TRAINING MANUAL

Shark Identification and Sampling Methodology

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Contents:

Background and Objectives

PERSGA/SAP has the mandate to help regional efforts for biodiversity conservation; within this context it is necessary to increase capacity building among local fisheries staff in the correct identification of elasmobranch fishes and the proper sampling methods for this group of fishes. This will enable fisheries workers to improve the data reporting and information gathering that are essential for stock assessment and management of the resource.

The main objectives of this training manual are to assure that enumerators will be capable of correctly identify the different species of sharks and rays that occur in the fishery and record the fisheries and biological information needed for stock assessment and management. In particular, there is a need for the catch data to be reported by principal species and species groups.

Why should fisheries staff know how to identify sharks and record fisheries information?

Mainly because we want to do Fisheries Management and Conservation. Different species have different population dynamics and respond differently to exploitation. The countries of the region also need to comply with FAO's Code of Conduct for Responsible Fisheries and with the International Plan of Action for Conservation and Management of Sharks (IPOA-Sharks). Both of this initiatives call for shark and ray fisheries to record catch and effort information and to perform stock assessment on a species by species basis.

Sharks and Batoids are a group of fishes that are very fragile and sensitive to fisheries exploitation. Historical data show that sharks and rays have been easily overexploited in many parts of the world (Stevens et al. 2000). Many species grow very slowly and take many years to reproduce (Table 1). Sharks and rays have very few young every time they reproduce (between 1 and 80, mostly 12) compared to other marine organisms that release millions of eggs into the water and could potentially produce large recruitments. Also, many shark and ray species take several years to attain their first sexual maturity. For these reasons populations take many years to grow back to their original numbers once exploitation has brought down their abundances.

Table 1. Rebound potential (r_{2M}) of Pacific sharks as a function of life history parameters (modified from Smith et al. 1998)

		Species	Female A_{mat}	Longevity	Fecundity	M	r_{2M}
High	1	Gray smoothhound	2	12	3.2	0.368	0.136
	2	Brown smoothhound	2	15	3.8	0.295	0.127
	3	Bonnethead	3	12	9.0	0.368	0.105
	4	Sharpnose	4	10	5.0	0.440	0.084
Medium	5	Common thresher	5	19	4.0	0.234	0.069
	6	Oceanic whitetip	5	22	6.0	0.203	0.067
	7	Blue	6	20	23.2	0.223	0.061
	8	Blacktip	7	18	5.2	0.247	0.054
	9	Gray reef	7	18	5.0	0.247	0.054
	10	Sand tiger	6	35	2.0	0.129	0.052
	11	Mako	7	28	8.0	0.160	0.051
	12	Whitetip reef	8	16	2.2	0.277	0.048
	13	Galapagos	8	24	8.0	0.186	0.048
	14	Silky	9	25	5.2	0.179	0.043
	15	Tiger	9	28	34.4	0.160	0.043
	16	Great white	9	36	7.0	0.125	0.040
Low	17	Pacific angel	10	35	6.0	0.129	0.038
	18	Lemon	12	25	8.2	0.179	0.034
	19	Spiny dogfish (NWA)	10	50	6.0	0.091	0.034
	20	Soupfin (School)	12	40	28.0	0.113	0.033
	21	Leopard	13	30	12.0	0.150	0.032
	22	Sandbar	15	30	7.8	0.150	0.028
	23	Scalloped H-H	15	35	21.6	0.129	0.028
	24	Bull	15	27	3.6	0.166	0.027
	25	Sevengill	16	32	88.2	0.140	0.026
	26	Dusky	21	40	6.4	0.113	0.020
	27	Spiny dogfish (BC)	25	70	7.2	0.065	0.017

Shark and batoid diversity

There are at least 460 different species of sharks recognized by science. The batoids (skates, rays, mantas and guitar fishes) are also part of the shark group. They are basically a group of “flat sharks” and amount to almost 600 species. Thus, the total of shark-like fishes is about 1100 species and keeps growing as new species keep being discovered. In the RSGA region there are at least 37 different kinds of sharks and about 30 different batoids. This species are listed in Table 2.

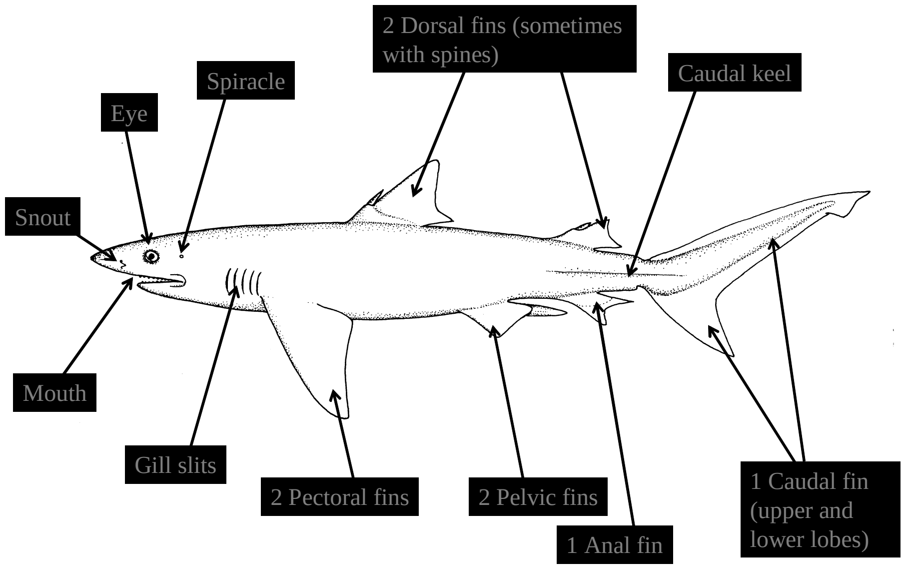
Table 2. LIST OF FAMILIES AND SPECIES OCCURRING IN THE RED SEA AND GULF OF ADEN

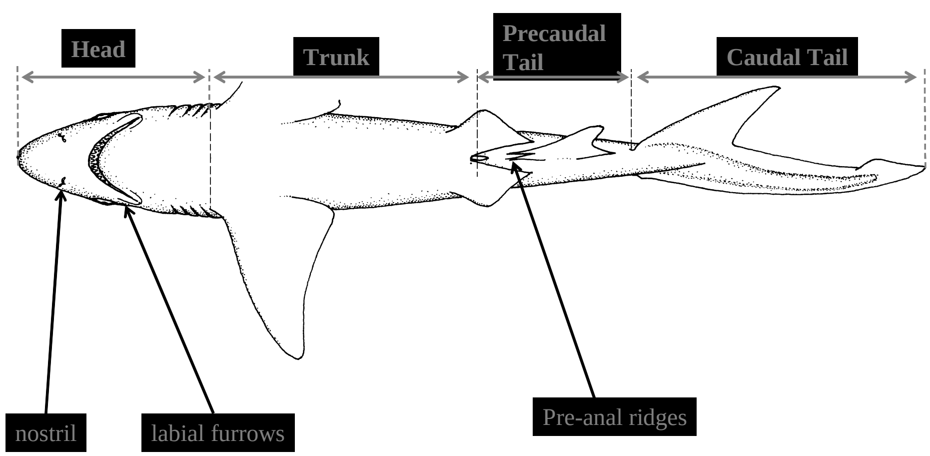
An asterix is given when species accounts are given. A question mark indicates that presence in the area needs confirmation.

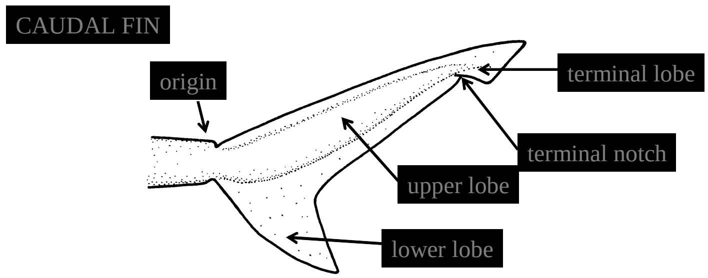
Sharks		**Batoids**	
Order Squaliformes		Order Pristiformes	
		Family Pristidae	
Family Echinorhinidae		*	*Anoxypristis cuspidata*
*	*Echinorhinus brucus*	*	*Pristis pectinata*
Family Centrophoridae		*	*Pristis zijsron*
*	*Centrophorus atromarginatus*	Order Torpediniformes	
*	*Centrophorus granulosus*	Family Torpedinidae	
*	*Centrophorus tessellatus*	*	*Torpedo panthera*
*	*Deania profundorum*	*	*Torpedo sinuspersici*
? Order Squatiniformes		Family Narkidae	
? Family Squatinidae			*Heteronarce bentuviai*
?	*Squatina africana*	Order Rhinobatiformes	
?	*Squatina squatina*	Family Rhinobatidae	
Order Heterodontiformes		?	*Rhinobatos cemiculus*
Family Heterodontidae		?*	*Rhinobatos granulatus*
*	*Heterodontus ramalheira*	*	*Rhinobatos halavi*
*	*Heterodontus sp A*	?	*Rhinobatos obtusus*
Order Lamniformes		*	*Rhinobatos punctifer*
Family Odontaspididae		?*	*Rhinobatos salalah*
*	*Carcharias taurus*	?*	*Rhinobatos schlegelii*
Family Alopiidae		?*	*Rhinobatos thouin*
*	*Alopias pelagicus*	Family Rhynchobatidae	
*	*Alopias superciliosus*	*	*Rhina ancylostoma*
*	*Alopias vulpinus*	?	*Rhynchobatus australiae?*
Family Lamnidae		*	*Rhynchobatus djiddensis*
?	*Carcharodon carcharias*	Order Myliobatiformes	
*	*Isurus oxyrinchus*	Family Dasyatidae	
Order Orectolobiformes		*	*Dasyatis kuhlii*
Family Stegostomatidae		?	*Dasyatis pastinaca*
*	*Stegostoma fasciatum*	*	*Himantura fai*
Family Ginglymostomatidae		*	*Himantura gerrardi*
*	*Nebrius ferrugineus*	*	*Himantura imbricata*
Family Rhincodontidae		*	*Himantura uarnak*
*	*Rhincodon typus*	*	*Pastinachus sephen*
Order Carcharhiniformes		?	*Taeniura grabata*
Family Scyliorhinidae		*	*Taeniura lymma*
*	*Halaelurus boesemani*	*	*Taeniura meyeni*
*	*Apristurus indicus*	*	*Urogymnus asperrimus*
Family Proscyllidae		Family Gymnuridae	
*	*Eridacnis radcliffei*		*Aetoplatea tentaculata*
Family Triakidae		*	*Gymnura poecilura*
*	*Iago omanensis*	Family Myliobatidae	
*	*Mustelus mosis*	*	*Aetobatus flagellum*
Family Hemigaleidae		*	*Aetobatus narinari*
*	*Hemigaleus microstoma*	?	*Aetobatus ocellatus*
*	*Hemipristis elongatus*	*	*Aetomylaeus milvus*
Family Carcharhinidae		*	*Aetomylaeus vespertilio*
*	*Carcharhinus albimarginatus*	Family Rhinopteridae	
*	*Carcharhinus altimus*	*	*Rhinoptera javanica*
*	*Carcharhinus amblyrhynchoides*	?	*Rhinoptera jayakari?*
*	*Carcharhinus amblyrhynchos*	Family Mobulidae	
*	*Carcharhinus amboinensis*	*	*Manta birostris*
*	*Carcharhinus brevipinna*	*	*Mobula eregoodootenkee*
*	*Carcharhinus dussumieri*	*	*Mobula japanica*
*	*Carcharhinus falciformis*	?	*Mobula kuhlii*
*	*Carcharhinus leucas*	*	*Mobula tarapacana*
*	*Carcharhinus limbatus*		
*	*Carcharhinus longimanus*		
?	*Carcharhinus macloti*		

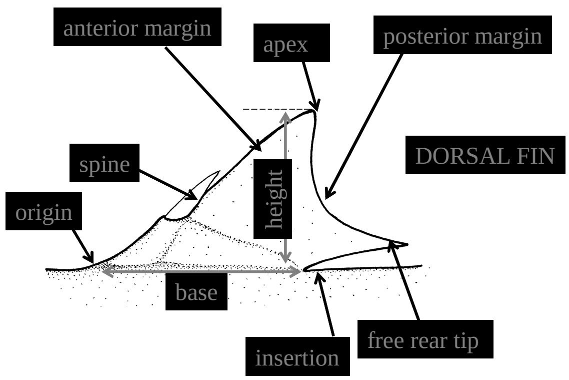
Basic terminology of sharks

The basic terminology of shark anatomy used for identification is shown in the following diagrams:



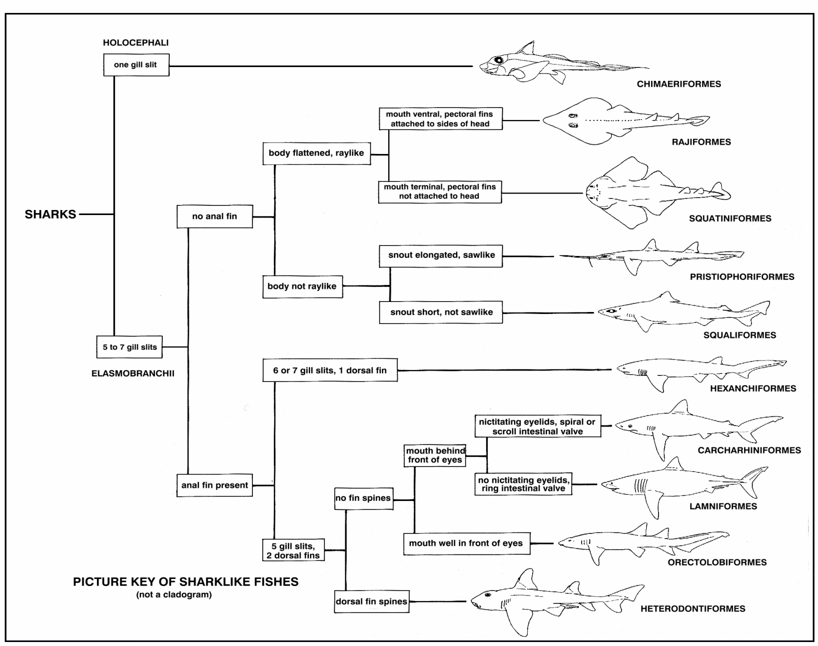




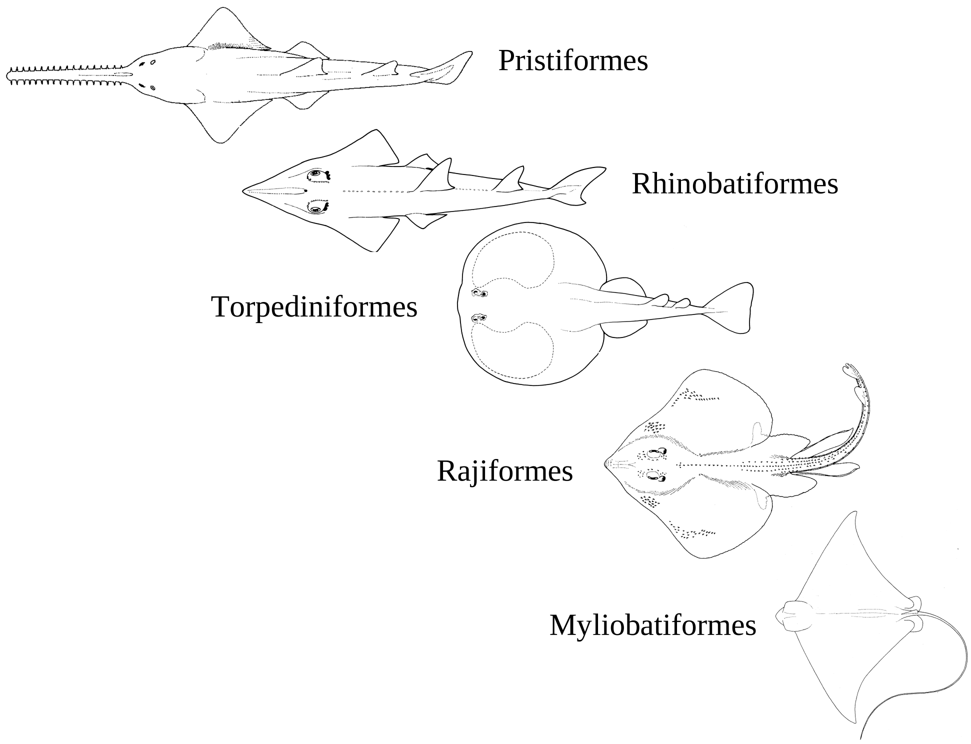


Shark and Batoid Classification

'Typical' sharks are classified into 8 Orders (only 4 are found in the region) and 35 Families (only 13 found in the region), and more than 99 Genera. There are currently more than 465 known species of sharks.

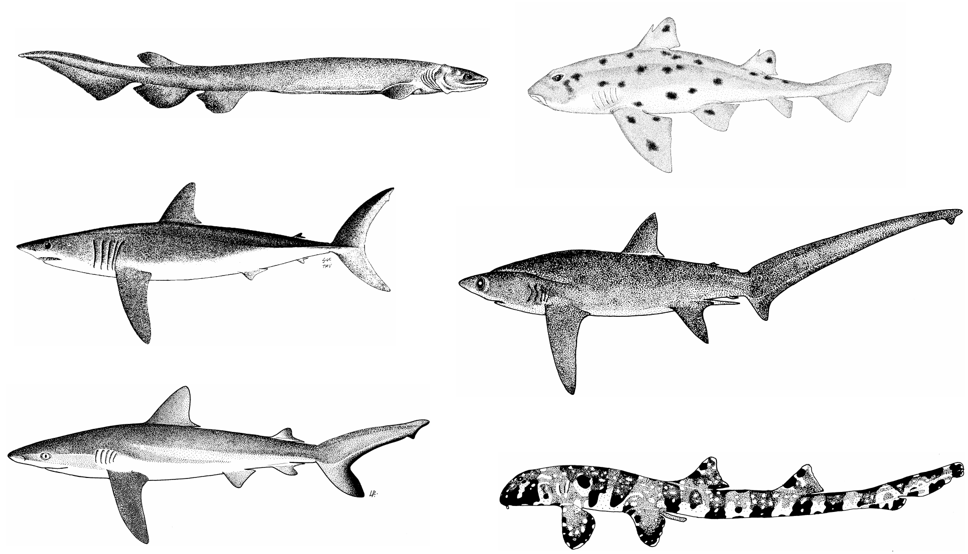


The batoids (“flat sharks”) are classified into 5 orders (only 4 found in the region), 15 families (only 9 found in the region), and about 62 genera. There are nearly 600 recognized species of batoids.

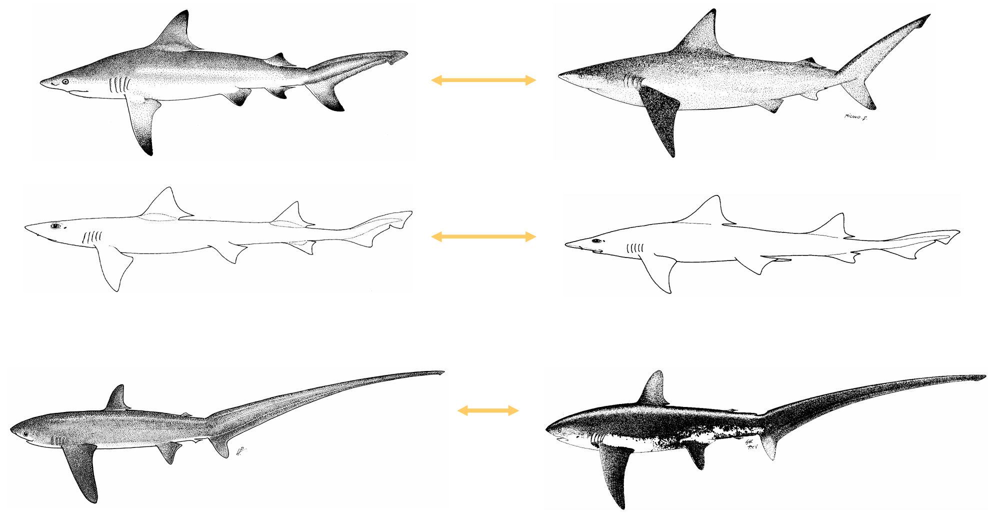


In general, it is relatively easy to differentiate between different families or genera of sharks and rays because their general body shape is different, but sometimes it is very difficult to separate species within the same genus.

Sharks of different Orders and Families:



Sharks of the same Family or genus:



Characters used in elasmobranch identification

These are the **most useful** characters used for shark and batoid identification:

Fins:

- number
- size & shape
- position
- Presence/absence of fin spines

Head:

- shape and proportions of snout in relation to mouth

Teeth:

- shape
- number of teeth rows

Body colour and markings

These are some of the **secondary** characters useful for identification in some groups of sharks and batoids:

Number of vertebrae (total, caudal, precaudal, monospondylous, diplospondylous)

Pattern of dermal denticles coverage inside the roof of the mouth

Shape of body dermal denticles

The best field strategy for the successful identification of sharks and batoids is first to do a good literature review before starting. Users should get to know the species that are likely to be found in the region, their general appearance and the key identification characters of each species. It is recommended that you use a regional field guide for this if available (one is being developed for the RSGA region).

Once in the field it is extremely important to put attention during the first or learning stage of identification. The following steps can provide you with very valuable aid in identification. First, take a photograph of the lateral side, underside of head, and any conspicuous characters of each specimen. This will allow you to carefully compare its characteristics against the keys or descriptions you will find in your literature.

Take also a sample of teeth. For most shark species, the shape of the teeth can provide a very good diagnostic of the species when used along with a photograph of the specimen. Teeth should be taken from the front row of the upper jaw, including the middle part of the jaw as well as some lateral teeth. If possible, collect also a few of the teeth of the lower jaw.

A good set of photographs and sample of teeth from a shark can almost always provide enough information to identify a shark to the species level.

Orders of sharks in the PERSGA region

Heterodontiformes – bullhead sharks

Bullhead sharks are the only group with anal fin and spines in the dorsal fins. They have the mouth in front of the eyes, and supraorbital crests.

There is only one Family in the region: Family Heterodontidae –bullhead sharks.

Lamniformes – Mackerel sharks and relatives

These sharks have no movable eyelid and they have the mouth arched and extending behind the eyes. They are divided in

Three Families in the region: Family Odontaspididae – sandtiger sharks; Family Alopiidae – thresher sharks; Family Lamnidae – Mackerel sharks.

Orectolobiformes – Nurse sharks and whale sharks

These sharks have the mouth in front of the eyes but in contrast with the Heterodontiformes, they have no spines on the dorsal fins. They have the 4th gill opening overlapping with the 5th, which is generally reduced in size, and also have nostrils with barbels.

This Order is represented by three Families in the Region: Family Stegostomatidae – zebra sharks; Family Ginglymostomatidae – nurse sharks; and Family Rhincodontidae – Whale shark.

Carcharhiniformes – Ground sharks and relatives

This is the Order with most species in the region. These sharks have the mouth arched and extending behind the eyes, a movable eyelid that protects the eye, and intestinal valve or scroll or spiral type.

This is the most diverse Order in the region an is represented by six Families: Family Scyliorhinidae- Cat sharks; Family Proscylliidae – Finback catsharks; Family Triakidae – smoothhounds; Family Hemigaleidae – Weasel sharks; Family Carcharhinidae – Requiem sharks; and Family Sphyrnidae – Hammerhead sharks.

Orders of Batoid fishes in the PERSGA Region

Pristiformes – sawfishes

This batoids have a shark-like body form, a saw-like elongated snout with strong lateral teeth on each side, and the gill slits on the underside of the head.

Only one Family exists: Family Pristidae.

Torpediniformes – Electric rays and numbfishes

This batoids have pectoral fins expanded and fused with the head and trunk forming an oval disc. The tail is shark-like in shape and without spines. This group is the only elasmobranch group with electric organs on the sides of the head (seen through the skin as a pattern of hexagonal markings).

There are two Families in the region: Family Torpedinidae – Electric rays; and Family Narkidae – Numbfishes.

Rhinobatiformes – Guitarfishes, wedge-fishes and shark-rays

Batoids in this Order have a shark-like body shape, the pectoral fins are expanded and fused with head and trunk, they have two sub-equal and well-separated dorsal fins, and no saw-like snout.

There are two Families in the region: Family Rhynchobatidae – Wedge-Fishes; and Family Rhinobatidae – guitarfishes.

Myliobatiformes – Stingrays, butterfly rays, eagle rays and mantas

The body is flattened with the pectoral fins greatly expanded and fused with the head and trunk, the tail is whip-like, sometimes with a spine or two. Sometimes there is a single dorsal fin but no caudal fin.

This is the most diverse Order and has a total of five Families in the region: Family Dasyatidae – Stingrays; Family Gymnuridae – Butterfly rays; Family Myliobatidae – Eagle rays; Family Rhinopteridae – Cow-nose rays; and Family Mobulidae – Mantas and devil rays.

Sampling Methodology

The main purpose of fisheries sampling is to gather the information that is needed for the stock assessment of the main species. This includes the estimation of catch composition by species, the estimation of size and age structure of the catches by species, the establishment of length-weight and other meristic relationships by species (needed for the estimation of total catch for each species), the estimation of fishing effort, information on fishing grounds, and the collection of biological data/samples.

The information from sampling can be entered in the field in formats similar to the one shown below:

Sampling Data Log-Sheet for Sharks and Rays

Regional Organization for the Conservation of the Red Sea and Gulf of Aden

Name of recorder ____________________

Date ____________________

City/town ____________________

Name of locality or boat ____________________

Type of boat ____________________

Type and amount of fishing gear ____________________

Number of days fishing ____________________

Approximate fishing grounds ____________________

Sample number	**Species name**	Second dorsal-fin length D2L	Pre-caudal length PCL	Fork length FL	**Total length TL**	**Weight W**	whole (w) or gutted (g)?	**Sex**	**Relative age**: Newborn (N) Juvenile (J) Preadult (PA) Adult (A)	**Clasper length**	**Samples taken**	**Observations**

Lengths should be measured along a strait flat line parallel to the mid axis of the shark as shown below:

Total length

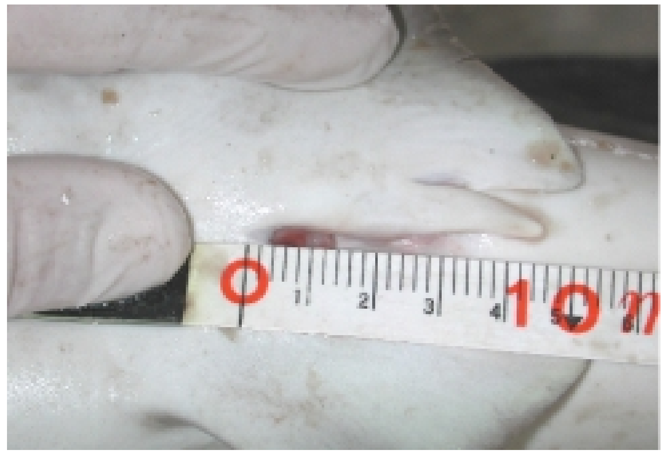
Fork length

Precaudal length

Length to 2[nd] dorsal fin

Finally, whenever possible, sharks should be weighted and the claspers of males measured to the shortest millimeter.

Weight



Clasper length (sexual maturity in males)

Literature:

Stevens, J. D., R. Bonfil, et al. (2000). "The effects of fishing on sharks, rays, and chimaeras (chondrichthyans), and the implications for marine ecosystems." ICES Journal of Marine Science **57**: 476-494.

Smith, S. E., D. W. Au, et al. (1998). "Intrinsic rebound potentials of 26 species of Pacific sharks." Marine and Freshwater Research **49**(7): 663-678.