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COPEPODS COLLECTED ON THE WHALING GROUNDS OFF NORTHERN JAPAN AND AROUND THE BONIN ISLANDS

Masateru Anraku
Faculty of Fisheries, Hokkaido University

Introduction

Since Brady (1883) reported on the pelagic copepods in the western Pacific adjacent to Japan in the Challenger Expedition, 1873–76, copepod fauna in this region has been investigated by several Japanese workers. Sato (1913) made research around Hokkaido, Marukawa (1921) in the northern Pacific near Japan, and Tanaka (1935, 1937, 1938, 1953) in the Izu region. In 1937 Mori published a monograph of copepods from waters neighbouring Japan. Honjo (1951) gave an account of copepods from the Izu Islands region, and Matsue & Komaki (1952) on the materials from the same region. The author has made investigations on plankton copepods off Sanriku (Anraku, 1952), in the Oshoro Bay, west coast of Hokkaido (Anraku, 1953), and in the Okhotsk Sea (Anraku, 1954).

The present paper is a report on the faunistic investigation of plankton copepods collected from the whaling grounds in the northwestern Pacific and around the Bonin Islands in 1951 and 1952 inclusive.

The author wishes to express his hearty thanks to Professor Sigeru Motoda, Faculty of Fisheries, Hokkaido University, for valuable suggestions rendered during the course of his work. He also desires to acknowledge his indebtedness to Dr. Tokiharu Abe, of the Tokai Regional Fisheries Research Laboratory, for providing him facilities of the present investigation. Thanks are also due to the Committee for the Improvement of Equipment of Whaling Vessels for kindly placing materials at his disposal.

Northwestern Pacific

In 1951 the collections were made by the catcher boat, Toshi Maru No. 3, at thirty-four positions (fig. 1) from August 14 to September 2. The net, made of material nearly equal to no. 3 bolting cloth, 45 cm in mouth diameter, was hauled from 150 metre depth to the surface at every station. The collections in 1952, were made by the catcher boat, Konan Maru No. 6, at twenty-nine positions (fig. 1) from August 30 to September 13, and the hauls were made from either 100 or 150 metre depth to the surface.

From the materials more than seventy species of copepods were identified (table 1). Often the warm water type of copepod was represented by such species as Copilia mirabilis, Sapphirina nigromaculata, Paracalanus aculeatus, Corycaeus...
speciosus, Setella gracilis, Euterpe acutifrons, Labidocera acuta and Temora stylifera, while the cold water type was represented by such species as Calanus cristatus, C. plumchrus, Eucalanus bungii bungii, Pseudocalanus minutus and Candacia columbiae. The species number of warm water type was comparatively large, though less in individual number, while the species number of cold water type was very small, each species being composed of abundant individuals.

The adult forms of neither Calanus cristatus nor Calanus plumchrus were found in these collections, possibly due to the shallow haul. The most part of the above species collected were those of copepodid stage V. Yanagisawa (1942) mentioned that the southern species, such as Eucalanus subcrassus, were found even at a station situated 39°N, 143°E. In the present materials there were many southern forms of copepods additional to Eucalanus subcrassus even in the region between 41°N and 42°N.

However, Gaidius, Gaetanus, Pleuromamma and Heterorhabdus and Phyllopus which were found in the previous collection in this region (Anraku, 1952), were rare or absent in the present materials, probably due to the shallow haul in the present case as compared with the previous work. Among the twenty-eight species of copepods reported by Marukawa (1921) from the northwestern Pacific near Japan, the following twelve species could not be found from the present materials; viz., Calanus pauper, Eucalanus ocularus, Euchaeta tonsa, Labidocera wollastoni, L. pav, Metridia longa, Pontella chierchiae, Corycaeus danae, C. venustus, Sapphirina gemma, Scolecithrix danae and Pseudolovenula magna. On the other hand, more

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Fig. 1. Chart showing the positions of collection in 1951 (●) and 1952 (×)
### Table 1. List of species collected in the northwestern Pacific

<table>
<thead>
<tr>
<th>Species</th>
<th>Author/Reference</th>
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<td><em>Calanus plumchrus</em></td>
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<td>KRÖYER</td>
</tr>
<tr>
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<td>CLAUS</td>
</tr>
<tr>
<td><em>C. tenuicornis</em></td>
<td>DANA</td>
</tr>
<tr>
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<td>CLAUS</td>
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<td><em>C. vulgaris</em></td>
<td>DANA</td>
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<tr>
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<td><em>Eucalanus elongatus</em></td>
<td>DANA</td>
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<tr>
<td><em>E. bungii bungii</em></td>
<td>JOHNSON</td>
</tr>
<tr>
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<td>DANA</td>
</tr>
<tr>
<td><em>E. subcrassus</em></td>
<td>GIESBRECHT</td>
</tr>
<tr>
<td><em>E. sp.</em></td>
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<tr>
<td><em>Rhincalanus nasutus</em></td>
<td>GIESBRECHT</td>
</tr>
<tr>
<td><em>Paracalanus aculeatus</em></td>
<td>GIESBRECHT</td>
</tr>
<tr>
<td><em>P. parvus</em></td>
<td>CLAUS</td>
</tr>
<tr>
<td><em>Acrocalanus gracilis</em></td>
<td>GIESBRECHT</td>
</tr>
<tr>
<td>Clausocalanus <em>pfegens</em></td>
<td>FARRAN</td>
</tr>
<tr>
<td><em>C. furcatus</em></td>
<td>BRADY</td>
</tr>
<tr>
<td>Pseudocalanus <em>minutus</em></td>
<td>KRÖYER</td>
</tr>
<tr>
<td>Bradyidius <em>armatus</em></td>
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<td><em>Euchaeta marina</em></td>
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<tr>
<td>Scolecithricella <em>minor</em></td>
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<tr>
<td>Scolecithrix sp.</td>
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</tr>
<tr>
<td>Phaena <em>spinifera</em></td>
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<td>Centroperges <em>bradyi</em></td>
<td>Wheeler</td>
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<td><em>T. stylifera</em></td>
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<td>Metridia lucens</td>
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<td>Lucicutia flavicornis</td>
<td>CLAUS</td>
</tr>
<tr>
<td>Heterorhabdus papilliger</td>
<td>CLAUS</td>
</tr>
<tr>
<td>Candacia <em>bipinnata</em></td>
<td>GIESBRECHT</td>
</tr>
<tr>
<td><em>C. columbiae</em></td>
<td>CAMPBELL**</td>
</tr>
<tr>
<td><em>C. spp.</em></td>
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<td><em>Acartia negligenis</em></td>
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<tr>
<td>A. <em>danae</em></td>
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<td><em>L. detruncata</em></td>
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<tr>
<td><em>Oncaeae venusta</em></td>
<td>PHILIPPI</td>
</tr>
<tr>
<td><em>O. media</em></td>
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</tr>
<tr>
<td><em>O. conifera</em></td>
<td>GIESBRECHT</td>
</tr>
<tr>
<td><em>O. mediterranea</em></td>
<td>CLAUS</td>
</tr>
<tr>
<td><em>O. sp.</em></td>
<td></td>
</tr>
<tr>
<td><em>Sapphirina nigromaculata</em></td>
<td>CLAUS</td>
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<td><em>S. sp.</em></td>
<td></td>
</tr>
<tr>
<td><em>Coelilia mirabilis</em></td>
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</tr>
<tr>
<td><em>C. quadrata</em></td>
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</tr>
<tr>
<td>Corycaeus <em>anglicus</em></td>
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</tr>
<tr>
<td><em>C. speciosus</em></td>
<td>DANA</td>
</tr>
<tr>
<td><em>C. spp.</em></td>
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</tr>
</tbody>
</table>

*According to the communications of Mr. Z. Nakai and Dr. O. Tanaka *Calanus plumchrus* Marukawa 1921 is quite identical with *C. tonsus* Brady 1883.

**The author is indebted to Dr. O. Tanaka for kindness in informing him that *Candacia pacifica* Mori 1937 was pointed out by Davis (1949, Univ. Wash. Publ. Zool., 14) to be the synonym of *C. columbiae* Campbell 1929.

than thirty species found in the present investigation were not described in the list of Marukawa (1921).

The number of individuals of the principal copepods occurring in 1951 is given in table 4. The samples from stations 10, 19, 21 and 27 were mainly composed of
such cold water species as Calanus plumchrus, C. cristatus and Eucalanus bungii bungii, indicating the prevailing cold Oyashio Current. The warm water species, such as Sapphirina, did not appear in those stations. However, the two types of copepods have intermingled at stations 4, 25 and 38. The total number of individuals in the areas eastward from station 32 was very small, there being collected only a few individuals of Temora and Corycaeus.

Thalassiothrix mediterranea var. pacifica, one of the temperate or south temperate species of diatom, was abundantly found in each of the seventeen stations. This species is one which has been reported by Cupp (1943) as a new variety distributed off southern California and in the Gulf of California, sometimes in moderately large numbers.

The individual number of the principal copepods occurring at each position of 1952 is given in table 5. The difference of copepod fauna between 1951 and 1952 was shown by the presence of Copilia mirabilis and Calanus vulgaris, as well as abundant occurrence of other warm water species, but this may have no significance but that the period and latitude of collection differed in these two years.

Generally, the warm water species occurred in richness in areas southward from 41°N, and in these areas, the cold water species, Calanus plumchrus and Calanus cristatus, greatly decreased in number. The warm water species entirely disappeared from the northern positions, off Shikotan Island (St. 27, 28, 29, 30 and 32), while a large number of Calanus plumchrus, C. cristatus and Eucalanus bungii bungii were found in these positions.

The monotonous communities of diatoms composed of Chaetoceros atlanticus and Ch. concavicornis, which are both cold water species, covered the areas of positions 28 and 32.

Around the Bonin Islands

In 1951 the collections were made by the Shinyo Maru, training ship of the Tokyo University of Fisheries, at forty-nine positions (fig. 1) from April 23 to May 15. The net was hauled from 150 metre depth to the surface, but sometimes from 50 metres. The collections in 1952 were made by the catcher boat, Seki Maru No. 11, on forty positions (fig. 1) from June 27 to July 12. The hauls were made from 100 metre depth to the surface.

About eighty species of copepods were identified (table 2); half of them belonged to the warm water species.

Brady (1883) mentioned sixteen species of copepods gathered from the southern waters of Japan. Among the species which he has listed, Aetideus giesbrechti, Scolecithrix danae, Centropages violaceus, Pontella plumata (= Pontellina plumata) and Setella gracilis were found in the present investigation. The following eleven species did not appear in the present materials though they were listed by Brady (1883): Calanus propinquus, C. tonsus, Eucalanus setiger, Rhincalanus gigas, Euchaeta hessel, Leuckartia scapularis, Candacia pectinata, Pontella detruncata,
Table 2. List of species collected around the Bonin Islands

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<tr>
<td>- <em>C. minor</em> (CLAUS)</td>
<td></td>
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<tr>
<td>- <em>C. vulgaris</em> (DANA)</td>
<td></td>
</tr>
<tr>
<td>- <em>C. darwinii</em> (LUBBOCK)</td>
<td></td>
</tr>
<tr>
<td>- <em>C. pauper</em> GIESBRECHT</td>
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<td>- <em>C. gracilis</em> (DANA)</td>
<td></td>
</tr>
<tr>
<td>- <em>Eucalanus elongatus</em> (DANA)</td>
<td></td>
</tr>
<tr>
<td>- <em>E. attenuatus</em> (DANA)</td>
<td></td>
</tr>
<tr>
<td>- <em>E. crassus</em> GIESBRECHT</td>
<td></td>
</tr>
<tr>
<td>- <em>E. subcrassus</em> GIESBRECHT</td>
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<tr>
<td>- <em>E. mucronatus</em> GIESBRECHT</td>
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<td>- <em>Rhincalanus nasutus</em> GIESBRECHT</td>
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<td>- <em>R. cornutus</em> DANA</td>
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<td>- <em>P. parvus</em> (CLAUS)</td>
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<td>- <em>Acrocalanus gracilis</em> GIESBRECHT</td>
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<tr>
<td>- <em>Clausocalanus furcatus</em> (BRADY)</td>
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<td>- <em>C. arcuicornis</em> (DANA)</td>
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<td>- <em>Euchaeta marina</em> (PRESTANDREA)</td>
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<td>- <em>Phaenna spinifera</em> CLAUS</td>
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<td>- <em>Centropages bradyi</em> WHEELER</td>
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<td>- <em>C. concinnus</em> DANA</td>
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<tr>
<td>- <em>C. spp.</em></td>
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*Oncaea obtusa* and *Phyllopus bidentatus*.

The composition of the copepod community of the two years as studied by the present author does not show any striking difference. Individual number occurring at each position of 1951 and 1952 is listed in tables 6 and 7 respectively.

**Considerations of the occurrence of warm water copepods at various latitudes**

The distribution of the warm water copepods has often been studied from the viewpoint of zoogeography (Ekman, 1953, pp. 324-332). Three genera, *Sapphirina*, *Copilia* and *Corycaeus*, have been considered to be those which are mainly distributed in the warmer latitudes.

The number of the positions where the above genera have occurred is tabulated against the total number of positions of net haul divided into various latitudes (table 3).

Table 3. Number of positions at which three most common genera of warm water copepods were present in 1951—52 inclusive. Figures in parentheses are total number of positions where net haul was made.

<table>
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<th>Latitude (N)</th>
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<th>Sapphirina</th>
<th>Copilia</th>
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It may be clearly seen from this table that the above warm water genera were distributed at almost every position situated in the southern latitudes whilst the occurrences were few in the positions of northern latitudes. *Corycaeus* was the most numerous in number of individuals among the three and it did not occur in the area on the north of 41°N, while it appeared all stations on the south of 28°N. The number of individuals of both *Sapphirina* and *Copilia* was smaller than that of *Corycaeus* throughout the observations. These two had entirely disappeared in the region northwards of 40°N, though they occurred often in the southern latitudes.

The distribution area of the above copepods is possibly responsible to the
flowing up of the warm Kuroshio Current in the North Pacific.

Summary

1. More than one-hundred species of pelagic copepods were identified from the materials sampled off northern Japan and around the Bonin Islands in 1951 and 1952.

2. Typical cold water copepods (Calanus cristatus, C. plumchrus, Eucalanus bungii bungii, Pseudocalanus minutus and Candacia columbiæ) occurred richly in the region northward from 38°N, while typical warm water copepods (Copilia spp., Sapphirina spp., Corycaeus spp., Calanus minor, C. vulgaris, C. darwinii, C. pauper, Eucalanus elongatus, E. crassus, E. subcrassus, Mecynocera clausi, Paracalanus aculeatus, Aetideus giesbrechti, Temora stylifera, T. tubinata, T. discaudata, Labidocera acuta, L. detruncata, Setella gracilis, Euterpe acutifrons) were commonly found in the southern region, having not occurred northward from 42°N.

3. The number of positions at which three genera of the typical warm water copepods (Copilia, Sapphirina and Corycaeus) have occurred was decreased northward, these copepods having occurred at nearly all positions of southern latitudes.

Literature cited


· · · · · · · · · · (1953). Seasonal distribution of pelagic copepods at Oshoro Bay, west coast of Hokkaido. Ibid. 3 (3), 187–192.

· · · · · · · · · · (1954). Distribution of plankton copepods off Kitami, Hokkaido, in Okhotsk Sea in summer, 1949 and 1950. Ibid. 4 (4), 249–254.


Table 4. Result of collection from northwestern Pacific in 1951

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