

Otoliths atlas of 77 fish species from the Iskenderun Bay, Northeastern Mediterranean Sea

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Abstract

This photographic atlas presents scanning electron micrographs of the sagittae of 77 marine teleost fish species, belonging to 36 families and 21 orders from the Iskenderun Bay, north-eastern Mediterranean using morphological features and morphometric variables. The morphological description was based on the otolith shape, outline, the shape of sulcus acusticus, ostium, cauda, features of anterior, and the posterior region. Both left (proximal surface) and right (distal surface) otoliths from the same specimen are photographed by scanning electron microscopy (SEM). Otolith shape indices including form-factor (FF), roundness (RD±SD), aspect ratio (AR), circularity (C), rectangularity (R), and ellipticity (E) are calculated for each species. A total of 76 species could be found in the AFORO database and made comparison, however otoliths of *Apogonichthyoides pharaonis* and *Saurida lessepsianus* have not found in the database.

Keywords: Earstones, Sagitta, Inner-ear, SEM, Otolith database, Shape.

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Introduction

In teleost fish, otoliths are composed of aragonite and organic material depositions increasing with fish age. Otoliths represent three paired structures formed in the inner-ear (Tuset et al. 2008) known as lapillus, asteriscus, and sagitta providing a sense of balance to fish, and also aid in hearing (Popper and Lu 2000). The sagittae is usually the largest one, and is extensively used in fisheries and ichthyological studies. They are commonly used for age determination, and generally considered to serve as taxonomical and biological archives, as they reflect species' age, growth, development population structure, and even water quality (Campana 2005; Schulz-Mirbach et al. 2011; Bani et al. 2013; Jawad 2018). Otoliths have never digested in the stomachs of predator allowing precise information on the length, weight, age, and quantity of fish prey individuals to as important knowledge for trophic ecology (Campana and Casselman 1993; Nielsen and Andersen 2001; Lowry 2011).

Furthermore, the sagittae morphology is species-specific and has been used in many studies for species identification (Tuset et al. 2006; Lord et al. 2012; Sadighzadeh et al. 2012; Bani et al. 2013). In a few cases, the asterisci or lapilli are also used in species identification and systematics (Assis 2003, 2005). Therefore, for accurate species identification, a reference collection of otoliths from known species must be produced to generate sufficient comparative material to produce accurate descriptions of morphological characteristics (Osman et al. 2020). In addition, it constitutes an important instrument for species identification using sagittae collected in fossiliferous layers, in archaeological sites (Aguilera et al. 2016). Since otoliths resist degradation better than most other tissues, shape and size of the preserved or undigested otoliths recovered from fossilized sediments, native middens, and the stomachs and droppings of fish predators can be used to reconstruct the species composition of the diet or fish assemblage (Campana 2004).

Reliable identification of fossil otoliths of geological ages is only possible through a detailed comparison with relevant otoliths of the species of the region (Aguilera et al. 2016). In this context, otolith atlas a useful tool for identifying species and systematic studies not only actual species but also fossil ones. Therefore, the preparation of otolith atlas of living species in the region is an important tool for the comparison. Some study conducted on identification of otolith morphology of actual species (Kasapoglu and Duzgunes 2015; Bostancı et al. 2015; Bostancı and Yedier 2018; Yedier and Bostancı 2020) and fossils (Rückert-Ülkümen 2006; Üner

and Ongen 2009; Landau et al. 2013; Schwarzhans 2014) in Turkey. This atlas aims to investigate the morphology of the sagittae of some fish species from Iskenderun Bay using SEM images of the otoliths.

Material and Methods

A total of 77 fish species were collected from Iskenderun Bay, the north-eastern Mediterranean by commercial bottom trawl vessels from September to December 2006. The sampled specimens were stored in ice and transferred to the laboratory kept in deepfreeze.

In the laboratory, identifications of species were confirmed (Fischer 1987; Whitehead et al. 1984, 1986a, 1986b). We follow the classification of Nelson et al. (2016) and van der Laan et al. (2014) with orders, families and subfamilies arranged systematically, but genera and species alphabetically within each family/subfamily. The taxonomic status of the species follows Fricke et al. (2020) unless mentioned otherwise.

After species identification, sagittae were removed from at least three specimens for each species (Holden and Raitt 1974). After removal, the otoliths were then pre-treated with a 3% potassium hydroxide (KOH) solution, rinsed with distilled water, and then air-dried and stored in elisa plate. A mature specimen and mod length have been selected to image analysis. Both left (proximal surface) and right (distal surface) otoliths from same specimen were used to produce an image by scanning electron microscopy (SEM) in Technology Research and Application Centre, Erciyes University. The mounting stubs were then coated with a thin layer of gold by the ion sputter machine. The standard coating duration of this machine was 35 to 40 seconds. SEM (LEO 440 Computer Controlled Digital) images were obtained using a standard procedure.

The descriptions of otolith morphology are done based on the main characters; shape, sulcus acusticus, ostium, cauda, anterior region and posterior region. The terminology used to describe the otolith parts and their morphological variations for each section, follows Tuset et al. (2008). The distal and proximal surfaces of otolith images including species name and scale have given for each species (Fig. 1).

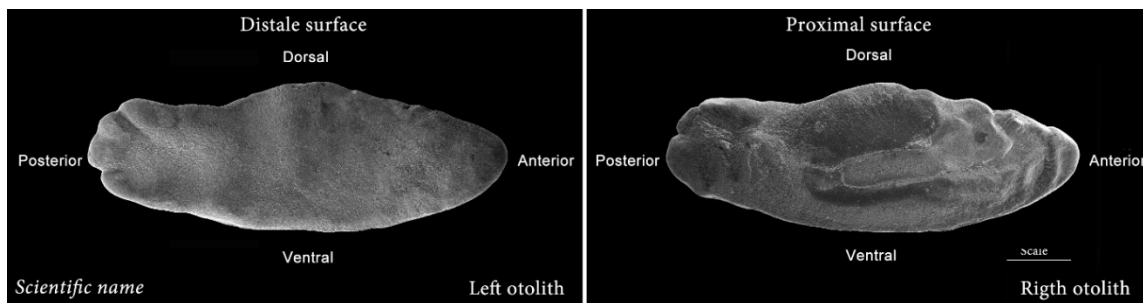


Figure 1. Presentation of SEM images of sagittae for each species.

To describe the otolith morphology, the measurements used are the following morphometrics from 10 specimens in each species (Fig. 2): L: otolith length (mm); H: otolith height (mm); A, otolith area (mm²); P, otolith perimeter (mm); SL, sulcus acusticus length (mm); OL, ostium length (mm); OH, ostium height (mm); CL, caudal length (mm); CH, caudal height (mm); CS, length of crista superior above cauda (mm) and CI, length of crista inferior below cauda (mm).

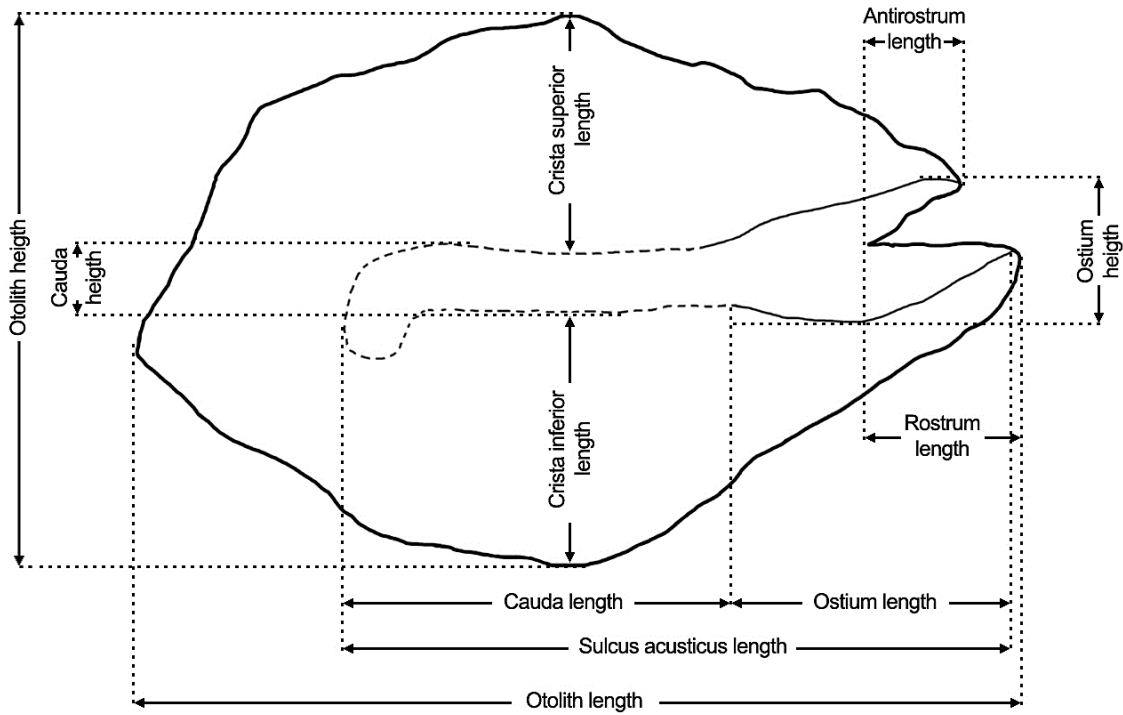


Figure 2. Measurements of the sagittae.

Some otolith shape indices, including form-factor (FF), roundness ($RD \pm SD$), aspect ratio (AR), circularity (C), rectangularity (R), and ellipticity (E) are calculated using the formulas given below (Tuset et al. 2003, 2006; Ponton 2006).

$$FF = (4\pi * A) / P^2$$

$$RD \pm SD = (4 * A) / (\pi * L^2)$$

$$AR = L / H$$

$$C = P^2 / A$$

$$R = A / (L * H)$$

$$E = (L - H) / (L + H)$$

To make an easy comparison some ratio between the variables including CS/CI, CL/CH, CL/OL, OL/OH, CH/OH were calculated.

Results

A total of, 77 marine fish species belonging to 21 orders and 36 families have been analysed from the Iskenderun Bay. AFORO database offers an open online catalogue and the shape analysis of otolith images (Lombarte et al. 2006). A total of 76 species could be found in the database and made a comparison, however the otoliths of *Apogonichthyoides pharaonis* and *Saurida lessepsianus* have not found in the database. Both pairs of SEM images of sagittae and the morphological descriptions are presented in systematic orders as follows:

ANGUILLIFORMES

Congridae

Conger conger (Linnaeus, 1758), European conger (Fig. 3)

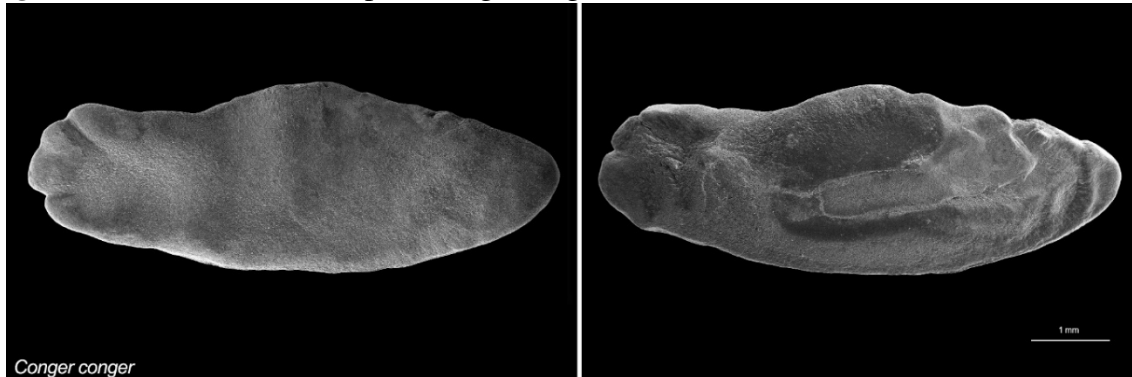


Figure 3. SEM image of sagittae of *Conger conger*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.629±0.008	0.338±0.005	2.751±0.056	19.970±0.239	0.730±0.004	0.467±0.008

Shape : oblong; dorsal margins sinuate and ventral margin entire.

Sulcus acusticus : homosulcoid, ostial, median.

Ostium : funnel-like, equal or shorter than the cauda.

Cauda : round-oval, straight.

Anterior region : round; sinuate; rostrum short, broad, round; antirostrum absent; excisura wide without a notch.

Posterior region : round; sinuate to lobed.

Depression : both dorsal and ventral depressions absent.

Gnathophis mystax (Delaroché, 1809), Thinlip conger (Fig. 4)

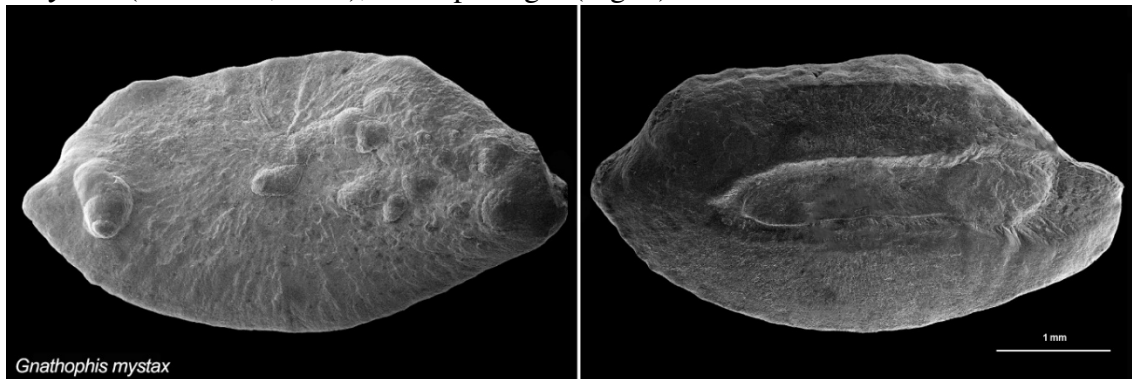


Figure 4. SEM image of sagittae of *Gnathophis mystax*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.795±0.009	0.471±0.016	1.927±0.048	15.810±0.170	0.713±0.006	0.317±0.011

Shape : elliptic; dorsal margin entire and ventral margin sinuate.

Sulcus acusticus : heterosulcoid, ostial, median.

Ostium : funnel-like, shorter than the cauda.

Cauda : tubular, straight, ending far from posterior.

Anterior region : blunt; sinuate; rostrum short, and blunt; antirostrum absent; excisura wide without a notch.

Posterior region : peaked; sinuate.

Depression : dorsal depression wide and shallow over the cauda; ventral depression absent.

CLUPEIFORMES

Clupeidae

Dussumieria elopsoides Bleeker, 1849, Slender rainbow sardine (Fig. 5)

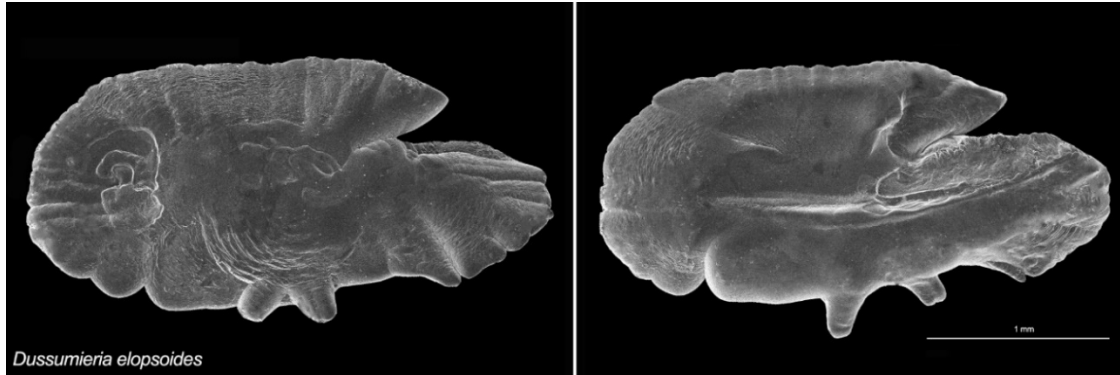


Figure 5. SEM image of sagittae of *Dussumieria elopsoides*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.560±0.030	0.466±0.002	1.905±0.057	22.480±1.187	0.697±0.018	0.311±0.014

Shape : rectangular; ventral margin dentated to irregular, dorsal margin sinuate to crenate.

Sulcus acusticus : heterosulcoid, ostial, median.

Ostium : funnel-like, longer than the cauda.

Cauda : tubular, straight, ending far from the posterior margin.

Anterior region : double-peaked; lobed to crenate; rostrum broad, long, pointed; antirostrum broad, pointed; excisura wide with a deep, acute notch.

Posterior region : round; sinuate to crenate.

Depression : both dorsal and ventral depressions absent.

Sardina pilchardus (Walbaum, 1792), European pilchard (Fig. 6)

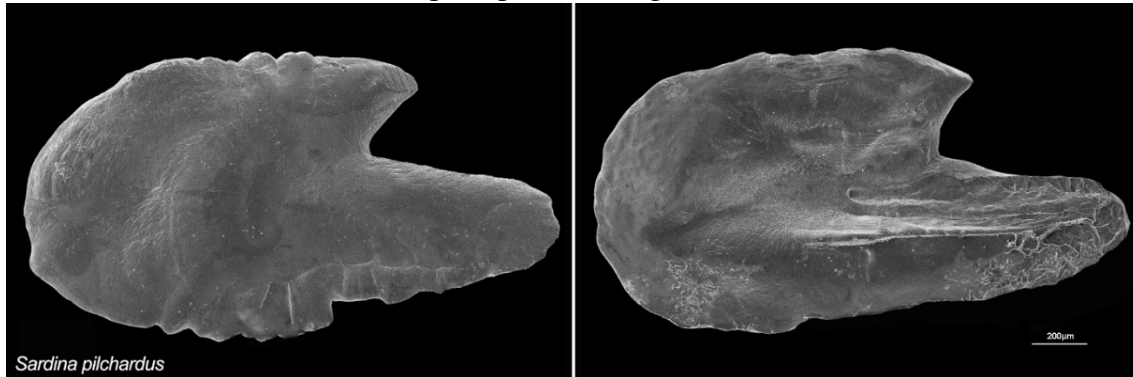


Figure 6. SEM image of sagittae of *Sardina pilchardus*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.616±0.053	0.482±0.016	1.887±0.021	20.465±1.756	0.715±0.032	0.307±0.005

Shape : lanceolated; dorsal and ventral irregular to crenate.

Sulcus acusticus : pseudo-archaesulcoid, ostial, median.

- Ostium* : funnel-like, longer and wider than the cauda.
Cauda : tubular, straight, ending far from the posterior margin.
Anterior region : double-peaked; sinuate; rostrum broad, long, pointed; antirostrum, broad, pointed; excisura wide with a deep, acute notch.
Posterior region : round; entire to sinuate.
Depression : both dorsal and ventral depressions absent.

ARGENTINIFORMES

Argentinidae

Argentina sphyraena Linnaeus, 1758, Argentine (Fig. 7)

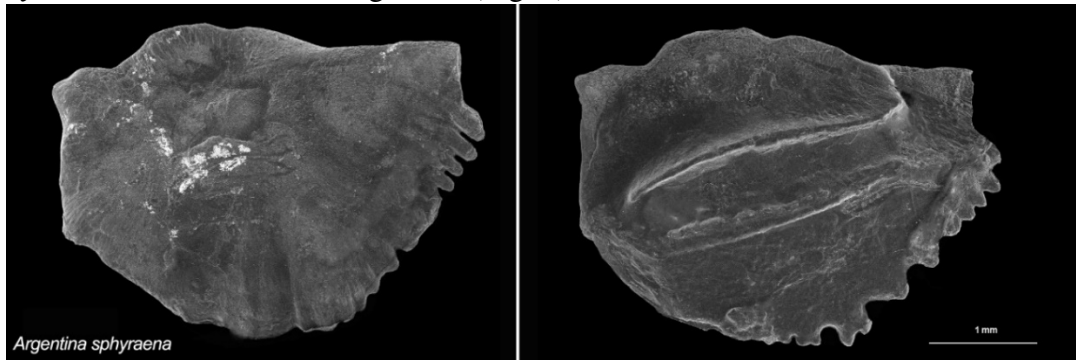


Figure 7. SEM image of sagittae of *Argentina sphyraena*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.745±0.059	0.695±0.012	1.309±0.025	16.923±1.345	0.715±0.002	0.134±0.010

- Shape* : rhomboidal; dorsal margin crenate and ventral margins irregular to crenate.
Sulcus acusticus : heterosucloid, ostial, supramedian.
Ostium : funnel-like, shorter than the cauda.
Cauda : tubular, straight, ending close to the posterior margin.
Anterior region : bunt; crenate; rostrum short, broad, triangular, pointed; antirostrum absent; excisura very wide without a notch.
Posterior region : flattened; sinuate.
Depression : both dorsal and ventral depressions present.

AULOPIFORMES

Synodontidae

Saurida lessepsianus Russell, Golani & Tikochinski, 2015, Lizardfish (Fig. 8)

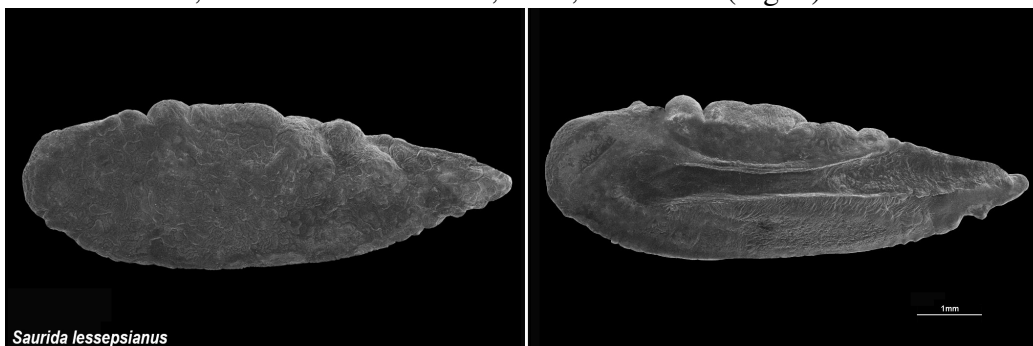


Figure 8. SEM image of sagittae of *Saurida lessepsianus*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.567±0.003	0.308±0.007	2.898±0.050	22.157±0.118	0.701±0.004	0.487±0.007

Shape : slightly lanceolated; dorsal margin irregular and ventral margin sinuate.

Sulcus acusticus : heterosulcoid, ostial, median.

Ostium : funnel-like, shorter than the cauda.

Cauda : tubular, straight, ending half way to the posterior margin.

Anterior region : lanceolated; crenate; rostrum narrow, long, pointed; antirostrum absent; excisura wide without a notch.

Posterior region : round; sinuate.

Depression : dorsal depression present over the cauda; ventral depression absent.

Aulopidae

Aulopus filamentosus (Bloch, 1792), Yellowfin aulopus (Fig. 9)

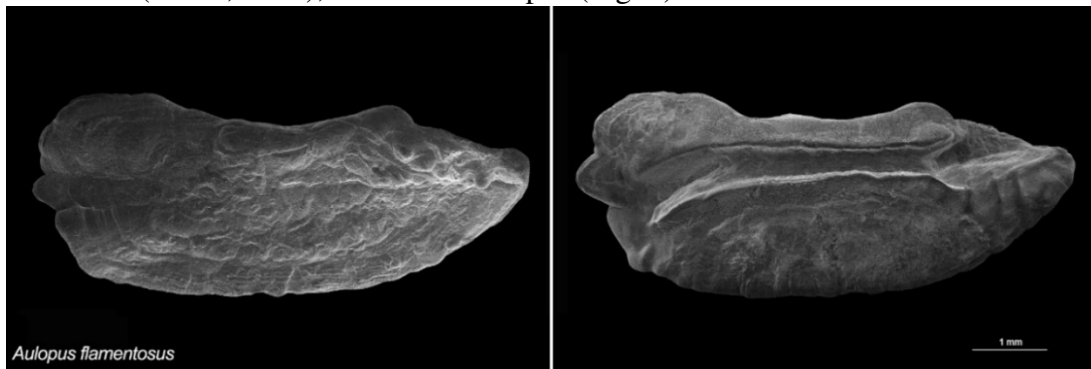


Figure 9. SEM image of sagittae of *Aulopus filamentosus*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.644±0.000	0.385±0.002	2.409±0.030	19.521±0.013	0.728±0.012	0.413±0.005

Shape : kidney-shaped; dorsal and ventral margins sinuate.

Sulcus acusticus : heterosulcoid, ostial, suprmedian.

Ostium : funnel-like, shorter than the cauda.

Cauda : tubular, curved, slightly, ending close to the posterior margin.

Anterior region : peaked; sinuate; rostrum short and broad; antirostrum absent; excisura wide without notch.

Posterior region : oblique; irregular.

Depression : dorsal and ventral depressions absent.

GADIFORMES

Merlucciidae

Merluccius merluccius (Linnaeus, 1758), European hake (Fig. 10)

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.395±0.096	0.357±0.013	2.426±0.059	32.799±7.991	0.680±0.009	0.416±0.010

Shape : spindle-shaped; dorsal and ventral margins lobed to dentate.

Sulcus acusticus : homosulcoid, mesial, median and concave dorsally.

Ostium : elliptic, broad, shorter than the cauda.

Cauda : elliptic, broad, separated from the ostium by node, ending close to the posterior margin.

Anterior region : peaked to blunt; lobed; rostrum short and broad; antirostrum absent; excisura wide without notch.

Posterior region : lanceolated; dentate.

Depression : dorsal and ventral depressions absent.

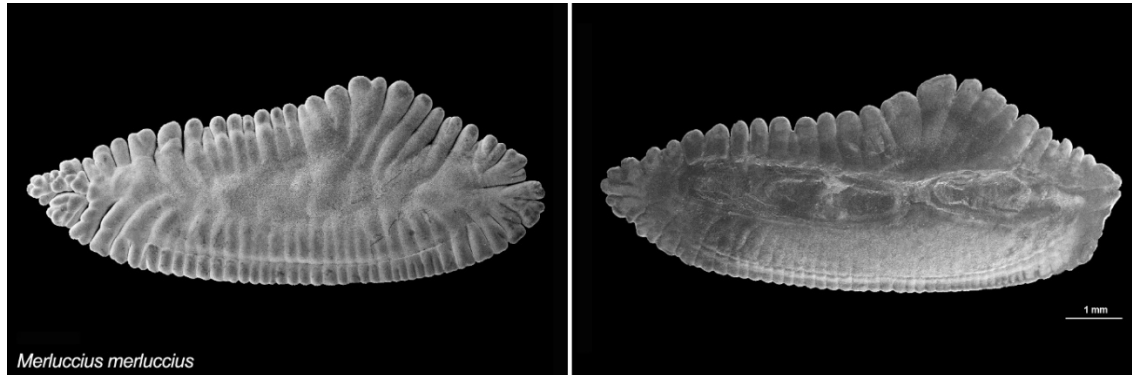


Figure 10. SEM image of sagittae of *Merluccius merluccius*.

Gadidae

Phycis phycis (Linnaeus, 1766), Forkbeard (Fig. 11)

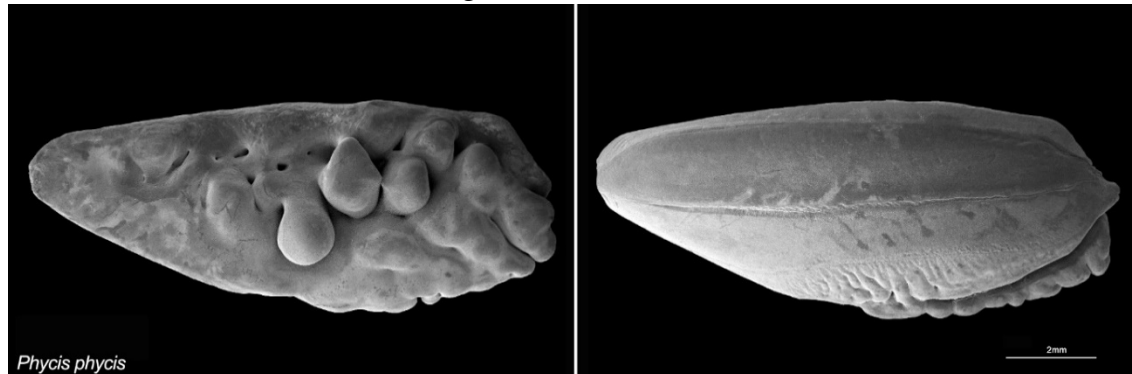


Figure 11. SEM image of sagittae of *Phycis phycis*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.677±0.002	0.392±0.008	2.407±0.035	18.550±0.061	0.741±0.004	0.413±0.006

Shape : spindle-shaped; dorsal margins entire to sinuate, antero-ventral margin irregularly dentate postero-ventral margin entire.

Sulcus acusticus : archaesusloid, pseudo-ostiocaudal, supramedian, broad, approaching both the anterior and posterior margins.

Ostium-cauda : undifferentiated, straight.

Anterior region : round, sinuate; rostrum undefined.

Posterior region : lanceolated, broad; entire.

Depression : dorsal and ventral depressions absent.

KURTIFORMES

Apogonidae

Apogon imberbis (Linnaeus, 1758), Cardinal fish (Fig. 12)

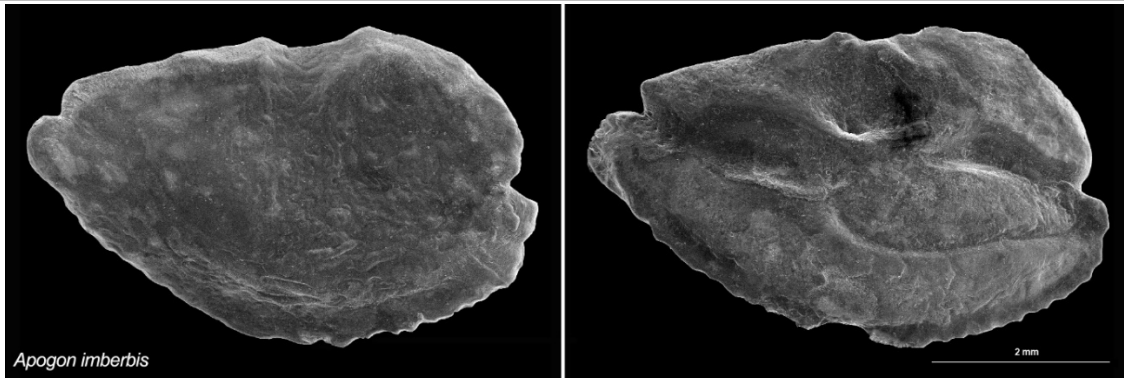


Figure 12. SEM image of sagittae of *Apogon imberbis*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.767±0.018	0.561±0.013	1.609±0.024	16.378±0.374	0.709±0.005	0.233±0.007

Shape : ova; dorsal margin sinuate and ventral margin crenate.

Sulcus acusticus : heterosulcoid, pseudo-ostiocaudal, slightly concave, median.

Ostium : discoidal, elliptic, longer than the cauda.

Cauda : tubular, straight, ending close to posterior margin.

Anterior region : round; crenate; rostrum short, broad, round; antirostrum short, broad, round; excisura narrow with a notch.

Posterior region : round to peaked; sinuate to crenate.

Depression : dorsal depression small over the costa to cauda; ventral depression absent.

Apogonichthyoides pharaonis (Bellotti, 1874), Pharaoh cardinalfish (Fig. 13)

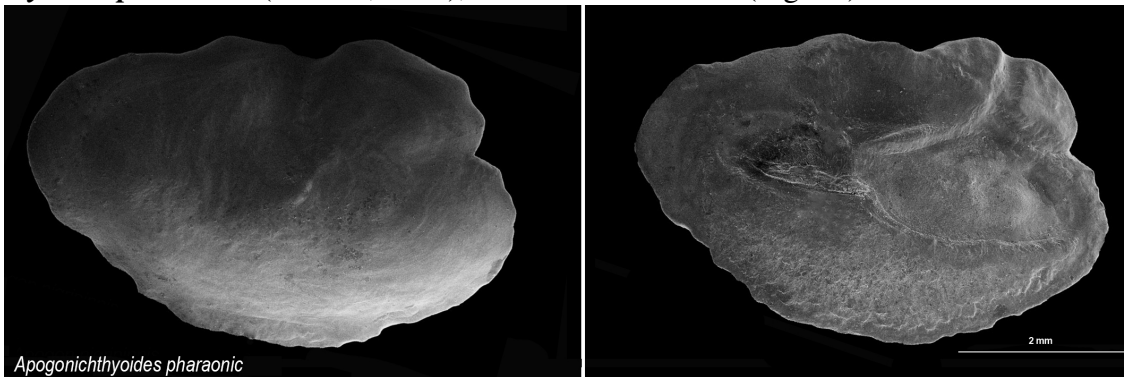


Figure 13. SEM image of sagittae of *Apogonichthyoides pharaonis*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.821±0.009	0.599±0.009	1.541±0.022	15.307±0.175	0.725±0.001	0.213±0.007

Shape : elliptic; dorsal and ventral margins sinuate.

Sulcus acusticus : heterosulcoid, pseudo-ostiocaudal, slightly concave, median.

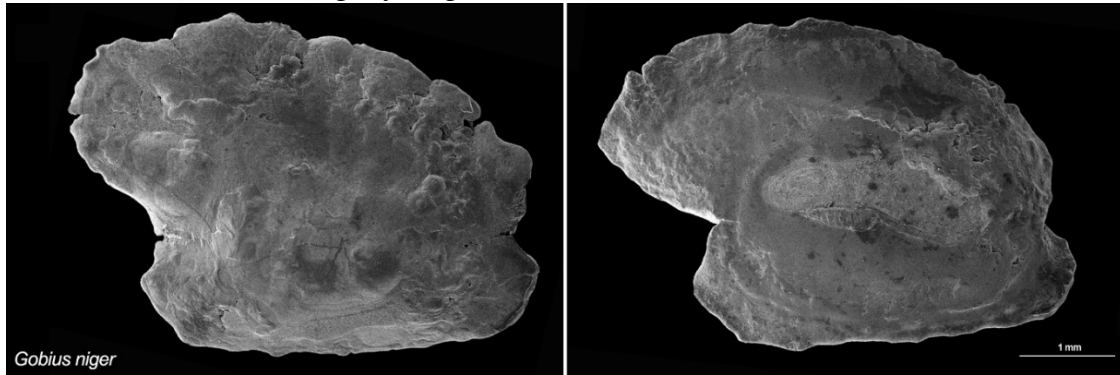
Ostium : discoidal, elliptic, longer than the cauda.

Cauda : tubular, straight, ending close to posterior margin.

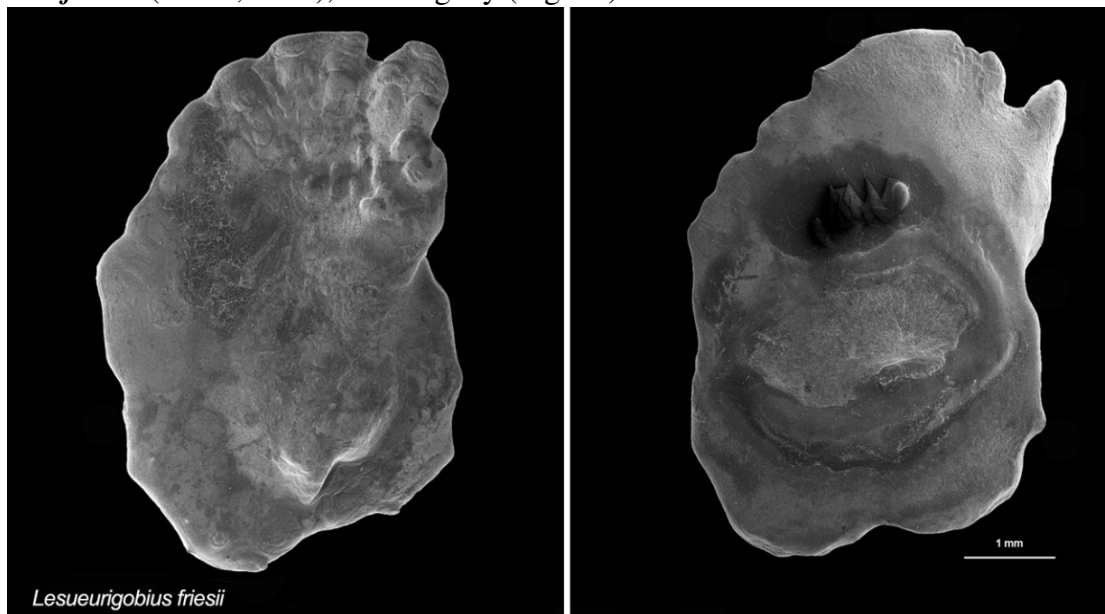
Anterior region : round; sinuate; rostrum short, broad, round; antirostrum short, broad, round; excisura narrow with a shallow notch.

Posterior region : round; sinuate.

Depression : dorsal depression small over the costa to cauda; ventral depression absent.

Gobiiformes**Gobiidae***Gobius niger* Linnaeus, 1758, Black goby (Fig. 14)**Figure 14.** SEM image of sagittae of *Gobius niger*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.699±0.042	0.656±0.000	1.405±0.002	18.010±1.071	0.724±0.001	0.168±0.001

Shape : squared to irregular; dorsal and ventral margins sinuate to crenate.*Sulcus acusticus* : homosulcoid, mesial, median.*Ostium* : round-oval, as long as the cauda, but wider, ending far from the anterior margin.*Cauda* : round-oval, ending far from the posterior margin.*Anterior region* : flattened; crenate; antirostrum absent; excisura narrow with a shallow notch.*Posterior region* : double peaked; sinuate to crenate.*Depression* : dorsal and ventral depressions absent.*Lesueurigobius friesii* (Malm, 1810), Fries's goby (Fig. 15)**Figure 15.** SEM image of sagittae of *Lesueurigobius friesii*

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.768±0.006	1.353±0.053	0.721±0.007	16.365±0.123	0.767±0.023	-0.162±0.005

- Shape* : square or slightly discoidal; dorsal and vertical margins irregular.
Sulcus acusticus : homosulcoid, mesial, median.
Ostium : round-oval, ending far from the anterior margin.
Cauda : round-oval, ending far from the posterior margin.
Anterior region : flattened; sinuate to irregular; rostrum undefined.
Posterior region : flattened; sinurate to crenate.
Depression : dorsal and ventral depressions absent.

MUGILIFORMES

Mugilidae

Chelon auratus (Risso, 1810), Golden grey mullet (Fig. 16)

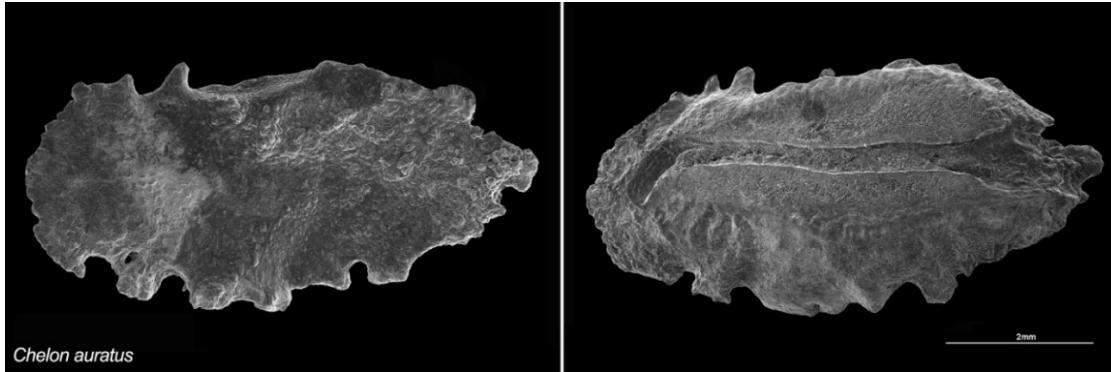


Figure 16. SEM image of sagittae of *Chelon auratus*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.494±0.041	0.437±0.003	2.009±0.031	25.547±2.140	0.689±0.006	0.335±0.007

- Shape* : rectangular; dorsal and ventral margins irregular.
Sulcus acusticus : heterosulcoid, ostial, suprmedian.
Ostium : funnel-like, much shorter than the cauda.
Cauda : tubular, sinuous, ending close to the posterior margin.
Anterior region : irregular; irregular; rostrum very short, broad, round; antirostrum absent; excisura moderately wide with a shallow notch.
Posterior region : irregular; irregular.
Depression : dorsal depression poorly developed over the cauda; ventral depression absent.

Chelon labrosus (Risso, 1826), Thicklip grey mullet (Fig. 17)

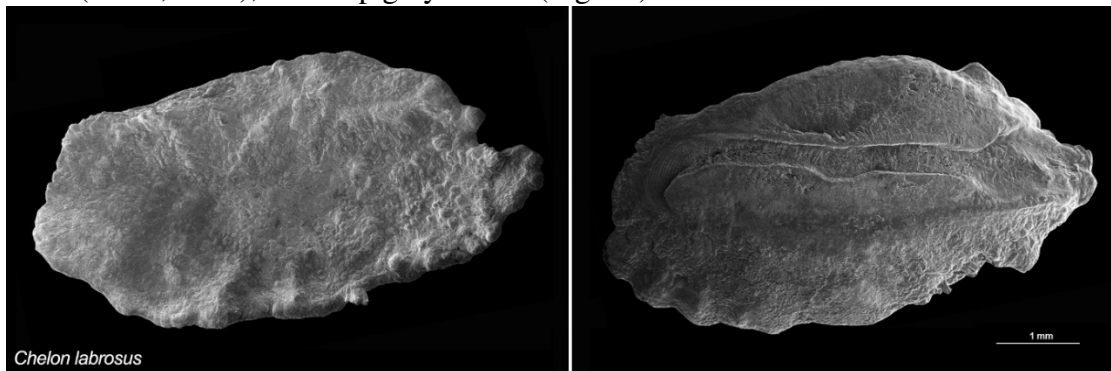


Figure 17. SEM image of sagittae of *Chelon labrosus*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.685±0.011	0.480±0.019	1.936±0.071	18.344±0.295	0.730±0.002	0.319±0.016

Shape : rectangular; dorsal and ventral margins sinuate to crenate.

Sulcus acusticus : heterosulcoid, ostial, suprmedian.

Ostium : funnel-like, much shorter than the cauda.

Cauda : tubular, sinuous, ending close to the posterior margin.

Anterior region : angled-round; crenate; rostrum very short, broad, round; antirostrum absent; excisura moderately wide without a notch.

Posterior region : round; crenate.

Depression : dorsal depression small over the cauda; ventral depression absent.

***Chelon ramada* (Risso 1827), Thinlip grey mullet (Fig. 18)**

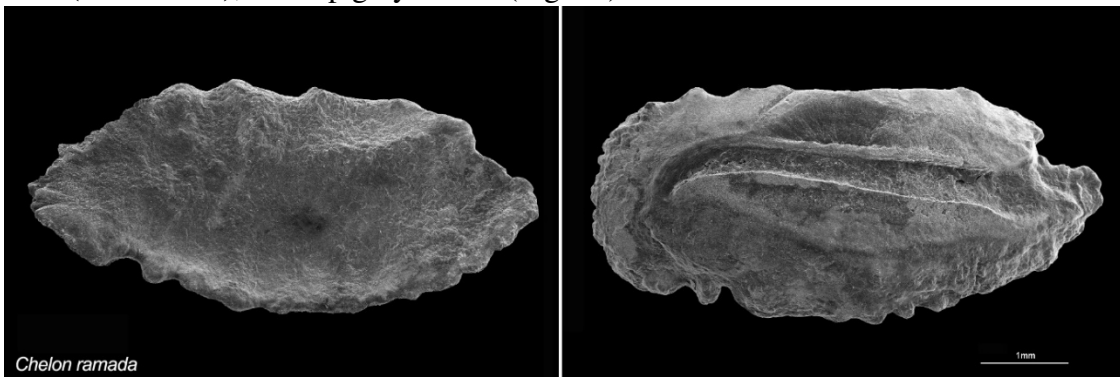


Figure 18. SEM image of sagittae of *Chelon ramada*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.639±0.001	0.433±0.028	2.086±0.083	19.666±0.032	0.708±0.018	0.352±0.017

Shape : rectangular; dorsal and ventral margins crenate.

Sulcus acusticus : heterosulcoid, ostial, suprmedian.

Ostium : funnel-like, much shorter than the cauda.

Cauda : tubular, sinuous, ending close to the posterior margin.

Anterior region : angled-round; crenate; rostrum very short, broad, round; antirostrum absent; excisura moderately wide with a shallow notch.

Posterior region : round; crenate.

Depression : dorsal depression small over the cauda; ventral depression absent.

***Planiliza carinata* (Valenciennes, 1836), Keeled mullet (Fig. 19)**

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.475±0.068	0.398±0.022	2.334±0.034	26.721±3.805	0.730±0.030	0.400±0.006

Shape : rectangular; dorsal margin crenate ventral margin irregular.

Sulcus acusticus : heterosulcoid, ostial, suprmedian.

Ostium : funnel-like, much shorter than the cauda.

Cauda : tubular, sinuous, ending close to the posterior margin.

Anterior region : angled; crenate; rostrum very short, broad, round; antirostrum absent; excisura moderately wide without a notch.

Posterior region : round to irregular; crenate.

Depression : dorsal depression small over the cauda; ventral depression absent.

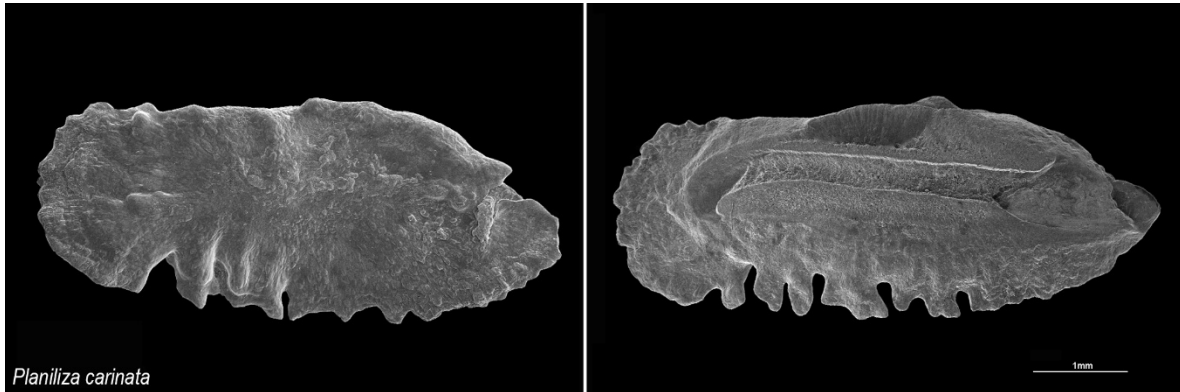


Figure 19. SEM image of sagittae of *Planiliza carinata*.

Mugil cephalus Linnaeus, 1758, Flathead grey mullet (Fig. 20)

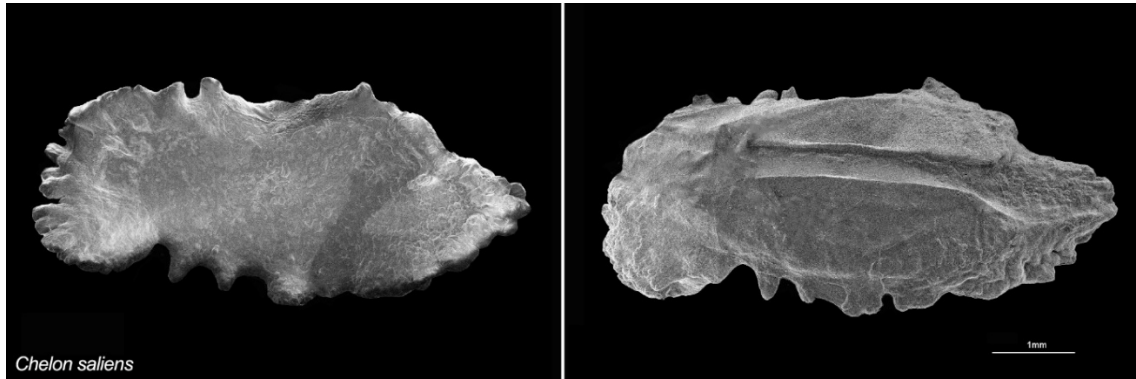


Figure 20. SEM image of sagittae of *Mugil cephalus*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.492±0.011	0.412±0.004	2.147±0.002	25.561±0.553	0.695±0.006	0.364±0.001

Shape : rectangular; dorsal and ventral margins irregular.

Sulcus acusticus : heterosulcoid, ostial, supramedian.

Ostium : funnel-like, much shorter than the cauda.

Cauda : tubular, sinuous, ending close to the posterior margin.

Anterior region : angled to irregular; crenate; rostrum short, broad, round; antirostrum absent; excisura moderately wide without a notch.

Posterior region : irregular; irregular.

Depression : dorsal depression small over the cauda; ventral depression absent.

CARANGIFORMES

Carangidae

Alectis alexandrinus (Geoffroy Saint-Hilaire, 1817), Alexandria pompano (Fig. 21)

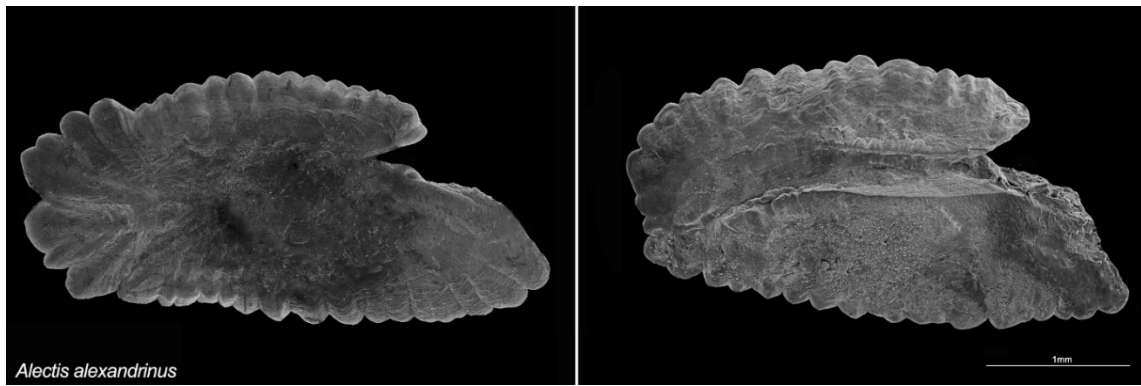


Figure 21. SEM image of sagittae of *Alectis alexandrinus*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.552±0.020	0.462±0.042	1.960±0.189	22.771±0.841	0.709±0.003	0.323±0.043

Shape : lanceolated; dorsal and ventral margins lobed.

Sulcus acusticus : heterosulcoid, ostial, median.

Ostium : funnel-like, shorter than the cauda.

Cauda : tubular, curved, slightly; ending close to the posterior margin.

Anterior region : double-peaked; crenate; rostrum long, wide, pointed; antirostrum short, broad, round; excisura wide with a shallow notch.

Posterior region : irregular; lobed.

Depression : both dorsal and ventral depressions absent.

Alepes djedaba (Forsskål, 1775), Shrimp scad (Fig. 22)

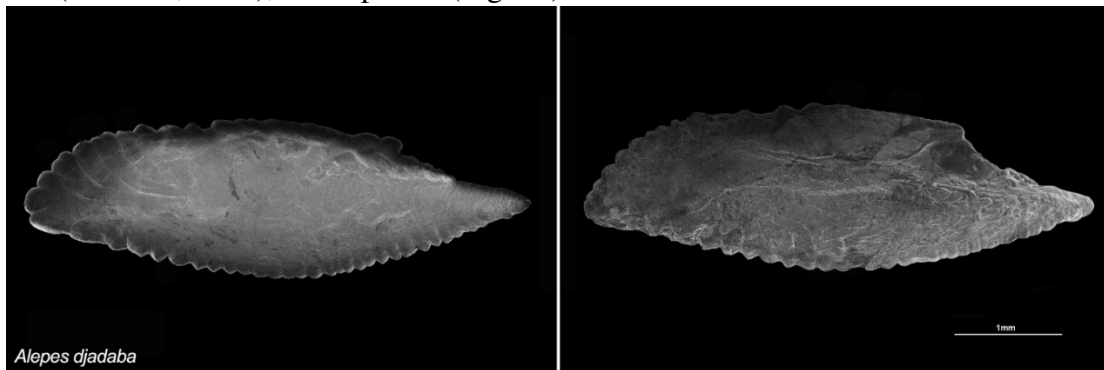


Figure 22. SEM image of sagittae of *Alepes djedaba*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.468±0.026	0.275±0.005	3.099±0.134	26.873±1.506	0.668±0.016	0.512±0.016

Shape : lanceolated to fusiform; dorsal and ventral margins lobed.

Sulcus acusticus : heterosulcoid, ostial, median.

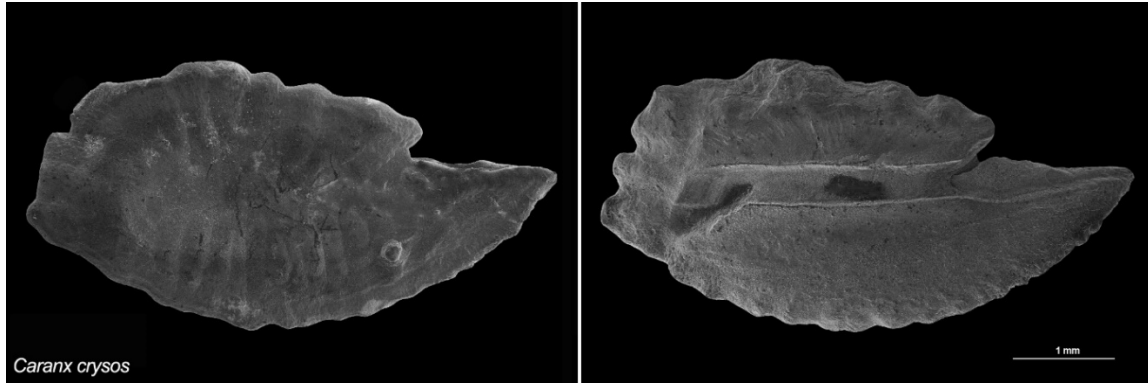
Ostium : funnel-like, shorter than the cauda.

Cauda : tubular, curved, strongly, ending close to the posterior margin.

Anterior region : lanceolated; sinuate; rostrum long, narrow, pointed; antirostrum absent; excisura wide without a notch.

Posterior region : lanceolated; lobed.

Depression : both dorsal and ventral depressions absent.

Caranx crysos (Mitchill, 1815), Blue runner (Fig. 23)**Figure 23.** SEM image of sagittae of *Caranx crysos*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.638±0.027	0.423±0.005	1.954±0.009	19.723±0.841	0.649±0.004	0.323±0.002

Shape : lanceolated; dorsal and ventral margins crenate.

Sulcus acusticus : heterosulcoid, ostial, median.

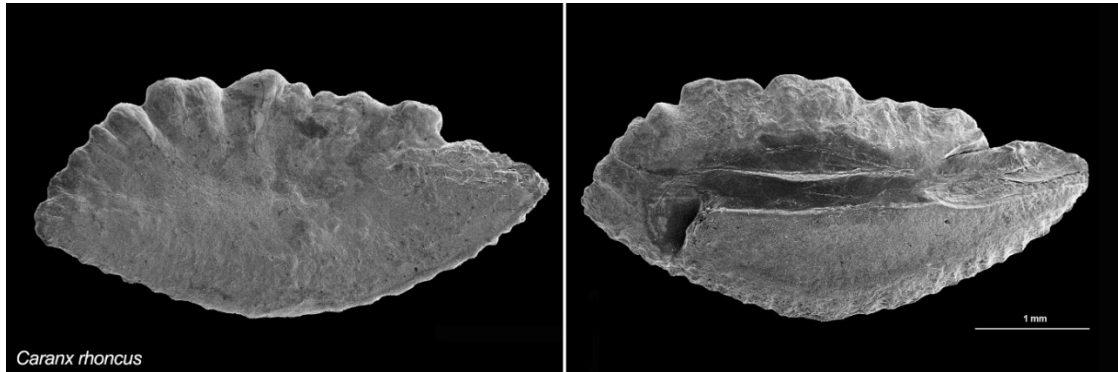
Ostium : funnel-like, shorter than the cauda.

Cauda : tubular, curved, strongly, ending close to the posterior margin.

Anterior region : peaked; sinuate; rostrum long, pointed; antirostrum short, broad, pointed; excisura wide, with a notch.

Posterior region : round to irregular; irregular.

Depression : dorsal depression long through the cauda; ventral depression absent.

Caranx rhonchus Geoffroy Saint-Hilaire, 1817, False scad (Fig. 24)**Figure 24.** SEM image of sagittae of *Caranx rhonchus*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.643±0.002	0.415±0.007	2.027±0.053	19.556±0.059	0.661±0.007	0.339±0.012

Shape : lanceolated; dorsal margin lobed and ventral margins crenate.

Sulcus acusticus : heterosulcoid, ostial, median.

Ostium : funnel-like, shorter than the cauda.

Cauda : tubular, curved, strongly, ending close to the posterior margin.

Anterior region : peaked; crenate; rostrum long, pointed; antirostrum short, broad, pointed; excisura wide, with a notch.

Posterior region : angled; lobed to crenate.

Depression : dorsal depression long through the cauda; ventral depression absent.

Trachinotus ovatus (Linnaeus, 1758), Pompano (Fig. 25)

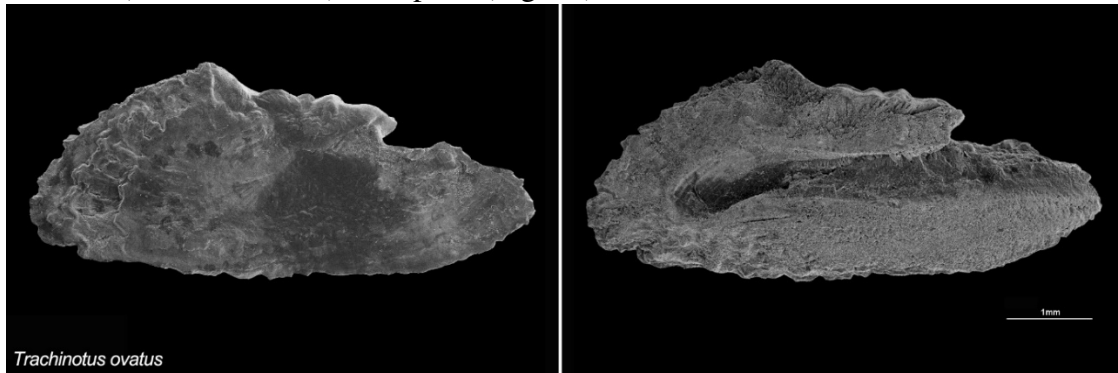


Figure 25. SEM image of sagittae of *Trachinotus ovatus*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.549±0.008	0.366±0.005	2.321±0.009	22.910±0.320	0.668±0.007	0.398±0.002

Shape : elliptic to slightly fusiform; dorsal and ventral margins dentate to irregular.

Sulcus acusticus : heterosulcoid, ostial, median.

Ostium : funnel-like, shorter than the cauda.

Cauda : tubular, curved, slightly, ending close to the posterior margin.

Anterior region : peaked; irregular; rostrum long, pointed; antirostrum short, broad, pointed; excisura wide, with a notch.

Posterior region : oblique; irregular.

Depression : dorsal and ventral depressions absent.

Trachurus mediterraneus (Steindachner, 1868), Mediterranean horse mackerel (Fig. 26)

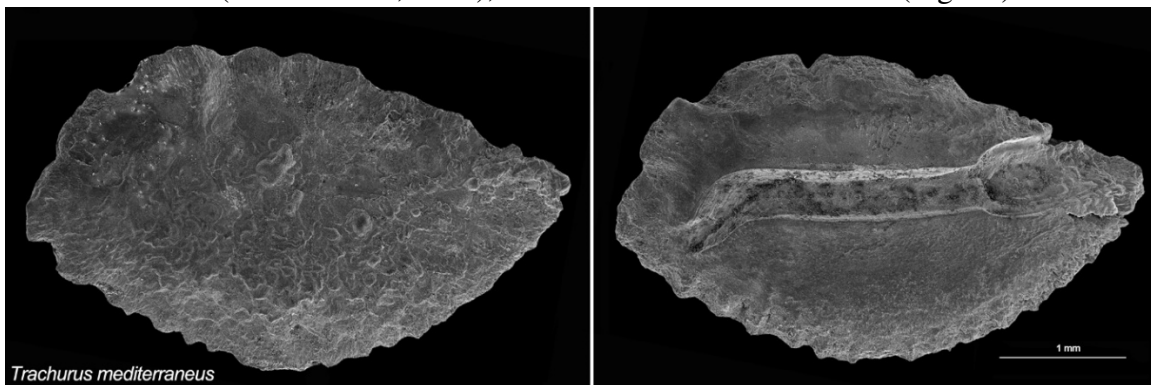


Figure 26. SEM image of sagittae of *Trachurus mediterraneus*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.689±0.005	0.517±0.005	1.691±0.003	18.249±0.142	0.686±0.008	0.257±0.001

Shape : elliptic to lanceolated; dorsal and ventral margins crenate.

Sulcus acusticus : heterosulcoid, ostial, median.

Ostium : funnel-like, shorter than the cauda.

Cauda : tubular, curved, strongly, ending close to the posterior margin.

Anterior region : peaked; irregular; rostrum short, pointed; antirostrum short, broad, pointed; excisura wide, with a notch.

Posterior region : round; crenate.

Depression : dorsal depression long through the cauda; ventral depression absent.

Trachurus picturatus (Bowdich, 1825), Blue jack mackerel (Fig. 27)

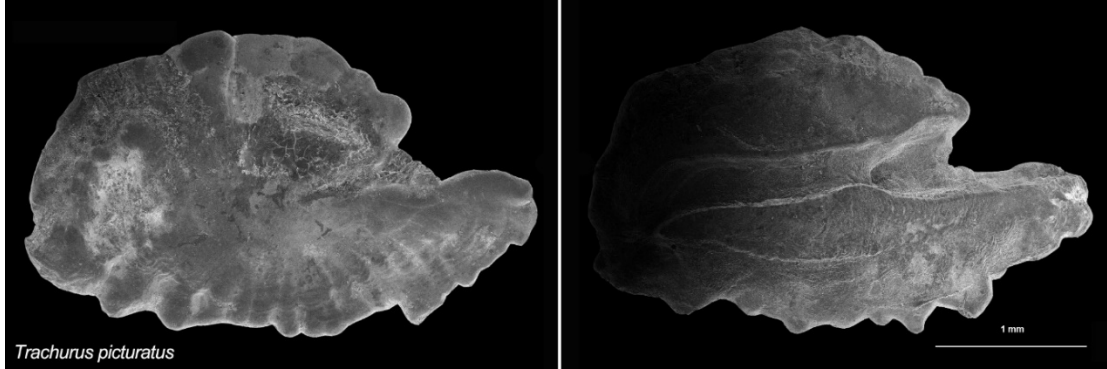


Figure 27. SEM image of sagittae of *Trachurus picturatus*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.616±0.004	0.528±0.001	1.633±0.064	20.392±0.124	0.677±0.028	0.240±0.018

Shape : lanceolated; dorsal margin sinuate to crenate and vertical margin lobbed.

Sulcus acusticus : heterosulcoid, ostial, median.

Ostium : funnel-like, shorter than the cauda.

Cauda : tubular, curved, strongly, ending close to the posterior margin.

Anterior region : peaked; irregular; rostrum long, pointed; antirostrum short, broad, pointed; excisura wide, with a deep notch.

Posterior region : round; sinuate.

Depression : dorsal depression long through the cauda; ventral depression absent.

ISTIOPHORIFORMES

Sphyraenidae

Sphyraena chrysotaenia Kluzinger, 1884, Yellowstrip barracuda (Fig. 28)

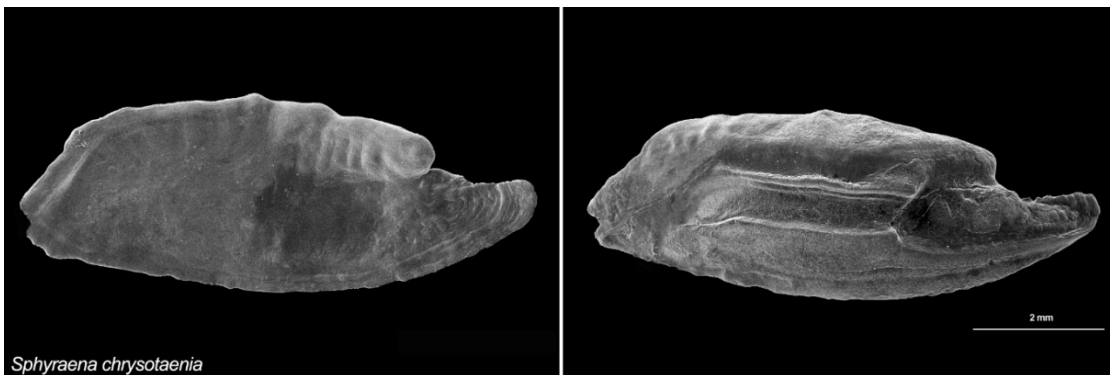


Figure 28. SEM image of sagittae of *Sphyraena chrysotaenia*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.595±0.024	0.341±0.017	2.647±0.062	21.140±0.865	0.709±0.018	0.452±0.009

Shape : lanceolated; dorsal and ventral margins mostly sinuate to crenate.

Sulcus acusticus : heterosulcoid, ostial, median.

Ostium : funnel-like, shorter than the cauda.

Cauda : tubular, curved, slightly, ending close to the posterior margin.

Anterior region : peaked; crenate; rostrum long, pointed; antirostrum short, broad, pointed; excisura wide, with an acute notch.

Posterior region : oblique; sinuate to crenate.

Depression : dorsal depression long through the cauda; ventral depression absent.

Sphyraena sphyraena (Euphrasen, 1788), European barracuda (Fig. 29)

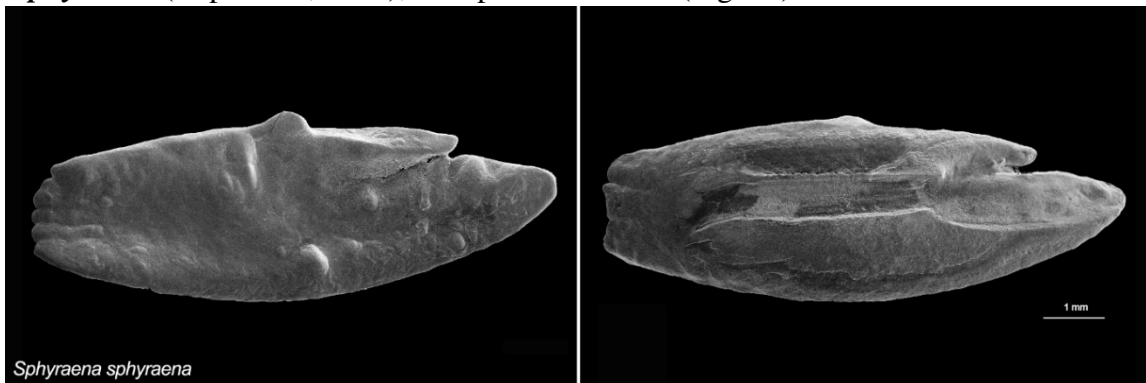


Figure 29. SEM image of sagittae of *Sphyraena sphyraena*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.568±0.002	0.331±0.005	2.769±0.040	22.128±0.071	0.719±0.022	0.469±0.006

Shape : rectangular; dorsal and ventral margins sinuate.

Sulcus acusticus : heterosulcoid, ostial, median.

Ostium : funnel-like, shorter than the cauda.

Cauda : tubular, curved, slightly, ending close to the posterior margin.

Anterior region : peaked; sinuate; rostrum long, pointed; antirostrum short, broad, pointed; excisura moderate, with a narrow deep notch.

Posterior region : flattened; lobed.

Depression : dorsal depression long through the cauda; ventral depression absent.

PLEURONECTIFORMES

Citharidae

Citharus linguatula (Linnaeus, 1758), Spotted flounder (Fig. 30)

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.752±0.054	0.526±0.019	1.603±0.005	16.762±1.200	0.662±0.026	0.232±0.002

Shape : pentagonal; dorsal and ventral margins sinuate and lobbed.

Sulcus acusticus : heterosulcoid, ostial, median.

Ostium : funnel-like, shorter than the cauda.

Cauda : tubular, straight, ending close to the posterior margin.

Anterior region : peaked; sinuate; rostrum long, pointed; antirostrum short, broad, pointed; excisura moderate, with a narrow deep notch.

Posterior region : angled; lobed to sinuate.

Depression : dorsal depression long over the costa to cauda; ventral depression absent.

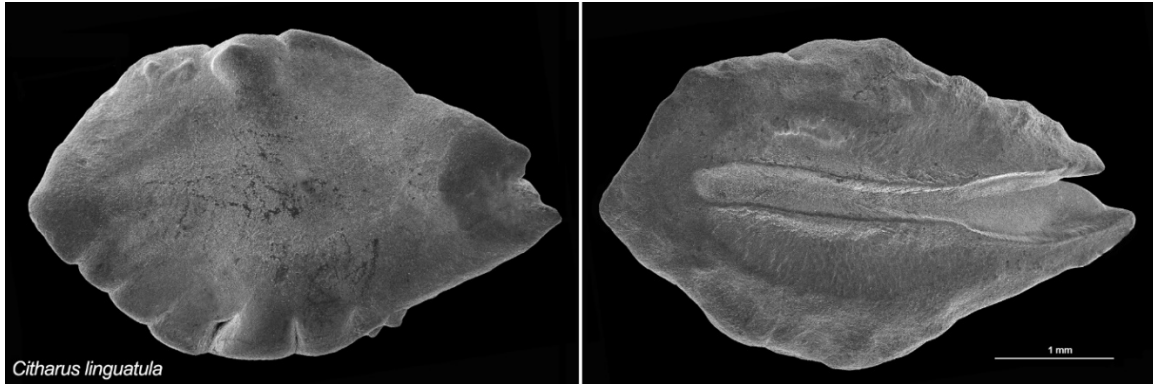


Figure 30. SEM image of sagittae of *Citharus linguatula*.

Bothidae

Arnoglossus laterna (Walbaum, 1792), Scaldfish (Fig. 31)

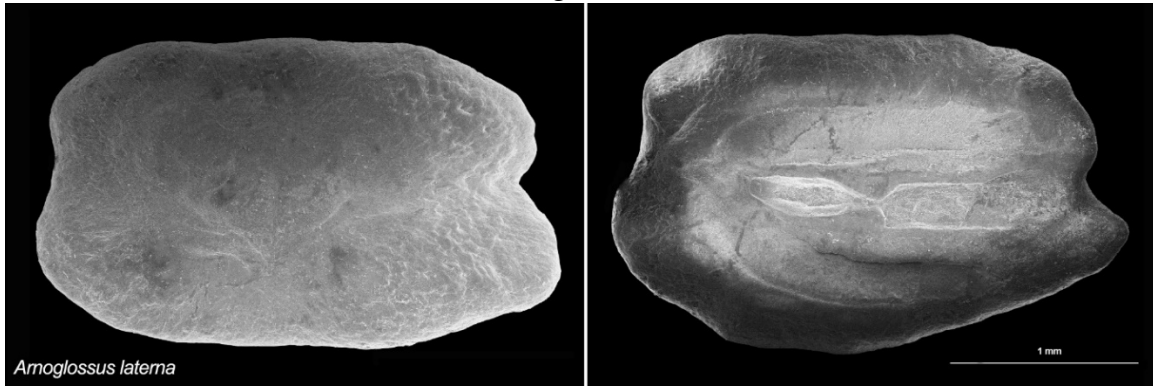


Figure 31. SEM image of sagittae of *Arnoglossus laterna*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.014±0.001	0.630±0.009	1.649±0.049	14.968±0.255	0.816±0.035	0.245±0.014

Shape : bullet-shaped, ventral and dorsal margins sinuate.

Sulcus acusticus : heterosulcoid, mesial, median.

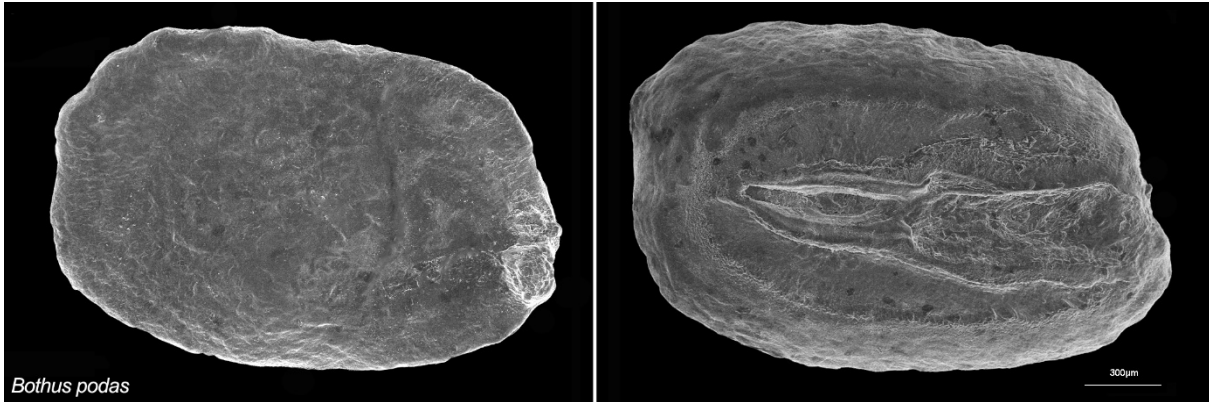
Ostium : round-oval, wider and longer than cauda, separated from the ostium by node, ending close to the anterior margin.

Cauda : round-oval, straight, ending far from the posterior margin.

Anterior region : double-peaked; sinuate; rostrum short, round; antirostrum short, broad, round; excisura moderate, with a wide shallow notch.

Posterior region : flattened to double-peaked; sinuate.

Depression : dorsal and ventral depressions present all over the costa and cauda.

Bothus podas (Delaroche, 1809), Wide-eyed flounder (Fig. 32)**Figure 32.** SEM image of sagittae of *Bothus podas*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.887±0.020	0.657±0.032	1.549±0.065	14.164±0.319	0.799±0.005	0.215±0.020

Shape : bullet-shaped, ventral and dorsal margins sinuate.

Sulcus acusticus : heterosulcoid, mesial, median.

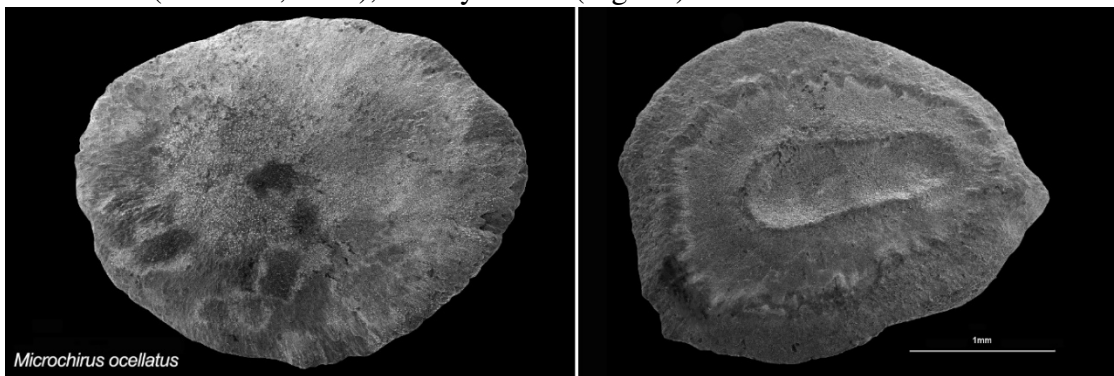
Ostium : round-oval, wider and longer than cauda, separated from the ostium by node, ending close to the anterior margin.

Cauda : round-oval, straight, ending far from the posterior margin.

Anterior region : round; sinuate; rostrum short, round; antirostrum absent; excisura moderate without a notch.

Posterior region : round; sinuate.

Depression : dorsal and ventral depressions present all over the costa and cauda.

Soleidae***Microchirus ocellatus*** (Linnaeus, 1758), Foureyed sole (Fig. 33)**Figure 33.** SEM image of sagittae of *Microchirus ocellatus*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.906±0.006	0.738±0.005	1.274±0.021	13.871±0.088	0.738±0.018	0.120±0.008

Shape : discoidal to elliptical; ventral and dorsal margins sinuate.

Sulcus acusticus : homosulcoid, mesial, median.

Ostium : round-oval, poorly separated from the ostium by node, ending close to the anterior margin.

Cauda : round-oval, straight, ending far from the posterior margin.

Anterior region : round; sinuate; rostrum short, round; antirostrum absent; excisura narrow without a notch.

Posterior region : round; sinuate.

Depression : dorsal and ventral depressions present and full round.

Solea solea (Linnaeus, 1758), Common sole (Fig. 34)

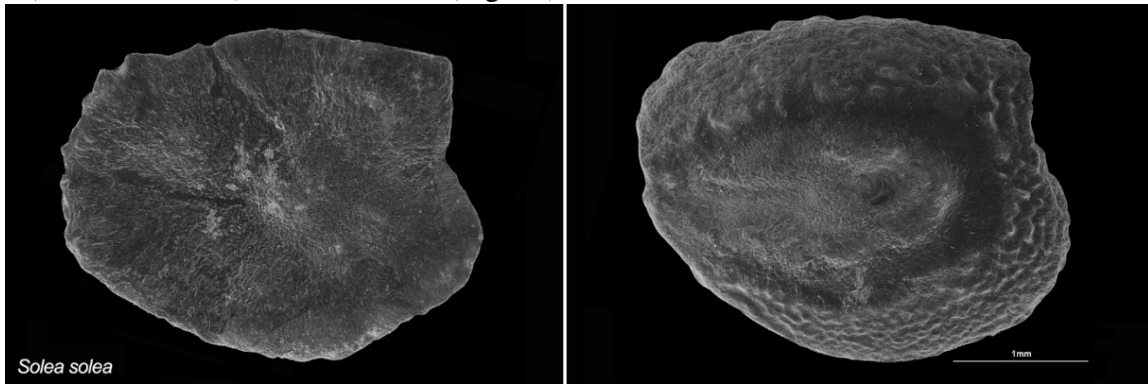


Figure 34. SEM image of sagittae of *Solea solea*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.864±0.023	0.805±0.027	1.238±0.041	14.550±0.387	0.782±0.000	0.106±0.017

Shape : discoidal to elliptic; ventral and dorsal margins sinuate to crenate.

Sulcus acusticus : heterosulcoid, mesial, median.

Ostium : round-oval, as long as and wider than cauda, ending far from the anterior margin.

Cauda : round-oval, straight, ending close to the posterior margin.

Anterior region : round; sinuate; rostrum short, round; antirostrum wide broad; excisura wide without a shallow notch.

Posterior region : round; crenate.

Depression : dorsal and ventral depressions present and full round.

Cynoglossidae

Cynoglossus sinusarabici (Chabanaud, 1931) (Fig. 35)

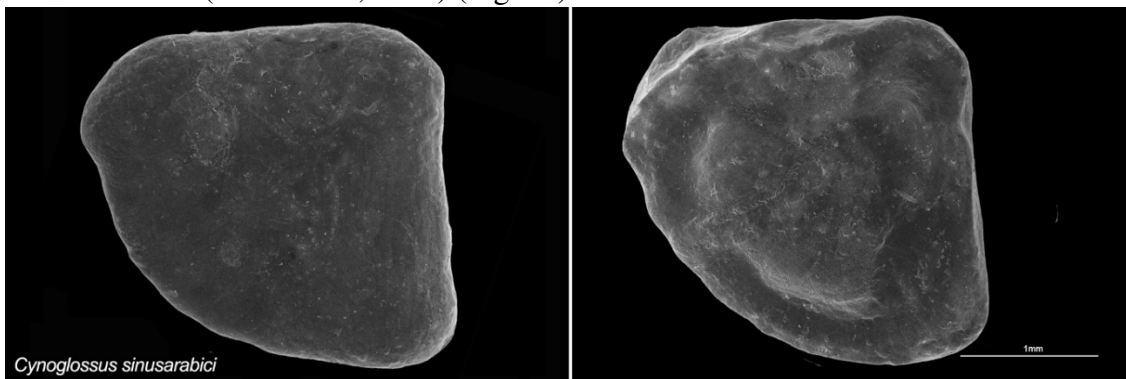


Figure 35. SEM image of sagittae of *Cynoglossus sinusarabici*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.898±0.005	0.988±0.003	1.042±0.013	13.994±0.074	0.809±0.013	0.020±0.006

Shape : oval to triangular; dorsal and ventral margins entire to sinuate.

Sulcus acusticus : archaesusulcoid, mesial, median.

Ostium-cauda : undifferentiated.

Anterior region : flattened; sinuate; rostrum, antirostrum and excisura absent.

Posterior region : round; sinuate.

Depression : dorsal and ventral depressions present and full round.

CALLIONYMIFORMES

Callionymidae

Callionymus filamentosus Valenciennes, 1837, Blotchfin dragonet (Fig. 36)

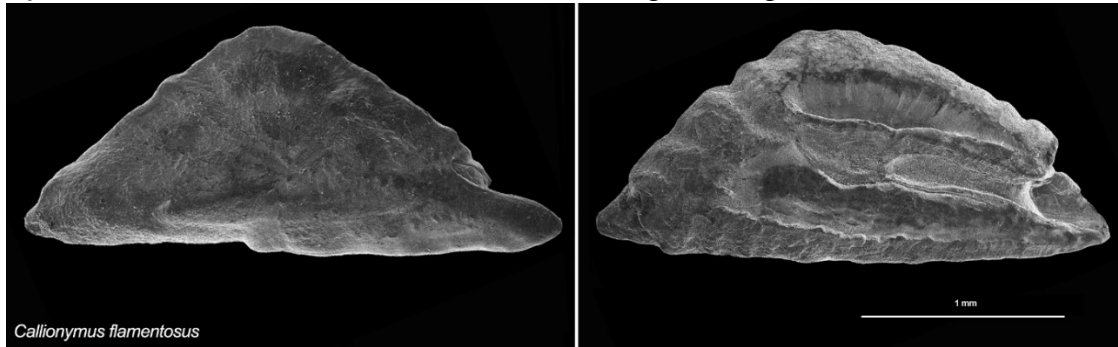


Figure 36. SEM image of sagittae of *Callionymus filamentosus*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.614±0.039	0.364±0.044	2.218±0.111	20.508±1.294	0.633±0.044	0.378±0.021

Shape : triangular; dorsal margin round and sinuate, ventral margin straight and sinuate.

Sulcus acusticus : heterosulcoid, ostial, median.

Ostium : tubular, longer than cauda.

Cauda : round-oval, more dorsal than the ostium, ending far from to the posterior margin.

Anterior region : peaked; crenate; rostrum short, broad, pointed; antirostrum short, broad, round; excisura relatively narrow with a shallow, acute notch.

Posterior region : peaked to lanceolated; crenate.

Depression : both dorsal and ventral depressions present and long.

SCOMBRIFORMES

Scombridae

Scomber colias Gmelin, 1789, 1782, Atlantic chub mackerel (Fig. 37)

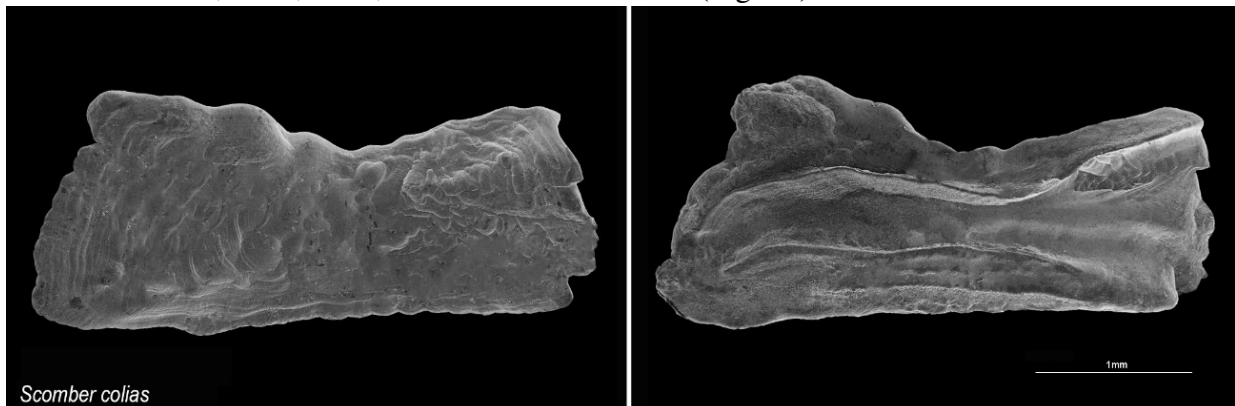


Figure 37. SEM image of sagittae of *Scomber colias*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.572±0.010	0.419±0.005	2.228±0.081	21.968±0.391	0.733±0.035	0.380±0.016

- Shape* : kidney-shaped to ectangular; dorsal and ventral margins irregular to sinuate.
Sulcus acusticus : heterosulcoid, ostial, with well-developed ventral and dorsal ridges, median.
Ostium : funnel-like, shorter than the cauda.
Cauda : tubular, slightly curved, ending very close to the posterior margin.
Anterior region : flattened; irregular; rostrum round to pointed, antirostrum and becomes the anterior most extreme of the otolith; excisura wide with a deep, acute notch.
Posterior region : flattened, irregular.
Depression : both dorsal and ventral depressions present and long.

Trichiuridae

Trichiurus lepturus Linnaeus, 1758, Largehead hairtail (Fig. 38)

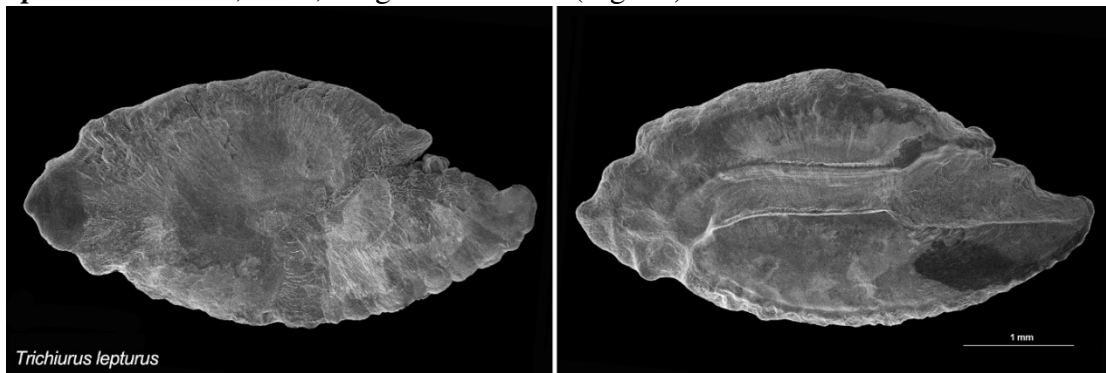


Figure 38. SEM image of sagittae of *Trichiurus lepturus*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.662±0.033	0.428±0.003	1.981±0.000	19.016±0.939	0.667±0.004	0.329±0.000

- Shape* : elliptic; dorsal and ventral margins sinuate.
Sulcus acusticus : heterosulcoid, ostial, median.
Ostium : funnel-like, shorter than the cauda.
Cauda : tubular, curved, slightly, ending close to the posterior margin.
Anterior region : peaked; crenate; rostrum long, pointed; antirostrum short, broad, pointed; excisura wide, with a notch.
Posterior region : peaked; crenate.
Depression : dorsal depression present over the cauda and ventral depression absent.

TRACHINIFORMES

Trachinidae

Trachinus araneus Cuvier, 1829, Spotted weever (Fig. 39)

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.675±0.009	0.466±0.000	1.930±0.036	18.614±0.237	0.707±0.013	0.317±0.008

- Shape* : elliptic; dorsal margin partly lobed and sinuate, ventral margin sinuate.
Sulcus acusticus : heterosulcoid, pseudo-ostial, elliptic, median.
Ostium : tubular, longer than the cauda.

- Cauda* : tubular, straight, slightly flexed posteriorly, ending half way to the posterior margin.
Anterior region : peaked; crenate; rostrum short, pointed; antirostrum and excisura absent.
Posterior region : oblique; irregular.
Depression : dorsal depression small and poorly developed and ventral depression absent.

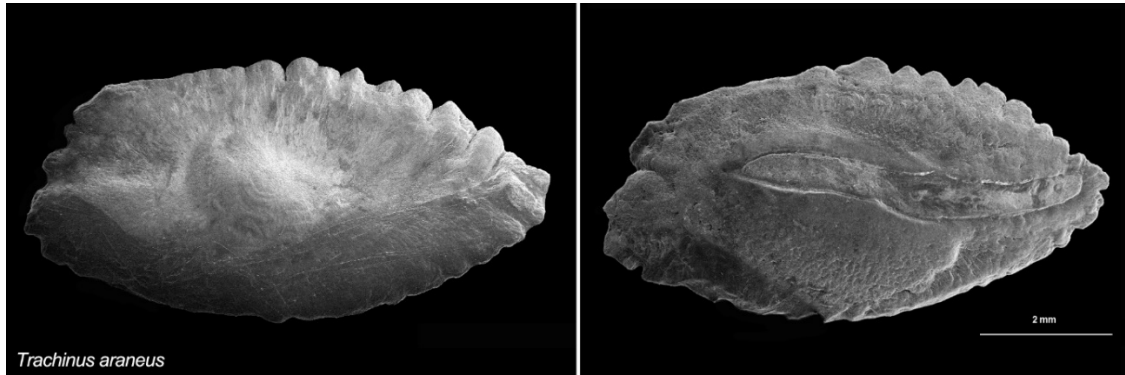


Figure 39. SEM image of sagittae of *Trachinus araneus*.

Trachinus draco Linnaeus, 1758, Greater weever (Fig. 40)

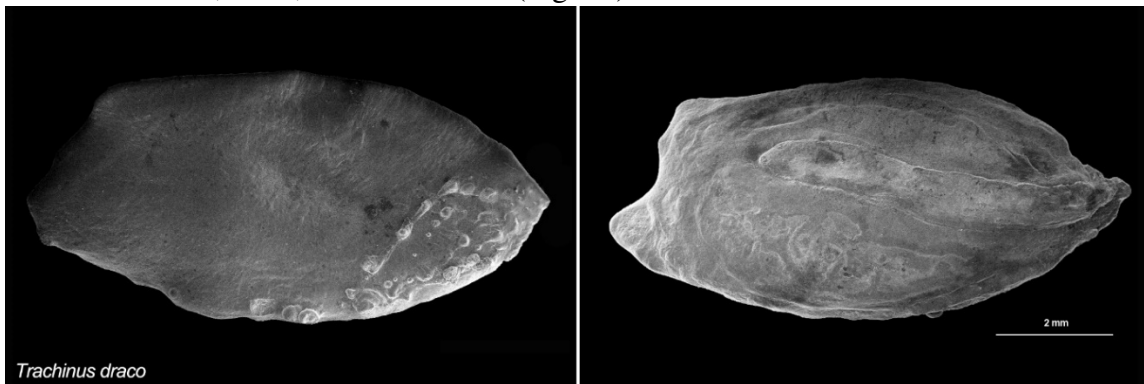


Figure 40. SEM image of sagittae of *Trachinus draco*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.750±0.023	0.438±0.015	2.111±0.065	16.763±0.517	0.726±0.003	0.357±0.013

- Shape* : rectangular; dorsal and ventral margin sinuate.
Sulcus acusticus : archaesusoid, ostia to pseudo-ostial, elliptic, median to inframedian.
Ostium : tubular, concave, longer than the cauda.
Cauda : tubular, straight, slightly flexed posteriorly, ending half way to the posterior margin.
Anterior region : peaked; rostrum very small, pointed; antirostrum absent; excisura very narrow without a notch.
Posterior region : double-peaked; sinuate.
Depression : dorsal depression small and poorly developed and ventral depression absent.

Uranoscopidae

Uranoscopus scaber Linnaeus, 1758, Atlantic stargazer (Fig. 41)

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.745±0.002	0.489±0.013	1.888±0.014	16.872±0.044	0.726±0.014	0.307±0.003

- Shape* : oval to elliptic; dorsal and ventral margins partly sinuate, lobbed and crenate.
Sulcus acusticus : heterosulcoid, pseudo-ostial, median.
Ostium : tubular, longer than the cauda.
Cauda : tubular, straight or slightly concave dorsally, ending far from the posterior margin.
Anterior region : peaked to round; crenate; rostrum very small, pointed; antirostrum absent; excisura very narrow without a notch.
Posterior region : double-peaked; sinuate.
Depression : dorsal depression wide and shallow over the cauda and ventral depression absent.

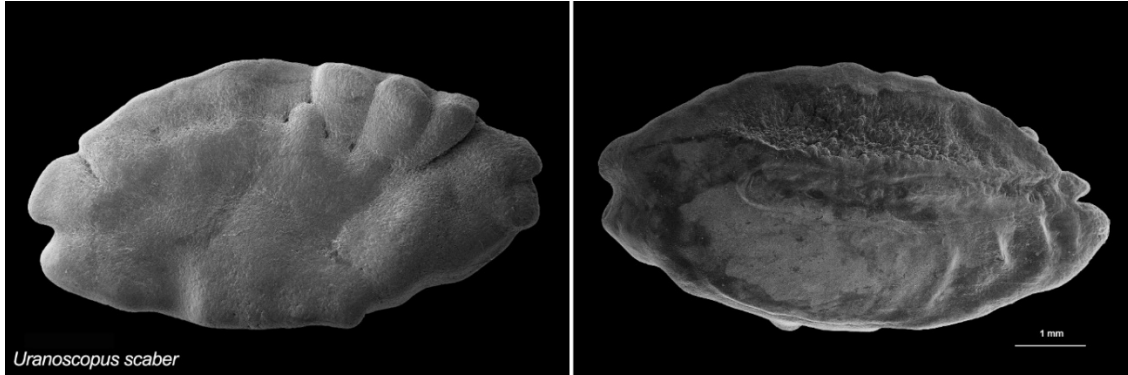


Figure 41. SEM image of sagittae of *Uranoscopus scaber*.

LABRIFORMES

Labridae

Xyrichthys novacula (Linnaeus, 1758), Pearly razorfish (Fig. 42)

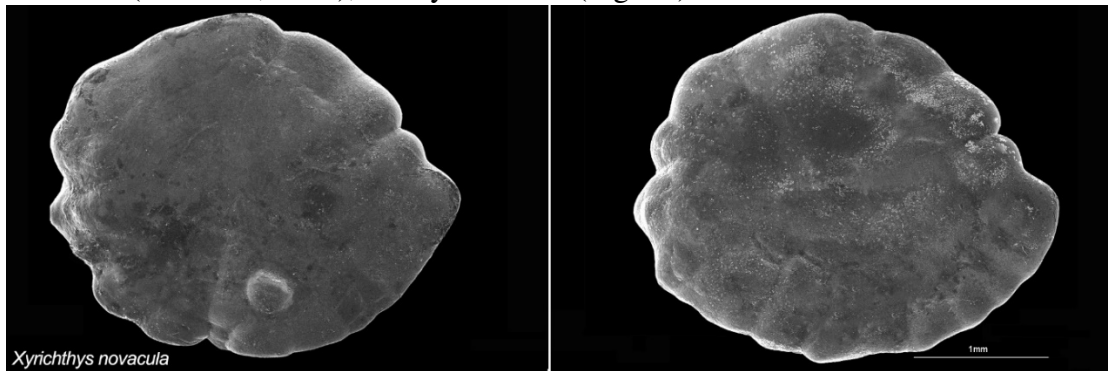


Figure 42. SEM image of sagittae of *Xyrichthys novacula*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.881±0.001	0.753±0.002	1.225±0.011	14.271±0.019	0.724±0.008	0.101±0.004

- Shape* : discoidal; dorsal and ventral margins sinuate and partly lobbed.
Sulcus acusticus : archaesusulcoid, pseudo-ostial, median.
Ostium-cauda : undifferentiated.
Anterior region : round; sinuate; rostrum short, broad, round; antirostrum very short, broad, round; excisura narrow, with a shallow notch.
Posterior region : round; sinuate to lobbed.
Depression : both dorsal and ventral depressions absent.

PERCIFORMES

Mullidae

Mullus barbatus Linnaeus, 1758, Striped mullet (Fig. 43)

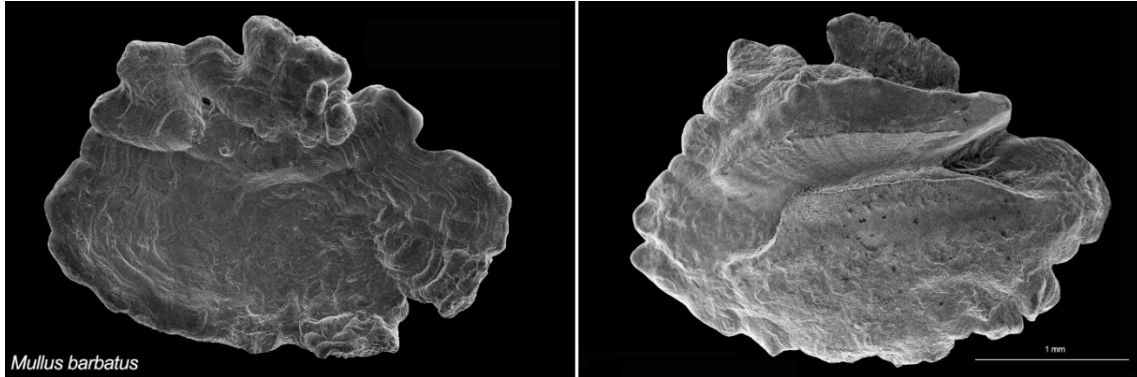


Figure 43. SEM image of sagittae of *Mullus barbatus*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.628±0.014	0.631±0.011	1.353±0.000	20.005±0.436	0.670±0.012	0.150±0.000

Shape : irregular; dorsal and ventral margins irregular.

Sulcus acusticus : heterosulcoid, ostial, median.

Ostium : funnel-like, shorter than the cauda.

Cauda : tubular, curved, strong, ending half way to the posterior margin.

Anterior region : irregular; irregular; rostrum short, broad, pointed; antirostrum short, broad, pointed; excisura wide with an acute notch.

Posterior region : irregular; crenate.

Depression : dorsal depression shallow over the cauda and ventral depression absent.

Upeneus moluccensis (Bleeker, 1855), Goldband goatfish (Fig. 44)

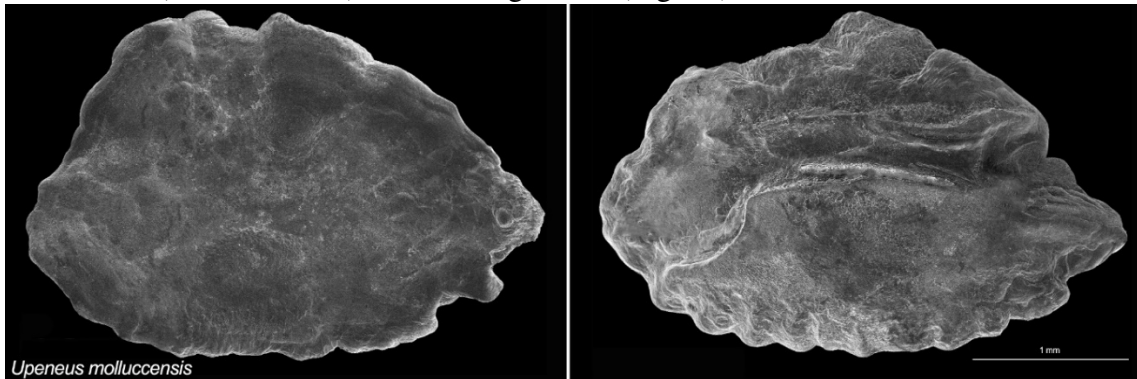


Figure 44. SEM image of sagittae of *Upeneus moluccensis*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.766±0.006	0.590±0.043	1.500±0.060	16.403±0.136	0.694±0.023	0.200±0.019

Shape : elliptic; dorsal and ventral margins irregular to crenate.

Sulcus acusticus : heterosulcoid, ostial, median.

Ostium : funnel-like, shorter than the cauda.

Cauda : tubular, curved, strong, ending close to the posterior margin.

Anterior region : peaked to round; irregular; rostrum short, broad, pointed; antirostrum short, broad, pointed; excisura wide with an acute notch.

Posterior region : round; crenate.

Depression : dorsal depression shallow over the cauda and ventral depression absent.

Upeneus pori Ben-Tuvia & Golani, 1989, Por's goatfish (Fig. 45)

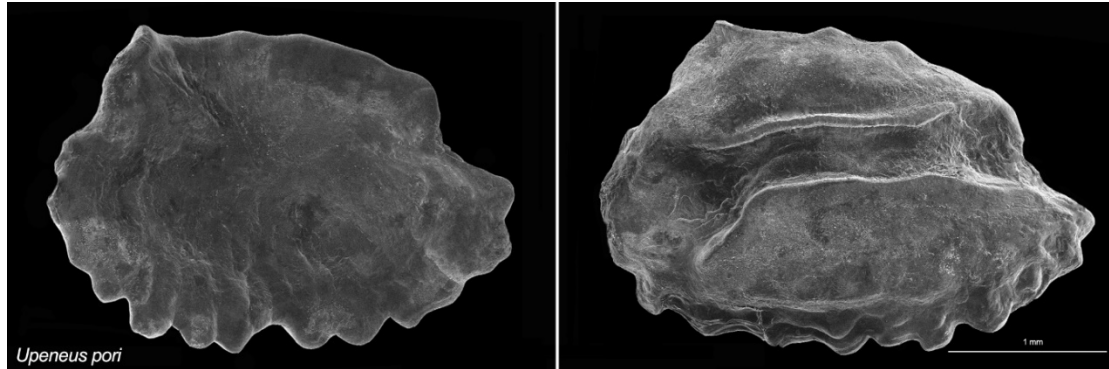


Figure 45. SEM image of sagittae of *Upeneus pori*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.731±0.028	0.627±0.024	1.434±0.006	17.205±0.658	0.706±0.024	0.178±0.002

Shape : elliptic to oval; dorsal margin lobed to crenate and ventral margin sinuate to crenate.

Sulcus acusticus : heterosulcoid, ostial, median.

Ostium : funnel-like, shorter than the cauda.

Cauda : tubular, curved, strong, ending close to the posterior margin.

Anterior region : peaked to round; crenate; rostrum short, broad, pointed; antirostrum short, broad, pointed; excisura wide with a shallow notch.

Posterior region : round; crenate.

Depression : dorsal depression shallow over the cauda and ventral depression absent.

PERCIFORMES

Terapontidae

Pelates quadrilineatus (Bloch, 1790), Fourlined terapon (Fig. 46)

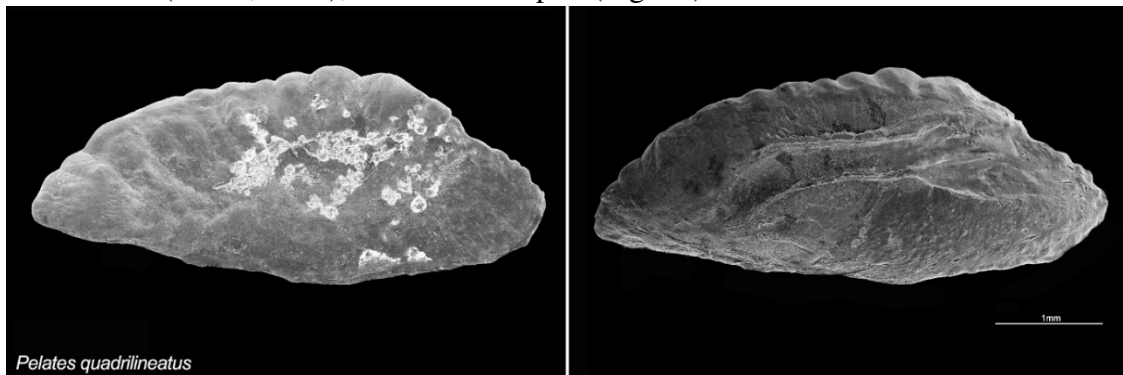


Figure 46. SEM image of sagittae of *Pelates quadrilineatus*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.658±0.006	0.379±0.001	2.335±0.014	19.085±0.169	0.696±0.003	0.400±0.002

- Shape* : fusiform; dorsal margin crenate and ventral margin sinuate.
Sulcus acusticus : heterosulcoid, ostial, median.
Ostium : funnel-like, shorter than the cauda.
Cauda : tubular, curved, strong, ending half way to the posterior margin.
Anterior region : peaked; rostrum broad, short, round; antirostrum poorly defined; excisura moderate without a notch.
Posterior region : lanceolated; lobed to sinuate.
Depression : dorsal depression shallow over the cauda and ventral depression absent.

Serranidae

Epinephelus aeneus (Geoffroy Saint-Hilaire, 1817), White grouper (Fig. 47)

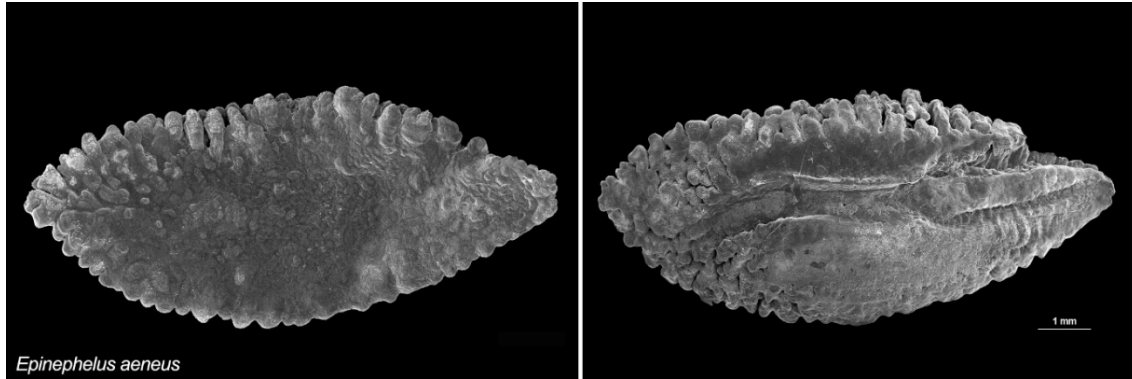


Figure 47. SEM image of sagittae of *Epinephelus aeneus*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.457±0.005	0.390±0.005	2.212±0.006	27.494±0.292	0.678±0.006	0.377±0.001

- Shape* : fusiform; dorsal and ventral margins crenate to dentate.
Sulcus acusticus : heterosulcoid, ostial, median.
Ostium : funnel-like, shorter than the cauda.
Cauda : tubular, curved, strong, ending close to the posterior margin.
Anterior region : peaked; crenate; rostrum long, peaked; antirostrum poorly defined; excisura moderate without a notch.
Posterior region : peaked; irregular to crenate.
Depression : dorsal depression shallow over the cauda and ventral depression absent.

Epinephelus costae (Steindachner, 1878), Goldblotch grouper (Fig. 48)

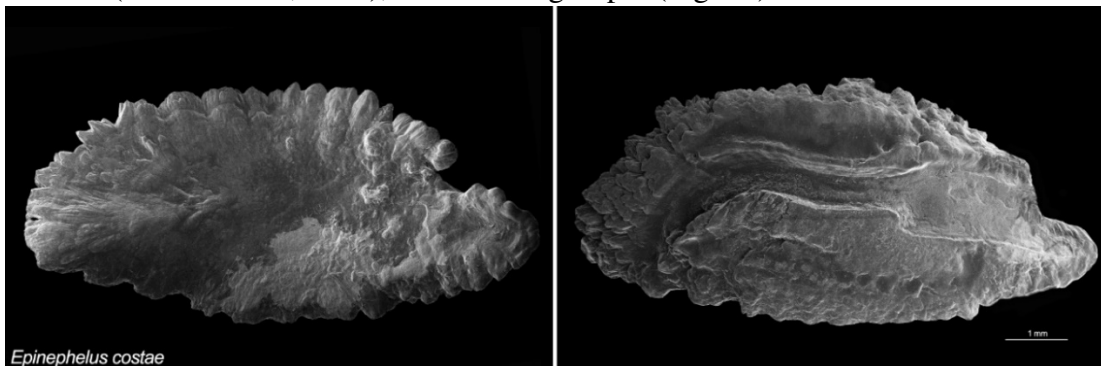


Figure 48. SEM image of sagittae of *Epinephelus costae*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.506±0.043	0.432±0.002	2.073±0.072	24.937±2.127	0.703±0.022	0.349±0.015

Shape : fusiform; dorsal and ventral margins crenate to irregular.

Sulcus acusticus : heterosulcoid, ostial, suprmedian.

Ostium : funnel-like, shorter than the cauda.

Cauda : tubular, curved, strong, ending close to the posterior margin.

Anterior region : peaked; crenate; rostrum long, peaked; antirostrum poorly defined; excisura moderate without a shallow notch.

Posterior region : oblique; irregular to crenate.

Depression : dorsal depression shallow over the cauda and ventral depression absent.

Mycteroperca rubra (Bloch, 1793), Mottled grouper (Fig. 49)

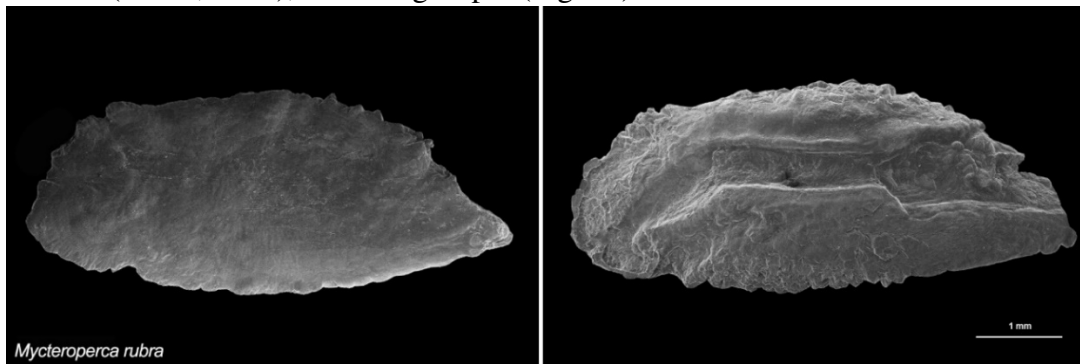


Figure 49. SEM image of sagittae of *Mycteroperca rubra*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.589±0.004	0.390±0.000	2.388±0.069	21.352±0.144	0.732±0.021	0.410±0.012

Shape : rectangular to oblong; dorsal and ventral margins crenate to irregular.

Sulcus acusticus : heterosulcoid, ostial, suprmedian.

Ostium : funnel-like, shorter than the cauda.

Cauda : tubular, curved, strong, ending close to the posterior margin.

Anterior region : peaked; crenate; rostrum long, peaked; antirostrum poorly defined; excisura moderate without a shallow notch.

Posterior region : oblique; crenate.

Depression : dorsal depression shallow over the cauda and ventral depression absent.

Serranus cabrilla (Linnaeus, 1758), Comber (Fig. 50)

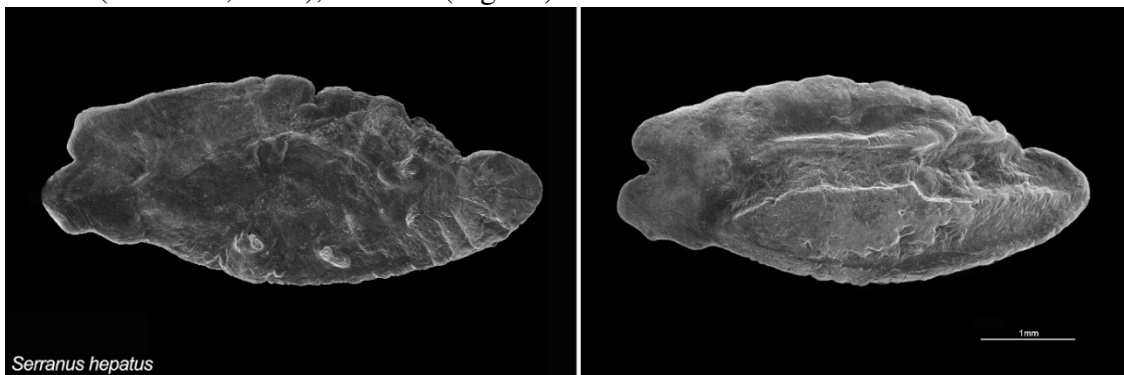


Figure 50. SEM image of sagittae of *Serranus cabrilla*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.633±0.029	0.392±0.020	2.282±0.113	19.873±0.911	0.701±0.000	0.390±0.021

Shape : fusiform to oblong; dorsal and ventral margins sinuate to crenate.

Sulcus acusticus : heterosulcoid, ostial, median.

Ostium : funnel-like, shorter than the cauda.

Cauda : tubular, curved, slightly, ending half way to the posterior margin.

Anterior region : peaked; sinuate; rostrum short, round; antirostrum poorly defined; excisura wide without a shallow notch.

Posterior region : double-peaked, sinuate.

Depression : dorsal depression shallow over the cauda and ventral depression absent.

Pomatomidae

Pomatomus saltatrix (Linnaeus, 1766), Bluefish (Fig. 51)

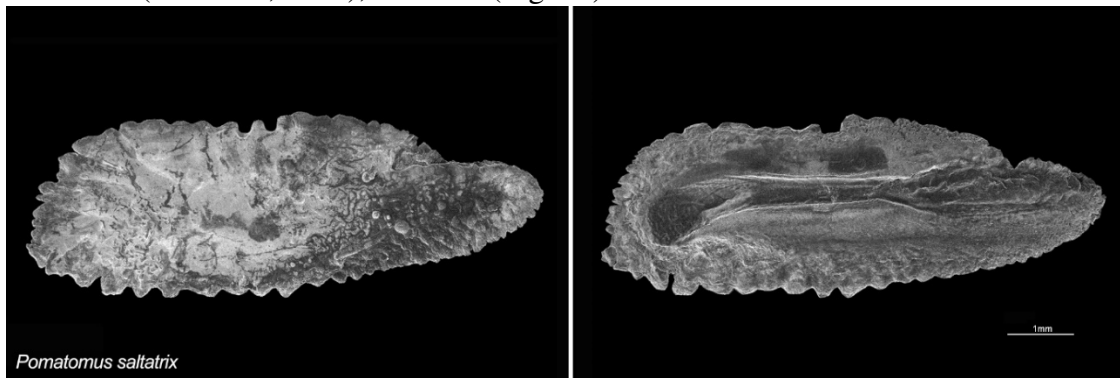


Figure 51. SEM image of sagittae of *Pomatomus saltatrix*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.441±0.015	0.334±0.010	2.760±0.075	28.540±0.947	0.723±0.002	0.468±0.011

Shape : fusiform to oblong; dorsal and ventral margins crenate.

Sulcus acusticus : heterosulcoid, ostial, median.

Ostium : funnel-like, shorter than the cauda.

Cauda : tubular, curved, slightly, ending close to the posterior margin.

Anterior region : lanceolated; crenate; rostrum elongated, broad, round; antirostrum poorly developed, round; excisura very wide without a notch.

Posterior region : oblique; irregular to crenate.

Depression : dorsal and ventral depressions present through the cauda and shallow.

Leiognathidae

Equulites klunzingeri (Steindachner, 1898), Kluzinger's Ponyfish (Fig. 52)

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.744±0.011	0.557±0.000	1.542±0.034	16.895±0.257	0.674±0.015	0.213±0.011

Shape : elliptic; dorsal and ventral margins crenate.

Sulcus acusticus : heterosulcoid, ostial, median.

Ostium : funnel-like, shorter than the cauda.

Cauda : tubular, curved, slightly, ending close to the posterior margin.

Anterior region : peaked; crenate; rostrum elongated, broad, round; antirostrum poorly developed, round; excisura very wide with a shallow notch.

Posterior region : round; crenate.

Depression : dorsal and ventral depressions present through the cauda, wide and shallow.

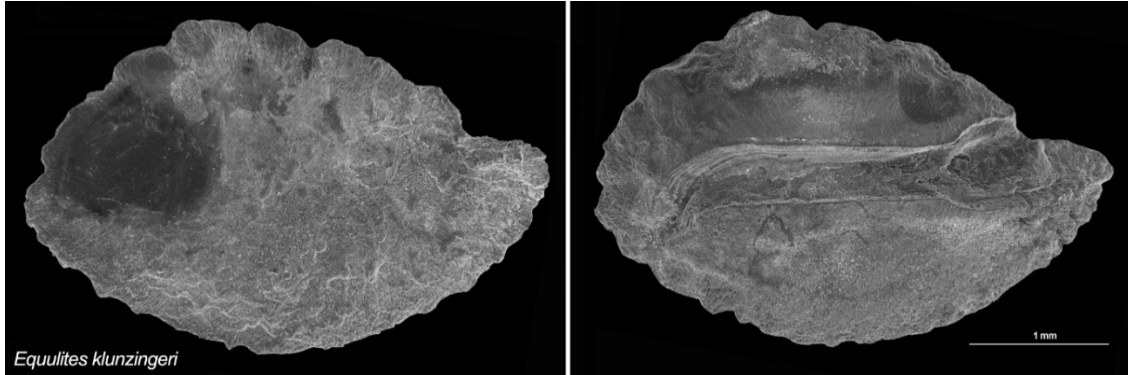


Figure 52. SEM image of sagittae of *Equulites klunzingeri*.

Cepolidae

Cepola macrophthalmalma (Linnaeus, 1758), Red bandfish (Fig. 53)

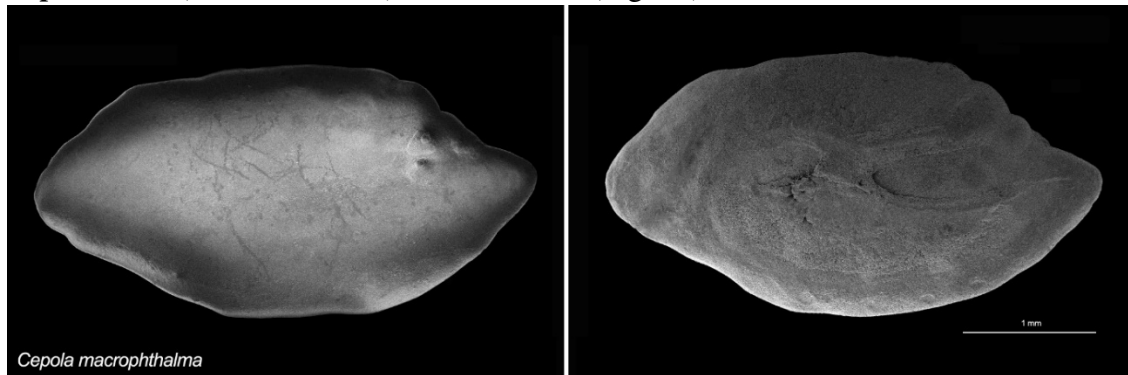


Figure 53. SEM image of sagittae of *Cepola macrophthalmalma*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.801±0.013	0.474±0.017	1.935±0.083	15.684±0.251	0.720±0.005	0.318±0.019

Shape : oval; dorsal and ventral margins sinuate.

Sulcus acusticus : heterosulcoid, ostial, median.

Ostium : funnel-like, shorter than the cauda.

Cauda : tubular, straight, ending far from the posterior-dorsal margin.

Anterior region : peaked; sinuate; rostrum short, broad, slightly pointed; antirostrum poorly defined, round; excisura moderate without a notch.

Posterior region : peaked; sinuate.

Depression : both dorsal and ventral depressions absent.

SCORPAENIFORMES

Scorpaenidae

Helicolenus dactylopterus (Delaroche, 1809), Blackbelly rosefish (Fig. 54)

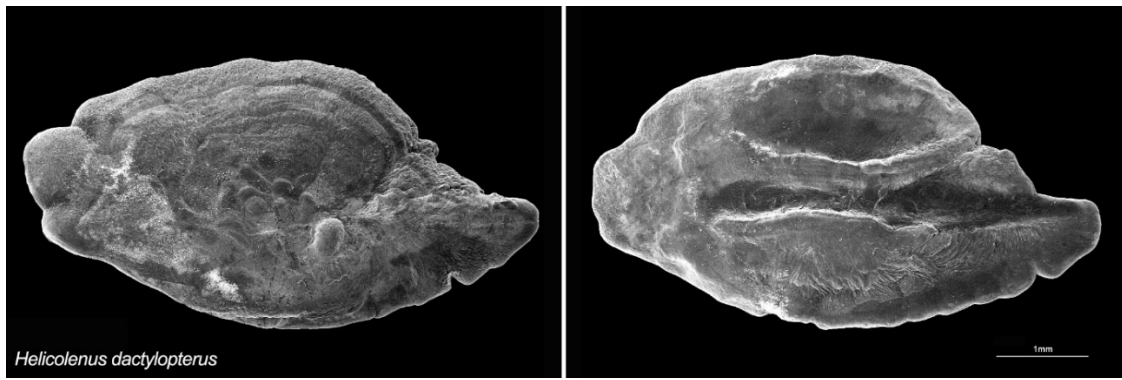


Figure 54. SEM image of sagittae of *Helicolenus dactylopterus*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.724±0.010	0.461±0.020	1.882±0.047	17.361±0.236	0.681±0.013	0.306±0.011

Shape : oval, dorsal and ventral margins sinuate to partly crenate.

Sulcus acusticus : heterosulcoid, ostial, median.

Ostium : funnel-like, as long as the cauda.

Cauda : tubular, straight, ending half way to the posterior margin.

Anterior region : peaked; sinuate; rostrum short, broad, slightly pointed; antirostrum poorly defined, round; excisura moderate with a shallow notch.

Posterior region : oblique; sinuate to lobed.

Depression : dorsal depression wide and deep and ventral depression absent.

Scorpaena notata Rafinesque, 1810, Small red scorpionfish (Fig. 55)

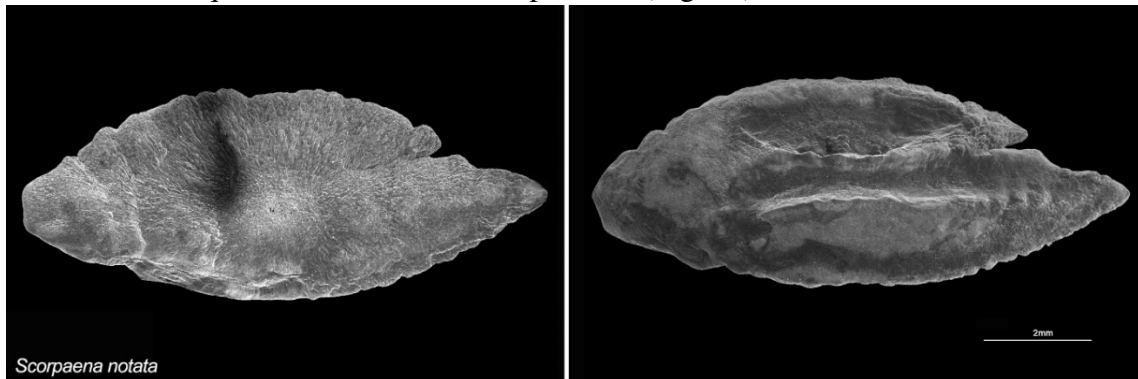


Figure 55. SEM image of sagittae of *Scorpaena notata*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.571±0.019	0.348±0.002	2.468±0.045	22.012±0.719	0.675±0.009	0.423±0.007

Shape : fusiform; dorsal and ventral margins crenate.

Sulcus acusticus : heterosulcoid, ostial, median.

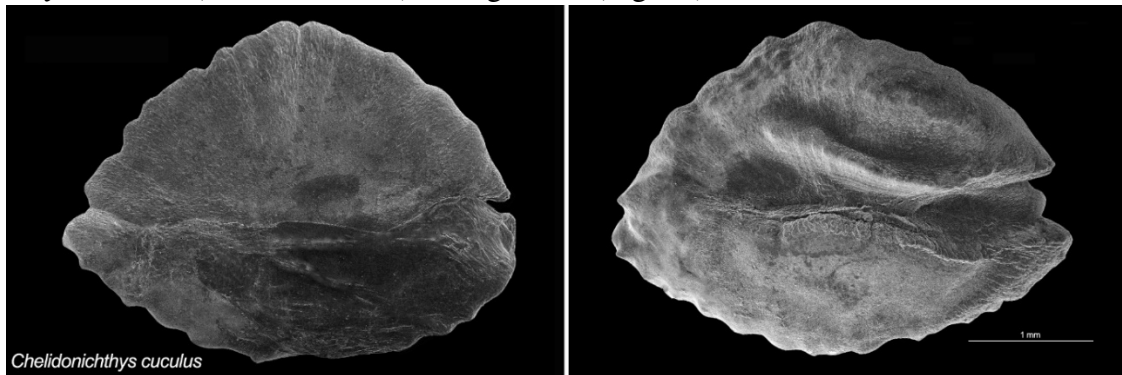
Ostium : funnel-like, as long as the cauda.

Cauda : tubular, straight, ending half way to the posterior margin.

Anterior region : peaked; sinuate; rostrum long, slightly pointed; antirostrum poorly defined, pointed; excisura moderate with a narrow notch.

Posterior region : peaked; sinuate.

Depression : dorsal depression wide and deep and ventral depression absent.

Triglidae***Chelidonichthys cuculus*** (Linnaeus, 1758), Red gurnard (Fig. 56)**Figure 56.** SEM image of sagittae of *Chelidonichthys cuculus*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.772±0.017	0.656±0.020	1.355±0.027	16.272±0.356	0.698±0.007	0.151±0.010

Shape : elliptic; dorsal and ventral margins crenate.

Sulcus acusticus : heterosulcoid, ostial, median.

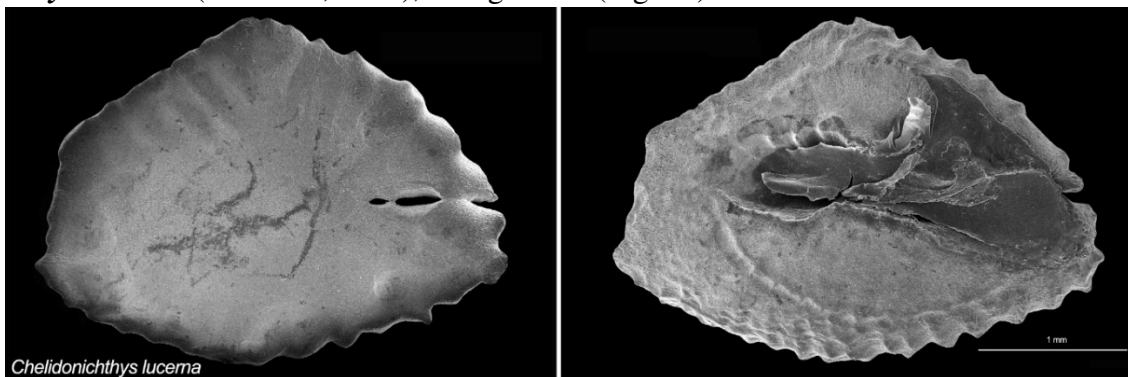
Ostium : funnel-like, shorter than the cauda.

Cauda : tubular, straight, ending half way to the posterior margin.

Anterior region : double-peaked; crenate; rostrum very short, broad, round or blunt; antirostrum shorter than the rostrum, small, broad, round to pointed; excisura narrow with an acute notch.

Posterior region : peaked; crenate.

Depression : dorsal depression wide and deep and ventral depression absent.

Chelidonichthys lucerna (Linnaeus, 1758), Tub gurnard (Fig. 57)**Figure 57.** SEM image of sagittae of *Chelidonichthys lucerna*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.723±0.011	0.630±0.021	1.382±0.031	17.378±0.255	0.683±0.008	0.160±0.011

Shape : pentagonal; dorsal and ventral margins serrate to crenate.

Sulcus acusticus : heterosulcoid, ostial, median.

Ostium : funnel-like, longer than the cauda.

Cauda : tubular, straight, ending half way to the posterior margin.

Anterior region : blunt, angled; crenate; rostrum very short, broad, round or pointed; antirostrum poorly developed, broad, round; excisura narrow with an acute notch.

Posterior region : oblique; sinuate.

Depression : dorsal depression wide and deep and ventral depression absent.

MORONIFORMES

Moronidae

Dicentrarchus labrax (Linnaeus, 1758), European seabass (Fig. 58)

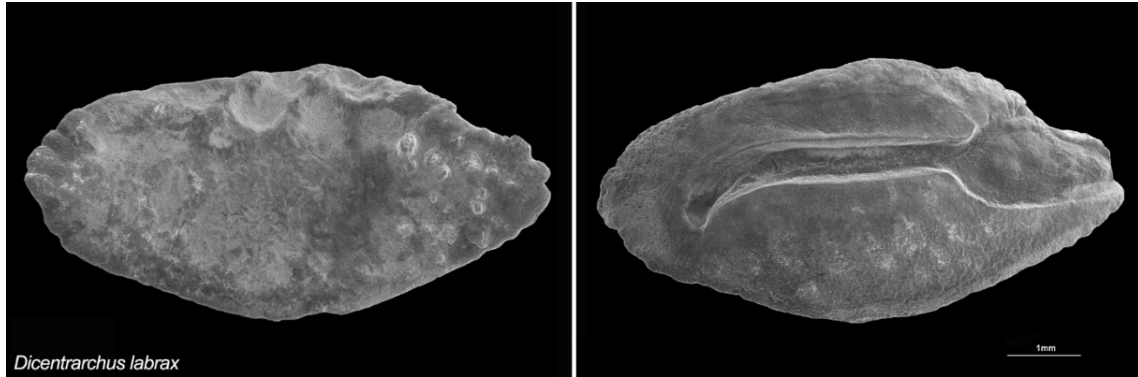


Figure 58. SEM image of sagittae of *Dicentrarchus labrax*

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.740±0.021	0.444±0.000	2.006±0.035	16.985±0.485	0.699±0.012	0.335±0.008

Shape : fusiform to oval; dorsal and ventral margins sinuate to slightly crenate.

Sulcus acusticus : heterosulcoid, ostial, median.

Ostium : funnel-like, longer than the cauda.

Cauda : tubular, straight, ending close to the posterior margin.

Anterior region : peaked; crenate; rostrum short, broad, round; antirostrum poorly developed, broad, round; excisura narrow without a notch.

Posterior region : round; crenate.

Depression : dorsal depression through the cauda shallow and ventral depression absent.

ACANTHURIFORMES

Sciaenidae

Umbrina cirrosa (Linnaeus, 1758), Shi drum (Fig. 59)

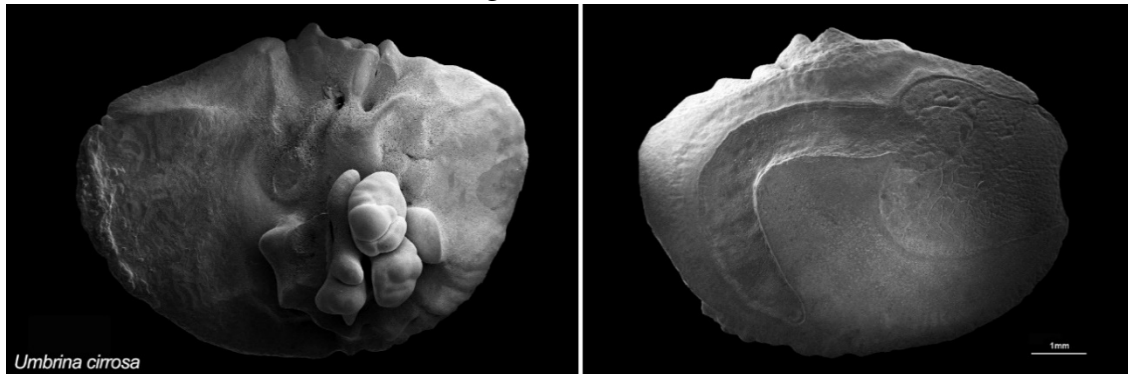


Figure 59. SEM image of sagittae of *Umbrina cirrosa*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.854±0.006	0.713±0.006	1.329±0.018	14.709±0.111	0.744±0.004	0.141±0.007

- Shape* : bullet-shaped, dorsal and ventral margins sinuate to slightly crenate.
Sulcus acusticus : heterosulcoid, ostial, suprmedian.
Ostium : funnel-like, very wide, as long as the cauda.
Cauda : tubular, curved, curled, ending close to the posterior margin.
Anterior region : round; sinuate; rostrum broad, round; antirostrum absent; excisura with a very small notch.
Posterior region : round; sinuate.
Depression : dorsal depression shallow and ventral depression absent.

SPARIFORMES

Sillaginidae

Sillago suezensis Golani, Fricke & Tikochinski 2013, Silver sillago (Fig. 60)

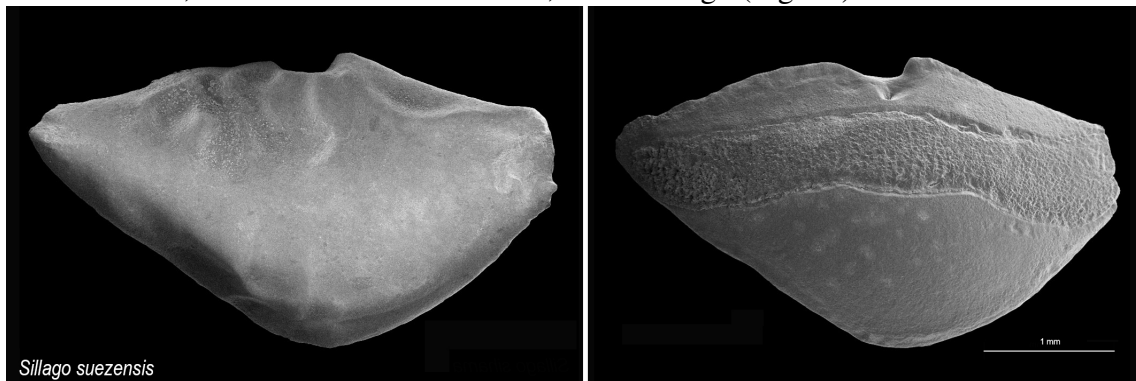


Figure 60. SEM image of sagittae of *Sillago suezensis*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.746±0.015	0.470±0.021	1.768±0.049	16.840±0.348	0.652±0.010	0.277±0.013

- Shape* : rhomboidal; dorsal and ventral margins entire to sinuate.
Sulcus acusticus : archaesulcoid, ostial, suprmedian.
Ostium-cauda : undifferentiated.
Anterior region : blunt; sinuate; rostrum very small, short, broad and round, antirostrum absent; excisura wide without notch.
Posterior region : peaked; entire to sinuate.
Depression : both dorsal and ventral depressions absent.

Sparidae

Boops boops (Linnaeus, 1758), Bogue (Fig. 61)

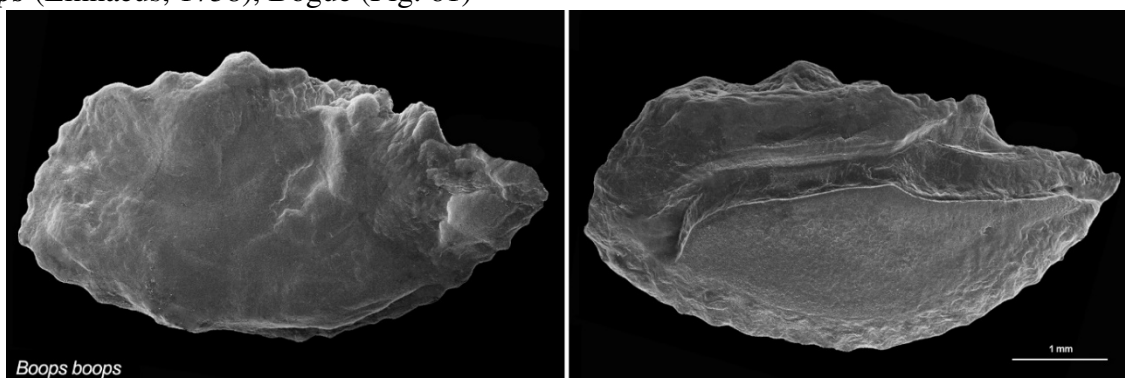


Figure 61. SEM image of sagittae of *Boops boops*.

FF	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.682±0.034	0.472±0.012	1.812±0.027	18.455±0.929	0.672±0.007	0.289±0.007

Shape : elliptic; dorsal margin irregular and ventral margin crenate.

Sulcus acusticus : heterosulcoid, ostial, supramedian.

Ostium : funnel-like, wider and shorter than the cauda.

Cauda : tubular, curved, strong, ending close to the posterior margin.

Anterior region : peaked; crenate; rostrum broad, long, slightly pointed; antirostrum very small, narrow, pointed; excisura wide with a shallow notch.

Posterior region : oblique; sinuate, crenate.

Depression : dorsal depression shallow and ventral depression absent.

Centracanthus cirrus Rafinesque, 1810, Curled picarel (Fig. 62)

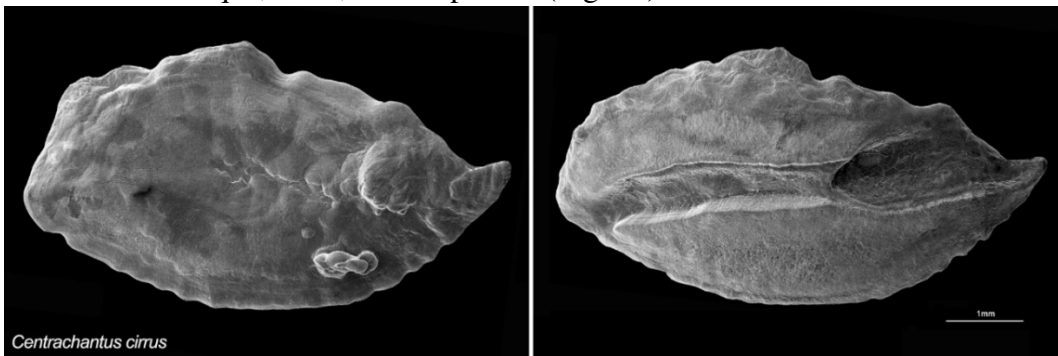


Figure 62. SEM image of sagittae of *Centracanthus cirrus*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.721±0.004	0.461±0.022	1.843±0.070	17.431±0.102	0.667±0.006	0.296±0.017

Shape : oval; dorsal and ventral margins crenate.

Sulcus acusticus : heterosulcoid, ostial, median.

Ostium : funnel-like, wider and shorter than the cauda.

Cauda : tubular, curved, slightly, ending close to the posterior margin.

Anterior region : peaked; sinuate; rostrum broad, long, slightly pointed; antirostrum very small, narrow, pointed; excisura wide with a shallow notch.

Posterior region : oblique; sinuate.

Depression : dorsal depression poorly developed and ventral depression absent.

Dentex macrophthalmus (Bloch, 1791), Large-eyed dentex (Fig. 63)

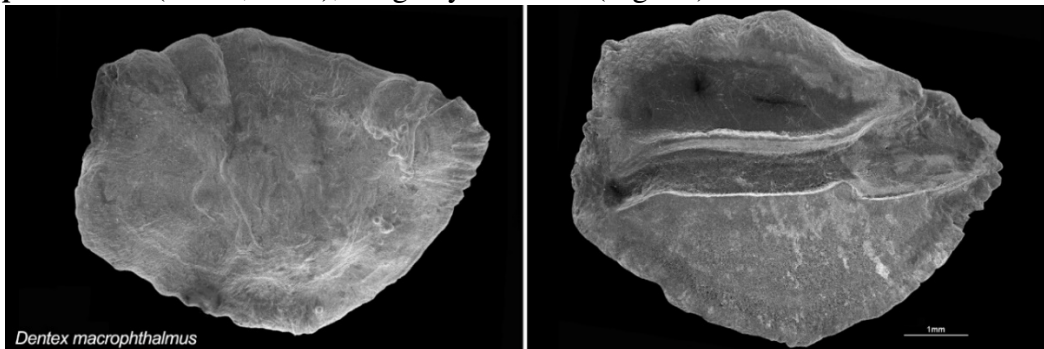


Figure 63. SEM image of sagittae of *Dentex macrophthalmus*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.816±0.009	0.670±0.034	1.303±0.014	15.393±0.176	0.685±0.027	0.131±0.005

Shape : pentagonal; dorsal and ventral margins sinuate to crenate.

Sulcus acusticus : heterosulcoid, ostial, median.

Ostium : funnel-like, wider and shorter than the cauda.

Cauda : tubular, curved, slightly, ending close to the posterior margin.

Anterior region : angled; crenate; rostrum short, broad, slightly pointed; antirostrum poorly developed; excisura wide with a shallow notch.

Posterior region : flattened; sinuate.

Depression : dorsal depression wide and ventral depression absent.

Dentex maroccanus Valenciennes, 1830. Morocco dentex (Fig. 64)

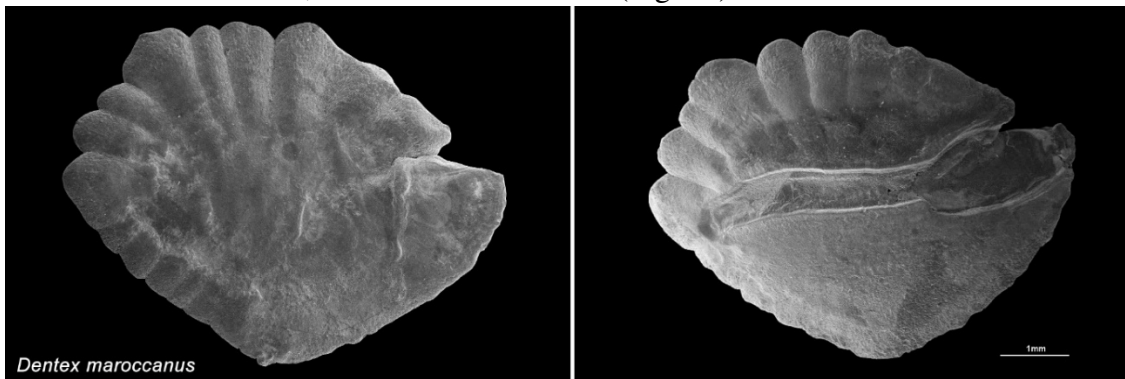


Figure 64. SEM image of sagittae of *Dentex maroccanus*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.786±0.005	0.667±0.007	1.289±0.002	15.978±0.100	0.676±0.006	0.126±0.001

Shape : pentagonal; dorsal margin lobed and ventral margin crenate.

Sulcus acusticus : heterosulcoid, ostial, median.

Ostium : funnel-like, wider and shorter than the cauda.

Cauda : tubular, curved, strongly, ending close to the posterior margin.

Anterior region : angled; crenate; rostrum short, broad, slightly pointed; antirostrum very small, broad, developed; excisura wide with a shallow notch.

Posterior region : peaked; lobbed to sinuate.

Depression : dorsal depression poorly developed and ventral depression absent.

Diplodus annularis (Linnaeus, 1758), Annular seabream (Fig. 65)

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.707±0.022	0.573±0.015	1.581±0.006	17.788±0.556	0.711±0.016	0.225±0.002

Shape : oval to pentagonal; dorsal and ventral margins crenate.

Sulcus acusticus : heterosulcoid, ostial, median.

Ostium : funnel-like, wider and shorter than the cauda.

Cauda : tubular, curved, slightly, ending close to the posterior margin.

Anterior region : peaked; crenate; rostrum short, broad, slightly pointed; antirostrum poorly developed; excisura wide with a shallow notch.

Posterior region : oblique; crenate.

Depression : dorsal depression deep and ventral depression absent.

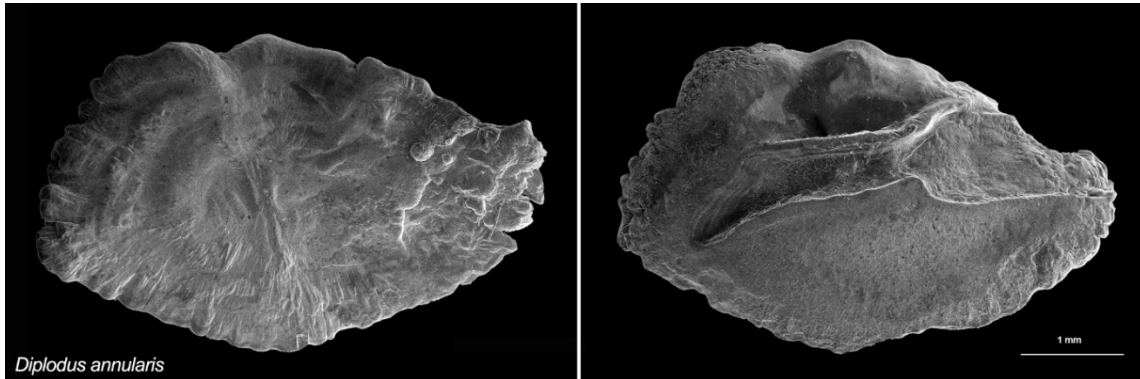


Figure 65. SEM image of sagittae of *Diplodus annularis*.

Diplodus puntazzo (Cetti, 1777), Sharpsnout seabream (Fig. 66)

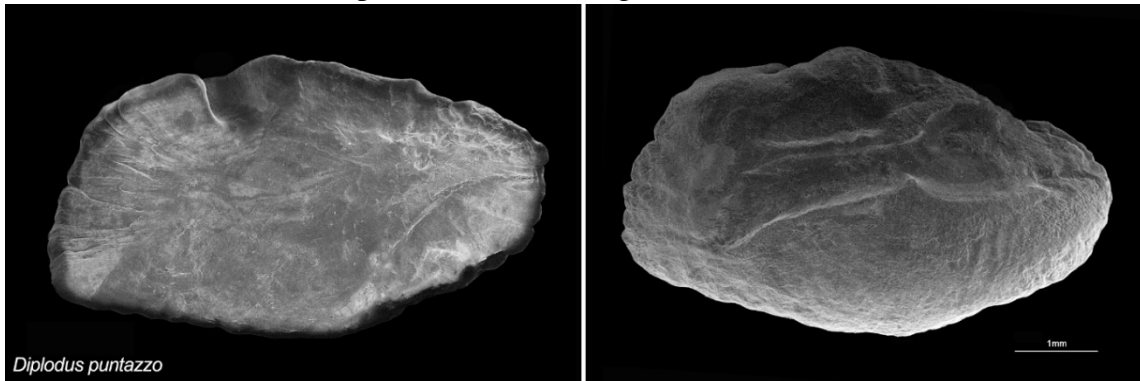


Figure 66. SEM image of sagittae of *Diplodus puntazzo*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.788±0.014	0.534±0.010	1.715±0.070	15.956±0.286	0.719±0.015	0.263±0.019

Shape : oval; dorsal and ventral margins sinuate to crenate.

Sulcus acusticus : heterosulcoid, ostial, median.

Ostium : funnel-like, wider and shorter than the cauda.

Cauda : tubular, curved, slightly, ending close to the posterior margin.

Anterior region : round; crenate; rostrum short, broad, slightly pointed; antirostrum absent; excisura wide without a notch.

Posterior region : oblique; sinuate to crenate.

Depression : dorsal depression shallow and ventral depression absent.

Diplodus sargus (Linnaeus, 1758), White seabream (Fig. 67)

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.744±0.001	0.492±0.014	1.856±0.080	16.881±0.012	0.716±0.010	0.299±0.020

Shape : oval; dorsal and ventral margins sinuate to crenate.

Sulcus acusticus : heterosulcoid, ostial, median.

- Ostium* : funnel-like, wider and shorter than the cauda.
Cauda : tubular, curved, slightly, ending close to the posterior margin.
Anterior region : peaked; sinuate; rostrum short, broad, round; antirostrum absent; excisura wide without a notch.
Posterior region : oblique; sinuate to crenate.
Depression : dorsal depression deep and ventral depression absent.

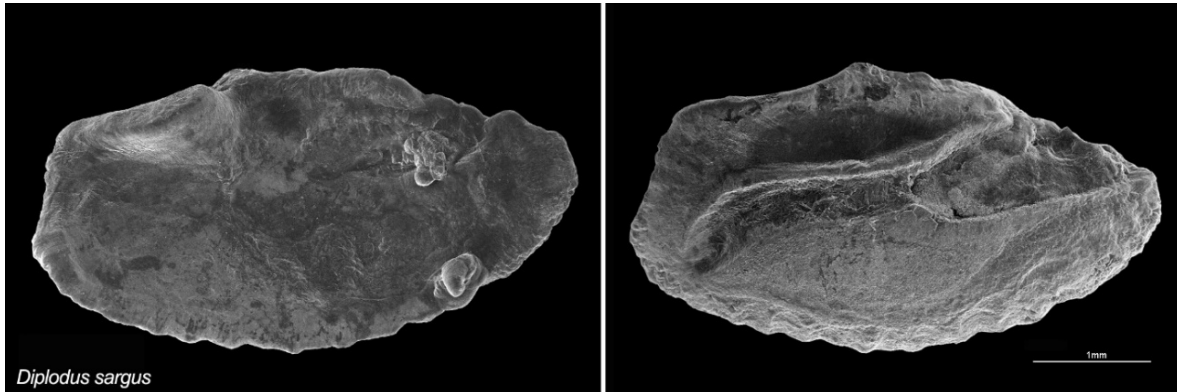


Figure 67. SEM image of sagittae of *Diplodus sargus*.

Diplodus vulgaris (Geoffroy Saint-Hilaire, 1817), Common two-banded seabream (Fig. 68)

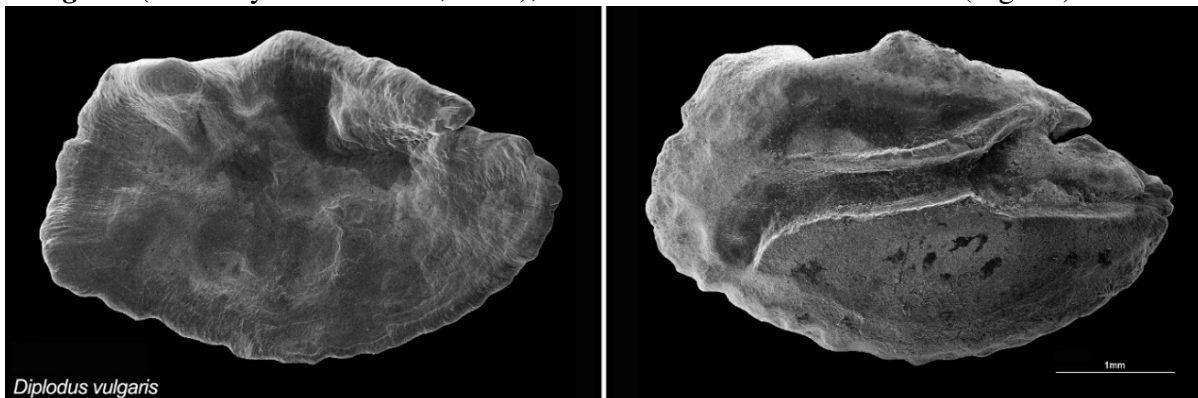


Figure 68. SEM image of sagittae of *Diplodus vulgaris*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.731±0.044	0.570±0.011	1.567±0.005	17.211±1.027	0.702±0.011	0.221±0.002

- Shape* : pentagonal; dorsal and ventral margins sinuate to crenate.
Sulcus acusticus : heterosulcoid, ostial, median.
Ostium : funnel-like, wider and shorter than the cauda.
Cauda : tubular, curved, slightly, ending close to the posterior margin.
Anterior region : peaked to round; crenate; rostrum short, broad, pointed; antirostrum absent; excisura wide without a notch.
Posterior region : oblique; sinuate to crenate.
Depression : dorsal depression deep and ventral depression absent.

Lithognathus mormyrus (Brünnich, 1768), Striped seabream (Fig. 69)**Figure 69.** SEM image of sagittae of *Lithognathus mormyrus*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.687±0.002	0.447±0.003	1.870±0.002	18.300±0.050	0.657±0.005	0.303±0.000

Shape : fusiform to pentagonal; dorsal and ventral margins sinuate to crenate.

Sulcus acusticus : heterosulcoid, ostial, median.

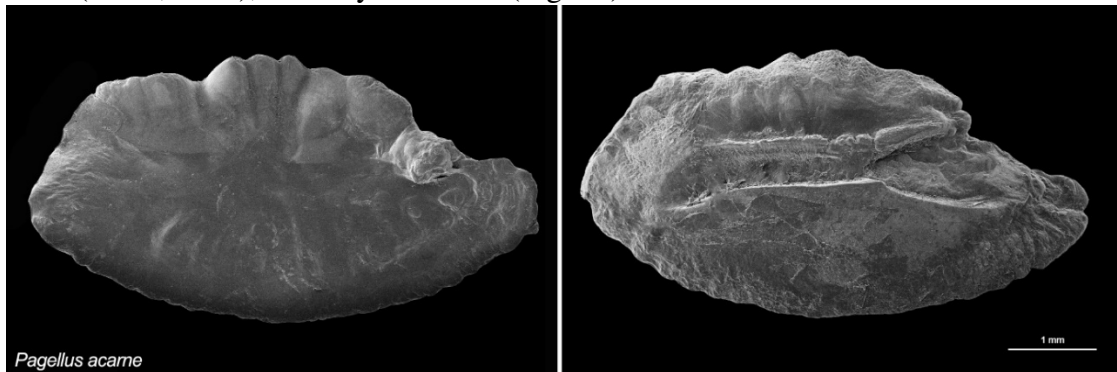
Ostium : funnel-like, wider and shorter than the cauda.

Cauda : tubular, curved, slightly, ending close to the posterior margin.

Anterior region : peaked; sinuate; rostrum short, broad, pointed; antirostrum absent; excisura wide without a notch.

Posterior region : oblique; sinuate to crenate.

Depression : dorsal depression deep and ventral depression absent.

Pagellus acarne (Risso, 1827), Axillary seabream (Fig. 70)**Figure 70.** SEM image of sagittae of *Pagellus acarne*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.708±0.011	0.470±0.001	1.905±0.019	17.739±0.263	0.703±0.006	0.312±0.005

Shape : oval; dorsal and ventral margins sinuate to crenate.

Sulcus acusticus : heterosulcoid, ostial, median.

Ostium : funnel-like, wider and shorter than the cauda.

Cauda : tubular, curved, slightly, ending close to the posterior margin.

Anterior region : peaked; sinuate; rostrum short, broad, round; antirostrum small; excisura wide with a shallow notch.

Posterior region : oblique; sinuate to crenate.

Depression : dorsal depression deep and ventral depression absent.

Pagellus erythrinus (Linnaeus, 1758), Common pandora (Fig. 71)

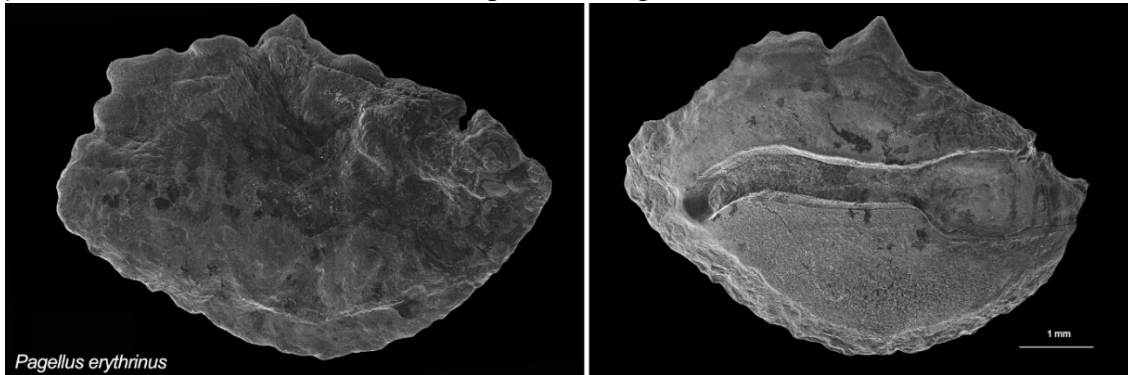


Figure 71. SEM image of sagittae of *Pagellus erythrinus*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.736±0.019	0.584±0.014	1.402±0.049	17.085±0.452	0.643±0.007	0.167±0.017

Shape : pentagonal to oval; dorsal margin crenate and ventral margin sinuate.

Sulcus acusticus : heterosulcoid, ostial, median.

Ostium : funnel-like, wider and shorter than the cauda.

Cauda : tubular, curved, slightly, ending close to the posterior margin.

Anterior region : peaked; sinuate; rostrum short, broad, peaked; antirostrum small; excisura wide with a shallow notch.

Posterior region : oblique; sinuate to crenate.

Depression : dorsal depression poorly developed and ventral depression absent.

Pagrus auriga Valenciennes, 1843, Redbanded seabream (Fig. 72)

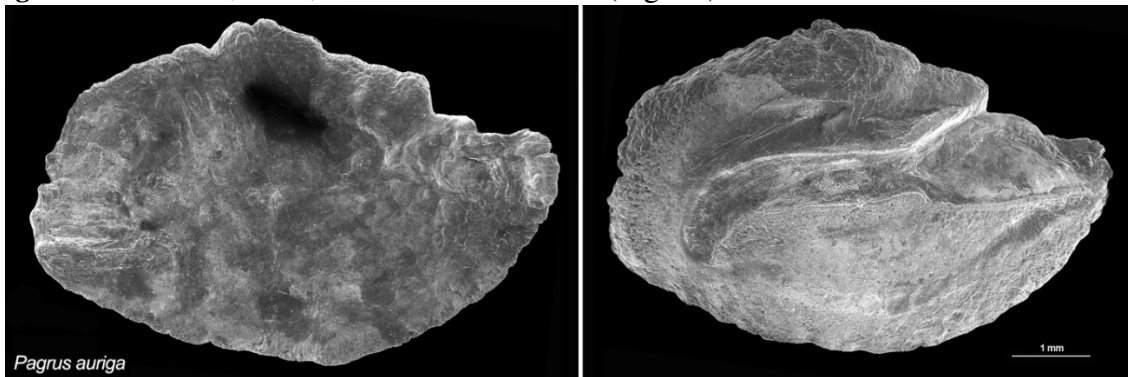


Figure 72. SEM image of sagittae of *Pagrus auriga*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.752±0.001	0.578±0.014	1.494±0.023	16.703±0.027	0.679±0.006	0.198±0.007

Shape : pentagonal to oval; dorsal anal ventral margins sinuate to crenate.

Sulcus acusticus : heterosulcoid, ostial, median.

Ostium : funnel-like, wider and shorter than the cauda.

Cauda : tubular, curved, markedly, ending close to the posterior margin.

Anterior region : peaked; sinuate; rostrum short, broad, peaked; antirostrum small; excisura wide with a

shallow notch.

Posterior region : oblique; sinuate to crenate.

Depression : dorsal depression over the cauda and ventral depression absent.

Pagrus caeruleostictus (Valenciennes, 1830), Bluespotted seabream (Fig. 73)

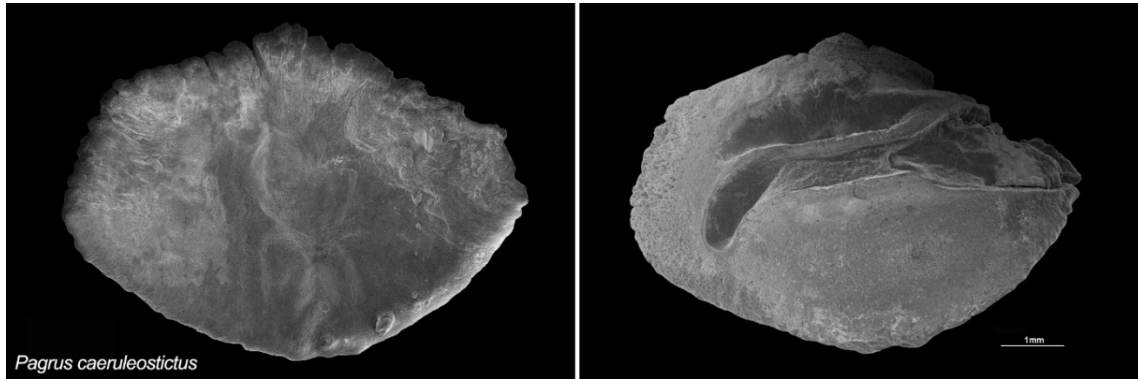


Figure 73. SEM image of sagittae of *Pagrus caeruleostictus*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.785±0.045	0.624±0.013	1.391±0.004	16.042±0.925	0.681±0.016	0.164±0.001

Shape : pentagonal to oval; dorsal anal ventral margins sinuate to crenate.

Sulcus acusticus : heterosulcoid, ostial, median.

Ostium : funnel-like, wider and shorter than the cauda.

Cauda : tubular, curved, markedly, ending close to the posterior margin.

Anterior region : peaked; sinuate; rostrum short, broad, peaked; antirostrum small; excisura wide with a shallow notch.

Posterior region : oblique; sinuate to crenate.

Depression : dorsal depression deep and ventral depression absent.

Sarpa salpa (Linnaeus, 1758), Salema (Fig. 74)

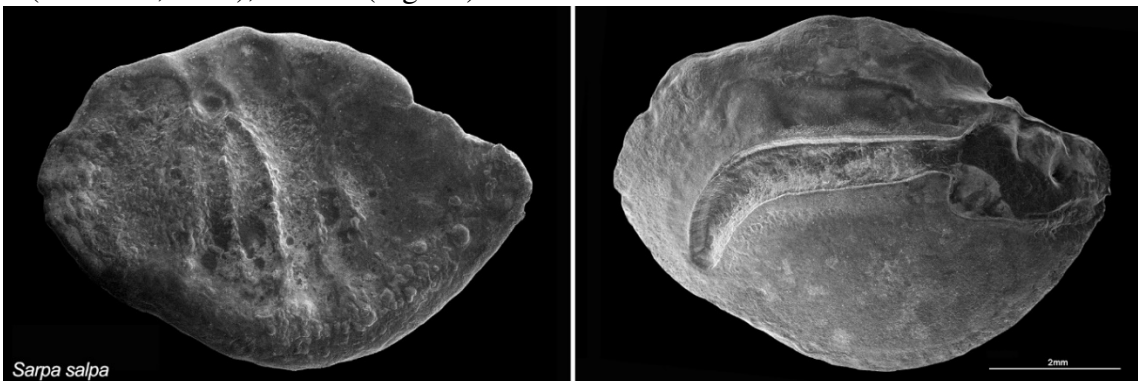


Figure 74. SEM image of sagittae of *Sarpa salpa*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.854±0.025	0.618±0.021	1.410±0.033	14.726±0.440	0.684±0.007	0.170±0.011

Shape : elliptic; dorsal anal ventral margins sinuate.

Sulcus acusticus : heterosulcoid, ostial, median.

- Ostium* : funnel-like, wider and shorter than the cauda.
Cauda : tubular, curved, markedly, ending close to the posterior margin.
Anterior region : peaked; sinuate; rostrum short, broad, round; antirostrum small; excisura wide with a shallow notch.
Posterior region : round; sinuate.
Depression : dorsal depression over the cauda and ventral depression absent.

Sparus aurata Linnaeus, 1758, Gilthead seabream (Fig. 75)

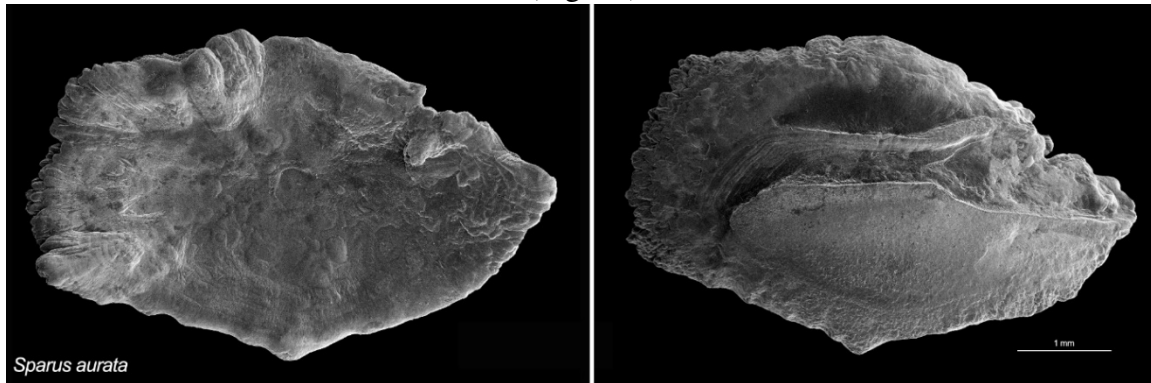


Figure 75. SEM image of sagittae of *Sparus aurata*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.660±0.020	0.544±0.003	1.595±0.002	19.041±0.576	0.681±0.004	0.229±0.001

- Shape* : pentagonal; dorsal anal ventral margins sinuate to crenate.
Sulcus acusticus : heterosulcoid, ostial, median.
Ostium : funnel-like, wider and shorter than the cauda.
Cauda : tubular, curved, markedly, ending close to the posterior margin.
Anterior region : peaked; sinuate; rostrum short, broad, peaked; antirostrum small; excisura wide with a shallow notch.
Posterior region : oblique; crenate to irregular.
Depression : dorsal depression deep and ventral depression absent.

Spicara maena (Linnaeus, 1758), Blotched picarel (Fig. 76)

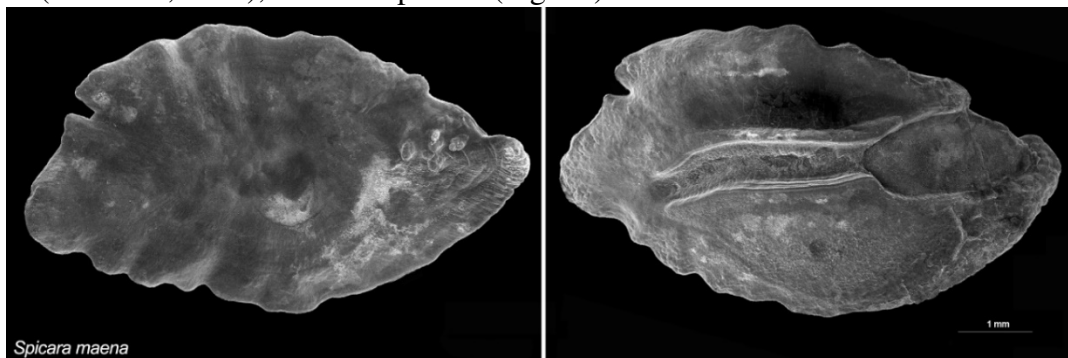


Figure 76. SEM image of sagittae of *Spicara maena*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.712±0.018	0.496±0.005	1.705±0.015	17.663±0.437	0.664±0.013	0.261±0.004

- Shape* : pentagonal to oval; dorsal and ventral margins sinuate to crenate.
Sulcus acusticus : heterosulcoid, ostial, median.
Ostium : funnel-like, wider and shorter than the cauda.
Cauda : tubular, curved, slightly, ending close to the posterior margin.
Anterior region : peaked; sinuate; rostrum short, broad, round; antirostrum small; excisura wide with a shallow notch.
Posterior region : oblique; sinuate to crenate.
Depression : dorsal depression deep and ventral depression absent.

Spicara smaris (Linnaeus, 1758), Picarel (Fig. 77)

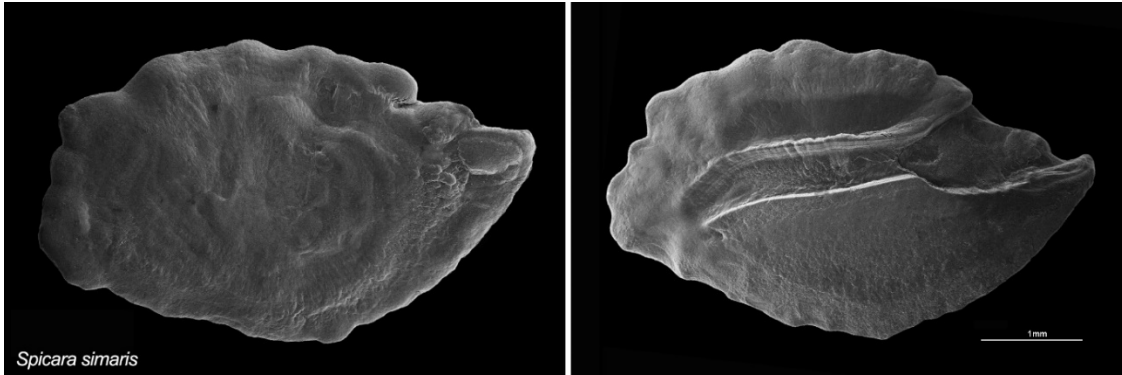


Figure 77. SEM image of sagittae of *Spicara smaris*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.764±0.017	0.531±0.013	1.597±0.020	16.453±0.368	0.666±0.024	0.230±0.006

- Shape* : pentagonal; dorsal and ventral margins sinuate to crenate.
Sulcus acusticus : heterosulcoid, ostial, median.
Ostium : funnel-like, wider and shorter than the cauda.
Cauda : tubular, curved, slightly, ending close to the posterior margin.
Anterior region : peaked; sinuate; rostrum short, broad, pointed; antirostrum small; excisura wide with a shallow notch.
Posterior region : oblique; sinuate to crenate.
Depression : dorsal depression deep and ventral depression absent.

CAPROIFORMES

Caproidae

Capros aper (Linnaeus, 1758), Boarfish (Fig. 78)

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.484±0.009	1.204±0.040	0.751±0.019	25.981±0.472	0.710±0.005	-0.142±0.012

- Shape* : hour-glass; dorsal margin sinuate to crenate and ventral margin dentate to irregular.
Sulcus acusticus : heterosulcoid, ostio-caudal, median.
Ostium : funnel-like.
Cauda : tubular.
Anterior region : double-peaked; rostrum and antirostrum large, broad and round or slightly pointed; excisura wide with an acute, deep notch.

Posterior region : notched; postrostrum and postantirostrum short, broad and round, postantirostrum longer; excisura caudalis wide with a shallow to deep, wide notch.

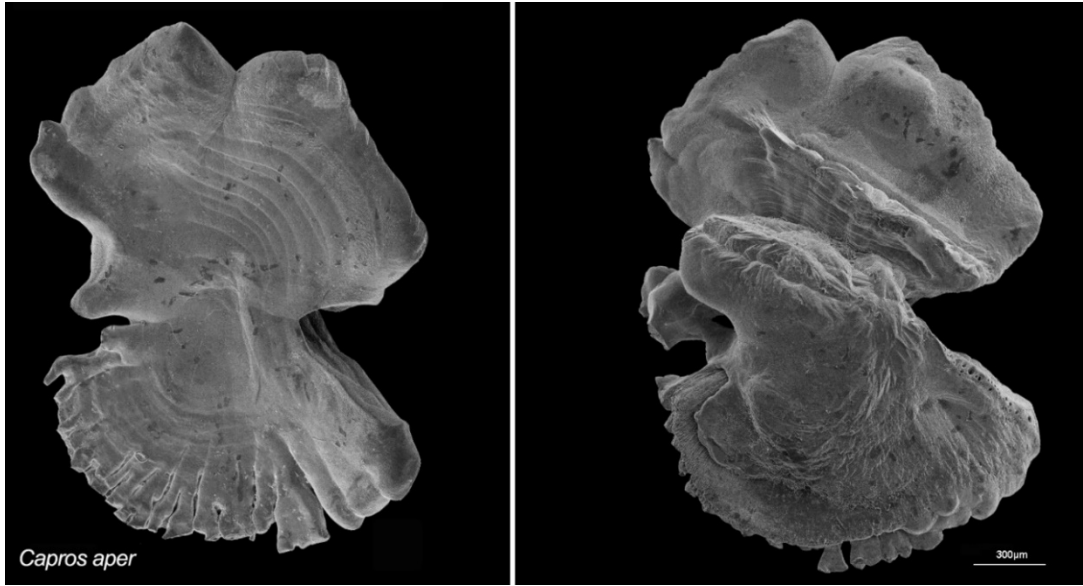


Figure 78. SEM image of sagittae of *Capros aper*.

LOPHIIFORMES

Lophiidae

Lophius budegassa Spinola, 1807, Black-bellied angler (Fig. 79)

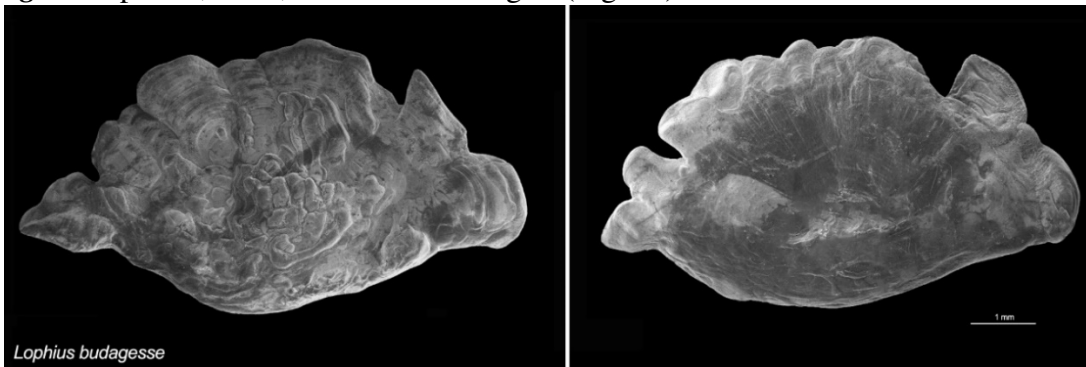


Figure 79. SEM image of sagittae of *Lophius budegassa*.

FF±SD	RD±SD	AR±SD	C±SD	R±SD	E±SD
0.607±0.017	0.468±0.044	1.812±0.047	20.723±0.582	0.665±0.045	0.289±0.012

Shape : semicircular; dorsal margin lobed to irregular and ventral margin entire to sinuate.

Sulcus acusticus : archaesulcoid, mesial, median.

Ostium-cauda : undifferentiated.

Anterior region : irregular, rostrum short, broad, round; antirostrum very short, broad, round; excisura wide without a notch.

Posterior region : peaked; lobed.

Depression : dorsal depression deep and ventral depression absent.

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