

A new species of the morid genus *Gadella* (Teleostei: Gadiformes) from the Galápagos Islands

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Abstract A new species of deepwater morid fish, *Gadella thysthlon*, is described on the basis of five specimens from the Galápagos Islands. It differs from other species of *Gadella* by its low dorsal and anal fin ray counts (8+56–58 and 64–66 respectively), moderate number of gill rakers (4–5+9–11), small luminous organ that is closer to the anus than the interventral line, and its dark body, bright red-orange median fins with dark bases, and melanophores on the tongue apex and the palatal midline.

Key words. — Galápagos Islands; *Gadella*; Gadiformes; Moridae.

The deepwater luminous cod genus *Gadella* is widespread in most oceans but known from few published specimens from widely scattered localities. Until recently, the taxonomic relationships within this genus, and between other morid genera, were unclear. Reviews of *Gadella* by Paulin (1989) and Trunov (1992) defined and clarified this poorly understood group of deepwater cods. *Gadella* differs from other morid genera primarily by the absence of a chin barbel and vomerine teeth, and the presence of a luminous organ in advance of the anus. Nine species are currently recognized worldwide.

Recently, five specimens of an undescribed species of *Gadella* were collected along with *G. filifer* (Garman, 1899) from the Galápagos Islands and are described in this report. Two of the specimens (the holotype and one paratype) were captured alive by the manned submersible *Johnson Sea-Link* during dives around Isla Fernandina and Isla San Cristobal at 479–570 m depth. Three additional specimens were collected dead on the ocean surface after the 1995 eruption of Volcan Fernandina produced superheated water in the deepslope off Isla Fernandina (McCosker et al., 1997).

Materials and Methods

Measurements and meristic counts follow Hubbs and Lagler (1958) and Paulin (1989). Morphological measurements are expressed as a percentage of the standard length (SL) and are listed in the description

as a mean, with the ranges of these measurements in parentheses. Measurements of the light organ are expressed as percentages of the total linear distance between the interventral line (the line between the insertion of the two pelvic fins) and the origin of the anal fin; this measurement is abbreviated as V-af (Paulin, 1989). Counts of the first dorsal rays include the rudimentary first ray which is often seen only in radiographs. Meristic counts, proportional measurements, and morphological and chromatic descriptions from other *Gadella* species are taken primarily from Paulin (1989), as well as from Böhlke and Mead (1951), Parin (1985), and Trunov (1992), and from several *Gadella* specimens in the CAS collection listed below. Institutional abbreviations follow standardized symbolic codes proposed by Leviton et al. (1985).

Gadella thysthlon sp. nov. (Figs. 1, 2; Table 1)

Holotype. CAS 86541 (111.4 mm SL), collected off Cabo Hammond (00°28'S, 91°37'W), Isla Fernandina, Galápagos Islands, at 570 m on 14 Nov. 1995 by J. E. McCosker et al. with the *Johnson Sea-Link*.

Paratypes. CAS 86563 (214.0 mm SL), collected on a seamount southeast of Isla San Cristobal (01°06'S, 89°12'W), Galápagos Islands, at 479 m on 5 Nov. 1995 by J. E. McCosker et al. with the *Johnson Sea-Link*; CAS 86550, 2 (73.6–159.0 mm SL) and USNM 418180 (168.0 mm SL), collected on the surface of the ocean near Cabo Hammond (00°28'S, 91°37'W) after the eruption of Volcan Fernandina, Isla Fernandina, Galápagos Islands, on 4–5 Feb. 1995 by G. Merlen. Additional specimens of the new species (non-types) and of *G. filifer* were given to the Instituto Nacional de Pesca, Guayaquil, Ecuador.

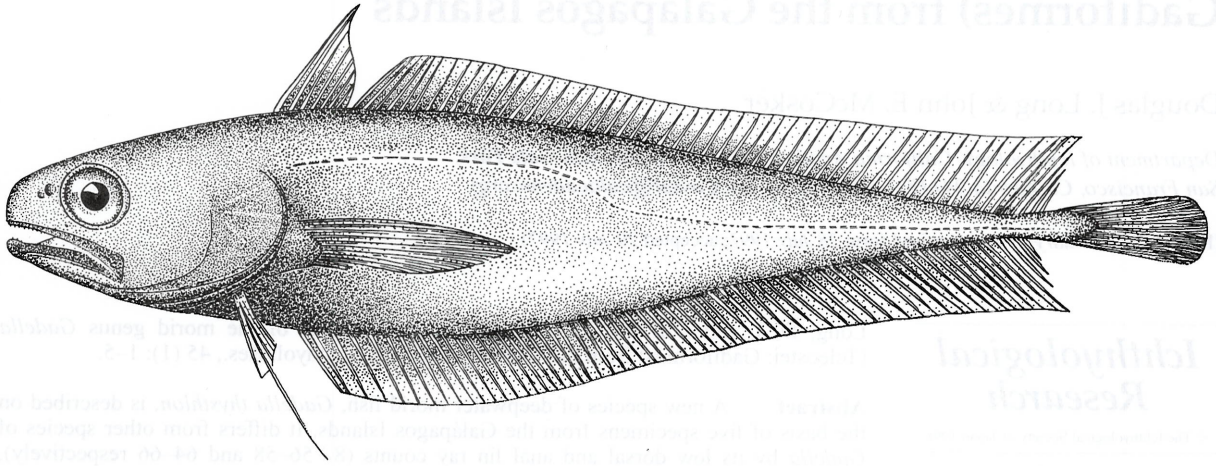


Fig. 1. Illustration of the holotype of *Gadella thysthlon* sp. nov. (CAS 86541), 111.4 mm SL, from the Galápagos Islands.



Fig. 2. Holotype of *Gadella thysthlon* sp. nov. (CAS 86541), 111.4 mm SL, photographed before preservation.

Comparative material. *Gadella filifer*: CAS 86545 (171.6 mm SL) collected by the *Johnson Sea Link* at 550 m off Roca Redonda, Galápagos Islands, 19 Nov. 1995; CAS 86540 (141.5 mm SL), collected by the *Johnson Sea Link* at 580 m off Isla Wolf, Galápagos Islands, 23 Nov. 1996; CAS 57849, 6 (91.4–115.6 mm SL), trawled at 0–1000 m between Isla Isabela and Isla Fernandina, Galápagos Islands, 17 Aug. 1968. *Gadella imberbis*: CAS 32006, 3 (155.5–213.2 mm SL) trawled at 274 m in the north western Atlantic Ocean (36°33.5'N, 74°42.6'W), 10 June 1973; CAS 56876 (59.7 mm SL) trawled between 513–768 m in the Caribbean Sea off St. Kitts and Nevis Is. (17°09'N, 62°42.6'W), 4 Aug. 1978; CAS 88439, 4 (154.1–160.9 mm SL) trawled at 439 m in the Caribbean Sea off Barranquilla, Colombia (11°12'N, 74°21'W), 3 Dec. 1968; CAS 117423, 3 (108.9–149.5 mm SL), trawled at 366 m in the Gulf of Mexico off the Mississippi Delta (29°13.3'N, 88°90'W), 22 May 1951; CAS 117424 (174.6 mm SL) trawled at 403 m in the Gulf of Mexico (27°51.5'N, 91°32.5'W), 11 Nov. 1951. *Gadella jordani*: CAS 118669, 5

(137.9–208.3 mm SL) caught off Shikoku, Japan, 30 Jan. 1951.

Diagnosis. A *Gadella* with: a small light organ placed closer to the anus than to the interventral line; comparatively low fin ray counts (D 8+56–58; A 64–66); small scales embedded in the gular region; and body coloration dark, fins red-orange with dark bases, a dark palatal midline, and a dark terminal end of the tongue.

Description. (Proportions represent the mean and range of the percentage of standard length). Body (Fig. 1) elongated and laterally compressed, body depth moderate 18.8 (16.4–20.6), caudal peduncle depth narrow 2.1 (2.0–2.4). Head moderately large,

length 25.1 (24.2–26.5), predorsal length 26.5 (25.3–29.5); head depth 15.7 (15.2–16.3) and width 13.7 (13.3–14.0). Snout short 6.8 (6.5–7.0) and blunt anteriorly, maxilla long 12.7 (12.1–13.2) and moderately narrow with a weak arch, posterior end extends just below posterior rim of orbit, chin barbel absent. Orbit round, eye diameter moderately large 6.0 (4.8–6.0), bony interorbital width 5.5 (5.3–6.0). Branchiostegal membranes free from isthmus, branchiostegal rays 8. Gill rakers slender and moderately long, 4–5+9–11. Vertebrae 55 to 57 (15+40–42).

Pectoral fin moderately long 16.5 (13.5–18.4), originates posterior to gill opening and extends to between 14th–16th anal rays, pectoral fin rays 25–27. Pelvic fins moderately elongate, with filamentous second ray that originates below branchiostegal mem-

branes well in advance of pectoral fin and extends to between 3rd to 5th anal rays; pelvic rays 5–6. First dorsal ray embedded, first external dorsal fin ray originates above or slightly posterior to pectoral base, dorsal fin height 9.3 (7.9–10.6), slightly longer than anterior rays of second dorsal fin 7.7 (7.1–8.3); interdorsal space minute or absent, second dorsal fin extends nearly to beneath caudal fin; dorsal fin rays 8+56–58, last rays free. Anal fin origin beneath pectoral origin and extending nearly to caudal fin, rays 64–66, last rays free. Small gap between median fins and origin of caudal fin, caudal rays 29–31, its posterior margin rounded or slightly tapered.

Small scales cover most of body except lips, branchiostegal membrane, and membrane of opercular margin; scales on anterior portion of gular area small

Table 1. Selected measurements of *Gadella thysthlon* sp. nov. in mm followed by the percentage of standard length in parentheses

| | Holotype | | Paratypes | | |
|-------------------------------|-------------|-------------|-------------|-------------|-------------|
| | CAS 86541 | CAS 86563 | USNM 418180 | CAS 86550 | CAS 86550 |
| Standard length | 111.4 | 214.0 | 168.0 | 159.0 | 73.6 |
| Body depth | 22.0 (19.7) | 44.1 (20.6) | 33.5 (19.9) | 27.7 (17.4) | 12.1 (16.4) |
| Caudal peduncle depth | 2.7 (2.4) | 4.4 (2.1) | 3.3 (1.96) | 3.2 (2.0) | 1.6 (2.2) |
| Head length | 29.6 (26.5) | 54.9 (25.6) | 40.7 (24.2) | 39.9 (25.1) | 17.9 (24.3) |
| Head width | 15.0 (13.5) | 30.1 (14.0) | 23.7 (14.0) | 21.7 (13.6) | 9.8 (13.3) |
| Head depth | 17.0 (15.2) | 34.1 (15.9) | 27.1 (16.1) | 25.9 (16.3) | 11.2 (15.2) |
| Snout length | 7.8 (7.0) | 15.0 (7.0) | 11.8 (7.0) | 10.5 (6.6) | 4.8 (6.5) |
| Orbital diameter | 6.2 (5.6) | 10.2 (4.8) | 8.5 (5.1) | 8.2 (5.2) | 4.4 (6.0) |
| Bony interorbital width | 6.7 (6.0) | 11.8 (5.5) | 9.1 (5.4) | 8.7 (5.5) | 3.9 (5.3) |
| Maxilla length | 13.6 (12.1) | 27.9 (13.0) | 22.1 (13.2) | 19.9 (12.5) | 9.5 (12.9) |
| Predorsal length | 32.9 (29.5) | 56.3 (26.3) | 42.6 (25.3) | 40.7 (25.6) | 18.9 (25.6) |
| Pectoral fin length | 20.5 (18.4) | 35.0 (16.4) | 29.9 (17.8) | 26.1 (16.4) | 1.0 (13.5) |
| Height of first dorsal fin | 11.9 (10.6) | 17.0 (7.9) | NA | NA | NA |
| Height of second dorsal fin | 9.2 (8.3) | 15.5 (7.1) | NA | NA | NA |
| Pelvic fin to anal fin (V-af) | 11.4 | 30.7 | 20.0 | 19.1 | 8.3 |
| Light organ diameter | 0.8 (6.6) | 2.0 (6.3) | 1.25 (6.26) | 1.20 (6.28) | 0.6 (7.2) |
| From insertion of ventral fin | 3.8 (32.9) | 12.8 (41.5) | 7.7 (38.6) | 7.4 (38.5) | 3.1 (36.7) |
| From light organ to anus | 2.9 (25.0) | 6.25 (20.4) | 4.3 (21.3) | 4.0 (20.7) | 2.0 (24.1) |
| Pectoral fin rays | 26 | 25 | 25 | 27 | 26 |
| Pelvic fin rays | 5 | 5 | 6 | 5 | NA |
| Dorsal fin rays | 8+56 | 8+56 | 8+58 | 8+56 | NA |
| Anal fin rays | 66 | 65 | 66 | 64 | NA |
| Caudal rays | 29 | 31 | 30 | 31 | 30 |
| Gill rakers | 5+10 | 5+11 | 4+10 | 5+10 | 4+9 |
| Branchiostegal rays | 8 | 8 | 8 | 8 | NA |
| Lateral line scales | 115 | 120 | 120 | 118 | NA |
| Transverse scales | 12 | 12 | 12 | 11 | NA |
| Vertebrae | 55 (15+40) | 57 (15+42) | 57 (15+42) | 56 (15+41) | NA |

Light organ measurements are given as the proportion of the distance between the insertion of the pelvic and anal fins. NA is listed in cases where the specimens are too small or damaged to permit proper counts.

and embedded. Scales in longitudinal series 115–120, from base of first dorsal fin to lateral line 11–12. Lateral line commences just posterior to upper angle of operculum and continues as a dark tube to just behind axis of pectoral fin, then continues as a series of disjunct tubes nearly to origin of caudal rays.

Teeth small and conical, vertical or with a slight posterior inclination, about equal in anterior 2/3 of jaw, grading to slightly smaller posteriorly. Tooth rows 1–2 in upper jaw, 2–3 in lower jaw. Teeth absent on vomer and palatines.

Light organ small, 6.5 (6.3–7.2) in V-af and closer to anus than to interventral line; interventral line to anterior margin of light organ 37.6 (32.9–41.5) in V-af; posterior margin of light organ to anterior margin of anus 22.3 (20.7–25.0) in V-af.

Color when fresh (Fig. 2). — Body entirely dark brown to blackish with a metallic blue sheen; median, pelvic, and caudal fins bright orange-red with a blackish base, pectoral fins pale with orange margins.

Color when preserved in ethanol. — Scaled specimens dark chocolate brown; gular area, branchiostegal membrane, opercular membrane, upper and lower lips, and portion of head anterior to eyes blackish with blue-black and dark brown highlights; scaleless specimens and exposed areas light tan with yellowish or pinkish highlights; in all specimens bluish around abdominal region from anterior gular area to beyond anal fin and to dorsal origin of pectoral fins. Fins clear to whitish with darkly pigmented bases; pigmentation on dorsal fin of largest specimen extends closer to distal margin. Inside of mouth generally whitish except for densely clustered melanophores on upper apical half of tongue; small melanophores scattered on vomer, in a thin line in center of palate from vomer to back of throat, on inner margins of upper and lower tooth rows, and in back of throat; both large and small melanophores scattered throughout tooth rows in upper and lower jaws; exposed posterior portion of maxilla light, but premaxilla blackish. Iris of eye is opaque blue surrounded by dark ocular membrane at margins.

Etymology. The Greek *thysthlon* is the sacred torch used to ignite ceremonial fires during the festivals that celebrated Bacchus (Roman) or Dionysus (Greek), the god of wine and revelry. The unique life color of this new *Gadella*, with bright orange-red fins emanating from a dark body, resembles such a torch, here considered a noun in apposition.

Remarks. The only other *Gadella* from the Galápagos Islands, *G. filifer* (Garman, 1899), differs

from *G. thysthlon* by having extremely long pelvic and pectoral fins and a filamentous second dorsal ray, more gill rakers (8–9+17–19), more second dorsal fin rays (64–71) and anal fin rays (72–74), fewer scales from the insertion of the first dorsal fin to the lateral line (8), no gular scales, a larger light organ (ave. 8.4 in V-af), a narrower body depth (ave. 16.7% SL) and caudal peduncle depth (ave. 1.3% SL), and has dusky fins, a dark palatal membrane and lacks a dark tongue tip.

The eastern Pacific *G. obscurus* (Parin, 1985) differs from *G. thysthlon* by having more dorsal fin rays (10+65) and anal fin rays (76), fewer lateral line scales (109), a higher gill raker count (6+13), and a smaller light organ (4.6 in V-af). *Gadella molokaiensis* Paulin, 1989 from Hawaiian waters differs by having slightly more first dorsal fin rays (8–9), second dorsal fin rays (70–74) and anal fin rays (71–76), more gill rakers (5+11–14), and more longitudinal scales (125).

The new *Gadella* species differs from other species found outside the central and eastern Pacific in the following ways: the east African *G. edelmanni* (Brauer, 1906) differs in having more dorsal fin rays (8–9+63–65), fewer gill rakers (2+10–11), fewer scales between the first dorsal fin and the lateral line (7), and a smaller light organ (ave. 5.7 in V-af). *Gadella imberbis* (Vaillant, 1888) from the Caribbean Sea and the southwestern and southeastern Atlantic differs by having more first dorsal fin rays (9–11), fewer gill rakers (3–4+4–10), fewer vertebrae (49–51), fewer longitudinal scales (81–88), a larger light organ (ave. 8.6 in V-af), larger teeth, its head and body are a pale tan with light or dusky branchiostegal membranes, and it lacks dark pigment on the fin bases. The Japanese *G. jordani* (Böhlke & Mead, 1951) has more second dorsal fin rays (67–74) and anal fin rays (65–72), a smaller light organ (ave. 3.7 in V-af), the head and body are pinkish-tan, and it lacks dark fin bases and pigmentation on the upper palate. The Mediterranean *G. maraldi* (Risso, 1810) differs by having more first dorsal fin rays (10–11), fewer scales between the first dorsal fin and the lateral line (8–9), fewer longitudinal scales (90–99), fewer gill rakers (3+7–9), fewer vertebrae (52), a larger light organ (ave. 9.1 in V-af), enlarged canine-like teeth are interspersed with smaller teeth in the jaws, and the head and body (in preserved fish) are pale tan with dark tips on the median fins. *Gadella norops* Paulin, 1987 from Australia and the Indian Ocean differs in having more dorsal rays (8–10+72–77) and anal fin rays (71–78), more vertebrae (59–63), a smaller light organ (ave. 4.0 in V-af), and when fresh,

the color of the head and body are pinkish and the median fins have black tips. *Gadella svetovidovi* Trunov, 1992 from the southeastern Atlantic has more dorsal (11–12+63–73) and anal fin rays (68–73), very short and fewer gill rakers (3+7–9), shorter pectoral and pelvic fins, wider median fins, and much larger teeth.

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