

Management and Conservation Program of a Protected Wildlife Species: The Case of Marine Turtles in the Philippines

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The Pawikan Conservation Project (PCP) promulgated through EO 542 is the government's response to conserve and manage the dwindling marine turtle resources of the country. Currently attached to the Wildlife Division of the Protected Areas and Wildlife Bureau, the PCP is responsible for the development and implementation of conservation and protection policies, management and propagation schemes, and massive information and education programs aimed at ensuring the survival and growth of the country's remaining marine turtle population. Three major activities are implemented by the project: resource management and protection, research and investigation, and information and services extension. These activities are concentrated mainly in Turtle Islands, Tawi-Tawi which has the highest density of nesting green turtles in the country. In spite of the internal and external constraints of the PCP, its successes provide useful lessons to other conservation efforts.

Introduction

The worldwide exploitation of marine turtles for commercial trade has led to the rapid population decline of these unique reptiles which are believed to have existed more than 100 million years ago. This prompted marine turtle conservationists and specialists, international conservation organizations, and governments to develop conservation measures, legislations, and programs, to save the remaining marine turtles from extinction.

Of the eight recognized species of sea turtles worldwide, five have been reported to occur in the Philippines. These are (1) Green Turtle (*Chelonia mydas*); (2) Hawksbill (*Eretmochelys imbricata*); (3) Olive Ridley (*Lepidochelys olivacea*); (4) Loggerhead (*Caretta caretta*); and (5) Leatherback (*Dermochelys coriacea*).

A task force on marine turtles (Task Force Pawikan) was created in the Philippines through the issuance of Executive Order No. 542, on 26 June 1979. During the first two years of its operations, the project was attached to the Office of the President and was afterwards transferred to the Ministry of Natural Resources (now DENR), where it was placed under the Office of the Deputy Minister

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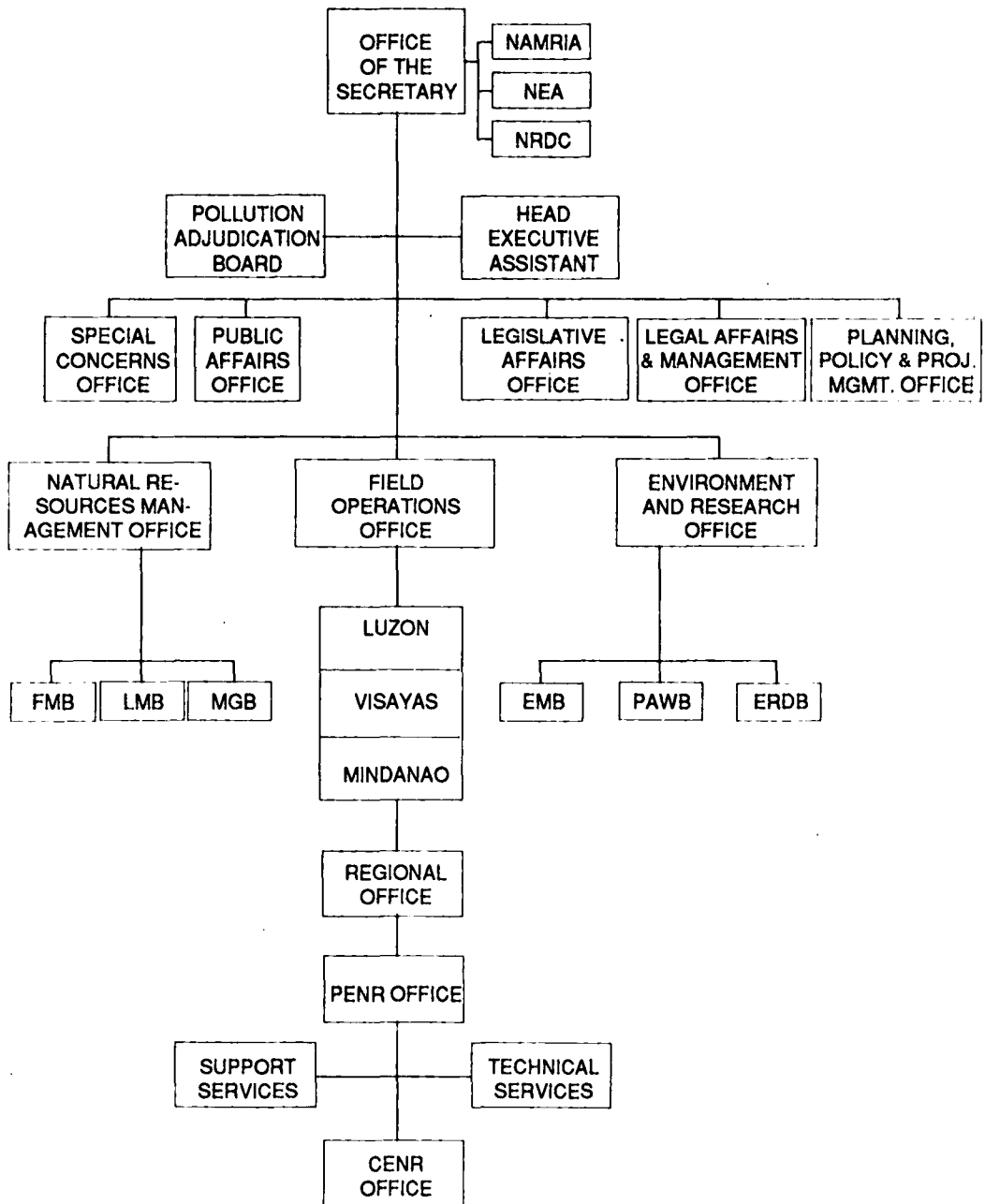


Figure 1. Present Organizational Structure of the DENR.

(Undersecretary). With the issuance of Special Order No. 78 series of 1988, it was put under the Wildlife Division of the Protected Areas and Wildlife Bureau (PAWB) (Figure 1).

The task force, now known as the Pawikan Conservation Project (PCP), is tasked to pursue the following objectives: (1) enforce existing rules and regulations pertaining to marine turtles; (2) conduct field investigations relevant to the formulation of updated policies for the economic utilization of the species; (3) conduct information and extension work aimed at making people responsive to and participative in the marine turtle conservation movement; (4) conduct socioeconomic surveys to be used as basis in the formulation of substitute avocations for people who are currently utilizing marine turtles as income source; (5) coordinate with international agencies concerned with the conservation of marine turtles; and (6) select, establish and manage marine turtle sanctuaries exclusively for the propagation and absolute protection of marine turtles.

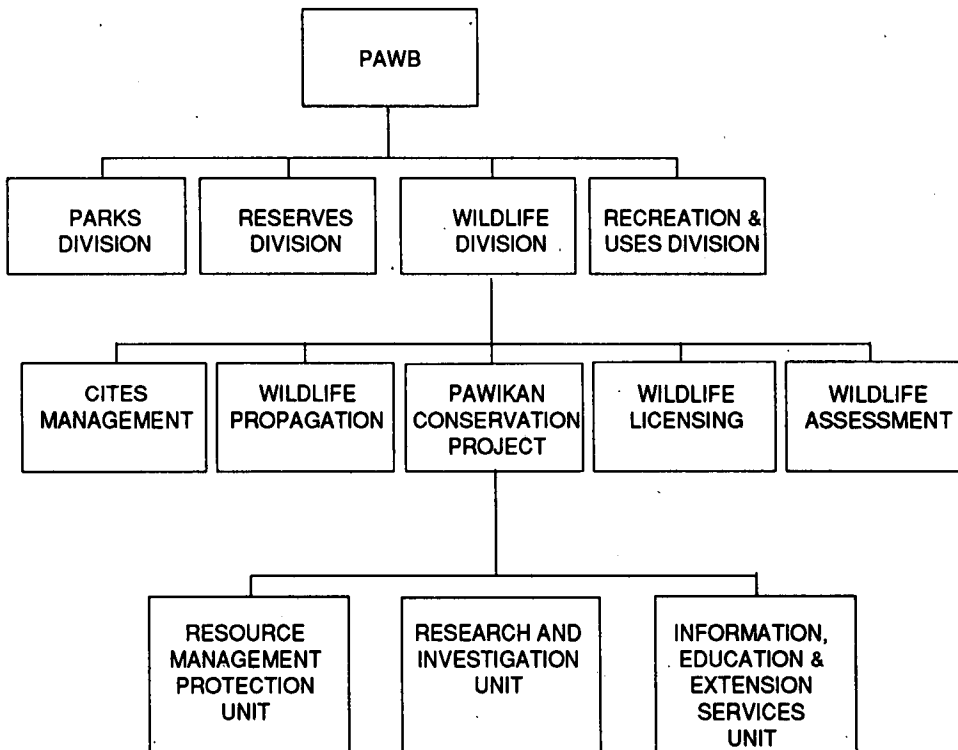


Figure 2. Description of Project Management (Organizational Structure)

To perform these tasks, the PCP instituted three major units implementing specific activities to conserve and manage the country's remaining marine turtle resources. These units are Resource Management and Protection Unit, Research and Investigation Unit and Information and Extension Services Unit (Figure 2).

Although mandated to implement a nationwide conservation program, the PCP is constrained to concentrate its activities on Turtle Islands in Tawi-Tawi. This is due to insufficient funds for national coverage and the significance of Turtle Islands in terms of density of nesting green turtles. The significance of the Turtle Islands and its urgent need for a more effective management scheme are stressed in the reports of the PCP-PAWB-DENR and Dr. Colin Limpus of the Queensland National Park of Australia who is also a member of the IUCN Marine Turtle Specialist Group.

- (1) The Turtle Islands are traditional nesting area of the green turtle (*Chelonia mydas*). Because sea turtles exhibit site fixity, i.e., they return to their natal beach, the loss of the turtle population in Turtle Islands will be permanent since a particular population could not be replenished by any other population, even of the same species;
- (2) The Turtle Islands (of the Philippines and Sabah) and the Berau Islands (Indonesia) support the only major (i.e., thousands of nesting females annually) green turtle breeding aggregation in the ASEAN Region. There are only about 10 known major green turtle breeding aggregations in the world;
- (3) The Turtle Islands supply green turtles to feeding grounds throughout the ASEAN Region from which they migrate back to breed in the Turtle Islands;
- (4) Approximately 80 percent of all green turtles nesting each year within the Philippines occur at the Turtle Islands. Success in the management of this particular rookery will therefore have a significant positive impact on the nationwide population of green turtles;
- (5) Annually, tens of thousands of green turtles are being harvested for food and the stuffing trade particularly throughout the Philippines and Indonesia. Since the Turtle Islands are the principal breeding place for the species within the ASEAN Region, it follows that these are principally Turtle Islands' turtles that are being harvested. This has been confirmed by the recovery of Turtle Islands tagged turtles among the turtles harvested throughout the Philippines and Indonesia.
- (6) The mass harvesting of turtle eggs has been in progress in the Turtle Islands for decades. As a result, the green turtle population of the Turtle

Islands has shown a more than 88 percent decline in egg production over a period of 39 years from 1951 to 1990;

- (7) Existing conservation and management practices being implemented in the Turtle Islands is inadequate to halt the continuing decline in the green turtle population. This is primarily due to lack of sufficient funds;
- (8) Unless this population decline is stopped and reversed, it is anticipated that within a decade or so the annual turtle egg production will be inadequate to feed even the local inhabitants;
- (9) To ensure future recovery of the population, the turtles' nesting beaches must be managed principally to maximize hatchling production; and
- (10) The Turtle Islands is a natural laboratory where marine turtle scientists can conduct scientific researches on most aspects of the biology and ecology of green turtles all year around. This nesting ground can be an important source of scientific basis for updating conservation and management policies for marine turtles.

The project activities in the Turtle Islands and in other parts of the Philippines focus on the following: resource management and protection, research and investigation, and information and extension. An organizational unit is assigned to handle each category of activities.

Resource Management and Protection

The Resource Management and Protection Unit implements the activities aimed at propagating the marine turtles. It ensures the effective enforcement of existing rules and regulations pertaining to marine turtle conservation. Part of the enforcement is the managing and maintenance of marine turtle sanctuaries and the prohibition of the commercial use of turtles and turtle by-products. The implementation of rules and regulations involves deployment of technical staff based in Manila to the Turtle Islands assisted by locally hired Forest Rangers.

Maintenance and Monitoring of Declared Sanctuaries

Although nine sites are declared as sanctuaries, the concentration of this specific activity is in Baguan Island Marine Turtle Sanctuary (BIMTS) in the Turtle Islands. The maintenance of BIMTS has great importance due to its high nesting density. This island sanctuary has a land area of only 35 hectares but accounts for more than 50 percent of the total egg production of the entire Turtle Islands. The activities in the sanctuary includes daily patrols within the vicinity to protect the nesting beach against egg poaching. The Philippine Navy through the

Taganak Light Station has extended assistance by detailing navy personnel in the Island. Prior to the detailing of navy personnel to the sanctuary, egg poaching was very rampant and on some nights, 2,000 to 3,000 eggs were lost to poachers. The presence of the Navy considerably reduced poaching and at the same time protected the surrounding waters against illegal fishing.

A 40hp speed boat and a communication system which consisted of a Single Side Band (SSB), 1 VHF Base and 3 handheld VHF radios were also acquired through a grant from World Wildlife Fund (WWF). These equipment greatly increased the mobility and coordination of the field staff, which are two basic requirements of the effective management of the sanctuary.

Deployment of Central Office Based Personnel

The deployment of Central Office based technical personnel is critical to the management activities in Turtle Islands. Every year, the PCP plans the deployment of three technical teams to the area. However, this is sometimes reduced to two teams due to lack of funds for travel. The technical teams alternately supervise the resource management and research activities in the islands with an average of two months duration per engagement. The usual delay in the release of the project's budget by the Department of Budget and Management (DBM) likewise delays the target schedule of deployment by about one to two months.

Travel to Turtle Islands entails considerable time and effort, since the area is located about 950 km. South Southwest (SSW) of Manila and only about 22.5 km North Northeast (NNE) of Sandakan Sabah, Malaysia (Figure 3). The usual mode of transportation when traveling to the islands from Manila is by fishing boat where travel time averages from 50 to 60 hrs. (direct to Turtle Islands). This is the easiest and most economical way of traveling. But at times the team takes the Zamboanga route due to the inavailability of the fishing boat. The travel time via Zamboanga may take from 7 to 21 days, depending on the prevailing sea conditions, and availability and schedule of motor launches plying the route. Another possible route is via Puerto Princesa - Brookes Point or Rio Tuba - Cagayan de Tawi-Tawi (now Mapun) to Turtle Islands.

Maintenance of Nesting Beaches

A strategy employed by the project which has yielded significant positive results is the protection of the various habitats of these endangered species. Because of the importance of turtle eggs in the conservation effort, the protection of natural nests has always been a main cause of concern. One of the primary tasks in the maintenance of nesting beaches is clearing the nesting beaches of drifted logs. These logs which comes from log ponds in nearby Sandakan are physical obstruc-

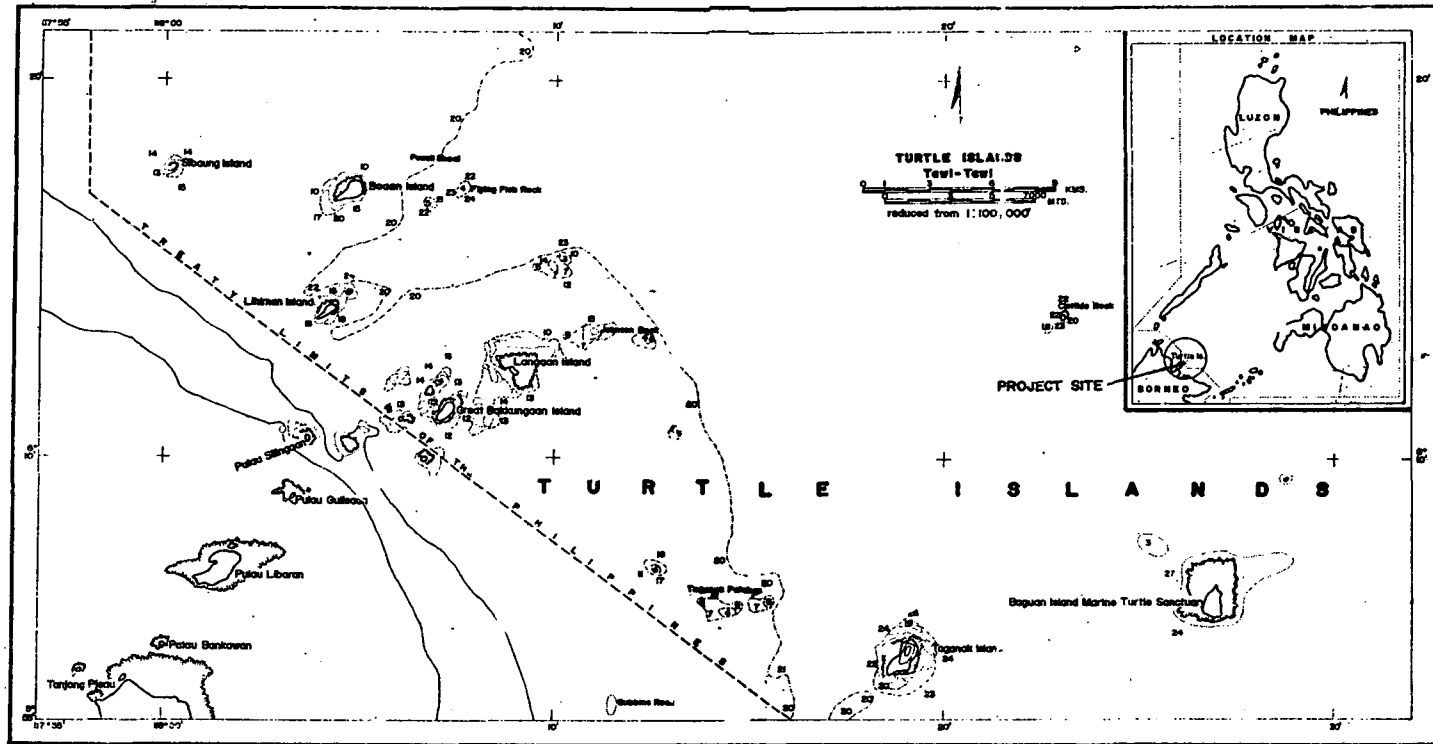


Fig. 3. Borneo-Northeast Coast, Marchesa Bay to Taganak Island

tion in nesting beaches. Clearing of drifted logs requires a power saw which cut them into sizes that could be manually hauled back to the sea.

Another activity is the monitoring and protection of natural nests against inundation and natural predators. This involves the relocation of nests laid in areas far from the field stations as well as nests laid in low lying areas where there is a possibility of nest damage by the rising tide.

Rational Allocation of Turtle Eggs

Realizing that turtle eggs have been a traditional source of livelihood in the locality for decades, a compromise with the residents was achieved through the issuance of MNR Administrative Order No. 33 series of 1982. Said order among other things provided for the disposition of turtle eggs in Tawi-Tawi as follows:

1.1 Thirty (30) percent of the eggs laid shall be reserved for preservation purposes, while ten (10) percent maybe gathered and the proceeds hereof shall be given to the Tawi-Tawi Marine Turtle Foundation to be organized.

1.2 The remaining sixty (60) percent of the eggs may be gathered by authorized permittees under the supervision of a TFP Officer, provided a municipal fee per egg gathered shall be paid to the municipality, the amount of which fee shall be determined by the Sangguniang Bayan of the municipality.

The order grants permits to bona fide residents of Turtle Islands to collect turtle eggs from the islands of Taganak, Lihiman, Langaan and Bakkungan, following the principle of rational distribution of this resource. Baguan Island which was declared as a marine turtle sanctuary was set aside for total conservation where any form of exploitation is not allowed.

To implement the Order, the following procedures are employed to rationalize the granting of permits to bona fide residents of Turtle Islands: (1) prioritization of new applicants over former permittees; (2) implementation of strict screening procedures for applicants; (3) registration of application for permits administered by PCP Manila-based personnel on all the islands; (4) lottery of slots for collection by qualified applicants; and (5) photo documentation of all applicants and permittees for proper identification.

As a result of these procedures, past problems such as the granting of two or more permits to a single person and falsification of names have been eradicated. As of June 1992, 956 permits were distributed to qualified residents. The beneficiary families were able to generate additional income of approximately ₱5,000.00 to ₱6,000.00. From 1984 to 1991, 3,093,064 eggs were collected by qualified permittees while 5,803,840 were conserved or 65 percent of the total (Table 1).

This scheme shows that with proper management practices and strategies to accommodate the immediate needs of the people, marine turtles can still be protected and the remaining population allowed to survive for future generations.

Table 1. Number of Eggs Conserved and Collected vis-a-vis Eggs Produced from the Turtle Islands (1984-1991)

<i>Year</i>	<i>Total Eggs Produced</i>	<i>Total Eggs Conserved</i>	<i>Total Eggs Exploited</i>	<i>% of Eggs Conserved</i>
1984	1,264,898	638,669	626,229	50
1985	1,039,278	590,882	448,396	57
1986	1,456,276	782,302	673,974	78
1987	762,341	595,259	167,082	58
1988	1,027,334	633,765	403,629	66
1989	1,110,375	822,585	295,791	70
1990	763,606	546,817	216,786	72
1991	1,590,387	1,140,353	450,034	72
Total	9,081,390	5,803,880	3,093,064	65

Source: Pawikan Conservation Project, DENR.

Maintenance of Resource Hatcheries

Resource hatcheries are established in the islands of Taganak, Lihiman, Bakkungan and Langaan. The hatcheries serve to maximize the number of turtle eggs for conservation. Since MNR AO No. 33 stipulates that 30 percent of the total turtle egg production is conserved for propagation, the hatcheries provide the conserved eggs ample protection from predators and egg poachers. The site of the conserved hatcheries is near the nesting beach for easier transplanting. Based on the recorded egg production of 9,081,390 from 1984 to 1991, 2,724,417 or 47 percent of the total number of eggs conserved were transferred to the hatcheries.

Prohibition of the Trade of Marine Turtles and Its Products

MNR AO No. 12 concerns the regulations for the conservation of marine turtles in the Philippines. Included in this Order are provisions prohibiting the trade of marine turtles or any of its by products and its corresponding penalties. To assess the extent of trade, the inventory and monitoring of curio-shops which may be trading marine turtle products are conducted.

From 1983 to June 1992, a total of 306 establishments were inventoried and informed regarding the ban on trading of marine turtle by-products. The project monitors all stalls in Pistang Pilipino and has recently positively identified 19 stalls involved in the trade. These stalls were reported to the Wildlife Division of

Protected Areas and Wildlife Bureau with the recommendation for the confiscation of said articles. The PCP is handicapped in terms of effecting confiscation, because all PCP personnel are casuals and not clothed with ample legal protection if ever a trader files counter charges to harass PCP staff.

Harnessing Regional Office for Conservation

A move to tap the DENR's regional offices for assistance in manpower and logistical support was initiated in 1989. This was necessitated by severe lack of funds needed for the PCP to be able to implement a program which would have impact throughout the archipelago. A close look at the present DENR organization reveals that the structure at the regional level is diffused enough to encompass the entire archipelago but centralized enough for a coordinated resource management and data collection schemes. Upon the recommendation of the PCP, Special Order No. 884, series of 1989, was issued by the DENR Secretary designating all Regional Technical Directors (RTDs) for Environment and Protected Areas as PCP Field Action Officers (FAO). As stipulated under SO No. 884, the regional FAOs are to perform the following duties and responsibilities:

- (1) Assist and coordinate with the PCP in overseeing marine turtle conservation activities in their respective regions including the areas where the PCP is currently conducting scientific researches and management activities, e.g., Turtle Islands, Tawi-Tawi and El Nido, provided that in these areas, PCP shall be the lead organization in implementing the marine turtle conservation program to be supported by the FAOs of Regions IX and IV, respectively;
- (2) Ensure full implementation of all rules and regulations pertaining to the conservation of marine turtle resources;
- (3) Facilitate the arrest of persons who committed, or are committing, any of the offenses against the existing pertinent laws;
- (4) Facilitate the confiscation/seizure of vessel/carrier, gears, tools, equipment and other paraphernalia used in the commission of the offenses, including the catch itself, as instrument of proceed of the crime pursuant to article 45 of the Revised Penal Code;
- (5) Assist the PCP in conducting a Conservation Education Program in their respective regions;
- (6) Submit quarterly progress and accomplishment reports on the conservation, research, and information campaign activities to the PAWB Director.

This strategy proved to be successful in providing support and assistance for the activities of the PCP. The assistance was particularly valuable in the aspect of information dissemination and researches such as population, migration and distribution studies. On several occasions, some FAOs reported cases of apprehensions of violators of laws on sea turtle conservation.

Developments and status reports from FAOs are constantly being received by the PCP. These reports give a broader view of the status of the remaining sea turtle population throughout the archipelago and the efforts being done at the regional level through the FAOs.

Coordination with DENR Regional Offices

In support of the marine turtle conservation activities being pursued in the regions, a procedural manual on tagging, hatchery management, and release of hatchlings after completion of incubation are distributed to regional offices. The PCP likewise discourages the practice of headstarting and recommended that this should not be employed as a conservation strategy.

Research and Investigation

Information concerning marine turtle biology and ecology relevant to its conservation and management are collected through the conduct of scientific researches and field investigations. This is carried out by the Research and Investigation Unit. The objectives of this unit are as follows: (1) conduct population and migratory studies through saturation tagging and collection of data on the daily nesting incidence of turtles; (2) work hand in hand with the Resource Management and Protection Unit in the maintenance and management of hatcheries in the BIMTS for research purposes; (3) undertake scientific researches which would yield valuable inputs required in the formulation of updated conservation and management policies and propagation schemes; and (4) conduct habitat surveys to identify areas where marine turtles still occur.

Conduct of Population Studies

The procedures performed for the on-going population studies are saturation tagging and nesting incidence monitoring. These yield valuable information on the current population status of nesting marine turtles, migratory pattern/s of sea turtles, and the determination of the peak and lean nesting seasons. This activity is being conducted mainly in the BIMTS where high density nesting occurs. Measurements of tagged turtles are also taken by the tagging team. Based on PCP data, average curved carapace length and width of nesters in BIMTS are 99.48 cm. and 87.59 cm., respectively.

At the BIMTS, tagging operation usually starts with the rising tide every night until early morning to ensure that majority of nesting turtles are encountered. To date, a total of 4,356 neophyte turtles are tagged. Neophyte turtles are turtles encountered for the first time and were tagged accordingly. On very rare occasions, male turtles which have been stranded by the receding tide while mating are tagged by the tagging team. Male sea turtles in the Philippines are not known to crawl up to the nesting beaches making them very difficult to tag.

Renesters refer to turtles which were tagged during a previous nesting season. Nesting marine turtles come back to lay their eggs 2-3 years after the last season they laid their eggs. Partial data from PCP tag recoveries ($n = 24$) revealed that the average renesting interval recorded in BIMTS is 2.5 years.

Internesting is defined as the number of times a turtle would lay its eggs within one nesting season. Limpus (1984, pers. comm.) stated that in one nesting season, turtles successfully lay their eggs 5 times on the average, the intervals of which is 2-15 days. In 1990, the internesting behavior of nesting green turtles in Baguan Island was studied by the Research and Investigation Unit. A total of 109 internesters were recorded and 62 of these or 56.88 percent fall within the 2-15 days range. The average internesting interval observed was 11.08 days. It was observed however, that internesting interval in Baguan Island exceeds 15 days and can at times even reach 58 days. A possible explanation is that the turtle may have been missed by the tagging teams within the inclusive dates.

In some nesting beaches of the Turtle Islands, nesting turtles with Malaysian tags are occasionally encountered by the PCP's forest rangers assigned in the island. Some of these turtles are listed in Table 2. Three of these Malaysian tagged turtles were internesters. The recovery of Malaysian tags on our Turtle Islands shows that the group of six islands within our Turtle Islands as well as the three nesting islands on the Malaysian side of the border is actually one well defined green turtle rookery which only happened to be situated along and was cut across by the treaty limits between the Philippines and Malaysia.

Nesting Incidence Monitoring

This activity accounts for all complete nests, false nests and false crawls made by turtles during the previous night until early morning. A team of technical personnel and forest rangers regularly inspect the continuous 1.6 km. nesting beach and the smaller pocket nesting beaches of Baguan Island every morning. As of June 1992 a total of 42,820 complete nests were recorded from the nesting beach of BIMTS.

Table 3 below presents the annual and monthly distribution of complete nests from 1984 to July 1992 in BIMTS.

Table 2. Malaysian Tagged Turtles Encountered in Langaan Island, Turtle Islands

<i>Date</i>	<i>Left Tag</i>	<i>Clutch Size</i>
July	22,901	no data
August	25,491	no data
September 16, 1990	25,618	93
October 8, 1990	25,658	81
October 16, 1990	25,658	87
October 16, 1990	25,629	110
October 25, 1990	25,629	88
October 27, 1990	25,637	92
November 17, 1990	26,639	no data
November 28, 1990	26,639	no data
November 28, 1990	26,652	no data
December 01, 1990	26,639	no data

Source: Pawikan Conservation Project, DENR.

Table 3. Annual and Monthly Distribution of Complete Nest in BIMTS (1984 - 1992)

<i>Month</i>	<i>1984</i>	<i>1985</i>	<i>1986</i>	<i>1987</i>	<i>1988</i>	<i>1989</i>	<i>1990</i>	<i>1991</i>	<i>1992</i>	<i>Total</i>
Jan		274	213	410	253	286	252	509	350	2,547
Feb		156	222	253		345	209	593	371	2,149
Mar		214	213	215		168	182	629	579	2,200
Apr		238	249	241	44	348	204	659	456	2,439
May		254	365	396	586	816	165	787	452	3,821
Jun		261	457	429	656	682	191	815	660	4,151
Jul	218	369	598	387	789	784	378	1260	135	4,918
Aug	628	399	647	453	572	736	473	1208		5,116
Sep	605	496	578	389	627	794	502	1067		5,058
Oct	402	511	661	461	684	679	559	835		4,792
Nov	341	415	573	97	122	297	448	566		2,859
Dec	100	265	435	355	528	259	375	453		2,770
Total	2,294	3,852	5,211	4,086	4,861	6,194	3,938	9,381	3,003	82,820

Source: Pawikan Conservation Project, DENR.

As may be gleaned from Table 3, lower nesting incidence generally occurs during the first half of the year increasing in July and peaks on September and October. Based on the total number of recorded complete nests (42,820), and the average number of eggs per nest (101), the total egg production of the island is estimated at 4,324,820 (1984 - 1992).

Maintenance of Research Hatcheries

The Research and Investigation Unit maintains three functional research hatcheries in the BIMTS for research purposes. The third hatchery, which is the newest addition was completed on 6 September 1990 and has a dimension of 10 meters x 30 meters and can accommodate a maximum of 470 artificial nests.

A total of 971,762 eggs were transplanted to these hatcheries from 1984 to the present. Usually, collection of eggs from the nesting beach and pocket beaches to be transplanted into the hatchery is performed simultaneously with the nesting incidence activity. Eggs that were laid in the high tide water mark, those laid in the pocket beaches and those laid in the farthest ends of the nesting beach are prioritized to be transferred to the hatchery for protection against inundation, poachers and predators.

In the hatchery, eggs are carefully placed in artificial nests with a depth of 60 cm. Wire enclosures are placed around each nest to collect all emerging hatchlings from the nest. A total of 431,573 hatchlings which emerged from these hatcheries were released to the sea.

Conduct of Habitat Survey

As of the present, habitat surveys have been conducted in 74 sites located in 13 provinces. All surveys were conducted by the PCP in coordination with the Forest Management Bureau (formerly Bureau of Forest Development) and DENR regional offices. The primary objective of this activity is to gather qualitative baseline information on such aspects as species present, nesting incidence, density of turtle populations, and physical and biological features of a specific locality. Recommendations based on survey reports and criteria for selection of sanctuaries have been formulated to establish certain areas as marine turtle sanctuaries. A total of nine sites have already been proclaimed as sanctuaries. These are Bancauan and Baguan Islands in Tawi-Tawi; Bacuit Bay, Halog Island, Tanobon Island, Panata Cay and Kota Islands in Palawan; Caluya and Panagatan Island in Antique.

Augmentative Researches

Reproductive Potential. Studies are done to evaluate the reproductive potential of green turtles in BIMTS. One of these studies was entitled "Evaluation of the Reproductive Potential of the *Chelonia mydas* Nesting Population in the Baguan Island Marine Turtle Sanctuary, Turtle Islands, Philippines." This study was funded by the US Fish and Wildlife Service under the auspices of the Haribon Foundation.

This study documented for the first time the characteristics of natural nests of green turtles in terms of clutch size, hatching success, emergence success, sex ratio of hatchlings and incubation period from a Philippine nesting beach. It also established the hatching and emergence percentages and sex ratio of hatchlings emerging from the nesting beach of Baguan Island. The PCP is now utilizing the data collected to assess the effectivity of present conservation practices and if necessary, to design new conservation methods.

Sample nests from two nesting seasons (lean and peak) were monitored and one sample hatchling from each nest was collected at the end of incubation. Results showed that the annual average hatching success and emergence percentage was 87.13 percent and 85.74 percent, respectively, which is significantly higher than the results obtained from the hatchery (49.90 percent and 47.78 percent). The mean incubation period was 54.32 days and the average clutch size of 146 nests was 95.61 eggs/nest. Histological examination revealed that male - female sex ratio from the natural nests was 1:8.6. Sex ratio obtained from hatchery samples is 0 male to one female during the same period. Some statistics gathered during this study are shown on Table 4.

Table 4. Selected Reproductive Statistics for Green Turtles Nesting in Baguan Island Marine Turtle Sanctuary

<i>Parameter</i>	<i>Average Value</i>
Clutch size	95.61 eggs (n=146)
Incubation period	54.32 days (n=146)
Emergence success	85.74% (n=146)
Hatching success	87.13% (n=146)
Male: Female hatchling sex ratio	1:8.6 (n=146)

Previous sex ratio analysis of hatchlings emerging from the BIMTS hatcheries revealed that almost 100 percent of the hatchling produced were females. This was attributed to the high temperature obtaining in the hatcheries since these are totally exposed to sunlight. Studies have shown that the sex of hatchlings is determined by nest temperatures, i.e., higher temperatures will produce more females. Because of the disparity of results obtained from natural nests and hatchery nests, the Research and Investigation Program designed an experimental set-up for the hatchery that is envisioned to approximate results of sex ratio obtained from natural nests.

Hatchery Experiment. A portion of the hatchery measuring 4 m x 23 m was completely shaded as an attempt to simulate the conditions of the natural nesting beach. The experiment was conducted to evaluate the hatching and emergence percentages of artificially incubated eggs and determine the sex ratio of hatchlings incubated in a shaded area. A histological examination of specimen gonads was

done to determine the sex ratio. Table 5 summarizes the results of the study conducted.

Table 5. Hatching Success, Emergence Percentage and Incubation Period of Eggs and Sex Ratio of Hatchlings Under a Shaded Hatchery

Clutch Size (N#16)	60	65	70	75	80
Emergence %	88.23	86.15	82.32	86.08	83.59
Hatching Success	93.23	83.65	83.84	88.58	86.48
Incubation Period (Days)	57.94	57.44	58.69	58.06	58.94
Sex Ratio (M:I:F)	6:3:7	9:4:3	4:5:7	2:5:9	6:6:4

From 80 samples studied, 27 samples were males, 23 were intersexes and 30 were females. Intersex refer to gonads examined that exhibit both the male and female phenotype, which becomes defined (male or female) in the latter stages of life. Another experimental set-up is needed to attain a male-female sex ratio of 1:8.6 of natural nests. Hatchery experiments are performed since hatcheries are inevitable in the operations and in the conservation of marine turtles against predation, inundation, poachers and from other nesters.

Nester-Egg Size Relationship. The experiment was conducted to determine the relationship between the nester size and its egg size. Marine turtle nesters were selected at random. The length and width of the marine turtle nesters' carapace were measured using inelastic tape measure. Thirty eggs from each selected nester were weighed and measured using a vernier caliper.

A total of 1,263 eggs from 46 nesters were monitored for this experiment. Initial processing using statistical methods showed that there was no significant relationship between the nester size and egg size in the nesting population of the BIMTS. The average weight and diameter of marine turtle eggs in the BIMTS was also established.

Relative Fecundity of Nesters. This activity aims to estimate the number of eggs that a nesting turtle will lay in one breeding season. Fifty nesting turtle samples were selected at random. The number of eggs laid and the duration in between nesting activity were recorded.

Out of the total number of samples, only nine were observed to have laid three times or more. The number of samples monitored was not enough to form a basis for a conclusive statement. The activity needed more samples. However, partial results were encouraging.

A detailed research proposal was prepared for this activity and monitoring procedures were improved. At present, this experiment is being implemented in BIMTS.

Clutch Size as a Factor in Hatching and Emergence Success of Chelonia mydas. This activity aims to establish the optimum number of eggs (clutch size) that will ensure the highest hatching and emergence success which may be employed for the hatcheries. Initial data collected revealed that there was no relationship between the parameters mentioned.

Further analysis of this activity suggested that there are other factors/variables that affect the hatching and emergence success. As such, this experiment has been modified to include other parameters such as difference of time elapsed after laying during transplantation, nest depth, and incubation period.

Isolation and Identification of Fungi Found in Necrotic Skin Lesions of Captive Hawksbills (Eretmochelys imbricata). Through the assistance of the PCP, this study was conducted by Dr. Mundita Sison-Lim, former student of the UP College of Veterinary Medicine. Skin scrapings from a total of 10 turtles were used as specimens for the isolation of fungi. All of the 10 turtles exhibited necrotic skin lesions mostly on the head and neck.

Based on direct microscopic examination of the skin scrapings, a tentative diagnosis of mycosis was made. However, to confirm the presence of fungi, isolation and identification of specific fungi found in the lesions were done. The isolates were identified as *Penicillium*, *Geotrichum*, *Fusarium*, *Scolecobasidium* and *Drechslera*. It was concluded that the disease is a management problem. The fungi isolated are opportunists, meaning, predisposing factors are necessary to initiate a disease. The turtles could have been wounded first before contracting the disease.

Information System Management

Through encoding of data, information received from the field from 1982 to 1990 were stored for easy retrieval. The data were on: tagging, nesting, incidence, hatchery, and regional activities, among others.

Information and Extension

The Information and Extension Unit disseminates relevant information and creates greater awareness among the populace regarding the on-going marine turtle conservation program of the government. Developmental communication packages in the form of fora, symposia, conferences, seminars, workshops, audio-visual presentations were conducted. In addition, print communication materials were produced. The PCP employs the most available channels of information

dissemination such as broadcast, print, film and folk media. The informational and educational materials produced and distributed included the following: posters, t-shirts, billboards, flyers, and primers. Each of these materials were designed to suit the level of understanding of a specific type of audience.

Following are the information materials produced and distributed from 1984 to June 1992:

(1) Marine Turtle Conservation Posters

A total 5,200 copies of marine turtle conservation posters in three designs were produced. These posters convey to the general public that their participation is needed to attain success in the conservation efforts. The target audience which is the general public were informed of how they can positively contribute to the efforts of conserving sea turtles. The materials are written in English and Pilipino. The latest poster design, produced in 1990, illustrates the five species of marine turtles which have been reported in the Philippines. These illustrations will help guide the general public especially those who live along the coastal areas, classify and differentiate the turtles they have seen or encountered. In addition, the poster tells the public to report to the DENR any encountered marine turtle with tags attached to their front flippers. Reports of such encounter help the PCP in establishing the migratory routes, distribution, and population density of the marine turtles.

To date, 5,000 posters have been distributed to private and government agencies such as the DENR regional offices for dissemination to coastal communities, elementary and high schools, colleges, teachers, as well as beach and dive resorts.

(2) Marine Turtle Conservation Billboard

Three billboard signs measuring 4 ft. x 8 ft. each were produced. The billboards displayed MNR Administrative Order No. 12 stipulating that it is unlawful to exploit or even possess marine turtles and any of its by-products from curioshops. These were produced to discourage tourists from buying marine turtle by-products. The billboard signs were displayed in strategic places, such as the Ninoy Aquino International Airport (NAIA), Pistang Pilipino, and Cartimar.

(3) Marine Turtle Conservation Flyer

Five thousand copies of a folded six-faced colored flyer on marine turtle conservation were produced in 1990. The flyers were distributed to hotels, resorts and given to the NAIA Information Department. This flyer is intended to inform local and foreign tourists about natural and man-made threats to the survival of marine turtles, as well as, and the existing ban on the exploitation of this species. Information is also given on how they can participate and help in protecting these endangered species.

(4) Marine Turtle Conservation Primer

A total of 5,100 copies of the marine turtle conservation primer were produced and distributed to various schools and DENR regional offices. The text of this primer discusses the rationale for conserving marine turtles, some aspects of marine turtle biology and ecology, species identification, and existing rules and regulations pertaining to marine turtle conservation. These rules and regulations were translated into five local dialects. This primer serves as reference for students and an informational material for coastal, as well as, city-dwelling folks.

(5) Marine Turtle Conservation Postcard

Six thousand copies of pre-paid postcards were produced and distributed to selected DENR Offices whose areas of jurisdiction include coastal communities. The postcards serve as sources of feedback from the regions regarding marine turtle sightings and tag returns. To date, 67 percent postcards have been received by the PCP. Data gathered from these postcards will be plotted on a base map to show the distribution and possible migratory patterns of sea turtles in the Philippines.

(6) Intervening Activities

On the Spot Coloring Contest for the children of PAWB personnel with ages 4-6, 7-9, and 10-12 years old was sponsored. The objective of the contest was to inform and educate the children on the sad plight of marine turtles and on the need to conserve them. The mechanics of the contest included the viewing of VTR documentary film on marine turtle conservation then afterwards asking the participants to apply in the coloring contest what they have seen and learned from the film.

Ninety five copies of marine turtle conservation brochures and 24 sets of a compilation of MNR Administrative Orders were also given to concerned parties. Photoslides, photos for exhibit, a VTR documentary film on the PCP marine turtle conservation, and other VTR films such as "The Coral Triangle," "The Farewell to the Ancient Mariner," and "Fate of the Sea Gypsy" were lent to students, regional offices, and other interested and concerned citizens.

(7) Conduct of a Socioeconomic Survey

The most recent socioeconomic survey of the Turtle Islands was conducted by the PCP from 12-20 July 1990. Basically, the survey was divided into five major areas of concern. These included the respondent's profile, economic sufficiency, social adequacy, production, and their reactions to the project (PCP).

Initial analysis revealed that 97.5 percent of the respondents were Muslims and the rest were Christians who belong to either Catholic or Baptist denomination. The Tausugs comprise about 46.4 percent of the population followed by the Jama Mapuns with 36 percent and other ethnic groups with 17.6 percent mostly from the Visayan region. Mapun and Tausug are the most commonly used dialects.

Two barangays comprise the islands, namely: Barangay Likod, and Barangay Dambilah. Barangay Likod is located in Taganak Island which is made up of four sitios, namely: Bakkao, Pallang, Limao-Limao, and Tong-bato. Barangay Dambilah comprises the rest of the islands (Boaan, Lihiman, Langaan, Bakkungan, Baguan) and the southwestern side of Taganak Island which is called Poblacion. As of May 1990, the Turtle Islands had a population of 2,296 persons comprising a total of 369 households with a population growth rate 0.44 percent. Having a land area of 392 has., Turtle Islands has 585 persons per sq. km. which is above the national level of 202 persons per sq. km. Its population is almost equally divided between males and females. In-migration rate in the Turtle Islands is relatively high since 31.2 percent of the present population moved into the area only recently (1985-1990).

Fishing is the major source of income (72 percent) and most of the catch is sold to Sandakan, Malaysia which is also the main source of their basic needs such as rice, household needs and production inputs. Although the average income per family in the Turtle Islands (P62,604.50/annum) is high compared to Sulu (P31,097/annum) and Tawi-tawi (P33,443/annum), its value is significantly reduced when exchanged for Malaysian Ringgits (P10/1 ringgit).

Health care in the islands is wanting as manifested by the high rate of malnutrition and lack of medical facilities and practitioners. Only two midwives are available to address the health needs of the local population. The area also has a high illiteracy rate (51.55 percent) due to the inadequate quality of education. Common sources of potable water are shallow wells. Kerosene lamps are used as lighting source in most of the houses.

Marine Turtle Management and Support Activities

To upgrade the technical capabilities of the PCP personnel, five field personnel based in Turtle Islands were retrained on hatchery management. The correct and recommended practices of hatchery management in Baguan Island was taught to these personnel from August to September of 1990. Topics included in the hatchery management training were: (1) Handling of turtle eggs; (2) Excavation of artificial nests and maintenance of hatcheries; (3) Monitoring of emergence; (4) Monitoring of hatchlings released; (5) Data recording and management; and (6) Reporting.

The PCP has also conducted marine turtle management and conservation training for DENR personnel from Region IX. Unfortunately, due to budgetary constraints, no other training for other DENR regional personnel was conducted after 1990.

The three-day training aimed to impart to the participants basic knowledge, skills, and attitude required in the effective performance of their functions in the conservation of marine turtles. The course content of the training are as follows: (1) The Pawikan Conservation Project; (2) Population Status; (3) Species and Sex Identification; (4) Biology and Ecology of Marine Turtles; (5) Introduction to Marine Turtle Conservation; (6) Hatchery Management; (7) Headstarting; (8) Overview of PCP Researches; (9) Existing Rules and Regulations; and (10) Marine Turtle Conservation Concepts, Principles, and Strategies.

Recently, personnel of the Debt-for-Nature-Swap Program, particularly from the El Nido Marine Sanctuary were given a lecture on the overview of the PCP conservation activities. The lecture was funded by World Wildlife Fund (WWF).

Institutional Linkages and Coordination

The PCP has already gained headway and momentum in the aspects of management, protection, research, and information dissemination. This was partly made possible through the support extended by international institutions such as the WWF which awarded to the project a grant for the purchase of a 40 hp. speed boat and radio communication equipment. The US Fish and Wildlife Service likewise provided funding through the Haribon Foundation for the conduct of a scientific experiment in the BIMTS. The support extended to the project by foreign institutions particularly for the Turtle Islands operations, is a clear manifestation of the international community's concern and the significance of the Turtle Islands as an important rookery of green sea turtles in the whole ASEAN region.

Local agencies such as the DENR regional offices and the Philippine Navy Detachment in Turtle Islands, Tawi-Tawi, SOUTHCOM and NAVFORSOUTH have likewise contributed significantly to the Project. Through these agencies, renewed thrust in the over-all conservation and management efforts for the perpetuation of our country's marine turtles was achieved.

Problems Encountered

Although the project has so far been successful in meeting its objectives, the implementation has not been smooth. The PCP also has its share of problems. A major and perennial problem which is also the root cause of other problems of the

project is the severe lack of funds to effectively implement a nationwide conservation program. As provided for under Executive Order No. 542 series of 1979, the Task Force Pawikan was supposed to be allotted an annual budget of two million pesos. Unfortunately however, it has never been appropriated the whole amount ever since its operation. Table 6 shows the annual appropriations released to the project from 1982 to 1991. It was in CY 1992 and for the first time in ten years that the project has an approved budget of ₱2,153,000.

Table 6. Summary of Budget Releases (In Thousand Pesos)

<i>Year</i>	<i>Amount Released</i>
1982	₱ 500
1983	1,340
1984	1,340
1985	1,281
1986	1,487
1987	1,236
1988	1,296
1989	1,439
1990	1,286
1991	1,551
	₱ 12,756

Other problems encountered by the PCP as well as recommended courses of actions are presented in Table 7.

Summary and Recommendations

Executive Order No. 542, signed on 26 June 1979 created the Task Force Pawikan, now referred to as the Pawikan Conservation Project. This became the Philippine government's urgent response to conserve and manage the dwindling marine turtle resources of the country. The project is responsible for the development and implementation of conservation and protection policies, management and propagation schemes, and massive information and education programs to ensure the survival and growth of the country's remaining marine turtle population. The PCP is DENR locally funded project and is now attached to the Wildlife Division of the PAWB. (The transfer of the PCP to PAWB was effected on 27 January 1989 through the issuance of DENR Special Order No. 78, series of 1989. At present, the PCP operates with a personnel complement of 16 casuals and 9 contractuales.)

Table 7. Major Problems/Constraints Encountered by the PCP and Recommended Courses of Action

<i>Major Problems / Constraints</i>	<i>Details</i>	<i>Recommendation / Proposed Plan of Action</i>
(1) Field operations are subjected to security problems due to remote location of project sites.	Egg poaching is difficult to control in the absence of military security.	Detail of regular military security to project personnel operating in the field.
(2) Transportation and communication problems due to remoteness of project sites.	Reports from the field are usually delayed due to inavailability of regular means of communication. Health problems and emergencies are difficult to manage due to the absence of medical facilities near the project sites.	Provide capital outlay to purchase motor launch which can ply the Turtle Islands-Zamboanga route.
(3) Insufficient funds resulting to inadequate work force.	The PCP is mandated to implement a nationwide conservation program. However, due to lack of funds, personnel and other resources can only be concentrated in Turtle Islands.	Increase budget allocation particularly for personal services.
(4) Lack of necessary field and research equipment.	The PCP is not allowed to purchase equipment and construct facilities, e.g., field and research stations.	Provide funds for capital outlay.
(5) Delay in the release of funds and processing of RIVs and travel documents.	Salaries are always delayed. PCP wardens in the Turtle Islands have not received their salaries since January this year.	Detail one accountant and one budget officer to the project in order to expedite the processing of documents.
(6) Inadequate authority or police powers to effectively enforce laws, rules and regulations pertaining to marine turtle conservation.	Apprehension of violators is difficult to effect due to lack of enforcement skills and powers.	Review and revise all pertinent rules and regulations pertaining to marine turtle conservation. Train PCP personnel on legal procedures pertaining to apprehensions and filing of cases against violators.
(7) Lack of security of tenure and low compensation of PCP personnel.	All staff are either contractual or casuals even though some have rendered services for already 10 years.	Review and revision of position classification of plantilla personnel.
(8) Lack of support and appreciation from local government authorities, congressmen, and councilmen.	Experience with former mayors of the Turtle Islands have shown that these local executives would like to exercise control over turtle egg resources being very easy and accessible means of income.	Conduct an information seminar which should be attended by these local officials to impart on them basic knowledge and attitude needed for the effective, sound management, and protection and propagation of the remaining marine turtle resources

Table 7. (Cont'd.)

Major Problems/Constraints	Details	Recommendation / Proposed Plan of Action
(9) Lack of support and appreciation from some PAWB and DENR management and senior officials particularly on the procedures, strategies, and travel plans of the PCP.	Possibly a result of misinformation, ignorance and prejudgment by concerned officials causing unnecessary delays in the processing of important documents of the PCP.	in their locality. Request officials concerned with processing of documents and evaluation of the project to attend an information seminar which may be conducted by PCP and convince them to visit project site in the Turtle Islands to observe for at least a week resource management and research operations of the PCP. This will provide them basis for an accurate and qualified evaluation of the PCP's programs and activities.
(10) Expanded responsibilities of the PCP resulting from the issuance of AO No. 55 series of 1991 regarding the management and protection of the endangered sea cow (<i>Dugong dugon</i>)	AO No. 55 mandated the PCP to lead the implementation of a nationwide program on dugong conservation but did not allocate funds for this program. This likewise made the project title/name of the PCP already inappropriate.	Allocate additional funds to PCP for dugong related conservation activities. If possible, change the project title to Marine Wildlife Conservation Program.

In order to achieve its objectives, the project has instituted three regular activities, namely: (1) Resource Management and Protection; (2) Research and Investigation; and (3) Information and Education. The main thrusts of the PCP are concentrated on the management of the Turtle Islands, Tawi-Tawi which harbors approximately 80 percent of the total marine turtle resources of the country and the gathering of scientific information needed to develop updated policies and conservation as well as propagation strategies. The momentum already gained by the information drive is being sustained thereby maintaining the awareness of our countrymen on the sad plight of marine turtles and the need to conserve them for future generations of Filipinos.

The implementation of the project has its share of problems most of which are the result of inadequate funding. Other problems include the following:

- (1) Security problems during field operations due to the remote location of project sites;
- (2) Transportation and communication problems due to location;
- (3) Insufficiency of funds resulting to inadequate work force;
- (4) Lack of necessary field equipment and living quarters;
- (5) Delay in the release of funds;

- (6) Inadequate authority or police powers to effectively enforce laws, rules and regulations; and
- (7) Low compensation.

The following solutions to these problems are recommended: (1) Detail of regular military security to project personnel operating in the field; (2) Increase in budget allocation; (3) Allocation of funds for capital outlay (field equipment); (4) Increase travel allowances to include hazard pay; (5) Detail of one accountant and one budget officer to the project to expedite the processing of papers; (6) Review and revision of all pertinent laws, rules and regulations pertaining to marine turtles specifically in the areas of apprehension, imposition of penalties, etc., and train PCP personnel on legal procedures pertaining to apprehension, and filing of cases against violators; and (7) Review and revision of position classification e.g., regularization of plantilla personnel.

In order to strengthen the existing program, the following recommendations should be pursued in the future:

- (1) The Turtle Islands should be declared and categorized as an ASEAN Transfrontier Wildlife Sanctuary and should encompass all six islands within Philippine territory and the three islands on the Malaysian side of the treaty limits. The management and authority should include other ASEAN countries like Malaysia, Indonesia, Brunei, Thailand, and Singapore. The Turtle Islands is a major source of green turtles and turtle eggs for these countries. Their participation therefore is needed for a more effective and concerted conservation effort implemented at the regional level.
- (2) Provide community development projects for Turtle Islands communities. This is envisioned to ease the pressure on the exploitation of turtle eggs. The area has vast potentials for development of fishery and tourism-based livelihood projects.
- (3) Formulate and implement a nationwide "Marine Wildlife Management and Conservation Program." The PCP at present is also involved in sea cow (*Dugong dugon*) conservation, research, and information activities. With additional funding and training of technical staff, the PCP can undertake a program which can include other marine wildlife species such as other marine mammals, i.e., whales and dolphins which are likewise threatened with extinction and are also in urgent need of management and protection.

- (4) For the past years, the programs and thrusts of DENR have been heavily biased towards the terrestrial component of our environment. The damage of the country's marine environment is already very extensive and unless management and protection programs are immediately implemented, millions of coastal folks are bound to suffer just as millions are now already suffering. There is therefore an urgent need to realign DENR's thrusts to give more attention to the marine component of Philippine environment.

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