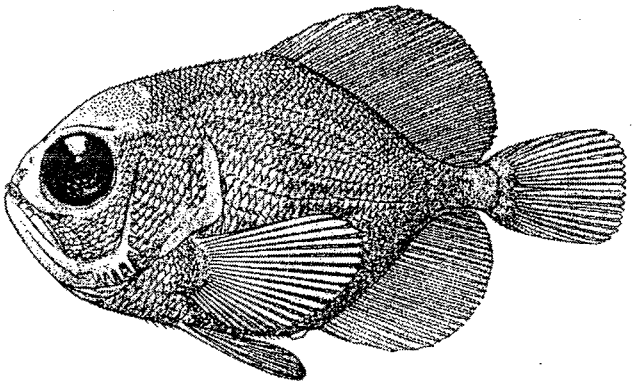
NOAA Technical Memorandum NMFS-SEFSC-500

PRELIMINARY GUIDE TO THE IDENTIFICATION OF THE EARLY LIFE HISTORY STAGES OF BRAMID FISHES OF THE WESTERN CENTRAL NORTH ATLANTIC

BY

W. J. Richards



U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southeast Fisheries Science Center
75 Virginia Beach Drive
Miami, Florida 33149

May 2003

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U.S. DEPARTMENT OF COMMERCE
Donald L. Evans, Secretary

National Oceanic and Atmospheric Administration
Conrad C. Lautenbacher, Jr., Under Secretary for Oceans and Atmosphere

National Marine Fisheries Service
William T. Hogarth, Assistant Administrator for Fisheries

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It will be a chapter entitled Bramidae in the "Guide to the early life history stages of fishes of the western central North Atlantic".

Author's address:
NOAA Fisheries
75 Virginia Beach Drive
Miami, FL 33149

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BRAMIDAE: Pomfrets

by W. J. Richards

The bramids are a small family of perciform fishes that are oceanic and cosmopolitan in distribution with 21 species in seven genera in two subfamilies Braminae and Pteraclinae (Nelson 1994, Moteki et al. 1995). Nine species in six genera are known from our area (Mead 1972) and they are listed in Table Bramidae 1. Distribution and habitat data are given in Table Bramidae 2. Most adults are pelagic and occasionally taken by long line vessels and young stages are taken at offshore stations, but all are generally uncommon. One species, *Eumegistes brevorti*, is taken near the bottom in deep water >300 m. They are small to medium size fishes with some reaching 1 m in length. Mead (1972) has done the most comprehensive work on these including descriptions of ELH stages and aspects of their ecology. Moser & Mundy (1996) reviewed the ELH stages of California Current species, one of which (*Brama dussmieri*), also occurs in our area and added much information on this poorly known group. Sanzo (1928) described the eggs and early larvae of *Brama raji* (=*B. brama*) in some detail. Prior to Sanzo's work, Lütken (1880) had described a juvenile *Brama brama* and Schmidt (1918) had described flexion larvae and juveniles of this species.

Eggs have been described only for species of *Brama* and they are large eggs ca. 1.6 mm in diameter. The eggs are heavily pigmented with a single oil globule. Sanzo (1928) has color illustrations of the egg and larval stages showing the presence of yellow pigment as well as black melanophores. The larvae are well developed upon hatching. The early larvae have been referred to as 'tadpoles' by Moser & Mundy (1996) because of their shape – large round head and gut that is heavily pigmented and a long tail with little pigment. Larvae are known for all the species except *Taractes rubescens* and no small larvae are known for *Taratctes asper*. Nearly complete size series are known for the other species except for very early larvae. The larger larvae and juveniles all have the round head and gut with heavy pigment that extends onto the tail and fins with growth. Useful characters for identification are meristics, fin placement and shape, and pigmentation. Details are provided in the individual species accounts together with illustrations from the literature. Young bramids are quite unique and it is doubtful that they could be misidentified with other families. Larval caristids are similar in shape but have pigment bands on the tail. One species of caristid was erroneously placed in *Pteraclis* because of the superficial resemblance (Hartel & Triant 1998). Young tetraodontids are round and pigmented, but myomere numbers easily separate them.

Table Bramidae 1. Meristic characters for the Family Bramidae. Data from Mead 1972; Moser & Mundy 1996 Pacific only.

	Fins				
Species	Dorsal	Anal	Pectoral	Vertebrae	Gill rakers
Eumegistius					
brevorti	33	22	20	16+21=37	2+7=9
Taractes					
asper	31-34	23-26	18-20	17-18+22-23=41-42	1-2+7-8=8-10
rubescens	30-32	21-23	19-22	18-19+20-22+40-41	1-3+7-8=9-12
Brama					
caribbea	32-35	27-30	19-21	15-16+20-22=36-38	5+9-10=14-15
dussumieri	33-35	27-29	19-21	14-17+24-26=40-43	3-5+9-12=13-15
Pacific	32-36	25-29	18-22	14-17+22-27=38-43	3-6+9-14
brama	35-38	29-32	20-23	16-17+21-25=41-43	4-7+8-12=15-18
Taratichthys					
longipinnis	33-38	27-30	20-22	19-22+25-26=44-47	1-3+6-9=8-12
Pterycombus					
brama	48-53	38-43	20-23	21-23+24-27=48-51	1-2+6-8=7-10
Pteraclis					
carolinus	48-54	42-47	18-19	24-25+24-27+1=49-52	1+6-8=7-9

Table Bramidae 2. Distribution and habitat of bramids. Data from Mead 1972 & original.

Species	Distribution	Habitat
Eumegistius		
brevorti	Circumglobal off large islands, Cuba & Bahamas in our area	Benthic, > 300 m
Taractes		
asper	Only larvae known from Sargasso Sea, adults from eastern Atlantic & North Pacific	Pelagic
rubescens	Atlantic & Pacific Oceans, Gulf of Mexico & off Trinidad	Pelagic
Brama		
caribbea	Throughout our area, most abundant in the Caribbean Sea	Pelagic
dussumieri	Circumglobal in tropical waters	Pelagic
brama	North Atlanitc Ocean, young from Florida to Mediterranean	Pelagic
Taratichthys		
longipinnis	Tropical & temperate Atlantic	Pelagic
Pterycombus		
brama	Tropical & temperate western North Atlantic	Pelagic
Pteraclis		
carolinus	Abundant in Sargasso Sea, rare in eastern North Atlantic	Pelagic

MERISTICS

Vertebrae:	
Precaudal	16-17
Caudal	21-25
Total	41-43
Number of Fin Rays:	
Dorsal	35-38
Anal	29-32
Pectoral	20-23
Pelvic	I,5
Caudal	
Principal	17(9+8)
Gill Rakers	4-7+8-12=15-18
Branchiostegals	7

LIFE HISTORY

Range: North Atlantic Ocean, young from Florida to Mediterranean Sea.
Habitat: Epi- & mesopelagic.
ELH Pattern: Oviparous, planktonic eggs & larvae.
Spawning season: Summer months.

LITERATURE

Lütken 1880, Mead 1972, Sanzo 1928, Schmidt 1918.

ILLUSTRATIONS

Figure Bramidae 1. A) Egg from Sanzo 1928, Fig. 2. B) 4.20 mm larva from Sanzo 1928, Fig. 6. C) 7.5 mm SL larva from Mead 1972, Fig 16A;D) 9.5 mm SL larva from Mead 1972, Fig. 16B; E) 19.7 mm SL juvenile from Mead 1972, Fig. 17 A.

EARLY LIFE HISTORY DESCRIPTION

EGGS:

Diameter: 1.55-1.6 mm.
No. of Oil Globules: 1 large, oval 0.40 x 0.32 mm.
Shell: smooth.
Yolk: homogenous.
Embryo: black chromatophores & yellow chromatophores in late stage eggs on tail myomeres near gut, dorsally at myomere 14, 27, & dorsally & ventrally at myomere 38 & caudal fin area.

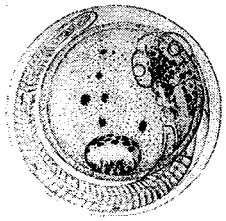
LARVAE:

Length at Hatching: 4.80 mm TL
Length at Flexion: 5.0-6.5 mm SL
Length at Transformation: ca. 10.0 mm SL.
Sequence of Fin Development: P_1, C_1, P_2, D & A & C_2
Pigmentation: Melanophores cover entire head & gut area with few near the tip of notochord. Yellow pigment covers head & D, A & C fin anlagen in 4.2-4.8 mm larvae illustrated by Sanzo (1928). Melanophores develop on dorsum anteior to D fin and continue to spread over trunk & tail to cover all but snout & caudal peduncle. Ca. 10 mm pigment forms 2 bands in D fin. Little pigment in A fin. C fin tips pigmented <10 mm, continues with growth. Gill membranes colorless.
Fin placement: D fin origin behind vertical of P_1, P_1 fin set low <15 mm & remains low, separated from P_2 by distance < width of P_1 base. P_2 under or slightly in advance P_1 fin, fails to reach A origin.
Squamation: No scales <12 mm.
Teeth: present at all sizes.

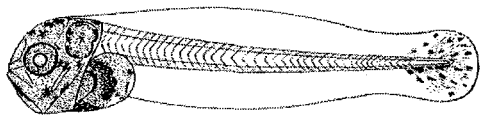
JUVENILES:

Diagnostic characters: P_1 set low, separated from P_2 by distance < width of P_1 base to 130 mm. P_2 under or slightly in advance P_1 fin, fails to reach A origin, but extends over & beyond >55 mm. Preopercular spines 4 or more, longest at angle in single plane, overgrown at 50 mm.

A

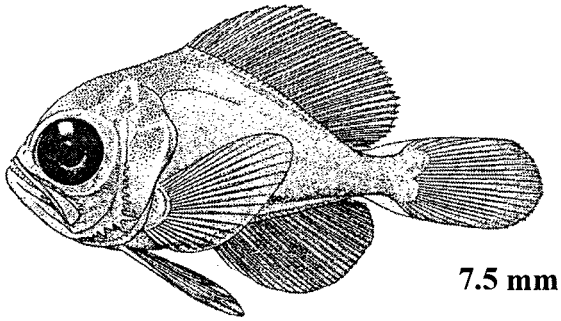


B



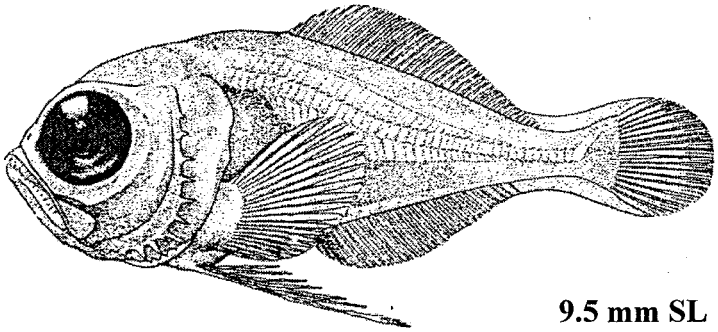
4.20 mm

C



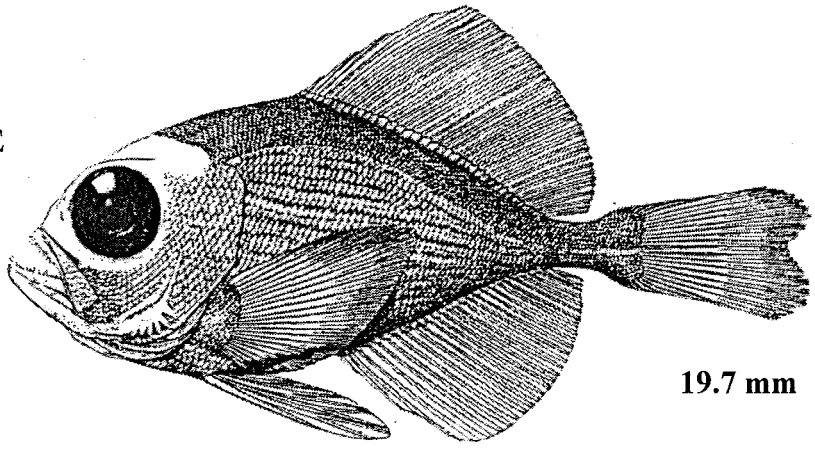
7.5 mm SL

D



9.5 mm SL

E



19.7 mm

MERISTICS

Vertebrae:	
Precaudal	14-17
Caudal	24-26
Total	40-43
Number of Fin Rays:	
Dorsal	33-35
Anal	27-29
Pectoral	19-21
Pelvic	I,5
Caudal	
Principal	17(9+8)
Gill Rakers	3-5+9-12=13-15
Branchiostegals	7

LIFE HISTORY

Range: Circumglobal in tropical waters.
Habitat: Epi- & mesopelagic.
ELH Pattern: Oviparous, planktonic eggs & larvae.
Spawning season: Year around in our area.

LITERATURE

Mead 1972, Moser & Mundy 1996.

EARLY LIFE HISTORY DESCRIPTION

EGGS: Unknown.

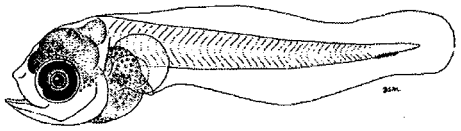
LARVAE:
Length at Hatching: 3.0 mm.
Length at Flexion: 4.2-5.3 mm SL
Length at Transformation: 7.6-8.6 mm SL.
Sequence of Fin Development: P_1, C_1, P_2, D & A & C_2
Pigmentation: Melanophores cover entire head & gut area with few near the tip of notochord. Melanophores develop on dorsum anteior to D fin and continue to spread over trunk & tail to cover all but snout & caudal peduncle. D fin colorless <10 mm, developing band or bands, dark by 35 mm. A fin colorless to 30 mm & without lobe to 100 mm. C fin tips pigmented <10 mm, continues with growth. Gill membranes with few melanophores or colorless.
Fin placement: D fin origin behind vertical of P_1, P_1 fin set low <15 mm & intermediate in position & angle of base. P_2 under P_1 fin base, extends to or beyond A origin at 5-70 mm..
Squamation: Scales form 6.5-7.5 mm, complete at 15 mm, caudal peduncle scales bear spines similar to adjacent scales.
Teeth: present at all sizes, palatines ossify at 7 mm, anterior canines present.

JUVENILES:
Diagnostic characters: A fin colorless to 30 mm & without lobe to 100 mm. Preopercular spines 6 or more, overgrown at 50 mm.

ILLUSTRATIONS

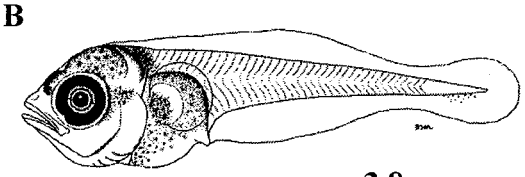
Figure Bramidae 2. A) 3.4 mm larva from Moser & Mundy 1996, B) 3.8 mm larva from Moser & Mundy 1996, C) 5.0 mm larva from Moser & Mundy 1996, D) 6.5 mm larva from Mead 1972, E) 18.1 mm juvenile from Mead 1972, F) 38.7 mm juvenile from Mead 1972.

A



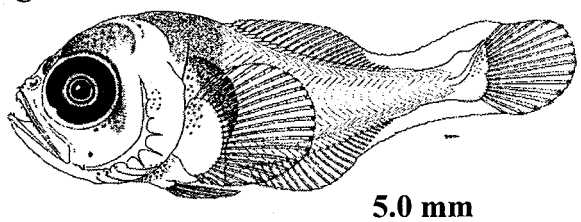
3.4 mm

B



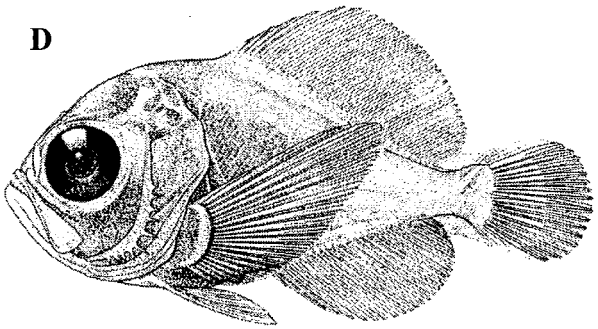
3.8 mm

C



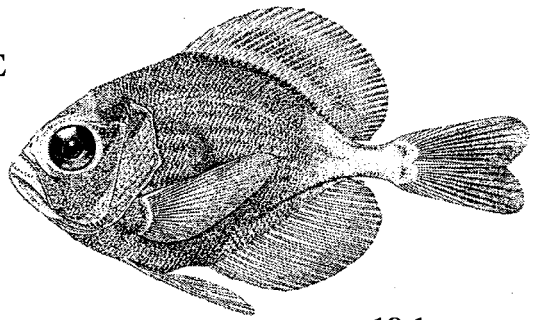
5.0 mm

D



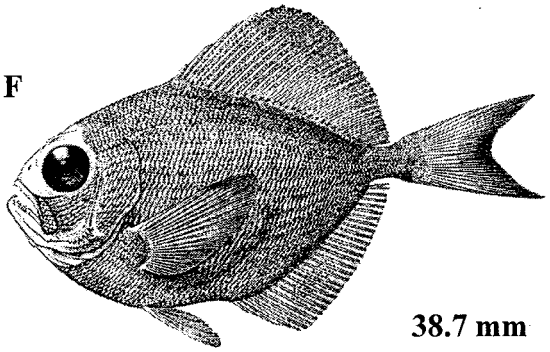
6.5 mm

E



18.1 mm

F



38.7 mm

MERISTICS

Vertebrae:	
Precaudal	15-16
Caudal	20-22
Total	36-38
Number of Fin Rays:	
Dorsal	32-35
Anal	27-30
Pectoral	19-21
Pelvic	I,5
Caudal	
Principal	17(9+8)
Gill Rakers	5+9-10=14-15
Branchiostegals	7

LIFE HISTORY

Range: Western central North Atlantic, most abundant in the Caribbean Sea.
Habitat: Epi- & mesopelagic.
ELH Pattern: Oviparous, planktonic eggs & larvae.
Spawning season: August to May in the Caribbean Sea.

LITERATURE

Mead 1972.

EARLY LIFE HISTORY DESCRIPTION

EGGS: Unknown.

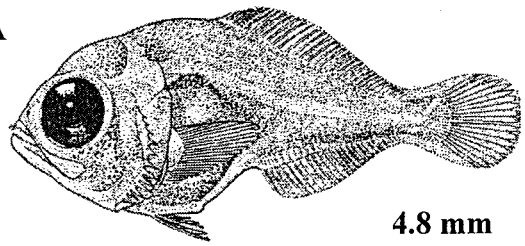
LARVAE:
Length at Hatching: unknown.
Length at Flexion: <5 mm SL
Length at Transformation: 15 mm SL with full complement of fin rays.
Sequence of Fin Development: P_1, C_1, P_2, D & A & C_2
Pigmentation: Preflexion: pigment on head over brain, on cheek below & behind eye, on & under branchiostegal membrane, beneath opercle, along rami of both jaws, dorsal & posterior margin of abdomen cavity dark, above & remainder of body colorless, all fins colorless & area over heasrt colorless. Post-flexion: pigment develops on the dorsum anteior to D fin & continue to spread over trunk & tail to cover all but snout & caudal peduncle. D fin pigmentation begins at tip at 9 mm & forms 2 parallel bands in some juveniles, generally limited to anterior half. A fin colorless to 30 mm & without lobe to 100 mm. C fin tips pigmented <10 mm, continues with growth. Gill membranes colorless.
Fin placement: D fin origin behind vertical of P_1, remaining consant. A fin behind vertical from D fin & constant. P_1 fin set low <10 mm rising rapidly from >10 mm, axis shift to horizontal by 30 mm. C fin changes shape to more lunate by 30 mm. P_2 under A origin in <7 mm, short fails to reach A fin >10 mm..
Squamation: Scales form 7 mm, complete at 15 mm, caudal peduncle scales bear spines similar to adjacent scales.
Teeth: recurved teeth on premaxillary at 3.8 mm, anterior teeth strong, remainder small & conical. Palatine teeth at 7 mm.

JUVENILES:
Diagnostic characters: A fin colorless <50 mm & without lobe. Preopercular spines 6 or more, overgrown at 25 mm.

ILLUSTRATIONS

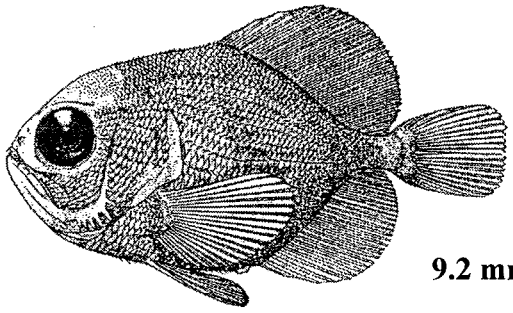
Figure Bramidae 3. All from Mead 1972. A) 4.8 mm, B) 9.2 mm, C) 17.0 mm, D) 38.0 mm.

A



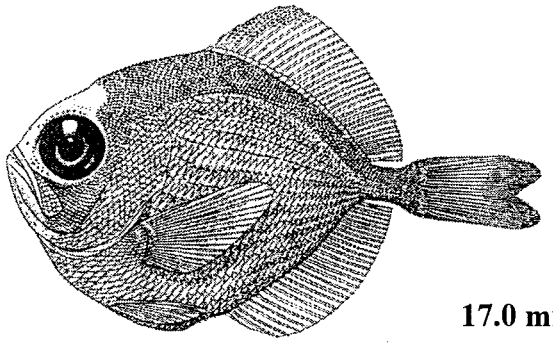
4.8 mm

B



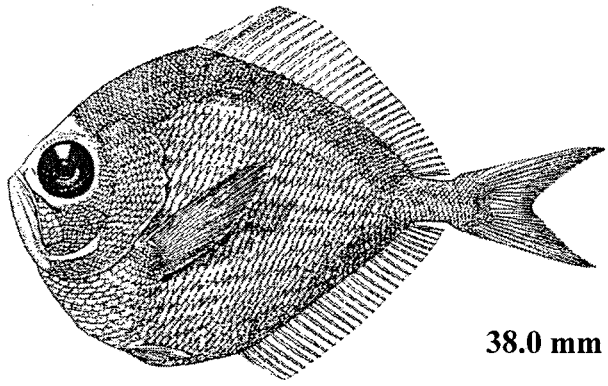
9.2 mm

C



17.0 mm

D



38.0 mm

MERISTICS

Vertebrae:	
Precaudal	16
Caudal	21
Total	37
Number of Fin Rays:	
Dorsal	33
Anal	22
Pectoral	20
Pelvic	I,5
Caudal	
Principal	17(9+8)
Gill Rakers	2+7=9
Branchiostegals	7

LIFE HISTORY

Range: Circumglobal off large islands, Cuba & Bahamas in our area.
Habitat: Epi- & mesopelagic.
ELH Pattern: Oviparous, planktonic eggs & larvae.
Spawning season: Unknown.

LITERATURE

Mead 1972.

EARLY LIFE HISTORY DESCRIPTION

EGGS: Unknown.

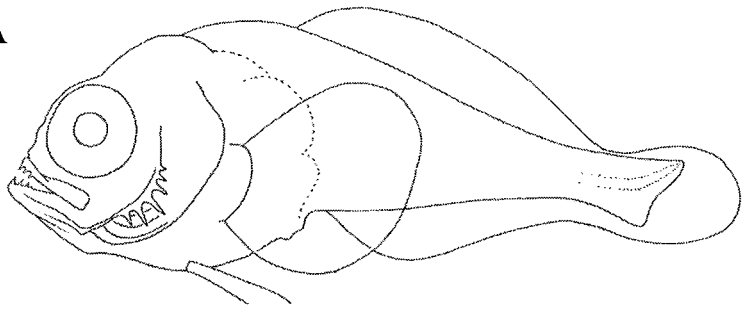
LARVAE:
Length at Hatching: unknown.
Length at Flexion:unknown
Length at Transformation: unknown.
Sequence of Fin Development: Presumed to be P_1, C_1, P_2, D & A & C_2
Pigmentation: Few specimens so not documented.
Fin placement: D fin origin over posterior end of abdominal cavity when first formed at ca. 5 mm moving forward to lie behind a vertical through P_1 at 8.5 mm. A fin origin in posterior half of body present from 5 mm. P_1 insertion vertical, fin extending beyond D & A fin origins at 6 mm. P_2 inserts well in advance of P_1 at all sizes, reaching A fin origin at 5.8 mm & beyond at greater lengths.
Squamation: no scales <8.5 mm.
Spination: Preopercular spines upswept from 6 mm (generic character).
Teeth: teeth present on posterior half of jaws by 5.5 mm as well as anterior; no enlarged canines.

JUVENILES:
Diagnostic characters: Meristics and upswept preopercular spines.

ILLUSTRATIONS

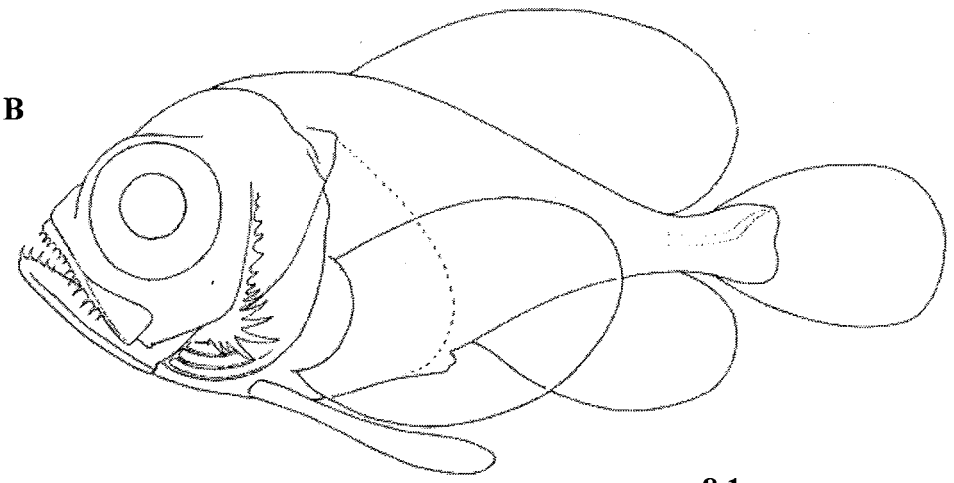
Figure Bramidae 4. All from Mead 1972 & from West Africa. A) 6.1 mm, B) 8.1 mm.

A



6.1 mm

B



8.1 mm

MERISTICS

Vertebrae:	
Precaudal	17-18
Caudal	22-23
Total	41-42
Number of Fin Rays:	
Dorsal	31-34
Anal	23-26
Pectoral	18-20
Pelvic	I,5
Caudal	
Principal	17(9+8)
Gill Rakers	1-2+7-8=8-10
Branchiostegals	7

LIFE HISTORY

Range: Larvae known only from Sargasso Sea, adults from eastern Atlantic & North Pacific.
Habitat: Epi- & mesopelagic.
ELH Pattern: Oviparous, planktonic eggs & larvae.
Spawning season: Unknown.

LITERATURE

Mead 1972.

EARLY LIFE HISTORY DESCRIPTION

EGGS: Unknown.

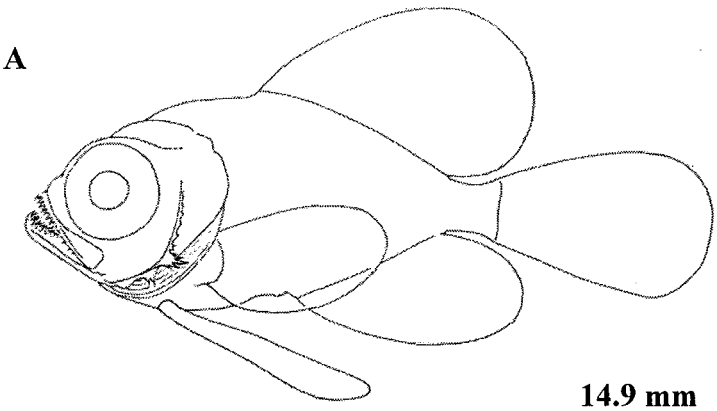
LARVAE:
Length at Hatching: unknown.
Length at Flexion:unknown
Length at Transformation: unknown.
Sequence of Fin Development: Presumed to be P_1, C_1, P_2, D & A & C_2
Pigmentation: Few specimens so not documented. D fin colorless at 14.9 mm. A fin colorless.
Fin placement: D fin origin at mid-body at 9.1 mm, slightly more advanced at 14.9 mm. A fin origin under 8th D fin-ray. P_1 longer at 9.1 mm than at 14.9 mm. P_2 inserts under anterior P_1 moving anteriorly then posteriorly in larger juveniles. P_2 tip extends well beyond A fin origin.
Squamation: primordial sclaes on head & body at 9.1 mm.
Spination: Diagnostic patch of preopercular spines which includes laterally as well as posteriorly directed spines incompletley developed at 14.9 mm. These spines similar to *Brama* at <10 mm.
Teeth: teeth present on posterior half of jaws by 9.1 mm as well as anterior; no enlarged canines.

JUVENILES:
Diagnostic characters: Meristics and patch of preopercular spines formed by outward rotation of upper & lower spines of the 5 or 6 forming this cluster.

ILLUSTRATIONS

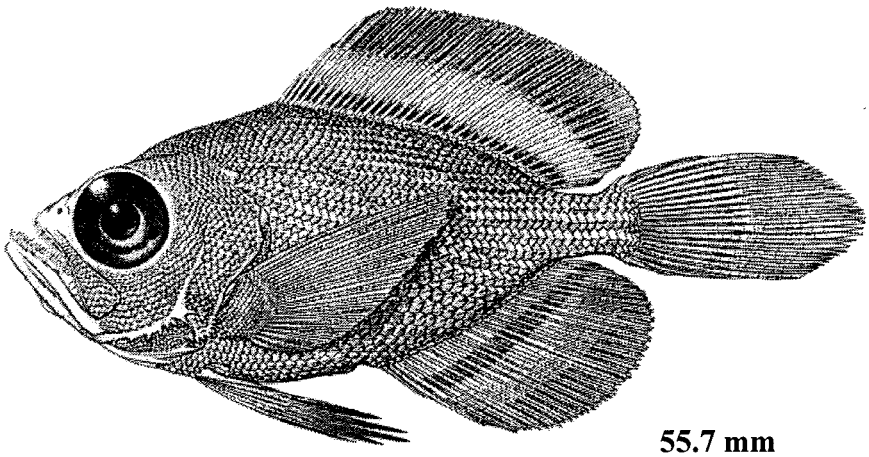
Figure Bramidae 5. Both from Mead. A) 14.9 mm, B) 55.7 mm.

A



14.9 mm

B



55.7 mm

MERISTICS

Vertebrae:	
Precaudal	18-19
Caudal	20-22
Total	40-41
Number of Fin Rays:	
Dorsal	30-32
Anal	21-23
Pectoral	19-22
Pelvic	I,5
Caudal	
Principal	17(9+8)
Gill Rakers	1-3+7-8=9-12
Branchiostegals	7

LIFE HISTORY

Range: Atlantic & Pacific Oceans, Gulf of Mexico & off Trinidad.
Habitat: Epi- & mesopelagic.
ELH Pattern: Oviparous, planktonic eggs & larvae.
Spawning season: Unknown.

LITERATURE

Mead 1972.

EARLY LIFE HISTORY DESCRIPTION

EGGS: Unknown.

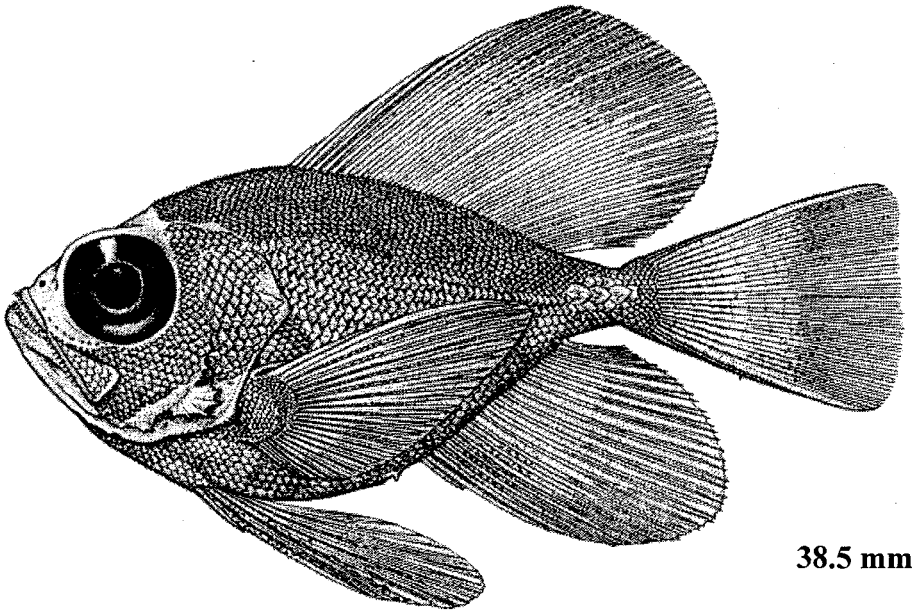
LARVAE: Unknown

JUVENILES:
Diagnostic characters: Meristics, enlarged caudal peduncle scales present on smallest juvenile.

ILLUSTRATIONS

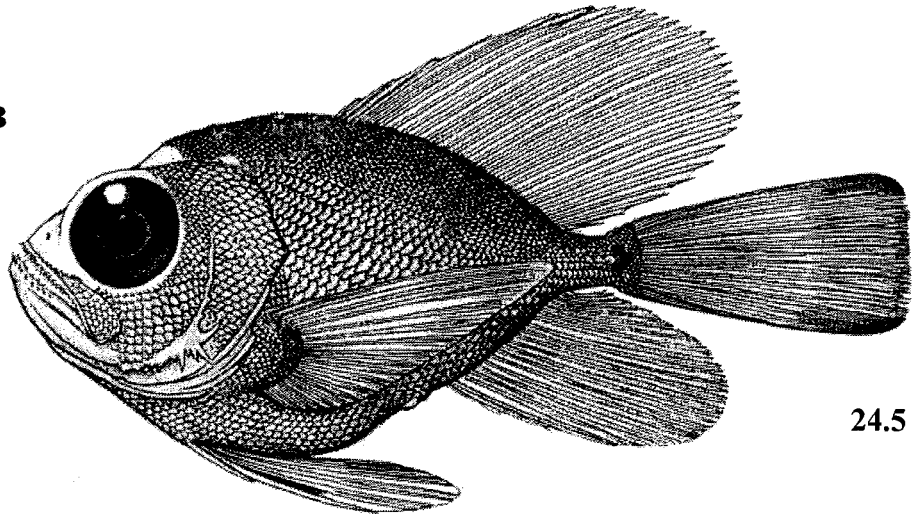
Figure Bramidae 6. Both from Mead 1972. A) 38.5 mm eastern Pacific juvenile, B) 24.5 mm eastern Atlantic juvenile.

A



38.5 mm

B



24.5 mm

MERISTICS

Vertebrae:	
Precaudal	19-22
Caudal	25-26
Total	44-47
Number of Fin Rays:	
Dorsal	33-38
Anal	27-30
Pectoral	20-22
Pelvic	I,5
Caudal	
Principal	17(9+8)
Gill Rakers	1-3+6-9=8-12
Branchiostegals	7

LIFE HISTORY

Range: Tropical & temperate Atlantic.
Habitat: Epi- & mesopelagic.
ELH Pattern: Oviparous, planktonic eggs & larvae.
Spawning season: Unknown.

LITERATURE

Mead 1972.

EARLY LIFE HISTORY DESCRIPTION

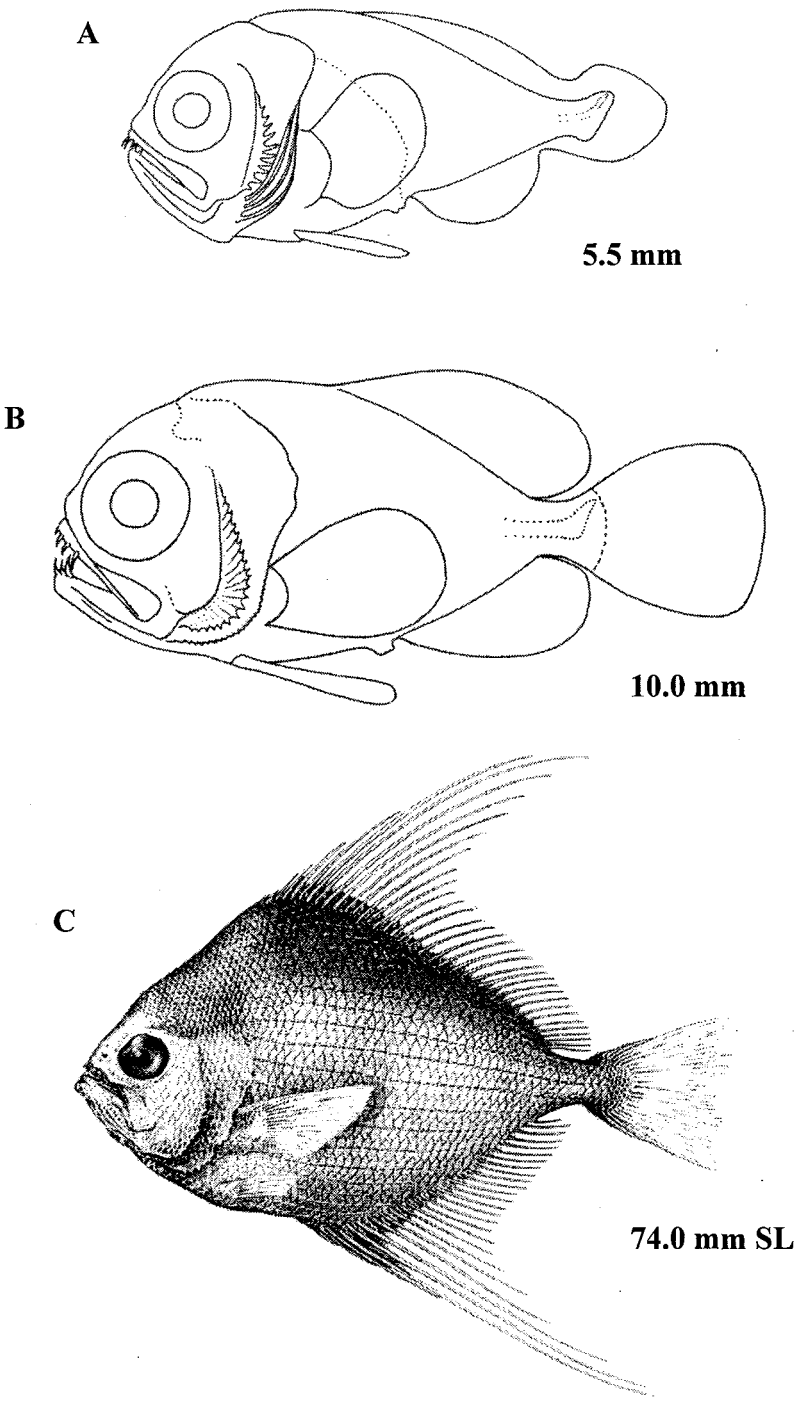
EGGS: Unknown.

LARVAE:
Length at Hatching: unknown.
Length at Flexion: 5.5-6.5 mm.
Length at Transformation: unknown.
Sequence of Fin Development: Presumed to be P_1, C_1, P_2, D & A & C_2
Pigmentation: Appears on gular fold at 6.5 mm, light coloration on anterior half of body. Sharp demarcation of colorless caudal peduncle. All fins colorless at 20 mm, some pigment in P_2 fin at 100 mm.
Fin placement: D fin origin between P_1 base and A fin origin. A fin origin in vertical behind D fin origin. D & A fins develop in parallel with no lobes or pigment. P_1 base vertical. P_2 inserts under preopercle, shifting posteriorly at 15 mm, rarely extends beyond A fin origin.
Squamation: complete at 8-9 mm.
Spination: Preopercular spines fringe-like appearance at 7 mm , formed by short uniform spines along anterior & ascending arms.
Teeth: 3-4 or fewer long recurved caninies in anterior half of upper & lower jaw, few minute teeth appear in posterior half at ca. 10-15 mm.

JUVENILES:
Diagnostic characters: Meristics, anterior P_2 insertion, colorless caudal peduncle, fringe-like preopercular spines.

ILLUSTRATIONS

Figure Bramidae 7. All from Mead 1972.A) 5.5 mm, B) 10.0 mm, C) 74.0 mm SL.


A
5.5 mm
B
10.0 mm
C
74.0 mm SL

MERISTICS

Vertebrae:	
Precaudal	21-23
Caudal	24-27
Total	48-51
Number of Fin Rays:	
Dorsal	48-53
Anal	38-43
Pectoral	20-23
Pelvic	I,5
Caudal	
Principal	17(9+8)
Gill Rakers	1-2+6-8=7-10
Branchiostegals	7

LIFE HISTORY

Range: Tropical & temperate western North Atlantic.
Habitat: Pelagic, young from 25-300 m.
ELH Pattern: Oviparous, planktonic eggs & larvae.
Spawning season: Unknown.

LITERATURE

Mead 1972.

ILLUSTRATIONS

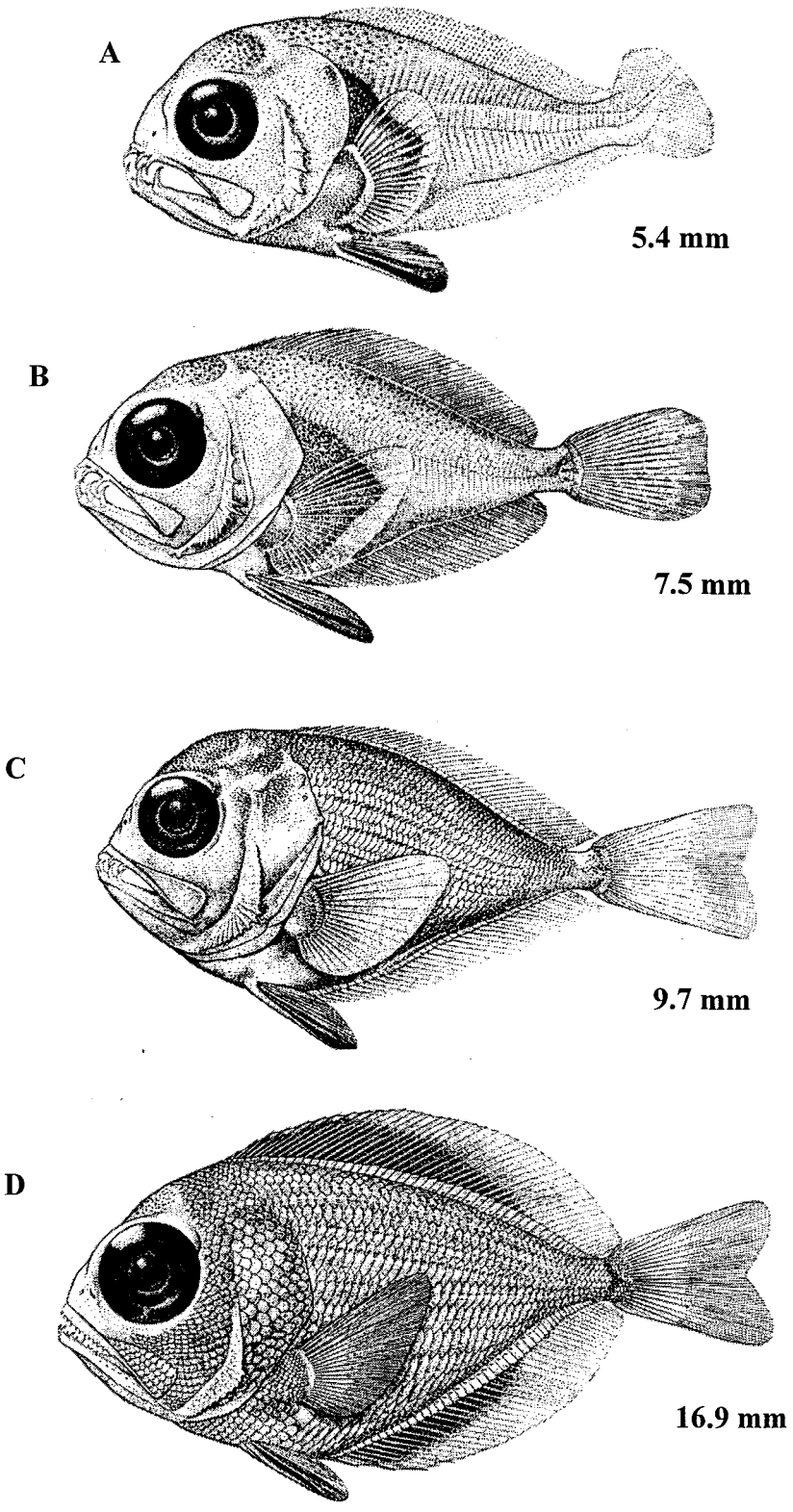
Figure Bramidae 8. All from Mead 1972. A) 5.4 mm, B) 7.5 mm, C) 9.7 mm, D) 16.9 mm.

EARLY LIFE HISTORY DESCRIPTION

EGGS: Unknown.

LARVAE:
Length at Hatching: unknown.
Length at Flexion: 4.4-5.4 mm.
Length at Transformation: unknown.
Sequence of Fin Development: Presumed to be P_1, C_1, P_2, D & A & C_2
Pigmentation: Predorsal area more heavily pigmented than remainder of head. D fin without pigment <12-15 mm, first pigment in proximal half of rays 10 to 20, spreading anteriorly, posteriorly and distally, but incomplete on last rays at 20 mm.. A fin colorless below ca. 14 mm, pigment then spreading from proximal parts of rays 2 to 10. P_2 fin black at all lengths, pigment restricted to outer 4 elements. C fin colorless at all sizes.
Fin placement: D fin origin about over P_1 base in small specimens moving forward to vertical over posterior rim of orbit, D origin separated from scaleless nape by about 10 predorsal scales, or prior to scale formation by an area more heavily pigmented than head. No anterior lobe on D fin. A fin origin under posterior end of abdominal cavity, moving to beneath P_1 base by 20 mm.No anterior A fin lobe. P_1 base axis vertical, nearly vertical at 20 mm, base becomes higher & narrower with growth. P_2 inserts slightly in advance of vertical from P_1 base but behind that from eye.
Squamation: scale pockets visible on trunk at ca. 6.0 mm, scales on D & A fin sheaths at 7.0 mm corresponding in number with fin rays. Caudal peduncle mid-lateral scale spines not enlarged.
Spination: Preopercular spines evenly graduated, fringe-like appearance becoming overgrown by 15 mm.
Teeth: confined to recurved anterior canines <10 mm, teeth in posterior part of jaws appearing at ca. 12 mm, initially smaller than anterrior 'baby teeth'. None on vomer or palatines.

JUVENILES:
Diagnostic characters: Meristics, anterior origin of D fin (as in *Pteraclis*)


A
5.4 mm
B
7.5 mm
C
9.7 mm
D
16.9 mm

MERISTICS

Vertebrae:	
Precaudal	24-25
Caudal	24-27
Total	49-52
Number of Fin Rays:	
Dorsal	48-54
Anal	42-47
Pectoral	18-19
Pelvic	I,5
Caudal	
Principal	17(9+8)
Gill Rakers	1+6-8=7-9
Branchiostegals	8

LIFE HISTORY

Range: Abundant in Sargasso Sea, rare in eastern North Atlantic.

Habitat: Epi- & mesopelagic, young near the surface but may occur to 400 m or greater.

ELH Pattern: Oviparous, planktonic eggs & larvae.

Spawning season: Unknown, but young in all but November to January.

LITERATURE

Mead 1972.

ILLUSTRATIONS

Figure Bramidae 9. All from Mead 1972. A) 3.5 mm, B) 4.2 mm, C)5.5 mm, D) 8.0 mm, E) 10.0 mm, F) 12.5 mm, G) 14.5 mm, H) 24.6 mm.

EARLY LIFE HISTORY DESCRIPTION

EGGS: Unknown.

LARVAE:

Length at Hatching: unknown.

Length at Flexion: 4.8-6.0 mm.

Length at Transformation: unknown.

Sequence of Fin Development: Presumed to be P_1, C_1, P_2, D & A & C_2

Pigmentation: Gill membranes black at all sizes. D fin pigmentation forms at ca. 8-10 mm, but still incomplete posteriorly at 25 mm. A fin forms at 8-10 mm in anterior part spreading posteriorly, last few unpigmented at 25 mm. P2 fin colorless <10 mm, pigment restricted to distal end of filamentous ray between 10-25 mm. C fin colorless.

Fin placement: D fin origin progresses forward with growth, behind P_1 vertical at 3.5 mm, over center of eye at 14 mm, over or advance of anterior orbit at 23-24 mm. No anterior fin lobe. A fin origin progresses forward with growth, under posterior end of abdominal cavity at 3.5 mm, advances to P_1 fin, inserts in advance of P_1 fin vertical at 6 mm. P_2 fin developes late >6.5 mm, in advance P_1 vertical advancing forward to below eye at 10 mm, extends beyond anal fin origin at all sizes, 2nd ray becoming long & filamentous, short stout splint spine, 4th & 5th rays hair-like.

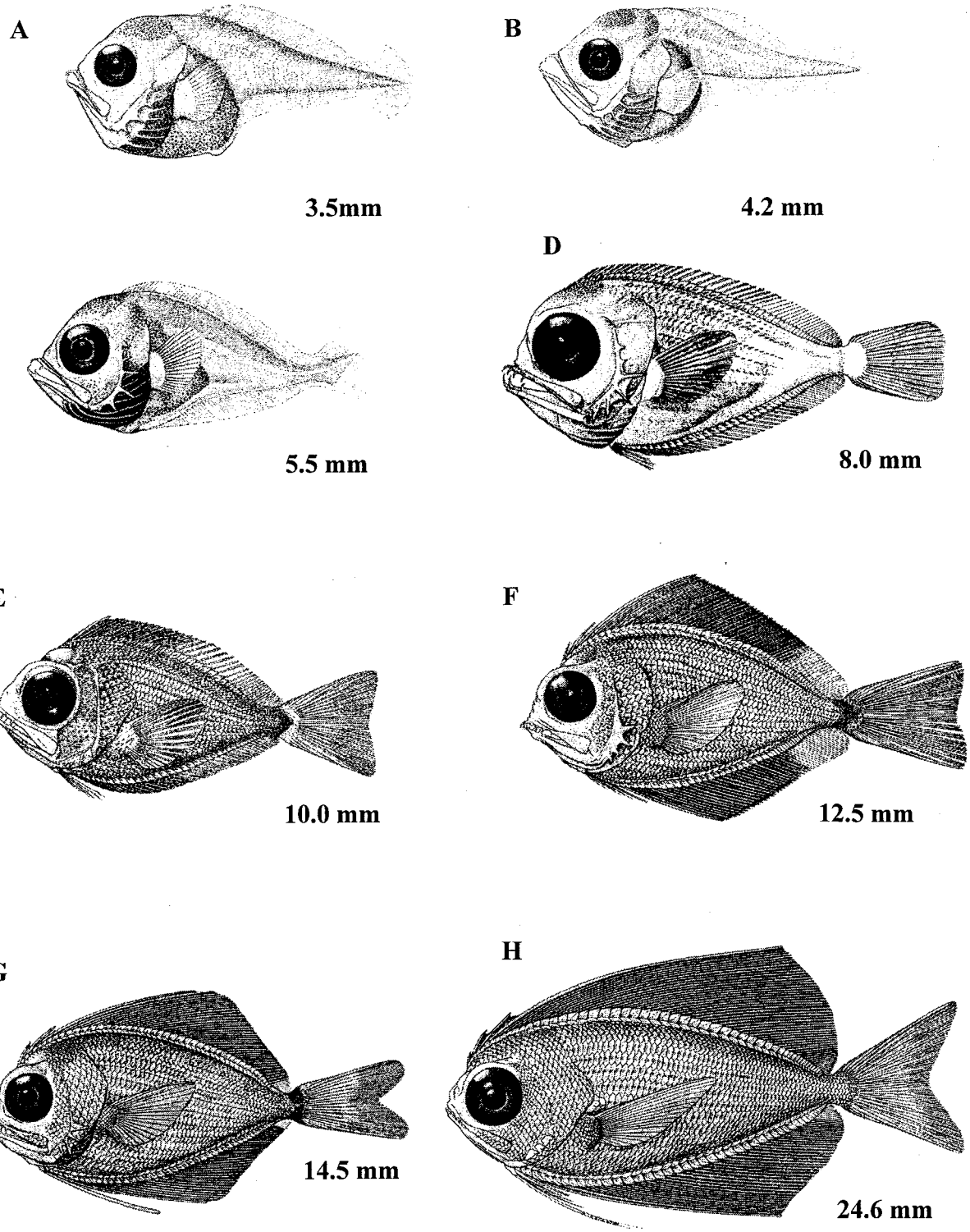
Squamation: scale pockets at 5.8 mm, complete at 10 mm appearing first around P_1 fin & spreading posteriorly. Scales also form base of D fin & lateral to A fin (ca.8-9 mm), last scales to form on cheek & dorsal & ventral CP. All scales of head, fin sheaths, & trunk bear pointed retrorse spines.

Spination: Preopercular spines simple, of unequal length appearing at ca. 6.

Teeth: confined to anterior half of jaw 3.5-8 mm 1-6 in number; heavy, recurved & directed outward, number increasing rapidly >10 mm, no vomerine or palatine & none on premaxillary.

JUVENILES:

Diagnostic characters: Meristics, filamentous P_2 ray. Appear adult-like at ca. 24 mm.


A
3.5mm
B
4.2 mm
C
5.5 mm
D
8.0 mm
E
10.0 mm
F
12.5 mm
G
14.5 mm
H
24.6 mm

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