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)

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Abstract

This publication is part of a series that will constitute an Atlas of Teleostei Otoliths for the Southeastern-Southern Brazilian area. It presents the results of the morphological and morphometric analyses of 31 Perciformes (two species of Centropomidae; two of Acropomatidae; two of Serranidae; two of Priacanthidae; two of Malacanthidae; one of Pomatomidae; six of Carangidae; three of Lutjanidae; five of Gerreidae and six of Haemulidae). Whenever available in the collection, otoliths from three distinct specimen sizes were illustrated and photographed in order to show their variation during development. For each characteristic the frequency of occurrence was calculated within each length class (TL) and among length classes (during development) and differences were analyzed by a multiple χ^2 test (significance 0.05).

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

Resumo

Esta publicação é parte de uma série que constituirá um Atlas de Otólitos para os Teleostei da Região Sudeste-Sul brasileira. Nela são apresentados os resultados de análises morfológicas e morfométricas de 31 espécies de peixes Perciformes (duas espécies de Centropomidae; duas de Acropomatidae; duas de Serranidae; duas de Priacanthidae; duas de Malacanthidae; uma de Pomatomidae; seis de Carangidae; três de Lutjanidae; cinco de Gerreidae e seis de Haemulidae). Três otólitos de tamanhos distintos de cada espécie foram desenhados e fotografados, sempre que possível. Para cada característica foram calculadas as frequências de ocorrência dentro de cada classe de comprimento total (TL) e entre classes distintas (diferenças ontogenéticas) através de um Teste χ^2 múltiplo (significância 0,05).

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

INTRODUCTION

Many papers have been published showing the value of otolith photographs and drawings for the analysis of the features of these structures in such different areas as: taxonomy, phylogeny, archeology, paleontology, species geographic variation, stock identification, food webs and others.

Since the 1990s the potential of the otolith collections has become clear as revealing supporting analyses of population structure, growth dynamics, and environmental conditions (Geffen; Morales-Nin, 2013) and recently, otolith collections have come to be useful in focusing on otolith analysis as indicative of past environmental events.

This publication is part of a series that will constitute an Atlas providing a permanent visual record of otoliths of fish species from the Southeastern-Southern Brazilian coast, providing a valuable legacy for otolith shape and size analysis.

MATERIAL AND METHODS

The sampling area and the methodology followed Rossi-Wongtschowski et al. (2014). Additionally this paper includes otoliths from two new surveys as follows:

http://dx.doi.org/10.1590/S1679-875920161100064(sp1)

- Araçá Bay Project (BA) I, II, III, IV and V. "Biodiversity and functioning of a subtropical coastal ecosystem: support for integrated management", undertaken between 2010 and 2014.
- Araçá Bay Project (BA) I, II, III and IV. "Ichthyofauna composition and abundance of tidal pools at Araçá Bay, São Sebastião (SP) and their space-temporal patterns", conducted in 2014.

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

RESULTS

Part IV: Perciformes

Family Centropomidae

Otolith shape varies from elliptic to trapezoidal, the anterior region tends to be peaked-round, *cauda* morphology is always tubular strongly curved, *pseudorostrum* and *pseudoantirostrum* are always absent.

Centropomus parallelus (Poey 1860) **- Plate 1**

Maximum Size:	720 mm (TL) (FROESE; PAULY, 2015)
Distribution:	Western Atlantic from Southern Florida and the Mexican Gulf coast to South Brazilian coast (MENEZES et al., 2003; FROESE; PAULY, 2015)
Habitat:	Coastal waters (freshwater, brackish and marine), estuaries and lagoons (CERVIGÓN et al., 1992; ESCHE-MEYER, 2015)
Diet:	Fish, crustaceans and insect larvae (TONINI et al., 2007)
Collection:	40 otoliths from 20 fish (TL ranging from 214 to 405 mm)
Sample:	14 left otoliths grouped into 8, 20 mm classes (240 to 400 mm)

Shape: elliptic to trapezoidal. ***Anterior region:*** peaked-round (85.71%), angled-round. ***Posterior region:*** oblique (42.86%), round, angled-round. ***Dorsal edge:*** sinuate to entire (57.14%), crenate to entire, lobed to entire. ***Ventral edge:*** sinuate to entire (28.57%), entire (28.57%), crenate (21.43%), crenate to entire, lobed to entire. ***Profile:*** concave-convex. ***Rostrum and antirostrum orientation:*** does not apply. ***Rostrum:*** developed. ***Antirostrum:*** absent. ***Sulcus acusticus:*** *position:* median; *orientation:* horizontal; *opening:* pseudo-ostial (50%), para-ostial (50%); *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* elliptic (71.43%), rectangular; *cauda*: tubular strongly curved.

Significant differences ($p<0.05$) were obtained within some length classes for *rostrum* and *antirostrum* orientation. During growth development statistical differences were only found for the anterior region.

Shape indices	Mean ± Sd	Minimum	Maximum
OL/TL (%)	4.15 ± 0.15	3.82	4.38
OH/OL (%)	57.19 ± 2.89	49.65	60.55
OT/OL (%)	15.01 ± 0.79	13.56	16.35
OT/OH (%)	26.29 ± 1.62	23.45	29.99
Circularity	17.05 ± 1.73	15.41	22.05
Rectangularity	0.73 ± 0.01	0.72	0.76

Centropomus undecimalis (Bloch 1792) - **Plate 2**

Maximum Size:	1400 mm (TL) (FROESE; PAULY, 2015)
Distribution:	Western Atlantic from North Carolina to Central America and to South Brazilian coast (MENEZES et al., 2003; ESCHEMEYER, 2015)
Habitat:	Coastal waters (freshwater, brackish and marine), estuaries and lagoons (CERVIGÓN et al., 1992; ESCHEMEYER, 2015)
Diet:	Fishes and crustaceans (shrimps and crabs) (FROESE; PAULY, 2015)
Collection:	35 otoliths from 19 fish (TL ranging from 146 to 382 mm)
Sample	16 left otoliths grouped into 7, 20 mm classes (140 to 380 mm)

Shape: elliptic to trapezoidal. ***Anterior region:*** peaked-round. ***Posterior region:*** oblique (43.75%), round (37.50%), angled-round. ***Dorsal edge:*** sinuate to entire (37.50%), lobed to sinuate (31.25%), crenate to lobed, sinuate. ***Ventral edge:*** sinuate to entire (56.25%), lobed to sinuate, entire. ***Profile:*** concave-convex. ***Rostrum and antirostrum orientation:*** in agreement (68.75%), does not apply. ***Rostrum:*** developed. ***Antirostrum:*** underdeveloped (37.50%), absent (31.25%), developed (31.25%). ***Sulcus acusticus:*** *position:* median; *orientation:* horizontal; *opening:* ostial; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* elliptic (93.75%), rectangular; *cauda*: tubular strongly curved.

Significant differences ($p<0.05$) were obtained within some length classes for anterior region and *ostium*. No differences appeared during growth development.

Shape indices	Mean ± Sd	Minimum	Maximum
OL/TL (%)	3.94 ± 0.33	3.38	4.48
OH/OL (%)	54.74 ± 1.69	51.66	57.46
OT/OL (%)	14.01 ± 0.90	12.95	16.38
OT/OH (%)	25.60 ± 1.69	22.54	29.43
Circularity	17.95 ± 2.75	16.31	27.78
Rectangularity	0.72 ± 0.01	0.70	0.74

Family ACROPOMATIDAE

The otoliths from two species of the collection are very different, but the *sulcus acusticus* opening is ostial, the *ostium* morphology is frequently funnel-like, *pseudorostrum* and *pseudoantirostrum* are always absent.

Synagrops bellus (Goode & Bean 1896) - **Plate 3**

Maximum Size:	230 mm (TL) (FIGUEIREDO et al., 2002), but attaining 290 mm in our collection.
Distribution:	Eastern and Western Atlantic from Canada and Bermuda to Rio Grande do Sul (FIGUEIREDO et al., 2002; HAIMOVICI et al., 2008)
Habitat:	Deep shelf and slope waters (FROESE; PAULY, 2015)
Diet:	Fish and crustaceans (VASKE-JÚNIOR et al., 2009)
Collection:	2525 otoliths from 1277 fish (TL ranging from 79 to 290 mm)
Sample:	98 left otoliths grouped into 12, 20 mm classes (60 to 290 mm)

Shape: elliptic to trapezoidal (53.03%), trapezoidal, elliptic. ***Anterior region:*** peaked. ***Posterior region:*** oblique (42.86%), oblique-round, round, flattened. ***Dorsal edge:*** lobed to sinuate (58.16%), sinuate to entire. ***Ventral edge:*** sinuate to entire (57.14%), lobed to entire, serrate to entire, dentate to entire. ***Profile:*** concave-convex. ***Rostrum and antirostrum orientation:*** in agreement. ***Rostrum:*** underdeveloped. ***Antirostrum:*** underdeveloped. ***Sulcus acusticus:*** *position:* median; *orientation:* ascending (94.90%), horizontal; *opening:* ostial; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* funnel-like; *cauda*: tubular curled (62.24%), tubular markedly curved.

Significant differences ($p<0.05$) were obtained within some length classes for shape, posterior region, dorsal edge, ventral edge and *sulcus acusticus* orientation. During growth development statistical differences were found for shape, posterior region, dorsal edge, ventral edge and *sulcus acusticus* orientation.

Shape indices	Mean ± Sd	Minimum	Maximum
OL/TL (%)	3.37 ± 0.64	2.40	4.87
OH/OL (%)	63.15 ± 2.54	56.20	68.23
OT/OL (%)	18.22 ± 1.07	15.02	20.51
OT/OH (%)	28.90 ± 1.99	24.71	34.07
Circularity	17.33 ± 0.64	16.16	19.18
Rectangularity	0.68 ± 0.02	0.62	0.72

Synagrops spinosus (Schultz 1940) - **Plate 4**

Maximum Size:	130 mm (TL) (FIGUEIREDO et al., 2002), but attaining 158 mm in our collection.
Distribution:	Western Pacific and Western Atlantic from Canada along the Gulf of Mexico to Uruguay (FIGUEIREDO et al., 2002; HAIMOVICI et al., 2008)
Habitat:	Outer continental shelves in sandy and muddy areas (FIGUEIREDO et al., 2002)
Diet:	Fish, crustaceans and cephalopods (NASCIMENTO, 2006)
Collection:	4362 otoliths from 2230 fish (TL ranging from 30 to 158 mm)
Sample:	70 left otoliths grouped into 7, 20 mm classes (20 to 140 mm)

Shape: elliptic (61.43%), rhomboidal. ***Anterior region:*** peaked. ***Posterior region:*** round (68.57%), angled, oblique, flattened. ***Dorsal edge:*** sinuate to entire (67.14%), lobed to sinuate entire. ***Ventral edge:*** sinuate to entire (64.29%), lobed to sinuate, entire. ***Profile:*** flattened. ***Rostrum and antirostrum orientation:*** does not apply (71.43%), in agreement. ***Rostrum:*** developed. ***Antirostrum:*** absent (71.43%), underdeveloped, developed. ***Sulcus acusticus:*** *position:* median; *orientation:* horizontal; *opening:* ostial; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* funnel-like (85.71%), elliptic; *cauda*: tubular straight (57.14%), tubular slightly curved, tubular strongly curved.

Significant differences ($p<0.05$) were obtained within some length classes for shape, posterior region, dorsal edge, ventral edge, *sulcus acusticus* orientation, *ostium* and *cauda* morphology, *rostrum* and *antirostrum* orientation and *antirostrum* development. During fish development statistical differences were found for shape, *rostrum* and *antirostrum* orientation and *antirostrum*.

Shape indices	Mean ± Sd	Minimum	Maximum
OL/TL (%)	6.57 ± 0.54	4.99	7.90
OH/OL (%)	51.06 ± 2.22	46.68	62.11
OT/OL (%)	11.23 ± 2.54	7.95	18.94
OT/OH (%)	22.02 ± 5.00	16.41	34.96
Circularity	17.19 ± 0.72	15.75	19.77
Rectangularity	0.68 ± 0.03	0.60	0.74

Family SERRANIDAE

Anterior region peaked-round, *sulcus acusticus* opening is ostial, *ostium* is longer and approximately equal to the *cauda* length, *pseudorostrum* and *pseudoantirostrum* are always absent.

Epinephelus marginatus (Lowe 1834) - **Plate 5**

Maximum Size:	1500 mm (TL) (FROESE; PAULY, 2015)
Distribution:	Mediterranean Sea, Eastern and Southwest Atlantic and Western Indian Ocean off South Africa to Southern Mozambique (ESCHEMEYER, 2015; FROESE; PAULY, 2015)
Habitat:	Rocky bottoms and closer to shore in rocky tidal pools (FIGUEIREDO; MENEZES, 1980)
Diet:	Mainly crabs and octopi; larger individuals feed on a greater proportion of fish (FROESE; PAULY, 2015)
Collection:	24 otoliths from 12 fish (TL ranging from 210 to 326 mm)
Sample:	9 left otoliths grouped into 4, 20 mm classes (200 to 300 mm)

Shape: elliptic. ***Anterior region:*** peaked-round. ***Posterior region:*** oblique-round. ***Dorsal edge:*** dentate to crenate (66.67%), crenate to sinuate, crenate. ***Ventral edge:*** crenate to (55.56%), dentate to crenate, lobed to crenate, dentate to serrate. ***Profile:*** concave-convex. ***Rostrum and antirostrum orientation:*** in agreement. ***Rostrum:*** developed. ***Antirostrum:*** underdeveloped. ***Sulcus acusticus:*** *position:* median; *orientation:* horizontal (66.67%), ascending; *opening:* ostial; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* rectangular (55.56%), funnel-like; *cauda*: tubular strongly curved (77.78%), tubular markedly 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 (%)	3.40 ± 0.17	3.18	3.62
OH/OL (%)	49.23 ± 1.86	47.10	52.11
OT/OL (%)	11.34 ± 0.91	9.87	12.95
OT/OH (%)	23.06 ± 1.98	20.96	27.45
Circularity	33.24 ± 4.39	25.65	41.50
Rectangularity	0.68 ± 0.01	0.66	0.69

Serranus phoebe (Poey 1851) **- Plate 6**

Maximum Size:	205 mm (TL) (FIGUEIREDO; MENEZES, 1980; FIGUEIREDO et al., 2002)
Distribution:	Western Atlantic from Bermuda and South Carolina through northeastern Gulf of Mexico to southeastern Brazil (FIGUEIREDO; MENEZES, 1980; FROESE; PAULY, 2015)
Habitat:	Rocky areas (FROESE; PAULY, 2015)
Diet:	Mainly shrimps, crabs and, less frequently, bivalves (FIGUEIREDO; MENEZES, 1980)
Collection:	10 otoliths from 5 fish (TL ranging from 111 to 178 mm)
Sample:	1 left otolith (167 mm TL)

Shape: fusiform. ***Anterior region:*** peaked-round. ***Posterior region:*** peaked. ***Dorsal edge:*** sinuate to entire. ***Ventral edge:*** 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 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 (%)	3.53 ± 0	3.53	3.53
OH/OL (%)	46.78 ± 0	46.78	46.78
OT/OL (%)	15.42 ± 0	15.42	15.42
OT/OH (%)	32.97 ± 0	32.97	32.97
Circularity	19.13 ± 0	19.13	19.13
Rectangularity	0.66 ± 0	0.66	0.66

Family PRIACANTHIDAE

The two species of this family are very different from each other and presented no common features. *Pseudorostrum* and *pseudoantirostrum* are always absent.

Heteropriacanthus cruentatus (Lacepède 1801) **- Plate 7**

Maximum Size:	507 mm (TL) (FROESE; PAULY, 2015), but attaining 571 mm in our collection.
Distribution:	Circumglobal in tropical seas (FIGUEIREDO et al., 2002; ESCHEMEYER, 2015)
Habitat:	Shallow areas, common in lagoons and seaward reefs, around islands (FIGUEIREDO et al., 2002)
Diet:	Nocturnal habits, feeding mainly on invertebrates (FIGUEIREDO et al., 2002)
Collection:	101 otoliths from 53 fish (TL ranging from 166 to 571 mm)
Sample:	26 left otoliths grouped into 16, 20 mm classes (160 to 560 mm)

Shape: rhomboidal to elliptic (38.46%), elliptic (30.77%), rectangular, rhomboidal to rectangular. ***Anterior region:*** peaked. ***Posterior region:*** round (38.46%), oblique (30.77%), flattened (30.77%). ***Dorsal edge:*** lobed to sinuate (61.54%), lobed, dentate to lobed. ***Ventral edge:*** lobed to irregular (88.46%), lobed, dentate to irregular. ***Profile:*** concave-convex. ***Rostrum and antirostrum orientation:*** in agreement (73.08%), in disagreement, does not apply. ***Rostrum:*** developed (96.15%), underdeveloped. ***Antirostrum:*** developed (57.69%), underdeveloped; absent. ***Sulcus acusticus:*** *position:* median; *orientation:* horizontal (96.15%), ascending; *opening:* ostial (76.92%), ostio-caudal; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* elliptic (61.54%), bent-concave, tubular; *cauda*: tubular strongly curved (61.54%), tubular markedly curved.

Significant differences ($p<0.05$) were obtained within some length classes for anterior region, dorsal edge, ventral edge, *sulcus acusticus* opening, *ostium* and *cauda* morphology, and *rostrum* development. No differences appeared during the fish's development.

Shape indices	Mean ± Sd	Minimum	Maximum
OL/TL (%)	2.29 ± 0.39	1.63	3.12
OH/OL (%)	76.26 ± 9.05	57.76	92.40
OT/OL (%)	17.04 ± 4.73	11.61	30.31
OT/OH (%)	22.80 ± 7.03	13.33	38.25
Circularity	25.40 ± 2.79	21.78	35.91
Rectangularity	0.65 ± 0.04	0.60	0.73

Priacanthus arenatus (Cuvier 1829) **- Plate 8**

Maximum Size:	400-500 mm (TL) (BERNARDES et al., 2005)
Distribution:	Western Atlantic from Canada to northern Argentina and Eastern Atlantic from Madeira to Northern Angola (BERNARDES et al., 2005; FIGUEIREDO; MENEZES, 1980)
Habitat:	Demersal, found in coral reefs and on rocky bottoms from coastal areas to 130 m depth (FIGUEIREDO; MENEZES, 1980; BERNARDES et al., 2005; FROESE; PAULY, 2015)
Diet:	Feeds mainly on small fish, crustaceans and polychaetes (FIGUEIREDO; MENEZES, 1980; BERNARDES et al., 2005)
Collection:	80 otoliths from 49 fish (TL ranging from 74 to 435 mm)
Sample:	1 left otolith (78 mm)

Shape: piriform. ***Anterior region:*** irregular. ***Posterior region:*** round. ***Dorsal edge:*** entire. ***Ventral edge:*** entire. ***Profile:*** concave-convex. ***Rostrum and antirostrum orientation:*** in agreement. ***Rostrum:*** developed. ***Antirostrum:*** developed. ***Sulcus acusticus:*** *position:* supramedian; *orientation:* horizontal; *opening:* ostial; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* tubular; *cauda*: 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 (%)	2.22 ± 0	2.22	2.22
OH/OL (%)	89.02 ± 0	89.02	89.02
OT/OL (%)	28.32 ± 0	28.32	28.32
OT/OH (%)	31.82 ± 0	31.82	31.82
Circularity	20.35 ± 0	20.35	20.35
Rectangularity	0.65 ± 0	0.65	0.65

Family MALACANTHIDAE

The two species of this family analyzed did not show any common features. *Pseudorostrum* and *pseudoantirostrum* are always absent.

Caulolatilus chrysops (Valenciennes 1833) **- Plate 9**

Maximum Size:	500-600 mm (TL) (FIGUEIREDO et al., 2002; FROESE; PAULY, 2015)
Distribution:	Western Atlantic from North Carolina to Southeastern Brazilian coast (MENEZES et al., 2003; FIGUEIREDO et al., 2002)
Habitat:	Found on rubble, shells and coral bottoms at depth of more than 50 m (FIGUEIREDO; MENEZES, 1980; FIGUEIREDO et al., 2002)
Diet:	Crustaceans and other invertebrates; occasionally small fish (FIGUEIREDO et al., 2002)
Collection:	12 otoliths from 6 fish (TL ranging from 283 to 469 mm)
Sample:	4 left otoliths grouped into 4, 20 mm classes (280 to 460 mm)

Shape: rectangular. ***Anterior region:*** peaked-round (50%), round, peaked. ***Posterior region:*** round (75%), flattened. ***Dorsal edge:*** lobed to entire (50%), dentate to crenate, dentate to sinuate. ***Ventral edge:*** lobed to sinuate (50%), dentate to sinuate (50%). ***Profile:*** concave-convex. ***Rostrum and antirostrum orientation:*** in agreement. ***Rostrum:*** developed. ***Antirostrum:*** developed. ***Sulcus acusticus:*** *position:* median; *orientation:* horizontal (50%), descending (50%); *opening:* ostial; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* funnel-like; *cauda*: tubular strongly curved (75%), tubular markedly 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 (%)	1.94 ± 0.17	1.79	2.17
OH/OL (%)	45.66 ± 2.45	43.58	48.79
OT/OL (%)	17.51 ± 2.03	15.12	19.98
OT/OH (%)	38.26 ± 2.60	34.70	40.94
Circularity	24.02 ± 3.96	20.75	29.68
Rectangularity	0.76 ± 0.03	0.73	0.79

Lopholatilus villarii (Miranda Ribeiro 1915) **- Plate 10**

Maximum Size:	1070 mm (TL) (FROESE; PAULY, 2015)
Distribution:	Southern Atlantic from Rio de Janeiro to Uruguay and Argentina (FIGUEIREDO; MENEZES, 1980; MENEZES et al., 2003)
Habitat:	Demersal on muddy bottoms from 100 to 400 m depths (BERNARDES et al., 2005)
Diet:	Fish; crustaceans; mollusks; ophiuroides (CARVALHO-FILHO, 1992)
Collection:	4 otoliths from 2 fish (TL ranging from 342 to 398 mm)
Sample:	1 left otolith (342 mm)

Shape: elliptic. ***Anterior region:*** peaked. ***Posterior region:*** irregular. ***Dorsal edge:*** lobed. ***Ventral edge:*** entire. ***Profile:*** concave-convex. ***Rostrum and antirostrum orientation:*** in agreement. ***Rostrum:*** developed. ***Antirostrum:*** underdeveloped. ***Sulcus acusticus:*** *position:* inframedian; *orientation:* horizontal; *opening:* ostial; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* tubular; *cauda*: 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 (%)	3.68 ± 0	3.68	3.68
OH/OL (%)	59.37 ± 0	59.37	59.37
OT/OL (%)	18.49 ± 0	18.49	18.49
OT/OH (%)	31.15 ± 0	31.15	31.15
Circularity	19.06 ± 0	19.06	19.06
Rectangularity	0.63 ± 0	0.63	0.63

Family POMATOMIDAE

Pomatomus saltatrix (Linnaeus 1766) **- Plate 11**

Maximum Size:	1300 mm (TL) (FROESE; PAULY, 2015)
Distribution:	Circumglobal in tropical and subtropical waters except in Eastern and Central Pacific; Western Atlantic from Nova Scotia to Argentina (CARVALHO-FILHO, 1992; BERNARDES et al., 2005)
Habitat:	Oceanic and coastal waters; surface waters over the continental shelf (BERNARDES et al., 2005; FROESE; PAULY, 2015)
Diet:	Fish, crustaceans and cephalopods (BERNARDES et al., 2005)
Collection:	111 otoliths from 57 fish (TL ranging from 76 to 471 mm)
Sample:	22 left otoliths grouped into 8, 20 mm classes (120 to 460 mm)

Shape: rectangular to lanceolated (72.73%), rectangular, fusiform. ***Anterior region:*** lanceolated-round (72.73%), peaked-round, peaked. ***Posterior region:*** oblique-round (50%), oblique (41%), flattened. ***Dorsal edge:*** lobed to sinuate (54.55%), sinuate to entire, dentate to sinuate, lobed. ***Ventral edge:*** sinuate to entire (54.55%), lobed to sinuate, lobed to irregular, dentate to sinuate, dentate to irregular. ***Profile:*** concave-convex. ***Rostrum and antirostrum orientation:*** does not apply. ***Rostrum:*** developed. ***Antirostrum:*** absent. ***Pseudorostrum and pseudoantirostrum:*** absent. ***Sulcus acusticus:*** *position:* median; *orientation:* horizontal; *opening:* ostial; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* funnel-like (90.91%), tubular; *cauda*: tubular strongly curved (50%), tubular slightly curved (50%).

Significant differences ($p<0.05$) were obtained within some length classes for shape, anterior region, posterior region, dorsal edge, ventral edge and *ostium* morphology. No differences were found during the fish's development.

Shape indices	Mean ± Sd	Minimum	Maximum
OL/TL (%)	2.90 ± 0.24	2.68	3.85
OH/OL (%)	36.00 ± 2.40	32.22	44.64
OT/OL (%)	7.56 ± 0.85	6.40	10.52
OT/OH (%)	20.99 ± 1.67	18.02	23.86
Circularity	28.28 ± 2.64	24.16	34.95
Rectangularity	0.71 ± 0.02	0.68	0.76

Family CARANGIDAE

Otoliths of elliptic or fusiform to lanceolated shape. The most common profile is concave–convex mainly in adult fish. *Pseudorostrum* and *pseudoantirostrum* are always absent.

Caranx hippos (Linnaeus 1766) **- Plate 12**

Maximum Size:	1240 mm (TL) (CERVIGÓN et al., 1992)
Distribution:	Western Mediterranean; Eastern Atlantic from Portugal to Angola; Western Atlantic from Nova Scotia to Uruguay (MENEZES; FIGUEIREDO, 1980; ESCHEMEYER, 2015; FROESE; PAULY, 2015)
Habitat:	Neritic waters over the continental shelf; freshwater; brackish; marine (CERVIGÓN et al., 1992; ESCHEMEYER, 2015)
Diet:	Small fish, invertebrates (MENEZES; FIGUEIREDO, 1980)
Collection:	13 otoliths from 8 fish (TL ranging from 173 to 209 mm)
Sample:	4 left otoliths grouped into 2, 20 mm classes (160 to 200 mm)

Shape: fusiform to lanceolated (75%), fusiform. ***Anterior region:*** lanceolated (50%), peaked (50%). ***Posterior region:*** round (50%), peaked-round (50%). ***Dorsal edge:*** sinuate to entire (50%), entire (50%). ***Ventral edge:*** lobed (50%), lobed to sinuate (50%). ***Profile:*** concave-convex. ***Rostrum and antirostrum orientation:*** in agreement. ***Rostrum:*** developed. ***Antirostrum:*** underdeveloped (50%), developed (50%). ***Pseudorostrum and pseudoantirostrum:*** absent. ***Sulcus acusticus:*** *position:* supramedian; *orientation:* horizontal; *opening:* ostial; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* funnel-like; *cauda*: tubular strongly curved (50%), tubular markedly curved (50%).

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

Shape indices	Mean ± Sd	Minimum	Maximum
OL/TL (%)	2.50 ± 0.09	2.43	2.63
OH/OL (%)	38.35 ± 2.61	35.04	41.20
OT/OL (%)	11.03 ± 1.10	9.45	11.90
OT/OH (%)	28.74 ± 2.07	26.97	30.81
Circularity	23.76 ± 2.24	21.68	26.29
Rectangularity	0.68 ± 0.01	0.67	0.70

Caranx latus (Linnaeus 1766) **- Plate 13**

Maximum Size:	1010 mm (TL) (FROESE; PAULY, 2015)
Distribution:	Eastern, Central and Western Atlantic, from New Jersey through the Gulf of Mexico to Southern Brazil (MENEZES; FIGUEIREDO, 1980; ESCHEMEYER, 2015)
Habitat:	Pelagic; usually found on offshore reefs; juveniles are common along sandy beach shores with low salinity waters (MENEZES; FIGUEIREDO, 1980; FROESE; PAULY, 2015)
Diet:	Fish; shrimps and, less frequently, other invertebrates (MENEZES; FIGUEIREDO, 1980)
Collection:	59 otoliths from 33 fish (TL ranging from 143 to 196 mm)
Sample:	2 right otoliths grouped into 2, 20 mm classes (160 to 180 mm)

Shape: fusiform. ***Anterior region:*** peaked. ***Posterior region:*** oblique-round. ***Dorsal edge:*** lobed to sinuate. ***Ventral edge:*** lobed. ***Profile:*** concave-convex. ***Rostrum and antirostrum orientation:*** in agreement. ***Rostrum:*** developed. ***Antirostrum:*** underdeveloped. ***Pseudorostrum and pseudoantirostrum:*** absent. ***Sulcus acusticus:*** *position:* median; *orientation:* descending; *opening:* ostial; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* funnel-like; *cauda*: 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 (%)	2.55 ± 0.06	2.51	2.59
OH/OL (%)	41.54 ± 1.72	40.33	42.75
OT/OL (%)	9.09 ± 0.00	9.09	9.09
OT/OH (%)	21.90 ± 0.90	21.26	22.54
Circularity	23.99 ± 3.02	21.86	26.13
Rectangularity	0.68 ± 0.02	0.67	0.69

Oligoplites saurus (Bloch & Schneider 1801) - **Plate 14**

Maximum Size:	350 mm (TL) (CERVIGÓN et al., 1992)
Distribution:	Western Atlantic from Maine and Northern Gulf of Mexico to Uruguay; Eastern Pacific from Mexico to Ecuador (ESCHEMEYER, 2015; FROESE; PAULY, 2015)
Habitat:	Coastal waters (freshwater, brackish, marine), usually along sandy beaches, bays and inlets (CERVIGÓN et al., 1992; MENEZES; FIGUEIREDO, 1980)
Diet:	Fish and crustaceans; juveniles feed on scales of other fish (MENEZES; FIGUEIREDO, 1980)
Collection:	103 otoliths from 70 fish (TL ranging from 22 to 144 mm)
Sample:	17 left otoliths categorized into 5, 20 mm classes (20 to 140 mm)

Shape: semicircular (89.47%), elliptic to lanceolated. ***Anterior region:*** oblique (52.63%), peaked, oblique-round, lanceolated, peaked-round. ***Posterior region:*** round (47.37%), oblique-round, double-peaked, oblique to angled, angled-round. ***Dorsal edge:*** entire (94.74%), lobed to entire. ***Ventral edge:*** entire. ***Profile:*** plane-convex (89.47%), concave-convex. ***Rostrum and antirostrum orientation:*** in agreement (63.16%), does not apply. ***Rostrum:*** underdeveloped (89.47%), developed. ***Antirostrum:*** underdeveloped (63.16%), absent. ***Sulcus acusticus:*** *position:* median; *orientation:* horizontal; *opening:* ostial (73.68%), ostio-caudal; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* funnel-like, rectangular; *cauda*: tubular strongly curved (63.16%), tubular slightly curved, tubular straight.

Significant differences ($p<0.05$) were obtained within some length classes for shape, anterior region, posterior region, dorsal edge, *cauda* morphology, profile and *rostrum* development. During growth development statistical differences were found only for anterior region and posterior region.

Shape indices	Mean ± Sd	Minimum	Maximum
OL/TL (%)	1.56 ± 0.15	1.27	1.90
OH/OL (%)	61.38 ± 5.77	51.85	73.08
OT/OL (%)	21.16 ± 2.65	14.36	25.00
OT/OH (%)	34.41 ± 2.26	27.37	36.67
Circularity	16.21 ± 1.30	14.02	19.45
Rectangularity	0.71 ± 0.03	0.65	0.76

Seriola fasciata (Bloch 1793) **- Plate 15**

Maximum Size:	700 mm (TL) (CERVIGÓN et al., 1992; MENEZES; FIGUEIREDO, 1980)
Distribution:	Western Atlantic from Massachusetts to Southern Brazil; Eastern Atlantic including Mediterranean Sea (ESCHEMEYER, 2015; MENEZES; FIGUEIREDO, 1980)
Habitat:	Benthopelagic; coastal or epipelagic in neritic waters (CERVIGÓN et al., 1992; FROESE; PAULY, 2015)
Diet:	Squid and fish (MENEZES; FIGUEIREDO, 1980)
Collection:	2 otoliths from 1 fish (TL ranging 205 mm)
Sample:	1 left otolith (205 mm)

Shape: fusiform to lanceolated. ***Anterior region:*** lanceolated. ***Posterior region:*** round. ***Dorsal edge:*** lobed. ***Ventral edge:*** lobed to sinuate. ***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 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 (%)	1.84 ± 0	1.84	1.84
OH/OL (%)	41.01 ± 0	41.01	41.01
OT/OL (%)	12.96 ± 0	12.96	12.96
OT/OH (%)	31.61 ± 0	31.61	31.61
Circularity	25.39 ± 0	25.39	25.39
Rectangularity	0.62 ± 0	0.62	0.62

Trachinotus carolinus (Linnaeus 1766) **- Plate 16**

Maximum Size:	640 mm (TL) (FROESE; PAULY, 2015)
Distribution:	Western Atlantic from Massachusetts through the Gulf of Mexico to Southern Brazil; also found in Argentina (MENEZES; FIGUEIREDO, 1980; MENEZES et al., 2003)
Habitat:	Coastal waters; bays and estuaries; juveniles found on sandy beaches (CERVIGÓN et al., 1992; FROESE; PAULY, 2015)
Diet:	Invertebrates (mollusks and crustaceans); small fish (MENEZES; FIGUEIREDO, 1980)
Collection:	88 otoliths from 56 fish (TL ranging from 20 to 252 mm)
Sample:	5 right otoliths grouped into 4, 20 mm classes (20 to 240 mm)

Shape: fusiform (60%), fusiform to lanceolated. ***Anterior region:*** peaked (60%), lanceolated-round. ***Posterior region:*** round (60%), peaked-round. ***Dorsal edge:*** sinuate to entire. ***Ventral edge:*** sinuate to entire (80%), lobed to sinuate. ***Profile:*** concave-convex. ***Rostrum and antirostrum orientation:*** does not apply (60%), in agreement. ***Rostrum:*** developed. ***Antirostrum:*** absent (60%), underdeveloped. ***Sulcus acusticus:*** *position:* median; *orientation:* horizontal; *opening:* ostial; *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 (%)	2.58 ± 0.49	1.87	3.02
OH/OL (%)	49.85 ± 8.13	41.07	61.11
OT/OL (%)	10.98 ± 2.37	8.68	14.18
OT/OH (%)	22.35 ± 4.82	14.54	26.92
Circularity	20.66 ± 4.45	16.45	26.08
Rectangularity	0.66 ± 0.02	0.63	0.70

Trachinotus falcatus (Linnaeus 1758) **- Plate 17**

Maximum Size:	1220 mm (TL) (MENEZES; FIGUEIREDO, 1980)
Distribution:	Western Atlantic from Massachusetts to Southeastern Brazil (MENEZES et al., 2003; MENEZES; FIGUEIREDO, 1980)
Habitat:	Sandy flats; around reefs; usually solitary or in small schools (FROESE; PAULY, 2015)
Diet:	Invertebrates (mollusks, crabs, shrimps); small fish (MENEZES; FIGUEIREDO, 1980)
Collection:	132 otoliths from 78 fish (TL ranging from 18 to 163 mm)
Sample:	16 left otoliths grouped into 4, 20 mm classes (10 to 160 mm)

Shape: elliptic (71%), elliptic to discoidal, discoidal, fusiform. ***Anterior region:*** peaked-round (71%), peaked. ***Posterior region:*** round (76%), oblique-round, double peaked-round, angled-round. ***Dorsal edge:*** lobed to sinuate (41%), sinuate to entire (35.29%), entire. ***Ventral edge:*** lobed to sinuate (53%), sinuate to entire, entire. ***Profile:*** flattened (65%), concave-convex. ***Rostrum and antirostrum orientation:*** does not apply. ***Rostrum:*** developed (65%), underdeveloped. ***Antirostrum:*** absent. ***Sulcus acusticus:*** *position:* median; *orientation:* horizontal; *opening:* ostial; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* funnel-like; *cauda*: tubular straight (47%), tubular slightly curved, round-oval.

Significant differences ($p<0.05$) were obtained within some length classes for shape, anterior region, posterior region and profile. No differences appeared during fish development.

Shape indices	Mean ± Sd	Minimum	Maximum
OL/TL (%)	2.72 ± 0.33	2.02	3.26
OH/OL (%)	67.26 ± 9.31	42.09	77.92
OT/OL (%)	19.73 ± 3.09	13.73	25.00
OT/OH (%)	29.54 ± 3.90	21.21	36.94
Circularity	16.36 ± 1.31	14.42	0.64
Rectangularity	0.67 ± 0.02	0.64	0.71

Family LUTJANIDAE

The otolith of this family is clearly elliptic, the profile is concave-convex, the *rostrum* is developed*, pseudorostrum* and *pseudoantirostrum* are always absent.

Lutjanus analis (Cuvier 1828) **- Plate 18**

Maximum Size:	940 mm (TL) (FROESE; PAULY, 2015)
Distribution:	Western Atlantic from Massachusetts to Southeastern Brazil (MENEZES; FIGUEIREDO, 1980; MENEZES et al., 2003)
Habitat:	Continental shelf areas; freshwater; brackish; juveniles occur over sandy bottoms and in clear waters (MENEZES; FIGUEIREDO, 1980; CERVIGÓN et al., 1992)
Diet:	Crustaceans, mollusks and fish (FREITAS et al., 2011)
Collection:	36 otoliths from 18 fish (TL ranging from 45 to 410 mm)
Sample:	11 left otoliths grouped into 8, 20 mm classes (40 to 360 mm)

Shape: elliptic. ***Anterior region:*** round (45.45%), peaked-round (45.45%), peaked. ***Posterior region:*** angled (36.36%), oblique (27.27%), round, blunt, peaked. ***Dorsal edge:*** lobed to sinuate (63.64%), lobed, sinuate to entire. ***Ventral edge:*** sinuate to entire (54.55%), lobed to sinuate, lobed. ***Profile:*** concave-convex. ***Rostrum and antirostrum orientation:*** in agreement (90.91%), does not apply. ***Rostrum:*** developed. ***Antirostrum:*** underdeveloped (63.64%), developed, absent. ***Sulcus acusticus:*** *position:* median; *orientation:* horizontal; *opening:* ostial; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* funnel-like (63.64%), elliptic, rectangular; *cauda*: tubular strongly curved.

No significant differences ($p<0.05$) appeared within some length classes and during fish development.

Shape indices	Mean ± Sd	Minimum	Maximum
OL/TL (%)	4.37 ± 0.38	3.80	5.27
OH/OL (%)	59.77 ± 1.80	55.60	62.03
OT/OL (%)	15.93 ± 1.39	14.29	18.99
OT/OH (%)	26.65 ± 2.16	23.64	30.61
Circularity	18.58 ± 2.24	16.56	23.48
Rectangularity	0.69 ± 0.01	0.67	0.70

Lutjanus synagris (Linnaeus 1758) **- Plate 19**

Maximum Size:	600 mm (TL) (FONSECA, 2009)
Distribution:	Western Atlantic from North Carolina to Southeastern Brazil including Gulf of Mexico and Caribbean Sea (MENEZES; FIGUEIREDO, 1980; CARVALHO-FILHO, 1992)
Habitat:	Coastal waters down to 400 m depth; rocky bottoms and coral reefs (MENEZES; FIGUEIREDO, 1980)
Diet:	Crustaceans and fish (MENEZES; FIGUEIREDO, 1980; FONSECA, 2009)
Collection:	61 otoliths from 31 fish (TL ranging from 76 to 316 mm)
Sample:	15 left otoliths grouped into 6, 20 mm classes (60 to 300 mm)

Shape: elliptic. ***Anterior region:*** peaked-round (66.67%), round. ***Posterior region:*** round (80%), oblique. ***Dorsal edge:*** lobed (66.67%), lobed to entire. ***Ventral edge:*** lobed (66.67%), sinuate to entire, entire. ***Profile:*** concave-convex. ***Rostrum and antirostrum orientation:*** in agreement (60%), does not apply. ***Rostrum:*** developed. ***Antirostrum:*** underdeveloped (46.67%), absent (40%), developed. ***Sulcus acusticus:*** *position:* median; *orientation:* horizontal; *opening:* ostial; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* rectangular (66.67%), funnel-like; *cauda*: tubular slightly curved (80%), tubular strongly curved.

Significant differences ($p<0.05$) were obtained within some length classes for anterior region, posterior region, dorsal edge, ventral edge and profile. Significant differences were found during growth for anterior region, dorsal edge and ventral edge.

Shape indices	Mean ± Sd	Minimum	Maximum
OL/TL (%)	4.91 ± 0.41	4.03	5.43
OH/OL (%)	61.56 ± 3.01	55.85	65.52
OT/OL (%)	19.67 ± 2.11	16.04	22.20
OT/OH (%)	31.93 ± 2.67	25.33	34.83
Circularity	20.97 ± 3.59	16.14	26.92
Rectangularity	0.69 ± 0.01	0.66	0.71

Pristipomoides freemani Anderson 1966 **- Plate 20**

Maximum Size:	233 mm (TL) (FIGUEIREDO et al., 2002)
Distribution:	Western Atlantic from Panama to Uruguay (MENEZES; FIGUEIREDO, 1980; MENEZES et al., 2003)
Habitat:	Deep waters on the continental shelf; soft or semi-hard bottoms from 50 to 150 m depth (CERVIGÓN et al., 1992; FROESE; PAULY, 2015)
Diet:	Crustaceans and fish (ANDREOLI et al., 2014)
Collection:	4 otoliths from 2 fish (TL ranging from 202 to 217 mm)
Sample:	2 right otoliths grouped in 1, 20 mm class (200 to 217 mm)

Shape: elliptic. ***Anterior region:*** peaked. ***Posterior region:*** round. ***Dorsal edge:*** dentate to sinuate (50%), sinuate (50%). ***Ventral edge:*** dentate to sinuate (50%), sinuate (50%). ***Profile:*** concave-convex. ***Rostrum and antirostrum orientation:*** in agreement. ***Rostrum:*** developed. ***Antirostrum:*** underdeveloped. ***Sulcus acusticus:*** *position:* median; *orientation:* horizontal; *opening:* ostio-caudal (50%), ostial (50%); *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* rectangular; *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 (%)	4.36 ± 0.32	4.14	4.58
OH/OL (%)	63.36 ± 1.42	62.36	64.36
OT/OL (%)	21.91 ± 1.39	20.94	22.89
OT/OH (%)	34.57 ± 1.41	33.57	35.57
Circularity	18.94 ± 1.10	18.16	19.72
Rectangularity	0.65 ± 0.00	0.65	0.65

Family GERREIDAE

Otolith shape is frequently elliptic and the anterior region is peaked round, although *Diapterus rhombeus* presents some variation. *Sulcus acusticus* opening is ostial and the ostium funnel-like in most of the species.

Diapterus rhombeus (Cuvier 1829) **- Plate 21**

Maximum Size:	400 mm (TL) (FROESE; PAULY, 2015)
Distribution:	Western Atlantic: North Carolina, Central America and the Antilles to Brazil (MENEZES et al., 2003)
Habitat:	Common in shallow waters lined by mangroves; hypersaline and brackish waters (FROESE; PAULY, 2015)
Diet:	Algae and small benthic invertebrates (MENEZES; FIGUEIREDO, 1980)
Collection:	1163 otoliths from 594 fish (TL ranging from 14 to 255 mm)
Sample:	94 left otoliths grouped into 12, 20 mm classes (18 to 220 mm)

Shape: elliptic (32.98%), rhomboidal to pentagonal (30.85%), elliptic to rhomboidal, discoidal, pentagonal. ***Anterior region:*** angled-round (61.70%), angled, peaked, peaked-round, oblique to angled, oblique-round. ***Posterior region:*** oblique to angled (30.85%), oblique (29.79%), oblique-round, round, angled, oblique to peaked. ***Anterior dorsal edge:*** does not apply (67.02%), sinuate, lobed to sinuate, crenate, lobed, entire. ***Dorsal edge:*** sinuate (35.11%), lobed to sinuate (26.60%), lobed, sinuate to entire, crenate, dentate to sinuate, entire. ***Posterior dorsal edge:*** does not apply (67.02%), sinuate, lobed, crenate, sinuate to entire, entire. ***Ventral edge:*** sinuate (44.68%), lobed to sinuate, crenate, sinuate to entire, lobed, crenate to sinuate, entire. ***Posterior ventral edge:*** does not apply (67.02%), sinuate, crenate, lobed. ***Profile:*** concave-convex (84.04%), biconvex. ***Rostrum and antirostrum orientation:*** in agreement (57.45%), does not apply. ***Rostrum:*** developed (95.74%), underdeveloped. ***Antirostrum:*** underdeveloped (59.57%), absent. ***Pseudorostrum and pseudoantirostrum:*** absent. ***Sulcus acusticus:*** *position:* supramedian (84.04%), median; *orientation:* horizontal (60.64%), descending; *opening:* ostial; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* funnel-like (86.17%), elliptic; *cauda*: tubular slightly curved (70.21%), tubular straight, tubular strongly curved.

Significant differences ($p<0.05$) occurred within some length classes for shape, anterior region, posterior region, posterior dorsal edge, dorsal edge, anterior dorsal edge, ventral edge, posterior ventral edge, *sulcus acusticus* position and orientation, *ostium* and *cauda* morphology, profile, *rostrum* and *antirostrum* orientation development. During growth development significant differences were only found for *ostium* morphology and *rostrum* development.

Shape indices	Mean ± Sd	Minimum	Maximum
OL/TL (%)	4.24 ± 0.41	3.68	5.88
OH/OL (%)	76.21 ± 9.11	58.58	92.09
OT/OL (%)	19.08 ± 4.40	13.96	32.00
OT/OH (%)	24.84 ± 3.50	19.78	36.92
Circularity	18.22 ± 1.99	14.11	22.72
Rectangularity	0.68 ± 0.01	0.65	0.71

Eucinostomus argenteus (Baird & Girard 1855) **- Plate 22**

Maximum Size:	280 mm (TL) (FIGUEIREDO; MENEZES, 1980)
Distribution:	Western Atlantic from Florida to São Paulo State (FIGUEIREDO; MENEZES, 1980)
Habitat:	Coastal waters and estuaries (FIGUEIREDO; MENEZES, 1980)
Diet:	Mainly polychaetes and crustaceans (DENADEI et al., 2012)
Collection:	1972 otoliths from 943 fish (TL ranging from 13 to 212 mm)
Sample:	75 left otoliths grouped into 10, 20 mm classes (10 to 190 mm)

Shape: elliptic. ***Anterior region:*** angled-round (48.00%), round (42.67%), peaked-round. ***Posterior region:*** round (84.00%), angled-round. ***Dorsal edge:*** sinuate to entire (54.67%), sinuate, lobed to sinuate, entire. ***Ventral edge:*** lobed to sinuate (37.33%), sinuate (29%), sinuate to entire, dentate to sinuate. ***Profile:*** concave-convex (84.00%), biconvex. ***Rostrum and antirostrum orientation:*** does not apply (53.36%), in agreement, in disagreement. ***Rostrum:*** developed (50.67%), absent, underdeveloped. ***Antirostrum:*** absent (53.33%), developed, underdeveloped. ***Pseudorostrum and pseudoantirostrum:*** absent. ***Sulcus acusticus:*** *position:* supramedian; *orientation:* horizontal (89.33%), descending; *opening:* ostial; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* funnel-like; *cauda*: tubular strongly curved (58.67%), tubular markedly curved, tubular slightly curved.

Significant differences ($p<0.05$) were obtained within some length classes for anterior region, posterior region, dorsal edge, ventral edge, *sulcus acusticus* orientation, *cauda* morphology, profile, *rostrum* and *antirostrum* orientation and development. During growth significant differences were found for profile and *rostrum* development.

Shape indices	Mean ± Sd	Minimum	Maximum
OL/TL (%)	3.84 ± 0.52	2.32	4.84
OH/OL (%)	64.33 ± 4.22	55.91	74.32
OT/OL (%)	22.94 ± 3.00	14.48	29.52
OT/OH (%)	35.63 ± 3.79	25.90	44.83
Circularity	17.43 ± 1.36	14.82	21.41
Rectangularity	0.69 ± 0.02	0.60	0.74

Eucinostomus gula (Quoy & Gaimard 1824) **- Plate 23**

Maximum Size:	238 mm (TL) (FIGUEIREDO; MENEZES, 1980)
Distribution:	Western Atlantic from Florida to São Paulo State (FIGUEIREDO; MENEZES, 1980)
Habitat:	Coastal waters and estuaries (FIGUEIREDO; MENEZES, 1980)
Diet:	Benthic invertebrates (SOARES 2008)
Collection:	266 otoliths from 138 fish (TL ranging from 73 to 201 mm)
Sample:	41 left otoliths grouped into 6, 20 mm classes (70 to 190 mm)

Shape: elliptic (87.80%), hour-glass. ***Anterior region:*** angled-round (80.49%), round. ***Posterior region:*** round (53.66%), angled-round (46%). ***Dorsal edge:*** sinuate to entire (68%), entire, lobed to sinuate, sinuate. ***Ventral edge:*** sinuate to entire (78%), lobed to sinuate, sinuate, entire. ***Profile:*** concave-convex. ***Rostrum and antirostrum orientation:*** in agreement. ***Rostrum:*** developed (68.29%), underdeveloped. ***Antirostrum:*** developed (60.98%), underdeveloped, absent. ***Pseudorostrum:*** absent (71%), underdeveloped, developed. ***Pseudoantirostrum:*** absent (56.10%), developed, underdeveloped. ***Sulcus acusticus:*** *position:* supramedian; *orientation:* horizontal; *opening:* ostial (98%), ostio-caudal; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* funnel-like; *cauda*: tubular slightly curved (51%), tubular strongly curved, tubular straight.

Significant differences ($p<0.05$) were obtained within some length classes for shape, anterior region, dorsal edge, ventral edge, *sulcus acusticus* opening, *cauda* morphology and *rostrum*, *antirostrum*, *pseudorostrum* and *pseudoantirostrum* development. During development significant differences only appeared for *pseudorostrum* development.

Shape indices	Mean ± Sd	Minimum	Maximum
OL/TL (%)	3.71 ± 0.35	3.12	5.22
OH/OL (%)	58.10 ± 4.25	47.77	65.20
OT/OL (%)	20.02 ± 1.63	17.05	23.10
OT/OH (%)	34.53 ± 2.46	29.51	39.25
Circularity	18.32 ± 1.87	15.93	22.97
Rectangularity	0.66 ± 0.03	0.55	0.70

Eucinostomus melanopterus (Bleeker 1863) **- Plate 24**

Maximum Size:	222 mm (TL) (FIGUEIREDO; MENEZES, 1980)
Distribution:	Western Atlantic from Florida to São Paulo State (FIGUEIREDO; MENEZES, 1980)
Habitat:	Coastal waters and estuaries (FIGUEIREDO; MENEZES, 1980)
Diet:	Planktonic organisms. mainly zooplankton (FROESE; PAULY, 2015)
Collection:	191 otoliths from 96 fish (TL ranging from 57 to 230 mm)
Sample:	41 left otoliths grouped into 7, 20 mm classes (50 to 210 mm)

Shape: elliptic. ***Anterior region:*** angled-round (85%), round, peaked-round. ***Posterior region:*** round (68.29%), angled-round. ***Dorsal edge:*** sinuate to entire (73.17%), entire, lobed to sinuate, sinuate. ***Ventral edge:*** sinuate (44%), lobed to sinuate (37%), sinuate to entire, dentate to sinuate. ***Profile:*** concave-convex. ***Rostrum and antirostrum orientation:*** in agreement (90.24%), does not apply. ***Rostrum:*** developed (90.24%), underdeveloped. ***Antirostrum:*** developed (73.17%), underdeveloped, absent. ***Sulcus acusticus:*** *position:* supramedian; *orientation:* horizontal; *opening:* ostial; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* funnel-like; *cauda*: tubular markedly curved (76%), tubular curled.

Significant differences ($p<0.05$) were obtained within some length classes for anterior region, posterior region, dorsal edge, ventral edge, *cauda* morphology, *rostrum* and *antirostrum* orientation and development. During growth statistical differences were only found for the posterior region.

Shape indices	Mean ± Sd	Minimum	Maximum
OL/TL (%)	3.18 ± 0.22	2.48	3.75
OH/OL (%)	68.36 ± 4.14	60.92	75.69
OT/OL (%)	21.87 ± 1.70	18.66	26.22
OT/OH (%)	32.06 ± 2.67	27.01	38.82
Circularity	18.02 ± 1.15	16.27	21.47
Rectangularity	0.67 ± 0.02	0.61	0.71

Eugerres brasillianus (Cuvier 1830) **- Plate 25**

Maximum Size:	500 mm (TL) (FROESE; PAULY, 2015)
Distribution:	Western Atlantic from South Carolina to Santa Catarina, Brazil (MENEZES et al., 2003)
Habitat:	Lagoons; estuaries (MENEZES; FIGUEIREDO, 1980)
Diet:	Invertebrates present in the substrate (PAIVA et al., 2008)
Collection:	53 otoliths from 27 fish (TL ranging from 152 to 219 mm)
Sample:	18 left otoliths grouped into 4, 20 mm classes (140 to 200 mm)

Shape: elliptic. ***Anterior region:*** angled-round (88.89%), oblique to peaked. ***Posterior region:*** oblique (44.44%), oblique to peaked (44.44%), angled-round. ***Dorsal edge:*** lobed to sinuate (72.22%), sinuate. ***Ventral edge:*** lobed to sinuate (61.11%), sinuate. ***Profile:*** concave-convex. ***Rostrum and antirostrum orientation:*** in agreement (88.89%), does not apply. ***Rostrum:*** developed. ***Antirostrum:*** developed (77.78%), underdeveloped, absent. ***Pseudorostrum and pseudoantirostrum:*** absent. ***Sulcus acusticus:*** *position:* median; *orientation:* descending (94.44%), horizontal; *opening:* ostial; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* funnel-like; *cauda*: tubular strongly curved (66.67%), tubular markedly curved.

Significant differences ($p<0.05$) were obtained within some length classes for anterior region, posterior region, dorsal edge, *sulcus acusticus* orientation, *rostrum* and *antirostrum* development. No differences appeared during fish development.

Shape indices	Mean ± Sd	Minimum	Maximum
OL/TL (%)	3.21 ± 0.19	2.97	3.68
OH/OL (%)	60.08 ± 3.44	54.84	66.33
OT/OL (%)	13.64 ± 0.81	11.91	15.14
OT/OH (%)	22.73 ± 1.24	20.65	24.85
Circularity	19.26 ± 1.33	17.11	21.80
Rectangularity	0.67 ± 0.02	0.64	0.70

Family HAEMULIDAE

The otolith shape of this family is always elliptic, oval or elliptic to oval. Anterior region is angled-round or round, *pseudorostrum* and *pseudoantirostrum* are always absent.

Anisotremus surinamensis (Bloch 1791) **- Plate 26**

Maximum Size:	760 mm (TL) (FROESE; PAULY, 2015)
Distribution:	Western Atlantic, from Florida through the Gulf of Mexico and the Caribbean Sea to South Brazil (MENEZES; FIGUEIREDO, 1980; MENEZES et al., 2003)
Habitat:	Coastal waters and rocky bottoms. Often near the shelter of caves, ledges, or wrecks (MENEZES; FIGUEIREDO, 1980)
Diet:	Crustaceans, urchins and small fish (MENEZES; FIGUEIREDO, 1980)
Collection:	4 otoliths from 2 fish (TL ranging from 169 to 177 mm)
Sample:	1 left otolith (177 mm)

Shape: oval. ***Anterior region:*** round. ***Posterior region:*** round. ***Dorsal edge:*** sinuate to entire. ***Ventral edge:*** sinuate to entire. ***Profile:*** concave-convex. ***Rostrum and antirostrum orientation:*** does not apply. ***Rostrum:*** absent. ***Antirostrum:*** absent. ***Sulcus acusticus:*** *position:* supramedian; *orientation:* ascending; *opening:* ostial; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* rectangular; *cauda*: tubular markedly 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 (%)	4.41 ± 0	4.41	4.41
OH/OL (%)	63.89 ± 0	63.89	63.89
OT/OL (%)	18.18 ± 0	18.18	18.18
OT/OH (%)	28.46 ± 0	28.46	28.46
Circularity	14.66 ± 0	14.66	14.66
Rectangularity	0.74 ± 0	0.74	0.74

Conodon nobilis (Linnaeus 1758) **- Plate 27**

Maximum Size:	336 mm (TL) (CERVIGÓN et al., 1992)
Distribution:	Western Atlantic, from Texas and Eastern Florida and Jamaica through the Gulf of Mexico to Southern Brazil (MENEZES; FIGUEIREDO, 1980; MENEZES et al., 2003)
Habitat:	Found along sandy shores and over shallow muddy bottoms down to 100 m depth (MENEZES; FIGUEIREDO, 1980; CERVIGÓN et al., 1992)
Diet:	Crustaceans and small fish (MENEZES; FIGUEIREDO, 1980)
Collection:	32 otoliths from 16 fish (TL ranging from 109 to 335 mm)
Sample:	6 left otoliths grouped into 3, 20 mm classes (100 to 220 mm)

Shape: elliptic. ***Anterior region:*** angled-round. ***Posterior region:*** peaked (85.71%), angled-round. ***Dorsal edge:*** dentate (28.57%), lobed (28.57%), lobed to sinuate, sinuate, sinuate to entire. ***Ventral edge:*** lobed (85.71%), sinuate to entire. ***Profile:*** concave-convex. ***Rostrum and antirostrum orientation:*** in agreement. ***Rostrum:*** developed. ***Antirostrum:*** developed (57.14%), underdeveloped. ***Sulcus acusticus:*** *position:* median; *orientation:* horizontal; *opening:* ostial; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* rectangular (57.14%), funnel-like; *cauda*: tubular markedly 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 (%)	5.21 ± 0.54	4.72	6.29
OH/OL (%)	61.01 ± 2.42	57.43	64.96
OT/OL (%)	21.05 ± 2.07	17.64	23.53
OT/OH (%)	34.54 ± 3.60	29.71	39.07
Circularity	20.55 ± 3.81	15.32	24.13
Rectangularity	0.69 ± 0.01	0.68	0.70

Haemulon aurolineatum (Cuvier 1830) **- Plate 28**

Maximum Size:	250 mm (TL) (FROESE; PAULY, 2015)
Distribution:	Western Atlantic, from Massachusetts and Bermuda through the Gulf of Mexico to Santa Catarina (MENEZES; FIGUEIREDO, 1980; MENEZES et al., 2003)
Habitat:	Seagrass beds, sandy bottoms and coral reefs (CERVIGÓN et al., 1992; MENEZES; FIGUEIREDO, 1980)
Diet:	Algae, detritus and benthic invertebrates (MENEZES; FIGUEIREDO, 1980)
Collection:	28 otoliths from 14 fish (TL ranging from 149 to 180 mm)
Sample:	8 left otoliths grouped into 2, 20 mm classes (140 to 160 mm)

Shape: oval (75%), elliptic to oval. ***Anterior region:*** angled-round (87.50%), angled. ***Posterior region:*** oblique-round (50%), angled-round, round. ***Dorsal edge:*** sinuate to entire (87.50%), entire. ***Ventral edge:*** sinuate

to entire. ***Profile:*** concave-convex. ***Rostrum and antirostrum orientation:*** in agreement. ***Rostrum:*** underdeveloped (62.50%), developed. ***Antirostrum:*** underdeveloped. ***Sulcus acusticus:*** *position:* supramedian; *orientation:* horizontal; *opening:* ostial; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* rectangular; *cauda*: tubular markedly 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 (%)	4.65 ± 0.13	4.43	4.84
OH/OL (%)	68.78 ± 1.74	66.67	71.58
OT/OL (%)	21.15 ± 1.01	19.11	22.45
OT/OH (%)	30.76 ± 1.56	28.65	33.21
Circularity	14.93 ± 0.16	14.76	15.15
Rectangularity	0.72 ± 0.01	0.72	0.73

Haemulon steindachneri (Jordan & Gilbert 1882) **- Plate 29**

Maximum Size:	300 mm (TL) (FROESE; PAULY, 2015)
Distribution:	Eastern Pacific and Western Atlantic, from Panama to Southeastern Brazil and Argentina (MENEZES; FIGUEIREDO, 1980; MENEZES et al., 2003)
Habitat:	Coastal waters, sandy and rubble bottoms and rocky areas, forms shoals (MENEZES; FIGUEIREDO, 1980; CERVIGÓN et al., 1992)
Diet:	Benthic invertebrates (SOARES, 2008)
Collection:	103 otoliths from 52 fish (TL ranging from 99 to 258 mm)
Sample:	33 left otoliths grouped into 8, 20 mm classes (100 to 240 mm)

Shape: elliptic to oval. ***Anterior region:*** angled-round (84.85%), angled. ***Posterior region:*** angled (60.61%), angled-round, oblique-round. ***Dorsal edge:*** sinuate to entire (93.94%), entire. ***Ventral edge:*** sinuate to entire (66.67), entire, lobed to sinuate. ***Profile:*** concave-convex. ***Rostrum and antirostrum orientation:*** in agreement (69.70%), does not apply. ***Rostrum:*** underdeveloped (66.67%), developed. ***Antirostrum:*** underdeveloped (60.61%), absent, developed. ***Sulcus acusticus:*** *position:* supramedian; *orientation:* horizontal; *opening:* ostial; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* funnel-like (54.54%), rectangular (45.45%); *cauda*: tubular markedly curved (84.85%), tubular strongly curved.

Significant differences ($p<0.05$) were obtained within some length classes for anterior region, posterior region, dorsal edge, ventral edge, *ostium* and *cauda* morphology, *rostrum* and *antirostrum* orientation and development. During the fish's development significant differences were found for dorsal edge and *cauda* morphology.

Shape indices	Mean ± Sd	Minimum	Maximum
OL/TL (%)	4.87 ± 0.38	3.61	5.50
OH/OL (%)	70.71 ± 1.67	66.99	73.57
OT/OL (%)	20.70 ± 1.50	18.14	24.02
OT/OH (%)	29.28 ± 2.24	25.24	35.16
Circularity	14.81 ± 0.49	14.05	16.14
Rectangularity	0.72 ± 0.01	0.70	0.73

Orthopristis ruber (Cuvier 1830) **- Plate 30**

Maximum Size:	400 mm (TL) (CERVIGÓN et al., 1992)
Distribution:	Western Atlantic from Caribbean to Southern Brazil (MENEZES; FIGUEIREDO, 1980; MENEZES et al., 2003)
Habitat:	Coastal waters down to 200 m depth; over sandy, rocky or muddy bottoms; brackish water. Juveniles found associated with algae areas (MENEZES; FIGUEIREDO, 1980; FROESE; PAULY, 2015)
Diet:	Crustaceans in general mainly amphipods (AGUIAR; FILOMENO, 1995)
Collection:	815 otoliths from 422 fish (TL ranging from 54 to 287 mm)
Sample:	99 left otoliths grouped into 12, 20 mm classes (40 to 280 mm)

Shape: elliptic (86.87%), elliptic to oval. ***Anterior region:*** angled-round (76.77%), peaked-round, peaked, round. ***Posterior region:*** oblique (40.40%), oblique to peaked, round, angled-round, oblique-round, peaked-round. ***Dorsal edge:*** sinuate to entire (73.74%), lobed to sinuate, entire, lobed, sinuate. ***Ventral edge:*** sinuate to entire (54.55%), entire, lobed to sinuate, lobed, sinuate. ***Profile:*** concave-convex (97.98%), plane-convex. ***Rostrum and antirostrum orientation:*** does not apply (55.56%), in agreement. ***Rostrum:*** developed (76.77%), underdeveloped. ***Antirostrum:*** absent (55.56%), underdeveloped. ***Sulcus acusticus:*** *position:* supramedian; *orientation:* horizontal; *opening:* ostial; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* funnel-like (58.59%), rectangular, elliptic; *cauda*: tubular strongly curved (52.53%), tubular markedly curved, tubular slightly curved.

Significant differences ($p<0.05$) were obtained within some length classes for shape, anterior region, posterior region, dorsal edge, ventral edge, *cauda* morphology, profile and *rostrum* development. During the fish's growth significant differences were found for dorsal edge, *cauda* morphology and *rostrum* development.

Shape indices	Mean ± Sd	Minimum	Maximum
OL/TL (%)	4.31 ± 0.55	3.43	5.56
OH/OL (%)	61.91 ± 4.42	49.07	70.62
OT/OL (%)	18.23 ± 1.84	13.78	22.59
OT/OH (%)	29.50 ± 2.82	23.08	36.58
Circularity	16.01 ± 0.82	14.67	19.01
Rectangularity	0.70 ± 0.01	0.67	0.73

Pomadasys corvinaeformis (Steindachner 1868) **- Plate 31**

Maximum Size:	250 mm (TL) (CERVIGÓN et al., 1992)
Distribution:	Western Atlantic, from Mexico and the Caribbean coasts to Southern Brazil (MENEZES; FIGUEIREDO, 1980; MENEZES et al., 2003)
Habitat:	Coastal waters, over sandy and rocky bottoms. Found in water with low salinity (MENEZES; FIGUEIREDO, 1980; FROESE; PAULY, 2015)
Diet:	Crustaceans, small fish and mollusks (MENEZES; FIGUEIREDO, 1980; DENADAI et al., 2013)
Collection:	979 otoliths 491 fish (TL ranging from 62 to 178 mm)
Sample:	55 left otoliths grouped into 6, 20 mm classes (60 to 160 mm)

Shape: elliptic to oval (78.18%), elliptic. ***Anterior region:*** angled-round (87.27%), angled, round. ***Posterior region:*** angled (74.55%), oblique to angled, angled-round, round, peaked. ***Dorsal edge:*** sinuate to entire (78.18%), lobed to entire, lobed to sinuate, entire. ***Ventral edge:*** sinuate to entire (49.09%), lobed to sinuate, lobed to entire, entire. ***Profile:*** concave-convex. ***Rostrum and antirostrum orientation:*** in agreement (92.73%), does not apply. ***Rostrum:*** underdeveloped (89.09%), developed. ***Antirostrum:*** underdeveloped (63.64%), developed, absent. ***Sulcus acusticus:*** *position:* supramedian; *orientation:* horizontal; *opening:* ostial; *morphology:* heterosulcoid; *colliculum:* heteromorphic; *ostium:* funnel-like (50.91%), rectangular (49.09%); *cauda*: tubular strongly curved (54.55%), tubular markedly curved (45.45%).

Significant differences ($p<0.05$) were obtained within some length classes for shape, anterior region, posterior region, dorsal edge, ventral edge, *rostrum* and *antirostrum* orientation and development. During the fish's development, significant differences were found for posterior region, dorsal edge, *rostrum* and *antirostrum* orientation and *rostrum* development.

Shape indices	Mean ± Sd	Minimum	Maximum
OL/TL (%)	5.41 ± 0.39	4.64	6.26
OH/OL (%)	67.79 ± 2.25	63.62	72.90
OT/OL (%)	22.46 ± 1.77	18.75	27.63
OT/OH (%)	33.17 ± 2.86	27.91	41.14
Circularity	15.97 ± 0.91	14.72	18.95
Rectangularity	0.69 ± 0.01	0.65	0.72

IDENTIFICATION KEYS

The identification keys include genres with two or more species described in the publication.

Family CENTROPOMIDAE

Genus *Centropomus*

Sulcus acusticus opening is pseudo-ostial or para-ostial; *antirostrum* is absent……*C. parallelus*
Sulcus acusticus opening is ostial; *antirostrum* is underdeveloped, absent or developed; ……*C. undecimalis*

Family ACROPOMATIDAE

Genus *Synagrops*

Otolith shape is elliptic to trapezoidal; *cauda* is tubular markedly to tubular curled……*S. bellus*
Otolith shape is elliptic or rhomboidal; *cauda* is tubular straight to strongly curved……*S. spinosus*

Family CARANGIDAE

Genus *Trachinotus*

Smaller otoliths of both species are very similar.
Bigger otoliths have an *excisura* at the *sulcus acusticus* opening; *Antirostrum* underdeveloped…….……*T. carolinus*
Bigger otoliths do not have an *excisura* at the *sulcus acusticus* opening; *Antirostum* absent…..……*T. falcatus*

Family LUTJANIDAE

Genus *Lutjanus*

Posterior region is angled or oblique; *ostium* is frequently funnel-like or elliptic……..*L. analis*
Posterior region in most cases round; *ostium* is frequently rectangular…….……...…*L. synagris*

Family GERREIDAE

Genus *Eucinostomus*

1. *Antirostrum* absent.....*Eucinostomus argenteus*
Antirostrum developed.....2
2. *Cauda* tubular markedly curved or tubular curled.....*Eucinostomus melanopterus*
Cauda tubular slightly curved or tubular strongly curved.....*Eucinostomus gula*

ACKNOWLEDGMENTS

Special thanks are due to: Thiago José Balbi and Nicolas Nathan dos Santos for some otolith measurements and to Alexandre Arackawa, Laura Montserrat and Michelle Konig for the otolith 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

AGUIAR, J.B.S. & M.J.B. FILOMENO. 1995. Hábitos alimentares de *Orthopristis ruber* (Cuvier, 1830), (Osteichthyes – Haemulidae) na Lagoa da Conceição, SC, Brasil. Biotemas 8 (2): 41-49.

ANDREOLI, T. B.; BEGOSSI, A.; CLAUZET, M. Ethnoecology of Lutjanidae (snappers) in a small-scale fishery (Bertioga – SP). UNISANTA BioSci., v. 3, n. 1, p. 15-20, 2014.

BERNARDES, R. A.; FIGUEIREDO, J. L.; RODRIGUES, A. R.; FISCHER, L. G.; VOOREN, C. M.; HAIMOVICI, M.; ROSSI-WONGTSCHOWSKI, C. L. D. B. Peixes da Zona Exclusiva da região Sudeste-Sul do Brasil: levantamento com armadilhas, pargueiras e rede de arrasto de fundo (Série Documentos REVIZEE). São Paulo: EDUSP, 2005. 304 p.

CARVALHO-FILHO, A. Peixes da Costa Brasileira. 2ª. ed. São Paulo: Marca d'Água, 1992. 304 p.

CERVIGÓN, F.; CIPRIANI, R.; FISCHER, L. W.; GARIBALDI, L.; HENDRICKX, M.; LEMUS, A. J.; MÁRQUEZ, R.; POUTIERS, J. M.; ROBAINA, G.; RODRIQUEZ, B. Guia de campo de las espécies comerciales marinas y de aguas salobres de la costa septentrional de Sur América. Roma: FAO, 1992. 513 p.

DENADAI, M. R.; SANTOS, F. B.; BESSA, E.; FERNANDEZ, W. S.; LORCA, L.; TURRA, A. Population biology and diet of *Pomadasys corvinaeformis* (Perciformes: Pomadasyidae) in Caraguatatuba Bay, Southeastern Brazil. Rev. Biol. Trop., v. 61, n. 4, p. 1947-1954, 2013.

DENADAI, M. R.; SANTOS, F. B.; BESSA, E.; FERNANDEZ, W. S.; PASCHOAL, C. C.; TURRA, A. Diets of *Eucinostomus argenteus* (Baird & Girard, 1855) and *Diapterus rhombeus* (Cuvier, 1829) (Perciformes: Gerreidae) in Caraguatatuba Bay, southeastern Brazil. Pan-American Journal of Aquatic Sciences, v.7, p.143-155, 2012.

ESCHMEYER, W. N. CATALOG OF FISHES: GENERA, SPECIES, REFERENCES. Available at: <http://research.calacademy.org/research/ichthyology/catalog/fishcatmain.asp 2015>. Acessed in 05/11/2015.

FIGUEIREDO, J. L.; MENEZES, N. A. Manual de peixes marinhos do Sudeste do Brasil. III. Teleostei (2). São Paulo: Museu de Zoologia da USP, 1980. 90 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: Imprensa Oficial do Estado de São Paulo, 2002. 242 p.

FONSECA, J. F. Estudo da dieta do *Lutjanus synagris* (Linnaeus, 1758) e *Ocyrus chrysurus* (Bloch, 1791), Teleostei: Perciformes: Lutjanidae, no banco dos abrolhos, Bahia, Brasil e pesca das principais espécies de lutjanídeos e serranídeos na região. 2009. Dissertação (Mestrado) - Universidade Estadual Paulista, Instituto de Biociências. Rio Claro, 2009. 146 f.

FREITAS, M. O.; ABILHOA, V.; SILVA, G. H. C. Feeding ecology of *Lutjanus analis* (Teleostei: Lutjanidae) from Abrolhos Bank, Eastern Brazil. Neotrop. Ichthyol., v. 9, n. 2, p. 411-418, 2011.

FROESE, R.; PAULY. D. Fishbase: World Wide Web electronic publication. Available from: <http://www.fishbase.org>. Acessed in 20/05/2013.

GEFFEN, A. J.; MORALES-NIN, B. Fish otoliths: national treasures that can enrich ICES science. ICES Insight, v. 50. p. 44-49, 2013.

HAIMOVICI, M.; ROSSI-WONGTSCHOWSKI, C. L. D. B.; BERNARDES, R. A.; FISCHER, L. G.; VOOREN, C. M.; DOS SANTOS, R. A.; RODRIGUES, A. R.; SANTOS, S. Prospecção pesqueira de espécies demersais com rede de arrasto-de-fundo na Região Sudeste-Sul do Brasil. São Paulo: Instituto Oceanográfico-USP/Série Documentos REVIZEE, 2008.

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.

MENEZES, N. A.; FIGUEIREDO, J. L. Manual de peixes marinhos do Sudeste do Brasil. IV. Teleostei (3). São Paulo: Museu de Zoologia da Universidade de São Paulo, 1980. 96 p.

NASCIMENTO, M. C. Alimentação de peixes na plataforma continental externa e talude superior na região sudeste-sul do Brasil. 2006. Dissertação (Mestrado) - Universidade Estadual Paulista, Instituto de Biociências. Rio Claro, 2006. 89 f.

PAIVA, A. C. G.; CHAVES, P. T. C.; ARAÚJO, M. E. Estrutura e organização trófica da ictiofauna de águas rasas em um estuário tropical. Rev. Bras. Zool., v. 25, n. 4, p. 647-661, 2008.

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. (special issue1), p. 1-103, 2014.

SOARES, L. S. H.; MUTO, E. Y.; GASPARRO, M. R.; ROSSI-WONGTSCHOWSKI, C. L. D. B. Organização trófica dos peixes. In: PIRES-VANIN, A. M. S. (Org.). Oceanografia de um ecossistema subtropical: plataforma de São Sebastião. São Paulo: EDUSP, 2008. p. 406-425.

TONINI, W. C. T.; BRAGA, L. G. T; VILA NOVA, D. L. D. Dieta de juvenis do robalo *Centropomus parallelus* Poey, 1860 no sul da Bahia, Brasil. Bol. Inst. Pesca, v. 33, n. 1, p. 85-91, 2007.

VASKE-JÚNIOR, T.; TEIXEIRA, A. F.; GADIG, O. B. F. Aspectos biológicos do peixe-olhudo-dentinho, *Synagrops bellus* (Actinopterygii: Acropomatidae), da plataforma externa e talude superior do estado de São Paulo, Brasil. Panam. J. Aquat. Sci., v. 4, n. 2, p. 179-187, 2009.

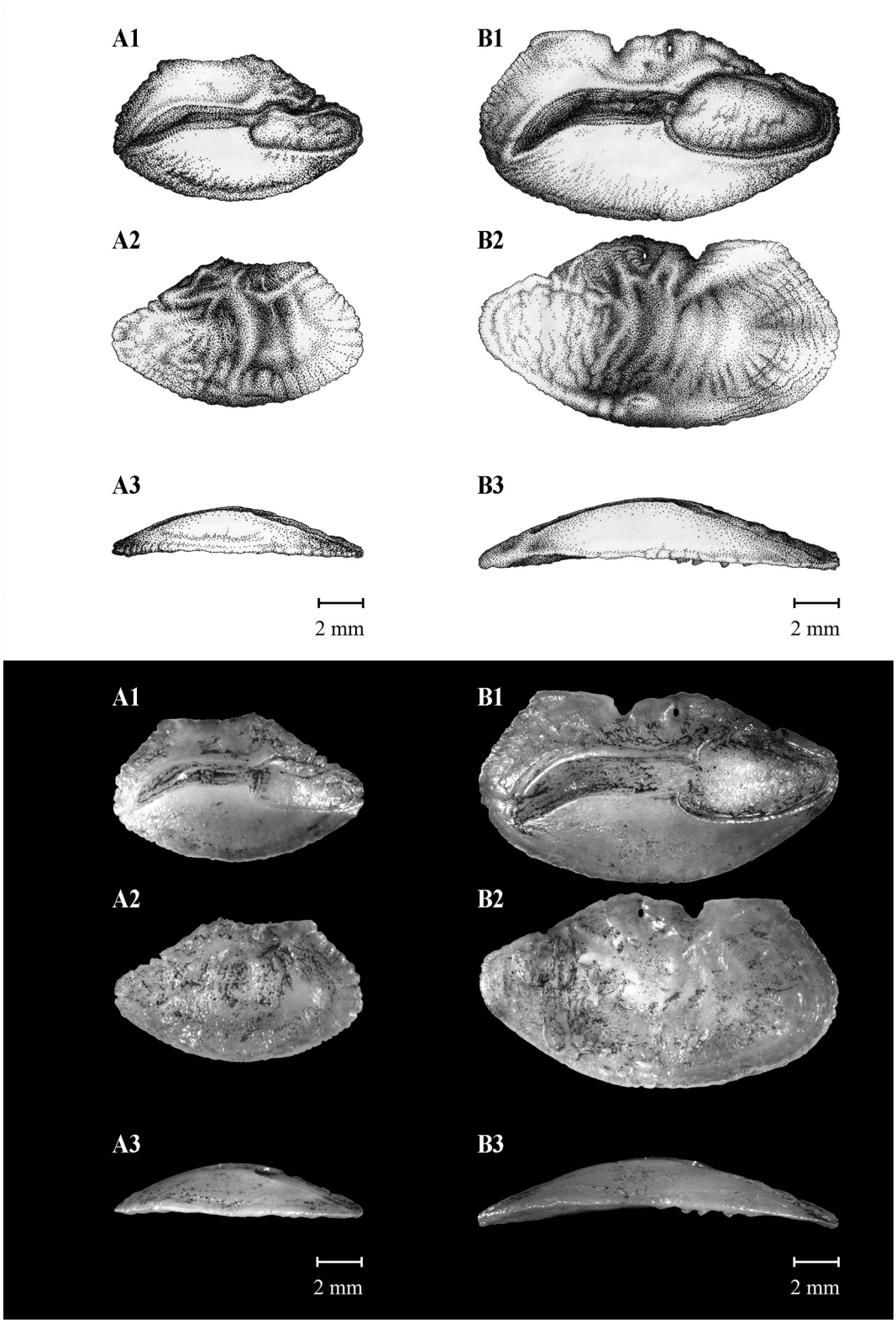

Plate 1. Illustrations (above) and photographs (below) of *Centropomus parallelus* otoliths from fish with total lengths: A. 246 mm; B. 405 mm. The medial face is shown in A1, B1; the lateral face in A2, B2; and the ventral profile in A3, B3 (Illustration and Photos: Alexandre Arackawa).

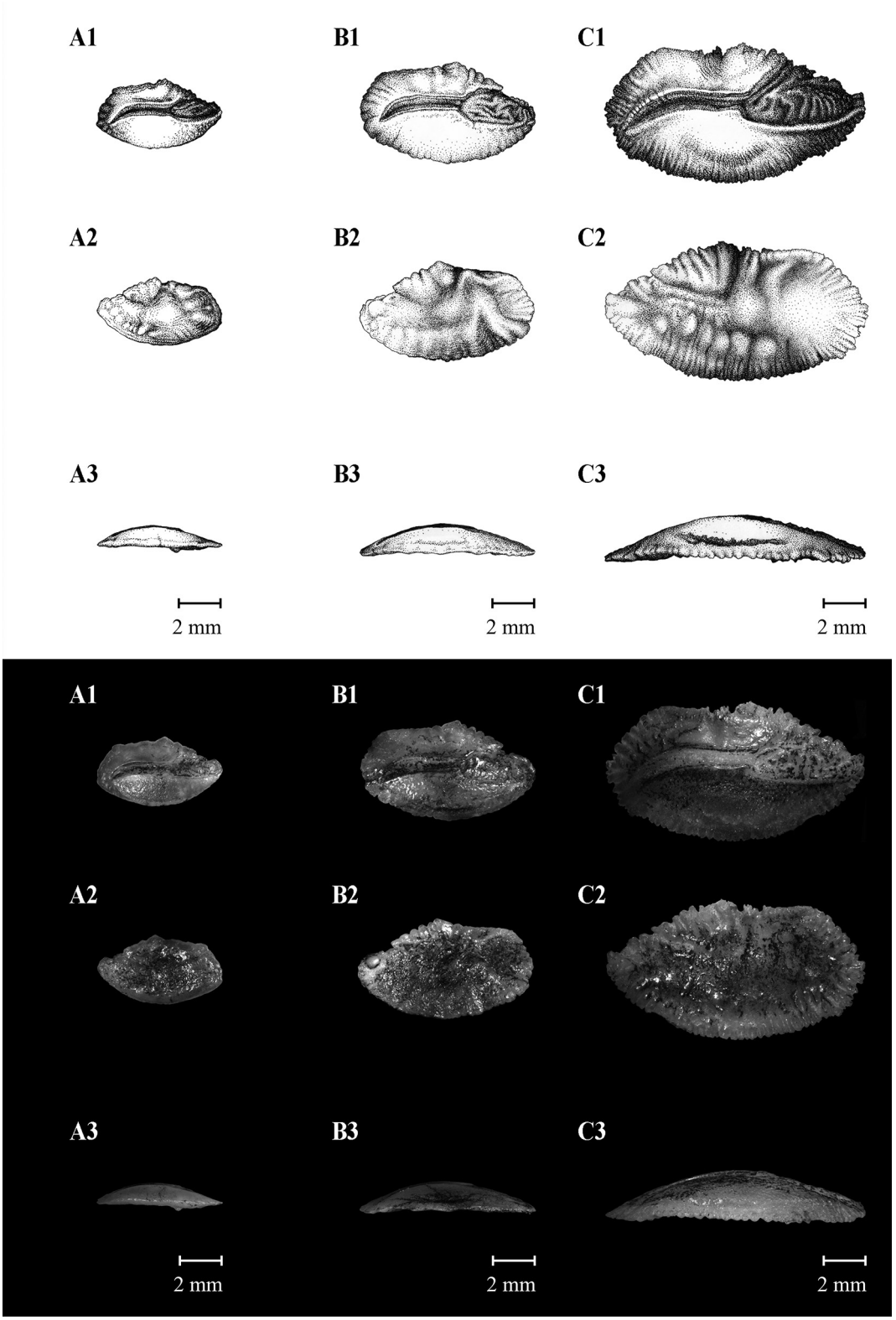

Plate 2. Illustrations (above) and photographs (below) of *Centropomus undecimalis* otoliths from fish with total lengths: A. 146 mm; B. 250 mm; C. 382 mm. The medial face is shown in A1, B1, C1; the lateral face in A2, B2, C2; and the ventral profile in A3, B3, C3 (Illustration and Photos: Alexandre Arackawa).

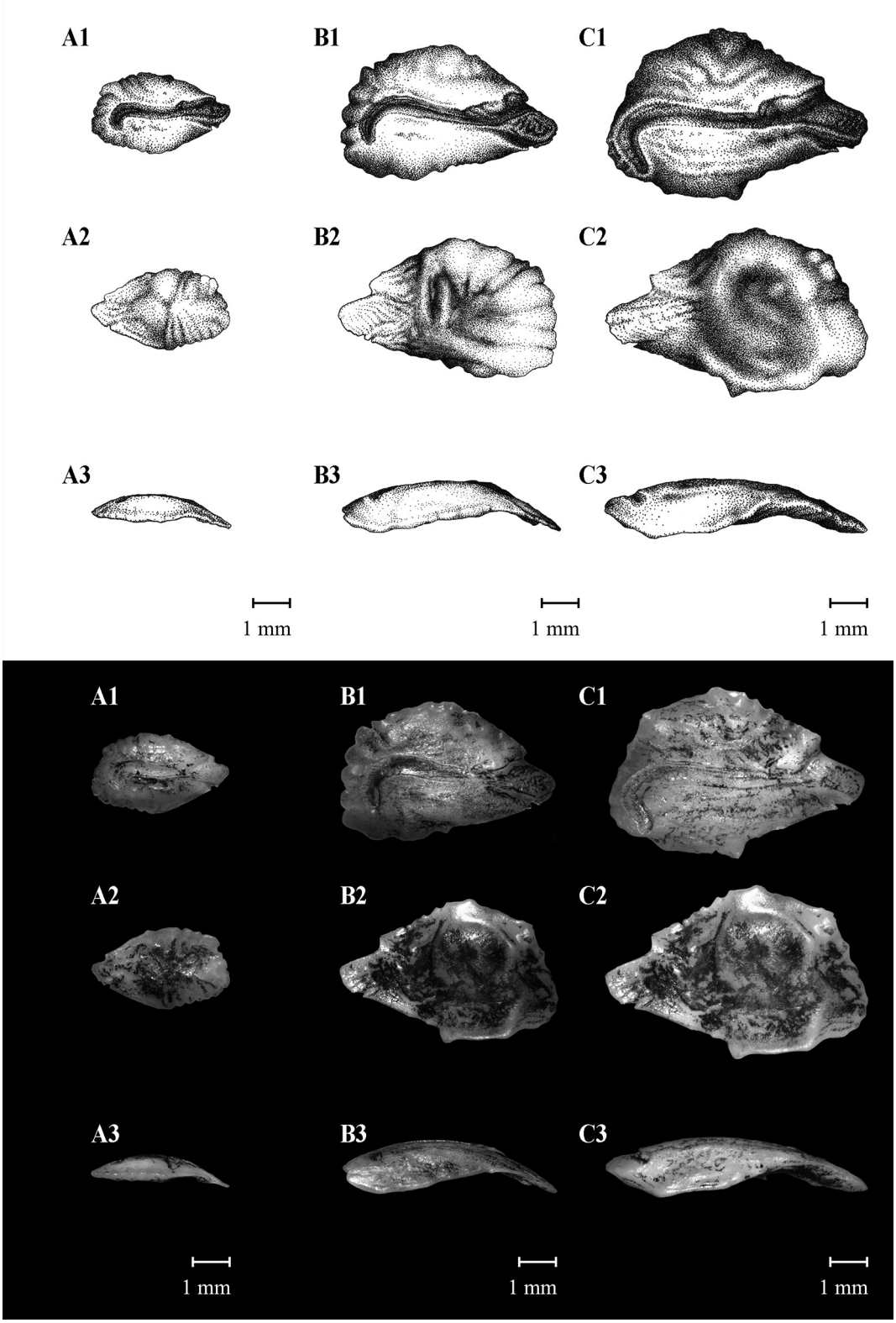

Plate 3. Illustrations (above) and photographs (below) of *Synagrops bellus* otoliths from fish with total lengths: A. 79 mm; B. 177 mm; C. 290 mm. The medial face is shown in A1, B1, C1; the lateral face in A2, B2, C2; and the ventral profile in A3, B3, C3 (Illustration and Photos: Alexandre Arackawa).

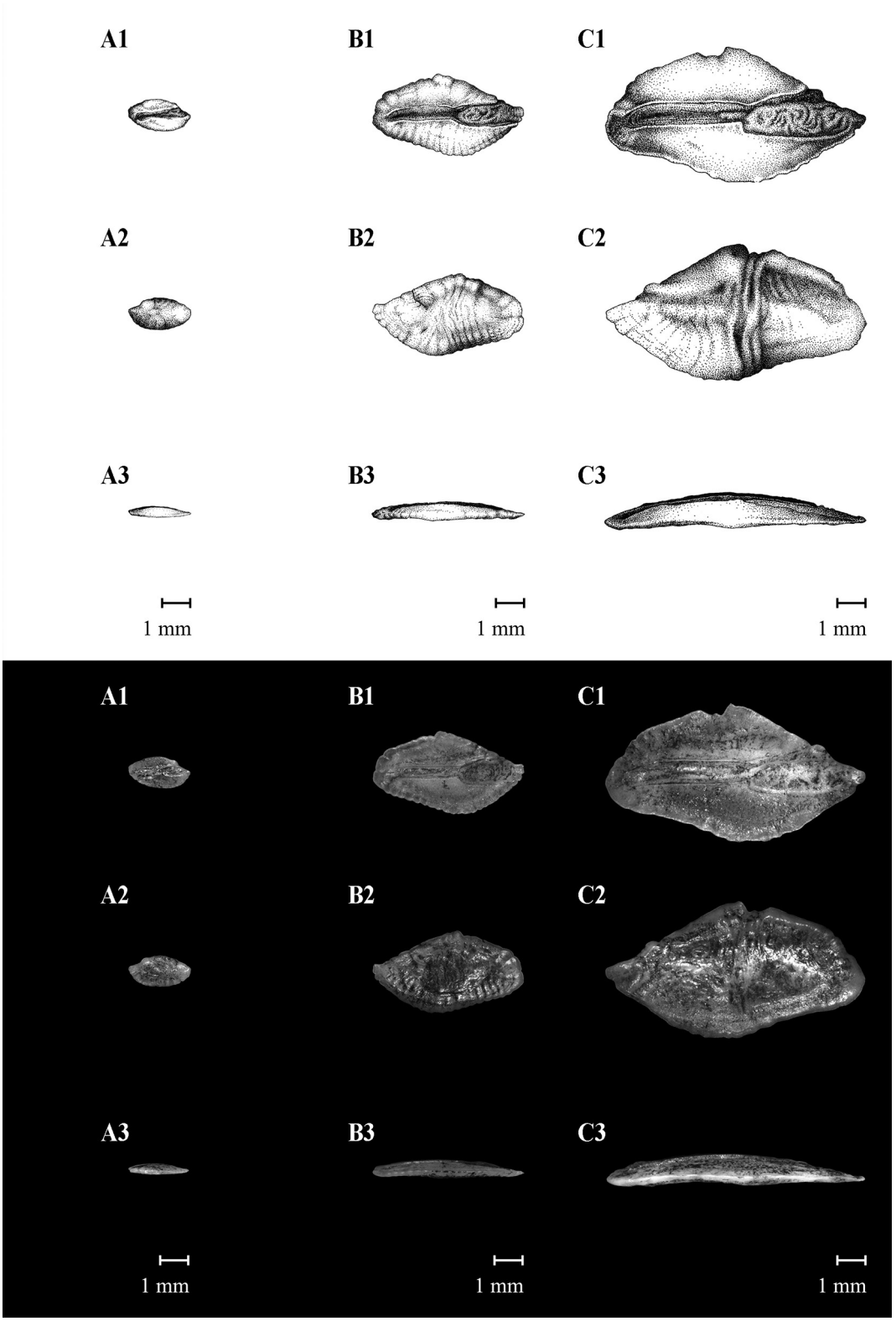

Plate 4. Illustrations (above) and photographs (below) of *Synagrops spinosus* otoliths from fish with total lengths: A. 51 mm; B. 85 mm; C. 158 mm. The medial face is shown in A1, B1, C1; the lateral face in A2, B2, C2; and the ventral profile in A3, B3, C3 (Illustration and Photos: Alexandre Arackawa).

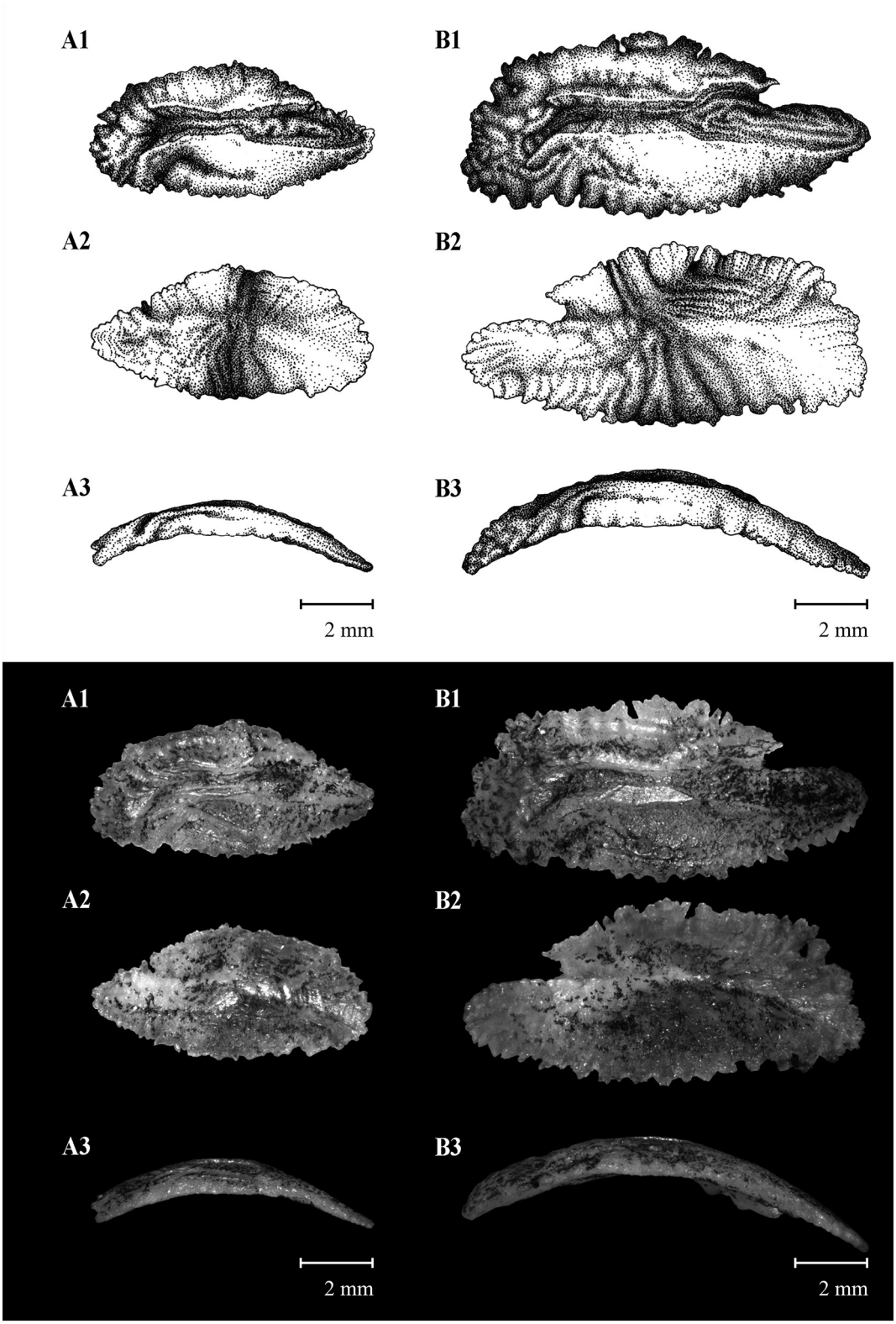

Plate 5. Illustrations (above) and photographs (below) of *Epinephelus marginatus* otoliths from fish with total lengths: A. 210 mm; B. 308 mm. The medial face is shown in A1, B1; the lateral face in A2, B2; and the ventral profile in A3, B3 (Illustration and Photos: Alexandre Arackawa).

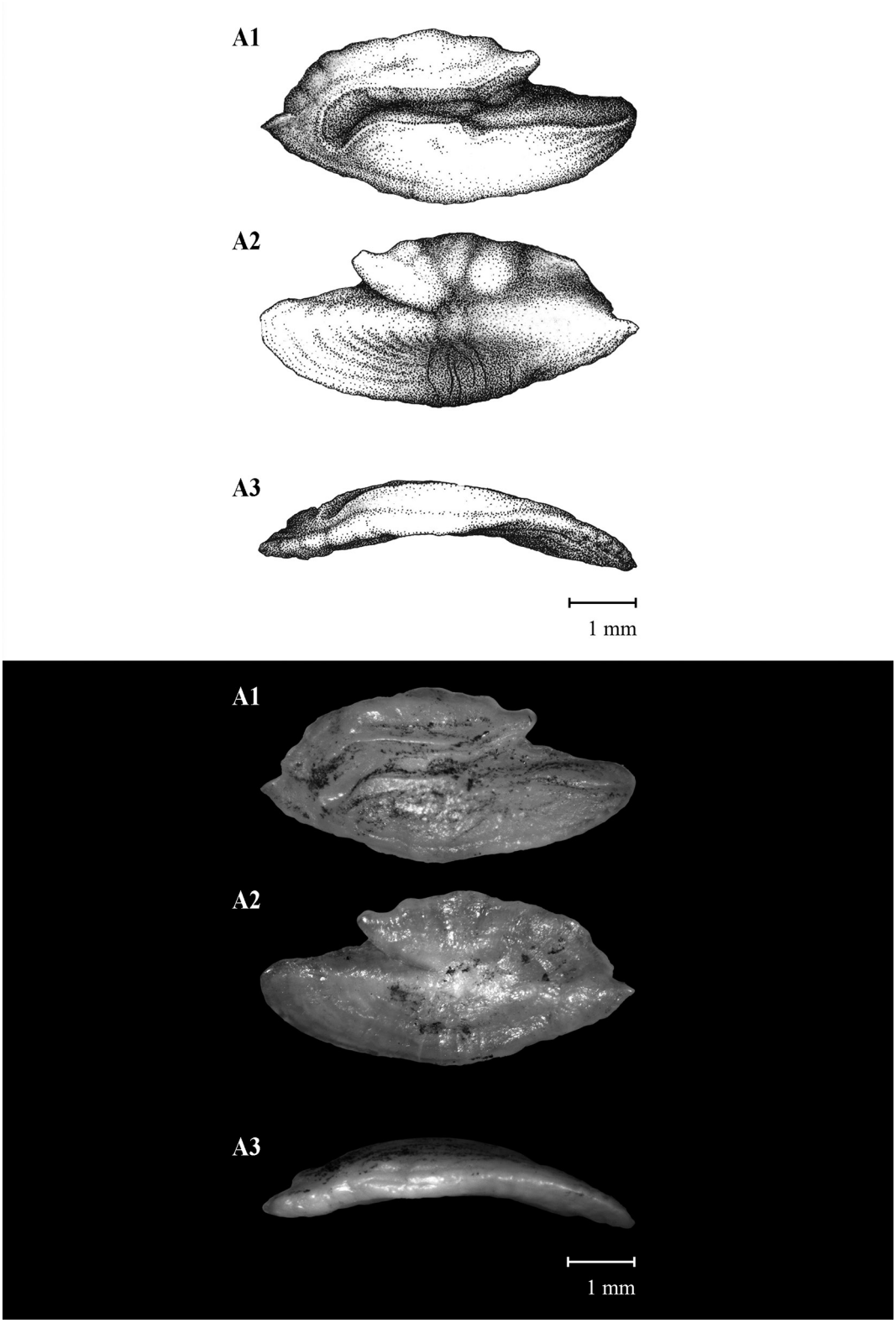

Plate 6. Illustrations (above) and photographs (below) of *Serranus phoebe* otolith from fish with total length: A. 167 mm. The medial face is shown in A1; the lateral face in A2; and the ventral profile in A3 (Illustration and Photos: Alexandre Arackawa).

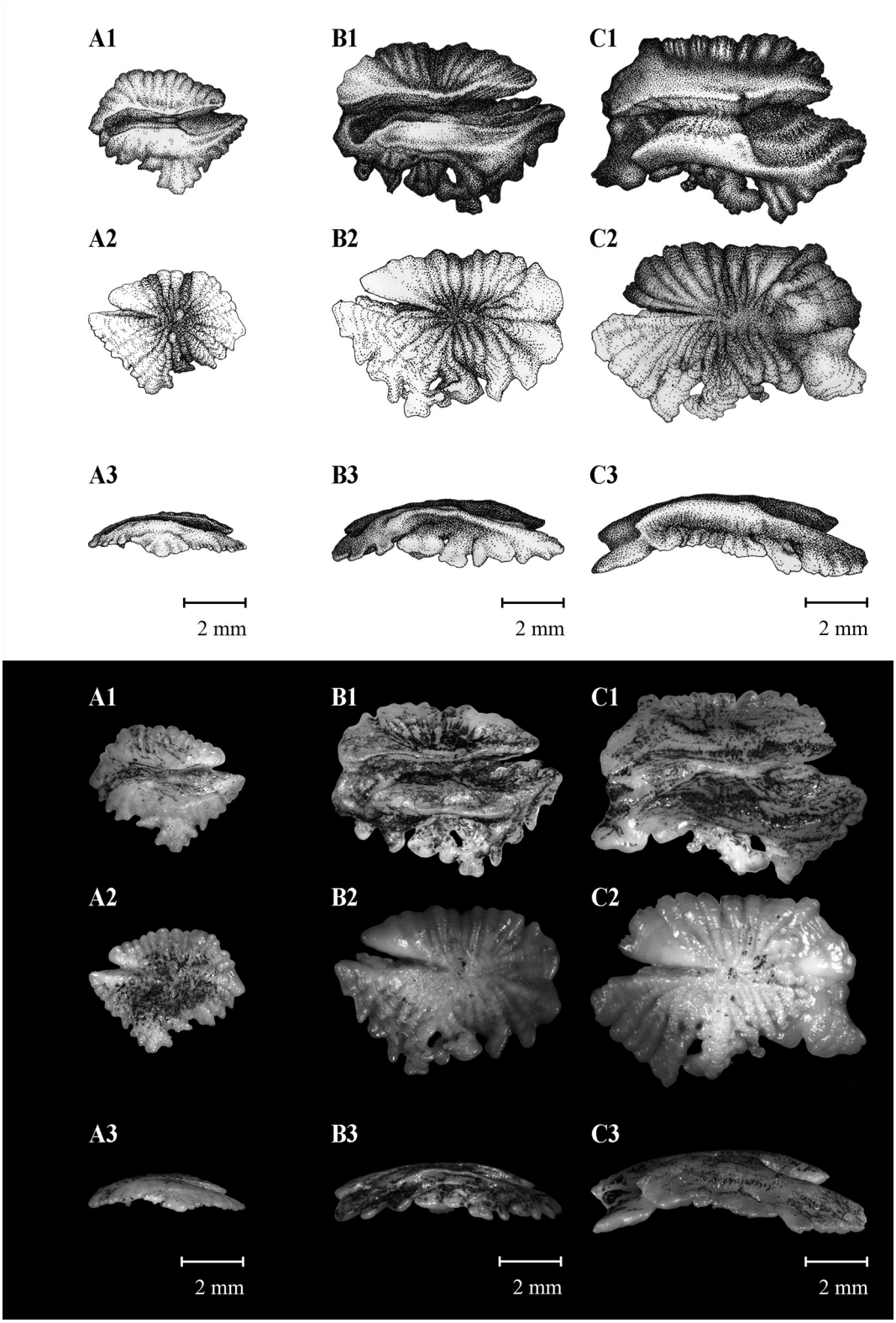

Plate 7. Illustrations (above) and photographs (below) of *Heteropriacanthus cruentatus* otoliths from fish with total lengths: A. 166 mm; B. 330 mm; C. 571 mm. The medial face is shown in A1, B1, C1; the lateral face in A2, B2, C2; and the ventral profile in A3, B3, C3 (Illustration and Photos: Alexandre Arackawa).

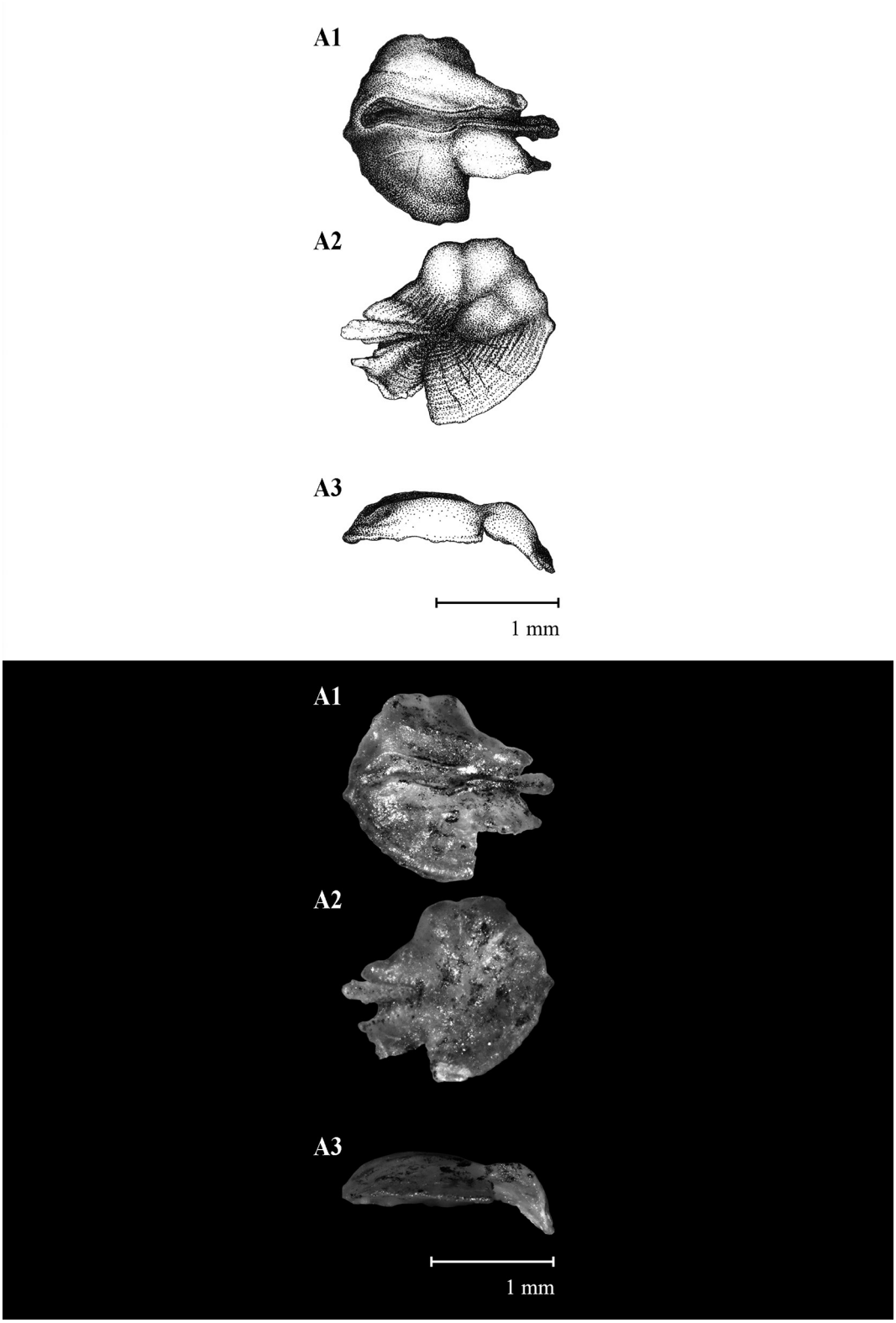

Plate 8. Illustrations (above) and photographs (below) of *Priacanthus arenatus* otolith from fish with total length: A. 78 mm. The medial face is shown in A1; the lateral face in A2; and the ventral profile in A3 (Illustration and Photos: Alexandre Arackawa).

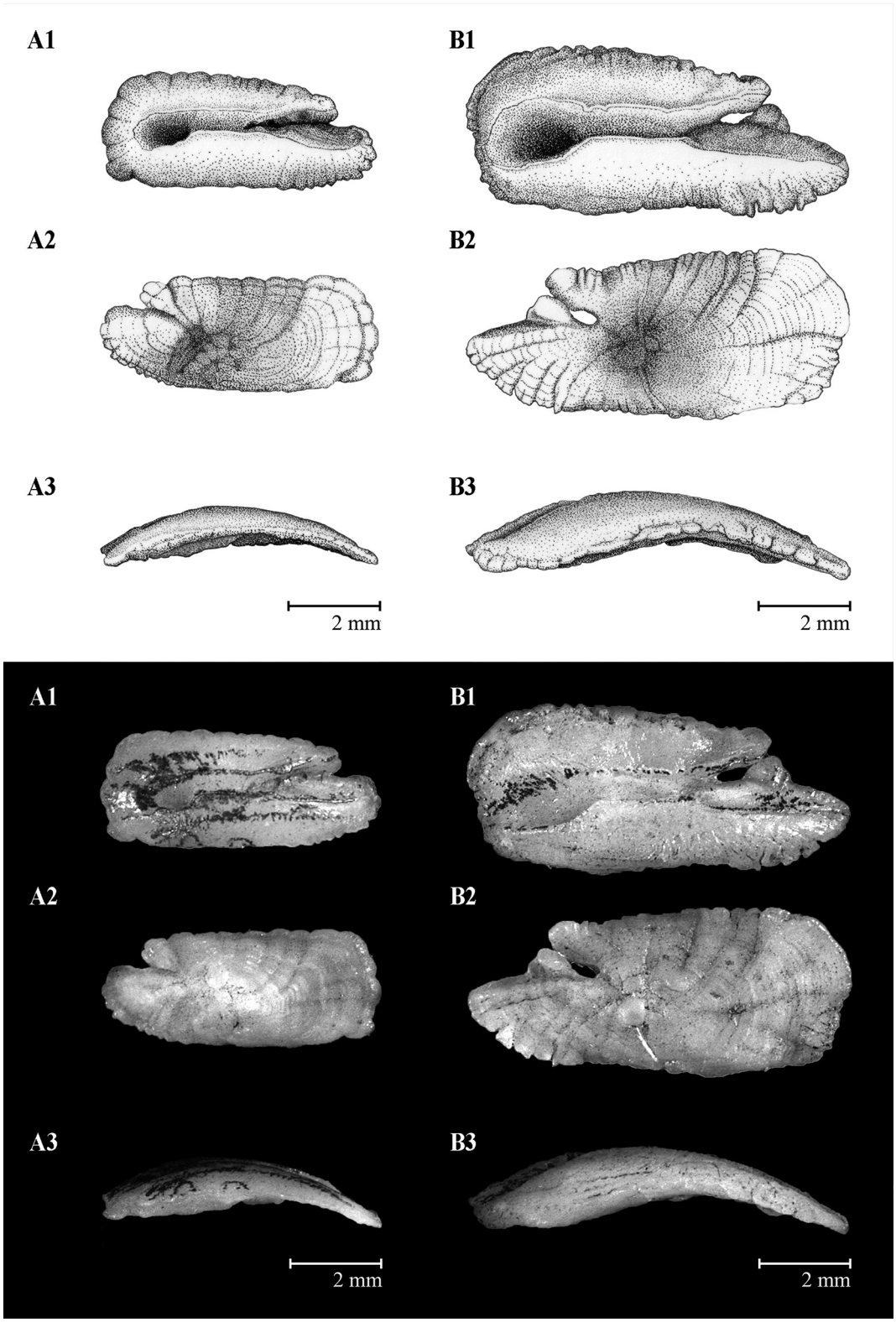

Plate 9. Illustrations (above) and photographs (below) of *Caulolatilus chrysops* otoliths from fish with total lengths: A. 283 mm; B. 469 mm. The medial face is shown in A1, B1; the lateral face in A2, B2; and the ventral profile in A3, B3 (Illustration: Laura Montserrat; Photos: Cesar Santificetur).

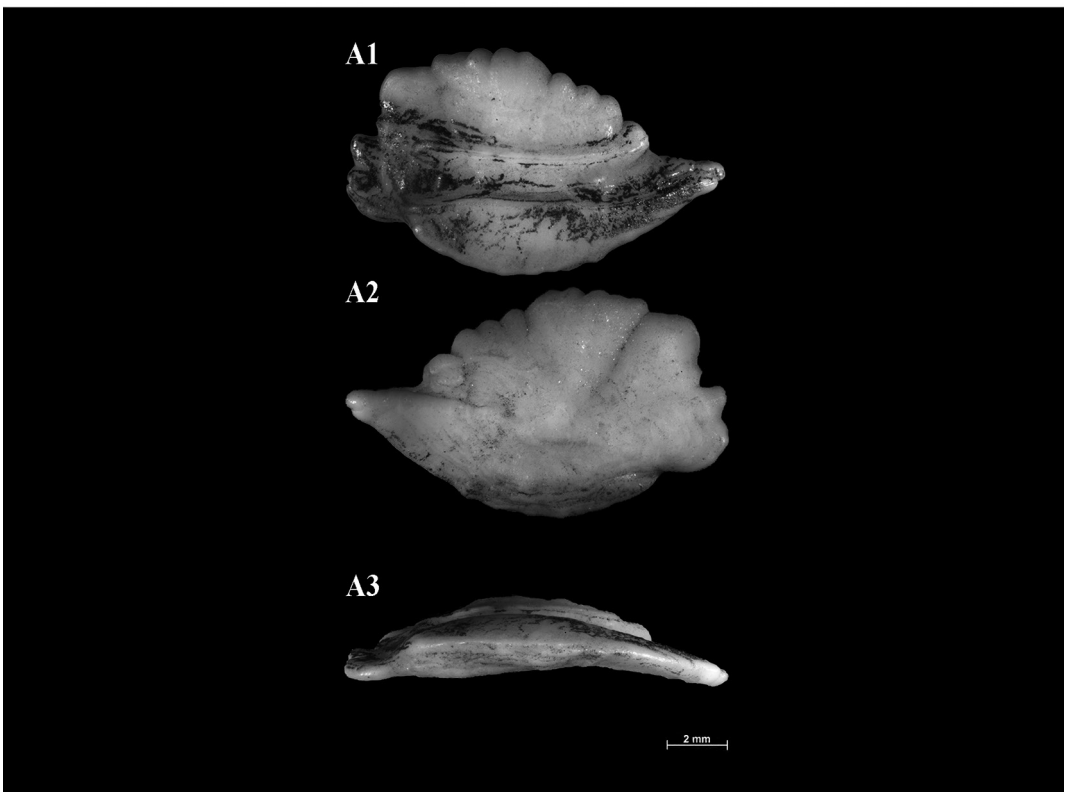

Plate 10. Illustrations (above) and photographs (below) of *Lopholatilus villarii* otolith from fish with total length: A. 342 mm. The medial face is shown in A1; the lateral face in A2; and the ventral profile in A3 (Illustration: Laura Montserrat; Photos: Cesar Santificetur).

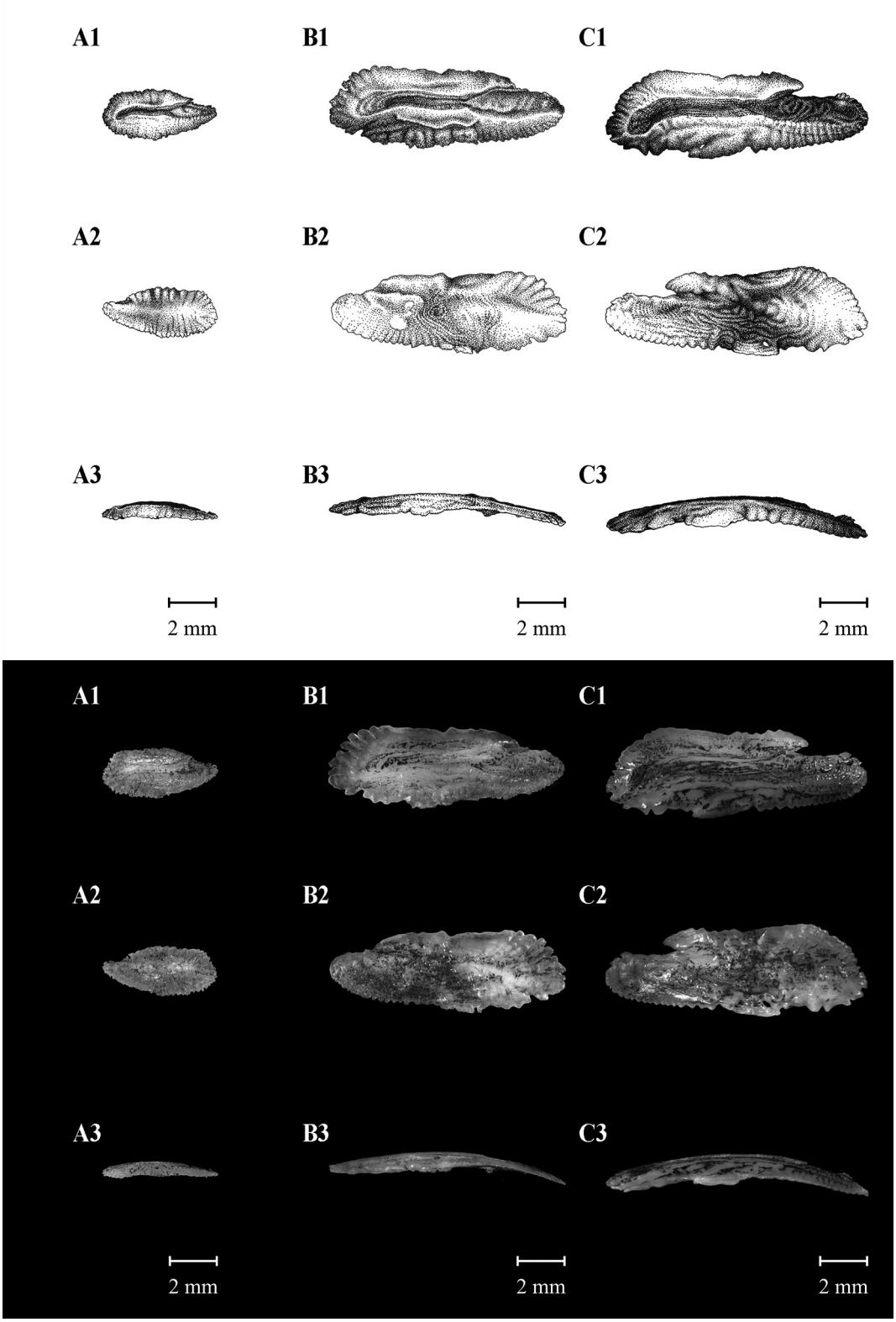

Plate 11. Illustrations (above) and photographs (below) of *Pomatomus saltatrix* otoliths from fish with total lengths: A. 121 mm; B. 314 mm; C. 471 mm. The medial face is shown in A1, B1, C1; the lateral face in A2, B2, C2; and the ventral profile in A3, B3, C3 (Illustration and Photos: Alexandre Arackawa).

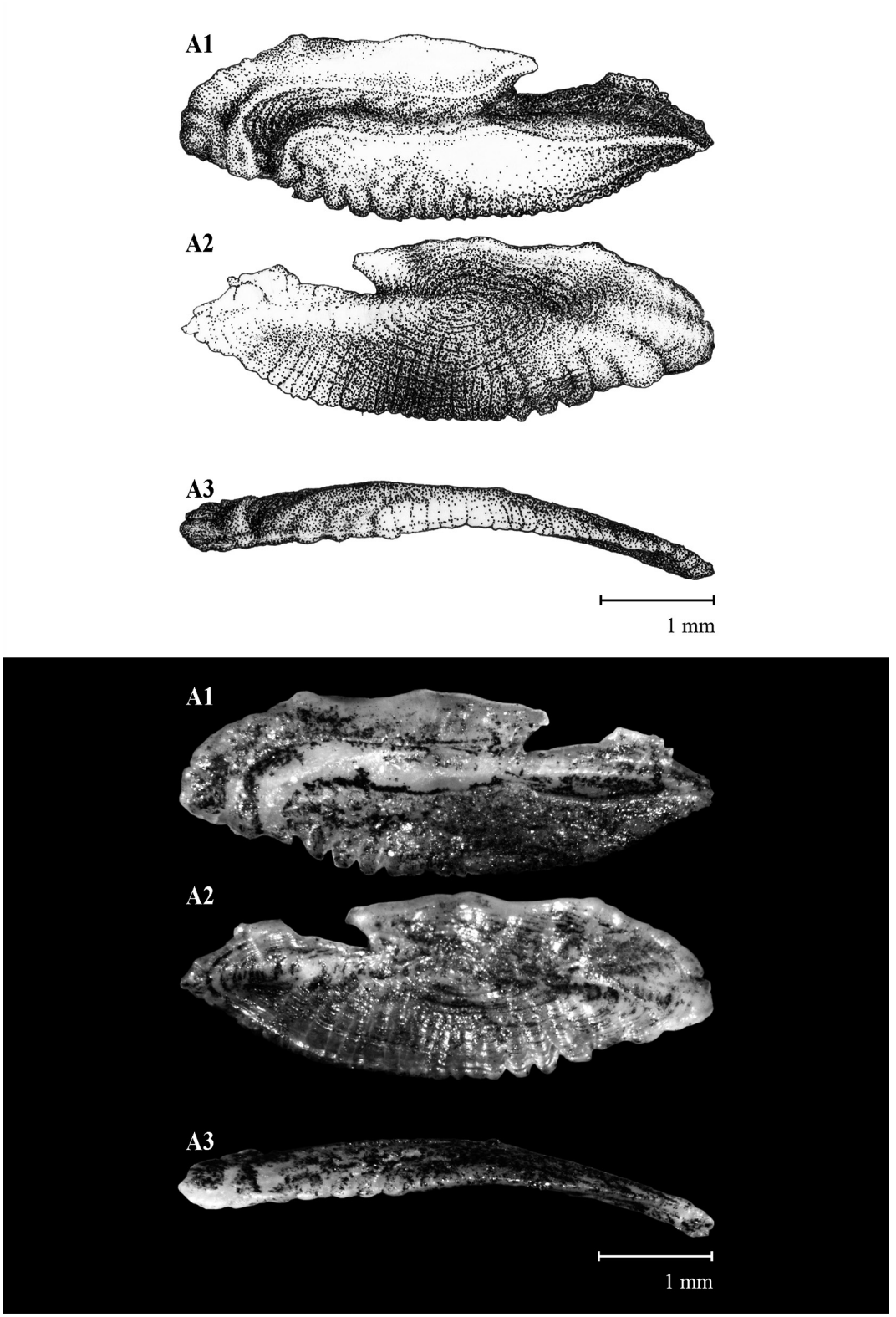

Plate 12. Illustrations (above) and photographs (below) of *Caranx hippos* otolith from fish with total length: A. 205 mm. The medial face is shown in A1; the lateral face in A2; and the ventral profile in A3 (Illustration and Photos: Alexandre Arackawa).

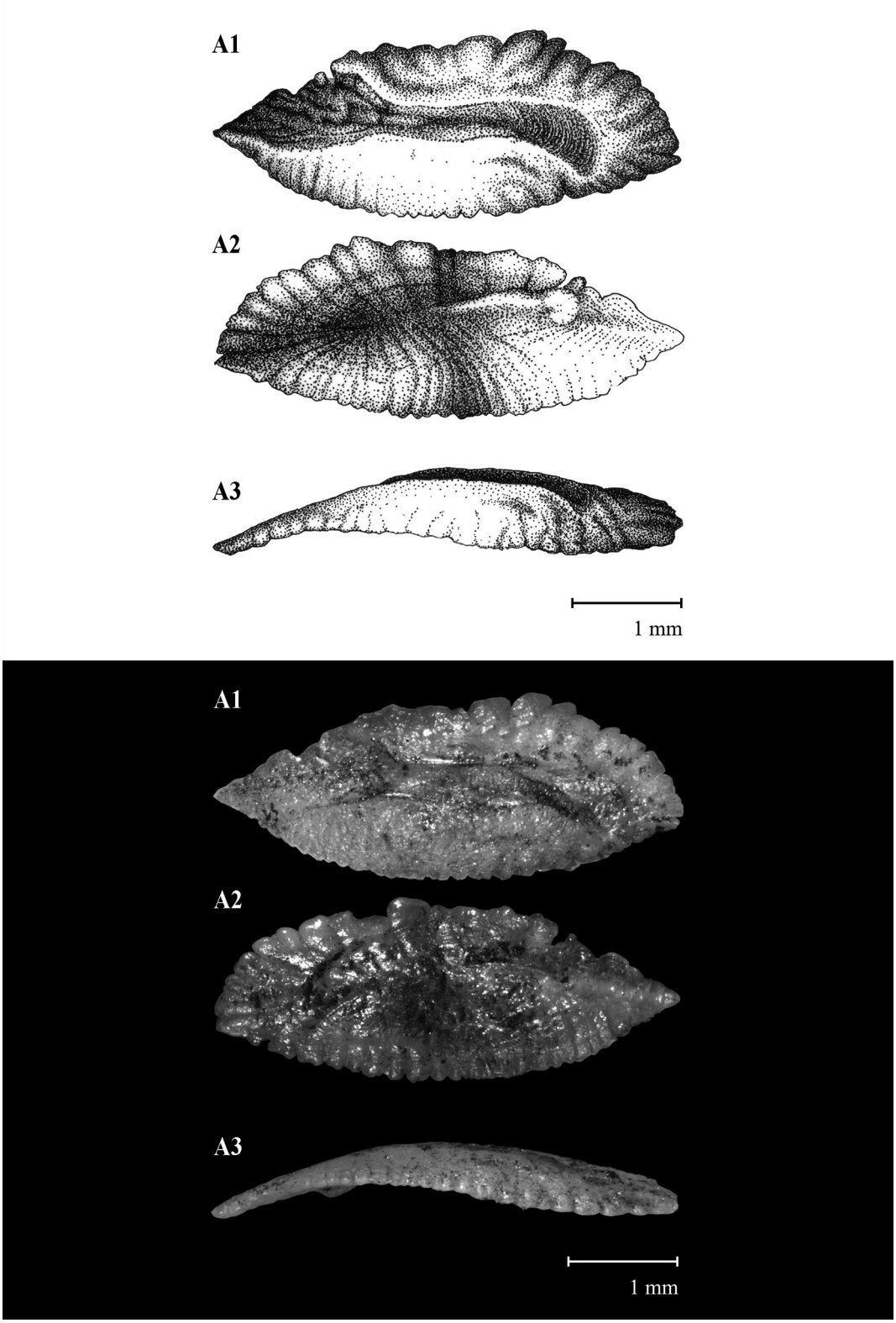

Plate 13. Illustrations (above) and photographs (below) of *Caranx latus* otolith from fish with total length: A. 171 mm. The medial face is shown in A1; the lateral face in A2; and the ventral profile in A3 (Illustration and Photos: Alexandre Arackawa).

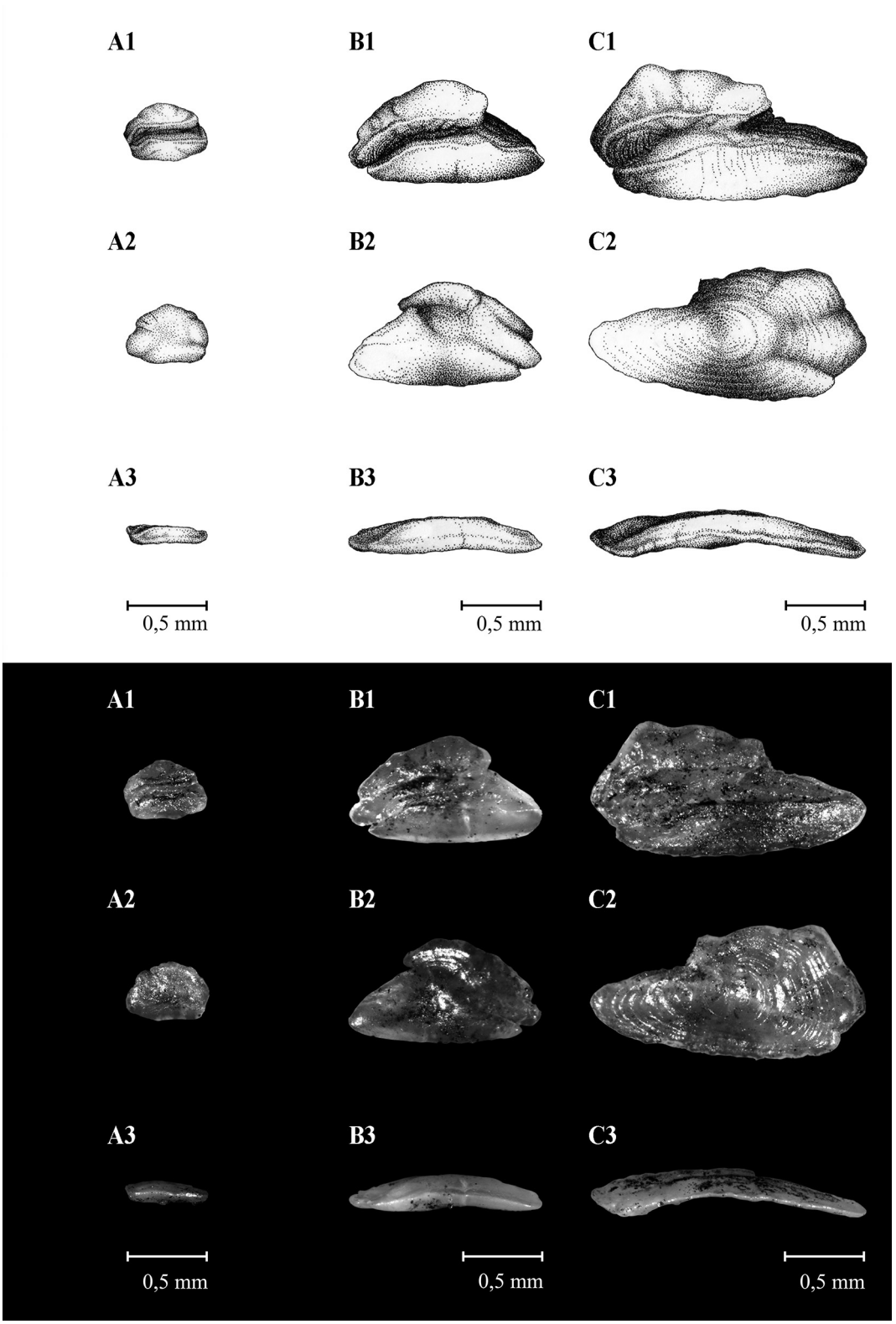

Plate 14. Illustrations (above) and photographs (below) of *Oligoplites saurus* otoliths from fish with total lengths: A. 32 mm; B. 80 mm; C. 142 mm. The medial face is shown in A1, B1, C1; the lateral face in A2, B2, C2; and the ventral profile in A3, B3, C3 (Illustration and Photos: Alexandre Arackawa).

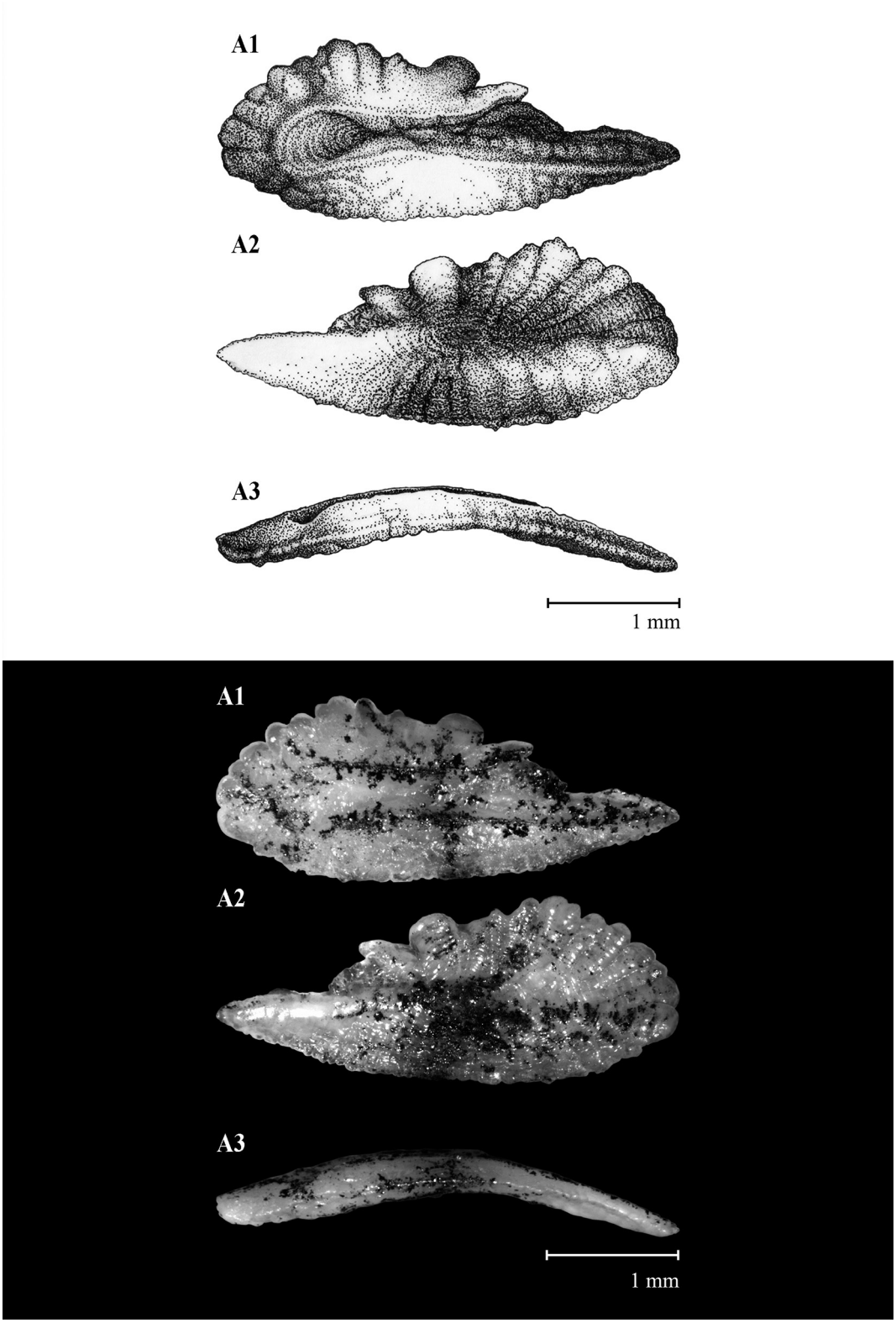

Plate 15. Illustrations (above) and photographs (below) of *Seriola fasciata* otolith from fish with total length: A. 205 mm. The medial face is shown in A1; the lateral face in A2; and the ventral profile in A3 (Illustration and Photos: Alexandre Arackawa).

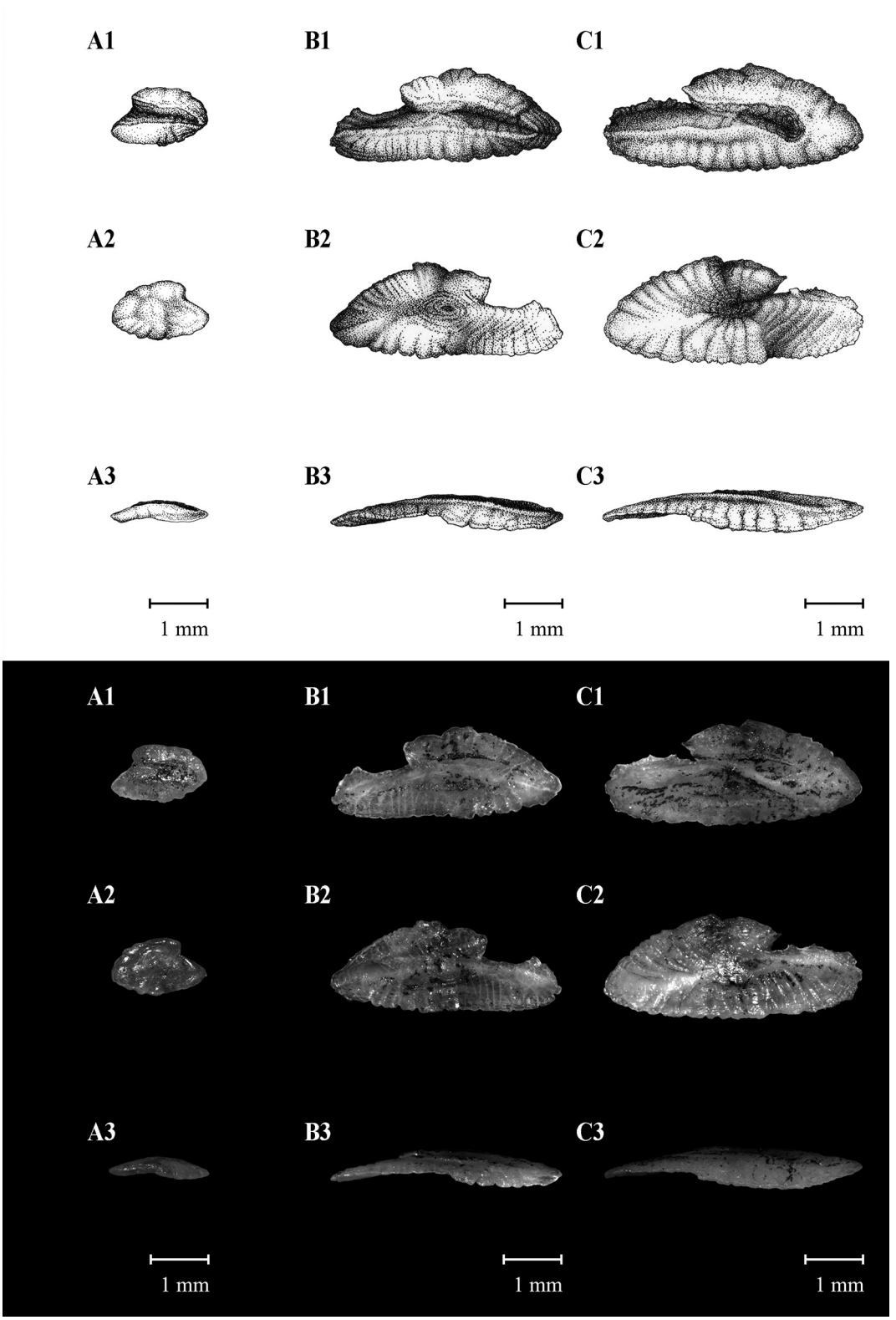

Plate 16. Illustrations (above) and photographs (below) of *Trachinotus carolinus* otoliths from fish with total lengths: A. 33 mm; B. 184 mm; C. 252 mm. The medial face is shown in A1, B1, C1; the lateral face in A2, B2, C2; and the ventral profile in A3, B3, C3 (Illustration and Photos: Alexandre Arackawa).

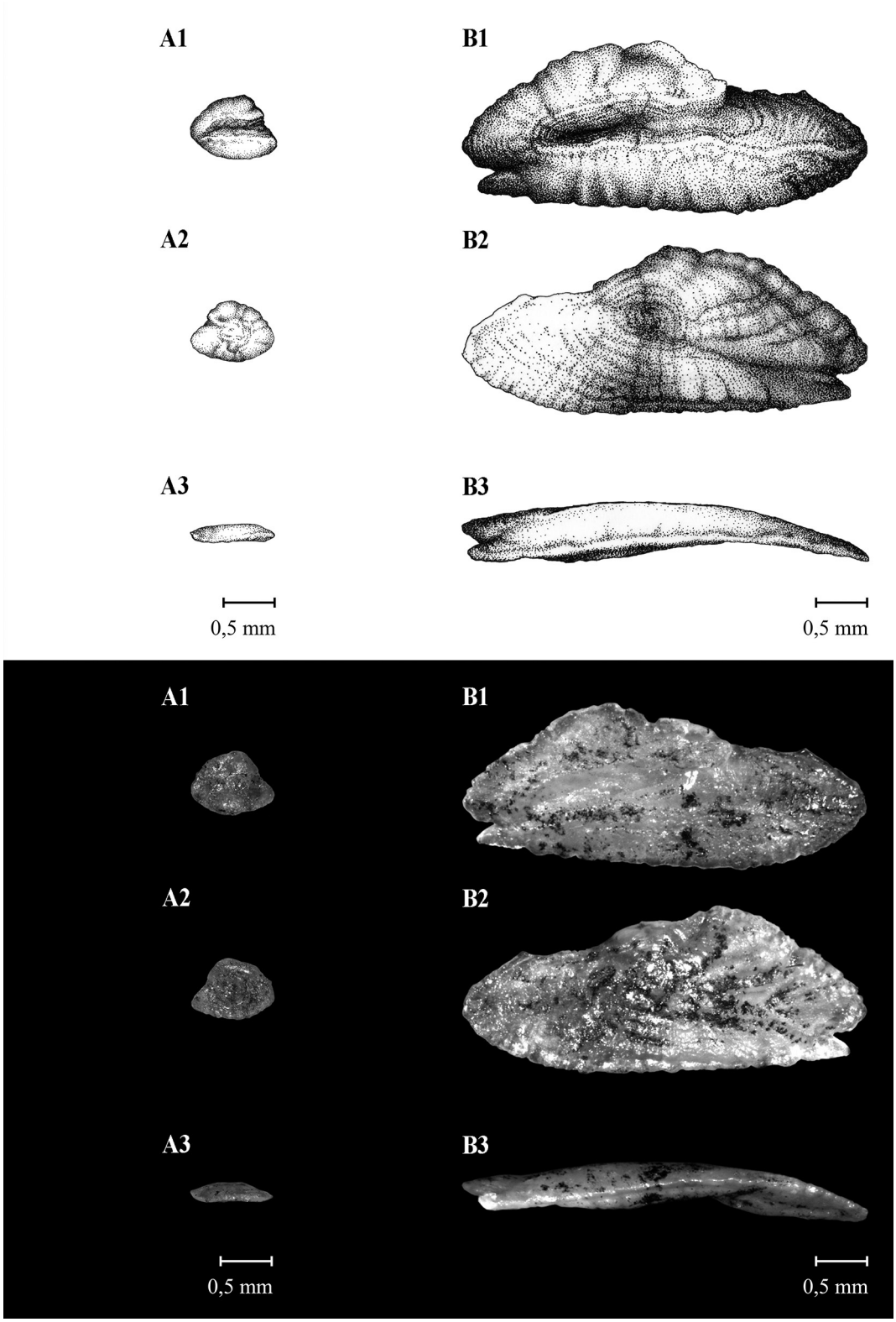

Plate 17. Illustrations (above) and photographs (below) of *Trachinotus falcatus* otoliths from fish with total lengths: A. 25 mm; B. 163 mm. The medial face is shown in A1, B1; the lateral face in A2, B2; and the ventral profile in A3, B3 (Illustration and Photos: Alexandre Arackawa).

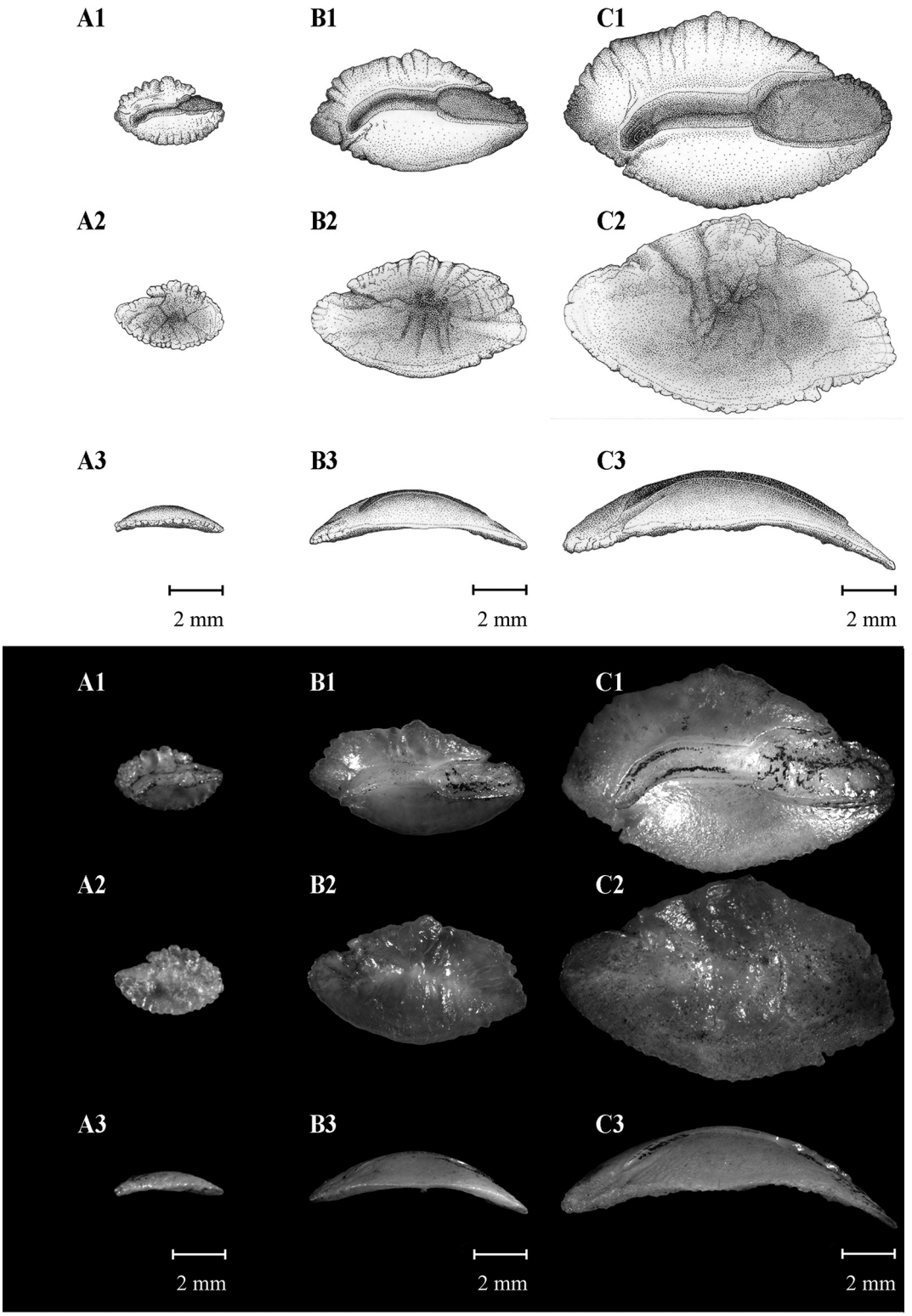

Plate 18. Illustrations (above) and photographs (below) of *Lutjanus analis* otoliths from fish with total lengths: A. 45 mm; B. 209 mm; C. 363 mm. The medial face is shown in A1, B1, C1; the lateral face in A2, B2, C2; and the ventral profile in A3, B3, C3 (Illustration: Laura Montserrat; Photos: Cesar Santificetur).

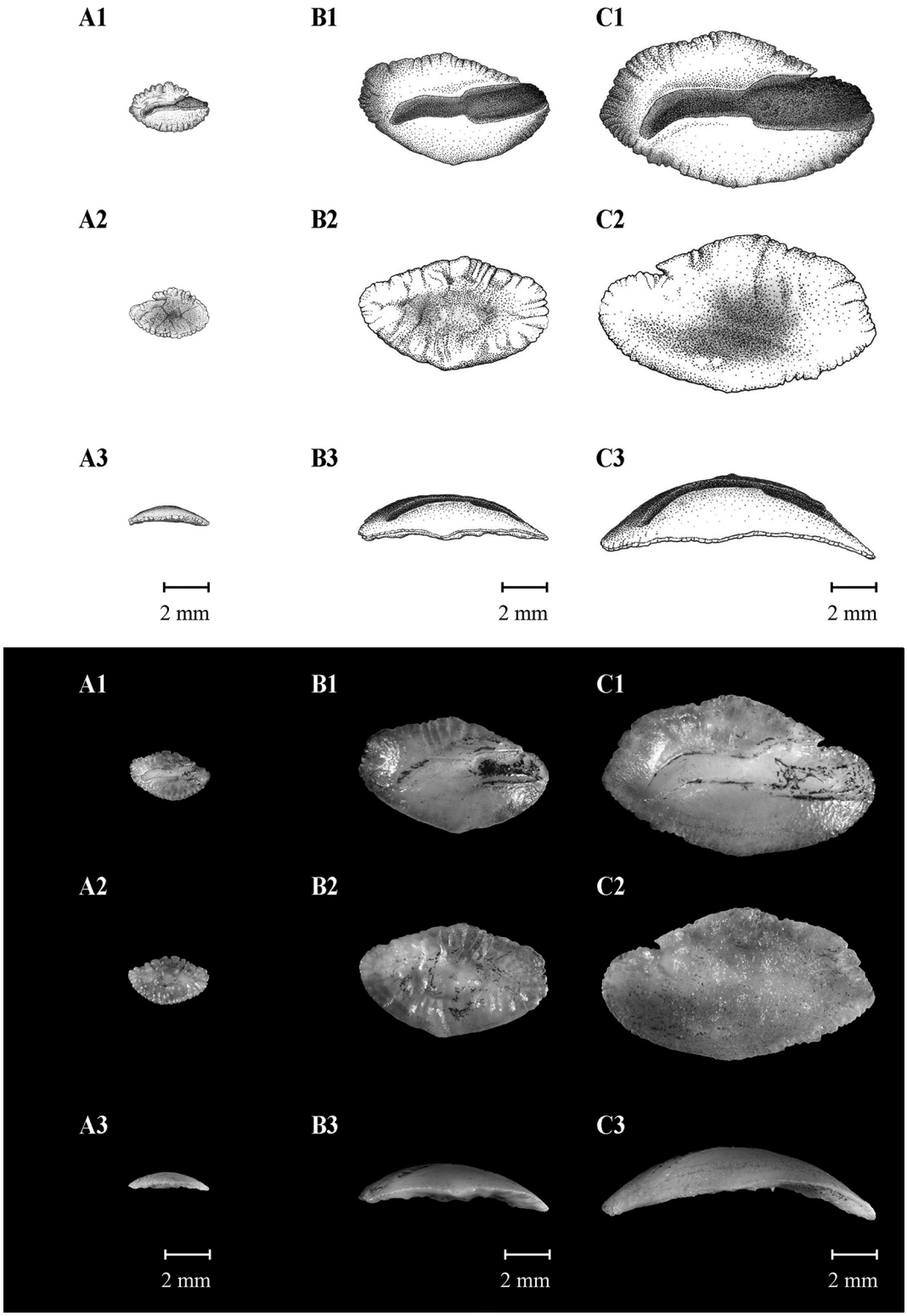

Plate 19. Illustrations (above) and photographs (below) of *Lutjanus synagris* otoliths from fish with total lengths: A. 79 mm; B. 165 mm; C. 300 mm. The medial face is shown in A1, B1, C1; the lateral face in A2, B2, C2; and the ventral profile in A3, B3, C3 (Illustration: Laura Montserrat; Photos: Cesar Santificetur).

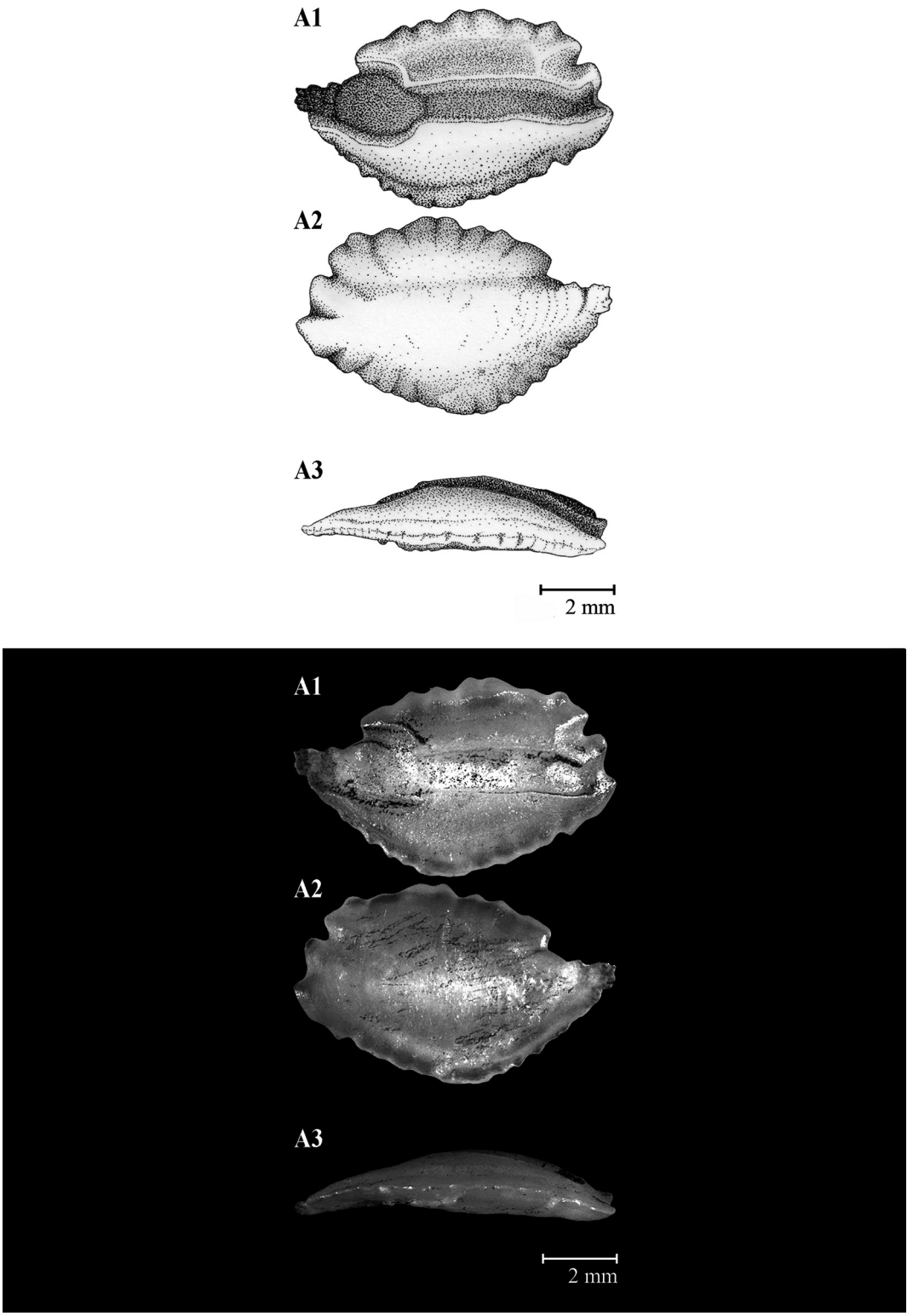

Plate 20. Illustrations (above) and photographs (below) of *Pristipomoides freemani* otolith from fish with total length: A. 217 mm. The medial face is shown in A1; the lateral face in A2; and the ventral profile in A3 (Illustration: Laura Montserrat; Photos: Cesar Santificetur).

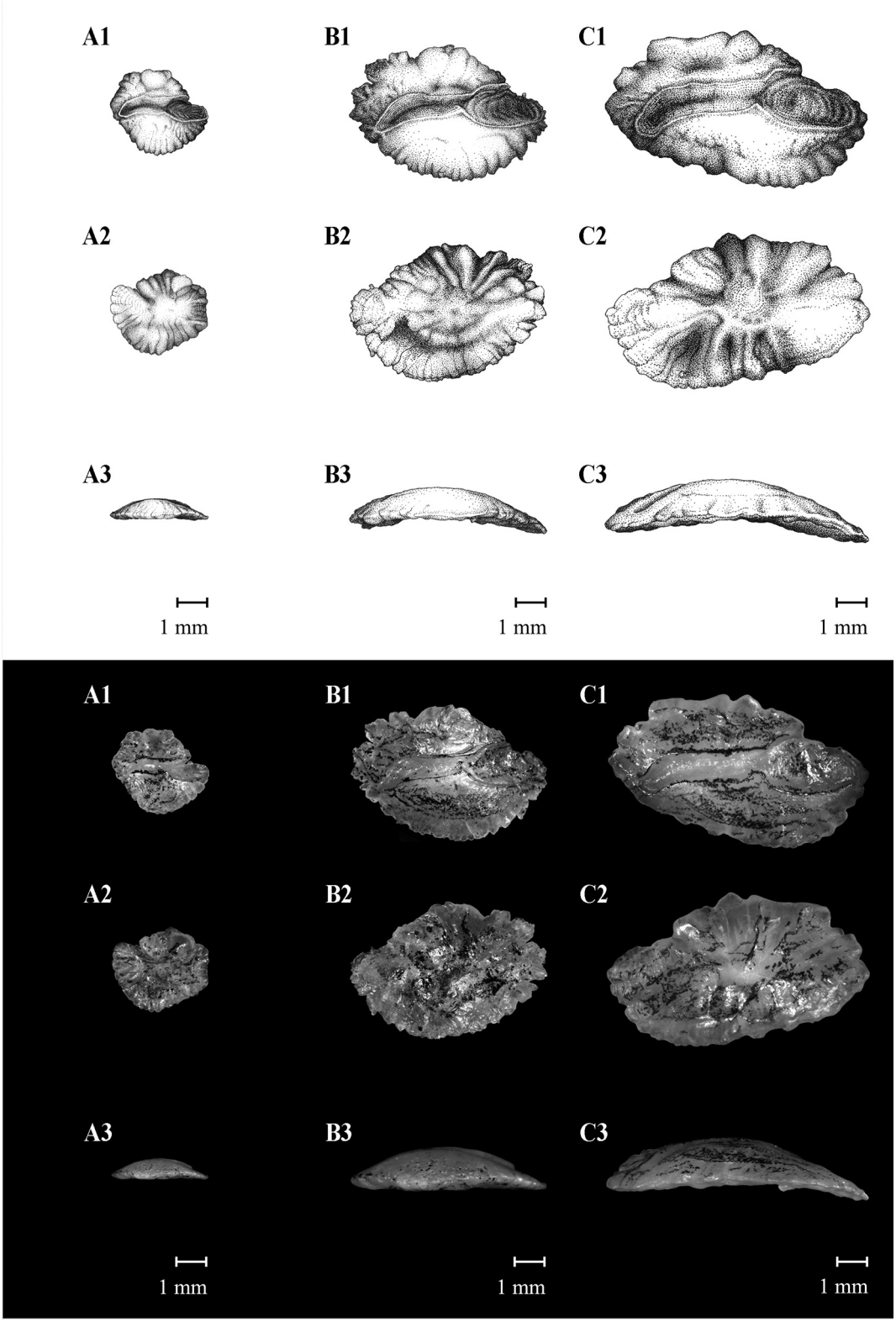

Plate 21. Illustrations (above) and photographs (below) of *Diapterus rhombeus* otoliths from fish with total lengths: A. 75 mm; B. 152 mm; C. 230 mm. The medial face is shown in A1, B1, C1; the lateral face in A2, B2, C2; and the ventral profile in A3, B3, C3 (Illustration and Photos: Alexandre Arackawa).

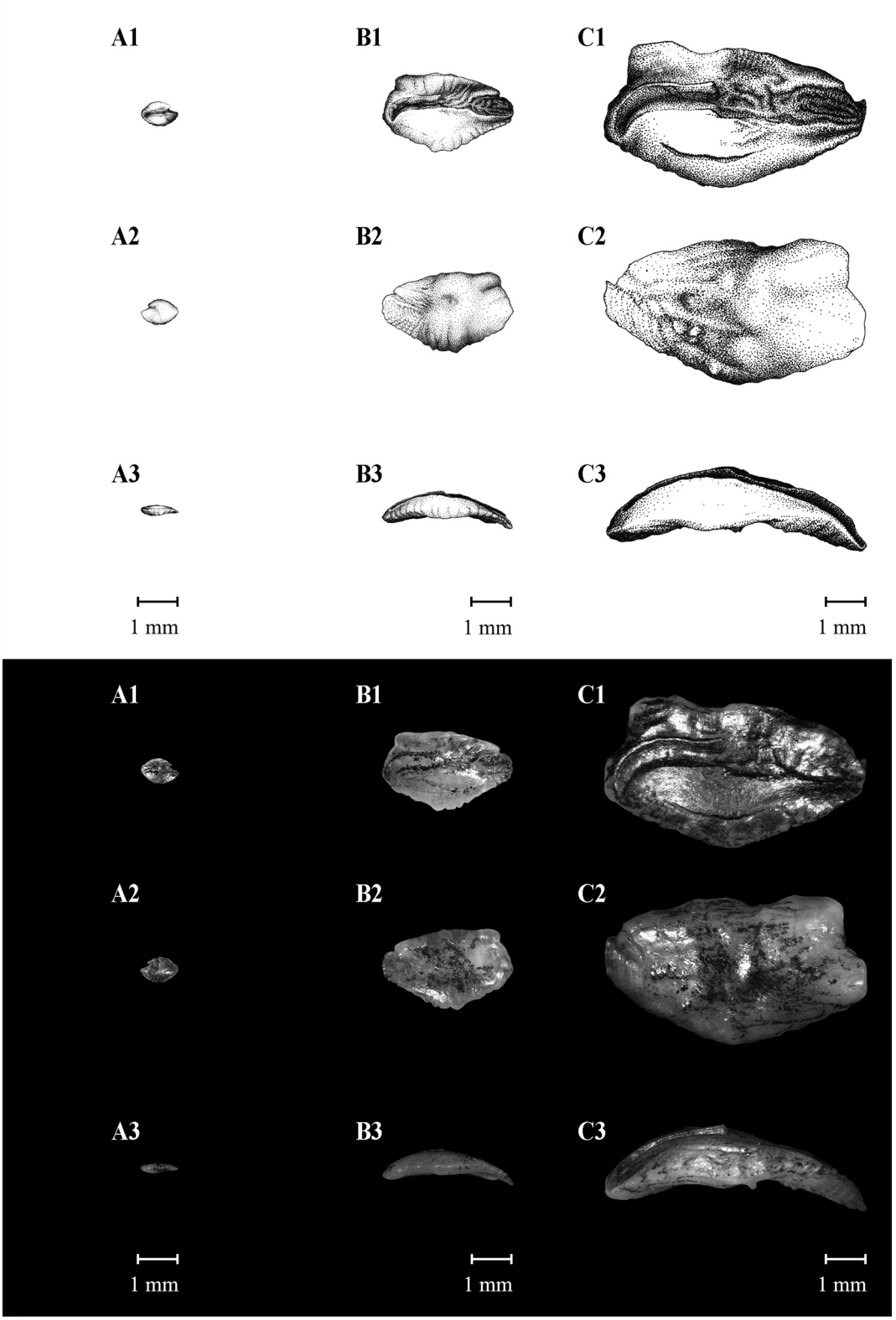

Plate 22. Illustrations (above) and photographs (below) of *Eucinostomus argenteus* otoliths from fish with total lengths: A. 20 mm; B. 84 mm; C. 201 mm. The medial face is shown in A1, B1, C1; the lateral face in A2, B2, C2; and the ventral profile in A3, B3, C3 (Illustration and Photos: Alexandre Arackawa).

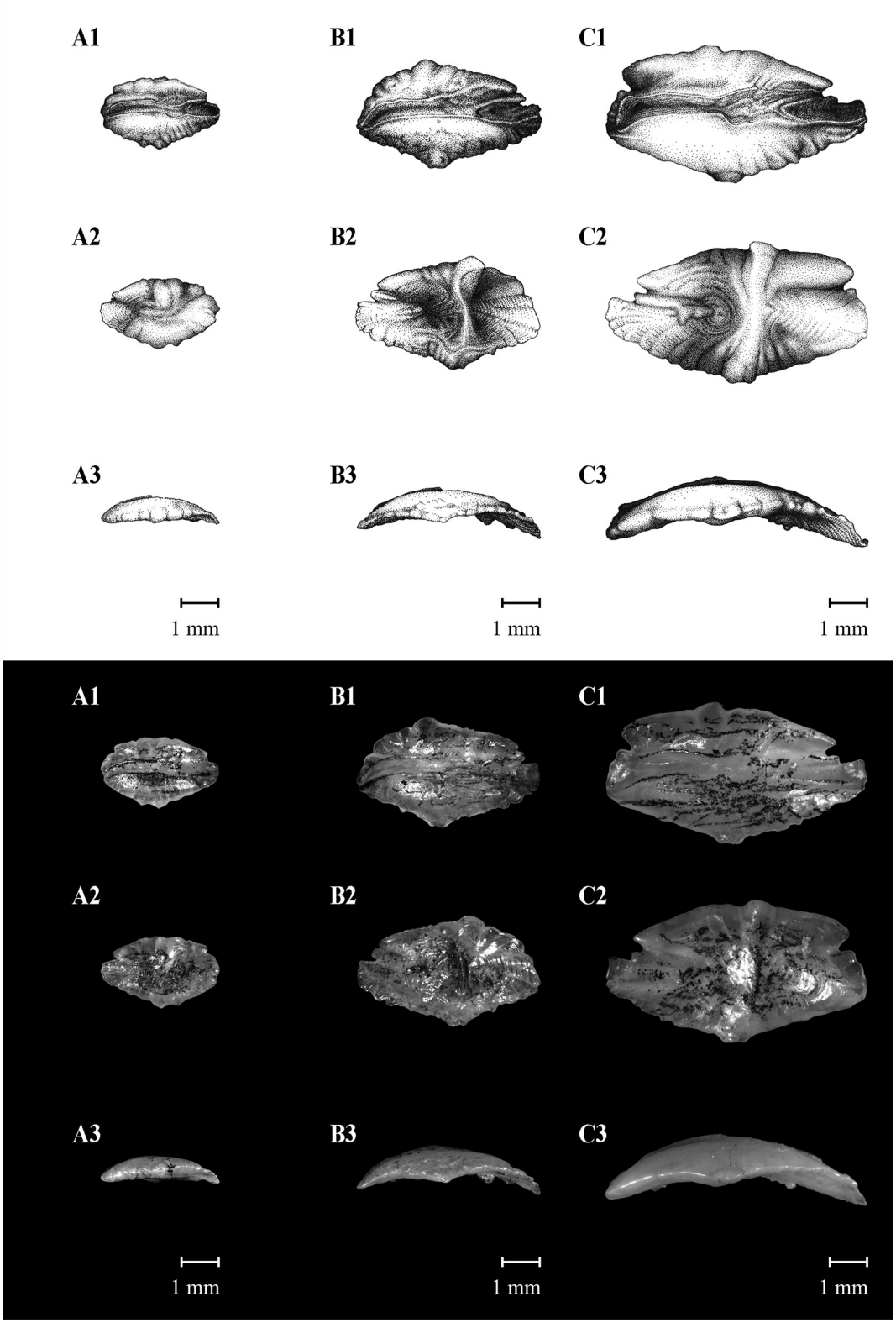

Plate 23. Illustrations (above) and photographs (below) of *Eucinostomus gula* otoliths from fish with total lengths: A. 73 mm; B. 138 mm; C. 189 mm. The medial face is shown in A1, B1, C1; the lateral face in A2, B2, C2; and the ventral profile in A3, B3, C3 (Illustration and Photos: Alexandre Arackawa).

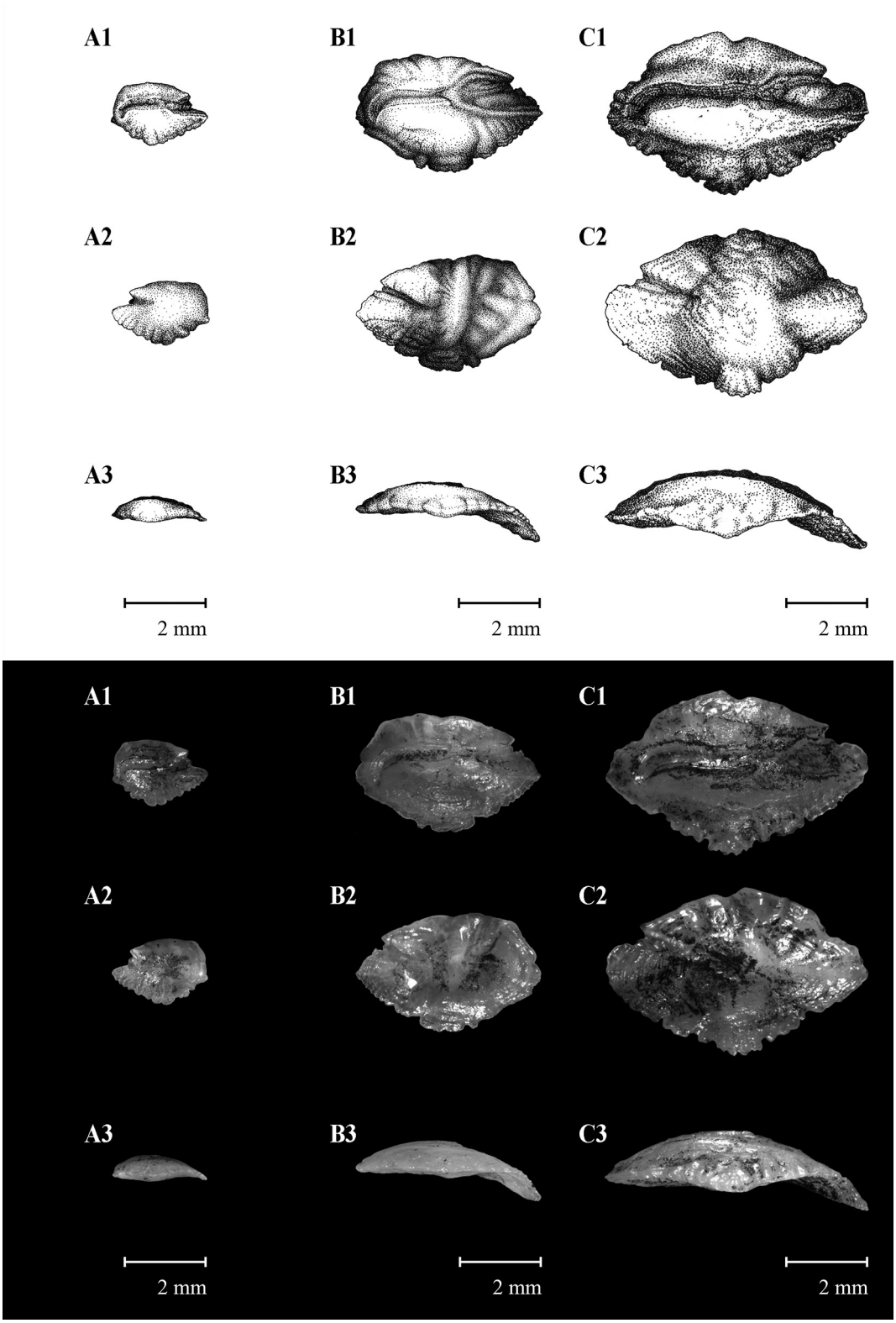

Plate 24. Illustrations (above) and photographs (below) of *Eucinostomus melanopterus* otoliths from fish with total lengths: A. 60 mm; B. 137 mm; C. 214 mm. The medial face is shown in A1, B1, C1; the lateral face in A2, B2, C2; and the ventral profile in A3, B3, C3 (Illustration and Photos: Alexandre Arackawa).

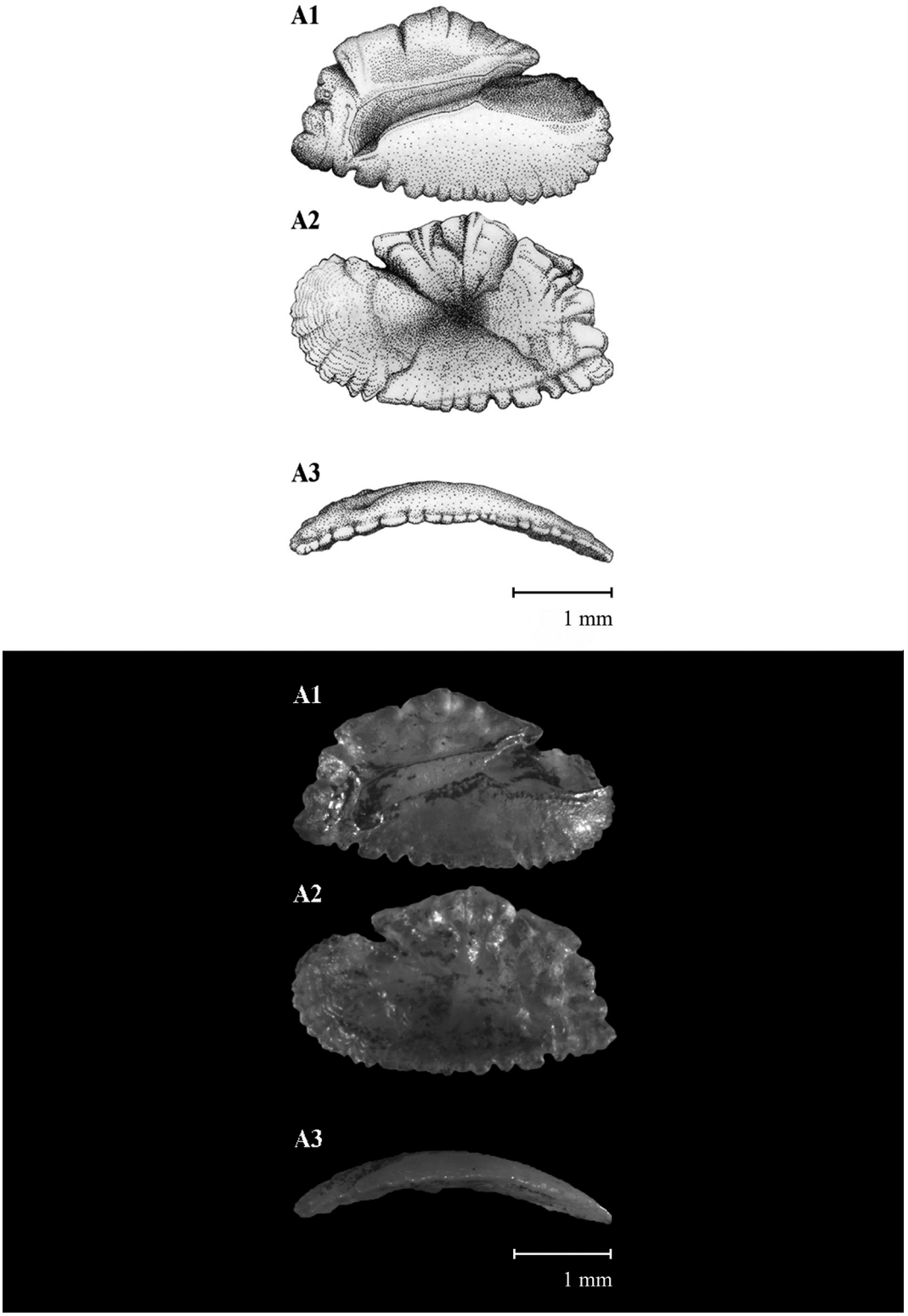

Plate 25. Illustrations (above) and photographs (below) of *Eugerres brasillianus* otolith from fish with total length: A. 207 mm. The medial face is shown in A1; the lateral face in A2; and the ventral profile in A3 (Illustration: Laura Montserrat; Photos: Cesar Santificetur).

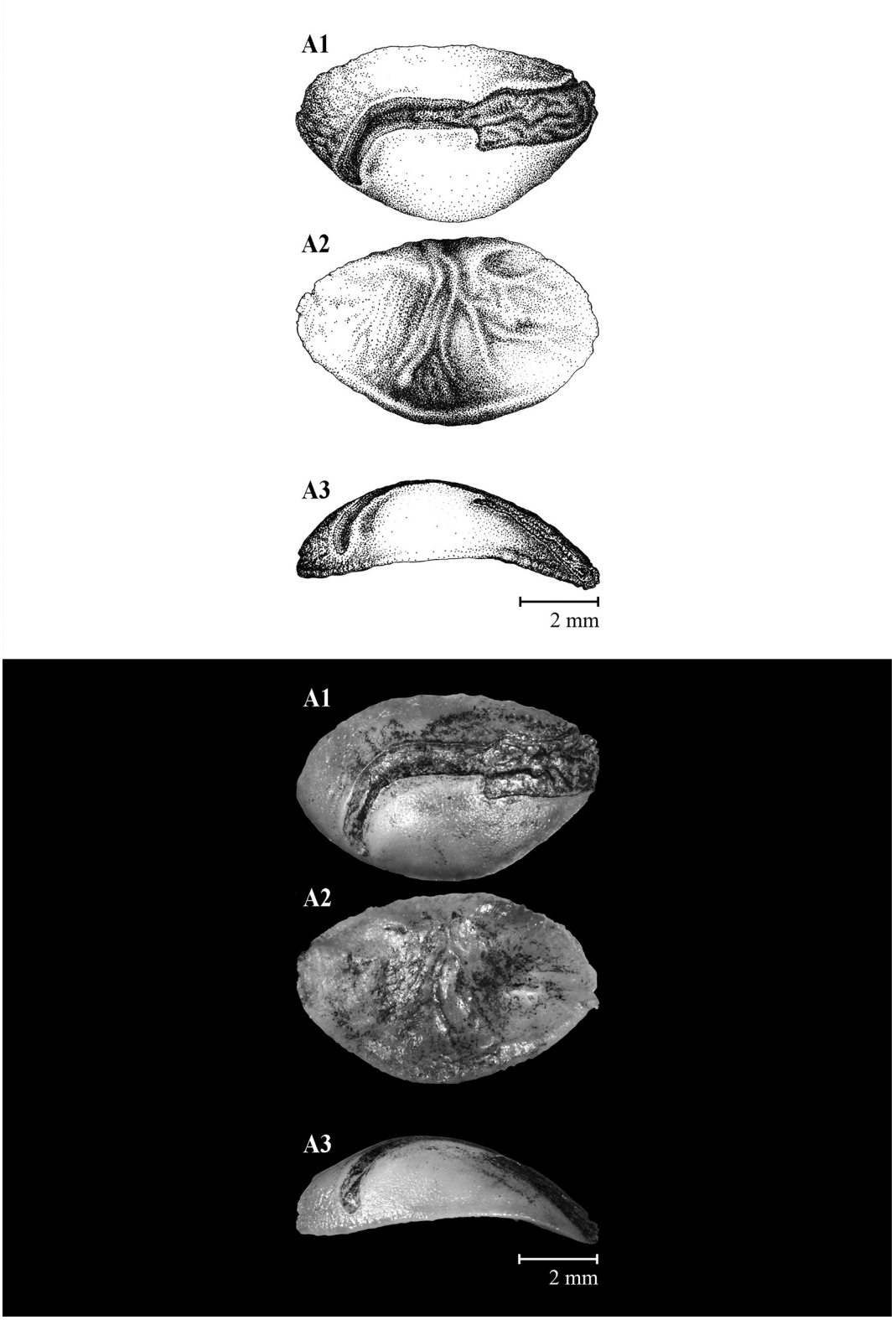

Plate 26. Illustrations (above) and photographs (below) of *Anisotremus surinamensis* otolith from fish with total length: A. 177 mm. The medial face is shown in A1; the lateral face in A2; and the ventral profile in A3 (Illustration and Photos: Alexandre Arackawa).

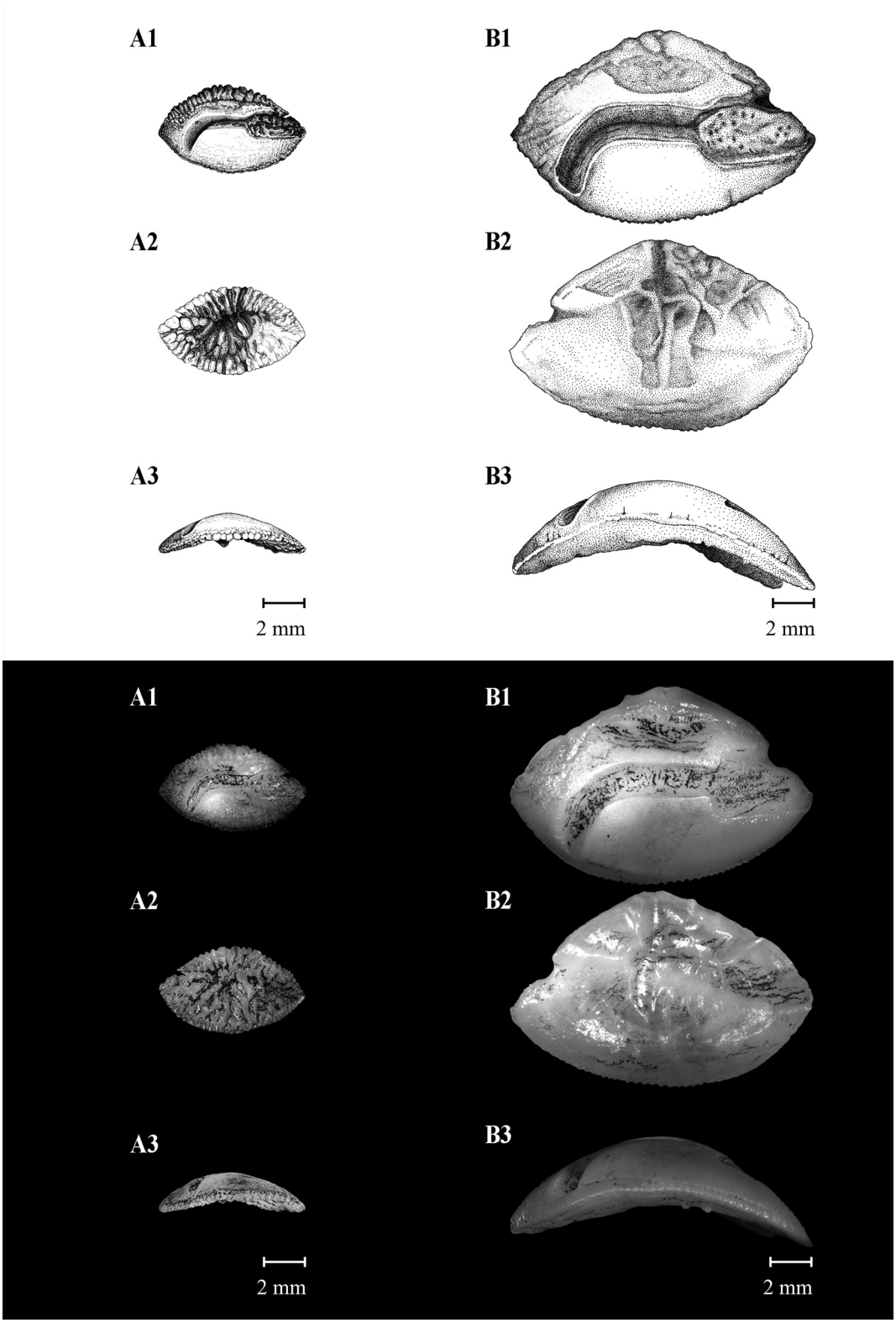

Plate 27. Illustrations (above) and photographs (below) of *Conodon nobilis* otoliths from fish with total lengths: A. 109 mm; B. 335 mm. The medial face is shown in A1, B1; the lateral face in A2, B2; and the ventral profile in A3, B3 (Illustration: Silvia Gonsales, Michelle Konig; Photos: Alexandre Arackawa).

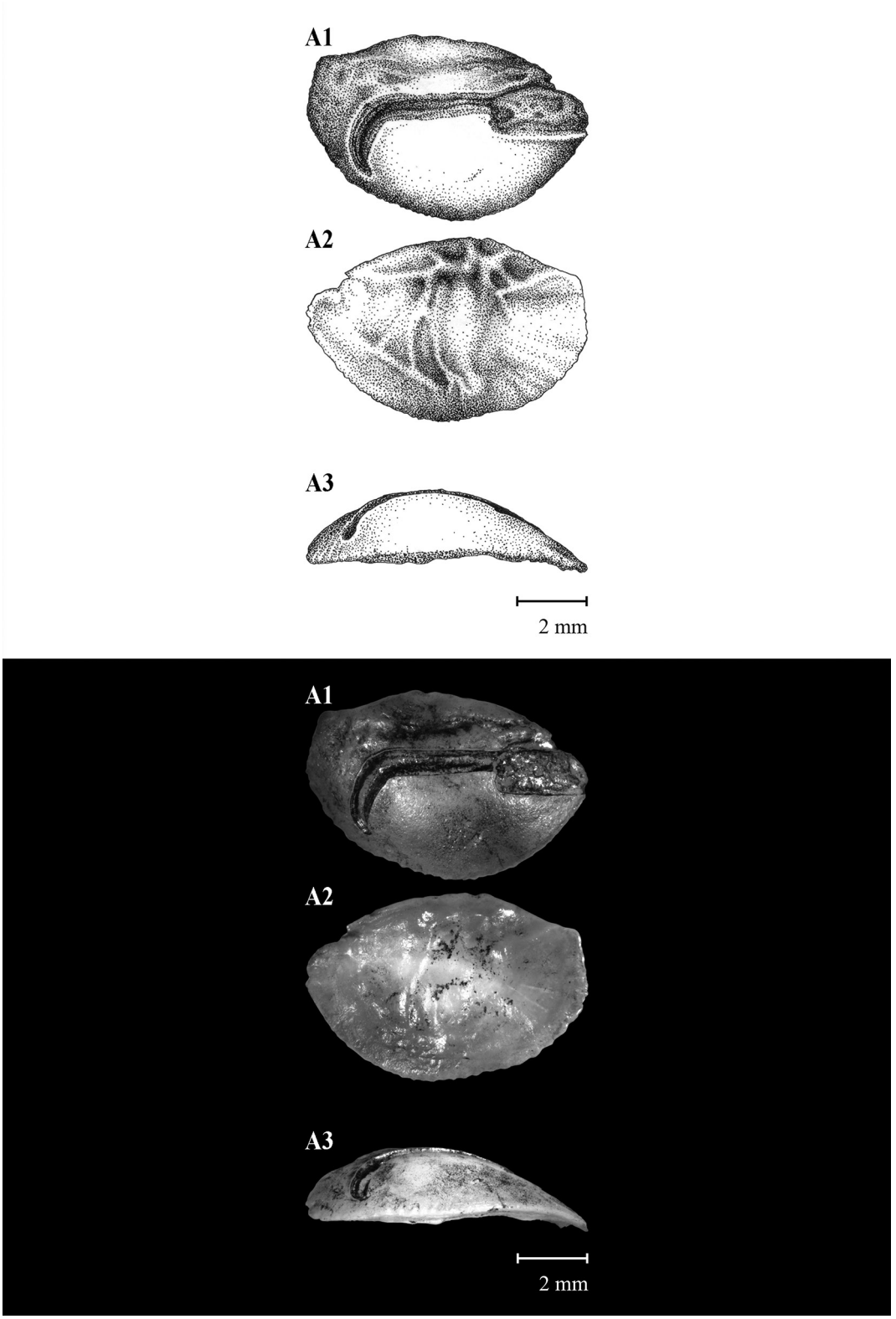

Plate 28. Illustrations (above) and photographs (below) of *Haemulon aurolineatum* otolith from fish with total length: A. 172 mm. The medial face is shown in A1; the lateral face in A2; and the ventral profile in A3 (Illustration: Michelle Konig; Photos: Alexandre Arackawa).

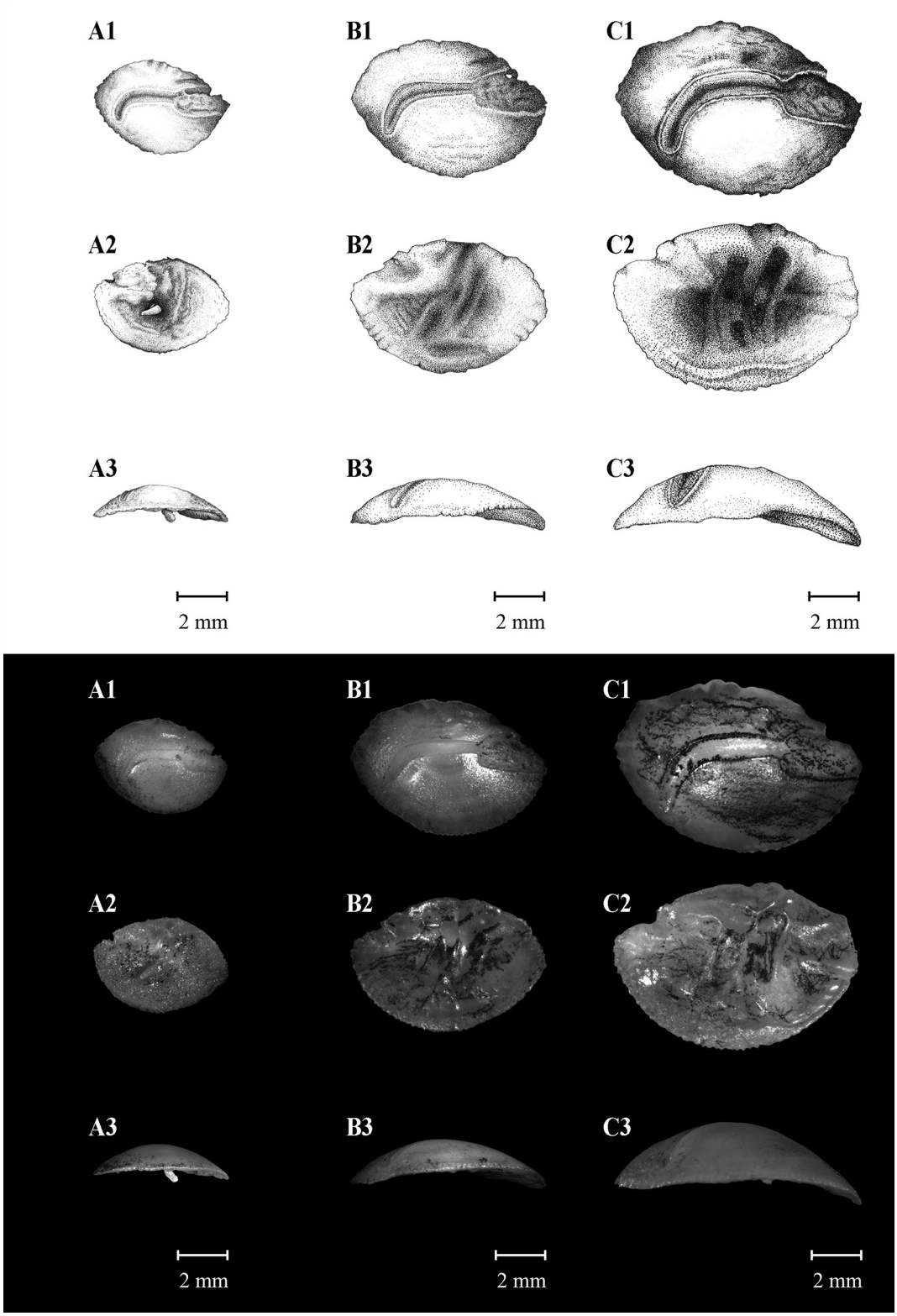

Plate 29. Illustrations (above) and photographs (below) of *Haemulon steindachneri* otoliths from fish with total lengths: A. 105 mm; B. 161 mm; C. 236 mm. The medial face is shown in A1, B1, C1; the lateral face in A2, B2, C2; and the ventral profile in A3, B3, C3 (Illustration: Michelle Konig; Photos: Alexandre Arackawa).

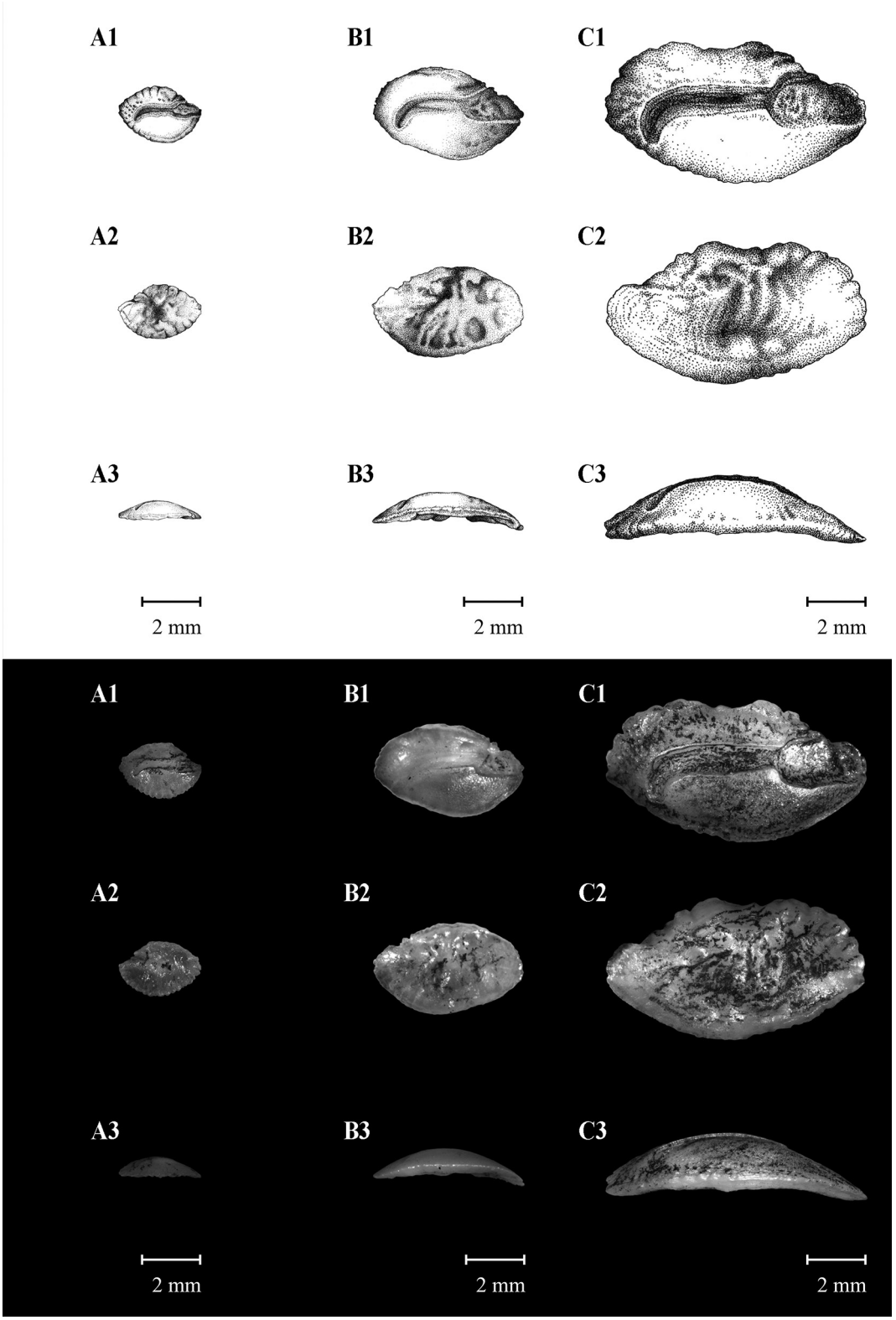

Plate 30. Illustrations (above) and photographs (below) of *Orthopristis ruber* otoliths from fish with total lengths: A. 58 mm; B. 140 mm; C. 254 mm. The medial face is shown in A1, B1, C1; the lateral face in A2, B2, C2; and the ventral profile in A3, B3, C3 (Illustration: Michelle Konig, Alexandre Arackawa; Photos: Alexandre Arackawa).

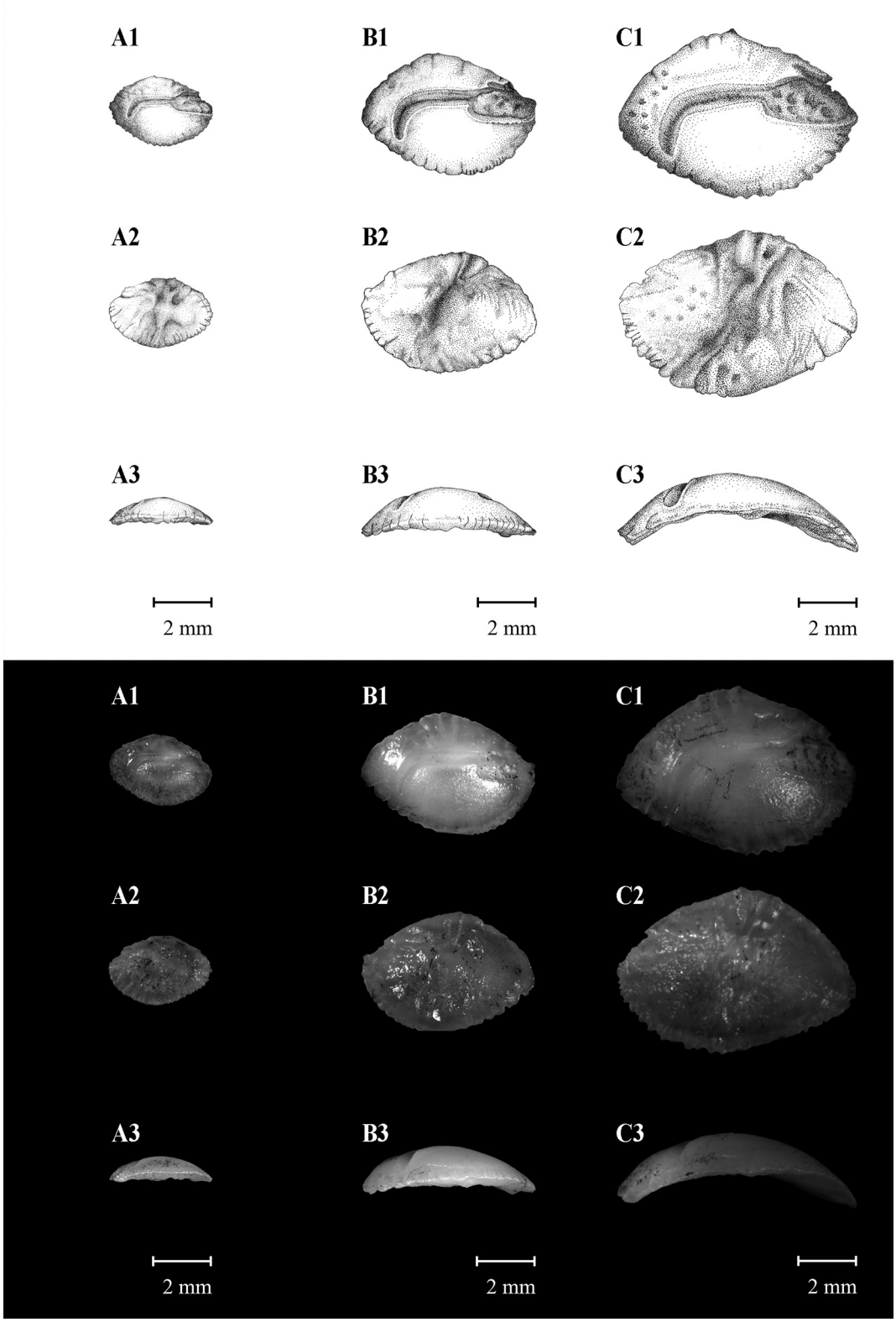

Plate 31. Illustrations (above) and photographs (below) of *Pomadasys corvinaeformis* otoliths from fish with total lengths: A. 62 mm; B. 125 mm; C. 178 mm. The medial face is shown in A1, B1, C1; the lateral face in A2, B2, C2; and the ventral profile in A3, B3, C3 (Illustration: Michelle Konig; Photos: Alexandre Arackawa).