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SHORT NOTE

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Aspects of the biology of the icefish *Dacodraco hunteri* (Notothenioidei, Channichthyidae) in the Ross Sea, Antarctica

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Abstract On the basis of five specimens, the icefish *Dacodraco hunteri* (Notothenioidei, Channichthyidae) is documented for the first time in the Ross Sea, Antarctica. Meristic counts and morphometric measurements are provided for this small, streamlined, laterally compressed species. *D. hunteri* has a weakly ossified skeleton with considerable cartilage in the skull. It has a partially persistent notochord and reduced amounts of bone in the vertebral column since the centra are incompletely constricted. Its weight in seawater averages only 1.28% of its weight in air and, as one of the lightest notothenioids, *D. hunteri* is probably a permanent inhabitant of the water column. The diet consists of relatively large specimens of the pelagic nototheniid fish *Pleuragramma antarcticum*.

Introduction

The biology of the channichthyid icefish *Dacodraco hunteri* Waite, 1916 is unknown (Iwami and Kock 1990). The species account is based on only seven specimens (Iwami and Kock 1990) and the monograph treating the phylogeny and systematics of channichthyids includes only two specimens of *D. hunteri* (Iwami 1985). Extensive trawling by R/V *Polarstern* in the Weddell and Lazarev Seas has resulted in additional catches of *D. hunteri* (Ekau 1988, 1990; Schwarzbach 1988; Hubold 1992; Zimmermann 1997). Although there is little published information regarding this species, *D. hunteri* is known to inhabit deep, high-latitude shelf waters (Kock 1992). Two recent cruises of the R/V *Nathaniel B. Palmer* in the southwestern Ross Sea yielded five specimens of *D. hunteri*, the first occurrence for this species in the Ross Sea. These specimens are the subject of this report.

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Materials and methods

D. hunteri were collected during cruises 96-6 (11 December 1996 to 8 January 1997) and 97-9 (20 December 1997 to 10 January 1998) of the R/V *Nathaniel B. Palmer* in the southwestern Ross Sea. The ship pulled a 9.1-m-long Marinovich Gulf Coast-style flat trawl, a light-duty commercial otter trawl. The footrope was 11 m long, but the effective width or mouth opening covered by netting was only 7.6 m. Towing speed was 2.0–3.0 knots for 30–60 min. Four specimens were taken during cruise 96-6 at station 119 (77°19′S, 165°41′E, bottom depth 910 m, 8 January 1997). One additional specimen was procured during cruise 97-9 at station 30 (76°16′S, 165°16′E, bottom depth 737 m, 27 December 1997). Living specimens were observed and the buoyancy of *D. hunteri* was determined aboard ship by weighing heavily anaesthetized specimens in seawater following the procedures of Eastman and DeVries (1982). Meristic counts were obtained from soft radiographs; morphometric measurements were made on specimens preserved in 10% formalin and stored in 70% ethanol. The kidneys were examined under light microscopy after conventional histological processing. Specimens were deposited as two lots in the Museum of Comparative Zoology, Harvard University, Cambridge, Mass. under catalog numbers MCZ 154360 and 154361.

Results and discussion

Data for the specimens are summarized in Table 1. Specimens were 73–82% of maximum known total length (Iwami and Kock 1990). Gonads were in the resting stage, with the exception of the somewhat larger testes of the specimen from station 30. Microscopy revealed that the kidneys were aglomerular. The parietal peritoneum was speckled with melanophores and was darkest laterally. Dark pigment was absent from the *tunica serosa* of the gastrointestinal tract. The relatively light peritoneal pigmentation suggests that bioluminescent organisms

Table 1 Meristic, morphometric and morphological data for *Dacodraco hunteri* from the Ross Sea. Ratios are expressed as percent of standard length

Cruise/station no.	NBP 96-6/119				NBP 97–9/30
Specimen no.	1	2	3	5	1
Total length, preserved (mm)	213	229	233	238	226
Standard length, preserved (mm)	183	198	205	204	194
Weight, fresh (g)	61	68	83	89	65
Dorsal spines/rays	IV/32	III/34	IV/33	III/34	IV/33
Anal rays	32	33	33	34	32
Pectoral rays	26	25	25	26	25
Vertebrae (abdominal + caudal)	20 + 34 = 54	20 + 35 = 55	20 + 35 = 55	20 + 34 = 54	20 + 34 = 54
Stomach length/standard length	13.2	8.5	18.9[a]	22.0[a]	7.5
Intestine length/standard length	44.8	45.4	43.4	47.0	42.8
Pyloric caeca	4	4	4	4	4
Sex	Male	Male	Female	Female	Male
Stomach contents	1 Pleuragramma	Empty	1 Pleuragramma	1 Pleuragramma	Empty
Air/seawater weight (%)	1.07	1.18	1.20	1.68	

[a] Stomach full and distended when preserved; length may be unusually long

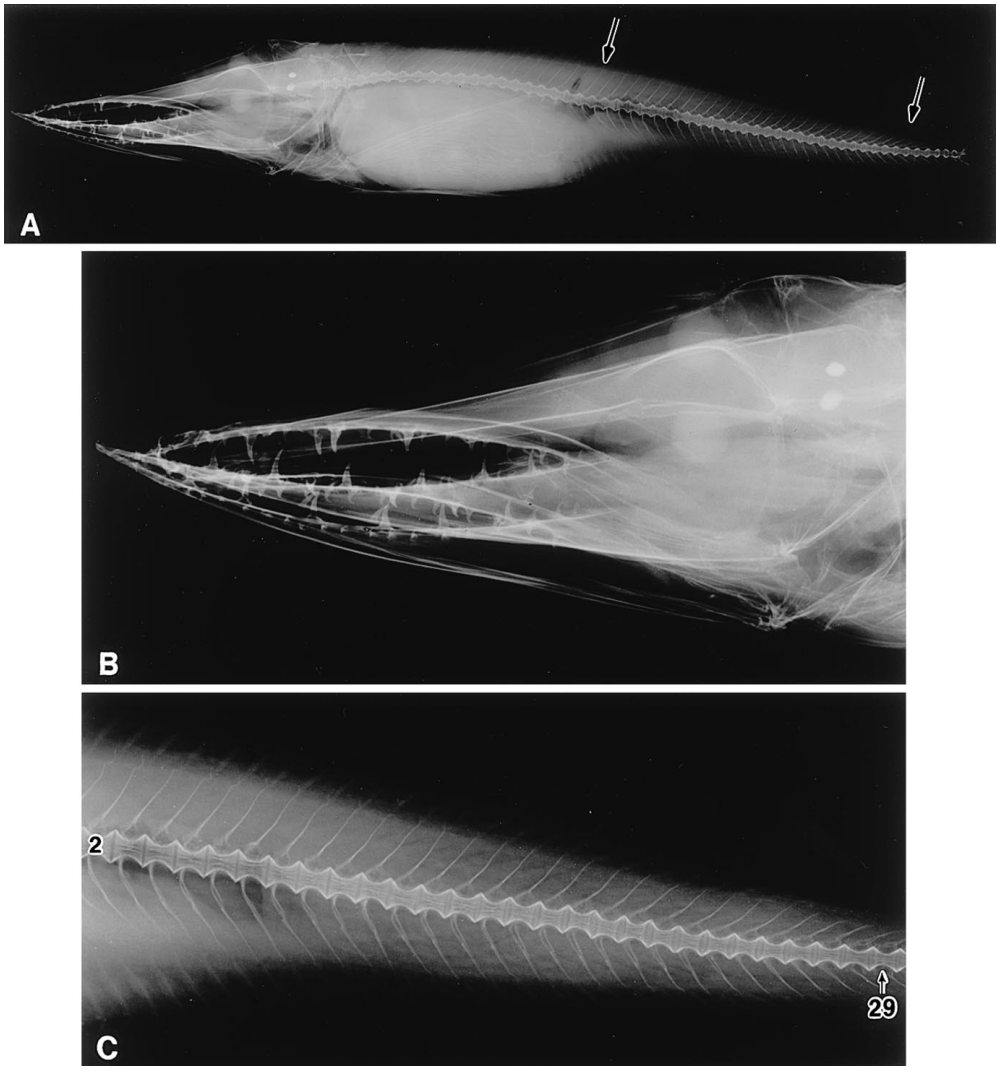

Fig. 1A–C Radiographs of *Dacodraco hunteri*, NBP 96-6, station 119, specimen 5, MCZ 154360 (Kodak Industrex M film, 30 kV, 2.7 mA, 3.9 min exposure). **A** Slightly oblique left lateral view with superficial structures obliterated by long exposure time, enhancing visualization of skull and vertebral column. *Dark area* from caudal vertebrae 2–7 is an artifact resulting from removal of muscle sample. *Arrows* indicate region of vertebral column enlarged in **C** × 0.6. **B** Enlargement of head showing the relatively small amount of bone (*white tones*) and predominance of cartilage (*gray tones*). Otoliths may be used as a standard of reference for densest material in body. Bowing of jaws and series of large canine teeth are evident. × 1.6 **C** Enlargement of caudal vertebrae 2–29 showing partially constricted centra with large notochordal foramen and small vertebral processes. × 1.6

were not important prey items. The only grossly visible lipid deposits were located in the mesenteries and subcutaneously in the mid-ventral body wall. The body wall deposit was at least twice as thick as the adjacent hypaxial musculature. The gastrointestinal morphology was typical for channichthyids with the exception that the pyloric caeca were longer and more numerous than the one to three short, bunt caeca typical for this family (Ojeda 1986; Eastman and DeVries 1997). Relative intestinal length was less than in other channichthyids (Ojeda 1986). Three of five stomachs contained single, relatively large (90–100 mm SL) specimens of the pelagic notothenid *Pleuragramma antarcticum* Table 1).

In four specimens (Table 1), measurements of buoyancy averaged 1.28% (±0.27 SD). Small samples of other channichthyids (*Cryodraco*, *Chionodraco*, *Pagetopsis*) were in the range 2.51–3.15%. With the exception of the neutrally buoyant notothenids *Dissostichus mawsoni* and *Pleuragramma antarcticum*, *Dacodraco hunteri* had the lowest percentage weight of any notothenioid measured to date (Eastman and DeVries 1982) and is probably a permanent inhabitant of the water column.

Radiography (Fig. 1A–C) indicated that the low weight in water was at least partially attributable to reduced ossification in the skull and vertebral column. The skull contained areas of cartilage sheathed by thin laminae of bone (Fig. 1B). Since *Dacodraco hunteri* had a partially persistent notochord, vertebral centra were incompletely constricted around the relatively large notochordal foramen (Fig. 1C). The amount of vertebral bone was therefore reduced. Among notothenioids, the delayed ossification of bones during ontogeny is most pronounced in channichthyids (Voskoboynikova 1997). This and the persistence of the larval notochord suggest that heterochrony played a role in the diversification of notothenioids, especially those living in the water column.

Dacodraco hunteri had a streamlined, laterally compressed body and a relatively long head with less opercular flaring than the majority of channichthyid species. In this sense it was similar to *Chaenodraco wilsoni*, *Champsocephalus gunnari and C. esox*, although the head in these three species was shorter (Iwami and Kock 1990). In life, the large eyes of *Dacodraco hunteri* bulged from the profile of the body, indicating that feeding vectors were directed up and down in the water column as well as laterally. The head was narrow and pointed, with more distinctly bowed jaws than other channichthyids (Fig. 1A,B). Given the small size of this species and the narrowness of the jaws, the bowing may serve to accommodate thick soft-bodied prey, which are impaled transversely on the large canine teeth before being swallowed. The limited data on diet indicated that, in the Ross Sea, *Dacodraco hunteri* feed pelagically or benthopelagically on relatively large *Pleuragramma*, some of the prey approaching 50% of its own length.

In conclusion, this report documents the circum-Antarctic distribution and aspects of the biology of a little-known channichthyid. *Dacodraco hunteri* is another example of the repeated diversification of pelagic species, especially in the families Nototheniidae (Eastman 1993) and Channichthyidae (Nybelin 1947; Chen et al. 1998), into under-utilized habitats in the water column of the Antarctic shelf.

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