KEMENTERIAN KELAUTAN DAN PERIKANAN

CORAL TRIANGLE INITIATIVE
ON CORAL REEFS, FISHERIES AND FOOD SECURITY
INDONESIA

WCS

IDENTIFICATION TRAINING ON SHARKS AND RAYS

Species Visual ID and Design Monitoring

Lombok – West Nusa Tenggara
25th – 27th February 2019

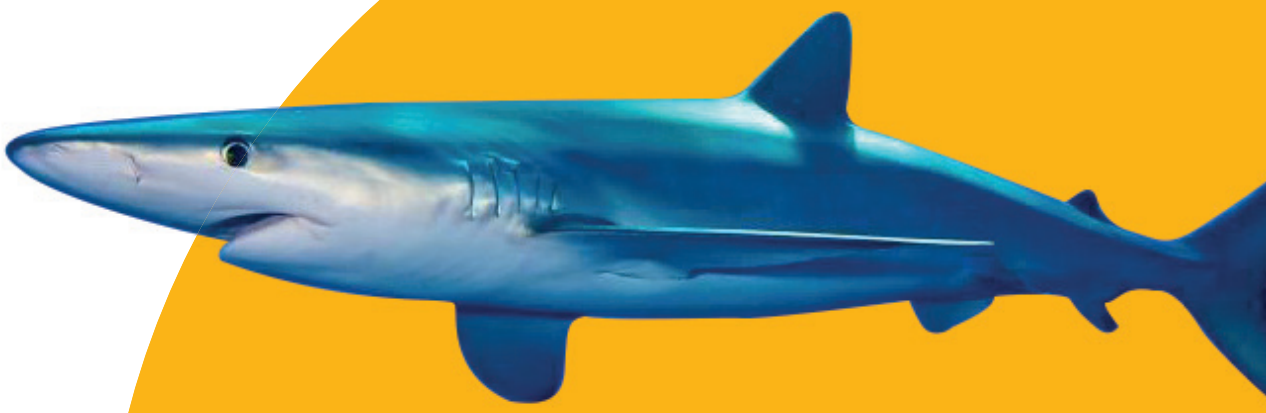


Table of Contents

1 Training Schedule

Time	Agenda	Resources Needed	Person-in-Charge
Day 1: February 25th - Monday			
8:30 - 9:00	Registration	• Attendance sheets • Training kits • Name tags	KKHL & WCS
9:00 - 9:30	Opening Program 1. Welcome Remarks 2. Message from the CTI-RS 3. Message from Chair of TSWG 4. Remarks from WCS 5. Opening Remarks 6. Photo Session	• MC • Photographer	1. Governor of NTB: welcome remarks, arah kebijakan perikanan NTB 2. Interim Executive Director of CTI-CFF RS: Latar belakang kegiatan, komitment CTI terhadap threatened species 3. Chair of TSWG (Papua New Guinea) 4. Country Director of WCS Indonesia 5. MMAF: 6. Fotographer -KKHL
9:30 - 9:45	Session 1: Overview of the Training • Rationale and Objectives of the Training • Session Overview • Expected Outputs and Outcomes	• Presentation • LCD • Wide screen	Efin -WCS
9:45 – 10:15	Session 2: Brief Overview of West Nusa Tenggara Fisheries and Tanjung Luar • Description of the area • Location and significance • Lesson learned • Video on Ocean and Us	• Presentation • LCD • Wide screen	West Nusa Tenggara Fisheries Office
10:15 - 10:30	Coffee Break		
10:30 - 11.30	Session 3: Overview on sharks and rays • Regional status of sharks and rays in CTI region • Sharks and rays in CITES • Indonesia regulation on sharks protection	• Presentation • LCD • Wide screen	Mr. Dharmadi-MMAF

Time	Agenda	Resources Needed	Person-in-Charge
11:30 - 12:30	Session 4: How to Design Landing Monitoring • Background on methodology • How to Design Landing Monitoring? • Biology Measurement in Landing Monitoring Q and A	• Module	Benaya - WCS
12:30 - 1:30	Lunch		
1:30 – 1.45	Pre-Test:		Trainer
1:45 - 3:00	Session 5: How to Identify Sharks	• Module	Mr. Darmadi
3:00 - 3:30	Coffee Break		
3:30 - 4:45	Session 6: How to Identify Rays	• Module	Benaya WCS
4:45 - 5:00	Wrap up and Exercise for Day 2 Closing of day-1	• Minutes of meeting	Efin -WCS
6:00 - 7:30	Dinner at Hotel		WCS Indonesia
Day 2: February 26th - Tuesday			
6:00 - 6:30	Breakfast and registration	• Attendance List	KKHL
6:30 - 6:45	Briefing for Field trip		Efin -WCS
6:45 - 7:45	Depart to Tanjung Luar Landing Site	• Car and Bus	WCS
7:45 - 10:00	Field observation • Identification morphology sharks and rays • Biological measurement • Fisheries measurement • Technical photographic	• Measuring instrument, module identification	Trainer
10:30 - 11:30	Travel back to the hotel	Car / Bus	WCS Indonesia
11:30 - 1:00	Lunch and Break		
13:00 - 15:00	Session 7: Evaluation of field observation Evaluating identification process and evaluating the sharks and rays pictures	• Minutes meeting • Module	Benaya-WCS
3:00 - 3:15	Coffee Break		
3:15 - 4:45	Session 8: How to Collect and input Sharks and Rays Data Format Excel provided by trainer Format Sheet for field observation	• Module	Benaya & Efin-WCS
4:45 - 5:00	Wrap up and close day-2 Preparation for Tanjung Luar Site visit	• Minutes of meeting	Efin-WCS
6:00 - 7:30	Dinner		

Time	Agenda	Resources Needed	Person-in-Charge
Day 3: February 27th - Wednesday			
6:00 - 6:30	Breakfast and registration	• Attendance List	WCS Indonesia
6:30 - 6:45	Briefing		WCS Indonesia
6:45 - 7:45	Depart to Tanjung Luar Landing Site	• Car / Bus	WCS Indonesia
7:45 - 10:30	Independent field observation • Identification morphology sharks and rays • Biological measurement • Technical photographic		Trainer
10:30 - 11:30	Travel back to the hotel	• Car / Bus	WCS Indonesia
11:30 - 13:00	Lunch and Break		
13:00 – 15:00	Discussion and lesson learn from participants		Benaya & Efin-WCS
15.00 – 15.15	Post-Test		
15:15 - 15:30	Wrap up and synthesis		Chair of TSWG
15:30 - 16:00	Closing program		CTI-CFF RS

2 Training Team

TRAINER

Dharmadi is a senior elasmobranch researcher in Indonesia Center for Fisheries Research. He finished his study about fisheries biology in 1986, then he started working in a private company in Indonesia. His research footprint started in 1991 until now. He is Indonesia coordinator on shark and ray data collection in Southeast Asia-SEAFDEC project and Research Project leader on "Sawfish Status in Indonesia". As member of IUCN - Species Survival Commision (SSC) Shark Specialist Group (SSG), he wrote some books about sharks and rays species in Indonesia and Southeast Asian Region.

TRAINER

Benaya Simeon was born in a coastal town in Indonesia. She studied about fish behavior in bachelor degree, then for master degree she got a grant from for her research about shark behavior. Now she works as sharks and rays officer in Wildlife Conservation Society – Indonesia Program. She collects sharks and rays fisheries data, assist in design, implementation, analysis, and write-up of applied research on sharks and rays fisheries.

FACILITATOR

Efin Muttaqin is sharks and rays coordinator in Wildlife Conservation Society-Indonesia Program. His sharks landing monitoring project started in 2011 in Aceh then in West Nusa Tenggara in 2013. He developed some protocols for landing monitoring sharks and rays which were used by WCS-IP team until now.

FIELD ASSISTANT

Muhsin, Muhammad Ali, and Abdul Kohar

They conduct daily landing monitoring for sharks and rays. They identify species, conduct biology measure and record fisheries information from sharks and rays fishing fleet.

3 Introduction

Sharks and rays Fisheries in Indonesia

Elasmobranchs are now recognised as being one of the world's most threatened species groups, with one quarter of species threated with extinction according to the IUCN Red List of Threatened Species (Dulvy et al. 2014). This is primarily due to overfishing through capture in both targeted and by-catch fisheries, with an estimated annual global fishing mortality of 100 million per year (Worm et al. 2013). In turn, this fishing pressure is perpetuated by local and global markets for a wide range of elasmobranch commodities (Dent and Clarke 2015).

Indonesia is the world's largest elasmobranch fishing nation (Dent and Clarke 2015), with annual elasmobranch production over the past decade (2005-2014) approximately 90,000 to 120,000 tonnes per year, with a 10-year annual average of 104,898 (SD 8,124) tonnes per year (MMAF, 2016). Shark and rays fisheries in Indonesia has been started before the 1940's coastal communities primarily caught sharks in mixed-species fisheries, with similar utilisation as for other species of fish, which were primarily consumed as food. International trade in shark products began gaining commercial importance in Indonesia in the 1970's, predominantly driven by international demand for shark fins in China and Hong Kong.

West Nusa Tenggara Province is known as one of the highest shark producer in Indonesia. East Lombok District is one of areas that contribute to the sharks and rays catch in West Nusa Tenggara with Tanjung Luar is main fish landing port in West Nusa Tenggara where shark fishing activities has existed since 1940s. Sharks are the main fishing target for some fishing communities in this area, fished using long line with fishing vessels size ranging from 5 to 20 GT.

Sharks were mainly caught by bottom longline and surface longline, while some also caught by gillnet as bycatch. Fishing grounds of Tanjung Luar shark fishers spread in 9 provinces, West Nusa Tenggara, East Nusa Tenggara, Bali, East Java, South Sulawesi, West Sulawesi, Southeast Sulawesi, South Kalimantan, and Central Kalimantan waters. Those fishing grounds also spread in three Indonesian Fisheries Management Areas (FMAs), FMA 712, FMA 573 and FMA 713.

4 Modul

Module 1: How to design landing monitoring

Background

Sharks, rays, skates, and chimaera are cartilaginous fish which are included in the sub-class of *Elasmobranchi*, the *Chondrichthyes* class. Ecologically, elasmobranch plays an important role in the food chain and ecosystem balancer in the ocean. Some types of sharks and rays are positioned as top predators and meso-predator. Sharks and rays are also one of the important visual indicators species for the health of coral reef ecosystems (Friedlander et.al., 2002, Griffin et. Al., 2008).

In addition to its important position in the ecosystem, sharks and rays also have different biological characters from teleost. Limited number of tillers, long gestation period, and slow growth make sharks are slower to reproduce compared to teleost fish.

It is known that 46% of 1041 types of shark and ray are species with habitats in coastal waters until the continental shelf (Dulvy et al. 2014). The existence of sharks and rays in these habitats causes sharks and rays to be very vulnerable both to the pressure of artisanal fisheries and habitat degradation. On the other hand, artisanal fisheries are still one of the livelihoods of people in several countries including Indonesia. Sharks and rays are still fisheries commodity both as target and by-catch by multi-gear and multi-species fisheries.

Landing Monitoring of sharks and rays at local fish landing can provide a lot of information, both biological and fisheries information. However, there are many challenges considering that generally fishing fleet has several fishing gear. High-precision recording of each aspect is expected to provide comprehensive data by minimizing the bias which

is caused by conditions and variation of information in the field.

Definition

Shark and rays landing monitoring is one of the survey methods to determine the pattern of shark and ray fisheries utilization in a particular area.

Objective

The objectives of this training module are:

1. Participants can analyze shark and ray fisheries characters in their respective countries
2. Participants understand the method of landing monitoring that conducted by WCS over the past 5 years in Tanjung Luar.
3. Participants can design an appropriate monitoring landing in their respective countries by adapting the methods used in Tanjung Luar

Monitoring Design

Monitoring design is a very important step to ensure that monitoring activities can be carried out effectively and efficiently. To discuss effective survey activities, the important thing that needs to be done is to consider the pattern of fishing activities in an area, through the following information

- General information of fisheries activities in an area,
- The number of fishermen,
- The number and type of vessels from the operating fishing unit,
- Type of operated fishing gear,
- Location of fish landing or auction,
- Pattern of fishing activities, and
- Other important information related to fisheries activities.

Information can be obtained by collecting secondary data from related parties such as local government, fishing port authority, research institutions and others. In addition, information can be obtained by conducting pre-survey and direct observation in the field. In pre-survey we were able to gather information to captains, fishermen, ship owners and key figures who knew about fisheries information.

Information will be able to help us in determining the following technical aspects:

- Location and number of sample points
- Number of people to be involved in data collection.

A. Determination of survey location

Ideally the monitoring location needs to be conducted in all fish landing locations, but if this is not possible, then several locations can be chosen for representing all fisheries activities within area, such as the representation of fishing unit. The selected monitoring sites are fish landing locations which have diversity of fishing gear types that operating in the region.

B. Time of monitoring

Time of fish landing monitoring can be conducted by census and sampling. Data collection of census catch is carried out every day at all landing sites. Collection of sampling data throughout the month at several fish catch landing sites.

C. Equipment and Materials

Equipment and materials which used in fish landing monitoring activity are: digital cameras, data sheets, ruler/roll meters, scales, label of fishing gear types, stationery (pencils), and tablets (for data input).

D. Types of collected data

In general, data structure of shark landing monitoring result divided into:

1. Fishing fleet data
   - Location of data collection
   - Trip ID
   - Date (dd/mm/yyyy)
   - Boat name
   - Fleet size (Gross tones)
   - Machine capacity (HP)
   - Number of setting
   - Soaking time
   - Days at sea
   - Days of operation
   - Fishing gear
   - Number of Hooks

- Hook size
- Mesh size (net)
- Number of piece (net)
- Operational cost (fuel, ice)
- Number of crew
- Provincial water zones
- Geographic position
- Fisheries Management Area

2. Species Data
   - Category (Shark or Ray)
   - Family
   - Species
   - Sex
   - Embryo
   - Number of embryo
   - Size of embryo
   - Clasper length
   - Total Length (TL)
   - Pre Caudal Length (PCL)
   - *Stage maturity* (male and female)
   - Number or individuals
3. Price Data
   - Auction price
   - Auction buyer
   - Real price
   - Real Buyer
4. Other Data
   - Other existing fleet
   - Origin
   - Total number

Implementation Technique

- Prepare data sheets, camera, stationery and other equipment which needed for data collection
- Ask permission from fishermen, ship owners and buyers to record data
- When we see the fishermen landing their catches, ask permission to get photos of sharks and rays catches.
- Record the name of shark and ray species, fish length, sex, clasper length.
- For other information such as fishing fleet, price data can be carried out by asking the crew, captain or shark and ray buyers or collectors/middle-man.
- Do not forget thank the fishermen
- Download all documentation (photos) and name them according to the photo legend.
- Input the recorded data in the database that has been prepared.

How to Measure Shark and Rays

1. Measure the length of the shark

Length which used for shark measurement are totaling length and pre-caudal length (see figure 1). Set the shark specimen to correct position before measure its length (see figure 2).

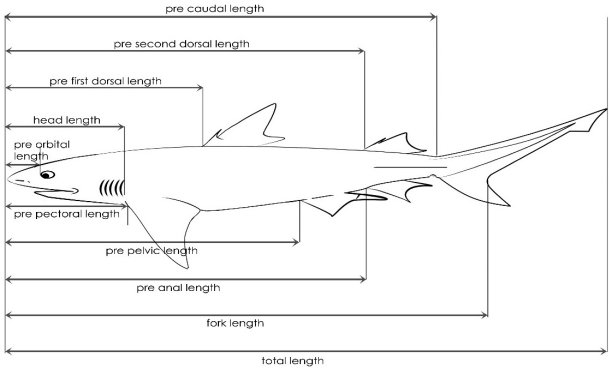


Figure 1. Shark length measurement (credit picture: H.Siregar)

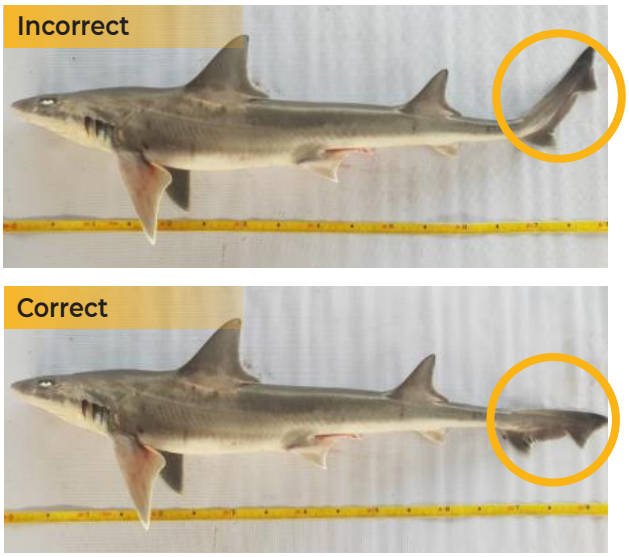


Figure 2. How to put shark position for the measurement

2. Measure the length of ray

Ray sizes are also given as total lengths except in the families Dasyatidae, Gymnuridae, Myliobatidae, Rhinopteridae and Mobulidae,in which the tail is frequently absent or damaged. For these groups the size measurement used is total length (TL) and disc width (DW). So generally, length which used

for ray measurement are total length(TL) and disc width (DW) (see figure 3). Set the shark specimen to correct position before measure its length (see figure 2).

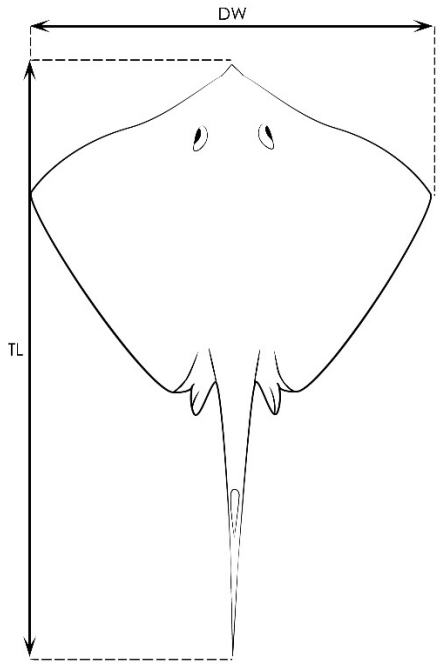


Figure 3. Ray length measurement (credit picture: H.Siregar)

3. Identify sex and stage of maturity

Identify sex from sharks and rays which landed as below:

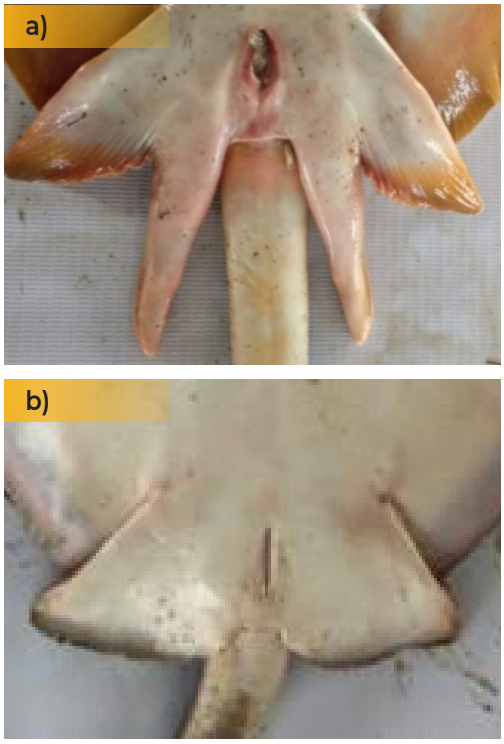


Figure 4. a) Clasper on male sharks and rays, b) cloaca on female sharks and rays

Record the stage of maturity from male individual with classification as below:

1. NC = Non Calcification
2. NFC = Non Full Calcification
3. FC = Full Calcification

Record the stage of maturity form female individual with classification as below (Hall et al. 2012):

1. Immature Very small ovaries; uteri similar in size, thin and flaccid.
2. Maturing, virgin Functional (right) ovary contains small yolked ova; the two functional uteri beginning to enlarge but are mostly thin and flaccid.
3. Mature, non-pregnant Right ovary contains yolked ova > 2·0 mm in diameter; uteri enlarged along entire length.
4. Mature, pregnant Fertilized eggs or embryos in both uteri.
5. Mature, post-partum Uteri very enlarged and flaccid, having recently released young.

Documenting Shark and Ray

Taking pictures is useful as a documentation for recording shark and ray landing. The documentation procedure is as follows:

- Setting the camera (bring up the date option)
- Choose the appropriate photo resolution, (3 to 5 mega pixel)
- Prepare the data sheets and other equipment which is needed for data collection.
- Ask permission for taking pictures of catch.
- Prepare the supported tools such as data form sheets, white photo frames/base, and ruler.
- Prepare a white photo base, can use a white plastic poster, white styrofoam, blue plastic, or blue styrofoam
- Place the ruler in horizontal position and make sure the position is straight
- Position the shark and ray in horizontal position with its head on the left side.

Example:

Correct

Incorrect

Enumerator:

Location	Trip ID	Date	Boat Name	GT	Machine capacity (HP)	Number of Setting	Soaking Time	Days at sea	Days of operation	Fishing gear	Number of Hook (Line)/ pieces (net)

Hook Size (Line)/ Mesh size (net)	Operational cost	Number of Crew	Provincial water zones	Fishing Ground (GPS position)	FMA

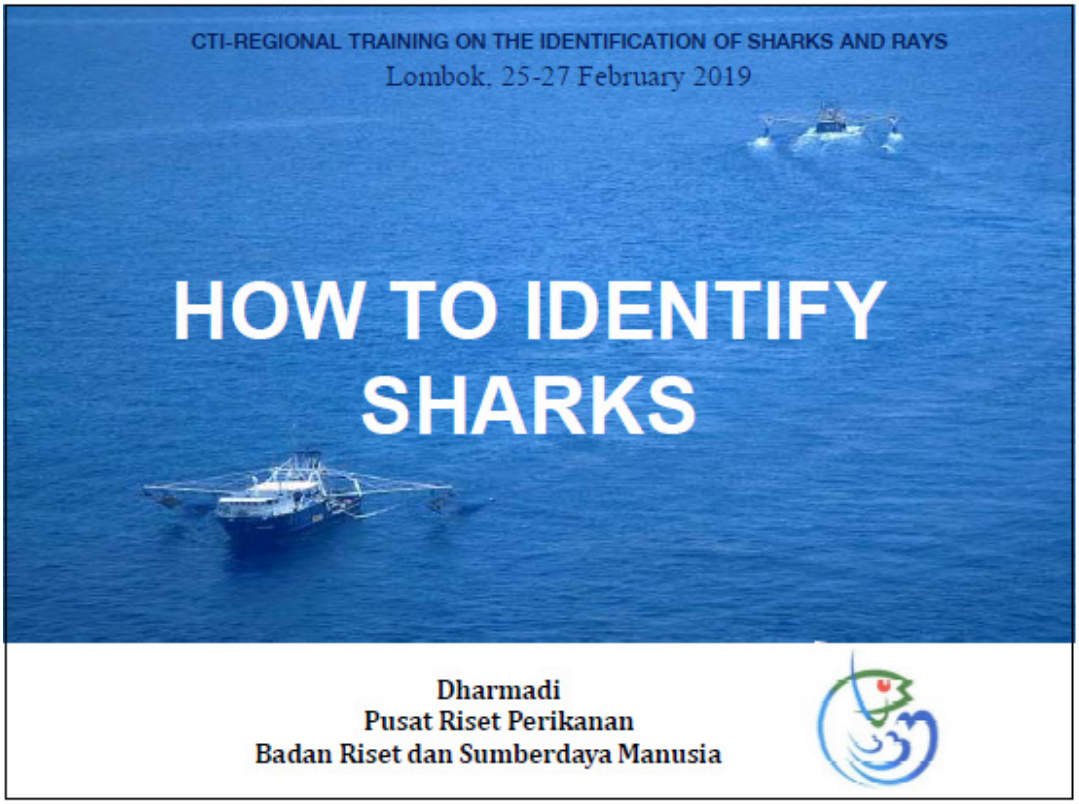
Catch and auction result

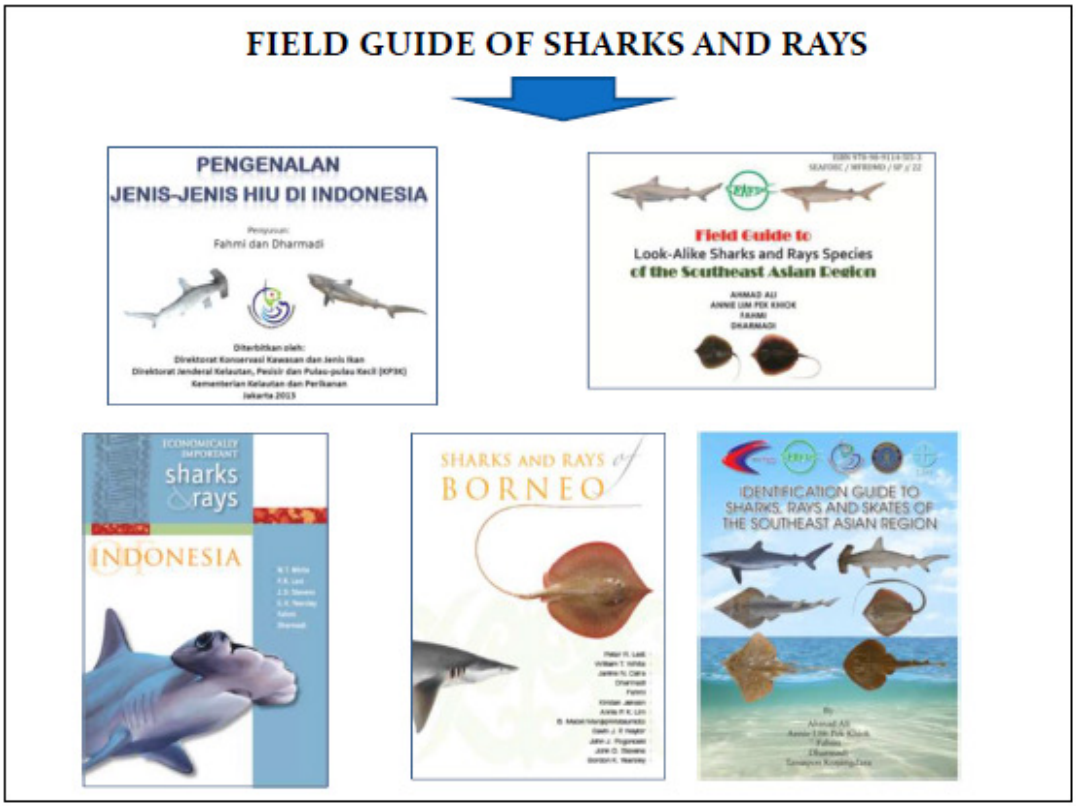
Trip ID	Category	Species	Sex	Embrio	Number of embrio	Length of embrio	Clasper (cm)	TL (cm)	PCL(cm)	TKG	Jumlah Individu	Harga Lelang	Pembeli Lelang	Harga Riil	Pembeli Riil

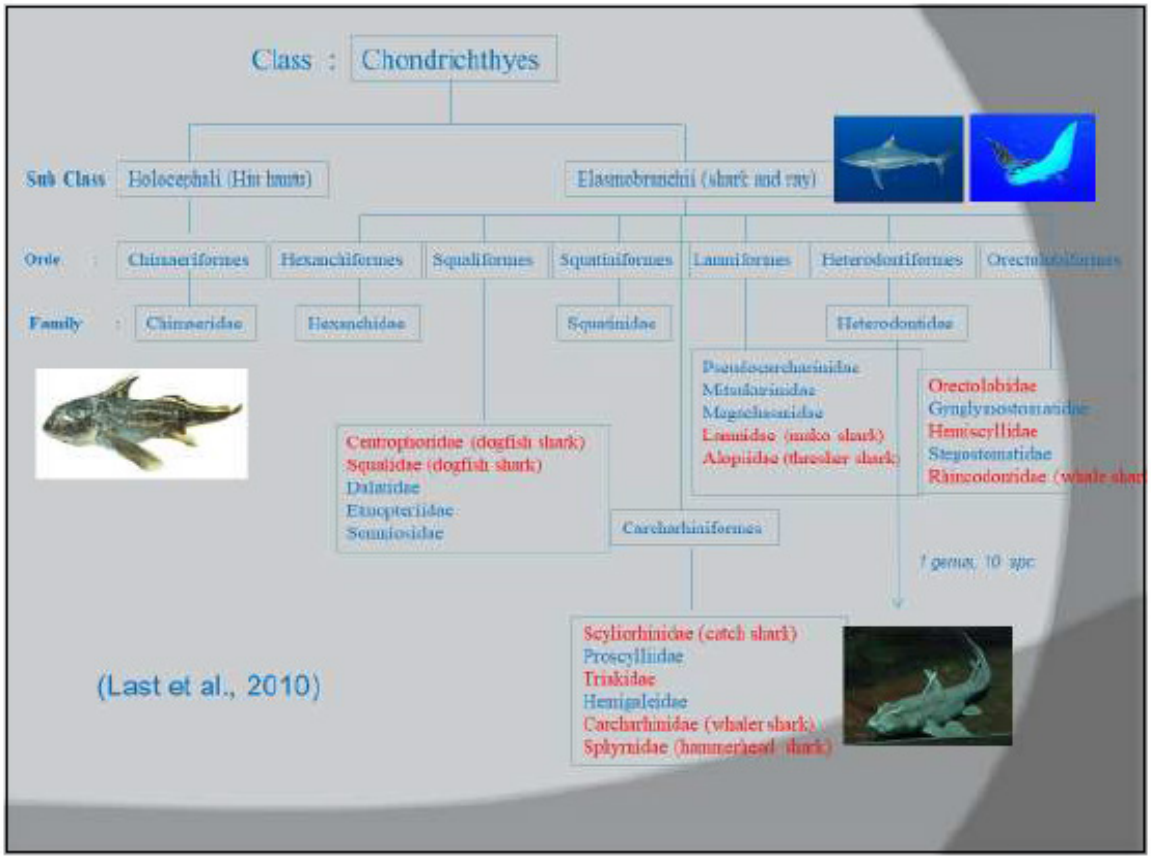
Other fish

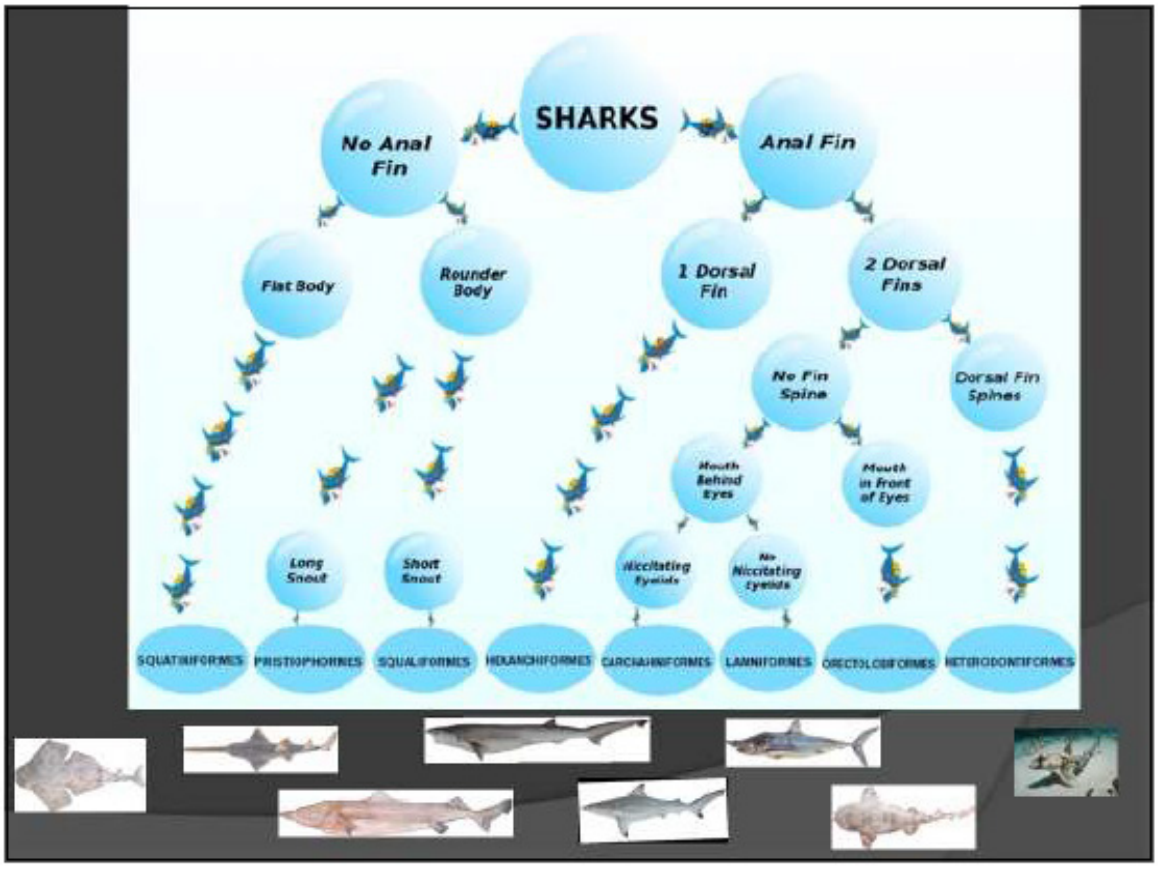
Trip ID	Spesies lain	Jumlah	Harga	Pembeli	Kapal Lain (ada/tidak)	Asal	Jumlah	Apakah tahu kapal tsb?

Module 2:
How to Identify Sharks

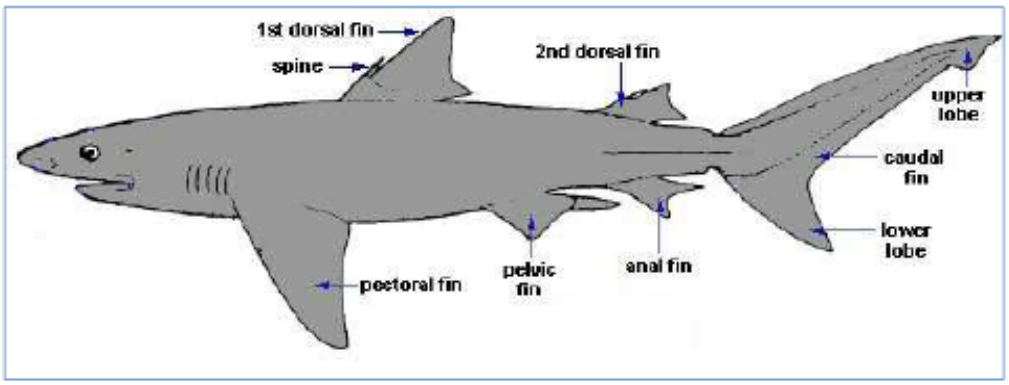




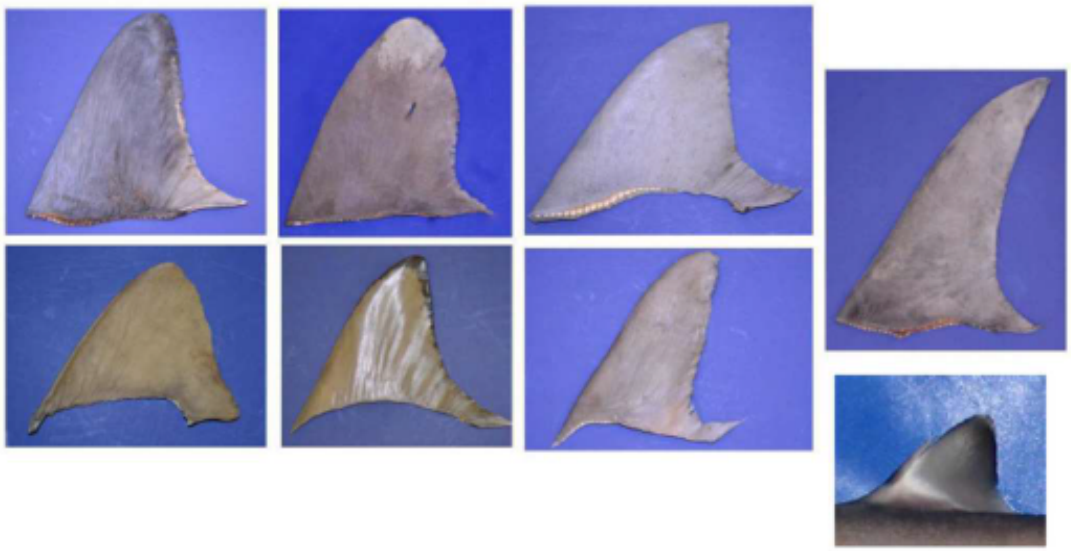

Class : Chondrichthyes
Sub Class
Holocephali (Hin hunts)
Elasmobranchii (shark and ray)
Orde
Chimaeriformes
Hexanchiformes
Squaliformes
Squatiniformes
Lamniformes
Heterodontiformes
Orectolobiformes
Family
Chimaeridae
Hexanchidae
Squatinidae
Heterodontidae
Pseudocarchariidae
Mitsukurinidae
Megachasmidae
Lamnidae (mako shark)
Alopiidae (thresher shark)
Orectolobidae
Ginglymostomatidae
Hemiscyllidae
Stegostomatidae
Rhincodontidae (whale shark)
Centrophoridae (dogfish shark)
Squalidae (dogfish shark)
Dalatiidae
Etmopteridae
Somniosidae
Carcharhiniformes
1 genus, 10 spc
Scyliorhinidae (catch shark)
Proscylliidae
Triakidae
Hemigaleidae
Carcharhinidae (whaler shark)
Sphyrnidae (hammerhead shark)
(Last et al., 2010)

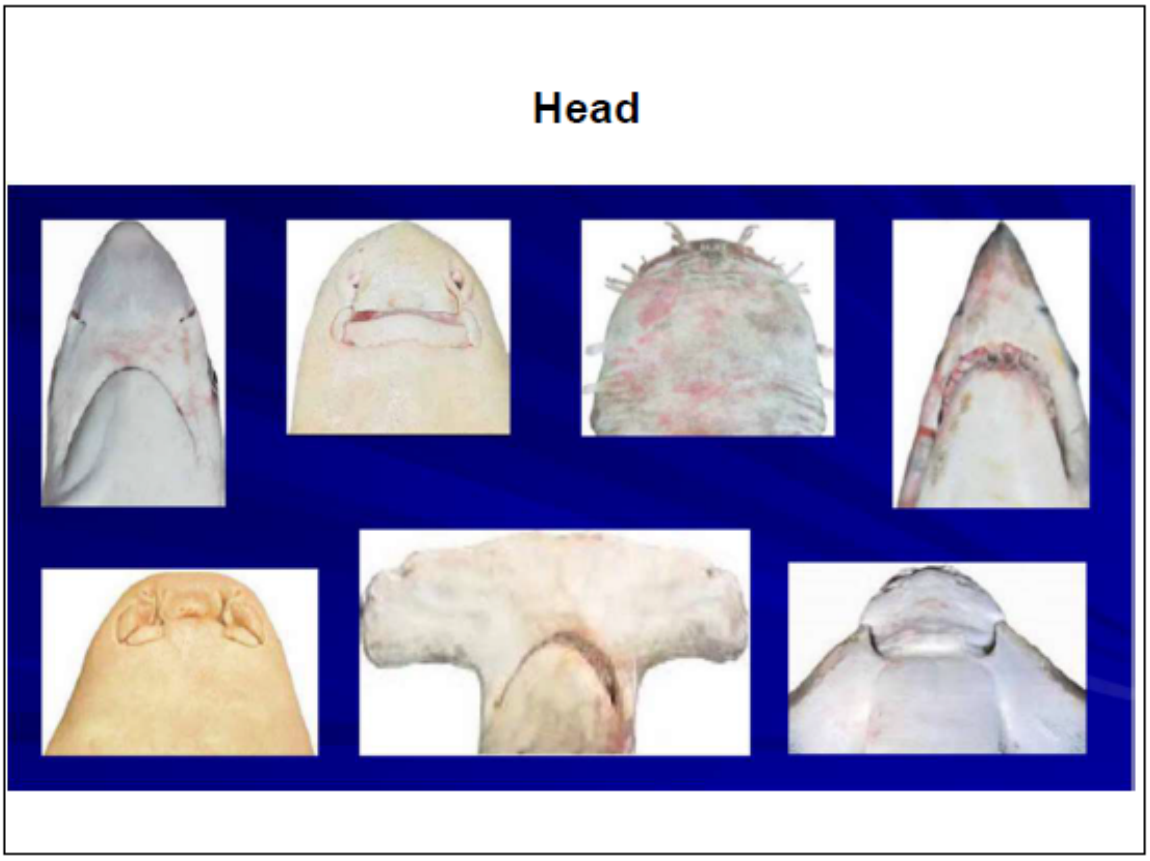

SHARKS
No Anal Fin
Anal Fin
Flat Body
Rounder Body
1 Dorsal Fin
2 Dorsal Fins
No Fin Spine
Dorsal Fin Spines
Mouth Behind Eyes
Mouth in Front of Eyes
Long Snout
Short Snout
Nictitating Eyelids
No Nictitating Eyelids
SQUATINIFORMES
PRISTIOPHORIFORMES
SQUALIFORMES
HEXANCHIFORMES
CARCHARINIFORMES
LAMNIFORMES
ORECTOLOBIFORMES
HETERODONTIFORMES

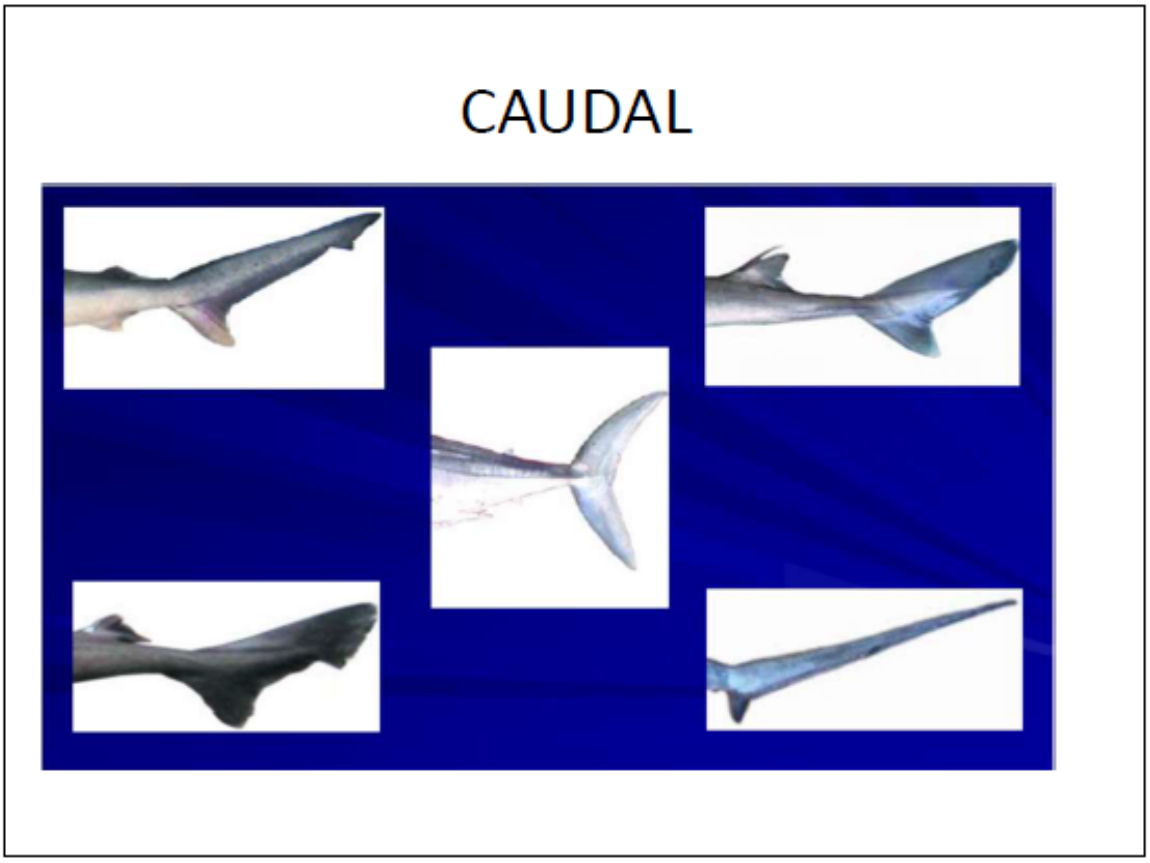
Sharks have five different types of fins:
pectoral, pelvic, dorsal, anal, and **caudal.**

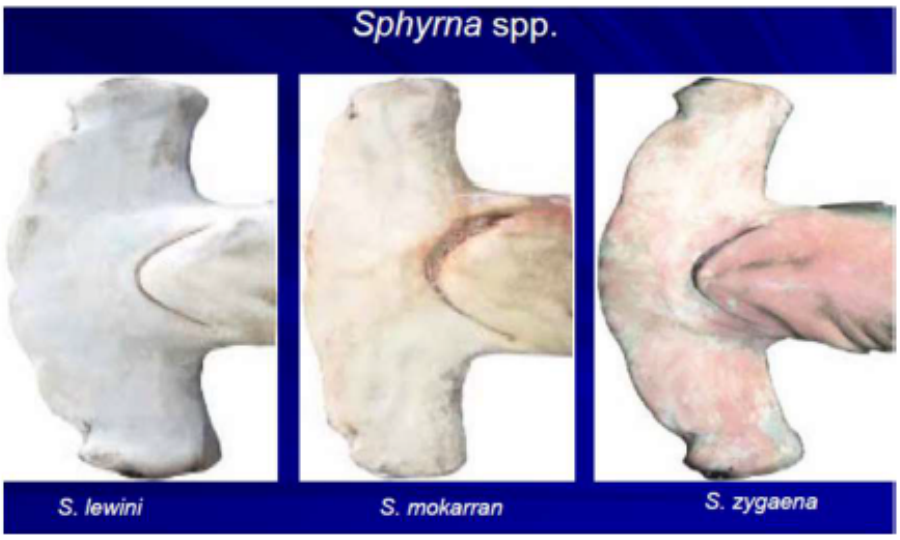


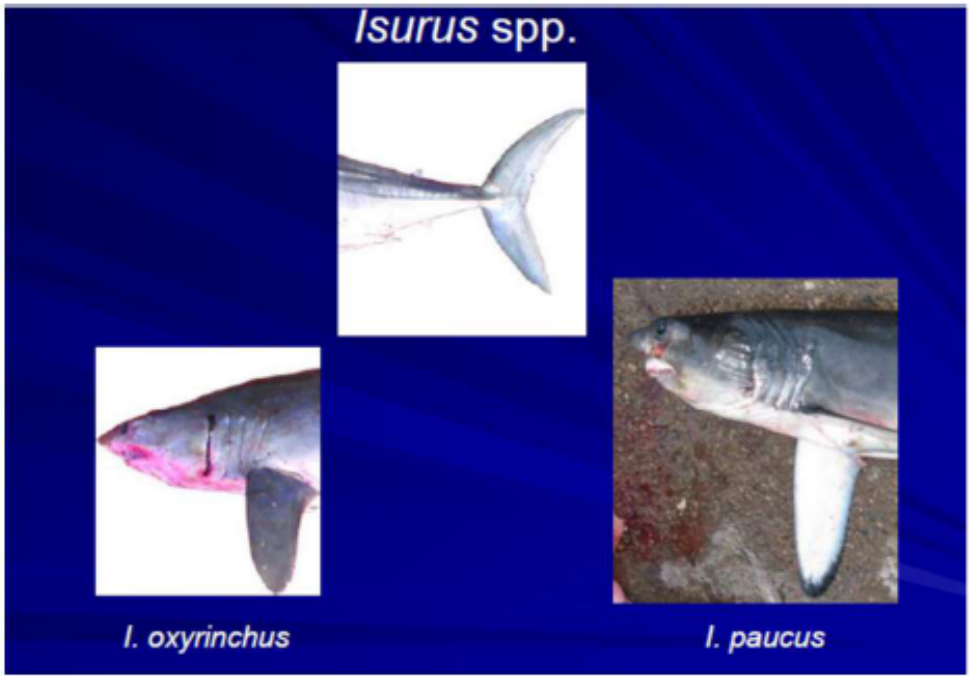
DORSAL FIN

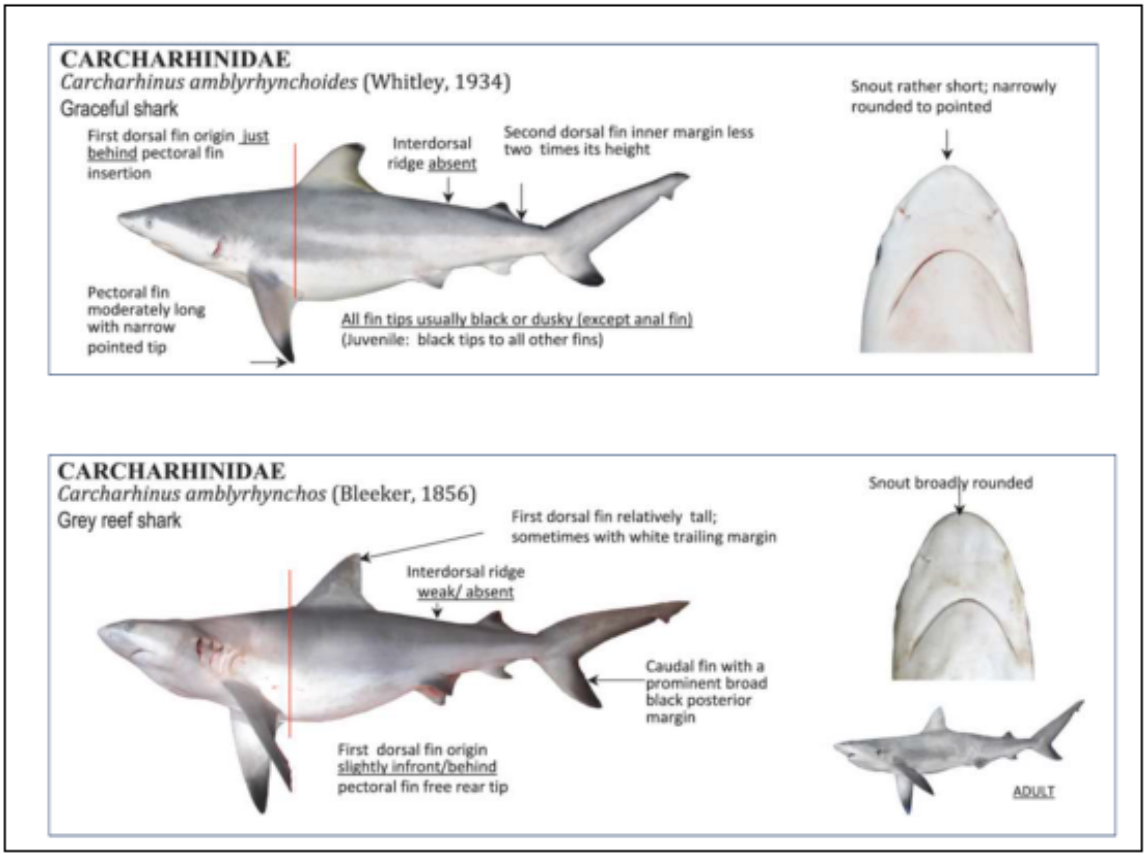


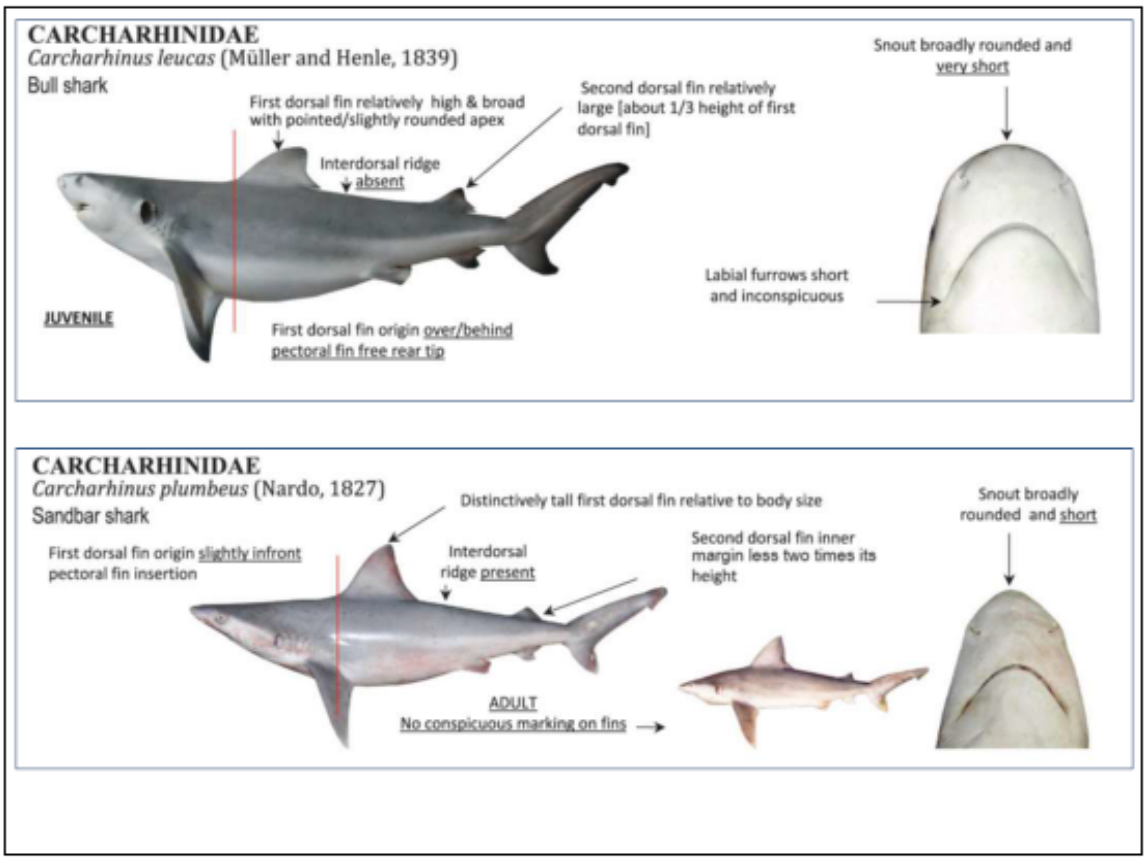

Head

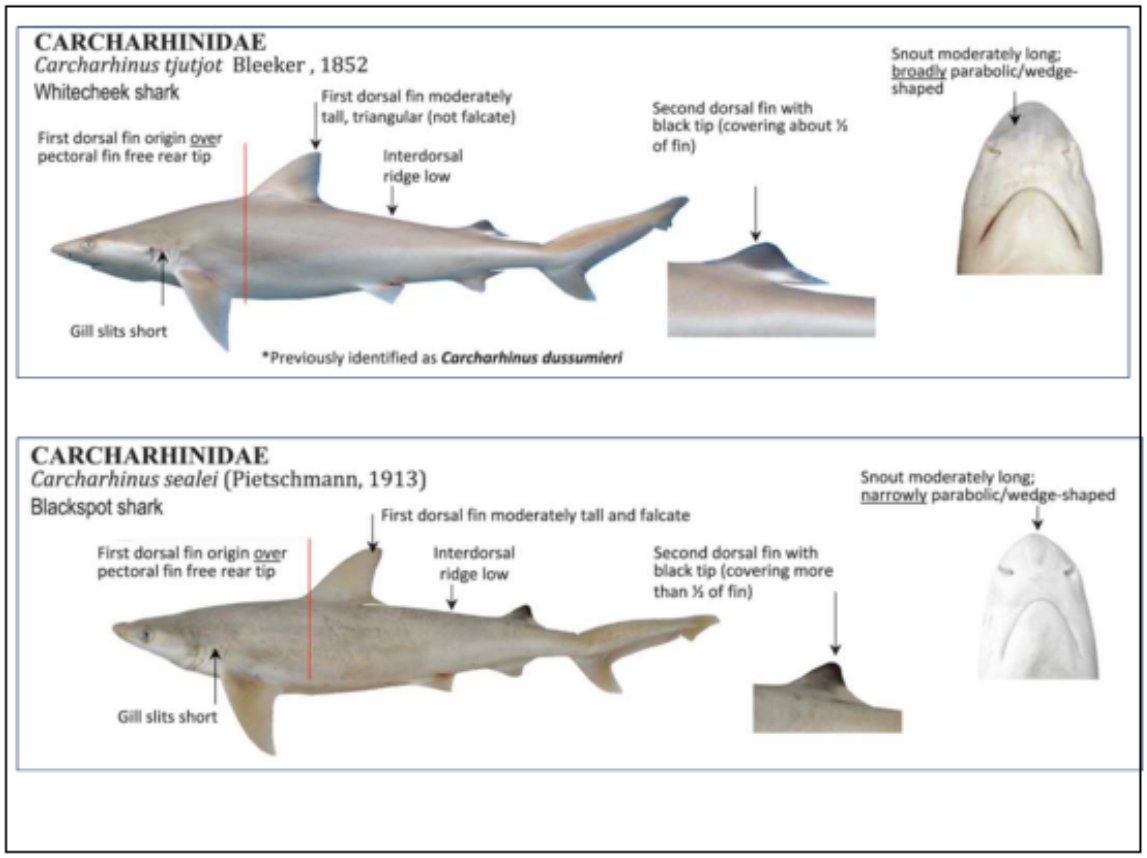

CAUDAL

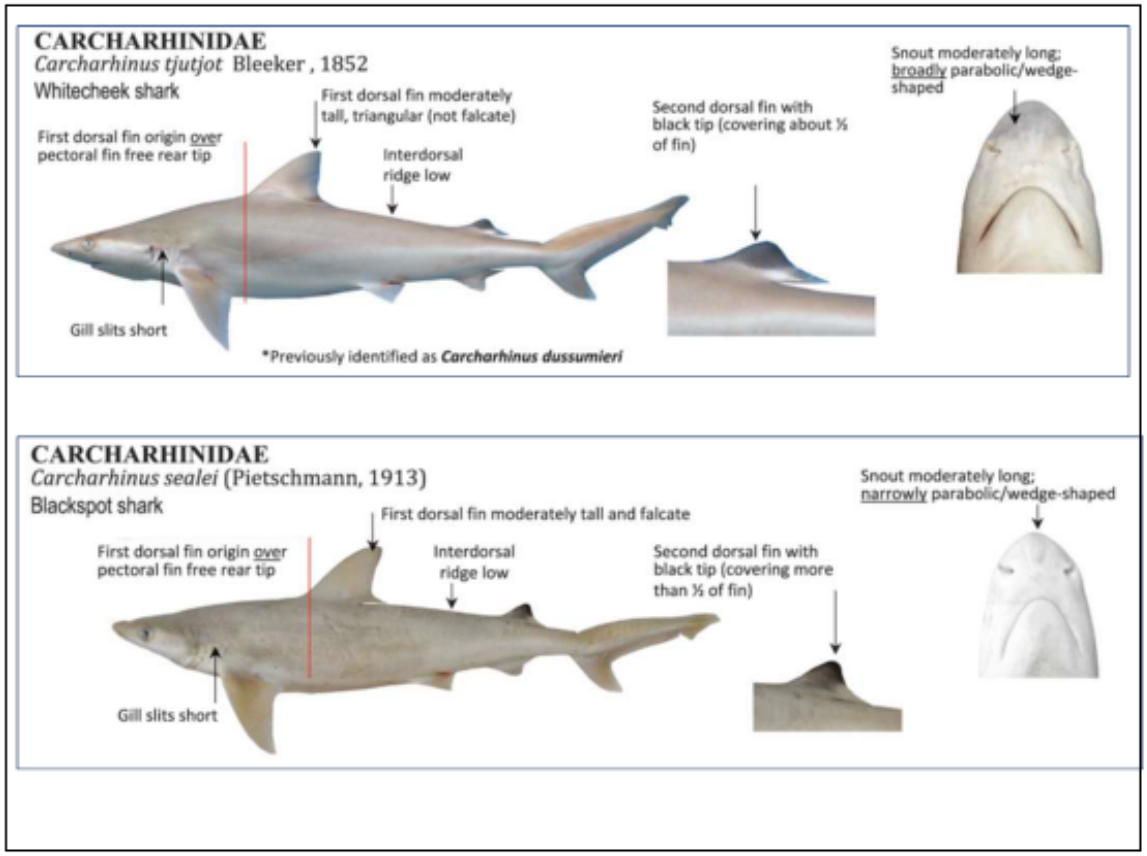

Sphyrna spp.
S. lewini
S. mokarran
S. zygaena

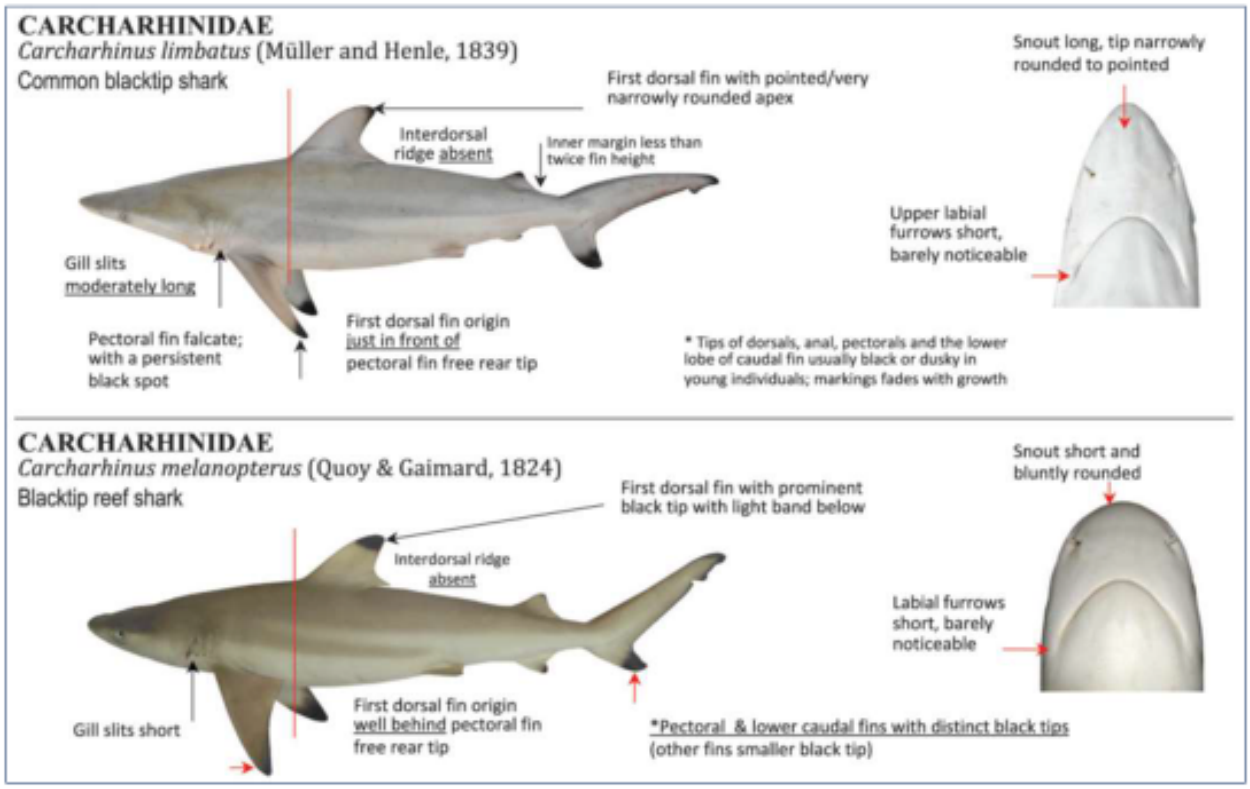

Isurus spp.
I. oxyrinchus
I. paucus

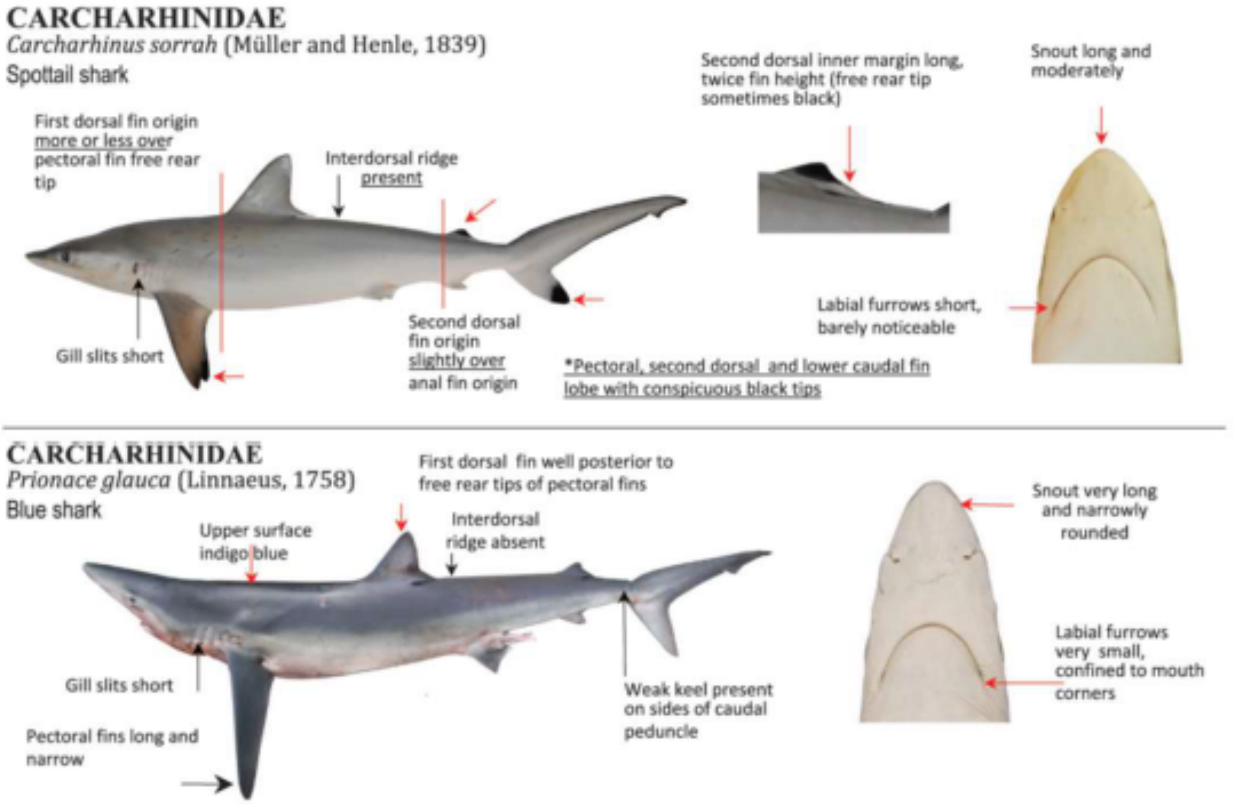

CARCHARHINIDAE
Carcharhinus amblyrhynchoides (Whitley, 1934)
Graceful shark
First dorsal fin origin just behind pectoral fin insertion
Interdorsal ridge absent
Second dorsal fin inner margin less two times its height
Snout rather short; narrowly rounded to pointed
Pectoral fin moderately long with narrow pointed tip
All fin tips usually black or dusky (except anal fin)
(Juvenile: black tips to all other fins)
CARCHARHINIDAE
Carcharhinus amblyrhynchos (Bleeker, 1856)
Grey reef shark
First dorsal fin relatively tall; sometimes with white trailing margin
Snout broadly rounded
Interdorsal ridge weak/ absent
Caudal fin with a prominent broad black posterior margin
First dorsal fin origin slightly infront/behind pectoral fin free rear tip
ADULT

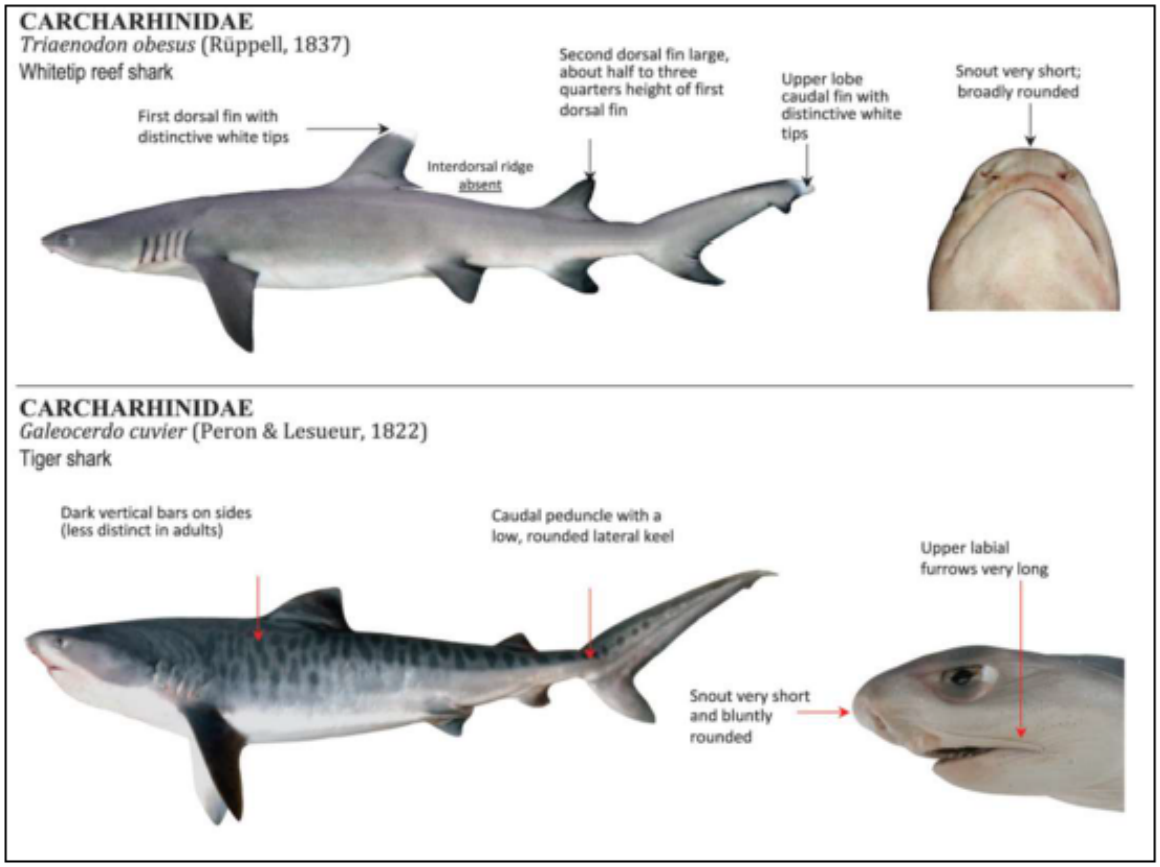

CARCHARHINIDAE
Carcharhinus leucas (Müller and Henle, 1839)
Bull shark
First dorsal fin relatively high & broad with pointed/slightly rounded apex
Second dorsal fin relatively large [about 1/3 height of first dorsal fin]
Snout broadly rounded and very short
Interdorsal ridge absent
Labial furrows short and inconspicuous
JUVENILE
First dorsal fin origin over/behind pectoral fin free rear tip
CARCHARHINIDAE
Carcharhinus plumbeus (Nardo, 1827)
Sandbar shark
Distinctively tall first dorsal fin relative to body size
Snout broadly rounded and short
First dorsal fin origin slightly infront pectoral fin insertion
Interdorsal ridge present
Second dorsal fin inner margin less two times its height
ADULT
No conspicuous marking on fins

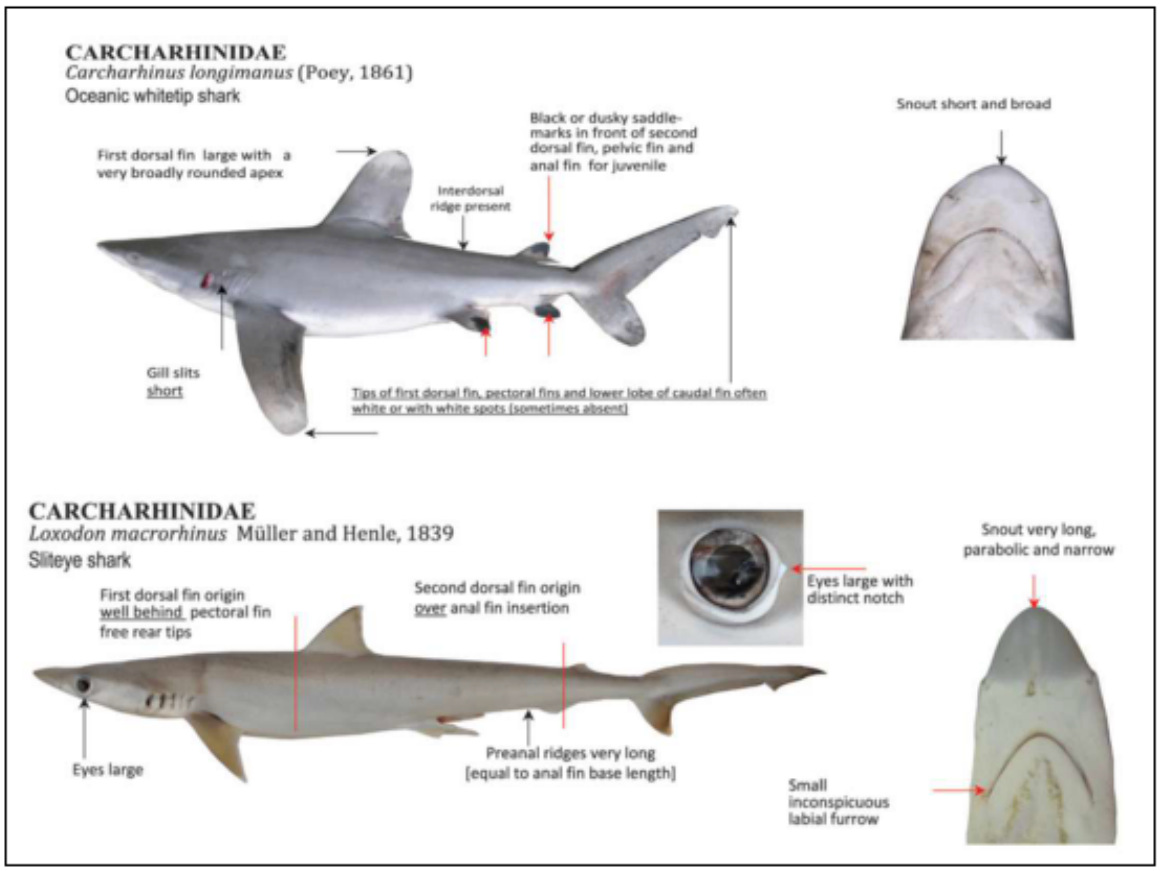

CARCHARHINIDAE
Carcharhinus tjutjot Bleeker , 1852
Whitecheek shark
First dorsal fin moderately tall, triangular (not falcate)
First dorsal fin origin over pectoral fin free rear tip
Interdorsal ridge low
Second dorsal fin with black tip (covering about ⅓ of fin)
Snout moderately long; broadly parabolic/wedge-shaped
Gill slits short
*Previously identified as Carcharhinus dussumieri
CARCHARHINIDAE
Carcharhinus sealei (Pietschmann, 1913)
Blackspot shark
First dorsal fin moderately tall and falcate
First dorsal fin origin over pectoral fin free rear tip
Interdorsal ridge low
Second dorsal fin with black tip (covering more than ⅓ of fin)
Snout moderately long; narrowly parabolic/wedge-shaped
Gill slits short

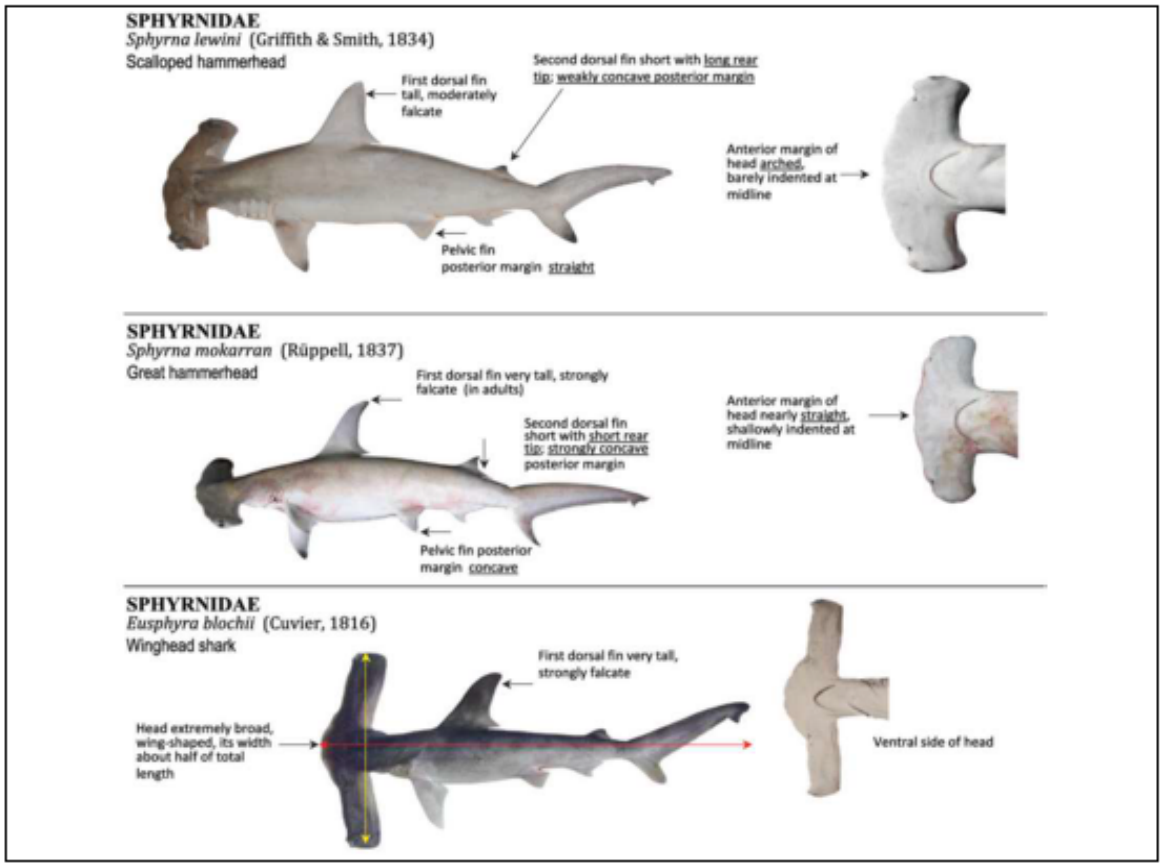

CARCHARHINIDAE
Carcharhinus tjutjot Bleeker , 1852
Whitecheek shark
First dorsal fin moderately tall, triangular (not falcate)
First dorsal fin origin over pectoral fin free rear tip
Interdorsal ridge low
Second dorsal fin with black tip (covering about ⅓ of fin)
Snout moderately long; broadly parabolic/wedge-shaped
Gill slits short
*Previously identified as Carcharhinus dussumieri
CARCHARHINIDAE
Carcharhinus sealei (Pietschmann, 1913)
Blackspot shark
First dorsal fin moderately tall and falcate
First dorsal fin origin over pectoral fin free rear tip
Interdorsal ridge low
Second dorsal fin with black tip (covering more than ⅓ of fin)
Snout moderately long; narrowly parabolic/wedge-shaped
Gill slits short

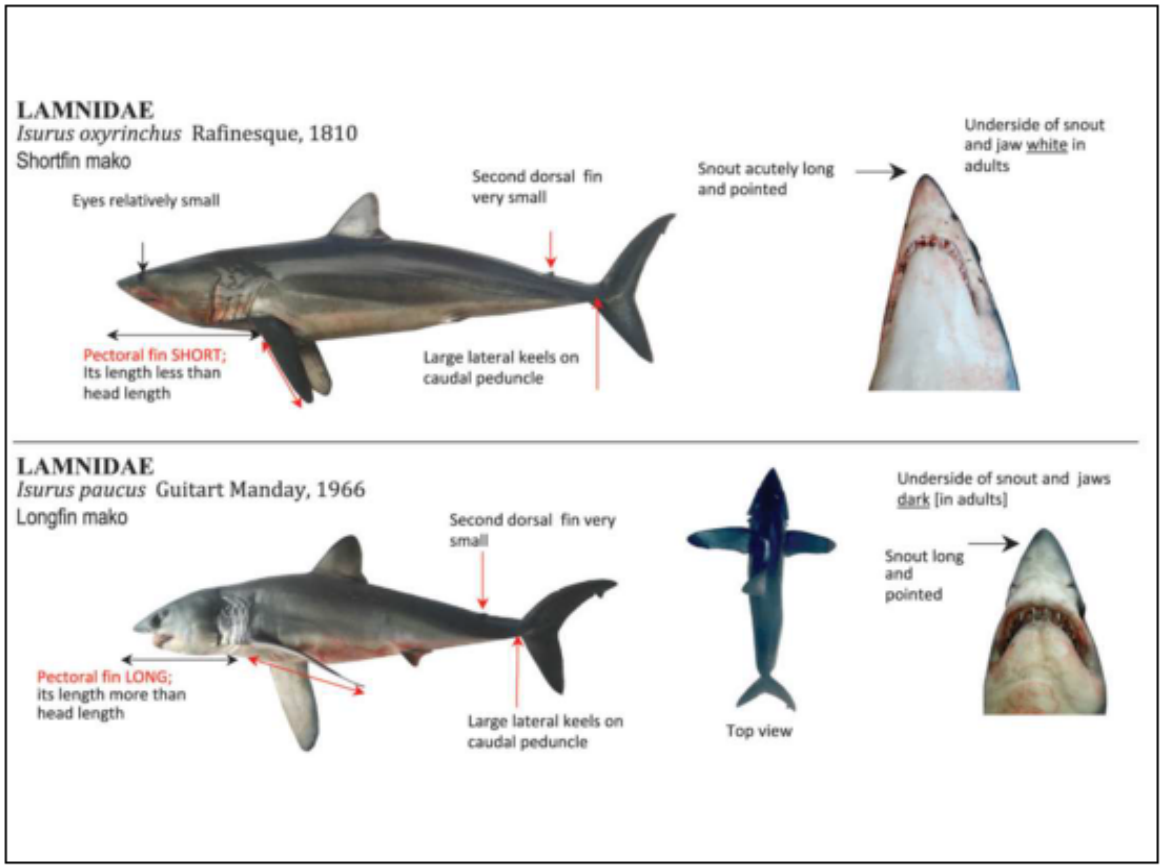

CARCHARHINIDAE
Carcharhinus limbatus (Müller and Henle, 1839)
Common blacktip shark
First dorsal fin with pointed/very narrowly rounded apex
Interdorsal ridge absent
Inner margin less than twice fin height
Gill slits moderately long
Pectoral fin falcate; with a persistent black spot
First dorsal fin origin just in front of pectoral fin free rear tip
Snout long, tip narrowly rounded to pointed
Upper labial furrows short, barely noticeable
* Tips of dorsals, anal, pectorals and the lower lobe of caudal fin usually black or dusky in young individuals; markings fades with growth
CARCHARHINIDAE
Carcharhinus melanopterus (Quoy & Gaimard, 1824)
Blacktip reef shark
First dorsal fin with prominent black tip with light band below
Interdorsal ridge absent
Gill slits short
First dorsal fin origin well behind pectoral fin free rear tip
Snout short and bluntly rounded
Labial furrows short, barely noticeable
*Pectoral & lower caudal fins with distinct black tips (other fins smaller black tip)

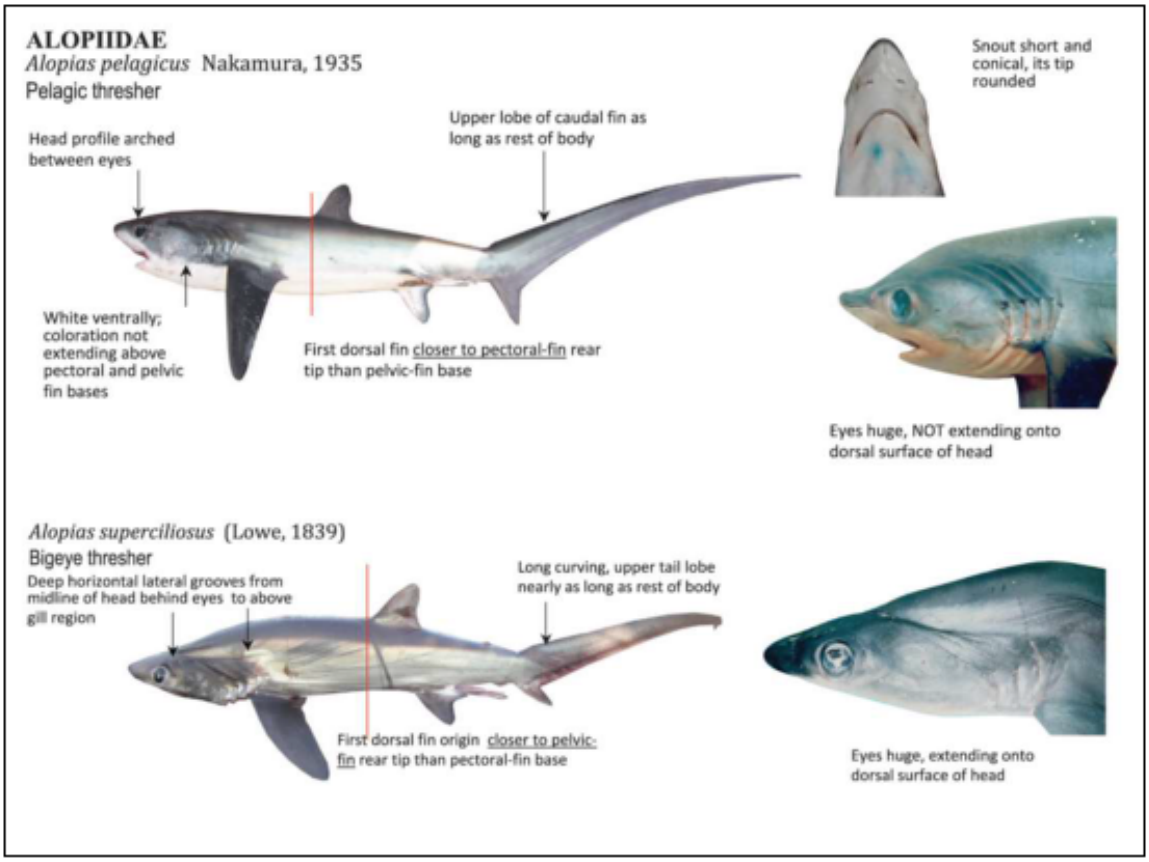

CARCHARHINIDAE
Carcharhinus sorrah (Müller and Henle, 1839)
Spottail shark
First dorsal fin origin more or less over pectoral fin free rear tip
Interdorsal ridge present
Gill slits short
Second dorsal fin origin slightly over anal fin origin
Second dorsal inner margin long, twice fin height (free rear tip sometimes black)
Snout long and moderately
Labial furrows short, barely noticeable
*Pectoral, second dorsal and lower caudal fin lobe with conspicuous black tips
CARCHARHINIDAE
Prionace glauca (Linnaeus, 1758)
Blue shark
First dorsal fin well posterior to free rear tips of pectoral fins
Upper surface indigo blue
Interdorsal ridge absent
Gill slits short
Pectoral fins long and narrow
Weak keel present on sides of caudal peduncle
Snout very long and narrowly rounded
Labial furrows very small, confined to mouth corners

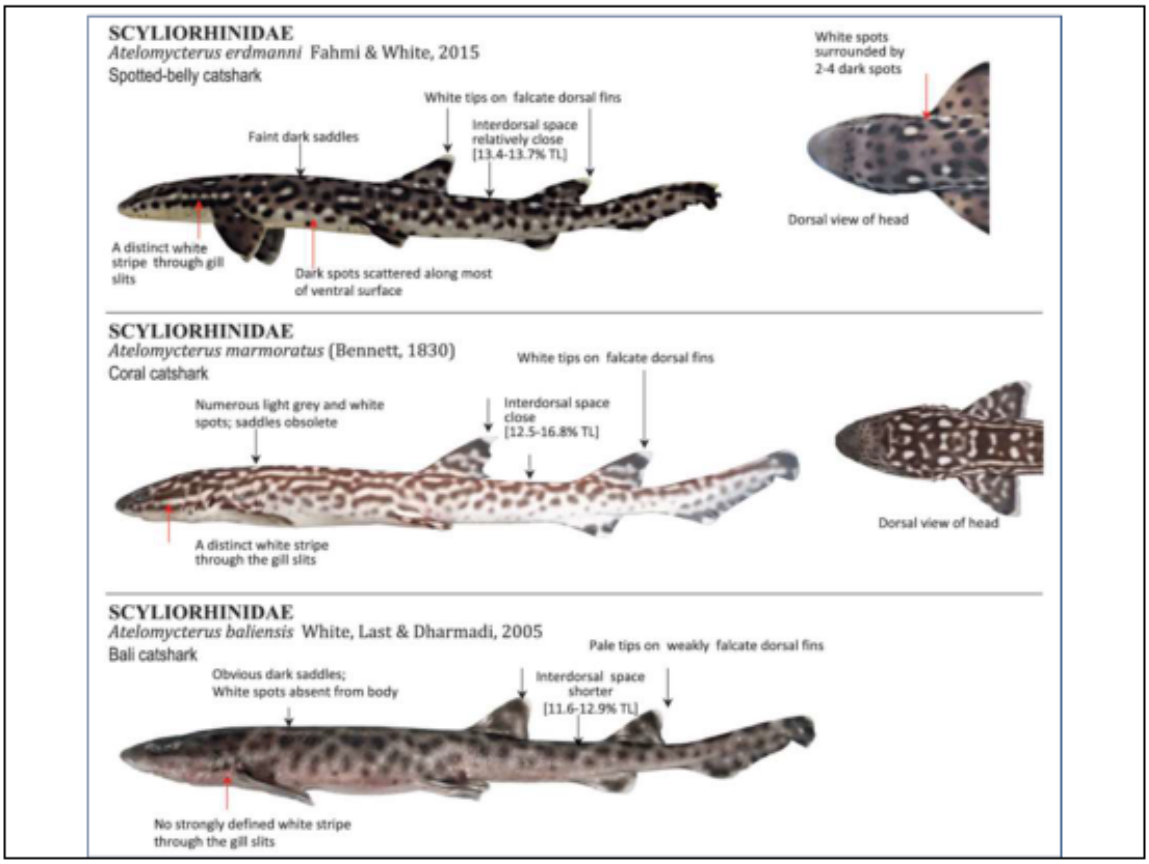

CARCHARHINIDAE
Triaenodon obesus (Rüppell, 1837)
Whitetip reef shark
First dorsal fin with distinctive white tips
Interdorsal ridge absent
Second dorsal fin large, about half to three quarters height of first dorsal fin
Upper lobe caudal fin with distinctive white tips
Snout very short; broadly rounded
CARCHARHINIDAE
Galeocerdo cuvier (Peron & Lesueur, 1822)
Tiger shark
Dark vertical bars on sides (less distinct in adults)
Caudal peduncle with a low, rounded lateral keel
Upper labial furrows very long
Snout very short and bluntly rounded

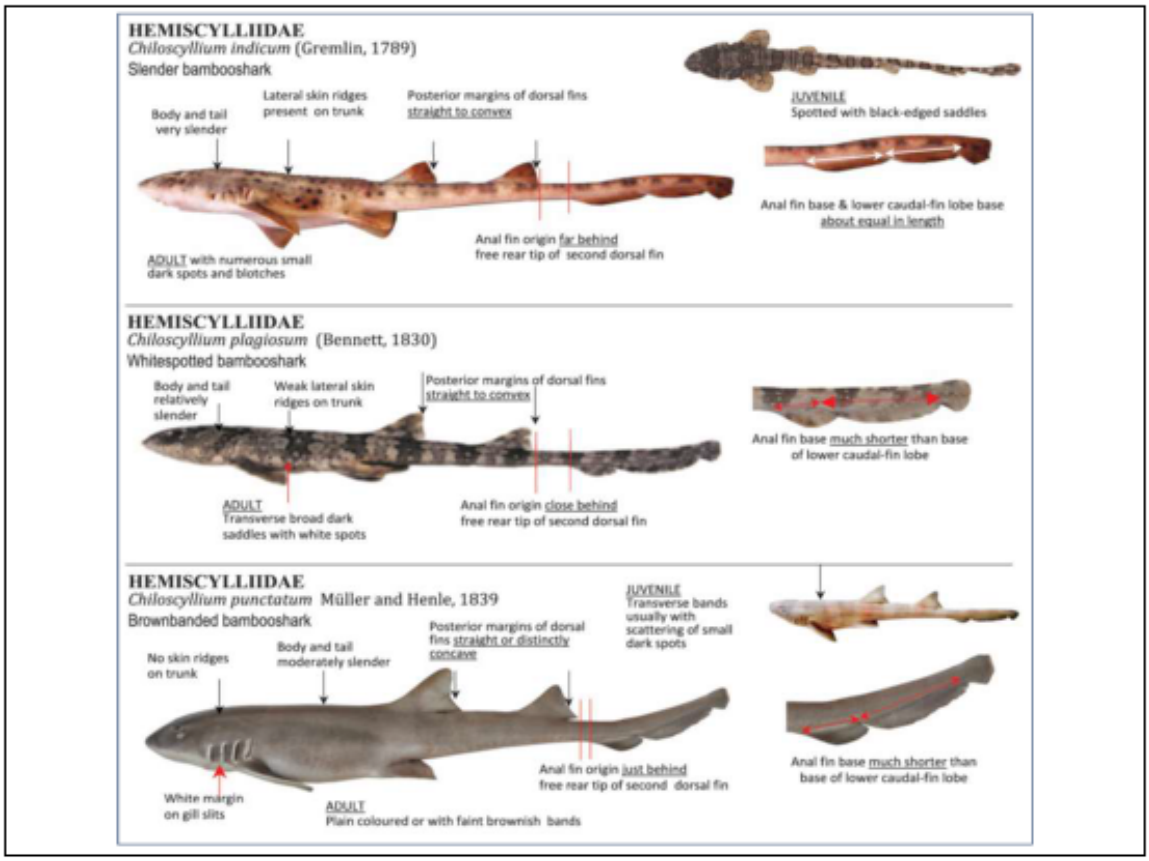

CARCHARHINIDAE
Carcharhinus longimanus (Poey, 1861)
Oceanic whitetip shark
First dorsal fin large with a very broadly rounded apex
Interdorsal ridge present
Black or dusky saddle-marks in front of second dorsal fin, pelvic fin and anal fin for juvenile
Snout short and broad
Gill slits short
Tips of first dorsal fin, pectoral fins and lower lobe of caudal fin often white or with white spots (sometimes absent)
CARCHARHINIDAE
Loxodon macrorhinus Müller and Henle, 1839
Sliteye shark
First dorsal fin origin well behind pectoral fin free rear tips
Second dorsal fin origin over anal fin insertion
Eyes large with distinct notch
Snout very long, parabolic and narrow
Eyes large
Preanal ridges very long [equal to anal fin base length]
Small inconspicuous labial furrow

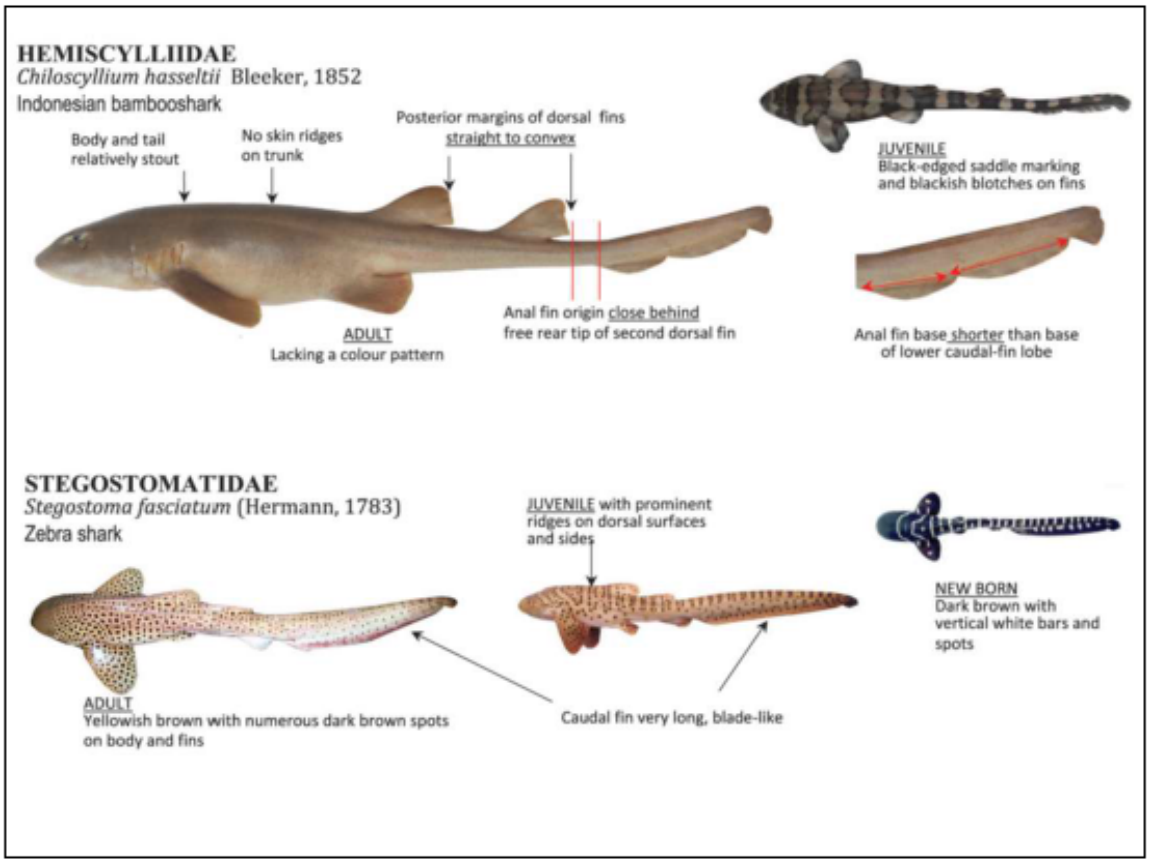

SPHYRNIDAE
Sphyrna lewini (Griffith & Smith, 1834)
Scalloped hammerhead
First dorsal fin tall, moderately falcate
Second dorsal fin short with long rear tip; weakly concave posterior margin
Anterior margin of head arched, barely indented at midline
Pelvic fin posterior margin straight
SPHYRNIDAE
Sphyrna mokarran (Rüppell, 1837)
Great hammerhead
First dorsal fin very tall, strongly falcate (in adults)
Second dorsal fin short with short rear tip; strongly concave posterior margin
Anterior margin of head nearly straight, shallowly indented at midline
Pelvic fin posterior margin concave
SPHYRNIDAE
Eusphyra blochii (Cuvier, 1816)
Winghead shark
First dorsal fin very tall, strongly falcate
Head extremely broad, wing-shaped, its width about half of total length
Ventral side of head

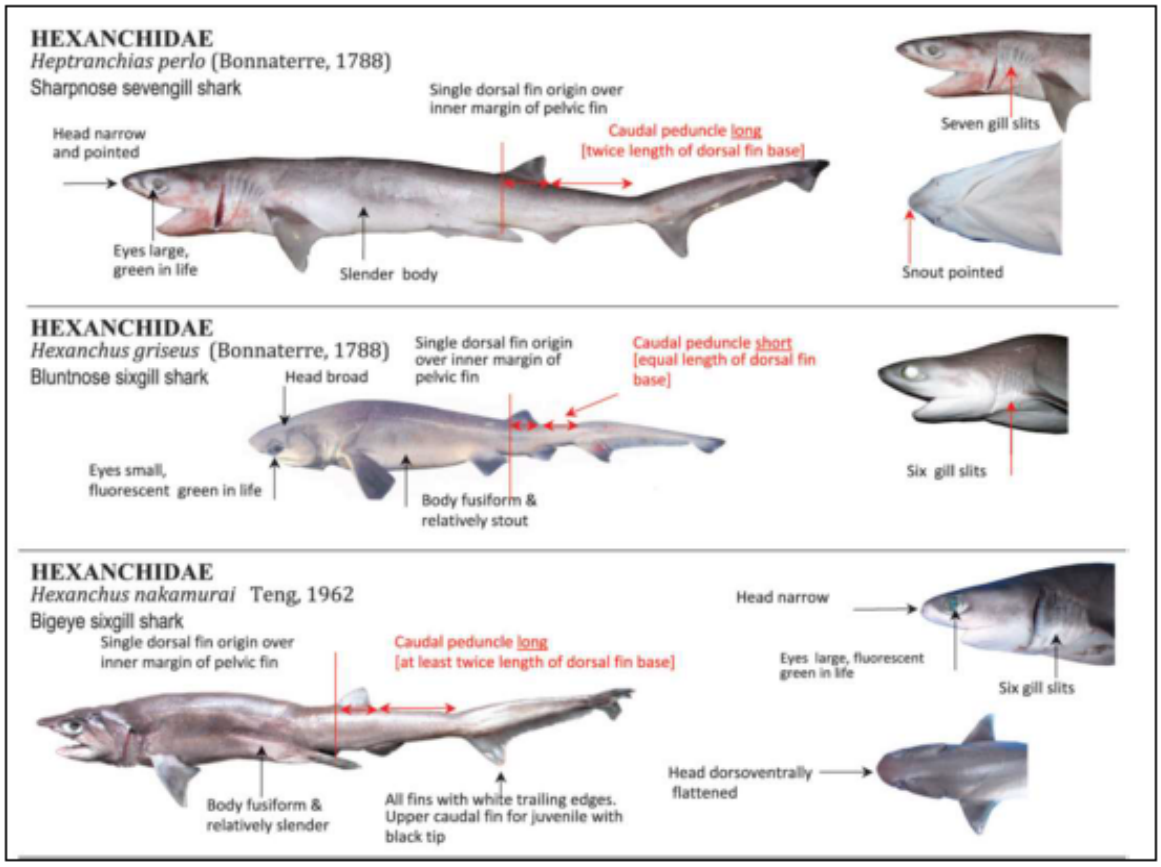

LAMNIDAE
Isurus oxyrinchus Rafinesque, 1810
Shortfin mako
Eyes relatively small
Second dorsal fin very small
Snout acutely long and pointed
Underside of snout and jaw white in adults
Pectoral fin SHORT; Its length less than head length
Large lateral keels on caudal peduncle
LAMNIDAE
Isurus paucus Guitart Manday, 1966
Longfin mako
Second dorsal fin very small
Underside of snout and jaws dark [in adults]
Snout long and pointed
Pectoral fin LONG; its length more than head length
Large lateral keels on caudal peduncle
Top view


ALOPIIDAE
Alopias pelagicus Nakamura, 1935
Pelagic thresher
Head profile arched between eyes
Upper lobe of caudal fin as long as rest of body
Snout short and conical, its tip rounded
White ventrally; coloration not extending above pectoral and pelvic fin bases
First dorsal fin closer to pectoral-fin rear tip than pelvic-fin base
Eyes huge, NOT extending onto dorsal surface of head
Alopias superciliosus (Lowe, 1839)
Bigeye thresher
Deep horizontal lateral grooves from midline of head behind eyes to above gill region
Long curving, upper tail lobe nearly as long as rest of body
First dorsal fin origin closer to pelvic-fin rear tip than pectoral-fin base
Eyes huge, extending onto dorsal surface of head


SCYLIORHINIDAE
Atelomycterus erdmanni Fahmi & White, 2015
Spotted-belly catshark
White spots surrounded by 2-4 dark spots
White tips on falcate dorsal fins
Faint dark saddles
Interdorsal space relatively close [13.4-13.7% TL]
Dorsal view of head
A distinct white stripe through gill slits
Dark spots scattered along most of ventral surface
SCYLIORHINIDAE
Atelomycterus marmoratus (Bennett, 1830)
Coral catshark
White tips on falcate dorsal fins
Numerous light grey and white spots; saddles obsolete
Interdorsal space close [12.5-16.8% TL]
Dorsal view of head
A distinct white stripe through the gill slits
SCYLIORHINIDAE
Atelomycterus baliensis White, Last & Dharmadi, 2005
Bali catshark
Pale tips on weakly falcate dorsal fins
Obvious dark saddles; White spots absent from body
Interdorsal space shorter [11.6-12.9% TL]
No strongly defined white stripe through the gill slits


HEMISCYLLIIDAE
Chiloscyllium indicum (Gremlin, 1789)
Slender bambooshark
Body and tail very slender
Lateral skin ridges present on trunk
Posterior margins of dorsal fins straight to convex
ADULT with numerous small dark spots and blotches
Anal fin origin far behind free rear tip of second dorsal fin
JUVENILE
Spotted with black-edged saddles
Anal fin base & lower caudal-fin lobe base about equal in length
HEMISCYLLIIDAE
Chiloscyllium plagiosum (Bennett, 1830)
Whitespotted bambooshark
Body and tail relatively slender
Weak lateral skin ridges on trunk
Posterior margins of dorsal fins straight to convex
ADULT
Transverse broad dark saddles with white spots
Anal fin origin close behind free rear tip of second dorsal fin
Anal fin base much shorter than base of lower caudal-fin lobe
HEMISCYLLIIDAE
Chiloscyllium punctatum Müller and Henle, 1839
Brownbanded bambooshark
No skin ridges on trunk
Body and tail moderately slender
Posterior margins of dorsal fins straight or distinctly concave
White margin on gill slits
ADULT
Plain coloured or with faint brownish bands
Anal fin origin just behind free rear tip of second dorsal fin
JUVENILE
Transverse bands usually with scattering of small dark spots
Anal fin base much shorter than base of lower caudal-fin lobe


HEMISCYLLIIDAE
Chiloscyllium hasseltii Bleeker, 1852
Indonesian bambooshark
Body and tail relatively stout
No skin ridges on trunk
Posterior margins of dorsal fins straight to convex
ADULT
Lacking a colour pattern
Anal fin origin close behind free rear tip of second dorsal fin
JUVENILE
Black-edged saddle marking and blackish blotches on fins
Anal fin base shorter than base of lower caudal-fin lobe
STEGOSTOMATIDAE
Stegostoma fasciatum (Hermann, 1783)
Zebra shark
ADULT
Yellowish brown with numerous dark brown spots on body and fins
JUVENILE with prominent ridges on dorsal surfaces and sides
Caudal fin very long, blade-like
NEW BORN
Dark brown with vertical white bars and spots


HEXANCHIDAE
Heptranchias perlo (Bonnaterre, 1788)
Sharpnose sevengill shark
Single dorsal fin origin over inner margin of pelvic fin
Caudal peduncle long [twice length of dorsal fin base]
Head narrow and pointed
Eyes large, green in life
Slender body
Seven gill slits
Snout pointed
HEXANCHIDAE
Hexanchus griseus (Bonnaterre, 1788)
Bluntnose sixgill shark
Head broad
Single dorsal fin origin over inner margin of pelvic fin
Caudal peduncle short [equal length of dorsal fin base]
Eyes small, fluorescent green in life
Body fusiform & relatively stout
Six gill slits
HEXANCHIDAE
Hexanchus nakamurai Teng, 1962
Bigeye sixgill shark
Single dorsal fin origin over inner margin of pelvic fin
Caudal peduncle long [at least twice length of dorsal fin base]
Body fusiform & relatively slender
All fins with white trailing edges. Upper caudal fin for juvenile with black tip
Head narrow
Eyes large, fluorescent green in life
Six gill slits
Head dorsoventrally flattened

Thank you

Module 3:
How to Identify Rays

Rays which better known in scientific circles as "batoid fishes" are the largest subgroup of chondricthyan fises. Presently comprise 26 families and 633 valid name species. Rays vary in dimension from ~25 cm or so to more than 6.5 m. The body is mostly dorsoventrally flattened and usually modified into a disc formed by the complete or partial fusion of the pectoral fins with the head and trunk. Pectoral fins which are often greatly enlarge, join the head forward of the gill slits (Last et al. 2016).

Some aspects which important to indent rays are morphology, size, distribution, habitat, biology, fisheries. These are the main features by which a species can be most easily identified in the field. These characteristics include body shape, teeth shapes, fin positions, dimensions, and colour patterns. Generally morphology of ray consist of:

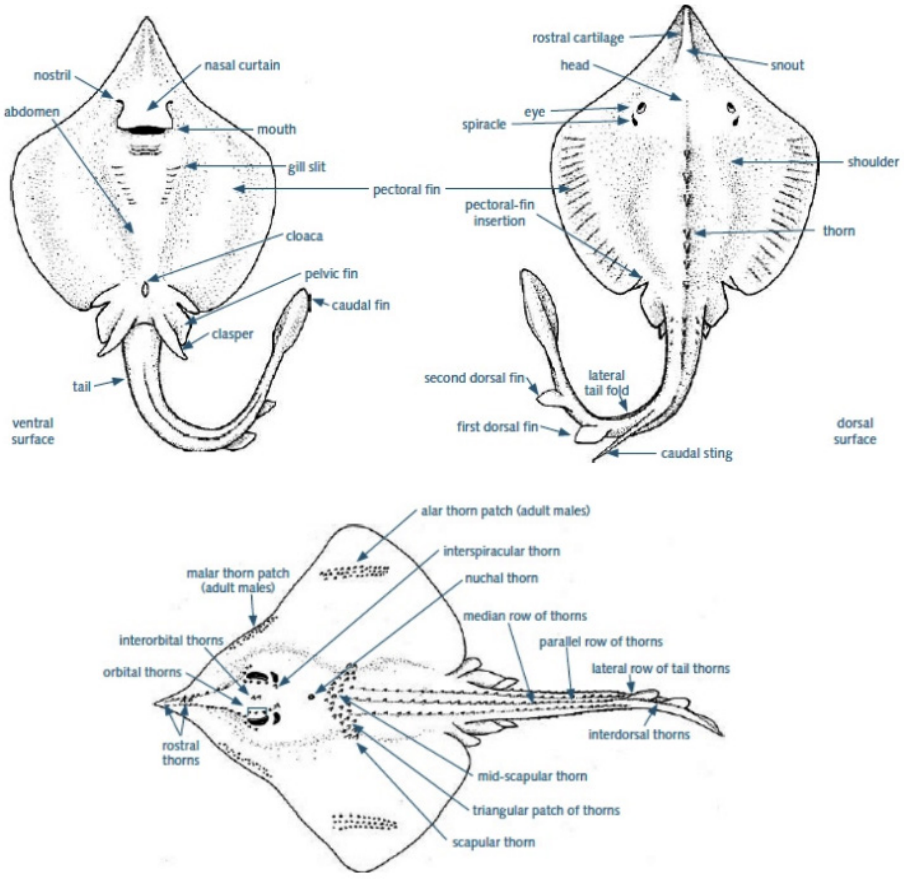


Figure 5. Ray morphology (Credit: Last et al.2016)

The body shape of rays also varies as below:

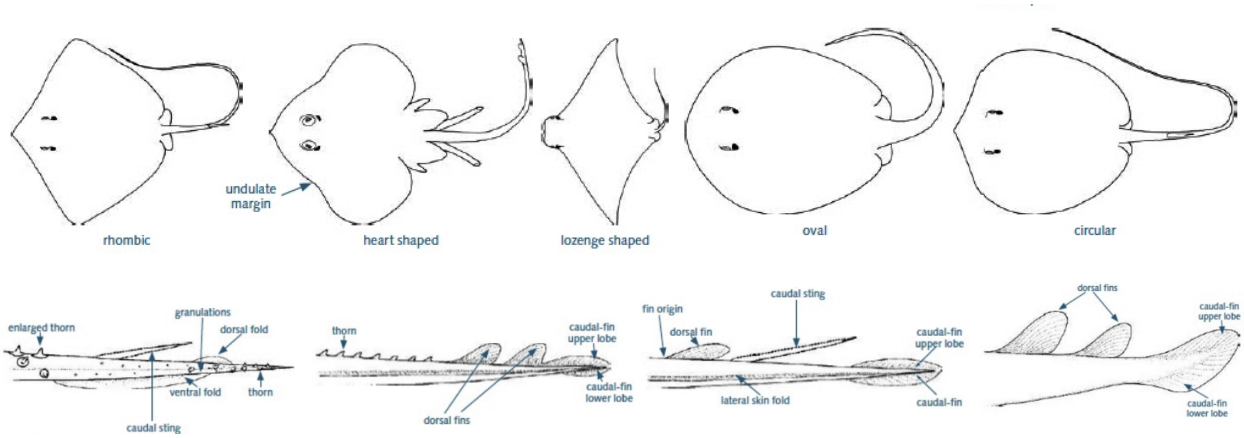


Figure 6. Disc shaped and tail characteristic (Credit: Last et al.2016)

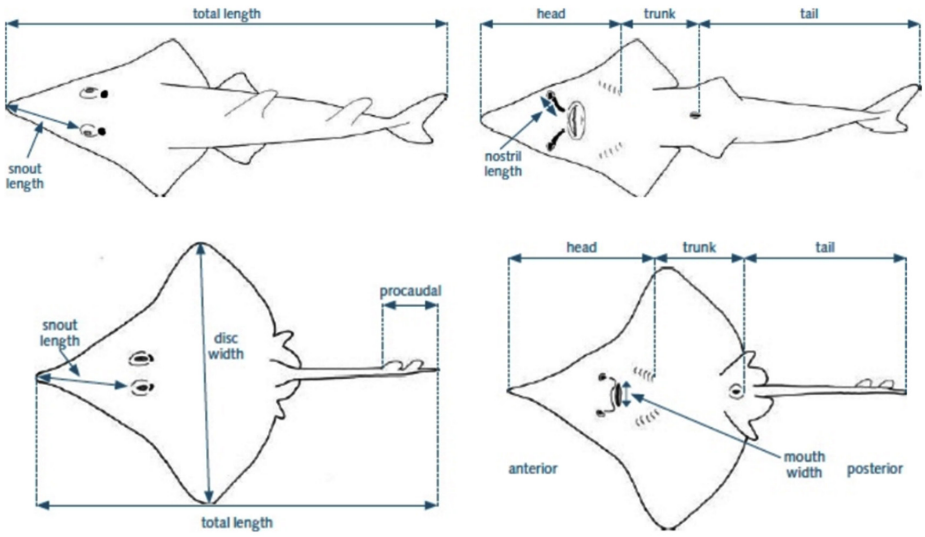
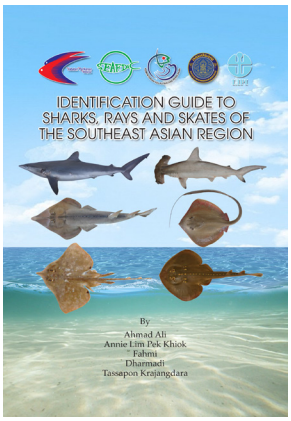
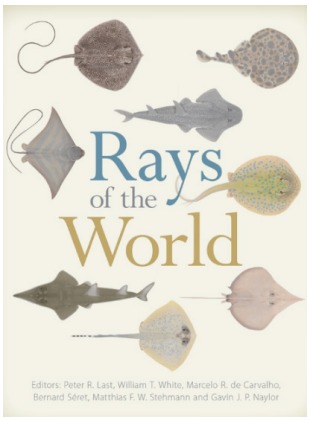


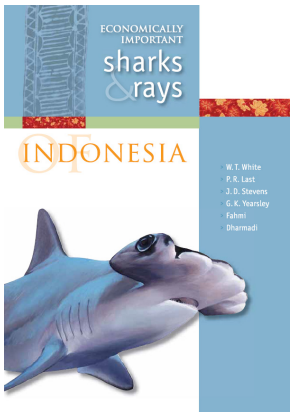
Figure 7. Body part of rays (Credit: Last et al.2016)

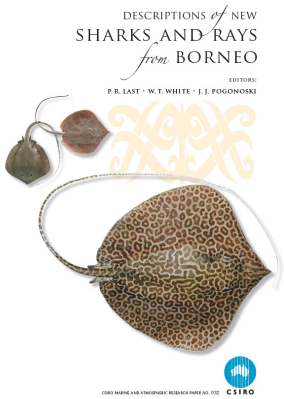
Identification Books

Identification book that used are:









Family of Rays

Pristidae/Sawfish

Snout modified into an elongate, flattened, saw-like blade with enlarged teeth along lateral margins

Anoxypristis cuspidata

Pristis clavata

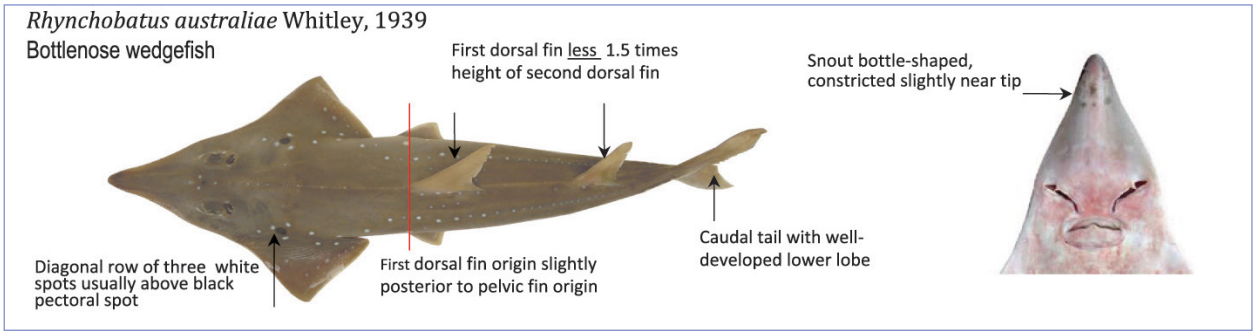
Pristis pristis

Pristis zijsron

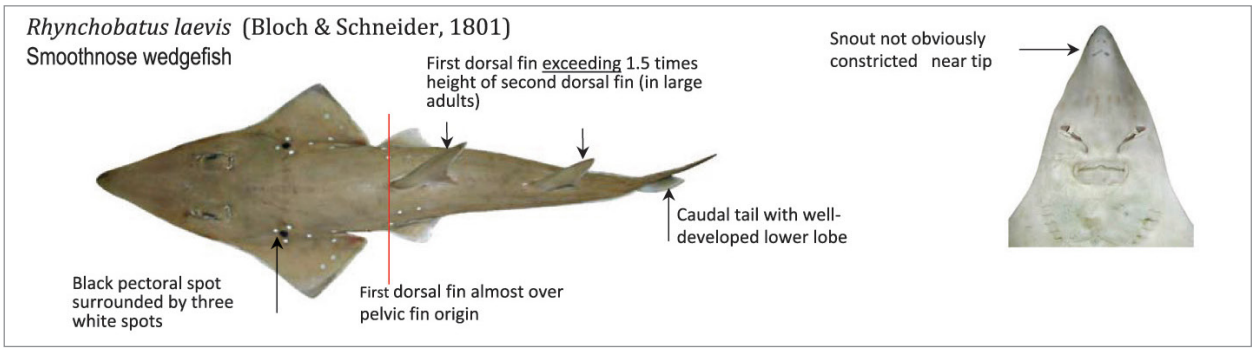
Credit: Last et al. 2016

Rhinidae/Wedgefish

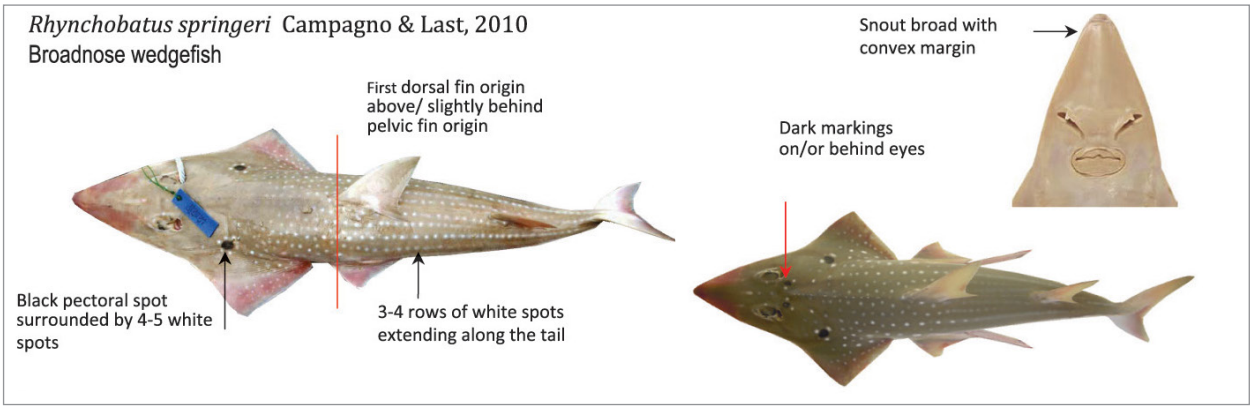
Snout varying from short to relatively long and either broadly rounded or acutely pointed.



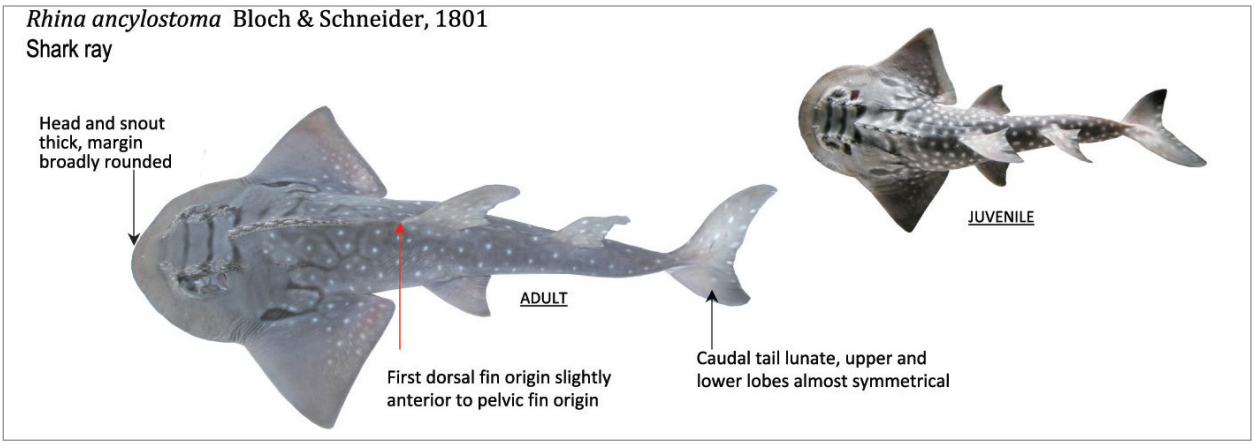
Credit: Ali et al. 2017



Credit: Ali et al. 2017



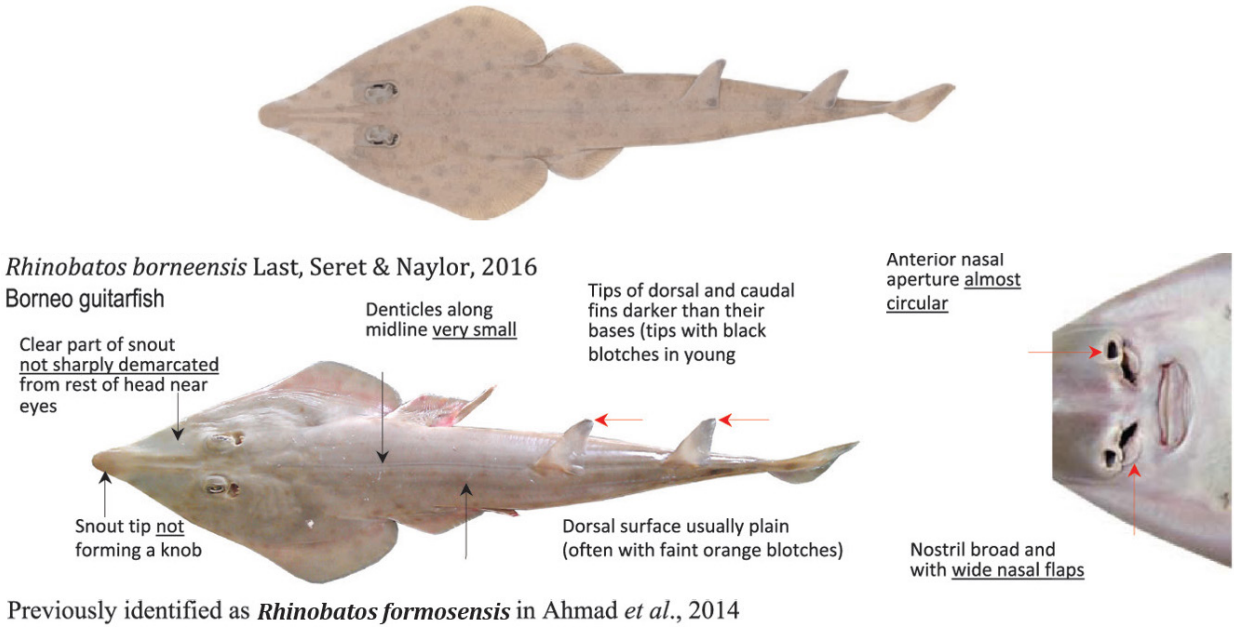
Credit: Ali et al. 2017



Credit: Ali et al. 2017

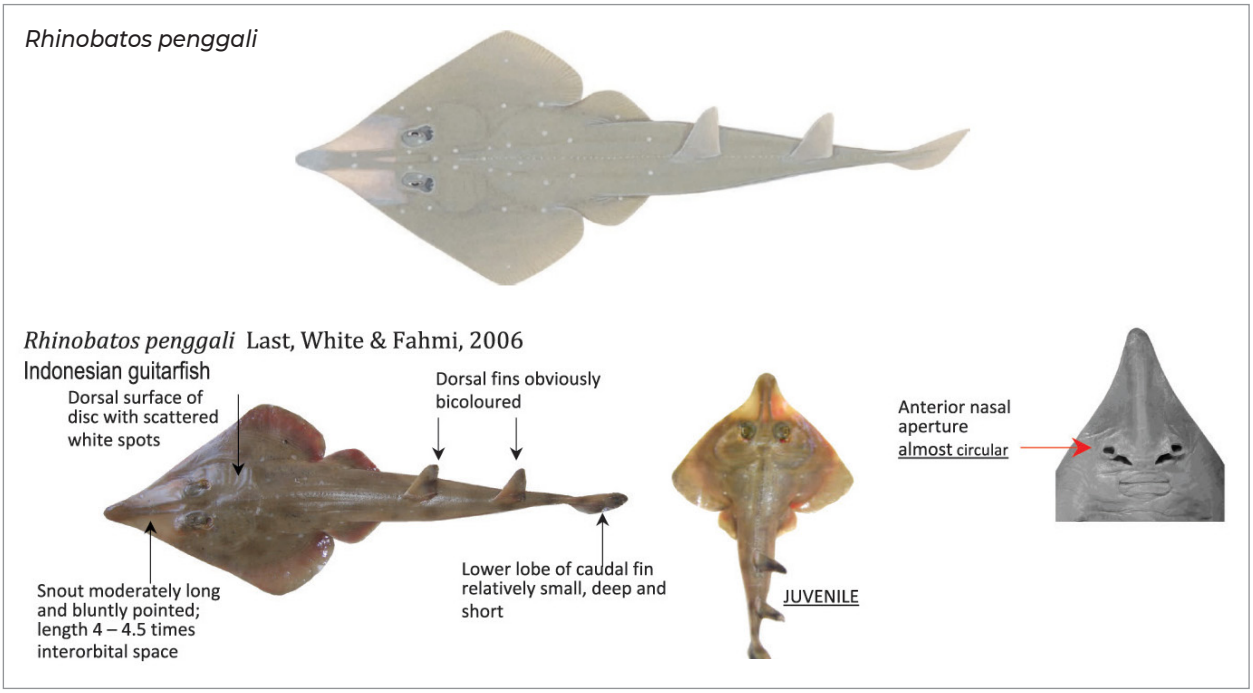
Rhinobatidae/Guitarfish

Rhinobatos borneensis



Credit: Last et al. 2016, Ali et al. 2017

Rhinobatos penggali



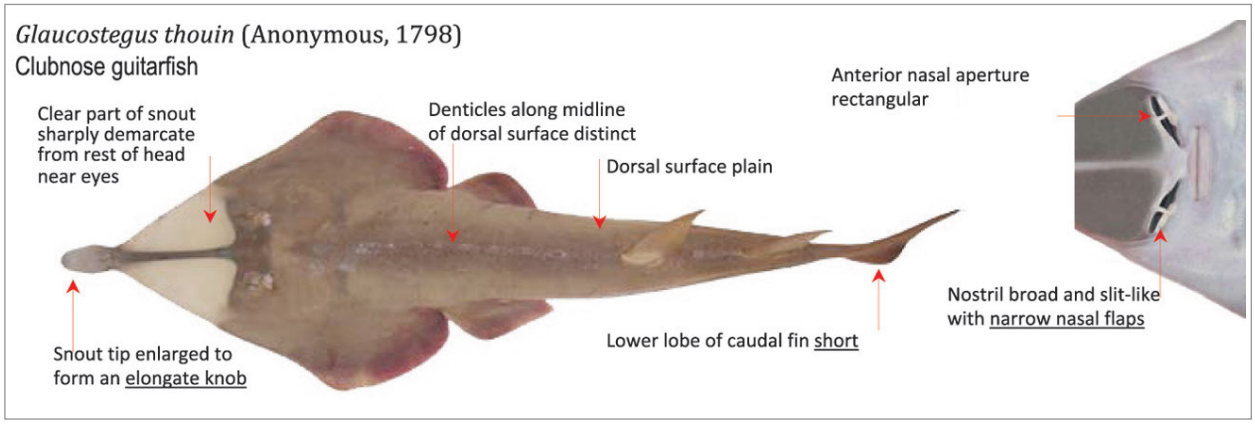
Credit: Last et al. 2016, Ali et al. 2017

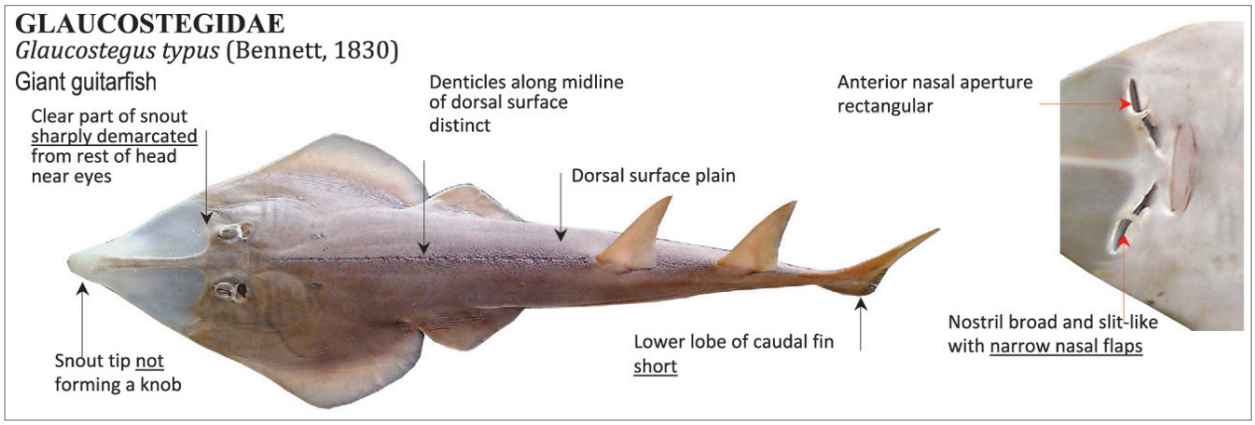
Rhinobatos sainsburyi

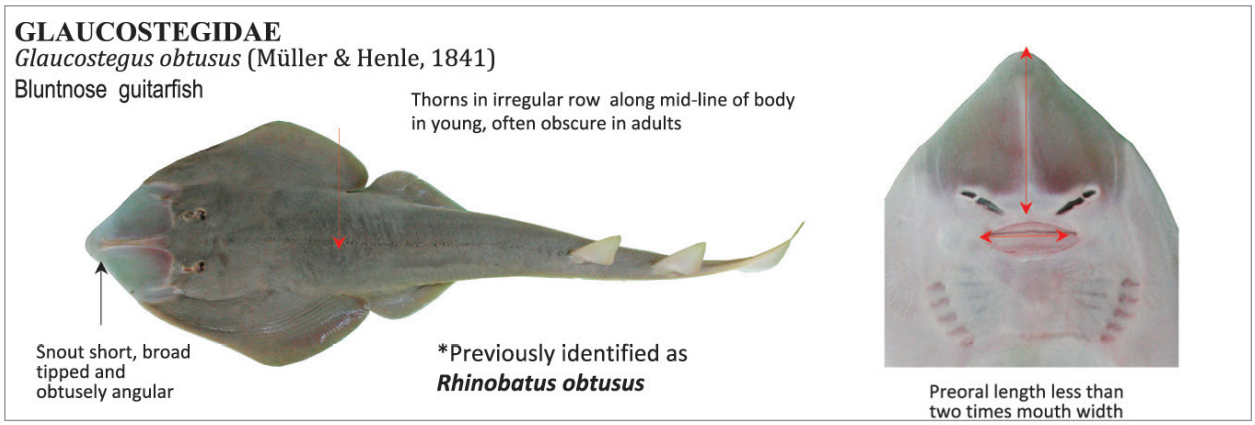
Rhinobatos whitei

Credit: Last et al. 2016

Glaucostegidae/ Giant-Guitarfish

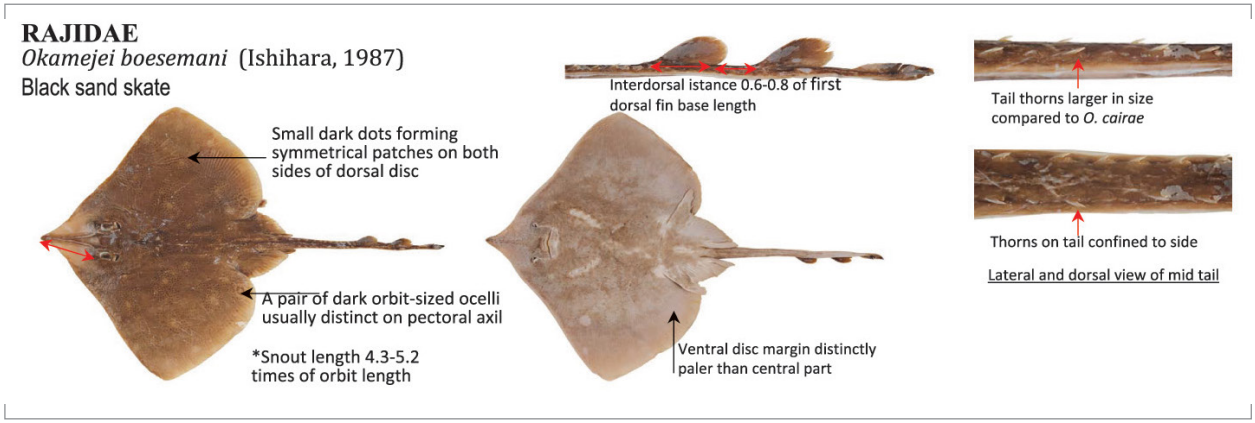


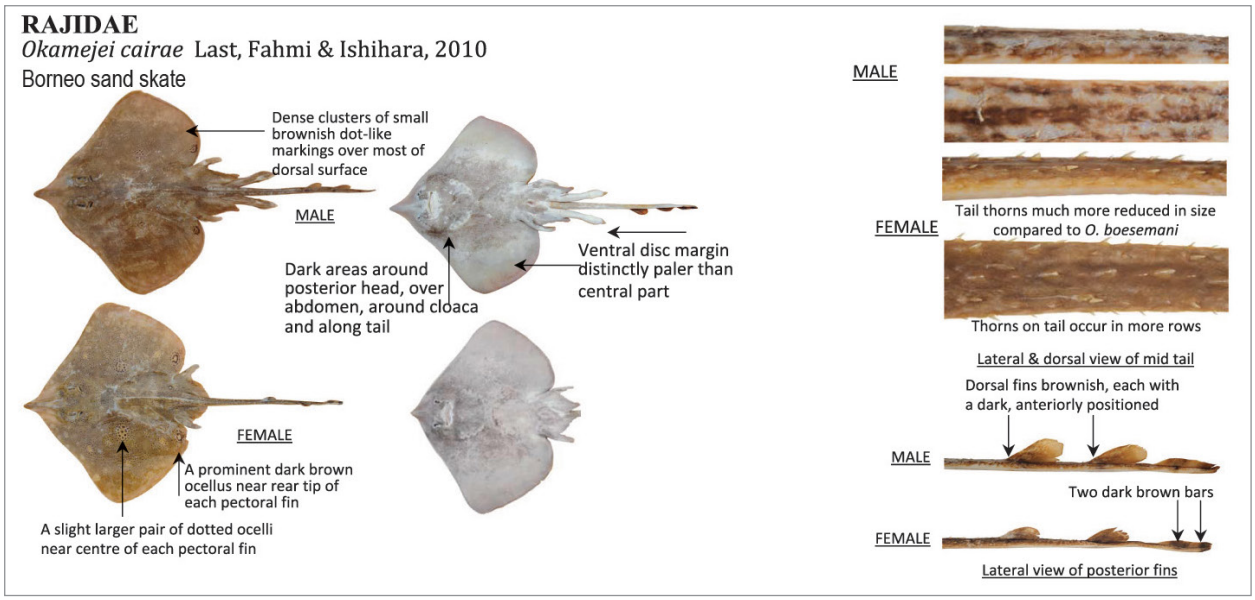


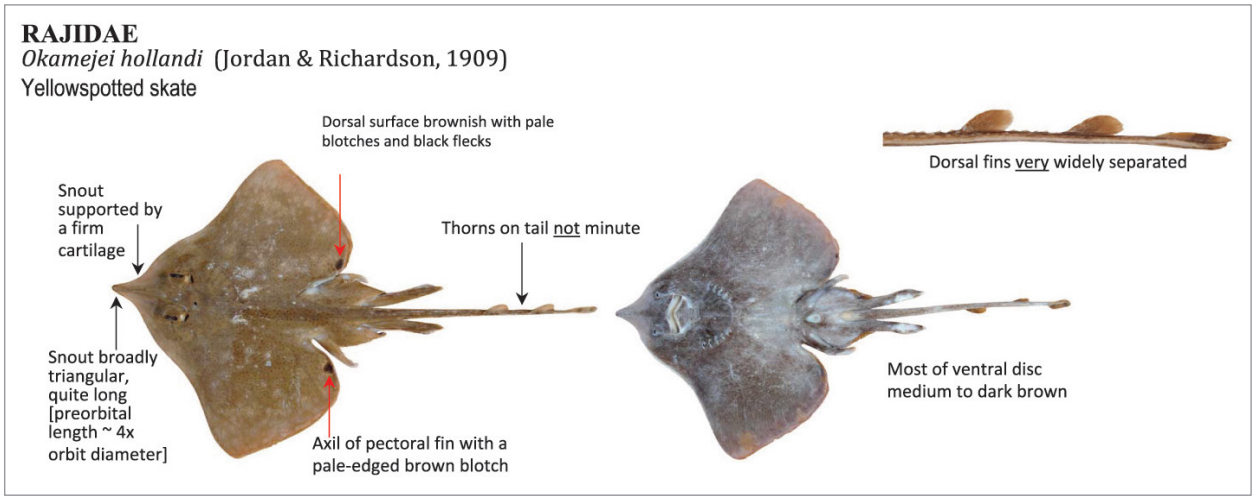


Credit: Ali et al. 2017

Rajidae/Skates

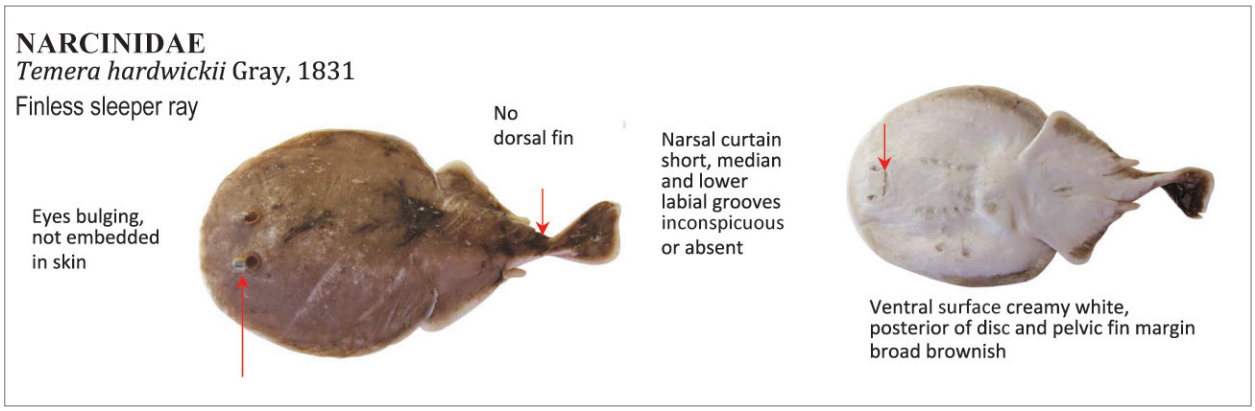






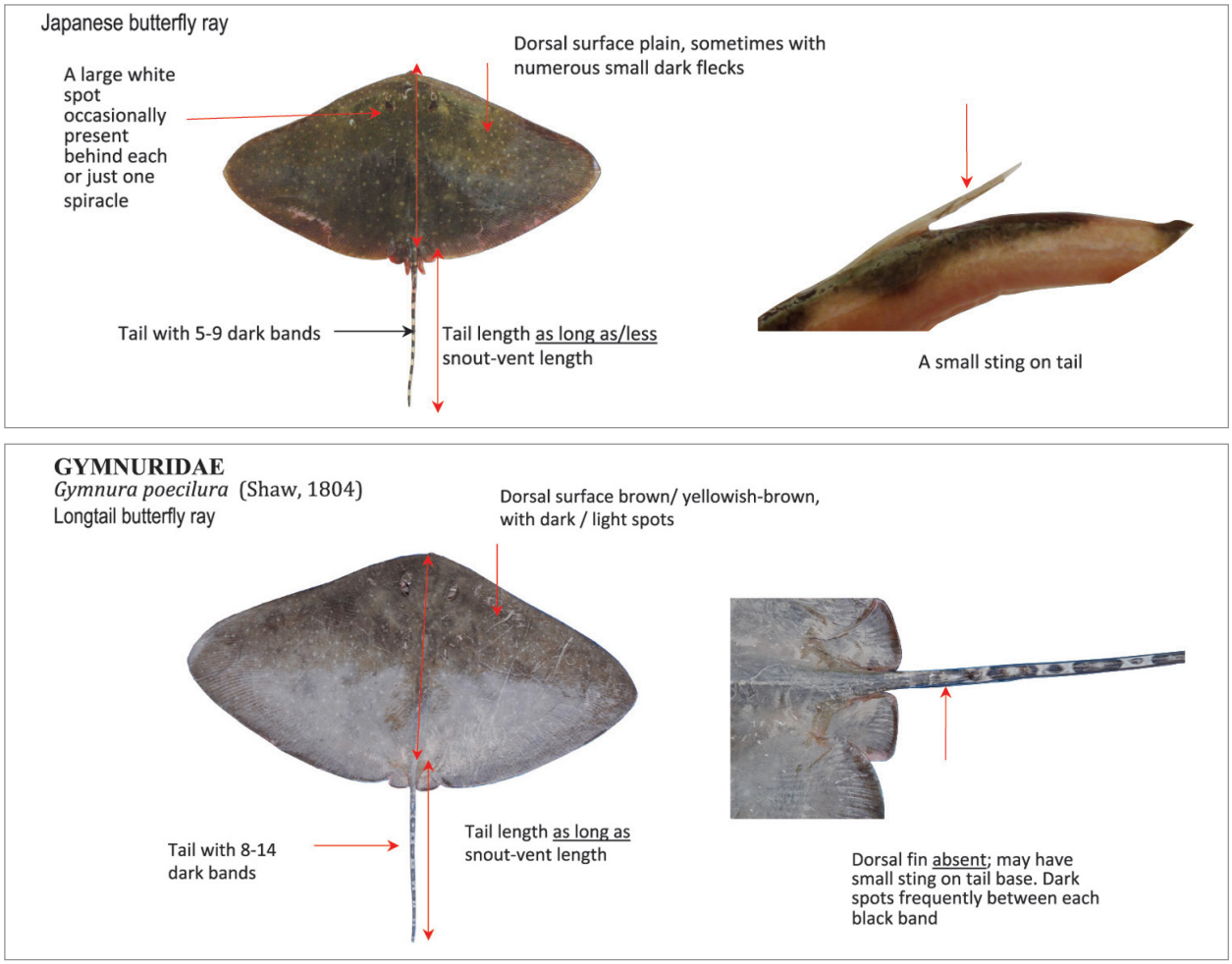
Credit: Last et al. 2017

Narcinidae/Numbfish



Credit: Ali et al. 2017

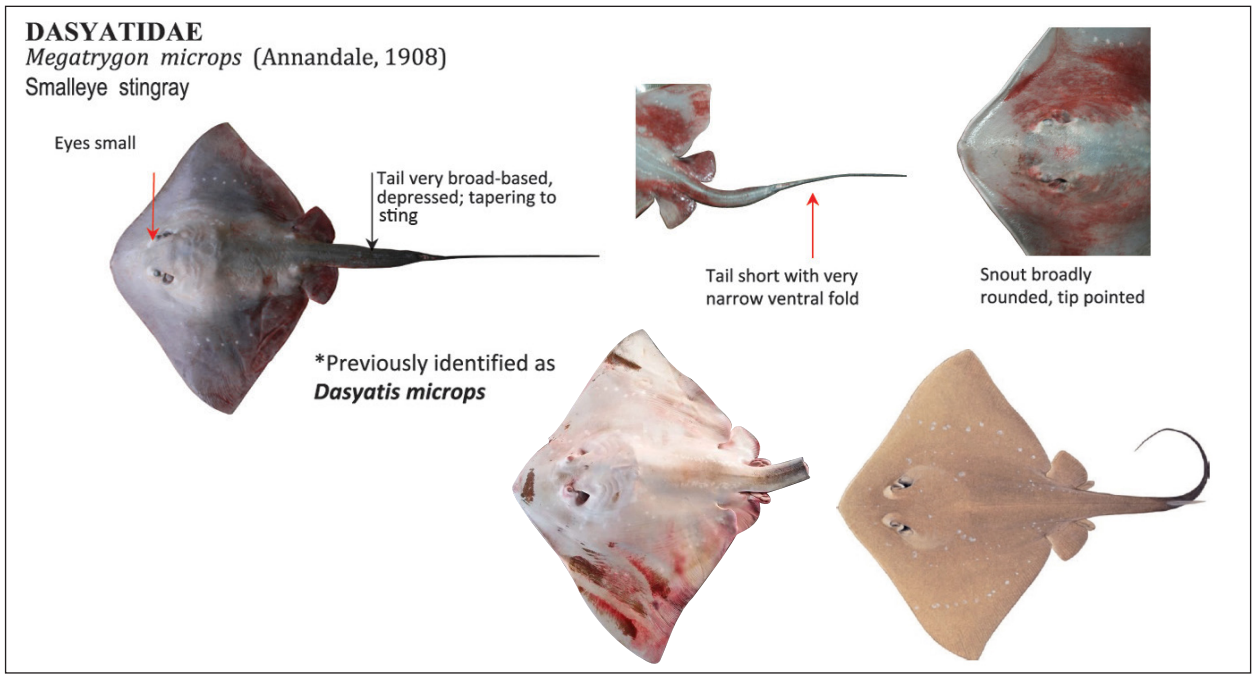
Narcinidae/Butterfly ray



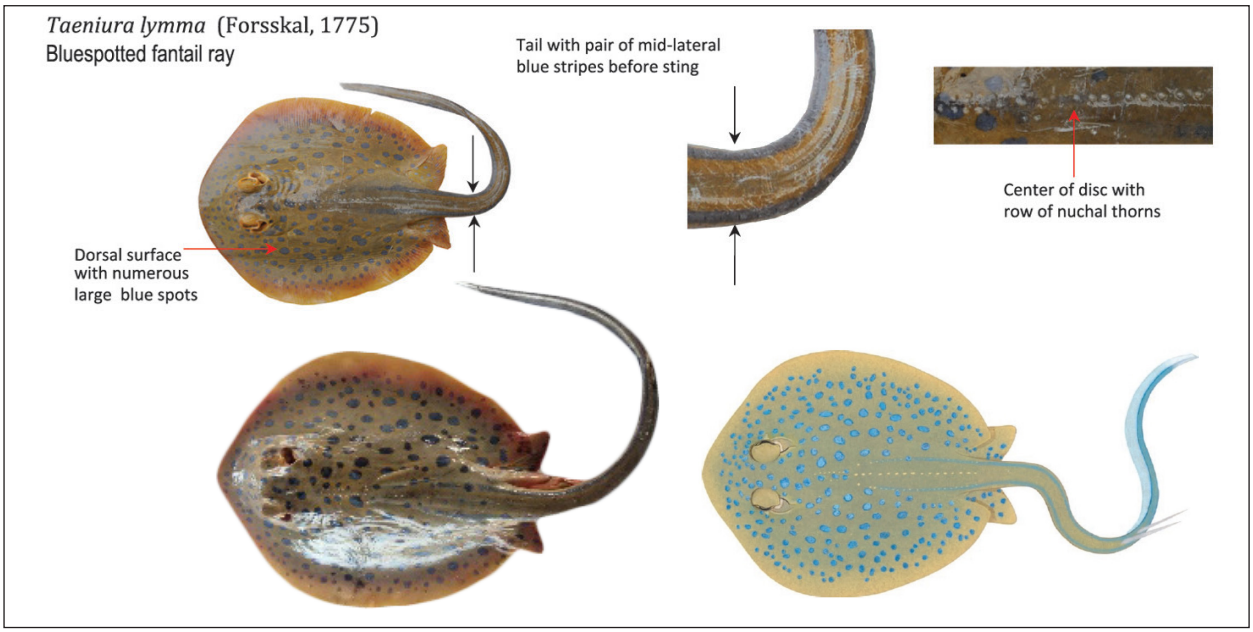
Credit: Ali et al. 2017

Dasyatidae/Stingray

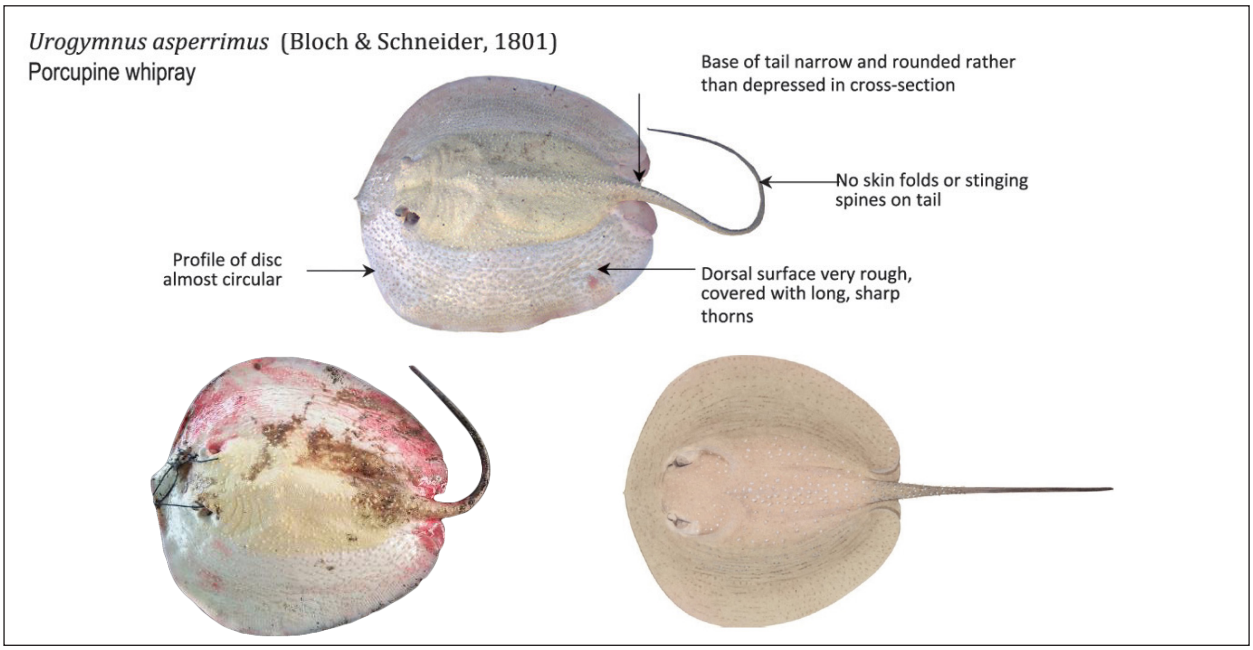
This family has been confirmed that the 2 largest genera (*Dasyatis* and *Himantura*) each consist of several genera. Presently this family contains of 19 genera. Example species are below:



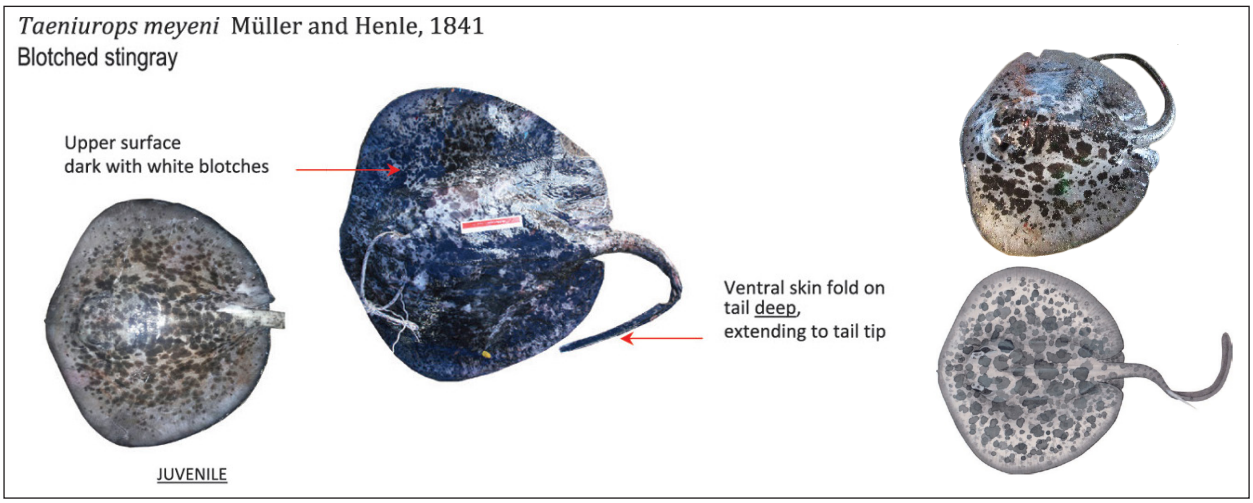
Credit: Ali et al. 2017, Last et al. 2016, Muhsin WCS-IP



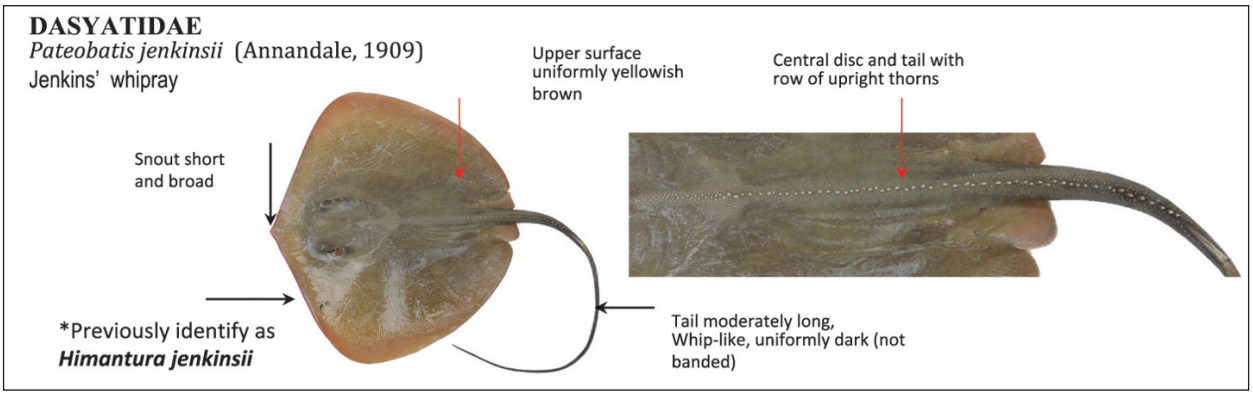
Credit: Ali et al. 2017, Last et al. 2016, Benaya WCS-IP

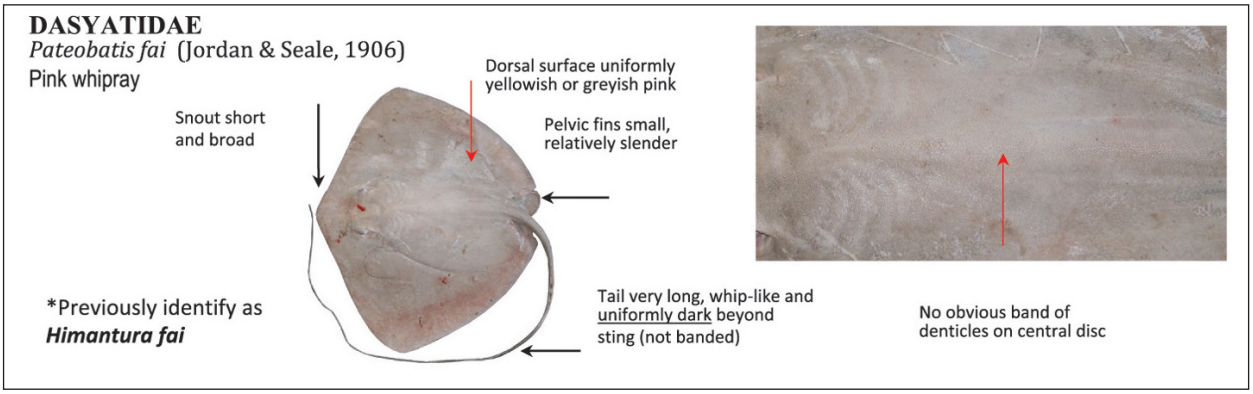


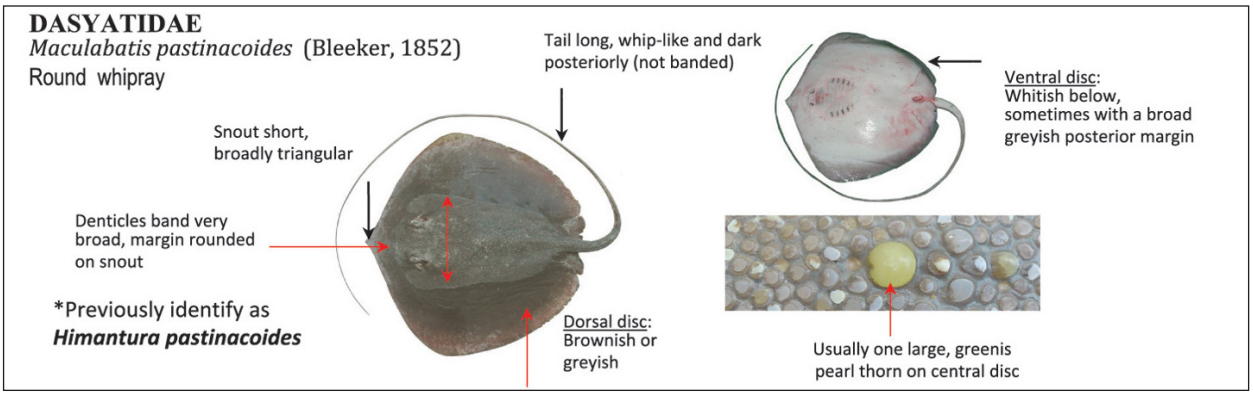
Credit : Ali et al. 2017, Last et al. 2016, Muhsin WCS-IP

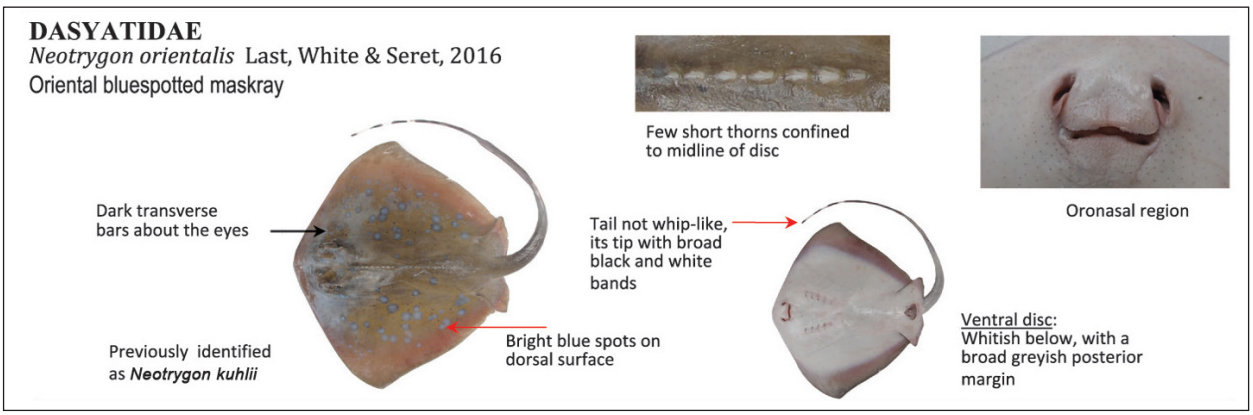


Credit : Ali et al. 2017, Last et al. 2016, Muhsin WCS-IP









Source : Ali et al. 2017

Look alike species of Dasyatidae

Neotrygon orientalis

Neotrygon kuhlii

Neotrygon caeruleopunctata

Neotrygon australiae

Himantura uarnak

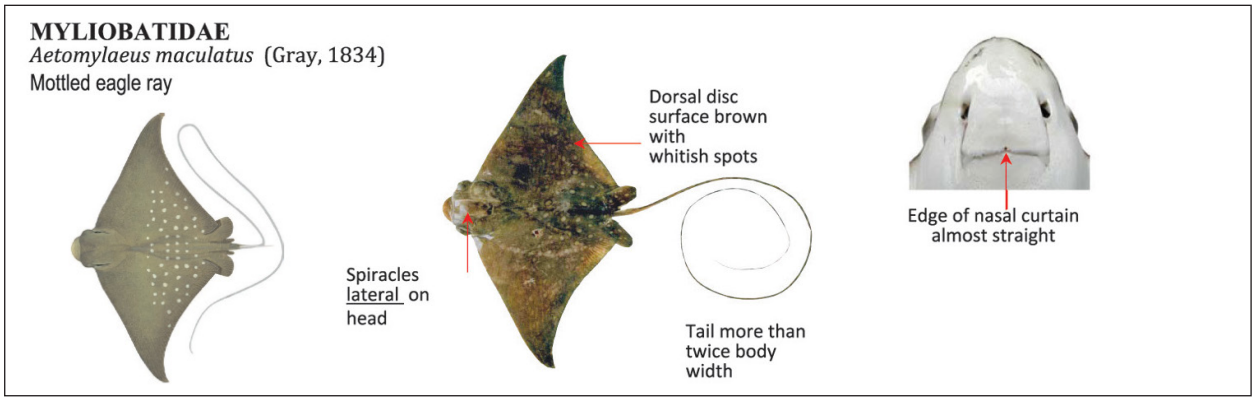
Himantura undulata

Himantura leoparda

Himantura australie

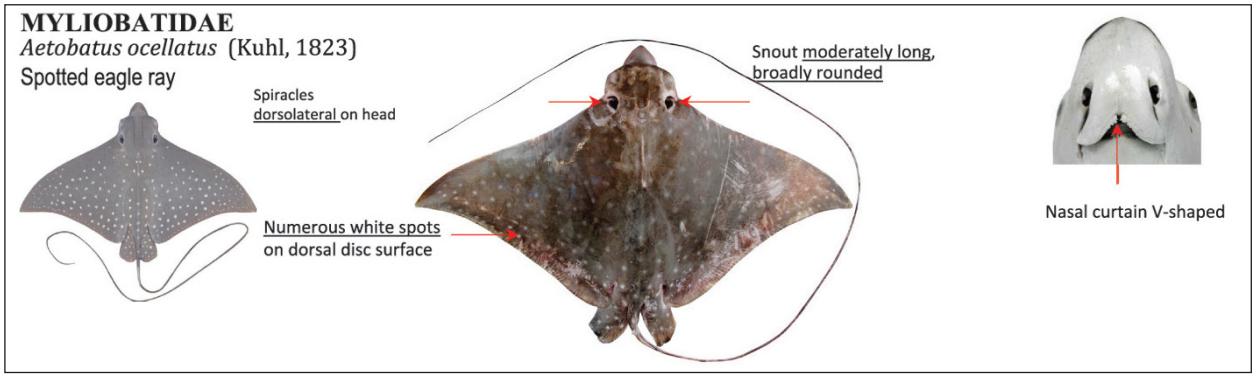
Credit: Last et al.2016

Myliobatidae/ Eagle Ray



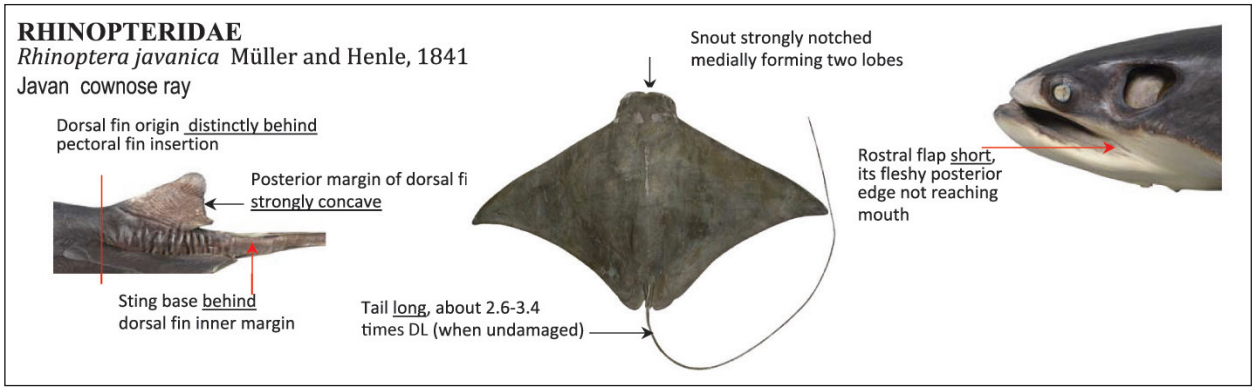
Credit : Ali et al. 2017, Last et al. 2016

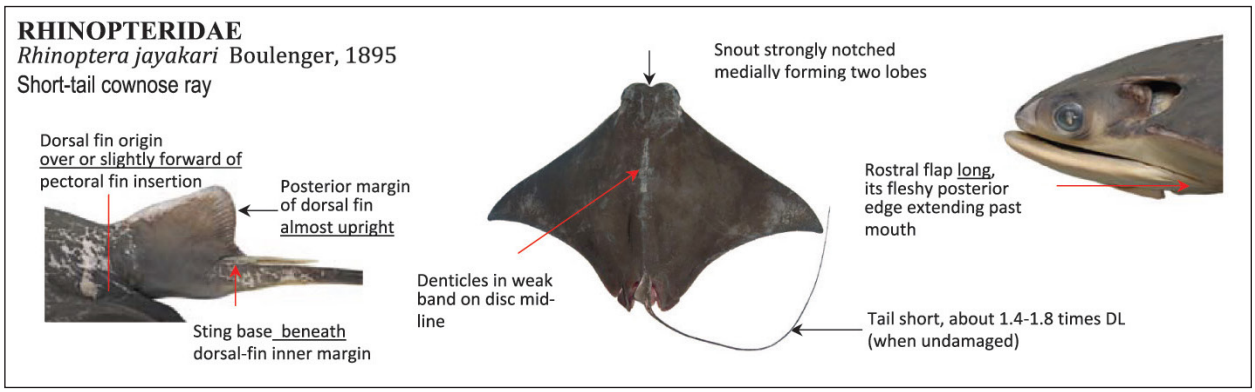
Aetobatidae/ Eagle Ray



Credit : Ali et al. 2017, Last et al. 2016

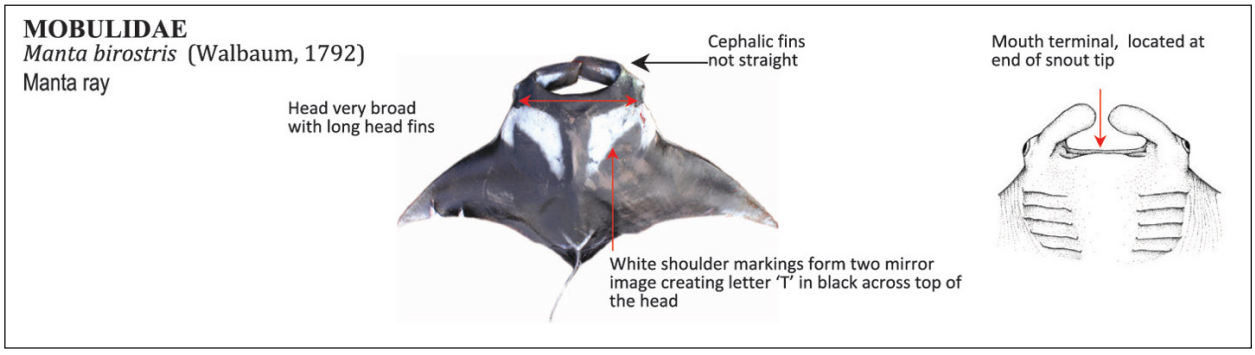
Rhinopteridae/ Cownose Ray

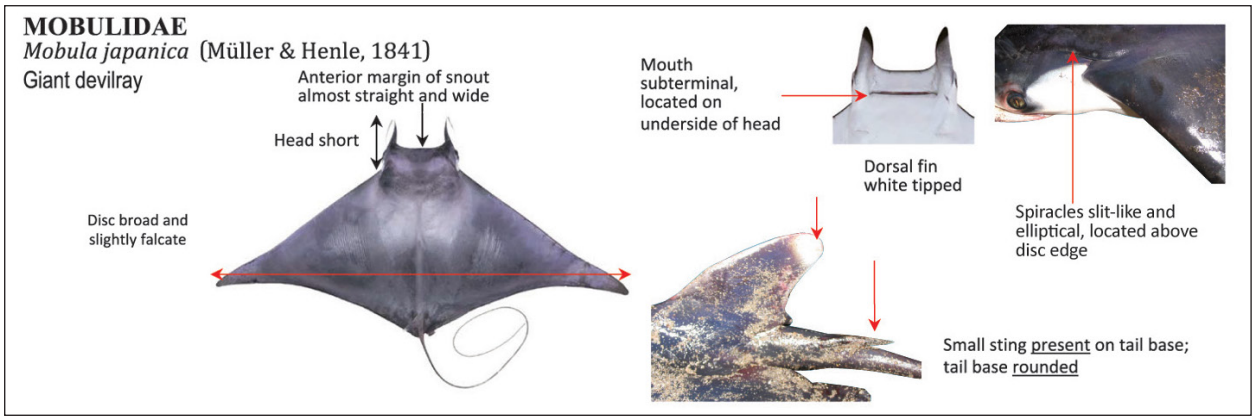


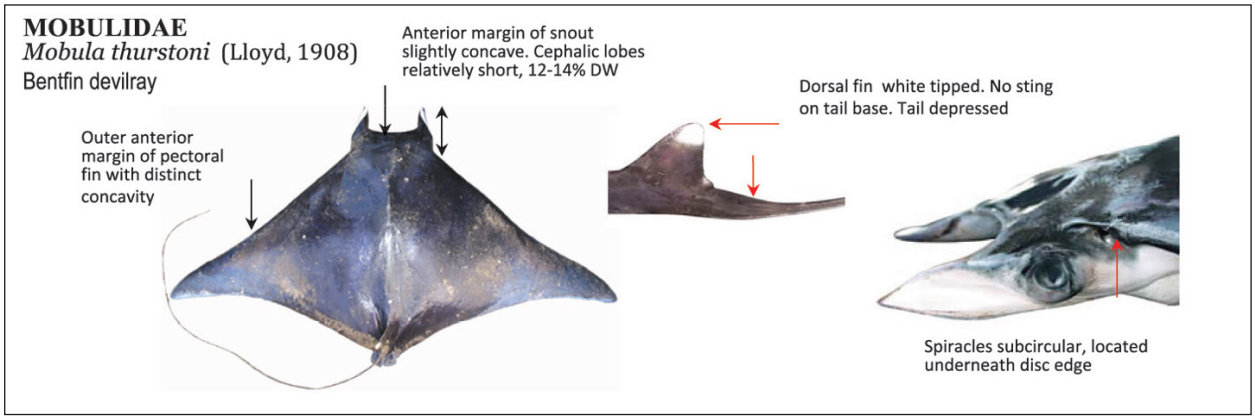


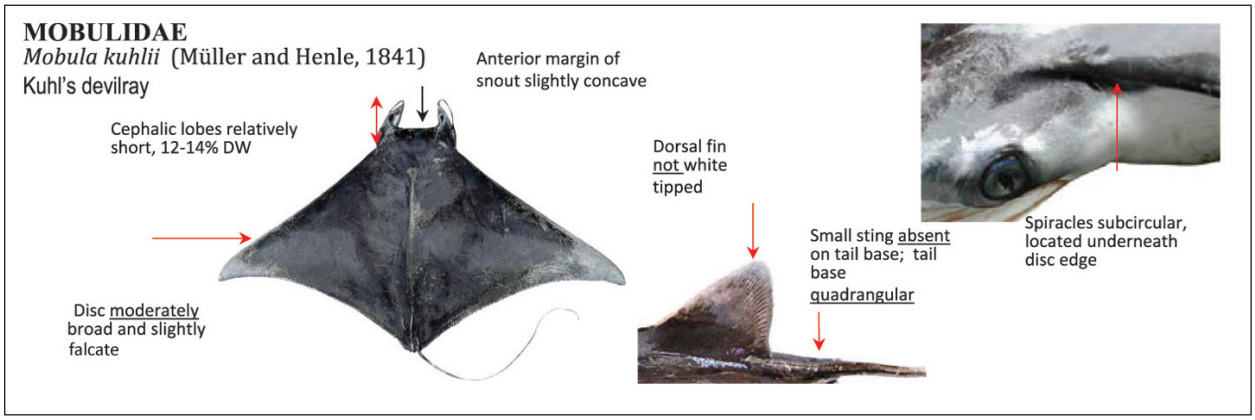
Credit: Ali et al. 2017

Mobulidae/ Devil Ray




MOBULIDAE
Mobula japanica (Müller & Henle, 1841)
Giant devilray
Anterior margin of snout almost straight and wide
Head short
Disc broad and slightly falcate
Mouth subterminal, located on underside of head
Dorsal fin white tipped
Spiracles slit-like and elliptical, located above disc edge
Small sting present on tail base; tail base rounded


MOBULIDAE
Mobula thurstoni (Lloyd, 1908)
Bentfin devilray
Anterior margin of snout slightly concave. Cephalic lobes relatively short, 12-14% DW
Outer anterior margin of pectoral fin with distinct concavity
Dorsal fin white tipped. No sting on tail base. Tail depressed
Spiracles subcircular, located underneath disc edge


MOBULIDAE
Mobula kuhlii (Müller and Henle, 1841)
Kuhl's devilray
Anterior margin of snout slightly concave
Cephalic lobes relatively short, 12-14% DW
Disc moderately broad and slightly falcate
Dorsal fin not white tipped
Small sting absent on tail base; tail base quadrangular
Spiracles subcircular, located underneath disc edge

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