Atlas of marine bony fish otoliths (*sagittae*) of Southeastern-Southern Brazil Part VI: Albuliformes, Anguiliformes, Osmeriformes, Stomiiformes, Aulopiformes, Myctophiformes, Ophidiiformes, Polimixiiformes, Batrachoidiformes and Lophiformes

*Marcella Bockis Giaretta, Carolina Correia Siliprandi, Cesar Santificetur, Marina Rito Brenha-Nunes, Valéria Regina Martins Conversani, Carmen Lucia Del Bianco Rossi-Wongtschowski**

Instituto Oceanográfico da Universidade de São Paulo
(Praça do Oceanográfico, 191, CEP: 05508-120, São Paulo, SP, Brazil)

*Corresponding author: cwongski@usp.br

ABSTRACT

This publication is part of a series that will constitute an Atlas of Teleostei Otoliths of the Southeastern-Southern Brazilian region. In this article, we present the results of *sagittae's* morphologic and morphometric analyses from fishes remaining to the orders: Albuliformes (one species), Anguiliformes (four), Osmeriformes (one), Stomiiformes (one), Aulopiformes (five), Myctophiformes (nine), Ophidiiformes (three), Polimixiiformes (one), Batrachoidiformes (one) and Lophiformes (three). Features, measurements and indices were analyzed according to methodology used in anterior series. Whenever possible three otoliths of each species have been illustrated and photographed. The frequency of occurrence of each characteristic was calculated by total length classes (TL) and differences within and among them have been analyzed applying multiple χ^2 test (significance 0.05).

Descriptors: Teleost, Otolith, Morphology, Morphometry, Southwestern Atlantic, Brazil.

RESUMO

Esta publicação é sequência de uma série que constituirá um Atlas de Otólitos de Teleostei da região Sudeste-Sul brasileira. Neste artigo são apresentados resultados de análises morfológicas e morfométricas dos *sagittae* de peixes pertencentes às ordens: Albuliformes (uma espécie), Anguiliformes (quatro), Osmeriformes (uma), Stomiiformes (uma), Aulopiformes (cinco), Myctophiformes (nove), Ophidiiformes (três), Polimixiiformes (uma), Batrachoidiformes (uma) e Lophiformes (três). Foram analisadas feições, medidas e índices usualmente empregados conforme metodologia apresentada nas séries anteriores. Três otólitos de cada espécie foram desenhados e fotografados, sempre que possível. A frequência de ocorrência de cada característica por classe de comprimento total foi calculada (CT) e as diferenças dentro de cada classe e entre elas foram analisadas aplicando o Teste χ^2 múltiplo (significância 0,05).

Descritores: Teleósteos, Otólitos, Morfologia, Morfometria, Atlântico Sudoeste, Brasil.

INTRODUCTION

Many papers have been published since the 1980´s showing the value of photographs and drawings in the analysis of otolith features. Parallel to this development, otolith collections have proved to be useful in the analysis of past populations' genetics and populations' structure, growth dynamics and environmental conditions.

During the 5th International Otolith Symposium, which occurred in Palma de Mallorca in 2014, the latest developments in otolith analytical techniques and novel applications were presented. A special workshop on otolith shape analysis was held focusing on these structures as indicators for community, population and individual analysis, and environmental events.

Since 2014, as a contribution for these studies we have been improving the Collection of Teleostei Fish Otoliths of the Southeastern-Southern Brazilian region (COSS-Brasil) held at the Instituto Oceanográfico - USP (IOUSP). Now the collection contains 51.886 pairs of otoliths from 66 families, 24 orders and 202 species (ROSSI-WONGTSCHOWSKI et al., 2016). Furthermore, we started to publish results on the shape of those otoliths (ROSSI-WONGTSCHOWSKI et al.,

Submitted on: 04/08/2016
Approved on: 06/09/2016
http://dx.doi.org/10.1590/S1679-87592017133806502

2014; SILIPRANDI et al., 2016; BRENHA-NUNES et al., 2016). Together, these publications will constitute an Atlas of Otoliths of the Southeastern-Southern Brazilian region. Now we present results of morphologic and morphometric analyses of species remaining to the orders Albuliformes (1), Anguiliformes (4), Osmeriformes (1), Stomiiformes (1), Aulopiformes (5), Myctophiformes (9), Ophidiiformes (3), Polimixiiformes (1), Batrachoidiformes (1) and Lophiformes (3).

MATERIAL AND METHODS

The sampled area and the methodology of this study followed that presented in ROSSI-WONGTSCHOWSKI et al. (2014), SILIPRANDI et al. (2016), BRENHA-NUNES et al. (2016).

The acronyms present in the shape indices tables are: TL = total fish length, OL = otolith length, OH = otolith height and OT = otolith thickness.

RESULTS

Order ALBULIFORMES

Family ALBULIDAE

Albula vulpes (Linnaeus 1758) - **Plate 1**

Maximum Size:	1040 mm (TL) (FROESE; PAULY, 2016).
Distribution:	Western Atlantic from New England to Southeastern Brazil (CARVALHO-FILHO, 1992).
Habitat:	Present over sand and mud bottoms and shallow coastal waters (estuaries and bays) (FROESE; PAULY, 2016).
Diet:	Feeds on mollusks and crustaceans (CARVALHO-FILHO, 1992).
Collection:	83 otoliths from 43 fish (TL ranging from 32 to 153 mm).
Sample:	29 left otoliths categorized into 7, 20 mm classes (20 to 140 mm).

Shape: oblong. ***Anterior region:*** round. ***Posterior region:*** round (62%), peaked, peaked-round. ***Dorsal edge:*** sinuate (59%), entire. ***Ventral edge:*** lobed (69%), lobed to sinuate, lobed to entire, crenate. ***Profile:*** concave-convex. ***Rostrum and antirostrum orientation:*** does not apply. ***Rostrum:*** absent. ***Antirostrum:*** absent. ***Pseudorostrum:*** absent. ***Pseudoantirostrum:*** absent. ***Sulcus acusticus:*** *position:* supramedian; *orientation:* descending; *opening:* ostial; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* tubular (90%), funnel-like; *cauda:* tubular markedly curved (76%), tubular slightly curved, tubular strongly curved.

Statistical differences ($p < 0.05$) within some length classes were obtained for dorsal and ventral edges, posterior region and *ostium* and *cauda* morphology. Along the fish's growth statistical differences were found for dorsal edge and posterior region.

Shape índices	Mean ± Sd	Minimum	Maximum
OL/TL (%)	5.05 ± 0.32	4.32	5.62
OH/OL (%)	56.44 ± 2.30	52.76	60.83
OT/OL (%)	17.47 ± 1.79	13.55	20.11
OT/OH (%)	30.98 ± 3.21	23.86	36.30
Circularity	16.91 ± 1.54	13.49	22.89
Rectangularity	0.73 ± 0.03	0.68	0.77

Order ANGUILIFORMES

Family CONGRIDAE

The anterior region is always round, the cauda is frequently tubular straight and *rostrum*, *antirostrum*, *pseudorostrum* and *pseudoantirostrum* are always absent.

Ariosoma opistophthalmum (Ranzani 1839) - **Plate 2**

Maximum Size:	270 mm (TL) (FIGUEIREDO; MENEZES, 1978), but attaining 335 mm in our collection.
Distribution:	Southwest Atlantic from Rio de Janeiro to Uruguay (MENEZES et al., 2003).
Habitat:	Often buried in the bottom not too deep substrates (CERVIGÓN et al., 1992).
Diet:	Feeds on small fish, crustaceans and mollusks (SCOTT; SCOTT, 1988).
Collection:	26 otoliths from 13 fish (TL ranging from 178 to 335 mm).
Sample:	7 left otoliths categorized into 4, 20 mm classes (200 to 320 mm).

Shape: oval. ***Anterior region:*** round. ***Posterior region:*** peaked round. ***Dorsal edge:*** entire. ***Ventral edge:*** entire. ***Profile:*** plane-convex. ***Rostrum and antirostrum orientation:*** does not apply. ***Rostrum:*** absent. ***Antirostrum:*** absent. ***Sulcus acusticus:*** *position:* median; *orientation:* ascending (71%), horizontal; *opening:* para-ostial (57%), mesial; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* oval (71%), elliptic; *cauda:* tubular straight (86%), tubular slightly curved.

The small number of otoliths examined did not permit the statistical analysis of the data but its morphometric characteristics are shown below:

Shape índices	Mean ± Sd	Minimum	Maximum
OL/TL (%)	2.01 ± 0.17	1.80	2.26
OH/OL (%)	79.50 ± 4.60	72.08	85.19
OT/OL (%)	19.86 ± 2.04	17.38	23.00
OT/OH (%)	24.96 ± 1.60	23.22	28.21
Circularity	14.22 ± 0.17	14.01	14.47
Rectangularity	0.68 ± 0.01	0.67	0.70

Conger orbignyanus Valenciennes 1837 - **Plate 3**

Maximum Size:	1120 mm (TL) (FROESE; PAULY, 2016).
Distribution:	Western Atlantic from Rio de Janeiro (Brazil) to Argentina (FIGUEROA et al., 2009).
Habitat:	Coastal fish may enter estuaries and rivers, found on rocky, sand or mud substrates (CARVALHO-FILHO, 1992).
Diet:	Generalist species, feeds mainly on fish, crustaceans and mollusks (CARVALHO-FILHO, 1992).
Collection:	8 otoliths from 5 fish (TL ranging from 394 to 953 mm).
Sample:	3 left otoliths categorized into 3, 20 mm classes (440 to 940 mm).

Shape: oblong. ***Anterior region:*** round. ***Posterior region:*** round. ***Dorsal edge:*** sinuate to entire (67%), entire. ***Ventral edge:*** entire (67%), lobed to entire. ***Profile:*** concave-convex. ***Rostrum and antirostrum orientation:*** does not apply. ***Rostrum:*** absent. ***Antirostrum:*** absent. ***Sulcus acusticus:*** *position:* median; *orientation:* descending; *opening:* ostial; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* funnel-like; *cauda:* tubular straight.

The small number of otoliths examined did not allow the statistical analysis of the data but its morphometric characteristics are present below:

Shape indices	Mean ± Sd	Minimum	Maximum
OL/TL (%)	1.28 ± 0.49	0.96	1.84
OH/OL (%)	40.35 ± 0.72	39.57	40.98
OT/OL (%)	12.44 ± 0.73	11.98	13.28
OT/OH (%)	30.84 ± 1.74	29.45	32.79
Circularity	18.89 ± 0.34	18.52	19.17
Rectangularity	0.74 ± 0.01	0.74	0.75

Family MURAENIDAE

The otolith shape is mostly cuneiform, the *ostium* is funnel-like and the *cauda* is tubular straight in most of cases or slightly curved. *Pseudorostrum* and *pseudoantirostrum* are absent.

Gymnothorax conspersus Poey 1867 - **Plate 4**

Maximum Size:	1100 mm (TL) (FROESE; PAULY, 2016).
Distribution:	Western Atlantic from North Carolina to Southern Brazil (MENEZES et al., 2003).
Habitat:	Little known, lives below 200 m depth (BÖHLKE; BÖHLKE, 1980).
Diet:	Fish and crustaceans (LOWE-MCCONNELL, 1987; BÖHLKE; BÖHLKE, 1980).
Collection:	40 otoliths from 26 fish (TL ranging from 465 to 750 mm).
Sample:	13 left otoliths categorized into 8, 20 mm classes (480 to 740 mm).

Shape: cuneiform. ***Anterior region:*** blunt (46%), oblique-round, oblique, blunt-round. ***Posterior region:*** peaked-round (54%), peaked, blunt-round. ***Dorsal edge:*** sinuate to entire (46%), entire (38%), lobed to entire. ***Ventral edge:*** entire (69%), sinuate to entire, lobed to sinuate. ***Profile:*** concave-convex (92%), plane-convex. ***Rostrum and antirostrum orientation:*** does not apply (69%), in agreement. ***Rostrum:*** absent (69%), underdeveloped. ***Antirostrum:*** underdeveloped (77%), developed. ***Sulcus acusticus:*** *position:* median (92%), inframedian; *orientation:* horizontal; *opening:* ostial; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* funnel-like; *cauda:* tubular straight (69%), tubular slightly curved.

Statistical differences ($p < 0.05$) within some length classes were obtained only for ventral edge. No differences were found during the fish development.

Shape indices	Mean ± Sd	Minimum	Maximum
OL/TL (%)	0.64 ± 0.05	0.54	0.71
OH/OL (%)	59.27 ± 6.96	47.80	69.97
OT/OL (%)	28.07 ± 3.63	22.25	33.51
OT/OH (%)	47.93 ± 8.36	35.16	63.00
Circularity	15.74 ± 1.09	14.37	18.54
Rectangularity	0.72 ± 0.02	0.68	0.74

Gymnothorax ocellatus Agassiz 1831 - **Plate 5**

Maximum Size:	600 mm (TL) (SZPILMAN, 2000).
Distribution:	Western Atlantic; Caribbean and Central America to Southern Brazil (MENEZES et al., 2003).
Habitat:	Estuaries, brackish lagoons, mangroves and open beaches; commonly found on sand and rubble bottoms (CARVALHO-FILHO, 1992).
Diet:	Crustaceans and fish (CARVALHO-FILHO, 1992).
Collection:	96 otoliths from 52 fish (TL ranging from 339 to 586 mm).
Sample:	29 left otoliths categorized into 12, 20 mm classes (340 to 580 mm).

Shape: cuneiform (69%), elliptic to cuneiform, elliptic. ***Anterior region:*** double-peaked (41%), double-peaked-round (34%), blunt, round. ***Posterior region:*** oblique-round (21%), peaked-round (21%), peaked (17%), oblique to peaked (17%). ***Dorsal edge:*** sinuate to entire (38%), entire, lobed to sinuate, serrate to entire. ***Ventral edge:*** lobed to sinuate (34%), sinuate to entire (34%), entire (31%). ***Profile:*** plane-convex. ***Rostrum and antirostrum orientation:*** in agreement (90%), does not apply. ***Rostrum:*** underdeveloped (59%), developed, absent. **Antirostrum:** underdeveloped (52%), developed (45%), absent. ***Sulcus acusticus:*** *position:* median; *orientation:* horizontal; *opening:* ostial; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* funnel-like; *cauda:* tubular straight (62%), tubular slightly curved.

Statistical differences ($p < 0.05$) within some length classes were obtained for shape, *rostrum* and *antirostrum* orientation and development. No differences were found during the fish's development.

Shape indices	Mean ± Sd	Minimum	Maximum
OL/TL (%)	0.84 ± 0.10	0.61	0.98
OH/OL (%)	66.98 ± 6.05	54.55	81.67
OT/OL (%)	24.84 ± 2.96	20.95	31.82
OT/OH (%)	37.39 ± 5.69	29.37	50.24
Circularity	15.90 ± 0.95	14.15	17.78
Rectangularity	0.74 ± 0.02	0.59	0.81

Order OSMERIFORMES

Family ARGENTINIDAE

Argentina striata Goode & Bean 1896 - **Plate 6**

Maximum Size:	240 mm (TL) (FROESE; PAULY, 2016).
Distribution:	Western Atlantic from Nova Scotia to Southern Brazil (MENEZES et al., 2003).
Habitat:	Found on mud bottoms and cooler waters (BERNARDES et al., 2005).
Diet:	Benthic crustaceans and protozoa (SCOTT; SCOTT, 1988).
Collection:	1838 otoliths from 939 fish (TL ranging from 50 to 241 mm).
Sample:	75 left otoliths categorized into 10, 20 mm classes (40 to 220 mm).

Shape: pentagonal (47%), trapezoidal, elliptic to trapezoidal. ***Anterior region:*** peaked (69%), oblique to peaked. ***Posterior region:*** flattened (53%), round, oblique to peaked, oblique. ***Anterior dorsal edge:*** sinuate (53%), entire, lobed to sinuate, lobed. ***Posterior dorsal edge:*** (55%), lobed, sinuate, serrate to sinuate. ***Anterior ventral edge:*** sinuate (53%), serrate to sinuate, lobed to sinuate, entire. ***Posterior ventral edge:*** sinuate (39%), entire, round, lobed. ***Central ventral edge:*** sinuate (64%), round, entire. ***Profile:*** plane-convex. ***Rostrum and antirostrum orientation:*** does not apply. ***Rostrum:*** developed. ***Antirostrum:*** absent. ***Pseudorostrum:*** absent. ***Pseudoantirostrum:*** absent. ***Sulcus acusticus*:** position: supramedian; *orientation:* descending; *opening:* ostial; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* funnel-like (70%), elliptic; *cauda:* tubular straight.

Statistical differences ($p < 0.05$) within some length classes were obtained for shape, dorsal, posterior dorsal, ventral, central ventral and posterior ventral edges, anterior and posterior regions and *ostium* morphology. Along the fish's development statistical differences were found for shape, dorsal, posterior dorsal, ventral, central ventral and posterior ventral edges, anterior and posterior regions and *ostium* morphology.

Shape indices	Mean ± Sd	Minimum	Maximum
OL/TL (%)	3.16 ± 0.19	2.65	3.52
OH/OL (%)	69.02 ± 5.59	60.00	81.96
OT/OL (%)	15.94 ± 2.10	12.16	20.76
OT/OH (%)	23.12 ± 2.58	18.73	29.74
Circularity	17.11 ± 1.65	14.72	23.36
Rectangularity	0.67 ± 0.02	0.63	0.71

Order STOMIIFORMES

Family STERNOPTYCHIDAE

Maurolicus stehmanni Parin & Kobyliansky 1993 - **Plate 7**

Maximum Size:	50 mm (TL) (FROESE; PAULY, 2016), but attaining 59 mm in our collection.
Distribution:	Southwest Atlantic along the continental slope of South America (MENEZES et al., 2003; ALMEIDA; ROSSI-WONGTSCHOWSKI, 2007).
Habitat:	Mesopelagic; moving to surface at night; occurs along the continental slope (FIGUEIREDO et al., 2002).
Diet:	Mainly copepods and euphausiids (KAARTVEDT et al., 1998).
Collection:	937 otoliths from 498 fish (TL ranging from 24 to 59 mm).
Sample:	59 left otoliths categorized into 2, 20 mm classes (20 to 40 mm).

Shape: pyriform. ***Anterior region:*** peaked. ***Posterior region:*** round. ***Dorsal edge:*** sinuate (65%), entire, lobed. ***Ventral edge:*** lobed to entire (70%), lobed, sinuate, sinuate to entire. ***Profile:*** flattened. ***Rostrum and antirostrum orientation:*** does not apply (75%), in agreement. ***Rostrum:*** developed. ***Antirostrum:*** absent (75%), underdeveloped. ***Pseudorostrum:*** absent. ***Pseudoantirostrum:*** absent. ***Sulcus acusticus:*** *position:* median; *orientation:* horizontal; *opening:* ostial; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* funnel-like (85%), tubular; *cauda:* tubular straight.

Statistical differences ($p < 0.05$) within some length classes were obtained for dorsal and ventral edges and *ostium* morphology. No differences were found during the fish's development.

Shape indices	Mean ± Sd	Minimum	Maximum
OL/TL (%)	3.86 ± 0.66	3.19	6.50
OH/OL (%)	75.30 ± 3.03	70.48	80.95
OT/OL (%)	18.19 ± 3.36	13.98	27.93
OT/OH (%)	24.10 ± 3.97	19.29	36.47
Circularity	18.84 ± 2.37	16.20	26.37
Rectangularity	0.58 ± 0.04	0.50	0.63

Order AULOPIFORMES

Family CHLOROPHTHALMIDAE

The *sulcus acusticus* opening is frequently ostial, the *ostium* is frequently funnel-like and *pseudorostrum* and *pseudoantirostrum* are always absent.

Chlorophthalmus agassizi Bonaparte 1840 - **Plate 8**

Maximum Size:	400 mm (TL) (FROESE; PAULY, 2016).
Distribution:	Western Atlantic from Nova Scotia to Uruguay (MENEZES et al., 2003).
Habitat:	Associated with mud and clay bottom; occurs on the continental shelf and beginning of the slope (FROESE; PAULY, 2016).
Diet:	Crustaceans and other invertebrates (MACPHERSON; ROEL, 1987).
Collection:	574 otoliths from 303 fish (TL ranging from 88 to 167 mm).
Sample:	37 left otoliths categorized into 5, 20 mm classes (80 to 160 mm).

Shape: oblong (92%), rectangular to oblong. ***Anterior region:*** round (89%), oblique-round, angled-round. ***Posterior region:*** round (65%), oblique-round, angled-round, flattened. ***Dorsal edge:*** sinuate to entire. ***Ventral edge:*** entire (70%), sinuate to entire. ***Profile:*** flattened. ***Rostrum and antirostrum orientation:*** does not apply. ***Rostrum:*** absent (95%), underdeveloped. ***Antirostrum:*** absent. ***Sulcus acusticus:*** *position:* supramedian; *orientation:* descending; *opening:* ostial (97%), ostiocaudal; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* funnel-like; *cauda:* tubular slightly curved (92%), tubular strongly curved.

Statistical differences ($p < 0.05$) within some length classes were obtained for shape, ventral edge, anterior and posterior regions, *rostrum* development, *sulcus acusticus* opening and *cauda* morphology. No differences were found during the fish's development.

Shape indices	Mean ± Sd	Minimum	Maximum
OL/TL (%)	2.92 ± 0.26	2.38	3.47
OH/OL (%)	48.44 ± 3.08	42.24	57.14
OT/OL (%)	14.21 ± 1.23	11.24	16.67
OT/OH (%)	29.41 ± 2.55	21.93	33.52
Circularity	17.51 ± 0.62	16.07	18.81
Rectangularity	0.71 ± 0.03	0.62	0.78

Parasudis truculenta (Goode & Bean 1896) - **Plate 9**

Maximum Size:	250 mm (TL) (FROESE; PAULY, 2016), but attaining 296 mm in our collection.
Distribution:	Western Atlantic from Massachusetts to Southern Brazil (MENEZES et al., 2003).
Habitat:	Benthic species, found on the continental shelf and the beginning of the slope (BERNARDES et al., 2005).
Diet:	Frequently fish and occasionally squids (FIGUEIREDO et al., 2002).
Collection:	1999 otoliths from 1047 fish (TL ranging from 91 to 296 mm).
Sample:	88 left otoliths categorized into 11, 20 mm classes (80 to 280 mm).

Shape: elliptic (53%), elliptic to rectangular, rectangular***. Anterior region:*** peaked-round (48%), angled, oblique, angled-round. ***Posterior region:*** peaked-round (52%), flattened, oblique, angled-round. ***Dorsal edge:*** sinuate (76%), entire, lobed, lobed to sinuate. ***Ventral edge:*** lobed to sinuate (47%), dentate to lobed, lobed, sinuate. ***Profile:*** flattened. ***Rostrum and antirostrum orientation:*** in agreement (74%), does not apply***. Rostrum:*** developed. ***Antirostrum:*** underdeveloped (66%), absent, developed. ***Sulcus acusticus:*** *position:* median (93%), supramedian; *orientation:* horizontal (73%), descending; *opening:* ostial (93%), para-ostial*. morphology:* pseudo-archaesulcoid; *colliculum:* heteromorphic; *ostium:* funnel-like (93%), elliptic; *cauda:* tubular straight (90%), elliptic.

Statistical differences ($p < 0.05$) within some length classes were obtained for shape, ventral and dorsal edges, anterior and posterior regions, *sulcus acusticus* opening, orientation and position, *cauda* and *ostium* morphology and *rostrum* and antirostrum orientation. Along the otolith's growth statistical differences were found for shape, ventral edge, anterior and posterior regions.

Shape indices	Mean ± Sd	Minimum	Maximum
OL/TL (%)	1.83 ± 0.32	1.38	3.74
OH/OL (%)	73.11 ± 5.25	62.08	88.63
OT/OL (%)	17.63 ± 1.21	14.79	22.11
OT/OH (%)	24.18 ± 1.76	19.89	29.94
Circularity	16.99 ± 1.67	14.78	22.76
Rectangularity	0.73 ± 0.03	0.66	0.78

Order AULOPIFORMES

Family SYNODONTIDAE

The otolith shape is frequently fusiform or fusiform to laceolate, the anterior region is lanceolate or peaked, the posterior region is round or flattened and the *sulcus acusticus* opening is always ostial. *Pseudorostrum* and *pseudoantirostrum* are always absent.

Saurida brasiliensis Norman 1935 - **Plate 10**

Maximum Size:	250 mm (TL) (FROESE; PAULY, 2016).
Distribution:	Western Atlantic from North Carolina to Southern Brazil (MENEZES et al., 2003).
Habitat:	Species associated with the bottom (FIGUEIREDO et al., 2002).
Diet:	Feeds on fish (ANDERSON et al., 1966).
Collection:	615 otoliths from 319 fish (TL ranging from 7 to 128 mm).
Sample:	37 left otoliths categorized into 5, 20 mm classes (40 to 120 mm).

Shape: fusiform to lanceolate (51%), fusiform, oblong, lanceolate. ***Anterior region:*** lanceolate (57%), peaked, peaked-round. ***Posterior region:*** round (46%), flattened, oblique-round, double-peaked-round. ***Dorsal edge:*** lobed to sinuate (51%), sinuate to entire, entire ***Ventral edge:*** sinuate to entire (46%), entire (43%), lobed to sinuate. ***Profile:*** plane-convex. ***Rostrum and antirostrum orientation:*** does not apply (86%), in agreement. ***Rostrum:*** developed. ***Antirostrum:*** absent (86%), underdeveloped. ***Sulcus acusticus:*** *position:* median; *orientation:* horizontal (73%), descending; *opening:* ostial; *morphology:* pseudo-archaesulcoid; *colliculum:* heteromorphic; *ostium:* tubular; *cauda:* tubular straight.

Statistical differences ($p < 0.05$) within some length classes were obtained for shape, dorsal edge, anterior and posterior regions, *sulcus acusticus* orientation, *antirostrum* development and *rostrum* and *antirostrum* orientation. Along the fish's growth statistical differences were found for shape, anterior and posterior regions and *sulcus acusticus* orientation.

Shape indices	Mean ± Sd	Minimum	Maximum
OL/TL (%)	3.44 ± 0.20	2.79	3.85
OH/OL (%)	49.96 ± 4.43	38.59	56.82
OT/OL (%)	15.67 ± 1.86	12.34	21.84
OT/OH (%)	31.43 ± 3.15	25.68	38.78
Circularity	17.55 ± 1.25	15.05	20.47
Rectangularity	0.68 ± 0.02	0.64	0.72

Saurida caribbaea Breder 1927 - **Plate 11**

Maximum Size:	180 mm (TL) (FROESE; PAULY, 2016).
Distribution:	Western Atlantic from Florida to Uruguay (BERNARDES et al., 2005).
Habitat:	Inhabits unconsolidated substrates, throughout the continental shelf: occasionally on coastal areas (RUSSELL et al., 2015).
Diet:	Small fishes and crustaceans (THOMPSON, 2002).
Collection:	1994 otoliths from 1053 fish (TL ranging from 36 to 146 mm).
Sample:	54 left otoliths categorized into 7, 20 mm classes (20 to 140 mm).

Shape: fusiform to lanceolate (70%), fusiform, oblong. ***Anterior region:*** lanceolate (70%), peaked. ***Posterior region:*** flattened (45%), round (36%), oblique-round (15%), blunt-round. ***Dorsal edge:*** sinuate to entire (47%), lobed to sinuate (47%), entire. ***Ventral edge:*** sinuate to entire (40%), lobed to sinuate, entire. ***Profile:*** plane-convex. ***Rostrum and antirostrum orientation:*** does not apply (64%), in agreement. ***Rostrum:*** developed. ***Antirostrum:*** absent (64%), underdeveloped. ***Sulcus acusticus:*** *position:* median; *orientation:* descending (74%), horizontal; *opening:* ostial;

morphology: pseudo-archaesulcoid; *colliculum:* heteromorphic; *ostium:* funnel-like (49%), tubular (45%), elliptic; *cauda:* tubular straight.

Statistical differences ($p < 0.05$) within some length classes were obtained for shape, dorsal edge, anterior and posterior regions, *sulcus acusticus* orientation, ostium morphology, *antirostrum* development and *rostrum* and *antirostrum* orientation. Along the fish's development statistical differences were found for shape, dorsal edge and anterior region.

Shape indices	Mean ± Sd	Minimum	Maximum
OL/TL (%)	3.34 ± 0.24	2.62	3.89
OH/OL (%)	47.04 ± 3.77	40.77	55.70
OT/OL (%)	14.07 ± 2.08	10.25	21.02
OT/OH (%)	29.88 ± 3.32	24.55	40.24
Circularity	18.38 ± 1.07	16.52	20.69
Rectangularity	0.68 ± 0.02	0.63	0.72

Synodus foetens (Linnaeus 1766) - **Plate 12**

Maximum Size:	500 mm (TL) (SAMPAIO, 2008).
Distribution:	Western Atlantic from North Carolina to São Paulo (SAMPAIO, 2008).
Habitat:	Found on shallow and deep ocean, sand flats and mud bottom; also found in open ocean over continental shelf (FROESE; PAULY, 2016).
Diet:	Crustaceans and small fish (SAMPAIO, 2008).
Collection:	149 otoliths from 80 fish (TL ranging from 65 to 400 mm).
Sample:	49 left otoliths categorized into 10, 20 mm classes (100 to 360 mm).

Shape: fusiform (69%), elliptic, rectangular to elliptic, fusiform to lanceolate. ***Anterior region:*** peaked (96%), lanceolate. ***Posterior region:*** round (71%), flattened, angled, oblique. ***Dorsal edge:*** lobed to sinuate (51%), dentate to lobed, sinuate, entire. ***Ventral edge:*** sinuate to entire (41%), lobed to sinuate (39%), entire, lobed ***Profile:*** concave-convex (69%), plane-convex. ***Rostrum and antirostrum orientation:*** in agreement (59%), does not apply. ***Rostrum:*** developed. ***Antirostrum:*** underdeveloped (59%), absent. ***Sulcus acusticus:*** *position:* median; *orientation:* horizontal; *opening:* ostial; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* funnel-like; *cauda:* tubular strongly curved (84%), tubular markedly curved, tubular slightly curved.

Statistical differences ($p < 0.05$) within some length classes were obtained for shape, dorsal and ventral edges, anterior and posterior regions, profile, *cauda* morphology, *antirostrum* development and *sulcus acusticus* orientation. Along the otolith's growth statistical differences were found for shape, dorsal edge and profile.

Shape indices	Mean ± Sd	Minimum	Maximum
OL/TL (%)	1.82 ± 0.10	1.53	2.07
OH/OL (%)	48.71 ± 6.20	15.74	61.34
OT/OL (%)	17.32 ± 2.61	12.89	26.29
OT/OH (%)	36.47 ± 10.64	27.40	104.17
Circularity	19.64 ± 1.65	15.89	22.76
Rectangularity	0.71 ± 0.20	0.63	0.82

Order MYCTOPHIFORMES

Family MYCTOPHIDAE

The most species present the otolith shape is elliptic, except to those who have shape discoidal or oval. The anterior region is double peaked or peaked and the posterior region is always round. The *ostium* is bigger than *cauda*. *Pseudorostrum* and *pseudoantirostrum* are always absent.

Diaphus dumerilii (Bleeker 1856) - **Plate 13**

Maximum Size:	90 mm (TL) (FROESE; PAULY, 2016), but attaining 102 mm in our collection.
Distribution:	Indian and tropical Atlantic throughout the East coast of South America (BERNARDES et al., 2005).
Habitat:	High-oceanic mesopelagic species found up to 750m depth. (FROESE; PAULY, 2016).
Diet:	Copepods and crustacean larvae (ALWIS; GJOSAETER, 1988).
Collection:	1131 otoliths from 575 fish (TL ranging from 28 to 102 mm).
Sample:	41 left otoliths categorized into 5, 20 mm classes (20 to 100 mm).

Shape: elliptic. ***Anterior region:*** double-peaked (78%), peaked. ***Posterior region:*** round. ***Dorsal edge:*** entire (51%), sinuate to entire (46%), lobed to sinuate. ***Ventral edge:*** serrate to sinuate (95%), lobed to sinuate, sinuate to entire. ***Profile:*** flattened. ***Rostrum and antirostrum orientation*:** in agreement. ***Rostrum:*** developed. **Antirostrum:** developed (88%), underdeveloped. ***Sulcus acusticus:*** *position:* median; *orientation:* horizontal (95%), ascending; *opening:* ostial; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* tubular; *cauda:* round-oval (85%), elliptic.

Statistical differences ($p < 0.05$) within some length classes were obtained for dorsal and ventral edges, anterior region, *antirostrum* development, *cauda* morphology and *sulcus acusticus* orientation. Along the fish's growth statistical differences were found only for anterior region.

Shape indices	Mean ± Sd	Minimum	Maximum
OL/TL (%)	5.20 ± 0.42	4.67	6.95
OH/OL (%)	72.15 ± 2.91	66.05	81.25
OT/OL (%)	14.64 ± 2.42	9.82	20.93
OT/OH (%)	14.64 ± 2.99	14.63	28.13
Circularity	20.25 ± 2.99	12.83	19.04
Rectangularity	0.72 ± 0.01	0.70	0.74

Diaphus hudsoni Zurbrigg & Scott 1976 - **Plate 14**

Maximum Size:	84 mm (TL) (FROESE; PAULY, 2016), but attaining 94 mm in our collection.
Distribution:	Indian Ocean, Pacific and South Atlantic (MENEZES et al., 2003).
Habitat:	Along the upper slope and the outer edge of the continental shelf (CERVIGÓN et al., 1992).
Diet:	Generalist species, feeds mainly on crustaceans and krill (TSARIN, 1997).
Collection:	346 otoliths from 176 fish (TL ranging from 64 to 94 mm).
Sample:	20 left otoliths categorized into 2, 20 mm classes (20 to 40 mm).

Shape: discoidal (80%), discoidal to elliptic, elliptic. ***Anterior region:*** peaked (80%), double-peaked, angled. ***Posterior region:*** round. ***Dorsal edge:*** sinuate to entire (85%), entire. ***Ventral edge:*** serrate to sinuate (75%), serrate. ***Profile:*** flattened. ***Rostrum and antirostrum orientation:*** in agreement (95%), does not apply. ***Rostrum:*** developed. ***Antirostrum:*** developed (50%), underdeveloped (45%), absent. ***Sulcus acusticus:*** *position:* median; *orientation:* horizontal (80%), descending; *opening:* ostial; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* tubular (95%), funnel-like; *cauda:* round-oval (70%), elliptic.

Statistical differences ($p < 0.05$) within some length classes were obtained for shape, dorsal and ventral edges, anterior region, *antirostrum* development, *rostrum* and antirostrum orientation, *ostium* morphology and *sulcus acusticus* orientation. Along the otolith's development statistical differences were found for *antirostrum* development.

Shape indices	Mean ± Sd	Minimum	Maximum
OL/TL (%)	5.20 ± 0.42	4.67	6.95
OH/OL (%)	72.15 ± 2.91	66.05	81.25
OT/OL (%)	14.64 ± 2.42	9.82	20.93
OT/OH (%)	20.25 ± 2.99	14.63	28.13
Circularity	16.37 ± 1.37	12.83	19.04
Rectangularity	0.72 ± 001	0.70	0.74

Diaphus perspicillatus (Ogilby 1898) - **Plate 15**

Maximum Size:	71 mm (TL) (FROESE; PAULY, 2016), but attaining 104 mm in our collection.
Distribution:	Pacific, Indian and Western Atlantic from Cape Cod to South Brazil (MENEZES et al., 2003).
Habitat:	Oceanic species, occurs from the surface to 1500m (FROESE; PAULY, 2016).
Diet:	Generalist species, feeds mainly on crustaceans and krill (TSARIN, 1997).
Collection:	127 otoliths from 65 fish (TL ranging from 49 to 104 mm).
Sample:	31 left otoliths categorized into 4, 20 mm classes (40 to 100 mm).

Shape: elliptic (58%), elliptic to discoidal, discoidal. ***Anterior region:*** angled (48%), double-peaked (42%), peaked. ***Posterior region:*** round (74%), blunt-round, angled-round. ***Dorsal edge:*** sinuate to entire (84%), entire. ***Ventral edge:*** serrate to sinuate (77%), serrate, crenate to sinuate, dentate to sinuate. ***Profile:*** flattened. ***Rostrum and antirostrum orientation:*** in agreement (97%), does not apply. ***Rostrum:*** developed (58%), underdeveloped. ***Antirostrum:*** underdeveloped (55%), developed (42%), absent. ***Sulcus acusticus:*** *position:* median; *orientation:* ascending (81%), horizontal; *opening:* ostial; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* tubular; *cauda:* round-oval.

Statistical differences ($p < 0.05$) within some length classes were obtained for dorsal and ventral edges, anterior and posterior regions, *antirostrum* development and *rostrum*, *antirostrum* and *sulcus acusticus* orientation. Along the fish's growth statistical differences were found only for posterior region.

Shape indices	Mean ± Sd	Minimum	Maximum
OL/TL (%)	4.82 ±0.92	3.40	5.86
OH/OL (%)	80.80 ± 8.51	70.51	115.28
OT/OL (%)	17.99 ± 2.23	12.17	22.53
OT/OH (%)	22.32 ± 2.39	17.21	30.14
Circularity	16.11 ± 0.96	14.66	17.98
Rectangularity	0.71 ± 0.04	0.50	0.74

Hygophun hygomii (Lütken 1892) - **Plate 16**

Maximum Size:	68 mm (TL) (FROESE; PAULY, 2016), but attaining 74 mm in our collection.
Distribution:	Circumglobal. In Brazil is recorded only in the Southeast region (MENEZES et al., 2003).
Habitat:	Oceanic species present from the surface to 800 m depth (FROESE; PAULY, 2016).
Diet:	Generalist species, feeds mainly on crustaceans and krill (TSARIN, 1997).
Collection:	540 otoliths from 276 fish (TL ranging from 38 to 74 mm).
Sample:	23 left otoliths categorized into 3, 20 mm classes (20 to 60 mm).

Shape: oval (52%), discoidal (48%). ***Anterior region:*** double-peaked (96%), blunt to angled. ***Posterior region:*** round. ***Dorsal edge:*** lobed to sinuate (48%), sinuate to entire (39%), sinuate. ***Ventral edge:*** lobed to sinuate (48%), sinuate to entire (39%), sinuate. ***Profile:*** plane-convex. ***Rostrum and antirostrum orientation:*** in agreement. ***Rostrum:*** developed (70%), underdeveloped. ***Antirostrum:*** developed (83%), underdeveloped. ***Sulcus acusticus:*** *position:* median; *orientation:* horizontal (83%), ascending, descending; *opening:* ostial; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* tubular; *cauda:* round-oval.

Statistical differences (p<0.05) within some length classes were obtained for shape, dorsal and ventral edges, anterior region, *antirostrum* development and *sulcus acusticus* orientation. Along the otolith's development statistical differences were found for shape, dorsal and ventral edges.

Shape indices	Mean ± Sd	Minimum	Maximum
OL/TL (%)	7.99±2.10	4.79	11.70
OH/OL (%)	95.94±4.15	90.63	106.56
OT/OL (%)	23.09±2.22	17.90	26.35
OT/OH (%)	23.39±2.55	17.72	28.82
Circularity	14.29±0.49	13.66	15.39
Rectangularity	0.75±0.04	0.71	0.90

Lepidophanes guentheri (Goode & Bean 1896) - **Plate 17**

Maximum Size:	78 mm (TL) (FROESE; PAULY, 2016).
Distribution:	Present along the Brazilian coast from Cabo Frio to Northern Argentina (MENEZES et al., 2003; FIGUEIREDO et al., 2002).
Habitat:	Mesopelagic during the day and epipelagic at night for food purposes (HULLEY, 2015).
Diet:	Consumes zooplankton (SCOTT; SCOTT, 1988).
Collection:	673 otoliths from 370 fish (TL ranging from 30 to 77 mm).
Sample:	22 left otoliths categorized into 3, 20 mm classes (20 to 60 mm).

Shape: discoidal (68%), oval. ***Anterior region:*** oblique-round (32%), peaked, oblique to peaked, double-peaked. ***Posterior region:*** round. ***Dorsal edge:*** entire (64%), sinuate to entire. ***Ventral edge:*** sinuate to entire (59%), entire, serrate to sinuate. ***Profile:*** plane-convex. ***Rostrum and antirostrum orientation:*** does not apply. ***Rostrum:*** underdeveloped (59%), developed. ***Antirostrum:*** absent (41%), underdeveloped (32%), developed. ***Sulcus acusticus:*** *position:* median; *orientation:* descending; *opening:* ostial; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* funnel-like (77%), tubular; *cauda:* round-oval (91%), elliptic.

Statistical differences (p<0.05) within some length classes were obtained for ventral edge, anterior region, *rostrum* and *antirostrum* development and *cauda* morphology. Along the fish's development statistical differences were found for ventral edge, anterior region and *rostrum* and *antirostrum* orientation.

Shape indices	Mean ± Sd	Minimum	Maximum
OL/TL (%)	11.83±3.99	2.97	18.98
OH/OL (%)	76.87±3.00	72.64	85.71
OT/OL (%)	17.01±4.44	11.18	26.02
OT/OH (%)	21.31±5.62	14.04	34.04
Circularity	14.26±1.05	11.87	17.76
Rectangularity	0.73±0.03	0.69	0.79

Myctophum obtusirostre (Taning 1928) - **Plate 18**

Maximum Size:	90 mm (TL) (BERNARDES et al., 2005).
Distribution:	Inhabits tropical waters of the Atlantic, Pacific and Indian Oceans. Most abundant in the Florida coast and Northern of South America (FIGUEIREDO et al., 2002).
Habitat:	Mesopelagic, between 325 to 700m depth. Exhibit vertical migration at night (FROESE; PAULY, 2016).
Diet:	Mainly zooplankton (SCOTT; SCOTT, 1988).
Collection:	31 otoliths from 16 fish (TL ranging from 48 to 82 mm).
Sample:	5 left otoliths categorized into 1, 20 mm classes (60 mm).

Shape: discoidal (80%), discoidal to rhomboidal. ***Anterior region:*** double-peaked. ***Posterior region:*** round. ***Dorsal edge:*** sinuate to entire (60%), lobed to sinuate. ***Anterior ventral edge:*** lobed to sinuate (60%), sinuate to entire, lobed to entire. ***Posterior ventral edge:*** round (80%), sinuate to entire. ***Anterior edge:*** round. ***Posterior edge:*** round (80%), lobed. ***Profile:*** flattened. ***Rostrum and antirostrum orientation:*** in agreement. ***Rostrum:*** developed. ***Antirostrum:*** developed. ***Sulcus acusticus:*** *position:* supramedian; *orientation:* ascending; *opening:* ostial; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* tubular; *cauda:* round-oval.

The small number of otoliths examined did not permit the statistical analysis of the data but its morphometric characteristics are shown below:

Shape indices	Mean ± Sd	Minimum	Maximum
OL/TL (%)	4.05±0.29	3.54	4.25
OH/OL (%)	94.71±10.80	87.37	113.69
OT/OL (%)	18.08±5.00	14.46	27.39
OT/OH (%)	19.64±3.04	15.61	24.09
Circularity	15.71±0.48	15.04	16.32
Rectangularity	0.70±0.01	0.68	0.72

Notoscopelus resplendens (Richardson 1845) - **Plate 19**

Maximum Size:	95 mm (TL) (FROESE; PAULY, 2016).
Distribution:	Pacific, Indian and Atlantic oceans, present along the Brazilian coast (FIGUEIREDO et al., 2002).
Habitat:	Inhabits open seas, from 300 to 2,000 m depth (FROESE; PAULY, 2016).
Diet:	Feeds on crustaceans, krill, fish eggs and larvae (SCOTT; SCOTT, 1988).
Collection:	8 otoliths from 4 fish (TL ranging from 79 to 83 mm).
Sample:	3 left otoliths categorized into 2, 20 mm classes (60 to 80 mm).

Shape: elliptic. ***Anterior region:*** angled (67%), peaked. ***Posterior region:*** round. ***Dorsal edge:*** entire. ***Ventral edge:*** serrate to sinuate (67%), lobed to sinuate. ***Profile:*** flattened. ***Rostrum and antirostrum orientation:*** in agreement (67%), does not apply. ***Rostrum:*** underdeveloped. ***Antirostrum:*** underdeveloped (67%), absent. ***Sulcus acusticus:*** *position:* median; *orientation:* horizontal; *opening:* ostial; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* tubular; *cauda:* round-oval.

The small number of otoliths examined did not allow the statistical analysis of the data but its morphometric characteristics are shown below:

Shape indices	Mean ± Sd	Minimum	Maximum
OL/TL (%)	4.22±0.12	4.10	4.34
OH/OL (%)	65.49±1.23	64.12	66.47
OT/OL (%)	16.42±0.98	15.29	17.05
OT/OH (%)	25.06±1.04	23.85	25.66
Circularity	15.06±0.17	14.87	15.18
Rectangularity	0.73±0.01	0.72	0.74

Notoscopelus caudispinosus (Johnson 1863) - **Plate 20**

Maximum Size:	140 mm (TL) (FIGUEIREDO et al., 2002).
Distribution:	Occurs in all oceans. In the Western Atlantic is found from Cape Cod to the South of Brazil (MENEZES et al., 2003).
Habitat:	Mesopelagic species exhibiting and nocturnal migrations for feeding purposes (FROESE; PAULY, 2016).
Diet:	Feeds on zooplankton (SCOTT; SCOTT, 1988).
Collection:	112 otoliths from 59 fish (TL ranging from 42 to 78 mm).
Sample:	20 left otoliths categorized into 2, 20 mm classes (40 to 60 mm).

Shape: elliptic. ***Anterior region:*** angled (60%), peaked. ***Posterior region:*** round (95%), flattened. ***Dorsal edge:*** lobed to entire (60%), lobed. ***Ventral edge:*** lobed to entire (85%), sinuate, lobed. ***Profile:*** flattened. ***Rostrum and antirostrum orientation:*** in agreement (75%), does not apply. ***Rostrum:*** underdeveloped (55%), developed. ***Antirostrum:*** underdeveloped (45%), absent, developed. ***Sulcus acusticus:*** *position:* median; *orientation:* horizontal; *opening:* ostial; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* tubular; *cauda:* round-oval.

Statistical differences (p<0.05) within some length classes were obtained for ventral edge and posterior region. No differences were found during the fish development.

Shape indices	Mean ± Sd	Minimum	Maximum
OL/TL (%)	4.62±0.16	4.41	4.91
OH/OL (%)	65.35±1.43	63.12	68.61
OT/OL (%)	16.09±0.95	14.24	17.67
OT/OH (%)	24.62±1.31	21.97	26.47
Circularity	15.34±0.36	14.77	15.79
Rectangularity	0.74±0.01	0.72	0.75

Family NEOSCOPELIDAE

Neoscopelus macrolepidotus Johnson 1863 - **Plate 21**

Maximum Size:	250 mm (TL) (FROESE; PAULY, 2016).
Distribution:	Tropical and subtropical waters. Western Atlantic from Florida to Suriname and South Brazil (MENEZES et al., 2003).
Habitat:	Found on the continental slope between 300 and 800 m depth. Benthopelagic species (BERNARDES et al., 2005).
Diet:	Feeds mainly on plankton (PARIN et al., 1997).
Collection:	27 otoliths from 14 fish (TL ranging from 45 to 102 mm).
Sample:	13 left otoliths categorized into 4, 20 mm classes (40 to 100 mm).

Shape: kidney-shaped (92%), kidney-shaped to rectangular. ***Anterior region:*** round. ***Posterior region:*** round. ***Dorsal edge:*** entire. ***Ventral edge:*** entire. ***Profile:*** flattened. ***Rostrum and antirostrum orientation:*** does not apply. ***Rostrum:*** developed. ***Antirostrum:*** underdeveloped. ***Pseudorostrum:*** absent. ***Pseudoantirostrum:*** absent. ***Sulcus acusticus:*** *position:* median; *orientation:* descending; *opening:* ostial (85%), pseudo-ostial; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* funnel-like (69%), oval; *cauda:* tubular straight.

The small number of otoliths examined did not permit the statistical analysis of the data but its morphometric characteristics are shown below:

Shape indices	Mean ± Sd	Minimum	Maximum
OL/TL (%)	- ± -	-	-
OH/OL (%)	66.81±4.20	62.20	77.01
OT/OL (%)	14.88±1.35	13.28	18.18
OT/OH (%)	22.38±2.56	17.36	26.14
Circularity	15.44±0.54	14.55	16.63
Rectangularity	0.70±0.03	0.64	0.74

Order OPHIDIIFORMES

Family OPHIDIIDAE

Otoliths with similarities in *sulcus acusticus*: the *ostium* is tubular and the *cauda* is round-oval. *Pseudorostrum* and *pseudoantirostrum* are always absent.

Genypterus brasiliensis Regan 1903 - **Plate 22**

Maximum Size:	1015 mm (TL) (BERNARDES et al., 2005).
Distribution:	Occurs in the Western South Atlantic from Rio de Janeiro to Argentina (MENEZES et al., 2003).
Habitat:	Associated with soft mud bottom (BERNARDES et al., 2005).
Diet:	Benthic invertebrates and fish (CARVALHO-FILHO, 1992).
Collection:	28 otoliths from 14 fish (TL ranging from 402 to 705 mm).
Sample:	8 left otoliths categorized into 6, 20 mm classes (400 to 620 mm).

Shape: elliptic. ***Anterior region:*** round (63%), oblique-round, blunt to peaked. ***Posterior region:*** blunt to lanceolate (63%), oblique to peaked, oblique to lanceolate, double-peaked. ***Dorsal edge:*** lobed. ***Ventral edge:*** entire (50%), lobed to entire, sinuate to entire. ***Profile:*** concave-convex. ***Rostrum and antirostrum orientation:*** does not apply. ***Rostrum:*** absent. ***Antirostrum:*** absent. ***Sulcus acusticus:*** *position:* median; *orientation:* ascending; *opening:* ostial; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* tubular; *cauda:* round-oval.

The small number of otoliths examined did not permit the statistical analysis of the data but its morphometric characteristics are shown below:

Shape indices	Mean ± Sd	Minimum	Maximum
OL/TL (%)	2.93±0.21	2.57	3.11
OH/OL (%)	48.84±3.03	44.43	54.00
OT/OL (%)	16.75±3.33	14.25	24.21
OT/OH (%)	34.34±6.72	28.98	49.06
Circularity	21.84±1.33	19.29	23.68
Rectangularity	0.71±0.02	0.68	0.74

Ophidion holbrookii Putnam 1874 - **Plate 23**

Maximum Size:	270 mm (TL) (FROESE; PAULY, 2016).
Distribution:	Western Atlantic from North Carolina to Santa Catarina (CARVALHO-FILHO, 1992).
Habitat:	Lives on the continental shelf until 75m depth, associated with soft bottoms (CERVIGÓN et al., 1992).
Diet:	---
Collection:	8 otoliths from 4 fish (TL ranging from 201 to 242 mm).
Sample:	4 left otoliths categorized into 3, 20 mm classes (200 to 240 mm).

Shape: elliptic. ***Anterior region:*** round (63%), oblique-round, blunt to peaked. ***Posterior region:*** blunt to lanceolate (63%), oblique to peaked, oblique to lanceolate, double-peaked. ***Dorsal edge:*** lobed. ***Ventral edge:*** entire (50%), lobed to entire, sinuate to entire. ***Profile:*** concave-convex. ***Rostrum and antirostrum orientation:*** does not apply. ***Rostrum:*** absent. ***Antirostrum:*** absent. ***Sulcus acusticus:*** *position:* median; *orientation:* horizontal; *opening:* ostial; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* tubular; *cauda:* round-oval.

The small number of otoliths examined did not the statistical analysis of the data but its morphometric characteristics are shown below:

Shape indices	Mean ± Sd	Minimum	Maximum
OL/TL (%)	3.21±0.23	2.94	3.48
OH/OL (%)	83.65±4.42	78.25	88.27
OT/OL (%)	29.21±4.08	23.32	32.01
OT/OH (%)	34.84±3.85	29.80	38.99
Circularity	14.73±0.33	14.27	15.07
Rectangularity	0.63±0.02	0.61	0.64

Raneya brasiliensis (Kaup1856) - **Plate 24**

Maximum Size:	310 mm (TL) (FROESE; PAULY, 2016).
Distribution:	Southwest Atlantic from Rio de Janeiro to Northern Argentina (BERNARDES et al., 2005).
Habitat:	Coastal benthic fish, occurs between 30 and 200 m depth (CARVALHO-FILHO, 1992).
Diet:	Feeds on benthic invertebrates generally (CARVALHO-FILHO, 1992).
Collection:	168 otoliths from 85 fish (TL ranging from 75 to 286 mm).
Sample:	54 left otoliths categorized into 10, 20 mm classes (60 to 280 mm).

Shape: rhomboidal (78%), oval to rhomboidal. ***Anterior region:*** round (74%), angled-round. ***Posterior region:*** peaked. ***Dorsal edge:*** entire (46%), lobed to sinuate, sinuate to entire, lobed to entire. ***Ventral edge:*** entire (87%), sinuate to entire, lobed to sinuate. ***Profile:*** plane-convex. ***Rostrum and antirostrum orientation:*** does not apply. ***Rostrum:*** absent. ***Antirostrum:*** absent. ***Sulcus acusticus:*** *position:* median; *orientation:* horizontal; *opening:* para-ostial (57%), pseudo-ostial, ostial; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* tubular; *cauda:* round-oval.

Statistical differences (p<0.05) within some length classes were obtained for shape, dorsal and ventral edges, anterior region and *sulcus acusticus* opening. Along the otolith's growth statistical differences were found for dorsal edge, anterior region and *sulcus acusticus* opening.

Shape indices	Mean ± Sd	Minimum	Maximum
OL/TL (%)	3.46±0.36	2.93	5.32
OH/OL (%)	81.56±6.61	51.13	99.57
OT/OL (%)	26.70±2.72	18.80	33.37
OT/OH (%)	32.87±3.48	25.14	42.97
Circularity	15.04±0.63	14.12	16.49
Rectangularity	0.62±0.03	0.49	0.66

Order POLIMIXIIFORMES

Family POLIMIXIIDAE

Polymixia lowei Günther 1859 - **Plate 25**

Maximum Size:	300 mm (TL) (BERNARDES et al., 2005).
Distribution:	Western Atlantic from Canada to French Guyana, including the Gulf of Mexico and Caribbean and along the Brazilian coast to Uruguay (BERNARDES et al., 2005).
Habitat:	Demersal fish found on soft bottoms; occurs in the continental shelf and upper slope (FIGUEIREDO et al., 2002; FROESE; PAULY, 2016).
Diet:	Small demersal species and crustaceans (HAIMOVICI et al., 1994).
Collection:	54 otoliths from 28 fish (TL ranging from 131 to 184 mm).
Sample:	19 left otoliths categorized into 3, 20 mm classes (120 to 160 mm).

Shape: pentagonal. ***Anterior region:*** angled. ***Posterior region:*** oblique to flattened (84%), angled, oblique-round. ***Anterior dorsal edge:*** sinuate (89%), lobed. ***Posterior dorsal edge:*** lobed (53%), lobed to sinuate, sinuate to entire. ***Central dorsal edge:*** lobed (95%), lobed to sinuate. ***Anterior ventral edge:*** sinuate to entire (84%), entire, sinuate. ***Posterior ventral edge:*** sinuate to entire (68%), lobed to sinuate, entire, sinuate. ***Profile:*** concave-convex. ***Rostrum and antirostrum orientation:*** in agreement. ***Rostrum:*** underdeveloped. ***Antirostrum:*** underdeveloped. ***Pseudorostrum:*** absent. ***Pseudoantirostrum:*** absent. ***Sulcus acusticus:*** *position:* supramedian; *orientation:* horizontal; *opening:* ostial; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* funnel-like; *cauda:* tubular markedly curved (89%), tubular curled.

Statistical differences (p<0.05) within some length classes were obtained for dorsal, central dorsal, ventral and posterior ventral edges, posterior region and *cauda* morphology. Along the fish's development statistical differences were found for dorsal edge, anterior region and *sulcus acusticus* opening.

Shape indices	Mean ± Sd	Minimum	Maximum
OL/TL (%)	4.24±0.09	4.07	4.46
OH/OL (%)	82.34±2.17	78.55	85.73
OT/OL (%)	18.71±1.22	16.51	20.99
OT/OH (%)	22.72±1.27	20.82	24.90
Circularity	15.47±0.62	14.71	16.83
Rectangularity	0.70±0.01	0.67	0.73

Order BATRACHOIDIFORMES

Family BATRACHOIDIDAE

Porichthys porosissimus (Cuvier 1829) - **Plate 26**

Maximum Size:	350 mm (TL) (FISCHER et al., 2011).
Distribution:	Western Atlantic from the Northeast Brazil to Argentina (SAMPAIO, 2008).
Habitat:	Demersal species inhabiting sand, rubble and mud bottoms, from coastal beaches to 200 m depth (FISCHER et al., 2011).
Diet:	Feeds mainly on crustaceans and fishes, and other benthic organisms (SOARES et al., 1993; OLIVIER et al., 1968).
Collection:	754 otoliths from 380 fish (TL ranging from 62 to 307 mm).
Sample:	97 left otoliths categorized into 13, 20 mm classes (60 to 300 mm).

Shape: elliptic (86%), cuneiform, discoidal. ***Anterior region:*** blunt-round (89%), oblique-round. ***Posterior region:*** round (90%), oblique-round. ***Dorsal edge:*** irregular (23%), lobed to sinuate (18%), dentate to lobed, sinuate to entire. ***Ventral edge:*** entire (49%), sinuate to entire, lobed to sinuate, lobed. ***Profile:*** plane-convex. ***Rostrum and antirostrum orientation:*** does not apply. ***Rostrum:*** absent (77%), developed. ***Antirostrum:*** absent. ***Pseudorostrum:*** absent. ***Pseudoantirostrum:*** absent. ***Sulcus acusticus:*** *position:* median; *orientation:* horizontal; *opening:* mesial (76%), para-ostial, ostio-caudal, caudal; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* round-oval; *cauda:* elliptic.

Statistical differences ($p<0.05$) within some length classes were obtained for shape, dorsal and ventral edges, anterior and posterior regions, *rostrum* development and *sulcus acusticus* opening. Along the fish's development statistical differences were found for dorsal and ventral edges.

Shape índices	Mean ± Sd	Minimum	Maximum
OL/TL (%)	3.99±0.27	3.41	5.06
OH/OL (%)	86.07±10.32	16.26	101.51
OT/OL (%)	18.14±2.50	12.00	27.83
OT/OH (%)	21.77±8.58	15.71	102.24
Circularity	21.74±3.56	16.83	34.56
Rectangularity	0.70±0.28	0.57	0.76

Order LOPHIFORMES

Family OGCOCEPHALIDAE

The *sulcus acusticus morphology* is always archaesulcoid and *ventral edge* frequently entire for the species analysed. *Ventral edge* with little variation is atypical in other families. *Pseudorostrum* and *pseudoantirostrum* are always absent.

Dibranchus atlanticus Peters 1876 - **Plate 27**

Maximum Size:	394 mm (TL) (FROESE; PAULY, 2016).
Distribution:	Inhabits the Atlantic Ocean from Canada to Southern Brazil and the coast of Africa (BERNARDES et al., 2005).
Habitat:	Found on sandy bottom with preference of mud on the slope region between 180 and 910 m depth (FIGUEIREDO et al., 2002; FROESE; PAULY, 2016).
Diet:	Benthic species mainly polychaetes, small crustaceans, bivalve mollusks, starfish and brittle and sea spiders (SCOTT; SCOTT, 1988).
Collection:	40 otoliths from 21 fish (TL ranging from 88 to 188 mm).
Sample:	15 left otoliths categorized into 5, 20 mm classes (80 to 180 mm).

Shape: semicircular (47%), rectangular, elliptic to rectangular. ***Anterior region:*** round (80%), flattened. ***Posterior region:*** round (53%), flattened, oblique-round. ***Dorsal edge:*** lobed (47%), dentate, entire, dentate to entire. ***Ventral edge:*** entire. ***Profile:*** plane-convex. ***Rostrum and antirostrum orientation:*** does not apply. ***Rostrum:*** absent. ***Antirostrum:*** absent. ***Sulcus acusticus:*** *position:* inframedian; *orientation:* descending (67%), horizontal, ascending; *opening:* mesial; *morphology:* archaesulcoid (93%), homosulcoid; *colliculum:* monomorphic (93%), homomorphic; *ostium:* absent (93%), oval; *cauda:* absent (93%), round-oval.

Statistical differences (p<0.05) within some length classes were obtained for dorsal edge, anterior region, *sulcus acusticus* morphology and orientation, *colicullum*, *ostium* and *cauda* morphology. No differences were found during the fish's development.

Shape indices	Mean ± Sd	Minimum	Maximum
OL/TL (%)	3.63±0.38	2.97	4.35
OH/OL (%)	71.83±5.26	65.61	84.68
OT/OL (%)	29.17±4.38	22.59	35.70
OT/OH (%)	40.72±6.32	31.20	54.03
Circularity	16.22±2.20	13.86	21.80
Rectangularity	0.75±0.05	0.69	0.85

Ogcocephalus vespertilio (Linnaeus 1758) - **Plate 28**

Maximum Size:	300 mm (TL) (SAMPAIO, 2008).
Distribution:	Western Atlantic Ocean from Antilles to Brazil (FROESE; PAULY, 2016).
Habitat:	Benthic species; inhabits sludge sedments and corals (CARVALHO-FILHO, 1992).
Diet:	Feeds on benthic invertebrates and small fish (CARVALHO-FILHO, 1992).
Collection:	96 otoliths from 57 fish (TL ranging from 56 to 198 mm).
Sample:	25 left otoliths categorized into 7, 20 mm classes (40 to 160 mm).

Shape: elliptic. ***Anterior region:*** angled-round (52%), round, oblique-round, angled. ***Posterior region:*** angled-round (44%), round, oblique-round. ***Dorsal edge:*** sinuate (68%), entire. ***Ventral edge:*** entire (72%), sinuate. ***Profile:*** plane-convex (60%), biconvex. ***Rostrum and antirostrum orientation:*** does not apply. ***Rostrum:*** absent. ***Antirostrum:*** absent. ***Sulcus acusticus:*** *position:* inframedian (56%), median. *orientation:* descending (60%), horizontal, ascending; *opening:* mesial; *morphology:* archaesulcoid; *colliculum:* homomorphic; *ostium:* absent; *cauda:* absent.

Statistical differences (p<0.05) within some length classes were obtained for dorsal and ventral edges, anterior region, *sulcus acusticus* orientation and position and profile. Along the otolith's development statistical differences were found for posterior region, profile and *sulcus acusticus* position.

Shape índices	Mean ± Sd	Minimum	Maximum
OL/TL (%)	3.28±0.63	2.04	5.36
OH/OL (%)	58.59±3.39	52.04	65.33
OT/OL (%)	22.73±2.69	16.33	28.28
OT/OH (%)	38.85±4.52	29.84	47.40
Circularity	14.61±0.42	13.97	15.48
Rectangularity	0.74±0.02	0.70	0.79

Family LOPHIDAE

Lophius gastrophysus Miranda Ribeiro 1915 - **Plate 29**

Maximum Size:	890 mm (TL) (BERNARDES et al., 2005).
Distribution:	Western Atlantic Ocean from Florida to North Carolina to Argentina (CARUSO, 1983; FIGUEIREDO et al., 2002).
Habitat:	Unconsolidated bottoms (CERVIGÓN et al., 1992).
Diet:	Crustaceans, squid and fish (MUTO et al., 2005).
Collection:	44 otoliths from 24 fish (TL ranging from 59 to 720 mm).
Sample:	20 left otoliths categorized into 13, 20 mm classes (40 to 720 mm).

Shape: semicircular (80%), discoidal. ***Anterior region:*** round (55%), oblique-round, oblique to irregular. ***Posterior region:*** round (65%), oblique-round, irregular, oblique to peaked. ***Dorsal edge:*** lobed (75%), dentate to lobed. ***Ventral edge:*** entire (45%), lobed, sinuate. ***Profile:*** plane-convex. ***Rostrum and antirostrum orientation:*** does not apply. ***Rostrum:*** absent. ***Antirostrum:*** absent. ***Pseudorostrum:*** absent. ***Pseudoantirostrum:*** absent. ***Sulcus acusticus:*** *position:* median (50%), inframedian; *orientation:* horizontal; *opening:* mesial; *morphology:* archaesulcoid; *colliculum:* homomorphic; *ostium:* absent; *cauda:* absent.

Statistical differences (p<0.05) within some length classes were obtained for dorsal edge, anterior and posterior regions and *sulcus acusticus* position. No differences were found during the fish's development.

Shape indices	Mean ± Sd	Minimum	Maximum
OL/TL (%)	1.89±0.31	1.40	2.70
OH/OL (%)	71.89±11.72	55.08	92.63
OT/OL (%)	18.92±9.31	7.54	38.95
OT/OH (%)	25.42±9.24	11.85	42.05
Circularity	18.68±2.91	14.90	25.72
Rectangularity	0.70±0.03	0.62	0.75

ACKNOWLEDGMENTS

Special thanks are due to Thiago José Balbi for some otoliths measurements and to Alexandre Arackawa, Laura Montserrat and Michelle Konig for the otoliths drawings. This paper received substantial financial support from the Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP Process numbers- 2010/51631-2 and 2014/03764-4).

REFERENCES

ALMEIDA, E. M.; ROSSI-WONGTSCHOWSKI, C. L. D. B. *Maurolicus stehmanni* Parin & Kobyliansky, 1993 (Sternoptychidae): length of first maturation, and spawning seasons in the south-southeast Brazilian region. *Braz. J. Oceanogr.,* v. 55, n. 4, 309-322, 2007.

ALWIS, A. DE.; GJØSAETER, J. Feeding behaviour of *Diaphus dumerilii* in NW Africa with notes on its relation to other myctophyds in the area. Flødevigen rapportser. Tromsø: Havforskningsinstituttet, 1988. p. 55-69.

ANDERSON, W. W; GEHRINGER, J. W.; BERRY, F. H. Family Synodontidae, Lizardhshes. In: OLSEN, Y. H.; GEHRINGER, J. W. Atz. (Eds.) Fishes of the Western North Atlantic. Copenhagen: Bianco Luno's Printing. 1966.

BERNARDES, R. A.; FIGUEIREDO, J. L.; RODRIGUES, A. R.; FISHER, L. G.; VOOREN, C. M.; HAIMOVICI, M.; ROSSIWONG-TSCHOWSKI, C. L. D. B. Peixes da Zona Econômica Exclusiva da região Sudeste-Sul do Brasil: levantamento com armadilhas, pargueiras e rede de arrasto de fundo. São Paulo: EDUSP, 2005. 295 p.

BÖHLKE, J. E.; BÖHLKE, E. B. The identity of moray *Gymnotorax conspersus* Poey, and description of *G. kolpos*, n. sp., from the western Atlantic Ocean. *Proc. Acad. Nat. Sci. Phila.*, v. 132, p. 218-227, 1980.

BRENHA-NUNES, M. R.; SANTIFICETUR, C.; CONVERSANI, V. R. M.; GIARETTA, M. B.; ROSSI-WONGTSCHOWSKI, C. L. D. B.; SILIPRANDI, C. C. Atlas of marine bony fish otoliths (*sagittae*) of Southeastern-Southern Brazil Part IV: Perciformes (Centropomidae, Acropomatidae, Serranidae, Priacanthidae, Malacanthidae, Pomatomidae, Carangidae, Lutjanidae, Gerreidae and Haemulidae). *Braz. J. Oceanogr.*, v. 64, n. sp.3, p. 23-75, 2016.

CARUSO, J. H. The systematic and distribution of the lophiid anglerfishes: II. Revisions of the genera Lophiomus and Lophius. *Copeia*, v. 1, p. 11-30, 1983.

CARVALHO-FILHO, A. Peixes: costa brasileira. São Paulo: Marca D'Água, 1992. 304 p.

CERVIGÓN, F.; CIPRIANI, R.; FISCHER, W.; GARIBALDI, L.; HENDRICKX, M.; LEMUS, A. J.; MÁRQUEZ, R.; POUTIERS, J. M.; ROBAINA, G.; RODRIGUEZ, B. Fichas FAO de identificación de especies para los fines de la pesca: guía de campo de las especies comerciales marinas y de aquas salobres de la costa septentrional de Sur América. Rome: FAO, 1992. 513 p.

FISCHER, L. G.; PEREIRA, L. E. D.; VIEIRA, J. P. Peixes estuarinos e costeiros. Série Biodiversidade do Atlântico Sudoeste. Rio Grande: Ecoscientia, 2011. 130 p.

FIGUEIREDO, J. L.; MENEZES, N. A. Manual de peixes marinhos do Sudeste do Brasil. II. Teleostei (1). São Paulo: Museu de Zoologia da Universidade de São Paulo, 1978. 110 p.

FIGUEIREDO, J. L.; SANTOS, A. P.; YAMAGUTI, N.; BERNARDES, R. A.; ROSSI-WONGTSCHOWSKI, C. L. D. B. Peixes da zona econômica exclusiva da região sudeste-sul do Brasil: levantamento com rede de meia-água. São Paulo: EDUSP, 2002. 242 p.

FIGUEROA, D. E.; MACCHI, G.; HAIMOVICI, M. News about the reproductive ecology of the southern conger eel *Conger orbignianus*. *J. Mar. Biol. Ass. UK*., v. 90, n. 3, p. 461-465, 2010.

FROESE, R.; PAULY, D. FishBase. World Wide Web electronic publication. Available in: <http://www.fishbase.org>. Acessed: 1. 2016

HAIMOVICI, M.; MARTINS, A. S.; FIGUEIREDO, J. L.; VIEIRA, P. C. Demersal bony fish of the outer shelf and upper slope of the southern Brazil subtropical convergence ecosystem. *Mar. Ecol. Prog. Ser.*, v. 108, p. 59-77, 1994.

HULLEY, P. *Lepidophanes guentheri*. 2015. The IUCN Red List of Threatened Species 2015: e.T15599136A15603825. Available in: < http://dx.doi.org/10.2305/IUCN.UK.2015-4.RLTS.T15599136A15603825.en>. Acessed: 12 May 2016.

KAARTVEDT, S.; KNUTSEN, T.; HOLST, J. C. Schooling of the vertically migrating mesopelagic fish *Maurolicus muelleri* on light summer nights. *Mar. Ecol. Prog. Ser.*, v. 170, p. 287-290, 1998.

LOWE-MCCONNELL, R. H. Ecological studies in tropical fish communities. Cambridge: Cambridge University Press, 1987. 382 p.

MACPHERSON, E.; ROEL, B. A. Trophic relationships in the demersal fish community off Namibia. *S. Afr. J. Mar. Sci.*, v. 5, n. 1, p. 585-596, 1987.

MENEZES, N. A.; FIGUEIREDO, J. L. Family Engraulidae. In: MENEZES, N. A.; BUCKUP, P. A.; FIGUEIREDO, J. L.; MOURA, R. L. (Eds). Catálogo das espécies de peixes marinhos do Brasil. São Paulo: Museu de Zoologia da Universidade de São Paulo, 2003. 160 p.

MUTO, E. Y.; SILVA, M. H. C.; VERA, G. R.; LEITE, S. S. M.; NAVARRO, D. G.; ROSSI-WONGTSCHOWSKI, C. L. D. B. Alimentação e relações tróficas de peixes demersais da plataforma continental externa e talude superior da Região Sudeste-Sul do Brasil. São Paulo: Instituto Oceanográfico da USP, 2005. 64 p.

OLIVIER, S. R.; BASTIDA, R.; TORTI, M. R. Sobre el ecosistema de las águas litorales de Mar del Plata. Niveles tróficos y cadenas alimentarias pelágico-demersales y bentónico-demersales. Buenos Aires: Armada Argentina, Servicio de Hidrografia Naval, 1968. p. 5-45.

PARIN, N. V.; MIRONOV, A. N.; NESIS, K. N. Biology of the Nazca and Sala y Gómez submarine ridges, an outpost of the Indo-West Pacific fauna in the Eastern Pacific Ocean: composition and distribution of the fauna, its communities and history. In: BLAXTER, J. H. S.; SOUTHWARD, A. J.; GEBRUK, A. V.; SOUTHWARD, E. C.; TYLER, P. A. (Eds.). Advances in marine biology: The biogeography of the oceans. San Diego: Academic Press, 1997. p. 147-228.

ROSSI-WONGTSCHOWSKI, C. L. D. B.; CHALOM, A.; SILIPRANDI, C. C.; BRENHA-NUNES, M. R.; CONVERSANI, V. R. M.; SANTIFICETUR, C.; GIARETTA, M. B. COSS-Brasil: Coleção de Otólitos de Peixes Marinhos da Região Sudeste-Sul do Brasil. São Paulo: Instituto Oceanográfico da Universidade de São Paulo, 2016.

ROSSI-WONGTSCHOWSKI, C. L. D. B. Morfologia de Otólitos. In: VOLPEDO, A. V.; VAZ-DOS-SANTOS, A. (Ed.). Métodos de estudo com otólitos: princípios e aplicações. 1. ed. Buenos Aires: PIESCI, 2015. Edição Bilíngue. Espanhol: p. 29-58. Português: p. 237-256.

ROSSI-WONGTSCHOWSKI, C. L. D. B.; SILIPRANDI, C. C.; BRENHA, M. R.; GONSALES, S. A.; SANTIFICETUR, C.; VAZ-DOS--SANTOS, A. M. Atlas of marine bony fish otoliths (Sagittae) of Southeastern - Southern Brazil Part I: Gadiformes (Macrouridae, Moridae, Bregmacerotidae, Phycidae and Merlucciidae); Part II: Perciformes (Carangidae, Sciaenidae, Scombridae and Serranidae. *Braz. J. Oceanogr*., v. 62, n. spe 1, p. 1-103, 2014.

RUSSELL, B.; POLANCO FERNANDEZ, A.; MOORE, J.; MCEACHRAN, J. D. *Saurida caribbaea*. 2015. The IUCN Red List of Threatened Species 2015 e.T16441631A16510162. Available in: <http://dx.doi.org/10.2305/IUCN.UK.2015-4.RLTS.T16441631A16510162.en>. Acessed: 06 May. 2016.

SAMPAIO, C. L. S. Identificação das espécies marinhas: permitidas pela legislação brasileira. In: SAMPAIO, C. L. S.; NOTTINGHAM, M. C. (Org.). Guia para Identificação de Peixes Ornamentais. Brasília: IBAMA, 2008. 205 p.

SCOTT, W. B.; SCOTT, M. G. Atlantic fishes of Canada. *Can. Bull. Fish. Aquat. Sci.,* v. 3, p. 219-731, 1988.

SILIPRANDI, C. C.; BRENHA-NUNES, M. R.; ROSSI-WONGTSCHOWSKI, C. L. D. B.; SANTIFICETUR, C.; CONVERSANI, V. R. M. Atlas of marine bony fish otoliths (*sagittae*) of Southeastern-Southern Brazil Part III: Clupeiformes (Clupeidae, Engraulidae, Pristigasteridae). *Braz. J. Oceanogr.*, v. 64, n. spe. 3, p. 1-22, 2016.

SOARES, L. S. H.; GASALLA, M. A.; RIOS, M. A. T.; ARRASA, M. V.; ROSSI-WONGTSCHOWSKI, C. L. D. B. Grupos tróficos de onze espécies dominantes de peixes demersais da plataforma continental interna de Ubatuba, Brasil. *Publ. Esp. Inst. Oceanogr*., v. 10, p. 189-198, 1993.

SZPILMAN, M. Peixes marinhos do Brasil: guia prático de identificação. Rio de Janeiro: Mauad, 2000. 288 p.

THOMPSON, B. A. Synodontidae. Lizardfishes. In: CARPENTER, K. E. (Ed.). FAO species identification guide for fishery purposes. The living marine resources of the Western Central Atlantic. Rome: FAO, 2002. p. 923-930.

TSARIN, S. A. Myctophids of the sound scattering layer and their place in pelagic food webs. In: Proceedings of the International Symposium on the Role of Forage Fishes in Marine Ecosystems. Anchorage: Sea Grant College Program Report, 1997. p. 271-275.

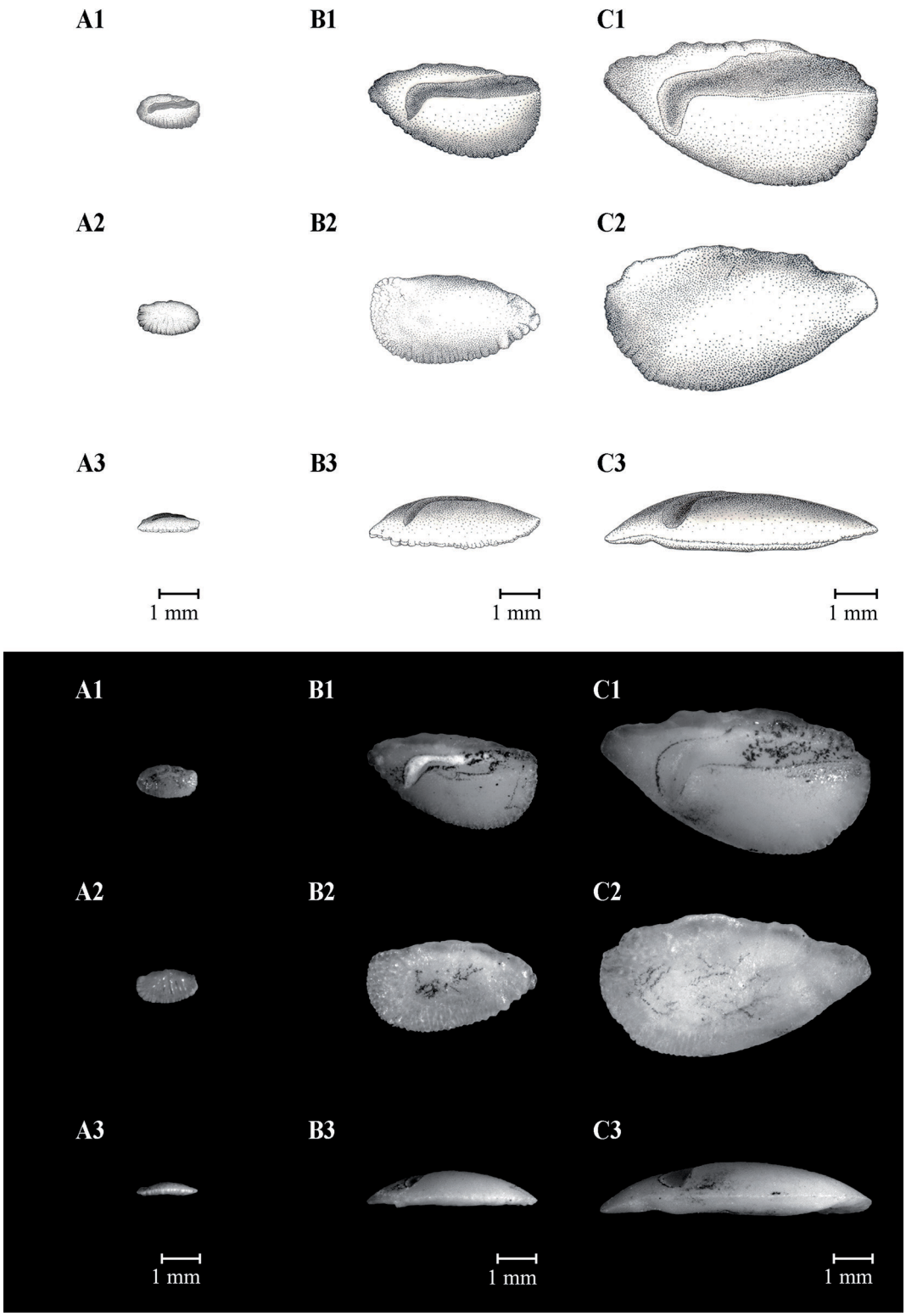


Plate 1. Illustration (above) and photographs (below) of *Albula vulpes* otoliths from fish with total length of A. 32 mm; B. 86 mm; C. 153 mm. The medial face is shown in A1; B1; C1; the lateral face in A2; B2; C2; the ventral profile in A3; B3; C3 (Illustration: Laura Montserrat; Photos: Cesar Santificetur).

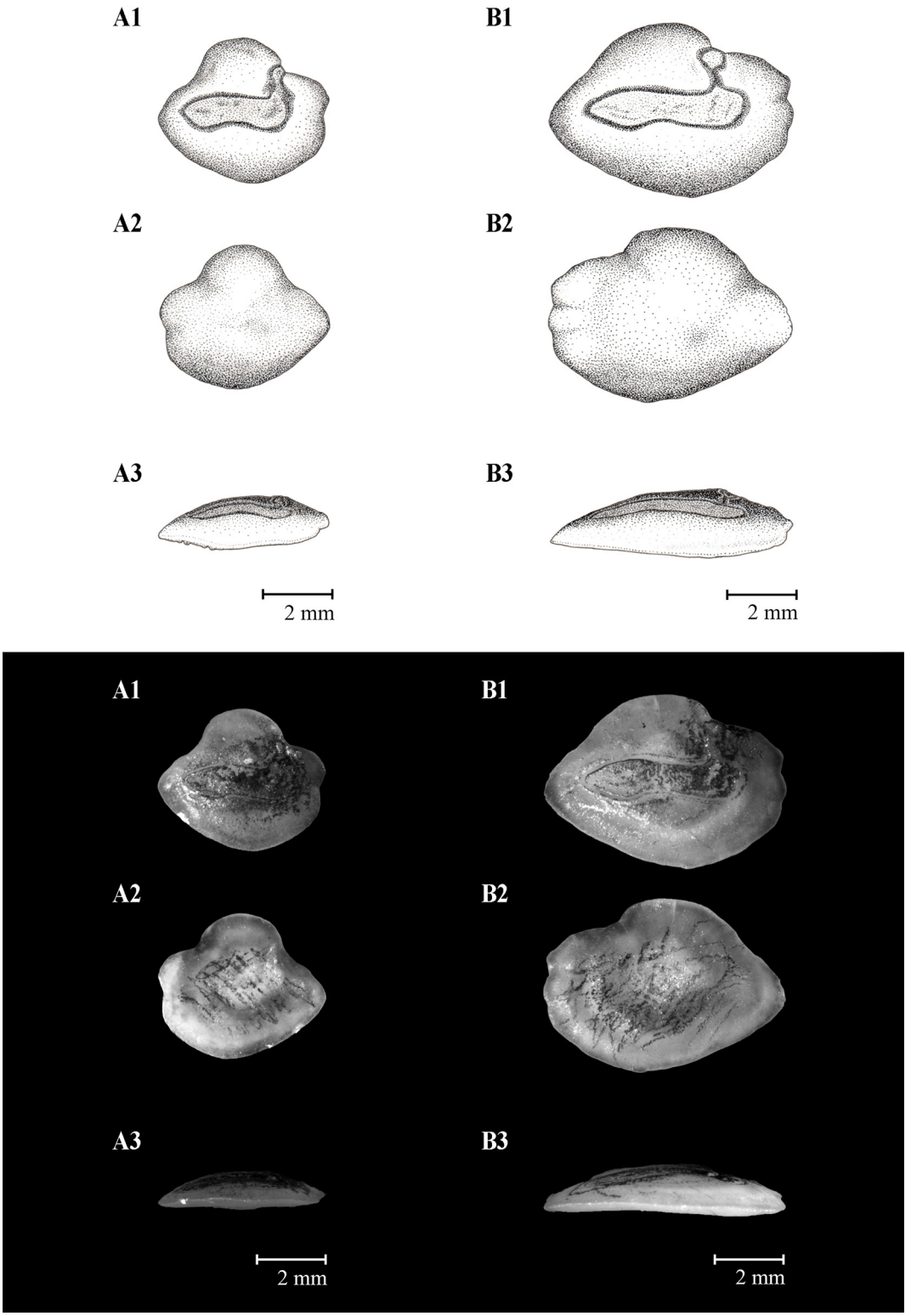


Plate 2. Illustration (above) and photographs (below) of *Ariosoma opistophthalmum* otoliths from fish with total length of A. 215 mm; B. 335 mm. The medial face is shown in A1; B1; the lateral face in A2; B2; the ventral profile in A3; B3 (Illustration: Laura Montserrat; Photos: Cesar Santificetur).

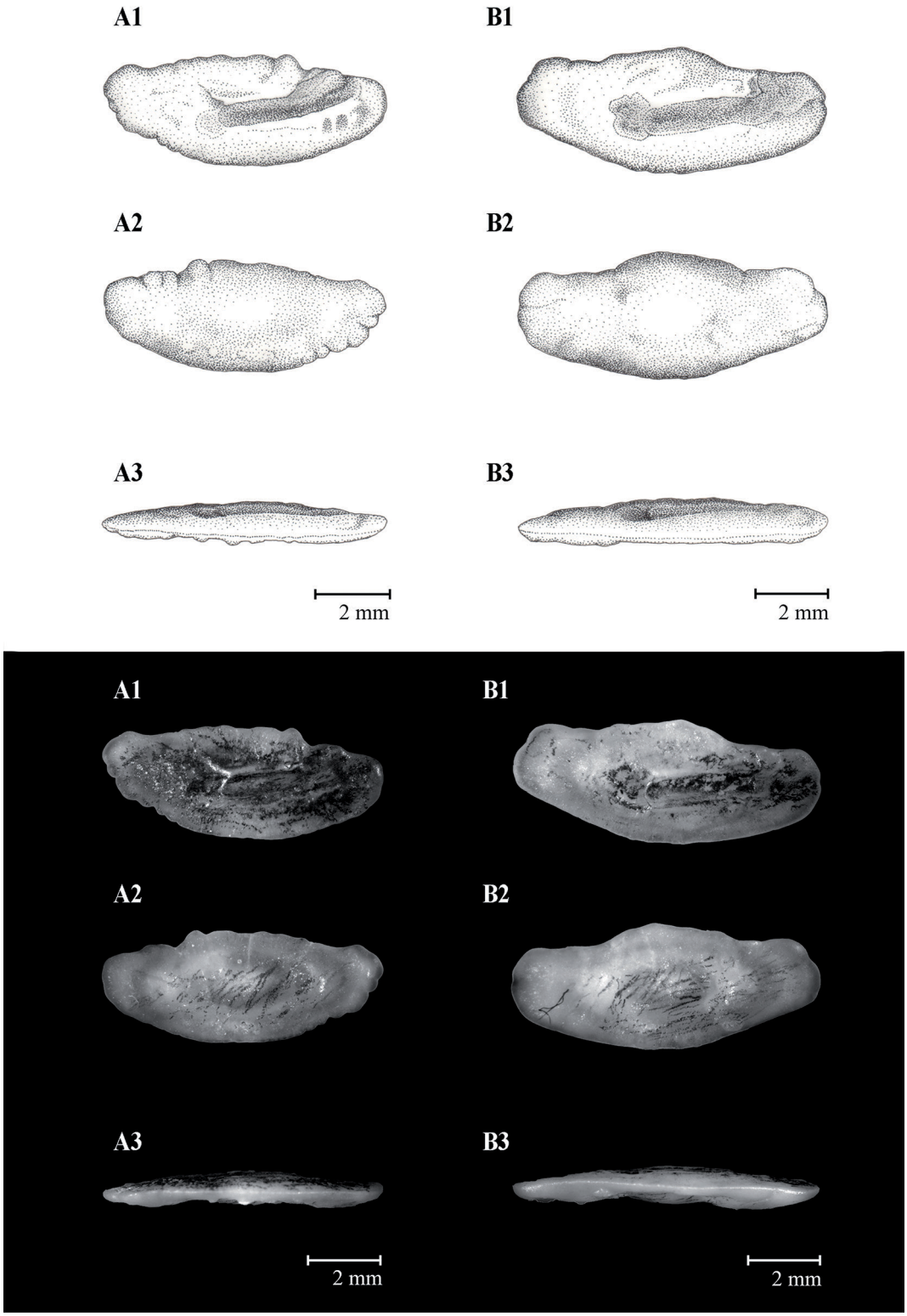


Plate 3. Illustration (above) and photographs (below) of *Conger orbignyanus* otoliths from fish with total length of A. 454 mm; B. 953 mm. The medial face is shown in A1; B1; the lateral face in A2; B2; the ventral profile in A3; B3 (Illustration: Laura Montserrat; Photos: Cesar Santificetur).

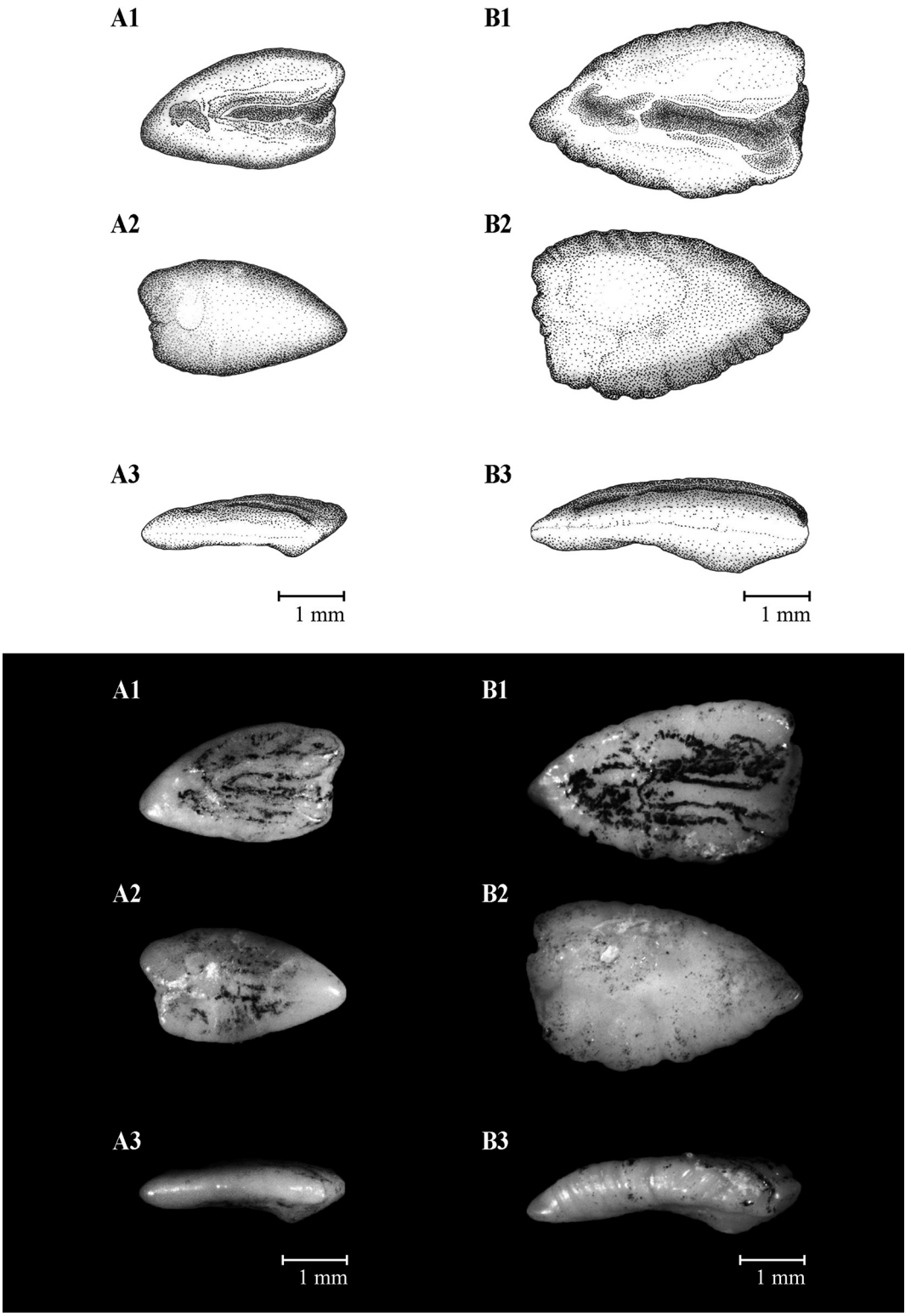


Plate 4. Illustration (above) and photographs (below) of *Gymnothorax conspersus* otoliths from fish with total length of A. 482 mm; B. 750 mm. The medial face is shown in A1; B1; the lateral face in A2; B2; the ventral profile in A3; B3 (Illustration: Laura Montserrat; Photos: Cesar Santificetur).

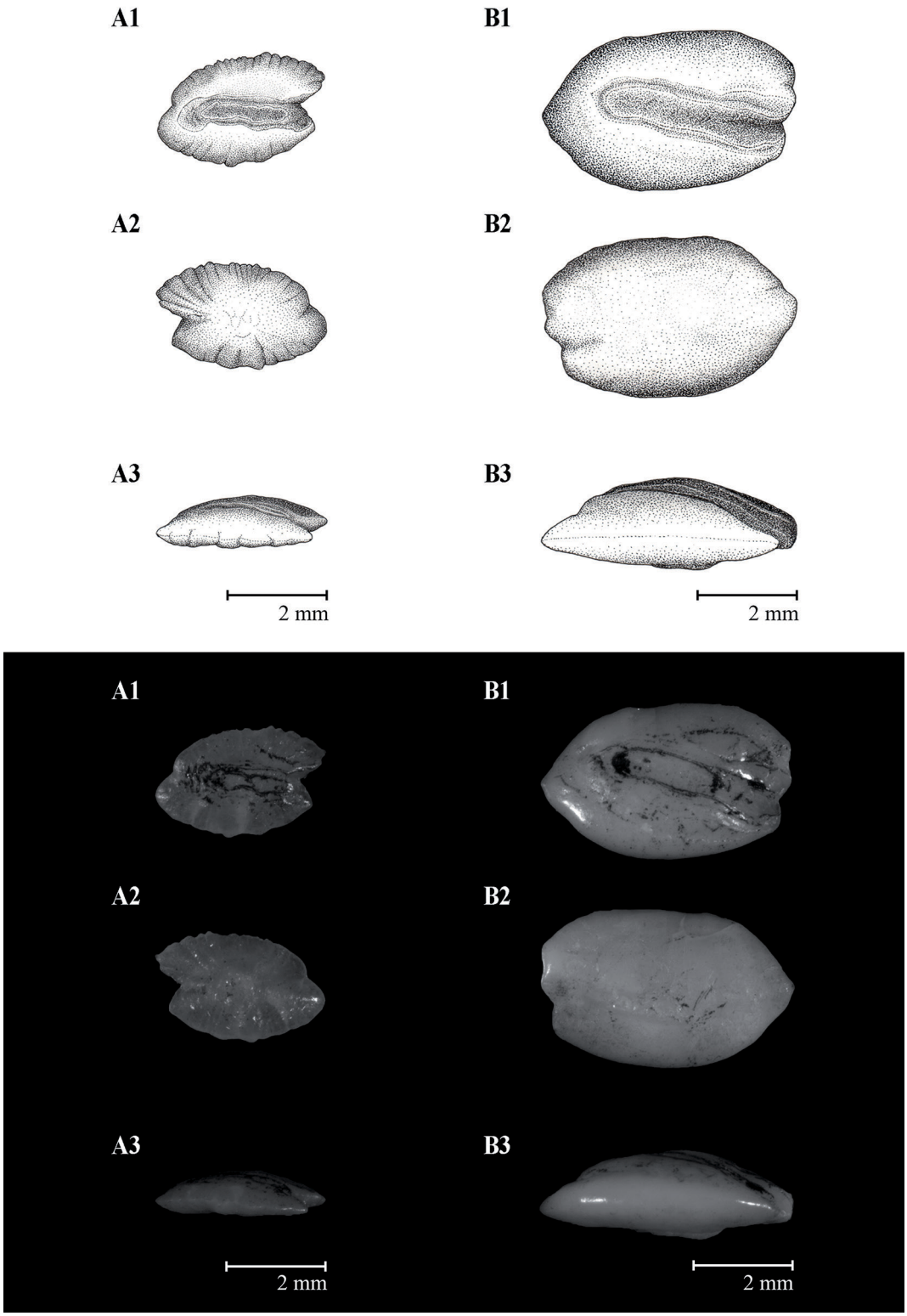


Plate 5. Illustration (above) and photographs (below) of *Gymnothorax ocellatus* otoliths from fish with total length of A. 341 mm; B. 550 mm. The medial face is shown in A1; B1; the lateral face in A2; B2; the ventral profile in A3; B3 (Illustration: Laura Montserrat; Photos: Cesar Santificetur).

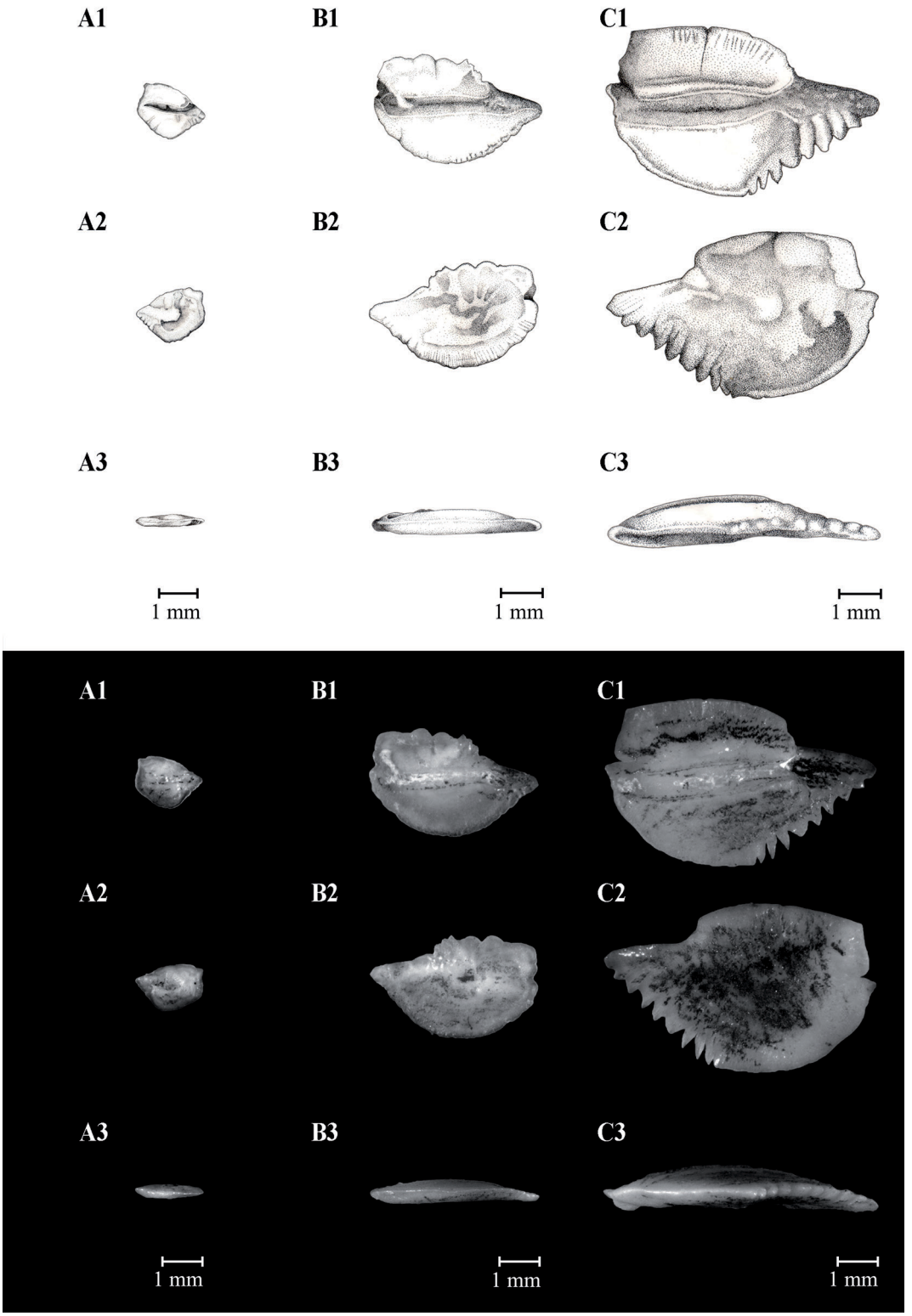
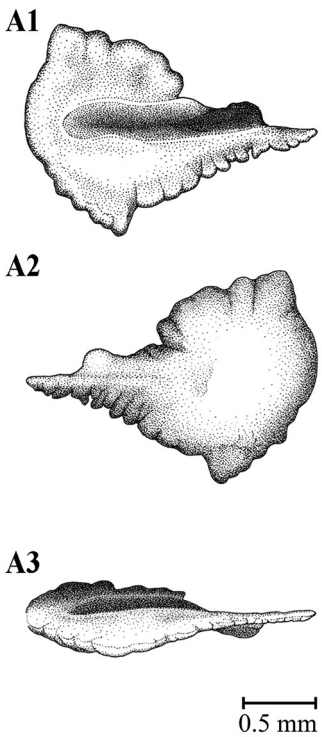


Plate 6. Illustration (above) and photographs (below) of *Argentina striata* otoliths from fish with total length of A. 55mm; B. 137 mm; C. 220 mm. The medial face is shown in A1; B1; C1; the lateral face in A2; B2; C2; the ventral profile in A3; B3; C3 (Illustration: Laura Montserrat and Michelle Konig; Photos: Cesar Santificetur).



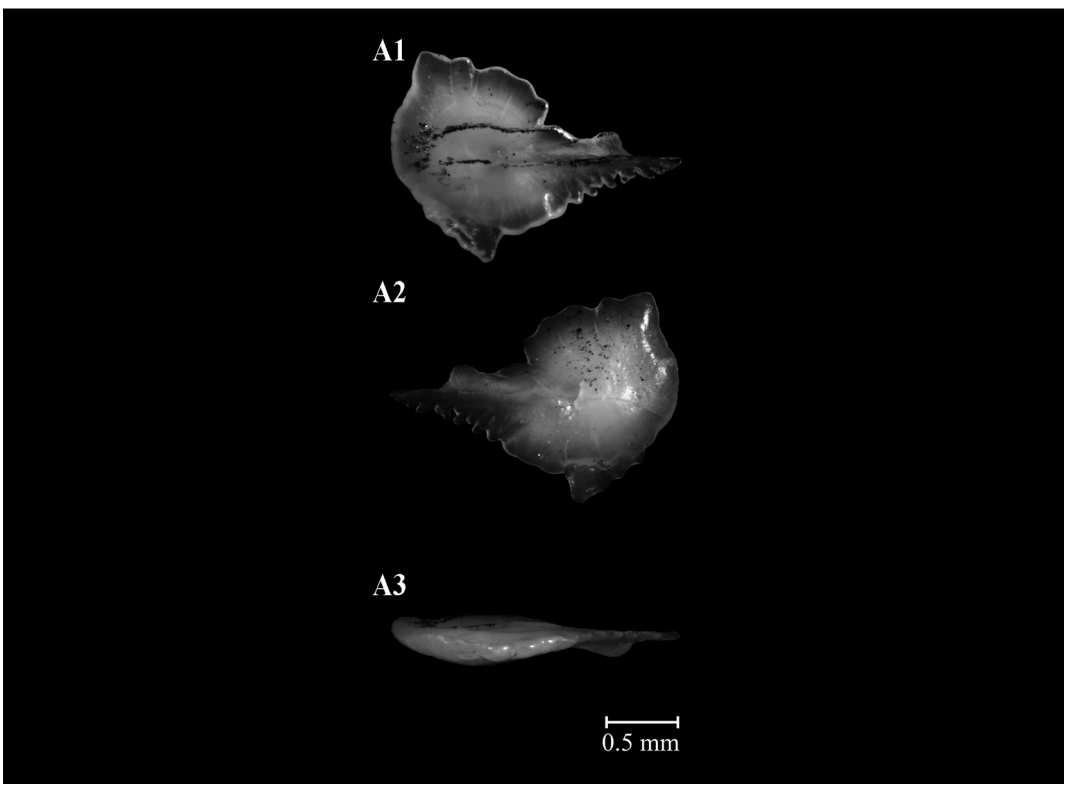


Plate 7. Illustration (above) and photographs (below) of *Maurolicus stehmanni* otoliths from fish with total length of A. 55 mm; internal side A1. The medial face is shown in A2; the ventral profile in A3 (Illustration: Michelle Konig; Photos: Cesar Santificetur).

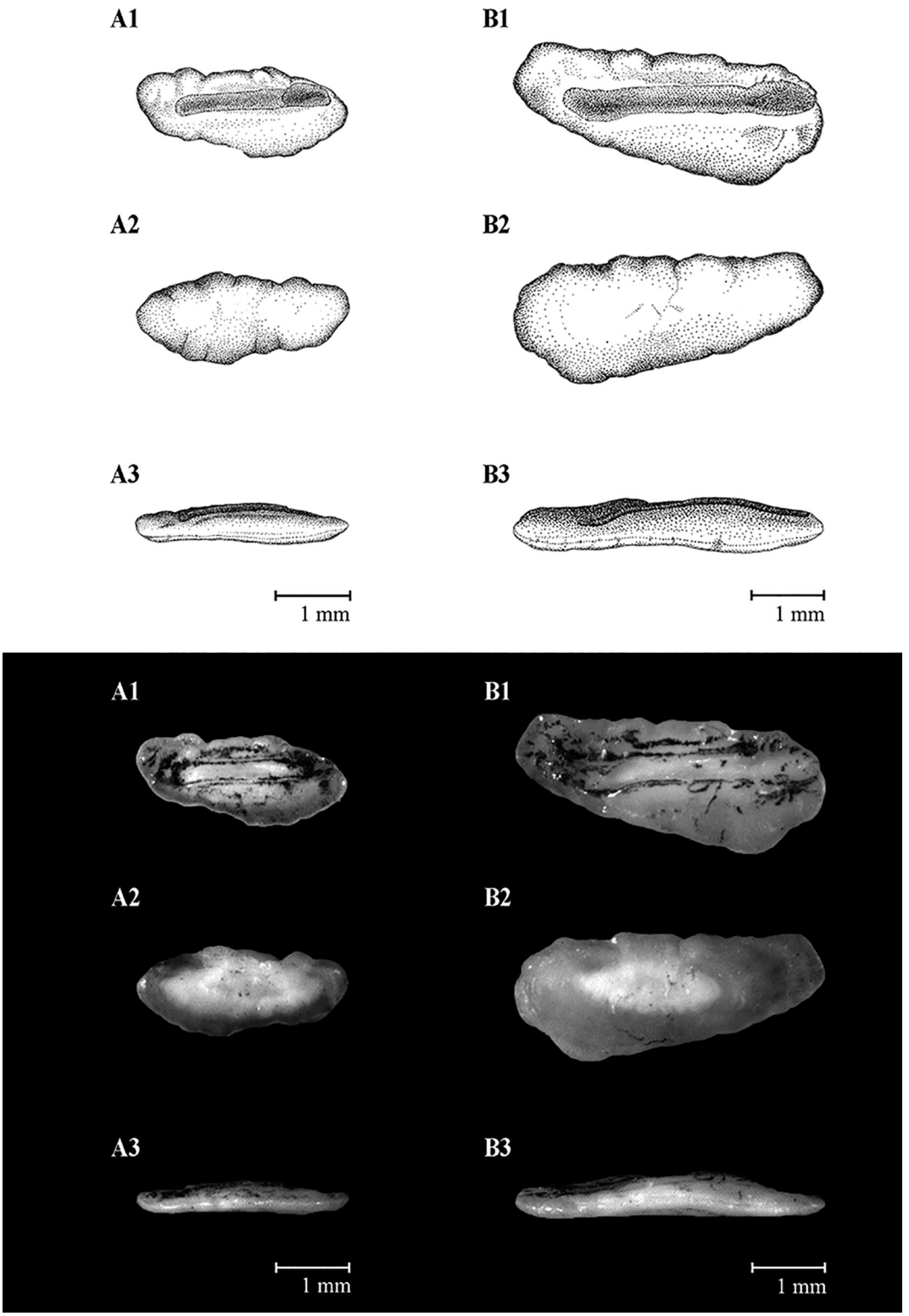


Plate 8. Illustration (above) and photographs (below) of *Chlorophthalmus agassizi* otoliths from fish with total length of A. 88 mm; B. 167 mm. The medial face is shown in A1; B1; the lateral face in A2; B2; the ventral profile in A3; B3 (Illustration: Laura Montserrat; Photos: Cesar Santificetur).

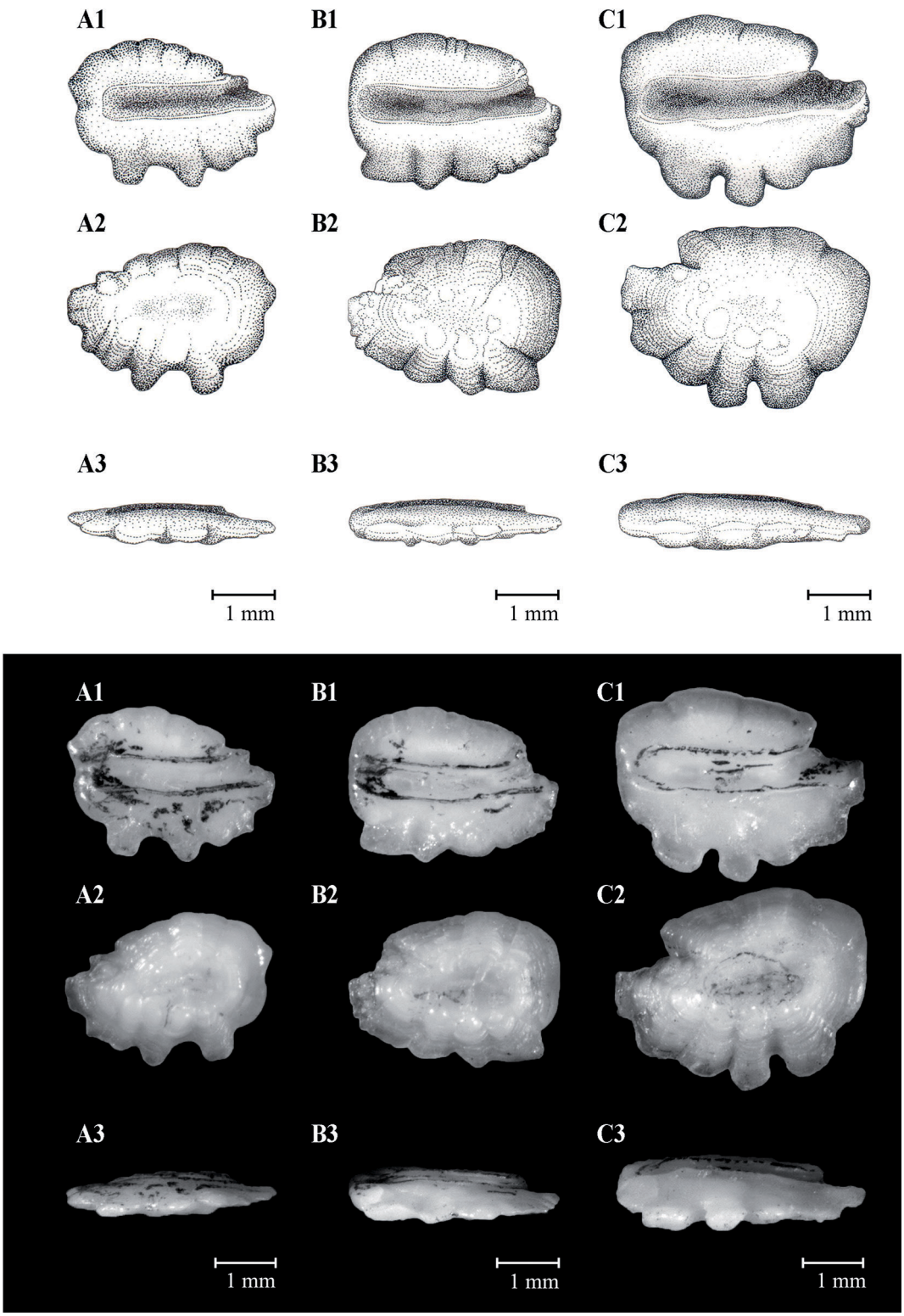


Plate 9. Illustration (above) and photographs (below) of *Parasudis truculenta* otoliths from fish with total length of A. 91 mm; B. 188 mm; C. 296 mm. The medial face is shown in A1; B1; C1; the lateral face in A2; B2; C2; the ventral profile in A3; B3; C3 (Illustration: Laura Montserrat; Photos: Cesar Santificetur).

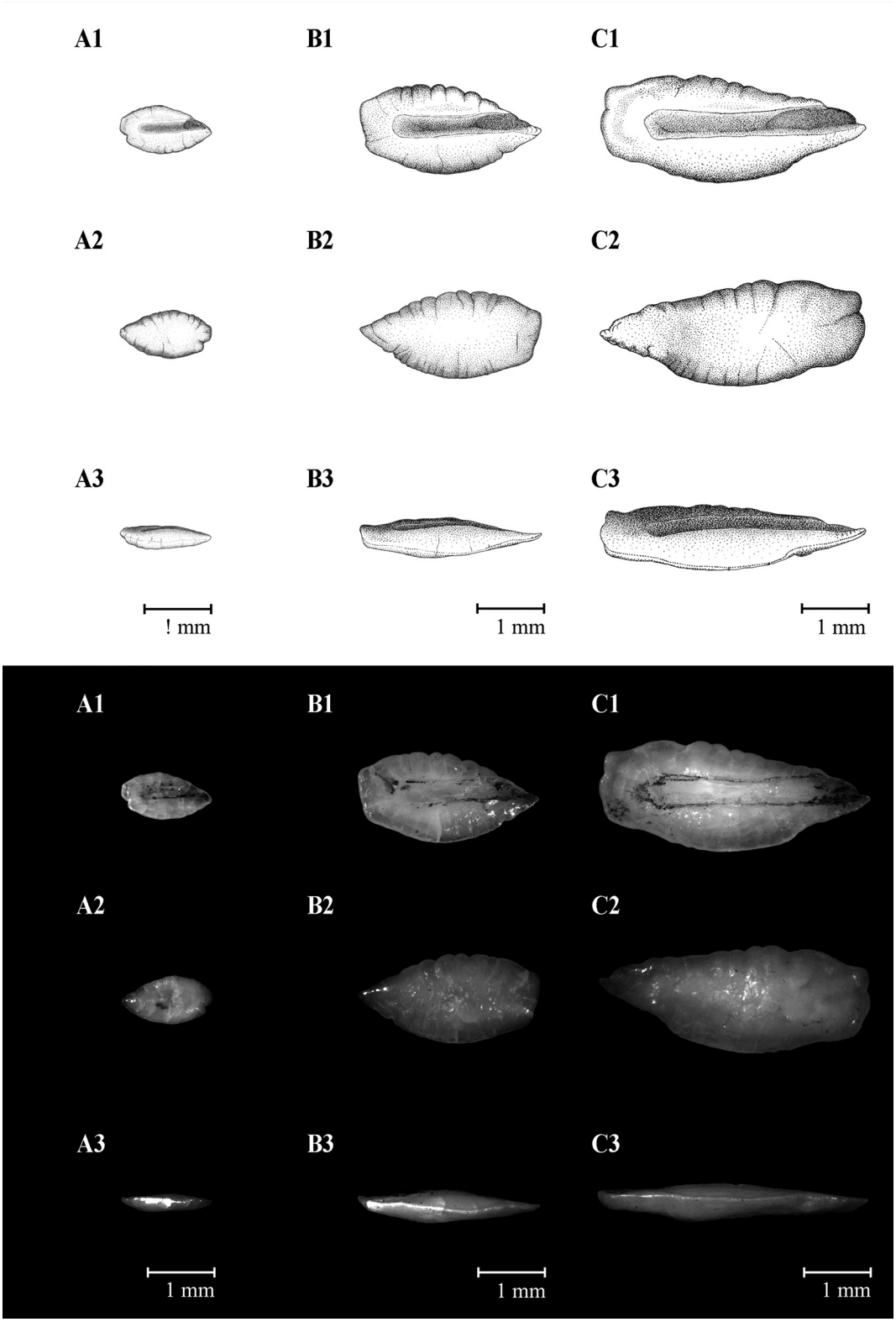


Plate 10. Illustration (above) and photographs (below) of *Saurida brasiliensis* otoliths from fish with total length of A. 45 mm; B. 87 mm; C. 128 mm. The medial face is shown in A1; B1; C1; the lateral face in A2; B2; C2; the ventral profile in A3; B3; C3 (Illustration: Laura Montserrat; Photos: Cesar Santificetur).

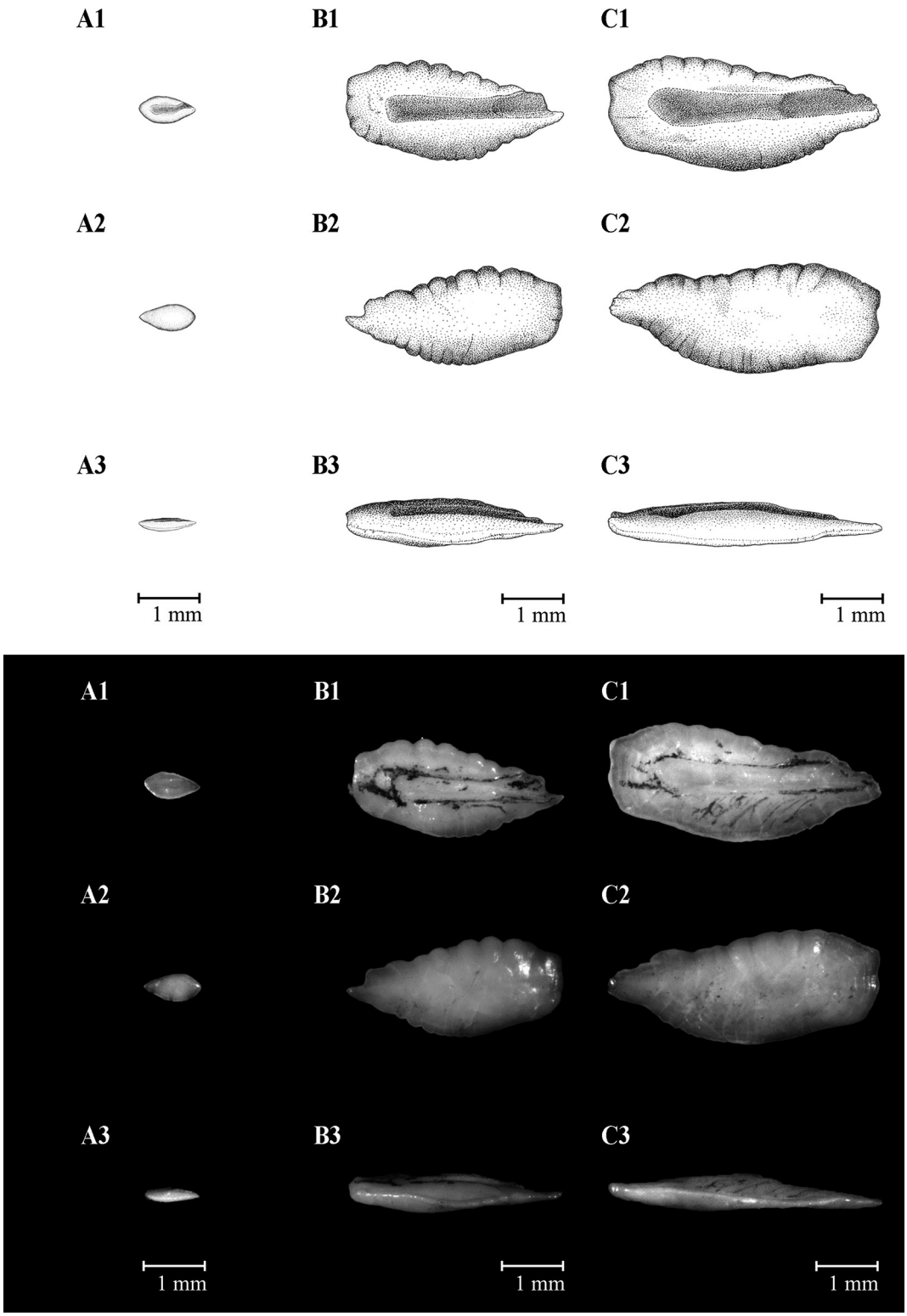


Plate 11. Illustration (above) and photographs (below) of *Saurida caribbaea* otoliths from fish with total length of A. 37 mm; B. 92 mm; C. 146 mm. The medial face is shown in A1; B1; C1; the lateral face in A2; B2; C2; the ventral profile in A3; B3; C3 (Illustration: Laura Montserrat; Photos: Cesar Santificetur).

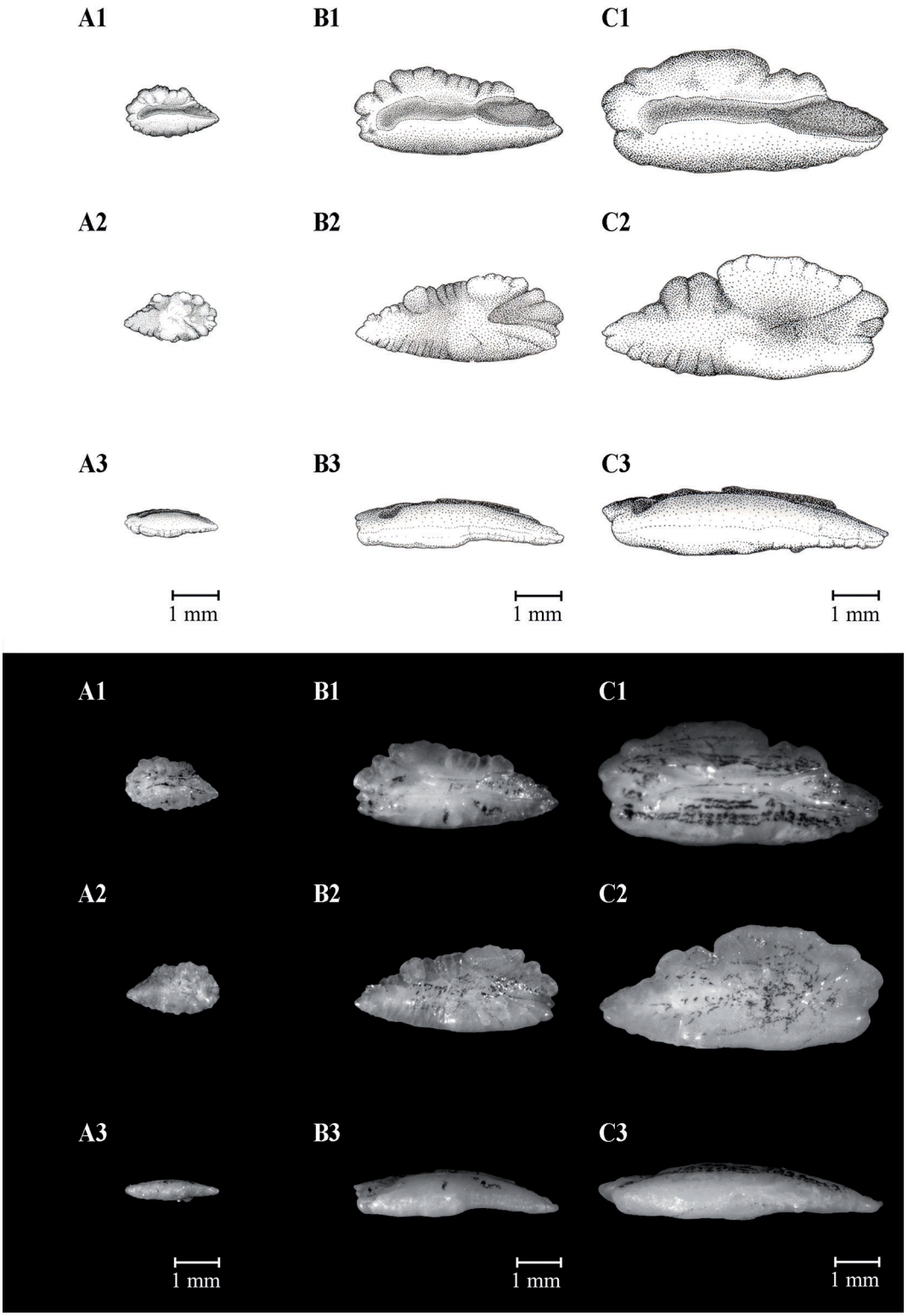


Plate 12. Illustration (above) and photographs (below) of *Synodus foetens* otoliths from fish with total length of A. 106 mm; B. 214 mm; C. 375 mm. The medial face is shown in A1; B1; C1; the lateral face in A2; B2; C2; the ventral profile in A3; B3; C3 (Illustration: Laura Montserrat; Photos: Cesar Santificetur).

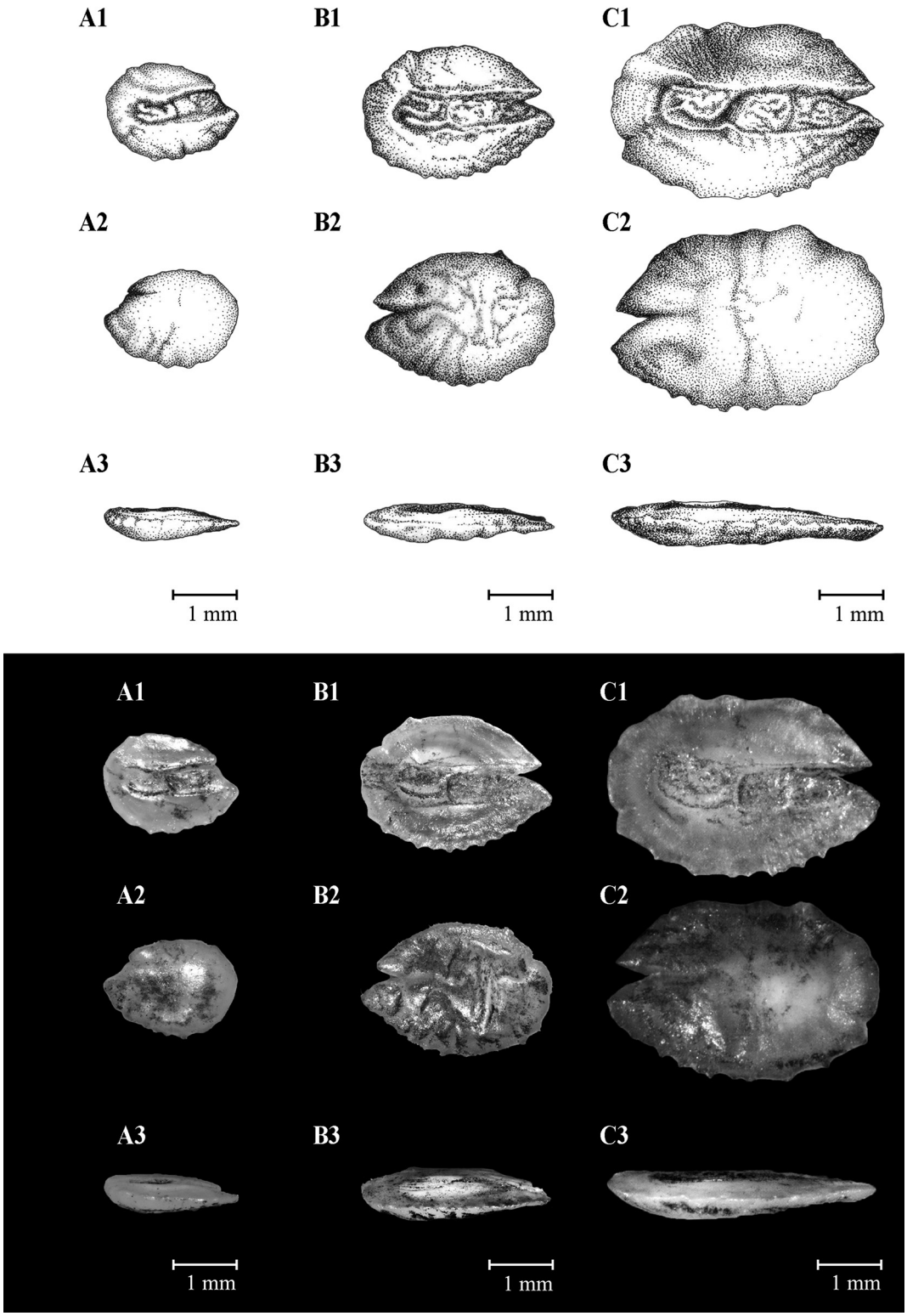


Plate 13. Illustration (above) and photographs (below) of *Diaphus dumerilii* otoliths from fish with total length of A. 28 mm; B. 65 mm; C. 102 mm. The medial face is shown in A1; B1; C1; the lateral face in A2; B2; C2; the ventral profile in A3; B3; C3 (Illustration: Alexandre Arackawa; Photos: Cesar Santificetur).

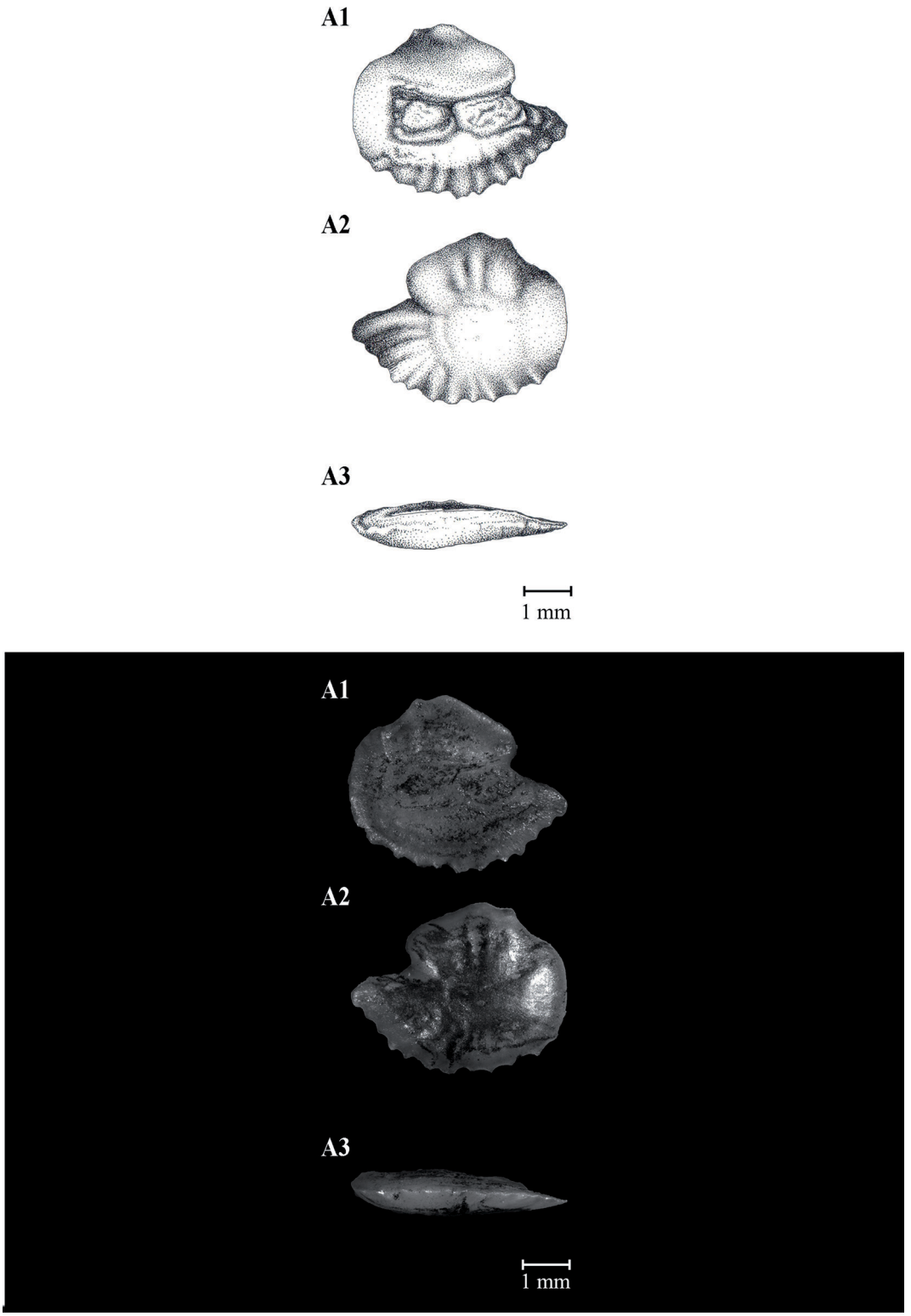


Plate 14. Illustration (above) and photographs (below) of *Diaphus hudsoni* otoliths from fish with total length of A. 94 mm. The medial face is shown in A1; the lateral face in A2; the ventral profile in A3 (Illustration: Alexandre Arackawa; Photos: Cesar Santificetur).

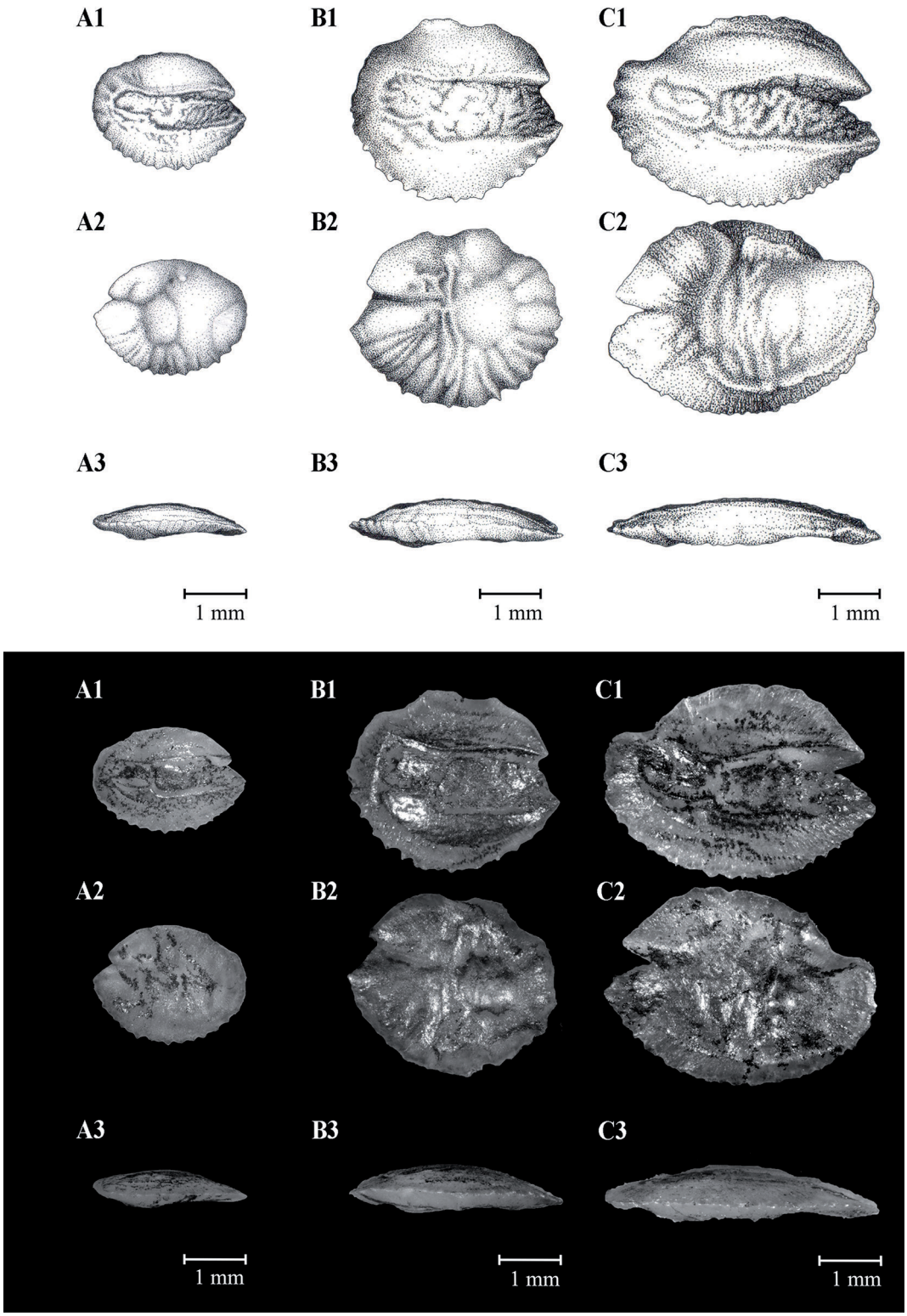


Plate 15. Illustration (above) and photographs (below) of *Diaphus perspicillatus* otoliths from fish with total length of A. 49 mm; B. 75 mm; C. 104 mm. The medial face is shown in A1; B1; C1; the lateral face in A2; B2; C2; the ventral profile in A3; B3; C3 (Illustration: Alexandre Arackawa; Photos: Cesar Santificetur).

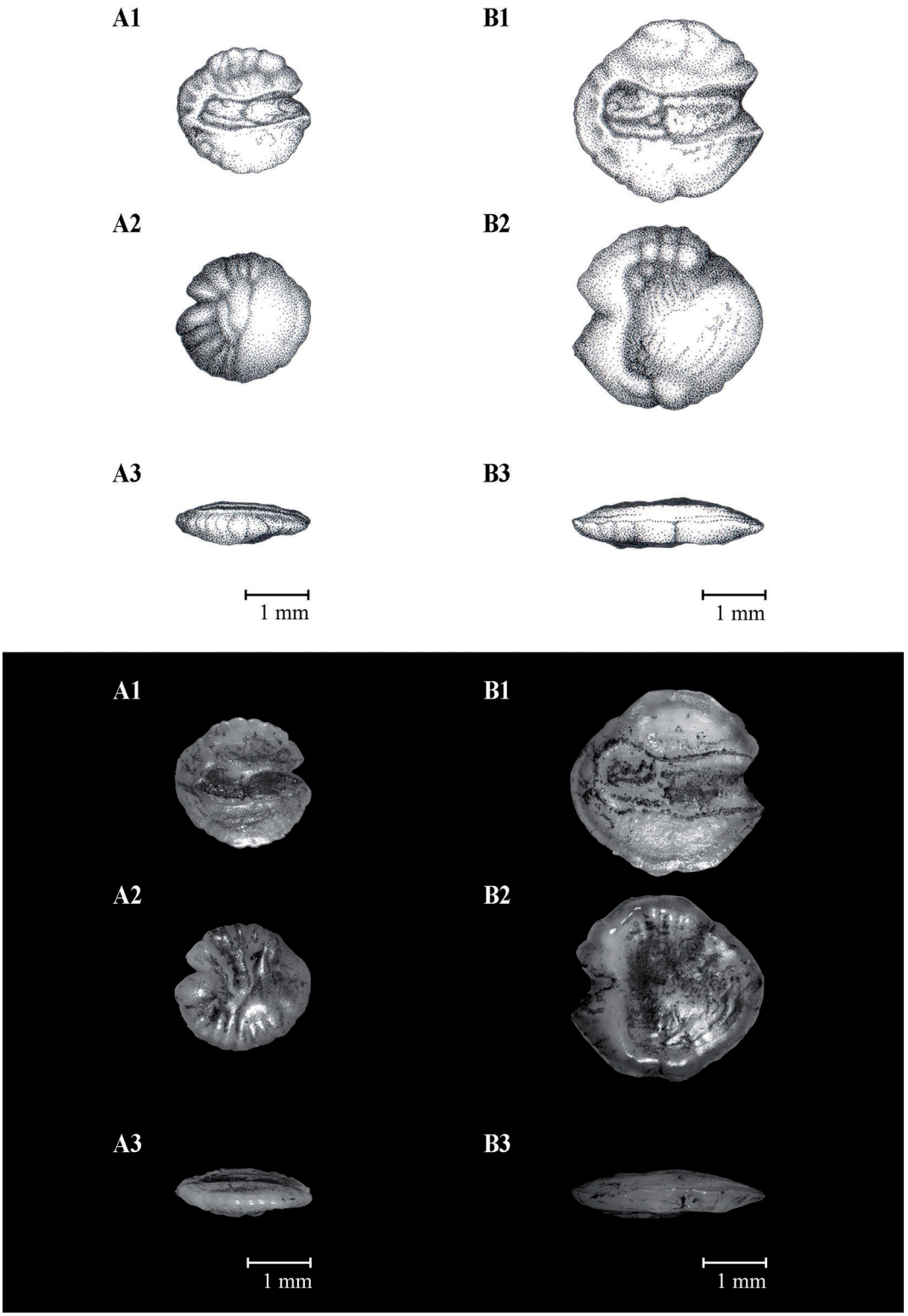


Plate 16. Illustration (above) and photographs (below) of *Hygophum hygomii* otoliths from fish with total length of A. 38 mm; B. 74 mm. The medial face is shown in A1; B1; the lateral face in A2; B2; the ventral profile in A3; B3 (Illustration: Alexandre Arackawa; Photos: Cesar Santificetur).

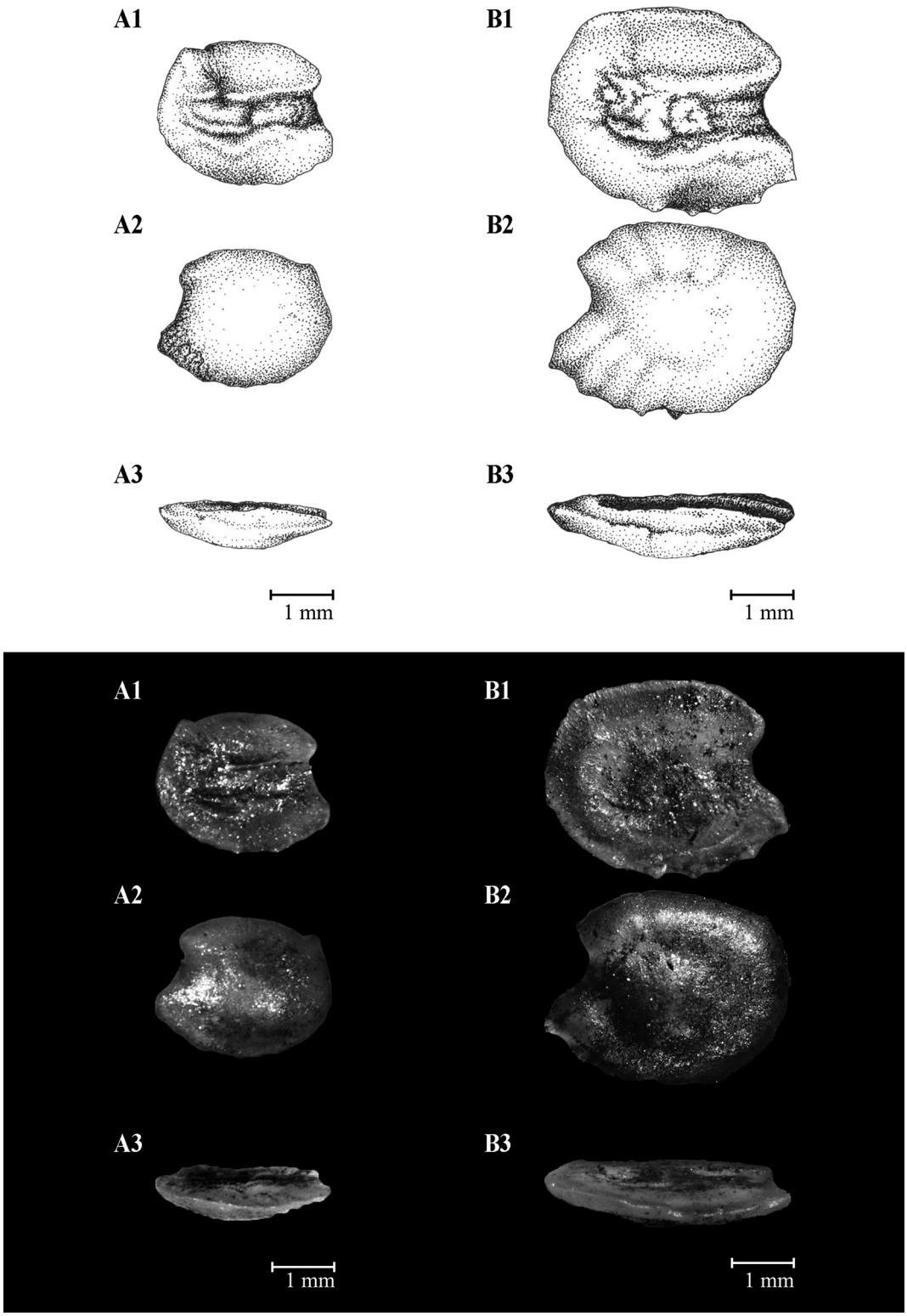


Plate 17. Illustration (above) and photographs (below) of *Lepidophanes guentheri* otoliths from fish with total length of A. 30 mm; B. 77 mm. The medial face is shown in A1; B1; the lateral face in A2; B2; the ventral profile in A3; B3 (Illustration: Alexandre Arackawa; Photos: Cesar Santificetur).

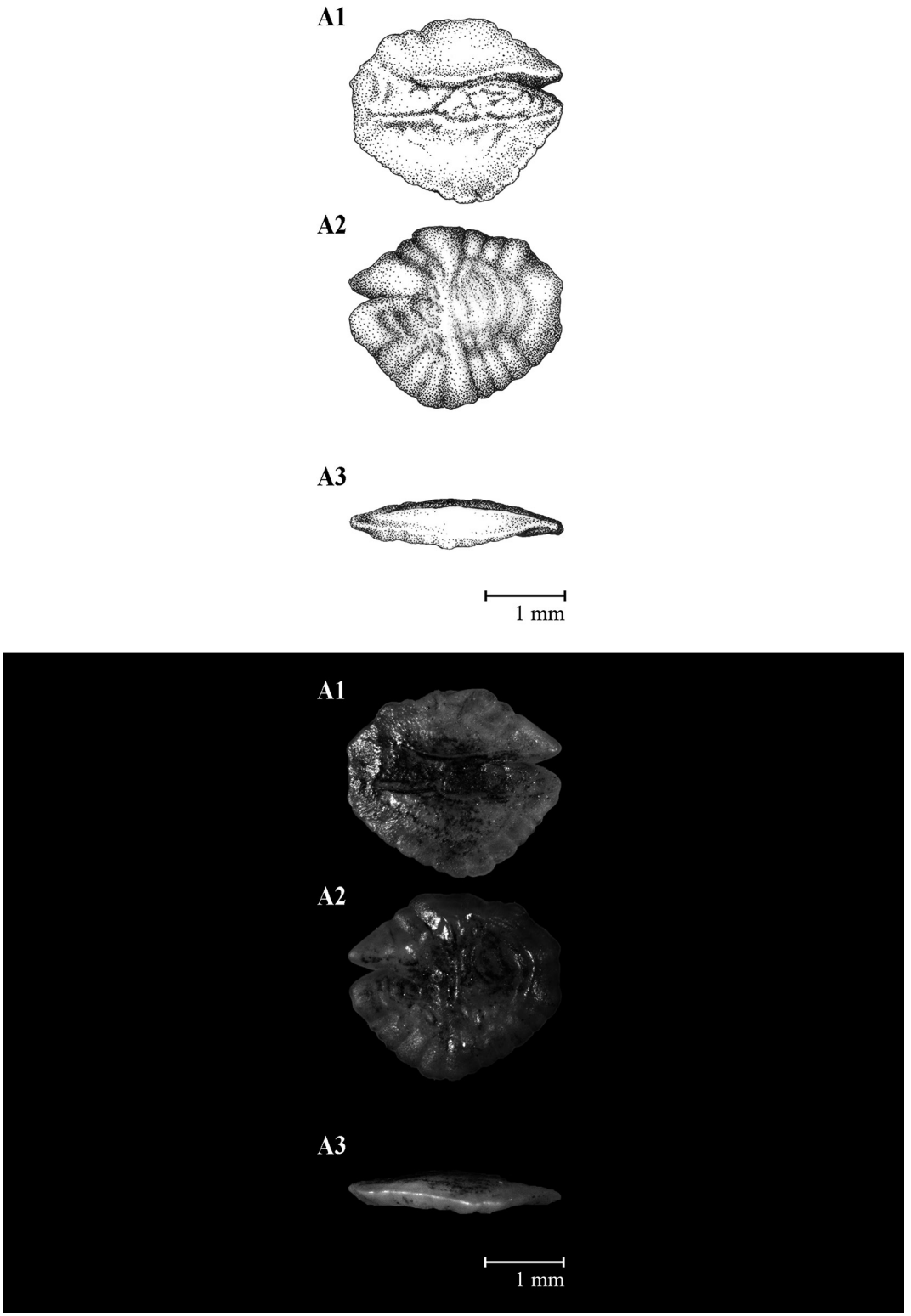
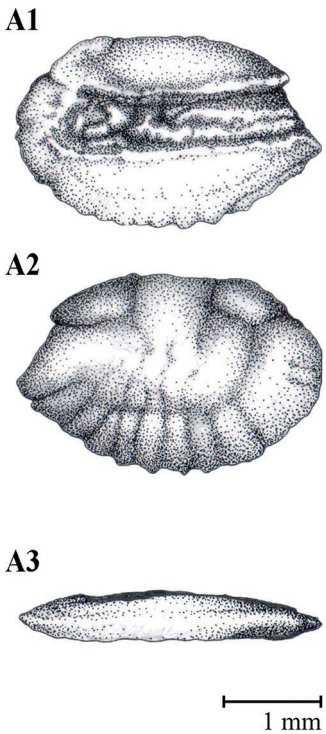


Plate 18. Illustration (above) and photographs (below) of *Myctophum obtusirostre* otoliths from fish with total length of A. 69 mm. The medial face is shown in A1; the lateral face in A2; the ventral profile in A3 (Illustration: Alexandre Arackawa; Photos: Cesar Santificetur).



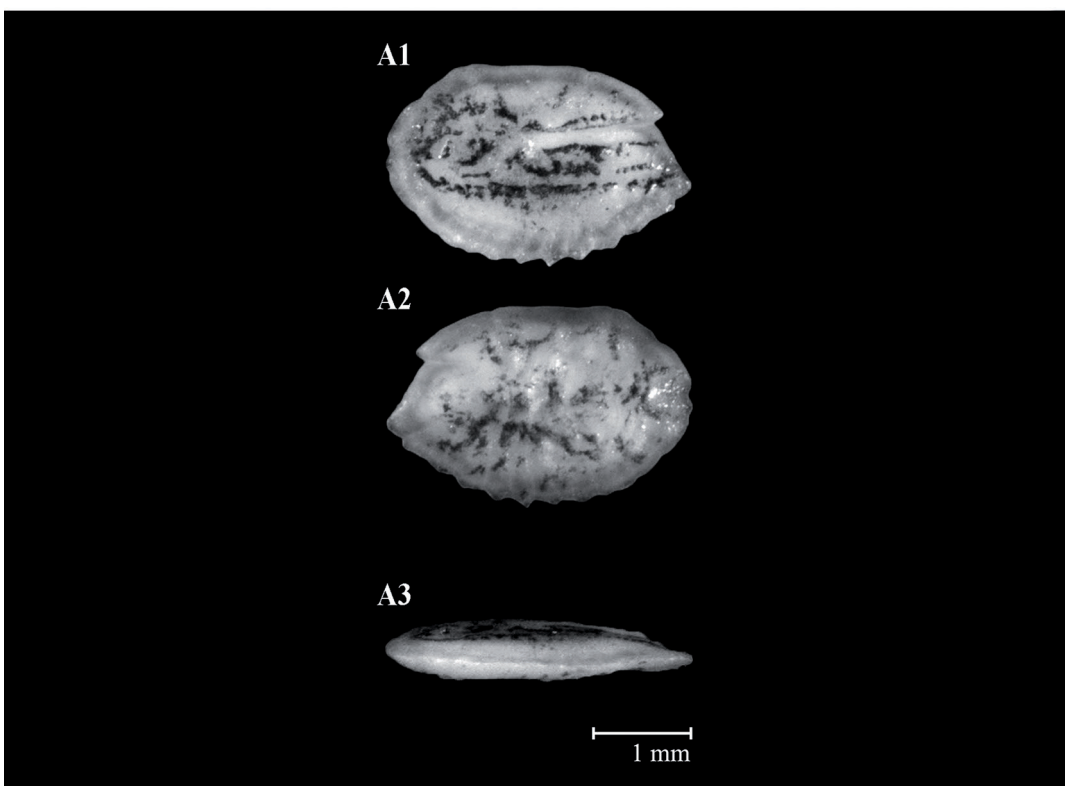


Plate 19. Illustration (above) and photographs (below) of *Notoscopelus resplendens* otoliths from fish with total length of A. 82 mm. The medial face is shown in A1; the lateral face in A2; the ventral profile in A3 (Illustration: Alexandre Arackawa; Photos: Cesar Santificetur).

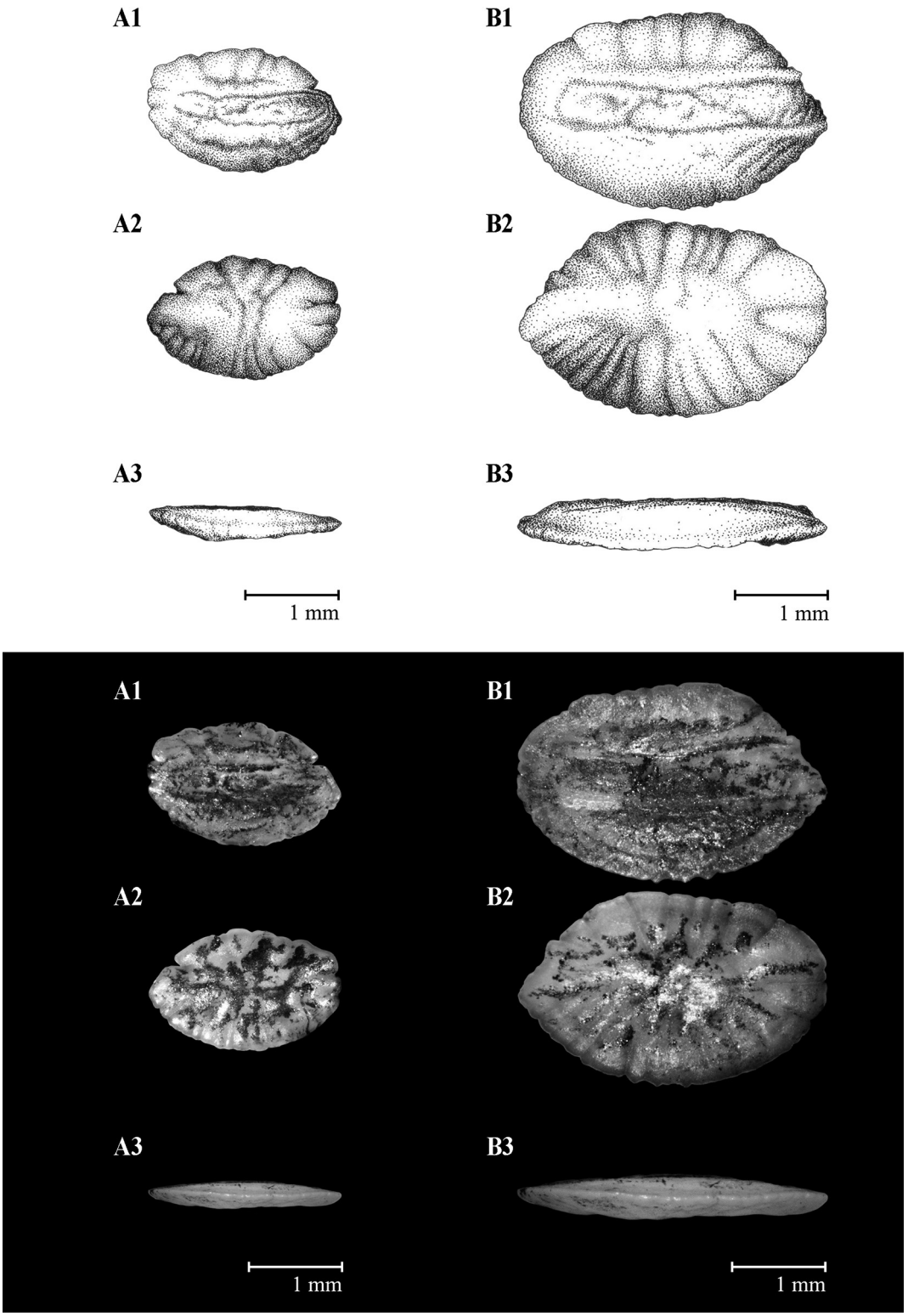


Plate 20. Illustration (above) and photographs (below) of *Notoscopelus caudispinosus* otoliths from fish with total length of A. 43 mm; B. 78 mm. The medial face is shown in A1; B1; the lateral face in A2; B2; profile of the ventral region A3; B3 (Illustration: Alexandre Arackawa; Photos: Cesar Santificetur).

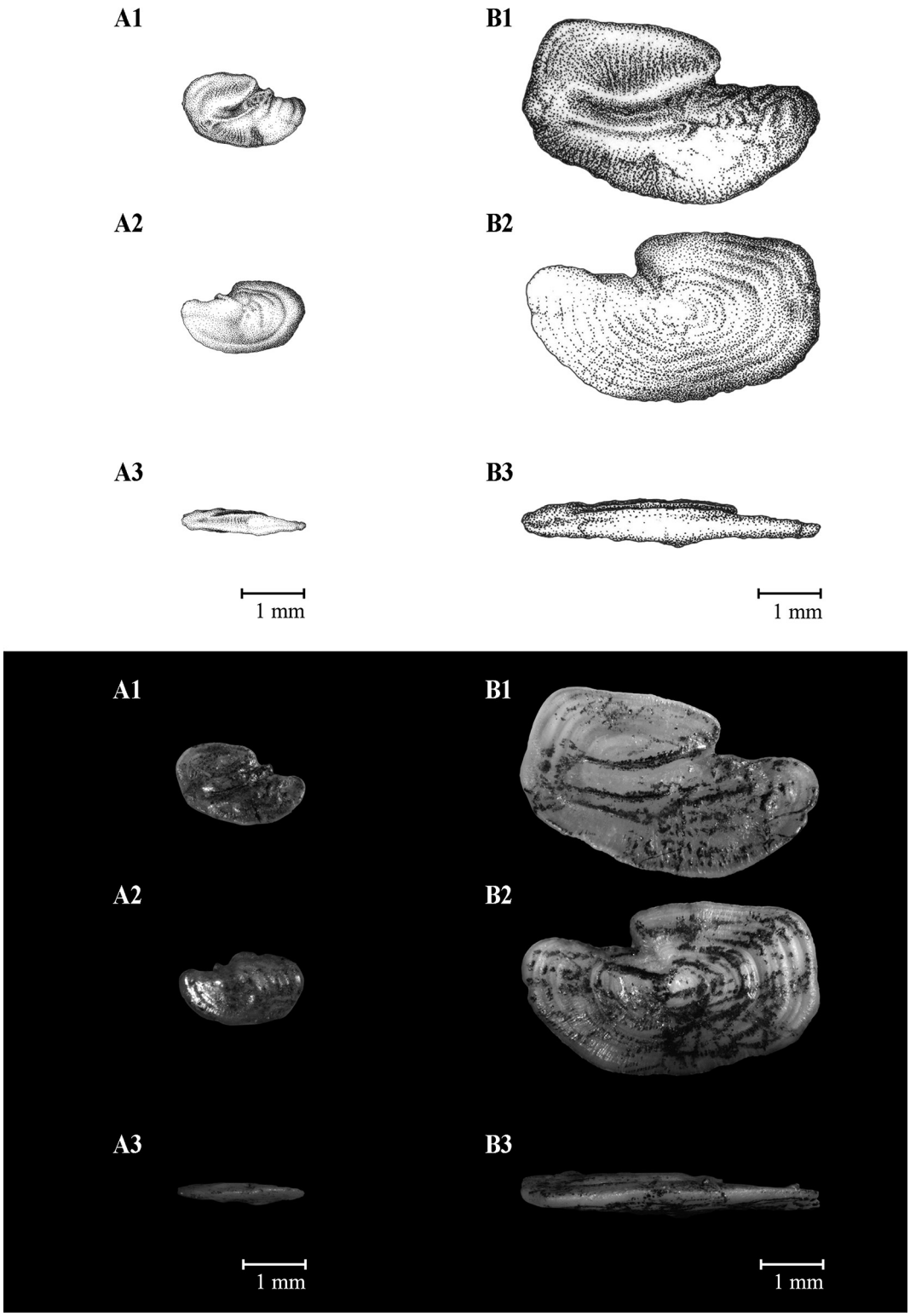


Plate 21. Illustration (above) and photographs (below) of *Neoscopelus macrolepidotus* otoliths from fish with standard length of A. 45 mm; B. 102 mm. The medial face is shown in A1; B1; the lateral face in A2; B2; the ventral profile in A3; B3 (Illustration: Alexandre Arackawa; Photos: Cesar Santificetur).

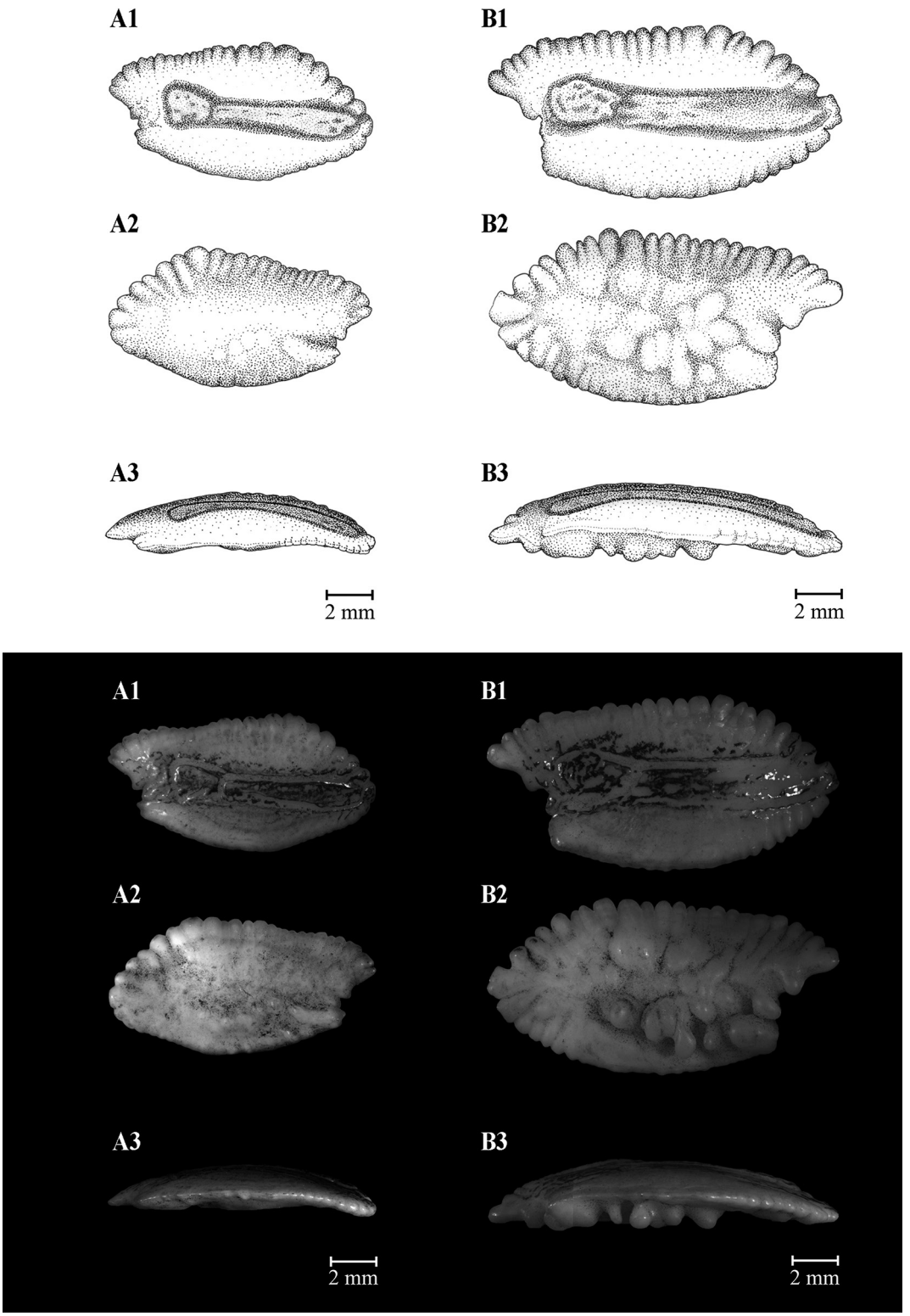


Plate 22. Illustration (above) and photographs (below) of *Genypterus brasiliensis* otoliths from fish with total length of A. 402 mm; B. 601 mm. The medial face is shown in A1; B1; the lateral face in A2; B2; the ventral profile in A3; B3 (Illustration: Laura Montserrat; Photos: Cesar Santificetur).

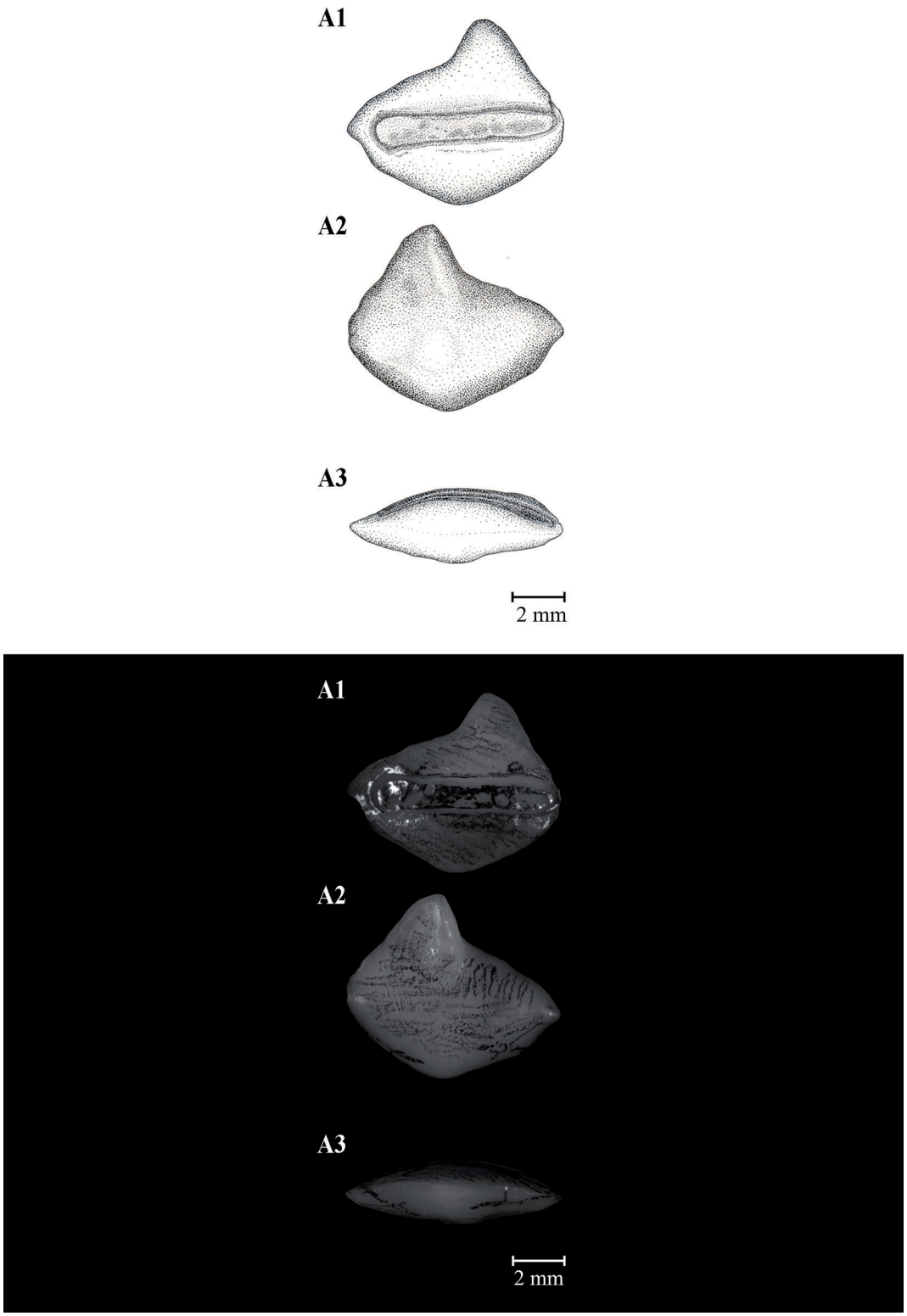


Plate 23. Illustration (above) and photographs (below) of *Ophidion holbrookii* otoliths from fish with total length of A. 242 mm. The medial face is shown in A1; the lateral face in A2; the ventral profile in A3 (Illustration: Laura Montserrat; Photos: Cesar Santificetur).

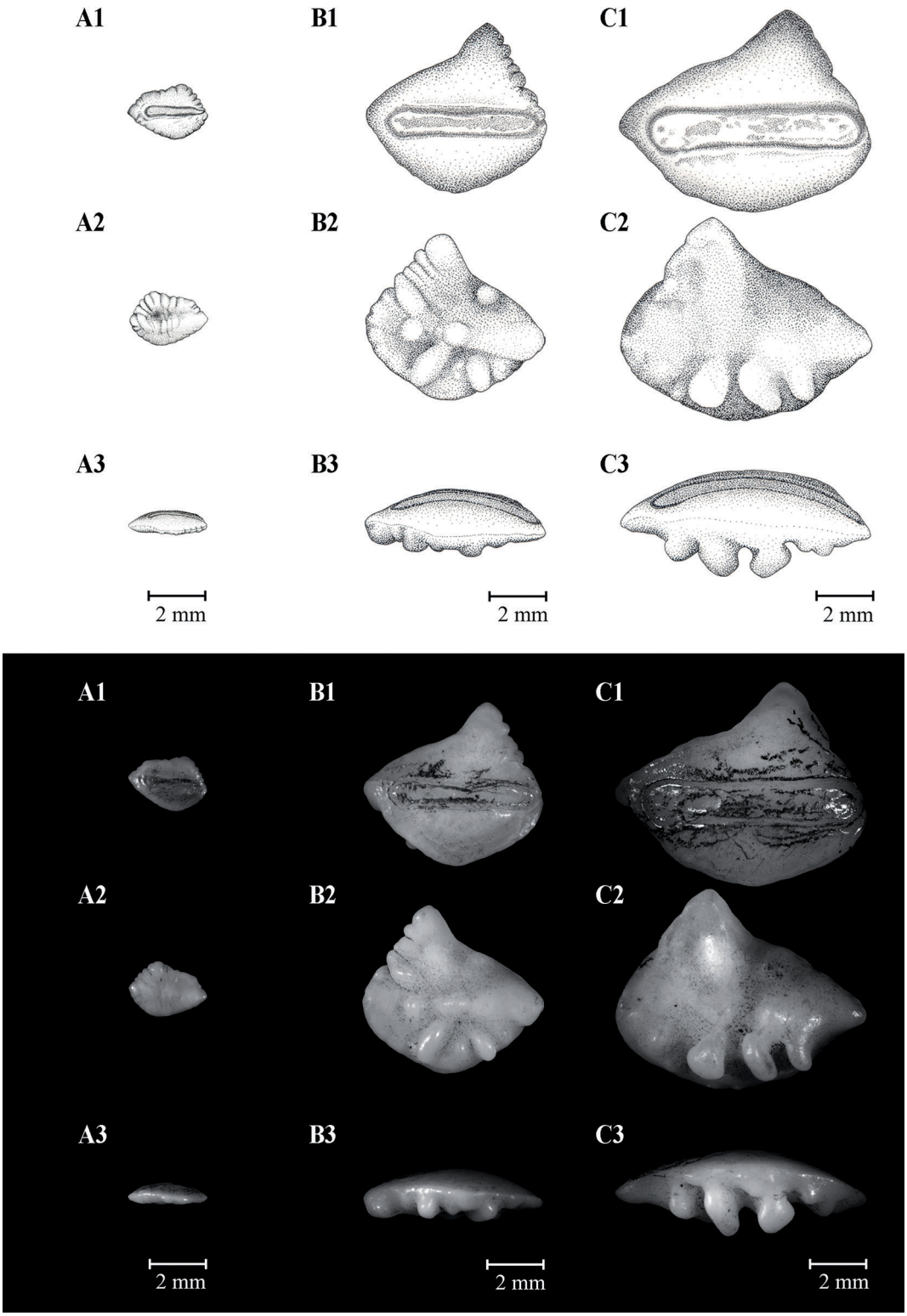
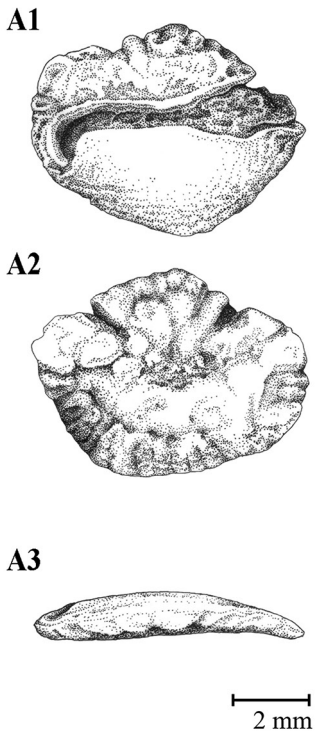


Plate 24. Illustration (above) and photographs (below) of *Raneya brasiliensis* otoliths from fish with total length of A. 75 mm; B. 198 mm; C. 286 mm. The medial face is shown in A1; B1; C1; the lateral face in A2; B2; C2; the ventral profile in A3; B3; C3 (Illustration: Laura Montserrat; Photos: Cesar Santificetur).



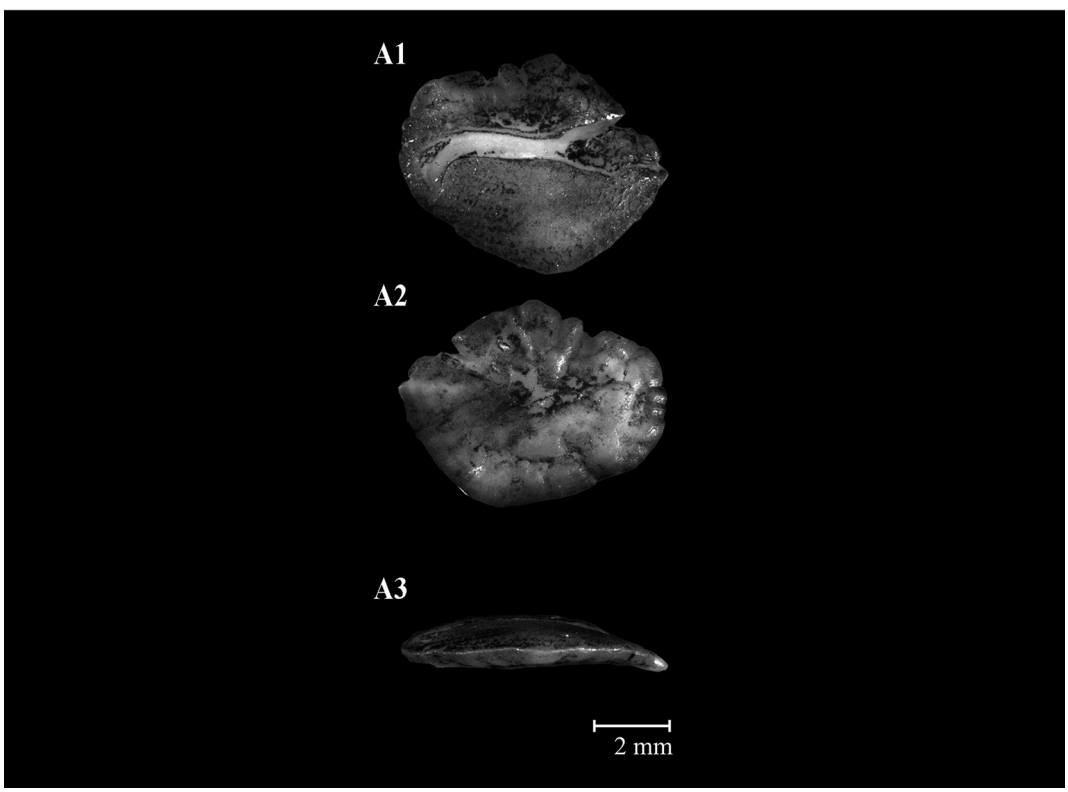


Plate 25. Illustration (above) and photographs (below) of *Polymixia lowei* otoliths from fish with total length of A. 175 mm. The medial face is shown in A1; the lateral face in A2; the ventral profile in A3 (Illustration: Silvia de Almeida Gonsales; Photos: Cesar Santificetur).

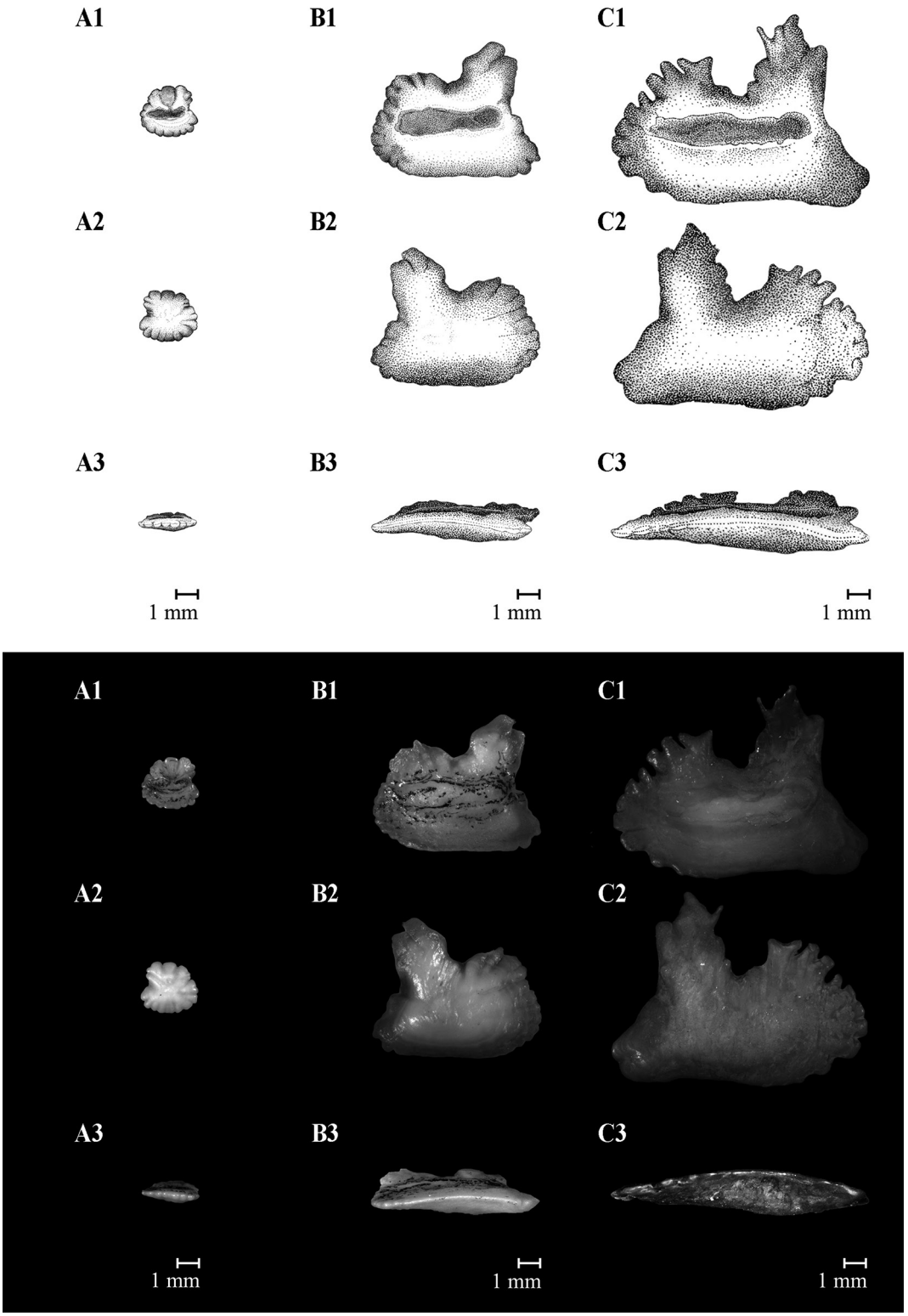


Plate 26. Illustration (above) and photographs (below) of *Porichthys porosissimus* otoliths from fish with total length of A. 62 mm; B. 183 mm; C. 307 mm. The medial face is shown in A1; B1; C1; the lateral face in A2; B2; C2; the ventral profile in A3; B3; C3 (Illustration: Laura Montserrat; Photos: Cesar Santificetur).

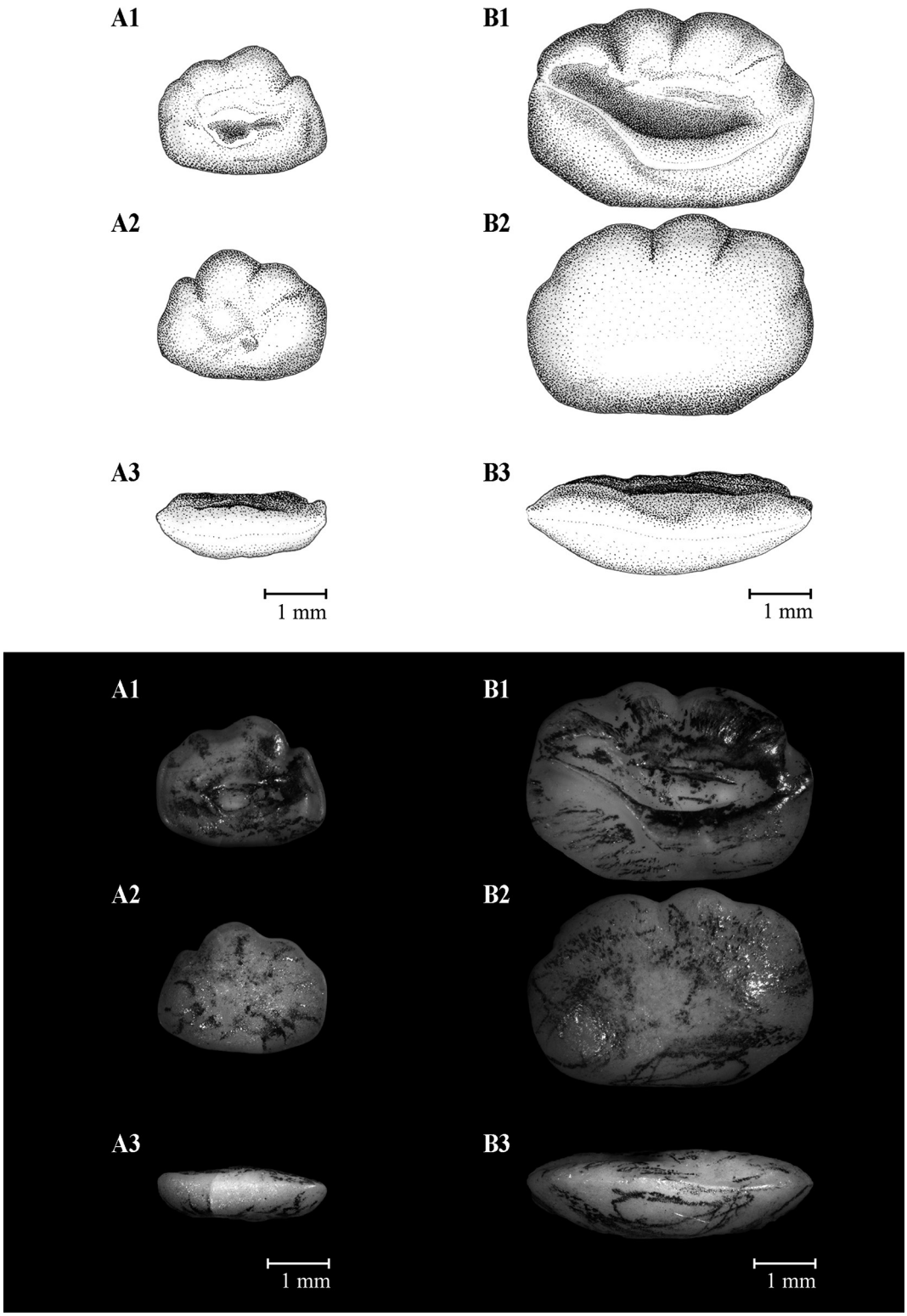
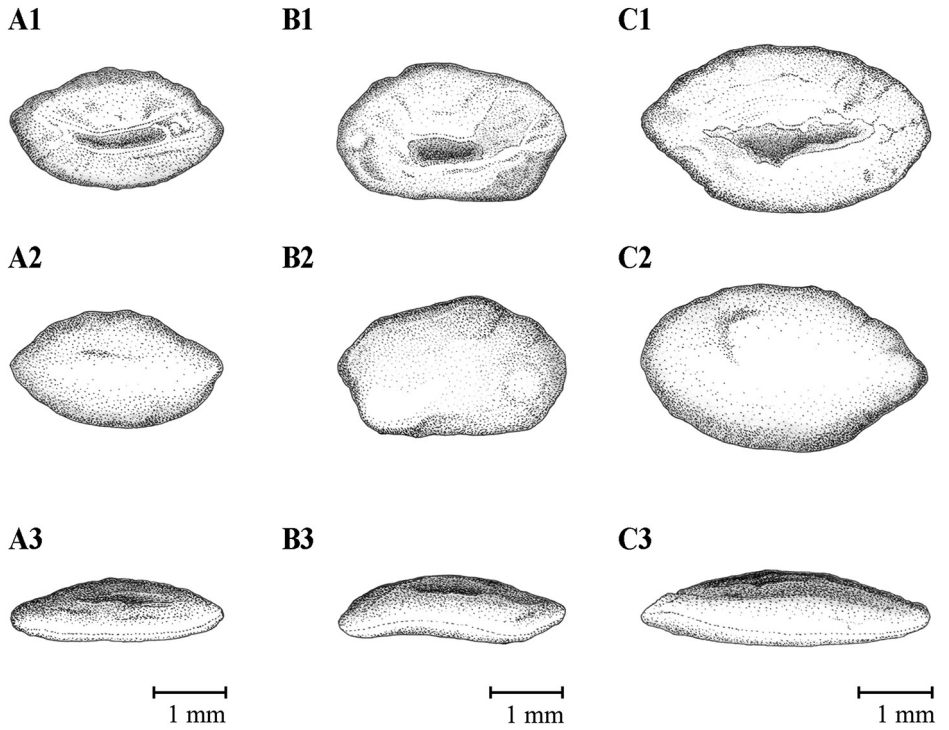


Plate 27. Illustration (above) and photographs (below) of *Dibranchus atlanticus* otoliths from fish with total length of A. 88 mm; B. 188 mm. The medial face is shown in A1; B1; the lateral face in A2; B2; the ventral profile in A3; B3 (Illustration: Laura Montserrat; Photos: Cesar Santificetur).



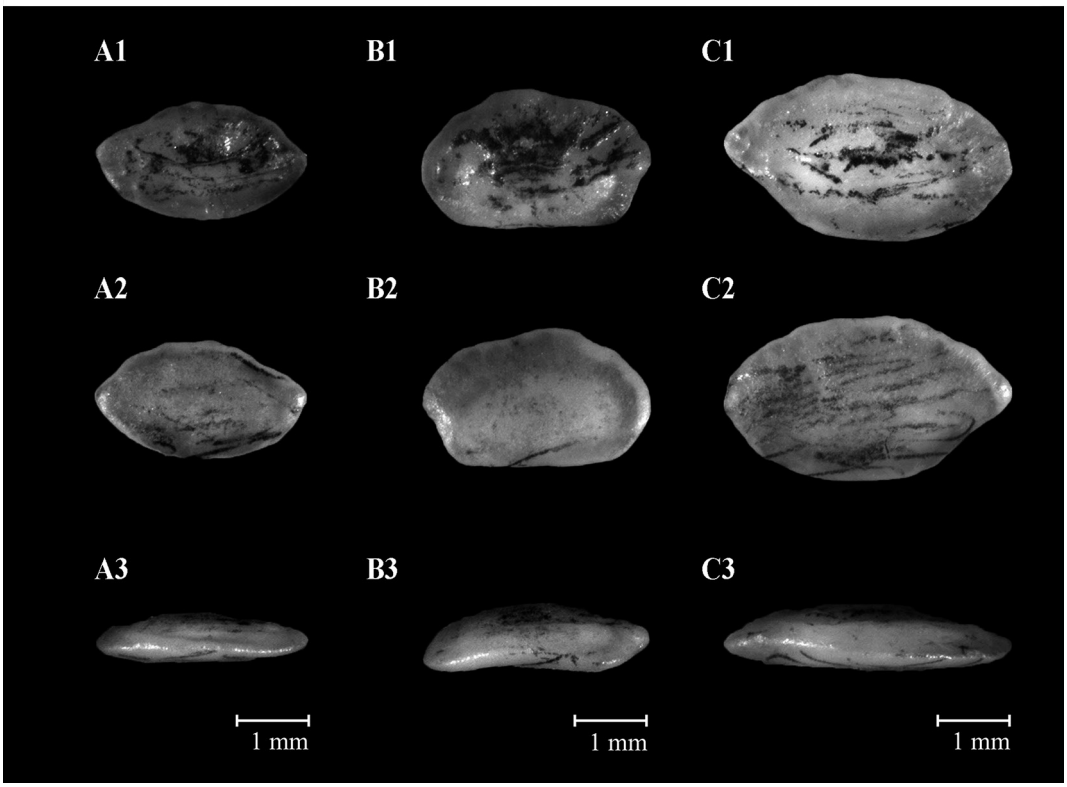


Plate 28. Illustration (above) and photographs (below) of *Ogcocephalus vespertilio* otoliths from fish with total length of A. 56 mm; B. 116 mm; C. 176 mm. The medial face is shown in A1; B1; C1; the lateral face in A2; B2; C2; the ventral profile in A3; B3; C3 (Illustration: Laura Montserrat; Photos: Cesar Santificetur).

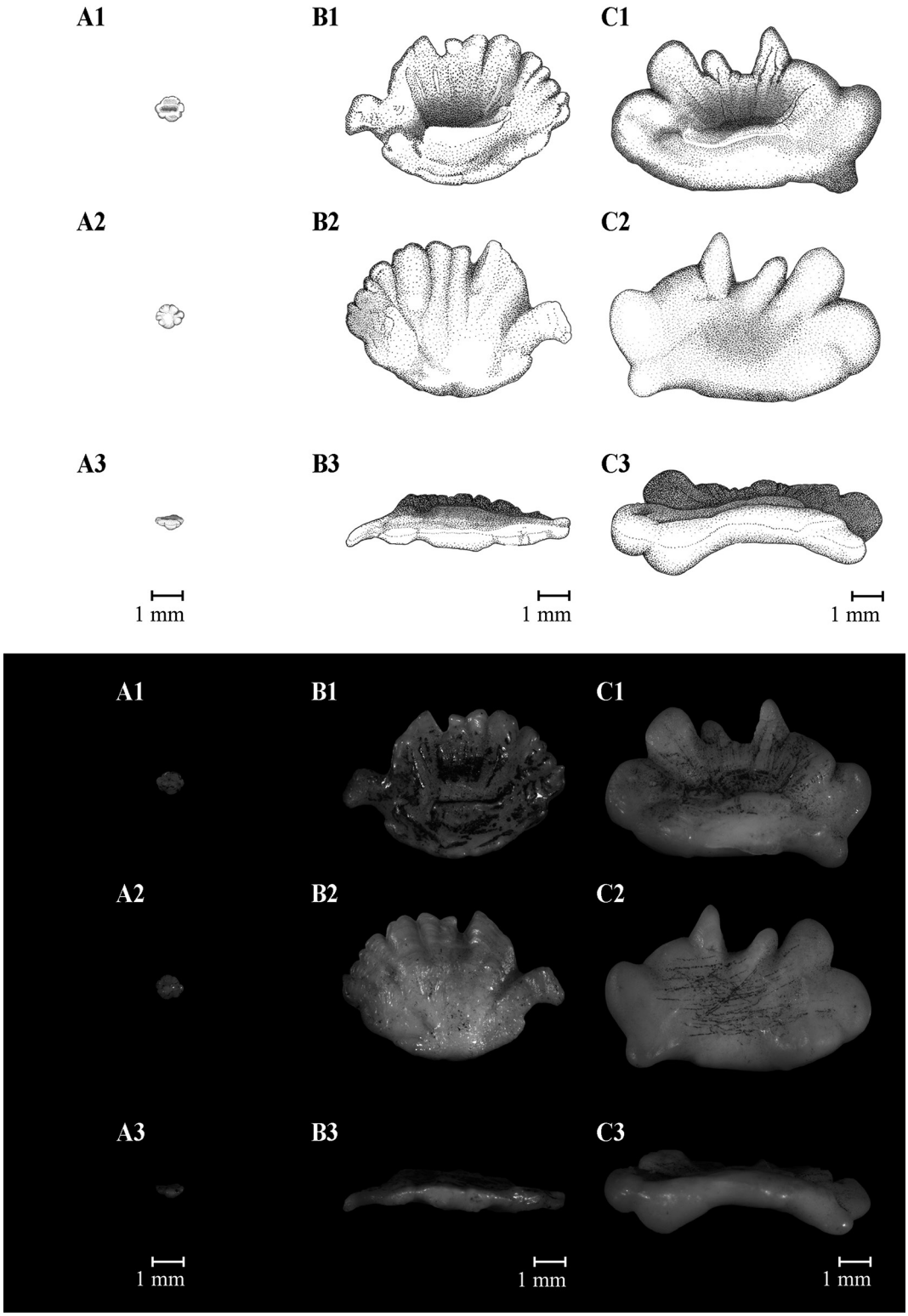


Plate 29. Illustration (above) and photographs (below) of *Lophius gastrophysus* otoliths from fish with total length of A. 59 mm; B. 384 mm; C. 720 mm. The medial face is shown in A1; B1; C1; the lateral face in A2; B2; C2; the ventral profile in A3; B3; C3 (Illustration: Laura Montserrat; Photos: Cesar Santificetur).