Atlas of marine bony fish otoliths (*sagittae*) of Southeastern-Southern Brazil Part V: Perciformes (Sparidae, Sciaenidae, Polynemidae, Mullidae, Kyphosidae, Chaetodontidae, Mugilidae, Scaridae, Percophidae, Pinguipedidae, Blenniidae, Gobiidae, Ephippidae, Sphyraenidae, Gempylidae, Trichiuridae, Scombridae, Ariommatidae, Stromateidae and Caproidae)

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ABSTRACT

This publication is part of a series prepared with the purpose to constitute an Atlas of Teleostei Otoliths for the Southeastern-Southern Brazilian area. Here we present the results of 15 morphological features and six shape indices for 33 Perciformes species of 20 families. Whenever available in out collection, three otoliths of each species were illustrated and photographed. The frequency of occurrence of each feature was calculated inside and among total length classes being the differences analyzed through multiple $\chi 2$ tests (significance level 0.05). Based on otoliths measurements, six shape indices values were obtained being the minimum, maximum, mean and standard deviations values presented.

Descriptors: Otoliths, Morphology, Morphometry, Southwestern Atlantic, Brazil, Perciformes.

RESUMO

Esta publicação é a continuação de uma série que deverá resultar em um Atlas de Otólitos de Teleósteos da Região Sudeste-Sul brasileira. Aqui apresentamos os resultados de análises morfológicas relativas a 15 características e seis índices usualmente utilizados para a caracterização dessas estruturas. Neste estudo são apresentados os resultados obtidos para 33 espécies de Percifomes de 20 famílias. Sempre que possível, foram desenhados e fotografados três otólitos de cada espécie. A frequência de ocorrência de cada característica morfológica foi calculada por classes de comprimento total (TL) e para toda a amostra, sendo as diferenças, dentro de cada classe e, ao longo do desenvolvimento do peixe, analisadas por meio de testes de χ^2 múltiplo (nível de significância 0,05). A partir de medidas dos otólitos, foram calculados valores de seis índices de forma, sendo aqui apresentados seus valores mínimo, máximo, média e desvio padrão.

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

INTRODUCTION

Many papers have been published showing the importance of the otoliths as indicators for community, population, individual analysis and environmental events.

As a contribution for these studies we have been producing several papers about the shape of these structures since their specific variation is useful for studies on taxonomy, phylogeny, archeology, paleontology, species geographic variation, stock identification, food webs and others.

The basic material for our studies comes from the *Collection of Otoliths of Teleostei Fish of Southeastern-Southern Brazil* (COSS-Brasil), held at the Laboratory of Ichthyofauna and Growth (Laboratório de Ictiofauna e Crescimento – LABIC) of Instituto Oceanográfico, (Universidade de São Paulo - Brasil), presently containing 51886 otoliths corresponding to 201 different species (ROSSI-WONGTSCHOWSKI et al., 2016).

This publication contains the results of fifteen morphological data and six shape indices of the mostly common features for 33 Perciformes species.

Submitted on: 18/07/2016
Approved on: 22/11/2016
http://dx.doi.org/10.1590/S1679-87592017131006502

At the end of these publications we intend to constitute an Atlas of Teleostei Otoliths for the Southeastern-Southern Brazilian region.

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) and BRENHA-NUNES et al. (2016).

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

RESULTS

PART V: PERCIFORMES

Family SPARIDAE

The *sulcus acusticus* opening is ostial, the *ostium* is funnel-like and the c*auda* is frequently tubular strongly curved; the profile is concave-convex; the *pseudorostrum* and *pseudoantirostrum* are always absent and the *rostrum* is developed in mostly cases.

Archosargus rhomboidalis (Linnaeus 1758) **Plate 1**

Maximum Size:	355 mm (TL) (MENEZES; FIGUEIREDO, 1980)
Distribution:	Western Atlantic, from New Jersey and Northeastern Gulf of Mexico to Southeastern Brazil (MENEZES et al., 2003)
Habitat:	Coastal waters over mud or sand bottoms, occasionally found in coral reef and rocky areas (MENEZES; FIGUEIREDO, 1980)
Diet:	Mainly benthic invertebrates (mollusks and crustaceans); adults feed mostly on algae (VAUGHAN, 1978)
Collection:	77 otoliths from 39 fish (TL ranging from 115 to 160 mm)
Sample:	22 left otoliths categorized into 4, 20 mm classes (100 to 160 mm)

Shape: elliptic (77%), elliptic to triangular. ***Anterior region:*** peaked-round (41%), oblique (36%), angled-round. ***Posterior region*****:** oblique-round (45%), round (36%), oblique. ***Dorsal edge:*** crenate to sinuate (50%), sinuate to entire, lobed to sinuate, crenate to entire. ***Ventral edge:*** sinuate to entire. ***Profile*****:** concave-convex. ***Rostrum and antirostrum orientation*****:** does not apply (50%), in agreement (50%). ***Rostrum*****:** developed (82%), underdeveloped. ***Antirostrum*****:** absent (50%), underdeveloped, developed. ***Sulcus acusticus*****:** *position*: median; *orientation*: horizontal; *opening*: ostial; *morphology*: heterosulcoid; *colliculum*: heteromorphic; *ostium*: funnel-like; *cauda*: tubular strongly curved (59%), tubular markedly curved, tubular slightly curved.

Statistical differences ($p<0.05$) within some length classes were obtained for shape, dorsal edge, *rostrum* and *antirostrum* orientation and development. Along the growth development, statistical differences were found for *rostrum* and *antirostrum* orientation and *antirostrum* development.

Shape indices	Mean±Sd	Minimum	Maximum
OL/TL (%)	2.94±0.22	2.53	3.54
OH/OL (%)	67.10±2.68	62.44	71.85
OT/OL (%)	16.58±1.27	15.01	20.11
OT/OH (%)	24.72±1.67	21.77	27.99
Circularity	18.73±1.19	16.80	20.67
Rectangularity	0.69±0.01	0.67	0.71

Calamus penna (Valenciennes 1830) **Plate 2**

Maximum Size:	500 mm (TL) (MENEZES; FIGUEIREDO, 1980)
Distribution:	Western Atlantic from Florida and Bahamas to Southeastern Brazil (CARVALHO-FILHO, 1992; MENEZES et al., 2003)
Habitat:	Shallow waters over rocky areas or reefs. Adults are often founds on flat bottoms (CARPENTER, 2002)
Diet:	Mainly crustaceans, mollusks and urchins (CARVALHO-FILHO, 1992; CARPENTER, 2002)
Collection:	1 otolith from 1 fish (TL: 167 mm)
Sample:	1 left otolith (167 mm)

Shape: triangular. ***Anterior region*****:** peaked. ***Posterior region*****:** peaked-round. ***Anterior dorsal edge*****:** sinuate. ***Posterior dorsal edge*****:** sinuate to entire. ***Ventral edge*****:** sinuate. ***Profile*****:** concave-convex. ***Rostrum and antirostrum orientation*****:** in disagreement. ***Rostrum*****:** developed. ***Antirostrum*****:** developed. ***Sulcus acusticus*****:** *position*: supramedian; *orientation*: ascending; *opening*: ostial; *morphology*: heterosulcoid; *colliculum*: heteromorphic; *ostium*: funnel-like; *cauda*: tubular strongly curved.

Only one otolith was examined not allowing statistical analysis of the data but its morphometric characteristics are shown below:

Shape indices	Mean±Sd	Minimum	Maximum
OL/TL (%)	3.43±0	3.43	3.43
OH/OL (%)	45.28±0	45.28	45.28
OT/OL (%)	15.91±0	15.91	15.91
OT/OH (%)	35.14±0	35.14	35.14
Circularity	20.63±0	20.63	20.63
Rectangularity	0.69±0	0.69	0.69

Pagrus pagrus (Linnaeus 1758) **Plate 3**

Maximum Size:	910 mm (TL) (CARPENTER, 2002)
Distribution:	Western Atlantic, from New York to Argentina and Mediterranean sea (FIGUEIREDO et al., 2002; BERNARDES et al., 2005)
Habitat:	Over rocks, reefs or sand bottoms at depths from 10 to 200 m (MENEZES; FIGUEIREDO 1980; CARVALHO-FILHO, 1992)
Diet:	Crustaceans, mollusks and fish (LANBROPOULOU et al., 1999)
Collection:	214 otoliths from 109 fish (TL ranging from 65 to 273 mm)
Sample:	63 left otoliths categorized into 11, 20 mm classes (60 to 260 mm)

Shape: elliptic (51%), elliptic to pentagonal (49%)**.** ***Anterior region*****:** angled (68%), peaked, angled-round, peaked-round. ***Posterior region*****:** angled (60%), angled-round, round, oblique to angled. ***Anterior dorsal edge*****:** does not apply (51%), sinuate (43%), dentate, lobed to sinuate, dentate to lobed. ***Posterior dorsal edge*****:** does not apply (51%), dentate, lobed, lobed to sinuate. ***Anterior ventral edge*****:** lobed to sinuate (46%), dentate to lobed, sinuate, lobed. ***Posterior ventral edge*****:** lobed to sinuate (46%), dentate to lobed, sinuate, lobed. ***Profile*****:** concave-convex (83%), plane-convex. ***Rostrum and antirostrum orientation*****:** in agreement (56%), does not apply, in disagreement. ***Rostrum*****:** developed. ***Antirostrum*****:** developed (41%), absent (33%), underdeveloped. ***Sulcus acusticus*****:** *position*: supramedian (87%), median; *orientation*: horizontal; *opening*: ostial; *morphology*: heterosulcoid; *colliculum*: heteromorphic; *ostium*: funnel-like; *cauda*: tubular strongly curved (52%), tubular slightly curved (48%).

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

Shape indices	Mean±Sd	Minimum	Maximum
OL/TL (%)	4.37±0.39	3.64	5.33
OH/OL (%)	73.30±3.85	62.77	81.90
OT/OL (%)	18.17±1.48	14.78	22.29
OT/OH (%)	24.84±2.23	21.23	30.23
Circularity	19.17±1.78	15.53	22.53
Rectangularity	0.66±0.02	0.63	0.70

Family SCIAENIDAE

Cynoscion leiarchus (Cuvier 1830) **Plate 4**

Maximum Size:	908 mm (TL) (FROESE; PAULY, 2015)
Distribution:	Western Atlantic from Panama along the Caribbean sea to Southeastern Brazil (CHAO, 2002; MENEZES et al., 2003)
Habitat:	Brackish waters and estuaries over mud and sand bottoms to about 25 m depth (CERVIGÓN et al., 1992)
Diet:	Mainly fish and crustaceans (CHAO, 2002)
Collection:	12 otoliths from 6 fish (TL ranging from 229 to 292 mm)
Sample:	6 left otoliths categorized into 3, 20 mm classes (220 to 280 mm)

Shape*:** elliptic. ***Anterior region*:** round. ***Posterior region*:** angled-round. ***Anterior dorsal edge*:** entire (67%), sinuate to entire. ***Ventral edge*:** sinuate to entire. ***Profile*:** biconvex. ***Rostrum and antirostrum orientation*:** does not apply. ***Rostrum*:** absent. ***Antirostrum*:** absent. ***Pseudorostrum and Pseudoantirostrum: absent. ***Sulcus acusticus*:** *position*: median; *orientation*: horizontal; *opening*: pseudo-ostial; *morphology*: heterosulcoid; *colliculum*: heteromorphic; *ostium*: discoidal; *cauda*: tubular markedly curved, tubular curled.

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

Shape indices	Mean±Sd	Minimum	Maximum
OL/TL (%)	4.79±0.19	4.58	5.10
OH/OL (%)	9.84±1.32	48.70	52.23
OT/OL (%)	23.38±1.08	21.93	24.45
OT/OH (%)	46.93±2.37	43.69	49.74
Circularity	16.24±0.34	15.63	16.68
Rectangularity	0.78±0.01	0.77	0.79

Family POLYNEMIDAE

Polydactylus virginicus (Linnaeus 1758) **Plate 5**

Maximum Size:	330 mm (TL) (FELTES, 2002) but attaining 352 mm in our collection.
Distribution:	Western Atlantic from Florida to Argentina (MENEZES et al., 2003)
Habitat:	Coastal waters, estuaries and mangroves over sandy and muddy bottoms (CARVALHO-FILHO, 1992)
Diet:	Mainly crustaceans, followed by chaetognaths, polychaetes and plant material (LOPES; OLIVEIRA-SILVA, 1998)
Collection:	46 otoliths from 24 fish (TL ranging from 215 to 352 mm)
Sample:	12 left otoliths categorized into 6, 20 mm classes (200 to 340 mm)

Shape*:** oblong (67%), oblong to rectangular. ***Anterior region*:** flattened (42%), round (33%), oblique-round. ***Posterior region*:** oblique (50%), round, peaked-round. ***Dorsal edge*:** lobed to sinuate (83%), sinuate to entire. ***Ventral edge*:** sinuate to entire (75%), lobed to sinuate, entire. ***Profile*:** concave-convex. ***Rostrum and antirostrum orientation*:** in agreement. ***Rostrum*:** underdeveloped. ***Antirostrum*:** developed (58%), underdeveloped. ***Pseudorostrum: absent. ***Pseudoantirostrum:*** absent. ***Sulcus acusticus*:** *position*: median; *orientation*: horizontal (67%), descending; *opening*: ostial; *morphology*: heterosulcoid; *colliculum*: heteromorphic; *ostium*: funnel-like; *cauda*: tubular strongly curved (75%), tubular markedly curved.

Statistical differences (p<0.05) within some length classes were obtained for dorsal and ventral edges and *sulcus acusticus* orientation. No differences appeared during the fish's development.

Shape indices	Mean±Sd	Minimum	Maximum
OL/TL (%)	2.40±0.13	2.19	2.73
OH/OL (%)	49.17±1.88	45.85	51.57
OT/OL (%)	15.02±1.06	13.44	16.80
OT/OH (%)	30.57±2.10	26.27	33.59
Circularity	21.38±1.70	19.31	24.61
Rectangularity	0.71±0.03	0.67	0.76

Family MULLIDAE

Otolith shape is frequently elliptic to trapezoidal; the profile is concave-convex; the *rostrum* is developed; the *pseudorostrum* and *pseudoantirostrum* are always absent; the *cauda* is tubular markedly curved with the final region round and deeper.

Mullus argentinae Hubbs & Marini 1933 **Plate 6**

Maximum Size:	300 mm (TL) (FROESE; PAULY, 2015)
Distribution:	South-Western Atlantic from Rio de Janeiro to Mar del Plata, Argentina (MENEZES; FIGUEIREDO, 1985)
Habitat:	Coastal waters to 190 m depth, commonly in muddy bottom (MENEZES; FIGUEIREDO, 1985; BERNARDES et al., 2005)
Diet:	Little invertebrates (zooplankton and zoobenthos) (BERNARDES et al., 2005; MAGRO et al., 2000)
Collection:	771 otoliths from 419 fish (TL ranging from 75 to 245 mm)
Sample:	66 left otoliths categorized into 9, 20 mm classes (60 to 220 mm)

***Shape*:** elliptic to trapezoidal (73%), elliptic, fusiform. ***Anterior region*:** peaked (36%), peaked-round (32%), oblique, double-peaked. ***Posterior region*:** oblique (53%), oblique to angled, angled, oblique-round. ***Dorsal edge*:** sinuate (55%), lobed to sinuate, lobed, irregular. ***Ventral edge*:** lobed to sinuate (59%), sinuate, lobed, irregular. ***Profile*:** concave-convex. ***Rostrum and antirostrum orientation*:** in agreement (98%), does not apply. ***Rostrum*:** developed (98%), underdeveloped. ***Antirostrum*:** developed (94%), underdeveloped, absent. ***Sulcus acusticus*:** *position*: median; *orientation*: horizontal; *opening*: ostial; *morphology*: heterosulcoid; *colliculum*: heteromorphic; *ostium*: funnel-like; *cauda*: tubular markedly curved.

Statistical differences (p<0.05) within some length classes were obtained for shape, anterior region, *sulcus acusticus* opening, *rostrum* and *antirostrum* orientation and development. Along the growth statistical differences were found only for the anterior region, *rostrum* and *antirostrum* orientation and development.

Shape indices	Mean±Sd	Minimum	Maximum
OL/TL (%)	2.31±0.43	1.76	3.83
OH/OL (%)	67.04±4.88	55.12	81.38
OT/OL (%)	18.90±1.74	15.12	23.74
OT/OH (%)	28.25±2.38	24.35	33.67
Circularity	20.17±3.06	16.25	39.26
Rectangularity	0.68±0.03	0.56	0.72

Upeneus parvus Poey 1852 **Plate 7**

Maximum Size:	300 mm (TL) (FROESE; PAULY, 2015)
Distribution:	Western Atlantic from North Carolina to Santa Catarina state (MENEZES; FIGUEIREDO, 1985)
Habitat:	Coastal waters from 25 to 112 m depth, live on mud-sandy bottom (MENEZES; FIGUEIREDO, 1985)
Diet:	Mainly benthic invertebrates (FROESE; PAULY, 2015)
Collection:	148 otoliths from 79 fish (TL ranging from 81 to 175 mm)
Sample:	39 left otoliths categorized into 5, 20 mm classes (80 to 160 mm)

Shape: elliptic (97%), elliptic to trapezoidal. ***Anterior region*****:** angled (49%), peaked (44%), oblique, double-peaked. ***Posterior region*****:** angled-round (49%), round, angled, oblique-round. ***Dorsal edge*****:** lobed to sinuate (36%), lobed, dentate to lobed, sinuate. ***Ventral edge*****:** lobed to sinuate (59%), lobed, dentate to lobed, sinuate. ***Profile*****:** concave-convex. ***Rostrum and antirostrum orientation*****:** does not apply (56%), in agreement. ***Rostrum*****:** developed (72%), underdeveloped. ***Antirostrum*****:** absent (49%), underdeveloped (44%), developed. ***Sulcus acusticus*****:** *position*: median; *orientation*: horizontal; *opening*: ostial (95%), ostio-caudal; *morphology*: heterosulcoid; *colliculum*: heteromorphic; *ostium*: funnel-like; *cauda*: tubular markedly curved.

Statistical differences (p<0.05) within some length classes were obtained for shape, anterior region, *sulcus acusticus* opening, *rostrum* and *antirostrum* orientation and development. Along the growth, statistical differences were found for the anterior region, *rostrum* and *antirostrum* orientation and development.

Shape indices	Mean±Sd	Minimum	Maximum
OL/TL (%)	2.73±0.23	2.31	3.54
OH/OL (%)	65.80±2.58	60.75	72.75
OT/OL (%)	16.45±1.26	14.23	20.00
OT/OH (%)	25.03±1.94	21.72	31.0
Circularity	17.91±1.67	15.65	22.3
Rectangularity	0.70±0.02	0.66	0.70

Family KYPHOSIDAE

Otolith shape is fusiform; the posterior region tends to be oblique-round; the profile is concave-convex; the *rostrum* and *antirostrum* are frequently developed and in agreement; the *pseudorostrum* and *pseudoantirostrum* are always absent; the *ostium* is funnel-like and the *cauda* is frequently tubular markedly curved.

Kyphosus incisor (Cuvier 1831) **Plate 8**

Maximum Size:	910 mm (TL) (FIGUEIREDO et al., 2002; BERNARDES et al., 2005)
Distribution:	Western Atlantic from Virginia to Mar del Plata, Argentina (FIGUEIREDO et al., 2002; BERNARDES et al., 2005)
Habitat:	Shallow waters on rocky bottom (BERNARDES et al., 2005)
Diet:	Algae including *Sargassum* and some invertebrates (BERNARDES et al., 2005; SILVANO; GÜTH, 2006)
Collection:	2 otoliths from 1 fish (TL: 254 mm)
Sample:	1 left otolith (254 mm)

Shape: fusiform. ***Anterior region*****:** lanceolated-round. ***Posterior region*****:** oblique-round. ***Dorsal edge*****:** lobed to sinuate. ***Ventral edge*****:** sinuate to entire. ***Profile*****:** concave-convex. ***Rostrum and antirostrum orientation*****:** in agreement. ***Rostrum*****:** developed. ***Antirostrum*****:** developed. ***Sulcus acusticus*****:** *position*: median; *orientation*: horizontal; *opening*: ostial; *morphology*: heterosulcoid; *colliculum*: heteromorphic; *ostium*: funnel-like; *cauda*: tubular markedly curved.

Since only one otolith was analyzed it was not possible statistical analysis of the data but its morphometric characteristics are shown below:

Shape indices	Mean±Sd	Minimum	Maximum
OL/TL (%)	2.72±0	2.72	2.72
OH/OL (%)	38.78±0	38.78	38.78
OT/OL (%)	11.00±0	11.00	11.00
OT/OH (%)	28.36±0	28.36	28.36
Circularity	26.35±0	26.35	26.35
Rectangularity	0.71±0	0.71	0.71

Kyphosus sectatrix (Linnaeus 1758) **Plate 9**

Maximum Size:	760 mm (TL) (FROESE; PAULY, 2015).
Distribution:	Western Atlantic from Massachusetts and Bermuda to Santa Catarina state (MENEZES; FIGUEIREDO, 1985; CARVALHO-FILHO, 1992)
Habitat:	Shallow waters, sand or rocky bottom around coral reefs (CARVALHO-FILHO, 1992)
Diet:	Benthic algae, zooplankton, crabs and mollusks (CARVALHO-FILHO, 1992; FROESE; PAULY, 2015)
Collection:	28 otoliths from 15 fish (TL ranging from 25 to 454 mm)
Sample:	9 left otoliths categorized into 4, 20 mm classes (280 to 340 mm)

Shape*:** fusiform. ***Anterior region*:** round (89%), peaked-round. ***Posterior region*:** oblique-round (78%), peaked-round. ***Dorsal edge*:** lobed to sinuate (56%), crenate to sinuate, crenate to lobed. ***Ventral edge*:** crenate to sinuate (89%), dentate to lobed. ***Profile: concave-convex. ***Rostrum and antirostrum orientation*:** in agreement. ***Rostrum*:** developed. ***Antirostrum*:** developed (78%), underdeveloped. ***Sulcus acusticus*:** *position*: median; *orientation*: horizontal; *opening*: ostial; *morphology*: heterosulcoid; *colliculum*: heteromorphic; *ostium*: funnel-like; *cauda*: tubular markedly curved (78%), tubular strongly curved.

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

Shape indices	Mean±Sd	Minimum	Maximum
OL/TL (%)	2.20±0.19	1.76	2.40
OH/OL (%)	44.61±1.71	41.90	47.46
OT/OL (%)	12.15±0.43	11.60	12.91
OT/OH (%)	27.28±1.59	25.47	29.90
Circularity	25.72±2.38	23.39	29.65
Rectangularity	0.71±0.02	0.67	0.74

Family CHAETODONTIDAE

Chaetodon striatus Linnaeus 1758 **Plate 10**

Maximum Size:	160 mm (TL) (FROESE; PAULY, 2015)
Distribution:	Eastern and Western Atlantic, from New Jersey to Santa Catarina state, Brazil (MENEZES; FIGUEIREDO, 1985)
Habitat:	Rocky bottoms and reef areas from coastal shelf to oceanic islands (BURGESS, 2002; CARVALHO-FILHO, 1992)
Diet:	Small benthic invertebrates, as coral polyps, crustaceans and mollusk eggs (BURGESS, 2002; FROESE; PAULY, 2015)
Collection:	25 otoliths from 13 fish (TL ranging from 128 to 149 mm)
Sample:	8 left otoliths categorized into 2, 20 mm classes (120 to 140 mm)

***Shape*:** elliptic. ***Anterior region*:** angled-round (38%), peaked (38%), peaked-round. ***Posterior region*:** round (63%), oblique to angled, oblique, flattened. ***Dorsal edge*:** sinuate to entire (63%), lobed to sinuate. ***Ventral edge*:** sinuate to entire. ***Profile*:** concave-convex. ***Rostrum and antirostrum orientation*:** in agreement. ***Rostrum*:** developed. ***Antirostrum*:** developed (50%), underdeveloped (50%). ***Pseudorostrum and Pseudoantirostrum*:** absent. ***Sulcus acusticus*:** *position*: median; *orientation*: descending (88%), horizontal; *opening*: ostial; *morphology*: heterosulcoid; *colliculum*: heteromorphic; *ostium*: funnel-like; *cauda*: tubular sinuous (75%), tubular strongly curved.

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

Shape indices	Mean±Sd	Minimum	Maximum
OL/TL (%)	3.43±0.21	3.23	3.81
OH/OL (%)	55.52±4.71	49.57	63.05
OT/OL (%)	18.93±1.81	16.82	22.22
OT/OH (%)	34.15±2.64	30.53	38.19
Circularity	19.80±1.32	17.59	21.92
Rectangularity	0.69±0.02	0.66	0.74

Family MUGILIDAE

Otolith shape is oblong; the posterior region is round; the *antirostrum* is absent in mostly cases; the *pseudorostrum* and *pseudoantirostrum* are always absent; *sulcus acusticus* position supramedial and orientation ascending.

Mugil curema Valenciennes 1836 **Plate 11**

Maximum Size:	910 mm (TL) (HARRISON, 2002)
Distribution:	Eastern Atlantic from Senegal River to the Congo River; Western Atlantic, from Nova Scotia to Argentina (HARRISON, 2002; FROESE; PAULY, 2015)
Habitat:	Inshore waters and estuaries with mud-sandy bottom (HARRISON, 2002; FROESE; PAULY, 2015)
Diet:	Organic detritus and small particulate materials (HARRISON, 2002)
Collection:	1231 otoliths from 642 fish (TL ranging from 21 to 452 mm)
Sample:	117 left otoliths categorized into 20, 20 mm classes (20 to 420 mm)

***Shape*:** oblong (88%), elliptic. ***Anterior region*:** angled-round (42%), peaked, angled, double-peaked. ***Posterior region*:** round (88%), oblique-round, angled-round. ***Dorsal edge*:** entire (44%), sinuate to entire, dentate to lobed, lobed to sinuate. ***Ventral edge*:** sinuate to entire (53%), dentate to lobed, lobed to sinuate, lobed. ***Profile*:** concave-convex. ***Rostrum and antirostrum orientation*:** does not apply (64%), in agreement. ***Rostrum*:** developed (53%), underdeveloped, absent. ***Antirostrum*:** absent (64%), underdeveloped, developed. ***Sulcus acusticus*:** *position*: supramedian (98%), median; *orientation*: ascending (94%), horizontal; *opening*: ostial; *morphology*: heterosulcoid; *colliculum*: heteromorphic; *ostium*: funnel-like (79%), elliptic; *cauda*: tubular sinuous (85%), tubular slightly curved, tubular strongly curved.

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

Shape indices	Mean±Sd	Minimum	Maximum
OL/TL (%)	3.65±0.82	2.14	5.61
OH/OL (%)	52.29±6.29	41.69	70.90
OT/OL (%)	14.99±2.21	11.35	23.28
OT/OH (%)	28.68±2.42	22.78	35.06
Circularity	21.38±4.15	14.82	39.66
Rectangularity	0.71±0.04	0.46	0.78

Mugil liza Valenciennes 1836 **Plate 12**

Maximum Size:	1000 mm (TL) (HARRISON, 2002; MENEZES; FIGUEIREDO, 1985)
Distribution:	Western Atlantic from Bermudas to Rio de Janeiro state (MENEZES; FIGUEIREDO, 1985)
Habitat:	Inshore marine waters and brackish estuaries (HARRISON, 2002; FROESE; PAULY, 2015)
Diet:	Organic detritus and filamentous algae (FROESE; PAULY, 2015)
Collection:	4 otoliths from 2 fish (TL ranging from 373 to 485 mm)
Sample:	2 left otoliths categorized into 2, 20 mm classes (360 to 480 mm)

Shape**:** oblong. ***Anterior region*****:** peaked. ***Posterior region*****:** round. ***Dorsal edge*****:** sinuate (50%), lobed to entire (50%). ***Ventral edge*****:** crenate to irregular (50%), crenate to lobed (50%). ***Profile*****:** concave-convex. ***Rostrum and antirostrum orientation*****:** does not apply. ***Rostrum*****:** developed. ***Antirostrum*****:** absent. ***Sulcus acusticus*****:** *position*: supramedian; *orientation*: ascending; *opening*: ostial; *morphology*: heterosulcoid; *colliculum*: heteromorphic; *ostium*: funnel-like; *cauda*: tubular slightly curved.

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

Shape indices	Mean±Sd	Minimum	Maximum
OL/TL (%)	2.26±0.25	2.09	2.44
OH/OL (%)	44.98±4.16	42.04	47.92
OT/OL (%)	13.32±0.11	13.24	13.39
OT/OH (%)	29.74±2.99	27.63	31.85
Circularity	26.41±1.82	25.13	27.70
Rectangularity	0.68±0	0.68	0.68

Family SCARIDAE

Nicholsina usta (Valenciennes 1840) **Plate 13**

Maximum Size:	300 mm (TL) (WESTNEAT, 2002; FROESE; PAULY, 2015)
Distribution:	Western Atlantic from New Jersey to São Paulo state, Brazil (MENEZES; FIGUEIREDO, 1985)
Habitat:	Shallow waters and seagrass beds (WESTNEAT, 2002; FROESE; PAULY, 2015)
Diet:	Herbivorous, feeding on seagrass (WESTNEAT, 2002)
Collection:	5 otoliths from 3 fish (TL ranging from 148 to 175 mm)
Sample:	3 left otoliths categorized into 2, 20 mm classes (140 to 160 mm)

***Shape*:** elliptic (67%), elliptic to rectangular. ***Anterior region*:** peaked (33%), double-peaked-round (33%), angled-round (33%). ***Posterior region*:** oblique-round (67%), round. ***Dorsal edge*:** lobed to sinuate. ***Ventral edge*:** dentate to lobed (67%), lobed. ***Profile*:** concave-convex. ***Rostrum and antirostrum orientation*:** in agreement (67%), in disagreement. ***Rostrum*:** developed. ***Antirostrum*:** developed. ***Pseudorostrum and Pseudoantirostrum*:** absent. ***Sulcus acusticus*:** *position*: supramedian; *orientation*: horizontal; *opening*: ostial; *morphology*: heterosulcoid; *colliculum*: heteromorphic; *ostium*: funnel-like (67%), round-oval; *cauda*: elliptic.

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

Shape indices	Mean±Sd	Minimum	Maximum
OL/TL (%)	2.12±0.14	1.95	2.22
OH/OL (%)	52.22±7.65	46.46	60.90
OT/OL (%)	13.36±1.73	11.81	15.22
OT/OH (%)	25.62±0.74	25.00	26.44
Circularity	25.40±3.69	21.24	28.25
Rectangularity	0.70±0.01	0.68	0.71

Family PERCOPHIDAE

The *rostrum* is developed and the *antirostrum* is frequently absent; the *pseudorostrum* and *pseudoantirostrum* are always absent; the *ostium* is tubular in most cases.

Bembrops heterurus (Miranda Ribeiro 1903) **Plate 14**

Maximum Size:	301 mm (TL) (BERNARDES et al., 2005)
Distribution:	Western Atlantic from Rio de Janeiro state, Brazil to Uruguay (BERNARDES et al., 2005)
Habitat:	Soft bottom of the continental shelf, from 80 to 600 m depth (BERNARDES et al., 2005; FROESE; PAULY, 2015)
Diet:	Crustaceans and fish (BERNARDES et al., 2005)
Collection:	208 otoliths from 107 fish (TL ranging from 65 to 202 mm)
Sample:	52 left otoliths categorized into 8, 20 mm classes (60 to 200 mm)

***Shape*:** elliptic to trapezoidal (60%), elliptic to rectangular. ***Anterior region*:** peaked. ***Posterior region*:** round (42%), oblique-round (38%), flattened, oblique to angled. ***Dorsal edge*:** sinuate to entire (65%), lobed to entire. ***Ventral edge*:** sinuate to entire (52%), lobed to entire, lobed to sinuate. ***Profile*:** biconvex (71%), plane-convex. ***Rostrum and antirostrum orientation*:** does not apply (77%), in agreement. ***Rostrum*:** developed. ***Antirostrum*:** absent (77%), underdeveloped. ***Sulcus acusticus*:** *position:* median; *orientation*: horizontal; *opening*: ostial; *morphology*: heterosulcoid; *colliculum*: heteromorphic; *ostium*: tubular; *cauda*: round-oval (90%), tubular straight.

Statistical differences (p<0.05) within some length classes were obtained for posterior region, ventral edge, profile, *rostrum* and *antirostrum* orientation, *antirostrum* development and *cauda* morphology. Along the otolith growth statistical differences were found for the posterior region and profile.

Shape indices	Mean±Sd	Minimum	Maximum
OL/TL (%)	3.12±0.39	2.44	4.09
OH/OL (%)	55.99±2.13	51.61	60.16
OT/OL (%)	20.36±1.33	17.58	24.44
OT/OH (%)	36.41±2.68	29.41	42.21
Circularity	17.59±0.84	15.72	19.96
Rectangularity	0.70±0.02	0.65	0.74

Percophis brasiliensis (Quoy & Gaimard 1825) **Plate 15**

Maximum Size:	650 mm (TL) (BERNARDES et al., 2005; MENEZES; FIGUEIREDO, 1985)
Distribution:	South-Western Atlantic from Rio de Janeiro to Argentina (MENEZES; FIGUEIREDO, 1985)
Habitat:	Demersal from 15 to 128 m depths (BERNARDES et al., 2005)
Diet:	Fish, crustaceans, and mollusks (BERNARDES et al., 2005)
Collection:	46 otoliths from 24 fish (TL ranging from 245 to 590 mm)
Sample:	8 left otoliths categorized into 6, 20 mm classes (280 to 580 mm)

***Shape*:** spindle-shaped to lanceolated. ***Anterior region*:** lanceolated. ***Posterior region*:** round (50%), peaked-round, oblique to peaked. ***Dorsal edge*:** lobed to sinuate (75%), lobed. ***Ventral edge*:** sinuate to entire (63%), lobed to entire, entire. ***Profile*:** concave-convex. ***Rostrum and antirostrum orientation*:** does not apply. ***Rostrum*:** developed. ***Antirostrum*:** absent. ***Sulcus acusticus*:** *position*: median; *orientation*: horizontal; *opening*: ostial; *morphology*: heterosulcoid; *colliculum*: heteromorphic; *ostium*: tubular (63%), funnel-like; *cauda*: tubular straight (63%), tubular slightly curved.

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

Shape indices	Mean±Sd	Minimum	Maximum
OL/TL (%)	2.33±0.12	2.19	2.49
OH/OL (%)	26.63±2.06	23.69	30.00
OT/OL (%)	11.60±1.45	9.99	14.03
OT/OH (%)	43.45±2.27	41.33	46.77
Circularity	26.47±1.82	23.31	28.62
Rectangularity	0.71±0.01	0.69	0.73

Family PINGUIPEDIDAE

Pseudopercis numida (Miranda Ribeiro 1903) **Plate 16**

Maximum Size:	1200 mm (TL) (FROESE; PAULY, 2015)
Distribution:	Southwestern Atlantic from Rio de Janeiro to Rio Grande do Sul, Brazil; also found in Nuevo Gulf, Argentina (MENEZES et al., 2003; VENERUS et al., 2007)
Habitat:	Deeper waters of the continental shelf (BERNARDES et al., 2005)
Diet:	Small fish and crustaceans (MENEZES; FIGUEIREDO, 1985; FROESE; PAULY, 2015; ELÍAS; RAJOY, 1992)
Collection:	22 otoliths from 11 fish (TL ranging from 128 to 620 mm)
Sample:	7 left otoliths categorized into 4, 20 mm classes (120 to 460 mm)

***Shape*:** lanceolated (86%), elliptic. ***Anterior region*:** lanceolated (86%), peaked. ***Posterior region*:** angled-round (57%), peaked-round, round. ***Dorsal edge*:** entire (43%), sinuate to entire, lobed to sinuate. ***Ventral edge*:** entire (57%), lobed to sinuate, sinuate to entire. ***Profile*:** concave-convex. ***Rostrum and antirostrum orientation*:** in agreement (57%), does not apply. ***Rostrum*:** developed. ***Antirostrum*:** underdeveloped (57%), absent. ***Pseudorostrum and pseudoantirostrum*:** absent. ***Sulcus acusticus*:** *position*: median; *orientation*: horizontal; *opening*: ostial; *morphology*: heterosulcoid; *colliculum*: heteromorphic; *ostium*: funnel-like; *cauda*: tubular slightly curved (71%), tubular straight.

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

Shape indices	Mean±Sd	Minimum	Maximum
OL/TL (%)	3.77±0.56	2.85	4.25
OH/OL (%)	48.56±2.65	45.72	53.42
OT/OL (%)	15.78±2.05	12.87	19.05
OT/OH (%)	32.64±4.89	24.08	40.00
Circularity	18.94±1.77	17.36	21.67
Rectangularity	0.67±0.01	0.64	0.69

Family BLENIIDAE

Scartella cristata (Linnaeus 1758) **Plate 17**

Maximum Size:	120 mm (TL) (FROESE; PAULY, 2015)
Distribution:	Western Atlantic from Florida to Santa Catarina state; Southern parts of the Mediterranean (MENEZES; FIGUEIREDO, 1985; FROESE; PAULY, 2015)
Habitat:	Shallow rocky areas and tidal pools (BERNARDES et al., 2005; FROESE; PAULY, 2015)
Diet:	Invertebrates and algae (FROESE; PAULY, 2015)
Collection:	29 otoliths from 16 fish (TL ranging from 15 to 24 mm)
Sample:	8 left otoliths categorized into 2, 20 mm classes (15 to 20 mm)

Shape**:** elliptic (88%), discoidal. ***Anterior region*****:** angled-round (50%), round, oblique-round. ***Posterior region*****:** round (75%), angled-round. ***Dorsal edge*****:** entire. ***Ventral edge*****:** entire. ***Profile*****:** biconvex (75%), plane-convex. ***Rostrum and antirostrum orientation*****:** does not apply. ***Rostrum*****:** underdeveloped. ***Antirostrum*****:** absent. ***Pseudorostrum and Pseudoantirostrum*****:** absent. ***Sulcus acusticus*****:** *position*: supramedian (88%), median; *orientation*: horizontal; *opening*: ostial; *morphology*: heterosulcoid; *colliculum*: heteromorphic; *ostium*: funnel-like; *cauda*: tubular strongly curved.

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

Shape indices	Mean±Sd	Minimum	Maximum
OL/TL (%)	3.26±0.48	2.75	3.95
OH/OL (%)	72.56±4.63	62.67	78.00
OT/OL (%)	35.12±5.94	26.67	43.75
OT/OH (%)	48.28±6.81	40.82	60.00
Circularity	13.49±0.34	13.12	13.94
Rectangularity	0.77±0.02	0.72	0.80

Family GOBIIDAE

Otolith shape is squared; *rostrum*, *antirostrum*, *pseudorostrum* and *pseudoantirostrum* are always absent; *sulcus acusticus* opening is mesial with the *ostium* and *cauda* oval-round or elliptic.

Bathygobius soporator (Valenciennes 1837) **Plate 18**

Maximum Size:	165 mm (TL) (MENEZES; FIGUEIREDO, 1985)
Distribution:	Eastern Atlantic from Senegal to Angola; Western Atlantic from Florida to Rio Grande do Sul state, Brazil; Mediterranean sea (MENEZES; FIGUEIREDO, 1985; FROESE; PAULY, 2015)
Habitat:	Rocky tidal pools and muddy bottom in estuaries (MENEZES; FIGUEIREDO, 1985)
Diet:	Zoobenthos (little crabs and shrimps) (FROESE; PAULY, 2015)
Collection:	713 otoliths from 402 fish (TL ranging from 13 to 135 mm)
Sample:	60 left otoliths categorized into 7, 20 mm classes (13 to 120 mm)

***Shape*:** square. ***Anterior region*:** notched (85%), flattened, notched-round, angled. ***Posterior region*:** flattened (43%), oblique, oblique to peaked, round. ***Dorsal edge*:** lobed (40%), sinuate (37%), lobed to sinuate, entire. ***Ventral edge*:** sinuate (70%), entire, lobed. ***Anterior edge*:** sinuate (55%), entire. ***Posterior edge*:** sinuate (77%), entire, lobed, lobed to sinuate. ***Profile*:** concave-convex (83%), plane-convex. ***Rostrum and antirostrum orientation*:** in agreement (87%), does not apply. ***Sulcus acusticus*:** *position*: median; *orientation*: descending (88%), horizontal; *opening*: mesial; *morphology*: heterosulcoid; *colliculum*: heteromorphic; *ostium*: round-oval; *cauda*: elliptic.

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

Shape indices	Mean±Sd	Minimum	Maximum
OL/TL (%)	3.39±0.44	2.66	4.65
OH/OL (%)	88.57±8.28	73.16	108.20
OT/OL (%)	22.74±5.56	16.22	44.07
OT/OH (%)	25.57±4.78	18.62	41.94
Circularity	16.57±2.16	6.24	21.91
Rectangularity	0.78±0.05	0.72	1.05

Ctenogobius smaragdus (Valenciennes 1837) **Plate 19**

Maximum Size:	150 mm (TL) (FROESE; PAULY, 2015)
Distribution:	Western Atlantic, from South Carolina to Southeastern Brazilian coast (MENEZES; FIGUEIREDO, 1985; MENEZES et al., 2003)
Habitat:	Shallow waters over muddy bottoms of the continental shelf (FROESE; PAULY, 2015)
Diet:	--
Collection:	1 otolith from 1 fish (TL: 45 mm)
Sample:	1 right otolith (45 mm)

***Shape*:** square. ***Anterior region*:** round. ***Posterior region*:** blunt-round. ***Dorsal edge*:** lobed to entire. ***Ventral edge*:** entire. ***Anterior edge*:** lobed. ***Posterior edge*:** entire. ***Profile*:** biconvex. ***Rostrum and antirostrum orientation*:** does not apply. ***Sulcus acusticus*:** *position*: median; *orientation*: ascending; *opening*: mesial; *morphology*: heterosulcoid; *colliculum*: heteromorphic; *ostium*: elliptic; *cauda*: round-oval.

Since only one otolith was analyzed it was not possible statistical analysis of the data but its morphometric characteristics are shown below:

Shape indices	Mean±Sd	Minimum	Maximum
OL/TL (%)	2.56±0	2.56	2.56
OH/OL (%)	106.96±0	106.96	106.96
OT/OL (%)	29.57±0	29.57	29.57
OT/OH (%)	27.64±0	27.64	27.64
Circularity	15.95±0	15.95	15.95
Rectangularity	0.76±0	0.76	0.76

Ctenogobius boleosoma (Jordan & Gilbert 1882) **Plate 20**

Maximum Size:	75 mm (TL) (FROESE; PAULY, 2015)
Distribution:	Western Atlantic, from North Carolina, Bahamas, and northern Gulf of Mexico to Southeastern Brazilian coast (MENEZES; FIGUEIREDO, 1985; MENEZES et al., 2003)
Habitat:	Found on tide pools and estuaries with cryptic habitats and burrows (WYANSKI; TARGETT, 2000)
Diet:	Mainly crustaceans (CORRÊA; UIEDA, 2007)
Collection:	778 otoliths from 439 fish (TL ranging from 12 to 55 mm)
Sample:	30 left otoliths categorized into 3, 20 mm classes (14 to 40 mm)

Shape**:** square (70%), discoidal. ***Anterior region*****:** flattened (47%), round, blunt, angled-round. ***Posterior region*****:** blunt-round (63%), round, oblique-round. ***Dorsal edge*****:** entire (73%), sinuate to entire, sinuate. ***Ventral edge*****:** entire (97%), sinuate to entire. ***Anterior edge*****:** entire (57%), does not apply, sinuate to entire. ***Posterior edge*****:** entire (70%), does not apply. ***Profile*****:** plane-convex. ***Rostrum and antirostrum orientation*****:** does not apply. ***Sulcus acusticus*****:** *position*: median; *orientation*: ascending; *opening*: mesial; *morphology*: heterosulcoid; *colliculum*: heteromorphic; *ostium*: round-oval; *cauda*: elliptic (60%), round-oval.

Statistical differences (p<0.05) within some length classes were obtained for shape, anterior and posterior regions and dorsal, ventral, anterior and posterior edges. Along the growth statistical differences were found for shape, anterior and posterior regions and dorsal, anterior and posterior edges.

Shape indices	Mean±Sd	Minimum	Maximum
OL/TL (%)	3.59±0.45	2.70	4.47
OH/OL (%)	97.12±6.25	84.09	108.70
OT/OL (%)	31.19±5.31	24.06	39.62
OT/OH (%)	31.96±3.93	26.45	39.29
Circularity	13.40±2.38	1.15	15.01
Rectangularity	0.79±0.02	0.73	0.82

Family EPHIPPIDAE

Chaetodipterus faber (Broussonet 1782) **Plate 21**

Maximum Size:	910 mm (TL) (MENEZES; FIGUEIREDO, 1985)
Distribution:	Western Atlantic, from New England to Southern Brazil (MENEZES; FIGUEIREDO, 1985; MENEZES et al., 2003)
Habitat:	Coastal waters (estuaries, mangroves and sandy beaches) (FIGUEIREDO et al., 2002)
Diet:	Invertebrates (crustaceans, mollusks, cnidarians) (HAYSE, 1990; FIGUEIREDO et al., 2002)
Collection:	60 otoliths from 32 fish (TL ranging from 26 to 283 mm)
Sample:	20 left otoliths categorized into 8, 20 mm classes (20 to 280 mm)

Shape**:** elliptic (40%), elliptic to rectangular (35%), rectangular to fusiform, elliptic to discoidal. ***Anterior region*****:** peaked-round (50%), peaked, angled-round. ***Posterior region*****:** round (75%), oblique, oblique-round. ***Dorsal edge*****:** sinuate (40%), sinuate to entire, lobed to sinuate, crenate to entire. ***Ventral edge*****:** sinuate to entire (35%), lobed to sinuate, sinuate, crenate. ***Profile*****:** concave-convex (65%), flattened, plane-convex. ***Rostrum and antirostrum orientation*****:** in agreement (70%), does not apply. ***Rostrum*****:** developed (85%), underdeveloped. ***Antirostrum*****:** underdeveloped (50%), developed, absent. ***Pseudorostrum and Pseudoantirostrum*****:** absent. ***Sulcus acusticus*****:** *position*: median; *orientation*: horizontal; *opening*: ostial; *morphology*: heterosulcoid; *colliculum*: heteromorphic; *ostium*: funnel-like; *cauda*: tubular slightly curved (85%), round-oval, tubular strongly curved.

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

Shape indices	Mean±Sd	Minimum	Maximum
OL/TL (%)	3.84±0.67	2.35	5.09
OH/OL (%)	58.64±10.94	44.61	87.00
OT/OL (%)	19.11±4.2	13.96	26.58
OT/OH (%)	33.27±8.94	25.65	54.97
Circularity	19.75±2.33	16.54	25.28
Rectangularity	0.71±0.03	0.67	0.75

Family SPHYRAENIDAE

Otolith shape is normally spindle-shaped; the posterior region is oblique or flattened; the profile is concave-convex; the *rostrum* and *antirostrum* orientation are in agreement with the *rostrum* developed and *antirostrum* frequently underdeveloped; *pseudorostrum* and *pseudoantirostrum* are always absent; the *ostium* is funnel-like and the *cauda* is predominantly tubular slightly curved.

Sphyraena barracuda (Walbaum 1792) **Plate 22**

Maximum Size:	910 mm (TL) (MENEZES; FIGUEIREDO, 1985)
Distribution:	Western Atlantic, from New England to Southern Brazil (MENEZES; FIGUEIREDO, 1985; MENEZES et al., 2003)
Habitat:	Coastal waters (estuaries, mangroves and sandy beaches) (FIGUEIREDO et al., 2002)
Diet:	Invertebrates (crustaceans, mollusks, cnidarians) (HAYSE, 1990; FIGUEIREDO et al., 2002)
Collection:	6 otoliths from 3 fish (TL ranging from 436 to 563 mm)
Sample:	2 left otoliths categorizad into 2, 20 mm classes (460 to 580 mm)

Shape*:** spindle-shaped to lanceolated. ***Anterior region*:** lanceolated. ***Posterior region: oblique. ***Dorsal edge*:** lobed to sinuate. ***Ventral edge*:** sinuate. ***Profile*:** concave-convex. ***Rostrum and antirostrum orientation*:** does not apply. ***Rostrum*:** developed. ***Antirostrum*:** absent. ***Sulcus acusticus*:** *position*: median; *orientation*: horizontal; *opening*: ostial; *morphology*: heterosulcoid; *colliculum*: heteromorphic; *ostium*: funnel-like; *cauda*: tubular slightly curved.

Since only one otolith was analyzed it was not possible statistical analysis of the data but its morphometric characteristics are shown below:

Shape indices	Mean±Sd	Minimum	Maximum
OL/TL (%)	2.50±0	2.50	2.91
OH/OL (%)	31.25±0	31.25	31.81
OT/OL (%)	12.24±0	12.24	13.59
OT/OH (%)	39.18±0	39.18	42.73
Circularity	25.88±0	21.64	25.88
Rectangularity	0.67±0	0.67	0.73

Sphyraena guachancho Cuvier 1829 **Plate 23**

Maximum Size:	2000 mm (TL) (CARVALHO-FILHO, 1992)
Distribution:	Western Atlantic from Massachusetts to Argentina, also found in the Eastern Atlantic (CARVALHO-FILHO, 1992; MENEZES et al., 2003)
Habitat:	Shallow and coastal waters over muddy bottoms, often found in estuaries (MENEZES; FIGUEIREDO, 1985)
Diet:	Mainly fish and crustaceans (MENEZES; FIGUEIREDO, 1985)
Collection:	179 otoliths from 93 fish (TL ranging from 140 to 644 mm)
Sample:	7 left otoliths categorized into 7, 20 mm classes (140 to 440 mm)

***Shape*:** spindle-shaped (71%), rectangular. ***Anterior region*:** peaked. ***Posterior region*:** oblique (57%), flattened, round. ***Dorsal edge*:** sinuate to entire (71%), lobed to sinuate. ***Ventral edge*:** sinuate to entire (57%), entire. ***Profile*:** concave-convex. ***Rostrum and antirostrum orientation*:** in agreement (86%), does not apply. ***Rostrum*:** developed. ***Antirostrum*:** underdeveloped (86%), absent. ***Sulcus acusticus*:** *position*: median; *orientation*: horizontal; *opening*: ostial; *morphology*: heterosulcoid; *colliculum*: heteromorphic; *ostium*: funnel-like; *cauda*: tubular slightly curved (86%), tubular straight.

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

Shape indices	Mean±Sd	Minimum	Maximum
OL/TL (%)	3.06±0.43	2.42	3.71
OH/OL (%)	35.67±5.09	30.34	43.16
OT/OL (%)	13.15±2.00	11.21	15.94
OT/OH (%)	36.84±1.84	34.45	40.38
Circularity	21.24±0.48	20.67	22.20
Rectangularity	0.73±0.01	0.72	0.74

Sphyraena tome Fowler 1903 **Plate 24**

Maximum Size:	450 mm (TL) (CARVALHO-FILHO, 1992)
Distribution:	Southwestern Atlantic from Rio de Janeiro to northern Argentina (CARVALHO-FILHO, 1992; MENEZES et al., 2003)
Habitat:	Pelagic; shallow and coastal waters (MATSUURA; SUZUKI, 1997)
Diet:	Mainly fish (MATSUURA; SUZUKI, 1997)
Collection:	13 otoliths from 7 fish (TL ranging from 291 to 412 mm)
Sample:	2 left otoliths categorized into 1, 20 mm class (400 mm)

***Shape*:** spindle-shaped. ***Anterior region*:** peaked. ***Posterior region*:** flattened. ***Dorsal edge*:** sinuate to entire. ***Ventral edge*:** entire. ***Profile*:** concave-convex. ***Rostrum and antirostrum orientation*:** in agreement. ***Rostrum*:** developed. ***Antirostrum*:** underdeveloped. ***Sulcus acusticus*:** *position*: median; *orientation*: horizontal; *opening*: ostial; *morphology*: heterosulcoid; *colliculum*: heteromorphic; *ostium*: funnel-like; *cauda*: tubular straight (50%), tubular slightly curved (50%).

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

Shape indices	Mean±Sd	Minimum	Maximum
OL/TL (%)	3.15±0.02	3.14	3.17
OH/OL (%)	31.32±1.94	29.95	32.69
OT/OL (%)	12.84±0.20	12.70	12.98
OT/OH (%)	41.07±1.91	39.72	42.42
Circularity	22.09±0.30	21.87	22.30
Rectangularity	0.73±0.02	0.71	0.74

Family GEMPYLIDAE

Thyrsitops lepidopoides (Cuvier 1832) **Plate 25**

Maximum Size:	400 mm (TL) (HAIMOVICI et al., 2008)
Distribution:	Southwest Atlantic, from Espirito Santo, Brazil, to Argentina, also found in Chile (MENEZES et al., 2003; HAIMOVICI et al., 2008)
Habitat:	Mesobenthopelagic, inhabits the continental slope (BERNARDES et al., 2005; FROESE; PAULY, 2015)
Diet:	Small fish and euphausiids (FIGUEIREDO et al., 2002; BERNARDES et al., 2005)
Collection:	1218 otoliths from 657 fish (TL ranging from 27 to 366 mm)
Sample:	59 left otoliths categorized into 14, 20 mm classes (20 to 320 mm)

***Shape*:** elliptic to lanceolated (83%), elliptic, rectangular. ***Anterior region*:** lanceolated (83%), peaked. ***Posterior region*:** oblique (58%), round, flattened. ***Dorsal edge*:** lobed (41%), lobed to sinuate, sinuate, dentate to sinuate. ***Ventral edge*:** lobed (51%), lobed to sinuate, dentate to lobed, sinuate. ***Profile*:** concave-convex (85%), plane-convex. ***Rostrum and antirostrum orientation*:** in agreement (86%), does not apply. ***Rostrum*:** developed. ***Antirostrum*:** underdeveloped (66%), developed, absent. ***Pseudorostrum*:** absent (88%), underdeveloped, developed. ***Pseudoantirostrum*:** absent (90%), underdeveloped. ***Sulcus acusticus*:** *position:* median; *orientation*: horizontal; *opening*: ostial (54%), *ostio-caudal* (46%); *morphology*: heterosulcoid; *colliculum*: heteromorphic; *ostium*: funnel-like; *cauda*: tubular slightly curved (39%), tubular straight, tubular strongly curved, elliptic.

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

Shape indices	Mean±Sd	Minimum	Maximum
OL/TL (%)	2.53±0.36	1.30	4.55
OH/OL (%)	50.77±4.41	45.17	69.86
OT/OL (%)	10.67±3.59	6.68	21.90
OT/OH (%)	20.81±5.66	13.16	38.71
Circularity	22.63±3.83	15.56	36.15
Rectangularity	0.65±0.06	0.41	0.86

Family TRICHIURIDAE

Otoliths are longer than taller being fusiform or spindle-shaped; the anterior region is peaked or lanceolated; *pseudorostrum* and *pseudoantirostrum* are always absent.

Benthodesmus elongatus (Clarke 1879) **Plate 26**

Maximum Size:	1000 mm (TL) (FROESE; PAULY, 2015)
Distribution:	Tropical and subtropical waters of the Southern Hemisphere; South Brazilian coast from Cabo Frio to Argentina (BERNARDES et al., 2005)
Habitat:	Juveniles are mesopelagic and adults benthopelagic living between 170 and 950 m depth (FIGUEIREDO et al., 2002; BERNARDES et al., 2005)
Diet:	Crustaceans, small fish and squids (NAKAMURA; PARIN, 1993; FIGUEIREDO et al., 2002)
Collection:	207 otoliths from 114 fish (TL ranging from 256 to 494 mm)
Sample:	61 left otoliths categorized into 13, 20 mm classes (240 to 480 mm)

Shape: spindle-shaped. ***Anterior region*****:** peaked-round (90%), peaked. ***Posterior region*****:** flattened (38%), oblique, blunt, peaked-round. ***Dorsal edge*****:** sinuate to entire (93%), lobed to sinuate. ***Ventral edge*****:** sinuate to entire (84%), entire, lobed to sinuate. ***Profile*****:** flattened. ***Rostrum and antirostrum orientation*****:** does not apply. ***Rostrum*****:** absent (69%), developed. ***Antirostrum*****:** absent. ***Sulcus acusticus*****:** *position:* median; *orientation:* horizontal; *opening:* mesial (38%), pseudo-ostial (31%), ostial (31%); *morphology:* archaesulcoid (77%), pseudo-archaesulcoid; *colliculum:* unimorphic (77%), heteromorphic; *ostium:* absent (77%), tubular, funnel-like; *cauda:* absent (77%), tubular straight.

Statistical differences (p<0.05) within some length classes were obtained for anterior and posterior regions, dorsal and ventral edges, *rostrum* development and *sulcus acusticus*, *colliculum*, *ostium* and *cauda* morphology. Along the development, statistical differences were found only for the posterior region.

Shape indices	Mean±Sd	Minimum	Maximum
OL/TL (%)	0.75±0.05	0.50	0.92
OH/OL (%)	32.71±1.47	29.53	36.75
OT/OL (%)	4.14±1.28	11.69	17.47
OT/OH (%)	43.28±4.03	35.40	52.94
Circularity	21.70±0.83	19.82	24.21
Rectangularity	0.73±0.02	0.70	0.77

Evoxymetopon taeniatus Gill 1863 **Plate 27**

Maximum Size:	2000 mm (TL) (PARIN; NAKAMURA, 2002)
Distribution:	Western Atlantic, from Bermuda and Bahamas, and the Caribbean sea to the Southeastern-Southern Brazilian coast; also found in North Pacific (PARIN; NAKAMURA, 2002; BERNARDES et al., 2005)
Habitat:	Benthopelagic on continental slope, sometimes on shelf areas (PARIN; NAKAMURA, 2002)
Diet:	---
Collection:	38 otoliths from 22 fish (TL ranging from 512 to 1760 mm)
Sample:	10 left otoliths categorized into 10, 20 mm classes (500 to 1640 mm)

Shape**:** fusiform to lanceolated. ***Anterior region*****:** lanceolated. ***Posterior region*****:** peaked-round. ***Dorsal edge*****:** sinuate to entire (80%), lobed to sinuate. ***Ventral edge*****:** lobed to sinuate (60%), sinuate to entire, dentate to sinuate. ***Profile*****:** flattened. ***Rostrum and antirostrum orientation*****:** in agreement. ***Rostrum*****:** developed. ***Antirostrum*****:** developed (80%), underdeveloped. ***Sulcus acusticus*****:** *position:* median; *orientation:* horizontal; *opening:* ostial; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* funnel-like (80%), tubular; *cauda:* tubular straight.

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

Shape indices	Mean±Sd	Minimum	Maximum
OL/TL (%)	0.71±0.05	0.65	0.71
OH/OL (%)	34.24±1.77	32.02	37.50
OT/OL (%)	12.91±1.2	11.18	14.68
OT/OH (%)	37.67±2.48	33.62	41.13
Circularity	26.45±2.34	23.04	30.81
Rectangularity	0.66±0.02	0.63	0.69

Lepidopus altifrons Parin & Collette 1993 **Plate 28**

Maximum Size:	95 mm (TL) (FROESE; PAULY, 2015).
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, 2015).
Diet:	Feeds on crustaceans, krill, fish eggs and larvae (SCOTT; SCOTT, 1988).
Collection:	517 otoliths from 288 fish (TL ranging from 223 to 798 mm)
Sample:	89 left otoliths categorized into 13, 20 mm classes (200 to 800 mm)

Shape: fusiform (76%), lanceolated, fusiform to lanceolated. ***Anterior region*****:** peaked (76%), lanceolated. ***Posterior region*****:** round (63%), flattened, oblique, angled-round. ***Dorsal edge*****:** sinuate to entire (74%), entire. ***Ventral edge*****:** lobed to entire (54%), lobed to sinuate, entire, sinuate to entire. ***Profile*****:** flattened. ***Rostrum and antirostrum orientation*****:** in agreement (79%), does not apply. ***Rostrum*****:** developed. ***Antirostrum*****:** underdeveloped (56%), developed, absent. ***Sulcus acusticus*****:** *position:* median; *orientation:* horizontal; *opening:* ostial; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* funnel-like; *cauda:* tubular straight.

Statistical differences (p<0.05) within some length classes were obtained for shape, anterior and posterior regions, dorsal and ventral edges, *rostrum* and *antirostrum* orientation and *antirostrum* development. Along the growth development statistical differences were found for shape, anterior and posterior regions.

Shape indices	Mean±Sd	Minimum	Maximum
OL/TL (%)	0.86±0.08	0.67	1.14
OH/OL (%)	34.68±1.94	29.01	40.16
OT/OL (%)	11.53±1.28	8.80	15.60
OT/OH (%)	33.28±3.52	26.70	43.80
Circularity	23.82±1.83	19.25	29.49
Rectangularity	0.67±0.02	0.61	0.74

Trichiurus lepturus Linnaeus 1758 **Plate 29**

Maximum Size:	2340 mm (TL) (FROESE; PAULY, 2015)
Distribution:	Circumtropical in temperate waters of the world; Western Atlantic from Northern Virginia to Northern Argentina (PARIN; NAKAMURA, 2002; BERNARDES et al., 2005)
Habitat:	Over shallow coastal waters until 300 m depth (CERGOLE et al., 2005)
Diet:	Juveniles feed on crustaceans and small fish; adults feed mainly on fish (MARTINS et al., 2005)
Collection:	2460 otoliths from 1315 fish (TL ranging from 104 to 1825 mm)
Sample:	158 left otoliths categorized into 37, 40 mm classes (140 to 1820 mm)

Shape: fusiform. ***Anterior region*****:** peaked. ***Posterior region*****:** blunt to peaked (56%), peaked-round, peaked, angled. ***Dorsal edge*****:** sinuate (89%), lobed to sinuate. ***Ventral edge*****:** sinuate (69%), lobed to sinuate, lobed, entire. ***Profile*****:** concave-convex. ***Rostrum and antirostrum orientation*****:** in agreement (72%), does not apply. ***Rostrum*****:** developed. ***Antirostrum*****:** underdeveloped (61%), absent, developed. ***Sulcus acusticus*****:** *position:* median; *orientation:* horizontal; *opening:* ostial; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* funnel-like (98%), elliptic; *cauda:* tubular straight.

Statistical differences (p<0.05) within some length classes were obtained for posterior region, dorsal and ventral edges, *rostrum* and *antirostrum* orientation, *antirostrum* development, and *ostium* morphology. Along the growth statistical differences were found only for the posterior region.

Shape indices	Mean±Sd	Minimum	Maximum
OL/TL (%)	0.78±0.26	0.40	2.42
OH/OL (%)	38.97±1.99	32.80	44.67
OT/OL (%)	19.02±1.65	14.96	23.63
OT/OH (%)	48.83±3.65	38.51	57.70
Circularity	20.34±2.04	0.06	28.63
Rectangularity	0.70±0.04	0.66	0.75

Family SCOMBRIDAE

Katsuwonus pelamis (Linnaeus 1758) **Plate 30**

Maximum Size:	1100 mm (TL) (FROESE; PAULY, 2015)
Distribution:	Cosmopolitan in tropical and temperate seas; Western Atlantic from Massachusetts to Southern Brazil (COLLETTE, 2002; MENEZES et al., 2003)
Habitat:	Deep coastal and oceanic waters; forming large schools (CARVALHO-FILHO, 1992; COLLETTE, 2002)
Diet:	Fish, crustaceans and cephalopods (TANABE, 2001)
Collection:	9 otoliths from 8 fish (TL ranging from 333 to 630 mm)
Sample:	2 right otoliths categorized into 2, 20 mm classes (360 to 460 mm)

Shape: rectangular to lanceolated. ***Anterior region*****:** lanceolated-round. ***Posterior region*****:** double-peaked-round. ***Dorsal edge*****:** sinuate to entire. ***Ventral edge*****:** dentate to lobed. ***Profile*****:** concave-convex. ***Rostrum and antirostrum orientation*****:** in agreement. ***Rostrum*****:** developed. ***Antirostrum*****:** underdeveloped (50%), developed (50%). ***Pseudorostrum*****:** developed. ***Pseudoantirostrum*****:** underdeveloped (50%), developed (50%). ***Sulcus acusticus*****:** *position:* median; *orientation*: horizontal; *opening*: *ostio-caudal*; *morphology*: heterosulcoid; *colliculum*: heteromorphic; *ostium*: funnel-like; *cauda*: tubular slightly curved.

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

Shape indices	Mean±Sd	Minimum	Maximum
OL/TL (%)	1.04±0.02	1.02	1.05
OH/OL (%)	45.02±1.8	43.75	46.29
OT/OL (%)	19.40±0.91	18.75	20.04
OT/OH (%)	43.07±0.31	42.86	43.29
Circularity	38.26±5.34	34.49	42.04
Rectangularity	0.63±0.03	0.61	0.65

Family ARIOMMATIDAE

Ariomma bondi Fowler 1930 **Plate 31**

Maximum Size:	300 mm (TL) (FROESE; PAULY, 2015)
Distribution:	Western Atlantic from Gulf of Maine and the northern Gulf of Mexico to Uruguay; also West Africa (HAEDRICH, 2002; MENEZES et al., 2003)
Habitat:	Demersal or benthopelagic on the outer continental shelf; juveniles occur in surface waters. (BERNARDES et al., 2005; HAIMOVICI et al., 2008)
Diet:	Mainly small crustaceans (HAEDRICH, 2002)
Collection:	1727 otoliths from 994 fish (TL ranging from 15 to 227 mm)
Sample:	88 left otoliths categorized into 10, 20 mm classes (15 to 180 mm)

***Shape*:** elliptic to lanceolated (72%), elliptic, elliptic to discoidal. ***Anterior region*:** lanceolated (65%), peaked. ***Posterior region*:** round (75%), flattened, oblique, double-peaked. ***Dorsal edge*:** lobed to sinuate (56%), lobed, entire, sinuate to entire. ***Ventral edge*:** lobed to sinuate (58%), lobed, sinuate to entire. ***Profile*:** concave-convex. ***Rostrum and antirostrum orientation*:** in agreement (91%), in disagreement, does not apply. ***Rostrum*:** developed. ***Antirostrum*:** underdeveloped (70%), developed, absent. ***Pseudorostrum and Pseudoantirostrum*:** absent. ***Sulcus acusticus*:** *position:* median; *orientation:* ascending (57%), horizontal; *opening:* ostial (94%), *ostio-caudal*; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* funnel-like; *cauda:* tubular slightly curved (50%), tubular strongly curved, tubular straight, round-oval.

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

Shape indices	Mean±Sd	Minimum	Maximum
OL/TL (%)	2.82±0.25	2.03	3.67
OH/OL (%)	58.90±6.18	44.11	84.21
OT/OL (%)	9.07±2.66	4.68	18.18
OT/OH (%)	15.29±3.57	8.33	24.39
Circularity	21.08±3.57	10.45	31.01
Rectangularity	0.67±0.04	0.58	0.94

Family STROMATEIDAE

Peprilus paru Linnaeus 1758 **Plate 32**

Maximum Size:	300 mm (TL) (HAEDRICH, 2002) but attaining 304 mm in our collection.
Distribution:	Western Atlantic from New York to Argentina (BERNARDES et al., 2005)
Habitat:	Coastal and inshore waters over the continental shelf at depths from 25 to 70 m; (CARVALHO-FILHO, 1992; HAEDRICH, 2002)
Diet:	Jellyfish, small fish, crustaceans and others invertebrates (BERNARDES et al., 2005)
Collection:	471 otoliths from 245 fish (TL ranging from 37 to 304 mm)
Sample:	63 left otoliths categorized into 14, 20 mm classes (20 to 300 mm)

***Shape*:** elliptic (60%), fusiform, discoidal to elliptic. ***Anterior region*:** peaked. ***Posterior region*:** angled (33%), round, oblique, angled-round. ***Dorsal edge*:** sinuate to entire (65%), lobed, lobed to sinuate, dentate to sinuate. ***Ventral edge*:** sinuate to entire (49%), lobed, lobed to sinuate, dentate to sinuate. ***Profile*:** concave-convex. ***Rostrum and antirostrum orientation*:** in agreement (90%), in disagreement, does not apply. ***Rostrum*:** developed. ***Antirostrum*:** underdeveloped (75%), developed, absent. ***Pseudorostrum and Pseudoantirostrum*:** absent. ***Sulcus acusticus*:** *position:* median; *orientation:* horizontal; *opening:* ostial; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* funnel-like; *cauda:* tubular slightly curved (62%), tubular straight.

Statistical differences ($p<0.05$) within some length classes were obtained for shape, posterior region, dorsal and ventral edges, *rostrum* and *antirostrum* orientation, *antirostrum* development and *cauda* morphology. Along the development statistical differences were found for shape, posterior region, dorsal and ventral edges.

Shape indices	Mean±Sd	Minimum	Maximum
OL/TL (%)	4.00±0.60	2.92	5.85
OH/OL (%)	56.35±8.71	45.41	78.40
OT/OL (%)	10.20±2.17	7.98	18.41
OT/OH (%)	18.00±1.40	14.79	23.57
Circularity	21.59±2.62	17.47	31.24
Rectangularity	0.67±0.02	0.64	0.71

Family CAPROIDAE

Antigonia capros Lowe 1843 **Plate 33**

Maximum Size:	305 mm (TL) (FROESE; PAULY, 2015)
Distribution:	Circumtropical; Western Atlantic from New Jersey to Uruguay (FIGUEIREDO et al., 2002; BERNARDES, 2005)
Habitat:	Adults are found close to bottom and juveniles occur in mid water (FIGUEIREDO et al., 2002)
Diet:	Mainly crustaceans, cephalopods and mollusks (BERNARDES et al., 2005)
Collection:	1157 otoliths from 598 fish (TL ranging from 32 to 209 mm)
Sample:	73 left otoliths categorized into 9, 20 mm classes (20 to 180 mm)

***Shape*:** rhomboidal (88%), tall. ***Anterior region*:** double-peaked (60%), double-peaked-round, peaked, angled. ***Posterior region*:** angled-round (67%), round. ***Dorsal edge*:** sinuate to entire (51%), lobed to sinuate, dentate to sinuate, entire. ***Ventral edge*:** sinuate to entire (81%), lobed to sinuate, serrate to sinuate, entire. ***Profile*:** plane-convex. ***Rostrum and antirostrum orientation*:** in agreement (97%), does not apply. ***Rostrum*:** developed (85%), underdeveloped. ***Antirostrum*:** underdeveloped (51%), developed (47%), absent. ***Pseudorostrum and Pseudoantirostrum*:** absent. ***Sulcus acusticus*:** *position:* supramedian; *orientation:* ascending; *opening:* ostial (86%), *ostio-caudal*; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* bent; *cauda:* tubular straight (84%), tubular strongly curved, tubular slightly curved.

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

Shape indices	Mean±Sd	Minimum	Maximum
OL/TL (%)	5.38±0.79	3.97	7.72
OH/OL (%)	117.97±13.13	81.88	149.47
OT/OL (%)	22.84±3.94	14.80	31.95
OT/OH (%)	19.34±2.29	14.39	25.84
Circularity	18.06±1.92	14.37	23.02
Rectangularity	0.66±0.04	0.62	0.86

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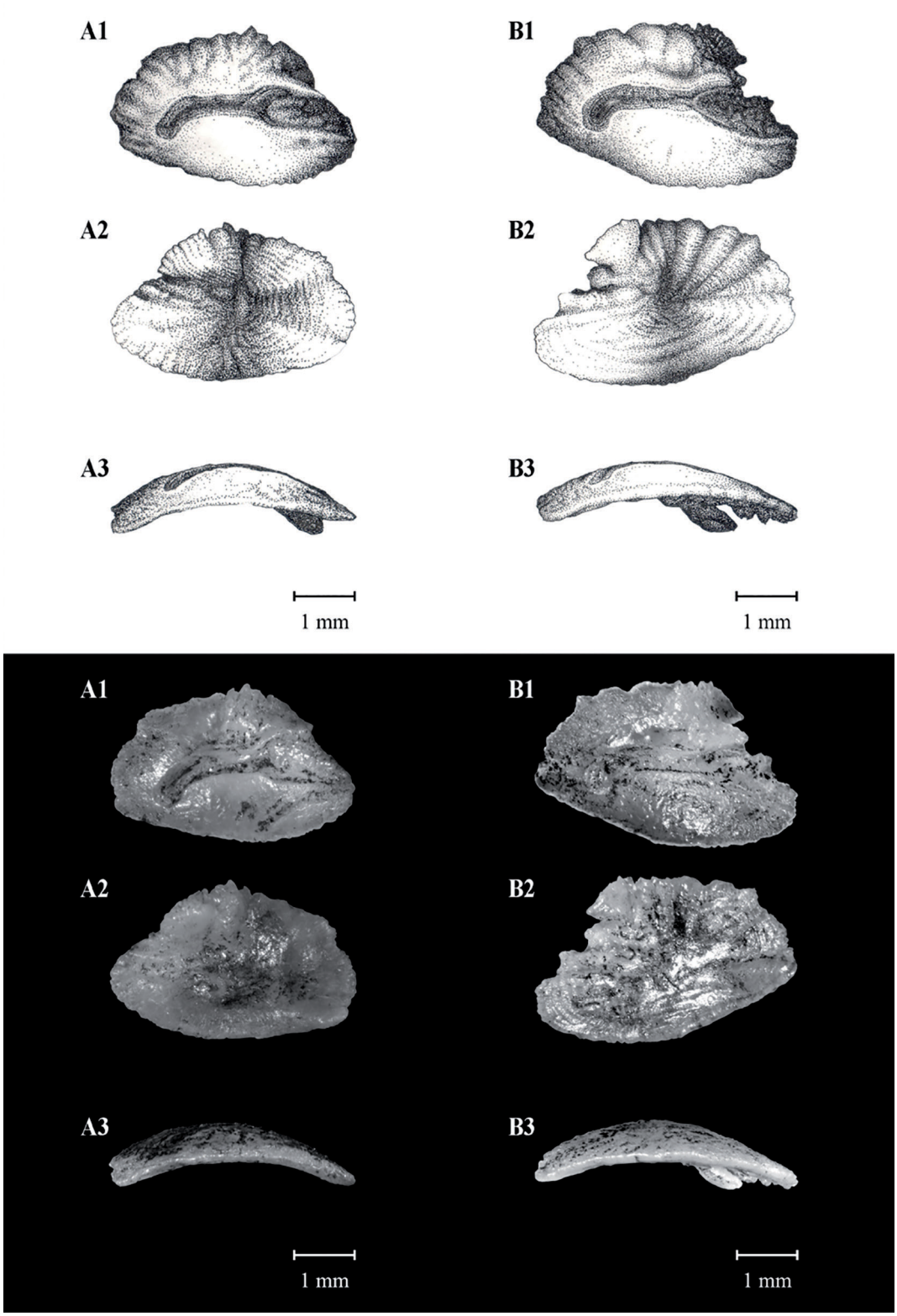

Plate 1. Illustrations (above) and photos (below) of *Archosargus rhomboidalis* otoliths from fish with total lengths: A. 115 mm; B. 160 mm. The medial face is shown in A1, B1; the lateral face in A2, B2; and the ventral profile in A3, B3 (Illustrations and Photos: Alexandre Arackawa).

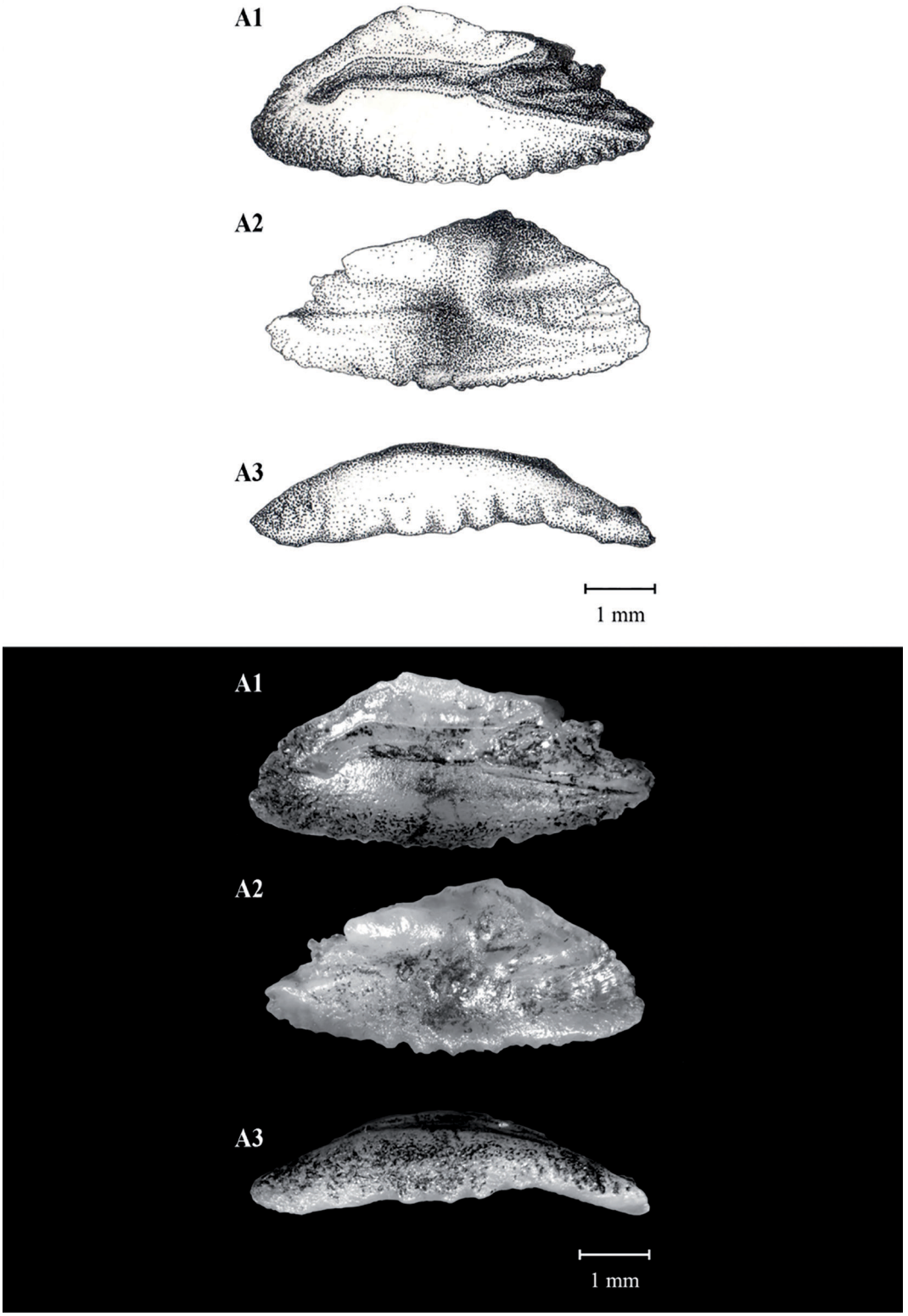

Plate 2. Illustrations (above) and photos (below) of *Calamus penna* otolith from a fish with 167 mm total length. The medial face is shown in A1; the lateral face in A2; and the ventral profile in A3 (Illustrations and Photos: Alexandre Arackawa).

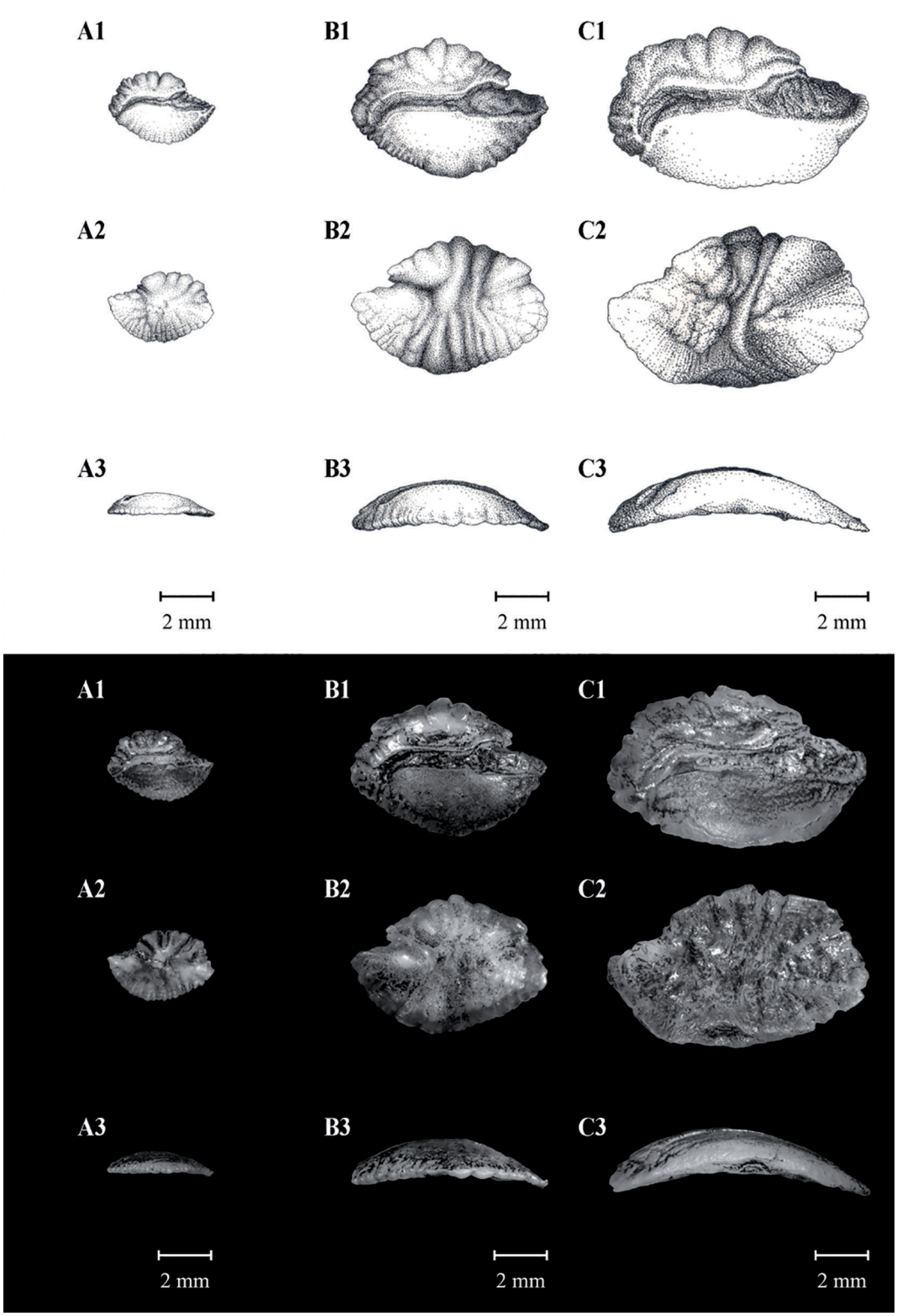

Plate 3. Illustrations (above) and photos (below) of *Pagrus pagrus* otoliths from fish with total lengths: A. 69 mm; B. 153 mm; C. 273 mm. The medial face is shown in A1, B1, C1; the lateral face in A2, B2, C2; and the ventral profile in A3, B3, C3 (Illustrations: Alexandre Arackawa; Photos: Alexandre

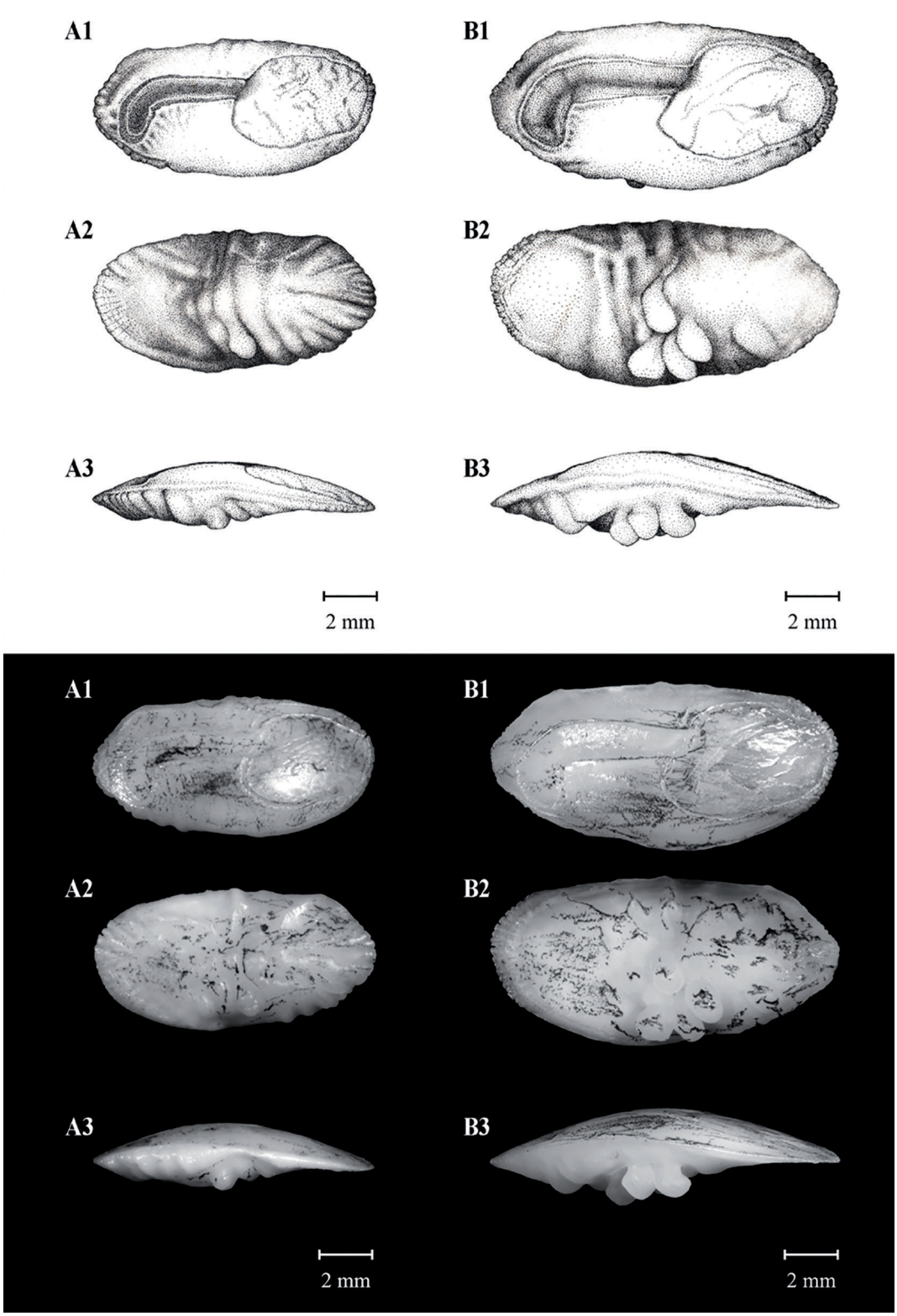

Plate 4. Illustrations (above) and photos (below) of *Cynoscion leiarchus* otoliths from fish with total lengths: A. 229 mm; B. 292 mm. The medial face is shown in A1, B1; the lateral face in A2, B2; and the ventral profile in A3, B3 (Illustrations and Photos: Alexandre Arackawa).

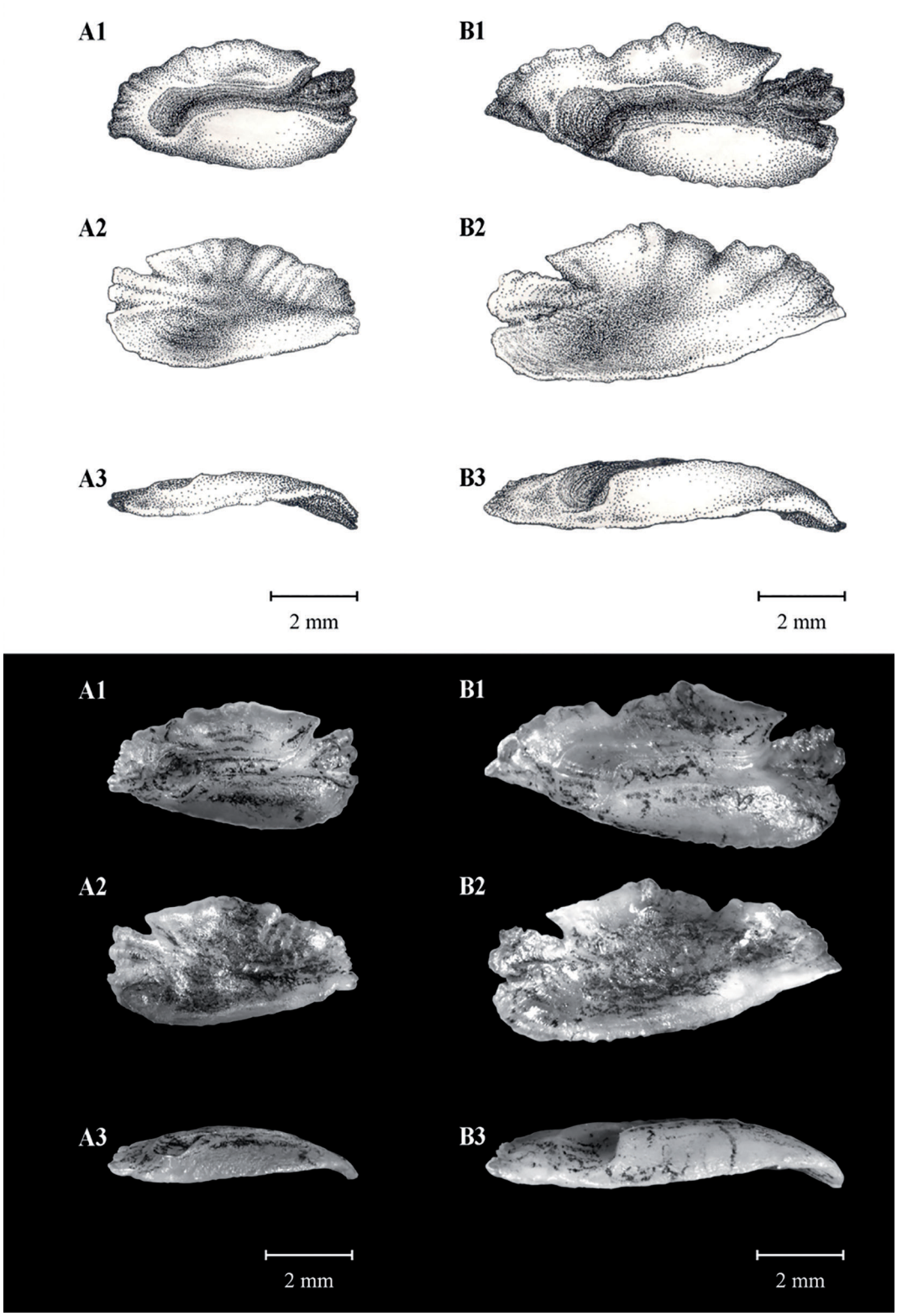

Plate 5. Illustrations (above) and photos (below) of *Polydactylus virginicus* otoliths from fish with total lengths: A. 215 mm; B. 344 mm. The medial face is shown in A1, B1; the lateral face in A2, B2; and the ventral profile in A3, B3 (Illustrations and Photos: Alexandre Arackawa).

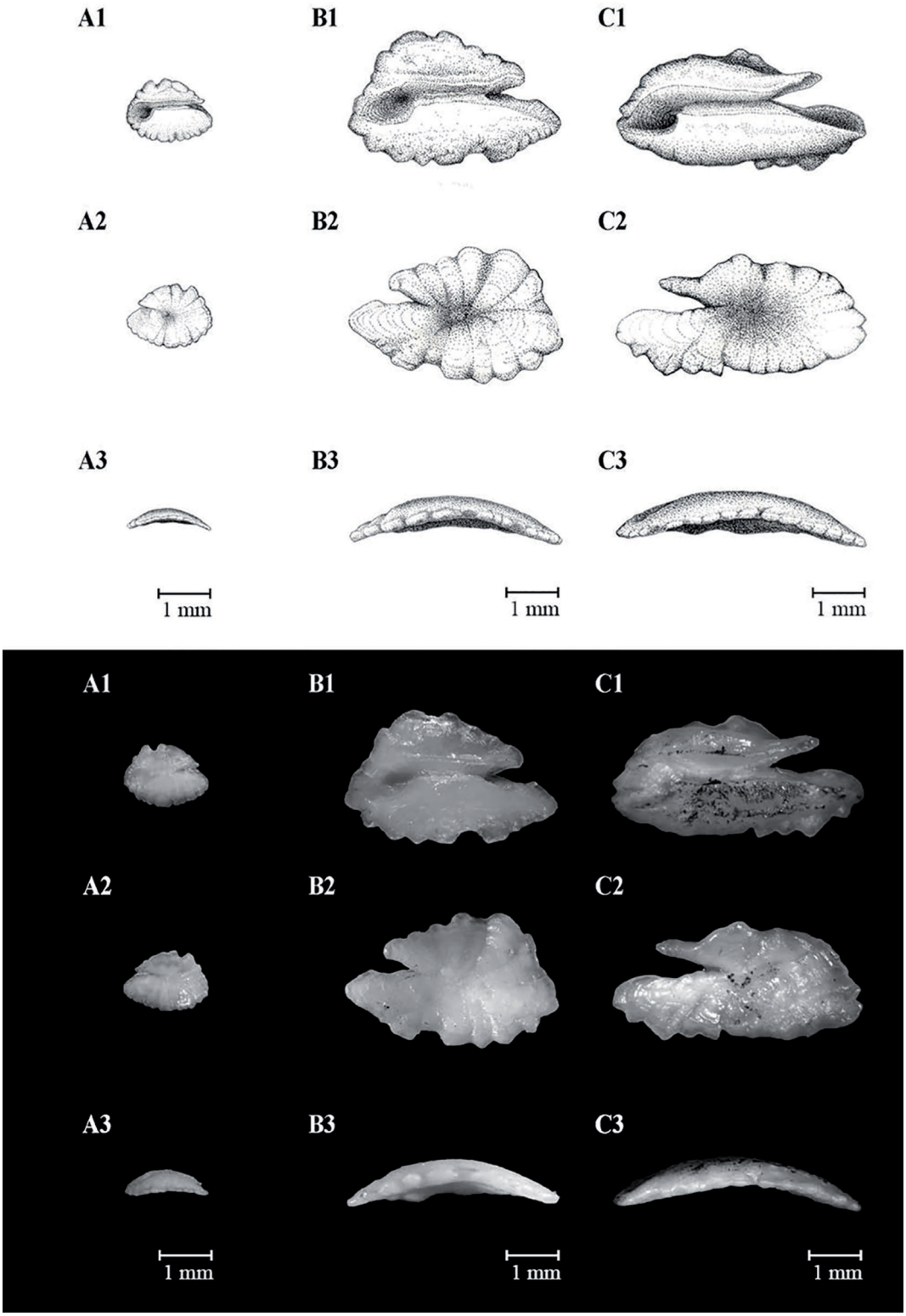

Plate 6. Illustrations (above) and photos (below) of *Mullus argentinae* otoliths from fish with total lengths: A. 129 mm; B. 192 mm; C. 243 mm. The medial face is shown in A1, B1, C1; the lateral face in A2, B2, C2; and the ventral profile in A3, B3, C3 (Illustrations: Laura Montserrat; Photos: Cesar Santificetur).

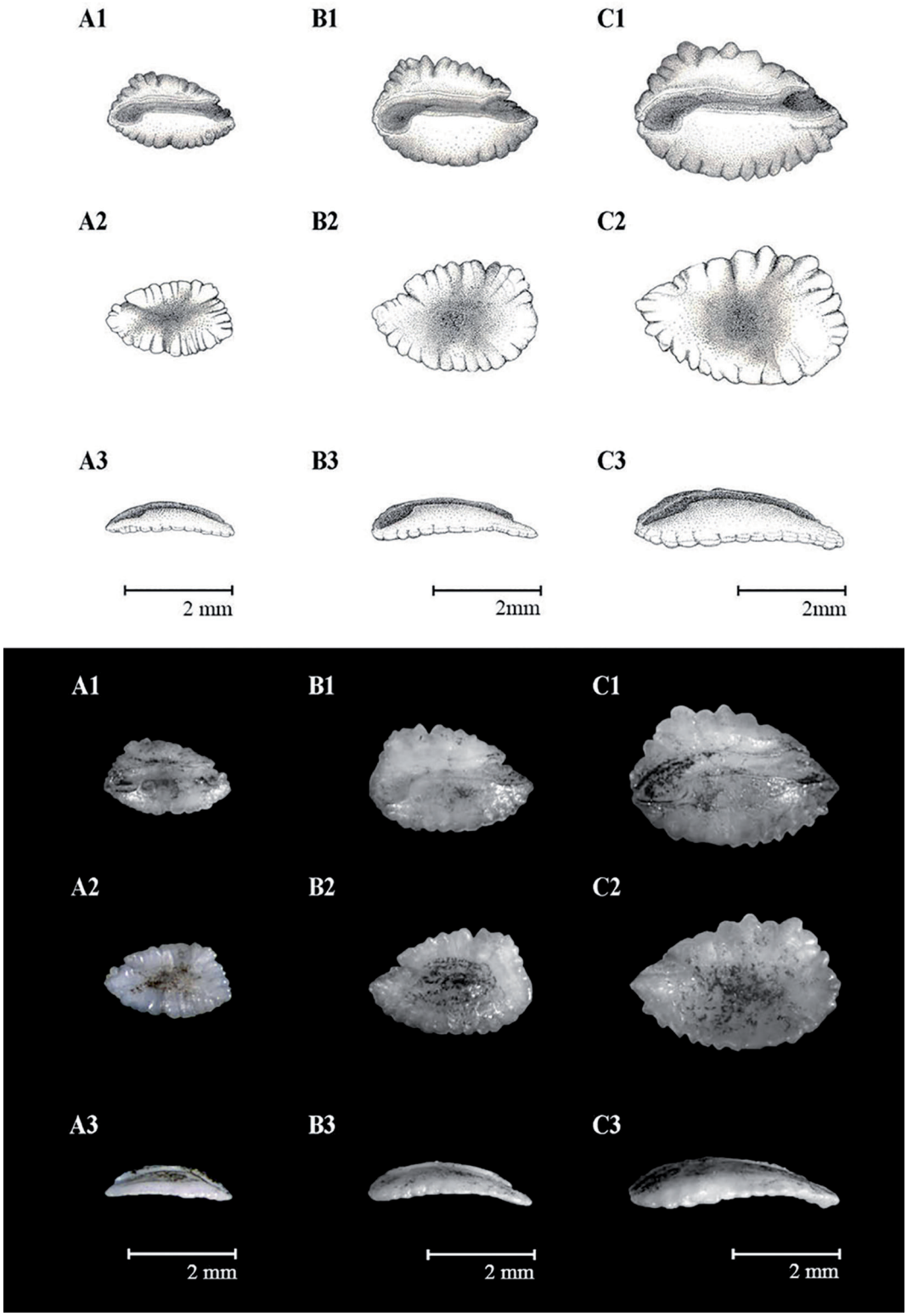

Plate 7. Illustrations (above) and photos (below) of *Upeneus parvus* otoliths from fish with total lengths: A. 84 mm; B. 129 mm; C. 175 mm. The medial face is shown in A1, B1, C1; the lateral face in A2, B2, C2; and the ventral profile in A3, B3, C3 (Illustrations: Laura Montserrat; Photos: Cesar Santificetur).

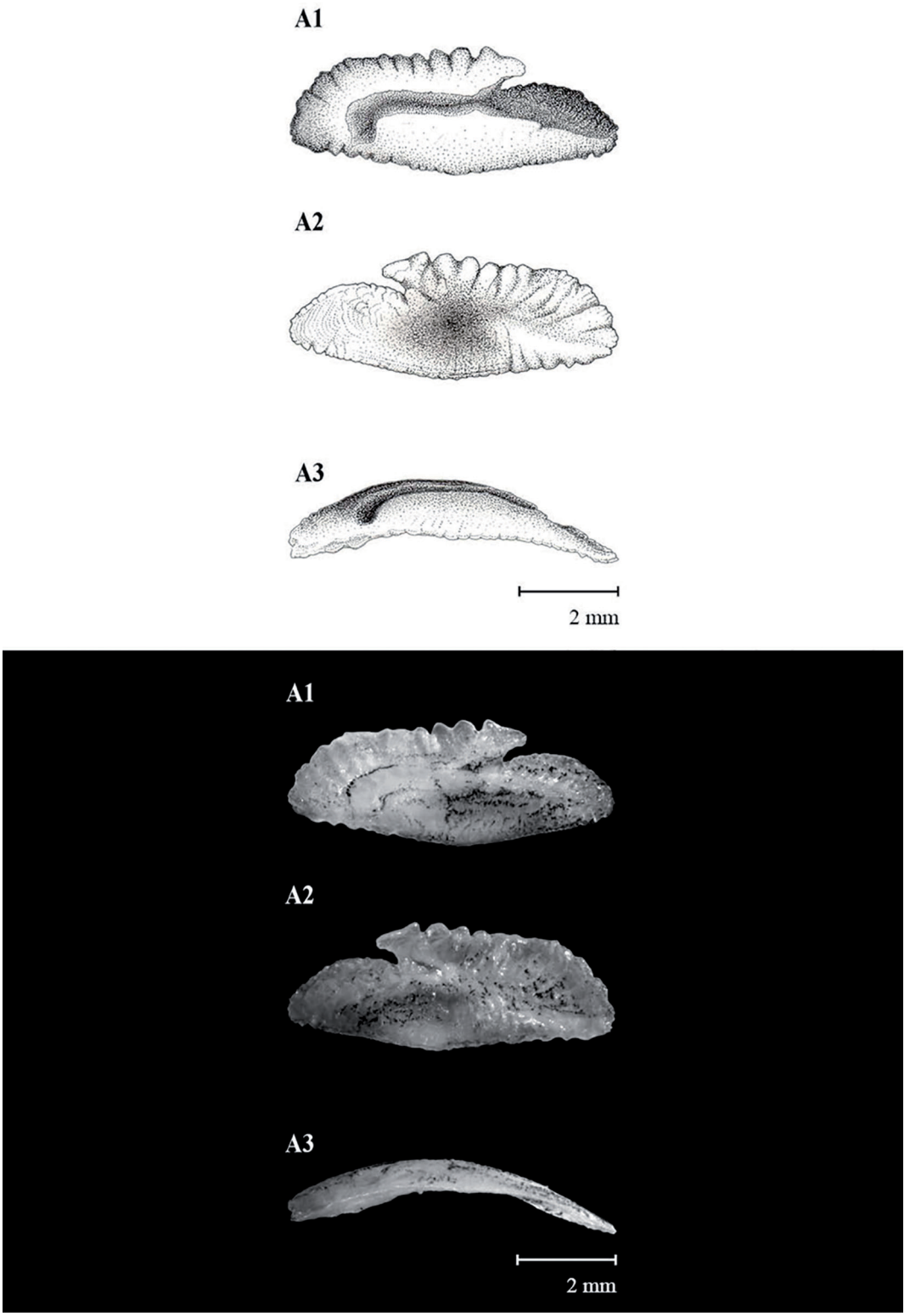

Plate 8. Illustrations (above) and photos (below) of *Kyphosus incisor* otolith from a fish with 254 mm total length. The medial face is shown in A1; the lateral face in A2; and the ventral profile in A3 (Illustrations: Laura Montserrat; Photos: Cesar Santificetur).

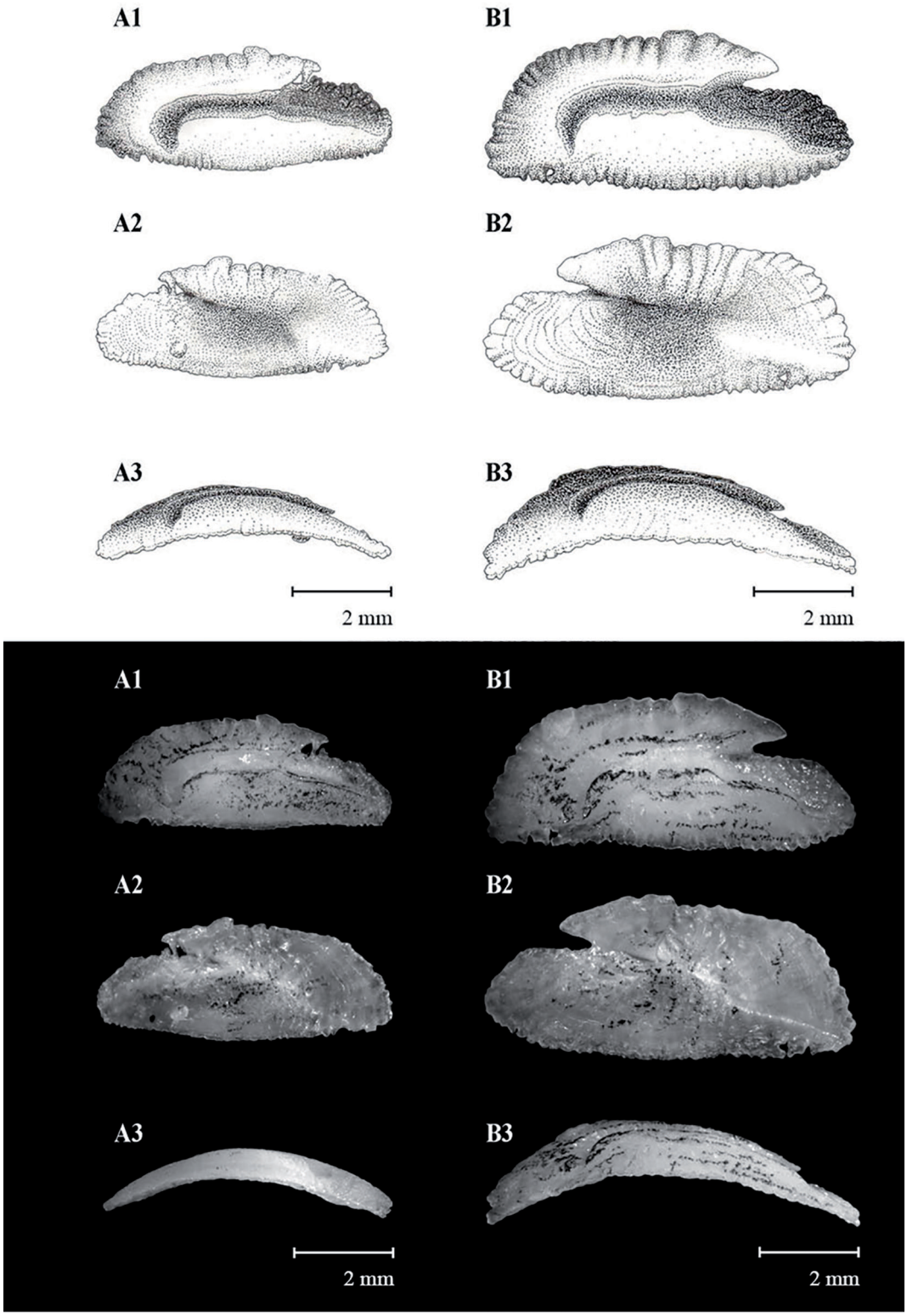

Plate 9. Illustrations (above) and photos (below) of *Kyphosus sectatrix* otoliths from fish with total lengths: A. 280 mm; B. 454 mm. The medial face is shown in A1, B1; the lateral face in A2, B2; and the ventral profile in A3, B3 (Illustrations: Laura Montserrat; Photos: Cesar Santificetur).

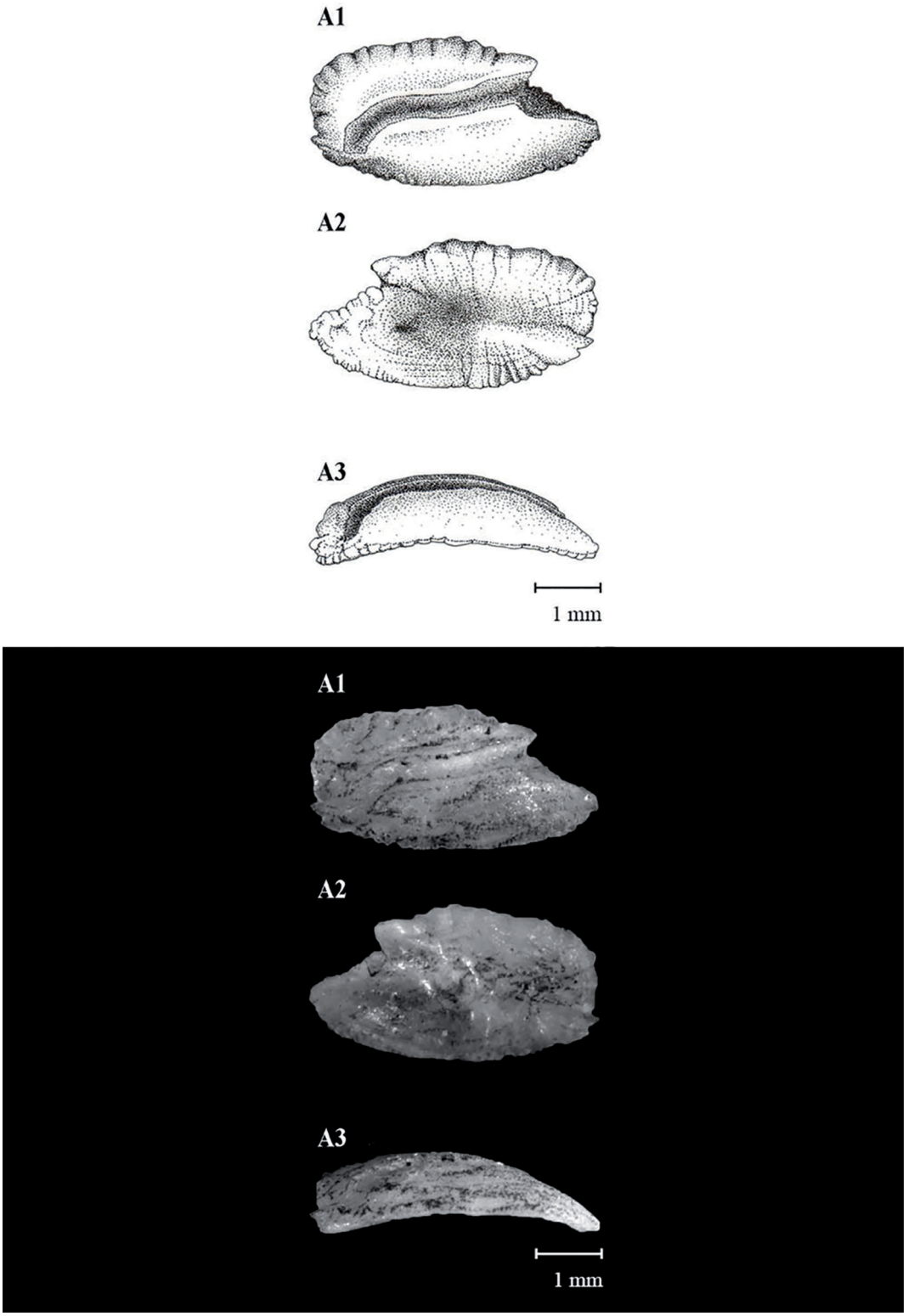

Plate 10. Illustrations (above) and photos (below) of *Chaetodon striatus* otolith from a fish with 149 mm total length. The medial face is shown in A1; the lateral face in A2; and the ventral profile in A3 (Illustrations: Laura Montserrat; Photos: Cesar Santificetur).

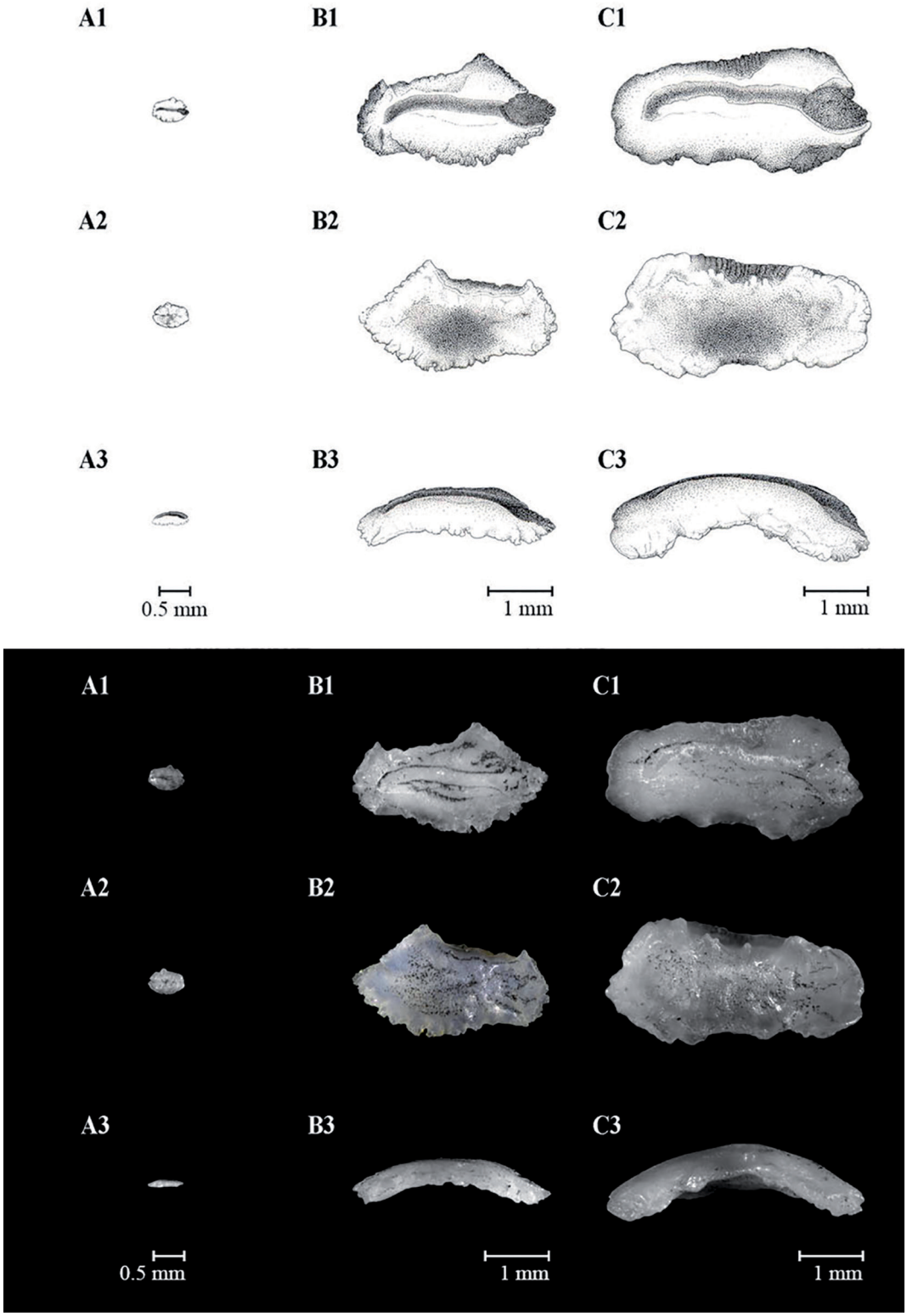

Plate 11. Illustrations (above) and photos (below) of *Mugil curema* otoliths from fish with total lengths: A. 29 mm; B. 259 mm; C. 422 mm. The medial face is shown in A1, B1, C1; the lateral face in A2, B2, C2; and the ventral profile in A3, B3, C3 (Illustrations: Laura Montserrat; Photos: Cesar Santificetur).

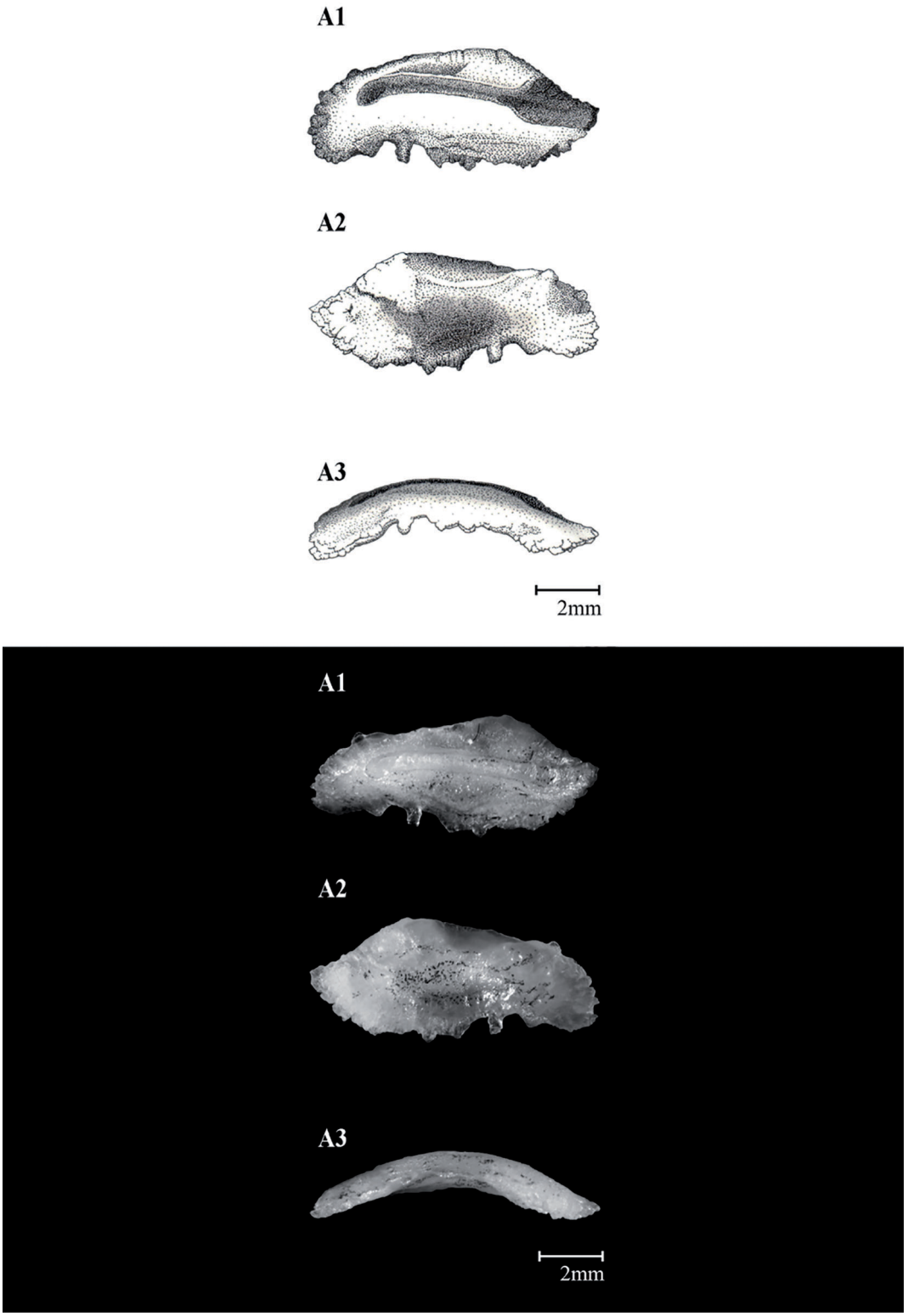

Plate 12. Illustrations (above) and photos (below) of *Mugil liza* otolith from a fish with 373 mm total length. The medial face is shown in A1; the lateral face in A2; and the ventral profile in A3 (Illustrations: Laura Montserrat; Photos: Cesar Santificetur).

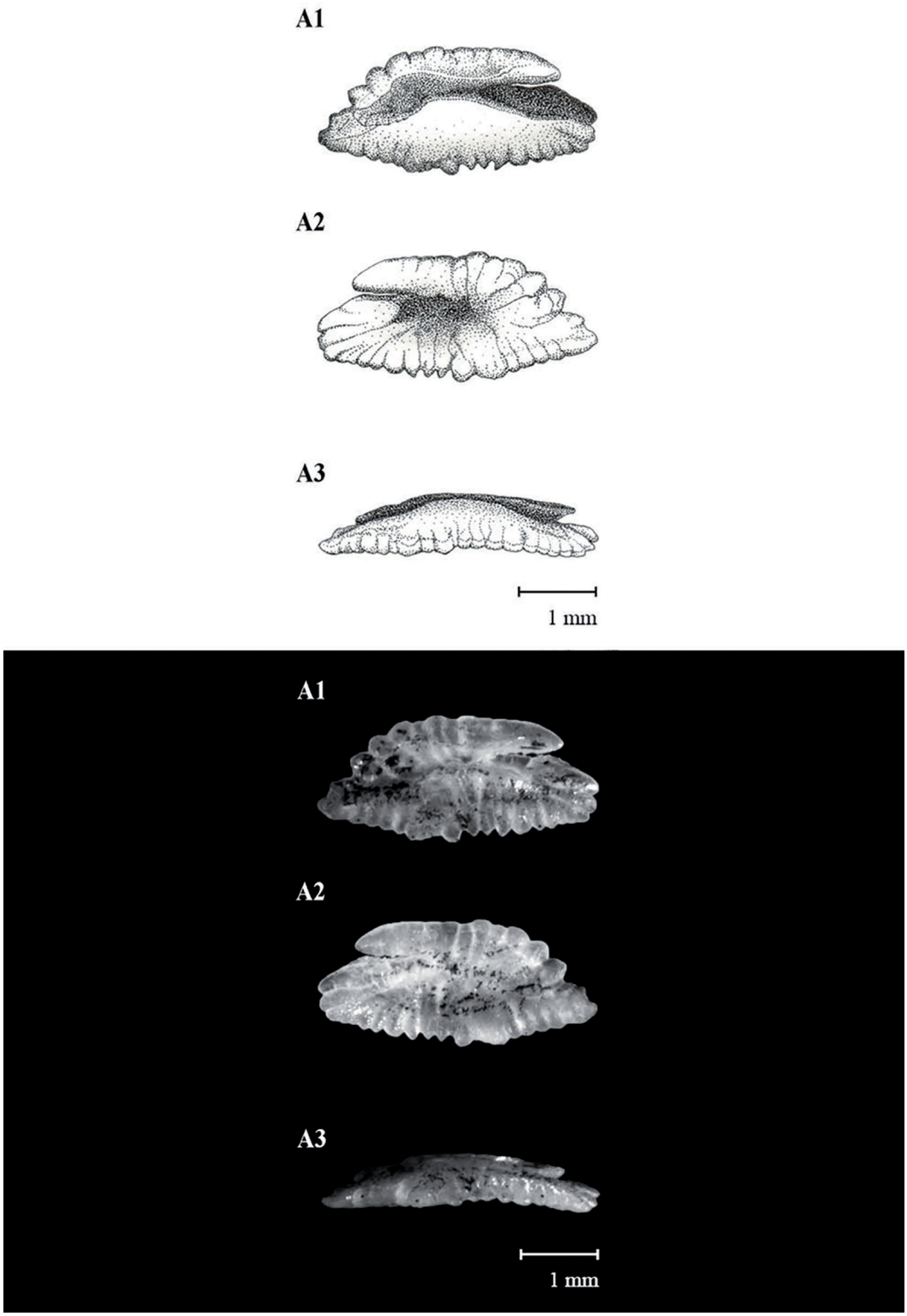

Plate 13. Illustrations (above) and photos (below) of *Nicholsina usta* otolith from a fish with 175 mm total length. The medial face is shown in A1; the lateral face in A2; and the ventral profile in A3 (Illustrations: Laura Montserrat; Photos: Cesar Santificetur).

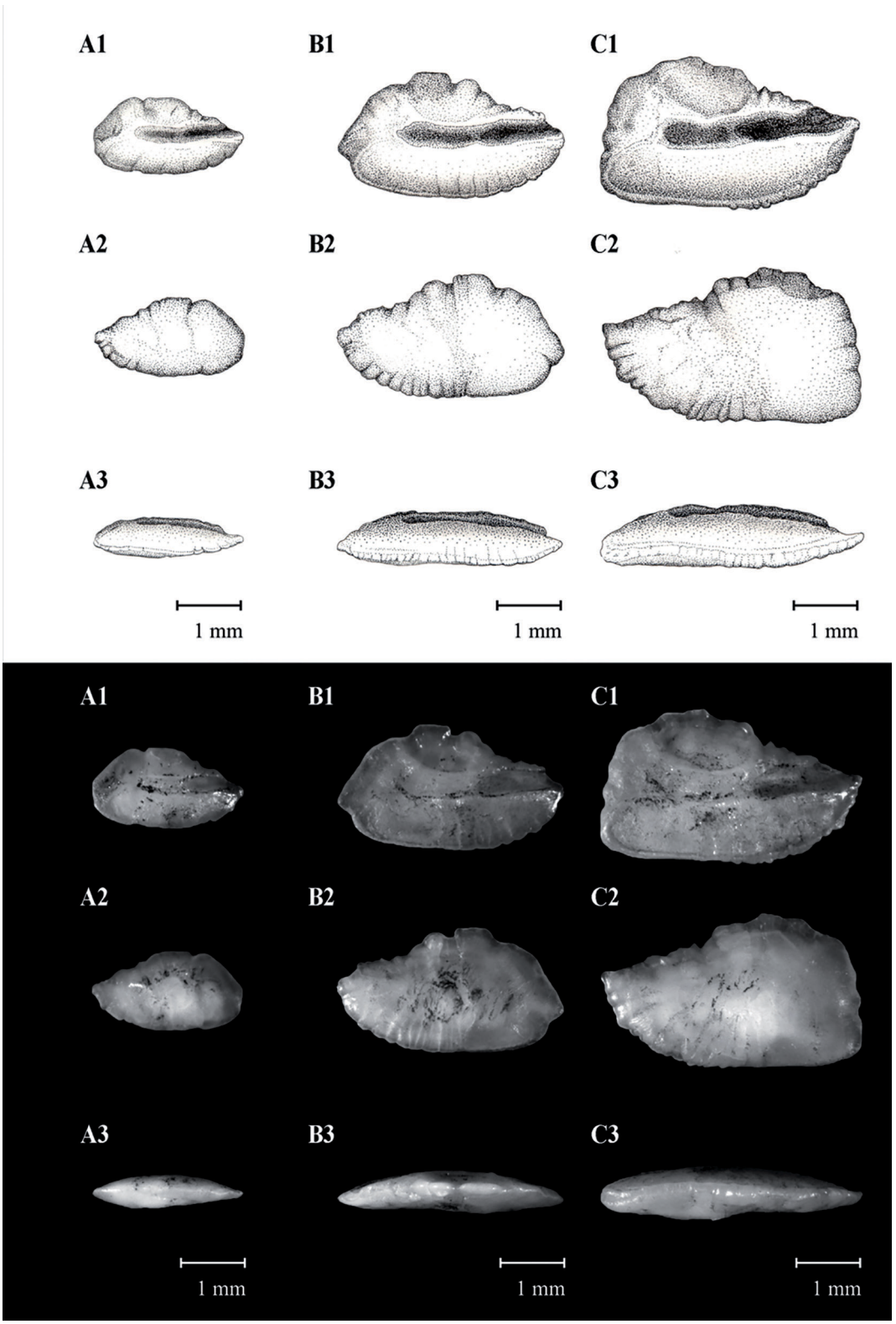

Plate 14. Illustrations (above) and photos (below) of *Bembrops heterurus* otoliths from fish with total lengths: A. 73 mm; B. 134 mm; C. 200 mm. The medial face is shown in A1, B1, C1; the lateral face in A2, B2, C2; and the ventral profile in A3, B3, C3 (Illustrations: Laura Montserrat; Photos: Cesar Santificetur).

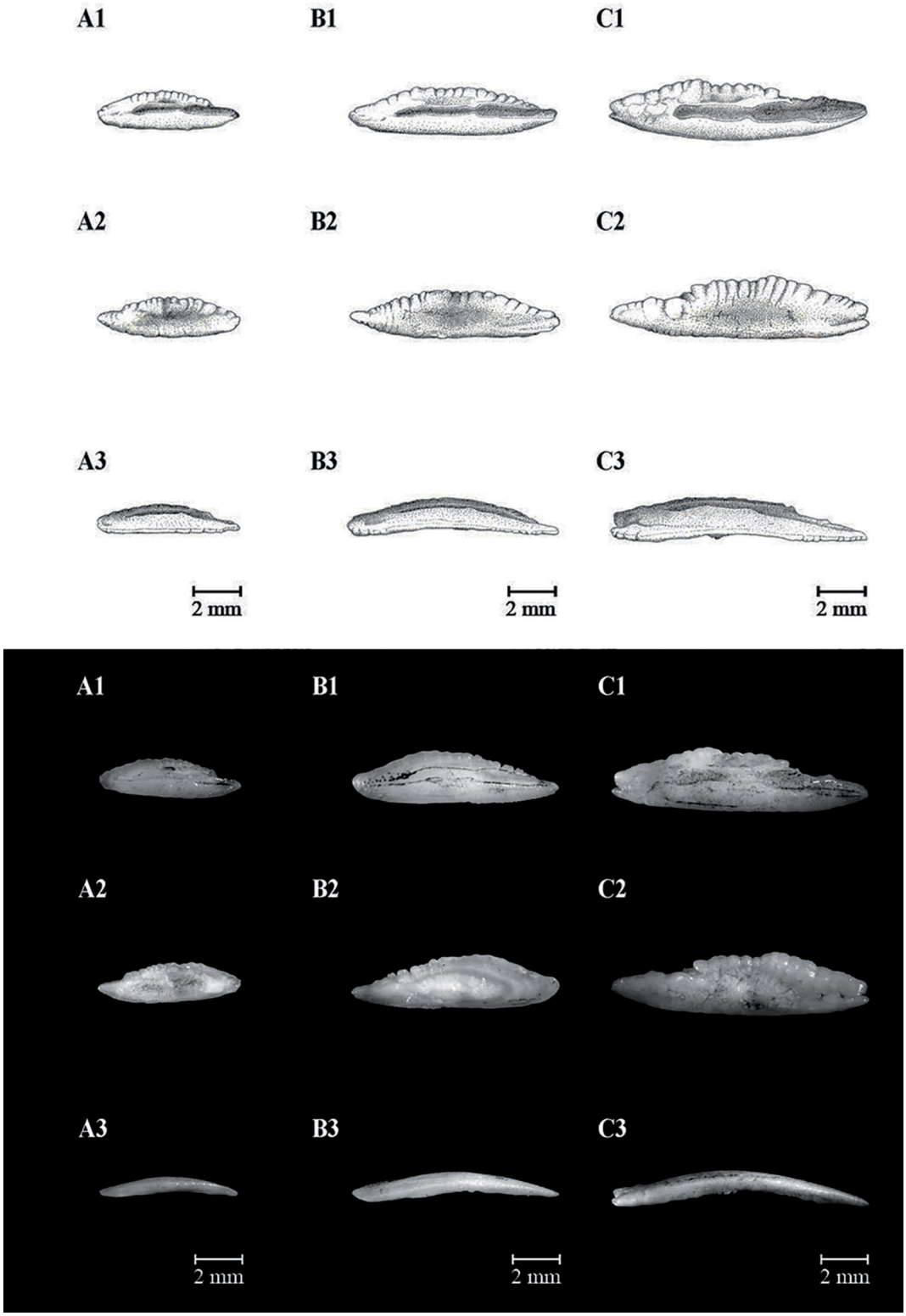

Plate 15. Illustrations (above) and photos (below) of *Percophis brasiliensis* otoliths from fish with total lengths: A. 284 mm; B. 430 mm; C. 590 mm. The medial face is shown in A1, B1, C1; the lateral face in A2, B2, C2; and the ventral profile in A3, B3, C3 (Illustrations: Laura Montserrat; Photos: Cesar Santificetur).

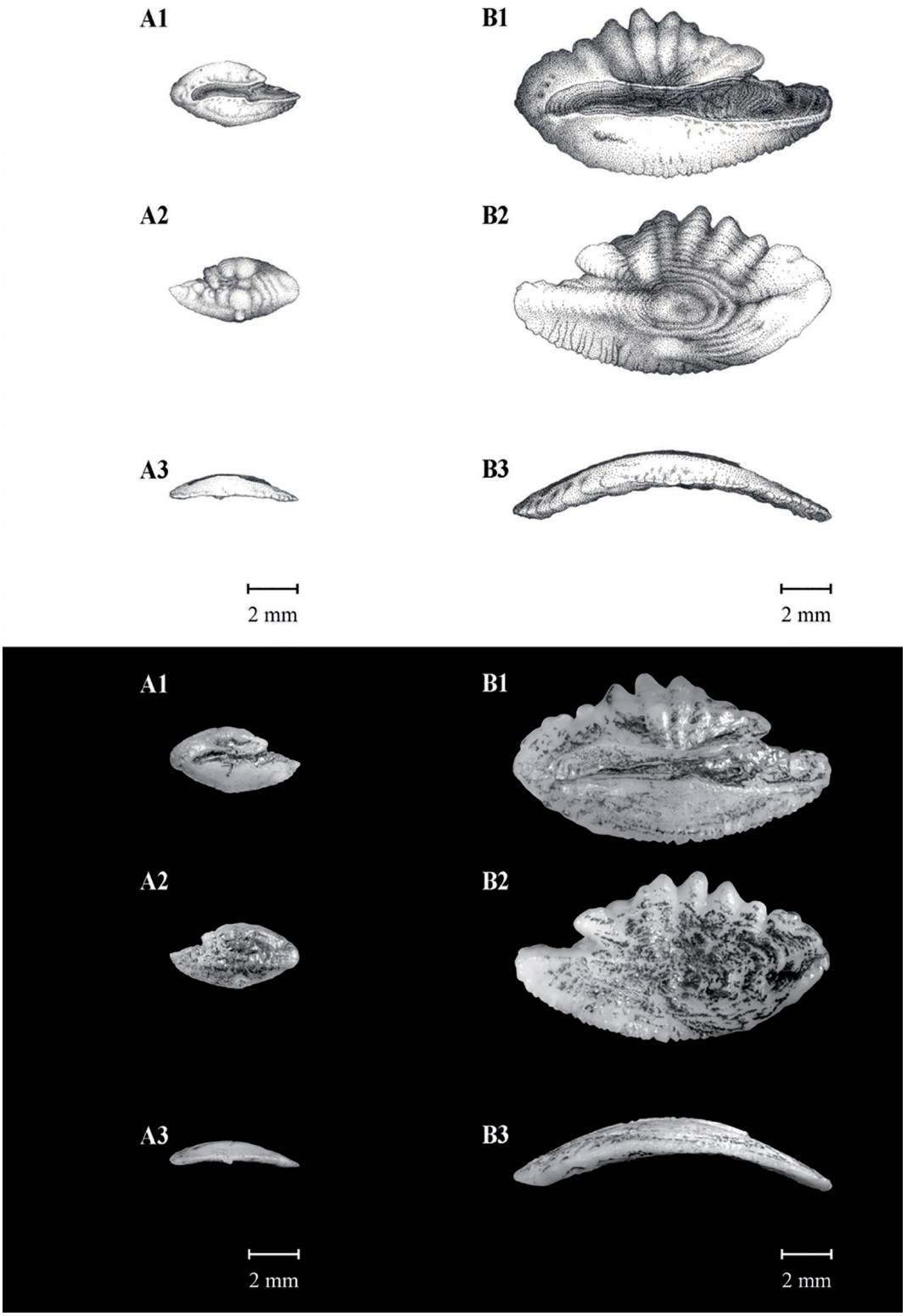

Plate 16. Illustrations (above) and photos (below) of *Pseudopercis numida* otoliths from fish with total lengths: A. 128 mm; B. 467 mm. The medial face is shown in A1, B1; the lateral face in A2, B2; and the ventral profile in A3, B3 (Illustrations and Photos: Alexandre Arackawa).

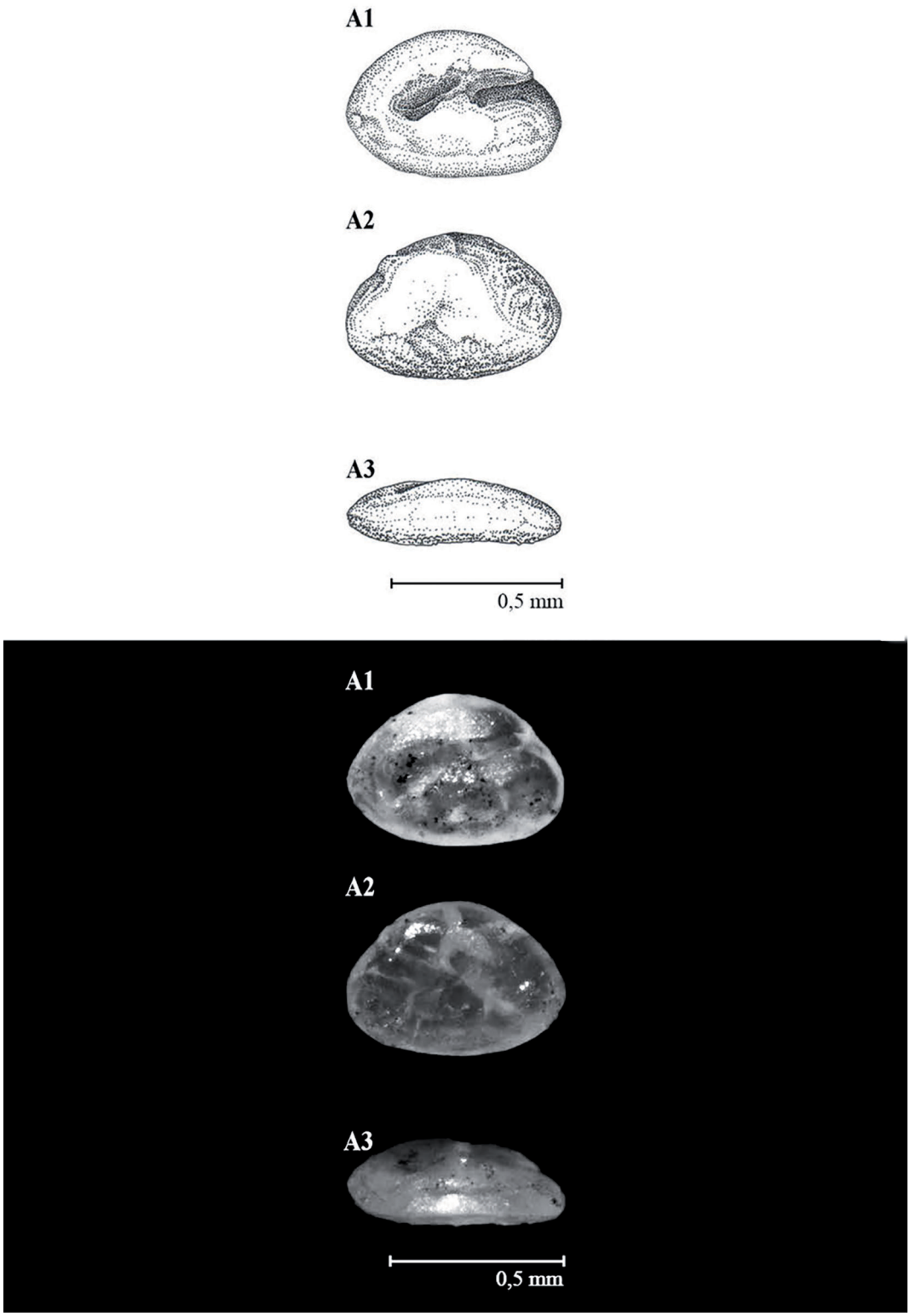

Plate 17. Illustrations (above) and photos (below) of *Scartella cristata* otolith from a fish with 22 mm total length. The medial face is shown in A1; the lateral face in A2; and the ventral profile in A3 (Illustrations: Silvia de Almeida Gonsales; Photos: Cesar Santificetur).

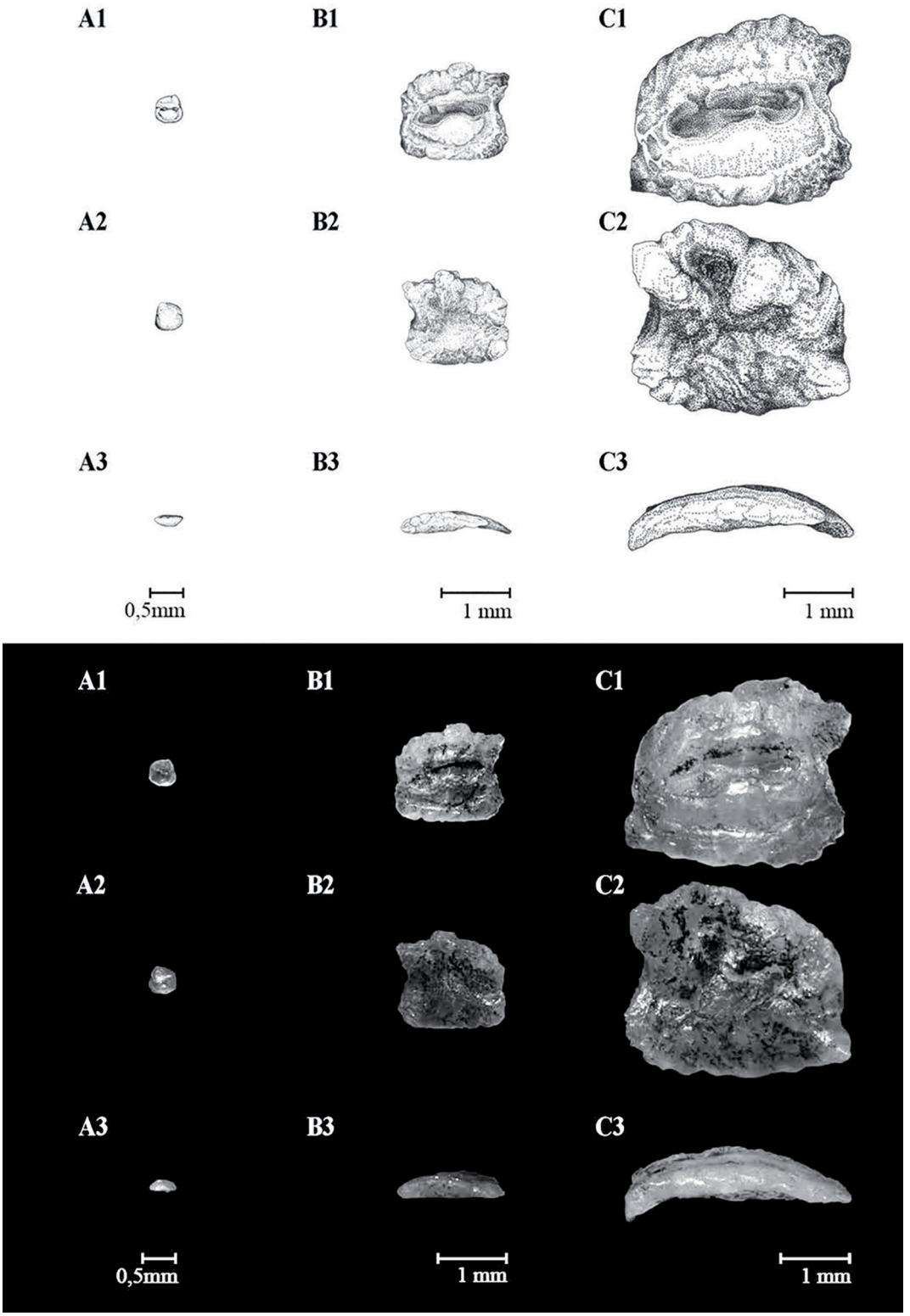

Plate 18. Illustrations (above) and photos (below) of *Bathygobius soporator* otoliths from fish with total lengths: A. 13 mm; B. 75 mm; C. 131 mm. The medial face is shown in A1, B1, C1; the lateral face in A2, B2, C2; and the ventral profile in A3, B3, C3 (Illustrations: Silvia de Almeida Gonsales; Photos: Cesar Santificetur).

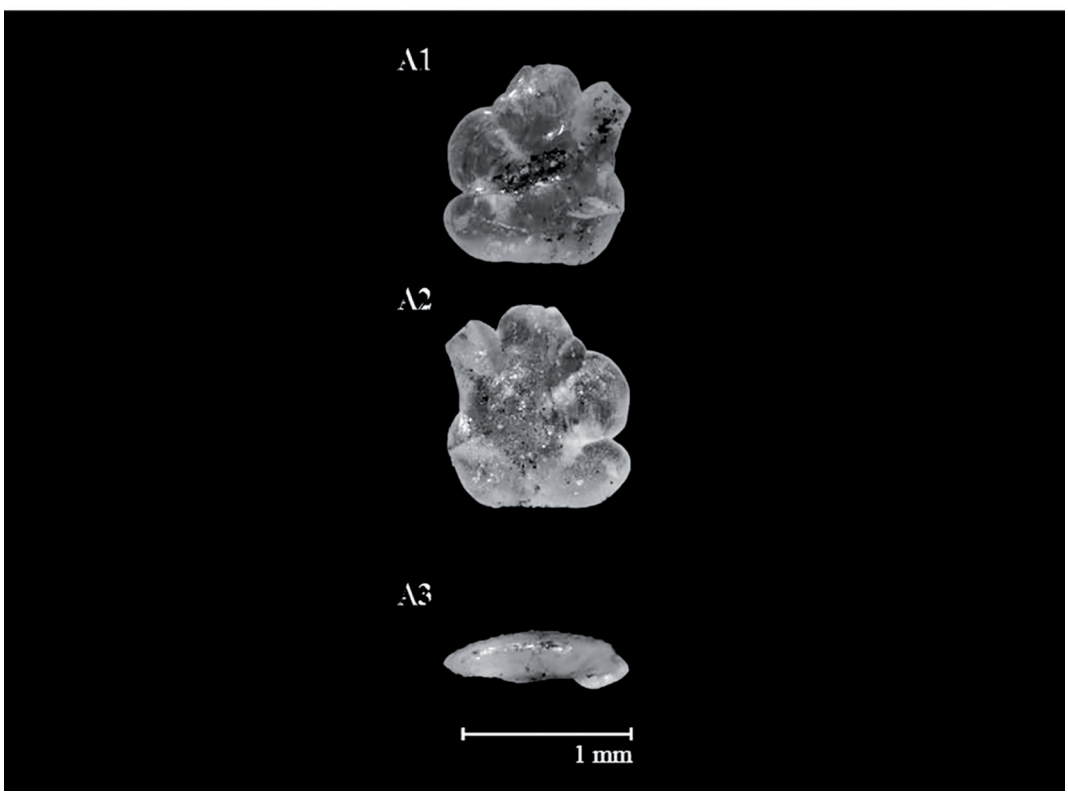

Plate 19. Illustrations (above) and photos (below) of *Ctenogobius smaragdus* otolith from a fish with 45 mm total length. The medial face is shown in A1; the lateral face in A2; and the ventral profile in A3 (Illustrations: Silvia de Almeida Gonsales; Photos: Cesar Santificetur).

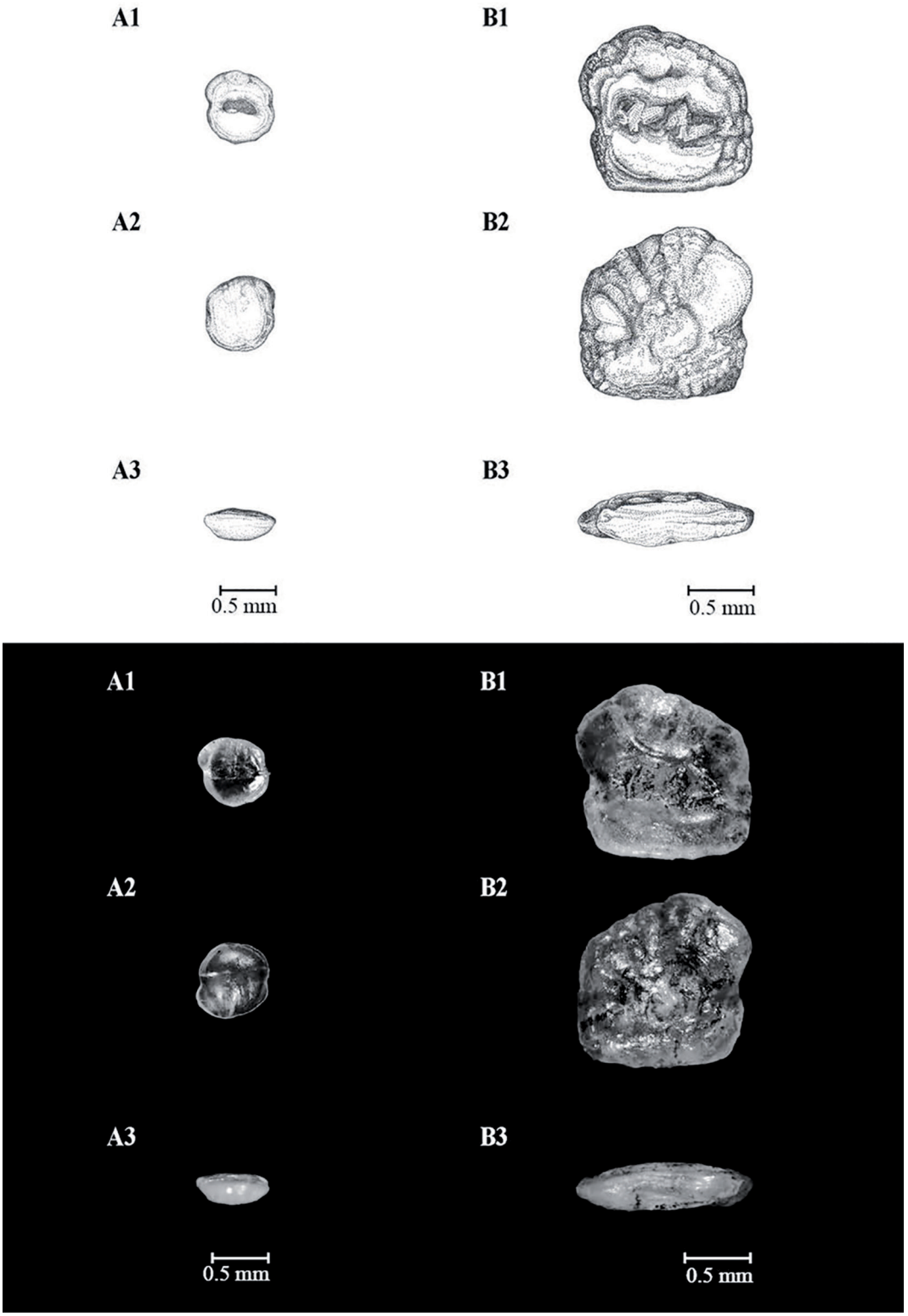

Plate 20. Illustrations (above) and photos (below) of *Ctenogobius boleosoma* otoliths from fish with total lengths: A. 17 mm; B. 55 mm. The medial face is shown in A1, B1; the lateral face in A2, B2; and the ventral profile in A3, B3 (Illustrations: Silvia de Almeida Gonsales; Photos: Cesar Santificetur).

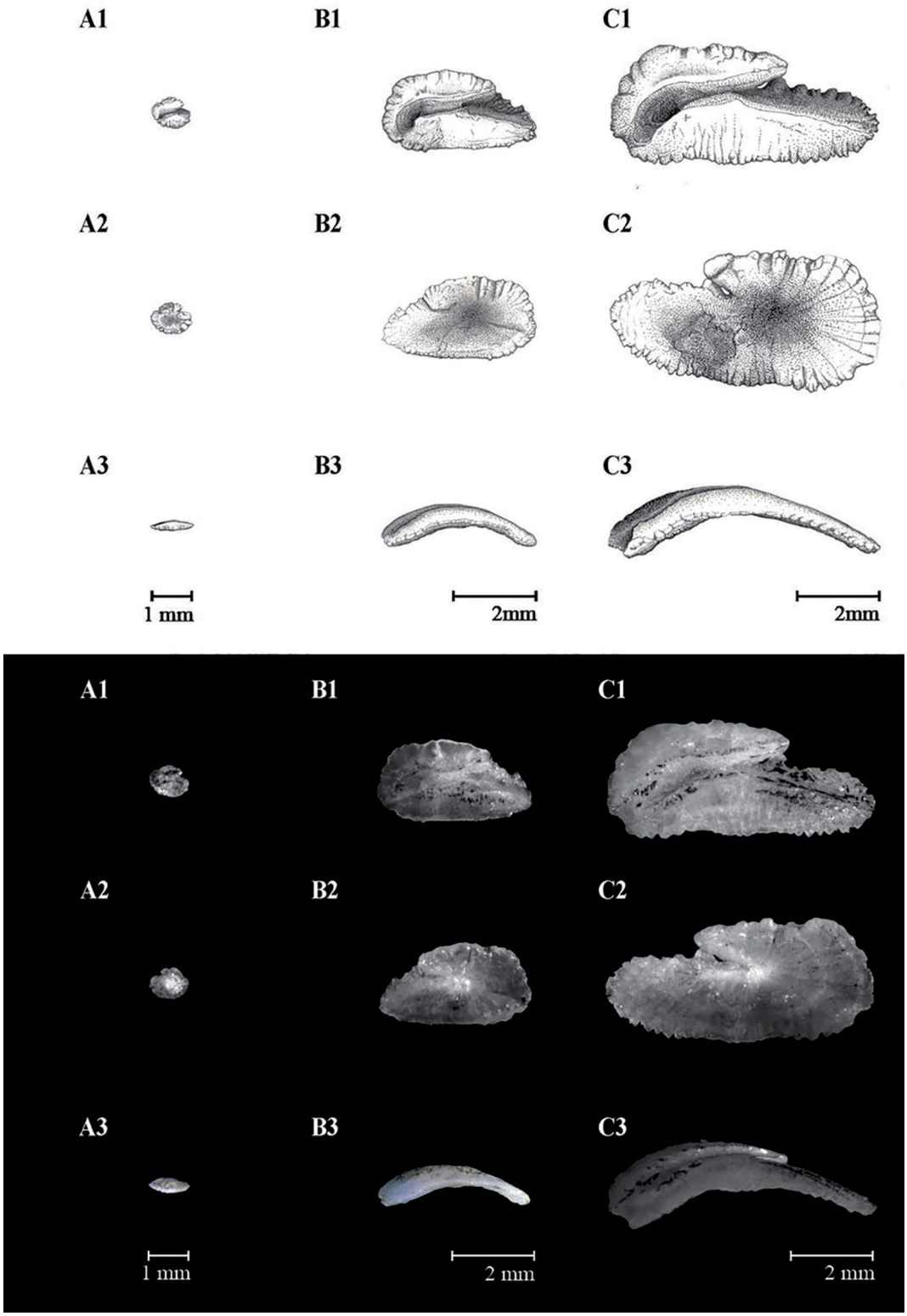

Plate 21. Illustrations (above) and photos (below) of *Chaetodipterus faber* otoliths from fish with total lengths: A. 20 mm; B. 114 mm; C. 283 mm. The medial face is shown in A1, B1, C1; the lateral face in A2, B2, C2; and the ventral profile in A3, B3, C3 (Illustrations: Laura Montserrat; Photos: Cesar Santificetur).

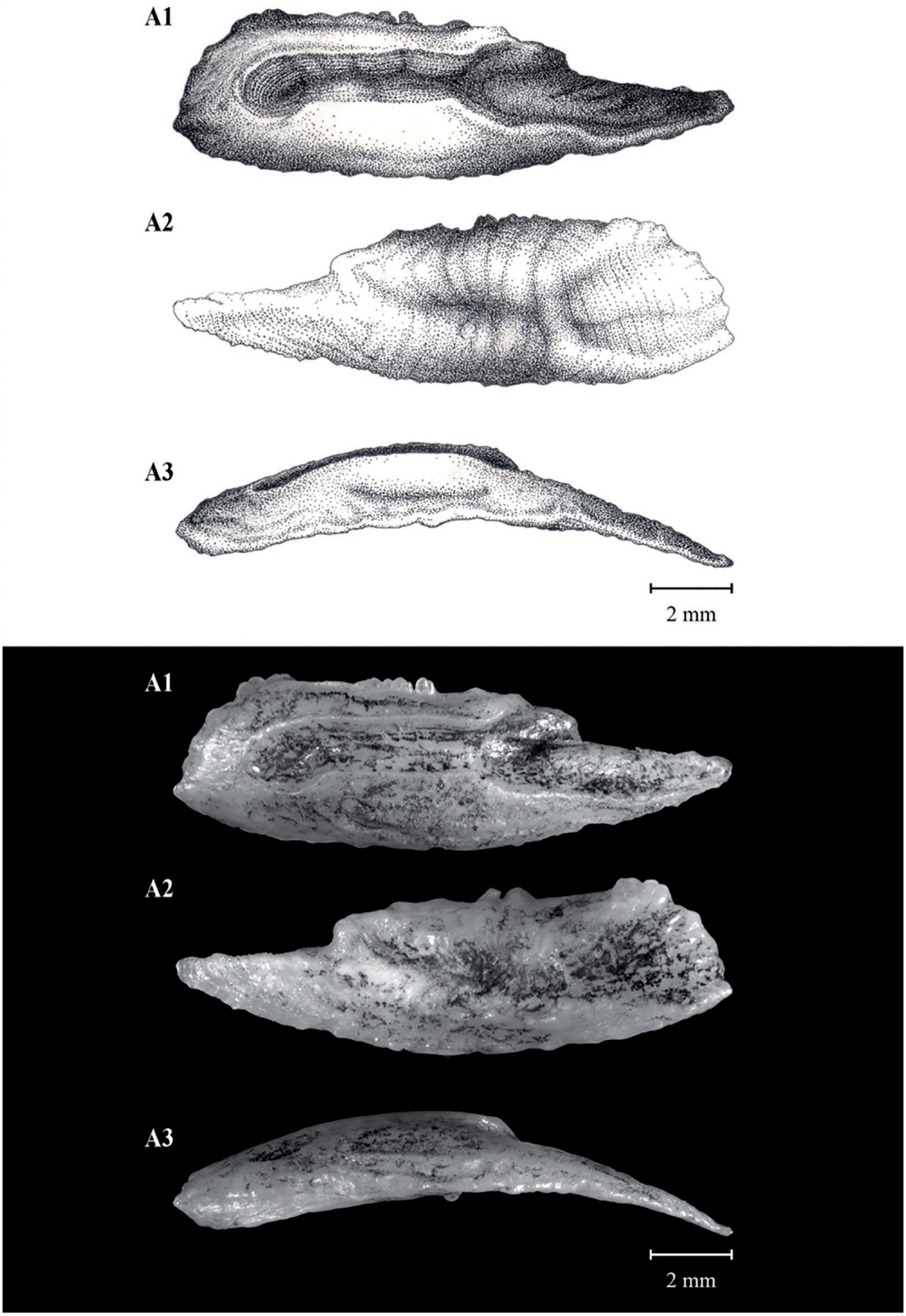

Plate 22. Illustrations (above) and photos (below) of *Sphyraena barracuda* otoliths from a fish with 563 mm total lengths. The medial face is shown in A1; the lateral face in A2; and the ventral profile in A3 (Illustrations and Photos: Alexandre Arackawa).

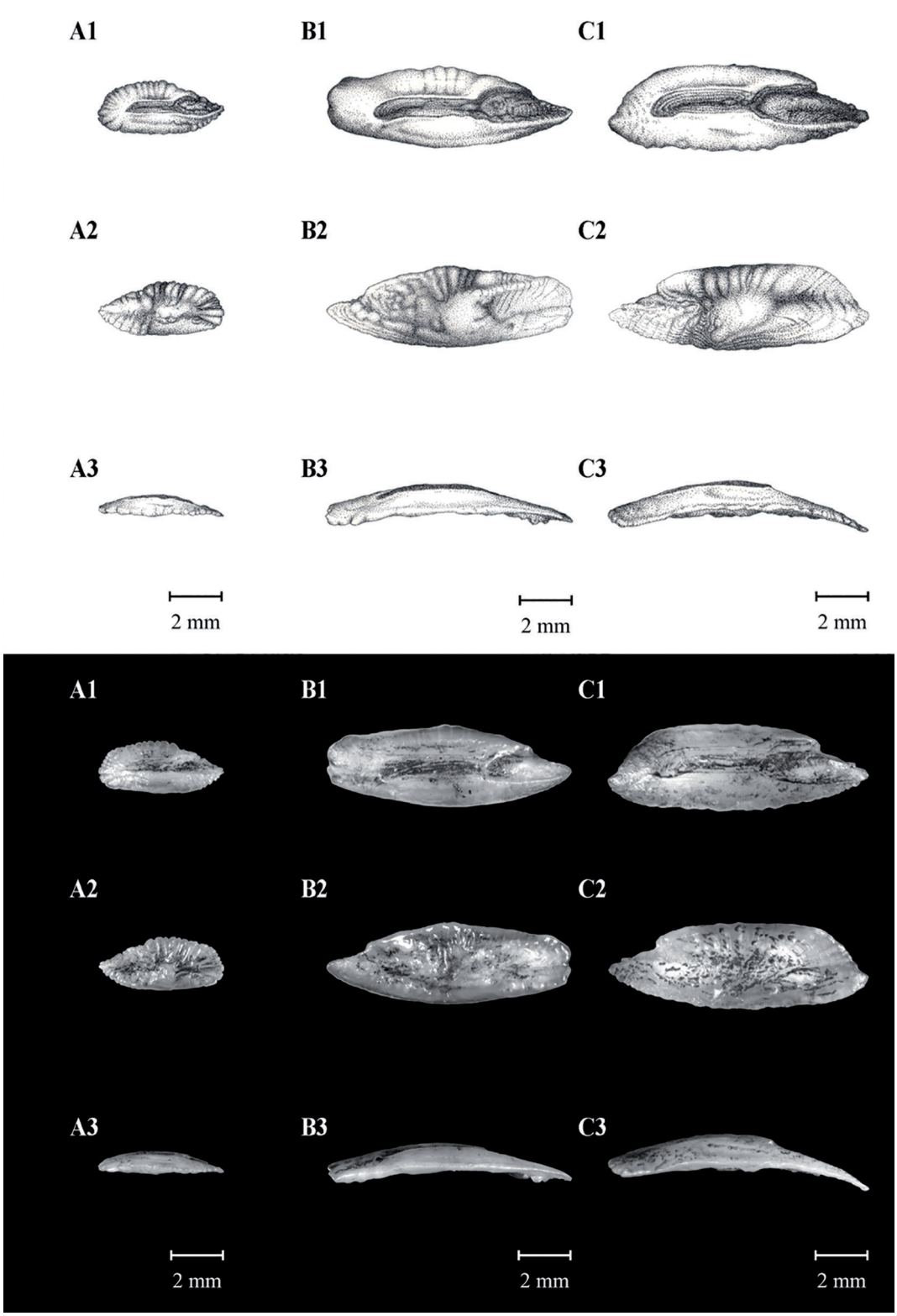

Plate 23. Illustrations (above) and photos (below) of *Sphyraena guachancho* otoliths from fish with total lengths: A. 140 mm; B. 309 mm; C. 455 mm. The medial face is shown in A1, B1, C1; the lateral face in A2, B2, C2; and the ventral profile in A3, B3, C3 (Illustrations and Photos: Alexandre Arackawa).

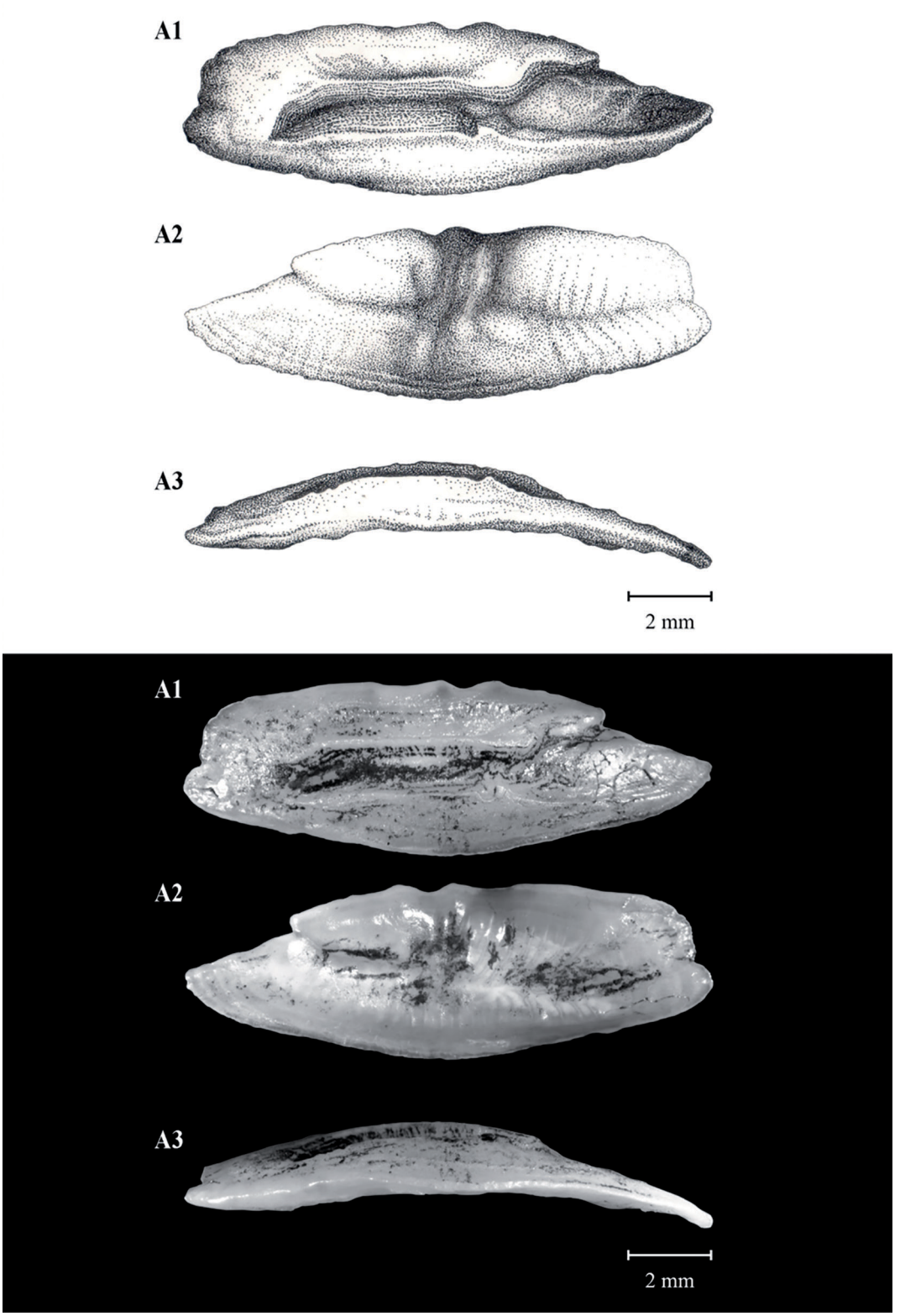

Plate 24. Illustrations (above) and photos (below) of *Sphyraena tome* otolith from a fish with 412 mm total length. The medial face is shown in A1; the lateral face in A2; and the ventral profile in A3 (Illustrations and Photos: Alexandre Arackawa).

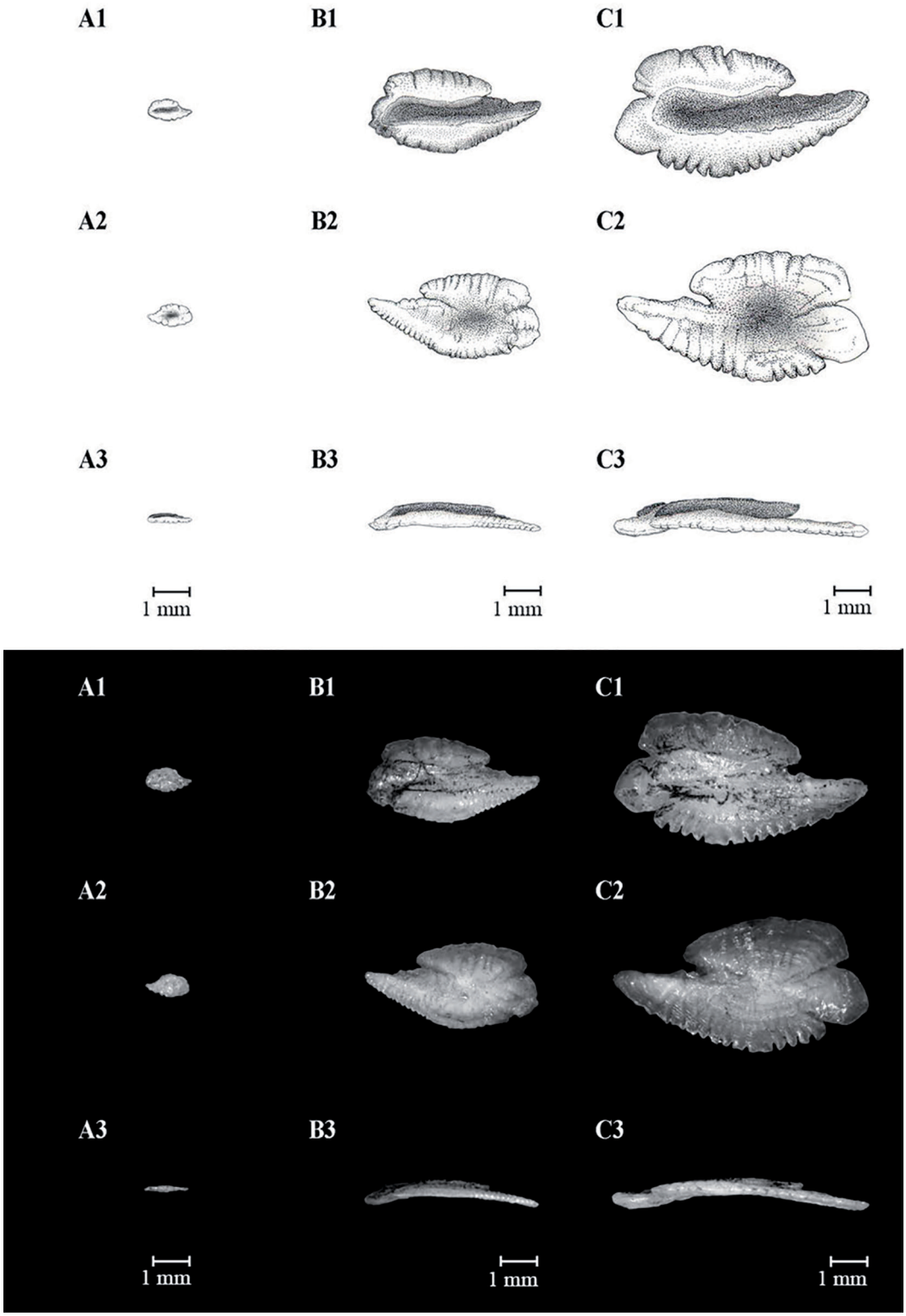

Plate 25. Illustrations (above) and photos (below) of *Thyrsitops lepidopoides* otoliths from fish with total length: A. 29 mm; B. 197 mm; C. 308 mm. The medial face is shown in A1, B1, C1; the lateral face in A2, B2, C2; and the ventral profile in A3, B3, C3 (Illustrations: Laura Montserrat; Photos: Cesar Santificetur).

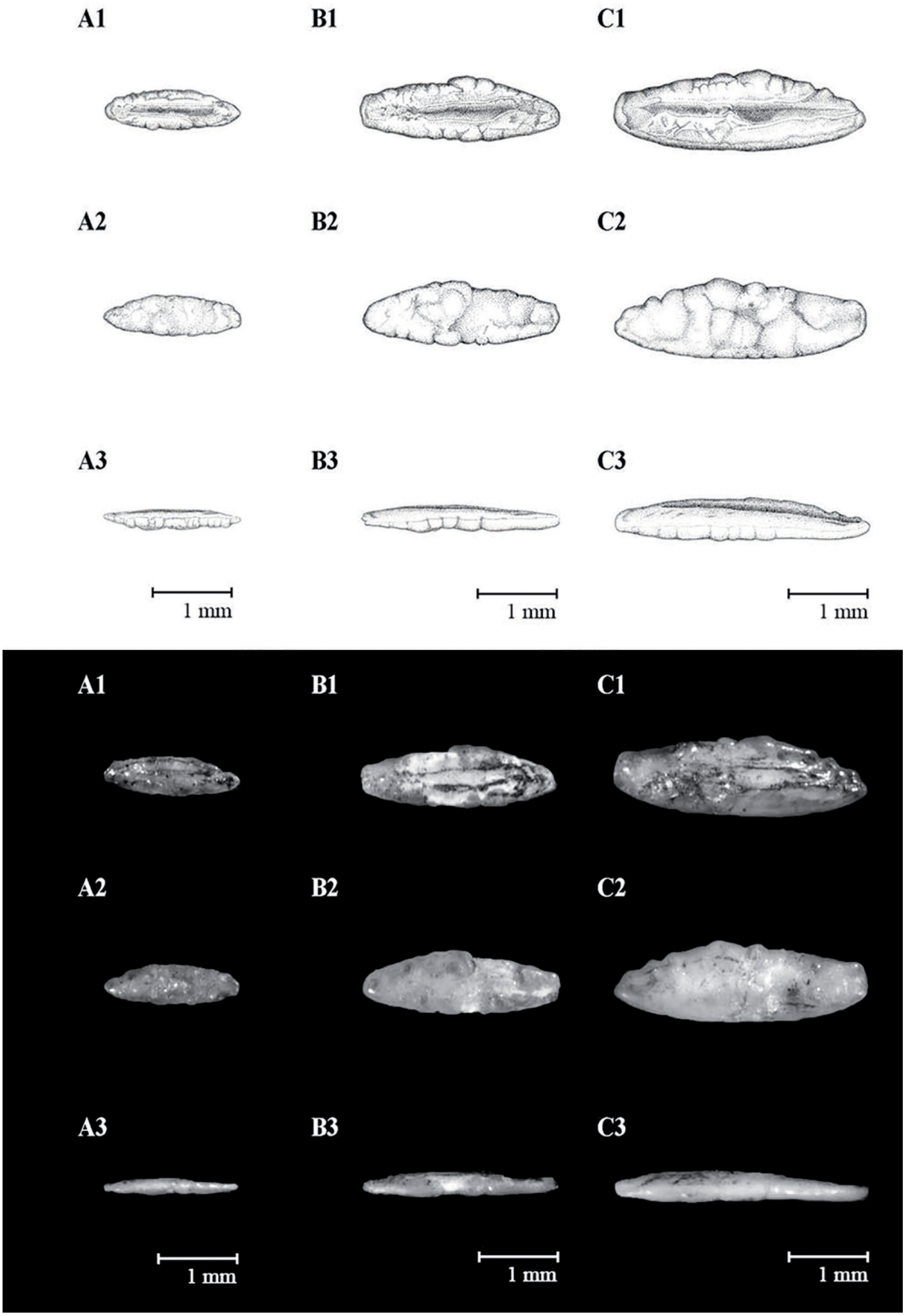

Plate 26. Illustrations (above) and photos (below) of *Benthodesmus elongates* otoliths from fish with total lengths: A. 259 mm; B. 370 mm; C. 494 mm. The medial face is shown in A1, B1, C1; the lateral face in A2, B2, C2; and the ventral profile in A3, B3, C3 (Illustrations: Laura Montserrat; Photos: Cesar Santificetur).

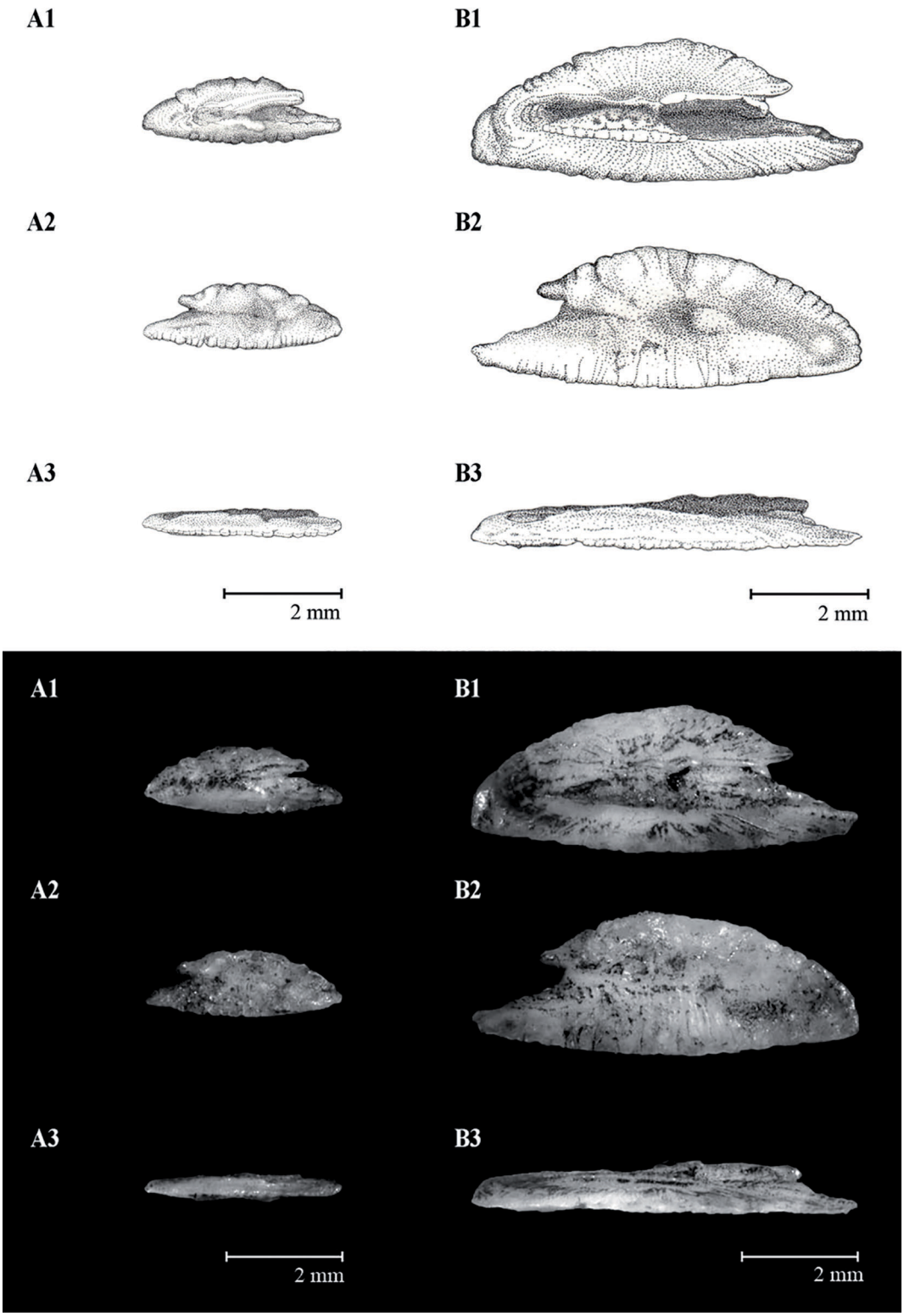

Plate 27. Illustrations (above) and photos (below) of *Evoxymetopon taeniatus* otoliths from fish with total lengths: A. 512 mm; B. 1640 mm. The medial face is shown in A1, B1; the lateral face in A2, B2; and the ventral profile in A3, B3 (Illustrations: Laura Montserrat; Photos: Cesar Santificetur).

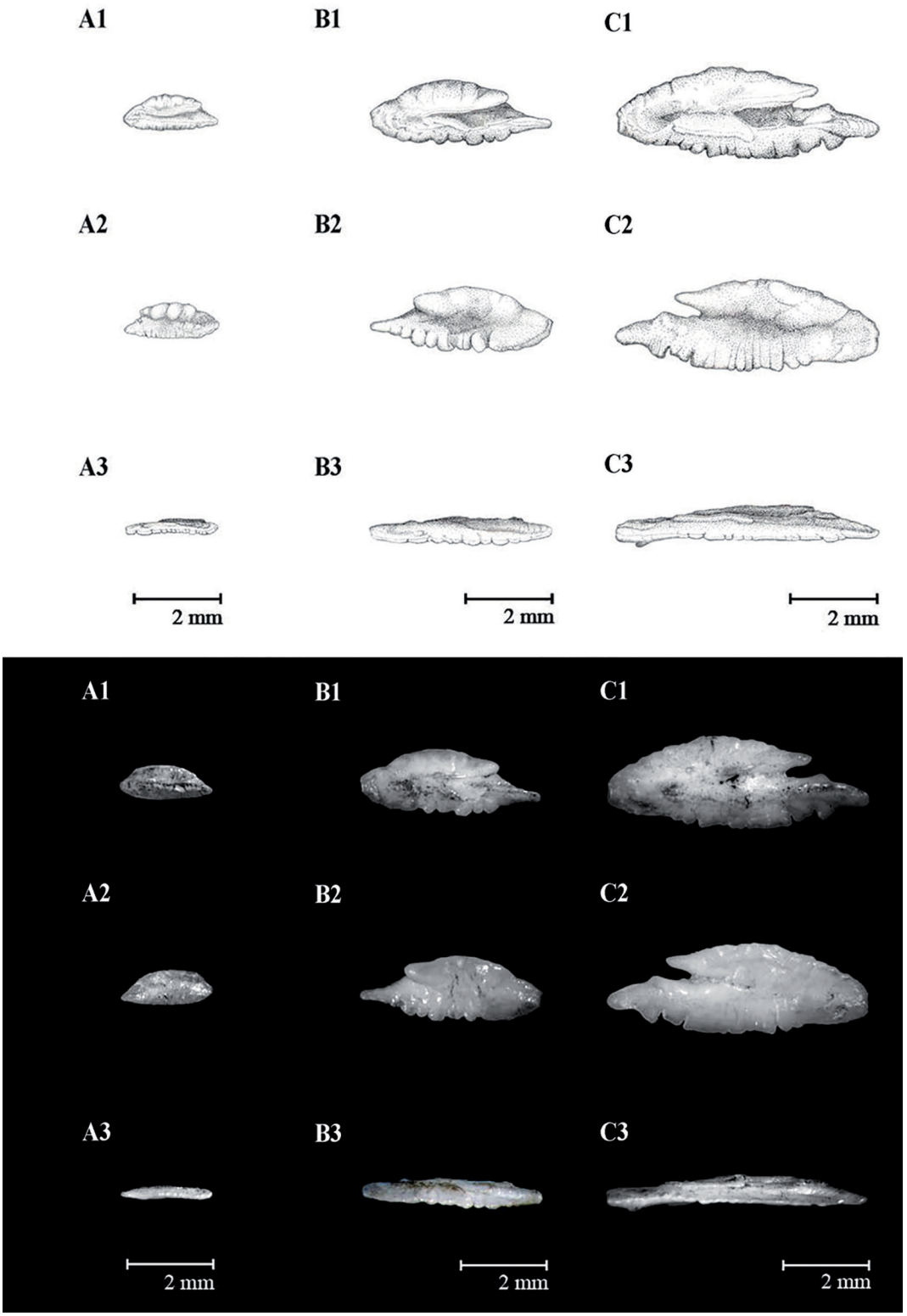

Plate 28. Illustrations (above) and photos (below) of *Lepidopus altifrons* otoliths from fish with total length: A. 256 mm; B. 530 mm; C. 795 mm. The medial face is shown in A1, B1, C1; the lateral face in A2, B2, C2; and the ventral profile in A3, B3, C3 (Illustrations: Laura Montserrat; Photos: Cesar Santificetur).

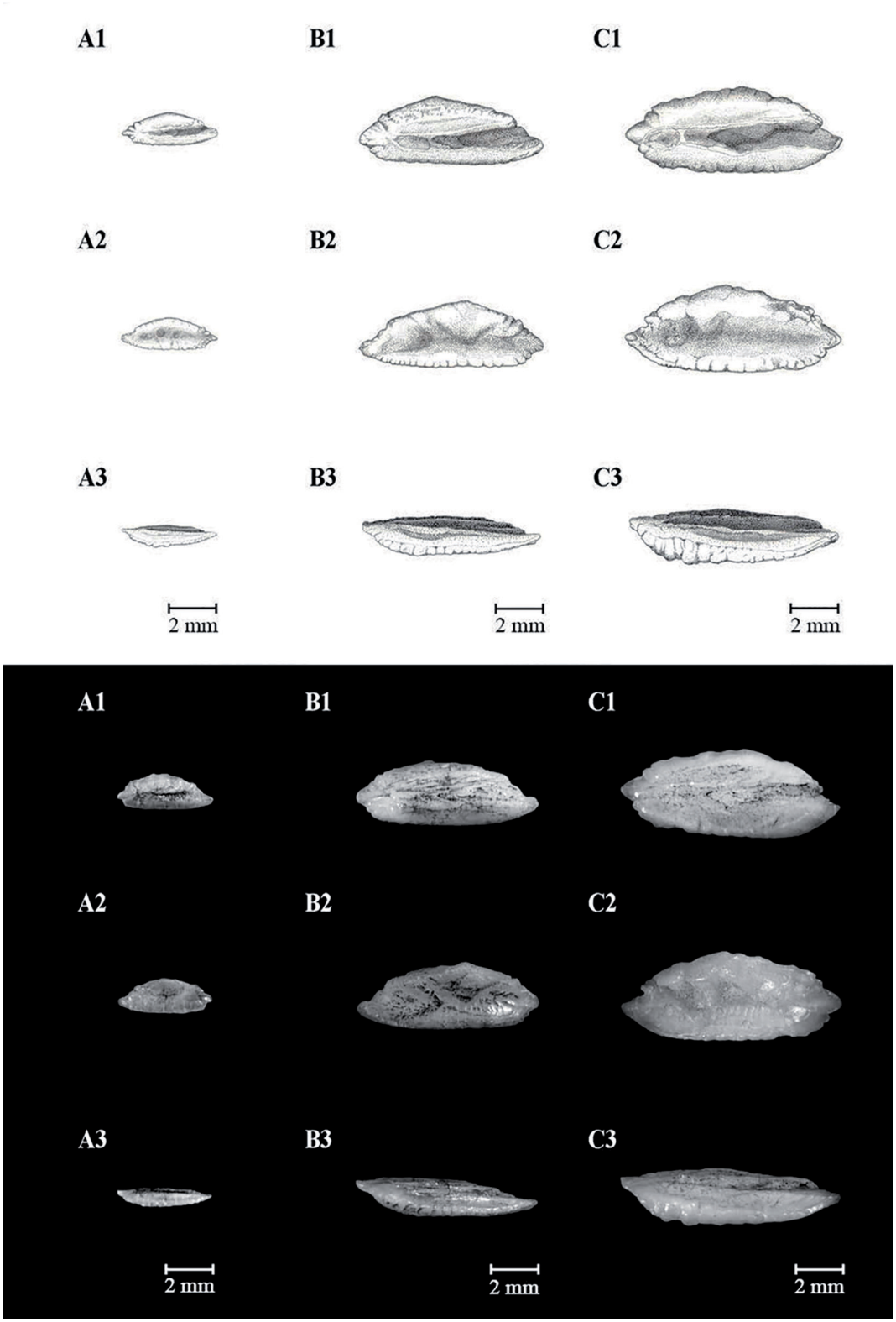

Plate 29. Illustrations (above) and photos (below) of *Trichiurus lepturus* otoliths from fish with total lengths: A. 745 mm; B. 903 mm; C. 1825 mm. The medial face is shown in A1, B1, C1; the lateral face in A2, B2, C2; and the ventral profile in A3, B3, C3 (Illustrations: Laura Montserrat; Photos: Cesar Santificetur).

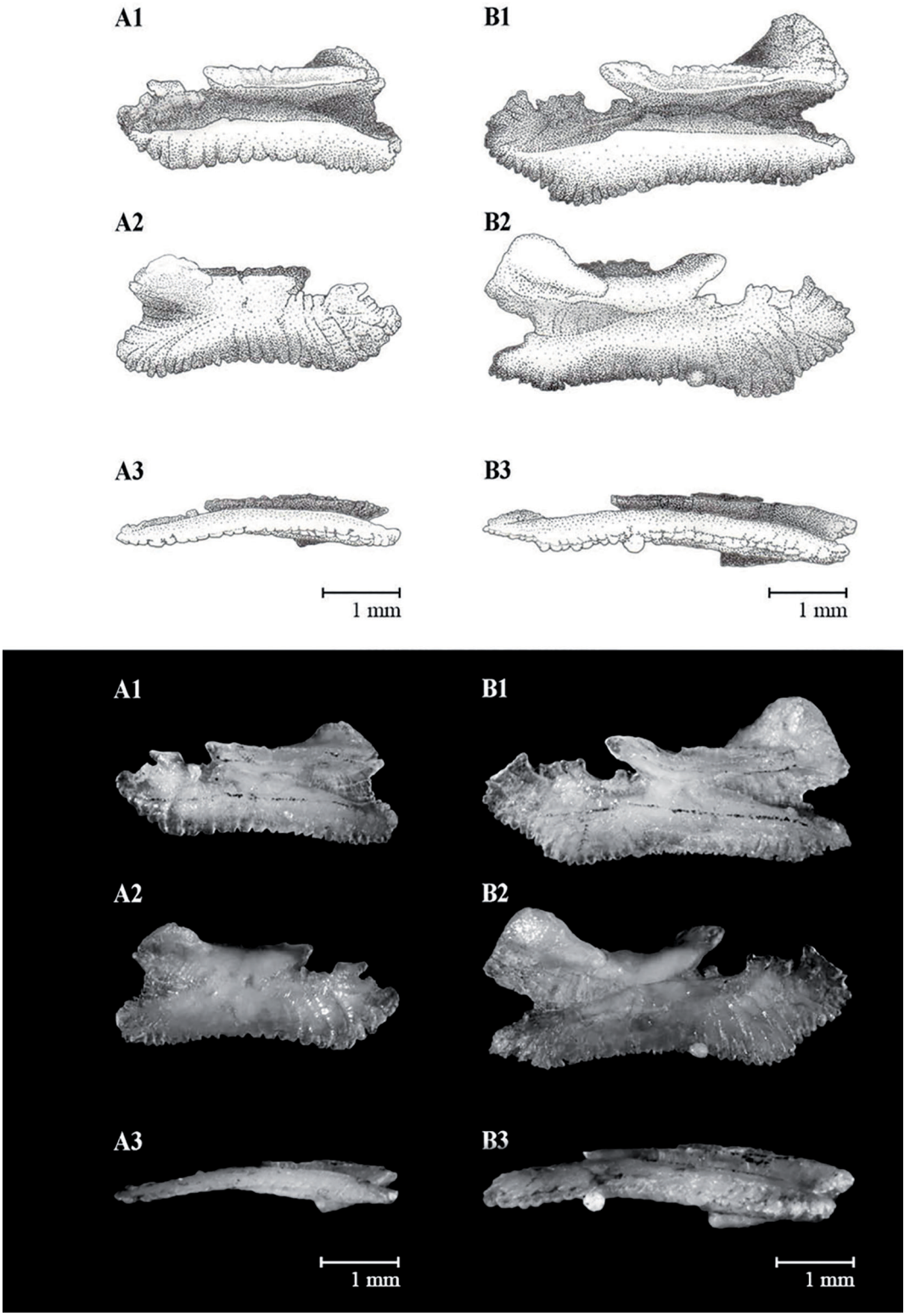

Plate 30. Illustrations (above) and photos (below) of *Katsuwonus pelamis* otoliths from fish with total lengths: A. 375 mm; B. 473 mm. The medial face is shown in A1, B1; the lateral face in A2, B2; and the ventral profile in A3, B3 (Illustrations: Laura Montserrat; Photos: Cesar Santificetur).

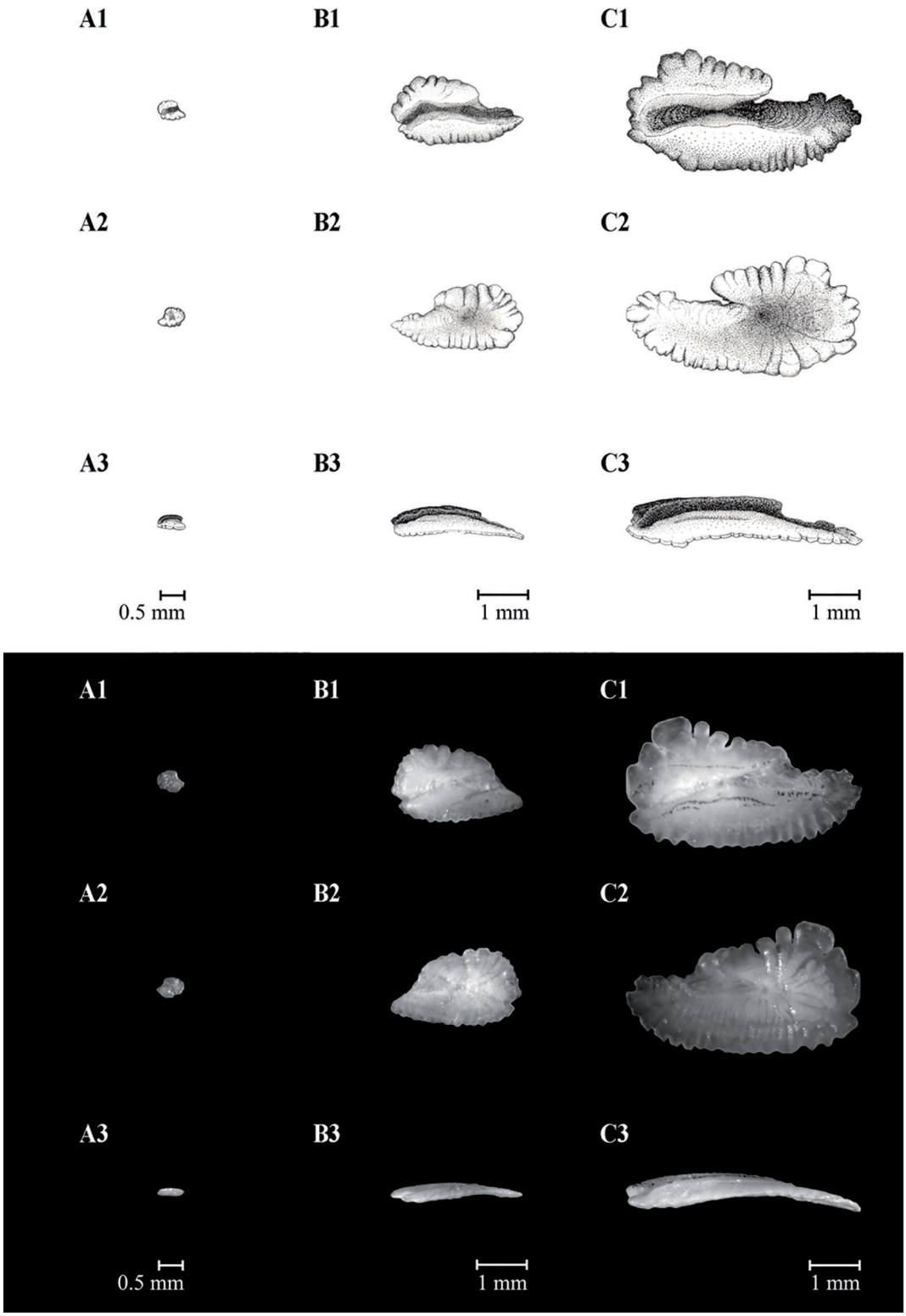

Plate 31. Illustrations (above) and photos (below) of *Ariomma bondi* otoliths from fish with total lengths: A. 17 mm; B. 103 mm; C. 191 mm. The medial face is shown in A1, B1, C1; the lateral face in A2, B2, C2; and the ventral profile in A3, B3, C3 (Illustrations: Laura Montserrat; Photos: Cesar Santificetur).

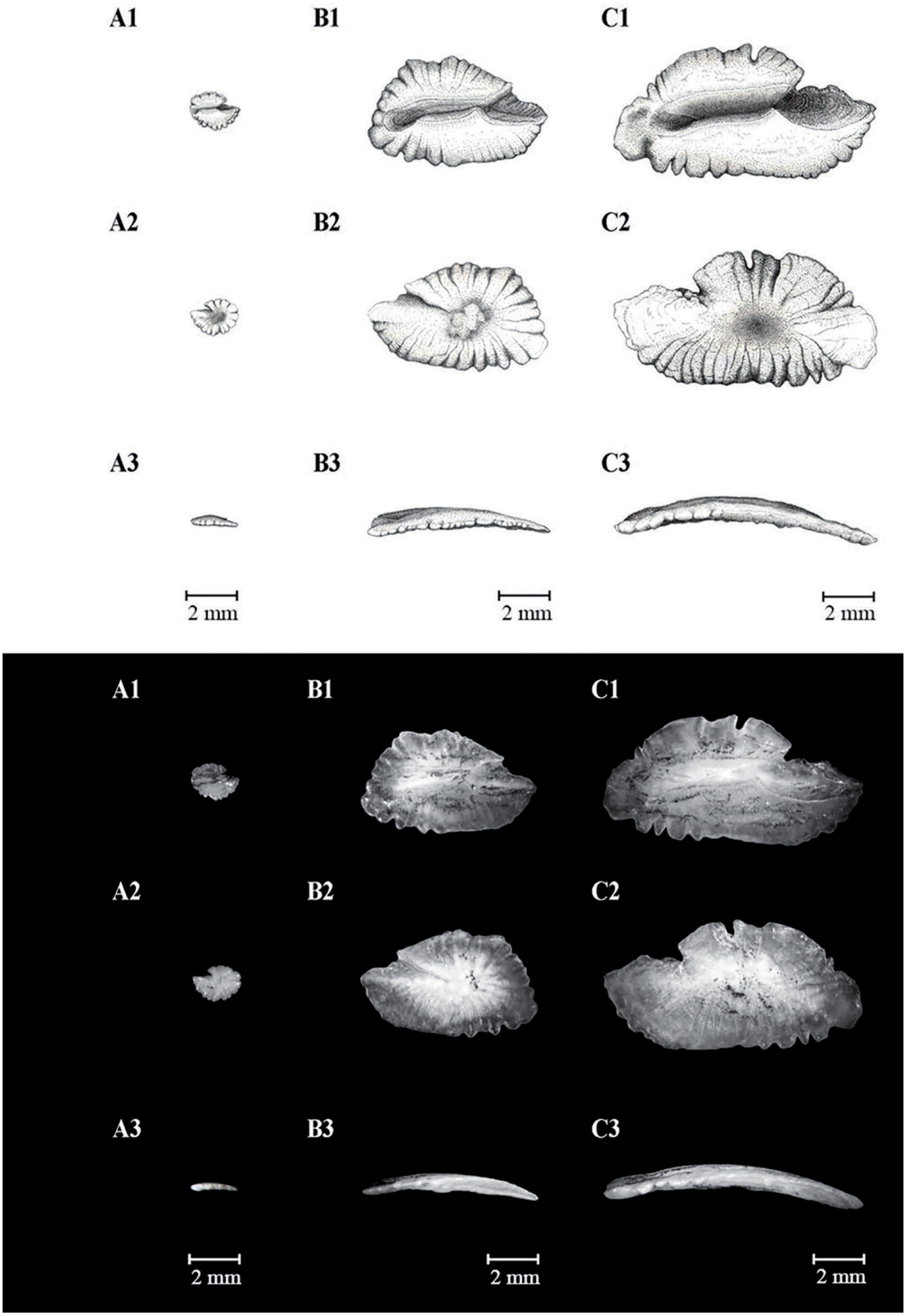

Plate 32. Illustrations (above) and photos (below) of *Peprilus paru* otoliths from fish with total lengths: A. 37 mm; B. 168 mm; C. 301 mm. The medial face is shown in A1, B1, C1; the lateral face in A2, B2, C2; and the ventral profile in A3, B3, C3 (Illustrations: Laura Montserrat; Photos: Cesar Santificetur).

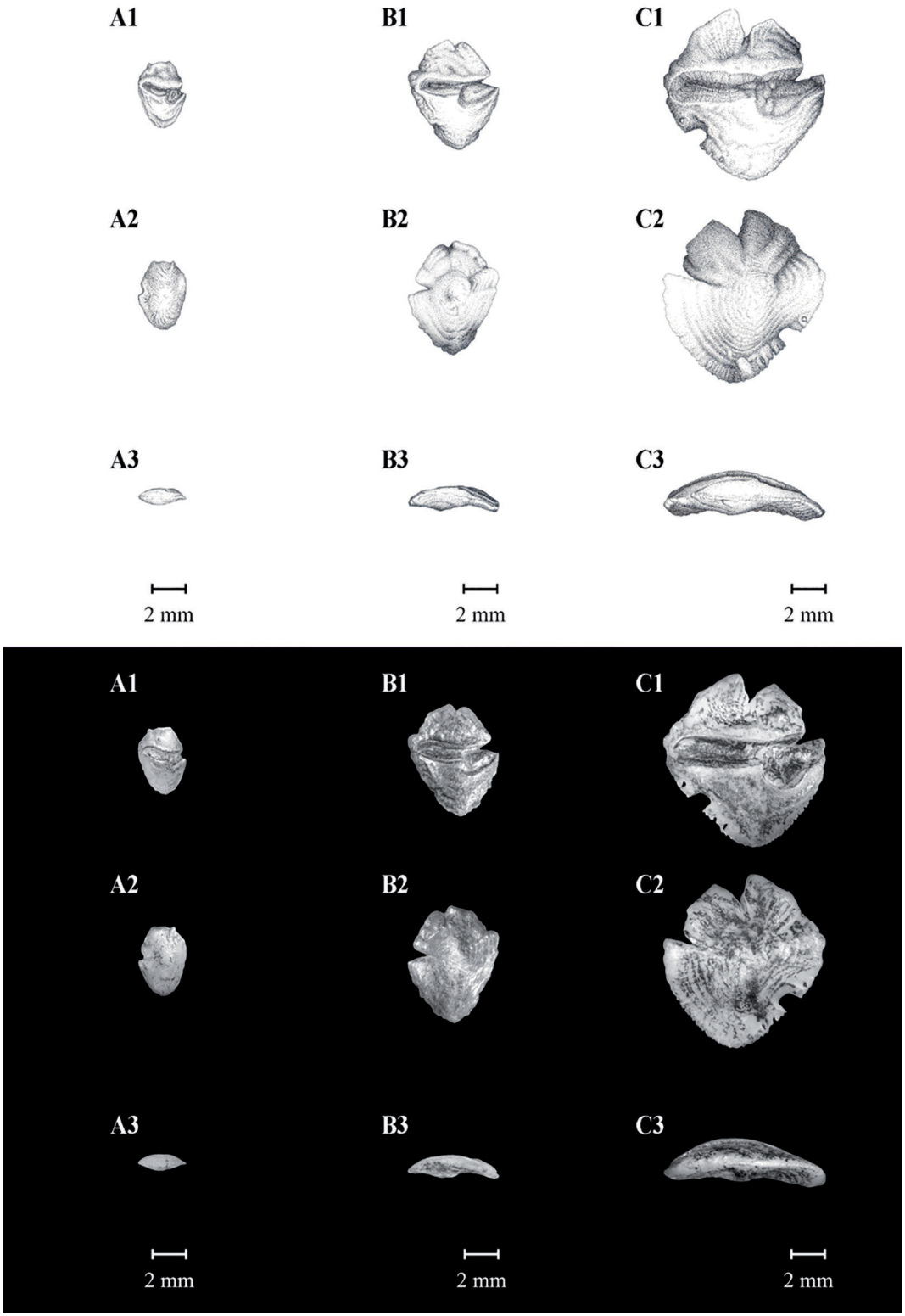

Plate 33. Illustrations (above) and photos (below) of *Antigonia capros* otoliths from fish with total lengths: A. 35 mm; B. 112 mm; C. 191 mm. The medial face is shown in A1, B1, C1; the lateral face in A2, B2, C2; and the ventral profile in A3, B3, C3 (Illustrations and Photos: Alexandre Arackawa).