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by A. V. Monakov and Yu. I. Sorokin

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The Food and Feeding Habits of Some Fresh Water Calanoida.

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Research into the food and feeding habits of some copepod crustaceans was mainly conducted on salt water forms (Beklemishev, 1954a; Gauld, 1959, 1964; Petipa, 1959 1960, 1964, 1965, 1967; Conover, 1960, 1964, 1966; Berner, 1962; Marshall and Orr, 1966). The present project studied the feeding habits of fresh water calanoida and the function of their appendices in locomotion and food gathering.

The objects of observation were Eurytemora velox, Heterocope appendiculata and Hemidiaptomus amblyodon. The first two species inhabit the shoreline and waters of the Rybinsk reservoir. H. amblyodon is found in spring puddles in the vicinity of Borka.

The crustaceans caught in the reservoir were transfered to 5 - 10 litre aquariums filled with natural water which had previously been filtered through # 71 gauze. The animals were adapted to the food which was later used in the experiment. The period of adapting to laboratory conditions usually took 12 - 24 hours. The water temperature in the aquariums varied from 17 to 21 degrees.

Observations on feeding were made under binoculars or a magnifying glass, utilizing various containers (watch glasses, glass with holes and aquariums measuring 5 - 100 cc.)

Experiments to establish copepod capacity to use and absorb various foods utlized radiocarbon methods previously described (Sorokin 1966). We shall discuss some of its peculiarities below.

Eurytemora velox. This species' swimming is somewhat reminiscent of cyclopod locomotion (Monakov 1967), but the jumps characteristic of cyclopods follow after a period of slow motion brought about by *Eurytemora*'s moving its oral appendices (illustration 1). Thus the oral appendices (illustration 2 - 6) have two functions: locomotion and filtering. The rapid vibration of the second antennae and mandibular palpi produces a fairly complex system of water currents which can be well observed under the microscope. They differ from those previously described for other species of copepoda. Stoch and Pfisterer (1925), observing the work of oral appendices, noted that the basic food current flows from the swimming legs forward. Food particles move in the same direction when *Epischura* feeds (Kozhova, 1956). According to T. S. Petipa (1959), when *Acartia clausi* feeds on small algae, it creates circular currents directed backward and sideways, ie: the same as with *Eurytemora*.

The water currents created by the vibration of the second antennae and mandibular palpi are often not closed and reach beyond the range of the crustacean's body (at times this distance exceeds his size).

Into the oral cavity, shielded from behind by the bristles of the second maxillae, maxillary and swimming legs (and from the sides by the feathered protrusions of the first maxillae) float suspended food objects (algae, the simplest pieces of detritus). They are retained by the bristles of the second maxillae and the maxillary legs which form a type of scoop. An insignificant number of food particles, striking the walls of this scoop, change direction and move to the oral cavity. At irregular intervals the maxillary legs and second maxillae make a characteristic raking motion, the food enters the mouth and is swallowed.

As previously noted, the filtration points are quite strong. At times they catch small animals, especially if their concentration is fairly high in the experiment container. Even copepod nauplii, which can swim rapidly, do not escape the currents and become Eurytemora's victims.

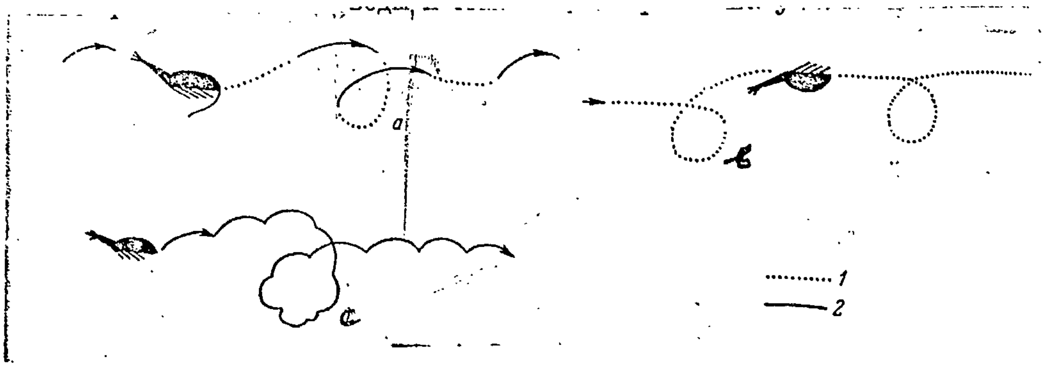

Illustration 1: swimming methods.

a - Eurytemora velox; b - Hemidiaptomus amblyodon; c - Heterocope appendiculata (1 - movement through oral appendices; 2 - movement by abdominal strikes).

The prey is caught by the second maxillae with the aid of the maxillary legs and is directed towards the mouth. On a live crustacean it is difficult to trace the function of the mandibles which lie under the upper lip. Apparently their function is to tear and grind large particles. During swallowing, weak movements of the first maxillae are apparent. The maxillary extremities have strong bristles (illustr. 4) which apparently serve to push food through. If larger animals (*Bosmina*, *Polyphemus*, *Scapholeberis*) enter the radius of the oral appendices' activity, they are discarded by the crustacean.

Eurytemora does not actively attack its prey, but catches it when the latter is sucked into the "food compartment". This distinguishes *Eurytemora* from *Acartia clausi* (Petipa 1959) and from *Calanus hyperboreus* (Conover 1966) which actively persue their prey. In Conover's oppinion (1966) the feeding habits of crustaceans vary at times even within the species. In other words, the animals exhibit individual peculiarities in their behaviour. Some feed more actively than others. In this author's experiments, for example, *C. hyperboreus* raised on a culture of small algae "paid no attention" to large algae. If the female of the species was fed the eggs of other crustaceans, they subsequently refused plant food.

Thus, by feeding habit, *Eurytemora* is a filtrator, never-the-less capable of catching small animals (Lowndes 1935).

This conclusion was confirmed by experiments utilizing food marked by C^{14}. The experimental crustaceans were placed in small containers of 20 to 200 cc, filled with natural water which had been filtered through fine cheese cloth or a number 6 membrane filter, and offered the marked food.

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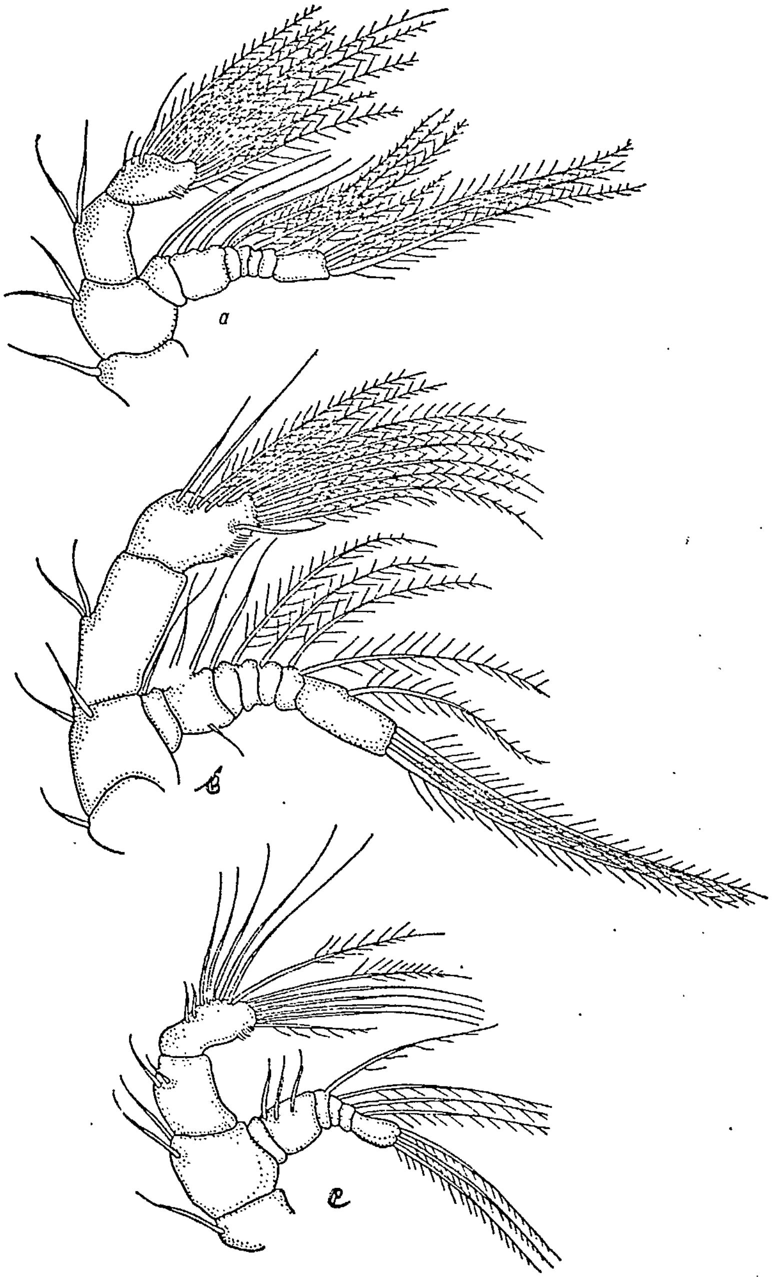

Illustration 2: Second antenae. a - Eurytemora velox (enlarged 140 x); b - Hemidiaptomus amblyodon (enlarged 70x); c - Heterocope appendiculata (enlarged 70x).

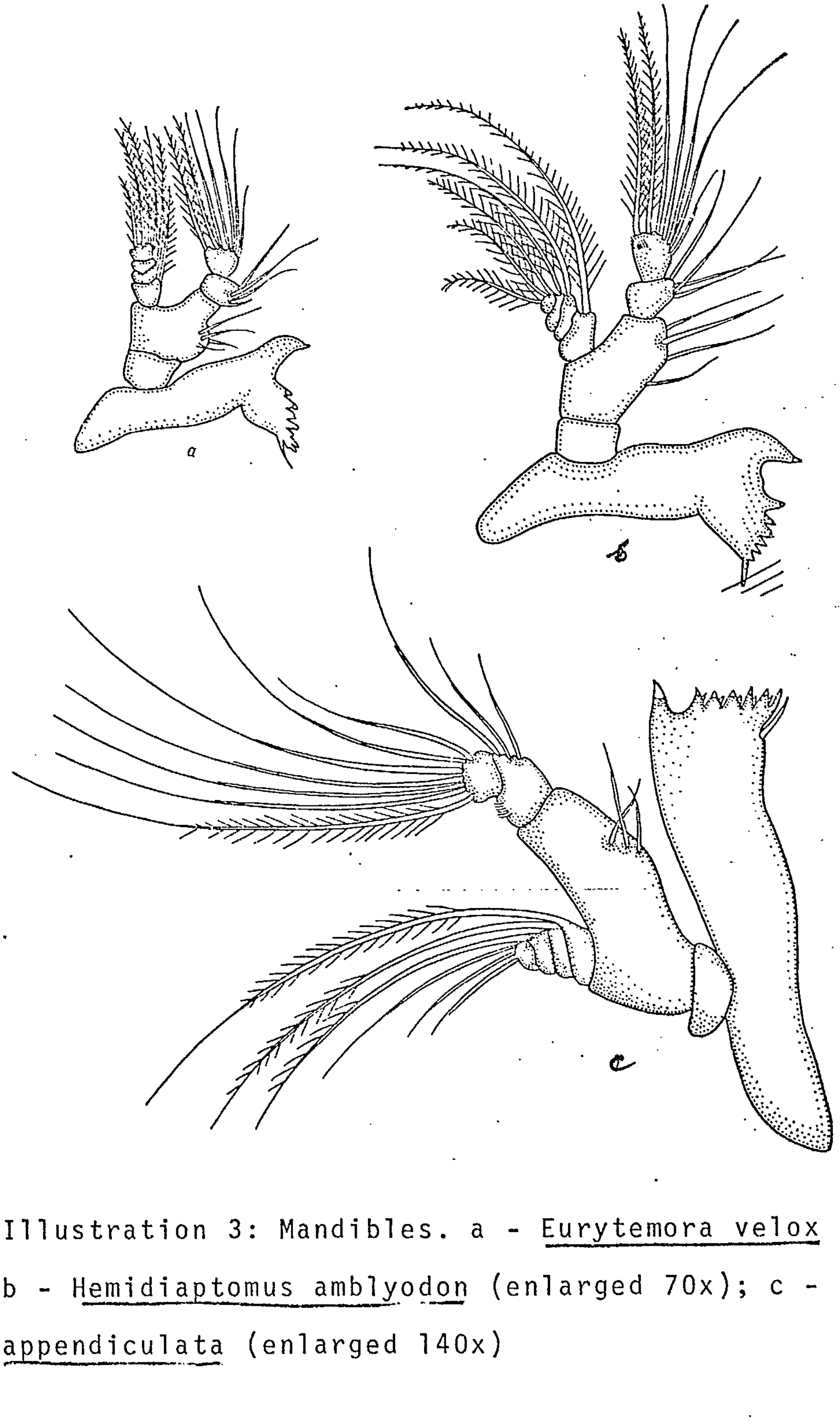

Illustration 3: Mandibles. a - Eurytemora velox (enlarged 140x); b - Hemidiaptomus amblyodon (enlarged 70x); c - Heterocope appendiculata (enlarged 140x)

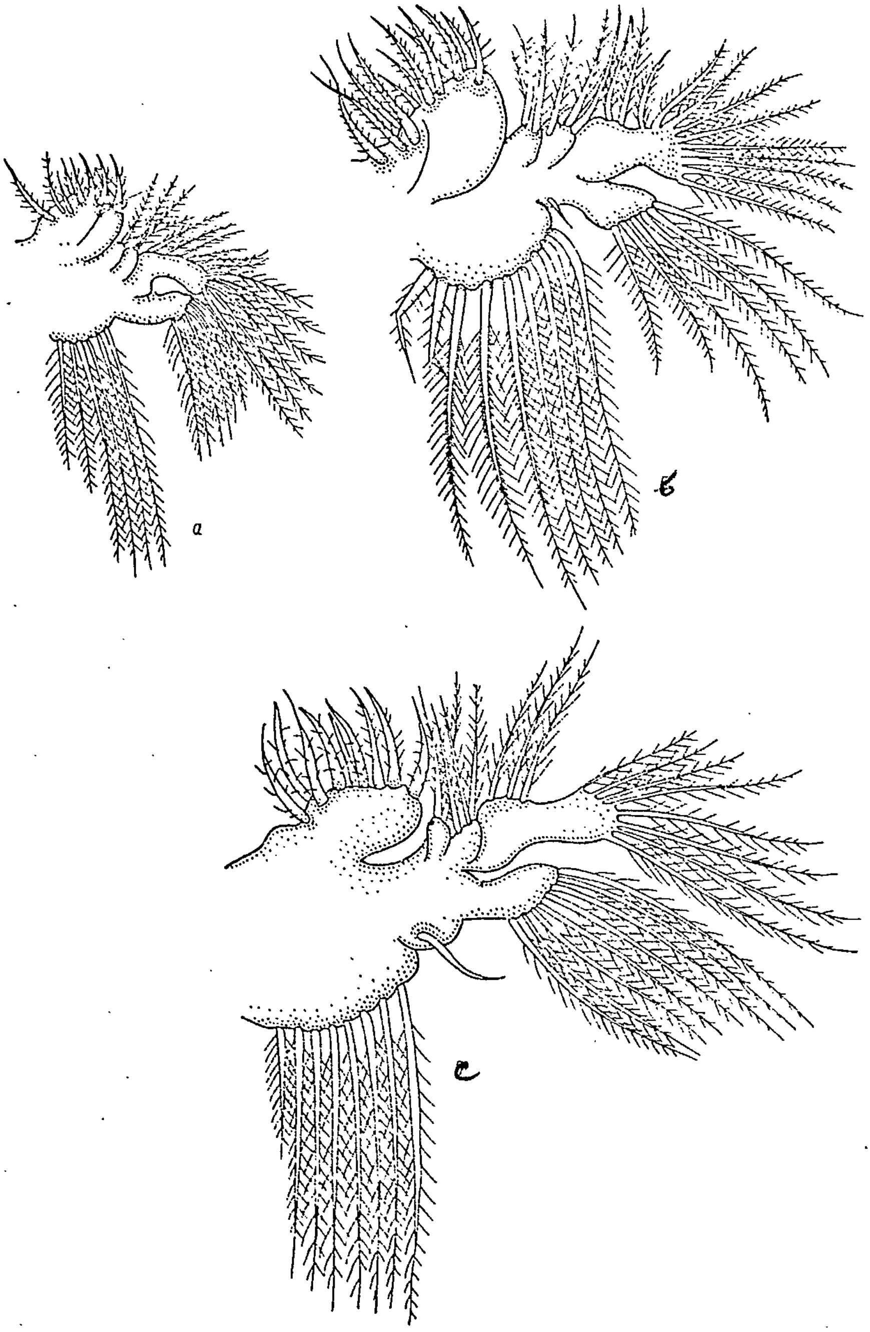

Illustration 4: First maxillae. Same designation as in illustration 3.

The concentration of the latter was changed depending on the experiment's aim. Each experiment was repeated. Food consumptiion (R) was measured over a 30 - 40 min. period. In this time *Eurytemora*'s bowels were filled. Experiments measuring food absorbtion $\mathcal{L}_u$ (without allowance for loss of C^{14} during respiration) lasted as much as 3 - 4 hours.

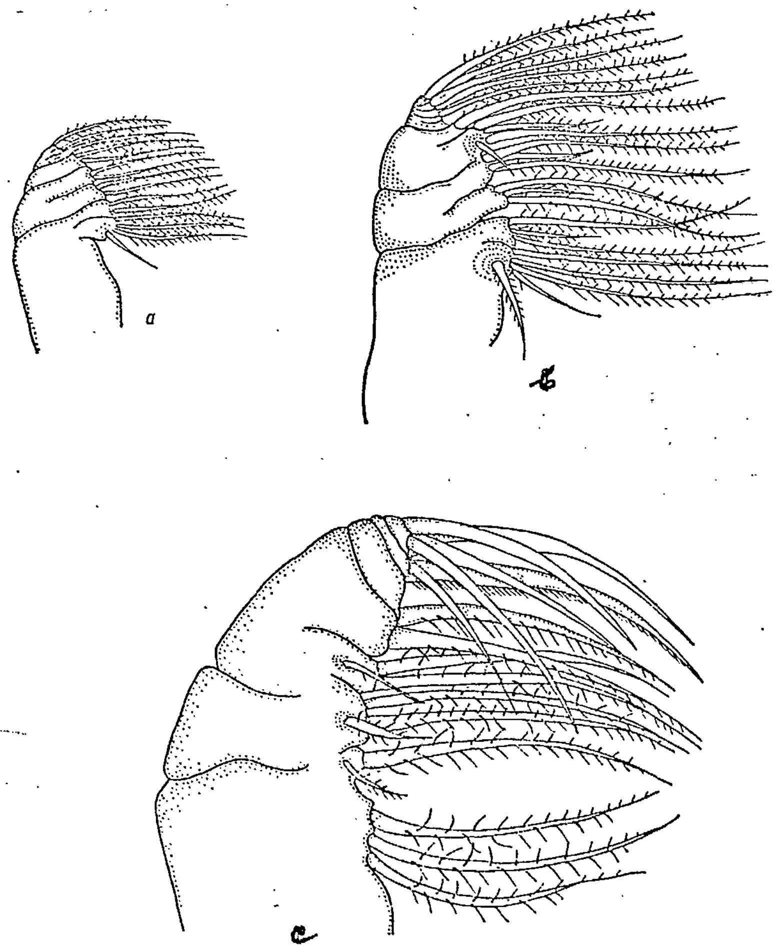

Illustration 5: Second Maxillae. Designation as in illustr. 3.

Both were measured at the end of the experiment as to the radioactivity of the animals (allowing for self-absorbtion and Sr - the specific activity of the food).

To indicate the intensity of feeding, indices of use (R/S in %) and absorption (Su/S in %) were utilized. They represented the relation of used (or absorbed) food to the total carbon content in the crustacean's body.

First we wanted to know which type of food (various algae, bacteria) are better filtered by Eurytemora. We judged this by the amount of food caught within a short period of time (20 - 30 minutes).

From Table 1 it follows that Eurytemora velox does not filter any bacteria, utilizes Chlamydomonas only very little, but successfully uses planktonic algae (Chlorella, Nitzschia, Scenedesmus). 1186

Apparently the saprophytic bacteria offered the crustaceans in the experiment were not filtered out because of their small size (0.6 - 2.0 mk).

Further we tried to establish the degree of algae absorption. For food the experiment utilized Chlorella, which, as previous experiments had shown, was well utilized by the crustaceans.

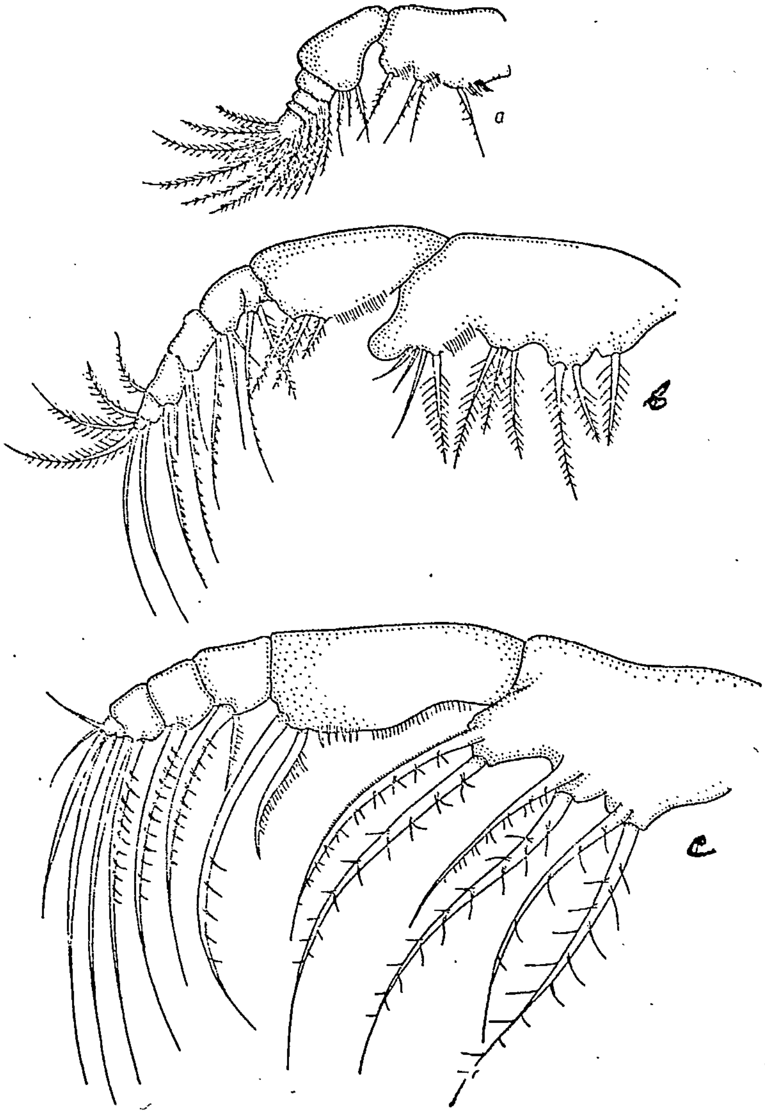

Illustration 6: Maxillary legs. Same designation as in illustration 3.

Algae concentration in the experimental containers varied in the range 4 - 6 g/cu.m. (calculated by biomass).

The figures of table 2 show great variations in use and absorption, probably due to varying feeding speeds of individual animals. The experiments showed very low ~~values~~ absolute values of S_u and indices of absorption (S_u/S). The low algae absorption indices were also observed with other species of <u>Calanoida</u>, in particular with <u>Diaptomus gracilis</u> and <u>D. graciloides</u>.

Table I: Use of various foods by crustaceans

Type of food	Eurytemora		
	Number of observations	R (in mkg) S per day	R/S in %
Saprophyte bacteria	3	0	0
Chlorella	11	4.0± 0.3	61.6
Scenedesmus	2	3.7±0.7	57.0
Nitzschia	3	3.0±0.3	46.1
Chlamydomonas	3	0.4±0.3	6.1

Type of food	Heterocope		
	Number of observations	R (in mkg) S per day	R/S in %
Saprophyte bacteria	2	0	0
Chlorella	6	0.2±0.06	0.8
Scenedesmus	6	1.8±0.5	7.2
Nitzschia	2	0.4±0.1	4.6
Chlamydomonas	2	0	0

The small numerical indices of absorbtion reflect the slow rate of crustaceans' growth with corresponding food.

Parallel experiments were carried out to explain the relation of S_u to algae concentration. It was found that S_u reaches a maximum when algae concentration is 12g/cu.m. (based on biomass). Higher food concentrations lower the value of S_u (illustration 7). Consequently the clear plato of S_u reached when food concentration reaches near natural conditions, as observed in experiments on the feeding of *daphnii* (Monakov & Sorokin, 1961) and diatomids (Malovitska & Sorokin, 1961), is lacking in experiments with *Eurytemora*. The explanation is probably that *Eurytemora* in general badly absorbs green algae. During the experiments concerning the crustaceans' ability to filter out various types of food particles, we coincidentally calculated the value of S_u for some algae. It appears that neither *Scenedesmus* nor *Chlamydomonas* were absorbed by the crustaceans (table 3).

Table II: Use and Digestion of Chlorella by the Crustacean *Eurytemora velox.*

R (in mkg , S per day)	S_u (in mkg, S per day)	S_u/S (in %)
3.6	0.04	0.4
3.4	0.06	0.9
5.0	0.01	0.1
5.6	0.05	0.7
2.0	0.04	0.6
1.8	0.02	0.3
3.4	0.01	0.1
4.0	0.01	0.1

Table III: Absorption rate of various foods by the crustaceans

Type of food	*Eurytemora*		
	No. of observations	S_u (in mkg, S/day	S_u/S (in %)
Saprophytic bacteria	3	0	0
Chlorella	8	0.03+0.006	0.4
Scenedesmus	2	0	0
Chlamydomonas	2	0	0
Microcystis	-	-	-
Paramaecium	-	-	-
Keratella	4	2.6+0.3	40
Bosmina	3	0.1+0.002	1.5

Table III: Absorption rate of various foods by the crustaceans

Type of food	Hemidiaptomus		
	No. of observations	S_u (in mkg, S/day	S_u/S (in %)
Saprophytic bacteria	10	0.8+0.09	1.0
Chlorella	10	0.2+0.01	0.3
Scenedesmus	10	4.3+0.06	5.8
Chlamydomonas	10	8.0+0.6	10.8
Microcystis	-	-	-
Paramaecium	-	-	-
Keratella	10	11.5+0.8	15.7
Bosmina	10	5.4+0.5	7.2

Table III: Absorption rate of various foods by the crustaceans

Type of food	Heterocope		
	No. of observations	S_u (in mkg, S/day	S_u/S (in %)
Saprophytic bacteria	2	0	0
Chlorella	6	0.07±0.05	0.3
Scenedesmus	6	0.3±0.1	1.2
Chlamydomonas	2	0	0
Microcystis	6	0.02±0.0	0.1
Paramaecium	4	1.0±0.08	4.0
Keratella	9	2.3±0.2	9.2
Bosmina	2	8.5±0.5	34.0

In short term control experiments on the feeding of crustaceans (Daphnia pulex), known to feed on algae (a culture of Chlamydomonas), S_u was very high (6 mkg S/specimen x day) which is 100 fold the figure obtained when E. velox is fed Chlorella.

E. velox's ability to utilize small invertebrates suggested special experiments concerning the absorption of animal food. The crustaceans were offered Keratella cochlearis (100 mk long) and Bosmina longirostris (200 - 300 mk long). Considering that E. velox is not an active carnivore, the concentration of food objects in the experiment containers was relatively high. The results are shown in table 3, indicating that animal food was absorbed considerably better than algae. Experiments utilizing bosminae yielded very low values of S_u, which demonstrates that E. velox ~~is incapable~~ rejects ~~on~~ animals larger than 200 mk.

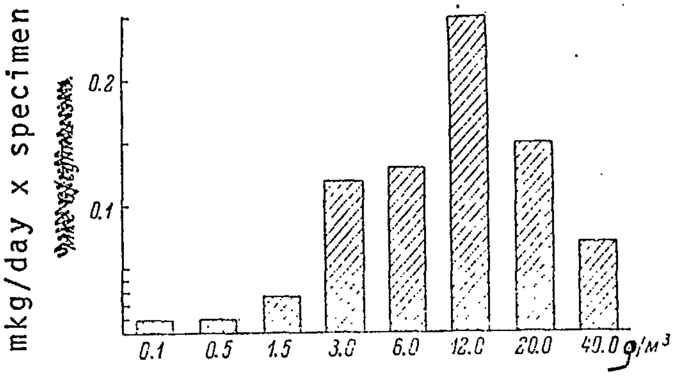

Diagram 7: The influence of chlorella concentration (in g/cu.m.) on S_u (in mkg S/day x specimen) with Eurytemora velox.

It may be assumed that in nature E. velox's food consists mainly of small animals (protozoa, rotatoria)
Planktonic algae and detritus should be regarded as supplementary sources of food.

Hemidiaptomus amblyodon. This species, as opposed to many others, ~~soars, but~~ is ~~rather~~ in constant motion - a rapid and fluid gliding - brought about by vibrating the oral appendices. This vibration gives the crustacean an advancing movement and a speed (about 2 cm/ sec.) which is considerable if its size is taken into account. The swimming pattern of H. amblyodon is schematically illustrated in drawing 1.

On a small area of water, where the crustacean can no longer move, his oral appendices continue to vibrate actively and create mighty currents which differ little from the currents produced by Eurytemora. These currents may be found in a radius up to 10 mm from the crustacean. Into them are drawn particles suspended in the water, small invertebrates & ~~[illegible]~~ (copepoda nauplii, young Cladocera & Rotatoria) which are seized by the second maxillae and directed towards the mouth. Apparently food capturing is the same as with Eurytemora. But unlike the latter, H. amblyodon is also capable of active hunting. In this it is aided by an exceptional ability - to move and maneuver..The crustacean rapidly glides through the water with broadly spread antennae. The numerous bristles on the antennae act as detectors. When some animal (Daphnia, Polyphemus) comes within the radius of the first antennae, H. amblyodon changes direction of motion towards the irritant by a sharp strike of its abdomen.

At this time one can observe how the relatively large maxillary legs of H. amblyodon move slightly downward and to the side. The seizing movement is so rapid that it is difficult to observe the function of particular appendices. Having seized the prey, the crustacean continues to swim rapidly, holding its prey with the second maxillae and the maxillary legs. Small polyphemes (dimensions up to 1 mm) are eaten very rapidly.

Female H. amblyodons are considerably larger than males and are more active hunters. We did not observe any canibalism. Distributed among small aquariums previously stocked with polyphemus, the crustaceans actively hunted, and even after an hour the remains of cladocera bodies were on the bottom of the aquariums. Arthropoda fecis contained polyphem remains (breast legs, parts of antennae).

The following experiment was conducted to clarify which animal species then inhabiting the reservoir were prefered for food. Aquariums with 500 cc of natural water were stocked with H. amblyodon (males and females seperately) and food was introduced in the form of Scapholeberis mucronata (0.9 - 1.1 mm), Polyphemus pediculus (0.7 - 0.9 mm), Simocephalus vetulus (1.0 - 1.1 mm) and Acanthodiaptomus denticornis (1.1 - 1.3 mm). The experiment was repeated three times and lasted 24 hours at 20 degrees C. Under these conditions H. amblyodon expressed a clear preferedce for Polyphemus and Scapholeberis. Simocephalus was consumed in smaller quantities and Aconthodiaptomus was entirely rejected. The first two species, forming flocks, were most easily accessible to H. amblyodon. *Simocephalus* rapidly clung to the aquarium walls, thereby noticably reducing the chances of meeting the predator. *A. denticornis*, freely floating through the water, were always able to escape collision with *H. amblyodon* due to their ability to make sharp jumps at the moment of danger.

The predatory feeding habit of *H. amblyodon* does not inherently exclude the ability to filter. We have said that its oral appendages create strong currents. Table 3 shows the results of experiments aimed at establishing *H. amblyodon*'s ability to utilize various foods. The experiments were conducted at temperatures of 18 - 20 degrees ~~Centigrade~~ and lasted 3 - 4 hours. 10 crustaceans each were placed in 50 cc containers. Each experiment was repeated five times. Food concentration in the containers was aimed to duplicate natural conditions.

H. amblyodon is a large form which has a mouth apparatus clearly witnessing the predators' feeding habit as well as its capacity to filter and absorb both bacterioplankton and algae. It is interesting that the absolute absorbtion quantities of *H. amblyodon* were considerably larger than those of *Eurytemora*, while the latter would seem much better adjusted for feeding on small objects (table 3). Only the amount of *Clorella* absorption remained quite small with *H. amblyodon.*

The amount of animal food absorbed, especially of rotifers was predictably higher: indices of absorption reached 15% (table 3).

The daily rations were obtained in experiments of various duration at a temperature of 20 degrees (table 4). In the first two series (duration 24 - 18 hours) the relation of average daily food consumption (in mkg S) to the carbon content of the predator's body amounted to 30 - 50%. These figures are close to those previously obtained for predatory cyclops (Monakov & Sorokin, 1959; Shushkin & Pechen', 1964).

The third series of experiments consisted of ten observations yielding very high indices of utilization R/S (table 4)

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Table IV: Relation between duration of Experiment and daily consumption of food by the crustacean Hemidiaptomus amblyodon

Duration of Experiment (in Hours)	type of food	Concentartion (in specimens/l)	Biomass (in g/cc)	R (in mkg S/day)	R/S in %	No of observations
24	mixed	120	9.0	22.3	30.0	6
18	Polyphemus	60	4.5	39.3	53.1	10
4	Polyphemus	60	4.5	127.0	171.6	10

The values are undoubtedly greater than those obtained in nature. This points to the possiblity of obtaining excessive figures for the predator's daily rations in a short term experiment, at the expense of the daily rhythm of their feeding. Short term experiments to determine the daily consumption are probably only valid for filtrator crustaceans whose feeding process is often directly related to their breathing and movements.

Thus *H. amblyodon* is capable of actively hunting comparatively large crustaceans (1.5 mm) and to filter food particles 0.2 x 2 mk. The available information makes it difficult to judge the basic feeding method. Apparently both ways are utilized equally by this species in its natural state since the intestines of specimens usually contain animal remains, algae and detritus-like material.

Heterocope appendiculata. The basic means of locomotion are short, uninterrupted jumps, effected by simultaneous strikes of the abdomen and the rear antennae. At the same time *H. appendiculata*, like the two previous species, can speed up the motion of the second antennae thereby creating water currents which slowly move it forward. This type of motion is not characteristic of the species. (illustration 2).

In spite of the fact that *H. appendiculata*, and apparently the other species of this family, can create filtering currents with their oral appendages, a predatory feeding habit predominates. The mechanism for seizing prey is not appreciably different from that previously described by us for *Heterocope* saliens (Monakov 1968). H. appendiculata does not persue its prey, but rather reacts to its presence. In this case H. appendiculata's activity increases markedly, its movements become brisker. The crustacean begins to circle the place of contact with its prey with widely spread antennae. If the latter is not highly mobile, the predator seizes it fairly rapidly. The second maxillae and maxillary legs, which carry strong, thorn-like bristles which become smaller at the edges (illustration 5 & 6) hold and press the prey to the mouth. The position of the swimming legs remains the same - they are stretched forward and the ends of their feathered bristles seem to cover the victim's body from below.

Having seized its victim, heterocope continues to swim actively. (This peculiarity of predatory calanid behaviour distinguished them from cyclopods who usually sink with their prey to the bottom or onto water plant branches.) Rapidly moving its oral appendices, the predator maneuvers its prey so that its head faces the oral opening, while the thorns of the upper lip hold it from above.

Apparently the mandibles aid in tearing the food which is then pushed into the oesophagus by rhytmic contractions of the gullet. This is confirmed by dissection: the intestines of individual H. appendiculata taken from nature contain large numbers of animal remains [1] (Table 5). Therefore the predatory feeding habits of this species is beyond doubt.

Table 5. Heterocope appendiculata food (based on dissection)

Food remains	No. of intestines conaining remains	% of intestines conaining remains
algae	5	8.9
indistinguishable remains of crustaceans	6	10.7
copepods	25	44.4
Cladocera	21	37.5

1- Mainly thoracic peduncles and postabdomen of cladocera; mandibles and swimmerets of copepoda.

Describing the movements of *H. appendiculata*, we said that the crustacean can also create filtering currents which are not as strong as those of the first two species. Observations on small quantities of water showed that the currents are sufficient to draw small algae into the food chamber. The intestines of the experimental animals soon acquired algae colouring. Later, *heterocope*'s filtering ability was confirmed by experiments, although its utilization of algae was considerably smaller than that of *Eurytemora velox* (Table 1) and their absorption very low (Table 3). Experiments which involved feeding a culture of *Scenedesmus* to *H. appendiculata* made for an exception: here S_u measured 0.3 mkg S/specimen day.

The absorption of animal feed was high. When feeding on *rotatoria*[1], S_u measured 2 mkg, ie: approximately the same as *Eurytemora velox* which feeds on this food, but five times lower than *Hemidiaptomus amblyodon*. When *Bosmina longirostris* was utilized as food, a record figure of 8 mkg S was reached. The relationship of S_u to S was then a little over 30%. S_u was fairly high when *Heterocope appendiculata* was fed protozoa (table 3). When the concentration of food (*Ceriodaphnia quadrangula*) was raised, S_u reached a maximum at *H. appendiculata's* biomass of 4 g/cu. m. and then began to waver (illustr. 8).

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[1] Rotifers.

Table 6. Heterocope's daily consumption of animal feed (*Polyphemus*)

Concentration (specimens/l)	100
Biomass (in g/cu m.)	7.5
Experiment duration (in hrs)	24
Number of observations	2
R (in mkg S/day)	11.6
R/S (in %)	46.0

In the aquarium, H. appendiculata, like H. amblyodon, eats mainly polyphemus and utilizes almost no large daphnii and diatomids. The amount of daily favourite food consumption (polyphemus pediculus) was 11. 6 mkg S/specimen day or 46% of the predator's body carbon content (table 6).

One may conclude that the predominant favourite food of H. appendiculata are various types of planktonic crustaceans, rotatoria and protozoa. Algae with cells no smaller than 10 - 20 mk are apparently a supplememtary source of food.

We observed three types of feeding habits on three calanid species: filtration (Eurytemora velox), mixed (Hemidiaptomus amblyodon) and predatory (Heterocope appendiculata).

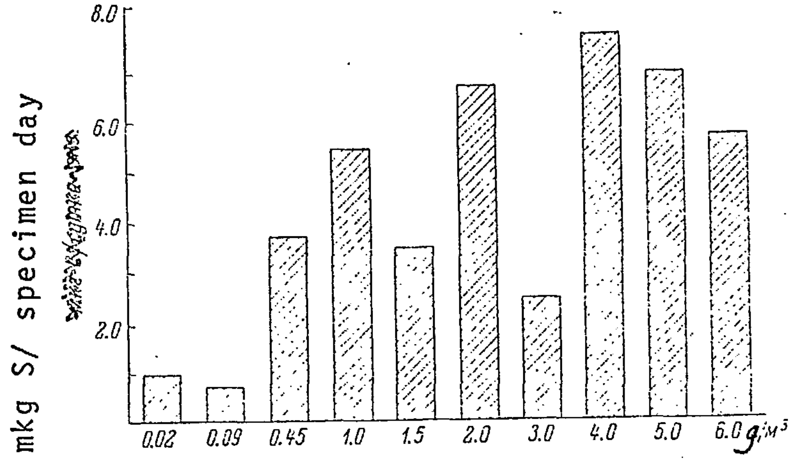

Diagram 8. The influence of food concentration (Ceriodaphnia in g/cu. m.) on S_u(in mkg S/ specimen day) with Heterocope appendiculata.

The first and third species do not exclude other types of feeding. We shall try to clarify the extent to which the oral appendices of these species determine their feeding habits. So far this has only been attempted for salt water copepods (Anraku a Omori, 1963; Petipa, 1967).

Single branched, multi-segmented calanid antennae have a similar structure and assure the crustacean's soaring ability. In the male, one antenna also serves a holding function during copulation. It is possible that the first antennae are also sense organs. The second or rear antennae have two branches. Their endopodites consist of two segments, the exopodite of seven. Both branches attach to the bi-segmented basopodite and are armed with feathered bristles (ill. 2). The second antennae of the species serve locomotion and their circular motion creates filtering currents. In the three species, the second antennae have significantly lost the ability to circular motion. They are noticably different from the second antennae of H. amblyodon and E. velox in number, length and degree of bristle feathering (illistration 2). This tends to explain H. appendiculata's low gliding ability, in comparison to the others two species.

The next two pair of oral appendices are the mandibles, shaped like a chitin plate armed with teeth, turned inward and covered from above by a lip (illustration 3).

The mandible's role reduces itself to grinding and tearing particles. Some salt water calenoida have various types of flint capped mandibular teeth which may be used for systematization (Beklemishev 1954b, 1959). Attached to the plate is the mandibular palpus - a well developed growth which differs little from the second antennae. The mandibular palpus consists of the bi-segmented endopodite and the four-segmented exopodite. The functional role of the mandibular palpi is analogous to the second antennae. The species studied do not display a large difference in their structure.

The first maxillae and maxillulae are plates with heavily feathered bristles. The maxillae are not segmented, but one may distinguish a basopodite having a first segment with three endites on the inside and one exside on the outside which ~~look like~~ resemble the growth on the second segment of the basopodite (illustration 4). The maxillular exsides in the species studied and some salt water calanoida participate in the filtering of food particles, while the predatory type appendage endites, armed with short and strong thorn-like bristles, can participate in holding the prey. The general structure of the first maxillae is similar in the species studied.

The second maxillae consist of two basopodite segments and one tri-segmented branch. It should be noted that its segmentation is not always clear. The ends are armed with long, closely feathered bristles.

The second maxillae armament varies among the species studied. Crustaceans capable of filtering have the second maxillae as the basic sifting device (illustration 5a, b). With *Eurytemora velox* and *Hemidiaptomus amblyodon* the proximate and distal bristles of the second maxillae are closely feathered with hairs which increase the filtering capacity of the appendix. At the same time, the second maxillae of *Hemidiaptomus amblyodon* help the maxillipeds to seize and hold their prey by virtue of their large size. Typical predators (*Heterocope appendiculata*) have firmer distal bristles on the second maxillae. They resemble claws and are not feathered (illustration 5c).

The last pair of oral appendices are the maxillary legs which consist of two large basopodite segments and one four or five segment branch. The build and aramament of the maxillary legs is closely related to the animals feeding habits. The mid and dital parts of *Eurytemora velox* maxillary legs are closely covered with hairs and only in the proximal parts are they thorn-like and show little feathering (illustration 6a).

In the case of *Hemidiaptomus amblyodon*, only the four distal bristles are reminiscent of the appearance of those on *Eurytemora velox*. The remaining appendages on the endopodite are claw-like and have hairs only on the inside (illustration 6b).

The maxillipeds of the predatory *Heterocope* entirely loose the appearance of filtering appendices and are armed with mighty claw-like bristles along the whole inside edge, including the proximal parts (illustration 6c).

Thus there is a distinct relationship between the structure of the oral appendices, their function and the feeding habit.

Let us note that although the species' studied posses a fairly similar and analogous functional apparatus for seizing food, the crustaceans' feeding habits differ noticably. This holds true even within the family *Diaptomidae*. Thus *Endiptomus coeruleus* (Rylov, 1930) and *E. gracilis* (Naumann, 1923; Malovitski & Sorokin, 1961) belong to typical filtrators, while *Hemidiaptomus amblyodon* (current paper) utilizes mixed feeding.

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The biological distinction between the feeding habits of the different species which often live simultaneously in the same biotype, is evident. This question has been sufficiently clarified by Fryer (1954) on two species of *Eudiaptomus* and later by the same author (Fryer, 1957) in a work on the feeding of cyclopoids.

The co-existence of *Eurytemora velox* and *Heterocope appendiculata* in the reservoir shows that both species are assured food, have different feeding needs. The shortage of one food or another may occur in small reservoirs (artificial pools, puddles) but their inhabitants (specifically *Hemidiaptomus amblyodon*) are very flexible in their feeding habits. Another species inhabiting temporary reservoirs - *Heterocope saliens* - feeds on animals if they are present, or on phytoplankton when these are absent and even on tree pollen (Monakov, 1968). Such flexibility is apparently common to most species whose life cycle is limited by the duration of water in the reservoir.

Footnote

1. Among the bowel remains there is a predominance of thoracic legs, *cladocera* postabdomens, copeped mandibles and swimming legs.

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