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NORTHERNMOST RECORDS OF *GADELLA MARALDI* (ACTINOPTERYGII: GADIFORMES: MORIDAE) IN THE NORTH-EASTERN ATLANTIC

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Abstract. Four specimens of *Gadella maraldi* (Moridae) were captured in the north-eastern Atlantic. One specimen was caught off the Galician coast (north-western Spain) and three individuals on the Porcupine Bank (off western Ireland). Morphometric measurements and meristic counts of one specimen were recorded. The Irish specimens constitute a new northern limit for the distribution of this species in the north-eastern Atlantic.

Keywords: *Gadella maraldi*, new records, Porcupine Bank, seamount, northern limit

The family Moridae, also known as morid cods, includes 110 species and 18 genera (Okamoto et al. 2007). The genus *Gadella* Lowe, 1843 comprises 13 species distributed from temperate- to tropical regions in the deep sea (usually deeper than 150 m) of almost all oceans (Okamoto et al. 2010). *Gadella* specimens can be distinguished from the other morid genera by the presence of a ventral light organ in advance of the anus and by the absence of a barbel (Paulin 1989, Trunov 1992). However, Sazonov and Shcherbachev (2000) questioned the absence of a barbel as a distinguishing character and they pointed out that comparative anatomical investigations are needed to determine the real rank and taxonomical position of *Gadella*.

In the Eastern Atlantic, only three species of *Gadella* have been reported: *Gadella imberbis* (Vaillant, 1888), known from Cape Verde to Namibia (Froese and Pauly 2012), *Gadella svetovidovi* Trunov, 1992, known only from scattered localities from Western Sahara and the Canary Islands (Sazonov 1996, Brito et al. 2002), and *Gadella maraldi* (Risso, 1810), reported off southern Portugal, Madeira, Josephine Bank, Azores, Great Meteor Bank, Canary Islands, off north-western Spain and the Mediterranean Sea (Maul 1952, Shcherbachev et al. 1985, Saldanha et al. 1995, Santos et al. 1997, Uiblein et al. 1999, Brito et al. 2002, Bañón et al. 2010).

Four specimens of *G. maraldi* were caught during surveys carried out in autumn by the Instituto Español de Oceanografía (IEO) (Table 1, Fig. 1). Three individuals were captured by bottom trawl on the Porcupine Bank using a Baca-GAV 39/52 with a cod-end mesh size of 20 mm during the annual surveys carried out since 2001 in

Table 1

Records of *Gadella maraldi* off the north-western coast of Spain and on the Porcupine Bank

Area	Date	Latitude	Longitude	Depth (m)	TL (mm)
Northern Spain	2 Oct 1996	43°53′37N	8°40′57W	437	78
Northern Spain	7 Oct 2009	43°40′50N	8°52′08W	567	115[B]
Porcupine Bank	7 Sep 2003	51°13′27N	13°52′49W	556	155
Porcupine Bank	25 Sep 2011	53°57′38N	12°55′26W	591	157
Porcupine Bank	1 Oct 2011	53°15′56N	14°34′15W	490	171

[B] Specimen recorded in Bañón et al. (2010).

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ICES Subdivisions VIIb and VIIk. One specimen was caught with a Baca trawl 44/60 with a cod-end mesh size of 10 mm during the annual bottom trawl survey undertaken since 1983 on the northern continental shelf of Spain (ICES Subdivisions VIIIc and IXa).

Only the specimen caught on 25 September 2011 from the Porcupine Bank (Fig. 2) could be fixed in 10% formalin, preserved in 70% alcohol and stored in the fish collection of the IEO in Santander (IEOST11001). Measurements were taken on the preserved specimen following Hubbs and Lagler (1958).

The specimen showed the main distinctive characters of the species: body elongate, compressed, and tapering posteriorly; head long with snout rather broad and obtusely rounded; chin barbel absent; no teeth on vomer and palatines; pectoral fin extending far past anal fin origin; body and head covered with small cycloid scales with exception of lips and chin; light organ present as small, scaleless patch on belly. Fresh coloration dark brown; operculum covered by numerous small dark spots; belly and sides below pectoral fins bluish-black; oral cavity pale.

According to Paulin (1989) and Trunov (1992), *G. maraldi* can be distinguished from the other two species of *Gadella* present in the eastern Atlantic by the length of the ventral fins, reaching the base of the 7th anal fin ray, while in *G. svetovidovi* they only reach the anterior edge of the anal fin base and in *G. imberbis* to the base of the 4th anal fin ray. Moreover, these authors pointed out that these species could also be separated by the upper jaw dentition. Thus, *G. maraldi* has two rows of teeth with the outermost row consisting of sharp, fang-like teeth, separated from each other by smaller teeth. *G. svetovidovi* has two rows of large canine-like teeth while *G. imberbis* has two rows of smaller, more closely set teeth.

Nearly all the morphometric- (Table 2) and meristic data (Table 3) are in agreement with the body proportions and radial formulae reported by other authors in the north-

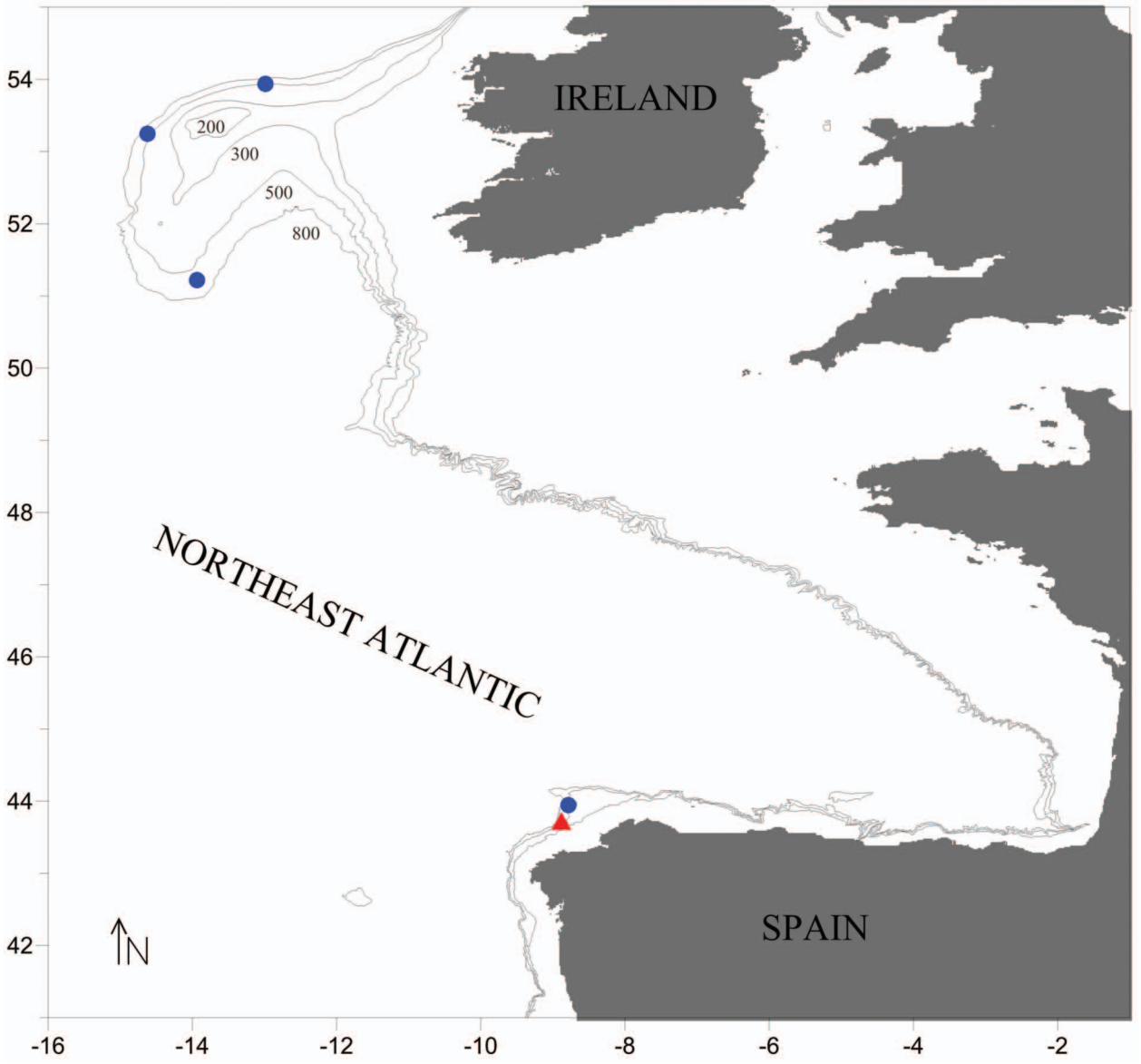

Fig. 1. Geographic distribution of the captures of *Gadella maraldi*; Blue circles represent the new records and the red triangle shows the specimen recorded in Bañón et al. (2010)

eastern Atlantic and the Mediterranean Sea (Maul 1952, Aguiar and Pereira 1982, Kabasakal 1998). The only exceptions were the slight deviations observed in head length, inter-orbital distance and pre-first dorsal length. Although the number of measured specimens of *G. maraldi* is very low, these variations could lie within the natural range of this species or could also be due to the different geographic origin (Mediterranean Sea and Atlantic Ocean) and latitude of the specimens. The geographical variations may be associated with changes in environmental conditions, mainly temperature, which is known to be an important cause of morphometric variations (Barlow 1961). Likewise, all specimens were captured within the known range of length and depth reported for this species, up to 300 mm TL and 150–748 m depth (Cohen et al. 1986, Froese and Pauly 2012) (Table 1).

Fig. 2. *Gadella maraldi* (157 mm TL) caught on the Porcupine Bank in 2011 (Specimen No. IEOST11001)

Table 2

Morphometric data and weight of *Gadella maraldi* according to different sources

Parameter	Presently reported study			Aguiar and Pereira (1982)		Kabasakal (1998)			
	[mm]	[% SL]	[g]	[mm]	[% SL]	[mm]	[% SL]	[mm]	[% SL]
Total length (TL)	157			278		206		176	
Standard length (SL)	141			245		181		158	
Head length	35	24.8			26.3		28.2		25.9
Snout length	9	6.8			7.1		7.2		7.6
Post-orbital length	18	12.8			11.4		13.3		12.7
Inter-orbital distance	9	6.4			7.1		8.8		8.2
Eye diameter	9	6.4			6.3		7.7		6.3
Maxillar length	17	12.1			—		—		—
Pre-1st dorsal length	46	32.6			29.8		—		—
Pre-2nd dorsal length	54	38.3			—		—		—
Pre-anal length	48	34.0			34.5		—		—
1st dorsal fin base	12	8.5			—		8.8		8.9
2nd dorsal fin base	78	55.3			—		55.8		55.7
Anal fin base	89	63.1			—		65.2		64.6
Pectoral fin length	28	19.9			19.2		18.2		19.6
Ventral fin length	22	15.6			—		—		—
Body maximum depth	32	22.7			22.0		24.3		24.1
Body maximum width	16	11.3			—		—		—
Weight			19.7						

Presently reported study was based on a single specimen deposited in the fish collection of the Instituto Español de Oceanografia in Santander, Spain (Specimen No. IEOST11001).

Table 3

Meristic data of *Gadella maraldi* according to different sources

Parameter	Presently reported study	Maul (1952)	Aguiar and Pereira (1982)	Kabasakal (1998)	
1st dorsal fin rays	10	11–12	11	11	10
2nd dorsal fin rays	54	60	55	54	54
Anal fin rays	60	66–67	61	57	57
Pectoral fin rays	24	25	24	24	20
Ventral fin rays	7	7	7	7	7
Branchiostegal rays	6	7	7	—	—
Total gill rakers	12	—	—	11	11
Pyloric caeca	11	11	11	—	—

Presently reported study was based on a single specimen deposited in the fish collection of the Instituto Español de Oceanografía in Santander, Spain (Specimen No. IEOST11001).

Although the occurrence of this species in the western part of the Iberian Peninsula was previously indicated by Cohen et al. (1986), no data of its presence in this area was provided until one specimen was captured off southern Portugal (Saldanha et al. 1995) and subsequently in the north-western Spain (Bañón et al. 2010). Thus, the presently studied specimens represents the third record of *G. maraldi* caught in this area in the last 20 years.

The presently studied specimens from the Porcupine Bank constitute a significant extension (~1200 km) from the previously known northern distributional limit of *G. maraldi* in the North-eastern Atlantic (off the north-west coast of Spain). They may also represent another example of the presence of this species on isolated seamounts and off islands in the north-eastern Atlantic such as Madeira, Josephine Bank, Azores, Great Meteor Bank, and Canary Islands. The Porcupine Bank exhibits similar features to a seamount with an anticyclonic eddy and associated upwelling on the bank summit and contrasting depths. The north-western part of the bank descends abruptly down to depths greater than 4000 m, while the south-eastern part has a gentle slope and the eastern part is connected to the Irish shelf by the narrow Slyne Ridge (330–340 m depth). The shallowest depth is 150 m at the top of the bank (Mohn et al. 2002, White 2007).

The presence of tropical and subtropical species northward of their known distribution range has been proposed as a possible effect of climatic change (Quéro et al. 1998, Poulard and Blanchard 2005). Moreover, a shelf edge current of relatively saltier and warmer water has been reported around the Porcupine Bank (Pingree and Le Cann 1990, Mohn and White 2007). Both factors could encourage the displacement and the presence of warm-water fish species in the area. However, there is currently insufficient data to support either of these two hypotheses.

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REFERENCES

Aguiar A., Pereira J.A. 1982. *Physiculus dalwigki* Kaup, 1858 and *Gadella maraldi* (Risso, 1810) newly recorded in Azorean waters (Pisces: Moridae). Cybium **6** (3): 35–38.

Bañón R., Villegas-Ríos D., Serrano A., Mucientes G., Arronte J.C. 2010. Marine fishes from Galicia (NW Spain): an updated checklist. Zootaxa **2010** (2667): 1−27.

Barlow G.W. 1961. Causes and significance of morphological variation in fishes. Systematic Zoology **10** (3): 105–117.

Brito A., Pascual P.J., Falcón J.M., Sancho A., González G. 2002. Peces de las Islas Canarias. Catálogo comentado e ilustrado. Francisco Lemus Editor, La Laguna, Islas Canarias, Spain.

Cohen D.M. 1986. Moridae. Pp. 713–723. *In*: Whitehead P.J.P., Bauchot M.-L., Hureau J.C., Nielsen J., Tortonese E. (eds.) Fishes of the north-eastern Atlantic and the Mediterranean. UNESCO, Paris.

Froese R., Pauly D. (eds.) 2012. FishBase. [version 08/2012] http://www.fishbase.org

Hubbs C.L., Lagler K.F. 1958. Fishes of the Great Lakes region. Bulletin of Cranbrook Institute of Science **26**: 1−213.

Kabasakal H. 1998. Confirmation of the presence of *Gadella maraldi* (Risso, 1810) in the seas of Turkey. Institut za oceanografiju i ribarstvo, Split, Croatia **80**: 1–8.

Maul G.E. 1952. Monografia dos peixes do Museu Municipal do Funchal. Familia Gadidae e Bregmacerotidae. [Monograph of the fishes of the Funchal Museum. Family Gadidae and Bregmacerotidae]. Boletim do Museu Municipal do Funchal **6** (15): 5−51. [In Portugease.]

Mohn C., Bartsch J., Meincke J. 2002. Observations of the mass and flow field at Porcupine Bank. ICES Journal of Marine Science **59** (2): 380−392.
DOI: 10.1006/jmsc.2001.1174

Mohn C., White M. 2007. Remote sensing and modelling of bio-physical distribution patterns at Porcupine and Rockall Bank, northeast Atlantic. Continental Shelf Research **27** (14): 1875−1892. DOI: 10.1016/j.csr.2007.03.006

Okamoto M., Matsuda K., Matsuda T. 2010. Description of a pelagic juvenile specimen of *Gadella jordani* (Actinopterygii: Gadiformes: Moridae) from southern Japan, with a note on the color in life. Species Diversity **15**: 131–138.

Okamoto M., Sato N., Asahida T., Watanabe Y. 2007. Pelagic juveniles of two morids (Teleostei: Gadiformes: Moridae), *Antimora microlepis* and *Physiculus japonicus*, from the western North Pacific. Species Diversity **12** (1): 17−27.

Paulin C.D. 1989. Review of the morid genera *Gadella*, *Physiculus*, and *Salilota* (Teleostei: Gadiformes) with descriptions of seven new species. New Zealand Journal of Zoology **16** (1): 93−133. DOI: 10.1080/03014223.1989.10423706

Pingree R., Le Cann B. 1990. Celtic and Armorican slope and shelf residual currents. Progress in Oceanography **23** (4): 303–338. DOI: 10.1016/0079-6611(89)90003-7

Poulard J.C., Blanchard F. 2005. The impact of climate change on the fish community structure of the eastern continental shelf of the Bay of Biscay. ICES Journal of Marine Science **62** (7): 1436−1443. DOI: 10.1016/j.icesjms.2005.04.017

Quéro J.-C. 1998. Changes in the Euro-Atlantic fish species composition resulting from fishing and ocean warming. Italian Journal of Zoology **65** (Suppl. 1): 493–499. DOI: 10.1080/11250009809386873

Saldanha L., Almeida A.J., Andrade F., Guerreiro J. 1995. Observations on the diet of some slope dwelling fishes of southern Portugal. Internationale Revue der gesamten Hydrobiologie und Hydrographie **80** (2): 217–234. DOI: 10.1002/iroh.19950800210

Santos R.S., Porteiro F.M., Barreiros J.P. 1997. Marine fishes of the Azores. Annotated checklist and bibliography. A catalogue of the Azorean marine ichthyodiversity. Arquipélago—Life and Marine Sciences, Bulletin of the University of Azores **1997** (Suppl. 1): 1−244.

Sazonov Y.I. 1996. A new record of the rare species *Gadella svetovidovi* (Gadiformes, Moridae) off the northwest Africa coast. Journal of Ichthyology **36** (6): 473−475.

Sazonov Y.I., Shcherbachev Y.N. 2000. A Review of the Indian Ocean species from the genus *Gadella* (Gadiformes, Moridae), with a description of two new species. Journal of Ichthyology **40** (Suppl. 1): S64−S73.

Shcherbachev Y.N., Kukuev E.I., Shlibanov V.I. 1985. Composition of the benthic and demersal ichthyocenoses of the submarine mountains in the southern part of the North Atlantic Range. Journal of Ichthyology **25** (?): 110−125.

Trunov I.A. 1992. Fish of the family Moridae from the southeastern Atlantic (Genera *Gadella*, *Halargyreus*, and *Antimora*). Journal of Ichthyology **32** (4): 38−45.

Uiblein F., Geldmacher A., Köster F., Nellen W., Kraus G. 1999. Species composition and depth distribution of fish species collected in the area of the Great Meteor Seamount, eastern central Atlantic, during cruise M42/3, with seventeen new records. Informes técnicos del Instituto Canario de Ciencias Marinas **5**: 47−85.

White M. 2007. Benthic dynamics at the carbonate mound regions of the Porcupine Sea Bight continental margin. International Journal of Earth Sciences **96** (1): 1–9. DOI: 10.1007/s00531-006-0099-1

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