



## NORTHERN RANGE EXTENSION OF THE GLADIATOR BOX CRAB, *ACANTHOCARPUS ALEXANDRI* STIMPSON, 1871 (DECAPODA: BRACHYURA: CALAPPIDAE) IN THE NORTHWEST ATLANTIC

Darrell R. J. Mallowney, Earl G. Dawe, William A. Coffey, and Hubert J. Squires<sup>†</sup>

(DRJM, correspondence, darrell.mallowney@dfo-mpo.gc.ca; EGD; WAC) Science Branch, Fisheries and Oceans Canada, Northwest Atlantic Fisheries Centre, P.O. Box 5667, 80 East White Hills Road, St John's, Newfoundland and Labrador, Canada, A1C 5X1; (HJS) 14 Solomons Drung, Portugal Cove – St. Philips, Newfoundland and Labrador, Canada, A1M 5X1 † deceased 14 September 2010

### ABSTRACT

A specimen of a gladiator box crab, *Acanthocarpus alexandri* Stimpson, 1871, was captured off the northeast coast of Newfoundland during June 2009. This is the first report of the species in Canadian Atlantic waters, and represents a major northern expansion in the distributional range by approximately 800-900 kilometres. The known distribution of this western Atlantic species now extends from Newfoundland to Brazil, encompassing tropical, temperate, and sub-arctic marine ecosystems.

**KEY WORDS:** *Acanthocarpus alexandri*, Newfoundland, range extension

DOI: 10.1651/10-3414.1

### INTRODUCTION

The gladiator box crab *Acanthocarpus alexandri* Stimpson, 1871, is a member of Calappidae. Rathbun (1937) suggested these crabs date as far back as the Cretaceous, although Bellwood (1988) found that the oldest fossil records of Calappidae were more likely in the Oligocene. The most prominent diagnostic feature of this species is the presence of long inferior spines on the meri of the chelipeds, which are roughly half the width of the carapace (Fig. 1). The literature on the species is limited, but some basic biology and life history characteristics are known. Haefner (1981) showed sexual dimorphism in body depth, pleon width, and length of the inferior spines, and observed allometric growth for many morphometric features in both sexes, and he also estimated that both sexes achieved sexual maturity between 18-24 mm carapace width (CW). Members of Calappinae are generally assumed to be molluscivorous, with dimorphic chelae adapted to crush and open shells and procure soft portions of the prey (Shoup, 1968). Haefner (1981) confirmed the chelae were dimorphic but found polychaetes and amphipods dominated the diet of gladiator box crabs in George's Basin off Massachusetts (Haefner, 1981).

The gladiator box crab inhabits the western Atlantic Ocean. It had previously been known to occur from George's Bank in the north to Brazil in the south, with the depth distribution ranging between 68-476 m (Williams, 1965, 1984). Before now, it had never been collected in Canadian Atlantic waters. We now document the capture of this crab off Newfoundland, estimate the degree of known range extension, and discuss similarities and differences in habitat between the northeast coast of Newfoundland and George's Bank, the previously known northern limit of distribution.

### MATERIALS AND METHODS

A single male gladiator box crab, captured as by-catch in a commercial snow crab *Chionoecetes opilio* (Fabricius, 1788) trap during the 2009 fishery, was delivered to Fisheries and Oceans Canada (DFO) in March 2010. The crab trap spanned 127 cm across the bottom with a mesh size of 14 cm. The trap was part of a long-line ('fleet') of gear that had been deployed for approximately 48 hours at a depth of about 265-275 m. We identified the crab using Williams (1984).

Bottom temperature for the time and area of capture was estimated using data from a multi-species bottom trawl survey conducted each fall along the northeast Newfoundland shelf (Doubleday, 1981). These surveys are stratified based on area and depth, with set locations randomly assigned within pre-defined strata each year. We used mean bottom temperature from sets in the stratum from which the crab was captured (stratum 621), during 2009, as a proxy for temperature at the time and location of capture.

### RESULTS

The specimen was a male (Fig. 1), measuring 30 mm CW, and was alive when captured. Both the size and colour were consistent with previous descriptions of the species (Williams, 1965, 1984). Fouling of the walking legs and dactyls was evident, indicating the crab had not recently molted.

The crab was captured at 50°21'N, 54°41'W on 18 June 2009. This extends the northern limit of the known distributional range by seven to eight degrees of latitude, or approximately 800-900 kilometres. Another crab of the same species and about the same size was captured in the same fleet of gear. However, it was in poor condition and was returned to the water.

The mean bottom temperature from the multi-species trawl survey in stratum 621 during early-mid December 2009 was 1.22°C, with temperatures ranging from -0.05°C to 2.20°C (not shown).

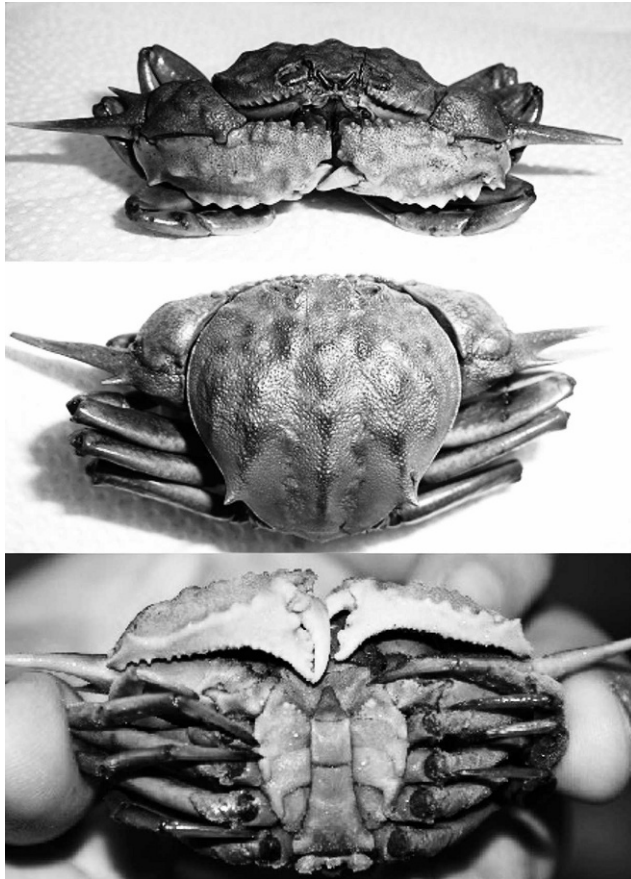


Fig. 1. Frontal (top), dorsal (middle), and ventral (bottom) view of a male gladiator box crab *Acanthocarpus alexandri* Stimpson, 1871, captured on the Northeast Newfoundland shelf in spring 2009.

#### DISCUSSION

The capture of this crab off the northeast coast of Newfoundland represents a large northern extension of the range for *A. alexandri*. It is unknown whether the presence of this species in Newfoundland's sub-arctic waters is a function of natural or human factors. The finding could have resulted from either natural processes in association with global warming, or alternatively from some human activity such as shipping. The scenario is somewhat analogous to the recent introduction of another small crab species, the European green crab *Carcinus maenus* (Linnaeus, 1758), northward into Newfoundland waters. For that species, genetic studies have shown a link to populations occurring to the southwest of Newfoundland (Scotian shelf), and ballast water of sea-going vessels has been deemed the most probable vector of introduction (Blakeslee et al., 2010). Similarly, we feel that a migration by the gladiator box crab from George's Basin to the northeast coast of Newfoundland is unlikely, due to the considerable distance and natural barriers, such as the Laurentian Channel along with a generally westerly flowing current, that would have to be overcome. The lack of documentation of this species off the southern coasts of Nova Scotia and Newfoundland further supports the idea that some human agent was the likely cause of introduction.

There is a possibility the species has been present off northeast Newfoundland for an extended period of time

without being reported. Presently, we have no measure of abundance or understanding of the degree of localization. As the probability of catching such a small animal in a large-meshed snow crab trap is low, and at least one other crab of this species was captured, there could be a localized population of gladiator box crabs off the northeast coast. There are other commercial fisheries for ground fish and shrimp in and adjacent to the capture area, but the gear used in those fisheries may not readily select for these small animals, as ground fish gillnets are normally large-meshed and shrimp trawls use toggle chains to keep the fishing line off bottom. Recent surveys conducted for snow crab in adjacent bays using small-meshed (2.5 cm) traps have not captured any gladiator box crabs, nor have multi-species trawl surveys using a small-meshed (12.7 mm) cod-end liner conducted in adjacent offshore areas.

There are notable similarities and differences in habitat between the northeastern coast of Newfoundland and George's Basin, the previously known northern limit of distribution. The bottom substrate in our capture area consists primarily of sand and mud. This substrate composition as well as the capture depth (265-275 m) is consistent with the habitat described for other areas, including George's Basin (Williams, 1965, 1984; Haefner, 1981). Haefner (1981) reported the diet of gladiator box crabs in the Middle Atlantic Bight was not dominated by molluscs as assumed, but consisted primarily of polychaetes and amphipods. Squires and Dawe (2003) showed polychaetes, small crustaceans, and clams were common components of the snow crab diet off the northeast coast of Newfoundland. Therefore, similarities in prey availability could allow the diet of gladiator box crabs off Newfoundland to be similar to that of the Middle Atlantic Bight, or molluscs (clams) could constitute a larger portion of the diet in our area.

There is clear differentiation between bottom temperature along the northeast coast of Newfoundland and all other capture areas, including the previously known northern range limit of George's Basin. Branches of the southerly flowing Labrador Current create a cold marine environment off the northeast coast of Newfoundland. Bottom temperature is normally highest in late fall and early winter, coincident with the timing of the multi-species trawl survey. Our estimate of 1.22°C in stratum 621 is consistent with Colbourne et al. (2010), who showed bottom temperatures in this area were between 1-2°C during the fall of 2009. In contrast, in the more temperate waters of George's Basin, bottom temperatures in the 200-300 m depth interval normally range from about 7-9°C (Mountain, 2004). Bottom temperatures are at even higher levels in the more southerly areas of the range, at latitudes near the equator as well as in shallower depths. Clearly, this species is eurythermal, as reflected by the large geographic range of distribution in the Atlantic, stretching from Newfoundland to Brazil, and encompassing tropical, temperate, and sub-arctic marine ecosystems.

#### ACKNOWLEDGEMENTS

We would like to thank Gordon Rice, a fisherman from LaScie, Newfoundland, for providing the crab specimen and details of capture.

We also thank Darlene Fiander of Fisheries and Oceans Canada for taking and providing photographs of the crab.

#### REFERENCES

- Bellwood, O. 1998. The phylogeny of box crab genera (Crustacea: Brachyura: Calappidae) with notes on their fossil record, biogeography and depth distribution. *Journal of Zoology*, London 244: 459-471.
- Blakeslee, A. M. H., C. H. McKenzie, J. A. Darling, J. E. Byers, J. M. Pringle, and J. Roman. 2010. A hitchhiker's guide to the Maritimes: anthropogenic transport facilitates long-distance dispersal of an invasive marine crab to Newfoundland. *Diversity and Distributions*: DOI 10.1111/j.1472-4642.2010.00703.x.
- Colbourne, E. B., J. Craig, C. Fitzpatrick, D. Senciall, P. Stead, and W. Bailey. 2010. An assessment of the physical oceanographic environment on the Newfoundland and Labrador shelf in NAFO subareas 2 and 3 during 2009. NAFO Scientific Council Research Document 10/16: 1-24.
- Doubleday, W. G. 1981. Manual on groundfish surveys in the NAFO area (Revised). NAFO Scientific Council Series 81/VI/7: 1-78.
- Fabricius, O. 1788. Beskrivelse over den store Gronlandske krabbe. Nye Samling af det Kongelige Danske Videnskabers Selskabs Skrifter, Kongelige Danske Videnskabernes Selskab 3: 181-190.
- Haefner Jr., P. A. 1981. Morphometry, reproductive biology, and diet of *Acanthocarpus alexandri* Stimpson, 1871 (Decapoda, Brachyura) in the Middle Atlantic Bight. *Journal of Crustacean Biology* 1: 348-357.
- Linnaeus, C. 1758. *Systema Naturae per Regna Tria Naturae, Secundum Classes, Ordines, Genera, Species, cum Characteribus, Differentiis, Synonymis, Locis* (edit. 10). Vol. 1. Laurentii Salvii, Holmiae [Stockholm]. 823 pp.
- Mountain, D. G. 2004. Variability of the water properties in NAFO subareas 5 and 6 during the 1990s. *Journal of Northwest Atlantic Fishery Science* 34: 101-110.
- Rathbun, M. J. 1937. The oxystomatous and allied crabs of America. United States National Museum Bulletin 166: 1-278.
- Shoup, J. B. 1968. Shell opening by crabs of the genus *Calappa*. *Science* 160: 887-888.
- Squires, H. J., and E. G. Dawe. 2003. Stomach contents of snow crab (*Chionoecetes opilio*, Decapoda, Brachyura) from the northeast Newfoundland shelf. *Journal of Northwest Atlantic Fishery Science* 32: 27-38.
- Stimpson, W. 1871. Preliminary report on the Crustacea dredged in the Gulf Stream in the Straits of Florida by L. F. de Pourtales, Assist. U. S. Coast Survey. Part I. Brachyura. *Bulletin of the Museum of Comparative Zoology at Harvard College* 2: 109-160.
- Williams, A. B. 1965. Marine decapod crustaceans of the Carolinas. *Fishery Bulletin, United States* 65: 1-298.
- . 1984. *Shrimps, lobsters, and crabs of the Atlantic coast of the eastern United States, Maine to Florida*. Smithsonian Institution Press: 1-550.

RECEIVED: 6 October 2010.

ACCEPTED: 26 November 2010.