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Indo-West Pacific species of *Trachinotus* with spots on their sides as adults, with description of a new species endemic to the Marquesas Islands (Teleostei: Carangidae)

WILLIAM F. SMITH-VANIZ[1] & STEPHEN J. WALSH[2]
[1]*Florida Museum of Natural History, University of Florida, Gainesville, FL 32611-7800, USA, E-mail: smithvaniz@gmail.com*
[2]*U.S. Geological Survey, Wetland and Aquatic Research Center, 7920 NW 71st Street, Gainesville, FL 32653, USA, E-mail: swalsh@usgs.gov*

Abstract

Diagnoses, comparisons, photographs and distribution maps are given for three previously described Indo-West Pacific species of *Trachinotus* that develop spots on their sides as adults. A new species, *Trachinotus macrospilus*, is described from the Marquesas Islands where it is endemic and the only species of the genus present. It differs from the other spotted Indo-West Pacific species most noticeably in having adults with only one or two large spots on each side, the largest spot larger than the iris diameter, and in having no large spot positioned above the pectoral fin. An identification key is given for all Indo-West Pacific species of *Trachinotus* and a molecular phylogeny, including 16 of the 20 valid species of *Trachinotus* is presented. A neotype is designated for *Scomber botla* Shaw, 1803.

Key words: taxonomy, Carangidae**,** *Trachinotus macrospilus* **n. sp.**, endemic, Marquesas Islands

Introduction

The carangid genus *Trachinotus* Lacepède, 1801 occurs in all tropical oceans and currently includes 19 species (Fricke *et al*., 2019). Some of them are important sport fishes (McPhee *et al*., 1999; Parker and Booth, 2015) especially the larger species (Olch, 2017). Members of the genus may be recognized by: lateral line without scutes and weakly convex above pectoral fin, becoming straight posteriorly; dorsal fin VI–or VII–I, 17–27; dorsal-fin spines of adults very short with anterior margins not connected by interradial membranes; anal-fin II–I, 16–25; dorsal fin without trisegmented radials; vertebrae 10 + 14; first haemal spine straight with strong attachment; ventral vertebral foramina absent; both jaws with bands of villiform teeth; basibranchial and basihyal tooth plates absent (Hilton *et al*, 2010); supramaxilla minute or absent; pair of large lateral processes on ventral surface of basioccipital; adductor mandibulae without separate dorsal section (A_1') originating on suborbital shelf (Smith-Vaniz, 1984); adipose eyelid weakly developed.

Three previously described Indo-West Pacific species of *Trachinotus* have spots on their sides as adults*, T. baillonii* (Lacepède, 1801), *T. botla* (Shaw, 1803) and *T. coppingeri* Günther, 1884. Herein we redescribe these three previously recognized valid species and describe a new species, *T. macrospilus*, endemic to the Marquesas Islands (7°50'-10°35'S; 138°25'-140°50'W), where it is the only *Trachinotus* present. Unlike *T. baillonii*, its inferred sister species, the new species has the largest spot on its side larger than the iris diameter (the iris surrounds the pupil but the two terms are often used interchangeably and misapplied in the literature), and in adults of comparable sizes the dorsal- and anal-fin lobes are usually shorter. Four other species of *Trachinotus* that occur in the region, *T. blochii* (Lacepède, 1801), *T. mookalee* Cuvier, 1832, *T. anak* Ogilby, 1909 and *T. africanus* Smith, 1967, never develop spots on their sides (Smith-Vaniz, 1999). Three other species with spotted adults are the eastern Atlantic *T. ovatus* (Linnaeus, 1758) and *T. goreensis* Cuvier, 1832 and the southwestern Atlantic *T. marginatus* Cuvier, 1832. The four Indo-West Pacific species with spots on their sides as adults are compared. An identification key to all Indo-West Pacific species of *Trachinotus* and a molecular phylogeny of 16 of the 20 valid species of the genus are presented.

Species recognition of the Indo-West Pacific spotted species has been confounded, in part, because the dor-

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sal- and anal-fin lobes undergo extensive allometric growth and the spots are individually and bilaterally variable in number, size, location, and intensity. *Trachinotus baillonii* is the most widely distributed species and occurs throughout the Indian Ocean and eastward to the Gambier Islands. *Trachinotus botla* is restricted to continental areas of the Indian Ocean. *Trachinotus coppingeri* also co-occurs with *T. baillonii* but has a more restricted distribution and is known only from eastern Australia, New Caledonia, Lord Howe and Norfolk islands. In much of the early literature *T. botla* was either not recognized as a validly described species, regarded as a synonym of *T. russelii* Cuvier, 1832 or confused with *T. coppingeri*. Ogilby (1915:95–98) includes a good discussion of the confusion surrounding application of scientific names of these "swallowtail" species of *Trachinotus*. Previously, five different nominal species names were variously applied to *T. baillonii*.

Methods and materials

In the material examined sections, specimen sizes are given as mm fork length (FL), unless indicated as standard length (SL), and cleared and stained specimens are indicated as "C&S." Parenthetical expressions present number of specimens followed by size range. Collector names are given only for types. Localities are usually abbreviated and listed by major geographic areas. Coordinates for some localities plotted on the distribution maps and in the species examined sections are approximations and were often obtained using Google Earth Pro©. Many valid *Trachinotus* literature records were too general to be plotted on distribution maps. Pectoral-ray counts do not include the dorsal-most spine-like element. Gill raker counts are from the first gill arch, usually on the right side, with the raker at the angle included in the lower-limb count; rudimentary gill rakers are defined as tubercles or short rakers with the diameter of their bases greater than their height. Number of anal-fin pterygiophores (Apt) inserted in the first interhemal space (IHS1) (Fig. 1, Table 1) was determined from C&S or x-rayed specimens. Variation in relative shapes of vomer and palatine tooth patches are shown (Fig. 2); specimens with dentition most like Fig. 2A were tabulated as 1.0, those like Fig. 2B were tabulated as 2.0 (Table 2).

TABLE 1. Frequency distribution of number of anal-fin pterygiophores (Apt) inserting into first interhemal space (IHS1) among species of *Trachinotus*. See Fig. 1.

Species	Number of Apt in IHS1				
	1	2	3	4	mean
*Trachinotus macrospilus**			5		3.0
*Trachinotus baillonii**		3	42	1	3.0
*Trachinotus botla**			13		3.0
*Trachinotus coppingeri**		1	5	1	3.0
Trachinotus africanus		10			2.0
Trachinotus anak		11			2.0
Trachinotus blochii	3	83			2.0
Trachinotus mookalee		13			2.0

*Species with spots on sides as adults; all others lack spots.

TABLE 2. Frequency distribution of vomerine and palatine dentition types A or B (see Fig. 2) in selected Indo-West Pacific *Trachinotus* species.

	Vomerine teeth		Palatine teeth	
Species	A	B	A	B
T. macrospilus	4	23	5	22
T. baillonii	10	185	17	164
T. botla	79	0	59	0
T. coppingeri	9	53	44	11

The following measurements and abbreviations were used: standard length (SL) tip of snout to end of hypural plate; fork length (FL) tip of snout to tip of shortest middle caudal-fin ray; total length (TL) tip of snout to vertical from tip of longest caudal-fin ray; snout to origin of first dorsal fin (Sn-D1O); snout to origin of second dorsal fin

(Sn-D2O); snout to origin of pelvic fin (Sn-P2O); snout to origin of anal fin (Sn-A2O); spinous dorsal-fin origin to pelvic-fin origin (D1O-P2O); spinous dorsal-fin origin to anal-fin origin (D1O-A2O); second dorsal-fin origin to pelvic-fin origin (D2O-P2O); second dorsal-fin origin to anal-fin origin (D2O-A2O); height of dorsal-fin lobe (HtD2lobe); height of anal-fin lobe (HtA2lobe); pectoral fin length (P1ln); pelvic fin length (P2ln); length of dorsal-fin base (D2base); length of anal-fin base (A2base); head length from tip of snout to posterior margin of opercular flap (HL); postorbital head length from posterior margin of orbit to posterior margin of opercular flap (POHL); eye diameter is the horizontal diameter of the orbit (Eye diam); snout length from anterior tip of upper jaw to anterior margin of eye (SNL); upper jaw length from anterior tip of upper jaw to posterior end of maxilla (UJL); maxilla depth is the greatest vertical measurement of the upper jaw (Dmax).

We assembled a cytochrome c oxidase I (COI) dataset, including 16 of the 20 valid species of *Trachinotus* (Table 3) by downloading previous published sequences from BOLD (http://www.boldsystems.org/) and GenBank (https://www.ncbi.nlm.nih.gov/genbank/). Sequences were aligned in Mesquite v 3.10 (Maddison & Maddison, 2016) using MUSCLE (Edgar, 2004). PartitionFinder v2.1.1 (Lanfear *et al*., 2017) was used to find the best partitioning scheme of the possible subsets (one per codon position) and the best gamma model of nucleotide substitution using the Akaike Information Criterion (AICc) and the greedy search algorithm (Lanfear *et al*., 2012). Maximum likelihood (ML) analyses were implemented in RAxML v 8.2.8 (Stamatakis, 2014) using the best partitioning scheme and model of nucleotide evolution with 1000 rapid bootstraps. Estimates of evolutionary divergence of sequence pairs between groups were conducted in MEGA7 (Kumar *et al*., 2016) using the Kimura 2-parameter (K2P) model (Kimura, 1980).

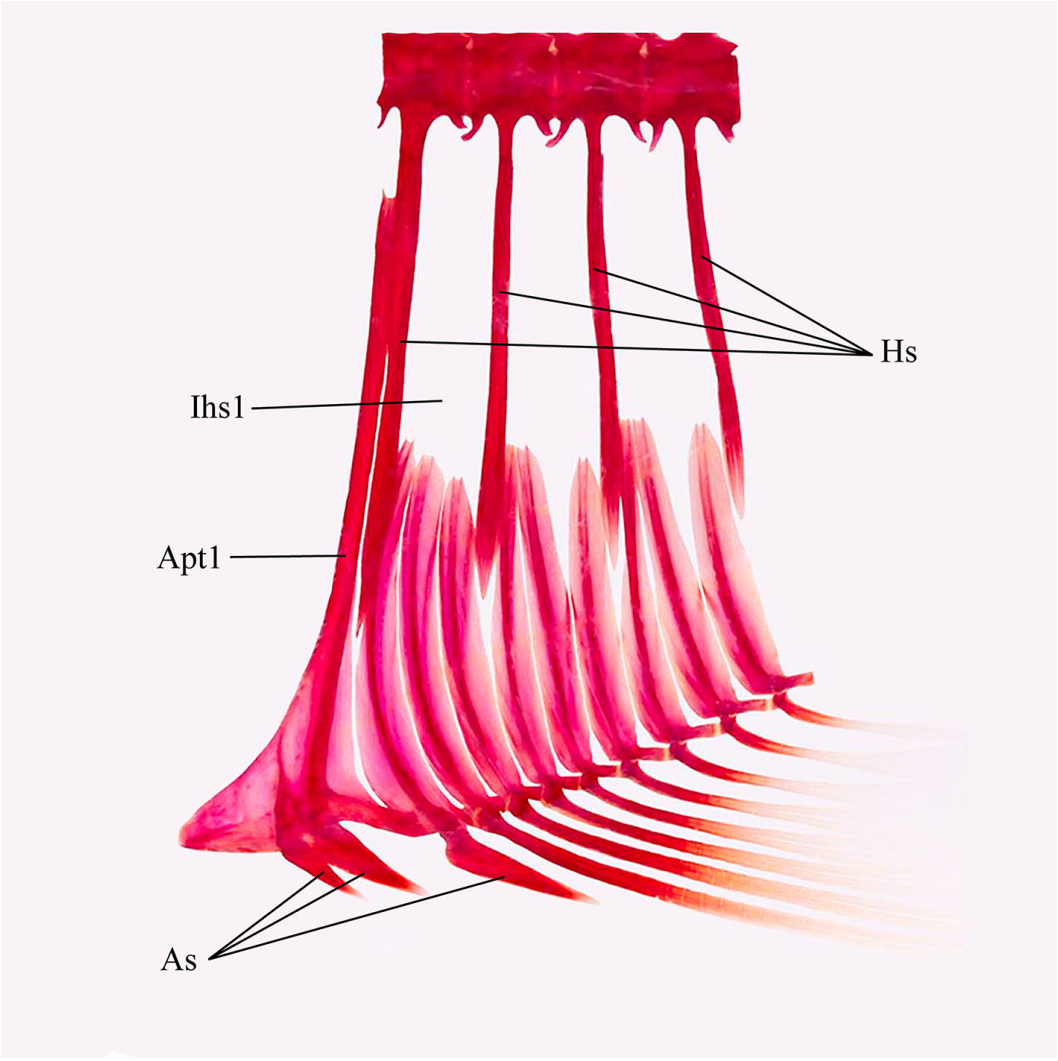

FIGURE 1. Anterior part of anal fin of *Trachinotus macrospilus* (ANSP 153724) with 3 pterygiophores in first interhemal space. Abbreviations: **As**, anal-fin spines; A**pt**1, first anal-fin pterygiophore; **Hs**, haemal spines; **IHS**1, first interhaemal space. Photograph by Zachary S. Randall.

TABLE 3. Species, localities, Barcode of Life Data (BOLD) and GenBank accession numbers for cytochrome c oxidase subunit I (COI) sequences used in this study.

Species, author & date	Locality	BOLD	GenBank
Trachinotus africanus JLB Smith 1963	Indonesia, Java	FOAH846-08	N/A
T. africanus	South Africa	TZMSC064-05	JF494715
Trachinotus anak Ogilby 1909	Western Australia	FOAC409-05	N/A
T. anak	China	GMNIN118867-17	KP641583
Trachinotus baillonii (Lacepède 1801)	China	DBMF107-10	JX261175
T. baillonii	Eastern Australia	FOAC408-05	N/A
T. baillonii	Taiwan	FTWS199-09	N/A
T. baillonii	Eastern Australia	LIFS849-08	KP641583
T. baillonii	French Polynesia, Moorea	MBFA763-07	JQ432195
T. baillonii	Seychelles Islands	SAIAB486-06	N/A
T. baillonii	Seychelles Islands	UKFBJ1015-08	KF930507
Trachinotus blochii (Lacepède 1801)	Eastern Australia	FOAC411-05	EF609481
T. blochii	Taiwan	GBMIN125267-17	KU943808
T. blochii	Seychelles Islands	SAIAB448-06	N/A
Trachinotus botla (Shaw 1803)	South Africa	TZMSC538-06	JF494719
T. botla	South Africa	TZMSA220-04	JF494722
T. botla	South Africa	TZMSA300-04	JF494723
T. botla	South Africa	TZMSC524-05	JF494718
Trachinotus carolinus (Lacepède 1766)	United States, Florida	SMSA087-09	JQ842749
T. carolinus	United States, North Carolina	BCOLL389-08	N/A
T. carolinus	United States, Florida	SMSA486-09	JQ842751
Trachinotus coppingeri Günther 1884	Eastern Australia	FOAC406-05	EF609482
T. coppingeri	Eastern Australia	FOAD511-05	N/A
T. coppingeri	Eastern Australia	FOAD515-05	N/A
Trachinotus falcatus (Linnaeus 1758)	Panama, Colon	LIDM1349-08	N/A
T. falcatus	Mexico, Quintana Roo	MLIII368-08	N/A
T. falcatus	Mexico, Quintana Roo	MLIII196-08	N/A
Trachinotus goodei Jordan & Evermann 1896	Mexico, Quintana Roo	MXV148-11	N/A
T. goodei	Mexico, Quintana Roo	MXV149-11	N/A
Trachinotus goreensis Cuvier 1832	Nigeria, Abia	BAFEN355-10	HM883015
T. goreensis	Nigeria, Abia	BAFEN357-10	HM883017
Trachinotus macrospilus **n. sp.**	Marquesas Islands	MARQ384-12	MK567136
T. macrospilus	Marquesas Islands	MARQ385-12	MK567135
Trachinotus mookalee Cuvier 1832	India	GBMIN119993-17	KU296860
T. mookalee	India	GBMIN124842-17	KU296862
T. mookalee	India	GBMIN130195-17	KU296861
Trachinotus ovatus (Linnaeus 1758)	Israel, Levant Basin	BIM405-15	N/A
T. ovatus	Portugal	MLFPI019-09	KI768314
T. ovatus	N/A	GBGC1144-06	DQ027991
Trachinotus paitensis Cuvier 1832	Gulf of California	ANGBF1237-12	HQ010062
Trachinotus rhodopus	Costa Rica, Pacific Ocean	RDFCA397-05	N/A
Trachinotus stilbe (Jordan & McGregor 1898)	Galapagos Islands	LIDMA1275-12	N/A
Lichia amia (Linnaeus 1758)	South Africa	TZMSB172-04	JF493770
L. amia	Turkey	DNATR812-13	KC500786
Scomberoides commersonnianus (Lacepède 1801)	Malaysia, Malacca Strait	DBMF064-10	N/A

Abbreviations used for institutional specimen depositories follow Fricke and Eschmeyer (2019) and Sabaj (2016) as follows: American Museum of Natural History, New York (AMNH); Academy of Natural Sciences of Philadelphia of Drexel University (ANSP); Australian Museum, Sydney (AMS); Natural History Museum, London (BMNH); Bernice P. Bishop Museum, Honolulu (BPBM); California Academy of Natural Sciences, San Francisco (CAS); Commonwealth Scientific and Industrial Research Organization, Division of Marine Research, Hobart (CSIRO); Field Museum of Natural History, Chicago (FMNH); Kagoshima University Museum, Ichthyology, Kagoshima (KAUM-I); Museum of Comparative Zoology, Harvard University, Ichthyology Department, Cambridge (MCZ); Museum National d'Histoire Naturelle, Paris (MNHN); Museum of New Zealand Te Papa Tongarewa, Wellington (NMNZ); Museum Victoria, Melbourne (NMV); Northern Territory Museum of Arts & Sciences, Darwin (NTM); Queensland Museum, Brisbane (QM); Royal Ontario Museum, Toronto (ROM); South African Institute of Aquatic Biodiversity (formerly J.L.B. Smith Institute of Ichthyology), Grahamstown (SAIAB); South African Museum, now the Iziko Museum, Cape Town (SAM); Stanford University, collection now at CAS (CAS-SU); Florida Museum of Natural History, Gainesville (UF); University of Michigan, Museum of Zoology, Ann Arbor (UMMZ); National Museum of Natural History, Smithsonian Institution, Washington, D.C. (USNM); University of Washington, College of Ocean and Fishery Sciences, Seattle (UW); Western Australian Museum, Perth (WAM).

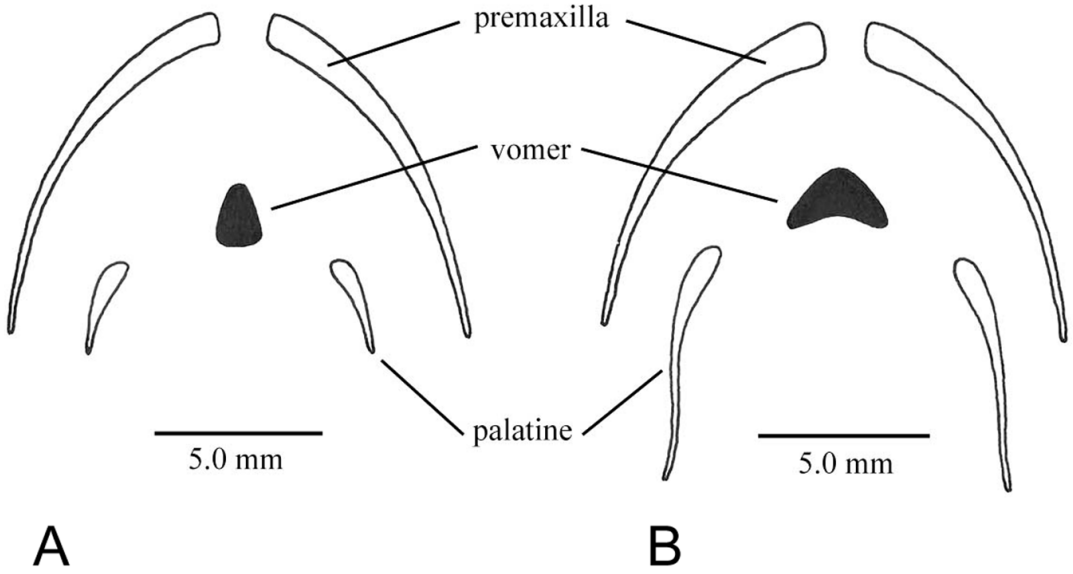

FIGURE 2. Variation in shapes of vomer and palatine tooth patches in *Trachinotus* spp.: **A**, *Trachinotus botla*, CAS 16478, 231 mm FL; **B**, *Trachinotus baillonii*, CAS 16479, 226 mm FL.

Taxonomy

Trachinotus macrospilus new species

Marquesas dart

Figures 1, 3, 4, 5A-8, 11; Tables 1–8

Trachinotus oblongus (not of Cuvier) Kendall & Goldsborough, 1911:272, pl. 1 (description; Nukuhiva); Fowler, 1938:279 (listed; Nuka Hiva).

Trachinotus bailloni (not of Lacépede) Weber and de Beaufort, 1931:288 (in part, distribution included Marquesas); Bagnis *et al*., 1972:47, unnumbered color photo (misidentification, in part, upper photo).

Trachinotus sp. Randall, 1985:472 (listed; Marquesas); Randall and Earle, 2000:13 (listed; Marquesas); Delrien-Trottin *et al*., 2015, unpaginated (listed as Marquesas endemic species).

Holotype. USNM 409238, 292 mm FL, Marquesas Islands, Hatuta'a, North Rock, 7°53'47"S, 140°33'43"W, 0-10 m, rotenone, MARQ-238, S. Planes, E. Delrieu-Trottin, P. Sasal, J. Mourier, M. Veuille, R. Galzin, T. Lison de Loma, G. Mou-Tham and J.T. Williams, 31 Oct. 2011.

Paratypes. 28 specimens, 22–339 mm FL, all from the Marquesas Islands: USNM 409237 (1, 292), USNM 409239 (1, 303), USNM 409240 (1, 298), and USNM 409241 (1, 324), all taken with the holotype; ANSP 153724 (1, 141 C&S; 2, 167–191) and BPBM 10441 (2, 174–175), Nuka Hiva, Taiohas Bay, bait seine, D.W. Strasburg, 6 Sep. 1957; CAS 29872 (1, 22), Nuka Hiva, Taiohas Bay, night lights of Yacht "Zaca," Templeton Crocker Expedition, 6–15 Oct. 1934; USNM 409236 (1, 339), Hatuta'a, North Rock, J.T. Williams *et al*., 6 Jul. 2012; USNM 409385 (1, 142) and USNM 409386 (1, 65), Tahuata, on W side of island in Baie Anaeta, 0–3 m, J.T. Williams *et al*., 6 Nov. 2011; BPBM 10470 (2, 135–152), Via Taha, bait net, "Charles H. Gilbert," cruise 54, J. Magnuson, 18 Oct. 1961; BPBM 12473 (1, 275), Nuku Hiva, W. side Santineaae de l'ouest, 3 m, D.B. Cannoy, 10 May 1971; BPBM 27776 (2, 191–206), Taiohae Bay, beach seine, "Hugh M. Smith," cruise 31, J.E. King, 25 Nov. 1955; BPBM 12408 (1, 296), Ua Huka, 4 mi., NE of Motu Takatai, near shore, 8 ft. spear, J.E. Randall, 6 May 1997; MCZ 29732 (1, 194), MCZ 29733 (1, 169) and MCZ 29734 (1, 209), Nuka Hiva, received from U.S. Bureau of Fisheries, via A. Agassiz, 4 Aug. 1910; UF 133588 (1, 192), Ua Pou, NW corner, 2 m, speared, L. Rocha, 18 Aug. 2003; USNM 412504 (1, 248), Ua Pou, 9°28'S, 140°03'07"W, 2–30 m, J.T. Williams *et al*., 5 Nov. 2011; USNM 66065 (3, 209–245) and USNM 66066 (1, 201), Nuka Hiva, "Albatross," 1899-1900.

Diagnosis. A species of *Trachinotus* in which adults have only 1 or 2 large black spots on their sides; the largest spot larger than iris diameter (usually smaller than iris diameter in *T. baillonii* and equal to or larger than eye diameter in *T. botla* and *T. coppingeri*), and in having no large spot positioned above the pectoral fin (adults of *T. botla* and *T. coppingeri* have 1 or 2 large spots above the pectoral fin). Height of largest spot plotted against head length is also larger than in *T. baillonii* (Fig. 6). Heights of dorsal- and anal-fin lobes of adults are also usually shorter than in the other three species (Fig. 7). Dorsal fin VI-I, 23–26; anal-fin II-I, 23–25; vomerine tooth patch usually chevron shaped and palatine tooth patch relatively long (Fig. 2B).

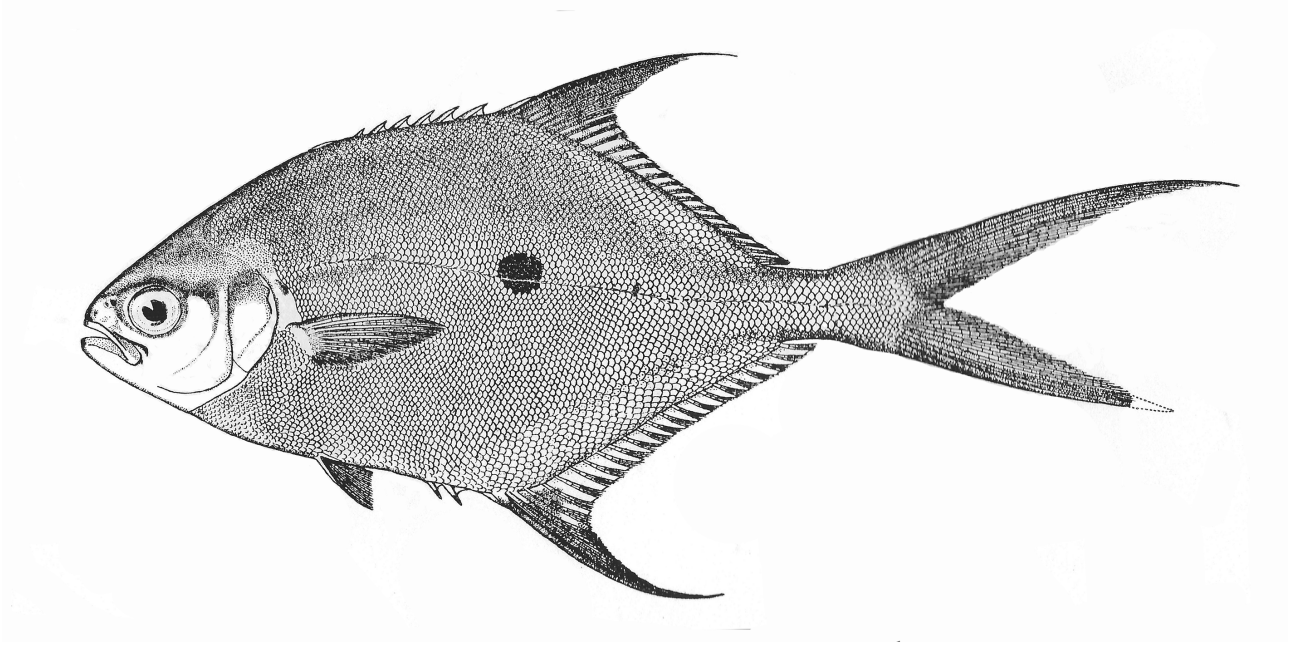

FIGURE 3. *Trachinotus macrospilus*, MCZ 29732, 211 mm FL, Marquesas Islands. After Kendall and Goldsborough, 1911, plate 1, as "*Trachinotus oblongus*."

Description. Counts and measurements of the holotype are given first followed in parentheses by those of the paratypes. Body depth 2.8 (2.2–2.7) in FL; head length 4.5 (4.0–4.7) in FL; convex dorsal profile; dorsal fin VI-I, 24 (23–26), spines short becoming partially embedded in large individuals; anal fin II-I, 24 (23–24); pectoral fin 16 (15–16); vertebrae (precaudal + caudal) 10 + 14; anal-fin pterygiophores inserted in first interhaemal space 3 (Fig. 1); dorsal- and anal-fin lobes relatively short and subequal in length (Fig. 7); anal-fin base only slightly longer than dorsal-fin base; caudal fin deeply forked with long pointed lobes; pectoral fin 1.3 (1.2–1.8) in HL, pelvic fin 2.7 (2.2–3.4) in HL; pectoral/pelvic fin ratio 2.1 (1.6–2.5); lateral line slightly curved over pectoral fin, then straight to base of caudal fin, no scutes; developed gill rakers: upper 9 (6–11), lower 15 (14–17), total 24 (21–27); upper jaw extends slightly beyond anterior margin of iris; head bluntly pointed; cheek scaled; jaws with narrow band of villiform teeth; tongue without teeth; vomerine tooth patch usually chevron shaped and palatine tooth patch relatively

long (Fig. 2B, Table 2). Selected mensural data mostly for specimens >200 mm FL are given in Tables 7–8 and selected measurements are plotted in Figs. 6–8.

Color when fresh (Figs. 4, 5A). Head and body mostly silvery, bluish above becoming white below; sides with 1 or 2 large black spots with well-defined margins and occasionally a very small faint spot, the largest spot larger than iris diameter but smaller than eye diameter; all large spots extend about 1/3 their diameter below lateral line and none above the pectoral fin, largest spot ranges from a vertical well in front of to slightly behind second dorsal-fin origin. Pelvic fin white and lobes of dorsal, anal, and caudal fins dusky (outer margins very dark in 142 mm FL specimen (Fig. 4C.).

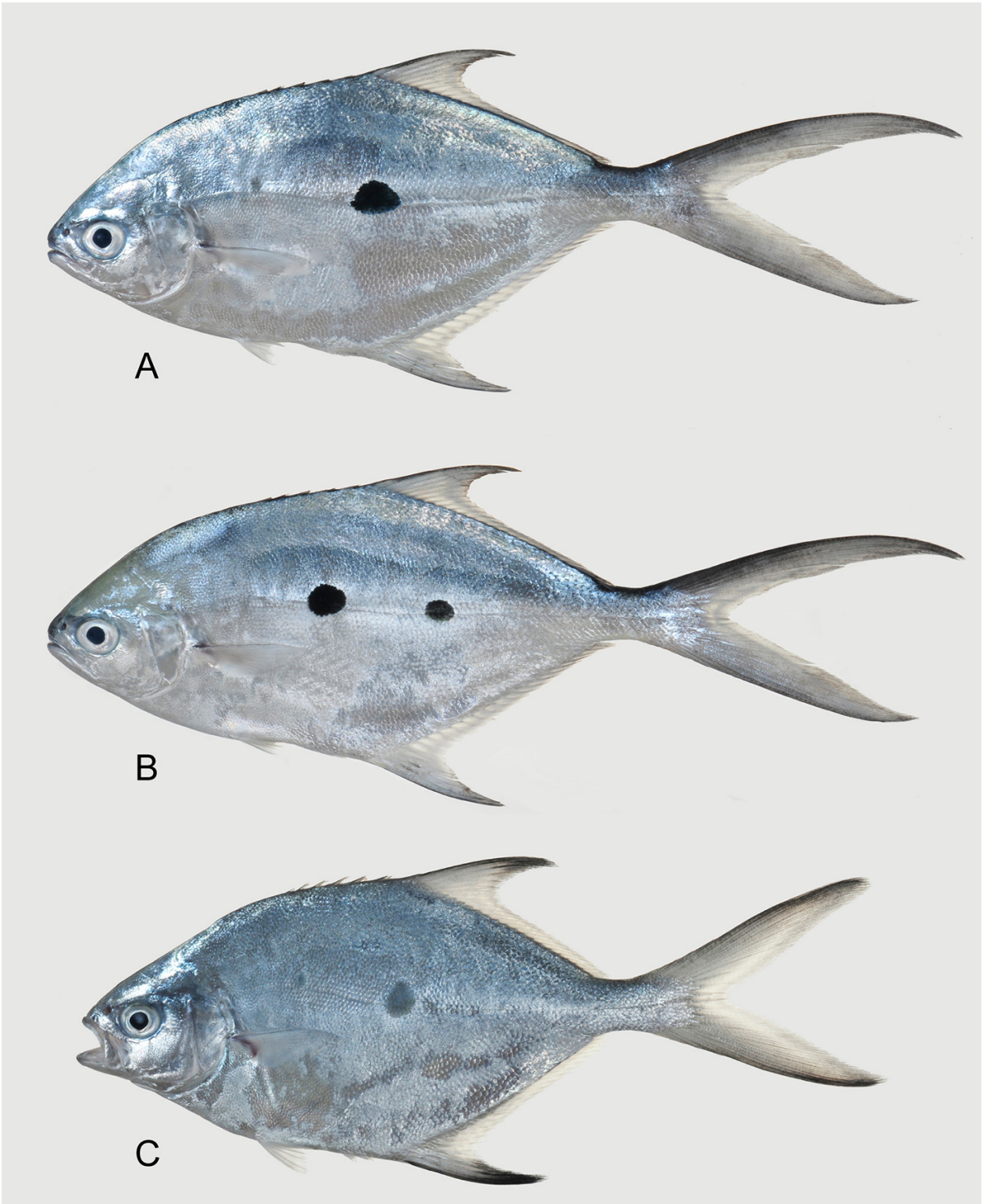

FIGURE 4. *Trachinotus macrospilus*, all from the Marquesas Islands: **A**, USNM 409238, 292 mm FL, holotype (left side); **B**, USNM 409238, holotype (right side reversed); **C**, USNM 409385, 142 mm FL. Photographs by Jeffrey T. Williams.

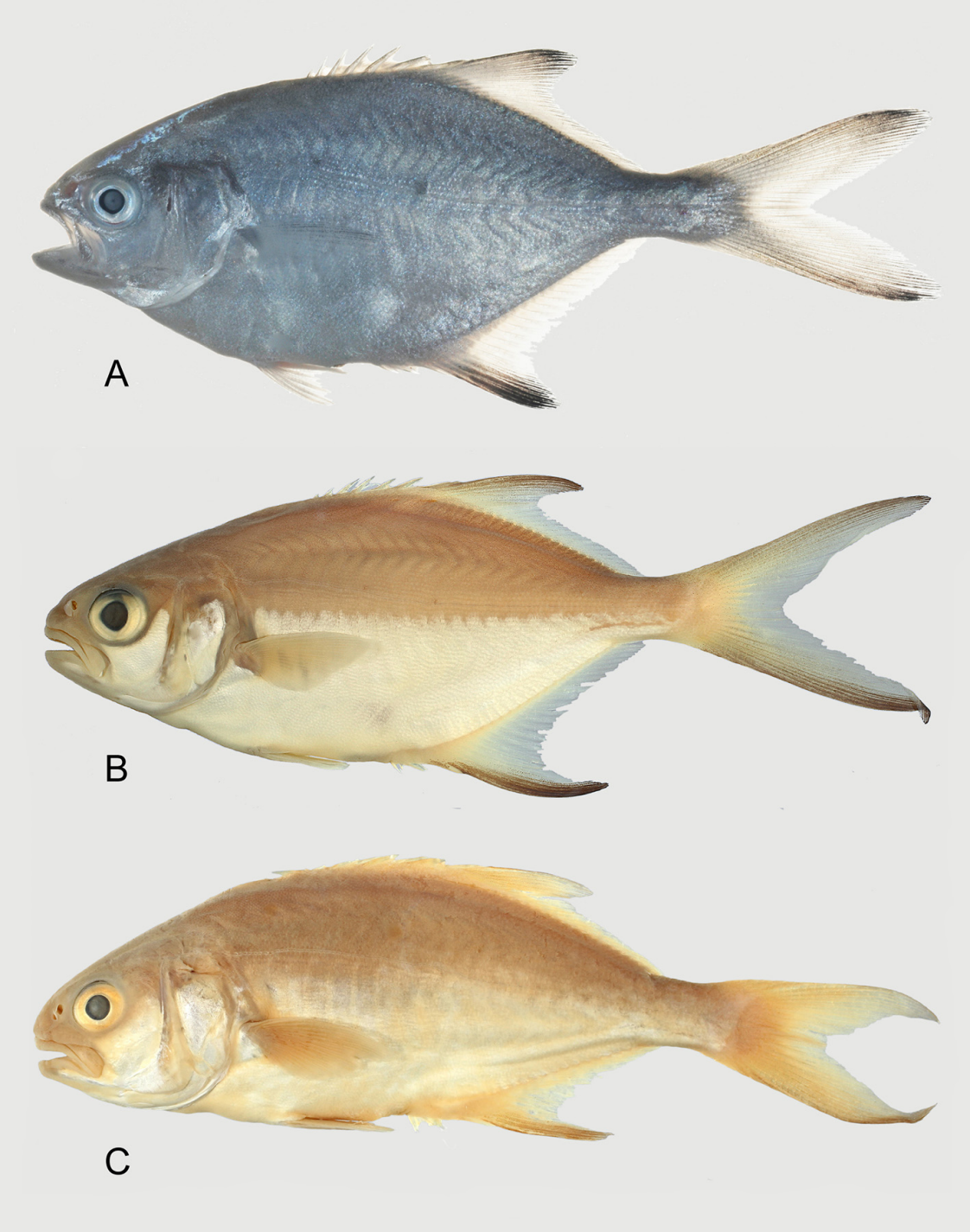

FIGURE 5. *Trachinotus* juveniles: **A**, *T. macrospilus*, USNM 409386, 65 mm SL, Marquesas Island; **B**, *T. baillonii*, ANSP 134305, in preservative, 87 mm FL, Cocos-Keeling Island; **C**, *T. botla*, ANSP 54830, in preservative, 74 mm FL, Pakistan. Photographs by Jeffrey T. Williams (A) and Zachary Randall (B, C).

Color in alcohol similar to life colors except head and body uniformly pale except for black spots.

Comparisons. The new species is most closely related to the allopatric *T. baillonii* but differs in having a larger spot on the side (Fig. 6), which is larger than iris diameter (vs. approximately equal to or smaller than iris diameter in *T. baillonii*). Height of the dorsal- and anal-fin lobes are usually shorter than in the other three species (Fig. 7). Adults of *T. botla* and *T. coppingeri* also differ in having the largest spot on the side approximately equal to eye diameter and oval-shaped or vertically elongate (especially in large specimens), and 1 or 2 large spots above the pectoral fin (vs. no large spot present in *T. macrospilus*).

Size. Largest examined specimen 34 cm FL and 42 cm TL.

Ecology. Adults have only been collected from the surf zone.

Distribution. (Fig. 11) Endemic to the Marquesas Islands.

Remarks. With a reported shore fish fauna of 495 species and 13.7% endemism (Delrien-Trottin *et al*., 2015), the Marquesas Islands have the third greatest species-level endemism for insular coral reef fishes in the Indo-Pacific. Easter Island, with a much smaller total fauna of only 169 marine fish species and a similar geographic size, has a 21.7% rate of endemism (Randall and Cea, 2011), exceeded only by Hawaii with about 25% endemism of its marine ichthyofauna (Randall, 2007). The Marquesas Islands are high islands of recent volcanic origin and, as discussed by Randall and Earle (2000), combined with their isolation both geographically and hydrographically (westernly South Equatorial Current and major upwelling events) has led to the high level of endemism of the ichthyofauna.

Etymology. From the Greek *makros* (long, large) and *spilos* (spot), in reference to the relative height of the largest and usually single spot on the mid-side of the body of adults.

TABLE 4. Frequency distribution of segmented dorsal- and anal-fin rays in Indo-West Pacific species of *Trachinotus* with spots on their sides in adults.

	Segmented dorsal-fin rays									
	20	21	22	23	24	25	26	N	Mean	SD
T. macrospilus				5	19*	4	1	29	24.0	0.7
T. baillonii	1	12	47	171	76	7		314	23.1	0.8
T. botla			35	59	9			103	22.7	0.6
T. coppingeri				5	37	25		67	24.3	0.6

	Segmented anal-fin rays								
	19	20	21	22	23	24	N	Mean	SD
T. macrospilus					17	12*	29	23.4	0.5
T. baillonii		7	23	139	134	10	313	22.4	0.8
T. botla	7	68	26	2			103	20.2	0.6
T. coppingeri				10	40	17	67	23.1	0.6

*includes holotype

TABLE 5. Frequency distribution of gill-raker counts on first gill arch of Indo-West Pacific species of *Trachinotus* with spots on their sides as adults. Only specimens ≥ 60 mm FL are included.

	Developed gill rakers on upper limb												
	5	6	7	8	9	10	11	12	13	14	N	Mean	SD
T. macrospilus		1	–	13	10	2	2				28	8.6	1.0
T. bailloni	2	6	31	80	105	29	3	1	–	1	258	8.5	1.1
T. botla	2	31	36	16	2						87	6.8	0.8
T. coppingeri	1	5	30	20	1						57	7.3	0.7

	Developed gill rakers on lower limb														
	8	9	10	11	12	13	14	15	16	17	18	19	N	Mean	SD
T. macrospilus							1	12	7	8			28	15.8	0.9
T. bailloni				5	8	5	18	85	107	28	1	1	258	15.4	1.2
T. botla	2	–	9	23	32	12	5	4					87	11.8	1.3
T. coppingeri				3	12	31	11						57	12.9	0.8

	Total developed gill rakers																	
	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	N	Mean	SD
T. macrospilus						1	–	6	6	10	4	1				28	24.4	1.3
T. bailloni		2	4	6	4	9	10	46	82	59	24	8	2	1	1	258	23.9	1.9
T. botla	5	15	24	21	12	5	4	–	1							87	18.7	1.6
T. coppingeri		1	4	9	23	12	8									57	20.1	1.2

TABLE 6. Comparison of selected characters in species of *Trachinotus* with spots on side of adults.

	T. macrospilus	*T. baillonii*	*T. botla*	*T. coppingeri*
Number of large spots over pectoral fin in adults	none	none	one	two
Color of spots in fresh specimens	black	black	silvery gray	silvery gray
Size of largest spot in adults	larger than iris diameter	usually smaller than iris diameter	about size of eye diameter	about size of eye diameter
Maximum spot height (% HL) in specimens ≥ 100 mm FL	16.5-30.6, mean 23.2	16.5-17.9, mean 11.2	23.2-46.2, mean 34.7	19.3-41.7, mean 30.2
Segmented anal-fin rays	23-24	20-24, usually 22-23	19-22, usually 20-21	22-24
Developed lower limb gill rakers	14-17	11-19, usually 14-17	8-15, usually 10-13	11-14, usually 12-14
Vomerine dentition (see Fig. 2)	A or B, usually B	A or B, usually B	A	A or B, usually B
Palatine dentition (see Fig. 2)	A or B, usually B	A or B, usually B	A	A or B, usually A
Height of dorsal-fin lobe (% FL) in specimens ≥ 200 mm FL	16.1-21.5, mean 18.1	18.9-46.0, mean 28.9	27.7-44.5, mean 36.2	23.3-39.8, mean 31.0
Height of anal-fin lobe (% FL) in specimens ≥ 200 mm FL	14.9-23.4, mean 18.5	19.7-52.1, mean 36.1	26.0-45.2, mean 33.9	20.2-43.2, mean 34.5
Length of pelvic fin (% FL) in specimens ≥ 200 mm FL	6.6-9.1, mean 7.4	6.1-10.1, mean 8.1	7.3-14.3, mean 10.5	6.9-9.8, mean 8.5

TABLE 7. Morphometric data for *Trachinotus macrospilus*. Range, mean, and sample size including holotype. SD= standard deviation; N= number of specimens.

	Holotype	Range	N	**Mean**	**SD**
Fork length (FL, mm)	292	134-339	27	---	---
Percent fork length					
Snout to spinous dorsal-fin origin (Sn-D1O)	37.7	25.9-39.5	23	37.2	2.6
Snout to soft dorsal-fin origin (Sn-D2O)	47.3	36.6-55.3	23	52.0	3.7
Snout to pelvic-fin origin (Sn-P2O)	28.4	25.3-35.1	23	31.4	2.1
Snout to anal-fin origin (Sn-A2O)	44.0	27.5-56.5	23	48.8	6.2
Spinous dorsal-fin origin to pelvic-fin origin (D1O-P2O)	38.1	25.0-41.5	23	36.8	3.4
Spinous dorsal-fin origin to anal-fin origin (D1O-A2O)	37.2	29.0-45.0	23	41.5	3.3
Rayed dorsal-fin origin to pelvic-fin origin (D2O-P2O)	37.3	30.1-48.2	23	43.5	3.9
Rayed dorsal-fin origin to anal-fin origin (D2O-A2O)	35.4	29.1-45.3	24	41.0	3.6
Maximum body depth	35.8	35.8-45.4	20	41.8	2.6
Pectoral-fin origin to rayed dorsal-fin insertion	---	40.2-65.7	22	56.5	6.1
Height dorsal-fin lobe	18.4	16.1-28.4	25	22.1	3.8
Height anal-fin lobe	18.8	14.9-32.0	26	23.9	5.1
Pectoral-fin length	17.0	12.4-19.3	26	17.5	1.3
Pelvic-fin length	7.3	6.6-10.7	24	8.5	1.3
Length dorsal-fin base	35.7	26.0-38.6	24	34.9	2.3
Length anal-fin base	38.6	27.0-40.6	24	37.7	2.6
Head length (HL)	22.2	21.3-24.8	27	23.0	0.9
Percent head length					
Post-orbital head length	45.8	34.2-47.1	23	43.7	2.6
Eye diameter	25.7	20.5-41.1	27	29.6	4.0
Snout length	25.2	23.0-26.6	22	24.5	1.1
Upper jaw length	33.3	32.9-39.6	21	35.3	1.7
Maxilla depth	7.5	7.5-9.5	20	8.5	0.6

Trachinotus baillonii **Lacepède**

Smallspot pompano, Smallspotted dart, Blackspotted dart, Blackspotted swallowtail
Figures 2B, 5B, 6–11; Tables 1–6, 8

Caesiomorus baillonii Lacepède, 1801:92,93, pl. 3, fig. 1 (original description, based on description and figure in Commerson manuscript [Smith-Vaniz *et al*., 1979:36; locality not stated but Fort Dauphin, near Tôlanaro, Madagascar according to Fricke *et al*., 2019; no types known); Whitley, 1948:20 (Western Australia); Whitley, 1964:44 (listed).

Caesiomorus quadripunctatus Rüppell, 1829:90, pl. 24, fig. 1 (original description; Massawa, Eritrea, Red Sea; holotype SMF 2896); Smith, 1967:163 (listed in synonymy of *T. baillonii*).

Trachinotus oblongus Cuvier *in* Cuvier & Valenciennes, 1832:437 (original description; Java, Indonesia and Puducherry, India; syntype MNHN A-6824 (Pondicherry); Boulenger, 1888:661 (Muscat, Oman); McCulloch, 1929:192 (checklist Australian fishes; listed in synonymy of *T. botla*); Smith-Vaniz *et al*., 1979:29 (listed as synonym of *T. baillonii*).

Trachynotus oblongus. Günther, 1860:484 (Pondicherry, Java and Sumatra).

Trachinotus quadripunctatus. Cuvier *in* Cuvier and Valenciennes, 1832:434 (redescription); Cantor, 1849:122 (description; Sea of Penang); Günther, 1860:484 (listed in synonymy of *T. baillonii*); Wakiya, 1924:220, pl. 34, fig. 2 (Kii, Japan); Smith, 1967:164 (listed in synonymy of *T. baillonii*).

Trachynotus baillonii. Günther, 1860:484 (in part, *T. russelii* listed in synonymy; India and Malaysia); Day, 1865:98 (Malabar); Playfair, 1868:861 (Seychelles); Playfair and Günther, 1867:64 (Aden and Zanzibar); Klunzinger, 1871:449 (Red Sea); Day, 1875, 233, pl. 51A, fig. 4 (Aden and India); Alleyne and Macleay, 1877:330 (New Guinea); Macleay, 1881:545 (Port Jackson and Torres Straits); Fourmanoir, 1957:215, pl. 13A (Madagascar).

Trachinotus baillonii. Cuvier *in* Cuvier and Valenciennes, 1832:431 (redescription); Boulenger, 1888:661 (Muscat, Oman); Waite, 1903:25 (Lord Howe Island); Waite, 1904:200 (Lord Howe Island); Kendall and Goldsborough, 1911:271, pl. 2, fig. 1 (Funafuti, Ellice Islands); Oshima, 1925:407 (Taiwan); Fowler, 1928:152 (Funafuti, Bonin and Society Islands); McCulloch, 1929:182 (checklist Australian fishes); Fowler, 1934a:406 (New Hebrides and Funafuti, after Whitley); Fowler,

1938:279 (Malden, Christmas and Society islands, Bora Bora, Mangareva); Schultz, 1943:87 (Enderbury and Canton islands); Fowler, 1949:78 (Baker Island); Smith, 1967:163, pl. 37 (Mozambique and Seychelles); Maugé, 1967:225 (Toliara [=Tuléar], Madagascar); Klausewitz, 1967:66 (Sarso Island, Saudia Arabia); Allen *et al*., 1976:401 (Lord Howe Island); Schroeder, 1980:182, color fig. 265 (Philippines); Gushiken, 1983:164 (Okinawa); Gushiken in Masuda *et al*., 1984:154, color pl. 137-D (Japanese Archipelago); Dor, 1984:131 (Red Sea); Masuda *et al*., 1984:154, pl. PL 137-D (southern Japan); Wass, 1984:15 (Samoa); Talwar and Kacker, 1984:486 (India); Kojima, 1985:10, fig. 3 (description of juveniles); Allen, 1985:2337, color fig. 192 (Kendrew Island, Dampier Archipelago); Smith-Vaniz, 1986:658, fig. 210.48 (Natal to Marshall Islands); Myers, 1988:144 (Marianna Islands); Paxton *et al*., 1989:585 (Zoological Catalogue of Australia); Winterbottom *et al*., 1989:35, fig. 193 (Chagos Archipelago); Manilo and Bogorodsky, 2003:S107 (Oman, Gulf of Aden and Somali); Allen 2009:83, unnumbered color fig. (Brunei); Francis, 1991:221, fig. 17 (Norfolk Island, Cemetery Bay); Francis, 1993:161 (Australia, Lord Howe and Norfolk islands); Okiyama, 1993:465-466, unnumbered figs., 9.2 and 17.2 mm SL (description of early stage); Kulbicki and Williams, 1997:15 (Ouvéa Atoll, New Caledonia); Randall, 1992:53, color fig. 111 (Maldive Islands); Randall and Anderson, 1993:17 (Maldive Islands); Randall, 1995:472, color fig. 470 (Gulf of Oman); Chen *et al*., 1997:listed in Appendix (Spratly Islands); Lin and Shao, 1999:65, color figs. 79–80 (Taiwan); Fricke, 1999:257 (Réunion and Mauritius); Randall and Lim, 2000 (South China Sea); Smith-Vaniz, 1999:2745, unnumbered fig. (broadly distributed Indo-West Pacific species); Hutchins, 2001:33 (Western Australia); Allen and Adrim, 2003:38 (Indian Ocean and W. Java); Durville *et al*., 2003:99 (Glorieuses Is., listed); Randall *et al*., 2003:15 (Tonga checklist); Lobel and Lobel, 2004:71 (Wake Atoll); Heemstra *et al*., 2004:3315 (Rodriques Island); Kuiter and Tonozuka, 2004:245, unnumbered color photographs; (Maldives and Bali); Letourneur *et al*., 2004:211 (Reunion Island checklist); Randall, 2005:238, unnumbered color pl. (South Pacific); Kim *et al*., 2005: 313, unnumbered color photo (Korea); Senou *et al*., 2006:456 (Sagami Sea); Springer and Smith-Vaniz, 2008:31 (supraneural and pterygiophore insertion patterns); Fricke *et al*., 2009:58 (Reunion, Mauritius, Rodrigues); Kimura *et al*, 2009:126, unnumbered color fig. (southern Thailand); Rahman *et al*., 2009:226, unnumbered color photograph (Bangladesh); Mundy *et al*., 2010:29 (Howland and Baker islands); Motomura and Matsuura, 2010:117, color fig. 201 (Yaku-shima Island, southern Japan); Golani and Bogorodsky, 2010:30 (Red Sea); Allen and Erdmann, 2012:439, unnumbered color fig. (East Indies); Rainboth *et al*., 2012:86, pl.68, color fig. 1420 (Binh Chang Bay, Viet Nam and Gulf of Thailand); Abdussamad *et al*., 2013:25, color fig. 11 (India); White *et al*., 2013:174, color fig. 63.44 (Indonesia); Hussain and Jawad, 2014:254, color fig. 3 (Iraq); Fricke *et al*., 2014:81 (Papua New Guinea); Moore *et al*., 2014:186 (Kimberly region, Australia); Psomadakis *et al*., 2015:230, pl. 17, color fig. 142 (Pakistan); Ikeda and Nakabo, 2015:401, color pl. 137-8 (Minabe, southern Japan); Stuart-Smith *et al*., 2015:146, unnumbered color photograph; Australia); Koeda *et al*., 2016:38, color fig. 173 (Yonaguni-jima Island); Joshi *et al*., 2016:44 (Gulf of Mannar, checklist); Fricke *et al*., 2018:187 (Madagascar checklist); Golani and Fricke, 2018:86 (Gulf of Aqaba and Red Sea); Jawad *et al*., 2018:106, fig. 6F (Arabian Gulf); Kimura *et al*., 2018:138, unnumbered color fig. (Ha Long Bay, northern Vietnam); Fricke *et al*., 2019:149 (New Ireland, Papua New Guinea).

Trachinotus bailloni. Castelnau, 1879:352 (listed; Port Jackson); Steindachner, 1902:22 (southern Arabia and Socotra Island); Jordan and Seale, 1906:235 (listed; Samoa); Jordan and Starks, 1907:495, fig. 2 (Naha, Okinawa); Jordan and Richardson, 1909:180 (Takao, Formosa); Ogilby, 1916:149, pl. 18 (synonymy; Queensland Australia); Wakiya, 1924:219 (Taiwan); Oshima, 1925:407 (Philippines); McCulloch, 1929:182 (checklist of Australian fishes); Weber and de Beaufort, 1931:288 (synonymy; description; distribution); Herre, 1936:117 (Malekula Island, New Hebrides); Roxas and Agco, 1941:66, pl. 11, fig. 2 (Philippines); Blegvad and Løppenthin, 1944:103, fig. 57 (Larak Island, Iran); Smith, 1949:223, fig. 541 (rare in South Africa, reaches to Natal); Woods, 1953:509 (Bikini Island, Eniwetok, Rongelap and Rongerik atolls and Guam); Herre, 1953:284 (synonymy; Philippines); Munro, 1955:131, pl. 22, fig. 369 (Ceylon); Munro, 1956:184 (New Guinea); Williams, 1958:424, pl.26, fig. 26 (East Africa); Arnoult *et al*., 1958:67 (Aldabra); Scott, 1959:66, unnumbered fig. (Malaya); Munro, 1960:133, fig. 850 (Western Australia, Northern Territory, and Queensland, Australia); Suzuki, 1962:151 , fig. 51 (skeletal anatomy); Fourmanoir and Gueze, 1962:13 (Réunion); Taylor, 1964:178 (Arnhem Land, northern Australia); Schultz, 1966:163 (Agfayan Point, Guam); Munro, 1967:233, pl. 26, fig. 392 (New Guinea); Smith and Smith, 1969:22, pl. 10, fig. G (Seychelles); Lindberg and Krasyukova, 1969:196, fig. 223 (Sea of Japan); Bagnis *et al*., 1972:47, unnumbered color photo (misidentification, in part [upper photo = *T. macrospilus*]; Polynesia); Burgess and Axelrod, 1973:813, fig. 322 (Maldives); Randall, 1973:189 (Society Islands); Kailola, 1975:122 (Baxter Bay and Daugo Island, Papua New Guinea); Fourmanoir and Laboute, 1976:181, unnumbered color fig. (New Caledonia); Grant, 1978:218, unnumbered fig. (northern Queensland, Australia); Jones and Kumaran, 1980:290, fig. 246 (Laccadive Islands); Russell, 1983:56 (Capricorn group, Great Barrier Reef); Randall, 1985:472 (Rapa and Society islands); Hutchins and Swainston, 1986:58, 130, fig. 287 (Western Australia to New South Wales); Allen and Swainston, 1988:74, color fig. 457 (northwestern Australia); Allen & Steene, 1988:170, fig. 171 (Christmas Island, Indian Ocean); Myers, 1989:132, fig. 1j (Micronesia); Randall *et al*., 1990:168, pl. V-10 (Great Barrier Reef and Coral Sea); Randall *et al*., 1990:20 (Rapa); Allen and Smith-Vaniz, 1994:11 (Cocos-Keeling); Sadovy and Cornish, 2000:108, unnumbered color photo (Hong Kong); Larson *et al*., 2013:125 (Northern Territory, Australia); Rajan *et al*., 2013:60 (Andaman and Nicobar Is.).

Trachinotus russelli (not of Cuvier). Jordan and Seale, 1906:235 (listed, New Guinea; record unreliable, probably based on *T. baillonii*); Jordan and Richardson, 1909:180 (Taiwan); Munro, 1955:131 (Ceylon).

Trachynotus cuvieri Wakiya, 1924:220 (original description; Misaki, Japan; no types known).

Trachynotus jordani Wakiya, 1924:221, pl. 35, fig. 1 (original description; Bonin Islands, Japanese seas; holotype FMNH 59374); Fowler, 1934a:406 (listed as synonym of *T. baillonii*).

Trachinotus botla (not of Shaw). Fowler, 1934a:406 (Guadalcanal, Solomon Island, after Whitley).
Trachynotus bailloni. Bleeker, 1879:18 (Mauritius); Baissac, 1952:69 (Rodriques); Fourmanoir, 1957:215, pl. 13A (Madagascar).

Type material examined. SMF 2896 (258 mm FL), dry mount, holotype of *Caesiomorus quadripunctatus* Rüppell, Massawa, Red Sea; MNHN A.6824 (117 mm FL), syntype of *Trachinotus oblongus* Cuvier, Pondicherry, India, Leschenaut; FMNH 59374 (323 mm FL), holotype of *Trachinotus jordani*, Bonin (= Ogasawara) Islands, Japan.

Other material examined. 361 specimens, 15–432 mm FL: **Mozambique**: SAIAB 11339 (1, 283), Pinda (14°13'S, 40°46'E). **Chagos Archipelago**: ANSP 152963 (3, 299–328), ANSP 153004 (4, 69–79), Diego Garcia Atoll; ROM 37027 (2, 271–337), ROM 37039 (2, 224–301), ROM 37040 (2, 259–275), ROM 37041 (18, 60–118); USNM 265653 (4, 265–301). **Mascarene Islands**: Cargados Carajos Shoals (= St. Brandon Shoals) (16°35'S, 59°37'E): ROM 37027 (2, 271–337), ROM 37037 (1, 64), ROM 37039 (2, 224–301), ROM 37040 (2, 259–275), ROM 37041 (18, 63–114), USNM 229490 (2, 278–298), USNM 265653 (4, 265–301), USNM 265654 (1, 175) and USNM 444910 (2, 46–51). **Seychelles**: ANSP 148763 (1, 205) and ANSP 131949 (10, 223–329), Amirante Islands; ANSP 153036 (1, 215), Curieuse Island; ANSP 131733 (17, 36–50), ANSP 131734 (14, 15–79), ANSP 148746 (2, 101–104) and CAS 58524 (6, 95–113), Mahé Island (4°43'S, 55°28'E) ; SAIAB uncat. (1, 227), Assumption Is. (9°47'S, 46°31'E). **Mauritius**: BPBM 20273 (3, 35–141) and MCZ 6071 (2, 243–257). **Gulf of Oman**: BPBM 21446 (1, 276), Muscat, Port Qaboos fish market. **Pakistan**: ANSP 172852 (1, 160) and ANSP 172854 (1, 82), Sonmiani Bay near Hab River mouth (24°53'N, 66°41'E); AMS I.40 (1, 148), Karachi (25°07'N, 63°48'E). **India**: ANSP 153042 (1, 216), Porto Nova (11°49'N, 79°76'E); BPBM 27614 (1, 221), Kerala State, Kovalam. **Cocos-Keeling Islands**: ANSP 134305 (12, 48–94). **Sri Lanka**: ANSP 148741 (4, 141–170, including 2, 141–145 C&S), ANSP 151001 (1, 320), ANSP 151101 (9, 240–345), ANSP 158301 (1, 189), ANSP 158302 (1, 226) and CAS 16479 (2, 226–237). **Bay of Bengal**: CAS 44283 (1, 218), SW of Ranang. **Singapore**: CAS-SU 18037 (1, 412). **Myanmar**: CAS-SU 39572 (2, 124–138), Southern Moscos Group. **Viet Nam**: CAS 32188 (18, 47–102), Binhchang Bay (12°21'40"N, 109°15'38"E). **Taiwan**: FMNH 52144 (1, 280), CAS-SU 13072 (1, 252) and CAS-SU 20998 (1, 163), Takao (= Kaohsiung). **Japan**: CAS-SU 21227 (1, 164), Okinawa, Naha; FMNH 59496 (1, 170), Kii; UMMZ 181499 (1, 34 SL), Nagasaki; FMNH 59374 (1, 325) and USNM 5703 (4, 91–166), Ogasawara Islands. **Marcus Island**: BPBM 7048 (1, 198). **Thailand**: CAS 16367 (3, 308–337) and CAS 32196 (1, 131), Gulf of Thailand (10°25'51"N, 99°15'46"E). **Indonesia**: ANSP 153377 (1, 203) and BPBM 29911 (1, 204), Lombok (08°06'S, 116°00'E); USNM 191874 (1, 84), between Gillolo and Makyan Ids.; USNM 383045 (1, 72), Moluccas, near Ambon (03°37'S, 128°14'E). **Philippines**: CAS 49636 (1, 268). Manila Bay; CAS-SU 13606 (1, 265), Dumaguete; USNM 56203 (1, 167), Mindano, Zamboanga; USNM 168319–20 (2, 238–248), Baganga Bay; USNM 168321 (1, 248), Cotabato Market; USNM 191878 (3, 119–151), Masbate Island; USNM 191879 (1, 145), Panay, Nogas Island; USNM 195238 (2, 216–232), Matnog Bay; USNM 195239 (1, 203), Pandanon Island; USNM 195240 (1, 185), Ticao Island; USNM 438080 (1, 200), Auroa Prov., Dinadiawa City Market (15°02'S, 121°36'E); USNM 345997 (1, 347), Iloilo City fish Mkt. **Fiji**: ANSP 149651 (2, 258–260), near Suva. **Western Australia**: WAM P.29183–001 (1, 293), Coulomb Point (17°21'S, 122°09'E); WAM P.24349–001 (1, 239), Kendrew Islands (20°29'N, 116°32'E); NTM S.10813–002 (11, 77–142), Dampier Archipelago, Rosemary Island (20°29'S, 133°36'E); WAM P.23968–9 (2, 112–148); WAM P.5573 (1, 189), Perth vicinity; WAM P.3093–001 (1, 195), Bunbury (33°20'S, 116°36'E); AMS I.6996 (1, 99), Mandurah (32°32'S, 115°43'E). N**orthern Australia**: AMS IA.1642 (1, 280), AMS IA.2564 (1, 240) and QM I.3978 (1, 223), Gulf of Carpentaria, Pellew Group (15°33'S, 136°47'E); USNM 173951 (1, 284), Gulf of Carpentaria, Groote Eylandt (13°49'S, 136°38'E); NTM S.10588–001 (5, 200–292), New Year Island (10°54'S, 133°02'E); NTM S.11287–001 (1, 207), East Woody Island. **Eastern Australia**: AMS I.11895 (1, 241), Torres Strait, Murray Island (09°56'S, 144°04'E); QM I.11242 (1, 111), north Cairns, Turtle Bay; AMS I.13954 (1, 292), AMS I.19448–017 (1, 152) and QM I.19497 (1, 210), Queensland, Lizard Island (14°40'S, 115°11'E); QM I.5661 (1, 124), Townsville; CAS-SU 20581 (1, 175), Maryborough; AMS IA.2698 (1, 179), Michaelimas Cay (16°42'S, 146°10'E); QM I.20079 (1, 110), Queensland, Russell River (17°22'S, 145°58'E); USNM 176828 (2, 280–289), Great Barrier Reef; QM I.11243 (1, 141), Magnetic Island (19°08'S, 145°28'E); AMS IB.6358 (1, 314), Queensland, Cleveland bay (19°13'S, 146°55'E); WAM P.8900–02 (3, 155–206), Flinders Reef (26°58'S, 153°29'E); AMS I.22862 (1, 432), Coffs Harbour (30°18'S, 153°08'E); USNM 47836 (1, 217), Port Jackson (Sydney Harbour) (33°51'S, 151°15'E). **Papua New Guinea**: CSIRO C241 (1, 207), Woodlark Island (09°6'S, 152°50'E); CSIRO C868 (1, 276), Port Moresby, Daugo Island. **New Britain**: CSIRO C176 (1, 248), Jacquinot Bay; CSIRO C1053 (1, 297), Pulie River; CAS-SU 28209 (1, 108), Rabaul; CAS-SU 64420 (1, 186), Atliklikun Bay; AMS IB.1522 (1, 189), Bismark Archipelago. **Solomon Islands**: AMS I.15113 (1, 255), Guadalcanal; ANSP

153026 (1, 67), Bougainville. **Vanuata (New Hebrides Is.)**: USNM 356227 (1, 125); AMS I.11291 (1, 191) and CAS-SU 25190 (1, 230), Malekula Island (16°22'S, 167°31'E). **Palau**: CAS 32179 (12, 50–156), Augulpelu Reef (07°17'N, 134°31'E). **Caroline Islands**: CAS 32078 (2, 191–198), CAS 32079 (2, 153–186) and CAS 32710 (2, 152–186), Ifaluk Atoll (07°14'N, 144°27'E). **Wake Island**: CAS 24035 (1, 343), (19°18'N, 186°38'E). **Tuvalu (Ellice Islands)**: USNM 66063 (1, 107); USNM 66064 (1, 190); AMS I.3563 (1, 83), Funafuti Atoll (08°32'S, 179°07'E). **Marshall Islands**: USNM 142035 (9, 44–143) and UW 11063 (4, 80–121), Bikini Atoll; CAS 96485 (2, 176–237), BPBM 12206 (1, 196) and UF 42442 (4, 79–106), Eniwetok Atoll; USNM 142034 (2, 258–296) and UW 13397 (2, 37–78), Rongelap Atoll. **Kiribati (Gilbert Islands)**: BPBM 7634 (1, 206), Fanning Island (03°52'N, 159°20'W). **Baker and Howland Is.**: ANSP 148764 (2, 306–334), Baker Island (0°11'41"N, 176°29'W); ANSP 153023 (2, 56–59), Howland Island (0°48'S, 176°38'W). **Phoenix Islands**: ANSP 158303 (3, 58–67), CAS 40466 (1, 228) and USNM 115322 (3, 41–78), Canton Island (02°50'S, 171°40'W); ANSP 148759 (5, 230–342), McKean Island (03°59'S, 174°13'W); **Niue**: NMNZ P.14444 (1, 295), (19°04'S, 169°52'W). **Cook Island**: NMNZ 14445 (1, 354), Aitutaki (18°52'S, 159°45'W). **Kiritimati (Christmas Island)**: ANSP 105573 (1, 182), (01°52'S, 157°20'W). **Line Islands**: ANSP 153045 (6, 111–179) and BPBM 3890 (1, 246), Malden Island (04°01'S, 154°56'W); ANSP 148762 (2, 317–234), Vostok Island (10°06'S, 152°23'W). **Society Islands**: MCZ 17088 (2, 316–340), no precise locality; USNM 392381 (1, 219), Moorea. **Rapa** (27°36'S, 144°21'W): BPBM 13066 (1, 325). **Gambier Archipelago**: AMNH 8264 (1, 207), Mangareva (32°15'S, 134°56'W); USNM 400969 (1, 216), Kouaku Island (32°13'S, 134°52'W).

Diagnosis. A species of *Trachinotus* in which adults have 3–7 black spots with well-defined margins on lateral line (spots usually absent in specimens <10–13 cm FL), the largest spot usually smaller than iris diameter (larger than iris diameter in *T. macrospilus* and equal to or larger than eye diameter in *T. botla* and *T. coppingeri*), and adults usually have no large spot positioned above the pectoral fin although small individuals may have 1 or 2 very small spots (adults of *T. botla* and *coppingeri* have 1 or 2 large spots above the pectoral fin). Dorsal fin VI-I, 20–25; anal-fin II-I, 20–24; vomerine tooth patch usually chevron shaped and palatine tooth patch relatively long (Fig. 2B, Table 2). Selected mensural data for specimens ≥200 mm FL are given in Table 8 and selected measurements are plotted (Figs. 6–8).

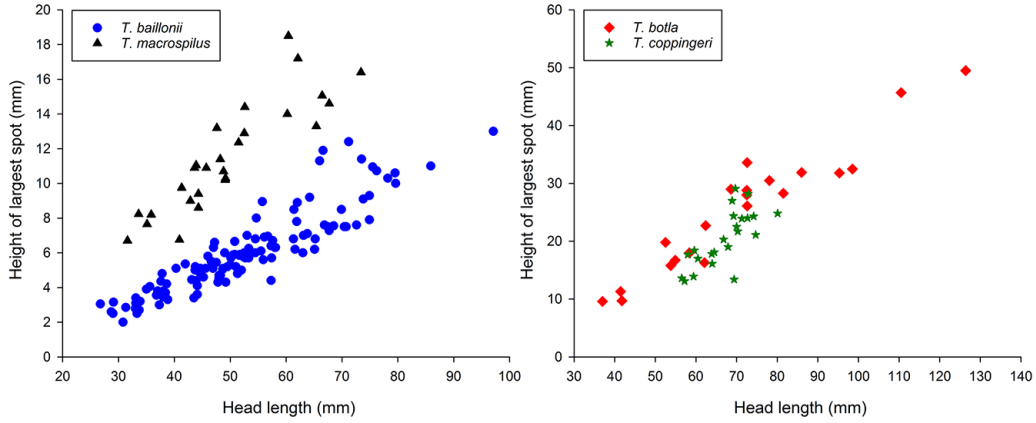

FIGURE 6. Height of largest spot on mid-side of body plotted against head length in four species of *Trachinotus*.

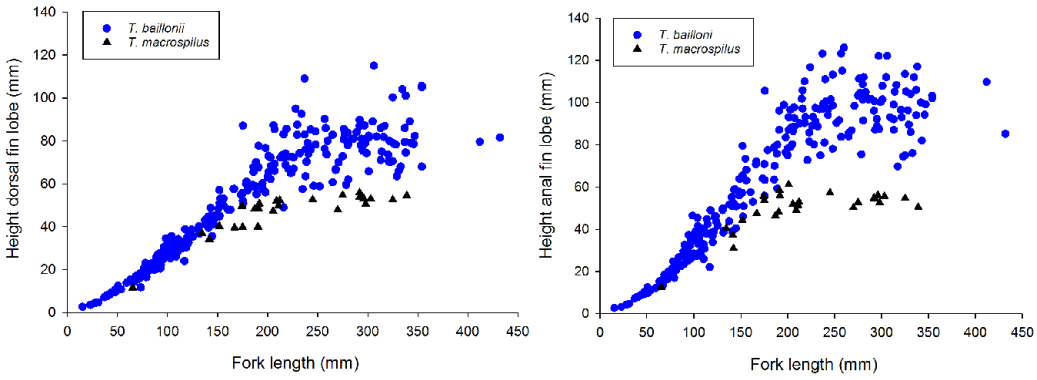

FIGURE 7. Heights of dorsal- and anal-fin lobes plotted against fork length in two species of *Trachinotus*.

Comparisons. *Trachinotus baillonii* is superficially similar to the allopatric *T. macrospilus* but has smaller spots on its side (Fig. 6) (usually smaller than iris diameter vs. larger than iris diameter, and in *T. botla* and *T. coppingeri* the largest spot equal to or larger than eye diameter), and the heights of the dorsal- and anal-fin lobes are usually longer (Fig. 7). Adults usually have no large spots above the pectoral fin, although 1 or 2 faint small spots are often present in smaller specimens of *T. baillonii* (vs. 1 or 2 large spots above the pectoral fin in *T. botla* and *T. coppingeri*).

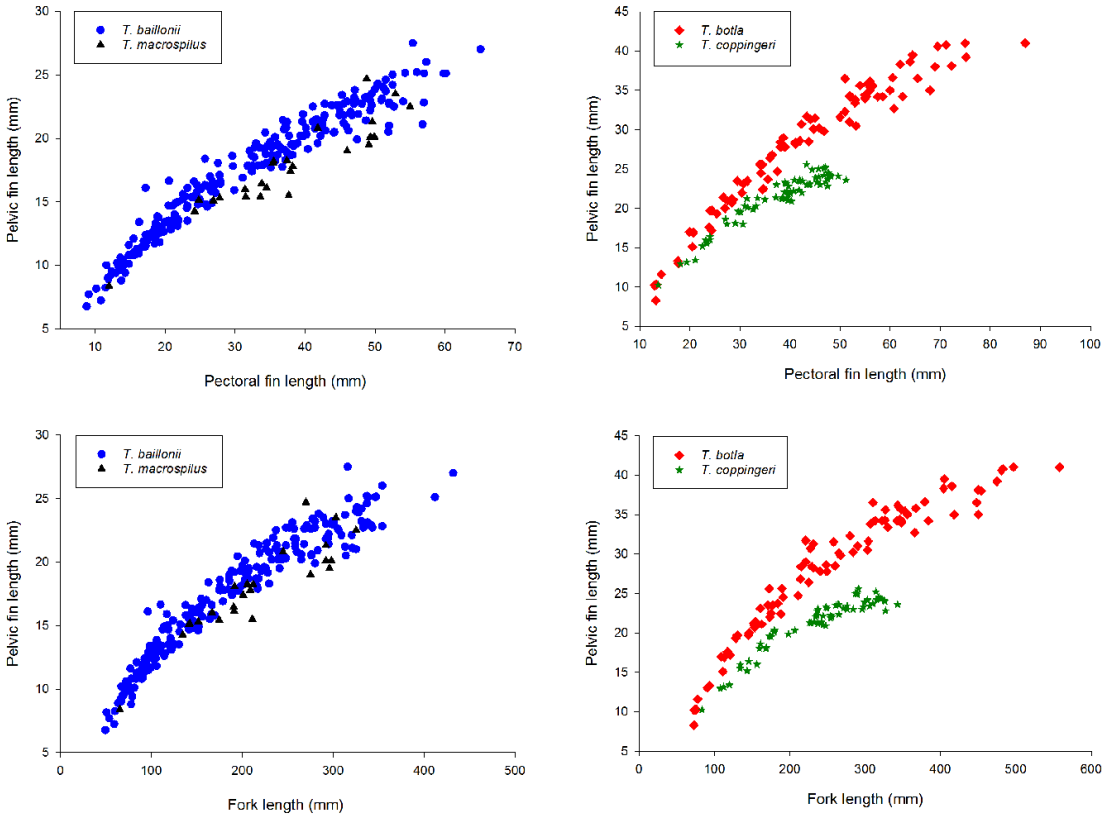

FIGURE 8. Pectoral-fin length plotted against pelvic-fin length and fork length in four species of *Trachinotus*.

Size. Largest specimen examined 43 cm FL, 53 cm TL and about 0.9 kg.

Ecology. According to Kuiter and Tonozuka (2004:245), "juveniles of *Trachinotus baillonii* form schools in sheltered bays. Adults are usually seen in pairs or small groups in surface waters, patrolling reef edges or beaches."

Distribution. (Fig. 11) Red Sea, East Africa, Seychelles, Madagascar and Mascarenes east to the northern Line and Gambier Islands, north to southern Japan and Korea, and south to Australia, Lord Howe, Norfolk Island, Tonga and Rapa.

Etymology. Named for the French botanist and zoologist Louis Antoine François Baillon (1778–1851).

Remarks. In his account of *Trachinotus baillonii*, Woods (1953:510) correctly noted that "Wakiya's (1924) attempt to separate the species *T. quadripunctatus* Rüppell, *T. cuvieri* Wakiya, and *T. jordani* Wakiya is based on nothing more than normal variation within this species, in view of (1) the variation in spots along the sides … ; (2) the fact that the lobes of the dorsal, anal, and caudal fins increase in length with size, while the paired fins apparently do not increase in the same proportion; (3) the variation in nostril size in our series (the size of the posterior nostril varies in relation to that of the anterior, while one specimen with a much larger posterior nostril has the lower jaw slightly protruding)." Kendall and Goldsborough (1911) also discussed the confused application of names in the literature, and in their key to species recognized *T. quadripunctatus* and *T. oblongus* (the latter a misidentification of *T. macrospilus*, see Fig. 3) as valid species distinct from *T. baillonii* but failed to appreciate that absence or presence of spots changes with growth while spot size in adults is relatively consistent. One specimen from the Gulf of Oman (BPBM 21446) is exceptional in having five spots on the left side and none on the right side.

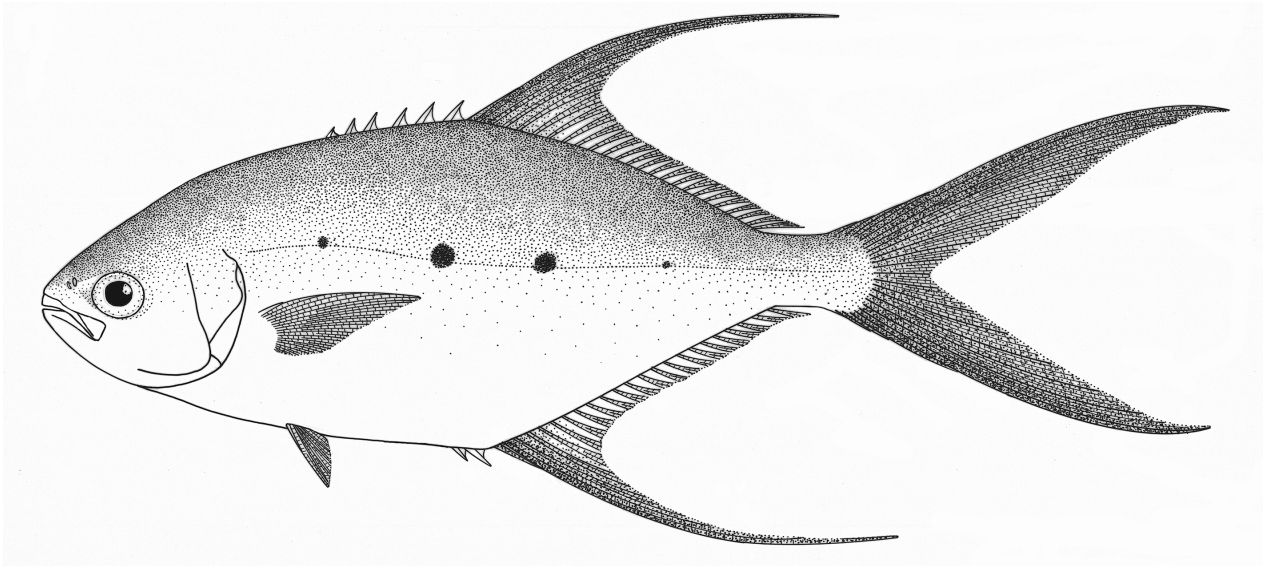

FIGURE 9. *Trachinotus baillonii*, ANSP 149651, 260 mm FL, near Suva, Fiji. Drawn by Tracy D. Pedersen.

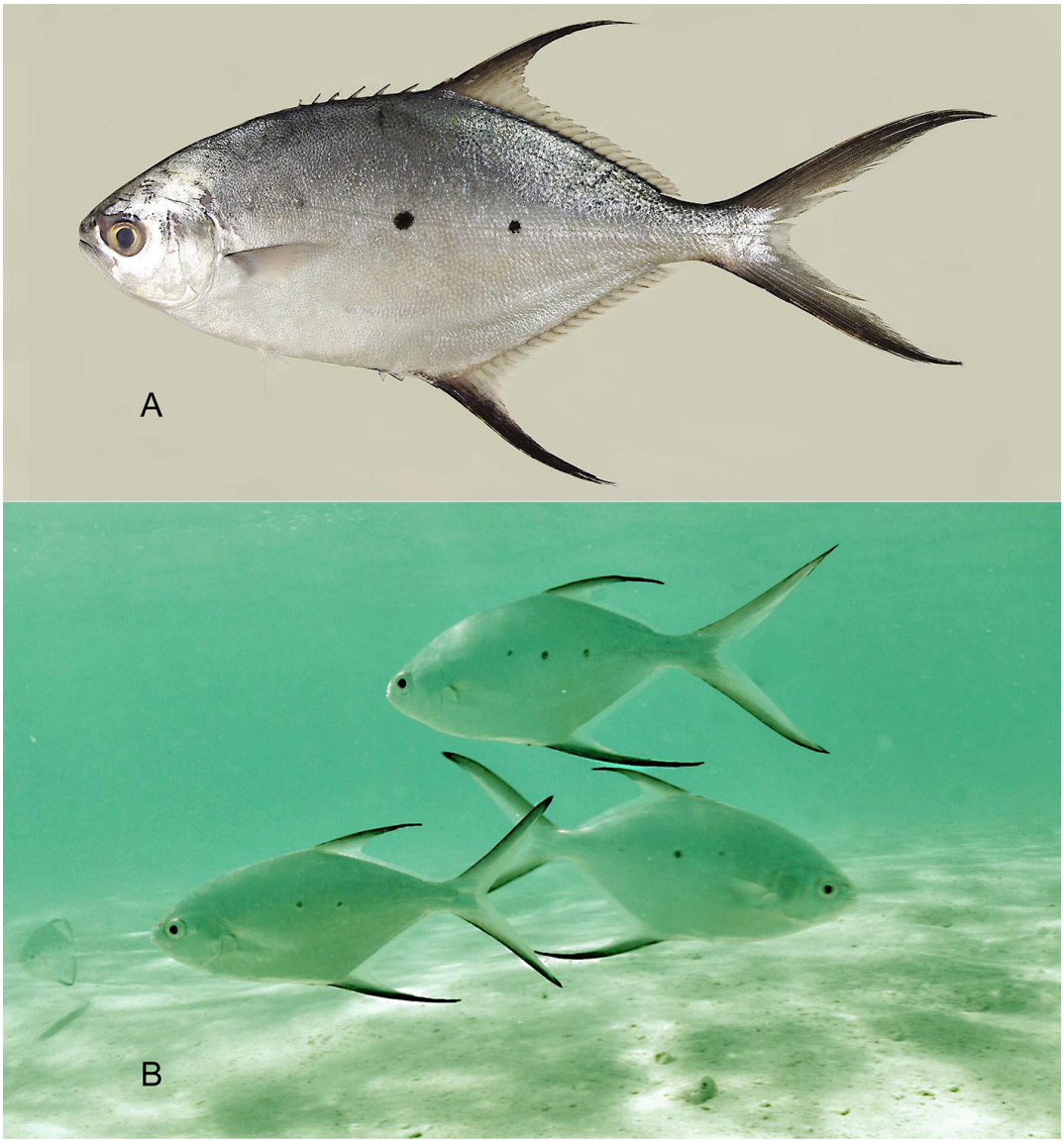

FIGURE 10. *Trachinotus baillonii*: **A**, KAUM I57304, 230 mm SL, Okiakima-jima Island, Japan (Hiroyuki Motomura); **B**, Exmouth Gulf, Australia (John Sear).

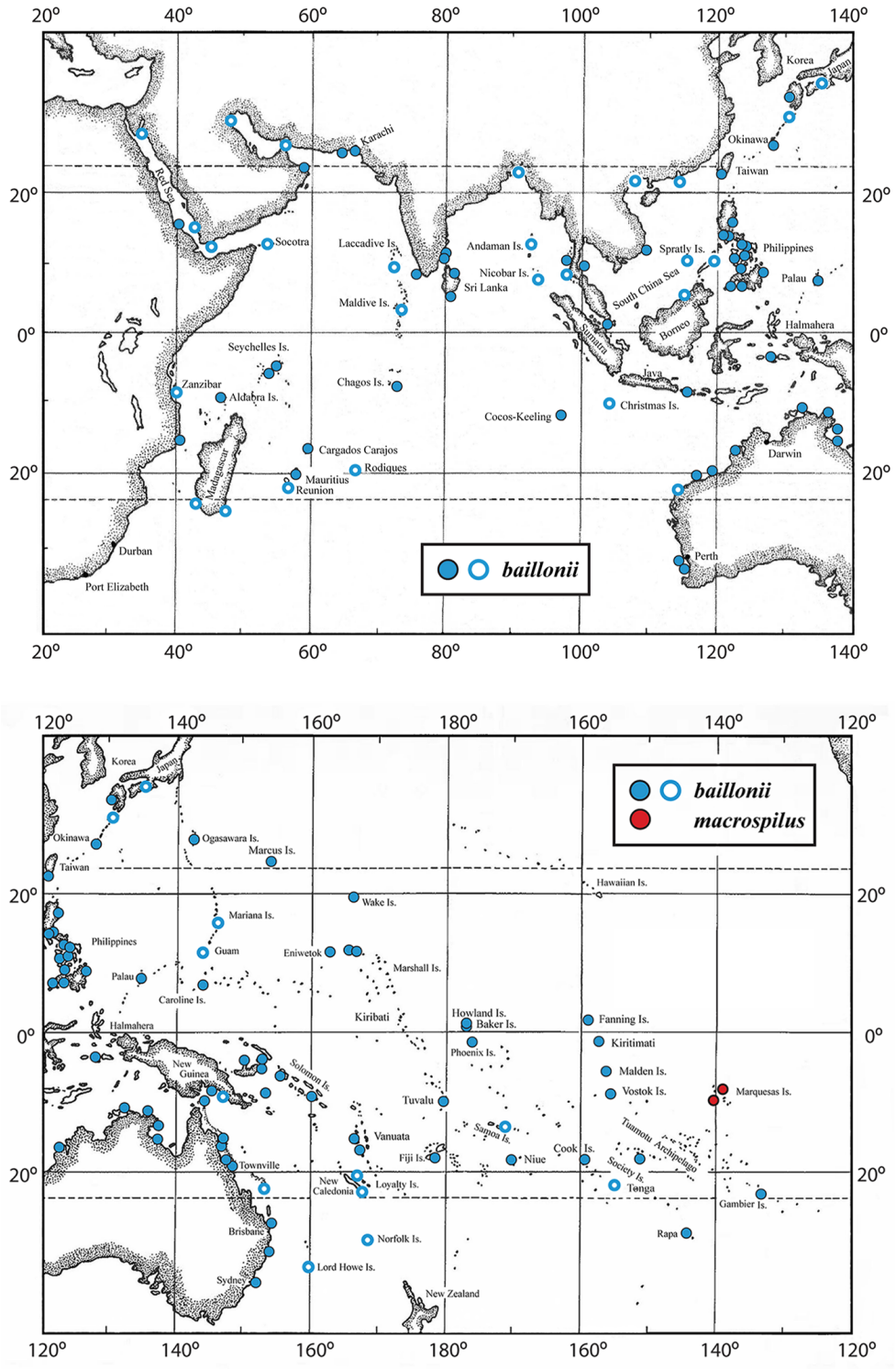

FIGURE 11. Distributions of *Trachinotus macrospilus* and *T. baillonii*. Solid symbols indicate specimens examined; open symbols indicate acceptable literature or photographic records.

Trachinotus botla **(Shaw)**

Largespot pompano, Common dart

Figures 2A, 5C, 6–8, 12–16; Tables 1–6, 8

Scomber botla parah Russell, 1803:32, pl. 142 (non-valid name; Vizagapatam, India).

Scomber botla Shaw, 1803:591 (original description; Vizagapatam, India; no types known); Day, 1875:233 (listed as synonym of *Trachinotus russelii*).

Trachinotus russelii Cuvier *in* Cuvier & Valenciennes, 1832:436 (original description; Pondichéry = Puducherry, India; syntypes MNHN A-5663); McCulloch, 1914:223 (misidentification = *T. botla*, Bernier Island, Western Australia); Oshima, 1925:408 (after Day); McCulloch, 1929:192 (checklist of Australian fishes; listed as synonym of *T. botla*); Smith, 1967:163, pl. 37 (Natal, Mozambique and Kenya); Smith-Vaniz *et al*., 1979:30 (syntype listed as synonym of *T. botla*); Talwar and Kacker, 1984:488 (India); Joshi *et al*., 2011:407, color pl. LVI (India); Joshi *et al*., 2016:44 (Gulf of Mannar, checklist).

Trachynotus russellii. Day, 1875:233, pl. 51B, fig. 3 (Canara, India); Barnard, 1927:554 (description; Natal Coast); Gushiken, 1983:164 (description after Williams, 1958; no specimens listed from Japan).

Trachynotus oblongus (not of Cuvier). Gilchrist and Thompson, 1908:187 (Natal).

Trachinotus russelli. Pellegrin, 1914:228 (Madagascar); Weber and de Beaufort, 1931:289 (synonymy with *T. oblongus*, *T. coppingeri* and *T. velox* listed as synonyms; description; distribution); Munro, 1955:131 (Ceylon), pl. 22, fig. 370, after Ogilby, 1915, pl. 28 = *T. coppingeri*; Williams, 1958:424, pl. 26, fig. 27 (East Africa); Munro, 1960:133, fig. 851 (in part, only records from Western Australia); Fourmanoir and Crosnier,1964:17 (Nosy Be, Madagascar); Maugé, 1967:225 (Toliara [=Tuléar], Madagascar); Abdussamad *et al*., 2013:25, color fig. 12 (India).

Trachynotus russelli. Pellegrin, 1914:228 (Mahambo and Fort Dauphin [Tolagnaro], Madagascar).

Trachinotus botla. Smith-Vaniz *et al*., 1979:30 (syntype listed with *T. russellii* in synonymy); Smith-Vaniz, 1986:659, fig. 210.50 (South Africa to Kenya and Madagascar); Hutchins and Swainston, 1986:58, 130, fig. 288 (Western Australia to Northern Territory); Van der Elst, 1988:161, unnumbered color photo (southern Africa); Allen and Swainston, 1988:74, color fig. 459 (northwestern Australia). Paxton *et al*., 1989:586 (Zoological Catalogue of Australia); Hutchins, 1990:270 (Shark Bay, Western Australia); Smale *et al*., 1995:127, pl. 74, figs. E1-3 (otolith description); Randall, 1995:472, color fig. 472 (Gulf of Oman); Smith-Vaniz, 1999:2747, unnumbered fig. ("apparently restricted to the Indian Ocean," including Western Australia); Hutchins, 2001:33 (Western Australia); Manilo and Bogorodsky, 2003:S107 (Oman, Gulf of Aden and Somali); Allen and Adrim, 2003:38 (Sumatra to Java); Heemstra & Heemstra, 2004:314, unnumbered color fig. (southern Africa); Springer and Smith-Vaniz, 2008:31 (supraneural and pterygiophore insertion patterns); White *et al*., 2013:176, color fig. 63.46 (Indonesia); Moore *et al*., 2014:186 (Kimberly region, Australia); Psomadakis *et al*, 2015:230, pl. 18, color fig. 143 (Pakistan); Parker & Booth, 2015:247 (biology and life history); Fricke *et al*., 2018:188 (Madagascar).

Trachinotus russellii. Oshima, 1925:408 (compiled, after Day); Smith, 1949:222, fig. 549 (Natal, Delagoa and occasionally East London); Kiener, 1966:1119, pl 19, fig. 35 (Madagascar).

Trachinotus baillonii. (not of Lacepède) Fowler, 1934b:452 (Natal).

Caesiomorus botla. Whitley, 1948:20 (Western Australia).

Palinurichthys umhlangae Smith, 1949:304, fig. 849b (original description; Umhlanga, KwaZulu-Natal, South Africa; syntype SAIAB [formerly RUSI] 13654).

Trachinotus coppingeri (not of Günther) Joshi *et al*., 2011:399, color pl. 60, fig. A (Tuticorin, India); Abdussamad *et al*., 2013:25, color fig. 13 (India); Joshi *et al*., 2016:44 (Gulf of Mannar, checklist).

Type material examined. CAS-SU 14445 (342 mm FL), neotype of *Trachinotus botla* Shaw, Vizagapatam, India, 17°41'N, 83°13'E (see Nomenclatural history); MNHN A.5663 (314 mm FL), dry mount on glass plate, syntype of *Trachinotus russelii* Cuvier, Pondichéry, Sonnerat, India; SAIAB [formerly RUSI] 13654 (32 mm FL), syntype of *Palinurichthys umhlangae* Smith, Umhlanga, KwaZulu-Natal, South Africa.

Other material examined. 110 specimens, 73–558 mm FL, including 39 uncataloged specimens from Sri Lanka and India that cannot be located but presumably were transferred to CAS (listed as CAS uncat.). Data for these specimens were taken by F.H. Berry when he worked at the National Marine Fishery Service's former Tropical Atlantic Biological Laboratory in Miami, Florida, and subsequently made available to us. **South Africa**: SAM 9979 (1, 178), Durban; SAM 9980 (1, 167), Natal; SAIAB 10453 (1, 178) and SAIAB 11079 (2, 248–258), Maputo Bay (= Delagoa Bay), (25°59'S, 32°57'E); ANSP 159120 (2, 128–152 C&S), Sodwana Bay (27°32'S, 32°41'E); ANSP 54830 (5, 91–184), ANSP 93097 (1, 348) and ANSP 95000 (2, 121–189), Durban (29°53'S, 31°03'E); SAIAB 7491 (1, 313), Isipingo (29°59'S, 30°41'E); SAIAB 10268 (2, 290–327), Algoa Bay (33°50'S, 25°50'E. **Mozambique**: SAIAB 55601 (1, 287), Ponta Lipobane, (17°00'S, 92°05'E). **Madagascar**: UMMZ 185864 (1, 146), St. Augustin, near Tuléar. **Somalia**: ANSP 163300 (1, 450), Ras Hafun (10°17'N, 51°09'E). **Pakistan**: ANSP 172850 (3, 50–175), ANSP 172851 (7, 72.6–111.2), ANSP 172853 (1, 113) and ANSP 206162 (1, 154), Sonmiani Bay near Hab River mouth (24°53'N, 66°41'E). **India**: ANSP 152962 (1, 266), ANSP 153031 (3, 152–171), ANSP 158305 (1, 191) and CAS uncat. (7, 177-284) Porto Nova (11°30'N, 79°45'E); CAS-SU 69911 (2, 145–154), Orissa State, Puri (19°49'S, 85°54'E). **Sri Lanka**: ANSP 148732 (12, 303–475), ANSP 150961 (1, 366 SL), ANSP 158304 (1, 130), ANSP 158499 (5, 188–221), BPBM 27740 (1, 280), CAS 16478 (2, 229–231), CAS 244377 (1, 407), CAS uncat. (18, 304–481), sta. FJS 69–59; CAS uncat. (5, 289–483), sta. S-V 69–75; CAS uncat. (5, 337–446), sta. S-V 113; CAS uncat. (1, 371, sta. PCH 69–207; CAS uncat. (2, 334–359), sta. TI 69–309; CAS uncat. (1, 310), sta.

TI 70–302. **Myanmar**: CAS-SU 39573 (1, 161), Southern Mosco Group (14°07'N, 97°14'E). **Indonesia**: CSIRO H 8369-01 (1, 415), W. Java, Pelabuhanratu (7°2'N, 106°32'E). **Western Australia**: ANSP 153944 (2, 497–558) Port Quobba (24°29'S, 113°25'E); WAM P.26675–007 (1, 172), Dirk Hartog Island (26°08'S, 113°10'E); WAM P.5595–001 (1, 231), Yanchep (31°33'S, 115°37'E); WAM P.24543 (1, 227), Fremantle (32°03'S, 115°44'E); WAM P.702 (1, 279), Garden Island (32°12'S, 115°40'E).

Diagnosis. A species of *Trachinotus* in which adults have 3–5 silvery gray (in fresh specimens) oval or vertically oblong spots above or slightly touching lateral line (spots usually absent in specimens <15 cm FL); only the first spot positioned above the pectoral fin and several of the larger spots much larger than eye diameter; dorsal fin VI- or VII-I, 22–24; anal-fin II-I, 19–22, rarely 22; vomerine tooth patch round or triangular-shaped and palatine tooth patch relatively short (Fig. 2A, Table 2). Selected mensural data mostly for specimens >200 mm FL are given in Table 8 and selected measurements are plotted in Figs. 6–8.

Comparisons. *Trachinotus botla* is superficially similar to the allopatric *T. coppingeri* but adults differ in having one large spot above the pectoral fin (vs. two spots above lateral line); segmented anal-fin rays 19–22, rarely 22 (vs. 22–24 rays); vomerine tooth patch round or oval-shaped (vs. vomerine tooth patch frequently chevron-shaped, Table 2); and ratio of pelvic-fin length to pectoral-fin length greater than in the three other species (Fig. 8). Adults of *Trachinotus botla* differ most noticeably from both *T. baillonii* and *T. macrospilus* in having much larger spots on the sides, the largest about equal to or larger than eye diameter (vs. smaller than or only a little larger than iris diameter), and in fresh specimens the spots are silvery gray (vs. black).

Size. Largest specimen examined 56 cm FL, 75 cm TL. The Australian Anglers Association (WA Division) reported a maximum weight of 3.5 kg for *Trachinotus botla* based on a fish from Quabbo, Western Australia, caught in August 1983.

Ecology and life-history. In a study of the biology and life history of *Trachinotus botla* in South Africa, Parker and Booth (2015:251) stated "it appears to be the only 'permanent' surf zone carangid species that completes its entire life cycle inshore." Based on age determinations from otoliths, these investigators determined that *Trachinotus botla* is a fast-growing and short-lived species. Fish attained 132 mm FL within two months and the oldest male and female were both six years old and measured 434- and 495-mm FL respectively. Age at 50% sexual maturity was calculated as 247 mm FL. Spawning season was between November and February. Small fish were restricted to shallow areas of the inshore surf zone and fed predominantly on copepods, small teleosts, and mole crabs. Larger fish fed on mussels, gastropods, and crab megalopae in deeper areas of the surf zone. In South Africa 45% of *Trachinotus botla* 10–35 cm FL had a large parasitic isopod, *Cymothoa borbonica* Schioedte and Meinert, attached to the tongue (Parker and Booth, 2013). Although the isopod restricts the mouth cavity, damages the basihyal (tongue), and causes a decrease in growth rates, parasitized fish seem to feed effectively.

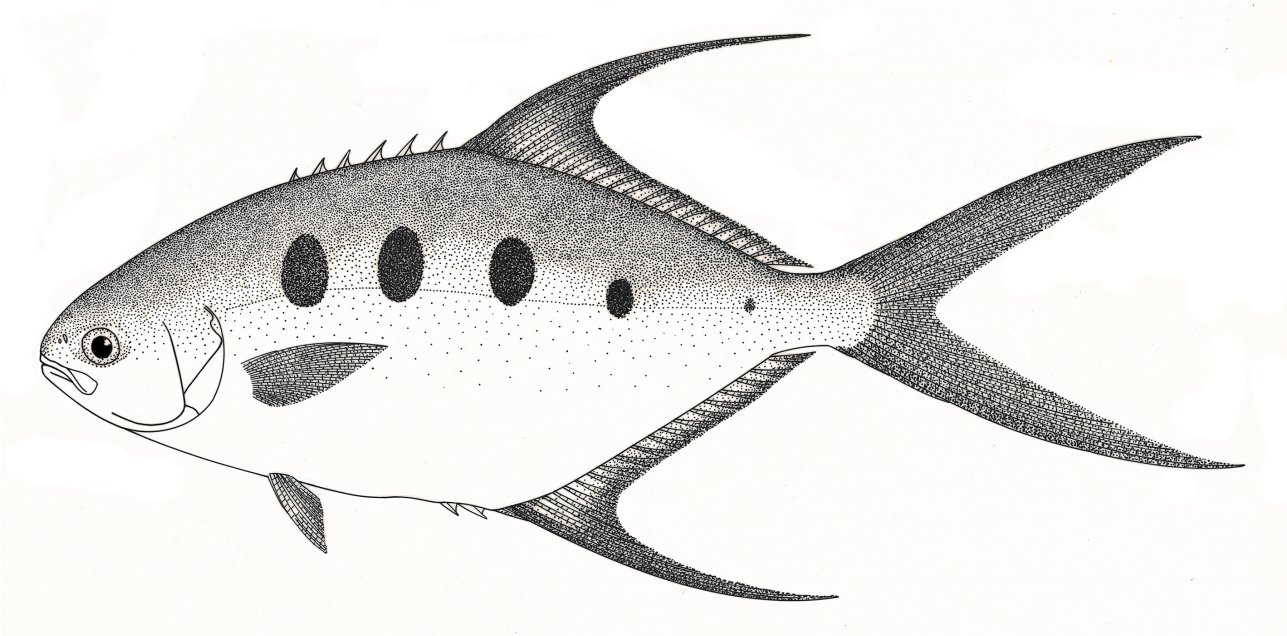

FIGURE 12. *Trachinotus botla*, ANSP 148732, 343 mm FL, Sri Lanka. Drawn by Tracy D. Pedersen.

Distribution. (Fig. 13) South Africa (Algoa Bay), to Somalia, Madagascar, Gulf of Oman to Pakistan, India, Sri Lanka and Myanmar, and south to Indonesia (West Java, Pelabuhanratu) and Western Australia. All records of *T. botla* from Papua New Guinea and New Britain (Munro, 1956, 1967) apparently are based on misidentifications of *T. baillonii*; however, Munro's (1967, pl. 26, fig. 393) drawing of *Trachinotus russelli* appears to be a slight modification of previously published ones of *T. coppingeri* based on New South Wales specimens. The four "Fairwind" specimens available from New Britain (CSIRO C176, Jacquinot Bay and C1053, Pulie) and Papua New Guinea (CSIRO C241, Woodlark Island) and (CSIRO C868, Daugo Island) collected during 1948 and 1950 are all *T. baillonii*.

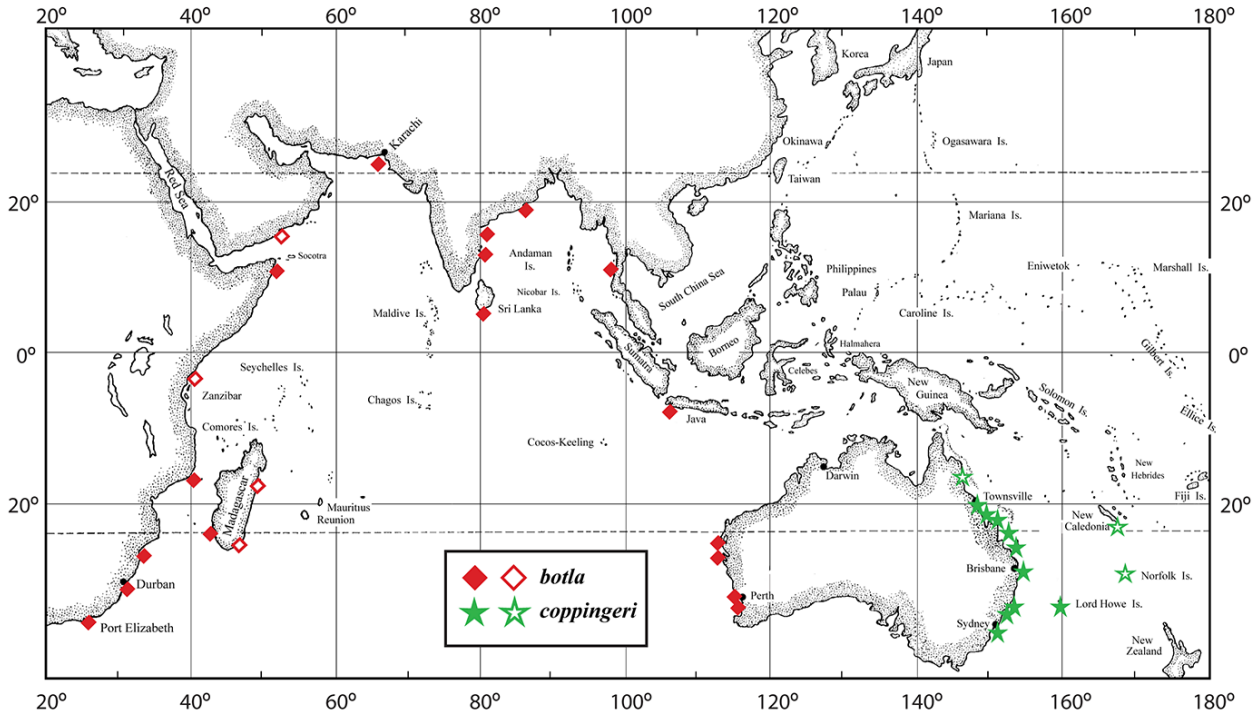

FIGURE 13. Distributions of *Trachinotus botla* and *T. coppingeri*. Solid symbols indicate specimens examined; open symbols acceptable literature records.

Etymology. The specific epithet *botla* is based on the common name used by native people in India for fishes during the early 1800s.

Nomenclatural history. Shaw's (1803) *Scomber botla*, a composite species, was based primarily on Russell's (1803) plate 142 of "botla parah" from Vizagapatam, India, here reproduced as Fig. 14. When an original description relates to more than one taxon the availability of a name is not affected (Article 17 of the International Code of Zoological Nomenclature, ICZN 1999). In his brief original description Shaw referred to two of Russell's plates, with plate 142 clearly referable to *Trachinotus botla* and plate 137 to the carangid now known as *Scomberoides commersonnianus* Lacepède. In contrast to plate 142, Shaw preceded his reference to plate 137 by a question mark indicating uncertainty about their conspecificity although his text description included characters of both genera. In the original description of *Trachinotus russelii* (misspelling of Russell), Cuvier in Cuvier and Valenciennes (1832:436) did not mention Shaw's earlier description (perhaps unaware of it) but cited Russell's plate 142 indicating that it was a drawing of his new species, hence adoption of the patronym. Day (1875) also recognized *T. russelii* as a senior synonym, as did Weber and de Beaufort (1931:289). In a footnote the latter authors specifically rejected Shaw's name based on the composite nature of the description; other authors followed that opinion or unquestionably adopted Cuvier's name. In contrast, Ogilby (1915:95) concluded that Shaw's name has priority over *T. russelii* Cuvier because both descriptions were based on the same Russell figure. All Australian ichthyologists have followed Ogilby in recognizing *Trachinotus botla* as a senior synonym of *T. russelii* and since the 1980s most authors who published on Indo-West Pacific *Trachinotus* have done likewise (see synonymy).

According to Fricke *et al*. (2019) no types of *T. botla* are known. In view of the above nomenclatural inconsistency and following qualifying conditions of Article 75.3 of the Code (ICZN, 1999), we designate CAS-SU

14445 as the neotype (Fig. 15) of *Scomber botla* Shaw. This 342 mm FL (316 mm SL) specimen was obtained from Vizagapatam, India, by A.W. Herre in 1940 (no exact date). The specimen has dorsal fin VII-I, 22, anal fin II-I, 20, developed gill rakers 6+12, and vomerine and palatine tooth pattern type A. The two largest body spots on the left side are 33.6 and 30.2 mm in height and the eye diameter is 18.0 mm. The following measurements are given as percent FL: dorsal-fin lobe height 41.5, anal-fin lobe height 44.5, pectoral-fin length 16.7, and pelvic-fin length 10.0; ratio pectoral/pelvic = 1.7.

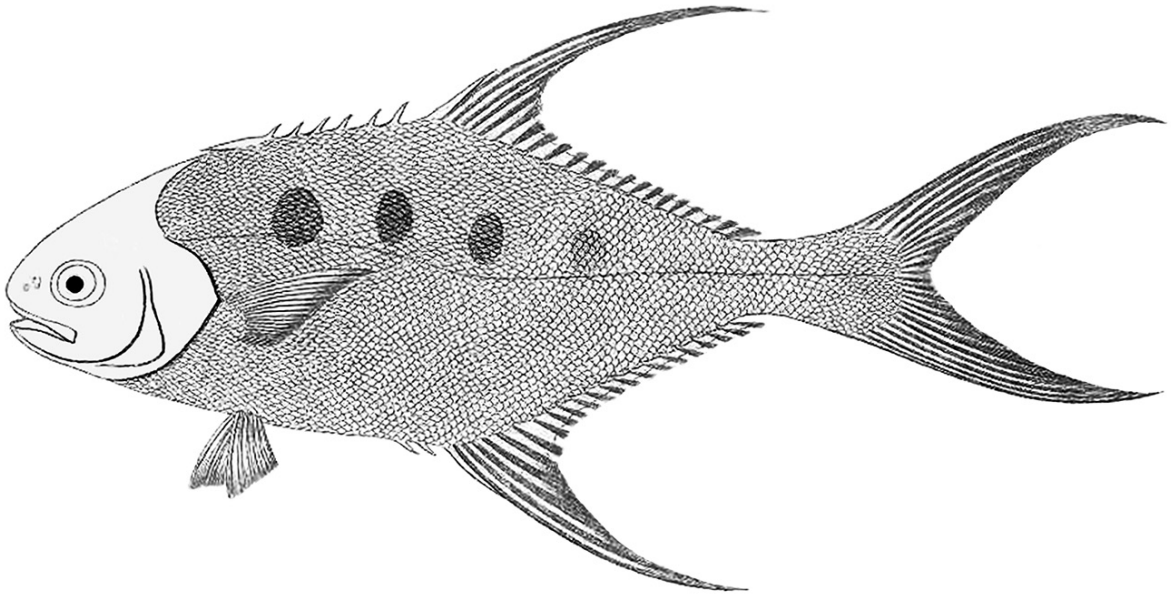

FIGURE 14. Original drawing of Russell's (1803) "botla parah," plate 142

FIGURE 15. *Trachinotus botla*, SU 14445, neotype, 342 mm FL, Vizagapatam, India. Photograph by Jon Fong.

Trachinotus coppingeri **Günther**

Swallowtail dart; Surf dart

Figures 6–8, 13, 17, 18; Tables 1–6, 8

Trachynotus coppingeri Günther, 1884:29, pl. 3, fig. A (original description; Percy Island, Queensland, Australia; holotype BMNH 1881.10.12.44).

FIGURE 16. *Trachinotus botla*: **A**, 380 mm FL, Karachi, Pakistan; **B**, CSIRO H 8369–01, 415 mm FL, Indonesia, Java. Photographs courtesy of: **A**, Hamid Badar Osmany and **B,** Commonwealth Scientific and Industrial Research Organization (CSIRO).

Trachinotus russellii (not of Cuvier) Waite, 1904:199 (Lord Howe Island); Stead, 1908:93, fig. 62 (New South Wales, Australia); Weber and de Beaufort, 1931:289 (*T. coppingeri* and *T. velox* erroneously listed as synonyms); Munro, 1955:131 (pl. 22, fig. 370, after Ogilby, 1915, pl. 28); Munro, 1960:133, fig. 851 (in part, Australian records from Queensland); Munro, 1967:234, pl. 26, fig. 393 (figure 393 is a duplication of Ogilby's 1915, plate 28 based on a specimen of *T. coppingeri* from Moreton Bay, New South Wales; Coleman, 1980:150, unnumbered color fig. (southern Australia).

Trachynotus russelei [sic] (not of Cuvier) Ogilby, 1916:151–152 compared with *T. baillonii*); McCulloch, 1929:192 (checklist of Australian fishes) Borodin, 1932:77 (New Caledonia).

Trachinotus velox Ogilby, 1908:14 (original description; south Passage, Queensland, Australia; holotype QM I.1536); McCulloch, 1929:182 (checklist Australian fishes; listed in synonymy of *T. botla*); Smith-Vaniz, 1999:2748 unnumbered fig. (Australian endemic, listed as junior synonym of *T. coppingeri*).

Trachinotus coppingeri. Day, 1888:790 (listed as synonym of *Trachinotus russellii*); Jordan and Seale, 1906:235 (listed as synonym of *T. russelli*); Ogilby, 1915:93 (listed in synonymy of *T. botla*); McCulloch, 1929:192 (checklist of Australian fishes; listed as synonym of *T. botla*); Hutchins and Swainston, 1986:58, 130, fig. 289 (Queensland to New South Wales, Sydney); Paxton *et al*., 1989:586 (Zoological Catalogue of Australia); Francis, 1993:161 (Australia and Lord Howe Island); Johnson, 1999:735 (Moreton Bay, Queensland); Smith-Vaniz, 1999:2748, unnumbered fig. (Queensland Australia and Lord Howe Island); Springer and Smith-Vaniz, 2008:31 (supraneural and pterygiophore insertion pattern); Fricke *et al*., 2011:396 (checklist; New Caledonia); McPhee *et al*., 1999:89 (movement patterns in Australia).

Trachinotus botla (not of Shaw) Ogilby, 1915:93, pl. 28 (synonymy in part; *T. oblongus* and *T. russelli* listed as synonyms; Queensland, Australia); McCulloch, 1929:192 (listed from New South Wales, Queensland and Lord Howe Island); Roughley, 1951:59, color pl. 23 (Queensland, Australia); Munro, 1956:184 (New Guinea and New Britain records apparently all based on misidentified R/V Fairwind collections of *T. baillonii*; Marshall, 1964:229, pl. 38, fig. 240 (Queensland and New South Wales, Australia); Allen *et al*., 1976:401 (Lord Howe Island); Russell, 1983:56 (Capricorn group, Great Barrier Reef); Randall *et al*., 1990:168, color pl. V-12 (Great Barrier Reef and Coral Sea); same color drawing also used by Allen and Swainston (1988) for northwestern Australian *T. botla*.

Caesiomorus botla (not of Shaw). Whitley, 1964:44 (listed).

Trachinotus russelli. Grant, 1982:216, color pl. 81 (Queensland, Australia)

Trachinotus coppingeri (not of Günther) Joshi *et al*., 2011:399, color pl. 60, fig. A (Tuticorin, India); Abdussamad *et al*., 2013:25, color fig. 13 (India); Joshi *et al*., 2016:44 (Gulf of Mannar, checklist).

Type material examined. BMNH 1881.10.12.44 (134 mm FL), holotype of *Trachinotus coppingeri* Günther, Percy Island (21°39'S, 150°16'E), Queensland, Australia; QM I.1536 (176 mm FL), holotype of *Trachinotus velox* Ogilby, South passage (28°22'S, 153°26'E), Moreton Bay, Queensland, Australia.

Other material examined. 65 specimens, 83–343 mm FL. **Eastern Australia**: BMNH 1914.8.20.167 (1, 264) New South Wales, D.J. Stead; QM 6653 (1, 325), Magnetic Island (19°08'S, 146°50'E); AMS IB.5433 (1, 343), Townsville District (19°16'S, 144°44'E); AMS IA.7481 (1, 298), Lindeman Island (20°27'S, 149°02'E); AMS E.1883 (1, 296), North Reef (23°11'S, 151°54'E); AMS I.15620–027 (2, 287–321) and ANSP 152961 (1, 303), Capricorn Group, One Tree Islands (23°30'S, 152°05'E); CSIRO C3215 (1, 248), Brisbane vicinity; QM I.97 (1, 168), QM I.1659 (1, 244), QM I.1670 (1, 112) and QM I.1671 (1, 107), Moreton Bay (27°27'S, 153°20'E); ANSP 151616 (14, 244–327), ANSP 153828 (10, 228–256), QM I.11455 (3, 161–175), QM I.20061 (1, 318), QM I.20062 (1, 261), Stradbroke Island (27°25'S, 153°35'E); AMS I.22893 (1, 160), Arrawarra Beach (30°04'S, 153°12'E); AMS I.22891 (1, 134), Woolgoolga Beach (30°07'S, 153°12'E); AMS I.14880 (1, 120), Trial Bay (30°53'S, 153°04 'E); AMS I.875 (1, 207), Port Stephens (32°42'S, 152°06'E); AMS IA.4224 (1, 198), New Port (33°39'S, 151°19'E); AMS IB.2109 (1, 83), North South Wales, Middle Harbour (33°48'S, 151°16'E); AMS IA.4936–37 (2, 143–156), AMS I.9719 (1, 326) and; MNHN A.4060 (1, 237), MNHN A.4078 (1, 226), Sydney (33°53'S, 151°13'E); AMS I.7402 (1, 264), Waverley (33°54'S, 151°17'E); CAS-SU 13055 (1, 257), Botany Bay (34°0'S, 151°11'E); AMS IB.430 (1, 146), Gunnamatta Bay (34°04'S, 151°09 'E). **South Australia**: USNM 176876 (1, 173), "Kangaroo Island vicinity" (ca. 35°50'S, 137°15'E). **Lord Howe Island** (31°31'S, 159°05'E): AMS I.6017 (1, 299), AMS I.9283 (1, 248), AMS I.12916 (1, 236), AMS I.10653 (1, 249), AMS I.13680 (1, 314), AMS I.13681 (1, 303), AMS I.13682–83 (2, 179–180).

Diagnosis. A species of *Trachinotus* in which adults have 3–7 dark, vertically elongate or oval spots just touching lateral line or about one-forth below lateral line (spots very faint or absent in specimens <12 cm FL), the first two spots positioned above pectoral fin and several of the larger spots much larger than eye diameter and with their dorsal margins poorly defined; dorsal fin VI-I, 23–25; anal-fin II-I, 22–24; vomerine tooth patch oblong or chevron-shaped, usually chevron-shaped, and palatine tooth patch variable in length, usually relatively short (Fig. 2A, Table 2). Selected mensural data for specimens >200 mm FL are given in Table 8 and selected measurements are plotted in Figs. 6–8.

Comparisons. *Trachinotus coppingeri* is most similar to the allopatric *T. botla*, adults sharing with that species several spots on the sides that are equal to or larger than the eye diameter and silvery gray in fresh specimens but differs in having two spots (vs. only one spot) above the pectoral fin; segmented anal-fin rays 22–24 (vs. 19–22, rarely 22); vomerine tooth patch frequently chevron shaped (vs. consistently round or oval-shaped); and lower ratio of pelvic-fin length to pectoral-fin length (Fig. 8). *Trachinotus coppingeri* also differs from the other three species in having the upper margins of the large spots poorly defined. Adults of *Trachinotus baillonii* and *T. macrospilus* differ most noticeably from *T. coppingeri* in having black spots on sides with well-defined margins, and the largest spots smaller than the eye diameter.

Size. Largest specimen examined 34 cm FL, ca. 45 cm TL, but attains a larger size. Grant (1982) reported a total length of 60 cm.

Ecology and palatability. *Trachinotus coppingeri* is the most common member of the genus in southern Queensland and northern New South Wales regions of Australia. It is generally found in the surf zone and is an important species caught by commercial and recreational beach fishers; the majority are caught by sportfishers who do not have a high regard for its edibility (McPhee *et al*., 1999). In contrast, Marshall (1964) described it (as *Trachinotus botla)* as a splendid food-fish and Grant (1978) as a good-food fish that should be bled immediately upon capture. Spawning occurs between October and April. Tagging and recapture studies indicated random and unpredictable movement patterns, consistent with the temporally and spatially patchy prey of surf zone fishes in general (McPhee *et al*., 1999). Most tagged fish moved <4 km from their release sites but movement of 275 km was recorded for one 250 mm FL sub-adult.

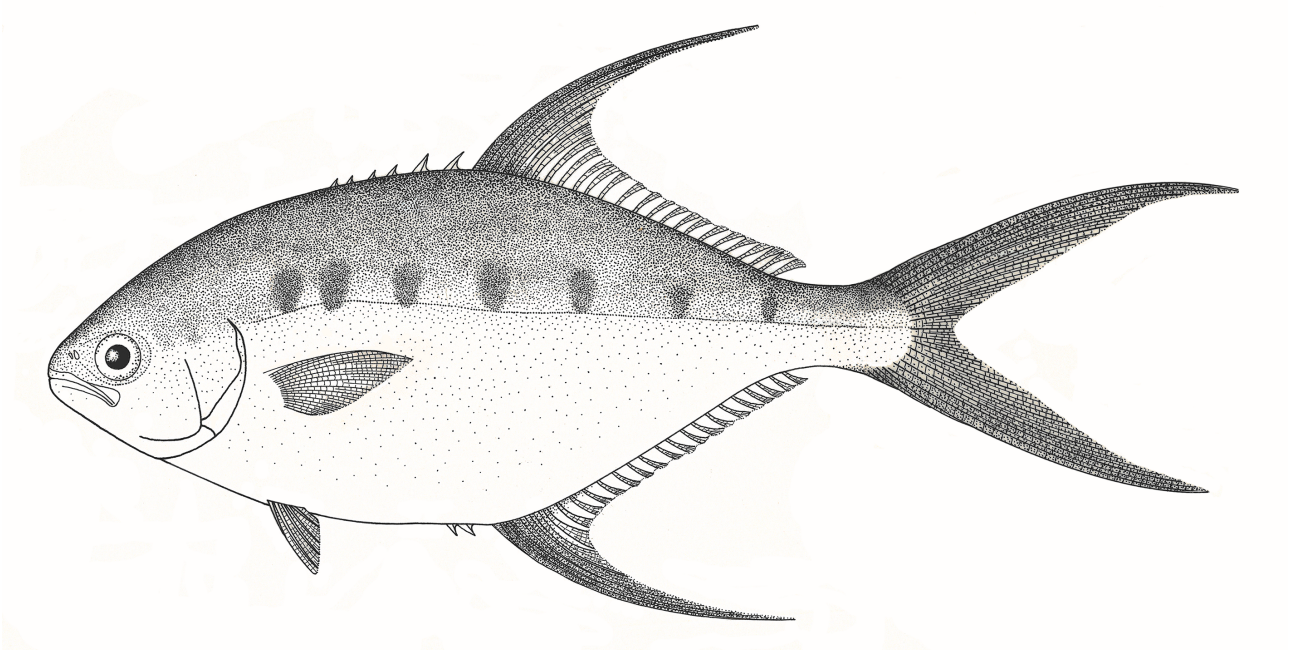

FIGURE 17. *Trachinotus coppingeri*, ANSP 153828, 254 mm FL, Australia, Queensland. Drawn by Karen Ackoff.

Distribution. (Fig. 13) Eastern Australia and Lord Howe Island, and reliably reported from New Caledonia (Borodin, 1932; Fricke *et al*., 2011) and Norfolk Island (Francis, 1993). A single specimen from southern Australia, near Kangaroo Island (USNM 176876), where the species is not established, was stated to have been obtained by Col. John K. Howard between 18 April and 20 March 1953. This record (not plotted on Fig. 14) either documents a rare waif occurrence or possibly a specimen locality error.

Records of *Trachinotus coppingeri* from southern India (Joshi, 2011:399; Abdussamad *et al*., 2013:25) are based on misidentifications of *Trachinotus botla* (Smith-Vaniz and Carpenter, 2015). Kailola (1975:122) recorded only *Trachinotus baillonii* and *T. blochii* in the fish reference collection at the Kandu Fisheries Research Laboratory, Port Moresby (16 specimens from three localities).

Etymology. Named for Richard William Coppinger (1847–1910), Irish naval surgeon and naturalist, and author of 'The Cruise of the Albert, 1878-82" (Coppinger, 1883).

Remarks. Günther's (1884) description and illustration of the holotype of *Trachinotus coppingeri* indicate that the 134 mm FL specimen lacked spots on the side of its body. Ogilby (1908), who apparently was unaware of Günther's earlier description, emphasized that the 176 mm FL holotype of *T. velox* had a series of spots along the lateral line. He stated "… this very distinct species has been confounded with the Indian *Trachinotus russellii* [= *T. botla*], the confusion having doubtless arisen through the similarity of the color markings." He also observed (p. 15) "… we have no authentic knowledge of the occurrence of [*T. botla*] in the seas of the Commonwealth, and all records of [the species] eastward from a line drawn between the west coast of Australia and the Moluccas must be looked upon with grave suspicion." Subsequently, several Australian authors (see synonymy) followed Ogilby (1915) in erroneously listing both *T. coppingeri* and *T. velox* as synonyms of *T. botla*.

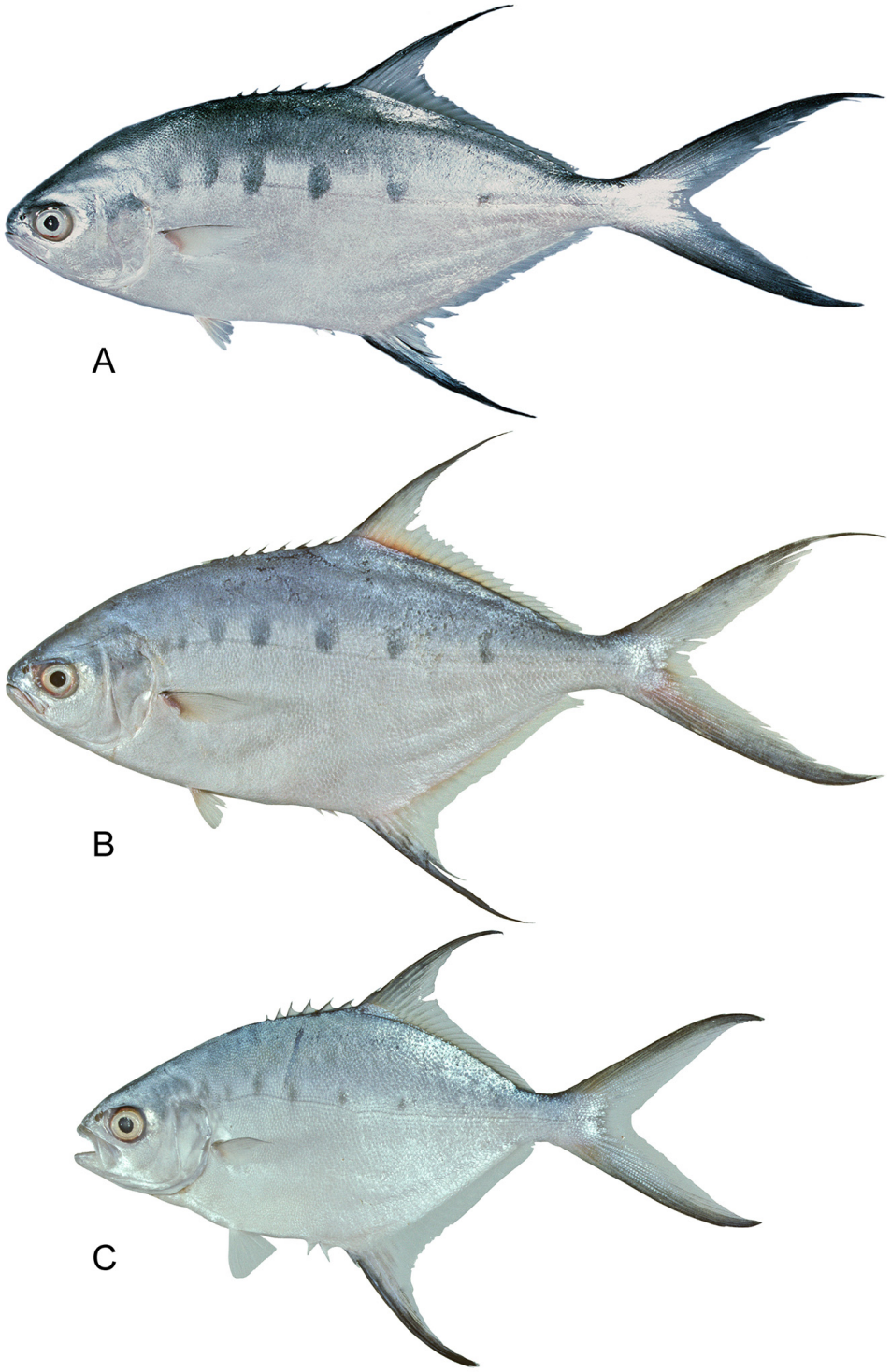

FIGURE 18. *Trachinotus coppingeri,* all from Queensland Australia: **A**, CSIRO H 4305–03, 295 mm FL; **B**, CSIRO H 5221–01, 254 mm FL; **C**, CSIRO H 4599-03, 146 mm FL. Photographs courtesy of Commonwealth Scientific and Industrial Research Organization (CSIRO).

TABLE 8. Morphometric ratios for species of *Trachinotus* with spots on their sides in specimens ≥200 mm FL. All values except pectoral/pelvic fin ratio, eye diameter, and maximum spot height and are percentages of fork length. Pectoral/pelvic fin ratio is quotient of fin measurements in mm for specimens ≥100 mm FL. Eye diameter and maximum spot height are percentages of head length and includes specimens ≥100 mm FL. Bold measurements are especially useful in distinguishing among species.

	macrospilus			baillonii			botla			coppingeri		
	N	Range	Mean (SD)	N	Range	Mean (SD)	N	Range	Mean (SD)	N	Range	Mean (SD)
Standard Length (mm)	10	245-339	---	127	200-432	---	76	211-558	---	48	206-343	---
Sn-D1O	7	25.9-37.7	35.3 (4.2)	46	34.6-38.6	36.7 (0.9)	14	35.6-39.5	37.2 (1.1)	20	34.9-38.0	36.4 (0.7)
Sn-D2O	7	36.6-52.3	48.8 (5.6)	51	49.3-54.9	52.5 (1.0)	14	52.6-55.5	53.9 (0.9)	20	50.6-54.2	52.2 (0.9)
Sn-P2O	7	25.3-30.5	29.2 (1.9)	43	28.7-40.0	31.0 (1.7)	12	28.3-42.2	30.7 (3.9)	20	28.9-32.8	30.7 (0.9)
Sn-A2O	7	34.1-51.9	47.1 (6.2)	43	49.0-54.5	52.4 (1.2)	12	51.6-59.5	54.5 (2.0)	20	40.2-55.4	52.1 (3.1)
D1O-P2O	7	25.0-38.1	33.6 (4.2)	76	29.5-37.0	33.2 (1.8)	53	29.1-37.0	32.8 (1.7)	22	30.6-37.0	33.4 (1.9)
D1O-A2O	7	29.0-42.2	38.5 (4.5)	46	36.4-51.6	40.7 (2.7)	10	38.3-45.2	41.7 (2.0)	18	37.4-44.0	40.4 (1.9)
D2O-P2O	7	30.1-43.8	39.4 (4.6)	48	32.9-46.0	41.4 (2.5)	11	33.6-45.7	41.9 (3.2)	20	29.8-46.1	40.2 (3.5)
D2O-A2O	8	29.1-41.7	37.5 (3.9)	86	4.2-45.0	37.7 (4.4)	27	35.9-42.6	39.6 (1.9)	21	34.5-43.4	38.9 (2.6)
Height dorsal-fin lobe	10	16.1-21.5	**18.1 (1.7)**	115	18.9-46.0	28.9 (5.5)	65	27.7-44.5	36.2 (4.1)	46	23.3-39.8	31.0 (4.0)
Height anal-fin lobe	10	14.9-23.4	**18.5 (2.1)**	114	19.7-52.1	36.1 (7.0)	66	26.0-45.2	33.9 (3.6)	45	20.2-43.2	34.5 (4.7)
Pectoral-fin length	10	12.4-18.1	16.6 (1.5)	111	14.1-19.4	16.5 (1.0)	54	14.4-19.6	16.5 (1.2)	48	13.6-20.2	15.7 (1.0)
Pelvic-fin length	9	6.6-9.1	7.4 (0.9)	107	6.1-10.1	8.1 (0.9)	54	7.3-14.3	**10.5 (1.6)**	47	6.9-9.8	8.5 (0.7)
Length dorsal-fin base	8	26.0-37.2	34.7 (3.7)	52	32.4-37.0	34.1 (1.1)	14	31.8-36.4	34.0 (1.5)	22	33.5-37.7	35.1 (1.0)
Length anal-fin base	8	27.0-40.2	36.7 (4.2)	52	32.7-39.0	35.5 (1.3)	14	30.1-34.9	**32.7 (1.1)**	22	34.4-40.8	36.7 (1.7)
Head length (HL)	10	21.3-22.7	22.1 (0.5)	122	19.9-24.9	22.8 (1.0)	70	19.8-25.3	22.3 (1.2)	47	21.8-24.9	23.2 (0.7)
Pectoral/pelvic ratio	24	1.6-2.5	2.1 (0.3)	192	1.2-2.7	1.9 (0.3)	78	1.2-2.1	1.5 (0.2)	64	1.4-2.2	1.8 (0.2)
Eye diameter	27	20.5-41.1	29.6 (3.9)	145	14.1-47.2	28.9 (3.1)	48	14.7-27.8	23.2 (3.1)	60	16.8-29.4	23.9 (2.7)
Maximum spot height	27	16.5-30.6	**23.2 (2.9)**	117	6.5-17.9	**11.2 (2.0)**	21	23.2-46.2	**34.7 (6.1)**	23	19.3-41.7	**30.2 (5.4)**

Key to Indo-West Pacific species of *Trachinotus*

1a One to seven dark spots on or near lateral line (spots usually absent in specimens smaller than about 10–15 cm FL); segmented dorsal-fin rays 20–26; anal-fin pterygiophores inserting in first interhemal space typically 3 (Fig. 1, Table 1) 2

1b No spots on or near lateral line at any size; segmented dorsal-fin rays 18–20 (except 21–23 in *T. africanus*); anal-fin pterygiophores inserting in first interhemal space typically 2 5

2a Adults with black spots in fresh specimens; no large spot above pectoral fin in adults 3

2a Adults with silvery-gray spots in fresh specimens; 1 or 2 large spots above pectoral fin in adults. 4

3a Largest spot on side of adults usually smaller than or approximately size of iris diameter; adults with 2-6 spots (usually 3) spots on sides; height of dorsal-fin lobe 18.9–46.0% FL, mean 28.9%, in specimens >200 mm FL (broadly distributed in Indo-West Pacific) . . . . . *T. baillonii*

3b Largest spot on side of adults distinctly larger than iris diameter; adults typically with 1 or 2 spots on side; height of dorsal-fin lobe 16.1–21.5% FL, mean 18.1%, in specimens >200 mm FL (Marquesas Island endemic) . . . . . *T. macrospilus*

4a Adults typically with only one spot above pectoral fin; vomerine tooth patch consistently round or triangular-shaped; segmented dorsal-fin rays 22–24, usually 22 or 23; segmented anal-fin rays 19–22, rarely 22 (Indian Ocean including Western Australia) . . . . . *T. botla*

4b Adults with two spots above pectoral fin; vomerine tooth patch usually chevron shaped; segmented dorsal-fin rays 23–25, usually 24 or 25; segmented anal-fin rays 22–24 (Eastern Australia, Lord Howe and Norfolk islands) . . . . . *T. coppingeri*

5a Segmented dorsal-fin rays 21–23; segmented anal-fin rays 19–21; axillary base beneath pectoral fin often with black ring-like blotch (Western Indian Ocean, Gulf of Oman and Bali) . . . . . *T. africanus*

5b Segmented dorsal-fin rays 18–20; segmented anal-fin rays 16–18; axillary base beneath pectoral fin without black ring-like blotch 6

6a Supraoccipital bone of skull becoming broad and sausage-shaped in adults (Fig. 19A), this character easily observed by simple dissection along midline of skull; in life, anal-fin yellow; teeth in narrow band on tongue, persisting to about 50 cm FL (Persian Gulf, Pakistan, India, China and southern Japan) . . . . . *T. mookalee*

6b Supraoccipital bone of skull thin and blade-like in adults (Fig. 19B); in life, color of anal fin variable, yellow or brownish with orange anterior margin; tongue toothless (except 2 or 3 slender teeth rarely present in small specimens of *T. blochii*) 7

7a Supraneural bone a swollen inverted tear-drop, becoming oval-shaped in large adults (Fig. 20); in life, anal-fin lobe brownish with anterior margin orange; nasal bone not swollen in adults (broadly distributed in Indo-West Pacific) . . . . . *T. blochii*

7b Supraneural bone not swollen as above, shaped like an inverted "L" with the short arm projecting anteriorly; in life, anal-fin lobe yellow; nasal bone greatly swollen (hyperostotic) in adults (Eastern and northern Australia, South China Sea and southern Japan) . . . . . *T. anak*

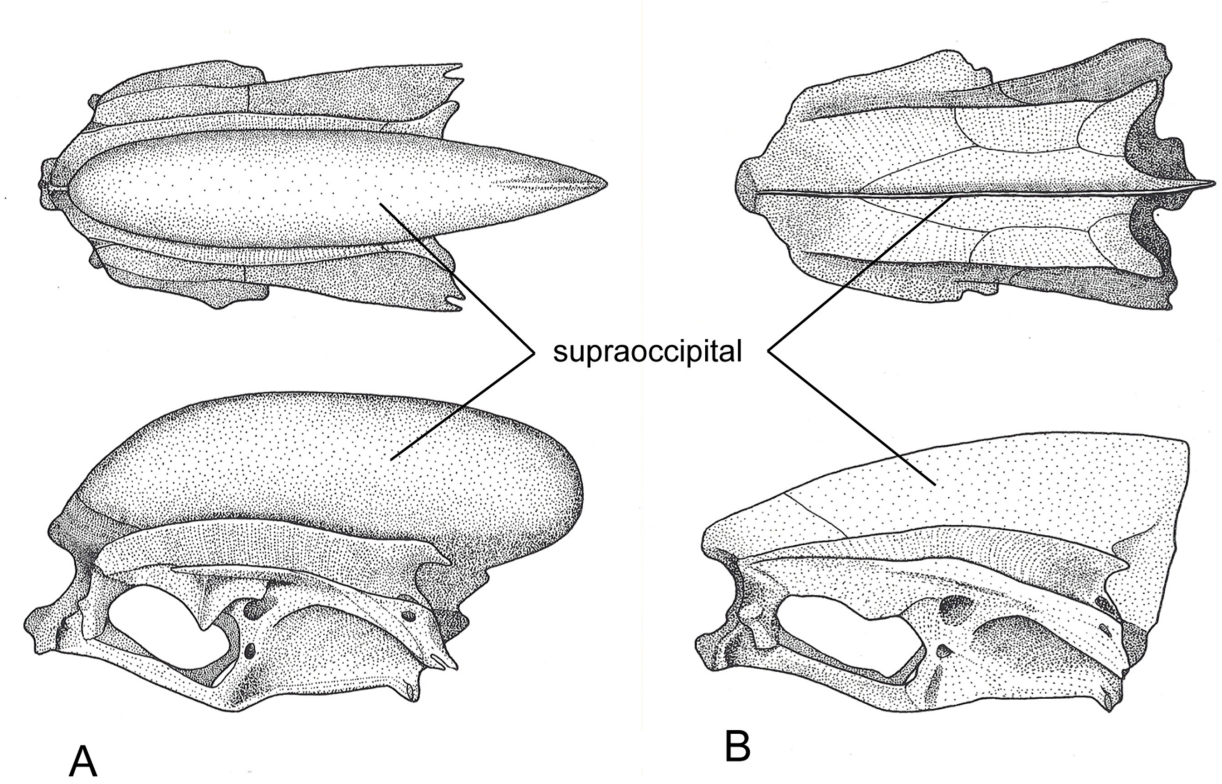

FIGURE 19. Dorsal and lateral views of skull in *Trachinotus*: **A**, *T. mookalee*, ANSP 148969, 570 mm FL, Cochin, India; **B**, *T. africanus*, ANSP 148968, 532 mm FL, Durban, South Africa (supraoccipital shape is the same in all species, except *T. mookalee*). Drawn by William F. Smith-Vaniz.

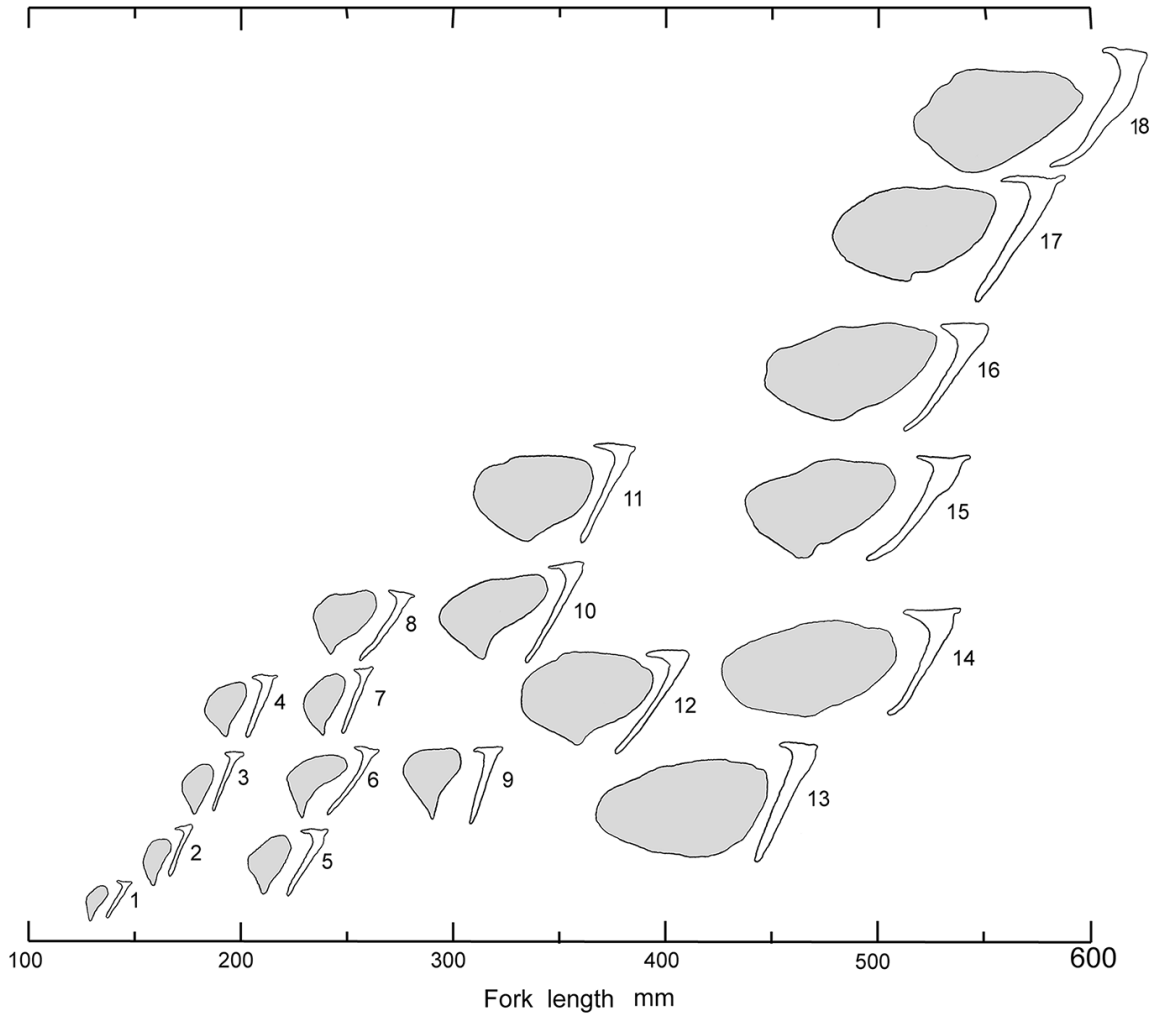

FIGURE 20. Hyperostotic first supraneural (shaded) and adjacent non-hyperostotic supraneural in lateral view (anterior to left). Outlines traced from radiographs plotted against fork length (FL) in *Trachinotus blochii*. Numbers correspond to the following specimen voucher catalog numbers, FL mm lengths (in parentheses) and localities: **1**, CAS 32093 (130) Madagascar; **2**, ANSP 148749 (160) Madagascar; **3**, ANSP 148749 (178) Madagascar; **4**, ANSP 148740 (190) Sri Lanka; **5**, ANSP 144395 (212) Sri Lanka; **6**, ANSP 148735 (229) Chagos; **7**, ANSP 151014 (237) Sri Lanka; **8**, ANSP 151015 (246) Sri Lanka; **9**, ANSP 151015 (291) Sri Lanka; **10**, ANSP 148735 (329) Chagos; **11**, ANSP 138159 (335) Seychelles; **12**, ANSP 138159 (364) Seychelles; **13**, ANSP 148735 (407) Chagos; **14**, ANSP 138157 (461) Seychelles; **15**, ANSP 148733 (469) Sri Lanka; **16**, ANSP 148735 (483) Chagos; **17**, ANSP 148787 (520) Sri Lanka; **18**, ANSP 138883 (556) Gulf of Oman.

Molecular analysis

The molecular matrix consisted of 45 terminal taxa aligned to 651 nt. The average sequence length was 638 nt. The aligned matrix contained no indels or stop codons. Partitioning by codon position and using the GTR+G model for each partition was the best recovered model available in RAxML. The most likely topology and nodal support is presented in Figure 21. Our primary objective was to determine the sister-species of *Trachinotus macrospilus* based solely on COI data for 16 of the 20 valid species of *Trachinotus*. We give no morphological data for most of these species because our study was not intended to be a revision of the genus, although we include an identification key (above) for all eight Indo-West Pacific species of *Trachinotus*.

Santini and Garnevale (2014) investigated carangoid evolutionary relationships, including 14 species of *Trachinotus*, using DNA sequences for seven nuclear and mitochondrial loci downloaded from GenBank. Here we briefly

compare some their results with ours. The single sequence for "*T. ovatus*" used by Santini and Garnevale (2014) was retrieved from GenBank (Xi *et al*., 2013), but based on our results, was a misidentification of *T. anak* from China. Their hypothesized phylogeny indicated a sister-species relationship for these "two species" in contrast to our results where the two species were recovered in divergent clades, with *T. anak* most closely related to *T. mookalee*. GenBank includes numerous sequences of "*T. ovatus*" all with China localities (where the species does not occur) and the Chinese literature contains many misidentifications of *T. anak* or *T. mookalee* as "*T. ovatus"* (e.g., Zhang *et al*., 2000). *Trachinotus ovatus* occurs from the eastern Atlantic, Western Baltic, North Sea and Mediterranean Sea (Fricke *et al*., 2019). The other two species are found only in the Indo-West Pacific, including Taiwan and China (Smith-Vaniz, 1999).

In the phylogeny of Santini and Garnevale (2014), *T. botla, T. baillonii* and *T. coppingeri* were placed in one clade (no sequences for *T. macrospilus* were included). Our phylogeny has *T. botla*, *T. ovatus*, *T. baillonii* and *T. macrospilus* in the same clade. The latter two species have the lowest interspecific K2P distance (1.96%) of any other *Trachinotus* species pair combination indicative of a relatively recent evolutionary divergence in accord with the narrow distribution and endemic status of *T. macrospilus*. In our analysis the four species with spotted adults and *T. ovatus*, were assigned to the same clade. *Trachinotus botla* was hypothesized to be the most distantly related of the five species although bootstrap support (51%) for the assignment of *T. ovatus* to the group is relatively weak. Both studies agree that *T. goodei*-*T. rhodopus* and *T. carolinus*-*T. paitensis* are Amphi-American species pairs (Western Atlantic/Eastern Pacific); their interspecific distances are 2.05% and 4.13%, respectively. Excluding these two species pairs and *T. baillonii*-*T. macrospilus*, interspecific K2P distances for the other *Trachinotus* species ranged from 7.99% to 15.72%.

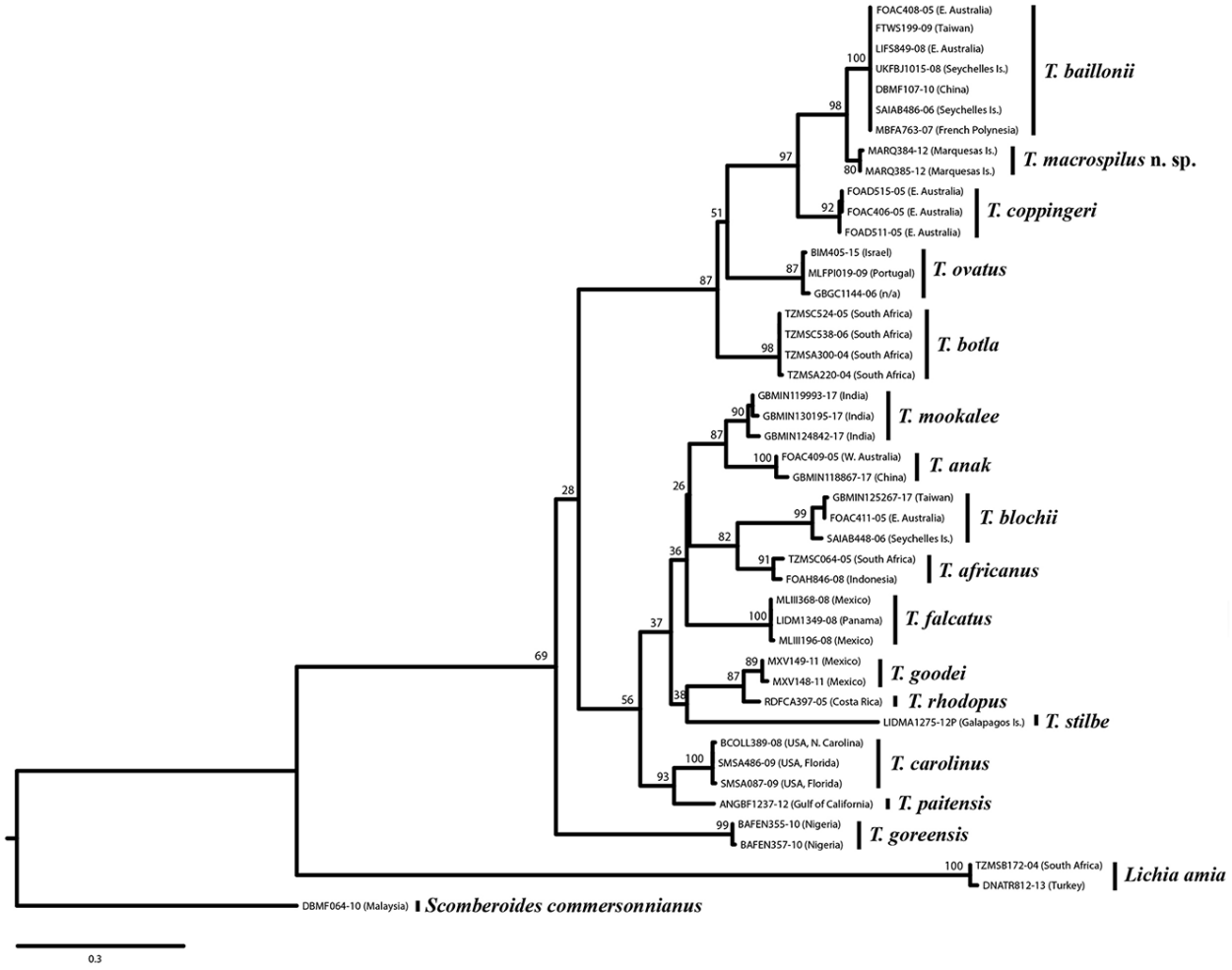

FIGURE 21. Maximum parsimony phylogeny of 16 of 20 species of *Trachinotus* and out-group carangid taxa *Lichia* and *Scomberoides*. Numbers above branches are maximum parsimony bootstrap support calculated from 1000 pseudoreplications.

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