

REVIEW: TAXONOMIC CONTRIBUTION FOR ECOTOURISM DEVELOPMENT IN INDONESIA

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ABSTRACT

This paper describes about the role of taxonomic in ecotourism development in Indonesia. Development and management of ecotourism in Indonesia recently are still quite slow and inadequate. It is due to the lack of knowledge of local community about the information of flora and fauna which is used as ecotourism attraction. Therefore the taxonomical science needs to be applied to the development of ecotourism in Indonesia. In addition, some species which are used as tourist attractions needs to be identified and classified to preserve the resource. Implementation of taxonomy related to survey, documentation, data collection, identification and classification to establish the identity of a species for ecotourism attraction. Methods are commonly used for the implementation of taxonomy in the ecotourism development, i.e. (1) morphological observation, (2) vocalizations and (3) molecular analysis. Morphological observations can be applied by qualitative and quantitative observations. Qualitative observation is an observation of a species, which is related to morphology and coloration, and comparison with other species which are suspected related. Quantitative observation is a morphometric analysis, which is a concept of quantitative analysis of the species that related to the size and shape of a species. Vocalization method is applied by determining the vocal character of a species, by comparing the data, which has obtained, with the data vocals from other species which are suspected related. Molecular analysis is commonly used to support the identification of morphological and vocalization of the species. Molecular methods, which are commonly applied for species identification, are usually hybridization, DNA sequencing, restriction mapping, chromosome banding and immunological method

Keywords: taxonomy, ecotourism, Indonesia, morphological observation, vocalization, molecular identification

INTRODUCTION

Ecotourism is nature-based tourism. Based on the principles of green productivity and ecology, it has low impact to the environment [1]. Ecotourism is an activity, which is considered as sustainable tourism. Ecotourism has specific characteristics. These specific characteristics are the concern to the environmental conservations and providing economic benefits to local community. Therefore, every ecotourism activity should be based on the principles of sustainable management. These principles are based on the nature, focus on conservation activities, focus on the development of sustainable tourism, relate to the education development activities, accommodate local culture and provide benefits to the local economy [2].

Indonesia is an archipelago that has ecosystem and species diversity. The diversity of flora, fauna and their ecosystems, as well as cultural diversity, are potential for ecotourism attraction because it can attract tourists to visit an area [3]. The diversity of flora and fauna found

in the area can be seen from the survey that describes what species are there in the region. Taxonomy is one of knowledge that is important in ecotourism development. By knowing the species that exist in a region, we can identify the rare or endangered species. The existence of rare or endangered species will attract the tourists to visit the region and causing the tourism activities that provide economic benefits to local community. In addition to attract tourists visit, a rare or endangered species in a region will lead researcher to conserve it. By applying the taxonomy, the local community also can learn these rare or endangered species and how to preserve it so that there is a contribution from the local community to conserve it.

One of environmental communities has implemented taxonomy was Coral Cay Conservation. Coral Cay Conservation had implemented taxonomy for survey and species identification. Coral Cay Conservation is an organization working in ecotourism sector. These organization sent volunteers to survey the most endangered coral reefs and tropical forests [4]. Survey, identification and classification that were part of taxonomic assessment were useful for establishing the identity of the species [5]; [6]; [7]; [8]. By applying it, a new species and their distribution, which can determine the level of

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diversity of fauna in the area and conservation status of the species, can be known [6]; [9]; [10]; [11]; [12]; [13]. Ecotourism requires taxonomic information because ecotourism is not limited to recreation, landscape, and scenery. Ecotourism also related to the ecosystem diversity that reflects the diversity of flora and fauna [14]. The diversity of flora and fauna in an area should be studied to obtain information.

Basic information and other scientific information is an absolute requirement for any sustainable management of natural resources. This paper aims to describe the role of taxonomic in ecotourism development. It is particularly important because numerous biodiversity forms for tourism attraction need to be identified and classified to ensure the sustainability use of such resources.

BIODIVERSITY AND TAXONOMY

Biodiversity is a term that describes the diversity of whole life on earth, from the smallest and simplest, such as microorganisms, to which has a complex system, such as the rain forest, including the describes of the diversity of habitats and ecosystems that support a whole life on earth and the interaction forms of life and the rest of the environment [15]; [16].

Based on the hierarchy, biodiversity can described through the three concepts, i.e. genetics diversity, species diversity and ecosystem diversity [15]; [16]. Genetics diversity depends on genetics variation inherited within and between populations of organisms. Genetics variation will be arises in individuals if there are gene and chromosome mutations, and in organisms with sexual reproduction it can be inherited through the recombination. Species diversity is a concept explaining about species richness in a habitat and represents biodiversity. It can be said like that because species is a unit of fundamental descriptive of life. Ecosystem diversity is a concept obtained through analysis of component species diversity which is involve assessment of the relative abundance of different species. it means that species abundance is directly proportional to the area or habitat of the species. If there more area or habitat diverse, many species found in there will be equally abundant [16].

Biodiversity is essential to support human life because it may provide goods and services. Components of biodiversity can be used directly as food, medicines, building materials, and etc. Moreover, biodiversity also provides more

benefit indirectly, in the form of environmental regulation, soil conservation, and pollution control. It is estimated that 40 percent of the global economy is based on biological products and processes. Percentage of biodiversity can be affected by several factors; one of them is the rapid development of the tourism industry. It is due to its role to global gross domestic product (GDP), generate the number of occupations so it can reduce the number of unemployed, and also serve the number of clients [17].

Scientists implement some sciences to analyze the percentage of the biodiversity in an area. one of them is taxonomic science. Taxonomy is one of sciences that learn about observation, nomenclature and classifying species or organisms of the world. Scientists identify species or organisms and classify them based on the characteristics of morphological, behavioural, genetic, biochemical and etc. Taxonomy is a tool used to identifying, naming, describing and calculating the components of biological diversity. it provides basic knowledge to support biodiversity management and implementation of the convention on biological diversity [4].

DEVELOPMENT OF ECOTOURISM IN INDONESIA

In 1995, ecotourism sector started to become public attention in Indonesia. At that time, there were national seminar and workshop organized by Pact-Indonesia and WALHI (Indonesian Forum for the Environment) in Bogor. Based on these meeting, there was an opinion had proposed, i.e. local community should be involved in every ecotourism activities. The involvement of local community could be through the management of ecotourism proportionally [3]; [18].

The second national workshop of ecotourism was held in Bali in 1996. These workshop had aim to strengthen the ecotourism movement in Indonesia through the formation of Indonesian Ecotourism Society (MEI). This community was formed with some purposes, i.e. (1) to increasing the awareness about potential natural resources conservation as ecotourism attractions in Indonesia, (2) to evolving the quality of environmental education for tourists and (3) to providing economic benefits for local community around tourist's area. The activities of ecotourism society have increased since 1996. It caused MEI to organize the first meeting in 1997 in Flores (NTT) and in 1998 in Tana Toraja, Sulawesi Selatan [19] as cited in [3]. At that time, there were several areas in Indonesia were trying

to develop ecotourism because these areas have several ecotourism attractions, e.g. Kalimantan, Sumatra, West Java and Bali.

In Kalimantan, development of ecotourism was undertaken in 1990-1997 by Kalpataru Adventure. It was proposed in Tanjung Putting National Park due to flora and fauna found in Tanjung Putting National Park could be used as ecotourism attractions. For example, the presence of orangutans and proboscis monkeys have increased tourists visitation in Kalimantan. However ecotourism development in Tanjung Putting, at that time, has some obstacles, e.g. smoke from fires, economic crisis, political instability, and concerns about the safety of travel in Indonesia [19] as cited in [3].

In Sumatra, the idea of ecotourism development was proposed at Mei meeting in 1996. The project was built up in Dusun Pamah Simelir because it had unique attractions, e.g. water rafting, bird watching, the presence of orangutan, deer and siamang. However, during the development, the project had some obstacles, e.g. a plane accident, forest fires, political riots which were reducing international tourists visitation, and economic crisis which was increasing the price of agricultural products. These obstacles were leading to changing the efforts of local community, from ecotourism sector to the agriculture. The new ecotourism project was developed after the project in Pamah Simelir. It was developed in Dusun Sayum Sabah because Sayum Sabah also has some ecotourism attractions, e.g. the river, local fruits, the culture and tradition of the karo zahe ethnic group and an ancient castle [19] as cited in [3].

The development of ecotourism in Gunung Halimun National Park (TNGH), West Java Province, was conducted in 1994-1999. These project was built up to socialize the conservation of flora and fauna and the sustainable benefits through the empowerment and involvement of local community. It was done because in addition to conserve the environment, this project also provide economic benefits to local communities. Promotion of ecotourism in Gunung Halimun National Park was conducted by direct promotion and indirect promotion. Direct promotions were carried out by distribution of flyers, trekking maps, video promotions, slides and posters. Indirect promotions were carried out by press releases, articles, host seminars and distribution of information to the research centers, NGOs and conservationists. However, the economic crisis caused tourist visitation to Gunung Halimun

National Park decreased in 1998 [19] as cited in [3].

Ecotourism development in Bali started in 1980s by Ida Ayu Agung Mas [19] as cited in [3]. Bali is one of the international tourist destinations in Indonesia because of some reasons, e.g. traditional culture of balinese [20]. Therefore Ida Ayu Agung Mas has created Sua Bali to build up a tourist resort whose activities are based on the relationship of dynamic, balanced and harmonic between human, spirituality and environment [19] as cited in [3].

Development of ecotourism since the early 1990s until the end of 1999 is still very slow. Many ecotourism policies that have been generated, but ecotourism products in Indonesia are still limited. Many things that cause slow development of ecotourism in Indonesia, i.e. [18]:

1. There are no guidelines which can encourage ecotourism to be the nature conservation and sustainable economic.
2. Understanding of ecotourism by the various stakeholders, which can be considered as supporter and implementer of ecotourism activities, are still low.
3. The truth of the concept of ecotourism, which could be used as a sustainable economic activities and empowerment of local communities, is still in doubt.

One of the examples from successful ecotourism development was undertaken by a group of anglers, in the Serangan Village, Bali through the sea horse breeding and the development of ecotourism floating zone. It was conducted based on the anglers concern to the environmental damage. The activity began in 2000 with the prevention of fishing or catching other marine animals in an unwise way, like coral mining and using of cyanide. In 2001, the anglers began educating elementary and junior high schools children to planting (transplantation) of coral reefs. Around 2003-2004, they formed Anglers Group, Karya Segara, that had primary goal for environmental remediation program. In addition, they began working with the Ministry of Marine and Fisheries. They got support in the form of seed as much as 2,000 colonies of coral reefs, which consists of 3 types of coral reefs, i.e. massive, sub-massive and acrophora. At the end of 2005, they received support from NGOs Samdhana as much as Rp 45 million for the development of the seeds. Through Yayasan Bahtera Nusantara, they were supported to

undertake cultivation and conservation activities, including community capacity building. They began to cultivate of two species of sea horses in 2006, i.e. *Hippocampus kuda* and *H. histrix*, through independent research. In 2009, they began to associate with the travel agency, Pro Bali Pandu Wisata, and proposed the idea to sell a package of eco-tourism program, i.e. adopt coral reef. At the end of 2009, they associated with PT Poros Nusantara to make an activity, The Coral Day, that made people think of coral reefs in a day. The Program was better in 2010 and started a lot of tourist visitation from China. In 2012, they made associate with Pro Bali Pandu Wisata to create a floating information center as well assembled as ecotourism program. Anglers group, Karya Segara, was not only doing the rehabilitation in Serangan Village, but also almost all over the coast of Bali. They also not only cooperated with the government in Bali but also in some locations such as Lombok, Sulawesi, NTT (Kupang, Alor and Rote) and Halmahera [21].

Taxonomic Implementation for Ecotourism Attraction in Indonesia

Taxonomy has an important role in the development of eco-tourism attraction in Indonesia. It is related to the survey, documentation, data collection, identification and classification which serve to establish the identity of a species. The tourists with a variety of ecotourism activities, such as bird watching, wildlife viewing, game fishing, diving and snorkeling, need data of flora and fauna found the tourist area. With the availability of the data of flora and fauna in a tourist area, will facilitate the tourists to recognize the species, both rare and endangered and new species, which are, be the main attraction in the area. In addition to the data of flora and fauna in the area, it is known the diversity of species present in the area, which can also be used as an attraction in an area.

Taxonomic role has potency in determining the degree of biodiversity that found in Indonesia. Taxonomy by applying the principle and the stages of implementation, from identification, understanding of the content of units that is identified, a complete analysis, to sharing information about the unit that is worked, so the utilization and preservation can be designed with maximum results. Taxonomic information is also needed in the field of tourism. For example is a wealth of information about natural, attractive treading, where and when the

emergence, in what form, the content of appeal which can be expected, at the level of species, ecosystems, and other germplasm [14].

Based on the statement of Mardiasuti et al. [22], taxonomy is needed to record the number of species that found in Indonesia. Taxonomy plays a role in the process of collection of certain species, where the survey results will be compiled in the form of documents. The documents have been arranged expected to be used as a reference in carrying out field activities which are often carried out by NGOs, practitioners of conservation biology and ecotourism. In the study also explained that, in order to ensure the establishment of data collection system and high-quality information, inclusive, accessible, transparent, trustworthy and reliable to take important decisions, must reach several requirements, one of them is to strengthen the baseline study for the taxonomy. The statement is also supported by Eprilurahman et al. [23] whose research has focused on the diversity of reptiles and amphibians in the area of ecotourism. It is essential for a tourist area to have the data of fauna, because each of fauna, including herpetofauna has an important role in maintaining the balance of ecosystems and the sustainability of the tourist area. In addition, these data can be an attraction and benefit in an ecotourism area.

One of the examples of the taxonomic contribution that used for tourism development, i.e. identification of bird species as the basic information for the bird watching race in Tahura Ngurah Rai Bali as a means of environmental education for students. According to Sudaryanto et al. [24], one of the types of activities that is quite a lot of attention and is a new trend, is ecotourism. One of them is bird watching activity while the observation of the bird race is called Bird watching Race. Bird watching is one of the efforts to increase awareness of students on the environment, especially birds, and to promote ecotourism. According to the statement of BirdLife International Indonesia Programme (BIIP) in Sudaryanto et al. [24], bird watching activity is a tourism activity that can increase the income. Some countries such as Kenya, Costa Rica, Nepal, India, Thailand and Malaysia are countries that have made bird watching activity as a business in the tourism sector. Many travel agencies in Europe and the United States, which organize bird watching tour, bringing tourists to these countries though these countries do not

have as much as diversity of bird species in Indonesia [24]; [25].

In addition to bird watching activity, another ecotourism activity that implements taxonomy to collect the data of species is marine tourism. One of the regions in Indonesia that held Marine tourism is Bali. Bali's rich marine resources have long been an important economic asset to the island, both as a source of food security for local community and also as a focus for marine tourism. Marine tourism has some attractions, i.e., diving and snorkeling attractions in Nusa Penida, Candi Dasa, Menjangan Island (Bali Barat National Park), and the Tulamben [13].

Fish and coral reef diversity in the sites can attract tourist's visitation to try some ecotourism attractions, e.g. diving, snorkeling and game fishing. Therefore it is needed data that represent fish and coral reef diversity in the site so survey and species identification is needed to collect the data. Based on the statement of Allen and Erdmann [9], the principle aim of the species survey was to provide a comprehensive report of the species that found in the site. Such as reef fish survey that has conducted by Allen and Erdmann [9]. They have recorded 805 fish species for the survey. Combined with previous survey efforts by them, primarily at nearby Nusa Penida in 2008, the current total for the Bali region is 977 species in 320 genera and 88 families.

Besides these surveys provide a comprehensive report of the species, it also can identify new species that found in the site. Such as coral reef survey that has conducted by Turak and DeVantier [13]. Based on this survey, they discovered the presence of local endemic coral reef, *Euphyllia* sp. in Bali, and other apparently local endemic corals, notably *Acropora suharsonoi*. Uniqueness of coral which they found in Bali, suggests that the region does have a degree of fauna uniqueness, possibly related to the strong current flow through Lombok Strait [13]; [26].

WWF Indonesia also implemented taxonomy while it developed ecotourism jungle track, in Punggualas. This organization aimed to determine the location and the line of interpretation of transects/ jungle track ecotourism based on biodiversity potential, identification of species dominance to the biodiversity in line area, provide the biodiversity information in the form of nomenclature as initial capital to create and develop ecotourism in Punggualas [27].

Mangrove is one of the important coastal and marine ecosystems, in addition to coral reefs and seagrass beds. Mangrove has several benefits such as ecological and economic benefits. Mangrove in Nusa Penida bring many benefits to the local community as the object of mangrove tour ecotourism, coastal protection, preventing seawater intrusion into coastal and place spawn and breed for fish and other marine life. To protect mangroves, coral reefs, seagrass beds and other marine biota Nusa Penida is beneficial for community, and then this time the establishment of Marine Protected Areas (MPA) Nusa Penida is underway. Hopefully with the MPA's coastal and marine resources Nusa Penida can be managed in a sustainable manner, including mangroves and sustainable. In order to collect data and information in order to provide input for the establishment of MPA and sustainable mangrove management, then the identification of mangrove species that exist on Nusa Lembongan and Nusa Ceningan important to do. By knowing, the types of mangrove management can be done [28].

METHOD FOR TAXONOMIC IMPLEMENTATION IN ECOTOURISM ATTRACTION

Taxonomy can be applied to analyze the diversity of flora and fauna, and identify new species of flora and fauna in an area as a tourist attraction. Some of the methods that were generally used were (1) Morphological observation [6]; [28]; [29]; [30]; [31]; [32]; [33]; [34], (2) vocalization [6]; [31] and (3) molecular analysis [35].

Based on the types of data, morphological observations were divided into (1) qualitative morphological observation and (2) quantitative morphological observation. Qualitative morphological observation was conducted by observation overall morphology and coloration of the species and comparison with another species which was presumably still have the relationship. For example is mangrove identification in Nusa Lembongan and Nusa Ceningan. It was done by direct observation in the field at some point of observation. Observations were made in the outer zone, the middle and closest to the mainland. Observations were made by observing the difference of roots, leaves, flowers and fruits of mangrove [28].

Quantitative morphological observation is commonly performed using morphometric methods. Morphometric method is a quantitative concept that describes of species by using

statistical analysis of body size (part of body) of the species. Morphometric methods could be applied to quantify the trait of evolutionary significance, analyzing of fossil record, impact of mutations on shape of species, developmental changes on shape of species, covariance between ecological factors and shape of species, estimating quantitative-genetic parameters of shape of species [36]. For example is identification of six new species of squaloid shark of the genus *Etmopterus* [10]. These identification used morphometric methods through the differences of body shape, vertebral counts and the size and shape of luminescent markings on the flank, caudal peduncle and caudal fin [10]. Allen and Erdmann [37] also conducted morphological analysis and made identification key to identify a new species of whiptail (Pisces: Nemipteridae) from eastern Indonesia.

Vocalization was conducted by determine vocal character of the species through the comparison the vocal data with vocal data of another species [6]; [31]. Vocal character of the new species was also identified through the implementation of taxonomy. Vocal data was analyzed through the quantification of distinctiveness of the birdsong in relation to other bird species within the clade. Researchers conducted a discriminant analysis (DA) based on the comparison of birdsong recordings. Based on the each recording, they calculated mean values of the following variables, i.e. notes/strophe, length (in seconds) of longest note (one per strophe), strophe length (seconds), maximum and minimum fundamental frequencies (one each per strophe), number of strophes per phrase, length of interval between phrases (in seconds) and, for phrases with more than one strophe, interval between strophes and length of phrase (in seconds); we also calculated bandwidth (maximum minus minimum fundamental frequency within a given strophe), strophe pace (number of notes per strophe/strophe length) and, for phrases with more than one strophe, phrase pace (phrase length/ strophes per phrase) [6].

Molecular analysis is commonly needed to support another identification methods. There are several molecular method for taxonomic identification, i.e. (1) hybridization, (2) DNA sequencing, (3) restriction mapping, (4) chromosome banding and (5) immunological method [35]. Hybridization is a fusion of two single-stranded of DNA or RNA or one of each to

form complementary bonds (double-stranded nucleic acid). Related species will be known by the higher percentage of hybridization. DNA sequencing is a comparison of DNA sequences of species are sequenced from one end to another's. Related species will have similarity DNA sequences. Restriction mapping is conducted by restriction of DNA strand that produce segments of DNA are isolated from different species and form restriction mapping. Related species will have more similar restriction map. Chromosome banding is conducted by observation of chromosomes obtained from different species, through the certain staining techniques; resulting transverse bands appear on chromosomes. The most common methods of dye based chromosome banding are (1) G-(Giemsa), (2) R-(reverse), (3) C-(centromere) and (4) Q-(quinacrine) banding. Immunological method is conducted by testing of Antibodies to recognize the macromolecules on the cell surface of different species. Related species usually have macromolecules which are recognized by the same antibodies [35].

CONCLUSION

Based on the analysis, Taxonomy can help identifying and classifying species for reference data that can be used as ecotourism attraction and environment conservation. The identification method can be applied in several ways, i.e. (1) the morphological observations; (2) vocalization; and (3) molecular analysis.

REFERENCES

- [1]. Hundloe, T. 2002. Linking Green Productivity to Ecotourism. Experiences in the Asia-Pacific Region. Chapter 2. The Changing Nature of Tourism. Asian Productivity Organization. Tokyo
- [2]. Hidayati, D., Mujiyani, Rachmawati L. and Zaelani A. 2003. Ekowisata: Pembelajaran dari Kalimantan Timur. Pustaka Sinar Harapan. Jakarta
- [3]. Dalem, A.A.G.R. 2002. Linking Green Productivity to Ecotourism. Experiences in the Asia-Pacific Region. Chapter 10. Ecotourism in Indonesia. Asian Productivity Organization. Tokyo
- [4]. Secretariat of the Convention on Biological Diversity. 2008. Guide to the Global Taxonomy Initiative Issue 30 of CBD technical series. Secretariat of the Convention on Biological Diversity. Montreal

- [5]. Dobzhansky, T.H. 1935. *Drosophila Miranda*, a New Species. Genetics. 20. 377-391
- [6]. Mahood S.P., John A.J.I., Eames J.C., Oliveros C.H., Moyle R.G., Chamnan H., Poole C.M., Nielsen H. and Sheldon F.H. 2013. A New Species of Lowland Tailorbird (Passeriformes: Cisticolidae: *Orthotomus*) From the Mekong Floodplain of Cambodia. Forktail. 29. 1-14
- [7]. McLellan I., Mercado M. and Elliott S. 2005. A New Species of *Notoperla* (Plecoptera: Gripopterygidae) From Chile. Illiesia. 1. 5: 33-39
- [8]. Ward S. and Larson H. 2012. Threatened Species of the Northern Territory: Northern River Shark, New Guinea River Shark: *Glyphis garricki*. Department of Land Resources Management. <http://www.lrm.nt.gov.au>. Accessed on 14th September 2013
- [9]. Allen G.R. and Erdmann M.V. 2012. Bali Marine Rapid Assessment Program 2011. Chapter 3. Reef Fishes of Bali, Indonesia. RAP Bulletin of Biological Assessment. 64. 15-68
- [10]. Last P.R., Burgess G.H. and Seret B. 2002. Description of Six New Species of Lantern-Sharks of the Genus *Etmopterus* (Squaloidea: Etmopteridae) From the Australasian Region. Cybium. 26. 3: 203-223
- [11]. Lazuardi M.E., Sudiarta I.K., Ratha I.M.J., Ampou E.E., Nugroho S.C. and Mustika P.L. 2012. Bali Marine Rapid Assessment Program 2011. Chapter 4. The Status of Coral Reefs in Bali. RAP Bulletin of Biological Assessment. 64. 69-77
- [12]. Schindler I. and Linke H. 2013. *Betta hendra* a New Species of Fighting Fish (Teleostei: Osphronemidae) From Kalimantan Tengah (Borneo, Indonesia). Vertebrate Zoology. 63. 1: 35-40
- [13]. Turak E. and DeVantier L. 2012. Bali Marine Rapid Assessment Program 2011. Chapter 5. Biodiversity and Conservation Priorities of Reef-building Corals in Bali, Indonesia. RAP Bulletin of Biological Assessment. 64. 78-130
- [14]. Adisoemarto, S. 2005. Pentingnya Pengukuran Derajat Keanekaragaman Hayati: Betapa Kaya Indonesia dalam Plasma Nutfah Tetapi Berapa Kayanya?. Komisi Nasional Sumberdaya Genetik. Bogor
- [15]. Pearce D. And Moran D. 1994. The Economic Value of Biodiversity IUCN - The World Conservation Union. Earthscan Publications Ltd. London
- [16]. Swingland, I.R. 2001. Biodiversity, Definition of. Encyclopedia of Biodiversity. Academic Press. 1. 377-391
- [17]. Christ C., Hillel O., Matus S. and Sweeting J. 2003. Tourism and Biodiversity: Mapping Tourism's Global Footprint. Conservation International. Washington
- [18]. Triutami, H.W. 2009. Keterlibatan Warga Pulau Pramuka dalam Usaha Ekowisata di Kepulauan Seribu. Skripsi. Faculty of Human Ecology. Bogor Agricultural Institute
- [19]. Sudarto, G. 1999. Ekowisata: Wahana Pelestarian Alam, Pengembangan Ekonomi Berkelanjutan, dan Pemberdayaan Masyarakat. Yayasan Kalpataru Bahari and Yayasan KEHATI: Indonesia.
- [20]. Izawa, T. 2010. Ecotourism in Bali: Backgrounds, Present Conditions and Challenges. Journal of Ritsumeikan Social Sciences and Humanities. 2. 73-103
- [21]. Sigit, R.R. 2013. Kelompok Nelayan di Bali ini Mampu Tangkarkan Kuda Laut dan Membangun Zona Ekowisata Terapung. <http://mongabay.co.id>. Accessed on 10th September 2013
- [22]. Mardiasuti A., Kusriani M.D., Mulyani Y.A., Manullang S. and Soehartono T. 2008. Arahan Strategis Konservasi Spesies Nasional 2008- 2018. Directorate General of Forest Protection and Nature Conservation- Department of Forestry RI. Jakarta
- [23]. Eprilurahman R., Hilmy M.F. and Qurniawan T.F. 2009. Studi Keanekaragaman Reptil dan Amfibi di Kawasan Ekowisata Linggo Asri, Pekalongan, Provinsi Jawa Tengah. Berkala Penelitian Hayati. 15. 93-97
- [24]. Sudaryanto L.P., Yuni E.K. and Hardini Y. 2010. Birdwatching Race di Tahura Ngurah Rai Bali Sebagai Sarana Pendidikan Lingkungan untuk Pelajar dan Mahasiswa. Ejournal University of Udayana. 9. 1: 2-8
- [25]. Paine, J.R. 1997. Status, Trends and Future Scenarios for Forest Conservation Including Protected Areas in the Asia-Pacific Region. Asia-Pacific Forestry Sector Outlook Study Working Paper Series. No. 4. FAO. Rome
- [26]. Turak E., DeVantier L. and Erdmann M. 2012. *Euphyllia baliensis* sp. nov. (Cnidaria: Anthozoa: Scleractinia: Euphylliidae): a new species of reef coral from Indonesia. Zootaxa. 3422. 52-61
- [27]. Elisabeth. 2010. Identifikasi Jungle Track Berbasis Biodiversity. E-Newsletter: Program Konservasi Sebangau. 6th Edition

- [28]. Welly M., Sanjaya W., Sumerta I.N. and Anom D.N. 2010. Identifikasi Flora dan Fauna Mangrove Nusa Lembongan dan Nusa Ceningan. Coral Triangle Center (CTC) and Balai Pengelolaan Hutan Mangrove Wilayah I. Nusa Penida
- [29]. Allen G.R. and Rajasuriya A. 1995. *Chrysiptera kuiteri*, a new species of Damsel fish (Pomacentridae) from Indonesia and Sri Lanka. Records of the Western Australian Museum. 17. 283-286
- [30]. Chen J. and Deharveng L. 1997. A New Record of the Genus *Sinella* in Indonesia with a New Species of the Subgenus *Coecobrya* (Collembola: Entomobryidae). The Raffles Bulletin of Zoology. 45. 1: 135-138
- [31]. Jonsson K.A., Poulsen M.K., Haryoko T., Reeve A.H. dan Fabre P.H. 2013. A New Species of Masked-Owl (Aves: Strigiformes: Tytonidae) from Seram, Indonesia. Zootaxa. 3635. 1: 51-61
- [32]. Randall J.E. and Chen I. 2007. *Tomiyamichthys tanyspilus*, a New Species of Gobiid Fish from Indonesia. Zoological Studies. 46. 6: 651-655
- [33]. Suhardjono Y.R. and Deharveng L. 1992. *Siamanura primadinae*, a New Species of Neanurinae (Collembola: Neanuridae) from East Java, Indonesia. Raffles Bulletin of Zoology. 40. 1: 61-64
- [34]. Yoshitomi H. and Putra N.S. 2011. A New Species of the Genus *Acontosceles* (Coleoptera: Limnichidae: Thaumastodinae) from Indonesia. Bonn Zoological Bulletin. 60. 2: 165-168
- [35]. Singh, A.K. 2012. Molecular Taxonomy: Use of Modern Methods in the Identification of a Species. Indian Journal L. Science. 2. 1: 143-147
- [36]. Qiang J., Chiappe L.M. and Shu'an J. 1999. A New Late Mesozoic Confuciusornithid Bird from China. Journal of Vertebrate Paleontology. 19. 1-7
- [37]. Allen, G.R. and M.V. Erdmann. 2008. *Pentapodus numberii*, a New Species of Whiptail (Pisces: Nemipteridae) from Eastern Indonesia. Zoological Studies. Vol. 48(2): 280-286