Bay of Bengal
Large Marine Ecosystem Project

SHARK AND RAY FISHERIES OF MYANMAR – Status and Socio-Economic Importance

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The programme

The Tanintharyi Conservation Programme is an initiative of Fauna & Flora International's (FFI) Myanmar Programme, implemented in collaboration with the Myanmar Forest Department and a number of local, national and international collaborators and stakeholders. FFI Myanmar operates the programme under a MoU with the Forest Department specifically for marine and terrestrial conservation activities in Tanintharyi Region.

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Cover image

Sharks at Thabawwseik Village fish market, Dawei District. Credit: FFI Myanmar.

Table of contents

ACRONYMS

BOBLME	Bay of Bengal Large Marine Ecosystem
DoF	Department of Fisheries, Myanmar
CITES	Convention on International Trade in Endangered Species
FAO	Food and Agriculture Organization
FFI	Fauna & Flora International
GEF	Global Environment Facility
IUCN	International Union for the Conservation of Nature
MFRDMD	Marine Fishery Resources Development and Management Department
NPOA	National Plan of Action
SEAFDEC	Southeast Asian Fisheries Development Center
WCS	Wildlife Conservation Society

EXECUTIVE SUMMARY

This report forms part of the Bay of Bengal Large Marine Ecosystem (BOBLME) Project of the Food and Agriculture Organisation (FAO) of the United Nations: “Strengthening existing marine reserves and shark conservation in Myanmar”. This project is a collaborative effort between BOBLME and FFI with technical support from SEAFDEC-MFRDMD. As an initial step to achieving improved conservation of sharks, an assessment of the current status of sharks and the fisheries including socio-economic information was initiated, with this report detailing the findings of the assessment. The assessment was carried out in two parts:

1. Desk-based review of historical shark and ray catch records and fishing legislation
2. Field-based surveys (market surveys and socio-economic surveys with fishers) at 5 fishing towns in Myanmar and 1 in Thailand.

Records show Myanmar may be home to as many as 58 shark and 71 ray species (including Critically Endangered (2), Endangered (2), Vulnerable (18) and Near Threatened (18) shark species. There is a national ban on shark fishing through a declaration made by the Department of fisheries, however this has yet to be formalised in law and shark and ray populations appear to be in severe decline.

Despite the ban, surveys revealed an active market for shark products both for national and international consumption. Sharks were reported both as incidental and as a targeted catch and fishers who intentionally catch sharks overwhelmingly want to see the ban lifted. Those who catch them incidentally find them a valuable by-product. There are no restrictions on ray fishing (including Red List species) and it appears rays are being caught in very large numbers e.g. 4000 tonnes in Tanintharyi Region in 2013-14. Surveys also revealed an abundance of juvenile shark and ray species for sale in markets.

Key threats to sharks were identified as: longline fishing, sale of bycatch, over-capacity of Myanmar’s fishing fleet, fishing of juveniles, lack of enforcement, destructive fishing practices e.g. dynamite, and high market demand for shark products for export.

It is intended that the information in this report should feed into the planned drafting of Myanmar’s National Plan of Action (NPOA) and the development of a set of recommendations and required actions to combat the decline in both shark and ray populations.

INTRODUCTION

Dulvy *et al.* (2014) have estimated that more than half of all chondrichthyans (the class of fish that includes sharks, rays and chimaeras) face an elevated risk of extinction (a proportion that is significantly higher than for most other vertebrates), identifying large-bodied species inhabiting shallow waters as particularly vulnerable. Population declines are most acute in the Indo-Pacific and Mediterranean Sea. Chondrichthyan declines have significant and cascading effects on marine ecosystems. Life cycle traits of late maturation, and long gestation make chondrichthyans sensitive to elevated fishing pressures and slow to recover from over-exploitation. Over recent decades, chondrichthyan catches have become increasingly dominated by ray species, Of particular significance to the demand for chondricthyans is the unmonitored and unregulated fin trade, driven by demand in Asia for shark fin soup. This trade is lucrative and not limited to sharks, but also shark-like rays such as wedgefishes and sawfishes (Dulvy *et al.* (2014). Other significant drivers of chondrichthyans are demand for meat, oil and gillrakers of large rays. Some of the most threatened species of chondrichthyans are declining as a result of being caught incidentally by fisheries targeting other species.

One country in which targeted shark sightings have declined dramatically is Myanmar and the number of sharks observed at landing sites throughout the country indicates a lucrative market (Holmes *et al.* 2013). This is supported by the fact that during 200 transect surveys of coral reefs within Myeik Archipelago by Fauna & Flora International (FFI) between 2013 and 2015 no shark species were directly observed (Howard *et al.* 2014). Shark demand from neighbouring countries is also increasing. Surveys conducted by the Dr. Fridtjof Nansen research vessel in collaboration with the Department of Fisheries Myanmar (DoF) found a severe decline (up to 90%) in pelagic and demersal fish yields in Myanmar waters since 1980 (Krakstad *et al.* 2014).

In 2004 two shark reserves were designated by the DoF within the Myeik Archipelago and in 2008 a nationwide ban was introduced. However, a lack of resources and human capacity to manage these reserves effectively mean that they are unlikely to have achieved their stated purpose. There has been no monitoring of compliance in the Myeik shark reserves. This is compounded by a lack of baseline data on shark species in Myanmar's waters which further hampers monitoring and conservation efforts. Such issues highlight the need for enhanced management of sharks, and also ray conservation within Myanmar to ensure populations are able to recover and local extinctions are avoided. Through its involvement in the Bay of Bengal Large Marine Ecosystem (BOBLME) initiative (a coordinated programme of action to

improve the lives of coastal populations through improved regional management of the Bay of Bengal environment and its fisheries) the Government of Myanmar has expressed its commitment to sustainable environmental management and sustainable coastal livelihoods.

As a first step to improving the conservation of sharks and rays within Myanmar an assessment of the fishery was deemed necessary. Likewise the importance of sharks and rays to fishers and traders was also assessed to gain an understanding of the socio-economic value of the species and fishery. This report therefore details recent findings collected from landing sites and fisher interviews throughout Myanmar as well as review of catch data/statistics from fisheries and survey reports.

METHODS

This fishery assessment involved observational surveys of sharks and ray species caught at landing sites and/or fish markets in Hlaing Gyi (Ayeyarwady Region), Yangon (Yangon State), Dawei, Myeik and Kawthaung Towns (Tanintharyi Region), the villagers of Thayawtathangyi Island (Don Pale, Lin Long and Palawar Villages) and Langann Island (Langann village) (also Tanintharyi Region) and Ranong (Thailand) Figure 1. At each of these sites fishers and traders were consulted in semi-structured interviews. Questions covered: knowledge of the shark ban and shark reserves, species caught, value, uses and markets, effect of the ban on fishers and traders, fishing gears and areas. Over 50 individual fishers and traders were interviewed.

Given the current nation-wide ban, it was harder to get responses from fishers and traders at markets where large sharks were being sold, with some providing minimal input and two traders declining to be interviewed. However, most interviewees were forthcoming and their responses provide us with an understanding of the current shark and ray fishery in Myanmar. Secondary data was also collected from catch statistics from the DoF (although only for rays) and a review of former market surveys conducted on the shark and ray fishery and current scientific surveys of marine resources in Myanmar.

LEGISLATION

Within Myanmar two pieces of legislation have been enacted which specifically target the conservation/management of shark species:

1. *Notification 2/2001*: this law prohibits the capture and sale of Whale shark (*Rhincodon typus*);

2. *Notification 2/2004*: this laws outlines the creation of two shark reserves (see Figure 2) within the Myeik Archipelago in which targeting of sharks is prohibited (not including rays).

Figure 1 Sites surveyed during current assessment.

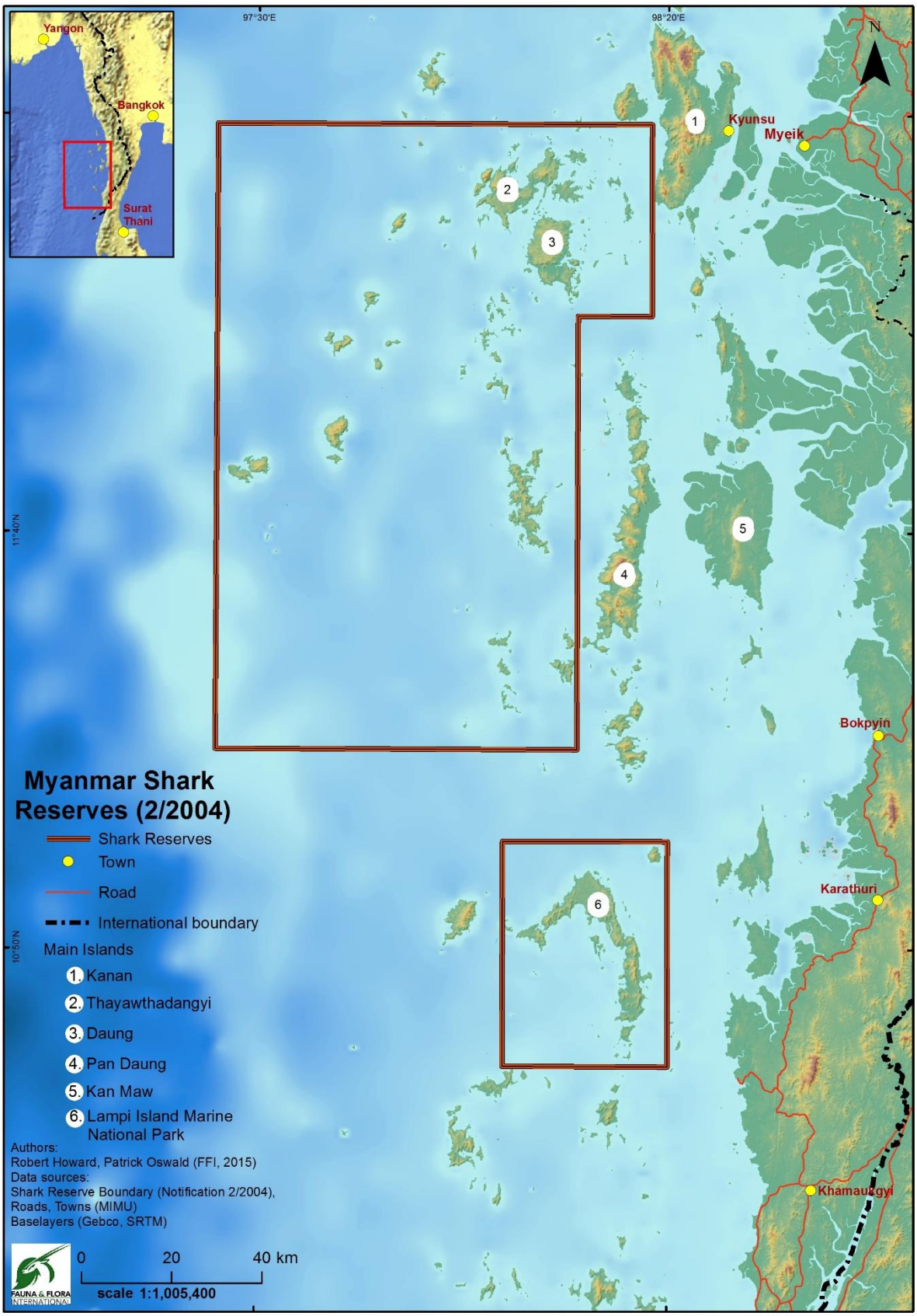

Figure 2 Myanmar Shark Reserve boundaries (red boxes). Notification 2/2004.

The two shark reserves were created in 2004 by the DoF and comprise almost 25% of the archipelago's total area; however no effective conservation plan has been developed for these sites meaning the reserves lack physical demarcation, active law enforcement, catch monitoring or awareness raising programmes. At landing sites visited during this assessment less than 10% of respondents were aware of the reserves and this was usually only for the block surrounding Lampi Island.

There is also a reported nationwide ban on shark fishing which began in 2008. This appears to have been a declaration by DoF calling an end to shark fishing, however no legal document exists to back this up. Its creation does, however, have the potential to nullify the purpose of the shark reserves given that the ban covers all of Myanmar's waters. Those shark fishers (5) interviewed in Rakhine had all switched to a different fishery since DoF enforced the shark ban. However, incidental catches (or those reported as such) of sharks in nets or on long-lines and subsequent selling of this catch in the market does not appear illegal or seems to be tolerated by authorities. No legislation exists for the capture or selling of rays including those of the Mobulidae family. Myanmar is however a signatory to the CITES convention and a number of shark and ray species are listed as CITES Appendix I or Appendix II (see Table 1).

SPECIES

The number of shark and ray species within Myanmar varies depending on which lists are used. Ahmad and Lim (2012) in their Field Guide to Sharks of the Southeast Asian Region lists 34 shark and 44 ray species for Myanmar, however following recent trips to landing sites by the authors as well as a review of literature on shark studies suggest there may be as many as 58 shark and 71 ray species (Table 1). The high diversity of sharks was recorded from the Order Carcharhiniformes with 43 species followed by Order Orectolobiformes and Squaliformes with 6 species respectively. However, low diversity was recorded for the Orders Lamniformes, Hexanchiformes and Squatiniformes where only one species were recorded from each order. As for batoids, high diversity was recorded for the Order Myliobatiformes with 46 species followed by Rhinobatiformes (11 species) and Torpediniformes (9 species). Only 3 species were recorded from Order Pristiformes and 2 species for Order Rajiformes. With new species continuously discovered, the number is expected to increase in the future as a greater understanding of Myanmar's marine biodiversity evolves. At present the deep water species are mostly unknown due to limited research activity.

The number of species which are actually targeted or caught as by-catch and traded, following review of landing site reports and the current surveys, is 24 for shark and 14 for ray (Table 2). Of these the most commonly caught shark species, observed from surveys in 2006-2010 in Yangon (San San Khine, 2010), were spadenose shark, *Scoliodon laticaudus*, with 64% of the catch followed by scalloped hammerhead shark, *Sphyrna lewini* and grey bamboo shark, *Chiloscyllium griseum*. For rays the most commonly caught species was the dwarf whipray, *Himantura walga*, with 95% of the catch followed by whitenose whipray *Himantura uarnacoides.* During the recent surveys the most common species noted of shark were spot-tail shark, *Carcharhinus sorrah,* spadenose shark, *Scoliodon laticaudus,* Indonesian bambooshark*, Chiloscyllium* cf *hasselti,* and brownbanded bambooshark, *Chiloscyllium punctatum*. For rays, markets mostly included bluespotted stingray, *Neotrygon kuhlii,* scaly whipray, *Himantura imbricata, and* whitespotted whipray *Himantura gerrardi*. For the Mobula rays, although not in large numbers two species were observed caught including Japanese devilray, *Mobula japonica* and bentfin devilray *M. thurstoni*.

Table 1 Species of sharks and rays recorded in Myanmar (see below table for source data). IUCN status from **www.**iucnredlist**.org/** (accessed 11/04/15) (NA: Not Assessed, LC: Least Concern, DD: Data Deficient, NT: Near Threatened, Vu: Vulnerable, En: Endangered, CE: Critically Endangered). CITES status from www.checklist.cites.org (accessed 11/04/15) (App. I: CITES Appendix I; App. II: CITES Appendix II). (Note: some names may have changed from the original lists to be in keeping with the latest nomenclature).

#	Order/Family/Scientific name	Common name (English)	IUCN red list/CITES	1	2	3	4	5	6
ORDER: HEXANCHIFORMES (1)									
	Family Hexanchidae (1)	**Sixgill and sevengill sharks**							
1	*Heptranchias perlo (*Bonnaterre, 1788)	Sharpnose sevengill shark	NT						*
ORDER: SQUALIFORMES (6)		**DOGFISHES**							
	Family Echinorhinidae (1)	**Bramble sharks**							
2	*Echinorhinus brucus* Bonnaterre, 1788	Bramble shark	DD	*					
	Family Squalidae (2)	**Dogfish sharks**							
3	*Squalus megalops* (Macleay, 1881)	Piked spurdog	DD	*					*
4	*Squalus* sp.	Dogfish shark			*			*	
	Family Centrophoridae (3)	**Gulper sharks**							
5	*Centrophorus granulosus* (Bloch & Schneider, 1801)	Gulper shark	VU						*
6	*Centrophorus moluccensis* Bleeker, 1860	Smallfin gulper shark	DD					*	
7	*Centrophorus* sp.	Gulper shark							*
ORDER: SQUATINIFORMES (1)		**ANGEL SHARKS**							
	Family Squatinidae (1)	**Angel sharks**							
8	*Squatina* sp.	Angel shark						*	
ORDER: ORECTOLOBIFORMES (6)		**CARPET SHARKS**							
	Family Hemiscyllidae (4)	**Longtailed carpet sharks**							
9	*Chiloscyllium griseum* Müller and Henle, 1838	Grey bambooshark	NT	*	*				
10	*Chiloscyllium hasselti* Bleeker, 1852	Indonesian bambooshark	NA	*					
11	*Chiloscyllium punctatum* Müller and Henle, 1838	Brown-banded bambooshark	NT	*	*				

12	*Hemiscyllium* sp.	Carpetshark							*
	Family Stegostomatidae (1)	**Zebra shark**							
13	*Stegostoma fasciatum* (Hermann, 1783)	Zebra shark	VU	*	*				
	Family Rhincodontidae (1)	**Whale shark**							
14	*Rhincodon typus* Smith, 1828	Whale shark	VU App. II	*	*				
ORDER: LAMNIFORMES (1)		**MACKEREL SHARKS**							
	Family Alopidae (1)	**Thresher sharks**							
15	*Alopias superciliosus* (Lowe, 1839)	Bigeye thresher	VU						*
ORDER CARCHARHINIFORMES		**GROUND SHARKS**							
	Family Scyliorhinidae (6)	**Catsharks**							
16	*Apristurus* sp.	Catshark							*
17	*Atelomycterus marmoratus* (Bennett, 1830)	Coral catshark	NT	*					
18	*Bythaelurus* sp.	Catshark							*
19	*Bythaelurus canescens* (Günther, 1878) (potentially misidentified)	Dusky catshark	DD						*
20	*Bythaelurus lutarius* (Springer & D'Aubrey, 1972)	Mud catshark	DD						*
21	*Haploblepharus edwardsii* (Schinz, 1822)	Puffadder shyshark	NT					*	
	Family Proscylliidae (3)	**Finback catsharks**							
22	*Eridacnis radcliffei* Smith, 1913	Pygmy ribbontail catshark	LC						*
23	*Proscyllium habereri* Hilgendorf, 1904	Graceful catshark	DD						*
24	*Proscyllium magnificum* Last & Vongpanich, 2004	Finback catshark		*					*
	Family Triakidae (4)	**Hound sharks**							
25	*Iago omanensis* (Norman, 1939)	Bigeye houndshark	LC						*
26	*Mustelus mosis* Hemprich & Ehrenberg, 1899	Arabian smooth-hound	DD			*			
27	*Triakis megalopterus* (Smith, 1839)	Sharptooth houndshark	NT					*	
	Family Hemigaleidae (3)	**Weasel sharks**							
28	*Chaenogaleus macrostoma* (Bleeker, 1852)	Hooktooth shark	VU	*	*				
29	*Hemigaleus microstoma* Bleeker, 1852	Sicklefin weasel shark	VU	*	*				*
30	*Hemipristis elongatus* (Klunzinger, 1871)	Fossil shark		*	*				*
	Family Carcharhinidae (24)	**Requiem sharks**			*				
31	*Carcharhinus albimarginatus* (Rüppell, 1837)	Silvertip shark	NT	*	*				
32	*Carcharhinus amblyrhynchos* (Bleeker, 1856)	Gray reef shark	NT		*				
33	*Carcharhinus amboinensis* (Muller & Henle, 1839)	Pigeye shark	DD	*	*				
34	*Carcharhinus amblyrhynchoides* (Whitley, 1934)	Graceful shark	NT	*	*				
35	*Carcharhinus brevipinna* (Müller and Henle, 1839)	Spinner shark	NT	*	*				
36	*Carcharhinus dussumieri* (Müller and Henle, 1839)	Whitecheek shark	NT	*	*				
37	*Carcharhinus falciformis* (Müller and Henle, 1839)	Silky shark	NT	*	*			*	
38	*Carcharhinus leucas* (Müller and Henle, 1839)	Bull shark	NT	*	*				
39	*Carcharhinus limbatus* (Müller and	Common blacktip shark	NT	*	*				

	Henle, 1839)								
40	*Carcharhinus melanopterus* (Quoy & Gaimard, 1824)	Blacktip reef shark	VU	*	*			*	
41	*Carcharhinus plumbeus* (Nardo, 1827)	Sandbar shark	VU	*	*				
42	*Carcharhinus sealei* (Pietschmann, 1916)	Blackspot shark	NT	*					
43	*Carcharhinus sorrah* (Müller and Henle, 1839)	Spottail shark	NT		*				
44	*Carcharhinus* sp.							*	
45	*Galeocerdo cuvier* (Peron & Lesueur, 1822)	Tiger shark	NT	*	*				
46	*Glyphis gangeticus* (Müller & Henle, 1839)	Ganges shark	CE		*				
47	*Glyphis siamensis* (Steindachner, 1896)	Irrawaddy River shark	CE	*					
48	*Loxodon macrorhinus* Müller and Henle, 1839	Sliteye shark	LC	*	*				*
49	*Rhizoprionodon acutus* (Rüppell, 1837)	Milk shark	LC	*	*				
50	*Rhizoprionodon oligolinx* Springer, 1964	Gray sharpnose shark	LC	*	*				
51	*Scoliodon laticaudus* Müller & Henle, 1838	Spadenose shark	NT		*	*		*	
52	*Scoliodon* sp.	Spadenose shark						*	
53	*Triaenodon obesus* (Rüppell, 1837)	Whitetip reef shark	NT	*	*				
54	**Family Sphyrnidae (4)**	**Hammerhead sharks**							
55	*Eusphyra blochii* (Cuvier, 1817)	Winghead shark	NT					*	
	Sphyrna lewini (Griffith & Smith, 1834)	Scalloped hammerhead	EN App. II	*	*				
56	*Sphyrna mokarran* (Rüppell, 1837)	Great hammerhead	EN App. II	*	*				
57	*Sphyrna* sp.	Hammerhead shark						*	
58	*Spyrna zygaena* (Linnaeus, 1758)	Smooth hammerhead	VU App. II					*	
	TOTAL SPECIES = 58								
	TOTAL FAMILIES = 15								

No.	Order/Family/Scientific name	Common name (English)	IUCN Red list/CITES	1	2	3	4	5	6
ORDER: PRISTIFORMES (3)		**SAWFISHES**							
	Family: Pristidae (3)	**Sawfishes**							
1	*Anoxypristis cuspidata* (Latham, 1794)	Narrow sawfish	EN App. I	*					
2	*Pristis pectinata* Latham, 1794	Smalltooth or wide sawfish	CE App. I	*					
3	*Pristis pristis* (Linnaeus 1758)	Freshwater sawfish	CE App. I	*					
ORDER: RHINOBATIFORMES (11)		**GUITARFISHES**							
	Family: Rhinidae (1)	**Shark ray**							
4	*Rhina ancylostoma* Bloch & Schneider, 1801	Shark ray	VU	*				*	
	Family: Rhynchobatidae (2)	**Wedgefishes**							
5	*Rhynchobatus australiae* Whitley, 1939	Whitespotted wedgefish	VU	*					
6	*Rhynchobatus* sp.	Wedgefish			*				
	Family: Rhinobatidae (8)	**Shovelnose rays**							
7	*Glaucostegus granulatus* (Cuvier,	Granulated guitarfish	VU	*					

	1829)								
8	*Glaucostegus halavi* (Forsskal,1775)	Halavi guitarfish	DD	*					
9	*Glaucostegus typus* (Bennett, 1830)	Giant guitarfish	VU						*
10	*Rhinobatos formosensis* Norman, 1926	Taiwan guitarfish	VU						*
11	*Rhinobatos obtusus* (Müller and Henle, 1841)	Widenose guitarfish	VU	*					
12	*Rhinobatus* cf *puncifer*	Spotted guitarfish				*	*		
13	*Rhinobatos schlegelii* Müller and Henle, 1841	Brown guitarfish	DD				*		
14	*Rhinobatus* sp.								*
ORDER: TORPEDINIFORMES (9)		**ELECTRIC RAYS**							
	Family: Narcinidae (5)	**Numbfishes**							
15	*Narcine brunnea* Annandale, 1909	Brown numbfish	NA	*					
16	*Narcine lingula* Richardson, 1840	Rough numbfish	DD	*					
17	*Narcine prodorsalis* Bessednov, 1966	Tonkin numbfish	DD	*					*
18	*Narcine timlei* (Bloch & Schneider, 1801)	Blackspotted numbfish	DD	*					
19	*Narcine* sp.	Numbfish							*
	Family: Narkidae (2)	**Sleeper rays**							
20	*Narke dipterygia* (Bloch & Schneider, 1801)	Spottail sleeper ray	DD	*					
21	*Temera hardwickii* Gray, 1831	Finless sleeper ray	VU	*					
	Family: Torpedinidae (2)	**Torpedo ray**							
22	*Torpedo nobiliana* Bonaparte,1835	Atlantic torpedo							*
23	*Torpedo* sp.	Torpedo ray							*
ORDER: RAJIFORMES (2)		**SKATES**							
	Family: Rajidae (2)	**Skates**							
24	*Okamejei* cf *powelli* (Alcock, 1898)	Whiteblotched skate			*				
25	*Raja* sp.	Skates							*
ORDER: MYLIOBATIFORMES (46)		**STINGRAYS**							
	Family: Plesiobatidae (1)	**Giant stingarees**							
26	*Plesiobatis daviesi* (Wallace, 1967)	Giant stingaree	LC						*
	Family: Hexatrygonidae (1)	**Sixgill stingray**							
27	*Hexatrygon bickelii* Heemstra & Smith, 1980	Sixgill stingray	NA						*
	Family: Dasyatidae (25)	**Stingrays**							
28	*Dasyatis akajei* (Müller and Henle, 1841)	Red stingray	NT		*				
29	*Dasyatis bennettii* (Muller & Henle, 1841)	Bennett's stingray	DD	*					
30	*Dasyatis fluviorum* Ogilby, 1908	Estuary stingray	VU		*				
31	*Dasyatis microps* (Annandale, 1908)	Smalleye stingray	DD	*					
32	*Dasyatis sinensis* (Steindachner, 1892)	Chinese stingray	NA	*					
33	*Dasyatis zugei* (Müller and Henle, 1841)	Sharpnose stingray	NT	*	*				
34	*Dasyatis* sp.	Stingray						*	*
35	*Himantura bleekeri* (Blyth, 1860)	Bleeker's whipray	VU					*	
36	*Himantura fai* Jordan & Seale, 1906	Pink whipray	LC	*	*				
37	*Himantura gerrardi* (Gray, 1851)	Whitespotted whipray	VU	*	*				*
38	*Himantura imbricata* (Bloch & Schneider, 1801)	Scaly whipray	DD	*	*				

39	*Himantura jenkinsii* (Annandale, 1909)	Jenkin's whipray	LC	*	*				
40	*Himantura toshi* Whitley, 1939	Blackspotted whipray	LC	*	*				
41	*Himantura uarnacoides* (Bleeker, 1852)	Whitenose whip ray	VU	*	*	*			
42	*Himantura uarnak* (Forsskal, 1775)	Spotted whipray	VU	*	*	*		*	
43	*Himantura undulata* (Bleeker, 1852)	Honeycomb whipray	VU	*	*				
44	*Himantura walga* (Müller and Henle, 1841)	Dwarf whipray	NT	*	*	*			
45	*Himantura* sp.	Whipray			*				
46	*Neotrygon annotata* Last, 1987	Plain stingray	NT		*				
47	*Neotrygon kuhlii* (Müller & Henle, 1841)	Bluespotted stingray	DD						*
48	*Pastinachus atrus* (Macleay, 1883)	Eastern cowtail stingray	NA	*					
49	*Pastinachus solocirostris* Last, Manjaji and Yearsley, 2005	Roughnose stingray	EN			*			
50	*Taeniura lymma* (Forsskal, 1775)	Ribbontail stingray	NT	*					
51	*Taeniurops meyeni* Müller and Henle, 1841	Round ribbontail ray	VU	*			*		
52	*Urogymnus asperrimus* (Bloch & Schneider, 1801)	Porcupine ray	VU	*					
	Family: Gymnuridae (3)	**Butterfly rays**							
53	*Gymnura micrura* (Bloch & Schneider, 1801)	Smooth butterfly ray	DD	*				*	
54	*Gymnura poecilura* (Shaw, 1804)	Longtail butterfly ray	NT	*	*				
55	*Gymnura zonura* (Bleeker, 1852)	Zonetail butterfly ray	VU		*				
	Family: Myliobatidae (7)	**Eagle rays**							
56	*Aetobatus flagellum* (Bloch & Schneider, 1801)	Longhead eagle ray	EN	*					
57	*Aetobatus ocellatus* (Kuhl, 1823)	Whitespotted eagle ray	NA	*					
58	*Aetomylaeus maculatus* (Gray, 1834)	Mottled eagle ray	EN	*					
59	*Aetomylaeus milvus* (Müller and Henle, 1841)	Ocellate eagle ray	NA	*					
60	*Aetomylaeus nichofii* (Bloch & Schneider, 1801)	Banded eagle ray	VU	*	*			*	
61	*Aetomylaeus vespertilio* (Bleeker, 1852)	Ornate eagle ray	EN		*				
62	*Myliobatis* sp.	Kite ray						*	
	Family: Rhinopteridae (3)	**Cownose rays**							
63	*Rhinoptera adspersa* Müller and Henle, 1841	Rough cownose ray	NA	*					
64	*Rhinoptera javanica* Müller and Henle, 1841	Javanese cownose ray	VU	*	*				
65	*Rhinoptera neglecta* Ogilby, 1912	Australian cownose ray	DD						*
	Family: Mobulidae (6)	**Devil rays**							
66	*Manta birostris* (Walbaum, 1792)	Manta ray	VU App. II			*			
67	*Mobula eregoodootenkee* (Bleeker, 1859)	Longfin devil ray	NT	*	*				
68	*Mobula japanica* (Müller and Henle, 1841)	Spinetail devil ray	NT	*					
69	*Mobula kuhlii* (Müller and Henle, 1841)	Shortfin devil ray	DD	*					
70	*Mobula thurstoni* (Lloyd, 1908)	Smooth tail devil ray	NT	*					
71	*Mobula* sp.	Devil ray		*					

	TOTAL SPECIES = 71								
	TOTAL FAMILIES = 15								

1. Sharks: Ahmad and Lim (2012).
   Rays: Ahmad *et al.* (2014).
2. Maung Hla and Thein Thein Kyi (2012)
3. Current report 2014-15 (only new species to Ahmad and Lim (2012) and Ahmad *et al.* (2014) listed).
4. San San Khine (2010).
5. Strømme *et al.* (1979)
6. Krakstad *et al.* (2014).

Table 2. List of shark and ray species recorded at landing sites (see below table for source data).

#	Common Name	Species Name	Source (see below)		
			2004	2007-08	2014/15
Shark					
1	Silvertip shark	*Carcharhinus albimarginatus*	*		
2	Graceful shark	*Carcharhinus amblyrhynchoides*	*		*
3	Pigeye shark	*Carcharhinus amboinensis*	*		
4	Spinner shark	*Carcharhinus brevipinna*	*		
5	Whitecheek shark	*Carcharhinus dussumieri*	*		
6	Silky shark	*Carcharhinus falciformis*	*		
7	Bull shark	*Carcharhinus leucas*	*	*	
8	Black tip shark	*Carcharhinus limbatus*			*
9	Black tip reef shark	*Carcharhinus melanopterus*	*		*
10	Sandbar shark	*Carcharhinus plumbeus*	*		*
11	Spot-tail shark	*Carcharhinus sorrah*	*		*
12	Hooktooth shark	*Chaenogaleus macrostoma*	*		
13	Grey bamboo shark	*Chiloscyllium griseum*	*	*	*
14	Brownbanded bamboo shark	*Chiloscyllium punctatum*	*		*
15	Tiger Shark	*Galeocerdo cuvier*	*		*
16	Sliteye shark	*Loxodon macrorhinus*	*		*
17	Arabian smooth-hound	*Mustelus mosis*			*
18	Milk shark	*Rhizoprionodon acutus*	*		
19	Grey sharpnose shark	*Rhizoprionodon oligolinx*	*		
20	Spadenose shark	*Scoliodon laticaudus*	*	*	*
21	Scalloped hammerhead	*Sphyrna lewini*	*	*	*
22	Great hammerhead	*Sphyrna mokarran*	*		
23	Piked spurdog	*Squalus megalops*			*
24	Zebra shark	*Stegostoma fasciatum*	*		
Rays					
1	Longtail butterfly ray	*Gymnura poecilura*		*	
2	Whitespotted whipray	*Himantura gerrardi*		*	
3	Whitenose whipray	*Himantura uarnacoides*		*	*
4	Reticulate whipray	*Himantura uarnak*			*
5	Dwarf whipray	*Himantura walga*		*	*
6	Blue-spotted mask ray	*Neotrygon kuhlii*		*	

7	Whiteblotched skate	*Okamejei* cf *powelli*			*
8	Roughnose stingray	*Pastinachus solocirostris*			*
9	Shark ray	*Rhina ancylostoma*		*	
10	Sharpnose guitarfish	*Rhinobatos granulatus*		*	
11	Spotted guitarshark	*Rhinobatos* cf *puncifer*		*	*
12	Brown guitarshark	*Rhinobatos schlegelii*		*	
13	Blotched fantial ray	*Taeniura meyeni*		*	
14	Porcupine ray	*Urogymnus asperrimus*		*	

Surveys of shark landing sites:

1. Sittway, Hlaing Gyi, Myeik in 2004 (Maung Hla and Thein Thein Kyi, 2012).
2. Pazundaung (Yangon) 2006-2010 (San San Khine, 2010).
3. Hlain Gyi, Yangon, Dawei, Myeik, Kawthaung and Ranong 2014-15 (current assessment).

SHARK/RAY FISHERIES

Gear

Before the ban was introduced fishers report using pelagic longlines varying from 200-1000 hooks/line and up to 3km long to target 'big-sized sharks'. Eels and other 'large' fish were used as bait. Interestingly fishers interviewed in Ayeyarwady Region report that the peak season was from February to May. However fishers in Dawei and Myeik said that the rainy season (i.e. July-September) was the best time to catch sharks which concurs with Khaing Khaing Thein (2008) surveys of landing sites covering Sittway, Hlaing Gyi and Myeik in which the majority of landings were during the wet season. This difference may be a result of the different fishing grounds accessed (see section "Current local market/landing site observations and fisher interviews".)

Since the ban on shark fishing most fishers have switched to gillnetting with many targeting hilsa (*Tenualosa ilisha*), mullet and a range of other bony fish species plus crabs and lobsters. Longlines are still used for catching species such a mackerel but with smaller hook sizes and inshore fishing from small wooden boats run by 20-30hp engines. Fishers state that sharks are caught accidently with most being juveniles, although all sizes of rays are hooked. This is the same for other gears such as bottom trawlers, grouper traps, drift nets and gill nets, in which sharks are caught as by-catch. In Thayawthatangyi however, it is reported that one or two boats still target sharks while most shark fishing is conducted by fishers from Myeik. This is undertaken by longlining with hooks designed specifically for sharks. Each longline is approximately 500m long with around 800 hooks. For bait small sardines are used or the hooks are simply covered with coagulated palm oil. Elsewhere in the archipelago dynamite is used as an indirect form of targeting sharks by luring them to an area that has been recently bombed as they became attracted to the dead fish floating in the water. The sharks are then caught using hook and line. However this appears more to be of a "bonus" of dynamite fishing rather than the main motivation for its use.

Rays are caught in similar ways to sharks using drift or stationary nets, but also by fish and shrimp trawlers as by-catch. For the larger species of ray longlines are used. In Ayeyarwady Region fishers have started targeting manta and mobula rays near Coco Kyun Island using 18 inch mesh size gillnets. These fishers work for 90 days at the fishing ground and every 15 days a "mother boat" will collect their catch. In the Langann Island group within Myeik Archipelago a fishery targeting devil rays has been ongoing for approximately 8 years, although not by villagers on the island. These fishers use purse seine nets from 10-15m wooden boats.

Status and Catches of Shark and Rays

Due to the ban placed on shark fishing in 2008 catch data on this group of fish is no longer collected by DoF and historical catch data is difficult to access except for specific survey data or anecdotal information from fishers. Several scientific surveys conducted to either monitor the status of Myanmar's fisheries as a whole, monitor landing sites or assessments of the health of coral reef ecosystems together provide information on both past and current status shark populations (see below). For rays, however, the Department of Fisheries in Tanintharyi has records from 2010 to present on catches, although officers state that caution should be used in interpreting the data.

With respect to the IUCN Redlist status (as of 11/04/2015) for sharks in Myanmar two are listed as Critically Endangered (*Glyphis gangeticus* and *Glyphis siamensis*) and two as Endangered (*Sphyrna lewini* and *Sphyrna mokarran*). A further nine sharks are listed as Vulnerable and 20 Near Threatened (Table 1). Two species of rays are listed as Critically Endangered (*Pristis pectinate* and *Pristis pristis*, both sawfishes) and five species Endangered (*Aetobatus flagellum, Aetomylaeus maculatus, Aetomylaeus vespertilio, Anoxypristis cuspidate and Pastinachus solocirostris*); with 18 listed as Vulnerable and nine Near Threatened. With regards to CITES regulations one shark is listed in Appendix I (*Rhincodon typus)* and three in Appendix II (*Sphyrna lewini, Sphyrna mokarran and Sphyrna zygaena*). There are three ray species in Appendix I (*Anoxypristis cuspidate, Pristis pectinate* and *Pristis pristis)* and one in Appendix II (*Manta birostris*). The only species with a high threat status (EN or CE or Appendix I or II) that was observed in the markets in the current assessment was the scalloped hammerhead, *Sphyrna lewini,* of which several individuals of less than 20cm were observed in the Thabawwseik beach market in Dawei.

- Dr. Fridtjof Nansen

In 1978-1980 the research vessel Dr Fridtjof Nansen undertook surveys to find new fish resources for Myanmar (Strømme *et al.* 1979). This was repeated and expanded in 2013 with ecosystem based surveys including abundance of demersal and pelagic fish resources (Krakstad *et al.* 2014). From 1978-80 to 2013 the surveys found a 50% decrease in both shark and ray catches (Figure 3). However, in comparing the changes in biomass between the two surveys the authors note that caution must be taken given the differences in survey methods (i.e. aimed trawls verse random trawls) and the number of surveys conducted. They do state however that "there is a shift in standing stock biomass away from long lived and highly valuable species towards smaller fish with shorter life spans and of lower commercial value….reflect[s] a picture of a fishery that may suffer both from growth and recruitment overfishing".

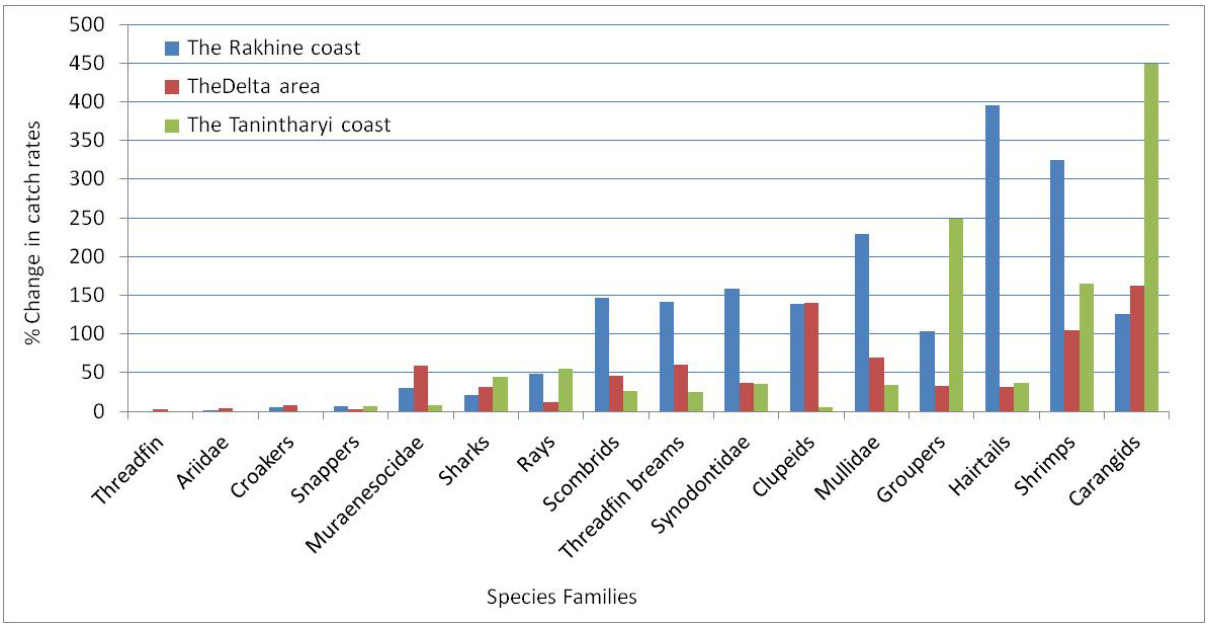

Figure 3 Percentage change in demersal catch rates, including sharks and rays, between the 1979 survey (aimed trawling) and the 2013 survey (random trawls). 1979 values = 100% (Source Krakstad *et al.* 2014).

- PhD Thesis: San San Khine

Between June 2006 to May 2010 San San Khine undertook a PhD study of elasmobranch landings at the Nyauna Dan Jetty in Yangon where fishing vessels from the Ayeyarwady landed their catch (San San Khine, 2010). Catch rates of four species of shark and 12 ray species were monitored over this period. For both shark and ray species a marked decrease in landings was observed over the survey period. Shark individual recordings declined by 49% (2007-08 annual catch 6462; 2008-09 annual catch 3289) and rays by 48% (2007-08 annual catch 38600; 2008-09 annual catch 20159). Of these catches the most abundant

shark species recorded was *Scoliodon laticaudus* which declined from 4070 in 2007-08 to 2261 in 2008-09. For rays the most dominant catch was *Himantura walga* which decreased from 36530 individuals in 2007-08 to 19600 in 2008-09.

- Coral Reef Assessments, Myeik Archipelago

Since 2013 Fauna & Flora International (FFI) have undertaken coral reef assessments of the Myeik Archipelago using Reef Check methodology. The study includes standardized transects replicated over a reef to record fish abundance and diversity and several other variables at an average depth of 6m. During 115 surveys (covering the period from January 2013 to May 2014) not a single shark or ray species was observed during the transects (Howard *et al.* 2014). In December 2014 FFI undertook further surveys of the archipelago and during 28 dives not one shark was seen (Howard (eds) 2015). For rays however the blue-spotted stingray (*Neotrygon kuhlii*) was observed at several sites but in very low numbers.

- Department of Fisheries Data

Department of Fisheries officers in each district collect catch data from select landing sites within their jurisdiction. The below information was provided by the Tanintharyi Regional fisheries office, which includes data for Dawei, Myeik and Kawthaung Districts. Separate district data was also provided for Myeik and Kawthaung. (Note: 1viss (Myanmar measurement) = 1.5kg).

Tanintharyi Region

Year	Inshore	Offshore	Catch (viss)	Catch (Kg)
2010-2011	4908	250	5158000	3,438,666
2011-2012	3944	600	4552000	3,034,667
2012-2013	4991	470	5461000	3,640,667
2013-2014	5753	381	6134000	4,089,333

Year/District	Catch (viss)	Catch (Kg)
Myeik		
2010-2011	1,512,000	1,008,000
2011-2012	1,101,000	734,000
2012-2013	899,000	599,333
2013-2014	1,825,000	1,216,667
2014-2015 Jan	2,933,000	1,955,333
Kawthaung		
2010-2011	214,000	142,666
2011-2012	1,183,000	788,666
2012-2013	1,476,000	984,000
2013-2014	1,284,000	856,000
2014-2015 Jan	1,258,000	838,666

As noted above the data should be interpreted with caution given the potential for over inflating figures or incorrect rounding. Given the decrease in ray catches observed by the other above studies these figures appear unrealistic but on recent observations at fish markets and landing sites large quantities of rays are being sold with 400 litre ice boxes full of rays seen at several markets (see photos at end of this report). It is possible that what is being observed is a case of hyperstability (where the index remains stable despite actual population declines) and catches are exceeding what the current populations of rays can support in the long-term. The slight increase in catches noted from the Fisheries Department data maybe a response of the shark ban in 2008 with fishers changing their target species.

- BOBLME/FFI SocMon surveys

In 2014, as part of the BOBLME project, FFI undertook socio-economic surveys of two island communities within Myeik Archipelago (Schnieder *et al.* 2014). One of the questions from this survey related to the perceived decline in catch trends for a range of marine resources as observed by local villagers. Over 50% of household heads reported a decline in shark and ray catch trends over the past 5 years with the majority of other interviewees either unsure preferring not to answer (no respondent reported an increase in catches) (Figure 4).

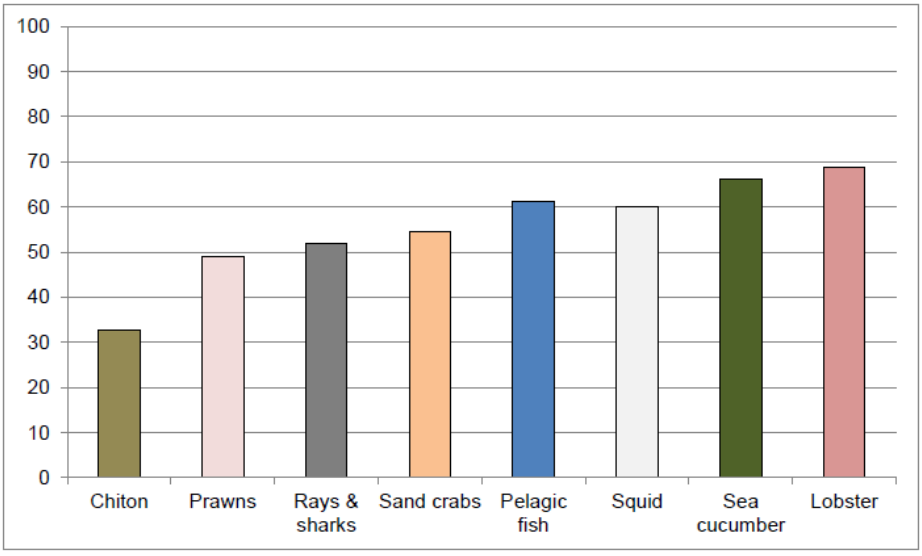

Figure 4 Percentage of household heads who report perceived decline in catch trends over the past 5 years (source: Schnieder *et al.* 2014)

- WCS Dive Tourism Surveys

As part of their Marine Conservation in Myanmar Report from 2013 WCS (Wildlife Conservation Society) undertook dive tourism surveys to gain an understanding of the status of the marine environment through diver perceptions (Holmes *et al.* 2013). Six dive guides

were interviewed, some who have been working since 2005 and all reported a decline in shark sightings during dives and with tourists recently returning from dives noticed the rarity of sharks in the area. This information was based on approximately 674 dives within the Myeik Archipelago.

- Current local market/landing site observations and fisher interviews
:

Surveys of local markets show that despite the ban sharks are still caught but most traders report them as by-catch. The majority of specimens observed in the market were either small species or juveniles. However, a number of large dried sharks were observed and fishers state that there are still several boats specifically targeting sharks with produce either going to secret markets or to Ranong. During interviews prices for sharks and rays and their products were also sought and these are provided in Table 3 in the section on socio-economics below along with information on value, markets and product uses.

In **Ayeyarwady** Region fishers report catching between 300-450kg daily before the shark ban producing up to 1500kg of salt-dried shark meat per trip. They believe that sharks are still abundant in the deep waters of Myanmar and around Coco Kyun and Preparis Islands (Figure 5), including tiger, thresher, hammerhead and bull sharks (fishers here did not comment on shark catches after the ban unless relating to small individuals caught as by-catch). For rays, as a response to export demands from East Asian markets, fishing for manta and mobula gill rakers has driven an offshore gillnet fishery near Coco Kyun Island. This business was started in June 2014 due to very high demand from China. These fishers work for 90 days at the fishing ground and every 15 days a mother boat will collect their catch which comprises of 5-10 manta rays/month or 60-120 tail/year. Fishers who target hilsa reported to catch about 40-55 mobula rays a year which are accidently caught in their nets. Some fishers in Hlaing Gyi said they incidentally caught big sharks such as tiger, thresher, mako and hammerhead sharks. The flesh was salted on the boat, brought back to the village and sun dried. During the current survey no fresh sharks or rays were found in the markets of Hlaing Gyi, and only two small-sized spot-tail shark (*Carcharhinus sorrah*) and more than 20 dwarf whipray (*Himantura walga*) were observed being dried.

At the Nyaung Tann Jetty in **Yangon**, which is used to unload catches of deep water trawlers for auction, sharks were rare and rays were seen in low numbers compared to other marine fish species being traded. Two species of sharks (*Scoliodon laticaudus* and *Mustelus mosis*) and five species of rays (*Himantura uarnacoides*, *Pastinachus solocirostris, Rhinobatus* cf *puncifer, Himantura uarnak* and *Himantura walga*) were recorded, all being

adults. The dominant species observed were Bleeker's whipray (*Himantura uarnacoides*) with more than 100 tails counted. Traders at the jetty noted that the peak season for shark and ray landings is from June to August with sharks reported to be bycatch only. All sharks were landed with whole fins attached.

In the **Dawei** local fish market (in Taninitharyi Region) only several individuals of rays (*Dasyatis* sp. and *Himantura* spp.) and shark (*Chiloscyllium punctatum* and *C. hasselltii*) were observed. The rays and sharks found were juveniles and constituted only a fraction of the fish found at the market. Traders reported that the largest landing site for marine fish is at Thabawwseik outside of Dawei Town on the beach. At Thabawwseik beach market/landing site 10 devil rays, *Mobula japonica*, were found with sizes ranging from 1-2.5m. Among the rays two species that were common at the market were *Himantura Jenkinsi* and *H.walga*. More than one species of whip ray, *Himantura* spp., were also present in large numbers. Several juvenile sharks were found including, C*hiloscyllium punctatum, C. hasseltii*, *Carcharhinus melanopterus, Carcharhinus* sp., a species from the genus *Loxodon* (probably *L. macrorhinus*) and *Sphyrna lewini.*

In the market of the nearby town of Maungmagan, over 100 small blue–spotted stingrays, *Neotrygon kuhlii* and 20 plus sharp nose stingray, *Dasyatis zugei* were observed. At this market only juveniles of sandbar shark, *Carcharhinus plumbeus* and three small scalloped hammerhead sharks, *Sphyrna lewini* were seen.

All catches at these markets were reported to the assessment team as by-catch, although the large number of rays seen would suggest that these are being targeted. One fish boat owner said that before the banning of shark fishing the income of the fishermen was higher with a shark earning a much higher price than any other fish of the same size due to the expensive shark fin. Everybody seemed to agree that catch was decreasing year after year and that the fish caught were getting smaller and smaller. The destructive fishing methods practiced by trawlers with very fine mesh was the reported cause.

Figure 5 Shark target areas, Preparis and Coco Kyun Islands, Ayeyarwady Region. (Note this is not an exhaustive list of areas, only those provided by fisherman and traders during this assessment).

In the markets of **Myeik** Town at the Linn Lunn buying centre large quantities of gutted and sliced ray, mostly *Neotrygon kuhlii* and *Himantura walga* were found. No fresh sharks were seen, only dried parts and judging from the size of the sliced meat the sharks were relatively large. The market owner said that all rays and sharks were accidently caught in the nets intended for other fish species. Also in Myeik in an area known as Dawei Kann quarter where rays and sharks were processed for dried meat several hundred dried rays and sharks were found on drying shelves and large numbers of adult sized Jenkin's ray, *Himantura jenkinsii* were being processed. Within Dawei Kann, over 20 large, unidentified sharks were being dried and separated into fins and skins. Two shark traders running this operation refused to meet the survey team. However other fishermen in the area noted that everybody seemed to be aware of the shark ban although large sharks caught were sent to secret landing sites at night and immediately gutted and cut into pieces for drying the next morning. The dried fin went to China while the dried meat was either sold locally or sent to Yangon. Local fisherman stated that police, usually in plain clothes infrequently monitor the market and inform the DoF of any illegal catches.

At a second market in the Tha-Kay-Ta quarter of Myeik fish from boats anchored in the harbour were transported to this buying centre by mini-tractor and trailer. One eagle ray *Aetobatus ocellatus* and one devil ray, *Mobula japonica* were found and reported as by-catch. Also observed were *Neotrygon kuhlii*, *Himantura uarnak*, *H. gerrardi*, *H. walga*, *H. uarnacoides* and *Urogymnus asperrimus*, although not in large numbers. Over 100 juvenile shark species, mostly *Chiloscyllium* cf *hasselti* and *Chiloscyllium punctatum* were seen. These however were not from one boat but collected from several fishing vessels. A buyer at the market said the rays and sharks were all caught with long line hooks. When asked what affect the ban had on business the traders at this market said they simply moved to dealing in other fish species. They noted that the ban was hardest on the fishers who had to learn new fishing techniques although those that used long-lines continued this with this method but use smaller hooks to targets species such as mackerel.

At a landing site in **Kawthaung** on the Thai border no rays or sharks were observed. Traders said rays and juvenile sharks were not normally seen in Kawthaung with most products being sent directly to Ranong in Thailand. At the Phan-pha-larr Jetty in **Ranong** large quantities of both shark and rays were found. Virtually all sharks found were juveniles including *Carcharhinus melanopterus, C. sorrah, Chiloscyllium hasseltii* and *C. punctatum* and at least a dozen tiger sharks, *Galeocerdo cuvier*. A diverse collection of rays were seen including *Rhinobatus* cf *punctifer* in large numbers as well as *Dasyatis ushiei*, *Himantura gerrardi*, *H. imbricata*, *H. jenckinsii, H. leoparda*; *H. uarnak*; *H. uarnacoides*, *H. undulata*; *H.*

walga, Neotrygon kuhlii and *Urogymnus asperrimus*. Workers at the market, mostly Burmese said that greater quantities of large shark and ray meat could be found at private company markets in which outsiders, particularly Burmese, were not allowed to visit.

In the villages visited on the islands of **Thayawtathangyi** (Don Pale, Lin Long and Palawar Villages) and **Langann** (Langann village) within the Myeik Archipelago none of the approximately 40 fishers that were talked to were aware of the shark reserves but were aware of the country wide ban. However, these fishers were using either stationary nets, drift nets or spearfishers targeting mullet, snapper, sand crab, parrotfish, sea cucumber or porcupine fish with none reported to target sharks. The fishers noted that those that shark fishers are not from the islands and are either longline fishers from Myeik or Kawthaung, with those from Kawthaung often working for a Thai owner. However there are long-line fishers throughout the islands but they are usually targeting species such as mackerel which require a much smaller hook then those required for sharks and only small sharks are hooked as bycatch. They noted that those who target sharks try to keep clear of villages and will hide their large hook long-line gear under nets etc. on their boats to avoid detection. Spearfishers from Lin Long village whose main fishing ground is Torres Island in the dry season said they occasionally see shark fishers out in this area but the numbers of boats have decreased and it had been 3 years since they had seen boats from Indonesia that used to come to the islands to fish for sharks. The fishers interviewed stated that although sharks get caught in their nets they were not an important catch for them and given the ban it was easier not to actively target them even though high prices could be sought for fins (see Table 3). As noted above, Langann villagers report an active ray fishery which targets devil rays which has been operating in the area for about eight years involving around five boats. During a separate visit to Langann in December 2014 the FFI team encountered a boat with thirty bentfin devilray *Mobula thurstoni*, a Near Threatened species (pers. comm. Soe Thiha, FFI).

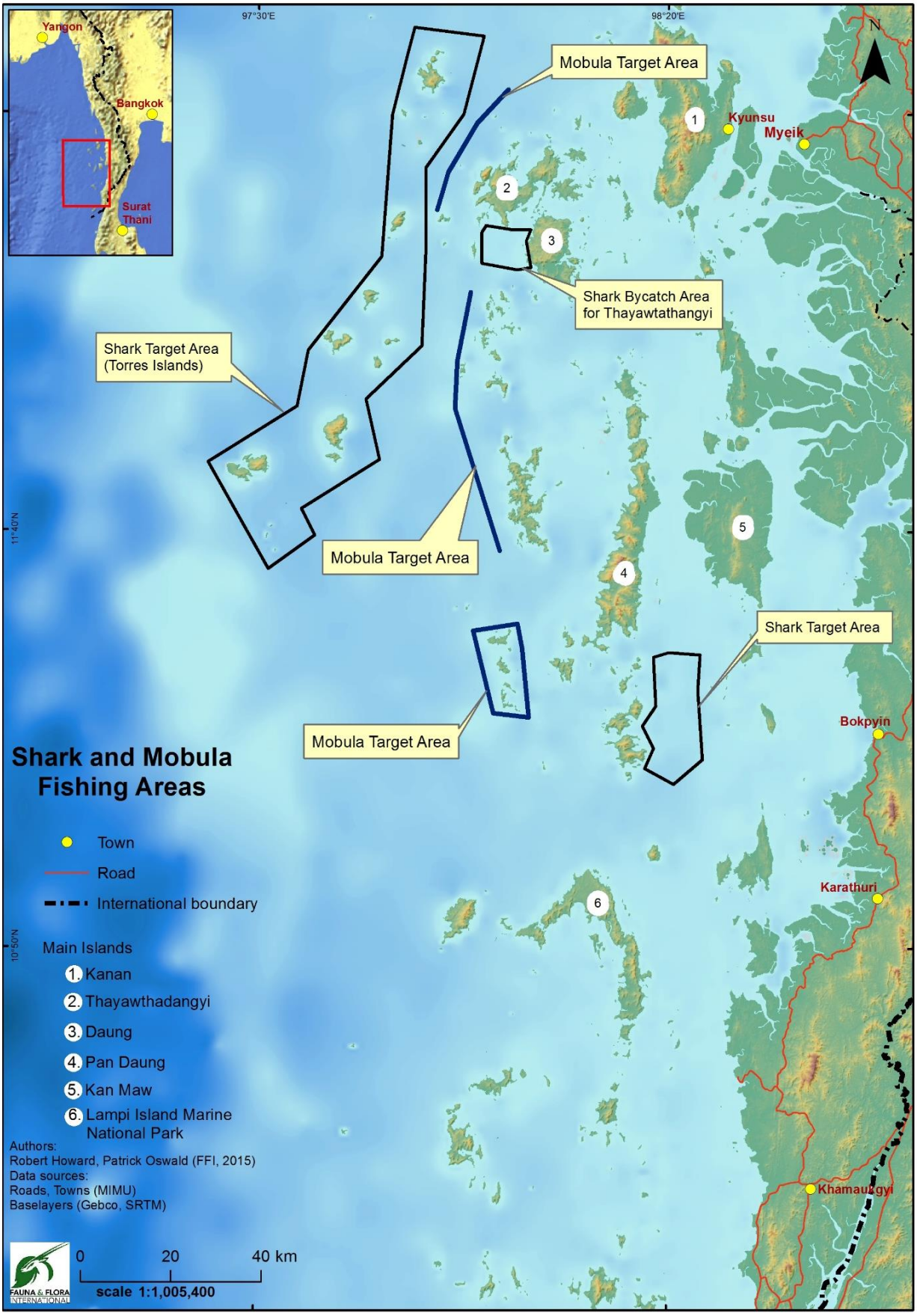

Figure 6 Shark and ray target or bycatch areas in Myeik Archipelago. (Note this is not an exhaustive list of areas, only those provided by fisherman and traders during this assessment).

Socio-economics

Table 3 details the prices of shark and ray products before and after the ban was imposed as provided by the fishers and traders interviewed above. Included in the table is a list of the current prices of other marine resources to be able to compare with the value of sharks. As can be seen fresh shark and ray meat is similar in price to other marine products. The price for dried shark fins is a fraction of what could be earned before the ban was in place (this is surprising given that often when a product becomes banned the price in the market increases), but at $35USD/kg there is still an incentive for fishers to actively target large sharks. No price was given for the Tanintharyi area or in Ranong Thailand for fins. Fisher groups in the Ayeyarwady Region stated that they could earn as much as $30,000USD/month targeting sharks and their monthly income dropped about 50% following the ban when they switched from pelagic longline targeting sharks to gill netting hilsa, shad and other bony fish. Manta ray and other mobula gill rakers are still highly sought after and the high price is gives fishers an incentive to target these rays.

Table 3 Price of shark and rays and their products. Data provided by fishers and traders in Ayeyarwady Region, Yangon, Dawei, Myeik, Ranong and the island villagers of Don Pale, Palawar, Lin Long and Langann in Myeik Archipelago.

Product	**Before Ban**	**Now**
Myanmar		
Dried shark fins	Small $66-100/kg; Large US$134-200/kg	US$35/kg (price from Ayeyarwady Region only)
Salt-dried shark meat	US$4-4.8/kg	Consumed locally, no price given
Dried shark skin	US$0.66/kg	-
Shark fresh meat	-	$2-3/1.5kg
Dried shark meat	-	$8-10/1.5kg
Ray fresh meat	-	$2-2.50/1.5kg
Dried ray meat	-	$7-8/1.5kg
Dried mobula rays gill rakers		$100-300/1.5kg
Fresh devil ray	-	$20-50 per individual
Dried manta gill rakers	US$66/kg-$135/kg	US$135/kg
Manta salted meat	US6.6/kg	-
Ranong (Thailand)		
Fresh shark meat	-	$0.30-$1.25/kg
Fresh ray meat	-	$0.30-$1.25/kg
Other Marine Resource Products in Myanmar		
Fresh Sand crab	-	$1-3/1.5kg (size dependant)
Fresh Mullet	-	$1-2.50/1.5kg (species dependant)
Fresh Shrimp	-	$2/1.5kg
Fresh Mackerel	-	$1.50-3/kg
Fresh Squid	-	$2/kg

From the markets and jetties noted above shark and ray products are sent to a number of destinations within Myanmar and for export to countries within the region. In Hlaing Gyi fishers said that small-sized sharks and rays were caught as by-catch and consumed by crews and their families, while those that caught larger sharks would process them out on the boats to avoid detection before offloading them at unknown markets. At the Yangon market traders said that dried ray skin were exported to Thailand and salt-dried meat to China. In Dawei traders state that the juvenile sharks and ray were usually for local markets in the region but dried meat was often sent to Yangon and to states further in the north of Myanmar. This was similar to shark and ray products in Myeik, however dried fins were all being sent to China through Thailand. Likewise in Ranong dried parts of shark including fins, skulls, skin and the meat were being exported to China while some destined for Singapore markets. The skin of some rays species such as *Himantura uarnacoides, H. gerrardi, H. uarnak, H. undulata* and *Pastinachus spp* were valued as quality leather. Shark's teeth and jaws are used for the curio trade. The fins of shark and gill rakers of manta and mobula rays were highly valued as gourmet food and Chinese medicine.

DISCUSSION

The assessments on status and catches show shark and ray populations are in decline and even with a ban in place for sharks there is still an active fishery within Myanmar and willing markets both in-country and abroad to incentivise this fishery. Some of the main threats contributing to this decline include:

1. Continued targeting of sharks by **longline fishers**. The number of fishers has apparently decreased since the ban, however shark populations are diminishing and as such any level of shark fishing which targets the mature adults will have serious consequences;
2. Large numbers of sharks being caught and sold as **by-catch** which is compounded by an **over capacity** of Myanmar's fishing fleet. According to Department of Fisheries there are 968 offshore and 2389 inshore fishing vessels in Tanintharyi alone for 2014/15 (Myint Shwe, 2014). With minimal regulation of gear types such as mesh size and fishing areas, shark and rays will continue to be caught in high numbers as by-catch even without those specifically targeting sharks.
3. Catches dominated by **juveniles** with some observed at markets only 1-2 weeks old. This severe case of recruitment overfishing will limit population's ability to recover.

4. There is very **little enforcement** of the current rules prohibiting shark fishing. DoF has no vessels to patrol and market places and landing sites appears to be able to freely trade shark products.
5. The use of **dynamite** to lure sharks into an area around coral reefs is not only threatening the shark populations but also degrading the habitat in which some shark species rely on as both nursery and feeding grounds.
6. **Export demand** from East Asian markets for gill rakers has driven an offshore gillnet fishery for manta and mobula rays in Ayeyarwady Region.

To address these threats Myanmar is redrafting its National Plan of Action (NPOA) on sharks and using this current assessment to guide the NPOA and develop a set of recommendations and required actions to combat the decline in both shark and ray populations. One such recommendation will be the strengthening of the laws surrounding shark fishing and trading.

From a socio-economic perspective it appears that those specifically targeting sharks before 2008 were heavily hit by the ban, with some quoting an initial loss of 50% of their income when forced target other species of fish. Not only did losses come from moving to a less lucrative target species but fishers had to learn new skills such as the use of different gears and understanding the movements and habitats of their new target species. Traders on the other hand, although initially suffering losses, had only to seek new markets and as such the ban caused a less of an impact on their income. The current number of fishers targeting sharks appears small, i.e. less than 10 boats in Myeik Archipelago according to other fishers, with most preferring to catch less controversial species, although many do admit to catching sharks as by-catch. If the current ban on shark fishing was heavily regulated with even by-catch made illegal it is difficult to know how much of an economic impact this would have on individual fishers as they say sharks make up a fraction of their catch. The largest bearing would be for those illegally targeting and trading large sharks. For ray the economic benefits for fishers and traders in Myanmar appear to be very high with over 4000 tonnes caught alone in Tanintharyi in 2013-14 (according to DoF statistics). Any restrictions on such catches could see many fishers negatively impacted, however given the high catch rate yet declining populations, fishers will be economically affected either way. Similarly for sharks, with or without the ban, people's incomes would be negatively impacted when these catches become economically due to rapid decline in populations and sizes. When such bans are put it place, support mechanisms to those fishers who would be most affected are recommended such as provision of different equipment to allow a smoother transition into new fisheries sectors.

On a positive note, this assessment did find elasmobranch biodiversity in Myanmar to be amongst the richest in the Southeast Asia Region, with four species confirmed as new records for Myanmar. These included one shark species (Mustelus mosis) and three batoids/rays (*Rhinobatos cf puncifer, Okamejei cf powelli* and *Pastinachus solosirostris*). However, information on the status of shark and ray resources is still inadequate for the purpose of stock assessment and effective conservation management. Present statistical data collection does not record landing by species and therefore does not indicate the status of the resources either by abundance or vulnerability. Projects to collect landing data at the species level should be initiated at several selected major landing sites. For detailed taxonomy and training there is a need to develop a strategy for building a biodiversity baseline through a core national collection of sharks and rays species from freshwater to deepwater. DoF Myanmar and universities can directly contribute to better understanding in taxonomy and management of sharks and rays resources by involving their staff and post graduate students in the training and workshops at national and regional level.

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ANNEX 1. PHOTOGRAPHS

Haing Gyi, Coastal demersal longline

Haing Gyi Dried shark fins (tiger shark, bull sharks etc)

Nyaing Tann Jetty, Yangon (*Himantura uarnacoides*)

Nyaing Tann Jetty, Yangon (*Scoliodon laticaudus*)

Maungmakan Market, Dawei (*Neotrygon kuhlii*)

Thabawwseik, Dawei (*Mobula* sp.)

Thabawwseik, Dawei (various shark species)

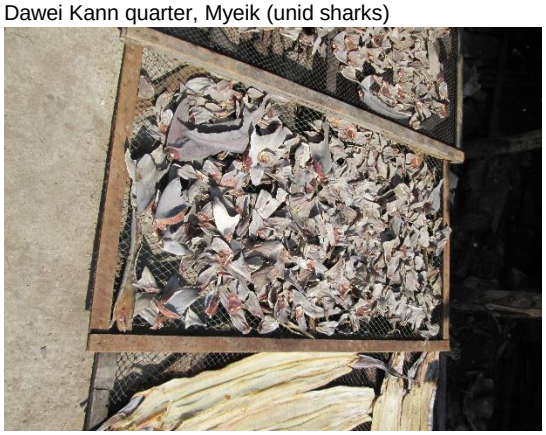
Thabawwseik, Dawei (*Himantura walga* and *H. imbricata*)

Myeik market (*Himantura imbricata and Neotrygon kuhlii*)

Dawei Kann quarter, Myeik (*Himantura* cf *gerarrdi*)

Dawei Kann quarter, Myeik (unid sharks)

Dawei Kann quarter, Myeik (unid sharks skins)



Dawei Kann quarter, Myeik (*Carcharhinus sorrah* is one of the species)

Dawei Kann quarter, Myeik (most likely *Carcharhinus* spp.)

Dawei Kann quarter, Myeik (most likely *Carcharhinus* spp.)

Dawei Kann quarter, Myeik (*Scoliodon laticaudus* approx.. 20cm in length)

Tha-Kay-Ta quarter, Myeik (*Chiloscyllium* cf *hasselti* and *Chiloscyllium punctatum*)

Myeik (unid shark and rays drying)

Myeik (unid shark and rays drying)

Ranong (*Carcharhinus melanopterus* and *Chiloscyllium punctatum*)

Ranong (various ray species)

Ranong (*Rhinobatus* cf *punctifer*)

Ranong (*Galeocerdo cuvier*)

Ranong (*Rhina encylostoma*)