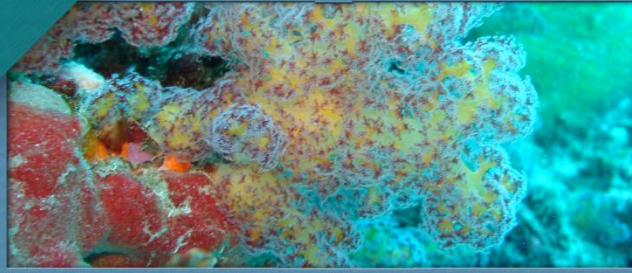




# Bay of Bengal Large Marine Ecosystem Project



# Situation analysis of the Myeik Archipelago

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## Situation analysis of the Myeik Archipelago



The situation analysis report summarizes the status of marine and coastal resources in the Myeik Archipelago, socio-economic characteristics, current and future threats to resources and critical habitats and management capacity and institutional responses. In-depth information on relevant policy and legal framework is provided in *The National Report of Myanmar on Sustainable Management of the Bay of Bengal Large Marine Ecosystem* (BOBLME, 2004) and summarized in *the Transboundary Diagnostic Analysis Vol. 2. Background and Environmental Assessment* (BOBLME, 2012). Key short and long-term interventions for conservation action recommended in this report stem from a synthesis of existing knowledge from literature reviews, government and non-government reports, graduate studies, newspaper; as well as data and information gathered from personal communications, group discussions at workshops and a series of four ecological expeditions undertaken as part of a cooperative effort by IUCN Asia Regional Office in partnership with Fauna and Flora International (FFI) between 2014 and 2015, in collaboration with the BOBLME Project.

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## Acronyms used

|           |   |
|-----------|---|
| ASEAN     | Association of South East Asian Nations                                   |
| BANCA     | Biodiversity and Nature Conservation Association                          |
| BOBLME    | Bay of Bengal Large Marine Ecosystem Project                              |
| CPUE      | Catch per Unit Effort   |
| DHT       | Directorate of Hotels and Tourism   |
| DRA       | Dawei Research Association  |
| EAf       | Ecosystem Approach to Fisheries   |
| EAfM      | Ecosystem Approach to Fisheries Management                                |
| EEZ       | Exclusive Economic Zone   |
| EIA       | Environment Impact Assessment   |
| FAO       | Food and Agriculture Organization   |
| FFI       | Fauna and Flora International   |
| GCRMN     | Global Coral Reef Monitoring Network                                      |
| ICM       | Integrated Coastal Management   |
| ICSF      | International Collective in Support of Fish Workers                       |
| INGO      | International Non-Government Organizations                                |
| IOSEA MoU | Indian Ocean and Southeast Asia Marine Turtle Memorandum of Understanding |
| IUCN      | International Union for the Conservation of Nature                        |
| IUU       | Illegal, Unreported and Unregulated                                       |
| JICA      | Japan International Cooperation Agency                                    |
| LMMA      | Locally Managed Marine Areas  |
| LNGO      | Local Non-Government Organizations  |
| MAAS      | Myanmar Academy of Arts and Science                                       |
| MABR      | Myeik Archipelago Biodiversity Research                                   |
| MCS       | Monitoring, Control and Surveillance                                      |
| MEP       | Myanmar Environmental Project   |
| MERN      | Myanmar Environment Rehabilitation Network                                |
| MFF       | Myanmar Fisheries Federation  |
| MIC       | Myanmar Investment Commission   |
| MLFRD     | Ministry of Livestock, Fisheries and Rural Development                    |
| MNP       | Marine National Park  |
| MOECAF    | Ministry of Environmental Conservation and Forestry                       |
| MPA       | Marine Protected Area   |

|         |  |
|---------|--|
| MPE     | Myanmar Pearl Enterprise                       |
| MSAM    | Marine Science Association, Myanmar            |
| MSP     | Marine Spatial Planning                        |
| MSY     | Maximum Sustainable Yield                      |
| NAG     | Network Activities Group                       |
| NBSAP   | National Biodiversity Strategy and Action Plan |
| NGOs    | Non-Government Organizations                   |
| NPOA    | National Plan of Action                        |
| NWCD    | Nature and Wildlife Conservation Division      |
| PMBC    | Phuket Marine Biological Centre                |
| SAP     | Strategic Action Programme                     |
| SCUBA   | Self-Contained Underwater Breathing Apparatus  |
| SEAFDEC | South East Asian Fisheries Development Centre  |
| TED     | Turtle Exclusion Devices                       |
| UNDP    | United Nations Development Programme           |
| WCS     | Wildlife Conservation Society                  |



## 1. Introduction

Myeik Archipelago contains about 800 islands of primarily limestone and granite in the southern Tanintharyi coastal region of Myanmar, covering an area of about 3 434 000 ha (Novak, et al., 2009). The Archipelago is geographically located between 11°21' N and 98°10' E, distributed along approximately 600 km of Myanmar's Andaman coast (**Figure 1**). The Myeik Archipelago extends from Mali Island north of Myeik, to Za Det Gyi Island in Kawthoung, the southernmost tip of Myanmar. The Tanintharyi coast is influenced by tectonic movement and volcanic activity resulting from the docking of the Indian tectonic plate with the Eurasian plate in the early Miocene. The twisting of the Eurasian plate as the Indian plate dragged its margins northwards formed the metamorphic mountain ranges of Tanintharyi Yoma, provided many rocky shorelines and the rocky headlands and capes jutting out into the sea. The Myeik Archipelago itself is composed mainly of metamorphic rocks of the Mergui Series, following tectonic lines north to south. Outer islands, like those of northern Thailand, are mostly granitic, whereas inshore islands are often composed of limestone. The coastal plain is narrow and gradually rises towards the east, reaching 2 073 m at Myint Moe Let Khat Taung, the highest peak (Istituto Oikos and BANCA, 2011; Novak *et al.*, 2009; Tin Win, 2004).



Figure 1. Map of Myanmar, showing Myeik Archipelago (in the southeast corner) and the three coastal regions.

Many of the islands of Myeik Archipelago are covered by lowland wet evergreen forest and have been historically associated with flourishing and extensive coral reef, mangrove and seagrass

communities (Wildlife Conservation Society, 2013). Areas of wildlife significance include breeding beaches for sea turtles, aggregation sites for manta rays at Black Rock and roosting sites of Plain-pouched Hornbill (e.g. Hornbill Island with its 150 individual roosts). Coral reefs are mostly found around the outer islands and mangroves cover much of the inner islands (BOBLME, 2012). Rivers including Ye, Dawai, Tanintharyi and Lenya input large volumes of fresh water and sediment into the system. The region receives the southwest monsoon rain from mid-May to mid-October. July and August are generally regarded as the period of maximum rainfall, with December being the driest month. Tanintharyi experiences on average 4 122 mm of rainfall per year; the coastal area record ranges from 2 538 mm to 5 076 mm (the heaviest recorded annual rainfall) (Nay Win Oo, 2002). Despite the monsoon, the annual temperature range is quite low (average 26.6°C, with monthly average maximum of 28°C in March and minimum of 25°C in December), although daily temperatures can vary by around 8°C.

## 2. Socio-ecological systems of Myeik Archipelago

### 2.1. Biophysical systems

#### 2.1.1. Mangroves

Myanmar hosts the fourth largest mangrove coverage among Asian countries, after Malaysia, Bangladesh and Papua New Guinea (Food and Agriculture Organization, Regional Office for Asia and the Pacific, 2003). Of the total Myanmar mangroves, nearly half is located on Ayeyawaddy flood plains, with the remainder in Tanintharyi and a lesser fraction in the Rakhine area (**Figure 2**) (Tin Win, 2004). There are few recent or published studies on associated biodiversity. Information available shows that species distributions and compositions of mangroves differ amongst the three coastal regions. The Rakhine mangroves are made up primarily of *Rhizophora mucronata*, *R. candelria*, *Sonneratia* spp., *Kandelia rheedii*, *Bruguiera* spp., *Xylocarpus granatum*, *X. moluccensis*, *Nipa fruticans*, and *Phoenix paludosa*. The Ayeyawaddy mangroves consist of *Rhizophora mucronata*, *R. conjugata*, *Bruguiera parviflora*, *B. gymnorrhiza*, *B. cylindrica*, *Heritiera formos*, *Sonneratia apetala*, *S. griffithii*, *S. caseolaris*, *Xylocarpus granatum*, *X. molluccensis*, *Ceriops roxburghiana*, *C. mimosoides*, *Avicennia officinalis*, *Kandelia rheedii*, and *Excoecaria agallocha*. The mangroves of the Tanintharyi Region comprise *Rhizophora* spp., *Sonneratia caseolaris*, *Ceriops tagal*, *Xylocarpus granatum*, *Avicennia officinalis* and *Bruguiera* spp. (Fund, 2008). Common families include Avicenniaceae, Combretaceae, Euphorbiaceae, Rhizophoraceae, Sonneratiaceae and Sterculiaceae. When compared with other regions *Rhizophora* spp. are more abundant in the Tanintharyi and *Avicennia latana* is found only in this area (Kyaw Tint *et al.*, 2012).

Over the past few decades, mangroves have been undergoing over-exploitation, illegal felling, agricultural expansion and conversion to fishponds, shrimp ponds and rice paddies (Nay Win Oo, 2002). Some 300 000 ha of mangroves were lost from 1975 to 2005 (Spalding *et al.*, 2010). Official historical data on total mangrove coverage with a delineation of the primary and secondary mangrove forests is hardly available (Food and Agriculture Organization, Regional Office for Asia and the Pacific, 2003). **Table 1** presents mangrove coverage in three areas in 2004 and 2010, including encroachment and remaining mangrove forest. The area of mangroves however appears to have increased between 2004 and 2010; and the encroachment areas in Rakhine and Ayeyarwady in 2010 were even greater than areas recorded in 2004. This is because the areas estimated and marked as “remaining” in the literature incorporate large areas of replanted forest and do not accurately reflect the areas of unharvested primary forest. Even so, the number of encroachments in 2010 demonstrates how rapid and to what extent mangroves were depleted and degraded as compared to 2004. In Myanmar, mangrove replantation is likely a responsive action although research suggests replanted forest supports only a small fraction of the biodiversity of primary forest and delivers concomitantly reduced ecosystem goods and services.

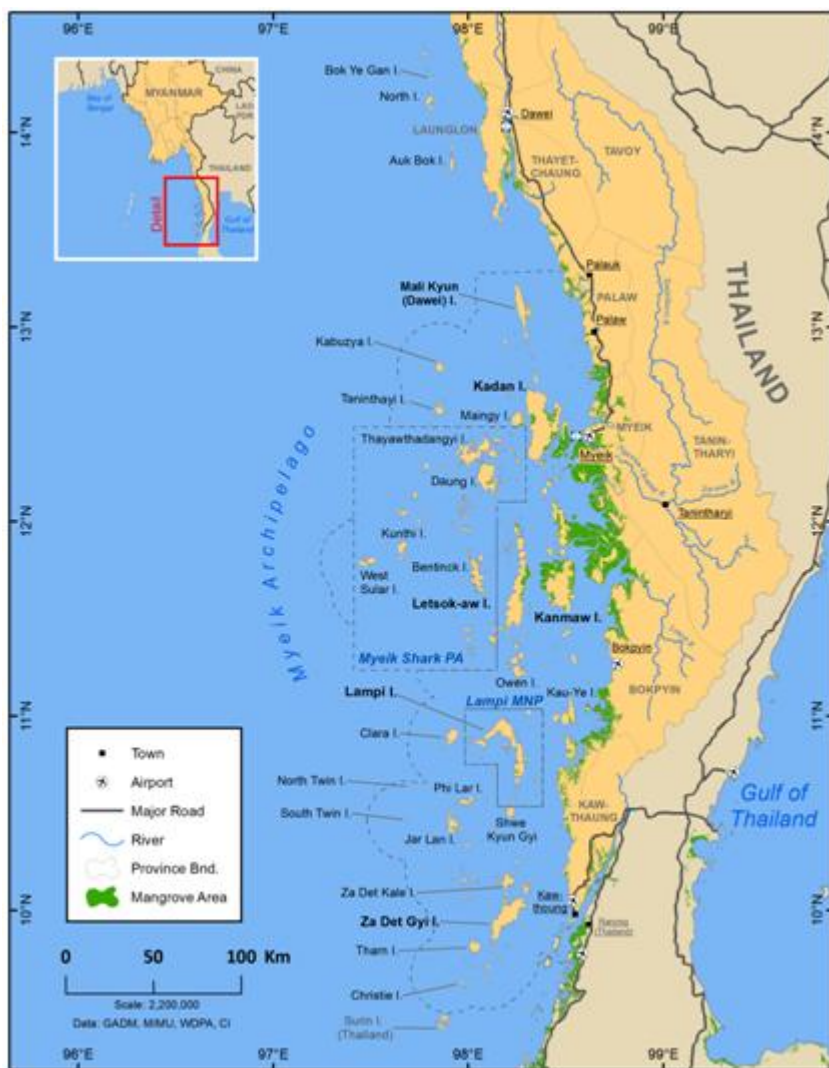


Figure 2. Distribution of mangroves in Myanmar.

Source: Spalding, Ravilious, & Green, 2001

Table 1. Mangrove forests coverage in the Rakhine State, Ayeyarwady and Tanintharyi regions in 2004 and 2010

| State/region       | Area (ha), as of 2004 | Area (ha), as of 2010 | Encroachment (ha), as of 2010 | Remaining (ha), as of 2010 |
|--------------------|-----------------------|-----------------------|-------------------------------|----------------------------|
| Rakhine State      | 64 752                | 167 483               | 69 964                        | 97 519                     |
| Ayeyarwady Region  | 177 256               | 296 448               | 271 600                       | 24 848                     |
| Tanintharyi Region | 140 024               | 195 103               | 5 026                         | 190 077                    |
| Total              | 382 032               | 659 034               | 346 590                       | 312 444                    |

Source: adapted from Tin Win, 2004 and Kyaw Tint *et al.*, 2012

Cyclone Nargis devastation in May 2008, along with higher population and easier accessibility to mangrove forests than other regions have resulted in the highest mangrove loss in Ayeyarwady in 2010 (92% loss). Of the 5 026 ha of mangroves that had been converted to other purposes in

Tanintharyi Region in 2010, 3 600 ha were converted for agriculture (mainly for paddy cultivation: (Nang Mya Han, 2010), and 1 426 ha converted for fisheries (into fish or shrimp culture ponds). The exploitation of the mangroves in this area is comparatively less than in other regions because of relatively low human population and the fact that the coastal landscape is more sheltered (Nay Win Oo, 2002). The forests of Tanintharyi are thus much richer floristically and face comparatively fewer threats (regardless of existing illegal logging for charcoal and poles) than in other regions (Kyaw Tint *et al.*, 2012). Although mangroves are the most-studied marine habitat in the country, little has been published regarding their economic value and contribution to fisheries and the livelihoods of people living in the coastal zone (Emerton and Yan Min Aung, 2013). Often, in accounting the global area of mangrove forests, Myanmar has not been included in tabulated figures. The integrative significance of Myanmar mangrove forests to regional ecosystem functions is therefore difficult to determine (Food and Agriculture Organization, Regional Office for Asia and the Pacific, 2003; Emerton, 2014).

### 2.1.2. Coral reefs

Myanmar has a reported total coral reef area of 187 000 ha (BOBLME, 2012), although this is principally an extrapolation of potential habitat area rather than a surveyed quantity. Reliable quantitative, survey-based historical baseline research for comparison of coral reef condition in Myanmar has been limited. Coral community in the Myeik Archipelago was largely unexplored and the species diversity and health of this ecosystem was poorly known until recently. Literature suggests that coral reefs in Rakhine and Tanintharyi Regions, in particular offshore islands of Myeik Archipelago, are the most extensive and diverse. These islands populate a shallow marine shelf, less than 100 m deep, that encloses the Myeik Archipelago; the shelf gradually narrows toward the south where it eventually terminates in a minor slope with 100 m relief, merging with the Sunda Shelf at the Strait of Malacca. At its northern end, the shelf drops precipitously into the Central Andaman Trough (3 000 m deep). As such, the extant coral communities of Myeik are entirely Holocene and have arisen from drowned reefs in the Andaman Sea following the sea level rises since the last glacial maximum (approximately 7 000 years ago). Until the opening of the Malacca Strait, Myeik reefs were probably contiguous with those to the south; however countervailing currents have since limited connectivity (Kokkiatiwong and Limpisachong 1992) and organisms with passive larvae.

The recorded coral formation in Myeik Archipelago consists of fringing reefs, submerged pinnacles and seamounts, limestone caves, sheer and sloping rock walls, and boulder-strewn sand bottoms. The formation has been historically reported (e.g. by Fischer, 1985; Reef Check Europe, 2001; (GCRMN, 2005) outstanding around small islands, especially in the Gregory Group and relatively poor around Lampi Island. **Table 2** presents number of coral species identified by a variety of authorities. The number has increased significantly (51 species in 1972 to 512 species in 2014) as a result of the recent meta-search by the Marine Science Department at Mawlamyine University, which trawled through hundreds of graduate theses, identifying a total of 512 species of hard corals (Scleractinian and Hydrozoan corals) from studies on 24 islands of the northern Myeik Archipelago.

Table 2. Number of coral species in Myeik Archipelago

| Location                                    | Number of coral species | Number of coral genera | Authority  |
|---|-------------------------|------------------------|--|
| “Mergui Archipelago”                        | 51                      | 26                     | Pillai 1972  |
| “Mergui Archipelago”                        | 61 (+4)                 | 31 (+3)                | Reef Check Europe 2001                                       |
| “Mergui Archipelago”                        | 65                      | Not stated             | Wilkinson 2004   |
| Tanintharyi Coast                           | 93                      | 47                     | Nang Mya Han 2010 (compilation of studies between 1982-2002) |
| Tayawthetangyi Island and Tanintharyi Coast | 114                     | 60                     | War War Soe 2008   |
| Myanmar                                     | 283                     | 64                     | WCS 2014 (estimated)   |
| Northern Myeik                              | 512                     | Not stated             | Tint Tun (graduate thesis meta-survey WCS 2014)              |

Since this is more than twice the number of species found in the entirety of neighboring Thailand - both Andaman and South China Sea assemblages – and is equal to the very richest parts of the Coral Triangle, the count may be slightly optimistic. Given the fact that the graduate work spans several decades during which scleractinian taxonomy was extensively revised, it is entirely possible that the count includes a proportion of superseded nomenclature. The prolonged isolation of north Andaman reefs is conducive to speciation, therefore, the likelihood of endemism amongst corals is high (Brown, 2007).

Previously, coral reefs in Myanmar were assumed to be in similar condition to what they were hundreds of years ago, due to isolation and difficult access by the sparse coastal population (BOBLME, 2012; Spalding *et al.*, 2001) Myanmar Ministry of Hotels and Tourism has flagged reef-based eco-tourism as a major future source of income for the region; although the marketing assumption of “pristine reefs” may be based on a flawed premise. Considering there is no government or NGO-supported coral reef monitoring program in the country (Wilkinson, 2004), the blanket assumptions about the good health and aesthetic values of Myeik coral reefs are questionable.

Between February 2014 and January 2015, four survey expeditions were undertaken as part of a cooperative effort by International Union for Conservation of Nature (IUCN) Asia Regional Office in partnership with Fauna and Flora International (FFI) and in collaboration with the BOBLME Project. Complementing earlier work in 2013 in two separate survey efforts (Tun, 2013; Cox *et al.*, 2013), this series of expeditions targeted the more remote and harder to reach outer islands. Rapid ecological surveys have successfully reached the goal of assessing coral reef condition and establishing baseline biodiversity in a variety of sites throughout the Myeik Archipelago. Overall, coral communities in the Northern Myeik Archipelago were dominated by *Porites*, particularly on outer fringing reefs. *Acropora* was visually dominant on inner reefs and below these two, a broad suite of faviids, *Psammocora* and *Fungia* (mushroom corals) were abundant (Obura *et al.*, 2014) While basic diversity is equivalent to, and shows strong affiliation with Andaman Thai reefs - the abundance of key reef infrastructure species is generally low and the overall condition of most coral reefs is either poor or very poor. Coral health indicators showed that many reefs were under pressure from various stressors (Figure 3). The overall resilience or health of reefs was scored at average to below average levels (range 3.1 to 2.6 on a 1 (poor) to 5 (good) scale) (Obura *et al.*, 2014) although Wilkinson, (2004) suggested that initial surveys reported that most of the reefs of southern Myeik possessed >50% live cover, in the Reefs at Risk analysis (Burke *et al.*, 2002), the authors suggested a 56% decline of coral reef cover due to overfishing, destructive fishing, coastal development, sedimentation, marine-based pollution and live coral trade.



The IUCN/BOBLME Rapid ecological assessment of the southern Myeik Archipelago (2014) indicates that many reefs have less than 10% live hard coral cover, and are dominated by corallimorphs and algae growing on dead coral and rubble. Soft corals and azooxanthellate hexacorals are the most prevalent anthozoan lifeforms, particularly offshore. There was a general absence of fish and high presence of sea urchins, suggesting high fishing impacts. Biomass of fishes averages less than that of Thai reefs, although was equivalent to the most heavily fished reefs in that country. The proximal cause of the ecological impoverishment is a combination of the effects of the 2010 mass bleaching event, contiguous with prolonged exposure to Malthusian fishing techniques (principally blast fishing) and unregulated marine product resource extraction (e.g. sea cucumbers and clams). While corallivorous predators were encountered (sometimes in quite high numbers) they are not believed to be the root cause of the decline in reef condition in southern Myanmar. The scant information recorded in Myanmar references was discovered to be sadly out of date or inaccurate, with many sites historically associated with high coral cover and reef fish diversity were found to be completely devastated. Recruitment of juvenile corals and fishes was found to be quite high, even in badly degraded reefs, which suggests the existence of reservoirs of biodiversity within the archipelago that would reward pro-active conservation measures. Without direct intervention, however, the recovery potential of these sites is low.



**Figure 3. Coral communities in the Myeik Archipelago (during the IUCN/BOBLME survey 2015).**

- a) Coral communities illustrating diversity and abundance of coral species
- b) Corals damaged by a combination of bleaching event and dynamite fishing
- c) Corals impacted by fishing activity and entangled by fishing net.

### 2.1.3. Seagrass beds

As with other marine resources, information on the status of seagrass beds in Myanmar has been very limited (BOBLME, 2012). Studies by (Novak *et al.*, 2009) and (Tint Tun and Bendell 2010) reveal ten seagrass species in Myanmar waters including *Cymodocea rotundata*, *C. serrulata*, *Halodule pinifolia*, *H. uninervis*, *Syringodium isotofolium*, *Enhalus acoroides*, *Halophila beccarii*, *H. decipiens*, *H. ovalis.*, and *Thalassia hemprichii*. Seagrass beds of varying sizes and diverse species can be found along the Rakhine and Tanintharyi coasts, supporting a large number of marine fish and shrimp larvae, especially the post larvae of *Penaeus semisulcatus*. Since estuarine and brackish condition of the water is influenced by large volume of freshwater runoff, no seagrass is present in the coastal zones off the Ayeyarwady Delta and Mon State (BOBLME, 2004). According to (Soe Htun *et al.*, 2001), seagrass species found in other areas are also present in Myeik Archipelago. Intertidal seagrass meadows in the Archipelago are dominated by *Cymodocea rotundata* and *Thalassia hemprichii*, species characteristic of reef habitats (Tint Tun and Bendell 2010)

Tint Tun and Bendell (2010) report relatively large patches of seagrasses and great diversity of seagrass species around Lampi Island, with isolated patches in the northern part of the Myeik Archipelago (**Figure 3** - solid circles represent areas where seagrasses were found while open circles denote areas with no seagrasses). The nature of the coastline appears to limit potential for seagrass distribution in the northern areas. Depth and turbidity (low clarity) of waters, high exposure to strong waves and winds are major factors contributing to less-suitable conditions for seagrass growth in the northern region (Novak *et al.*, 2009). Seagrasses around Lampi Island are reported to

occur often on reef flats or in sandy intertidal areas as monospecific beds. Meadows are observed on flats inshore of coral reefs in the east where they are sheltered from the southwest monsoon.

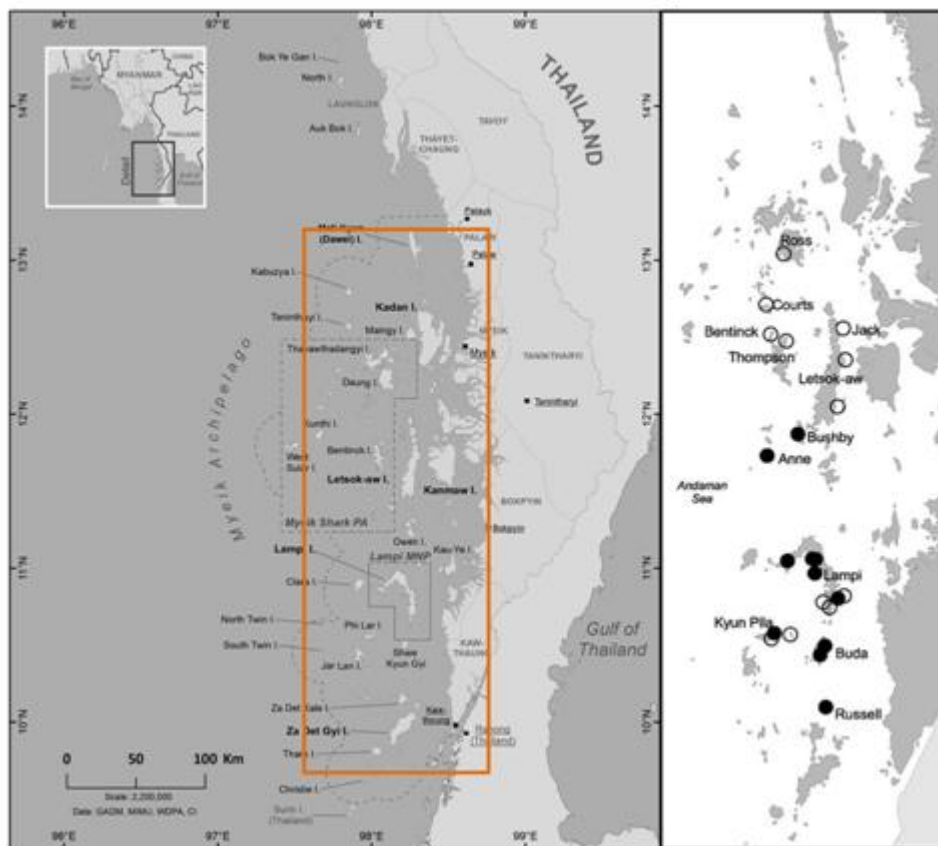


Figure 4. Locations of seagrass beds in the Myeik Archipelago.

Source: Novak *et al.*, 2009

The economic and ecological importance of seagrass beds are recognized as fishing grounds and habitats for dugongs (Ilangakoon and Tun 2007; Soe Htun *et al.*, 2001). Unlike the Andaman coast of Thailand, where seagrasses and mangroves co-occur, the habitats appear mutually exclusive around Lampi Island (Tint Tun and Bendell 2010). In the review literature, the seagrass beds along Tanintharyi coastline are reported to be in near-pristine condition (Soe Tun *et al.*, 2001), well preserved and facing no immediate threats (Ilangakoon and Mya ThanTun, 2007). This notion contradicts information provided by some local marine researchers, suggesting a growing stress over seagrass resources due to a recent increase in numbers and activity of “baby trawlers” (vessels less than around 10 tonnes total displacement, that are often able to skirt or escape regulations governing the larger commercial fishing vessels) in near-shore coastal waters (Frank Momberg and Zau Lunn, personal communication, 2014). Since seagrass beds are perceived to have only indirect benefits to coastal populations, government-sponsored study on this marine habitat may continue to be limited. Damage caused by fishing operations (especially scarring from demersal trawls) has also not been evaluated (Nang Mya Han and San Tha Tun, personal communication, 2014).

#### 2.1.4. Seaweeds

There have been a few studies on seaweed diversity in each of the coastal regions in Myanmar. Although the rocky shores of Myeik Archipelago are the most suitable habitats for seaweeds, the small number of Myanmar phycologists find it difficult to cope with year-round studies of the entire regional flora. Occasional visits are made possible only during the winter and summer months. Despite the existing problems, as many as 122 genera and 307 species of seaweeds in the country have been reported by Kyi Win (1972) and Kyaw Soe and Kyi Win (1975, 1977) (cited in BOBLME,

2004). *Sargassum* and *Hypnea* are the most abundant genera in Myanmar. *Sargassum* beds formed along the Rakhine and Tanintharyi coastal regions provide good habitats, refuges and spawning grounds for commercially important fishery resources. Additionally, seaweeds have been consumed for many years as vegetable and as a source of agar extraction. This resource however has scarcely been noticed or recognized as an important part of the marine environment (BOBLME, 2012) although commercial seaweed farms have sprung up in the Tanintharyi region under a Japanese development initiative (Nang Mya Han, personal communication, 2014).

### **2.1.5. Marine wildlife**

#### Cetacean (whales, dolphins and porpoises)

In Myanmar, the study on cetacean in their natural habitats in terms of the size of populations, distribution, migratory patterns, and the age of individual whale, dolphin and porpoise seems to be very limited. Most of the existing studies are based on reported sightings, reported strandings and reported by-catch. Whale Bay in Myeik Archipelago (east of Kan Maw (Kisseraing) Kyun) was named according to the historical sightings of whales in the past. According to interviews with artisanal fishermen and offshore bottom trawler skippers by (Tint Tun, 2006), whales were sighted near Kunthi Island, Kyun Me Gye (Clara Island) and Lagyan Aw of Kyunn Tann Shey (Lampi Island). Anecdotal evidence also suggests the presence of resident pods of Bryde's Whales in the Myeik Archipelago, similar to those found in the upper Gulf of Thailand (Mya Than Tun, personal communication, 2014). Whale skeletons from by-catch and stranding have been preserved and articulated for display at a number of institutions in Myanmar, including at the Marine Science Department of Myeik University, Patheingyi University and Mawlamyine University, the Department of Zoology of Dawei University, the DoF in Yangon and the Yangon Zoological Gardens (Nang Mya Han, personal communication, 2014). Whale stranding records indicate the existence of an individual rare Longman's beaked whale (*Indopacetus pacificus*) on the western coast of the Gulf of Mottama in 2005, a Blue whale (*Balaenoptera musculus*) in Mon State in 2006 and a Strap-toothed beaked whale (*Mesoplodon layardii*) in the Ayeyarwady Delta in 2011. This occurrence was considered an anomaly and not an extension of the species distribution (Aung Myo Chit *et al.*, 2012).

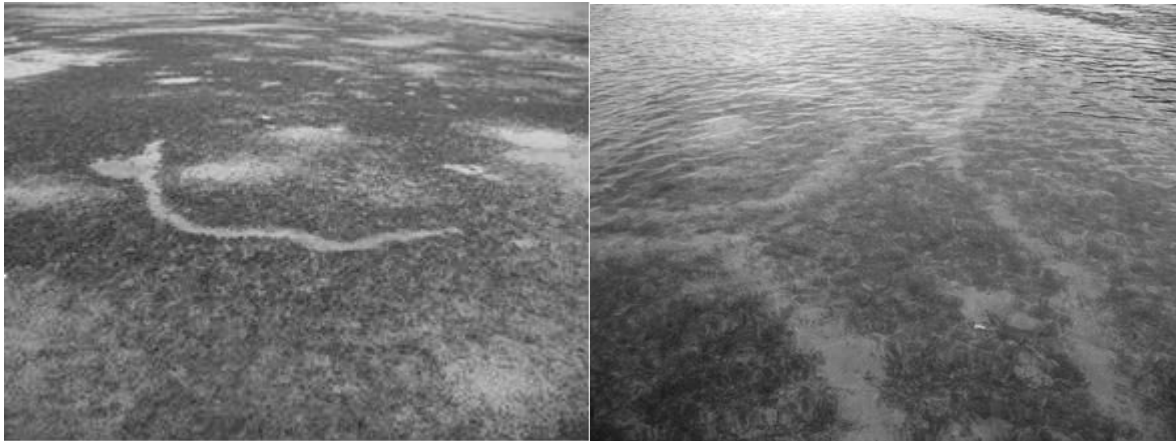
People in southern Myanmar believe that dolphins will rescue and help human having incidents at sea; in northern Rakhine State, people are scared of water sprayed from the blowholes of the dolphins (most likely, Indo-Pacific humpback) they encounter (San Tha Tun, personal communication, 2014). Commonly encountered cetacean species in Myanmar coastal waters include finless porpoises, Irrawaddy Indo-Pacific humpback and bottlenose, Pan Tropical spotted and spinner dolphins. Irrawaddy dolphin (*Orcaella brevirostris*) has been protected under the category "Completely protected animal" in the Protection and Wildlife Conservation of Natural Areas Law, also known as Wildlife Law, since 1994. However, accidental entanglement in purse-seine nets, beach-seine nets, gill nets and long lines have been reported as major threats to Myanmar's cetaceans. Local fishermen typically declared that they would release any dolphins entangled in their nets; this may not always be credible, given the fact that dolphin oil is in demand for medicinal purposes (Nang Mya Han, personal communication, 2014), and dolphin meat seems to have market value in Myeik and Dawei areas (Mya Than Tun and Tint Tun, personal communication, 2014). Fish sellers estimated that two or three dolphins per month could be found in the Mee Kwet Zay (early morning fish market) in Myeik, and about 30 cetaceans of various species are put on sale per month during all seasons at the Maungmagan fish market. This market was the main distribution point to local villages for dried and salted dolphin meat, skin, fins and internal organs in past years (Tint Tun, 2006). The sale of marine mammal products is illegal and discouraged by official policy; however, the use of accidentally-killed dolphins is regarded as practical by local people. It is unclear whether local support for the black market for dolphin products exists to the degree that dolphins are actively hunted.

### Dugong

A report on global assessment of dugong, 'Dugong: Status Report and Action Plans for Countries and Territories' by UNEP and IUCN (2002), has not listed Myanmar as a country supporting a population of dugong in national waters. Historically however, the presence of dugong in Myanmar waters has been known within the country and has been documented as far back as the 1850's by Rev. S Benjamin (Mason, 1882). According to the Myanmar Wildlife Law, dugong (*Dugong dugon*) is listed as completely protected animal on 26 October 1994. Myanmar became one of the first signatory states of Memorandum of Understanding (MoU) on the conservation and management of dugongs and their habitats throughout their range on 31 October 2007. As of February 2013, 26 countries have signed this MoU which is designed to facilitate national level and trans-boundary actions that will in turn lead to the conservation of dugong populations and their habitats. Despite being a signatory state of the dugong MoU (UNEP/CMS, 2011), there has been no effective conservation activities on dugong in Myanmar (Tint Tun, 2011). Studies using qualitative data were recently conducted in Rakhine State and Tanintharyi Region. It is found that occurrence of dugong in Rakhine was well informed and documented by Aye, 2004; Ilangakoon and Tun 2007; Tun and Ilangakoon, 2006, 2007; Tun *et al.*, 2009, but data of the Myeik Archipelago is relatively scarce (Tint Tun, 2011).

In 2008, 2009 and 2010, information on dugongs was gathered during the various visits to Lampi MNP. Dugongs were observed at Sular Islands, La Ngan group, Pale Kyuun Island, Lampi Island, Bo Lut Islands and Nyaung Wee Islands in southern part of Myeik Archipelago (Tint Tun, 2011). Interviews with local people and observation on seagrass beds were conducted in order to provide information to develop dugong conservation and management in Myanmar (Tint Tun, 2011). Dugong stranding information was first given by two Mokens from Nyaung Wee village in January 2008 and the second stranding reported by a Moken villager in March 2010. The first dugong was found on the east coast of Nyaung Wee village among the mangrove adjacent to a seagrass bed and the second dugong was stranded at Ma Kyone Galet village (Tint Tun, 2011). In reference to the dugong stranding information, the trace of the dugong occurrence was taken notice of whenever seagrass beds were visited. All dugong feeding trails were found at the area where *Halophila ovalis* is the dominant seagrass species (Tint Tun, 2011; Tint Tun and Bendell 2010). These trails were captured and used as evidence of dugong occurrence in Myeik Archipelago (**Figure 4**).

The major threats to dugongs are accidental by-catch in set nets used for skates and rays. Information from local fishermen suggests that dugongs are not largely targeted but if they are accidentally killed or seen stranded, they will be used for local consumption (Mya Than Tun, personal communication, 2014). Despite its legally protected status in Myanmar under the Wildlife Law (Notification No. 583/94), there is a lack of awareness regarding the dugong's conservation status among both the coastal communities and the authorities. For this reason, and because there are no clear official guidelines for reporting, dugong strandings and by-catch are not always reported to the responsible authorities (Ilangakoon and Mya Than Tun 2007) Nonetheless, unlike in other Asian countries such as Sri Lanka and India where it is considered a delicacy or in Thailand where there is prevalence of strong superstitious or medicinal values in relation to dugong body parts, teeth or tears, in Myanmar dugong flesh is not considered to be of any special significance or importance (Ilangakoon and Tun, 2007) These factors have, in fact, contributed to the absence of demand-driven direct hunting of dugongs in Myanmar.



**Figure 5. Dugong feeding trail through a patch of *Halophila ovalis* at Lampi Island.**

**Left - Nyaung Bin Aw (Khe Taung Aw) on the east coast of Lampi Island, March 2008**

**Right - East coast of Nyaung Wee Island, November-December 2008 (Tun and Bendell 2011) Turtles**

Five species of marine turtles breed and feed regularly in Myanmar waters: Green turtles (*Chelonia mydas*), Loggerhead turtle (*Caretta caretta*), Olive ridley turtle (*Lepidochelys olivacea*), Leatherback turtle (*Dermochelys coriacea*) and Hawksbill turtle (*Eretmochelys imbricata*). Green turtles are the most common in the Tanintharyi region (Indian Ocean - South East Asian, 2003). Hawksbill and Leatherback turtles - once abundant, but which are still occasionally reported by fishermen in the Rakhine and Tanintharyi areas, have disappeared completely from the Ayeyarwady area in recent years (Nang Mya Han, 2012). Based on the IUCN Red list categories, Olive Ridley turtle is listed as *Vulnerable*; while Loggerhead turtle and Green turtle are *Endangered*; and Hawksbill turtle and Leatherback turtle are *Critically Endangered*.

Most of Hawksbill turtles are sighted near Longlonebok Island (South Moscos, situated in 13 °55' N 97°52' E) and its adjacent areas. These turtles had been killed for their carapace in order to make combs, broaches and some ornamental materials, as well as for taxidermy (Thant Soe and Lwin Maung Maun, 2012). Despite no report of intentional catching of turtles at present, there are cases of turtles being killed and eggs being consumed when they take shelter on the beach from bad weather conditions (Maung Maung Lwin, 2011). In addition, interviews with local people suggest that turtles are also caught for their meat. The validity of this information is however questionable because no recent data on population trends or in-depth assessment of threats to individual species is available (National Marine Fisheries Service and U.S. Fish and Wildlife Service, 2013).

Only anecdotal records exist of turtle nesting beaches (with no species specified) in the Myeik Archipelago - six nesting beaches on Lampi Island (Oikos, personal communication, 2014) and some on other offshore islands (Maung Maung Lwin, 2011). Green turtles are reported to be abundant near the seagrass meadows of *Thalassia hemprichii* which is the feeding ground for this species (Thant Soe and Lwin Maung Maun, 2012). Tha Mi La Island, near Pathein, is a known nesting area for Green and Loggerhead turtles (Maung Maung Lwin, 2011). Kaing Thaug Kyun, and Taung Ka Done Kyun (small islands at the mouth of the Ayeyarwady) are said to be nesting sites for Olive ridley (Maung Maung Lwin, 2011) and Loggerhead turtles (Nang Mya Han, 2012), and Kadonalay and Gayetgyi Islands have been a research site of Olive Ridley nests since 1998 (Cho Hla Aung, 2003).

Legislation enacted in 1993 by DoF sought to reduce impacts on nesting beaches and to restore nursery and feeding habitats. Further regulatory effort by DoF in 2005, after official reports stated that the number of marine turtles in the country's coastal waters had plummeted by about 80% between 2000 and 2004, sought to impose the use of Turtle Exclusion Devices (TEDs) on trawlers and mandate the release of accidentally caught turtles (Marine Turtle News, 2005). However there is



no recent published data to assess its effectiveness. Uptake of TEDs appears to be low, and drowning in gill nets is cited as a major source of mortality for sea turtles (Aung and Maung, 2012).

#### **2.1.6. Fishery resources**

The marine territory of Exclusive Economic Zone (EEZ) extends about 520 262 km<sup>2</sup> providing considerable large fisheries resources. Fishery resources in Myanmar waters are typical of Southeast Asia with large quantities of fish and shrimp in the EEZ (Win Aung, 1995). The fisheries sector is Myanmar's fourth largest exchange earner after timber, minerals and rice (FAO, 2001). The Norwegian research vessel Dr Fridtjof Nansen under the EAF-Nansen project in Myanmar waters conducted the first surveys in 1979-1980, establishing important benchmark information on the state of the Myanmar marine resources. But DoF marine fishery surveys since the 1980s were restricted in scope and very much limited by lack of resources and catch statistics are very approximate and do not account for the complete removals from stocks associated with destructive fishing techniques (Pitcher, 2007). In late 2013, the second expedition program by RV Dr Fridtjof Nansen, operating within the framework of the FAO EAF-Nansen Project and BOBLME, conducted a scientific survey on the fish resources, marine biodiversity and oceanography in Myanmar waters (Mya Than Tun, personal communication, 2014). The 2013 survey provided strong insights into the current status of the marine resources and represented a wake-up call for resource managers. Existing literature (prior to the 2013 Nansen survey) suggests that there are approximately 470 species of marine fishes, including 67 commercially important pelagic species and 13 crustacean species (Tin Win, 2004). Several species remain to be identified (Khin Maung Soe, 2008) The 2013 Nansen survey captured 444 species belonging to 129 fish families (Yin Yin Moe, 2014). Disturbingly, the results of the 2013 Nansen survey showed that pelagic and demersal fish biomass had fallen by 90% and 70% respectively since 1980. This survey also reported that the capture rate of marine fishes in shelf areas (<200 m depth) of Tanintharyi Region had declined by 85% (from 894 kg/hour to 133 kg/hour), reflecting the decline in biomass.

Research surveys between 1981-1984 and 1994 indicated mackerel, anchovy and small tuna are commercially important species in the Tanintharyi coastal region (Tin Win, 2004). Of economically significant species, three species are listed as *Endangered* in the IUCN Red list of threatened species including Hilsa shad (*Tenualosa ilisha*), Indian threadfin (*Polynemus indicus*), and four-finger threadfin (*Eleutheronema tetradactylum*). Each of these species is heavily harvested for food along the coasts of Myanmar; the regional stock of hilsa is overfished throughout its range, mostly because of the pervasive use of fine mesh gillnets that remove juveniles prior to reproduction, especially in riverine areas (BOBLME, 2012) Some may have also suffered due to loss of habitat, or environmental degradation due to land-use changes. For example, Indian threadfin which is found in seagrass beds, that are vulnerable to sedimentation and urban runoff and Four-finger threadfin, which is at risk due to accumulated pollutants from its primarily crustacean diet ([www.myanmarbiodiversity.org](http://www.myanmarbiodiversity.org)).

#### **2.1.7. Shore birds and sea birds**

During five sailing expeditions of 10 days each from 28 December 2006 to 10 April 2007 under the Myeik Archipelago Biodiversity Research (MABR), a total of 126 bird species were identified in Myeik Archipelago, five of which are listed as *Endangered* in the IUCN Red list such as Masked finfoot (*Heliopais personata*), Nordmann's greenshank (*Tringa guttifer*) and Black-bellied tern (*Sterna acuticauda*). Plain-pouched hornbill (*Aceros subruficollis*) is one of the key species of Myeik Archipelago listed as *Vulnerable* in the IUCN Red list due to its small and declining population and to the shrinking of its habitat, the lowland tropical forest. The species has a small distribution range confined to Southern Myanmar and adjacent Thailand and to Northern Malaysia with a total population range of 2 500-10 000 birds. The Plain-pouched hornbill has not been recorded in Myanmar since 1941 and in the Myeik Archipelago since 1920 until recently. The cruise undertaken by BANCA in collaboration with EcoSwiss and Istituto Oikos led to the rediscovery of an estimated number of 200 individuals of Plain-pouched hornbills. This bird is a highly mobile and gregarious species that is often seen flying across the islands of the archipelago. It tends to form night roosts on

small islets where several individuals congregate at night to sleep safely on large trees near the summit of the island. One such roost has been localized in the Ko Phawt Island. Along with previous research activities, the Ko Phawt Island is therefore identified as ideal point of observation for hornbill populations in the area. According to (Beffasti, 2009), this island is also a home to over 5 000 Flying foxes.

## **2.2. Socio-economic systems**

### **2.2.1. Demography and well-being of coastal population**

The Government of Myanmar conducted its most recent census in thirty one years in March/April 2014. Based on provisional census data released in August 2014 by the Ministry of Immigration and Population, Myanmar has a population of 51.4 million people. People who were out of the country at the time of the census are not included in these figures. Considering the population growth rate (estimated by World Bank 2012 be around 0.8% per annum), Myanmar as a nation is unlikely to face a problem of overpopulation, but records from the Myanmar's Ministry of National Planning and Economic Development Central Statistical Organization indicate high and rising human population pressure in coastal and delta areas. The statistics reveal a rising population living in the coastal and delta areas from 9 633 720 people in 1983 to 12 651 406 people in 1997. There is no information from the recent (2014) National census about how many people are living on the coast of the Tanintharyi Region or on islands of the Myeik Archipelago. Based on (Nay Win Oo, 2002), population growth in the coastal areas is accelerating; this results in increased demand for land and increasingly intense exploitation of coastal and marine resources. Until recently, data on demographics and socio-economic conditions or coastal livelihoods in the archipelago concerning either Moken or Myanmar citizens has been limited. Information that has been documented is mostly from on or around Lampi Island, which is the first (and only) Marine National Park in Myanmar, and therefore has been subjected to a more intense scrutiny. In recent years there have been rapid socio-economic assessments on some islands of the Myeik Archipelago e.g. FFI socio-economic baseline assessment on Thayawthadangyi and La Ngan Islands; and IUCN rapid socio-economic assessment on Jar Lan, Medcalfe, Sular Khamouk, Thayawthadangyi, Mee Sane and La Ngan Islands which coincided with the final biophysical survey in January 2015.

According to the socio-economic assessments undertaken by FFI and IUCN, communities on islands of the Myeik Archipelago comprise of mainlander Myanmar migrants, Karen and Moken. It is estimated that the Myeik Archipelago and adjacent areas of the Andaman Sea support over 1 000 Moken. It is of some importance to note that the Moken are not recognized as Myanmar citizens (the same situation prevails for the Moken peoples of Thailand) and thus are not counted in national statistics, nor provided for in the national budget. The Moken are probably not the most populous ethnic group living in the Myeik Archipelago, however; both ethnic Karen and mainlander Myanmar live in small and large villages on both a seasonal and permanent basis. Most (if not all) Moken switched to live permanently on land, giving up their traditional nomadic lifestyle in their traditional houseboat called "*Kabang*" about 20 years ago. Reasons for migrants moving to islands vary; some escaped from the previous conflicts on mainland, some searched for land and resources, while some sought brighter economic prospects.

Despite limited historical baseline socio-economic data, their dependence on marine resources is reported to be high, and different types of fisheries have been recognized the most important economic activity for people living in the Myeik Archipelago. There is a long history of in-migration from other regions of Myanmar which has created a growing fishing industry in the region. Findings from surveys conducted by Istituto Oikos and BANCA (2011); FFI (2014) and IUCN (2015) have revealed high degree of specialization and low levels of livelihood diversification within the sample sites. The studies indicate that most marine and agricultural products are sold, rather than used for domestic consumption, suggesting heavy dependence on imports from the mainland and a cash economy. About half of the population lives in housing classified as very low standard, low standard or substandard. Many residents both on the mainland and the islands do not have access to

sufficient clean water or sanitation services (Nang Mya Han, 2010). On some islands fresh water is not enough to support the entire communities for the entire year. Education levels of most households surveyed are low. Primary education is available on islands of the archipelago, but higher education must be obtained on the mainland. Access to electricity, health facilities and waste management and infrastructure are inadequate (Istituto Oikos and BANCA (2011); FFI, (2014); IUCN, (2015)) (see **Figure 6**)



**Figure 6.** Snapshot of villages in the Myeik Archipelago, taken during the IUCN/BOBLME survey 2015.

- a. Fishing village of Khin Pyi Son Island of La Ngan Islands (the sisters);
- b. Housing and infrastructure at the village of Jar Lan Kyun (Lord Loughborough Island);
- c. Primary schooling at the village of Thadawthadangyi Kyun.

### 2.2.2. Economic activities

Fisheries comprise the most important economic activity of the Myeik Archipelago. The type of catches, fishing gear and techniques and the number of fishing boats have changed over the past few years, with an increase in both inshore and offshore vessels. This has provided opportunities for other smaller commercial activities on offshore islands and mainland to offer fishers with a wide range of goods and support services e.g. food and drink, fresh fruit and vegetables, karaoke and mechanical workshops. Numerous anecdotal reports from various sources, including from DoF suggest that the Moken have depauperised the sea cucumber populations in pursuit of the large returns paid by Thai and Chinese purchasers for *trepang* (dried beche-de-mer) for the Chinese medicinal market. While it is unlikely the Moken are the only players in the beche-de-mer harvest, the results of a traditional practice that has become commercialized are the impoverishment of reef populations of holothurians and an egregious disregard for MPA integrity. The interviews with local people and livelihoods surveys conducted by a group of researchers from Istituto Oikos, BANCA and Forest Department (FD) during 22-30 January 2009 allowed some insights into ongoing economic activities in the Archipelago and of their impacts on biodiversity (Befasti, 2009). During their trip from Myeik to Kawthoung, diverse activities were observed including large scale logging, fishing activities, hunting (e.g. mouse deer, monkeys, wild pigs, porcupines, wildcats and squirrels), snails collecting, aquaculture and fishery industry (fish, squid, shrimp, ice factory and cold storage, fish processing plant). Large tracts of forest are being converted to commercial plantations of oil palm and rubber - largely financed by Thai corporate entities. An increase in betel nut plantations on some islands have recently been driven by market demand from overseas. Some forested land is cleared for betel nut palms, and products are sold to mainland for consumption and natural dyeing fabric industry in Sri Lanka.

#### Fisheries

Until the last decades of the 20<sup>th</sup> century, Myanmar marine fisheries were partitioned into onshore fisheries, inshore fisheries and offshore fisheries. Inshore fisheries were regarded as those that took place landward of the 8-fathom (~15 m) contour line - which was usually taken as 3-5 nautical miles from shore. After the promulgation of the 1990 Marine Fisheries Law, the onshore and inshore fisheries were combined into inshore (coastal) fisheries (Khin Maung Soe, 2008), which used a fixed spatial reference for administration. Currently, fishing activities in coastal waters are arbitrarily partitioned into two types namely: small-scale (artisanal) fisheries and commercial fisheries.

| Reference  | Fishing zone I  | Fishing zone II  |
|--|---|--|
| Silvestre, G.T., L.R. Garces, I. Stobutzki, M. Ahmed, R.A.V. Santos, C.Z. Luna and W. Zhou. 2003 | Northern area: shore to 5 nm,<br>Southern area: shore to 10 nm<br><br>• Coastal: vessels < 30 feet<br>or engine < 12 HP | Outer limit of zone I to EEZ<br><br>• Industrial: vessels > 30 feet<br>or engine > 12 HP |

Small-scale fisheries generally operate along or close to the shore and use low technology approaches for subsistence and income generation for local fishermen and their families. Inshore fishery includes areas that are within five nautical miles from shore along the Rakhine coast and ten nautical miles from shore for the Ayeyarwady and Tanintharyi coasts. Boats fishing in these areas can be no more than 30 feet (~9 m) long and use engines of no more than 12 horsepower. Typical fishing gears used by these fishers include long lines, drift nets, gillnets, stowed nets, trammel nets, purse seines and traps. Inshore fisheries actually are of small scales but supply several high value species (e.g. lobsters, shrimp, grouper, mud crab and clams). Offshore fishing extends from the demarcation line of inshore fisheries out to the edge of Myanmar's EEZ. These fishers use larger boats and gear including bottom trawls (mostly beam trawls, although otterboard trawls are also common), purse seines, drift nets and long-lines. Offshore vessels range from 30 to more than 100 tonnes displacement (Khin Maung Soe, 2008; Maung Maung Lwin, 2011) although smaller vessels (< 15 tonnes) are common, especially in the Myeik Archipelago.

*“Coral is sold at some beaches and fishing on coral reefs is increasing. Illegal dynamite fishing is widespread in coastal areas and is also a major threat to coral systems”*

Kyaw Tint of MERN,  
Myanmar Times,

The socio-economic assessment undertaken by IUCN/BOBLME in early 2015 suggests that small-scale fishers on islands of the Myeik Archipelago depend on various fishing gears and methods and target different species; and these are associated with ethnicity of the communities. Burmese fishers are likely to target multiple species of fish and squid using driftnet, long lines and spears; Karen fishers target deep sea organisms and reef fishes and are specialized in spearfishing with air compressor; while Moken fishers harvest sea cucumber, giant clam, squid and chiton from nearshore coastal waters using spears and hand collection (**Figure 7**). Very few people have direct connection with the markets on mainland. Marine resources are mostly processed on site and largely sold to local collectors at village level in which fishers have little or no power to negotiate fair prices. Given the low income from high value products, these fishers maybe incentivized to catch as much as possible in order to make a living and cover their cost of fishing. There have also been complaints from local fishers over the decline in fish catch (and income) due to the exploitation of fishery resources from commercial fishing boats, particularly light luring boats, trawlers who trawl in nearshore fishing grounds at night, boats using small mesh size nets and dynamite fishers.

According to (Yin Yin Moe, 2014), marine fisheries account for 54% of all Myanmar fisheries production. Marine fish production in the Myeik Archipelago has doubled over the last decade, with official receipts from 535 470 tonnes in 2001-2002 to 1 041 120 tonnes in 2009-2010 (Nang Mya Han, 2010). In Myeik Archipelago alone, export of fisheries products rises from 61 858 tonnes in 2001-2002 to 130 338 tonnes in 2009-2010 (Nang Mya Han, 2010). Fishery products of the Myeik Archipelago are landed mainly in Dawei, Myeik and Kawthoung for onward sale to other cities and

countries. The products are exported alive, fresh frozen or chilled and processed. The cross-border trade system, particularly with China and Thailand, has been the major transaction mode for Myanmar fisheries export. Over 2009-2010, Thailand was the greatest importer of Myanmar's finfish, importing 108 511 tonnes of marine and freshwater fish, followed by Kuwait, China and Singapore (Khin Maung Soe, 2008).



**Figure 7. Snapshots of small-scale fishers illustrating different resource use and various fishing methods.**

- a) and b) Moken processing sea cucumber and giant clam harvested in shallow areas nearshore by hand collection;
- c) A Burmese fisher preparing shark long line;
- d) Fishing boats of Burmese fishers illustrating gears used and process and storage of products caught;
- e) Karen fishers demonstrating spearfishing of a large volume of reef fishes caught from outer reef islands.

### Aquaculture

Due to increase in local demand and foreign earning potentials in export markets, significant investments are flowing into aquaculture, enthusiastically supported by government agencies. Fishery production from aquaculture is reported in the 2001 official DoF statistics as 115 870 tonnes. Of the total aquaculture production, an estimated 18 794 tonnes comes from coastal aquaculture. Shrimp farming in particular has grown significantly in the past 10 years and shrimp export accounts for nearly 50% of the total value of fishery export. Culture of marine fish (groupers) and crabs are in smaller scales. Several thousand tonnes of crabs are 'fattened' for export, but not included in the above coastal aquaculture statistics (Food and Agriculture Organization, Regional Office for Asia and the Pacific, 2003)

Aquaculture is practiced largely in freshwater and brackish water along the coastal area and on a limited scale in sea water. Reasons contributing to this might be the traditional preference of Myanmar people towards freshwater fish and the abundance and accessibility of marine fish in the ocean (Hla Win, 2004; Win Oo, 2001) However, due to the continuing deterioration of fish habitat and inland fish stocks (Win Oo, 2001) together with high foreign demand for food fish of high-value species such as shrimps, sea bass (*Lates calcarifer*) and various *Epinepheline serranids* (groupers) (Tin Win, 2004), the government has encouraged the industry to increase total fishery production through culture-based fishery. In response to the new policy aquaculture production started to increase rapidly in the early 1990s (Win Oo, 2001). The area of aquaculture in 2002-2003 was 127 204 ha including 80 000 ha of Freshwater prawn (*M. rosenbergii*) and Marine shrimp (*P. monodon*) ponds. In Kyun Su Township (Myeik area) in Taninthayi Region, commercial scale net



cage culture of Orange spotted groupers (*Epinephelus coioides*) and Greasy groupers (*E. tauvina*) is in operation as a pioneering farm run by private sector (Hla Win, 2004). Oyster, scallop, yellow tail, mackerel, red sea bream, halibut, eel, puffer fish, shrimp and lobsters are also produced in the region through hanging culture, cage culture and sea bed sowing.

Myeik Archipelago has four soft-shelled crab culture farms in operation (Nang Mya Han and San Tha Tun, personal communication, 2014). The Doung Koo Maw, one of the crab culture farms, collects wild crabs from local areas within a five kilometer radius. The technology is based on crab farming in Ranong in Thailand as one of the shareholders is the owner of the Ranong farm (Food and Agriculture Organization, Regional Office for Asia and the Pacific, 2003). Apparently, there is a huge potential for the development of aquaculture, especially of mariculture that is yet to be initiated in Myanmar (Nay Win Oo, 2002). It has been envisaged that with combined efforts by the government, cooperatives and private sector the aquaculture industry will expand very rapidly. DoF strongly believe that sustainable development of aquaculture techniques and mangrove-friendly aquaculture practices has been ensured by strict guidelines, yet the technology and practices promoted are not necessarily in line with sustainable ecological best practice.

The downside of the cage culture and pond aquaculture of both finfish and shrimp is the requirement for stock feed. Although it is not mentioned in any of the government reports, Myanmar aqua culturists appear to exclusively use feed products derived either from the processing of “trash” fish, or small fish captured locally using fine-meshed nets in mangrove streams. The capture of small fish from mangroves using extremely fine nets for use as aquaculture food removes juveniles of commercially important species and those important for local food security from the ecosystem. The ecosystem consequences of stock food provision however do not seem to have been factored in the DoF’s enthusiasm for the development of aquaculture as an alternative livelihood income for coastal populations, although they have a striking example of the depauperisation of mangrove ecologies by such practices in Thailand. Until recently, DoF has taken steps to ban collection of wild fry particularly for grouper and shrimp farming systems, and there is a closed season for grouper fingerlings between July and September. Brood stock for shrimp hatcheries is still reasonably abundant in Myanmar, but as for many resources, the local people seem to prefer the (free) wild-caught alternative.

In line with fisheries and aquaculture of fish species, there are other economic activities in the Myeik Archipelago such as seaweed farming, pearl oyster farming, betel nuts plantations, retail shops and fresh water stations supplying water to fishing boats and tourist vessels in exchange for fuel and other goods.

### **3. Current and future threats to coastal and marine resources**

#### **3.1. Conversion of natural habitats**

The environmental problems Myanmar is facing today are considered not in association with industrialization and urbanization, rather deforestation and loss of biodiversity (Tin Win, 2004). The 4<sup>th</sup> National report on biodiversity (2009) confirms that socio-economic pressure is the major factor contributing to Myanmar biodiversity loss. The main threats identified in the report are habitat destruction, especially related to forest depletion, degradation and cover change, hunting and illegal wildlife trade. Myanmar remains one of the ten countries in the world with the largest annual net loss of forest area and among the five countries (Indonesia, Australia, Myanmar, Madagascar and Mozambique) with the largest net loss of mangrove area during the period 2000-2010 (Food and Agriculture Organization, 2010). Though mangrove forests appear to be better conserved in Myeik Archipelago in comparison to other Myanmar coastal regions, this habitat is facing an estimated decrease of 2.5% per annum (Kyaw Tint *et al.*, 2012). Commercial logging and conversion of forest to intensive agriculture are the main causes of habitat loss. Palm oil concessions have been granted in

large areas of Tanintharyi Region and rubber plantations have almost doubled in area from 1990 to 2010. Data and information on betel nut plantations on islands offshore of the Myeik Archipelago has been limited. Replacement of natural forest by oil palm, rubber and betel nut plantations can result in increased erosion and decreased groundwater retention which subsequently increase runoff and sedimentation. Nitrification from agricultural chemicals can multiply adverse consequences on the already threatened marine ecosystems in the Myeik Archipelago.

### 3.2. Tourism development

Tourism is one of the fastest-growing industries in Myanmar, especially since 1996 when the Myanmar Government launched a tourism promotion campaign 'Visit Myanmar Year'. Since then, there have been a growing number of foreign tourists to Myanmar. This number increased by 93% between 2012 and 2013 and is expected to continue to grow in future years. In early 2014, the EU declared that Myanmar is the 2014's world best travel destination, indicating increased interest in Myanmar tourism. Given the "opened door" market economy, there has been a substantial growth in tourist visitation to the southern islands of the Myeik Archipelago through the Kawthoung border point. In January 1997, the Ministry of Hotels and Tourism issued the Tourist transport business license to three companies based in Phuket, Thailand. Currently the number of companies allowed to bring tourists to Lampi Island MNP and other selected islands of the southern part of the Myeik Archipelago has increased to 34, including Thai and Myanmar companies, although there are no Myanmar companies that are equipped to handle diving tourism. Liveaboard dive boats have a well-travelled series of routes that include the Burma Banks, Western Rocky Island, Three Islets, High Rock, Black Rock, North Twin Island, South Twin Island and Roe Bank. The sight of corals, marine life particularly charismatic macro fauna like sharks, manta rays, whale sharks and Moken culture are the main tourism attractions in the southern Myeik Archipelago. The development of tourist infrastructure has been slow and limited. No tourism activity has been reported on the mainland and public road transportation in coastal cities of Tanintharyi Region has only been open to foreigners for travel in 2013. Three existing tourist accommodations are Andaman Resort in Kha Yin Gwa Kyun (MacLeod Island), Andaman Club in Thahtay Kyun, and Treasure Island Resort in Pakchan River, off Kawthoung. There is no accommodation for tourists neither on Lampi Island Marine National Park nor on other islands offshore. Tourists visiting Lampi are solely dependent on sailing cruises and liveaboard diving boats from the neighboring Thailand. Tourism related facilities such as tea shops and restaurants in the local villages are also limited, offering very low standards of food options.

Since it is perceived as a tool to boost the local and national economy (Istituto Oikos and BANCA 2011) and to reduce illegal practices and promote natural resource conservation (Tint Tun, personal communication, July 2014), tourism development is prioritized in the government of Myanmar's framework for economic and social reforms. To ensure the benefits of tourism and minimum negative impacts, the Myanmar Responsible Tourism Policy was adopted in 2012. This report broadly outlines the government's official tourism development policies and plans for the eight-year period between 2013 and 2020. The report identified the Myeik Archipelago as "Emerging/potential tourist destination", but detailed information specifically to marine tourism activities and its management or challenges and opportunities for tourism in the archipelago seem to be neglected (Myanmar Tourism Master Plan 2013-2020, Final Report). An increased interest in tourism development in Myeik Archipelago are however apparent in other sources, including a SCUBA dive training camp in Dawei (Minister of Hotels and Tourism, Htay Aung, the New Light of Myanmar, June 2013), tourism development projects on Kyun Phila (Great Swinton Island) ([www.thedevelopmentadvisor.com/news/myanmar-mergui-resort-kyun-phila-great-swinton](http://www.thedevelopmentadvisor.com/news/myanmar-mergui-resort-kyun-phila-great-swinton)), Khuntee (Gabuza Island), Eastern Sula Island, Langan Island, Tanintharyi Island ([www.irrawaddy.org/burma/four-islands-marked-development-burmas-mergui-archipelago.html](http://www.irrawaddy.org/burma/four-islands-marked-development-burmas-mergui-archipelago.html)) and Lampi Island (Milo Tedeschini, personal communication, 2014).

### 3.3. Fisheries

#### 3.3.1. Overexploitation of fishery resources

The coastal waters of Myanmar have been heavily exploited through fisheries since the introduction of (destructive) trawling in the 1970s (BOBLME, 2004). Myeik Archipelago is among the best known fishing grounds in the Andaman Sea for both Myanmar and foreign trawlers. An increasing demand of marine fish for local consumption, high dependency of artisanal fisher folk upon coastal waters for their livelihood and income generation, and a large number of commercial fishing boats have contributed to overfishing in the Myeik Archipelago. Overfishing has become a great concern, reflected in some changed fisheries statistic figures such as number of fishing vessels engaged in fisheries, biomass, Maximum Sustainable Yield (MSY) and Catch Per Unit Effort (CPUE) of fishing trawlers. Marine products from Myanmar waters were mostly taken for domestic consumption until the late 1980s. From the early 1990s when the government encouraged the production and export of marine products, marine fish production had tripled between 1988 and 2008, the volume of marine product exports increased 70-fold and export earnings grew from US\$ 10 million in 1988 to US\$ 561 million in 2008. Yet, it is important to note that by 2003, marine fish production had already passed the predicted MSY (of 1.05 million tonnes), and by 2008 the marine fish production was far beyond the MSY reaching 1.68 million tonnes. Since 1980, the results of the 2013 Nansen survey indicated 90% decline of pelagic biomass and 70% of demersal fish (Yin Yin Moe, 2014).

The situation can be far more alarming than it appears since the official figures are much lower than the actual catch by legal and illegal fishing operators (Maung Aung Myoe, 2013). The Myanmar Fisheries Federation (MFF) statistics reveal that the average hourly catch rate of a vessel at sea has decreased by almost three-quarters over the past 50 years. From 1955 to 1957, the rate was 324 kg per hour but this number dropped to 288 kg in 1982-1983 and 186 kg in 1993. By 2006, the last year for which figures are available, Myanmar's fishing vessels were catching on average just 86 kg of fish an hour ([www.mmtimes.com/2010/news](http://www.mmtimes.com/2010/news)). In order to harvest the same amount of catch as previously, fishers require extra trawling time and days to fish at seas (Toe Nandar Tin, personal communication, 2014). In response, the DoF has increased allowed fishing days per trip for fishing vessels from 25 days to 90 days. This allows fishers to maintain their total catch and also transport their products to the nearby landing sites, but reduces accountability, since DoF is less able to monitor their landings when they offload product at sea during the extended trips.

Trawlers are often seen weaving between the mid-shelf and offshore islands, but it is unclear whether they are knowingly engaging in encroachment on inshore grounds, or believe themselves to be operating legally within the designated zones. Since the DoF has limited capacity to interdict and arrest illegal fishers, except in partnership with the Myanmar Navy or Army Coastal Defense, the distinction probably remains debatable and licensing of vessels and banning trawl fishing are unlikely to be successful (Khin Maung Soe, 2008; Kyaw Tint *et al.*, 2012). Small powered vessels (< 15 m) are frequently able to venture out to the westernmost islands of Myeik Archipelago to capture reef and pelagic fishes and squids. These small vessels shelter in the lee of offshore islands or rocks at night, and continue to fish wherever they have opportunity. Harvest of sea cucumber and giant clam by the Moken are unregulated and unsustainably practiced, at the same time, spearfishing with compressor by the Karen tend to remove key ecologically-important species such as parrotfish and rabbitfish from the ecosystem. Regular and targeted efforts to remove herbivorous species from the ecosystems will have significant impact on the ecological balance and functioning of the reef and the trophic structure (food web). Although individually small, the number of small vessels engaging in fishing for reef-associated fishes places significant downward pressure on reef biomass and resource replenishment. If hookah spearfishing continues to be practiced at the same time as the use of dynamite, the issues facing the archipelago could be far worse than what currently being recognized. Species like sharks, manta rays, seahorses are in decline because they are reportedly caught as bycatch and sold to the markets on mainland. Corals that are physically damaged by dynamite can no longer provide habitats for marine species. The removal of herbivores from the ecosystems has

made it difficult for new coral recruits to settle and grow. Exacerbating the situation, overexploiting small and juvenile fish driven by the Thai market demand for fishmeal processing is accelerating the trajectory towards the collapse of fisheries in the Myeik Archipelago (**Figure 8**).



**Figure 8.** Snapshots of fishery products caught in the Myeik Archipelago illustrating overexploitation and unsustainable fishing practices

- a) and b) Products caught by commercial fishing trawler including small and juvenile fish driven by Thai market demand for fishmeal processing industry;
- c) Dried shark fin, meat and skin and d) dried manta ray meat, skin and gill rakers ready to be sold at high price at mainland markets;
- e) and f) Herbivorous fish caught by spears (and probably dynamite) being sold to a middleman for onward sale on mainland.

### 3.3.2. Illegal, Unreported and Unregulated (IUU) fishing

IUU fishing is an important maritime security concern for Myanmar. Thai fishing boats have been recognized illegally operating in Myanmar waters since the early 1980s, particularly in the Tanintharyi area. In December 1988, the Myanmar military government granted fishing rights for Thai trawlers. Subsequently, 241 Thai fishing trawlers were granted permits for legally fishing in Myanmar waters by mid-1989. Up until 1992, 231 Thai fishing trawlers had been seized by the Myanmar government for illegal fishing activities and 2 346 crewmen arrested (Maung Aung Myoe, 2013). IUU fishing issues at that time were inadequate Monitoring, Control and Surveillance (MCS) capabilities, transshipment at sea and encroachment of foreign vessels into national waters. Notably, IUU fishing issues for national and foreign fishing vessels are identified, but the “inshore” fishing category is never reported. The main reason for this is that DoF is entirely focussed on combating overcapacity in industrial fisheries, and regards any illegal activities by local people as inconsequential and of negligible scale. However, given that over 30 000 boats are registered in the inshore fisheries; this is probably somewhat short-sighted, even allowing for the huge constraints on capacity experienced by DoF.

*IUU fishing issues in Myanmar waters involve: contravention of the reporting procedure; fishing in unauthorized areas; over limited fishing days; trans-shipment at the sea; unregistered and unlicensed vessel; use of prohibited fishing method; fishing in closed season and area and encroachment of the foreign vessels.*

SEAFDEC (2010)

Anecdotal evidence suggests that IUU fishing across the archipelago has persisted due to a lack of monitoring and surveillance and corruption among law enforcement authorities. Nowadays, illegal

fishing is perpetrated by Thai fishing boats as well as Myanmar fishing boats from various regions. Fishermen commonly use inappropriate fishing gears and techniques in inshore waters and ignore fishing restrictions, leading to destruction of nearshore habitats such as coral reefs and seagrass beds. Myanmar fisheries law prohibits purse seine nets less than 3.5 inch mesh size, for trawl net cod-end mesh size less than 2 inches. It is of note that Thai trawlers commonly use trawls with smaller than 1 inch mesh and purse seiners often use meshes down to 10 mm (2/5") (SEAFDEC, 2010). Notionally, Thai (and other foreign-flagged) vessels operated in Myanmar waters must conform to Myanmar gear restrictions and protocols; it was unlikely, even if the vessels were registered to fish in Myanmar's EEZ, that they were carrying duplicate sets of gear to satisfy Myanmar's requirements. This practice then was another source of IUU extraction that is detrimental to the sustainability of Myanmar's fisheries. Since fishing rights are terminated and will not be given to foreign-flagged vessels from April 2014, this may ameliorate some of the gear-mismatch problems as well as reducing total effort.

In addition to foreign-flagged vessels, a proportion of the Myanmar-registered commercial fishing vessels operating inshore are what is known as "baby trawlers" - those of less than about 15 tonnes displacement and 30' (9 m) length. These vessels skirt the restrictions on commercial fishing in inshore waters by nature of their length/power limits, but can still drag small beam trawls and are reputed to be a constant threat to inshore seagrass habitats and are a source of complaints from local (artisanal) fishermen (Frank Momberg and Tim Maung Win, personal communication, January 2014). Destructive fishing method like dynamite fishing, also known as blast fishing and bomb fishing, is one of the well-known problems requiring urgent response. To date, official records in relation to blast fishing in Myanmar waters have been very limited (if ever existed). However, anecdotal reports state that this illegal practice has persisted and is considerably common in Myeik Archipelago, particularly around Lampi and other surrounding offshore islands, although Lampi Island is designated as Marine National Park. Results from the recent IUCN/BOBLME socio-economic survey indicate the expansion of dynamite fishing practices to the northern Myeik Archipelago and this may be practiced at the same time with spearfishing. Blast fishing is perceived to be the most efficient practice allowing fishers to catch a large number of fish within limited budget and short duration of time. This activity can destroy seabed and kill fish, mollusk, coral and plant in a radius of three nautical miles.

The contiguous EEZ between Thailand and Myanmar at the southern end of the Myeik Archipelago means that there is frequent encroachment, which sometimes leads to confrontations and violence (e.g. <http://www.bangkokpost.com/news/local/370858/navy-protests-as-myanmar-fires-on-boat>). The duplication and forged permits by Thai fishermen have further contributed to a tension between the two countries, especially since the majority of crewmen on the Thai boats are Myanmar nationals, who can often influence any enforcement officials unwilling to board and search vessels at sea. Despite this, there is some anecdotal evidence concerning Myanmar maritime enforcement officers taking bribes from Thai trawlers in exchange for turning a blind eye to dynamite fishing. While illegal fishing is mainly claimed to be carried out by foreign fishermen, it appears that in Lampi Island alone approximately 10% of local fishermen regularly use dynamite fishing. In these cases, it is unclear whether the issue has been overlooked or resolved through bribes. Moreover, most catches from the southern part of the archipelago are landed in Kawthoung and Ranong piers including seahorses, manta rays, sharks, pufferfish and parrotfish. It is argued that the figures for Tanintharyi coastal area do not reflect illegal fishing; corruption is rampant and protection money is not uncommon. For these reasons, the situation can be considered worse than official figures reveal.



## 4. Institutional and legal framework

### 4.1. Governmental bodies: roles and responsibilities

#### 4.1.1. Department of Fisheries (DoF)

The DoF, under the Ministry of Livestock, Fisheries and Rural Development (MLFRD), is responsible for matters related to fisheries resources, fisheries products, aquatic living organisms and aquatic endangered species. The DoF has several directorates including Capture fisheries, Aquaculture, Research and development and Administration. The national office of the DoF is in Naypyidaw while states/regions and districts offices are across the country.

The key responsibilities of the DoF are: the conservation and rehabilitation of fishery resources; the promotion of fisheries research and surveys, collection and compilation of fishery statistics and information, provision of fisheries extension services, supervision of fishery sectors and ensuring the sustainability of fishery resources. The DoF also oversees some conservation areas such as the marine component of the Thamihla Kyun wildlife sanctuary and is the management authority for two shark protected areas, crab protected areas and turtle conservation areas. Research programs on endangered species such as marine turtles and Irrawaddy dolphins are also undertaken by this governmental department.

#### 4.1.2. Forest Department (FD)

The FD is under the Ministry of Environmental Conservation and Forestry (MOECAF). It is responsible for protection and conservation of the wildlife and sustainable management of forest resources, including mangrove forests. The Nature and Wildlife Conservation Division (NWCD) of the FD is the key implementing agency for the designation and management of protected areas both land-based and marine-based.

#### 4.1.3. Ministry of Education (MoE)

The MoE has major responsibilities to establish an educational system based on Myanmar traditional culture, patriotic spirit and morality and ensures that it is compatible with political, economic and social objectives. It oversees all formal education in the country from basic to higher education. The ministry also supervises the implementation of educational programs, develop educational research and sets educational policies. The MoE also oversees the universities, three of which have Marine Science Departments (Mawlamyine, Myeik, and Pathein) engaged in coastal and marine research.

#### 4.1.4. Ministry of Hotels and Tourism (MoHT)

The MoHT oversees and administers matters regarding the hotel and tourism sectors. It also establishes guides to investment in and operating of tourism business. Directorate of Hotels and Tourism has five branch offices in Yangon, Mandalay, Bagan, Taungyi and Pathein. Myanmar Hotels and Services has ten branches, four of which are similar to the DHT and other offices are in Yangon international airport, Myitkyina, Bhamo, Tachileik and Kawthoung. The ministry is the key authority to grant permits for tourism development, in consultation with the Myanmar Investment Commission (MIC).

#### 4.1.5. Ministry of Mines

The Ministry of Mines officially supports the mining of copper, lead, silver, zinc, refined tin, tin concentrates and tin-tungsten, gold, iron, steel, coal, and the production of industrial minerals, as well as gems and stones, pearls and salt. The Myanmar Pearl Enterprise (MPE) under the Ministry of Mines is responsible for pearl breeding and cultivating, as well as improving the pearl industry, including cooperation and support for local and foreign joint ventures. The MPE has helped establish Myanmar as one of the major pearl producers in the world.

#### 4.1.6. Navy of the Union of Myanmar

The Myanmar Navy is the naval branch of the armed forces of Myanmar. The Navy is an important factor in Myanmar's security however, it is a "junior" service in the military hierarchy of Myanmar,

and is politically quite weak. It was expanded in recent years to an external threat defense role in Myanmar's territorial waters. It patrols and enforces various marine fisheries laws, in particular those relating to offshore fishing. Fauna and Flora International (see below) have recently begun to engage with and train a small number of Navy personnel in marine environmental monitoring, since the Navy is the only government agency that has the capacity to patrol and monitor the offshore areas of Myanmar's EEZ.

## **4.2. Non-Government Organizations (NGOs)**

The NGOs have a positive influence on the protection of natural resources and the effectiveness of conservation policies in Myanmar. Despite a limitation on the economic sanctions and the complicated bureaucratic procedures that apply to foreign subjects in Myanmar, the cooperation with international organizations has supported research surveys resulting in the discovery of new species and the establishment of new protected areas. International cooperation has provided funding and training for the management of protected areas, including development actions to encourage grassroots support for conservation. It is also contributing to strengthen the civil society of Myanmar by building the capacity of national and local organizations to plan and manage conservation and development initiatives (Istituto Oikos and BANCA 2011). International and local NGOs working in relation to coastal and marine resources conservation are as follows:

### **4.2.1. International Non-Governmental organizations (INGOs)**

#### International Union for the Conservation of Nature (IUCN)

The IUCN is founded in 1948 as the world's first global environmental organization. It consists of over 1 200 member organizations including about 200 government and 900 NGOs and almost 11 000 voluntary scientists and experts across the world. Its principles are to deliver conservation and sustainability at both the global and local level. IUCN's approach in Myanmar is to strengthen the technical and operational capacity of NGOs and government partners working on issues of global conservation significance. To date, the work has focused on coastal and freshwater wetlands. In 2012, IUCN alongside the Bay of Bengal Large Marine Ecosystem (BOBLME) Project and in collaboration with Mangrove for the Future (MFF) and Myanmar Environment Rehabilitation Network (MERN) hosted a workshop entitled 'Conservation and sustainable management of coastal and marine ecosystems in Myanmar'. Key partners of the IUCN apart from MERN are the FD and the MOECF. In early 2014, IUCN with marine researchers from Thailand conducted biological surveys in the southern Myeik Archipelago. IUCN, in cooperation with FFI and BOBLME has hosted a workshop in Myeik in October 2014 with an aim to review the situation analysis of the Archipelago and introduce MPA concepts to relevant stakeholders, particularly regional government officials.

#### Istituto Oikos

Istituto Oikos is an Italian NGO founded in 1996, operating in key biodiversity areas in Europe, Africa, Asia and South America to conserve and manage the natural resources as tools of social and economic development. Oikos started in Myanmar in 2009 on the environmental project in Lampi MNP in collaboration with the FD and BANCA. Its activities include the promotion of environmental education and awareness, community forestry establishment, forest and marine resources management, mangrove plantation and income generation. Oikos have permanent staff on Lampi Island and are entering the second phase of their project on the Island. In early 2014, a final draft "Lampi Marine National Park general management plan" was submitted to the FD outlining freshwater supply, waste management, environmental education and sustainable tourism development. The sphere of coastal and marine ecosystems are however not included in the management plan. In line with adequate guidelines for the only MNP in Myanmar, Oikos cooperate closely with FD and partly support the park staff training to enhance enforcement capacity, provide patrol boats and assist in the establishment of the park office onsite.

### Fauna and Flora International (FFI)

The FFI was founded in Africa in 1903 with an aim to conserve threatened species and ecosystems. Its projects encompass species and ecosystem security, policy and behavior, capacity building, livelihoods and business and biodiversity. The FFI has been working across five continents including Asia-Pacific region. The local partner, BANCA, has been working closely with the FFI to conduct biodiversity assessment and conservation status reviews and strengthened local civil society organizations to protect biodiversity through protected area management. Since early 2013, FFI have conducted a series of reef surveys - mostly in the northern part of the Myeik Archipelago, using modified Reef Check™ methods and also cooperates with BOBLME in various fields (e.g. on seagrass and sharks conservation and socio-economic monitoring). FFI have quite strong partnerships with several government agencies responsible for environmental governance; however have traditionally focused on terrestrial issues.

### Wildlife Conservation Society (WCS)

The WCS, founded in 1895, has the mission to save wildlife and wild places across the globe. It is committed to address four issues: climate change; natural resource exploitation; the connection between wildlife health and human health and the sustainable development of human livelihoods. The WCS is the first international conservation NGO to work in Myanmar, establishing a program in 1993. This INGO has a MoU with both the MOECF and the MLFRD and has worked with the DoF for over a decade. WCS has a multitude of active projects, albeit almost entirely focused on terrestrial issues, particularly in the north and around the Ayeyarwady region. They produced the first comprehensive analysis of marine conservation issues in Myanmar in early 2013 (Holmes *et al.*, 2013).

## **4.2.2. Local (Myanmar) Non-Governmental organizations (LNGOs)**

### Biodiversity and Nature Conservation Association (BANCA)

The BANCA is a Burmese NGO established in Yangon. Its aim is to conserve natural diversity through actions based on surveys and research, partnership, network building, environmental education and public awareness, and improvement of rural livelihoods. BANCA has a number of partner organizations including Myanmar and INGOs operating in the country. Currently, this Myanmar NGO works closely with the FFI to conduct surveys of coral reefs in the Myeik Archipelago.

### Marine Science Association, Myanmar (MSAM)

The MSAM is formed with alumni of marine biology and marine science courses. The association collaborates with Marine Science Departments at Mawlamyine, Patheingyi and Myeik Universities and concentrates on research, conservation and sustainable development of coastal areas.

### Community NGOs and conservation groups

The Tanintharyi Region has almost no community-based environmentalism. Although many of the NGOs listed above actively seek out and cultivate “grassroots” environmentalists, Myanmar’s recent history has not been particularly amenable to their evolution. Their absence renders any attempts at MPA security, combatting IUU and encroachment or degradation of natural resources immensely more difficult, since there is no easy way to reach the target demographics. The Dawei Research Association (DRA), a local research and conservation group based in Dawei, is one among a very few working broadly on environment, social and economic and human right issues. Detailed information regarding its past, present and future projects are however not widely publicized. Nang Mya Han from Myeik University describes public education concerning environmental issues as amongst the most pressing concern in regards to resource management for Tanintharyi Region. The International Collective in Support of Fish Workers (ICSF) has also done some works with local partner organizations to strengthen coastal communities and community-based organizations, e.g. empowerment of small scale fishers.

### **4.3. Research, education and training**

#### **4.3.1. Myanmar Academy of Arts and Science (MAAS)**

The MAAS was established in 1999 under the MoE and is comprised of experts from across a range of academic fields. The academy conducts regular seminars and publishes the Journal of the Myanmar of Arts and Science.

#### **4.3.2. Universities**

The majority of university researchers working in coastal and marine related fields are at Mawlamyine University, Patheingyi University and Myeik University in which Marine Science Departments are situated. The country's first Marine biology program was established in 1973 at the University of Mawlamyine in Mon State on the Tanintharyi coast before becoming Marine Science Department in 1986. Along with the Marine Science Departments at the three universities, marine related studies are conducted at Zoology, Botany and Chemistry departments at Bago University, Dagon University, Sittwe University and Yangon University. Programs such as naval architecture, ocean and marine engineering, marine electrical systems, port and harbour engineering and marine navigation are offered at Myanmar Maritime University run by the Ministry of Transport. The University of Yangon's Department of Chemistry engages in research on marine and coastal pollution.

#### **4.3.3. Phuket Marine Biological Centre (PMBC), Thailand**

The PMBC was established in 1966 under a bilateral agreement between the governments of Thailand and Denmark. The Center was transferred from Department of Fisheries, Ministry of Agriculture and Cooperatives to the Department of Marine and Coastal Resources, Ministry of Natural Resources and Environment, in accordance with the Thai government agency reform of 3 October 2002. The PMBC is located at the southern Cape Panwa of Phuket Island in Thailand. The main objective is to carry out research on and assess abundance of the marine and coastal flora and fauna in the Andaman Sea and the Gulf of Thailand. The center hosts several workshops and trainings which allows Myanmar scientists to attend and learn new technologies applicable to effective resource management, e.g. on coral reef monitoring and conservation.

## **5. Pro-active management schemes**

### **5.1. Protected areas**

Myanmar's protected area system was introduced in the 1980s. Designations of natural areas under the Wildlife Law 1994 include Scientific nature reserve, National park, Marine National Park, Nature reserve, Wildlife sanctuary, Geo-physically significant reserve and other Nature reserve determined by the Minister. Myanmar has declared a total of 35 protected areas throughout the country, four of which are protected areas with marine elements (1%). Lampi Island is a single marine protected area in Myeik Archipelago and is the only Marine National Park in the country. The others, Mainmahla Kyuun, Moscos Island and Thamihla Kyuun, are designated as wildlife sanctuaries. Coral reefs are known to be encompassed within their boundaries. The administration and management of Marine National Parks lies under the MOECAP as protected areas; and under the MLFRD for the conservation of marine resources (Istituto Oikos and BANCA 2011).

#### **5.1.1. Lampi Marine National Park**

Lampi Island, also known as Kyuun Tann Shey or Sullivan Island, is located in Myeik Archipelago in Boke Pyin Township of Tanintharyi Region. Lampi Island covers an area of 20 461 ha and was designated as a Marine National Park on 27 February 1996 (Tint Tun and Bendell 2010). The protected area includes Lampi Island and surrounding satellite islands with an area extending two miles from the outer islands (but there is no demarcation buoy or signal). Legal framework and boundaries of the MNP according to the notification no. 40/96 are presented in Box 1 and illustrated in **Figure 9** Key protected resources comprise of coral reefs, mouse deer and Moken culture. On

Lampi alone, 195 plant species of the evergreen forest and 63 species typical of the mangrove forest, 19 mammal, 228 bird, 19 reptile, 10 amphibian, 42 fish, 42 crab, 50 gastropod, 41 bivalves, 35 sea-cucumber (holothurians), 73 seaweed, 11 seagrass and 333 plankton species have been identified (Istituto Oikos and BANCA, 2011).

#### Box 1

**National designation:** Marine national park

**Area:** 20 461 ha or 79 mile<sup>2</sup> or 205 km<sup>2</sup> (49.9 km length, 11.3 km width)

**Coordinates:** 10°41' N - 10°49' N, 98°04' E - 98°18' E

**Location:** Myeik Archipelago, Bokeyyin Township, Tanintharyi Region

**Boundary:**

**North:** two nautical miles north from the shoreline of Two Hill Island.

**East:** two nautical miles east from the shoreline of Pulo Gabon Island, Dolphin Islands (War Kyunn), Marble Island, Gregory Group Islands and Palo Taban Islands.

**South:** two nautical miles south from the shoreline of Pulo Tuhan Island which is south east of Lampi Island, Palo Nalo (Bo Cho) Island, Gu Gyi (Kyun) Island and Pulo Lobiaung Island.

**West:** two nautical miles west from the shoreline of Kanzagyi Island, Wa Ale Kyun Island, Ko Phawt Island, Pulo Tayu Island, Kular Island, Observation Island, Pulo Tuante Island and Pulo Lobiaung (Lin Shu) Island.

**Legal reference:**

Notification letter No. 40/96 from Minister of Forestry Lieutenant Gen. Chit Swe (20 August 1996)

**Laws and policy framework:**

- Protection of Wildlife and Wild Plants and Conservation of Natural Areas Law, Art. 8A, 1994
- Forest Department: Notification letter to DOF, 2004 February 23rd, REF: No fishing within 2 miles offshore from the low water level around Lampi Island
- Ministry of Home Affairs, General Administration Office, Boke Pyin: Notification of Lampi Island Marin National Park, N. 7/96, 1st September 1996

**Site governance:** Nature and Wildlife Conservation Division (NWCD, FD)

**IUCN category:** Ib, wilderness area

**International status:** ASEAN Heritage park

**Key protected resources:** Coral reefs, Lesser Mouse-deer and Moken culture

Mammal species stated in the FAO report (1983) and in the notification letter for the establishment of the Lampi Island MNP, like the Barking Deer (*Muntiacus muntjak*), the Capped Langur (*Trachypithecus pileatus*) and the White-handed Gibbon (*Hylobates lar*), had not been observed by local people and nor were they found during the MABR and MEP surveys in 2006-2010. Also, it is important to note that coral reef composition and abundance were never mentioned in any document despite being one of the key protected resources of the MNP.

Lampi Island is home to tropical evergreen forests, mangroves, beach and dune forests and known to be surrounded by coral reefs and seagrass meadows. A great proportion of available biological and ecological data of Myeik Archipelago seem to be concentrated on this island. Yet, a comprehensive survey and verification of existing information are required. Lampi has two spring-fed perennial rivers and numerous streams flowing from the uplands into the Andaman Sea, allowing favorable conditions for human settlements. Although permanent settlements are prohibited on Lampi Island, two permanent and two seasonal villages (Ma Kyone Galet, War Kyun, Ko Phawk and Salet Galet) with total population of 3 000 are residing within the protected area (Soe Htun *et al.*, 2001). This area was previously uninhabited due to the presence of pirates and insurgents. The population number has continually increased through several flows of migration from 227 households in 1995 to 375 in 2008 and 564 in 2010, especially since 1996 when tourism was promoted (Saw Mon Theint, 2013). Socio-economic and demographic pressures appear to be



the main threats to the natural and cultural values of the park (Nature and Wildlife Conservation Division and Istituto Oikos, 2014; Saw Mon Theint, 2013). War Kyunn Island, east of Lampi, has been almost entirely leased to Annawarsoe Company for ice factory since 1980. The company brought migrant workers from various places of Tanintharyi Region, mostly from Palaw Township. An estimated 430 m<sup>3</sup> of freshwater has been supplying to the ice factory per month through underwater pipeline from Lampi Island (Istituto Oikos, personal communication, 2014). Given an increasing population trend and greater demand on freshwater, proper planning in relation to human settlements and conservation measures are needed. This will also help avoid potential conflicts among community members in the future.

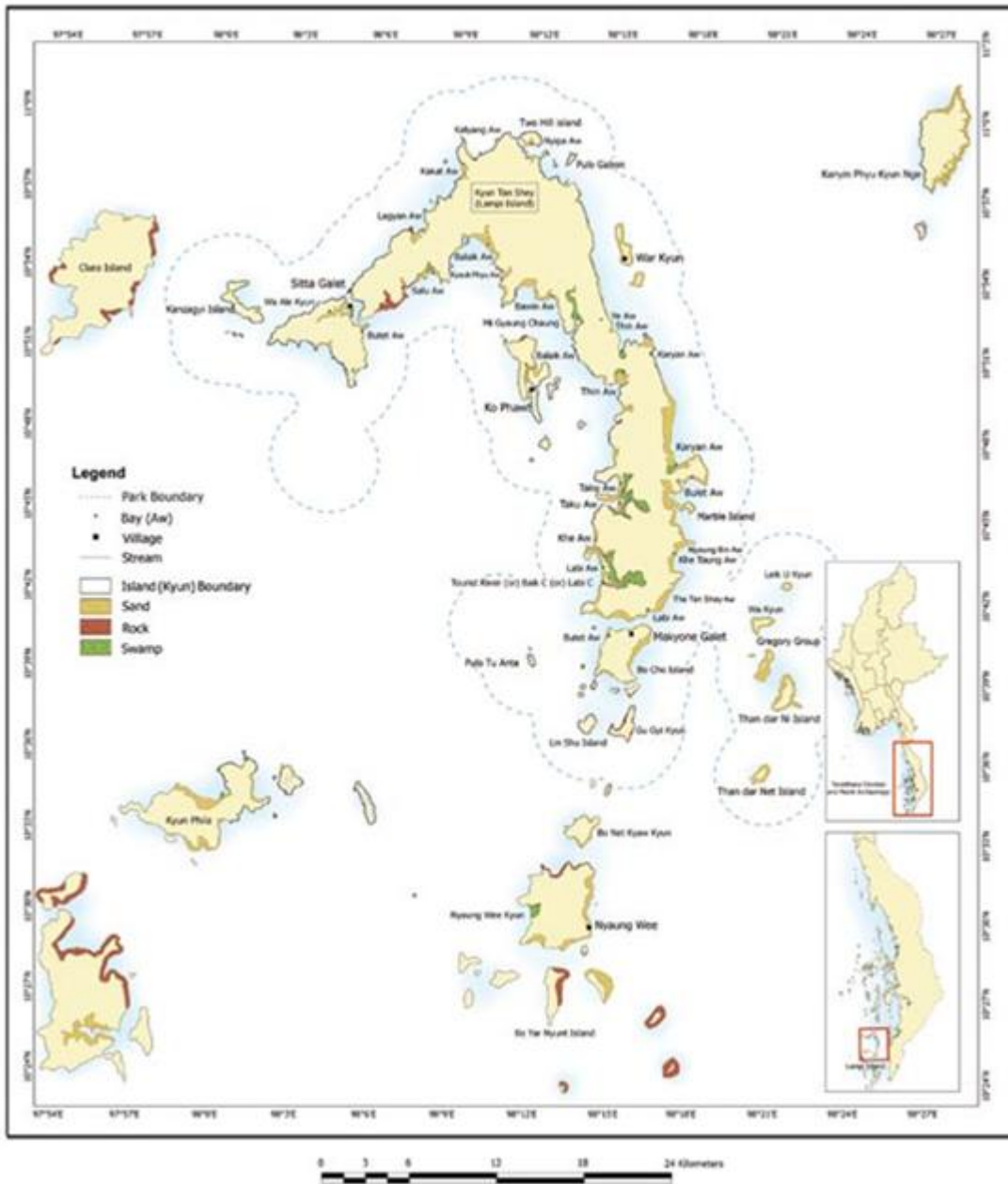


Figure 9. Map of Lampi Island, showing Marine National Park boundary and biophysical characteristics

Source: Istituto Oikos and BANCA, 2011

Harvesting of fish, squid and sea cucumber are the principal livelihoods for Myanmar, Moken and other ethnic groups inhabiting the islands. Lines, net and set gillnet are used for prawn fishing

especially in War Kyunn area; while traps, bag and artificial prawn baits are used to catch squid in the area of Ma Kyone Galet, Ko Phawt, Sitta Galet including War Kyunn. A very small minority of fishermen has the necessary collection and carrying license from the FD. Local fishers use fishing vessels of small-medium dimension and often have disputes with large fishing vessels illegally coming to catch near the shore destroying their traps, nets as well as the fishing ground. Their catches are mostly traded to the neighboring country Thailand. Although it is operated in a small scale, harvesting of sea cucumbers seems to provide an important source of income for these fishers. The dried beche-de-mer is profitable for local and foreign markets with prices range from US\$ 7-9 per kg for species like lolly fish (*Holothuria atra*) up to US\$ 100 per kg for one of the most valuable species like the sandfish (*Holothuria scabra*) (Nang Mya Han and San Tha Tun, personal communication, 2014). The traditional practice that has become commercialized has resulted in over-exploitation (Istituto Oikos and BANCA 2011) and the impoverishment of reef populations of holothurians. It is unclear how severe the issue is when compared with a well-known destructive fishing issue occurring in the surrounding area. Regardless of who are engaged in dynamite fishing, such practice is widespread and unlikely to show a downtrend in the near future, unless fish populations substantially decline and blast fishing cannot make much difference. Concurrent with unsustainable fishing practices, tourism development proposals on the two marine turtle nesting beaches on Lampi have recently attracted much attention. Given the fact that tourism management guidelines and zoning are not in place, the uncontrolled development can lead to irreversible destruction of coastal and marine resources.

These economic activities are presenting significant threats to the areas even though Lampi is designated a Marine National Park. This is mainly due to gaps in legislations, unclear jurisdiction, limited human capacity, inadequacies of infrastructure and minimal allocation of capital for the management of coastal and marine resources which then result in no regular patrol, no enforcement and importantly, bribery. In response to the existing problems, General management plan for Lampi MNP has recently been drafted by Istituto Oikos in collaboration with NWCD, with zoning and responsive action plans outlining park operations, ecosystem management, community outreach and tourism management (Nature and Wildlife Conservation Division and Istituto Oikos, 2014). Six permanent park staffs are currently positioned on Lampi Island with proper communication equipment and a patrol boat.

### 5.1.2. Shark protected area

As of 2004, it is estimated that there are 23 species of sharks in Rakhine State, eight in Hinegyigun and 20 in Myeik Archipelago. Recent information on sharks distribution, occurrence and population trend are almost non-existent. The results from surveying expeditions from FFI and IUCN in the Northern and Southern Myeik Archipelago between 2014 and 2015 are unlikely supportive to the historical abundance of shark populations. Despite the designation of a Shark protection area, only a single shark was observed (at Black Rock) during the four survey expeditions. Based on literature, most species are threatened by intensive fishing pressure for fins and meat, although there are very few large-scale shark fin industries in the country; most only process up to dried raw fins and then export them. The largest export destination for Myanmar shark fin products is China, followed by Thailand and Singapore. Since there has never been shark identification guides for research in Myanmar, the DoF has relied on regional resources provided through SEAFDEC and FAO (Holmes *et.al.*, 2013). With the limitation, the DoF has however produced outreach materials such as posters that emphasize the role of sharks in ocean ecosystems as part of their public awareness programs (personal observation, 2014). As a member country of SEAFDEC, the DoF has initiated a plan on prevention and conservation of sharks across the country. Accordingly, two shark protected areas of 1 706 km<sup>2</sup> (1 706 000 ha) and 11 734 km<sup>2</sup> (11 734 000 ha) were designated in Tanintharyi region on 5 May 2004. According to the order number 2/2004 issued by the DoF on 2 May 2004, no individual can conduct shark fishing operation in the Shark protected Area (I) and Shark protected area (II) (**Figure 10**), and collection of marine fauna and flora is also prohibited (Eleven News, 2012) Fishery resources monitoring system (FIRMS, 2004) A brief draft National Plan of Action sharks was

produced in 2005 and FFI works with BOBLME on revising this NPOA and capacity development on sharks conservation and management.

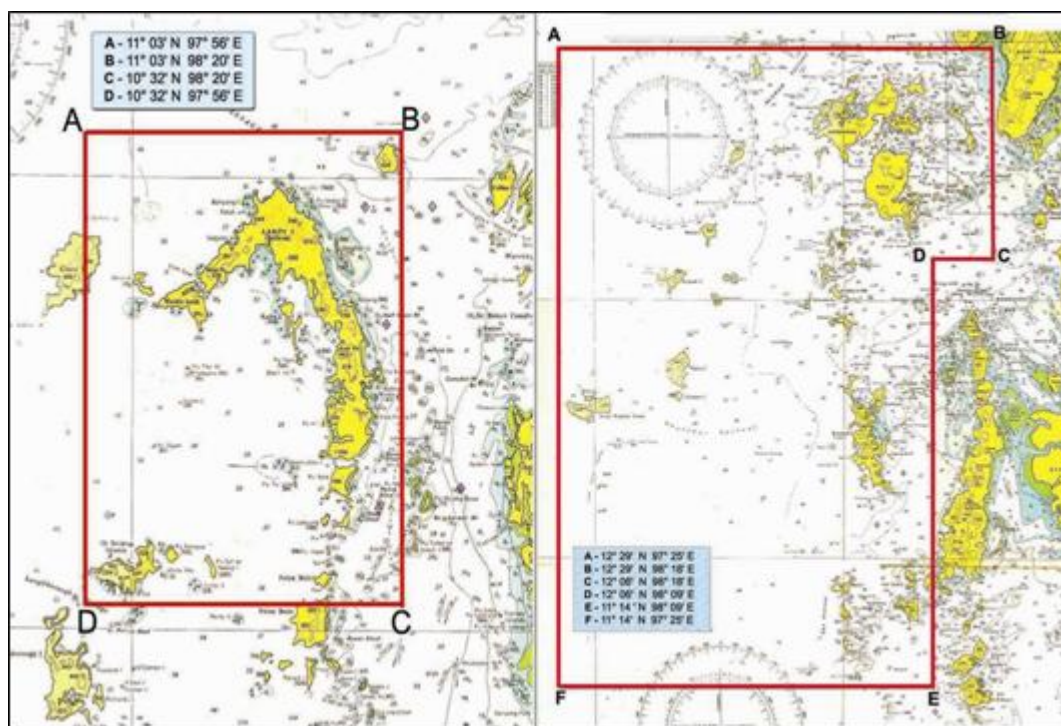


Figure 10. Boundaries of the two existing Shark protected areas in Myanmar

Source: Department of Fisheries

Having been declared as Shark protected areas, even if they appear to have no recent record of sharks, management plan or current shark conservation program in place, can be seen as an opportunity to monitor, control and surveillance activities at sea and resource extraction on the protected islands in the future once adequate capacity and regulations and enforcement are in place.

### 5.1.3. Crab protected area

Information regarding Crab protected areas is very limited and almost never mentioned in any document related to marine conservation in Myanmar. Most of the information here is gathered from interviews and the document entitled “Overview on the needs of public awareness for sustainable development in Tanintharyi coastal urban areas” by Nang Mya Han (Nang Mya Han, 2010). Crab species of economic importance in Myanmar are *Scylla serrata*, *S. olivacea* and *Perisesarma bidens* which can be found in mangrove swamps along Rakhine Coast, Ayeyawady Delta and Tanintharyi Coast. In Myeik Archipelago, larger variety of crabs can be harvested including *Portunus pelagicus*, *P. sanguinolentus*, *Charybdis feriata* and *Ranina ranina*. Due to an increase in crab harvest in Myeik Archipelago since 2000, the DoF has established three Crab protected areas of 40 ha, 46 ha and 121 ha (Figure 11). Any crabs less than 100 g of weight must be released in order to protect juvenile crabs. Apart from this restriction (San Tha Tun, personal communication, 2014) and the boundaries of the three Crab protected areas, further information in terms of management practices, conservation plans, monitoring programs or enforcement seems to be unavailable.

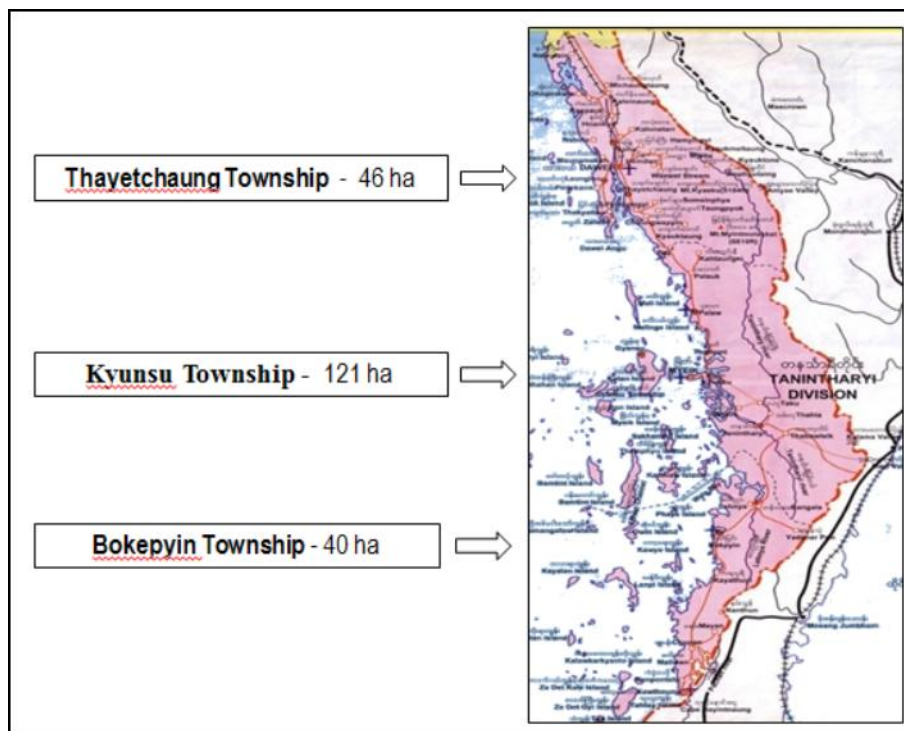


Figure 11. Location of Crab protected areas in Myanmar

Source: Nang Mya Han (2010)

#### 5.1.4. Turtle conservation areas

Anecdotal evidence suggest there are a number of sea turtle nesting sites in Myeik Archipelago, but information on conservation status of turtles in the area seems to be non-existent - not even in Lampi MNP where six turtle nesting beaches are documented. Most of the available data appears to be limited to the Delta region. The first Myanmar sea turtle conservation program was introduced in Thamihla Kyuun (Diamond Island) in Ngaputaw Township, Ayeyarwaddy in 1963. Yet, beaches were leased by the DoF for turtle egg collection until 1986. In 1986-87, the program was fully revived with an aim to safeguarding nests and releasing hatchlings into the ocean. At that time, several department hatcheries with skilled technicians were established (Indian Ocean - South East Asian, 2003). A number of turtle islands have been designated as turtle conservation areas and 35 nesting sites were recorded. However, the conservation activities were conducted in only six of these beaches (Maung Maung Lwin, 2011). Legal framework on turtle conservation and management which include directives to protect turtle landing beaches and utilizing of turtle eggs, meat and turtle shell was issued in 1993 (see Box 2). The egg collection program was run through local fishing communities, and required one-third of the eggs to remain in the area to hatch. Despite the requirement, (Thorbjarnarson *et al.*, 2000) argue that very few individuals have complied with the restrictions.

**Box 2****Legal framework:**

Under the 1905 Fishery Law (11/1905), it is forbidden to trespass in turtle nesting areas without official consent. Under Notification No. 11/1993, all turtles caught accidentally must be released, sea turtles cannot be consumed, Turtle Excluder Devices (TEDs) must be used on trawling gear in all fishing areas and damaged fishing gear cannot be thrown into the ocean.

Under Agriculture Notification No. 1/2005 (1924), it is forbidden to trespass within three miles of a turtle hatching area and turtle eggs cannot be eaten.

The momentum of the activity was accelerated when Myanmar became a member of the Association of South East Asian Nations (ASEAN) in 1997, and of SEAFDEC in 1999 (Indian Ocean - South East Asian, 2003; Thant Soe and Lwin Maung Maun, 2012). In 2001 the activities were enhanced by extending collaboration in line with the MoU on conservation and management of marine turtles and their habitats of Indian Ocean and Southeast Asia (IOSEA - MoU) with the international turtle conservation program (Maung Maung Lwin, 2011). Marine turtle hatching, hatchling releasing, tagging, study on interaction of marine turtles, fishing activities, public awareness, information gathering, education and training programs were conducted at Longlonebok Island as well as its adjacent areas in 2005. Fishermen and local people were instructed to release turtles back into the sea unharmed if they are caught accidentally in their fishing gears and report to the DoF. Based on (Tint Tun and Bendell 2010) and (Thant Soe and Lwin Maung Maun 2012), involvement of local people contributed greatly to the database of turtles in the areas and enhanced the understanding of turtle protection. Given the limited information documented and no regular activity or long-term management plan in place, the management outcome and continuity of the conservation actions are yet to be known.

## **5.2. Mangroves conservation and management**

In response to the rapid mangrove loss, FD implemented mangrove rehabilitation programs which include the establishment of the department and promoted mangrove plantation, regeneration improvement felling, community forestry and protection of natural mangrove forests in Ayeyarwady Delta, Rakhine and Tanintharyi Coasts. The larger stands of the Ayeyarwady have received the most productive and systematic management because they supply fuel wood and charcoal to Yangon (Nay Win Oo, 2002). The previous Wildlife Protection Act of 1936 was replaced with the 'Protection of Wildlife, Wild Plants and Natural Area Law' in June 1994 in order to rehabilitate threatened wildlife and sanctuaries. Since 1995, Myanmar Forest Policy has focused on the protection of nature and sustainability of natural resources, on satisfying the basic needs of the people, and on the participation and awareness of the people in biodiversity conservation (Nay Win Oo, 2002). Community forestry, research plantations and nursery centers were established across the three regions in cooperation with JICA, FAO and UNDP. Based on (Ei Thandar Bol, 2013) cited in the WCS report on Marine Conservation in Myanmar, by 2013, 40 ha of mangrove forest plantations were established in Tanintharyi, 2 812 ha in Ayeyawady, and 249 ha in Rakhine. The number of Tanintharyi plantations seems to contradict the FD record cited in (Nang Mya Han, 2010) suggesting that as of 2010 there were 2 063 ha of mangrove plantations and 455 ha of community forestry in Myeik Archipelago alone (mostly in Kyunsu, followed by Myeik Township). It is also notable that (Ei Thandar Bol, 2013) reported 0 ha of mangrove forest plantations in Tanintharyi in 2009-2010 and 2011-2012. This demonstrates difficulty in obtaining reliable and accurate data. Based on interviews with Myeik University researchers, mangrove rehabilitation program has recently attracted much attention in Myeik Archipelago. Degraded mangrove areas have been rehabilitated with the collaboration between the FD, Myeik University and local communities, and a Mangrove research park was established in Myeik where over 100 000 mangrove trees and all species of mangroves are to be planted (<http://wif.org.lk/partnership.html>). In addition, June 5 of every year is recognized as mangrove planting day and July is known as tree plantation month. This shows an effort in mangrove



restoration and rehabilitation and ever growing importance of local participation in resource conservation in Myeik Archipelago and also around Myanmar coasts.

### **5.3. Conventional fisheries management**

Under the Myanmar national laws, fishing activity is controlled by a licensing and registration system designed to control both vessel and gear types. Two fishing zones have been established through a licensing scheme whereby zones are designated for specific fishing gear, classes of fishing vessels and ownership. This is an attempt to provide equitable allocation of resources and reduce conflicts between traditional and commercial fishers. Commercial fishing vessels using trawlers and purse seines are prohibited from fishing within five nautical miles in the Rakhine and ten nautical miles from shore in the Ayeyarwady Delta and Tanintharyi Coasts.

#### **5.3.1. Prohibition of fishing gear**

Under the Law relating to the Fishing Rights of Foreign Fishing Vessels 1989 and Myanmar Marine Fisheries Law revision 1990, fishing gear that is destructive to the environment and the fisheries resources are unambiguously prohibited. These gears include pair trawl fishing, electric fishing, fishing using poisons, chemicals, explosives, purse seine net less than 3.5 inch mesh size, for trawl net cod-end mesh size less than 2 inches.

#### **5.3.2. Fishing licenses**

The fishing efforts have been controlled by the licensing system. Any fishing activities without licenses are illegal. Inshore fishers or people intending to collect marine products for sale and sport fishing businesses are required to have a license from the DoF officers of respective Township. Likewise, offshore fishers need a license from the DoF of respective state or region. Foreign fishers were allowed to access Myanmar's marine resources under the Foreign Investment Law and required a license from the Director General of the DoF until recently. Since April 2014, the DoF stopped issuing new fishing licenses to foreign fishers due to overcapacity. Licenses being expired before the end of March will no longer be renewed and fishers currently holding active licenses are allowed to fish until their fishing rights terminate. However, joint-venture cooperation between foreign fishermen and Burmese fishermen can remain in operation (Mya Than Tun and Toe Nandar Tin, personal communication, 2014). Without effective policing and data about how many foreign-flagged vessels are operating in Myanmar, it is unclear how much reduction in total effort will be achieved; it may reduce the number of "legitimate open access fishers" who exploited the previous open door fishery policy, but are unwilling to engage in blatantly illegal activity, but is unlikely to seriously impair the illegal fishers who were never registered to fish in Myanmar.

#### **5.3.3. Closed fishing areas**

The DoF has restricted fishing in various fishing grounds along the Myanmar coastline including the Rakhine Coast, Ayeyawady Region, Mon State and Tanintharyi Region. It is important to note that no-fishing areas have been declared around Lampi Island (Notification No. 5/94), Pearl Island (Notification No. 7/93) and in both of the Shark protected areas (Notification No. 2/2004). Additionally, the State, having been empowered by the Forest law 1992, declared all mangrove forests as protected areas, and thus fishing within three hundred yards around mangrove areas is strictly prohibited (Win Oo, 2001). Documentation informing the implementation of this management scheme; how the restrictions are enforced; or whether or not it has positive effects on fish population is however very limited (if ever existed).

#### **5.3.4. Seasonal closure**

One of the DoF important conservation initiatives is the complete closure of marine fisheries for three months at the beginning of the monsoon season (May-July). The pre-monsoon period is one of widespread reproductive activity in tropical fishery stocks and the three-month closure should allow unimpeded spawning and recruitment for several economically important species, circumventing the impacts of fishing on spawning aggregations and the removal of gravid females from the spawning stock. The result of this sort of "spawning closure" is to increase the effective spawning

population in heavily exploited fisheries (such as the Hilsa fishery). This initiative affects both commercial and artisanal fishers, although it is unlikely that DoF will pursue the restrictions for subsistence fishers. The initiative is quite likely to have serious consequences for the commercial fishery, although the monsoon is traditionally a period of rough seas and very restricted fishing activity, with effort concentrated in comparatively sheltered regions. Thousands of crewmen will need to find alternative livelihoods for the three months intercession, a consequence that is of concern to policymakers. However, since the fishery is usually downscaled during this time, it is a period when many fishing crews have traditionally sought employment ashore, or in neighbouring Thailand and so the upheaval is not likely to be as severe as it first appears. Also, anecdotal reports suggest that over 60% of fishing vessels are still allowed to fish during closed season and the three-month period was determined with little consideration of different spawning time and habitats of each species; therefore, it is difficult and premature to indicate whether this is functioning well and meets its main purposes.

## 6. Management recommendations for Myeik Archipelago

Given imminent threats facing fisheries and marine ecosystems in the Myeik Archipelago, it is recommended that immediate actions be taken to restore damaged ecosystems, protect existing resources and habitats and ensure long-term livelihood and food security. **Table 3** enumerates importance, relevance and action statements of coastal management interventions for the Myeik Archipelago. The box below shows color identification of priority/importance (as low to medium, high), relevance (as local, regional, national) and action statements (as immediately possible, conditional) of each strategic action.

|         |  |
|---------|--|
| L-M     | Low to medium importance/priority            |
| H       | High importance/priority                     |
| L       | Local  |
| L, R, N | Local, regional and national                 |
| N       | National                                     |
| P       | Action underway/immediately possible         |
| D       | Action must be deferred until conditions met |

**Table 3. Priorities, relevance and action statement of responsive management actions to the sustainable management of marine resource**

| Management interventions                         | Strategic actions  | Priority/importance | Relevance | Action statement |
|--|--|---------------------|-----------|------------------|
| <b>Socio-ecological Profiling</b>                | Coastal profiling and baseline data - biophysical and socio-economic   | H                   | N         | P                |
|  | Research and monitoring programs   | H                   | L, R, N   | D                |
|  | Habitat and resource mapping   | H                   | L, R, N   | D                |
|  | Traditional knowledge on resource use and conservation   | L-M                 | L         | P                |
|  | Center of excellence e.g. coastal and marine research center   | L-M                 | N         | P                |
|  | Information sharing mechanisms and communication channels for dissemination of environmental messages and education  | L-M                 | N         | P                |
| <b>Community-based conservation initiatives</b>  | Integration of community participation into the management and monitoring of resources and conservation  | L-M                 | L         | D                |
|  | Capacity development and empowerment   | H                   | L         | P                |
|  | Better education and awareness   | H                   | L, R, N   | P                |
|  | A sense of ownership and responsibility for resources  | H                   | L         | D                |
|  | Establishment of local governance and representation   | L-M                 | L         | D                |
| <b>Planned and regulated marine tourism</b>      | Tourism planning, management guidelines and regulations  | H                   | N         | P                |
|  | Lessons learned from the Maldivian tourism management model  | L-M                 | N         | P                |
|  | Tourism as a tool for the conservation of species and natural habitats and the alternative income generation for local communities   | H                   | L, R, N   | D                |
|  | Collaboration of hotelier with MoHT, DoF, FD and Navy in habitat protection  | H                   | N         | D                |
| <b>Fisheries management</b>                      | EAFM – Ecosystem-based Approach to Fisheries Management  | H                   | L, R, N   | D                |
|  | Regulations to control fishing gears and methods for both small scale and commercial fishers   | H                   | L, R, N   | D                |
|  | Enhanced capacity of line departments in patrolling and law enforcement to combat IUU fishing  | H                   | N         | D                |
|  | Organization of local fishery cooperative or fisher association  | L-M                 | L         | D                |
|  | Transboundary cooperation between Myanmar and Thailand   | H                   | N         | D                |
| <b>Management of marine ecosystems</b>           | Identification of gaps in the marine protected area network and land-use policy  | H                   | N         | P                |
|  | Capacity building  | H                   | L, R, N   | P                |
|  | Sustainable financing of MPAs  | L-M                 | N         | D                |
|  | Involvement of local population in the management of local resources and conservation in and outside MPA boundaries  | L-M                 | L         | D                |
|  | Establishment of protected area network including areas of regional and global conservation importance and integrating a holistic planning framework such as resilience, ICM, MSP, and ridge to reef concepts            | H                   | N         | D                |
|  | Transboundary marine ecosystem management to support habitat connectivity and migratory fish species   | H                   | N         | D                |
| <b>Good governance and effective enforcement</b> | Clear legislation identifying the governing authority responsible for managing coastal and marine resources and the enforcement authority to prosecute and punish illegal practitioners/poachers (inside & outside MPAs) | H                   | N         | D                |
|  | Clear roles and responsibilities among line agencies for the effective implementation of marine-related plans and regulations  | H                   | N         | D                |
|  | Cooperative actions between regulatory and enforcement agencies  | H                   | L, R, N   | D                |
|  | Partnerships and collaboration of all stakeholders, particularly DoF, FD and Navy  | H                   | N         | D                |
| <b>Alternative livelihood generation</b>         | Equity in benefit sharing of fishery products  | H                   | L, R      | D                |
|  | Value-added marine fishery products  | L-M                 | L         | P                |
|  | Self-reliance and self-dependency through home grown agriculture, small-scale gardens and animal raising   | H                   | L         | P                |
|  | Livelihood diversification e.g. well-managed aquaculture and mariculture   | H                   | L, R, N   | D                |

### 6.1. Socio-ecological profiling

There are a number of reports, documentation and research studies in relation to Myanmar natural resources and conservation; however a review of published studies shows that there is still much to learn to understand the status of Myanmar coastal and marine resources and complex socio-economic characteristics. To meet coastal planning needs and address critical issues related to coastal management, adequate natural science and social science information must be made available in a practical and policy-relevant form. Baseline data of resources/individual species occurrence, distribution, population trend, threats and conservation status is an urgent need. Demographic and socio-economic studies of Myanmar nationals and other ethnic groups on both mainland and islands are important. Traditional knowledge of various ethnic groups should be preserved and passed on to the next generations, e.g. traditional fishing methods, traditional cultivation techniques, the use and construction of the Moken *Kabang*, traditional medicine, etc. Habitat maps of the marine environment of the Myeik Archipelago will help provide a better understanding of the distribution and extent of marine habitats such as coral reefs, seagrass beds, mangroves, marine wildlife and fishery resources. An understanding of how particular human activities are undertaken in relation to marine habitats serves to establish sensible approaches to the conservation needs of each habitat and to facilitate better management of the marine environment. New methods and technologies have been developed in recent years to allow rapid site evaluation and appraisal including the “SocMon” approach to socio-economic monitoring.

Having limited and outdated ecological and socio-economic baseline data means that there is very little upon which to base management decisions such as zoning, extraction quotas, usage types or even population models. In the absence of reliable survey data, it is best to take a 'precautionary approach' which is one of the principles of an ecosystem approach to responsible fisheries and sustainable marine resource management (Staples and Funge-Smith, 2009). In-country capacity to conduct research, particularly at universities, needs to be improved. Introducing coastal resource management into the local education curriculum may be a good start. Establishment of centers for coastal and marine research at national level should be considered and communication channels for dissemination of environmental messages and education are necessary. There is a need and opportunity to encourage partnerships and collaborations between Myanmar government authorities and academic institutes and that of the neighboring countries (such as Thailand and India) and international agencies with relevant expertise. Workshops, trainings and study tours of best (and bad) practices from other areas can serve as lesson learned and help improve understanding of the socio-economic and ecological importance of coastal and marine ecosystems and responsive resolutions to the existing problems.

### 6.2. Community - based conservation initiatives

There is growing evidence that marine conservation works best when local communities are responsible for management of their resources. This is particularly the case in low-income countries, where national capacity for enforcement of marine and fisheries legislation may be weak. In Myeik Archipelago, there has been limited (if ever existed) community-based conservation initiative or involvement of local communities in the conservation and management of resources; whereas, in Ayeyarwady Delta and Rakhine State the conservation programs involving local communities have contributed to positive outcomes. The mangrove restoration in Ayeyarwady and the conservation of shorebirds in Rakhine show that the participation of local people is essential for sustainable coastal management, protection of biodiversity, food security and long-term livelihoods of the coastal communities. The need for integrating community participation into the management and monitoring of their resources is emphasized in the 2011 National Biodiversity Strategy and Action Plan (NBSAP) and one of the key recommendations by various INGOs such as Istituto Oikos, FFI and WCS. Promoting the engagement of local communities in resource management and conservation

reflects the needs to link action on the ground with better education and awareness. Communities need to be empowered to allow meaningful partnership and sustaining outcome.

There are several ways through which Myanmar and INGOs and academic institutions could build grass-root support for conservation, for instance, changing public perceptions towards conservation through awareness raising programs; encouraging ecotourism and best practices; forming local patrol groups and fisher groups; promoting a sense of ownership and responsibility for resources; and establishing local governance or representation (respected or influential persons like monks and ethnic group leaders). Local fishery cooperatives or fisher associations may be formed to help regulate local resource use, fishing gears, closed season or closed areas (no-take zone); negotiate fair price for fishery products and manage savings for fishers. There is a need for management authorities and civil society to identify and fulfill capacity needs and gaps, and building on strengths and opportunities for effective monitoring and management of coastal and marine resources at local level. Adequate capacity in terms of skills and knowledge, technology, infrastructure and institutions must be developed.

### **6.3. Planned and regulated marine tourism**

Considering the remote location and difficulty to access the offshore islands of the Myeik Archipelago, the expansion of tourism may be slow and at small scale. This provides an opportunity for Myanmar authorities to put proper tourism planning and management in place. Without adequate regulations and guidelines, unplanned tourism can have significant impacts not only on physical-ecological (e.g. loss of biodiversity, pollution and erosion), but also on social (e.g. overcrowding, abandon of traditional activities, drugs and crime) and economic aspects (e.g. high cost of living, seasonal income). Aesthetic values and some deteriorated resources can be recovered but the loss of cultural values and severely degraded resources may be irreversible.

Having maritime border with Thailand, the potential for coastal tourism, boating and reef-based tourism in the Archipelago is much higher. Growing tourism demand from Thailand and the ASEAN region offers many ways to improve the economic situation of the people of Tanintharyi in a sustainable and fair way. It also has the potential to reduce over-exploitation by creating alternative uses of resources, thus acting as a tool for the conservation of species and natural habitats. It is important for Myeik Archipelago to develop a tourism management framework which promotes the four principles of sustainable tourism: the conservative use of natural and social resources, the competitive advantage for the tourism businesses, the quality of life of the host community and a high level of tourist satisfaction. Considering the natural and human characteristics, there are common elements between the Maldives and the Myeik Archipelago; for example, a vast area comprising of small islands (1 190 islands in the Maldives and 800 in Myeik Archipelago), physical separateness between islands, traditionally associated with fisheries, home to indigenous population and inviting image of island tourism. In line with an increased tourism development, the Maldivian government has imposed strict regulations and guidelines for resort construction and operation to protect the natural environment and the human environment of the local population/islanders. Tourism development is under the 'one island one resort' scheme; each of the Resort Islands is a self-sustained enterprise and complies with Environmental Impact Assessment (EIA), land-use controls, architectural and design controls, biodiversity conservation and waste management. Individual resort protects coral reefs and resources on and around the island and employs local people for all tourism services. Local fishers can sell their captured and cultured fish products directly at fair price to the tourism providers on islands. The Maldivian concept showcases that tourism could be a force for development that is economically and environmentally attractive. Since tourism in Myanmar begins later than in many maritime countries in the region, lessons learned from other places offer an opportunity for the Myeik Archipelago to manage tourism sustainably. Yet, given very weak state presence across the Myeik Archipelago, there are few alternatives. Hotel developers should be particularly concerned about dynamite fishing that damages coral reefs and marine life and endangers divers. Even so, tourism's reach will be limited to selected islands; it is not



a comprehensive solution. In the long-term, more localized governance is needed. In order for sustainable management of resources, the hotelier has to work with the community, in collaboration with the MoHT, DoF and FD. Facilitating the development of environmentally sustainable tourism in the area may be a promising option. The more stakeholders that are interested in protecting the environment, the more likely the unsustainable practices will be addressed and/or reported to the authorities.

#### **6.4. Fisheries management**

Coastal and marine ecosystems are composed of both natural and human elements. Fish populations are one portion of the complex ecosystems that are influenced by many environmental factors and human activities. Fisheries should be considered as systems in which social systems and ecological systems are in fact linked. This perspective calls for a new way of managing fisheries, that is, through an ecosystem-based approach. An Ecosystem Approach to Fisheries Management (EAFM) is geographically specified fisheries management that takes account of knowledge and uncertainties about and among living marine resources, their habitats and human components of ecosystems and strives to balance diverse societal objectives. The aim is to ensure that, despite variability, uncertainty and likely natural changes in the ecosystem, the capacity of aquatic ecosystem health, both natural and human, is maintained indefinitely for the benefit of present and future generations (Staples and Funge-Smith 2009).

In the Myeik Archipelago, illegal and destructive fishing including industrial-scale trawlers, baby trawlers, dynamite fishing, light-luring fishing with small mesh size nets and removal of key ecologically-important species from the ecosystems are imminent threats that need immediate responses. Limited capacity of line departments in patrolling and enforcement illegal activities offshore and corruption among various authorities are major reasons contributing to such persistent issues. To retain ecological balance and sustain fish stocks for future generations, unsustainable fishing practices and methods operated by both small-scale and commercial fishers need to be controlled. Cooperative actions between regulatory and enforcement agencies are needed. There is potential for Navy, Army and local authorities to have a shared role and responsibility in patrolling to support resource conservation and habitat protection, given limited capacity from the agencies on the mainland. Local fishers are fragmented and since they are often part of the IUU supply chain, also part of the problem. Organizing these fishers into an effective association is therefore a major long-term undertaking. In the short term, data and information on the economic impacts of IUU fishing in the neighboring countries can be used as a learning experience. In addition to the economic aspect, ecological value of species and habitats must be taken into account in the long-term sustainable fisheries management planning. Since some destructive fishing materials are bought from Thailand and marine fisheries in the Myeik Archipelago are to a large degree driven by Thai market economy, it is imperative for the two countries to consider transboundary cooperation to combat IUU fishing and ameliorate issues confronting the sustainability of Myanmar fisheries. Engagement of local fishers against IUU fishing is significant. Both local and international NGOs capable of supporting the formation and organization of fishers associations should be identified. Network Activities Group (NAG) may be considered as a key supporter. In 2007, it was suggested that actions to combat IUU fishing should include seeking external assistance for upgrading MCS capabilities, improving education programs and developing aquaculture as an alternative to capture fisheries (Asia-Pacific fishery commission, 2007). These mechanisms should be endorsed and other actions supporting the momentum of such practices should be promoted.

#### **6.5. Management of marine ecosystems**

Guided by the National Forest Policy and Master plan, the FD has made strenuous efforts to expand the coverage of protected areas during the last decade. Four (one Marine National Park, three Wildlife sanctuaries) out of 36 protected areas in the country are consisting of marine elements: Lampi Marine National Park, Mainmahla Kyuun, Moscos Island and Thamihla Kyuun. Generally,

MPAs can play a critical role in protecting marine species and habitats, conserving marine biodiversity, restoring fisheries populations, managing tourism activities and minimizing conflicts among diverse resource users. However, protected areas in the Myeik Archipelago, including Lampi MNP, Shark protected areas and Crab protected areas, face many challenges in achieving their objectives. Systematic review of the marine ecosystems for the purpose of identifying gaps in the marine protected area network and land-use policy is a critically important deficit. Illegal activities such as logging and destructive fishing have persisted within the park boundaries. To address these challenges and ensure the benefits of MPAs on biodiversity and coastal communities, there is an urgent need for capacity development, sustainable financing of MPAs and involvement of the local population in the management of MPAs.

Engagement of communities in the management of protected areas and local resources through Locally Managed Marine Areas (LMMA) approach is encouraged by FFI recently. A total 12 LMMAs based on the known occurrence, distribution and status of coral reefs, mangroves, seagrass beds and mudflats are proposed with an aim of protecting key habitats and fisheries whilst alleviating poverty and empowering local fishing communities to take an active role in managing the resources on which they depend. La Ngan Islands are the pilot area for LMMA implementation supported by FFI. Socio-economic assessment was conducted together with ongoing capacity development and awareness raising. Consultation with local communities has been undertaken in order to develop regulations for fisheries, such as no-take zone and other resource protection and management.

It is important for Myanmar to consider the establishment of a protected area network to include areas of regional and global conservation importance and to integrate a holistic planning framework such as resilience, ICM, MSP, and ridge to reef concepts. An MPA network is identified by IUCN as "a collection of individual marine protected areas operating cooperatively and synergistically, at various spatial scales and with a range of protection levels, in order to fulfill ecologically aims more effectively and comprehensively than individual sites could alone". Well planned networks of MPAs provide important spatial links to maintain ecosystem processes and connectivity. Since Myanmar and Thailand share a maritime border and largely depend upon coastal and marine ecosystems in the Andaman Sea for their livelihoods and food security, it is important for the two countries to promote transboundary marine ecosystem management to support habitat connectivity and migratory fish species. Effective management of existing MPAs and the establishment of additional MPAs in Myeik Archipelago, particularly around Za Det Kyi to be connected to Surin and Similan MPAs in Thailand, can make a significant difference.

## **6.6. Good governance and effective regulatory enforcement**

There are a number of policies regulating fisheries and making concerted efforts to protect marine ecosystems as well as to conserve coastal and marine species. The effectiveness of policies implementation however depends mostly on the political will and the availability of resources to implement. With limited capacities, implementation and enforcement of legislations can be difficult. In the case of Myanmar, the sector specific policies are unclear who has authority to manage and enforce in the coastal zone and whether the NWCD within MOECF or the DoF within MLFRD has authority for the conservation and management of marine components in Marine protected areas. These obscure and/or overlapping responsibilities hinder an efficient implementation of marine-related plans and regulations, especially when combined with ineffective cooperation and coordination between regulatory and enforcement agencies; between different ministries or departments; and between centers and peripheries.

To address these issues, there is an urgent need for Myanmar to have interagency task forces and defined agency whose scope includes administration of MPAs, or any integrated management vision for multiple-stakeholder use of maritime resources. It is important to have clear legislation identifying the governing authority responsible for managing coastal and marine resources (inside and outside MPAs) and the enforcement authority to prosecute and punish illegal

practitioners/poachers. There are a few options. Myanmar can consider giving management and enforcement authorities to a division within the DoF or the FD or establish a new department in separation to the two departments, for instance, Department of Coastal and Marine Resources and Department of National Park; or have the Navy as enforcement authority. Partnerships and collaboration of all stakeholders, particularly DoF, FD and Navy is highly recommended.

### **6.7. Alternative livelihood generation**

Communities in the Myeik Archipelago appear to have a high degree of specialization and low levels of livelihood diversification. Heavy dependence on fisheries and the use of advanced and destructive fishing gears and methods have evidently resulted in the decline in fish stock and more fishing effort. Since most fishery products are sold at local level in exchange for cash, rice and vegetables, inequity in benefit sharing has incentivized fishers to harvest as much as possible, leading to overexploitation of resources. Value chain should be studied and fishers should be enabled to secure higher prices per unit catch as an incentive for more sustainable fisheries management. Self-reliance and self-dependency through home grown agriculture, small-scale gardens and animal raising will not only help reduce their expenditure, but also support food security. Single specialized livelihood and/or target species and dependency on a cash economy tend to be vulnerable to shocks and stresses. For this reason, alternative income generation is significantly needed to help enhance resilience (or reduce household vulnerability) and lessen pressure on marine resources. Well-managed mariculture and aquaculture of high value species such as sea bass, a variety of groupers and mollusks can provide alternative income and also help protect resources in the surrounding areas. These operations require low investment and low technology. To ensure contributions to food supplies and sustain the farming operations, aquaculture and mariculture need to be sustainable. It is important that guidelines for sustainable farming operations be taken into consideration in aquaculture and mariculture management planning.

## **7. Concluding remarks**

Myeik Archipelago has been recognized as home to diverse and abundant natural resources and critical habitats. Low density of coastal population and no massive coastal development are favorable conditions for the Archipelago to protect their once known pristine marine environments. The Myanmar government has expressed its commitment to put 10% of its marine areas under protection by 2020; however, a range of factors constrain the ability of the government and other actors to meet this target. This report offers an overview of past and current condition of socio-ecological systems of the Myeik Archipelago; demonstrates ecological services and functioning; and identifies key actors playing significant roles in managing resources. The final section of the report summarized important management interventions and responsive actions to better management of marine resources and ecosystems in the Archipelago. In spite of persistent and ongoing challenges, there are still potential and opportunities for Myanmar to learn from other nations and demonstrate “best practice” in sustainable environmental development. Major tasks will be to effectively address knowledge gaps and legislation gaps. However, with political commitment and institutional mobilization to develop the region, it is possible for Myanmar to conserve marine biodiversity, sustain food security and ensure livelihoods of their coastal communities. To reach these aims, effective law enforcement, good governance and transparency are required. Good coordination between line agencies and collaboration with educational institutes, civil society and NGOs is a significant driver. Also, it is recommended that transboundary cooperation between Myanmar and Thailand in combating illegal fishing and promoting protected areas network be pushed forward. Myanmar participation in the BOBLME has been instrumental in fostering transboundary cooperation. The future implementation of BOBLME Strategic Action Programme (SAP) will be critical to follow up many key actions identified in this report. With strong

presence in Southeast Asia and extensive experiences in developing effective marine protected areas, IUCN will have a major role in implementing the BOBLME SAP in the Myeik Archipelago.

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Bangladesh, India, Indonesia, Malaysia, Maldives, Myanmar, Sri Lanka and Thailand are working together through the Bay of Bengal Large Marine Ecosystem (BOBLME) Project to lay the foundations for a coordinated programme of action designed to better the lives of the coastal populations through improved regional management of the Bay of Bengal environment and its fisheries.

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