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Results of the research cruises of FRV 'Walther Herwig' to South America. LXXI. A first record of the Antarctic fish *Lindbergichthys nudifrons* (Lönnberg, 1905) from the Beagle Canal, Tierra del Fuego (Pisces, Perciformes, Nototheniidae).*

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with 2 Figures and 1 Table

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Kurzfassung

Ergebnisse der Forschungsreisen des FFS 'Walther Herwig' nach Südamerika. LXXI. Ein Erstnachweis der antarktischen Fischart *Lindbergichthys nudifrons* (Lönnberg, 1905) aus dem Beagle Kanal, Feuerland (Pisces, Perciformes, Nototheniidae).

Während der 3. Antarktisexpedition (1981) mit dem FFS 'Walther Herwig' wurde ein Exemplar der antarktischen Nototheniidenart *Lindbergichthys nudifrons* zusammen mit zwei häufigen patagonischen Nototheniidenarten im Beagle-Kanal bei Ushuaia gesammelt. Dieser Erstfund in subantarktischen kontinentalen Gewässern Feuerlands wird ausführlich beschrieben.

Abstract

A specimen of the notothenid fish *Lindbergichthys nudifrons* was sampled, along with two common Patagonian notothenid species, during the 3rd German Antarctic Expedition (1981) with FRV 'Walther Herwig' at Ushuaia in the Beagle Canal. A detailed description of this specimen is given, which represents the first record of *L. nudifrons* in subantarctic continental waters of Tierra del Fuego.

* Dedicated to Dr. Gerhard Krefft on the occasion of his 80th birthday in 1992.

1. Introduction

Nototheniid fishes, or Notothens, are by far the dominant group of primarily demersal teleosteans in the Southern Ocean. The family comprises 56 species (including two spp. n. described in this issue) of 16 genera. All 16 genera are representred by the 39 species inhabiting almost exclusively the Southern Ocean as defined in GON and HEEMSTRA (1990). The vast majority of genera are small units for usually one to five species only. This reflects the high degree of evolutionary specialisation among the fishes of the Southern Ocean and occupation of ecological niches accordingly.

Lindbergichthys, considered at subgeneric rank under *Lepidonotothen* by DEWITT *et al.* (1990) but elevated to generic rank by BALUSHKIN (1993), represents one of such small units with two species only, which are geographically widely separated. *L. mizops* (Günther, 1880) inhabits shelf waters around subantarctic islands in the Indian Ocean sector of the Southern Ocean (Heard, Kerguelen, Crozet Isl.). Records from the Ross Sea (HASCHEMEYER and JANNASCH, 1983) and eventually from the Weddell Sea (HUBOLD, 1992) are not documented by samples deposited in a scientific collection to allow re-examination and rather appear to be misidentifications. *L. nudifrons* exhibits a wider distributional range in the Atlantic sector. The latter species spreads from both sides of the Antarctic Peninsula just south of 60 S along the Scotia Arc, i.e. South Shetland, South Orkney and South Sandwich Islands, to the north (South Georgia) and west again (Shag Rocks). The latter locality is confirmed by seven specimens deposited at ZIN (coll. # 46033) and various published records, e.g. SKORA and SOSINSKI (1983). According to the rather differing distributional subareas, with possibly no interaction between the populations, the absolute fecundity decreases from northernmost to southernmost areas of occurrence (DEWITT *et al.*, 1990: 300).

From phylogenetic points of view, the genus *Lindbergichthys* is intermediate between, on the one hand, the genera *Nototheniops* and *Lepidonotothen* and, on the other hand, the genus *Gobionotothen* (BALUSHKIN, 1989: 120-121). The inclusion of *Lindbergichthys* and *Nototheniops* at subgeneric rank in *Lepidonotothen*, as advocated by DEWITT *et al.*, (1990), has led to the establishing of a paraphyletic unit. Compared with the latter consequence, REGAN's (1914) concept was closer to the present understanding; he considered species of both present genera *Lindbergichthys* and *Gobionotothen* among his "*acuta*"-group of species within the genus *Notothenia (sensu lato)*.

Only a few species of the family inhabit continental Patagonian waters of South America, as well as waters further south into the Atlantic sector of the Southern Ocean, e.g. *Dissostichus eleginoides* Smitt, 1898, *Paranotothenia magellanica* (Forster, 1801), *Patagonotothen guntheri* (Norman, 1937). However, the latter examples are species of primarily subantarctic Patagonian distribution, which have probabely invaded the Southern Ocean along the Falkland Islands(Islas Malvinas)-South Georgia Ridge and even further on along the Scotia Arc.

The present record of *L. nudifrons* from Tierra del Fuego waters appears to be another example (after e.g. *Lepidonotothen squamifrons macrophthalma* (Norman, 1937), *L. kempi, L.larseni, Notothenia coriiceps, N. rossi*) of a spreading in opposite direction, as indicated already by previous records from the Shag Rocks. It was captured in the harbour of Ushuaia together with the common Patagonian nototheniid species *Patagonotothen longipes* (Steindachner, 1875) (**ISH 275-1981**) and *P. tessellata* (Richardson, 1844) (**ISH 276-1981**).

2. Material and methods

The mode of description and terminology follows BALUSHKIN (1990). Institutional acronyms: ISH = Institut für Seefischerei Hamburg, ZIN = Zoological Institute of the Russian Academy of Sciences, St. Petersburg.

ISH 484-1981, 1 specimen of *L. nudifrons* 102.0 mm SL; FRV "Walther Herwig" at the jetty in Ushuaia, 7.III.1981. Collector Dr. K.-H. Kock (ISH), who reported having taken this and other nototheniid juvenile specimens by dipnet close to the surface in the evening out of dense fish schools assembled under the stern lights of the vessel. After having kept specimens alive for a while in a bucket on deck, when they were observed, a subsample was finally preserved in formalin for the ISH collection but only superficially looked at for identification.

Antarctic specimens of *L. nudifrons,* herein used for presenting comparative meristics and morphometrics *(Table 1),* were collected by the junior author during an expedition in 1984/85 on board the RV "Gizhiga" (ZIN uncatalogued):

1 spec. 125 mm SL, stat. 113, 1.I.1985; 61°17.0'S, 55°51.8'W, 225-235 m; bottom trawl. - 9 spec. 93-182 mm SL, stat. 125, 3-4.I.1985; 61°47.9'S, 54°06.0'W, 285-290 m; bottom trawl. - 2 spec. 152, 176 mm SL, stat. 128, 5.I.1985; 61°54.5'S, 54°10.6'W, 320 m; bottom trawl. - 1 spec. 177 mm SL, stat. 130, 5.I.1985; 61°50.3'S, 54°00.5'W, 280-300 m; bottom trawl. - 7 spec. 143-184 mm SL, stat. 132, 6.I.1985; 61°44.1'S, 53°49.6'W, 280-285 m; bottom trawl.

3. Description of ISH 484-1981 (Figures 1-2)

3.1 Principal meristic characters

D V, 38; A 35; P 22/22 (both with upper rays broken off); C 33, of which 13 branched rays; 58 vertical rows of scales on trunk counted from base of pectoral; 36/36 tubular scales in dorsal lateral line; median lateral line without tubular scales; gill rakers on first arch in inner row 0+1+10 = 11, in outer row 4+1+11 = 16; total vertebrae 52, of which 16 abdominal.

3.2 Lateral line system

Supraorbital canal with 3 pores in front of the coronal commissure and 1 pore behind situated posterior to eye. Infraorbital canal with 7 pores, of which 4 in lachrymal bone. Temporal canal with 5 pores, excluding the sensory pore in the supracleithrum. Preopercular-mandibular canal with 10 pores. 1 pore in coronal, 3 pores in supratemporal commissure.

3.3 Squamation

Scales on sides of body weakly ctenoid, with ctenii usually only on the middle of the scale's posterior margin. Scales cycloid on belly, in front of and between ventral fins, along edges

Table 1: Meristics and measurements of 20 *L. nudifrons* from off the Antarctic South Shetland Islands, taken during the 1984/85 expedition of RV 'Gizhiga' at stations 113, 125, 128, 130, 132; see: Chap. '2. Material and Methods'. Character abbreviations: see 3.4 'Morphometrics' in descriptive text.

characters	range	mean	characters	range	mean
D1	4 - 5	4.3	In % of SL		
D2	37 - 39	37.8	LV	19.5 - 24.9	22.7
A	33 - 36	34.6	LVA	22.2 - 28.3	25.7
P	21 - 23	22.4	lcp	4.6 - 7.3	5.7
ULl	32 - 41	35.8	hcp	7.3 - 9.2	8.5
gill rakers			Lc1	24.5 - 27.3	26.1
outer row	16 - 19	17.2			
inner row	11 - 14	11.9			
			In % of Lc1		
In % of SL			Wc	54.9 - 73.4	63.6
H	19.2 - 25.8	22.9	Ho	50.0 - 59.8	56.6
aD1	26.7 - 29.1	28.0	aO	25.0 - 29.7	27.7
aD2	34.2 - 38.6	36.3	O	29.3 - 34.3	31.3
aA	44.4 - 51.1	47.2	Lmx	36.8 - 43.3	39.2
LP	18.9 - 22.6	20.4	Lmd	38.1 - 46.6	44.6
			iO	4.8 - 7.7	6.4

of anal fin base, on bases of pectoral fins, between occiput and spinous dorsal fin, between spinous dorsal fin and dorsal lateral line. The cycloid scales on the operculum and in the angle between the temporal canal and the supratemporal commissure are minute like those on belly. Scaleless are the upper surface of snout and head, preorbitals, the lining of seismosensory canals on head, the interoperculum and lower part of the suboperculum, and ventral areas of the head.

3.4 Morphometrics

In per cent of SL (102.0 mm): body depth at origin of anal fin (H) - 17.1; antedorsal distance to D1 (aD1) - 28.9; antedorsal distance to D2 (aD2) - 36.1; height of D1 (hD1) - 7.4; anteanal distance (aA) - 50.5; length of pectoral fin (LP) - 23.5; length of ventral fin

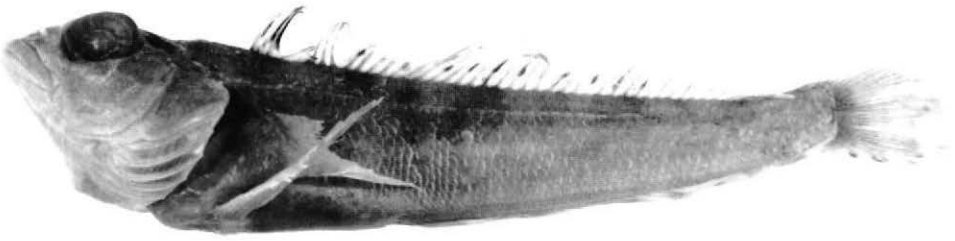

Figure 1: *Lindbergichthys nudifrons*, ISH 484-1981, from the Beagle Canal. Lateral view.

Figure 2: *Lindbergichthys nudifrons*, ISH 484-1981, from the Beagle Canal. Dorsal view.

(LV) - 25.3; distance base of ventral fin to anal fin (LVA) - 22.7; length of caudal peduncle (lcp) - 4.2; height of caudal peduncle (hcp) - 7.4; head length to bony margin of operculum (Lc1) - 27.2.

In per cent of head length (Lc1) (27.8 mm): width of head (Wc) - 52.2; depth of head at midlevel of eye (Ho) - 54.7; antorbital distance (= snout length) (aO) - 26.6; diameter of eye (O) - 34.2; distance from snout tip to nostril (Sn-N) - 19.4; internarial distance (N-N) - 15.1; length of upper jaw (Lmx) - 36.3; length of lower jaw (Lmd) - 46.0; interorbital distance (iO) - 7.2.

3.5 Skeleton, based on radiographs

Vertebrae to first interneurale of D1: 2; to first interneurale of D2: 7; to first interhaemale: 12. Free caudal vertebrae in dorsal view: 9; in ventral view: 6. A pair of interneuralia situated jointly between the neural spines of second and third vertebrae. Six interneuralia in front of first interneurale of D2, one of which free and not bearing a fin ray. Five interhaemalia in front of first caudal vertebra under abdominal section of vertebral column. Vertebrae of urostyle articulating with five hypural plates. Formula for the distribution of principal fin rays with reference to hypural plates: 1-5-2-5-2. Caudal fin with 33 rays, of which 10 are upper marginal, 15 principal and 8 lower marginal ones.

3.6 Colouration (in isopropanol)

On medium greyish-ochre ground colour, four to five more or less indistinct oblique dark bars on body; belly and isthmus plain pale ochre; two oblique dark stripes on cheek; a circular blackish spot on D1; lines of small dark spots on caudal, anal and especially second dorsal fins; pectoral and pelvic fins pale, the latter spotted.

4. Descriptive and zoogeographical remarks

The first known specimen from Tierra del Fuego agrees well in all features with previous descriptions of *L. nudifrons* from Antarctic waters in both, external morphology and meristics (e.g. NORMAN, 1938; BELLISIO, 1966; DEWITT *et al.*, 1990) and skeletal characters based on x-ray analysis (BALUSHKIN, 1989). We would like to add at this opportunity the following measurements and meristic counts, obtained by the junior author during an expedition aboard the RV 'Gizhiga' in 1984/1985 off the South Shetland Islands, to previously published information on Antarctic *L. nudifrons*:

The finding of an Antarctic fish species in subantarctic continental waters of South America naturally is of considerable interest from the zoogeographical point of view. Since the Drake Passage opened about 23 million years ago (BARKER and BURRELL, 1977; MILLER, 1987) and the circumpolar Antarctic current system had established, the Antarctic and notalian populations of nototheniid fishes have evolved independently of each other. Only a few species of this family have been able to penetrate through the Antarctic Convergence either way and establish populations isolated from each other in both climate zones. Low taxonomic ranking of such separated populations as subspecies only (e.g. of *Patagonotothen guntheri* and *Lepidonotothen squamifrons macrophthalma*; see BALUSHKIN and PERMITIN, 1982; BALUSHKIN and KOZMINA, 1990), or no intraspecific distinction at all between others (e.g. in *Dissostichus eleginiodes*; see ZACHAROV and FROLKINA, 1976; VODOLAZOVA and BALUSHKIN, 1988) indicate a relatively recent dispersal of these fishes, probably dating back no further than to the Pleistocene.

The very limited interchange between the fish faunas of the Patagonian-Falkland and the Antarctic regions is seemingly caused by the irregular latitudinal fluctuations of the Antarctic Convergence, as discussed e.g. by EASTMAN and GRANDE (1989), and the separation by deep water between shelf areas of Patagonia and Antarctica.

Intensified investigations of Tierra del Fuego's waters will be required to prove, whether the ISH 484-1981 specimen was a casual individual record only, or the first example taken of a yet undiscovered spreading of *L. nudifrons* into subantarctic Patagonian waters. LLORIS and RUCABADO (1991) have not found this species during a recent faunal survey within the eastern Beagle Canal.

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