



Identification methods of the Carangidae fishes and their larvae in the Southeast Asian region

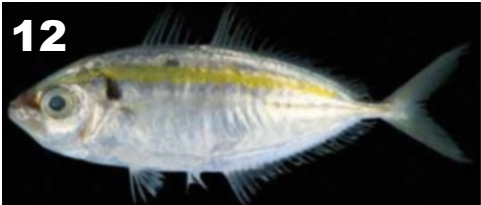
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Main References (Adults)

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A representative species of the selected 16 carangid genera in the Southeast Asian region

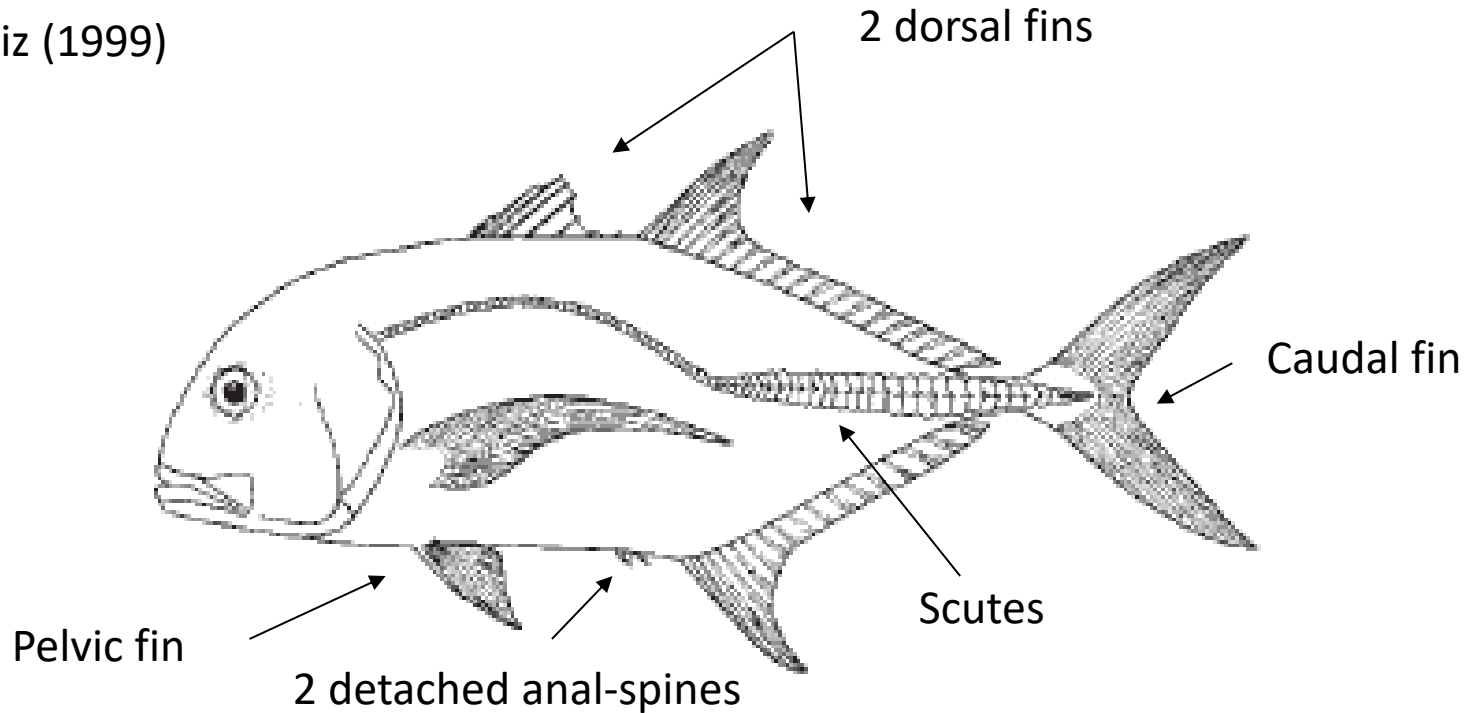


1: *Alectis ciliaris*; 2: *Atropus atropus*; 3: *Parastromateus niger*; 4: *Ulua mentalis*; 5: *Carangoides malabaricus*; 6: *Caranx sexfasciatus*; 7: *Gnathanodon speciosus*; 8: *Alepes melanoptera*; 9: *Scomberoides commersonianus*; 10: *Atule mate*; 11: *Selar crumenophthalmus*; 12: *Selaroides leptolepis*; 13: *Seriolina nigrofasciata*; 14: *Megalaspis cordyla*; 15: *Elagatis bipinnulata*; 16: *Decapterus macrosoma*

Kimura (2011)

Carangid fishes

Smith-Vaniz (1999)



- Body ranging from elongate and fusiform to deep and strongly compressed.
- Two dorsal fins (D1: 4-8 spines; D 2: 1 spine and 18-44 soft rays).
- Two detached anal-fin spines (1 spine in *Elagatis* and *Seriolina*).
- Pelvic fin with 1 spine and 5 soft rays (absent in *Parastromateus*).
- Caudal fin forked.
- Scutes present on straight lateral line (prominent, reduced or absent).
- Single or multiple finlets present in 2nd dorsal and anal fins (only in *Decapterus* and *Megalaspis*).



Habitat, biology, and fisheries

Smith-Vaniz (1999)

- Mostly schooling species (but *Alectis* generally solitary).
- Some species have largely continental distributions and occur primarily in brackish environments (especially young).
- Others such as *Elagatis* and *Naucrates* are pelagic, usually found at or near the surface, mostly in oceanic waters, often far offshore.
- This is one of the most important families of commercial fishes, and all species are used for food.
- For **1995**, FAO's Yearbook of Fishery Statistics reports a total catch of **around 959 300 t** of Carangidae from the Western Central Pacific.
- Caught commercially with trawls, also with purse seines, traps, and on line gear.
- The larger species of *Trachinotus*, *Seriola*, and *Caranx* are highly regarded as sportfish.

Tribes, genera and species of the Carangidae in the Southeast Asian region (1/2)



No	Tribe	Genus	Species
1	Carangini	<i>Alectis</i>	2
2	Carangini	<i>Alepes</i>	4
3	Carangini	<i>Atropus</i>	1
4	Carangini	<i>Atule</i>	1
5	Carangini	<i>Carangoides</i>	15
6	Carangini	<i>Caranx</i>	8
7	Carangini	<i>Decapterus</i>	6
8	Carangini	<i>Gnathanodon</i>	1
9	Carangini	<i>Megalaspis</i>	1
10	Carangini	<i>Parastromateus</i>	1
11	Carangini	<i>Selar</i>	2
12	Carangini	<i>Selaroides</i>	1
13	Carangini	<i>Ulua</i>	1
14	Carangini	<i>Uraspis</i>	1

Subtotal

1 tribe

14 genera

45 species

Tribes, genera and species of the Carangidae in the Southeast Asian region (2/2)

No	Tribe	Genus	Species
15	Naucratini	<i>Elagatis</i>	1
16	Naucratini	<i>Naucrates</i>	1
17	Naucratini	<i>Seriola</i>	2
18	Naucratini	<i>Seriolina</i>	1
19	Scomberoidini	<i>Scomberoides</i>	4
20	Trachinotini	<i>Trachinotus</i>	5
Subtotal	3 tribes	6 genera	14 species
Total	4 tribes	20 genera	59 species

Meristic data of the Carangidae genera in the South- east Asian region (1/2)

Tribe	Genus	Species	Dorsal fin	Anal fin	Scutes	Vertebrae
Carangini	<i>Alectis</i>	2	IV~VII-I, 18~20	(II)-I, 15~17	6~30	10 + 14
Carangini	<i>Alepes</i>	4	VII~VIII-I, 21~27	II-I, 18~23	35~69	10 + 14
Carangini	<i>Atropus</i>	1	VIII-I, 19~22	II-I, 17~18	31~37	10 + 14
Carangini	<i>Atule</i>	1	VIII-I, 22~25	II-I, 18~21	36~52	10 + 14
Carangini	<i>Carangoides</i>	15	VIII-I, 17~34	II-I, 14~27	11~45	10 + 14~15
Carangini	<i>Caranx</i>	8	VIII-I, 18~24	II-I, 14~20	26~42	10 + 14~15
Carangini	<i>Decapterus</i>	6	VIII-I, 27~38 + 1	II-I, 20~30 + 1	24~40	10 + 14
Carangini	<i>Gnathanodon</i>	1	VII~VIII-I, 18~21	II-I, 15~17	14~26	10 + 14
Carangini	<i>Megalaspis</i>	1	VIII-I, 9~11 + 7~10	II-I, 8~10 + 6~8	51~59	10 + 14
Carangini	<i>Parastromateus</i>	1	(V~VI)-I, 40~45	(II)-I, 35~39	8~19	10 + 14

Spines in parenthesis are not visible due to burying under the body.
Numerals with “+” are number of finlet(s).

Meristic data of the Carangidae genera in the South- east Asian region (**2/2**)

Tribe	Genus	Species	Dorsal fin	Anal fin	Scutes	Vertebrae
Carangini	<i>Selar</i>	2	VIII-I, 23~28	II-I, 19~23	29~46	10 + 14
Carangini	<i>Selaroides</i>	1	VIII-I, 24~26	II-I, 20~23	20~33	10 + 14
Carangini	<i>Ulua</i>	1	VIII-I, 20~22	II-I, 17~18	26~38	10 + 14
Carangini	<i>Uraspis</i>	1	VI~VIII-I, 24~30	(II)-I, 17~22	24~39	10 + 14
Naucratini	<i>Elagatis</i>	1	V~VI-I, 23~28 + 2	(I)-I, 15~20 + 2	0	10 + 14
Naucratini	<i>Naucrates</i>	1	IV~V-I, 25~29	II-I, 15~17	0	10 + 15
Naucratini	<i>Seriola</i>	2	VI~VII-I, 26~35	II-I, 18~22	0	10 + 14
Naucratini	<i>Seriolina</i>	1	V~VIII-I, 30~37	(I)-I, 15~18	0	11 + 13
Scomberoidini	<i>Scomberoides</i>	4	VI~VII-I, 19~21	II-I (II), 16~20	0	10 + 16
Trachinotini	<i>Trachinotus</i>	5	V~VI-I, 18~25	II-I, 16~24	0	10 + 14

Meristic data of the Carangidae species in the South-east Asian region (1/6) [Tribe Carangini]

Species	Dorsal fin	Anal fin	Scutes	Vertebrae
<i>Alectis ciliaris</i>	IV~VII-I, 18~20	(II)-I, 15~17	8~30	10 + 14
<i>A. indica</i>	V~VI-I, 18~20	(II)-I, 15~17	6~13	10 + 14
<i>Alepes djedaba</i>	VIII-I, 23~25	II-I, 18~21	39~51	10 + 14
<i>A. kleinii</i>	VIII-I, 21~26	II-I, 19~22	35~45	10 + 14
<i>A. melanoptera</i>	VII-I, 23~26	II-I, 18~21	49~69	10 + 14
<i>A. vari</i>	VIII-I, 23~27	II-I, 20~23	48~69	10 + 14
<i>Atropus atropus</i>	VIII-I, 19~22	II-I, 17~18	31~37	10 + 14
<i>Atule mate</i>	VIII-I, 22~25	II-I, 18~21	36~52	10 + 14
<i>Carangoides armatus</i>	VIII-I, 19~22	II-I, 16~18	11~24	10 + 14
<i>C. bajad</i>	VIII-I, 24~26	II-I, 21~24	20~30	10 + 14
<i>C. coeruleopinnatus</i>	VIII-I, 20~23	II-I, 16~20	16~38	10 + 14
<i>C. chrysophrys</i>	VIII-I, 18~20	II-I, 14~17	20~37	10 + 14

Meristic data of the Carangidae species in the South-east Asian region (2/6) [Tribe Carangini]

Species	Dorsal fin	Anal fin	Scutes	Vertebrae
<i>Carangoides dinema</i>	VIII-I, 17~19	II-I, 15~17	23-30	10 + 14
<i>C. ferdau</i>	VIII-I, 26~34	II-I, 21~27	21~37	10 + 14
<i>C. fulvoguttatus</i>	VIII-I, 25~30	II-I, 21~26	14~21	10 + 14
<i>C. gymnostethus</i>	VIII-I, 28~33	II-I, 24~27	15~31	10 + 14~15
<i>C. hedlandensis</i>	VIII-I, 19~22	II-I, 16~18	17~29	10 + 14
<i>C. malabaricus</i>	VIII-I, 20~23	II-I, 17~19	19~36	10 + 14
<i>C. oblongus</i>	VIII-I, 20~22	II-I, 18~19	37~45	10 + 14
<i>C. orthogrammus</i>	VIII-I, 28~33	II-I, 23~27	19~31	10 + 14
<i>C. plagiotaenia</i>	VIII-I, 22~24	II-I, 18~20	11~19	10 + 14
<i>C. praeustus</i>	VIII-I, 21~24	II-I, 18~20	23~34	10 + 14
<i>C. talamparoides</i>	VIII-I, 20~23	II-I, 17~19	20~32	10 + 14

Meristic data of the Carangidae species in the South-east Asian region (3/6) [Tribe Carangini]

Species	Dorsal fin	Anal fin	Scutes	Vertebrae
<i>Caranx bucculentus</i>	VIII-I, 18~19	II-I, 15~17	33~39	10 + 14
<i>C. heberi</i>	VIII-I, 19~21	II-I, 15~17	30~40	10 + 14
<i>C. ignobilis</i>	VIII-I, 18~21	II-I, 15~17	26~38	10 + 14
<i>C. lugubris</i>	VIII-I, 20~22	II-I, 16~19	26~33	10 + 14
<i>C. melampyngus</i>	VIII-I, 21~24	II-I, 17~20	27~42	10 + 14
<i>C. papuensis</i>	VIII-I, 21~23	II-I, 16~19	31~39	10 + 14
<i>C. sexfasciatus</i>	VIII-I, 19~22	II-I, 14~17	27~36	10 + 15
<i>C. tille</i>	VIII-I, 20~22	II-I, 16~18	33~42	10 + 14
<i>Decapterus akaadsi</i>	VIII-I, 27~30 + 1	II-I, 20~24 + 1	32~35	10 + 14
<i>D. kurroides</i>	VIII-I, 28~29 + 1	II-I, 22~25 + 1	31~36	10 + 14
<i>D. macarellus</i>	VIII-I, 30~36 + 1	II-I, 26~30 + 1	24~40	10 + 14

Meristic data of the Carangidae species in the South-east Asian region (4/6) [Tribe Carangini]

Species	Dorsal fin	Anal fin	Scutes	Vertebrae
<i>Decapterus macrosoma</i>	VIII-I, 32~38 + 1	II-I, 26~30 + 1	24~40	10 + 14
<i>D. russelli</i>	VIII-I, 27~32 + 1	II-I, 24~28 + 1	30~40	10 + 14
<i>D. tabl</i>	VIII-I, 29~33 + 1	II-I, 23~26 + 1	30~40	10 + 14
<i>Gnathanodon speciosus</i>	VII~VIII-I, 18~21	II-I, 15~17	14~26	10 + 14
<i>Megalaspis cordyla</i>	VIII-I, 9~11 + 7~10	II-I, 8~10 + 6~8	51~59	10 + 14
<i>Parastromateus niger</i>	(V~VI)-I, 40~45	(II)-I, 35~39	8~19	10 + 14
<i>Selar boops</i>	VIII-I, 23~25	II-I, 19~21	37~46	10 + 14
<i>S. crumenophthalmus</i>	VIII-I, 23~28	II-I, 21~23	29~42	10 + 14
<i>Selaroides leptolepis</i>	VIII-I, 24~26	II-I, 20~23	20~33	10 + 14
<i>Ulua mentalis</i>	VIII-I, 20~22	II-I, 17~18	26~38	10 + 14
<i>Uraspis uraspis</i>	VI~VIII-I, 24~30	(II)-I, 17~22	24~39	10 + 14

Meristic data of the Carangidae species in the South-east Asian region (5/6) [Tribe Naucratiini]

Species	Dorsal fin	Anal fin	Scutes	Vertebrae
<i>Elagatis bipinnulata</i>	V~V-I, 23~28 + 2	(I)-I, 15~20 + 2	0	10 + 14
<i>Naucrates ductor</i>	IV~V-I, 25~29	II-I, 15~17	0	10 + 15
<i>Seriola dumerili</i>	VI~VII-I, 29~35	II-I, 18~22	0	10 + 14
<i>S. rivoliana</i>	VII-I, 26~33	II-I, 18~22	0	10 + 14
<i>Seriolina nigrofasciata</i>	V~VIII-I, 30~37	(I)-I, 15~18	0	11 + 13

Meristic data of the Carangidae species in the Southeast Asian region (6/6) [Tribe Scomberoidini & Trachinotini]

Species	Dorsal fin	Anal fin	Scutes	Vertebrae
<i>Scomberoides lysan</i>	VI~VII-I, 19~21	II-I, 17~19	0	10 + 16
<i>S. commersonianus</i>	VI~VII-I, 19~21	II-I, 16~19	0	10 + 16
<i>S. tala</i>	VI~VII-I, 19~21	II, 16~19	0	10 + 16
<i>S. tol</i>	VI~VII-I, 19~21	II-I, 17~20	0	10 + 16
<i>Trachinotus africanus</i>	VI-I, 21~23	II-I, 19~21	0	10 + 14
<i>T. baillonii</i>	V~VI-I, 21~25	II-I, 20~24	0	10 + 14
<i>T. blochii</i>	VI-I, 18~20	II-I, 16~18	0	10 + 14
<i>T. botla</i>	VI-I, 22~24	II-I, 19~21	0	10 + 14
<i>T. mookalee</i>	VI-I, 18~20	II-I, 16~18	0	10 + 14

Key to the genera and subgenera of Carangidae occurring in the area Smith-Vaniz (1999)

- 1a. Posterior straight part of lateral line with hardened scutes; in adults, pectoral fins long and falcate, in most genera longer than head (Fig. 1) (about equal to head length in *Selar* and *Trachurus*, and shorter than head length in some *Decapterus* spp.) → 2
- 1b. No scutes in lateral line (only pored scales, not enlarged); pectoral fins relatively short, shorter than head (about 50 to 90% of head length) → 19
- 2a. Pored scales in curved lateral line scute-like, expanded dorsoventrally (Fig. 2) (caution: in large fish may be obscured by overgrowth of smaller scales); dorsal accessory lateral line normally extends posteriorly at least to below origin of second dorsal fin, usually farther posteriorly (Figs 2 and 3) *Trachurus*
- 2b. No enlarged scute-like scales in curved lateral line; dorsal accessory lateral line terminating before origin of spinous dorsal fin → 3

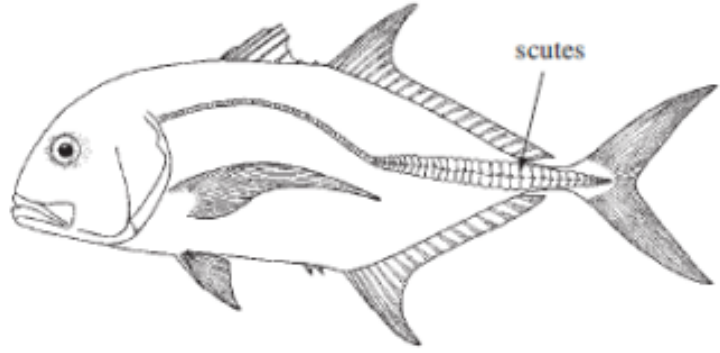


Fig. 1 *Caranx*

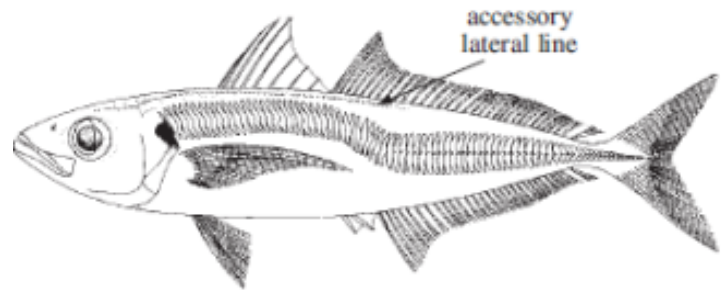


Fig. 2 *Trachurus*

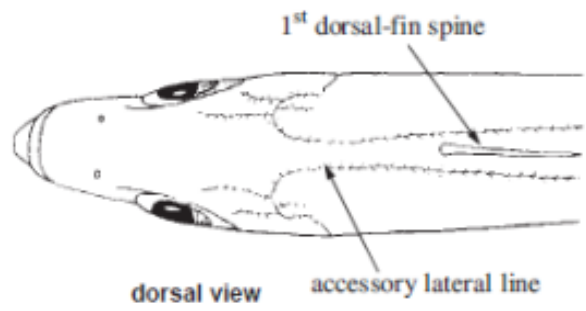


Fig. 3 *Trachurus*

The target area of this key is the warm waters of the Indian and western Pacific Oceans. Therefore, it includes fishes outside of the Southeast Asian waters. The same applies to the following keys for each genus.

- 3a. Pelvic fins, if present (absent in specimens larger than about 10 cm fork length), positioned distinctly anterior to a vertical line through pectoral-fin base; soft anal-fin rays 35 to 39 *Parastromateus*
- 3b. Pelvic fins (always present) not positioned distinctly anterior to a vertical through pectoral-fin base: soft anal-fin rays 15 to 31 → 4

- 4a. Scales on body minute, inconspicuous and embedded giving the impression of naked skin; in smaller fish, anterior soft rays of dorsal and anal fins filamentous (Fig. 4). *Alectis*
- 4b. Scales on body small but conspicuous, not embedded; in smaller fish, anterior soft rays of dorsal and anal fins not filamentous → 5

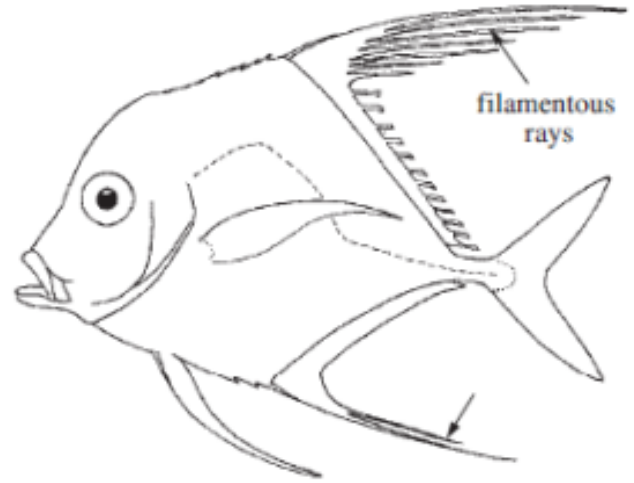


Fig. 4 *Alectis*

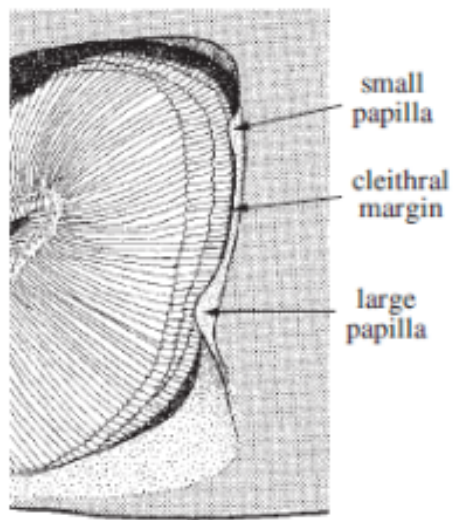
- 5a. Second dorsal and anal fins with 1 or more distinctly separate finlets → 6
- 5b. Second dorsal and anal fins without finlets → 7

- 6a. Single detached terminal 2-rayed finlet in dorsal and anal fins (Fig. 5); shoulder girdle (cleithrum) margin with 2 papillae, the lower papilla larger (Fig. 6); maximum scute height smaller than eye diameter . . . *Decapterus*



Fig. 5 *Decapterus*

- 6b. Posterior soft dorsal- and anal-fin rays consisting of 6 to 10 detached finlets; shoulder girdle margin smooth; maximum scute height larger than eye diameter (Fig. 7) . . . *Megalaspis*



gill chamber after lifting operculum

Fig. 6 *Decapterus*

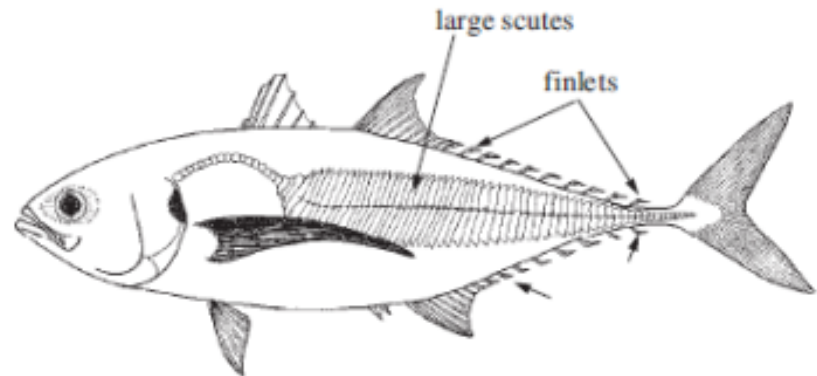
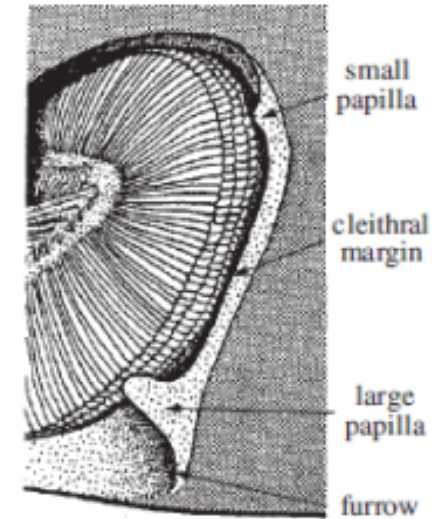


Fig. 7 *Megalaspis*

- 7a. Shoulder girdle (cleithrum) margin with a furrow ventrally, a large papilla immediately above it and a smaller papilla near upper edge (Fig. 8). *Selar*
- 7b. Shoulder girdle margin smooth → 8
- 8a. Upper jaw without teeth → 9
- 8b. Upper jaw with 1 or 2 rows or a band of minute teeth (caution: teeth difficult to detect in some *Carangoides*) → 10



gill chamber after lifting operculum

Fig. 8 *Selar*

- 9a. Lower jaw with a series of minute teeth; a prominent black opercular spot encroaching on shoulder; adipose eyelid well developed posteriorly *Selaroides*
- 9b. Lower jaw with a few feeble teeth in young (smaller than 10 cm fork length), absent in adults; no black opercular spot; adipose eyelid poorly developed *Gnathanodon*
- 10a. Tongue, roof and floor of mouth white, the rest dark (Fig. 9); anal-fin spines reabsorbed or reduced and immovable; no teeth on vomer or palatines *Uraspis*
- 10b. Lining of mouth not distinctly black and white; anal-fin spines normal and movable; teeth present on vomer and palatines → 11



Fig. 9 *Uraspis*

- 11a. Fleshy adipose eyelid completely covering eye except for a vertical slit centred on pupil (Fig. 10a); terminal ray of dorsal and anal fins finlet-like, a little more separated from other rays but not detached, and about twice length of penultimate ray *Atule*
- 11b. Fleshy adipose eyelid, if present, not well developed anteriorly, most of anterior half of pupil exposed; terminal ray of dorsal and anal fins not finlet-like (except terminal ray length 1.5 times the length of penultimate ray in large *Alepes djedeba*) → 12

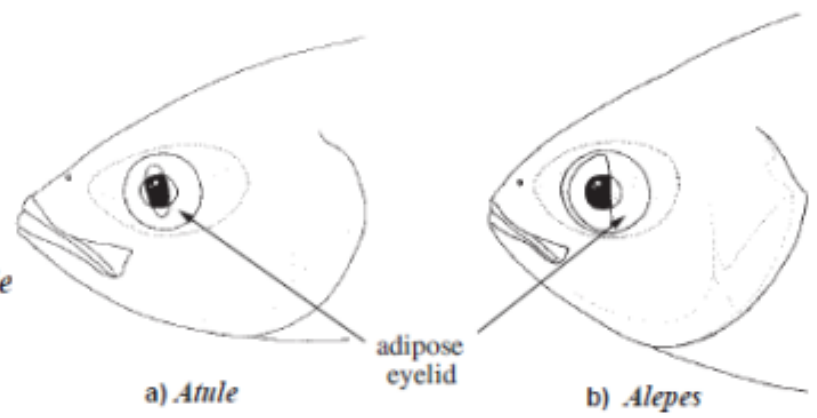


Fig. 10

- 12a. Both jaws with a single row of numerous, comb-like teeth; adipose eyelid well developed on posterior half of eye only (Fig. 10b) *Alepes*
- 12b. Dentition not as above; adipose eyelid, if present, variously developed → 13

- 13a. Upper jaw anteriorly with 2 irregular rows of short conical teeth, posteriorly inner surface of jaw paved with blunt teeth (Fig. 11a); snout shorter than eye diameter “*Alepes*”
- 13b. Dentition not as above; snout usually equal or larger than eye diameter → 14

- 14a. Upper jaw with an outer series of moderate to strong canines and an inner band of fine teeth (Fig. 11b); lower jaw with a single row of teeth → 15
- 14b. Dentition not as above → 16

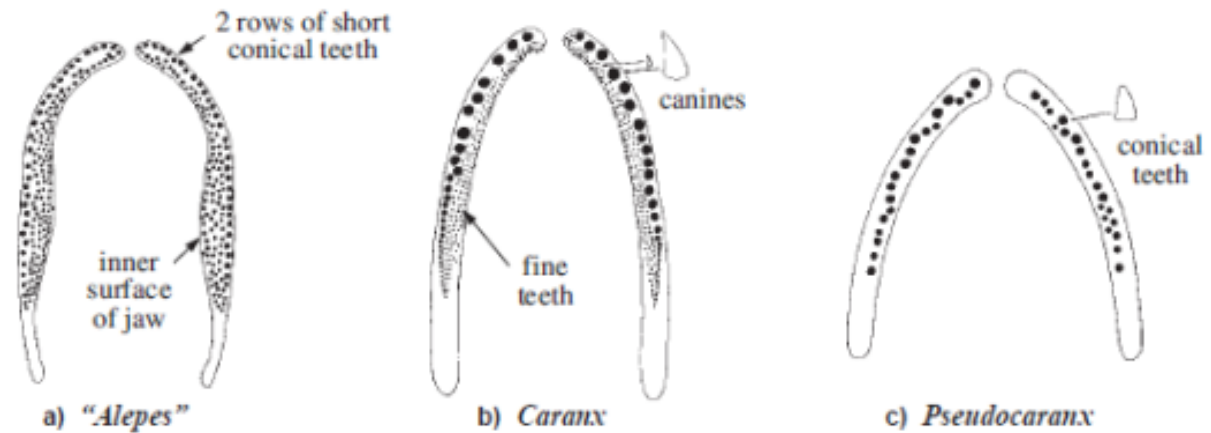


Fig. 11 ventral view of teeth in upper jaw (teeth on roof of mouth not shown)

- 15a. Body generally deep, with dorsal profile more convex than ventral; total gill rakers 20 to 31 on first gill arch; segmented dorsal- and anal-fin rays never produced as filaments; 2 to 4 canines anteriorly in each jaw. *Caranx*
- 15b. Body shallow with dorsal and ventral profiles equally convex; total gill rakers 34 to 39 on first gill arch; segmented dorsal- and anal-fin rays produced as filaments in adult males; no canines anteriorly in either jaw *Pantolabus*

- 16a. Both jaws with single series of short, conical teeth (upper jaw sometimes with an inner row of conical teeth anteriorly) (Fig. 11c); breast completely scaly *Pseudocaranx*
- 16b. Both jaws with a band of teeth, at least anteriorly; breast naked ventrally (most species) to completely scaly → 17
- 17a. Belly with a deep median groove, accommodating pelvic fins, anus, and anal-fin spines (Fig. 12a); pelvic fins conspicuously long and black, tip of appressed fins extending almost to origin of anal fin; curved lateral line short, chord of curved part of lateral line contained 1.5 to 2 times in straight part (Fig. 12b) *Atropus*
- 17b. Belly without median groove; pelvic fins not conspicuously long and black; curved lateral line moderate in most species, with chord of curved part of lateral line contained less than 1.5 times in straight part → 18

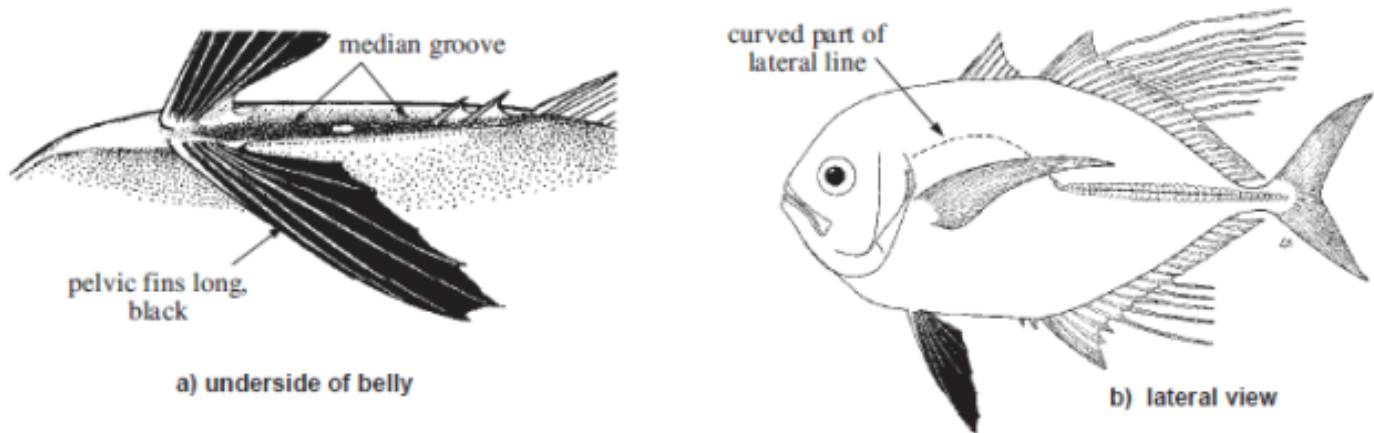


Fig. 12 *Atropus*

- 18a. Gill rakers long, feather-like, and project into mouth along side of tongue (Fig. 13); total gill rakers 54 to 86 on first gill arch; lower jaw becoming prominent in large adults, with the angle of "chin" projecting beyond upper jaw (Fig. 14) *Ulua*
- 18b. Gill rakers of normal length and shape; total gill rakers 21 to 37 on first gill arch; shape of lower jaw not as above *Carangoides*

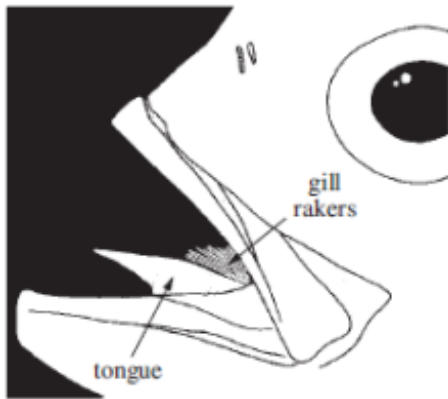


Fig. 13 *Ulua*

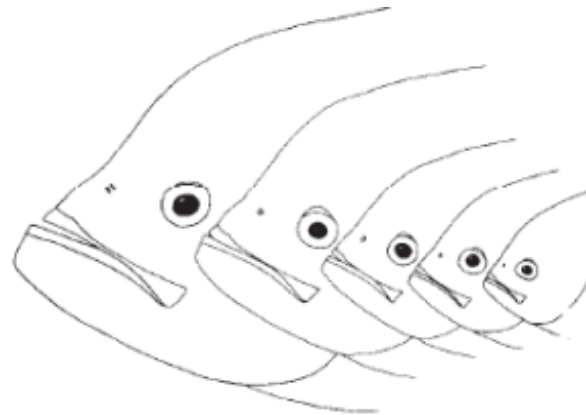


Fig. 14 *Ulua*

- 19a. Bases of soft dorsal and anal fins unequal in length, anal-fin base shorter and only about 45 to 70% of dorsal-fin base length (Fig. 15); caudal-peduncle grooves present, dorsally and ventrally (Fig. 16). → 20
- 19b. Base of soft anal fin as long as, or only slightly shorter than, base of dorsal fin; no caudal-peduncle grooves. → 23

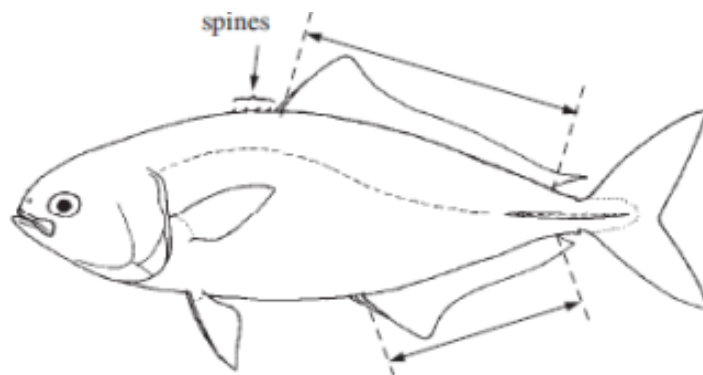


Fig. 15 *Naucrates*

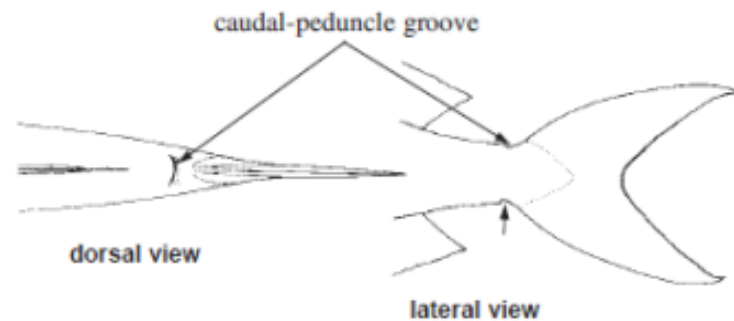


Fig. 16 *Naucrates*

- 20a. Terminal 2-rayed finlet present in dorsal and anal fins (Fig. 17); upper jaw ending distinctly before eye (to below anterior margin of eye in young) *Elagatis*
- 20b. No finlets in dorsal and anal fins; upper jaw ending below anterior margin of eye to posterior margin of eye → 21

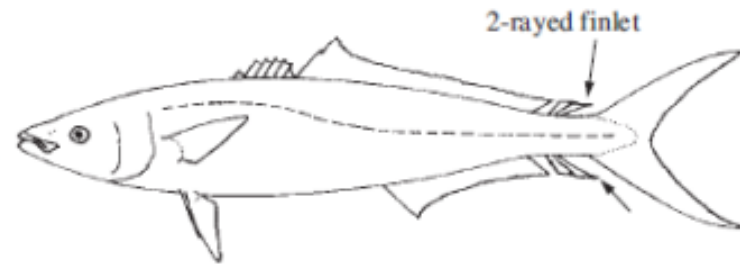
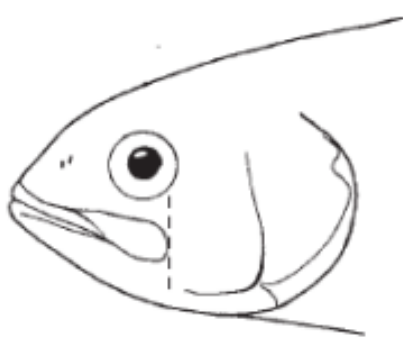
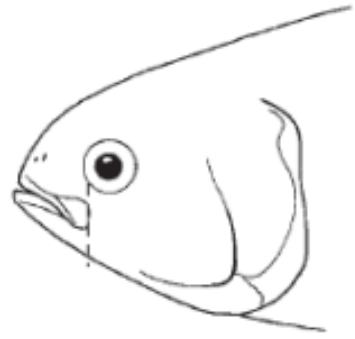


Fig. 17 *Elagatis*

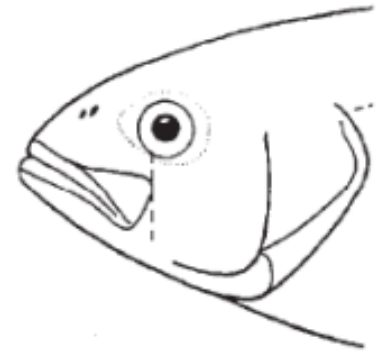
- 21a. Upper jaw broadly rounded posteriorly and usually terminating below posterior margin of eye (Fig. 18a); gill rakers on first gill arch mostly consisting of rudiments, 4 to 10 total elements *Seriolina*
- 21b. Upper jaw truncate or slightly rounded posteriorly and terminating below about anterior margin of eye to middle of eye (Fig. 18b, c); gill rakers on first gill arch mostly well developed, 11 to 29 total elements → 22



a) *Seriolina*



b) *Naucrates*



c) *Seriola*

Fig. 18

22a. First dorsal fin with IV or V spines; soft anal-fin rays 15 to 17; fleshy keel laterally on caudal peduncle well developed (Fig. 19) *Naucrates*

22b. First dorsal fin with VII or VIII spines (caution: anterior spines may become completely embedded in large individuals); soft anal-fin rays 18 to 22 (except 15 to 17 in *S. hippos*); fleshy keel on caudal peduncle absent to moderately developed (*S. lalandi*) *Seriola*

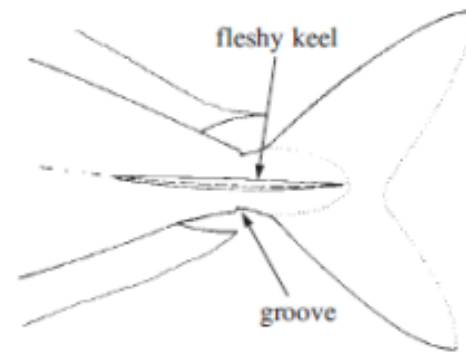


Fig. 19 *Naucrates*

23a. Posterior soft dorsal- and anal-fin rays consisting of semi-detached finlets (Fig. 20); distal quarter to half of rays not connected by interradiation membrane (unattached portion of rays increasing with growth); lower jaw of adults with 2 rows of conical teeth separated by a shallow groove; upper lip joined to snout at midline by a bridge of skin (frenum), except crossed by a shallow groove in very young *Scomberoides*

23b. Posterior soft dorsal- and anal-fin rays not consisting of semi-detached finlets (Fig. 21); lower jaw without teeth or with band of small villiform teeth; upper lip separated from snout at midline by a continuous deep groove *Trachinotus*

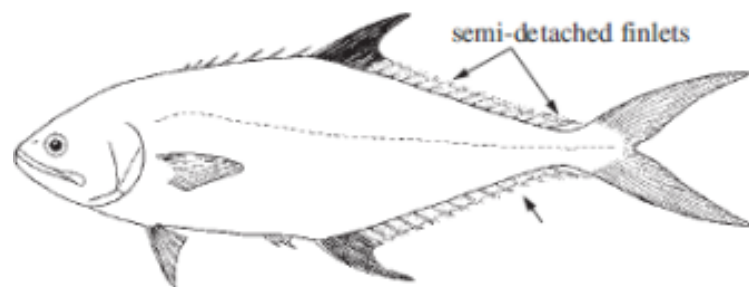


Fig. 20 *Scomberoides*

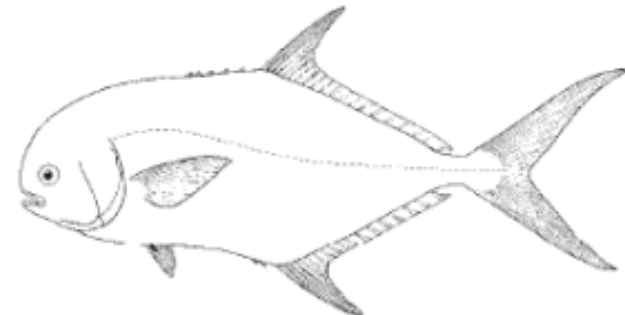


Fig. 21 *Trachinotus*

Key to the species of *Alectis* occurring in the area

- 1a. Profile of nape and head broadly rounded; suborbital depth relatively narrow, contained 1.7 to 3 times in upper jaw length (Fig. 22); gill rakers (excluding rudiments) on lower limb of first arch 12 to 17 *Alectis ciliaris*
- 1b. Profile of nape and head somewhat angular; suborbital depth relatively broad, contained 0.8 to 1 times in upper jaw length (Fig. 23); gill rakers (excluding rudiments) on lower limb of first arch 21 to 26 *Alectis indica*



Fig. 22 *Alectis ciliaris*

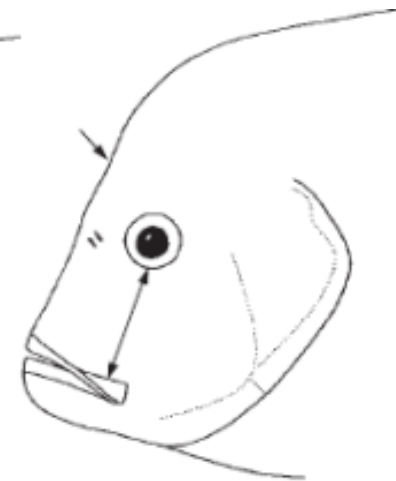


Fig. 23 *Alectis indica*

Key to the species of *Alepes* occurring in the area

- 1a. Interradial membranes of spinous dorsal fin black; total gill rakers 24 to 30 on first arch
..... *Alepes melanoptera*
- 1b. Interradial membranes of spinous dorsal fin transparent to dusky; total gill rakers 32 to 47 on first arch (except 27 to 30 in *A. apercna*). → 2
- 2a. Total gill rakers 27 to 30 on first gill arch; upper jaw with supramaxilla relatively small and without an anterior spine-like projection (Fig. 24a) *Alepes apercna*
- 2b. Total gill rakers 32 to 47 on first gill arch; upper jaw with supramaxilla relatively large and with an anterior spine-like projection (Fig. 24b, c). → 3

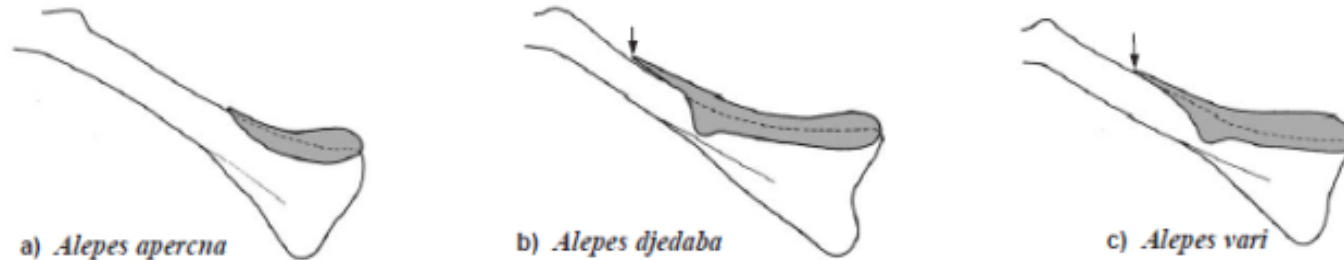


Fig. 24 upper jaw (supramaxilla shaded)

- 3a. Total gill rakers on first gill arch 38 to 47, of which 10 to 14 on upper limb, and 27 to 33 on lower limb; lateral line with 31 to 36 scales and 39 to 51 scutes (total 77 to 85); scutes larger (Fig. 25a); ultimate ray of dorsal and anal fins about 1.3 to 1.5 times the length of penultimate ray *Alepes djedaba*
- 3b. Total gill rakers on first gill arch 32 to 38, of which 9 to 12 on upper limb, and 23 to 26 on lower limb; lateral line with 42 to 50 scales, 48 to 69 scutes (total 86 to 119); scutes smaller (Fig. 25b); ultimate and penultimate rays of dorsal and anal fins of equal length . *Alepes vari*

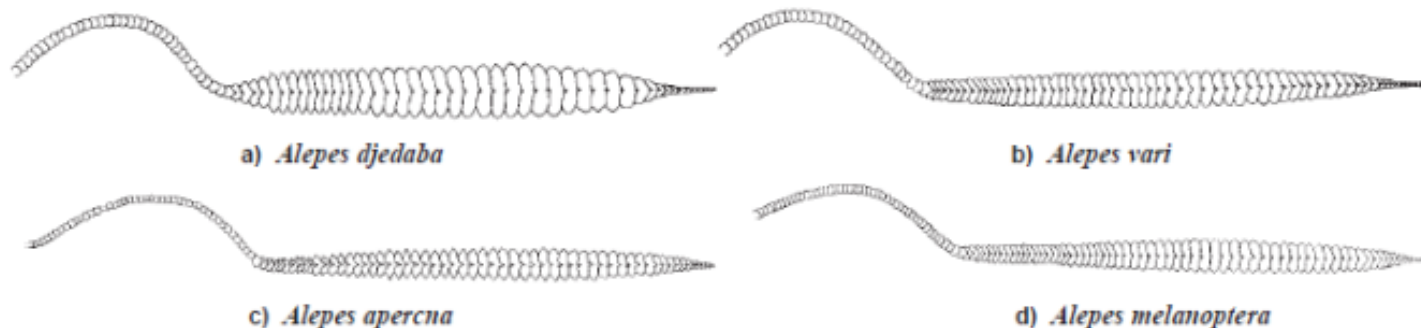


Fig. 25 lateral line

Key to the species of *Carangoides* occurring in the area

Note: species of *Carangoides* that have variable patterns of breast squamation may key out under both sections of couplets when this character is utilized.

- 1a. Breast completely scaly or with a small, median naked area ventrally, scarcely if at all visible in lateral view (Fig. 26) → 2
- 1b. Breast partially to completely naked → 5

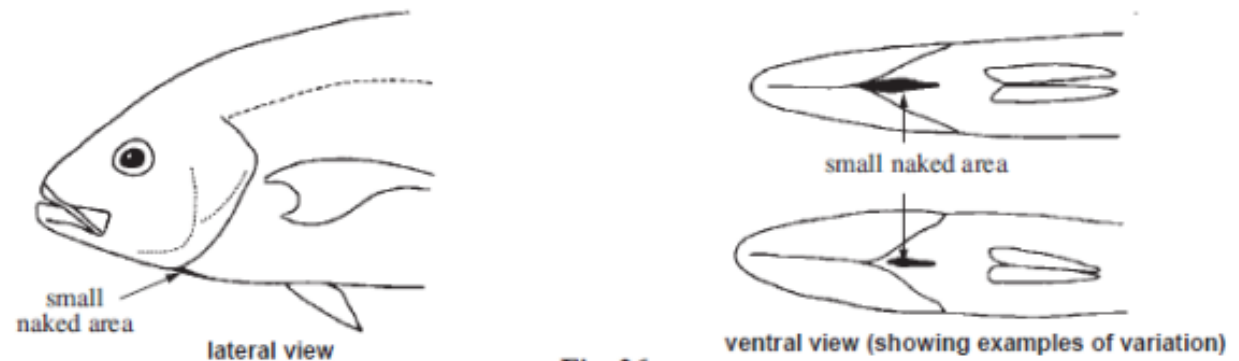


Fig. 26

- 2a. Second dorsal fin with a conspicuous black blotch or submarginal band; vomerine tooth patch anchor-shaped, with a long posteromedian extension (Fig. 27a, b) → 3
- 2b. Second dorsal fin without a conspicuous black blotch or submarginal band; vomerine tooth patch without a distinct posteromedian extension (Fig. 27c) → 4

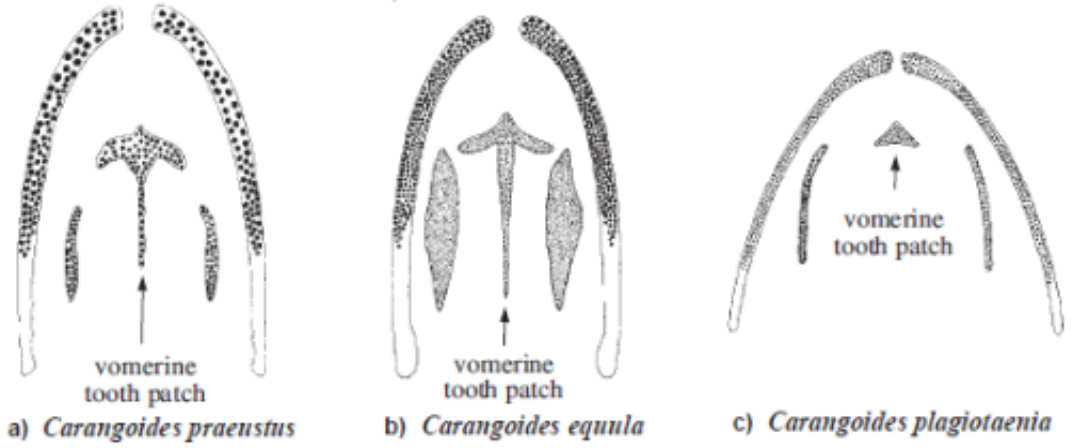


Fig. 27 tooth patches on roof of mouth and upper jaw

- 3a. Second dorsal fin with a conspicuous black blotch anteriorly (Fig. 28); soft anal-fin rays 18 to 20; total gill rakers on first gill arch 32 to 37 *Carangoides praeustus*
- 3b. Second dorsal fin with a submarginal black band (Fig. 29); soft anal-fin rays 21 to 24; total gill rakers on first gill arch 27 to 32 *Carangoides equula*

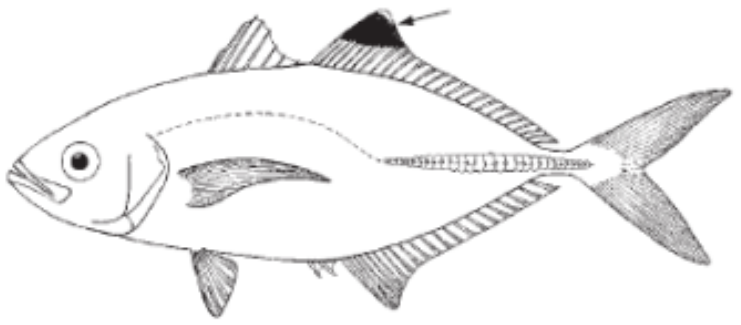


Fig. 28 *Carangoides praeustus*

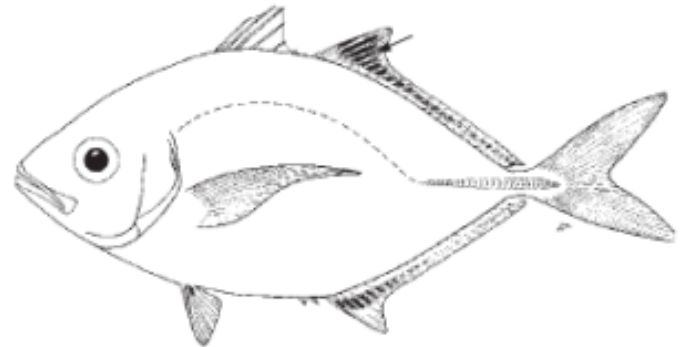


Fig. 29 *Carangoides equula*

- 4a. Soft anal-fin rays 18 to 20; posterior margin of preopercle outlined in black, at least in adults (Fig. 30); scutes 11 to 18 *Carangoides plagiotaenia*
- 4b. Soft anal-fin rays 21 to 24; posterior margin of preopercle not black; scutes 20 to 30 . . . *Carangoides bajad*

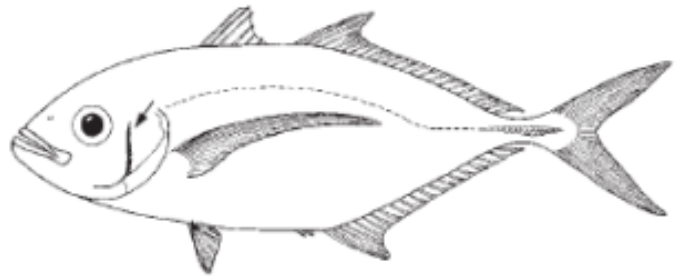


Fig. 30 *Carangoides plagiotaenia*

- 5a. Naked area of breast separated from naked base of pectoral fins by a broad band of scales (Fig. 31) → 6
- 5b. Naked area of breast uninterrupted to naked base of pectoral fins (Fig. 37). → 13
- 6a. Second dorsal fin with a conspicuous black blotch anteriorly (Fig. 28); vomerine tooth patch anchor-shaped, with a long posteromedian extension (Fig. 27a) . . . *Carangoides praeustus*
- 6b. Second dorsal fin without a conspicuous black blotch; vomerine tooth patch without a distinct posterior extension → 7

- 7a. Soft dorsal-fin rays 25 to 34; soft anal-fin rays 21 to 26 → 8
- 7b. Soft dorsal-fin rays 17 to 23; soft anal-fin rays 15 to 19. → 10
- 8a. Naked area of breast extends posteroventrally well beyond origin of pelvic fins (Fig. 31a)
 *Carangoides fulvoguttatus*
- 8b. Naked area of breast does not extend posteroventrally beyond origin of pelvic fins
 (Fig. 31b). → 9

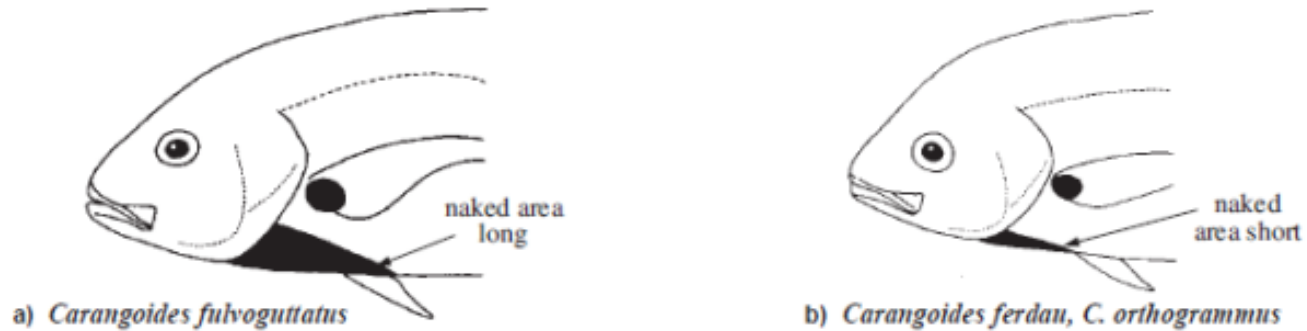


Fig. 31

- 9a. In life, typically 5 or 6 distinct dusky bands on sides of adults and yellow or orange spots on sides, if present, small, numerous and mostly above lateral line (Fig. 32); lips not papillose in adults. *Carangoides ferdau*
- 9b. In life, dark bands usually absent on sides of adults and several relatively large, oblong yellow spots with dark centres present mostly below lateral line (Fig. 33); lips finely papillose in adults. *Carangoides orthogrammus*

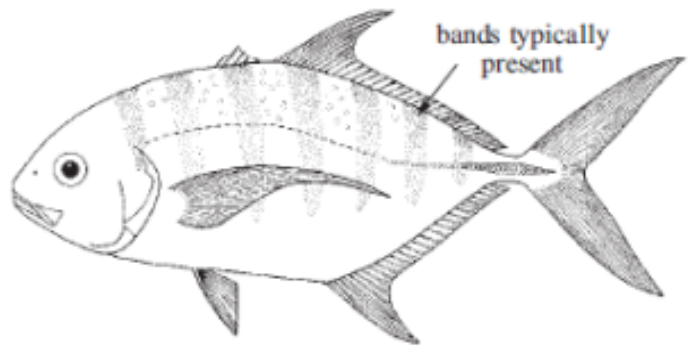


Fig. 32 *Carangoides ferdau*

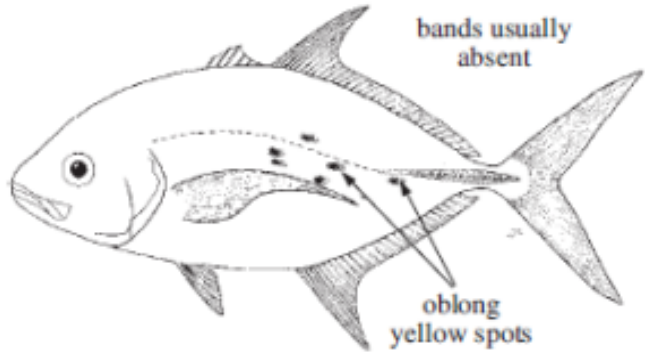


Fig. 33 *Carangoides orthogrammus*

- 10a. Straight part of lateral line slightly longer than curved part (Fig. 34); scutes 37 to 45
 *Carangoides oblongus*
- 10b. Straight part of lateral line slightly shorter than curved part (Fig. 35); scutes 16 to 38 → 11

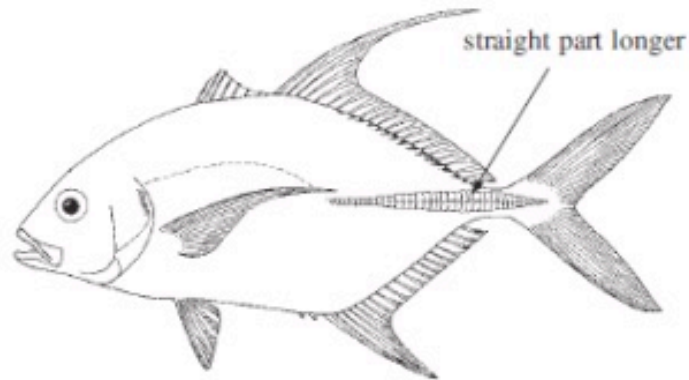


Fig. 34 *Carangoides oblongus*

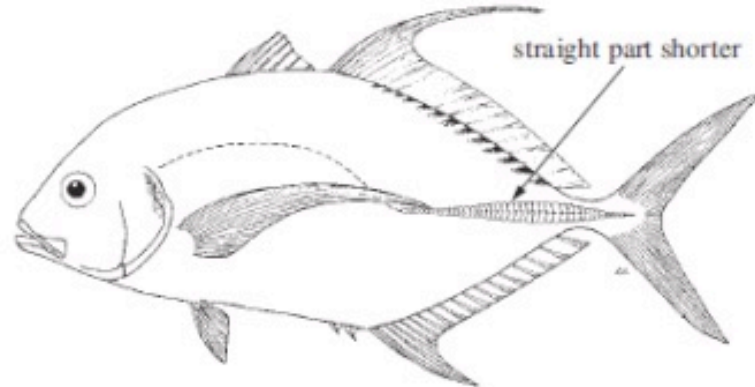


Fig. 35 *Carangoides dinema*

- 11a. No small dark blotches on dorsum between bases of dorsal-fin rays
 *Carangoides caeruleopinnatus*
- 11b. Small dark blotches (becoming larger posteriorly) on dorsum between bases of dorsal-
 fin rays → 12
- 12a. Soft dorsal-fin rays 20 to 22 (rarely 19); large black spot usually present on shoulder;
 naked area of breast extends posteroventrally well beyond origin of pelvic fins (Fig. 36a)
 *Carangoides humerosus*
- 12b. Soft dorsal-fin rays 17 to 19; no large black spot present on shoulder; naked area of
 breast typically does not extend posteroventrally beyond origin of pelvic fins (Fig. 36b)
 *Carangoides dinema*

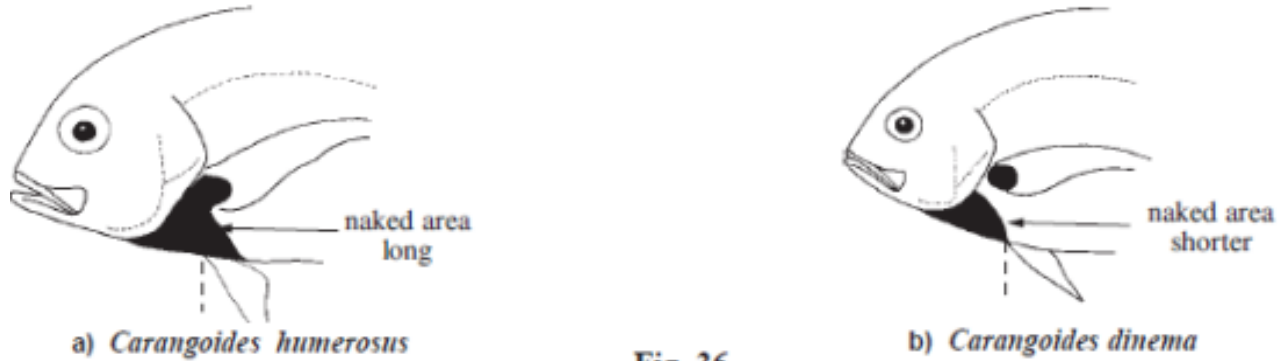


Fig. 36

- 13a. Soft dorsal-fin rays 25 to 32 (rarely 25) → 14
- 13b. Soft dorsal-fin rays 17 to 23 → 15

- 14a. Profile of snout angular and, in specimens larger than about 30 cm fork length, horizontal line from tip of snout distinctly below level of eye (Fig. 37a); soft anal-fin rays 21 to 26 (rarely 25 or 26); total gill rakers (including rudiments) on first gill arch 22 to 27, of which 6 to 8 on upper limb, and 17 to 21 on lower limb; vertebrae 10+14 *Carangoides fulvoguttatus*
- 14b. Profile of snout moderately rounded and, in specimens larger than about 30 cm fork length, horizontal line from tip of snout at or through level of eye (Fig. 37b), soft anal-fin rays 24 to 26 (usually 25); total gill rakers (including rudiments) on first gill arch 27 to 31, of which 7 to 9 on upper limb, and 19 to 22 on lower limb; vertebrae 10+15 *Carangoides gymnostethus*

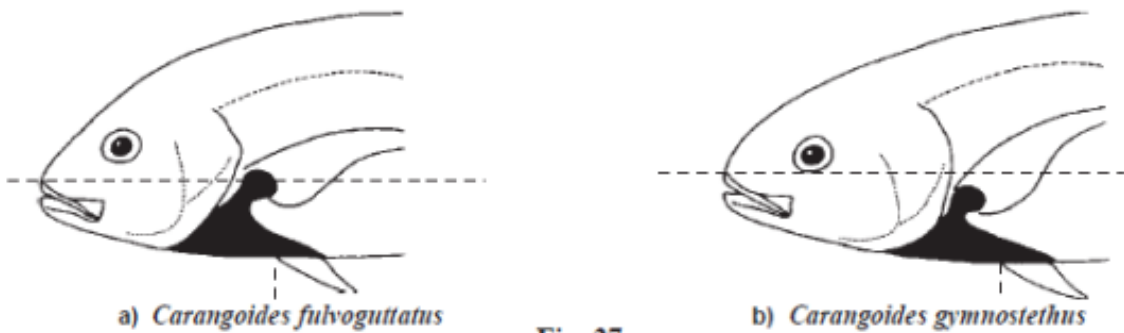


Fig. 37

- 15a. Small area naked of scales anteriorly just above pectoral-fin base (Fig. 38a) → 16
 15b. Area anteriorly just above pectoral-fin base completely scaly (Fig. 38b) → 17

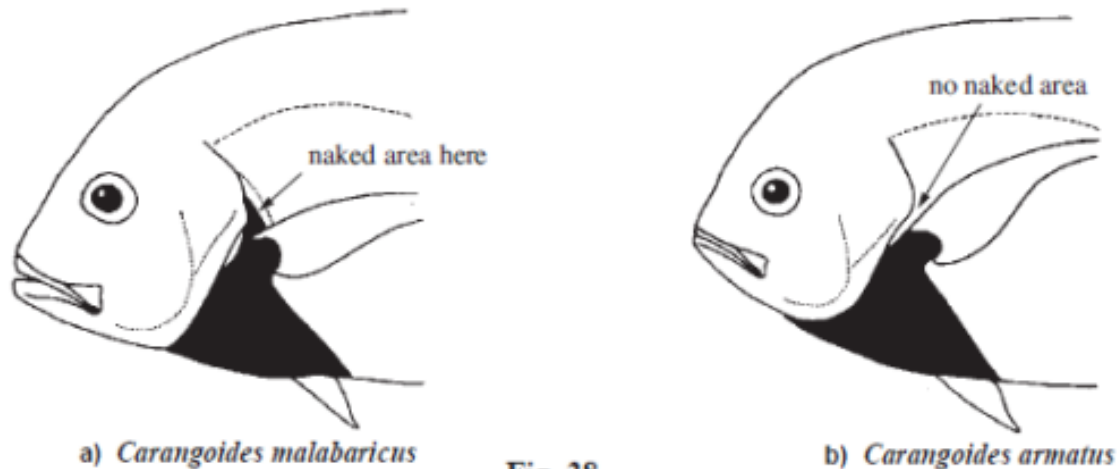


Fig. 38

- 16a. Total gill rakers (including rudiments) on first gill arch 32 to 38, of which 8 to 12 on upper limb, and 21 to 27 on lower limb; in life, tongue greyish brown to brown . . . *Carangoides malabaricus*
 16b. Total gill rakers (including rudiments) on first gill arch 27 to 31, of which 6 to 9 on upper limb, and 19 to 22 on lower limb; in life, tongue white to pale grey *Carangoides talamparoides*
- 17a. Small dark blotches (becoming larger posteriorly) on back between bases of dorsal-fin rays; naked area of breast typically does not extend posteroventrally beyond origin of pelvic fins (Fig. 36b); soft dorsal-fin rays 17 to 19 *Carangoides dinema*
 17b. Colour pattern not as above; naked area of breast extends posteroventrally well beyond origin of pelvic fins (Fig. 38b); soft dorsal-fin rays 18 to 23 → 18
- 18a. Total gill rakers (including rudiments) on first gill arch 31 to 37 *Carangoides armatus*
 18b. Total gill rakers (including rudiments) on first gill arch 20 to 27 → 19

- 19a. Adults with a steep dorsal head profile, and with a distinct break ("bump") in profile in the interorbital region (Fig. 39a); 3 to 8 (usually 5 to 7) of central soft rays of dorsal and anal fins elongated in mature males (about 17 cm fork length); eye diameter about equal to, or larger than snout length *Carangoides hedlandensis*
- 19b. Dorsal head profile not as steep in adults, and no distinct break ("bump") in profile in the interorbital region (Fig. 39b, c); central soft rays of dorsal and anal fins not elongated in mature males; eye diameter slightly to much smaller than snout length → 20
- 20a. Dorsal profile of snout gently sloped, then abruptly vertical just above mouth cleft (Fig. 39b); soft dorsal-fin rays 18 to 20; soft anal-fin rays 15 to 17 *Carangoides chrysophrys*
- 20b. Dorsal profile of snout not as above (Fig. 39c), soft dorsal-fin rays 20 to 23 (usually 22 or 23); soft anal-fin rays 16 to 20 (usually 18 or 19) *Carangoides caeruleopinnatus*

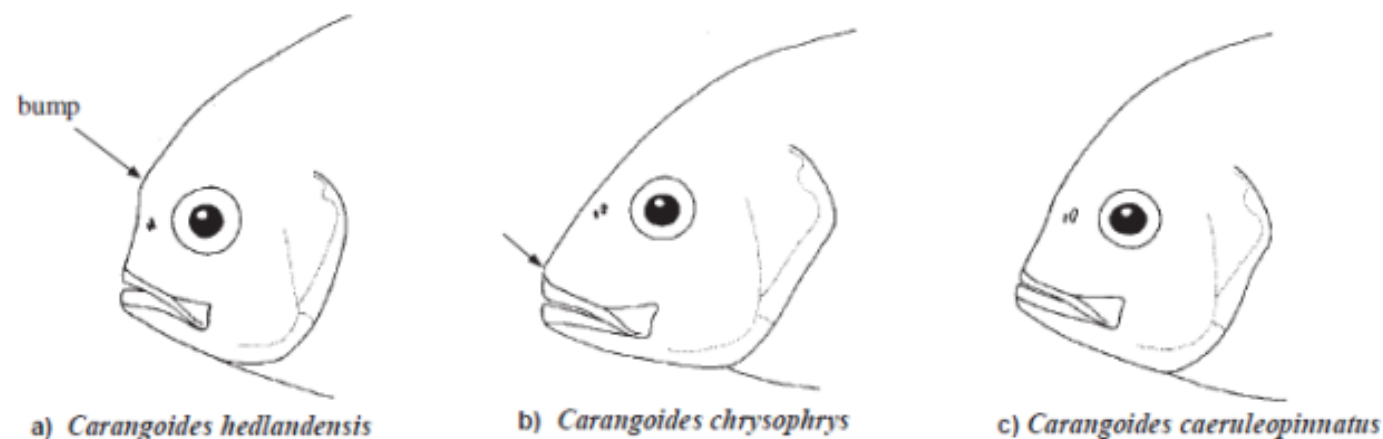


Fig. 39

Key to the species of *Caranx* occurring in the area

Note: species of *Caranx* that have variable patterns of breast squamation will key out under both sections of a couplet when this character is utilized.

- 1a. Breast completely scaly → 2
- 1b. Breast naked ventrally, frequently with small patch of prepelvic scales (Fig. 40) → 6

- 2a. In life, body coloration essentially uniform grey to brown; lobe of dorsal fin relatively long, contained 2.3 to 5.3 times in fork length; profile of head relatively steep and angular (Fig. 41) *Caranx lugubris*
- 2b. Body coloration not as above; lobe of dorsal fin contained 4.2 to 8.8 times in fork length; profile of head not noticeably steep and angular → 3

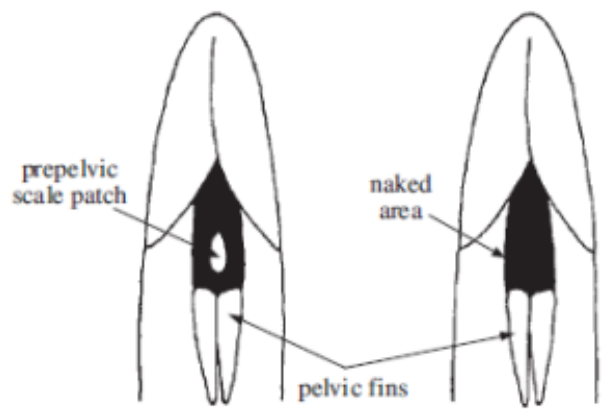


Fig. 40 ventral view



Fig. 41 *Caranx lugubris*

- 3a. Small black spots scattered on head and body (forming at about 16 to 22 cm fork length); snout length contained 9.2 to 12.7 times in fork length; total gill rakers (including rudiments) on first gill arch 25 to 29 (usually 26 or 27), and total soft dorsal- and anal-fin rays 39 to 44 *Caranx melampygyus*
- 3b. No small black spots scattered on head and body; snout length contained 13.1 to 18.4 times in fork length; total gill rakers (including rudiments) on first gill arch 22 to 25, except 24 to 27 in *C. heberi* which has 34 to 38 total soft dorsal- and anal-fin rays → 4

- 4a. No small black spot present on upper margin of opercle; upper lobe of caudal fin frequently with distal half noticeably dark or black, especially in juveniles; in adults, adipose eyelid only slightly developed (Fig. 42a) *Caranx heberi*
- 4b. A small, black spot present on upper margin of opercle; upper lobe of caudal fin usually uniformly pigmented; in adults, adipose eyelid well developed, especially posteriorly (Fig. 42b, c) → 5
- 5a. In adults, dorsal-fin lobe without white tip; dorsal profile of head strongly convex and a black spot on upper margin of opercle, in adults, at least 1/2 the diameter of pupil (Fig. 42b); in specimens larger than 15 cm fork length, postorbital head length longer, contained 5.7 to 7.3 times in fork length, and dorsal-fin lobe shorter, contained 5.7 to 8.8 times in fork length; vertebrae 10+14 *Caranx tille*
- 5b. In adults, dorsal-fin lobe with white tip; dorsal profile of head moderately convex and black spot on upper margin of opercle, its size in adults no larger than twice the diameter of pupil (Fig. 42c); in specimens larger than 15 cm fork length, postorbital head length shorter, contained 6.4 to 8.2 times in fork length, and dorsal-fin lobe longer, contained 5 to 6.6 times in fork length; vertebrae 10+15 *Caranx sexfasciatus*

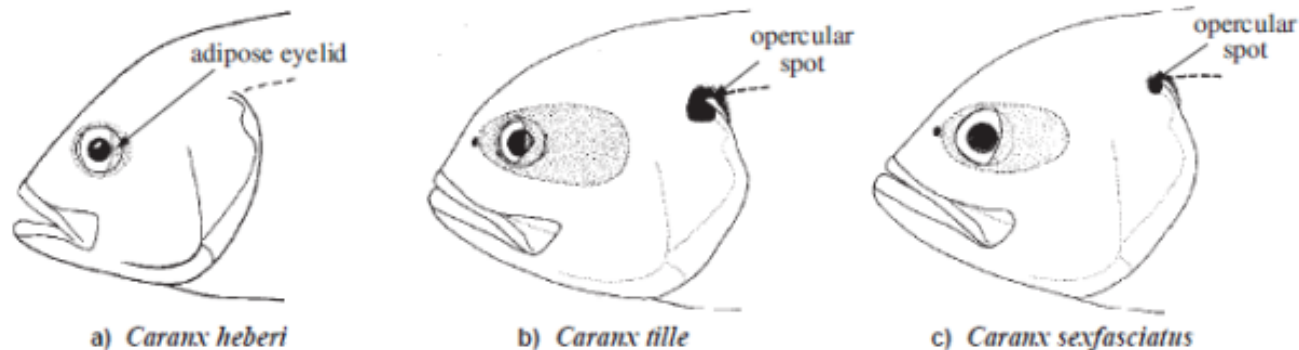


Fig. 42

- 6a. Naked area of breast uninterrupted to naked base of pectoral fins (Fig. 43); curved part of lateral line short, chord of curved part contained 2.5 to 3.3 times in straight part; scutes larger (Fig. 44a) *Caranx bucculentus*
- 6b. Naked area of breast separated from naked base of pectoral fins by a broad band of scales; curved part of lateral line moderate, with chord of curved part contained less than 1.5 times in straight part; scutes smaller (Fig. 44b) → 7

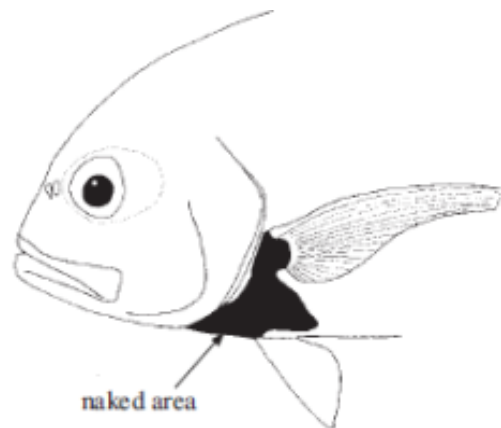


Fig. 43 *Caranx bucculentus*

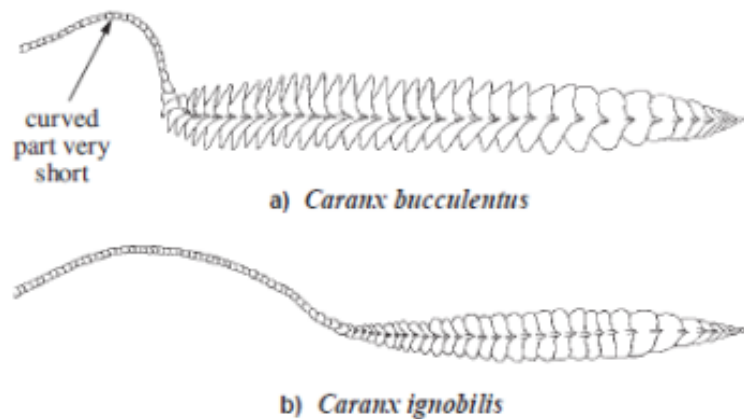


Fig. 44 lateral line

- 7a. Total gill rakers (including rudiments) 20 to 24 on first gill arch; general body colour silvery to black; in specimens larger than 15 cm fork length, body depth contained 2.5 to 3.2 times in fork length *Caranx ignobilis*
- 7b. Total gill rakers (including rudiments) 23 to 30 (rarely 23) on first gill arch; general body colour bronze to yellow-green; in specimens larger than 15 cm fork length, body depth contained 2.7 to 3.8 times in fork length → 8
- 8a. Total soft dorsal- and anal-fin rays 34 to 38 (rarely 38); upper lobe of caudal fin frequently with distal half noticeably dark or black (especially in juveniles), and posterior margin of lower lobe without a narrow white border; no pale spot on shoulder just behind posterodorsal margin of opercle; adults without small black spots *Caranx heberi*
- 8b. Total soft dorsal- and anal-fin rays 37 to 41 (rarely 37); upper lobe of caudal fin usually uniformly pigmented, and posterior margin of lower lobe with a narrow white border; in life a conspicuous pale spot, approximately the diameter of pupil, on shoulder just behind posterodorsal margin of opercle (Fig. 45); adults with small black spots on body above lateral line (forming at about 25 cm fork length). *Caranx papuensis*

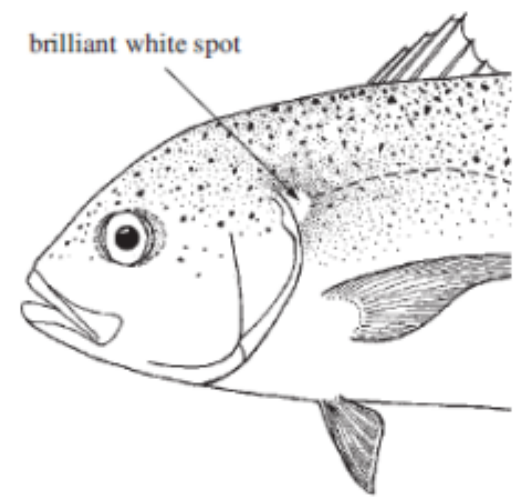


Fig. 45 *Caranx papuensis*

Key to the species of *Decapterus* occurring in the area

- 1a. Posterior end of upper jaw concave above, rounded and produced below (Fig. 46a); straight part of lateral line with 14 to 29 scales (Fig. 47a) *Decapterus macrosoma*
- 1b. Posterior end of upper jaw straight above, straight to slightly concave below (Fig. 46b-e); straight part of lateral line with 0 to 15 scales (except 18 to 39 scales in *D. macarellus*) → 2

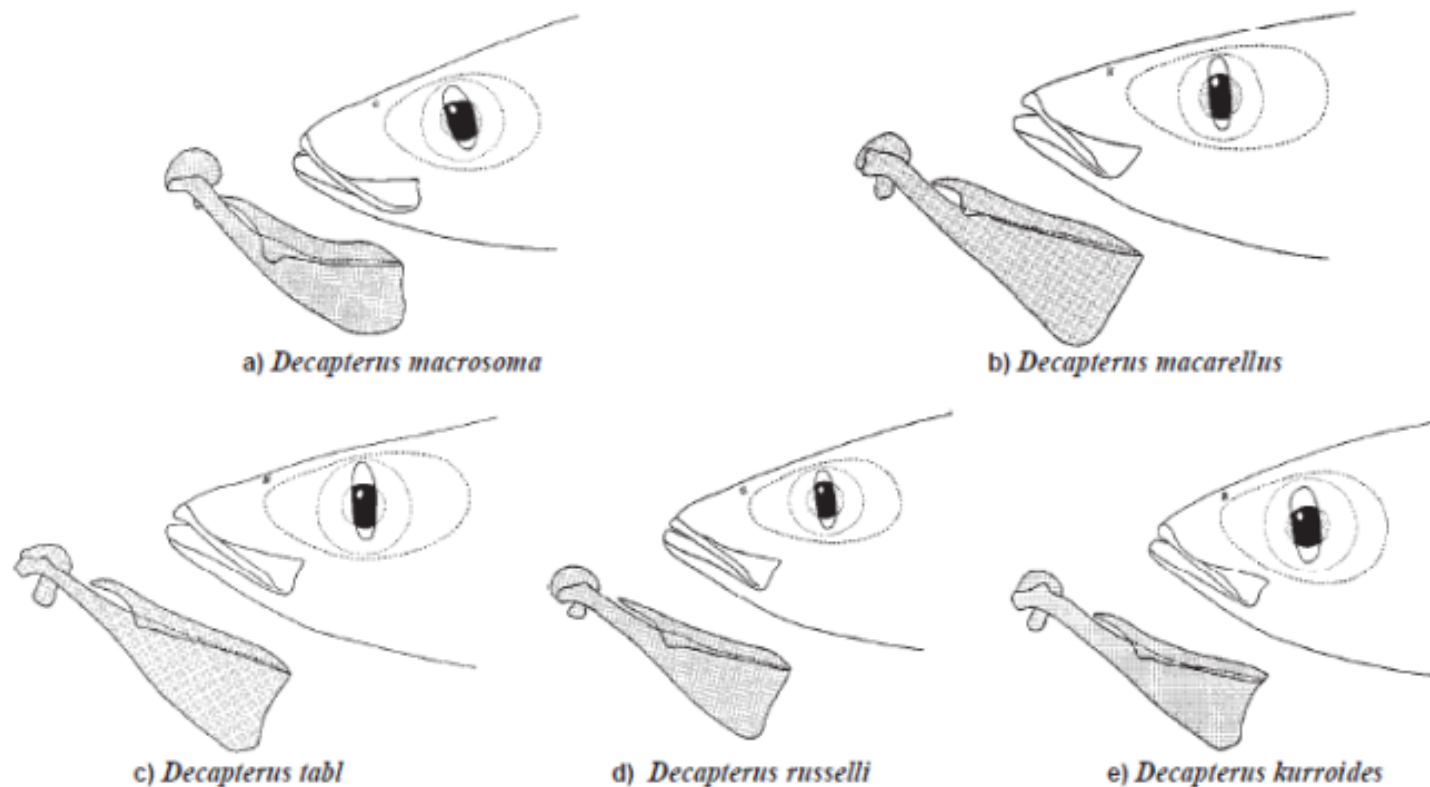


Fig. 46

- 2a. Posterior end of upper jaw noticeably slanted anteroventrally (Fig. 46b); straight part of lateral line with 18 to 39 scales and 24 to 40 scutes = 52 to 67 total (Fig. 47b); pectoral fins usually shorter in adults, 58 to 72% head length; oral valve (membrane) at symphysis of upper jaw conspicuously white (Fig. 48) *Decapterus macarellus*
- 2b. Posterior end of upper jaw not as noticeably slanted anteroventrally (Fig. 46c-e); straight part of lateral line with 0 to 10 scales and 30 to 40 scutes = 30 to 49 total (except 5 to 15 scales and 32 to 42 scutes = 41 to 50 total in *D. muroadsi*; Fig. 47c); pectoral fins usually longer in adults, 71 to 105% head length (except 62 to 83% in *D. tabl*); oral valve (membrane) at symphysis of upper jaw dusky or transparent (except white in *D. muroadsi*) → 3

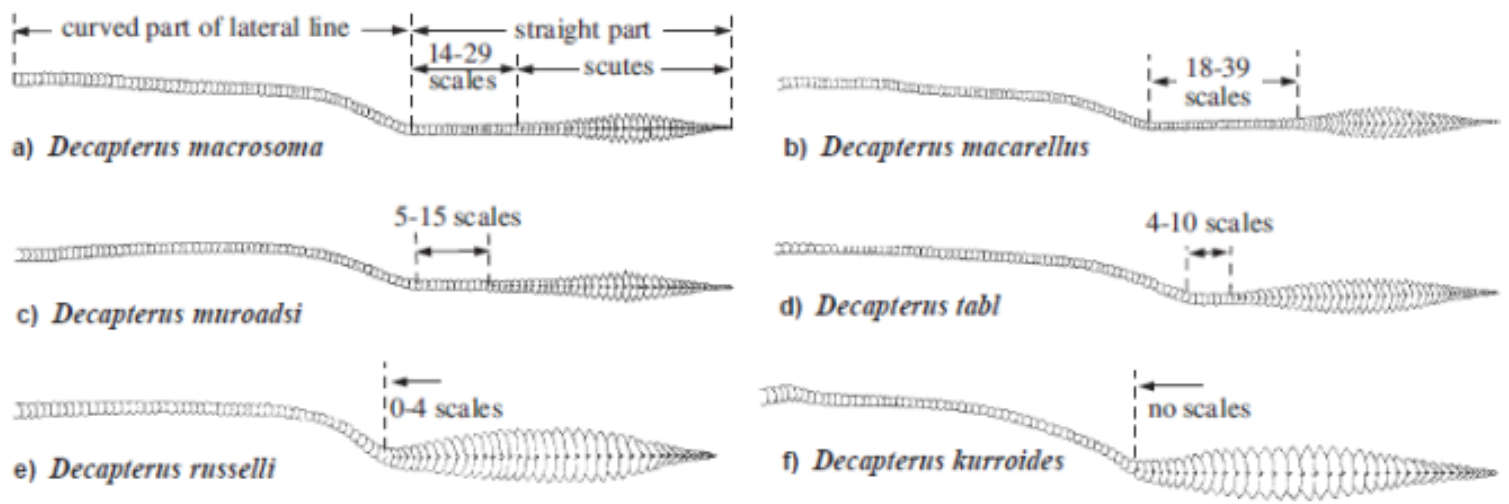


Fig. 47 lateral line

3a. In life, caudal fin with upper lobe greenish yellow and lower lobe grey; oral valve (membrane) at symphysis of upper jaw conspicuously white in adults (Fig. 48); gill rakers on lower limb of first gill arch 36 to 42 *Decapterus muroadsi*

3b. In life, caudal fin with upper and lower lobes both hyaline, brownish or red; oral valve (membrane) at symphysis of upper jaw transparent or dusky; gill rakers on lower limb of first gill arch 26 to 33 (except 30 to 39 in *D. russelli*). → 4

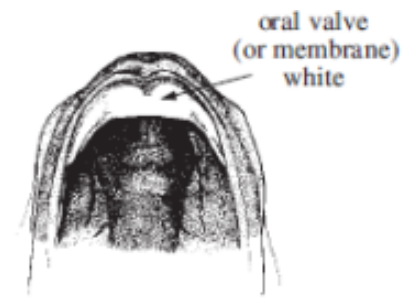


Fig. 48 ventral view of upper jaw and roof of mouth

4a. Scutes relatively small (Fig. 47d); curved part of lateral line with 61 to 73 scales; straight part of lateral line with 4 to 12 anterior scales; total lateral-line scales and scutes (excluding scales on caudal fin) 103 to 118; in life, caudal fin red; posterodorsal margin of opercular membrane minutely serrated in large adults (Fig. 49) *Decapterus tabl*

4b. Scutes relatively large (Fig. 47e, f); curved part of lateral line with 42 to 62 scales; straight part of lateral line with 0 to 4 anterior scales; total lateral-line scales and scutes (excluding scales on caudal fin) 77 to 102; in life, caudal fin dusky or red; posterodorsal margin of opercular membrane smooth in adults. → 5

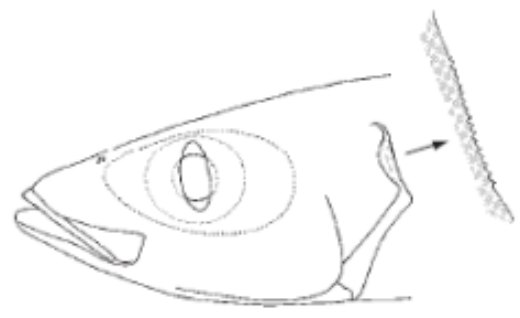


Fig. 49 *Decapterus tabl*

5a. In life, caudal fin hyaline to dusky; gill rakers on lower limb of first gill arch usually 32 to 39; soft anal-fin rays (including finlet) 25 to 29 (rarely 25); eye usually smaller . . . *Decapterus russelli*

5b. In life, caudal fin red; gill rakers on lower limb of first gill arch usually 26 to 32; soft anal-fin rays (including finlet) 22 to 26 (rarely 26); eye usually larger *Decapterus kurroides*

Key to the species of *Scomberoides* occurring in the area

- 1a. Total gill rakers 8 to 15 on first gill arch; scales on midbody below lateral line broadly oblong or bluntly lanceolate (Fig. 51a, b); lobe of dorsal fin uniformly pigmented (Figs 52 and 53) → 2
- 1b. Total gill rakers 21 to 27 on first gill arch; scales on midbody below lateral line sharply lanceolate or needle-like (Fig. 51c, d); distal half of dorsal-fin lobe abruptly and heavily pigmented (Figs 55 and 56) → 3

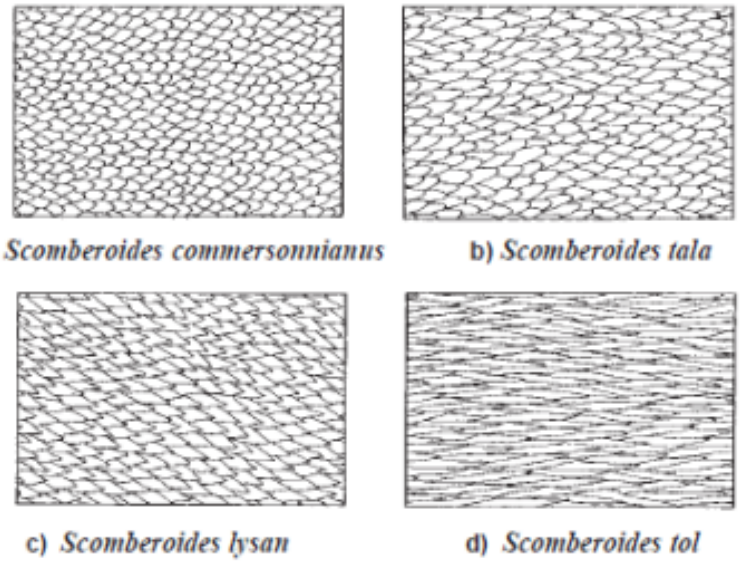


Fig. 51 scales on midbody below lateral line

- 2a. Upper jaw extends well beyond posterior margin of eye, especially in adults (Fig. 52); in adults, teeth of inner and outer rows in lower jaw subequal in size (Fig. 54a); in life, large oval blotches above or touching lateral line . . . *Scomberoides commersonianus*
- 2b. Upper jaw extends slightly beyond posterior margin of eye (Fig. 53); in adults, inner row of teeth in lower jaw distinctly larger than those in outer row (Fig. 54b); in life, vertically elongate blotches intersecting lateral line *Scomberoides tala*

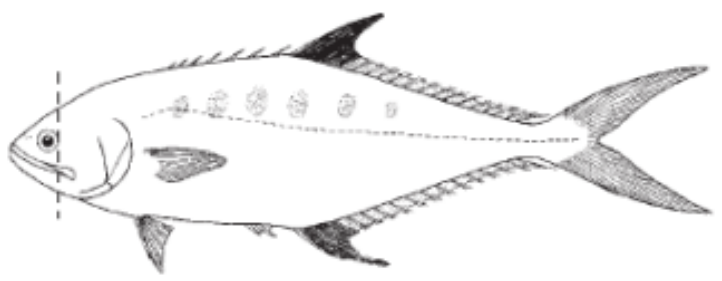


Fig. 52 *Scomberoides commersonianus*

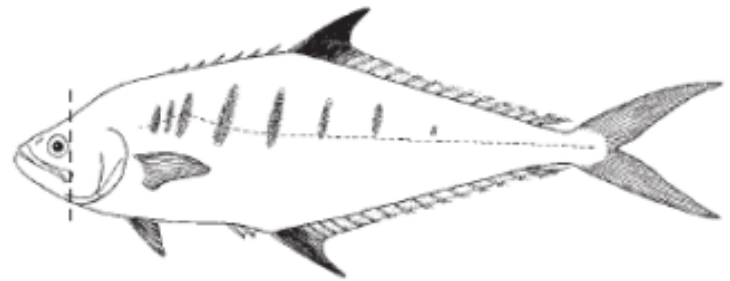


Fig. 53 *Scomberoides tala*

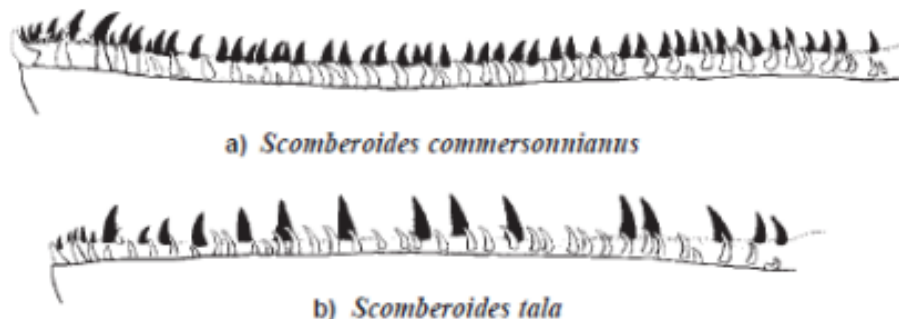


Fig. 54 teeth in lower jaw (teeth in inner row black)

- 3a. Scales on midbody below lateral line sharply lanceolate (Fig. 51c); in adults, upper jaw extends to or slightly beyond posterior margin of eye (Fig. 55); in life, a double series of 6 to 8 dusky, roundish blotches above and below lateral line, occasionally connected by narrow isthmus *Scomberoides lysan*
- 3b. Scales on midbody below lateral line slender, needle-like (Fig. 51d); in adults, upper jaw does not extend to posterior margin of eye (Fig. 56); in life, oval or vertically oblong dark blotches, the first 4 or 5 intersecting lateral line *Scomberoides tol*

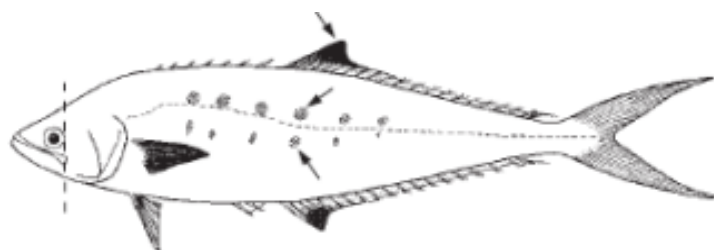


Fig. 55 *Scomberoides lysan*

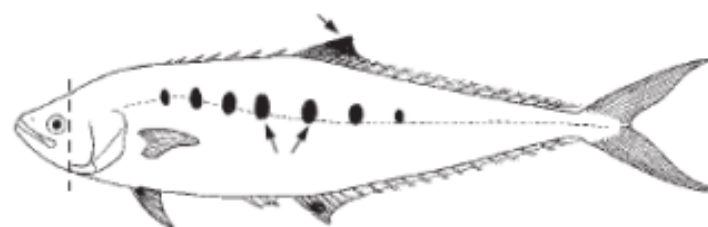


Fig. 56 *Scomberoides tol*

Key to the species of *Selar* occurring in the area

- 1a. Curved part of lateral line with 48 to 56 scales; curved part of lateral line moderate, with chord of curved part contained 0.7 to 1.2 times in straight part; scutes smaller (Fig. 57a) *Selar crumenophthalmus*
- 1b. Curved part of lateral line with 21 to 24 scales; curved part of lateral line short, chord of curved part contained 2.1 to 3 times in straight part; scutes larger (Fig. 57b) *Selar boops*

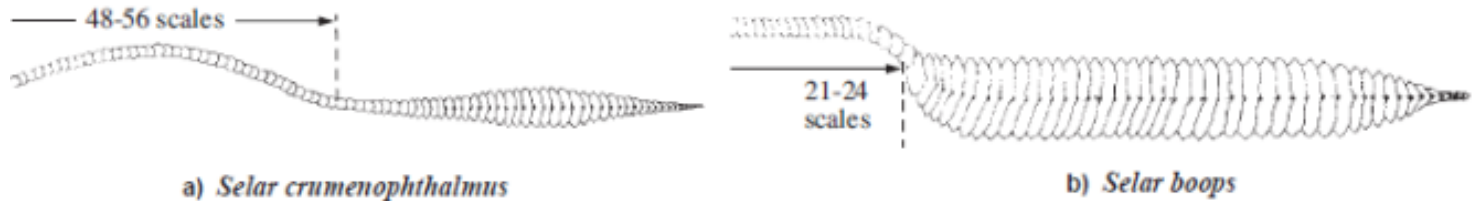


Fig. 57 lateral line

Key to the species of *Seriola* occurring in the area

1/2

- 1a. Soft dorsal- and anal-fin rays 22 to 25 and 15 to 17 (rarely 17), respectively; in specimens larger than about 20 cm fork length, total gill rakers (excluding rudiments) on first gill arch 10 to 12; in life, papillae surrounding broad band of teeth in both jaws engorged with blood giving teeth a red appearance *Seriola hippos*
- 1b. Soft dorsal- and anal-fin rays 27 to 35 and 18 to 22, respectively; in specimens larger than about 20 cm fork length, total gill rakers (excluding rudiments) on first gill arch 11 to 29; in life, papillae surrounding broad band of teeth in both jaws not engorged with blood, appearance of teeth white → 2
- 2a. Upper jaw moderately slender posteriorly, with slender supramaxilla (Fig. 58a); caudal fin yellowish; in adults, a moderate cutaneous keel laterally on caudal peduncle; vertebrae 11+14 *Seriola lalandi*
- 2b. Upper jaw relatively broad posteriorly, with broad supramaxilla (Fig. 58b-d); caudal fin dark to dusky sometimes with a lighter posterior margin; in adults, cutaneous keel on caudal peduncle absent to slightly developed; vertebrae 10+14 → 3

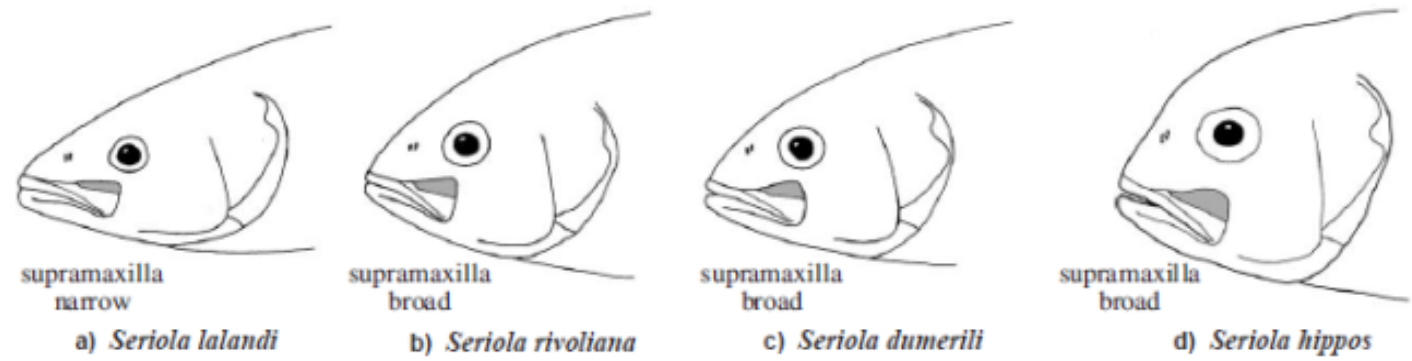


Fig. 58 lateral view of head (supramaxilla shaded)

- 3a. In adults, length of dorsal-fin lobe about 1.3 to 1.6 times longer than pectoral fins (Fig. 59a) and 18 to 22% of fork length; in specimens larger than about 20 cm fork length, total gill rakers (excluding rudiments) 22 to 26 on first gill arch; first pterygiophore of anal fin straight in specimens larger than about 10 cm fork length (Fig. 60a) *Seriola rivoliana*
- 3b. In adults, length of dorsal-fin lobe about equal to, or slightly longer than pectoral fins (Fig. 59b) and 13 to 18% of fork length; in specimens larger than about 20 cm fork length, total gill rakers (excluding rudiments) 11 to 19 on first gill arch; first pterygiophore of anal fin moderately curved (Fig. 60b) *Seriola dumerili*

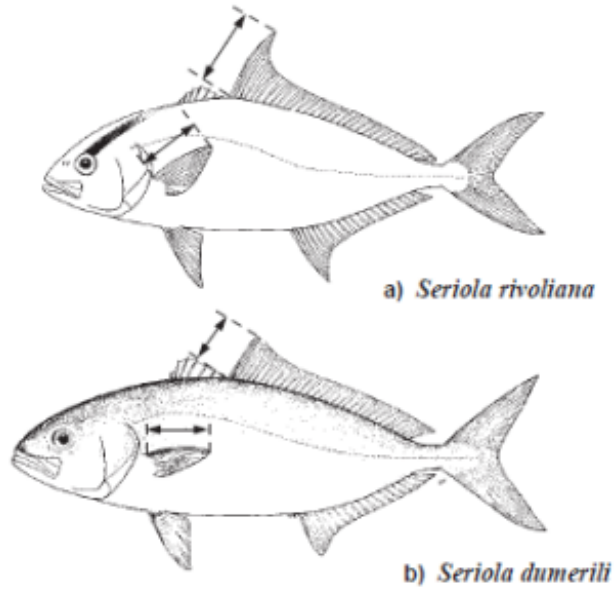


Fig. 59

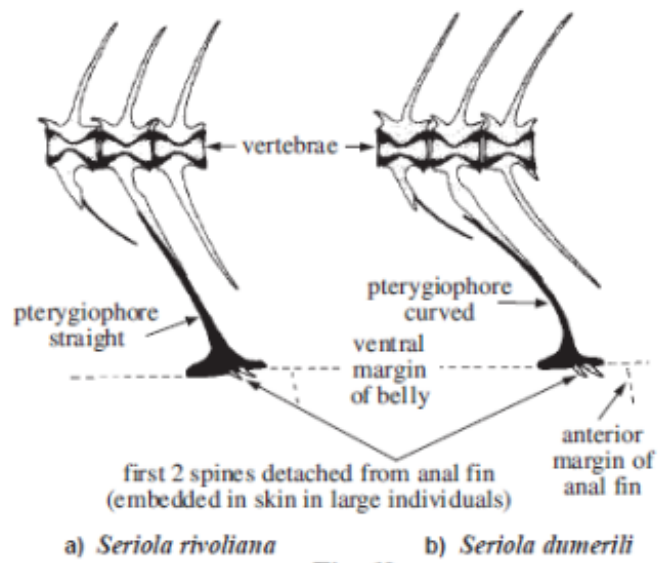


Fig. 60

Key to the species of *Trachinotus* occurring in the area

- 1a. One to 7 spots in a longitudinal row on or near lateral line (spots absent on specimens smaller than about 10 to 13 cm fork length); soft dorsal-fin rays 21 to 25 → 2
- 1b. No spots in a longitudinal row on or near lateral line; soft dorsal-fin rays 18 to 20 (except 21 to 23 in *T. africanus*) → 4

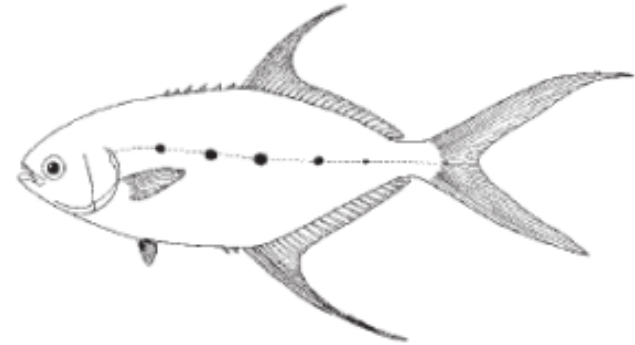


Fig. 61 *Trachinotus baillonii*

- 2a. In adults, all spots equal to, or smaller than eye diameter, and with about half of spot below lateral line (Fig. 61); gill rakers (including rudiments) on lower limb of first gill arch 15 to 19; vomerine and palatine tooth patches typically type "A" (Fig. 62a) *Trachinotus baillonii*
- 2b. In adults, anterior 2 spots larger than eye diameter and at least two-thirds of spot above lateral line (Figs 63 and 64); gill rakers (including rudiments) on lower limb of first gill arch 11 to 15; vomerine and palatine tooth patches usually type "B" or "C" (Fig. 62b, c) → 3

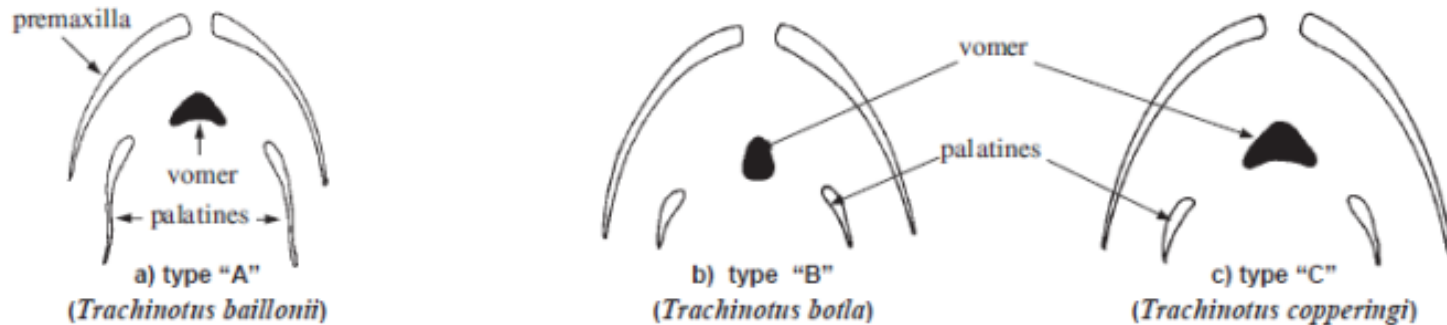


Fig. 62 tooth patches on roof of mouth and upper jaw

- 3a. Soft anal-fin rays 19 to 21; in adults only 1 dark spot above pectoral fins, and in large specimens spots oval-shaped (Fig. 63); dorsal-fin lobe usually longer than anal-fin lobe in specimens larger than about 25 cm fork length; pelvic fins long, their length contained 1.5 to 1.7 times in pectoral-fin length in specimens larger than about 25 cm fork length; vomerine tooth patch usually type "B" (Fig. 62b) *Trachinotus bolta*
- 3b. Soft anal-fin rays 22 to 24; in adults 2 dark spots above pectoral fins, and in large specimens spots more vertically elongate (Fig. 64); dorsal-fin lobe consistently shorter than anal-fin lobe in specimens larger than about 25 cm fork length; pelvic fins relatively short, their length contained 1.7 to 2.2 times in pectoral-fin length in specimens larger than about 25 cm fork length; vomerine tooth patch usually type "C" (Fig. 62c)
 *Trachinotus copperingi*

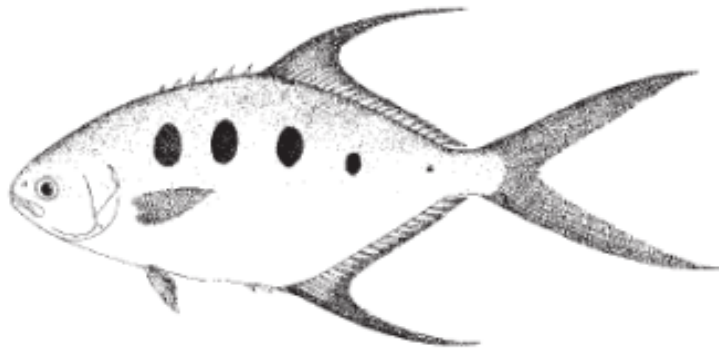


Fig. 63 *Trachinotus bolta*

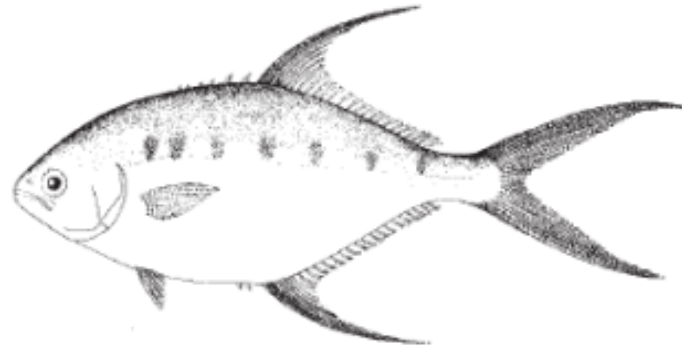


Fig. 64 *Trachinotus copperingi*

- 4a. Soft dorsal- and anal-fin rays 21 to 23 and 19 to 21, respectively; body often with a black oval-shaped blotch in axillary base under pectoral fins *Trachinotus africanus*
- 4b. Soft dorsal- and anal-fin rays 18 to 20 and 16 to 18, respectively; body uniformly pigmented in axillary base under pectoral fins. → 5
- 5a. First predorsal bone inverted teardrop- or oval-shaped (Fig. 65a, this character is easily observed by simple dissection along midline of nape); height of dorsal-fin lobe longer, 35 to 60% of fork length in specimens 10 to 40 cm fork length *Trachinotus blochii*
- 5b. First predorsal bone shaped like an inverted "L" with the arm projecting anteriorly (Fig. 65b, c); anal-fin lobe yellow without a brownish anterior margin; height of dorsal-fin lobe moderate, 24 to 37% of fork length in specimens 10 to 40 cm fork length → 6

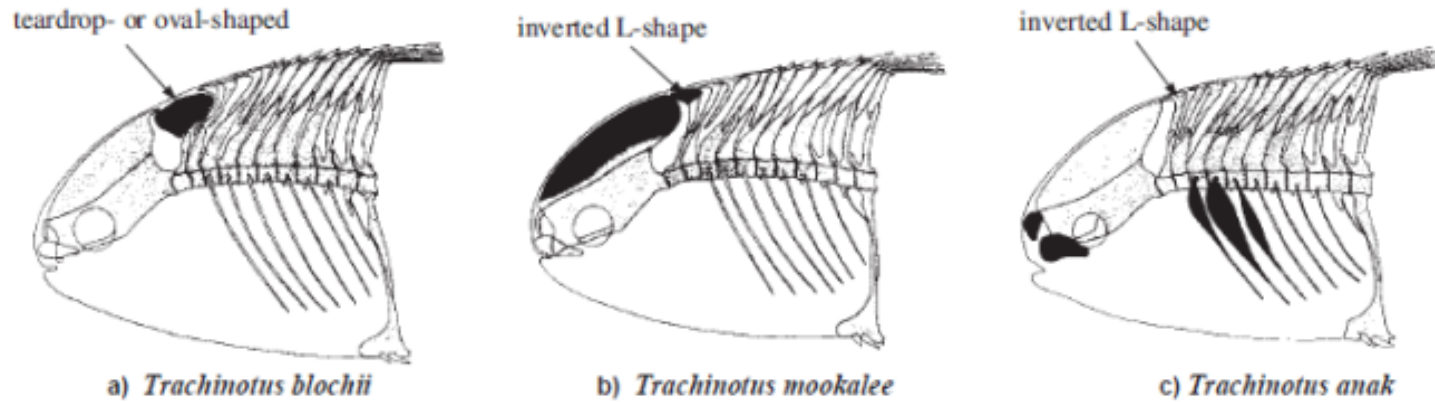


Fig. 65 anterior part of skeleton in lateral view
(hyperossified bones shown in black)

- 6a.** Teeth in a narrow band on tongue, persisting to about 50 cm fork length; supraoccipital bone of skull becoming broad and sausage-shaped (Fig. 66a) in specimens larger than about 30 cm fork length; profile of snout evenly rounded in specimens larger than about 20 cm fork length; preorbital and nasal bones never exhibiting hyperostosis *Trachinotus mookalee*
- 6b.** No teeth on tongue; supraoccipital bone of skull thin and blade-like in adults (Fig. 66b); profile of snout essentially straight immediately above upper lip in specimens larger than about 20 cm fork length; preorbital and nasal bones hyperossified in specimens larger than about 30 cm fork length (Fig. 65c) *Trachinotus anak*

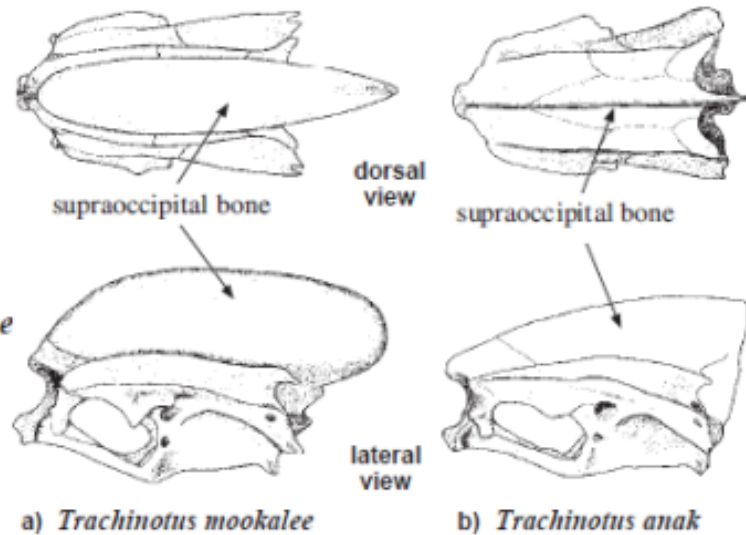


Fig. 66 skull

Note: the skull of *Trachinotus africanus* is used here for *T. anak*; the supraoccipital bone shape is nearly identical in both species

Key to the species of *Ulua* occurring in the area

- 1a. Total gill rakers on first gill arch 54 to 61, of which 16 to 21 on upper limb, and 37 to 41 on lower limb; tongue with central band of villiform teeth; in specimens smaller than about 15 cm fork length, first anal-fin ray produced but not filamentous, not extending beyond caudal peduncle *Ulua aurochs*
- 1b. Total gill rakers on first gill arch 74 to 86, of which 23 to 27 on upper limb, and 51 to 61 on lower limb; tongue without central band of villiform teeth; in specimens smaller than about 15 cm fork length, first anal-fin ray filamentous, extending beyond caudal peduncle *Ulua mentalis*

Key to the species of *Uraspis* occurring in the area

- 1a. Naked area of breast extends uninterrupted to naked base of pectoral fins (Fig. 69a); scales in curved part of lateral line 61 to 82 *Uraspis uraspis*
- 1b. Naked area of breast separated from naked base of pectoral fins by a broad band of scales (Fig. 69b); scales in curved part of lateral line 48 to 66 *Uraspis helvola* and *U. secunda*
(no verified records from the area; adults of these 2 species are virtually impossible to distinguish)

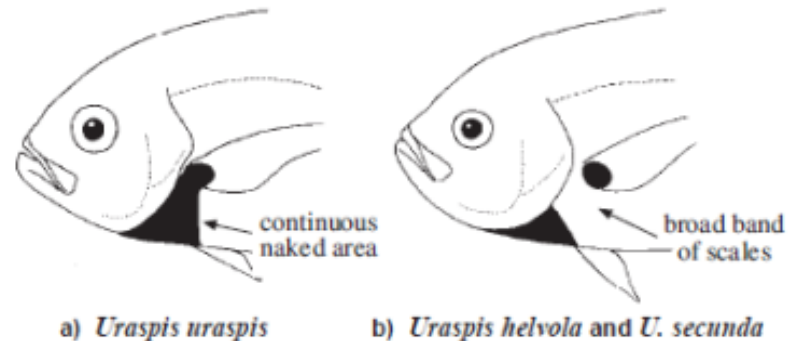


Fig. 69



Main References (Larvae) 1/2

- Laroche, W. A., W. F. Smith-Vaniz and S. L. Richardson (1984). Carangidae: Development. Pages 510-522. In H. G. Moser, W. J. Richards, D. M. Cohen, M. P. Fahay, A. W. Kendall, Jr., S. L. Richardson (eds.). Ontogeny and systematics of fishes. American Society of ichthyologists and Herpetologists. Spec. Publ. 1.
- Chayakul, R. (1996). The fish larvae in the Gulf of Thailand. Department of Fisheries (Thailand). 217pp.
- Watson, W., S. R. Charter, H. G. Moser, D. A. Ambrose, and E. M. Sandknop (1996). Carangidae: jacks. Pages 914-953. In H. G. Moser (ed.). The early stages of fishes in the California Current region. California Cooperative Oceanic Fisheries Investigations Atlas 33.



Main References

(Larvae) 2/2

- Leis, J. M. and T. Trnski (2000). Carangidae (jacks, pompanos, trevallys). Pages 499- 517. *In* J. M. Leis and B. M. Carson-Ewart (eds.). The larvae of Indo-Pacific coastal fishes. An identification guide to marine fish larvae. Brill, Leiden.
- Laroche, W. A., J. G. Ditty, J. T. Lamkin and S. R. Whitcraft. (2006). Carangidae: jacks. Pages 1439-1509. *In* W. J. Richards (ed.) Early stages of Atlantic fishes. An identification guide for the Western Central North Atlantic. CRC, Boca Raton.
- Hiraga, H., I. Kinoshita and J. Kojima (2014). Carangidae. Pages 773-803. *In* M. Okiyama (ed.). An atlas of early stage fishes in Japan. Tokai Univ. Press, Hadano.

Larval information of the carangid species distributing in the Southeast Asian region (1/2)

Tribe	Genera	Species 1*	Species 2**	Remarks
Carangini	<i>Alectis</i>	2	2	
Carangini	<i>Alepes</i>	4	(1)	as <i>Alepes</i> sp.
Carangini	<i>Atropus</i>	1	0	
Carangini	<i>Atule</i>	1	1	
Carangini	<i>Carangoides</i>	15	(2 ≅)	as <i>Carangoides</i> spp.
Carangini	<i>Caranx</i>	8	1	
Carangini	<i>Decapterus</i>	6	2	
Carangini	<i>Gnathanodon</i>	1	1	
Carangini	<i>Megalaspis</i>	1	0	
Carangini	<i>Parastromateus</i>	1	1	

*Species 1: consisting species of each genus.

**Species 2: number of species of which larvae are known. Numerals in parentheses are not included in a total.

Larval information of the carangid species distributing in the Southeast Asian region (2/2)

Tribe	Genera	Species 1	Species 2	Remarks
Carangini	<i>Selar</i>	2	1	
Carangini	<i>Selaroides</i>	1	1	
Carangini	<i>Ulua</i>	1	(1)	as <i>Ulua</i> sp.
Carangini	<i>Uraspis</i>	1	(1)	as <i>Uraspis secunda</i>
Naucratini	<i>Elagatis</i>	1	1	
Naucratini	<i>Naucrates</i>	1	1	
Naucratini	<i>Seriola</i>	2	2	
Naucratini	<i>Seriolina</i>	1	1	
Scomberoidini	<i>Scomberoides</i>	4	2	
Trachinotini	<i>Trachinotus</i>	5	2	

4 Tribes

20 Genera

50 species [18 Genera]

[19 species]

Total numbers of genera and species with larval information are in “[].”

Three groups of the carangid larvae in the Southeast Asian region

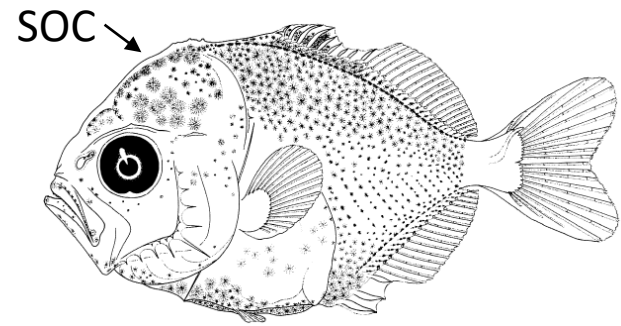
Group **1**: supraoccipital crest (SOC) present; body shape deep.

Group **2**: supraoccipital crest (SOC) present; body shape moderate.

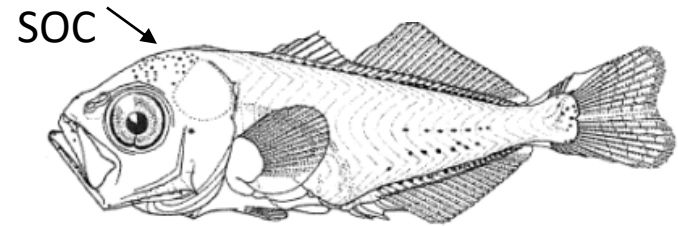
Group **3**: supraoccipital crest (SOC) absent; body shape deep.

Group **4**: supraoccipital crest (SOC) absent; body shape moderate.

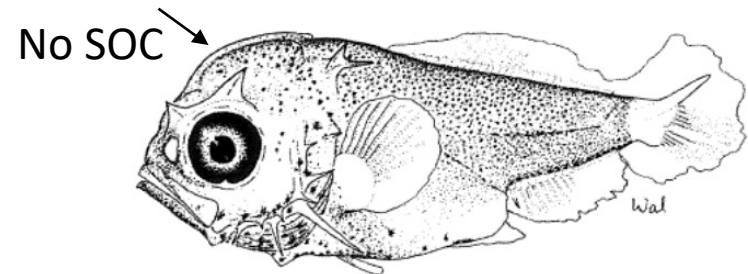
* SOC is reduced mostly at postflexion stage.



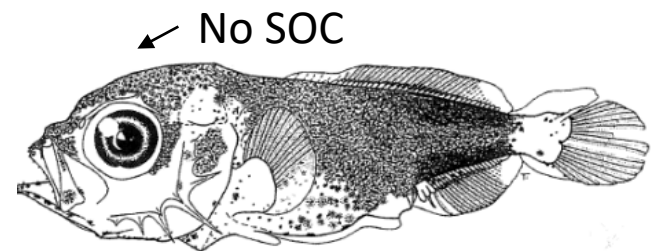
Caranx sexfasciatus 5.5 mm SL (Watson et. al., 1996)



Selar crumenophthalmus 8.1 mm SL (Watson et. al., 1996)



Naucratis ductor 4.7 mm SL (Laroche et al., 2006)



Seriola rivoliana 6.5 mm SL (Laroche et. al., 1996)

Genera and species with larval information available among carangid fishes in the Southeast Asian region – **Group 1**

Characters	Tribe	Genus	Species
Group 1: Supraoccipital crest (SOC) present; body shape deep	Carangini	<i>Alectis</i>	<i>A. ciliaris</i>
			<i>A. indica</i>
		<i>Carangoides</i>	<i>Carangoides</i> spp.
		<i>Caranx</i>	<i>C. sexfasciatus</i>
		<i>Gnathanodon</i>	<i>G. speciosus</i>
		<i>Parastromateus</i>	<i>P. niger</i>
		<i>Ulua</i>	<i>Ulua</i> sp.

Genera and species with larval information available among carangid fishes in the Southeast Asian region – **Group 2**

Characters	Tribe	Genus	Species
Group 2: Supraoccipital crest (SOC) present; body shape moderate	Carangini	<i>Alepes</i>	<i>Alepes</i> sp.
		<i>Decapterus</i>	<i>D. macarellus</i>
			<i>D. macrosoma</i>
		<i>Selar</i>	<i>S. crumenophthalmus</i>
		<i>Selaroides</i>	<i>S. leptolepis</i>
	Naucratiini	<i>Elagatis</i>	<i>E. bipinnulata</i>
	Scomberoidini	<i>Scomberoides</i>	<i>S. lysan</i>
			<i>S. tol</i>

Genera and species with larval information available among carangid fishes in the Southeast Asian region – **Group 3**

Characters	Tribe	Genus	Species
Group 3: Supraoccipital crest (SOC) absent; body shape deep	Carangini	<i>Uraspis</i>	<i>U. secunda</i> *
	Naucratiini	<i>Naucratus</i>	<i>N. ductor</i>
	Trachinotini	<i>Trachinotus</i>	<i>T. baillonii</i>
			<i>T. blochii</i>

- Presence of supraoccipital crest in carangini *Uraspis larvae* is obscure.
- Larvae of carangini *Atrops atrops* are unknown.
- * Taiwan and Australia species (*U. uraspis* in the Southeast Asia region)

Genera and species with larval information available among carangid fishes in the Southeast Asian region – **Group 4**

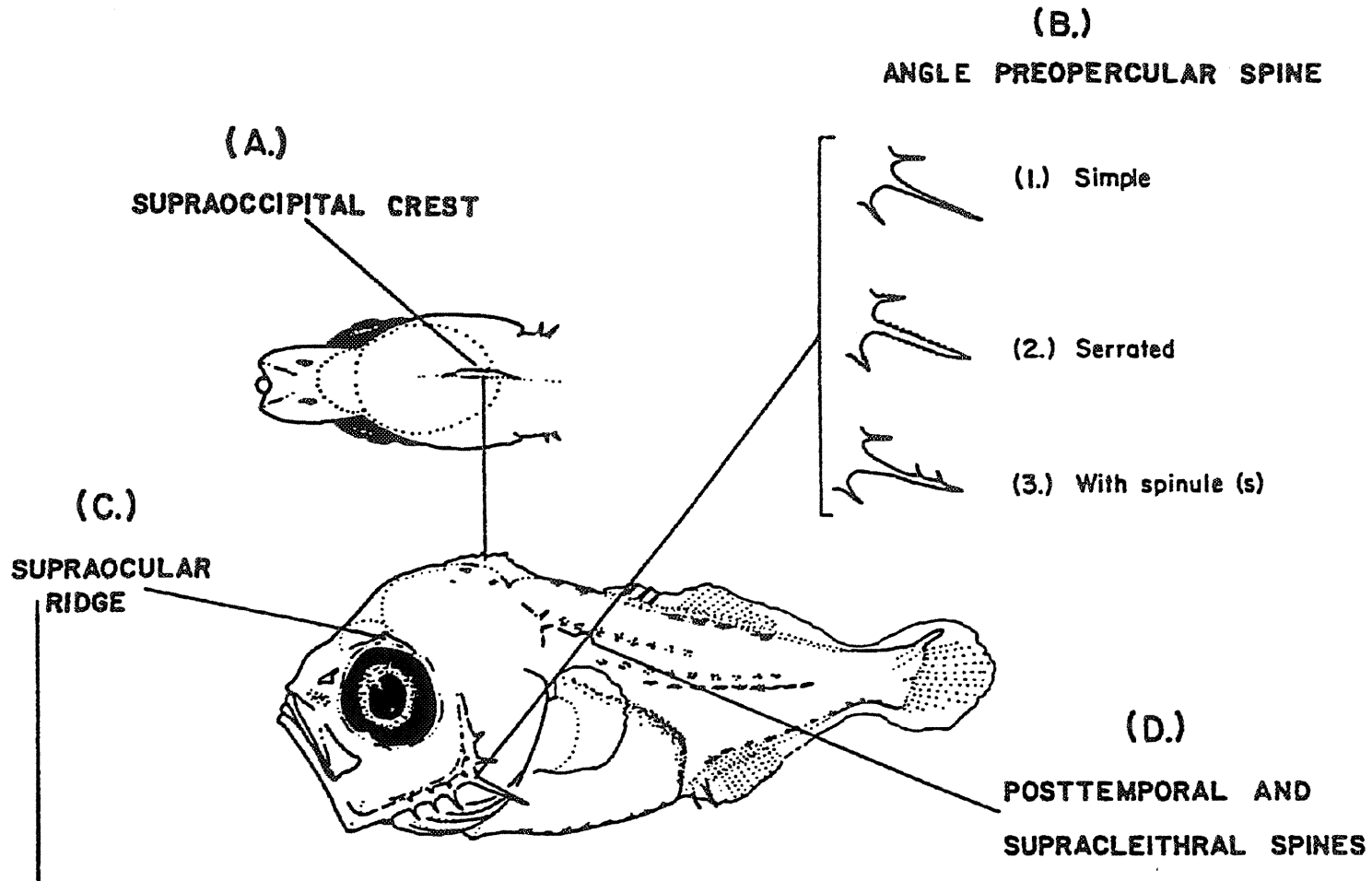
Characters	Tribe	Genus	Species
Group 4: Supraoccipital crest (SOC) absent; body shape moderate	Carangini	<i>Atule</i>	<i>A. mate</i>
	Naucratini	<i>Seriola</i>	<i>S. dumerili</i>
			<i>S. rivoliana</i>
		<i>Seriolina</i>	<i>S. nigrofasciata</i>

- Larvae of carangini *Megalaspis cordyla* are unknown.

Some characters used to identify carangid larvae

Laroche et al. (1996)

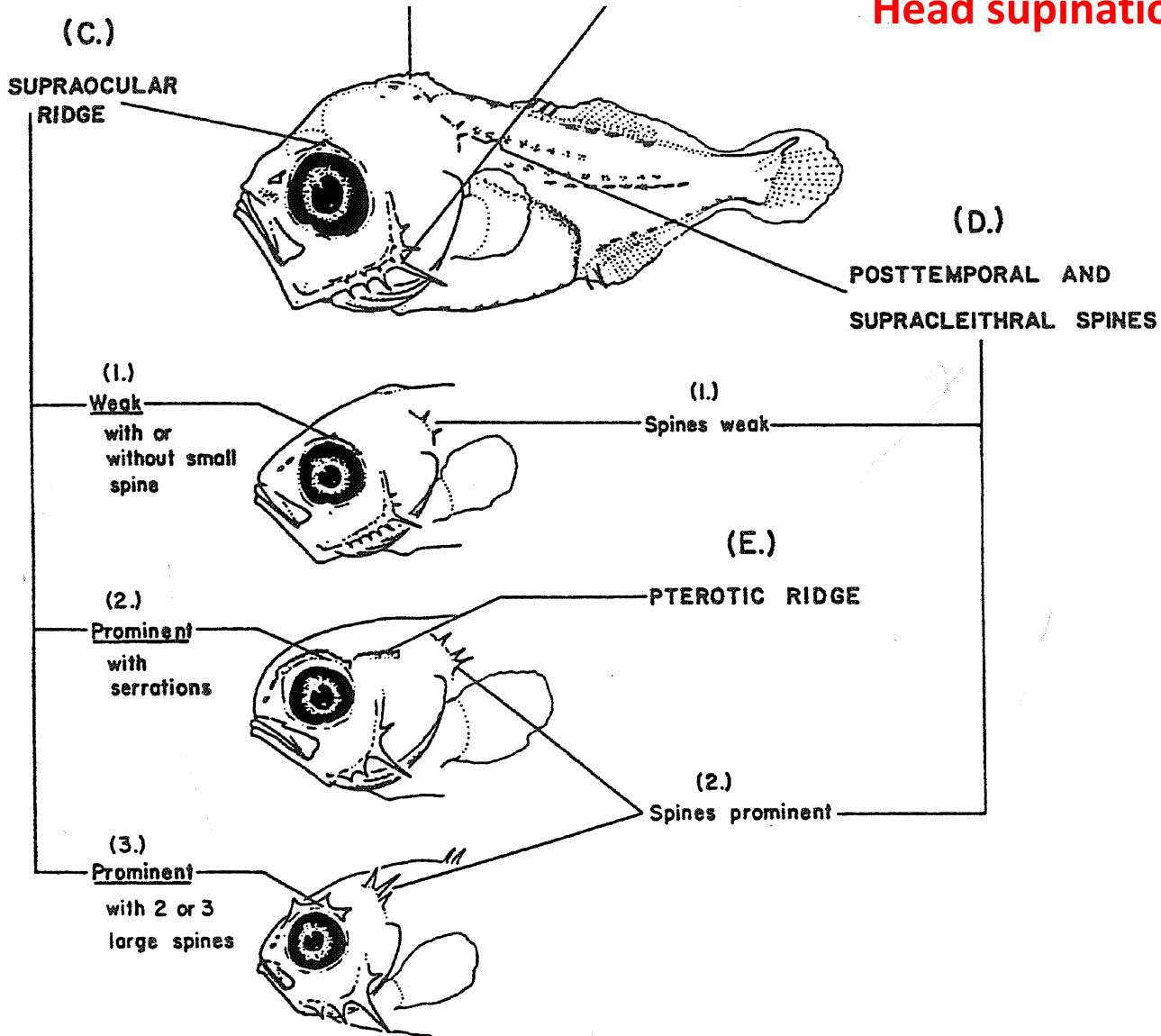
Head supination – 1/2



Some characters used to identify carangid larvae

Laroche et al. (1996)

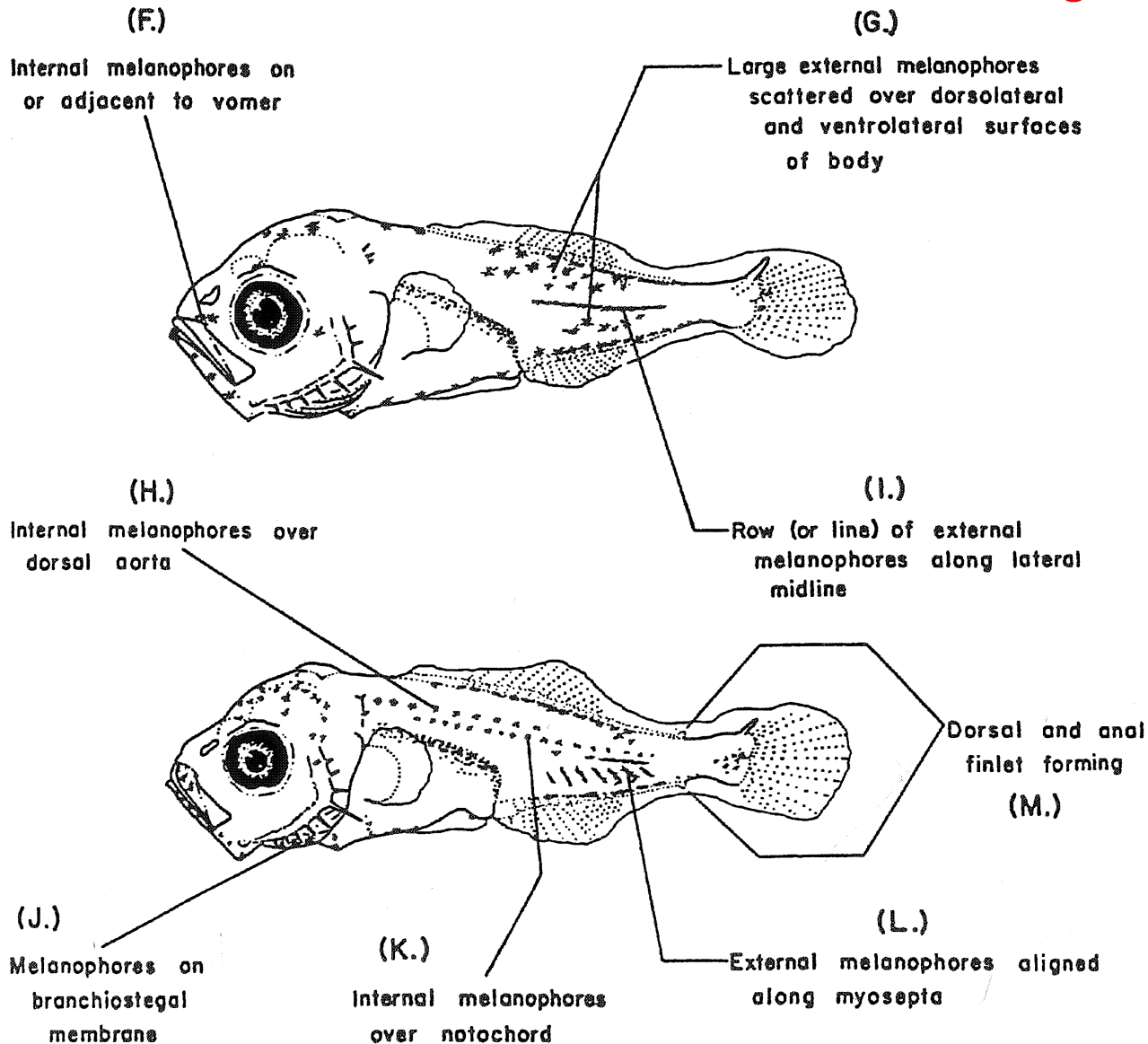
Head supination – 2/2



Some characters used to identify carangid larvae

Laroche et al. (1996)

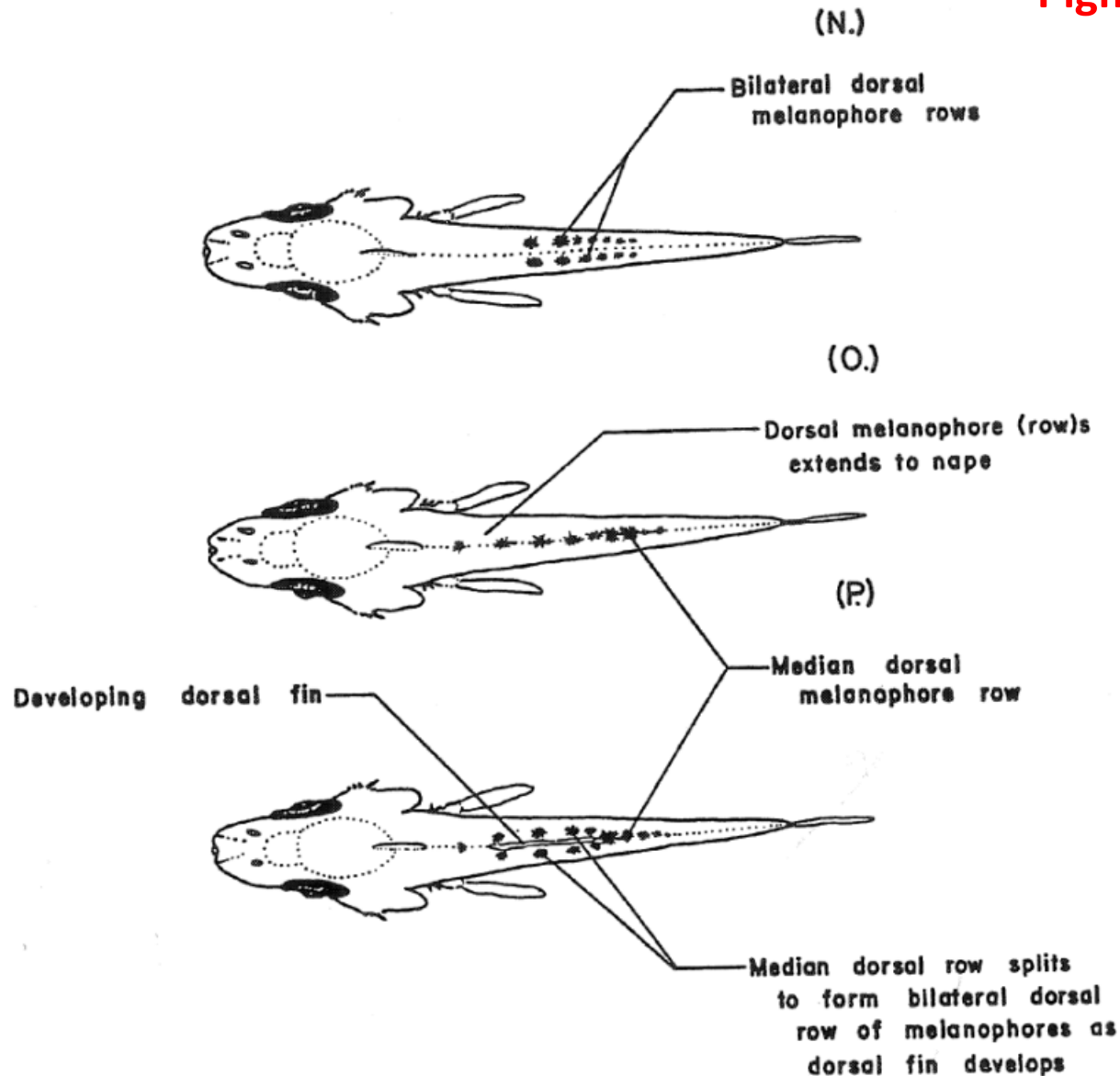
Pigment – 1/3



Some characters used to identify carangid larvae

Laroche et al. (1996)

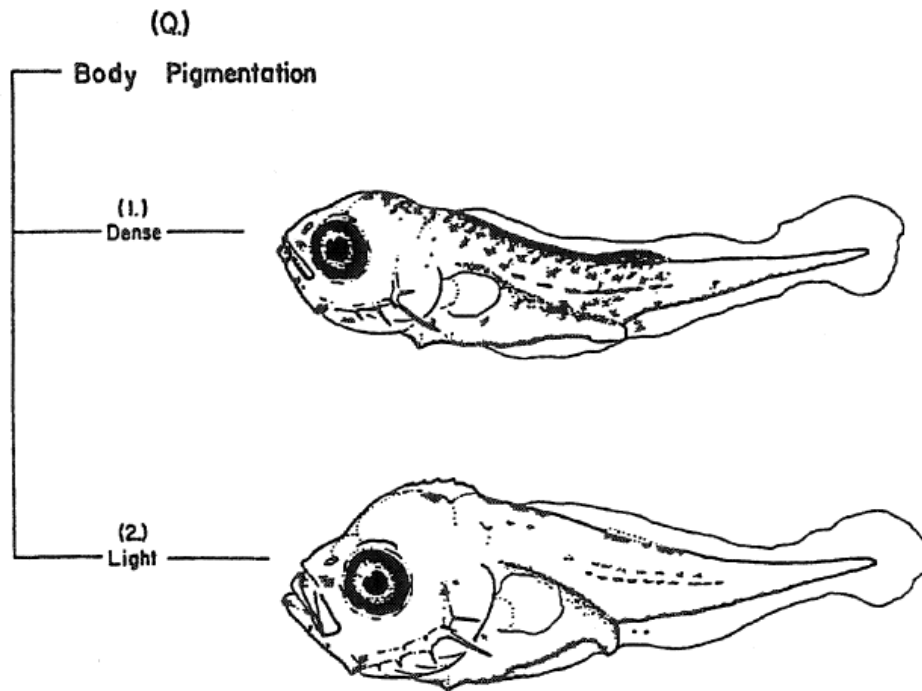
Pigment – 2/3



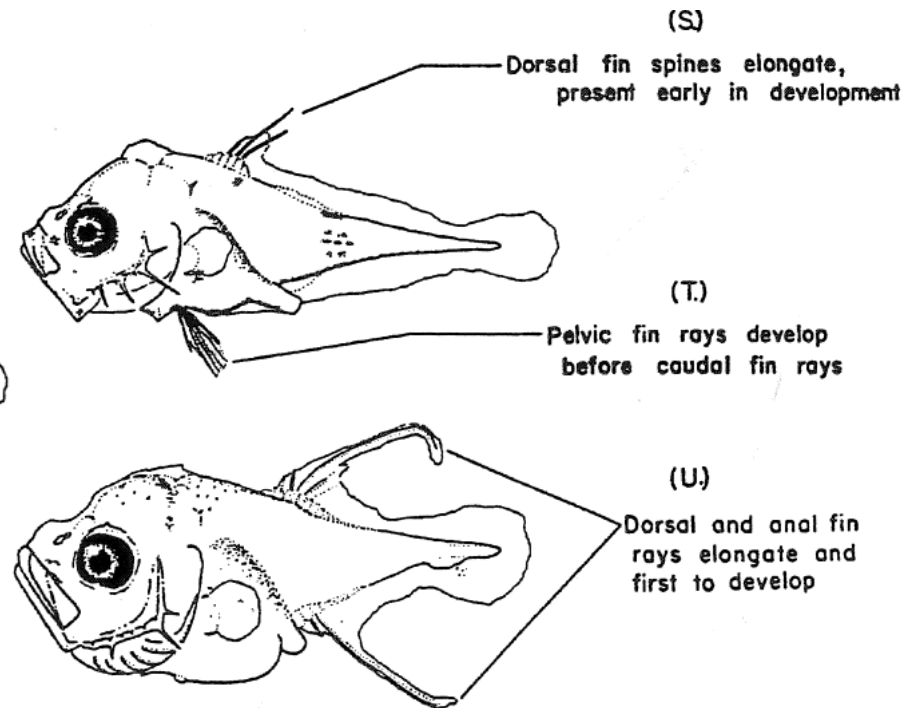
Some characters used to identify carangid larvae

Laroche et al. (1996)

Pigment – 3/3



Fin elongation





carangin *Alectis ciliaris*

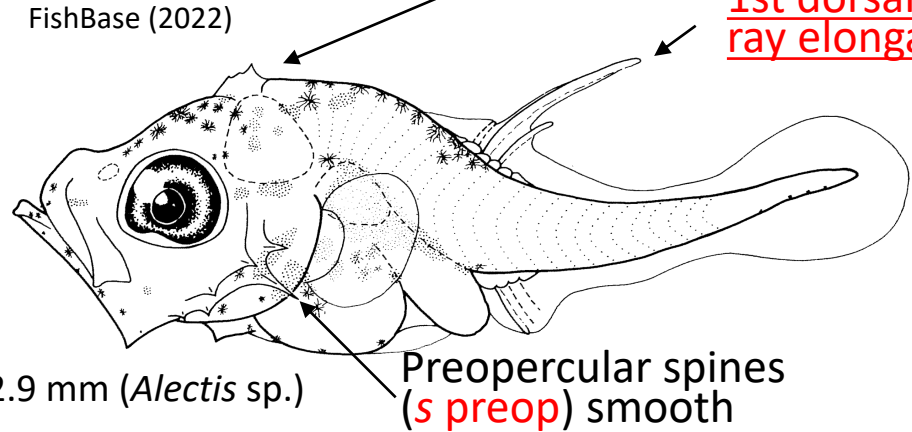
D: IV~VII-I, 18~20
 A: (II)-I, 15~17
 Scutes: 8~30
 V: 10+14



FishBase (2022)

Supraoccipital crest (SOC) present

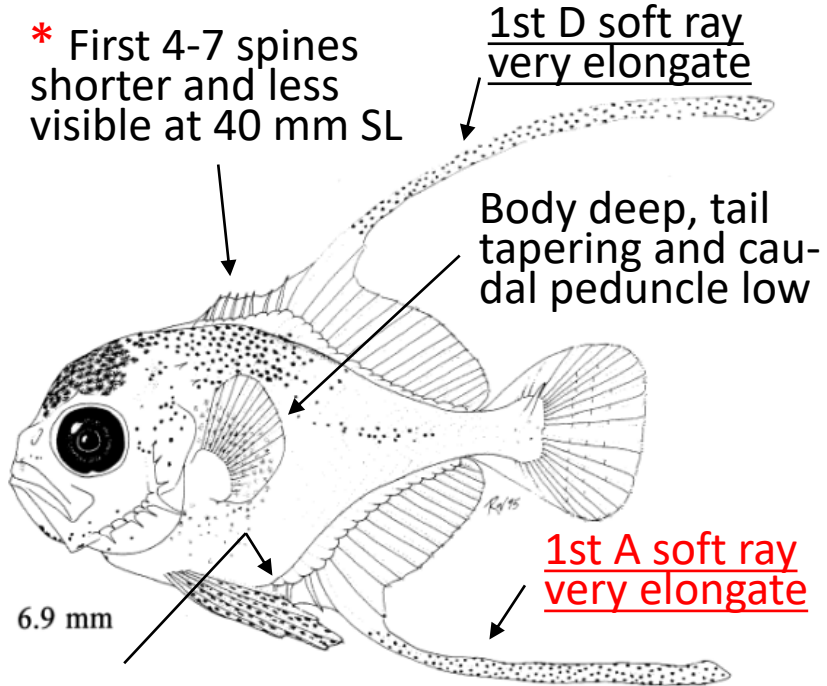
1st dorsal-fin (D) soft ray elongate



* First 4-7 spines shorter and less visible at 40 mm SL

1st D soft ray very elongate

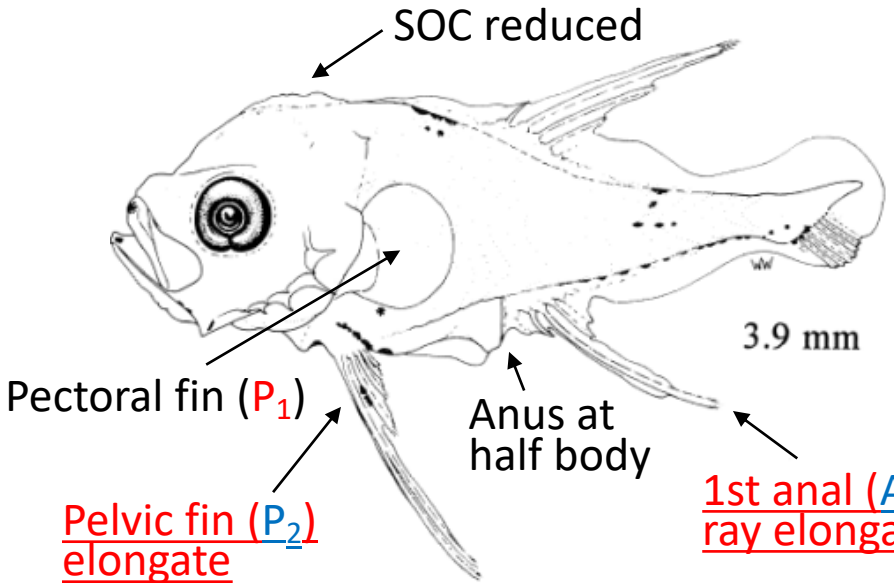
Body deep, tail tapering and caudal peduncle low



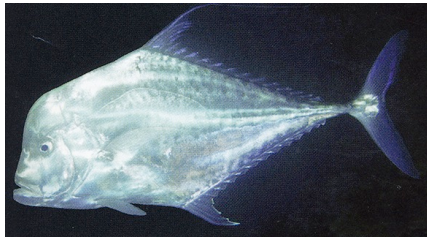
* Detached 2 spines invisible due to burying under skin in 15-cm juvenile

1st A soft ray very elongate

* First 3 D soft rays, and first 2 A- and P₂ soft rays elongate in more 13 mm SL



*Distinguishing character underlined



FishBase (2022)

carangin *Alectis indica*

D: V~VI-I, 18~20
A: (II)-I, 15~17
Scutes: 6~13
V: 10+14

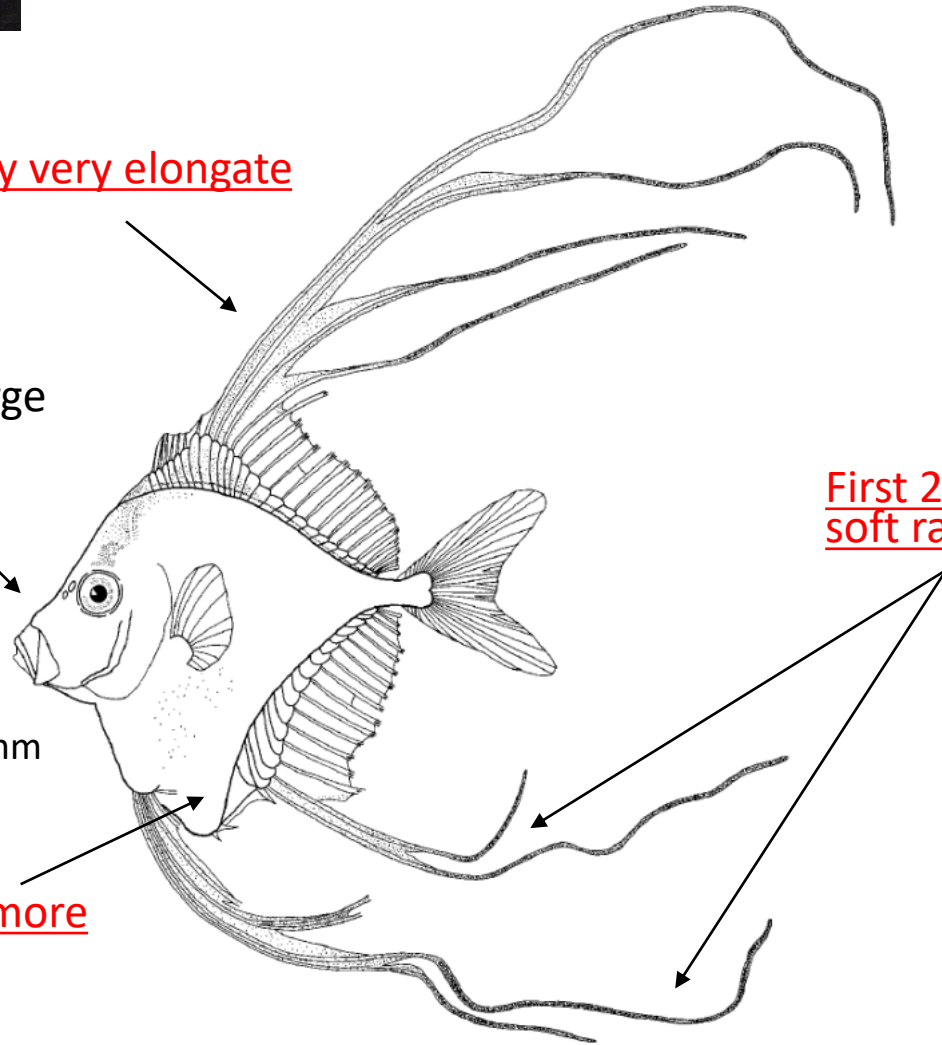
First 4 D soft ray very elongate

Snout relatively large

21.3 mm

Gut protrude more downward

First 2 A- and pelvic-fin soft rays very elongate



Hiraga et al. (2014)



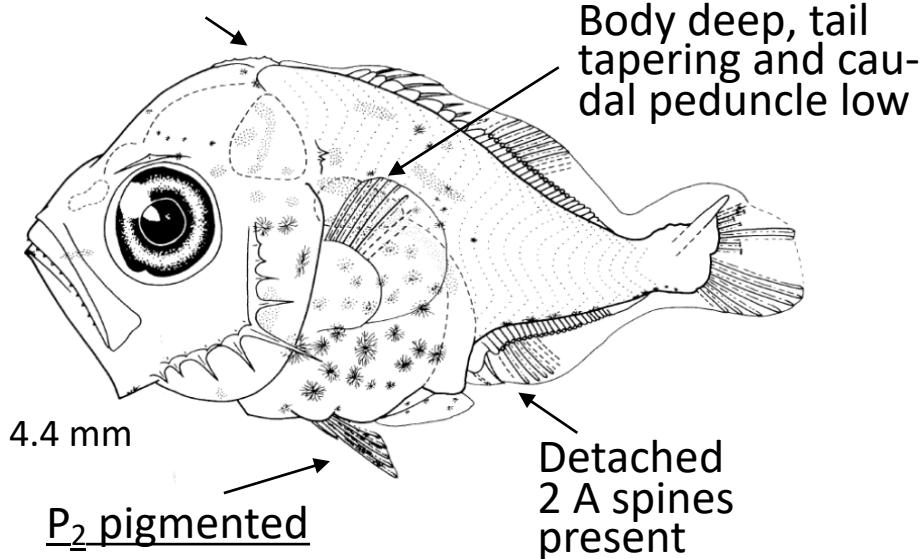
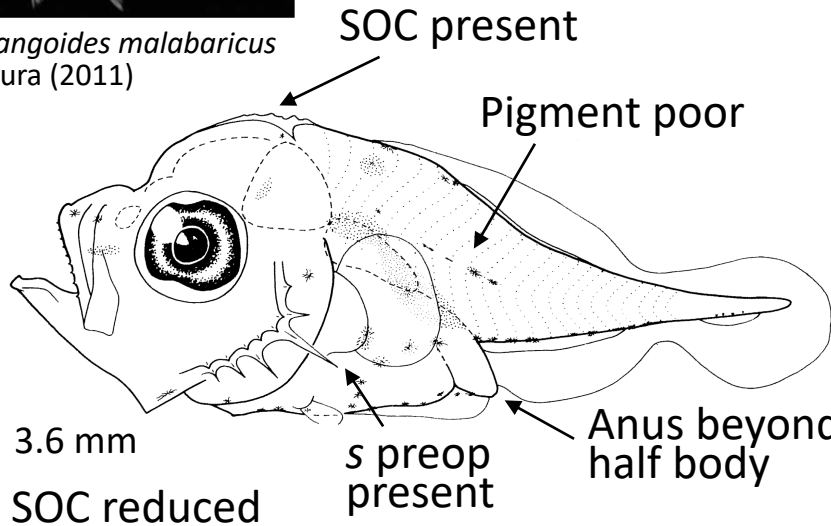
Carangoides malabaricus
Kimura (2011)

carangin *Carangoides* sp./spp.

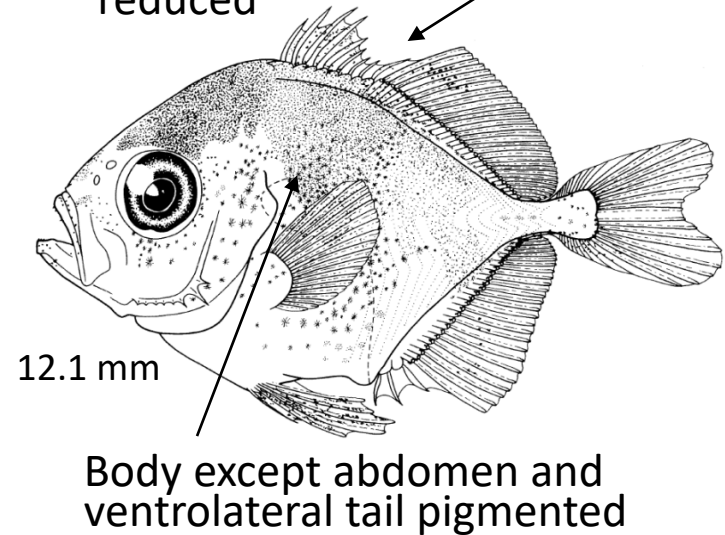
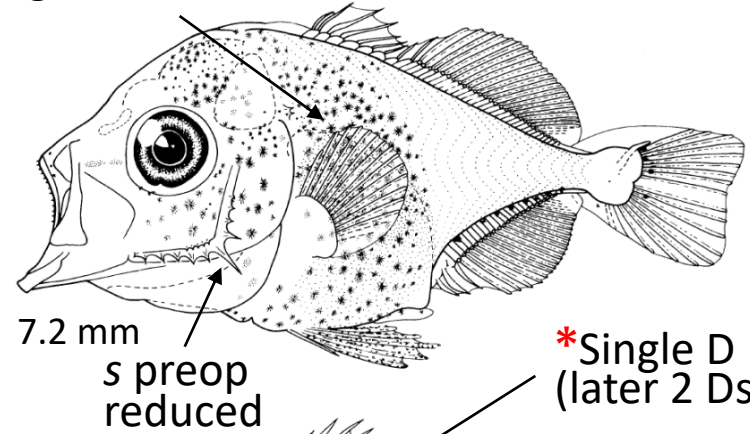
Group 1 (3/7)



Genus *Carangoides*
D: VIII-I, 17~34
A: II-I, 14~27
Scutes: 11~45
V: 10+14~15



Anterior half body pigmented



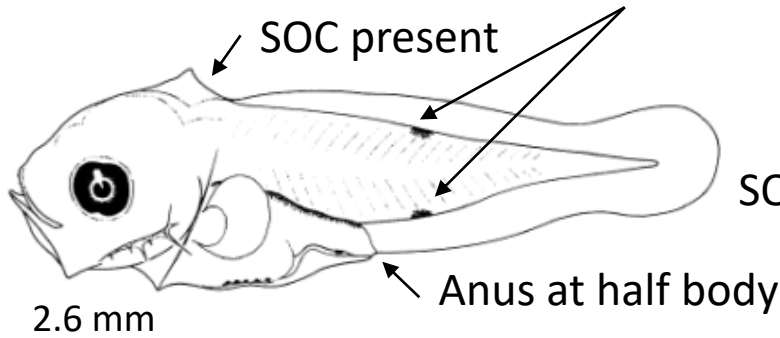


Kimura (2011)

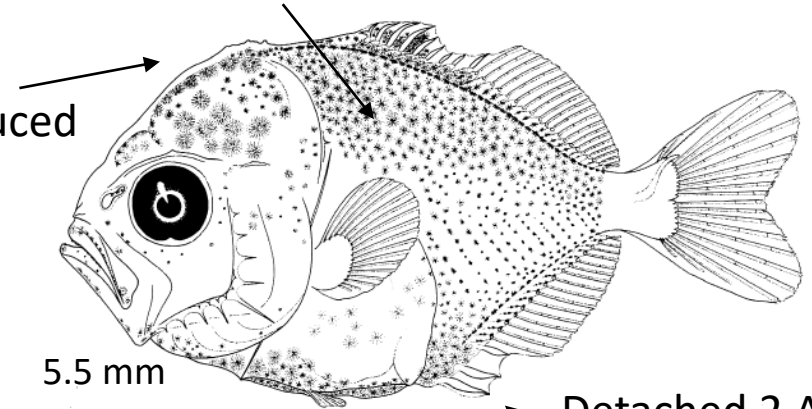
carangin *Caranx sexfasciatus*

D: VIII-I, 19~22
 A: II-I, 14~17
 Scutes: 27~36
 V: 10+15

Symmetrically- located 2 pigment spots present

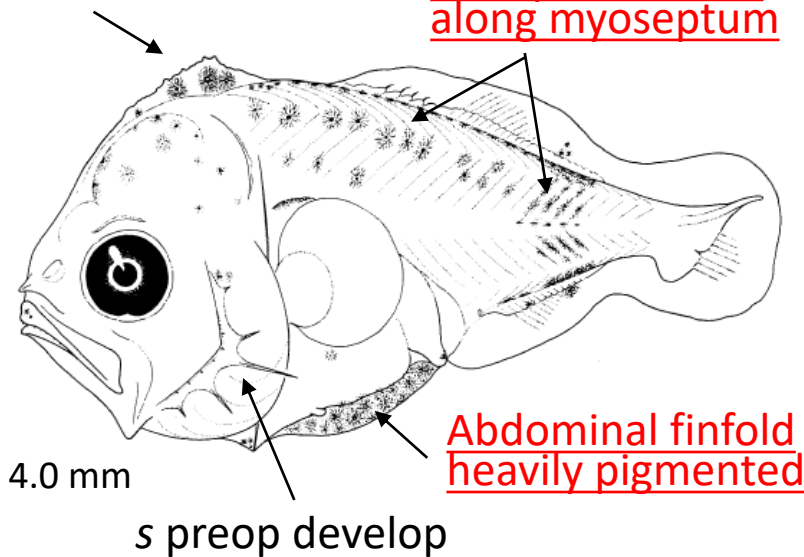


Body deep, tail tapering and caudal peduncle low

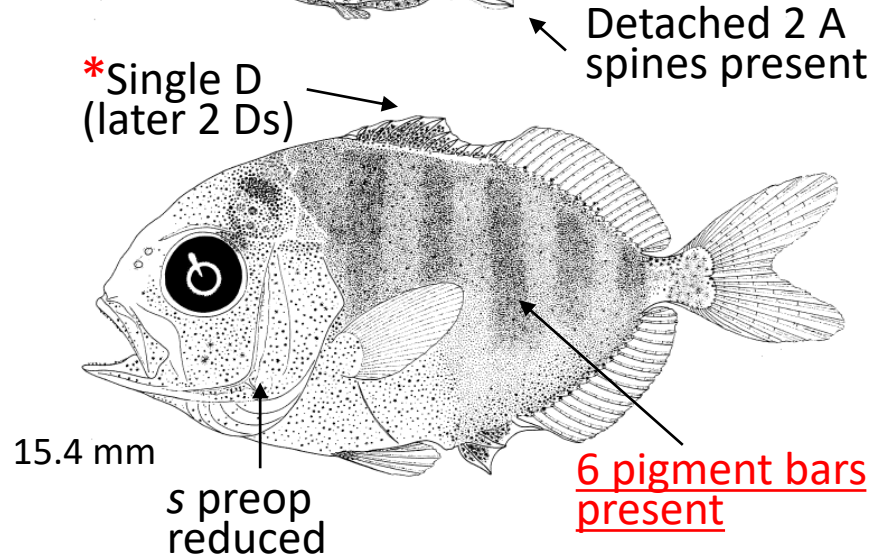


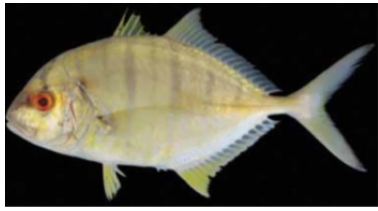
SOC pigmented

Pigment present on myomere and along myoseptum



*Single D (later 2 Ds)

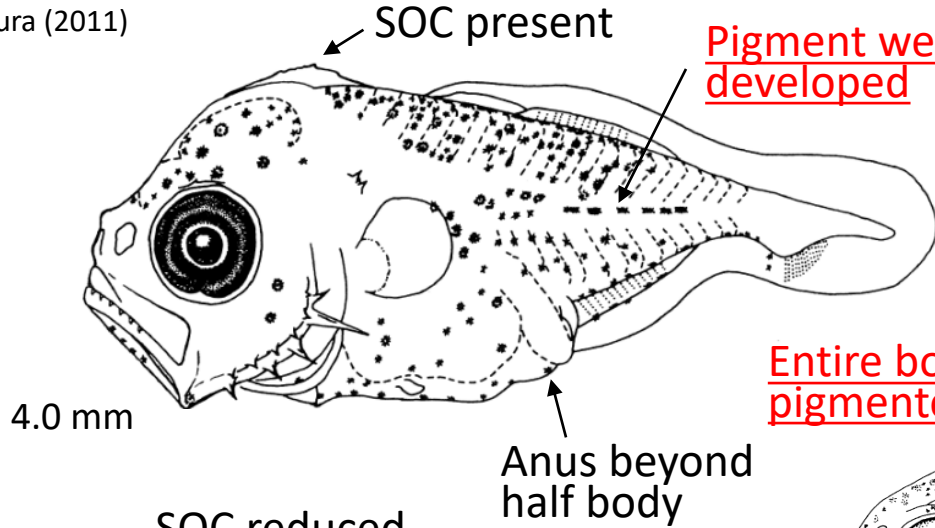




Kimura (2011)

carangin *Gnathanodon speciosus*

D: VII~VIII-I, 18~21
A: II-I, 15~17
Scutes: 14~26
V: 10+14



4.0 mm

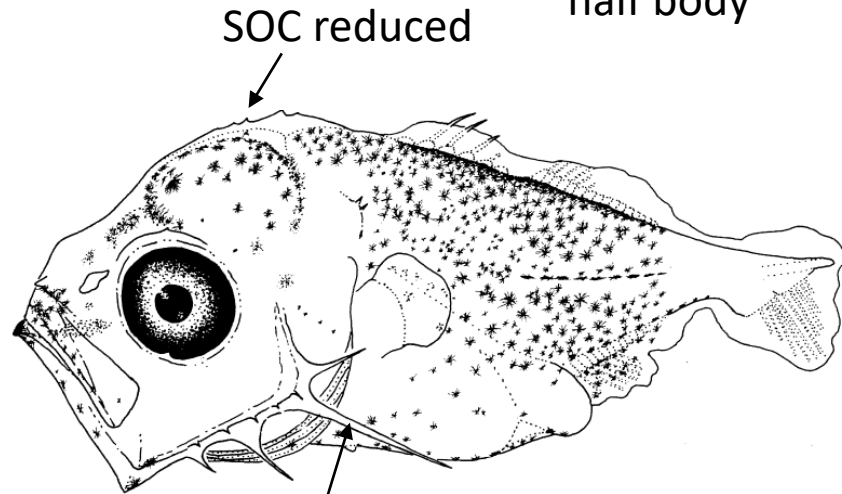
Anus beyond half body

Entire body pigmented

Body deep and caudal peduncle low

*Single D (later 2 Ds)

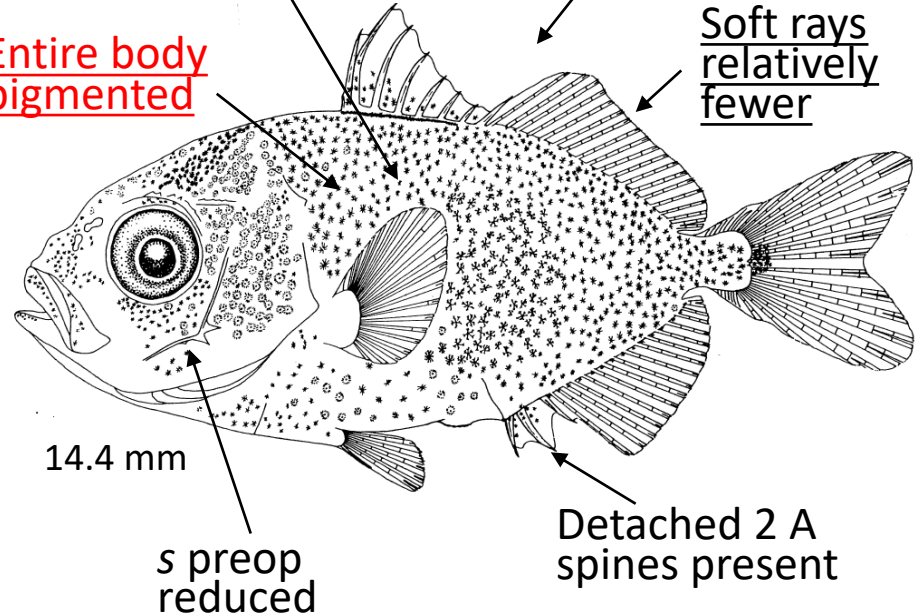
Soft rays relatively fewer



SOC reduced

4.0 mm

s preop at angle very elongate



14.4 mm

s preop reduced

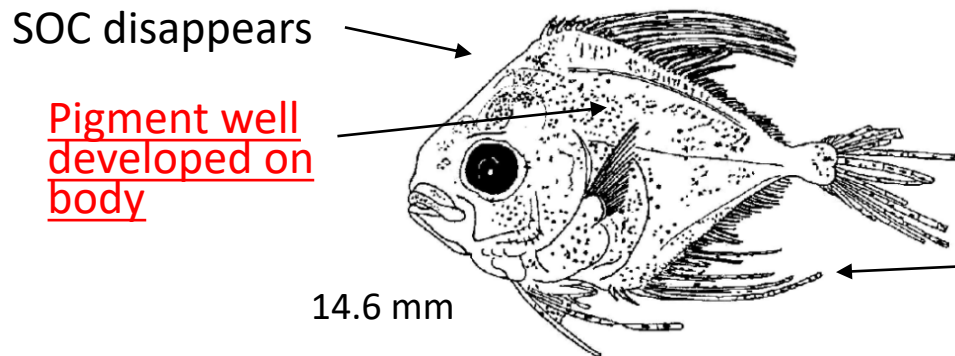
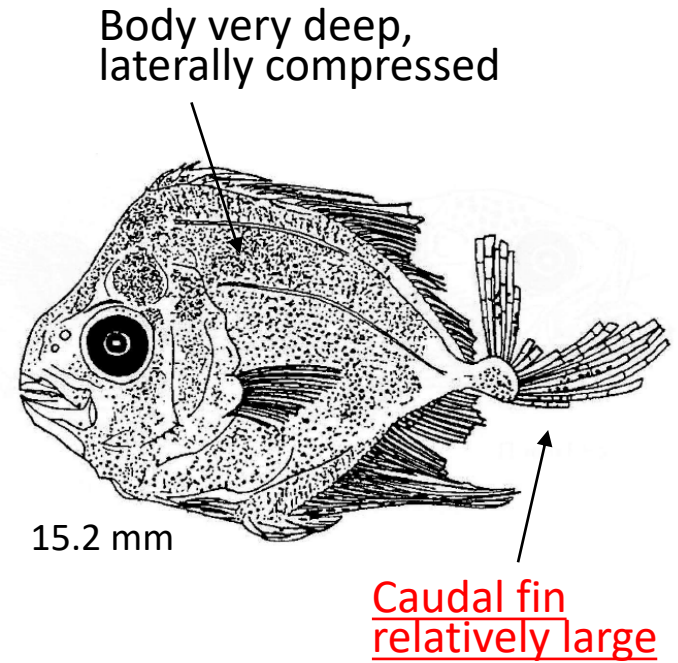
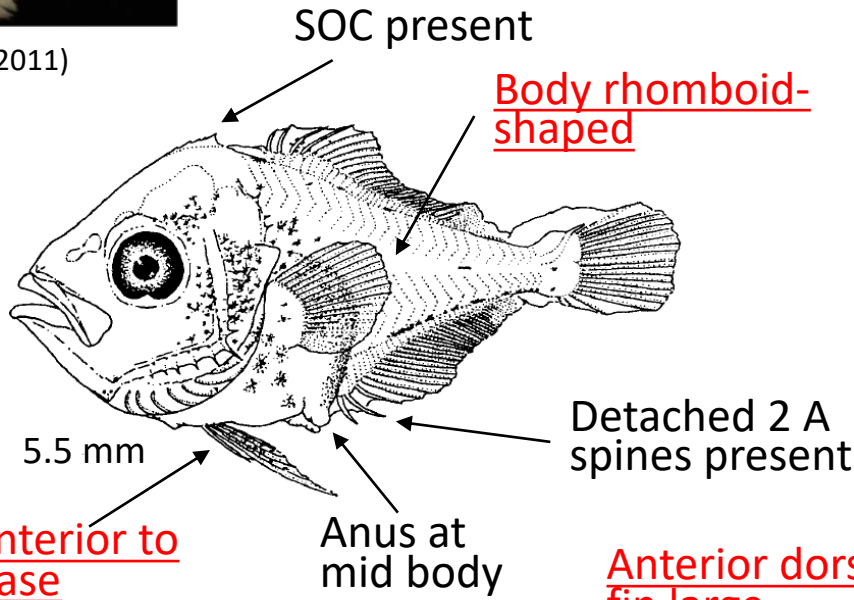
Detached 2 A spines present



Kimura (2011)

carangin *Parastromateus niger*

D: (V~VI)-I, 40~45
A: (II)-I, 35~39
Scutes: 8~19
V: 10+14



Anterior anal fin large

5.5 mm: Laroche et al. (1984); 14.6mm and 15.2 mm: Chayakul (1996)

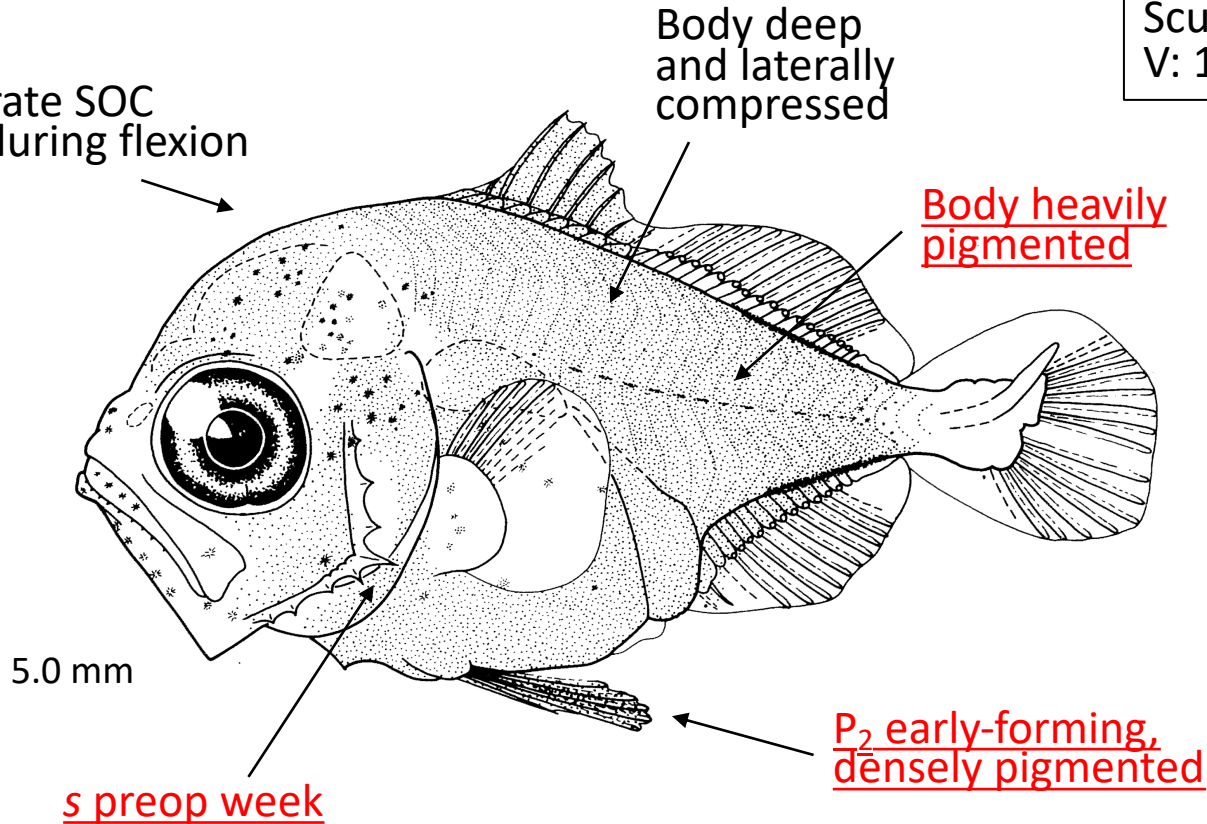


Ulua mentalis
FishBase

carangin *Ulua sp.*

Ulua mentalis
D: VIII-I, 20~22
A: II-I, 17~18
Scutes: 26~38
V: 10+14

* A low, serrate SOC disappears during flexion (by 5.0 mm)



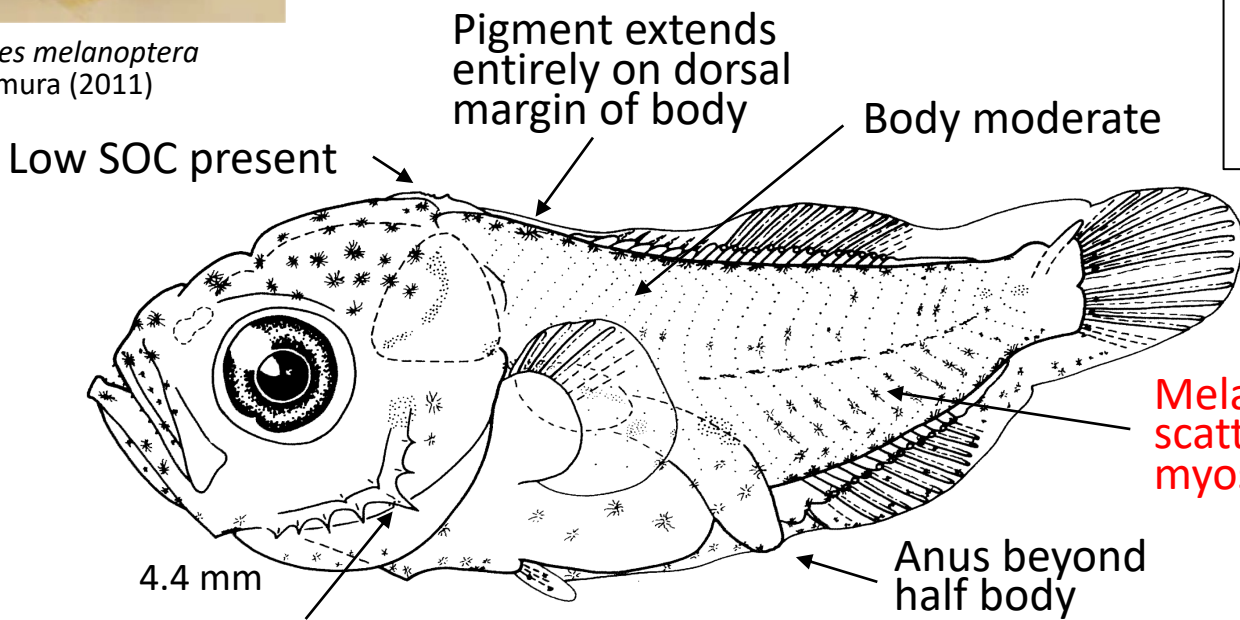
Leis and Trnski (2000)



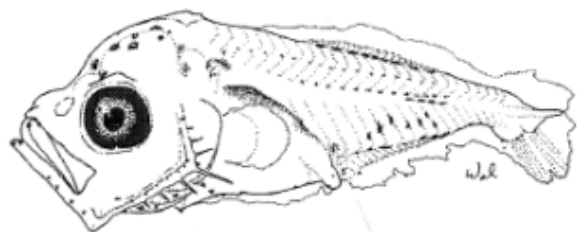
Alepes melanoptera
Kimura (2011)

carangin *Alepes* sp.

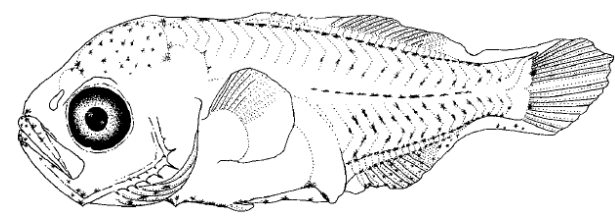
Genus *Alepes*
 D: VII~VIII-I, 21~27
 A: II-I, 18~23
 Scutes: 35~69
 V: 10+14



Leis and Trnski (2000)



Selar crumenophthalmus 4.1 mm (Laroche et al., 2006)



Atule mate 4.9 mm (Laroche et al., 1984)

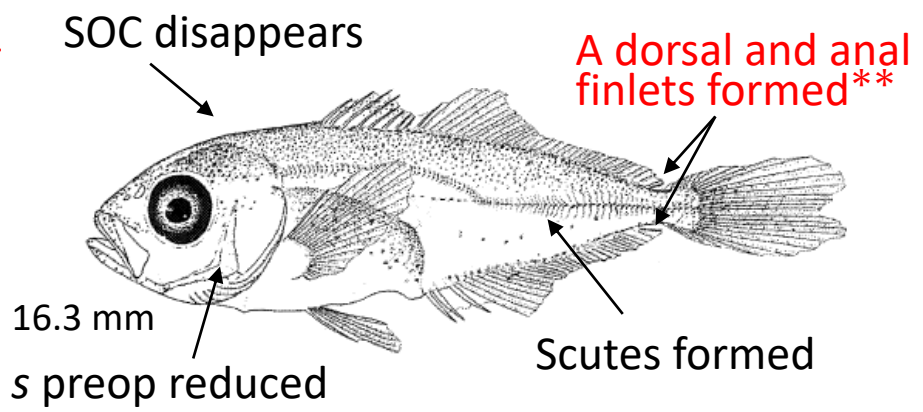
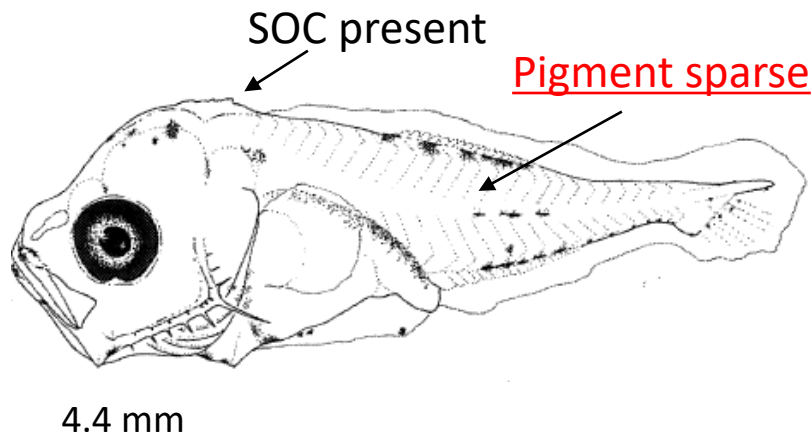
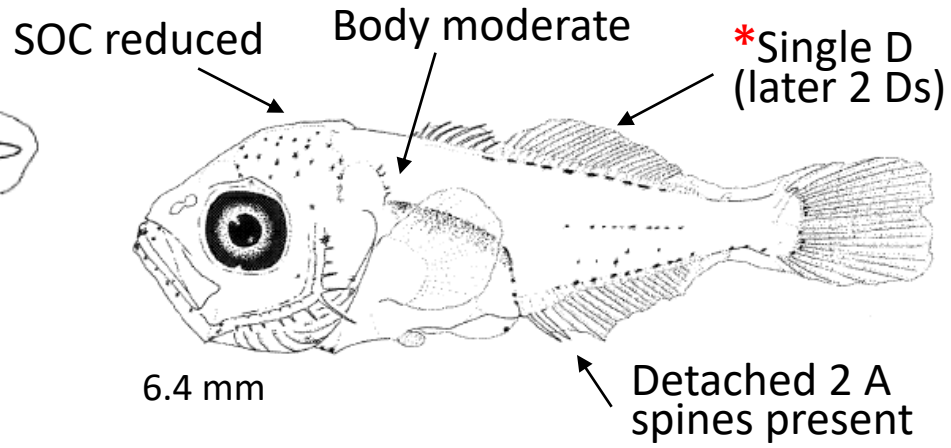
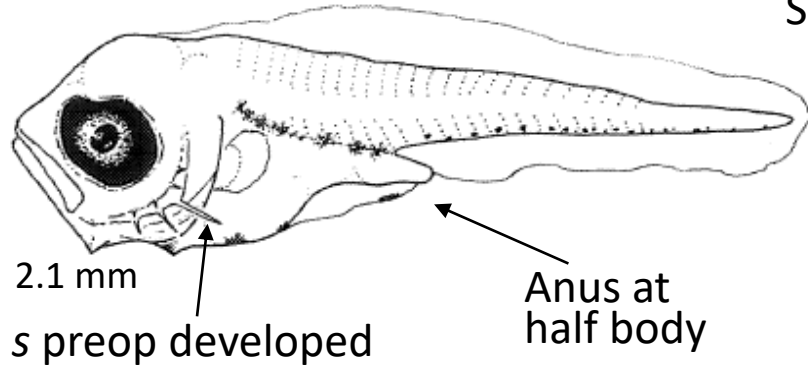
Characters of body shape and pigment patterns on myoseptum in the tail are shared by *Alepes*, *Selar* and *Atule* larvae in 4 mm. *Selar* in 4 mm have a slender body, longer preopercular spines, poor pigment and melanophores of dorsal body in tail are limited at the anterior tail. *Atule* larvae have no supraoccipital crest.



FishBase (2022)

carangin *Decapterus macarellus*

D: VIII-I, 30~36+1
A: II-I, 26~30+1
Scutes: 24~40
V: 10+14



Laroche et al. (2006)

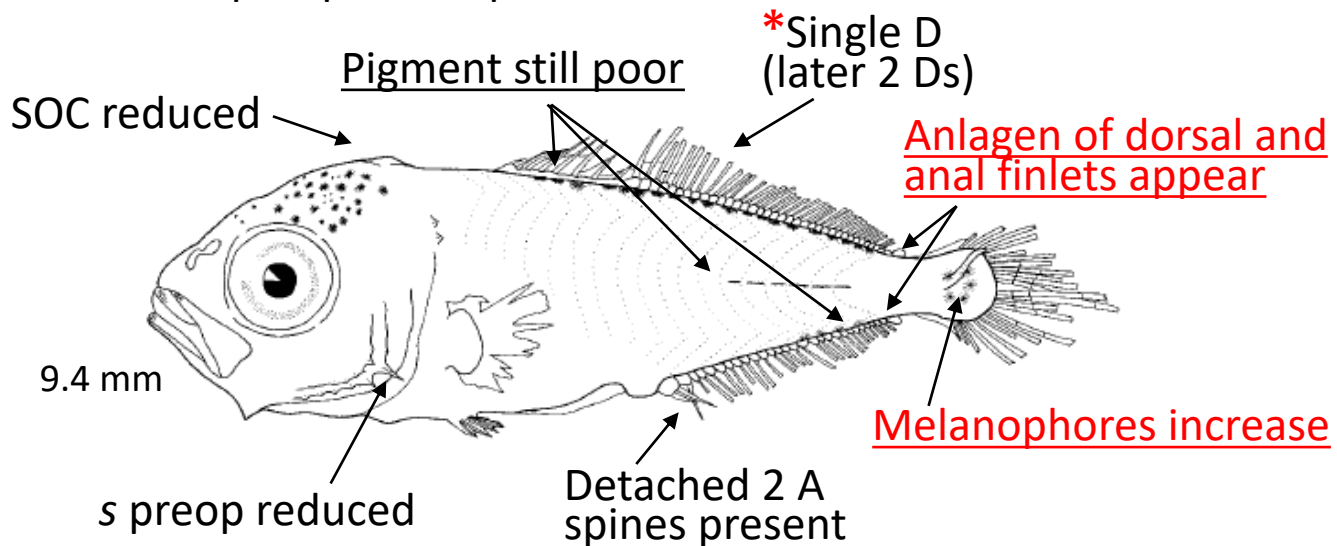
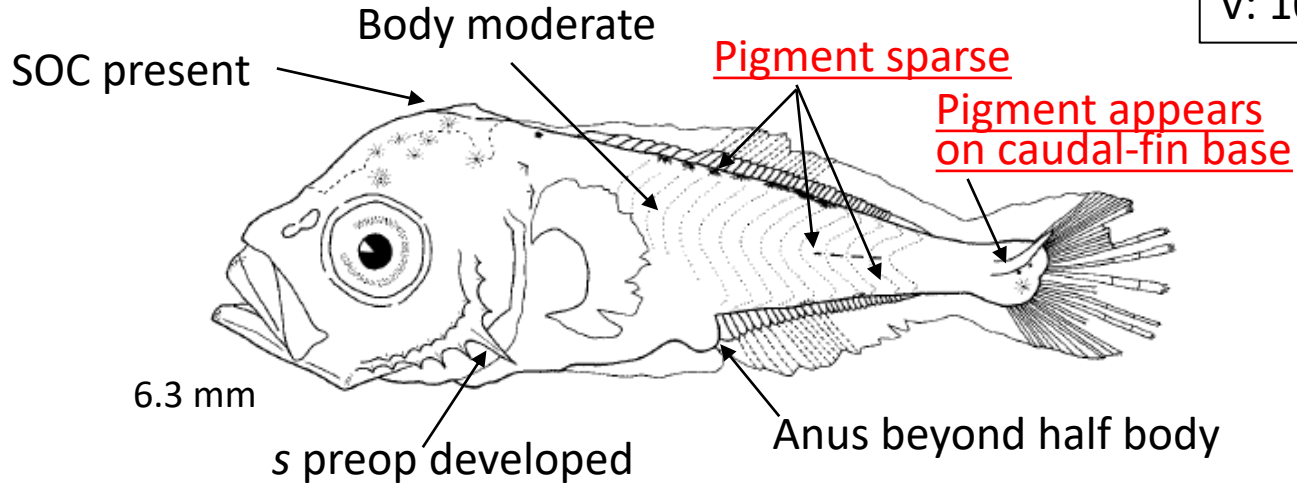
** In this size, finlets are continuous to 2nd dorsal and anal fins by fin membranes. Spaces between pterygiophores of last dorsal and anal soft rays and finlets are wider than those of each 2 soft rays. This feature indicates finlet formation.



Kimura (2011)

carangin *Decapterus macrosoma*

D: VIII-I, 32~38+1
A: II-I, 26~30+1
Scutes: 24~40
V: 10+14



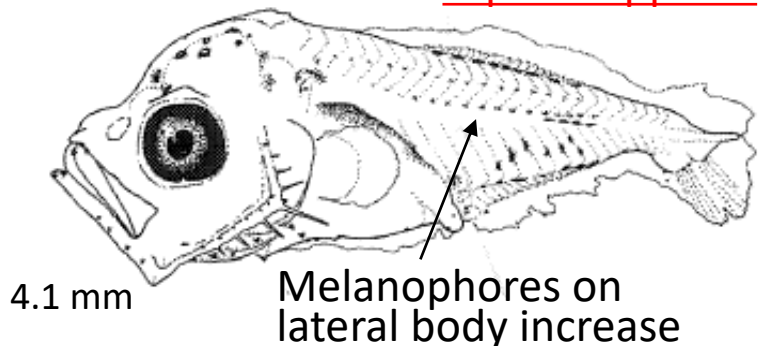
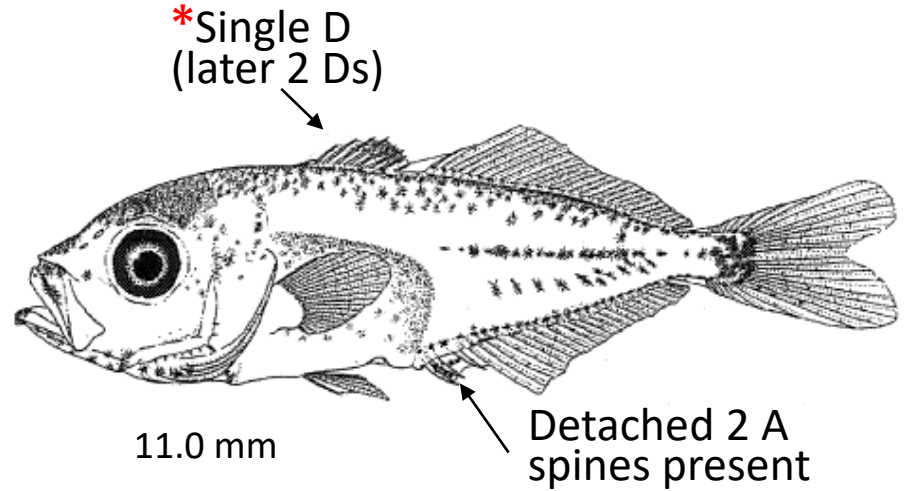
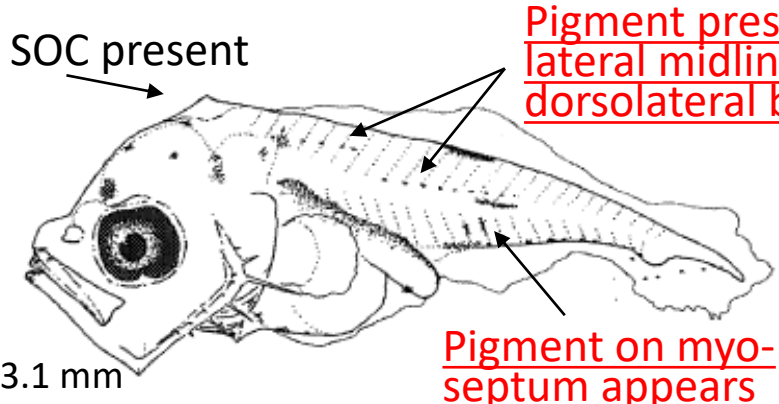
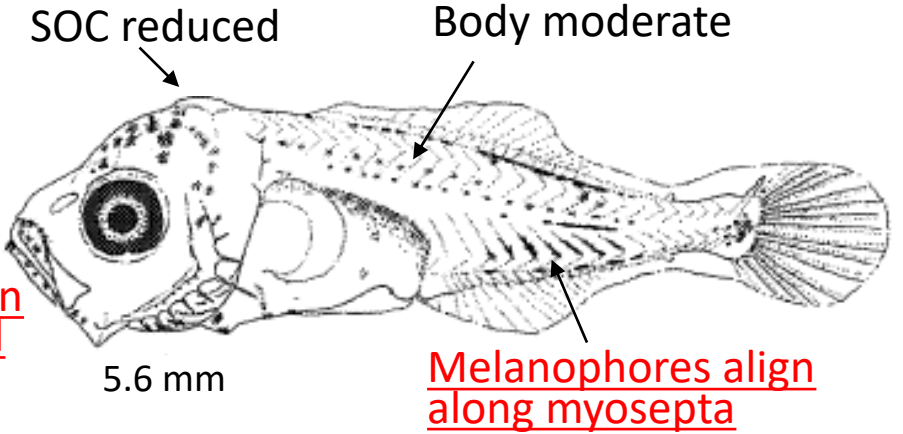
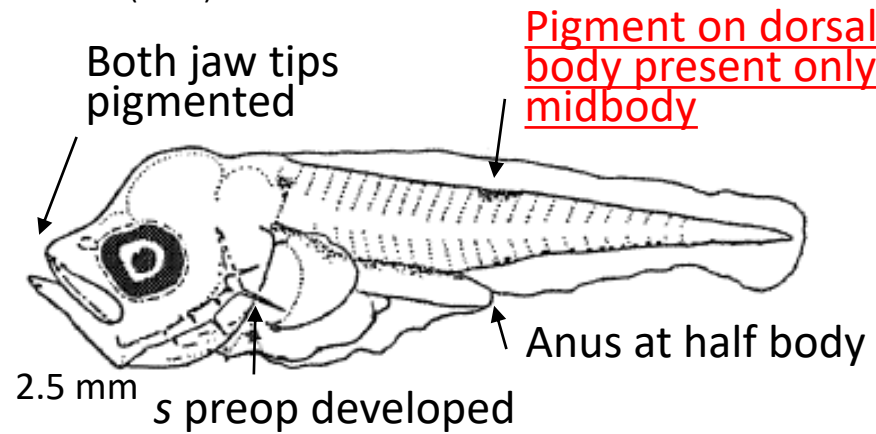
Hiraga et al. (2014)



Kimura (2011)

carangin *Selar crumenophthalmus*

D: VIII-I, 23~28
A: II-I, 21~23
Scutes: 29~42
V: 10+14



* Similar to *Atule mate* (no SOC).



Kimura (2011)

carangin *Selaroides leptolepis*

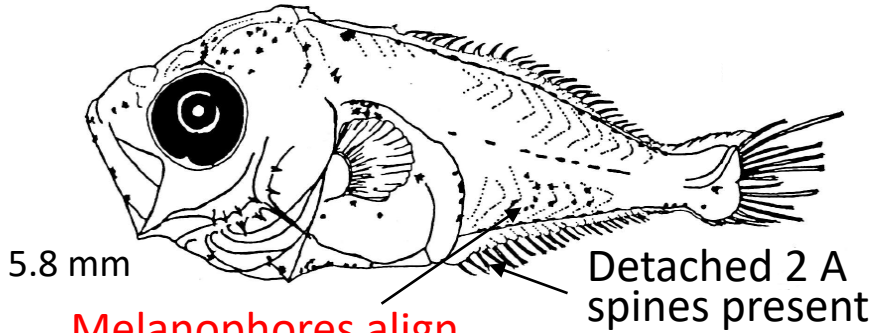
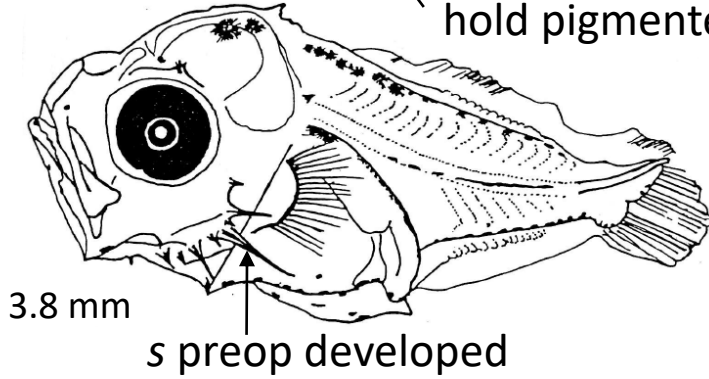
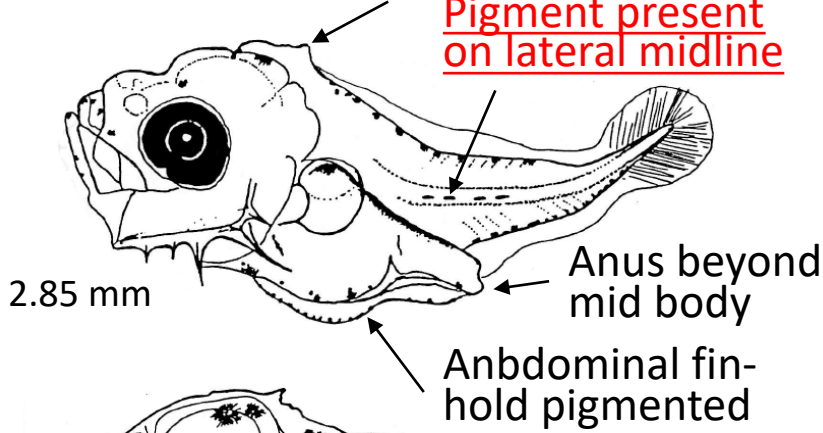
Group 2 (5/7)



D: VIII-I, 24~26
A: II-I, 20~23
Scutes: 20~33
V: 10+14

SOC present

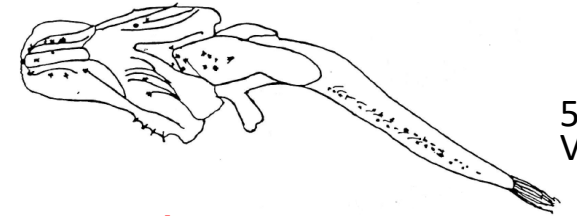
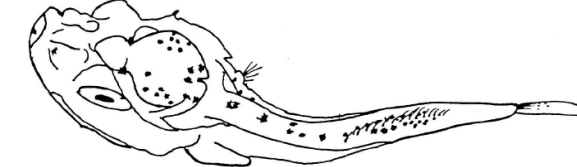
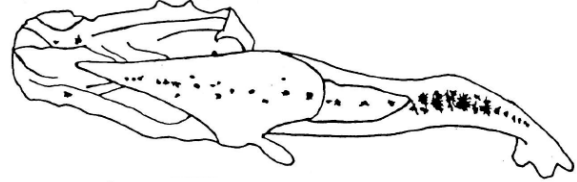
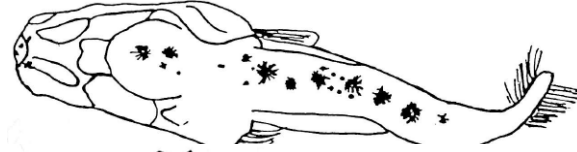
Pigment present on lateral midline



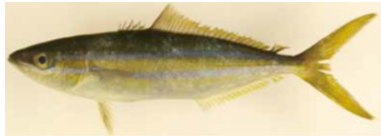
Melanophores align along myosepta

Chayakul (1996)

Pigment patterns on dorsal and ventral body



* Similar to *Selar crumenophthalmus*.
Note: pigment on dorsal body.



Kimura (2011)

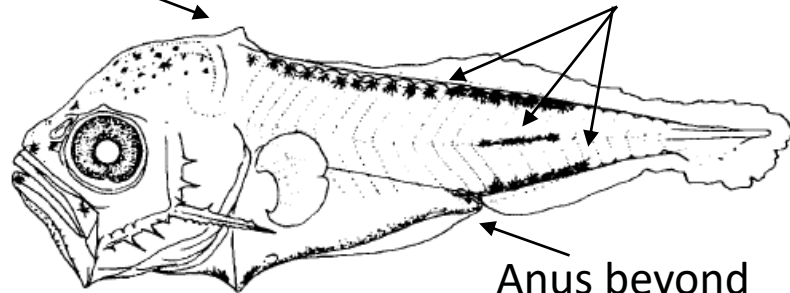
naucratin *Elagatis bipinnulata*

D: V~V-I, 23~28+2
A: (I)-I, 15~20+2
Scutes: 0
V: 10+14

Pigment present densely on dorsal, lateral midline and ventral body

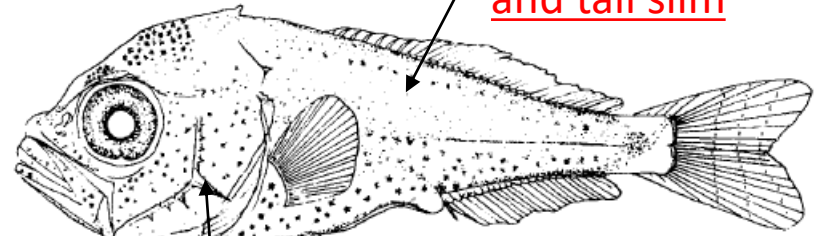
Trunk and tail gradually tapering, and tail slim

Small SOC present



3.6 mm

Anus beyond mid body

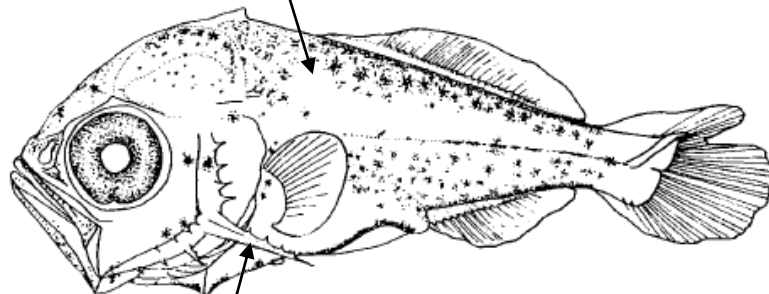


7.7 mm

s preop reduced

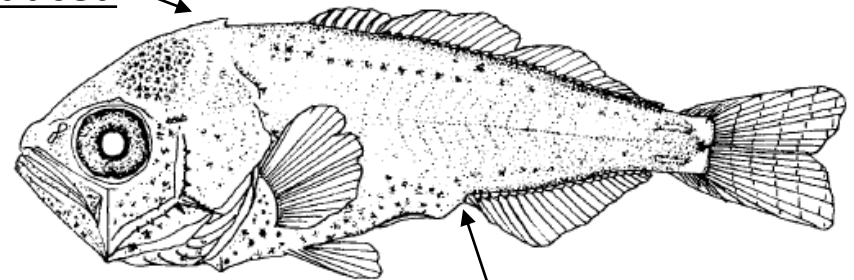
Pigment scattered on whole body

SOC reduced



5.5 mm

s preop long and serrate



10.4 mm


Detached 2 A spines absent (later detached 1 A spine present)

Hiraga et al. (2014)



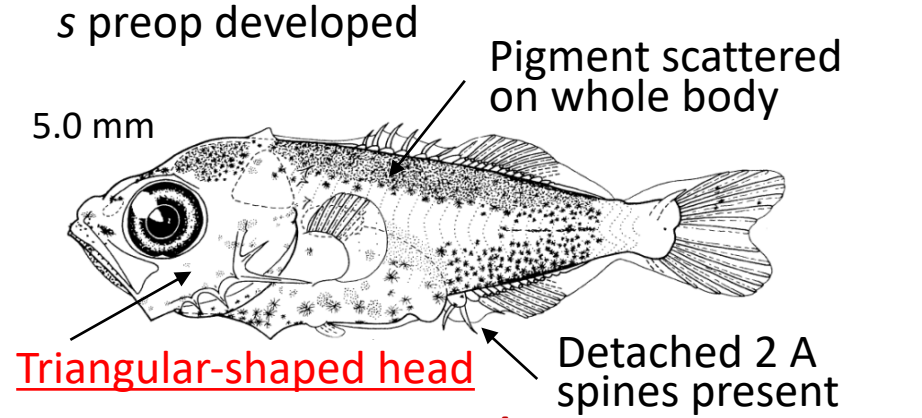
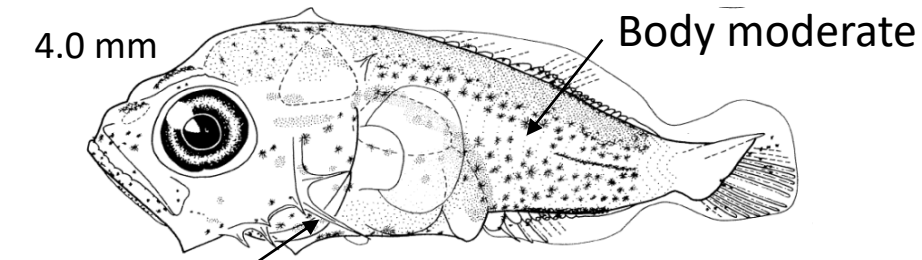
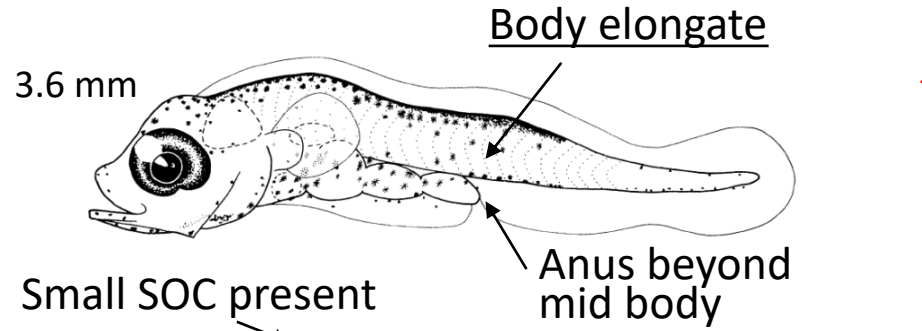
S. commersonianus
Kimura (2011)

scomberoidin *Scomberoides* sp./spp.

Group 2 (7/7) 

S. lysan and *S. tol*

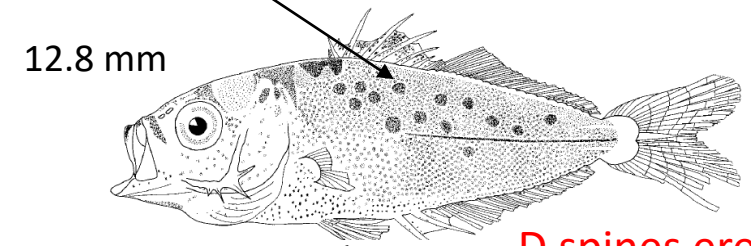
Genus *Scomberoides*
D: VI~VII-I, 19~21
A: II-I (II), 16~20
Scutes: 0
V: 10+16



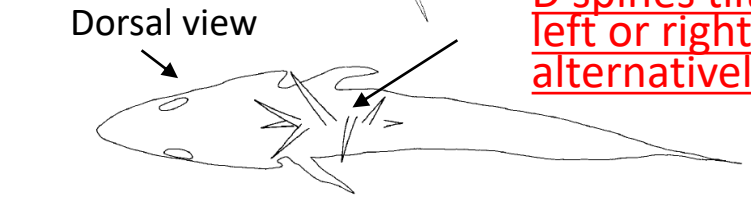
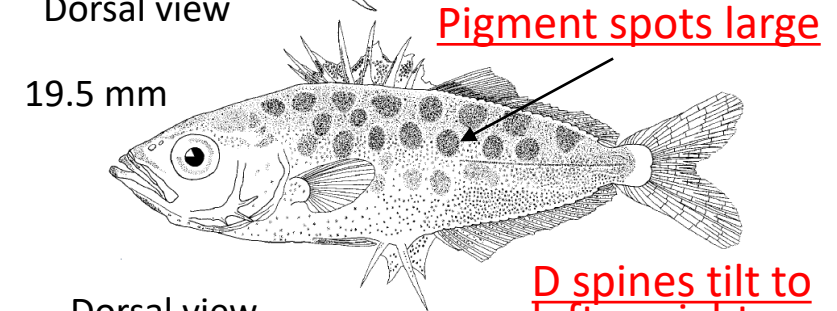
Scomberoides sp./spp.

Leis and Trnski (2000)

Pigment spots small



D spines erect vertically



Pigment spots large

D spines tilt to left or right alternatively

S. lysan (upper) and *S. tol* (lower)

Hiraga et al. (2014)



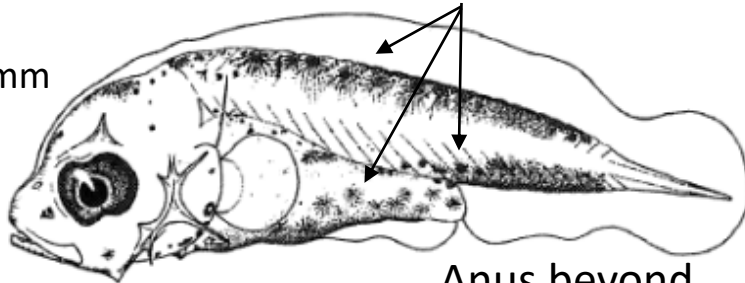
FishBase

naucratin *Naucrates ductor*

Pigment present densely on dorsal and ventral body, and abdomen

D: IV~V-I, 25~29
A: II-I, 15~17
Scutes: 0
V: 10 + 15

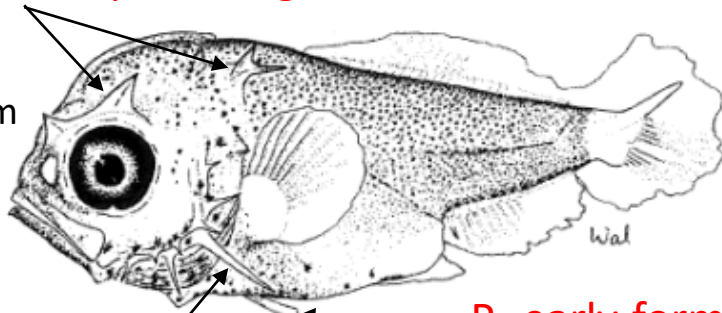
2.9 mm



Anus beyond mid body

Supraorbital, post-temporal & supra-cleithrum spines large

4.7 mm

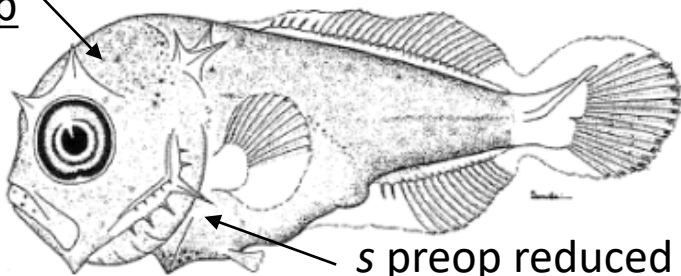


P₂ early-forming

s preop developed

Head round, and body deep

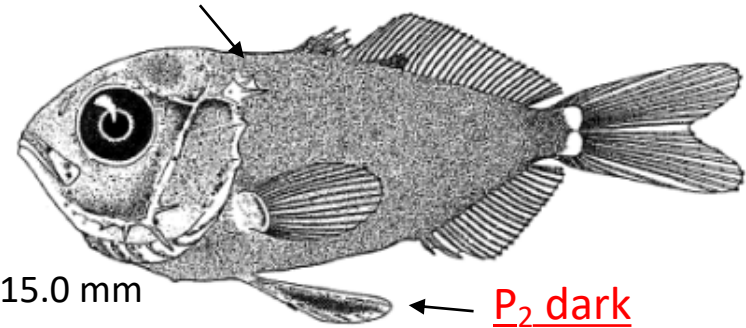
5.9 mm



s preop reduced

Body dark

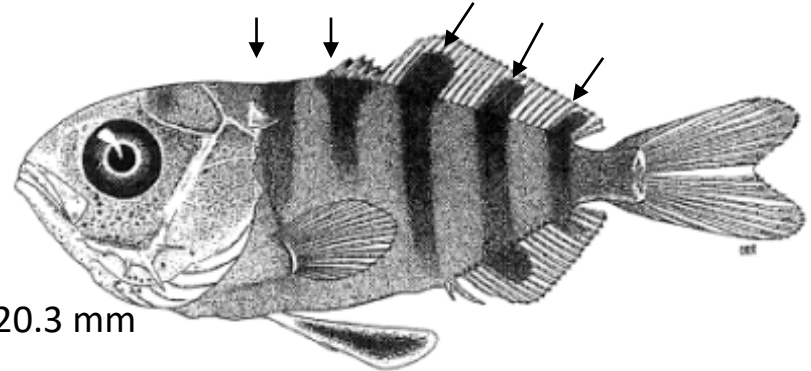
15.0 mm



P₂ dark

5 – 6 pigment bars

20.3 mm



Laroche et al. (2006)

trachinotin *Trachinotus baillonii*
Trachinotus blochii

T. baillonii
D: V~VI-I, 21~25
A: II-I, 20~24
Scutes: 0
V: 10 + 14

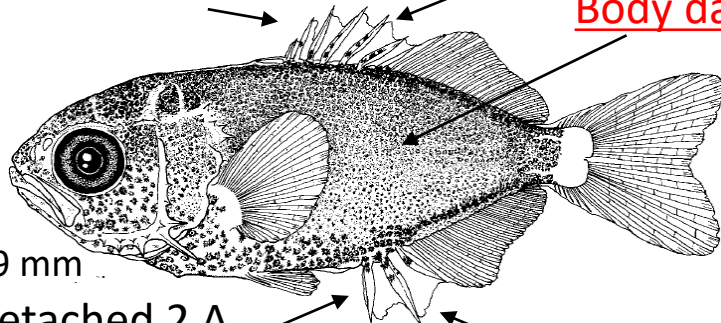


T. blochii FishBace

T. blochii
D: VI-I, 18~20
A: II-I, 16~18
Scutes: 0
V: 10 + 14

T. baillonii

Anterior dorsal-fin membrane unpigmented



9.9 mm

Detached 2 A spines present

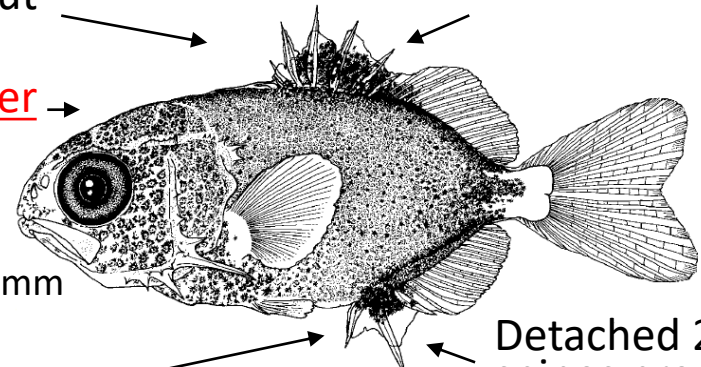
Dorsal-fin spines stout

Body dark

Body deeper

T. blockii

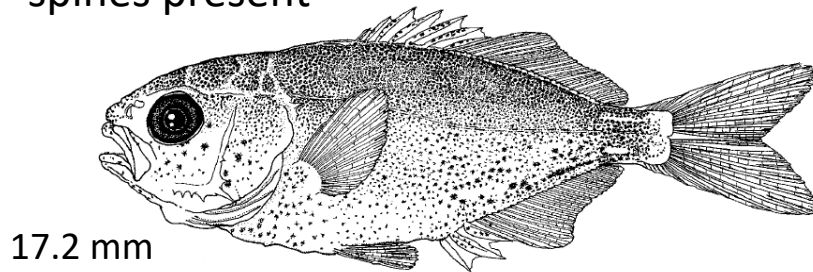
Anterior dorsal-fin membrane pigmented



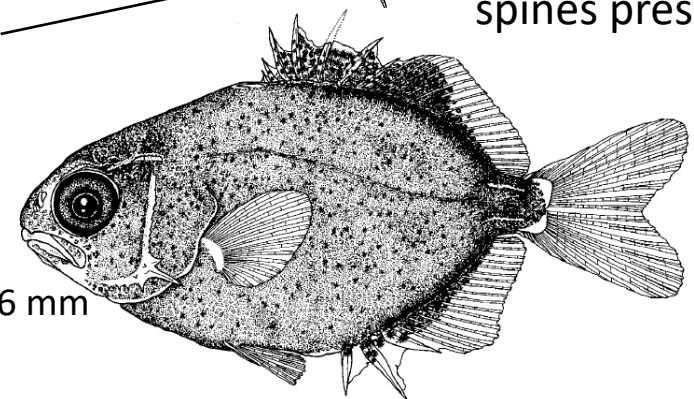
8.9 mm

Detached 2 A spines present

Anal-fin spines stout

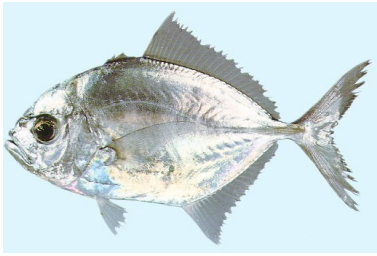


17.2 mm



16.6 mm

T. africanus (from Bali), *T. botla* (Mynmar) and *T. mookatee* (Gulf of Thailand) are reported in the region.



U. uraspis FishBase

carangin *Uraspis secunda*

U. uraspis

D: VI~VIII-I, 24~30

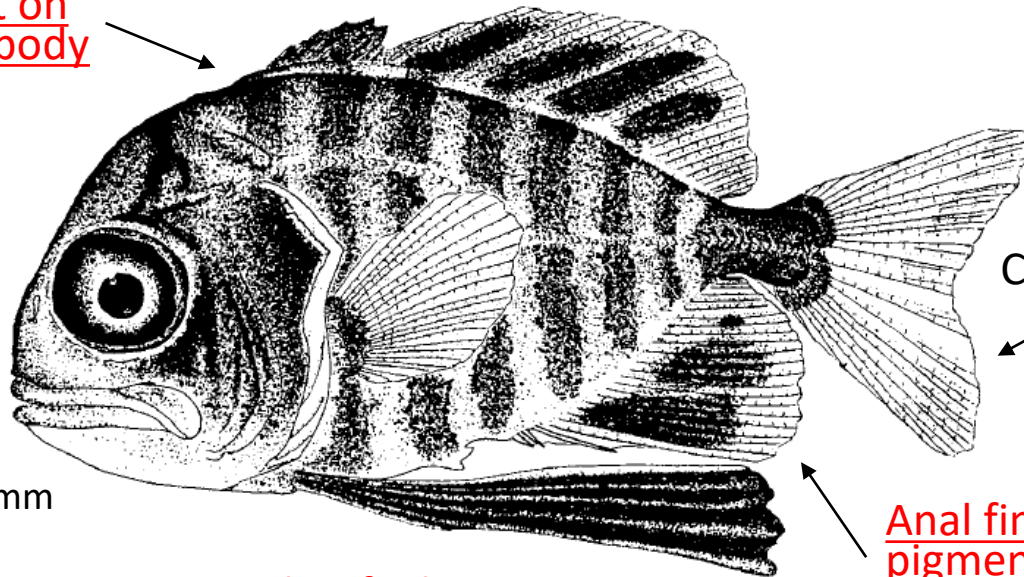
A: (II)-I, 17~22

Scutes: 24~39

V: 10 + 14

7 pigment bars present on lateral body

Dorsal fin large with pigment blotches on membrane



Caudal fin large

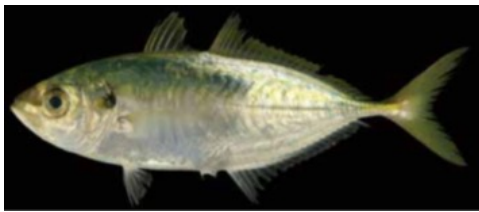
Anal fin large with pigment blotches on membrane

Pelvic fin large and heavily pigmented

25.6 mm

*Larvae of this species are not known.

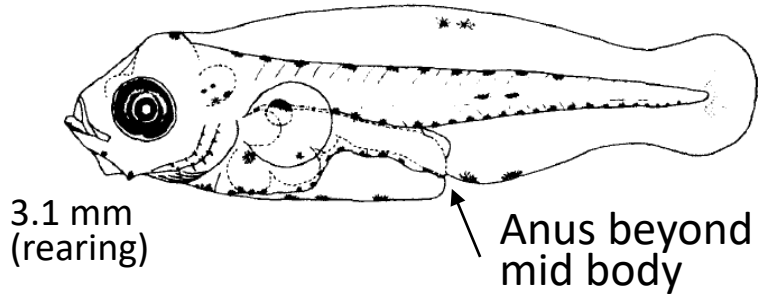
Laroche et al. (1984)



Kimura (2011)

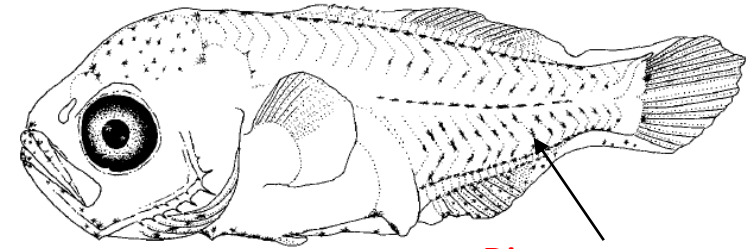
carangini *Atule mate*

D: VIII-I, 22~25
A: II-I, 18~21
Scutes: 36~52
V: 10+14



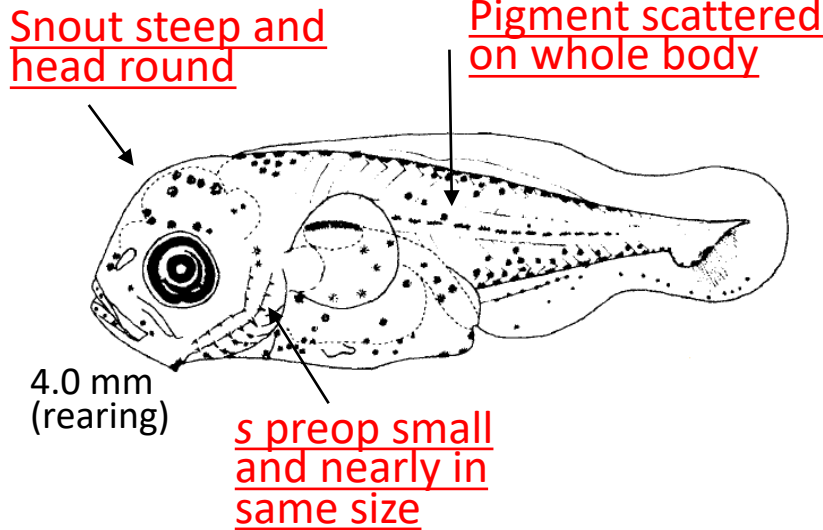
3.1 mm (rearing)

Anus beyond mid body



4.9 mm

Pigment present along myoseptum

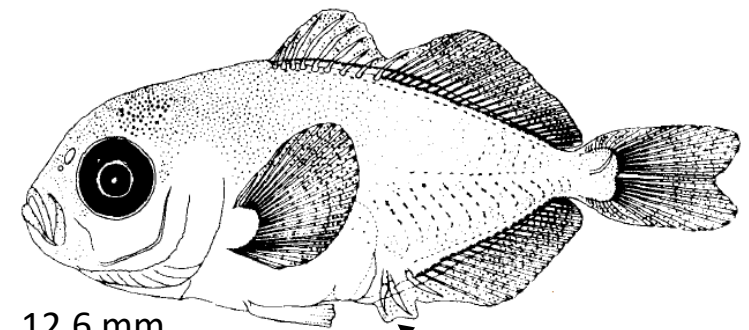


Snout steep and head round

Pigment scattered on whole body

4.0 mm (rearing)

s preop small and nearly in same size



12.6 mm (rearing)

Detached 2 A spines present



FishBase

naucratin *Seriola dumerili*

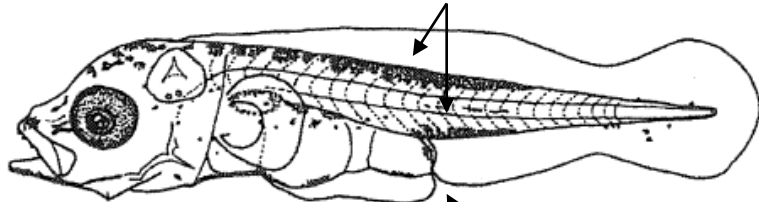
Group 4 (2/4)



D: VI~VII-I, 29~35
 A: II-I, 18~22
 Scutes: 0
 V: 10+14

Body elongate

Melanophores on dorsal and ventral body dark

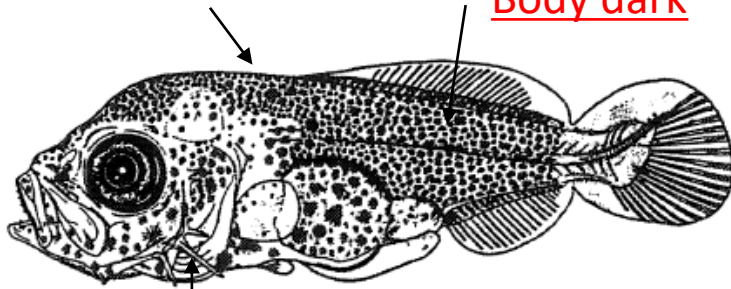


4.62 mm

Anus beyond mid body

Body moderate

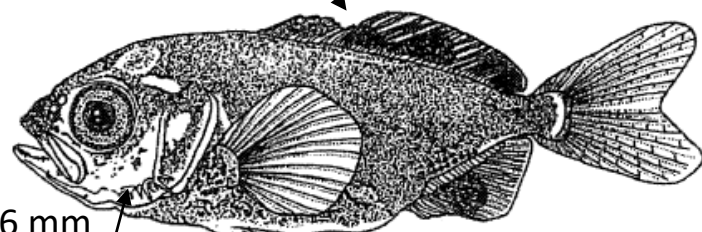
Body dark



6.27 mm

s preop at angle long

Blotches present on dorsal- and anal-fin membranes

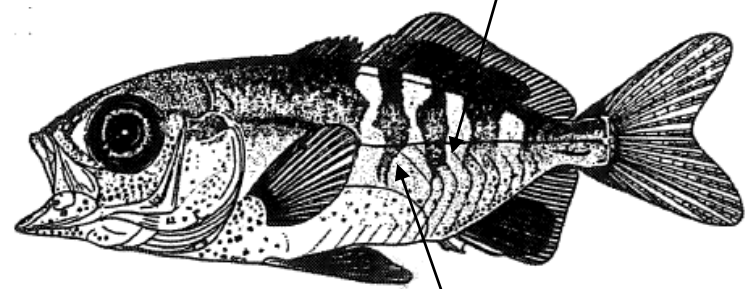


9.6 mm

s preop reduced

Pelvic-fin dark

Body color at fresh gold



19.4 mm


6 pigment bars present on lateral body

* Larvae of *S. dumerili* and *S. rivoliana* are quite similar. Pigment patterns on the D and A fin membranes may differ.



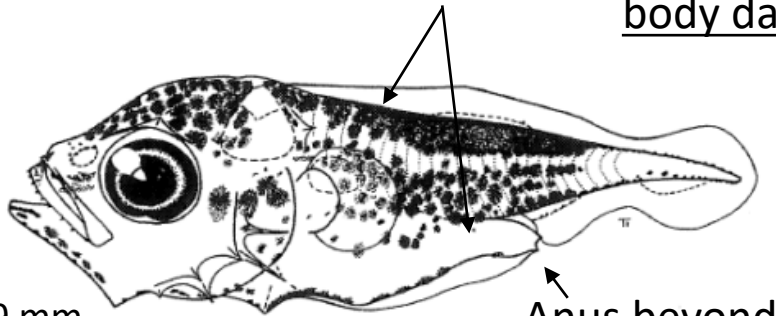
FishBace

naucratin *Seriola rivoliana*

Group 4 (3/4) 

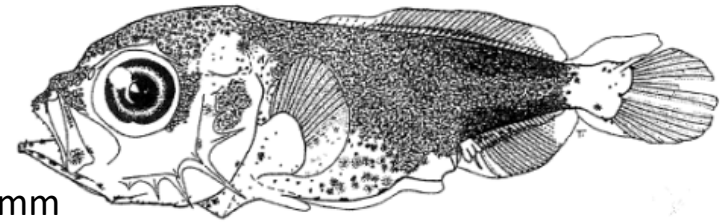
D: VII-I, 26~33
 A: II-I, 18~22
 Scutes: 0
 V: 10+14

Melanophores on dorsal and ventral body dark



3.9 mm

Anus beyond mid body

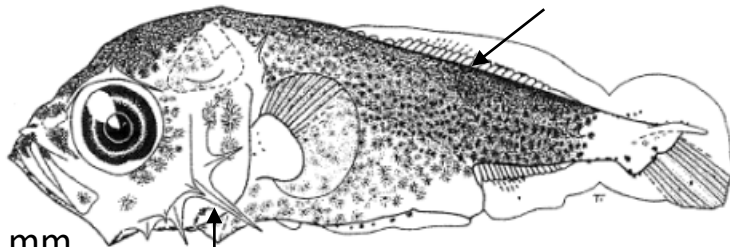


6.5 mm

Blotches present on dorsal- and anal-fin membranes

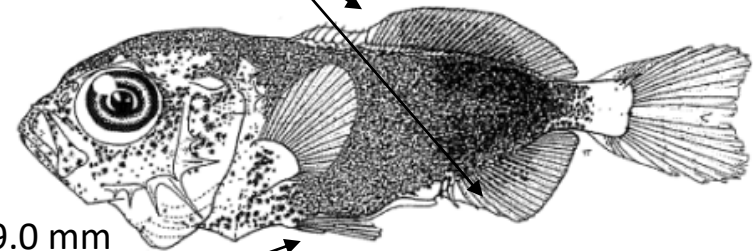
Body color at fresh gold (> 10 mm SL)

Body dark



5.2 mm

s preop at angle long



9.0 mm

Pelvic-fin dark

6 pigment bars present on lateral body later

* Larvae of *S. rivoliana* and *S. dumerili* are quite similar. Pigment patterns on the D and A fin membranes may differ.

Laroche et al. (2006)



naucratin *Seriolina nigrofasciata*

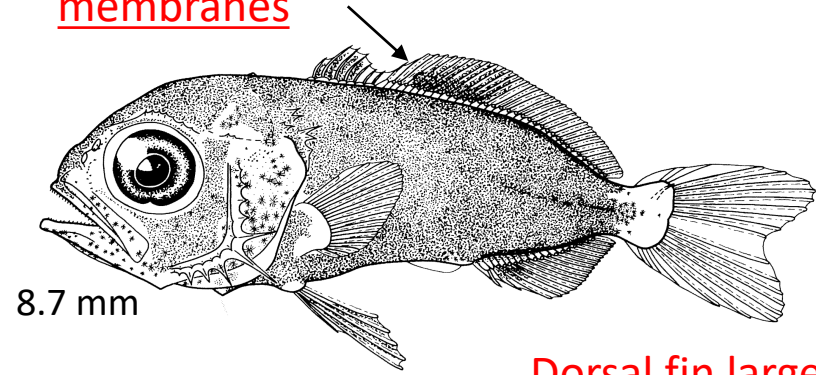
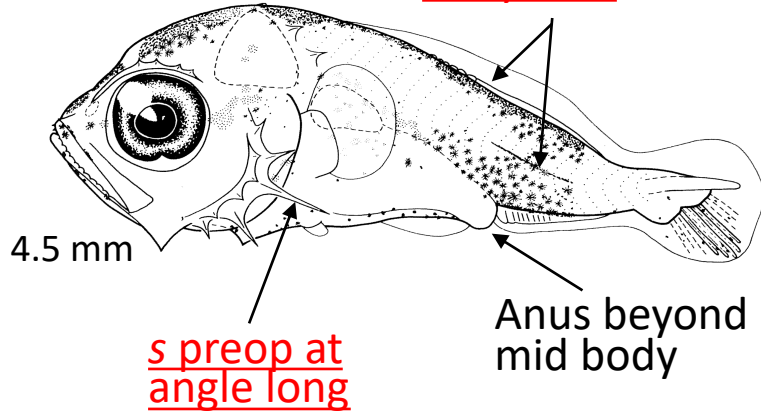
D: V~VIII-I, 30~37
A: (I)-I, 15~18
Scutes: 0
V: 11 + 13

Kimura (2011)

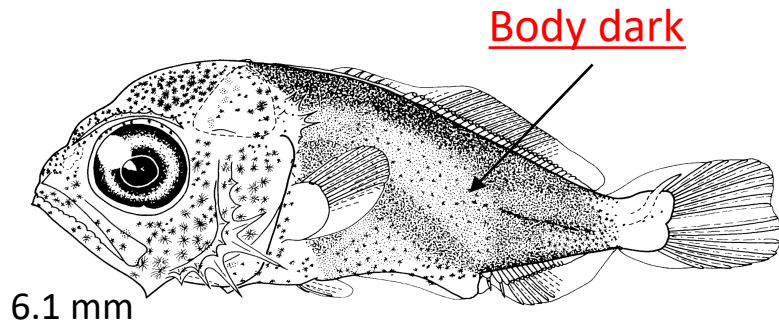
Eye large

Melanophores on dorsal and ventral body dark

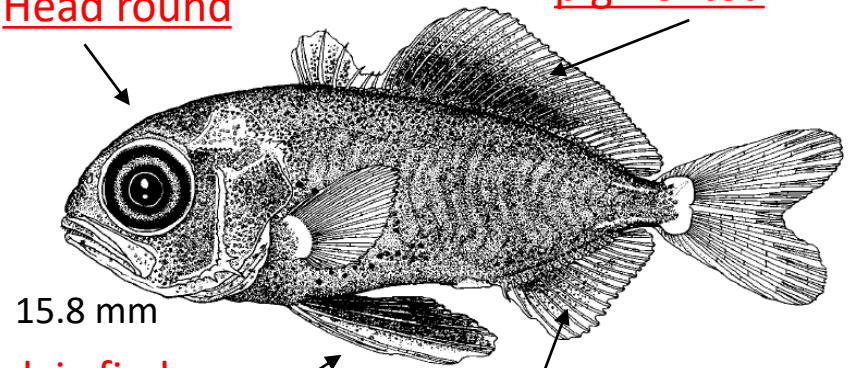
Blotches present on dorsal- and anal-fin membranes



Dorsal fin large and membrane pigmented



Head round



Pelvic fin large and dark

Anal-fin membrane pigmented

Thank you for your attention



Let's take a look
under microscope

