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Decapod Crustacea of the Atlantic Coast of Canada

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CONTENTS

Abstract

SQUIRES, H. J. 1990. Decapod Crustacea of the Atlantic Coast of Canada. Can. Bull. Fish. Aquat. Sci. 221: 532 p.

Eighty-nine species of decapod crustaceans from the Atlantic coast of Canada are described (including details of mouthparts and other appendages) and original drawings provided for each. Distribution records for each species from 100° W Longitude (80° N latitude) in the Arctic (including Hudson Bay) to the northern edge of Georges Bank, and from 0 to 1000 m in depth are provided also. The Introduction has a brief history of collections of decapod Crustacea in the area, and the Appendix includes a list of mythological references to some taxonomic names used. Tables summarize details of features of appendages according to family. One new species, *Bythocaris spinipleura*, is described. A species of *Macrobrachium* trawled in deep water of the Fundian Channel, southwest of Nova Scotia is also described. Brief notes on the biology of and fishery for each species where applicable are included.

Résumé

SQUIRES, H. J. 1990. Decapod Crustacea of the Atlantic Coast of Canada. Can. Bull. Fish. Aquat. Sci. 221: 532 p.

L'auteur décrit 89 espèces de crustacés décapodes peuplant les eaux canadiennes de l'Atlantique, donne une description détaillée des parties buccales et d'autres appendices et présente des illustrations inédites de chacune. Il inclut aussi des données sur l'aire de répartition de chaque espèce, à partir de 100° de longitude ouest et 80° de latitude nord de l'Arctique (y compris la baie d'Hudson) jusqu'à la limite nord du banc Georges et de 0 à 1 000 m de profondeur. L'introduction comprend un bref historique des relevés de crustacés décapodes effectués dans cette région tandis que l'appendice inclut une liste des noms mythologiques d'où sont tirés des noms taxonomiques. Les caractéristiques des appendices sont résumées selon la famille sous forme de tableaux. L'auteur décrit une nouvelle espèce, *Bythocaris spinipleura*, ainsi qu'une espèce du genre *Macrobrachium* capturée au chalut dans les eaux profondes du chenal Fundian, au sud-ouest de la Nouvelle-Écosse. Il inclut aussi de brèves notes sur la biologie et l'exploitation, selon le cas, de chaque espèce.

ACKNOWLEDGEMENTS

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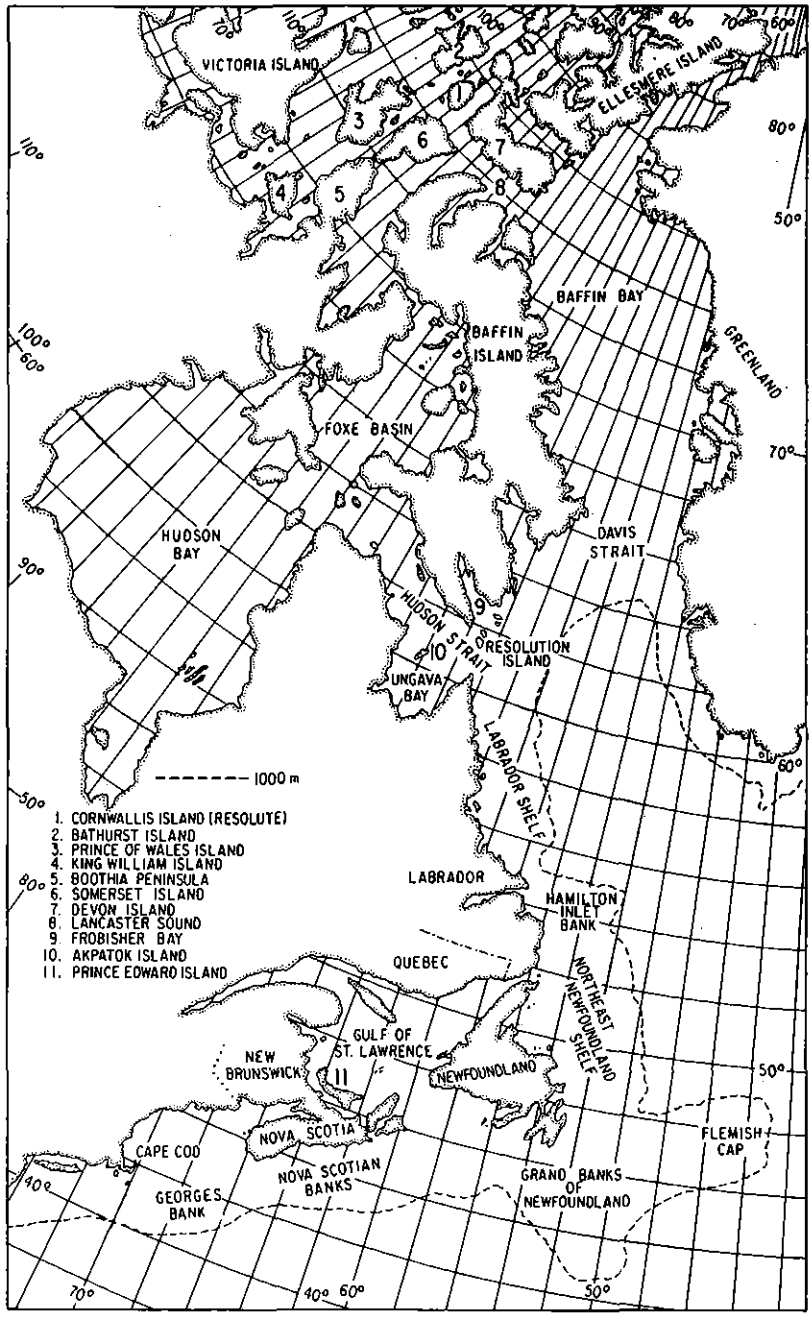

Fig. 1. Map of Area of reference and place names mentioned in text (original map designed by American Geographical Society for Folio 12, in Serial Atlas of Marine Environment).

INTRODUCTION

The purpose of this publication is to give a detailed description of the external morphology of species of decapod crustaceans found in the Canadian Arctic-boreal marine zoogeographic province of the Atlantic coast. The animals include shrimps, lobsters and crabs as well as shrimp-like or lobster-like and crab-like species of the Phylum Crustacea (Class Malacostraca: Order Decapoda (Schram 1986)). The area for this purpose is limited in the south by the northern part of Georges Bank or 42° N latitude and extends into the Canadian Arctic to include Hudson Bay and as far as Prince of Wales Island or 100° W longitude, and at depths not greater than 1 000 m throughout (Fig. 1). The decapod Crustacea in this region comprise only about 89 out of a world total of about 9 000 recent species (excluding fossil species; McLaughlin 1980). These crustaceans have many important commercial species throughout the world (Holthuis 1980) but only seven are exploited in commercial fisheries in the area of reference.

In this region the decapod crustaceans, although few in numbers of species, occur in considerable numbers, and many appear as prey species for marine mammals and fishes of major commercial importance. Apart from this the various species occupy ecological niches throughout the region, and they are so prevalent that any discrete marine area may be characterized by assemblages of them (Squires 1965a).

With respect to characteristic environmental assemblages of decapods the large area of Ungava Bay, for example, could be characterized by six decapod species that are prevalent throughout the bay (although 17 species were taken in all; Squires 1957). Also in a small local area in Bonavista Bay, Newfoundland, where specimens were obtained while Scuba diving, two species of shrimps (*Pandalus montagui* and *Eualus pusiolus*) were found to occupy a particular niche with a shallow rocky substrate (Ennis and Squires unpublished). On the other hand such assemblages can be predicted where well-defined conditions occurred. For example, where soft mud and detritus bottom occurs at more than 200 m deep (200–300 m) and where bottom temperatures are higher than 2° C there is almost certain to be a homogenous population of *Pandalus borealis* (Squires 1961). And where sandy mud and shallow eel-grass (*Zostera* sp.) beds occur in this region there will almost always be *Crangon septemspinosa* present.

To understand interaction between species of fishes and invertebrates in the ecosystem it is important to recognize prey species when found in stomachs. Often only fragments of decapod crustaceans are found, but with knowledge of detailed morphology of species, identification is often possible. Descriptions of species of decapods in the present work have therefore been presented in detail and with accompanying drawings so that even fragments may be recognizable to species on examination with a dissecting microscope.

Previous taxonomic studies of decapod crustaceans of this region are now out of print (Whiteaves 1901; Rathbun 1929; Squires 1965a) and out of date in at least some of the naming of species. Also the morphological details presented here can only be obtained by reference to many publications, or in some instances have not previously been published. All drawings in the present work have been made from actual specimens of the various species.

There is some overlap in distribution and treatment of the present species by the recent magnificent work of Williams (1984). Most of his species are from the Virginian and Carolinian zoogeographical provinces or farther south, and some of the more arctic or deepwater species are not included. However, some species included in the present work have their main centres of distribution more to the south and occur in the area of reference only ocasionally. An example of such a species is *Callinectes sapidus* which is found even in the Tropics but wanders into the Maritimes in some warm summers.

Review of Species of Decapod Crustacea in the Area of Reference

Keys to identify families, genera and species of decapod crustaceans in the region have, for the most part, been borrowed from authors as indicated but are usually modified to include only the species present. They have limitations for application to other areas, therefore, or to species not in the present work.

Synonymies included here are few and listed merely to indicate authors who provide descriptions and other data on the particular species which might be of further interest.

World distributions are mentioned as provided by authors referred to. Distribution in the area of reference is marked on a map for each species. Records for Greenland are generally not included as in Squires (1966), although a few, such as for *Pandalus borealis*, are put in to indicate a major fishing area or presence further north than our records. Distribution records for the southern part of the area of reference are from Williams and Wigley (1977).

Descriptions of Species

Equal treatment has been given as much as possible to the description of each species with a drawing provided for each part described. These drawings are representative in that they show proportions and shapes closely but cannot be said to depict the intrinsic beauty of form of the original with all its complexity. Descriptions follow the same pattern for each species and are prefaced by a statement of the distinguishing characteristics which summarizes features that may be used to identify the species. This is followed by a detailed description beginning with (a) the integument and colour of the whole animal; (b) the rostrum, carapace and abdomen; (c) the anterior sensory appendages, the antennules and antennae and the eyes; (d) the mouth parts used for manipulating items of food, including the paired mandibles, maxillules, maxillae and three pairs of maxillipeds; (e) the five pairs of legs or pereopods, the front pairs of which are generally chelate and used for the capture of food, and the others mainly used for locomotion; (f) the five pairs of swimmerets or pleopods in most species, used for locomotion but also modified for transferral of spermatophores in males and/or to carry eggs in females in some species.

Additional functions of the appendages include bailing water through the gills or branchia (including *podobranchs* on epipods, *arthrobranchs* at the membrane joining maxillipeds or legs to the thorax, and *pleurobranchs* on the walls of the thorax) by the exopod of the maxilla (the scaphognathite), also the action of grooming hooks of the epipods (Bauer 1981) in cleaning the setobranchs which stream thread-like setae over the gills to keep them free of fouling organisms. The somites or segments of the abdomen equipped with internal extensor and flexor muscles (not illustrated here) in shrimps or lobsters give powerful flexures of the abdomen, using the large tailfan of uropods and telson to propel the animal at considerable speed for sudden escape.

Morphology of Rostrum, Carapace, Abdomen and Appendages

(Figures 2 and 3)

The rostrum is an anterior extension of the median dorsal part of the carapace and may be very short or long and may have fixed or moveable spines dorsally and ventrally. Usually there is a lateral ridge to give it greater strength, and this is generally confluent with the orbit.

The carapace is a rigid covering of the head and thorax extending laterally to enclose the gills and origins of the appendages, usually a pair on each of the 14 somites. Anteriorly the orbits give protection to the eyes and there may be a series of spines: supraorbital, suborbital, antennal, branchiostegal and pterygostomian at or near the anterior edge. Other spines may be located on specific areas of the carapace such as the gastric, hepatic, cardiac and branchial. These areas may also exhibit ridges or grooves characteristic of a species.

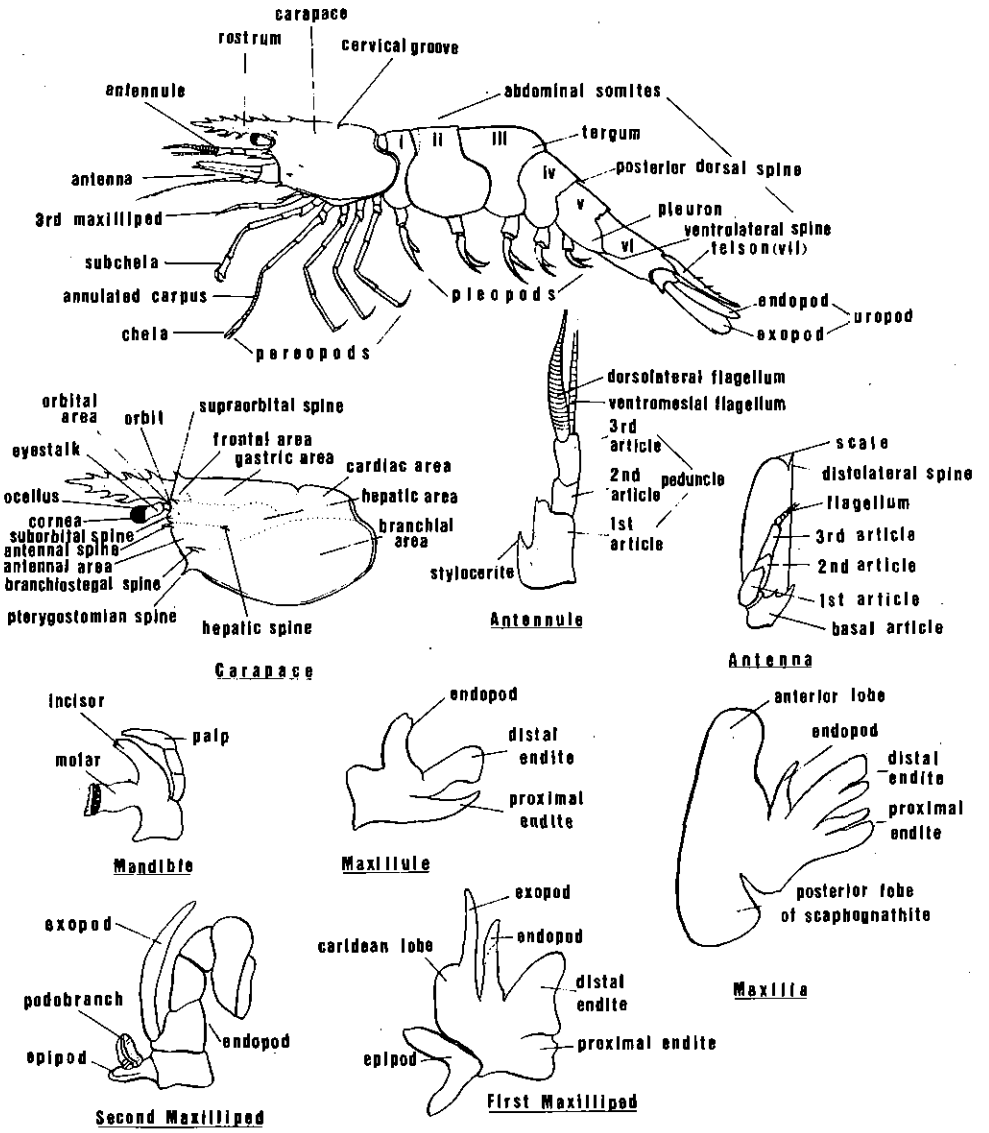

Fig. 2. Names of morphological features of decapod crustaceans referred to in the text.

The abdomen is equally a large part of the anatomy and more clearly shows body segmentation. Six of the seven somites each have a dorsolateral covering or tergum and a ventrolateral pleuron, the latter hanging down at each side and sometimes armed with spines. The seventh somite or telson is usually tapered and armed with dorsolateral and terminal spines, but is greatly varied according to species.

The eyes, when present, have a multi-faceted cornea, and sometimes an accessory ocellus. They are spherical or ovoid in shape from the front, of various colours with some translucency, and at the end of a somewhat conical stalk. The latter may sometimes have a tubercle, often characteristic of a species or genus.

The antennules (c) or first pair of antennae have a three-segmented peduncle, the first segment usually with a lateral wing-like expansion — the stylocerite — with sharp

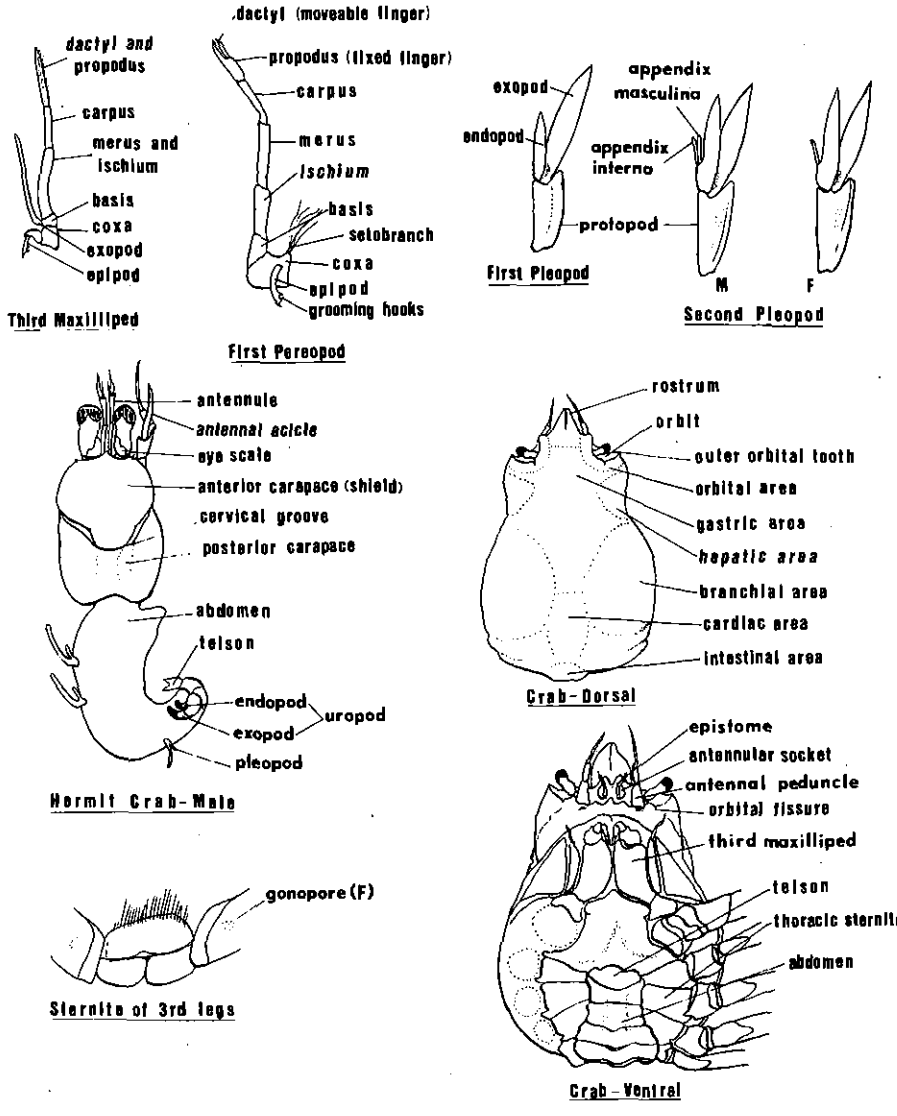

Fig. 3. Names of morphological features of decapod crustaceans referred to in the text.

tip, and the third with two flagella. The dorsolateral or outer flagellum is usually dilated proximally for part of its length, and the ventromesial or inner flagellum usually more slender and longer (the dorsolateral with two branches in the family Palaemonidae).

The antennae (d) or second pair of antennae usually have two basal segments and a three-segmented peduncle with a distal long flagellum. Distally the basal segments have a flat lamella or scale, the scaphocerite, in some species modified as a thorn.

The mandibles (e) or teeth may have a molar and incisor process and a segmented palp; in some species the molar or the incisor is present and the other parts may be missing. The right may be slightly different from the left. The right shears past outside the left.

The maxillules (f) are flat and slightly curved lying close to the mandibles and usually consisting of two endites fringed with spinous setae (stronger at the tips), an endopodal palp and an inconspicuous outer shoulder or exopod.

The maxillae (g) are also flat and slightly curved and lie close outside the maxillules with usually two pairs of fringed endites forming part of a setal basket to filter food particles. There is a thin endopod pointing anteriorly, and a two-lobed lateral scaphognathite strongly muscled at about the centre by which it is swung to and fro to act as a bailer of water through the gills.

The first maxillipeds (h), also thin and slightly curved, fit against the maxillae, and mostly consist of two large endites mesially, the proximal of which is triangular in cross-section with its thickened and setose edge at the centre, and a thin narrow endopod lying close to a foliaceous exopod which has a wide lobe in caridean shrimps. There is usually a bilobed epipod.

The second maxilliped (i) is somewhat leglike but small and flattened to fit against the 1st maxilliped: it sometimes has seven segments but usually fewer; a slender exopod is usually present and sometimes an epipod with attached podobranch.

The third or outer maxilliped (k) is large and extends forward anterior to and sometimes larger than the 1st leg but usually has fewer segments. Often it has a slender exopod and an epipod somewhat similar to the epipods of the legs and sometimes with an attached podobranch.

The five pairs of pereopods (the spelling follows Chace 1986, and Williams 1984, and other recent authors) are appendages of the thorax and all are quite similar: they each have seven segments, i.e. the *coxa* joined to the pre-coxa or body wall, and *basis*, *ischium*, *merus*, *carpus*, *propodus* and *dactyl* in order from the base to the tip. The first two legs are chelate in most caridean shrimps: the dactyl forming the moveable part or "finger" and an extension of the propodus forming the fixed finger, both usually with opposing rows of teeth. Other decapods may have one or more or no legs chelate.

The five pairs of pleopods consisting of a protopod and usually an endopod and exopod are ventrally on the first five abdominal somites. Often the anterior two pairs of pleopods are sexually modified, and in females of some species that carry eggs, the posterior pairs at least become covered with thread-like setae in "breeding dress" and exude a type of cement which causes the eggs to adhere to the setae. The 6th somite has a pair of uropods each with a protopod and an exopod and endopod. The 7th somite or telson (t; Schram 1986) has no appendages but dorsolateral and terminal spines.

In all species of decapod crustaceans all appendages and the integument in general are variously fringed or covered with setae which perform various functions, many sensory, but some perform a mechanical service such as the plumose setae fringing the scaphognathite which add to the stroking surface of the bailer. In a drawing only some of the numerous setae can be shown, and reference to them is generally omitted from descriptions in this work.

Measurements and Biological Assessment

Carapace length (cl) is taken as the standard measurement for shrimp-like or lobster-like decapods, i.e., from the posterior edge of the orbit to the posterior edge of the carapace in the midline (between parallels), and the length of the anterior part or calcified portion of hermit crabs, but carapace width (cw) is given additionally in crabs because of common usage. Total body length is mentioned where it is the only length given in the literature. Under "Biology" the greatest carapace length is given where available.

Also under "Biology" is discussed reproductive potential of the species where known, and food, where observations have been made and referred to in the literature. A brief note is also given on the fishery for the species if it is fished.

Only brief mention of parasites is made under species in question.

As is well known, all species of decapod crustaceans hatch from the egg as a larva which, as it grows, moults into a stage more like the adult than the former stage (four stages in most caridean shrimps). The post-larval stage can usually be identified to species without difficulty, although even in the juvenile form adult features may be somewhat modified (as in the juvenile form of *Eualus macilentus* called *E. stoneyi* by Rathbun 1902). Identifications of small juveniles in some species are therefore to be attempted with caution. Larval identifications are based on larvae hatched from eggs of identified adults (as for example, Haynes 1973, 1976, 1978a, b, 1979), although some have also been identified from the plankton (Frost 1936; Squires 1965b). Because of the length of the present study and lack of specimens of most species, larvae have not been included.

Determining Sex in Species

In penaeid shrimps the male has a *petasma* on the protopod of the first pleopod and the female has a *thelycum* formed from the sternites of the 3rd to 5th legs.

In caridean shrimps the male has an accesory appendage, the appendix masculina next to the appendix interna on the second pleopod.

In hermit crabs of the genus *Pagurus* the male has only 3 unpaired pleopods while the female has 4. In *Parapagurus* the male has paired large pleopods modified for transferral of spermatophores, and the female first pleopods are very small.

In lobsters and lobster-like species the first pleopods may be strongly modified in males for transferral of spermatophores while they are not so modified in females. However, there are exceptions such as in *Callianassa* where the male has no first pleopods. In true hermaphroditic species, such as *Calocaris templemani*, there are male openings of the vas deferens on the coxa of the 5th legs and of the female oviduct on the coxa of the 3rd legs, but the 1st pleopods are modified for transferral of spermatophores. In protandric hermaphrodites such as *Pandalus borealis* the male secondary characters change at the intersex phase and are lacking in the female.

In crabs there are only two pairs of strongly modified pleopods in males and the abdomen is narrow, sometimes with fused somites, while in females there are four pairs of setose pleopods (the first usually missing) and the abdomen is wide and without fused somites.

In decapods in general the genital openings are on body somite XII (of the third legs) in females and XIV (of the fifth legs) in males. There are also minor secondary characteristics in males and females that vary throughout the order. Some of these are referred to by Butler (1980); reference to them is made under species in the present work.

History of Collections of Decapods in the Area of Reference
(partly from Squires 1965a)

Sabine (1824) recorded five species of decapod crustaceans from Davis Strait as collected by the 1st Parry Expedition in search of a northwest passage to the Pacific during 1819–20. Two of these species, new to science, were named *Crangon septemcarinatus* (= *Sabinea septemcarinata*) and *Alphaeus polaris* (= *Lebbeus polaris*). The 2nd and 3rd Parry Expeditions collected 5 species near Igloolik in Foxe Basin (Ross 1826 and 1835). Pfeffer (1886) identified 2 species collected by the German Arctic Expedition of 1882–83 from Cumberland Sound. These were *Hippolyte groenlandicus* (= *Lebbeus groenlandicus*) and *Hippolyte amazo* (= *Lebbeus polaris*). Ohlin (1895) also recorded *Eualus fabricii* from the Cumberland Sound collection. These and other collections of decapod crustaceans from Davis Strait and West Greenland were reviewed by Hansen (1908), Hofsten (1916) and Stephensen (1935). Hansen also recorded the decapods collected in Davis Strait by the *Ingolf* in 1900 and Stephensen those of the *Godthaab*

Expedition in 1910. Stations of these expeditions and records of occurrence of species are reviewed by Squires (1965a, 1966). Also the deep-sea expeditions worked a few stations at depths less than 1 000 m on the continental slope: namely, the *Challenger* off Nova Scotia in 1873, and the *Hirondelle* and *Michael Sars* on the Grand Banks in 1877 and 1910, respectively. Bate (1888) listed 4 species, Milne-Edwards and Bouvier (1894) 4 species, and Sivertsen and Holthuis (1956) 9 species taken by these respective expeditions in the area of reference.

Whiteaves (1901) reviewed collections of invertebrates including crustaceans from eastern Canada during the mid and late 1800s. Those that led to publications about decapod crustaceans included collections by Stimpson (1854) at Grand Manan; Bell's Report of Progress of his survey of 1882–83–84 on the east coast of Ungava Bay and the north coast of Hudson Strait (Appendix iv by S. I. Smith, 1884); Packard's (1867) "View of the invertebrate fauna of Labrador"; Verrill in 1861 at Anticosti and Mingan Islands and Whiteaves 1871, 1872 and 1873 in the Gulf of St. Lawrence (Whiteaves 1901); U.S. Fish Commission 1872, 1877 and 1883 from Georges Bank to the coast of Nova Scotia (Smith 1895); Stearns 1882 in shallow water of the coast of Labrador (Smith 1895); Low in 1897, 1898 and 1899 in Ungava Bay and Hudson Bay including Richmond Gulf, and Wakeham in 1897 of the Hudson Bay Exploring Expedition in the *Diana* on the west coast of Hudson Bay (Rathbun 1919).

The *Diana* and *Neptune* expeditions in Hudson Bay in 1897 and 1903–04 collected decapod Crustacea that were reported on by Rathbun (1919). Further collections were made by the *Loubyrne* expedition in Hudson Bay in 1930 (Van Winkle and Schmitt 1936). Species collected were listed by Squires (1967a).

Outside of Hudson Bay the Canadian Arctic Expedition of 1910 collected decapods near the mouth of Hudson Bay and at Port Burwell in Ungava Bay (Rathbun 1919). Other collections from Hudson Strait and the coast of Labrador were reported by Rathbun (1919). Collections from Capt. Robert A. Bartlett's voyages into Foxe Basin in 1927 and south of Ellesmere Island in 1933 were included in Van Winkle and Schmitt's (1936) report.

Rathbun (1929) reviewed earlier collections from the Canadian Atlantic coast, revised the taxonomy and gave the ranges in distribution of 52 species of decapod crustaceans.

Other collections reported on were 7 species of hippolytids by Leim (1921) including a new species *Lebbeus zebra* (without comparing it with *L. microceros*); 6 species of decapod crustaceans from the Gulf of St. Lawrence by Boone (1930); 21 species collected in groundfish and plankton surveys off the Newfoundland coast by Frost and Thompson (Frost 1936), and 24 species taken in the St. Lawrence estuary by Prefontaine and Brunel (1962).

During 1947–61 the *Calanus* Expeditions of McGill University (Fisheries Research Board of Canada Eastern Arctic Investigations) collected fishes and invertebrates throughout the Arctic from Ungava Bay and Frobisher Bay to Foxe Basin and Hudson Bay. The collections of decapod crustaceans were reported on by Squires (1957, 1962, 1965a, 1966, 1967a). Extension of this arctic program was undertaken by the Arctic Biological Station, Ste-Anne-de-Bellevue, and the Freshwater Institute, Winnipeg, of the Fisheries Research Board of Canada (now Stations of the Science Branch of the Department of Fisheries and Oceans). Squires (1968a and 1969) reported on species of decapods from work done in 1960–65.

Extensive groundfish and shrimp surveys in the fishing area from the Nova Scotia Banks to Cape Dyer, Baffin Island, during 1946–60, by the Fisheries Research Board of Canada collected thousands of specimens comprising 48 species which were reported on by Squires (1965a and 1966).

More recent published accounts of decapod crustaceans from the area include studies in the St. Lawrence estuary and the Gulf of St. Lawrence by Couture and Trudel (1968 and 1969a, b) and Fréchette et al (1970).

Since 1960 fisheries surveys throughout the area by the Canadian Department of Fisheries and Oceans and provincial fisheries departments have been very comprehensive, identifying various stocks and leading to special fisheries for species of fishes as well as shrimps and crabs. Also some southerly surveys for the origin of squid spawning have collected pelagic and deep-sea species of decapods some of which are extra-limital to the present work.

Discovery of a Marine Species of *Macrobrachium*

A well-documented collection (three specimens including one male and two females) of a species of *Macrobrachium* from the Fundian Channel, off Nova Scotia (Lat. 43°28′ N, Long. 67°32′ W, on July 11, 1974, by the MV "*A. T. Cameron*", Trip 225, Station 18; collector: Dr. J. G. Scott) is a first for such a marine area (depth just over 200 m). The genus and all its species were formerly taken only in estuaries or completely freshwater locations, although it is well-known that some species effect migrations through marine areas. Unfortunately the large second legs of all three specimens were lost in their capture with fishing gear, so that naming the species is precluded since descriptions of species of this genus are dependant in part on the large legs. However, remaining features are described as for other species. The specimens, including 2 females 8 and 9 mm cl and 1 male 8 mm cl, (No. ARC 8958232) are in the collections of the Atlantic Reference Centre, Huntsman Marine Science Centre, St. Andrews, N. B.

Oceanography of the Area

A summary of hydrographic conditions in the region was given by Hachey (1961), reviewed for the northern part by Squires (1965a) and Templeman (1975) and by Petrie et al (1988) among others. Also regular overviews of conditions in the major part of the area are given such as those by Trites and Drinkwater (1984, 1985, 1986), and Drinkwater and Trites (1988). Conditions in the arctic were reviewed by Dunbar (1951).

The area is influenced greatly by the presence of arctic water of the Labrador Current even as far south as Georges Bank, and the volume of water with temperatures less than 0° C increases during November to April. Ice cover prevails in northern areas during these months (as long as 9 months in Hudson Bay and further north) and in some years reaches as far south as Nova Scotia. The cold water with sea ice in winter, and salinites a few parts per thousand (ppt) lower than oceanic water, is swept toward the east coast presumably by Coriolis force. In northern areas it tends to be deeper near the coast and becomes shallower offshore and is underlain by Atlantic water of higher density and temperature with which some mixing occurs especially at the edge of the continental shelf (Smith and Sandstrom 1988). As the arctic water reaches the Grand Banks off Newfoundland there is increased turbulence and greater mixing with Atlantic water which continues farther south. Throughout the region there are influences of stream runoff and inshore warming in summer and cooling with formation of shore ice especially in the north during winter. Also there are influences of the Gulf Stream Drift often in the form of giant eddies of warm core water (Smith and Sandstrom 1988) which contribute to the mixing and raising of temperature over the continental shelf and shallower banks. In the global sense the immense volume of warm water of the Gulf Stream and the northern edge of the Sargasso Sea lie only a few hundred kilometres to the southeast of the Grand Banks, and their moderating influence is felt to a geater or less extent from year to year depending upon weather.

In the Gulf of St. Lawrence there is penetration of warm (to 5° C) Atlantic water from the Laurentian Channel (Lauzier and Trites 1958), reaching as far as the Esquiman and Mingan channels as a bottom layer. Surface layers are contributed to by the flow of

arctic water in through the Straits of Belle Isle and from the outflow of the St. Lawrence River. Surface currents are generally anticlockwise but otherwise deflected by winds as shown by the movement of ice cover in winter.

Over the Nova Scotian banks the surface layer is mostly under the influence of southbound arctic water of the Labrador Current and outflows from the Gulf of St. Lawrence. But there are intrusions of Atlantic water forming an intermediate cool layer and a warmer bottom layer (6–8° C), the latter occasioned by Gulf Stream incursions (Smith et al 1978). The Bay of Fundy area is influenced by extreme tides and southward flowing cool water from the surface layer of the Nova Scotian Banks mixing with upwelling and surface water from the Gulf of Maine (Scott and Scott 1988).

Seasonal changes greatly influence the life cycle of decapod crustaceans, the winter cold supressing reproductive as well as other development, and summer warmth allowing for growth through moulting and the development and release of sexual products. So propagation continues even in the far north and populations are maintained. However, pockets of cold arctic water such as in some deepwater bays in Newfoundland may influence negatively the capability of *Pandalus borealis* in such areas to be self-propagating (Squires 1968b), while other species such as *Eualus macilentus* appear to be more cold-adapted (Squires 1967b). Several species of decapods including *Homarus americanus*, *Crangon septemspinosa* and *Cancer irroratus* reach their furthest north (at the Straits of Belle Isle) in the area as a result of lack of cold adaptation, but many species, especially in the families Hippolytidae, Pandalidae and Crangonidae have adapted to the cold extremes of even the arctic part of the area.

Fisheries for Decapod Crustaceans in the Area of Reference

Market demand for the tasty meat of decapod crustaceans has led to their exploitation at least in the case of lobster since the late 19th century. However, fisheries for other species of decapods (mainly *Pandalus borealis* and *Chionoecetes opilio*) in Canadian waters did not begin until well after the middle of the 20th century. These fisheries are reviewed briefly under relevant species.

Fisheries research surveys conducted by the Fisheries Research Board of Canada (later the Science Branch of the Department of Fisheries and Oceans) from the late 1940s onward gave an indication of incidental occurrences of species such as those of decapod crustaceans and, to some extent, indicated their relative abundance throughout the area. In the Newfoundland area (for example) some follow-up was done in a directed survey for fishable quantities of *Pandalus borealis* in 1957 and 1958 with positive results (Squires 1961). Although well-publicised at the time, a fishery was not initiated until ten years later following further surveys (Frechet 1971) and demonstration fishing under the auspices of federal–provincial government departments (Brothers 1971). Other provincial surveys (Couture 1971; Frechet 1971; Legare 1971) have led to fisheries for *Pandalus borealis* in the Bay of Fundy, off Nova Scotia and in the Gulf of St. Lawrence. Fisheries to date for *Pandalus borealis* from Greenland to the Gulf of Maine have been reviewed by Parsons and Fréchette (1989).

Brunel (1963) reported an initial by-catch fishery for the Snow Crab (*Chionoecetes opilio*) off Gaspé, Quebec, in 1960 and 1961. The fishery for this species expanded rapidly after the mid-60s and reached a peak of 47 000 tons in 1982, fourth in landed value of Canadian fisheries species, i.e. cod, lobster, scallop and snow crab. Catches of other crabs are of much less significance and occur mainly as bycatches in fisheries for other species (Elner 1985).

Recent research surveys have located fishable quantities of *Pandalus montagui* which is now exploited commercially in Hudson Strait and Ungava Bay (D. G. Parsons, personal communication).

Research on Decapod Crustaceans

Apart from biological studies referred to under relevant species, present research is directed towards population assessments of lobster, northern or pink shrimp and snow crab in an effort to provide management advice for fisheries of these species. Also routine sampling from these populations provides opportunity for further biological studies related to growth, reproduction and other factors in their life history.

Relationships with other animal species in the area, principally fish and other large predators, are shown by the occurrence of decapod crustaceans in stomach contents taken incidentally to other studies of these species (Lilly, personal communication). Also their own stomach contents can indicate predation on species in their community in the ecosystem and their degree of competition with other species.

Studies on behaviour in aquaria and in their natural habitat have led to an understanding of the possibilities of aquaculture or "ranching" of some of the species.

TAXONOMIC REVIEW OF SPECIES OF DECAPOD CRUSTACEA IN THE AREA OF REFERENCE

Marine and arctic-boreal species of decapod crustaceans of the east and northeast coasts of Canada from the Queen Elizabeth Islands (100° W long.) to the northern edge of Georges Bank (42° N lat.). Depths from 0 to 1 000 m.

Phylum	CRUSTACEA Pennant, 1777
Class	MALACOSTRACA Latreille, 1806
Order	DECAPODA Latreille, 1803
Suborder	DENDROBRANCHIATA Bate, 1888
Infraorder	PENAEIDEA Boas, 1880
Superfamily	PENAEOIDEA Rafinesque, 1815
Family	ARISTEIDAE Alcock, 1901
	Benthesicymus bartletti Smith, 1882 *Gennadas elegans* Smith, 1882 *Gennadas valens* Smith, 1884 *Pleoticus robustus* (Smith, 1885) *Plesiopenaeus edwardsianus* (Johnson, 1867)
Superfamily	SERGESTOIDEA Dana, 1852
Family	SERGESTIDAE Dana, 1852
	Sergestes arcticus Krøyer, 1859 *Sergia robusta* (Smith, 1882)
Family	LUCIFERIDAE Burkenroad, 1983
	Lucifer faxoni Borradaile, 1915
Suborder	EUKYPHIDA Boas, 1880
Infraorder	CARIDEA Dana, 1952
Superfamily	OPLOPHOROIDEA Dana, 1852
Family	OPLOPHORIDAE Dana, 1852
	Acanthephyra pelagica (Risso, 1816) *Acanthephyra purpurea* A. Milne-Edwards, 1881 *Hymenodora glacialis* (Bucholz, 1874) *Notostomus elegans* A. Milne-Edwards, 1881 *Notostomus robustus* Smith, 1884 *Oplophorus spinosus* (Brullé, 1839) *Systellaspis debilis* (A. Milne-Edwards, 1881)
Family	NEMATOCARCINIDAE Smith, 1884
	Nematocarcinus cursor A. Milne-Edwards, 1881 *Nematocarcinus rotundus* Crosnier et Forest, 1973
Superfamily	PASIPHAEOIDEA Dana, 1852

Family	PASIPHAEIDAE Dana, 1852
	Parapasiphaea sulcatifrons (Smith, 1884)
	Pasiphaea multidentata Esmark, 1866
	Pasiphaea tarda Krøyer, 1845
Superfamily	PALAEMONOIDEA Rafinesque, 1815
Family	PALAEMONIDAE Rafinesque, 1815
	Leander tenuicornis (Say, 1818)
	Macrobrachium sp.
	Palaemonetes pugio Holthuis, 1949
	Palaemonetes vulgaris (Say, 1818)
Superfamily	ALPHEOIDEA Rafinesque, 1815
Family	HIPPOLYTIDAE Dana, 1852
	Bythocaris gracilis Smith, 1885
	Bythocaris payeri (Heller, 1875)
	Bythocaris spinipleura, new species
	Caridion gordoni (Bate, 1858)
	Eualus fabricii (Krøyer, 1842)
	Eualus gaimardi belcheri (Bell, 1855)
	Eualus gaimardi gaimardi (H. Milne-Edwards, 1837)
	Eualus macilentus (Krøyer, 1842)
	Eualus pusiolus (Krøyer, 1842)
	Hippolyte coerulescens (Fabricius, 1775)
	Latreutes fucorum (Fabricius, 1798)
	Lebbeus groenlandicus (Fabricius, 1775)
	Lebbeus microceros (Krøyer, 1842)
	Lebbeus polaris (Sabine, 1821)
	Spirontocaris lilljeborgi (Danielssen, 1859)
	Spirontocaris phippsi (Krøyer, 1842)
	Spirontocaris spinus (Sowerby, 1805)
Superfamily	PANDALOIDEA Dana, 1852
Family	PANDALIDAE Dana, 1852
	Dichelopandalus leptocerus (Smith, 1881)
	Pandalus borealis Krøyer, 1838
	Pandalus montagui Leach, 1814
	Pandalus propinquus G. O. Sars, 1869
	Stylopandalus richardi (Coutière, 1905)
Superfamily	CRANGONOIDEA H. Milne-Edwards, 1837
Family	CRANGONIDAE H. Milne-Edwards, 1837
	Argis dentata (Rathbun, 1904)
	Crangon septemspinosa Say, 1818
	Metacrangon jacqueti agassizi (Smith. 1882)
	Pontophilus brevirostris Smith, 1881
	Pontophilus norvegicus (M. Sars, 1861)
	Sabinea hystrix (A. Milne-Edwards, 1881)
	Sabinea sarsi Smith, 1879
	Sabinea septemcarinata (Sabine, 1824)
	Sclerocrangon boreas (Phipps, 1774)
	Sclerocrangon ferox (G. O. Sars, 1877)

Suborder	REPTANTIA Boas, 1880
Infraorder	ASTACIDEA Latreille, 1803
Family	NEPHROPIDAE Dana, 1852
	Homarus americanus H. Milne-Edwards, 1837
Infraorder	THALASSINIDEA Latreille, 1831
Family	AXIIDAE Huxley, 1879
	Axius serratus Stimpson, 1852 *Calocaris templemani* Squires, 1965
Family	CALLIANASSIDAE Dana, 1852
	Callianassa atlantica Rathbun, 1926 *Callianassa biformis* Biffar, 1971
Infraorder	PALINURA Latreille, 1803
Family	POLYCHELIDAE Wood-Mason, 1874
	Polycheles granulatus Faxon, 1893 *Stereomastis sculpta* (Smith, 1880)
Infraorder	ANOMALA Boas, 1880
Family	PAGURIDAE Latreille, 1803
	Pagurus acadianus Benedict, 1901 *Pagurus arcuatus* Squires, 1964 *Pagurus longicarpus* Say, 1817 *Pagurus politus* (Smith, 1881) *Pagurus pubescens* Krøyer, 1838
Family	LITHODIDAE Samouelle, 1819
	Lithodes maja (Linnaeus, 1758) *Neolithodes grimaldii* (A. Milne-Edwards and Bouvier, 1894)
Family	PARAPAGURIDAE Smith, 1882
	Parapagurus pilosimanus Smith, 1879
Family	GALATHEIDAE Samouelle, 1819
	Munida iris iris A. Milne-Edwards, 1880 *Munida tenuimana* G. O. Sars, 1871 *Munida valida* Smith, 1883 *Munidopsis curvirostra* Whiteaves, 1874
Infraorder	BRACHYURA Latreille, 1803
Section	EUBRACHYURA de Saint Laurent, 1980
Subsection	HETEROTREMATA Guinot, 1977
Family	MAJIDAE Samouelle, 1819
	Chionoecetes opilio (O. Fabricius, 1780) *Hyas araneus* (Linnaeus, 1758) *Hyas coarctatus coarctatus* Leach, 1815 *Libinia emarginata* Leach, 1815

Family	CANCRIDAE Latreille, 1803
	Cancer borealis Stimpson, 1859
	Cancer irroratus Say, 1817
Family	GERYONIDAE Colosi, 1923
	Geryon quinquidens Smith, 1897
Family	PORTUNIDAE Rafinesque, 1815
	Callinectes sapidus Rathbun, 1896
	Carcinus maenas (Linnaeus, 1758)
	Ovalipes ocellatus (Herbst, 1799)
	Portunus sayi (Gibbes, 1850)
Family	XANTHIDAE MacLeay, 1838
	Neopanope sayi (Smith, 1869)
	Rhithropanopeus harrisi (Gould, 1841)
Subsection	THORACOTREMATA Guinot, 1977
Family	GRAPSIDAE MacLeay, 1838
	Planes minutus (Linnaeus, 1758)

NOTE: Higher categories based on Schram (1986).

N.B. The following keys refer only to species present in the area of reference and should be used with caution in other areas.

Key to the Suborders of the Decapoda
(From various authors)

1 Body usually flattened vertically (compressed); pereopods with the basis and ischium free; one fixed point in the carpo-propodal articulation 2

Body usually flattened horizontally (depressed); pleopods almost never natatory; the anterior pereopod at least with the basis and ischium fused; two fixed points in the carpo-propodal articulation ..... REPTANTIA

2 Third pereopods with a chela; pleura of 2nd abdominal somite not overlapping those of first and third; gills dendrobranchiate ..... DENDROBRANCHIATA (Infraorder PENAEIDEA)

Third pereopods without a chela; pleura of 2nd abdominal somite overlapping those of first and third; gills phyllobranchiate ..... EUKYPHIDA (Infraorder CARIDEA)

Key to Families of Dendrobranchiata (Penaeidea)
(After Burkenroad, 1983)

1 Last two pairs of pereopods well developed; branchiae numerous ..... ARISTEIDAE

Last two pairs of pereopods reduced in length; not more than eight branchiae on either side 2

2 Carapace moderately compressed; lower antennular flagellum and gills present ..... SERGESTIDAE

Carapace highly compressed, anteriorly neck-like; lower flagellum and gills absent ..... LUCIFERIDAE

Key to Families of Eukyphida (Caridea)
(After Holthuis, 1955)

1 First pair of pereopods chelate or simple 2

First pair of pereopods subchelate ..... CRANGONIDAE

2 Fingers of first pairs of chelae slender and long, their cutting edges pectinate ..... PASIPHAEIDAE

Cutting edges of fingers of chelae not all pectinate 3

3 Carpus of second pair of pereopods not annulated; first pair with well-developed chelae; some with exopods 4

Carpus of second pair of pereopods with two or more annulations; pereopods without exopods 5

4 Last three pairs of pereopods not conspicuously lengthened; carpus of each shorter than propodus ..... OPLOPHORIDAE

Last three pairs of pereopods enormously lengthened; carpus of these legs several times longer than propodus; ischio-meral joints of all legs larger than others ..... NEMATOCARCINIDAE

5 Chelae of first pair of pereopods distinct 6

Chelae of first pair of peropods microscopically small or indistinct ..... PANDALIDAE

6 First pair of chelae heavier than second ..... HIPPOLYTIDAE

First pair of chelae usually more slender than or rarely subequal to second pair ..... PALAEMONIDAE

Key to the Infraorders of the Reptantia
(After various authors and Schram, 1986)

1 Sternite of the last thoracic somite free or modified from the others.
Telson asymmetrical or with sutures ..... ANOMALA
Telson symmetrical and without sutures ..... THALASSINIDEA

Sternite of last thoracic somite not free from others 2

2 Abdomen large, symmetrical; uropods present and developed into a tail fan.
First three pairs of pereopods chelate ..... ASTACIDEA
First four or no pereopods chelate ..... PALINURA

Abdomen small, dorsoventrally flattened, symmetrical, recurved to the sternal face of the enlarged cephalothorax and tail fan not developed; uropods rudimentary or none ..... BRACHYURA

Key to Families of the Anomala
(After Williams, 1984)

1 Uropods present; abdomen usually soft and with reduced pleura and terga ... 2

No uropods; abdomen strongly calcified and pressed against sternum as in Brachyura ..... LITHODIDAE

2 Uropods and telson asymmetrical; uropods modified for holding body in shell.
Two genital openings; male without sexual pleopods ..... PAGURIDAE
One genital opening in female; male with sexual pleopods ..... PARAPAGURIDAE

Uropods symmetrical, unmodified; telson sutured ..... GALATHEIDAE

Key to Families of the Infraorder Thalassinidea
(After Williams, 1984)

1 Podobranchs on at least the first three pairs of pereopods; uropods with transverse suture on exopod ..... AXIIDAE

No podobranchs on pereopods; no transverse sutures on uropods ..... CALLIANASSIDAE

Key to the Families of the Infraorder Brachyura
(After various authors)

1 Carapace usually conspicuously narrowed in front, with distinct rostrum sometimes forked ..... MAJIDAE

Carapace wide in front, rostrum reduced or absent 2

2 Fifth pair of legs with flattened paddle-like dactyl, adapted for swimming ..... PORTUNIDAE

Fifth pair of legs without flattened paddle-like dactyl 3

3 Front of carapace with 3 or more teeth, one median; carapace transversely oval ..... CANCRIDAE

Front of carapace without a single median tooth 4

4 Spines, not teeth, on anterolateral border of carapace, two median teeth at front ..... GERYONIDAE

Teeth, not spines, at anterolateral edge of carapace 5

5 Four teeth at anterolateral edge of carapace, carapace oval ..... XANTHIDAE

Only two, if any, modified teeth at anterolateral edge of carapace; carapace quadrate ..... GRAPSIDAE

Family GALATHEIDAE Samouelle, 1819

Makarov 1962: 79; Rathbun 1929: 24;
Williams 1984: 231; Zariquiey Alvarez 1968: 268.

Body shrimplike, carapace elongate, with well-defined areas, sometimes ornamented with transverse ciliated ridges; rostrum prominent, spiniform, projecting beyond the eyes; first pereopods elongate, slender, chelate; abdomen depressed with bend at fourth rather than the third somite as in shrimp; sexually modified pleopods on 1st and 2nd somites in males, not present on first somite in females.

Key to species of Family Galatheidae in area of reference

1 Eyes opaque, non-pigmented and without facets; exopod of 1st maxilliped without flagellum ..... *Munidopsis curvirostra*

Eyes pigmented and with facets; exopod of 1st maxilliped with flagellum 2

2 Posterior margin of carapace without spines 3

Posterior margin of carapace with spines ..... *Munida tenuimana*

3 First article of antennule with outer spine smaller than inner .... *Munida iris iris*

First article of antennule with distolateral (outer) spine larger than distomesial (inner) spine ..... *Munida valida*

Genus *Munida* Leach, 1820
Makarov 1962: 90; Zariquiey Alvarez 1952: 148, figs. 1 and 2.

The rostrum is a long slender spine on each side of which is a somewhat shorter supraorbital spine; carapace and abdomen with transverse ridges bearing anteriorly short dense setae; cervical groove well marked at about the middle of the carapace; eyes are large and well pigmented; 1st pereopods are very long, slender and spinulose; exopod of 1st maxilliped with flagellum.

Munida iris iris A. Milne-Edwards, 1880
Williams 1984: 233, fig. 168.
(Figures 217 and 218)

DISTINGUISHING CHARACTERISTICS

Rostral spine with small serrate spines, about twice as long as supraorbital spines, the latter not extending to distal edge of cornea and almost parallel to the rostrum; 1st article of antennular peduncle with mesial spine longer than distolateral spine; carapace with no spines at posterior edge; 2nd abdominal somite with only one pair of small spinules on anterior margin; pubescence and fringes of transverse ridges of carapace, abdomen and legs iridescent.

DESCRIPTION

Integument rigid, smooth except for ridges or transverse striae with dense anterior fringes of short setae which are iridescent. Colour pinkish with setal iridescence.

Carapace almost as wide as long; rostral spine with low sagittate spines, long (0.5 cl) forming short ridge on carapace dividing the epigastric region, the latter with a moderate spine followed by three small epigastric spines; supraorbital spines about half rostrum, only slightly diveregent on each side of rostrum (almost parallel with it); large external orbital spine with a small lateral behind it, followed by 3 anterior branchial and 2 posterior branchial spines at lateral edge; 2 inner anterior branchial spines near cervical groove and 3 post-cervical spines; posterior cardiac region with median saddle of interrupted striae but no spines; no spines on posterior border.

Sternite of 3rd maxilliped with left and right oval halves with an anterior spine. Sternal plates (z) of legs also calcified and widening posteriorly, of the first legs with three anterior spines, and of legs II and III with lateral projections the latter with 3 teeth anteriorly, IV without teeth, all plates symmetrical with faint midventral separation. Sternum of V separated from others as in all anomurans.

Abdomen with 2 small anterior spines on tergum of 2nd somite (1st somite partly hidden under the carapace); no spines on 3rd somite; pleura of 2nd to 5th pointed ventrally; terga with transverse striae and no spines; 6th with a median join and a triangular median posterior area, ventrolaterally an acuminate spine.

Telson (t) scaly in appearance with inbricated striae in semicircles or minor arcs, and five major defined areas: the anterior or anal area with a proximal faint median separation, a wide lateral at each side with outer straight edge and small posterior spines, a central area with faint separation from laterals, and a terminal subtriangular area with faint median separation and small midmarginal notch and long setal fringe but no spines. Branches of uropod are shorter than telson, the inner with straight sagittate edge and the outer (shorter) with setose straight edge, both subtriangular in outline.

Eye large, cornea ovate, with short stalk.

Antennule (c) 1st article with 3 sharp inner spines, one distal shorter than long distal outer spine, 2nd article slender and about equal to 3rd, the latter expanded distally with very short ventromesial flagellum and slightly longer dorsolateral flagellum.

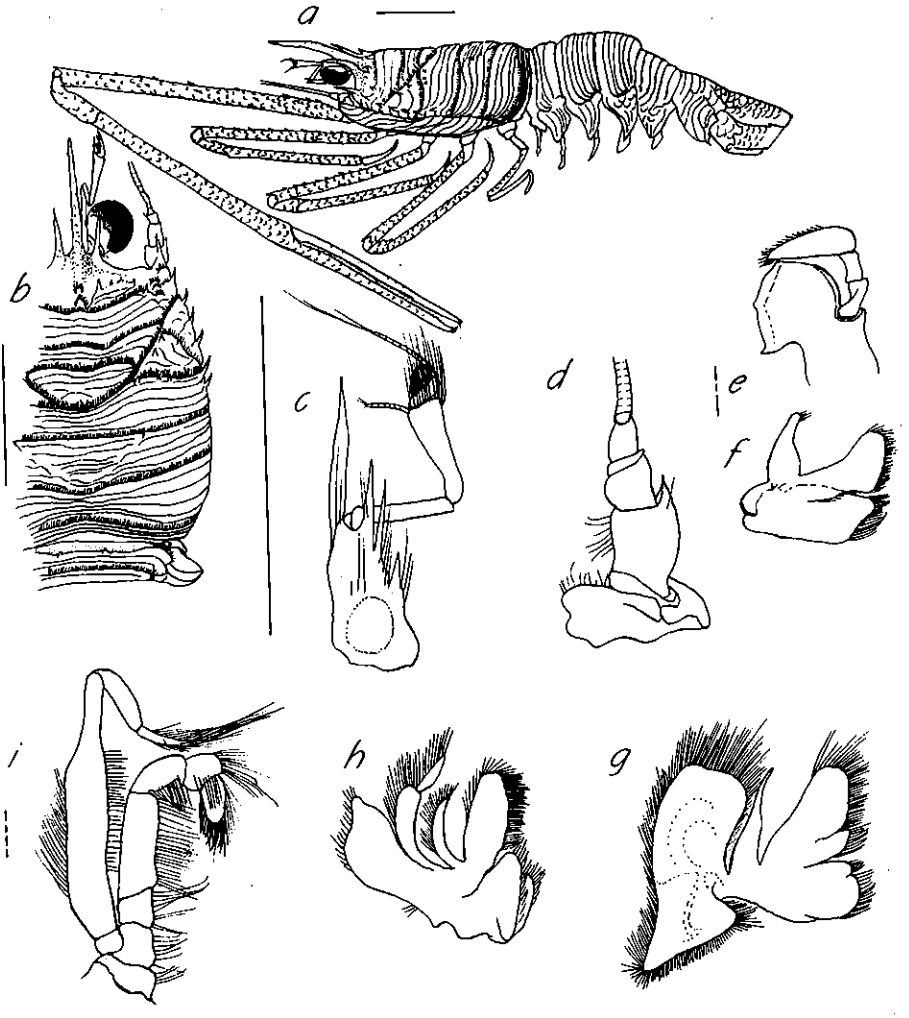

Fig. 217. *Munida iris iris*: *a*, whole animal from left side; *b*, carapace in dorsal aspect; *c*, antennule; *d*, antenna; *e*, mandible; *f*, maxillule; *g*, maxilla; *h*, first maxilliped; *i*, second maxilliped; solid line = 10 mm, broken line = 1 mm.

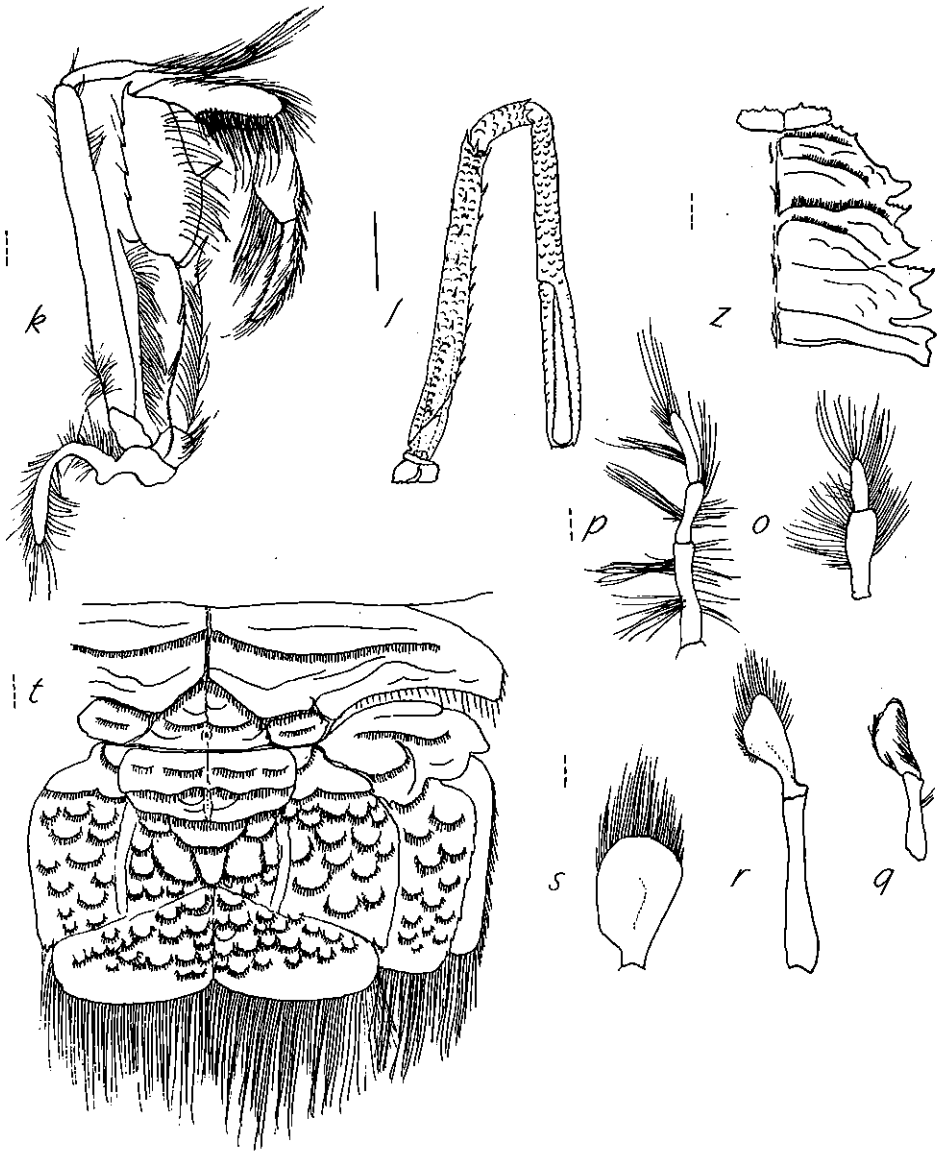

Fig. 218. *Munida iris iris*: *k*, third maxilliped; *l*, first pereopod; *z*, sternum; *o*, F second pleopod; *p*, F third pleopod; *q*, M first pleopod; *r*, M second pleopod; *s*, M third pleopod; *t*, telson; solid line = 10 mm, broken line = 1 mm.

Antenna (d) basal segment or synopod with squamous lobe and narrower lobe surrounding edge of 1st article; 1st article with distal spine outside about as long as other two together.

Mandible (e) heavily calcified, slightly curved edge with tooth at centre and sharp tooth at lower corner, separated by a cleft from short molar lying inside the incisor; palp with three segments.

Maxillule (f) distal endite slightly expanded to spinose edge, about as wide as slightly pointed proximal endite; endopod short, not clearly bifid.

Maxilla (g) proximal endite scarcely bilobed, a small short lobe at distal corner to wide rounded lobe; distal endite unequally bilobed; endopod slender with long attenuate point about equal to anterior lobe of scaphognathite, the latter wider and longer than subtriangular posterior lobe.

Maxilliped I (h) distal endite thin, narrower than thickened proximal endite; endopod slender, curved, slightly shorter than narrow exopod, the latter with short lash; epipod larger than exopod and slightly pointed.

Maxilliped II (i) leglike, distal segment longer than wide, penultimate slightly inflated; exopod longer than endopod, with long lash.

Maxilliped III (k) leglike, with seven segments, dactyl narrow; merus with distal spine and 4 low outer spines and one large inner spine on proximal third; ischium with large inner and outer distal spine and crista dentata of numerous small teeth continued on basis. Epipod long, club-like, setose.

Pereopods: I (l) chelate, much longer than others, covered with scale-like striae, subcylindrical, fingers long and slender but shorter than palm, with cutting edge of small serrate teeth with distal tooth and curved tips crossing over each other, merus with series of spines and strong distal spines. II–IV long and slender, scaly, merus with distal spines and series of lateral spines. V much smaller than others, with a small pseudo-chela and many brush setae terminally.

Pleopods: female II (o) uniramous, endopod with one segment, many long setae; female III (p) endopod with two segments and tufts of long wavy setae, setae also on protopod; male I (q) uniramous, endopod expanded, spatulate, about as long as protopod; male II (r) modified as in I for transferral of spermatophore, endopod expanded distally, spatulate, protopod much longer; other pleopods (s) foliaceous, wide and uniramous with apical setae.

Range of Distribution

From off Nova Scotia to the Gulf of Mexico and through the Caribbean Islands to the Amazon River, Brazil (Williams 1984). Depths 43–613 m (Wenner and Read 1982).

Records of occurrence in the area of reference are in Fig. 219.

Biology

Lengths of carapace including rostrum 47 mm in males and 45 mm in females.

Breeding season as shown by occurrence of ovigerous females is long, perhaps year round in parts of its range. Females bear an average of 7 900 eggs each. Males have larger chelae according to their size than females after maturity.

Parasitization by a bopyrid isopod (*Anuropodione carolinensis*) averaged about 10% off North Carolina (Williams and Brown 1972).

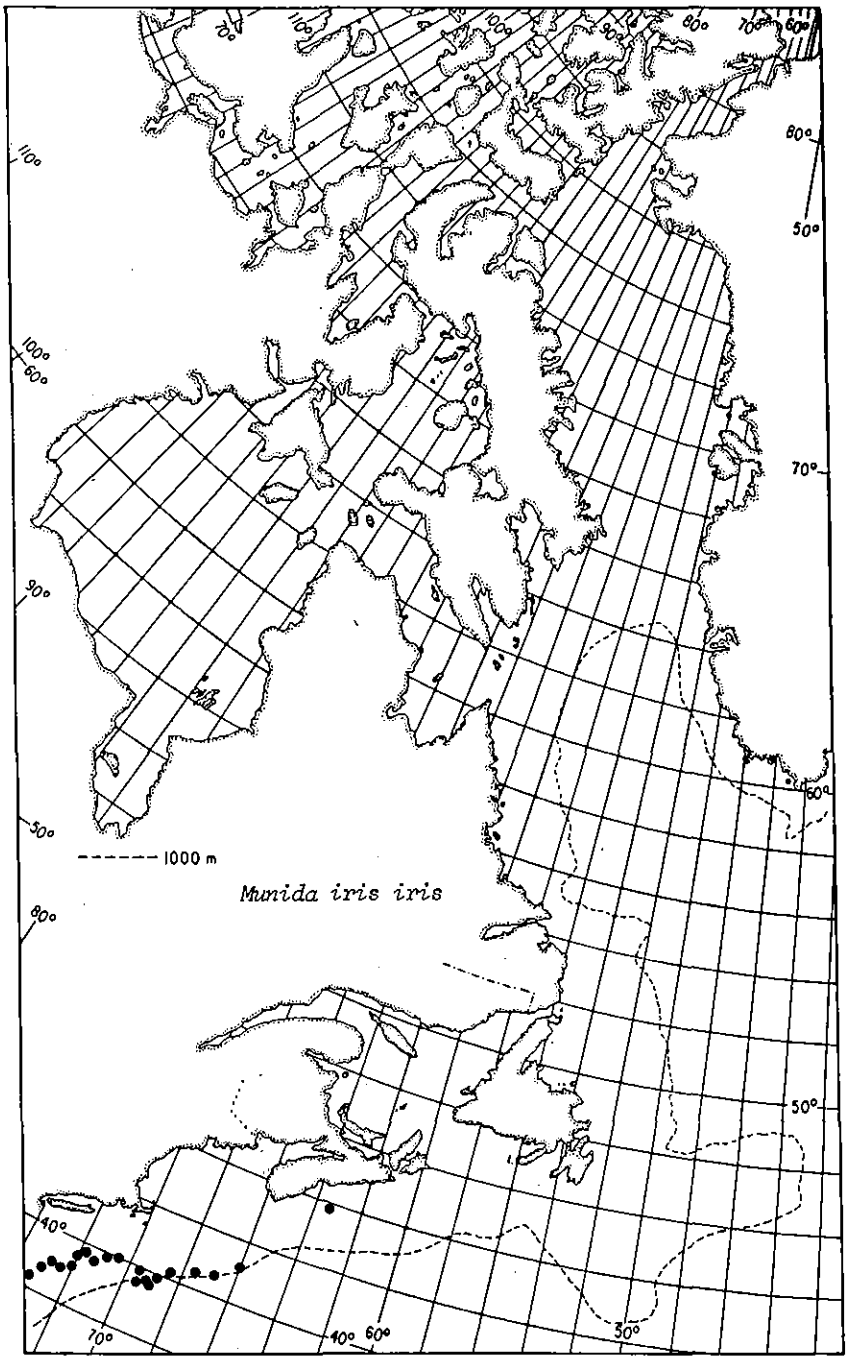

Fig. 219. *Munida iris iris*, distribution records in the area of reference.

Munida tenuimana G. O. Sars, 1871
Selbie 1914: pl. XI, figs. 15, 16;
Zariquiey Alvarez 1952: 197, fig. 6.
(Figures 220 and 221)

DISTINGUISHING CHARACTERISTICS

Carapace with about 6 spines on posterior margin; supraorbital spines about half as long as rostral spine and almost parallel with it; lateral margin with about 6 spines; two spines in epigastric and 4 in metagastric areas; two spines behind cervical groove; no middorsal spines. Abdominal somites 2–4 with spines along anterior margins (first somite is hidden under carapace).

DESCRIPTION

Integument calcified, covered with many transverse striations with short forward directed setae. Colour pale greyish-pink.

Rostrum a single spine or stylet almost half as long as carapace with fine granules laterally and scattered short setae dorsally, flanked by supraorbital spines about half as long and lying parallel to it; supraorbitals trending upward and rostrum slightly descending below level of carapace but turning up slightly at tip.

Carapace depressed, almost as wide as long, with many transverse striations or low ridges with forward-directed short setae; just behind and in line with supraorbitals are two pairs of spines in gastric area and a small spine in hepatic area; pronounced cervical groove behind which are two widely spaced spines near anterior corners of well-defined cardiac area (cardiac groove); lateral spines following external orbital and hepatic are two large anterior branchial and two posterior branchial in decreasing size; posterior margin with pronounced ridge and 6 stout spines directed forward.

Ventrally the sternites form a broad shield-shaped area (in reverse (z)) with four clear divisions for legs 1–4, with a midventral line (clearer posteriorly) and an anterior cross-piece at the third maxillipeds (fifth sternite separate).

Abdomen wide, depressed; first somite narrow, partly hidden under carapace; strong forward spines on somites 2–4 as follows: 6 (4–8), 4 and 2, respectively. Pleura pointed ventrally.

Telson (t) wider than long; surface with imbricate markings (scales) with setal fringes; with symmetrical divisions distally rounded on each side of anal tube and faint midline proximally, and without spines; uropodal branches with squarish outer corners, both shorter than telson, protopod with short spine.

Eye large, cornea globular, with very short thick stalk.

Antennule (c) 1st article broad, slightly compressed; inner edge grooved with a long distal spine and a slightly shorter outer spine; outer edge also has two long lateral spines on distal half; 2nd article shorter and more slender than 1st but longer than 3rd, the latter expanded slightly toward tip, flagella short.

Antenna (d) 1st article with long distal spine at each side; 2nd with long distal inner spine; 3rd (the shortest) with outer moderate distal spine.

Mandible (e) incisor calcified, edge forming a low peak with small tooth slightly off-centre and a lower extended corner with very small teeth; molar short with oval irregular surface behind incisor; palp with three segments.

Maxillule (f) distal endite curved and expanded distally to spinous edge; proximal wide with slightly concave edge; endopod slender.

Maxilla (g) endites large unequally bilobed, proximal with submarginal curved row of long setae; endopod tapering to sharp point, exceeding wide anterior lobe of scaphognathite, the latter longer than short triangular posterior lobe, a shallow notch separating them at outer edge.

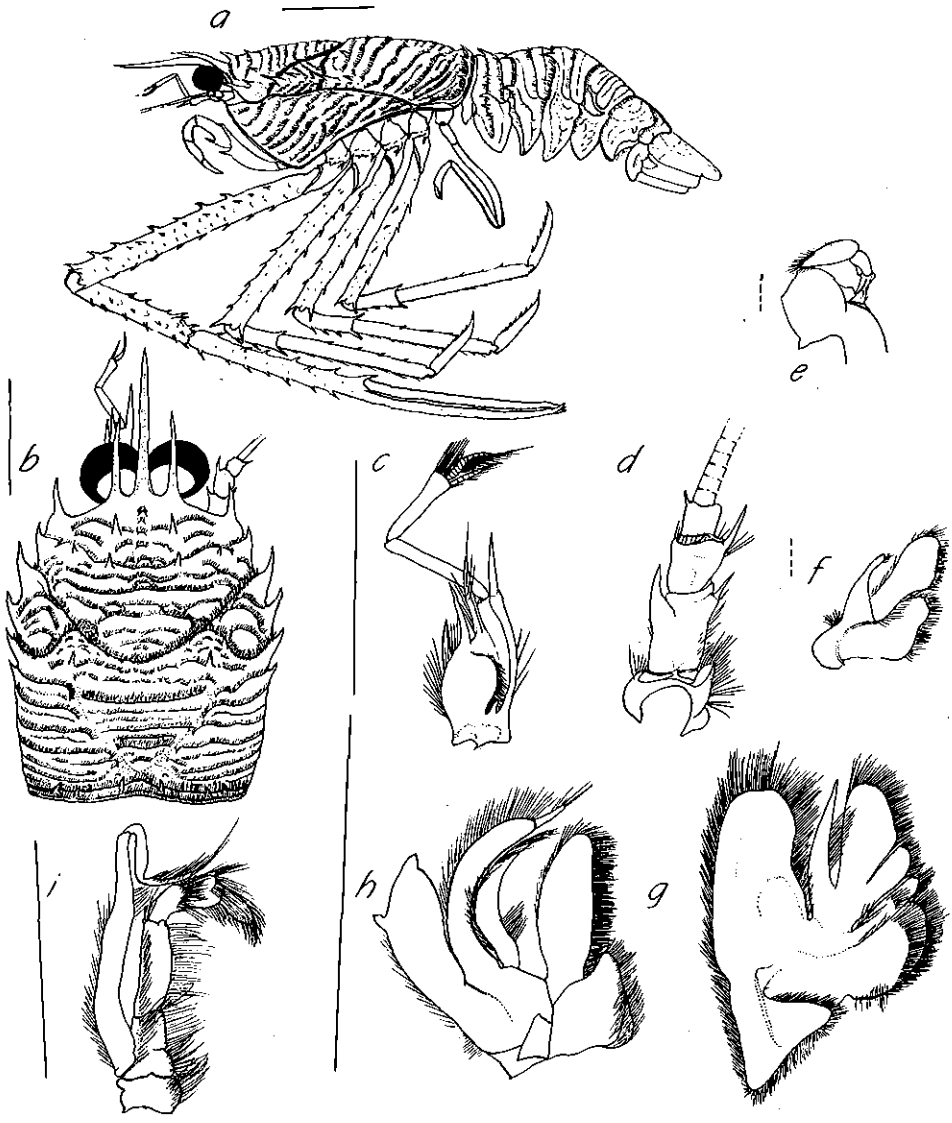

Fig. 220. *Munida tenuimana*: *a*, whole animal from left side; *b*, carapace in dorsal aspect; *c*, antennule; *d*, antenna; *e*, mandible; *f*, maxillule; *g*, maxilla; *h*, first maxilliped; *i*, second maxilliped; solid line = 10 mm, broken line = 1 mm.

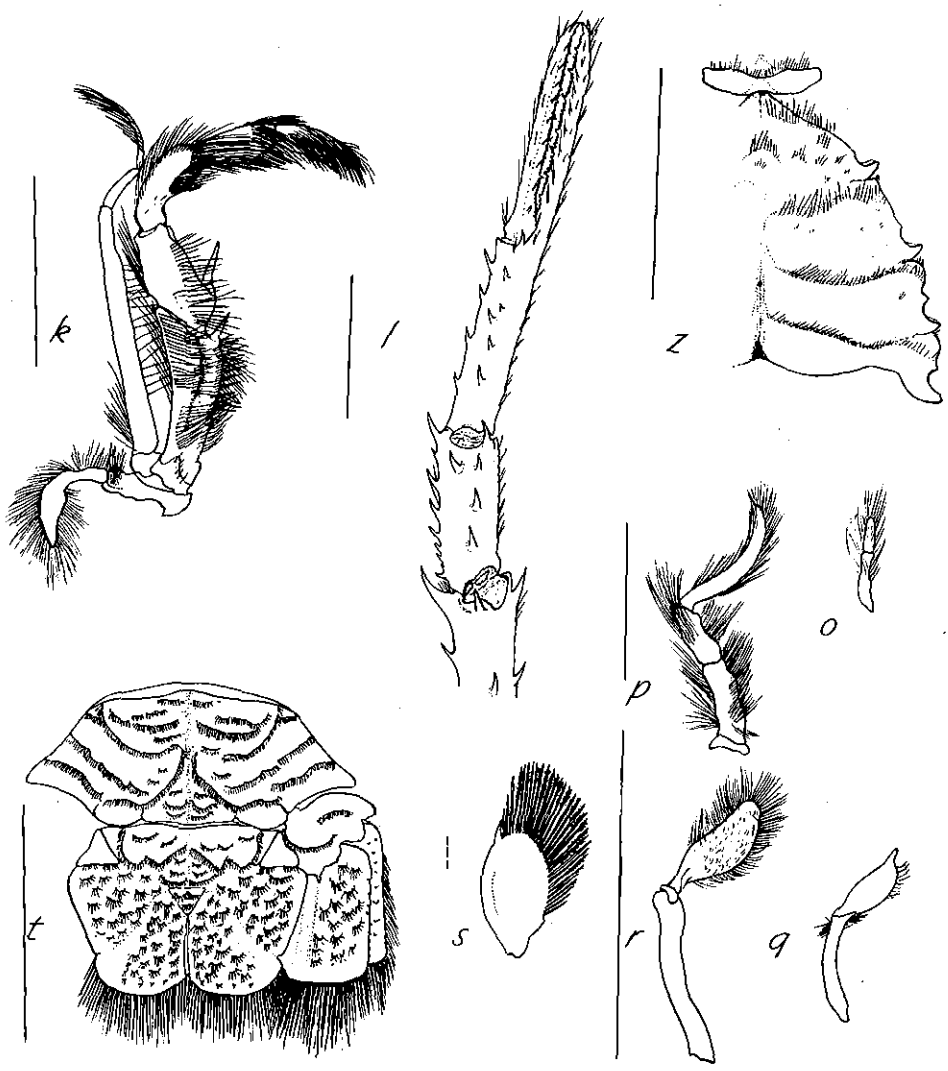

Fig. 221. *Munida tenuimana*: *k*, third maxilliped; *l*, first pereopod; *z*, sternum; *o*, F second pleopod; *p*, third pleopod; *q*, M first pleopod; *r*, M second pleopod; *s*, M third pleopod; *t*, telson; solid line = 10 mm, broken line = 1 mm.

Maxilliped I (h) distal endite long (wide) stepped in from shorter thickened proximal endite; endopod slender sickle-shaped, almost as long as narrow exopod, the latter with short one-piece flagellum or lash; epipod wider than exopod with small distal projections.

Maxilliped II (i) leglike, slightly compressed. Exopod long, with lash.

Maxilliped III (k) leglike, ischium with crista dentata of many very small spines, also strong distal spine; merus with very strong spine on proximal third; exopod slender, long, exceeding ischium and merus, with lash. Epipod long, dilated toward tip but pointed.

Pereopods: I (l) chelate, very long and slender, fingers longer than palm, ischio-merus, carpus and propodus with series of strong fixed spines, propodal finger terminating in spine as well as curved tip; II–IV long but shorter than I, series of fixed spines on ischio-merus to propodus, dactyl with moveable spines on flexor edge; V small and slender, with pseudo-chela, modified for grooming.

Pleopods: female I not present, II (o) small, endopod smaller than protopod; female III (p) endopod with two segments the distal sickle-shaped; male I (q) protopod slender, endopod shorter, expanded but pointed; male II (r) endopod spatulate, setose, shorter than protopod; male III–V (s) short and rounded with distal appendix and fan of plumose setae.

Range of Distribution

In the western Atlantic from Davis Strait to the Grand Banks, and eastern Atlantic from Iceland and Norway to British Isles and in the Mediterranean (Selbie 1914). Depths 440–650 m and temperatures 3.5–4.4° C (Squires 1965a).

Records of occurrences in the area of reference are in Fig. 222.

Biology

Lengths of males to 31 mm cl and females 24 mm cl. Stomachs of most specimens examined were empty but sponge spicules and a pycnogonid were found in one stomach (Squires 1965a)

Lebbeus polaris, *Pasiphaea tarda*, *Pandalus propinquus* and *Pontophilus norvegicus* were present in catches with this species (Squires 1965a).

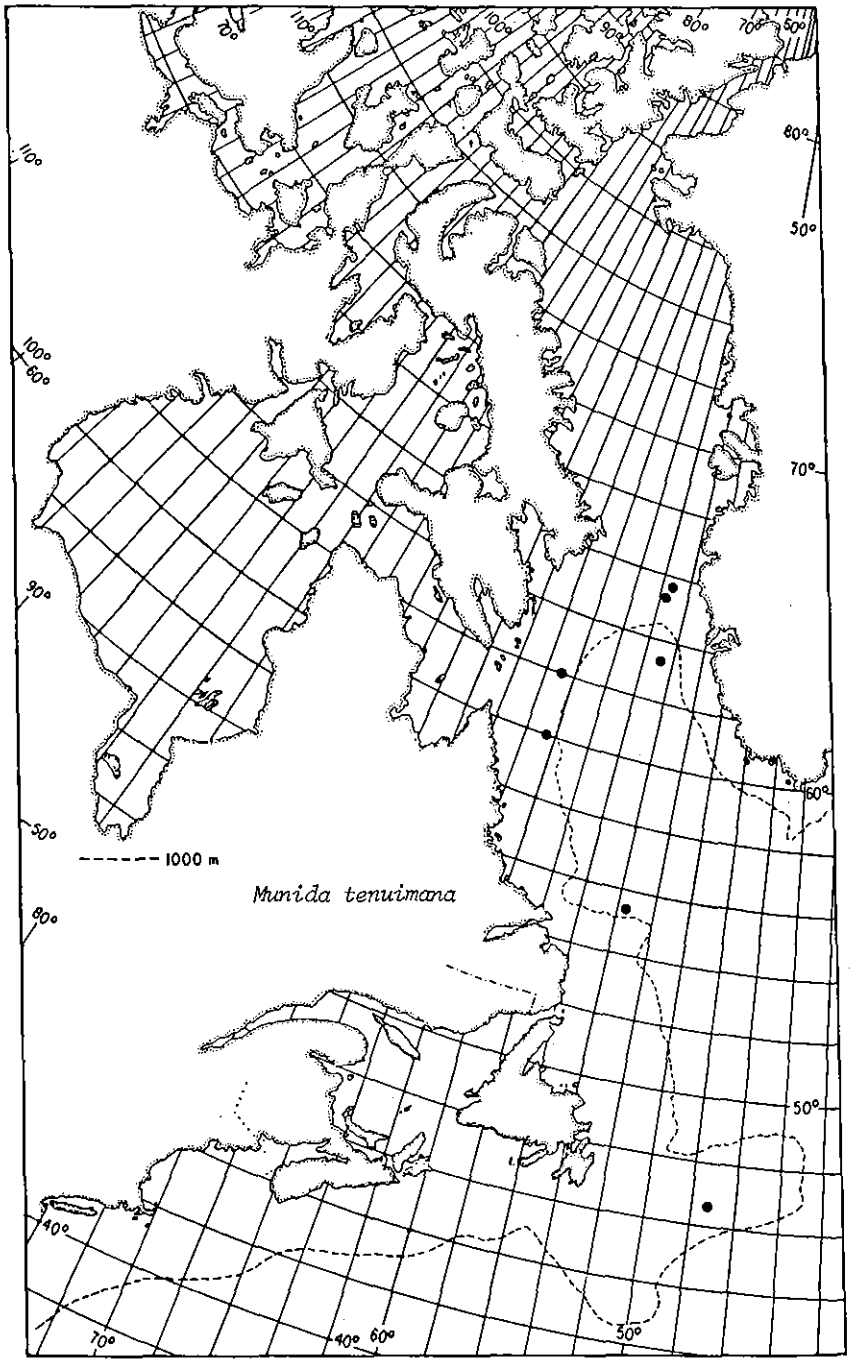

Fig. 222. *Munida tenuimana*, distribution records in the area of reference.

Munida valida Smith, 1883
Williams 1984: 237, figs. 172, 173.
(Figures 223 and 224)

DISTINGUISHING CHARACTERISTICS

Rostral spine more than twice as long as outwardly divergent supraorbital spines, the latter exceeding cornea of eyes, all three spines covered with fine granules, seemingly smooth; small spines in midline behind rostrum in epigastric area; no spines on posterior margin of carapace; 2nd and 3rd somites of abdomen (1st narrow and hidden under carapace) with anterior marginal spines; 1st article of antennule with outer distal spine longer than inner distal spine.

DESCRIPTION

Integument calcified, covered with numerous short setae, also transverse striations or low ridges with anterior short setal fringes. Colour greyish pink.

Rostrum a slender median spine about 0.4 cl about on level with dorsal carapace but tip slightly ascending, supraorbital spine on each side ascending and divergent slightly less than half rostrum but exceeding cornea of eye.

Carapace depressed, width about 0.8 cl; pronounced cervical groove with lateral branch separating anterior branchial (with three lateral spines) from posterior branchial area (with two lateral anterior spines); laterally ahead of cervical groove is large spine with accessory basal spine and anterior to it the large postorbital spine; behind and in line with supraorbital spines are two pairs of gastric spines the anterior pair much the larger; in the median line between the large pair are two small spines; a small spine in hepatic area lateral to smaller pair; behind cervial groove a widely separate pair of moderate spines and no spines posterior to them.

Ventrally sternal plates widening and decreasing in length posteriorly (z), separated by faint midventral line, with rounded depression at centre of sternum of fifth legs; plate between third maxillipeds narrow, with edges almost parallel but slightly curved.

Abdomen depressed, 1st somite narrow partly hidden, 2nd somite with about 11 stout spines along anterior edge directed forward and 3rd with about 6 spines; all terga except 6th with transverse striations fringed with short setae, 6th with ridges arcuate or scale-like and setal fringes directed posteriorly; pleura rounded except 2nd which is slightly pointed, all with scale-like striations.

Telson (t) wider than long, slightly narrowing distally; symmetrically divided at centre by anal tube but no clearly defined areas; shallowly notched at middle of posterior edge only slightly rounded. Uropodal branches squarish at outer corners both considerably shorter than telson, spiny at outer edges; protopod with posterior curved spine.

Eyes large, cornea globular, much larger than short stalk.

Antennule (c) 1st article robust, longer than much more slender 2nd or 3rd, with long sharp ascending dorsal spine on distal two-thirds and outer small lateral spine near its base, also two distal spines, the outer longer than the inner.

Antenna (d) 1st article of peduncle with distolateral spine at each side.

Mandible (e) heavily calcified, incisor with small tooth at centre of curved edge and larger tooth at lower corner; palp with three segments.

Maxillule (f) distal endite widely expanded to spinous edge, wider than thin pointed proximal endite; endopod short.

Maxilla (g) endites large, unequally bilobed; endopod with attenuate sharp apex, slightly exceeded by somewhat pointed anterior lobe of scaphognathite, the latter almost twice as long as axe-shaped posterior lobe.

Maxilliped I (h) distal endite large, set back from edge of thickened proximal endite; endopod slender, sickle-shaped, slightly longer than narrow exopod, the latter with short one-piece lash; epipod large foliaceous, tulip-shaped in outline.

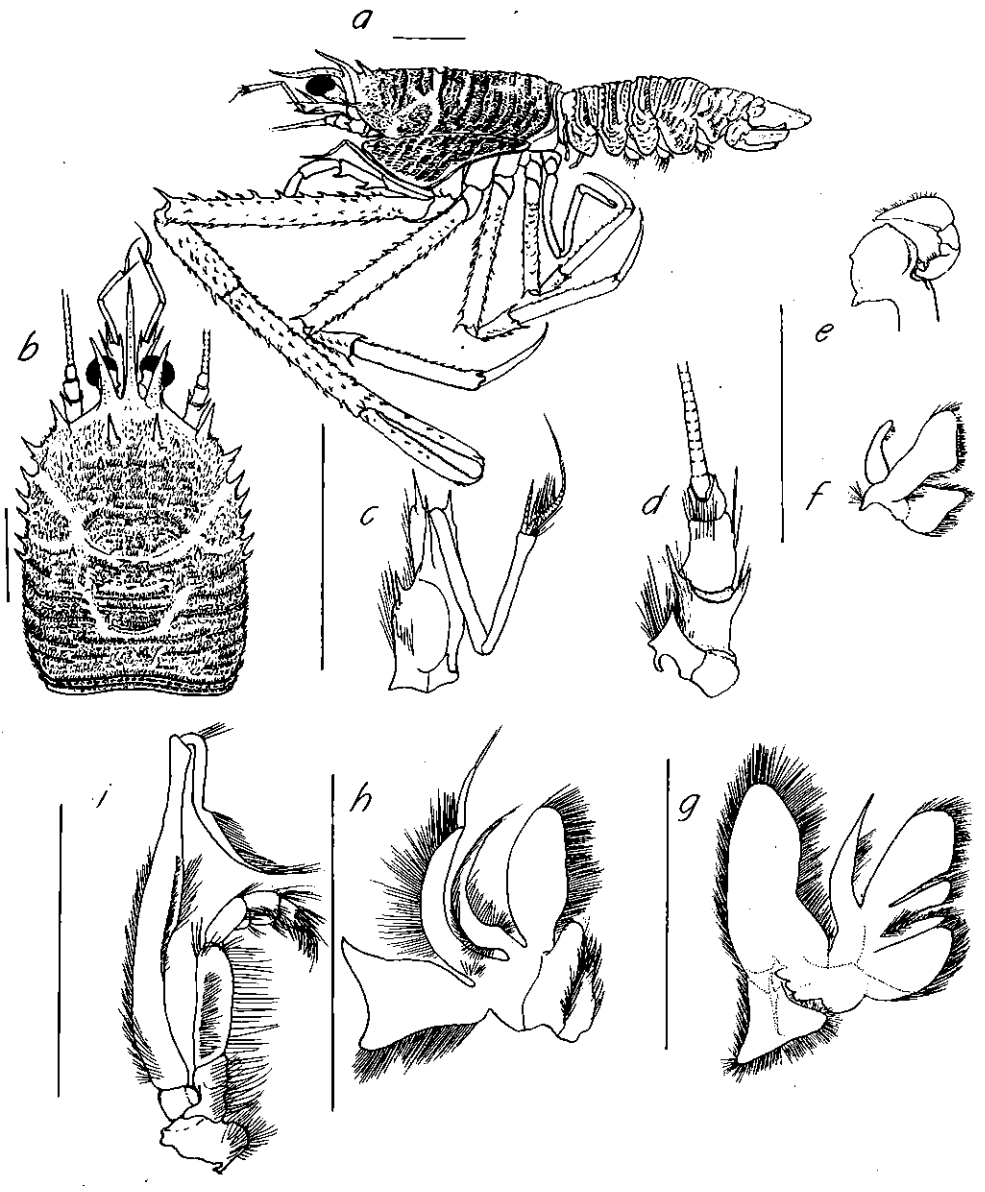

Fig. 223. *Munida valida*: *a* whole animal from left side; *b*, carapace in dorsal aspect; *c*, antennule; *d*, antenna; *e*, mandible; *f*, maxillule; *g*, maxilla; *h*, first maxilliped; *i*, second maxilliped; solid line = 10 mm.

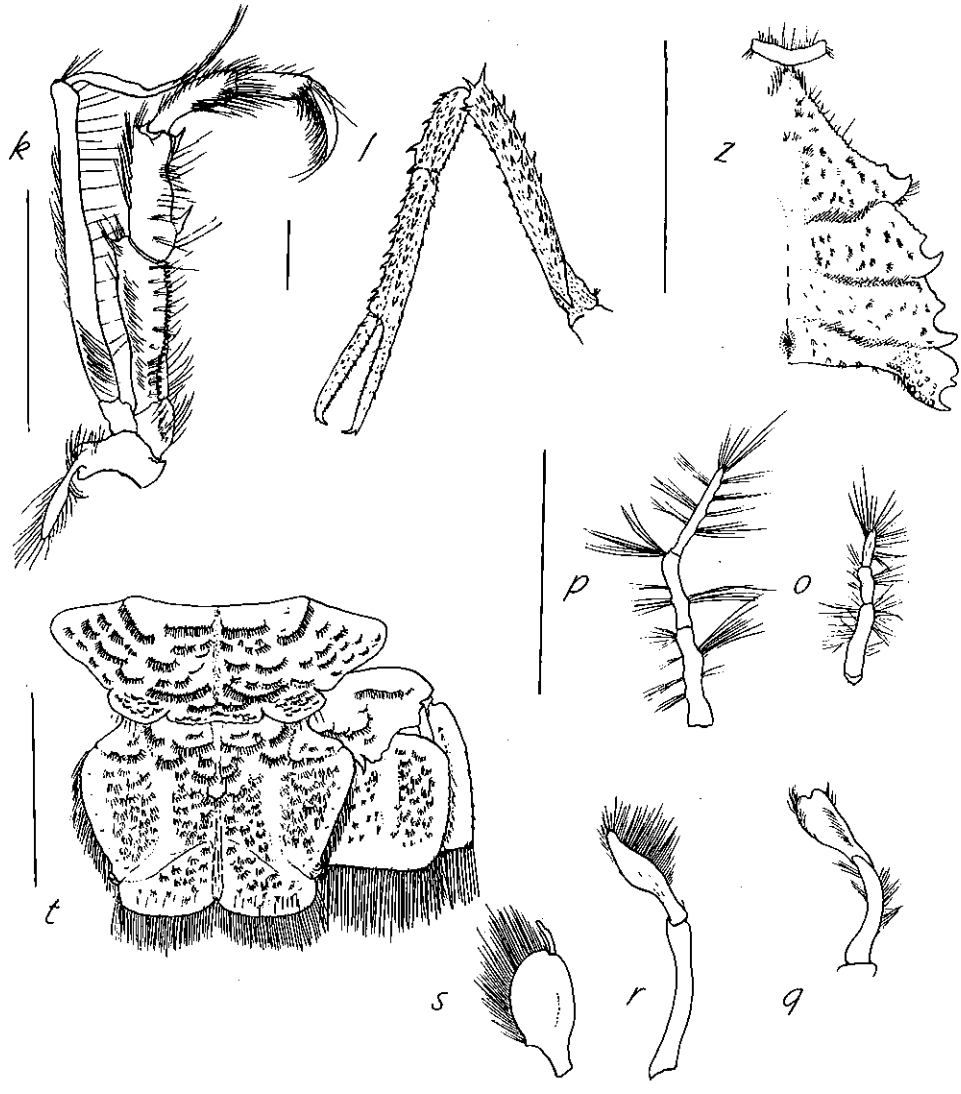

Fig. 224. *Munida valida*: *k*, third maxilliped; *l*, first pereopod; *z*, sternum; *o*, F second pleopod; *p*, third pleopod; *q*, M first pleopod; *r*, M second pleopod; *s*, M third pleopod; *t*, telson; solid line = 10 mm.

Maxilliped II (i) leg-like, slightly compressed, exopod much longer than endopod, with long lash.

Maxilliped III (k) leg-like, dactyl long and curved; merus with inner distal and proximal spine, ischium with crista dentata of many small spines (few also in line on basis) and distal outer blunt spine; exopod slender, longer than ischium plus merus, with long lash. Epipod moderate, club-shaped.

Pereopods: I (l) chelate, very long, fingers shorter than palm, series of strong fixed spines on merus, carpus and propodus, latter with apical spine as well as curved tip and dactyl with three apical spines as well as curved tip; II–IV in decreasing length and slenderness, series of fixed spines on merus, carpus and propodus (fewer on the latter) and strong distal spines on merus and carpus; dactyl long and sharp, without lateral spines. V much more slender and shorter than others, without spines, but with pseudochela for grooming.

Pleopods: female I not present, II (o) uniramous, endopod in two parts, with long setal bunches; III (p) uniramous, endopod in two parts, proximal curved distally, with many tufts of setae; male I (q) endopod spatulate, shorter than II (r), the latter also with spatulate endopod which could possibly fit with I to form a tube for transferral of spermatophore. III–V (s) wide, short, with small apical appendix and fringe of plumose setae.

Range of Distribution

Off Nova Scotia to Gulf of Mexico and Caribbean to Golfo de Morrosquillo, Colombia (Williams 1984, in part). Depths 90–1823 m (Wenner and Boesch 1979).

Records of occurrence in the area of reference are in Fig. 225.

Biology

Lengths of carapace including rostrum in male 54 mm and female 49 mm.

Ovigerous females have been taken almost year round suggesting continuous breeding (Williams 1984).

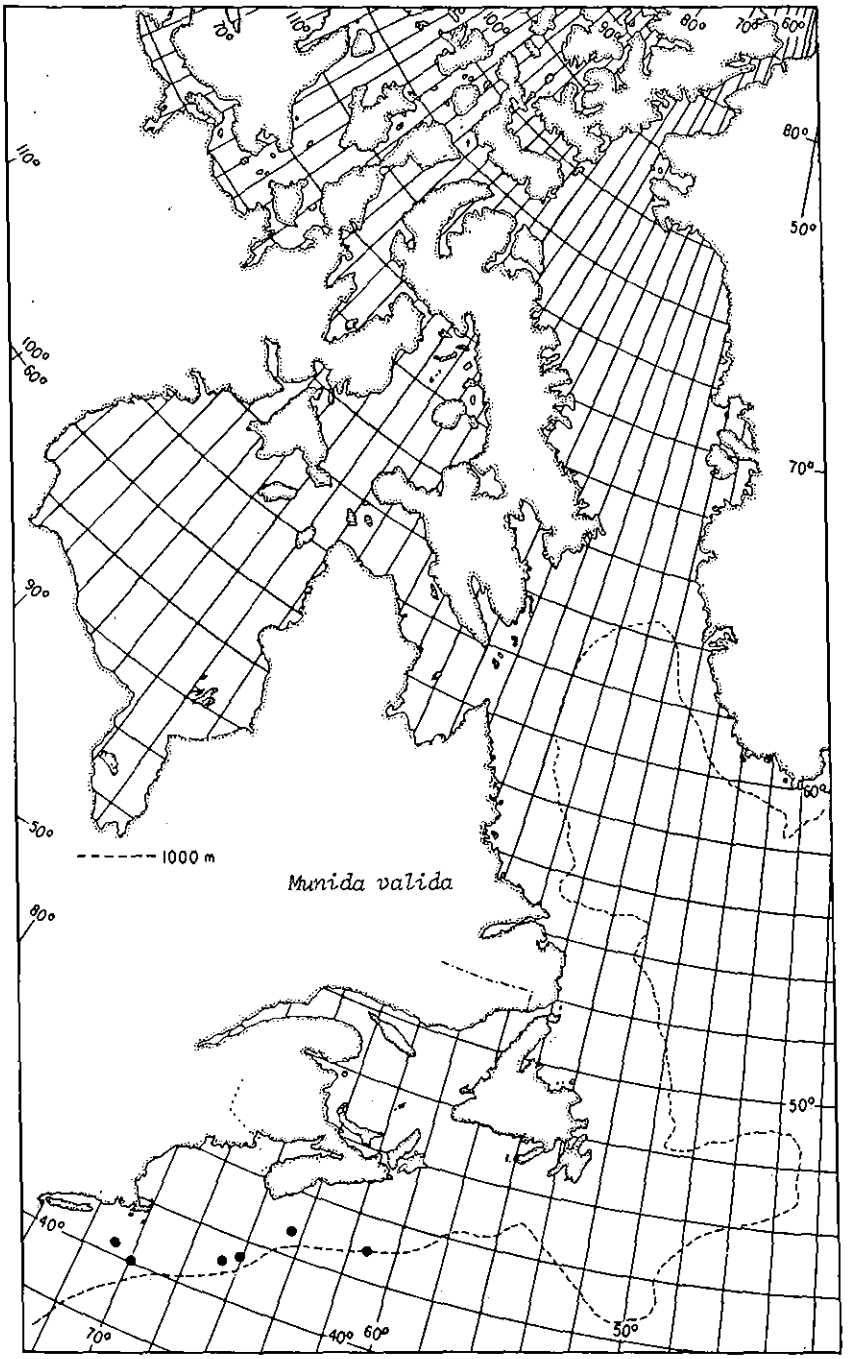

Fig. 225. *Munida valida*, distribution records in the area of reference.

Genus *Munidopsis* Whiteaves, 1874
Makarov 1962: 96; Rathbun 1929: 24.

Rostrum spiniform, sometimes with small but never long supraorbital spines; eyes without pigment or facets, and eyestalks may be free or fused with the orbit; carapace depressed, rectangular in outline, integument strongly calcified; first legs chelate about as long as or slightly longer than others.

Munidopsis curvirostra Whiteaves, 1874
Rathbun 1929: 24, fig. 31;
Whiteaves 1901: 257, fig. 1, 1a.
(Figures 226 and 227)

DISTINGUISHING CHARACTERISTICS

Rostrum a single long and stoutish spine curving upward, one-half to two-thirds carapace length; eyes without pigment or facets, eyestalks free; transverse ridge on middle of cardiac area with strong forward-directed spine; carapace heavily calcified, 2 middorsal spines behind base of rostrum; a middorsal spine on anterior edge of somites 2–4 of the abdomen; exopod of 1st maxilliped without flagellum.

DESCRIPTION

Integument rigid, opaque, rough, with ridges or striations and short setae. Colour greyish white, eyes yellowish.

Rostrum like a curved spike, tapering gradually to a fine point, slightly compressed dorso-ventrally, lateral ridges with fine spinules and confluent with orbit, also covered with fine setae, curved strongly upward.

Carapace squarish but longer than wide, surface covered with short setae and small transverse irregular ridges; in rounded gastric area is a pair of spines behind rostrum and ahead of two in midline; also anterolateral spine on a small mound with two small accessory spines behind anterior edge; cervical groove is followed by depressed area and a transverse cardiac ridge with median spine directed forward.

Sternal plates (z) of 1st to 4th legs fused but with clear divisions, increasing moderately in width posteriorly; 5th narrower, separate; plate of 3rd maxilliped small, with pointed ends laterally.

Abdomen heavily calcified, 2nd to 4th tergites with transverse ridge and forward-directed median spine; pleura extended ventrally but with rounded tips.

Telson (t) broadly shield-shaped and symmetrical on each side of anal tube, with five pairs of matching pieces of varying sizes and a wide proximal triangular centre-piece; terminally a shallow central notch and long setae; uropodal branches with smooth straight outer edges and slightly rounded corners, both shorter than telson.

Eye rounded, with free stalk, but unpigmented and without corneal facets.

Antennule (c) 1st article very stout and longer than other two combined; with dorsolateral spine longer than distomesial spines, the inner with lateral teeth, also spines on inner edge; 2nd and 3rd articles subequal; flagella short.

Antenna (d) peduncle short, articles decreasing distally, each with small distolateral spines.

Mandible (e) heavily calcified, incisor with very small tooth at centre of curved edge and small spine at lower corner; palp with three segments.

Maxillule (f) distal endite expanded to straight spinous edge; proximal with almost parallel sides and slightly concave edge and a short narrow accessory lobe; endopod slender, curved.

Maxilla (g) endites large, unequally bilobed; endopod tapering to sharp point, slightly exceeding anterior rounded lobe of scaphognathite, the latter much longer than triangular posterior lobe, both separated by a notch in outer edge, posterior with an inner fold line.

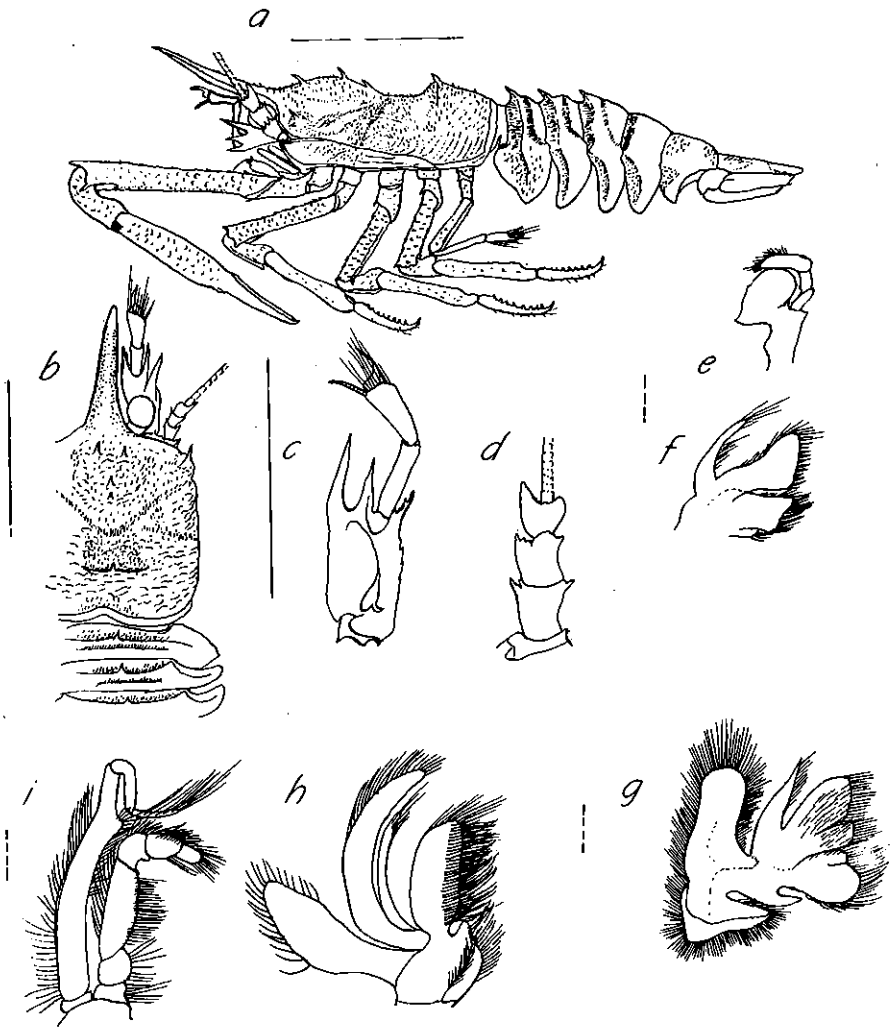

Fig. 226. *Munidopsis curvirostra*: *a*, whole animal from left side; *b*, carapace in dorsal aspect; *c*, antennule; *d*, antenna; *e*, mandible; *f*, maxillule; *g*, maxilla; *h*, first maxilliped; *i*, second maxilliped; solid line = 10 mm, broken line = 1 mm.

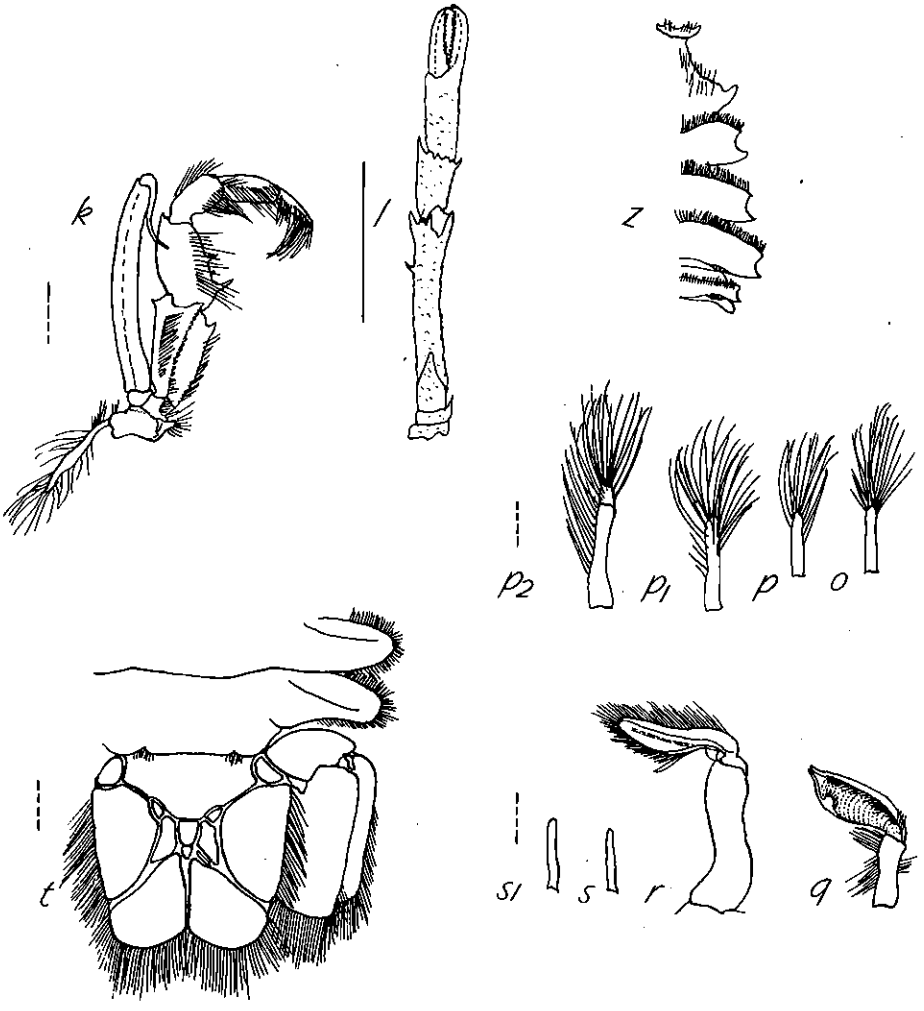

Fig. 227. *Munidopsis curvirostra*: *k*, third maxilliped; *l*, first pereopod; *z*, sternum; *o*, F second pleopod; *p*, F third pleopod; *p1*, F fourth pleopod; *p2*, F fifth pleopod; *q*, M first pleopod; *r*, M second pleopod; *s*, M third pleopod; *s1*, fourth pleopod; *t*, telson; solid line = 10 mm; broken line = 1 mm.

Maxilliped I (h) distal endite large, pedunculate and set back from thickened edge of proximal endite; endopod slender with apical setae only, shorter than narrow curved exopod, the latter without lash or flagellum; epipod large pedunculate.

Maxilliped II (i) leglike with seven segments, distal with apical strong curved spines; exopod long with distolateral projection and long lash.

Maxilliped III (k) leglike, with seven segments, ischium with crista dentata of many small spines and distolateral spine on each side; merus with two large spines and small one between them on inner edge and short distal tooth at outer edge; all segments triangular in cross-section; exopod slender, longer than merus and ischium combined, and with short lash. Epipod moderately long and narrow, somewhat club-shaped, setose.

Pereopods: I (l) chelate, longer and more robust than others, fingers with sagittate teeth, propodus with double spines at apex between which apical spine of dactyl fits; strong distal spines on carpus and merus, and a strong inner spine on distal third of merus; II–IV similar, with distal spine on merus and a row of about 8 strong teeth on flexor edge of long dactyls; V slender and short, with pseudo-chela (fingers flattened and oval) and strong setae on dactyl and propodus, the merus appears hollow along one side into which the carpus can fit.

Pleopods: female I not present, II (o) one short segment only with apical setae, III and IV similar but different in size; V (p2) slightly larger with additional short apical segment; male I not present, II (q) spatulate, endopod foliaceous folded inward, longer than protopod; III (r) protopod long and stout, endopod spatulate also folded inward: II and III together able to form a tube; IV and V (s) small.

Range of Distribution

Davis Strait to North Carolina in the western Atlantic and Iceland and the Britsh Isles to northwest Africa in the eastern Atlantic. Depths 75–2 325 m (Selbie 1914).

Records of occurrence in the area of reference are shown in Fig. 228.

Biology

Lengths to 12 mm cl in males and 15 mm cl in females.

Most females were ovigerous in March and one out of two in August; all ovigerous and large non-ovigerous females had large ova in the ovaries, and were first ovigerous at 9 mm cl. Males were first mature (carrying spermatophores) at 8 mm cl.

Stomach contents were phytobenthos, foraminiferans, crustaceans, polychaetes and small bivalves (Squires 1965a).

Decapod species also present in the catches with this species were *Acanthephyra pelagica*, *Pandalus borealis*, *Pandalus propinquus*, *Lebbeus polaris* and *Sabinea sarsi* (Squires 1965a).

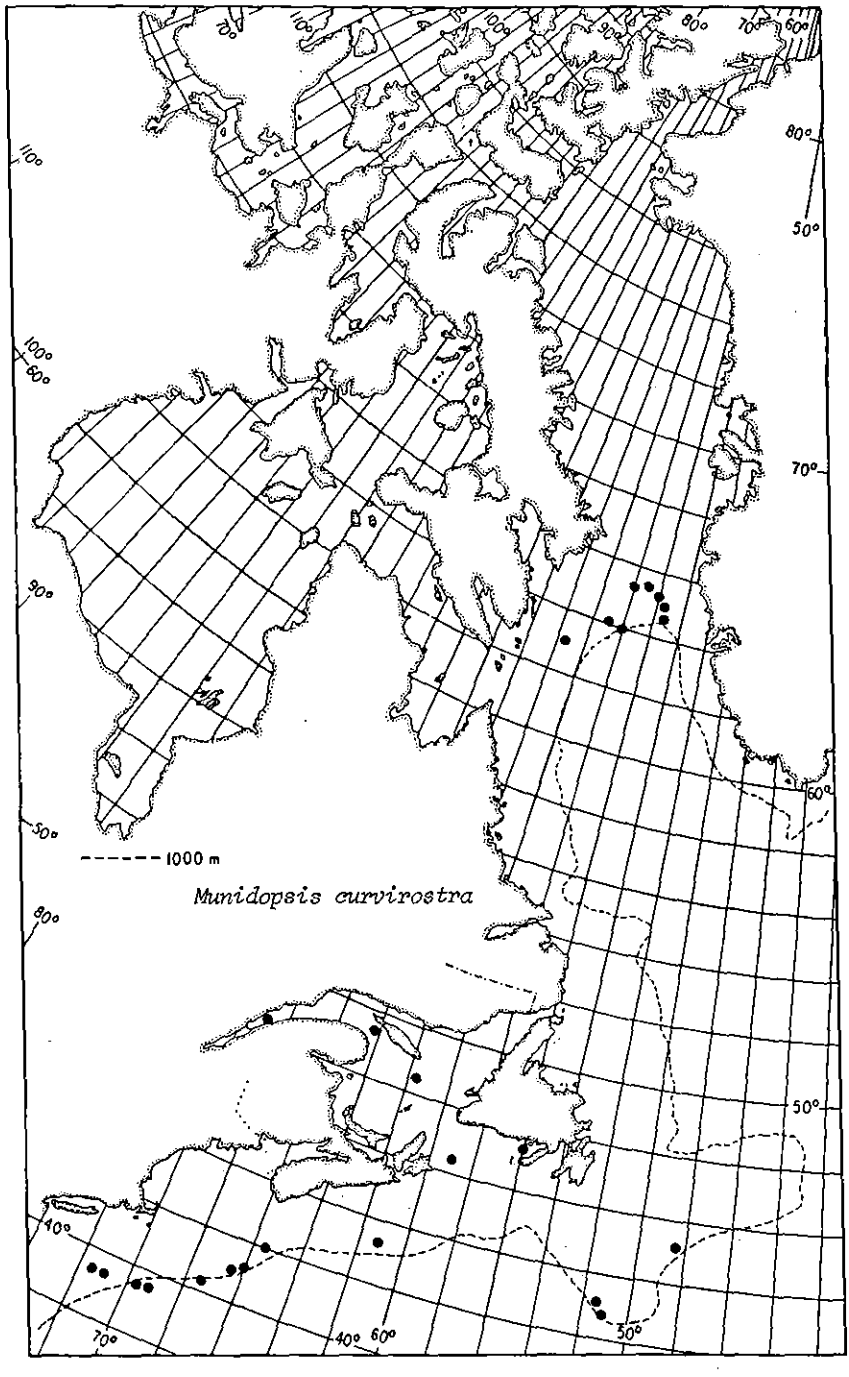

Fig. 228. *Munidopsis curvirostra*, distribution records in the area of reference.

GLOSSARY

Abdomen — the flexible part of the body behind the carapace, the "tail" or hind part in shrimps and lobsters, held under the carapace in crabs.
Abdominal somite — a division or segment of the abdomen.
Accessory tooth — tooth distolateral to crista dentata.
Acicle — antennal scale reduced to a spine, as in hermit crabs.
Aesthetasc — a sensory seta as on the antenna.
Annulations — evenly spaced rings on an appendage such as on a flagellum of the antenna.
Antenna — outer sensory appendage lateral to the antennule at front of body: usually with one flagellum.
Antennal scale — flat blade forming exopod of antenna, sometimes reduced to a spine.
Antennal spine — spine at front of carapace just below orbit, behind antenna.
Antennule — inner sensory appendage at front of body: usually with two flagella.
Anterior — front or towards the front: opposite to posterior.
Anterolateral teeth — teeth at the front edge at the side in crabs, between the orbit and the extreme lateral spine.
Apical — at the tip.
Appendix interna — small branch on inner edge of endopod of pleopod; usually tipped with minute hooks.
Appendix masculina — small branch on inner edge of endopod of second pleopod of male between appendix interna and edge.
Arthrobranch — gill attached at the membrane between a leg and the body wall.
Ascending — sloping upward.

Basicerite — second segment of basal article of antenna, bearing scale.
Basis — second segment of a leg (pereopod).
Bifurcate — forming two branches.
Biunguiculate — with two strong spines at the tip of a leg (dactyl).
Biramus — with two branches.
Branchia — gill.
Branchial region — part of carapace over the gills.
Branchiocardiac groove — groove separating the branchial and cardiac regions on the carapace.
Branchiostegal spine — spine on or near anterior edge of carapace below the antennal spine or branchiostegal groove.
Brush setae — tuft of short stiff setae on terminal segments of legs used for grooming.
Buccal cavity — cavity in which the mouthparts are situated in crabs.

Carapace — chitinous case or shell covering the head and thorax or fore part of the body.
Cardiac region — part of the carapace over the heart, with the gastric region in front and branchial regions at the sides.
Caridean lobe — lamellate expansion of exopod of 1st maxilliped.
Carina — a ridge.
Carpus — fifth segment of a leg, forming the "knee" bend.
Central lobe — endopod in 1st maxilliped.
Cervical groove — groove or complex of grooves across carapace at about the middle and turning forward obliquely at each side.
Chela — pincer or claw formed by dactyl and forward part of propodus both usually with occluding rows of teeth.
Chelipeds — legs bearing chelae.
Chromatophore — contractile cell containing colour in integument.

Cincinnuli — grappling hooks distally on appendix interna, etc.
Compressed — flattened from side to side.
Cornea — outer faceted coating of the eye.
Coxa — first or proximal segment of leg.
Crista dentata — serrated median border or row of strong spines on ischium of third maxilliped.

Dactyl — (dactylus) terminal or seventh segment of leg; moveable finger of chela.
Depressed — flattened from top to bottom or dorsoventrally.
Descending — sloping downwards.
Diaeresis — transverse groove on exopod of uropod.
Distal — towards the tip or away from point of attachment.
Distolateral — outer side towards the tip.
Dorsal — back or upper surface.
Dorsolateral — upper surface and at the side.

Endites — medial branches on protopod of maxillule, maxilla and 1st maxilliped.
Endopod — inner branch of biramous appendage; central lobe of maxilla and 1st maxilliped.
Endostome — part of epistome forming palate in brachyuran crabs.
Epigastric spine — usually last spine in rostral-carapacial series in gastric region.
Epipod — a process attached to coxa of maxilliped or leg, sometimes with terminal hook for grooming setobranch.
Epistome — sternal plate lying between the labrum and antennae of crabs, the anterior part of the buccal frame.
Exopod — the outer branch of a biramous appendage: attached to basis of leg or protopod of pleopod.
Eyescale — a short flat pointed process at base of eyestalk in hermit crabs.
Eyestalk — a stalk at the end of which is the cornea of the eye.

Finger — one of the parts of a chela; the moveable part or dactyl occludes with the fixed finger or extension of the propodus.
Flagellum — the annulated, flexible or whiplike part of an antenna or antennule or maxilliped.
Flexor — the edge towards which a limb is flexed or bent.
Front — frontal part of carapace, between orbits in crabs.

Gastric region — median part of carapace over the stomach, in front of cervical groove.
Gill cavity — space under carapace containing gills or branchia.
Gonopores — openings for extrusion of sexual products on coxa of 3rd legs in females and 5th legs in males.

Hepatic region — small subtriangular area of carapace between the gastric and branchial regions.
Hepatic spine — spine at anterior edge of hepatic region.

Incisor — sharp-edged or cutting (or holding) part of mandible.
Infraorbital spine — spine on lower margin of orbit.
Ischium — third segment from attachment of leg.

Keel — a longitudinal ventral carina.
Keelson — extension to keel.
Key — arrangement of statements of characters of species giving alternatives to help in identification.

Lamella — thin flat blade.
Lamina — expanded part of lamellate appendage.
Larva — form of young decapod after hatching from egg, different from adult.
Lash — flagellum or distal part of exopod of maxilliped.
Lateral — at the side.
Linea anomurica — longitudinal groove or uncalcified line on carapace in anomurans such as hermit crabs.
Linea thalassinica — longitudinal groove or uncalcified line on carapace in anomalans such as *Callianassa*.
Luminescent — producing light.

Mandibles — mouthpart with heavy jaws lying behind other mouthparts.
Maxilla — the second pair of mouthparts following the maxillule.
Maxilliped — one of three pairs of mouthparts following the maxilla.
Maxillule — the first pair of mouthparts following the mandibles.
Median — the middle line.
Merus — the middle or fourth segment of a leg.
Mesial — referring to part nearest the midline.
Molar — thick part of mandible with cusps for grinding or holding.
Movable spine — spine in a socket allowing movement.

Ocellus — little eye or pigment spot near cornea.
Ocular acicle — eye scale in hermit crabs.
Ommatidia — visual unit of compound eye covered by cornea.
Orbit — cavity at front of carapace containing the eye.
Orbital region — narrow area around orbits.
Organs of Pesta — small luminescent areas on hepatopancreas in *Sergestes*.
Ovigerous — carrying eggs on pleopods.

Palate — roof of buccal cavity in crabs.
Palm — part of chela behind the fingers.
Palp — appendage attached to mandible.
Peduncle — proximal part of appendage to which organs are attached.
Pereopod — one of five pairs of legs.
Petasma — complex genital structure attached to inner edge of protopod of first pair of pleopods in male penaeid shrimps.
Photophore — luminescent organ.
Pleon — abdomen.
Pleonite — abdominal somite.
Pleopod — one of five pairs of abdominal appendages: swimmerets.
Pleurobranch — gill attached to wall of thorax above attachment of legs.
Pleuron — ventrolateral part of shell covering somites of abdomen below point of articulation.
Plumose seta — seta with lateral setae or plumes like a feather.
Podobranch — gill attached to an epipod or coxa of appendage.
Posterior — towards the hind part.
Posteroventral — lower part to the rear.
Prehensile — for grasping.
Propodus — sixth segment of leg.
Prosartema — a thin ciliated lobe from dorsal surface of first article of antennule, extending forward over the eye; in some Penaeidea only.
Protopod — proximal segment (fused coxa and basis) of appendage such as pleopod.
Proximal — towards the point of attachment.

Pseudochela — chela-like modification of dactyl occluding with extension of propodus of 5th pereopod.
Pterygostomian spine — spine at anterolateral edge of carapace.

Ramus — branch.
Rasp — rows of rough chitinous elements on surface of terminal segments of uropods or pereopods in hermit crabs.
Retrorse — bending backward from tip.
Rostral formula — number of dorsal spines on rostrum plus those on carapace over number of ventral spines.
Rostrum — projection of front of carapace between orbits.

Scale — antennal scale.
Scaphocerite — antennal scale.
Scaphognathite — "bailer"; exopod of maxilla functioning as a propellor to force water through gill cavity.
Serrate — saw-toothed or with fixed spines along edge.
Seta — slender bristlelike organ, more or less rigid, from surface of shell.
Setobranch — tuft of long threadlike setae on coxa of some legs of some species of decapods, trailing into gill cavity, possibly discouraging settling of fouling organisms. Cleaned by action of claw-bearing epipods (Bauer 1981).
Setose — bearing many setae.
Shield — anterior part of carapace of hermit crab.
Sinus — any space or cavity; may refer to concavity at edge of shell.
Somite — in body segmentation a part or section.
Spermatophore — aggregation of sperm cells in various forms extruded from the gonopore of the male decapod.
Spine — a sharp needle-like projection.
Sternal plates — partly fused ventral plates between legs.
Sternum — ventral part of thorax between legs.
Stylocerite — lateral lobe often with forward spine on 1st article of antennule.
Subchela — a chela formed by the dactyl folding back on front of propodus as in Crangonidae.
Subequal — almost but not quite equal.
Subtriangular — shaped almost like a triangle.
Suborbital spine — spine on lower rim of orbit.
Sulcus — a groove.
Supraorbital spine — a spine near front of carapace above the eye.
Suture — line or seam at junction of plates or around base of spine.
Sympod — protopod.

Tail fan — telson and uropod at each side of it.
Telson — last or seventh somite of abdomen bearing anal opening.
Tergum — dorsal plate of each abdominal somite, between pleura.
Thelycum — genital structure (seminal receptacle) formed from last two thoracic sternal plates in female Penaeidea.
Truncate — as if cut off.
Tubercle — small rounded protuberance.

Uropod — one of a pair of appendages attached to 6th abdominal somite, each with an inner and outer branch (endopod and exopod).

Vas deferens — tubule for passage of spermatozoa.

TABLE 5.

Appendages	Families of decapods		
	LITHODIDAE	GALATHEIDAE	MAJIDAE
Antennule	No stylocerite; 1st article stout, others more slender.	No stylocerite; 1st article much stouter than others and with large sharp distal spines.	No stylocerite; 1st article short, almost spherical; others slender, folding obliquely in socket.
Antenna	No scale or acicle; basal article with strong spine.	No scale; articles with a few stout spines.	No scale; basal article fused with carapace, longer than wide.
Mandible	Palp 3-segmented; incisor heavily calcified, edge almost straight, molar behind it.	Palp 3-segmented; incisor heavily calcified, edge with central and corner tooth; molar behind it.	Palp 3-segmented; incisor heavily calcified, edge curved with blunt corner tooth; molar behind.
Maxillule	Distal endite larger and wider than proximal, latter rounded; endopod moderate, slightly curved.	Endites about equal; endopod with wide base and slender neck.	Distal endite much larger than narrow tapered proximal; endopod 2-segmented, stout.
Maxilla	Endites unequally bilobed, large.	Endites unequally bilobed, proximal with small distal lobe.	Endites unequally bilobed (proximal reduced in *Libinia*).
Scaphognathite	Lobes about equal, posterior subtriangular; endopod about as long as anterior.	Ant. lobe much larger than posterior, latter subtriangular; endopod as long as anterior.	Ant. lobe wider than long, subtriangular (except in *Libinia*); endopod short.
Maxilliped I	Endites large; endopod slender almost as long as exopod, latter with short lash. Epipod reduced.	Endites large; endopod slender about as long as exopod, latter with short lash. (except in *Munidopsis*) Epipod larger than exopod.	Endites large; endopod thick, subtruncate, about as long as exopod (with long lash). Epipod extremely long, ribbonlike.
Maxilliped II	Dactyl longer than wide.	Dactyl longer than wide.	Dactyl longer than wide. Epipod extremely long, ribbonlike.
Maxilliped III	Crista dentata with one accessory tooth in *Lithodes*, two in *Neolithodes*.	Crista dentata without accessory tooth.	Operculiform, rigid. Epipod extremely long, ribbonlike.