

## Literature Cited

- CHAMBERLAIN, F. M.  
1907. Some observations on salmon and trout in Alaska. Rep. U.S. Comm. Fish. 1906, 112 p. (Bur. Fish. Doc. 627).
- DELL, M. B.  
1963. Oceanic feeding habits of the sockeye salmon, *Oncorhynchus nerka* (Walbaum), in Aleutian waters. M.S. Thesis, Univ. Michigan, Ann Arbor, 40 p.
- HARTMAN, W. L., W. R. HEARD, AND B. DRUCKER.  
1967. Migratory behavior of sockeye salmon fry and smolts. J. Fish. Res. Board Can. 24:2069-2099.
- MANZER, J. I.  
1969. Stomach contents of juvenile Pacific salmon in Chatham Sound and adjacent waters. J. Fish. Res. Board Can. 26:2219-2223.
- STRATY, R. R.  
1974. Ecology and behavior of juvenile sockeye salmon (*Oncorhynchus nerka*) in Bristol Bay and the eastern Bering Sea. In D. W. Hood and E. J. Kelley (editors), Oceanography of the Bering Sea, p. 285-319. Inst. Mar. Sci., Univ. Alaska, Fairbanks.
- SYNKOVA, A. I.  
1951. Food of Pacific salmon in Kamchatka waters. [In Russ.] Izv. Tikhookean. Nauchno-Issled. Inst. Rybn. Khoz. Okeanogr. 34:105-121.

H. RICHARD CARLSON

Northwest Fisheries Center Auke Bay Laboratory  
National Marine Fisheries Service, NOAA  
P.O. Box 155, Auke Bay, AK 99821

### OCCURRENCE OF TWO GALATHEID CRUSTACEANS, *MUNIDA FORCEPS* AND *MUNIDOPSIS BERMUDEZI*, IN THE CHESAPEAKE BIGHT OF THE WESTERN NORTH ATLANTIC OCEAN<sup>1,2</sup>

Living male specimens of *Munida forceps* A. Milne-Edwards and *Munidopsis bermudezi* Chace (Table 1) were collected on the continental slope and rise south of Norfolk Canyon off the coast of Virginia on 18-19 November 1974. An ovigerous female *M. bermudezi* was also collected on 14 September 1975 in the Norfolk Canyon. They were taken with a 15-m shrimp trawl (12-mm stretch mesh inner liner) towed from the RV *James M. Gillis* (University of Miami, Florida).

*Munida forceps* has been reported from 80 to 338 m within the Gulf of Mexico and in the south-

western Atlantic between lat. 22°46.5' and 26°37.0'N (Chace 1940, 1942; Springer and Bullis 1956; Bullis and Thompson 1965). Our find is consistent with the previously reported depth range, but it extends the geographic range of the species northward by 10° latitude.

*Munidopsis bermudezi* has been reported from the coast of Cuba (lat. 21°19'N, long. 76°05'W) at a depth of 2,654 m (Chace 1940, 1942), the Gulf of Mexico (lat. 25°50.5'N, long. 94°27'W) at 3,294 m (Pequegnat and Pequegnat 1970), and north of the Azores (lat. 45°26'N, long. 25°45'W) at 3,171 m (Sivertsen and Holthuis 1956).

The *Munida forceps* sample also included the galatheids *M. iris* A. Milne-Edwards and *M. longipes* A. Milne-Edwards and other decapods including *Bathynectes superbus* (Costa), *Cancer borealis* Stimpson, *C. irroratus* Say, *Homarus americanus* H. Milne Edwards, and penaeidean and caridean shrimps. The association of *M. forceps* with *M. iris* and *M. longipes* in our sample is previously unreported. Some previous records have shown associations with *M. stimpsoni* A. Milne-Edwards (Chace 1942) and with *M. flinti* Benedict and *M. irrasa* A. Milne-Edwards (Milne-Edwards 1880 from Pequegnat and Pequegnat 1970). Others (Benedict 1902; Bullis and Thompson 1965; Pequegnat and Pequegnat 1970) have not specified association of *M. forceps* with other galatheids.

TABLE 1.—Station and morphometric data for *Munida forceps* and *Munidopsis bermudezi* captured near Norfolk Canyon off the coast of Virginia. Length and width measurements in millimeters.

Item	<i>Munida forceps</i>		<i>Munidopsis bermudezi</i>
	Male	Male	Female
Station	79	86	35
Collection	C74-499	C74-506	C74-168
Location, lat.	36°43.2'N	36°41.6'N	36°57.9'N
long.	74°38.0'W	73°47.0'W	73°21.5'W
Date of collection	Nov. 1974	Nov. 1974	Sept. 1975
Depth (m)	220-310	2,620-2,650	2,915-2,955
Bottom temperature (°C)	10.6	3.0	2.3
Bottom salinity (‰)	—	34.82	35.11
Total length (rostral tip to posterior margin of telson)	34	81.4	83.2
Carapace width, anterior	7.9	28.4	28.8
posterior	10.4	31.0	31.5
Carapace length (orbit to posterior margin)	13.5	33.5	33.5
Carapace length (including rostrum)	18.5	44.8	43.8
Cheliped (right) length	45	42.4	40.8
Carpus length	4.0	8.5	7.5
Merus length	15.2	14.5	13.0
Propodus length	25.6	19.3	14.3
Propodus width	4.5	8.8	8.0
Dactylus length	15.1	10.5	8.3
Second left pereopod length	28.8	48.7	46.5

<sup>1</sup>Research supported by National Science Foundation Grant GA-37561, J. A. Musick, Principal Investigator and by U.S. Department of Commerce, National Marine Fisheries Service Contract No. 03-4-043-353 for C.E.L. and P.A.H. participation.

<sup>2</sup>Contribution No. 717, Virginia Institute of Marine Science.

In November 1974, *Munidopsis bermudezi* was associated with *M. curvirostra* Whiteaves. Previous accounts did not indicate association of *M. bermudezi* with other galatheids. Other decapods taken in the November sample were *Lithodes agassizii* Smith, *Stereomastis sculpta* (Smith), and penaeidean and caridean shrimps, including *Hymenodora gracilis* Smith, a species occurring in the Azores sample (Sivertsen and Holthuis 1956).

In September, *M. bermudezi* was associated with *M. bairdii* (Smith) and *M. crassa* (Smith), as well as *Lithodes agassizii* and caridean shrimp.

The ovigerous *M. bermudezi* had not shed all eggs onto the pleopods. The 19 external eggs were tan and averaged 2.8 mm in diameter. These eggs were spherical with no visible blastoderm and were recently extruded. The ovary was tan and very well developed. It contained 106 ova averaging 2.7 mm in diameter. All eggs were measured with an ocular micrometer.

We suspect that these species with tropical affinities are normally present, though rare, in the Chesapeake Bight; but they could be accidental migrants. In either case, the probability of detection was raised by the recent increase in sampling intensity in the vicinity of Norfolk Canyon as compared to other areas of the continental slope between Florida and North Carolina. The question of how far north the tropical fauna extends along the southeastern coast of North America is still unanswered (Briggs 1974). Cerame-Vivas and Gray (1966) noted that the inshore fauna of the North Carolina shelf was warm temperate (Carolinian) but that the offshore fauna was tropical. In a study of sea stars of North Carolina, Gray et al. (1968) found 13 species that occurred in a northward extension of the Caribbean Province along the outer shelf and that these species ranged slightly northward past Cape Hatteras.

The authors are grateful for the assistance of Fenner A. Chace Jr., in confirming the identification of the specimens. All specimens have been deposited at the United States National Museum, Washington, D.C.

### Literature Cited

- BENEDICT, J. E.  
1902. Descriptions of a new genus and forty-six new species of crustaceans of the family Galatheidae, with a list of the known marine species. Proc. U.S. Natl. Mus. 26:243-334.
- BRIGGS, J. C.  
1974. Marine zoogeography. McGraw-Hill, N.Y., 475 p.
- BULLIS, H. R., AND J. R. THOMPSON.  
1965. Collections by the exploratory fishing vessels *Oregon*, *Silver Bay*, *Combat* and *Pelican* made during 1956 to 1960 in the southwestern North Atlantic. U.S. Fish Wildl. Serv., Spec. Sci. Rep. Fish. 510, 130 p.
- CERAME-VIVAS, M. J., AND I. E. GRAY.  
1966. The distributional pattern of the benthic invertebrates of the continental shelf off North Carolina. Ecology 47:260-270.
- CHACE, F. A., JR.  
1940. The Atlantis expeditions to the West Indies in 1938 and 1939, under the joint auspices of the University of Havana and Harvard University. List of Stations. Woods Hole Oceanogr. Inst., Contrib. 274, 8 p.  
1942. Reports on the scientific results of the Atlantis expeditions to the West Indies, under the joint auspices of the University of Havana and Harvard University. The anomuran Crustacea. I. Galathea (Families Chirostylidae, Galathea and Porcellanidae). Torreia (Havana) 11:1-106.
- GRAY, I. E., M. E. DOWNEY, AND M. J. CERAME-VIVAS.  
1968. Sea-stars of North Carolina. U.S. Fish Wildl. Serv., Fish. Bull. 67:127-163.
- MILNE-EDWARDS, A.  
1880-81 Reports on the results of dredging under the supervision of *Alexander Agassiz*, in the Gulf of Mexico and in the Caribbean Sea 1887 '78, '79 by the U.S. Coast Survey Steamer "Blake," Lieut.-Commander *C. D. Sigsbee*, U.S.N., and Commander *J. R. Bartlett*, U.S.N., Commanding. VIII. Études préliminaires sur les Crustacés. Bull. Mus. Comp. Zool. Harv. Coll. 8:1-68.
- PEQUEGNAT, L. H., AND W. E. PEQUEGNAT.  
1970. Deep-sea anomurans of Superfamily Galatheaidea with descriptions of three new species. In W. E. Pequegnat and F. A. Chace, Jr. (editors), Contributions on the biology of the Gulf of Mexico, Vol. 1, p. 125-170. Gulf Publ. Co., Houston.
- SIVERTSEN, E., AND L. B. HOLTHUIS.  
1956. Crustacea Decapoda (the Penaeidea and Stenopodidea excepted). Rep. Sci. Result "Michael Sars" North Atl. Deep-sea Exped. 1910 5(12):1-54.
- SPRINGER, S., AND H. R. BULLIS, JR.  
1956. Collections by the *Oregon* in the Gulf of Mexico. U.S. Fish. Wildl. Serv., Spec. Sci. Rep. Fish. 196, 134 p.
- CHACE E. LAIRD  
ELIZABETH G. LEWIS  
PAUL A. HAEFNER, JR.

Virginia Institute of Marine Science  
Gloucester Point, VA 23062