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A contribution to the knowledge of the ichthyofauna of the Adriatic Sea: *Arnoglossus imperialis* (Rafinesque, 1810) (Heterosomata, Bothidae) a new species in the Adriatic Sea

Prilog poznavanju ihtiofaune Jadranskog mora: *Arnoglossus imperialis* (Rafinesque, 1810) (Heterosomata, Bothidae) nova vrsta Jadranskog mora

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Presence of the species *Arnoglossus imperialis* (Rafinesque, 1810) in the Adriatic has been doubtful. Zei and Sabioncello (1940) reported 22 specimens recorded from trawl catches in the channel area of the middle Adriatic in 1939 and 1940. Later, however, Zei (1949) refering to his earlier paper (op. cit.) stated that the presence of *Arnoglossus imperialis* was not established with certainty since the determination was made on specimens of which all were females, material was analyzed on board and they had no time enongh for a proper identification. Regretfully, they preserved no individual. This author, however, kept this species in his checklist of species but leaving the question of its presence in the Adriatic open. Šoljan (1948—75) took no account at all of this ealier potential finding of *Arnoglossus imperialis* in the Adriatic in his checklist (key for determination) of the Adriatic fishes neither with doubt like he did with a series of other species such as *Arnoglossus kessleri* Schmidt, 1915.

Up to now, five species and subspecies of Bothidae family have been recorded from the Adriatic; in addition to relatively rare subspecies *Bothus podas podas* (Delaroche, 1809) there have been reported four species of genus *Arnoglossus: A. laterna* (Walbaum, 1792), *A. kessleri* Schmidt, 1915 (rare species), *A. rueppelli* (Cocco, 1844) and *A. thori* Kyle, 1913. With the species *A. imperialis,* the presence of which has here been established for the first time with certainty and evidenced in the Adriatic, family Bothidae includes 6 species and subspecies and genus *Arnoglossus* 5 species. At the same time the figure of 399 fish species and subspecies *(sensu lato)* recorded from the Adriatic (Jardas, 1985) has increased to 400. With the finding of species

A. imperialis the Adriatic ichthyofauna includes all the species of genus *Arnoglossus* present in the Mediterranean and eastern Atlantic (Nielsen, 1979).

Arnoglossus imperialis was found among the preserved fishes of the collection at the Institute of Oceanography and Fisheries in Split in 1986. Three adult male specimens were found of total lengths 118.5, 138.0 and 141.0 mm (Fig. 1). It is only known that they were caught near the small

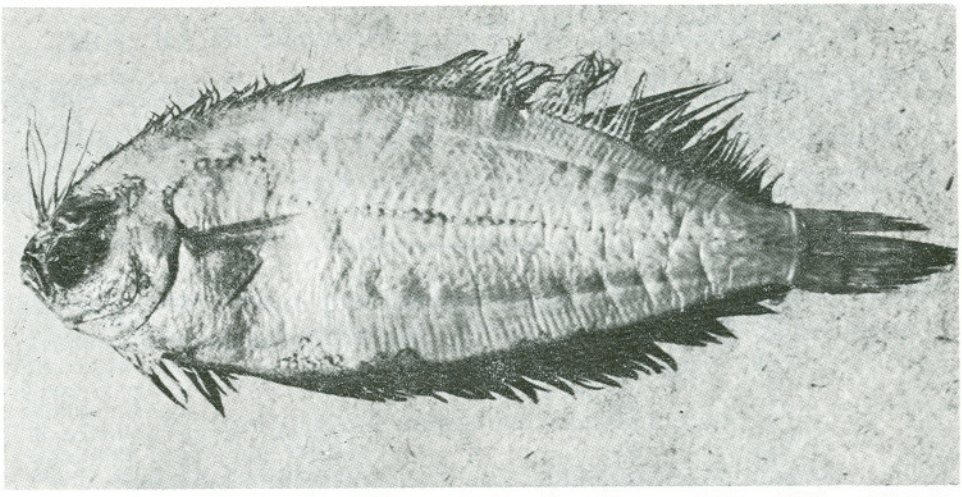

Fig. 1. *Arnoglossus imperialis* (Raf.), ♂, 141 mm LT, middle Adriatic.

island Brusnik (west of the Vis Island in the middle Adriatic). No other data on the place of the finding are known such as depth, bottom substratum. Presumably they were caught by a trammel net since this gear was exclusively used in that area at that time, lowered to maximum 40 m depth. This assumption is supported by the data on vertical distribution of this species (Bini, 1968) after whom this species inhabits the depths between 80 and 350 m but in winter (when our specimens were caught) they can reach the shallower waters of not more than several tenths of meters. This agrees well with the depths to which trammel nets are operated. After the same author this species occurs at muddy bottoms in deeper waters and sandy-muddy bottoms in shallower waters.

As to the depth the data given by Klimaj and Rutkowicz (1970) are of considerable interest since they reported these fish to inhabit the depths of 10 to 100 m prevalently in coastal waters. Some other authors, however, (Dieuzeide *et al.*, 1955; Tortonese, 1975) reported the same depths as Bini.

After Nielsen (1979) *Arnoglossus imperialis* are distributed in the western Mediterranean and eastern Atlantic, that is from Scotland accros the Azores to Angola where he considered them as frequent fish. Sanches (1966) reported these fish as frequent for the area of Angola. Torchio (1961) fonud these fish to be distributed in the central and western Mediter-

ranean (pointing out that they were not recorded eastwardly from the Ionian Sea) and eastern Atlantic, from Scotland and Ireland to Senegal. The same author reported their high numbers along the coast of Algeria, in the coastal waters of central Africa and in deeper waters of North Atlantic, considering them rather frequent in the Ligurian Sea at 200—300 m depths. Economidis (1973) reported, however, their records from the seas of Greece (not stating where exactly they were caught from), and Aksiray (1954) for the coasts of Turkey. Bini (1968) included this species in the checklist of fish species of Italian coastal waters reporting it as rare in the Tyrhenian and Ligurian Seas, and very rare in Ionian Sea. This species, as already mentioned, has not been established in the Adriatic with certainy till now. Therefore this species should be held as widely distributed in the Mediterranean: both in its eastern and western parts and in the Adriatic. This species has not been recorded from the Black Sea (Svetovidov, 1964; Tortonese, 1971).

Sexual dimporphism is best marked in *Arnoglossus imperialis* in relation to all the species of this genus (Torchio. 1961, 1961a). Adult males are characterized by prolongated anterior rays (second, third, fourth, fifth and sometimes sixth) of dorsal fins with the atrophy of the interradial membrane at that part of dorsal fin and prolongated left ventral fins (hipertrophy is particularly marked in fourth, fifth and sixth rays whose interradial membrane is black). Since these properties are missing or poorely marked in adult females, it is very likely that female specimens of this species were mistaken for the specimens of *Arnoglossus laterna*. The relationship between the initial rays of dorsal fins between the specimens from the Adriatic (n = 3 ♂♂) and Ligurian Sea (n = 4 ♂♂ and 1 ♀) (Torchio, 1961) is given in Table 1.

Specimens of *Arnoglossus imperialis* from the Adriatic were worked out in detail. Morphometric and meristic characters were analyzed as well as stomach contents. A total of 18 morphometric and 10 meristic body characters were taken into consideration. Relative values of the relationship between body dimensions in the Adriatic specimens were calculated and compared to those of the fish from the Mediterranean and eastern Atlantic. Results are presented in Tables 1, 2, 3, 4 and in the Appendix.

Table 1. Length of anterior rays of dorsal fin in *Arnoglossus imperialis* from the Adriatic (n = 3) and Ligurian Sea (n = 5) (Torchio, 1961)

Specimens		Rays of dorsal fin: length in mm						
Sex	LT (mm)	I	II	III	IV	V	VI	VII
		Authors' data (Adriatic Sea)						
♂	141.0	8	23	27	23	22	10	9
♂	118.5	7	19	23	20	14	10	6
♂	138.0	8	22	27	24	17	11	10
		Torchio (1961) (Ligurian Sea)						
♂	147.0	9	23	27	29	23	14	10
♂	128.0	5	10	18	14	9	7	7
♂	127.0	6	11	20	19	15	—	8
♂	116.0	5	14	18	17	14	9	9
♀	104.0	5	10	8	7	7	7	7

Table 2. Relative relationship of morphometric characters to standard length (LS) in *Arnoglossus imperialis* from the Adriatic (n = 3), Mediterranean and Atlantic

Morphometric relationship	Authors' data Range	$\bar{X}$	Norman (1943)	Roux *et al.** (1957)	Torchio (1961)* Range	$\bar{X}$
LS/Tmax	2.56— 2.58	2.57	2.33—2.75	2.32—2.37	2.36— 2.59	2.50
LS/Tmin	10.04—10.58	10.26	—	—	—	
LS/C	4.14— 4.20	4.17	3.80—4.25	3.72—3.96	3.83— 4.42	4.21
LS/Ld	1.04		—	—	—	
LS/La	1.33— 1.36	1.34	—	—	—	
LS/Lc	4.64— 4.81	4.74	—	—	—	
LS/Lp left	6.10— 6.64	6.38	—	5.81—6.33	5.56— 6.62	5.94
LS/Lp right	10.95—11.75	11.25	—	—	9.78—11.11	10.44
LS/Lpa	4.14— 4.44	4.25	—	—	—	

* Relative relationship calculated according to absolute values of measured morphometric characters given by the author

Table 3. Relative relationships of morphometric characters of the head to head length (C) in *Arnoglossus imperialis* from the Adriatic (n = 3), Mediterranean and Atlantic

Morphometric relationship	Authors' data Range	$\bar{X}$	Norman (1943)	Roux *et al.** (1957)	Torchio (1961)* Range	$\bar{X}$
C/postorbit. length	2.22—2.28	2.25	—	—	—	
C/preorbit. length	4.43—4.89	4.61	—	—	4.60—5.75	5.00
C/eye diameter	3.01—3.22	3.14	2.83—4.00	3.00—3.12	3.28—3.83	3.54
C/maxilar length	2.83—2.91	2.86	2.83—3.25	—	2.86—3.13	2.95
C/mandibular length	2.03—2.07	2.05	2.10—2.20	—	2.00—2.09	2.07

* Relative relationships calculated according to absolute values of measured morphometric characters given by the author

Table 4. Meristic characters of the species *Arnoglossus imperialis* from the Adriatic (n = 3), Mediterranean and eastern Atlantic

Meristic characters	Authors' data	Norman (1943)	Dieuzeide *et al.* (1955)	Roux *et al.* (1957)	Torchio (1961a)	Bini (1968)	Tortonese (1975)
D	100—102	(94)95—106	94—105	94—96	99—104	99—104	93—106
A	76— 79	74— 82	74— 82	74	75— 80	75— 80	74— 82
P left	11	9— 11	9— 11	—	10— 12	10— 12	—
P right	10	—	—	—	—	10— 12	—
V	6	6	6— 7	—	6	6	—
C	17	17	17	—	17	17	—
Branchiosp.	9	8— 10	—	8—10	7— 9	—	7— 10
Vertebrae	43	42— 45	—	—	—	—	42— 45
Pyloric caeca	4	—	—	—	—	—	—
L. lat.	57— 60	58— 63	—	59	—	56— 63	56— 63

Obtained meristic characters gave the fin formula:

D. 100—102; A. 76—79; P. left 11; P. right 10; V. 6; C, 17.

Obtained values of meristic characters as well as morphometric relationships (Tables 2, 3 and 4) are in broad agreement with those given for the other Mediterranean parts (Norman, 1943; Torchio, 1961; Bini, 1968; Tortonese, 1975).

Our data show some departures from the data for the midAtlantic African coasts (Roux *et al.*, 1957) concerning some very important biometric characteristics such as the relationship of standard length to maximum body width (Ls/Tmax), standard length to head length (Ls/C), the number of rays of dorsal and anal fins. Torchio (1961) came to the similar conclusions comparing his results with the results of biometric analysis of Poll (1959) suggesting the existence of tropical subspecies of this species.

The analysis of alimentary tract contents showed the residues of two adult specimens of Polychaeta Errantia, 7 Polychaeta larvae, 7 whole and several damaged Crustacea Decapoda larvae. Stomachs of two specimens were extraordinarily full while the stomach of the third specimen was almost empty. Content was mainly an amorphous mass.

There is no detailed data on this species food habits. Bini (1968) only reported these fish to feed very likely like other species of the genus, which means that they are carnivorous preying on benthic avertebrata, manily Crustacea.

* * *

Data on biology of this species are also very scarce. Dieuzeide *et al.* (1985) reported this species to spawn in spring period in the coastal area of Algeria. Klimaj and Rutkowicz (1970) reported the same period for the Mediterranean and summer period for the North Sea. Bini (1968) and Tortonese (1975) pointed to the fact that they probably spawn all year round with the maximum in spring. After Tortonese their eggs are of 0.75 mm diameter, metamorphosis beginning when fish achieve about 30 mm in length.

The Mediterranean specimens are smaller than the Atlantic ones. Maximum length that these fish achieve is 15 cm (LT) (Bini, 1968) or 15 to 20 cm (Dieuzeide *et. al.*, 1955) in the Mediterranean, and 20 cm (Bini, 1968) or 25 cm (Klimaj and Rutkowicz, 1970; Tortonese, 1975) in the Atlantic.

Torchio (1961) suggested, on the basis of the data from Ligurian Sea, that males are prevalent among adult specimens.

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PRILOG POZNAVANJU IHTIOFAUNE JADRANSKOG MORA: *ARNOGLOSSUS IMPERIALIS* (RAFINESQUE, 1810) (HETEROSOMATA, BOTHIDAE) NOVA VRSTA JADRANSKOG MORA

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KRATKI SADRŽAJ

U radu se izvještava o prvom sa sigurnošću i dokumentirano utvrđenom nalazu vrste *Arnoglossus imperialis* (Rafinesque, 1810) u Jadranskom moru. Pronađena su tri primjerka muškog spola u nesređenom materijalu ihtiološke

zbirke Instituta za oceanografiju i ribarstvo u Splitu (1986. god.) s naznakom lokaliteta — Brusnik i datumom nalaza — veljača 1951. god.

Izvršena je detaljna analiza morfometrijskih i meurističkih karaktera primjeraka, a dobiveni rezultati uspoređeni su sa rezultatima mjerenja istih karaktera na primjercima u Mediteranu i istočnom Atlantiku.

Daje se također i analiza sadržaja probavila.

APPENDIX

Absolute values of morphometric and meristic characters of analyzed specimen of the species *Arnoglossus imperialis* from the Adriatic

Specimen	1	2	3
Sex	♂	♂	♂
1. *Morphometric characters* (in mm):			
Total length (LT)	141.0	118.5	138.0
Standard length (LS)	117.5	99.5	115.0
Head length (C)	28.4	23.9	27.4
Eye diameter (O)	9.3	7.3	8.6
Postorbital length	12.4	10.6	12.0
Snout length	6.2	5.3	5.6
Maxilar length	9.9	8.3	9.4
Mandibular length	13.8	11.5	13.2
Maximum body width (Tamx)	45.8	38.7	44.5
Width of pedunculum (Tmin)	11.7	9.4	11.3
Length of dorsal fin basis (Ld)	113.0	95.8	110.8
Length of anal fin basis (La)	88.5	73.3	86.4
Length of pectoral fin (Lp) left	17.7	16.3	18.0
Length of pectoral fin (Lp) right	10.0	9.0	10.5
Length of ventral fin (Lv) left	11.2	9.6	12.4
Length of ventral fin (Lv) right	10.3	7.4	9.8
Caudal fin length (Lc)	24.4	20.9	24.8
Preanal length (Lpa)	28.2	24.0	25.9
2. *Meristic characters:*			
Number of vertebrae	43	43	43
Number of gill-rakers on the first branchial arch	9	9	9
D*	102	101	100
A	77	79	76
P right	10	10	10
P left	11	11	11
V right	6	6	6
V left**	6	6	6
C	17	17	17
No. of scales in l. lateralis	57	60	59
No. of pyloric caeca	4	4	4

* Second, third, fourth and fifth rays prolongated; third ray the longest

** Fourth, fifth and sixth rays black; fourth ray the longest

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