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厦门大学

硕士学位论文

印度尼西亚观赏珊瑚贸易的管理研究：以巴厘省近 7 年管理为例

Managing Ornamental Coral Trade in Indonesia: A Case Study in Bali Province during the Last Seven Years

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Abbreviation

AKKII	:	*Asosiasi Koral Kerang dan Ikan Hias Indonesia* (the Indonesia Coral, Shell and Ornamental Fish Association)
ASEAN-WEN	:	the Association of Southeast Asian Nations - Wildlife Enforcement Network
BAP	:	An official report of inspection or examination
Bea Cukai	:	*Direktorat Jenderal Bea dan Cukai* (Directorate General of Customs and Excise)
BKSDA Bali	:	*Balai Konservasi Sumber Daya Alam Bali* (Conservation and Natural Resources Agency of Bali Province)
CBD	:	Convention on Biological Diversity
CI	:	Conservation International
CITES	:	Convention on International Trade in Endangered Species of Wild Fauna and Flora
COO	:	A Certificate of Origin (CO), an official certification of goods traded
CoP	:	Conference of the Parties
COREMAP	:	The Coral Reef Rehabilitation and Management Program in Indonesia
Ditjen Daglu	:	*Direktorat Jenderal Perdagangan Luar Negeri* (Directorate General of Foreign Trade)
Ditjen KSDAE	:	*Direktorat Jenderal Konservasi Sumber Daya Alam dan Ekosistem* (Directorate General for Conservation of Natural Resources and Ecosystem)
Ditjen PHKA	:	*Direktorat Jenderal Perlindungan Hutan dan Konservasi Alam* (Directorate General for Forest Protection and Nature Conservation)
Ditpolair	:	*Direktorat Polisi Air Baharkam POLRI* (Directorate of Water Police)
FAO-CCRF	:	Food and Agriculture Organization of the United Nations - Code Of Conduct for Responsible Fisheries
FOB	:	Free-on-board payment system
ICRWG	:	Indonesian Coral Reef Working Group
IUCN	:	International Union for Conservation of Nature
Kemendag	:	*Kementerian Perdagangan* (Ministry of Trade)

Kepmen	:	*Keputusan Menteri* (Ministerial Decree)
KKH	:	*Direktorat Konservasi Keanekaragaman Hayati* (Directorate of Conservation and Biodiversity)
LIT	:	Line Intercept Transect
LPS	:	Large Polyp Species
MoEF	:	Ministry of Environment and Forestry
MoMAF	:	Ministry of Marine Affairs and Fisheries
MoU	:	Memorandum of Understanding
MPA	:	Marine Protected Area
NDF	:	Non-Detriment Finding principle of CITES
NGO	:	Non-governmental organization
P2O-LIPI	:	*Pusat Penelitian Oseanografi – Lembaga Ilmu Pengetahuan Indonesia* (Research Center of Oceanography - The Indonesian Science Institution)
Perpres	:	*Peraturan Presiden* (Presidential Regulation)
POLRI	:	*Kepolisian Negara Republik Indonesia* (Indonesian National Police)
PP	:	*Peraturan Pemerintah* (Government Regulation)
PSDH	:	*Provisi Sumber Daya Hutan* (An administrative costs of natural resources utilization)
SATS-DN	:	*Surat Angkut Tumbuhan dan Satwa Liar – Dalam Negeri* (Domestic freight letter for plants and wildlife)
SATS-LN	:	*Surat Angkut Tumbuhan dan Satwa Liar – Luar Negeri* (International freight letter for plants and wildlife)
SITU	:	*Surat Izin Tempat Usaha* (Location permit for a business unit)
SIUP	:	*Surat Ijin Usaha Perdagangan* (Indonesian business permit)
SPS	:	Small Polyp Species
TAC	:	Total Allowable Catch
TNC	:	The Nature Conservancy
UNCLOS	:	The United Nations Convention on the Law of the Sea
UPT KSDA	:	*Unit Pelaksana Teknis - Konservasi Sumber Daya Alam* (The Technical Implementation Unit of Conservation and Natural Resources Agency)
WCS	:	Wildlife Conservation Society

WTO	:	World Trade Organization
WWF	:	The World Wide Fund for Nature

摘 要

随着水族产业的需求不断增加，世界范围内观赏珊瑚贸易持续增长。印度尼西亚作为一个主要的出口国，在世界范围内出口珊瑚礁，除最大市场美国外还有其他 87 个进口国。珊瑚是《濒危野生动植物种国际贸易公约(CITES)》条款中提及的高度珍惜物品，因此在印度尼西亚的珊瑚贸易管理中，环境与森林部的自然资源和生态系统保护局 (KSDAE of MoEF) 和印度尼西亚科学研究所的海洋学研究中心 (P2O-LIPI)，分别受委托作为官方授权的管理和科研机构。在珊瑚出口之前，参与这项贸易的众多群体包括渔民、中间商、批发商，以及珊瑚公司。据 CITES 的报告，从 1985 年到 2014 年，共有 25,569,984 株珊瑚从印度尼西亚上市。同一时期，超过 49%（12719104 株）的珊瑚是出口到美国。随着贸易的持续发展，养殖珊瑚在过去十年里稳步增长。同样的结果在巴厘岛区域的出口贸易记录上也得到体现。巴厘自然资源保护中心 2016 年的报告显示，2010-2016 年期间，有 9,583,821 株观赏珊瑚由巴厘岛的珊瑚公司进行出口交易，其中大部分是养殖珊瑚，年增长率为 19.06%。这几乎占了印度尼西亚出口总额的 60%，这些贸易都是由 25 个珊瑚公司开展的。现有的管理措施，如配额、许可证制度和禁捕区域的空间管理已付诸实施，尽管仍需要各种改进。因此，在决策过程中需要更全面的研究和科学数据，制定适应的管理策略，从而确保可持续的珊瑚贸易。

关键词：巴厘，濒危野生动植物种国际贸易公约，珊瑚礁管理，珊瑚贸易，观赏性珊瑚

Abstract

The world ornamental coral trade continues to grow as the result of increasing demand for aquarium industries. Indonesia as a major exporter has distributed corals worldwide with the USA as the biggest market, followed by 87 other importing countries. Ditjen KSDAE (Directorate General for Conservation of Natural Resources and Ecosystem) of MoEF (Ministry of Environment and Forestry) and P2O-LIPI (Research Center of Oceanography - The Indonesian Science Institution) was mandated as a management and scientific authority, respectively, in this curio trade management in Indonesia which is highly referred to CITES provisions. The trade entangles numbers of fishermen, middlemen, wholesalers, and coral companies in advance of exportation. As reported by CITES, a total of 25,569,984 corals were traded from Indonesia in 1985 until 2014. More than 49% (12,719,104 pieces) of all corals were exported to the USA in the same period. As the trade directed to be more sustainable, cultured corals grew steadily during the last decade. BKSDA Bali (Conservation and Natural Resources Agency of Bali Province) also reported similar results in regional coral exportation from Bali. There were 9,583,821 pieces of ornamental corals, mostly were cultured corals, traded by coral companies based in Bali during 2010 – 2016, with annual growth rate of 19.06%. It constituted almost 60% of total Indonesia exportation and was carried out by 25 coral companies. Existing management measures e.g. quotas, licensing system, and spatial management through no-take zones have been put into effects despite still requires various improvements. More comprehensive studies and scientific data are therefore essential in decision making process to set out adaptive management strategies and thus ensuring sustainable coral trade.

Key words: Bali, CITES, Coral reef management, Coral trade, Ornamental coral

Chapter 1 Introduction

1.1 Research Background

Coral reefs are one of marine ecosystems and the greatest achievements of nature in ocean. Coral reef ecosystem is constructed and placed by diverse marine organisms (Veron, 1995). Coral reefs which are widespread in the bottom of the sea provide many benefits to the wider community. Approximately 500 million people depend on coral reefs for food, coastal protection, building materials, and income from tourism. This includes 30 million who are virtually totally dependent on coral reefs for their livelihoods or for the land they live on (Wilkinson, 2008). This ecosystem is marine life that valued by mankind whatever nationality and needs to be protected from all threats. Although not everyone had seen coral reefs, the beauty and the wonder of coral reefs continue to attract the attention of many people, was covered by various mass media, became the object of visual art, was written in numerous publications, and became lecture module in various strata of education (Reid et al., 2009).

Indonesia as the archipelago country which is settled in the world coral triangle area has abundant coral reef resources which are totally potential for the state development. Broadly speaking, it was estimated that total economic value of Indonesian marine resources from marine sectors coming out at US$ 1.2 trillion per year, greater than Gross Domestic Product (GDP) Indonesia which is only US$ 1 trillion (ANTARA News, 2014). Of which, coral reefs are definitely play its significant role adding those value, particularly for its marvelous beauty which is traded from ocean to aquarium.

It has also been acknowledged that the world ornamental coral trade has the potential to cause overharvesting, introduction of exotic species as an alien, and others collateral damage to coral reef habitat through direct collection (Smith et al., 2008; Jones et al., 2009; Rhyne et al., 2009). These are certainly imperative issues for Indonesia as the biggest ornamental coral exporters and already traded them for many years (Wabnitz et al., 2003). However, according to the aquarium hobbies the trade itself is still less effects comparing to other anthropogenic stressors including global climate change (Carpenter et al. 2008); unsustainable global market demand of coral reef biota such as shark fin, Napoleon wrasse, and traditional medicine; and the

perpetual development of coastal areas and aquatic resources. Rhyne et al. (2009) stated that these non-aquarium related threats are likely to be far more severe and pervasive than the direct damage done by aquarium collectors, though comparative data are lacking.

Since the global coral reef threats are still remaining, the International Union for Conservation of Nature (IUCN) put in them amongst protected fauna and categorized in Appendix II CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora). Its trading should be well-monitored to prevent any possibilities of overexploitation which can bring corals to be extinct as CITES mandate. Nowadays, the use of Indonesian ornamental coral is under supervised by Ministry of Environment and Forestry (MoEF) *casu quo* Directorate General for Conservation of Natural Resources and Ecosystem (*Direktorat Jenderal Konservasi Sumber Daya Alam dan Ekosistem* / *Ditjen KSDAE*) (Kudus, 2005).

Increased ornamental coral trading is the result of growing demand for aquarium industries, mostly come from United States and European countries. In line with that, increased frequency of trade services also took place between market countries and exporter countries, such as: Indonesia and the Philippines which represent about 85% of the global trade volume (Rhyne et al., 2012). In the other hand, aquarium technology has well developed since 1990 thus causing more people eager to make and has a seawater aquarium in their home. The number and the production scale of coral exporters are also growing. There are more than 45 enterprises according to the Indonesia Coral, Shell and Ornamental Fish Association (*Asosiasi Koral Kerang dan Ikan Hias Indonesia / AKKII*) in 2015.

In some extent, aquarium hobbyists as the main customers of this industry shift their display preference from fish-only tanks to miniature reef ecosystems that include many invertebrate species. Those miniature reef tanks are scale models of wild reefs where the dominant biomass includes reef-building corals assembled around a framework of ‘‘live rock’’. Only for ornamental fish, Indonesia along with more than 45 countries have supplied an estimated 30 million reef fishes annually in a global trade that includes over 1400 species. Meanwhile, over 1.5 million live corals and 1.5 million kg of live rock were traded in 2005. This demand for coral has led to an explosion in the live coral trade with annual increases of 10–50% since 1987. The high value of this trade, estimated globally at $USD 200–330 million annually, is one factor fueling growth of this industry, but the growth continues without full consideration of the

impacts to coral reefs (Rhyne et al., 2009). Recently, those numbers are likely greater considering the addition of cultured corals.

This rapidly changing state of the marine aquarium trade creates myriad management challenges relevant to the trade of ornamental coral. Several government institutions in Indonesia have been working on their legal responsibility related to coral reef governance, including ornamental coral trade (Adrianto, 2013). They regulated and managed all activities regarding coral reef utilization. It is highly needed since Indonesia settled in the Coral Triangle region which has great impoverishment and high population density and at the same time, extremely abundant biodiversity (Rhyne et al., 2014). Their duties took part as the most crucial aspect in the process of policy development to create effective institutional arrangements that ensure sustainable coral reef ecosystem (Wang et al., 2014). Otherwise, a great amount of coral reefs may be only as fairy tale to future generations due to continuous degradation over it.

1.2 Statement of The Problem

Corals are an important biota in the marine environment. These animals grow relatively slowly but has high survival rate so that they can reach a large size and form reefs (hermatypic corals). Corals can act as providers of niches and habitats for fish and other marine organisms. Therefore, taking this creatures excessively can cause a decrease in the abundance and diversity of marine organisms.

The controversy between those who oppose and those who support the permissibility of ornamental coral trade continues both domestically and abroad. In the case of Indonesia's coral trade, the opposing party adhering to Research Center of Oceanography-The Indonesian Science Institution (*Pusat Penelitian Oseanografi – Lembaga Ilmu Pengetahuan Indonesia / P2O-LIPI*) report that the condition of coral reefs in Indonesia are very apprehensive and coral species which are highly traded to be rarely found in nature. Meanwhile, coral enterprises as part of the pro-parties stated that, according to their experience, in the export business of ornamental coral has not been getting difficulty in obtaining coral stock to be traded. They believe that the ornamental coral stock in nature is still abundant.

Based on the above, there is a contradiction between utilization and conservation efforts mainly on ornamental coral species that has high economic value. On the other hand, the coral trade activity has absorbed a lot of employee. It is estimated that the

number of workers in this field reached 8,420 persons (AKKII, 2001). Therefore, a good management is really needed to bridge the conservation efforts and coral trade activity which continues to run today.

1.3 Research Significance

Ornamental coral is just like a coin which has two sides. It need to be protected to ensure its existence and services while it also highly aesthetic economic commodity. This research will reveal how the ornamental coral trade rate in Indonesia, particularly in Bali, tend to be by assessing its last seven years data. It will become new information that can help to set up a new innovative way of coral trade management.

1.4 Research Objectives

Based on the available background information aforementioned, it is very important to do assessment related to ornamental coral trade in Indonesia. Those facts triggered this study to set the following objectives:

- To analyze the existing legal basis and institutional arrangements for coral trade management in Indonesia as well as their efficacy and adequacy on it
- To assess the coral trade in Bali during the last seven years (2010 – 2016)
- To analyze the existing management of coral trade in Indonesia
- To analyze what is being done to fulfill the coral trade stock as a conservation efforts

1.5 Research Outline

This thesis is organized into five chapters. The first chapter emphasized on the background of the study associated with the issues and problems of ornamental coral trade in Indonesia. Explanation about the study area and research methods is presented in Chapter Two. Chapter Three will elaborate authorized institutions related to coral trade in Indonesia. It first briefly describes Indonesian coral reefs and ornamental coral trade in Indonesia. The next discussion introduces existing institutions who put in charge in ornamental coral trade in Indonesia. The discussion on legal basis of coral governance is also presented, giving information about steps taken by the government, the industry, and local community to ensure the marine ornamental trade develops

sustainably. Chapter Four is a case study of the implementation of ornamental coral trade in Bali. It will elaborate how those beautiful commodity were gathered from ocean until they are traded in the global aquarium market. The discussion about the last seven years coral trade in Bali according to exportation data from Conservation and Natural Resources Agency of Bali Province (*Balai Konservasi Sumber Daya Alam Bali / BKSDA Bali*) and what did coral exporters experience are also set out in this chapter. This chapter will further examine the current management of this curio trade in Indonesia. Potential problems and conservation efforts will also be discussed. The last chapter will conclude with a summary and recommendations (see Fig. 1-1).

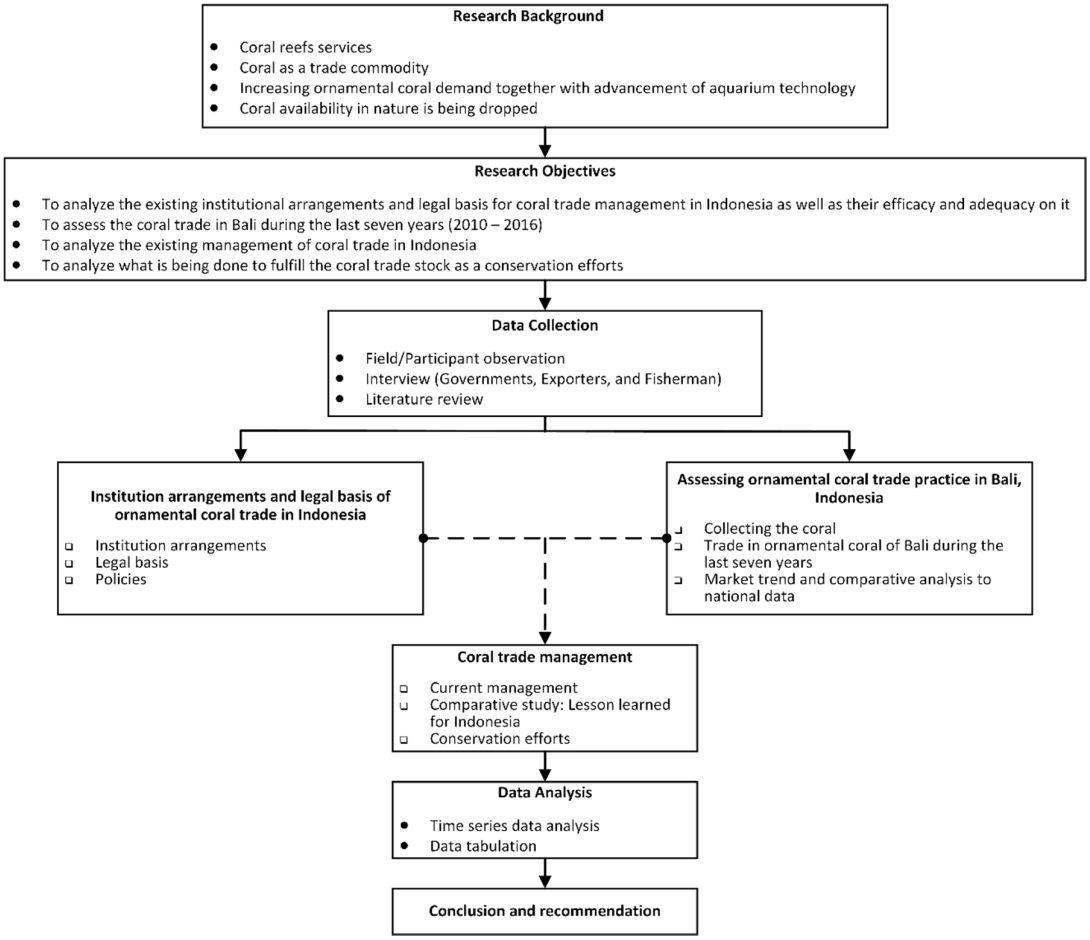

Fig. 1-1 Summarized research framework

Chapter 2 Research Methods

2.1 Introduction

Research method encompasses the methods and rules abridging the collection and analysis of data (Lofland et al., 2005). This chapter provides an overview of the study area and research methods used to conduct the research. Methodological tools used to collect data for this research include document or literature review and interviews.

2.2 Study Area

The study was conducted in Bali, which is an island and province of Indonesia. The province (8°3'40"-8°50'48"S and 114°25'53"-115°42'40"E) includes the island of Bali and a few smaller neighboring islands namely Nusa Penida, Nusa Lembongan, Nusa Ceningan, Serangan, and Menjangan. With a population of 4,165,115 people and approximately 5,781 km^2 of total area, Bali is home to most of Indonesia's Hindu minority. The province is divided into nine administrative regions comprised of eight regencies / *Kabupaten* (Jembrana, Tabanan, Badung, Gianyar, Klungkung, Bangli, Karangasem, and Buleleng) and one city / *Kota* (Denpasar) (Ministry of Internal Affairs, 2016; Provincial Government of Bali, 2016).

Geographically, Bali and its neighboring islands are located on the southern edge of the Coral Triangle, renowned for its globally outstanding marine biodiversity (Hutomo and Moosa, 2005). Formerly, the marine fauna of Bali was not well known. Yet, it is now a host of a diverse reef coral fauna, with a confirmed total of 406 reef-building (hermatypic) coral species. The number contributed 68,81% out of all coral species found in Indonesia totaling around 590 species from 80 coral genera. This is mainly caused by local–regional factors in oceanography, especially upwelling and ocean swell. Another key factor is suitability of habitat and substratum. Coastlines of Bali and adjacent islands have been formed predominantly by limestone, indicating earlier periods of reef growth and deposition. (Hoeksema and Putra, 2000; Suharsono, 2008; Turak and DeVantier, 2012).

Presently, the coastal areas of Bali are a place for various marine activities across different communities. Frey (2012) identified those activities are important economic

sectors including fishing and collection (for both ornamental and food species); aquaculture (shrimp, fish, seaweed, pearls); salt production; boat building and repair; and tourism. Tourism revenues are commonly received by hotels, 'homestays' (*losmen*), and restaurants; dive operators and other providers of ecotourism; and personal charters and guides.

In the context of ornamental marine species trade, the coastal waters of Bali has now been a favorite coral farming location. Dozens of companies set up their farm here. These coral farms scattered along the northern and southern part of Bali Island, such as Gilimanuk, Sumberkima, Gondol, Patas, Sambirenteng, Tembok, and Candidasa. There are also three sites outside the island which are located in Serangan Island, Nusa Lembongan (Desa Julut Batu), and Nusa Penida (Desa Ped). According to BKSDA Bali, the most favorite location is Serangan Island which is occupied by 21 companies in early 2017 (see Fig. 2-1).

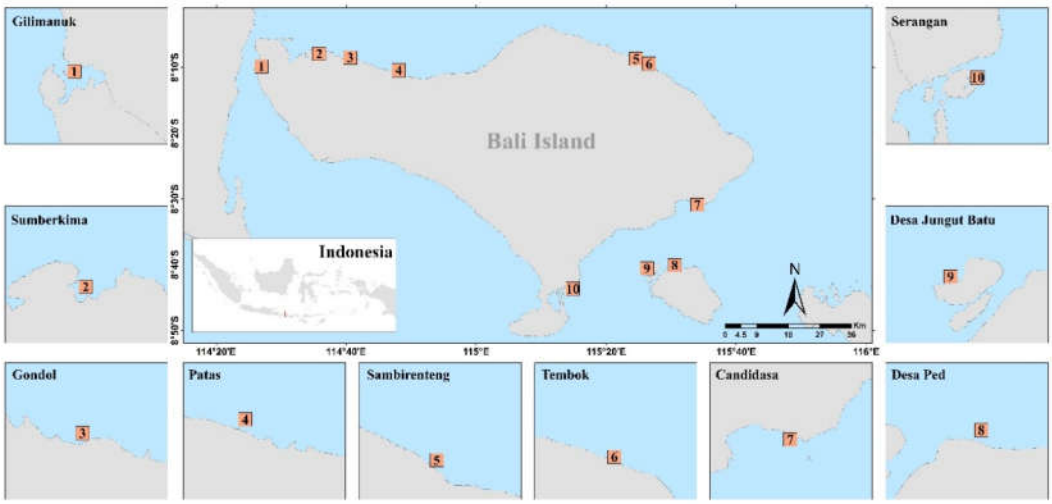

Fig. 2-1 Coral farming locations in Bali

The coral farms in Bali are officially developed by 24 companies of which 21 of them located their farm in Serangan Island. This place has a strategic location as it is close to company office and international airport of Ngurah Rai, Bali where the coral will be shipped away. The other preferred place is Gilimanuk placed by four companies. Meanwhile, the rest eight places are only settled by one or two companies.

The primary site for this research was Denpasar administrative area. It was selected based on BKSDA Bali data which pointed out that almost 90% of total coral exporters located their business in Denpasar. The BKSDA Bali office as regional management authority is also placed in here. Data collection was conducted here in the

form of interviews, field participant observations, and relevant documents from the coral companies or government official record on coral exportation.

2.3 Research Methods

An overview of the data collection procedures used to conduct this research is presented here. The study was carried out by means of three ways, including:

- Field observation, was recorded using field notes and photography as well as participated in coral farming activities.
- Interviews, was conducted against the fishermen, government official, and coral companies employee.
- Literature search, reviewed archival material e.g. ornamental coral trade data on CITES Database.

2.3.1 Field observation

The activity observed during fieldwork were coral farming, coral handling in shelter pond, and packaging before shipment. Coral farming was observed in Serangan Island waters. Observation started from making artificial substrate, planting, maintenance and harvesting ornamental coral. Henceforth, harvested corals are placed in shelter pond for acclimatization prior to packaging. It usually takes around 6-24 hours. This observation was conducted in coral farm and production warehouse of a coral company in Denpasar, Bali.

2.3.2 Interviews

Interviews are a way to get in-depth and comprehensive information. This study applied an informal interview that provide several questions in response to coral trade issues to be asked with some flexibility (Berg, 2004; 2009). It is an approach to reveal new insights by being grounded in the lived realities of coral traders, businessmen, government official, and coral trade practitioners (e.g. fishermen, scholars, and NGOs) through the collective translation of experiences or beliefs into research results (Wridt, 2008). The flexibility allowed the interviewer to improve from the set questions where the responses provided additional information (Neuman, 2014).

Informal or unstructured interviews were used to analyze the views, actions and interactions of different interested groups. It is one of the best approach to explaining

non-word based activities, human behaviors, and perceptions. Unstructured interviews, by nature, have less structure with a general topic used to start discussion. Interviews may be recorded by taking notes, audio recording, or video recording then transcribed and analyzed using qualitative analysis techniques (Kindon, 2001; Brooks et al., 2011).

Research interviews involved ten coral exporters in Bali through its director, manager, or employee; government employees; and coral farmers whose occasionally supplying ornamental corals to companies. Interview data was recorded using handwritten notes and audio recorder. These were later transcribed to a digital file on computer. The results blended together in the discussion of each related section. Furthermore, some 'gray literature' which is unavailable in the public domain were also obtained during the interviews, mostly are internal company documents. Meanwhile, electronic mail contact was also used during the study period to clarify and cross-check the details of collected data.

2.3.3 Literature review

A literature search involves reviewing all readily available materials. These materials included academic papers, annual reports regarding coral trade or coral reef status, coral exporter company information, and online newspapers. Several academic papers derived from sciencedirect.com; nature.com; researchgate.net; sciencemag.org; and online repository of Indonesian universities (Universitas Gadjah Mada, Bogor Agricultural University, Universitas Diponegoro, and Universitas Hasanuddin) have been reviewed to get the base framework of research. In order to filter the relevant papers, some keywords such as: 'coral trade', 'ornamental coral', 'Indonesian coral', '*perdagangan karang*' (coral trade), and '*karang hias*' (ornamental coral) have been used through those official websites. The last two keywords were being used only for Indonesian literatures.

The annual reports were obtained from BKSDA Bali and AKKII since all international trade in ornamental coral require recommendation, declaration, and permit from these two institutions. The BKSDA Bali data is provincial level data of all exported ornamental corals during last seven years (2010-2016). It encompasses coral species name, number and source of coral exported, and export report from each coral company.

Furthermore, the national data of coral trade is also used to determine proportion of the number coral traded from Bali. This data is collected from AKKII which is the

primary association of the Indonesia ornamental marine species. It contains data on annual coral export realization traded from Indonesia to several destination countries. Furthermore, the study also used data from the CITES trade database (UNEP World Conservation Monitoring Centre, Cambridge, UK) which is the primary source of data on international wildlife trade and contains data on imports, exports, and re-exports of CITES listed species to know the global market trend of ornamental corals traded from Indonesia.

All Indonesian trade in hard corals for the period 1985–2014 was extracted from both the CITES Trade Data Dashboards and Database on 24th January 2017. The CITES Trade Data Dashboards provides an interactive, dynamic way of viewing the trade data submitted by CITES Parties in their annual reports to the Convention. The National Dashboard was used in this study, which displaying trade data by country or region in 5 year periods. It provides a control panel to select what kind of data to be displayed, including trade volume over time, trade by source, top 10 importing/exporting countries, top 5 terms in trade, appendix listed traded, top 10 species in trade, top 10 families in trade, re-exports, and species occurrence.

Meanwhile, the CITES Trade Database represents trade reported by either the importing or exporting country and includes the details e.g. year, taxon, importer, exporter, origin, import and export quantity, term, purpose, and source. Data for all species of coral were downloaded in a comparative tabulation report. The data was then simplified in accordance with the objectives of research. The following table is filter selection used to obtain the data.

Table 2-1 Filter selection used for data collection in CITES trade database

Year range	From 1975 to 2014
Exporting countries	Indonesia
Importing countries	All countries
Source	(C) Captive-bred animals; (D) Captive-bred/artificially propagated (Appendix I); (F) Born in captivity (F1 and subsequent); (I) Confiscations/seizures; (R) Ranched; (W) Wild
Purpose	All purposes
Trade terms	(COR) raw corals; (LIV) live
Species	Helioporacea; Alcyonacea; Pennatulacea; Actiniaria; Zoanthidia; Corallimorpharia; Scleractinia; Rugosa; Tabulata; Antipatharia; Ceriantharia

The study used ‘all countries’ to determine destination countries. ‘Source’ means source of the specimen as reported by the exporting country. There were six types of sources in this study. According to (UNEP-WCMC, 2013), the definition of each source are below:

- (C) Animals bred in captivity in accordance with Resolution Conf. 10.16 (Rev.), as well as parts and derivatives thereof, exported under the provisions of Article VII, paragraph 5, of the Convention.
- (D) Appendix-I animals bred in captivity for commercial purposes in operations included in the Secretariat's Register, in accordance with Resolution Conf. 12.10 (Rev. CoP15), and Appendix-I plants artificially propagated for commercial purposes, as well as parts and derivatives thereof, exported under the provisions of Article VII, paragraph 4, of the Convention.
- (F) Animals born in captivity (F1 or subsequent generations) that do not fulfil the definition of 'bred in captivity' in Resolution Conf. 10.16 (Rev.), as well as parts and derivatives thereof.
- (I) Confiscated or seized specimens.
- (R) Ranched specimens: specimens of animals reared in a controlled environment, taken as eggs or juveniles from the wild, where they would otherwise have had a very low probability of surviving to adulthood.
- (W) Specimens taken from the wild.

All purposes were included in the analysis, although the vast majority of trade was reported as commercial (T). Later, the name of species submitted were coral orders based on Veron (2013) concerning corals classification. The term ‘coral’ itself is commonly used for both ‘soft’ and ‘hard’ corals and includes eleven coral orders. However, there were only three coral orders recorded by CITES data, namely: Helioporacea, Scleractinia, and Antipatharia.

Chapter 3 Institution arrangements and legal basis of ornamental coral trade in Indonesia

3.1 Introduction

This chapter analyzes authorized institutions related to coral trade in Indonesia. It first briefly describes Indonesian coral reefs and ornamental coral trade in Indonesia based on data of global marine aquarium trade. The next discussion introduces existing institutions who put in charge in ornamental coral trade in Indonesia. The discussion on legal basis of coral governance is also presented, giving information about steps taken by the government and international parties to ensure the marine ornamental trade develops in sustainable way. The relevant issues and problems associated with the institutional arrangements of coral trade are also analyzed in this chapter. A conclusion will be presented in the end to summarize this chapter.

3.2 Overview of Indonesian ornamental coral trade

Ornamental coral has been traded globally since the 1930s. The market demand growth slowly in the initial years but it has increased establishing a multi-million dollar industry since the 1980s (Wood et al., 2012; Hardin and LeGore, 2005). Millions of people kept corals both for private and public aquaria while developing technologies and improved understanding of coral biology likely spur on further growth (Rhyne and Tlusty, 2012; Wabnitz et al., 2003). The majority of ornamentals are obtained from coral reefs with about 45 countries around the globe. Most of them are tropical countries who have suitable waters environment for the survival and growth of corals. The principal suppliers are Indonesia and the Philippines which have been supplying about two-thirds of the market demand (Wood, 2001; Tlusty, 2002). The import market is dominated by the USA and still expanding globally (Murray et al., 2012).

The term ‘corals’ encompasses both stony corals, defined as ‘marine colonial polyps characterized by a calcareous skeleton that often form reefs’, soft corals, and sea fans. Overall, the global live coral trade are coming from seven most popular genera, including: Trachyphyllia, Euphyllia, Goniopora, Acropora, Plerogyra, and Catalaphyllia. They were composing for approximately 56% of the live coral trade

between 1988 and 2002. Sixty-one species of soft coral were also traded, amounting to close to 390,000 pieces per year. *Sarcophyton* spp. (leather/mushroom/toadstool coral) and *Dendronephthya* spp. were two of the most commonly traded soft coral species (Wabnitz et al., 2003). Meanwhile, CITES Secretariat in 2012 released a data that five most popular genera of coral traded during 1996-2012 were Acropora, Pocillopora, Fungia, Heliopora, and Trachyphyllia (Fig. 3-1).

Green and Shirley (1999) noted that many trade records identified taxa at levels higher than species, such as *Anthipatharia* spp. or *Scleractinia* spp. The majority only identified genus: overall a total of 119 recognized Scleractinian genera. Dead corals, mainly the skeletons of genera with predominantly branching growth forms (e.g. *Pocillopora* spp., *Porites* spp. and *Acropora* spp.), accounted for more than 90% of the trade up to the early 1990s, but since then there has been a large increase in the amount of live coral traded. *Euphyllia* spp., *Goniopora* spp., *Catalaphyllia* spp., *Trachyphyllia* spp. and *Heliofungia* spp. as an example of colorful species with large polyps dominate the live trade in contrast to the trade in dead coral.

Fig. 3-1 The most commonly traded genera of ornamental corals worldwide during 1988-2012. From left to right; top: Trachyphyllia, Fungia, Pocillopora, and Catalaphyllia; bottom: Goniopora, Plerogyra, Euphyllia, and Acropora (source: reefcorner.org)

Tomascik et al. (1997) stated that with 85,707 km^2 of total coral reef area, the amount of stony corals in Indonesia was recorded by 362 species. Acropora is the biggest genus which is consists of 62 species, then Montipora and Porites by 29 and 14 species respectively. These three genus of corals dominated live coral cover percentage in Indonesia and provide high biodiversity of marine wildlife (Suharsono, 2008a). Until

2015, according to AKKII's data, there were more than 87 coral species traded from Indonesia in the global aquarium market.

The CITES monitored trade in more than 2000 species of ornamental corals. Records for black corals (from 1982-1997) and stony corals (from 1985-1997) were analyzed in the first global assessment of the legal trade in coral: 70 nations imported a total of 19,262 ton (or 34,600,000 pieces) from 120 exporting nations over this period. The USA accounting for more than 56% by weight of the global trade, compared with 15% for the EU. In the meantime, the Philippines was a major exporter (19% by weight) but since the late 1980s it was superseded by Indonesia (Green and Shirley, 1999).

It is generally acknowledged that Indonesia is amongst the major exporter countries of ornamental coral. In the period of 1997-2001, around 71% of the world live coral trade derived from Indonesia (Wabnitz et al., 2003). All stock of ornamental corals were obtained from different sites of Indonesian waters. Most of them were collected from Celebes/Sulawesi Island, Maluku, West Nusa Tenggara, and East Nusa Tenggara. Those places are fit and suitable for coral growth. The water quality, seawater current pattern, and type of substrate for corals settlement are strongly support the coral growth. Of which, Sulawesi became marine biodiversity center and the origin place for the parents (F0) of cultivated corals (Kudus, 2005).

According to CITES data, the global live coral trade rose steadily from 1997 to 1999 with 934,463 live pieces and 1,142,242 live pieces being traded worldwide respectively in those years. The trade decreased to 942,661 pieces in 2001. Since the late 1980s, Indonesia became the largest coral exporting country (Green and Shirley, 1999). It was shown on the CITES data that direct exports of live wild-sourced coral from Indonesia represented 78% (729,703 pieces) of the global total for all coral species in 1997, 66% (640,190 pieces) in 2000, and 71% (669,192 pieces) in 2001 (Wabnitz et al., 2003).

The numbers of data presented were based on importers report because values based on exporters' information are an indicator of the number of permits issued rather than the actual quantity of corals exported for the aquarium trade. To illustrate the difference, in 2001 data from all importers showed a total of 669,192 pieces having been exported from Indonesia, whilst information provided by exporters indicate 1,442,413 pieces were exported from Indonesia (Fig. 3-2). Overall, Indonesia, Fiji, the Solomon Islands, and Tonga together supplying more than 95% of live coral exports from 1997 to 2001 (Wabnitz et al., 2003).

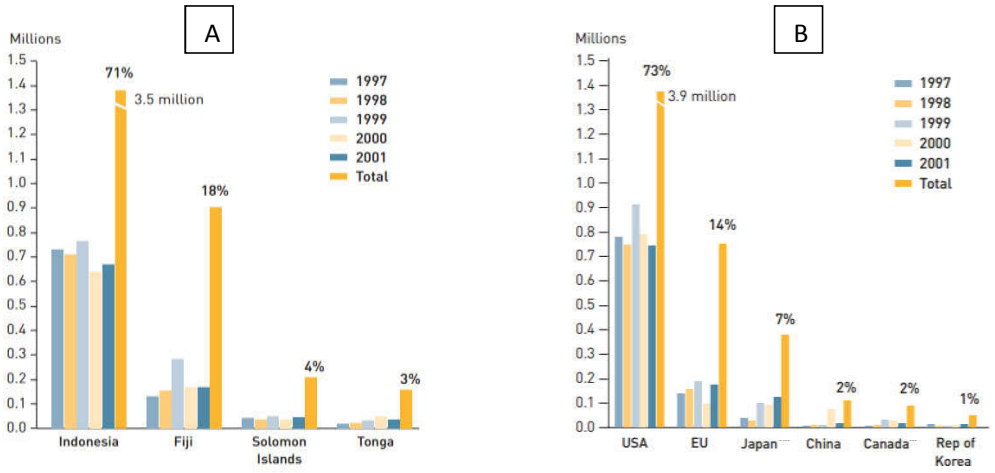

Fig. 3-2 Major exporters (A) and importers (B) of live and wild-sourced corals (pieces) in 1997 – 2001 (source: Wabnitz et al., 2003)

The updated data released by CITES also shows that coral traded by Indonesia from 1990 to 2012 growth positively though there were steep reduction in the number of coral exported in 1994 and 1997. During 22 years, Indonesia exported both live and raw corals to 88 countries. The highest amount was recorded in 2012 indicate 1,384,435 pieces being exported worldwide (Fig. 3-3).

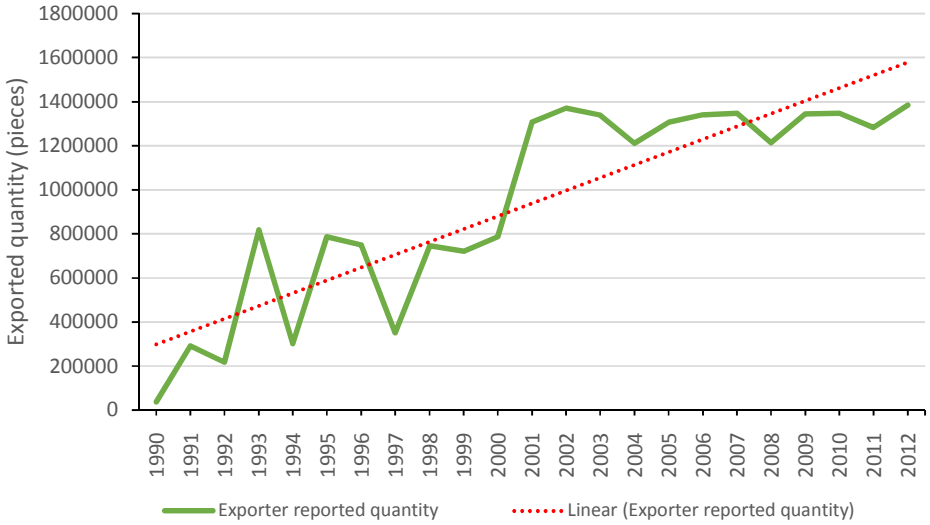

Fig. 3-3 Quantity of exported corals (pieces) from Indonesia in 1990-2012 (source: CITES trade database, 2017)

Furthermore, approximately 27.5 million kg of coral were exported during the period 1996-2010, with the vast majority (98%) harvested from the wild. Trade

recorded in pieces was converted to kilograms using conversion factors from Green and Shirley's (1999) research. Trade in corals increased from 1997 to 2004 and has remained fairly constant since 2005 (Fig. 3-4). The apparent decrease in 2009 and 2010 can be attributed to missing annual reports for these years from the second largest coral' exporter (Fiji) at the time of analysis (CITES Secretariat, 2012).

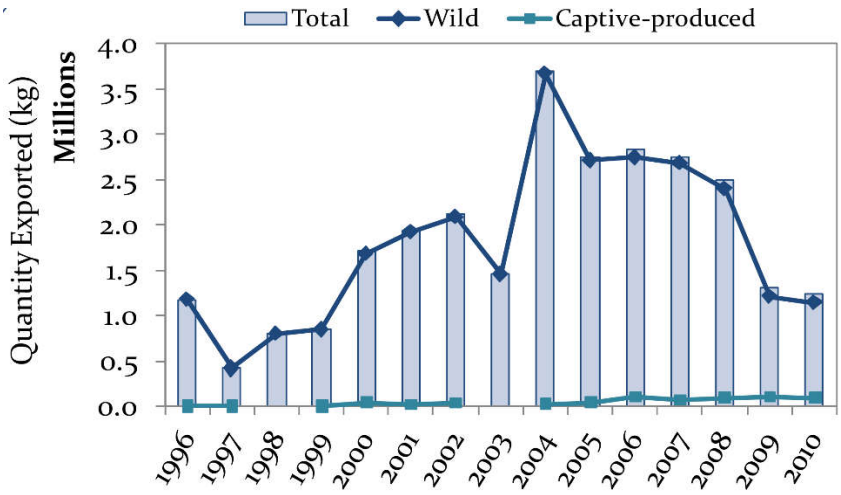

Fig. 3-4 Estimate of direct exports of live and raw corals (kg) during 1996-2010 (source: CITES Secretariat, 2012)

In the period of 1997-2001, CITES statistics show the major importers of stony corals to be the United States, Japan, Germany, France, China (including Hong Kong), Canada, Netherlands, and the United Kingdom, together importing more than 95% of the total number of live corals being traded worldwide. Taking the EU as one statistical entity, 73% of total live coral imports were accounted for by the United States, 14% by the EU, 7% by Japan, 2% by China, 2% by Canada, and 1% by the Republic of Korea.

Henceforth, the biggest exporter and importer of ornamental corals did not change. Indonesia accounted for over half of exports of live and raw coral (14,189,731 kg); Fiji (6,443,281 kg); and Viet Nam (3,376,657 kg) were major exporters, together accounting for a further 39% of trade during 1996-2010 (Fig. 3-5). The vast majority of coral exports from these countries were wild-sourced. For the same period, the United States imported the majority of live and raw coral (13,310,857 kg); no other country accounted for more than 10% of coral imports (CITES Secretariat, 2012).

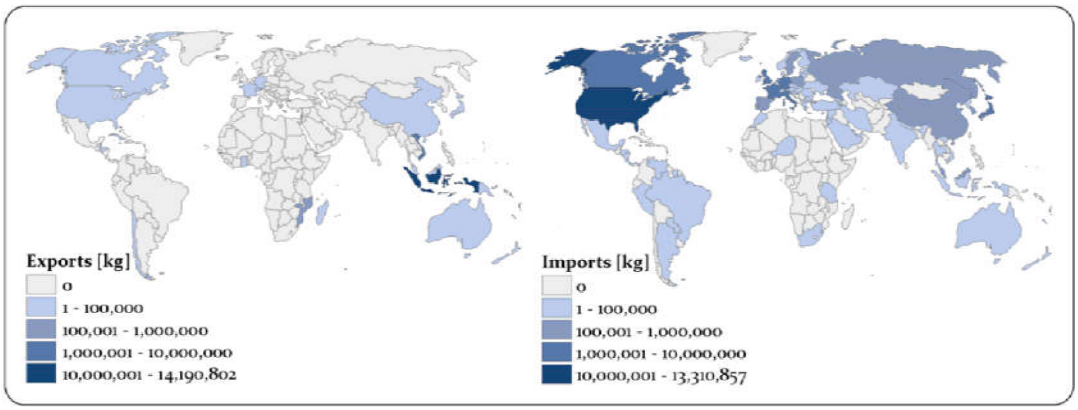

Fig. 3-5 Top exporting and importing countries of corals (kg) during 1996-2010 (source: CITES Secretariat, 2012)

Meanwhile, Kudus (2005) also revealed that the United States became the main destination country of ornamental coral trade from Indonesia during 1999-2003 which was accounted for 64,71% of stony corals. Commonly traded coral genera, based on AKKII export and import data 1999-2003, include *Goniophora* spp. (flowerpot coral), *Euphyllia* spp. (anchor or hammer coral), *Trachyphyllia* spp. (open brain coral), *Heliofungia* spp. (mushroom coral), and *Catalaphyllia* spp. (elegance coral).

In recognition of these facts, the Indonesian government has set institutional arrangements to manage the trade exported worldwide by coral companies. Broadly, the trade implied in coastal and marine resources governance which is the primary responsibility of the state. The authority for coral trade management is the responsibility of Ministry of Environment and Forestry. However, in practice, this responsibility is shared amongst various agencies.

3.3 Institutional arrangements of ornamental coral trade in Indonesia

According to Article 2 (1) of Act no.32 year 2004, the governmental system in Indonesia is divided into three main levels, namely: national, provincial, and regency. On these three levels, several governmental institutions have been working on their duties to implement CITES regulations in ornamental coral trade. CITES Secretariat as international organization who has authority in coral trade cooperates with Management Authority (MA) in each country. It aims to make all CITES conventions

and regulations enforced effectively. Subsequently, MA in each country cooperates with various national or regional departments. The objectives of these authorities include nature preservation, cultural asset preservation, communications and coordination of promotion, development and preservation, and safety and maintenance.

Currently, ornamental coral trade in Indonesia is governed by MoEF *casu quo* Ditjen KSDAE as MA in cooperation with the LIPI *casu quo* P2O-LIPI as Scientific Authority (SA). In practice, MA policies mostly based on SA recommendations. In addition, there are several governmental organizations put in charge in ornamental coral trade.

3.3.1 Conservation and Natural Resources Agency, Ministry of Environment and Forestry (BKSDA-MoEF)

As mentioned in Chapter XIII Article 65 of Regulation no.8 of 1999 on the use of plants and wild animals, MA that set to regulate the coral trade is the department who has responsible for forestry and conservation of plants and animals. Referring to these regulations, duties and functions of the MA in Indonesia have been displaced due to changes in the nomenclature of institutional authority and the incorporation of the realm of state ministries. In the past, MA was held by Forestry Department with extension to Directorate General for Forest Protection and Nature Conservation (*Direktorat Jenderal Perlindungan Hutan dan Konservasi Alam / Ditjen PHKA*). However, with the merger of the Ministry of Environment and the Ministry of Forestry, the name and organization of Ditjen PHKA amended by Forestry Minister Regulation no. P.18 / Menlhk-II/2015 on the Organization and Administration of the Ministry of Environment and Forestry. Ditjen PHKA changed its name to the Ditjen KSDAE which has the task of organizing the formulation and implementation of policies in the field of conservation management of natural resources and ecosystems. In practice, the management of coral trade by Ditjen KSDAE implemented by BKSDA in each province under the Directorate of Conservation and Biodiversity (*Direktorat Konservasi Keanekaragaman Hayati / KKH*).

MoEF cq. Ditjen KSDAE has been handling a variety of matters relating to the management and distribution of ornamental coral including the utilization and exploitation that involves ranks of the Technical Implementation Unit (UPT), especially BKSDA in almost every province. There are 27 BKSDA and only 14 BKSDA directly involved in dealing with the institutional arrangement of ornamental coral trade. This

relates to the quota which is only obtained by certain provinces. Duties and authority of both Ditjen KSDAE and BKSDA in making use of ornamental coral has been governed by a decision of the MoEF, which reflects a utilization control mechanism based on ornamental coral conservation of natural resources and ecosystems.

Observations during the research fieldwork shows that the task of BKSDA deal directly with each coral export companies. This relates to the permits that must be obtained before an ornamental coral exported to the destination country. These permits are the export application form (Form C), and the dossier for ornamental reef stock owned, planting coral (coral farming), and harvesting coral for delivery. All documents must be owned by each company to obtain a CITES permit that will be approved and issued by the MA at the central level through MoEF. Furthermore, the company must attach those required documents in the ornamental coral packages to be sent.

3.3.2 Research Center of Oceanography, the Indonesian Science Institution (P2O-LIPI)

The role of P2O-LIPI as ornamental coral trade SA in Indonesia has been mandated in Article 65 Government Regulation no.8 of 1999. In Article 66, SA has the authority to make recommendations to the MA and monitor permission and realization of the trade. P2O-LIPI recommendations to the MA include the determination of the classification list of coral species will be traded, catch and trade quotas (including export, import, introduction of non-native species) of all coral specimens included in the market list. In addition, SA recommends the number, type, and location of the ornamental coral that can be traded as the basis for quotas decision-making by Ditjen KSDAE.

SA also conducted biological monitoring and evaluation to the coral reefs in Indonesia as the basis for delimitation over ornamental coral trade permit. However, until now the results of the monitoring are still a very common because it only concerns about the general condition of coral reefs in Indonesia. Given the object of marine aquarium trade are each of trafficked species, the study concerning biological aspects of each species should be organized. Until now there are several studies on biological aspects of traded coral species although still limited in some aspects such as growth rate and intra-species competition (Crabbe and Smith, 2005; Nugraha, 2008; Knittweis and Wolff, 2010; Haris et al., 2011; Jipriandi et al., 2013).

Field assessments found that SA carried out annual checks on the cultivation activities of ornamental coral in every coral exporter company. All respondents interviewed admitted that it was organized by SA based on the agreement between the government, coral companies, and AKKII. Annual check results are used for basic regulations to each company. For an instance, some coral company managers said that their company is not allowed to export certain species of coral because it has not had sufficient brood stock.

In the international sphere, P2O-LIPI act as an independent party to provide recommendations to the international convention (CITES) in the field of conservation of plants and wild animals. There are several marine aquarium species that have been recommended by P2O-LIPI in cooperation with other agencies (e.g. MoEF, MoMAF, Universities, NGOs, and local government) to be elevated their status in CITES Appendix. In 2011, P2O-LIPI through MoMAF (Ministry of Marine Affairs and Fisheries) initiative has proposed to limit the capture of Banggai cardinal fish (*Pterapogon kauderni*)). For ornamental coral species, twelve years before, protection towards black coral (*Anthiphates* spp.) have been established through Government Regulation no. 7 of 1999 (Wisuda, 2015; MoMAF; 2017).

3.3.3 Directorate General of Customs and Excise

The Directorate General of Customs and Excise (*Direktorat Jenderal Bea dan Cukai / Bea Cukai*) is an Indonesian government agency that serves the community in the field of customs and excise. Bea Cukai has the authority in conducting export document checking, particularly for export permit or CITES document issued by Ditjen KSDAE. The officer of Bea Cukai should check on the authenticity of CITES permit, conformity of document contents about the amount and the species of coral traded, and validity period of the document.

Bea Cukai duties and functions here are crucial for being the last gate before the coral is sent to the destination country. Given the development of world trade that is increasingly borderless, slit of violation becomes easier. In addition, the volume of ornamental coral trade is also increasing rapidly with Indonesia as the world's largest exporter of ornamental coral (Green and Shirley, 1999; Wabnitz et al., 2003). The issue concerning the duty of Bea Cukai such as smuggling is expected to be tackled down by Bea Cukai. All custom officers in coordination with the MA will have to work extra to meet the mandate of CITES.

In practice, Bea Cukai has its shortages because of the limitations of officers in the field of coral reef science. Suitability of trade documents with coral traded requiring officers to know the traits and characteristic of coral species. AKKII's data indicated that, there are more than 87 coral species from Indonesia are being traded in 2015. Meanwhile, the latest data from several companies (CV. Cahaya Baru Bali, CV. Bali Aquarium, PT. Aneka Tirta Surya and PT Agung Marine Aquatic) showed that there are more than 154 species have been traded. Apart from differences in the amount of coral traded between the AKKII's data and coral exporter due to differences in the grouping of species, characteristics of each species listed are certainly to be known by Bea Cukai checking officer. Recognizing this, the Indonesian government has taken the initiative to put the fish quarantine officers at Indonesia international airports to cooperate with Bea Cukai officers in overseeing the distribution of ornamental coral Indonesia.

3.3.4 Fish Quarantine Center, Ministry of Marine Affairs and Fishery

The legal responsibility of Fish Quarantine Center refers to Law no.16 year 1992 concerning animal, fish, and plant quarantine. This act regulates the export and import of certain types of plants and animals, including corals. Coral in the legislation system of Indonesia is an animal that is classified in the category of fish. As mentioned in Chapter 1 Article 1 that the fish are all aquatic biota that part or all of their life cycle be in the water, alive or dead, including parts thereof.

The institution has the authority to check the health of coral traded and concordance between coral traded inside the export box and its document attached. Overall, the actions undertaken by a quarantine officer encompass examination; relegation; observation; treatment; detention; rejection; extermination; and exemption. The quarantine officers must issue a rejection towards enter and exit of a certain species to and from Indonesia if they have the possibility to endanger native aquatic species. In the domestic scale, it also have to do the same things from an island to another island in Indonesia.

In the case of coral trade, rejection for dangerous or invasive coral species rarely occurs. Rejection is more common due to the nonconforming export documents attached. In addition, there were many cases of domestic smuggling coral without official documents. In early 2017, there were 3 cases of coral smuggling in Bali and Lombok thwarted by Fish Quarantine Center cooperate with the Indonesian Water

Police. The last case occurred on January 23rd (Suriyani, 2017), the government foiled the smuggling of more than 1300 units of coral in Lombok Barat. In 2016, there were 4 cases of discomfiture coral smuggling in Bali.

3.3.5 Directorate of Water Police, the Indonesian National Police

The Indonesian National Police (*Kepolisian Negara Republik Indonesia / POLRI*) is the police force of Indonesia. Until this day, POLRI still holds control of law enforcement and policing duties all over Indonesia nationally. The unit within the National Police of Indonesia which has responsibility as wildlife and animal agency is Subdit-Satwa K9. Although this unit has the scope to oversight of all the wildlife, but the work of Subdit-Satwa K9 tend to focus on terrestrial wildlife. In the coral trade practices, the POLRI unit that frequently intervened in the supervision of trading and distribution of ornamental coral is the Directorate of Water Police (*Direktorat Polisi Air Baharkam POLRI / Ditpolair*).

Ditpolair tasked to carry out the functions of POLRI that includes patrols, including the first handling of criminal acts regarding flora and fauna (coral) illegal trade; the search and rescue accident in the waters; and coastal community development. The unit is respectively taking part in natural resources conservation missions. In the field, it became the main unit in monitoring illegal trade of marine species. The official news reported that the smuggling of marine ornamental species were first thwarted by Ditpolair (Mahendra, 2016; Villagers Post, 2016; Hikmah, 2017; Saut, 2017). It also cooperates with Civil Servants Investigator to carry out public education in natural resources conservation and ecosystem protection.

3.3.6 Directorate General of Foreign Trade, Ministry of Trade

The Directorate General of Foreign Trade (*Direktorat Jenderal Perdagangan Luar Negeri / Ditjen Daglu*) is under supervision of the Ministry of Trade (*Kementerian Perdagangan / Kemendag*) which has responsibility on the formulation of policies related to the development of foreign trade in Indonesia. This directorate has the authority to facilitate business legality in international coral trade for all dealers. Facilities provide by Ditjen Daglu including business permit in coral trade (*Surat Ijin Usaha Perdagangan* / *SIUP*), provide business capital to stimulate a good business growth, set up a base price and put tax price for protected wild animals (including coral) trade as written in CITES and Indonesian legislations.

All respondents of coral companies stated that the existence of the Ditjen Daglu is less perceived by the exporters in the coral trade practices. Functions and duties of Ditjen Daglu was limited to granting a business license in ornamental coral trade. Regarding the tax on any protected species, they are not too concerned on it since the payment using free-on-board (FOB) system. Green and Shirley (1999) described that the free-on-board price is the cost of a single specimen, and excludes any transportation, packaging, and taxation costs which are incurred additionally by the importer or buyer.

3.3.7 Universities, Non-governmental organizations, Association, and Coastal Communities

Ditjen KSDAE as MA shall coordinate with all relevant institutions or agencies for the policies development, CITES implementation, and law enforcement. In addition to five governmental institutions abovementioned, an MA has cooperated with the institutions or organizations including universities or scientific institutions, NGOs, associations, and local community groups as mandated by the Forestry Ministerial Decree 447/Kpts-II/2003 on administration of plants and wild animal collection and distribution. Such cooperation can be realized with the establishment of cross-agency working group and develop a Memorandum of Understanding (*MoU*) to enhance the management practices of coral trade.

The role of universities, NGOs, associations, and local communities is crucial because they might provide advices and recommendations to the SA and MA through their scientific studies and activities undertaken. Several studies have been carried out by universities in Indonesia in relation to coral reef ecosystem though the topics discussed were not directly related to coral trade, e.g. the percentage of coral cover in several Indonesian waters, the abundance of reef fish and others reef biota, coral reef ecosystem management, coral transplantation techniques, and coral biology (Wirada and Baiquni, 2013; Yohanis, 2013; Beginer et al., 2014; Setyadi and Djumanto, 2014; Seto and Djumanto, 2014; Simarangkir, 2015; Savitri et al., 2015; Andrianto, 2016; Malik, 2016; Alfi et al., 2016). A number of NGOs such as Conservation International (CI), World Wildlife Fund for Nature (WWF), Wildlife Conservation Society (WCS), and The Nature Conservancy (TNC) are also working in Indonesia for the conservation of marine ecosystems. The NGOs are increasingly important actors in marine resource governance and often cooperate with the local government on variety of ways including planning and creation a set of guidelines for conservation actions, training and

education in sustainable fishing methods, donating financial resources, and coral reef rehabilitation (Ozhan, 2000; Calado et al., 2012; Espinosa-Romero et al., 2014; Deighan and Jenkins, 2015; Morshed and Asami, 2015; Cook et al., 2017). For coastal communities, NGO experts can be used profitably as consultants to environment authorities and can also be used as teachers in public awareness as well as capacity building program (Ibrahim and Aziz, 2012).

To this end, there is an NGO, namely Indonesian Coral Reef Working Group (ICRWG), who became main partner of the MA and SA to ensure sustainable practice of coral trade in Indonesia. Timotius et al. (2009) stated that it is an independent group that Ditjen KSDAE works with since the initiation of coral culture promoted. Representatives of NGO, university, governments, and private sectors sit together in ICRWG since it was established in 2001. This cooperation aims to assist government in order to make a better management of ornamental coral trade. The consolidated group also ascertained properness of culturing mechanism and objectivity.

Meanwhile, the association acts as a coordinator agency for all coral trader and bridging the businesses with the government. The definition of 'the association' is an organization formed up by business entities on plants and wild animals based on the similarity of species traded. In the coral trade practices in Indonesia, these roles held by AKKII. Since the coral trade began in the 1980's till present, AKKII has helped the government (MA and SA) in the implementation of CITES, including monitoring coral species population as a material consideration of setting a quota, allocating export quota, monitoring coral trade, monitoring illegal activities both by the AKKII members or non-members, carry out conservation activities upon coral species traded, and foster the AKKII members to implement coral trade practices according to the international and Indonesian rules and laws. Furthermore, AKKII is a government partners in guidance and controlling coral trade and responsible only to its members.

3.4 Legal basis

Trade in ornamental corals has brought a variety of legislation from several distinct areas of law. Corals and other species of wild animals are subject to restrictions on international movement with the purpose of animal protection from over exploitation (Cooper and Rosser, 2002). In regards to ornamental coral trade, the law highly refers to CITES regulation and Indonesian Law no.5 year 1990 regarding Natural Resources

and Ecosystem Conservation. Another laws, including: Government Regulation (*Peraturan Pemerintah* or *PP*), Presidential Regulation (*Peraturan Presiden* or *Perpres*), and Ministerial Decree (*Keputusan Menteri* or *Kepmen*) also has been putted into effect. Since ornamental corals belong to Appendix II of CITES, all national regulations are thus highly considering CITES provisions.

3.4.1 CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora)

CITES is an international agreement between governments. The text of the Convention was finally agreed at a meeting of representatives of 80 countries in Washington, D.C., the United States of America, on 3 March 1973, and on 1 July 1975 CITES entered in force. Based on the desire to use the plants and wild animals in a sustainable manner, Indonesia has ratified CITES through Presidential Decree no.43 of 1978. Since 1975, CITES has aimed to ensure that international trade in specimens of wild animals and plants does not threaten their survival (Dee et al., 2014). CITES Secretariat (2016) stated that many wildlife species in trade are not endangered, but the existence of an agreement to ensure the sustainability of the trade is important in order to safeguard these resources for the future. Today, it accords varying degrees of protection to more than 35,000 species of plants and animals, whether they are traded as live specimens, fur coats or dried herbs.

CITES works by subjecting international trade in specimens of selected species to certain controls. All import, export, re-export and introduction from the sea of species covered by the Convention has to be authorized through a licensing system. The Convention required all parties to designate one or more Management Authorities in charge of administering that licensing system and one or more Scientific Authorities to advise them on the effects of trade on the status of the species. The Indonesian government has appointed Ditjen KSDAE as an MA and P2O-LIPI as an SA to implement CITES regulations.

CITES is probably the most important global convention for the protection of species (Abensperg-Traun, 2009), with its 183 member states and legal instruments to enforce compliance (Reeve, 2006; CITES Secretariat, 2016). It gives producer and consumer countries their share of the joint responsibility for the prevention of trade in endangered species and for an effective regulation of trade in others (Wijnstekers,

2011). The species covered by CITES are listed in three Appendices which subject them to different levels or types of trade controls to avoid over-exploitation (Table 3-1).

Table 3-1 CITES Appendices

Appendix	Content
I	Species that are threatened with extinction and CITES strictly prohibits all international trade except when the purpose of the import is not commercial (e.g. most hunting trophies, parts, and derivatives such as carved products as tourist souvenirs). For instance, sea turtles, including: Green Turtle (*Chelonia mydas*), Hawksbill Turtle (*Eretmochelys imbricata*), Kemp's Ridley Turtle (*Lepidochelys kempii*), Leatherback Turtle (*Dermochelys coriacea*), Loggerhead Turtle (*Caretta caretta*), and Olive Ridley Turtle (*Lepidochelys olivacea*) are listed on Appendix I, prohibiting all international trade in this species for jewelry and luxury items. Trade in specimens of these species is permitted only in exceptional circumstances, such as: the specimen is not to be used for primarily commercial purposes, the specimen was legally obtained, and the trade will not be detrimental to the survival of the species (Abensperg-Traun, 2009; Dee et al., 2014; CITES Secretariat, 2016)
II	Species that are not necessarily now threatened with extinction but that may become so unless international trade is closely controlled. Export permits for Appendix II specimens can be issued by the exporting country only when (a) the Scientific Authority has advised that export will be non-detrimental to the survival of that species or when a Management Authority regulating exports is satisfied that (b) the specimen was not obtained illegally and (c) risk of injury and cruel treatment during transport was minimized for living specimens. Appendix II covers over 30,000 species. Over 2000 hard corals (all Scleractinians) are listed on Appendix II (Abensperg-Traun, 2009; Dee et al., 2014)
III	Species for which a country has asked other CITES Parties to help in controlling international trade. Trade in Appendix-III species is regulated using CITES export permits (issued by the country that listed the species in Appendix III) and certificates of origin (issued by all other countries). There are 4 species of red and pink corals listed in Appendix III which were proposed by China, namely, *Corallium elatius*, *Corallium japonicum*, *Corallium konjoi*, and *Corallium secundum* (CITES Secretariat, 2016; NOAA Fisheries, 2017)

CITES Appendix II listed all species of hard coral. Since 1985, CITES has prepared mechanism to regulate international trade of stony coral and protect natural resource from overexploitation. At present, all CITES members agreed to ensure that international trade is not detrimental to the survival in the wild of coral species listed in the CITES Appendices. The term ‘‘detrimental’’ is used throughout the Convention text as its fundamental principle. Although no formal definition is given, some relevant sentences are stated in CITES articles to provide an understanding of Non-Detriment Finding (NDF) principle. The following box presented CITES definition of NDF concerning species listed in Appendix II (see CITES 1973 for the full text).

Convention on International Trade in Endangered Species of Wild Fauna and Flora

Article IV

Regulation of trade in specimens of species included in Appendix II

[. . .]

2. The export of any specimen of a species included in Appendix II shall require the prior grant and presentation of an export permit. An export permit shall only be granted when the following conditions have been met:

(a) a Scientific Authority of the State of export has advised that such export will not be detrimental to the survival of that species; [. . .]

3. A Scientific Authority in each Party shall monitor both the export permits granted by that State for specimens of species included in Appendix II and the actual exports of such specimens. Whenever a Scientific Authority determines that the export of specimens of any such species should be limited in order to maintain that species throughout its range at a level consistent with its role in the ecosystems in which it occurs and well above the level at which that species might become eligible for inclusion in Appendix I, the Scientific Authority shall advise the appropriate Management Authority of suitable measures to be taken to limit the grant of export permits for specimens of that species.

[. . .]

6. The introduction from the sea of any specimen of a species included in Appendix II shall require the prior grant of a certificate from a Management Authority of the State of introduction. A certificate shall only be granted when the following conditions have been met:

(a) a Scientific Authority of the State of introduction advises that the introduction will not be detrimental to the survival of the species involved; and [. . .]

In the case of Appendix II species, the Convention text identifies some aspects of ‘‘not detrimental’’ by requiring that export ‘‘should be limited in order to maintain that species throughout its range at a level consistent with its role in the ecosystems in which it occurs and well above the level at which that species might become eligible for inclusion in Appendix I’’. Therefore, all international trade in taxa listed in Appendix II CITES must be accompanied by an assessment of the impact of trade on wild populations, termed a Non-Detriment Finding (Smith et al., 2011) and should ensure that species traded are obtained legally.

SA in each signatory countries is agency appointed by CITES to make NDF and to advise the authorities who issue CITES permits (designated as MA). There is no specific methodology set by the Convention on how to make NDFs, although resolutions of the Conference of the Parties (CoP) to CITES provide some further information and guidance. SA do not normally make the reasoning behind NDF publically available. This makes it difficult to assess whether improvements could be

made to current methods, to identify where important knowledge gaps exist, and to direct scientific research to improve NDF (Smith et al., 2011).

Indonesia through the study conducted by SA and several parties (NGOs, government institutions, academia, and exporters association) has been implementing NDF principle although the methods used are not based on the IUCN (International Union for Conservation of Nature) checklist for NDF (Suharsono and Bruckner, 2008). The checklist was the result of a workshop led by the IUCN in October 1998 and another in October 1999, the second under contract from the CITES Secretariat. It was contained in a report: CITES Scientific Authorities' Checklist to assist in making Non-detriment Findings for Appendix II Exports which recommended the findings and advice of the Scientific Authority of the country of export be based on several elements, including: population status, distribution, population trend, harvest, other biological and ecological factors, and trade information relating to the species concerned (CITES, 2017).

Suharsono and Bruckner (2008) stated, the study used two criteria to ascertain the NDF, namely: the decrease in total number and measurement of the exported coral species. The main data was evaluation of export realization. The field data was result from monitoring which was collected by means of LIT (Line Intercept Transect) and Belt Transect and was analyzed whether or not there is a decrease in the number and measurement, and is there any change in state of the abundance of one species of coral, for instance from the status of commercialization or to be prevented from being commercialized. The results were the amount exported for each coral species is relatively small compared to the existing potency and the size of each coral species did not show any significant decrease.

Apart from the above, Indonesia is also being applied some provisions of sustainable used (Suharsono and Bruckner, 2008) to comply with the CITES regulations regarding NDF, among others:

- The location of coral harvesting is outside conservation area, tourism area, protected areas by the Local Government, agreed traditional areas of local community;
- Size of the harvested coral are between 5-20 cm;
- Coral harvesting in one location can be done only after its abundance has been evaluated by SA (P2O-LIPI) and ICRWG;

- Coral harvesting must be done by trained fishermen;
- Collecting of wild-coral must be done with care without destructing the targeted coral or other biota in the surrounding area that are not the target;
- The amount of coral collected or harvested must be based on the quota which was decided by the Supreme Court (MA). Issuance of permit and extension of permit needs a verification, field monitoring, and evaluation;
- Field monitoring is done once a year in the collection site to obtain information in deciding the quota;
- Monitoring is to be done by the MA and SA starting from collection site up to the exporting site;
- Collection and division of quota is based on province and diversified for each province in order to prevent concentrated harvesting in one location;
- Export permission is not given for recently dead coral. Permit is given only for live corals, this is to push fishermen and exporters to be more careful so as not to suffer from loss. Handling living coral need real care starting from the time of collection up to the hand of exporters so that they will remain in good condition;
- The policy to permit export of living coral only is also intended to prevent smuggling of coral;
- All exporters and fishermen are required to execute coral transplantation. The portion of coral quota from nature will be decreased and those from transplantation will be increased and at the appropriate time there will be no corals taken from the wild.

Those provisions could be different in every CITES members as long as are not being under CITES standards. Decisions regarding NDFs are not straightforward due to some factors, e.g. the status of the species in the wild may be relatively poorly understood, harvests may be taken from unknown localities, and they could vary in intensity and harvest method (Smith et al., 2011). Signatories to CITES are permitted to enact more strictly domestic regulations. For instance, the Philippines banned the trade of stony corals, seahorses, and giant clams (Ross, 1984; Vincent et al., 2011) though those species are permitted to be exported as listed on Appendix II of CITES.

However for the trade of all CITES-listed species must be reported to CITES Secretariat. In the context of coral trade, importer and exporter countries should deliver an annual report on the realization of the number of coral species traded (Green, 2003).

It provides information of ornamental coral species traded, including: live or dead coral, cultivated or wild-sourced coral, destination country, and the number of exported coral.

3.4.2 Law no.5 year 1990 regarding Natural Resources and Ecosystem Conservation

This law generally provides about a framework for the conservation of all living natural resources (plants and animals) and their ecosystem, both on land and in the sea. It was mentioned that living natural resources conservation should be done wisely to ensure the continuity of their availability and roles with keep maintain and enhance the quality and diversity of their value (Article 1, Section 2). There are several approaches are taken in the conservation of living natural resources including the protection of life support systems, the conservation of plants, animals and their ecosystem, and the sustainable use of these resources. The efforts that have been taken by the Indonesian government were establishing nature protection areas (including wildlife sanctuary/*cagar alam* and wildlife preserve/*suaka margasatwa*) and nature sustainable areas (including national park/*taman nasional*, grand forest park/*taman hutan raya*, and nature recreational park/*taman wisata alam*).

It is imperative to implement this legislation since it provides a basis for protection and conservation of marine and coastal ecosystems including coral reef ecosystem where the commodities of the trade derived. There are two types of the living natural resources, protected and not protected. Subsequent to this, protected plants and wild animals are listed in Government Regulation no.7 of 1999. The list was made based on LIPI recommendations as scientific authority, CITES appendices, and species status on the IUCN red list. All Scleractinian corals are included in unprotected fauna. There is only one coral species listed, namely *Anthiphates* spp. (black coral).

Nevertheless, the legislation explains broadly concerning the conservation efforts. This act does not explicitly describe the protection of certain marine ecosystems, e.g. mangroves, coral reefs, and sea grass or any particular plants and animal species. The implementation of this act should therefore regarding another legislations (e.g. Government Regulation no.7 of 1999 on preservation of plants and wild animals, Government Regulation no.8 of 1999 on utilization of plants and wild animals, and Forestry Ministerial Decree no.447/Kpts-II/2003 regarding administration on collecting or catching and distribution of plants and wild animals).

Furthermore, this act aims to pursuit the realization of living natural resources sustainability as well as the balance of the ecosystem so that it can be better to support society welfare and the human life quality. It is clear that in addition to keep natural resources sustainability, conservation activities must ensure the level of local community well-being. In conducting conservation activities, the responsibility and duty is not merely belongs to the Government, but the society as well. In the context of ornamental coral trade, the term of "Government" is highly related to Ditjen KSDAE and P2O-LIPI whereas the society can cover the fishers or collectors, the wholesaler, the exporter, the importer, the trans-shipper, and the retailer.

The problem is the centralistic approach on the management of conservation areas, especially marine national parks. The centralistic approach is likely creating conflict and rejection from the local fishers. Nurhidayah (2010) noted that the centralistic approach contained in this legislation is not suitable and contravenes the autonomy law no 22/1999 enacted in 1999 and revised with the law no 32/2004 in 2004. The MoEF is still using the centralistic approach in the management of marine conservation areas but public participation, particularly local coral collectors/fishers, who highly depend on marine resources is needed for effective management of marine conservation areas. For instance, establishment of marine protected areas regardless the local community involvement has had an impact on their livelihood. It must be considered that the local wisdom of indigenous population has been implemented there in a long time and maintained marine species stock abundance. Several study proved that local knowledge is priority criteria to be considered for marine management (Cinner et al., 2005; McClanahan et al., 2006; Ehler and Douvere, 2009; Weeks et al., 2014). Thus, a revision of this legislation which included the decentralization on the management of marine conservation areas to local government is needed. Meanwhile, the gap in local government capacity to manage their marine areas can be filled by means of training, workshops, and other learning activities with the involvement of the expert scholars.

The other issue of this act is the overlapping authorities responsible for marine resources conservation. Based on this legislation, the MoEF is appointed as the authority in the management of all living marine natural resources. However, in the new legislation, the Law no.45 of 2009 on fisheries and the Law no.27 of 2007 on management of coastal zone and small islands the responsible authority for marine resources management is the MoMAF. Nurhidayah (2010) stated that those legislations

also govern marine resources conservation with a different approach. The MoMAF applied decentralization approaches to the local government though it does not include devolution to local people by means of community based marine conservation. To some extent, those two government institutions use different criteria to achieve the goals. The MoEF uses ecosystem approach whereas the MoMAF uses zoning system modification from IUCN. The overlapping legislation can therefore create confusion in the implementation.

In the practice of ornamental coral trade, the overlapping issue emerged when the Minister of Marine Affairs and Fisheries stated that all domestic trade and export of Indonesian corals must be banned (Primadhyta, 2015; Medistiara, 2016; Sukmana, 2016). The ban was likely based on the Law no.45 of 2009 on fisheries which is implicitly mentioned that corals are belong to 'fish' resources. The act explains all 'fish' resources are under authorize of MoMAF. The definition of 'fish' resources is mentioned in Article 1, Section 4, that "fish is all kinds of an organism that the whole or part of its life cycle be in the waters".

In response to this, coral exporters didn't put high concern on the ban stated by the Minister of MAF. If ornamental coral trade and all related activities must be banned, the only institution who has authority for the prohibition is MoEF through Ditjen KSDAE as management authority appointed by CITES Secretariat. MoMAF is indeed involves on marine ornamental species trade by means of Fish Quarantine Center. Yet, its involvement limited to species checking and doesn't change any decision issued by MoEF.

3.4.3 Government Regulation no.7 year 1999 on Preservation of Plants and Wild Animals

This legislation was enacted in January 27th, 1999 by the Third President of Indonesia. According to Chapter 1, Arcticle 1, the term of 'preservation' is described as an attempt to keep the diversity of plants and wild animals and their ecosystems both within and outside their habitat in order not to become extinct. This act aim to prevent plants and wild animal species from extinction; maintain genetic purity and diversity of them; and maintain the balance and stability of the existing ecosystem. These three purposes has set out to be used for human welfare in a sustainable manner. There are three ways recommended in the preservation of plants and wild animals, namely:

determination and classification of protected and unprotected; management of plants and animals species and their habitats; maintenance and breeding.

This regulation classified plants and animals into two groups, protected and unprotected. A plant and animal species must be categorized as 'protected' if it has met the criteria: having a small population; steep decline in the number of individuals in the wild; and has a limited distribution area (endemic). The act has listed 294 species of flora and fauna as protected species. There are seven species of fish (*Homaloptera gymnogaster*, *Latimeria chalumnae*, *Notopterus* spp., *Pritis* spp., *Puntius microps*, *Scleropages formasus*, and *Scleropages jardini*) and one species of coral (*Anthiphates* spp. / Black coral) amongst those protected animals. Other corals are categorized as unprotected animal and can be traded by means of export and import.

Preservation of plant and animal species can be done through management actions in their habitat (*in situ*) and outside of its natural habitat (*ex situ*). *In situ* management is implemented in the kind of activities: identification; inventory; monitoring; coaching habitats and populations; rescue actions; study, research and development. In the practice of coral trade, *in situ* activity is often carried out by the SA to determine the availability of coral stock in nature. Meanwhile, *ex situ* management is carried out through several actions such as maintenance; breeding; study, research, and development; rehabilitation of wildlife; rescue of plants and animals. Coral cultivation is an example of *ex-situ* management which is performed by exporter companies on their coral farm. To some extent, it is a subject of compulsory inspection by the SA to assess coral farming is being done and the availability of cultured corals stock owned by the exporters. The results of this inspection will be the basis for consideration of export quotas given to each company.

3.4.4 Government Regulation no.8 year 1999 on Utilization of Plants and Wild Animals

This act entered into force at the same time with the Government Regulation No. 7 year 1999. It mentioned that utilization of plants and wild animals is the use of natural resources, both plants and animals, or parts thereof and the products thereof. This legislation aims to utilize the plants and wild animals in a sustainable manner for the welfare of the people. This utilization is implemented in coordination with the Ditjen KSDAE as MA and LIPI as SA by means of several activities including study, research and development; breeding; hunting; trading; exhibition; exchange; cultivation of

medicinal plants; and animal care for hobbyist. Yet, there is an exception for the use of twelve species of plants and wild animals including rafflesia flower (*Rafflesia arnoldii*); anoa (*Bubalus depressicornis*, *Bubalus quarlesi*); Buru babirusa (*Babyrousa babyrussa*); Javan rhinoceros (*Rhinoceros sondaicus*); Sumatran rhinoceros (*Dicerorhinus sumatrensis*); Komodo dragon (*Varanus komodoensis*); bird-of-paradise (all species from family Paradiseidae); Javan Hawk-eagle (*Nisaetus bartelsi*); Sumatran tiger (*Panthera tigris sumatrae*); Mentawai leaf monkey (*Presbytis potenziani*); Orangutan (*Pongo pygmaeus*, *Pongo abelii*); and Javan gibbon / Owa Jawa (*Hylobates moloch*), which are only allowed with the permission of the President.

According to Chapter V, Article 18, the utilization through the trade is only allowed for plants and wild animals that are not protected by law as listed in Appendices of Government Regulation No. 7 year 1999. Those plants and wild animals can be obtained from the captivity and retrieval or collection from their habitat with a limitation quota determined by MA. Although this legislation came into effect in 1999, the second provision has been practiced by coral traders two years earlier. In 1997, Indonesia has established quotas for 39 coral genera in consultation with the CITES (Green and Shirley, 1999).

The legislation stated that the trade of coral can only be done by enterprises established under Indonesian law after the MoEF approval. In advance, the business entities must: have coral shelter and facilities that meet technical requirements and prepare an annual work plan of coral trade prior to being approved as a coral exporter. Subsequently, it has to submit a report in every coral exportation. This act also required all coral companies to pay administrative costs (*Provisi Sumber Daya Hutan / PSDH*) as set by Government Regulation no.12 year 2014 on the types and rates on the type of non-tax state revenue applied to the MoEF.

3.4.5 Forestry Ministerial Decree no.447/Kpts-II/2003 regarding administration on collecting or catching and distribution of plants and wild animals

The legislation was enacted by Ministry of Forestry, which has now changed its nomenclature into Ministry of Environment and Forestry (MoEF) since Indonesia's new president has been elected in 2014. This act regulates all administrative affairs in exploiting living natural resources as well as provides the procedure for getting permits to collect, catch, breed, distribute, export, and import plants and wild animals in regard to precautionary principle, scientific based, and NDF principle of CITES. The

collection of plants and wild animals from their natural habitat can only be done outside of the conservation areas, nature reserves, and/or hunting parks. Those conservation areas include National Parks (*taman nasional*), Nature Parks (*taman wisata alam*), and Grand Forest Parks (*taman hutan raya*). Meanwhile, nature reserves consist of wildlife sanctuary (*cagar alam*) and wildlife preserve (*suaka margasatwa*).

Individuals or institutions can apply for two types of permits, namely non-commercial use (study, research, non-commercial exhibition, exchange, hunt, and hobby) and commercial use (captivity, trade, commercial exhibition, and cultivation of medicinal plants). Since the coral trade is commercial use, the permit application can only be done by institutions or business entities established under the laws of Indonesia including private companies, cooperative, local/regional owned enterprises, and state owned companies. This ministerial decree set out three coral trade permit including take and capture permit for wild-sourced ornamental corals, domestic and international dealer permit for ornamental coral trade. Those permit will be issued by means of the head of KSDAE (*Direktur Jenderal / Dirjen KSDAE*) agreement after the business entities concerned meet the requirements as written in the decree.

This legislation has set out a rigidly provisions for the specimen that can be traded to ensure sustainable utilization and can be accounted for the national or international level. All species of coral traded by the domestic or international dealer must be registered on quota list and collected or harvested through cultivation verified by SA. In order to make coral trade to be tracked, the management of ornamental coral is under the Central Government authority. Thus, all business entities who want to be an international dealer for Indonesian ornamental coral should propose permit documents to the Ditjen KSDAE as an MA. The following flowchart (Fig. 3-6) is the steps must be taken by any business entities to get the international dealer permit which is valid for five years.

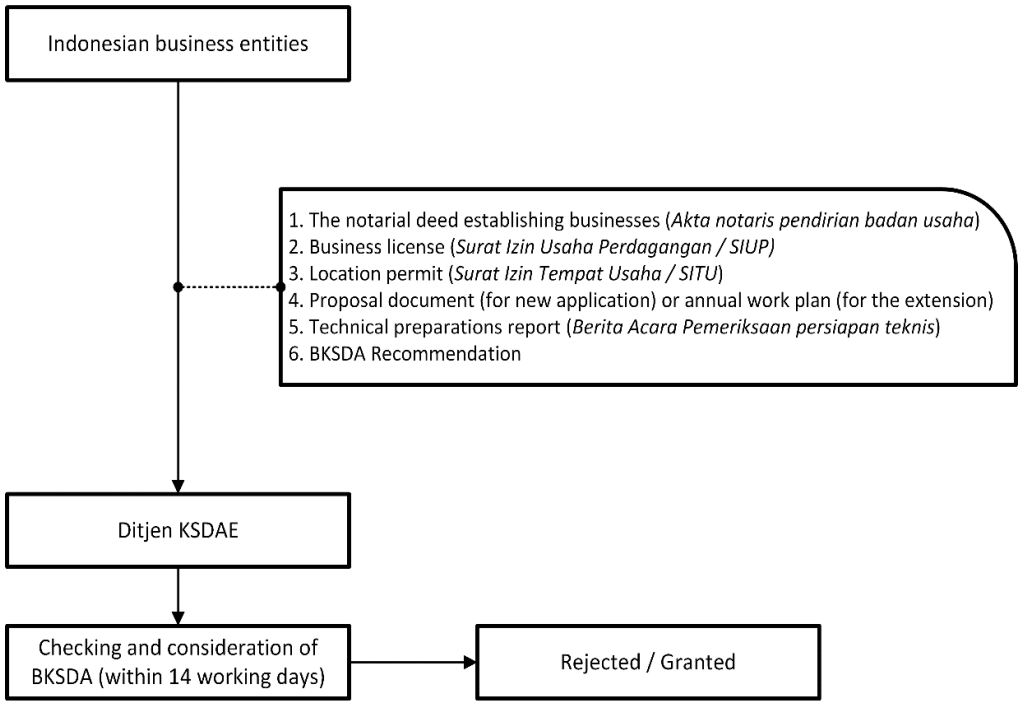

Fig. 3-6 Flowchart of international dealer permit application in Indonesia

The flowchart is based on Chapter 3, Part 4, Paragraph 2, Article 51 about commercial use permit for international dealer. The archives submitted to the Ditjen KSDAE encompasses six documents aforementioned (Fig. 3-6). For the proposal or annual work plan must cover information including company profile, the origin of coral species traded, coral cultivation and sheltering technique, transportation and trans-shipping for coral traded, company facilities and infrastructure, and conservation action plan to be implemented. Meanwhile, consideration taken by Ditjen BKSDA to reject or grant permit application consist of several points, namely the business properness (technical and administrative), production properness (wild-coral collection and mari-culture technique), bio-ecological feasibility, and executive understanding of the coral reef conservation.

After gaining international dealer permit, any business entities has officially been approved as coral exporting company and has the right to sell ornamental corals abroad. Each exporters must obtain a permit for international commercial circulation prior to coral exportation. Based on Chapter 3, Part 6, Paragraph 2, Article 62, international commercial circulation is defined as trading and demonstration, including traveling live-animal exhibitions by means of exportation, importation, re-export, and introduction from the sea, which aims to gain economic advantages either in cash or

kind, and is intended for the benefit of re-sale, exchange, provision of services or other forms of utilization or economic benefit to or from abroad. The permit will be issued as a bilingual document approved by Dirjen KSDAE, also known as international coral freight letter (*Surat Angkut Tumbuhan dan Satwa Liar – Luar Negeri / SATS-LN*) or CITES permit (see Appendix 1). For the purposes of exportation, CITES permit must be duplicated as many as six copies, comprised of four documents given to Dirjen KSDAE, customs (Bea Cukai), fish quarantine center, and BKSDA, a document attached to coral box exported, and the last for company archive. The following figure is the flowchart to get CITES permit (Fig. 3-7).

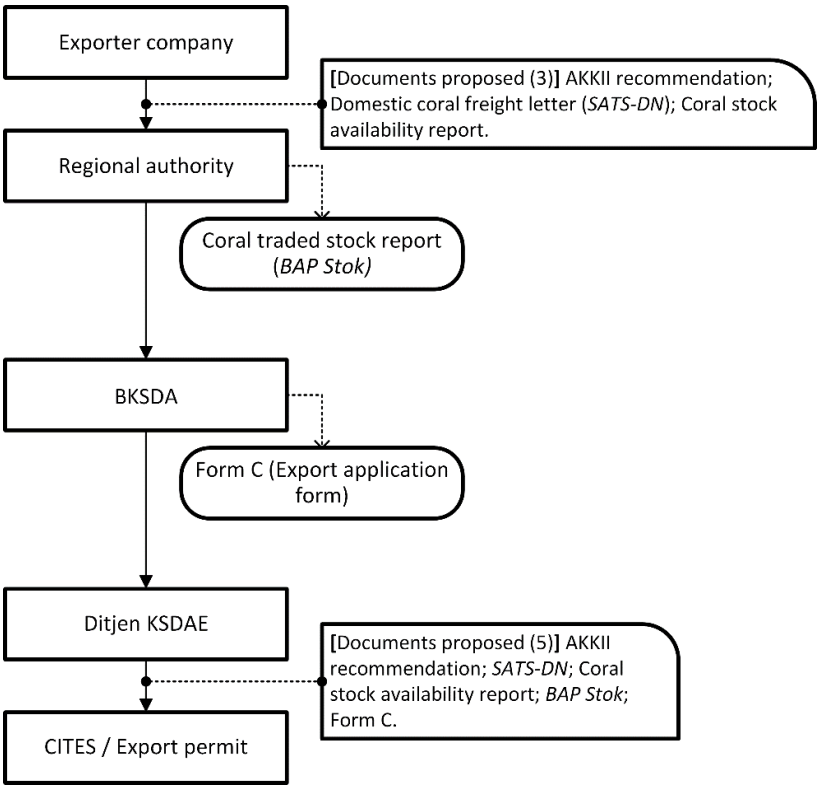

Fig. 3-7 Flowchart of CITES permit application in Indonesia

After all, there are many improvements of detail provisions in this legislation regarding coral trade. Seventeen relevant legal considerations applied for its enactment. It has been amended twice since it was enacted in 1998 as Forestry Ministerial Decree no.62/Kpts-II/1998. The amendment was published in 1998 and 2000 through Forestry and Plantation Ministerial Decree no.460/Kpts-II/1998 then Forestry and Plantation Ministerial Decree no.104/Kpts-II/2000. After 2003 and the following years, this

ministerial decree became a reference for those who will exploit the plants and wild animals, particularly coral reef biota.

3.4.6 Decision of the Directorate General for Forest Protection and Nature Conservation (*Ditjen PHKA*) no.10/IV-KKH/2004

The decision was made to provide technical guidelines of artificial coral shelter. It is known that all coral which will be traded have to go through acclimatization process in shelter pond. It is needed as they became stress due to being moved from the sea or coral farm (Suharsono, 2008b). According to these facts, the guidelines aim to provide standard requirements of artificial coral shelter and ensuring survival rate and quality of coral traded.

The contents within the technical guidelines are general requirements before an exporter willing to build the shelter pond. It includes legal permit from authorized institutions, the facilities must be owned, and the ambient level of seawater quality. Another requirements were technical terms for shelter pond, shelter capacity, supporting facilities, and shelter care instructions.

3.4.7 Director General PHKA Regulation no.9/IV/Set-3/2008 regarding a guide to propagating the ornamental coral

Indonesian government hopes that in the following years ahead, live coral collection can be partly or totally replaced by coral farming products. Timotius et al. (2009) noted that since 2002, government has encouraged companies/exporters to initiate coral farming or coral culture to decrease live coral collection. Consequently, a number of companies were soon built coral farming in several areas. Ditjen PHKA (now became Ditjen KSDAE) was furthermore to foster coral farming, decided not to issue permit to do wild live coral collection anymore for new companies, but they were directed to build coral farming.

This regulation was enacted in a response to aforementioned facts. It includes information concerning bio-ecology of coral reefs, technical guidelines of coral propagation, and a brief administration manners to get coral farming permit. Developing artificial reef, closure areas, coral translocation (ex-situ), and coral propagation are an effort to address the problem on coral ecosystems damage in their natural habitat. These efforts are also alternative ways to reduce the pressure on the

utilization of coral reef resources. This policy has been included in the domestic or international coral trade permit issued to coral companies.

Today, coral propagation effort within the framework of sustainable utilization of ornamental coral continues to grow. The Technical Implementation Unit of Conservation and Natural Resources Agency (*Unit Pelaksana Teknis / UPT KSDA*) has been working on coral propagation surveillance as well as independent and/or collaboration in monitoring with the ICRWG is still underway and conducted continuously. It is recognized that the activities of coral propagation is a substantial investment. It must have a clear scientific conception and reference as well as support from comprehensive field practices in the implementation of legality aspects. Setting a strong and transparent administration with the support of relevant stakeholders are expected to get optimal results.

3.4.8 Other relevant laws

There are other relevant international and domestic regulations, treaty, and agreements concerning ornamental coral trade in Indonesia. These regulations are not directly be references in coral trade practice but are used occasionally concerning related cases. For instance, the Law no.45 year 2009 on fisheries given a meaning of 'fish' which corals implied in the definition. Other legislations are also relevant as the scope encompasses conservation, trade, marine ecosystems management, customs, and supervision over natural resources. The following list is a brief description of other laws and agreements related to the trade in ornamental corals.

- International Union for Conservation of Nature Red List of Threatened Species

Provides taxonomic, conservation status and distribution information on plants, fungi and animals that have been globally evaluated using the IUCN Red List Categories and Criteria. These criteria are relevant to all species and all regions of the world in order to inform and catalyze action for biodiversity conservation (IUCN, 2017; Dee at al., 2014).

- 1982-United Nations Convention on the Law of the Sea (UNCLOS)

Defines the rights and responsibilities of nations with respect to their use of the world's oceans. It provides guidelines for research; businesses; utilization, protection, and conservation of the marine environment, and the management of marine natural resources (UN, 2001).

- 1993-Convention on Biological Diversity (CBD)

The key international treaty to develop national strategies for the conservation and sustainable use of biodiversity. It is the overarching framework for stemming and reversing biodiversity loss by the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of benefits arising from the use of genetic resources (Cooper and Mooney, 2013; Jones et al., 2016)

- Food and Agriculture Organization of the United Nations, Code of Conduct for Responsible Fisheries (FAO CCRF)

A reference framework for national and international efforts, including in the formulation of policies and other legal and institutional frameworks and instruments, to ensure the effective conservation, management and development of living aquatic resources, with due respect for the ecosystem and biodiversity (FAO, 2017).

- The World Trade Organization (WTO) regulations

Provides a framework for certainty, security and stability for trade. Its main function is to ensure that trade flows as smoothly, predictably, and freely as possible. Yet, there is little enforcement for the aquarium trade (Lee, 2012; Dee at al., 2014; WTO, 2017).

- Association of Southeast Asian Nations' Wildlife Enforcement Network (ASEAN-WEN)

Locating in the busiest maritime lane concomitant with the growing number of cases highlight commercial trades in wild flora and fauna triggered ASEAN countries to improve CITES implementation. The ASEAN-WEN is the wildlife law enforcement network that involves police, customs and environment agencies of all 10 ASEAN countries (Lin, 2005; Phelps and Webb, 2015; ASEAN-WEN, 2017).

- Law no.32 year 2009 on Environmental Protection and Management

This regulation acts as government action to prevent environment degradation and to build up a better environment. Human-caused or anthropogenic activities such as: pollution, overfishing, destructive fishing practices using dynamite or cyanide, irresponsible collection of live corals, and mining coral for building materials (Bryant et al., 2009) are strictly prohibited by this law.

- Law no.27 year 2007 on Management of Coastal Zone and Small Islands

Acts as a framework of integrated coastal management in Indonesia. The fundamental principle is sustainable utilization coastal resources with highly focus on public participation.

- Law no.32 year 2004 on Local Government

Explaining about the authority of local governments to manage natural resources (both on land and in the sea) located in its jurisdiction. This legislation is in line with the decentralization approaches by MoMAF on the management of marine resources. Furthermore, this act implemented in coral trade practice through permit application which required coral companies to get regional authority recommendation (see Fig. 3-7).

- Law no.45 year 2009 on Fisheries

A framework of fisheries management in Indonesia with the principle of optimal utilization and conservation. Since the act prescribed fisheries resources in a broad definition, this lead to overlapping management in coral trade.

- Law no.16 year 1992 on Animal, Fish, and Plants Quarantine

This act regulates domestic and international trade of live animals and plants by means of quarantine actions. It required all traffickers to ensure the health of animals and plants that are being traded.

- Law no.17 year 2006 on Customs Regulations

Explains regulation on the surveillance of export and import of all traded commodity. It also arranges export and import costs.

- Government Regulation no.12 year 2014 on the types and rates on the type of non-tax state revenue applied to the MoEF

It set out the administrative costs (*PSDH*) of each natural resources utilization. The utilization of plants and wild animals is regulated in the annex, point XVII. The PSDH is charged for permit application; domestic and international trade; artificial propagation, captive breeding, and ranching; restocking; and fines for any violations concerning natural resources protection and conservation.

- Minister of Trade Regulation no.50/M-DAG/PER/9/2013 on Export provisions

Provides provisions on the export of plants and wild animals that are not protected by the Indonesian law and belonging to CITES appendices. It explains that the exportation can only be done by company who already got agreement letter for plants and wild animals export from the Directorate General of Foreign Trade.

3.5 Conclusion

This chapter has shown that in the lure of beautiful morphology of ornamental corals, there was increasing number of the coral traded from Indonesia since 1990's. Previously, Indonesia has superseded the Philippines as a major exporter. The Indonesian ornamental corals have distributed worldwide with the USA as the biggest market. There were five most popular coral genera on that trade ranging from Acropora, Pocillopora, Fungia, Heliopora, and Trachyphyllia. In the following years, the trade likely continue to increase as the trendline shows a positive growth in the number of coral exported.

To deal with that, Indonesian government appointed MoEF *casu quo* Ditjen KSDAE as MA in cooperation with the P2O-LIPI as SA. It is required to all CITES member to have at least one MA and SA to regulate coral trade, as well as other plants and wild animals broadly. The key role of MA is oversee the trade through permit issuance based on SA recommendations. In practice, the MA also have coordination with another institutions such as Directorate General of Customs and Excise, Fish Quarantine Center, Directorate of Water Police, Directorate General of Foreign Trade, Universities, Non-governmental organizations, and Association (AKKII). The MA also worked with the local communities as they are a frontier in marine biota utilization.

The job of these institutions are highly referred to the CITES provisions. It used NDF approach as the fundamental principle considering the stock availability and the survival of coral species traded in the wild. Several Indonesian national laws, government regulation, and certain ministerial regulations came into effect to implement the CITES provisions on international coral trade. These regulations provide a framework, guidelines, technical assistance, and requirements for coral companies who want to circulate Indonesian corals globally. Some regulations have an overlapping issue concerning coral trade management. However, it did not put high concern to coral traders as the MA is still governed by the MoEF.

Chapter 4 Assessing ornamental coral trade practice in Bali, Indonesia: A market trend and comparative analysis

4.1 Introduction

This chapter is a case study of the ornamental coral trade practice in Bali. It presents the last seven years report on the coral trade. An up to date report data in the broader scale is also presented as this study used a market trend and comparative analysis. It first describes the trade network prior to exportation. It will elaborate how did the fishermen as a frontier producer collect the corals as well as culture them in a coral farm. The next section presents results and discussion on analysis of coral trade data in Bali and in national scale of Indonesia derived from BKSDA Bali, AKKII, and CITES trade database. This chapter will further examine the management of this curio trade in Indonesia. Potential problems and conservation efforts will also be discussed. The final section concludes with a brief review based on its findings.

4.2 The coral trade network

The distribution network for ornamental corals forms a long market chain. Olivier (2003) pointed out that it is a kind of complex, highly dynamic system, and there is a trend toward bypassing intermediaries and more vertical integration. Yet, sketchily, it has simple network from the collection until the corals received by the consumers (Fig. 4-1). Wabnitz et al. (2003) added that the trade involves a series of collectors, fishers, import and export wholesalers, middlemen and exporters, a number of importers, retailers and, more recently, trans-shippers.

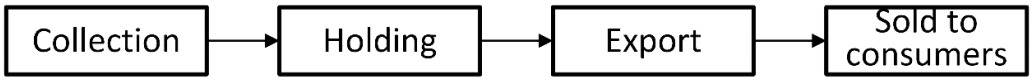

Fig. 4-1 Simplified market chain of ornamental coral trade

The organization of ornamental coral trade is started from the ocean by means of corals collection. It is carried out by the fishermen which mainly live in local area. They tend to work alone or in small groups, who are either self-employed or working for a company. At present, the collection is performed by two ways: direct take in the reefs

area (wild capture) and coral farming through propagation. The wild-sourced and/or harvested corals are then transported to holding ponds prior to exportation. In importing countries, the corals will received by wholesalers then sold to consumers. The following sections will prescribe more about the way of coral collection as an initial stage on market network, the distribution channels of two sources of corals, and the main players in corals trade.

4.2.1 Wild-sourced corals

Since the trade began in 1980's, the source of coral was only wild capture. CITES database recorded that in the period of 1985-1999 corals exported from Indonesia were totally wild corals. The global corals market also had the similar case with the wild organisms as the major part of the trade. Still and all, it was not entirely wild sourced corals as the propagation technique had begun to be applied (Green and Shirley, 1999; Tlusty, 2002; Tissot et al., 2010; Thornhill, 2012; Olivotto et al. 2016).

Today, wild corals collection is still occurred in Indonesia though only permitted for old companies established before 2002. This is a mandate of Ditjen KSDAE to protect coral reef ecosystem which is experiencing over exploitation. Coral collection efforts effectuated by the fishermen must be environmental friendly and does not damage the reefs area. These should be based on the SA recommendations concerning species abundance, growth rates or other biological aspects. In addition, collectors can't take corals directly in all of Indonesian waters as the harvest sites has also determined by the SA (Fig. 4-2).

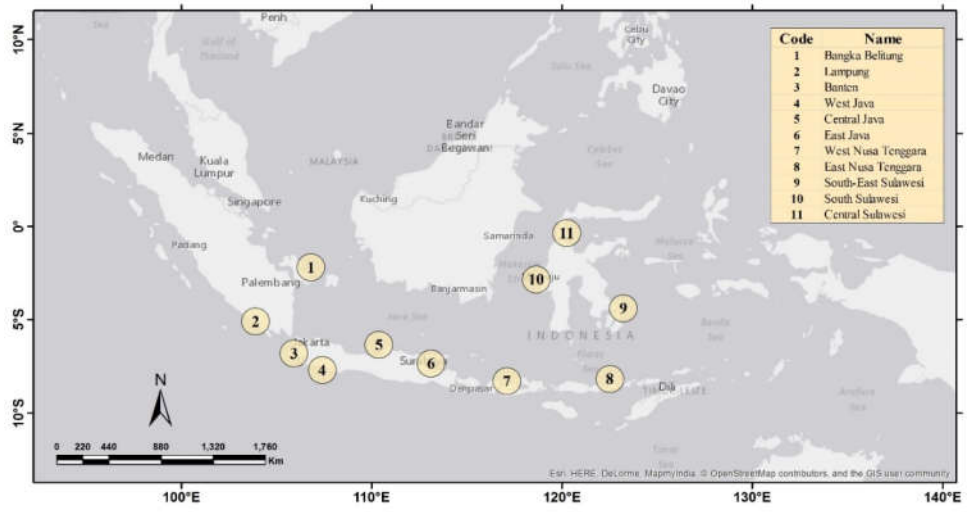

Fig. 4-2 Locations of wild-sourced corals collection in Indonesia

The Indonesian government has set out several locations for wild corals collection. These sites spread out in 11 provinces including: Bangka-Belitung, Lampung, Banten, West Java, Central Java, East Java, West Nusa Tenggara, East Nusa Tenggara, Southeast Sulawesi, South Sulawesi, and Central Sulawesi. UNEP-WCMC (2015) reported that the harvest locations were selected based on the coral abundance with annual assessments to assist with establishing the quotas.

In these locations, wild corals were collected by the fishermen by a method called 'hookah' for wild corals collection. This method uses compressors which are installed on their vessels and connected to long plastic tubes that divers bite between their teeth or to which a regulator is attached. They often use a hammer, iron crowbar, chisel or screwdriver to remove target colonies. Specimens are preferably removed with a small portion of the reef to which the organism is attached. Typically, collectors tend to target small-sized colonies of hard and soft corals that can be removed whole. However, sometimes only fragments are taken (Wabnitz et al., 2003). Kudus (2005) added that non-hermatypic corals that free living on the seabed are the preferred specimens as the fishers can take them directly without any tools. The most frequently encountered of these such corals are *Fungia* sp. dan *Heliofungia* sp.

Hereafter, corals taken by fishermen for trade have a certain size as set by the SA. Determination of this size is applied in order to reduce the negative effects on the corals, optimize the reproductive capacity of species and the sustainability principles, and guarantee the coral marketing as the consumers have a specific size of corals to be put in the aquarium. There are exceptions against corals utilized for an educational purposes, medical interests, and the public aquarium which allowed beyond a predetermined size. However, for the cultured corals are allowed to be set in several sizes that could be more vary (this part will be discussed in the next section). As for the wild corals size that have been agreed and may be taken are as follows:

- Massive; Sub-massive; and Solitary (members of the Family Fungiidae) corals, maximum diameter and length is 25 cm.
- Branching corals, maximum diameter and length is 25 cm as measured by the length of a branch or the diameter of the colony. Branching corals must be taken from mature and grown colonies instead of a small colonies as they have not been able to reproduce. To date, the abundance and rejuvenation of branching corals are still relatively high so that collection of such corals tend to be more in number.

- Encrusting and foliose corals, maximum diameter is 25 cm by crosswise measurement.
- Type of target species that have high demand but not included in the three groups above. The collection only limited to one piece of specimen with a maximum size of 25 cm.

The size and number of ornamental corals taken by fishermen is based on orders from the middlemen or exporters. At times, some fishermen took more coral species to be used as stock. Those corals are then placed in a hidden place with a depth of about 15 meter. They arranged neatly and put a tag by coral type so that if there are more orders they do not need to go again to collect corals on the new orders list.

In practice, fishermen usually take corals in the reef slope area at depths of 10-40 meter (Fig. 4-3). They rarely do corals collection in reef flat due to the area is dominated by branching corals and tend to be uniform. What the fishers did is correspond to scientific results of several studies concerning reef zonation (Murray 1880; Chappell, 1980; Karlson et al. 2004; Block, 2007; Montaggioni and Braithwaite, 2009; Obura, 2011; Knowlton and Jackson, 2013; Barkley et al. 2015).

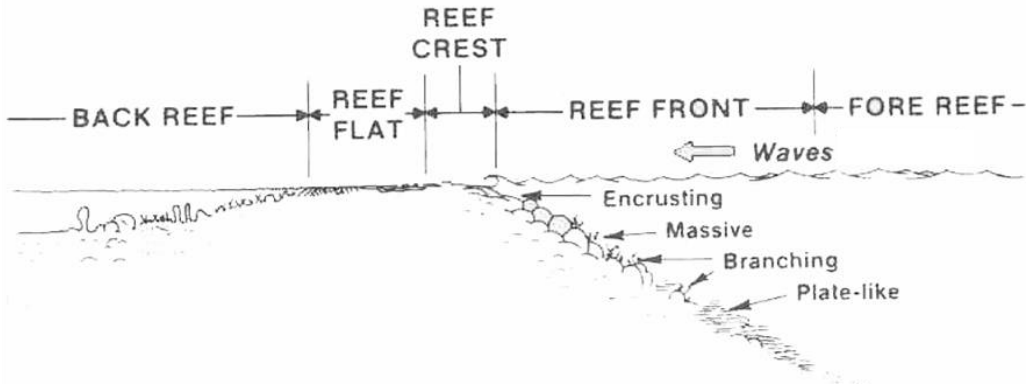

Fig. 4-3 Zonation of a near shore reef (source: Zarinah, 2007)

The reef slope or fore-reef or the seaward slope is the area of reef that is the farthest away from the shore. The area is home to abundant coral species due to the most hospitable and favorable environment. The diversity of corals on this part of the reef is strongly correlated with light availability and limited wave action. The most diverse coral species are found on the reef slope between 15-20 meters of depth, and as depth increases diversity of coral species decreases. The coral species richness declines across three adjacent habitats from reef slopes, reef crests, and reef flats (Chappell, 1980; Karlson et al. 2004; Block, 2007).

Afterwards, collected corals should be wrapped in plastic bags and then put in the basket. This is done to avoid injury due to friction between the corals in one basket. Later on, they are sorted on a boat and placed inside a polystyrene box containing seawater. During the sorting process, direct exposure to sunlight should be minimized to avoid corals become stress. Fishermen typically bring collected corals back to shore at the same day. However, in collection sites that tend to be fairly isolated, corals may be on board the boat for several days before being landed. Once ashore, corals are transported to domestic wholesaler or directly to exporters and then placed in holding tanks for quarantine.

The corals received by domestic wholesaler or middlemen still have a longer distribution chain (Fig. 4-4). The domestic traders will then send wild corals to exporters by road using a pick-up car or truck. These shipments must be accompanied by an official document, known as SATS-DN (*Surat Angkut Tumbuhan dan Satwa Liar – Dalam Negeri* or coral domestic freight letter). Meanwhile, coral sent by collectors to exporters will be re-propagated in coral farm or placed in shelter pond for quarantine.

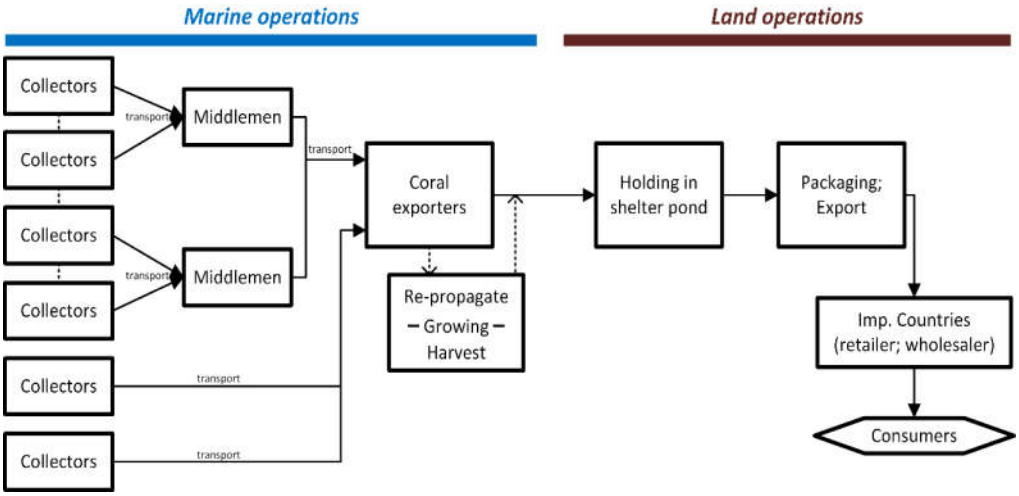

Fig. 4-4 Distribution channels of wild-sourced ornamental corals

Most of wild hard corals will have re-propagation in coral company' farm whereas soft corals normally put directly in shelter pond. According to AKKII data in 2016, these processes were done by 48 coral companies (actually these were 59 company warehouses in total as a company may has more than one warehouses) in Indonesia who obtained permit to sell wild corals abroad. These companies spread out in 6 provinces where 4 provinces are also harvest location for wild corals. Amongst all warehouses, there were 24 company warehouses located in Bali comprising 40.68% of

total amount (Table 4-1). The rest were based in Banten, East Java, Jakarta, Southeast Sulawesi, and East Nusa Tenggara.

Table 4-1 Amount of coral companies that obtained export permit for wild corals based on warehouse location

Warehouse Location	Amount	Percentage
Bali	24	40.68%
Banten	12	20.34%
East Java	11	18.64%
DKI Jakarta	8	13.56%
Southeast Sulawesi	3	5.08%
East Nusa Tenggara	1	1.69%
Total	59	100.00%

Based on research fieldwork, these 24 licensed coral companies for wild corals export in Bali are conducted re-propagation. This mode aims to fragment coral specimens into smaller pieces as the corals size sent by the fishermen/middlemen are too big to be exported. Besides that, re-propagation intends to bring back the vivid colors of corals through refreshment in open waters or controlled shelter ponds by reason of they were initially in pale colors due to stress during transportation. This method does not require a long time, normally in a week, as it is just to make wild corals fragment looks more natural previous to exportation.

Wild corals that have been matched in size and do not require re-propagation, habitually need a quarantine for hours in shelter pond. This is done to restore the health of corals which previously stress wherefore domestic shipments. It was known that the longer the delivery time will alter the composition of water parameters in coral bags which can cause physiological damage and even death of corals. Cole et al. (1999) and Watson et al. (2010) claimed that recommended length of shipments time ranges from 24 to 48 hours. Therefore, if the shipments pass through multiple transit locations, a quarantine should preferably be done at each location.

Corals are then packed in plastic bags filled with seawater and oxygen. The bags are made of transparent polyethylene plastic and should be at least 3 mil thick to withstand some abuse without leaking. Many experienced commercial shippers choose for a more expensive 4-mil plastic bag. Corals in bags then sealed and placed in a cardboard box. It often reinforced with polystyrene foam for added insulation. Ornamental corals packed from Asia frequently make use of one of two size boxes: 60x42x30 cm or 49x38x38 cm (LxWxH). In Indonesia, it could be vary amongst coral

exporters. Although there are many different sizes and shapes used for shipping ornamental corals, the boxes were packed upon the safety procedure for live marine biota shipment (Cole et al., 1999; Wabnitz et al., 2003; Watson et al., 2010).

4.2.2 Cultured corals

Supply of cultured corals from Indonesia was recorded in the early of 21st century (2000-2004) by CITES, comprising 2.2% of total export. Given the fact that wild collection is a threat to coral reef conservation, the industry is now directed to elevate cultured corals production (Shuman et al., 2004; Timotius et al. 2009; Rhyne et al., 2014). The coral industry in Indonesia is obligated to have a coral farm as a place production of corals traded. At present, wild corals collection is only licensed to coral companies established before 2002 (Timotius et al., 2009). Ditjen KSDAE decided not to issue permit to conduct such activities anymore for all new coral companies. As a consequence, cultured corals probably continue to rise in number as well as bring many benefits (Pomeroy et al., 2006; Leal et al., 2016).

In trade, culturing corals often touted as an effective way to reduce pressure on coral reef resources. By means of this technique, ornamental coral production can be enhanced to meet market demand. Besides in corals production, consumer preferences should also be directed to cultured corals through quota limitation on wild corals. Timotius et al. (2009) claimed that until now consumers still tend to favor wild corals with a slow growth rate. This trend must be changed slowly in view of the growth rate of coral could be lower than the exploitation rate. On the other hand wild corals are also more difficult to adapt to aquarium conditions instead of cultured corals, although it has more attractive appearance.

To date, there are two procedures to culture coral by way of biological characteristics of coral in reproduction. These modes including asexual reproduction through fragmentation (Arvedlund et al., 2003) and sexual reproduction (Olivotto et al., 2016). Fragmentation, or better known by the terms of “transplantation” (in Indonesia) and “fragmentation” (globally) is a common asexual reproductive mode of hermatypic corals which the body of the parents brakes or is broken into disparate fragments to be produced as a new colony. Meanwhile, sexual reproduction for sure is much more biologically rather than the previous one. Corals are triggered to spawn eggs and sperm for internal within their bodies or external fertilization. This method require a lot of steps and tend to be costly. It needs many experimental or laboratory works with more

labor intensive for hatcheries and larval rearing (Epstein et al., 2001; Horoszowski-Fridman et al., 2011).

The first method likely to be done by all exporters to supply the traded coral stock. During research fieldwork in Bali, there were no companies that apply coral cultivation method through sexual reproduction. It was acknowledged that propagation is an easy process that does not need specialized skills and a lot of equipment. Broadly, based on ICRWG monitoring, Timotius et al. (2009) revealed that coral farming method used in all coral companies throughout Indonesia is propagation through fragmentation for most hard corals species. The monitoring team never met other method applied in fields.

Coral propagation in Bali for a trade purpose conducted by fishermen who are working for company. Some are self-employed and worked in a small community. They later sell the harvested corals to the company. Fishermen propagated coral at 10 locations surrounding Bali Island which have been designated by BKSDA. These include Gilimanuk, Sumberkima, Gondol, Patas, Sambirenteng, Tembok, Candidasa, Nusa Lembongan (Desa Julut Batu), Nusa Penida (Desa Ped), and Serangan Island. The latter one is the most occupied place as coral farm.

There are 21 exporters who placed their coral farm in Serangan Island. The protocols to propagate corals are similar in every company. They use racks and tables made of iron to put coral fragments. Another type of table made of PVC is not suitable in Serangan Island waters since the waves are relatively strong. Racks generally have a dimension of 1 m^2 with a capacity of a hundred of coral nubbins or 16 brood stocks for each. Elastic strap which is a scraps of vehicle inner tube, is mounted in each rack frame to withhold or binding fragment substrate. Two racks can be placed in a 2 m^2 iron table (Fig. 4-5). There are two kinds of table including open type (no upper part that can be coated by nets as a sediment catcher) and semi-closed type (having upper part to be overlaid by nets).

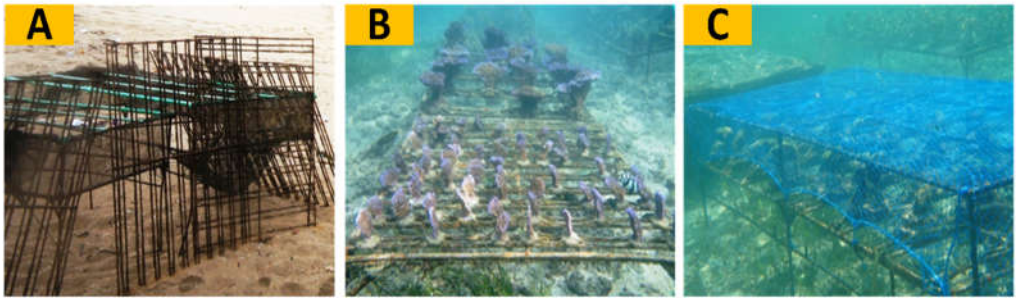

Fig. 4-5 Racks (a) and tables for coral propagation in Serangan Island, Bali. Open type table (b) has no upper part to be coated by nets as applied in semi-closed table (c)

Fragment substrates placed on each rack are artificial materials made by mixing equal parts of Portland cement and aragonite sand. This mixed materials also known as aragocrete. It is a common fragment substrate generally well received by consumers (Barton et al., 2015). A substrate provides a concave-like area for adhesion of the coral fragment. Furthermore, it is made like a dome with two levels where the bottom has wider area to be tied on rack frame. Normally, a coral company makes three types of substrates used to stick brood stocks, coral nubbins, and nano corals which have diameter of 15-20 cm, 4-6 cm, and 2-4 cm respectively (Fig. 4-6). The second one is predominantly to be made as favored by the market.

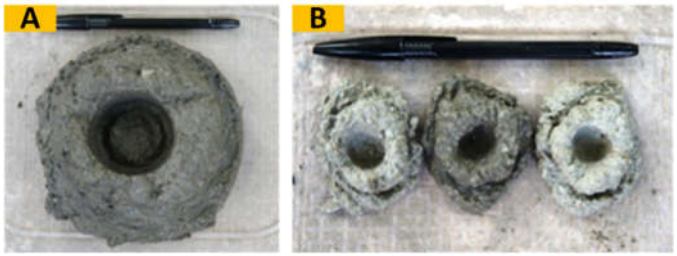

Fig. 4-6 Examples of substrates for coral propagation of (a) brood stock and (b) coral nubbins

Small fragments then be attached on a substrate using an adhesive stuffs. These fragments were initially detached from large brood stock colonies (Fig. 4-7) which are available in coral farm or obtained from wild reef area (Bongiorni et al., 2011) using several tools such as: tin snips, side cutters, pliers, hammer, and chisel (Rinkevich, 2000; Shaish et al., 2008, 2010; Barton et al., 2015). A coral colony designated as a brood stock in coral farm, at least has a minimum age of 1.5 years for branching corals e.g.: *Acropora* sp. (Lirman, 2000; Rahmat et al., 2001) and *Montipora* sp. (Kavousi et

al., 2016) or 2.5 – 3.5 years for another coral life-forms. Meanwhile, an adhesive substance regularly used is a car refinish material used to fill pits, scratches, and other superficial irregularities (Willemse, 1989).

Coral fragments were cut in medium size and cultivated with minimal wound in order to hasten recovery after planting. Suharsono (2008b) claimed fragment size should be 3-5 cm with at least two branches. Several studies revealed that corals with a single branch and size less than 3 cm growth slowly (Sadarun, 1999; Cahyadi, 2001; Herdiana, 2001; Aziz, 2002; Zakaria, 2002; Nani, 2003; Soong and Chen, 2003; Subhan, 2003; Syahrir, 2003; Sugiyanto, 2004; Yuliantri et al., 2006; Johan et al., 2007). Besides that, larger fragment size also makes cultured corals have less aesthetic shape. Coral companies in Bali, however, has implemented measuring in coral fragments of 5-8 cm in length size with a minimum of two branches.

Fig. 4-7 Cutting coral fragments from a brood stock colony

Concurrently with the planting steps, each coral fragment has to be appended with a tag given by BKSDA Bali. This tag is attached to coral nubbin and nano coral substrates as these are coral size that will be exported while brood stock is only placed in coral farm. The tag is made by plastic material and include some information such as code of BKSDA area, company code, and year of propagation. The following figure is the tag used to propagate corals for trade purpose.

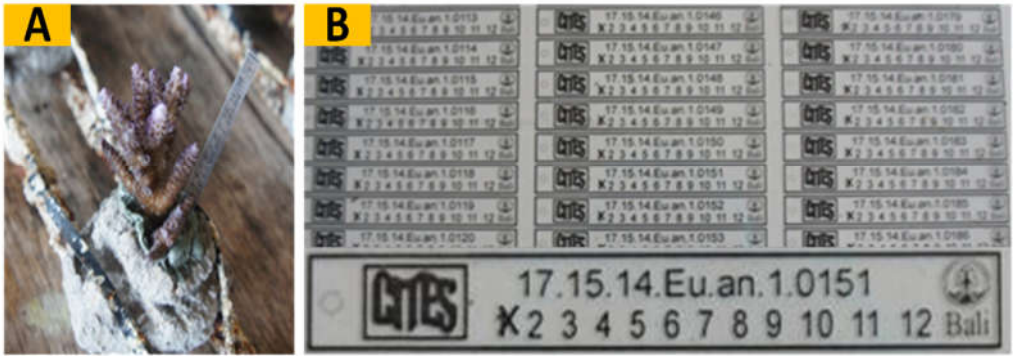

Fig. 4-8 Tags on coral fragment (a). The tag (b) includes BKSDA code, company code, year of propagation, species name, filial generation, and plantation order is respectively indicated in "17.15.14.Eu-an.1.0.151". Others are logo of CITES and BKSDA Bali while the lower row indicates month of propagation

Afterwards, fishermen raised all coral fragments until the harvest time which is differ depending on species. Ditjen KSDAE through Director General PHKA Regulation no.9/IV/Set-3/2008 has listed harvest time of 35 cultured coral species (Table 4-2). Nonetheless, the list is not enough yet considering that there are 80 coral species have already successfully to be cultured as it was reported by AKKII in 2016. Fishermen used to compare similarity amongst species to get around of such things. The other way is predicted the harvest time of unlisted species based on common genus or family. The list only used to cultured species whereas for the purpose of re-propagation (refinement) of wild corals fishermen did not implement it.

Table 4-2 Harvest time of cultured coral species in Indonesia

Harvest time	Species name (Code)			
3-6 months	- *Acropora* sp.	(Ac sp)	- *Pocillopora verrucosa*	(Po ve)
	- *Alveopora spongiosa*	(Al sp)	- *Porites lichen*	(Pr li)
	- *Hydnophora microcomos*	(Hy mi)	- *Porites nigrescens*	(Pr ni)
	- *Hydnophora rigida*	(Hy ri)	- *Porites cylindrica*	(Pr cy)
	- *Merulina ampliata*	(Me am)	- *Seriatopora caliendrum*	(Se ca)
	- *Montipora* sp.	(Mo sp)	- *Seriatopora hystrix*	(Se hy)
	- *Pocillopora damicornis*	(Po da)	- *Stylophora pistillata*	(St pi)
	- *Pocillopora eydouxi*	(Po ey)		
8-12 months	- *Acanthastrea echinata*	(Ac ec)	- *Galaxea fascicularis*	(Ga fa)
	- *Caulastrea* sp.	(Ca sp)	- *Goniastrea pectinata*	(Go pe)
	- *Echinophyllia aspera*	(Ec as)	- *Goniastrea retiformis*	(Go re)
	- *Echinopora lamellosa*	(Eh la)	- *Pavona cactus*	(Pa ca)
	- *Euphyllia glabrescens*	(Eu gl)	- *Platygyra lamellina*	(Pl la)

Table 4-2 *(continued)*

Harvest time	Species name (Code)			
8-12 months	- *Euphyllia paraancora*	(Eu pa)	- *Turbinaria mesenterina*	(Tu me)
	- *Favia* sp.	(Fa sp)	- *Turbinaria peltata*	(Tu pe)
	- *Favites chinensis*	(Fv ch)	- *Turbinaria reniformis*	(Tu re)
	- *Galaxea astreata*	(Ga as)	- *Turbinaria stellulata*	(Tu st)
> 24 months	- *Lobophyllia hemprichii*	(Lo he)	- *Symphyllia agarricia*	(Sy ag)

During the harvesting, cultured corals must be cleaned of macro algae attached in the substrate. These macro algae might be harm due to their attachment on coral host. On the other hand, algae play important roles in reef ecology as they are the basis of the reef food-web and major reef formers (Diaz-Pulido and McCook, 2008). Another researchers added that the algae have mutual interaction with corals (Sorel et al., 2014) through regulation of immune system (Weis, 2008) and provide essential nutrients (Yellowlees et al., 2008). They also brought more natural appearance for cultured corals that make them more favorable for aquarium hobbyists.

The harvested corals from propagation effort have similar treatment with the wild-sourced. All harvested corals should be wrapped in plastic bags and then put in a polystyrene box containing seawater. Fishermen typically harvested corals at low tide as the waves tend to be quieter. This activity normally takes 3-4 hours until the corals are temporary packaged then to be transported to company warehouse.

Corals are then placed in shelter pond for acclimatization for approximately 24 hours. During this process, harvested corals are put in plastic racks and grouped by species and order list. Each racks contained 25 – 35 pieces of corals that have been laid out neatly so as not rubbing each other. On the next day, corals are ready to be packed.

The distribution channels for cultured corals may be shorter than wild corals. There are less transportation due to the coral farm located close to company warehouse. Yet, for companies which have coral farms in another places, transportation can take several hours by land. As it was aforementioned that there are 9 more locations for coral farm outside Serangan Island. Each location has its own water parameters and bathymetric form which is more suitable for certain coral species. These locations, except Serangan Islands, are predominantly used to propagate large polyp species

(LPS) and deep-water corals. Another reason is traders do not need to do re-propagation as they did for wild corals.

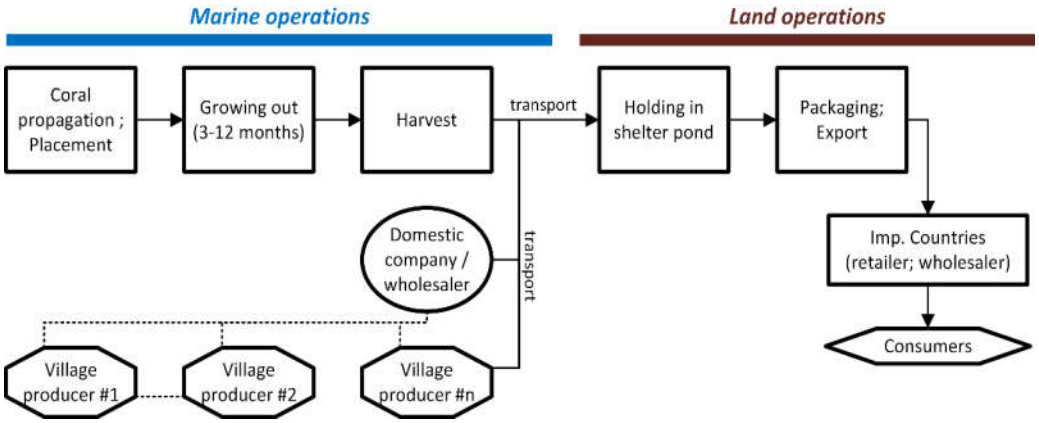

Fig. 4-9 Distribution channels of cultured ornamental corals

There are domestic wholesaler and village producer (Fig. 4-9) which also become players supplying cultured corals for international trade. Technically, they conducted coral propagation and other marine operations (e.g. maintaining, harvesting) in the same way with the coral exporters. They worked in a small group consist of local communities. Village producers can sell cultured coral to coral companies directly or cooperated with domestic wholesalers / companies. These domestic companies must have SATS-DN since they run their business within national scale.

Furthermore, the next stages of land operations for cultured corals are exactly same with the previous one. Once quarantine finished, corals are prepared to be packed in two layers transparent polyethylene plastic bag. A paper, normally, placed at the bottom of the second layer bag in order to now if there is leakage. Packed corals are then sealed and placed in a polystyrene box intended for reinforcement before being put into a cardboard box. Each cardboard box need to be accompanied by all required documents including CITES permits, Certificate of Origin (COO), health certificate, invoice, packing / order list, and airway bill, as a license allowing corals to leave the exporting country. As all the export provisions have completed, BKSDA and Bea Cukai officer will stamp and sign on the attached documents.

Wabnitz et al. (2003) added at the receiving end, importers must clear the shipment with customs and the consignment undergoes another veterinary check. The importer then transfers the shipment to a wholesale facility. Once the boxes have opened, corals are moved to holding ponds in order to acclimatize them to life in captivity, particularly to new different water parameters. Care is taken to minimize

stress and thus ensure maximum survival rates. The lighting provision of the right color spectrum at the appropriate intensity, is of crucial importance to the survival of coral species in indoor captivity. Following this process, corals are either sold to other wholesalers or retailers.

4.2.3 The Trade Players

The series of players in marine aquarium trade is widespread and constitute a market chain distributing corals from ocean to aquarium. These mainly involve collectors, wholesalers, and coral exporter companies. The following sections will elaborate the roles of these players (Olivier, 2003) in the context of ornamental coral exportation in Bali.

4.2.3.1 The Fishers or Collectors

Collectors are typically small-scale fishers who work alone, in small groups (often as family units), or are employed by coral companies. The terms of collectors are either used for wild and cultured coral fishers. For wild coral collection, they usually work with artisanal equipment. They are the first link in the distribution chain. A groups of collectors may supply domestic wholesalers and some sell directly to the exporters. Wild coral collectors are paid for the number of corals they collect whereas cultured coral farmers are normally paid monthly as they worked for a company. In Bali, a wild coral collected by fishers is paid for 1 – 2 USD which is worth up to 18 – 298 USD (price based on www.uniquecorals.com) in an importing country. Wabnitz et al. (2003) stated shipping charges are the main reason behind the discrepancy between marine ornamental prices in the exporting country and final retail price. At the same time, the salary for a cultured coral farmer may be ranging from 150 – 250 USD per month.

4.2.3.2 The Wholesaler

These players also known as middlemen. They buy corals from collectors and then sell to exporters. Some wholesalers are now disappearing from the scene, particularly for the importer wholesalers who are still working in traditional way and intended to re-sale or re-export the corals. This mainly because of the introduction of transshipping and the development of the electronic market. Middlemen also can order from a trans-shipper aside from their own trans-shipment. Ordering corals through a trans-shipper may get better prices but then acclimatization is compulsory to be conducted for corals refreshment. It means the wholesalers must have the necessary

equipment and obtaining an operating license and equipment certification. After all, in exporting countries, the middlemen are only bridging between collectors and exporters.

4.2.3.3 The Exporter

They are the main player in the global trade of ornamental coral. Exporters are licensed companies which is now spread in 7 provinces in Indonesia, including Banten, DKI Jakarta, Central Java, East Java, Bali, East Nusa Tenggara, and Southeast Sulawesi. To date, there are 26 coral exporters in Bali, of which 24 companies have a permit to export wild-sourced corals. According to AKKII data in 2016, this number constitutes 45.61% of all coral companies in Indonesia.

In the case of wild corals collection, they buy corals either from wholesalers or directly from collectors. They may also employ their own fishermen. Meanwhile, for cultured corals, 4 – 10 people are employed by the company at each coral farm. Collected or harvested corals have to be put in shelter ponds for quarantine. Therefore, infrastructure needs can be substantial, requiring warehouses full of containers, aquariums, tanks, or even outdoor concrete basins. Finally, exporters must fulfill all required documents for each consignment to sell corals abroad.

4.2.3.4 Airline companies

All exporters used the service of international airline companies to transport corals to destination countries. These airlines are the members of air transport associations such as the International Air Transport Association (IATA) and the Animal Transportation Association (AATA). Today, 265 airlines or 83% of total air traffic are the member of IATA. The associations are dedicated to safe live marine ornamentals transportation worldwide with global standards for airline safety, security, efficiency and sustainability. These are implemented on the corals packaging which used double layers of box, polystyrene as first layer then a cardboard box for outer layer. The airlines are therefore important players by reason of the better service of transportation, the better quality of corals accepted by importers.

4.2.3.5 The Government

Of all that has been above described, the government is liable key important player in coral trade. The government institutions are mainly involved in the law enforcement of the trade. As it was elaborated in previous chapter that they set up rules and regulations in order to improve management schemes. For an example, Indonesian

government has established annual quota either for wild or cultured corals to repress exploitation against the reef. They have numerous cooperation with several scientific agencies, associations, NGOs, and local communities in order to enact better coral trade management. Such example is a product of this cooperation. Another example is limitation of the locations for wild corals collection.

4.3 Results and Discussion

Analyses of trade data of ornamental corals were based on CITES database, AKKII annual report, and BKSDA Bali data. It first presents the trade in Indonesia during three decades according to CITES database. It will provide a big scheme of the trade before an explanation in regional analysis of the international trade in Bali. Despite the trade in Bali did not use such a long time series data as in first section, the analysis revealed the market trend based on seven years BKSDA Bali data and the proportion of international corals trade in Bali province upon of total national exportation using AKKII data. Furthermore the current management in coral trade in Indonesia and lesson learnt from the marine ornamental trade of several exporting countries are also figured out in advance of the suggested management approaches that can be applied in the trade.

4.3.1 Trade in ornamental corals in Indonesia

The CITES data recorded corals trade in Indonesia has begun since 1985. The total number of ornamental corals exported from Indonesia grew annually. During the period of 1985 until 2014, the trade grew at yearly rate of 3.13%.

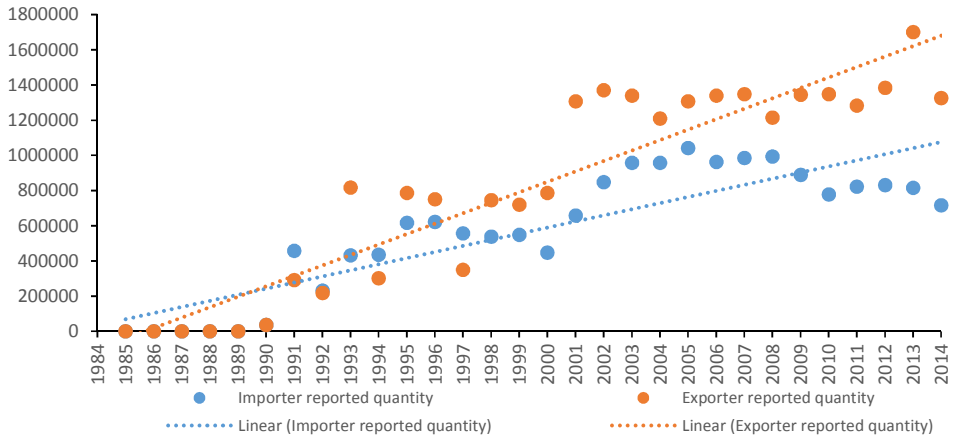

Fig. 4-10 Market trend of ornamental corals exported by Indonesia during 1985-2014 as reported by CITES

The results indicate that the number of corals exported by Indonesia did not match with the amount received by importing countries. The reason is that differences in documents reported in exporting and importing countries. AKKII as a bridging agency are compiled coral trade data in Indonesia as an exporting country from all coral company reports. Meanwhile, the MA also recorded data based on permits issuance. In importing countries, information and the number of ornamental corals are derived from the actual quantity of corals imported for the aquarium trade in every national port entry (Green, 2003; Wabnitz et al., 2003). In addition, the importer reports could be vary as it was obtained from several countries. To date, 89 countries are imported corals from Indonesia.

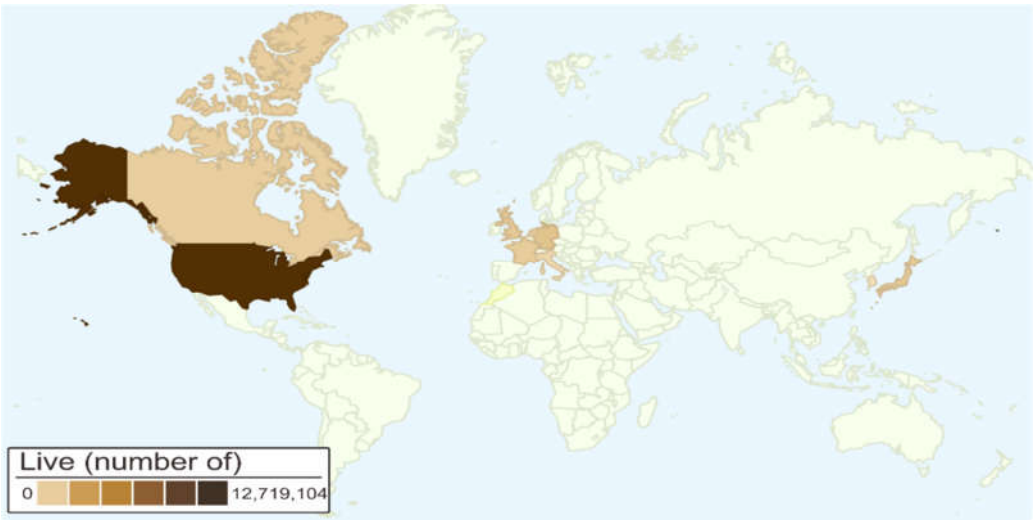

Fig. 4-11 Distribution map of ornamental corals exported by Indonesia during 1985-2014 as reported by CITES

As reported by Indonesian authority to CITES, a total of 25,569,984 corals were traded within three decades. These corals were distributed all over the world with the USA as the largest importer comprising a total amount of 12,719,104 corals in the same period of time. This amount contributed 49.74% of total exported corals by Indonesia. The rest corals were mainly exported to Canada, East Asia, and European countries.

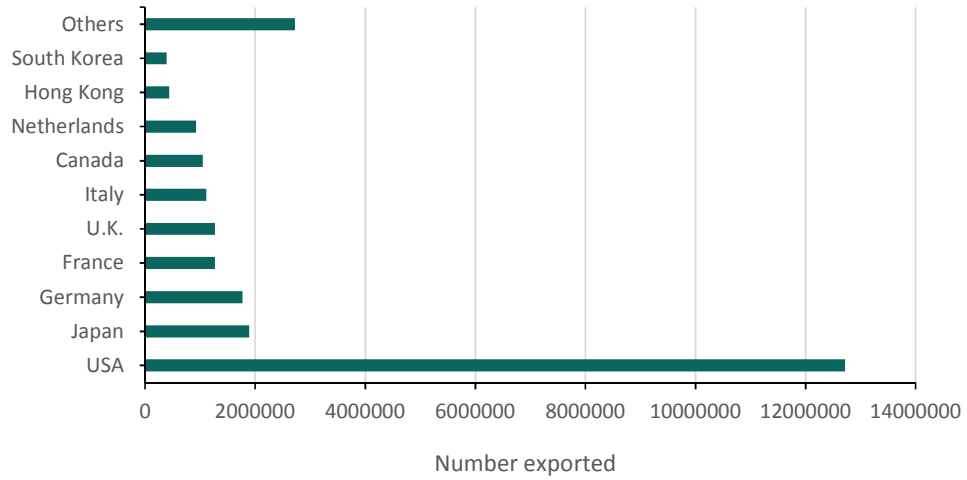

Fig. 4-12 Top ten importers of ornamental corals from Indonesia during 1985-2014 as reported by CITES

Japan, Germany, France, U.K., Italy, Canada, Netherlands, Hong Kong, South Korea, together with other 79 importing countries constitute 50.26% of total Indonesian corals exportation. Japan as the second largest importer have imported 1,890,157 pieces of ornamental corals and contributed 7.39% of the total amount. Japan with South Korea and Hong Kong, P.R. China have made importations of 2,722,987 (10.65%) pieces of corals in East Asian region. Meanwhile, five European countries (Germany, France, U.K., Italy, Canada, and Netherlands) made up of 6,354,036 (21.23%) corals exportations. The aggregate of Indonesian wild and cultured corals exportation to Canada was 1,051,292 pieces or set up 4.11% of total exportation during 1985 – 2014. Moreover, the other 79 countries (see Appendix 2) have imported 2,722,566 pieces of ornamental corals and constitute 10.65% of total coral exportation from Indonesia.

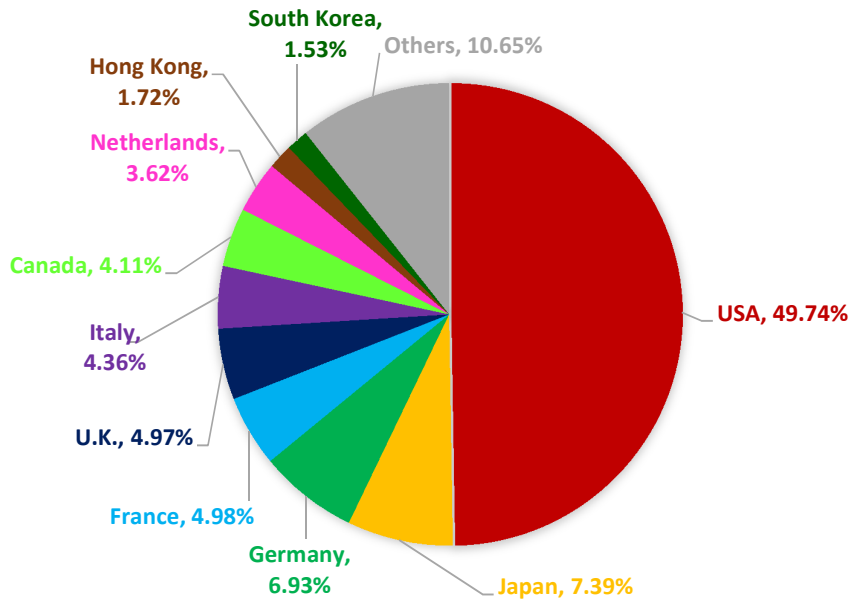

Fig. 4-13 Market share of ornamental corals exported by Indonesia during 1985-2014 as reported by CITES

The corals were either obtained from wild collection or cultured corals. Since the beginning until 2003, trade were only comprised of wild sourced corals. Despite the fragmentation technique was founded in 1960's (Wells, 1966; Highsmith, 1982; Hoeksema 2013), CITES database recorded that cultured corals from Indonesia were started to be traded since 2004.

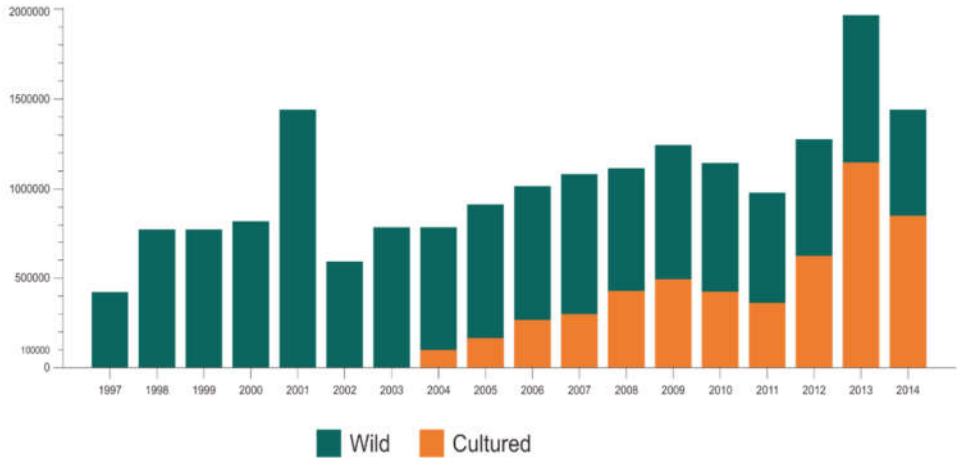

Fig. 4-14 Source of live corals exported by Indonesia during 1997-2014 as reported by CITES

Trend in cultured corals trade grew steadily during a decade since it has begun in 2004. It had smooth decline in 2010 but then started to increase again in 2012. In the last year of data, second decline was occurred again. Furthermore, in the 5 years temporal analysis, the portion of cultured corals indicate consumers were moving towards sustainable trade.

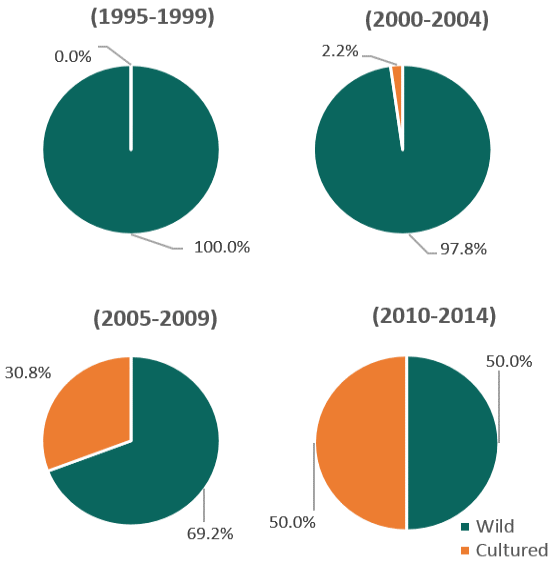

Fig. 4-15 Five years temporal changes in exported corals proportion of Indonesia during 1997-2014 as reported by CITES

As it was directed by CITES provisions and KSDAE, the trade in ornamental corals should not detriment to coral reef ecosystem (Suharsono and Bruckner, 2008; Timotius et al., 2009; Smith et al., 2011). The trade may meet those mandate as the cultured corals traded from Indonesia globally increased in proportion based on five years temporal data of CITES. It was fully consisted of wild corals in 1995-1999. In the second five years (2000-2004), the cultured corals represented 2.2% of total exportation by Indonesia. The trade of wild corals decreased dramatically in third five years concurrently with increasing portion of cultured corals by 30.8%. In the fourth five years, wild sourced and cultured corals has had same portion in corals export realization. Recognizing these trends, the portion of cultured corals traded from Indonesia will seemingly continue to increase. On the other hand, hobbyist are tend to put their option in cultured ones by reason of these such corals are adapt better to aquarium conditions.

4.3.2 Seven years ornamental coral trade in Bali, Indonesia

Despite the data obtained from different source in different time period, the corals traded from Bali presented similar results with the national exportation report of Indonesia. There were 9,583,821 pieces of ornamental corals traded by coral companies based in Bali during 2010 – 2016. The number accounted for approximately 50% of total corals exportation by Indonesia. In this period, international coral trade in Bali grew at annually rate of 19.06%. The trade has carried out by 25 coral companies as reported by BKSDA Bali in 2016.

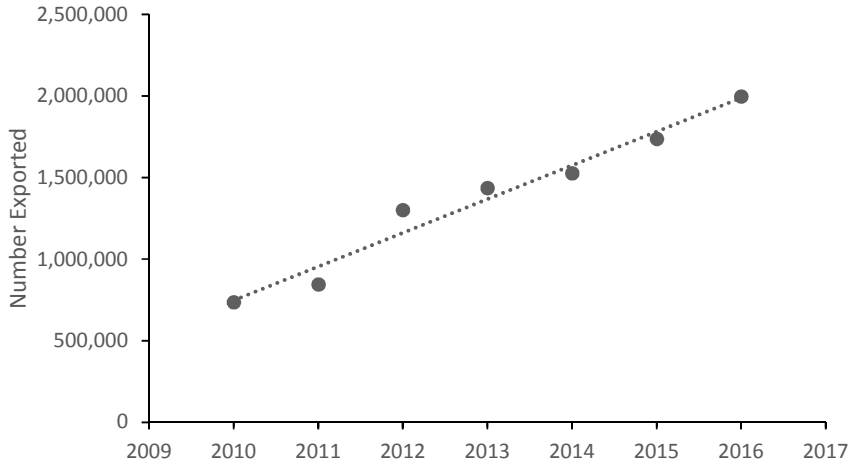

Fig. 4-16 Number of ornamental corals exported by coral companies based in Bali, Indonesia during 2010-2016

In 2010, exporters in Bali has exported 735,960 pieces of corals. It might be a big number as compared to export realization by Indonesia which was traded 1,347,762 corals as reported by CITES. In the following six years, the corals trade from Bali was continuing to rise. The highest amount of corals traded in Bali was reached in 2016, made up of 1,998,307 exported corals. These corals were either obtained from wild habitat and fragmentation.

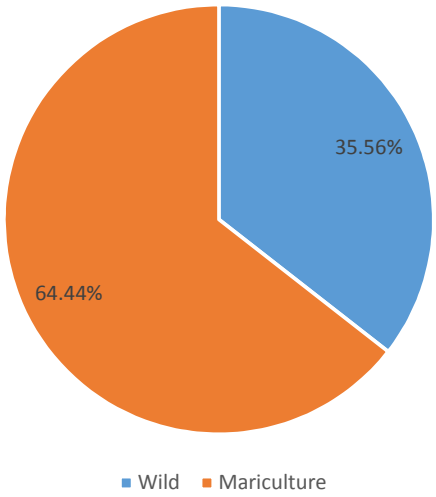

Fig. 4-17 Source of ornamental corals exported by coral companies based in Bali, Indonesia during 2010-2016

The trade in Bali indicated different results in source of coral proportion as compared to national exportation. Based on BKSDA Bali data, coral trade in Bali was apparently more sustainable than aggregate trade done by all coral companies in Indonesia. Bali exporters has sold 6,469,776 cultured coral pieces abroad. This number contributed 64.44% of total exportation by Bali coral companies. It might be a consequence of prohibition in wild coral collection in Bali since 2002. As it must be collected outside Bali waters, the trade is definitely arranged in a longer distribution channels notwithstanding there are wild collection area in neighboring provinces such as Java and Nusa Tenggara. On the other hand, wild sourced corals only constituted 35.56% of total export, comprised of 3,114,045 coral pieces.

In addition, BKSDA Bali had complete identification of all those 9,583,821 corals using scientific names. It is an obligation to use species name due to exported corals have numerous common names which differ on each destination countries. Although, listing common names in coral trade is rarely occurred, (Rhyne et al., 2012) revealed that this regulation was based on the practice of trade in reef fish which is using common names on invoices so that makes subsequent differentiation to a genus and species level challenging.

There were 62 species name of wild corals traded including two others Scleractinia (substrate / soft corals and base rocks / live rocks). Eighty species name of corals have been listed in exportation list as a result of successful propagation in each company coral farm (see Appendix 3). Looking at the most commonly exported genus, species of Goniopora and Acropora dominate in wild and cultured corals, respectively.

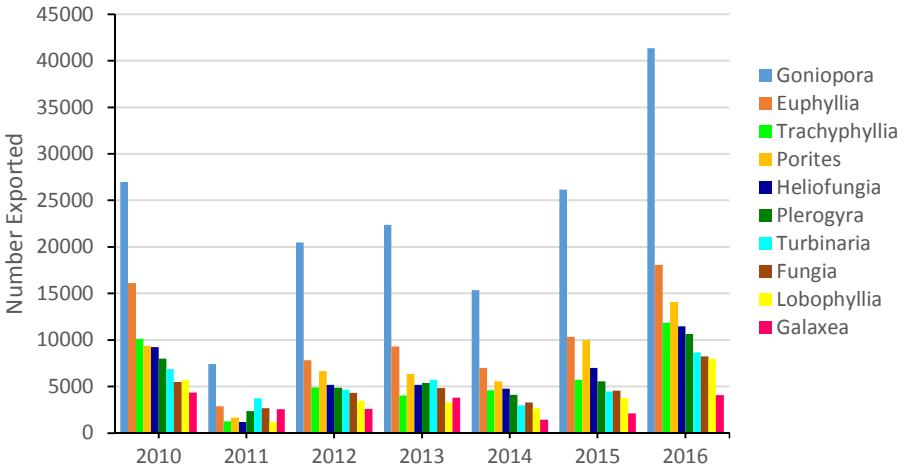

Fig. 4-18 Top ten wild-coral genus exported by coral companies based in Bali, Indonesia during 2010-2016

According to BKSDA Bali data, *Goniopora* spp. accounted for only 5.14% of all wild corals traded. These species are followed by species belonging to genus of Euphyllia, Trachyphyllia, Porites, Heliofungia, Plerogyra, Turbinaria, Fungia, Lobophyllia, and Galaxea. Of all these top ten genera only made up 17.09% of all wild corals exported from Bali during 2010 until 2016. This likely because all wild stony corals species have no big different in the number of quota exported. Overall, stony or hard corals constituted 30.46% of total wild corals exported or equivalent to 951,713 live coral pieces as seen in Fig. 4-19.

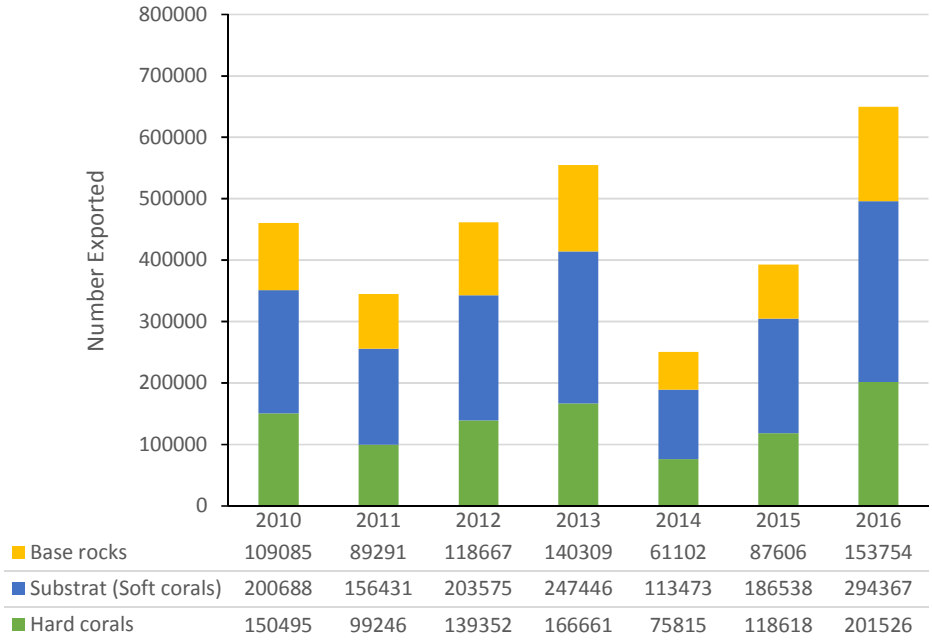

Fig. 4-19 Proportion of wild-corals exported by coral companies based in Bali, Indonesia during 2010-2016

On the other hand, there were two categories constitute a huge portion in total amount of wild corals traded, namely base rocks and soft corals. They were recorded without information on scientific names of species and thus there were no exact number on pieces traded of each species. Base rocks and soft corals contributed 24.42% (759,814 pieces) and 45.12% (1,402,518 pieces) of total wild corals traded, respectively. Unlike stony corals which are cover under CITES, base rocks and soft corals are not (Harriot, 2003; Wabnitz et al., 2003). This evidently came out as the reason behind those empty specific report as well as causing high numbers of specimens being traded. CITES defined 'base rocks' as pieces of live or artificial rocks to which are attached live invertebrate species and coralline algae. It is normally transported in moist not in water as live corals trade. Meanwhile, Wabnitz et al. (2003) noted that term 'soft corals' often extends to contain sea fans include all species under the order Alcyonacea (soft coral and Stolonifera) with the exception of *Tubipora musica* which, due to its calcified skeleton, it belongs to stony corals.

As the trade is directed to be more sustainable, farming on branching corals has shown positive trend in seven years trading. Acropora as coral genus with the highest growth rate amongst others (Green and Shirley, 1999; Timotius et al., 2009) came out as the most cultured corals traded. They were traded more than 3.3 million pieces or represented 51.56% of all cultured corals traded from Bali during 2010 – 2016.

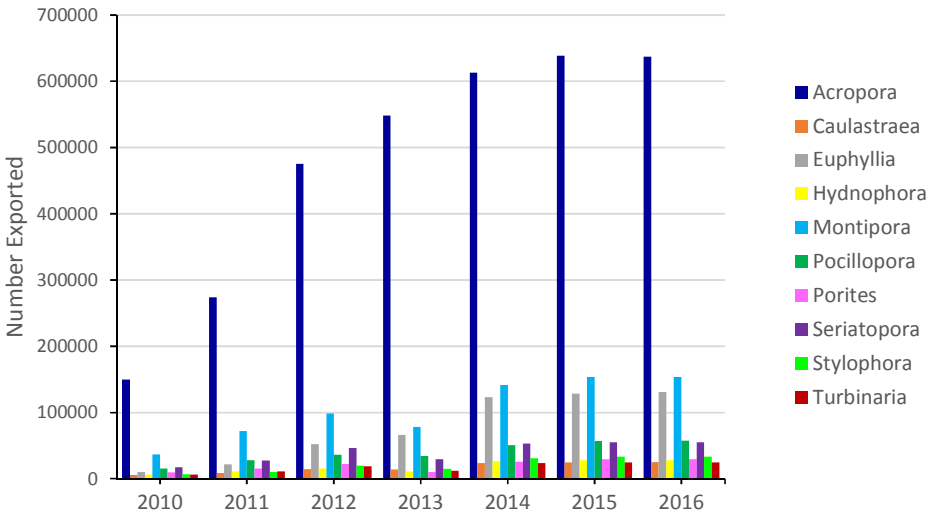

Fig. 4-20 Top ten cultured-coral genus exported by coral companies based in Bali, Indonesia during 2010-2016

The other genera of commonly traded cultured corals are Caulastrea, Euphyllia, Hydnopora, Montipora, Pocillopora, Porites, Seriatopora, Stylophora, and Turbinaria. These ten genera have been exported during 2010 until 2016 from Bali with total amount of 5,820,748 coral pieces, equal to 89.97% of all cultured corals traded. The results clearly showed that nine others species were less traded rather than Acropora. Of those top ten genera, over 57% were only comprised of the genus of Acropora. Besides these species are fast growing which can reach 20 cm/year (Green and Shirley), genus Acropora has hundreds species that can successfully propagated. Overall, Veron (1993) stated this genus include 368 nominal species that most species have light skeleton which allow them to grow quickly.

However, there is very little information available on the growth rate of most coral genera in trade. Several studies have been conducted to identify the growth rate of certain coral species. This is imperative since biological aspects of coral may be the basic of coral trade management, particularly concerning collection quota of each wild

species traded. This study has compiled the growth rate of 12 coral genera included either in top ten wild or cultured-corals genus as presented in Table 4-3.

Table 4-3 Growth rates of twelve genera of commonly traded corals

Species Name	Growth rates (cm/year)		Source
	min	max	
Acropora spp.	2.3	20	Green and Shirley (1999)
Euphyllia spp.	4.6	7.9	Green and Shirley (1999)
Fungia spp.	0.8	2.8	Green and Shirley (1999)
Goniopora spp.	1.8	-	Green and Shirley (1999)
Heliofungia spp.	0.1	1.2	Knittweis (2008)
Hydnophora spp.	1.8	6.6	Iswara (2009); Muhidin (2012)
Lobophyllia spp.	1.6	2.4	Green and Shirley (1999); Margono (2009)
Montipora spp.	2	4.4	Barnes (1987); Simanjuntak (2012)
Pocillopora spp.	2.7	13	Andani et al. (2014); Wibowo (2009); Ariston (2013)
Porites spp.	0.5	2.8	Green and Shirley (1999); Rani et al. (2004); Insafitri and Nugraha (2006); Nugraha (2008); Lalang (2015)
Seriatopora spp.	1.6	6	Green and Shirley (1999)
Stylophora spp.	3.4	5.8	Wibowo (2009); Aditiyana (2012)

The growth rate of corals could vary depend on species life-form. According to the studies aforementioned in Table 4-3, the growth rate of corals can range from 0.1 to 20 cm per year. Barnes (1987) stated massive corals can grow 0.3 to 2 cm per year whereas branching corals can reach up to 10 cm per year. Meanwhile, in coral trade, hobbyist often categorized into large polyp species (LPS) and small polyp species (SPS). LPS groups are typically slow growing rather than SPS corals.

Timotius et al. (2009) revealed that the extraction of slow-growing corals is about four times larger of fast-growing corals. Wabnitz et al. (2003) also showed that most traded genera since 1999 are slow-growing. Despite the trade in Bali has shown different situation, a high attention should be put on this fact. Timotius et al. (2009) added fast growing species were succeeded to be propagated but the successful has not been followed yet with slow-growing ones. Therefore, these species need more research on bio-ecological aspect and on finding best culture method for every species.

Above all, proportion of exported corals done by coral companies based in Bali were increasing in numbers during 2013 until 2015. These data are comparison between BKSDA Bali which is provide Bali exportation and AKKII data presented Indonesia exportation in ornamental corals. The numbers of exported corals and company

reported their export realization were growing within those 3 years. Bali exporters contributed more than 50% of coral trade in Indonesia.

Table 4-4 Proportion of corals exported from Bali towards total corals exportation in Indonesia

Year	Corals exported (pieces)		Proportion (%)	Number Exporter reported
	Bali	Indonesia		
2013	1,436,958	2,855,963	50.31%	20
2014	1,527,695	2,824,634	54.08%	21
2015	1,737,734	2,958,798	58.73%	25

Considering this fact, proportion of corals traded from Bali presumably continue to grow up in the subsequent years. Besides growing in number, existing companies are adding up their coral farm in another locations as well as expanding it as the number of brood stock corals increased. It is an example of management in cultured corals set by SA. In other words, the company will have more export quota with increasing brood stock corals.

In addition, it is better to further elaborate the management way since all those aforementioned data showed positive trend. The current management of coral trade is broadly implement in all Indonesian regions including Bali. There were no typical characteristic of a region in Indonesia which make it has privilege in coral trade management. Currently, the main focus is on quota arrangement. Yet, this regulation is still questionable by reason of lack in scientific data. For an example, European Union banned importation of several coral species from Indonesia as the status of these corals are unclear (Wabnitz et al., 2003; Kudus, 2005; Timotius et al., 2009; UNEP-WCMC, 2015). The other ways of management will be more prescribed in the next section.

4.3.3 Applying lessons learnt for improved existing management

Ditjen KSDAE as an MA has put several management ways in order to control the ornamental coral trade. As it should be not detriment to corals species, these must be recommended by SA through its scientific consideration on coral reef ecosystem. The decision in management of ornamental coral trade is likely depend on the condition of the reef and corals abundant or stock availability (Morrisey et al., 2011; Rhyne et al., 2012, 2014; Fujita et al., 2014; Dulvy and Kindsvater, 2015; Flower et al., 2017). To date, management measures for ornamental corals include annual quota, establishment

of wild corals collection area, licensing system on coral exporter companies, and the establishment of no-take zones.

4.3.3.1 Harvest quota

Harvest quota for corals export was established in 1997. The quota was developed based on the assumptions that reef accretion rates range from 1 to 1.5 cm per year, corals grow at a rate of 2.5-30 cm per year, and allowable harvest occurs on about 30% of the reefs in Indonesia that are in good to excellent condition (Suharsono, 1999 in Bruckner and Borneman, 2006). The policy is mainly focused in wild-sourced coral since quota of cultured-corals are based on production planning of each company.

Precautionary principle alongside with scientific recommendations are used to determine the quota limitation of coral traded. Quota list issued once a year regarding all CITES-listed species as well as another species whose are not listed or protected by the regulations (Kudus, 2005). It is clear that quota list should be more based on the stock numbers of coral offspring or young corals settled in their habitat. However, the lack of study concerning the abundant of certain coral species make the policy become questionable.

A lesson from another exporting countries e.g. the Philippines, the Maldives, Fiji, the Kingdom of Tonga together with one importing country, USA also run into the same problem (Saleem and Islam, 2008; Rhyne et al., 2009; Dee et al., 2014). Setting quota for ornamental coral trade management is challenging as it needs stock assessment on each species. In the meantime, the broad scheme of coral reef management should be based on multiple species protection (Murawski, 2007; Curtin and Prelezzo, 2010; Katsanevakis et al., 2011). Annual quota has been attempted to control the curio corals trade in those countries, yet, less studies, and even no assessments have been conducted to determine the status of targeted species (Dee et al., 2014).

Nevertheless, LIPI as an SA has reported that coral reef of Indonesia was in stable state over the period 1993 – 2014. This report was based on annual monitoring data upon corals coverage in Indonesian waters conducted by COREMAP (The Indonesia Coral Reef Rehabilitation and Management Project) program. Susanto et al. (2015) stated the long-term monitoring encompasses approximately 1000 stations in 78 areas.

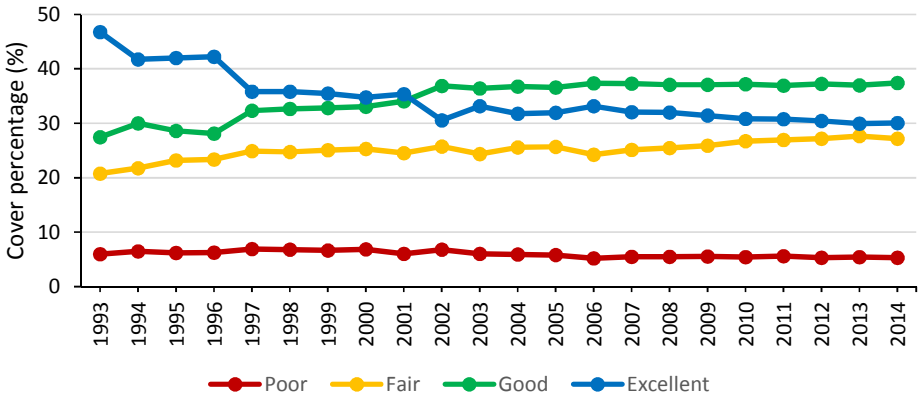

Fig. 4-21 Status of Indonesian coral reefs in 1993-2014

The monitoring result was released on a four tier scale: poor, fair, good, and excellent. As seen in Fig. 4-21, coral coverage in poor condition remained stable. It was recorded that coral in fair and good condition had slightly move up as its coverage. 'Good' coral coverage had increased by 9.96% during 22 years. Meanwhile coral in excellent experienced decline by 16.84% over the same period.

It could be presumably conclude that Indonesian reefs did not change in coral cover and thus became partly basis for quota. However, this fact is far away from enough as there are more severe factors causing coral coverage declined rather than direct collection for marine aquarium trade which appear to be relatively minor threats to coral. The scientists noted that those more relevant factors include anthropogenic activities e.g. ocean acidification (Riegl et al., 2009), rising seawater temperature (Guldberg et al., 2007), destructive fishing methods (Bryant et al., 1998), sedimentation, ship grounding, and pollution (Anthony et al., 2014), as well as natural phenomenon such as storm (Anthony et al., 2014) and predation (Rotjan and Lewis, 2008). Another concern is that monitoring in coral coverage mainly observed on corals life form. The monitoring normally used LIT method which only categorized corals based on physical appearance rather than population status

It was widely recognized that such studies on population status are essential in developing ecologically sustainable quotas. Fortunately, researches on coral species abundant is now growing up. It is likely triggered by temporary suspension for the export of several wild coral species. Timotius et al. (2009) noted there were two studies demonstrated species population of *Heliofungia actiniformis* and *Catalaphyllia jardinei*. In 2015, UNEP-WCMC revealed studies on species population, trade patterns,

and conservation status of ten wild corals including two species which were previously studied, namely: *Euphyllia cristata*, *Plerogyra sinuosa*, *Plerogyra turbida*, *Eguchipsammia fistula*, *Heliofungia actiniformis*, *Hydnophora microconos*, *Blastomussa wellsi*, *Scolymia vitiensis*, *Mycedium elephantotus*, and *Trachyphyllia geoffroyi*. Although there was no species specific population information available, trade pattern were remain stable in quota exportation and those species were categorized as least concern, near threatened, and vulnerable by the IUCN.

Above all, LIPI normally conducted four steps prior to quota recommendation which are then promulgated by Ditjen KSDAE. These steps include fieldwork observations to get information (coral habitat and market inclination) from fishermen and coral exporters, stock assessment, stakeholder consultation, and drafting quota recommendations based on species and location. In advance of final quota recommendation, it must go through experts and stakeholder discussion for draft evaluation. In 2016, SA had set up species and location based quota of 1,979,750 pieces of wild corals (see Appendix 4). Once the draft has approved, it submitted to MA to be announced to AKKII and coral exporters. Each coral exporter has its own quota to export ornamental corals. Another parties whose get annual quota report are CITES Secretariat and regional BKSDA. The flowchart of quota recommendations for ornamental quota is presented in the following figure.

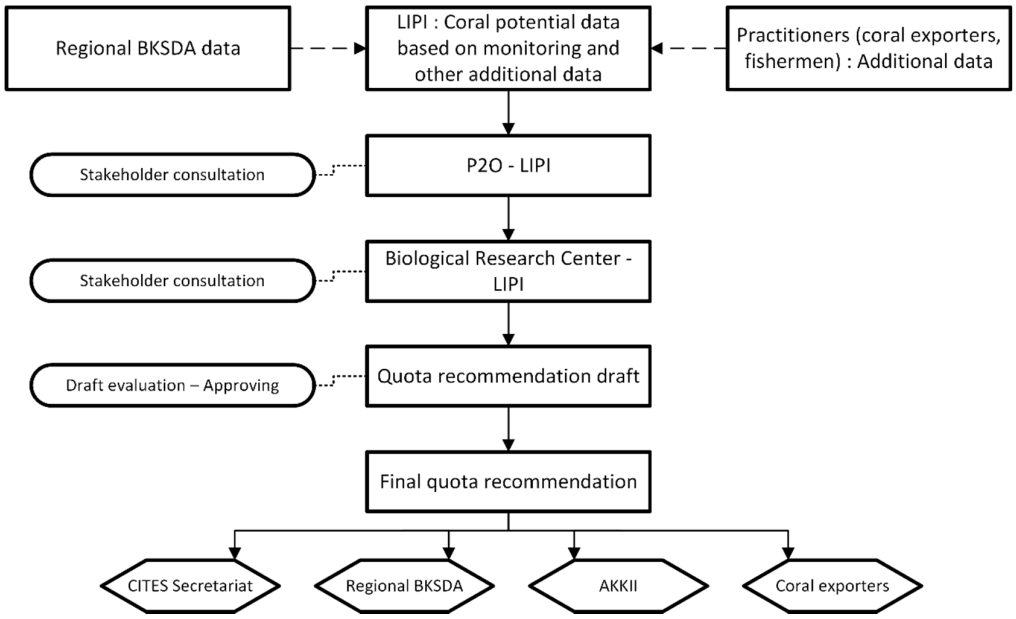

Fig. 4-22 Quota recommendation process of ornamental coral trade in Indonesia (adapted from Kudus, 2005)

The quota policy also established based on location of collection area (see Fig. 4-2). The SA in cooperation with the scientists, NGO, and AKKII conducted annual field monitoring to obtain further information in order to help determine the next year quota. It differs at each harvest collection. The province-based quota is established to prevent overharvesting at a certain concentrated sites. The distribution of harvest areas aims to avoid overexploitation in certain sites (UNEP-WCMC, 2015). MA officially announced that wild corals collection area is divided into eleven harvest sites.

Bali which represented more than 50% of total Indonesian corals exportation is excluded from those harvest sites. This was confirmed by coral company managers/directors during field interview which stated that all wild corals entering Bali were coming from another islands, particularly Nusa Tenggara and Sulawesi (see Table 4-5). Kudus (2005) pointed out that Bali no longer has quota as wild-sourced corals collection area since 2002 as a consequence of coral reef conservation program.

Table 4-5 Province-based quota of Indonesian wild corals in 2016

Location	Category			Amount
	Hard Coral	Soft Coral	Live Rock	
Bangka-Bel.	59039	49629	0	108668
Banten	21136	100212	49914	171262
West Java	49058	100212	49914	199184
Central Java	42517	150796	100216	293529
East Java	48398	100212	49913	198523
Lampung	63282	100212	100216	263710
West NT	48251	49629	0	97880
East NT	48116	49629	0	97745
South Sul.	85638	100212	0	185850
Southeast Sul.	90772	49628	49913	190313
Central Sul.	73543	49629	49914	173086
Total	629750	900000	450000	1,979,750

Amongst the eleven sites, The Spermonde Archipelago in South Sulawesi was reported as the largest coral collection area in Indonesia which supports an estimated 100 coral fishermen. The total reef area of this archipelago was estimated at 4290 km^2. It extends approximately 60 km offshore from Makassar, the provincial capital of South Sulawesi. The archipelago encompasses 150 islands with fringing reefs, hundreds of submerged patch reefs, and extensive soft substrate habitats (Bruckner and Borneman, 2006).

Nonetheless, the highest collection quota was not in Spermonde, South Sulawesi. According to the AKKII data in 2016, MA allocated highest quota to Central Java

amounted to 293,529 wild corals that comprised of 42,517 hard corals; 150,796 soft corals; and 100,216 live rocks. Meanwhile, East Nusa Tenggara with the lowest quota accounted for 97,745 pieces of permitted wild corals to be collected for trade. This quota is apparently subject to change as yearly corals status may be dynamic. The changes in quota can occur against coral species, collection sites through rotational harvest, or allocation on each exporters.

The policy in allocating quota on each company is based on exportation record. A company that cannot export corals as many as allocated in present year, its quota may be reduced in the next year. Timotius et al. (2009) added, this is only implemented towards coral companies established before 2002. There are 48 companies whose now got license to collect wild corals in their habitat. Meanwhile, another companies are only permitted to export cultured corals as a consequence of licensing system.

4.3.3.2 Licensing system

As a part of management measures in coral trade, license aims to fulfill NDFs compliance of CITES. Broadly, it is a kind of regulation in achieving sustainable fisheries exploitation (Brown and Farmer, 2007). Licensing system by means of permits allow us to reduce impacts on high-use of vulnerable coral species. This is implemented through a requirement for all coral exporters to become AKKII's members and get permit in advance of doing international trade.

The permit provides several provisions (as discussed in Chapter 3) that should be completed by coral exporters. For instance, all new coral exporters are required to have minimal brood stock of cultured corals in order to get export permit. The obligation is likely time consuming for a new company as they have to raise a certain coral species in their farm at least for 1.5 years. This time span is an estimation time started from initial stage of propagation using wild corals brood stock (F0) until harvest time of second generation of cultured corals (F2). It is necessary to prevent 'premature' coral trading, in such case like a company who claimed its traded corals represents F2 when in fact derived from the first generation (F1) or even directly taken from nature without going through propagation technique (Giyanto, 2007). While not necessarily the solution to all coral trade management challenges, licenses are potentially valuable tool that can be used for more than mere export limitation.

It is also imperative to enforce licensing policy towards individuals, despite licensing in business entities has been implemented. Several exporting countries has

applied such coral trade management strategy. In Fiji many collectors are required to have a license so that they can engage in commercial ornamentals trades. As Fiji has formal constitutional recognition for customary rights over marine areas, license applicants have to go through a unique mechanism. They must get an approval from the highest chief of each coastal tribe, or *vanua* which is regarded as the custodial chief. In order to seek approval by the *vanua* for commercial activities, an individual or company must first approach the custodian with a traditional ceremony. Subsequently, the Fisheries Department as an official agency issued licenses on the basis of this approval (Bowden-Kerby A. 2003).

In the Philippines, fishers are typically required to have a license or appropriate accreditation to collect coral reef wildlife. However, there are no catch limits, species quotas, size limits, nor restocking programs (Gonzales and Savaris, 2005 in Dee et al., 2014). In contrast, the license system in Australia are more developed than the Philippines. The government restricted destructive gear types and limiting entry through a licensing system, which has not issued new commercial licenses since 1997. The license permit is integrated with a variety of management controls such as regulating the species that may be taken, applying bag limits, established Special Management Areas and closed waters during spawning season, and permanent spatial closures (Roelofs and Silcock, 2008).

Meanwhile, lesson learnt from ornamental coral trade in India revealed that the license policy should be first initiated with the help of fishermen who solely depend on wild corals collection for their livelihood. This would ensure that only trained and conscientious collectors take part in the trade. The license can be extended to wholesalers and retailers, so that they can receive ornamental corals only from licensed or trained fishermen. It also confirms that the wild corals obtained legally and in a sustainable manner. In addition, in importer countries, ornamental coral consumers should also be encouraged to make procurement only from a certified wholesaler or retailer, thus reducing the potential for illegal trade. This policy will act as an excellent conservation effort to monitor the diversity and abundance of ornamental species that are supplied through the trade (Prakash et al., 2017). Furthermore this will provide positive inputs for LIPI in processing recommendation quota and thus will lead to effective management.

4.3.3.3 Marine Protected Areas (MPAs)

Another management strategy has adopted by Indonesia for coral harvest is the establishment of no-take zones. The idea is generally known as MPAs. Many studies and practical experiences have demonstrated that an MPA is one of the effective tools in coral reef conservation (Pomeroy et al., 2005; Powell et al., 2016; Trujillo et al., 2016; Islam et al., 2017; Wu et al., 2017). The amount of MPAs is growing rapidly around the world which is being driven by global conservation targets and promote sustainable use of resources. At present, approximately 27% of all reefs around the world are located inside marine protected areas (Chavanich et al., 2015; Ban et al., 2017; Dudley et al., 2017).

Indonesian government defined MPA as a marine water area, which is protected and managed through a zoning system, to achieve sustainable management of fish resources and ecosystems. The zoning system generally divided into four categories: no-use zone, no-take zone, buffer zone, and multi-use zone (see Fig. 4-23). Indonesia government has committed to establishing and effectively managing MPAs covering 200,000 km^2 in the next three years. Despite the importance of marine conservation, this was also triggered by an ambitious target of the CBD agreed by all state members which set a goal of having 10 percent of coastal and ocean water in protected areas by 2020 (Dudley et al., 2017). To date, there has been a tremendous growth in MPAs in Indonesia: from only 54,198 km^2 in 2003, the total protected area tripled to 164,511 km^2 as of July 2015. Of those MPAs established, 30% are managed by the MoEF, 35% by the MoMAF, and the remaining 35% by local governments (Susanto et al., 2015).

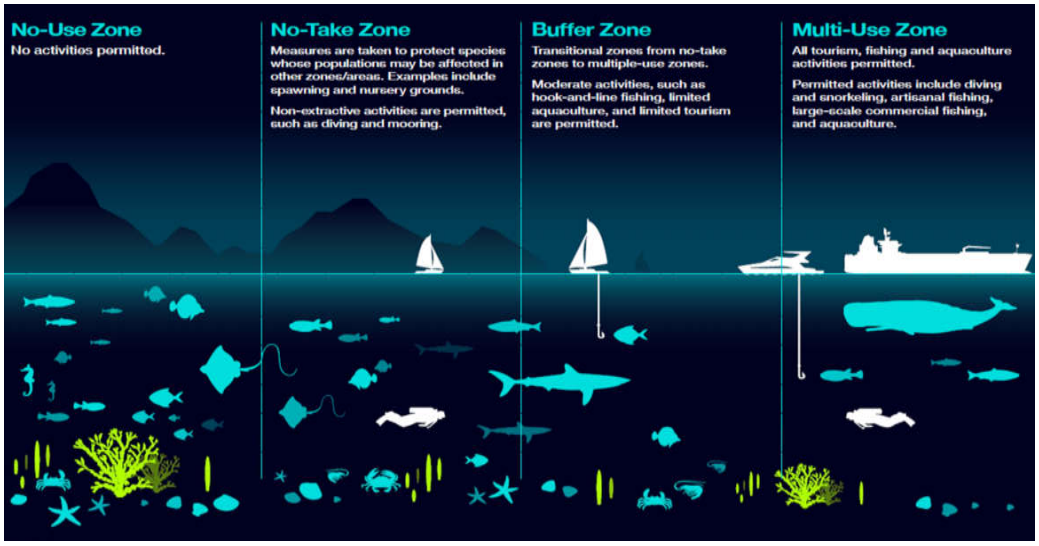

Fig. 4-23 Features of MPAs worldwide (source: Korting, 2015)

Well designed and managed Marine Protected Areas (MPAs) can produce conservation benefits to coral reefs within no-take zones and in neighboring areas through biomass transport or 'spillover'. The term spillover has been largely used to define any movement/displacement of biomass or individuals from MPAs towards fished areas disregarding the life stages (i.e. adults, juveniles, larvae) or the underlying mechanisms (i.e. density-dependent or density-independent) involved (Di Lorenzo et al., 2016). Some studies on reef fish assemblages revealed that spillover effect has increased as growing number of no-take zones. This may implies that MPAs are properly enforced to protect and recover the reefs (Abesamis and Russ, 2005; Colléter et al., 2014; Di Lorenzo et al., 2014; Edgar et al., 2014).

Empirical evidences showed tangible benefits of MPAs enforcement despite it was not specifically mentioned certain coral species. MPAs in Sumilon islands, the Philippines has increased reef fish density and fish catch by 500 ind./m^2 and 22 tonnes/km^2 respectively after 10 years implementation. In New Zealand, managed marine reserves brought an evidence that reef fish (*Pagrus auratus*) density move up 7 times in MPAs rather than outside its boundary and the growth rate of lobster biomass increased 10.9% per year. A closure marine area in Japan of 13.7 km^2 for 4 years has increased crab (*Chionoecetes opilio*) abundance around 10 – 42%. In addition, two MPAs in Kenya (Mombasa Marine Park Kenya) and South Africa has increased fish catch 3 times per trap and size of pelagic fishes, respectively (Ali, 2009 in Nainggolan et al., 2013).

Weeks et al. (2014) posted another example in Nusa Penida MPA in Bali, Indonesia. The MPA contains a variety of critical marine ecosystems, including coral reefs (with 298 species of coral and 576 species of fish), mangroves, and sea grass beds which is designed to protect unique and endangered species that are focus on no-take zone for tourism activities (see Fig.4-23). There is also temporary periodic closure held yearly, known as *Nyepi Segara*. From an ecological perspective (Carter et al., 2014), the abundance of some fish populations increased within MPA. With regards to fish abundance, surveys from 2010 have shown that for the key commercial species of fish there has been a generally increasing trend in numbers; from 1,915 ind./ha in 2010 to 2,568 ind./ha in 2013. Linear trend showing the average (%) cover of hard coral and soft coral combined at 3 and 10 meters of depth (2008 – 2013) was also growing up though no stock assessments yet on corals population status. In addition, there is

considerable 'casual observational' information available from diving activities that supports the view that Nusa Penida is host to a healthy and vibrant marine ecosystems.

However, most of MPAs are failing to meet their full potential and describe a clear path forward for achieving better conservation outcomes. Even if 10% world's MPAs target is met, the actual conservation value may be limited because MPAs often exist in name only. In other words, they do not truly provide protection (Halpern, 2014).

Edgar et al. (2014) have determined five key features which must be owned by MPA so it can be 'truly' marine protected area. These five key features are: no take or full protection, well enforced, age greater than 10 years, size larger than 100 km^2, and isolated by deep water or sand. The authors found it after they investigated 87 MPAs worldwide. The conservation benefits of MPAs increase exponentially with the accumulation of five key features and it was nearly absent in MPAs with fewer than three of these factors. The following figure depicts simply case of these five key features.

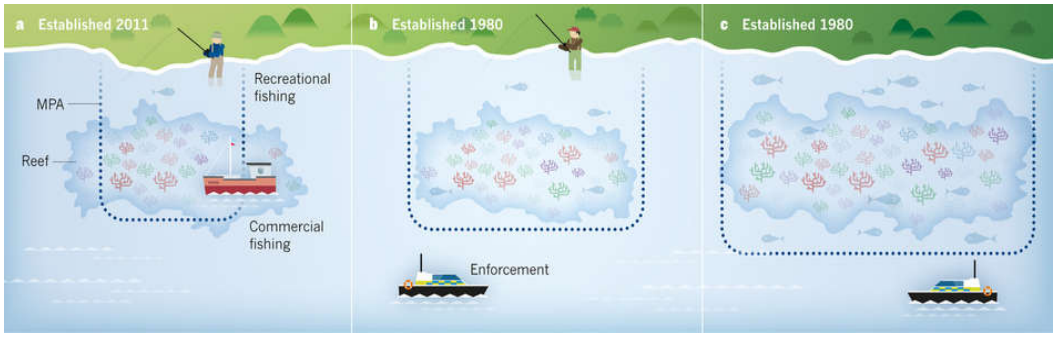

Fig. 4-24 Five factors for effective protection of MPAs (source: Halpern, 2014)

They find that, compared with unprotected areas, there is no benefit gained from an MPA with none of these features. For example Fig. 4-24a, a young MPA that is still fished by recreational and small-scale commercial fishermen, is too small to encompass the reef and in which protection is not well enforced, or even from an MPA with one or two features. Yet, the conservation value of an MPA rises exponentially as the number of features increases from three, an older MPA that protects an isolated reef and is enforced, but that is small and not fully protected (Fig. 4-24b). The best one is a 37 years old MPA (Fig. 4-24c) that protects an isolated reef in no take-large marine area and have a good enforcement (Halpern, 2014).

With all of the designation of MPAs, it certainly takes an important roles for marine ornamental trade, broadly in marine ecosystems management and conservation.

The ability of MPAs will ensure sustainability, particularly by means of spillover effects, as well as global conservation goals (Halpern et al., 2010). At present, Indonesian MPAs are still growing up in number and management. Indonesian government, through MoMAF, targeted 35 effective MPAs are fully established by 2020 (Susanto et al., 2015). It has been predicted globally that conservation will be more effective to make ocean health with more well-managed MPAs which are designed to act as networks.

One key advantage of using MPAs within the context of ornamental trade is to deliberately plan for spatial configurations that minimize negative impacts to particularly coral reef ecosystem and minimize externalities from human activities that could reduce the effectiveness of the MPA. The concept of buffer zones around MPAs with lower levels of protection but with some limits on use is one strategy to minimize the impacts of such externalities (e.g., limited aquaculture next to a no-take reserve). MPAs will almost always be a necessary component of all marine ecosystems management. However, MPAs alone will rarely be sufficient to achieve the range of goals inherent in comprehensive marine management (Halpern et al., 2010).

4.3.4 Moving towards sustainable ornamental coral trade

4.3.4.1 Alternative approaches and successful practices

Methods such as gear restrictions; entry, size, and catch limits; fishing bans; spatial management; and size limits are commonly used, with mixed success, in this trade. Voluntary certification approaches, such as the Marine Aquarium Council, have also been attempted, but these programs were not viable. Conversely, stock assessments, scientifically-set quotas, and rights-based fisheries management approaches (e.g., licensing systems and exclusive fishing zones) remain underutilized. The limited employment of these management techniques is largely due to data, management capacity, and resource limitations (e.g., finances or enforcement and monitoring personnel), as well as a lack of attention to ornamental fisheries. Furthermore, many of these methods likely require modifications in order to be made appropriate for aquarium fisheries (Dee et al., 2014).

4.3.4.2 Catch limits and data-limited stock assessments

Quotas set limits on the overall collection of a coral species or group of species in a given year. These have utilized species-specific quotas which are currently used often based on historical levels of export. Yet, the quotas are still based on insufficient data and unclear identification whether collecting effort is currently over or under sustainable levels (Dee et al., 2014). Oftentimes managers (MA) must make decisions with limited data about the corals population status (Fujita et al., 2014).

Methods to assess data-limited fisheries are emerging to meet this challenge (Wilson et al., 2010; Fujita et al., 2014). For instance, marine reserves can function as proxies for unfished conditions, thereby providing a relative measure of stock status at local scales (Wilson et al., 2010). This approach, known as the MPA-based decision tree method, compares catch-per-unit-effort and size structure within and outside of reserves as estimates of fishing mortality to calibrate TAC levels. However, the applicability of this approach and others to ornamental corals may be limited due to insufficient information on catch and effort trends or the biology of targeted species (Donaldson, 2003; Fujita et al. 2014). To address these problems and improve ornamental coral management, a tiered approach involving biomass, productivity-susceptibility analysis, and a combination of stock specific and aggregate quotas can be used (Fujita et al., 2014). To date, these data-limited methods have not been widely applied to ornamental fisheries, but offer promising tools for future management.

4.3.4.3 Rights-based management

The term ‘right-based’ in marine ornamental management was explicitly introduced by Dee et al. (2014). As a type of catch share or rights-based program, quotas allocate a tradable portion of the annual total allowable catch (TAC) of corals to a harvest site, thereby incentivizing the long-term maintenance of the curio trade (Costello et al., 2008). For instance, a rotation system of location based TAC (Kudus, 2005; Timotius et al., 2009) would allow certain harvest sites to recover, and thus making corals supply stable. Nevertheless, establishment of such system requires the TAC to be set appropriately by means of data-intensive stock assessments. For this reason, scientifically set quotas in ornamental fisheries is apparently hampered by data availability and management capacity limitations.

Spatial rights-based management, e.g., MPAs, may offer a more promising direction, especially in areas with a history of traditional marine tenure systems

(Hilborn et al., 2005). For instance, Nusa Penida MPA in Bali allows access to coral farming areas (Desa Ped and Desa Jungut Batu, see Fig.2-1), as well as mechanisms for conservation effort through local wisdoms. Such approaches can improve the socioeconomic benefits to local communities concomitant with strengthening marine ecosystems.

4.3.4.4 Other promising directions

Other potential strategies to reform the trade include strengthening aquaculture and industry reform. It is worth noting that aquaculture holds promise for alleviating collection pressure on wild populations (Moorhead and Zeng, 2010; Olivotto et al., 2011). Increasing numbers of coral farming has already reduced the wild sourced corals collection. These benefits, however, will depend on the extent successful propagation of corals species (SPS, LPS, slow or fast growing, all life form types of corals) as many as possible to fulfill the market demand.

Overall, all of those possible management strategies can be summarized in Table 4.6 below.

Table 4-6 Management initiatives to promote coral reef conservation and sustainable ornamental coral trade (adapted from Bruckner, 2005)

Measure	Approach and Rationale
CITES	Ensures that member countries established sustainable management plans
Mariculture/Aquaculture	Reduce wild harvest; stock enhancement programs
Habitat restoration	Recover degraded reefs and enhance coral-fishery
Artificial reefs	Reduce pressure on coral reefs; enhance coral-fishery through creation of additional habitat
Limitations on number of collectors	Reduce total harvest; allows control over collectors through licensing and reporting requirements
Training for fishers	Reduce habitat degradation; improve quality of ornamental corals
Quotas	Species specific protection; quota is based on life history traits and population dynamic in collection area
Size limits	Minimum and maximum sizes to increase survival and protect key life stages
Species restrictions	Prohibitions on the take of rare and ecologically important species or species with slow growth rate
Collection and handling standards	Reduce habitat degradation and coral mortality by eliminating destructive fishing practices; reduce post harvesting mortality

Table 4.6 (*continued*)

Measure	Approach and Rationale
Zoning	Reduce conflicts with other users such as divers and food fishers
Spatial closures	Provide undisturbed spawning area; reduce user conflicts; maintain portion of stock from exploitation; enhance potential for spillover
Temporal closures	Protect species during spawning periods and recruitment events to enhance reproduction and allow some individuals to grow beyond target size; allow areas to recover from exploitation.
Education for hobbyists, importers and retailers	Promote sustainable ornamental fisheries by encouraging hobbyists to request cyanide free fishes and fishes that are harvested from reefs with management plans

4.4 Conclusion

Ornamental coral trade in Bali, Indonesia and generally worldwide formed a long market chain. Both wild and cultured corals trade involve a series of collectors, middlemen, wholesalers, exporting companies, as well as airlines companies. Despite it differs on how did traded corals obtain, the distribution channels are typically similar. Wild sourced corals network likely has a longer chain since re-propagation might be conducted. The rest channels on land operations are same.

Corals exportation from Bali has shown positive trend, as it did on national export, with the annual growth rate of 19.06%. However, as wild corals collection became global concern in coral reef conservation, the trade is directed to increase cultured corals production through mariculture and managed by several management approaches. These strategies include annual quota, establishment of wild corals collection area, licensing system on coral exporter companies, and the establishment of no-take zones.

The policies was established more than a decade resulting the healthy on coral reef ecosystem which is reported as coral cover percentage. Based on current practices and lessons learned, it still needs more specific assessments on growth rates, recruitment, distribution and abundance of corals as the trade demanded each marine ornamental species. This would be challenging considering broad concept of marine ecosystems management that required multi species protection. Nevertheless, such methods are suggested to be continued with some enhancements to compensate for the shortcomings of existing implementation.

Chapter 5 Conclusion and Recommendation

5.1 Conclusion

This study has explored the coral trade regionally in Bali as well as in Indonesia through market trends analysis. Two main works have been presented in in Chapter 3 and 4 in order to answer research questions and objectives in Chapter 1. It was primarily based on literature review of relevant previous studies reinforced with stakeholder interviews, official data, and field observation.

In Chapter 3, authorized institutions related to coral trade in Indonesia were analyzed. This study observed there are two main government institutions who put in charge in ornamental coral trade, namely Ditjen KSDAE of MoEF as management authority and P2O-LIPI as scientific authority. The key role of MA is oversee the trade through permit issuance based on SA recommendations. To deal with that, MA and SA cooperated with another institutions such as Directorate General of Customs and Excise, Fish Quarantine Center, Directorate of Water Police, Directorate General of Foreign Trade, Universities, Non-governmental organizations, AKKII, and importanly the local communities as they are a frontier in marine biota utilization. The working protocols are referred to existing Indonesian regulations in regard to the CITES provisions which applied NDF approach as the fundamental principle. Despite some issues on overlapping authorities responsible for marine resources utilization emerged, it did not make any deterioration in coral trade management.

Thereafter, market trend of ornamental coral trade in Bali and Indonesia was analyzed in Chapter 4. This study firstly identified the distribution channels of both wild and cultured corals based on current trade in Bali involving local fishermen, middlemen, domestic wholesalers, and coral exporter companies. According to data recorded by CITES, AKKII, and BKSDA Bali, the trade has shown positive trend and grew at yearly growth rate by 3.3% (Indonesian exportation during 1985-2014) and 19.06% (exportation from Bali only in 2010-2016). Proportion of cultured corals was continuing to rise as sustainable management strategy implemented and thus reducing exploitation on coral reef ecosystem. Existing management approaches, however, must be enhanced with more relevant scientific data.

5.2 Recommendation

Commonly used indicators of coral reef status, such as species richness and coral cover, likely appear to provide broad map of data. An up to date report data in species specific biological aspects are therefore more substantial as the trade subject is a coral species. Though it is challenging, such studies are imperative so that providing more scientific data towards sustainable management measures e.g. quotas, licensing system, and spatial management through no-take zones establishment.

Finally, no matter how management thresholds are arranged, good governance which encourages for compliance with science-based goals and rules, coupled with sufficient institutional capacity, will be essential for the sustainable management of ornamental coral trade. Many studies revealed the lack of institutional capacity, particularly in developing countries which supply most corals traded, weakens management strategies that have been designed. Expand capacity-building efforts, e.g. training and technical assistance, are therefore recommended as a good management depends upon building human and institutional capacity.

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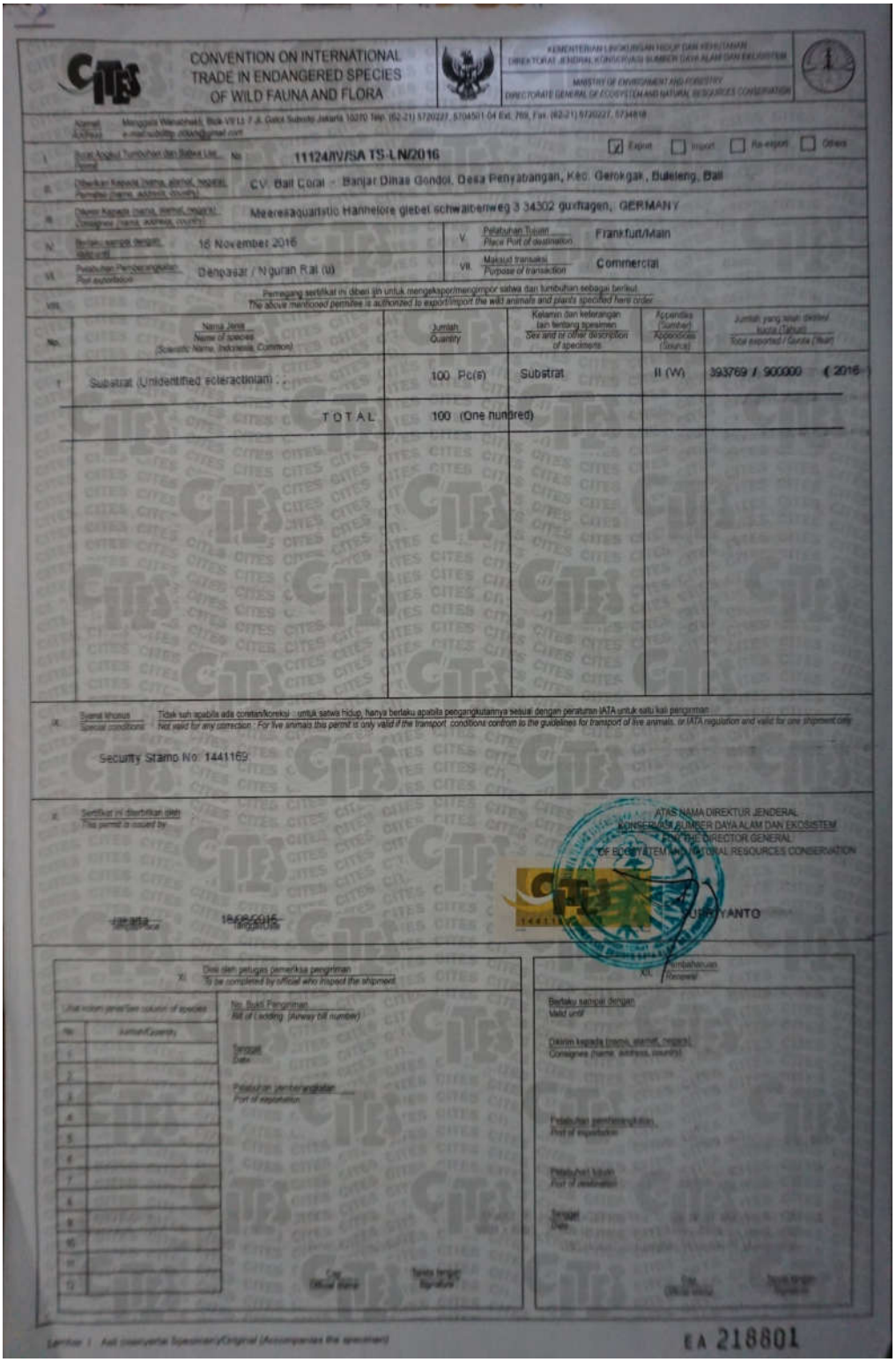
Praise be to Allah, Thee we worship, Thee we ask for help, who show us the straight path and gave countless blessings.

Appendix

Appendix 1. CITES Permit document



CONVENTION ON INTERNATIONAL TRADE IN ENDANGERED SPECIES OF WILD FAUNA AND FLORA

KEMENTERIAN LINGKUNGAN HIDUP DAN KEHUTANAN
DIREKTORAT JENDERAL KONSERVASI SUMBER DAYA ALAM DAN EKOSISTEM
MINISTRY OF ENVIRONMENT AND FORESTRY
DIRECTORATE GENERAL OF ECOSYSTEM AND NATURAL RESOURCES CONSERVATION

Export ☐ Import ☐ Re-export ☐ Others

No. 11124/IV/SATS-LN/2016

CV. Bali Coral - Banjar Dinas Gondol, Desa Penyabangan, Kec. Gerokgak, Buleleng, Bali

Meeresaquaristic Hannelore glebet schwalbenweg 3 34302 guxhagen, GERMANY

16 November 2016

Denpasar / Ngurah Rai (I)

V. Pelabuhan Tujuan / Place Port of destination: Frankfurt/Main

VII. Maksud transaksi / Purpose of transaction: Commercial

Pemegang sertifikat ini diberi ijin untuk mengekspor/mengimpor satwa dan tumbuhan sebagai berikut.
The above mentioned permitee is authorized to export/import the wild animals and plants specified here order

No.	Nama Jenis (Nama Ilmiah, Indonesia, Umum) / Name of species (Scientific Name, Indonesia, Common)	Jumlah / Quantity	Kelamin dan keterangan lain tentang spesimen / Sex and or other description of specimens	Appendiks (Lampiran) / Appendices (Source)	Jumlah yang telah diekspor (Tahun) / Total exported (Year)
1	Substrat (Unidentified scleractinian) : -	100 Pc(s)	Substrat	II (W)	393769 / 900000 (2016
	TOTAL	100 (One hundred)			

X. Syarat khusus / Special conditions: Tidak sah apabila ada coretan/koreksi ... untuk satwa hidup, hanya berlaku apabila pengangkutannya sesuai dengan peraturan IATA untuk satu kali pengiriman
Not valid for any correction ... For live animals this permit is only valid if the transport conditions confrom to the guidelines for transport of live animals, or IATA regulation and valid for one shipment only

Security Stamp No: 1441169

XI. Sertifikat ini diterbitkan oleh / This permit is issued by

ATAS NAMA DIREKTUR JENDERAL
KONSERVASI SUMBER DAYA ALAM DAN EKOSISTEM
FOR THE DIRECTOR GENERAL
OF ECOSYSTEM AND NATURAL RESOURCES CONSERVATION

Jakarta 18/05/2016

XII. Diisi oleh petugas pemeriksa pengiriman / To be completed by official who inspect the shipment

Jumlah/Quantity

No. Surat Pengiriman / Bill of Lading (Airway bill number)

Tanggal / Date

Pelabuhan pemberangkatan / Port of exportation

XIII. Pemberitahuan / Recipient

Berlaku sampai dengan / Valid until

Dikirim kepada (nama, alamat, negara) / Consignee (name, address, country)

Pelabuhan pemberangkatan / Port of exportation

Pelabuhan tujuan / Port of destination

Tanggal / Date

Lembar 1 : Asli (disertakan Spesimen) / Original (Accompanies the specimen)

EA 218801

Appendix 2. Total export of Indonesian ornamental coral in all importing countries during 1985 – 2014 as reported by CITES

No.	Importer	Amount	No.	Importer	Amount
1	USA	12,719,104	46	Slovakia	9,152
2	Japan	1,890,157	47	Romania	7,556
3	Germany	1,771,181	48	Ireland	6,732
4	France	1,272,786	49	Lebanon	6,591
5	U.K.	1,271,666	50	Kazakhstan	4,914
6	Italy	1,113,895	51	Pakistan	3,598
7	Canada	1,051,292	52	Peru	3,168
8	Netherlands	924,507	53	Iraq	2,535
9	Hong Kong	440,458	54	Qatar	2,531
10	South Korea	392,371	55	North Korea	2,448
11	Russia	352,324	56	Estonia	2,204
12	Sweden	201,688	57	Algeria	1,704
13	Spain	196,513	58	Malta	1,665
14	Poland	192,411	59	Bulgaria	1,583
15	Taiwan	191,163	60	Croatia	1,568
16	Switzerland	144,026	61	Syria	1,402
17	Malaysia	139,075	62	Saudi Arabia	1,386
18	South Africa	99,406	63	UNKNOWN	1,200
19	Austria	93,294	64	Macau	1,175
20	Belgium	90,881	65	Venezuela	1,175
21	Denmark	83,475	66	Morocco	1,169
22	Israel	81,851	67	Costa Rica	971
23	U.E.A.	81,488	68	India	850
24	Iran Republic	60,616	69	Panama	656
25	Czech Republic	60,279	70	Norfolk Island	600
26	Turkey	56,779	71	Suriname	587
27	Brazil	56,604	72	Paraguay	535
28	Norway	52,370	73	Egypt	475
29	Portugal	50,223	74	Tanzania	450
30	Hungary	45,623	75	Latvia	400
31	Greece	41,340	76	Australia	388
32	Ukraine	34,666	77	Armenia	352
33	China	33,013	78	Macedonia	324
34	Kuwait	31,539	79	Cocos Islands	250
35	Mexico	29,886	80	Iceland	203
36	Fiji	23,150	81	Laos	200
37	Finland	22,342	82	Luxembourg	150
38	Singapore	17,825	83	Slovenia	100
39	Lithuania	17,094	84	Vietnam	97
40	Jordan	14,400	85	Turkmenistan	59
41	Thailand	12,568	86	Oman	50
42	New Zealand	12,025	87	Bahrain	28
43	Georgia	9,991	88	San Marino	0
44	Cyprus	9,871	89	Swaziland	0
45	Argentina	9,585	Total amount		25,569,984

Appendix 3. Lists of coral species traded in 2016 as reported by BKSDA Bali

Table A. Wild corals

No.	Species name	No.	Species name
1	*Acanthastrea* spp.	32	*Heliofungia actiniformis*
2	*Acanthophyllia deshayesiana*	33	*Heliopora coerulea*
3	*Acropora* spp.	34	*Herpolitha limax*
4	*Alveopora* sp.	35	*Hydnophora exesa*
5	*Alveopora spongiosa*	36	*Hydnophora microconos*
6	*Blastomussa wellsi*	37	*Lobophyllia corymbosa*
7	*Catalaphyllia jardinei*	38	*Lobophyllia* spp.
8	*Caulastrea* spp.	39	*Merulina ampliata*
9	*Cynarina lacrymalis*	40	*Millepora* spp.
10	*Cyphastrea serailia*	41	*Montastrea* spp.
11	*Diploastrea heliopora*	42	*Montipora foliosa*
12	*Distichopora* spp.	43	*Montipora* spp.
13	*Echinophyllia* spp.	44	*Mycedium* sp.
14	*Echinopora lamellosa*	45	*Mycedium elephantotus*
15	*Eguchipsammia fistula / Dendrophyllia fistula*	46	*Oxypora* sp.
16	*Euphyllia ancora*	47	*Pectinia* spp.
17	*Euphyllia cristata*	48	*Physogyra lichtensteini*
18	*Euphyllia divisa*	49	*Plerogyra sinuosa*
19	*Euphyllia glabrescens*	50	*Plerogyra turbida / Nemenzophyllia turbida*
20	*Euphyllia paraancora*	51	*Polyphyllia talpina*
21	*Euphyllia paradivisa*	52	*Porites* spp.
22	*Favia* spp.	53	*Scolymia vitiensis*
23	*Favites abdita*	54	*Symphyllia* spp.
24	*Favites* spp.	55	*Trachyphyllia geoffroyi*
25	*Fungia* spp.	56	*Tubastrea* spp.
26	*Galaxea astreata*	57	*Tubipora musica*
27	*Galaxea fascicularis*	58	*Turbinaria peltata*
28	*Goniastrea* spp.	59	*Turbinaria* spp.
29	*Goniopora lobata*	60	*Wellsophyllia radiata*
30	*Goniopora* spp.	61	Other Scleractinia (Substrat)
31	*Goniopora stokesi*	62	Other Scleractinia (Live rock)

Table B. Cultured corals

No.	Species name	No.	Species name
1	*Acanthastrea echinata*	41	*Leptoseris* spp.
2	*Acanthastrea* spp.	42	*Lithophyllon* spp.
3	*Acropora* spp.	43	*Lobophyllia* spp.
4	*Alveopora spongiosa*	44	*Merulina ampliata*
5	*Alveopora* spp.	45	*Micromussa amakusensis*
6	*Anacropora* spp.	46	*Millepora* spp.
7	*Astreopora* spp.	47	*Montastrea* spp.
8	*Australomussa rowyelensis*	48	*Montipora* spp.
9	*Barabattoia* spp.	49	*Mycedium elephantotus*
10	*Blastomussa merleti*	50	*Mycedium robokaki*
11	*Blastomussa wellsi*	51	*Mycedium* spp.
12	*Catalaphyllia jardinei*	52	*Nemenzophyllia turbida*
13	*Caulastraea* spp.	53	*Oxypora* spp.
14	*Cycloseris* spp.	54	*Pachyseris* spp.
15	*Cynarina lacrymalis*	55	*Pavona* spp.
16	*Cyphastrea* spp.	56	*Pectinia lactuca*
17	*Dendrophyllia* spp.	57	*Pectinia* spp.
18	*Diaseris* spp.	58	*Physogyra lichtensteini*
19	*Diploastrea heliopora*	59	*Platygyra* spp.
20	*Disticopora* spp.	60	*Plerogyra simplex*
21	*Echinophyllia* spp.	61	*Plerogyra sinuosa*
22	*Echinopora* spp.	62	*Plerogyra turbida*
23	*Euphyllia ancora*	63	*Plesiastrea versipora*
24	*Euphyllia cristata*	64	*Pocillopora* spp.
25	*Euphyllia divisa*	65	*Pocillopora verrucosa*
26	*Euphyllia glabrescens*	66	*Poliphyllia talpina*
27	*Euphyllia paraancora*	67	*Porites* spp.
28	*Euphyllia paradivisa*	68	*Psammocora* spp.
29	*Euphyllia yaeyamaensis*	69	*Scolymia* spp.
30	*Favia* spp.	70	*Seriatopora hystrix*
31	*Favites* spp.	71	*Seriatopora* spp.
32	*Fungia* spp.	72	*Scolymia* spp.
33	*Galaxea* spp.	73	*Stylocoeniella* spp.
34	*Goniastrea* spp.	74	*Stylophora pistillata*
35	*Goniopora* spp.	75	*Stylophora* spp.
36	*Heliofungia actiniformis*	76	*Symphyllia* spp.
37	*Heliopora coerulea*	77	*Trachyphyllia geoffroyi*
38	*Herpolitha limax*	78	*Tubastrea* spp.
39	*Hydnophora rigida*	79	*Tubipora musica*
40	*Hydnophora* spp.	80	*Turbinaria* spp.

Appendix 4. Species-based quota of Indonesian ornamental coral trade in 2016 as reported by AKKII

No	Species Name	Amount	No	Species Name	Amount
1	*Acanthastrea* sp.	1000	31	*Heliopora coerulea*	2500
2	*Acanthophyllia deshayesiana*	4000	32	*Herpolitha limax*	2000
3	*Acropora* sp.	3000	33	*Hydnophora exesa*	10000
4	*Alveopora* sp.	1050	34	*Hydnophora microconos*	6500
5	*Blastomussa wellsi*	3500	35	*Lobophyllia corymbosa*	13500
6	*Catalaphyllia jardinei*	19000	36	*Lobophyllia* sp.	11500
7	*Caulastrea* sp.	21000	37	*Merulina ampliata*	5000
8	*Cynarina lacrymalis*	7000	38	*Millepora* sp.	2000
9	*Cyphastrea serailia*	500	39	*Montastrea* sp.	7500
10	*Diploastrea heliopora*	500	40	*Montipora* sp.	3000
11	*Distichopora* sp.	1500	41	*Mycedium* sp.	1500
12	*Echinophyllia* sp.	1500	42	*Nemenzophyllia turbida* / *Plerogyra turbida*	12000
13	*Echinopora lamellosa*	500			
14	*Dendrophyllia fistula*	15000	43	*Oxypora* sp.	1000
15	*Euphyllia ancora*	20000	44	*Pectinia* sp.	2500
16	*Euphyllia cristata*	22000	45	*Physogyra lichtensteini*	11000
17	*Euphyllia divisa*	1000	46	*Plerogyra sinuosa*	23000
18	*Euphyllia glabrescens*	12000	47	*Polyphyllia talpina*	8000
19	*Euphyllia paraancora*	3000	48	*Porites* sp.	36500
20	*Euphyllia paradivisa*	2500	49	*Scolymia vitiensis*	4500
21	*Favia* sp.	7000	50	*Symphyllia* sp.	2700
22	*Favites* sp.	13500	51	*Trachyphyllia geoffroyi*	41000
23	*Fungia* sp.	26500	52	*Tubastrea* sp.	12000
24	*Galaxea astreata*	5600	53	*Tubipora musica*	8500
25	*Galaxea fascicularis*	8000	54	*Turbinaria peltata*	12000
26	*Goniastrea* sp.	2900	55	*Turbinaria* sp.	15000
27	*Goniopora lobata*	40000	56	*Wellsophyllia radiata*	10000
28	*Goniopora* sp.	44000	57	Substrat / Soft Corals	900000
29	*Goniopora stokesi*	43000	58	Live rock	450000
30	*Heliofungia actiniformis*	35000		TOTAL	1,979,750

Appendix 5. Lists of Indonesian coral exporter companies distinguished by permit hold to export wild or cultured corals in 2016 as reported by AKKII

Table A. Permit holders for wild corals exportation

No.	Company Name	Warehouse location (Province)					
1	Agung Aquatic Marine	Bali					
2	Aneka Tirta Surya	Bali	Banten		Jatim	Sultra	
3	Aqua First Bali	Bali					
4	Aqua Marindo				Jatim		
5	Aqualine	Bali			Jatim		
6	Aristocratama Binausaha						
7	Asia Pacific Aquatics			DKI			
8	Bali Aquarium	Bali			Jatim		
9	Bali Coral	Bali				Sultra	
10	Bali Double C	Bali					
11	Bali Samudra Anugrah	Bali					
12	Banyu Biru Sentosa		Banten				
13	Bekael Eska Gemilang		Banten				
14	Blue Star Aquatic	Bali					
15	Cahaya Baru	Bali	Banten				
16	Coral International	Bali					
17	Demonia Perkasa	Bali					
18	Dharma Inti Permai		Banten				
19	Dinar Darum Lestari	Bali	Banten		Jatim		
20	Dirga Mega Cipta			DKI			
21	Diyo Enggal Makmur	Bali					
22	Dunia Alam Mulia				Jatim		
23	Fantasy Aquarium		Banten				
24	Gloria International		Banten				
25	Golden Marindo Persada		Banten	DKI		Sultra	
26	Hiu Samudra Pratama	Bali					
27	Inti Putra Pertiwi Persada	Bali					
28	Intisamudra Lestari	Bali					
29	Kharisma Surya Lestari			DKI			
30	Krakatau Koral Lestari	Bali					
31	Megah Indo Lestari			DKI			
32	MG Coral	Bali					
33	Nini Srirejeki	Bali					
34	Pacific Anekamina		Banten				
35	Panorama Alam Tropika						NTT
36	Pusat KUD Mina				Jatim		
37	Putra Pelangi Samudra	Bali					
38	Sangputra Wimasjaya				Jatim		
39	Sarana Teknik	Bali					
40	Seaquest				Jatim		
41	Segoro Utomo				Jatim		
42	Serico Gema Pratama		Banten				
43	Srikandi Aquarium				Jatim		
44	Tanjungsari Aquarium	Bali					
45	Tripratama Lestari			DKI			
46	Trisentosa I. Niaga	Bali					
47	Tropikal Aqua World			DKI			
48	Vivaria Marine		Banten	DKI			
	Amount	24	12	8	11	3	1

Table B. Permit holders for cultured corals exportation

No.	Company Name	Provinces						
1	Abadi Mandiri				Jatim			
2	Agung Aquatic Marine	Bali						
3	Aksara Bahana Abadi	Bali						
4	Aneka Karang Sepanjang	Bali						
5	Aneka Tirta Surya	Bali	Banten		Jatim	Sultra		
6	Aristocratama Binausaha				Jatim			
7	Aqua First Bali	Bali						
8	Aqua Marindo				Jatim			
9	Aqualine	Bali						
10	Bali Aquarium	Bali			Jatim			
11	Bali Coral	Bali				Sultra		
12	Bali Double C	Bali						
13	Bali Samudra Anugrah	Bali						
14	Bali Sea Farm	Bali						
15	Banyu Biru Sentosa		Banten					
16	Bekael Eska Gemilang		Banten					
17	Blue Star Aquatic	Bali						
18	Cahaya Baru	Bali	Banten					
19	Coral International	Bali						
20	Demonia Perkasa	Bali						
21	Dharma Inti Permai		Banten					
22	Dinar Darum Lestari	Bali	Banten		Jatim			
23	Diyo Enggal Makmur	Bali						
24	Dunia Alam Mulia				Jatim			
25	Fantasy Aquarium		Banten					
26	Gloria International		Banten					
27	Golden Marindo Persada		Banten	DKI		Sultra		
28	Hiu Samudra Pratama	Bali						
29	Intisamudra Lestari	Bali						
30	Kharisma Surya Lestari			DKI				
31	Krakatau Koral Lestari	Bali						
32	Nini Srirejeki	Bali						
33	Pacific Anekamina		Banten					
34	Panca Naga Jaya	Bali						
35	Panorama Alam Tropika						NTT	
36	Putra Pelangi Samudra	Bali						
37	Pura Baruna Lestari							Jateng
38	Sangputra Wimasjaya				Jatim			
39	Sarana Teknik	Bali						
40	Seaquest				Jatim			
41	Segoro Utomo				Jatim			
42	Serico Gema Pratama		Banten					
43	Srikandi Aquarium				Jatim			
44	Tanjungsari Aquarium	Bali						
45	Trisentosa Intrabuana Niaga	Bali						
46	Vivaria Marine		Banten	DKI				
	Amount	26	12	3	11	3	1	1