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SHORT NOTE

Joseph T. Eastman · James P. Barry

Underwater video observation of the Antarctic toothfish *Dissostichus mawsoni* (Perciformes: Nototheniidae) in the Ross Sea, Antarctica

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Abstract A towed benthic camera system captured images of a ca. 66-cm-long Antarctic toothfish partially under a boulder at 76°30′S, 174°59′E (depth 454 m) in the southern Ross Sea. This is noteworthy because, excluding McMurdo Sound, there are only two published records for this species in the Ross Sea and none in an offshore locality. Adult *Dissostichus mawsoni* are neutrally buoyant and live and feed in the lower reaches of the water column. Benthic perching is unexpected, suggesting that this subadult is not neutrally buoyant.

Introduction

The Ross Sea is a large embayment of the Antarctic continental shelf extending to nearly 78°S (Fig. 1). The fish fauna includes about 80 species and is dominated by endemic perciforms of the suborder Notothenioidei (Eastman and Hubold 1999). With maximum sizes of 2 m and over 100 kg (DeVries 1998; Kock and Everson 1998), toothfishes of the nototheniid genus *Dissostichus* are the largest fish in the Antarctic Ocean and the subjects of an expanding fishery (Kock 1992; Merrett and Haedrich 1997). The Antarctic toothfish, *Dissostichus mawsoni* Norman 1937, inhabits cold waters between the Antarctic Polar Front and the continental margin, whereas the Patagonian toothfish, *D. eleginoides* Smitt 1898, lives primarily north of the Antarctic Zone (DeWitt et al. 1990). Under the auspices of the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR), commercial vessels have conducted exploratory longlining in high-latitude shelf waters. In 1999/2000, 745 t of *D. mawsoni* were taken in CCAMLR Statistical Subarea 88.1 (Fig. 1) in the western Ross Sea (Anonymous 2000). Although the distribution of *D. mawsoni* is considered in several papers (Yukhov 1970, 1971, 1972; Abe and Iwami 1989) and a book (Yukhov 1982), most data are based on specimens taken from the stomachs of sperm whales in oceanic waters at 60–70°S, far north of the shelf break. With the exception of McMurdo Sound (Eastman and DeVries 2000), there are few locality records for *D. mawsoni* in the Ross Sea.

During a video survey of benthos in the Ross Sea, we incidentally acquired brief images of *D. mawsoni*. In this note we record for the first time an in situ observation of this species at an offshore locality and in an unexpected benthic habitat. Underwater photography is useful for providing information on habitat preferences in Antarctic fish (Gutt and Ekau 1996).

Materials and methods

We obtained video sequences of the benthos using a towed camera system positioned ~2 m above the sea floor. The system includes a pressure-housing enclosing batteries, a hi-8 SONY camcorder to record imagery from the camera at 30 frames s^{-1}, and control electronics. The color camera (Deep-Sea Power and Light SeaCam 4000, auto-focus mode) was oriented orthogonal to the sea floor, thereby minimizing perspective distortion (Wakefield and Genin 1987). Two 250-W lights (DSP&L SeaLite) illuminated the sea floor from the nose and tail of the system. Three glass sphere floats mounted on top buoyed the system over the sea floor above a heavier anchor chain attached to the tail section by a short bridle. The system was normally deployed ~2 m above the sea floor, although topographic irregularities (e.g., erratic boulders) occasionally snagged the anchor line and temporarily decreased the distance above the bottom. We hung a visual scale (one or two weighted tennis balls attached to the ends of a 0.5-m ruler) from the front of the camera system so that it appeared in the field of view. The tennis balls were also punctured to allow equilibration with ambient pressure. Camera tows consisted of deploying the system from the ship while underway at slow speed (0.25–0.5 knots),

J.T. Eastman (✉)
Department of Biomedical Sciences,
Ohio University, Athens,
OH 45701-2979, USA
E-mail: eastman@ohiou.edu
Tel.: +1-740-5932350
Fax: +1-740-5972778

J.P. Barry
Monterey Bay Aquarium Research Institute,
7700 Sandholdt Road, Moss Landing,
CA 95039-9644, USA

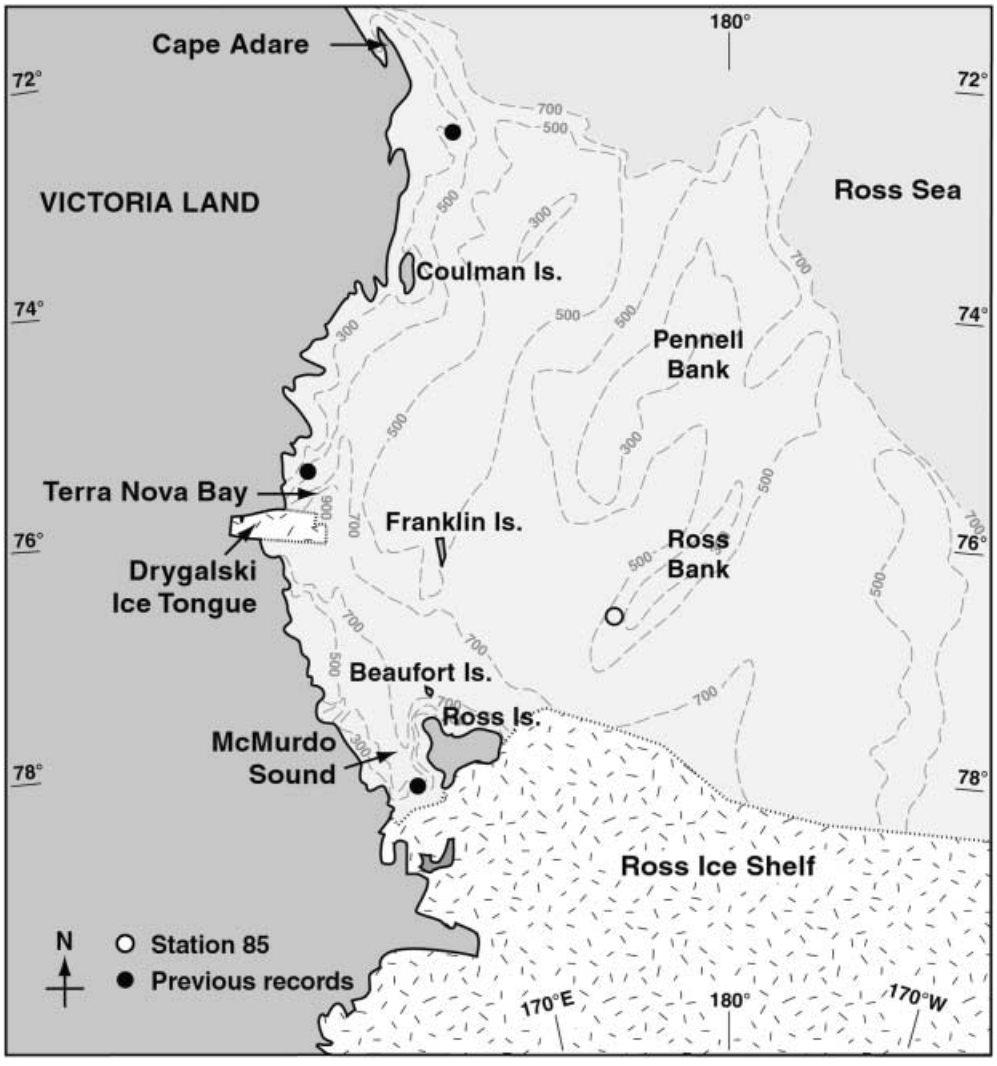

Fig. 1. Map of the western Ross Sea showing literature-documented sites of capture (●) of *Dissostichus mawsoni* and the video observation at station 85 (○). The shelf break is near the 700-m isobath. CCAMLR Statistical Subarea 88.1 includes most of the mapped area from 170°W to the Victoria Land Coast. Bathymetry modified from GEBCO (1993)

allowing the system to reach the sea floor, and then towing for 15–20 min before recovery.

Results and discussion

On 1 December 1998, we obtained a 2 s video image of a large fish at station 85, cruise 98-7 of the RV *Nathaniel B. Palmer*. This station (76°29.87′S, 174°58.63′E) was located on the Ross Bank in the southern Ross Sea (Fig. 1) at a depth of 454 m. Time on station was 2010–2346 h; there was no ice cover and bottom temperature was –1.91°C. Although our survey of the benthos involved 57 video tows and 5,910 m^2 of sea floor analysis in the western and central portions of the Ross Sea, this was the only image of *D. mawsoni* that we obtained.

Description of the image

The video shows a dorsoposterior view of the left side of the trunk of a large fish resting on the sea floor. The fish is oriented headfirst under the overhang of a large boulder on a light silt and dark cobble substrate (Fig. 2A). Body color is a uniform medium to dark gray with indications of dark vertical bars posteriorly. The posterior one-half of the body is exposed and the left pectoral fin is splayed against the bottom, providing a landmark for measurement. Using a 6.5-cm-diameter tennis ball as a spatial scale in our video frames (the 0.5-m ruler was not visible in these frames), we estimate the exposed portion of the fish (posterior tips of pectoral fin to caudal fin margin) as 34 cm long, and therefore the total length (L_T) of the fish is 66 cm (mean of three estimates ± 5.6 cm SD). The estimate of L_T is made on the basis that, for a series of eight published and unpublished drawings and photographs of *D. mawsoni*, the pectoral to caudal measurement averages 52% of L_T (± 3.6% SD). For reference and comparison, Fig. 2B shows a similar portion of the trunk of a specimen of *D. mawsoni* from the aquarium at the U.S. McMurdo Station. Since the tennis ball was slightly above the sea floor in these images and the fish was resting on the bottom, the ball served as a reasonably accurate scale.

Fig. 2A, B. A video image of a *Dissostichus mawsoni* resting on the sea floor and partially concealed beneath rock overhang at 454 m depth in the Ross Sea. Sea anemone is attached to the top of the rock. Tennis ball (*arrowed*) used for scale. **B** *D. mawsoni* in the aquarium facility at the U.S. McMurdo Station. Image **A** is faint but in original video it resembles aquarium specimen **B** in shape of the trunk, large pectoral fins and the thick, dark vertical bars

The basis of the identification

Our identification of this specimen as *D. mawsoni* is based on its large size and the shape and color of the trunk (Fig. 2). The far southerly locality (76°29′S) and –1.91°C water temperature at station 85 exclude the morphologically similar sub-Antarctic species *D. eleginoides*, which lacks antifreeze.

The nototheniid, *Gvozdarus svetovidovi*, is the only other fish in the southern Ross Sea with a similar trunk shape and size approaching 1 m in length (DeWitt et al. 1990). However, it is more specialized than *D. mawsoni* for life in the water column, possessing small pelvic fins and silvery coloration (Balushkin 1989; Shandikov and Kratkiy 1990). *Gvozdarus* is therefore unlikely to settle on the bottom.

Dissostichus mawsoni in the Ross Sea

Most life-history information for *D. mawsoni* in the Ross Sea is based on specimens captured or observed within a few kilometers of the U.S. McMurdo Station (77°51′S, 166°40′E). *D. mawsoni* have been collected for scientific study since the early 1960s (Wohlschlag 1968) and they are now known to be abundant in McMurdo Sound at certain times of the year. Scientific setline fishing for *D. mawsoni* is most productive from late September to mid December, with catches peaking in October/November (Winter et al. 1983; DeVries 1998). There are also occasional recaptures of marked specimens (DeVries 1980, 1988, 1998; Winter et al. 1983). Other research on the McMurdo population indicates that *D. mawsoni* lives and feeds in the water column. For example, setline captures are from the lower 100 m at bottom depths of 500–600 m (Raymond 1975). In October/November, relatively large specimens (124–163 cm L_T; 23–58 kg) are close to neutral buoyancy (Eastman and DeVries 1981) and feed primarily on the pelagic nototheniid *Pleuragramma antarcticum* (Eastman 1985). Finally, ultrasonic tracking (Ross et al. 1982) and video observations (Davis et al. 1999) also document the water-column habitat of *D. mawsoni* and its interaction with Weddell seals.

As evidenced by its presence in the stomachs of sperm whales, *D. mawsoni* has a wide distribution in the mesopelagic zone north of the shelf break of the Ross Sea at 73°S (Yukhov 1970). However, outside McMurdo Sound there are only two previously published records for *D. mawsoni* south of the shelf break, and both these are near the coast (Fig. 1). One specimen was collected 65 km from the Victoria Land coast (72°30′S, 172°56′E) at 550 m with a bottom trawl in late February (Iwami and Abe 1981). Three other large specimens (120–167 cm L_T) were taken just off the coast (74°45′S, 164°30′E) near the Italian station at Terra Nova Bay with vertical and bottom longlines and gill nets at 530–655 m in late December to mid-January

(Vacchi and Greco 1994). An additional specimen has since been taken at this same location in early February, by means of a gill net set at 263 m (M. La Mesa, personal communication).

Significance of the observation

Our video observation of *D. mawsoni* is noteworthy for several reasons. Other than commercial-fishery reports, this is only the third record for this species outside McMurdo Sound and the sole record from an offshore locality. Station 85 is 170 km from Franklin Island (the closest land), 175 km from Cape Crozier on Ross Island, and 250 km from McMurdo Station on the east side of McMurdo Sound (Fig. 1).

Large specimens (> 100 cm L_T) of *D. mawsoni* feed from early December to April in the mesopelagic zone about 1,000 km north of the Ross Sea coast (Yukhov 1982). The specimen seen in our video is too small to be a part of this migration. Yukhov (1982) suggested that fish of < 90–100 cm L_T are sexually immature and remain on the continental shelf; the video observation at station 85 is consistent with this hypothesis.

Finally, it is interesting that a neutrally buoyant species such as *D. mawsoni*, the least dense adult notothenioid measured to date (Eastman 1993), would settle on the bottom under a rock overhang. However, a 66-cm subadult *D. mawsoni* may not be neutrally buoyant since there is an ontogenetic decrease in density as lipid accumulates in larger fish. Small *D. mawsoni* (29–40 cm L_T) from the Antarctic Peninsula are not neutrally buoyant, having a percentage weight (wt. in seawater/wt. in air×100) of 3.9% (J.T. Eastman, unpublished data). Underwater photographs have also documented bottom-perching behavior in *D. eleginoides* (Collins et al. 1999). Although this species was originally suspected to be bottom-oriented in its behavior, with a life-cycle that did not include an offshore feeding migration in the mesopelagic zone (Yukhov 1982), recent work indicates that large adult *D. eleginoides* do migrate to feed in pelagic waters (García de la Rosa et al. 1997).

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