

From the Woods Hole Oceanographic Institution, Woods Hole, Mass.

Ergebnisse der Forschungsreisen des FFS „Walther Herwig“ nach Südamerika

XXIII. Fishes of the Family Nomeidae (Perciformes, Stromateoidei)

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with 7 text figures and 7 tables

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A. Introduction

As one of the most strictly oceanic of the six stromateoid families, the Nomeidae remains among the least well known. There are three genera recognized in the family, one of which, *Nomeus*, is apparently monotypic. The other two genera, *Cubiceps* and *Psenes*, contain each about six species. Most specimens in collections are juveniles, adults being generally unknown. The scarcity of adults may be accounted for either because their size and agility enable them to avoid most nets, or because marked changes in appearance during growth result in their remaining unrecognized.

The consistent use of very large nets by the FFS „Walther Herwig“ in the midwaters of the ocean has resulted in the capture of especially large, and thus valuable, specimens of midwater fishes. During her two cruises to South America in 1966 and 1968, „Walther Herwig“ took 155 specimens in *Cubiceps* and *Psenes* ranging from 24 to 312 mm in standard length; 155 were added during the cruise in 1971. The presence of adults in this collection provides an opportunity to resolve certain questions of identity and to associate the adults with the proper juveniles. The broad latitudinal coverage of the collections, from almost 40° N to almost 40° S, is valuable from a zoogeographic standpoint; the data suggest a zonation of species.

B. Generic distinctions

The differences between *Cubiceps* and *Psenes* are not marked. Maximum depth of the body — less than 35% of the standard length in *Cubiceps* and greater than 40% in *Psenes* — has been an important key character to distinguish the two. While this distinc-

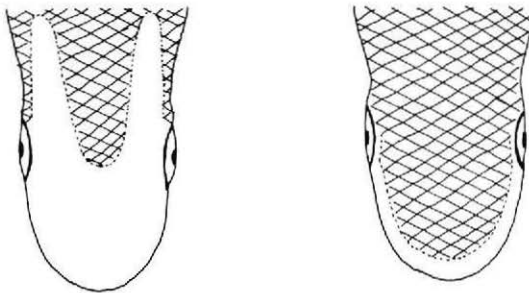


Fig. 1: Head scalation in *Psenes* and *Cubiceps*, diagrammatic view from above.

* dedicated to Dr. G. Krefft on the occasion of his 60th birthday

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Table 1 "Walther Herwig", Cruises 15, 23 and 36. Stations at which Nomeidae were taken.

Station	Position		Date	Time* (GMT)	Depth, m	Temperature, °C		
						At Depth	Surface	200 m
176/66	37 17 N	13 50 W	9— V—66	2230—2345	600—120—0	11.0—14.8	16.7	13.4
177/66	33 45 N	16 00 W	10— V—66	2110—2225	600—160—0	11.6—16.8	18.4	16.3
178/66	31 41 N	17 19 W	11— V—66	2140—2300	500—230—0	12.1	18.9	16.4
179/66	27 30 N	18 48 W	12— V—66	2150—2220	500—100—0	12.6—19.6	20.5	17.1
180a/66	23 50 N	20 08 W	13— V—66	1930—2050	1000—270—0		21.9	16.7
182/66	10 46 N	23 54 W	16— V—66	2205—2320	300—200—0	10.4—11.2	26.0	11.2
183/66	06 30 N	24 33 W	17— V—66	2225—2255	50—0	28.7	28.7	12.5
184/66	06 25 N	24 34 W	17— V—66	2340—0100	320—150—0	13.3	28.7	12.5
186/66	01 24 S	25 58 W	19— V—66	2110—2225	330—170—0	12.4	27.3	12.0
187/66	05 34 S	26 58 W	20— V—66	2155—2315	320—160—0	9.1—15.2	28.0	11.8
189/66	13 31 S	28 09 W	22— V—66	2100—2200	160— 45—0	21.8—26.7	26.7	18.6
193/66	25 27 S	36 56 W	26— V—66	2205—2315	160— 90—0	17.1—22.2	23.8	16.8
195/66	30 24 S	44 55 W	28— V—66	2303—0055	560—155—0	17.5	22.3	16.0
196/66	32 44 S	48 43 W	29— V—66	2310—0045	580— 70—0	11.4—21.7	21.8	20.1
6—II/68	32 31 N	16 54 W	21— I—68	0025—0040	90—0	18.2	18.2	16.8
7—I/68	29 40 N	18 02 W	21— I—68	1950—2005	200—220—0	16.5—15.8	19.0	16.5
7—III/68	29 23 N	18 10 W	22— I—68	0042—0112	2000—0		19.0	16.5
10—II/68	20 10 N	21 40 W	28— I—68	2125—2140	120—140—0	18.8—16.8	20.5	15.3
10—III/68	20 04 N	21 46 W	28— I—68	2240—2310	600—540—0	9.4— 9.5	20.5	15.3
11—II/68	16 11 N	22 24 W	29— I—68	2140—2155	220—240—0	12.2—11.6	21.5	12.5
12—II/68	12 07 N	23 08 W	30— I—68	2235—2305	2000—0		23.9	12.0
13—I/68	08 29 N	24 07 W	31— I—68	2025—2040	140—160—0	12.4—12.0	25.2	11.5
13—II/68	08 21 N	24 10 W	31— I—68	2140—2210	500—520—0	8.3— 8.1	25.2	11.5
18—II/68	06 04 S	26 56 W	4— II—68	2127—2142	220—240—0	11.0—10.4	26.9	12.0
20—II/68	13 53 S	27 37 W	6— II—68	2145—2200	180—200—0	20.1—17.7	26.7	17.7

Table 1 continued

Station	Position		Date	Time* (GMT)	Depth, m	Temperature, °C		
						At Depth	Surface	200 m
26-I/68	29 56 S	42 23 W	12-II-68	2230-2245	32-54-0	22.7-21.5	24.6	17.1
26-II/68	29 58 S	42 27 W	12-II-68	2328-2343	380-400-0	14.0-13.7	24.6	17.1
26-III/68	30 01 S	42 30 W	13-II-68	0040-0110	570-590-0	10.4-10.1	24.6	17.1
29-III/68	35 16 S	49 26 W	16-II-68	0057-0127	540-560-0	11.0-10.5	22.9	17.1
63/68**	30 07 S	47 58 W	27-II-68	0915-0945	520-0	10.6	25.8	17.0
350-I/71	38 39 S	52 09 W	5-III-71	2347-0007	119-0	20.0	22.2	17.5
371-I/71	40 00 S	30 40 W	10-III-71	2120-2135	102-0	15.6	18.4	14.6
406/71	39 19 S	03 15 W	19-III-71	2000-2130	2000-0	2.5	14.8	10.3
412-II/71	37 08 S	05 23 E	21-III-71	1900-2030	2200-0	2.7	16.1	12.2
447-I/71	18 43 S	04 14 W	4-IV-71	1910-1925	82-0	18.0	23.3	14.5
447-II/71	18 39 S	04 16 W	4-IV-71	2010-2025	310-0	11.0	23.3	14.5
451/71	15 45 S	06 06 W	5-IV-71	2050-2150	1900-0	3.2	23.9	13.1
455-I/71	13 12 S	08 58 W	6-IV-71	1934-2020	102-0	18.5	25.3	12.3
463-I/71	08 12 S	14 07 W	8-IV-71	1947-2002	108-0	19.5	27.5	11.0
463-III/71	08 11 S	14 12 W	8-IV-71	2225-2240	640-0	5.9	27.5	11.0
471-I/71	02 30 S	18 55 W	10-IV-71	2018-2033	105-0	13.8	28.5	13.1
471-II/71	02 29 S	18 58 W	10-IV-71	2115-2130	304-0	11.8	28.5	13.1
471-III/71	02 27 S	19 00 W	10-IV-71	2233-2253	657-0	5.2	28.5	13.1
482-III/71	04 38 N	19 41 W	13-IV-71	2312-2327	756-0	5.5	27.4	13.2
486/71	07 32 N	20 54 W	14-IV-71	2040-2140	1300-0	4.3	25.2	12.5
498-I/71	17 22 N	22 58 W	17-IV-71	2055-2110	105-0	15.6	20.4	14.3
498-III/71	17 27 N	22 55 W	17-IV-71	2303-2318	610-0	9.2	20.4	14.3
512/71	32 17 N	16 24 W	22-IV-71	2125-2225	1800-0	5.0	17.1	16.1

* shooting and heaving excluded

** 140'-bottom trawl

tion remains useful for specimens smaller than about 150 mm SL, the present material shows it cannot be relied upon for larger ones. On the other hand, examination of this material has revealed another character which is particularly useful in large specimens. In *Cubiceps*, the top of the head is covered with scales as far forward as the nostrils and out upon the temporal region. In *Psenes*, a fairly narrow band of scales runs forward only as far as the eyes, and the temporal region is naked. Head scalation in *Psenes* is thus much reduced and localized in comparison with *Cubiceps* (Fig. 1). Further distinctions, reinforced by the present material, are the presence of teeth on the tongue in *Cubiceps* and their absence in *Psenes*, and the location of the origin of the dorsal fin over or behind the insertion of the pectoral fin in *Cubiceps* and before the insertion of the pectoral in *Psenes*.

C. Species

The station data where Nomeidae were taken is given in Table 1; the species and their collection numbers are listed in Table 7. All trawls were made with a combined mid-water-bottom net having a rectangular mouth and a 1600-mesh circumference (CMBT 1600). The numbers of the stations at which each species was caught are included in the individual species accounts. Also under each species are a brief description of important characters, comparison with other species, biological observations, distribution, and Atlantic synonyms. Some additional material, mainly from "Walther Herwig" cruise no. 36, was examined in Hamburg during a brief visit there in late 1971, when the present manuscript had been virtually completed. Such material is set off from the rest and marked with an asterisk; in general it was not closely examined, but was identified using the criteria of this paper.

1. *Cubiceps gracilis* Lowe, 1843 (Fig. 2, Table 2)

Material (7 specimens, 42–97 mm SL): stations 176/66, 177/66, and 10–III/68; + 1*, 55 mm, station 177/66. Not included are the remaining 19 specimens from station

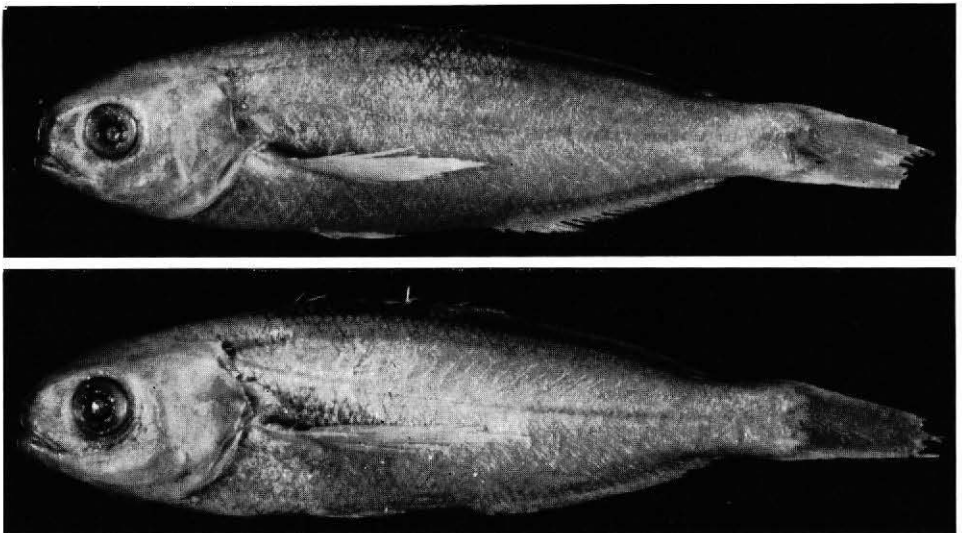


Fig. 2: *Cubiceps gracilis*, two immature specimens 94 and 97 mm SL, "Walther Herwig" station 176/66.

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Table 2 Measurements and counts of *Cubiceps gracilis*

Station	10—III	177	177	177	177	176	176
Standard length, mm	41.7	42.5	76.0	79.5	90.3	94.4	96.5
In percent of SL:							
Head length	32	29	30	30	31	28	31
Pectoral fin length	—	23	32	33	31	30	34
Pelvic fin length	15	15	13	14	13	13	13
Predorsal distance	42	40	34	39	37	38	39
Preanal distance	59	59	61	60	61	61	59
Maximum depth	31	28	26	28	27	27	27
Least depth of caudal peduncle	10	10	09	10	09	10	09
Head length, mm	13.2	12.5	23.0	24.0	27.9	27.6	29.7
In percent of head length:							
Snout	22	24	26	25	24	24	24
Eye diameter	30	30	28	28	25	25	27
Length of upper jaw	24	28	26	26	25	25	26
Interorbital width	30	28	26	29	27	28	28
Dorsal	—	XI,23	XI,23	XI,22	XI,22	XI,23	XI,23
Anal	—	III,21	III,21	III,20	III,21	III,21	III,21
Pectoral	24	22	22	22	22	23	22
Gill rakers	—	—	9+1+16	8+1+16	8+1+16	8+1+17	8+1+17
Lateral line scales	—	—	62?	60	60	60?	60?
Vertebrae	33	33	33	32	33	33	33

177/66, and 6 (of 13) specimens from station 512/71. Additional specimens, which were not preserved, were caught at the stations 178/66 (8), 179/66 (1), 6—II/68 (3), 7—I/68 (1), and 7—III/68 (1). This species resembles the one which follows, *C. caeruleus*, to a remarkable degree. Proportional measurements and counts overlap very largely, only vertebral number providing positive separation. *C. gracilis* almost always has 33 vertebrae (15 precaudal + 18 caudal), but may occasionally have 32 (15 + 17). *C. caeruleus* always has 31 vertebrae (13 + 18). The best character to distinguish the two is the vomerine and glossohyal teeth. In *C. gracilis*, these occur in rather broad knobby patches, resembling tiny cobblestones, whereas in *C. caeruleus* the teeth are pointed and are arranged in a single longitudinal row. Little or no allometric growth occurs between about 40 and 100 mm SL (Table 2). Much larger adults (750 mm SL) have been reported from the Mediterranean (ARIOLA, 1912; TORTONESE, 1959). *C. gracilis* is apparently limited to the northeastern Atlantic and Mediterranean. The northernmost record is from Ireland, and the southernmost is the small specimen from station 10—III. Atlantic synonyms — *Navarchus sulcatus* Filippi and Verany, 1859 (Mediterranean), *Trachelocirrus mediterraneus* DOUMET, 1863 (Sète), *Cubiceps lowei* OSORIO, 1909 (Portinho do Arrabida), and *Aphareus obtusirostris* BORODIN, 1930 (Azores).

2. *Cubiceps caeruleus* Regan, 1914 (Fig. 3, Table 3)

Material (7 specimens, 67—312 mm SL): stations 180a/66, 20—II/68, 26—I/68, 26—III/68 and 29—III/68; + 12*, 35—440 mm, stations 350—I/71, 447—I/71, 447—II/71, 451/71, and 455—I/71. *C. caeruleus* is distinguished from *C. gracilis* by the combination of 31 vertebrae and the single row of sharp-pointed little teeth on the shaft of the vomer and on glossohyoid. *C. caeruleus* seems to have slightly more lateral

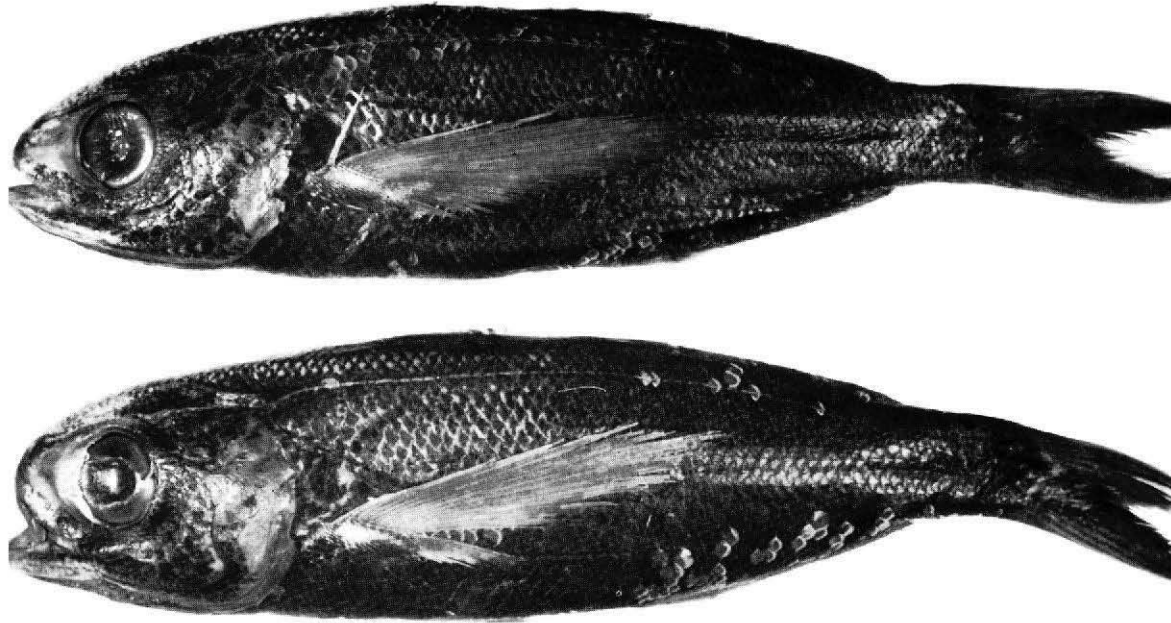


Fig. 3: *Cubiceps caeruleus*, two adults 290 and 312 mm SL, “Walther Herwig” station 29 –III/68.

Table 3 Measurements and counts of *Cubiceps caeruleus*

Station	20–II	180a	26–I	26–III	29–III	29–III
Standard length, mm	67.4	75.0	125.9	135.	290.	312.
In percent of SL:						
Head length	30	30	31	31	31	31
Pectoral fin length	28	28	37	37	40	40
Pelvic fin length	14	13	14	10	11	12
Predorsal distance	38	37	37	38	39	38
Preanal distance	62	61	62	60	62	61
Maximum depth	34	31	29	28	28	28
Least depth of caudal peduncle	10	11	10	10	10	10
Head length, mm	20.1	22.8	39.1	42.0	90.0	95.3
In percent of head length:						
Snout	26	26	32	26	32	32
Eye diameter	30	28	28	30	27	26
Length of upper jaw	27	28	27	29	29	28
Interorbital width	32	29	33	33	32	31
Dorsal	XI,21	XI,22	XI,22	XI,22	XI,22	XI,21
Anal	III,21	III,19	III,21	III,20	III,20	III,20
Pectoral	23	23	22	21	21	20
Gill rakers	—	9+1+18	8+1+17	8+1+17	10+1+18	10+1+18
Lateral line scales	—	—	—	—	—	64
Vertebrae	31	31	31	31	31	31

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line scales, but this count is often difficult to make on these fishes, and is generally unreliable. Allometry in this species does not seem particularly marked (Table 3). The greatest change is in the length of the paired fins, the pectorals becoming relatively longer with growth and the pelvics relatively shorter. Smaller specimens had slightly more pectoral fin rays than larger specimens. The color of the larger specimens in alcohol is very dark brown; the young are somewhat lighter. The two largest specimens (290 and 312 mm SL) are adults, but all others are immature. Maturity may be reached at around 200 mm SL. Originally described from the Tasman Sea and reported here for the first time from the Atlantic, *C. caeruleus* is probably to be found worldwide, except for the northeastern Atlantic where it is replaced by its closely related congener, *C. gracilis*. Specimens heretofore assigned to *C. gracilis* from the western Atlantic (BACKUS et al., 1969: 97) and Japan (ABE, 1955) can be reassigned, on the basis of their teeth, to *C. caeruleus*. No Atlantic synonyms.

3. *Cubiceps capensis* (Smith, 1849)

Material (16* specimens, 137–166 mm SL): stations 371–I/71, 406/71, and 412–II/71. This species has knobby patches of teeth like those of *C. gracilis* on the vomer and tongue. There are 31 vertebrae and 16–18 pectoral finrays (HAEDRICH, 1967). No Atlantic synonyms.

4. *Cubiceps pauciradiatus* Günther, 1872 (Fig. 4, Table 4)

Material (14 specimens, 64–149 mm SL): stations 184/66, 186/66, 187/66, 189/66, 193/66, 196/66, 13–I/68, and 13–II/68; + 121*, 40–160 mm, stations 183/66, 463–I/71, 463–III/71, 471–I/71, 471–II/71, and 471–III/71. 63 specimens of *Cubiceps* caught at station 195/66 but not preserved probably belong to this species. Since, however, the possibility that they represent *C. caeruleus* cannot be fully excluded, they are marked with a question mark in table 7, and also in figure 6. *C. pauciradiatus*

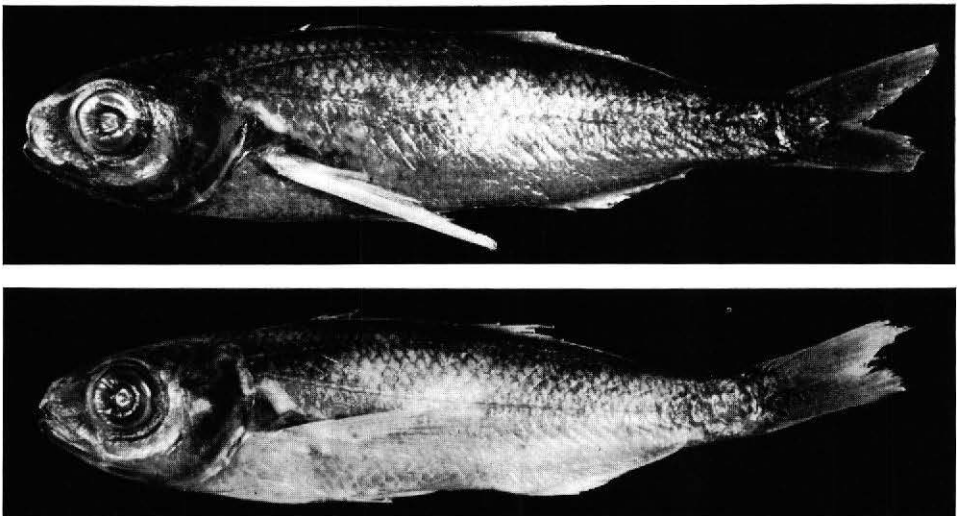


Fig. 4: *Cubiceps pauciradiatus*, two adults 98 and 106 mm SL, “Walther Herwig” station 196/66.

Table 4 Measurements and counts of *Cubiceps pauciradiatus*

Station	184	184	184	187	193	193	196
Standard length, mm	64.5	73.0	78.5	80.5	88.2	94.2	97.8
In percent of SL:							
Head length	29	29	29	30	32	31	30
Pectoral fin length	25	31	28	32	34	36	33
Pelvic fin length	13	14	08	14	12	13	13
Predorsal distance	35	37	37	37	38	38	38
Preanal distance	62	63	61	62	66	65	66
Maximum depth	23	22	24	24	25	25	25
Least depth of caudal peduncle	10	09	10	09	10	10	09
Head length, mm	18.6	21.0	22.8	24.5	28.1	29.5	29.5
In percent of head length:							
Snout	25	27	25	26	26	26	26
Eye diameter	26	29	29	29	33	28	31
Length of upper jaw	24	29	27	26	27	27	24
Interorbital width	30	24	30	31	33	31	31
Dorsal	XI, 17	XI, 17	XI, 17	XI, 18	XII, 18	XI, 17	XII, 18
Anal	II, 15	II, 15	II, 15	II, 16	II, 16	II, 15	II, 15
Pectoral	16	17	17	20	20	19	18
Gill rakers	7+1+16	7+1+16	8+1+16	8+1+16	8+1+16	8+1+16	8+1+18
Lateral line scales	55	55	56	52	—	—	50
Vertebrae	31*	31*	31*	31*	31	31	31
Station	193	196	13-II	13-I	186	189	
Standard length, mm	98.5	105.5	111.2	118.6	133.0	148.5	
In percent of SL:							
Head length	30	29	29	27	30	30	
Pectoral fin length	35	31	—	37	37	36	
Pelvic fin length	13	13	12	12	12	11	
Predorsal distance	39	36	37	36	35	35	
Preanal distance	65	64	63	65	67	65	
Maximum depth	24	24	23	24	24	26	
Least depth of caudal peduncle	09	09	09	10	09	09	
Head length, mm	30.0	31.0	31.8	33.3	40.0	44.5	
In percent of head length:							
Snout	30	29	29	27	26	29	
Eye diameter	31	29	29	29	32	30	
Length of upper jaw	27	28	28	28	25	25	
Interorbital width	33	33	29	30	30	35	
Dorsal	XII, 17	XII, 17	XI, 16	XI, 16	XI, 17	II, 18	
Anal	II, 14	II, 15	II, 15	II, 15	II, 15	II, 16	
Pectoral	18	18	16	18	18	20	
Gill rakers	8+1+17	8+1+16	+1+17	9+1+18	8+1+15	8+1+16	
Lateral line scales	48?	51	52	56	50	56	
Vertebrae	31	31	31*	31*	31	31	

*) Apparently 13+18, and thus perhaps *Cubiceps athenae*, all others apparently 14+17.

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belongs to the species group for which NICHOLS and MURPHY (1944) erected the subgenus *Mandelichthys*. Species in this group are generally small, and are distinguished from the larger members of the *gracilis-caeruleus* group by the greatly expanded coracoid, which forms a bony keel on the breast, by having only two anal spines, and by having the pelvic insertion well behind the end of the pectoral fin base. Second dorsal and anal finrays number each less than 20. Five nominal species are known, and these differ but little from one to another (HAEDRICH, 1965). One distinction between *C. pauciradiatus*, known previously only from Central and Western Pacific, and *C. athenae* HAEDRICH 1965, the only *Mandelichthys* species previously known from the Atlantic, is the number of vertebrae. Both have 31, but the count seems to be 14 precaudal + 17 caudal in *C. pauciradiatus* and 13 + 18 in *C. athenae*. It is admittedly very difficult to make this distinction from even the best of radiographs, but it did appear that the “Walther Herwig” material contained specimens with both counts; otherwise there seemed to be no differences between them. The specimens with 14 + 17 vertebrae are definitely *C. pauciradiatus*. The specimens with 13 + 18 remain a problem. They occur in the more northerly stations (184/66, 187/66 and 13/68) where *C. athenae*, which is known so far only from the Gulf of Mexico, Caribbean, and New York Bight area, might be expected. These problematical specimens have been tentatively included here in *C. pauciradiatus* (vertebral counts marked with an asterisk in Table 4), but further study of specimens from intervening areas is needed to resolve the question of identity and of the validity of *C. athenae*. As in the previous species, allometry is not pronounced (Table 4). Specimens larger than 100 mm SL were mature. *C. pauciradiatus*, reported here for the first time from the Atlantic, may be world wide in its distribution. It is known for sure from the Central and Western Pacific Ocean, and is probably synonymous with *C. longimanus* FOWLER, 1934 from the western Indian Ocean. As suggested above, *C. athenae* HAEDRICH, 1965 may be an Atlantic synonym.

5. *Psenes pellucidus* Lütken, 1880

Material (one specimen, 33 mm SL): station 10—III; + 11*, 55—195 mm, stations 498—I/71 and 498—III/71. This small specimen of *P. pellucidus* is clearly recognizable by the deep body (52% SL), 30 second dorsal and 30 anal finrays, 41 vertebrae, and long knifelike teeth in the lower jaw. It resembles no other *Psenes*. LÜTKEN'S figure (1880: 516) of a small specimen is excellent. With growth, the body becomes quite slender (depth = 17% SL in a 420-mm specimen) and the bold spotted color pattern gives way to a sombre brown or deep blue. *P. pellucidus* occurs in all oceans. Atlantic synonyms are *Psenes edwardsii* EIGENMANN, 1902 (off Rhode Island), *Cubiceps ismaelensis* DIEUZEIDE and ROLAND, 1955 (Algeria), and *Cubiceps niger* DA FRANCA, 1957 (Angola).

6. *Psenes arafurensis* Günther, 1889 (Fig. 5, Table 5)

Material (6 specimens, 23—201 mm SL): stations 182/66, 11—II/68, 12—II/68 (not meas.) and 13—II/68; + 3*, 19—75 mm, stations 482—III/71, 486/71, and 498—III/71. Knifelike teeth in the lower jaw, 31 vertebrae, and more anal finrays than second dorsal finrays serve to distinguish *P. arafurensis*. It most resembles *P. maculatus* LÜTKEN, 1880, an Atlantic species not represented in the “Walther Herwig” collections, but *P. maculatus* has 33—35 vertebrae and the number of anal finrays never exceeds the number of second dorsal finrays. Allometry in *P. arafurensis* follows the usual pattern in stromateoids, with the relative length of the pectoral fin increasing and the relative length of the head, pelvic fin, preanal distance, and, particularly, maximum depth

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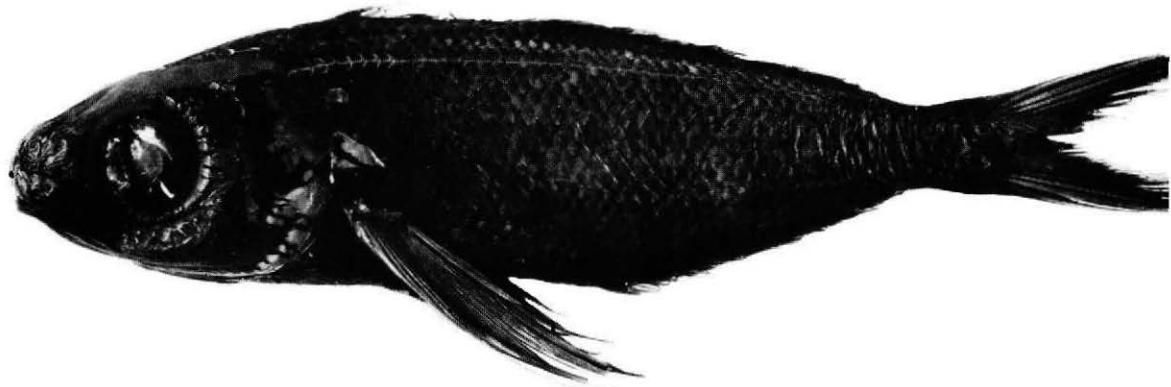
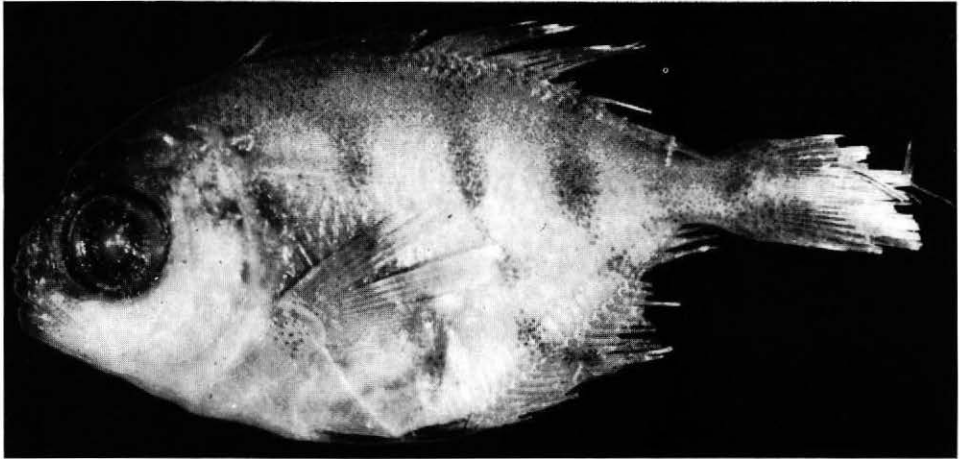


Fig. 5: *Psenes arafurensis*, juvenile (above) 30 mm SL and adult (below) 201 mm SL, "Walther Herwig" station 13—II/68.

decreasing with growth (Table 5). Color change is dramatic. The young are light-colored, silvery to pale tan, with brown spots, but the adult, collected for the first time by the "Walther Herwig", is uniformly dark, almost black. *P. arafurensis* is known from all oceans, where it tends to be tropical. An Atlantic synonym is *Psenes benardi* ROSSIGNOL and BLACHE, 1961 (Gulf of Guinea).

7. *Psenes cyanophrys* Cuvier and Valenciennes, 1833 (Table 6)

Material (two specimens, 39—140 mm SL): station 18—II/68 and 63/68. *P. cyanophrys* has 24—28 second dorsal and anal finrays, fine dark longitudinal streaks on the sides, and small pointed teeth in both jaws. It resembles no other *Psenes*. Allometry is again pronounced (Table 6); of interest is the fact that the predorsal distance, preanal distance, and maximum depth all continue to relatively increase with growth. But whether this trend continues in the adult cannot be said, for the 140-mm specimen, one of the largest known, is still immature. *P. cyanophrys* is widespread in all oceans. Atlantic synonyms are *Psenes chapmani* FOWLER, 1906 (Cape Verdes) and *Psenes rotundus* SMITH, 1949 (South Africa).

230229

Table 5 Measurements and counts of *Psenes arafurensis*

Station	11—II	182	13—II	182	13—II
Standard length, mm	23.0	23.8	29.9	33.2	201.
In percent of SL:					
Head length	40	39	35	37	35
Pectoral fin length	28	31	29	32	37
Pelvic fin length	26	23	23	24	11
Predorsal distance	41	44	40	40	38
Preanal distance	62	64	56	57	55
Maximum depth	54	55	51	50	28
Least depth of caudal peduncle	09	10	09	10	08
Head length, mm	9.2	9.2	10.6	12.3	69.8
In percent of head length:					
Snout	20	22	26	24	31
Eye diameter	39	43	41	37	28
Length of upper jaw	35	37	34	34	30
Interorbital width	33	38	—	28	31
Dorsal	XI,21	XI,21	XI,21	XI,21	XI,21
Anal	III,22	III,22	III,23	III,22	III,22
Pectoral	20	20	19	20	20
Gill rakers	—	—	—	—	9+1+18
Lateral line scales	—	—	—	—	55
Vertebrae	31	31	31	31	31

Table 6 Measurements and Counts of *Psenes cyanophrys*

Station	18—II	63
Standard length, mm	39.2	140.0
In percent of SL:		
Head length	28	33
Pectoral fin length	20	37
Pelvic fin length	17	15
Predorsal distance	31	40
Preanal distance	43	62
Maximum depth	40	55
Least depth of caudal peduncle	08	11
Head length, mm	10.9	46.0
In percent of head length:		
Snout	28	32
Eye diameter	33	23
Length of upper jaw	34	30
Interorbital width	—	40
Dorsal	X,26	X,27
Anal	III,26	III,26
Pectoral	19	17
Gill rakers	—	10+1+19
Lateral line scales	—	60
Vertebrae	31	31

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D. Distribution

The distributions of the species in *Cubiceps* (Fig. 6) and *Psenes* (Fig. 7) fall within fairly discrete latitudinal zones. Interpretation of the zoogeography is aided by considering the "Walther Herwig" data, along with the few other known records, in terms of the distribution patterns proposed by BACKUS *et al.* (1970). *Cubiceps gracilis* falls into one of the restricted northern patterns. Like *Gonostoma denudatum*, *Diaphus holti*, and *Argyropelecus olfersi* (BACKUS *et al.*, 1970) it is restricted to the northeastern Atlantic and Mediterranean. *C. capensis* may be an equivalent of *C. gracilis* in the

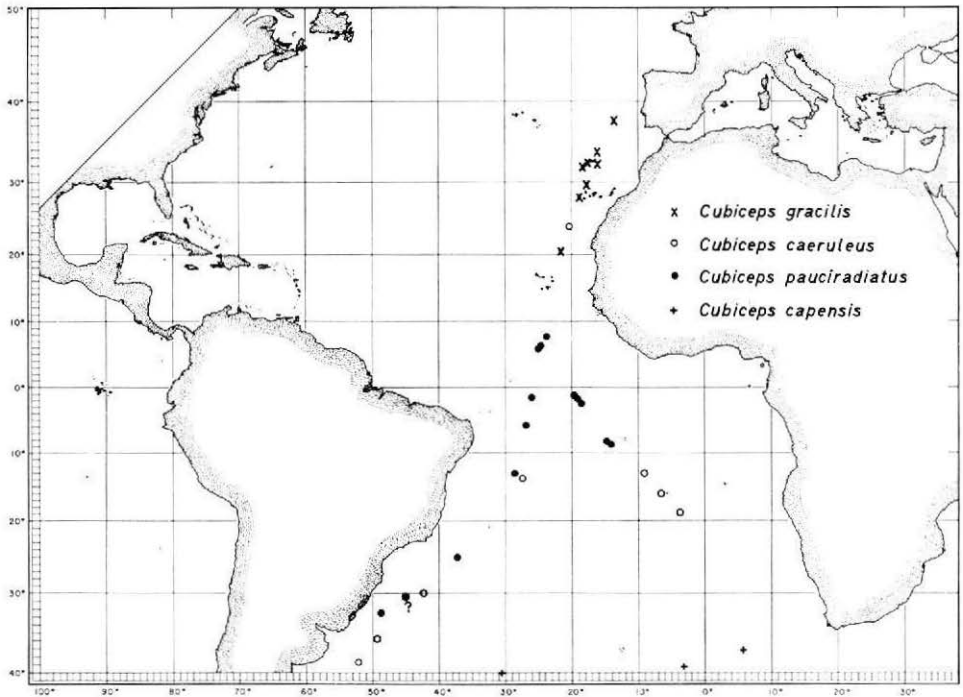


Fig. 6: Distribution of the species in *Cubiceps* taken by "Walther Herwig".

Southern Hemisphere; it was only taken south of the subtropical Convergence. *C. caeruleus* is probably broadly tropical, like *Ceratoscopelus warmingi*. Small specimens are not uncommon in the Sargasso Sea, and a large one has been found in the stomach of a swordfish (*Xiphias*) taken off southern New England (HAEDRICH, unpub.). None are known from the Caribbean and Gulf of Mexico, however, nor were any captured by "Walther Herwig" in the strictly tropical eastern Atlantic; anti-tropicality cannot be ruled out. Until the *pauciradiatus-athenae* species problem is resolved, *C. pauciradiatus* cannot be assigned a pattern. If both are synonymous, it is tropical; if not, it is, like *Diaphus vanhoeffeni* and *Chauliodus schmidti*, Guinean.

Psenes arafurensis is a tropical species, like *Gonostoma atlanticum*. It is known from the Gulf of Guinea (ROSSIGNOL and BLACHE, 1961) and is not uncommon in the Caribbean and Gulf of Mexico, but does not occur in the Sargasso Sea. *P. pellucidus* is probably anti-tropical. In the eastern North Atlantic it is known from the "Walther Herwig"

250229

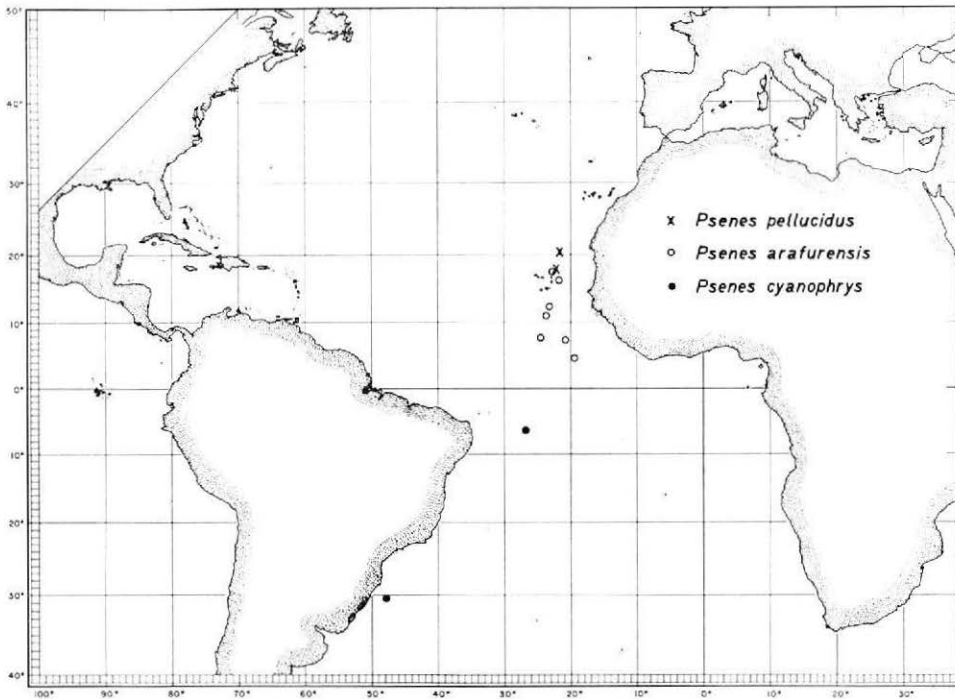


Fig. 7: Distribution of the species in *Psenes* taken by "Walther Herwig".

records and from Algeria (DIEUZEIDE and ROLAND, 1955). It occurs in the western North Atlantic in the Sargasso Sea and Slope Water, but apparently not in the Caribbean or Gulf of Mexico. Such a distribution might well be an amended version of the Sargasso Sea pattern (BACKUS et al., 1970). *P. pellucidus* is known only from Angola (DA FRANCA, 1957) in the South Atlantic. Only two specimens of *P. cyanophrys* were taken by "Walther Herwig". This wide-ranging species (HAEDRICH, 1967) is not often taken far at sea, and may be more of a coastal fish than are its congeners.

E. Summary

Midwater trawling by FFS "Walther Herwig" from 40° N to 40° S in the Atlantic Ocean during 1966, 1968, and 1971 captured 310 specimens divided among 7 species in the genera *Cubiceps* and *Psenes* (Stromateoidei, Nomeidae). The largest specimens reveal that, due to allometric growth, maximum depth of the body cannot be used to differentiate between the two genera in specimens larger than 150 mm SL, but the markedly reduced head scalation in *Psenes* can. The distribution of the individual species is zoned with respect to latitude. *Cubiceps gracilis*, a species with knobby teeth on the vomer and tongue and 32–33 vertebrae, occurs only in the north-eastern Atlantic and Mediterranean. To the south, it is replaced by the broadly tropical *C. caeruleus*, a species with a single row of pointed teeth on the vomer and tongue and 31 vertebrae. *C. capensis*, with knobby teeth and 31 vertebrae, occurs south of the Subtropical Convergence. The distribution of *C. pauciradiatus*, a diminutive species with 16–18 second dorsal and anal finrays, is either tropical or Guinean. *Psenes arafurensis*, with knife-like teeth in the lower jaw, 31 vertebrae, and more anal than dorsal finrays, is tropical. *P. pellucidus*, with knife-like teeth in the lower jaw, 30 dorsal and anal finrays and 41 vertebrae, replaces *P. ara-*

290229

fulvensis to the north and south; it may be anti-tropical. Only two specimens of *P. cyanophrys* were taken; this deep-bodied horizontally striped species, though widely distributed, is probably more coastal than its oceanic congeners.

F. Zusammenfassung

Schwimmschleppnetzänge des FFS „Walther Herwig“ im Atlantik zwischen etwa 40° Nord- und 40° Südbreite während der Südamerikareisen 1966, 1968 und 1971 umfassen 310 Nomeiden, die sich auf 7 Arten der Gattungen *Cubiceps* und *Psenes* verteilen.

Die größten Exemplare zeigen, daß infolge allometrischen Wachstums die maximale Körperhöhe nicht mehr als Gattungsunterschied benutzt werden kann, wenn die Tiere größer als 150 mm SL werden. Dafür erwies sich die merklich reduzierte Kopfbeschuppung bei *Psenes* als gutes Gattungsmerkmal. Die Verbreitung der einzelnen Arten zeigt eine latitudinale Zonierung. *Cubiceps gracilis*, eine Art mit pflastersteinartigen Zähnen auf Vomer und Zunge sowie mit 32–33 Wirbeln, kommt nur im Nordostatlantik und Mittelmeer vor. Zum Süden hin wird diese Art durch die tropische (s. 1.) *C. caeruleus* ersetzt, eine Art mit einer einzigen Reihe spitzer Zähne auf Vomer und Zunge sowie mit 31 Wirbeln. *C. capensis*, mit Pflasterzähnen und 31 Wirbeln tritt südlich der Subtropischen Konvergenz auf. Die Verbreitung von *C. pauciradiatus*, einer Zwergart mit 16–18 Strahlen in der zweiten Dorsalis und Anals, ist entweder tropisch oder guineisch. *Psenes arafurensis*, mit messerförmigen Zähnen im Unterkiefer, 31 Wirbeln und mehr Anal- als Dorsalstrahlen, ist tropisch. *P. pellucidus*, mit messerförmigen Unterkieferzähnen, 30 Dorsal- und Analstrahlen sowie 41 Wirbeln, ersetzt *P. arafurensis* im Norden und Süden; diese Art mag antitropisch genannt werden. Nur zwei Exemplare von *P. cyanophrys* wurden gefangen. Diese hochrückige, längsgestreifte Art ist trotz weiter Verbreitung wahrscheinlich mehr an die Küsten gebunden als ihre ozeanischen Gattungsgenossen.

Die Fänge von *Cubiceps caeruleus* und *C. pauciradiatus* stellen Erstnachweise für das Vorkommen beider Arten im Atlantik dar, das abgebildete große Exemplar von *Psenes arafurensis* (ISH717/68) ist das erste bekanntgewordene adulte Tier seiner Art.

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Table 7 Nomeidae collected by FFS "Walther Herwig" during Cruises 15, 23 and 36

Species	Collection No.	Station No.	Number of Specimens	
	ISH		captured	preserved
<i>Cubiceps gracilis</i>	58/66	176/66	2	2
	117/66	177/66	24	24
	—	178/66	8	—
	—	179/66	1	—
	—	6-II/68	3	—
	—	7-I/68	1	—
	—	7-III/68	1	—
	451/68	10-III/68	1	1
	3045/71	512/71	13	6

290229

Table 7

Species	Collection No. ISH	Station No.	Number of Specimens captured preserved	
<i>Cubiceps caeruleus</i>	1722/66	180a/66	1	1
	1121/68	20—II/68	1	1
	1391/68	26—I/68	1	1
	1449/68	26—III/68	1	1
	1655/68	29—III/68	3	2
	455/71	350—I/71	2	2
	1714/71	447—I/71	5	5
	1729/71	447—II/71	1	1
	1821/71	451/71	3	3
	1832/71	455—I/71	1	1
<i>Cubiceps capensis</i>	764/71	371—I/71	13	5, 4 USNM, 4 ZMUC
	1090/71	406/71	2	2
	1200/71	412—II/71	1	1
<i>Cubiceps pauciradiatus</i>	1720/66	183/66	21	21
	491/66	184/66	3	3
	613/66	186/66	1	1
	654/66	187/66	1	1
	707/66	189/66	1	1
	821/66	193/66	3	3
	—	195/66	63*)	—
	933/66	196/66	3	3
	681/68	13—I/68	1	1
	716/68	13—II/68	1	1
	1970/71	463—I/71	1	1
	2054/71	463—III/71	44	10
	2149/71	471—I/71	3	3
	2186/71	471—II/71	46	10, 5 USNM, 5 ZMUC
	2243/71	471—III/71	6	2
<i>Psenes pellucidus</i>	452/68	10—III/68	1	1
	2769/71	498—I/71	10	5, 2 USNM, 2 ZMUC
	—	498—III/71	1	1 ZMUC
<i>Psenes arafurensis</i>	392/66	182/66	2	2
	505/68	11—II/68	1	1
	649/68	12—II/68	1	1
	717/68	13—II/68	2	2
	2475/71	482—III/71	1	1
	2550/71	486/71	1	1
	1761/71	498—III/71	1	1
<i>Psenes cyanophrys</i>	1006/68	18—II/68	1	1
	1794/68	63/68	1	1

*) unidentified, possibly *C. caeruleus*.

280229

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290229