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

Susana RUIZ-PICO 1*, Juan C. ARRONTE 1, Rafael BAÑÓN 2, and Olaya FERNÁNDEZ-ZAPICO 1

1 Instituto Español de Oceanografía, Centro Oceanográfico de Santander, Spain
2 Servizo de Planificación, Dirección Xeral de Recursos Mariños, Consellería de Pesca e Asuntos Marítimos, Santiago de Compostela, Spain

Ruiz-Pico S., Arronte J.C., Bañón R., Fernández-Zapico O. 2012. Northernmost records of *Gadella maraldi* (Actinopterygii: Gadiformes: Moridae) in the north-eastern Atlantic. Acta Ichthyol. Piscat. 42 (3): 263–267.

**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

| 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       | 115B    |
| 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).

* Correspondence: Dr Susana Ruiz-Pico, Instituto Español de Oceanografía, Centro Oceanográfico de Santander, Promontorio de San Martín s/n, 39004, Santander, Spain, phone: +34 942291716, fax: +34 942275072, e-mail: susana.ruiz@st.ieo.es.
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)](image)

| Parameter                        | Presently reported study | Aguiar and Pereira (1982) | Kabasakal (1998) |
|----------------------------------|--------------------------|----------------------------|------------------|
|                                  | [mm] [g] [mm] [% SL]     | [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]               |
| Snout length                     | 9 [6.8]                  | 7.1 [7.2]                 |
| Post-orbital length              | 18 [12.8]                | 11.4 [13.3]               |
| Inter-orbital distance           | 9 [6.4]                  | 7.1 [8.8]                 |
| Eye diameter                     | 9 [6.4]                  | 6.3 [7.7]                 |
| Maxillar length                  | 17 [12.1]                | — [—]                     |
| Pre-1st dorsal length            | 46 [32.6]                | 29.8 [34.5]               |
| Pre-2nd dorsal length            | 54 [38.3]                | — [—]                     |
| Pre-anal length                  | 48 [34.0]                | 34.5 [35.8]               |
| 1st dorsal fin base              | 12 [8.5]                 | — [—]                     |
| 2nd dorsal fin base              | 78 [55.3]                | — [—]                     |
| Anal fin base                    | 89 [63.1]                | — [—]                     |
| Pectoral fin length              | 28 [19.9]                | 19.2 [18.2]               |
| Ventral fin length               | 22 [15.6]                | — [—]                     |
| Body maximum depth               | 32 [22.7]                | 22.0 [24.3]               |
| 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 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, Maul (1952) Aguiar and Pereira (1982) Kabasakal (1998)) and G. 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.

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., Tortone 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 Portuguese.]

Mohn C., Bartsch J., Meinecke 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

| Parameter                  | Presently reported study | Maul (1952) | Aguiar and Pereira (1982) | Kabasakal (1998) |
|----------------------------|--------------------------|-------------|---------------------------|-----------------|
| 1st dorsal fin rays        | 10                       | 11–12       | 11                        | 11              |
| 2nd dorsal fin rays        | 54                       | 60          | 55                        | 54              |
| Anal fin rays              | 60                       | 66–67       | 61                        | 57              |
| Pectoral fin rays          | 24                       | 25          | 24                        | 24              |
| Ventral fin rays           | 7                        | 7           | 7                         | 7               |
| Branchiostegal rays        | 6                        | 7           | 7                         | —               |
| Total gill rakers          | 12                       | —           | —                         | 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).
Received: 10 May 2012
Accepted: 21 August 2012
Published electronically: 30 September 2012