ORIGINAL RESEARCH

Otolith atlas for marine fishes of the southwestern Atlantic occurring along southern Brazil (28° S-34° S)

MANUEL HAIMOVICI1, *, LUCAS DOS S. RODRIGUES1, SILVIA H. B. LUCATO1, MARCIO DE A. FREIRE1, LUCIANO G. FISCHER2 and LUIS G. CARDOSO1

1Laboratório de Recursos Pesqueiros Demersais e Cefalópodes, Instituto de Oceanografia (IO), Universidade Federal do Rio Grande (FURG), Avenida Itália, km 8, 96203-900 - Rio Grande, Brazil. 2Núcleo em Ecologia e Desenvolvimento Socioambiental de Macaé (NUPEM), Instituto de Biodiversidade e Sustentabilidade, Universidade Federal do Rio de Janeiro (UFRJ), Avenida Sao José Barreto, 764, 27910-970 - Macaé, Brazil. ORCID Manuel Haimovici https://orcid.org/0000-0003-1741-8182, Lucas dos S. Rodrigues https://orcid.org/0000-0003-2310-2619, Luciano G. Fischer https://orcid.org/0000-0002-7219-4364, Luis G. Cardoso https://orcid.org/0000-0003-1026-0853

ABSTRACT. Otoliths are acellular apposition structures composed of approximately 90% of calcium carbonate and other inorganic salts, which develop over a protein matrix located in the inner ear of bony fishes playing an essential role in the senses of balance and hearing. These structures grow throughout a fish’s lifetime. Owing to their species-specific shape, otoliths are an important tool for the identification of fish species in the diet of predators when collected from stomachs and, due to their low water content, are helpful for archaeological, paleontological and anthropological studies for its presence in fossilized remains. This atlas is aimed at the identification of abundant or frequent bony fishes otoliths in the diet of predators and in fossilized remains from the continental shelf and upper continental slope of southern Brazil between Santa Marta Grande cape (28° S) and Chui (34° S) on the border with Uruguay. It includes the otolith description of 136 bony fishes species, including most of the abundant and frequent species in the region. Easy to use graphics are provided to infer fish size based on otolith measurements. Vouchers of different sizes of otolith of all species included in this atlas are deposited and available for consultation at the Demersal Fisheries Resources and Cephalopods Laboratory (IO-FURG).

Key words: Shape, morphology, length-weight relation, stomach content, feeding ecology.

Atlas de otolitos de peces marinos presentes en el Atlántico Sudoccidental a lo largo del sur de Brasil (28° S-34° S)

RESUMEN. Los otolitos son estructuras de aposición acelular compuestas por alrededor de un 90% de carbonato de calcio y otras sales inorgánicas, que se desarrollan sobre una matriz proteica ubicada en el oído interno de los peces óseos y que desempeña un papel fundamental en los sentidos del equilibrio y la audición. Estas estructuras crecen a lo largo de la vida de un pez. Debido a su forma especie-específica, los otolitos son una herramienta importante para la identificación de las especies de peces en la dieta de los depredadores cuando se recolectan de estómagos y, debido a su bajo contenido de agua, son útiles para estudios arqueológicos, paleontológicos y antropológicos debido a su presencia en los restos fosilizados. Este atlas tiene como objetivo la identificación de otolitos de peces óseos abundantes o frecuentes en la dieta de los depredadores y restos fosilizados de la plataforma continental y talud continental superior del sur de Brasil entre el Cabo Santa Marta Grande (28° S) y Chui (34° S) en la frontera con Uruguay. Incluye la descripción de otolitos de 136 especies de peces óseos, incluyendo la mayoría de las especies abundantes y frecuentes en la región. Se proporcionan gráficos fáciles de usar para inferir el tamaño del pez en función a las medidas de...
INTRODUCTION

Otoliths are acellular apposition structures that grow throughout a fish lifetime and are located in the inner ear of bony fishes, playing an essential role in the senses of balance and hearing (Popper and Lu, 2000; Schulz-Mirbach et al. 2019). Their structure is composed of approximately 90% of calcium carbonate and other inorganic salts, which develop over a protein matrix (Blacker 1969; Degens et al. 1969).

The inner ear or ‘labyrinth’ of most bony fishes, including all teleosts, consists of three semicircular canals, each with an ampulla and end organs in which otoliths (sagittae, lapilli, and asterisci) are located (Figure 1). In adult fishes, the three pairs of otoliths differ markedly in shape and size, with the sagittae usually being the largest pair and the lapilli the smallest (Smale et al. 1995). However, in some orders as Cypriniformes and Siluriformes, lapillus is the largest otolith (Assis 2005; Volpedo and Fuchs 2010).

Otoliths recall the attention since antiquity (Duffin 2007; Tuset et al. 2008) given an extensive account of its popular use from classical times to the present. These uses comprised the divining of weather conditions and protection trusting of sailors against sea storms, aphrodisiac properties, relief of several types of pain, colic and swelling, elimination of calculi from several organs and, healing of diseases such as malaria, jaundice, recurrent fevers and nosebleeds.

Otolith shapes are highly species-specific and vary widely among species (Popper et al. 2005). For this reason, they are used for the identification of bony fishes, an important tool in feeding- and trophic-related studies in which predator stomach contents are analyzed to reconstruct the community composition and prey size in the diet. Identification of fish through their otoliths is aided by their degradation resistance better than most other tissues, and often are the only identifiable animal remains recovered from stomachs and droppings (Härkönen 1986).

Otoliths are mainly formed by aragonite crystals (Degens et al. 1969). The sagitta is usually the largest otolith and has the greatest morphological variability, making it the most frequently used for fish identifications (Campana 2004). Typically, sagitta otoliths have a rostrum and an antirostrum in their anterior margin while their proximal surface presents a sulcus acusticus—a scar related to the point of attachment of the sen-
sory macula. The extension of the sulcus varies substantially among species and may have an ostium in the anterior end and a cauda in the posterior end (Figure 2).

The analysis of the shape and microstructure of otolith enables a large variety of studies (Begg et al. 2005; Campana 2005). They are metabolically almost inert structures that grow by mineral and protein deposition. For these reasons, they allow records of the entire lifetime of fish, including growth, date of hatching, migration pathways, water temperature, population identity and climatological parameters (Franco et al. 2018), ecomorphology and functional ecology (Tuset et al. 2016; Assis et al. 2020). For example, given a measurement of otolith size it is possible to estimate the length of the fish from which the otolith was obtained. Although there is variability in the size of otoliths among fish of the same length, these estimates provide useful approximations of fish length. Some ingestion metrics, such as Prey-Specific Index of Relative Importance (PSIRI), are based on these estimations to be calculated (Brown et al. 2012).

In addition to their broad applicability in fisheries sciences due to their high fossilization potential, otoliths play an important role in identifying fossil fish remains in palaeo-ichthyological studies, for example, to identify fossil fish assemblages for phylogenetics (Nolf 1985; Lin et al. 2019; Aguilera et al. 2020) and reconstruct reef fish communities (Lin et al. 2019). Archeologists and anthropologists may also use otoliths to reconstruct fishing and food habits of ancient populations and palaeoclimatologists to reconstruct climatological events (Reitz and Wing 2008; Bertucci et al. 2018; Agiadi et al. 2022; Milheira et al. 2023).

Otoliths have been used for prey identifications since older times (Tuset et al. 2008). The systematic collection of otolith for trophic relations studies began in the 1960s (Fitch and

![Figure 2. Terms used to describe the proximal face of the *sagitta* otoliths. OL: otolith length, OH: otolith height.](image)
Brownell 1968; Pinkas et al. 1971) and was soon followed by the publications of comprehensive atlases of fish otoliths from different marine regions. Examples are for Bering Sea fishes (Morrow 1977), northeast Atlantic (Härkönen 1986), Antarctica (Hecht et al. 1987; Williams and McEldowney 1990), southern Africa (Smale et al. 1995), northeastern Pacific (Harvey et al. 2000), northwestern Atlantic (Campana 2004) northeastern Atlantic and Mediterranean Sea (Tuset et al. 2008) and Argentina (Volpedo and Echeverria 2000; Volpedo et al. 2017). In Brazil, diverse published papers included the description of a large number of otoliths from southern and southeastern Brazil including Bastos (1990), Abilhôa and Corrêa (1992), Corrêa and Vianna (1993) and Lemos et al. (1992, 1995). More recently, Rossi-Wongtschowski et al. (2014), Brenha-Nunes et al. (2016), Siliprandi et al. (2016), Giaretta et al. (2017), Conversani et al. (2017) and Santificetur et al. (2017a, 2017b), described otoliths of different orders of teleosts that, together, constitutes an atlas.

In 1976, the otolith collection in the Instituto de Oceanografia of the Universidade Federal do Rio Grande-FURG (IO-FURG) started to be formed. Initially, from fishes landed commercially in the port of Rio Grande, sampling onboard commercial fishing boats and from bottom trawl and longline surveys by the RV ‘Atlântico Sul’ (Haimovici et al. 1994, 1996, 2004, 2008). In fact, these different sampling/catch methodologies allowed to improve the representativeness of fish species from several habitats along southern Brazil. Furthermore, since the 1980s, many researchers and graduate students have consulted this collection in order to identify the fish species from otoliths.

In this manner, this atlas is aimed at the identification of otoliths in the diet and in fossilized remains of abundant or frequent bony fishes from the continental shelf and upper continental slope of southern Brazil between Santa Marta Grande Cape (28° S) and Chui (34° S) on the border with Uruguay (Figure 3). It describes the otoliths of 136 species classified among 66 families and 25 orders of fishes, including most of the commercially important teleosts fished along southern Brazil. The nomenclature of the species follows mostly Fricke et al. (2018). Vouchers of different sizes of otolith of all species included in this atlas are deposited and available for consultation at the Demersal and Cephalopods Laboratory (IO-FURG).

**MATERIALS AND METHODS**

**Preparation of the images**

Typically, otoliths of small-, medium-, and large-sized specimens in the size range of each species from the collection were selected to produce digital images. Otoliths were sprinkled with finely powdered graphite to enhance their surface details. Very smooth otoliths were etched with 0.1
to 0.2 hydrochloric acid solutions for 1 to 10 min, washed, and dried before covering them with graphite.

Images were taken using a high definition digital camera attached to a binocular microscope (Moticam 2300-Live Resolution, 3.0 MP) for small size otoliths, and a high-definition digital camera (Sony DSC-H100, 16.1MP) for large size otoliths. Otoliths were placed over an opaque black surface and illuminated with a high-intensity dual fiber optic illuminator (Nikon NI-150).

**Measurements**

All specimens had their total (TL), fork (FL), or pre-anal (PAL) length measured from the tip of the snout to the most distal point of the caudal fin, bifurcation on the caudal fin or immediately anterior to the cloaca, respectively, recorded in the mm and total weight (TW) recorded in grams.

On the otoliths, the maximum length (otolith length: OL) and the maximum height between the dorsal and ventral margins (otolith height: OH) were measured with a 0.1 mm precision under a binocular microscope.

**Organization of the plates**

Each species is presented on one page. Besides the name of the species, family, and order, the information included was:

1) A paragraph indicating: the worldwide and southwestern Atlantic Ocean distribution, the larger typical size in southern Brazil, the environment in which the species was found (marine, estuarine, anadromous or catadromous), and its habitat (neritic, demersal, benthodermersal, epipelagic, mesopelagic, benthopelagic). These last were based on the gears with which the collected specimens were fished (either in research surveys or commercial fishing) complemented with information from Nelson (1994), and Fishbase (Froese and Pauly 2023).

2) A paragraph with the exploitation status of the species (target, incidentally landed catch, discarded on board or occasionally fished) and the gear and depth range in which it was fished.

3) Two or three references were included. The first was related to the distribution range in the southwestern Atlantic Ocean, most frequently Menezes et al. (2003), Bernardes et al. (2005), Cousseau and Perrota (2013) and Fishbase. Second references were publications in which information on size ranges or reporting depth at which the species was fished in bottom trawl and bottom longline surveys (Haimovici et al. 1994, 1996, 2004, 2008). For commercially crucial species or those poorly represented in surveys (e.g. mullets, anchovies, and bluefish that form pelagic schools), references on the species’ life history, biology, or fishery were available.

4) One to four images of the proximal face of (preferentially) right-side otolith look cover a wide spectrum of species’ length. Each image is from a different individual and has approximately the same size (favoring visualization of details in shape and sulcus acusticus). The total, fork or preanal length (TL; FL; PAL) of fish and OL are next to each otolith image.

5) A short description of main figures of the *sagitta* otoliths: shape, thickness, distal face, proximal face, anterior, posterior, dorsal and ventral margins, rostrum and antirostrum, sulcus acusticus (also known as sulcus groove), ostium, cauda and crista. In the case of catfishes of the Family Ariidae, *lapilli* otoliths are the largest. Their description was based on the shape, thickness, anterior and posterior regions, lateral and medial edges, profile and the sulculus *lapilli* (as defined by Santificetur et al. (2017b) modified from Assis (2005).

6) The number of specimens with examined otoliths, the range of length and weight of the fish and lengths and heights of otoliths.

7) A box with (a) the best-fit regressions coefficients (linear or potential) between the total,
fork or preanal length and the OL and the OH, (b) the best fit regressions coefficients (potential) between the TW and the OL and the otolith height, (c) the range of the quotient between height and length of otoliths (d) weight-length relationships reproduced from Haimovici and Velasco (2000).

8) A graph in which the fish length (total, fork or pre-anal) was plotted against otolith lengths. For those species for which more than five fish were available, a regression line and 95% confidence limits were included. In this way, the most likely length range of the fish can be inferred visually and directly from the otolith length.

In general, the same text structure is followed throughout the atlas, however we highlight some exceptions: (1) for Order Pleuronectiformes, we fit regressions for otolith of both sides due to asymmetry in the fish body. There is a potential influence of eye migration during early life phases on internal head structures, including the associated otolith; (2) for *Sardinella aurita* we preferred otolith height instead of otolith length in relationship plot due to fragility of otolith rostrum, which increases the risk of breakage; (3) we fit sex-specific regressions for *Astroscopus sexpinosus* that have notorious differences in the size of their otoliths.

**Anatomical terminology**

Terms used to describe otoliths in this guide mostly followed the nomenclature of former works, mainly Härkönen (1986), Smale et al. (1995), Campana (2004), and Tuset et al. (2008). The otolith description took into account the shape, convexity, margins, rostrum, antirostrum, ostium, cauda and crista of the sulcus acusticus. Shapes of the outline or lateral view of otoliths were grouped into sixteen basic categories: discoidal, oval, trapezoidal, pentagonal, rhomboidal, oblong, fusiform, semicircular, lanceolate, arrow-shaped, spindle-shaped, kidney-shaped, cuneiform, elliptic, hour-glass, and irregular (Figure 4). Outlines of the anterior and posterior margins of otoliths were described according to their shape in five categories: flattened, double-peaked, round, oblique, and angled (Figure 5). Outlines of dorsal and ventral margins of otoliths were described according to their shape in three categories: flattened, convex, and angled (Figure 6). The texture of dorsal and ventral margins of the *sagitta* otolith was classified into five categories: sinuate, serrate, dentate, lobate, and smooth (Figure 7). The type of opening displayed by the sulcus acusticus was classified as opened or closed at anterior and posterior margins (Figure 8). The shape of the ostium was described in six categories: funnel-like, tubular, round-oval, pear-like, lateral, and rectangular (Figure 9). The shape and curvature of cauda was described in five categories: elliptic, tubular-straight, tubular slightly curved ventrally, tubular strongly curved ventrally, and tubular curled ventrally (Figure 10).

This atlas is aimed to facilitate the comparisons of otoliths collected from stomach contents of predators found in middens or, once otoliths are measured, to easily infer the fish size (available through easy-to-use relationships and graphics). Although the vast volume and the quality of data available in this atlas, we would like to clarify that images and descriptions of otoliths were based on individuals we had access. Therefore, the morphological description does not pretend to be exhaustive and error-free. Over time, otoliths change shape throughout lifetime and tend to show individual changes in overall otolith morphology in older individuals (e.g. the emergence of spicules, teeth), which do not configure a taxonomic criterion. Despite this drawback we hope that the material and findings available in this atlas become useful for studies related to trophic ecology (e.g. stomach contents), ecomorphology and ichthy-archeology, formalizing contributions of the otolith collection from IO-FURG.
Figure 4. Terms used to describe the general shapes of the lateral view of *sagitta* otoliths.
Figure 5. Terms used to describe the anterior and posterior margins of *sagitta* otoliths.

Figure 6. Terms used to describe the dorsal and ventral margins of *sagitta* otolith.

Figure 7. Terms used to describe the texture of margins of *sagitta* otoliths.
Figure 8. Terms used to describe the type of opening displayed by the sulcus acusticus of *sagitta* otoliths.

- Opened at anterior margin
- Closed at anterior margin
- Opened at posterior margin
- Closed at posterior margin

Funnel-like

Pear-like

Tubular

Lateral

Round-oval

Rectangular

Elliptic

Tubular-strongly curved ventrally

Tubular-straight

Tubular-slightly curved ventrally

Tubular-curled ventrally

Figure 9. Terms used to describe the shape of ostium of *sagitta* otoliths.

Figure 10. Terms used to describe the shape and curvature of cauda of *sagitta* otoliths.
**RESULTS**

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Family Congridae  
*Ariosoma opistophthalmum* (Ranzani 1839)

**Distribution and habitat.** Western Atlantic Ocean from Rio de Janeiro to Uruguay (22° S-36° S). Small-sized (TL < 250 mm) benthic marine species. It is rarely fished by bottom trawlers in the outer shelf and upper continental slope (300-600 m) along southern Brazil.

**Exploitation.** Not targeted by any fishery.

**References.** Menezes et al. (2003); Haimovici et al. (2008).


**Material.** Otoliths from 2 specimens, 286 and 321 mm TL, 25.6 and 31.2 g TW, 4.31 and 5 mm OL, and 3.37 and 3.49 mm OH.

**Relationships.** Insufficient data.
**Bassanago albescens** (Barnard 1923)

**Distribution and habitat.** Western Atlantic Ocean, Florida, USA to Uruguay (31° N-36° S). Large-sized (TL > 1,000 m) demersal marine species. It occurs on the upper continental slope, rarely fished by bottom trawlers and discarded on board along southern Brazil.

**Exploitation.** Not targeted by any fishery.

**References.** Menezes et al. (2003); Bernardes et al. (2005); Haimovici et al. (2008) as *Rechias dubius.*


**Material.** Otoliths from 115 specimens ranging between 370 to 730 mm TL, 53 to 740 g TW, 5.2 to 10 mm OL and 3.5 to 6.49 mm OH.

**Relationships.**

\[
\begin{align*}
\text{TL} &= 70.872 \text{ OL}^{0.994} \quad R^2 = 0.87 \\
\text{TL} &= 93.973 \text{ OH}^{1.123} \quad R^2 = 0.83 \\
\text{TW} &= 0.0421 \text{ OL}^{4.23} \quad R^2 = 0.87 \\
\text{TW} &= 0.1431 \text{ OH}^{4.759} \quad R^2 = 0.83 \\
\text{TW} &= 1E-09 \text{ TL}^{4.129} \quad R^2 = 0.95 \\
\text{OH/OL} &= \text{min. 0.51-max. 0.70}
\end{align*}
\]
**Conger orbignianus** Valenciennes 1837

**Distribution and habitat.** Southwestern Atlantic Ocean from southeastern Brazil to northern Argentina (22° S–42° S). Large-sized (TL < 1,500 mm) demersal (benthic) marine species. It occurs in the shelf to the upper continental slope along southern Brazil.

**Exploitation.** Frequently fished in small quantities by bottom trawlers and occasionally landed for bait.

**References.** Menezes et al. (2003); Haimovici et al. (1996).

**Material.** Otoliths from 40 specimens ranging between 425 to 1,155 mm TL, 80 to 2,340 g TW, 6.45 to 10.9 mm OL, and 2.8 to 4.65 mm OH.

**Relationships.**

- \( TL = 17.901 \, OL^{1.716} \) \( R^2 = 0.88 \)
- \( TL = 75.977 \, OH^{1.788} \) \( R^2 = 0.81 \)
- \( TW = 0.0016 \, OL^{5.850} \) \( R^2 = 0.89 \)
- \( TW = 0.218 \, OH^{6.098} \) \( R^2 = 0.82 \)
- \( TW = 7E-08 \, TL^{3.441} \) \( R^2 = 0.99 \)

**OH/OL = min. 0.37-max. 0.45**

Family Ophichthidae

*Ophichthus gomesii* (Castelnau 1855)

**Distribution and habitat.** Southwestern Atlantic Ocean from southeastern Brazil to northern Argentina (22° S-42° S). Large-sized (TL < 1,500 mm) demersal (benthic) marine species. It occurs in the shelf to the upper continental slope along southern Brazil. Occasionally caught in small numbers by bottom trawlers and discarded on board.

**Exploitation.** Not targeted by any fishery.

**References.** Haimovici et al. (1996); Menezes et al. (2003).


**Material.** Otoliths from 40 specimens ranging between 425 to 1,155 mm TL, 80 to 2,340 g TW, 2 to 3.7 mm OL, and 1 to 1.91 mm OH.

**Relationships.**

\[
\begin{align*}
\text{TL} &= 245.08 \text{OL}^{0.831} \quad R^2 = 0.97 \\
\text{TL} &= 442.29 \text{OH}^{0.86} \quad R^2 = 0.87 \\
\text{TW} &= 19.236 \text{OL}^{2.049} \quad R^2 = 0.94 \\
\text{TW} &= 83.544 \text{OH}^{2.078} \quad R^2 = 0.82 \\
\text{TW} &= 2E-05 \text{TL}^{2.484} \quad R^2 = 0.94 \\
\text{OH/OL} &= \text{min. 0.42-max. 0.52}
\end{align*}
\]

![Graph of Total length vs Otolith length]
Order Argentiniformes  
Family Argentinidae  
*Argentina striata* Goode and Bean 1896

**Distribution and habitat.** Western Atlantic: Nova Scotia to Uruguay (46° N-36° S). Small-sized (TL < 250 mm) bathypelagic marine species. It is present in the outer shelf and upper continental slope (50-600 m) along southeastern Brazil. Occasionally fished in small numbers by bottom trawlers and discarded on board.

**Exploitation.** Not targeted by any fishery.

**References.** Menezes et al. (2003); Haimovici et al. (2008).

**Material.** Otoliths from 12 specimens ranging between 86 to 221 mm total length (TL), 3.9 to 64.6 g TW, 2.88 to 7.04 mm OL, and 2.08 to 4.8 mm OH.

**Relationships.**

\[
\begin{align*}
\text{TL} &= 20.436 + 25.546 \text{ OL} \quad R^2 = 0.92 \\
\text{TL} &= 46.520 \text{ OH}^{0.958} \quad R^2 = 0.91 \\
\text{TW} &= 0.203 \text{ OL}^{2.819} \quad R^2 = 0.93 \\
\text{TW} &= 0.537 \text{ OH}^{3.020} \quad R^2 = 0.89 \\
\text{TW} &= 3E-06 \text{ TL}^{3.163} \quad R^2 = 0.99 \\
\text{OH/OL} &= \text{min.} 0.60-\text{max.} 0.72
\end{align*}
\]

Order Atheriniformes
Family Atherinopsidae
Atherinella brasiliensis
(Quoy and Gaimard 1825)


Exploitation. Occasionally by small scale fishers with cast nets.

References. Menezes et al. (2003); Fischer et al. (2011).


Material. Otoliths from 39 specimens ranging between 27 to 155 mm TL, 0.1 to 29.1 g TW, 0.7 to 4.1 mm OL, and 0.5 to 2.5 mm OH.

Relationships.

\[
\begin{align*}
\text{TL} &= 34.173 \text{OL}^{1.056} \quad R^2 = 0.98 \\
\text{TL} &= 55.037 \text{OH}^{1.179} \quad R^2 = 0.97 \\
\text{TW} &= 0.234 \text{OL}^{3.325} \quad R^2 = 0.98 \\
\text{TW} &= 1.041 \text{OH}^{3.725} \quad R^2 = 0.98 \\
\text{TW} &= 4\times10^{-6} \text{TL}^{3.129} \quad R^2 = 0.99 \\
\text{OH/OL} &= \text{min. 0.51-max. 0.82}
\end{align*}
\]
**Odontesthes argentinensis** (Valenciennes 1835)

**Distribution and habitat.** South America: southern Brazil, Argentina and Uruguay. Mid-sized (TL > 400 mm) freshwater, estuarine and marine species.

**Exploitation.** Fished with gillnets by small scale fishers in estuaries and coastal waters.

**References.** Menezes et al. (2003); Fischer et al. (2011).


**Material.** Otoliths from 67 specimens ranging between 23 to 421 mm TL, 0.05 to 449 g TW, 0.4 to 6.95 mm OL, and 0.31 to 3.5 mm OH.

**Relationships.**

\[
\begin{align*}
\text{TL} &= 52.432 \text{OL}^{0.987} \quad R^2 = 0.97 \\
\text{TL} &= 77.629 \text{OH}^{1.117} \quad R^2 = 0.96 \\
\text{TW} &= 0.753 \text{OL}^{3.048} \quad R^2 = 0.97 \\
\text{TW} &= 2.599 \text{OH}^{3.447} \quad R^2 = 0.96 \\
\text{TW} &= 3E-06 \text{TL}^{3.124} \quad R^2 = 0.99 \\
\text{OH/OL} &= \text{min. 0.46-max. 0.93 }
\end{align*}
\]
**Odontesthes bonariensis** (Valenciennes 1835)

**Distribution and habitat.** Southwestern Atlantic Ocean from southern Brazil to Argentina. Mid-sized (TL > 400 mm) freshwater, estuarine and marine species. Common in southern Brazil.

**Exploitation.** Fished with gillnets by small scale fishers in estuaries and coastal waters.

**References.** Menezes et al. (2003).

**Description.** Shape cuneiform. **Distal face** slightly concave. **Proximal face** convex. **Anterior margin** angled. **Posterior margin** oblique. **Dorsal margin** convex to angled, sinuate. **Ventral margin** convex, sinuate. **Rostrum** present, prominent. **Antirostrum** present. **Sulcus acusticus** opened at the anterior region, closed at posterior region. **Ostium** broader and shorter than cauda, deep, rectangular. **Cauda** deep, tubular-straight. **Crista** absent.

**Material.** Otoliths from 7 specimens ranging between 264 to 390 mm TL, 206 to 439 g TW, 5.8 to 7.64 mm OL, and 3.1 to 4.23 mm OH.

**Relationships.**

- TL = 3.7743 + 50.341 OL, \( R^2 = 0.94 \)
- TL = 134.02 OH\(^{0.735}\), \( R^2 = 0.85 \)
- TW = 17.91 OL\(^{1.570}\), \( R^2 = 0.71 \)
- TW = 68.81 OH\(^{1.286}\), \( R^2 = 0.67 \)
- TW = 3E-03 TL\(^{2.001}\), \( R^2 = 0.94 \)
- OH/OL = min. 0.47-max. 0.57
Order Aulopiformes
Family Chlorophthalmidae
Chlorophthalmus agassizi Bonaparte 1840

**Distribution and habitat.** Atlantic Ocean and Mediterranean Sea, western Atlantic from New England, USA to Uruguay. Small-sized (TL < 250 mm) demersal marine species. It is present in the outer shelf and upper continental slope (100-600 m) along southern Brazil. Occasionally fished in small numbers by bottom trawlers and discarded on board.

**Exploitation.** Not targeted by any fishery.

**References.** Menezes et al. (2003); Haimovici et al. (2008).


**Material.** Otoliths from 32 specimens ranging between 79 to 164 mm TL, 3.2 to 30.2 g TW, 2.79 to 4.4 mm OL, and 1.22 to 1.8 mm OH.

**Relationships.**

\[
\begin{align*}
\text{TL} &= -29.28 + 45.673 \text{ OL} \quad R^2 = 0.73 \\
\text{TL} &= 60.11 \text{ OH}^{1.711} \quad R^2 = 0.79 \\
\text{TW} &= 0.026 \text{ OL}^{4.907} \quad R^2 = 0.86 \\
\text{TW} &= 1.107 \text{ OH}^{5.498} \quad R^2 = 0.79 \\
\text{TL} &= 3E-06 \text{ TL}^{3.161} \quad R^2 = 0.96 \\
\text{OH/OL} &= \text{min. 0.39-max. 0.49}
\end{align*}
\]
Parasudis truculenta (Goode and Bean 1896)

Distribution and habitat. Western Atlantic: New England, USA to southern Brazil. Small-sized (TL < 300 mm) demersal marine species. It is present in the outer shelf and upper continental slope (200-600 m) in southern Brazil. Occasionally fished in small numbers by bottom trawlers and discarded on board.

Exploitation. Not targeted by any fishery.

References. Menezes et al. (2003); Bernardes et al. (2005); Haimovici et al. (2008).

Description. Shape elliptic to oval. Distal face straight. Proximal face straight. Anterior margin angled. Posterior margin round to flattened. Dorsal margin convex, smooth to lobate. Ventral margin convex, lobate to dentate. Rostrum present, prominent. Antirostrum present. Sulcus acus-
Family Synodontidae
*Saurida caribbaea* Breder 1927

**Distribution and habitat.** Western Atlantic: northeastern Florida to Uruguay. Small-sized (TL < 200 mm) demersal marine species. It is present in the outer shelf and upper continental slope (200-600 m) along southern Brazil. Occasionally fished in small numbers by bottom trawlers and discarded on board.

**Exploitation.** Not targeted by any fishery.

**References.** Menezes et al. (2003); Bernardes et al. (2005); Haimovici et al. (2008).


**Material.** Otoliths from 14 specimens ranging between 69 to 139 mm TL, 1.4 to 17.6 g TW, 1.24 to 4.8 mm OL, and 0.63 to 1.85 mm OH.

**Relationships.**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Equation</th>
<th>$R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>TL</td>
<td>$36.061 + 19.38 \times OL$</td>
<td>0.92</td>
</tr>
<tr>
<td>TL</td>
<td>$82.366 \times OH^{0.602}$</td>
<td>0.71</td>
</tr>
<tr>
<td>TW</td>
<td>$0.611 \times OL^{1.817}$</td>
<td>0.75</td>
</tr>
<tr>
<td>TW</td>
<td>$2.505 \times OH^{2.159}$</td>
<td>0.71</td>
</tr>
<tr>
<td>TW</td>
<td>$4E-07 \times TL^{3.569}$</td>
<td>0.93</td>
</tr>
</tbody>
</table>

$OH/OL = \text{min. 0.38-max. 0.51}$
**Synodus foetens** (Linnaeus 1766)

**Distribution and habitat.** Western Atlantic: Massachusetts, USA and northern Gulf of Mexico to southern Brazil. Mid-sized (TL < 500 mm) brackish and marine coastal waters species.

**Exploitation.** It is incidentally caught by bottom trawlers in the continental shelf north of Santa Catarina along southern Brazil. Probably landed in small numbers.

**References.** Robins and Ray (1986); Menezes et al. (2003).

**Material.** Otoliths from 20 specimens ranging between 275 to 470 mm TL, 140 to 640 g TW, 4.8 to 7.87 mm OL, and 2.34 to 3.47 mm OH.

**Relationships.**

\[
\begin{align*}
\text{TL} &= 48.585 + 46.978 \text{OL} & R^2 &= 0.74 \\
\text{TL} &= 136.74 \text{OH}^{0.911} & R^2 &= 0.56 \\
\text{TW} &= 10.227 \text{OL}^{1.760} & R^2 &= 0.65 \\
\text{TW} &= 19.230 \text{OH}^{2.569} & R^2 &= 0.54 \\
\text{TW} &= 2\times10^{-5} \text{TL}^{2.767} & R^2 &= 0.94 \\
\text{OH/OL} &= \text{min. 0.38-max. 0.62}
\end{align*}
\]


(a) 3.7 mm OL, 221 mm TL

(b) 9 mm OL, 470 mm TL
**Trachinocephalus myops** (Forster 1801)

**Distribution and habitat.** Worldwide in tropical and warm temperate waters. Mid-sized (TL < 500 mm) demersal, brackish water and coastal marine species.

**Exploitation.** It is incidentally caught by bottom trawlers in the continental shelf north of Santa Catarina along southern Brazil.

**References.** Sulak (1990); Menezes et al. (2003).


**Material.** Otoliths from 3 specimens ranging between 171 to 275 mm TL, 39.4 to 73.2 g TW, 6.79 to 11.2 mm OL, and 3.58 to 6.61 mm OH.

**Relationships.** Insufficient data.
Order Batrachoidiformes  
Family Batrachoididae  
Porichthys porosissimus (Cuvier 1829)

Distribution and habitat. Southwest Atlantic: Espírito Santo, Brazil to Argentina. Small-sized (TL < 350 mm) demersal marine species. It is present in the continental shelf along southern Brazil.

Exploitation. Frequent in catches of bottom trawlers, larger specimens landed in small quantities.

References. Haimovici et al. (1996); Menezes et al. (2003).


Material. Otoliths from 54 specimens ranging between 25 to 334 mm TL, 0.12 to 429 g TW, 1.0 to 11.6 mm OL, and 1.0 to 9.25 mm OH.

Relationships.

\[
\begin{align*}
\text{TL} &= 24.395 \text{ OL}^{1.019} \quad R^2 = 0.99 \\
\text{TL} &= 20.374 \text{ OH}^{1.209} \quad R^2 = 0.99 \\
\text{TW} &= 0.082 \text{ OL}^{3.301} \quad R^2 = 0.99 \\
\text{TW} &= 0.046 \text{ OH}^{3.914} \quad R^2 = 0.99 \\
\text{TW} &= 3E-06 \text{ TL}^{3.236} \quad R^2 = 0.99 \\
\text{OH}/\text{OL} &= \text{min. 0.76-max. 1.17}
\end{align*}
\]
Order Beloniformes
Family Exocoetidae
*Exocoetus volitans* Linnaeus 1758

**Distribution and habitat.** Circumtropical.

**Exploitation.** Not targeted by any fishery.

**References.** Menezes et al. (2003).

![Otolith Image](a) 6.1 mm OL, 152 mm TL


**Material.** Otoliths from 1 specimen of 152 mm TL, 24 g TW, 6.07 mm OL and 3.47 mm OH.

**Relationships.** Insufficient data.
Order Beryciformes
Family Berycidae
*Beryx splendens* Lowe 1834

**Distribution and habitat.** Circumglobal, excluding the northeast Pacific and Mediterranean Sea. Mid-sized (TL < 500 mm) demersal marine species. It is present in the outer shelf and upper continental slope (300-600 m) along southern Brazil. Occasionally fished and landed in small numbers by bottom trawlers.

**Exploitation.** Not targeted by any fishery.

**References.** Menezes et al. (2003); Haimovici et al. (1994, 2008).


**Material.** Otoliths from 34 specimens ranging between 165 to 367 mm TL, 58 to 638 g TW, 7.13 to 13.95 mm OL, and 5.19 to 10.5 mm OH.

**Relationships.**

TL = -75.63 + 30.60 OL\(^{1.172}\) \(R^2 = 0.92\)

TL = 23.020 OH\(^{1.172}\) \(R^2 = 0.95\)

TW = 0.024 OL\(^{3.806}\) \(R^2 = 0.91\)

TW = 0.135 OH\(^{3.576}\) \(R^2 = 0.95\)

TW = 6E-06 TL\(^{3.133}\) \(R^2 = 0.97\)

OH/OL = min. 0.64-max. 0.77

---

(a) 7.9 mm OL, 165 mm TL

(b) 14.5 mm OL, 367 mm TL

---

![Otoliths image](image-url)
Order Clupeiformes  
Family Clupeidae  
*Brevortia pectinata* (Jenyns 1842)

**Distribution and habitat.** Southwestern Atlantic Ocean: São Paulo to northern Argentina (23° S-41° S). Small-sized (TL < 350 mm) estuarine and demersal marine species. It is caught by gillnets and purse seines in estuaries and coastal waters (<50 m) along southern Brazil. Fished with gillnets and occasionally by bottom trawlers or purse seiners. Usually discarded on board or used as bait.

**Exploitation.** Not targeted by any fishery.

**References.** Haimovici et al. (1996); Menezes et al. (2003).


**Material.** Otoliths from 42 specimens ranging between 31 to 330 mm TL, 0.28 to 440 g TW, 0.44 to 4.16 mm OL, and 0.59 to 2.1 mm OH.

**Relationships.**

\[
\begin{align*}
\text{TL} &= -3.265 + 82.017 \text{ OL} \quad R^2 = 0.96 \\
\text{TL} &= 83.482 \text{ OH}^{1.973} \quad R^2 = 0.87 \\
\text{TW} &= 4.498 \text{ OL}^{3.313} \quad R^2 = 0.99 \\
\text{TW} &= 6.064 \text{ OH}^{0.170} \quad R^2 = 0.86 \\
\text{TW} &= 1E-06 \text{ TL}^{3.153} \quad R^2 = 0.99 \\
\text{OH/OL} &= \text{min. 0.45-max. 0.81}
\end{align*}
\]
**Harengula clupeola** (Cuvier 1829)

**Distribution and habitat.** Western Atlantic: Gulf of Mexico and southeastern Florida to southern Brazil. Small-sized (TL < 200 mm) brackish and pelagic-neritic marine species. It was recorded in the Patos Lagoon Estuary and shallow coastal waters along southern Brazil.

**Exploitation.** Not targeted by any fishery.

**References.** Figueiredo and Menezes (1978); Fischer et al. (2011).

![Image](3.1 mm OL, 160 mm TL)

**Description.** Shape rectangular. **Distal face** slightly concave. **Proximal face** slightly convex. **Anterior margin** double-peaked. **Posterior margin** round. **Dorsal margin** flattened, smooth to sinuate. **Ventral margin** convex, sinuate. **Rostrum** present, prominent. **Antirostrum** present. **Sulcus acusticus** opened at the anterior region, closed at posterior margin. **Ostium** same width and length of cauda, shallow, undefined. **Cauda** shallow, elliptic. **Crista** present.

**Material.** Otoliths from 5 specimens ranging between 72 to 160 mm TL, 4.5 to 49 g TW, 1.26 to 3.19 mm OL, and 0.68 to 1.8 mm OH.

**Relationships.**

\[
\begin{align*}
    \text{TL} &= 8.1519 + 49.357 \text{ OL} \quad R^2 = 0.99 \\
    \text{TL} &= 83.482 \text{ OH}^{1.973} \quad R^2 = 0.87 \\
    \text{TW} &= 4.498 \text{ OL}^{3.313} \quad R^2 = 0.99 \\
    \text{TW} &= 6.064 \text{ OH}^{6.170} \quad R^2 = 0.86 \\
    \text{TL} &= 1E-06 \text{ TW}^{3.153} \quad R^2 = 0.99 \\
    \text{OH/OL} &= \text{min. 0.52-max. 0.61}
\end{align*}
\]
Family Dromosomatidae

*Sardinella aurita* Valenciennes 1847

**Distribution and habitat.** Gulf of Mexico to Argentina. Small-sized (TL < 300 mm) pelagic marine species.

**Exploitation.** An important purse seine fishery mostly north of Santa Catrina along southern Brazil, incidentally caught in small quantities in Rio Grande do Sul.

**References.** Lima and Castello (1995); Menezes et al. (2003).


**Material.** Otoliths from 25 specimens ranging between 102 to 278 mm TL, 6.7 to 242 g TW, 1.18 to 4.35 mm OL, and 0.08 to 1.83 mm OH.

**Relationships.**

\[
\begin{align*}
\text{TL} &= 32.733 + 48.573 \text{ OL} \quad R^2 = 0.79 \\
\text{TL} &= 127.38 \text{ OH}^{1.209} \quad R^2 = 0.94 \\
\text{TW} &= 5.324 \text{ OL}^{2.314} \quad R^2 = 0.81 \\
\text{TW} &= 19.384 \text{ OH}^{4.100} \quad R^2 = 0.97 \\
\text{TW} &= 3E-06 \text{ TL}^{3.217} \quad R^2 = 0.99 \\
\text{OH/OL} &= \text{min. 0.07-max. 0.46}
\end{align*}
\]

**Note.** We preferred OH instead OL in the plot relationship due to the fragility of otolith ostium, which increases the risk of breakage.
Family Engraulidae

Anchoa marinii Hildebrand 1943

Distribution and habitat. Southwest Atlantic from southeastern Brazil to Argentina (22° S-40° S). Small-sized (TL < 140 mm) benthopelagic estuaries and coastal species. It occurs in estuarine and coastal waters along southern Brazil.

Exploitation. Not targeted by any fishery.

References. Chao et al. (1982); Menezes et al. (2005); Fischer et al. (2011).

Material. Otoliths from 43 specimens ranging between 34 to 115 mm TL, 0.23 to 8 g TW, 1.44 to 4.08 mm OL, and 1.12 to 2.4 mm OH.

Relationships.

\[
\begin{align*}
\text{TL} &= -1.385 + 28.126 \text{OL} \quad R^2 = 0.95 \\
\text{TL} &= 34.719 \text{OH}^{1.362} \quad R^2 = 0.92 \\
\text{TW} &= 0.089 \text{OL}^{3.177} \quad R^2 = 0.89 \\
\text{TW} &= 0.215 \text{OH}^{4.063} \quad R^2 = 0.86 \\
\text{TW} &= 7E-06 \text{TL}^{2.939} \quad R^2 = 0.97 \\
\text{OH/OL} &= \text{min. 0.57-max. 0.78}
\end{align*}
\]

**Engraulis anchoita** Hubbs and Marini 1935

**Distribution and habitat.** Southwest Atlantic: north of Rio de Janeiro, Brazil to San Jorge Gulf, Argentina (22° S-47° S). Small-sized (TL < 200 mm) benthopelagic marine species.

**Exploitation.** It is fished by purse seiners mainly for live bait along southern Brazil.

**References.** Lima and Castello (1995); Menezes et al. (2003); Cousseau and Perrota (2013).


**Material.** Otoliths from 32 specimens ranging between 62 to 180 mm TL, 1.3 to 33.4 g TW, 1.85 to 4.34 mm OL, and 1.05 to 2.33 mm OH.

**Relationships.**

\[
\begin{align*}
\text{TL} &= 27.364 \text{OL}^{1.285} \quad R^2 = 0.97 \\
\text{TL} &= 58.547 \text{OH}^{1.361} \quad R^2 = 0.96 \\
\text{TW} &= 0.097 \text{OL}^{4.043} \quad R^2 = 0.98 \\
\text{TW} &= 1.067 \text{OH}^{4.286} \quad R^2 = 0.97 \\
\text{TW} &= 3E-06 \text{TL}^{3.116} \quad R^2 = 0.99 \\
\text{OH/OL} &= \text{min. 0.47-max. 0.58}
\end{align*}
\]
**Lycengraulis grossidens**
(Spix and Agassiz 1829)

**Distribution and habitat.** Western Atlantic from Venezuela to northern Patagonia in Argentina (19° N-41° S). Small-sized (TL < 300 mm) freshwater, brackish, marine, pelagic-neritic, anadromous species. It is fished in small quantities in estuaries and shallow coastal waters with gillnets and beach seines along southern Brazil.

**Exploitation.** Not targeted by any fishery.

**References.** Menezes et al. (2003); Fischer et al. (2011); Mai et al. (2014).


**Material.** Otoliths from 47 specimens ranging between 37 to 245 mm TL, 0.2 to 125.3 g TW, 0.72 to 5.12 mm OL, and 0.54 to 2.4 mm OH.

**Relationships.**

<table>
<thead>
<tr>
<th>Equation</th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>TL = 42.557 OL0.980</td>
<td>0.97</td>
</tr>
<tr>
<td>TL = 64.150 OH1.297</td>
<td>0.96</td>
</tr>
<tr>
<td>TW = 0.351 OL3.215</td>
<td>0.96</td>
</tr>
<tr>
<td>TW = 1.357 OH4.239</td>
<td>0.94</td>
</tr>
<tr>
<td>TW = 1E-06 TL3.314</td>
<td>0.99</td>
</tr>
</tbody>
</table>

\[ \text{OH/OL} = \text{min. 0.47-max. 0.75} \]
Family Pristigasteridae  
*Pellona harroweri* (Fowler 1917)

**Distribution and habitat.** Western Atlantic from Panama to southern Brazil. Small-sized (TL < 200 mm) brackish, marine coastal, pelagic-neritic species. It is recorded in the Patos Lagoon Estuary and shallow coastal waters along southern Brazil.

**Exploitation.** Not targeted by any fishery.

**References.** Menezes et al. (2003); Fischer et al. (2011).

**Material.** Otoliths from 10 specimens ranging between 105 to 175 mm TL, 11 to 51 g TW, 3.21 to 4.82 mm OL, and 2.32 to 3.11 mm OH.

**Relationships.**
- \( TL = -25.44 + 40.480 \times OL \) \( R^2 = 0.73 \)
- \( TL = 31.637 \times OH^{1.434} \) \( R^2 = 0.78 \)
- \( TW = 0.126 \times OL^{3.829} \) \( R^2 = 0.86 \)
- \( TW = 0.236 \times OH^{4.601} \) \( R^2 = 0.82 \)
- \( TW = 7E-06 \times TL^{3.091} \) \( R^2 = 0.98 \)
- \( OH/OL = \text{min. 0.65-max. 0.74} \)

**Order Gadiformes**  
**Family Bregmacerotidae**  
*Bregmaceros atlanticus* Goode and Bean 1886

**Distribution and habitat.** Atlantic and Indian oceans and Mediterranean Sea. Southwards to Uruguay and South Africa. Small-sized (TL < 100 mm) demersal marine species. It is present in the outer shelf and upper continental slope (< 100 m) along southern Brazil.

**Exploitation.** Not targeted by any fishery.

**References.** Menezes et al. (2003); Haimovici et al. (2008).

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**Material.** Otoliths from 20 specimens ranging between 50 to 73 mm TL, 0.5 to 1.8 g TW, 1.57 to 2.18 mm OL, and 1.43 to 1.99 mm OH.

**Relationships.**

\[
\begin{align*}
\text{TL} &= 30.997 \text{OL}^{1.083} \quad R^2 = 0.61 \\
\text{TL} &= 34.355 \text{OH}^{1.074} \quad R^2 = 0.59 \\
\text{TW} &= 0.098 \text{OL}^{3.731} \quad R^2 = 0.67 \\
\text{TW} &= 0.142 \text{OH}^{3.666} \quad R^2 = 0.64 \\
\text{TW} &= 2E-06 \text{TL}^{3.227} \quad R^2 = 0.97 \\
\text{OH/OL} &= \text{min. 0.89-max. 0.94}
\end{align*}
\]
Family Macrouridae

Coelorinchus marinii Hubbs 1934

**Distribution and habitat.** Southwest Atlantic: from southern Brazil to South Georgia. Small-sized (TL < 400 mm) bentopelagic marine species. It is present in the upper continental slope (< 300 m) along southern Brazil. Occasionally fished in small numbers by bottom trawlers and discarded on board.

**Exploitation.** Not targeted by any fishery.

**References.** Cohen (1990); Menezes et al. (2003); Haimovici et al. (2008).


**Material.** Otoliths from 53 specimens ranging between 94 to 390 mm TL, 2 to 148 g TW, 3.71 to 12.15 mm OL, and 2.75 to 6.1 mm OH.

**Relationships.**

\[
\begin{align*}
\text{TL} &= -65.28 + 38.450 \text{OL} \quad R^2 = 0.94 \\
\text{TL} &= 11.089 \text{OH}^{1.932} \quad R^2 = 0.93 \\
\text{TW} &= 0.023 \text{OL}^{3.766} \quad R^2 = 0.77 \\
\text{TW} &= 0.012 \text{OH}^{5.353} \quad R^2 = 0.78 \\
\text{TW} &= 1E-04 \text{TL}^{2.043} \quad R^2 = 0.79 \\
\text{OH/OL} &= \text{min. 0.50-max. 0.80} 
\end{align*}
\]
**Lucigadus ori** (Smith 1968)

**Distribution and habitat.** Southeast Atlantic and southwest Indian Ocean. In the western Atlantic from Costa Rica to Uruguay. Small-sized (TL > 300 mm) bathydemersal marine species. It is present in the upper continental slope (< 300 m) along southern Brazil. Occasionally fished in small numbers by bottom trawlers and discarded on board.

**Exploitation.** Not targeted by any fishery.

**References.** Menezes et al. (2003); Bernardes et al. (2005).

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**Material.** Otoliths from 52 specimens ranging between 104 to 237 mm TL, 2 to 28 g TW, 3.64 to 6.65 mm OL, and 2.57 to 4.33 mm OH.

**Relationships.**

- TL = -8.084 + 37.597 OL \( R^2 = 0.94 \)
- TL = 36.842 OH\(^{1.297} \) \( R^2 = 0.93 \)
- TW = 0.012 OL\(^{4.207} \) \( R^2 = 0.77 \)
- TW = 0.026 OH\(^{4.908} \) \( R^2 = 0.78 \)
- TW = 3E-07 TL\(^{3.389} \) \( R^2 = 0.79 \)
- OH/OL = min. 0.50-max. 0.80

---

![Graph](image.png)
**Malacocephalus laevis** (Lowe 1843)

**Distribution and habitat.** Atlantic, Pacific and Indian oceans. In the western Atlantic from Florida State to southern Brazil. Mid-sized (TL < 600 mm) bathydemersal marine species. It is present in the upper continental slope (< 300 m) along southern Brazil. Occasionally fished in small numbers by bottom trawlers and discarded on board.

**Exploitation.** Not targeted by any fishery.

**References.** Menezes et al. (2003); Bernardes et al. (2006); Haimovici et al. (2008).

---


**Material.** Otoliths from 57 specimens ranging between 276 to 575 mm TL, 29.8 to 490 g TW, 7.9 to 15 mm OL, and 4.57 to 7.85 mm OH.

**Relationships.**

\[
\begin{align*}
\text{TL} &= 31.180 \text{OL}^{1.042} \quad R^2 = 0.91 \\
\text{TL} &= 40.666 \text{OH}^{1.255} \quad R^2 = 0.88 \\
\text{TW} &= 0.004 \text{OL}^{4.282} \quad R^2 = 0.95 \\
\text{TW} &= 0.012 \text{OH}^{5.126} \quad R^2 = 0.91 \\
\text{TW} &= 1E-08 \text{TL}^{3.380} \quad R^2 = 0.93 \\
\text{OH}/\text{OL} &= \text{min.} 0.49-\text{max.} 0.60
\end{align*}
\]
**Malacocephalus occidentalis**  
Goode and Bean 1885

**Distribution and habitat.** Western Atlantic from Cape Cod USA to Uruguay. Mid-sized (TL < 500 mm) bathydemersal marine species. It is present in the upper continental slope (< 300 m) along southern Brazil. Occasionally fished in small numbers by bottom trawlers and discarded on board.

**Exploitation.** Not targeted by any fishery.

**References.** Menezes et al. (2003); Bernardes et al. (2006); Haimovici et al. (2008).


**Material.** Otoliths from 41 specimens ranging between 105 to 520 mm TL, 2 to 454 g TW, 3.85 to 14.2 mm OL, and 2.78 to 7.0 mm OH.

**Relationships.**

\[
\begin{align*}
TL &= -36.55 + 38.723 \text{OL} \quad R^2 = 0.93 \\
TL &= 17.900 \text{OH}^{1.771} \quad R^2 = 0.93 \\
TW &= 0.006 \text{OL}^{4.204} \quad R^2 = 0.98 \\
TW &= 0.003 \text{OH}^{6.235} \quad R^2 = 0.96 \\
TW &= 1E-04 \text{TL}^{2.043} \quad R^2 = 0.79 \\
\text{OH/OL} &= \text{min. 0.46-max. 0.73}
\end{align*}
\]
**Ventrifossa macropogon** Marshall 1973

**Distribution and habitat.** Western central and southern Atlantic: from western Caribbean to southern Brazil. Small bathydemersal marine species. It is present in the upper continental slope (< 400 m) along southern Brazil. Occasionally fished in small numbers by bottom trawlers and discarded on board.

**Exploitation.** Not targeted by any fishery.

**References.** Menezes et al. (2003); Haimovici et al. (2008).


**Material.** Otoliths from 52 specimens ranging between 94 to 390 mm TL, 2 to 148 g TW, 3.71 to 12.15 mm OL, and 2.75 to 6.1 mm OH.

**Relationships.**

\[
\text{TL} = -65.28 + 38.450 \text{ OL} \quad R^2 = 0.94 \\
\text{TL} = 11.089 \text{ OH}^{1.932} \quad R^2 = 0.93 \\
\text{TW} = 0.023 \text{ OL}^{3.766} \quad R^2 = 0.77 \\
\text{TW} = 0.012 \text{ OH}^{5.353} \quad R^2 = 0.78 \\
\text{TW} = 1E-04 \text{ TL}^{2.043} \quad R^2 = 0.79 \\
\text{OH/OL} = \text{min. 0.50-max. 0.80}
\]
**Ventrifossa mukocephalus** Marshall 1973

**Distribution and habitat.** Western central and southern Atlantic from western Caribbean to southern Brazil. Small (TL < 400 mm) bathydemersal marine species. It is present in the upper continental slope (< 400 m) along southern Brazil. Occasionally fished in small numbers by bottom trawlers and discarded on board.

**Exploitation.** Not targeted by any fishery.

**References.** Cohen et al. (1990); Haimovici et al. (2008).

**Material.** Otoliths from 5 specimens ranging between 166 to 215 mm TL, 12 to 26 g TW, 7.29 to 9.2 mm OL, and 4.86 to 5.51 mm OH.

**Relationships.**  
- \( TL = -3.898 + 23.40 \times OL \quad R^2 = 0.91 \)  
- \( TL = 24.487 \times OH^{1.246} \quad R^2 = 0.58 \)  
- \( TW = 0.032 \times OL^{3.005} \quad R^2 = 0.90 \)  
- \( TW = 0.031 \times OH^{3.893} \quad R^2 = 0.64 \)  
- \( TW = 6E-06 \times TL^{2.838} \quad R^2 = 0.91 \)  
- \( OH/OL = \text{min. 0.60-max. 0.67} \)

Family Merlucciidae
*Macruronus novaezelandiae* (Hector 1871)

**Distribution and habitat.** Southeast Pacific and southwest Atlantic: off southern Chile and southern Brazil. Large-sized (<1,150 mm TL) benthopelagic marine species. It is present in the upper continental slope (<400 m) along southern Brazil. Occasionally fished in small numbers by bottom trawlers and discarded on board.

**Exploitation.** Not targeted by any fishery.

**References.** Menezes et al. (2003); Bernardes et al. (2006); Haimovici et al. (2008).

**Material.** Otoliths from 70 specimens ranging between 78 to 770 mm TL, 3 to 3,500 g TW, 3.77 to 30.4 mm OL, and 1.67 to 9.93 mm OH.

**Relationships.**

\[
\begin{align*}
\text{TL} &= 36.878 \text{OL}^{0.990} \quad R^2 = 0.99 \\
\text{TL} &= 15.945 \text{OH}^{1.813} \quad R^2 = 0.96 \\
\text{TW} &= 0.577 \text{OL}^{2.520} \quad R^2 = 0.99 \\
\text{TW} &= 0.099 \text{OH}^{4.489} \quad R^2 = 0.98 \\
\text{TW} &= 5 \times 10^{-5} \text{TL}^{2.574} \quad R^2 = 0.99 \\
\text{OH/OL} &= \text{min. 0.30-max. 2.00}
\end{align*}
\]

*Merluccius hubbsi* Marini 1933

**Distribution and habitat.** Southwest Atlantic from off southern Brazil to southern Argentina (54° S). Large-sized (TL > 800 mm) benthopelagic marine species present in the outer shelf and upper continental slope of southern Brazil (50 to 500 m).

**Exploitation.** Commercially valuable species, mostly landed as incidental catch of bottom trawlers.

**References.** Menezes et al. (2003); Bernardes et al. (2005); Haimovici et al. (2008).


**Material.** Otoliths from 70 specimens ranging between 78 to 770 mm TL, 3 to 3,500 g TW, 3.77 to 30.4 mm OL and, 1.67 to 9.93 mm OH.

**Relationships.**

\[
\begin{align*}
& TL = 15.703 \, OL^{1.137} \quad R^2 = 0.99 \\
& TL = 32.017 \, OH^{1.338} \quad R^2 = 0.98 \\
& TW = 0.023 \, OL^{3.453} \quad R^2 = 0.99 \\
& TW = 0.197 \, OH^{4.065} \quad R^2 = 0.98 \\
& TW = 5E-06 \, TL^{3.032} \quad R^2 = 0.97 \\
& OH/OL = \text{min. 0.31-max. 0.51}
\end{align*}
\]
Family Moridae

*Antimora rostrata* (Günther 1878)

**Distribution and habitat.** Circumtropical. Large-sized (TL > 700 mm) benthopelagic marine species. It occurs in the lower slope 1,000-2,000 m deep along southeastern Brazil.

**Exploitation.** Not targeted by any fishery.

**References.** Menezes et al. (2005); Haimovici et al. (2017)

---


**Material.** Otoliths from 5 specimens ranging between 166 to 215 mm TL, 12 to 26 g TW, 12.33 to 17.31 mm OL, and 5.19 to 6.51 mm OH.

**Relationships.**

\[
\begin{align*}
\text{TL} = -0.028 + 29.525 \text{ OL} & \quad R^2 = 0.97 \\
\text{TL} = 50.486 \text{ OH}^{1.212} & \quad R^2 = 0.99 \\
\text{OH/OL} & \quad \text{min. 0.35-max. 0.48}
\end{align*}
\]

(a) 12.6 mm OL, 373 mm TL

(b) 17.5 mm OL, 516 mm TL
**Gadella imberbis** (Vaillant 1888)

**Distribution and habitat.** Atlantic Ocean. Small-sized (TL < 350) demersal, bentopelagic marine species. It is occasionally caught by bottom trawlers in the upper continental slope along southern Brazil, and discarded on board by bottom trawlers.

**Exploitation.** Not targeted by any fishery.

**References.** Menezes et al. (2003); Haimovici et al. (2008).


**Material.** Otoliths from 14 specimens ranging between 217 to 285 mm TL, 51.6 to 169 g TW, 5.5 to 6.7 mm OL, and 2.01 to 2.39 mm OH.

**Relationships.**

\[
\begin{align*}
\text{TL} &= 44.720 + 32.520 \text{ OL} \quad R^2 = 0.37 \\
\text{TL} &= 89.126 \text{ OH}^{1.248} \quad R^2 = 0.56 \\
\text{TW} &= 0.006 \text{ OL}^{5.369} \quad R^2 = 0.58 \\
\text{TW} &= 0.647 \text{ OH}^{6.201} \quad R^2 = 0.53 \\
\text{TW} &= 1E-08 \text{ TL}^{4.142} \quad R^2 = 0.80 \\
\text{OH/OL} &= \text{min. 0.32-max. 0.40}
\end{align*}
\]
Laemonema goodebeanorum
Meléndez C. and Markle 1997

Distribution and habitat. Western Atlantic: off Canada to off southern Brazil. Mid-sized (TL < 500 mm) benthopelagic marine species. It is occasionally caught and discarded on board by bottom trawls on the upper continental slope at depth over 300 m along southern Brazil.

Exploitation. Not targeted by any fishery.


(a) 6.4 mm OL, 257 mm TL.


Material. Otoliths from 1 specimen of 257 mm TL, 71.9 g TW, 6.43 mm OL and 2.25 mm OH.

Relationships. Insufficient data.
Family Phycidae

*Urophycis brasiliensis* (Kaup 1858)

**Distribution and habitat.** Southwest Atlantic: southern Brazil, Uruguay, and Argentina. A commercially important mid-sized (TL > 600 mm) brackish water and demersal marine species. It is present in the inner coastal shelf at depth under 100 m along southern Brazil.

**Exploitation.** Commercially fished by bottom trawls and gillnets.

**References.** Haimovici et al. (1996); Menezes et al. (2003).


**Material.** Otoliths from 82 specimens ranging between 44 to 586 mm TL, 0.2 to 1,520 g TW, 2.2 to 16.5 mm OL, and 0.8 to 6.4 mm OH.

**Relationships.**

\[
\begin{align*}
TL &= 9.1631 \text{OL}^{1.457} \quad R^2 = 0.98 \\
TL &= 0.060 \text{OH}^{0.728} \quad R^2 = 0.99 \\
TW &= 0.001 \text{OL}^{4.961} \quad R^2 = 0.98 \\
TW &= 0.423 \text{OH}^{4.599} \quad R^2 = 0.99 \\
TW &= 8E-07 \text{TL}^{3.391} \quad R^2 = 0.99 \\
\text{OH/OL} &= \text{min. 0.27-max. 0.42}
\end{align*}
\]

(a) 2.9 mm OL, 44 mm TL

(b) 8.4 mm OL, 205 mm TL

(c) 16.5 mm OL, 544 mm TL

![Graph](image-url)
**Urophycis mystacea** Miranda Ribeiro 1903

**Distribution and habitat.** Southwest Atlantic, Rio de Janeiro, Brazil to Argentina. Mid-sized (TL > 600 mm) demersal marine species. It is present in the upper continental slope (200-600 m) along the southeastern and southern Brazil.

**Exploitation.** Commercially fished with bottom trawls and gillnets.

**References.** Haimovici et al. (1994, 2008); Menezes et al. (2003).


**Material.** Otoliths from 65 specimens ranging between 124 to 438 mm TL, 12.5 to 720 g TW, 5.7 to 14.8 mm OL, and 2.1 to 5.65 mm OH.

**Relationships.**

\[
\begin{align*}
\text{TL} &= 9.9293 \text{OL}^{1.390} \quad R^2 = 0.97 \\
\text{TL} &= 44.884 \text{OH}^{1.309} \quad R^2 = 0.98 \\
\text{TW} &= 0.003 \text{OL}^{4.492} \quad R^2 = 0.96 \\
\text{TW} &= 0.498 \text{OH}^{4.225} \quad R^2 = 0.96 \\
\text{TW} &= 2E-06 \text{TL}^{3.227} \quad R^2 = 0.99 \\
\text{OH/OL} &= \text{min. 0.33-max. 0.42}
\end{align*}
\]

(a) 6.4 mm OL, 130 mm TL

(b) 9.4 mm OL, 225 mm TL

(c) 18.7 mm OL, 581 mm TL
Order Lophiiformes  
Family Lophiidae  
*Lophius gastrophysus* Miranda Ribeiro 1915

**Distribution and habitat.** Western Atlantic: North Carolina, USA to Argentina. Large-sized (TL > 800 mm) bathydemersal marine species. It is present in the outer shelf and upper continental slope along southeastern and southern Brazil.

**Exploitation.** Commercially valuable species. It is targeted with bottom gillnets and incidentally fished with bottom trawls.

**References.** Menezes et al. (2003); Pérez et al. (2005).


**Material.** Otoliths from 46 specimens ranging between 133 to 760 mm TL, 47 to 8,620 g TW, 5.7 to 14.8 mm OL, and 2.1 to 5.65 mm OH.

**Relationships.**
- \( TL = 23.596 \text{ OL}^{1.526} \quad R^2 = 0.89 \)
- \( TL = 51.604 \text{ OH}^{1.394} \quad R^2 = 0.92 \)
- \( TW = 0.185 \text{ OL}^{4.642} \quad R^2 = 0.87 \)
- \( TW = 2.006 \text{ OH}^{4.238} \quad R^2 = 0.91 \)
- \( TW = 1E-05 \text{ TL}^{3.061} \quad R^2 = 0.99 \)
- \( \text{OH/OI} = \min. 0.56-\max. 0.85 \)

![Otoliths with measurements](image-url)

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(a) 2.2 mm OL, 80 mm TL  
(b) 6.7 mm OL, 430 mm TL  
(c) 10.8 mm OL, 890 mm TL
Order Mugiliformes
Family Mugilidae
*Mugil liza* Valenciennes 1836

**Distribution and habitat.** Western Atlantic to Argentina. Mid-sized (TL < 600 mm) catadromous, freshwater, brackish and marine species.

**Exploitation.** It is commercially fished with gillnets, beach nets and purse seines in estuaries and coastal waters along southern Brazil.

**References.** Menezes et al. (2003); Mai et al. (2014).


**Material.** Otoliths from 82 specimens ranging between 25 to 595 mm TL, 0.2 to 2,378.9 g TW, 0.97 to 11.96 mm OL, and 0.6 to 5.45 mm OH.

**Relationships.**

\[
\begin{align*}
\text{TL} &= 20.252 \text{ OL}^{1.346} \quad R^2 = 0.96 \\
\text{TL} &= 39.412 \text{ OH}^{1.616} \quad R^2 = 0.98 \\
\text{TW} &= 0.102 \text{ OL}^{3.955} \quad R^2 = 0.96 \\
\text{TW} &= 0.714 \text{ OH}^{4.756} \quad R^2 = 0.98 \\
\text{TW} &= 1 \times 10^{-5} \text{ TL}^{2.961} \quad R^2 = 0.99 \\
\text{OH}/\text{OL} &= \text{min. } 0.39-\text{max. } 0.67
\end{align*}
\]
Order Myctophiformes  
Family Myctophidae  
*Diaphus dumerilii* (Bleeker 1856)

**Distribution and habitat.** Atlantic and western Pacific oceans. In the western Atlantic: from Cape to Argentina (51° N-36° S). Very small-sized (TL < 130 mm) mesopelagic marine species. Abundant on the upper continental slope (200-600 m) along southern Brazil, frequently caught in small numbers by bottom trawls and discarded on board.

**Exploitation.** Not targeted by any fishery.

**References.** Menezes et al. (2003); Haimovici et al. (1994, 2008).


**Material.** Otoliths from 19 specimens ranging between 64 to 98 mm TL, 1.6 to 6.2 g TW, 3.1 to 4.6 mm OL, and 2.1 to 3.05 mm OH.

**Relationships.**

\[
\begin{align*}
\text{TL} &= 17.585 \text{ OL}^{1.145} \quad R^2 = 0.91 \\
\text{TL} &= 23.109 \text{ OH}^{1.327} \quad R^2 = 0.76 \\
\text{TW} &= 0.022 \text{ OL}^{3.763} \quad R^2 = 0.94 \\
\text{TW} &= 0.048 \text{ OH}^{4.495} \quad R^2 = 0.79 \\
\text{TW} &= 3E-06 \text{ TL}^{3.141} \quad R^2 = 0.96 \\
\text{OH/OL} &= \text{min. 0.61-max. 0.72}
\end{align*}
\]
Order Ophidiiformes  
Family Ophidiidae  
*Genypterus brasiliensis* Regan 1903

**Distribution and habitat.** Southwest Atlantic: Rio de Janeiro, Brazil to Argentina. Large-sized (TL > 1,000 mm) demersal marine species. It is present in the outer shelf and upper continental slope along southern Brazil.

**Exploitation.** Valuable species. It is fished with hook and line and occasionally with bottom trawls.

**References.** Menezes et al. (2003); Haimovici et al. (2004, 2008).

**Material.** Otoliths from 44 specimens ranging between 232 to 985 mm TL, 50 to 5,600 g TW, 8.01 to 20.83 mm OL, and 3.68 to 10.43 mm OH.

**Relationships.**

- $\text{TL} = 11.896 \text{OL}^{1.431}$  \( R^2 = 0.96 \)
- $\text{TL} = 42.109 \text{OH}^{1.337}$  \( R^2 = 0.97 \)
- $\text{TW} = 0.001 \text{OL}^{4.871}$  \( R^2 = 0.96 \)
- $\text{TW} = 0.123 \text{OH}^{4.568}$  \( R^2 = 0.97 \)
- $\text{TW} = 4E-07 \text{TL}^{3.406}$  \( R^2 = 0.99 \)
- $\text{OH/OL} = \text{min. 0.42-max. 0.55}$

**Raneya brasiliensis** (Kaup 1856)

**Distribution and habitat.** Southwest Atlantic: Rio de Janeiro to northern Patagonia. Small-sized (TL > 300 mm) demersal marine species. It is incidentally caught and discarded on board of bottom trawlers fishing on outer the continental shelf along southern Brazil.

**Exploitation.** Not targeted by any fishery.

**References.** Haimovici et al. (1996); Menezes et al. (2003); Bernardes et al. (2005).


**Material.** Otoliths from 33 specimens ranging between 172 to 300 mm TL, 22.4 to 185 g TW, 5.5 to 9.5 mm OL, and 4.85 to 8.3 mm OH.

**Relationships.**

\[
\begin{align*}
\text{TL} &= 30.601 \text{OL}^{1.012} \quad R^2 = 0.95 \\
\text{TL} &= 40.099 \text{OH}^{0.961} \quad R^2 = 0.95 \\
\text{TW} &= 0.044 \text{OL}^{3.671} \quad R^2 = 0.95 \\
\text{TW} &= 0.118 \text{OH}^{3.478} \quad R^2 = 0.93 \\
\text{TW} &= 3E-07 \text{TL}^{3.561} \quad R^2 = 0.98 \\
\text{OH/OL} &= \text{min. 0.77-max. 0.94}
\end{align*}
\]
Order Perciformes
Family Anthiadiidae
Pronotogrammus martinicensis
(Guichenot 1868)

**Distribution and habitat.** Western Atlantic: Florida, USA to southern Brazil. Small-sized (TL < 200 mm) demersal marine species. It is incidentally caught and discarded on board of bottom trawlers on outer continental shelf and shelf break along southern Brazil.

**Exploitation.** Not targeted by any fishery.

**References.** Menezes et al. (2003); Bernardes et al. (2005); Haimovici et al. (2008).

![Otolith](a) 3.7 mm OL, 127 mm TL


**Material.** Otoliths from 2 specimens ranging between 118 and 127 mm TL, 33 and 34 g TW, 6.3 and 6.4 mm OL and 3.64 and 3.8 mm OH.

**Relationships.** Insufficient data.
Family Ariommatidae

Ariomma bondi Fowler 1930

Distribution and habitat. In the western Atlantic: Canada to Maine, USA and northern Gulf of Mexico to Uruguay (45° N-36° S) and eastern Atlantic from Senegal to Angola. Small-sized (TL < 300 mm) demersal marine, oceanodromous or bathypelagic species. It is incidentally caught and discarded on board by bottom trawlers fishing in the outer shelf and upper continental slope (50-600 m) along southern Brazil.

Exploitation. Not targeted by any fishery.

References. Menezes et al. (2003); Haimovici et al. (2008).


Material. Otoliths from 24 specimens ranging between 70 to 183 mm TL, 3.1 to 73 g TW, 1.92 to 5.12 mm OL and 1.02 to 2.64 mm OH.

Relationships.

\[
\begin{align*}
\text{TL} &= -0.942 + 37.552 \text{OL} & R^2 &= 0.94 \\
\text{TL} &= 66.220 \text{OH}^{1.021} & R^2 &= 0.96 \\
\text{TW} &= 0.393 \text{OL}^{3.260} & R^2 &= 0.95 \\
\text{TW} &= 2.687 \text{OH}^{3.307} & R^2 &= 0.94 \\
\text{TW} &= 6E-06 \text{TL}^{3.139} & R^2 &= 0.99 \\
\text{OH/OL} &= \text{min. 0.49-max. 0.60}
\end{align*}
\]

![Graph](image_url)
**Family Callionymidae**

*Synchiropus agassizii* (Goode and Bean 1888)

**Distribution and habitat.** Western Atlantic Ocean. Venezuela to Uruguay. Small-sized (TL < 300 mm) demersal marine species. It is occasionally fished and discarded on board by bottom trawlers in the upper continental slope along southern Brazil.

**Exploitation.** Not targeted by any fishery.

**References.** Menezes et al. (2003); Bernardes et al. (2005); Haimovici et al. (2008).

---


**Material.** Otoliths from 1 specimen of 205 mm TL, 37 g TW, 3.53 mm OL and 1.83 mm OH.

**Relationships.** Insufficient data.
Family Carangidae

*Caranx cryos* (Mitchill 1815)

**Distribution and habitat.** Western and eastern Atlantic. Mid-sized (TL < 700 mm). Estuarine and marine reef-associated species. Small specimens are occasionally caught by bottom trawlers in coastal waters (< 50 m) along southern Brazil. Usually discarded on board.

**Exploitation.** Not targeted by any fishery.

**References.** Haimovici et al. (1996); Menezes et al. (2003).

![Image](a) 3 mm OL, 163 mm TL


**Material.** Otoliths from 1 specimen of 163 mm TL, 51 g TW, 2.95 mm OL and 1.58 mm OH.

**Relationships.** Insufficient data.
**Chloroscombrus chrysurus** (Linnaeus 1766)

**Distribution and habitat.** Eastern Atlantic: Spain to Angola and western Atlantic: Massachusetts to Argentina. Mid-sized (TL < 650 mm) pelagic-neritic marine species. It is occasionally fished in the inner shelf (< 100 m) along southern Brazil.

**Exploitation.** Not targeted by any fishery.

**References.** Menezes et al. (2003); Haimovici et al. (1996).

**Material.** Otoliths from 4 specimens ranging between 155 to 258 mm TL, 39.6 to 159 g TW, 3.52 to 4.82 mm OL, and 1.98 to 2.52 mm OH.

**Relationships.** Insufficient data.

Decapterus punctatus (Cuvier 1829)

Distribution and habitat. Western Atlantic Ocean: from Nova Scotia to southern Brazil. Small-sized (TL > 300 mm) pelagic marine species. It is occasionally caught in the shelf and upper continental slope along southern Brazil.

Exploitation. Not targeted by any fishery.

References. Haimovici et al. (1996); Figueiredo et al. (2002); Menezes et al. (2003).


Material. Otoliths from 1 specimen of 191 mm TL, 52 g TW, 4.2 mm OL and 2.25 mm OH.

Relationships. Insufficient data.
Selene setapinnis (Mitchill 1815)

**Distribution and habitat.** Western Atlantic: Nova Scotia, Canada to Mar del Plata, Argentina. Mid-sized (TL > 400 mm) brackish water and benthopelagic marine species. It is incidentally caught in small quantities and discarded on board by bottom trawlers fishing in coastal waters along southern Brazil.

**Exploitation.** Not targeted by any fishery.

**References.** Menezes et al. (2003); Fischer et al. (2011).

(a) 2.6 mm OL, 182 mm TL

**Description.** Shape rectangular. **Distal face** slightly concave. **Proximal face** slightly convex. **Anterior margin** flattened. **Posterior margin** flattened. **Dorsal margin** flattened, sinuate. **Ventral margin** convex, sinuate. **Rostrum** present, prominent. **Antirostrum** present. **Sulcus acusticus** opened at the anterior region, closed at posterior region. **Ostium** broader and shorter than cauda, deep, funnel-like to undefined. **Cauda** deep, tubular-strongly curved ventrally. **Crista** absent.

**Material.** Otoliths from 2 specimens ranging between 179 and 182 mm TL, 4 and 4.13 g TW, 4.06 and 4.17 mm OL, and 2.56 and 2.57 mm OH.

**Relationships.** Insufficient data.
**Trachinotus marginatus** Cuvier 1832

**Distribution and habitat.** Southwest Atlantic from Rio de Janeiro to Argentina. Mid-sized brackish and benthopelagic marine species. It is occasionally caught by trawls and purse-seiners in coastal waters along southern Brazil.

**Exploitation.** Occasionally fished with gillnets by small scale fishers.

**References.** Menezes et al. (2003); Lemos et al. (2011).


**Material.** Otoliths from 65 specimens ranging between 145 to 490 mm TL, 39.1 to 1,250 g TW, 3.03 to 7.77 mm OL, and 1.2 to 3.22 mm OH.

**Relationships.**

\[
\begin{align*}
\text{TL} &= -30.12 + 64.416 \text{OL} \quad R^2 = 0.81 \\
\text{TL} &= 135.80 \text{OH}^{1.1251} \quad R^2 = 0.78 \\
\text{TW} &= 1.761 \text{OL}^{3.208} \quad R^2 = 0.83 \\
\text{TW} &= 34.19 \text{OH}^{3.231} \quad R^2 = 0.80 \\
\text{TW} &= 2E-05 \text{TL}^{2.916} \quad R^2 = 0.98 \\
\text{OH/OL} &= \text{min. 0.34-max. 0.48}
\end{align*}
\]
**Trachurus lathami** Nichols 1920

**Distribution and habitat.** Western Atlantic: Canada to northern Argentina. Small-sized (TL < 300 mm) benthopelagic marine species. It is commonly found in the continental shelf along southern Brazil. It is fished by bottom trawls and mostly discarded on board.

**Exploitation.** Not targeted by any fishery in the region.

**References.** Haimovici et al. (1996, 2008); Menezes et al. (2003).


**Material.** Otoliths from 39 specimens ranging between 108 to 216 mm TL, 10 to 82.7 g TW, 4.2 to 7.68 mm OL, and 2.4 to 3.68 mm OH.

**Relationships.**

\[
\begin{align*}
\text{TL} &= -16.98 + 30.010 \text{OL} \quad R^2 = 0.75 \\
\text{TL} &= 26.891 \text{OH}^{1.574} \quad R^2 = 0.84 \\
\text{TW} &= 0.083 \text{OL}^{3.307} \quad R^2 = 0.93 \\
\text{TW} &= 0.133 \text{OH}^{4.840} \quad R^2 = 0.84 \\
\text{TW} &= 5 \times 10^{-6} \text{TL}^{3.080} \quad R^2 = 0.99 \\
\text{OH/OL} &= \text{min. 0.47-max. 0.59}
\end{align*}
\]
Family Centrolophidae

*Centrolophus niger* (Gmelin 1789)

**Distribution and habitat.** Circumglobal in temperate waters. Large-sized (TL > 1,500 mm) epipelagic and mesopelagic marine species. It is fished by offshore longliners usually discarded on board along southern Brazil.

**Exploitation.** Not targeted by any fishery.


![Otolith](image)

(a) 28.8 mm OL, 770 mm TL


**Material.** Otoliths from 3 specimens ranging between 750 to 860 mm TL, 4,200 to 5,100 g TW, 28.93 to 30.31 mm OL and 12.53 to 14.11 mm OH.

**Relationships.** Insufficient data.
Family Cheilodactylidae
*Nemadactylus bergi* (Norman 1937)

**Distribution and habitat.** From Rio de Janeiro, Brazil to the Argentine and Chilean Patagonia. Mid-sized (TL < 500 mm) demersal marine species. It is incidentally caught but mostly discarded on board of bottom trawlers fishing in the outer shelf and upper continental slope (100-300 m) along southern Brazil.

**Exploitation.** Not targeted by any fishery in the region.

**References.** Menezes et al. (2003); Bernardes et al. (2006); Haimovici et al. (2008).

**Material.** Otoliths from 19 specimens ranging between 205 to 376 mm TL, 4.3 to 7.8 g TW, 4.3 to 7.85 mm OL, and 2.17 to 3.85 mm OH.

**Relationships.**

\[
\begin{align*}
    TL &= 14.15 + 45.444 \, OL \quad R^2 = 0.78 \\
    TL &= 82.044 \, OH^{1.170} \quad R^2 = 0.91 \\
    TW &= 2.025 \, OL^{2.674} \quad R^2 = 0.87 \\
    TW &= 6.243 \, OH^{3.477} \quad R^2 = 0.90 \\
    TW &= 1E-05 \, TL^{2.981} \quad R^2 = 0.97 \\
    OH/OL &= \text{min. 0.38-max. 0.53}
\end{align*}
\]


(a) 7.9 mm OL, 372 mm TL

(b) 11.8 mm OL, 550 mm TL

![Graph](image)
Family Epinephelidae

*Epinephelus marginatus* (Lowe 1834)

**Distribution and habitat.** Atlantic and western Indian oceans and the Mediterranean. In the western Atlantic from southern Brazil to Argentina. Very large (TL > 1,400 mm) rocky bottoms and reef-associated demersal marine species. It is frequent on biodetritic shelf bottoms at depth up to 200 m along southern Brazil.

**Exploitation.** Fished with hook and line on hard bottoms. IUCN status: Vulnerable (2016).

**References.** Menezes et al. (2003); Condini et al. (2018).


**Material.** Otoliths from 23 specimens ranging between 11.8 to 42 mm TL, 28.1 to 7,240 g TW, 4.2 to 18.15 mm OL, and 2.1 to 8.45 mm OH.

**Relationships.**

- \( TL = 15.475 \, OL^{1.360} \) \( R^2 = 0.97 \)
- \( TL = 45.225 \, OH^{1.301} \) \( R^2 = 0.98 \)
- \( TW = 0.258 \, OL^{3.201} \) \( R^2 = 0.99 \)
- \( TW = 1.684 \, OH^{3.788} \) \( R^2 = 0.98 \)
- \( TW = 8E-06 \, TL^{3.163} \) \( R^2 = 0.99 \)
- \( OH/OL = \text{min. 0.41-max. 0.57} \)
**Hyporthodus flavolimbatus** (Poey 1865)

**Distribution and habitat.** Western Atlantic: North Carolina, USA to southern Brazil. Large-sized (TL > 1,100 mm) demersal marine species. It is commercially valuable species occasionally fished with hook and line in the upper continental slope along southern Brazil.

**Exploitation.** IUCN status: Vulnerable (2016).

**References.** Menezes et al. (2003); Haimovici et al. (2004); Bernardes et al. (2006).


**Material.** Otoliths from 3 specimens ranging between 820 to 1,245 mm TL, 10,650 to 28,730 g TW, 7.64 to 9.19 mm OL and 8.60 to 9.21 mm OH.

**Relationships.** Insufficient data.
**Hyporthodus niveatus** (Valenciennes 1828)

**Distribution and habitat.** Western Atlantic: Canada to southern Brazil. Large-sized (TL > 1,200 mm) demersal marine species. It is commercially valuable species occasionally fished with hook and line in the upper continental slope along southern Brazil.

**Exploitation.** IUCN status: Vulnerable (2016).

**References.** Menezes et al. (2003); Haimovici et al. (2004); Bernardes et al. (2006).

**Description.** Shape lanceolate. **Distal face** concave. **Proximal face** convex. **Anterior margin** angled. **Posterior margin** round. **Dorsal margin** convex, dentate. **Ventral margin** convex, dentate to smooth. **Rostrum** present, prominent. **Antirostrum** present. **Sulcus acusticus** opened at the anterior region, closed at posterior region. **Ostium** broader and shorter than cauda, deep, funnel-like. **Cauda** deep, tubular-slightly curved ventrally. **Crista** present.

**Material.** Otoliths from 27 specimens ranging between 108 to 1,090 mm TL, 23.6 to 21,200 g TW, 4.7 to 26.2 mm OL, and 2.5 to 12.7 mm OH.

**Relationships.**
\[
\begin{align*}
\text{TL} &= 12.491 \text{OL}^{1.367} R^2 = 0.99 \\
\text{TL} &= 23.370 \text{OH}^{1.515} R^2 = 0.96 \\
\text{TW} &= 0.043 \text{OL}^{3.983} R^2 = 0.99 \\
\text{TW} &= 0.274 \text{OH}^{4.407} R^2 = 0.96 \\
\text{TW} &= 3 \times 10^{-5} \text{TL}^{2.910} R^2 = 0.99 \\
\text{OH/OL} &= \text{min. 0.42-max. 0.59}
\end{align*}
\]
Family Gempylidae  
*Promethichthys prometheus* (Cuvier 1832)

**Distribution and habitat.** Tropical and warm temperate waters of all oceans. Present along all the Brazilian coast. Large-sized (TL > 1,000 mm) benthopelagic marine species. It is present in the upper continental slope along southern Brazil.

**Exploitation.** Not targeted by any fishery in the region.

**References.** Menezes et al. (2003); Bernardes et al. (2005); Haimovici et al. (2008).


**Material.** Otoliths from 1 specimen of 645 mm TL, 1,413 g TW, 10.1 mm OL and 4.74 mm OH.

**Relationships.** Insufficient data.
**Thysitops lepidopoides** (Cuvier 1832)

**Distribution and habitat.** Southwest Atlantic: from Rio de Janeiro to Argentina, and Chile in the southeast Pacific. Small-sized benthopelagic marine species. It is incidentally caught and discarded on board of bottom trawlers fishing in the continental shelf and upper continental slope (<400 m) along southern Brazil.

**Exploitation.** Not targeted by any fishery in the region.

**References.** Menezes et al. (2003); Haimovici et al. (1996, 2008).


**Material.** Otoliths from 15 specimens ranging between 150 to 382 mm TL, 14.5 to 300.7 g TW, 3.85 to 8.9 mm OL and 1.85 to 4.1 mm OH.

**Relationships.**

- \[ TL = -23.87 + 45.583 \times OL \quad R^2 = 0.96 \]
- \[ TL = 76.387 \times OH^{1.113} \quad R^2 = 0.90 \]
- \[ TW = 0.156 \times OL^{3.524} \quad R^2 = 0.96 \]
- \[ TW = 1.605 \times OH^{3.802} \quad R^2 = 0.92 \]
- \[ TW = 4E-07 \times TL^{3.480} \quad R^2 = 0.98 \]

- \[ \frac{OH}{OL} = \text{min. 0.44-max. 0.50} \]
**Family Gerreidae**

*Eucinostomus argenteus* Baird and Girard 1855

**Distribution and habitat.** Western Atlantic from New Jersey to southern Brazil. Small-sized (TL < 350 mm) estuarine and marine species. Uncommon along southern Brazil.

**Exploitation.** Not targeted by any fishery.

**References.** Menezes et al. (2003).

**Material.** Otoliths from 6 specimens ranging between 130 to 215 mm TL, 29 to 131 g TW, 4.15 to 6.5 mm OL, and 2.35 to 3.65 mm OH.

**Relationships.**

\[
\begin{align*}
\text{TL} &= 1.2603 + 31.485 \text{OL} \quad R^2 = 0.95 \\
\text{TL} &= 51.388 \text{OH}^{1.065} \quad R^2 = 0.70 \\
\text{TW} &= 0.566 \text{OL}^{2.847} \quad R^2 = 0.81 \\
\text{TW} &= 1.757 \text{OH}^{3.257} \quad R^2 = 0.72 \\
\text{TW} &= 1E-05 \text{TL}^{2.991} \quad R^2 = 0.98 \\
\text{OH/OL} &= \text{min. 0.53-max. 0.65}
\end{align*}
\]


(a) 4.1 mm OL, 130 mm TL

(b) 6.8 mm OL, 215 mm TL
**Eucinostomus gula** (Quoy and Gaimard 1824)

**Distribution and habitat.** Western Atlantic from Massachusetts to Argentina. Small-sized (TL < 250 mm) coastal estuarine and marine species. It is occasionally present in estuarine and coastal waters along southern Brazil.

**Exploitation.** Not targeted by any fishery on the region.

**References.** Menezes et al. (2003); Fisher et al. (2011).


**Material.** Otoliths from 1 specimen of 158 mm TL, 96.5 g TW, 6.48 mm OL and 3.38 mm OH.

**Relationships.** Insufficient data.
Family Haemulidae  
*Boridia grossidens* Cuvier 1830

**Distribution and habitat.** Southwestern Atlantic Ocean: from Rio de Janeiro to northern Argentina (22° S-41° S). Small-sized (TL < 300 mm) demersal marine species. It is caught in small numbers by bottom trawlers in the inner shelf (< 100 m) along southern Brazil.

**Exploitation.** Not targeted by any fishery on the region.

**References.** Haimovici et al. (1996); Menezes et al. (2003).


**Material.** Otoliths from 12 specimens ranging between 210 to 290 mm TL, 130 to 320 g TW, 7.7 to 10.8 mm OL, and 4.5 to 6.35 mm OH.

Relationships.  
\[ TL = -0.243 + 27.024 \text{OL} \quad R^2 = 0.93 \]
\[ TL = 54.390 \text{OH}^{0.927} \quad R^2 = 0.64 \]
\[ TW = 0.285 \text{OL}^{2.996} \quad R^2 = 0.89 \]
\[ TW = 3.509 \text{OH}^{2.527} \quad R^2 = 0.58 \]
\[ TW = 5E-05 \text{TL}^{2.775} \quad R^2 = 0.95 \]
\[ \text{OH/OL} = \text{min. 0.50-max. 0.59} \]
**Conodon nobilis** (Linnaeus 1758)

**Distribution and habitat.** Western Atlantic: from Florida (USA) to northern Argentina (30° N-36° S). Small-sized (TL < 350 mm) demersal marine coastal species on soft bottoms. It is occasionally fished along southern Brazil.

**Exploitation.** Not targeted by any fishery on the region.

**References.** Menezes et al. (2003).

**Material.** Otoliths from 2 specimens ranging between 204 and 365 mm TL, 126 and 760 g TW, 9.56 and 15.1 mm OL and 6.13 and 9.69 mm OH.

**Relationships.** Insufficient data.

**Haemulopsis corvinaeformis**
(Steindachner 1868)

**Distribution and habitat.** Western Atlantic: from Mexico to southern Brazil. Small-sized (TL < 250 mm) brackish coastal and demersal marine species. It is incidentally caught by bottom trawlers in the inner continental shelf along southern Brazil.

**Exploitation.** Not targeted by any fishery in the region.

**References.** Menezes et al. (2003).

**Material.** Otoliths from 20 specimens ranging between 130 to 195 mm TL, 33 to 110 g TW, 6.5 to 9.1 mm OL, and 4.55 to 6.47 mm OH.

**Relationships.**
\[
\begin{align*}
\text{TL} &= -17.58 + 22.152 \text{OL} \quad R^2 = 0.90 \\
\text{TL} &= 26.010 \text{OH}^{1.066} \quad R^2 = 0.85 \\
\text{TW} &= 0.042 \text{OL}^{3.533} \quad R^2 = 0.94 \\
\text{TW} &= 0.212 \text{OH}^{3.372} \quad R^2 = 0.86 \\
\text{TW} &= 9E-06 \text{TL}^{3.117} \quad R^2 = 0.97 \\
\text{OH} / \text{OL} &= \text{min. 0.63-max. 0.73}
\end{align*}
\]

Orthopristis rubra (Cuvier 1830)

Distribution and habitat. Western Atlantic: Honduras to Brazil. Small-sized (TL < 400 mm) brackish and demersal marine species. It is incidentally caught by bottom trawlers in the inner continental shelf along southern Brazil.

Exploitation. Not targeted by any fishery on the region.

References. Haimovici et al. (1996); Menezes et al. (2003).

Material. Otoliths from 34 specimens ranging between 145 to 284 mm TL, 44 to 335 g TW, 6.15 to 10.47 mm OL, and 3.5 to 5.77 mm OH.

Relationships.

\[
\begin{align*}
& \text{TL} = -36.35 + 31.757 \text{OL} \quad R^2 = 0.85 \\
& \text{TL} = 22.968 \text{OH}^{1.489} \quad R^2 = 0.72 \\
& \text{TW} = 0.125 \text{OL}^{3.398} \quad R^2 = 0.80 \\
& \text{TW} = 0.247 \text{OH}^{4.237} \quad R^2 = 0.61 \\
& \text{TW} = 4E-05 \text{TL}^{2.822} \quad R^2 = 0.96 \\
& \text{OH/OL} = \text{min.} \ 0.51-\text{max.} \ 0.63
\end{align*}
\]

Family Liopropomatidae
*Bathyantias roseus* Günther 1880

**Distribution and habitat.** Southwestern Atlantic Ocean: Brazil and Uruguay. Small-sized (TL < 350 mm) bathydemersal marine species. It is incidentally caught in small numbers and mostly discarded by bottom trawlers fishing in the outer shelf and upper continental slope (100-300 m) along southern Brazil.

**Exploitation.** Not targeted by any fishery.

**References.** Menezes et al. (2003); Bernardes et al. (2005); Haimovici et al. (2008) as *Pinkea rosea*.

**Material.** Otoliths from 8 specimens ranging between 98 to 165 mm TL, 13 to 52 g TW, 5.78 to 9.25 mm OL, and 2.86 to 4.22 mm OH.

**Relationships.**
- \( TL = -1.524 + 17.524 \times OL \) \( R^2 = 0.99 \)
- \( TL = 25.275 \times OH^{1.263} \) \( R^2 = 0.95 \)
- \( TW = 0.056 \times OL^{3.066} \) \( R^2 = 0.95 \)
- \( TW = 0.287 \times OH^{3.521} \) \( R^2 = 0.91 \)
- \( TW = 3E-05 \times TL^{2.813} \) \( R^2 = 0.98 \)
- \( OH/OL = \text{min. } 0.46-\text{max. } 0.49 \)

Family Lobotidae

*Lobotes surinamensis* (Bloch 1790)

**Distribution and habitat.** Tropical to temperate waters of all oceans. Large-sized (TL > 800 mm) brackish and benthopelagic marine species. Currently rare, formerly frequent in shallow waters along southern Brazil.

**Exploitation.** Occasionally fished with gill nets.

**References.** Menezes and Figueiredo (1980); Menezes et al. (2003).

![Image](a) 12 mm OL, 445 mm TL


**Material.** Otoliths from 1 specimen of 445 mm TL, 1,740 g TW, 12 mm OL and 6.15 mm OH.

**Relationships.** Insufficient data.
Family Lutjanidae

*Pristipomoides freemani* Anderson 1966

**Distribution and habitat.** Western Atlantic from Panama to Uruguay. Small-sized (TL < 300 mm) demersal marine species. It is incidentally caught and discarded on board of bottom trawlers fishing in the outer continental shelf and shelf break (< 300 m) along southern Brazil.

**Exploitation.** Not targeted by any fishery.

**References.** Menezes et al. (2003); Bernardes et al. (2005); Haimovici et al. (2008).


**Material.** Otoliths from 15 specimens ranging between 72 to 280 mm TL, 3.5 to 270 g TW, 5.68 to 9.6 mm OL and 3.98 to 6.31 mm OH.

**Relationships.**

- \( TL = 21.230 \times OL^{1.074} \)  \( R^2 = 0.93 \)
- \( TL = 27.586 \times OH^{1.198} \)  \( R^2 = 0.88 \)
- \( TW = 0.093 \times OL^{3.249} \)  \( R^2 = 0.93 \)
- \( TW = 0.191 \times OH^{3.669} \)  \( R^2 = 0.91 \)
- \( TW = 1E-05 \times TL^{2.997} \)  \( R^2 = 0.98 \)
- \( \text{OH/OL} = \text{min. 0.61-max. 0.70} \)

![Graph](image)

(a) 6 mm OL, 145 mm TL

(b) 10 mm OL, 252 mm TL
Family Malacanthidae  
*Caulolatilus chrysops* (Valenciennes 1833)

**Distribution and habitat.** North Carolina to southern Brazil (36° N-35° S). Mid-sized (TL < 500 mm) demersal marine species on rubble bottoms. It is fished in small numbers by bottom trawlers in outer shelf and upper continental slope (100-300 m) along southeastern Brazil.

**Exploitation.** Not targeted by any fishery.

**References.** Doodley (1978); Haimovici et al. (1996); Menezes et al. (2003).


**Material.** Otoliths from 11 specimens ranging between 270 to 585 mm TL, 223 to 2,420 g TW, 6 to 10.8 mm OL and 3 to 5.04 mm OH.

**Relationships.**

- \( TL = -70.32 + 60.812 \text{ OL} \)  \( R^2 = 0.81 \)
- \( TL = 76.151 \text{ OH}^{1.304} \)  \( R^2 = 0.87 \)
- \( TW = 0.245 \text{ OL}^{3.928} \)  \( R^2 = 0.88 \)
- \( TW = 4.053 \text{ OH}^{4.121} \)  \( R^2 = 0.85 \)
- \( TW = 5E-06 \text{ TL}^{3.356} \)  \( R^2 = 0.98 \)
- \( \text{OH/OL} = \min. 0.43-\max. 0.50 \)

![Graph showing the relationship between otolith length and total length](image-url)
**Lopholatilus villarii** Miranda Ribeiro 1915

**Distribution and habitat.** Southwest Atlantic: Brazil, Uruguay, Argentina. Large-sized (TL > 800 mm) bathydemersal marine species. It is present in the outer shelf and upper continental slope (150-400 m) along southern Brazil.

**Exploitation.** Highly valuable species, fished hook and line.

**References.** Figueiredo and Menezes (1980); Haimovici et al. (2004); Ávila-da-Silva and Haimovici (2005).


**Material.** Otoliths from 14 specimens ranging between 248 to 778 mm TL, 160 to 6,450 g TW, 8.55 to 17.1 mm OL, and 4.97 to 10 mm OH.

**Relationships.**

- \[ TL = 16.334 \text{OL}^{1.288} \quad R^2 = 0.98 \]
- \[ TL = 39.371 \text{OH}^{1.191} \quad R^2 = 0.96 \]
- \[ TW = 0.025 \text{OL}^{4.157} \quad R^2 = 0.96 \]
- \[ TW = 0.418 \text{OH}^{3.854} \quad R^2 = 0.98 \]
- \[ TW = 3E-06 \text{TL}^{3.234} \quad R^2 = 0.99 \]
- \[ \text{OH/OL} = \min. 0.55-\max. 0.63 \]

![Graph](image)

(a) 8.8 mm OL, 270 mm TL

(b) 14 mm OL, 490 mm TL

(c) 21 mm OL, 825 mm TL
Family Mullidae
*Mullus argentinae* Hubbs and Marini 1933

**Distribution and habitat.** Southwest Atlantic: Brazil, Uruguay to northern Argentina. Small (TL < 300 mm) demersal marine species. It is incidentally caught mostly discarded on board by bottom trawlers fishing in the outer shelf and upper continental slope (50 to 300 m) along southern Brazil.

**Exploitation.** Not targeted by any fishery in the region.

**References.** Menezes et al. (2003); Bernardes et al. (2006); Haimovici et al. (2008).


**Material.** Otoliths from 39 specimens ranging between 119 to 221 mm TL, 20.3 to 196 g TW, 2.95 to 4.5 mm OL and 1.9 to 3 mm OH.

**Relationships.**

\[
\text{TL} = -51.05 + 62.481 \text{ OL} \quad R^2 = 0.76
\]

\[
\text{TL} = 50.427 \text{ OH}^{1.399} \quad R^2 = 0.73
\]

\[
\text{TW} = 0.228 \text{ OL}^{4.601} \quad R^2 = 0.73
\]

\[
\text{TW} = 1.009 \text{ OH}^{5.050} \quad R^2 = 0.80
\]

\[
\text{TW} = 8E-06 \text{ TL}^{3.127} \quad R^2 = 0.88
\]

\[
\text{OH/OL} = \text{min. 0.60-max. 0.77}
\]
**Upeneus parvus** Poey 1852

**Distribution and habitat.** Western Atlantic: North Carolina USA to Santa Catarina, Brazil. Small-sized (TL < 250 mm) demersal marine species. It is fished in small quantities by bottom trawlers in the outer continental shelf in southern Brazil.

**Exploitation.** Not targeted by any fishery.

**References.** Menezes and Figueiredo (1985); Bernardes et al. (2005).


**Material.** Otoliths from 14 specimens ranging between 77 to 237 mm TL, 3.6 to 167 g TW, 2.29 to 4.23 mm OL, and 1.37 to 2.74 mm OH.

**Relationships.**

\[
\begin{align*}
\text{TL} &= 25.217 \text{ OL}^{1.480} \quad R^2 = 0.82 \\
\text{TL} &= 48.035 \text{ OH}^{1.478} \quad R^2 = 0.88 \\
\text{TW} &= 0.101 \text{ OL}^{4.856} \quad R^2 = 0.82 \\
\text{TW} &= 0.816 \text{ OH}^{4.857} \quad R^2 = 0.82 \\
\text{TW} &= 3E-06 \text{ TL}^{3.245} \quad R^2 = 0.98 \\
\text{OH/OL} &= \text{min. 0.58-max. 0.76}
\end{align*}
\]
Family Opistognathidae

*Lonchopisthus lemur* (Myers 1935)

**Distribution and habitat.** Western central Atlantic: Puerto Rico to southern Brazil. Small-sized (TL < 100 mm) bathydemersal marine species. It is occasionally caught in the shelf break (100-200 m) along southern Brazil.

**Exploitation.** Not targeted by any fishery.

**References.** Menezes et al. (2003); Bernardes et al. (2006) as *L. meadi*.

---


**Material.** Otoliths from 1 specimen of 78 mm TL, 3.2 g TW, 4.23 mm OL and 2.68 mm OH.

**Relationships.** Insufficient data.
**Family Polyprionidae**  
*Polyprion americanus*  
(Bloch and Schneider 1801)

**Distribution and habitat.** Northern and southern Atlantic, southwest Pacific. In the southwestern Atlantic Ocean from Canada to Argentina. Very large (TL > 1,500 mm) marine epipelagic juveniles and demersal adults. It was an important commercial species fished with hook and line in the continental slope (200-600 m) along southern Brazil until the early 2000s.

**Exploitation.** Its fishery is considered collapsed in Brazil. Fishing forbidden since 2005.

**References.** Menezes et al. (2003); Haimovic et al. (2004); Bernardes et al. (2006).


**Material.** Otoliths from 29 specimens ranging between 441 to 1130 mm TL, 1,200 to 24,100 g TW, 10.2 to 25.2 mm OL, and 4.6 to 11.4 mm OH.

**Relationships.**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Equation</th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>TL</td>
<td>TL = 24.128 OL¹.¹⁷⁵</td>
<td>0.92</td>
</tr>
<tr>
<td>TW</td>
<td>TW = 0.111 OL³.⁷⁸⁴</td>
<td>0.78</td>
</tr>
<tr>
<td>TW</td>
<td>TW = 1.347 OH⁴.¹⁵⁶</td>
<td>0.82</td>
</tr>
<tr>
<td>TW</td>
<td>TW = 4E-09 TL³.²¹⁶</td>
<td>0.99</td>
</tr>
<tr>
<td>OH/OL</td>
<td>OH/OL = min. 0.36-max. 0.53</td>
<td></td>
</tr>
</tbody>
</table>

![Graph showing relationships between otolith length and total length](image)
Family Pomatomidae

*Pomatomus saltatrix* (Linnaeus 1766)

**Distribution and habitat.** Circumglobal. In the western Atlantic from Canada to Argentina. Large-sized (TL > 800 mm) brackish and pelagic marine species.

**Exploitation.** It is a commercially important species fished with purse-seiners, gillnets and occasionally by bottom trawlers in the continental shelf along southern Brazil.

**References.** Haimovici and Krug (1996); Menezes et al. (2003).

![Image](a) 5.3 mm OL, 147 mm TL

![Image](b) 8.3 mm OL, 257 mm TL


**Material.** Otoliths from 36 specimens ranging between 72 to 594 mm TL, 3.1 to 1,920 g TW, 2.95 to 15.7 mm OL and 1.4 to 5 mm OH.

**Relationships.**

\[
\begin{align*}
\text{TL} &= 18.828 \text{ OL}^{1.235} \quad R^2 = 0.99 \\
\text{TL} &= 41.482 \text{ OH}^{1.601} \quad R^2 = 0.98 \\
\text{TW} &= 0.048 \text{ OL}^{3.810} \quad R^2 = 0.99 \\
\text{TW} &= 0.571 \text{ OH}^{4.922} \quad R^2 = 0.99 \\
\text{TW} &= 6E-06 \text{ TL}^{3.076} \quad R^2 = 0.99 \\
\text{OH/OL} &= \text{min. 0.32-max. 0.49}
\end{align*}
\]
Family Priacanthidae

*Heteropriacanthus cruentatus* (Lacepède 1801)

**Distribution and habitat.** Circumglobal. In the western Atlantic Ocean from New York in USA to Argentina. Mid-sized (TL < 600 mm) benthopelagic marine species. It is occasionally fished by bottom trawls in the outer shelf and upper continental slope (100-300 m) along southern Brazil.

**Exploitation.** Not targeted by any fishery.

**References.** Menezes et al. (2003) as *Cookeous japonicus*; Bernardes et al. (2006); Haimovici et al. (2008).


**Material.** Otoliths from 28 specimens ranging between 227 to 540 mm TL, 228 to 2,294 g TW, 5.72 to 9.91 mm OL. and 4.36 to 7.11 mm OH.

**Relationships.**

\[
\begin{align*}
\text{TL} &= 14.417 \times \text{OL}^{1.581} \quad R^2 = 0.83 \\
\text{TL} &= 13.163 \times \text{OH}^{1.885} \quad R^2 = 0.77 \\
\text{TW} &= 0.188 \times \text{OL}^{4.072} \quad R^2 = 0.82 \\
\text{TW} &= 0.154 \times \text{OH}^{4.837} \quad R^2 = 0.74 \\
\text{TW} &= 2.04 \times \text{TL}^{2.578} \quad R^2 = 0.99
\end{align*}
\]

\[
\text{OH/OL} = \text{min. 0.65-max. 0.84}
\]
Family Sciaenidae

*Ctenosciaena gracilicirrhus* (Metzelaar 1919)

**Distribution and habitat.** Caribe and southwestern Atlantic Ocean: from Nicaragua to southern Brazil (10° N-34° S). Small-sized (TL < 250 mm) demersal marine species. It is fished and discarded on board by bottom trawlers mostly at depth of 50 to 100 m along southern Brazil.

**Exploitation.** Not targeted by any fishery.

**References.** Haimovici et al. (1996); Menezes et al. (2003).

**Material.** Otoliths from 49 specimens ranging between 82 to 192 mm TL, 7.5 to 102 g TW, 3.95 to 8.85 mm OL and 3.5 to 6.45 mm OH.

**Relationships.**

\[
\text{TL} = 20.591 \cdot OL^{1.004} \quad R^2 = 0.98 \\
\text{TL} = 12.990 \cdot OH^{1.433} \quad R^2 = 0.96 \\
\text{TW} = 0.081 \cdot OL^{3.248} \quad R^2 = 0.98 \\
\text{TW} = 0.013 \cdot OH^{4.822} \quad R^2 = 0.97 \\
\text{TW} = 9\times10^{-6} \cdot TL^{3.107} \quad R^2 = 0.98 \\
\text{OH/OL} = \text{min. 0.70-max. 0.92}
\]

**Cynoscion guatucupa** (Cuvier 1830)

**Distribution and habitat.** Southwestern Atlantic Ocean: from southeastern Brazil to northern Argentina (22° S–42° S). Medium-sized (TL < 600 mm) benthopelagic marine and coastal species. It inhabits the inner and outer shelf at depth up to 150 m, on sandy and muddy bottoms along southern Brazil.

**Exploitation.** An important target of bottom trawl and gillnet fisheries along southern Brazil.

**References.** Haimovic et al. (1996); Menezes et al. (2003); Miranda and Haimovic (2007); Mendonça et al. (2022).


**Material.** Otoliths from 78 specimens ranging between 21 to 448 mm TL, 0.07 to 1,105 g TW, 1.3 to 17.8 mm OL, and 1 to 8.9 mm OH.

**Relationships.**

- \( TL = 13.799 \times OL^{1.201} \) \( R^2 = 0.99 \)
- \( TL = 18.406 \times OH^{1.423} \) \( R^2 = 0.96 \)
- \( TW = 0.018 \times OL^{3.739} \) \( R^2 = 0.99 \)
- \( TW = 0.044 \times OH^{4.458} \) \( R^2 = 0.98 \)
- \( TW = 6E-06 \times TL^{3.093} \) \( R^2 = 0.99 \)

\( OH/OL = \min. \ 0.45-\max. \ 0.78 \)

(a) 1.6 mm OL, 24 mm TL
(b) 6.9 mm OL, 141 mm TL
(c) 10.6 mm OL, 236 mm TL
(d) 20.5 mm OL, 520 mm TL
**Cynoscion jamaicensis**  
(Vaillant and Bocourt 1883)

**Distribution and habitat.** Caribe and southwestern Atlantic Ocean: from Nicaragua to southern Brazil. Small-sized (TL < 350 mm) benthopelagic marine and coastal species inhabiting sandy and muddy bottoms of the inner shelf (20-100 m). Incidentally caught in the bottom trawl fishery along southern Brazil.

**Exploitation.** Fished mostly with bottom trawler.

**References.** Haimovici et al. (1996); Menezes et al. (2003); Alves et al. (2020); Mendonça et al. (2022).


**Material.** Otoliths from 38 specimens ranging between 140 to 325 mm TL, 25 to 456 g TW, 7.5 to 16.2 mm OL and 4.2 to 7.55 mm OH.

**Relationships.**

\[
\begin{align*}
\text{TL} &= 13.515 \text{ OL}^{1.146} \quad R^2 = 0.98 \\
\text{TL} &= 15.487 \text{ OH}^{1.509} \quad R^2 = 0.97 \\
\text{TW} &= 0.016 \text{ OL}^{3.661} \quad R^2 = 0.97 \\
\text{TW} &= 0.025 \text{ OH}^{4.815} \quad R^2 = 0.96 \\
\text{TW} &= 4E-06 \text{ TL}^{3.203} \quad R^2 = 0.99 \\
\text{OH/OL} &= \text{min. } 0.46-\text{max. } 0.60
\end{align*}
\]
Isopisthus parvipinnis (Cuvier 1830)

Distribution and habitat. Western Atlantic: Costa Rica to southern Brazil. Small-sized (TL < 250 mm) brackish and demersal marine species.

Exploitation. Not targeted by any fishery in southern Brazil.

References. Menezes et al. (2003).

Relationships. Insufficient data

![Otoliths](image)

(a) 6.9 mm OL, 160 mm TL

(b) 7.7 mm OL, 177 mm TL


Material. Otoliths from 4 specimens ranging between 160 to 177 mm TL, 38.4 to 54.5 g TW, 6.87 to 7.67 mm OL and 4.29 to 4.57 mm OH.
Larimus breviceps Cuvier 1830

Distribution and habitat. Caribe and southwestern Atlantic Ocean: from Costa Rica to southern Brazil. Small-sized (TL > 250 mm) demersal estuarine, coastal and marine species inhabiting sandy and muddy bottoms in brackish estuaries and shallow coastal waters of the inner shelf. It is incidentally caught by the shrimp trawl fisheries in coastal waters along southern Brazil during the warm season, and discarded on board.

Exploitation. Not targeted by any fishery.

References. Menezes et al. (2003); Haimovici et al. (2005).


Material. Otoliths from 20 specimens ranging between 116 to 292 mm TL, 23 to 350 g TW, 7.2 to 14.95 mm OL and 4.65 to 9.7 mm OH.

Relationships.

\[ TL = -44.37 + 22.263 \times OL \quad R^2 = 0.99 \]
\[ TL = 15.255 \times OH^{1.298} \quad R^2 = 0.98 \]
\[ TW = 0.012 \times OL^{3.817} \quad R^2 = 0.99 \]
\[ TW = 0.046 \times OH^{3.958} \quad R^2 = 0.98 \]
\[ TW = 1E-05 \times TL^{3.040} \quad R^2 = 0.99 \]
\[ OH/OL = \text{min. 0.63-max. 0.70} \]
Macrodon atricauda (Günther 1880)

Distribution and habitat. Southeastern Brazil to northern Argentina (22° S-40° S). Mid-sized (TL < 500 mm) estuarine, coastal demersal marine species. It inhabits the inner shelf at depth of up to 60 m on sandy and muddy bottoms along southern Brazil. An important target of bottom trawl and gillnet fisheries along southern Brazil and Uruguay.

Exploitation. An important target of bottom trawl and gillnet fisheries along southern Brazil.

References. Haimovici et al. (1996); Menezes et al. (2003).


Material. Otoliths from 59 specimens ranging between 248 to 778 mm TL, 160 to 6,450 g TW, 2.3 to 14.55 mm OL and 1.2 to 7.8 mm OH.

Relationships.

\[
\begin{align*}
\text{TL} &= 10.597 \text{ OL}^{1.335} \quad R^2 = 0.99 \\
\text{TL} &= 31.390 \text{ OH}^{1.301} \quad R^2 = 0.99 \\
\text{TW} &= 0.198 \text{ OL}^{0.587} \quad R^2 = 0.99 \\
\text{TW} &= 0.199 \text{ OH}^{4.029} \quad R^2 = 0.98 \\
\text{TW} &= 5E-06 \text{ TL}^{3.084} \quad R^2 = 0.99 \\
\text{OH/OL} &= \text{min. 0.40-max. 0.54}
\end{align*}
\]
**Menticirrhus americanus** (Linnaeus 1758)

**Distribution and habitat.** Western Atlantic form northern USA to northern Argentina (43°N-42°S). Mid-sized (TL > 500 mm) estuarine, coastal and demersal marine species. It inhabits the inner shelf at depth of up to 60 m on sandy and muddy bottoms along southern Brazil.

**Exploitation.** Fished and landed in small quantities by bottom trawl and gillnet fisheries.

**References.** Haimovici et al. (1996); Menezes et al. (2003).

**Material.** Otoliths from 28 specimens ranging between 94 to 430 mm TL, 6.1 to 1,100 g TW, 3.95 to 12.6 mm OL, and 1.8 to 4.75 mm OH.

**Relationships.**

\[
\begin{align*}
\text{TL} &= 15.141 \text{ OL}^{1.318} \quad R^2 = 0.99 \\
\text{TL} &= 34.069 \text{ OH}^{1.734} \quad R^2 = 0.98 \\
\text{TW} &= 0.013 \text{ OL}^{4.434} \quad R^2 = 0.99 \\
\text{TW} &= 0.202 \text{ OH}^{5.819} \quad R^2 = 0.97 \\
\text{TW} &= 1E-06 \text{ TL}^{3.360} \quad R^2 = 0.99 \\
\text{OH/OL} &= \text{min. 0.32-max. 0.47}
\end{align*}
\]

**Description.** Shape elliptic to irregular. **Distal face** slightly concave. **Proximal face** convex. **Anterior margin** round to angled. **Posterior margin** angled. **Dorsal margin** convex, smooth. **Ventral margin** convex, smooth to sinuate. **Rostrum** absent. **Antirostrum** absent. **Sulcus acusticus** opened at the anterior region, closed at posterior region. **Ostium** broader and shorter than cauda, shallow, pear-like. **Cauda** shallow, tubular-curled ventrally. **Crista** present.

(a) 4 mm OL, 94 mm TL  
(b) 6.9 mm OL, 192 mm TL  
(c) 12.3 mm OL, 414 mm TL
**Menticirrhus littoralis** (Holbrook 1847)

**Distribution and habitat.** Western Atlantic form northern USA to northern Argentina (38° N-33° S). Mid-sized (TL > 500 mm) estuarine, coastal and demersal marine species. It inhabits from the surf zone to 60 m deep. On the inner shelf it is found at depth of up to 60 m on sandy and muddy bottoms along southern Brazil.

**Exploitation.** It is fished in small quantities by bottom trawl and gillnet fisheries.

**References.** Haimovici et al. (1996); Menezes et al. (2003).


**Material.** Otoliths from 42 specimens ranging between 100 to 470 mm TL, 8.3 to 1,120 g TW, 3.65 to 13.65 mm OL, and 1.6 to 4.85 mm OH.

**Relationships.**

\[
\begin{align*}
\text{TL} &= 18.901 \times \text{OL}^{1.245} \quad R^2 = 0.99 \\
\text{TL} &= 48.102 \times \text{OH}^{1.469} \quad R^2 = 0.97 \\
\text{TW} &= 0.040 \times \text{OL}^{3.946} \quad R^2 = 0.98 \\
\text{TW} &= 0.777 \times \text{OH}^{4.652} \quad R^2 = 0.96 \\
\text{TW} &= 4E-06 \times \text{TL}^{3.168} \quad R^2 = 0.99 \\
\text{OH/OL} &= \text{min. 0.31-max. 0.46}
\end{align*}
\]
**Micropogonias furnieri** (Desmarest 1823)

**Distribution and habitat.** Southeastern Brazil to northern Argentina (22° S-41° 30’ S). Mid-sized (TL < 450 mm) demersal marine species. It inhabits estuaries and the inner and outer shelf at depth of up to 100 m, on sandy and muddy bottoms along southern Brazil.

**Exploitation.** It is the most important target of bottom trawl and gillnet, small and large scale fisheries along southern Brazil, Uruguay and Argentina.

**References.** Haimovici et al. (1996); Menezes et al. (2003); Cousseau and Perrota (2013).


**Material.** Otoliths from 153 specimens ranging between 30 to 705 mm TL, 0.2 to 5,906 g TW, 1.33 to 32.1 mm OL, and 1.2 to 29.0 mm OH.

**Relationships.**

- \( TL = 19.198 \times OL^{1.081} \)  \( R^2 = 0.99 \)
- \( TL = 25.947 \times OH^{1.063} \)  \( R^2 = 0.98 \)
- \( TW = 0.042 \times OL^{3.546} \)  \( R^2 = 0.99 \)
- \( TW = 0.113 \times OH^{3.489} \)  \( R^2 = 0.98 \)
- \( TW = 3E-06 \times TL^{3.278} \)  \( R^2 = 0.99 \)
- \( OH/OL = \) min. 0.67-max. 1.00

(a) 6.5 mm OL, 145 mm TL

(b) 12.7 mm OL, 300 mm TL

© 22.2 mm OL, 549 mm TL
**Paralonchurus brasiliensis** (Steindachner 1875)

**Distribution and habitat.** Western Atlantic from Panama to northern Argentina (10° N-40° S). Small-sized (TL > 300 mm) estuarine, coastal and demersal marine species. It is abundant in the inner shelf on sandy and muddy bottoms up to 50 m depth along southern Brazil.

**Exploitation.** Fished by bottom trawl fisheries, mostly discarded on board.

**References.** Haimovici et al. (1996); Menezes et al. (2003).


**Material.** Otoliths from 80 specimens ranging between 32 to 227 mm TL, 0.3 to 127.5 g TW, 2.2 to 9.55 mm OL, and 1.4 to 3.5 mm OH.

**Relationships.**

\[
\begin{align*}
TL &= 15.352 \text{OL}^{1.201} \quad R^2 = 0.97 \\
TL &= 20.106 \text{OH}^{2.097} \quad R^2 = 0.94 \\
TW &= 0.010 \text{OL}^{4.171} \quad R^2 = 0.98 \\
TW &= 0.026 \text{OH}^{7.290} \quad R^2 = 0.95 \\
TW &= 9 \times 10^{-7} \text{TL}^{3.443} \quad R^2 = 0.99 \\
\text{OH/OL} &= \text{min. 0.33-max. 0.64}
\end{align*}
\]
**Pogonias courbina** (Lacepède 1803)

**Distribution and habitat.** Western Atlantic: from Nova Scotia to northern Argentina (45° N-42° S). Very large (TL < 1,600 mm) estuarine and demersal marine species, inhabiting the inner shelf up to 50 m depth. It is targeted by estuarine and coastal gillnets and occasionally by bottom trawls along southern Brazil.


**References.** Haimovici et al. (1996); Menezes et al. (2003: 89); Haimovici and Cardoso (2017) as *P. cromis*; Azpelicueta et al. 2019.


**Material.** Otoliths from 83 specimens ranging between 164 to 1,330 mm TL, 64 to 31,700 g TW, 6.2 to 25.4 mm OL, and 5.1 to 16.8 mm OH.

**Relationships.**

<table>
<thead>
<tr>
<th>Equation</th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>TL = 8.619 OL^{1.589}</td>
<td>0.99</td>
</tr>
<tr>
<td>TL = 8.023 OH^{1.840}</td>
<td>0.99</td>
</tr>
<tr>
<td>TW = 0.011 OL^{4.654}</td>
<td>0.99</td>
</tr>
<tr>
<td>TW = 0.009 OH^{5.380}</td>
<td>0.98</td>
</tr>
<tr>
<td>TW = 2E-05 TL^{2.914}</td>
<td>0.99</td>
</tr>
<tr>
<td>OH/OL = min. 0.60-max. 0.84</td>
<td></td>
</tr>
</tbody>
</table>

(a) 12.7 mm OL, 300 mm TL

(b) 11.3 mm OL, 409 mm TL

(c) 19 mm OL, 930 mm TL
**Stellifer rastrifer** (Jordan 1889)

**Distribution and habitat.** Caribe and southwestern Atlantic Ocean: from Colombia to southern Brazil. Small-sized (TL > 150 mm) estuarine, coastal and demersal marine species inhabiting in brackish estuaries on sandy and muddy bottoms of shallow waters on the inner shelf. Incidentally caught and discarded on board by the shrimp trawl fisheries during summer along southern Brazil.

**Exploitation.** Not targeted by any fishery.

**References.** Menezes et al. (2003); Haimovici et al. (2005).

**Material.** Otoliths from 29 specimens ranging between 32 to 150 mm TL, 0.24 to 48.8 g TW, 1.8 to 4.95 mm OL, and 1.35 to 3.4 mm OH.

**Relationships.**

\[
\begin{align*}
\text{TL} &= 14.621 \, \text{OL}^{1.431} \quad R^2 = 0.89 \\
\text{TL} &= 21.690 \, \text{OH}^{1.510} \quad R^2 = 0.93 \\
\text{TW} &= 0.018 \, \text{OL}^{4.769} \quad R^2 = 0.88 \\
\text{TW} &= 0.067 \, \text{OH}^{5.055} \quad R^2 = 0.93 \\
\text{TW} &= 2E-06 \, \text{TL}^{3.338} \quad R^2 = 0.99 \\
\text{OH/OL} &= \min. 0.64 - \max. 0.77
\end{align*}
\]

Umbrina canosai Berg 1895

**Distribution and habitat.** Southeastern Brazil to northern Argentina (22° S-41° 30’ S). Mid-sized (TL < 450 mm) demersal and coastal marine species. It inhabits the inner and outer shelf at depth of up to 150 m on sandy and muddy bottoms along southern Brazil.

**Exploitation.** An important target of bottom trawl and gillnet fisheries along southern Brazil.

**References.** Haimovič et al. (1996); Menezes et al. (2003); Cousseau and Perrota (2013).


**Material.** Otoliths from 77 specimens ranging between 61 to 466 mm TL, 2 to 1,237 g TW, 3.15 to 15.85 mm OL and 2.7 to 9.7 mm OH.

**Relationships.**
\[
\begin{align*}
    \text{TL} &= 12.483 \text{ OL}^{1.316} \quad R^2 = 0.99 \\
    \text{TL} &= 11.881 \text{ OH}^{1.638} \quad R^2 = 0.97 \\
    \text{TW} &= 0.019 \text{ OL}^{4.093} \quad R^2 = 0.99 \\
    \text{TW} &= 0.016 \text{ OH}^{5.130} \quad R^2 = 0.97 \\
    \text{TW} &= 8E-06 \text{ TL}^{3.107} \quad R^2 = 0.99 \\
    \text{OH/OL} &= \text{min. 0.55-max. 0.89}
\end{align*}
\]

(a) 3.3 mm OL, 61 mm TL

(b) 6.2 mm OL, 138 mm TL

(c) 9.5 mm OL, 243 mm TL

(d) 15.7 mm OL, 466 mm TL

![Graph showing relationship between otolith length and total length](image)
Family Serranidae
Acanthistius brasilianus (Cuvier 1828)

Distribution and habitat. Southwestern Atlantic Ocean: central to southern Brazil. Mid-sized (TL < 400 mm) demersal marine species typically inhabiting hard bottoms. It is occasionally fished in small numbers by bottom trawlers in the continental shelf along southern Brazil.

Exploitation. Not targeted by any fishery.

References. Haimovici et al. (1996); Menezes et al. (2005).

(a) 11.2 mm OL, 266 mm TL


Material. Otoliths from 2 specimens ranging between 263 and 266 mm TL, 393 and 418 g TW, 11.1 and 11.2 mm OL and 5.12 and 5.28 mm OH.

Relationships. Insufficient data.
**Acanthistius patachonicus** (Jenyns 1840)

**Distribution and habitat.** Southwestern Atlantic Ocean from southeastern Brazil to southern Argentina (23° S-48° S). Large-sized (TL > 600 mm) demersal marine species typically inhabiting hard bottoms. It is fished in small numbers by bottom trawlers in the shelf along southern Brazil.

**Exploitation.** Not targeted by any fishery.

**References.** Haimovici et al. (1996); Menezes et al. (2005); Cousseau and Perrota (2013).

**Description.** Shape elliptic. **Distal face** concave. **Proximal face** convex. **Anterior margin** angled. **Posterior margin** angled. **Dorsal margin** convex, sinuate. **Ventral margin** convex, sinuate. **Rostrum** present, short. **Antirostrum** absent. **Sulcus acusticus** opened at the anterior region, opened at posterior region. **Ostium** broader and shorter than cauda, shallow, funnel-like. **Cauda** shallow, tubular-slightly curved ventrally. **Crista** present.

**Material.** Otoliths from 19 specimens ranging between 277 to 433 mm TL, 372.5 to 1,475 g TW, 12.6 to 18.1 mm OL, and 6.05 to 8.45 mm OH.

**Relationships.**

\[
\text{TL} = 11.344 \text{ OL}^{1.257} \quad R^2 = 0.86 \\
\text{TL} = 24.531 \text{ OH}^{1.344} \quad R^2 = 0.82 \\
\text{TW} = 0.022 \text{ OL}^{3.797} \quad R^2 = 0.87 \\
\text{TW} = 0.206 \text{ OH}^{4.116} \quad R^2 = 0.86 \\
\text{TW} = 2E-05 \text{ TL}^{2.928} \quad R^2 = 0.95 \\
\text{OH/OL} = \text{min. 0.44-max. 0.51}
\]
**Diplectrum formosum** (Linnaeus 1766)

**Distribution and habitat.** Western Atlantic from Virginia, USA, to Uruguay (35° N and 36° S). Small-sized (TL > 300 mm) demersal neritic marine shallow water species. Uncommon along southern Brazil.

**Exploitation.** Not targeted by any fishery.

**References.** Menezes et al. (2003).


**Material.** Otoliths from 15 specimens ranging between 152 to 203 mm TL, 50.4 to 100 g TW, 5.65 to 7.86 mm OL, and 2.83 to 3.57 mm OH.

**Relationships.**

\[
\begin{align*}
TL &= 31.66 + 21.687 \text{OL} \quad R^2 = 0.90 \\
TL &= 39.877 \text{OH}^{1.279} \quad R^2 = 0.88 \\
TW &= 0.798 \text{OL}^{2.383} \quad R^2 = 0.99 \\
TW &= 0.527 \text{OH}^{4.210} \quad R^2 = 0.89 \\
TW &= 2E-06 \text{TL}^{3.350} \quad R^2 = 0.99 \\
\text{OH/OL} &= \text{min. 0.44-max. 0.52}
\end{align*}
\]
**Diplectrum radiale** (Quoy and Gaimard 1824)

**Distribution and habitat.** Western Atlantic: Florida to Uruguay. Small-sized (TL > 300 mm) estuarine, demersal marine shallow water species. Uncommon along southern Brazil.

**Exploitation.** Not targeted by any fishery.

**References.** Menezes et al. (2003)


**Material.** Otoliths from 14 specimens ranging between 152 to 238 mm TL, 50.2 to 214 g TW, 5.81 to 8.75 mm OL, and 2.57 to 3.83 mm OH.

**Relationships.**

\[
\begin{align*}
TL &= -0.234 + 26.417 \times OL \quad R^2 = 0.91 \\
TL &= 57.026 \times OH^{1.076} \quad R^2 = 0.90 \\
TW &= 0.186 \times OL^{3.167} \quad R^2 = 0.91 \\
TW &= 1.923 \times OH^{3.529} \quad R^2 = 0.93 \\
WL &= 2E-05 \times TL^{2.981} \quad R^2 = 0.97 \\
OH/OL &= \text{min. 0.39-max. 0.48}
\end{align*}
\]
Dules auriga Cuvier 1829

**Distribution and habitat.** Southwest Atlantic: Espírito Santo, Brazil to northern Argentina. Small-sized (TL > 300 mm) demersal marine shallow water species. It is commonly caught and discarded on board by bottom trawlers in the shelf (< 150 m) along southern Brazil.

**Exploitation.** Not targeted by any fishery.

**References.** Menezes et al. (2003); Rovani and Cardoso (2018).


**Material.** Otoliths from 24 specimens ranging between 77 to 172 mm TL, 6.3 to 91 g TW, 3.7 to 7.55 mm OL, and 1.85 to 3.25 mm OH.

**Relationships.**

- TL = -3.791 + 23.621 OL \( R^2 = 0.92 \)
- TL = 38.816 OH\(^{1.291} \) \( R^2 = 0.86 \)
- TW = 0.054 OL\(^{3.707} \) \( R^2 = 0.96 \)
- TW = 0.488 OH\(^{4.547} \) \( R^2 = 0.90 \)
- TW = 2E-06 TL\(^{3.394} \) \( R^2 = 0.97 \)
- OH/OL = min. 0.41-max. 0.50
**Serranus atrobranchus** (Cuvier 1829)

**Distribution and habitat.** Western Atlantic: Florida to southern Brazil. Small-sized (TL < 200 mm) demersal marine species. It is incidentally caught in small quantities and discarded on board by bottom trawlers fishing in the outer continental shelf and shelf break along southern Brazil.

**Exploitation.** Not targeted by any fishery.

**References.** Menezes et al. (2003); Bernardes et al. (2005); Haimovici et al. (2008).


**Material.** Otoliths from 12 specimens ranging between 74 to 200 mm TL, 5.2 to 105 g TW, 1.7 to 3.73 mm OL and 1.91 to 2.27 mm OH.

**Relationships.**

\[
\begin{align*}
\text{TL} & = -28.67 + 30.546 \times \text{OL} \quad R^2 = 0.95 \\
\text{TL} & = 39.587 \times \text{OH}^{1.294} \quad R^2 = 0.96 \\
\text{TW} & = 0.067 \times \text{OL}^{3.644} \quad R^2 = 0.97 \\
\text{TW} & = 0.719 \times \text{OH}^{3.842} \quad R^2 = 0.97 \\
\text{TW} & = 8 \times 10^{-6} \times \text{TL}^{3.088} \quad R^2 = 0.99 \\
\text{OH/OL} & = \text{min. 0.44-max. 0.52}
\end{align*}
\]
Family Sparidae
*Pagrus pagrus* (Linnaeus 1758)

**Distribution and habitat.** Western and eastern Atlantic and Mediterranean Sea. In the western Atlantic: from New York to Argentina. Mid to large-sized demersal marine species (TL > 600 mm). It inhabits the continental shelf on bottom reefs and biotectic sediments. It is fished with hook and line and incidentally caught by bottom trawlers along southern Brazil.

**Exploitation.** Commercially valuable species. Its fishery in southern Brazil collapsed in the 1980s. Fished with hook and lines in small quantities.

**References.** Menezes et al. (2003); Bernardes et al. (2006); Haimovici et al. (2005, 2008, 2020).


**Material.** Otoliths from 34 specimens ranging between 113 to 458 mm TL, 24 to 1,365 g TW, 3.67 to 14.3 mm OL, and 2.58 to 8.63 mm OH.

**Relationships.**
\[
\begin{align*}
\text{TL} &= 14.390 \text{ OL}^{1.282} \quad R^2 = 0.99 \\
\text{TL} &= 17.201 \text{ OH}^{1.472} \quad R^2 = 0.99 \\
\text{TW} &= 0.078 \text{ OL}^{3.613} \quad R^2 = 0.99 \\
\text{TW} &= 0.095 \text{ OH}^{4.305} \quad R^2 = 0.98 \\
\text{TW} &= 2E-05 \text{ TL}^{2.949} \quad R^2 = 0.99 \\
\text{OH/OL} &= \text{min. 0.59-max. 0.75}
\end{align*}
\]
Family Synagropidae
Parascombrops spinosus (Schultz 1940)

Distribution and habitat. Western Atlantic: Canada to Uruguay. Small-sized (TL < 150 mm) bathydemersal marine species. It is incidentally caught and discarded on board by bottom trawlers fishing in the outer shelf and upper continental slope (50-600 m) along southern Brazil.

Exploitation. Not targeted by any fishery.

References. Menezes et al. (2003) as Synagrops spinosus; Bernardes et al. (2005); Haimovici et al. (2008).


Material. Otoliths from 35 specimens ranging between 70 to 149 mm TL, 3 to 29 g TW, 4.54 to 8.23 mm OL and 2.30 to 4.39 mm OH.

Relationships.

\[
\begin{align*}
\text{TL} &= 10.277 \text{OL}^{1.244} \quad R^2 = 0.94 \\
\text{TL} &= 26.602 \text{OH}^{1.156} \quad R^2 = 0.92 \\
\text{TW} &= 0.010 \text{OL}^{3.768} \quad R^2 = 0.93 \\
\text{TW} &= 0.179 \text{OH}^{3.512} \quad R^2 = 0.90 \\
\text{TW} &= 1E-05 \text{TL}^{2.969} \quad R^2 = 0.95 \\
\text{OH/OL} &= \text{min.} \ 0.48 - \text{max.} \ 0.54
\end{align*}
\]
**Synagrops bellus** (Goode and Bean 1896)

**Distribution and habitat.** Atlantic and western Pacific oceans. Small-sized marine (TL < 300 mm), bathydemersal species. It is incidentally caught and discarded on board by bottom trawlers fishing in the outer shelf and upper continental slope (50-600 m) along southern Brazil.

**Exploitation.** Not targeted by any fishery.

**References.** Menezes et al. (2003) Bernardes et al. (2005), Haimovici et al. (2008).


**Material.** Otoliths from 26 specimens ranging between 90 to 271 mm TL, 7 to 218.8 g TW, 3.27 to 6.75 mm OL and 1.85 to 4.46 mm OH.

**Relationships.**

\[ TL = 6.324 \text{OL}^{1.915} \quad R^2 = 0.95 \]
\[ TL = 14.422 \text{OH}^{1.951} \quad R^2 = 0.92 \]
\[ TW = 0.002 \text{OL}^{5.743} \quad R^2 = 0.95 \]
\[ TW = 0.033 \text{OH}^{5.771} \quad R^2 = 0.92 \]
\[ TW = 2E-05 \text{TL}^{2.906} \quad R^2 = 0.98 \]
\[ \text{OH/OL} = \text{min. 0.57-max. 0.70} \]
Family Trichiuridae

*Trichiurus lepturus* Linnaeus 1758

**Distribution and habitat.** Circumtropical and temperate waters of the world. Large-sized (TL > 1,500 mm) brackish, marine, benthopelagic, amphidromous species. It is common in the continental shelf and upper slope along southern Brazil.

**Exploitation.** Fished by bottom trawls in the continental shelf and mostly discarded on board.

**References.** Nakamura and Parin (1993); Haimovic et al. (1996, 2008); Menezes et al. (2003).


**Material.** Otoliths from 49 specimens ranging between 184 to 1,340 mm TL, 2 to 1,780 g TW, 1.8 to 8.6 mm OL, and 0.7 to 3.3 mm OH.

**Relationships.**

\[
\begin{align*}
\text{TL} &= 84.378 \text{ OL}^{1.302} & R^2 &= 0.98 \\
\text{TL} &= 298.78 \text{ OH}^{1.250} & R^2 &= 0.97 \\
\text{TW} &= 0.109 \text{ OL}^{4.526} & R^2 &= 0.98 \\
\text{TW} &= 8.834 \text{ OH}^{4.352} & R^2 &= 0.98 \\
\text{TW} &= 3E-08 \text{ TL}^{3.453} & R^2 &= 0.99 \\
\text{OH/OL} &= \text{min. 0.33-max. 0.48}
\end{align*}
\]
Family Zoarcidae

*Notolycodes schmidti* Gosztonyi 1977

**Distribution and habitat.** Southwest Atlantic: Brazil and Argentina. Mid-sized (TL < 400 mm) bathydemersal marine species. It is incidentally caught and discarded on board by bottom trawlers fishing in the upper continental slope along southern Brazil.

**Exploitation.** Not targeted by any fishery.

**References.** Anderson and Federov (2004).

![Otolith](image)

(a) 5.5 mm OL, 395 mm TL


**Material.** Otoliths from 3 specimens ranging between 338 to 395 mm TL, 234 to 388 g TW, 5.18 to 5.47 mm OL, and 3.39 to 4 mm OH.

**Relationships.** Insufficient data.
Order Pleuronectiformes
Family Cynoglossidae
Symphurus jenynsi Evermann and Kendall 1906

Distribution and habitat. Southwest Atlantic: southeastern Brazil and central Argentina. Small-sized (TL < 350 mm) demersal marine species. Incidentally caught in small numbers by bottom trawlers fishing in the continental shelf along southern Brazil and discarded on board.

Exploitation. Not targeted by any fishery.

References. Haimovici et al. (1996); Menezes et al. (2003).


Material. Otoliths from 31 specimens ranging between 52 to 355 mm TL, 1 to 394.1 g TW, 1.1 to 3.9 mm OL and 1.05 to 3.45 mm OH.

Relationships.
Left
TL = 45.627 OL\(^{1.449}\)\( R^2 = 0.95\)
TL = 53.539 OH\(^{1.462}\)\( R^2 = 0.94\)
TW = 0.500 OL\(^{4.651}\)\( R^2 = 0.94\)
TW = 0.832 OH\(^{4.704}\)\( R^2 = 0.93\)
TW = 2E-06 TL\(^{3.214}\)\( R^2 = 0.98\)
OH/OL = min. 0.81-max. 0.97

Right
TL = 47.175 OL\(^{1.012}\)\( R^2 = 0.93\)
TL = 47.776 OH\(^{1.583}\)\( R^2 = 0.94\)
TW = 0.547 OL\(^{4.580}\)\( R^2 = 0.93\)
TW = 0.574 OH\(^{5.891}\)\( R^2 = 0.93\)
OH/OL = min. 0.76-max. 1.00

\( TL \) = Total length, \( OL \) = Otolith length, \( OH \) = Otolith height, \( TW \) = Total weight.
Family Cyclopsettidae  
*Etropus longimanus* Norman 1933

**Distribution and habitat.** Southwestern Atlantic Ocean Rio de Janeiro, Brazil to Argentina. Very small-sized (TL < 150 mm) demersal marine species. It is occasionally fished and discarded on board by bottom trawlers in the continental shelf along southern Brazil.

**Exploitation.** Not targeted by any fishery.

**References.** Haimovici et al. (1996); Menezes et al. (2003).

![Otoliths from *Etropus longimanus*](image)


**Material.** Otoliths from 162 specimens ranging between 85 to 157 mm TL, 5 to 28.2 g TW, 2.4 to 4.1 mm OL, and 2 to 3.65 mm OH.

**Relationships.**

Left

\[ TL = 11.101 + 34.370 \text{ OL} \quad R^2 = 0.58 \]
\[ TL = 44.414 \text{ OH}^{1.016} \quad R^2 = 0.63 \]
\[ TW = 0.536 \text{ OL}^{2.466} \quad R^2 = 0.54 \]
\[ TW = 0.921 \text{ OH}^{2.673} \quad R^2 = 0.58 \]
\[ TW = 4 \times 10^{-5} \text{ TL}^{2.652} \quad R^2 = 0.93 \]
\[ \text{OH/OL} = \text{min. 0.74-max. 0.91} \]

Right

\[ TL = -10.260 + 34.370 \text{ OL} \quad R^2 = 0.61 \]
\[ TL = 51.216 \text{ OH}^{0.881} \quad R^2 = 0.51 \]
\[ TW = 0.392 \text{ OL}^{3.007} \quad R^2 = 0.60 \]
\[ TW = 1.211 \text{ OH}^{2.413} \quad R^2 = 0.91 \]
\[ \text{OH/OL} = \text{min. 0.72-max. 0.94} \]
*Syacium papillosum* (Linnaeus 1758)

**Distribution and habitat.** Western Atlantic: North Carolina, USA and northern Gulf of Mexico to southern Brazil. Small-sized (TL < 399 mm) marine demersal, reef-associated species. It is incidentally fished along southern Brazil by trawlers in Santa Catarina.

**Exploitation.** Not targeted by any fishery, along southern Brazil fished rarely by trawlers.

**References.** Menezes et al. (2003); Bernardes et al. (2005); Haimovici et al. (2008).


**Material.** Otoliths from 21 specimens ranging between 131 to 233 mm TL, 22.4 to 116 g TW, 3.9 to 7.2 mm OL, and 3 to 5.5 mm OH.

**Relationships.**

**Left**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Equation</th>
<th>$R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>TL</td>
<td>$-2.651 + 33.937 \text{OL}$</td>
<td>0.89</td>
</tr>
<tr>
<td>TL</td>
<td>$43.022 \text{OH}^{1.001}$</td>
<td>0.88</td>
</tr>
<tr>
<td>TW</td>
<td>$0.262 \text{OL}^{3.235}$</td>
<td>0.92</td>
</tr>
<tr>
<td>TW</td>
<td>$0.879 \text{OH}^{2.969}$</td>
<td>0.84</td>
</tr>
<tr>
<td>TW</td>
<td>$7\times10^{-6} \text{TL}^{3.072}$</td>
<td>0.99</td>
</tr>
<tr>
<td>OH/OL</td>
<td>min. 0.69-max. 0.86</td>
<td></td>
</tr>
</tbody>
</table>

**Right**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Equation</th>
<th>$R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>TL</td>
<td>$-9.169 + 35.484 \text{OL}$</td>
<td>0.95</td>
</tr>
<tr>
<td>TL</td>
<td>$42.855 \text{OH}^{1.025}$</td>
<td>0.85</td>
</tr>
<tr>
<td>TW</td>
<td>$0.203 \text{OL}^{3.422}$</td>
<td>0.97</td>
</tr>
<tr>
<td>TW</td>
<td>$0.434 \text{OH}^{3.579}$</td>
<td>0.85</td>
</tr>
<tr>
<td>OH/OL</td>
<td>min. 0.67-max. 0.84</td>
<td></td>
</tr>
</tbody>
</table>

(a) 3.8 mm OL, 128 mm TL

(b) 6.9 mm OL, 233 mm TL

Otolith length (mm)

Total length (mm)
Family Oncopteridae

*Oncopterus darwinii* Steindachner 1874

**Distribution and habitat.** Southwest Atlantic: Santa Catarina, Brazil to Golfo San Matías, Argentina. Small-sized (TL < 300 mm) demersal marine species. It is incidentally caught along southern Brazil and discarded on board of the bottom trawl fishery on the continental shelf.

**Exploitation.** Not targeted by any fishery.

**References.** Haimovici et al. (1996); Menezes et al. (2003).

![Image of an otolith](image)

(a) 2.7 mm OL, 285 mm TL


**Material.** Otoliths from 24 specimens ranging between 103 to 285 mm TL, 14.2 to 264 g TW, 1.25 to 2.85 mm OL, and 1.2 to 2.45 mm OH.

**Relationships.**

Left

\[
\begin{align*}
\text{TL} &= -40.23 + 118.94 \text{ OL} & R^2 &= 0.86 \\
\text{TL} &= 82.387 \text{ OH}^{1.431} & R^2 &= 0.93 \\
\text{TW} &= 5.864 \text{ OL}^{3.851} & R^2 &= 0.90 \\
\text{TW} &= 6.658 \text{ OH}^{4.237} & R^2 &= 0.94 \\
\text{TW} &= 2E-05 \text{ TL}^{2.923} & R^2 &= 0.99 \\
\text{OH/OL} &= \text{min. 0.81-max. 1.00} \\
\end{align*}
\]

Right

\[
\begin{align*}
\text{TL} &= -34.81 + 113.33 \text{ OL} & R^2 &= 0.91 \\
\text{TL} &= 80.421 \text{ OH}^{1.441} & R^2 &= 0.92 \\
\text{TW} &= 6.001 \text{ OL}^{3.689} & R^2 &= 0.95 \\
\text{TW} &= 6.242 \text{ OH}^{4.251} & R^2 &= 0.93 \\
\text{OH/OL} &= \text{min. 0.81-max. 1.00} \\
\end{align*}
\]

![Graph showing relationships between otolith length and total length](image)
Family Paralichthyidae
Paralichthys isosceles Jordan 1891

Distribution and habitat. Southwest Atlantic: Brazil to Argentina. Small-sized (TL > 400 mm) demersal marine species. It is incidentally caught along southern Brazil by the bottom trawl fishery in outer continental shelf and upper continental slope, mostly at depth between 50-200 m.

Exploitation. Fished by bottom trawlers on the continental shelf. Only larger specimens landed.


Material. Otoliths from 62 specimens ranging between 95 to 358 mm TL, 4.2 to 400 g TW, 2.3 to 7.55 mm OL, and 2 to 5.25 mm OH.

Relationships.

Left
TL = -1.558 + 43.982 OL R^2 = 0.98
TL = 36.144 OH^{1.328} R^2 = 0.98
TW = 0.232 OL^{3.637} R^2 = 0.98
TW = 0.146 OH^{4.683} R^2 = 0.97
TW = 5E-07 TL^{3.511} R^2 = 0.99
OH/OL = min. 0.68-max. 0.96

Right
TL = -2.746 + 44.441 OL R^2 = 0.98
TL = 35.349 OH^{1.369} R^2 = 0.98
TW = 0.245 OL^{3.621} R^2 = 0.98
TW = 0.139 OH^{4.811} R^2 = 0.97
OH/OL = min. 0.67-max. 0.96

(a) 2.2 mm OL, 96 mm TL
(b) 5.2 mm OL, 228 mm TL
(c) 8.9 mm OL, 392 mm TL
**Paralichthys orbignyanus** (Valenciennes 1839)

**Distribution and habitat.** Southwest Atlantic: Rio de Janeiro, Brazil to San Matias Gulf in Argentina. Large-sized (TL > 1,000 mm) demersal species. It inhabits brackish and marine coastal waters.

**Exploitation.** A valuable commercial species fished with gillnets in coastal lagoons, and with bottom trawls in shallow coastal waters along southern Brazil.

**References.** Menezes et al. (2003); Fischer et al. (2011); Cousseau and Perrota (2013).

**Description.** Shape cuneiform. **Distal face** concave. **Proximal face** convex. **Anterior margin** angled. **Posterior margin** round to double-peaked. **Dorsal margin** flattened, smooth to sinuate. **Ventral margin** convex, sinuate. **Rostrum** present, short. **Antirostrum** absent. **Sulcus acusticus** opened at the anterior region, closed at posterior region. **Ostium** broader and same length of cauda, shallow, tubular. **Cauda** shallow, tubular-straight. **Crista** present.

**Material.** Otoliths from 14 specimens ranging between 116 to 985 mm TL, 13.4 to 5,900 g TW, 2.5 to 12 mm OL, and 1.7 to 6 mm OH.

**Relationships.**

**Left**

\[
\begin{align*}
\text{TL} &= -135.1 + 96.843 \text{OL} \\
R^2 &= 0.92 \\
\text{TL} &= 50.144 \text{OH}^{1.702} \\
R^2 &= 0.91 \\
\text{TW} &= 0.342 \text{OL}^{3.610} \\
R^2 &= 0.77 \\
\text{TW} &= 2.009 \text{OH}^{3.547} \\
R^2 &= 0.66 \\
\text{TW} &= 5E-06 \text{TL}^{3.061} \\
R^2 &= 0.99 \\
\text{OH}/\text{OL} &= \text{min. 0.51-max. 0.77}
\end{align*}
\]

**Right**

\[
\begin{align*}
\text{TL} &= -119.9 + 97.274 \text{OL} \\
R^2 &= 0.91 \\
\text{TL} &= 53.627 \text{OH}^{1.701} \\
R^2 &= 0.89 \\
\text{TW} &= 0.144 \text{OL}^{4.433} \\
R^2 &= 0.88 \\
\text{TW} &= 1.721 \text{OH}^{3.860} \\
R^2 &= 0.74 \\
\text{OH}/\text{OL} &= \text{min. 0.49-max. 0.71}
\end{align*}
\]
**Paralichthys patagonicus** Jordan 1889

**Distribution and habitat.** Southwest Atlantic: Rio de Janeiro, Brazil to San Jorge Gulf in Argentina. Mid-sized (TL > 600 mm) demersal marine species. It is present in the continental shelf along southern Brazil.

**Exploitation.** A valuable commercial species targeted by double rig bottom trawlers in the inner continental shelf (< 100 m).

**References.** Menezes et al. (2003); Cousseau and Perrota (2013).

**Material.** Otoliths from 45 specimens ranging between 87 to 607 mm TL, 6.9 to 2,000 g TW, 2.1 to 12 mm OL, and 1.4 to 6.9 mm OH.

**Relationships.**

Left

\[ TL = -5.622 + 55.764 \text{ OL} \quad R^2 = 0.92 \]
\[ TL = 50.119 \text{ OH}^{1.334} \quad R^2 = 0.92 \]
\[ TW = 0.316 \text{ OL}^{3.630} \quad R^2 = 0.98 \]
\[ TW = 0.697 \text{ OH}^{4.055} \quad R^2 = 0.96 \]
\[ TL = 3E-06 \text{ TW}^{3.158} \quad R^2 = 0.99 \]
\[ \text{OH/OL} = \text{min. 0.57-max. 0.77} \]

Right

\[ TL = -10.81 + 53.689 \text{ OL} \quad R^2 = 0.91 \]
\[ TL = 53.085 \text{ OH}^{1.314} \quad R^2 = 0.87 \]
\[ TW = 0.251 \text{ OL}^{3.777} \quad R^2 = 0.99 \]
\[ TW = 0.433 \text{ OH}^{4.400} \quad R^2 = 0.99 \]
\[ \text{OH/OL} = \text{min. 0.55-max. 0.78} \]


(a) 2.5 mm OL, 131 mm TL

(b) 5.9 mm OL, 321 mm TL

(c) 11 mm OL, 607 mm TL

700
600
500
400
300
200

Total length (mm)

5.0 7.5 10.0

Otolith length (mm)

Side
Left
Right

5.0 7.5 10.0
Paralichthys triocellatus Miranda Ribeiro 1903

Distribution and habitat. Southwest Atlantic: Rio de Janeiro, Brazil to Uruguay. Small-sized (TL > 350 mm) demersal marine species. It occurs in the outer continental shelf and slope, mostly at depth between 100 and 300 m along southern Brazil.

Exploitation. Fished in small numbers by bottom trawlers. Only larger specimens landed.


Material. Otoliths from 29 specimens ranging between 161 to 323 mm TL, 36 to 383 g TW, 3.7 to 8 mm OL and 3 to 4.5 mm OH.

Relationships.
Left
TL = 15.557 + 40.088 OL \ R^2 = 0.90
TL = 40.968 OH^{3.331} \ R^2 = 0.84
TW = 0.542 OL^{3.183} \ R^2 = 0.89
TW = 0.358 OH^{4.445} \ R^2 = 0.84
TW = 2E-06 TL^{3.262} \ R^2 = 0.98
OH/OL = min. 0.55-max. 0.81

Right
TL = -6.318 + 43.466 OL \ R^2 = 0.92
TL = 39.291 OH^{3.368} \ R^2 = 0.88
TW = 0.358 OL^{4.445} \ R^2 = 0.85
TW = 0.365 OH^{4.453} \ R^2 = 0.85
OH/OL = min. 0.54-max. 0.75


(a) 4.3 mm OL, 188 mm TL

(b) 7.8 mm OL, 330 mm TL
**Xystreurys rasilis** (Jordan 1891)

**Distribution and habitat.** Southwest Atlantic: Rio de Janeiro, Brazil to Patagonia, Argentina. Mid-sized TL < 400 mm) demersal marine species. It occurs in the continental shelf along southern Brazil. Occasionally fished by bottom trawlers.

**Exploitation.** Larger specimens landed in small numbers.

**References.** Haimovici et al. (1996) as *Verrecundum rasile*; Menezes et al. (2003).


**Material.** Otoliths from 49 specimens ranging between 127 to 365 mm TL, 11.4 to 494 g TW, 3.2 to 7.4 mm OL, and 2.2 to 4.5 mm OH.

**Relationships.**

Left

\[
\begin{align*}
\text{TL} &= 29.810 \times \text{OL}^{1.264} \quad R^2 = 0.90 \\
\text{TL} &= 54.647 \times \text{OH}^{1.255} \quad R^2 = 0.78 \\
\text{TW} &= 0.107 \times \text{OL}^{4.215} \quad R^2 = 0.87 \\
\text{TW} &= 0.719 \times \text{OH}^{4.287} \quad R^2 = 0.78 \\
\text{TW} &= 1E-06 \times \text{TL}^{3.371} \quad R^2 = 0.98 \\
\text{OH/OL} &= \text{min. 0.52-max. 0.74}
\end{align*}
\]

Right

\[
\begin{align*}
\text{TL} &= 33.065 \times \text{OL}^{1.203} \quad R^2 = 0.92 \\
\text{TL} &= 51.319 \times \text{OH}^{1.339} \quad R^2 = 0.77 \\
\text{TW} &= 0.141 \times \text{OL}^{4.056} \quad R^2 = 0.90 \\
\text{TW} &= 0.583 \times \text{OH}^{4.566} \quad R^2 = 0.77 \\
\text{OH/OL} &= \text{min. 0.50-max. 0.76}
\end{align*}
\]
Order Polymixiiformes  
Family Polymixiidae  
Polymixia lowei Günther 1859

**Distribution and habitat.** Western Atlantic: Canada to Uruguay. Small-sized (TL < 300 mm) bathydemersal marine species. It is incidentally caught and discarded by bottom trawlers fishing in the outer shelf and upper continental slope (100-500 m) along southern Brazil.

**Exploitation.** Not targeted by any fishery.

**References.** Menezes et al. (2003); Bernardes et al. (2006). Haimovici et al. (2008).


**Material.** Otoliths from 48 specimens ranging between 73 to 242 mm TL, 6.3 to 186 g TW, 3.75 to 10.3 mm OL and 2.85 to 8.05 mm OH.

**Relationships.**

\[
\begin{align*}
\text{TL} &= -26.61 + 27.642 \: \text{OL} \\
\text{TL} &= 15.653 \: \text{OH}^{1.402} \\
\text{TW} &= 0.066 \: \text{OL}^{3.535} \\
\text{TW} &= 0.064 \: \text{OH}^{4.102} \\
\text{TW} &= 2E-05 \: \text{TL}^{2.921}
\end{align*}
\]

\[R^2 = 0.97\]
\[R^2 = 0.95\]
\[R^2 = 0.96\]
\[R^2 = 0.95\]
\[R^2 = 0.99\]

OH/OL = min. 0.63-max. 0.87

(a) 3.7 mm OL, 77 mm TL

(b) 6 mm OL, 140 mm TL

(c) 11.7 mm OL, 298 mm TL
Order Scombriformes  
Family Sphyraenidae  
*Sphyraena tome* Fowler 1903

**Distribution and habitat.** Rio de Janeiro and Rio Grande do Sul, Brazil to the north of Argentina. Small-sized (TL < 350 mm) pelagic-neritic marine species. It is incidentally caught and discarded on board by bottom trawlers in the continental shelf along southern Brazil.

**Exploitation.** Not targeted by any fishery.

**References.** Haimovici et al. (1996); Menezes et al. (2003).


**Material.** Otoliths from 5 specimens ranging between 130 to 325 mm TL, 7 to 150 g TW, 4.59 to 9.34 mm OL, and 1.97 to 3.43 mm OH.

**Relationships.**

\[
\begin{align*}
\text{TL} &= -10.08 + 36.737 \text{ OL} \quad R^2 = 0.98 \\
\text{TL} &= 42.887 \text{ OH}^{1.637} \quad R^2 = 0.99 \\
\text{TW} &= 0.006 \text{ OL}^{4.669} \quad R^2 = 0.96 \\
\text{TW} &= 0.172 \text{ OH}^{5.484} \quad R^2 = 0.99 \\
\text{TW} &= 7E-07 \text{ TL}^{3.303} \quad R^2 = 0.99 \\
\text{OH/OL} &= \text{min.} \ 0.63 - \text{max.} \ 0.87
\end{align*}
\]

(a) 3.8 mm OL, 130 mm TL  
(b) 8.5 mm OL, 303 mm TL  
(c) 9.1 mm OL, 325 mm TL
Family Stromateidae

*Peprilus paru* (Linnaeus 1758)

**Distribution and habitat.** Western Atlantic from Panama to Argentina. Small-sized (TL < 350 mm) brackish and bentipelagic marine species. It is incidentally caught by bottom trawl and gillnets boats fishing in the inner continental shelf along southern Brazil.

**Exploitation.** Larger specimens regularly landed.

**References.** Haimovici et al. (1996); Menezes et al. (2003).


**Material.** Otoliths from 63 specimens ranging between 14 to 342 mm TL, 0.1 to 602 g TW, 0.9 to 12.2 mm OL, and 0.8 to 5.7 mm OH.

**Relationships.**

\[
\begin{align*}
\text{TL} &= 17.028 \text{ OL}^{1.222} & R^2 &= 0.99 \\
\text{TL} &= 22.120 \text{ OH}^{1.484} & R^2 &= 0.97 \\
\text{TW} &= 0.112 \text{ OL}^{3.506} & R^2 &= 0.98 \\
\text{TW} &= 0.240 \text{ OH}^{4.252} & R^2 &= 0.96 \\
\text{TWL} &= 3E-05 \text{ TL}^{2.867} & R^2 &= 0.99 \\
\text{OH/OL} &= \text{min. 0.47-max. 0.89}
\end{align*}
\]
Stromateus brasiliensis Fowler 1906

Distribution and habitat. Southwest Atlantic: southern Brazil to Tierra del Fuego, Argentina. Mid-sized (TL < 500 mm) benthopelagic marine species. It is incidentally caught and discarded on board by bottom trawlers fishing in winter in the continental shelf along southern Brazil.

Exploitation. Not targeted by any fishery.

References. Haimovici et al. (1996); Menezes et al. (2003); Cousseau and Perrota (2013).


Material. Otoliths from 19 specimens ranging between 88 to 395 mm TL, 5.7 to 1,095.6 g TW, 2.8 to 9.8 mm OL, and 1.5 to 3.56 mm OH.

Relationships.

| TL = 30.200 OL^{1.097} | R^2 = 0.97 |
| TL = 48.773 OH^{1.606} | R^2 = 0.96 |
| TW = 0.141 OL^{3.802} | R^2 = 0.97 |
| TW = 0.757 OH^{5.537} | R^2 = 0.96 |
| TW = 1E-06 TL^{3.443} | R^2 = 0.99 |
| OH/OL = min. 0.34-max. 0.54 |
Order Scorpaeniformes  
Family Peristediidae  
Peristedion altipinne Regan 1903

Distribution and habitat. Southwestern Atlantic: Rio de Janeiro to Rio Grande do Sul. Small-sized (TL < 300 mm) bathydemersal marine species. It is incidentally caught and discarded by bottom trawlers fishing in the outer shelf and upper continental slope along southern Brazil.

Exploitation. Not targeted by any fishery.

References. Menezes et al. (2003); Bernardes et al. (2005); Haimovici et al. (2008).

cauda, deep, round-oval. Cauda deep, tubular-straight. Crista present.

Material. Otoliths from 35 specimens ranging between 98 to 240 mm TL, 7 to 133 g TW, 2 to 4.18 mm OL, and 1.59 to 2.86 mm OH.

Relationships.

\[
\begin{align*}
TL &= -14.74 + 59.871 \text{ OL} \quad R^2 = 0.91 \\
TL &= 51.408 \text{ OH}^{1.443} \quad R^2 = 0.92 \\
\text{TW} &= 0.765 \text{ OL}^{3.686} \quad R^2 = 0.94 \\
\text{TW} &= 0.980 \text{ OH}^{4.742} \quad R^2 = 0.94 \\
\text{TW} &= 3E-06 \text{ TL}3.249 \quad R^2 = 0.99 \\
\text{OH/OL} &= \text{min. 0.62-max. 0.84}
\end{align*}
\]


(a) 1.9 mm OL, 98 mm TL

(b) 4.3 mm OL, 240 mm TL
**Peristedion gracile** Goode and Bean 1896

**Distribution and habitat.** Southwestern Atlantic: Rio de Janeiro to Rio Grande do Sul. Small-sized (TL < 250 mm) bathydemersal marine species. It is incidentally caught and discarded by bottom trawlers fishing in the outer shelf and upper continental slope along southern Brazil.

**Exploitation.** Not targeted by any fishery.

**References.** Menezes et al. (2003); Bernardes et al. (2005). Haimovici et al. (2008).


**Material.** Otoliths from 17 specimens ranging between 100 to 223 mm TL, 5 to 67 g TW, 2.4 to 4.8 mm OL, and 1.42 to 2.48 mm OH.

**Relationships.**
- TL = -19.61 + 50.024 OL $\quad R^2 = 0.96$
- TL = 61.707 OH$^{1.372} \quad R^2 = 0.90$
- TW = 0.180 OL$^{3.785} \quad R^2 = 0.92$
- TW = 0.907 OH$^{4.624} \quad R^2 = 0.84$
- TW = 7E-07 TL$^{3.412} \quad R^2 = 0.96$
- OH/OL = min. 0.49-max. 0.69
Family Sebastidae  
*Helicolenus lahillei* Norman 1937

**Distribution and habitat.** Southwestern Atlantic: central Brazil to northern Argentina; south of Rio Grande to Argentina. Mid-sized (TL < 500 mm) demersal marine species. It is fished and discarded on board by the trawlers or used as bait by hook and line fishing boats in the upper continental slope along southern Brazil.

**Exploitation.** Not targeted by any fishery.

**References.** Menezes et al. (2003); Fagundes et al. (2005); Haimovici et al. (2008).

**Material.** Otoliths from 30 specimens ranging between 74 to 410 mm TL, 5.7 to 997 g TW, 3.7 to 13.8 mm OL, and 2.3 to 7.15 mm OH.

**Relationships.**

<table>
<thead>
<tr>
<th>Equation</th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>TL = 12.002 OL$^{1.340}$</td>
<td>0.98</td>
</tr>
<tr>
<td>TL = 20.992 OH$^{1.509}$</td>
<td>0.98</td>
</tr>
<tr>
<td>TW = 0.026 OL$^{4.027}$</td>
<td>0.98</td>
</tr>
<tr>
<td>TW = 0.142 OH$^{4.521}$</td>
<td>0.97</td>
</tr>
<tr>
<td>TW = 2E-05 TL$^{2.994}$</td>
<td>0.99</td>
</tr>
<tr>
<td>OH/OL = min. 0.48-max. 0.69</td>
<td>0.99</td>
</tr>
</tbody>
</table>


(a) 4.2 mm OL, 83 mm TL  
(b) 8.8 mm OL, 220 mm TL  
(c) 14.6 mm OL, 435 mm TL  

![Graph showing relationship between otolith length and total length](image)
**Family Setarchidae**  
*Setarches guentheri* Johnson 1862

**Distribution and habitat.** Circumglobal. It occurs along all Brazil. Small-sized (TL < 250 mm) benthopelagic marine species. It is caught in small numbers and discarded on board, by bottom trawlers in the upper continental slope along southern Brazil.

**Exploitation.** Not targeted by any fishery.

**References.** Menezes et al. (2003); Bernardes et al. (2005); Haimovici et al. (2008).


**Material.** Otoliths from 30 specimens ranging between 51 to 212 mm TL, 2 to 125.8 g TW, 2.48 to 10.65 mm OL, and 1.75 to 6.97 mm OH.

**Relationships.**

\[
\begin{align*}
\text{TL} &= 2.8434 + 20.159 \text{ OL} \quad R^2 = 0.96 \\
\text{TL} &= 26.482 \text{ OH}^{1.158} \quad R^2 = 0.98 \\
\text{TW} &= 0.081 \text{ OL}^{3.211} \quad R^2 = 0.98 \\
\text{TW} &= 0.204 \text{ OH}^{3.651} \quad R^2 = 0.98 \\
\text{TW} &= 7 \times 10^{-6} \text{ TL}^{3.150} \quad R^2 = 0.99 \\
\text{OH/OL} &= \text{min. 0.54-max. 0.72}
\end{align*}
\]
Family Triglidae

*Prionotus nudigula* Ginsburg 1950

**Distribution and habitat.** Southwestern Atlantic: Rio de Janeiro, Brazil to San Jorge Gulf along southern Argentina. Small-sized (TL < 300 mm) demersal marine species. It is incidentally caught and discarded on board by bottom trawlers fishing on the outer continental shelf and upper slope along southern Brazil.

**Exploitation.** Not targeted by any fishery.

**References.** Haimovici et al. (1996, 2008); Menezes et al. (2003); Cousseau and Perrota (2013).


**Material.** Otoliths from 45 specimens ranging between 84 to 227 mm TL, 5.6 to 143 g TW, 2.6 to 6.75 mm OL, and 1.75 to 4 mm OH.

**Relationships.**

- \( TL = -0.657 + 35.843 \times OL \) \( R^2 = 0.94 \)
- \( TL = 45.828 \times OH^{1.152} \) \( R^2 = 0.94 \)
- \( TW = 0.255 \times OL^{3.399} \) \( R^2 = 0.97 \)
- \( TW = 0.722 \times OH^{3.760} \) \( R^2 = 0.96 \)
- \( TW = 4E-06 \times TL^{3.204} \) \( R^2 = 0.99 \)
- \( OH/OL = \min. 0.59 - \max. 0.78 \)

(a) 1.9 mm OL, 69 mm TL

(b) 3.5 mm OL, 124 mm TL

(c) 7.4 mm OL, 265 mm TL
Prionotus punctatus (Bloch 1793)

**Distribution and habitat.** Circumglobal. It occurs along all Brazil. Small-sized (TL < 450 mm) demersal marine species. It is incidentally caught by bottom trawls and gillnets in the continental shelf along southern Brazil.

**Exploitation.** Larger specimens regularly landed.

**References.** Haimovici et al. (1996, 2008); Me-nezes et al. (2003: 74).

**Description.** Shape elliptic to oval. Distal face concave. Proximal face convex. Anterior margin round. Posterior margin round. Dorsal margin convex, smooth to dentate to sinuate. Ventral margin convex, smooth to dentate to sinuate. Ros-trum present, short. Antirostrum absent. Sulcus acusticus opened or closed at the anterior region, opened or closed at posterior region. Ostium same width and shorter than cauda, deep, round-oval to rectangular. Cauda deep, tubular-strongly curved ventrally. Crista present.

**Material.** Otoliths from 57 specimens ranging between 36 to 318 mm TL, 0.35 to 425 g TW, 1.5 to 9.0 mm OL, and 1.1 to 5.55 mm OH.

**Relationships.**

\[
\begin{align*}
&\text{TL} = 22.374 \text{ OL}^{1.246} \quad R^2 = 0.99 \\
&\text{TL} = 36.808 \text{ OH}^{1.275} \quad R^2 = 0.99 \\
&\text{TW} = 0.090 \text{ OL}^{3.939} \quad R^2 = 0.99 \\
&\text{TW} = 0.438 \text{ OH}^{4.023} \quad R^2 = 0.98 \\
&\text{TW} = 5E-06 \text{ TL}^{3.156} \quad R^2 = 0.99 \\
&\text{OH/OL} = \text{min. 0.55-max. 0.73}
\end{align*}
\]
**Order Siluriformes**  
**Family Ariidae**  
*Genidens barbus* (Lacepède 1803)

**Distribution and habitat.** Southwestern Atlantic Ocean from northeastern Brazil to the northern Argentina. Large-sized (TL > 800 mm) anadromous demersal species. It occurs in the Patos Lagoon and marine adjacent shelf waters along southern Brazil.

**Exploitation.** A commercially valuable species fished with gillnets in the estuary and trawl nets and hook and line in coastal waters up to 100 m. Its fishery in southern Brazil collapsed in the 1980s. Fishing is forbidden since 2014.

**References.** Menezes et al. (2003); Fischer et al. (2011).

**Description.** Shape oval. Anterior margin flattened. Posterior margin round. *Incisura linea basalis* absent in small individuals, deep in larger. *Sulculus lapilli* tubular slightly curved in small individuals, strongly curved in larger.

**Material.** Otoliths from 31 specimens ranging between 68 to 700 mm TL, 2.5 to 4,090 g TW, 3.35 to 14.7 mm OL, and 2.65 to 12 mm OH.

**Relationships.**

\[
\begin{align*}
\text{TL} &= 8.878 \text{OL}^{1.668} \quad R^2 = 0.98 \\
\text{TL} &= 12.193 \text{OH}^{1.624} \quad R^2 = 0.99 \\
\text{TW} &= 0.003 \text{OL}^{5.346} \quad R^2 = 0.98 \\
\text{TW} &= 0.009 \text{OH}^{5.201} \quad R^2 = 0.98 \\
\text{TW} &= 3E-06 \text{TL}^{3.196} \quad R^2 = 0.99 \\
\text{OH/OL} &= \text{min. 0.77-max. 1.00}
\end{align*}
\]

![Otolith images](a) 3.4 mm OL, 68 mm TL  
(b) 6.9 mm OL, 222 mm TL  
(c) 10.1 mm OL, 418 mm TL
**Genidens genidens** (Cuvier 1829)

**Distribution and habitat.** Southwestern Atlantic Ocean from Guianas to northern Argentina. Small-sized (TL \(< 450 \text{ mm})\) freshwater and estuarine species. Fished with gillnets in the Patos Lagoon along southern Brazil.

**Exploitation.** Small scale fishers in the Patos Lagoon.

**References.** Menezes et al. (2003); Fischer et al. (2011).

**Description.** Shape oval. *Anterior margin* flattened. *Posterior margin* round. *Incisura linea basalis* absent in small individuals, deep in larger. *Sulculus lapilli* tubular slightly curved in small individuals, strongly curved in larger.

**Material.** Otoliths from 33 specimens ranging between 116 to 380 mm TL, 12 to 580 g TW, 4.95 to 11.9 mm OL, and 4.15 to 9.9 mm OH.

**Relationships.**

\[
\begin{align*}
\text{TL} &= -79.10 + 39.958 \text{ OL} & R^2 &= 0.97 \\
\text{TL} &= 17.960 \text{ OH}^{1.350} & R^2 &= 0.96 \\
\text{TW} &= 0.013 \text{ OL}^{4.288} & R^2 &= 0.98 \\
\text{TW} &= 0.031 \text{ OH}^{4.262} & R^2 &= 0.96 \\
\text{TW} &= 4E-06 \text{ TL}^{3.149} & R^2 &= 0.99 \\
\text{OH/OL} &= \text{min. 0.78-max. 0.88}
\end{align*}
\]
Genidens planifrons
(Higuchi, Reis and Araújo 1982)

Distribution and habitat. Southwestern Atlantic Ocean. Endemic from the Patos Lagoon hydrographic basin. Large-sized (TL > 600 mm) anadromous demersal species. It is fished with gillnets, trawl and hook and line.

Exploitation. Commercially valuable species. Its fishery in southern Brazil collapsed in the 1980s. Fishing is forbidden since 2014. In risk of extinction.

References. Menezes et al. (2003); Fischer et al. (2011).

Description. Shape oval. Anterior margin flattened. Posterior margin round. Incisura linea basalis absent in small individuals, deep in larger. Sulculus lapilli tubular slightly curved in small individuals, strongly curved in larger.

Material. Otoliths from 17 specimens ranging between 78 to 630 mm TL, 4.5 to 2,480 g TW, 3.5 to 11.5 mm OL, and 2.9 to 10.8 mm OH.

Relationships.

\[
\begin{align*}
\text{TL} &= 7.432 \times \text{OL}^{1.816} \quad R^2 = 0.99 \\
\text{TL} &= 12.316 \times \text{OH}^{1.677} \quad R^2 = 0.99 \\
\text{TW} &= 0.003 \times \text{OL}^{5.543} \quad R^2 = 0.99 \\
\text{TW} &= 0.014 \times \text{OH}^{5.118} \quad R^2 = 0.99 \\
\text{TW} &= 6E-06 \times \text{TL}^{3.066} \quad R^2 = 0.99 \\
\text{OH/OL} &= \text{min. 0.82-max. 0.96}
\end{align*}
\]
Order Stomiiformes  
Family Sternoptychidae  
*Maurolicus stehmanni*  
Parin and Kobyliansky 1993

**Distribution and habitat.** Southwest Atlantic (between 23° S and 40° S). Very small (TL < 60 mm) mesopelagic marine species. Abundant along the continental slope of southern Brazil. It is an important forage fish for benthopelagic and pelagic fishes and squids.

**Exploitation.** Not targeted by any fishery.

**References.** Menezes et al. (2003); Bernardes et al. (2006); Almeida and Rossi Wongtschowsk 2007.


**Material.** Otoliths from 14 specimens ranging between 39 to 49 mm TL, 0.4 to 0.8 g TW, 1.4 to 1.8 mm OL, and 1.1 to 1.4 mm OH.

**Relationships.**

\[
\begin{align*}
\text{TL} &= 1.0935 + 26.390 \text{ OL} \quad R^2 = 0.97 \\
\text{TL} &= 34.173 \text{ OH}^{1.255} \quad R^2 = 0.99 \\
\text{TW} &= 0.358 \text{ OL}^{0.925} \quad R^2 = 0.99 \\
\text{TW} &= 0.465 \text{ OH}^{0.944} \quad R^2 = 0.99 \\
\text{TW} &= 1\times10^{-5} \text{ TL}^{2.581} \quad R^2 = 0.75 \\
\text{OH/OL} &= \text{min. 0.70-max. 0.84}
\end{align*}
\]
Order Syngnathiformes  
Family Dactylopteridae  
*Dactylopterus volitans* (Linnaeus 1758)

**Distribution and habitat.** Worldwide. In the western Atlantic Ocean: from Nova Scotia to northern Argentina. Small-sized (TL > 450 mm) benthic marine biodetritic and reef-associated species. It is occasionally fished and discarded on board by bottom trawlers on the shelf along southern Brazil.

**Exploitation.** Not targeted by any fishery.

**References.** Bernardes et al. (2003); Menezes et al. (2003).


**Material.** Otoliths from 14 specimens ranging between 67 to 200 mm TL, 3.5 to 69.6 g TW, 0.65 to 2.04 mm OL, and 0.5 to 1.42 mm OH.

**Relationships.**

<table>
<thead>
<tr>
<th>Equation</th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>$TL = 84.991 OL^{1.146}$</td>
<td>0.93</td>
</tr>
<tr>
<td>$TL = 121.14 OH^{1.177}$</td>
<td>0.93</td>
</tr>
<tr>
<td>$TW = 4.981 OL^{0.735}$</td>
<td>0.24</td>
</tr>
<tr>
<td>$TW = 6.668 OH^{0.907}$</td>
<td>0.43</td>
</tr>
<tr>
<td>$TW = 1E-05 TL^{2.962}$</td>
<td>0.99</td>
</tr>
<tr>
<td>OH/OL = min. 0.67-max. 0.84</td>
<td></td>
</tr>
</tbody>
</table>

![Otoliths](image)
Order Tetraodontiformes  
Family Balistidae  
*Balistes capriscus* Gmelin 1789  

**Distribution and habitat.** Western Atlantic Ocean: Nova Scotia to northern Argentina. (46° N-36° S). Mid-sized (TL < 400 mm) bentholigic marine species on biotritic and reef substrates. It is fished in small numbers by bottom trawlers in the inner shelf (< 100 m) along southeastern Brazil.  

**Exploitation.** Larger specimens regularly landed.  

**References.** Menezes et al. (2003); Fischer et al. (2011).

![Otoliths from 8 specimens ranging between 204 to 330 mm TL, 180 to 596.6 g TW, 1.1 to 1.38 mm OL, and 1.72 to 2.3 mm OH.](image)

**Description.** *Shape* hour-glass.

**Material.** Otoliths from 8 specimens ranging between 204 to 330 mm TL, 180 to 596.6 g TW, 1.1 to 1.38 mm OL, and 1.72 to 2.3 mm OH.

**Relationships.**

- $\text{TL} = -1.325 + 204.70 \text{OL}$  \hspace{1em} $R^2 = 0.89$
- $\text{TL} = 111.44 \text{OH}^{1.186}$  \hspace{1em} $R^2 = 0.99$
- $\text{TW} = 205.50 \text{OL}^{1.210}$  \hspace{1em} $R^2 = 0.99$
- $\text{TW} = 118.55 \text{OH}^{1.188}$  \hspace{1em} $R^2 = 0.99$
- $\text{TW} = 1E-04 \text{TL}^{2.627}$  \hspace{1em} $R^2 = 0.88$
- $\text{OH/OL} = \text{min. 1.36-max. 1.80}$
Family Monacanthidae
Stephanolepis setifer (Bennett 1831)

Distribution and habitat. Western Atlantic Ocean: North Carolina (USA), to southeastern Brazil, cited for the Indo-Pacific. Small (TL < 250 mm) marine, reef-associated species. It is incidentally caught and discarded onboard by the bottom, trawl fisheries in the continental shelf along southern Brazil.

Exploitation. Not targeted by any fishery.

References. Menezes et al. (2003) as S. hispidus; Fisher et al. (2011).

Description. Shape hour-glass.

Material. Otoliths from 15 specimens ranging between 125 to 228 mm TL, 40 to 220.3 g TW, 1.0 to 1.3 mm OL, and 1.0 to 1.25 mm OH.

Relationships.
\[
\begin{align*}
\text{TL} &= -196.2 + 324.50 \text{OL} & R^2 &= 0.61 \\
\text{TL} &= 128.45 \text{OH}^{2.772} & R^2 &= 0.84 \\
\text{TW} &= 35.845 \text{OL}^{7.087} & R^2 &= 0.71 \\
\text{TW} &= 38.272 \text{OH}^{8.446} & R^2 &= 0.82 \\
\text{TW} &= 1E-05 \text{TL}^{3.073} & R^2 &= 0.98 \\
\text{OH/OL} &= \text{min. 0.90-max. 1.00}
\end{align*}
\]
Order Trachichthyiformes  
Family Trachichthyidae  
*Gephyroberyx darwinii* (Johnson 1866)

**Distribution and habitat.** Atlantic and Indo-Pacific. Mid-sized (TL > 500 mm) benthopelagic marine species. Small specimens occasionally on the upper continental slope along southern Brazil.

**Exploitation.** Not targeted by any fishery.

**References.** Maul (1990); Bernardes et al. (2005); Haimovici et al. (2008).


**Material.** Otoliths from 52 specimens ranging between 270 to 473 mm TL, 392 to 2,139 g TW, 12.18 to 20.59 mm OL, and 8.6 to 14.71 mm OH.

**Relationships.**

<table>
<thead>
<tr>
<th>Relationship</th>
<th>Formula</th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>TL = 25.948 + 20.967 OL</td>
<td>R² = 0.93</td>
<td></td>
</tr>
<tr>
<td>TL = 39.801 OH¹.⁰⁰⁴</td>
<td>R² = 0.90</td>
<td></td>
</tr>
<tr>
<td>TW = 0.576 OL².⁶⁶⁸</td>
<td>R² = 0.88</td>
<td></td>
</tr>
<tr>
<td>TW = 1.622 OH².⁶⁰⁷</td>
<td>R² = 0.87</td>
<td></td>
</tr>
<tr>
<td>TW = 5E-05 TL².⁸⁵⁷</td>
<td>R² = 0.97</td>
<td></td>
</tr>
</tbody>
</table>

OH/OL = min. 0.68-max. 0.78
**Hoplostethus occidentalis** Woods 1973

**Distribution and habitat.** Atlantic, Indian and Pacific oceans. In the western Atlantic Ocean from Delaware, USA to southern Brazil. Small-sized (TL < 250 mm) benthopelagic marine species. Is is occasionally fished by bottom trawl in the outer shelf and upper continental slope (> 300 m) along southern Brazil.

**Exploitation.** Not targeted by any fishery.

**References.** Menezes et al. (2003); Bernardes et al. (2006); Haimovici et al. (2008).


**Material.** Otoliths from 56 specimens ranging between 39 to 162 mm TL, 0.7 to 73 g TW, 2.69 to 9.99 mm OL, and 1.85 to 7.56 mm OH.

**Relationships.**

\[
\begin{align*}
\text{TL} &= 12.035 \times \text{OL}^{1.120} \quad R^2 = 0.98 \\
\text{TL} &= 20.963 \times \text{OH}^{0.034} \quad R^2 = 0.98 \\
\text{TW} &= 0.020 \times \text{OL}^{3.488} \quad R^2 = 0.99 \\
\text{TW} &= 0.113 \times \text{OH}^{3.227} \quad R^2 = 0.99 \\
\text{TW} &= 1E-05 \times \text{TL}^{3.081} \quad R^2 = 0.99 \\
\text{OH}/\text{OL} &= \text{min. 0.63-max. 0.76}
\end{align*}
\]
Order Trachiniformes  
Family Percophidae  
*Bembrops heterurus* (Miranda Ribeiro 1903)

**Distribution and habitat.** Western Atlantic Ocean: Rio de Janeiro to Uruguay (22° S-36° S). Small-sized (TL < 300 mm) demersal marine species. Fished and discarded by bottom trawlers in the outer shelf and upper continental slope (100-600 m) along southern Brazil.

**Exploitation.** Not targeted by any fishery.

**References.** Haimovici et al. (1994, 2008); Me-nezes et al. (2003).


**Material.** Otoliths from 81 specimens ranging between 113 to 234 mm TL, 5.7 to 91.2 g TW, 3.1 to 5.88 mm OL, and 1.8 to 3.28 mm OH.

**Relationships.**

\[
\begin{align*}
\text{TL} &= -94.95 + 60.769 \text{ OL} & R^2 &= 0.81 \\
\text{TL} &= 45.580 \text{ OH}^{1.488} & R^2 &= 0.90 \\
\text{TW} &= 0.021 \text{ OL}^{4.848} & R^2 &= 0.92 \\
\text{TW} &= 0.450 \text{ OH}^{4.703} & R^2 &= 0.92 \\
\text{TW} &= 3E-06 \text{ TL}^{3.113} & R^2 &= 0.98 \\
\text{OH/OL} &= \text{min. 0.49-max. 0.61}
\end{align*}
\]

(a) 3.2 mm OL, 99 mm TL  
(b) 4.8 mm OL, 197 mm TL  
(c) 6.3 mm OL, 290 mm TL
**Percophis brasiliensis** Quoy and Gaimard 1825

**Distribution and habitat.** Southwest Atlantic off southern Brazil to central Argentina. Demersal marine mid-sized (TL > 700 mm) species. It is incidentally caught by bottom trawlers and gillnets along southern Brazil.

**Exploitation.** Larger specimens regularly landed.

**References.** Haimovici et al. (1996); Menezes et al. (2003); Cousseau and Perrota (2013).

---


**Material.** Otoliths from 31 specimens ranging between 151 to 660 mm TL, 9.5 to 1,220 g TW, 4.05 to 15.2 mm OL, and 1.25 to 3.45 mm OH.

**Relationships.**

\[
\begin{align*}
\text{TL} &= -20.05 + 46.718 \text{OL} \quad R^2 = 0.98 \\
\text{TL} &= 119.77 \text{OH}^{4.412} \quad R^2 = 0.97 \\
\text{TW} &= 0.093 \text{OL}^{3.561} \quad R^2 = 0.96 \\
\text{TW} &= 4.746 \text{OH}^{4.597} \quad R^2 = 0.97 \\
\text{TL} &= 9 \times 10^{-7} \text{TW}^{3.247} \quad R^2 = 0.99 \\
\text{OH} / \text{OL} &= \text{min. 0.21-max. 0.31}
\end{align*}
\]
**Family Pinguipedidae**  
*Pinguipes brasilianus* Cuvier 1829

**Distribution and habitat.** Rio de Janeiro, Brazil to Golfo San Jorge (22° S-45° S). Small-sized (TL < 400 mm) demersal marine species. It is incidentally caught in small quantities in hook and line commercial fishing on the upper continental slope along southern Brazil.

**Exploitation.** Larger specimens regularly landed.

**References.** Haimovici et al. (1996); Menezes et al. (2003); Cousseau and Perrota (2013).


**Material.** Otoliths from 10 specimens ranging between 322 to 442 mm TL, 460 to 1,076 g TW, 7.6 to 9.75 mm OL, and 3.5 to 4.55 mm OH.

**Relationships.**

\[
\begin{align*}
\text{TL} &= -54.53 + 51.369 \text{OL} \quad R^2 = 0.80 \\
\text{TL} &= 90.415 \text{OH}^{1.061} \quad R^2 = 0.82 \\
\text{TW} &= 0.408 \text{OL}^{3.507} \quad R^2 = 0.89 \\
\text{TW} &= 12.97 \text{OH}^{2.970} \quad R^2 = 0.81 \\
\text{TL} &= 3E-05 \text{TW}^{2.850} \quad R^2 = 0.99 \\
\text{OH/OL} &= \text{min. 0.44-max. 0.51}
\end{align*}
\]
**Pseudopercis numida** Miranda Ribeiro 1903

**Distribution and habitat.** Southwestern Atlantic: Rio de Janeiro to Rio Grande do Sul. Large-sized (TL > 900 mm) demersal marine species. It is present in the outer shelf and upper continental slope along southern Brazil.

**Exploitation.** Commercially fished in small numbers with hook and line on the upper continental slope.

**References.** Menezes et al. (2003); Haimovici et al. (2004); Bernardes et al. (2005).


**Material.** Otoliths from 16 specimens ranging between 543 to 950 mm TL, 1,890 to 10,300 g TW, 13.32 to 22.72 mm OL, and 6.63 to 10.81 mm OH.

**Relationships.**

\[
\begin{align*}
\text{TL} &= 19.682 \text{OL}^{1.273} \quad R^2 = 0.95 \\
\text{TL} &= 38.508 \text{OH}^{1.381} \quad R^2 = 0.91 \\
\text{TW} &= 0.122 \text{OL}^{3.706} \quad R^2 = 0.93 \\
\text{TW} &= 0.646 \text{OH}^{4.152} \quad R^2 = 0.91 \\
\text{TL} &= 1E-05 \text{TW}^{2.978} \quad R^2 = 0.96 \\
\text{OH/OL} &= \text{min. 0.47-max. 0.54}
\end{align*}
\]
**Pseudopercis semifasciata** (Cuvier 1829)

**Distribution and habitat.** Southwest Atlantic: São Paulo, Brazil to Santa Cruz, Argentina (23° S–48° S). Large-sized (TL > 800 mm) demersal marine species. It is present in the outer shelf and upper continental slope along southern Brazil.

**Exploitation.** Commercially fished in small numbers with hook and line on the upper continental slope.

**References.** Menezes et al. (2003); Haimovici et al. (2004); Cousseau and Perrota (2013).

**Description.** Shape elliptic to fusiform. **Distal face** concave. **Proximal face** slightly convex. **Anterior margin** angled. **Posterior margin** angled. **Dorsal margin** convex, sinuate. **Ventral margin** convex, sinuate. **Rostrum** present, prominent. **Antirostrum** present. **Sulcus acusticus** opened at the anterior region, closed at posterior margin. **Ostium** broader and shorter than cauda, deep, funnel-like. **Cauda** deep, tubular-slightly curved ventrally. **Crista** present.

**Material.** Otoliths from 18 specimens ranging between 275 to 1,140 mm TL, 251 to 17,400 g TW, 8.65 to 21.4 mm OL, and 3.45 to 9.45 mm OH.

**Relationships.**
- \( TL = 11.115 \, OL^{1.466} \) \( R^2 = 0.98 \)
- \( TL = 48.995 \, OH^{1.370} \) \( R^2 = 0.98 \)
- \( TW = 0.013 \, OL^{4.459} \) \( R^2 = 0.98 \)
- \( TW = 1.277 \, OH^{4.151} \) \( R^2 = 0.97 \)
- \( TL = 9E-06 \, TW^{3.033} \) \( R^2 = 0.99 \)
- \( OH/OL = \) min. 0.38-max. 0.49

![Graph](image)
Family Uranoscopidae

Astroscopus sexpinosus (Steindachner 1876)

Distribution and habitat. Southwestern Atlantic: from Rio de Janeiro to Buenos Aires province, Argentina (22° S-41° S). Mid-sized (TL > 500 mm) demersal marine species. It is present in the continental shelf along southern Brazil.

Exploitation. Incidentally caught in small numbers by industrial gillnets and bottom trawlers.

References. Haimovici et al. (1996); Menezes et al. (2003).


Material. Otoliths from 73 specimens ranging between 218 to 495 mm TL, 184.5 to 2,528 g TW, 9.35 to 22.6 mm OL, and 5.2 to 15 mm OH.

Relationships.

<table>
<thead>
<tr>
<th>Equation</th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>TL = 88.07 + 15.980 OL</td>
<td>0.60</td>
</tr>
<tr>
<td>TL = 91.118 OH^{0.574}</td>
<td>0.57</td>
</tr>
<tr>
<td>TW = 4.507 OL^{1.870}</td>
<td>0.54</td>
</tr>
<tr>
<td>TW = 10.222 OH^{1.864}</td>
<td>0.50</td>
</tr>
<tr>
<td>TL = 6E-06 TW^{3.195}</td>
<td>0.99</td>
</tr>
<tr>
<td>OH/OL = min. 0.55-max. 0.76</td>
<td></td>
</tr>
</tbody>
</table>

Note. We split by sex in relationship plot due evident differences.
Order Zeiformes
Family Caproidae
Antigonia capros Lowe 1843

Distribution and habitat. Circumtropical. In the western Atlantic Ocean: from New England, USA to Uruguay (44° N-36° S). Small-sized (TL < 300 mm) marine benthopelagic adults and pelagic juveniles. It occurs on biodetritic sediments of the shelf break along southern Brazil.

Exploitation. Not targeted by any fishery.

References. Bernardes et al. (2005); Menezes et al. (2005); Haimovici et al. (2008).


Material. Otoliths from 6 specimens ranging between 170 to 185 mm TL, 143.9 to 206 g TW, 7.64 to 9.19 mm OL, and 8.60 to 9.21 mm OH.

Relationships. Insufficient data.
Family Grammicolepididae
_Xenolepidichthys dalgleishi_ Gilchrist 1922

**Distribution and habitat.** Atlantic, Indian and Pacific oceans. Small-sized (TL < 260 mm) bathydemersal marine species. It is occasionally caught and discarded on board by trawlers fishing in the upper continental slope (200-600 m) along southern Brazil.

**Exploitation.** Not targeted by any fishery.

**References.** Menezes et al. (2003); Haimovici et al. (2008).

**Description.** Shape hour-glass.

**Material.** Otoliths from 19 specimens ranging between 90 to 187 mm TL, 12 to 123 g TW, 1.71 to 2.99 mm OL, and 1.65 to 3.08 mm OH.

**Relationships.**

\[
\begin{align*}
\text{TL} &= -35.69 + 78.381 \times \text{OL} \quad R^2 = 0.80 \\
\text{TL} &= 50.365 \times \text{OH}^{1.225} \quad R^2 = 0.92 \\
\text{TW} &= 1.369 \times \text{OL}^{4.306} \quad R^2 = 0.84 \\
\text{TW} &= 1.784 \times \text{OH}^{3.911} \quad R^2 = 0.92 \\
\text{TW} &= 9E-06 \times \text{TL}^{3.135} \quad R^2 = 0.99 \\
\text{OH} / \text{OL} &= \text{min. 0.97-max. 1.18}
\end{align*}
\]
Family Zeniontidae

Zenion hololepis (Goode and Bean 1896)

**Distribution and habitat.** Atlantic, northern Pacific and western Indian oceans. Small-sized (TL < 200 mm) bathydemersal marine species. It is occasionally caught and discarded by trawls in the upper continental slope (200-600 m) along southern Brazil.

**Exploitation.** Not targeted by any fishery.

**References.** Menezes et al. (2003); Haimovici et al. (2008).


**Material.** Otoliths from 24 specimens ranging between 75 to 145 mm TL, 31 to 51 g TW, 3.19 to 4.8 mm OL, and 2.54 to 3.97 mm OH.

**Relationships.**

- TL = -23.82 + 34.787 OL \( R^2 = 0.58 \)
- TL = 29.454 OH\(^{1.147} \) \( R^2 = 0.74 \)
- TW = 5.636 OL\(^{1.324} \) \( R^2 = 0.24 \)
- TW = 7.747 OH\(^{1.265} \) \( R^2 = 0.38 \)
- TW = 8E-04 TL\(^{2.214} \) \( R^2 = 0.71 \)
- \( \text{OH/OL} = \text{min. 0.73-max. 0.91} \)

![Otoliths](image)

(a) 2.7 mm OL, 71 mm TL

(b) 4.9 mm OL, 145 mm TL
ACKNOWLEDGEMENTS

To all laboratory technicians Antônio Carlos Sayão, José Radicio Nigro, Luiz Alberto Mendes, Luiz Fernando Mattos, Valnesi Rodrigues, Rubens Moralles, countless undergraduate and graduate students, Atlântico Sul crews, commercial vessel captains and colleagues that contributed with fish samples during this forty years long, and more recently to Andrea Rodriguez, Raquel Marquez and Jonatas Freitas for their contribution to the final edition in part of the figures, our acknowledgment. Special thanks to Dr Ricardo Palma for his sound comments on the structure and content of the manuscript. We finally thank the Conselho Nacional de Desenvolvimento Científico e Tecnológico –CNPq for grant assigned to MH, the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior –CAPES for grant assigned to LdSR, the Fundação de Amparo à Pesquisa do Estado do RS –FAPERGS for grant assigned to SHBL, and to CNPq, the Banco do Brasil, Comissão Interministerial para os Recursos do Mar –CIRM and Ministério do Meio Ambiente –MMA for funding assigned to scientific cruises.

Author contributions


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