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A KEY TO THE STROMATEOID FISHES

by

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Approved for Distribution

Richard H. Backus, Chairman
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Our primary purpose in preparing "A Key to the Stromateoid Fishes" is to provide field workers and curators with a convenient and concise aid for the identification of the diverse species in this somewhat difficult group. Secondarily, we hope to present, through the keys, a summary of the present state of our knowledge of these fishes, and to indicate areas where further investigation is needed.

The keys which compose this handbook have been derived from several sources. Some are slightly modified from already published or about-to-be-published sources. Others form a part of manuscripts in preparation. A third group of keys has been constructed from published species descriptions and our own often meagre data.

The keys are intended primarily for larger specimens. Small stromateoids are particularly confusing, and it is not our purpose to treat them here. The well-known and marked allometric growth in stromateoids remains a problem, and those who use these keys should be aware that the body proportions of very large and/or very small specimens can fall well outside the limits here set. We expect and hope for corrections and improvements to the keys, and have left them double-spaced so comments may be written in by users. We have not attempted to settle nomenclatural problems, but have used the oldest name we know of when a choice is necessary. Neither have we gone into the problem of synonymy to any great extent. In some cases we have approached this problem by including two names under one couplet in a key. The choice of which name to employ is thus passed on to the user.
This second edition of "A Key to the Stromateoid Fishes" is a partially up-dated version of the original (W.H.O.I. Ref. No. 69-70, September 1969). Errors have been corrected. Newly recognized characters have been added, particularly in the Nomeidae. The Keys to Ariomma and Stromateus are new. Where appropriate, recent literature is cited.

Following the key to families and genera, the individual generic keys are arranged in alphabetical order. A list of the included taxa follows. The more commonly used generic synonyms follow the proper name in parentheses.

Order Perciformes
Suborder Stromateoidei
  Family Amarsipidae
    Genus Amarsipus
      Amarsipus carlsbergi
  Family Ariommadidae
    Genus Ariomma (=Paracubiceps)
      Ariomma bondi
      Ariomma evermanni
      Ariomma indica
      Ariomma lurida
      Ariomma melanum
      Ariomma regulus
  Family Centrolophidae
    Genus Centrolophus (=Pomipilus)
      Centrolophus niger
    Genus Hyperoglyphe (=Palinurichthys)
      Hyperoglyphe antarctica
      Hyperoglyphe bythites
      Hyperoglyphe japonica
      Hyperoglyphe moseltii
      Hyperoglyphe perciformis
    Genus Icichthys
      Icichthys australis
      Icichthys lockingtoni
      Tubbia tasmanica
    Genus Psenopsis
      Psenopsis anomala
      Psenopsis cyanea
      Psenopsis obscura
Genus *Schedophilus* (=*Leirus*, *Mupus*)
*Schedophilus griseolineatus*
*Schedophilus huttoni*
*Schedophilus maculatus*
*Schedophilus medusophagus*
*Schedophilus ovalis*
*Schedophilus pemarco*

Genus *Seriolella* (=*Neptomenus*)
*Seriolella braura*
*Seriolella porosa*
*Seriolella punctata*
*Seriolella violacea*

Family Nomeidae
Genus *Cubiceps*
*Cubiceps athenae*
*Cubiceps aemuleus*
*Cubiceps capensis*
*Cubiceps carinatus*
*Cubiceps gracilis*
*Cubiceps longimanus*
*Cubiceps pauciradiatus*
*Cubiceps aquamiceps*

Genus *Nomeus*
*Nomeus gronovii*

Genus *Psenes*
*Psenes arafurenensis*
*Psenes cyanophyrs*
*Psenes maculatus*
*Psenes pellucidus*
*Psenes sio*
*Psenes whiteleggii*

Family Stromateidae
Genus *Pampus* (=*Stromateoides*)
*Pampus argenteus*
*Pampus chinensis*
*Pampus echinogaster*

Genus *Peprilus* (=*Poronotus*)
*Peprilus burti*
*Peprilus medius*
*Peprilus ovatus*
*Peprilus paru*
*Peprilus simillimus*
*Peprilus snyderi*
*Peprilus triacanthus*

Genus *Stromateus*
*Stromateus brasiliensis*
*Stromateus fiatola*
*Stromateus stellatus*

Family Tetragonuridae
Genus *Tetragonurus*
*Tetragonurus atlanticus*
*Tetragonurus owieri*
*Tetragonurus pacificus*
The key to families and genera is composed for the most part from keys published by R. L. Haedrich in *The stromateoid fishes: systematics and a classification* Bull. Mus. Comp. Zool., Harvard, 135 (2): 31-139 (1967). The summary of that paper states:

"The marine perciform suborder Stromateoidei is diagnosed by the possession of toothed pharyngeal sacs and small uniserial teeth in the jaws. Comparative study of the nature of the pelvic and dorsal fins, the dentition, the number of vertebrae and branchiostegals, and the structure of the caudal skeleton and pharyngeal sacs suggests a division of the suborder into 5 families and 14 genera: Centrolophidae - *Hyperoglyphe, Schedophilus, Centrolophus, Ictichthys, Seriolella, Penopsis*; Nomeidae - *Cubiceps, Nomeus, Psenes*; Ariommidae - *Ariomma*; Tetragonuridae - *Tetragonurus*; and Stromateidae - *Stromateus, Peprilus, Pampus*. In proceeding from the generalized to the highly evolved within the suborder the maximum size attained becomes smaller, the body becomes deeper, the pelvic fins are lost, the pharyngeal sacs become more elongate and the structure of the papillae within them becomes more complex, the number of branchiostegals and the number of elements in the caudal skeleton is reduced, and the number of vertebrae is increased. The major features of the centrolophid distribution are discontinuity, bipolarity, endemism, and sympatry of genera. The oceanic nomeids and tetragonurids are broadly sympatric in all oceans. The ariomnids are found in deep water over the edge of the continental shelves from the east coast of the New World to Japan, and near Hawaii. The stromateid distribution is characterized by discontinuity, widespread species, and allopatry of genera. The relationships and natural history of the stromateoid taxa are discussed. Synonymies, keys, and, under each genus, lists of nominal species are included."

Subsequent to the publication of "The stromateoid fishes . . . . . .", an additional family of stromateoids, the Amarsipidae, was discovered and described - R. L. Haedrich, "A new family of aberrant stromateoid fishes from the equatorial Indo-Pacific", DANA-Report No. 76: 1-14 (1969). The summary states:

"The possession of a perciform caudal skeleton, teeth uniserial in the jaws, an expanded lacrimal bone, an inflated and protruding top of the head, an extensive sub-dermal canal system, and a bony bridge over the anterior vertical canal of the ear refer a new small pelagic fish to the suborder Stromateoidei. The combination of jugular pelvic fins, teeth on the vomer, six hypural and two epural elements, and a total
lack of pharyngeal sacs is so distinctive that a new family, the Amarsipidae n. fam., loosely allied with the nomeid line, is required for the fish, Amarsipus carlsbergi n. gen., n. sp. About 50 specimens of Amarsipus, none of them adult, are known from the equatorial waters of the Pacific and Indian Ocean. Little allometry is apparent in growth from about 10 to 70 mm SL. Almost 90% of the specimens known were taken with less than 400 meters of wire out, suggesting that juvenile Amarsipus live probably shallower than 200 m deep in the water column, perhaps in the shallow equatorial current systems."

ILLUSTRATIONS

The seven plates which follow show one representative member and general range maps for each genus. The specimens illustrated, compiled from several sources, have not been drawn to scale; instead the standard length (SL) of each is indicated. The range maps are based primarily on our own data.
AMARSIPIDAE  Amarsipus carlsbergi  56 mm SL

ARIOMMIDAE  Ariomma bondi  189 mm SL

TETRAGONURIDAE  Tetragonurus cuvieri  129 mm SL
CENTROLOPHIDAE  Centrolophus niger  223 mm SL

CENTROLOPHIDAE  Icichthys lockingtoni  97 mm SL

CENTROLOPHIDAE  Schedophilus medusophagus  435 mm SL
CENTROLOPHIDAE  Hyperoglyphe perciformis  200 mm SL

CENTROLOPHIDAE  Psenopsis obscura  132 mm SL

CENTROLOPHIDAE  Seriolella violacea  265 mm SL
STROMATEIDAE  

**Pampus argenteus**  
267 mm SL

STROMATEIDAE  

**Peprilus medius**  
141 mm SL

STROMATEIDAE  

**Stromateus stellatus**  
180 mm SL
AMARSIPIDAE, Amarsipus

Key to Stromateoid Families and Genera

1 (8). Two dorsal fins, distinctly, though scarcely, separated, the first usually with ten to twenty spines; if there are fewer than ten spines, the longest spine is about the same length as the longest dorsal finray. Pelvic fins always present. Vomer, palatines, and basibranchials toothed or not ....................... 2

2 (3). Pelvic fins jugular, their origin well before the pectoral fins and under the posterior edge of the preopercle. Body translucent, no color pattern apparent, slender with a deep caudal peduncle. Pharyngeal sacs absent ..................

AMARSIPIDAE
One genus and species, Amarsipus carlsbergi Haedrich, 1969
Oceanic-tropical parts of the Pacific and Indian Oceans.


Vertebræ 45-47.

3 (2). Pelvic fins thoracic, their origin under the pectoral fins or behind. If the pelvic origin precedes the pectoral insertion, the body has distinct dark blotches on a silvery background; if the body is translucent, it is deep with a slender peduncle. Pharyngeal sacs present .................... 4

4 (7). The first dorsal fin with about ten long, slender spines, often folded into a groove, the longest spine nearly as long as, or longer than, the longest finray in the second dorsal. Anal finrays 14 to 30. Scales cycloid, thin, deciduous.

Fleshy lateral keels on peduncle near caudal fin base absent
or only slightly developed. 29 to 33, 41, or 42 vertebrae ... 5

5 (6). Vomer, palatines, and usually basibranchials with small, often almost indistinguishable, teeth. Caudal peduncle compressed, its least depth greater than 5% SL, without lateral keels. Usually more than fifteen rays in both the dorsal and anal fins ... 11

NOMEIDAE
Three genera
Oceanic - all oceans

6 (5). Vomer, palatines, and basibranchials toothless. Caudal peduncle square in cross-section, its least depth less than 5% SL, with two low lateral keels on each side near caudal fin base. Fourteen or fifteen rays (rarely 13 or 16) in both the dorsal and anal fins ... 16

ARIOMMIDAE
One genus, Ariomma, page 20
Oceanic and coastal - Atlantic, Indian Ocean, Japan, New Zealand, Hawaii

7 (4). The first dorsal fin with ten to twenty short spines, the longest only half the length of the longest finray in the second dorsal. Anal finrays 10 to 16. Scales keeled, heavy, very adherent. Modified scales form two well developed lateral keels on each side of peduncle near caudal fin base. 43 to 58 vertebrae ... 45

TETRAGONURIDAE
One genus, Tetragonurus, page 45
Oceanic - all oceans

8 (1). A continuous dorsal fin, or two dorsal fins scarcely separated, the first with less than ten spines; if spines are present,
the longest spine is less than half the length of the longest dorsal finray. Pelvic fins present or absent. Vomer, palatines, and basibranchials toothless. 9

9 (10). Pelvic fins always present. None or one to five weak spines, or five to nine stout spines precede dorsal finrays. Anal finrays 15 to 30. Median fins never falcate; their bases rarely the same length. Jaw teeth all conical, simple. Supramaxillary bone usually present, but hard to find in some. Seven branchiostegal rays. 24 to 26 or 50-60 vertebrae. 15

CENTROLOPHIDAE
Six genera
Oceanic and coastal - all oceans

10 (9). Pelvic fins never present in adults, rarely present in the young. No stout spines precede dorsal finrays, but, in some species, two to ten small blade-like spines resembling the ends of free interneurals protrude ahead of the fin. Anal finrays 30 to 50. Median fins often falcate; their bases about equal in length. Jaw teeth laterally compressed, either simple or with three to five cusps. No supramaxillary bone. Five to six branchiostegal rays. 30 to 48 vertebrae. 25

STROMATEIDAE
Three genera
Coastal - all oceans

NOMEID Genera

11 (14). Body elongate, maximum depth usually less than 35% SL, greatest in small specimens. Origin of dorsal fin behind, or
directly over in small specimens, insertion of pectoral fins. Scales on the top of the head extend forward of the eyes.

12 (13). Anal count I-III 14-25. Insertion of pelvic fins under end or behind base of pectoral fin. Teeth, knob-like or pointed, on the tongue. 30 to 33 vertebrae.

*Cubiceps*, page 23
Oceanic - all oceans

13 (12). Anal count I-II 24-29. Insertion of pelvic fins before or under insertion of pectoral fin, possibly behind in very large specimens. No teeth on the tongue. 41 vertebrae.

*Nomeus*
One species,
*Nomeus gronovii* (Gmelin, 1788)
Oceanic - tropical and temperate parts of all oceans

P 21-23, Vertebrae 41.

14 (11). Body deep, maximum depth usually greater than 40% SL, although can be reduced to 17% SL in very large specimens. Origin of dorsal fin before, or directly over in large specimens, insertion of pectoral fins. No scales on the top of the head forward of the eyes.

*Psenes*, page 16
Oceanic - all oceans

CENTROLOPHID Genera

15 (20). Spines of the dorsal fin weakly developed and all graduating to the dorsal rays.

16 (19). Weak denticulations on preopercular margin. Origin of dorsal fin usually well behind insertion of pectoral fins, but over
pectoral insertion in very small specimens. Body elongate, maximum depth usually less than 30% SL ............... 17

17 (18). Total elements in anal fin 23 to 27. Scales small, very deciduous, preopercle and cheek naked. Scales along lateral line 160 to 230. Vertebrae 25 .................

Centrolophus
Oceanic
One, perhaps two, species
Centrolophus niger (Gmelin, 1788) North Atlantic
Centrolophus maoricus Ogilby, 1893 Southern Ocean

Vertebrae 10 + 15.

18 (17). Total elements in anal fin 27 to 31. Scales moderate in size, not especially deciduous, present on preopercle and cheek. Scales in lateral line 100 to 130. Vertebrae 50 to 60...

.........................

Icichthys, page 28
Oceanic - North Pacific, Southern Ocean

19 (16). Nine to fifteen small spines on preopercular margin. Origin of dorsal fin usually before insertion of pectoral fins, but over pectoral insertion in very large specimens. Body deep, maximum depth usually greater than 35% SL ...........

Schedophilus, page 40
Oceanic and coastal - Atlantic Ocean, Seas of China, Australia/New Zealand

20 (15). Five to nine stout dorsal spines, shorter than and not graduating (graduating slightly in Psenopsis) to the dorsal rays..

......................... 21
21 (22). Dorsal finrays 19 to 25; anal finrays 14 to 21. Preopercular margins spinulose. Scales not especially deciduous. Lateral line arched anteriorly, straightening out over the anal fin. Adipose tissue around eye not well developed. Sclerotic bones not well ossified; golden iris appears as a complete ring.

Hyperoglyphe, page 16
Coastal - Western North Atlantic, West Africa, Japan, Southern Ocean

22 (21). Dorsal finrays 25 to 40, anal finrays 18 to 30. Preopercular margin entire or finely denticulate. Scales very deciduous. Lateral line follows dorsal profile. Adipose tissue around eye well developed. Sclerotic bones usually well ossified; golden iris appears divided by a vertical bar.

23 (24). Insertion of pelvic fins behind insertion of pectorals. Supramaxillary bone present. At least seven more dorsal finrays than anal finrays. Usually eight dorsal spines, the third, fourth and fifth the longest.

Seriolella, page 42
Coastal - Pacific South America
Australia/ New Zealand

24 (23). Insertion of pelvic fins before or just under insertion of pectorals. Supramaxillary bone absent. Number of dorsal finrays never exceeds number of anal finrays by more than five. Five to seven dorsal spines, increasing in length, posteriorly.

Paenopsia, page 9
Coastal - Indian Ocean, Northern Australia, Japan
STROMATEID Genera

25 (28). Inter- and subopercles not united to the isthmus. End of maxillary before or at anterior border of eye. Cusps on teeth in lower jaw subequal, the teeth appearing truncate to the naked eye. Spine on end of pelvic bone present or absent. In small specimens (less than 100 mm SL) pelvic fins present or absent. Six branchiostegal rays . . . . . . . . . . 26

26 (27). One to three flat blade-like spines ahead of median fins. A small spine projecting postero-ventrally from end of pelvic bone. Median fins falcate or not. Pelvic fins never present. 29 to 36 vertebrae . . . . . . . . . . . . . . . . . .

*Peprilus*, page 31
Coastal - North America, Central America, South America south to Peru and Argentina

27 (26). No flat blade-like spines ahead of median fins. No spine at end of pelvic bone. Median fins never falcate. Pelvic fins absent in adult, but present in some small specimens. 40 to 48 vertebrae . . . . . . . . . . . . . . . . . .

*Stromateus*, page 43
Coastal - Mediterranean, West Africa, southern South America

28 (25). Inter- and subopercles broadly united to isthmus. End of maxillary under eye. Central cusp on teeth of lower jaw much larger than the other two cusps, which can hardly be seen without extreme magnification. No spine at end of pelvic bone. Pelvic fins never present. Five branchiostegal rays . . . . . . . . . . . . . . . . . .

*Pampus*, page 30
Coastal - Indian Ocean to Japan
Key to the species in *ARIOMMA*

1 (4). Depth of body greater than 33% SL . . . . . . . . . . 2

2 (3). Vertical distance from top of eye to mid-dorsal line contained

four or more times in length of head; no distinct spots on

sides, only irregular dark blotches or body uniformly brown or

bluish-brown. . . . . . . . . . . . . . . . . . . . . . . . . . . . .

*Ariomma indica* (Day, 1870)
South Africa, Madagascar, Gulf of Suez, Gulf of Iran to southern Japan including
Indonesia and the Philippines

P 21-23.

Vertebrae 30-31.

3 (2). Vertical distance from top of eye to mid-dorsal line contained 3.7

or fewer times in length of head; irregular dark blotches on sides

of juveniles becoming distinct spots smaller than the eye in

individuals larger than 100 mm SL . . . . . . . . . . . . . .

*Ariomma regulus* (Poey, 1868)
Western Atlantic Ocean north to
North Carolina and south to British
Guiana including Gulf of Mexico and
Caribbean.


Vertebrae 30-32.

4 (1). Depth of body less than 28% SL . . . . . . . . . . . . . . . 5

5 (6). Eye large, diameter 32% or greater of length of head; peritoneum

pale, with few melanophores; scales relatively small, about 50-65

in lateral line.

*Ariomma lurida* Jordan and Snyder, 1904
Hawaii, Japan, New Zealand


Vertebrae 32.
6 (5). Eye relatively small, diameter less than 28% of length of head; peritoneum pale or dark, with few or many melanophores; scales small or large, either about 50-65 or about 30-45 in lateral line. . . . 7

7 (8). Peritoneum dark, with many melanophores; scales small, 50-65 in lateral line; interorbital scalation extends to anterior edge of eye. . . . . . . . . . . . . . . . . . . . . .

*Arionema melanum* (Ginsburg, 1954)
West equatorial Africa, Caribbean, Gulf of Mexico, and north to New York.

Vertebrae 30-31.

8 (7). Peritoneum pale, with few melanophores; scales large, 30-45 in lateral line; interorbital scalation extends forward either to anterior edge of pupil of eye or to posterior edge of eye . . . 9

9 (10). Interorbital scalation extends forward to anterior edge of pupil of eye; coloration tends to be brown to bluish-brown dorsally and silvery or pale ventrally . . . . . . . . . . . . . .

*Arionema bondi* Fowler, 1930
West equatorial Africa, Caribbean, Gulf of Mexico, north to the southern Gulf of Maine, south to Uruguay.

Vertebrae 30-31.

10 (9). Interorbital scalation extends forward only to posterior edge of eye; coloration tends to be a uniform light brown to brown to bluish-brown. . . . . . . . . . . . . . . . . . . .

*Arionema evermanni* Jordan and Snyder, 1907
Hawaii

Vertebrae 31.
A study has recently been completed by Horn entitled "Systematic status and aspects of the ecology of the elongate ariommid fishes (Suborder Stromateoidei) in the Atlantic." Bull. Mar. Sci. (In Press).

The abstract states:

"Ariomma bondi and Ariomma melanum are recognized as the only two species of elongate ariommid fishes in the Atlantic. The names Cubiceps nigrargenteus and Paracubiceps ledanoidis are placed in the synonymy of A. bondi, and Paracubiceps multisquamus is synonymized with A. melanum. The two species, while quite similar and closely related, can be distinguished on the basis of scale size and extent of head scalation, relative development of the cephalic lateral line, and the color of the peritoneum. These fishes are benthopelagic as adults over the continental shelf and slope in both the eastern and western Atlantic. Very little differentiation is apparent between eastern and western populations of each species, and it is suggested that gene flow is maintained by the transport of larvae in cross-Atlantic currents. The relationships of the two species to other members of this enigmatic stromateoid family remain a problem.

The two species of Ariomma occupy different depth zones. A. bondi is most frequently found at depths of less than 200 m and has been considered to be part of a sub-thermocline sparid community in the Gulf of Guinea. A. melanum usually occurs in a depth range of 200-600 m and has been considered to be a member of a deep shelf or continental slope community in the Gulf of Guinea. Results of the Guinean Trawling Survey show that Ariomma is widely distributed in the shelf region off tropical West Africa. The fishery potential of Ariomma appears to be considerable, particularly in the Gulf of Guinea."

Also, we have assumed that: A. indica (type locality, Madras)= A. africana (Durban)= A. dollfusi (Gulf of Suez)= Pseudes extraneous (Philippines); A. evermanni (Hawaii)= A. thompsoni (Hawaii). The status of A. brevimanus (Klunzinger, 1884), an elongate species described from a single 800-mm specimen from the Red Sea, remains unknown, and we have excluded it from the key.
Key to the species in CUBICEPS

1 (8). Anal finrays 18-24, dorsal finrays 19-26. Pelvic insertion under or just barely behind pectoral base. No bony keel on breast. May exceed 20 cm SL. 2

2 (3). Pectoral finrays 20-24, vertebrae 33-34. Cubiceps gracilis Lowe, 1843
Eastern Atlantic, Mediterranean,

3 (2). Dorsal finrays 16-21, vertebrae 31. 4

4 (5). Dorsal finrays 24-26, pectoral finrays 16-18. An oval patch of knobby teeth on the tongue. Cubiceps capensis (Smith, 1850)
South Atlantic

South Africa to Japan

Atlantic, Pacific Oceans

Cubiceps is one of the most poorly known stromateoid genera. Some helpful papers which lead to other references are: T. Abe, "Notes on the adult of Cubiceps gracilis from the western Pacific", 24
NOMEIDAE, *Cubiceps*.


Key to the species in HYPEROGLYPHE

1 (2). Dorsal finrays 19-21, anal finrays 15-17, lateral line scales 89-95

Hyperoglyphe antarctica (Carmichael, 1818)
Southern Ocean

Hyperoglyphe perciformis (Mitchill, 1818)
Atlantic Ocean, Florida to Nova Scotia

2 (1). Dorsal finrays 22-26, anal finrays 16-20, lateral line scales less than 89 or more than 95

3 (6). Lateral line scales less than 89

4 (5). Anal finrays 16-17, lateral line scales around 87

Hyperoglyphe bythites (Ginsburg, 1954)
Gulf of Mexico

5 (4). Anal finrays 18-20, lateral line scales around 75 (?)

Hyperoglyphe moselti (Cunningham, 1910)
Gulf of Guinea to South Africa, St. Helena

6 (3). Lateral line scales more than 95

Lateral line scales 99-103.
Hyperoglyphe japonica (Doderlein, 1885)
Japan

Hyperoglyphe macrophthalmia
(Miranda-Ribeiro, 1915)
Brazil

Key to the species in *Icichthys*


*Icichthys lockingtoni* Jordan and Gilbert, 1880  
North Pacific

3 (2). Vertebrae 50-51. Pectoral 16-17. About seven large lipped pores on each side of the head above the eye and opercles.  

*Icichthys australis* Haedrich, 1966  
Southern Ocean

Dorsal fin base 62% SL; anal fin base 42% SL; maximum depth 45% SL. Dorsal IV 44; anal III 32; pectoral 19 ....  

*Tubbia tasmanica* Whitley, 1943  
Known only from Tasmania, a single specimen 73 mm SL

*Tubbia* was considered by Haedrich (1967 - "The stromateoid fishes . . .", page 39) to be a synonym of *Schedophilus*. Examination of the type shows that this is probably not so. *Tubbia*, displaying characters intermediate between *Schedophilus* and *Icichthys*, remains an enigma.

"A new species of *Icichthys*, based on a single specimen from east of New Zealand, differs from the North Pacific *I. lookingtoni* in having fewer pectoral finrays (16 vs. 18-21) and vertebrae (51 vs. 56-60), and in having three epural elements in the caudal skeleton instead of two. The structure of the caudal skeleton of the new species suggests a close relationship of *Icichthys* to *Centrolophus*. The two genera probably stem from a common widespread ancestor. Today both are bipolar in distribution. *Centrolophus* in the Atlantic, *Icichthys* in the Pacific. *Icichthys lookingtoni* prefers cool waters and associates with medusae near the surface when young, descending to deeper layers with growth. Euphausiids and siphonophore tissue were found in stomach contents. Spawning occurs from winter into spring. Allometry is negative in all proportions investigated."

Key to the species in *Pampus*

1 (4). Median fins falcate and preceded by five to 10 flat, blade-like spines; vertebrae 14-16 + 20-26 ................. 2

2 (3). Gill rakers 2-3 + 8-10; dorsal finray formula V-X 38-43; anal finray formula V-VII 34-43; vertebrae 14-16 + 20-25; about 600 slender pyloric caeca .................

*Pampus argenteus* (Euphrasen, 1788)
Iranian Gulf to Japan

3 (2). Gill rakers 3-6 + 12-15; dorsal finray formula VIII-X 42-49; anal finray formula V-VII 42-47; vertebrae 14-15 + 24-26; pyloric caeca relatively thick and much fewer than 600 in number .................

*Pampus echinogaster* (Basilewsky, 1855)
China, Korea, and Japan

4 (1). Median fins not falcate, but finrays gradually diminish in length posteriorly; no spines preceding the median fins; vertebrae 14 + 19 .................

*Pampus chinensis* (Euphrasen, 1788)
India to China

Key to the species in *PEPRILUS*

1 (2). Row of about 17 to 25 relatively large pores immediately below anterior half of dorsal fin; premaxillary teeth usually with three small cusps ........................................... 2

2 (1). No row of pores below anterior half of dorsal fin; premaxillary teeth pointed, simple ........................................... 5

3 (4). Body elongate, shallow to moderately deep, 36-60% SL; eye moderately large, 6-13% SL; caudal vertebrae 17 to 20, usually 19, rarely 17 or 20; dorsal and upper ventral surfaces in adults often mottled with dark spots ............

.................

*Peprilus triacanthus* (Peck, 1804)
Atlantic Ocean - southern Newfoundland to Florida


4 (3). Body moderately elongate, moderately deep to deep, 46-64% SL; eye large, 7-14% SL; caudal vertebrae 16 to 18, usually 17; dorsal or upper ventral surface rarely if ever mottled. .

.................

*Peprilus burti* Fowler, 1944
Gulf of Mexico


5 (6). Dorsal and anal fins except in larvae and juveniles smaller than 50 to 75 mm SL moderately to extremely falcate, the longest anal ray six or more times the length of the shortest
6 (5). Dorsal and anal fins only slightly falcate, the longest dorsal and anal rays less than six times the length of the shortest of each ......................... 9

7 (8). Body ovate, very deep, 57-88% SL; dorsal rays 38 to 47, usually 41 to 45; gill rakers 20 to 23, usually 21 or 22; caudal vertebrae 16 to 18, usually 17 ..............

..................

_Peprilus paru_ (Linnaeus, 1758)
Atlantic - New York to Argentina, including Gulf of Mexico and Caribbean


8 (7). Body moderately elongate, moderately deep to deep, 46-62% SL; dorsal rays 42 to 51, usually 45 to 48; gill rakers 23-27, usually 24 to 26; caudal vertebrae 20 to 22, usually 21. ..

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_Peprilus medius_ (Peters, 1869)
Pacific Ocean - southern Gulf of California to northern Peru


9 (10). Body ovate, deep, 54-68% SL; eye moderately large, 8-12% SL; snout length considerably less than eye diameter, 5-7% SL; dorsal spines 3 or 4, most frequently 4; often a series of irregularly-spaced, medium sized pores visible along dorsal surface; total vertebrae 31-33, usually 32 ..........

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_Peprilus ovatus_ Horn, 1970
Northern Gulf of California

10 (9). Body elongate, shallow to moderately deep, 37-52% SL; eye small, 5-12% SL; snout length about equal to eye diameter, 6-8% SL; dorsal spines 2 to 4, usually 3; no series of medium-sized pores usually visible along dorsal surface; total vertebrae 30, 31, or 36 . ....... 11

11 (12). Dorsal rays 43 to 49, usually 45 to 48; anal rays 40 to 44; caudal vertebrae 21 or 22, usually 21; total vertebrae 36 . .........

*Peprilus snyderi* Gilbert and Starks 1904
Gulf of California and outer Baja California to Panama

D II-III 43-49. A II-III 40-44.

12 (11). Dorsal rays 41 to 48, usually 43 to 47; anal rays 35 to 44, usually 38 to 41; caudal vertebrae 17 or 18, usually 17; total vertebrae 30 or 31. .........

*Peprilus similimus* (Ayres, 1860)
Southern British Columbia to southern Baja California


"A complete revision is presented of the genus *Peprilus*, one of the three genera of the family Stromateidae. The nominal genera *Poronotus* and *Palometes* are placed in the synonymy of *Peprilus*. Seven species are recognized in the genus. *P. ovatus* is described as a new species and is apparently restricted
to the northern Gulf of California. *P. medius* and *P. palometa* are synonyms, and the former is the valid name. *P. alepidotus* is treated as a synonym of *P. paru*. Accounts of each species consist of a synonymy, diagnosis, description, distribution, the geographic variation, and the ontogenetic change.

"The genus *Peprilus* occurs in tropical and temperate waters along the coasts of North, Central, and northern South America. Four species *P. medius*, *P. ovatus*, *P. simillimus*, and *P. snyderi*, are distributed along the Pacific Coast, and three, *P. triacanthus*, *P. burti*, and *P. paru*, along the Atlantic Coast.

"Several aspects of functional morphology are considered. The vertebral column, skull, and pectoral fins appear to ossify earlier than the caudal skeleton and median fins, a sequence interpreted as being correlated with an early planktonic life followed by an independent nektonic existence. Vertebral number is relatively constant within a species and is considered to be of possible selective value in maintaining a certain body form. The absence of pelvic fins, the long pectoral fins which are used extensively for propulsion in adult fishes, and the compressed body may all be correlated with the continuous swimming habit of these fishes, especially those larger than 100 mm SL. An hypothesis is presented that the swimbladder is of hydrostatic advantage to juvenile fishes which hover under jellyfish medusae and that it becomes nonfunctional in larger fishes which swim continuously. The scales are highly deciduous, and the skin is underlain by an extensive canal system the function of which is unknown. The alimentary canal is composed of a small mouth with nipping teeth, a toothed, muscular pharyngeal sac, a U-shaped stomach, numerous pyloric caeca, and a long intestine. The food is shredded in the pharyngeal sac, and the great absorptive area of the caeca and intestine probably allows for maximum utilization of jellyfish and other food items.

"Considerations of life history and ecology are generally of four species - *P. triacanthus*, *P. burti*, *P. paru*, and *P. simillimus*. Spawning occurs in the pelagic surface layers at varying distances from shore. The eggs and larvae are planktonic, the latter becoming capable of independent locomotion at a size of about 10 mm SL. The species occur in a wide range of salinity and variously inhabit all depths over the continental shelf and generally over a sand or mud bottom. The genus is essentially tropical and warm temperate, only two species, *P. triacanthus* and *P. simillimus*, reaching cooler waters. Seasonal movements appear to be most pronounced in *P. triacanthus*, the species occurring most abundantly in temperate regions. Fishes smaller than 100 mm SL associate with jellyfish medusae of several genera. This association is apparently important during the early critical growth phases of the fishes. *Peprilus* is a low level carnivore; jellyfish
medusae seem to be an important element in the diet, especially of juveniles. Other food items include a variety of small crustaceans, polychaete worms, and small fishes. Fishes of the genus are evidently significant forage fishes for a number of larger fishes, some of which are of great commercial importance. The economically important species of *Pepriulus* are generally taken commercially in a region much smaller than the total range of the species, and this seems to reflect the pattern of migration and center of abundance of the particular species.

"Disruption of the Tethys Sea in the Miocene apparently facilitated the segregation of the early members of the family Stromateidae and led to the evolution of the three extant and essentially allopatric genera. The formation of the Central American land bridge in the Pliocene, the emergence and submergence of land areas associated with the Pleistocene glacial and interglacial periods, and the prevailing current systems all appear to have been important in producing the current level of differentiation and speciation in the genus.

"The elongate *P. snyderi* is considered to be the most primitive type and the deep-bodied *P. paru* the most highly derived form in the genus. The Camin-Sokal method for deducing relationships of contemporaneous species is used to reconstruct a dendrogram of species relationships. Two somewhat subtle species groups are recognized in the genus, and each group is represented on both sides of the Central American isthmus. Character displacement is invoked as a possible mechanism to explain the existence of two apparently distinct populations of *P. triacanthus* in the Atlantic off the southeastern coast of the United States.

"The distributions of the species of *Pepriulus* appear to correspond generally to the major faunal provinces of the Atlantic Coast and the Pacific Coast of the Americas. The species generally traverse the zoogeographic subdivisions established from the study of small fishes inhabiting rocky shores. Sympathy involves the more diverse species, and the similar or closely related species tend to parallel one another in different oceans or displace one another latitudinally along a continuous coastline. Niche separation seems to be produced largely by spatial arrangement and ecological displacement."
Key to the species in *Psenes*

1 (8). Teeth in lower jaw long, knife-like, compressed, close-set, very different from those in the upper jaw. Length of pelvic fin 16-52% SL. Maximum depth 17-69% SL. Vertebrae 31-42 ....... 2

2 (3). Elements in the second dorsal 27-32; elements in anal 28-34; musculature very soft, bases of median fins translucent. Banded color pattern in the young, but becoming uniform brown with growth. Vertebrae 41-42......

*Psenes pellucidus* Lütken, 1880
Atlantic, Northwestern Pacific, Indian Oceans
P 18-20. Vertebrae 15 + 26-27..

3 (2). Elements in second dorsal 22-24; elements in anal 21-27; musculature not particularly soft; bases of median fins not translucent. Marked banded or mottled color pattern.

Vertebrae 31-38..... 4


Vertebrae 35-38..... 5


*Psenes sio* Haedrich, 1970
Eastern Tropical Pacific
Vertebrae 15 + 21-23..

36
NOMEIDAE, *Psenes*

6 (5). Preanal distance 58-63% SL. Length of pectoral fin 30-34% SL. Anal spines III. Pectoral finrays 21-23. Vertebrae 35.

*Psenes maculatus* Lütken, 1880
Biantitropical in Atlantic Ocean


*Psenes arafuresis* Günther, 1889
Tropical Atlantic, Indian Oceans

8 (1). Teeth in lower jaw round in cross-section, neither long, knife-like, nor close-set, similar to those in the upper jaw. Length of pelvic fin 9-27% SL. Maximum depth 34-58% SL. Vertebrae 31-32.

*Psenes cyanophrys* Cuvier and Valenciennes, 1833
Circumtropical

9 (10). Elements in the second dorsal 24-28; elements in anal 27-31. Fine horizontal lines along sides. Maximum depth 44-52% SL.

Vertebrae 31.

*Psenes cyanophrys* Cuvier and Valenciennes, 1833
Circumtropical

10 (9). Elements in the second dorsal 17-20; elements in anal 20-21. Color pattern either vertically banded or clear. Maximum depth 36-46% SL. Vertebrae 31-32.
Psenes whiteleggii Waite, 1894
Indian Ocean, Australia

Vertebrae 13 + 18-19.

This key is from a manuscript in preparation by R. L. Haedrich.

Key to the species in *Psenopsis*


   *Psenopsis anomala* (Temminck and Schlegel, 1850)
   Japan

   *Psenopsis humerosa* Munro, 1958
   Dampier Archipelago, northeastern Australia
   Vertebrae 10 + 15.

2 (1). Elongate, maximum depth usually 25-40% SL. Pectoral finrays 16-20, dorsal finrays 26-29, anal finrays 21-27.


   *Psenopsis cyanea* (Alcock, 1890)
   Coasts of India


   *Psenopsis obscura* Haedrich, 1967
   Indonesia to South Africa in deep water
   Vertebrae 10 + 15.

The species of *Psenopsis* have been discussed by R. L. Haedrich - "A new species of *Psenopsis* (Stromateoidei, Centrolophidae) from Indo-Malayan seas", Jap. J. Ichthyol. XIV (4/6): 187-196 (1967). This key is based in part on that paper.
Key to the species in *Schedophilus*

1 (4). More than 43 elements in the dorsal fin, more than 27 in the anal. Body very soft and limp, spines in the median fins very weak. Gill rakers on the lower limb of the first arch less than 13. . . . . . . . . . . . . . . . . . . . . . 2

2 (3). Dorsal of 44-50 elements, anal 28-31; vertebrae 10 + 15 . .

*Schedophilus medusophagus* Cocco, 1838
North Atlantic, Southern Pacific?


10 + 15.

3 (2). Dorsal of 56-60 elements, anal 34-41; vertebrae 12 + 18-19 . .

*Schedophilus huttoni* (Waite, 1910)
Southern Ocean


12 + 18-19.

4 (1). Less than 41 elements in the dorsal fin, less than 28 in the anal. Body usually firm, spines in median fins often quite strong. Gill rakers on lower limb of the first arch more than 12. . . . . . . . . . . . . . . . . . . . . . . . . . 5


*Schedophilus pemarco* (Poll, 1959)
West Africa

Vertebrae 10 + 15.
CENTROLOPHIDAE, *Schedophilus*

6 (5). Dorsal IV-VIII 31-34, anal III 20-25.

7 (8). Pectoral finrays 21-22, gill rakers on lower limb of the first arch 16. Scales large, body very firm. Free interneurals

2

*Schedophilus ovalis* (Cuvier and Valenciennes, 1833)
Mediterranean, Eastern Atlantic, Australia


*Schedophilus griseolineatus* (Norman, 1937)
Southwestern Atlantic


10 (9). Anal III 24, vertebrae 12 + 17. Body vertically banded

*Schedophilus maculatus* Günther, 1860
Southern Ocean


See also the Key to *ICICHTHYS*, page 28, where *Tubbia tasmania*, an intermediate form, is included. The key to *Schedophilus* is from a manuscript in preparation by R. L. Haedrich.
Key to the species in *Seriolella*


*Seriolella violacea* Guichenot, 1848
Peru and Chile


3 (4). Deep-bodied, maximum depth greater than 30% SL. Dorsal finrays 26-33.

*Seriolella brama* (Gunther, 1860)
Southern Australia and New Zealand


4 (3). Elongate, maximum depth less than 30%SL. Dorsal finrays 34-39.

*Seriolella punctata* (Bloch and Schneider, 1801)
Southern Australia and New Zealand
*Seriolella porosa* Guichenot, 1848
Peru and Chile


Not included in this key, because of their uncertain status, are

*Seriolella velaini* Sauvage, 1879, Isle St. Paul, Indian Ocean, and
*Seriolella christopherseni* Sivertsen, 1945, Tristan da Cunha, Atlantic Ocean.
Key to the species in STROMATEUS

1 (2). Vertical bars on the sides and pelvic fins present in individuals of usually less than 100 mm SL; two dark skin flaps or scars in adults indicate former presence of pelvic fins; spots of varying color on adults but usually lost in preservation; 33 to 38 total anal fin elements.

*Stromateus fiatola* Linnaeus, 1758
Mediterranean Sea; West Africa south to Cape Town

Vertebrae 18-19+25-26 (43-45 total)

2 (1). Vertical bars and pelvic fins (or remnants of these fins) never present; dark spots along upper side of body, the number generally increasing with age; 36 to 48 total anal fin elements . . . . . . 3

3 (4). Vertebrae 45 to 49; total dorsal fin elements 47 to 56; total anal fin elements 40 to 48; pectoral fin relatively short, 15 to 26 percent of SL . . . . . . . . . . . . . . . . . . . . . . . . . . .

*Stromateus brasiliensis* Fowler, 1906
Atlantic Ocean - southern Brazil south to Tierra del Fuego and the Falkland Islands

Vertebrae 18-20+26-29 (45-49 total)

4 (3). Vertebrae 41 to 44; total dorsal fin elements 42-51; total anal fin elements 36 to 46; pectoral fin relatively long, 23 to 30 percent of SL . . . . . . . . . . . . . . . . . . . . . . . . . . .

*Stromateus stellatus* Cuvier, 1829
Pacific Ocean - Chile and Peru, rarely as far north as Lima or as far south as 45°S.

Vertebrae 17-18+24-27 (41-44 total).
A study has recently been completed by Horn entitled "Systematic comparison of the stromateid fishes Stromateus brasiliensis Fowler and Stromateus stellatus Cuvier from coastal South America with a review of the genus." Bull. Brit. Mus. (Nat. Hist.). (In Press). The synopsis states:

"Two populations of stromateid fishes occur along opposite coasts off southern South America and are recognized as distinct species. The available names are Stromateus brasiliensis Fowler, 1906, for the Atlantic population and Stromateus stellatus Cuvier, 1829, for the Pacific population. These allopatric species can be completely distinguished on the basis of vertebral counts. Differences also exist in median finray numbers, pectoral fin length, head length, and otolith length. The genus Stromateus is described and a key is provided to the three species. The third and quite distinct species, S. fiatola, occurs in the Mediterranean and off West Africa. The two South American species occupy an intermediate systematic position between S. fiatola and Peprilus snyderi, the most primitive species of an advanced stromateid genus."
Key to the species in *Tetragonurus*

1 (4). Vertebrae 40-51. Lateral series of scales to origin of caudal keels 73-95. Origin of dorsal above middle of pectoral fin or above its posterior third in adult; usually above middle or anterior half of pectoral fin in young. Origin of ventrals usually beneath pectoral base in very young specimens, not far behind it in adults. In adult, distance between upper angle of pectoral and insertion of ventral less than diameter of eye; interorbital distance and eye diameter very nearly equal; and snout slightly longer than diameter of eye. Larvae and small scaleless specimens without pigment on caudal fin or on end of caudal peduncle beyond urostyle.

2 (3). Dorsal spines 10-11. Vertebrae 40-43. Lateral series of scales to origin of caudal keels about 73-78. Ventrals appear at 5-5.5 mm SL. Dorsal spines formed at about 7 mm SL. No pigment spots on body behind vent until longer than about 13 mm SL, this posterior area still paler than anterior part of body in the largest specimen seen, 16.6 mm SL. Dorsal X-XI, 10-12; anal I 10-12; pectoral 15-17. *Tetragonurus pacificus* Abe, 1953

Pacific and Indian Oceans

3 (2). Dorsal spines 14-17. Vertebrae 45-51. Lateral series of scales to origin of caudal keels 83-95. Ventrals appear at about 6 mm SL. Dorsal spines formed at 8-10 mm SL. Pigment on small scaleless specimens extending to base of urostyle. Dorsal XIV-XVII, 10-13; anal I 9-12; pectoral 14-18.
Tetragonuridae, Tetragonurus

**Tetragonurus atlanticus** Lowe, 1839
Atlantic, Pacific, and Indian Oceans

4 (1). Vertebrae 52-58. Lateral series of scales to origin of caudal keels 97-114. Origin of dorsal behind end of pectoral fin or above its tip in adult, over the posterior half (sometimes middle) in young. Origin of ventrals well behind base of pectoral in adult, sometimes in very young just behind it. In adult, distance between upper angle of pectoral and insertion of ventral greater than diameter of eye, interorbital distance slightly greater than eye diameter, snout considerably longer than eye diameter. Larval and small scaleless specimens normally with some pigment at end of caudal peduncle and on base of caudal fin, this pigment sometimes fading in alcohol in smallest specimens. Dorsal XV-XXI, 10-17; anal I 10-15; pectoral 14-21. . . . . . . . . . . . . .

**Tetragonurus auvieri** Risso, 1810
Mediterranean Sea, Atlantic and Pacific Oceans.

This key has been adapted from M. Grey - "The fishes of the genus *Tetragonurus* Risso", DANA-Report No. 41: 1-75(1955).
Tentative keys to the stromateoid fishes, intended primarily as an aid to field workers and curators, summarize the current state of our knowledge of these animals. Six families, 15 genera, and 60 species are recognized. Larvae are not discussed.

### General range maps

- Maps showing the distribution of stromateoid fishes.

### Illustrations

- Illustration of one representative member of each genus.

**Reference:**

- Haedrich, Richard L.
- Horn, Michael H.

**Grants:**

- GA-31365X
- GB-7108
- GZ-259

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