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Status, Trends, and Potentials of Turtle Conservation in Bali: A Mini Review

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Abstract

Sea turtles in Bali has been exploited excessively, which caused decrease in population, and this issue has placed sea turtles threatened to extinction. This review article aimed to provide information regarding the status, trends, and potential of sea turtles in Bali. Information given in this article is vital to ensure reliable knowledge not to only understand our current situation, but also to increase efficiency in reliant to the problem sea turtles face. The literature study method is used to write this review paper, namely by accessing a number of research paper published nationally and internationally. It was explained that the status of sea turtles is known to be endangered and law enforcement is not sufficient overcoming the problem. Conservation trends such as nurturing hatchlings have shown to not only help restore the population of sea turtles, but also to bring economic benefits to the conservation sites and the people. Potentials of ecotourism and DNA Barcoding has shown to be effective to benefit the people economically and increase the efficiency of law enforcement and conservation. Solutions and methods of improvement such as ecotourism and DNA Barcoding explained in this article is practical for Bali to adapt, so that sea turtle conservation is capable to overcome its status and incline to its potential.

Keywords: conservation, sea turtles, ecotourism, DNA barcoding, Bali

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INTRODUCTION

Indonesia is a tropical country that consists of more than 17,500 islands along the equator with a sea area exceeding 360 million hectares. Indonesia also lies between the isothermal 20ºLU / LS, which indicates an ideal location to support the growth of various biodiversities, one of which is sea turtles. Sea turtles are marine reptiles that are capable of migrating long distances along the Indian Ocean, Pacific Ocean and Southeast Asia(Luschi, 2013). It is known that there are 7 types of sea turtles around the world (Robinson & Paladino, 2013) and 6 of them are in Indonesia (Ario *et al*., 2016).

The last few decades have shown a continuous decrease regarding the population of sea turtles which caused it to be endagered (Mazaris *et al*., 2017). Therefore, sea turtles have become one of the most protected fauna globally. There are several threats sea turtles face, biological and human threats (Hamann *et al*., 2010). Biologically, wild hatchlings have faced death threats from predatory animals such as crabs, birds and other reptiles. Regardless of the biological threat, humans are the main reason responsible for the population downturn of sea turtles (Guebert *et al*., 2013). Human threats such as, over-development of coastal areas (Hill *et al*., 2019), waste dump (Rice *et al*., 2021), illegal catching of turtle eggs (Williams, 2021), meat and shells for years have caused sea turtles to become endangered (Espinoza *et al*., 2021).

Due to the situation given, humans are moved to implement wildlife conservation programs. These programes are expected to prevent and stop the mass extinction of wild sea turtles, its habitat, and the use of turtles for commercial purposes such as selling eggs, meat and shells. Conservation programs are educational regarding the purpose of the program itself and the importance of sea turtles (Mazaris *et al*., 2017). Protecting turtle eggs have become one of the main conservation

programs. Because of this program, during 2016 to 2019, egg production has increased significantly from 6,602 to 23,400 eggs (Adi Eti Harnino *et al*., 2021). This amount surely is significant in restoring the population of sea turtles.

Sea turtle conservation in Indonesia, especially ecotourism, has great potential. Ecotourism increases opportunities for more future conservation programs as well as raising awareness in order to restore the habitat of sea turtles damaged by humans (Tisdell & Wilson, 2002). Ario *et al*., (2016) and Maharani *et al*., (2016) conducted a research that supports the statement given. Their research shows positive results in increasing public awareness by expanding ecotourism in Indonesia. Ecotourism is vital in conservation to ensure a sufficient protection of sea turtles, while the local community is economically weak (Stronza *et al*., 2019). The potentials of sea turtle conservation is dependent on activities and programs utilized to attract the public. The usage of sea turtles as tourist attraction is an alternative solution to have more resources to protect sea turtles and provide economic benefits (Wilson & Tisdell, 2003). These potentials will be a stepping stone to strengthen the implementation preservation, conservation and protection of sea turtles in all regions of Indonesia.

The continuous decrease of sea turtle population in Bali reveals the efficiency of turtle conservation is not at its optimal level due to lack of information regarding the problem of sea turtles in this province in a course of 5 to 10 years. In order to maintain the population of sea turtles is to maintain all possible habitat and nesting areas of this marine species in Bali. The knowledge derived from this article is to fill this lack of information. Knowing the conditions and situation sea turtles are experiencing in Bali will alter or create solutions to overcome the problem.

This review aims to provide new information regarding the status, trends and potential of sea turtle conservation in Bali. It is expected to contribute knowledge related to the bioconservation of wildlife in Indonesia that can be carried out wisely by the community, academics, practitioners, related conservation institutions, and the government in making policies in the field of animal welfare.

MATERIALS AND METHODS

This review article was written using the literature study method, namely by collecting and accessing a number of scientific articles published nationally and internationally, books, databases such as Science Direct, Wiley-Blackwell, Springer Nature, Google Scholar, NCBI, ResearchGate and PubMed (Wiradana *et al*., 2021) using keywords such as hatching process, hatching life turtle, Turtle Conservation, Nesting area, and population abundance and trends in Bali.

RESULTS AND DISCUSSIONS

Status of Sea Turtles in Indonesia

Sea turtles are marine migrating species that spend most of its life below sea level. Sea Turtles are considered rare marine biota and its protection is recorded in Indonesian legislation (Astiani *et al*., 2017). Six out of seven species of sea turtles are found in Indonesian waters, these six species include green turtle (*Chelonia mydas*), hawksbill turtle (*Eretmochelys imbricata*), gray turtle (*Lepidochelys olivacea*), flat turtle (*Natator depressus*), leatherback turtle (*Dermochelys coricea)*, and loggerhead turtle (*Carreta carreta*) (Pardede & Yealta, 2013; Suraeda *et al*., 2018).

Sea turtles are now endangered due to the decrease in population. This status is caused by various threats in which the main threat is man-made. In addition, one other crucial factors affected by a predator during the hatching period. It has been reported that sea turtle eggs have been stolen to be sold and eaten. It is for a fact, without the ability to produce, decrease in population of sea turtles are inevitable. Other forms of threats include exploitation of turtles to meet protein needs for some local communities, slaughtering turtles during traditional ceremonies, processing turtles into various

products from food to cosmetics and handicrafts, as well as capturing turtles for hatchlings, meat, skin, and shells (Adi Eti Harnino *et al*., 2021; Ginting *et al*., 2020; Sudiana, 2010).

Habitat disturbance that causes decrease in turtle population is excessive development of coastal areas that directly reduce the habitat for turtles to nest (Mazaris *et al*., 2009). Currently, all turtle species have been listed in Appendix I List of CITES (Convention on International Trade of Endangered Species). This convention prohibits all international trade activities for all products derived from turtles, whether in the form of eggs, meat or shells (Alfinda, 2017; Mansula & Romadhon, 2020).

Green turtles are one of the species of sea turtles in Indonesian waters threatened with extinction (Prihadi *et al*., 2018). These sea turtles are exploited massively by humans, IUCN in 1987 reports an incident estimated that every year as many as 30,000 turtles are caught from all beaches where turtles lay eggs in Indonesia. The report resulted in the world's animal lover organization threatening Indonesia (Bali) as the country for the largest turtle slaughtering. This is one of the biggest consequences of this species being classified as an endangered species in the International Union for Conservation of Nature (IUCN) Red List, namely species that are at risk of extinction in the near future (Ayuningtyas *et al*., 2019; Sudiana, 2010).

Through this pressure Sudiana (2010) explains, it was recorded that starting in 1990, the Indonesian government issued a ban on the use of sea turtles nationally. This prohibition makes the tradition of using turtles categorized as an act against the law. Seeing the dangers of illegal trade in reducing the number of turtle species in the Bali province, WWF is trying to overcome this crime by collaborating with the Bali government in socialization and training to maintain the number of turtle species in Bali (Pardede & Yealta, 2013). Some details concerning government regulation are as follows:

"Leatherback turtles are protected based on the Decree of the Minister of Agriculture No.327 / Kpts / Um / 5/1978; The loggerhead and lekang turtles are protected based on the Decree of the Minister of Agriculture No.716 / Kpts / Um / 10/1980; Hawksbill and Flatback Turtles are protected based on the Decree of the Minister of Forestry No.882 / Kpts-II / 1992, and Green Turtles are included in the 6 types of turtles that are protected under PP No.7 / 1999 concerning the preservation of plants and animals. National law no. 5 of 1990 and PP.NO.7 and 8 of 1990 concerning the conservation of endangered species (turtles)".

A research done by an academic community in 1991 was discussed by Sudiana (2010), this research states that Balinese people each year consume 17,985 turtles, equal to 24,730 kg. This indicates that Bali is highlighted as a province where people exploit sea turtles excessively (non-sustainable use). In correlation with this statement, the government, non-governmental organiation and other environmentalists have taken legal steps or formal initiatives to stop the usage of turtles in the form of trade and consumption in Bali. The lifestyle of people exploiting turtles excessively is a setback to ensure awareness being raised in order to conserve the population of sea turtles (López-Barrera *et al*., 2016). The effort to better the status of sea turtles with only law enforcement is not enough, in fact, the willingness of the community to abandon their lifestyle of using sea turtles in a large scale is key to reduce bad habits that threaten sea turtles to begin with.

Turtle Conservation

Sea turtle conservation aims to prevent extinction, eliminate unsustainable use, and educate society regarding the purpose of this species (Gangal *et al*., 2021; Quesada-Rodríguez *et al*., 2021; Riskas *et al*., 2018). This line of conservation has become a priority in Indonesia and is being implemented by most of the province. Indonesian law enforcement is keen to uphold sea turtle conservation as their priority, and facts supporting this statement (Table 2).

According to the Indonesian conservation map by Udayana University (UNUD) Bali and WWF-Indonesia, there were 42 cases of sea turtles traded illegally and thwarted by

Indonesian law enforcement officials in 2002-2009, in which 39 cases are Bali related. Furthermore, 2705 green turtles were successfully secured as evidence, while 2451 (90.6%) green turtles were successfully released into the sea, the remaining 254 (9.4%) green turtles were found dead when it had happened. Further successful findings are in 2009, when law enforcement was able to thwart 3 cases of sea turtle smuggling in Sinjai, 32 cases in Tanjung Benoa, 6 cases in Bali and 28 cases in Dompu (NTB) (WWF-Indonesia, 2020).

Although law enforcement plays an important role in sea turtle conservation, it has not been the only attempt to protect these species. There are plenty of sea turtle conservation, one of many is in context with resorts and tourism which has brought economic success. Bintan Resort is located in Riau and has been carrying out this program since 2004. In 2005, Nanyang Technological University and National University Singapore helped Bintan Resort educate the staff about turtle breeding. Lessons were also given to local communities concerning the importance of turtle population and the coastal environment. In line with techniques related to captivity, the success rate of hatching eggs also increases with a variation between 74%-98% (Winata *et al*., 2010). In 2009, the community of the Bintan Resort built a breeding ground in the local village. These efforts have succeeded in reducing the rate of turtle egg harvesting by the community from 91% in 2004 to 20% in 2009. Bintan Resort has begun to adopt the principle of releasing hatchlings directly when the sun begins to set. This activity is carried out based on the fact that Bintan Resort keeps data on the orientation of the beach where the turtle eggs hatch, so that they can return again after reaching adulthood. The practice of captive breeding and maintenance of hatchlings prior to the release is known to influence hatchling orientation and survival instincts. Moreover, because of the variation in the pattern of Indonesian Cross Flow each season, releasing hatchlings after being raised may change their pattern of spatial distribution. This level of conservation has proven to be economically beneficial due to the increase of hotel occupancy rates at the Bintan Resort. This hatchling release conservation program has become the number one conservation program to be awaited by tourists (Budiantoro *et al*., 2019).

Hatching process are impacted by the environment in which the egg is located (Madden *et al*., 2008). Factors that determine sea turtle eggs to hatch are temperature, gas exchange, embryonic development, water, and altered beaches. During the course of incubation, the embryo grows inside the egg from a few cells at the beginning to a self-sufficient organism at hatching 50 to 80 days later. How embryonic growth may be influenced by the environment or by exchange with the environment is unknown, however, embryonic growth is unlikely to be independent of the environment. Unfortunately, the knowledge of developmental and regulatory physiology inside the egg is rudimentary for all reptile egg especially sea turtles. At this point, temperature, gas exchange, and water are key components to ensure a successful hatching during the hatching period (Ackerman 2017). According to Maulana (2017), the depth of sea turtle eggs are also a factor ensuring successful hatching. As emphasized by Kushartono (2014) 15, 20, 25 cm depth obtains a safe temperature for this process which is around 25-27 degrees Celsius. During this hatching process, the mother sea turtle will not be there as these hatchlings independently head to the ocean and repeat the cycle of life (Budiantoro *et al*., 2019).

One of the conservation organizations in Bali, TCEC Serangan, has nurtured sea turtle eggs semi-natural and hatchlings, as well as providing life support to sick sea turtles. Similar to Bintan Resort, Turtle Conservation and Education Center (TCEC) has incorporated hatchling release as a part of their conservation program that attracts tourists who visit Serangan, Bali (Ginting *et al*., 2020). Ways to protect and preserve sea turtles to continue their life in the wild is to nurture their eggs and hatchlings (Ceriani & Wyneken, 2008). A part of this article is to provide indication and explanation as

Table 1. Trend of successful and unsuccessful sea turtle hatchings in Bali

Year	Amount of Eggs	Successful Hatchings	Unsuccessful Hatchings
2016	6,605	27	6,578
2017	11,029	1,976	9,053
2018	21,306	12,497	8,809
2019	23,400	11,652	10,979

Table 2. Comparison of potential analysis with supporting evidence for ecotourism incidents in TCEC, Bali

Potential	Parameters	Supporting Evidence: events with
Positive socio-economic impact	Increase in employment	New jobs at ecotourism Green Island.
Social learning	Carry out joint action or research	1. Involvement of research institutes or universities in TCEC. 2. MoU TCEC and BKSDA Bali on a turtle conservation program through a hatchling rearing demonstration plot. 3. Monitoring and evaluation as a form of single cycle learning is carried out by BKSDA Bali.
Conservation	Activities or programs that are carried out open to the public.	1. Release of hatchlings with local communities and tourists. 2. Monitoring turtle eggs in adjusted circumstances in order to increase the number of successful egg hatching. 3. The number of eggs produced each year has increased. 4. TCEC Serangan conservation location which is open to the public (Site seeing).
Raising public awareness The	Implementation of security measures and community involvement.	1. Observation posts along the coast are useful for observing if there are turtles that come to the land to lay eggs and save their eggs from natural predators and humans who want to take them. 2. Community and tourist involvement in giving donations and purchasing hatchlings to be released.

for the birth and death rate trend of hatchlings in Serangan and Saba Beach, Denpasar Bali from 2016 to 2019. The data obtained is secondary data cited from Suriyani, (2020) and Harnino *et al*., (2021) in which the two studies are correlated in carrying out the management and protection of sea turtles in the Turtle Conservation and Education Center (TCEC) and Saba Beach, Bali. A table regarding the successful hatchling rates trends from 2016 to 2019 (Table 1).

Overall, this data and statements provide a good indication of sea turtles sustainability, meaning, sea turtle egg conservation is developing every year. This helps restore balance concerning the number of sea turtles in Bali. Although hatching methods in Saba beach is not stated, a method adapted by TCEC that brought this success is adapting a semi natural nesting area. However, monitoring temperature and other factors that result in hatching failure needs to be considered and further studies, in

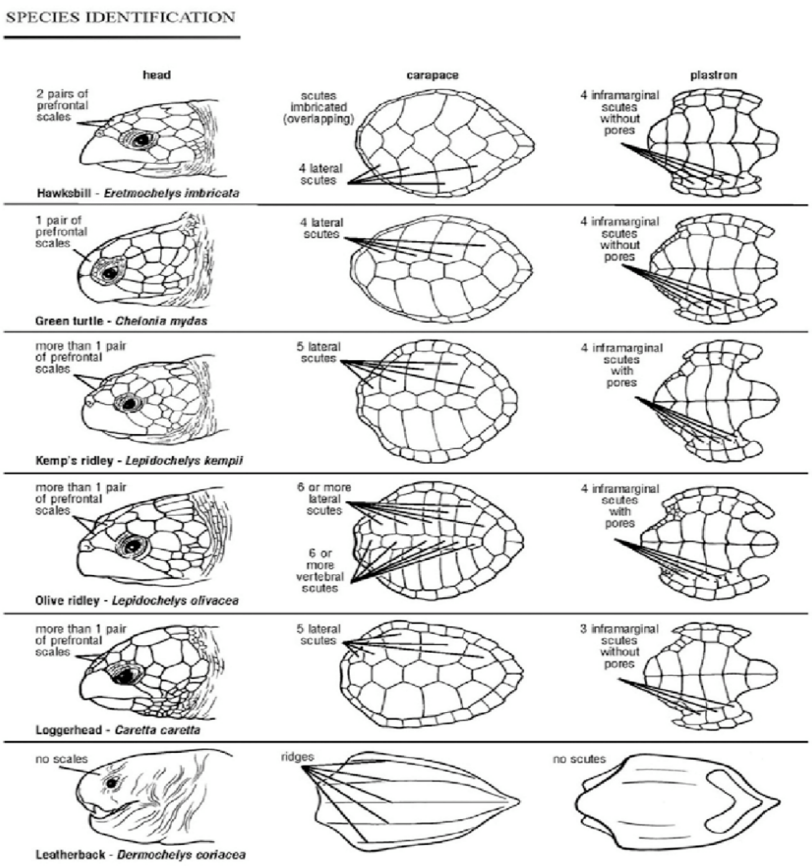

Figure 1. Species identification guide to sea turtles found in U.S. territorial waters. Source of figure courtesy of Dawn Witherington and Jeanette Wyneken (Wyneken, 2015).

order to avoid the increase of failed hatchings. Semi-natural in vitro conservation has potential to ensure monitoring during the hatching period.

Alfikri *et al*. (2019) conducted a research focusing on semi-natural hatching program and correlating between the numbers of eggs incubated and hatching success. This specific program was conducted in a time period of 7 years from 2012-2019. Semi-natural hatching programs has several processes, the first process is egg collection, in which these eggs are carefully placed in a plastic wrap and brought to the location of the semi-natural hatchery. Secondly, all eggs are placed into an artificial hole carefully prepared to obtain a suitable depth and temperature, this hole is made out of sand. The hole was 70 to 80 cm deep with a temperature around 27-30°C, this condition is safe from sea water flooding. There are two holes containing a number of eggs not uniformly. The result of this study revealed a high success hatchery rate about 50.59% (of the 85 incubated eggs), 93.06% (of the 72 incubated eggs); with a total hatchery success rate reaching 77.26%. This study indicates the biggest factor of failed hatching are mainly due to time consuming process during egg transfer, eggs from different parental combined in one artificial hole, and a large quantity of eggs incubated in one nest hole.

Another side to analyze is the factor of temperature. As mentioned by Ackerman (2017) temperature plays an important role making sure embryonic development won't experience disturbance to which hatching failure might occur. In the study of Alfikri, the eggs are placed not uniformly age and parental wise. Meaning, the temperature adjusted might not be suitable for all eggs in the same artificial nest that ultimately leads to hatching failure.

To compare this Alfikri's study and the overall trend of successful and unsuccessful sea turtle hatchings in Bali, the main problem of temperature that lead to hatching failure in Bali is manageable by the research conducted by Alfikri. It is revealed that temperature can be

controlled by the depth of the artificial nest also emphasized by Maulana (2017). Therefore, semi-natural hatchery program promising a 77.26% indicates a good result. Based on the result conducted by Alfikri *et al*. (2019) the semi-natural hatching program are recommended to be implemented as the main alternative is to avoid natural predators and illegal hunting. Although, in depth research regarding Semi-natural in vitro conservation should be done in order to control and optimal level of temperature, salinity, pH level, and humidity.

The Potential of Turtle Ecotourism

According to Alfinda, (2017), turtle breeding ecotourism is a tourism spot that can shelter turtle conservation activities as well as educational activities in the form of research. Rismang *et al*., (2018) explained that prior to conservation, sea turtles were used as raw material to support human social life which led to a decrease in its population. The catalysts for the extinction of turtles are destruction of nesting habitats, coastal abrasion, and turtle food that has been exploited on a large scale (Siqueira-Silva *et al*., 2020; Vásquez-Carrillo & Peláez-Ossa, 2021; Vélez-Rubio *et al*., 2018). Kuenzi & McNeely, (2008) continues by discussing ecotourism, namely nature-based tourism, as an option in promoting a unique and authentic environment, as well as being a tourism site. Ecotourism serves as a means of education, tourism, conservation, and harmonizing the economic needs of the community with the interest of conserving natural resources (Nahill, 2021). The potential and utilization of sea turtles as an ecotourism attraction can be seen from their egg laying behavior and foraging behavior (Dushani *et al*., 2021; Mobaraki *et al*., 2020). This can be supported by binocular facilities and interpreting services to increase visitor knowledge. The example of ecotourism will be useful in terms of economy, education and conservation to keep sea turtle life sustainable.

Based on the function of ecotourism, its potential also has an impact on socio-economy, education, conservation, and the increase of public awareness (Kiper, 2013). The following is a table of a study analysis from the research of Amelia *et al*., (2019) and Ginting *et al*., (2020) regarding the potential for ecotourism in TCEC Serangan, Bali that is supported by evidence of incidents (Table 2).

Based on this analysis, the theory of ecotourism potential according to Alfinda, (2017) is evident in TCEC Serangan. Even so, further research is needed in other turtle conservation sites such as Kurma Asih, BSTS, Saba Asri, and Deluang Sari. Research on the potential of ecotourism in the coming years is also needed to ensure that further conservation activities can incline to reach its potential.

DNA Barcoding

There are numerous ways to identify species, physical or external identification, being the most common techniques. According to Wyneken (2015) sea turtle identification, from external characters, is mainly based upon the scales on the head, from the jaws, the number of claws on the foot, and the number and arrangements of the plates or scutes on the shell. These characteristics varies between species. A detailed differentiation of this characteristics are shown in the image presented in Jeanette Wynekens' book (Figure 1).

Sea turtles are trafficked to maintain social lifestyle for example, the meats are cooked and shells are made into decoration all in one purpose to sell to communities. This specific case demolishes the capability to identify sea turtle species by its external characteristics. Because of this situation, DNA Barcoding plays an important role to uphold the law against sea turtle trafficking. According to Trivedi *et al*., (2016) DNA barcoding is an important tool in forensics and wildlife conservation. This can be used to identify endangered turtles by valuing illegally traded turtle meat, carcasses or eggs. One of the essential requirements of DNA barcodes is the collection and maintenance of samples as voucher specimens, which allows a reliable way of correcting the identification of the species from which data is accumulated. Coupon specimens provide permanent documentation for investigations of marine

biodiversity. DNA stem coding has great uses in the field of taxonomy (Ajmal Ali *et al*., 2014). In a separate study, DNA barcoding was carried out for sea turtles that are globally endangered. This study shows that DNA barcoding is not only a capable tool for species identification, but can also play an important role in wildlife forensics and conservation genetics (Yang *et al*., 2018).

Results of the research of Madduppa *et al*., (2019) regarding turtle DNA barcodes and their implications for conservation managers have developed protocols that allow identification of tissue samples of different qualities. The 719 bp fragments of the analyzed control region showed a high percentage similar to the GenBank CO1 sequence with 99% -100%. Four sea turtle species were identified among the samples, namely *Chelonia mydas* (4 samples), *Lepidochelys olivacea* (9 samples), *Eretmochelys imbricata* (2 samples) and *Dermochelys coriacea* (1 sample). This research has succeeded in strengthening the network of different sample sources by using the target DNA of the control area and therefore will be of benefit to the conservation of turtle management in Indonesia.

Sea turtles are migrating marine animals and the travel route of each species varies. Based on a research conducted by Mansfield *et al.* (2021), it was verified that (i) oceanic-stage green turtles travel to and remain within oceanic waters, (ii) often depart the Gulf Stream and North Atlantic Subtropical Gyre currents, orienting towards waters associated with the Sargasso Sea; (iii) remain at the sea surface, using thermally beneficial habitats that promote growth and survival of young turtles; (iv) green turtles orient differently compared to same stage loggerhead turtles. In order maintain the population and status of sea turtles, the origin of the trafficked turtle must be known in a geographical stand point. Knowing where these turtles are treated illegally, will make it possible for law enforcements to enforce the law. DNA Barcoding is a solution to this matter.

A research conducted by Abdalwahhab *et al*., (2020) revealed that DNA Barcoding was successfully carried out to identify 7 different fish families and 3 orders, by applying the sequencing of the cytochrome oxidase subunit 1 mitochondrial gene (COI) in the Northern Red Sea. This study revealed a 98% success of species identification implementing DNA Barcoding. This study emphasized more works using the applied analyses can be strongly recommended to aid proper conservation and management of economic aquatic species especially in the Red Sea. Another supporting research conducted by Pertiwi *et al*., (2020), aims to investigate trafficked turtles. This research also aims to identify the species and origin of the turtle population that is caught and traded on the illegal market in Bali, Indonesia. The results of Pertiwi *et al*., (2020) is a sample of turtles collected from illegal trade in Bali where the species are identified as *Chelonia mydas* (green turtle) and *Lepidochelys olivacea* (Olive Ridley sea turtle). This finding revealed that the illegal trade of sea turtles in 2020 still occurs in Bali, and the information must be given to the Indonesian government. Monitoring and protecting sea turtles in Bali must be a high priority because Bali is known as a center for illegal trade of sea turtles, and the exploitation of turtles in Bali has an impact on turtle population in other locations. This study can increase the awareness of turtle conservation and law enforcement for the exploitation of sea turtles. The efficiency of law enforcement and conservation itself can be increased using the DNA Barcoding method.

CONCLUSION

Based on the description of the results and discussion, it can be concluded that the status of turtles in Bali is threatened with extinction and until 2020 there are still illegal trades of sea turtles, which can be detected using the DNA Barcoding method. The trend of turtle conservation in Indonesia is the release of hatchlings during the sunset, where monitoring of hatchlings until they are ready to hatch is done semi-naturally. This trend has succeeded to increase the production of hatchlings each year, namely in 2016 as many as 6,605 to 2019 as many as 23,400 hatchlings. This helps restore

the balance of sea turtle population in Indonesia, especially Bali. During 2019, numbers of failed hatchlings inclines due to inconsistent sand temperature, which should be monitored closely in the future. A study analysis of comparing ecotourism potential with supporting incidents at TCEC Serangan is evident. Further studies are required to ensure accuracy in other Bali conservation sites. DNA *Barcoding is* proven to be reliable in increasing awareness of turtle conservation and law enforcement for the exploitation of sea turtles. This method can be implemented in the future to support the effectiveness of conservation and law enforcement in Bali. This paper emphasize recommendations regarding raising awareness in order to change mindsets of exploiting sea turtles, semi-natural hatchery programs to maintain external environmental conditions in order to achieve successful hatchings, sea turtle conservation incorporating ecotourism to benefit the conservation site itself in order to launch new conservation programs as well as an economical benefit to the society, and DNA Barcoding as a technological solution towards enforcing the law of sea turtle trafficking.

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