

# The Economic, Ecological, and Educational Benefits of Sea Turtle Conservation in North Bali Region

Gede Ananta Wijaya<sup>1</sup>, I Nyoman Purwakanta<sup>2</sup>, I Wayan Tantrawan<sup>3</sup>  
<sup>1,2,3</sup>PT Indonesia Power PLTGU Pemaron  
Singaraja, Indonesia

<sup>1</sup>[ananta.wijaya@indonesiapower.co.id](mailto:ananta.wijaya@indonesiapower.co.id), <sup>2</sup>[nyoman.purwakanta@indonesiapower.co.id](mailto:nyoman.purwakanta@indonesiapower.co.id), <sup>3</sup>[wayan.tantrawan@indonesiapower.co.id](mailto:wayan.tantrawan@indonesiapower.co.id)

**Abstract**—This study aimed at examining the economic benefits the sea turtle conservation brought to the coastal community, the impacts on the environment, and the benefits that it brings about to education sectors, especially as one of the biodiversity learning resources for the community and students in the region. The research design used in this study was qualitative descriptive. The data collection methods used were observation, questionnaires distribution, and interviews. The results revealed that the existence of the sea turtle conservation in North Bali region brought positive impacts on economic and educational sectors. In the economic sector, the sea turtle conservation has brought about positive impacts in developing the coastal areas particularly in Penimbangan Beach in North Bali region. Furthermore, in educational sector, the sea turtle conservation is often used as one of the learning resources for elementary school students in Pemaron Village near Penimbangan Beach.

**Keywords**—benefits; sea turtle conservation; economic; ecological; education sectors.

## I. INTRODUCTION

North Bali has coastal resources that provide economic benefits to the region. The northern region, which is outlined by the North Bali Sea positively affects the community on the preservation of the sea and the sea lives. One of the beaches that stretch along North Bali region that has become the commodity of the region is the Penimbangan Beach. Penimbangan Beach is a unique coastal area with a variety of ecosystem, potentials, and activities. The beach is 738 m-length, with an area of 2,938 m<sup>2</sup>. It is the ecosystem of various marine lives. Apart from that, Penimbangan Beach that has sandy sediments and freshwater springs under the sea, also provides positive impacts on the condition of the coral reef which could grow in shallow water, ranging from 3 - 12 meters and close to the beach.

The various types of underwater biota living in Penimbangan Beach must be preserved. Preliminary data from Kelompok Masyarakat Pengawas (POKMASWAS, or Supervisory Community Group) and North Maritime System (NMS, or a local community consisting of enthusiasts in North Bali Sea) showed that the local fishermen have carried out various activities in the area that provides economic values to the local residents. Many residents now open small food stalls and restaurants that sell various food and beverages. They also begin agricultural plantations in the surrounding area, and also

start housing and lodging business. What is more, the community usually conducts a number of religious activities and ceremonies at Segara Penimbangan Temple (Pura Segara Penimbangan) which is located at Penimbangan Beach. These circumstances have provided economic values to the region. Yet, on the other hand, the marine life is harmed by the large amount of liquid and solid waste disposed to the sea.

According to the head of the North Bali Scuba Diving Association, Mr. Mangku, the habitat of the marine life such as the green turtles which are locally known as the lekang turtles, have decreased due to environmental pollution. The economic values of Penimbangan Beach must be accompanied with a good management of the coastal areas so that the existing marine ecosystem can be preserved properly and can be used sustainably. Management of the coastal area of the Penimbangan Beach is important since it is home to a variety of activities and potentials that provide both ecological and economic benefits.

PLTGU Pemaron, a unit of PT Indonesia Power located in Pemaron village, North Bali region, concerned with the surrounding environment, one of which is the conservation of the sea turtles in Penimbangan Beach. This conservation is built in cooperation with POKMASWAS, NMS, SCUBA, and Marine Department of Ganesha University of Education. This conservation will bring about not only ecological and economic impacts, but also has benefits on education sector as one of marine life learning resources.

Regarding the above facts, the focus of the study is to describe the benefits of the sea turtle conservation pioneered by PT Indonesia Power in cooperation with the aforementioned parties, on the economic, ecological, and educational sectors of the community in the region.

## II. METHODS

This study used a descriptive research design, describing the economic and educational impacts that the sea turtle conservation in coastal areas of Penimbangan Beach has brought to the local community. To be specific, this study was focused on Banjar Galiran, Bakti Seraga Village, Buleleng district.

The respondents in this study were various parties including the Supervisory Community Group (POKMASWAS), the merchants/sellers around Penimbangan Beach, and teachers and

students of elementary schools in Pemaron Village who were involved in the hatchling release process.

The data collection methods used were direct observation (survey), questionnaire distribution, and unstructured interviews to determine the respondents' responses to the benefits of sea turtle conservation in improving the income of the local community and to the elementary school education.

The data in this study were analyzed qualitatively based on Miles and Huberman's interactive model (1992: 21-25). Data analysis using the model included four stages, namely (1) data collection, (2) data reduction, (3) data presentation, and (4) verification and conclusion drawing. All stages in this procedure were interrelated to one another.

### III. RESULT AND DISCUSSION

#### A. Result

Penimbangan Beach is a unique coastal area with a variety of ecosystems, potentials and activities. The beach is 738 m length with 2,938 m<sup>2</sup> potentially developed area. The existing ecosystem includes coral reefs, seagrasses (*lamun enhalus*), sandy sediments and underwater freshwater springs (Figure 3). The condition of the coral reefs is relatively good and they can be found in shallow area, ranging from 3 - 12 meters off the shore. The beach is also home to several points of underwater freshwater springs and the solitary coral reefs which are scattering around the sandy sediments. Three freshwater rivers (1 medium river called Tukad Banyuasri or Banyuasri river and 2 smaller ones) also flow to Penimbangan Beach.



Coastal Area of Penimbangan Beach. KL1 and KL 2: Rivers. R1 and R2: Restaurants. W1, W2 and W3: Small stalls. P1, P2 and P3: Agriculture. Pr: Segara Penimbangan Temple. Pru.1, Pru.2 and Pru.3: Residential complex. BK: fishermen group center. KP: sea turtle breeding. TB: Tukad Banyuasri. MAT1 and MAT2: Underwater Freshwater Springs. TKS1 and TKS2: Solitary Coral Reef Complex.

Such condition of Penimbangan Beach is suitable for sea turtle habitat. Sea turtles are marine animal which are classified as poikilothermal reptiles. Sea turtles are known for having the characteristics of being able to maintain a body temperature, i.e. adapting the temperature of the environment; breathing with the lungs; having skin scales; and oviparous (Zamani, 1996). POKMASWAS data reveals that from the six types of the sea turtles, namely Green Turtles (*Chelonia mydas*), Leatherback

Turtles (*Dermochelys coreacea*), Loggerhead Turtles (*Caretta caretta*), Hawksbill Turtles (*Erlmochelys imbricata*), Flatback Turtles (*Natator depressa*) and Lekang Sea Turtles (*Lepidochelys oliva*), the species that are found on Penimbangan Beach are the Hawksbill and Green turtles. The six species of the aforementioned sea turtles are classified as rare and under conservation. According to the Red Data Book of the International Union for Conservation of Nature and Natural Resources (IUCN), this animal is in danger of being threatened with extinction.

Mature turtles are often viewed hauling onto the coastal area of Penimbangan Beach and finding suitable sand for nesting. Turtles start to breed at the age of 30-50 years old. Mature sea turtles may migrate from their feeding sites to the breeding sites. This can take place every two to eight years depending on the conditions of the mature sea turtles. The mature sea turtles could reach 50 - 3,000 Km distance in the migration. Data on the number of migrations carried out by the sea turtles throughout their life are unclear. They seem to breed in a period of decades. After mating with several males, female turtles will slowly creep towards the beach using their front flippers. Sea turtles lay their eggs when the tide is the highest; they will haul onto the beach and perform several stages of the nesting process, namely: crawling, digging holes, laying eggs, refilling the nest (holes) with sand, re-sculpting and smoothing the surface, and returning to the ocean.

Observation results showed that female sea turtles started laying at night and the process ended before dawn. Female turtles will choose a nesting site which is clean from sea debris. By using their rear flippers, they dig the sand to make a hole of 50-70 cm deep. When the nest is ready, the female sea turtles will lay about 80-120 eggs, in which the size of the egg is equal to a ping pong ball. Turtles are easily distracted when coming to the beach or in preparing their nests. Human movements and lights will make them return to the sea before nesting. Sea turtles find the distraction or disturbance during the nesting process as annoyance. By using the rear flippers, they will refill the nest with sand, and with the front flippers they will camouflage the nest, and finally, they will return to the sea after several tiring hours.

In approximately 60 days, the eggs will hatch into hatchlings. Hatchling is a term used to refer to newly-born turtles, born with natural instinct when they hatch. Hatchlings will be confused (disoriented) if there is artificial light coming from the highway or from buildings having brighter lights than the natural ones. Instinctively, hatchlings will come out at night, reducing the danger of predators and also avoiding the possibility of dehydration. After breaking free of the eggshell, in an incubation period of approximately 2 months, hatchlings will start their struggle coming out of their nests as a group. If the hatchlings feel the sand temperature is warmer (meaning the sun is still shining), the travel to the sea will be paused and will only start again at night when the sand temperature is cooler. When hatchlings come out of the nest during the day, they are in great threat being eaten by crabs, birds, foxes and other wild animals on their way to the ocean.

Once they are in the water, they still need to avoid the threats since there are still many predators, such as fish and sharks,

endangering their life. The hatchlings then swim quickly until they are swept away by the waves which eventually carry them further into the ocean. Immediately after hatching, the hatchlings will disappear from shallow water near the hatching site. They will rarely be seen again in a few years. During this period, they follow the ocean currents and eat plankton that are close to sea level. Because observations are seldom made, very little is known about this 'absent year'. Young turtles may remain in one feeding site for several years before they move to another site. Hatchlings that are hatched in nature rather than in captivity tend to have higher risks of threatened by predators, thus, hatching turtle eggs are safer when done in captivity.

#### *B. Sea Turtle Conservation Program through Hatchery Breeding in Penimbangan Beach, Bakti Seraga, Buleleng*

Attempts to save the turtle population by establishing sea turtle breeding have been conducted for many years. The sea turtle conservation aims at keeping the natural cycles of the sea turtle reproduction. The conservation activities include rescuing the turtle eggs in their nests on the shore, moving the turtle eggs to the incubation site, and hatching, caring, raising the hatchlings to a certain size and finally, releasing (restocking) them into the ocean. Those processes become mandatory in a turtle conservation site. These attempts expected to be able to save the life span of the hatchlings to adulthood and reproduction phase, and increase the number of turtle populations living in the wild. The Penimbangan Beach Sea Turtle Conservation is one of the turtle conservations located in North Bali which is supported by PT Indonesia Power.

The Green Turtle (*Chelonia Mydas*) Conservation Program at the Penimbangan Beach Conservation in Bakti Seraga village, is a cooperation between Ganesha University of Education, Fishermen Group, and Pokmaswas of Bakti Seraga Village. The program is established by providing equipment in the form of flashlights, portable pumps petrol, as well as facilities for hatching and caring for the sea turtles, releasing sea turtles collected from confiscating, spoiling, found stranded, and collected by the community, as well as repairing the roof of the conservation building. The roof was modified in order to allow direct sunlight to come in to warm the turtle eggs in the incubation area. The sun lights can significantly assist the hatching process as an effort to conserve the endangered Green Turtle (*Chelonia Mydas*).



Turtle Breeding Locations



Search and Excavation of Hatching Eggs



Search and Excavation of Hatching Eggs



Eggs are placed in captivity



Figure 02 Hatchlings Conservation Program

The targeted achievement is to ensure and maintain the presence of the sea turtle eggs, to increase the number of eggs that hatch, and to re-release the hatchlings as an effort to conserve coral reefs on the coast of Penimbangan beach located in Bakti Seraga village, Buleleng, Bali. The number of eggs and hatchlings that have been released in the conservation site of the Penimbangan Coast is described in the following table.



NUMBER OF EGGS AND HATCHLINGS RELEASED

Data	Remarks	Year			
		2016	2017	2018	2019
Turtle Conservation Program through Hatchling Captivity at Penimbangan Beach, Bakti Seraga, Buleleng	Absolute results	1227	2984	3400	2015
	Number of eggs hatched and hatchling released	1017	2505	3150	4000

Based on the results of the research, the existence of the sea turtle conservation had positive impacts on economic, ecological, and educational sectors. The economic benefits that was brought about was an increase in the income of the community around the conservation area. Many local and international visitors came, either just to see or release the existing hatchlings. The percentage of income around the Penimbangan Beach shore had increased by 14% which was collected from donations from the surrounding community and from agencies which participated in hatchlings release. A hatchling release is valued at IDR 50,000.

With the large number of residents and visitors participating in the hatchling release, the donation collected by the organizer of the event could reach millions in each activity. A few agencies which have participated and donated in the hatchling release events included PT Indonesia Power Pemaron PLTGU, Employees Association of PT Indonesia Power employees, Buleleng Regional Police, Buleleng Regency PMD Office, Buleleng Fishery Department, Buleleng Natural Resources Conservation, Yonif Raider 900 / SBW, PKK (Women Association) of Bakti Seraga Village, domestic tourists and foreign tourists from Germany, Australia, Britain and India.

As for the biological aspect, there is an increase in sea turtle status data as follows table 01. Based on the above data, the sea turtle conservation could increase the number of turtles each year.

The educational aspect gained by the community is the training on how to breed hatchlings and how to release them. This turtle conservation involved a number of aspects such as providing facilities for hatching and captivating the sea turtles, releasing confiscated sea turtles, found on the shore, an /or voluntarily returned by the community. The program also involved repairing the roof of the captive breeding houses by modifying it, so that it could give access to direct sunlight to warm the turtle eggs in the turtle egg planting area. This consequently was expected could assist the hatching process.

For students, turtle conservation served as a marine life learning resource. When observing the hatchlings, students were given knowledge about how turtles lay eggs, how to care for turtle eggs, how to handle the hatching of the turtle eggs, and how to take care of the hatchlings.

During the release of the hatchling, students were taught about how to hold the hatchling, why the hatchling was placed inside the coconut shell cup, how long the hatchling could last

without being in the water, the right time to release the hatchling to the beach, and how to safely release the hatchling to the beach.

Similarly, the results of the questionnaire and interviews with teachers and students showed that the sea turtle conservation could be used as a learning resource. The teacher stated that students who were invited to go directly to the field to interact with nature had a better understanding of marine life especially about hatchlings, comparing to students who were only taught through books.

In addition, the students also mentioned that the conservation of hatchlings made them understand what marine life was like, especially the lives of sea turtles, how turtles lay eggs, how to care for turtle eggs, how to care for hatchlings, and how to release wild turtles. Students were also very excited to be able to directly touch the hatchlings and observed how the hatchlings swam in the sea.

The schools in North Bali region which have empowered hatchling conservation as a marine life learning resource were among others Dwi Aura Sukma Insani Pre-School, SD Negeri 1 Pemaron, SD Negeri 2 Pemaron, and a number of other elementary schools in Buleleng Regency.



Dwi Aura Sukma Insani Pre-School



Elementary Schools



PT Indonesia Power and other Company



PIKK Indonesia Power



Environmentalists

### C. Discussion

The sea turtle conservation was managed by referring to community-based ecotourism, the development of ecotourism supporting and allowing full involvement of the local community from the phases of planning, implementing, through the management of the whole benefits. This conservation emphasized on the active role of the community. The coastal community were knowledgeable about their surrounding nature and culture that were potentials as tourist attractions. Thus, this conservation had positive impacts on the economic sector in the form of creating employment opportunities for the coastal community, providing additional income from tourism services, i.e. guide fees, and the opening of food stalls for visitors [1,2,3,4].

In ecological sector, the sea turtle conservation brought benefits on the change in mindset of the community to develop efforts to conserve sea turtles. The conservation conducted by establishing observation posts along the coast for observing turtles which went up to the land to lay eggs and saved their eggs from natural predators and human who wanted to take them. In addition, the local community also attempted in participating and disseminating the importance of the sea turtle conservation by socializing it to children, students, and visitors. The existence of the conservation was crucial to keep the beaches in Bali to be safe for the sea turtles to lay their eggs.

Finally, in education sector, the sea turtle conservation had become one of the most important learning resources and had very valuable values in the context of student learning processes. The environment could enrich the learning materials and activities. This conservation became a learning resource which could be used for learning purposes and its existence could be found, applied and utilized for learning purposes [5, 6, 7, 8].

According to The Ecotourism Society, ecotourism is a form of travel to natural areas which is carried out with the aim of conserving the environment and preserving the lives and well-being of the local population, is expected to be a solution to the decline in the turtle population [9, 10, 11]. Based on Peraturan Menteri Dalam Negeri Republik Indonesia Nomor 33 Tahun 2009 Tentang Pedoman Pengembangan Ekowisata di Daerah, in the first article of the first item, mentioning ecotourism in the Development of Ecotourism in Regions in the first article of the first item, mentioning ecotourism education, understanding and support for conservation efforts natural resources, and increasing local people's income. tourist attractions that can shade turtle conservation activities as well as educational activities such as research.

The function of ecotourism is emphasized into three main functions namely the education function, the tourism function and the conservation function [12,13,14,15]. This educational function aims to provide information to the tourists who come to the importance of maintaining their survival and how to maintain and preserve the habitat of sea turtles. Besides the educational function also serves to facilitate the research activities related to sea turtles. Activities will be undertaken in the education function is to research the type and classification of sea turtles; research on the types and causes of sea turtle diseases; monitoring turtle nesting activities; releasing hatchlings into the sea; seminars and observing turtle. Tourism activities in turtle breeding sites on the coast are maximizing natural potential. The nature of the coastline which is flat with the waves allows tourists to enjoy the natural scenery by just sitting enjoying the atmosphere of the beach or doing activities with nature such as swimming, diving, canoeing, snorkeling or other activities.

Conservation function is a function in which there are activities that can maintain the survival and breeding of sea turtles in order to increase the number of turtle populations. Activities undertaken in the conservation function are to see, touch and feed turtles; releasing hatchlings into the sea; monitoring turtle nesting activities; and move turtle eggs to safe areas

#### IV. CONCLUSION

The sea turtle conservation provided multiplayer effects on economic, ecological, and educational sectors. The income of the surrounding community had increased, the awareness in protecting the coastal environment and marine life was also increased especially the awareness on the sea turtle life, and that the existenf the sea turtle conservation could be used as a learning resource. Based on these conclusion, a number of suggestions were made to the concerned parties. This program provided many benefits both for PT. Indonesia Power and for the community. Therefore, the management of PT Indonesia Power is expected to support this program in a sustainable manner through the allocation of environmental assistance funds. This program would not be possible without a good cooperation with POKMASWAS, NMS, Scuba, and scholars of Undiksha.

Thus, all parties were expected to always establish good cooperation attempting and providing solutions to the problems occured in the coastal area of Penimbangan Beach and its marine life. The turtle conservation was also expected to be developed in other coastal areas in the following years. The Department of Fisheries and Maritime Affairs was expected to continuously provide guidance for the community in participating, developing, and preserving the marine life. For the coastal community, the results of this study to were expected provide economic benefits.

The community around the coastline were expected to empower the utilization of turtle conservation as additional income sources by paying attention to environmental preservation and development of the marine life. The surrounding community was also expected to become water tourism tour guides who could provide tourists with awareness of the importance of protecting the sea and the ecosystem. For educators, this turtle conservation can be used as an alternative learning resource for students.

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