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NOTES ON THE ECOLOGY, DEVELOPMENT AND TAXONOMY OF COMMON CALANOID COPEPODS OF THE GEORGES BANK-GULF OF MAINE REGION

by

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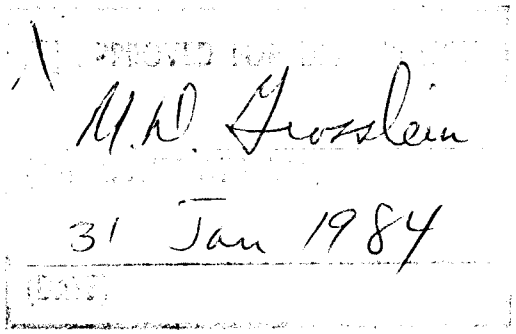

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INTRODUCTION

This manuscript represents an attempt by the authors to compile the most relevant taxonomic and ecological literature on calanoid copepods in the Georges Bank-Gulf of Maine region. The references were accumulated as an aid to the plankton sorters at the National Marine Fisheries Service in Woods Hole, Massachusetts, and the compilation will probably be most valuable to people pursuing a similar task.

An earlier version of the manuscript was written in 1978: "A guide to the developmental stages of common coastal, Georges Bank and Gulf of Maine copepods," Woods Hole Laboratory Reference Document Number 78-53. The current version is an attempt to expand and improve this earlier work, based upon discussions with and useful suggestions from colleagues.

In addition to merely compiling literature into a handy sorting guide, we have included a lot more taxonomic information incorporated into identification tables. Careful dissection of the copepods and examination under a dissection (and sometimes a compound) microscope are necessary in order to use the tables effectively.

The naupliar tables should probably be revised to include the mandibles, and maxillules should be referred to as first maxillae. Unfortunately, the body lengths recorded in the tables are not always from local specimens because the information was not available. It would not require very much additional time and effort for plankton sorters currently working in the region to record seasonal mean

lengths (and widths) of the dominant calanoids.

The terminology in the literature used to describe calanoid morphology and anatomy is extremely diverse, and conflicts exist among the experts on the standardization of these terms. Therefore, it was decided to quote the original authors in our descriptions even though the results produce quite a variety of descriptions. We have attempted to define all the ambiguous terms in the glossary and to note synonyms. It would be very useful if generalized, labelled diagrams of adult male and female calanoids and a nauplius could be included with the Glossary section.

Another major goal of this project was to redraw and standardize the figures from the old "Guide," and incorporate additional figures if available. This phase has not yet begun.

Although we have done an extensive search of the literature, there may be additional primary references and new references which could be incorporated, possibly filling in some of the blanks in the tables and generating additional tables.

This manuscript should be very useful and time-saving to scientists and technicians who are required to sort and identify copepods contained in plankton samples or stomach contents of larval, juvenile, and adult fish from the Georges Bank-Gulf of Maine region.

GLOSSARY OF TERMS

abdomen - body section posterior to the genital complex; bears no appendages.

acron - the presomital, non-segmented part of the body.

acuminate - tapers to a slender point.

aesthete - sense organ usually located on antennules in calanoids.

antennae - term usually used for the second biramous set of metasomal appendages in calanoids.

antennule - term usually used for the first large uniramous set of metasomal appendages in calanoids.

anus - anal opening occurs on last abdominal segment (anal segment).

apical - at the apex or tip.

article - synonym of segment, joint, or somite.

basipod - basal segment of an appendage; sometimes there are two basipods and sometimes they are fused into a single element.

basis - same as basipod.

bifurcated - divided into two parts; forked.

bilobed - divided into two lobes.

branch - same as ramus or furca (= plural).

bristle - short, stiff, hair-like structure.

brood sack - internal receptacle for eggs or nauplii forming part of genital complex.

caudal furca - term used to describe uropods (caudal branches); tail branches.

caudal ramii - same as caudal furca.

cephalon - head; anterior part of body excluding (or including - there is a conflict) the maxilliped segment.

cephalosome - fused somites forming the head; cephalon plus one or more pedigerous somites.

cephalothorax - prosome; cephalosome plus one or more pedigerous somites, if these are completely fused to cephalosome.

chela - claw or pincer.

chelate - claw-like.

coxa - not to be applied to copepod appendages; proximal or basal segment of an arthropod limb.

coxopod - not to be applied to copepod appendages; same as above.

denticle - tooth-like projection.

digitate - has finger-like processes.

distal - located away from point of origin or attachment; opposite of proximal.

dorsal - at the back of a structure or body; opposite of ventral.

egg sack - same as brood sack.

endopod - articulated with the basipod of a limb; located on the inner side of the limb.

exopod - articulated with the basipod of a limb; located on the outside of the limb.

filament - thin, thread-like projection.

foot - general term for terminal portion of a limb.

frontal organ - pair of semitubular outgrowths with hairs, plus the frontal pore.

furca - same as ramii or branches; usually refers to a forked segment.

geniculate - bent, or bendable like a knee joint.

genital segment - the first urosomal segment of the female.

hair - thin, thread-like projection.

hook - curved projection.

incurvate - curved inward.

joint - same as segment, article or somite; may be more properly used to describe actual hinge joint.

labium - lower lip.

labrum - upper lip usually above or in front of mandibles.

lamella - leaf-like structure.

lateral - near or on the side of a structure or body.

leg - usually used to refer to swimming leg.

lobate - having lobes.

mandibles - third pair of cephallic appendages, each consisting of a stout chitonized blade with a dentate inner edge and a palp (usually biramous).

maxillae - fifth pair of cephallic appendages; same as second maxillae; uniramous.

maxillipeds - sixth pair of cephallic appendages; uniramous.

maxillules - fourth pair of cephallic appendages; same as first maxillae; flattened, highly-modified biramous structures.

mesosome - should not be used for copepods; refers to anterior portion of abdomen.

metasome - pedigerous somites between the cephalon and the major articulation of the body.

naupliar eye - single, simple copepod eye.

neck - one or more fused trunk somites which are narrower than the cephalosome/cephalothorax.

oral opening - mouth; oral cavity; oral atrium.

pedigerous somites - somites bearing natatory legs 1-5.

penultimate - next to the last.

phyllopopodus - leaf-like; flattened.

pleopod - not to be used for copepods; usually an abdominal appendage used for swimming.

plumose (plumulose) - refers to setae covered with shorter, smaller setae along their margins; feather-like.

precoxa - not to be applied to copepod appendages.

prehensile - used for grasping.

prosome - complete body section anterior to the major articulation; can be divided into cephalon and metasome.

proximal - located close to the median line of the body; opposite of distal.

pseudochelate - having the appearnce of a chela.

ramus (uni-, bi-, tri-) - branch (one-, two-, or three-branched).

recurved - curving inward to backward.

rostrum - prominent anterior or anterio-ventral projection of the metasome.

securiform - protective.

segment - same as article, joint, or somite.

serrate - having a notched or toothed edge.

setae - more slender than spines (relative to the base); pliable or semi-pliable; length varies; tapers gradually to a point.

setose - possessing setae.

somite - same as segment, article or joint.

spinule - a minute spine.

spinose - possessing spines.

stylet - slender, rigid, pointed, spine-like projection.

subchelate - terminal segment of an appendage reflexed on the subterminal segment to give the appearance of a chela.

subequal - almost equal

swimming feet (also pleopods or pereiopods) - usually present on the first 5 thoracic somites; first four pairs usually biramous; fifth pair often specialized in males for copulation and may be reduced or missing in females.

sympod - synonym for basipod; may be 1 or 2 segments forming base of leg from which endopod and exopod arise.

telson - non-segmented post-somital body region.

terminal - at the tip of.

thorax - area between cephalon and genital complex.

trunk - fused thoracic segments and genital complex.

uropods - same as caudal rami and caudal furca; usually flatened abdominal appendages which, with the telson, form the tail fan in some crustaceans.

urosome - complete body section posterior to the major body.

ventral - lower or underside of body or structure; opposite of dorsal.

vulva - genital cavity underlying operculum.

wing - triangular (wing-like) shaped projection.

*Definitions were taken from an "unofficial" publication called Monoculus which solicited definitions for a glossary of terms for copepodologists from its readers; other sources include: J.C. Roff (1978) Owre and Foyo (1967), Lapedes (1978).

Acartia clausi Giesbrecht, 1889

Calanoida: Acartiidae

Distribution: *A. clausi* is widespread and abundant in shoal waters on both sides of the temperate North Atlantic. It occurs as a stray in the Gulf of St. Lawrence and from Delaware Bay to Cape Hatteras. It occurs year-round in the Gulf of Maine, and is a winter-spring species from the Gulf of Maine to Delaware Bay. It has a more southern distribution than *A. longiremis*, and it is gradually replaced by *A. tonsa* south of the Gulf of Maine.

Ecology: Mainly neritic; eurythermal; euryhaline.

Feeding Habits: Herbivorous, sometimes omnivorous.

Remarks: In the Gulf of Maine, *A. clausi* propagates in early spring and late summer.

References: Bigelow, 1926; Bigelow and Sears, 1939; Bowman, 1961; Brodskii, 1967; Conover, 1956; Conway and Minton, 1975; Deevey, 1960; Mullin, 1967; Ogilvie, 1956; Sars, 1903; Wilson, 1932.

TABLE 1. NAUPLIAR STAGES OF *ACARTIA CLAUSI* GIESBRECHT

		I	II	III	IV	V	VI
BODY LENGTH (MM)		*0.12	0.14	0.16	0.19	0.23	0.28
CAUDAL ARMATURE		2 TERMINAL SPINES	AS IN STAGE I	2 TERMINAL SETAE 2 TERMINAL SPINES	2 TERMINAL SETAE 2 TERMINAL SPINES 2 VENTRAL SPINES	AS IN STAGE IV	AS IN STAGE V
NO OF SETAE ON TERMINAL SEGMENT OF ANTENNULE		3	4	7	8	9	12
ANTENNA	MASTICATORY HOOKS						
	NO OF SETAE ON ENDOPOD						
	NO OF SETAE ON EXOPOD						
MAXILLULE		--	--	RUDIMENTARY	RUDIMENTARY	RUDIMENTARY	RUDIMENTARY
MAXILLA		--	--	--	--	RUDIMENTARY	RUDIMENTARY
MAXILLIPED		--	--	--	--	RUDIMENTARY	RUDIMENTARY
REMARKS		It is not possible to distinguish between *A. clausi* and *A. tonsa* before Stage III. *Lengths are from northern North Sea specimens.		The caudal spines of *A. clausi* are longer and stouter than those of *A. tonsa*.			1st and 2nd swimming feet rudimentary.

TABLE 2. COPEPODITE STAGES OF *ACARTIA CLAUSI* GIESBRECHT

	I	II	III	IV	V
CEPHALOTHORAX LENGTH (MM)	*0.25-0.42	0.42-0.51	0.51-0.65	♂ 0.70-0.76 ♀ 0.65-0.76	♂ 0.79-0.93 ♀ 0.79-0.84
NO OF METASOME SEGMENTS	3	4	5	♂ 4 ♀ 4	♂ 4 ♀ 4
NO OF UROSOME SEGMENTS	1	1	2	♂ 3 ♀ 2	♂ 4 ♀ 3
PAIRS OF SWIMMING FEET PRESENT	2	3	4	5	5
5th FEET	--	--	--	MALE: ASYMMETRICAL FEMALE: ASYMMETRICAL	AS IN STAGE IV
REMARKS	Urosome-cephalothorax ratio is 1:3 *Lengths from North Sea specimens			The most lateral caudal bristle on each ramus is thinner and about half as long as the 4 middle bristles in Stages IV-VI	

TABLE 3. ADULTS OF *ACARTIA CLAUSI* GIESBRECHT

	♂	♀
LENGTH(MM)	*0.79-0.99	0.79-0.93
NO OF METASOME SEGMENTS	4	4
NO OF UROSOME SEGMENTS	5	3
5th FEET	Asymmetrical; right leg: blunt process on 2nd and 3rd segment, 3rd segment bearing a small spinule, 4th segment elongate and curved; left leg: terminal segment with a serrated plate, distal segment short with a terminal spine and an equally long digitiform process.	Symmetrical; lateral bristles hairy, slightly longer than apical ones which are massive with a deep bilateral serrature on the distal half.
REMARKS	Last metasomal segment with a row of 4 to 6 small denticles on the edge: first 2 urosome segments each with a row of smaller denticles: antennule geniculate. *Lengths from North Sea specimens.	Denticles on metasome and urosome as in males.

Acartia danae Giesbrecht, 1889

Calanoida: Acartiidae

Distribution: *A. danae* has been recorded from the Gulf of St. Lawrence to $10^{o}15'$N latitude.

Ecology: Oceanic.

Feeding Habits: Herbivorous.

Remarks: None.

References: Brodskii, 1967; Mullin, 1967; Owre and Foyo, 1967; Rose, 1933; Wilson, 1932.

TABLE 4. ADULTS OF *ACARTIA DANAE* GIESBRECHT

	♂	♀
LENGTH(MM)	*0.73-0.80	1.08-1.27
NO OF METASOME SEGMENTS	4	4
NO OF UROSOME SEGMENTS	5	3
5th FEET	Asymmetrical; right leg: pointed projection on internal edge of 1st segment. Left leg: 3rd segment with 4 short spines.	Symmetrical; basal segment longer than wide; apical bristle twice as long as this segment and with denticles to end and large plumose seta 3 times as long as apical bristle.
REMARKS	Antennule geniculate; posterior corners of last metasomal segment produced into short, stout spines. *Lengths are from French specimens.	Last metasomal segment as in males.

Acartia longiremis (Lilljeborg, 1853)

Calanoida: Acartiidae

Distribution: *A. longiremis* is found from the Arctic Ocean to Chesapeake Bay. It is an inhabitant of shelf water in the southern part of its range (south of Cape Cod), and does not ordinarily occur in coastal waters or in bays south of Cape Cod.

Ecology: Neritic; eurythermal; euryhaline.

Feeding Habits: Herbivorous.

Remarks: *A. longiremis* attains its maximum abundance in the Gulf of Maine during the warmer months.

References: Bigelow, 1926; Bowman, 1961; Mullin, 1967; Sars, 1903; Wilson, 1932.

TABLE 5. ADULTS OF *ACARTIA LONGIREMIS* (LILLJEBORG)

	♂	♀
TOTAL LENGTH(MM)	*0.8-1.0	0.9-1.1
NO OF METASOME SEGMENTS	4	4
NO OF UROSOME SEGMENTS	4	3
5th FEET	Asymmetrical; similar to *A. clausi* except: terminal segment of right leg with thinner proximal part and less armature; distal segment of left leg with digitiform process shorter than spine on same segment; no characteristic crest on penultimate segment.	Symmetrical; apical bristles naked, slightly curved, and somewhat longer than hairy lateral bristles.
REMARKS	There is a delicate spinule on the dorsal face of each lateral lobe of the last segment of the metasome. *Lengths are from Woods Hole, Mass. specimens.	Spinule present as in males.

Acartia tonsa Dana, 1849

Calanoida: Acartiidae

Distribution: *A. tonsa* has been reported from the Gulf of St. Lawrence to the Gulf of Mexico. Cape Cod may be the northern boundary to its occurrence in significant numbers. It is a summer-fall species from Woods Hole to Delaware Bay, and occurs year-round from Delaware Bay to Florida. It occurs as a stray in the Gulf of St. Lawrence and the Gulf of Maine.

Ecology: Estuarine and neritic; eurythermal; euryhaline.

Feeding Habits: Herbivorous, sometimes omnivorous.

Remarks: The greatest number of nauplii occurs from July through October in the Narragansett Bay area.

References: Anraku and Omori, 1963; Bigelow, 1926; Brodskii, 1967; Conover, 1956; Deevey, 1960; Faber, 1966b; Heinle, 1966; Mullin, 1967; Rose, 1933; Wilson, 1932.

TABLE 6. NAUPLIAR STAGES OF *ACARTIA TONSA* DANA

		I	II	III	IV	V	VI
BODY LENGTH (MM)		*0.094	0.117	0.140	0.164	0.187	0.211
CAUDAL ARMATURE		2 TERMINAL SETAE	AS IN STAGE I	2 TERMINAL SETAE 2 TERMINAL SPINES	2 TERMINAL SETAE 2 VENTRAL SPINES 2 TERMINAL SPINES	AS IN STAGE IV	AS IN STAGE V
NO OF SETAE ON TERMINAL SEGMENT OF ANTENNULE							
ANTENNA	MASTICATORY HOOKS						
	NO OF SETAE ON ENDOPOD						
	NO OF SETAE ON EXOPOD						
MAXILLULE		--	--	RUDIMENTARY	RUDIMENTARY	RUDIMENTARY	RUDIMENTARY
MAXILLA		--	--	--	--	RUDIMENTARY	RUDIMENTARY
MAXILLIPED		--	--	--	--	RUDIMENTARY	RUDIMENTARY
REMARKS		It is not possible to distinguish between *A. tonsa* and *A. clausi* before Stage III. *Lengths are from Patuxent River estuary, Maryland specimens.		The caudal spines of *A. clausi* are longer and stouter than *A. tonsa*.			1st and 2nd swimming feet rudimentary.

TABLE 7. COPEPODITE STAGES OF *ACARTIA TONSA* DANA

	I	II	III	IV	V
TOTAL LENGTH (MM)	*0.394	0.464	0.580	♂♀ 0.680	♂♀ 0.820
NO. OF METASOME SEGMENTS	3	4	5	♂ 4 ♀ 4	♂ 4 ♀ 4
NO. OF UROSOME SEGMENTS	1	1	2	♂ 3 ♀ 2	♂ 4 ♀ 3
PAIRS OF SWIMMING FEET PRESENT	2	3	4	5	5
5th FEET	--	--	RUDIMENTARY	FEMALES: PROXIMAL SWELLING OF THE END SEGMENT TERMINATING IN A THIN SPINE	AS IN STAGE IV
REMARKS	Urosome-cephalothorax ratio 1:5 *Lengths are from Patuxent River estuary, Maryland specimens.			The most lateral caudal bristle on each ramus is heavy and nearly as long as 4 middle bristles, Stages IV-VI	

TABLE 8. ADULTS OF *ACARTIA TONSA* DANA

	♂	♀
LENGTH(MM)	*1.00-1.15	1.25-1.50
NO OF METASOME SEGMENTS	4	4
NO OF UROSOME SEGMENTS	5	3
5th FEET	Basipodite of left foot with round process on inner distal margin; apical bristle is bilaterally serrate at beginning of distal half, basally swollen and nearly as long as lateral bristle.	Right leg: slender 1st segment without internal spine Left leg: terminal segment with pointed spine and finger-like projection.
REMARKS	Genital segment with bundles of short bristles. *Lengths for Woods Hole, Mass. region specimens.	

Aetideus armatus (Boeck, 1872)

Calanoida: Aetideidae

Distribution: A. armatus is cosmopolitan and common to all oceans, except the Arctic Ocean. In the Gulf of Maine, it occurs as a stray from the open Atlantic waters.

Ecology: Oceanic, usually in deep water; not found regularly in water of a salinity below $35^{o}/oo$.

Feeding Habits: Omnivorous.

Remarks: None

References: Arashkevich, 1969; Bigelow, 1926; Brodskii, 1967; Farran, 1911; Jesperson, 1940; Sars, 1903; Scott, 1911; Vervoort, 1952; Wilson, 1932.

TABLE 9. ADULTS OF *AETIDIUS ARMATUS* (BOECK)

	♂	♀
TOTAL LENGTH(MM)	*1.25-1.45	1.3
NO OF METASOME SEGMENTS	3	3
NO OF UROSOME SEGMENTS	4	4
5th FEET	LEFT LEG NEARLY AS LONG AS THE UROSOME, RIGHT LEG UNDEVELOPED: 3RD SEGMENT LONGEST, DISTAL SEGMENT SHORTEST, WITH FINE HAIRS.	ABSENT
REMARKS	Rostrum large, bifurcated. *Lengths from Woods Hole specimens.	

Euchirella rostrata (Claus, 1866)

Calanoida: Aetideidae

Distribution: E. rostrata is widespread over the tropical, sub-tropical, and temperate regions of the world ocean. It is found along the continental slope.

Ecology: Oceanic; found in moderately deep water, exhibits a wide range of vertical distribution.

Feeding Habits: Mainly carnivorous.

Remarks: None.

References: Bigelow, 1926; Mullin, 1967; Park, 1976; Rose, 1933; Scott, 1911; Vervoort, 1952.

TABLE 10. ADULTS OF *EUCHIRELLA ROSTRATA* (CLAUS)

	♂	♀
TOTAL LENGTH (MM)	*2.60	2.96-2.66
NO OF METASOME SEGMENTS	3	3
NO OF UROSOME SEGMENTS	5	4
5th FEET	Asymmetrical; endopodites well developed and nearly twice as long on right leg as on left leg; exopod on left leg very short; distal segment pointed; inner margin of right exopodite smooth, non-serrate	ABSENT
REMARKS	Rostrum large, forehead without a crest in both sexes. *Lengths are from Gulf of Maine specimens.	Basipod of the fourth leg has a row of six or seven flattened spines.

Calanus finmarchicus (Gunnerus, 1765)

Calanoida: Calanidae

Distribution: In the North Atlantic, C. finmarchicus is distributed over the whole area north of about 55°N latitude. It has been recorded in all of the oceans from the highest latitudes to sub-tropical regions. It occurs year-round from the Gulf of St. Lawrence to Woods Hole, and is a winter-spring species from Woods Hole to Delaware Bay.

Ecology: Neritic and oceanic; eurythermal; stenohaline.

Feeding Habits: Herbivorous

Remarks: C. finmarchicus is most abundant in summer in the Gulf of Maine, and it is most abundant from April to early August from Cape Cod to Chesapeake Bay. It is the predominant species in the Gulf of Maine in all seasons. It has an annual maximum abundance in mid- and late-spring in waters of Southern New England and Georges Bank. In the eastern Gulf of Maine, breeding takes place in April-May and July-August. In the western Gulf of Maine breeding takes place in March-April and June-July, and possibly in September. In the Woods Hole region, the nauplii are present in significant numbers in March, April, and May, and the early copepodite stages are present in April-May and June-July. Stage V copepodites are present year-round. C. finmarchicus passes the autumn and winter as a Stage V copepodite and matures in early spring in the Woods Hole region and in the Gulf of Maine. The developmental period is ten weeks and mortality is highest among maturing adults. Maximal numbers occur at temperatures between 4°C and 7°C.

Calanus finmarchicus (cont'd)

References: Bigelow, 1926; Bigelow and Sears, 1939; Brodskii, 1967; Clarke and Zinn, 1937; Conway and Minton, 1975; Deevey, 1960; Farran, 1911; Fish, 1936a; Jeffries and Johnson, 1973; Lebour, 1916; Matthews, 1967; Mullin, 1967; Ogilvie, 1953; Sars, 1903; Sherman, Sullivan and Byron, 1978; Sherman, Jones and Kane, 1979.

TABLE 11. NAUPLIAR STAGES OF *CALANUS FINMARCHICUS* (GUNNERUS)

		I	II	III	IV	V	VI
BODY LENGTH (MM)		*0.22	0.27	0.40	0.48	0.55	0.61
CAUDAL ARMATURE		2 EQUAL TERMINAL SETAE	AS IN STAGE I, SETAE LONGER	2 LONG TERMINAL SETAE 2 LATERAL SPINES 2 TERMINAL SPINES 3 ROWS SHORT VENTRAL SPINES	2 LONG TERMINAL SETAE 6 LATERAL SPINES 2 TERMINAL SPINES 4 VENTRAL SPINES 3 ROWS SHORT VENTRAL SPINES	AS IN STAGE IV	2 LONG TERMINAL SETAE 8 LATERAL SETAE 2 TERMINAL SPINES 4 VENTRAL SPINES NO ROWS OF VENTRAL SPINES
NO OF SETAE ON TERMINAL SEGMENT OF ANTENNULE		3	4	7	11	13	
ANTENNA	MASTICATORY HOOKS	1 ON COXOPODITE	1 ON COXOPODITE 1 ON BASIPODITE	2 ON COXOPODITE 1 ON BASIPODITE	AS IN STAGE III	AS IN STAGE IV	
ANTENNA	NO OF SETAE ON ENDOPOD	2	4	6	6	9	
ANTENNA	NO OF SETAE ON EXOPOD	6	8	9	11	11	
MAXILLULE		--	--	BUD	RUDIMENTARY	RUDIMENTARY	RUDIMENTARY
MAXILLA		--	--	--	--	BUD	RUDIMENTARY
MAXILLIPED		--	--	--	--	BUD	RUDIMENTARY
REMARKS		*Lengths are from typical northern North Sea specimens.		Body flexed dorso-ventrally.			1st and 2nd swimming feet rudimentary.

TABLE 12. COPEPODITE STAGES OF *CALANUS FINMARCHICUS* (GUNNERUS)

	I	II	III	IV	V
TOTAL LENGTH (MM)	*0.73-0.84	1.01-1.15	1.29-1.46	♂♀ 1.66-1.94	♂♀ 2.25-2.61
NO OF METASOME SEGMENTS	4	5	5	♂ 5 ♀ 5	♂ 5 ♀ 5
NO OF UROSOME SEGMENTS	1	1	2	♂ 3 ♀ 3	♂ 4 ♀ 4
PAIRS OF SWIMMING FEET PRESENT	2	3	4	5	5
5th FEET	--	--	RUDIMENTARY		
REMARKS	* Lengths are from northern North Sea specimens. Antennules are longer than the body in all stages.				

TABLE 13. ADULTS OF *CALANUS FINMARCHICUS* (GUNNERUS)

	♂	♀
CEPHALOTHORAX LENGTH(MM)	*1.97-2.15	1.86-2.44
NO OF METASOME SEGMENTS	5	5
NO OF UROSOME SEGMENTS	5	4
5th FEET	Inner margin of 1st basipodite bearing curved row of denticles symmetrically on right and left legs; left exopodite slightly longer than right with triangular terminal segment; left endopodite reaching middle of second segment of exopodite.	Inner margin of 1st basipodite bearing symmetrical row of denticles on left and right legs.
REMARKS	Cephalothorax oblong, about 3 times the length of urosome; antennules longer than body. *Lengths are from North Sea specimens.	Urosome about 1/2 length of metasome.

Calanus helgolandicus (Claus, 1863)

Calanoida: Calanidae

Distribution: In the temperate North Atlantic, *C. helgolandicus* is found from 60^{o}N latitude to 20^{o}N latitude. It also extends westward across the North Atlantic Drift to the Labrador Grand Banks.

Ecology: Oceanic.

Feeding Habits: Herbivorous.

Remarks: None.

References: Brodskii, 1967; Fleminger and Hulsemann, 1977; Mullin, 1967; Sars, 1903; Wilson, 1932.

TABLE 14. ADULTS OF *CALANUS HELGOLANDICUS* (CLAUS)

	♂	♀
TOTAL LENGTH (MM)	*2.50-2.80	2.75-3.25
NO OF METASOME SEGMENTS	5	5
NO OF UROSOME SEGMENTS	5	4
5th FEET	More asymmetrical than *C. finmarchicus*; left exopodite more pronounced; 2nd segment thinner than 1st and endopodite of same leg reaching to 1/3 length of 2nd segment of exopodite; 1st segment of basipodite bearing crest of denticles in a straight line	1st basipodite bearing row of denticles on inner side.
REMARKS	*Lengths are from Woods Hole specimens.	Urosome more than 1/2 length of metasome.

Calanus hyperboreus Krøyer, 1838

Calanoida: Calanidae

Distribution: C. hyperboreus is an Arctic species, and it is abundant in mid-water slope fauna. Georges Bank and Cape Cod mark the southern limits to its occurrence as more than a stray.

Ecology: Oceanic; occurs in greatest numbers in temperatures from 1-5°C.

Feeding Habits: Herbivorous.

Remarks: The breeding season for C. hyperboreus is from November through February in the Gulf of Maine and the offshore waters to the east of Cape Cod. Its numbers increase from February to May and then decrease during June in the Gulf of Maine. It produces one generation a year in the Gulf of Maine. The final molt to the adult stage generally occurs in late autumn and early winter.

References: Arashkevich, 1969; Bigelow, 1926; Brodskii, 1967; Conover, 1967; Sars, 1903; Vervoort, 1951; Wilson, 1932.

TABLE 15. ADULTS OF *CALANUS HYPERBOREUS* KRÖYER

	♂	♀
TOTAL LENGTH(MM)	*3.0-7.0	7.0-10.0
NO OF METASOME SEGMENTS	5	5
NO OF UROSOME SEGMENTS	5	4
5th FEET	Left exopodite very slightly longer than right with distal segment slightly incurvate, narrowed and with short apical spine. Endopodite of left leg reaching middle of distal segment of exopodite. Basipodite with straight line of denticles.	1st basipodite with straight line of denticles.
REMARKS	Lateral borders of the fifth metasomal segment are acutely pointed in both sexes. *Lengths are from Woods Hole specimens.	

Calanus tenuicornis Dana, 1849

Calanoida: Calanidae

Distribution: C. tenuicornis has been reported between 40°58'N latitude and 10°30'N latitude (Long Island to the Caribbean) in the western North Atlantic.

Ecology: Oceanic.

Feeding Habits: Herbivorous.

Remarks: None.

References: Brodskii, 1967; Grice and Hart, 1962; Mullin, 1967; Rose, 1933; Vervoort, 1951.

TABLE 16. ADULTS OF *CALANUS TENUICORNIS* DANA

	♂	♀
TOTAL LENGTH (MM)	*1.5-1.8	1.8
NO OF METASOME SEGMENTS	5	5
NO OF UROSOME SEGMENTS	5	4
5th FEET	Slightly asymmetrical; left and right exopods of equal length; 2nd segment elongated; 3rd segment short, tapering distally with long terminal spine; left endopodite reaching proximal 1/3 of 3rd segment of exopodite; basipodite with smooth, nonserrate margins.	Symmetrical; basipodite with smooth nonserrate margins.
REMARKS	Caudal rami large with one very small seta on the outer edge; antennule very long extending beyond the caudal rami. *Lengths are from Brodskii, 1967.	

Nannocalanus minor (Claus, 1863)

Calanoida: Calanidae

Distribution: N. minor has been reported between 43°02'N latitude and 10°15'N latitude in the western North Atlantic.

Ecology: Oceanic.

Feeding Habits: Herbivorous.

Remarks: None.

References: Arashkevich, 1969; Colton, Temple and Honey, 1962; Grice and Hart, 1962; Rose, 1933; Vervoort, 1951; Wilson, 1932.

TABLE 17. ADULTS OF *NANNOCALANUS MINOR* (CLAUS)

	♂	♀
TOTAL LENGTH (MM)	*1.7-1.8	1.75-2.0
NO OF METASOME SEGMENTS	4	4
NO OF UROSOME SEGMENTS	5	4
5th FEET	Right leg: 3rd exopod segment with 2 internal spines; terminal spine short. Left leg: 3rd endopod segment with 3 small spines.	Basipodite with coarsely denticulate straight inner margins.
REMARKS	Last metasomal segment broadly rounded, partly overlapping the genital segment in both sexes. *Lengths are from Woods Hole specimens.	

Undinula vulgaris (Dana, 1849)

Calanoida: Calanidae

Distribution: U. vulgaris prefers tropical waters, but it has been found over the Great South Channel between Georges Bank and Cape Cod, the Eastern Channel between Georges Bank and Browns Bank, and the southern part of Georges Bank. It has been reported between 40°45'N latitude and 10°15'N latitude.

Ecology: Neritic and oceanic.

Feeding Habits: Herbivorous.

Remarks: None.

References: Björnberg, 1966; Colton, Temple and Honey, 1962; Itoh, 1970; Owre and Foyo, 1967; Wilson, 1932.

TABLE 18. ADULTS OF *UNDINULA VULGARIS* (DANA)

	♂	♀
TOTAL LENGTH (MM)	*2.25-2.5	2.4-2.85
NO OF METASOME SEGMENTS	4	4
NO OF UROSOME SEGMENTS	5	4
5th FEET	RIGHT LEG SHORT AND BIRAMONUS, 3-SEGMENTED; LEFT LEG UNIRAMOUS, ELONGATE, FORMING A COMPLICATED PREHENSILE STRUCTURE	ENDOPOD WITH SEVEN SETAE; THOSE ON THE FIRST AND SECOND SEGMENTS SPINE-LIKE; RAMI 3-SEGMENTED.
REMARKS	The outer margins of the second exopods of the second legs are invaginate. *Lengths are from Brodskii, 1967	Exopods of second legs as in males.

Calocalanus pavo (Dana, 1849)

Calanoida: Calocalanidae (Bernard, 1958)

Distribution: C. pavo is widely distributed in temperate and tropical waters. It has been found over deep water along the southern edge of Georges Bank.

Ecology: Oceanic; occurs mainly in the upper water column.

Feeding Habits: Herbivorous.

Remarks: None.

References: Colton, Temple and Honey, 1962; Itoh, 1970; Owre and Foyo, 1967; Rose, 1933; Wilson, 1932.

TABLE 19. ADULTS OF *CALOCALANUS PAVO* (DANA)

	♂	♀
TOTAL LENGTH (MM)	*1.0-1.5	0.8-1.25
NO OF METASOME SEGMENTS	4	4
NO OF UROSOME SEGMENTS	5	3
5th FEET	Asymmetrical; right leg: 4-segmented; left leg: 5-segmented.	Symmetrical; terminal segment with 5 plumose setae, 1 external spine, and 2 terminal spinules.
REMARKS	Caudal rami not perpendicular to body axis; last metasomal segment with spines. *Lengths are from Woods Hole Region specimens.	Caudal rami are perpendicular to the body axis, and are armed with plumose setae.

Candacia armata Boeck, 1872

Calanoida: Candaciidae

Distribution: C. armata is found in the Atlantic from 75°N latitude to 25°N latitude.

Ecology: Oceanic.

Feeding Habits: Carnivorous.

Remarks: None.

References: Bernard, 1965; Colton, Temple and Honey, 1962; Grice, 1963; Mullin 1967; Sars, 1903; Wilson, 1932.

TABLE 20. NAUPLIAR STAGES OF *CANDACIA ARMATA* BOECK

		I	II	III	IV	V	VI
BODY LENGTH (MM)		*0.20	0.23	0.27	0.31	0.34	0.36
CAUDAL ARMATURE		NONE	2 TERMINAL SETAE	2 LONG, 2 SHORT TERMINAL SETAE	2 LONG, 2 SHORT TERMINAL SETAE	AS IN STAGE IV	AS IN STAGE V
NO OF SETAE ON TERMINAL SEGMENT OF ANTENNULE		3	4	4	12	12	12
ANTENNA	MASTICATORY HOOKS	--	--	--	--	--	--
	NO OF SETAE ON ENDOPOD	2	2	2	3	5	5
	NO OF SETAE ON EXOPOD	5	5	5	5	5	5
MAXILLULE							
MAXILLA							
MAXILLIPED							
REMARKS		Egg: 0.17 mm diameter *Lengths are from laboratory reared specimens.					

TABLE 21. ADULTS OF *CANDACIA ARMATA* BOECK

	♂	♀
TOTAL LENGTH (MM)	*2.25-2.60	2.50-2.75
NO OF METASOME SEGMENTS	4	4
NO OF UROSOME SEGMENTS	5	3
5th FEET	Asymmetrical; terminal segment of right leg with an irregular chela.	Symmetrical; terminal segment tapered to a single acute point with small teeth on the external margin only.
REMARKS	In both sexes the frontal margin between the bases of the antennules is squarely truncated, and the last metasomal segment is produced into broad spines, and the urosome is asymmetrical. *Lengths are from Woods Hole specimens.	

Centropages bradyi Wheeler, 1899

Calanoida: Centropagidae

Distribution: *C. bradyi* is found in the temperate North Atlantic. It is only found in the Gulf of Maine as a stray from warmer waters offshore.

Ecology: Oceanic.

Feeding Habits: Omnivorous.

Remarks: None.

References: Bigelow, 1926; Brodskii, 1967; Colton, Temple and Honey, 1962; Mullin, 1967; Rose, 1933; Wilson, 1932.

TABLE 22. ADULTS OF *CENTROPAGES BRADYI* WHEELER

	♂	♀
TOTAL LENGTH (MM)	*2.0-2.25	2.0-2.35
NO OF METASOME SEGMENTS	5	5
NO OF UROSOME SEGMENTS		3
5th FEET	RIGHT LEG: DISTAL END OF LARGER ARM OF CHELA BENT OUTWARD. LEFT LEG: DISTAL SEGMENT OF EXOPODITE ACUTE TERMINALLY, WITH IRREGULARLY SWOLLEN PROXIMAL PART.	ENDOPODITE NOT PROTRUDING BEYOND APEX OF INNER PROCESS OF EXOPODITE.
REMARKS	In both sexes, the posterior corners of the last metasomal segment are rounded, without spines, and each caudal ramus has a peg-like process on the ventral surface at the distal margin between the two outer setae. *Lengths are from Woods Hole specimens.	

Centropages hamatus (Lilljeborg, 1853)

Calanoida: Centropagidae

Distribution: *C. hamatus* is found in the North Atlantic between 40°N latitude and 70°N latitude. It is a boreal and temperate species, and it occurs primarily in sheltered and inshore waters. It is found as a stray in the Gulf of St. Lawrence, and is a summer-fall species from the Gulf of Maine to Woods Hole. It is a winter-spring species from Woods Hole south.

Ecology: Littoral and neritic; eurythermal; euryhaline; although in southern New England waters it is not abundant at salinities below 30°/oo.

Feeding Habits: Omnivorous.

Remarks: Its maximum numbers on the Continental Shelf occur in June and July. The generation time is two months.

References: Bigelow, 1926; Bigelow and Sears, 1939; Conway and Minton, 1975; Deevey, 1960; Faber, 1966a; Farran, 1911; Mullin, 1967; Sars, 1903; Wilson, 1932.

TABLE 23. NAUPLIAR STAGES OF *CENTROPAGES HAMATUS* (LILLJEBORG)

		I	II	III	IV	V	VI
BODY LENGTH (MM)		*0.105	0.145	0.16	0.21	0.25	0.288-0.345
CAUDAL ARMATURE		2 TERMINAL SETAE	2 TERMINAL SETAE 3 ROWS OF SMALL VENTRAL SPINES	2 TERMINAL SETAE 2 VENTRAL SPINES 2 TERMINAL SPINES 2 ROWS OF SMALL VENTRAL SPINES	AS IN STAGE III	AS IN STAGE IV, BUT 4 VENTRAL SPINES	AS IN STAGE V
NO OF SETAE ON TERMINAL SEGMENT OF ANTENNULE		4	4	6	8	10	10
ANTENNA	MASTICATORY HOOKS	1 ON BASIPODITE	1 ON COXOPODITE 1 ON BASIPODITE	AS IN STAGE II	2 ON COXOPODITE 1 ON BASIPODITE	AS IN STAGE IV	AS IN STAGE V
	NO OF SETAE ON ENDOPOD	4	5	5	6	9	9
	NO OF SETAE ON EXOPOD	6	7	9	11	11	13
MAXILLULE		--	--	BUD	RUDIMENTARY	RUDIMENTARY	RUDIMENTARY
MAXILLA		--	--	--	BUD	BUD	RUDIMENTARY
MAXILLIPED		--	--	--	--	BUD	RUDIMENTARY
REMARKS		*Lengths are from Koga, 1970.					

TABLE 24. COPEPODITE STAGES OF *CENTROPAGES HAMATUS* (LILLJEBORG)

	I	II	III	IV	V
BODY LENGTH (MM)	*0.39-0.45	0.51-0.56	0.66-0.78	♂ 0.81-0.87 ♀ 0.79-0.96	♂ 1.01-1.32 ♀ 1.17-1.29
NO OF METASOME SEGMENTS	3	4	5	♂ 5 ♀ 5	♂ 5 ♀ 5
NO OF UROSOME SEGMENTS	2	2	2	♂ 3 ♀ 3	♂ 4 ♀ 3
PAIRS OF SWIMMING FEET PRESENT	2	3	4	5	5
5th FEET	--	--	RUDIMENTARY		
REMARKS	*Lengths are from North Sea specimens.				

TABLE 25. ADULTS OF *CENTROPAGES HAMATUS* (LILLJEBORG)

	♂	♀
CEPHALOTHORAX LENGTH (MM)	*0.90-1.03	0.96-1.27
NO OF METASOME SEGMENTS	5	5
NO OF UROSOME SEGMENTS	4	3
5th FEET	ASYMMETRICAL, RIGHT LEG WITH CHELA, LESS POWERFULLY DEVELOPED THAN IN *C. TYPICUS*	SYMMETRICAL
REMARKS	Antennule without spine-like protrusions; antennule geniculate. *Lengths are from Clyde Sea specimens.	Right spine on fifth metasomal segment turned outward; recurved spine on the ventral surface of the urosome in front of the genital oriface.

Centropages typicus Kröyer, 1849

Calanoida: Centropagidae

Distribution: Cape Sable, Nova Scotia marks the northern and eastern limits to its regular occurrence along the North American coastline. It is found year-round from Cape Cod to Chesapeake Bay, and possibly to Cape Hatteras. It is a summer-fall species in the Gulf of Maine, and a winter-spring species from Chesapeake Bay to Cape Hatteras.

Ecology: Neritic; eurythermal; euryhaline.

Feeding Habits: Omnivorous.

Remarks: The center of abundance of C. typicus is in Southern New England. On Georges Bank, abundance levels increase from late-spring through late-autumn. In the Gulf of Maine, local abundance increases during late summer and autumn. C. typicus has a generation time of two months. Maximal numbers occur at temperatures between 13°C and 22°C.

References: Bigelow, 1926; Dagg, 1978; Deevey, 1960; Farran, 1948; Jeffries and Johnson, 1973; Lawson and Grice, 1970; Mullin, 1967; Ogilvie, 1953; Sars, 1903; Sherman, Sullivan and Byron, 1978; Sherman, Jones and Kane, 1979.

TABLE 26. NAUPLIAR STAGES OF *CENTROPAGES TYPICUS* KRÖYER

		I	II	III	IV	V	VI
BODY LENGTH (MM)		*0.11	0.15	0.18	0.22	0.27	0.31
CAUDAL ARMATURE		2 SUBEQUAL TERMINAL SPINES	1 STOUT VENTRAL SPINE 1 SLENDER DORSAL SPINE 4 TRANSVERSE ROWS OF FINE HAIRS	2 STOUT BARBED TERMINAL SPINES 2 THIN SMOOTH TERMINAL SPINES 2 SMALL VENTRAL SPINES IN PLACE OF HAIRS	AS IN STAGE III	AS IN STAGE IV	AS IN STAGE V
NO OF SETAE ON TERMINAL SEGMENT OF ANTENNULE		3	4	6	8	11	12
ANTENNA	MASTICATORY HOOKS	1 ON COXOPODITE	1	1	1	1	1
	NO OF SETAE ON ENDOPOD	4	5	7	7	8	8
	NO OF SETAE ON EXOPOD	6	7	8	10	12	12
MAXILLULE		--	--	--	REPRESENTED BY A TRILOBED STRUCTURE	BILOBED; 5 SETAE ON EACH LOBE	4 LOBES
MAXILLA		--	--	--	--	--	5 LOBES
MAXILLIPED							2 SEGMENTS
REMARKS		Egg: 0.07 mm diameter Labrum conspicuous in all stages. *Lengths are from laboratory-reared specimens.					1st and 2nd swimming feet rudimentary.

TABLE 27. COPEPODITE STAGES OF *CENTROPAGES TYPICUS* KRÖYER

	I	II	III	IV	V
CEPHALOTHORAX LENGTH (MM)	*0.29	0.38	0.50	♂ ♀ 0.65	♂ 0.82 ♀ 0.88
NO OF METASOME SEGMENTS	3	4	5	♂ 5 ♀ 5	♂ 5 ♀ 5
NO OF UROSOME SEGMENTS	2	2	2	♂ 3 ♀ 3	♂ 4 ♀ 3
PAIRS OF SWIMMING FEET PRESENT	2	3	4	4	5
5th FEET	--	--	--	RUDIMENTARY	MALES: RIGHT 5TH FOOT WITHOUT INNER SPINE AND MORE SWOLLEN THAN LEFT FEMALES: STRONG INTERNAL SPINE-LIKE PROTRUSION FROM INNER PROXIMAL END OF TERMINAL SEGMENT
REMARKS	No rostral filaments; caudal rami bear 5 setae each in Stages I and II. *Lengths are from laboratory-reared specimens.	Rostral filaments present.	Caudal rami bear 6 setae each in Stages III to adult.	5th metasomal segment with symmetrical lateral spines; conspicuous spines on segments 1, 2, and 5 of antennule Stages IV - adult; males: right antennule swollen.	Females: with 1st urosomal segment enlarged.

TABLE 28. ADULTS OF *CENTROPAGES TYPICUS* KRÖYER

	♂	♀
CEPHALOTHORAX LENGTH (MM)	*1.05	1.20
NO OF METASOME SEGMENTS	5	5
NO OF UROSOME SEGMENTS	4	3
5th FEET	ASYMMETRICAL; CHELA ON RIGHT LEG POWERFUL AND WELL DEVELOPED.	SYMMETRICAL; STRONG INTERNAL SPINE-LIKE PROTRUSION FROM INNER PROXIMAL END OF TERMINAL SEGMENT.
REMARKS	Lateral spines on last metasomal segment asymmetrical; right antennule geniculate. *Lengths from laboratory-reared specimens.	Lateral spines more divergent than in males and turned backward; 1st two urosomal segments enlarged and asymmetrical, with 4 spines on genital segment.

Pseudodiaptomus coronatus Williams, 1906

Calanoida: Diaptomidae

Distribution: Along the North American coast, P. coronatus has been reported from the Gulf of St. Lawrence to the Gulf of Mexico. It is a temperate zone representative of a widely distributed but generally tropical genus. It inhabits a narrow estuarine band from Nova Scotia to the Gulf of Mexico, a few kilometers wide and 4000 kilometers long. It is a summer-fall species from Cape Cod to Florida, and is found year-round in Delaware Bay.

Ecology: Estuarine and coastal; found in temperatures from -0.65^{o} to $25.3^{o}C$; euryhaline.

Feeding Habits: No information.

Remarks: The egg hatches directly into a stage II nauplius. The nauplii have been recorded in the Narragansett Bay area from July through October, with maximum numbers in August.

References: Deevey, 1960; Faber, 1966b; Grice, 1969; Jacobs, 1961; Wilson, 1932.

TABLE 29. NAUPLIAR STAGES OF *PSEUDODIAPTOMUS CORONATUS* WILLIAMS

		I	II	III	IV	V	VI
BODY LENGTH (MM)		--	*0.20	0.22	0.26	0.30	0.36
CAUDAL ARMATURE		--	RIGHT SIDE: 1 STRONG TERMINAL SPINE LEFT SIDE: 1 TERMINAL SENSORY SETA	ASYMMETRICAL RT. SIDE: 1 SENSORY SETA, 1 COARSE SPINE TERMINALLY LEFT SIDE: 1 SHORT SETA, 1 LONG SENSORY TERMINAL SETA	AS IN STAGE III	AS IN STAGE IV	RT. SIDE: 1 COARSE SPINE, 1 LONG AND 1 SHORT TERMINAL SENSORY SETA LEFT SIDE: 2 SHORT TERMINAL SENSORY SETAE
NO OF SETAE ON TERMINAL SEGMENT OF ANTENNULE		--	3	7 PLUS 1 SENSORY SETA	10 PLUS 1 SENSORY SETA	13 PLUS 1 SENSORY SETA	AS IN STAGE V
ANTENNA	MASTICATORY HOOKS	--	--	--	--	--	--
	NO OF SETAE ON ENDOPOD	--	5	6	6 + 2 SPINES	9 + 2 SPINES	9 + 2 SPINES
	NO OF SETAE ON EXOPOD	--	7	9	10	11	11
MAXILLULE		--	--	REPRESENTED BY A SPINE	LAMELLA WITH 8 SETAE	LAMELLA WITH 11 SETAE	LAMELLA WITH 16 SETAE
MAXILLA		--	--	--	--	REPRESENTED BY A SPINE	AS IN STAGE V
MAXILLIPED		--	--	--	--	--	REPRESENTED BY 2 SPINES
REMARKS		Egg hatches into Stage II nauplius.	*Lengths are from laboratory-reared specimens.	Right caudal seta is longer than left one.			1st and 2nd swimming feet rudimentary.

TABLE 30. COPEPODITE STAGES OF PSEUDODIAPTOMUS CORONATUS WILLIAMS

	I	II	III	IV	V
BODY LENGTH (MM)	*0.44-0.52	0.54-0.62	0.66-0.74	♂ 0.78-0.82 ♀ 0.85-0.98	♂ 0.84-0.94 ♀ 1.16-1.24
NO. OF METASOME SEGMENTS	3	4	5	♂ 5 ♀ 5	♂ 5 ♀ 5
NO. OF UROSOME SEGMENTS	2	2	2	♂ 2 ♀ 2	♂ 4 ♀ 3
PAIRS OF SWIMMING FEET PRESENT	--	3	4	5	5
5th FEET	--	--	RUDIMENTARY	MALES: ENDOPOD-LIKE PROTRUSION ON LEFT FOOT FEMALES: SYMMETRICAL	MALES: LEFT FOOT WITH ENDOPOD REACHING NEARLY TO DISTAL END OF EXOPOD
REMARKS	*Lengths for Stages I-III are from laboratory-reared specimens; Stages IV and V are from Woods Hole, Mass. specimens.			1st urosomal segment: Males: small Females: large	

TABLE 31. ADULTS OF *PSEUDODIAPTOMUS CORONATUS* WILLIAMS

	♂	♀
TOTAL LENGTH(MM)	*0.94-1.02	1.38-1.48
NO OF METASOME SEGMENTS	5	5
NO OF UROSOME SEGMENTS	5	3
5th FEET	LEFT 5TH LEG WITH ENDOPOD REACHING NEARLY TO DISTAL END OF EXOPOD.	SYMMETRICAL WITH TERMINAL SEGMENT ELONGATE.
REMARKS	Antennule geniculate. *Lengths are from Woods Hole, Mass. specimens.	The suture between segments 2 and 3 of the urosome is incomplete; urosome asymmetrical.

Eucalanus elongatus (Dana, 1849)

Calanoida: Eucalanidae

Distribution: *E. elongatus* is widely distributed in the warmer southern areas and in the warmer ocean streams. It is a stray in the Gulf of Maine from the warmer and saltier Atlantic waters outside the continental shelf.

Ecology: Characteristic of the warm areas of the open ocean.

Feeding Habits: Herbivorous.

Remarks: None.

References: Arashkevich, 1969; Bigelow, 1926; Brodskii, 1967; Farran, 1911; Johnson, 1942; Rose, 1933.

TABLE 32. NAUPLIAR STAGES OF *EUCALANUS ELONGATUS* (DANA)

		I	II	III	IV	V	VI
BODY LENGTH (MM)		*0.214-0.260	0.270-0.330	0.430-0.550	0.620-0.740	0.745-0.890	0.920-1.029
CAUDAL ARMATURE		2 HEAVY TERMINAL SPINES	AS IN STAGE I	CAUDAL AREA CLEFT, EACH SIDE BEARS TERMINALLY: 1 OUTER SPINE 1 SLENDER SETAE ANTERIOR TO CLEFT: 2 VENTRAL SPINES	AS IN STAGE III, BUT: 4 VENTRAL, 4 LATERAL SPINES	AS IN STAGE IV, BUT: 6 LATERAL SPINES	AS IN STAGE V
NO OF SETAE ON TERMINAL SEGMENT OF ANTENNULE		3	4	7	11	14	17
ANTENNA	MASTICATORY HOOKS	1 ON BASIPODITE	1	2	2	2	2
	NO OF SETAE ON ENDOPOD	3	4	6	6	8	8
	NO OF SETAE ON EXOPOD	6	7	9	10	10	11
MAXILLULE		--	--	BUD	BUD	RUDIMENTARY	RUDIMENTARY
MAXILLA		--	--	--	BUD	BUD	RUDIMENTARY
MAXILLIPED		--	--	--	--	--	RUDIMENTARY
REMARKS		Nauplii of *E. elongatus* resemble those of *Rhincalanus cornutus* and *R. nasutus*. *Lengths are from California coast specimens.	Posterior end elongated	Right side of caudal area longer than left	Body: 2 distinct divisions.	Body: 3 distinct divisions.	1st and 2nd swimming feet rudimentary; body: 4 distinct divisions.

TABLE 33. ADULTS OF *EUCALANUS ELONGATUS* (DANA)

	♂	♀
TOTAL LENGTH (MM)	*3.75-5.00	5.90-6.30
NO OF METASOME SEGMENTS	4	4
NO OF UROSOME SEGMENTS	5	3
5th FEET	UNIRAMOUS; LEFT LEG MUCH LONGER THAN 4TH PAIR OF LEGS	ABSENT
REMARKS	In both sexes, the posterior corners of last metasomal segment are pointed and the metasome and abdominal segment are without spines. *Lengths are from Woods Hole specimens.	

Mecyonocera clausi I.C. Thompson, 1888

Calanoida: Eucalanidae

Distribution: In the western North Atlantic, *M. clausi* has been recorded between approximately 42°00'N latitude and 8°04'N latitude.

Ecology: Oceanic.

Feeding Habits: Herbivorous.

Remarks: None.

References: Colton, Temple and Honey, 1962; Mullin, 1967; Owre and Foyo, 1967; Rose, 1933; Wilson, 1932.

TABLE 34. ADULTS OF *MECYNOCERA CLAUSI* I.C. THOMPSON

	♂	♀
TOTAL LENGTH (MM)	*0.75-0.9	1.0-1.5
NO OF METASOME SEGMENTS	4	4
NO OF UROSOME SEGMENTS	4	3
5th FEET	SIMILAR TO FEMALE BUT SMALLER.	PENULTIMATE SEGMENT WITH A SINGLE SETA, END SEGMENT WITH 5 SETAE.
REMARKS	Both sexes have exceptionally long antennules. *Lengths are from Woods Hole specimens.	

Rhincalanus cornutus (Dana, 1849)

Calanoida: Eucalanidae

Distribution: *R. cornutus* occurs as a stray in the Gulf of Maine. It has been found in the Great South Channel between Georges Bank and Cape Cod, the Eastern Channel between Georges and Browns Banks, and the southern part of Georges Bank.

Ecology: Oceanic.

Feeding Habits: Herbivorous.

Remarks: None.

References: Bigelow, 1926; Colton, Temple and Honey, 1962; Gurney, 1934; Itoh, 1970; Rose, 1933; Wilson, 1932.

TABLE 35. NAUPLIAR STAGES OF *RHINCALANUS CORNUTUS* (DANA)

		I	II	III	IV	V	VI
BODY LENGTH (MM)		--	*0.45-0.47	0.65-0.70	1.0	1.2	1.33
CAUDAL ARMATURE		--	2 UNEQUAL TERMINAL SETAE, RIGHT SETA LONGER THAN LEFT	CAUDAL AREA CLEFT, EACH SIDE BEARS: 1 SHORT VENTRAL SPINE, 1 TERMINAL SPINE, 1 TERMINAL SETA	AS IN STAGE III, BUT WITH 4 ADDITIONAL LATERAL SPINES	AS IN STAGE IV	AS IN STAGE V
NO OF SETAE ON TERMINAL SEGMENT OF ANTENNULE		--	4	6	9	12	16
ANTENNA	MASTICATORY HOOKS	--	1 ON COXOPODITE	1	1	1	1
ANTENNA	NO OF SETAE ON ENDOPOD	--					
ANTENNA	NO OF SETAE ON EXOPOD	--	7	8			
MAXILLULE		--	--	--	BUD	RUDIMENTARY	RUDIMENTARY
MAXILLA		--	--	--	--	BUD	RUDIMENTARY
MAXILLIPED		--	--	--	--	--	BUD
REMARKS		Egg hatches into Stage II nauplius.	Body pear-shaped; labrum very large. *Lengths are from western south Atlantic Ocean specimens.		Right caudal spine 2½ times as long as left spine, and about 1/3 length of body.	Body divided into anterior and posterior regions.	1st and 2nd swimming feet rudimentary.

TABLE 36. ADULTS OF *RHINCALANUS CORNUTUS* (DANA)

	♂	♀
TOTAL LENGTH (MM)	*2.5-2.75	3.5-3.75
NO OF METASOME SEGMENTS		3
NO OF UROSOME SEGMENTS		3
5th FEET	LEFT LEG BIRAMOUS; RIGHT LEG TERMINATES IN A STOUT STRAIGHT CLAW	BOTH LEGS UNIRAMOUS, WITHOUT SETAE ON THE SECOND SEGMENT AND WITH 1 STOUT EXTERNAL SPINE ON THE THIRD SEGMENT.
REMARKS	In both sexes the head has an elongated projection; the rostral filaments visible in dorsal view; anterior projection of head anchor-shaped. *Lengths are from Woods Hole specimens.	

Rhincalanus nasutus Giesbrecht, 1888

Calanoida: Eucalanidae

Distribution: R. nasutus is widespread in the North Atlantic. It has been found over deep water along the southern edge of Georges Bank, and has been reported from the Gulf of St. Lawrence to $11^{o}18'$N latitude.

Ecology: Oceanic; found from the surface down to 1800 meters.

Feeding Habits: Herbivorous.

Remarks: None.

References: Bigelow, 1926; Brodskii, 1967; Colton, Temple and Honey, 1962; Farran, 1911; Gurney, 1934; Mullin, 1967; Owre and Foyo, 1967; Wilson, 1932.

TABLE 37. NAUPLIAR STAGES OF *RHINCALANUS NASUTUS* GIESBRECHT

		I	II	III	IV	V	VI
BODY LENGTH (MM)		--	--	--	*0.82-0.89	1.0	1.16
CAUDAL ARMATURE		--	2 UNEQUAL TERMINAL SETAE	CAUDAL AREA CLEFT; EACH SIDE BEARS: 1 SHORT VENTRAL SPINE, 1 TERMINAL SPINE, 1 TERMINAL SETA	AS IN STAGE III, BUT WITH 4 ADDITIONAL LATERAL SPINES	AS IN STAGE IV	AS IN STAGE V
NO OF SETAE ON TERMINAL SEGMENT OF ANTENNULE		--	4	6	9	12	16
ANTENNA	MASTICATORY HOOKS	--	1 ON COXOPODITE	1	1	1	1
ANTENNA	NO OF SETAE ON ENDOPOD	--					
ANTENNA	NO OF SETAE ON EXOPOD	--	7	8			
MAXILLULE		--	--	--	--	RUDIMENTARY	RUDIMENTARY
MAXILLA		--	--	--	--	BUD	RUDIMENTARY
MAXILLIPED		--	--	--	--	--	BUD
REMARKS		Egg hatches into Stage II nauplius.			Right and left caudal spines of almost equal length. *Lengths are from western south Atlantic Ocean specimens.	Body divided into anterior and posterior regions.	1st and 2nd swimming feet rudimentary.

TABLE 38. ADULTS OF *RHINCALANUS NASUTUS* GIESBRECHT

	♂	♀
TOTAL LENGTH (MM)	*3.0-4.0	4.0-5.5
NO OF METASOME SEGMENTS	3	3
NO OF UROSOME SEGMENTS		3
5th FEET	LEFT LEG BIRAMOUS; RIGHT LEG TERMINATES IN A STRONGLY CURVED SETA.	BOTH LEGS UNIRAMOUS, WITH 1 SETA ON THE SECOND SEGMENT AND 3 ON THE THIRD SEGMENT.
REMARKS	In both sexes the body is exceedingly slender and elongate; the rostral filaments are not visible in a dorsal view, and the head has a conical projection. *Lengths are from Woods Hole Region specimens.	

Euchaeta marina (Prestandrea, 1833)

Calanoida: Euchaetidae

Distribution: E. marina is a common epiplanktonic species known to occur widely in the tropical, sub-tropical, and temperate zones of all oceans. In the western North Atlantic, it has been reported from the Gulf of St. Lawrence to $10^{o}15'N$ latitude. It occurs in the Great South Channel between Georges Bank and Cape Cod, the Eastern Channel between Georges and Browns Banks, and the southern part of Georges Bank.

Ecology: Oceanic; its main concentration appears between depths of 25 and 100 meters; distribution occasionally extends down to 500 meters.

Feeding Habits: Carnivorous.

Remarks: None.

References: Arashkevich, 1969; Bernard, 1965; Brodskii, 1967; Colton, Temple and Honey, 1962; Owre and Foyo, 1967; Park, 1975; Rose, 1933; Wilson, 1932.

TABLE 39. NAUPLIAR STAGES OF *EUCHAETA MARINA* (PRESTANDREA)

		I	II	III	IV	V	VI
BODY LENGTH (MM)		*0.30	0.48	0.49	0.52	0.53	0.56
CAUDAL ARMATURE		NONE	2 LONG TERMINAL EQUAL SETAE	AS IN STAGE II	2 LONG, 2 SHORT TERMINAL SETAE	2 LONG, 6 SHORT TERMINAL SETAE	AS IN STAGE V
NO OF SETAE ON TERMINAL SEGMENT OF ANTENNULE		3	4	5	5	9	10
ANTENNA	MASTICATORY HOOKS						
	NO OF SETAE ON ENDOPOD						
	NO OF SETAE ON EXOPOD						
MAXILLULE							
MAXILLA							
MAXILLIPED							
REMARKS		*Lengths are from laboratory-reared specimens.					

TABLE 40. ADULTS OF *EUCHAETA MARINA* (PRESTANDREA)

	♂	♀
LENGTH(MM)	*3.0-3.5	2.25-4.0
NO OF METASOME SEGMENTS	4	4
NO OF UROSOME SEGMENTS	5	4
5th FEET	DISTAL SEGMENT OF LEFT LEG OF PAIR PRODUCED INTO LONG STYLET; SECOND SEGMENT OF SAME LEG BEARING LONG, SERRATE, APICALLY WIDENED PLATE.	ABSENT
REMARKS	Both sexes have a sharp apical process on the head. *Lengths are from Woods Hole Region specimens.	Genital segment asymmetrical

Euchaeta norvegica Boeck, 1872

Calanoida: Euchaetidae

Distribution: E. norvegica is widespread in the Gulf of St. Lawrence and in the deep oceanic triangle between the Scotian and Newfoundland Banks. It is characteristic of the continental slope as far south as Delaware Bay.

Ecology: Oceanic; generally found below 100 meters; optimum temperature less than 8^{o}C; 33-34^{o}/oo salinity.

Feeding Habits: Carnivorous.

Remarks: E. norvegica spawns throughout the year in the Gulf of Maine. It is one of the largest known copepods.

References: Bigelow, 1926; Brodskii, 1967; Mullin, 1967; Nicholls, 1934; Sars, 1903.

TABLE 41. NAUPLIAR STAGES OF *EUCHAETA NORVEGICA* BOECK

		I	II	III	IV	V	VI
BODY LENGTH (MM)		*0.55	0.60	0.64	0.68	0.73	0.78
CAUDAL ARMATURE		NONE	2 LONG TERMINAL SETAE	AS IN STAGE II	AS IN STAGE III	AS IN STAGE IV	2 LONG, 4 SHORT TERMINAL SETAE
NO OF SETAE ON TERMINAL SEGMENT OF ANTENNULE		3	6	7	9	11	14
ANTENNA	MASTICATORY HOOKS	--	--	--	--	--	--
	NO OF SETAE ON ENDOPOD	3	5	5	5	6	7
	NO OF SETAE ON EXOPOD	6	7	8	8	9	10
MAXILLULE		--	--	--	BUD	BUD	RUDIMENTARY
MAXILLA		--	--	--	BUD	BUD	RUDIMENTARY
MAXILLIPED		--	--	--	BUD	BUD	RUDIMENTARY
REMARKS		Egg: 0.4 mm diameter Examination of the antennule is the only reliable way to separate Stages II-V. *Lengths are from laboratory-reared specimens.					

TABLE 42. COPEPODITE STAGES OF *EUCHAETA NORVEGICA* BOECK

	I	II	III	IV	V
CEPHALOTHORAX LENGTH (MM)	0.9	1.7	2.3	♂ 2.8 ♀ 2.9	♂ 4.2 ♀ 4.3
NO OF METASOME SEGMENTS	2	3	3	♂ 3 ♀ 3	♂ 3 ♀ 3
NO OF UROSOME SEGMENTS	2	2	2	♂ 3 ♀ 3	♂ 4 ♀ 4
PAIRS OF SWIMMING FEET PRESENT	2	3	4	MALE: 5 FEMALE: 4	MALE: 5 FEMALE: 4
5th FEET					
REMARKS	Long setae and aesthetascs on antennule Stages I-VI. *Lengths are from laboratory-reared and North Atlantic specimens.				

TABLE 43. ADULTS OF *EUCHAETA NORVEGICA* BOECK

	♂	♀
TOTAL LENGTH (MM)	*6.0	8.1
NO OF METASOME SEGMENTS	3	3
NO OF UROSOME SEGMENTS	5	5
5th FEET	LONGER THAN UROSOME, LEFT LEG: DISTAL SEGMENT OF EXOPODITE WITHOUT SPINE, AND WITH A BUNDLE OF BRISTLES; DENTATE PLATE OF PENULTIMATE SEGMENT SPARSELY AND SHARPLY SERRATED WITH UNGUIFORM APEX.	ABSENT
REMARKS	Antennules bear characteristic long flexible setae. *Lengths are from Clyde Sea specimens.	Urosome about half the length of the metasome; genital segment has a large and thick ventral protuberance; antennule as in males.

Metridia longa (Lubbock, 1854)

Calanoida: Metridiidae

Distribution: *M. longa* is a true Arctic species. It is widespread in the Gulf of St. Lawrence and is found in the Gulf of Maine and over the continental shelf south of Martha's Vineyard.

Ecology: Oceanic; occurs more frequently in deeper water than at the surface off the North American coast.

Feeding Habits: Omnivorous.

Remarks: In the Gulf of Maine, *M. longa* is most abundant during the late autumn winter and early spring.

References: Arashkevich, 1969; Bigelow, 1926; Brodskii, 1967; Conway and Minton, 1975; Sars, 1903; Wilson, 1932.

TABLE 44. ADULTS OF METRIDIA LONGA (LUBBOCK)

	♂	♀
TOTAL LENGTH (MM)	*3.5-4.0	4.0-4.5
NO OF METASOME SEGMENTS	4	4
NO OF UROSOME SEGMENTS	5	3
5th FEET	Asymmetrical; distal segments elongate.	Symmetrical; 4-segmented; distal segment with 3 bristles, inner bristle longer than other two; distal margin of 2nd and 3rd segments with a spine.
REMARKS	No marginal tooth present on last metasomal segment; urosome about 2/3 length of metasome. *Lengths are from Woods Hole specimens.	

Metridia lucens Boeck, 1864

Calanoida: Metridiidae

Distribution: *M. lucens* has a more southern distribution than *M. longa*. It is widely distributed over the temperate and boreal parts of the North Atlantic.

Ecology: Oceanic; occurs from the surface down to 2000 meters, but is most abundant in the zone from 50 to 100 meters.

Feeding Habits: Omnivorous.

Remarks: *M. lucens* is found on Georges Bank in late winter and spring. It is most abundant in summer in the Gulf of Maine.

References: Bigelow, 1926; Conway and Minton, 1975; Farran, 1911; Mullin, 1967; Ogilvie, 1953; Sars, 1903; Sherman, 1963.

TABLE 45. NAUPLIAR STAGES OF METRIDIA LUCENS BOECK

		I	II	III	IV	V	VI
BODY LENGTH (MM)		*0.19	0.21	0.27	0.34	0.41	0.46
CAUDAL ARMATURE		2 EQUAL TERMINAL SETAE	2 TERMINAL SETAE 2 MINUTE SPINES	2 LONG TERMINAL SETAE 2 SERRATED TERMINAL SPINES 2 SERRATED VENTRAL SPINES 6 LATERAL SPINES	2 TERMINAL SPINES 4 VENTRAL SPINES 8 LATERAL SPINES	AS IN STAGE IV	AS IN STAGE V
NO OF SETAE ON TERMINAL SEGMENT OF ANTENNULE		3	4	7	11	14	15
ANTENNA	MASTICATORY HOOKS						
	NO OF SETAE ON ENDOPOD						
	NO OF SETAE ON EXOPOD					11	
MAXILLULE							
MAXILLA							
MAXILLIPED							
REMARKS		*Lengths are from northern North Sea specimens.					

TABLE 46. COPEPODITE STAGES OF METRIDIA LUCENS BOECK

	I	II	III	IV	V
BODY LENGTH (MM)	*0.56-0.59	0.70-0.82	0.93-1.04	♂ 1.15-1.29 ♀ 1.27-1.38	♂ 1.60-1.77 ♀ 1.86-2.03
NO. OF METASOME SEGMENTS				♂ 4 ♀ 4	♂ ♀
NO. OF UROSOME SEGMENTS		2	2	♂ 3 ♀ 3	♂ 4 ♀ 4
PAIRS OF SWIMMING FEET PRESENT	2	3	4	5	5
5th FEET	--	--	RUDIMENTARY		
REMARKS	*Lengths are from northern North Sea specimens			Urosome is 2/3 length of cephalothorax	

TABLE 47. ADULTS OF *METRIDIA LUCENS* BOECK

	♂	♀
TOTAL LENGTH (MM)	*1.80	2.25-2.73
NO OF METASOME SEGMENTS	4	4
NO OF UROSOME SEGMENTS	5	3 (2 SEGMENTS BECOME FUSED AFTER STAGE V)
5th FEET	ASYMMETRICAL; RIGHT LEG: 4-SEGMENTED; DISTAL SEGMENT LARGER THAN DISTAL SEGMENT OF LEFT LEG AND NOT NARROWED DISTALLY AS IN *M. LONGA*. LEFT LEG: 1 LARGE SPINE ON INNER SIDE OF 4TH SEGMENT.	SYMMETRICAL; 3-SEGMENTED; DISTAL SEGMENT WITH 3 BRISTLES, INNER ONE LONGER THAN REST; ALSO BEARS LONG OUTER SPINE; DISTAL MARGIN OF 2ND SEGMENT WITH SIMILAR SPINE.
REMARKS	Urosome about 2/3 the length of the cephalothorax; small marginal tooth on last metasomal segment. *Lengths are from North Sea specimens.	Urosome and last metasomal segment as in males.

Pleuromamma abdominalis (Lubbock, 1856)

Calanoida: Metridiidae

Distribution: *P. abdominalis* is widespread in tropical and temperate oceans. It occurs over deep water along the southern edge of Georges Bank.

Ecology: Oceanic.

Feeding Habits: Omnivorous.

Remarks: None.

References: Bigelow, 1926; Brodskii, 1967; Colton, Temple and Honey, 1962; Mullin, 1967; Rose, 1933; Scott, 1911.

TABLE 48. ADULTS OF *PLEUROMAMMA ABDOMINALIS* (LUBBOCK)

	♂	♀
TOTAL LENGTH (MM)	*2.68-4.3	2.4-4.36
NO OF METASOME SEGMENTS	4	4
NO OF UROSOME SEGMENTS	5	3
5th FEET	LEFT 5TH LEG HAS WIDE DISTAL SEGMENT.	4-SEGMENTED (3 FREE SEGMENTS); DISTAL SEGMENT HAS 3 APICAL BRISTLES OF UNEQUAL LENGTH AND 2 THIN SPINES.
REMARKS	Urosome asymmetrical; a dark brown vesicle located on the right or left side of the body. *Lengths are from Brodskii, 1967.	Antennule with 2 strong spines on the basal segments and several small denticles on the anterior margin.

Pleuromamma borealis (Dahl, 1893)

Calanoida: Metridiidae

Distribution: P. borealis is found in the Atlantic Ocean from 60°N latitude to 55°S latitude.

Ecology: Oceanic; found at depths of from 200 to 1000 meters.

Feeding Habits: Omnivorous.

Remarks: None.

References: Brodskii, 1967; Mullin, 1967; Rose, 1933.

TABLE 49. ADULTS OF *PLEUROMAMMA BOREALIS* (DAHL)

	♂	♀
LENGTH(MM)	*1.47-2.13	1.67-2.46
NO OF METASOME SEGMENTS	4	4
NO OF UROSOME SEGMENTS	5	3
5th FEET	Left leg with short blunt process on 3rd segment. Distal segment of right leg shorter and wider.	Symmetrical; 3-segmented with 2 free segments and 3 long slender terminal spines.
REMARKS	Antennules without prominent teeth; very similar to *P. gracilis*; distinguished by 5th legs. *Lengths are from Brodskii, 1967.	

Pleuromamma gracilis (Claus, 1863)

Calanoida: Metridiidae

Distribution: *P. gracilis* is widespread in tropical and temperate oceans. It has been found over the Great South Channel between Georges Bank and Cape Cod, the Eastern Channel between Georges and Browns Banks, and the southern part of Georges Bank.

Ecology: Oceanic; it occurs at depths of from 100 to 500 meters.

Feeding Habits: Omnivorous.

Remarks: None.

References: Bigelow, 1926; Brodskii, 1967; Colton, Temple and Honey, 1962; Mullin, 1967; Rose, 1933; Scott, 1911; Wilson, 1932.

TABLE 50. ADULTS OF *PLEUROMAMMA GRACILIS* (CLAUS)

	♂	♀
LENGTH(MM)	*1.15-1.85	1.5-2.0
NO OF METASOME SEGMENTS	4	4
NO OF UROSOME SEGMENTS	5	3
5th FEET	Distal segment of right leg elongate, slightly less widened than in other species of genus; penultimate segment of same leg with curved process with double row of blunt tubercles.	Symmetrical; 2-segmented with 1 free segment; distal segment with 3 terminal spines and 2 thin outer spines.
REMARKS	Antennule geniculate, without large spines. *Lengths are from Woods Hole Region specimens.	Genital segment symmetrical; anal segment with diverging lateral margins. Proximal segments of antennule with small low denticles.

Pleuromamma robusta (Dahl, 1893)

Calanoida: Metridiidae

Distribution: P. robusta is widespread in tropical and temperate oceans. It has been found over deep water along the southern edge of Georges Bank.

Ecology: Oceanic; occurs from the surface down to about 1500 meters.

Feeding Habits: Omnivorous.

Remarks: None.

References: Bigelow, 1926; Colton, Temple and Honey, 1962; Mullin, 1967; Sars, 1903; Scott, 1911; Wilson, 1932.

TABLE 51. ADULTS OF *PLEUROMAMMA ROBUSTA* (DAHL)

	♂	♀
LENGTH(MM)	*3.0-3.5	4.0-4.5
NO OF METASOME SEGMENTS	4	4
NO OF UROSOME SEGMENTS	5	3
5th FEET	Asymmetrical; right leg: larger with terminal segment dilated, securiform; left leg: terminal segment narrower and oblong.	Symmetrical, 4-segmented; terminal segment dilated and oval and finely ciliated on both edges; armed at tip with 3 setae, the outer 2 are short and inner 1 is long and slender.
REMARKS	Abdomen symmetrical; left antennule geniculate. *Lengths are from Woods Hole Region specimens.	

Paracalanus crassirostris (Dahl, 1894)

Calanoida: Paracalanidae

Distribution: Along the North American coast, *P. crassirostris* occurs from Cape Cod to the Gulf of Maine.

Ecology: Estuarine and neritic; eurythermal, euryhaline.

Feeding Habits: Herbivorous.

Remarks: The nauplii are found in the Narragansett Bay area from August into December. Maximum numbers are present in August.

References: Arashkevich, 1969; Faber, 1966b; Lawson and Grice, 1973.

TABLE 52. NAUPLIAR STAGES OF *PARACALANUS CRASSIROSTRIS* (DAHL)

		I	II	III	IV	V	VI
BODY LENGTH (MM)		*0.08	0.09	0.12	0.15	0.18	0.20
CAUDAL ARMATURE		2 SMOOTH SUBEQUAL TERMINAL SETAE LESS THAN 1/3 BODY LENGTH	AS IN STAGE I, BUT SETAE GREATER THAN 1/3 BODY LENGTH	AS IN STAGE II, BUT WITH 2 VENTRAL AND 2 TERMINAL SPINES	AS IN STAGE III, BUT WITH 4 LATERAL SPINES AND 4 VENTRAL SPINES	AS IN STAGE IV, BUT WITH 6 LATERAL SPINES	AS IN STAGE V
NO OF SETAE ON TERMINAL SEGMENT OF ANTENNULE		3	4	7	11	14	14
ANTENNA	MASTICATORY HOOKS	--	1	2	2	2	2
	NO OF SETAE ON ENDOPOD	2	4	7	7	8	8
	NO OF SETAE ON EXOPOD	5	7	8	10	11	12
MAXILLULE		--	--	--	BILOBED	AS IN STAGE IV	AS IN STAGE V
MAXILLA		--	--	--	--	--	RUDIMENTARY
MAXILLIPED		--	--	--	--	--	RUDIMENTARY
REMARKS		Egg: 0.06 mm diameter Labrum very large *Lengths are from laboratory-reared specimens.	Body noticeably flexed.	Metasome distinctly separated from cephalon.			1st and 2nd swimming feet rudimentary.

TABLE 53. COPEPODITE STAGES OF *PARACALANUS CRASSIROSTRIS* (DAHL)

	I	II	III	IV	V
TOTAL LENGTH (MM)	*0.26	0.34	0.40	♂♀ 0.43	♂♀ 0.47
NO OF METASOME SEGMENTS	2	4	5	♂ 5 ♀ 5	♂ 5 ♀ 5
NO OF UROSOME SEGMENTS	2	2	2	♂ 3 ♀ 3	♂ 4 ♀ 4
PAIRS OF SWIMMING FEET PRESENT	2	3	4	5	5
5th FEET	--	--	RUDIMENTARY	MALES: LEFT FOOT WITH 3 SEGMENTS FEMALES: UNIRAMOUS, 2 SEGMENTED	MALES: LEFT FOOT WITH 4 SEGMENTS
REMARKS	No rostrum present *Lengths are from laboratory-reared specimens.	Prominent, bilobate bulbous rostrum in Stages II-VI, distinguishes it from *P. parvus*, *Pseudocalanus*, and *Calanus*; no rostral filaments Stages II-VI.	1st and 5th metasomal segments incompletely separated		

TABLE 54. ADULTS OF PARACALANUS CRASSIROSTRIS (DAHL)

	♂	♀
TOTAL LENGTH (MM)	*0.46	0.56
NO OF METASOME SEGMENTS	3	3
NO OF UROSOME SEGMENTS	5	4
5th FEET	ASYMMETRICAL	SYMMETRICAL
REMARKS	Antennule has many large sensory aesthetascs; rostrum broadly based and tapered; no rostral filaments. *Lengths are from laboratory-reared specimens.	1st urosomal segment enlarged; rostrum as in CII-CV; no rostral filaments.

Paracalanus parvus Claus, 1863

Calanoida: Paracalanidae

Distribution: *P. parvus* is a cosmopolitan species and is common in shelf waters from Florida to the Gulf of Maine.

Ecology: Neritic and oceanic; its chief abundance is at depths of less than 100 meters; eurythermal; euryhaline.

Feeding Habits: Herbivorous.

Remarks: *P. parvus* is a summer-fall species from the Gulf of Maine to Delaware Bay. It is found year-round from Delaware Bay to Florida.

References: Bigelow, 1926; Bowman, 1971; Conway and Minton, 1975; Deevey, 1960; Mullin, 1967; Ogilvie, 1953.

TABLE 55. NAUPLIAR STAGES OF *PARACALANUS PARVUS* CLAUS

		I	II	III	IV	V	VI
BODY LENGTH (MM)		*0.09	0.105	0.15-0.16	0.205-0.210	0.24-0.25	0.25
CAUDAL ARMATURE		2-TERMINAL SETAE	AS IN STAGE I, SETAE LONGER	2 VENTRAL SPINES 2 TERMINAL SPINES 2 SENSORY SETAE MINUTE SPINES	4 LATERAL SPINES 4 VENTRAL SPINES 2 TERMINAL SPINES 2 SENSORY SETAE MINUTE SPINES	AS IN STAGE IV, BUT WITH 2 ADDITIONAL LATERAL SPINES	AS IN STAGE V
NO OF SETAE ON TERMINAL SEGMENT OF ANTENNULE		3	4	7	11	13	13
ANTENNA	MASTICATORY HOOKS						
	NO OF SETAE ON ENDOPOD						
	NO OF SETAE ON EXOPOD						
MAXILLULE		--	--	--	--	--	--
MAXILLA		--	--	--			
MAXILLIPED		--	--	--			
REMARKS		*Lengths are from Ogilvie, 1953.					

TABLE 56. COPEPODITE STAGES OF *PARACALANUS PARVUS* CLAUS

	I	II	III	IV	V
BODY LENGTH (MM)	*0.25-0.30	0.34-0.37	0.37-0.44	♂ 0.49-0.60 ♀ 0.44-0.53	♂ 0.50-0.78 ♀ 0.52-0.67
NO OF METASOME SEGMENTS	1	2-3	3-4	♂♀ 5	♂ 5 ♀ 4
NO OF UROSOME SEGMENTS	**1	**1	2	♂♀ 3	♂♀ 4
PAIRS OF SWIMMING FEET PRESENT	2 + 1	3 + 1	4 + 1	5	5
5th FEET				MALE: ASYMMETRICAL FEMALE: SYMMETRICAL; SMALL	AS IN STAGE IV
REMARKS	*Lengths are from North Sea specimens. **There is disagreement over whether the urosome has 1 or 2 segments in this stage.	Paracalanidae can be distinguished from Pseudocalanidae by lack of serration on the terminal spines of the exopods of the swimming feet.			

TABLE 57. ADULTS OF *PARACALANUS PARVUS* CLAUS

	♂	♀
CEPHALOTHORAX LENGTH(MM)	*0.73	0.64-0.75
NO OF METASOME SEGMENTS	3	3
NO OF UROSOME SEGMENTS	5	4
5th FEET	Asymmetrical, uniramous; right leg: 2-segmented, 2nd segment with a long inner spine and a short outer spine. Left leg: 5-segmented, terminal segment with 2 short thin spines.	Symmetrical, 2-segmented, uniramous; terminal segment narrow and pointed with smooth margins.
REMARKS	No serration on the terminal spine on the exopod of the swimming feet; rostral filaments present. *Lengths are from North Sea specimens.	

Labidocera aestiva Wheeler, 1899

Calanoida: Pontellidae

Distribution: *L. aestiva* is found on the Atlantic coast from Florida to the Gulf of St. Lawrence. It occurs regularly from early summer to early winter from Cape Cod to Chesapeake Bay.

Ecology: Estuarine and neritic; found at temperatures from 5.85°C to 26.65°C; euryhaline.

Feeding Habits: Carnivorous.

Remarks: *L. aestiva* nauplii are found in the Narragansett Bay area from July into November. The developmental time from nauplii to adults is 14 to 25 days. *L. aestiva* has the ability to produce resting eggs when biological and/or hydrographic conditions are unfavorable for year-round occurrence.

References: Anraku and Omori, 1963; Deevey, 1960; Faber, 1966b; Gibson and Grice, 1977; Grice and Lawson, 1976.

TABLE 58. NAUPLIAR STAGES OF *LABIDOCERA AESTIVA* WHEELER

		I	II	III	IV	V	VI
BODY LENGTH (MM)		*0.14-0.17	0.21-0.22	0.28-0.32	0.32-0.34	0.38-0.42	0.46-0.48
CAUDAL ARMATURE		2 EQUAL BARBED TERMINAL SPINES; CAUDAL AREA CLEFT	1 LONG BARBED SPINE, 1/2 BODY LENGTH 1 THIN SETA, TERMINALLY (1/2 LENGTH OF SPINE)	2 SHORT VENTRAL SPINES RIGHT SIDE: 1 SHORT SPINE, 1 SETA TERMINALLY LEFT SIDE: 1 BARBED SPINE, 1 SETA TERMINALLY	AS IN STAGE III	AS IN STAGE IV, BUT WITH 2 SHORT LATERAL SPINES	AS IN STAGE V
NO OF SETAE ON TERMINAL SEGMENT OF ANTENNULE		4	4	7	11	13	15
ANTENNA	MASTICATORY HOOKS	1 ON COXOPODITE 1 ON BASIPODITE	AS IN STAGE I	2 ON COXOPODITE 1 ON BASIPODITE	AS IN STAGE III	AS IN STAGE IV	AS IN STAGE V
	NO OF SETAE ON ENDOPOD	3	5	6	6	8	8
	NO OF SETAE ON EXOPOD	6	6	6	9	10	10
MAXILLULE		--	--	--	REPRESENTED BY 4 SETAE	REPRESENTED BY 5 SETAE	BILOBED
MAXILLA		--	--	--	--	--	REPRESENTED BY 3 SETAE
MAXILLIPED		--	--	--	--	--	RUDIMENTARY
REMARKS		Egg: 0.1 mm diameter Labrum prominent, all stages bear an unusually long masticatory hook on the basipodal segment of the left antenna. *Lengths are from laboratory-reared specimens.					1st and 2nd swimming feet rudimentary.

TABLE 59. COPEPODITE STAGES OF *LABIDOCERA AESTIVA* WHEELER

	I	II	III	IV	V
BODY LENGTH (MM)	*0.66-0.70	0.79-0.80	0.92-1.16	♂♀ 1.28-1.44	♂♀ 1.52-1.74
NO OF METASOME SEGMENTS	3	4	4	♂ 5 ♀ 5	♂ 5 ♀ 5
NO OF UROSOME SEGMENTS	2	2	2	♂ 3 ♀ 3	♂ 4 ♀ 3
PAIRS OF SWIMMING FEET PRESENT	2	3	4	5	5
5th FEET	--	--	--	MALES: RIGHT FOOT ELONGATED WITH FINE HAIRS ON INNER SURFACE FEMALES: SYMMETRICAL	MALES: RIGHT TERMINAL SEGMENT LONGER THAN LEFT
REMARKS	*Lengths are from laboratory-reared specimens.	Stages II - adult: the head bears a pair of lenses on the dorsal surface and a single oval lens on the ventral surface rostrum present			Females: 1st urosome segment enlarged

TABLE 60. ADULTS OF *LABIDOCERA AESTIVA* WHEELER

	♂	♀
TOTAL LENGTH (MM)	*1.80-2.30	1.95-2.32
NO OF METASOME SEGMENTS	5	5
NO OF UROSOME SEGMENTS	4	2
5th FEET	RIGHT FOOT HIGHLY MODIFIED; RIGHT TERMINAL SEGMENT LONGER THAN LEFT.	SYMMETRICAL; RAMI 1-SEGMENTED; EXOPOD TERMINATING IN 3 STOUT SPINES, ENDOPOD TERMINATING IN A SINGLE POINT.
REMARKS	Nearly entire head area covered by large dorsal lenses; right antennule geniculate. *Laboratory-reared specimens at Woods Hole, Mass.	

Clausocalanus arcuicornis (Dana, 1849)

Calanoida: Pseudocalanidae

Distribution: C. arcuicornis has been reported in the western North Atlantic from the Gulf of St. Lawrence to 10°15'N latitude. It has been found over deep water along the southern edge of Georges Bank.

Ecology: Characteristic of warm water oceanic areas; circumglobal.

Feeding Habits: Herbivorous.

Remarks: None.

References: Brodskii, 1967; Colton, Temple and Honey, 1962; Farran, 1911; Frost and Fleminger, 1968; Itoh, 1970; Owre and Foyo, 1967; Rose, 1933; Wilson, 1932.

TABLE 61. ADULTS OF *CLAUSOCALANUS ARCUICORNIS* (DANA)

	♂	♀
TOTAL LENGTH (MM)	*1.10-1.20	1.15-1.60
NO OF METASOME SEGMENTS	3	3
NO OF UROSOME SEGMENTS	4	4
5th FEET	Asymmetrical; uniramous; left leg: long, 4-segmented; right leg very short, less than 1/3 length of proximal segment of opposite leg with 2 very short distal segments and a basal segment equal in length to the former 2 segments.	Symmetrical; small; uniramous; distal end of terminal segment with wedge-shaped apical incision.
REMARKS	Second urosome segment as long as third and fourth combined. *Lengths are from Woods Hole specimens.	Caudal rami as long as wide; urosome shorter than fourth pair of legs.

Microcalanus pusillus Sars, 1901

Calanoida: Pseudocalanidae

Distribution: *M. pusillus* is found in the northern parts of the Atlantic Ocean.

Ecology: No information.

Feeding Habits: No information.

Remarks: None.

References: Brodskii, 1967; Conway and Minton, 1975; Ogilvie, 1953; Sars, 1903.

TABLE 62. NAUPLIAR STAGES OF *MICROCALANUS PUSILLUS* SARS

		I	II	III	IV	V	VI
BODY LENGTH (MM)		*0.08	0.09	0.13	0.16	0.18	0.21
CAUDAL ARMATURE		2 TERMINAL SPINES	AS IN STAGE I, SPINES LONGER	2 TERMINAL SPINES 2 TERMINAL SENSORY SETAE 2 VENTRAL SPINES	2 TERMINAL SPINES 2 TERMINAL SENSORY SETAE 4 VENTRAL SPINES 4 LATERAL SPINES	AS IN STAGE IV, BUT WITH 6 LATERAL SPINES	AS IN STAGE V
NO OF SETAE ON TERMINAL SEGMENT OF ANTENNULE		3	4	7	11	14	17
ANTENNA	MASTICATORY HOOKS						
	NO OF SETAE ON ENDOPOD						
	NO OF SETAE ON EXOPOD						
MAXILLULE							
MAXILLA							
MAXILLIPED							
REMARKS		*Lengths are from typical northern North Sea specimens.					

TABLE 63. COPEPODITE STAGES OF *MICROCALANUS PUSILLUS* SARS

	I	II	III	IV	V
TOTAL LENGTH (MM)	*0.25	0.31-0.42	0.39-0.42	♂ 0.48-0.65 ♀ 0.45-0.51	♂ 0.56-0.68 ♀ 0.51-0.59
NO. OF METASOME SEGMENTS				♂ ♀	♂ ♀
NO. OF UROSOME SEGMENTS	2	2	2	♂ 3 ♀ 3	♂ 4 ♀ 4
PAIRS OF SWIMMING FEET PRESENT	2	3	4	MALES: 5 FEMALES: 4	MALES: 5 FEMALES: 4
5th FEET	--	--	RUDIMENTARY	FEMALES: ABSENT	
REMARKS	*Lengths are from North Sea specimens Cephalothorax is deep and short; the terminal spine on the exopod of all but the first swimming feet is serrated.				

TABLE 64. ADULTS OF *MICROCALANUS PUSILLUS* SARS

	♂	♀
CEPHALOTHORAX LENGTH (MM)	*0.43-0.51	0.48-0.56
NO OF METASOME SEGMENTS	3	3
NO OF UROSOME SEGMENTS	5	4
5th FEET	ASYMMETRICAL; LEFT LEG ONLY 1/3 THE LENGTH OF RIGHT LEG	ABSENT
REMARKS	Cephalothorax short and deep and twice the length of the urosome. *Lengths are from Clyde Sea specimens.	Cephalothorax 3 times the length of the urosome.

Pseudocalanus sp. *(Boeck, 1864)

Calanoida: Pseudocalanidae

Distribution: Pseudocalanus is a northern species. It is widespread in the North Atlantic and in the Arctic, where it is circumpolar. It is found as far south as Cape Hatteras. It is a year-round species from the Gulf of St. Lawrence to Cape Cod, and a winter-spring species from Cape Cod to Chesapeake Bay.

Ecology: Neritic and oceanic; chief abundance is above 200 meters; maximum abundance occurs at temperatures between $5^{o}C$ and $15^{o}C$; euryhaline.

Feeding Habits: Herbivorous.

Remarks: Pseudocalanus has a developmental period of 8 weeks in the Gulf of Maine. Mortality is highest among the naupliar stages. Off eastern North America, Pseudocalanus is abundant as far north as the Arctic, and is seasonal south of the Gulf of Maine. It has two pulses of abundance, an annual maximum in late spring and a secondary pulse in late autumn, in the Gulf of Maine, Georges Bank, and Southern New England waters.

References: Bigelow, 1926; Conway and Minton, 1975; Corkett and McLaren, 1978; Davis, 1977; Deevey, 1960; Faber, 1966b; Fish, 1936b; Mullin, 1967; Ogilve, 1953; Sars, 1903; Sherman, 1963; Sherman, Sullivan and Byron, 1978; Sherman, Jones and Kane, 1979.

Pseudocalanus sp. (cont'd)

*Note: A formal revision of the genus Pseudocalanus is needed to clarify problems involving the nomenclature and delimitation of named species. Until that type of work is undertaken, we will follow the practice of Corkett and McLaren (1978) and use only the generic name, Pseudocalanus. See Corkett and McLaren (1978) for a discussion of this problem.

TABLE 65. NAUPLIAR STAGES OF *PSEUDOCALANUS* SP. (BOECK)

		I	II	III	IV	V	VI
BODY LENGTH (MM)		*0.176	0.187	0.26	0.33	0.38	0.44
CAUDAL ARMATURE		2 SHORT TERMINAL SPINES	AS IN STAGE I, SPINES LONGER	2 TERMINAL SPINES 2 VENTRAL SPINES 2 SENSORY SETAE	2 TERMINAL SPINES 4 VENTRAL SPINES 4 LATERAL SPINES 2 SENSORY SETAE	AS IN STAGE IV, BUT WITH 6 LATERAL SPINES	AS IN STAGE V
NO OF SETAE ON TERMINAL SEGMENT OF ANTENNULE		3	4	7	11	14	15
ANTENNA	MASTICATORY HOOKS						
	NO OF SETAE ON ENDOPOD	2					
	NO OF SETAE ON EXOPOD	6					
MAXILLULE		--	--	--	RUDIMENTARY		
MAXILLA		--	--	--			
MAXILLIPED		--	--	--			
REMARKS		*Lengths are from northern North Sea specimens.					1st and 2nd swimming feet rudimentary.

TABLE 66. COPEPODITE STAGES OF *PSEUDOCALANUS* SP. (BOECK)

	I	II	III	IV	V
BODY LENGTH (MM)	*0.42	0.52	0.62	♂♀ 0.73	♂ 0.87 ♀ 0.89
NO OF METASOME SEGMENTS	3	4	4	♂ 4 ♀ 4	♂ 4 ♀ 4
NO OF UROSOME SEGMENTS	2	2	2	♂ 3 ♀ 3	♂ 4 ♀ 4
PAIRS OF SWIMMING FEET PRESENT	2	3	4	MALES: 5 FEMALES: 4	MALES: 5 FEMALES: 4
5th FEET	--	--	--	MALES: SMALL, UNIRAMOSE FEMALES: ABSENT	AS IN STAGE IV
REMARKS	*Lengths are from Georges Bank specimens. The terminal spine on the exopod of all swimming feet but the first pair is serrated.				

TABLE 67. ADULTS OF *PSEUDOCALANUS* SP. (BOECK)

	♂	♀
CEPHALOTHORAX LENGTH(MM)	*0.85	0.96-1.00
NO OF METASOME SEGMENTS	3	3
NO OF UROSOME SEGMENTS	5	4
5th FEET	RIGHT: 3 SEGMENTED LEFT: 5 SEGMENTED	ABSENT
REMARKS	Antennule with well-developed aesthetascs terminal spine on the exopod of all swimming feet but the first is serrated; cephalothorax is short and rounded, about twice the length of the urosome. *Lengths are from Georges Bank specimens.	Serration on swimming feet as in males.

Scolecithrix danae (Lubbock, 1856)

Calanoida: Scolecithricidae

Distribution: S. danae has been found over Georges Bank, Browns Bank and the southern part of the Gulf of Maine. It has been reported from the Gulf of St. Lawrence to $10^{o}15'$N latitude.

Ecology: Oceanic.

Feeding Habits: Omnivorous.

Remarks: None.

References: Arashkevich, 1969; Colton, Temple and Honey, 1962; Owre and Foyo, 1967; Rose, 1933; Wilson, 1932.

TABLE 68. ADULTS OF *SCOLECITHRIX DANAE* (LUBBOCK)

	♂	♀
TOTAL LENGTH (MM)	*1.85-2.15	2.0-2.25
NO OF METASOME SEGMENTS	4	4
NO OF UROSOME SEGMENTS	5	4
5th FEET	LEFT AND RIGHT LEGS OF ABOUT EQUAL LENGTH; LEFT LEG BIRAMOUS; RIGHT LEG UNIRAMOUS WITH A VERY SHORT TERMINAL SEGMENT	ABSENT OR VERY SMALL
REMARKS	*Lengths are from Woods Hole Region specimens.	Genital segment with a posteriorly directed, shelf-like ventral projection; antennule extending past metasome.

Eurytemora americana Williams, 1906

Calanoida: Temoridae

Distribution: *E. americana* is found from Cape Cod to Chesapeake Bay.

Ecology: Prefers brackish water, but can survive in full seawater.

Feeding Habits: Omnivorous.

Remarks: None.

References: Brodskii, 1967; Deevey, 1960; Grice, 1971; Heron, 1964; Itoh, 1970; Katona, 1971.

TABLE 69. NAUPLIAR STAGES OF *EURYTEMORA AMERICANA* WILLIAMS

		I	II	III	IV	V	VI
BODY LENGTH (MM)		*0.12	0.16-0.18	0.20	0.24-0.26	0.30-0.31	0.36
CAUDAL ARMATURE		2 EQUAL TERMINAL SPINES	2 UNEQUAL TERMINAL SPINES, LONGEST ABOUT 1/3 BODY LENGTH	2 TERMINAL SPINES 2 TERMINAL SENSORY SETAE 2 VENTRAL SPINES LONGEST SPINE 1/3 BODY LENGTH	AS IN STAGE III, SPINES ABOUT 1/7 BODY LENGTH	AS IN STAGE IV, SPINES ABOUT 1/9 BODY LENGTH	AS IN STAGE V, VENTRAL SPINES LARGE
NO OF SETAE ON TERMINAL SEGMENT OF ANTENNULE		3	4	7	10 PLUS 1 SENSORY SETA	13 PLUS 1 SENSORY SETA	14 PLUS 1 SENSORY SETA
ANTENNA	MASTICATORY HOOKS	1 ON COXOPODITE	1	2	2	2	2
	NO OF SETAE ON ENDOPOD	4	5	7	7	9	9
	NO OF SETAE ON EXOPOD	6	7	9	9	10	12
MAXILLULE		--	--	RUDIMENTARY	WITH SEVERAL SETAE	AS IN STAGE IV	AS IN STAGE V
MAXILLA		--	--	--	--	RUDIMENTARY	RUDIMENTARY
MAXILLIPED		--	--	--	--	--	RUDIMENTARY
REMARKS		*E. americana* and *E. herdmani* can be separated most readily by the structure of the caudal armature. *Lengths are from laboratory-reared specimens.					1st and 2nd swimming feet rudimentary.

TABLE 70. COPEPODITE STAGES OF *EURYTEMORA AMERICANA* WILLIAMS

	I	II	III	IV	V
BODY LENGTH (MM)	*0.56-0.59	0.62-0.68	0.74-0.84	♂♀ 0.88-0.98	♂♀ 1.04-1.18
NO OF METASOME SEGMENTS	3	4	5	♂ 5 ♀ 5	♂ 5 ♀ 5
NO OF UROSOME SEGMENTS	2	2	3	♂ 3 ♀ 3	♂ 4 ♀ 3
PAIRS OF SWIMMING FEET PRESENT	2	3	4	5	5
5th FEET	--	--	--	MALES: PROTUBERANCE ON INNER SIDE OF RIGHT BASIPODAL SEGMENT FEMALES: 2-SEGMENTED SYMMETRICAL	MALES: RIGHT FOOT LONGER THAN LEFT, MARGINAL SPINES SMALL FEMALES: SPINE-LIKE PROCESSES ON INNER SIDE OF DISTAL SEGMENT; POINTED.
REMARKS	*Lengths are from laboratory-reared specimens.			Males: right antennule with spine-like protrusion on seventh from last segment.	Males: right antennule with spines on segments 7, 8, 9 from end.

TABLE 71. ADULTS OF *EURYTEMORA AMERICANA* WILLIAMS

	♂	♀
LENGTH(MM)	*1.24-1.30	1.20-1.40
NO OF METASOME SEGMENTS	5	5
NO OF UROSOME SEGMENTS	4	3
5th FEET	Right fifth leg longer than left; inner margin of the basipodite of right fifth leg is convex; 5-segmented; distal segment of left leg short, acute angular, with a spine on each angle.	Symmetrical; spines and setae long and thin; the spine-like protrusions of the inner margins project nearly perpendicularly to the axis of the leg; 3 free segments, distal segment short; inner process of penultimate segment long, obliquely directed and serrated.
REMARKS	Both sexes have numerous spinules on the dorsal surfaces of the caudal rami and the anal segment. *Lengths are from laboratory-reared specimens.	Wing-like projections on the fifth metasomal segment.

Eurytemora herdmani Thompson and Scott, 1897

Calanoida: Temoridae

Distribution: *E. herdmani* has a wide geographic distribution in certain coastal and estuarine waters along the northeastern and northwestern coasts of North America. It has been found from Narragansett Bay north to the Gulf of St. Lawrence.

Ecology: Neritic.

Feeding Habits: Omnivorous.

Remarks: During the summer and early autumn, it is at its maximum abundance in the Gulf of Maine. The nauplii are present in the Narragansett Bay area from May through July, and are most abundant in May.

References: Bigelow, 1926; Brodskii, 1967; Faber, 1966b; Grice, 1971; Heron, 1964; Itoh, 1970; Johnson, 1966; Katona, 1971.

TABLE 72. NAUPLIAR STAGES OF *EURYTEMORA HERDMANI* THOMPSON & SCOTT

		I	II	III	IV	V	VI
BODY LENGTH (MM)		*0.10-0.12	0.16-0.18	0.20-0.24	0.24-0.28	0.28-0.32	0.36-0.38
CAUDAL ARMATURE		2 TERMINAL EQUAL SPINES	2 SUBEQUAL TERMINAL SPINES (1/3 BODY LENGTH) 3 ROWS POSTERO-VENTRAL SPINES	2 TERMINAL SPINES 2 TERMINAL SENSORY SETAE SMALL VENTRAL SPINES (LONGEST SPINE 1/2 BODY LENGTH)	AS IN STAGE III LONGEST SPINE 1/3 BODY LENGTH	AS IN STAGE IV LONGEST SPINE 1/4 BODY LENGTH PLUS 2 VENTRAL SPINES	AS IN STAGE V, BUT 2 VENTRAL SPINES ARE LONG AND SLENDER
NO OF SETAE ON TERMINAL SEGMENT OF ANTENNULE		3	4	7	10 PLUS 1 SENSORY SETA	13 PLUS 1 SENSORY SETA	14 PLUS 1 SENSORY SETA
ANTENNA	MASTICATORY HOOKS	1 ON COXOPODITE	1	2	2	2	2
ANTENNA	NO OF SETAE ON ENDOPOD	3	5	7	7	7	9
ANTENNA	NO OF SETAE ON EXOPOD	6	7	9	10	10	12
MAXILLULE		--	--	--	REPRESENTED BY SEVERAL SETAE	AS IN STAGE IV	AS IN STAGE V
MAXILLA		--	--	--	--	RUDIMENTARY	RUDIMENTARY
MAXILLIPED		--	--	--	--	--	RUDIMENTARY
REMARKS		E. herdmani and E. americana nauplii can be separated most readily by the structure of the caudal armature. *Lengths are from laboratory-reared specimens.			Some nauplii may have a small pair of ventral hooks in the caudal area.		1st and 2nd swimming feet rudimentary.

TABLE 73. COPEPODITE STAGES OF *EURYTEMORA HERDMANI* THOMPSON & SCOTT

	I	II	III	IV	V
BODY LENGTH (MM)	*0.48-0.56	0.60-0.68	0.72-0.82	♂♀ 0.92-1.00	♂♀ 1.02-1.12
NO. OF METASOME SEGMENTS	3	4	5	♂ 5 ♀ 5	♂ 5 ♀ 5
NO. OF UROSOME SEGMENTS	2	2	3	♂ 3 ♀ 3	♂ 4 ♀ 3
PAIRS OF SWIMMING FEET PRESENT	2	3	4	5	5
5th FEET	--	--	--	MALES: PROTUBERANCE ON INNER SIDE OF SECOND BASIPODAL SEGMENT FEMALES: 2-SEGMENTED; SYMMETRICAL	MALES: MARGINAL SPINES LARGE. FEMALES: SPINE-LIKE PROCESSES ON INNER SIDE OF DISTAL SEGMENT ROUNDED.
REMARKS	Note: Copepodites of E. herdmani and E. americana cannot easily be separated until Stage IV. The structure and the size of the spines of the 5th legs are different in each species. *Lengths are from laboratory-reared specimens.			Males: antennule with spine-like protrusion on 7th from last segment.	Males: antennule with spines on segments 7, 8, 9 from the end. Females: postero-lateral corners of 5th metasomal segment protuberant.

TABLE 74. ADULTS OF *EURYTEMORA HERDMANI* THOMPSON & SCOTT

	♂	♀
LENGTH (MM)	*1.16-1.28	1.14-1.34
NO OF METASOME SEGMENTS	5	5
NO OF UROSOME SEGMENTS	4	3
5th FEET	Right leg is 5-segmented with 3rd segment longer and narrower than 2nd and bearing 3 spines (as in left leg); distal segment thin, almost filiform.	2nd segment subequal without armature; inner process of 3rd segment long and setose on both sides and directed forward; outer margin of 3rd segment with 2 spines: 1 apical and 1 shorter outer spine.
REMARKS	No spinules on the dorsal surface of the caudal rami and the anal segment. *Lengths are from laboratory-reared specimens.	Caudal rami and anal segment without spinules.

Eurytemora hirundoides Nordquist, 1888

Calanoida: Temoridae

Distribution: *E. hirundoides* has been collected widely in the North Atlantic region: Nova Scotia, Woods Hole, Narragansett Bay, and Chesapeake Bay.

Ecology: Neritic; characteristic of brackish to fresh water.

Feeding Habits: Omnivorous.

Remarks: None.

References: Brodskii, 1967; Davis, 1943; Itoh, 1970; Sars, 1903.

TABLE 75. NAUPLIAR STAGES OF *EURYTEMORA HIRUNDOIDES* NORDQUIST

		I	II	III	IV	V	VI
BODY LENGTH (MM)		*0.098-0.104	0.128-0.146	0.146-0.183	0.195-0.220	0.244-0.262	0.301-0.366
CAUDAL ARMATURE		2 FINE TERMINAL EQUAL SETAE	2 TRANSVERSE ROWS OF FINE HAIRS 2 TERMINAL SETAE MORE STRONGLY DEVELOPED, LEFT LONGER THAN RIGHT	1 ROW FINE HAIRS 2 SPINOSE TERMINAL SETAE 2 DELICATE TERMINAL SETAE 2 VENTRAL SETAE	AS IN STAGE III, HAIRS MORE PROMINENT	AS IN STAGE IV	AS IN STAGE V, HAIRS ABSENT
NO OF SETAE ON TERMINAL SEGMENT OF ANTENNULE		3	4	7	11	14	14
ANTENNA	MASTICATORY HOOKS	1 ON BASIPODITE	1	2	2	2	2
	NO OF SETAE ON ENDOPOD	3	5	6	6	6	7
	NO OF SETAE ON EXOPOD	5	7	8	8	8	9
MAXILLULE		--	--	REPRESENTED BY STOUT, SPINOSE SETAE	BILOBED, EACH LOBE WITH 3 SETAE TERMINALLY	INNER LOBE: 8 SETAE; OUTER LOBE: 5 SETAE	INNER LOBE: 9 SETAE; OUTER LOBE: 5 SETAE
MAXILLA		--	--	--	BUD	BUD	RUDIMENTARY
MAXILLIPED		--	--	--	--	RUDIMENTARY	RUDIMENTARY
REMARKS		Large broad labrum present. *Lengths are from laboratory-reared and Chesapeake Bay specimens.	Antennule bears a group of several fine spinules in Stages II-VI.	Base of each caudal seta ringed by fine hairs.	Body segmented posterior to the maxilla.		Body divided into 4 definite segments.

TABLE 76. COPEPODITE STAGES OF EURYTEMORA HIRUNDOIDES NORDQUIST

	I	II	III	IV	V
BODY LENGTH (MM)	*0.439-0.549	0.555-0.671	0.830-0.933	♂ 0.854-0.994 ♀ 1.037-1.220	♂ 1.135-1.287 ♀ 1.257-1.525
NO OF METASOME SEGMENTS	4	5	6	♂ 6 ♀ 6	♂ 6 ♀ 6
NO OF UROSOME SEGMENTS	2	2	3	♂ 3 ♀ 3	♂ 4 ♀ 3
PAIRS OF SWIMMING FEET PRESENT	2	3	4	5	5
5th FEET	--	--	--	--	MALES: ASYMMETRICAL FEMALES: SYMMETRICAL
REMARKS	1st metasomal segment bears a hump dorsally on its posterior border. *Lengths are from laboratory-reared and Chesapeake Bay specimens.			6th metasomal segment: Males: rounded Females: slightly angular	6th metasomal segment: Females: developed into pronounced points Females: genital segment swollen

TABLE 77. ADULTS OF *EURYTEMORA HIRUNDOIDES* NORDQUIST

	♂	♀
LENGTH(MM)	*1.403-1.647	1.482-1.708
NO OF METASOME SEGMENTS	5	5
NO OF UROSOME SEGMENTS	5	3
5th FEET	Asymmetrical; 4-segmented; distal segment of right leg swollen in proximal part; distal segment of left leg widened apically with 2 processes separated by a depression.	Symmetrical; inner apical spine smooth and 2-3 times longer than apical outer spine; penultimate segment with smooth outer spines and inner distal process.
REMARKS	Right antennule geniculate; long caudal rami. *Lengths are from Chesapeake Bay specimens.	6th metasomal segment is expanded into large triangular wings; genital segment asymmetrical; long caudal rami.

Temora longicornis Müller, 1785

Calanoida: Temoridae

Distribution: *T. longicornis* is found across the continental shelf from the Gulf of St. Lawrence to Chesapeake Bay. It is a summer-fall species in the Gulf of Maine. It is found year-round from the Gulf of Maine to Cape Cod, and it is a winter-spring species from Cape Cod to Delaware Bay.

Ecology: Littoral and neritic; the greatest abundance occurs in the upper 50 meters of the water column; eurythermal; euryhaline.

Feeding Habits: Omnivorous.

Remarks: The greatest mortality occurs during the naupliar stages.

References: Bigelow, 1926; Bigelow and Sears, 1939; Conway and Minton, 1975; Deevey, 1960; Harris and Paffenhofer, 1976; Mullin, 1967; Ogilvie, 1953; Rose, 1933; Sars, 1903.

TABLE 78. NAUPLIAR STAGES OF TEMORA LONGICORNIS MÜLLER

		I	II	III	IV	V	VI
BODY LENGTH (MM)		*0.112	0.16	0.21	0.26	0.32	0.38
CAUDAL ARMATURE		2 EQUAL TERMINAL SPINES	CAUDAL AREA ASYMMETRICAL, LEFT SPINE LONGER THAN RIGHT	LEFT SPINE MUCH LONGER THAN RIGHT 2 VENTRAL SPINES 2 TERMINAL SETAE	AS IN STAGE III, BUT WITH 4 VENTRAL AND 4 LATERAL SPINES	AS IN STAGE IV, BUT WITH 6 LATERAL SPINES	**AS IN STAGE V, BUT WITH 4 LATERAL SPINES
NO OF SETAE ON TERMINAL SEGMENT OF ANTENNULE		3	4	7	11	14	17
ANTENNA	MASTICATORY HOOKS						
	NO OF SETAE ON ENDOPOD						
	NO OF SETAE ON EXOPOD						
MAXILLULE							
MAXILLA							
MAXILLIPED							
REMARKS		*Lengths are from northern North Sea specimens.					**Ogilvie's drawing of Stage IV shows a reduction in the number of lateral spines from Stage V.

TABLE 79. COPEPODITE STAGES OF *TEMORA LONGICORNIS* MÜLLER

	I	II	III	IV	V
BODY LENGTH (MM)	*0.31-0.34	0.37-0.42	0.42-0.51	♂ 0.59-0.70 ♀ 0.53-0.70	♂ 0.62-0.70 ♀ 0.76-0.87
NO. OF METASOME SEGMENTS	4	5	5	♂ 4 OR 5 ♀ 4 OR 5	♂ 4 ♀ 4
NO. OF UROSOME SEGMENTS	1	1	2	♂ 3 ♀ 3	♂ 4 ♀ 3
PAIRS OF SWIMMING FEET PRESENT	2	3	4	5	5
5th FEET	--	--	RUDIMENTARY	MALES: ASYMMETRICAL LEFT LARGER THAN RIGHT FEMALES: SYMMETRICAL	AS IN STAGE IV
REMARKS	*Lengths are from North Sea specimens.			4th and 5th metasomal segments become fused	

TABLE 80. ADULTS OF *TEMORA LONGICORNIS* MÜLLER

	♂	♀
CEPHALOTHORAX LENGTH (MM)	*0.70-0.93	0.93-1.10
NO OF METASOME SEGMENTS	4	4
NO OF UROSOME SEGMENTS	5	3
5th FEET	ASYMMETRICAL; TERMINAL SEGMENT OF LEFT FOOT DISTINCTLY FORCIPATE.	SYMMETRICAL, 3-SEGMENTED; INTERNAL SPINE OF 3RD SEGMENT A LITTLE SHORTER THAN THOSE OF OTHER 2 SEGMENTS.
REMARKS	Antennule geniculate; characteristic diamond-shaped metasome when viewed dorsally and a humpback when viewed laterally; very long caudal rami. *Lengths are from Clyde Sea specimens.	Body shape and caudal rami as in males.

Tortanus discaudatus (Thompson and Scott, 1897)

Calanoida: Tortanidae

Distribution: T. discaudatus has a wide distribution in boreal waters on the Atlantic and Pacific coasts of North America. It has been recorded from the Gulf of St. Lawrence to Delaware Bay.

Ecology: Estuarine and neritic.

Feeding Habits: Carnivorous.

Remarks: T. discaudatus is most abundant in summer in the Gulf of Maine. The nauplii are present in the Narragansett Bay area from late March through July, and they are most abundant in May and June.

References: Bigelow, 1926; Brodskii, 1967; Faber, 1966b; Johnson, 1934; Mullin, 1967; Sherman, 1963.

TABLE 81. NAUPLIAR STAGES OF *IORTANUS DISCAUDATUS* (THOMPSON & SCOTT)

		I	II	III	IV	V	VI
BODY LENGTH (MM)		*0.12-0.14	0.185-0.205	0.23-0.26	0.30	0.32-0.34	0.36
CAUDAL ARMATURE		2 EQUAL TERMINAL SPINES	2 PLUMOSE TERMINAL SPINES, THE RIGHT HEAVIER AND LONGER	2 LONG TERMINAL SPINES 2 PLUMOSE TERMINAL SPINES 2 VENTRAL SPINES	AS IN STAGE III	AS IN STAGE IV	AS IN STAGE V
NO OF SETAE ON TERMINAL SEGMENT OF ANTENNULE		3	4	7	9	12	13
ANTENNA	MASTICATORY HOOKS	1 ON COXOPODITE 1 ON BASIPODITE	AS IN STAGE I	AS IN STAGE II	AS IN STAGE III	AS IN STAGE IV	AS IN STAGE V
ANTENNA	NO OF SETAE ON ENDOPOD	3	5	6	7	7	7
ANTENNA	NO OF SETAE ON EXOPOD	7	7	7	7	8	8
MAXILLULE		--	--	BUD	BUD	BUD	RUDIMENTARY
MAXILLA		--	--	--	BUD	BUD	RUDIMENTARY
MAXILLIPED		--	--	--	BUD	BUD	BUD
REMARKS		Egg: 0.11 mm diameter. All stages: large broad labrum and large masticatory hooks on antenna. Nauplii resemble those of *Acartia longiremis* and *A. bifilosa*. *Lengths are from laboratory-reared specimens.					1st and 2nd swimming feet rudimentary.

TABLE 82. COPEPODITE STAGES OF *TORTANUS DISCAUDATUS* (THOMPSON & SCOTT)

	I	II	III	IV	V
CEPHALOTHORAX LENGTH (MM)	*0.55	0.74	0.96	♂♀ 1.11	♂♀ 1.24-1.40
NO. OF METASOME SEGMENTS	4	5	6	♂ 6 ♀ 6	♂ 6 ♀ 6
NO. OF UROSOME SEGMENTS	1	2	2	♂ 3 ♀ 3	♂ 4 ♀ 3
PAIRS OF SWIMMING FEET PRESENT	2	3	4	5	5
5th FEET	--	--	RUDIMENTARY	MALES: ASYMMETRICAL WITH THUMB-LIKE PROCESS ON RIGHT FOOT FEMALES: SYMMETRICAL 2 SEGMENTS	AS IN STAGE IV
REMARKS	Urosome segment is deeply constricted; caudal rami symmetrical with 3 long terminal bristles, 1 short dorsal bristle, and 2 lateral spines *Lengths are from northeast Pacific Ocean specimens.			Caudal rami asymmetrical; right ramus longer than left	

TABLE 83. ADULTS OF *TORTANUS DISCAUDATUS* (THOMPSON & SCOTT)

	♂	♀
TOTAL LENGTH (MM)	*1.36-2.00	1.43-2.25
NO OF METASOME SEGMENTS	4	4
NO OF UROSOME SEGMENTS	5	3
5th FEET	Uniramose; right leg: chelate; left leg: 2nd segment has a long distal spine; 3rd segment with a serrated inner margin bearing 2 spines and a bundle of bristles.	Uniramose; symmetrical; 2-segmented; 1st segment short with a small lateral bristle; distal segment elongate and crescent shaped.
REMARKS	Caudal rami highly asymmetrical; lateral spine of right caudal ramus very prominent. *Lengths are from Brodskii, 1967.	Caudal rami as in males.

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