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PROGRAM
13 December, 2006

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9:30 – 10:00  Opening Remarks

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PHILIPPINES
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by Kongkiat Kittiwattanawong

14:40 - 15:00 CLOSING REMARKS
COMMUNITY INITIATED SURVEY AND CONSERVATION OF DUGONG IN CAPE SAN AGUSTIN, MINDANAO ISLANDS PHILIPPINES

Gliceto O. Dagondon¹*, Brian Lawas¹, Abraham Uy¹ and Joshua Donato²

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Abstract
Dugong (Dugong dugon) is endangered in Philippine archipelago with distribution confined to Palawan islands, Mindanao and selected Visayan islands. Few dozens are estimated left in Coron, northern Palawan islands. An equal number maybe still remaining in Philippine Sea-Pacific coastlines in eastern Mindanao and down to Celebes Sea in southern Mindanao. Sketchy information in Sulu Sea maybe added to their number but current peace and order situation doesn’t warrant sustain study and documentation. Dugong conservation project of GREEN Mindanao, an environmental NGO based in the island originally identified Pujada Bay in Mati, Davao Oriental but directed towards outer Cape San Agustin Peninsula adjacent with Davao gulf in southern Mindanao. Reported of dugong deaths were documented in Pujada Bay as well Hinatuan Bay in Surigao del Sur less than 500 kilometers of distance apart. Earlier report on dugong deaths are associated with dynamites, gill nets, caught in fish pens and stranding. Recent death and stranding of dugong documented in Cape San Agustin within July 2006 appear to be associated with series of intense tropical storm surges in a row almost every week for a month-period driving strong current and waves. It deprived dugong of food from foraging areas, weakened, dis-oriented in the process and hit reefs and rugged coasts. Recovered cadaver by community and testimonies of local partners corroborated this case; and associated with simultaneous incident of whale stranding in neighboring coasts.

The project method in locating active dugong habitat started with PCRA information on good and excellent seagrass areas while monitoring, location and documentation was conducted with local fishers (spear fishers, divers & artisanal fishers). Community partners engaged in documenting and monitoring active dugong habitat were provided with underwater camera and periodically observed and recorded their findings. Spear fishers were able to first took photos of foraging dugong while visual survey of dugong foraging seagrass area were located with the guidance of local fishers and community leaders. Local community monitoring recorded almost daily sighting in one of three communities surveyed and monitored in the past 6 months. An estimated at least 2 dozens resident dugong sighted, monitored and documented in the area between December 2005 to June 2006. Establishment of about 800 hectares Dugong Habitat Sanctuary (DHS) and marine protected area (MPA) ensued through barangay (village) legislation. Local government agencies of fishery, tourism and media provided support on capability building, publicity and campaign on dugong conservation.

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WILD DUGONGS RESPOND ACOUSTICALLY TO THEIR NEIGHBORS

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Keywords: dugong chirp, playback, call back, response calls, conspecific recognition

Abstract

Wild dugongs were found to call back more to conspecific calls than to artificially synthesized sounds. The population was exposed to 4 different playback stimuli: a wild dugong chirp, a synthesized down-sweep sound similar to the dugong chirp, a synthesized constant-frequency sound, and no sound as a control. Vocalizing dugongs were localized using an array of stereo-underwater-recording systems. Wild dugongs vocalized more frequently after the playback of dugong chirps (12.4 calls/min) than those of constant-frequency (1.9 calls/min) and control (2.1 calls/min), (p<0.01, Kruskal-Wallis test). Dominant frequencies of response calls were 4810 Hz to dugong chirps and 4470 Hz to down-sweep sounds. These were higher than those to other stimuli (3794 and 4044 Hz). Distances of calling-back dugongs from the playback speaker were significantly shorter for dugong chirps (10.19 m) and down-sweep (19.02 m) than that for constant-frequency (105.84 m) (p<0.001). The observed dominant frequencies of response calls (4510 Hz) were above the cut-off frequency of Lloyd’s mirror effect in shallow waters of the present study. Frequency-modulated narrow-band sounds like chirps travel longer and enable accurate measurements of source directions by binaural receivers. These suggest that chirps could be used for conspecific recognition in noisy acoustic scenes in tropical shallow waters.

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PATTERN ANALYSES ON THE VOCAL STRUCTURE OF CALLS AND GEOGRAPHIC VARIATIONS AMONG THREE AREAS

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Keywords: Dugong dugon, chirp, trill, call sequence, vocalization pattern

Abstract

Dugongs (Dugong dugon) vocalize several calls in a row. Previous reports showed that dugongs have two kinds of calls: long duration calls (trill) and short duration calls (chirp-squeaks hereinafter called chirp). Vocalization pattern of the dugong was classified and the differences and the similarities in the phonetic structure among different dugong areas were discussed in this paper. We collected the dugong calls from the southern part of Talibong Island, Thailand (2053 calls in total), Toba aquarium, Japan (694 calls), and Underwater World, Singapore (203 calls). Short duration calls with less than 300 milliseconds were defined as chirps and trills were defined as a call lasting over 300 milliseconds. The end of a call sequence was defined by a silence over 1 second. Within a call sequence, chirp-to-chirp transition was the most frequent among the 3 groups. Trills appeared in the end of a call sequence. The position of the trill did not differ among 3 groups. The average of the dominant frequency component of dugong calls collected in Thai waters was $4179.8 \pm 1630.6$ Hz (S.D.), $2567.2 \pm 1371.3$ Hz (S.D.) in Toba aquarium, and $7362 \pm 1745.6$ Hz (S.D.) in Underwater world. This study provided detailed information on the vocalization pattern of the dugong, although the functional use of the calls in the context of acoustic communication is yet to be clarified.

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DEVELOPMENT OF A METHOD FOR MONITORING SHIP NAVIGATIONS

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Keywords: Dugong, AUSOMS-D, man-made noise, ship monitoring system

Abstract
Effects of man-made, low-frequency sounds on the behavior of the dugong were discussed in this paper. We developed a monitoring system of power-driven vessel to assess the impact of man-made noise on dugongs. Ship navigation was monitored by questionnaire for boaters and visual observations from an anchored vessel. We used automatic under water sound monitoring systems for dugongs (AUSOMS-D) to record under water sound and to track ship navigations acoustically. The visual observations were performed for total of 10 hours and 20 minutes and 72 ships were detected. The acoustic monitoring was conducted for over 117 hours and detected 345 ships. Shortest distance between the visual-observation platform and the power-driven vessels ranged from 18 to 500 m or more. We calculated the monitoring range of the system by comparing the result of the visual observation and the acoustic survey. The system detected 51.4 % of noise-making ships within 500 meters from the observation platform, and 78.1 %, 89.5 %, and 100 % within 300, 200, and 100 meters, respectively. The ship navigation showed bimodal occurrence during 0600-0700 and during 1500-1700. Trajectory of a ship navigation was drawn by using 3 sets of AUSOMS-D. This study provided information on detailed technique for tracking the noise-making vessels and will lead to tracking the vocalizing animal, such as the dugong. Interaction between the man-made noise and the dugong behavior, however, still remains to be clarified.

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THE CORRELATION BETWEEN VOCALIZATION AND BEHAVIOR OF CAPTIVE DUGONGS

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Keywords: Dugong dugon, vocalization, call duration, call frequency, sound pressure

Abstract
The vocalization of animals usually has a very important function in their intraspecific interference. Correlation between acoustical characteristics of the dugong calls and its behavior was described in this paper. We recorded behavior and vocalization of a male and a female dugong kept in Toba aquarium in Japan. Video-recording was conducted in the daylight (total 54 hours for the male and 18 hours for the female). The underwater sound recording was performed all through the survey (total 93 hours for the male and 31 hours for the female). Through the observation, 616 male calls and 35 female calls were recorded. Call duration ranged from 34 to 5039ms, with call frequency ranging 1.0-8.6 kHz and sound pressure level of 128.9 $\pm$ 12.1 dB for the male. And call duration ranged from 110 to 3426 ms, with call frequency ranging 1.9-3.7 kHz and sound pressure level of 128.7 $\pm$ 7.8 dB for the female. Frequency band of female calls were narrower than that of male calls. Most of the female vocalizations did not coincide with the male vocalizations, separated for more than 2 hours in timing (31/35). Inter-call interval of the animals was 300-800 ms, matching well the result of the previous study (vocalization rate at every 800-900 ms.). Contrary to wild population, however, the dugongs in the aquarium did not respond acoustically to the vocalizations of the other individual. This study provided descriptive information on the vocalization-related behavior of dugongs in captivity.

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DUGONG (DUGONG DUGON) AND SEAGRASS IN THAILAND: PRESENT STATUS AND FUTURE CHALLENGES

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Keywords: Dugong, seagrass, Andaman Sea, Gulf of Thailand, conservation, management

Abstract
Dugong and seagrass researches in Thailand have been principally conducted by Phuket Marine Biological Center (PMBC), Department of Marine and Coastal Resources (DMCR). The first stranded dugong was reported in 1979. The interview surveys with villagers and aerial surveys for dugong population have been started in 1993 and 1997, respectively. Several research topics were documented on dugong either biological or chemical aspects including the management plan. While seagrass surveys have been originally conducted in 1988 particularly in the Andaman sea coast and seagrass data based-information was officially available in 1994. Seagrass surveys in the Gulf of Thailand have been recently performed. Although, the diversity of only 12 seagrass species have been reported in Thai waters, the seagrass bed has shown an important role of as the nursery ground of economically important species. Complete Seagrass National Action Plan of Thailand will be launched in 2007.

Thai waters particularly in Trang province possibly contain the largest dugong population in Southeast Asia regions. In order to conserve this population and to establish the protected area for dugongs, more understanding of dugong behavior and movement or migration patterns is required. To obtain this information, the study of movement behaviors fitting with satellite PTTs and/or GPS transmitters, and strengthen the aerial survey in large scale areas are the priority researches needed in near future. Furthermore, DMCR with cooperation of the Australian government have already drafted Convention of Migratory Species (CMS) and Action Plan for Dugong in May 2006. Next step is to encourage the signatory states to adopt and implement the CMS.

In sub-tidal zone down to 10 m depth, it is necessary to use high technology of underwater video camera for seagrass surveying. In order to achieve sustainable seagrass management, not only biological-based researches but also economic-based researches are needed. Such as economical value of marine flora and fauna in seagrass ecosystem have to be evaluated. Knowledge of flowering and reproductive cycle of each seagrass species are still lacking in Thailand. Meanwhile methodology of restoration in degraded seagrass beds are carefully under investigation. In addition, integrated management of dugong and seagrass were excellent achieved in Thailand (i.e. universities, National Park, Wildlife and Plant Department, and NGOs). The productive researches in region or among the regions (i.e. Cambodia, Vietnam, Japan, France, and America) are under cooperation.

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ENDANGERED MAMMAL, DUGONG DUGON IN GULF OF MANNAR, SOUTHEASTERN INDIA – BASELINE INFORMATION ON THE STATUS, AWARENESS AND CONSERVATION ISSUES

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Keywords: Dugong, Gulf of Mannar, conservation, awareness, baseline status information

Abstract

FAO report in 1976 stated that Gulf of Mannar (GoM) had larger numbers of Dugong dugon, but now this mammal is included in the endangered list. A field survey was conducted in nine villages on the GoM coastline (108 km) between Rameswaram and Ervadi in order to collect baseline details of dugong population. Almost all fisher folk (above 30 years old) have good knowledge about dugong. Though, all fishermen in the same age group witnessed dugong while fishing, fisherwomen (58%) have seen it on the shore and rarely during seaweed collection. Targeted dugong fishing was in practice 20 years back for meat, but such practice does not exist now because of strict enforcement, except few illegal catches. Presently, fishermen notice these mammals 2-3 times in a week in Appa Island area (in the Keezhakkarai group), where vast seagrass meadows (Enhalus acoroides, Thalassia hemprichii, Halophila ovata, Halophila ovalis, Halodule uninervis, Cymodocea serrulata, Syringodium isoetifolium) are available and very rare sightings in others areas.

Inclusion of dugong under scheduled list and strict enforcement vigil are the only concrete steps at present to save these mammals. The main set back is that there is no research or conservation programme so far to save the existing dugong population in GoM.

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THE DISTRIBUTION OF SEAGRASS MEADOWS AND DUGONG FEEDING TRAILS AROUND TALIBONG ISLAND, TRANG PROVINCE, THAILAND

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Keywords: Dugong dugon, Halophila ovalis, feeding trail, distribution, seagrass meadow

Abstract
Survey on distribution of seagrass meadows and dugong feeding trails was performed in the dry seasons from 2004 to 2005 around Talibong Island, Trang Province, southern Thailand. Seagrass meadows were observed around Talibong Island and between Talibong Island and the mainland Trang. These seagrass meadows were composed of 11 species of seagrasses: Enhalus acoroides, Halophila beccarii, Halophila decipiens, Halophila ovalis, Halophila minor, Thalassia hemprichii, Cymodocea serrulata, Cymodocea rotundata, Halodule pinifolia, Halodule uninervis and Syringodium isoetifolium. The total numbers of 22 dugongs were observed on February 27 and 28, 2004 on and around these seagrass meadows by aerial surveys. These seagrass meadows were used for dugongs as feeding grounds. We investigated the distribution and species composition of the seagrass meadows of southeast coast of the island and observed dugong feeding trails at the same time by diving surveys in 2005. We confirmed the communities where H. ovalis, C. serrulata, C. rotundata and E. acoroides respectively dominated in these seagrass meadows. Dugong feeding trails were distributed densely in the communities where H. ovalis dominated in tideland. Therefore, we concluded that dugongs in this study site fed selectively at the H. ovalis community in tideland in the dry season.

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MIGRATION PAGGEN OF *LUTJANUS ARGENTIMACULATUS* IN THE MANGROVE ESTUARY IN TRANG PROVINCE, THAILAND AS REVELED BY ULTRASONIC TELEMETORY

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**KeyWords:** Mangrove estuary, *Lutjanus argentimaculatus*, migration, biotelemetry, ultrasonic transmitter

**Abstract**

Migrational pattern of mangrove jack *Lutjanus argentimaculatus* was studied at the mangrove estuary of Trang province, Thailand using ultrasonic telemetry. Ultrasonic coded transmitters were surgically implanted in 8 fish that were monitored with 10 receivers installed along a creek of the estuary in June 2006. Salinity, oxygen saturation and water temperature were surveyed in the study area in order to find the environmental cues for migration. The fishes were wild *Lutjanus argentimaculatus* caught by fisherman and reared in the fish cages for 3 month. All the individuals were released in the same site in the middle of the mangrove creek. The biggest fishes (>30 cm TL) showed a tendency to swim down to the open sea within 2 days. On the contrary smaller individuals (<25 cm TL) stayed in the mangrove creek system for a whole period of tracking. Observations of the physical parameters showed that the most of the fish movements were associated with the rise of the water level. The results indicated that the movement pattern of the mangrove jack depended mostly on the life stage of the individual and the phase of the tidal cycle.

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VISCERAL TEMPERATURE FLUCTUATION IN PACIFIC BLUEFIN TUNA IN THE AQUACULTURE NET CAGE BY FASTING AND DIGESTION

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Keywords: Bluefin Tuna, Thunnus thynnus, biotelemetry, data logger, fasting

Abstract
Using the temperature data logger, a number of studies were carried out to investigate the visceral temperature of bluefin tuna (Thunnus orientalis). Visceral temperature reflects health condition of the fish because warm visceral temperature permits high level of swimming activity and enhances protein digestion of the fish. Thus, the visceral temperature provides fundamental information for the development of bluefin tuna culture. It had been known that food intake and swimming is the major factors that induced visceral warming. In the fasting, only swimming factor induces visceral warming. However, the effect of fasting on visceral temperature is still unknown. Hence, this experiment was carried out to compare the visceral temperature between fasting and digestion period in bluefin tuna.

Two tails of young bluefin tuna with an average body weight of about 15 kg were selected in this study. Data loggers were implanted into abdominal cavity of each fish in order to measure the visceral temperature, surrounding water temperature and depth of their stay. After implantation of dataloggers, the fish were cultured in two different net cages for 30 – 50 days. One is the feeding net cage which fish was fed with mackerel as bait. Another is the fasting net cage which fish was fasted throughout the experimental period.

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DIEL MOVEMENT PATTERNS OF MEKONG GIANT CATFISH
PANGASIANODON GIGAS IN THE MAE PEUM RESERVOIR, THAILAND

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Keywords: pla buk, acoustic telemetry, hatchery-reared fish

Abstract
In order to better understand the movement patterns of Mekong giant catfish Pangasianodon gigas, 8 immature hatchery-reared catfish tagged with the acoustic transmitters with the depth sensor were released in the Mae peum reservoir (Area: 8.3 km², Maximum Depth: approx. 15 m deep), Thailand in May 2003. Fourteen fixed monitoring receivers were used to monitor the tagged fish after their release. Seven fish were monitored for a week to about 5 months, and the other fish was monitored for up to approximately 15 months. The less transmitter signals of each fish (N = 4), which were monitored for more than 10 days, were recorded at night than during a day. Furthermore, the periodograms resulting from Fourier analysis revealed a marked circadian rhythm for each fish. All tagged fish showed active vertical movement during a day and did not change their swimming depth at night. They spent their time at significant greater depth during a day than at night during the rainy season (May to November) (T-test, P < 0.001). These results imply that the catfish displayed diel movement between the offshore during a day and inshore areas of the reservoir at night during the rainy season.

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ESTIMATION OF ANIMAL POSITIONS IN A SMALL SCALE USING ULTRASONIC CODED TRANSMITTERS AND PASSIVE MONITORING RECEIVERS

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Keywords: acoustic telemetry, coral reef, animal movement, position estimates

Abstract
The movements of aquatic animals have most often been elucidated by active tracking, where an individual is fitted with an acoustic transmitter and tracked through a research vessel with a receiver. In recent studies, a method has been developed to estimate short-term centers of activity of migratory aquatic animals using an array of automated monitoring receivers (Simpfendorfer et al. 2002; Mitamura et al. 2005). The method allows the researchers to roughly monitor long-term movements of animals over broad areas without actively tracking them. However, the method has not been applied to animals utilizing a relatively small space. The object of this study is to develop a method to monitor the fine-scale movements of animals in a small range. To achieve this, we estimated transmitter positions in a small area (200 ~ 300 m) using multiple receivers arranged in an array. We obtained 22 hours of data of 10 ultrasonic transmitters deployed in different locations from 6 receivers. We then converted them to position estimates based on weighted means of the number of signal receptions at each receiver during a set time period. In order to test the accuracy of the method, we compared the estimated positions with those measured by GPS. Periods between 10 and 120 minutes were tested to find the most appropriate interval for estimating positions. In this paper, we introduce the results of the study and possible application of the method to revealing fine-scale long-term animal movements in a small area.

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ACCUMULATIONS OF HEAVY METALS IN SEAGRASSES FROM SATTAHIP DISTRICT, CHONBURI PROVINCE, THAILAND

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Abstract
This study attempts to investigate accumulation of heavy metal in above and below ground of seagrass from Satahip district, Chonburi province. Four seagrass species; Enhalus acoroides, Cymodocea serrulata, Halophila ovalis and Halodule pinifolia were collected in wet and dry seasons. Mercury concentration was determined by using a Cold-Vapor Atomic Fluorescence Spectrophotometer (CVAFE) and other metals (Cd, Pb, Cu, Zn, Fe, Mn) were determined by Atomic Absorption Spectrophotometer (AAS) after acid digested in a microwave digester. Concentration of heavy metal in seagrass were found to vary by season, species, part of seagrass and station. All the studied metals (excepted Fe) accumulated significantly higher in above ground than below ground. Cd, Cu, Mn and Hg concentrations in the wet season were significantly higher than the dry season. Difference seagrass showed difference capabilities in accumulating heavy metal. In both seasons Cd and Mn concentrations in C. serrulata were higher than in E. acoroides and H. ovalis. In the dry season Cu and Fe concentrations were higher than the wet season.

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PATERNITY ANALYSIS OF GREEN TURTLE (*Chelonia mydas*)
HATCHLINGS AT KHRAM ISLAND, CHONBURI, THAILAND, USING
MICROSATELLITE GENETIC MARKERS

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Keywords: paternity, green turtle, *Chelonia mydas*, microsatellite genetic markers

Abstract
Conservation and rehabilitation of endangered species, such as sea turtles, require ecological knowledge. We recognize the importance of reproductive biology of green turtle (*Chelonia mydas*) at a population level. Green turtle is one of the most abundant species in Thailand’s east coast area. We analyzed paternity of green turtle hatchlings at Khram Island, Chonburi, inferring from DNA fingerprints of hatchlings and their mothers. We analyzed DNA fingerprints of four females and their hatchlings (two clutches/female and 10 - 20 hatchlings/clutch), collected during April – September 2004, using five microsatellite DNA genetic markers (cm72, cm3, cm58, cc117; Fitzsimmons et al., 1995 and cc7; Fitzsimmons, 1998). Preliminary results indicated that each female mated with at least 2 – 4 males. The results also suggest that multiple paternity is quite common in this population (100% of the females examined). The results confirm previous findings about multiple paternity in the Khram Island population of green turtle. This information may help the planning of conservation efforts and a breeding program that is consistent with the natural mating behavior.

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HEAVY METAL IN SEAGRASSES FROM LIBONG ISLAND AMPHUR KANTANG, TRANG PROVINCE

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Abstract
Six species of seagrasses; Enhalus acoroides, Halophila ovalis, Cymodocea serrulata, Cymodocea rotundata, Thalassia hemprichii, Halodule uninervis were collected from Libong Island Amphur Kantang, Trang Province by a diver. The seagrasses samples were washed with clean seawater and deionized water to remove suspended material and any organisms on the surface of the seagrasses. The above and below ground parts of the seagrasses samples were separated, freeze-dried and homogenized. The seagrass samples were digested with subboil distilled nitric acid in a microwave digester. Mercury in the digested sample was determined by cold vapor atomic fluorescence whereas cadmium, copper and lead contents were determined by graphite furnace atomic absorption.

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PRELIMINARY STUDY ON HEAVY METAL ACCUMULATION IN SEA TURTLE FROM THE ANDAMAN SEA OF THAILAND

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Abstract
Tissues samples from one hawksbill turtle and four green sea turtles from the Andaman Sea were dissected from strand sea turtles. Mercury, cadmium, copper and lead contents in the tissues were determined after digested with concentrated acid. Mercury in the digested sample was determined by cold vapor atomic fluorescence whereas cadmium, copper and lead contents were determined by graphite furnace atomic absorption. The highest mercury and copper contents were found in liver tissue followed by kidney tissue of both hawksbill and green sea turtles. The highest cadmium content was found in kidney tissue followed by liver tissue of green sea turtles. Since the tissue sample from hawksbill turtle contained only muscle and liver tissues, the highest cadmium content in hawksbill turtle was found in liver tissue. The highest lead content was found in food from a stomach of green sea turtles.

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INTERNATIONAL FRAMEWORK TO REDUCE SEA TURTLE MORTALITY ASSOCIATED WITH PELAGIC LONGLINE FISHERY

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Keywords: bycatch, FAO, longline fishery, RFMO, sea turtle

Abstract
There has been increasing concern over interactions of sea turtles with fisheries including pelagic longline, and worldwide measures on sea turtle conservation and fisheries management are required. Here I summarize recent development of international framework of FAO and Regional Fisheries Management Organizations (RFMOs) to reduce sea turtle mortality associated with pelagic longline fishery. In March 2004, report of the FAO Expert Consultation emphasized the importance of holistic management for sea turtle populations. FAO held a Technical Consultation on Sea Turtles Conservation and Fisheries in November 2004 and developed Guidelines to Reduce Sea Turtle Mortality in Fishing Operations under knowledge summarized by the Expert Consultation. The FAO Guidelines specified the following management measures for longline fishery: i) development and implementation of appropriate combinations of hook design, type of bait, depth, gear specifications and fishing practices in order to minimize bycatch or incidental catch and mortality of sea turtles; ii) research should include consideration of the impact of various mitigation measures on sea turtles, target species and other bycaught or incidentally caught species, such as sharks and seabirds; and iii) retention and use of necessary equipment for appropriate release of bycaught and incidentally caught sea turtles, including de-hookers, line cutting tools and scoop nets. In RFMOs, Inter-American Tropical Tuna Commission (IATTC) has launched programs to reduce sea turtle interaction with fisheries since 2000. In 2004, IATTC adopted resolution on a Three-Year Program to mitigate the impact of tuna fishing on sea turtles. The program included: i) collection and analysis of all available information on interactions with sea turtles; ii) mitigation measures for reducing sea turtle bycatch; iii) industry education; and iv) capacity building in coastal developing countries. Other RFMOs also encourage implementation of the FAO Guidelines to reduce the incidental catch of sea turtles and to ensure the safe handling of live-captured turtles.

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RESEARCH ON INTERACTION OF SEA TURTLE WITH PELAGIC LONGLINE FISHERY FOR ITS MITIGATION IN THE WESTERN NORTH PACIFIC

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Keywords: bycatch, circle hook, longline fishery, mitigation measure, sea turtle

Abstract
There has been increasing concern about the impact of longline fisheries on sea turtles. Sea turtle interactions and its mitigation measures have to be examined for each fishing ground. We conducted shallow-set longline fishing operations on a research vessel in the western North Pacific, May-July, 2002-2004, to investigate sea turtle interaction with pelagic longline fishery and to preliminarily examine the potential gear modifications (bait and hook types) to reduce sea turtle bycatch or mortality. A total of 54 loggerhead turtles Caretta caretta were caught in 76 operations (about 74,000 hooks), which were all alive. The mean straight carapace length was 67 cm (range: 52 - 82 cm); this suggested most of loggerhead turtles caught in this area were subadult. Loggerhead turtle catches ranged from 19.1 to 24.5 °C in sea surface temperature, which concentrated around the boundary of warm and cold water masses in the Kuroshio extension. Loggerhead turtle catch was more frequently observed on hooks hauled after sunrise. For bait type, the catches by mackerel bait were fewer than those by squid bait. In circle hook trial in 2003, the deep-hooking rates (proportion of deep-hooked (at esophagus or pharynx) to total in numbers) on squid bait were 0.41 and 0.23 in 3.8 sun conventional tuna hook (n=22) and 3.8 sun Tankichi type circle hook (n=13), respectively, but the difference was not significant (P>0.05, extended Fisher’s exact test). In 2004 the large 18/0 circle hook were tested, but its effect was not clarified due to very small catch numbers. Following these researches, we are implementing sea turtle mitigation studies, with consideration of their impacts on target and other non-target species catches.

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VERTICAL MOVEMENT OF HOOKING SEA TURTLES
IN PELAGIC LONGLINE FISHERY

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Keywords: longline fishery, post-hooking, sea turtle, vertical movement

Abstract
Major cause of mortality of sea turtles incidentally caught by longline fishery has been considered to drowning due to prevent from surfacing with heave load of the fishing. Investigation of post-hooking sea turtle is helpful to alleviate mortality or damage of the hooking turtle. We analyzed the vertical movement of the four turtles based on the data obtained from small bathy-thermograph systems attached near hooks to investigate motion or setting depth of longline gear in fishing operations on research vessels. With simply theoretical calculation based on the fishing gear weights in water and the line catenary figurations, we also estimated forces on the surfacing sea turtles from fishing gears. The vertical data about three olive ridley turtles Lepidochely olivacea obtained at the eastern North Pacific in October 2004, and one loggerhead turtle Caretta caretta at the Western North Pacific in July 2005. All turtles were alive when retrieved on deck, except for one olive ridley turtle that dehooked on retrieving. All turtles showed ascending movement just after hooking and reached surface within 10 min. The three olive ridley turtles showed 1.2, 2.1 and 3.6 bouts of vertical movement (a set of movement consists of ascent and descent) per hour with the mean interval between bouts of 13.0, 2.4 and 23.1 min, respectively. The loggerhead turtle showed 2.3 bouts per hour with the mean interval between bouts of 23.1 min. Although patterns of post-hooking behavior were different between turtles, turtles spent sufficient time at surface layer (shallower than 10m). When the turtles were in surface layer with the fishing gear they hooked, the forces on the turtles from the fishing gear were estimated at 0.6-1.6 kgf. In these cases, the hooked turtles could surface to breathe even though they were weighted with fishing gear.

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DEEP SETTING OF TUNA LONGLINE HOOKS USING MID-WATER FLOAT SYSTEM WITH LONG FLOAT LINES TO AVOID SEA TURTLE BYCATCH

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Keywords: sea turtle by-catch, tuna longline, deep hook setting, mid-water float

Abstract
This study presented mid-water float system with long float lines to avoid hooks being set at the habitat of sea turtle. Sea turtles are endangered species, and bycatch of sea turtle on tuna longline fisheries effect on sea turtle mortality is concerned in the present world. Bycatch of sea turtle occasionally occurred on hooks set at shallower waters in tuna longline fishing, while tuna, especially bigeye tuna (Thunnus obesus) was caught mostly on the hooks set at deeper during a daytime. We developed mid-water float system as a method of setting the hooks at almost the same depth. When enough long float line was deployed with mid-water float system, all hooks could be set in water deeper than where sea turtle predominantly forage and in the depth of tuna habitat.

Experiments of deep setting with mid-water float system were carried out in Indian Ocean on a research training ship, the Umitakamaru, Tokyo university of Marine Science and Technology in December 2005. One mid-water float (buoyancy in 2200gf, 2560gf, respectively) was attached to the center of one basket mainline which was hung with the float lines of 100m length. One basket of the longline gear had 12 branch lines, and the length of mainline per one basket was 588m. The conventional longline setting (the length of float lines were set at 40m) without any mid-water float was also conducted as a control treatment.

The mainline with long float lines were set at the depth from 125m to 175m. The vertical distances between shallowest and deepest hooks of the deep setting with mid-water float was at most 50m, while that of a conventional longline setting was over 150m. According to the video observation on on-deck operation, mid-water float could be snapped onto the mainline in the same way as the branch lines without any disturbance, and no entanglement of long float line occurred during the experiment. The mid-water float system with long float lines allowed all hooks to be set enough deep for the tuna catching, which is associated with avoidance of sea turtle bycatch as well as more effective tuna catch.

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MATING AND NESTING BEHAVIOR OF HAWKSBILL TURTLE

(Eretmochelys imbricata) IN CAPTIVITY

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Keywords : hawksbill, Eretmochelys imbricata, mating behavior, nesting behavior

Abstract

In the previous year’s SEASTAR 2000 symposium, we reported that two long term-reared mature females of hawksbill turtle laid a total of 894 eggs at 7 times during nesting periods. The rearing methods and the mature male and females used for observations were to same as the previous year’s report. In the present study, details of the mating and nesting behavior were monitored over 24 hour periods by the highly sensitive cameras fixed on the edge of the tank observation windows and on the upper side tank wall connected to the artificial laying sand beach, respectively. These graphics were recorded on hard discs, and then both mating and nesting behaviors were analyzed over subsequent days. Furthermore, to investigate the seasonal development of follicles in the females, they were monitored using an ultrasonograph at 3-4 times / month during the nesting periods, and 1-2 times / month at other times. Results of monitoring showed that the follicles of the two females were found to involute spontaneously after the nesting periods in 2004, and thereafter were not observed until the next nesting season. However, follicles developed from September to December after nesting periods in 2005 and ranged from 1.5 to 2.6 cm in diameter in April in 2006. In March, mating behavior was observed, and one female mated with the male for 120 minutes, and the other mated for 70 minutes at one time, respectively. Shelled eggs of the two females were observed by ultrasonograph from 19 to 20 days after mating, thereafter first laying was observed from 24 to 33 days after mating. Both females laid eggs a total number of 6 times, and the laying interval ranged from 14 to 18 days after first laying. Based on these results, we considered that ovulation cycle of the hawksbill turtles was two years, and the first laying occurred approximately in 1 month after mating in captivity.

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IMPLICATION OF PREDATION INCIDENCES BY ANT SPECIES ON GREEN TURTLE NESTS IN CHAGAR HUTANG REDANG ISLAND

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Abstract

In Chagar Hutang, Redang Island, Dorylus laevigatus and Pheidologeton affinis were the serious predatory ant species of the green turtle nests, and it was hypothesized that they were competitors to each other. Both species were consisted of polymorphic workers, and conducted mass raiding upon turtle nests. As a result of the observation of foraging behavior of ant species in 2004 by using food traps, D. laevigatus (a subterranean species) shared the bait with some terrestrial ant species in the early stage of the experiment except P. affinis. However, P. affinis was a terrestrial species and established satellite nests in the traps to occupy the bait. Traps placed in the habitat of Anoplolepis gracilipes were immediately occupied by them during whole experimental period and other terrestrial ant species were not found in the traps. Anoplolepis gracilipes seemed to be the strongest competitor among the terrestrial ant species in Chagar Hutang, which might result in reduction of the population number of P. affinis with the existence of A. gracilipes. As a result, D. laevigatus became a major predator upon turtle nests, which might cause the high rate of predation incidences in this area in 2004. The elimination of A. gracilipes may reduce predation incidences upon turtle nests by D. laevigatus.

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ORIENTATION TO THE LIGHT AND SWIMMING BEHAVIOR BY GROWING STAGE OF THE GREEN TURTLE HATCHLINGS

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Keywords: Head-starting, Magnetic orientation, Wave orientation, Dispersal movement, Chelonia mydas

Abstract

Head-starting is the practice of growing hatchlings in captivity to protect them from the high rates of natural predation that would have otherwise occurred in their early stage. It has been concerned whether the head-started turtles disperse to the open sea after the release like wild turtles, in other words, they are able to maintain the offshore headings, because they had experienced rearing for a while and then were no longer in “frenzy period”. Sea turtle hatchlings use a well-developed magnetic compass in combination with the sea light and wave cues to migrate offshore. Little known fact is, however, which growing stage this instinct continues to occur. In order to investigate the growing stage which hatchlings keep their willingness to migrate offshore, we conducted the orientation experiment in the laboratory and tracking experiment about the green turtle hatchlings by the growing stage. In this paper, we will introduce the result of these experiments.

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ESTABLISHMENT OF BIOLOGGING APPROACH OF SEA TURTLE IN THE NERITIC ENVIRONMENT

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Keywords: Data logger, Time scheduled releaser system, Radio telemetry

Abstract

Recently, the deployment of some data loggers is emerging as a powerful tool for quantifying behavioral parameters of aquatic animals. However, in the history of the study about sea turtles, this approach has been applied only into gravid female turtles which land on the same beach several times within a nesting season because data loggers require physical recovery for data retrieval. Therefore, our knowledge of ecology on sea turtles in the neritic and oceanic environment is still rudimentary. We therefore invested an automatic time scheduled release system that allows the loggers to be located and retrieved using VHF radio and ultrasonic signals without recapturing sea turtles. The data logger-recovery experiment was conducted on sea turtles in the neritic environment of the Yaeyama Islands, Okinawa, Japan. We will introduce the result of this experiment.

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DEEP DIVE AND SHALLOW DIVE: WHICH IS BETTER FOR GRAVID FEMALE GREEN TURTLES?

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Keywords: seasonal difference, diving behavior, water temperature, green turtles

Abstract

For maximizing reproductive output, gravid female green turtles save the cost of remaining at the nesting area for several weeks while consecutive eggs are laid. To examine the diving behavior of gravid females during inter-nesting period, we used time-depth-temperature data loggers. Five data loggers were attached to the carapace of gravid females in Huyong Island, Thailand with a calm dry season and a monsoonal rainy season (four loggers in dry season and 1 logger in rainy season). Ambient water temperature recorded by the data loggers showed that ocean surface mixed layer was developed in rainy season, suggesting the shallow areas were roughed by the movement of water, caused by strong ocean winds and heavy rain. All turtles continuously dived during inter-nesting period. However, we found a seasonal difference in diving behavior between two seasons. In dry season, turtles rested at the shallow water at the depth of less than 20 m. In contrast, a turtle in rainy season frequently dived in the depth of more than 20 m. Although there was a positive relationship between dive depth and dive duration, the deep dives more than 30 m often had short dive duration and bottom ratio. This result suggests that turtles cannot obtain an assured resting time in the deep diving. This hypothesis is supported by the results of our previous study that reproductive output (number of clutches and clutch size) in dry season was higher than in rainy season. In fact, shallow resting dive at a depth of less than 20m is a worldwide resting behavior in gravid female green turtles.

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STUDIES ON SEA TURTLES OF ANDAMAN AND NICOBAR ISLANDS:
OVERVIEW OF RESEARCH AND NEEDS

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Keywords: Andaman and Nicobar Islands, green, hawksbill, olive ridley, leatherback,
Rutland Islands, Cuthbert Bay, Galathea beach

Abstract

Andaman and Nicobar Islands archipelago is unique among the various ecosystems of India. Four species of sea turtles have been reported and previous studies indicated the existence of India’s best nesting beaches for Dermochelys coriacea, Eretmochelys imbricata and Chelonia mydas in these Islands. Green turtle is the common and widespread species. Hawksbill population is the largest in India and that of leatherback in Nicobar is one among the four colonies with more than 1000 individuals in Indo-Pacific. But, the studies pertaining to sea turtles in Andaman and Nicobar Islands are limited. There exist no earlier records on status and distribution of sea turtles in Andaman and Nicobar Islands until the initiation of survey by Bhaskar in 1978. In Nicobar Islands, most of the leatherback rookeries were found only in early 1990s. In general, most of the studies were limited to the location of turtle nesting beaches and only a very few places like Cuthbert Bay on the east coast of Andaman Islands, Rutland Islands of South Andaman and Galathea beach of Great Nicobar Islands have been studied to some extent. This could possibly be attributed to the remoteness of many islands. Detailed studies on biology, population dynamics, migration, foraging and nesting are lacking. The 2004 Indian Ocean tsunami exposed this lacuna as its effect on the sea turtle population in most of the places could not be established due to the lack of previous data. This paper reviews the study on sea turtles of this island ecosystem and important gap areas have been identified for a comprehensive study.

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SPECIES, DISTRIBUTION AND ABUNDANCE OF GIANT CLAMS ALONG THE WESTERN COAST OF THAILAND

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Abstract
A survey for species, distribution and abundance of giant clams was conducted in 2006 by a stratified strip transect method (25 x 4 m per transect). Transects were deployed parallel to the coastline (1 transect on the reef flat and another 4 transects on a reef slope). Nineteen sites in the Andaman Sea were surveyed i.e. Surin Islands 4 sites, Similan Islands 9 sites, Rok Islands 1 site, Tarutao Islands 4 sites and Adang-Rawi Islands 15 sites. There were 3 species of giant clams i.e. Tridacna crocea, Tridacna maxima and Tridacna squamosa. Tridacna maxima preferred the reef edge habitats while T. crocea was likely to live along the reef flat. These two species (T. maxima 13.1 ± 15.8 ind. per sq.m and T. crocea 11.5 ± 23.0 ind. per sq.m) were more significantly abundance than T. squamosa. (13.1 ± 15.8 ind. per sq.m). In addition, T. squamosa preferred deeper habitat along the reef slope. Giant clams were found highest at Adang-Rawi Islands (31 ind. per sq.m) while the other surveyed sites were in average 1-4 ind. per sq. m.

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PROGRESS OF SEA TURTLE RESCUE AT PHUKET MARINE BIOLOGICAL CENTER

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Keywords: stranding, rescue, Phuket Marine Biological Center

Abstract

Establishment of marine species stranding rescue project was one of the Marine Endangered Species Unit, Phuket Marine Biological Center’s strategies to conserve those threatened species. It is an annual project and was launched on January, 2005 and continued until present time (September, 2006). The project rescued and rehabilitated 51 stranded animals, 12 animals died during rehabilitation and 39 animals were successfully rehabilitated and were released back to the area where they came from. Also, there were 78 dead strandings occurred during the period. Post mortem examination on those cases was a good resource for much valuable information about their biology. This project is considered to be a successful operation and will likely be continued as a long term project.

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SATELLITE TELEMETRY STUDY ON HAWKBILL (*Eretmochelys imbricata*) IN PENINSULAR MALAYSIA

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**Keywords**: Hawksbill, Upeh Island, Satellite, Internesting, Migration

**Abstract**
This study was conducted on 16 June 2006 at Upeh Island, Malacca, Peninsular Malaysia. Pulau Upeh, is situated in the Strait of Malacca waters has recognized as a major nesting site for hawksbill in Peninsular Malaysia. The objectives of this study are to determine the internesting period and migration route of hawksbill completing her nesting activities at Upeh Island, Malacca. An adult female hawksbill turtle was selected for this study which the size of curve carapace length (CCL) is 80.0 centimeter, straight carapace length (SCL) is 72.6 cm and the weight is 59.0 kilogram. One unit of Platform Transmitter Terminal (PTT) had been attached to the dorsal part of carapace with special glue. The turtle was released to the sea at 1500 (local time) on 16 June 2006. The migration route of this turtles was detected by ARGOS satellite: KIWISAT 101 ARGOS PTT. During the first three weeks this turtles is migrates nearby the Upeh Island waters and manage to nest two times with the internesting period is nine (9) days. On the 10th July the turtle gradually swimming southwards near Muar and Pontian waters. Then a week later she entered Singapore waters and towards Riau Archipelago, Indonesian waters. To date she still swimming in Riau Archipelago waters.

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NESTING BIOLOGY OF GREEN TURTLE (*Chelonia mydas*)
AT HUYONG ISLAND

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**Keywords:**

**Abstract**
Nesting data of green turtles at Huyong (part of Similan Islands’ Marine National Park) during 1995-2006 was analyzed. The result showed increasing trend of nesters. Each nester laid 1-9 clutches per season with the average of 5 clutches per season. The highest nesting statistic was in 2001, found 92 clutches (10,183 eggs). The number of egg per clutch ranged between 101-120 eggs. The nesting occurred year round with the peak during May to August. The range of curved carapace length of nesters was 96-100 cm.

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PRELIMINARY SURVEY ON SEA TURTLE NESTING AT KRA ISLAND,
NAKHON SI THAMMARAT PROVINCE

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Key words: sea turtle, nesting

Abstract

The nesting of sea turtle survey at Kra Island, Nakornsi Thammarat Province by walking through the night on the beach methodology was taken about 5-10 days per month during March to August 2006. Two species of sea turtle, Green turtle (*Chelonia mydas*) and Hawksbill turtle (*Eretmochelys imbricata*), were observed nesting on this area. There were eight Green turtles and only one nesting of Hawksbill turtle, found in August. All of the turtles were tagged with microchip tags. Also, the biological data such as carapace length and width, nesting cycles and individual marker of the nesting females was recorded in this monitoring program. Besides, one of the Green turtle was setup the satellite transmitter on 12 August 2006 which was found moving to live in Vietnam later. In this survey, the total amount of clutches was fifteen composed of 1,560 eggs were recorded. In these amount 102 eggs was Hawksbill turtle eggs. Eleven clutches of eggs was collected back for the incubation. However, there were at least 12 clutches might be stolen by poachers or fishermen, discovering egg-search apparatus and dispersed eggs beside nests were always displayed in each survey. It means the crime of natural resources destroying was still conducting in the luxurious area of the Kra archipelago. Therefore, conservation and management on sea turtle nesting, coral reefs and other marine resources in this area are urgently to be protected.

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INVESTIGATION OF BLOOD LEAD CONCENTRATION IN SEA TURTLE STRANDED IN ANDAMAN SEA OF THAILAND

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Keywords: blood lead concentration, sea turtle, Andaman Sea

Abstract
Sea turtles play a significant role in coastal and marine ecosystems. Today the survival of these species is severely threatened by human-related activities, such as the increase recreational uses of beaches and their maintenance, commercial fishing, oil spills. In addition to the threat directly posed by human activities, factors such as the presence of predators, infectious diseases, and the bioaccumulation of heavy metals, are also responsible for the decline and depletion of sea turtle populations. Blood samples of stranded sea turtles rehabilitated at Phuket Marine Biological Center (PMBC) were collected during summer 2005. Three species of sea turtles were investigated in this study including 5 green turtles (Chelonia mydas), 4 olive ridley turtles (Lepidochelys olivacea) and 2 hawksbill turtles (Erethmochelys imbricata). Blood lead concentration were measured using LeadCare blood lead testing system. Lead uptake was found in 36% of sea turtles investigated in this study.
STRANDING RECORDS OF CETACEANS IN THAILAND

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Abstract
Stranding data of cetaceans in Thailand dated back to 1993 has been analyzed. Total numbers of 375 stranded cetaceans over the past 13 years have been recorded. Twenty-two species have been identified i.e. Suborder Myticeti (Balaenoptera edeni & Balaenoptera physalus) and Suborder Odonticeti (Feresa attenuate, Ziphius cavirostris, Kogia simus, Pseudorca crassidens, Neophocaena phocaenoides, Lagenodelphis hosei, Mesoplodon ginkgodens, Sousa chinensis, Orcaella brevirostris Tursiops aduncus, Peponocephala electra, Kogia breviceps, Grampus griseus, Steno bredanensis, Globicephala macrorhynchus, Physeter macrocephalus, Stenella longirostris, Stenella attenuate, Stenella coeruleoalba & Delphinus capensis). Among these, Brydes’ whale (Balaenoptera edeni) has highest occurrence frequency (74 records) following by bottlenose dolphin (Tursiops aduncus 49 records), finless porpoise (Neophocaena phocaenoides 45 records) and Irrawaddy dolphin (Orcaella brevirostris 41 records).

There were 4 species only found in the Gulf of Thailand (Balaenoptera physalus, Delphinus capensis, Globicephala macrorhynchus & Peponocephala electra), while there were 5 species only found in the Andaman Sea (Kogia simus, Lagenodelphis hosei, Mesoplodon ginkgodens, Physeter macrocephalus & Ziphius cavirostris ). The preliminary study on population genetic of 4 finless porpoise revealed that the two populations (the Gulf of Thailand VS the Andaman Sea) were not mixed.

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RESEARCH AND CONSERVATION OF IRRAWADDY DOLPHIN
(*Ocaella brevirostris*) IN SONGKHLA LAKE, THAILAND

Santi Nilwat, Supot Chantrapomsyl and Kongkiet Kitiwattanawong

Abstract
POSSIBILITY OF SIGHTING MONITORING SURVEYS ON LARGE MARINE ANIMALS OR COASTAL BIOLOGICAL CONDITIONS BY AN AIRSHIP, THE ZEPPELIN NT

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Keywords: airship, Zeppelin NT, monitoring survey, large marine animals, coastal biological conditions

Abstract
It should be pointed up that an airship, the Zeppelin NT has useful and effective observation platforms for sighting monitoring surveys on large marine animals and coastal biological environments. Large marine animals such as whales, dolphins, dugongs, sea turtles, tunas and rays or coastal biological conditions such as ecological states of coral reefs, sea grasses and sea weeds can be watched and monitored timely by eyes, cameras and video cameras from an observation platform of an aircraft. The most important properties characterized an airship as compared with a small airplane or a helicopter may be following items; a hovering performance in the air, a lower flight speed maintenance, a lower flight position keeping and a lower engine noise. These properties are very useful and effective research technologies for ecological and sociological studies on large marine animals or coastal biological conditions. The Zeppelin NT owned by Nippon Airship Company NAC in Japan is a semi-rigid airship with the non-flammable noble gas helium, but it is unlike non-rigid blimps. It has an internal triangular truss made of graphite-reinforced plastic and three longitudinal girders made of aluminum. NAC provides the Zeppelin NT for research missions on environmental observations or prospecting natural resources. It is expected to be applied the Zeppelin NT to conserve marine animals or coastal environments continuously.

Major technological specifications of the Zeppelin NT are as follows; Body length: 75m long, Body height: 17.5m, Maximum width: 19.5m, Envelope volume: 8225 m³, Payload: 1900kg, Top speed: 125km/h, Standard cruising speed: 70km/h, Standard operational altitude: 300m, but up to 2600m, Three propeller engines of the type Textron Lycoming IO-360 with a power of 147 kW [200 metric hp] Two lateral engines with tilting propellers and Total number of passenger included two pilots: 14.

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