig. 10).

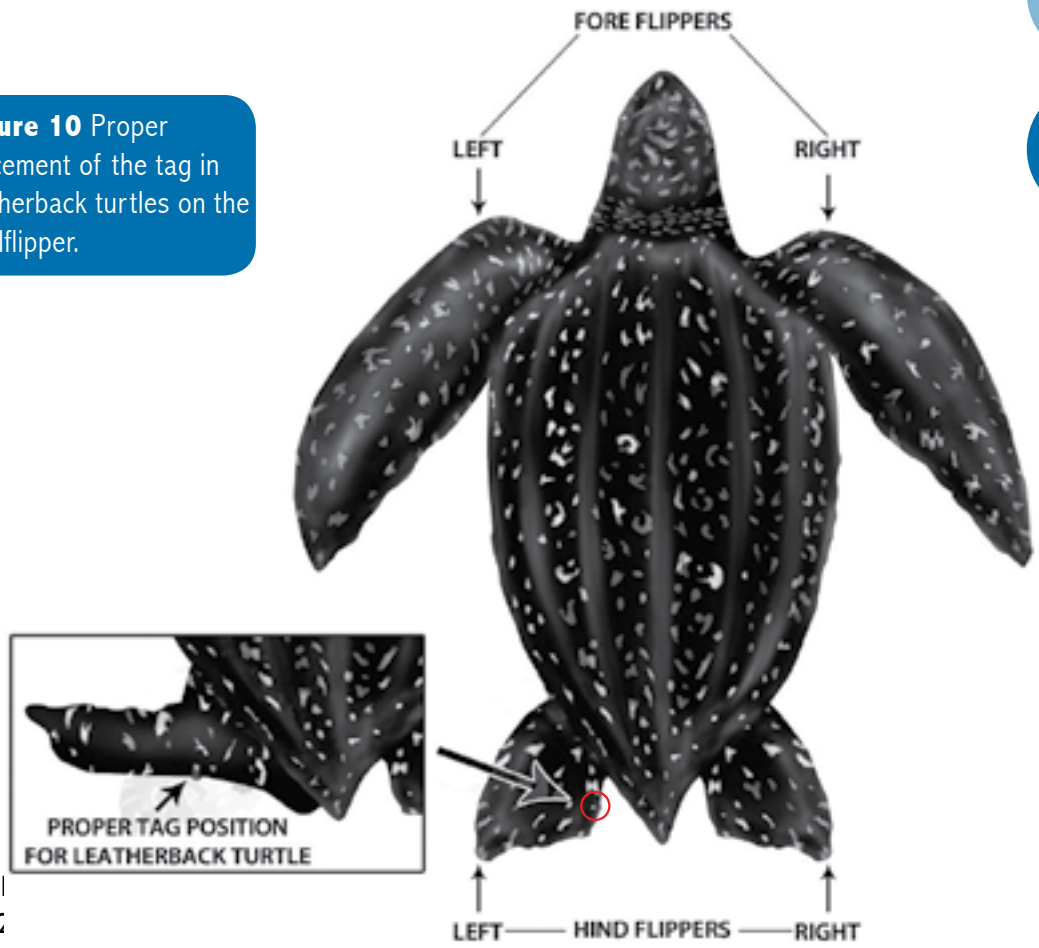


Figure 10 Proper placement of the tag in leatherback turtles on the hindflipper.

Remember that the area on the flipper where the tag is attached depends on the species.

3. Squeeze the handle of the tag applicator so that the tag point pierces the flipper. Continue to increase pressure on the applicator until the tag tip bends and hooks through the tag hole. If you encounter difficulty with penetrating the flipper with just the tag point (especially in large individuals), punch a small hole first on the flipper with a sharp icepick.
4. Check the underside of the tag. Make sure that the tip has properly locked over the hole. The tip should overlap the edge of the hole by at least 3 mm. If the overlap is less than 3mm, carefully fit the tag back into the applicator and squeeze the handle tighter until the required overlap is achieved.
5. If the tag still fails to attach, remove the used tag and replace it with a new one. Improperly crimped tags are quickly lost as they are easily detached. Make sure to bring extra tags when wastage is expected.
6. Record the final tag number in the Tagging Data Sheet (MT01) form. Make sure that the tag number written on the data sheet is the same as that on the flipper.

POST TAGGING

Make sure that all turtle-related information has been correctly written on the data sheet (MT01) before releasing the turtle.

RELEASE AFTER TAGGING

When the animal has been properly tagged, all pertinent information have been collected, and the necessary photos have been taken, the marine turtle may be released back to the open sea, as much as possible, in the area where it was tagged. Proper handling of marine turtles must be observed. For nesters, allow the turtle to crawl down to the sea as it would naturally do. For non-nesters, it is not necessary to make them crawl on the sand but they may also be released directly into the water. The best way is to gently place the animal in the water from a boat or on the shore and let it swim away. Avoid throwing the turtle into the water so as not to inflict injury nor disorient the animal.

Release nesters as soon as possible, within two hours after nesting to lessen unnecessary stress to the animal. There have been incidents when release was delayed due to: delayed arrival of politicians, VIPs and media wanting to join in the release activity, gathering several turtles for a one-time release, and public viewing. All of these are NOT valid reasons for delayed release and should be avoided. The only reasons for a delayed release would include: water is too shallow and the high tide is awaited, the weather condition is not good and the waves are too big, or the animal was confiscated far away from the sea. Lack of tags should also never be a reason to delay the release of marine turtles.

MONITORING AFTER RELEASE

Monitor the direction that the turtle took for at least two hours. The monitoring can be done from shore on an elevated platform or on a boat. Make sure that the turtle is not trapped in fishing gear or in tidal pools and flats. Request the community to inform the nearest DENR Office if they encounter the turtle again.

Tissue collection for DNA analysis

For genetic studies conducted by the DENR, it is recommended that a skin biopsy from both live and dead turtles be collected. Collection may be done using a biopsy punch or a sterilized pair of scissors and forceps. Practice proper restraint on the turtle. The site for tissue collection must be disinfected before and after the biopsy to avoid contamination. Wear gloves all the time. If done with scissors, collect a 1x1 cm skin sample from the posterior edge of a hindflipper in the soft tissue, not the scale. Place the sample in a polyethylene container filled with absolute or 95% Ethanol. If unavailable, 70% Ethanol will do for a short period of time. This is easily found at a local drugstore (e.g., Casino brand alcohol). Label the sample properly with the following information: name of the collector, species, date, and place of collection and send to the DENR-BMB.

CHAPTER 3: HATCHERY MANAGEMENT AND HATCHLINGS RELEASE

It is always best to leave a nest in its natural state because this will ensure a higher hatching success rate and for the natural sex ratio on the natural beach to be maintained. Intervention should only be employed under the following conditions:

- High risk of the high tide flooding the nest, which will kill the embryos
- Beach erosion is a problem
- High risk of predators and/or poaching in the area
- The nest is in a developed coast where light and disturbance is a concern

If any of these conditions exists, the nest may have to be relocated to a safer place. The management of nests and hatcheries requires day to day monitoring by a trained and dedicated personnel. In establishing a hatchery, the DENR-BMB needs to conduct site assessment, setting up, operations, and monitoring systems.

Some disadvantages of hatcheries (Shanker et al., 2003)

1. Hatcheries are often relatively expensive as they require investment in fencing, nest enclosures, and personnel.
2. Hatcheries require trained personnel for collection, relocation and reburial of eggs, as well as to guard the hatchery against people and animals.
3. Hatching success in hatcheries is regularly lower than in the wild.
4. Sex ratios in hatcheries may be skewed.
5. Improper methods of hatchling release leads to high rates of mortality, either while on the beach or at sea.

LEAVING THE NEST ON SITE (IN SITU)

In low nesting incident beaches, it is best to leave the nest where it is. Minimal disturbance should take priority all the time.

It may be difficult to locate the egg chamber and it is best left to DENR-BMB and their assigned local expert to determine the exact location of the eggs. To protect the eggs, a plastic mesh may be placed around the nest with the measurements indicated in Figure 11. It is not necessary to shade the nest. Label the nest marker with the nest code (especially if there are several), the species (if known), and the date of egg-laying.

When high tide is a problem, immediately relocate the eggs a little further up the shore in a spot not reached by the tide.

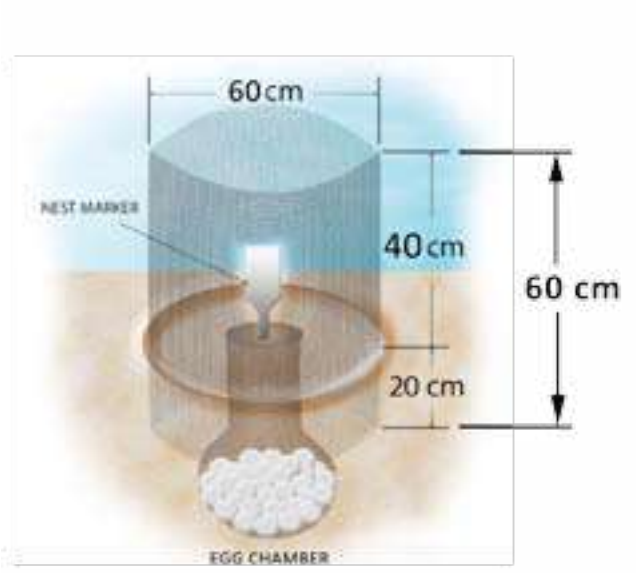


Figure 11 Proper enclosure to protect the nest (in situ).

RELOCATING EGGS TO A HATCHERY (EX SITU)

If relocating the eggs is necessary, a hatchery site needs to be identified and prepared. It is best to select a site in the same beach where the nesting occurred. An ideal hatchery site will have the following characteristics:

- Similar to the substrate where the nesting occurred, usually sandy with low organic soil content
- Free of roots of trees and excessive vegetation
- Above the high tide mark
- Similar shading and sun exposure characteristics as the natural beach
- Away from strong artificial light sources
- Away from foot and vehicular traffic

Make sure that the exact time of the egg laying is known. The eggs should be relocated into the hatchery (dug up, transported, and replanted) within two hours from laying. Otherwise, the risk of damaging the embryo inside the egg becomes higher. Transfer per clutch laid, making sure individual nests are separate from each other. Make sure that eggs from different clutches do not mix. If a laying female is found, it is best to let the nester finish the whole egg laying cycle – up to the camouflaging of the nest -before excavating the nest. The egg chamber can already be marked with a long colored string during the egg laying phase so that it will be easier to locate after camouflaging.

Digging up the eggs

- Make sure that the exact location of the egg chamber is determined.
- Dig up the nest carefully to prevent accidentally hitting the eggs and collapsing sand into the chamber.
- Once the egg chamber is excavated, slowly remove the eggs piece by piece and avoid horizontal or vertical rotation.
- Expect up to almost 200 eggs per nest.

Placing the eggs in a container

- Prepare a container, such as a plastic pail lined with moist sand.
- Move the eggs from the egg chamber to this container without rotation. Maintain the upright position as it was taken from the egg chamber.
- It is allowable to stack up the eggs in the container.
- Count the number of eggs extracted and record it on the Hatchery Data Form (MT05).
- Abnormal eggs may be present in the nest. These should be counted and documented, but not included in the transplant.
- Once the egg chamber is empty, secure the eggs in the pail with a cloth to prevent them from rolling.

Ideally, eggs need to be transferred within two hours of laying. If they need to be moved beyond two hours, extra care should be taken not to rotate the eggs when moving. This can be done by marking the top of the egg with a pencil before moving it out of the chamber, making sure that the mark is always on top. The chances of damaging the eggs increases drastically.

Transporting the eggs

- The transport of eggs should not take too long. Stay well within the two-hour limit.
- Make sure that the eggs are secure in the pail and will not roll around.
- Make sure that the eggs are not subjected to vibrations, especially when transporting in a vehicle.

Relocating the eggs

- Make sure that the egg chamber has been prepared in advance.
- The diameter of the egg chamber should be 30cm. The depth of the artificial nest should be 45cm for hawksbill turtles, 50cm for olive ridley turtles, 70cm for green turtles, and 80cm for leatherback turtles. The normal shape would be a narrow opening with a flask-shaped bottom (Fig. 11).
- The distance between the nests should be one meter from its side .
- Each clutch of eggs collected should have its own artificial nest.
- Carefully transplant the eggs one by one into the nest. Make sure that no rotation of the eggs takes place.
- Once all the eggs from the same clutch are in, cover the eggs with moist sand without making it too compact. Apply dry sand to finish the surface.
- Mark the center of the nest with a bamboo stick with the following information: nest code, species (if known), date of transplant, and number of eggs.
- Prepare a plastic mesh (<1cm) measuring 60cm in height by 195cm in width to make the enclosure. When the nest is encircled with the mesh, the resulting diameter of the enclosure will be 60cm with an overlap of 6cm. The enclosure should be imbedded at least 20cm into the sand. There is no need to cover the top of this enclosure.

HATCHERY MAINTENANCE AND MONITORING

- Clear the hatchery of plant overgrowth and fallen leaves on a daily basis.
- Start monitoring the nests for any signs of emergence starting at 40 days from transplant. Eggs hatch at 45 to 75 days after laying.
- Check the area for predators, especially crabs and monitor lizards.
- A typical hatchery structure for multiple nests (up to 4 at a time) with specifications is shown on the next page (Fig. 12).

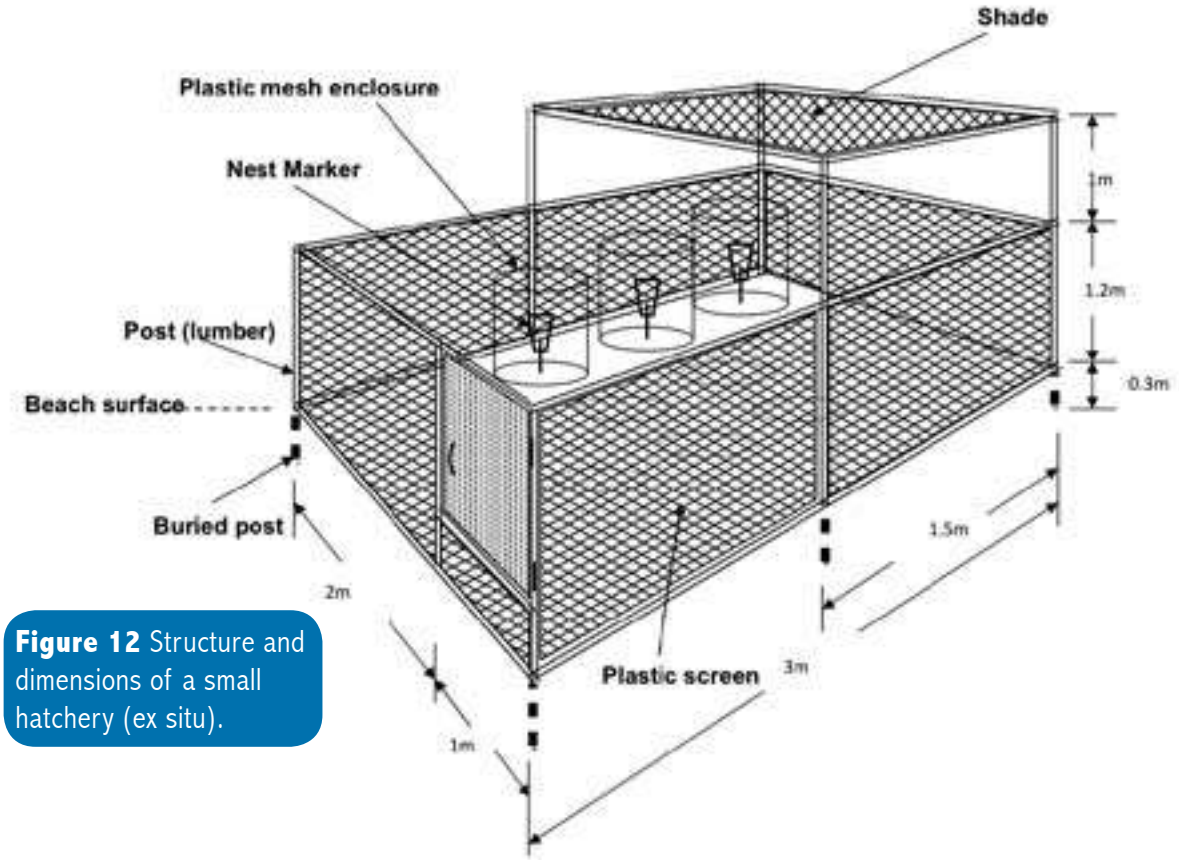


Figure 12 Structure and dimensions of a small hatchery (ex situ).

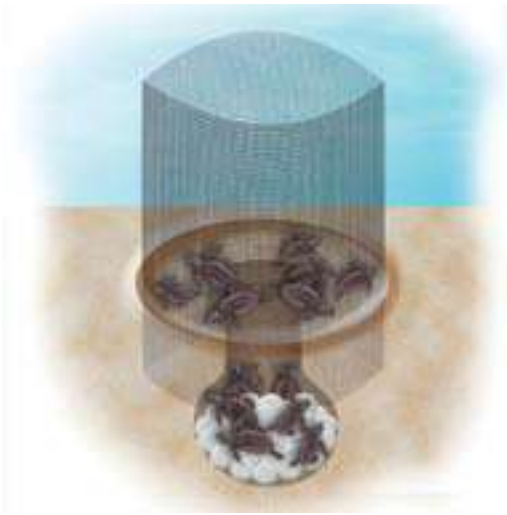


Figure 13 Emergence of hatchlings from a nest.

Hatchlings emergence

• Between 45 to 75 days, the eggs will hatch and the hatchlings will start to crawl up from the nest. This is called EMERGENCE (Fig. 13).

• The emergence process is initially slow, indicated by the partial sinking and collapse of the top layer of the egg chamber. Soon, a few hatchlings will be revealed, which may not be so active yet. Do not touch them at this point.. After about an hour, the hatchlings will be hyperactive with more individuals crawling out of the nest.

• The hatchlings will be trapped in the enclosure and you will be able to count the number of individuals.

• Emergence usually happens in the late evening.

Post-hatching monitoring

Emergence can be a slow process. Some eggs may not have hatched yet or not all hatchlings have crawled up to the surface after the first hatchlings have been observed. The whole emergence processs could last up to five days for most species but tends to be shorter with hawksbill turtles, usually within 24 hours. Therefore, it is important to wait-up to the sixth day for most species and after a day for hawksbills --before digging up the nest.

Excavation is an important part of hatchery management as this will ensure that the used egg chambers are cleaned out and allowed to breathe, aerated, and dried out in the sun. A hatchery site needs to be relocated after it has been used for a year in order to improve substrate condition and hatching success.

Complete excavation should be done after the recommended period. It is usual that the remainders in the nest are weak or dead hatchlings, or eggs that have not hatched, and the shells of emerged hatchlings. These need to be recorded, counted, and removed. The number of hatchlings that emerged, egg shells, and unhatched eggs with the dead hatchlings still in the nest will give you the hatching success percentage. Dead and very weak hatchlings are discarded together with unhatched eggs after excavation. Make sure that the leftovers from the nest are discarded far away from the hatchery site as these will attract flies and bacteria. It is best to bury the discards.

Nest Evaluation

Collecting data on nest contents can help with identifying problems during incubation either in the hatchery or in situ (Shanker et al., 2003). The MT06 (Marine Turtle Nest Evaluation Form) should be filled out as detailed below.

Nest contents can be categorized as:

- S - Shells: Number of hatched-out empty shells
- E - Emerged: Hatchlings that have emerged from the nest
- LIN- Live in Nest: Live hatchlings still within the nest
- DIN - Dead in Nest: Dead hatchlings within the nest
- DPE - Dead hatchling in pipped egg
- LPE - Live hatchling in pipped egg
- P – Predated: Open, partial /nearly complete shell with egg residue/dead embryo
- UD – Unhatched Undeveloped: Unhatched, undeveloped eggs with no obvious embryo
- UH – Unhatched Developed: unhatched eggs with obvious small embryo
- UHT – Unhatched Full Term: Unhatched full-term embryo

The number of hatched shells is difficult to count, and the error often depends on the skill and experience of the worker. Only shells that are more than 50% of the egg must be counted while small fragments must not be counted.

Calculating clutch size if unknown:
Estimated Total Clutch = components without shells + components with shells
Clutch Size or CS = (E + LIN + DIN) + (UD + UH + UHT + DPE + LPE) + P

Calclulating total number of hatchlings emerged if unknown (e.g., if a few escaped and were not counted):
E = S – (LIN + DIN)

Calculating hatching and emergence success:

If clutch size is determined by counting the hatchlings:
Emergence success (%) = (E / CS) x 100
Hatching success (%) = ((E + LIN + DIN) / CS) x 100

If clutch size is determined by counting the egg shells:
Emergence success (%) = ((S – (LIN + DIN)) / CS) × 100
Hatching success (%) = (S / CS) x 100

Total clutch size must include eggs that were lost between collection and relocation due to breakage or predation inside the hatchery.

Hatching success determines the wellness of the hatchery management. A hatching success of 80% and above (or close to the natural percentage if known) is a good indication of well-managed hatcheries. Values of 70% and below means that the management of the hatchery needs improvement.

RELEASE OF HATCHLINGS

Generally, hatchlings do not need assistance during emergence nor crawling across a stretch of beach to get to the sea. They have an innate vigor called 'infantile frenzy' that uses reserved energy in the yolk remains, which propels them across the beach and through the surf. This behavior allows the hatchling to evade predators on land and water, takes it quickly to the water, and ensures that it reaches its pelagic habitat in the next few days. This vigor declines an hour after emergence and is lost after a few days.

Hatchlings start navigating as soon as they hatch. This happens during emergence when they crawl out of the nest in synchrony (happens at night when the temperature is lower) and crawling on the beach using visual cues. Naturally, hatchlings would be attracted to the brighter sea horizon than the other direction, which is darker with beach vegetation. Once they hit the water, they swim perpendicular to the waves to move across the surf, where they use the Earth's magnetic field to navigate during their initial migration to the "lost year" habitat.

Hatchlings also imprint. This is an innate process that lets them get a record of their birth place, which will allow them to migrate back to the same site (or general area) as adults, when reproductively ready. Hatchlings imprint using their olfactory senses, on the shore, and their magnetic field sensors, when in the water, during their initial migration (Lohamm et al., 2009; Grassman and Owens, 1981).

To preserve the infantile frenzy and the imprinting process, the release of hatchlings should be as natural as possible. The release should be done within the first hour of emergence, as the infantile frenzy is greatly reduced afterwards. Emergence usually occurs in the night, therefore light sources need to be eliminated so that the hatchlings can find their way to the sea.

Natural nest

For natural nests that are not disturbed, allow the hatchlings to crawl down the beach on their own. It may not be possible to determine the number of hatchlings emerged, but it could be estimated when each nest is evaluated. Excavate the natural nest to determine the clutch size and the hatching success after a few days.

In situ and ex situ hatchery

Collect the hatchlings that are trapped in the mesh enclosure. Place the hatchlings in a plastic container just before release. Count the individuals and record along with other information in the Hatchery Data Form (MT05).

Choose a site for the release with the following characteristics:

- Free from artificial lights on land and in the water
- Free from obstructions such as man-made structures, drift logs, and excessive vegetation
- Free from land predators
- Free from predators in the sea
- Free from heavy waves and surges

Since the predation of hatchlings is a natural process, it may not be totally avoidable especially in reef areas where big fish abound. To lower the chances of predation, the following are suggested:

- Release a lot of hatchlings (more than one nest if possible) at the same time to provide a better chance for most to elude predators, especially in the water.
- Select several release points across the stretch of beach and each area should be at least 100m away from each other.
- Change the release sites often, as regularly used areas tend to habituate predators on land and in water in sites where food is made readily available.
- Always release at dusk or dawn or in the evening when predators will be less.
- Release immediately (in less than an hour from emergence) to ensure that infantile frenzy is still fully at work.
- Release hatchlings as far away as possible from artificial light sources (e.g., lights from buildings, boats, flash from cameras, flash lights).
- Place the hatchlings (from one or several clutches) on the sand facing the open sea at 10 m. from the edge of the waterline.

When release will be delayed for more than an hour, do the following: hatchlings should be placed in a container with moist sand and covered with a soft damp breathable cloth. Make sure that the container is big enough for only a single layer of hatchlings, as they will suffocate if they are on top of each other if the container is too small. Keep in a dark, warm and quiet place. The purpose of this technique is to imitate the nest condition which will calm the hatchlings down, thus preserving the energy reserves needed for infantile frenzy.

Hatchlings should not be kept in a container with water prior to release, as they will continually swim excessively, resulting to the expending of energy that is needed for infantile frenzy (Fig. 14).

Figure 14 Never place hatchlings in a container with water.

SPECIAL RELEASE ARRANGEMENTS

Again, it is best to let the hatchlings cross the beach to the water by themselves. If this needs to be facilitated, the release should always be done by the DENR personnel or trained partner managing the hatchery.

For purposes of ceremonial/educational/tourism activities in hatcheries, the best option is to only let the visitors observe the procedure as carried out by the DENR personnel or trained partner without any handling. If handling of the hatchlings is requested by the visitor/s, the procedures below must be strictly followed.

A fixed schedule (e.g., once a day at 7PM or only once a week at 7PM) can be announced in advance for the release of hatchlings with special viewing or handling privileges for visitors. This will prevent the hatchery from compromising their management.

- The release area for visitors should be designated outside of the regular release areas used by the hatchery.
- A fence should be built parallel to and 10m. away from the waterline. It is recommended that the fence be movable in order to allow for adjustments depending on tide levels.
- Visitors must stay behind the fence facing the water and not allowed to cross it.
- Only one hatchling should be handled per visitor.
- Handling of the hatchling should be gentle. Do not shake, squeeze, pinch, or drop the hatchling. The hatchling should always be in full view of the person assisting the release.
- The handling should be done in less than 5 minutes.
- Once the hatchlings are placed on the sand, they should not be handled any further. Allow them to cross the beach to the sea without interruption.
- Do not allow flash photography and use of torches during the release.

Handling of hatchlings should be at the minimum. Tourist activities with hatchlings should be controlled and strictly managed by the DENR partner facility.

WHY HEADSTARTING IS NOT ALLOWED

Having learned the life cycle of the turtle and the important processes that hatchlings undertake, it should be clearly stated that headstarting, the method of growing hatchlings for a few months or years before they are released, is NOT a conservation practice in the Philippines. It is not recommended because it disrupts the life cycle of the turtle. Therefore, it becomes a threat to marine turtle populations in the country. Additional pointers against headstarting include:

- It is illegal to keep threatened species under the Philippine Wildlife Act.
- The hatchlings fail to imprint.
- The hatchlings are unable to get to their important 'lost years' life phase due to loss of infantile frenzy.

CHAPTER 4: RESPONSE TO MARINE TURTLE REPORTS

When responding to marine turtle reports, it must be decided what type of response is needed based on a given situation. A rescue response is necessary if an animal is in distress, such as in the case of a bycatch or stranding incident. These are considered emergency situations. However, in most cases, the turtles encountered on land is part of their natural life cycle, particularly when females nest and hatchlings emerge. In such cases, the animals do not need to be rescued, but documentation and data gathering must be done. When dead animals are encountered, data gathering and tissue sampling would take priority.

A stranding is a situation wherein marine turtles are washed ashore dead, or alive but weak, or seen floating at sea but are dead or weak. These scenarios would require a response. It can also be a situation where a perfectly healthy female or hatchling becomes trapped on the beach and could not go back to the water. Situations where the turtle interacts with a gear, although not a stranding, would also require a response.

STRANDING CODES AND BODY CONDITIONS

The stranding codes used in this manual are based on the internationally recognized marine mammal stranding codes (Geraci and Lounsbury, 2005) with some modifications to suit the varying conditions of marine turtles in the Philippines. Code 6 has been added to reflect marine turtle slaughter and consumption incidents in the country.

CODE 1: ALIVE
Vital signs are present such as breathing and blinking (palpebral) or pupillary reflex.

CODE 2: DEAD - Carcass in Good Condition (Fresh)
Freshly dead with organs and body parts intact. Normal appearance, usually with little scavenger damage; fresh odor; minimal drying of eyes or mucous membrane; eyes clear; carcass not bloated.

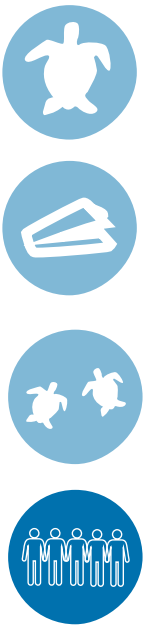
CODE 3: DEAD - Carcass decomposed, but organs generally intact (Fair)
Carcass intact, bloating evident, skin cracked and sloughing; possible scavenger damage; characteristic mild odor; mucous membranes dry, eyes sunken or missing.

CODE 4: DEAD - Carcass in advanced decomposition; organs not intact (Severe)
Carcass is intact, but collapsed; skin sloughing; often severe scavenger damage; strong odor; muscles nearly liquefied and easily torn, falling easily off bones; blood thin and black; viscera often identifiable but friable, easily torn and difficult to dissect.

CODE 5: DEAD - Skeletal remains with dried tissues (Desiccated)
Skeleton and carapace with any remaining tissues are desiccated.

CODE 6: Destroyed
Disarticulated skeleton with or without soft tissue due to human disturbance, e.g., butchered, burned, cooked.

PRE-RESPONSE PROCEDURE



RECEIVING THE REPORT

In responding to reports, practice discernment in separating the truth from embellishment and always keep an open mind while doing so. This is best done by gathering as much information from the source, to be able to confirm the report, and fill information gaps to help one decide on the action to take. Keep a logbook of stranding reports, which should include the following information from the informant with each stranding log:

- Location/Address where the marine turtle is
- Name, phone number (contact information), and current location of the informant
- Stranding Code
- Health status as perceived by the informant
- History of the marine turtle (e.g., raised as a pet, bought from a fisherman, date of stranding)

If the response is to be carried out, the response team needs to be mobilized and the materials and equipment prepared. Note that most of the reports might be received in the evening. The objectives of a response are the following:

1. To provide rapid and effective action that will best serve the well-being of the marine turtle;
2. To gain maximum scientific information from the incident;
3. To prevent the public from harming the marine turtle;
4. To help protect the public from injury, contamination, or communicable disease; and
5. To use the incident for education and raise awareness on marine turtle conservation.

RESPONSE TEAM

It is better to have a team respond to the turtle report as there are several procedures that can be divided among a minimum of three people:

1. Team leader and coordinator – coordinates with the reporter, government authorities, including the local officials, to initiate the response.
2. Data collector – prepares all the materials and equipment necessary for the response and handles the animal during the response.
3. Documenter – fills out the necessary forms to help the data collector and controls the crowd.

The members of the team should raise awareness in the area by turning the situation into an educational activity for the community. This will be a good opportunity to discuss conservation issues and how the community can help protect marine turtles.

EDUCATION AND AWARENESS

A prompt and speedy report on a marine turtle provides an opportunity to engage communities, local leaders, and media, among others. It would be best to use this opportunity to draw local support in conserving the marine turtles in the area. Having a captive audience is the best opportunity to raise awareness on marine turtles. Acknowledge the assistance provided by those who aided in the response activity. Discuss with all those who are present, specially the community, the step-by-step procedure so that when similar incident happens, they will be better prepared. In acknowledging their importance and invaluable help, one can gain the community's trust and attain the goals of turtle conservation. Inculcating the value of and role of these turtles in the ecosystem will establish a vigilant citizenry and abet future crimes against these animals.

ON-SITE RESPONSE PROCEDURES

Once on site, follow the steps provided in this section for both dead and live turtles. Make sure you have prepared the necessary stranding investigation equipment and data sheets for any situation, the basics of which were given in Chapter 2.

CHECK THE ENVIRONMENT

Upon arrival on site, it is necessary to first evaluate the environment that the turtle is in. Check for artificial light sources, condition of the surf, tide, presence of fishing activities, and weather condition. Evaluate whether the marine turtle is dead or alive.

CHECK THE ANIMAL'S VITAL SIGNS

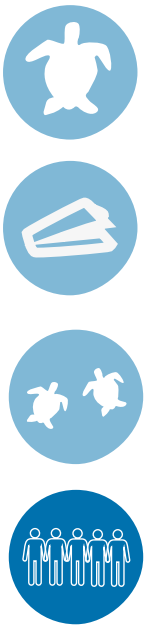
It is important to determine if the marine turtle is alive or dead. Check for the following vital signs:

1. Movement - There should be voluntary movement of any body part of the turtle, especially if stimulated by touching or poking lightly on the soft parts. In a healthy turtle, you will see a retraction reflex when the head and flippers are pulled. It would crawl when in the ground and will make swimming movements when lifted.
2. Blinking reflex - Gently press the periphery of the eye to elicit a blinking reflex (check for pupillary reflex using a flashlight if blinking reflex is absent to confirm).
3. Breathing - Place a small piece of cotton a few millimeters in front of the animal's nostrils and check for the movement in the cotton when the animal inhales or exhales. Remember that a healthy marine turtle is able to lift its head to breathe. A weak or injured animal might not be strong enough to lift its head or may take a long while between breaths.

An alert animal will show strong evidence of the vital signs. A weak animal will show minimal response. If the animal does not show any of the vital signs, then the animal is dead.

Perform the following procedures immediately, using the Marine Turtle Stranding Report Form (MT02):

- Identify the species.
- Determine the sex.
- Photograph the animal.
- Check the animal for the body condition.
- Check for signs of injury and external lesions.
- Check for fishing gear involvement. It is possible to find a fishing line extending from the mouth of the turtle.
- Check for the presence of a tag. Check the flippers for previously attached or existing tags (local or foreign). If the marine turtle already has (a) previously attached tag(s), write down the tag number, return address (if any), position of tag attachment, and type of tag in the data sheet.



DO NOT REMOVE THE TAG. However, tags from a dead turtle can be removed and sent to DENR together with the filled out Form MT02.

RESPONSE PROCEDURES FOR LIVE MARINE TURTLE REPORTS: CODE 1

When a live marine turtle is reported, it will usually be one of the following cases:

- Accidentally caught in fishing gear and still at sea
- Accidentally caught in fishing gear and brought to land
- Illegally captured and kept captive as pets, for display or for trade
- Beached marine turtles that are weak or injured
- Trapped or disoriented nesting turtles or hatchlings on land
- Weak marine turtle floating at sea

Marine turtles that are not in any of the above situations should be left alone, because they do not need rescuing nor assistance. A response on the beach may be a simple act of removing logs blocking the path of marine turtle nesters and hatchlings, untangling them from vegetation, or removing an artificial light source to facilitate their natural return of the turtle to the sea.

If the turtle is to be handled, perform restraint, documentation, and data collection as discussed in the previous chapter on tagging procedure.

Before deciding whether the live marine turtle can be released immediately or will require further observation or treatment, you need to assess the physical condition of the turtle. You must know what "normal" looks like before you can recognize those that would need therapy. Observe the marine turtle's behavior. Keep in mind that, out of the water, the animal may appear more inactive and non-responsive than they actually are. After checking the vital signs, it is best to observe the turtle's

behavior when placed in water deep enough so it could swim properly. It may be best to try this in a confined area first. It is a good sign if:

- Flipper movement is coordinated.
- The head is raised with each breath.
- The animal can fully submerge itself.
- The animal can swim normally.

If all four behavioral signs are observed, and the animal remains alert, RELEASE IMMEDIATELY after data collection and tagging. Other positive signs are described under acclimatization procedures in Chapter 5.

Given a choice, always opt for immediate release over rehabilitation. However, if rehabilitation is the logical choice, make sure that the animal is transported to the nearest appropriate rehabilitation facility as soon as possible.

NEVER DO THE FOLLOWING TO A LIVE MARINE TURTLE

- Hold captive for any amount of time for whatever reason
- Keep the animal out of the water for prolonged periods
- Allow the animal to crawl on cement or any hard surface
- Tie the animal
- Hold the animal upside down
- Bore holes on the carapace

RESCUE FROM FISHING GEARS

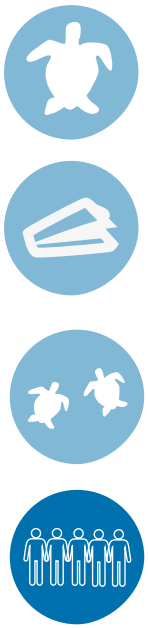
Marine turtles need to be rescued from fishing gear entanglement immediately as it may lead to death. It is highly possible that the turtle may suffocate, starve, drown, be eaten by predators, or acquire injury from an entanglement. It is more likely that a rescue response will be done in the water or on a boat. Do not jump in the water until you have fully assessed the situation considering the condition of the turtle, weather and currents, and the gear implicated in the incident. Collect data on the boat if the turtle is light enough to be lifted out of the water. The animal may be brought back to the shore to conduct a more thorough examination and data collection. If the marine turtle is too heavy to bring on to the boat or to the shore, it might be necessary to release immediately. Rescuers should be in proper gear, e.g. snorkeling or SCUBA gear, when in the water. Dead turtles, however, must be brought to the shore for a salvage response protocol. Make sure that the owner of the fishing gear is informed of the procedure to be undertaken. Destroying a fishing net will entail financial losses for the fisher.

A marine turtle entangled for some time may be weak from exhaustion and might even have water in its lungs. It will be necessary to rehabilitate the animal.

To rescue turtles entangled in nets (gill nets, trawls, seines):

- Carefully study how the turtle is entangled before attempting to cut it off.
- It may be best to cut off the net while the animal is in the water. Make sure that the animal is able to breathe.
- Slowly free the marine turtle from any entanglement by unravelling and cutting the net at certain points.

- Make sure that you do not provide additional trauma or injury to the animal.
- Do a physical assessment of the animal's condition. Pay special attention to external injuries when possible.



RESCUE FROM HOOK AND LINE

Marine turtles are known to bite the baits on a hook. It is possible that the hook could get lodged in the mouth or even ingested completely by the turtle. If not removed, the turtle will have difficulty swallowing, which may lead to starvation and death. To remove the hook and line, the turtle must be retrieved from the water and examined on the boat or on land. Always lift the animal by holding on to its body when retrieving it from the water.

The treatment is described in the rehabilitation section in Chapter 5.

RESCUE FROM CAPTIVITY (PETS, EXHIBIT, TRADE)

It is illegal to keep any marine turtle in confinement for any reason. Only turtles under rehabilitation can be kept in captivity in DENR- authorized wildlife rescue and rehabilitation centers, where they are not allowed to be displayed and are prepared for release. Marine turtles confiscated from capture facilities must be surrendered to the DENR Office for proper assessment and disposition. Captive turtles need to be reintroduced to the wild and acclimatized.

The acclimatization process will depend on how long and in what conditions the animal was kept in during captivity, and the condition or state the animal is in. Often, turtles that have been kept for years are very much releasable and would adapt quickly to living back in the wild. See Chapter 5 for the acclimatization procedures.

RESPONSE PROCEDURES FOR DEAD MARINE TURTLE REPORTS: CODES 2-6

A turtle is considered dead if it does not show any of the vital signs. If a marine turtle is dead, data and tissue collection should be maximized. If the animal was found at sea, it should be taken on board or back on land to facilitate a more thorough examination. It would be in your best interest to determine the cause of death of the animal. To be able to do this, the following actions should be taken:

- Interview knowledgeable respondents on the incident.
- Assess the environment for possible causes of the death (e.g., pollution, fishing activities in the area, weather condition, boat traffic, etc.).
- Necropsy and tissue sampling, which will be discussed in detail in a succeeding chapter.

If an illegal activity is suspected to be the cause of the death, an incident report should be submitted (with the data sheets) to the DENR and the appropriate enforcement agency.

Fill out Form MT02 (Stranding Report Form) for information needed about dead animals. Whenever possible, a necropsy should be performed and, at a minimum, tissue sample for DNA analysis must be collected.

DISPOSAL OF DEAD MARINE TURTLES

Dead marine turtles should be disposed properly because decaying animals will have a strong foul smell and may pose a health hazard. The only acceptable disposal for marine turtles is burial. This may be done on site or in a dedicated burial site for large marine vertebrates, such as those located in Dagupan, Pangasinan; Sta. Lucia, Puerto Princesa city, Palawan; Southeast Asian Fisheries Development Center (SEAFDEC) office, Iloilo; and the BFAR office in Bicol.

Bury the whole animal at least one meter deep. Choose a site that is away from communities and potential scavengers, especially domestic animals. Mark the area where the animal was buried for retrieval of the skeleton if required. It should be noted that it is illegal to keep any part of the animal without a permit from the DENR.

If a government or private entity wants to take custody of the dead carcass for educational purposes, such a request should be documented through a Turn-Over Receipt issued by the concerned DENR Regional or Field Office and an Acknowledgement Receipt issued by the requesting official.

DATA COLLECTION AND REPORTING

The six data collection and reporting forms for marine turtles are found annexed in this manual. These forms are utilized in tagging (MT01), stranding (MT02), rehabilitation (MT03), necropsy (MT04), hatchery (MT05), and nest evaluation (MT06). These forms are needed to evaluate the overall status of the animal. Each form should be filed out accordingly during the response itself as it will be difficult to remember the information if not recorded immediately.

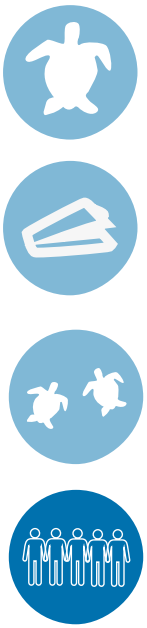
Residents of the community and witnesses must be interviewed to provide an accurate report on the matter. This will provide an insight into the practices and prevailing environmental conditions in the area and its effects on the animals. The information obtained from the coastal community regarding the incident may also prove advantageous in providing insights on the nesting seasonality and habitat use in the area.

PHOTO DOCUMENTATION

An important part of the data gathering is photodocumentation, which will not only prove that the incident took place but also show that the animal was indeed released or buried as indicated in the report. The photographs are also useful for proper species identification and for noting fisheries-turtle interactions, or other human-caused problems. At a minimum, the following needs to be taken:

- Top view, full body showing all the scales on the carapace
- Top view, close up of the head showing the prefrontal scales and the rostrum/beak

- Photograph of the tags with the codes clear enough to be read
- Photographs of any notable external lesions and markings
- Photograph of the released turtle



WRITE AND SUBMIT A REPORT

Submit the completed forms and photographs to DENR. The report may be submitted electronically or in hard copy. Copies must also be made for record keeping. The recommended offices to which the reports shall be submitted are listed below. The information will be useful in collating marine turtle incidents in the Philippines through a database of the DENR.

DENR-BMB National Office

OFFICE OF THE DIRECTOR
Biodiversity Management Bureau
Department of Environment and Natural Resources
Ninoy Aquino Parks and Wildlife Center
North Avenue, Diliman
Quezon City, Metro Manila
Telephone Number: (02) 9246031-35
Website: www.bmb.gov.ph
E-mail: bmb@bmb.gov.ph; wrd@bmb.gov.ph

In Palawan

OFFICE OF THE EXECUTIVE DIRECTOR
Palawan Council for Sustainable Development
PCSD Building, Sports Complex Road
Sta. Monica Height
Puerto Princesa City
Palawan
Website: www.pcsd.ph
Telephone Number: (48)4344234, 4344235
E-mail: oed@pcsd.ph

Disclaimer

The next chapters on rehabilitation and necropsy are highly technical and specialized which will require the supervision of a DENR-trained licensed veterinarian or a veterinary assisted biologist knowledgeable in marine turtles and their biology. If none is available, it is strongly recommended that the DENR-BMB be informed of the situation so that close coordination with them may ensue.

CHAPTER 5: REHABILITATION PROCEDURES

The goal of rehabilitation is to return turtles back to their natural habitat. It is best not to keep these animals captive far longer than is required. A significant measure of success for rehabilitation would be to have a high number of released turtles that have attained adequate health improvement or when traumatic problems have been successfully treated, thereby assuring maximum chance of survival in the wild.

Rehabilitating injured or sick marine turtles is expensive and time-consuming. There is a need for an appropriate facility to keep the turtles, full-time staff to care for it; and the appropriate program for reintegration back to the wild. Nevertheless, it may be necessary to rehabilitate because every marine turtle saved and returned to the sea potentially contributes to the stability of the population. It is highly recommended that a licensed veterinarian knowledgeable in marine turtle anatomy and physiology, be directly involved in the whole process of rehabilitation. In situations where proper rehabilitation facilities are lacking, the most viable option is to release the animal back to its natural habitat as soon as possible with minimal intervention.

The rehabilitation protocols in this chapter was established to:

1. Provide appropriate treatment to improve the marine turtle's current condition;
2. Ensure that released turtles will not introduce any pathogen into the wild population; and
3. Safeguard rescuers from possible disease transmission.

Maintaining a marine turtle in confinement for any period of time is viewed as permanent captivity, illegal, and goes against conservation goals for maintaining healthy marine turtle populations in the country.

A marine turtle must undergo rehabilitation when the following signs are evident:

1. Vital signs are weak or the animal remains unresponsive to stimuli.
2. There are obvious signs of trauma (e.g., bleeding, abnormal angle of limbs, fractures).
3. Fluids are coming out of the nostrils; and fluids in the lungs are suspected.

If there are no sign/s of trauma, categorize overall gross body condition to further determine whether the animal should be immediately released or needs rehabilitation. Use the characteristics given below to assess the condition of the animal. If any of these characteristics are observed, then the animal requires immediate medical intervention:

- Extremely sunken or bulging eyes
- Prominent (visible/pointed) occipital process at the back of the skull
- Thin neck muscles
- Depressed or sunken shoulder area
- Sunken or centrally-indented plastron
- Deep ulcerations on the skin or plastron
- Substantial air is unnaturally trapped in the body, e.g., air pockets found in places other than in the lungs; the animal will not be able to dive or may float partially tilted to one side

All the hard-shelled turtles are easy to handle in confinement. However, the leatherback does not do well in captivity and should be released or euthanasized if necessary.

HOLDING TANK

Rehabilitation facilities must have an above-ground tank, that is low maintenance, easy-to-clean and repair, in which to hold the turtles. The ideal material for the tank would be fiber glass with a sand and/or cartridge-based filtration system.

NOTE: While flow-through systems near shore have many advantages, these are not recommended as these are prone to problems arising from the source including temperature, water quality, and biohazards such as red tide or pollution.

When the ideal tank does not exist, any improvised tank that can hold sufficient water will suffice for the rehabilitation of the marine turtle. Such tank should be easy to clean and maintain. Water should be changed regularly, daily if possible, to prevent bacterial and fungal build-up.

It is better to have the holding tank outdoors but protected from inclement weather and too much sun. Minimize excessive heat and sunlight by installing a roof or shade-screen that will cover at least 50% of the surface area.

Maintain salinity levels at 28-32 ppt. Lower salinity levels or chlorinated water (levels of chlorine up to 1 ppm appear to be beneficial) may be used to influence hydration, remove leeches and barnacles, and aid in the control of severe skin and shell infection. Lowered salinity can assist turtles that have difficulty diving but may force recovering turtles to work harder to stay at the surface. It is best to assess what is most beneficial to the turtle's condition. Do not leave marine turtles in fresh or brackish waters for extended periods of time without checking serum electrolyte levels.

Excretion of excess salt may be compromised in a sick marine turtle. Elevated serum sodium levels may indicate a hydration imbalance or intake of saltwater. Regular blood profile readings must be monitored frequently. Adjust the salinity as needed.

IDEAL TANK SIZE

The following are the ideal specifications for a rehabilitation tank for marine turtles which are based on Bluvias and Eckert (2010):

1. Turtles up to 6cm CCL – for one turtle, a tank or sub-section of a tank with a surface area of at least five times the shell length by two times the shell width of the turtle plus a minimum water depth of 30cm. The minimum tank width must be no less than two times the shell width. The turtles should be housed separately.
2. Turtles greater than 6cm and up to 50cm CCL – for one turtle, a tank with a surface area of at least seven times the shell CCL by two times the shell CCW of the turtle plus a minimum water depth of 75cm. For each additional turtle, increase the original surface area by 50%. The minimum tank width must be no less than two

times the shell(s) width (e.g., for multiple turtles, the sum of the shell CCWs must be multiplied by two to determine the minimum tank width).

3. Turtles greater than 50cm and up to 65cm CCL – for one turtle, a tank with a surface area of at least seven times the shell length by two times the shell width of the turtle plus a minimum water depth of 1m. For each additional turtle, increase the original surface area by 50%. The minimum tank width must be no less than two times the shell(s) CCW (e.g., for multiple turtles, the sum of the shell CCWs must be multiplied by two to determine the minimum tank width).
4. Turtles greater than 65cm CCL – for one turtle, a tank with a surface area of at least nine times the shell length by two times the shell CCW of the turtle plus a minimum water depth of 1.2m. For each additional turtle, increase the original surface area by 100%. The minimum tank width must be no less than two times the shell(s) width (e.g., for multiple turtles, the sum of the shell CCWs must be multiplied by two to determine the minimum tank width).

DIAGNOSTIC TOOLS

HEMATOLOGIC (BLOOD) TEST

Blood may be collected from marine turtles at several sites, including the dorsal cervical sinus, the jugular vein, and the metatarsal vein. However, collecting from the dorsal cervical sinus (Fig. 15) is the easiest and fastest. The sinuses are found bilateral to the cervical vertebrae and anterior to the carapace. The collection site should be swabbed with an antiseptic prior to collection of blood. A properly restrained turtle should have its neck stretched flat and lower than the carapace to allow the sinuses to fill with blood. Insert a 1½-2-inch gauge-21 needle of the syringe into the skin surface outside of/lateral to the tendons that run parallel to the vertebral column. It is possible to collect as much as 3ml blood per kilogram of body weight, but this could only be done at this maximum volume every 45 days. Therefore, extract only a small amount needed for the tests if this is to be done regularly.

Figure 15 Site of blood collection on a marine turtle.

Complete blood count

Complete blood count (CBC) allows the veterinarian to make an accurate diagnosis of the animal's condition. The red blood cells of marine turtles are nucleated and would require a different set of reagents. EDTA should never be used on the blood samples as this will cause hemolysis of the cells. Use heparin instead to prevent blood coagulation. The following tests are basic to the evaluation of the health status of the turtle:

- Packed Cell Volume (PCV)
- Red Blood Cell (RBC) count
- White Blood Cell (WBC) count
- Differential WBC count

Hematology Reference Values

	Green turtle (Wood and Ebanks, 1984)	Hawksbill turtle (Hampel et al., 2009)	Olive ridley turtle (Guillermo, 2008)
Hemoglobin	7.5 to 12.5 g/dL	3.6 to 11.7 g/dL	31.9 to 45 mg/dL
PCV	33 to 62%	10 to 24%	17 to 32%
WBC	20 to 39 x10^9/L	1 to 4.5 x10^9/L	
Heterophils		56 to 90%	43 to 73.5%
Lymphocytes	42 to 94%	4 to 43%	14 to 35%
Monocytes		0 to 7%	0 to 0.5%
Eosinophils	1 to 47%	0 to 4%	0.5 to 20.5%
Basophils	3 to 44%	0 to 4%	0 to 1.5%
Thrombocytes	2 to 90%		
Neutrophils		0 to 7%	

Serum chemistry analyses

It is good practice to do further tests, especially if a definitive diagnosis cannot be reached. At the very least, serum blood chemistry values will give an idea of the severity of the condition and further guide the therapy needed for the turtle. Some of the more basic tests include:

- Liver function test
- Kidney function test
- Creatinine test
- Glucose test
- Total protein

Blood Biochemistry Reference Values for mature green, hawksbill, and loggerhead turtles (Campbell, 1996)

	Metric Units	SI units
Bilirubin	<0.1 mg/dL	<1.7 µmol/L
Calcium	6-11 mg/dL	1.5-2.8 mmol/L
Cholesterol	41-160 mg/dL	1-4.1 mmol/L
Creatinine	<0.3 mg/dL	<26.5 µmol/L
Glucose	60-120 mg/dL	3.3-6.7 mmol/L
Iron	20-45 µg/dL	3.6-8.1 µmol/L
Phosphorus	6-11 mg/dL	1.9-3.6 mmol/L
Total Protein	3-5 gm/dL	30-50 gm/L
Triglycerides	<285 mg/dL	<3.2 mmol/L
Urea nitrogen	20-80 mg/dL	14.57 mmol/L
Uric acid	<2 mg/dL	<119 mmol/L
Alkaline phosphate (ALP)	10-60 U/L	10-60 IU/L
Alanine aminotransferase (ALT)	10-30 U/L	10-30 IU/L
Aspartate aminotransferase (AST)	100-350 U/L	100-350 IU/L
Alkaline phosphatase (ALK)		10-60 IU/L

RADIOGRAPHIC EXAMINATION (X-RAY)

Radiography reveals traumatic conditions, such as fractures and joint dislocation, in marine turtles. A radiograph of the body can also help identify obstructions, ingestion of foreign materials (including hooks), and other internal problems.

However, in cases where the turtle is suspected to have ingested plastics, this may not be readily seen unless the gastrointestinal tract is severely obstructed. Nevertheless, enlargement of some areas along the gastrointestinal tract, followed by pockets of air, is a telltale sign of obstruction. Larger turtles, with their thick carapace, are more difficult to radiographand subject to diagnostic procedures.

A dorso-ventral view of the whole body is best for this procedure. If there are any obvious signs of trauma in a particular site of the body, it is highly advisable to take specific radiographs of that area from different views, e.g., dorso-ventral, antero-posterior or lateral oblique.

OTHER DIAGNOSTIC TOOLS

Collecting fecal samples and swabs can further assist in the diagnosis of the marine turtle's health conditions. Fecal samples may be collected when the turtle defecates or by extraction through the cloaca with a finger (lubricated gloves worn) to check for parasitic organisms. Direct microscopic examination and flotation techniques may be utilized for this purpose. Fecal samples may also be collected for bacterial cultures. Swabs of skin lesions may also be taken for fungal and bacterial cultures to determine probable causes of skin infection.

REHABILITATION PROCEDURES

Once the marine turtle arrives at the rehabilitation facility, certain management and general care protocols should be observed.

- An animal health record form should be updated at all times (MT03). All observations, medications given, and protocols employed in the case should be reported clearly. A well-documented case is important to monitor the status and health of the animal. It will also serve as a reference for similar cases in the future. Pertinent information collected from the turtle, such as weight, curved carapace length and width, among others, must be collected.

- Samples must be collected for laboratory tests on the turtle. The preceding section on Diagnostic Tools provides details on the more common tests used for marine turtles.

- Regularly check for the following changes or improvement on the turtle's condition:
  - Normalized blood profile
  - Strong reaction to stimuli
  - Weight gain

Make sure that you use different sets of tools and equipment when handling individual live turtles and for dead ones. Disinfect all reusable equipment with alcohol or iodine to prevent transmission of disease or contamination before and after handling the turtle. Dispose used cotton swabs, gloves, etc. as HAZARDOUS WASTE.

FEEDING

The best way to feed the turtle is to provide food in the tank and allow the turtle to find it. The food prepared must be appropriate for the particular species. Generally, all juvenile turtles may be fed with various types of fishes. Sub-adult and adult green turtles are fed with algae and seagrass, while the other species can subsist on fish, squid, and crustaceans. It is highly recommended that a wide variety of food be introduced to improve the nutritional quality of their diets. Generally, up to 10% of the body weight can be consumed by the animal per day. If the animal refuses to eat, tube feeding is highly recommended until the animal shows signs of health improvement and feeds on its own.

However, tube feeding is stressful to the animal and may further weaken or aggravate its condition. Esophageal tubing can result in upper intestinal food build-up, regurgitation, and aspiration of food. Combining all medications and vitamins into the turtle's food is recommended to avoid further unnecessary stress to the animal.

Oral administration of any medication, supplements, and rehydration fluid is the practical choice if treatment requires a prolonged period of time.

Materials needed for tube feeding:

- Feeding tube, the size of which should be appropriate to that of the turtle
- A gag or bite-block covered with rubber to avoid trauma to the beak and oral area (Fig. 16)
- Gruel (see inset)
- Food supplements (multivitamin-mineral combination), if needed
- Natural food coloring (optional: to aid in monitoring and assessment if the turtle regurgitates food)

Figure 16 An improvised gag or bite-block can be made using a padded PVC pipe with a hole bored in the middle.

Gruel Recipe

Ingredients:
- dextrose fluid
- fish meat or seagrass/seaweeds

Procedure:
1. Mash fish meat or seaweeds/ seagrass.
2. Mix in dextrose fluid at a ratio of 1:1.
3. Mix until an even consistency is achieved.

Note:
- Feed the turtle following the tube feeding method.
- Make sure that gruel is always freshly made.
- Start by feeding 3% of the total body weight twice a day, gradually increasing to 10% of its body weight twice a day.
- Judge amount to be given on the severity of dehydration.

To administer medication and/or food via a tube:

1. Take the turtle out of the water.
2. Calculate the amount of food intake depending on the severity of dehydration.
3. Open the mouth and prop with the bite-block. Take care not to hyper-extend the temporo-mandibular joint (Fig. 17).
4. Always lubricate the feeding tube before insertion. Carefully insert the flexible tube through the hole in the bite-block all the way to the distal part of the esophagus. Do not force the tube down the esophagus if there is resistance.
5. Give the amount of liquid or gruel based on the turtle's size and condition. Thinner gruel consistency should be administered to very weak animals as they may be unable to digest solid food properly. Thicker gruel consistency (more solid food materials) should be provided when the animal's condition has improved.
6. Maintain the turtle at a 45° angle for five minutes to facilitate movement of the material at a longer duration if the turtle is found to be weak (Fig. 18). Remember that the esophagus turns left into the stomach. Because of this feature, the gruel should be given slowly to avoid backflow.

Figure 17 Tube feeding of a marine turtle using a bite block.

Figure 18 Keep the turtle at a 45° angle while tube feeding.

7. Avoid placing the head lower than the body. This may cause the gruel or liquid to backflow or spill out.
8. Place the turtle back in the water as soon as possible to avoid regurgitation and aspiration. This allows it to safely expel any excess material.

NOTE: A little material may be expelled in the water through the nose. This should not be cause for alarm because it does not indicate aspiration.

COMMONLY ENCOUNTERED DISEASE CONDITIONS REQUIRING INTERVENTION

In wildlife medicine, always choose a treatment that is less invasive, hence surgical intervention is always a last option. For example, as ectotherms, it is difficult to gauge the level of anesthesia that marine turtles require.

WEAK TURTLES

Severely weak and/or emaciated turtles should be kept out of the water initially. Keep in mind that the turtle might be too weak to raise its head or swim properly and could drown during confinement even in shallow water. It is possible to keep the turtle out of the water for up to 24 hours. Damp towels may be used to keep the turtle wet.

If the animal shows sign of hypothermia, heat pads or infrared lamps may be provided. Place a cloth between the animal and the lamp to prevent overheating. When heat lamps are not available, warm wet towels may be placed on top of the carapace and replaced as they cool down.

When the turtle has shown marked improvement in its mobility, it may be transferred to a bigger pool.

Feed the turtle as often as needed (minimum interval between feedings is three hours) but the quantity of the food given must be regulated. For example, a three to four-kilogram turtle may be able to take only about 10ml of gruel initially. The total amount of food given per day should be equal to 10% of the turtle's body weight. Keep in mind that diet or food preference varies between species.

If fluid aspiration is suspected in weak turtles, the following procedures should apply:

- Raise the rear flippers about 20 cm higher than the head and observe if fluids are coming out of the nostrils (Fig. 19).

Figure 19 In cases of fluid aspiration, raise the rear of the turtle 20cm above the head.

- Gently shake the turtle while doing so to facilitate the expulsion of fluids.
- Let the turtle rest out of the water, but covered with wet towels, until it regains its strength, which may take up to 24 hrs.

BUOYANCY DISORDER

A turtle floating and partially tilted to one side or has difficulty submerging itself is usually caused by air abnormally trapped in the body. This often happens in the turtle's coelomic cavity. It can also result from excessive gas production in the digestive tract.

Treatment:
To remove excessive air from the coelomic cavity: Pierce the inguinal area with a 21-gauge needle while the turtle is on dorsal recumbency (Mader, 1996); Raise the lower half of the animal to avoid the internal organs and facilitate release of the air while pressure may be applied on the turtle's plastron to further assist in air expulsion: Weightbelts may also be attached to the turle to facilitate submerging until the problem has been resolved.

TRAUMA

Trauma may result from entanglement in nets, watercraft injuries, dynamite fishing, and other accidents. It can damage the soft parts of the turtle or the carapace. Wounds and fractures are the most likely cases encountered.

Wounds and fractures will not heal if the turtle's health condition is not adequate to support tissue repair or if it continuously loses weight. Make sure that the patient is fed properly. Any other medical problems should also be addressed.

Treatment:
The wounds on the hard surface and soft skin of the turtle should be cleaned and disinfected once a day using a 10% povidone-iodine solution. Gaping wounds may be closed using non-absorbable everting sutures. Partially healed wounds may have pockets of debris trapped deep in the tissue connected to the surface through fistulous tracts. These wounds need to be opened, cleansed, treated, and sutured. Associated secondary problems may include emaciation and increased buoyancy.

A turtle with a broken carapace must be taken out of the water before the following treatment is done:

1. Flush the crack on the carapace with sterile saline solution to cleanse it for easier inspection. Examine every small opening or break for debris.
2. Clean the wound. Debride if necessary. Flush the wound with 10% povidone-iodine solution.
3. Remove any hard, unattached material to maximize healing and promote normal shell calcification and repair.
4. Clean and dry the scutes surrounding the wound.
5. Cover the exposed soft tissues with antibiotic ointment. Avoid the wound edges as this might hinder natural carapace re-growth.
6. Cover the carapace over the fractured area with a piece of mosquito or fine mesh net made of plastic. The size of the mesh should exceed the size of the

damaged part. Apply Marine Epoxy® to the surface of net. Make sure the Epoxy extends beyond the net's edges (Fig. 20). Allow the glue to fully dry before returning the turtle to the water.

7. Observe and check that the bandage is intact for up to two days.
8. If the turtle is weak, it should be carefully examined and provide further treatment.

Figure 20 Repair of an open fractured carapace.

Minimize the use of acrylic, fiberglass, or other hard patch techniques for carapace repair. Although these materials aid in wound healing, a sealed wound may trap debris, which inhibits healing. Most fractures of the carapace require up to six weeks or more to heal.

Marine turtles have slow metabolism. What would normally be safe and acceptable doses for animals in general may already be toxic to an adult turtle. Avoid injecting antibiotics and vitamin supplements, especially when the underlying problem is still undetermined, as these will not be helpful and might even be fatal to the animal.

Trauma to the head and spine are more serious injuries. Clinically, these turtles can survive for extended periods but may exhibit recurring granuloma of the deep tissues. If the spinal cord is damaged, an increased incidence of constipation and colitis and even paralysis may occur. When this happens, the animal needs to be euthanized.

FISHING HOOKS AND DEBRIS INGESTION

Fishing hooks eaten by turtles may lodge in their intestinal tract. In cases of suspected ingestion, radiography must be performed to pinpoint the location and then provide therapeutic options. Hooks may also lacerate and perforate any part of the gastrointestinal tract, especially the mouth area and the esophagus. The hook may also make its way to the colon, which might be expelled but can also lodge in the lower intestinal area.

On several occasions, turtles ingest plastic materials --especially bags that they mistake for food, such as jellyfish. Monofilaments and ropes can cause abrasion of the digestive lining and may also result in perforations. Impaction is a common result of debris ingestion. Plastic materials may not be visible on x-rays but when impaction has occurred, it becomes noticeable.

Treatment:
If the hook is attached to the outer part of the mouth, the hook should be removed by cutting off the barb with a wire clipper to extricate it. It might be necessary to have the turtle bite on a pole made of hard wood to keep the mouth from closing

during the procedure. Caution must be observed at all times as the beak is sharp and strong.

If the hook has been ingested or is deep inside the mouth, an x-ray might be needed to determine its location. The removal of an ingested hook may require surgery, but first try flushing the hook and other debris with mineral oil which will then be passed through its cloaca. If surgery is not an option for lack of appropriate facilities and a properly trained veterinarian, it is recommended to cut the line as short as possible and release the animal in the hope that the hook will eventually slide off.

HYPOGLYCEMIA

Hypoglycemia is a condition where the glucose content in the blood is diminished. This condition is quite common and is easily overlooked especially in stranding cases. It is often seen in emaciated marine turtles and may be attributed to other underlying causes or a complication of other diseases. Symptoms may be vague and may include weakness and incoordination. Determine if a weak turtle is hypoglycemic by testing the blood for glucose levels.

Treatment:
Thin or emaciated turtles that show glucose levels of <60mg/dL may be treated by one of the following methods:

- Oral Administration should always be the first option because it is the most practical method. Nevertheless, its practicality depends partially on the ability of the turtle to transfer glucose-containing material (liquid or gruel) to the intestinal tract for absorption. If the intestinal tract is functional, give 1ml of 50% dextrose per kilogram of body weight at three to six times per day. The glucose supplement may be added to the gruel at feeding. Hypoglycemic patients would require more frequent feeding in small amounts.

  Weigh the turtle every day or at least every two days to monitor the animal's response to therapy and to determine when to decrease frequency of feeding. Decrease the feeding gradually if the turtle shows signs of improved weight. When feeding is brought down to three times daily, you can start weighing the animal twice a week until the animal is deemed healthy enough to be released.

- Intercoelomic cavity administration of glucose is needed when treating moderate to severe hypoglycemia. Place the turtle on dorsal recumbency with the hind part elevated to let the intestinal tract slide forward, then clean and disinfect the inguinal area. Use 5% glucose solution at 2-10% of the animal's body weight depending on the level of serum glucose (Campbell, 1996). Administer the solution slowly using a 20-gauge needle into the anterior inguinal area at a 30° angle.

INFECTIOUS DISEASES

Fibropapillomas are often observed in marine turtles, particularly the green turtle. These growths are often caused by a herpes virus, with contributions from environmental factors. The disease may be of epizootic proportions but not necessarily

fatal to the animal. The disease condition may be acute or chronic and is a growing concern in other parts of the world (Chaloupka, Balazs, and Work, 2009). It is always characterized by multiple tumorous growths on the head, neck, shoulder, and limbs, which should be easily distinguished from encrusting barnacles. Surgical removal of tumors is the common intervention in these cases.

Ectoparasites and endoparasites can cause serious debilitation to the turtle. Unfortunately, parasitic infections are rarely diagnosed until after the animal is dead. Ectoparasites such as amphipods, barnacles, and polychaete worms may be encountered and most are easily removed manually using forceps or tweezers. For endoparasites, nematodes, and trematodes are common.

Treatment:
Use of antiparasitic drugs is highly discouraged in marine turtles due to their slow metabolism and the highly toxic nature of these drugs. However, these parasites may complicate other disease conditions, such as intestinal impaction and severe dehydration. In such cases, the attending veterinarian needs to decide whether or not to treat for parasitism despite possible outcomes. The following are the recommended antiparasitic drugs:

FOR NEMATODES: Use fenbendazole at a dose of 50-100 mg/kg once and repeat after two weeks.

FOR TREMATODES: Use praziquantel at 16 mg/kg once then repeat after two weeks.

If therapy has been initiated, make sure that the animal is regularly monitored, which includes fecal examination. Once cleared of the parasite, as demonstrated by the fecal exam, the animal may be released when no other condition exists.

EXPOSURE TO OIL

Oil spills are a threat to marine life. If this occurs, it is best to recover the affected marine turtle for cleaning and possible treatment. The animal will probably be covered with oil, tar, or other petroleum-based products. In some cases, toxic materials may have also been ingested by the animal, hence toxicosis is also considered. The consequent release of the animal should be done in an area cleared from any spills or should only be done once the spill has cleared.

Treatment:

1. Remove oil and tar coating the turtle by bathing it with dishwashing detergent. Avoid the eyes and mouth.
2. Break down residue in the mouth by coating the mouth cavity with organic fats such as mayonnaise.
3. If ingestion of oil is suspected, provide gastrointestinal protectants, like kaolin-pectin or activated charcoal at a dose of 2 to 8 gram per kilogram body weight, to reduce toxic effects of the petroleum product.
4. Provide additional supportive therapy, such as fluids, as needed.

ACCLIMATIZATION

Once the turtle has been fully rehabilitated, it should first undergo an acclimatization process before it is released back to its natural habitat. Acclimatization before releasing turtles that were kept in captivity for some time will reduce stressful conditions and boost the turtle's chances of survival in the wild. The duration of the acclimatization process is determined at the time, when the following can be observed from the turtle (Bluvias and Eckert, 2010):

- Actively eating on its own – free feeding, diving to retrieve food
- Able to capture any live food given
- At a stable and normal weight
- No open wounds/sores, tumors, skin irritations, debilitating epibiota, parasites
- Defecating and urinating normally and regularly
- Actively moving, swimming, diving without assistance
- Resting comfortably on tank bottom
- Able to lift its head strongly when breathing
- Attempting to crawl when on solid ground
- Able to hold its limbs and head above the ventral surface of its body.
- Act as if swimming when lifted out of the water
- Blood parameters within normal limits

A marine turtle kept in captivity for only a few days does not need to undergo acclimatization. Generally, once a turtle has recovered from rehabilitation for a period of only a few months, the animal may be released immediately. Turtles which have been held in captivity for a year or more, especially those reared since hatchlings, need to undergo a period of acclimatization. Acclimatize the animal using the following steps:

1. Introduce the animal to the natural setting using a floating cage or a fixed structure like a fish corral. The minimum cage size should be nine times bigger than the carapace length of the turtle and at least 1.2 m deep.
2. Choose an area where an abundance of marine life thrives, such as seagrass for green turtles; mollusks for loggerhead; crustaceans for olive ridley turtles; and encrusting sponges and algae for hawksbills.
3. Initially, the turtle should be fed as it has been accustomed during rehabilitation/ captivity.
4. Slowly introduce the preferred food into its cage by following the species' dietary requirement. The animal should be fed 1-3 times per day, totalling to about 10% of its body weight.
5. Gradually reduce the food supply and observe if the animal will seek out natural prey on its own. If natural prey is not available, introduce live prey inside the cage.

6. Avoid human contact, if possible.

If the turtle eats regularly with no signs of thinning, then it is ready for actual release.

A turtle is only deemed fit for release after a careful assessment by a licensed government veterinarian after which s/he issues a certification for release. Again, animals under rehabilitation and acclimatization should never be displayed and/or exhibited to the public.

EUTHANASIA

Euthanasia is the practice of killing or putting an animal to death in a painless and humane manner. The decision to euthanize is arrived at when assessment of the marine turtle reveals any of the following:

- Suffering from serious and severely infected injuries and wounds that are incurable
- Suffering from a disease that is of public health significance
- Physically debilitated thus hindering its survival in the natural habitat
- There is a need to put an end to the suffering of the animal
- Rescue is impossible and there are no rehabilitation facilities

NOTE: Only a licensed veterinarian authorized by the DENR can recommend euthanasia.

For the marine turtle, an overdose of sedative or anesthetic injected intravenously through the dorsal cervical sinus is the recommended method. A gas anesthetic machine may also be used for euthanasia if available. It is easier to use a cone over the head instead of an endotracheal tube. A cocktail of Magnesium sulfate and Potassium chloride (1:1) to be given intracoelomic is also recommended. Continue to monitor the vital signs during the procedure until the animal is non-responsive.

CHAPTER 6: NECROPSY PROCEDURE

Necropsy is the examination of a dead animal's body to determine the cause/s of death. Organ and tissue samples are obtained for research purposes to provide information on the animal's life history and to identify possible human-related causes of death. A necropsy is performed by a trained veterinarian. Interpretation of the gross and microscopic and/or laboratory examination must be done by qualified professionals, such as a wildlife veterinarian or a veterinary pathologist.

Necropsies may be performed on carcassess for Codes 2 and 3. For practical purposes, only the method of necropsy will be described here. A more thorough discussion of the interpretation of lesions and findings may be found in Work (2000).

Always wear protective clothing and gloves when conducting a necropsy.

The following materials and equipment are needed:

NECROPSY EQUIPMENT
- Sharp knife (including sharpening stone or steel)
- Scissors (small and large)
- Forceps
- String
- Hack saw or bone saw
- Scalpels and razor blades
- Plastic ruler or measuring tape

SPECIMEN CONTAINERS AND SAMPLING EQUIPMENT
- Rigid plastic containers with tight fitting lids (approximately 1 liter)
- Small vials, tissue cassettes, or tags to identify specific samples
- Sterile vials or blood tubes
- Plastic bags with closure tops (zip-lock)
- Parafilm or sealing tape
- Aluminum foil
- Sterile syringes and needles
- Labeling tape or tags, water proof labeling pens, and pencil

TRANSPORT MATERIALS
- Ice coolers
- Leak-proof, break-proof containers
- Absorptive packing materials
- Sealing tape

NECROPSY PROCEDURE

1. Lay the carcass on the examination table in a prone position. Carefully examine the external surface of the carcass for any gross abnormalities or lesions, especially the skin areas.

2. Clean the carcass with water, if necessary, to view the lesions better.

3. Check the mouth and anal orifices for lesions, foreign bodies, fluids, and obstructions.

4. Photodocument any lesions found. Collect samples of lesions, when possible.

5. Turn the carcass onto its carapace. Prop the carapace at its sides with blocks of wood to stabilize the carcass.

6. Using a sharp, pointed knife or a hacksaw, cut through the soft tissue at the junction of the marginal and inframarginal scutes at the lateral aspects of the plastron and ventral aspect of the limbs, neck, and cloaca (indicated by the broken red line in Figure 21). Note for gases that may be released at this point, which may signify putrefaction.

Figure 21 Area of incision on the plastron for necropsy.

7. Utilizing a hook, lift the cut plastron at the neck area. Cut any connecting soft tissue as close to the plastron as possible to completely detach it from the rest of the body (Fig.22).

Caution must be observed when cutting the plastron between the two clavicles and the pelvis at the back as it is connected to the body by thick connective tissues and muscles. The heart is situated underneath the plastron and diligence is necessary to avoid puncturing the organ when cutting through the rostral-most border of the plastron.

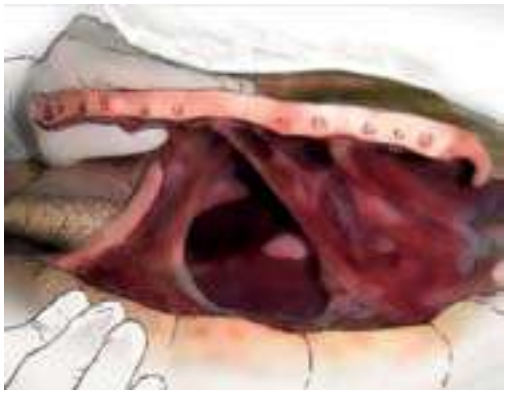


Figure 22 Detachment of the plastron.

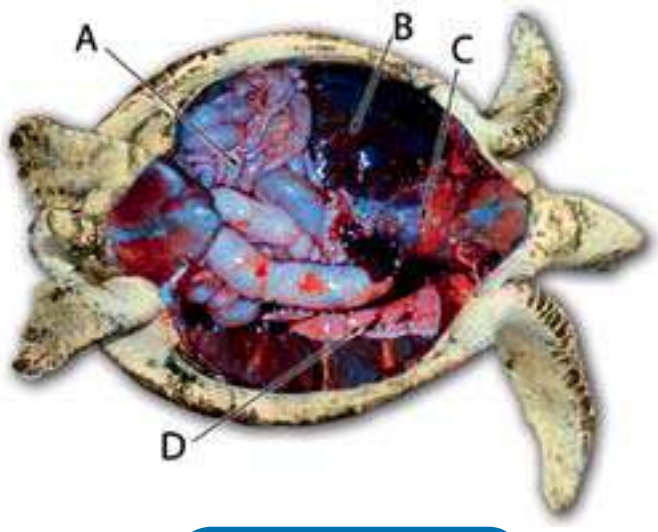


Figure 23 Internal organs of a marine turtle.
(A) intestines
(B) liver
(C) heart
(D) lungs

8. Once all attachments are cut, remove the entire plastron to expose the whole body cavity and internal organs (Fig. 23).

9. Characterize the organs in the Necropsy Form (MT 04). Note lesions and other interesting details. Weigh all organs. Take photographs and obtain tissue samples of the organs that need to be examined.

Obtaining samples requires a permit from the DENR. DNA samples are collected from the skin (1 x 1cm) and preserved in absolute or 95% Ethanol in a polyethylene container. Other organ samples for histopathological examination must be preserved in a 10% Formaldehyde solution (formalin). Further analyses will be conducted in an appropriate research institution with permission from DENR.

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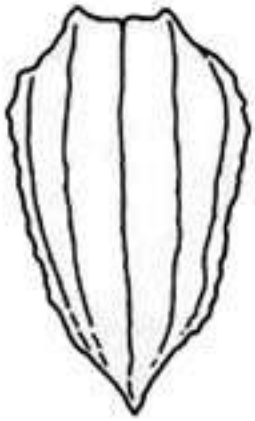
ANNEXES

1. Identification Key for Adult and Sub-Adult Marine Turtles
2. Identification Key for Marine Turtle Hatchlings
3. Philippine Marine Turtle Species Information
4. MT01 - Marine Turtle Tagging Data Form
5. MT02 - Marine Turtle Stranding Report Form
6. MT03 - Marine Turtle Rehabilitation Health Record
7. MT04 - Marine Turtle Necropsy Form
8. MT05 - Marine Turtle Hatchery Data Form
9. MT06 - Marine Turtle Nest Evaluation Form
10. Decision Flow Chart for a Marine Turtle Incident Response

IDENTIFICATION KEY FOR ADULT & SUB-ADULT MARINE TURTLES

Carapace with
- no large scales
- 7 distinct ridges



leatherback turtle
Dermochelys coriacea

Carapace with
- large scales or scutes
- no continuous ridges

4 pairs
costal scales

5 pairs (rarely 6) costal scales
- carapace longer than wide
- color red-brown to brown
- no pores in scales or bridge

loggerhead turtle
Caretta caretta

6-9 pairs or more costal scales
- carapace approximately circular
- color grey green
- pores in scales or bridge

olive ridley turtle
Lepidochelys olivacea

2 pairs pre-frontal scales
thick overlapping carapace scales

hawksbill turtle
Eretmochelys imbricata

1 pair pre-frontal scale
no thick overlapping carapace scales

green turtle
Chelonia mydas

IDENTIFICATION KEY FOR MARINE TURTLE HATCHLINGS

Carapace
Length: 5-7 cm
Distinctive ridges

leatherback turtle hatchling
Dermochelys coriacea

Carapace
Length: 4-5 cm
Carapace black,
plastron white

green turtle hatchling
Chelonia mydas

Carapace
Length: 4 cm
Carapace black,
plastron black

olive ridley hatchling
Lepidochelys olivacea

Carapace
Length: 3-4 cm
Carapace brown,
plastron brown

hawksbill turtle hatchling
Eretmochelys imbricata

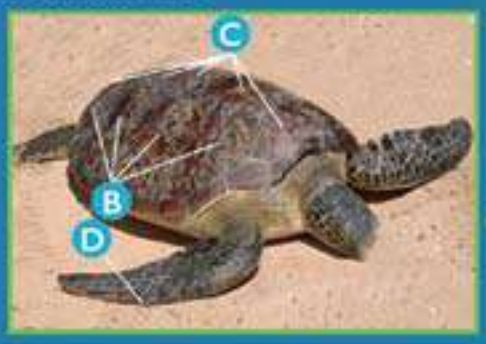
green turtle

SCIENTIFIC NAME *Chelonia mydas*

COMMON NAMES

bildog
katuan
pudno
payukan
pawikan
talisayon
tortuga
tuod

ANATOMY



A one pair pre-frontal scale
B four pairs lateral scale
C five central scales
D one claw on each foreflipper

STATUS

Endangered
(DENR A.O. No. 2004-15 dated May 22, 2004)

DESCRIPTION

maximum carapace length
125 cm

track width
100-130 cm

egg diameter
4-4.6 cm

clutch size average
110-130 eggs

open and white sand beaches

DIET

herbivorous

seagrass
algae

NESTING SITES

Turtle Islands,Tawi-Tawi
(>1,000 nesting sites recorded annually)
San Miguel Group of Islands, Mapun,Tawi-Tawi
Panikian Island, Pitogo, Zamboanga del Sur
Cagayancillo, Palawan
Tubbataha Reef, Palawan
Spratly Island, Palawan
Apo Reef, Sablayan, Occidental Mindoro

DISTRIBUTION

Widely distributed in the Philippines

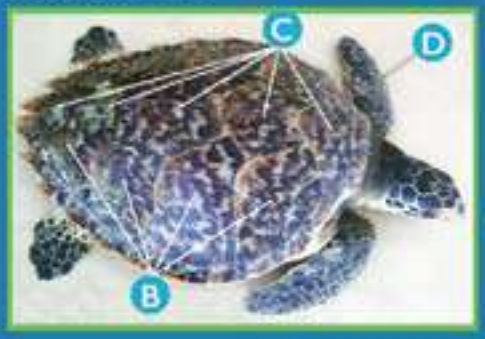
hawksbill turtle

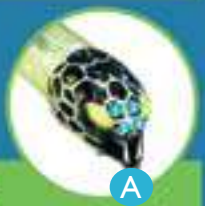
SCIENTIFIC NAME *Eretmochelys imbricata*

COMMON NAMES

kara
karahan
pawikan
sisik
sisikan
ulinaban

ANATOMY





A two pairs pre-frontal scale
B four pairs overlapping lateral scale
C five central scales
D two claws on each foreflipper

STATUS Critically endangered
(DENR A.O. No. 2004-15 dated May 22, 2004)

DESCRIPTION

maximum carapace length
91 cm

track width
70-85 cm

egg diameter
32-36 mm

clutch size average
70-180 eggs

shallow, coral strewn habitat to reach more heavily vegetated low profile beaches

DIET

spongivorous

sponges
algae
coral anemones

NESTING SITES

- Cagayan de Oro
- Davao City
- Davao del Norte
- Guimaras
- Misamis Oriental
- Occidental Mindoro
- Palawan
- Surigao del Sur

DISTRIBUTION

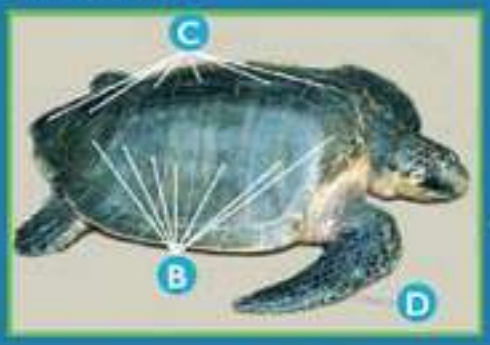
Widely distributed in the Philippines

olive ridley turtle

SCIENTIFIC NAME *Lepidochelys olivacea*

COMMON NAMES
kantiwan
lambangan
lunok
mukuy
pawikan

ANATOMY



A two pairs pre-frontal scale
B six or more pairs of lateral scales
C seven or more central scales
D one or two claws on each foreflipper

STATUS Endangered
(DENR A.O. No. 2004-15 dated May 22, 2004)

DESCRIPTION

maximum carapace lengths
70 cm

track width
70-80 cm

egg diameter
3.7-4.2 cm

clutch size average
105-120 eggs

metallic gray sand beaches usually near rivers, lagoons, or estuaries

DIET

omnivorous

crabs
shrimp
lobster
urchins
jellyfish
algae
fish

NESTING SITES

Bataan
Zambales
Batangas
Ilocos Sur
Davao del Sur Saranggani
Negros Occidental

DISTRIBUTION

Widely distributed in the Philippines

loggerhead turtle

SCIENTIFIC NAME *Caretta caretta*

COMMON NAME bulawon
pawikan

ANATOMY

A two pairs pre-frontal scale
B five pairs lateral scale
C six central scales
D two claws on each foreflipper

STATUS Endangered
(DENR A.O. No. 2004-15 dated May 22, 2004)

DESCRIPTION

113-180 kg
adult weight

maximum carapace length
114 cm

track width
70-90 cm

egg diameter
3.9-4.3 cm

clutch size average
90-130 eggs

Nests in
open beaches or along narrow bays having suitable sand

DIET

omnivorous

crabs
molluscs
algae
fish

NESTING SITES

no reported nesting in the Philippines

DISTRIBUTION

Foraging Areas:
Albay
Basilan
Camarines Sur
Palawan

leatherback turtle

SCIENTIFIC NAME *Demochelys coriacea*

COMMON NAMES
balimbing
benerakan
kantuhan
galangan
pawikan

ANATOMY

A head with no scales
B leathery carapace with no scutes
C carapace has seven longitudinal ridges
D flippers without scales and claw

STATUS Endangered
(DENR A.O. No. 2004-15 dated May 22, 2004)

DESCRIPTION

320-600 kg
adult weight

maximum carapace length
178 cm

track width
150-230 cm

egg diameter
5.1-5.5 cm

clutch size average
60-120 eggs

Nests in
isolated beaches adjacent to deep waters without reefs

DIET

gelatinivorous

jellyfish
tunicates
sea squirts

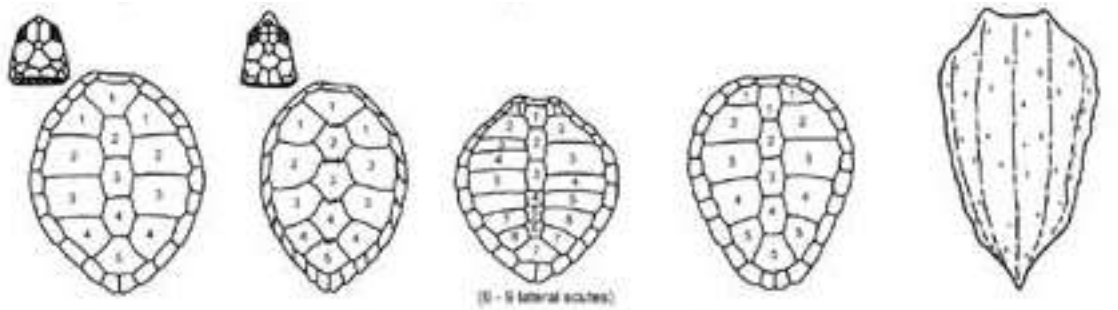
NESTING SITES
Legaspi, Albay
Eastern Samar
Negros Occidental

DISTRIBUTION

Foraging Areas:
Palawan
Negros Occidental
Antique
Oriental Mindoro
Ilo-ilo
Camarines Sur
Albay
Aurora
Catanduanes
Guimaras
Saranggani

MT01 MARINE TURTLE TAGGING DATA FORM

1. Species (refer to the species identification key)



[ ] green turtle [ ] hawksbill [ ] olive ridley [ ] loggerhead [ ] leatherback

2. Sex of marine turtle: [ ] male [ ] female How was sex determined? _____

3. Date of capture: _____ Geographical coordinates:

4. Place of capture: _____ Longitude N _____° _____' _____"
Latitude E _____° _____' _____"

5. Method of capture (e.g., caught in net, trapped in fish corral, hook and line): _____

6. Activity of turtle before capture: [ ] swimming [ ] mating
[ ] feeding [ ] nesting
[ ] others _____

7. Curved Carapace Length (CCL) in cm: _____

8. Curved Carapace Width (CCW) in cm: _____

9. WITH TAG(S), record serial number of tag(s) attached to the flippers:
Left tag: _____ Right tag: _____

10. NEW TAG(S) APPLIED, record serial numbers of new tag(s):
Left tag: _____ Right tag: _____

11. Date of tagging: _____

12. Date of release: _____

13. Place of release: _____

14. Observations (NOTE: fibropapillomas, propeller cuts, mutations, hook ingestion, etc.):
_____

15. Details of person(s) who reported, caught, captured, turned-over, donated the marine turtle:
Name(s): _____
Address(es): _____
Contact details (phone, email): _____

16. Details of DENR personnel responsible for tagging and releasing the marine turtle:
Name(s): _____
Position(s): _____
Field office: _____

INSTRUCTIONS:
- *Use one form per marine turtle*
- *Apply tags when there are no tags or if only one tag is attached to the turtle*
- *Do not remove existing tags from the flippers*
- *Do not re-tag marine turtles unless the existing tags are unreadable or about to fall off from the flipper*
- *Photograph the turtle (top view) and the tags attached*

SUBMIT FORM TO:
Wildlife Resources Division
Biodiversity Management Bureau
Department of Environment and Natural Resources
Ninoy Aquino Parks and Wildlife Center
North Avenue, Diliman
Quezon City, Metro Manila
Telephone Number: (02) 9246031-35, loc. 223
E-mail: bmb@bmb.gov.ph and wrd@bmb.gov.ph

MT02 MARINE TURTLE STRANDING REPORT FORM

Observer's Full Name_____ Stranding Date_____
month day year

Species _____ Number of turtles found (per day) _____

SEX: (CIRCLE) Female Male Undetermined How was sex determined?_____

Location (be specific)_____

Latitude _____ Longitude _____

Condition of the Turtle (use codes) _____ Final Disposition of Turtle (use codes)_____

Disposition Location _____

Tag Number(s) (include tag return address and disposition of tag) _____

_____

Remarks (note if turtle was involved with tar or oil, gear of debris entanglement, wounds or mutilations, propeller damage, papillomas, epizoa, etc.) continue on back if necessary.

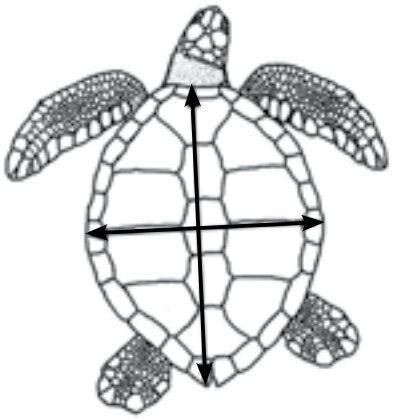
_____

_____

MEASUREMENTS:

Curved Carapace Length (CCL) in cm: _____
Curved Carapce Width (CCW) in cm: _____

Mark wounds, abnormalities, and tag locations



CODES:

SPECIES:
G = green sea turtle
HB = hawksbill turtle
OR = olive ridley turtle
LH = loggerhead turtle
LB = leatherback turtle
UN = Unidentified

CONDITION OF TURTLE:
1 = Alive
2 = Fresh dead
3 = Fairly decomposed
4 = Severely decomposed
5 = Desiccated
6 = Destroyed

FINAL DISPOSITION OF TURTLE:
1 = Buried: on beach/off beach
2 = Salvaged specimen: all/part
3 = Pulled up on beach: not buried
4 = Alive, released
5 = Alive but weak/injured, for rehabilitation

MT03 MARINE TURTLE REHABILITATION HEALTH RECORD

Name of Person Filling Up the Protocol: _____

Date: _____

Species/ Animal: _____

Age: _____ Sex: _____ Weight: _____ Measurement: _____

Description/ Identifying marks: _____

PHYSICAL EXAMINATION

I. General Appearance

_____ excellent
_____ good
_____ fair
_____ obese
_____ thin
_____ emaciated
_____ dehydrated (mild, moderate, severe)
_____ moribund
_____ others _____

Remarks: _____

_____

II. Skin/ Integuments/ Carapace/ Plastron

_____ NSO
_____ hematoma
_____ wound
_____ tumors/ papillae
_____ external parasites
_____ epibiota, % body coverage _____
_____ others _____

Remarks: _____

_____

III. Head

1. Eyes

_____ NSO
_____ discharge
_____ redness
_____ others _____
_____ opacity
_____ ulceration
_____ blindness

Remarks: _____

_____

IV. Digestive

____ NSO
____ wounds/ ulceration in oral cavity
____ broken beak
____ anal/ cloacal prolapse
____ inappetent
____ vomiting
____ constipated
____ diarrhea/ pasty vent (mucoid, bloody, watery)

Remarks: _____

_____

V. Respiratory/ Cardiovascular

____ NSO
____ nasal discharge
____ epistaxis
____ others _____
____ dyspnea
____ abnormal chest sound
____ coughing

Remarks: _____

_____

VI. Musculoskeletal/ Nervous

____ NSO
____ fractures
____ limping
____ lameness
____ others _____
____ paralysis
____ paresis
____ muscular dystrophy
____ ataxia

Remarks: _____

_____

Movement

Head lift ___ strong ___ weak ___ inactive
Head, tail, and limbs retraction reflex ___ strong ___ weak ___ inactive

Swimming: ___ submerge ___ floats Observations: _____

VII. Reproductive/ Genito-urinary.

____ NSO
____ cloacal tone
____ others _____
____ presence of discharge

Remarks: _____

_____

LABORATORAY TESTS:

Skin Scraping ____ parasites ____ fungi ____ others _____
Fecalysis ____ nematodes ____ cestode ____ trematode
____ coccidian ____ balantidia ____ amoeba
____ others _____

WBC Count _____ RBC Count _____
PCV _____ TP _____
Differential WBC Count _____
Blood Parasite _____
Radiographic Findings _____
Other Tests Conducted

Date Conducted	Examination Conducted	Results

MEDICAL PROCEDURES CONDUCTED

Date	Time	Treatment/s	Observations

*NSO - No Significant Observation

MT04 MARINE TURTLE NECROPSY FORM

Date of Death ☐ Location of death ☐

Date of Necropsy ☐ Time of Necropsy ☐

Specimen Number ☐
(should refer to a stranding form)

Note findings on the following, check if photographs and samples were taken

	Sample taken	Picture taken
EXTERNAL CONDITION	☐	☐
MUSCLES	☐	☐
SKELETON	☐	☐
COELOMIC CAVITY		
Liver	☐	☐
Heart	☐	☐
Trachea	☐	☐
Lungs	☐	☐
Kidney	☐	☐
Gonad	☐	☐
Thyroid Glands	☐	☐

GASTRO-INTESTINAL TRACT		
Esophagus	☐	☐
Crop	☐	☐
Stomach	☐	☐
Small intestines	☐	☐
Large intestines	☐	☐
Spleen	☐	☐
REPRODUCTIVE AND URINARY TRACT		
Gonads	☐	☐
Kidneys	☐	☐
Urinary tract and bladder	☐	☐
HEAD AND NECK REGION		
Brain	☐	☐
Salt Gland	☐	☐

DIAGNOSIS

CAUSE OF DEATH

Examined by _____

Contact details _____

Preservatives:

- *Tissue samples to be stored in 10:1 ratio with 10% neutral buffered Formaldehyde in a plastic leak-proof container.*
- *Parasites and epibionts in Absolute or 95% Ethanol in a plastic leak-proof container.*
- *DNA tissue sample in Absolute or 95% Ethanol in a clean leak-proof polyethylene container.*

MT05 MARINE TURTLE HATCHERY DATA FORM

Island/ Sitio/ Barangay/ Municipality/ Province (Location of hatchery) _____

_____

Month/ Year _____

Date Transplanted	Nest Code	No. of Eggs Transplanted	Date Emerged	No. of Hatchlings Emerged	No. of Hatchlings Released	Remarks

Submitted by _____

Date _____

MT06 MARINE TURTLE NEST EVALUATION FORM

Island/ Location of Nest _____

(CS) Clutch Size If Known _____

New Location _____

Number of Eggs Transplanted _____

Date Transplanted _____

Date of Emergence	Time of Emergence	No. of Hatchlings Emerged	Collected/ Recorded by
		(E) Total hatchlings emerged	

Classification of nest contents

EGGS:
- (S) No. of eggshells hatched _____
- (UHT) Unhatched full embryo _____
- (UH) Unhatched fertile eggs _____
- (LPE) Live pipped eggs _____
- (DPE) Dead pipped eggs _____
- (UD) Eggs without visible development _____
- (P) Predated _____

HATCHLINGS:
- (DIN) Hatchlings dead in nest _____
- (LIN) Hatchlings live in nest _____

*note for hatchlings with deformities

(CS) Estimated clutch size if unknown _____

Hatching success (%) _____

Emergence success (%) _____

Mortality (%) _____

Incubation period (days) _____

Date Excavated _____

Certified correct:

Signature _____

Printed Name _____

Date _____

DECISION FLOWCHART FOR A MARINE TURTLE INCIDENT RESPONSE

Legend:
CCL - Curved Carapace Length
cm - centimeters
MT - Marine Turtle Form
DENR - Department of Environment and Natural Resources