



# IDENTIFICATION OF SHARKS AND RAYS

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# CARTILAGINOUS SKELETON



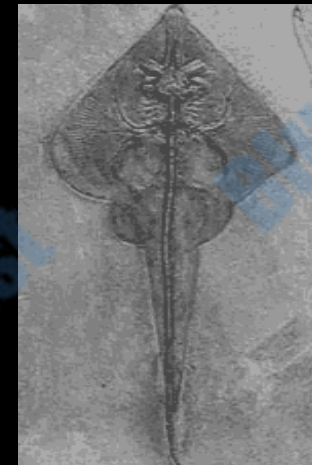
# SHARKS AND RAYS

## CARTILAGINOUS ELASMOBRANCH FISH

- ~1,250 species
  - 600 species of sharks
  - 650 species of rays
- 400 million years old
- Internal reproduction



*370 million-year-old shark  
called Cladoselache*



*160 million-year-old  
Blanket Ray*



© Chip Clark/Smithsonian Institution

**Dwarf Lanternshark**  
(*Etmopterus perryi*)



Javontae Murphy (Wikipedia)



**Pyjama shark** or striped  
catshark (*Poroderma  
africanum*)

# RAYS OF THE WORLD



260 species  
of Skates



180 species of Stingrays



45 species of Guitarfishes



70 species of Electric Rays

Majority are **bottom dwellers**  
with broad flattened bodies



**TARGET** and  
**NON-DISCARDED**  
**BYCATCH** in fisheries

Some **target shark fisheries**,  
primarily for shark liver oil





**Shark Fins**



**Ray Fins**



**Meat**



**Gill Plates**



# SHARKS & RAYS ARE *NOT* LIKE OTHER FISH!

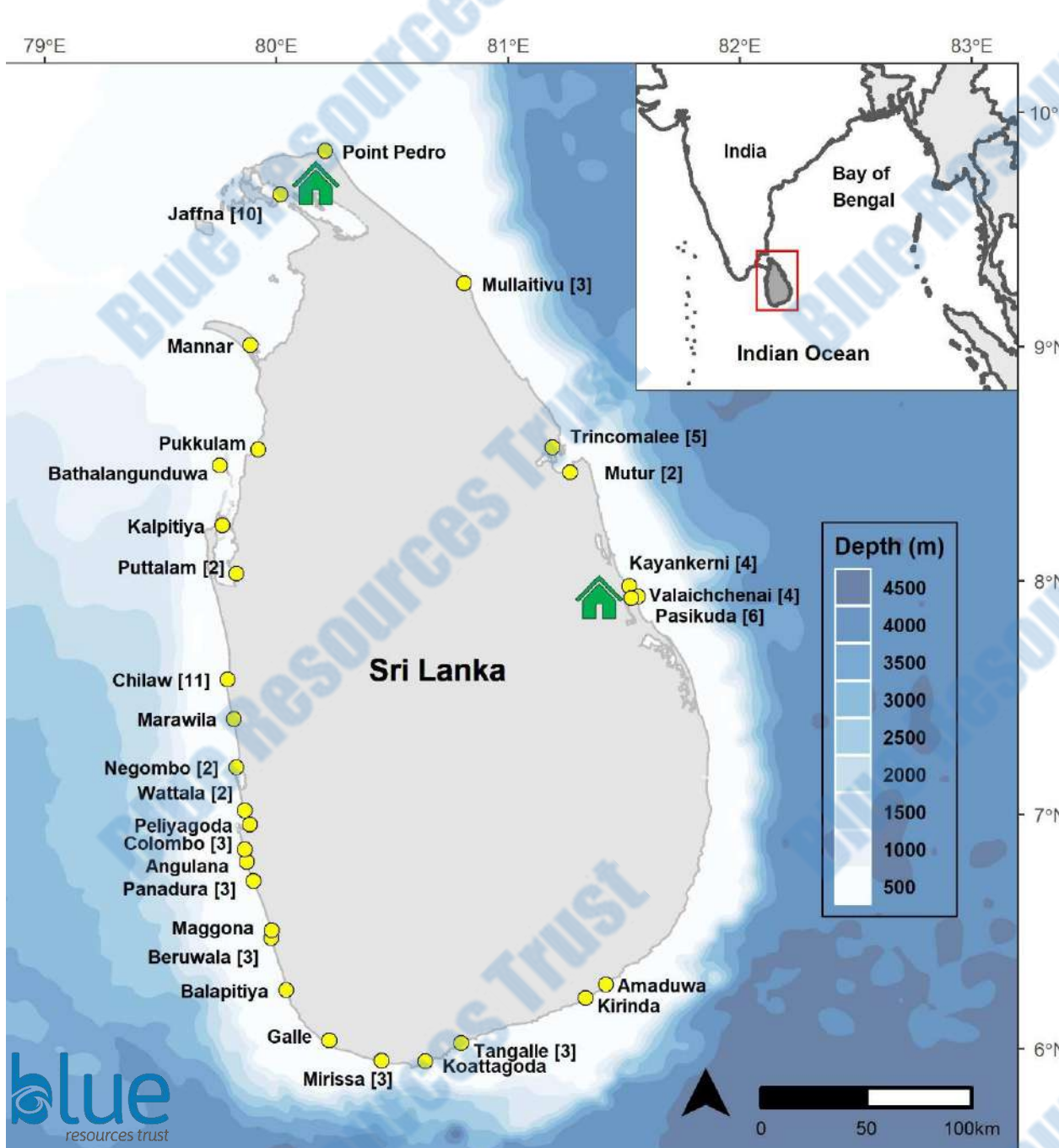


*Only 5 of the ~105 species of shark and ray are protected in Sri Lanka*

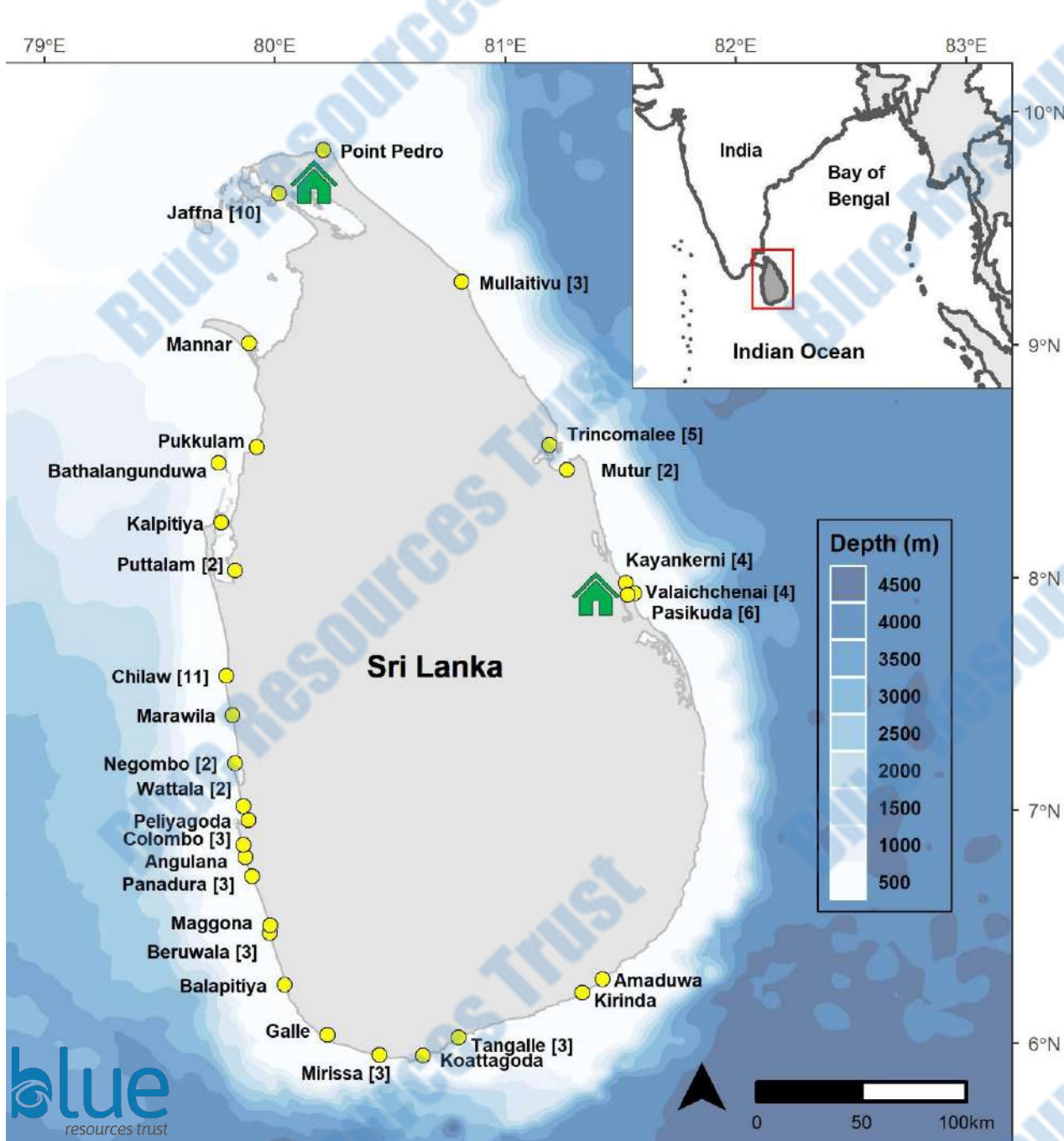
*Leopards and dolphins are **fully protected** in Sri Lanka*

*Tuna are **commercially fished** in Sri Lanka*

	Shortfin Mako Sharks	Most Sharks/Rays	Leopards	Spinner Dolphins	Skipjack Tuna
<b>Maximum age:</b>	28 – 32 years	Many live for 25 years Manta rays: 60 years Greenland sharks: ~400 years	12 – 15 years	20 – 25 years	6 – 8 years
<b>Age at maturity:</b>	18 – 21 years	5 – 15 years	2.5 – 4 years	7 years	1.5 years
<b>Gestation:</b>	15 – 19 months	5 – 19 months (most species: 11 - 12 months)	3.5 months	10 months	<1 week
<b>Number of offspring:</b>	10 – 18	1 – 50 (most species: 5 – 20)	2 – 4	1	80,000 – 1,250,000
<b>IUCN Red List:</b>	Endangered	>65% of Sri Lankan species are threatened with extinction	Vulnerable	Least Concern	Least Concern



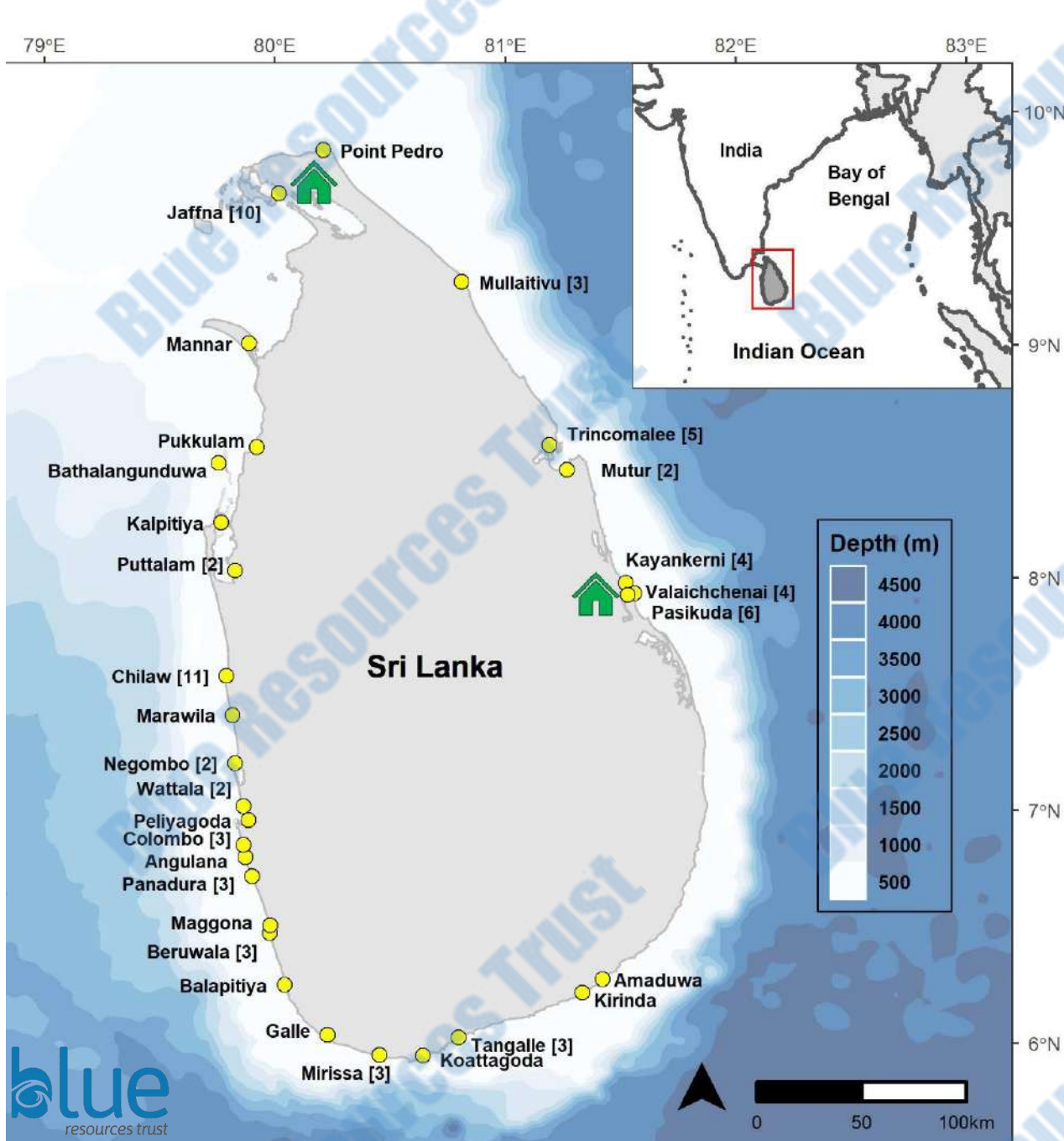
**>3,200 surveys**



**blue**  
resources trust

>3,200 surveys

**>44,000 sharks and rays**



>3,200 surveys

>44,000 sharks and rays

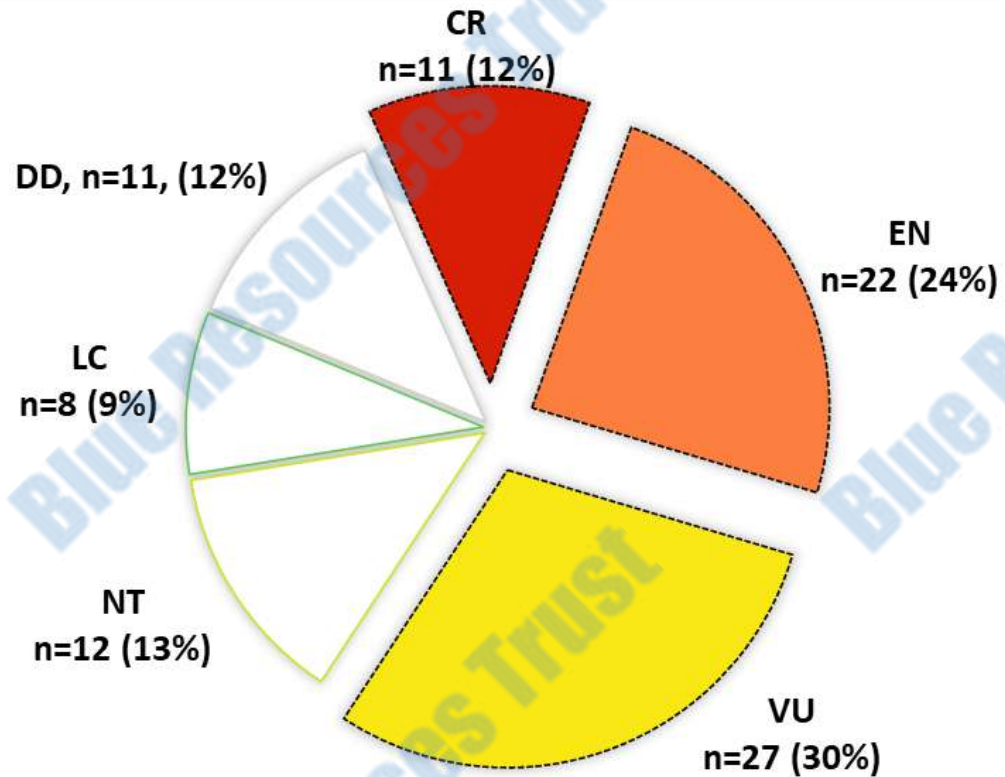
**>105 species**



# IUCN RED LIST STATUS FOR SL SPECIES

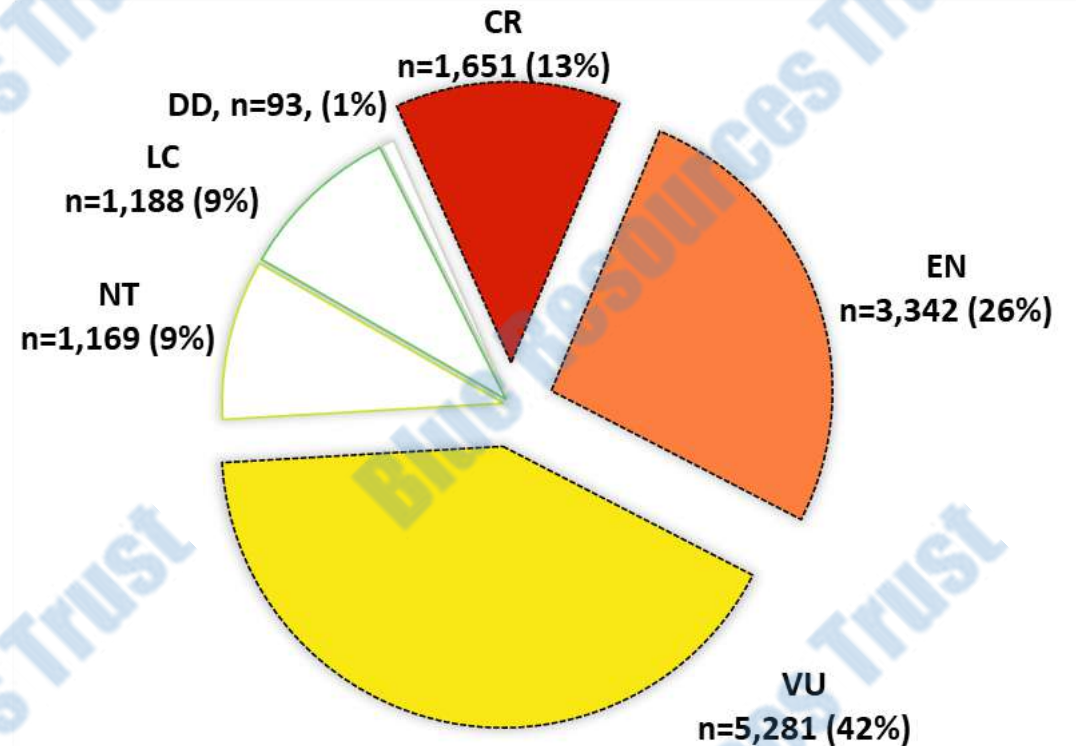
## SPECIES

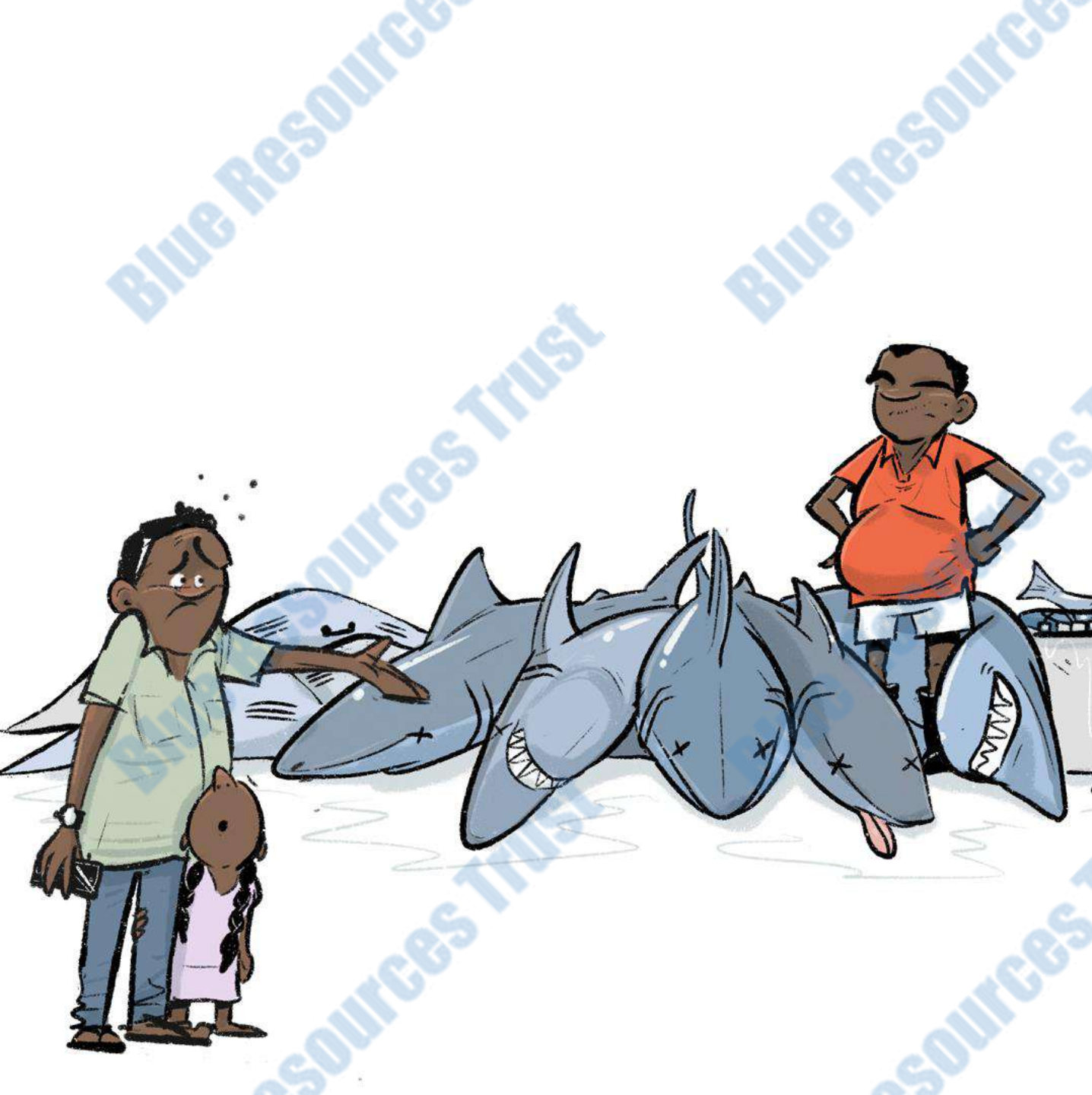
**66% threatened**



## SPECIMENS

**81% threatened**





# Multilateral Environmental Agreements



Photo by IISD/Klara Worth ([enb.iisd.org/cites/cop18/17aug.html](http://enb.iisd.org/cites/cop18/17aug.html))



CITES regulates  
trade at the point  
of **EXPORT**



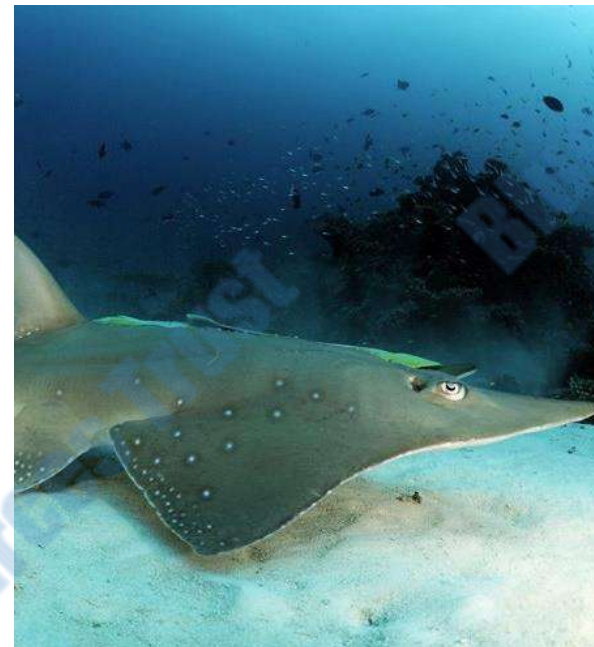
# CITES: Convention on International Trade in Endangered Species of Wild Fauna and Flora

*"export will not be detrimental to the survival of that species"*

**i.e. sustainable trade**



Photo by IISD/Klara Worth ([enb.iisd.org/cites/cop18/17aug.html](http://enb.iisd.org/cites/cop18/17aug.html))



# CMS - Convention on Migratory Species

- Appendix I species must be fully protected ("no-take")
- Appendix II species require regional coordination to improve their management





CMS, IOTC, and  
**national** management  
can impact **CAPTURE**



CITES regulates  
trade at the point  
of **EXPORT**



# IOTC

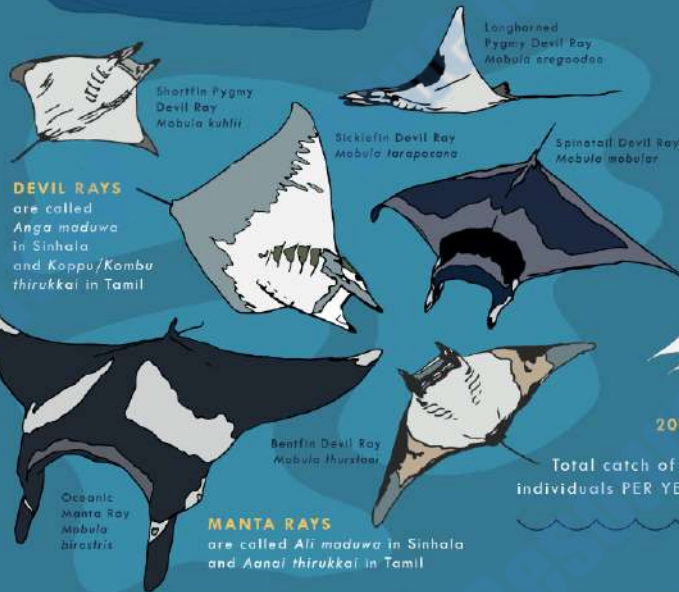
- 1. Resolution 12/09:** On the conservation of **thresher sharks** (family Alopiidae) caught in association with fisheries in the IOTC area of competence. *This includes a non-retention measure for all thresher sharks captured by fishing vessels on the IOTC Record of Authorised Vessels.*
- 2. Resolution 13/05:** On the conservation of **whale sharks** (*Rhincodon typus*). *This measure prohibits the intentional setting of a purse seine (or other gear type) on a whale shark in the IOTC Area of Competence and applies to all fishing vessels flying the flag of a CPC, on the IOTC Record of Fishing Vessels, or authorised to fish for tuna and tuna-like species managed by the IOTC on the high seas (it does not apply to artisanal fisheries operating exclusively in their respective EEZ).*
- 3. Resolution 13/06:** On a scientific and management framework on the Conservation of sharks species caught in association with IOTC managed fisheries. *This measure prohibits the retention of **oceanic whitetip sharks** by all fishing vessels flying their flag and on the IOTC Record of Authorised Vessels, or authorised to fish for tuna or tuna-like species managed by the IOTC on the high seas. This measure also enables stock and other assessments on shark species to enable the Scientific Committee to provide recommendations or advice to the IOTC Commission for further action.*

# IOTC

- 4. Resolution 17/05:** On the conservation of sharks caught in association with fisheries managed by IOTC. *This measure applies to all fishing vessels flying the flag of a Contracting Party or Cooperating Non-Contracting Party (CPC) and on the IOTC Record of Authorised Vessels, or authorised to fish for tuna or tuna-like species managed by the IOTC. It requires that CPCs take all necessary measures for full utilisation of sharks and prohibits the removal of shark fins onboard vessels (unless frozen, in which case the fins cannot be more than 5% of the weight of sharks onboard). This measure also enables the IOTC Working Party on Ecosystems and Bycatch (WPEB) to establish long-term projects on sharks to collect data to inform the IOTC Scientific Committee.*
- 5. Resolution 19/03:** On the conservation of **mobulid rays** caught in association with fisheries in the IOTC Area of Competence. *This measure applies to all fishing vessels flying the flag of a Contracting Party or CPC, and on the IOTC record of fishing vessels or authorized to fish for tuna and tuna like species managed by the IOTC. It prohibits the intentional setting of any gear type for mobulid rays in the IOTC Area of Competence and prohibits the retention of these species (with delayed implementation for unintentional capture by artisanal fisheries until 1<sup>st</sup> January 2022, and an exception for subsistence fisheries).*

# DEVILS IN DISTRESS

THE PLIGHT OF MANTA AND DEVIL RAYS IN SRI LANKA



**DEVIL RAYS**  
are called  
*Anga maduwa*  
in Sinhala  
and *Koppu/Kombu*  
*thirukkai* in Tamil

**MANTA RAYS**  
are called *Ali maduwa* in Sinhala  
and *Aana thirukkai* in Tamil

Coastal and offshore vessels capture these species across the northern Indian ocean using GILLNETS.



DECLINING BODY SIZE (1-2% per year) in three species suggest they may be experiencing UNSUSTAINABLE LEVELS OF CAPTURE.



Total catch of manta + devil rays in the early 2010s likely exceeded 100,000 individuals PER YEAR, however annual landings have since DRASTICALLY DECLINED.

Estimates of Spinetail Devil Ray mortality suggest that the species is being HEAVILY OVERFISHED.

Manta and devil rays have SLOW REPRODUCTIVE CYCLES and even low to moderate levels of bycatch can have major impacts.

 BLUE RESOURCES TRUST has conducted 1,346 SURVEYS between 2011-2020.

Total annual captures of manta and devil rays by SRI LANKAN ARTISANAL FISHING FLEETS exceed



Prior to 2010, manta and devil rays were often released at sea due to lack of demand, but as the GILL PLATE TRADE expanded, they were increasingly brought back to shore.

## RECOMMENDATIONS:



Fully protect manta and devil rays



Proactive fisheries management



Implement CMS + IOTC manta and devil ray conservation measures



Implement best handling and release practices

This study was supported by Linnaeus University, Save Our Seas Foundation, Shark Conservation Fund, Marine Conservation and Action Fund of the New England Aquarium, Ocean Park Conservation Foundation Hong Kong, and the Tokyo Cement Group.



Source: Fernando, D. and Stewart, J.D. 2021. High bycatch rates of manta and devil rays in the "small-scale" artisanal fisheries of Sri Lanka. *PeerJ*. <https://doi.org/10.7717/peerj.11994>

Questions?

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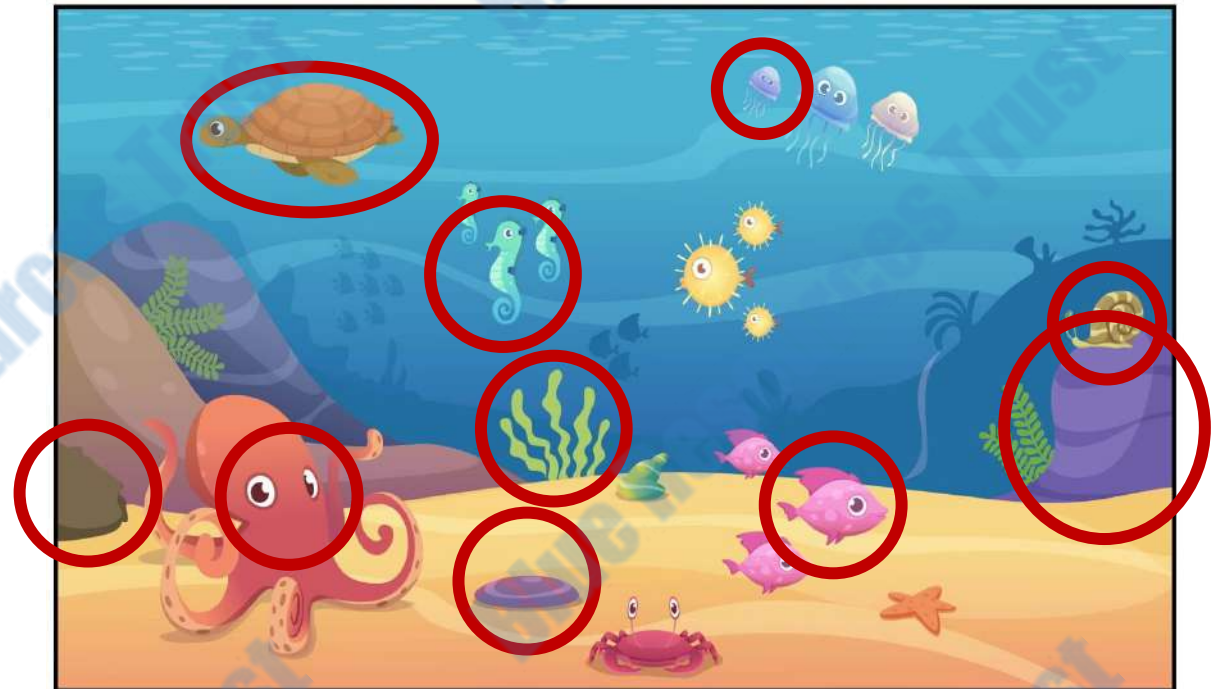
A



B



A



B



A



B



A



B



A



B



A



B

# Shark morphology



# Shark morphology



# Shark morphology



**Gills/ gill slits**

# Shark morphology



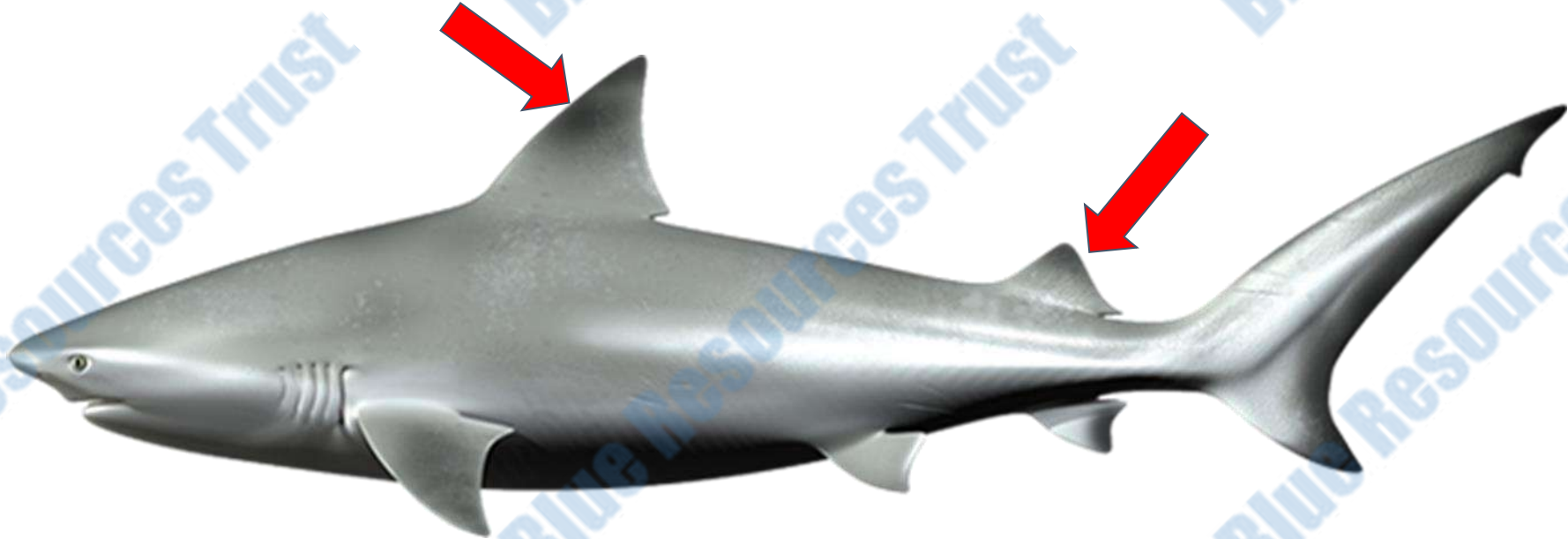
# Shark morphology



# Shark morphology



# Shark morphology



# Shark morphology

**1<sup>st</sup> Dorsal Fin**

**2<sup>nd</sup> Dorsal Fin**



# Shark morphology



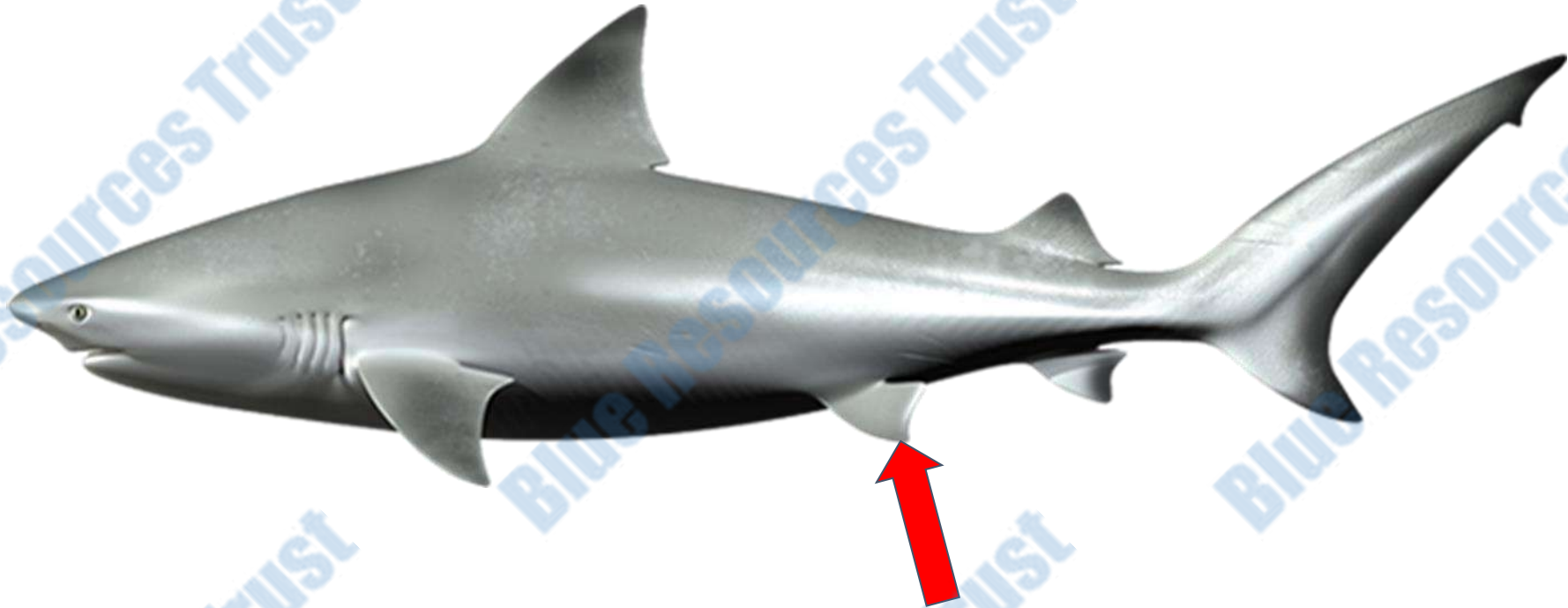
# Shark morphology



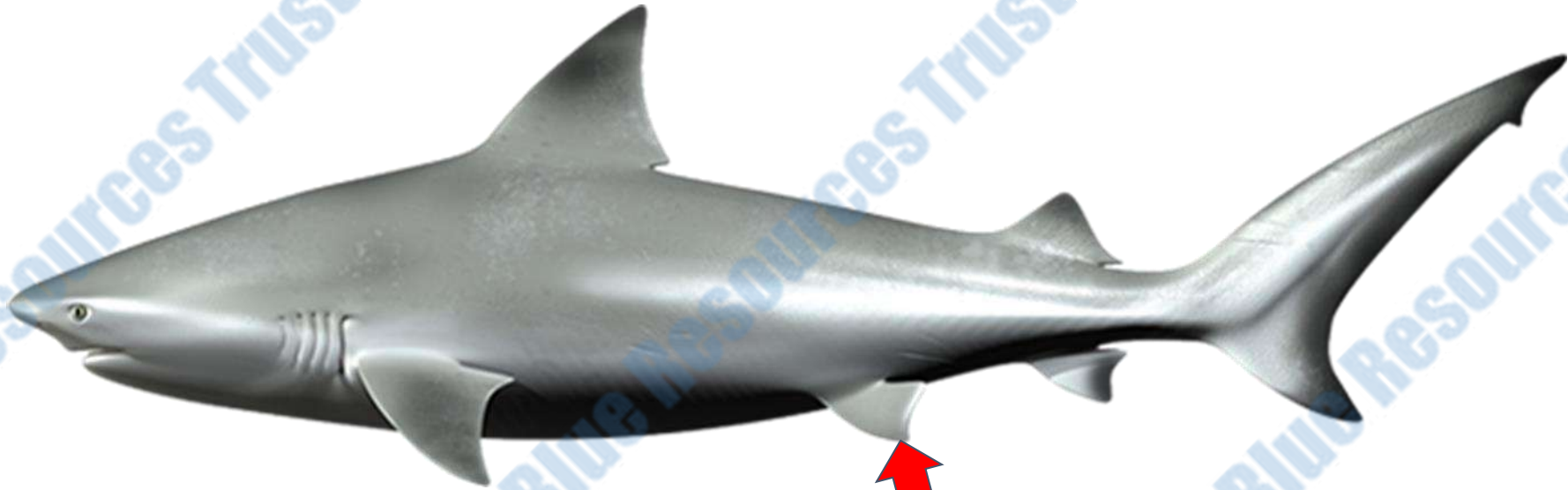
**Pectoral Fin**



# Shark morphology



# Shark morphology



**Pelvic Fin**

# Shark morphology



# Shark morphology



**Anal Fin**

# Shark morphology

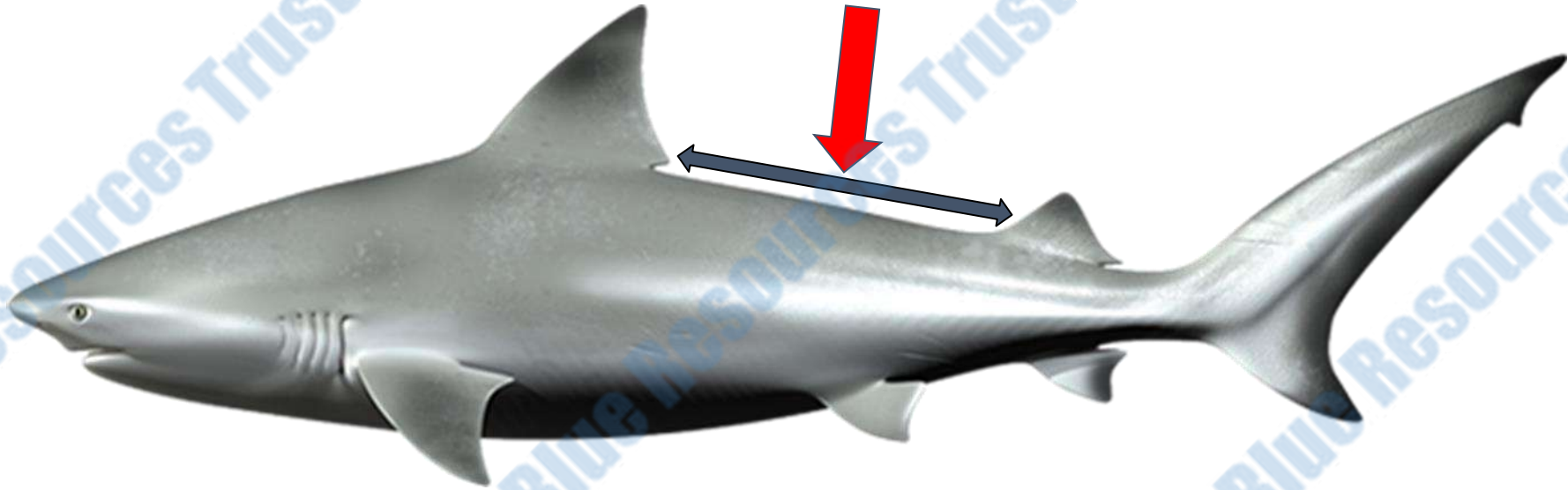


# Shark morphology



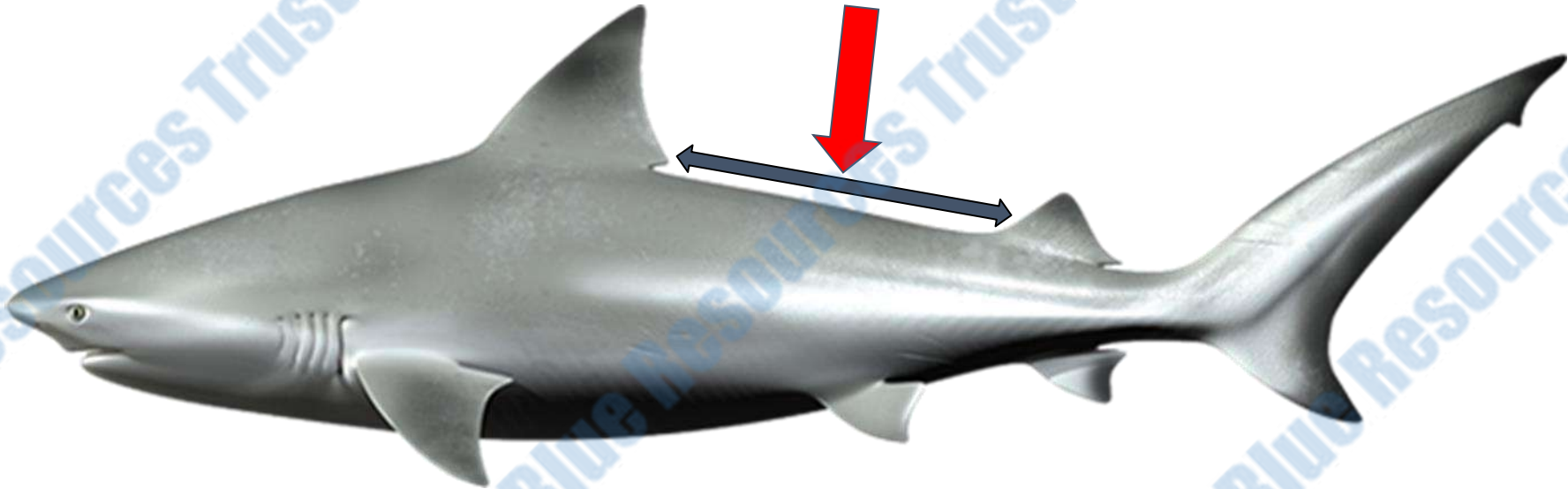
**Caudal Fin**

# Shark morphology

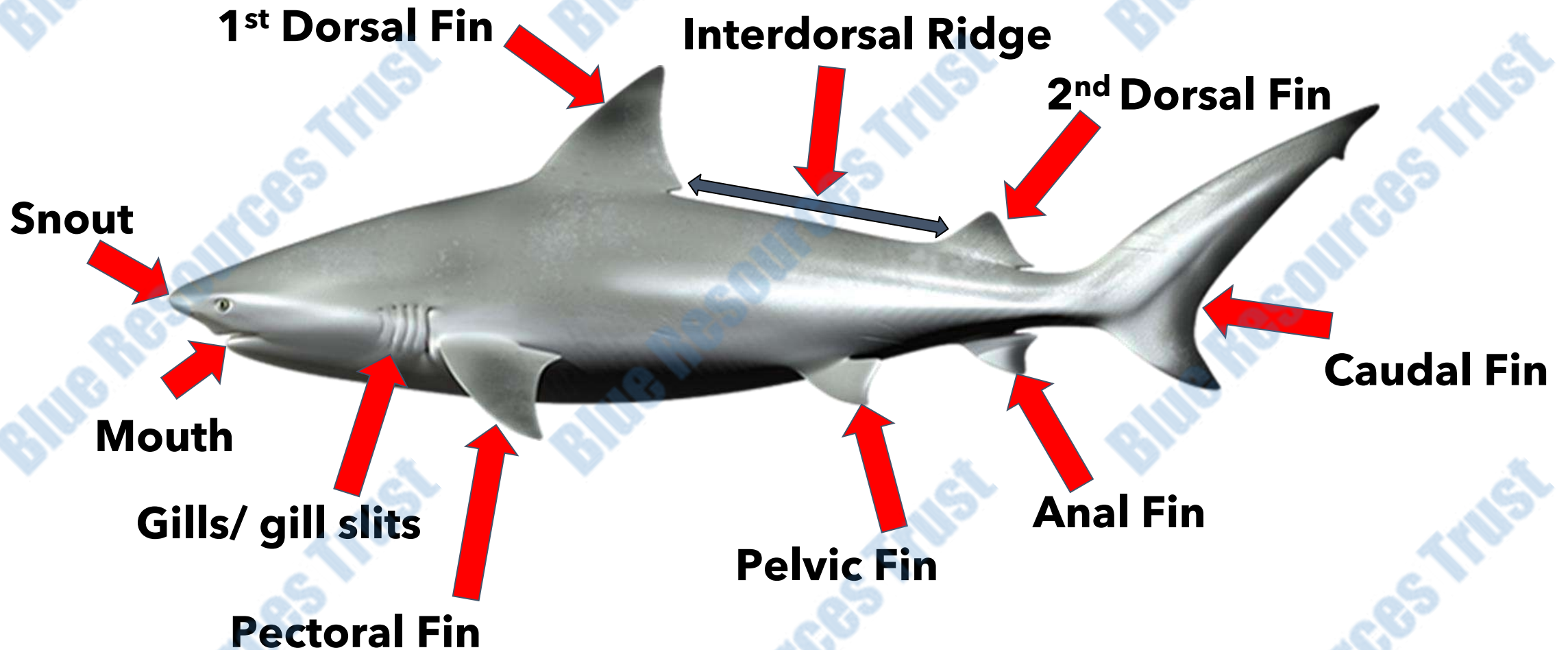


# Shark morphology

Interdorsal Ridge



# Shark morphology



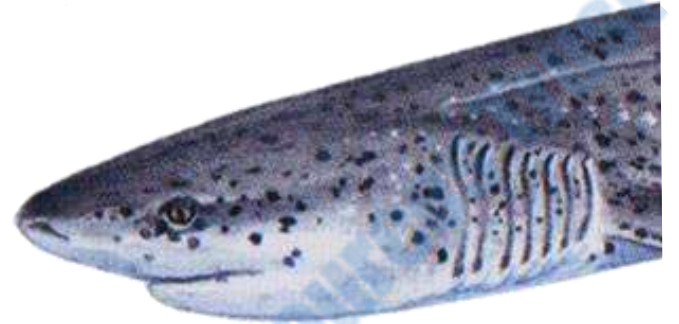
# Spot the Difference - I



A



B



C

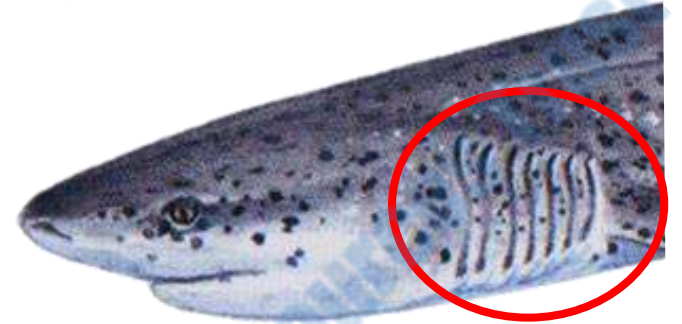
# Spot the Difference - I



A



B



C

# Spot the Difference - I



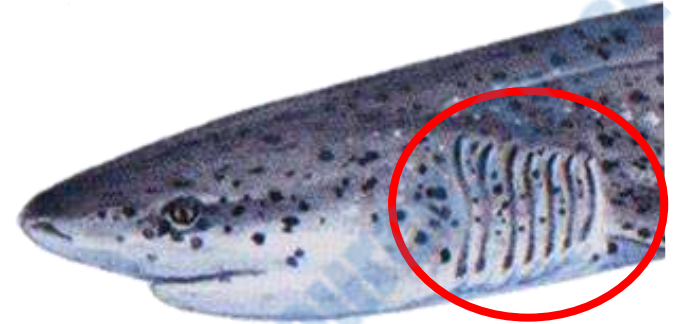
A

5 Gills



B

6 Gills



C

7 Gills

# Spot the Difference - II



A



B

# Spot the Difference - II



A



B

# Spot the Difference - II



A

Anal fin



B

No anal fin

# Spot the Difference - III



A



B

# Spot the Difference - III



A



B

# Spot the Difference - III



A

Two dorsal fins



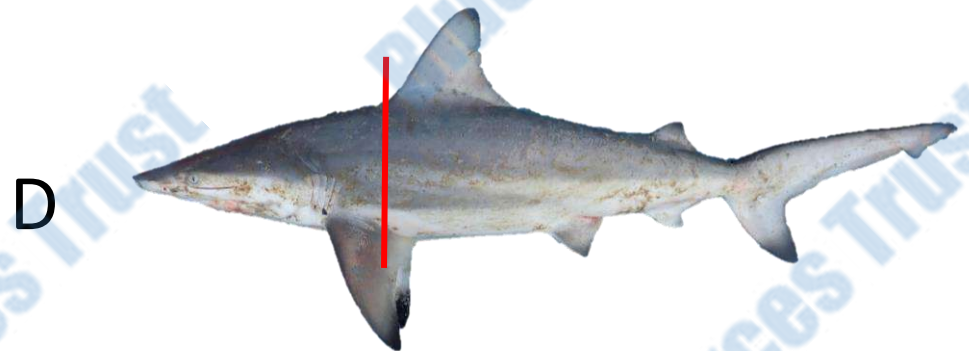
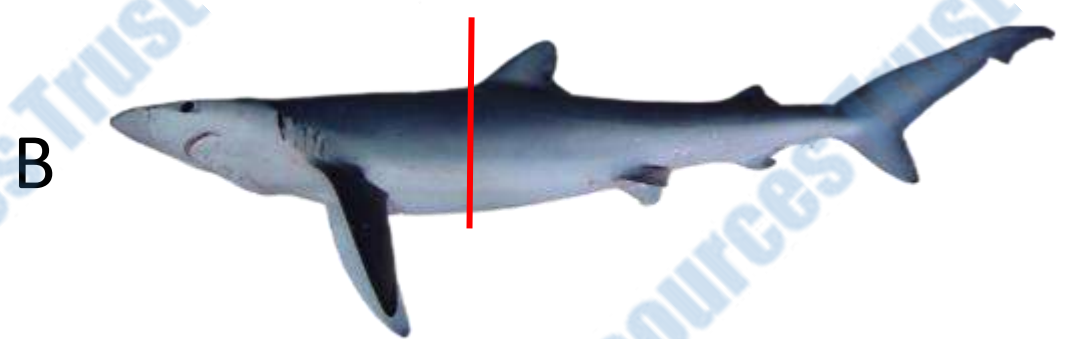
B

One dorsal fin

# Spot the Difference - IV



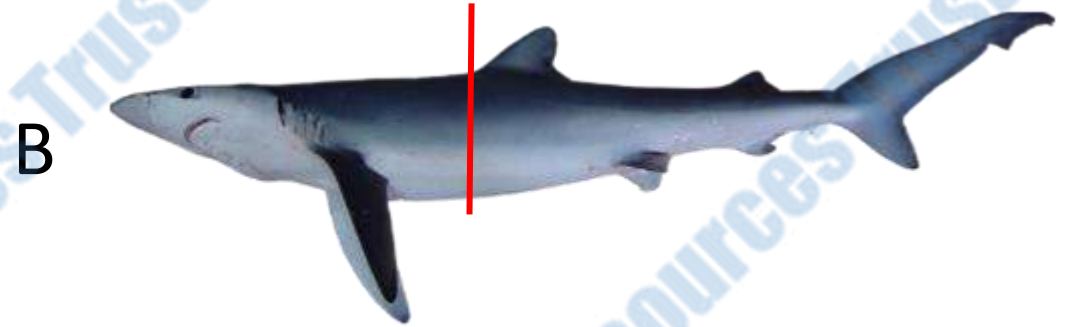
# Spot the Difference - IV



# Spot the Difference - IV



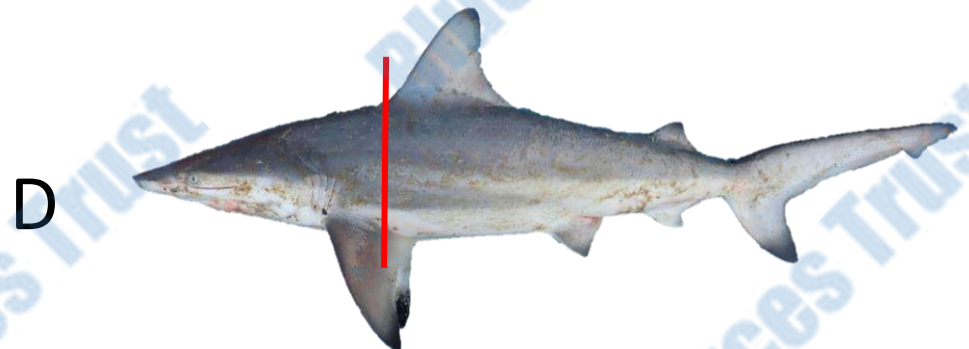
Dorsal almost over pelvic fin



Dorsal fin origin posterior to pectoral



Dorsal fin origin anterior to pectoral



Dorsal fin origin over pectoral

# Spot the Difference - V



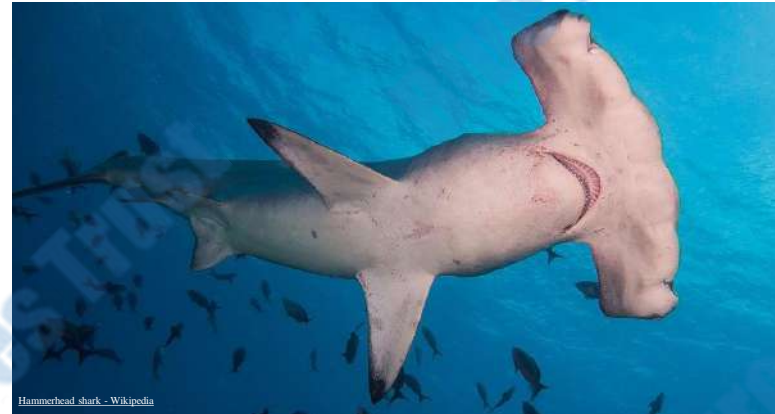
A



B



C

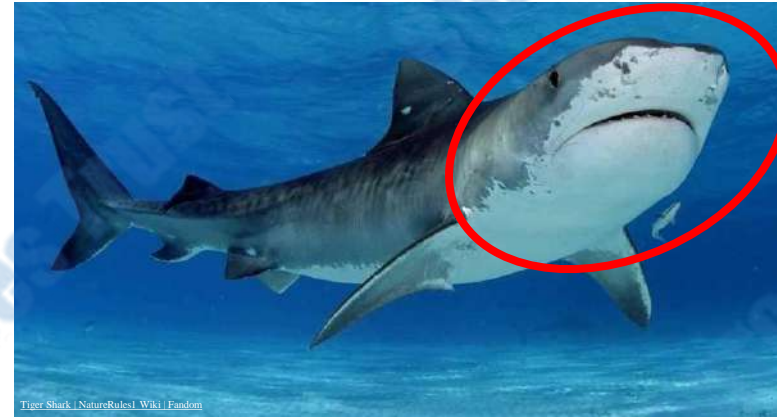


D

# Spot the Difference - V



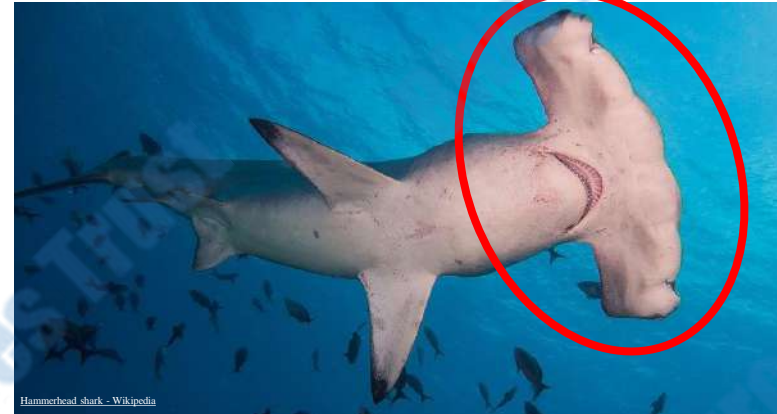
A



B



C

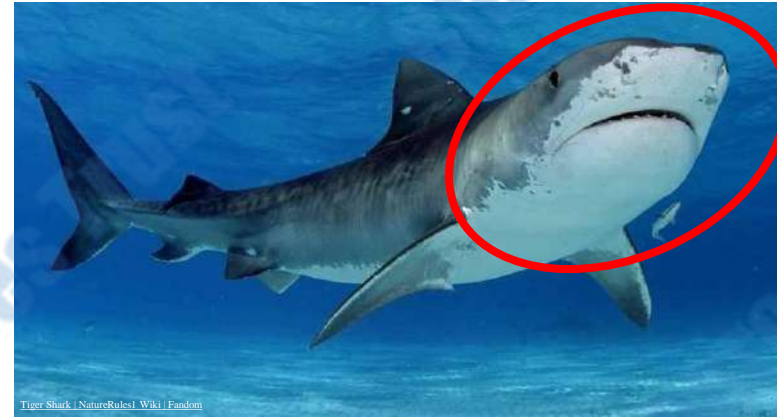


D

# Spot the Difference - V



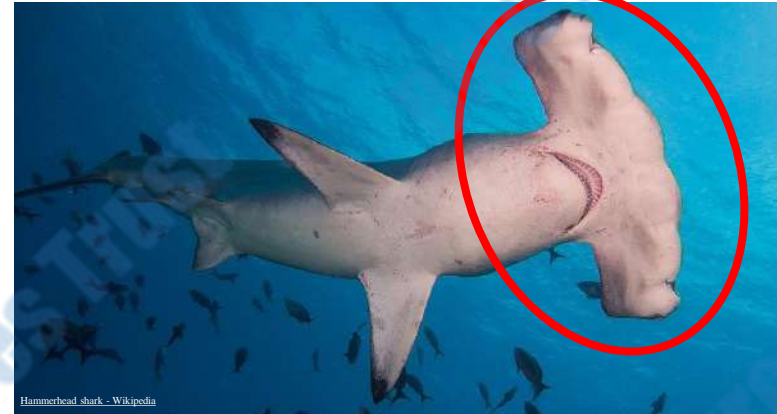
A Broad and flat head



B Broad and bluntly rounded



C Narrow pointed



D Hammerhead

# Spot the Difference - VI



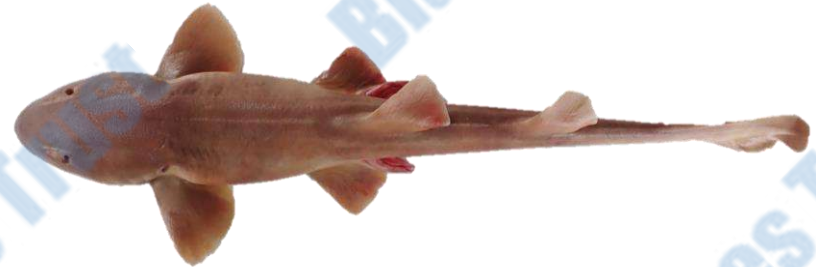
A



B



C



D

# Spot the Difference - VI



A



B



C



D

# Spot the Difference - VI



A Alopiidae



B Lamnidae



C Carcharhinidae



D Hemiscyllidae

# Spot the Difference - VII

A



B

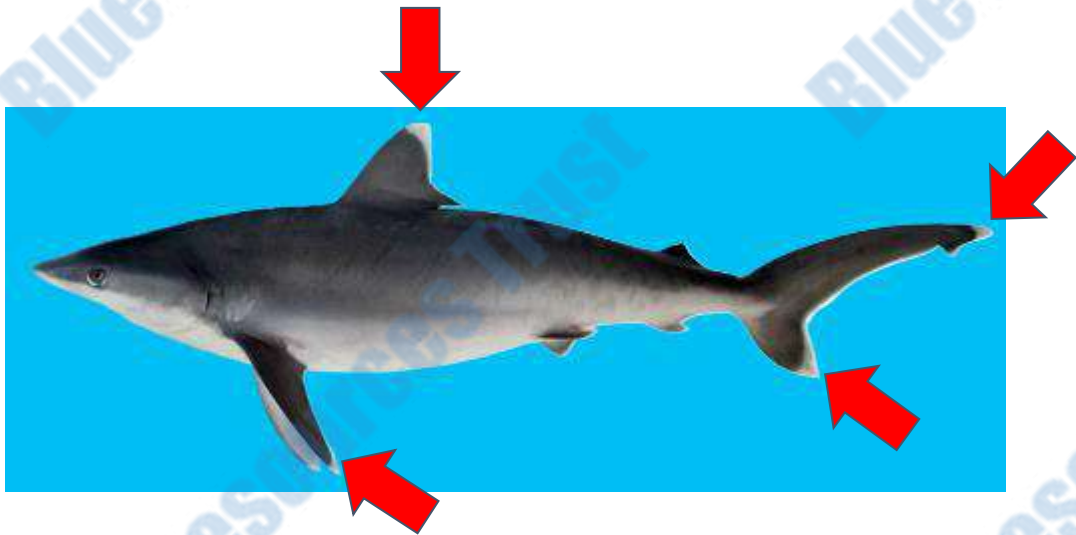


C

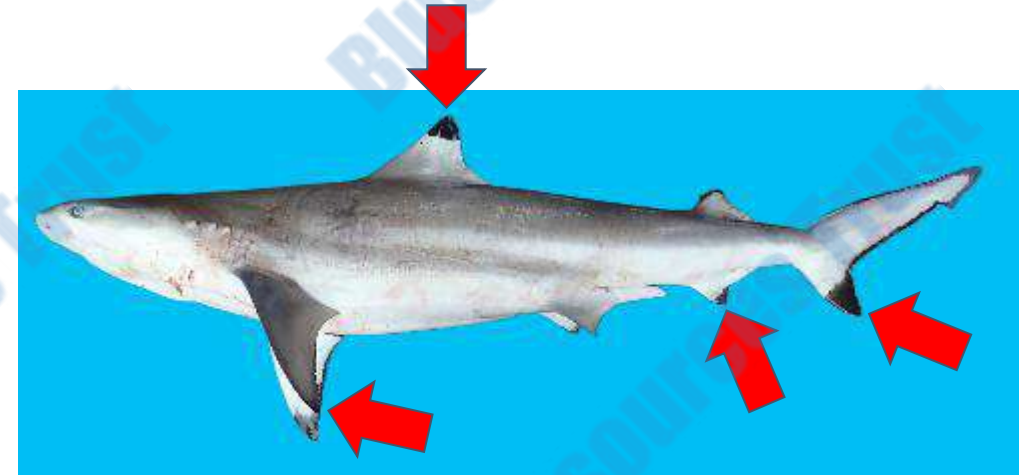


# Spot the Difference - VII

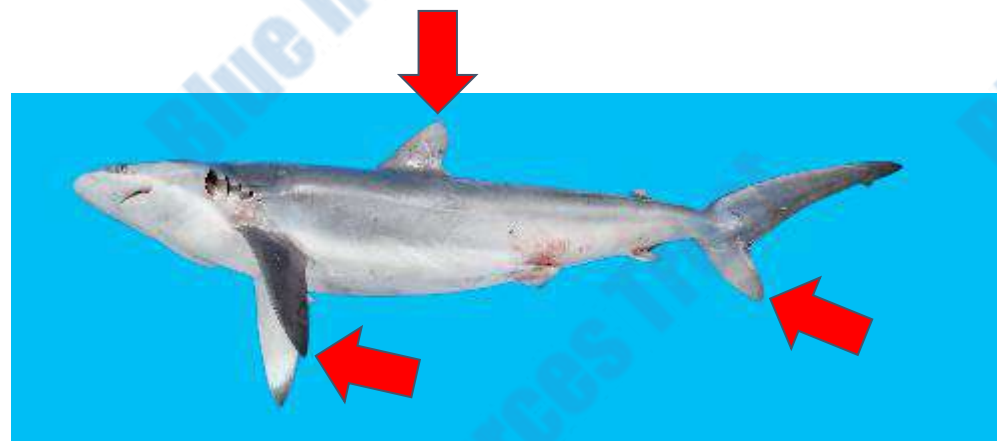
A



B

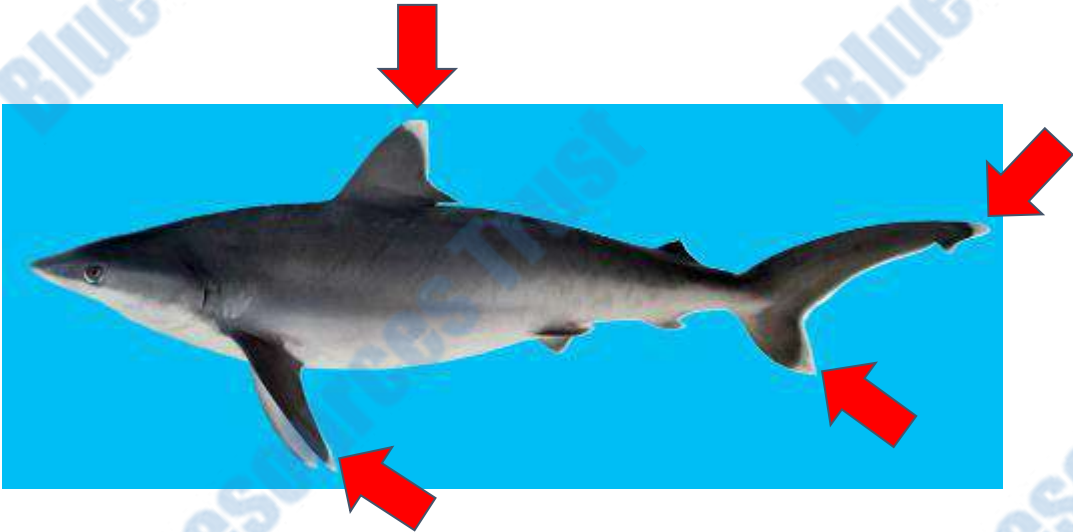


C



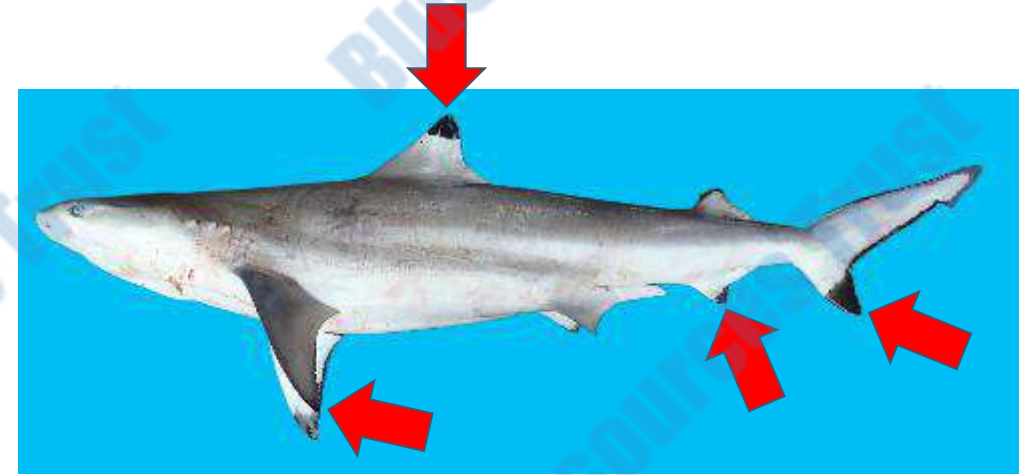
# Spot the Difference - VII

A



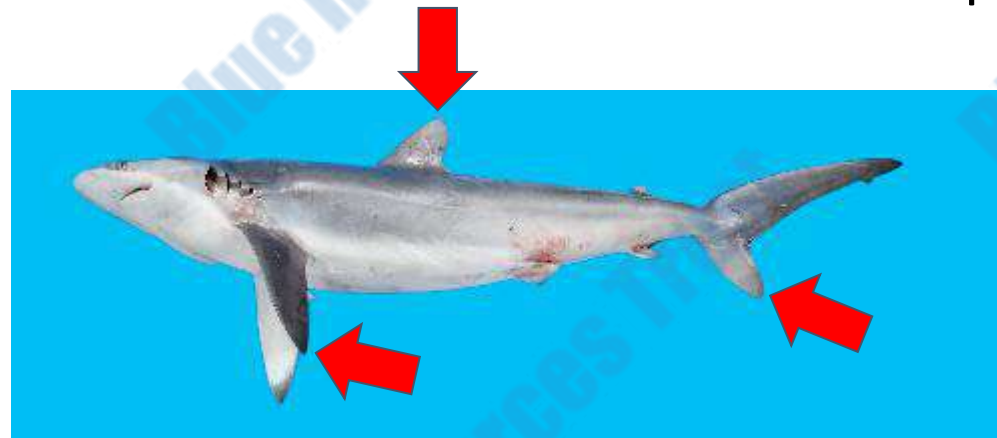
White tips on all fins

B



Black tips on all fins

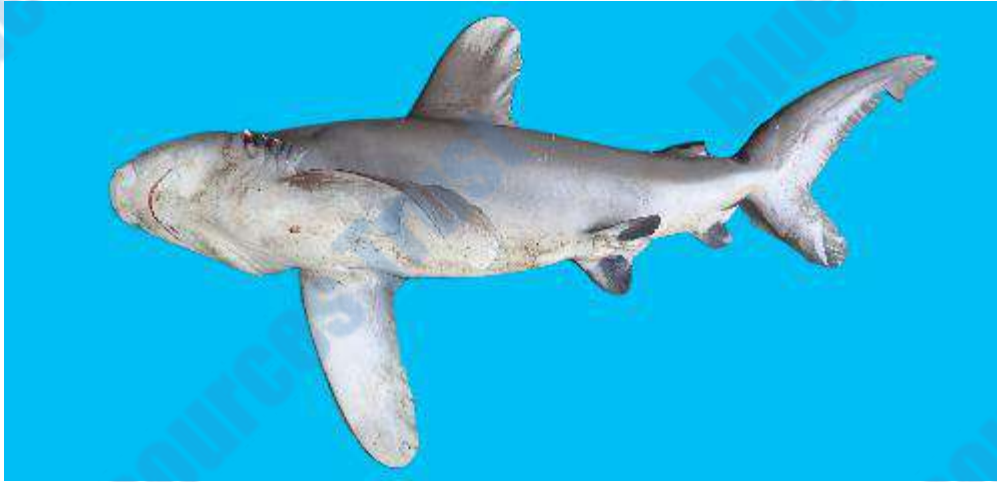
C



Dusk fin tips

# Spot the Difference - VII

D



E

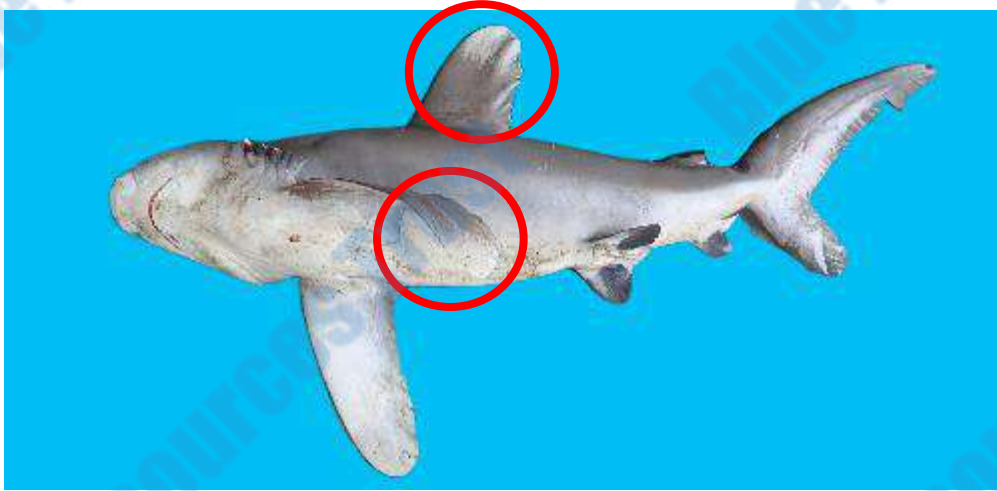


F

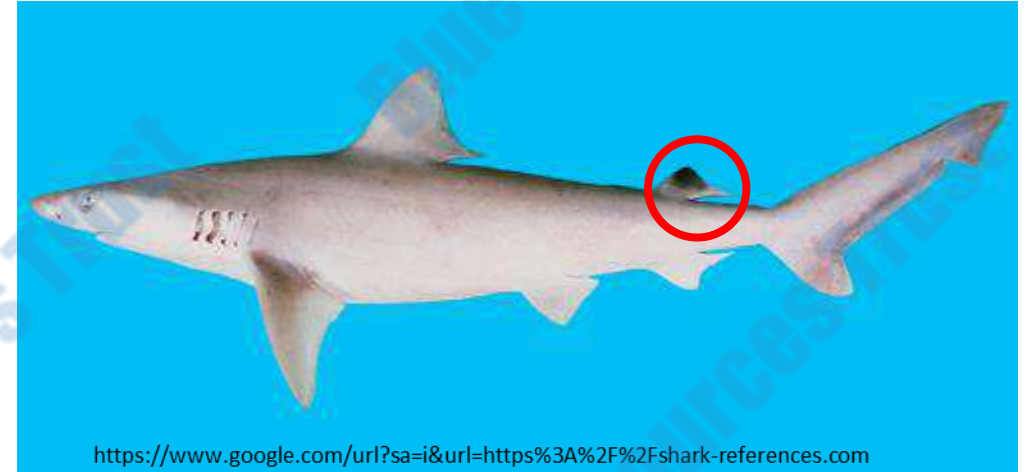


# Spot the Difference - VII

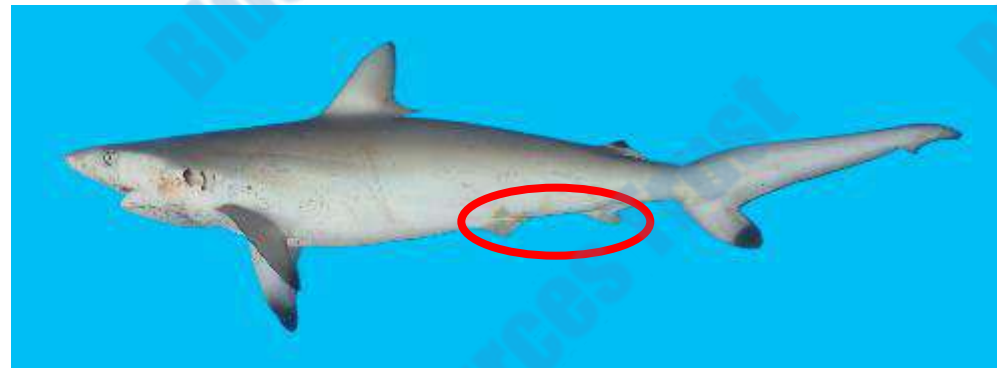
D



E

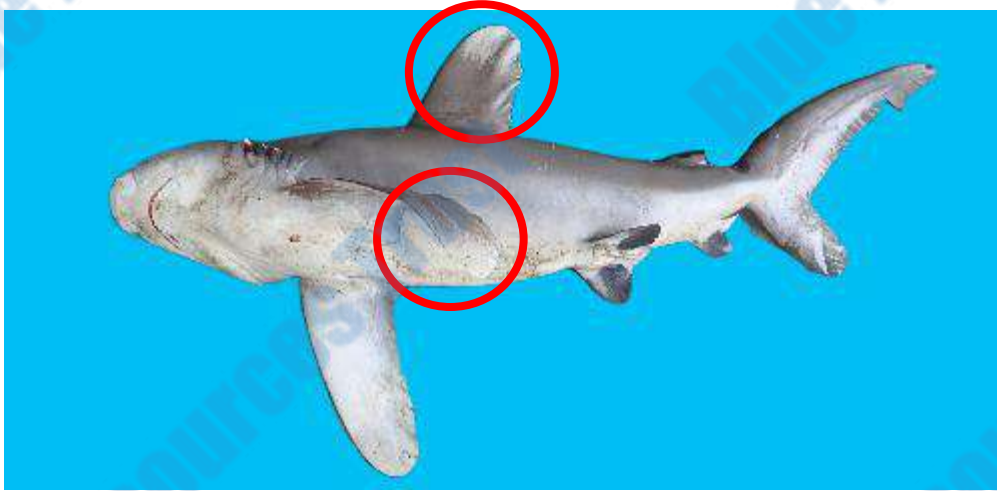


F



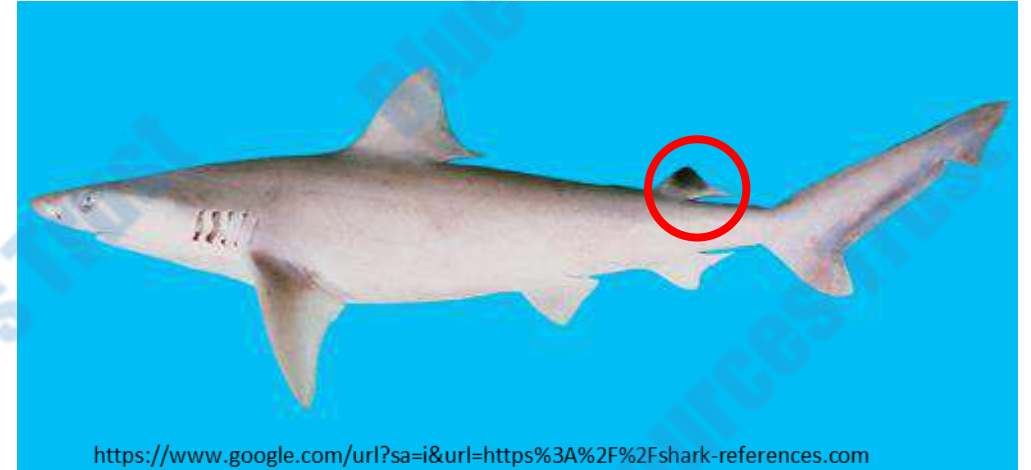
# Spot the Difference - VII

D



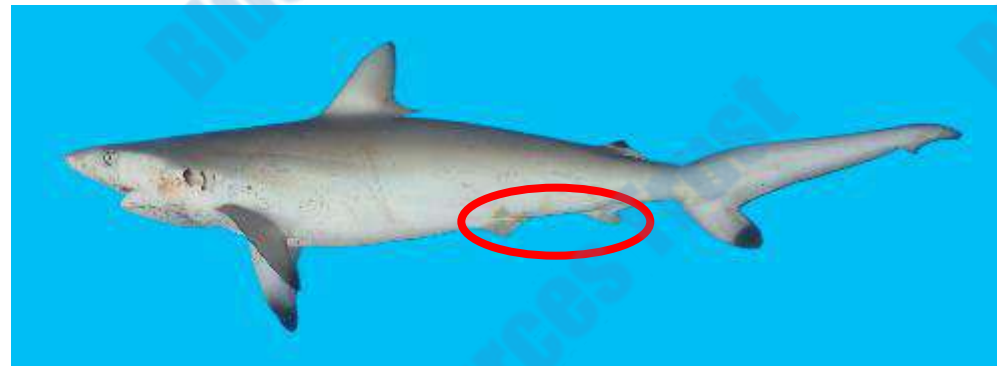
White tip on dorsal and pectoral fins

E



Black tip only on second dorsal fin

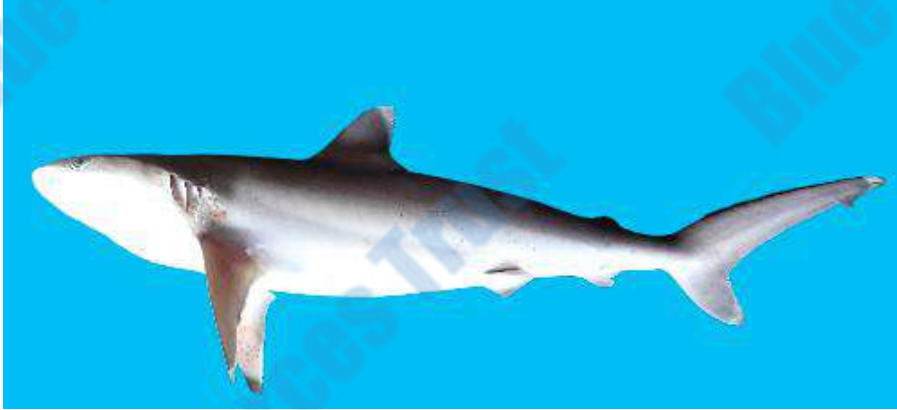
F



Black tips except on anal and pelvic fins

# Spot the Difference - VIII

A



B

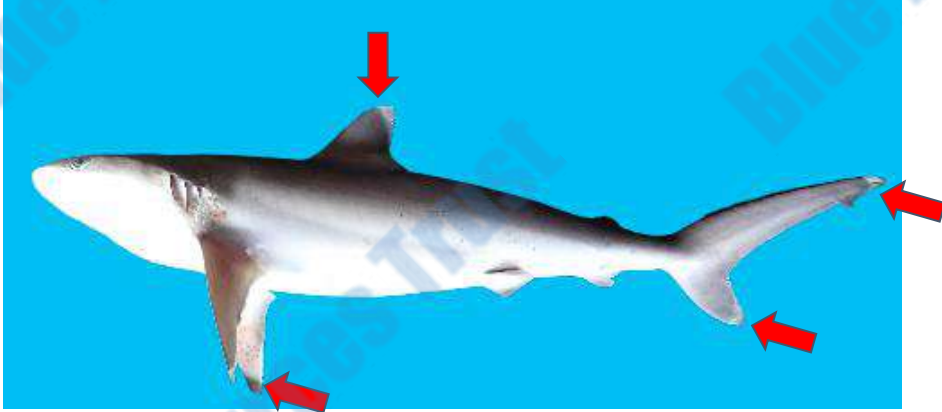


C

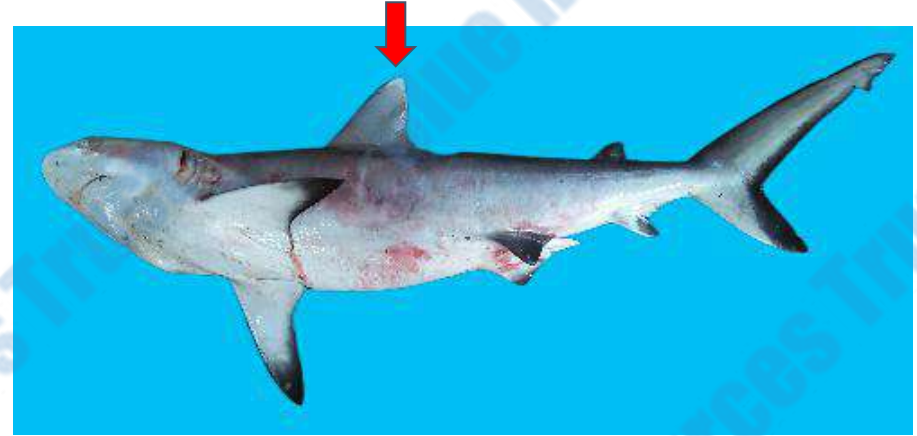


# Spot the Difference - VII

A



B

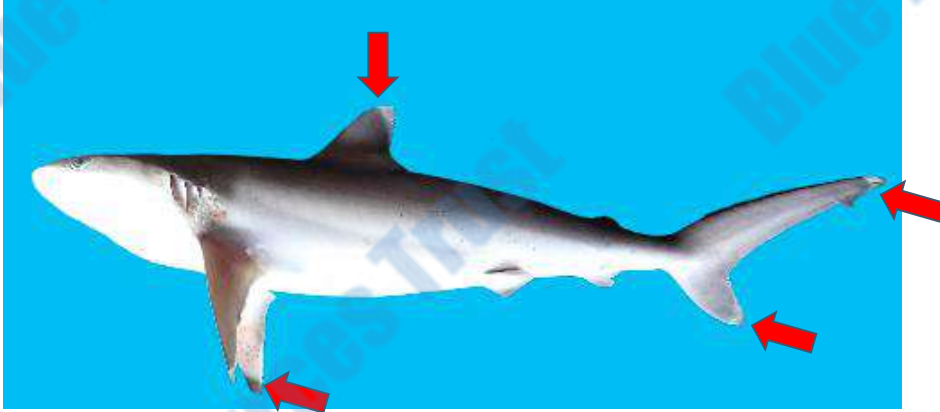


C



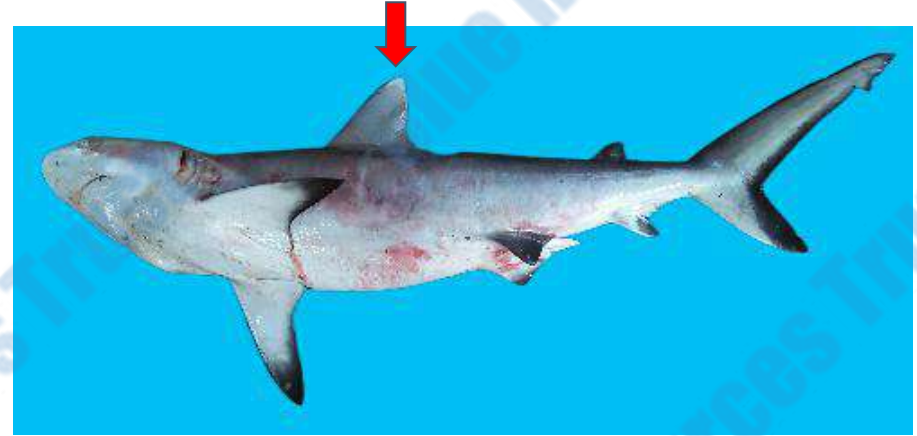
# Spot the Difference - VII

A



Silvertip Shark

B



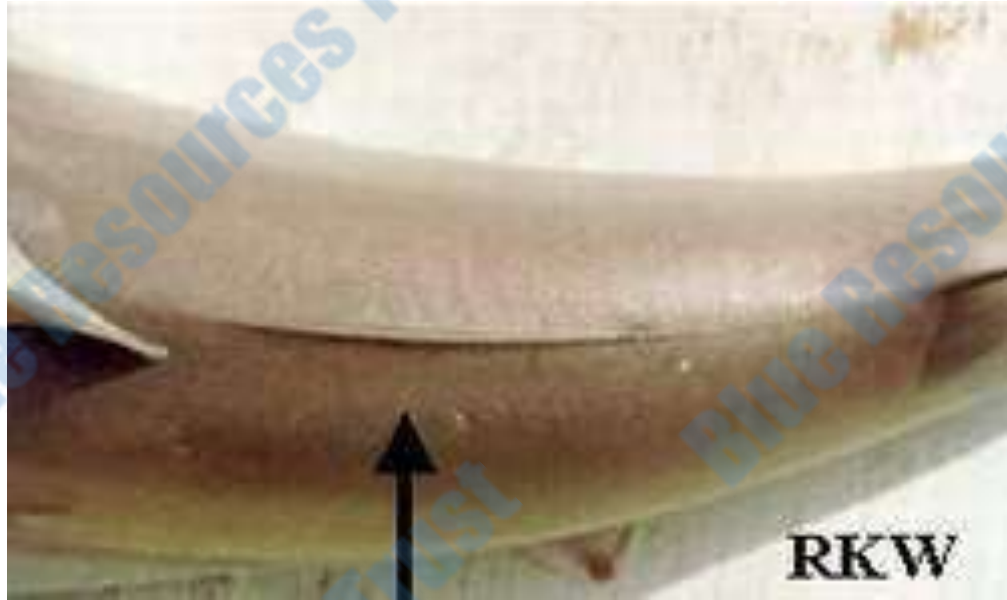
Gray Reef Shark

C

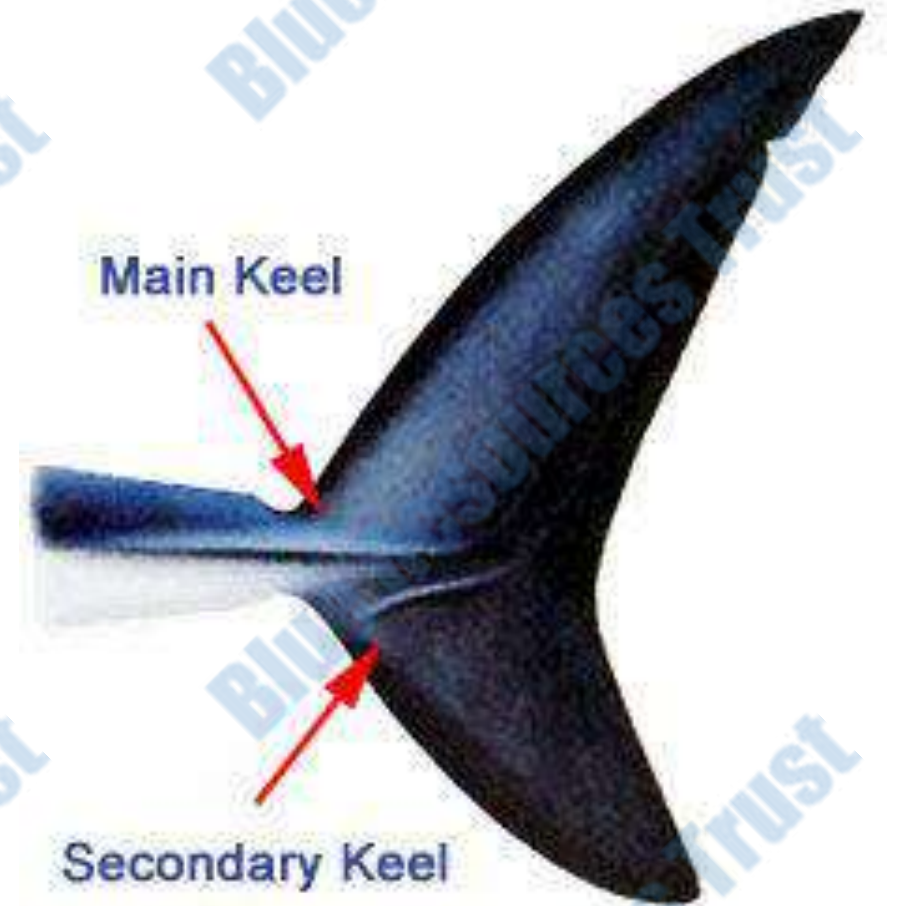


Oceanic Whitetip Shark

# Other Features - I



Interdorsal ridge

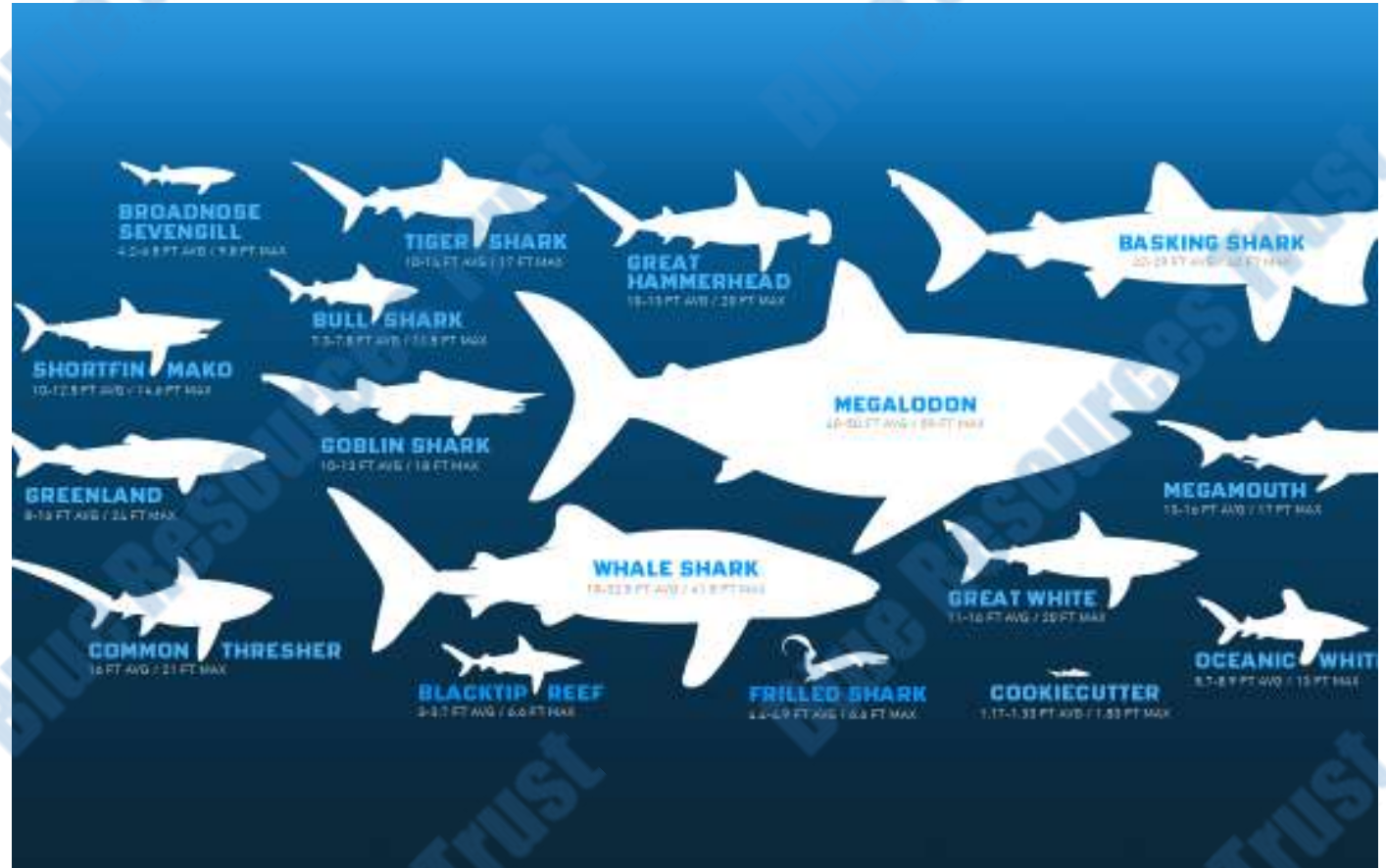


Lateral keel

# Other Features - II

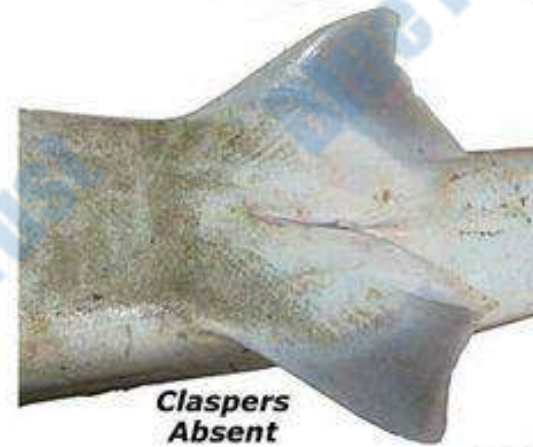
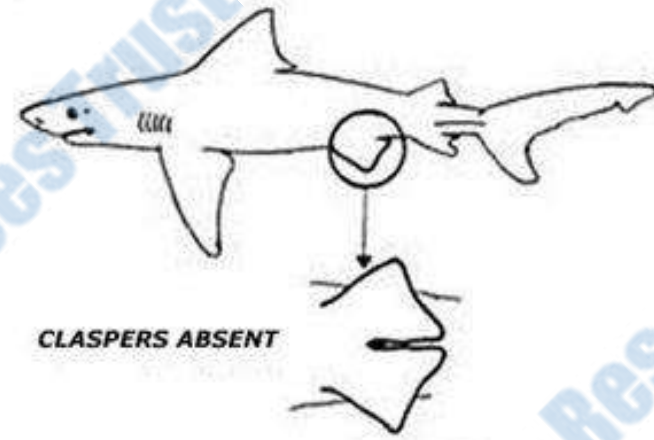
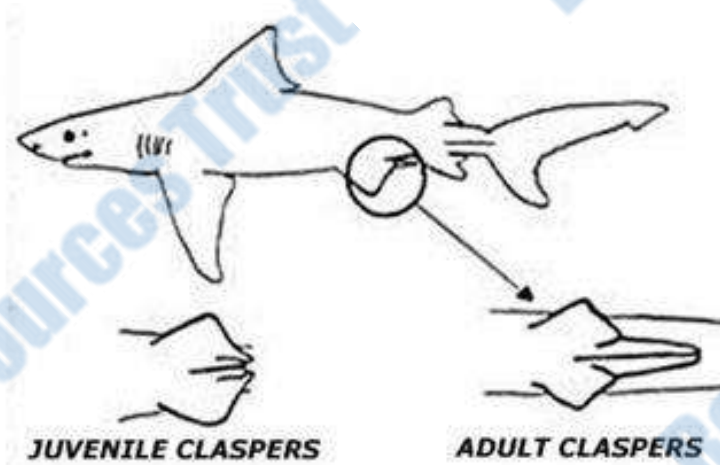


Teeth



Size range

# Other Features - III



IOTC-Species of interest



# Shortfin Mako Sharks (SMA)

- Pectoral fins curved and shorter than head length (not pass the 1<sup>st</sup> dorsal fin)
- Snout sharply pointed with white underneath
- Clear lateral line between dorsal dark shade and ventral white





# Longfin Mako Sharks (LMA)

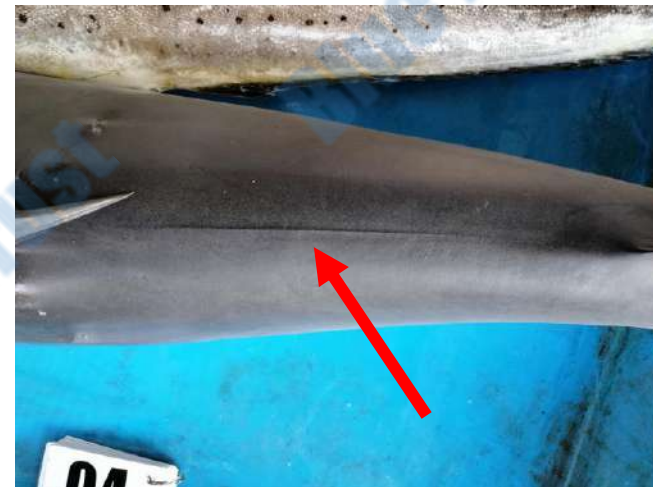
- Pectoral fins broad tipped and longer than head length (pass the 1st dorsal fin)
- Snout widely pointed, dark or dusky underneath
- Dorsal dark shade gradually decreasing





## Silky Sharks (FAL)

- 1<sup>st</sup> dorsal fin low with moderately rounded apex
- 1<sup>st</sup> dorsal fin origin well behind free rear tips of pectoral fins
- Interdorsal ridge present





# Blue Sharks (BSH)

- Snout extremely long and conical
- 1<sup>st</sup> dorsal fin small and origin well behind free rear tips of pectoral fins
- Pectoral fins very long and pointed tip
- No interdorsal ridge



Blue Resources Trust

Blue Resources Trust

Blue Resources Trust



Resources Trust

Resources Trust

# Oceanic Whitetip Shark (OCS)

- Snout short and broadly rounded
- 1<sup>st</sup> dorsal fin high with broadly rounded apex
- Pectoral fins long and broad with wide rounded tips
- Juveniles usually with black tips on all fins



# Hammerhead shark

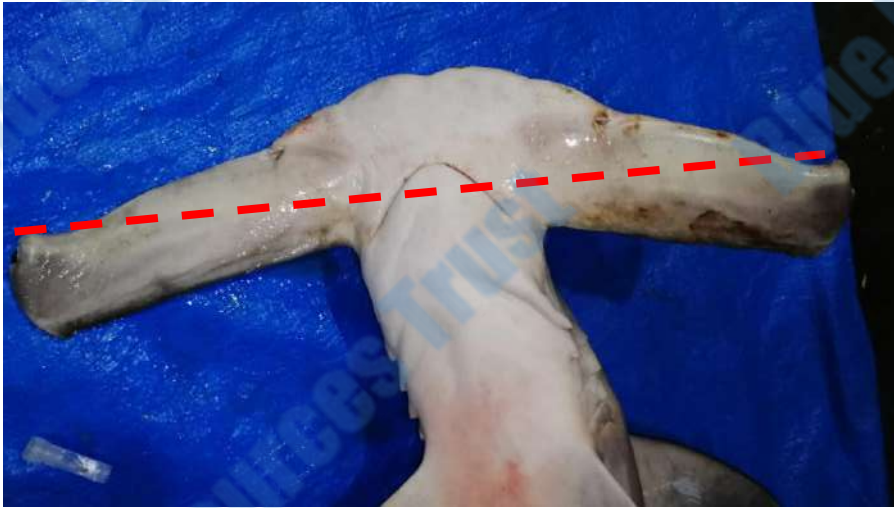




<https://www.floridamuseum.ufl.edu/discover-fish/species-profiles/sphyrna-zygaena/>

### Winghead Shark

Head broad and almost equal to half of its total length



### scalloped hammerhead (SPL)

Head with prominent central notch and 2 more at front of head



### Smooth Hammerhead (SPZ)

Head curved and no central notch



### Great Hammerhead (SPK)

Head nearly straight and only a central notch

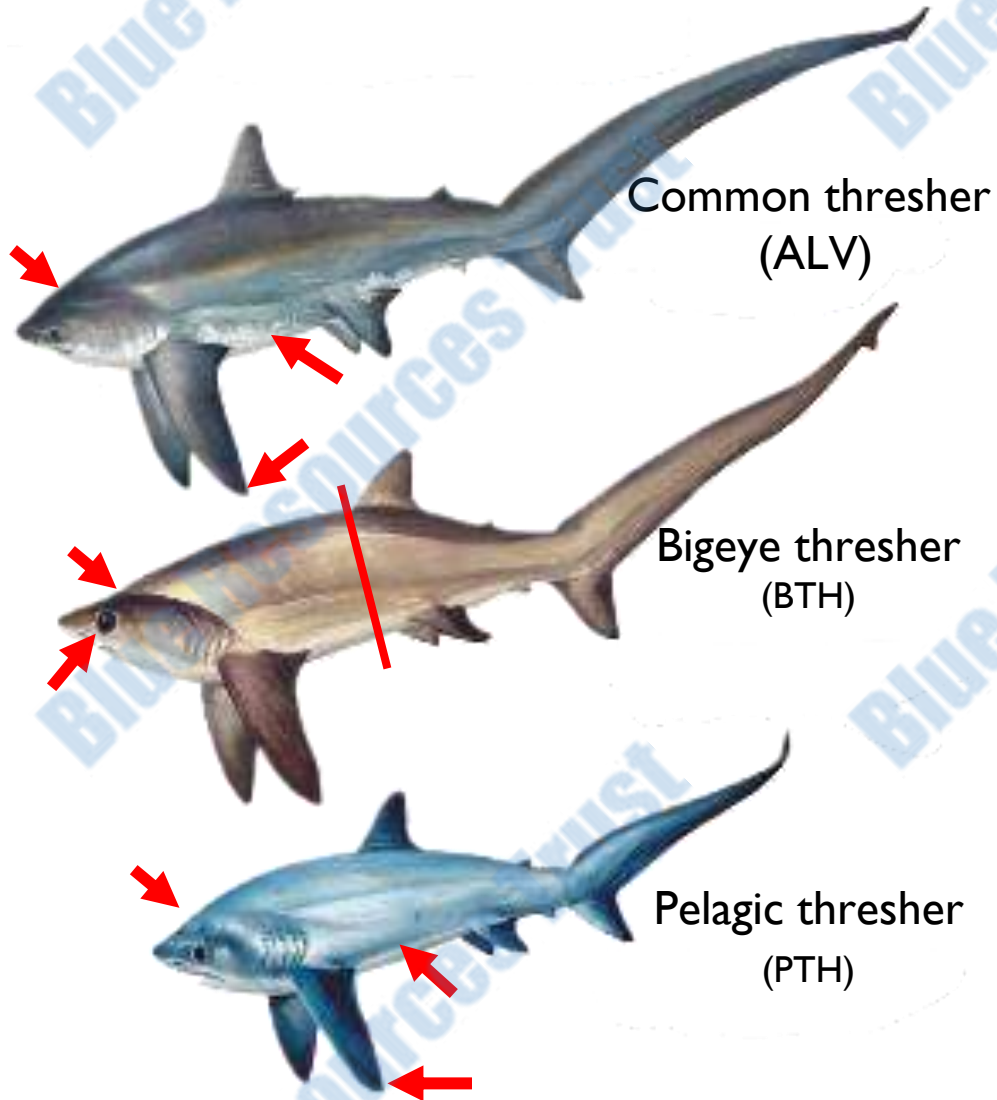


<https://www.floridamuseum.ufl.edu/discover-fish/species-profiles/sphyrna-zygaena/>

# Thresher shark



# Thresher shark

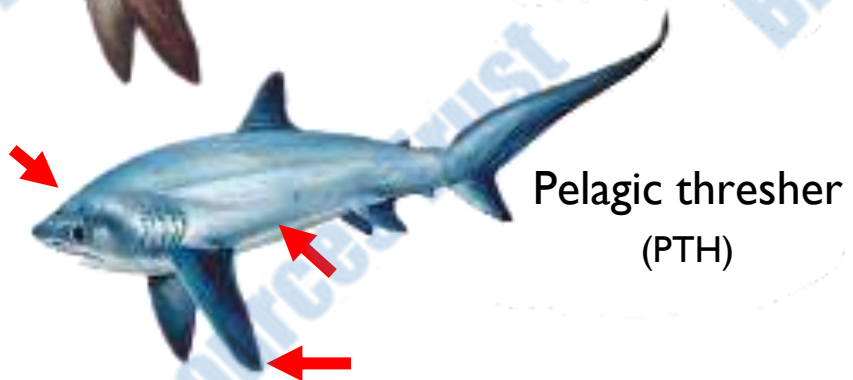
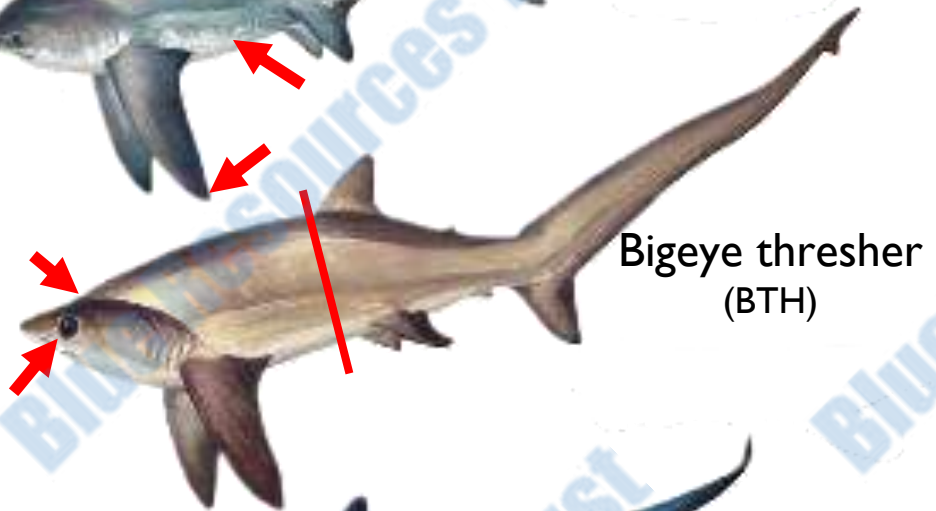
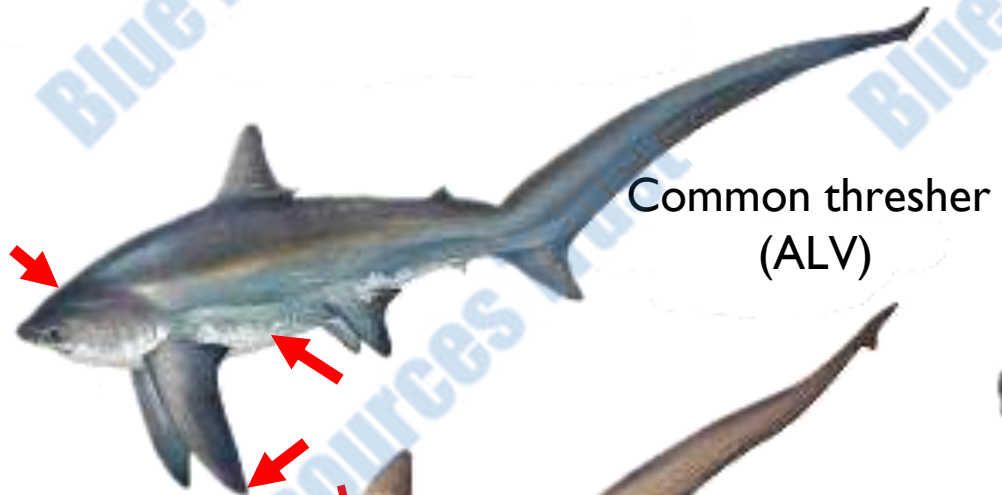


- No groove on head
- Pectoral fin tip - Pointed
- White colour of belly extending above pectoral and pelvic fins

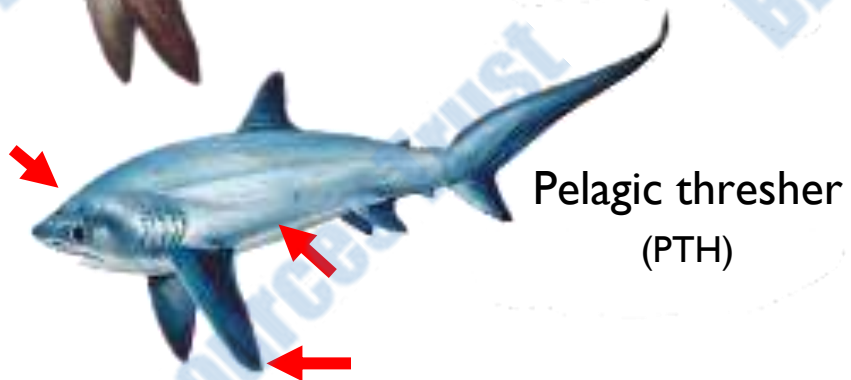
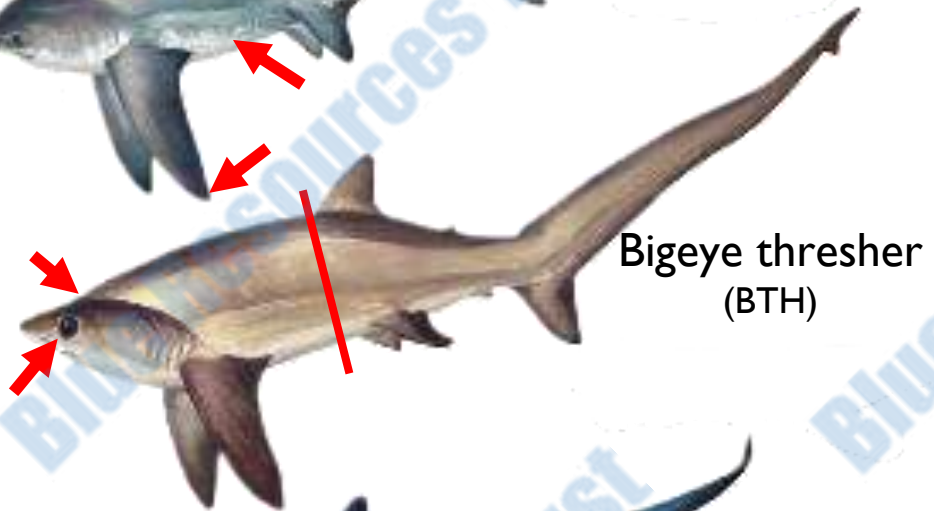
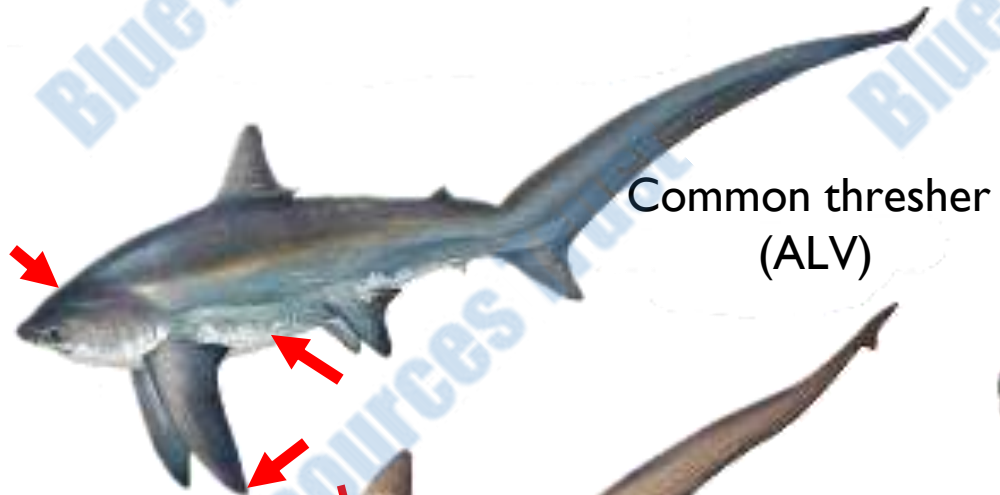
- Groove on head
- Huge eyes extending on the dorsal head surface
- Dorsal fin closer to pelvic fins than to pectoral fins

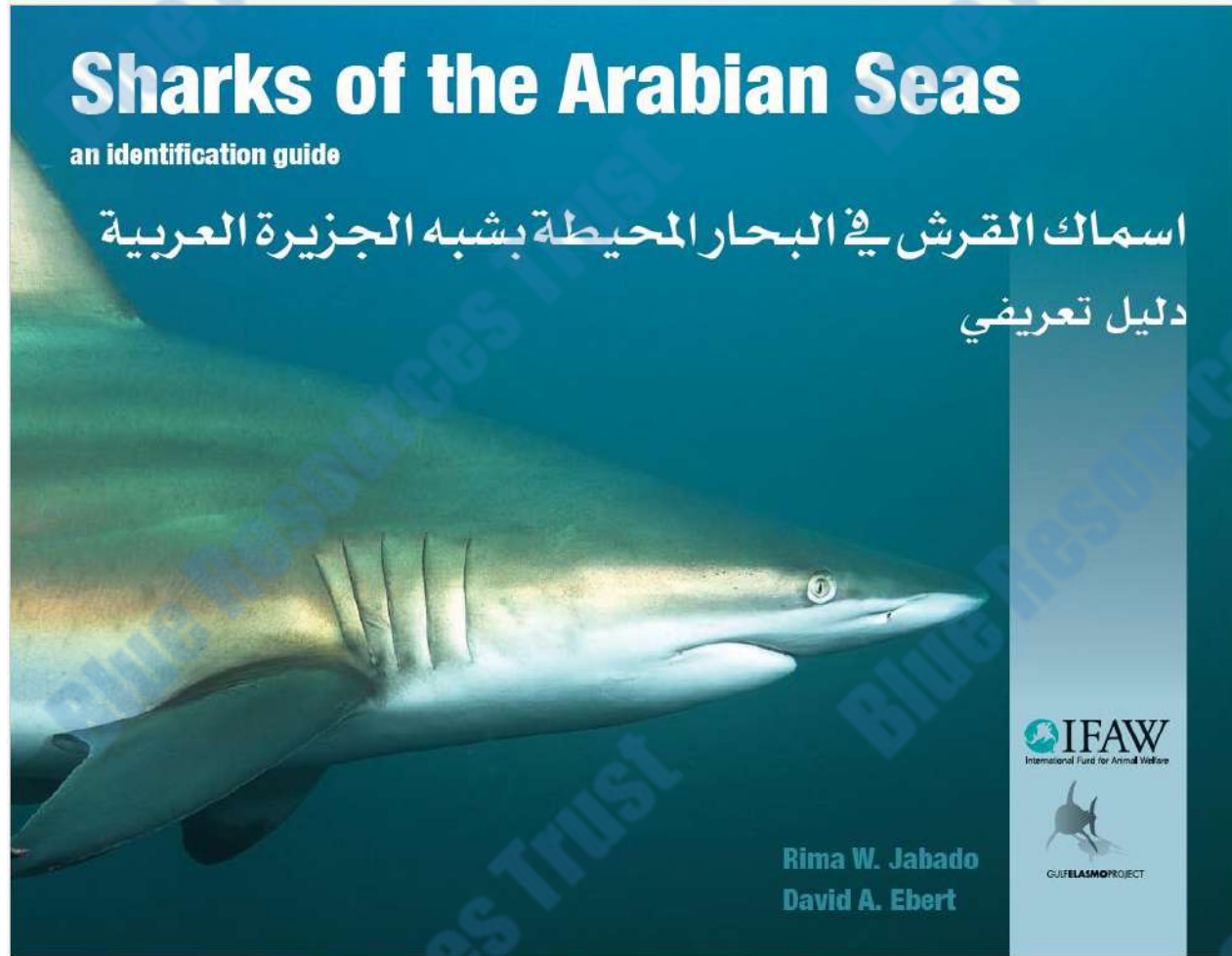
- No groove on head
- Pectoral fin tip – Rounded
- Side belly - Silvery or bluish

# Thresher shark



# Thresher shark





- How to use this guide - Page 22
- Shark morphology and glossary -  
Page 28-30
- Key to shark orders- Page 31

## KEY TO SHARK ORDERS IN THE REGION

### HEXANCHIFORMES: COW SHARKS

6 OR 7 GILL SLITS, ANAL FIN, 1 DORSAL FIN



### ECHINORHINIFORMES: BRAMBLE SHARKS

5 GILL SLITS, NO ANAL FIN, 2 DORSAL FINES,  
DORSAL FIN SPINES, SNOUT SHORT



### SQUALIFORMES: DOGFISH SHARKS

5 GILL SLITS, NO ANAL FIN, 2 DORSAL FINES,  
DORSAL FIN SPINES, SNOUT SHORT



### PRISTIOPHORIFORMES: SAWSHARKS

5 OR 6 GILL SLITS, NO ANAL FIN, 2 DORSAL FINES,  
SNOUT LONG AND SAW SHAPED WITH LONG BARBELS



### HETERODONTIFORMES: BULLHEAD SHARKS

5 GILL SLITS, ANAL FIN, 2 DORSAL FINES, DORSAL FIN  
SPINES



### LAMNIFORMES: MACKEREL SHARKS

5 GILL SLITS, ANAL FIN, 2 DORSAL FINES, MOUTH  
BEHIND FRONT OF EYES, NO NICTITATING EYELIDS



### ORECTOLOBIFORMES: CARPET SHARKS

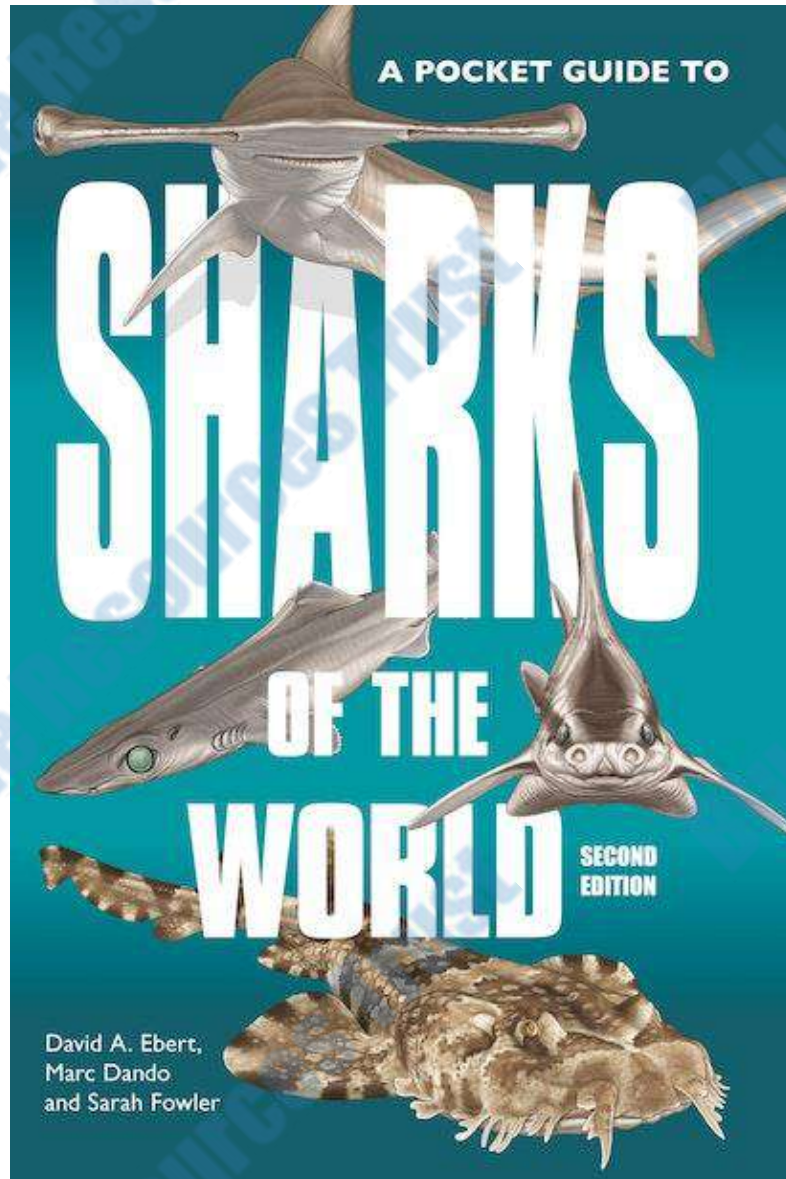
5 GILL SLITS, ANAL FIN, 2 DORSAL FINES,  
MOUTH WELL IN FRONT OF EYES



### CARCHARHINIFORMES: GROUND SHARKS

5 GILL SLITS, ANAL FIN, 2 DORSAL FINES, MOUTH  
BEHIND FRONT OF EYES, NICTITATING EYELIDS PRESENT





- How to use this guide - Page 12
- Topography of shark - Page 13-15
- Key to orders and families of sharks -  
Page 30-38
- Glossary - Page 254-258

Questions?



# Identify Species Landed!!



# Identify Species Landed!!



*Mobula eregoodoo*



*Mobula mobular (japanica)*



*Mobula kuhlii*



*Mobula tarapacana*



*Mobula thurstoni*



*Mobula birostris (Manta)*

# Why is ID'ing important?

- Field research
- International trade enforcement
  - Gill plate trade
- What can one ID:
  - Live/dead animals
  - Gill plates
  - Meat (*using genetics*)



*Mobula eregoodootenkee*



*Mobula japanica*



*Mobula kuhlii*



*Mobula tarapacana*

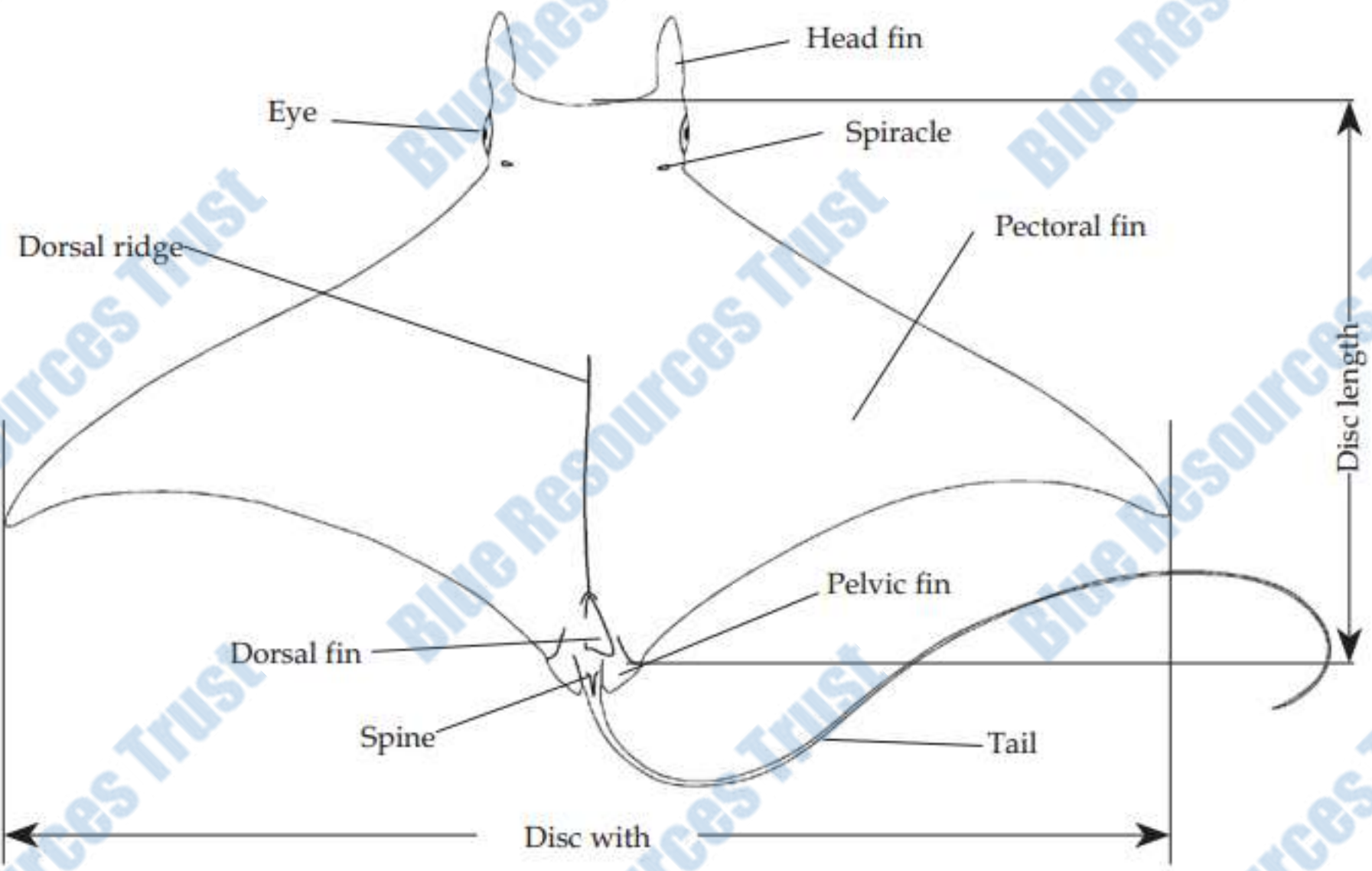


*Mobula thurstoni*



## Common *Mobula spp.* in the Indian Ocean

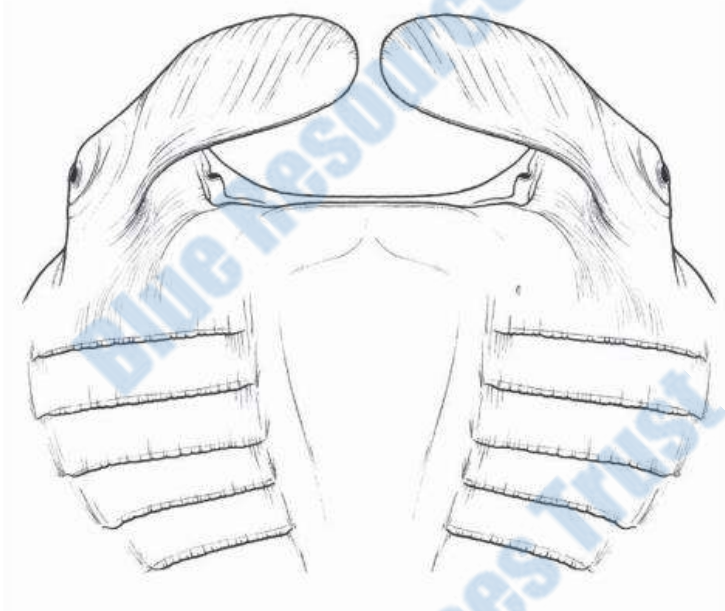
1. *Mobula birostris* – Oceanic Manta Ray
2. *Mobula mobular/japanica* – Spinetail Devil Ray
3. *Mobula tarapacana* – Sicklefin Devil Ray
4. *Mobula thurstoni* – Bentfin Devil Ray
5. *Mobula kuhlii* – Shorhorn Pygmy Devil Ray
6. *Mobula eregoodoo* – Longhorned Pygmy Devil Ray



# Distinguishing Features

## MANTA

Head width 21–22% of DW; toothband present only on lower jaw



## MOBULA

Head width 16–17% of DW; toothbands in both jaws.



Is the mouth terminal?

YES

NO

# Distinguishing Features

## MANTA

Head width 21–22% of DW; toothband present only on lower jaw

## MOBULA

Head width 16–17% of DW; toothbands in both jaws.

Is the mouth terminal?

YES

NO













A photograph showing three dead manta rays and mobulae lying on a dark, wet surface. The animals are arranged in a triangular pattern. The top ray is the largest, with a large, deep, bloody wound on its ventral side. The bottom ray is also large, with a similar bloody wound. The middle ray is smaller. All three animals have light-colored, possibly white or pale blue, skin with darker, mottled patterns on their dorsal sides. Their pectoral fins are spread out. In the background, a person's leg and foot are partially visible, and a dark vertical pole is on the right. A large, diagonal watermark reading "Blue Resources Trust" is overlaid across the image.

Manta  
(*Mobula birostris*)

Mobula  
(*Mobula mobular*)



***Mobula birostris***



***Mobula alfredi***

# 1) *Mobula mobular (japanica)* – Spinetail Devil Ray

- Up to **3.2 meters** in disc-width
- White ventral surface
- Deep-blue to black dorsal surface
- Spine at tail base



# 1) *Mobula mobular (japanica)* – Spinetail Devil Ray

- All gill slit covers are white
- Spiracle is slightly elongated, above the margin of the pectoral fin where the fin meets the body.
- white above eye-level



## 2. *Mobula tarapacana* – Sicklefin Devil Ray

- Up to **3.4 meters in disc-width**
- Olive-green dorsal surface
- No white shading above eye-level



© Tom Burd

## 2. *Mobula tarapacana* – Sicklefin Devil Ray

- Anterior ventral surface is white, while posterior region is grey with zigzagged margin
- Dark shading along 1<sup>st</sup> gill slit cover



### 3. *Mobula thurstoni* – Bentfin Devil Ray

- Up to **1.8 meters in disc-width**
- Ventral surface is mostly white, with dark shading along anterior margin double curvature
- Deep blue-black dorsal surface



### 3. *Mobula thurstoni* – Bentfin Devil Ray

- White shading does not extend above eye-level



### 3. *Mobula thurstoni* – Bentfin Devil Ray

- White shading does not extend above eye-level



*M. mobular* -  
white above eye-level:



#### 4) *Mobula kuhlii* – Short horned Pygmy Devil Ray

- Up to **1.2 meters in disc-width**
- Complete white ventral surface or with a dark grey-silvery sheen on the distal ends of the pectorals.
- Dark grey to light grey dorsal surface



## *Mobula kuhlii*

1. 120 cm disc-width
2. No spine.
3. **Short** tail.
4. White shading does not extend above eye level.



## *Mobula mobular (japonica)*

1. 320 cm disc-width
2. **Spine**
3. Very **long** tail (>DW)
4. White shading extends above eye level.



#### 4) *Mobula kuhlii* – Shortfin Pygmy Devil Ray

- Small, round spiracle below margin of the pectoral fin where the fin meets the body
- White markings do not extend above eye.
- No spine.



## 5) *Mobula eregoodoo* – Longhorned Pygmy Devil Ray

- Up to **1.3 meters in disc-width**
- White ventral surface with distinct triangular-shaped black or dark grey shading at leading edge of pectoral fins.
- Brown to light grey dorsal surface.



## 5) *Mobula eregoodoo* – Longhorned Pygmy Devil Ray

- Small, round spiracle below margin of the pectoral fin where the fin meets the body
- White markings do not extend above eye.
- Long-neck appearance.
- Long cephalic fins.
- No spine.



<i>M. Mobular (japanica)</i>	<i>M. tarapacana</i>	<i>M. thurstoni</i>	<i>M. kuhlii</i>	<i>M. eregoodoo</i>
DW: 320 cm	DW: 340 cm	DW: 180 cm	DW: 120 cm	DW: 130 cm
<i>Dorsal</i> : dark blue/black	<i>Dorsal</i> : olive green/brown	<i>Dorsal</i> : dark blue/black	<i>Dorsal</i> : grey	<i>Dorsal</i> : brown-grey
<i>Ventral</i> : completely white	<i>Ventral</i> : grey shading on posterior, white anterior; zigzag margin between both	<i>Ventral</i> : white with black-grey shading on distinctive curve	<i>Ventral</i> : mostly white with grey/silver pectoral tips	<i>Ventral</i> : white with distinct triangular-shaped black/dark-grey shading at leading edge of pectoral fins
White shading <u>above</u> eye; spine on base of tail; tail>DW	Black shading <u>over</u> 1 <sup>st</sup> gill slit cover; “sickle”-shaped pectoral; long-necked appearance	“S”-shaped pectoral		Long-necked appearance; unique gill plates
<i>Spiracle</i> : in an elongated slit under a distinct ridge, <u>above</u> the margin of the pectoral fin.	<i>Spiracle</i> : in an elongated slit under a ridge, <u>above and behind</u> the margin of pectoral fin.	<i>Spiracle</i> : small, sub-circular and <u>below</u> margin of pectoral fin where it meets the body	<i>Spiracle</i> : small, sub-circular and <u>below</u> margin of pectoral fin where it meets the body	<i>Spiracle</i> : small, sub-circular and <u>below</u> margin of pectoral fin where it meets the body





*M. mobular*



*M. tarapacana*



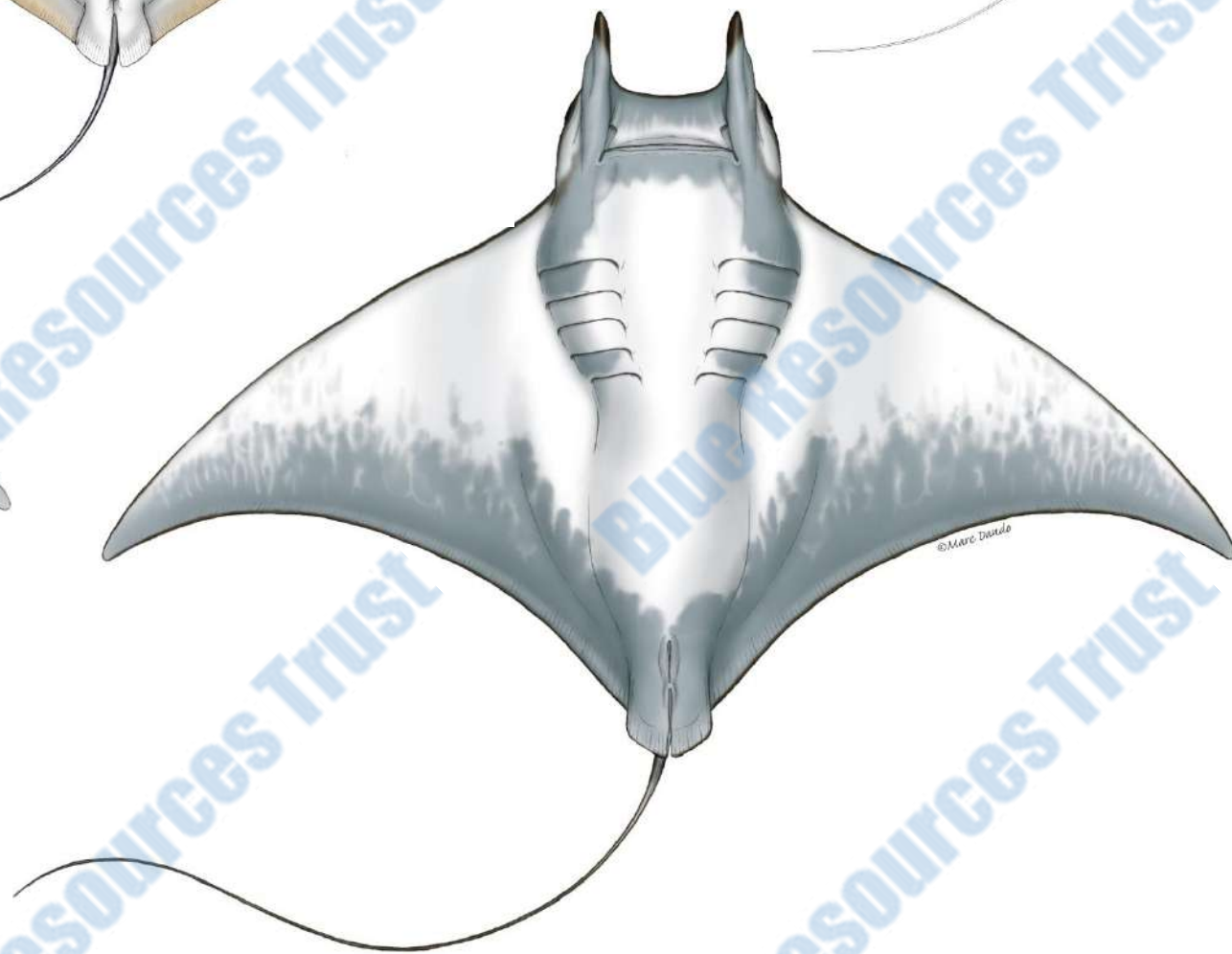
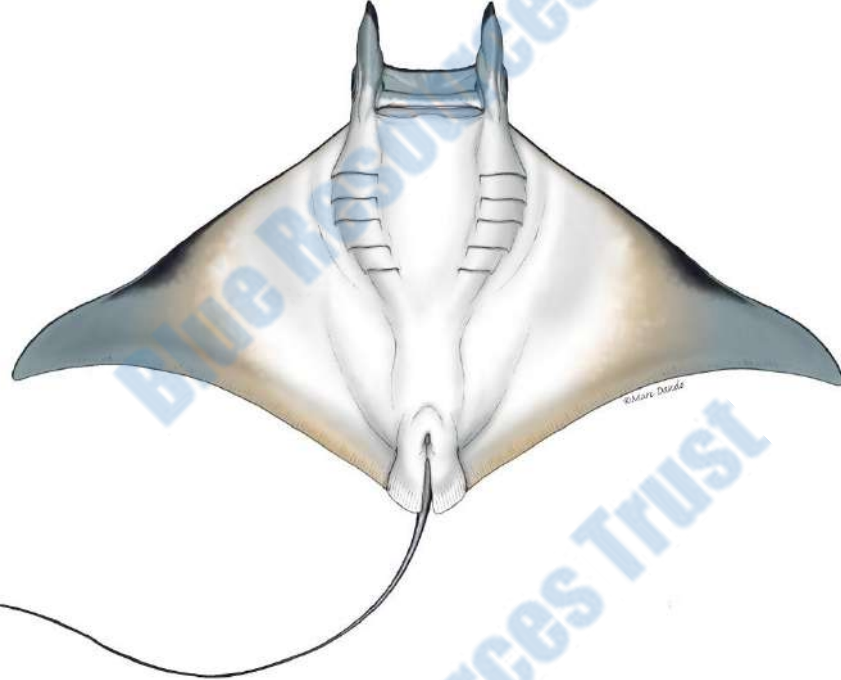
*M. kuhlii*

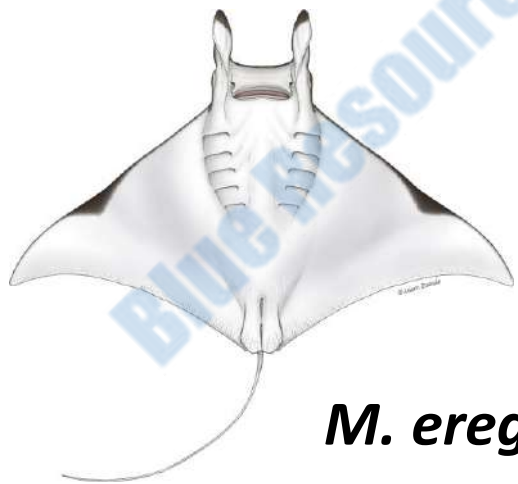


*M. thurstoni*

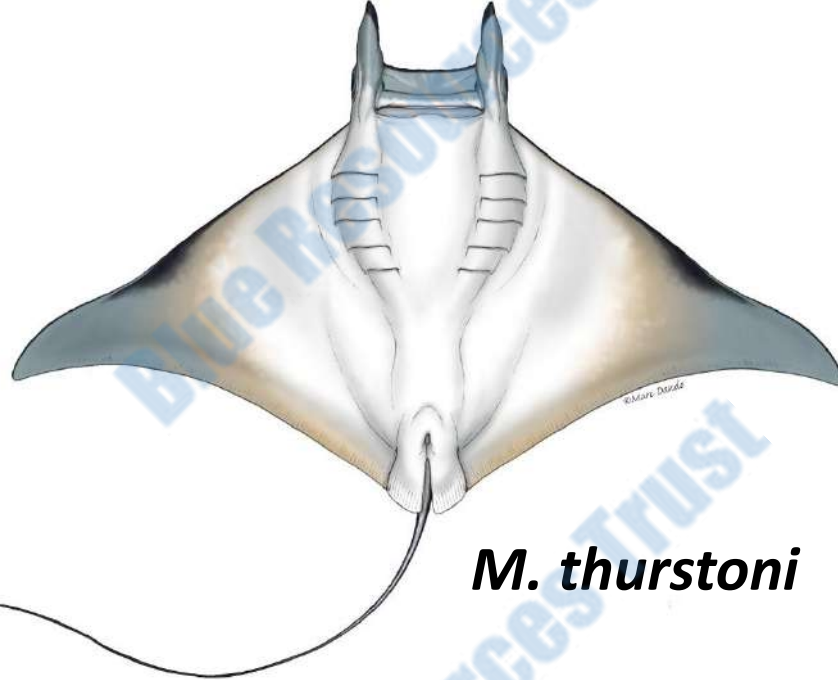


*M. eregoodoo*





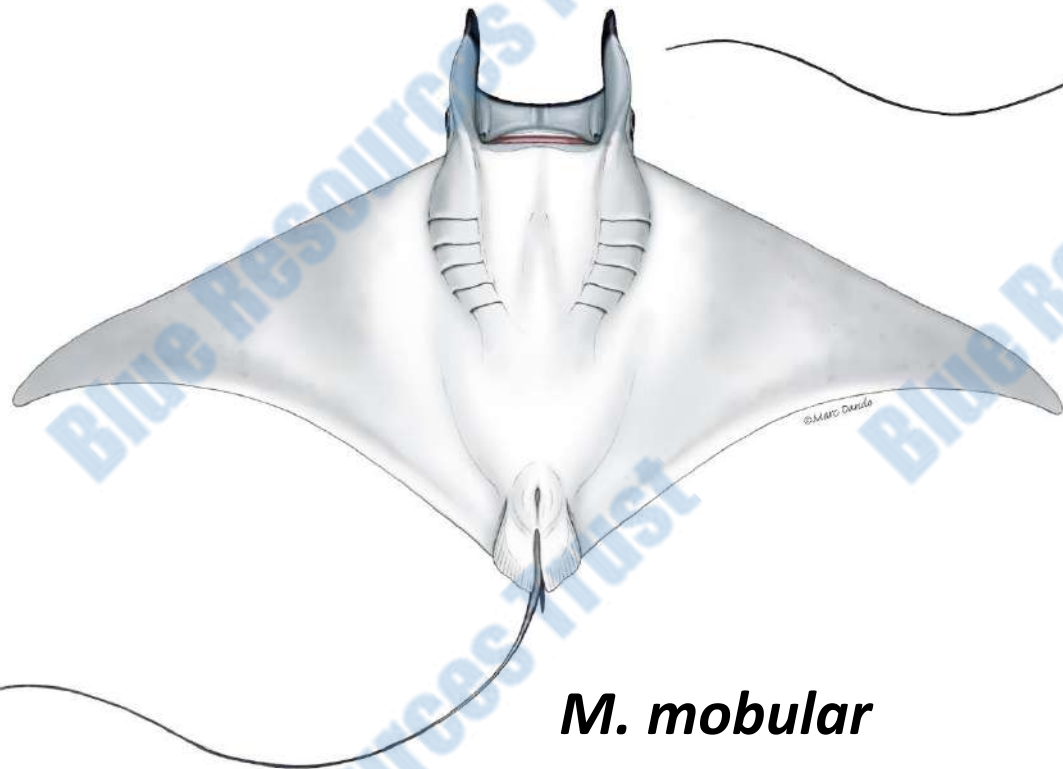
***M. eregoodoo***



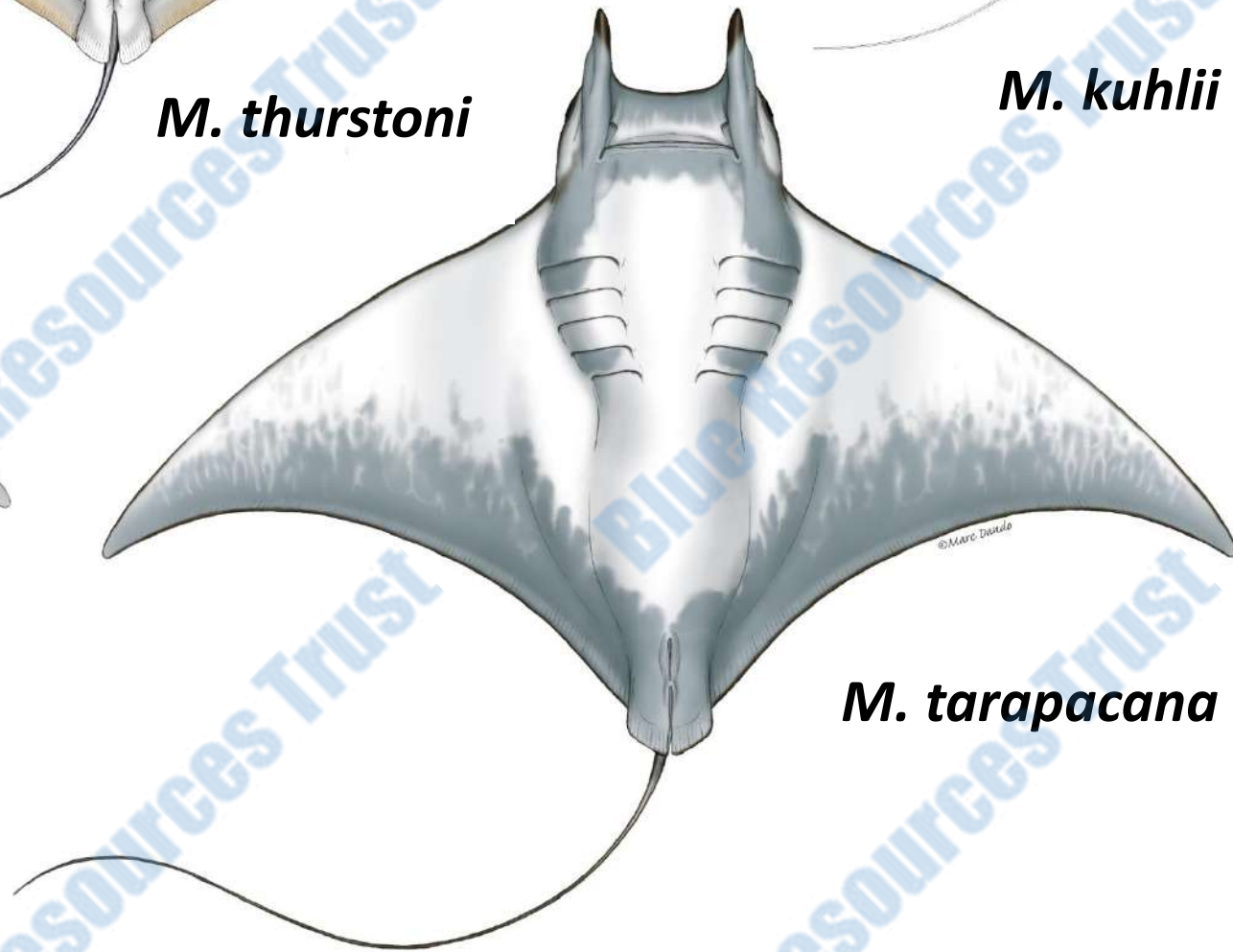
***M. thurstoni***



***M. kuhlii***



***M. mobular***



***M. tarapacana***

# Identify Species Landed!!



# Identify Species Landed!!



*Mobula tarapacana*



*Mobula birostris* (Manta)

# Identify Species Landed!!



*Mobula mobular (japanica)*



*Mobula tarapacana*



*Mobula thurstoni*



*Mobula birostris (Manta)*

# Identify Species Landed!!



*Mobula eregoodoo*



*Mobula mobular (japanica)*



*Mobula kuhlii*



*Mobula tarapacana*



*Mobula thurstoni*



*Mobula birostris (Manta)*











NOT a Manta or Mobula!











Questions?



BRAZIL  
2018

SPAIN  
2022

SRI LANKA  
2026

AUSTRALIA  
2010

SOUTH AFRICA  
2014



SHARKS  
INTERNATIONAL  
SRI LANKA 2026



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