

EUROFLEETS+ Floating University

“State and sustainable use of the ocean biological resources:
the case of the *Nephrops norvegicus* (Norway lobster)”

Onboard the R/V Mário Ruivo

Portugal, June 15th – July 5th 2021



Eurofleets+

An alliance of European marine research infrastructure
to meet the evolving needs of the research and industrial communities

BIOLOGICAL SAMPLING FOR ELASMOBRANCHES

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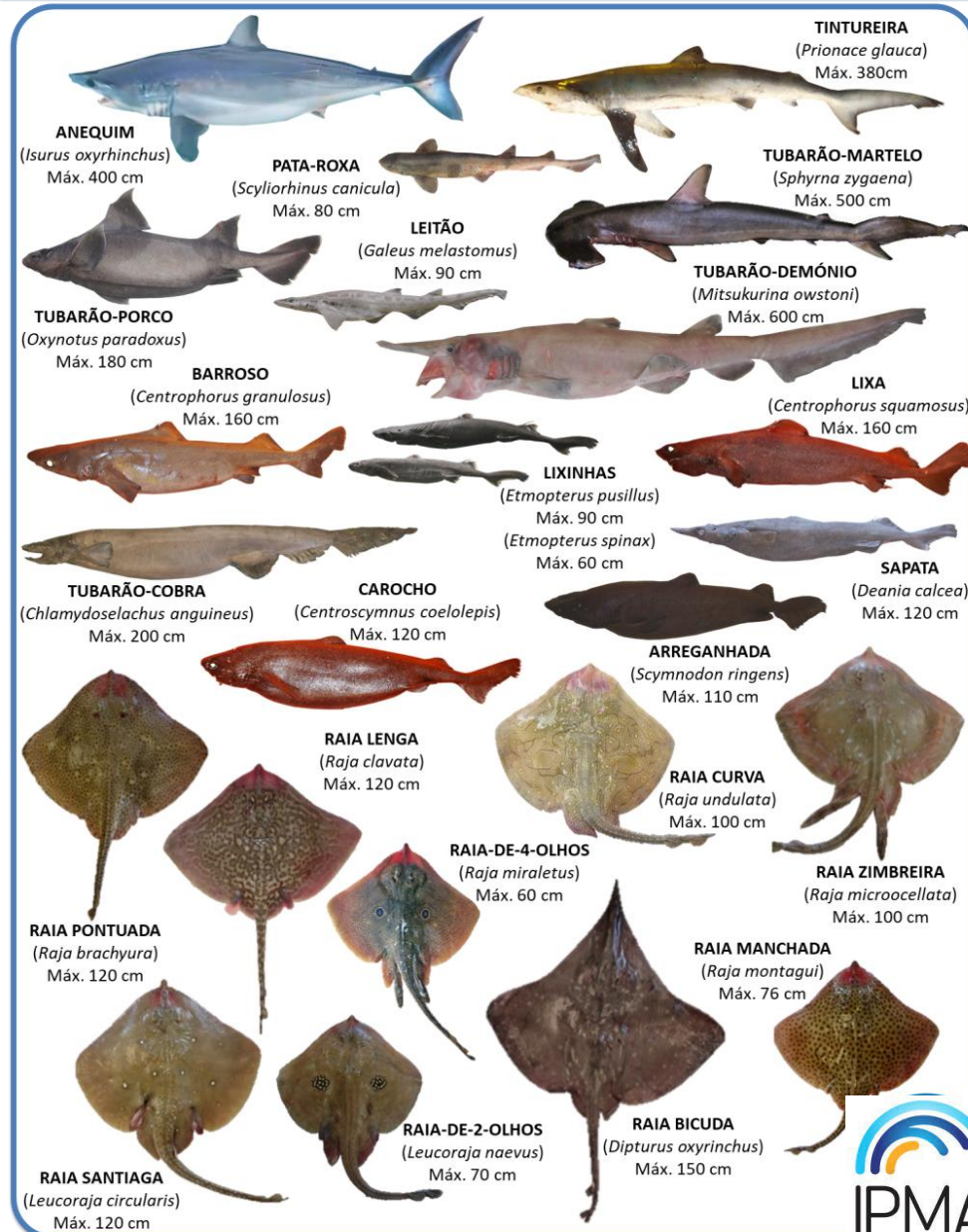


- ✓ sharks, skates and rays and chimaeras are a group of about 1100 species.
- ✓ long-lived, slow growth, late maturity and low fecundity
- ✓ result in low intrinsic rates of increase and low resilience to fishing mortality

Diversity

- Pelagic (e.g. Blue shark *Prionace glauca*, Shortfin mako *Isurus oxyrinchus*)
- Demersal (e.g. Lesser spotted dogfish *Scyliorhinus canicula*, thornback ray *Raja clavata*, Longnosed skate *Dipturus oxyrinchus*)
- Deep-water (> 400) (Lanternsharks *Etmopterus spp.*, Deania dogfishes *Deania spp.*, Leafscale gulper shark *Centrophorus squamosus*)

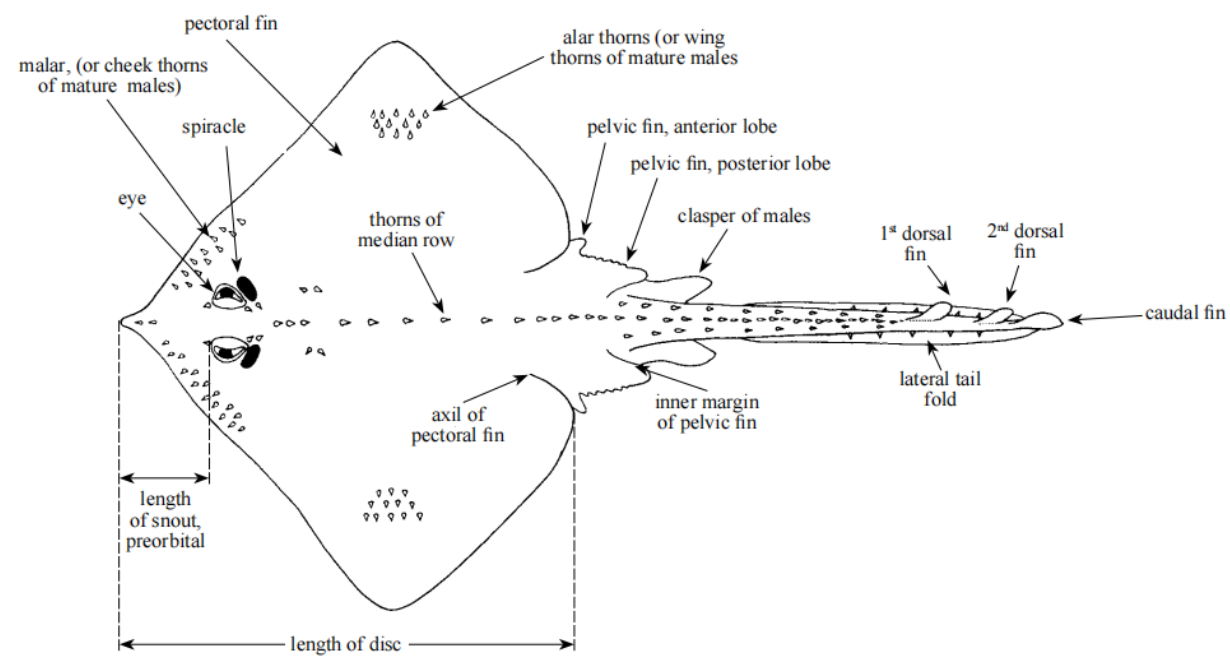
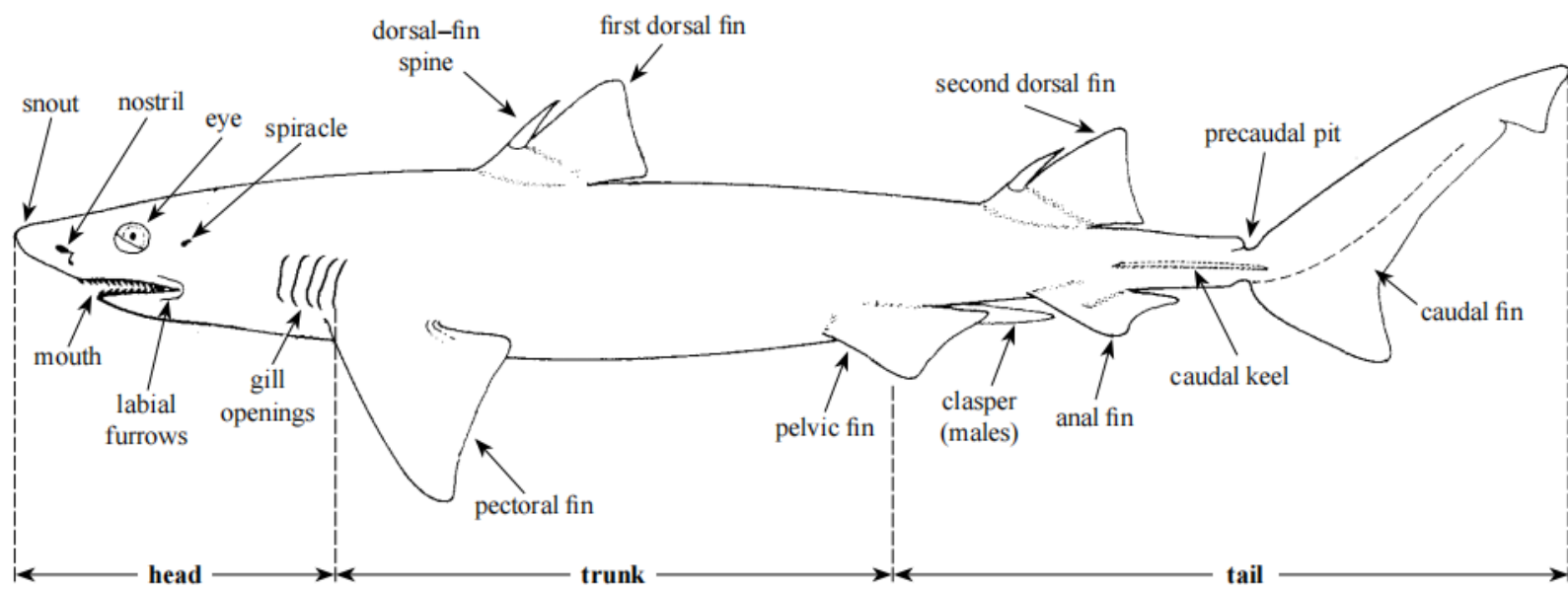
Sharks and Rays of Portugal





Collect information on:

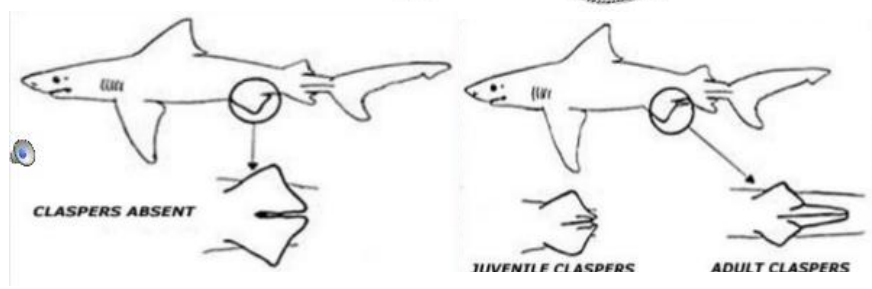
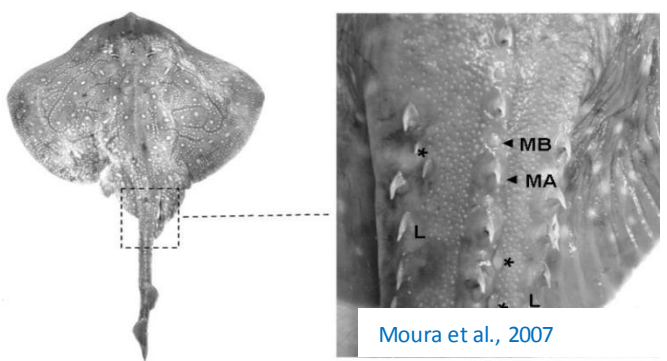
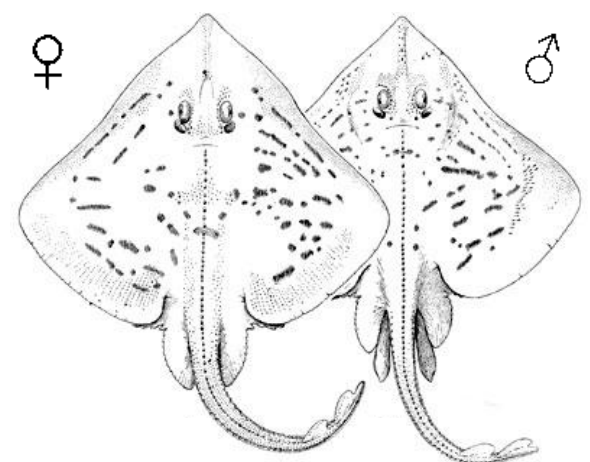
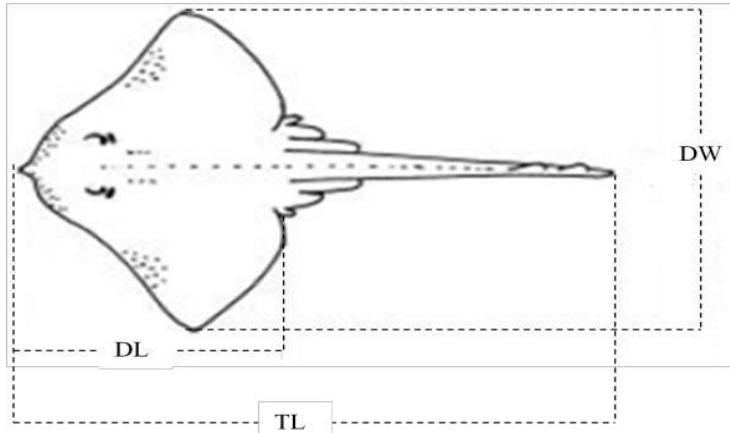
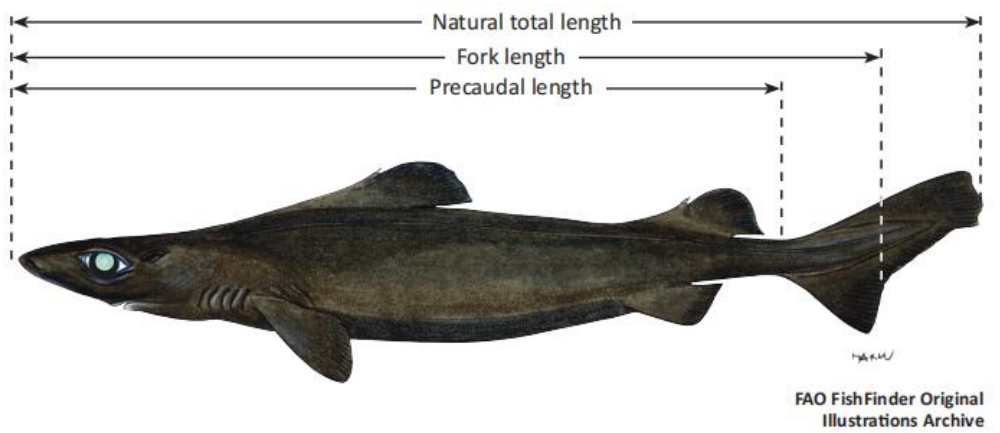
- ✓ geographical distribution and relative abundance
- ✓ biological parameters (sex-ratio, length-weight, maturity, growth...)
- ✓ biodiversity
- ✓ hydrographical and environmental parameters (e.g., temperature, salinity)
- ✓ sediment data to improve the definition of species habitat



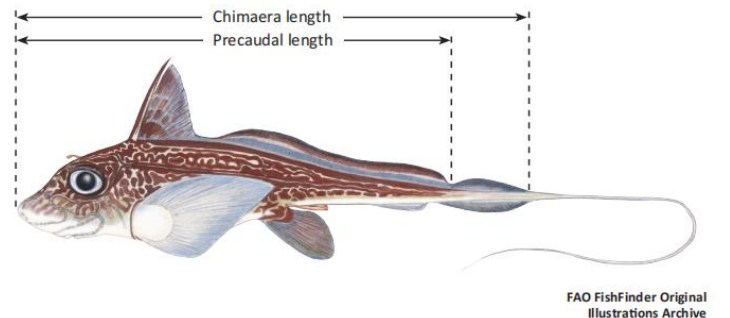


- ✓ Total length
- ✓ Disc length
- ✓ Disc width
- ✓ Fork length
- ✓ Pre-Caudal length
- ✓ Sex
- ✓ Maturity stage
- ✓ Total weight
- ✓ Gutted weight
- ✓ Liver weight
- ✓ Gonads weight

- ✓ Vertebra, fin or dorsal spines
- ✓ muscle
- ✓ other structures for histology studies, blood.....



Adapted from Fishes of the Western North Atlantic, 1949

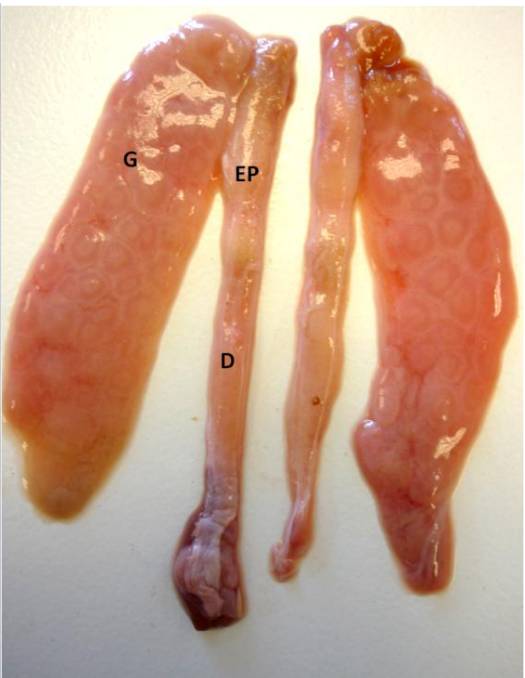
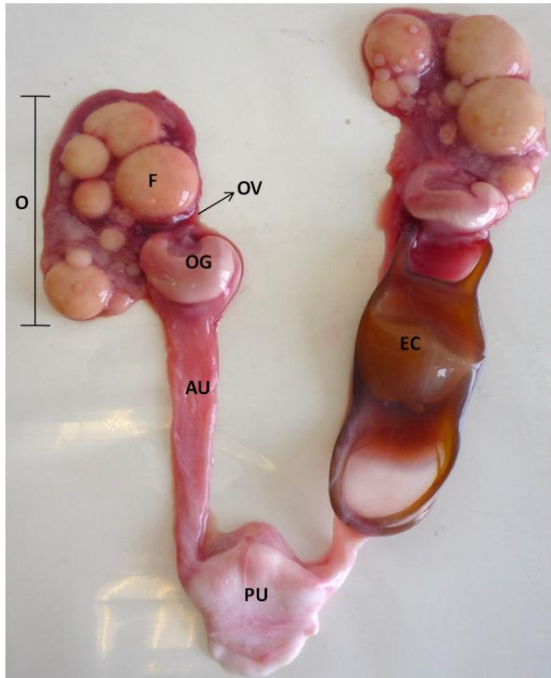




Oviparous species

Females

Males



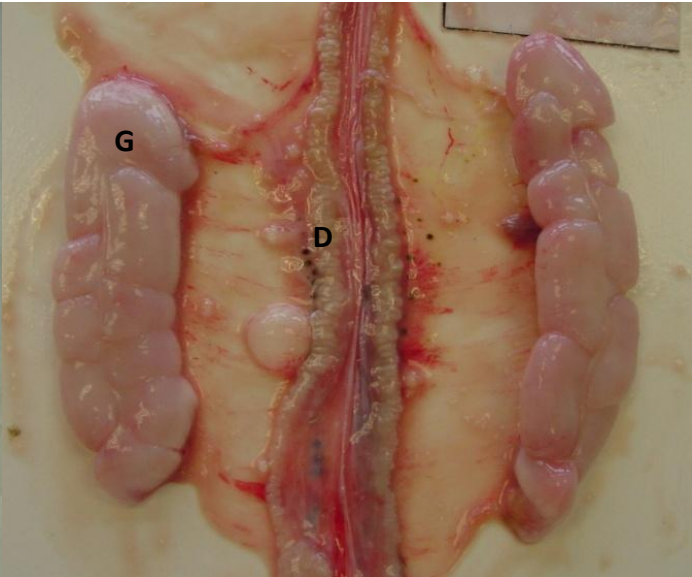
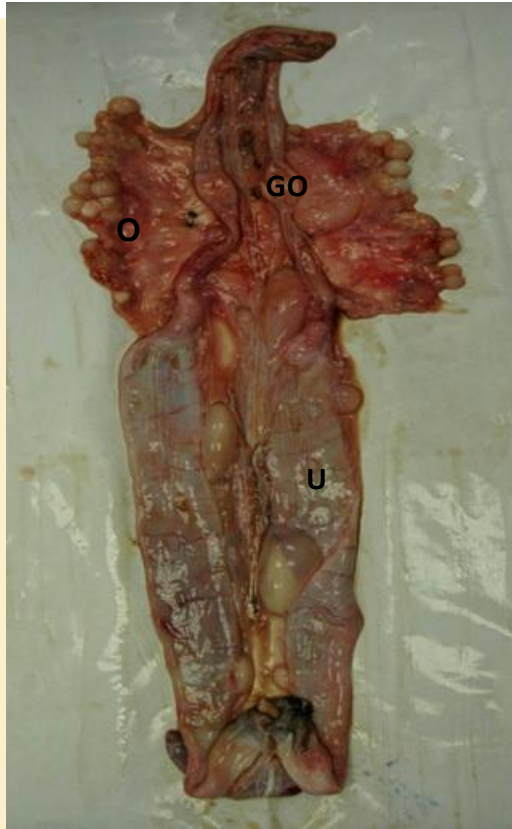
- O- ovary
- F- follicle
- Ov- oviduct
- OG- oviducal gland
- AU- anterior uterus
- PU- posterior uterus
- EC- egg capsules

- G- gonads
- EP- epididimus
- D- spermatic ducts

Viviparous species

Females

Males



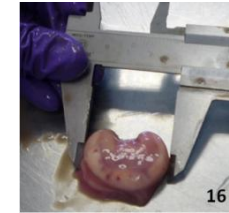
- O- ovary
- OG- oviducal gland
- U- uterus

- G- gonads
- D- spermatic ducts

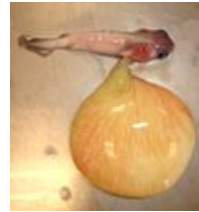


Females

- ✓ Anterior uterus width
- ✓ Posterior uterus length and width
- ✓ Oviducal gland width, height and thickness

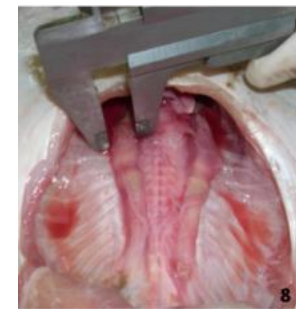
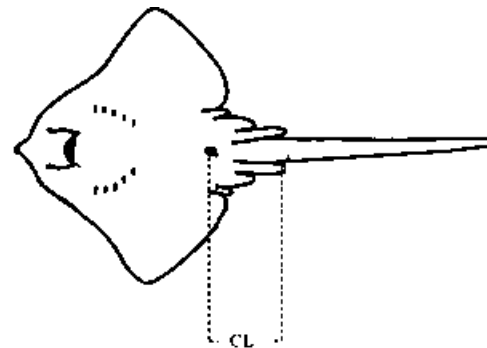


- ✓ Follicles diameter and number, maximum diameter and number of POFs and atresia in each ovary
- ✓ Egg capsules length, width and thickness, anterior and posterior horns length and anterior and posterior apron width of each egg capsule and weight (oviparous)
- ✓ Embryos total length, weight and sex



Males

- ✓ Clasper length
- ✓ Ducts width






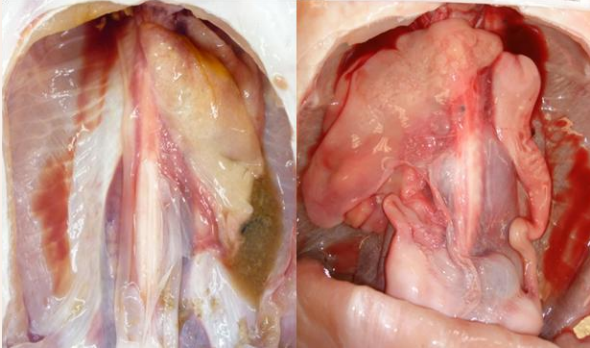
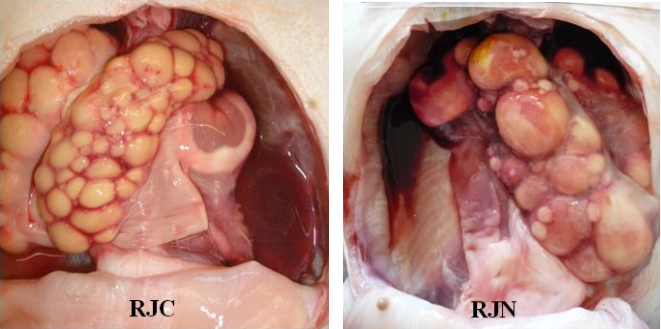
Oviparity

- Eggs are enclosed within an egg case and deposited in the sea.
- All batoids of the family Rajidae and six families and over 100 species of sharks in the orders Heterodontiformes, Orectolobiformes and Carcharhiniformes
- retained oviparity (egg capsules are retained in the oviduct and development proceeds for a longer period inside of the mother's body)
- extended oviparity (almost all of the embryonic development occurs outside of the mother's body)
 - Rajidae
 - Scyliorhinus spp.
 - Galeus spp.



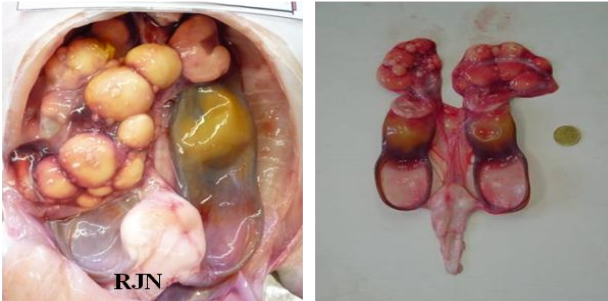
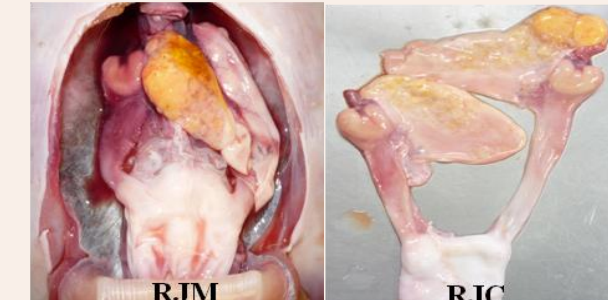
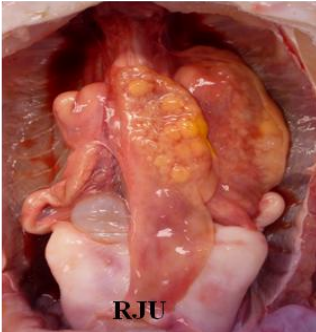


Females

Stage	Description	
1 Immature	Ovaries small whit a white colour and homogeneous. Undistinguishable follicles. In some species a thickening of the uteri where the oviducal gland will develop may be visible. Uteri thread-like.	
2 Developing	Ovaries with small follicles of different sizes, often restricted to the anterior portion of ovaries. Some may be larger and yellow in colour. Oviducal gland and uteri developing.	
3a Spawning capable	Ovaries large full of large yellow/orange follicles ready to be ovulated. Oviducal gland and uteri fully developed.	



Females

Stage	Description	
<p>3b Spawning</p>	<p>Similar to stage 3a. Presence of egg capsules.</p>	
<p>4a Regresing</p>	<p>Ovaries shrunken and flaccid, with few follicles of different size. Atretic follicles may be present. Presence of large follicles entering atresia. Oviducal gland and uteri with dimension similar to stage 3a, but flaccid (difference relative to stage 2).</p>	
<p>4b Regenerating</p>	<p>Ovaries large and full of small follicles (similar to stage 2). Pre-ovulatory follicles absent. Oviducal gland and uteri with dimension similar to stage 3.</p>	



Males

Stage	Description	
<p>1 Immature</p>	<p>Claspers flexible and smaller than pelvic fins. Tests small, sometimes with some visible lobules. Spermatic ducts straight hard to visualize.</p>	
<p>2 Developing</p>	<p>Claspers flexible and as long or longer than pelvic fins. Tests with visible lobules not occupying all the surface. Ducts developing and beginning to coil.</p>	



Males

Stage	Description	
<p>3a Spawning capable</p>	<p>Claspers totally developed, rigid and longer than pelvic fins. Tests fully developed filled with lobules in the surface. Ducts enlarged, tightly coiled and full of sperm.</p>	
<p>3b Spawning</p>	<p>Similar to stage 3a. Clasper's tips dilated and reddish. Sperm present in claspers and/or running from cloaca and /or from ducts when pressed.</p>	

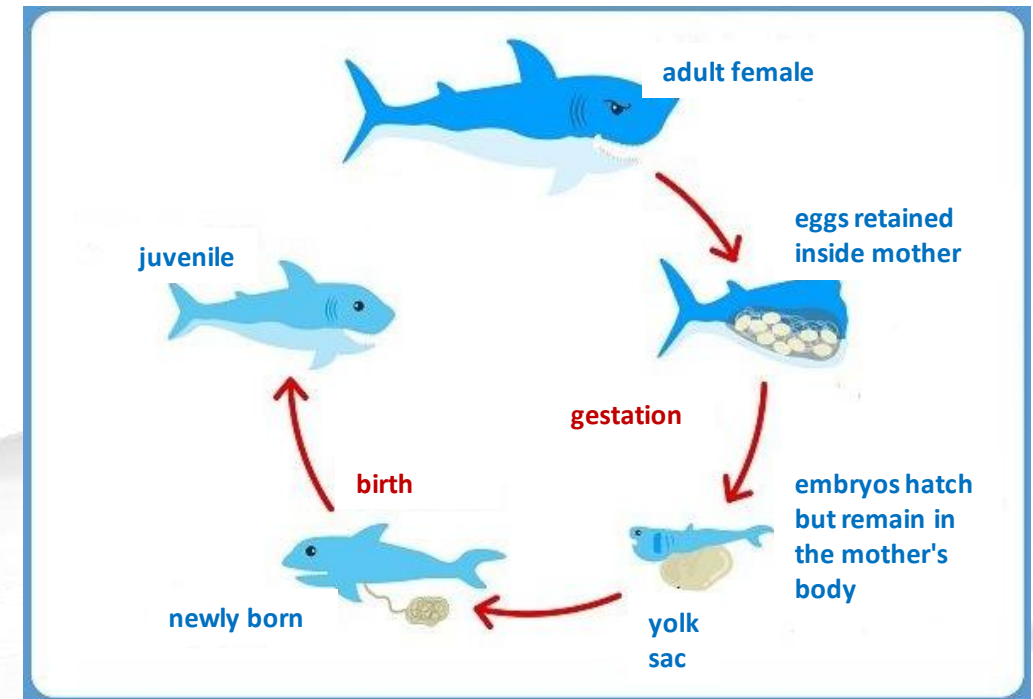


Aplacental viviparous

- Embryos development is retained within the mother for the duration of development, but no placental connection is formed between the mother and the embryo
- Placental analogues (those which possess placental analogues, e.g. Atlantic stingray *Dasyatis sabina*)
- Oophagy and adelphophagy (those which feed on other eggs or embryos, e.g. Porbeagle *Lamna nasus*)
- Aplacental yolk sacs (those dependent entirely on yolk reserves)
 - Etmopterus* spp.
 - order Squaliformes (*Deania* spp, *Centrophorus squamosus*, *Centrocygnus coelolepis*, *Scymnodon ringens*)




Placental viviparous

- during the course of embryonic development after an initial period of reliance on yolk from a yolk sac, the yolk sac attaches to the uterine wall and forms a yolk sac placenta and the associated yolk stalk forms the umbilical cord (great white shark *Carcharodon carcharias*)





Females

Stage	Description	
<p>1 Immature</p>	<p>Ovaries small, granular in appearance or with small oocytes. The uterus has a filamentous appearance (usually between 2 to 5 mm wide). The oviductal gland is not differentiated.</p>	
<p>2 Maturing</p>	<p>Oocytes at different levels of development. There are no atretic oocytes in the ovary. Uterus wider than in stage 1, but still relatively narrow and not striated. Oviductal gland may be visible, slightly dilated.</p>	
<p>3 Mature</p>	<p>Ovaries with large vitellogenic oocytes, which can reach 9 cm in diameter, depending on the species. They can be easily counted and measured.</p>	



Females

Stage	Description	
<p>4 Developing</p>	<p>Very large uterus due to the presence of eggs inside. Embryos cannot be distinguished.</p>	
<p>5 Diferenciacion</p>	<p>Inside the uterus, the yolk is segmented and it is possible to distinguish small embryos, not pigmented, and with large yolk sacs.</p>	
<p>6 Extruding</p>	<p>The embryos are fully formed and pigmented. Yolk sacs are very small.</p>	


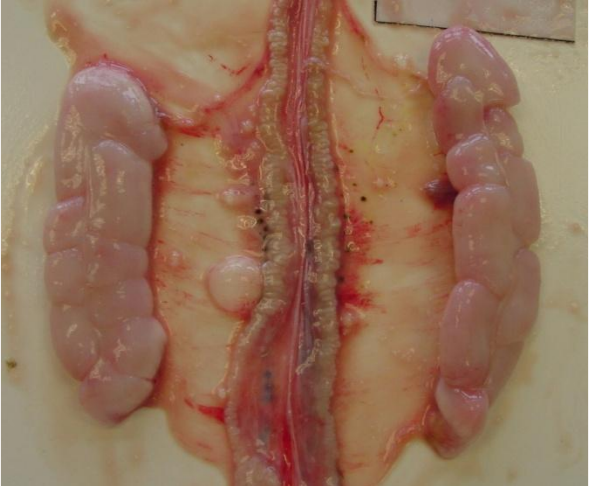


Females

Stage	Description	
<p>7 Resting</p>	<p>The uterus is empty but dilated and irrigated. The ovary has atretic oocytes (strong yellow and/or pinkish-brown color) of large dimensions.</p>	
<p>8 Regenerating</p>	<p>Stage similar to 2, distinguished from this due to the presence of many atresia in the ovary. The uterus slightly wider, striated and irrigated, really giving the impression that it has already released embryos.</p>	

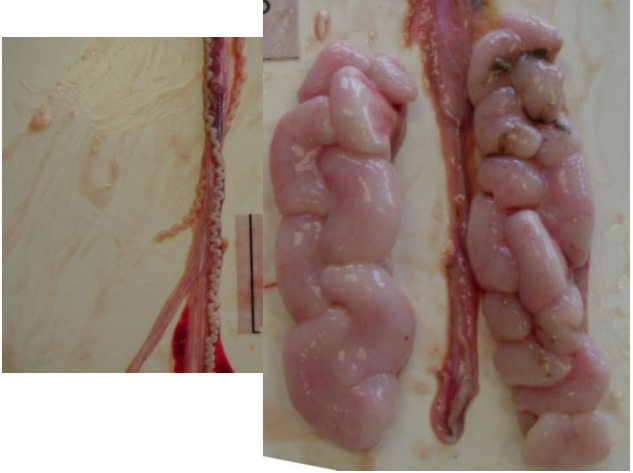
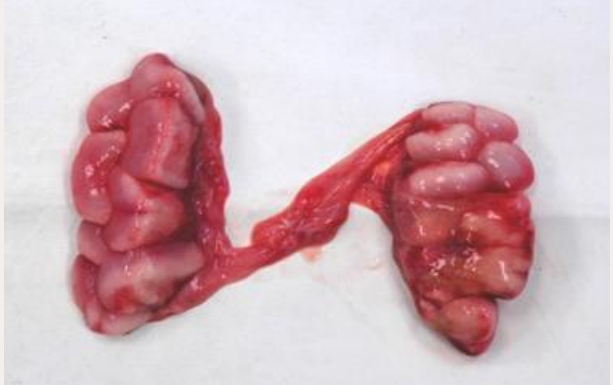


Males

Stage	Description	
<p>1 Immature</p>	<p>Claspers smaller than the pelvic fin and flexible. Small, filamentous, white testicles</p>	
<p>2 Developing</p>	<p>Claspers of the same size or larger than the pelvic fins but still flexible. Testicles larger than in stage 1. May be slightly convoluted. Ducts are coiled.</p>	

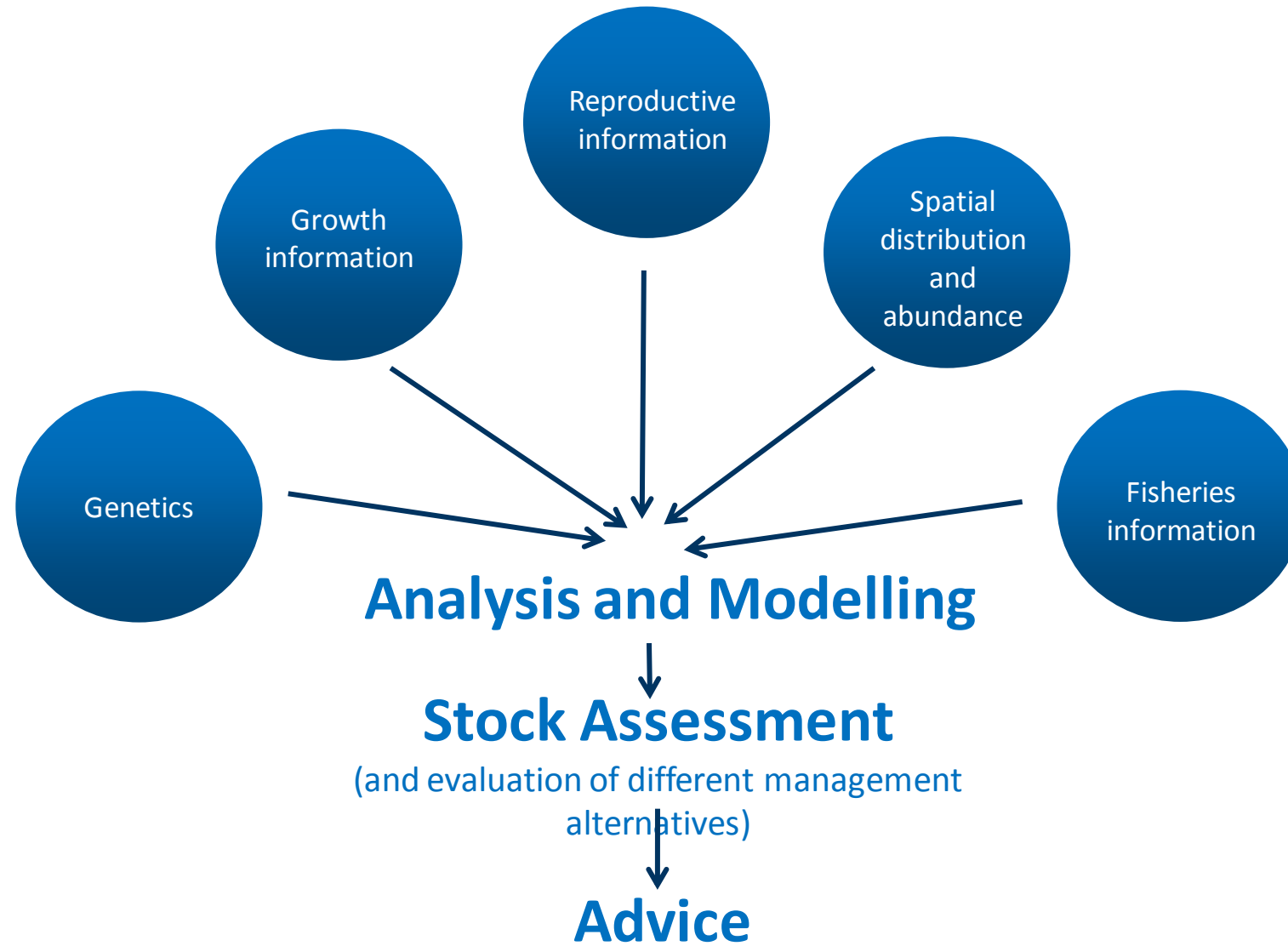


Males

Stage	Description	
<p>3 Mature</p>	<p>Claspers are fully developed and rigid. Its length may be only slightly longer than the pelvic fin. Testicles can have different sizes although they are always large and, in some species, quite convoluted. Ducts are very coiled.</p>	
<p>4 Active</p>	<p>Claspers tips dilated and red (open channels). Testicles and ducts equal to stage 3, although irrigation can sometimes be greater and the segments smaller.</p>	



Distribution and abundance	geographical distribution and relative abundance (number and weight of the individuals caught; georeferenced maturity data, sex ratio)
Growth	<p>Age estimation and growth parameters (asymptotic or maximum length L_{inf}, growth rate k or age or time when length theoretically equals zero t_0), age-at-maturity and length-at-maturity (age/length of the smallest mature fish, when 50% are mature ($L_{50\%}$ and $A_{50\%}$)) and the age or length of the largest immature fish).</p> <p>Population's age structure, growth rates, natural mortality, total mortality, susceptibility, productivity or yield per recruit or other biological reference points.</p>
Reproduction	Development of reproductive organs (oviducal gland, uterus, ovary development, claspers and ducts) relative to size or age, reproductive season (gonadosomatic index, size distribution of follicles, levels of atresia, proportion of active females), uterine state (e.g. maturity stage, size distribution of pups), fecundity (ovarian fecundity and/or uterine fecundity), egg-laying rates, size-at-hatching/Size-at-birth and other biological reference points.
Genetics	stock identification and structure
Ecology	feeding habits, habitat use and identification of essential fish habitats





Catsharks

Lesser-spotted dogfish, Black-mouth dogfish, Atlantic catshark *Galeus atlanticus*

These species are not subject to species-specific fisheries management measures in EU waters.

Assessment type: Survey trends-based (SYC - Portuguese demersal survey; GAU - Portuguese crustacean survey).

Deep-water sharks

Apristurus spp., *Chlamydoselachus anguineus*, *Centrophorus spp.*, *Centroscymnus coelolepis*, *Centroscymnus crepidater*, *Centroscyllium fabricii*, *Dalatias licha*, *Deania calcea*, *Etmopterus princeps*, *Etmopterus spinax*, *Galeus murinus*, *Hexanchus griseus*, *Oxynotus paradoxus*, *Somniosus microcephalus*, *Scymnodon ringens*

EU generic TAC (Northeast Atlantic)

- zero in 2010-2016 (2010-2011 only a small by-catch, 10% and 3%, of 2009 quotas permitted)

- 10 tonnes in 2017-2018; 7 tones in 2019-2020 (exclusively for bycatch in longline fishery targeting black scabbardfish. No target fisheries shall be permitted. Specific data-collection measures).

- ban of gillnets >600 m and ban of trawl fisheries (>800 m) in EU waters – protection of deep-water species and habitats.

- Deep-water sharks in the EU list are prohibited since 2020.

Rajidae

Raja clavata (RJC), *Raja brachyura* (RJH), *Raja microocellata*, *Raja miraletus*, *Leucoraja naevus* (RJN), *Leucoraja circularis*, *Dipturus oxyrinchus*

EU generic TAC (Bay of Biscay and Iberian Waters)

RJC, RJN, RJH shall be reported in official data.

2012: seasonal closure - May

2014: minimum landing size = 52 cm; 1st ICES Advice for Iberian skate stocks.

assessment type: Survey-based trends (RJC and RJM - Portuguese demersal survey; RJN - Spanish Survey); LPUE-based trends (RJH - Commercial polyvalent LPUE)

2016: seasonal closure - May and June

Rostroraja alba (RJA)

Raja undulata (RJU)

2009: RJU and RJA included in the prohibited species list.

2015: RJU - out of prohibited species list (9a); small experimental quota (~15 ton) aiming the collection of data on the species abundance. Other additional management measures (fishing licenses, maximum and minimum sizes, seasonal close, data report). Work in progress



THANK YOU!

