PALACKY UNIVERSITY OLOMOUC

Faculty of Science

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PROMOTING MARINE ECOSYSTEM PROTECTION

THROUGH EDUCATION AND COMMUNITY OUTREACH:

A CASE STUDY FROM SUMATRA, INDONESIA

Master's thesis

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ABSTRACT

This thesis aims at marine conservation, the possibilities of community involvement in conservation, and environmental education. The thesis is based on the author's research in Indonesia. The research was implemented in the areas of Aceh Singkil Regency and in Nias Regency during her volunteer internship in the project 'Banyak anak, banyak karang II. – Many kids, many corals II.' implemented by Liberec Zoo.

The researched area is rich in marine biodiversity and local communities are heavily dependent on the marine ecosystem. Appropriate protective measures are important for the protection of local ecosystems as well as for the food security of local people. The research consists of a survey in 18 schools in the area and involvement of three ex-poachers into the roles of environmental educators. The environmental education impact assessment for the three ex-poachers is presented.

The thesis in its theoretical part describes marine ecosystem protection and environmental education in general and in Indonesia. The second part of the paper is in the form of a case study and it provides profound biogeographic and socioeconomic analysis of the researched region, theoretical framework of the research methodology and results of the research.

The results indicate poor knowledge among participants of the survey, especially in the villages of Ujung Sialit and Suka Makmur. The questionnaire survey reveals that many respondents have undesired behavior towards the marine ecosystem and the environment (consumption of turtle eggs, throwing garbage, usage of destructive fishing practices). Change in the ex-poachers' knowledge was the most significant, however, positive changes appeared also in their values, opinions, attitudes and behaviours.

Keywords: marine conservation, environment, education, community outreach, poaching, Indonesia

ABSTRAKT

Diplomová práce se zabývá ochranou mořského ekosystému a možnostmi zapojování místních komunit do jeho ochrany a environmentálního vzdělávání. Práce je založena zejména na autorčině výzkumu v Indonésii. Výzkum byl implementován v oblastech Aceh Singkil a Nias během její stáže na projektu liberecké zoo 'Banyak anak, banyak karang II. – Many kids, many corals II.'

Zkoumaná oblast má bohatou mořskou biodiverzitu a lokální komunity jsou na mořském ekosystému velmi závislé. Vhodné kroky směrem k ochraně přírody a udržitelnosti jsou důležité jak pro zachování přírodního bohatství, tak pro zajištění potravinové bezpečnosti místních obyvatel.

Dotazníkové šetření bylo provedeno na 18 školách ve zkoumané oblasti. Dále byli tři bývalí pytláci želvích vajec zapojeni do unikátního vzdělávacího projektu na školách, do kterého se zapojili jako lektoři. Posouzení dopadu environmentálního vzdělávání u třech pytláků je předloženo, je zkoumán vliv vzdělávání na jejich znalosti, hodnoty, názory, přístupy a chování.

V teoretické části práce je popsán mořský ekosystém a možnosti jeho ochrany, a environmentální vzdělávání s důrazem na Indonésii. Druhá část práce má formu případové studie, její součástí je biogeografická a socioekonomická analýza zkoumaného regionu, metodologie, výzkum a výsledky výzkumu.

Výsledky indikují slabší znalost respondentů dotazníkového šetření, zejména ve vesnicích Ujung Sialit a Suka Makmur. Dotazníkové šetření ukázalo, že zhruba polovina respondentů projevuje známky chování, které negativně ovlivňují místní přírodu (konzumace želvích vajec, odhazování odpadků, destruktivní metody rybolovu). Dopad environmentálního vzdělávání u bývalých pytláků byl nejvýraznější u znalostí. Testy ukázaly také pozitivní změny jejich hodnot, názorů, přístupů a chování.

Klíčová slova: mořský ekosystém, životní prostředí, vzdělávání, komunita, pytláctví, Indonésie

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Zásady pro vypracování

This thesis is focused on the potential of education and community outreach in marine ecosystem conservation in the Banyak Islands in Sumatra, Indonesia. The aim is to determine effective methods of environmental education and to measure the impact of education activities in the local community. The first part of this thesis is descriptive, and it includes characteristics of marine ecosystem and its protection, main development and environmental issues in the area, as well as profound analysis of conservation educational techniques and activities. The second part of this thesis is rather practical since the author performs her own research in the archipelago of Banyak.

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V Olomouci dne 26. ledna 2017

Declaration

Hereby, I declare in lieu of oath that this master thesis: "Promoting Marine Ecosystem Protection Through Education and Community Outreach: A Case Study From Sumatra, Indonesia" was written by myself under the professional supervision of Mgr. Martin Schlossarek, Ph.D.

All information derived from the work of others has been acknowledged in the text and the list of references is attached.

Olomouc, 13th December 2019

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Signature

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List of Abbreviations

BKSDA   Nature Conservation Agency in Indonesia (Balai Konservasi Sumber Daya Alam)

EEFS   Environmental education for sustainability

IUCN   International Union for Conservation of Nature

KKP   Ministry of Marine Affairs and Fisheries (Kementarian Kelautan dan Perikanan)

KLHK   Ministry of Forestry and Environment (Kementarian Lingkungan Hidup dan Kehutanan)

KSDAE   Directorate General of Conservation of Natural Resources and Ecosystems (Ditjen Konservasi Sumber Daya Alam Ekosistem)

MPA   Marine protected area

NAP   National Action Plan

INTRODUCTION

Conservation and environmental efforts are on the rise over the last decades. Development agencies and other development organizations have started to fund conservation activities around the world and vice versa. (Campbell, Vainio-Mattila, 2003) An example of such efforts can be clearly seen in the Sustainable Development Goals, which emphasize the importance of conservation for sustainable living and further development. The goals 'Life below water' and 'Life on land' promote conservation and appeal for activities in the field of nature protection. (UNDP, 2019) Conservationists and development experts support an opinion that conservation and development are 'the opposite sides of the same coin' (Campbell, Vainio-Mattila, 2003).

This thesis presents a case study from Sumatra, Indonesia and is focused on community outreach in conservation. The area of the case study consists of several small islands off the western coast of Sumatra in areas of Aceh Singkil Regency and Nias Regency. Aceh Singkil, which is part of Aceh Province, is among the poorest parts of Indonesia. It is also one of the most religious parts in the country and Islamic law is being implemented here since 2006 (UU, no. 11/2006). Nias Regency is part of Sumatera Utara Province and it is slightly more developed. All areas of research have in common strong dependency on the marine ecosystem and struggle with habitat destruction and conservation threats especially due to destructive fishing methods and poaching. Many development issues are present in the area too. In 2004 and 2005 all parts of the researched areas were hit by a strong earthquake and tsunami (FAO, 2005).

The author's research consists of a questionnaire survey and environmental education impact assessment. The questionnaire survey was conducted in 18 schools in the Aceh Singkil Regency and the Nias Regency. Knowledge, opinions, and attitudes of local students among the marine ecosystem and its conservation were measured. Tests (environmental education impact assessment) and interviews were realized with the three ex-poachers. The impact (based on data from tests and interviews) of outreach and education was measured as they were involved in educational sessions at surveyed schools and the change in their knowledge, attitudes and opinions were quantified.

The thesis provides in its theoretical part descriptive analysis of marine conservation – both from worldwide and Indonesian perspective. Then the environmental education is in-depth discussed together with examples of successful projects. The second part of the thesis is written in the form of the case study and the author's research is presented. Profound biogeographic, as well as a socioeconomic description of the researched region, is provided. Both biogeographical and

socioeconomic analyses are enriched by using records from interviews with local inhabitants (key informants).

This thesis attempts to help meet the contemporary conservation needs and to contribute to the further involvement of conservation into development studies. It aims to investigate the potential of community outreach in conservation and to propose the measurement of the impact of conservation and educational activities in the local community. Since the author would like to focus her future work more in conservation this paper also aims to be an inspiration and pillar for her oncoming activities in Indonesia.

AIMS AND METHODOLOGY

This research aims to investigate the importance of community outreach in conservation in the areas of Aceh Singkil Regency and Nias Regency, Indonesia. To achieve this aim, the following steps have been done:

1. Find appropriate and effective methods for environmental education.
2. Identify conservation threats and development issues in the researched area.
3. Conduct questionnaire survey in the local schools.
4. Organize educational lectures in the local schools.
5. Measure impact of chosen conservation outreach activity.

First, the theories of environmental education techniques were studied to find and to set effective methods for education in the researched area. Theories how to work with children of different ages (9-18 years old) and how to involve interactive methods in education were investigated. Then, profound research about the region was conducted. Both biogeographical and socioeconomic aspects were studied to understand local conditions as much as possible. In both cases literature review was provided. For biogeographical part there was likewise conducted monitoring of local coral reefs. Also, socioeconomic analysis is built on data comparison on national and regional levels.

Identification of environmental threats and issues in the area helped to the author to prepare the questionnaires and tests. Apart from the previous study of literature, the questionnaires were designed after 4 months long stay of author in the area. During the first phase a pilot survey of questionnaires was done, and questionnaires were improved as the first version of questionnaires was less understandable for the participants. Final questionnaires consist of closed questions and measured knowledge about marine ecosystem together with values, opinions and attitudes towards conservation and nature. After pilot phase the questionnaire survey at 18 local schools was realized. In total 700 questionnaires were collected, the age variability of respondents was from 9 to 18 years old.

Furthermore, at each school a lecture about marine ecosystem was conducted. Each lecture was approximately 2 hours long and included topics about coral reefs, illegal fishing practises, sea turtles, poaching and plastic pollution.

To attempt the measurement of environmental education impact within a chosen conservation outreach activity, an experiment with the three ex-poachers[1] of turtle eggs was run. The ex-

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[1] In 2016 the representatives of Zoo Liberec together with Indonesian army arrested these ex-poachers in Bangkaru island (archipelago Pulau Banyak). It was first successful case of arresting poachers in Sumatra

poachers were involved in the roles of environmental educators during the lectures. An environmental education impact assessment was constituted.

The aim and the objectives of this research will help to answer these research questions:

1. How important is community outreach in conservation activities in the researched area?
    a. What are the main conservation threats in the area?
    b. Are the local people aware of the environmental threats and do they understand the functioning and the importance of marine ecosystem?
    c. What change in knowledge, opinions, attitudes, values and behaviors was observed in the three ex-poachers during the experiment?

To provide additional information and for the better understanding, the records from interviews with key respondents are presented in different parts of this thesis. The information from key respondents enrich the text and provide further explanation especially in the 'Case study' part. Furthermore, the author uses her notes in the thesis that are based on observation. The notes provide additional information as well and together with information from key informants strengthen the theories and findings of the research. The list of key informants is below.

	Period of interviews:	Representative of the:
Key informant no. 1	November 2018-May 2019	Liberec Zoo
Key informant no. 2	November 2018-August 2019	Nature Conservation Agency, Liberec Zoo
Key informant no. 3	December 2018-January 2019	Local community
Key informant no. 4	December 2018	Local community

Table 1: List of key informants, (created by author, 2019)

Since sometimes quite sensitive topics were discussed it was important to think about the research ethics too. All the participants were informed about the purpose of the research. When filling in the questionnaires children usually wrote down their names as their teachers often insisted on providing this information. Furthermore, participants were always assured that no one would be punished for the answers, so they were not worried to answer honestly. The three ex-poachers agreed that their names, photos and videos can be freely used in the Czech Republic. On the other hand, for the thesis it is not necessary to use all their personal information, so the author gave them numbers instead of use their number is the text. Other key respondents are anonymized as well, and the numbers were given to them.

(MZP, 2016). After spending almost two years in prison, the three ex-poachers were invited to join a unique educational project in local schools to offer them alternative source of income. All of them agreed and joined the project.

MOTIVATION

In July 2018 I went to archipelago Pulau Banyak as a volunteer of Liberec Zoo for two months. My task was to take activities with children on an everyday basis, focusing on environmental education, teaching English and regularly check coral nurseries that were constructed in the proximity of Balai island. Since that time, I visited the area two more times and in total spent about 10 months in the archipelago.

The conservation activities, which people from Zoo Liberec conducted during the first phase of the project, were highly appreciated by the local communities in the archipelago. I was happy when I got the opportunity to be involved in the second phase of the project 'Banyak anak, banyak karang II. – Many kids, many corals II.', which continued with coral restoration and started new educational phase around schools in Sumatra by involving ex-poachers into conservation activities as environmental educators.

During the time I spent in Pulau Banyak and its surroundings, I was involved in all parts of the project from initial planning to the final evaluation and I've met a lot of great and inspiring people.

Over time I spent in Indonesia I could see that doing conservation without involving local people and other stakeholders is almost impossible and if done without people, the impact of such activities is none or minimal. Community outreach is essential for conservation. I could see the change in people's minds, attitudes, and values after they were involved in conservation activities and education was provided to them.

Community work was always interesting to me. Since the beginning of my studies at university, I am a volunteer at Maendeleo organization which works with communities of farmers in Tanzania. Connecting conservation with community work seems like a natural transition.

My thesis does not reveal any taboo, nor is controversial, or opens an absolutely new topic. On the other hand, conservationists sometimes struggle with community outreach and proper methods for community outreach are still being researched. Hopefully, my thesis has the potential to help with proper community work for promoting conservation or inspire to start similar activities in other parts of the world.

This thesis is the graduation of my efforts in the archipelago and clue for my work in the future. During my stay in the field, I got invaluable experience and collected a lot of data for this research. My motivation for this thesis is to evaluate my gained experience and deepen my knowledge in marine conservation since in this area I would like to focus my work in the following years.

1. MARINE ECOSYSTEM AND ITS CONSERVATION

The first chapter briefly presents the marine ecosystem, its importance, and links to development. Focus is more on the possibilities of marine ecosystem protection, especially its protection in Indonesia. The statuses of marine protection in Indonesia, as well as institutions responsible for managing and enforcing the national nature protection laws, are described. This chapter aims to link marine conservation with development studies.

The marine ecosystem refers to tropical marine and coral reef ecosystems in this paper. Threats to coral reefs and other environmental issues will be described in the biogeographic analysis of the researched region as a part of the case study.

1.3. MARINE ECOSYSTEM

Covering more than 70 % of Earth and providing 99 % of habitat space, oceans dominate our lives in many ways (Erlandson, 2008). The oceans and seas help to maintain climate and drive weather systems together with the distribution of heat and moisture. Furthermore, much of breathable oxygen comes from phytoplankton and seagrasses. (NOAA, 2019a) Deep oceans, as well as shallow waters or coastal areas, create various ecosystems – coral reefs, mangroves, estuaries, artic, benthic, and other ecosystems (Erlandson, 2008).

Reefs are among the most diverse ecosystems in the world. As much as third of marine species live in reefs although the total area of coral reefs in the oceans is less than 0,1 % (Sheppard, Charles, et al. 2017). More than 50 % of Southeast Asian coral reefs are found in Indonesia. These reefs have the highest biodiversity in the world since Indonesia is situated in the Coral Triangle area. (Chou, Loke Ming, et al., 2002) Except for being some of the most biodiverse habitats, barrier reefs are among the oldest. Reefs have been formed for tens of thousands of years. (Spalding, et al., 2001)

Coral reefs are important to prevent coastal erosion and they function as natural protection from big waves (Spalding et al., 2001). They have significant economic value in many countries, especially from fishing and tourism. They are also a new promising source for treating diseases. (Burke, Selig and Spalding, 2002) Providing many resources, marine ecosystem and its proper conservation is a key for sustainable development in poor marine coastal areas. Since marine areas present attractive destinations, locals can profit from tourism and gain new jobs, which helps them with income diversification and leads to higher gender equality. (UN, 2019a)

Unfortunately, besides coral reefs are being one of the most unique ecosystems on Earth, they are one of the most threatened. According to the latest reports, roughly 27 % of the world's coral reefs have been lost with the estimation of another loss of 32 % within the following years. In the region

of Southeast Asia, which is the global center of marine biodiversity, over 80 % of coral reefs are considered threatened. (Burke, L., Selig, E., and Spalding, M., 2006) Less than 30 % of coral reefs in Indonesia can be considered as healthy (Hadi, Giyanto, 2018).

Globally, the total economic value provided by coral reefs has been estimated at US$ 29.8 billion per year. In Indonesia, the economic net benefits from coral reefs have been estimated to be US$ 1.6 billion per year. Degradation of reefs means a critical loss of biodiversity as well as loss in food security and employment. (Burke, Selig and Spalding, 2002) Steps towards conservation must be taken to reduce overfishing, pollution and to secure sustainable livelihoods. (UN, 2019a)

1.2. MARINE CONSERVATION

Marine conservation is about biodiversity maintenance, resource sustainability, and human well-being. There is an outgoing crisis in marine natural resources since the human population is rising and so its demand for natural resources. (Ray, McCormick-Ray, 2013) Within 100 km from coast more than 60 % of the world population is living (Erlandson, 2008). The aim of marine conservationists is to slow down or stop this crisis by protecting, restoring and managing sustainable using of marine resources. (Ray, McCormick-Ray, 2013)

There are many strategies and methods (e.g. establishment of marine protected areas, restoration, sustainable fisheries) which marine conservationists use to achieve their aims (Erlandson, 2008). Except for these methods, cooperation activities within countries created various organizations and ratified international laws and treaties which focus on marine conservation and its enforcement (Campbell, Vainio-Mattila, 2003).

On the other hand, there are many challenges to marine conservation strategies. Government instability, poverty, overpopulation, insufficient monitoring and low enforcement of laws affect negatively conservation programs, especially in developing countries. Sometimes local beliefs and rumors can present an obstacle for marine conservation actions too. (Lundquist, Granek, 2005) Conservation and development studies have a lot of in common. The development of environmentally sensitive areas is crucial both for conservation and sustainable livelihoods of local communities. (Campbell, Vainio-Mattila, 2003)

The following subchapters provide an overview of selected methods and questioning their efficiency and lessons learned. Environmental education, which is also an important part of marine conservation, will be in detail 17ehaviou in the second chapter.

1.2.1. Marine Protected Areas

Marine protected areas (MPAs) are marine environments with clearly defined areas that are managed for biodiversity conservation (Edgar, Russ, Babcock, 2007). MPAs now present the major strategy for marine conservation, in 2010 there were identified more than 5000 areas (Watson, et al., 2015). MPAs are thus essential parts of conservation programs. They can help to achieve these objectives of marine protection:

− to maintain ecological processes and life support systems;
− to conserve genetic diversity;
− to secure the sustainable use of species and habitats. (IUCN, 1980)

MPAs can range from small closed areas, they can protect only specific resource or habitat type, to large extensive MPAs that integrate the management of many species and habitats (Agardy, et al., 2003). Status of protection may range from seasonal closing of spawning sites to areas permanently closed to fishing as well as to areas with multiple types of zoning and allowed activities (Edgar, Russ, Babcock, 2007). The majority of MPAs are small, half of the MPAs are smaller than 10 km2 (Watson, et al., 2015).

MPAs as conservation tool are well accepted, on the other hand, its management and efficiency depend on the conjunction of other approaches and strategies and vary among regions (Edgar, Russ, Babcock, 2007). Education should be always integrated with MPAs and is seen as a crucial marine biodiversity protection strategy since it can change people's attitudes. Illegal fishing practices can be eradicated (decreased to a minimum) in MPAs when an appropriate education of local stakeholders is applied. Law enforcement pressures can be also reduced when a community is well educated and aware of marine protection. (Watson, et al., 2015) An inherent part of MPAs' efficiency is also to set clear goals and objectives, research methods and to have well-developed strategies for monitoring (Lundquist, Granek, 2005).

1.2.2. Community Outreach and Involvement

Community involvement in all stages of marine protection is one of the most important strategies, and it should be always applied. Involving local people, if successfully done, has the potential to help in law acceptance and its enforcement. Furthermore, education is perceived to be a prerequisite to their involvement in conservation activities. (Leslie, 2005) By involving local people in conservation (i.e. to outreach community), people's connection with conservation is strong and hence, they can benefit from it. When people benefit from conservation and take ownership of nature protection, they are more likely to support such activities. (Campbell, Vainio-Mattila, 2003)

The outreach of community begins with education, when people get an education and are aware of environmental issues, then other steps towards community involvement are initiated. Conservation can give people alternative sources of livelihoods when employing them directly in conservation programs and projects. Stakeholders can be involved at all levels of decision making. (Campbell, Vainio-Mattila, 2003)

Outreach can be applied to different age groups (from children to adults) and it often aims at influencing 19ehaviour. During community outreach methods from psychology and sociology are often used. Furthermore, benefits to the local community can be delivered through workshops, competitions or musical performances. Motivate community to promote and support conservation is one of the main pillars of community outreach. (Steinmetz, et al., 2014)

Conservationists should keep in mind that community involvement is not only about to get people on the side of conservation. It is also about giving them opportunities and be directly involved in conservation. Especially in developing countries, local communities are still not enough involved in conservation actions and this can be one of the reasons, why results are not delivered in the scope as planned. (Campbell, Vainio-Mattila, 2003) On the other hand, communities in developing countries are often the least powerful among the other stakeholders in conservation. Authorities should be involved as well, so the power and decision making can be given toward local groups. (Agrawal, Gibson, 1999)

1.2.3. Coral Restoration

Coral restoration means the process reef-building in areas that have been degraded, damaged, or destroyed. Such interventions should be designed to assist and to accelerate natural recovery processes. Coral restoration stands both for the direct physical restoration of corals and for the application of protective measures to avoid damages in the future. (Edwards, Gomez, 2007) Natural coral reefs have a considerably high ability to recover, on the other hand, many anthropogenic factors and invasive species lower this ability on a big scale. That is the reason why coral restoration is being applied as one of the marine conservation methods. Some stressors (such as massive bleaching) are so damaging to the corals that natural recovery is impossible and physical coral restoration is the only way how to save or renew a coral reef. (Edwards, 2010)

During the coral restoration process, small fragments are being collected (so-called opportunistic fragments) or cut and then grown in coral nurseries. After reaching sufficient size, grown corals are put back to the reefs. (Edwards, Gomez, 2007)

All phases of coral restoration projects need monitoring surveys as well as community work which is necessary to avoid another damage of newly restored corals. (Edwards, 2010)

1.3. MARINE PROTECTION IN INDONESIA

The following part describes the situation of marine protection in Indonesia. It presents authorities responsible for marine conservation, national laws, and the statuses of marine protection. Issues that challenge marine conservation in Indonesia are discussed. Furthermore, recommendations for marine conservation in Indonesia are presented at the end of this chapter.

Being situated in the heart of the Coral Triangle and having one of the largest economic exclusive zones, Indonesia has extremely rich marine biodiversity. For comparison, in Indonesia is up to 7 000 fish species, while in the Caribbean there are no more than 1 000 fish species (Ray and McCormick-Ray, 2013). With more than 17 500 islands Indonesian marine potential is enormous. Marine resources are one of the largest pillars for both the national economy and development. (Baransano, Mangimbulude, 2011)

On the other hand, rising population and rising demand for marine resources are threatening marine ecosystems throughout Indonesia. Overexploitation of resources has direct results – decreased water quality, erosion, abrasion, sedimentation and damaged coral reefs. (Baransano, Mangimbulude, 2011) The crisis between economic development and conservation is present in Indonesia (Manullang, 1999). Evidence suggests that most of the fisheries in Indonesia are overexploited (Mous, et al., 2005). The effects of overexploitation are worsened by destructive fishing techniques and poaching. (Baransano, Mangimbulude, 2011)

Ministry of Marine Affairs Fisheries (Kementarian Kelautan dan Perikanan/KKP[2]) is aware of the issues from the overexploitation of marine resources. However, the management of marine resources and protection is for the Indonesian government still challenging. Marine resources are not managed sustainably and law enforcement is not sufficient. Overexploitation is most visible in the Javan seas. (Mous et al., 2005)

The functioning and effectivity of authorities are rapidly decreasing in remote areas. In the rural areas, there is a high incidence of corruption, employees have insufficient or no training, and equipment is poor too. Illegal fishing practices and other poaching activities are often tolerated as there is no will to enforce the law and no alternatives for income diversification. (Keane, et al., 2008)

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[2] For the governmental institutions the Indonesian abbreviations will be used in the thesis. These abbreviations are used in the literature review as well.

1.3.1. Authorities Responsible for Marine Protection

The Indonesian government has a responsibility to manage marine resources for the greater benefit of its citizens. This responsibility is entitled to the Constitution. (Mous, et al., 2005) Conservation activities are mainly managed by the Ministry of Marine Affairs and Fisheries (KKP) and Ministry of Forestry and Environment (Kementerian Lingkungan Hidup dan Kehutanan/KLHK) and their directorates. Especially these two institutions are responsible to issue laws and regulations and they manage the establishment of protected areas. (Wiadnya, et al., 2011)

Ministry of Marine Affairs and Fisheries

The aim of the Ministry of Marine Affairs and Fisheries (KKP) is to sustainably manage marine and coastal areas. Tasks of KKP are to formulate and implement policies in the field of marine management, conservation and biodiversity protection, and in the field of management of coastal areas and small islands. Furthermore, KKP takes responsibility for zone planning, structuring of protection areas and setting their utilization. It also provides technical guidelines and supervision for conservation activities. Last but not least, it controls the sovereignty and security of the Indonesian seas. (KKP, 2019a)

Ministry of Marine Affairs and Fisheries is divided into subsections – directorates. Regulations can be issued both by the minister and directorates. Since 2005 the structure of KKP is following:

- Minister of Maritime Affairs and Fisheries;
- Secretary-General;
- Inspectorate General;
- Directorate General of Capture Fisheries;
- Directorate General of Aquaculture;
- Directorate General of Supervision and Control of Marine Resources and Fisheries;
- Directorate General of Fisheries Product Processing and Marketing;
- Directorate General of Marine, Coastal and Small Islands;
- Maritime and Fisheries Research Agency;
- Maritime and Fisheries Human Resources Development Agency;
- Expert staff. (KKP, 2019b)

Ministry of Forestry and Environment

The Ministry of Forestry and Environment (KLHK) manages the environment, forests, and the conservation of ecosystems. It was established in 2014 when the two ministries (The Ministry of Environment and The Ministry of Forestry) were merged. Planning and implementation of policies

in the field of environment and forestry in a sustainable manner is the main duty of KLHK. It also manages the conservation of wild plants and animals (statuses of species protection). (KLHK, 2019a)

Similarly, KLHK is divided into directorates, which are the following:

- Directorate General of Forestry and Environmental Planning
- Directorate General of Conservation of Natural Resources and Ecosystems;
- Directorate General of Watershed and Protection Forest Management;
- Directorate General of Sustainable Production Forest Management;
- Directorate General of Pollution and Environmental Damage Control;
- The Directorate General of Waste, Hazardous and Toxic Management;
- Directorate General of Climate Change Control;
- Directorate General of Social Forestry and Environmental Partnerships;
- Directorate General of Environmental and Forestry Law Enforcement. (KLHK, 2019a)

From the point of conservation, the most important is Directorate General of Conservation of Natural Resources and Ecosystems (Ditjen Konservasi Sumber Daya Alam Ekosistem/KSDAE). This directorate has the main responsibility for the implementation and enforcement of nature protection policies. (KLHK, 2019b)

Nature Conservation Agency

Nature Conservation Agency (Balai Konservasi Sumber Daya Alam/BKSDA) is a national agency under the administration of KSDAE. It has a form of implementation units and it has executive power in the conservation. BKSDA directly manages protected areas, supervises compliance with laws in the field, promotes conservation and informs about nature protection activities. The task of BKSDA is to work in the field and manage law enforcement rather than to create policies. (BKSDA Jakarta, 2019)

1.3.2. Government Management of Marine Resources and Conservation

In general, there are many national action plans (NAPs), programs and strategies created by the government (World Bank, 2001). For example, NAPs for the conservation of sharks, rays, coral reefs, or turtles are issued in 5 years periods (Dermawan ed., 2015a; Dermawan ed., 2015b; Dermawan ed., 2016). Marine protected areas are often managed together with other national and international non-governmental organizations, which provide especially funding and services to the community (e.g. education). This cooperation is usually administered through Memorandum of Understanding and an implementing organization gets defined management competencies for several years. (White, et al., 2014)

Classification of protected flora and fauna is managed both by the Ministry of Environment and Forestry and Ministry of Marine Affairs and Fishery. Both Ministries issue regulations to prohibit catches of protected species, and they set penalties and punishments. (Mous, et al., 2005) Full protection is given by law to these marine species:

- Dolphins (13 species)
- Manta rays (2 species);
- Bear paw clams (2 species);
- Sea turtles (6 species);
- Sawfish (4 species);
- Dugong;
- Whale shark;
- Whales (21 species). (Directorate General of Capture Fisheries/Direktorat Jenderal Pengelolaan Ruang Laut, 2019)

Fully protected species cannot be caught and when caught they must be released back to the sea. The trade of these species is strictly prohibited. Poaching, keeping and trading of these species is punished with fines and prison sentences. (UU, no. 20/2018)

1.3.3. Statuses of Marine Protection

Zones and statuses of marine protection are formulated both by KKP and KLHK. In case that MPAs are parts of terrestrial parks, they are under the management of KLHK. Nowadays, MPAs can be declared and administered also by local district and provincial governments since decentralization is being increasingly emphasized. (White, et al., 2014) The National Conservation Plan implemented in 1984 gives priority for MPAs establishment. Later, the strategy for a target of 30 million hectares of MPAs was presented. This strategy was dropped away and changed for a new target of 20 million hectares of MPAs by 2020. (World Bank, 2001) Furthermore, principles of conservation of ecosystems and their management are concerned by Act of the Republic of Indonesia Number 5 of 1990. This Act states that biodiversity protection is done especially through the conservation of habitats. The four categories of protected areas are defined in this Act. (UU, no. 5/1990)

MPAs' establishment is based especially on the evaluation of these criteria: uniqueness, the importance of ecological functions (spawning, nursery, feeding area), biodiversity, vulnerability, fisheries value, tourism value (White, et al., 2014).

The Ministry of Environment and Forestry defines 4 categories of protected areas which fit IUCN classification. The categories are the following:

- Taman Nasional (National Park, TNL) – large natural areas to protect ecological processes, species and ecosystems characteristics of the area;

- Taman Wisata Alam/Laut (Protected Landscape/Seascape, TWAL) – an area where the presence of people created specific characters with significant value;

- Suaka Margasatwa (Habitat/Species Management Area, SML) – aims to protect particular species or habitats, regular interventions to address requirements of species or habitat are often needed in these areas;

- Cagar Alam (Strict Nature Reserve, CAL) – a strictly protected area that protects biodiversity and geological/geomorphological features, the entrance of humans is strictly controlled. (UU, no. 5/1990; Wiadnya, et al., 2011; KKP, 2013; IUCN, 2019)

Categories of protected marine areas defined by the Ministry of Marine Affairs and Fisheries are very similar. On the other hand, the links to IUCN categories' have not been exactly defined.

- Taman Nasional Perairan (Aquatic National Park, TNP);
- Suaka Alam Perairan (Aquatic National Reserve, SAP);
- Taman Wisata Perairan (Aquatic Park, TWR);
- Suaka Perikanan (Fishery Reserves, SP); (Wiadnya, et al., 2011; KKP, 2013; White, et al., 2014; KKP, 2019c)

There are also defined conservation areas for small islands and coastal areas. However, definitions and statuses of protection of these conservation areas are unclear and the impact for conservation is more than minor. (Wiadnya, et al., 2011)

1.3.4. Needs for Marine Conservation

To improve the contemporary crisis in marine conservation better management is critically needed. Especially in remote areas management is poor and so is law enforcement which is caused mainly by lack of resources in national authorities. (White, et al., 2014) The Ministry of Marine Affairs and Fisheries acknowledges that there is a huge problem with illegal, unreported and unregulated fishing, which is not included in the national statistics (Wiadnya, et al., 2011).

According to Mous, et al. (2005) there are four (policy) needs for improvement of marine protection in Indonesia:

1. A shift from development-oriented management towards sustainability;
2. Understanding in Indonesian society that illegal, unreported and unregulated fishing is not sustainable in the long term and it does not generate higher profits;

3. Fisheries managers must start accepting that moving from overexploited areas to so-called untapped resources areas may contribute to further collapse rather than increase in their catches;

4. Marine protected areas should play an important role in marine policies.

For better implementation of conservation policies decentralization of decision making should be done through passing more competences to local authorities. Protected areas managed under KKP involve more stakeholders and there is visible decentralization to some degree, while protected areas managed under the LHK seem to be more centralistic. However, these MPAs are still in their early stages and thus immature. (Wiadnya, et al., 2011)

To promote sustainable fisheries the following restrictive measures are recommended: closing of fishing grounds, limiting the issuance of licenses, lower total allowable catches (Mous, et al., 2005). Furthermore, the creation of no-take zones should be promoted within MPAs (Wiadnya, et al., 2011). Then it is necessary to start strictly implement MPA policies. Authorities must be present in the field regularly and enforce the law. (White, et al., 2014)

When the MPAs are being well managed, they have a positive impact on biodiversity as well as on poverty alleviation. MPAs should be implemented together with community outreach projects to develop 25ehavioural and socioeconomic changes of stakeholders and local inhabitants. These community outreach projects should be last at least 5 years, so there is sufficient time to set new rules and people have enough time to prepare for the changes. (Gurney, 2014)

2. ENVIRONMENTAL EDUCATION

The second chapter defines environmental education, its development over the years and discusses effective methods of education and community outreach. Furthermore, this chapter provides an overview of selected educational and community outreach projects in Indonesia. Described are successful projects which applied education and outreach techniques, which were combined with other conservation strategies to promote marine ecosystem protection.

As discussed in the previous chapter, education and community outreach are essential for successful outcomes in marine conservation. In environmentally threatened areas, communities often do not have proper environmental education and awareness about environmental and conservation issues. (Keane, et al., 2008)

In general, education aims to form behavior. The aim of environmental education is to enable people to understand the complexities of the environment and environmental issues and to promote responsible behavior towards the environment. (Hungerford, Volk, 1990)

Environmental education is from its definition multidisciplinary. It combines psychology, sociology, pedagogy, biology, ecology, and many other sciences. Environmental education programs are often seen as an investment in the future as these programs promote sustainable living and nature protection. (Jacobson, McDuff, Monroe, 2015)

The objectives of environmental education are as follows:

- Awareness: to raise awareness among individuals and groups about the environment and its issues;
- Sensitivity: to acquire an understanding of the environment and its issues;
- Attitudes: to gain a set of values for the environment and to get the motivation to actively participate in environmental improvement and protection;
- Skills: to obtain skills for identifying and solving environmental issues;
- Participation: to enable groups and individuals to get the opportunity to be involved in the solution of environmental issues. (UNESCO, 1978)

The importance of environmental education is recognized internationally over the last 40 years with a strong emphasizing on its concept from the beginning of the new century. Environmental education is being more implemented in developing countries in the last decade too. (Rickinson, 2001) Nowadays, many conservation agencies and organizations have education and outreach programs. Governments and other national authorities around the world are implementing environmental education, for example in the school curriculum. The need for environmental

education and conservation outreach is growing rapidly as conflicts and crises over natural resources are being more severe. When the public is informed and involved, conservation goals can be achieved more easily. (Jacobson, McDuff, Monroe, 2015)

Modern environmental education is sometimes called environmental education for sustainability (EEFS) since it reflects the concept of sustainable living and it focuses more on links between environmental quality, ecology, and socioeconomic and political threats. EEFS attempts more on a holistic approach and requiring integration between environment and development problems. (Tilbury, 1995)

2.1. METHODS AND OUTREACH TECHNIQUES IN ENVIRONMENTAL EDUCATION

Environmental education has an advantage that it can be taught in many interactive ways and many environments. One of the main conditions of environmental education is that is must be attractive for the community, so it arouses interest among people and motivates them to take actions or shape their behavior. (Rickinson, 2001; NAAEE, 2012a)

A community can be outreached, and education can be delivered at schools, public events, during campaigns, or via social networks. Especially outreach in social networks is nowadays sharply increasing since it can address a lot of people in a quite short time. (Jacobson, McDuff, Monroe, 2015)

In general, environmental education programs should include the following methods:

- Active participation: Participants can be actively involved in education experience, they are not just receivers of verbal or visual communication;
- Place: Program is taking place in a particular environment, ideally it is using *in situ* systems and themes as to provide context for learning;
- Cooperative learning: Participants are working together, they work in groups, discuss and investigate environmental issues;
- Play: Participants are involved in games and competitions as an intentional teaching method;
- Investigation: Students take part in data collection;
- Reflection: Participants have the opportunity to reflect their experiences;
- Issue: Curriculum is focused on a real environmental problem, its consequences and possible solutions;
- Multimodal delivery of content: Delivered content is using more than one method or media, requiring using of other senses (touch, smell, vision);

– View: Program offers multiple points of view. (Stern, Powell, Hill, 2014; NAAEE, 2012a; NAAEE, 2012b)

The followings paragraphs describe more in-depth individual outreach techniques and methods in environmental education.

Environmental education at schools may have many forms. First, environmental issues can be included in the school curriculum. Second, environmental education is delivered by conservation agencies by providing materials or doing regular visits at schools. Education at schools is diverse, from short lectures, 1-day workshops and projects, or field trips, to systematic education on a regular basis. (Jacobson, McDuff, Monroe, 2015)

Conservation campaigns aimed at the wide public. They address a variety of issues, inform about species and habitats, raise public awareness about specific issues and promote biodiversity. Campaigns often raise funds for field projects around the world. Furthermore, for campaigns is typical that many people or agencies are involved, and they cooperate in the propagation of a certain topic. (EAZA, 2019)

Citizenship science aims to find links between environmental education and science. Citizen sciences allow lots of people to be engaged in relevant environmental issues and cooperate with scientists. This type of science refers to community-based monitoring and data collection on a specific environmental issue. Citizen science often takes advantage of social media and applications which enable the simple collection of data. (Wals, et al., 2014) A successful example of citizen science in marine conservation is CoralWatch program. This program outreaches the wide public and involve people around the world into coral reef monitoring. (CoralWatch, 2019)

Social media are enabling to shift community outreach in many new ways. Conservation organizations and agencies can broadcast announcements, provide information and many materials through social media networks and enable their recipients to forward these messages to the other people which range masses of internet users. (Gharis et al., 2014) Social media are also a very useful tool to address government and appeal for changes in policies. Petitions on environmental and conservation issues are circulating social media with great power and making pressure on political parties to make desired changes. (Jacobson, McDuff, Monroe, 2015)

A very inventive education and outreach technique is using the arts. Not surprisingly, arts can be applied for conservation topics too. Especially for youth, the arts can be very attractive, and it enables easy connection with conservation issues. Theatre plays, drawing, music, photography, video or written activities are all tools that are possible to use for raising awareness in the field of

environmental issues. Arts can create reactions that typical education and outreach methods do not. It stimulates new dialogues and develops new perspectives among the audience. (Jacobson, McDuff, Monroe, 2007)

2.2. MEASURING IMPACT OF ENVIRONMENTAL EDUCATION

The need for measuring the effectiveness and impact of environmental education for the evaluation of programs and projects is high. However, to measure the change in behavior or shift in values, which are the main goals of environmental education, can be rather difficult since it needs to quantify data and set indicators. On the other hand, methods, instruments, and techniques exist on how to make data more valid and to provide a quality evaluation of educational programs. (Thomson, Hoffman, Staniforth, 2003)

To define what is necessary to measure or what information to have, it is important to know who the environmentally responsible person is. A person with an environmental education is someone who has:

- An awareness and sensitivity about the environment and its problems;
- A basic understanding of processes in the environment and environmental threats;
- A motivation to actively participate in environmental improvement and protection;
- Skills for environmental problem identification and skill for solving problems;
- Active involvement in activities toward environmental improvement. (UNESCO, 1978)

According to Rickinson (2001) in most cases the following information is collected during measuring/evaluating environmental education outcomes:

- Environmental knowledge;
- Environmental attitudes, values, and behaviors;
- Perceptions of nature;
- Experiences from learning;
- Influences on adults.

These variables can be divided into well-established and traditional and emerging. Data on environmental knowledge, environmental attitudes and behaviors are considered to be more traditional. The others (perceptions of nature, experiences from learning, influences on adults) are emerging new variables to evaluate the impact of environmental education. (Rickinson, 2001)

From the point of environmental education and its goals, for evaluation of the effectiveness of program or project, the shift in values and behavioral changes are most desired. (Thomson,

Hoffman, Staniforth, 2003) Examples of instruments on how to measure these variables and their outcome indicators are described below:

A Shift in Values		Behavioural Change	
Measurement Instrument	*Outcome Indicator[3]*	*Measurement Instrument*	*Outcome Indicator[2]*
Questionnaires	Requires pre-test; quantitative shift in participants' values.	Questionnaires	Reqiuire pre-test; New behaviours gained after the program.
Interviews	Responses reveal higher appreciation of nature.	Interviews	Questions remarked on changes in participants' behaviour.
Focus group	Spontaneous comments of participants about change in their values. How many participants see values more supportive to the environment.	Observations	Observers tests for the presence/absence of selected behavioural criteria.
Journals	Written reference to changes the participants feel.	Focus group	How many students agreed their behaviour changed after program.
Feedback form	Personal comments on how the program/project changed/influenced participants.	Feedback form	Participants describe action projects/changes they have made.

Table 2: Measuring a shift in values and behavioural change, (based on Thomson, Hoffman, Staniforth, 2003, edited by author)

When measuring change (i.e. impact of delivered education) that occurred after delivering environmental education more instruments should be applied. 'Triangulation' of results gives mutually complementary results and strengthen them. Also, it is important to note that since the most important thing is to measure change, the subject (participant) should be examined at two different times (before and after the intervention). It means that pre/post-testing of participants should be applied. (Thomson, Hoffman, Staniforth, 2003)

2.1. ENVIRONMENTAL EDUCATION IN INDONESIA

Indonesia is among the most polluting countries in the world and also one of the largest sources of illegal wildlife products. Indonesian seas are full of plastics, there are high numbers of catches for the live fish aquarium trade, of seeking and processing of turtle products, or there is a high trade in

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[3] Quantitative/qualitative statements that result in the desired outcomes which we get after using the relevant measurement instrument.

corals (both for jewelry and aquariums). Those are clear evidence that there is a desperate need for environmental education in Indonesia. The trade in species mentioned above is in most cases the part of illegal wildlife trade. (Nijman, 2010; Edinger et al., 1995)

Environmental issues have not been discussed in Indonesia for a long time. In the 1960s scouts and university students started used outdoor activities and nature, however, their aim was rather to contribute to national unity instead of environment protection. (Nomura, 2009)

The era of NGOs started in the 1970s. That time environmental issues started to be attractive for the media. At the end of the 70s WWF established a conservation program for orangutans in Sumatra. Part of this project was an education program at local schools. Other environmental activities during the 80s and 90s were run as a result of community empowerment since there were rising concerns that top-down participation is not a right (and thus effective) approach. Such activities were run by scientific elites who were concerned about environmental degradation. It was researchers who started to understand that community involvement was crucial for their conservation programs. (Nomura, 2009)

Nowadays, environmental education is still not part of the national school curriculum. To some degree, it is being taught as part of other school subjects. Environmental issues are partially integrated with subjects like Pancasila, citizenship education, or natural sciences. The primary role in environmental education still has NGOs which run education programs around the whole country. (Prihantoro, 2015)

Since Indonesia is the largest Muslim country in the world, environmental education can be delivered through several Islamic approaches. Many Islamic scholars are contributing to conservation using Islamic approaches and giving examples to Indonesian Muslims on how to contribute to conservation efforts. Indeed, several Qur'anic principles emphasize the importance of a healthy environment and appeal for balance in nature and its conservation. According to *Khalifa* perspective, it is a human responsibility to be a guardian of the environment. *Mizan* principle calls for balance in nature and from its definition conservation measures are necessary. *Tawhid* principle discusses the nature of the Creator, His creation of the nature and importance of its conservation. (Mangunjaya, McKay, 2012)

Environmental education in Indonesia is still in its beginning. More interventions are needed to develop environmental actions and ethics among local people. Awareness about environmental issues among higher classes already do exist, but remote areas have still poor knowledge. It is necessary to motivate people to take environmental actions and to change their behavior in the field of environment protection. Non-formal methods of environmental education (especially mass

media and the Internet) should be used to outreach masses of people. (Sudarmadi et al., 2001; Udan Kusmawan et al., 2006)

2.1.1. Good Examples from Indonesia

A study from Raja Ampat District was one of the first studies which evaluate efficacy and benefits of using education and outreach activities to improve community knowledge and attitudes about a marine protected area. The study targeted about 6 000 people during the period between 2005 and 2010. This random survey included 1213 respondents and compared responses before and after education and outreach activities. The study investigated two questions: Do education and outreach activities result in better knowledge and more positive attitudes among villagers? What were the financial costs of these activities?

The education and outreach activities included the creation of a network within a community for the distribution of conservation information and to support the traditional marine management systems, meetings with village groups to provide local input on MPA design, publishing newspaper about marine conservation, development of environmental school curriculum witch teachers, creating a community program to grant small conservation activities, and developing new regulation to manage natural resources in the area. Furthermore, a social marketing campaign was created focusing on destructive fishing practices and overfishing.

The surveys measured knowledge and attitudes among marine environmental issues. Questionnaires consisted of 15 identical questions and were at the beginning of the project in 2005 and then at the end of the project in 2010. To analyze changes in responses between the 2005 and 2010 surveys, proportional comparisons were made and tested for statistical significance. The chi-quadrat and t-tests were used.

Over the five-year period, there was an average increase of 33% in 'yes' responses in the surveys. Most of the gains came from a reduction in 'not sure' responses. The shift from 'not sure' responses to 'yes' responses showed greater knowledge and more positive attitudes among environmental issues in the area. The greatest change was in stating that respondents are familiar with the idea of an MPA and that an MPA is beneficial to their family and community. The knowledge that fishing with dynamite and cyanide poisons is illegal increased from 34% in 2005 to 71% in 2012.

This study suggests that education and outreach activities primarily impacted people who not yet formed their opinions about conservation and did not have education about the environment. The 15 to 24 age group had the largest change in knowledge and attitudes. The study showed that education and outreach have a significant impact on the knowledge which resulted in positive attitudes about conservation and marine protected areas. (Leisher et al., 2012)

Another study from Karimunjawa National Park (Campbell et al., 2013) monitored governmental and non-governmental incentives that were conducted to reduce destructive fishing methods and improve MPA policies and their enforcement. The national park consists of 27 islands with population 9 000 inhabitants, where 70% of inhabitants depend on income from fishing activities. Since 2005, communities have been involved in park management including monitoring and involvement in implementing management policies.

Government together with NGOs organized village meetings, and village forums to manage economic and conservation strategies. Furthermore, training and education programs have been initiated. The need for new economic alternatives has led to the establishment of mariculture farming. Communities have been empowered to take part in the decision making – for example, 'no-take' zones and mariculture spots have been established based on a survey in the community.

Improvements have been noticed since 2009. There was a decrease in dynamite and cyanide fishing, the communities were more supporting 'no-take' zones and fines for those who were catching and trade in protected species. These changes were linked to the previous efforts in improving awareness of regulations and the support of new industries (tourism, mariculture) which enabled alternative sources of income.

This study finds that economic support from government, community, and NGOs is crucial to enable the transition of livelihoods and to promote sustainable fishing practices. The taken steps have led to a decrease in destructive fishing methods and an increase in biodiversity protection. (Campbell et al., 2013)

Surjadi and Supriatna (1998) conducted a similar study in Togean archipelago in Sulawesi which is one of the global biodiversity hotspots. Conservation International with local NGO YABSHI implemented in Togean Islands long-term research and conservation program. The scientific role of the program expanded to a community outreach and development program to build support for conservation activities.

Togean Islands struggle with threats that are common throughout Indonesia – dynamite and cyanide fishing, unmanaged tourism and deforestation for agriculture. Before the program started there was no coordination among government and community.

As there was not much biodiversity and socioeconomic information about the area, several studies were conducted. The participatory community-mapping project monitored coral reefs, fishing grounds, agricultural plantations, village boundaries, and water supplies. The data from monitoring provided information that could be used to influence both development and conservation plans.

Community outreach program helped local communities to establish tourist enterprises, several workshops and meetings with the government were conducted to promote better coordination among all stakeholders and to establish environmentally sustainable and well-managed tourism. Furthermore, based on participatory mapping new conservation zones were established. These steps had a positive influence on conservation, destructive fishing methods were decreased, and 'no-take' zones were more respected. Management of tourism was positively influenced too.

The study suggests that raising the local economy should be always part of conservation activities. Community forums and networks are a useful tool to spread knowledge, address social and conservation issues. Last but not least, when people are involved in the planning of the conservation and development programs, they are rather to follow regulations and more willing to adjust their behavior. (Surjadi, Supriatna, 1998)

CASE STUDY

The following chapters are based on empirical research since they provide the case study of community outreach in marine conservation in the regions of Aceh Singkil Regency and Nias Regency[4]. The author decided to use a case study design for her research.

A case study is characterized by an in-depth, multifaceted investigation of a single phenomenon. Different qualitative and quantitative methods can be used, and data are collected from more sources. The case study is often seen as an example of some broader phenomenon. Case studies are researched in their natural environments at defined time and space. (Merriam, 1988) These characteristics of the case study fit the objectives of the author's research. A phenomenon of community outreach in conservation in a certain area is analyzed in this thesis, so a case study research design is found to be an appropriate method.

As the first part of this case study, the researched region is described in detail. Both biogeographic and socioeconomic analyses are provided as background for the research. The biogeographic analysis describes natural conditions and main environmental threats in the area. The socio-economic analysis is focused mainly on a comparison of regional and national statistics. Socioeconomic data and indicators at the regional level are compared with the national average. A brief history of the region and development issues are included in socioeconomic analysis too. Situation after the tsunami and strong earthquake in 2004 and 2005 are described more profoundly.

In the other part of the case study, the author presents her research. First, the theoretical framework for the research is provided, then methodology and results with discussion are presented.

Individual parts of this case study are enriched with information from key respondents who were interviewed during the author's stay in the area.

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[4] Aceh Singkil Regency is in general described more in depth since the research was implemented mainly in this region.

2. BIOGEOGRAPHIC ANALYSIS OF THE RESEARCHED REGION

The researched area is located off the north-western coast of Sumatra, Indonesia. The researched villages (see Figure 1 and Table 3) are part of Aceh Singkil Regency, or Nias Regency.

Figure 1: The area of the research (created by author, based on mapchart.net, 2019)

Aceh Singkil Regency – Aceh Province	Nias Regency – Sumatera Utara Province
Pulau Balai	*Gunung Sitoli*
Teluk Nibung	*Gunung Sitoli Utara*
Ujung Sialit	
Suka Makmur	
Haloban	
Singkil	

Table 3: Researched villages (created by author, based on Badan Pusat Statistik data, 2019a, 2019b)

Singkil is a small port town in Sumatra while the other villages are situated in the remote archipelago of Pulau Banyak, which is consisting of 99 islands (but numbers vary among different authors). Only 3 islands of 99 are permanently inhabited. (Stringell et al., 2000) Inhabited islands (Pulau Balai, Teluk Nibung and Pulau Tuangku[5]) were subjected to the research. The archipelago is home to approximately 7 500 inhabitants. In Singkil there are approximately 23 000 inhabitants. Singkil and Pulau Banyak are administered by Aceh Province. (Badan Pusat Statistik, 2019a)

Nias is another island close to the archipelago Pulau Banyak and it represents individual Regency together with several small uninhabited islands. Nias' capital city Gunungsitoli is located on the north-east coast of the island. The total population of Nias is more than 800 000 inhabitants. The

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[5] In Pulau Tuangku there are three villages – Ujung Sialit, Suka Makmur and Haloban.

mainland of Nias Regency is quite hilly, high above sea levels vary from 0 to 800m. (Badan Pusat Statistik, 2019b)

Both regencies are located close to the equator with high rainfalls. Climate is strongly influenced by the Indian Ocean. The weather can change unexpectedly, especially in August/September when most storms occur. The average temperature is 26.3°C with the highest temperatures in May/June (maximum average 31.4°C) and lowest temperatures in October/November (minimum average 25.6°C). In Nias rainfalls are more regular, more than 20 days of each month rain occurs (in the afternoon). In Pulau Banyak rains occur mostly in the form of storms and the length of rains is irregular and unpredictable. (Badan Pusat Statistik, 2019a, 2019b)

In the region, many habitats can be found. Coral reefs, mangroves, and shallow waters are typical habitats around the coastal parts. (Stringell et al., 2000) Forest density is comparing to other parts of Indonesia considerably high in the mainland of Nias island and Pulau Tuangku. (Badan Pusat Statistik, 2019b)

This area is a habitat of endemic Nias Hill Myna which was considered to be extinct in the wild for many years but was rediscovered in the wild in 2015 by the Czech zoologists (Zoo Liberec, 2015). Throughout the area of Pulau Banyak and Nias, there are several beaches where sea turtles do nest. There are three species of sea turtles in the researched area – Leatherback turtle, Hawksbill turtle and Green turtle. Pulau Bangkaru is one of the most important nesting places for the sea turtles in Sumatra. (Stringell et al., 2000) Furthermore, the area is also habitat for other protected species of fish – Napoleon wrasse, Hammerhead shark, Manta rays and Whale shark. (Herdiana et al., 2007)

3.1. MARINE ECOSYSTEM IN PULAU BANYAK

The researched area is an important biodiversity spot. There are 360 reef fish species from 48 reef fish families. Most common in this area are families of surgeonfish, butterflyfish, wrasses, damselfish, angelfish, and parrotfish. Pulau Asok and Pulau Lambodong have the highest biodiversity in the archipelago Pulau Banyak. (Herdiana et al., 2007)

Unfortunately, the population of marine species is being severely decimated. Sea turtles are traded for meat, eggs, and shell. Fins of sharks are being discarded since they have high value in the Far East. Napoleon wrasse and large groupers are widely removed from the reefs to supply the live fish trade. (Hemelíková, 2019)

For coral reefs in the researched area was especially devastating an earthquake[6] in March 2005 (known as 'Nias earthquake', 8.0 Richter scale). The earthquake meant a real catastrophe for local people as well, devastating many homes and lives. Some parts of the islands were uplifted while the others were overflowed. The mass mortality of corals after this earthquake was one of the largest single extinction of coral reefs ever recorded. Undoubtedly, a long time is needed for the recovery of the local ecosystem. After almost 15 years there are still visible damages after the earthquake. For coral recovery it is necessary to reduce other threats as well since overfishing, destructive fishing methods and outbreaks of invasive species are issues present in the area. (Foster et al., 2006; Herdiana et al., 2007)

3.2. CONSERVATION ISSUES IN THE AREA

The following subchapters are describing the main threats to the marine ecosystem (coral reefs) in the researched area. The conservation issues were identified through interviews with local people and based on the author's observation in the field. The threats which were identified in the area are common in the region of Southeast Asia.

In general, factors that causing coral loss can be divided into four main categories: pollution, sedimentation, overfishing and climate change. Direct physical damages such as blast fishing or cyanide fishing present the fifth category. Corals are very sensitive to water quality as well as temperature. Long-term changes in these parameters lead to the high mortality of corals. (Spalding et al., 2001)

Bleaching and climate change

Coral bleaching is strongly connected to climate change. Due to anthropogenic activities that release greenhouse gases both sea and surface temperatures are rising. (Edwards, Gomez, 2007)

When corals are exposed to 1-2°C higher temperatures above the normal level for more than several weeks, it leads to an event called 'bleaching'. Temperatures above the normal gradient lead to a loss of zooxanthellae – algae which provides to coral much of its food. Without this symbiotic algae, coral practically starves to death. Since coral gets its color from zooxanthellae too, then after its loss, the coral loses its color within a few weeks. Anomalies in temperature lead to high mortality of coral and present a great issue in these days. The ability of reefs to recover from warming events is strongly affected by the severity of other anthropogenic factors. Healthy reefs can recover from bleaching in 5 up to 10 years. Reefs stressed by human activities show only a limited ability to recover. (Burke, Selig, Spalding, 2006)

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[6] The earthquake is in depth describe in the following chapter.

Increased coral bleaching events have been reported since 1979. The most severe bleaching event was reported in 1997-1998, some parts in the Central Indian Ocean recorded mass coral mortality (up to 90 %). The peak of coral bleaching in Indonesia was recorded in 2015-2016 (Vantier et al, 2005; Hadi, Giyanto, 2018).

Blast fishing

Phenomena of blast fishing occurred after World War II when thousands of unexploded shells were left behind. Today fishermen use dynamite and grenades, also they fill beer or soda bottles with potassium nitrate. A 1-kilo beer bottle can leave a crater of rubble in 1-2 meters in diameter or even more. Regularly bombed reefs show up to 80 % mortality and a limited chance of recovery. (McManus, Reyes, Nanola, 1997)

Cyanide fishing

Throughout the region of Southeast Asia, natural poisons have been used for a long time by communities to capture the fish. These practices were small-scale and did not cause such severe damage as poisons which are being used today. (Barber, Pratt, 1997)

The commercial use of poisons to catch fish came from the Philippines in the 1960's. Nowadays, the most common are used sodium cyanide and potassium cyanide poisons. Poisons in plastic bottles are applied by fishermen in the reefs. Poisons work as an anesthetic and make fish easy to capture. Paralyzed fish are captured alive, but the cyanide easily gets into currents which enable it to go far into other areas and killing coral and other marine life. (Barber, Pratt, 1997; Burke, Selig, Spalding, 2006; McManus, Reyes, Nanola, 1997)

The cyanide fishing is mainly applied to capture lobsters and aquarium fishes for export (e. g. Singapore, Malaysia or China). For example, for lobsters, there is high demand in Medan. (Hemelíková, 2019)

Both blast fishing and cyanide fishing are not only devastating to reefs but also to people (McManus, Reyes, Nanola, 1997). Destroying corals, using bombs or chemical substances to catch fish is illegal and prohibited by law in Indonesia with a sentence up to 6 years in prison or a fine Rp. 1 200 000 000 (UU, no. 45/2009).

Coral mining

Another example of direct physical damage to corals is their mining. Corals are being extracted for many purposes. They are used as a building material to lift-up houses, or as a protection from high tides. Communities also use live corals to build walls and barriers against waves. Furthermore, in some cases live corals are used to extract lime for cement production. Coral extraction causes

coastal erosion and often showing no recovery of corals. (Brown, Dunne, 1988; McManus, Reyes, Nanola, 1997)

Anchor damage

Anchor damage comes from boats since they usually drift until the anchor hooks on a solid coral. The anchor often damages several corals before catching hold and when retrieving the anchor back it causes another broke of corals. Damages are significant – scrapped coral, removal of its living tissue or totally smashed coral. Anchor damage is common in recreational areas and in other areas with increased boat traffic. (Guam Reef Life, 2019)

Crown-of-thorn starfish

This invasive species can grow up to 60 centimeters in diameter and have up to 21 short arms with poisonous spines. Crown-of-thorn starfish feed only on corals. In the region of Southeast Asia the blue and grey to green are the most common colors of this starfish. Groups of crown-of-thorn starfish move together through the reef preying on the coral and having a fatal effect on the reef. The presence of the starfish on the reef is obvious – the coral skeleton is left behind with white patches and skeletons often become overgrown with macroalgae. (Global Invasive Species Database, 2019)

For many decades these starfish were considered as rare but since 60's the outbreaks are being monitored. More than 30 individuals per hectare are considered as an outbreak. There are several theories that explain the outbreaks of crown-of-thorn starfish. A lot of plagues have been observed close to the island after big storms. Changes in salinity and nutrients after storms can help to larval survival. Changes in nutrients due to anthropogenic activities are considered to boost the number of crown-of-thorn starfish too. This starfish has only a limited number of predators. The exploitation of its predators (napoleon wrasse, triggerfish and triton shell) can lead to overpopulation. (Spalding et al., 2001; Edwards, Gomez, 2007; Vantier et al., 2005)

Control and elimination of its population when an outbreak occurs to prevent coral mortality is among the most commonly applied solution. On the other hand, few individuals per hectare are not damaging for the reef and as crown-of-thorn starfish prey on selected species of coral, it may help to manage coral diversity on the reef. (Edwards, Gomez, 2007)

In the area, there have already been recorded several outbreaks of crown-of-thorn starfish (Pulau Baguk, Pulau Rangit) (Herdiana et al., 2007). Nowadays, the new outbreak seems to be on the rise again in the area. The high density of crown-of-thorn starfish is in Pulau Palambak (Hemelíková, 2019).

3. SOCIOECONOMIC ANALYSIS OF THE RESEARCHED REGION

The history of Aceh Province is rather different compared to the other parts of Indonesia. Aceh's position at the tip of Sumatra made it be the first point of contact with Arab traders in the thirteen century. (Aspinall, 2007) Moreover, Islam spread from Aceh to the whole of Indonesia (Uddin, 2009). On the other hand, the process of Islamization in Aceh and other parts of Indonesia was not similar. In Java island, Islamic principles have mixed with indigenous customs while in Aceh the form of Islam have always been more conservative. (Reid, 2004)

Through the Aceh region, the wars and riots were quite common since the era of colonization. These conflicts were the result of a long history of defeats in the Aceh territory. (Aspinall, 2007) Until the Dutch conquest, most of the linkages were to the Malayan Peninsula. In 1824 whole Sumatra was declared as the Dutch territory even though Aceh had been guaranteed to keep its independence from Britain. Acehnese people were strictly against the Dutch power and rebellions were constant till 1942 when the Dutch completely left the region. (Reid, 2004)

Since Indonesia's independence, attempts to be different from the other parts of Indonesia were present. The role of religion was always high in Acehnese society. Several times representatives of Aceh tried to implement sharia rules into legislation (to both national and regional level), but these attempts were being denied for a quite long time. (Uddin, 2009) A change occurred in the 90s. Free Aceh Movement (established in 1976) has slightly moved from its requirements (e. g. move away from separatist tendencies to autonomy) and the attitude of the Indonesian government has changed too. In 1999 the law on the special position of Aceh was passed. Political changes continued, nowadays Aceh has a special autonomous status. Surprisingly, the tsunami in 2004 helped to end the long-term conflicts between the Free Aceh Movement and the Indonesian government. (Aspinall, 2007)

Implementation of *sharia* rules began in 2002 and culminated in 2009 and 2015, respectively, when criminal punishments were officially imposed. (Uddin, 2009) International organizations (e. g. Human Rights Watch, Amnesty International) warn that in the Aceh region human rights are being violated. The abusive practices like caning are on the rise nowadays. Adultery, same-sex sexual acts or intimate relationships outside marriage are all against the Acehnese law. Furthermore, many other restrictions (e. g. dress code for women) are imposed on daily life. (Amnesty International, 2018; Human Rights Watch, 2017)

The background of Nias is completely different from the Aceh region. Nias people are sometimes considered as a separate ethnic group and distinguished from other Indonesia tribes. Indonesians are mainly Muslims, inhabitants of Nias are mostly Christians. (Van Oven et al., 2010) The Dutch

colonization in Nias was for a long time unsuccessful and Nias was one of the last parts in Indonesia which was conquered. During the Dutch attacks, many villages were completely burned. Full Dutch control in Nias was set in 1914. Also, despite Christianity was brought in 1865, for a long time it was not accepted by the locals. The number of baptized people started to increase after 1916. Except for bringing a new religion to Nias, the Dutch broke the traditional village structure. Traditionally, villages in Nias were situated on the top of hills for defense purposes and as protection from the tsunamis. The Dutch constructed road networks and all villages were moved off to the roads and close to the coast. By moving the villages, the Dutch could easily transport the goods to the capital of Gunung Sitoli and in case of rebellions, they could reach the villages. Furthermore, missionaries were able to reach the villages too. (Mulia, 1981; Nias Heritage Museum, 2019)

After Indonesia's independence, there was no ground fighting in Nias. Nias stayed loyal to the central government, social and political upheavals bypassed Nias. During the 70's Nias was the poorest part of Sumatera Utara Province and there were no efforts to develop the island. (Nias Heritage Museum, 2019)

The tsunami in 2004 and the earthquake in 2005 ruined severely infrastructure in Nias. Similarly, as in Pulau Banyak, the landscape of Nias was changed too. The whole island was tilted on its side. After these catastrophes, there were huge efforts to rebuild the island. The result of rebuilding efforts is that Nias has developed infrastructure and is connected with the rest of the country by having an airport and it is also connected by ferry to Singkil, Sibolga, and Padang. Healthcare and education services significantly improved as well. (Nias Heritage Museum, 2019; Hemelíková, 2019)

4.1. REGIONAL AND NATIONAL COMPARISON

As mentioned above the areas of Singkil and Pulau Banyak are less developed and more religious comparing to Nias island. While areas of Aceh Singkil Regency are Muslims (except the village of Ujung Sialit and several families within the other villages), Nias's inhabitants are mostly Protestants (Hemelíková, 2019).

The most developed in the researched area is Gunung Sitoli, having good infrastructure and public services. Gunung Sitoli is comparing to other parts of the researched area less dependent on the marine ecosystems (i. e. fishing as the main source of income) since there is higher income diversification. (Hemelíková, 2019) From the area of archipelago Pulau Banyak, which is divided into two districts (Pulau Banyak and Pulau Banyak Barat), the most developed is Pulau Balai. Pulau Balai is connected with Singkil (coast of Sumatra) with public boats and ferry while the other villages don't have regular transportation (Key informant no. 1, 2019).

Village of Pulau Balai (sometimes divided into two parts as Pulau Balai and Pulau Baguk) has the highest population in the archipelago. The lowest population has the village of Suka Makmur. The villages in the district of Pulau Banyak Barat have only limited signal and electricity. (Badan Pusat Statistik, 2019a, 2019f, 2019g)

The real issue in the area is unregulated population growth. Limited space and job opportunities on the islands cause development as well as environmental threats. Building new houses is getting more complicated as there is not enough place, and plastic pollution is more severe since dumps on the islands are full and there are no finances to bring the garbage to Singkil. These problems are most severe in Pulau Balai village, where is the highest population density. In Teluk Nibung and Pulau Banyak Barat there is low population density but the possibilities of building new infrastructure are only limited. (Hemelíková, 2019)

The situation with garbage collection is slightly better on Nias island as there is already an implemented garbage collection system. Also seeking jobs is easier. (Key informant no. 2, 2019) Selected demographical statistics are in detail described in Table 4 (see below).

Province/ Regency	District	Village	Population	Sex ratio	Population density	Population growth (%)	Religion		
							Islam	Catholic	Protestant
Aceh / Aceh Singkil Regency	Pulau Banyak Barat	Ujung Sialit	1 243	105.11	134	2.03	9	1 234	0
		Suka Makmur	295	97.88	25		219	76	0
		Haloban	1 748	104.84	11.5		1 671	75	2
	Pulau Banyak	Pulau Balai	3 399	111.15	285	2.03	3 248	0	146
		Teluk Nibung	1 059	106.8	71		1 238	0	40
	Singkil	Singkil	23 269	97	143	2.33	23 254	15	0
Sumatera Utara / Nias Regency	Gunung Sitoli	Gunung Sitoli	71 688	98.5	657.15	2.07	N/A	N/A	N/A
	Gunung Sitoli Utara	Gunung Sitoli Utara	17 424	91.87	218.54	0.87	N/A	N/A	N/A

Table 4: Socioeconomic indicators of researched areas (created and edited by author, based on data Badan Pusat Statistik, 2019a-g)

The high population pressure can be seen in two indicators – population growth and the average number of people in one household. Both indicators have high values in all of the areas (see Table 4 and 5). In the area of Pulau Banyak there is only one doctor and no pharmacy. However, there are several nurses in the area. (Badan Pusat Statistik, 2019a) In case of emergency, a patient is taken to Singkil by speed boat, which takes one and a half-hour up to two hours (Key informant no. 1, 2019). The student-teacher ratio and the number of students in class indicators are similar within

the researched areas except for Ujung Sialit and Suka Makmur where the values of these indicator are the highest and the lowest, respectively (Badan Pusat Statistik, 2019a). In both cases, there is only one elementary school in each village but the number of inhabitants in Ujung Sialit is distinctly higher (Hemelíková, 2019).

Schools in the archipelago have in general low attendance among both students and teachers. Especially in Pulau Banyak Barat it is quite common that teachers do not go to schools. A similar situation is with the medical center in Pulau Balai, which is an only medical center in the archipelago, the doctor and nurses are often not present, but they are only called up in case of emergency. On the other hand, the equipment of the medical center is quite good since it is for example including a baby incubator (Hemelíková, 2019; Key informant no. 1, 2019). For more details see Table 5 below.

Province	District	Village	Average number of people in one household	Student-Teacher ratio	Number of students in class	Number of doctors	Number of pharmacies
Aceh / Aceh Singkil Regency	Pulau Banyak Barat	Ujung Sialit	5	21.3	39	0	0
		Suka Makmur	5	5.2	6.2	0	0
		Haloban	5	15.2	21.5	0	0
	Pulau Banyak	Pulau Balai	4	11.82	25.1	1	0
		Teluk Nibung	4	14.5	29	0	0
	Singkil	Singkil	4	11.3	21	8	12
Sumatera Utara / Nias Regency	Gunung Sitoli	Gunung Sitoli	5	15.8	24.1	36	24
	Gunung Sitoli Utara	Gunung Sitoli Utara	5	11.7	19.9	N/A	N/A

Table 5: Socioeconomic indicators of researched areas (created and edited by author, based on data Badan Pusat Statistik, 2019a-g)

When comparing both regencies with national statistics, the results support that Nias is more developed. When seeing Nias as a whole, its population growth is only 0.51 %, while national population growth is 1.33 %. The number of poor people in Aceh Singkil Regency is more than twice higher when compared with the national average. The higher number of women who gave birth in the last two years with doctor assistance in Aceh Singkil Regency can be explained by the fact that almost in all cases women when giving birth are taken to the hospital in Singkil. (Badan Pusat Statistik, 2019a, 2019b, 2019h; Hemelíková, 2019) All indicators are summarized in Table 6 (below).

	Aceh Singkil Regency	Nias Regency	Indonesia
Population growth (%)	2.38	0.51	1.33
Population density	64	142.26	138
Sex ratio	102.2	N/A	101
Average number of people in one household	4	5	3.9
Number of poor people (%)	22.11	16.37	9.8
Gross primary school enrolment (%)	84.43	117.45	106.4
Student-teacher ratio	10.07	15	17.1
Number of children under 5 years who got immunization (%)	75	N/A	70.5
Number of women who giving birth in last 2 years with doctor assistance (%)	32.92	N/A	21.78

Table 6: Comparison of indicators in Aceh Singkil Regency with national level (created and edited by author, based on data Badan Pusat Statistik, 2019a, 2019b, 2019h; The World Bank, 2019)

4.2. DEVELOPMENT ISSUES IN THE AREA

Overpopulation is an increasing problem in the researched area. High fertility is caused both by local tradition as well as by the unavailability of contraception. Contraception can be sold only to married couples. Furthermore, people are not willing to buy contraception in their villages since they are afraid of gossips. (Key informant no. 1, 2019)

High dependence on the marine ecosystem limits severely possibilities of income and its diversification. Women are usually housewives and men are looking for family income. In Pulau Balai the situation is improving slowly since there are increasing profits from tourism during June-August. Girls are often not allowed to study out of their villages and if they are permitted to attend school in the further area, they often have to return to the home village after finishing their studies. Traditionally, girls are staying in their home villages after marriage and their husbands have to move to the wives' villages. (Key informant no. 2, 2019)

Throughout Aceh (as well as throughout Indonesia) there is traditionally practiced female genital mutilation. Since the area is very religious, female genital mutilation (FGM) is obligatory for all women. It is unacceptable that a woman would not have FGM. This is connected with a strong religious belief that a woman without FGM will not be allowed to enter heaven. It is usually done to the girls under the age of 2. Among local people it is a ceremony, and no one perceives it as health-damaging. After a girl has her first period, she is officially becoming a Muslim and she has to start to cover herself. Boys undergo circumcision between the age of 10 up to 15 years old. (Hemelíková, 2019; Key informant no. 1, 2019)

The other development issues are directly connected with environmental threats in the area. Fishermen have to go further to catch the same amount of fish, or they are using destructive fishing practices to secure income for their families. Poaching or illegal logging of wood are often just desperate attempts to find additional income. (Key informant no. 2, 2019)

With the increasing population on the islands, water security is becoming an issue too. The water reserves are not high enough for the rising population. For example, in July-August 2019 there was a lack of water in the half of Pulau Balai village. The water stress will be probably rising in the future and it will be worsened due to the effects of climate changes (Hemelíková, 2019)

4.3. TSUNAMI AND EARTHQUAKE

During the short period, the region was hit by two large disaters, whose consequences were devastating in many ways. First, in December 2004 and then in March 2005, both a strong earthquake and a tsunami hit the area respectively. Socioeconomic and other consequences are discussed below.

The tsunami on 26 December 2004 was caused by an earthquake which was the world's strongest natural disaster since Krakatoa's eruption in 1883. The massive earthquake measured 9.0 on the Richter scale and was followed by up to twelve meters waves in western Aceh (BMKG, 2019). In the north Sumatra (i.e. provinces of Aceh and Sumatera Utara) there were 250 000 people dead or missing and 500 000 people were displaced. The islands off the west of Sumatra (Simelue, Pulau Banyak, Nias), which are being researched in this thesis, bore the greatest economic brunt of the disaster despite suffered relatively fewer casualties. Tidal waves after the tsunami struck the impoverished populations on the islands and destroyed housing, boats, plantations, and water supply. The primary economy sector was practically smashed. (FAO, 2005)

In Pulau Banyak archipelago many fishing boats and fishing grounds were lost. The fishing industry (as a primary source of income for the majority of families in the area) was destroyed. The houses on the coast were ruined. Many people had to leave their houses. People reported food stress and water insecurity. According to unofficial reports, 300 people died. Pulau Banyak was not directly hit by the tsunami but the damages were made by the tidal waves. Singkil, on the other hand, was hit by a smaller tsunami on the coastal part of the city. (FAO, 2005)

'My family used to have big boats and provide transportation of people and stock between Simelue, Pulau Banyak and Nias. We were quite rich when I was a child. But after the catastrophe, we lost all our boats, our house and we had to pay refunds to the people because their stock like rice and fruits

were lost. Until now my family has not been able to reach the income level which we had before the tsunami.' (Key informant no. 2, 2019)

The earthquake of 8.6 on the Richter scale, which is known as the 'Nias earthquake', hit on 28 March 2005 (BMKG, 2019). The Nias earthquake was caused by the rupture of the subduction megathrust after the 26 December 2004 earthquake (Hsu, et al., 2006). The most severe damages were in Nias – 90 % or Nias's inhabitants were affected by the earthquake and 80 % of homes were destroyed in Gunung Sitoli, Nias's capital. The earthquake caused a local tsunami too. The tsunami up to 3 meters high hit the coast of Nias island. Damages were also in the archipelago of Pulau Banyak, Singkil and Simelue island. The catastrophe severely harmed previous rehabilitation efforts and it was necessary to build new reconstruction plans in the area. The quakes were so strong that they caused dramatic changes in the area. In Nias and several islands in Pulau Banyak land uplifts or sunk were recorded. Furthermore, new islands appeared after the earthquake. (Nias Heritage Museum, 2019; FAO, 2005; WHO, 2005) Due to these uplifts, several coral reefs were destroyed in the area. Damages from catastrophes included also shattered beds of corals and overturning of coral colonies. Observations suggest that to coral reefs the earthquakes were more damaging than the tsunami. (Foster et al., 2006)

'In 2005 it was the first time I felt an earthquake, I was dancing at that time because I thought it is funny that the land is shaking. But then all people were really scared, the sea changed its color, and it was very dark, and the sea level rose quite a lot.' (Key informant no. 2, 2019) *'A lot of people lost their homes at that time. They had to move to the homes of their relatives and the new houses were built. Till now people are scared to stay in houses close to the beach because they still remember how their houses were flooded.'* (Key informant no. 3, 2019)

'I think we are lucky we live in Balai, because this island is surrounded by other islands, so it is protected. Singkil or Haloban do not have protection from other islands, they are in open spaces, so in these places, the damages from waves were much larger than here in Balai.' (Key informant no. 4, 2019)

Rehabilitation and reconstruction processes were immediate. The important role had many international organizations, which provided humanitarian aid, health services and assist with the reconstruction of infrastructure. This help was provided together with the cooperation of the Indonesian government. Huge amounts of investments flowed especially to Nias, where new schools and health centers were built. Since that time Nias, which was for a long time isolated, has a good connection with other parts of Indonesia through both maritime and air transport. (Nwe, 2005; Nazara, Resosudarmo, 2007)

'I remember that in 2005 we got a lot of school stuff from UNICEF. We received a lot of pencils, books, bags and other things, which I used till high school. Every child had something from UNICEF. I might have still some of these things at home since I did not go to school very often and they gave us a lot of school equipment.' (Key informant no. 2, 2019)

Both catastrophes are being strongly connected with many rumors and religious narratives among local people, especially in Aceh Province. People believe that the catastrophes were punishment for their lack of devotion to God. The catastrophes made a lot of Acehnese to renew their faith, or to be more devoted to God. Mosques left standing in Banda Aceh are one of the arguments, that says the catastrophes were God's intentions. People believe the mosques were spared by divine intervention. These religious narratives had a significant impact on promoting and strengthening sharia rule in Aceh Province. (Jatmiko, 2014; Kloos, Samuels, 2019) Although religious rumors and narratives are being still widely spread around the Aceh Province (Jatmiko, 2014; Kloos, Samuels, 2019), the catastrophes had an impact on ending up the conflict between the Indonesian government and Free Aceh Movement. The war and long-term conflicts in Aceh were ended and a peace agreement was signed. (Nazara, Resosudarmo, 2007)

5. THEORETICAL FRAMEWORK OF THE RESEARCH

The theoretical framework is necessary to better understand the researched phenomenon and to provide concepts and hypotheses for the research. This part defines key concepts, discusses relevant theories and models, and proposes relations between theories and the author's research. Hypotheses that are proposed, are also based on the regional analyses.

To identify the main concepts and theories, it is important to repeat the aim of this thesis and its research questions.

This thesis attempts to help meet the contemporary conservation needs and to contribute to the further involvement of conservation into development studies. It aims to investigate the potential of community outreach in conservation in the areas of Aceh Singkil Regency and Nias Regency, Indonesia, and to propose a measurement of the impact of educational activities in the local community.

The aim and objectives of this research are going to answer these research questions:

1. How important is community outreach in conservation activities in the researched area?
    a. What are the main conservation threats in the area?
    b. Are the local people aware of the environmental threats and do they understand the functioning and the importance of the marine ecosystem?
    c. What change in knowledge, opinions, attitudes, values and behaviors was observed in the three ex-poachers during the experiment?

The research consists of a questionnaire survey at local schools. Furthermore, it investigates the experiment of involving the three ex-poachers into the roles of environmental educators and observes the impact of this involvement on their knowledge, behaviors, and attitudes. At the very end of the research, the measurement for the impact of environmental education is proposed. The main conservation threats are identified in the third chapter and they are based on the author's observation and interviews with local people.

5.1. KEY CONCEPTS AND THEORIES

To propose hypotheses of the research, it is necessary to deal especially with two concepts:

1. Community outreach and involvement;
2. Environmental education.

The concepts can be called as complementary since education is in a lot of cases part of community outreach and involvement. According to Leslie (2005) education is perceived to be a prerequisite

to community involvement in conservation activities. The outreach of community begins with education, when people are educated and aware of environmental issues, then other community involvement starts. Conservation can, for example, give people alternative sources of livelihoods, when employing them directly in conservation programs and projects. (Campbell, Vainio-Mattila, 2003)

Theories from Leslie (2005) and Camblell, Vainio-Mattila (2003) provide support for the involvement of the three ex-poachers into the roles of environmental educators. The basic education in marine processes and its conservation was provided to these people and then they were involved in conservation by offering them a part-time job as environmental lecturers. The importance of the ex-poachers' education is further provided by the theories below.

The aim of environmental education is to enable people to understand the complexities of the environment and environmental issues and to promote responsible behavior towards the environment. (Hungerford, Volk, 1990). Illegal fishing and other poaching practices can be eradicated (decreased to a minimum) when appropriate education of local stakeholders is applied. Law enforcement pressure can be also reduced when a community is well educated and aware of marine protection. (Watson, et al., 2015) From the point of environmental education and its goals, for the evaluation of the effectiveness of a program or project, the shift in values and behavioral changes are the most desired. (Thomson, Hoffman, Staniforth, 2003)

The author and Liberec Zoo staff suggest that imprisonment itself does not have to lead to the change in behavior nor values. This is the reason why an idea of ex-poachers' involvement occurred in order to fulfill the requirement of achieving positive change in values, behavior, and knowledge. Also, talking about poaching is a quite sensitive topic and the author believes that the local community rather accepts it when someone local is talking about these issues. Furthermore, the author proposes that the ex-poachers can still keep their roles as 'environmental educators' and they can continue to spread their gained knowledge in their communities even after the educational project.

Leisher et al. (2012) suggest that education and outreach activities primarily impact people who not yet formed their opinions about conservation and did not have education about the environment. This is one of the reasons, why the educational program was focused mainly on children/young people.

In environmentally threatened and poor areas, communities often do not have proper environmental education and awareness about environmental and conservation issues. (Keane, et al., 2008) This theory is investigated further in the questionnaire survey, where respondents were

subjected to the questions about the marine ecosystem and its issues. The author expects rather poor knowledge and awareness among participants because the researched area is both poor and environmentally threatened. On the other hand, the author proposes that the knowledge among both students and the ex-poachers will be higher in cases that are easily observable from the environment (e. g. A monitor lizard eats turtle eggs).

Since the area of Banyak archipelago is poorer and more threatened comparing to the other parts of the researched region (Singkil, Nias), the lower outcomes in the survey are expected especially among students from these villages. The highest student-teacher ratio and the highest number of students per class are in the Ujung Sialit village, the outcomes are expected to be the poorest in this village. Furthermore, based on interviews with the key informants, the people from Ujung Sialit are more likely to use poisons and dynamite for fishing, the author expects more negative behaviors and attitudes among students from Ujung Sialit's school. (Key informant no. 2, 2019; Key informant no. 3, 2019; Hemelíková, 2019).

The eating habitats differ in many ways among Muslims and Christians. In general, for Muslims, it is forbidden ('*haram*') to eat turtle meat, while according to Christians the turtle meat is a healthy delicacy. Since Nias and Ujung Sialit are mainly inhabited by Christians, there is a higher probability that in these areas there is increased demand for turtle meat and more people are eating it. (Key informant no. 1, 2019; Key informant no. 2, 2019; Hemelíková, 2019). Furthermore, a widely spread rumor/belief is that turtle eggs are healthy and lead to a longer life. The author expects that the share of supporters of this rumor will be among both Muslim and Christian villages.

Except for factors that could influence results of the survey, which are mentioned above, and are based on socioeconomic and socioeconomic analyses and theories of environmental education and community outreach/involvement, there are other demographic and geographic factors that are questioned in the surveys. Aspects like age, sex, village are included to understand relations between these aspects and knowledge, behaviors, values and attitudes.

6. RESEARCH

The first contact with Liberec Zoo regarding the author's internship in the project was in May 2018. This internship was for two months in July and August 2018. After return to the Czech Republic, the author was offered to continue her internship and to participate in the second phase of the project. During the second project's phase, the author spent another 8 months in Pulau Banyak (November 2018 – January 2019 and March 2019 – September 2019). In total the author spent in the area for 10 months. The author got all the necessary support from Liberec Zoo to conduct her research.

The research itself started in November 2018. The research timetable is below. Since the questionnaire survey and involvement of the three ex-poachers were done simultaneously, the research timetable is parallel for both parts of the research.

	November 2018	December 2018	January 2019	February 2019	March 2019	April 2019	May 2019	June 2019	July 2019	August 2019
Survey proposal	x			x	x					
Pilot phase		x	x							
Data collection		x	x			x		x	x	x
Transcription of the data							x	x	x	x

Table 7: Timetable of the research (created by author)

The research sample for the questionnaire survey consists of 18 schools from 8 villages and has 700 respondents. The environmental education impact assessment was done for the three ex-poachers. Results are presented separately in the Chapter 'Results'.

The author also researched the coral restoration part of the program, however, these data are not presented here since it is out of the scope of this thesis.

6.1. METHODOLOGY

In Thomson, Hoffman, Staniforth (2003) recommended methods for investigating or measuring or evaluating environmental education are especially questionnaires, interviews, observations, and feedback forms. These instruments were also used in the research. The questionnaires were used for the surveys in the schools. To observe changes in knowledge, behaviors, and attitudes at the three ex-poachers, the author used interviews, observations, and tests.

Rickinson (2001) recommends collecting the following information for measuring/evaluating environmental education:

- **Environmental knowledge; attitudes, values, and behaviors;**
- **Perceptions of nature;**
- Experiences from learning;
- Influences on adults.

The information in bold was collected in the questionnaire survey as well as in the environmental education impact assessment in the three ex-poachers.

The question in both surveys and tests were based on author's previous research of environmental threats in the area. Furthermore, the questions and their composition were consulted with in-situ project coordinators from Liberec Zoo and with a local employee of BKSDA (Nature Conservation Agency). By consulting the composition of questions, the content validity criterium was fulfilled. Content validity, according to Disman (1993) investigates whether a chosen method measures what it is desired to investigated.

The ethics of the research was already discussed in the introduction of the thesis in the part 'Aims and Methodology'.

6.1.1. Questionnaire survey

In total, three versions of structured questionnaires were prepared to provide profound analysis of knowledge, attitudes, values and behaviours among local students. Each version consists of 13 questions:

- 5 knowledge-based questions;
- 4 questions investigating attitudes/values/behaviours/perceptions of the respondents;
- 4 questions on personal information and family background.

In knowledge-based question, there was only one correct answer. Attitudes, values, behaviours and perceptions-oriented questions did not have a correct answer. Instead, these questions were structured in a way that a respondent had to express precisely his/her perspective. The answers 'not sure', or 'I do not know' were not in the range of answers. These questions had in most of the cases 4 answer choices, so a respondent had to state more positive or more negative standpoint towards nature and conservation.

The personal information and family background questions were same in all versions of questionnaires. The participants were questioned about their age, sex and occupation of mother and father. Although there were three versions of the questionnaires, the results will be presented in the tables and categorized by knowledge, attitudes, values, behaviours and perceptions. In these categories the differences between sexes, age groups, villages and family backgrounds are

observed. Regarding family background the relations between respondents from low income families and middle/high income families are investigated. Family income is derived from 'father's occupation'. If 'father's occupation' is fisherman, the respondents background is presented as low income. If 'father's occupation' is in office/government work, the respondent is classified to be from middle income or high income family.

The very important part of the research was its pilot phase. The survey was first piloted at 8 schools to get questionnaires from different types of schools (both elementary and high schools were involved in the educational program). The first version of questionnaires consisted only from knowledge-based questions with multiple answer question. However, it appeared that the respondents do not understand the concept of multiple answer questions. Since the author also started to analyse more the region of Pulau Banyak and researched environmental threats in the area (see Chapter 3), she decided to add also questions oriented on participant's values, attitudes and behaviours to get more complex data of her research. Furthermore, some type of the questions seemed to be misunderstood by the recipients, these questions were reformulated to be clear for all participants. The questionnaires were structuralized to have multiple choice answers and one correct answer. They were designed in a way that every respondent could find a category for his/her.

6.1.2. Environmental education impact assessment

While the questionnaire survey is quantitative-based research, the impact measurement in the three ex-poachers is qualitative-based.

Thomson, Hoffman, and Staniforth (2003) recommend applying more instruments when measuring change (i.e. in this case impact of delivered education). According to them 'the triangulation' of results gives mutually complementary results and strengthens them. With the three ex-poachers the personal and group interviews were conducted, furthermore, they were examined at two different times (before/December 2018 and after the educational program/August 2019) by using tests, and the author also used the method of observation. The interviews were conducted basically after each lecture at the school and had a semi-structured form.

Environmental education impact assessment in ex-poachers observes the impact of educational interventions. The impact of education is observed in 6 dimensions which are described below. The author does not have enough participants to provide[7], for example, an index of environmental

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[7] The author planned at the very beginning of the project to conduct environmental education impact assessment in selected schools as well, however, it turned out to be complicated due to the impossibility of

education impact. The impact of education is provided in the form of assessment/evaluation in different dimensions. However, these dimensions might be applicable for a situation when having more participants as well, and thus, they could provide a good basis for the construction of multidimensional environmental education impact index when collecting data for evaluating other projects implemented by Liberec Zoo and measure change among a higher number of participants in similar environment.

Environmental education impact assessment has 6 dimensions. In each dimension there is 5 questions/issues – the assessment consists of in total 30 questions from different areas (dimensions):

1. Knowledge about marine ecosystem: coral reefs, sea turtles;
2. Knowledge in conservation;
3. Awareness about environmental threats: understanding of the negative effects and consequences;
4. Values: how a respondent values nature;
5. Opinions and attitudes: regarding environment and conservation;
6. Behaviors: does a respondent behaves responsibly towards environment.

Dimensions 1-3 are knowledge-based. Alternatively, they might be merged in one dimension too, however, the author prefers to work with 6 dimensions for better representation of results by using spider graphs.

The author worker with similar dimensions (categories) as in the questionnaire survey. Some questions that were used in the questionnaire survey were used also in tests for environmental education impact assessment. However, similarities in questions can be found mainly in dimensions 1-3 that are knowledge-based.

The information about knowledge was gained by using tests, other dimensions were investigated based on semi-structured interviews. Tests were given before the educational program with ex-poachers, and after the program. Tests consisted of same questions since the period between testing was almost 8 months. According to Disman (1993), researches that are testing at two different times, same tests/questionnaires can be given to the participants if time period is longer than 3 months. This criteria was fulfilled. The time period was long enough, so the ex-poachers couldn't be influenced by their previous answers. Same questions in tests were desirable to provide

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setting regularity in visits to selected schools. Too frequent holidays, poor school attendance and high weather changeability occurred to be the main obstacles for impact assessment in schools.

consistent and reliable comparison of results. Leisher et al. (2012), who surveyed education in outreach activities (see Chapter 2), were using same set of questions in their surveys as well.

If a respondent's answer (the author uses code 'yes=1') is correct, 1 point is added. In case the respondent replies wrong (code 'no= -1'), the respondent loses 1 point. The author decided to subtract points in case of wrong answer in dimensions 1-3 (knowledge-based questions) to eliminate attempts to create guesses. The respondent should be sure about his/her answer. Furthermore, the maximum score is 100 %. The maximum score should be reached by a person who has deep knowledge and understands and support conservation actions, such a person should have positive opinions and high values regarding nature. A person with a maximum score is further defined as someone who behaves responsibly towards the environment.

This assessment is provided for each of the ex-poachers by using a spider graph. Furthermore, since for that part of the research has only 3 participants, the author provides individual assessment for each ex-poacher, where she describes observed changes that are difficult to quantify (interest in nature, asking for advice, development of other skills, etc.).

6.2. DATA

The 'Data' part consists of profound descriptions of data from questionnaire surveys and environmental education impact assessment. Especially respondents' characteristics and backgrounds are provided in this part.

In the following subchapters, data for both parts of the research are presented. Data are organized mainly in tables and maps in order to be easily readable and understandable.

6.2.1. Questionnaire survey

To collect data for the questionnaire survey, the author handed out the questionnaires in 18 schools in the researched area. The questionnaires were distributed in paper form before each lecture with the three ex-poachers and then rewrote by the author into an electronic form.

Different schooling institutions were visited for the survey. Data were collected in all educational levels – elementary schools, junior high schools, and senior high schools. Also, several religious schools were included in the survey. Table 8 below describes the distribution of questionnaires in villages and the number of respondents. The geographical scope of the survey can be seen in Figure 2, which complements Table 8. The author created a map to provide the position of villages within the researched area.

District	Village	No.	School	Number of respondents from each school
Pulau Banyak **230 (32.8)**	Pulau Balai 162 (23.1)	1	Senior high school	57
		2	Junior high school	71
		3	Islamic elementary school	45
	Teluk Nibung 68 (9.7)	4	Junior high school	28
		5	Elementary school	30
Pulau Banyak **Barat** **116 (16.6)**	Haloban 63 (9)	6	Senior high school	33
		7	Junior high school	29
	Ujung Sialit 40 (5.7)	8	Elementary school	40
	Suka Makmur 13 (1.9)	8	Elementary school	14
Singkil **108 (15.4)**	Singkil 108 (15.4)	10	Islamic elementary school	57
		11	Islamic junior high school	27
		12	Islamic senior high school	24
Nias **246 (35.2)**	Gunung Sitoli 174 (24.9)	13	Islamic elementary school	53
		14	Junior high school	32
		15	Christian private junior high school	60
		16	Christian private junior high school	28
	Gunung Sitoli Utara 72 (10.3)	17	Elementary school	42
		18	Junior high school	30
TOTAL				**700 (100)**

Table 8: Distribution of questionnaires in schools and the number of respondents by the area, n (%), (created by author, 2019)

Figure 2: Map of questionnaire survey, (created by author, based on Google Maps, 2019)

As mentioned above, in the survey different schooling institutions were involved in the survey. Respondents were divided into 3 age groups. The age group 9-12 stands for elementary school, the group 13-15 presents junior high school and 16+ group indicates to senior high school. In Indonesia,

the primary level of education, which is compulsory, is for 6 years. Secondary education is divided into junior and senior levels – junior high school takes 3 years, while senior high school is attended for 4 years. The age distributions of respondents can be seen below in Table 9. The sex distribution of respondents is in the same table.

		sex	
age	boy	girl	TOTAL
9-12	152	171	323 (47)
13-15	114	142	256 (37.2)
16+	39	60	99 (14.4)
(not filled)	10	12	22 (3.1)
TOTAL	315 (45.1)	385 (54.8)	700 (100)

Table 9: Age and sex distribution of the respondents, n (%), (created by author, 2019)

To more characterize respondents, it is important to know their family backgrounds. This is in the questionnaire survey investigated by parents' occupation. By understand family backgrounds, it is possible to more analyse income situation of respondents and their dependence on marine ecosystem. In general, families of government officers and businessmen have higher living standards. Fishermen, farmers, loggers and labourers are traditionally among the poorest, the family situation is worse when a woman (mother) is housewife. Furthermore, it is possible to observe differences in knowledge, values, attitudes, and opinions among respondents from different family backgrounds. The family backgrounds are presented in Table 9 and Table 10 below.

	FATHER							
	farmer	fisherman	labourer	logger	office/ government	seller	small business	TOTAL
MOTHER								
farmer	34	21	3	2	2	0	0	62 (10)
housewife	15	**234**	10	3	**97**	12	31	402 (65)
office/government	2	7	1	1	**89**	2	6	108 (17.4)
seller	0	9	3	0	2	5	4	23 (3.7)
other	2	10	1	0	6	5	2	26 (4.2)
TOTAL	53 (8.5)	281 (45.2)	18 (2.8)	6 (1)	196 (31.6)	24 (3.9)	43 (6.9)	621 (100)

Table 10: Family backgrounds of respondents, expressed by mother's and father's occupations, n (%), (created by author, 2019)

In Table 10, the family backgrounds expressed by occupations of parents are expressed. In total 45 % of respondents' fathers are fishermen and 31 % of fathers are government officers. Regarding

mothers' situation, 65 % of women (mother) are housewives and 17 % of them are government officers. The most common family background is fisherman and housewife, which indicates a poor family situation. Also, findings in Table 10 might indicate low social mobility in the area since marriages among government officers are quite common, while marriages within other occupations are rare (e. g. a government officer and a fisherman). There is also the high number of government officers and housewives marriages that might be explained by the fact that officers have usually enough financial means to secure their wives and children, so the wives of government officers do not have to work although they might have a higher education. On the other hand, wives of fishermen usually have only low education and gaining a job is for them very difficult.

Other descriptions of family backgrounds can be seen in Table 11, where 'father's occupation' is categorized by villages. Dependence on the marine ecosystem among the villages can be seen in the 'fisherman' column. While Nias (Gunung Sitoli and Gunung Sitoli Utara) and Singkil have low marine ecosystem dependence (no more than 25 %), villages in Pulau Banyak (Pulau Balai, Teluk Nibung) and Pulau Banyak Barat (Haloban, Ujung Sialit, and Suka Makmur) show extremely high dependence on the marine ecosystem. Fishing as the main source of family income in the archipelago varies from 62.1 % in Teluk Nibung up to 96.5 % in Haloban.

	FATHER							TOTAL
	farmer	fisherman	labourer	logger	office/ government	seller	small business	
AREA								
Nias	**39**	**23** (10.2)	**9**	**1**	**120**	**12**	**20**	**224** (100)
Gunung Sitoli	13	7 (4.5)	2	0	108	10	17	157 (100)
Gunung Sitoli Utara	26	16 (23.8)	7	1	12	2	3	67 (100)
Pulau Banyak	**9**	**155** (74.5)	**4**	**1**	**18**	**6**	**15**	**208** (100)
Pulau Balai	3	114 (80.2)	3	0	10	1	11	142 (100)
Teluk Nibung	6	41 (62.1)	1	1	8	5	4	66 (100)
Pulau Banyak Barat	**1**	**85** (89.4)	**1**	**4**	**4**	**0**	**0**	**95** (100)
Haloban	0	56 (96.5)	1	0	1	0	0	58 (100)

Suka Makmur	1	11 (84.6)	0	0	1	0	0	13 (100)
Ujung Sialit	0	18 (75)	0	4	2	0	0	24 (100)
Singkil	**4**	**18 (19.1)**	**4**	**0**	**54**	**6**	**8**	**94 (100)**
Singkil	4	18 (19.1)	4	0	54	6	8	94 (100)
TOTAL	**53**	**281 (45.2)**	**18**	**6**	**196**	**24**	**43**	**621 (100)**

Table 11: Distribution of occupation's in the researched region and a family's dependence on marine ecosystem, expressed by father's occupation (fishermen=dependent), categorized by areas, n (%), (created by author, 2019)

The results from this part correspond with findings in the socioeconomic analysis of the region in Chapter 4. The tables above indicate that districts of Pulau Banyak and Pulau Banyak Barat are the poorest within the researched region and have a high dependence on the marine ecosystem.

The composition of questions in the survey is very complex. Except for knowledge many environmental issues in the research regions are investigated. Environmental threats were identified by the author first, then these threats were profoundly questioned in order to get precise results about the situation in the region.

6.2.2. Environmental education impact assessment

Data for environmental education impact assessment were collected from three respondents – the three ex-poachers who were involved in the project as lecturers to share their experience with children.

Their characteristics are very similar. All of them are from Haloban village (see Figure 2), they are fishermen and their spouses are housewives. Their other personal information is summarized in Table 12 below.

No.	Age	Number of children	Estimated monthly income (converted to USD, personal estimation)
1	28	3	284
2	34	4	284
3	56	8	213

Table 12: Personal information of the three ex-poachers (created by author, 2019)

The poorest among the three ex-poachers is the oldest one (number 3). For example, he does not own a mobile phone nor a motorbike. Both 1 and 2 have one smartphone, which they share with

their wives and each of them has one motorbike. The first and second ex-poachers are relatives (cousins).

Their 'poaching' history is quite different and interesting. The oldest one was poaching turtle eggs for many years as the main source of his income. The second one had poaching as additional income to fishing and did it for approximately 3 years. The first one was arrested during his first poaching attempt, he went poaching only once, his cousin (no. 2) persuaded him to join him and his older friend in 2016. Although, they have different 'poaching' history all of them were imprisoned for the same length of stay in prison in Singkil.

6.3.   RESULTS

In this chapter results of a questionnaire survey and environmental education impact assessment, respectively, are presented. The results will answer the research questions:

1. How important is community outreach in conservation activities in the researched area?
   a. What are the main conservation threats in the area?
   b. Are the local people aware of the environmental threats and do they understand the functioning and the importance of the marine ecosystem?
   c. What change in knowledge, opinions, and attitudes was observed in the three ex-poachers during the experiment?

The results of the questionnaire survey are presented mainly in tables and figures while environmental education impact assessment is presented by using spider graphs. Furthermore, for better understanding, the explanation of several posed questions is provided. In this part the results are described as well, however, further discussion is provided in the following part.

Knowledge – sea turtles	Question :	1. How do we classify turtles?	2. What role do turtles have in the sea ecosystem?	3. Why are turtles important in the sea ecosystem?	4. There are 1 000 of turtle hatchlings. How many of them will reach maturity?	5. What is the natural food of turtles?	6. I think that the population of sea turtles:
	Correct Answer:	Reptiles.	Turtles help to keep coral reefs healthy.	Turtles clean coral reefs.	1 – 3 of hatchlings reach maturity.	Jelly fish and algae.	is decreasing.
Sex	Boy	**26 (30.2)**	45 (52.3)	**77 (58.7)**	37 (28.2)	57 (61.2)	69 (74.1)
	Girl	34 (28.3)	**68 (56.6)**	65 (46.7)	**50 (35.9)**	**89 (76)**	**88 (75.2)**
Age	9-12	30 (20.9)	70 (48.9)	55 (57.3)	27 (28.1)	**71 (78)**	60 (66)
	13-15	**21 (32.3)**	**46 (70.7)**	43 (42.1)	**41 (40.1)**	55 (58.5)	**23 (88.5)**
	16+	X	X	**44 (60)**	19 (26)	20 (76.9)	74 (78.7)
Village	Pulau Balai	X	X	**55 (43.6)**	40 (31.7)	**25 (69.4)**	**19 (52.7)**
	Teluk Nibung	3 (9.9)	16 (53.3)	21 (55.2)	**21 (55.2)**	X	X
	Haloban	X	X	X	X	55 (87.3)	47 (74.6)
	Ujung Sialit	5 (12.5)	**11 (27.5)**	X	X	X	X
	Suka Makmur	**1 (7.7)**	6 (46.1)	X	X	X	X
	Singkil	X	X	46 (56.7)	**19 (23.4)**	**11 (40.7)**	21 (77.7)
	Gunung Sitoli	**27 (45)**	**45 (75)**	**21 (72.4)**	9 (31)	55 (64.7)	**70 (82.3)**
	Gunung Sitoli Utara	25 (34.7)	40 (55.5)	X	X	X	X
Father's occupation	Fisherman	10 (15.1)	33 (50)	53 (43.8)	**45 (37.1)**	**70 (74.5)**	61 (64.8)
	Office/ Gover.	**25 (40.9)**	**35 (57.3)**	**45 (62.5)**	18 (25)	38 (60.3)	**55 (87.3)**
TOTAL number of correct answers		**61 (28.3)**	**106 (49.7)**	**143 (53)**	89 (32.5)	**146 (69.1)**	**157 (74.4)**
TOTAL number of respondents		215 (100)	213 (100)	274 (100)	274 (100)	211 (100)	211 (100)

Table 13: Results for knowledge questions about sea turtles, categorized by sex, age and village, n (%), (created by author, 2019)
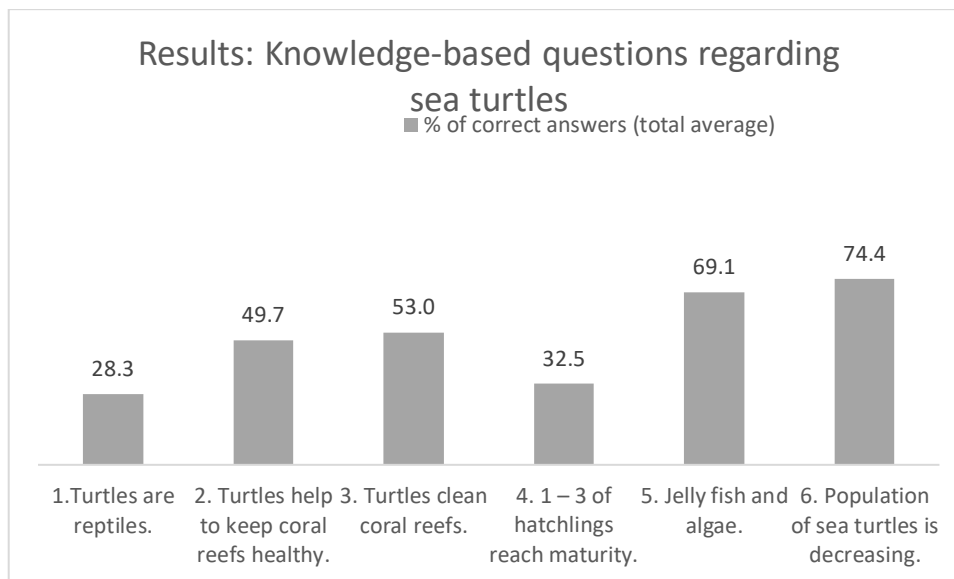
Figure 3: Percentage of correct answers in knowledge-based questions regarding sea turtles among all participants (created by author, 2019)

All knowledge-based questions can be further divided into 'scientific' knowledge and knowledge that can be gained by the respondent's observation or experience. Examples of 'scientific' questions are questions number 1 and 4. These questions were for the respondents more difficult and all had a lower rate of correct answers (28.3 % and 32.5 %, respectively).

Differences between girls and boys in this category are minimal. On the other hand, if age groups are compared by average success rate, the age group 16+ has the highest knowledge (60.4 %), while group 13-15 gets 56 % and group 9-12 has a knowledge rate of 49.8 %.

The poorer knowledge had respondents from Ujung Sialit and Suka Makmur villages. Moderate knowledge had respondents from Pulau Balai, Teluk Nibung, Singkil, and Gunung Sitoli Utara. High performance in knowledge had respondents from the city of Gunung Sitoli, where is higher schooling quality. Surprisingly, the best knowledge had respondents from Haloban. This might be explained by the fact that in Haloban village there is operating NGO HaKA, which employs several men from Haloban to patrol nesting beaches in Bangkaru island. The employees of HaKA are educated about seat turtles, so they can hand out their knowledge among the community in Haloban.

Differences within category father's occupation (family background) are present, however, there is no significant pattern, how these changes could be explained.

Knowledge – coral reefs		Question:	1. What is coral?	2. More than half of the breathable oxygen in the world comes from:	3. What living organism in the ocean helps to provide much of the Earth's oxygen?	4. We have coral which is 10 cm length. Can you guess how long time it has grown?	5. The most fish species in the sea we can find:
		Correct Answer:	A Tiny animal.	The oceans.	A coral.	1 year.	in the coral reefs.
Sex	Boy		15 (17.4)	**21 (24.4)**	83 (63.3)	**50 (38.1)**	**71 (76.3)**
	Girl		**37 (30. 8)**	27 (22.5)	**90 (64.7)**	36 (25.8)	88 (75.2)
Age	9-12		**36 (25.2)**	31 (21.6)	54 (54.2)	24 (25)	67 (73.6)
	13-15		16 (24.6)	**17 (26.1)**	62 (60.7)	**37 (36.2)**	72 (76.5)
	16+		X		**58 (79.4)**	23 (31.5)	**20 (76.9)**
Village	Pulau Balai		X	X	**93 (73.8)**	40 (31.7)	29 (80.5)
	Teluk Nibung		4 (13.3)	6 (20)	26 (68.4)	**15 (39.4)**	X
	Haloban		X	X	X	X	55 (87.3)
	Ujung Sialit		**18 (45)**	**9 (22.5)**	X	X	X
	Suka Makmur		1 (7.7)	2 (15.3)	X	X	X
	Singkil		X	X	**38 (47)**	23 (28.3)	17 (62.3)
	Gunung Sitoli		**2 (3.3)**	**9 (15)**	19 (65.5)	**8 (27.5)**	58 (68.2)
	Gunung Sitoli Utara		30 (41.6)	23 (32)	X	X	X
Father's occupation	Fisherman		**15 (24.2)**	12 (18)	**85 (70.2)**	**38 (31.4)**	**79 (84)**
	Office/ Gover.		7 (11.5)	11 (18)	40 (55.5)	20 (27.7)	47 (74.6)
TOTAL number of correct answers			**55 (25.5)**	**49 (22.8)**	**176 (64.2)**	**86 (31.3)**	**159 (75.3)**
TOTAL number of respondents			215 (100)	215 (100)	274 (100)	274 (100)	211 (100)

Table 14: Results for knowledge questions about coral reefs, categorized by sex, age and village, n (%), (created by author, 2019)
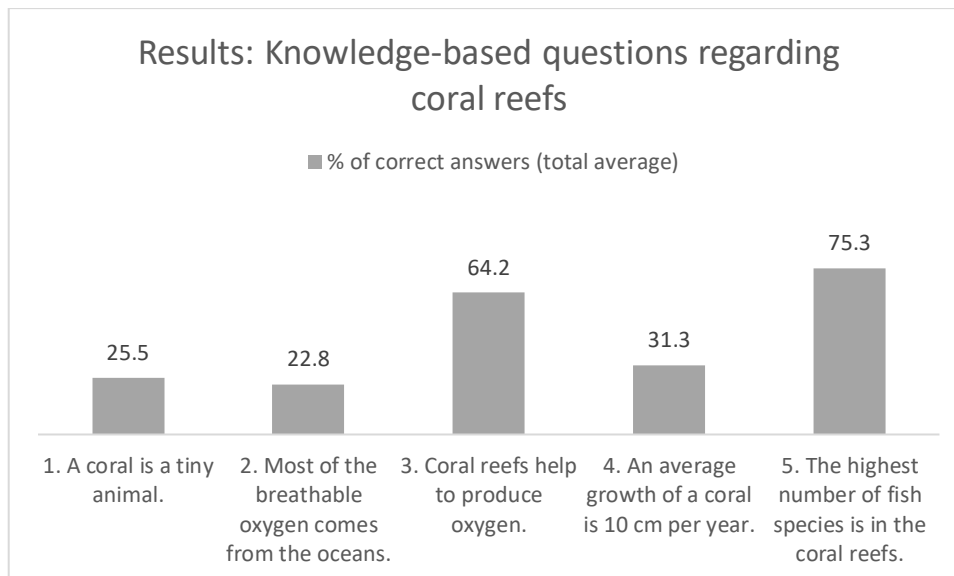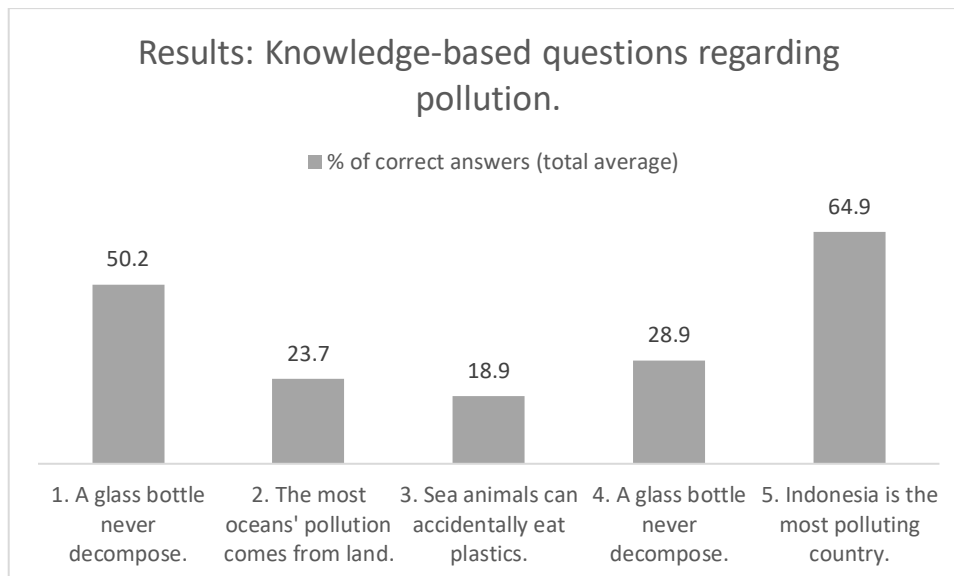
Figure 4: Percentage of correct answers in knowledge-based questions regarding coral reefs among all participants (created by author, 2019)

Similarly, there are no significant differences between boys and girls. When comparing age groups, the age group 16+ proved better knowledge than younger respondents. The respondents, whose fathers are fishermen, seem to have better knowledge in marine ecosystem except the question 2, where the results were same for the both categories (fishermen, office/government).

If controlled for the researched villages. A good performance has been revealed by respondents from Pulau Balai and Teluk Nibung (see questions 3 and 4). Better performance of question 4 by participants from Pulau Balai and Teluk Nibung can be explained by the fact that Liberec Zoo in these villages has coral nurseries and several children attend them regularly. Respondents from Haloban had the highest percentage of correct answers in question 5, however, it is disputable to compare among other villages this question was successful in general, it is one of the knowledge-experience questions. To know where the most fish species are can be observable by the respondents in their environment. Especially, children and young people join their fathers for fishing, so they have good knowledge what fish species live in different sea ecosystems. The poor knowledge was again proved among participants from Ujung Sialit and Suka Makmur.

Knowledge – pollution	Question:	1. How long time does glass bottle decompose?	2, Where does the most ocean's pollution come from?	3. It is possible that the sea animals can accidentally eat plastics?	4. You have plastic bottle, glass, bottle and aluminium can. Which one of these will never decompose?	5. Choose country which is polluting the oceans the most:
	Correct Answer:	Never.	Land.	Yes.	Glass bottle.	Indonesia.
Sex	Boy	**47 (54.6)**	31 (23.6)	**20 (21.5)**	26 (27.9)	**61 (65.5)**
	Girl	57 (47.4)	**34 (24.4)**	20 (17)	**34 (29)**	75 (64.1)
Age	9-12	58 (40.5)	**28 (29.1)**	**21 (23)**	**30 (32.9)**	48 (52.7)
	13-15	**48 (73.8)**	26 (25.4)	17 (18)	26 (27.6)	64 (68)
	16+	X	10 (13.6)	2 (7.7)	5 (19.2)	**25 (96.1)**
Village	Pulau Balai	X	25 (19.8)	**2 (5.5)**	9 (25)	24 (66.6)
	Teluk Nibung	11 (36.6)	**18 (47.3)**	X	X	X
	Haloban	X	X	4 (6.3)	**11 (17.4)**	**55 (87.3)**
	Ujung Sialit	**13 (32.5)**	X	X	X	X
	Suka Makmur	5 (38.5)	X	X	X	X
	Singkil	X	19 (23.4)	7 (25.9)	**10 (37)**	14 (51.8)
	Gunung Sitoli	**49 (81.6)**	**3 (10.3)**	**27 (31.7)**	31 (36.4)	**44 (51.7)**
	Gunung Sitoli Utara	30 (41.6)	X	X	X	X
Father's occupation	Fisherman	**15 (22.7)**	**28 (23.1)**	7 (7.4)	18 (19.1)	**70 (74.4)**
	Office/ Gover.	7 (11.4)	15 (20.8)	**20 (31.7)**	**25 (39.6)**	35 (55.5)
TOTAL number of correct answers		**108 (50.2)**	65 (23.7)	40 (18.9)	61 (28.9)	137 (64.9)
TOTAL number of respondents		215 (100)	274 (100)	211 (100)	211 (100)	211 (100)

Table 15: Results for knowledge questions about pollution, categorized by sex, age and village, n (%), (created by author, 2019)

Figure 5: Percentage of correct answers in knowledge-based questions regarding pollution among all participants (created by author, 2019)

In general, better knowledge regarding pollution has the youngest respondents from the age group 9-12 years. The results from knowledge-based questions regarding pollution suggest that the respondents are aware of the fact that Indonesia is one of the most polluting nations in the world (question 5), but they do not know what the consequences of pollution are – only 18.9 % of all respondents know sea animals can accidentally eat plastics. There are no significant differences between sexes and age groups. Among age groups, there is the only difference in question 5, where age group 16+ is significantly better. Older students might be better able to compare Indonesia with other countries.

In general, better knowledge was proved by respondents from Gunung Sitoli. Ujung Sialit and Suka Makmur have poorer familiarity with pollution and lower awareness among the length of decomposition of different materials.

Attitudes, values, behaviours – sea turtles	Question:	Hunt for turtle eggs, shell or meat is illegal and forbidden by law with punishment of 5 years in prison or fine of Rp. 100.000.000. This punishment is:	Have you ever eaten turtle eggs or turtle meat?	We all want to be healthy. Imagine that you want to help your friend who is often sick. Would you recommend him to eat turtle eggs or turtle meat in order to be healthier?	In my opinion, consumption of turtle eggs or turtle meat:
		Too strict/Strict.	Yes (one of them or both)	Yes (one of them or both)	Is healthy.
Sex	Boy	**73 (84.8)**	86 (46.5)	55 (42)	**53 (57)**
	Girl	95 (79.1)	**120 (50.8)**	**68 (48.9)**	48 (41)
Age	9-12	**119 (83.2)**	**77 (53.8)**	**53 (55.2)**	**54 (59.3)**
	13-15	54 (83)	25 (38.4)	37 (36.2)	43 (45.7)
	16+	X	X	35 (47.9)	4 (15.3)
Village	Pulau Balai	X	X	50 (39.6)	**25 (69.4)**
	Teluk Nibung	26 (86.6)	**9 (29.9)**	9 (23.6)	X
	Haloban	X	X	X	**16 (25.3)**
	Ujung Sialit	**25 (62.5)**	**30 (75)**	X	X
	Suka Makmur	11 (84.6)	9 (69.2)	X	X
	Singkil	X	X	**54 (66.6)**	14 (51.8)
	Gunung Sitoli	49 (81.6)	23 (38.3)	13 (44.8)	46 (54.1)
	Gunung Sitoli Utara	**65 (90.2)**	37 (51.3)	X	X
Father's occupation	Fisherman	**57 (86.3)**	**35 (53)**	45 (37.1)	40 (42.5)
	Office/ Gover.	41 (78.6)	26 (42.6)	**39 (54.1)**	**29 (46)**
MEAN		**176 (81.8)**	**108 (50.2)**	**126 (46)**	**101 (47.8)**
TOTAL number of respondents		215 (100)	215 (100)	274 (100)	211 (100)

Table 16: Results for attitudes, values and behaviours of respondents regarding sea turtles, categorized by sex, age and village, n (%), (created by author, 2019)
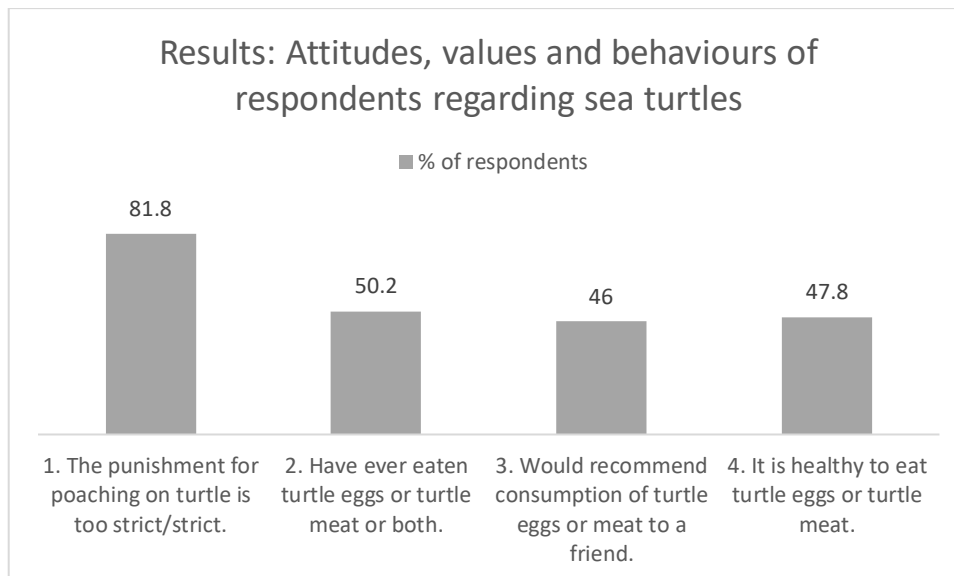
Figure 6: Results of attitudes, values and behaviours regarding sea turtles among all participants, in % (created by author, 2019)

Question 1 measured how the respondents value nature. Participants, in general, see the rate of punishment as 'too strict' or 'strict'. Surprisingly lower rates of 'too strict/strict' answers were among respondents from Ujung Sialit. The author does not have a theory nor a hypothesis to explain this result. The respondent from fisher families perceive this punishment more often as too/strict. These respondents seems to be more benevolent to this type of behaviour.

It seems that younger children more believe in myths that is why they consider turtle eggs/meat as healthier. Younger children are also more influenced by the opinions of their parents and especially the older generation believes in the health effects of turtle eggs and meat. Older children (teenagers) already have their own opinions and they are more open-minded. On the other hand, the half of the respondents state that the consumption of turtle eggs/meat is healthy and would recommend its consumption. An interesting result is that only 25.3 % of respondents from Haloban think turtle eggs are healthy. This result might be affected by the previous punishment of the ex-poachers and by the fact that rangers in Bangkaru island are from Haloban.

Significantly higher consumption of turtle eggs and meat is in Ujung Sialit village, followed by Suka Makmur village. Ujung Sialit is locally famous for turtle poaching s and there is also a high demand for turtle products. Since Ujung Sialit is the only Christian village in the archipelago, people from Ujung Sialit eat turtle meat as well. Suka Makmur is close to Ujung Sialit, the turtle eggs are traded here as well. Nias is inhabited mainly by Christians and there is a higher number of consumers too.

The respondents from fisher families more often eat turtle eggs, on the other hand, the respondents, whose fathers work in government office, would more recommend consumption of turtle eggs as well as more believe that it has healthy effects. Within rich families the turtle eggs

are perceived to be a delicacy. Among attitudes, values, and behaviors regarding turtle eggs, there are no differences between girls and boys.

Attitude, value, behaviour, and perception – coral reefs	Question:	Do you have some friends who can catch coral fish?	Destroying corals, using poisons and bombs for fishing is illegal and it is forbidden by law with punishment of 6 years in prison or fine Rp.1 200 000 000. This punishment is:	What colours of corals you see the most often?	In my opinion, to have a lot of corals which are healthy and big is according to me:
	Answer	Yes, I have.	Too strict/Strict.	Black, white, brown.	Very important/Important.
Sex	Boy	**39 (45.3)**	99 (75.5)	46 (49.4)	90 (96.7)
	Girl	42 (35)	**107 (76.9)**	79 (67.5)	**105 (89.7)**
Age	9-12	**64 (44.7)**	73 (76)	54 (59.3)	88 (96.7)
	13-15	17 (26.1)	**77 (75.5)**	59 (62.7)	**89 (94.6)**
	16+	X	55 (75.3)	13 (50)	26 (100)
Village	Pulau Balai	X	100 (79.3)	20 (55.5)	35 (97.2)
	Teluk Nibung	17 (56.6)	**25 (65.7)**	X	X
	Haloban	X	X	36 (57.1)	63 (100)
	Ujung Sialit	**29 (72.5)**	X	X	X
	Suka Makmur	5 (38.4)	X	X	X
	Singkil	X	56 (69.1)	22 (81.5)	**24 (88.8)**
	Gunung Sitoli	**13 (21.6)**	**26 (89.6)**	48 (56.4)	81 (95.2)
	Gunung Sitoli Utara	20 (27.7)	X	X	X
Father's occupation	Fisherman	**37 (56)**	**85 (70.2)**	52 (55.3)	**91 (97.8)**
	Office/ Gover.	16 (26.2)	45 (62.4)	35 (55)	60 (95.2)
MEAN		**84 (39)**	**207 (75.5)**	**126 (59.7)**	**203 (96.2)**
TOTAL number of respondents		215 (100)	274 (100)	211 (100)	211 (100)

Table 17: Results for attitudes, values, behaviours and perception of respondents among coral reefs categorized by sex, age and village, n (%), (created by author, 2019)
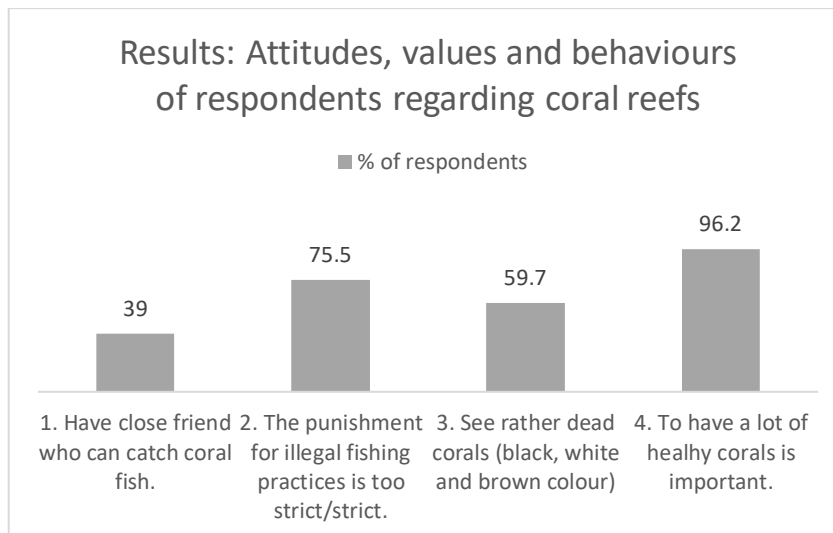
*Figure 7: Results of attitudes, values, behaviours and perception regarding coral reefs among all participants, in %
(created by author, 2019)*

Question 1 investigated behaviour – coral fish for live aquarium trade are caught in the large scale in the area, fishermen use mainly poisons to catch them. Author suggests that if a respondent's close friend or family member catches coral fish, there is probability that a poison to catch it has been used. Girls has lower rate of this behaviour that can be explained by the fact that girls spend their leisure time with other girls or women while boys spend their leisure time with other boys or men. Again, the highest percentage of this behaviour is present in respondents from Ujung Sialit (72.5 %). Respondents from age category 13-15 has lower rate of 'have friend who can catch coral fish'. Author suggests two hypotheses – older children are less willing to tell the truth, or children from the age category 9-12 more often catch coral fish to glasses or plastic bags and bring these fish to their homes. Possible are both hypotheses that strengthen each other. Also, the respondents from fisher families have more friends who catch coral fish.

Values of nature/attitudes among wildlife crimes are similar to those in the previous table. Similarly, respondents from fisher families stated more often that this punishment is too strict/strict. Question number 3 was investigating perception of respondents – the condition of local coral reefs. Black and white refer to dead corals and brown colour refer to algae on coral (dying coral). The worst situation seems to be in Singkil, where 81.5 % of respondents see these colours in coral reefs. Results from other villages as well as from family backgrounds support other coral reef monitoring researches throughout Indonesia – 70-60% of Indonesian coral reefs is considered to be damaged.

Almost all respondents stated that to have healthy and big coral reefs is very important or important (96.2 %). Respondents (local community) understand the importance of coral ecosystems and their dependence on marine life, however, the author suggests (based on the

results of the survey and her personal observation) that local communities do not know how to properly manage their marine areas.

Attitude, value, behaviour - pollution	Question:	What do you usually do with the plastic bag after eating your snack?	We all know that it is sometimes hard to find solution for what to do with the garbage. What do you usually do at home with the garbage?	In my opinion, the plastic pollution in the sea
	Answer	Throw it away.	Burn it. /Throw it to the sea.	I do not mind it. /Better to have garbage in the sea than on the island.
Sex	Boy	**10 (11.6)**	95 (72.5)	**43 (32.8)**
	Girl	5 (4.1)	**108 (77.6)**	30 (21.5)
Age	9-12	**15 (10.4)**	71 (73.9)	25 (26)
	13-15	3 (4.6)	**80 (78.4)**	**34 (33.3)**
	16+	X	54 (73.9)	14 (19.1)
Village	Pulau Balai	X	91 (72.2)	34 (26.9)
	Teluk Nibung	0 (0)	25 (65.7)	10 (26.3)
	Haloban	X	X	X
	Ujung Sialit	**10 (25)**	X	X
	Suka Makmur	0 (0)	X	X
	Singkil	X	**69 (85.1)**	**24 (29.6)**
	Gunung Sitoli	4 (6.6)	22 (75.8)	5 (17.2)
	Gunung Sitoli Utara	5 (6.9)	X	X
Father's occupation	Fisherman	2 (3)	95 (78.5)	31 (25.6)
	Office/ Gover.	**8 (13.1)**	56 (77.7)	19 (26.3)
MEAN		**19 (8.8)**	**207 (75.5)**	**73 (26.6)**
TOTAL number of respondents		215 (100)	274 (100)	274 (100)

Table 18: Results for attitudes, values and behaviours of respondents among pollution categorized by sex, age and village, n (%), (created by author, 2019)
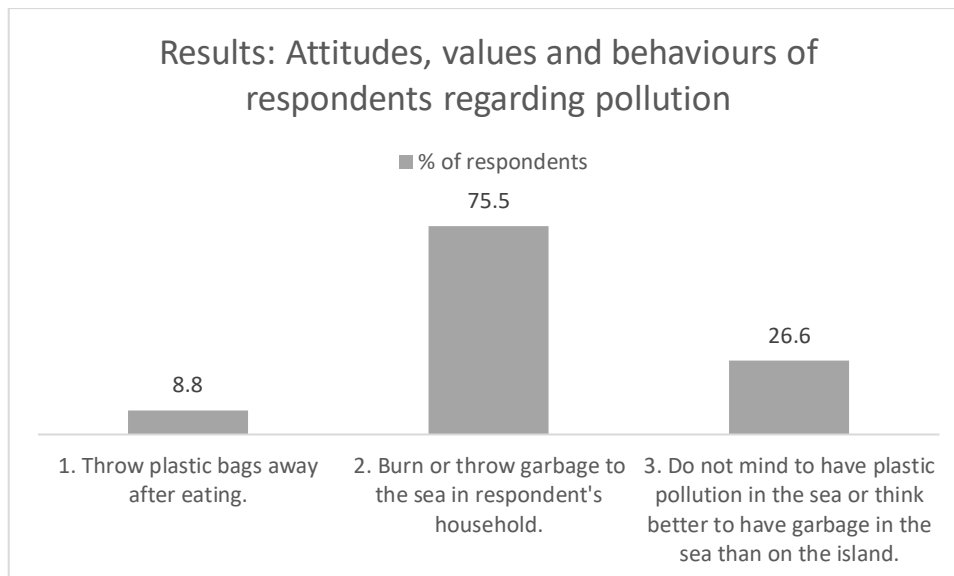
Figure 8: Results of attitudes, values, behaviours and perception regarding coral reefs among all participants, in %
(created by author, 2019)

The last set of questions is investigating attitudes, values, and behaviors in all participants regarding pollution.

It seems that younger children throw away the rubbish more often (higher incidence in the 'boy' category as well). Also, according to the author participants do throw away rubbish much more, however, they were not willing to admit this behavior in the survey since they know this behavior is undesired. The respondents who stated that they do not mind pollution in the sea or think it is better to have garbage in the sea than on the islands do not know the consequences of pollution (can be seen in question 'It is possible that the sea animals can accidentally eat plastics?' in the previous set of answers).

The second question investigated behavior of respondents and how they deal with garbage in households. The disposal of garbage in the researched region is very similar. 75.5 % of respondents burn or throw garbage to the sea. Unfortunately, local people do not much have other possibilities how to deal with garbage. On Balai island and in Singkil there are dumps, however, they are for a long time overfull and there is no possibility of transportation to other places or its procession.

Regarding family background, there are no significant differences in this category. Families with higher income (expressed as father's occupation is in office/government) deal with the garbage in the same way like poorer families. Also, opinions regarding plastic pollution in the sea do not change among families. The only differenci is in question 1, however, from the author's experience, people do throw garbage more, but they did not want to admit it.

6.3.2. Environmental education impact assessment

This subchapter provides environmental education impact assessment for the three ex-poachers who were involved in the educational program. Tables 19 and 20 provide overview of answers among the each of participant. If there is filled number 1 in 'YES' column, it means that a respondent's answer is correct or desirable. Number 1 in columns indicates a correct answer in dimensions 1-3 (knowledge-based questions), or desirable values, opinions, attitudes and behaviours in dimensions 4-6. In case that in a question there was a desirable answer 'no' or 'I disagree', the 'no' answer was given the 'yes' code and thus bonified as correct answer. This can be observed especially in 'Behavior' dimension by using '(1=No)' behind the question.

	'YES' in December 2018			'YES' in August 2019			TOTAL positive change
	1	**2**	**3**	**1**	**2**	**3**	
Dimension/Question							
D1: Knowledge about marine ecosystem							
There are 1 000 of turtle hatchlings. How many of them will reach maturity?	0	0	0	1	1	1	+3
When do turtles lay eggs?	1	1	1	1	1	1	
How do we classify sea turtles?	0	0	0	1	1	1	+3
What colours should a healthy coral reef have?	1	1	1	1	1	1	
What is a coral?	1	0	0	1	1	1	+2
D2: Knowledge in conservation							
How the protected areas can be beneficial?	0	0	0	1	1	0	+2
What turtle species are critically endangered?	0	1	1	1	1	1	+1
Damaging coral reefs is:	1	1	0	1	1	1	+1
What is a biodiversity?	0	0	0	0	1	0	+1
Which law sets list of protected species in Indonesia?	0	0	0	1	0	0	+1
D3: Awareness about environmental threats							
What effects does potassium have on corals?	1	1	1	1	1	1	
How fast is coral recovery after using a bomb for fishing?	0	0	0	1	1	1	+3
Thrown-of-crown starfish in coral reefs:	0	0	1	1	1	1	+2
The using of anchors:	1	1	0	1	1	0	
Plastic pollution is causing death to sea animals and sea birds.	0	0	0	1	1	0	+2

Table 19: Change in 'YES' (=correct/desired answer) among the three ex-poachers, dimensions 1-3 (created by author, 2019)

	'YES' in December 2018			'YES' in August 2019			TOTAL positive change
	1	**2**	**3**	**1**	**2**	**3**	
Dimension/Question							
D4: Values towards nature							
People who damage environment should be punished.	1	1	0	1	1	0	
Coral reefs are for fishermen who fishing in pelagic waters:	1	0	0	1	1	0	+1
Nature has for me important aesthetic and recreational value.	0	0	0	0	0	0	
I really like to spend time in nature.	0	0	0	0	0	0	
People who take protected species should be punished.	1	1	1	1	1	1	
D5: Opinions and attitudes regarding conservation and environment							
In my opinion, I can myself protect the environment.	1	1	0	1	1	0	
People who protect environment or work in conservation care more about nature than people. (1=No)	0	0	0	1	1	1	+3
A protected area is according to me:	0	0	0	1	1	0	+2
The consumption of turtle eggs is beneficial because.	0	0	0	1	1	1	+3
Everyone is responsible for the conservation of environment.	0	0	0	1	0	0	+1
D6: Behavior towards environment							
In the last 6 months I have used potassium to catch fish. (1=No)	1	1	0	1	1	1	+1
I spontaneously throw garbage away. (1=No)	0	0	0	1	1	0	+2
I use plastic bags for everything even when it is not necessary. (1=No)	0	0	0	1	0	0	+1
In the last 6 month I have used dynamite to catch fish. (1=No)	1	1	1	1	1	1	
I am willing to take conservation action. (1=No)	1	1	1	1	1	0	-1

Table 20: Change in 'YES' (correct/desired answer=1) among the three ex-poachers, dimensions 4-6 (created by author, 2019)

Although some of the questions were conservative, especially in 'Behavior' part, the participants known that there is no punishment eventhough some of their behaviors were illegal (e. g. 'In the last 6 months I have used potassium to catch fish'. The results in December 18 were poor in all dimensions. In knowledge-based questions (dimension 1-3), were for the participants more easier questions that are observable from environment or can be based on experience. The change in dimensions 1-3 was in general significantly higher comparing to dimensions 4-6.

The ex-poachers opinions, values, and attitudes were at the beginning very influenced by local rumors and beliefs. The poorest change was in dimension 4 (Values), as the ex-poachers stated

during the interviews, it is for them difficult to value nature on different levels as well, since nature/marine ecosystem is for their the main source of income and they do not have possibility to value nature for aesthetic reasons, for example. On the other hand, they agree that a punishment should be present in case a person is causing an environmental damage or threatening a protected species.

In dimension 5 (opinions and attitudes) there was the highest total change, the opinions and the attitudes of the ex-poachers were changed in positive way. The ex-poachers stated that these changes were mainly due to interviews and discussions which they consider as important part of the educational program.

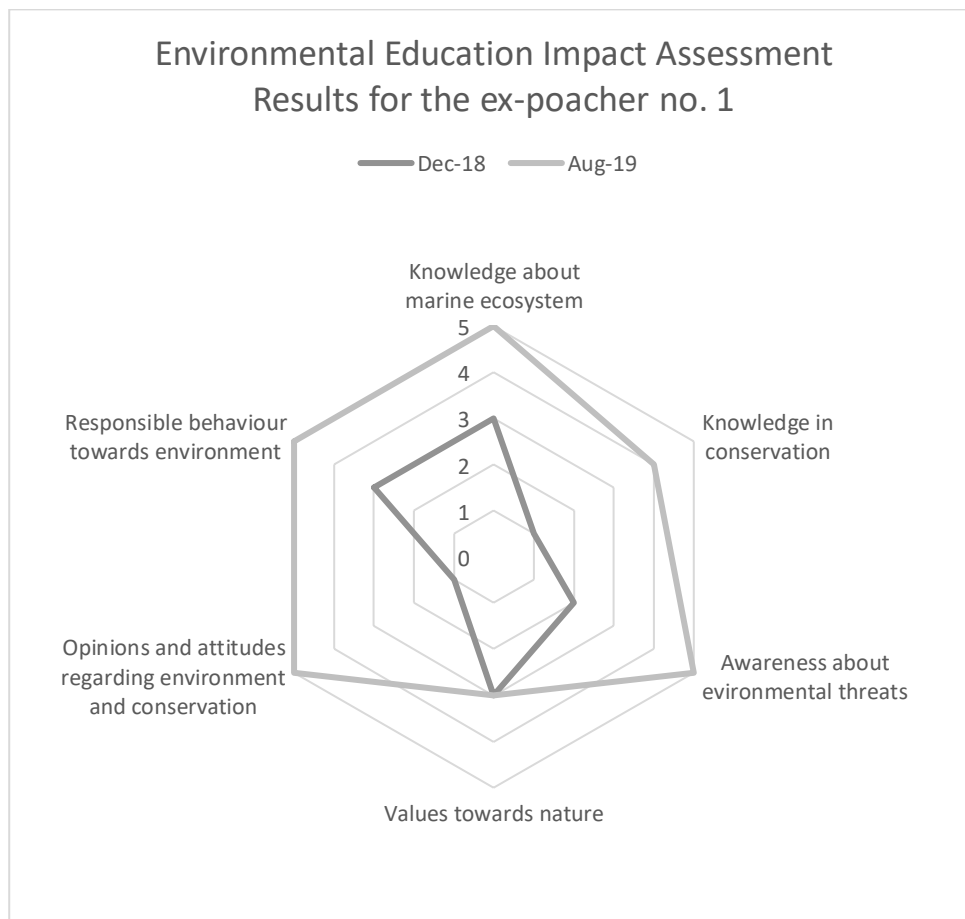The further assesment on invididual basis is provided below.

Figure 9: Spider graph for environmental education impact assessment in the ex-poacher no. 1, expressed as total score from each dimension before and after education (created by author, 2019)

The ex-poacher no. 1 had better results from the test at the beginning of the project as well as at the end of the project comparing to the other two ex-poachers. The author observed in him also the highest interest towards environment and conservation and high willingness to take conservation actions. During the lectures at schools, he was the most active. Better results in the ex-poacher no. 1 can be explained by the fact that he was youngest and it is more easier to achieve

changes among younger people. Furthermore, poaching has never been for him main source of income nor he did it for a long time.
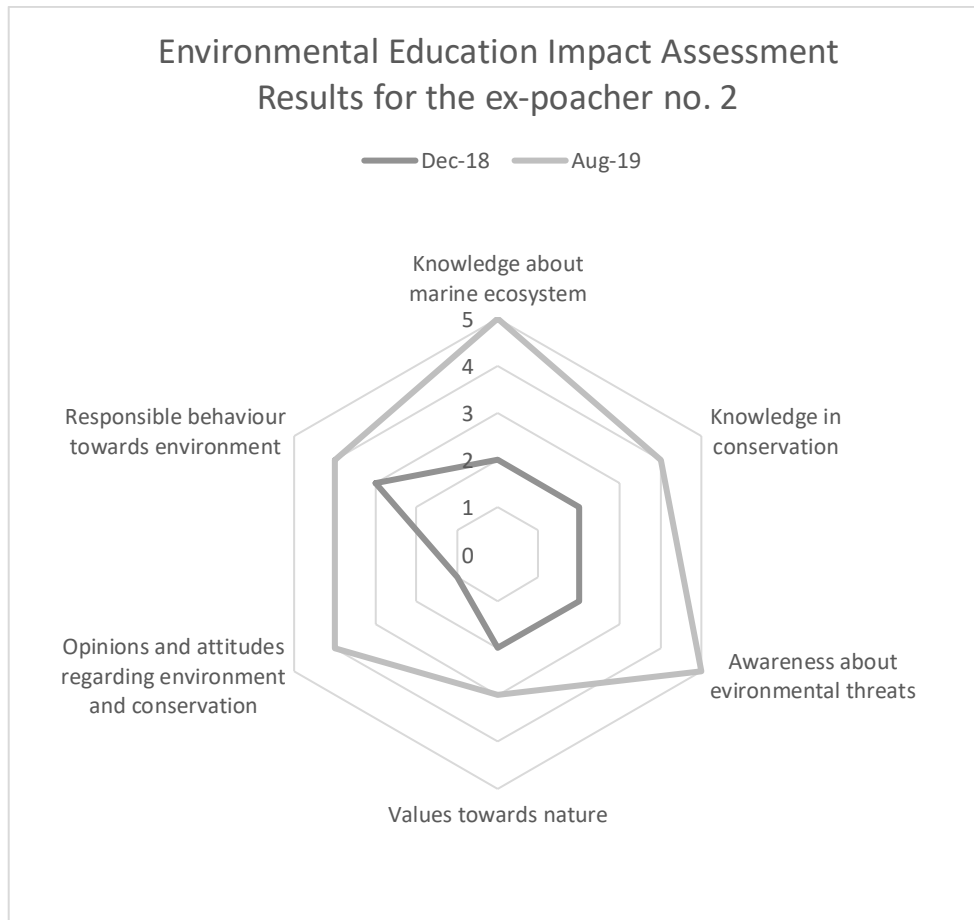

Figure 10: Spider graph for environmental education impact assessment in the ex-poacher no. 2, expressed as total score from each dimension before and after education (created by author, 2019)

The ex-poacher no. 2 also achieved considerable changes thank to the educational program. During interviews and discussions he was interested especially in coral restoration and rehabilitation of coral reefs. He was also asking a lot how the fishermen can improve their behaviour and introduce more responsible behaviours into their daily practices without loosing their income. He behaved very responsibly to his role of educator and together with ex-poacher no. 1 they expressed willingness to cooperate within other programs of Liberec Zoo.
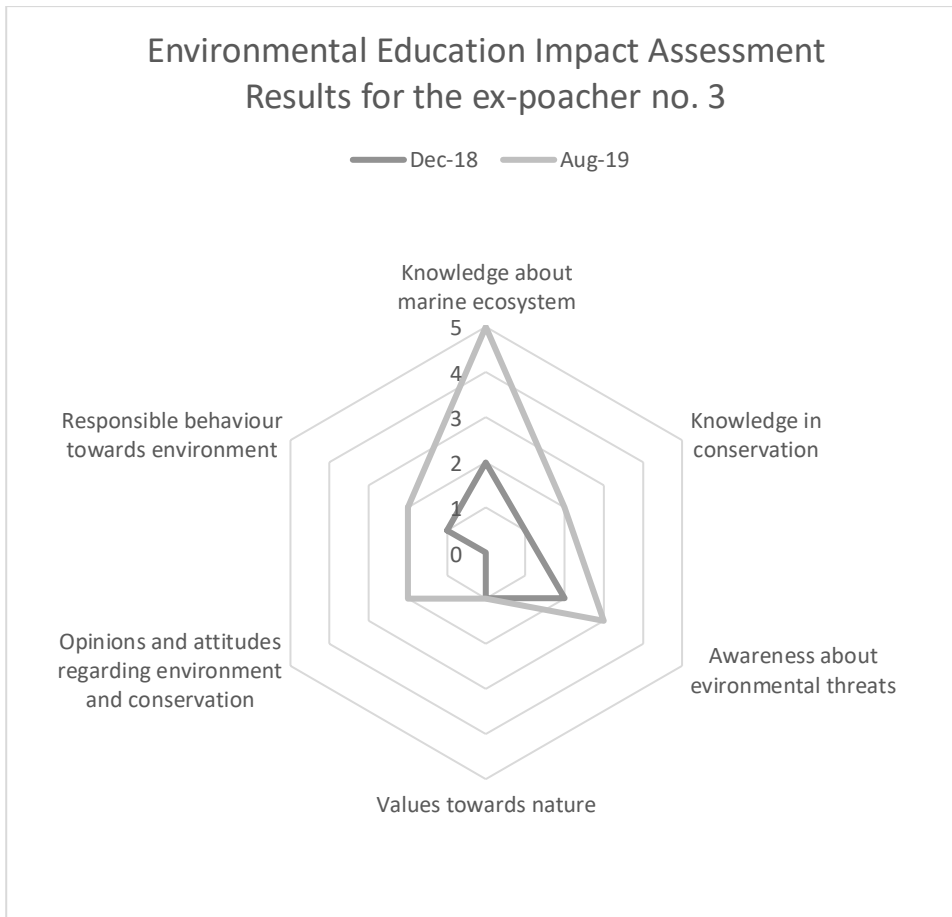
Figure 11: Spider graph for environmental education impact assessment in the ex-poacher no. 3, expressed as total score from each dimension before and after education (created by author, 2019)

The results in the case of the ex-poacher no. 3 are the poorest. However, he gained a good level of knowledge in the marine ecosystem, changes in other dimensions are only minor. During lectures at schools he was less active, on the other hand, he was more willing to talk with children at schools during the discussions. Also, he has high 'experience-based' knowledge especially about sea turtles. This knowledge he gained due to his long 'poaching history' since collecting of turtle eggs was his source of income for many years. Worse results in other dimensions might be explained by the fact that he was the oldest from the three ex-poachers. To achieve changes in ways of thinking among old people, the longer time is needed.

He was often tired from lectures at schools, he admitted that lectures at schools are exhausting for him. For the last month of the educational project, his son took over the role of environmental educator instead of his father due to deteriorating health. Although, the ex-poacher no. 3 quit the project sooner, he evaluated the project well and as beneficial for him. Concerning his health and age, he stated in August 2019 that the his is not willing to be further involved in conservation activities.

7.DISCUSSION

In both the questionnaire survey and environmental education impact assessment (tests and interviews) the knowledge, values, opinions, attitudes, and behaviors were investigated among the participants.

In the questionnaire survey as well as in tests, in general, there was a higher success rate in the knowledge that can be gained by experience or observation than in 'scientific' questions.

Differences among sexes were in most cases minor. The significant difference between sexes was in the question that investigated coral catch fish. 45.3 % of boys, who participated in the survey, have a friend who can catch coral fish (which are often traded for live fish aquarium trade) comparing to 35 % of girls. This might be explained by the fact that the sexes spend time separately in the researched area. The girls spend their leisure time with other girls and women while boys spend their leisure time with other boys and men. Separation of sexes is being preferred in Muslim societies. Also, boys have better knowledge regarding how long a coral grows (38.1 % boys comparing to 25.8 % of girls). In several cases, the girls seemed to have better knowledge in 'scientific' questions (How do we classify turtles, How many from 1 000 hatchlings reach maturity).

On the other hand, there were visible changes within age groups. The age group 9-12 showed poorer results than the older respondents. Older respondents also seem to less believe in local rumors and beliefs such as 'consumption of turtle eggs is healthy' (15.3 % respondents from 16+ category stated that consumption of turtle eggs is healthy compared to 59.3 % from 9-12 category). Based on the author's observation especially the older generation (parents) believe, turtle eggs help to maintain health and strengthen vitality. Small children are probably more influenced by the opinion of their parents while older children (teenagers) already tend to create their opinions and attitudes.

Interesting are also differences among the researched villages. Ujung Sialit and Suka Makmur are the most remote villages in the area with only limited electricity, signal, and transport. The respondents from these villages had worse results. 62.5 % of respondents from Ujung Sialit and 84.6 % from Suka Makmur stated that they have ever eaten turtle eggs or meat. Also, 72.5 respondents from Ujung Sialit have a friend who can catch coral fish. In contrast, knowledge was, in general, better in Gunung Sitoli and Singkil (city and town, respectively), where is better schooling quality. Good knowledge was also among participants from Haloban village. The author proposes a hypothesis that better knowledge is thanks to an NGO hAKA, which recruits men from Haloban village as rangers to guard nesting beaches on Bangkaru island. Rangers might have spread their knowledge about sea turtles within their community.

The author also observed differences in knowledge, opinions, attitudes, values, and behaviors among respondents from different family backgrounds. For this comparison, the author compared answers of respondents from fisher families (the respondent's father is fishermen) that are in general poor with respondents from families where the respondent's father work in an office (government). More respondents from fisher families have ever eaten turtle eggs or products, on the other hand, they consider its production in fewer cases as beneficial to their health. The author proposes that in fisher families, turtle products are more perceived as a natural part of the diet (as an alternative to hen eggs) while in the rich families the turtle eggs are considered to be a delicacy. Furthermore, within archipelago Pulau Banyak there is fishing as the main source of income while in Nias (Gunung Sitoli, Gunung Sitoli Utara), there is higher income diversification. Since in Nias the living standards are higher, it strengthens the hypothesis of turtle eggs to be delicacy within rich families. Consumption of turtle eggs is often considered to be a status symbol in the cities (Hemelíková, 2019).

Furthermore, children from fisher families have more often friends who can catch coral fish comparing to office/government category (56 % and 22 %, respectively). Also, children from fisher families are probably more benevolent towards wildlife crimes (destructive fishing practices and turtle poaching). Fishermen's children stated more often the punishment of these practices as too strict or strict. However, the perception of punishment was high in general within all categories (age, sex, village).

All respondents perceive coral reefs to be important and they give it the high values, on the other hand, according to the author's observation, the local communities often struggle with sustainable management of marine resources. The situation is similar throughout Indonesia, marine resources are often overexploited.

A big environmental problem within the area as well as in Indonesia is plastic pollution. The findings of the survey support that families deal with garbage in most cases by burning it or throwing it to the sea. Respondents were also less willing to admit that they litter. Only less than 9 % of respondents admit that they throw garbage regularly, however, the observation proved that people from local communities throw garbage very often (Hemelíková, 2019). The survey also reveals that there is low awareness about the consequences of plastic pollution in the sea (expressed by 'sea animals can eat plastics'). Only 19 % of respondents think that sea animals can accidentally eat plastics.

Regarding environmental education impact assessment among the three ex-poachers, they had a better knowledge of things that can be gained by experience and observation from the environment. These questions had a better success rate in the questionnaire survey as well.

Changes in knowledge, behaviors, values, opinions, and attitudes were positive among the ex-poachers. Especially the results from dimensions 1-3 that were investigating knowledge were highly increased, significant positive changes were also among the ex-poachers' opinions and attitudes. Minor positive change was in values, the ex-poachers stated that the main value of nature is for them from its economic value and aesthetic or recreational values of nature are for them rather minimal. The ex-poacher no. 1 achieved the most significant positive change. The poorer impact was in the case of the ex-poacher no. 3, who was the oldest. Except for positive changes that were measured by tests and are presented above, the author would like to emphasize that they were also other changes that are more difficult to measure.

During the educational program, the ex-poachers became more interested in environment and conservation and they actively asked questions and were open to discussion during the interviews which the author conducted with them. The ex-poachers also stated that their involvement in the educational program improved their status in the village. The local community evaluated positively their roles of environmental educators. The results of environmental education impact assessment furthermore support a theory that it is easier to change knowledge and opinions among younger people than in the old people.

The biggest limit of the research is according to the author that she did not manage to conduct the environmental education impact assessment in a higher number of respondents as was planned at the initial phase of the research. This was caused by the inability to achieve regularity in visits to local schools due to weather conditions and holidays. Also, the author assumes that responses in the question regarding pollution ('I throw away a plastic bag after eating my snack.') were not honest and answered according to reality.

As a strong point of the research, the author considers the complexity of both questionnaires and tests since they were based on the previous stay of the author in the area and consultations with local key informants and representatives of Liberec Zoo. Also, the project, as well as the research, were positively perceived by the local community.

CONCLUSION

This thesis focused on marine conservation by providing a case study from Sumatra, Indonesia. It aimed at community outreach, education of local people in conservation and environment, and involvement of local people into conservation activities.

The thesis answers these research questions:

1) How important is community outreach in conservation activities in the researched area?
   a) What are the main conservation threats in the area?
   b) Are the local people aware of the environmental threats and do they understand the functioning and the importance of the marine ecosystem?
   c) What change in knowledge, opinions, attitudes, values, and behaviors was observed in the three ex-poachers during the experiment?

Environmental and conservation threats in the researched area are similar to the other areas in Indonesia and Southeast Asia. The threats were investigated by the author's observation and interviews with key respondents. One of the most severe threats for the islands' communities is loss in coral reefs since they are heavily dependent on the marine ecosystem for their living. Many of these threats are caused by human activities and thus can be decreased. Such activities are destructive fishing methods, turtle poaching, pollution, and anchor damage.

The questionnaire survey was conducted at 18 schools. Questionnaires measured knowledge, attitudes, opinions, values, and behaviors of local children towards the marine ecosystem and conservation. The three areas were investigated – sea turtles, coral reefs, plastic pollution. The survey revealed lower knowledge, attitudes, opinions, values, and behaviors of respondents. The situation is the most severe in remote villages and slightly better in cities. Also, the differences between age groups and family backgrounds have been found. The respondents understand how the marine ecosystem is important for them, however, they are not aware of the threats and they might often be the cause of these threats. Also, regarding the functioning of the marine ecosystem, the respondents more understand the processes that are easily observable from the environment or can be gained by experience. 'Scientific' knowledge is deficient, and the respondents were often not able to connect the consequences of certain behaviors.

The author involved in conservation actions the three ex-poachers of turtle eggs. The change in their knowledge, opinions, attitudes, values, and behaviors was observed by using environmental education impact assessment that was constructed by the author. The most significant change was in knowledge, the lower change was within values of nature.

The changes in the three ex-poachers are positive, on the other hand, the author proposes that they should be tested again in the future to prove that achieved changes are long-term.

The environmental education impact assessment is also applicable in case that the more respondents are involved in testing since it is using 'yes' and 'no' codes. The assessment thus provides a good basis for measurement with the high number of respondents from a similar environment.

From the results of the questionnaire surveys and tests, and based on identified threats in the area, the further community outreach, education, and involvement of local people in educational activities are very important for both biodiversity and local communities.

The findings of this thesis were already presented to the representatives of Zoo Liberec. The results of the research, as well as the author's recommendations and 'lessons learned' from the project, will be used to improve implementation of the other project in Pulau Banyak and the Philippines and for planning and project design for a new project, which focuses on anti-tortoise shell campaign.

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