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Occurrence of the Macrourid Alevins Genera *Albatrossia* and *Coryphaenoides* in the Northern North Pacific Ocean

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Abstract Eighteen macrourid fishes at the early life stage were collected by midwater trawls from northern North Pacific waters, between Hokkaido and the coast of Alaska. The specimens, having a discoid pectoral fin supported with a peduncle base, are identified as alevins of *Albatrossia pectoralis*, *Coryphaenoides cinereus*, and *Coryphaenoides* sp. on the basis of the following counts: retia mirabilia and gas glands, first dorsal and pelvic fin rays, and pyloric caeca. Caudal pigmentation patterns in the present alevins facilitate their identification. *Ateleobrachium pterotum* Gilbert et Burke, 1912, known as a macrourid early life stage, is a junior synonym of *Albatrossia pectoralis*.

Recent knowledge and information on macrourid early life histories were summarized by Fahay and Markle (1984) and Merrett (1989). However, these data involved only 23 species (Merrett, 1989) among about 300 species of the family (Iwamoto, 1990), since macrourid eggs and alevins are generally lacking in collections and are poorly known. In the Pacific Ocean, one unidentified egg and alevins or juveniles of six species were reported by the following authors: macrourid egg from off Kodiak Island, Alaska by Kendall and Dunn (1985); *Ateleobrachium pterotum* from off Kamchatka by Gilbert and Burke (1912); since regarded as the early life stage of *Coryphaenoides acrolepis* (Johnsen, 1927); *Mesobius berryi* from the central to eastern North Pacific by Hubbs and Iwamoto (1977); *C. acrolepis*, *C. filifer*, and *C. leptolepis* from off Oregon by Stein (1980); *Hymenocephalus* sp. from southeast of the Ryukyu Islands by Endo et al. (1992).

During the midwater trawl surveys in the northern North Pacific by the T/V Oshoro-maru of Hokkaido University from 1989 to 1992, we obtained eighteen macrourid alevins (Fig. 1). The specimens with discoid pectoral fins are well characterized by six branchiostegal rays, no light organ, and anus just before anal fin origin, which are diagnostics of the following macrourine genera: *Albatrossia*, *Coryphaenoides*, *Cynomacrurus*, and *Macrourus* (Iwamoto, 1990). Because the distributional ranges of the latter two genera are restricted to the Atlantic and the Southern Ocean (Iwamoto, 1990), the alevins apparently belong to the former two genera. Furthermore, on the basis of morphological characters discussed by Merrett (1978, 1986) and Stein (1980), the alevins were identified with *Albatrossia pectoralis*, *Coryphaenoides cinereus*, and *Coryphaenoides* sp., and we describe them here.

The present materials were fixed and preserved in 5% buffered formalin, and are deposited in the larval collection of the Laboratory of Marine Zoology, Faculty of Fisheries, Hokkaido University (HUMZ-L). Methods for making counts and measurements generally follow Stein (1980) and Merrett (1989). Terminology for life history stages follows Merrett (1989).

Albatrossia pectoralis (Gilbert, 1892)
(Fig. 2A, B)

Synonymy of early life history

Ateleobrachium pterotum Gilbert and Burke, 1912: 94 (Holotype by original designation).

Macrurus sp. (*acrolepis* Bean?): Johnsen, 1927: 239.

Coryphaenoides (*Coryphaenoides*) *acrolepis*: Iwamoto and Stein, 1974: 12.

Material examined. HUMZ-L 5283, 5284, 6.6–7.7 mm in head length (HL), 38.9–41.1 mm in total length (TL), 48°39.0′N, 172°53.7′E, 0–400 m, 13 Aug. 1991; HUMZ-L 5534, 12.0 mm HL, 83.0 mm TL, 47°52.7′N, 167°48.5′E, 0–800 m, 13 Aug. 1992; USNM 74398 (holotype of *Ateleo-*

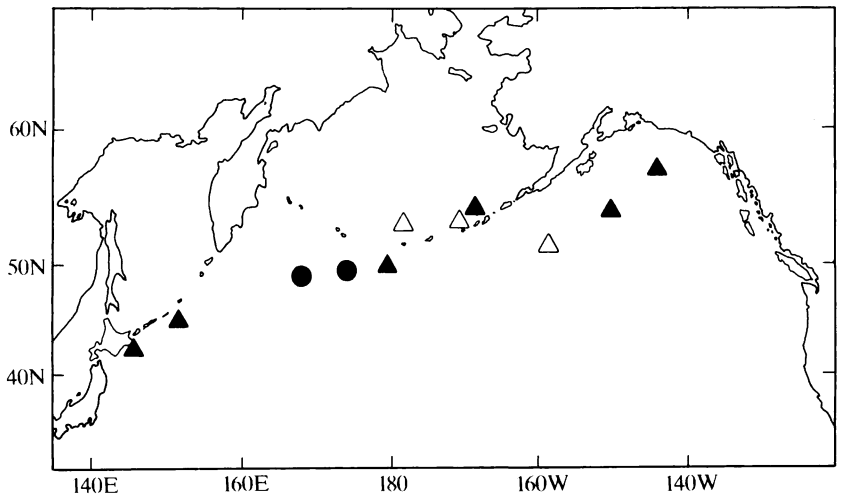

Fig. 1. Sampling localities of the alevins of *Albatrossia pectoralis* (●), *Coryphaenoides cinereus* (▲), and *Coryphaenoides* sp. (△) in the northern North Pacific Ocean.

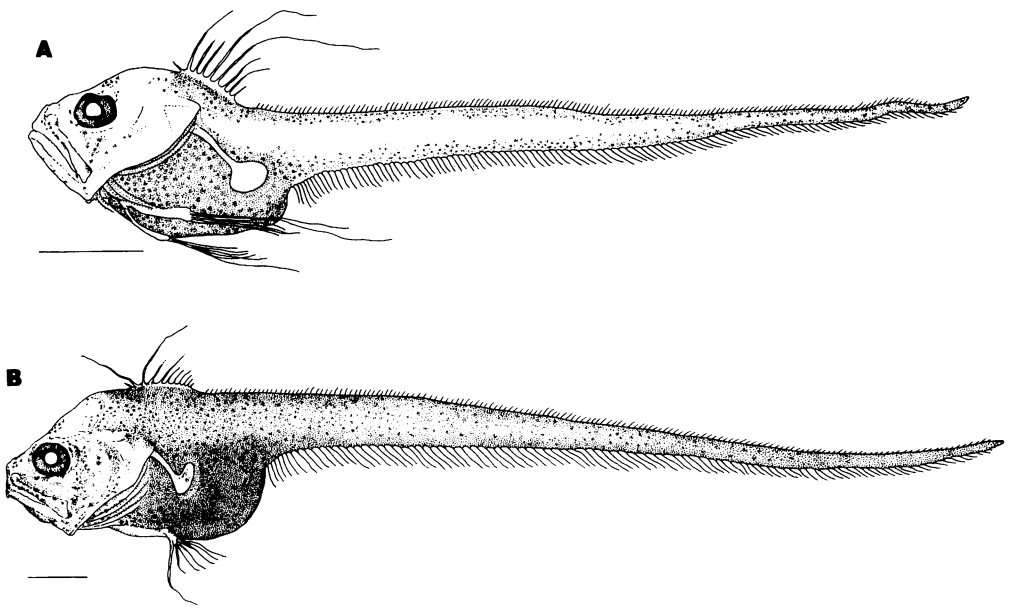

Fig. 2. *Albatrossia pectoralis*, A) HUMZ-L 5283, 7.7 mm HL; B) HUMZ-L 5534, 12.0 mm HL. Scale bars indicate 5 mm.

brachium pterotum), ca. 12 mm HL, 62.4+ mm TL, 52°37.5′N, 158°50.0′E, St. 4797, 0–1248 m, summer of 1906.

Diagnosis. The combination of retia and gas gland 2, pyloric caeca 14, and abdominal vertebrae 13–14. External melanophores present on dorsal and ventral margins of caudal region, sparse laterally, from second dorsal and anal fin origins to distal ends.

Description. Counts and measurements of three HUMZ-L specimens examined shown in Table 1. Gill-rakers on inner side of first arch 2+10=12 (HUMZ-L 5534); branchiostegal rays 6.

Body deep and compressed with a long, strap-like tail. Tail more elongated (head length [HL] ca. 6.9 in total length [TL]) at 12.0 mm TL. Head large, moderately compressed, length about 5.4–6.9 in TL. Eyes large, horizontal diameter about 3.8–4.0 in HL. Snout undeveloped and blunt. A chin barbel undeveloped at 7.7 mm HL, differentiated at 12.0 mm HL. Mouth large and oblique. Teeth in both jaws small, conical, arranged in one or two rows. First gill-slit restricted. Gill-rakers developed and tuberculate in shape; number of gill-rakers still incomplete at 7.7 mm HL, but complete at 12.0 mm HL. All fin rays except pectoral fin complete, first dorsal and pelvic fin rays prolonged. Anal fin much higher than second dorsal fin. No serrations on second spine of first dorsal fin. Pectoral fin discoid in shape with a stalked base; base extremely elongated at 7.7 mm HL; fin diminished in size and base shortened with growth. No light organ on abdomen. Anus immediately before anal fin origin. Vertebrae ossified.

External melanophores heavy on abdominal region, dense on first dorsal fin base, scattered on

Table 1. Counts and measurements in the eighteen alevins of *Albatrossia pectoralis*, *Coryphaenoides cinereus*, and *Coryphaenoides* sp. from the northern North Pacific Ocean

Species	HUMZ-L	HL (mm)	TL (mm)	1stD	P_2	RM	PC	AV
Albatrossia pectoralis								
	5284	6.6	38.9	9	7	2	14	13
	5283	7.7	41.4	9	7	2	—	13
	5534	12.0	83.0	11	7	2	—	14
Coryphaenoides cinereus								
	5279	4.6	23.9	9*	7*	4	6	13
	5281	4.8	25.1	9*	7/8*	—	—	13
	5219	5.0	31.0	10*	7*	4	6	13
	5278	5.0	25.4	10*	7*	—	—	13
	5282	5.7	31.1	9*	7/8*	—	—	13
	5461	5.8	34.1	11*	7/8*	—	6	13
	5462	5.9	30.8	11*	8	—	—	13
	5270	12.8	81.0	13	9	4	7	14
	5269	13.2	76.0	13	9	—	—	13
Coryphaenoides sp.								
	5277	2.5	13.5	0*	5*	—	—	*
	5275	2.8	15.8	0*	6*	—	—	*
	5271	3.2	17.8	7*	6*	—	—	*
	5272	3.5	19.3	8*	6*	4	14	*
	5273	4.2	21.0	8*	6/7*	4	14	14
	5274	5.0	26.1	9*	6/7*	4	14	13

* Incomplete numbers of fin rays or unossified abdominal vertebrae. 1stD, first dorsal fin rays; P_2, pelvic fin rays; AV, abdominal vertebrae; PC, pyloric caeca; RM, retia mirabilia and gas glands. Counts of 1stD include two spinous rays.

Table 2. Meristic characters of 8 macrourine species in the northern North Pacific. Abbreviations follow Table 1. The meristic counts of these species are cited from Okamura (1970), Iwamoto and Stein (1974), Stein (1980), and Endo and Okamura (1992)

Species	1stD	P_2	RM	PC	AV
Albatrossia pectoralis	9–11	6–8	2	12–16	13–14
Corypaenoides acrolepis	11–13	8–9	4	12–14	14–16
C. armatus	10–12	10–12	5–6	10–13	13–15
C. cinereus	12–14 (16)	8–10	4	5–7	13–14
C. filifer	13–16	9–10	4	8–12	—
C. leptolepis	10–12	9–11	6	11	12
C. longifilis	14–16	9–10	4	12	14–15
C. yaquinae	10–12	10–11	6	10–11	13–14

nape, circumorbital region, both jaws, opercular region, and gular region. Internal melanophores appear in caudal region. Pigmentation more extensive at 12.0 mm HL, especially on gular, dorsal and ventral margins, and on midline of body, discoid pectoral fin and pelvic fin base.

Remarks. From the literature, a monotypic *Albatrossia* and seven *Coryphaenoides* species possibly occur in the northern North Pacific (Table 2). *Al. pectoralis* can easily be separated from all the other *Coryphaenoides* species by two retia and gas glands, fewer first dorsal (9–11) and fewer pelvic (6–8) fin rays. Concerning the caudal pigmentation, the present alevins are similar to that of *C. acrolepis* in Stein (1980). In the latter, however, the last 20% of the tail is unpigmented.

Ateleobrachium pterotum, collected from off Kamchatka, was described as a monotypic macrourid species by Gilbert and Burke (1912). Since Johnsen (1927), this larval specimen has been regarded as the synonym of *C. acrolepis* (e.g., Iwamoto and Stein, 1974). Judging from the original description, this specimen clearly belongs to the alevin period, and the holotype examined is characterized by the following counts and features: branchiostegal rays 6; total first dorsal fin rays 10; pelvic fin rays (right) 8; gill-rakers 2+1+9=12; anus just before anal fin origin; no light organ on abdominal region. Because of very poor condition of the type specimen (e.g., tail lost), overall pigmentation except the dark peritoneum had already disappeared. According to the original description, the holotype had the following characters: color dark brown on the back, paler on the sides; black abdomen; barbel present; HL ca. 6.9 in TL. Comparing the adult meristic counts of the northern North Pacific species (Table 2) and their known pigmentation in the early life stages, the above-mentioned characters of *At. pterotum* well agree with those of *Al. pectoralis* alevin. Hence, we regard *At. pterotum* as a junior synonym of *Al. pectoralis* and not of *C. acrolepis*.

Coryphaenoides cinereus (Gilbert, 1895) (Fig. 3A–C)

Material examined. HUMZ-L 5219, 5.0 mm HL, 31.0 mm TL, 42°37.5′N, 144°33.5′E, 0–400 m, 2 Sep. 1989; HUMZ-L 5269,5270, 12.8–13.2 mm HL, 76.0–81.0 mm TL, 49°29.1′N, 179°59.2′E, 0–1000 m, 16 Jun. 1991; HUMZ-L 5278, 5.0 mm HL, 25.4 mm TL, 56°31.8′N, 143°57.6′W, 0–1000 m, 8 July 1991; HUMZ-L 5279, 4.6 mm HL, 23.9 mm TL, 53°47.5′N, 168°54.1′W, 0–1000 m, 4 Aug. 1991; HUMZ-L 5281,5282, 4.8–5.7 mm HL, 25.1–31.1 mm TL, 44°33.0′N, 151°38.7′E, 0–1000 m, 16 Aug. 1991; HUMZ-L 5461,5462, 5.8–5.9 mm HL, 30.8–34.1 mm TL, 53°02.8′N, 152°00.6′W, 0–400 m, 4 July 1990.

Diagnosis. Combination of retia and gas gland 4, pyloric caeca 6–7, and abdominal vertebrae 13–14. External melanophores appear on posterior half of caudal region.

Description. Counts and measurements of nine specimens examined shown in Table 1. Gill-rakers on inner side of first arch 0−1+11−13=11−14 (HUMZ-L 5269, 5270); branchiostegal rays 6.

Body deep and compressed with a long, strap-like tail. First dorsal and pelvic fin rays developed, but incomplete except in larger two specimens (HUMZ-L 5269, 5270). Head large, moderately compressed, HL about 5.1–6.3 in TL. Eyes large, horizontal diameter about 3.2–4.3 in HL. Snout undeveloped and blunt. A chin barbel developed at 13.2 mm HL. Mouth large and oblique. Teeth in both jaws small, conical, arranged in one or two rows. First gill-slit restricted at ca. 13 mm HL. Gill-rakers developed and tuberculate in shape, complete at ca. 13 mm HL. Second dorsal fin membranous and fin rays not differentiated at 4.8 mm HL, completed at 5.8 mm HL. Anal fin much higher than second dorsal fin. No serrations on second spine of first dorsal fin. Discoid pectoral fin with a moderately long stalked base. Metamorphosis of pectoral fin starts at 13.2 mm HL, with fin diminished in size, its stalked base almost disappeared, and a few fin rays differentiated at uppermost margin. No light organ on abdomen. Anus immediately before anal fin origin. Vertebrae ossified.

Pigment heavy on abdominal region, dense on first dorsal fin base, and scattered on nape, circumorbital region, both jaws and opercular region. Melanophores on first dorsal fin base nearly extend to predorsal area at 13.2 mm HL. Gular region slightly pigmented in two specimens (HUMZ-L 5270, 5278). Internal melanophores exist through whole length of caudal region.

Remarks. Among the seven *Coryphaenoides* species (Table 2), *C. cinereus* can only be divided from the remainders by its fewer pyloric caeca (5–7).

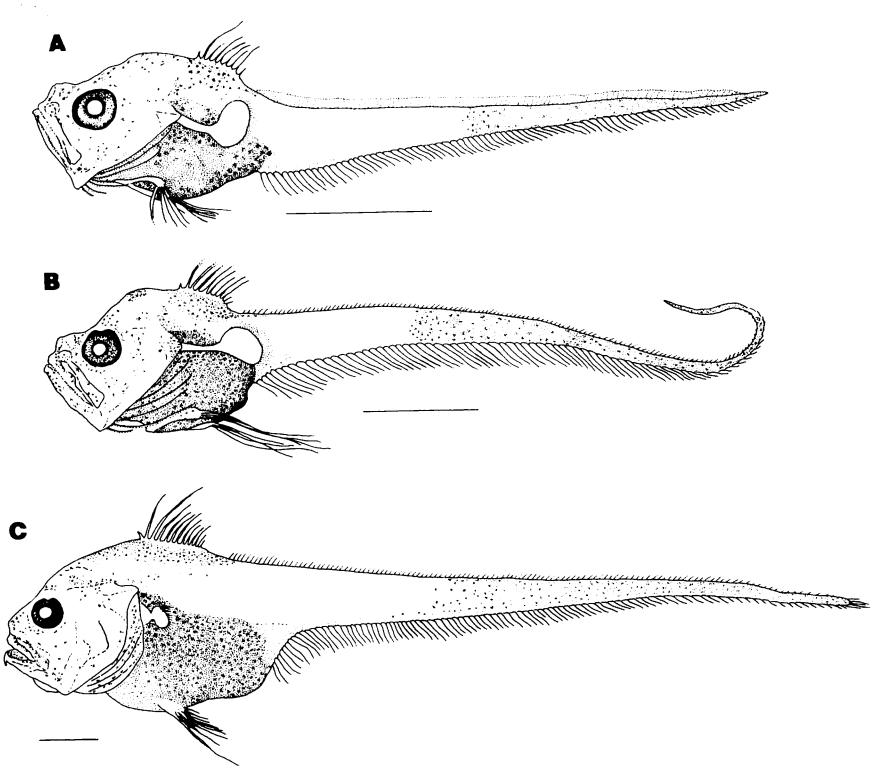

Fig. 3. *Coryphaenoides cinereus*, A) HUMZ-L 5281, 4.8 mm HL; B) HUMZ-L 5461, 5.8 mm HL; C) HUMZ-L 5269, 13.2 mm. Scale bars indicate 5 mm.

Coryphaenoides filamentosus, a closely related species of *C. cinereus*, was only recorded from off Tohoku district, Japan (Okamura, 1970). On the contrary, *C. cinereus* is widely distributed in the northern North Pacific (Iwamoto, 1990). The sampling localities of the present alevins (Fig. 1) falls in the distributional range of *C. cinereus*. Thus, we presently regard the present alevins as *C. cinereus*.

Coryphaenoides sp.
(Fig. 4A–D)

Material examined. HUMZ-L 5271–5274, 3.2–5.0 mm HL, 17.8–26.1 mm TL, 51°20.2′N, 157°57.7′W, 0–1000 m, 1 Jul. 1991; HUMZ-L 5275, 2.8 mm HL, 15.8mm TL, 52°55.8′N, 178°58.6′W, 0–400 m, 18 Jun. 1991; HUMZ-L 5277, 2.5 mm HL, 13.5 mm TL, 52°45.7′N, 171°41.6′W, 0–800 m, 22 Jun. 1991.

Diagnosis. Combination of retia and gas gland 4, pyloric caeca 14, and abdominal vertebrae 13–14. External melanophores appear on middle and distal tip of caudal region.

Description. Counts and measurements of six specimens examined shown in Table 1. Branchiostegal rays 6.

Body compressed with a long, strap-like tail. Head large, moderately compressed, HL about 5.0–5.6 in TL. Eyes large, horizontal diameter about 2.8–3.6 in HL. Snout undeveloped and blunt. Mouth large and oblique. Teeth in both jaws small, conical, arranged in one or two rows. Tubercular gill-rakers differentiated at 4.2 mm HL. All fin rays except pelvic undeveloped, and finfolds present on dorsal and anal margins of caudal region at 2.5 mm HL, first dorsal fin rays differentiated at 3.5 mm HL. Anal fin rays almost start to differentiate at 4.2 mm HL, developed at 5.0 mm HL. Second dorsal fin rays almost differentiated at 5.0 mm HL. Pelvic fin rays considerably extended beyond anal fin origin. Pectoral fin discoid in shape with a long stalked base, and the base considerably elongated beyond anal fin origin at 2.5–

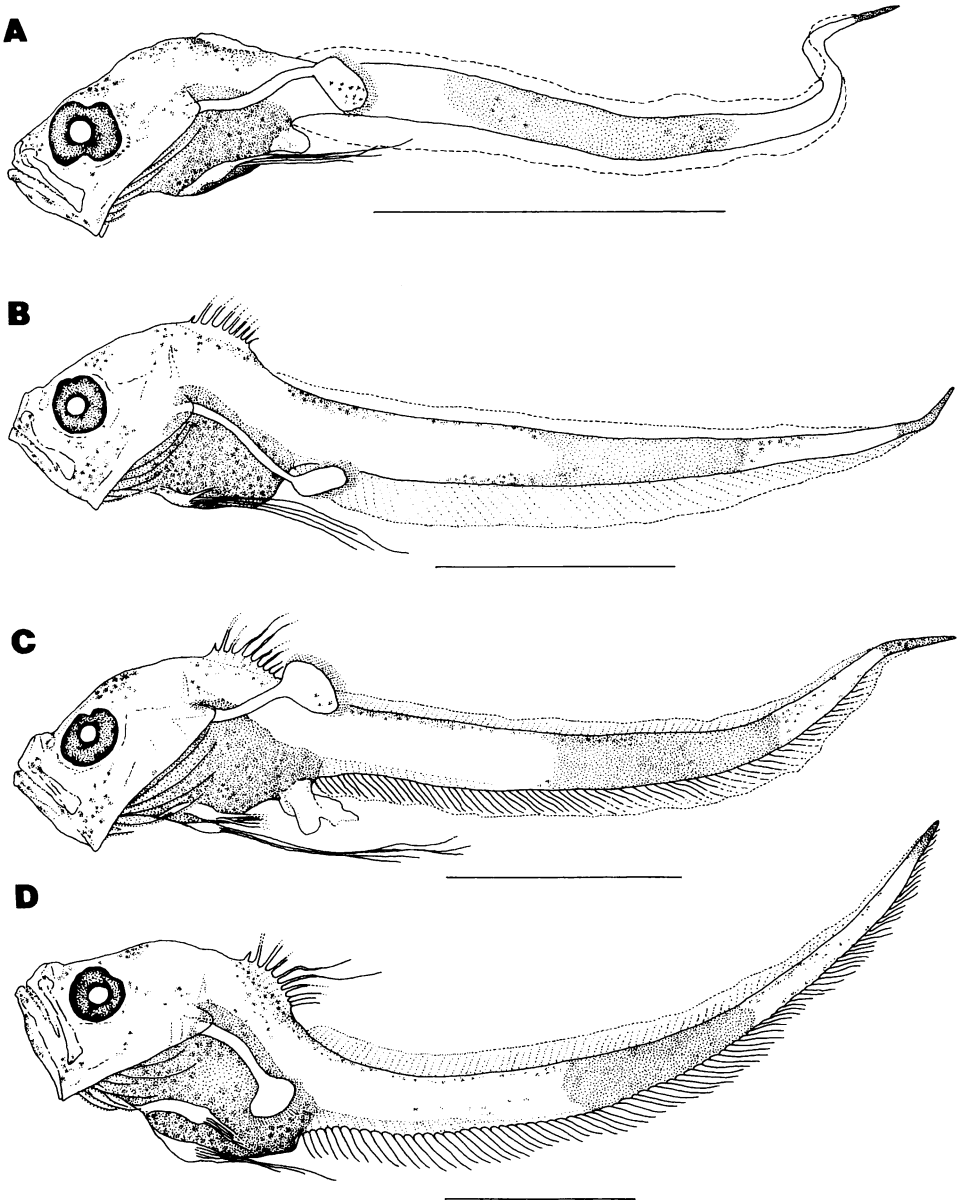

Fig. 4. *Coryphaenoides* sp., A) HUMZ-L 5277, 2.5 mm HL; B) HUMZ-L 5272, 3.5 mm HL; C) HUMZ-L 5273, 4.2 mm HL; D) HUMZ-L 5274, 5.0 mm HL. Scale bars indicate 5 mm.

3.5 mm HL, but slightly shortened at 4.2 mm HL. No light organ on abdomen. Anus immediately before anal fin origin. Vertebrae ossified at 3.5 mm HL.

External melanophores heavily pigmented on abdominal region, densely on first dorsal fin base, scattered on nape, circumorbital region, both jaws, opercular and gular regions, and middle and distal tip on caudal region as bands. At 3.5 mm HL, external melanophores appear on second dorsal and anal fin bases, and internal melanophores appear in anterior caudal region before middle band at 3.5 mm HL. Discoid pectoral fin pigmented in some specimens.

Remarks. In the present alevins, counts of four retia and gas gland, 14 pyloric caeca, and 13–14

abdominal vertebrae are comparatively similar to those of *C. acrolepis* (Table 2). But the present alevins are clearly distinguished from *C. acrolepis* by their caudal pigmentation: middle and distal tip pigmented as against only dorsal and ventral margins except the last 20% pigmented in the latter (Stein, 1980). Hence, we currently regard them as *Coryphaenoides* sp. on the basis of these inconsistencies.

Discussion

The present alevins of three species showed distinctive pigmentation in the caudal region: on dorsal and ventral margins in *Albatrossia pectoralis*; on posterior half in *Coryphaenoides cinereus*; and on middle and distal tip in *Coryphaenoides* sp. For the three *Coryphaenoides* alevins described by Stein (1980), caudal pigmentation appeared in *C. acrolepis*, but not in *C. filifer* or *C. leptolepis*. Thus, the four species are easily separated from *C. filifer* and *C. leptolepis* in the study area by their caudal pigmentation. We predict that these unique pigmentation patterns are a reliable character for identification of the species even at the early alevin period when meristic characters are undeveloped.

Trends in the development of fin rays and other organs vary in each species (Table 1 in Merrett, 1989). The present specimens of *C. cinereus* and *Coryphaenoides* sp. attain their full complements of the first dorsal and pelvic fin rays by >5.9 mm HL and >5.0 mm HL, respectively (Table 1). In North Atlantic species, the full complement of the first dorsal fin rays was present between 3 and 4 mm HL in *Coryphaenoides rupestris*, *Coryphaenoides* (*Lionurus*) sp. A and sp. B, and pelvic fin rays were completed at 2.5–3.0 mm HL in *C. rupestris* and at 2.5 mm HL in both *C.* (*Lionurus*) spp. (Merrett, 1978). Conversely, the full complement of first dorsal and pelvic fin rays in the North Pacific *C. acrolepis* occurred at 3.8 mm HL (Stein, 1980). In comparison with the above-mentioned alevins, the full complement of these fin rays in the present *C. cinereus* and *Coryphaenoides* sp. is apparently delayed.

The number of pyloric caeca is also an important character for identification of early life stages in macrourid species (Stein, 1980). However, the developmental trend of pyloric caeca is poorly known in comparison with other internal characters such as retia and gas gland. We dissected some alevins, and observed their full complement of pyloric caeca in two species; *Al. pectoralis* at 6.6 mm HL and *C. cinereus* at >4.6 mm HL. Even the alevin at 3.5 mm HL in *Coryphaenoides* sp. has 14 pyloric caeca, and this count is over the adult ranges of all reported *Coryphaenoides* species except *C. acrolepis* (Table 2). These data suggest that the pyloric caeca in the known species may be fully developed in the early alevin period.

The size at metamorphosis in macrourids is very poorly known (Merrett, 1989). Among the 23 known macrourid alevins, the size at metamorphosis was apparent only in the following three species; ca. 9 mm HL in *Caelorinchus occa* (Merrett, 1989), ca. 9.5 mm HL in *Coryphaenoides acrolepis*, and ca. 14 mm HL in *Coryphaenoides filifer* (Stein, 1980). For the present alevins of *Coryphaenoides cinereus*, a few pectoral fin rays differentiated at 13.2 mm HL, but not at 12.8 mm HL. Hence, metamorphosis in *C. cinereus* evidently starts at about 13 mm HL. For the other species, this change may occur at larger than 12.0 mm HL in *Al. pectoralis*, but is uncertain for *Coryphaenoides* sp.

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北部北太平洋におけるソコダラ科ムネダラ属とホカケダラ属仔魚の出現

遠藤広光・矢部　衛・尼岡邦夫

北海道沖からアラスカ沿岸沖の北部北太平洋で行われたビームトロール調査により，18個体 (2.5–13.2 mm HL) のソコダラ科 Alevin 期仔魚が採集された．これらの標本は，鰓条骨が6であること，腹部に発光器をもたないこと，肛門が脊鰭始部直前に位置することから，ムネダラ属 *Albatrossia* またはホカケダラ属 *Coryphaenoides* に属する．さらに，これら仔魚は尾部の黒色素胞により3型に分けられ，腹鰭鰭条数，鰾内の血管網数，幽門垂数などの計数形質に基づき，うち2型をムネダラ *Albatrossia pectoralis* とカラフトソコダラ *C. cinereus* の2種に同定した．種が確定できなかった *C.* sp. を含め，3種の Alevin 期仔魚の形態を初めて記載した．なお，Gilbert and Burke (1912) により記載された *Ateleobrachium pterotum* は，これまでイバラヒゲ *C. acrolepis* の仔魚と見なされてきたが，完模式標本を検討した結果ムネダラの新参シノニムであることが判明した．

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