

## Research article

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# *Echiodon prionodon*, a new species of Carapidae (Pisces, Ophidiiformes) from New Zealand

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**Abstract.** A new species of pearlfish, *Echiodon prionodon*, is described from three specimens. This species is diagnosed by having a serrated margin on the posterior edge of the fangs, expanded thoracic plates on some abdominal vertebrae and ventral swimbladder tunic ridges. This species was only found in coastal waters around the North Island of New Zealand. The diagnosis of *Eurypleuron* is revised.

**Key words.** *Echiodon*, *Eurypleuron*, pearlfish, New Zealand.

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## Introduction

The Carapidae, which include Pyramodontinae and Carapinae, are eel-like fishes. They range from shallow water to moderately deep waters of the continental slope (Nielsen *et al.* 1999). Several species belonging to the genera *Onuxodon*, *Carapus* and *Encheliophis* are well known for their unusual behavior of entering and living inside invertebrate hosts such as sea cucumbers, sea stars, or bivalves (Trott 1981). Some *Echiodon* species could be commensals with sponges or polychaete worm tubes (Nielsen *et al.* 1999), but it is not proven.

The Echiodontini tribe (Carapinae, Carapidae) comprises three genera (Markle & Olney 1990). 1) *Onuxodon* Smith, 1955, with three species, diagnosed by the presence of a rocker bone in front of the swimbladder and a commensal relationships with species of Mollusca (Tyler 1970; Parmentier *et al.* 2000; Amaoka & Yoseda 2005). 2) *Echiodon* Thompson, 1837, comprising a group of 11 valid species (and 1 unnamed larva) found over a depth range of 18–2000 m (Williams 1984a, b; Markle & Olney 1990; Williams & Machida 1992; Anderson 2005). This taxon is supported by one synapomorphy: a ventral patch of tunic ridges on the posterior swimbladder (Markle & Olney 1990). 3) *Eurypleuron* Markle & Olney, 1990, characterized by having thoracic plates formed by expanded parapophyses (transverse processes) on the fifth through 18-20th vertebrae (males only) and an exterilium gut supported by elongate, cartilaginous, ventral processes of the coracoid in vexillifer larvae. Markle & Olney (1990) considered the genus monospecific, *Eurypleuron owasianum* (Matsubara, 1953), with two major disjunct populations. However, these two populations have differences in D<sub>30</sub> counts, precaudal

vertebral numbers and stomach color. On the basis of these characters and the antitropical distributions (the Northern population is found above 20° North and Southern population occurs below 20° South), Williams & Machida (1992) proposed that these populations correspond to two different species: *Eurypleuron owasianum* in the north and *Eurypleuron cinereum* (Smith, 1955) in the south. According to the authors, additional specimens are required to better resolve this issue.

Examination of the collection of carapids held at the Museum of New Zealand Te Papa Tongarewa (Te Papa) revealed three specimens with characters shared by *Echiodon* and *Eurypleuron*. The three specimens are here described as a new species and comments on the diagnosis of these genera are given.

## Material and methods

Measurements were made with digital calipers to the nearest 0.1 mm. Information of the axial skeleton was obtained from X-ray digital photographs. The following abbreviations for meristic characters are from Markle & Olney (1990):

A <sub>30</sub>	=	anal-fin rays anterior to vertical through articulation between vertebrae 30 and 31
ARDO	=	anal-fin rays anterior to dorsal-fin origin
D <sub>30</sub>	=	dorsal-fin rays anterior to vertical through vertebrae 30 and 31
P1	=	pectoral-fin rays
PCV	=	precaudal vertebrae
VAO	=	vertebrae to anal-fin origin
VDO	=	vertebrae to dorsal-fin origin
VPB	=	vertebra number under predorsal bone

Other abbreviations are:

HL	=	head length
TL	=	total length
FAKU	=	Faculty of Agriculture, Kyoto University
NMNZ	=	Museum of New Zealand Te Papa Tongarewa
RUSI	=	Rhodes University, J.L.B. Smith Institute of Ichthyology, Grahamstown
ZMUC	=	Zoological Museum of the University of Copenhagen

The present specimens were compared with *Echiodon cryomargarites* Markle, Williams & Olney, 1983 (NMNZ P016530, NMNZ P016537), *Echiodon pegasus* Markle & Olney, 1990 (NMNZ P016529, NMNZ P020999), *Echiodon rendahli* (Whitley, 1941) (NMNZ P014855) and with radiographs of *Echiodon neotes* Markle & Olney, 1990 (ZMUC P77815), *Eurypleuron cinereum* (RUSI 309) and *Eurypleuron owasianum* (FAKU 34517, 34518, 34519).

## Results

Class Actinopterygii Klein, 1885  
Order Ophidiiformes Berg, 1937  
Family Carapidae Jordan & Fowler, 1902  
Genus *Echiodon* Thompson, 1837

*Echiodon prionodon* sp. nov.

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Figs 1-4

### Diagnosis

A species of *Echiodon*, with a serrated posterior margin on the fangs, expanded thoracic plates on some abdominal vertebrae, PCV 33–35,  $D_{30}$  42–45,  $A_{30}$  40–41.

### Etymology

From the Greek *prion* meaning saw, and *odous* (odon) meaning tooth, in reference to the unique morphology of the fang at the tip of the jaw.

### Type material

#### Holotype

♂, 165 mm TL, in NMNZ (P.041833), RV *Tangaroa*, sta. TAN 0413/119, 13 Nov. 2004.

#### Paratypes

NMNZ P.003281 (97 mm TL), off Kapiti Island, 40°51.0'S – 174°52.0'E, Fred Abernethy, 37 m, Apr. 1958, badly cleared and stained specimen; NMNZ P.052493 (57+ mm, anterior portion only), outer North Taranaki Bight, RV *Tangaroa*, sta. TAN 1105/137, 38°26.70'S – 173°18.97'E, 170-240 m epibenthic sled, 5 Apr. 2011.

### Type locality

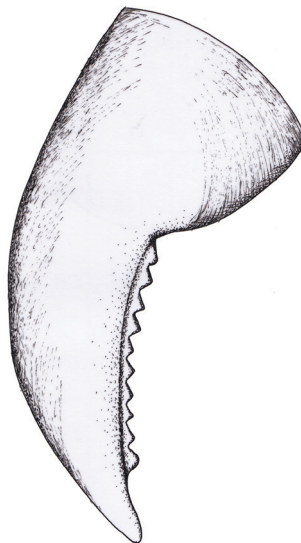
Off White Island, outer Bay of Plenty, New Zealand, 37° 33.57'S – 176° 59.1-58.8'E, 313 m bottom trawl.



**Fig 1.** *Echiodon prionodon* sp. nov., left lateral view (holotype NMNZ P.041833, 165 mm TL).

**Table 1.** Morphometric (mm) and meristic data for *Echiodon prionodon* sp. nov. Numbers in brackets refer to measurements in % head length.

	<b>NMNZ P.041833 Holotype</b>	<b>NMNZ P.003281 Paratype</b>	<b>NMNZ P.052493 Paratype</b>
Total length (mm)	165	97	-
Head length	17.8	12.8	12.5
Preanus length	21.1 (118)	14.9 (116)	15.4 (123)
Predorsal length	26.3 (147)	15.8 (123)	17.8 (142)
Snout length	2.5 (14)	2.0 (15)	2.2 (17)
Upper jaw length	7.8 (44)	5.9 (46)	6.0 (48)
Lower jaw length	9.3 (52)	6.4 (49)	6.8 (54)
Horizontal eye diameter	4.1 (23)	3.3 (25)	2.9 (23)
Head depth	6.9 (39)	5.3 (41)	-
Depth at anus	8.4 (47)	5.8 (45)	6.3 (50)
Interorbital length	2.2 (12)	1.4 (11)	1.5 (12)
Pectoral length	8.7 (49)	-	8.2 (65)
<b>Meristic</b>			
PCV	33	33	35
D <sub>30</sub>	45	42	-
A <sub>30</sub>	40	-	41
VDO	8	8	8
VAO	7	6	7
VPB	7	-	7
P <sub>1</sub>	15	14	13



**Fig. 2.** *Echiodon prionodon* sp. nov., left lateral view of the left premaxillary fang showing the posterior serrated margin.

## Description

Selected counts and measurements are given in Table 1 and the holotype is shown in Figure 1. Body slender, much higher than wide, tapering into a pointed tail; greatest body depth (at anus) approximately 5% of total length; no caudal fin; dorsal fin origin posterior to anal fin origin, anus ends in a tube at half length of the pectoral fin. Dorsal profile of head slightly convex. Snout rounded in lateral view, slightly projecting beyond upper jaw. Olfactory lobe approximately 70% of snout length, closer to the eye than to the snout tip; anterior nostril developed in a small tube; posterior nostril directly in front of anterior margin of eye, elliptical, being higher than long. Eye elongate, longer than high. Mouth oblique, upper jaw extending beyond posterior margin of eye; posterior portion of maxilla unsheathed. Anterior tip of lower jaw behind tip of snout, lower jaw occlusion with palatine bones. Short opercular spine exposed through an elliptical slit in skin. Gill opening extends from upper end of pectoral fin base to below rear end of maxillary. Seven branchiostegal rays. Ceratobranchials 1 with three slender gill-rakers, with tooth pads on upper limb; other gill-rakers tubercular.

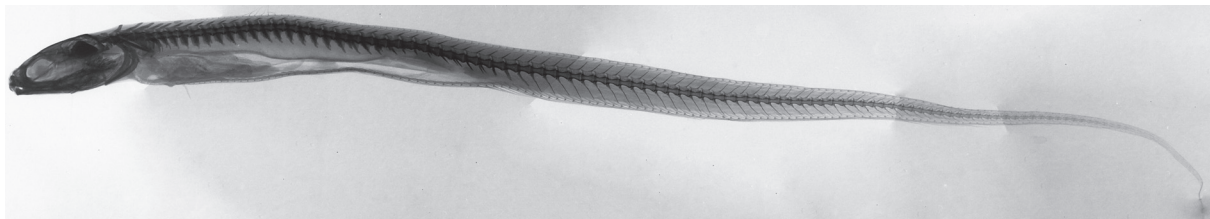
Two enlarged caniniform teeth near symphysis in premaxilla and in dentary (one tooth missing on left lower jaw in holotype). Each of these caniniform teeth has a serrated margin posteriorly (Fig. 2). Upper and lower jaw fangs are separated from the posterior teeth rows by a pronounced diastema. Eight to nine rows of small, minute, straight, conical teeth on dentary, 3-4 outer rows with smaller teeth. Four to five rows of small conical teeth on the upper jaw, teeth on inner rows somewhat longer and curved inwardly, teeth of outer rows similar to lower jaw teeth. Palatine with 4-5 rows of villiform teeth. Vomer a small oblong bump with irregular disposition of small conical teeth, posterior one being somewhat bigger. In the holotype (Fig. 3), vertebral centra 6 to 24 with parapophyses expanded to form lateral plates (vertebral centra 6 to 14 in NMNZ P.052493, 6 to 17 in NMNZ P.003281). Holotype swimbladder extends to 30<sup>th</sup> vertebral centra (57.9 mm from the snout tip), slight central constriction separating anterior part, brown with dark spots, and shorter posterior part, unpigmented and with ventral tunic ridges.

## Color pattern

After eight years in alcohol, the holotype has cream-colored body and head. Melanophores highly concentrated at the level of the geniohyoideus (throat), but not on the lower jaws, at the oro-branchial cavity on the tongue, the palate, branchial arches, on the inner face of the opercula, on the parietals and on the posterior parts of the frontal. Stomach and peritoneal cavity black, anus unpigmented. Melanophores concentrated at the base of dorsal and anal fins and forming lines on the lateral lines and on different myosepta. Pterygiophores of anal and dorsal fins black from the tip to approximately 1/5 of the body length.

## Differential diagnosis

*Echiodon prionodon* sp. nov. is unique in having serrated posterior margin on the fangs. Moreover, it differs from all others *Echiodon* species by the thoracic plates on some abdominal vertebrae and it differs from *Eurypleuron* species by having tunic ridges on the swimbladder.



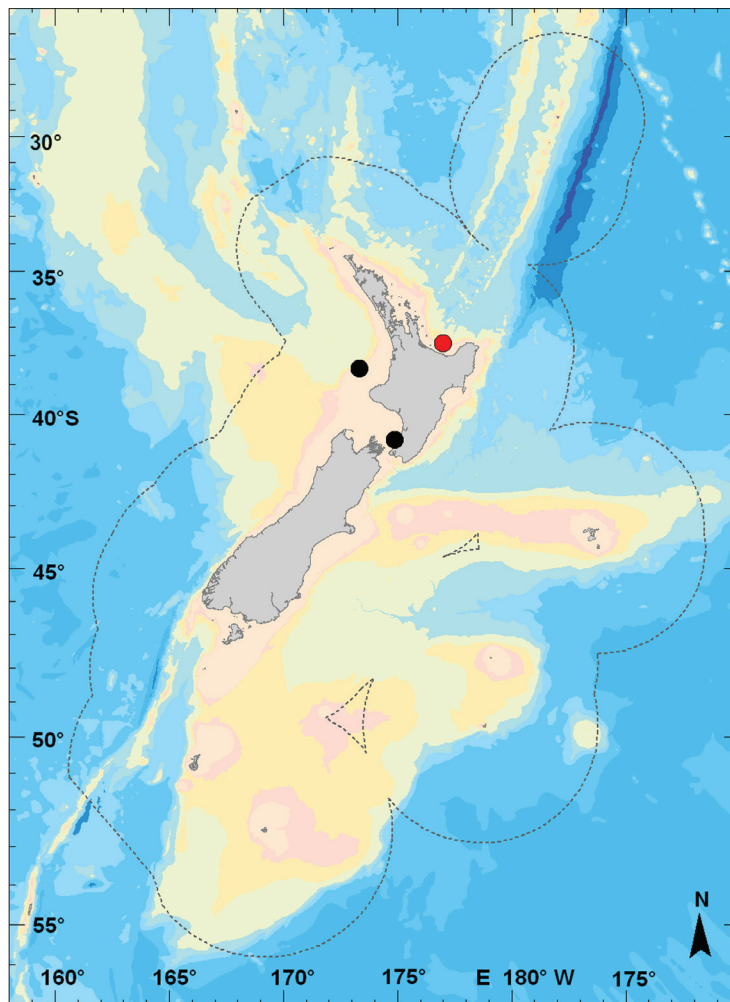
**Fig. 3.** *Echiodon prionodon* sp. nov., left lateral X-ray (holotype NMNZ P.041833, 165 mm TL).

## Distribution

Endemic to coastal waters around the North Island of New Zealand (Fig. 4). The species seems to be benthic from 30 to 315 m depth. The holotype was caught along with other fish species which usually are associated with shelly-gravel to sandy bottoms with patch reefs as *Gnathophis umbrellabius* (Whitley, 1948) (Congridae), *Hoplostethus mediterraneus* Cuvier, 1829 (Trachichthyidae) and *Paraulopus nigripinnis* (Günther, 1878) (Paraulopidae).

## Discussion

*Echiodon* and *Eurypleuron* are sister genera with similar morphologies (Markle & Olney 1990). Both have eel-like bodies, one to several large symphyseal fangs on dentary and premaxilla. They lack cardiform teeth, pelvic bones and rocker bone (Nielsen *et al.* 1999). In the carapid cladogram, Markle & Olney (1999: fig. 45) noted two non-homoplastic characters in support of *Eurypleuron*: greatly expanded plate-like parapophyses on centre 5 to 18-22 (males only) and an exterilium gut in larvae. The genus is currently monotypic but Williams & Machida (1992) recommended more research. They argued, that the genus consists of two species: a Northern Pacific population with *Eurypleuron owasianum* (Matsubara, 1953) and a Southern Pacific population with *Eu. cinereum* (Smith, 1955). In *Eurypleuron*



**Fig. 4.** Distribution of *Echiodon prionodon*. The red circle depicts the locality where the holotype was caught.

from both hemispheres, the only autapomorphic character (ventral tunic ridges on the swimbladder) that supports *Echiodon* was not found.

*Echiodon prionodon* sp. nov. shows characters of both genera: ventral tunic ridges on the swimbladder and expanded parapophyses. The number of plate-like parapophyses is, however, more variable than in *Eurypleuron owasianum* (from 8 to 18), which seems related to the size of the fish. I was unable to confirm the sex of the three specimens and therefore cannot confirm if it is a sex-related character. In addition, radiographs do not show the parapophyses expanded in the same way as in *Eurypleuron* and I conclude that this character results from either convergence or is a homoplastic character.

Many Ophidiiformes use their swimbladder and associated bones to produce sounds (Courtenay & McKittrick 1970; Parmentier *et al.* 2002; Fine *et al.* 2007; Parmentier *et al.* 2010). Previous anatomical studies showed all the carapids have sound-producing muscles and therefore are able to produce sounds (Parmentier *et al.* 2002). It is noteworthy that all the characters separating adult *Echiodon* from *Eurypleuron* are related to the sound-producing mechanism (Parmentier & Diogo 2006). This system could play an important role in the speciation process of the group.

Because swimbladder ventral tunic ridges are common to all the *Echiodon* species, it is more parsimonious to place *Ec. prionodon* sp. nov. in this genus; otherwise, the genus would be deprived of autapomorphic characters. Moreover, *Ec. prionodon* sp. nov. shares additional characters with other *Echiodon* species. It has in common with *Ec. drummondi* Thompson, 1837, *Ec. dentatus* (Cuvier, 1829) and *Ec. rendahli* a central constriction of the swimbladder, with *Ec. rendahli* a high number of PCV, the same kind of dentition (minute teeth in several rows on both lower and upper jaws) and the same geographic range (Williams 1984a; Markle & Olney 1990).

More research is required to define the diagnosis of *Eurypleuron*. The former diagnosis was: thoracic plates formed by expanded parapophyses (transverse processes) on the fifth through 18-20th vertebrae (males only); an exterilium gut supported by elongate cartilaginous ventral processes of the coracoid in vexillifer larvae; lack of ventral tunic ridges on the posterior portion of the swim bladder; dorsal-fin origin over anal-fin origin resulting in equivalent (or almost so)  $A_{30}$  and  $D_{30}$  values (Markle & Olney 1990). Two characters are now invalid: expanded parapophysis (this study) and the equal  $D_{30}$  and  $A_{30}$  counts, recently also found in the newly described species *Echiodon atopus* Anderson, 2005 from the South Atlantic (Anderson 2005).

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