

New zoarcid fish species from deep-sea hydrothermal vents of the Atlantic and Pacific Oceans

M. Biscoito¹, M. Segonzac² and A. J. Almeida³

¹ IMAR - Museu Municipal do Funchal (História Natural), R. da Mouraria, 31, 9004-546 Funchal, Portugal

² IFREMER, Centre de Brest, BP 70, 29280 Plouzané, France

³ IMAR – Laboratório Marítimo da Guia, Estrada do Guincho, 2750-642 CASCAIS, Portugal

Introduction

The fish family Zoarcidae has 45 genera, two of which have been recorded from active hydrothermal vent fields, *Pachycara* Zugmayer, 1911 and *Thermarces* Rosenblatt & Cohen, 1986.

The genus *Pachycara* contains 17 species occurring in the Pacific, Atlantic, Antarctic and Indian Oceans (Møller and Anderson, 2000). Three of them, *P. gymminium* Anderson and Peden, 1988, *P. rimae* Anderson, 1989 and *P. thermophilum* Geistdoerfer, 1994, have been collected in active deep-sea hydrothermal vents, the last two being endemic to this type of environment (Tunnicliffe *et al.*, 1998).

To date, only one species of *Pachycara* (*P. thermophilum*) has been recorded from the Mid-Atlantic Ridge hydrothermal vents. This species was originally described from Snake Pit (23°22'N, 3,480 m) and subsequently found at Logatchev (14°45'N, 3,000 m), TAG (26°N, 3,700 m) and Broken Spur (29°N, 3,020 m) (Parin, 1995; Anderson and Bluhm, 1996; Geistdoerfer, 1997).

In contrast with *Pachycara*, *Thermarces* has only 3 nominal species, all of them restricted to chemosynthetically-driven environments: *Thermarces cerberus* Rosenblatt & Cohen, 1986, from 21°N, 13°N, 11°N and 9°N, in the East Pacific Rise and also in the Galapagos Ridge, *T. andersoni* Rosenblatt & Cohen, 1986 from 13°N EPR [considered a doubtful species (Anderson, 1994)], and *T. pelophilum* Geistdoerfer, 1999 from the Barbados accretionary complex.

Collection of specimens

Mid-Atlantic Ridge - (*Pachycara* n. sp.).

In 1997 the newly discovered Rainbow vent field, in the Mid-Atlantic Ridge (36°13.8'N, 2270–2320 m) was first visited by biologists, during *Nautilé's* diving cruise MARVEL (Aug–Sept 1997, PIs: D. Desbruyères and A-M. Alayse). In one of the dives (PL 1197, 23/8/1997) a zoarcid fish was seen dwelling among mussels (Fig. 1). At that time

it was impossible to collect a specimen. One year later, during AMORES cruise PICO (Jun–Jul 1998, PI: D. Desbruyères) and the Franco-Portuguese AMAR (Luis Mendes-Victor, FCT contract PRAXIS/2/2.1/MAR/1748/95), cruise SALDANHA (July 1998, PI: F. Barriga), Rainbow vent field was revisited and explored with *Nautilé*. This time 6 specimens were collected with the submersible's slurp-gun, and preserved for identification.



Figure 1. *Pachycara* sp. n. amongst mussels at Rainbow vent field. Photograph taken from video recorded by the *Nautilé* during MARVEL cruise (Atlantic Ocean).

International Ridge-Crest Research: **Biological Studies:** Biscoito *et al.*, cont

Figure 2. *Thermarces* sp. n. at 9°50'N, EPR. Photograph taken from video recorded by the Nautilie during HOT'96 cruise (Pacific Ocean).

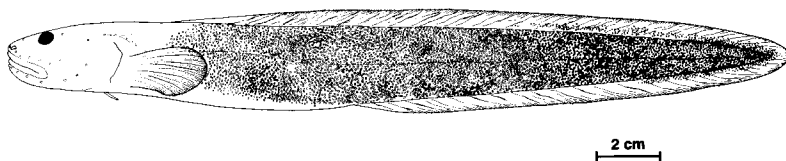


Figure 3. *Pachycara* sp. n. Drawing of the holotype, 247 mm SL.

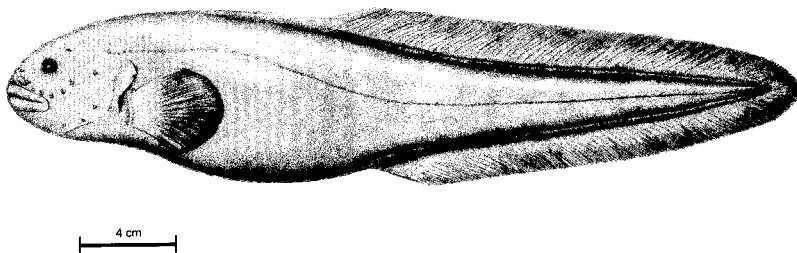


Figure 4. *Thermarces* sp. n. Drawing of the holotype, 375 mm SL.

East Pacific Rise, 9°N (Thermarces n. sp.).

Two specimens were collected with a baited fish trap during HOT 96 cruise (Feb–Mar 1996, PI: F. Gaill.) (Nautilie dive PL 1079, 08/03/1996) at the East Wall site (9°50.6'N, 2530 m) among mussels (many of them dead) (Fig. 2).

Results

Pachycara n. sp. (Fig. 3)

This new species, being de-

scribed elsewhere, is distinguished by the following characters: 31-32+85-86=117 vertebrae, gill rakers 2+14, dorsal fin with 109 rays, anal fin with 90-91 rays, pelvic fins present, with 2 rays, their length 11.4-13.5% HL, lateral line with medium-lateral and ventral branches, the latter very inconspicuous, scales absent from cheek, nape and abdomen.

It is undoubtedly very closely related to *P. thermophilum* Geistdoerfer, 1994, which also occurs in the same type of environment, 1,100 km south of Rainbow vent field. The first major difference found in our specimens is the presence of two branches of the lateral line (medium-lateral only in *P. thermophilum*).

Other differences include the interorbital width, which is consistently higher in our specimens than in *P. thermophilum* and the number of caudal vertebrae and dorsal and anal fin rays, whose counts are also higher in our specimens. In fact the vertebral formula do not coincide with any of the other 17 described species of *Pachycara*, with the exception of *P. bulbiceps*, Garman, 1899, which can easily be separated from our new species by the absence of pelvic fins.

Colour, uniformly light brown with whitish scale pockets, gives the specimens a mottled appearance. Outer margins of dorsal, anal and pectoral fins are dark. Eyes bluish and abdomen dark bluish brown. On video images taken by the submersible, the specimens appear almost white, with dark dorsal, anal and pectoral fins.

To date, this species is only known from Rainbow hydrothermal vent field, Mid-Atlantic Ridge (36°13.8'N, 2270–2320 m).

Thermarces n. sp. (Fig. 4)

This new species, being described elsewhere, is diagnosed by the following characters: vertebral formula 26-27+61=87-88, 79-81 dorsal fin rays, 15 pectoral fin rays and four teeth in a single row on vomer.

Our two specimens can easily be separated from *T. cerberus* and *T. pelophilum* by the above mentioned characters. Moreover, in all specimens of *T. cerberus* examined, teeth on vomer are not only more numerous, but always arranged in a patch, and not in a single row. Although colour should not be used as a diagnostic characteristic, it is worthwhile noting that our two specimens were uniformly dusky brown, when cap-

International Ridge-Crest Research: **Biological Studies:** Biscoito *et al.*, cont

tured. After four years in preservative, they have more or less kept the same colour. On the contrary, *T. cerberus* when fresh, are very light yellowish brown, sometimes mottled. After an equivalent time in preservative they become colourless. Another remarkable difference is the size of the body. *Thermarces* n. sp. is noticeable more corpulent than *T. cerberus*. Both differences, in colour and size, were confirmed by video observations.

This new species is only known with certainty from 9°N, 2520 m, East Pacific Rise.

Ecological information

Pachycara n. sp. lives well inside the active areas, usually amongst mussels and in between small boulders at the base of chimneys. Direct observations showed that these fish are usually solitary, the minimum observed distance between two specimens being 1.5 m. Consequently they seem not to be very abundant. In general they are not very active, unless disturbed. The temperature measured with *Nautilé's* probe in the exact place where a specimen was collected at Rainbow (marker PP37, 2287 m), was 15°C. Sea water temperature outside the active site was 3.8°C.

Stomach content analysis in one specimen revealed the remains of shrimp *Rimicaris exoculata* (Crustacea, Decapoda, Bresiliidae) together with orange-brown particles of oxides, very characteristic of Rainbow vent field. Based on the information available, *Pachycara* n. sp. can probably be considered endemic to Rainbow.

Thermarces n. sp. collected at East Wall (EPR, 9°N) lives inside or in the periphery of mussel beds (*Bathymodiolus thermophilus*) covering certain depressions on the basalts, bathed by mild temperature hydrothermal fluids (6.7°C) coming from diffuse vents (sea water temperature was 1.7°C). At this site the density of these fish was very low (4-5 individuals over several tens of square metres).

During the mission HOPE 99 (Apr – May 1999, PI: F. H. Lallier), great effort was made to obtain more specimens of this new species. All vent zoarcids collected at 13° and 9°N belonged to the species *T. cerberus*, which live in great numbers amongst clumps of *Riftia pachyptila*. On video images, all specimens observed showed the typical whitish colouration, leading us to conclude that they were all *T. cerberus*. At 9°N, none of the specimens recorded on video during the mission could be assigned to this new species, neither at East Wall, nor at various other sites extending 5 km further north.

Conclusions

The finding of these new species reinforces the position of the family Zoarcidae, as the dominant fish taxon in the hydrothermal vent environment. In the description of *Thermarces* n. sp., the authors will deal with the affinities of the new species with the *T. cerberus*/*T. andersoni* complex. In future missions to the EPR, emphasis should also be put in obtaining more specimens from *Thermarces* n. sp., not only to obtain material for genetic analyses in order to establish the relationship between the two species, but also to ascertain their distribution. We also expect to be able to collect more specimens of *Pachycara* n. sp. during the forthcoming ATOS cruise, scheduled for June 2001, in order to obtain material for genetic analyses.

Acknowledgements

The authors are indebted to Françoise Gaill, Daniel Desbruyères, Fernando Barriga and François Lallier, Chief-Scientists of HOT96, MARVEL and PICO, SALDANHA and HOPE 99 cruises respectively, for the invitations to take part in these cruises and collaboration on board. Thanks are also due to the Captains and crews of the French *N/O Nadir* and *N/O L'Atalante*, the pilots and technicians of the deep submersible *Nautilé*, and several colleagues for all their help at various levels during the cruises. Helena Encarnação of the Museu Munci-

pal do Funchal (História Natural) made the fine illustrations.

This work was made possible through funds obtained from the EU-MAST3 funded AMORES (Azores MOR Ecosystem Studies, Coordinator D. Desbruyères, MAST III contract MAS3-CT95-0040.) (Contract n° MAS3 95-0040), Portuguese PRAXIS XXI AMAR Project (Contract n° PRAXIS/2/2.1/MAR/1748/95, and by the URM7 Ifremer and Dorsales Programme. The examination of material at the MNHN in Paris was sponsored by the ICCTI-IFREMER Agreement in Oceanology.

References

- Anderson, M. E., Systematics and osteology of the Zoarcidae (Teleostei: Perciformes). *Ichthyological Bull.*, 60: 1-120, 1994.
- Anderson, M. E. & H. Bluhm, Description of new species of *Pachycara* Zugmayer, 1911 from the abyssal south-eastern Pacific and redescription of *P. thermophilum* Geistdoerfer, 1994, with a new key to the species. *Transactions of the Royal Society of South Africa*, 51: 219-227, 1996.
- Geistdoerfer, P., *Pachycara thermophilum* Geistdoerfer, 1994, 226. In: *Handbook of deep-sea hydrothermal vent fauna*. Desbruyères, D. & M. Segonzac (Eds.). IFREMER, Brest. 279, 1997.
- Møller, P. R. & M. E. Anderson, Assignment of *Lycodes microcephalum* Jensen, 1902 to *Pachycara* Zugmayer, 1911 (Teleostei: Zoarcidae). *Cybium*, 24(1): 61-65, 2000.
- Parin, N. V., Deep-Sea Fishes, *Haptenchelys texis* (Synphobranchidae) and *Pachycara thermophilum* (Zoarcidae) from Broken Spur Hydrothermal Vent Field (Mid-Atlantic Ridge). *Journal of Ichthyology*, 35(9): 328-332, 1995.
- Tunnicliffe, V., A. G. McArthur & D. McHugh, A Biogeographical Perspective of the Deep-Sea Hydrothermal Vent Fauna. *Advances in Marine Biology*, 34: 353-442, 1998. 