

List of microplankton in Uranouchi Inlet, Kochi, Japan during the summer of 1997

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Abstract: Ninety-nine species of microplankton excluding crustaceans are listed from Uranouchi Inlet, Kochi, Japan, during the summer of 1997. The list comprises 33 new records from Uranouchi Inlet.

Key words: Microplankton, phytoplankton, microzooplankton, Uranouchi Inlet

INTRODUCTION

Uranouchi Inlet is a semi-enclosed eutrophic inlet and leads to the open sea through a shallow mouth at Tosa Bay. It is known that the external saline water intrudes into the bottom of the Uranouchi Inlet at the spring tide. The difference between the densities of external and internal waters causes the intrusion, when the density of external water becomes higher than that of internal water in the summer stratification season (Munekage *et al.*, 1991). We investigated a short-term variation of microplankton effected by the intrusion during the summer of 1997. In this paper we report a list of microplankton in this study.

MATERIALS AND METHODS

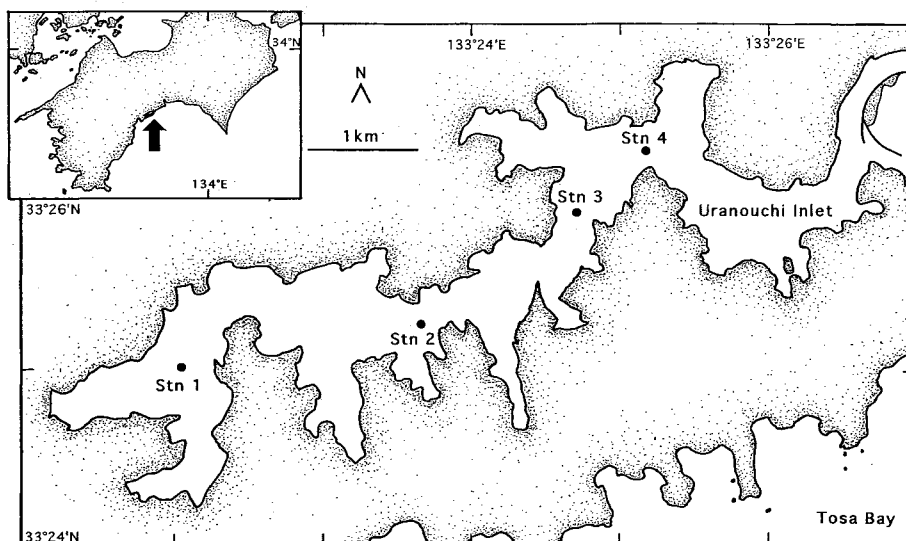


Fig. 1. Sampling locations in Uranouchi Inlet, Kochi, Japan.

Samples were collected at four stations in Uranouchi Inlet twice a week from 23th June through 28th July, 1997 (Fig. 1). Water samples were collected with a Niskin water sampler at four depths (0 m, 4 m, chlorophyll maximum layer and 1 m above the bottom) at each station. Samples were preserved in 1% borax-buffered formalin. The fixed samples were concentrated by settling and species identification and counting were made with a microscope. Copepods and the other crustaceans were not counted in this study. Species names of Bacillariophyceae and the others follow Yamaji (1984) and Chihara and Murano (1997), respectively.

RESULTS AND DISCUSSION

Ninety-nine species of microplankton are listed (Table 1). Previous studies reported more than 110 species excluding crustaceans from Uranouchi Inlet (Ueta, 1949, 1975, 1976; Ohno *et al.*, 1971; Matsumura *et al.*, 1995; Nakamachi and Iwasaki, 1998). In this study, 33 species are new records in Uranouchi Inlet.

Chaetoceroce compressum, *Skeletonema costatum*, *Chaetoceroce curvisetum*, *Chattonella* sp., *Chaetoceroce distans*, *Chaetoceroce* sp.1, *Gyrodinium dominans*, *Chaetoceroce affine* and *Rhizosolenia fragilissimus* were the abundant species. Of these, one species, *Chattonella* sp. was red tide species. The red tide occurred on 4th July and 8th July during the sampling period. Maximum density of red tide species was 3102 cells/ml at Stn 1 on 8th July.

Table 1. List of microplankton at four stations in Uranouchi Inlet, Kochi, Japan during the summer of 1997. Asterisk indicates the new record from the inlet.

| Species | Mean density (cells/ml) | | | | Maximum density (cells/ml) |
|-----------------------------------|-------------------------|-------|-------|-------|-------------------------------|
| | Stn 1 | Stn 2 | Stn 3 | Stn 4 | |
| DIVISION CYANOPHYTA | | | | | |
| Class Cyanophyceae | | | | | |
| Order Oscillatoriales | | | | | |
| Family Phormidiaceae | | | | | |
| <i>Trichodesmium thiebautii</i> * | 2 | 2 | 0 | 0 | 86 |
| DIVISION DINOPHYTA | | | | | |
| Class Dinophyceae | | | | | |
| Order Prorocentrales | | | | | |
| Family Prorocentraceae | | | | | |
| <i>Prorocentrum micans</i> | 0 | 0 | 0 | 0 | 1 |
| <i>Prorocentrum minimum</i> | 0 | 0 | 0 | 0 | 1 |
| <i>Prorocentrum gracile</i> * | 0 | 0 | 0 | 0 | 1 |
| <i>Prorocentrum dentatum</i> * | 26 | 7 | 4 | 3 | 435 |
| <i>Prorocentrum sigmoides</i> * | 1 | 0 | 0 | 0 | 59 |
| <i>Prorocentrum triestinum</i> | 1 | 2 | 1 | 1 | 46 |
| Order Dinophysiales | | | | | |
| Family Dinophysiaceae | | | | | |
| <i>Dinophysis caudata</i> | 0 | 0 | 0 | 0 | 2 |
| Order Gymnodiniales | | | | | |
| Family Gymnodiniaceae | | | | | |
| <i>Katodinium glaucum</i> * | 1 | 0 | 0 | 0 | 13 |
| <i>Gyrodinium britannia</i> * | 0 | 0 | 0 | 0 | 2 |

Table 1. Continued.

| Species | Mean density (cells/ml) | | | | Maximum density (cells/ml) |
|---|-------------------------|-------|-------|-------|-------------------------------|
| | Stn 1 | Stn 2 | Stn 3 | Stn 4 | |
| <i>Gyrodinium dominans</i> * | 21 | 222 | 48 | 28 | 8552 |
| <i>Gyrodinium spirale</i> * | 0 | 0 | 0 | 0 | 3 |
| <i>Gyrodinium</i> sp. 1 | 0 | 0 | 6 | 6 | 136 |
| <i>Gyrodinium</i> spp. | 2 | 2 | 0 | 0 | 25 |
| <i>Gymnodinium mikimotoi</i> | 13 | 13 | 6 | 5 | 200 |
| <i>Gymnodinium sanguineum</i> * | 0 | 0 | 0 | 0 | 2 |
| <i>Gymnodinium</i> sp. 1 | 8 | 19 | 3 | 3 | 536 |
| <i>Gymnodinium</i> sp. 2 | 1 | 0 | 7 | 2 | 17 |
| <i>Gymnodinium</i> spp. | 0 | 0 | 0 | 0 | 4 |
| Order Noctilucales | | | | | |
| Family Noctilucaeae | | | | | |
| <i>Noctiluca scintillans</i> * | 1 | 0 | 0 | 0 | 13 |
| Order Gonyaulacales | | | | | |
| Family Ceratiaceae | | | | | |
| <i>Ceratium furca</i> | 2 | 2 | 1 | 0 | 55 |
| <i>Ceratium macroceros</i> var. <i>gallicum</i> | 0 | 0 | 0 | 0 | 1 |
| Family Gonyaulacaceae | | | | | |
| <i>Alexandrium</i> spp. | 0 | 1 | 1 | 0 | 48 |
| Order Peridinales | | | | | |
| Family Peridiniaceae | | | | | |
| <i>Proto-peridinium pellucidum</i> * | 1 | 0 | 0 | 0 | 30 |
| <i>Proto-peridinium</i> sp. 1 | 2 | 0 | 0 | 0 | 38 |
| <i>Proto-peridinium</i> sp. 2 | 0 | 0 | 0 | 0 | 4 |
| <i>Proto-peridinium</i> sp. 3 | 0 | 1 | 0 | 0 | 18 |
| <i>Proto-peridinium</i> sp. 4 | 0 | 0 | 0 | 0 | 17 |
| <i>Proto-peridinium</i> spp. | 1 | 1 | 1 | 1 | 13 |
| DIVISION HETEROKONTOPHYTA | | | | | |
| Class Chrysophyceae | | | | | |
| Order Dictyochales | | | | | |
| Family Dictyocaceae | | | | | |
| <i>Dictyocha fibula</i> var. <i>stapedia</i> | 25 | 15 | 5 | 8 | 610 |
| <i>Distephanus speculum</i> | 34 | 11 | 3 | 2 | 373 |
| Family Ebriaceae | | | | | |
| <i>Ebria tripartita</i> * | 0 | 0 | 0 | 0 | 11 |
| Class Raphidophyceae | | | | | |
| Order Raphidomonadales | | | | | |
| Family Vacuolariaceae | | | | | |
| <i>Chattonella</i> sp. | 275 | 94 | 40 | 66 | 3102 |
| Class Bacillariophyceae | | | | | |
| Order Centrales | | | | | |
| Suborder Coscinodiscineae | | | | | |
| Family Thalassiosiraceae | | | | | |
| <i>Lauderia annulata</i> | 0 | 0 | 0 | 0 | 8 |

Table 1. Continued.

| Species | Mean density (cells/ml) | | | | Maximum density (cells/ml) |
|--|-------------------------|-------|-------|-------|-------------------------------|
| | Stn 1 | Stn 2 | Stn 3 | Stn 4 | |
| <i>Skeletonema costatum</i> | 19 | 61 | 123 | 165 | 1740 |
| <i>Thalassiosira rotula</i> | 0 | 1 | 1 | 0 | 10 |
| <i>Thalassiosira subtilis</i> * | 0 | 0 | 0 | 0 | 8 |
| <i>Thalassiosira</i> sp. 1 | 0 | 0 | 0 | 0 | 2 |
| <i>Thalassiosira</i> sp. 2 | 1 | 1 | 2 | 1 | 41 |
| <i>Thalassiosira</i> spp. | 8 | 8 | 8 | 5 | 67 |
| Family Mellosiraceae | | | | | |
| <i>Leptocylindrus danicus</i> | 3 | 3 | 4 | 5 | 52 |
| <i>Melosira sulcata</i> | 0 | 0 | 1 | 0 | 19 |
| Family Coscinodiscaceae | | | | | |
| <i>Coscinodiscus gigas</i> | 0 | 0 | 0 | 0 | 1 |
| <i>Coscinodiscus</i> spp. | 0 | 0 | 0 | 0 | 1 |
| Suborder Rhizosoleniineae | | | | | |
| Family Rhizosoleniaceae | | | | | |
| <i>Guinardia flaccida</i> | 0 | 0 | 0 | 0 | 8 |
| <i>Rhizosolenia flagilissima</i> * | 47 | 61 | 34 | 20 | 572 |
| <i>Rhizosolenia delicatula</i> | 0 | 0 | 1 | 0 | 32 |
| <i>Rhizosolenia stolterfothii</i> | 0 | 1 | 2 | 1 | 32 |
| <i>Rhizosolenia setigera</i> * | 0 | 1 | 1 | 0 | 8 |
| <i>Rhizosolenia indica</i> * | 0 | 0 | 0 | 0 | 2 |
| <i>Rhizosolenia</i> spp. | 6 | 9 | 8 | 5 | 103 |
| Suborder Biddulphiineae | | | | | |
| Family Biddulphiaceae | | | | | |
| Subfamily Hemiauloideae | | | | | |
| <i>Campylosira cymbelliformis</i> * | 0 | 0 | 0 | 0 | 11 |
| <i>Cerataulina pelagica</i> * | 1 | 3 | 2 | 4 | 30 |
| <i>Eucampia zodiacus</i> | 0 | 0 | 1 | 0 | 16 |
| <i>Eucampia groenlandia</i> * | 0 | 0 | 1 | 0 | 20 |
| <i>Eucampia cornuta</i> * | 0 | 0 | 0 | 1 | 12 |
| <i>Hemiaulus sinensis</i> * | 0 | 0 | 1 | 0 | 12 |
| <i>Hemiaulus hauckii</i> | 0 | 0 | 1 | 0 | 12 |
| Subfamily Biddulphiodeae | | | | | |
| <i>Biddulphia mobiliensis</i> * | 2 | 6 | 10 | 12 | 184 |
| Family Chaetoceraceae | | | | | |
| <i>Bacteriastrum comosum</i> | 0 | 0 | 2 | 1 | 52 |
| <i>Bacteriastrum delicatulum</i> * | 0 | 0 | 0 | 1 | 14 |
| <i>Bacteriastrum hyalinum</i> | 0 | 1 | 1 | 1 | 52 |
| <i>Bacteriastrum mediterraneum</i> * | 0 | 0 | 2 | 1 | 19 |
| <i>Bacteriastrum minus</i> * | 0 | 2 | 2 | 1 | 38 |
| <i>Bacteriastrum varians</i> | 1 | 4 | 7 | 4 | 56 |
| <i>Bacteriastrum</i> spp. | 1 | 1 | 4 | 4 | 36 |
| <i>Chaetoceros affine</i> | 23 | 30 | 36 | 25 | 380 |
| <i>Chaetoceros affine</i> var. <i>willei</i> | 0 | 3 | 5 | 6 | 112 |
| <i>Chaetoceros anastomosans</i> | 1 | 9 | 13 | 15 | 240 |

Table 1. Continued.

| Species | Mean density (cells/ml) | | | | Maximum density (cells/ml) |
|--|-------------------------|-------|-------|-------|-------------------------------|
| | Stn 1 | Stn 2 | Stn 3 | Stn 4 | |
| <i>Chaetoceros atlanticum</i> var. <i>neapolitanum</i> | 0 | 0 | 0 | 0 | 12 |
| <i>Chaetoceros compressum</i> | 12 | 52 | 80 | 78 | 1092 |
| <i>Chaetoceros costatum</i> * | 1 | 8 | 20 | 14 | 428 |
| <i>Chaetoceros curvisetum</i> | 7 | 44 | 86 | 88 | 1024 |
| <i>Chaetoceros debile</i> | 0 | 0 | 0 | 1 | 28 |
| <i>Chaetoceros decipiens</i> | 2 | 1 | 1 | 2 | 24 |
| <i>Chaetoceros didymum</i> * | 1 | 0 | 1 | 1 | 15 |
| <i>Chaetoceros distans</i> | 0 | 0 | 0 | 0 | 15 |
| <i>Chaetoceros distans</i> s. l. | 19 | 73 | 69 | 92 | 1728 |
| <i>Chaetoceros lacinosum</i> | 0 | 2 | 1 | 0 | 48 |
| <i>Chaetoceros lorenzianum</i> | 7 | 3 | 4 | 2 | 220 |
| <i>Chaetoceros messanense</i> | 0 | 0 | 1 | 0 | 8 |
| <i>Chaetoceros paradoxum</i> * | 1 | 1 | 3 | 2 | 70 |
| <i>Chaetoceros pseudocurvisetum</i> * | 1 | 1 | 2 | 2 | 56 |
| <i>Chaetoceros radicans</i> * | 0 | 1 | 9 | 5 | 176 |
| <i>Chaeroceros sociale</i> | 0 | 0 | 0 | 0 | 15 |
| <i>Chaetoceros tortissimum</i> * | 0 | 1 | 1 | 1 | 30 |
| <i>Chaetoceros</i> sp. 1 | 57 | 51 | 61 | 29 | 767 |
| <i>Chaetoceros</i> sp. 2 | 0 | 6 | 3 | 6 | 198 |
| <i>Chaetoceros</i> sp. 3 | 0 | 7 | 5 | 4 | 132 |
| <i>Chaetoceros</i> sp. 4 | 1 | 6 | 4 | 0 | 164 |
| <i>Chaetoceros</i> sp. 5 | 0 | 0 | 0 | 0 | 12 |
| <i>Chaetoceros</i> sp. 6 | 1 | 1 | 0 | 1 | 22 |
| <i>Chaetoceros</i> spp. | 15 | 34 | 50 | 46 | 438 |
| Family Lithodesmiaceae | | | | | |
| <i>Lithodesmium variabile</i> * | 1 | 1 | 1 | 1 | 14 |
| Order Pennales | | | | | |
| Suborder Araphidineae | | | | | |
| Family Daitomaceae | | | | | |
| <i>Asterionella glacialis</i> | 0 | 0 | 2 | 0 | 64 |
| <i>Thalassionema nitzschioides</i> | 0 | 0 | 2 | 0 | 32 |
| Suborder Raphidineae | | | | | |
| Family Nitzschiaceae | | | | | |
| <i>Cylindrotheca closterium</i> * | 21 | 10 | 13 | 9 | 278 |
| <i>Nitzschia</i> spp. | 1 | 2 | 3 | 6 | 77 |
| <i>Pleurosigma</i> spp. | 0 | 0 | 0 | 0 | 15 |
| DIVISION EUGLENOPHYTA | | | | | |
| Class Euglenophyceae | | | | | |
| Unidentified species | 0 | 0 | 0 | 0 | 7 |
| DIVISION CHLOROPHYTA | | | | | |
| Class Prasinophyceae | | | | | |
| Unidentified species | 6 | 1 | 2 | 2 | 90 |

Table 1. Continued.

| Species | Mean density (cells/ml) | | | | Maximum density (cells/ml) |
|-------------------------------|-------------------------|-------|-------|-------|-------------------------------|
| | Stn 1 | Stn 2 | Stn 3 | Stn 4 | |
| PHYLUM PROTOZOA | | | | | |
| SUBPHYLUM CILIOPHORA | | | | | |
| Class Polyhymenophora | | | | | |
| Order Oligotrichida | | | | | |
| Suborder Origotrichina | | | | | |
| Unidentified species | 5 | 3 | 5 | 4 | 61 |
| Class Kinetofraagminophorea | | | | | |
| Order Prostomatida | | | | | |
| Family Didiniidae | | | | | |
| <i>Mesodinium rubrum</i> | 0 | 0 | 1 | 0 | 38 |
| Suborder Tintinnina | | | | | |
| Family Codonellidae | | | | | |
| <i>Tintinnopsis aperta</i> | 0 | 0 | 0 | 0 | 1 |
| <i>Tintinnopsis beroidea</i> | 0 | 0 | 0 | 0 | 3 |
| <i>Tintinnopsis corniger</i> | 0 | 0 | 0 | 0 | 5 |
| <i>Tintinnopsis dadayi</i> | 0 | 0 | 0 | 0 | 1 |
| <i>Tintinnopsis</i> sp. | 0 | 0 | 0 | 0 | 5 |
| Family Metacyclididae | | | | | |
| <i>Helicostomella sublata</i> | 0 | 1 | 1 | 0 | 19 |
| Family Ptychocylididae | | | | | |
| <i>Favella ehrenbergii</i> | 0 | 0 | 0 | 0 | 2 |
| <i>Favella tarakaensis</i> | 0 | 0 | 0 | 0 | 4 |
| Family Tintinnidae | | | | | |
| Subfamily Tintinnae | | | | | |
| <i>Amphorellopsis acuta</i> | 2 | 1 | 1 | 1 | 29 |
| Subfamily Salpingellinae | | | | | |
| <i>Eutintinnus lususundae</i> | 0 | 0 | 0 | 0 | 6 |
| <i>Eutintinnus tubulosus</i> | 1 | 1 | 0 | 0 | 14 |

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