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ASSOCIATIONS OF PLANKTON DIATOMS AROUND JAPAN AS INVESTIGATED BY UNDERWAY SAMPLINGS ABOARD THE "OSHORO MARU" IN OCTOBER AND DECEMBER 1952*

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I. Introduction

The training ship "Oshoro Maru" of the Faculty of Fisheries, Hokkaido University, made a round-Japan cruise from October 14 to December 15, 1952. The purpose of this cruise was not only for the regular training of cadets in navigation and seamanship, but also for a preliminary trial of undersea observations at several localities along the coasts of Japan Islands by means of the "Kuroshio", Undersea Observation Chamber (Inoue et al., 1953) under supervision of Prof. N. Inoue, Faculty of Fisheries, Hokkaido University, and Dr. T. Sasaki, Scientific Research Institute, Tokyo. On this occasion Prof. Motoda who was on board the ship made collections of the surface plankton by underway samplings through the whole course of the cruise off the coasts of Honshu and Kyushu. These samples of plankton were put at the disposal of the present author. The plankton diatoms are dealt with in the present paper.

In Japanese waters in recent years a group of planktologists in Marine Observatories, Ministry of Transportation, has contributed to understanding the nature of water masses by observing the distribution of plankton diatoms.

With similar intention the present investigations were originally undertaken to observe how the diatom associations vary with the localities around the coasts of Japan within the comparatively short period of one cruise. There are such ocean currents around Japan that were traversed in the present cruise as the Tsushima Current off Japan Sea coasts, the Kuroshiwo (Japan Current) and Oyashiwo (Kurile Current) off the Pacific coasts. The particular interest may be aroused by the manner in which varying hydrographic conditions resulting from geographical and climatic effects during continuous flow of such currents, either southwards, or northwards, are reflected in the change of diatom associations. However, the track of the ship in the present cruise did not always follow a particular ocean current; the track was located very close to the coast, passing through the purely coastal waters, in certain areas, while in other areas it was shifted comparatively to the offing, touching with the prevailing ocean current. Accordingly, the findings herewith reported render possible some considerations such as above mentioned at some places, but in most descriptions are concerned with merely the findings in respect to

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characteristics in diatom associations in various localities at that time wheresoever inshore or offshore waters.

Before going further, the author wishes to express his sincere gratitude to Prof. S. Motoda under whose guidance he initiated his scientific research work. Cordial thanks are also due to from the author to Dr. T. Kawamura and Mr. M. Anraku for their many valuable advices given throughout the laboratory work. Kind help extended by Captain T. Fujii and his crew and cadets, and Prof. N. Inoue and Dr. T. Sasaki and their scientific staff aboard the ship during that cruise is gratefully appreciated.

II. Method, Location and Date of Samplings

The Handy Underway Plankton Catcher, model I, (Motoda, 1954) was employed in sampling the plankton materials. To sample the microplankton, composed mainly of phytoplankton, while underway, a narrow conical net of fine mesh bolting silk, XX 13, i. e., 129 meshes per linear inch, having approximately 0.11 mm mesh opening, is inserted into the catcher. As the catcher, model I, is very narrow, 5 cm in diameter of cylindrical case, and as it has a tapering head piece, it is easy to handle at high speed tow. The instrument was towed at the end of twenty-five meters of cotton flag line at a speed of about 9 knots for 30 minutes or less; duration of tow depended upon the circumstances.

Tows were made by cadets or sailors at intervals of four hours while the ship was sailing. The net inside was often clogged with sticky materials; on such an occasion it was washed to clean it out. The instrument was not equipped with any sinking vane, but it was supported by a heavy head piece to run through the water at about a half meter or so below the sea surface. There was no equipment such as current meter to measure the volume of water filtered by the net inside or to measure the exact distance of tow, so that the samples obtained are not available for accurately quantitative studies, but may be used for rough estimation of relative abundance of population. Of all of the samples the number of cells, often composing colonies, were counted for each species so far as identified.

Approximate location of the stations where collections were made is illustrated in Fig. 1, and more exact data on the position of the stations, date and hour of collections and temperature of the surface water at that time are given in Table 1. Total sum of the sample vials amounted to sixty-six, but that from St. 57 was lost and those from St. 35 and St. 36 did not contain any organism, but only water. These are omitted from the data.

III. Results of Observations

For the sake of convenience in arrangement descriptions will be made following the track of the ship in chronological order from departure, by grouping some of the stations on

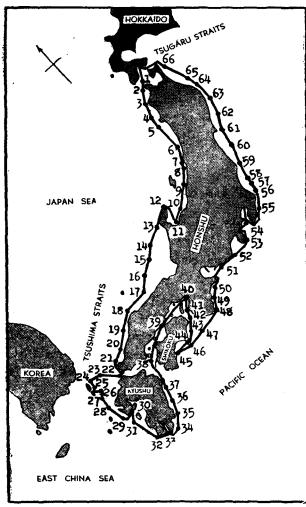


Fig. 1. Sketch map of Japan Islands showing track of the cruise and stations of sampling

the basis of neighbouring geographical situation and of apparently common associations of diatom population. Full data are given in Table 3 and summarized results in Table 2. Number of cells recorded in the text and table are only concerned with the number obtained by a tow of definite duration; all data are converted for thirty minutes' tow. It is natural that these numbers are far less than the actual number of cells which must be present in the volume of water that has been passed through the mouth opening of the instrument for such duration of tow. The filtration coefficient in such underway samplings will be much less than found in case of the use of other methods.

(1) St. 1 and 2 (Tsugaru Straits)

Cell number of total diatoms is from 3,900 (St. 1) to 25,200 (St. 2), averaging 14,550. Total species number is thirty-five. The most prevalent form is *Chaetoceros coarctatus*. This species has been

known in this region as one of the representatives of tropical diatoms which appear with drift of northwards Tsushima Current from southern seas in autumn (Asamushi Marine Biological Station, 1946-49; Kokubo, 1952; Hakodate Marine Observatory, 1954). Next comes *Chaetoceros didymus* occupying about 20 % of total cells. It is a warm temperate species. The prevalence of above species indicates the inflow of a tributary current of the Tsushima Current into Tsugaru Straits in this season.

(2) St. 3-13 (Japan Sea coast of northern Honshu)

The course of the ship is located adjacent to the coast. Total cell number is counted as between 4,800 and 190,000 and 72,000 in average. Species number is eighty-four.

The leading species are Chaetoceros coarctatus, Ch. decipiens, Ch. lorenzianus, Ch. didymus, Ch. distans, Climacodium biconcavum, C. Frauenfeldianûm and Thalassionema nitzschioides, though some of them are absent at some stations. Chaetoceros coarctatus has never occupied more than 20 % of total cells. Hyalochaete occupied about 50 % of total diatoms, and warm current species are found more or less commonly in the localities from Noto Peninsula to Niigata, agreeing with previous reports (Aikawa, 1936; Kawarada, 1953; Shimomura, 1954a). There are large concentrations of diatom population at St. 9 (188,400 cells) and St. 13 (179,400 cells), in which Hyalochaete and Thalassionema nitzschioides are dominant.

(3) St. 14 and 15 (Off Wakasa Bay)

These stations are located in the offing. Total cell number ranged from 7,800 (St. 14) to 32,800 (St. 15), with 20,300 in average. Number of species is twenty-one. Generally diatom population is poor both in total cell number and in species number. Chaetoceros corretatus is the leading species, occupying 76 % of total diatom cells. It is followed by Climacodium and Rhizosolenia. The prevalence of tropical and subtropical oceanic species as well as the poverty in total cells indicates that the ship has passed through the water of the Tsushima Current. Shimomura (1954b) reported that the Tsushima Current off Wakasa Bay is characterized by decrease in number of plankton, particularly of phytoplankton; the more one goes to the northeast in the path of this current, the less number of plankton he finds.

(4) St. 16-21 (Japan Sea coast of southern Honshu)

Total cell number lies between 17,000 and 427,500, with 176,700 in average. Species number is sixty-seven. Hyalochaete occupies more than 50 % of total diatoms. Chaetoceros lorenzianus and Ch. didymus are dominant through all stations; Ch. compressus is dominant at St. 17-19, and Ch. messanensis, Ch. distans, and Ch. radicans are at St. 19-21. Aikawa (1936) reported that Hyalochaete occupies more than 50 % of total phytoplankton on southern Japan Sea coast of Honshu being followed by Nitzschia seriata and Bacteriastrum in autumn. There are high concentrations of diatom population at St. 16 (362,000 cells) and St. 19 (408,000 cells), in which Hyalochaete and Thalassionema nitzschioides are dominant. St. 16 is located near the coast of the oki Islands where the abundance of diatoms has been induced possibly by the upwelling of underwater near the islands, though physical proof is not obtained. According to Aikawa (1934), the vicinity of the oki Islands is a high productive area, and also to Shimomura (1954b), the phytoplankton is very abundant from the north of the oki Islands to the offing of Wakasa Bay. Shimomura suggested that the abundance of phytoplankton off Wakasa Bay in summer is due to the upwelling water in that region.

Table 1. Record of collections

No.		Date		Hour	Posi		Locality	Temperature of	Remark
stat	ion				Lat.	Long.	Locality	surface water (°() Kemark
St.	1 2 3 4 5	October " " "	14 // 15 //	17:00-17:30 20:15-20:45 00:00-00:30 04:00-04:30 08:00-08:30	41-08-00 N. 40-38-00 N. 40-15-00 N.		Tsugaru Straits Off Cape Gongensaki Off Henashi Off Noshiro Off Ojika Peninsula	18.5 21.5 19.0 21.5 20.5	
* * * * * * * * * * * * * * * * * * * *	6 7 8 9 10	# # #	" " 1 "	11:50-12:20 16:00-16:30 19:45-20:15 23:45-00:15 07:45-08:00	38-47-30 N. 38-12-30 N. 38-12-30 N. 37-50-00 N. 37-09-05 N.	139-37-00 E. 139-19-00 E. 139-12-30 E. 138-44-00 E. 137-56-00 E.	Off Sakata Off Senami " Off Niigata Off Naoetsu	21.0 22.0 22.2 27.5 23.0	
# # # #	11 12 13 14 15	# # #	? 19 % 20	12:15- ? ? 19:45-20:15 23:45-00:15 03:45-C4:15	36-54-08 N. 37-36-00 N. 37-19-00 N. 37-00-00 N. 36-39-07 N.	137-19-42 E. 137-18-00 E. 136-28-05 E. 135-30-00 E. 135-01-05 E.	Toyama Bay Off Noto Peninsula "Off Tsuruga	22.5 22.0 19.0 20.0	
7 7 7 7	16 17 18 19 20	# # #	# # #	07:45-08:00 11:45-12:15 15:45-16:15 19:45-20:15 23:45-00:15	36-18-01 N. 35-51-05 N. 35-35-02 N. 35-13-05 N. 34-44-00 N.	134-18-09 E. 133-51-05 E. 132-55-08 E. 132-10-00 E. 131-22-00 E.	Off Tottori // Off Mastue Off Hamada Off Senzaki	20.4 22.4 20.3 22.1 20.4	
7 7 7 7 7 F	21 22 23 24 25	# # #	21 27 " " 28	03:45-04:15 23:45-00:15 03:45-04:15 07:45-08:15 16:15-16:45	34-28-00 N. 34-08-04 N. 34-30-00 N. 34-44-00 N. 34-18-05 N.	130-52-02 E. 130-38-00 E. 130-02-00 E. 129-31-07 E. 129-26-05 E.	Off Kokura Tsushima Straits Northeast coast of Tsushima East coast of Tsushima	22.2 22.0 19.8 22.2 21.8	
7 7 7 7 7 7	26 27 28 29 30 N	" " November	29 // 30 // 6	15:30-16:00 19:45-20:15 03:45-04:15 15:45-16:15 10:30-11:00	34-04-14 N. 33-53-05 N. 33-20-03 N. 32-48-06 N. 32-42-00 N.	129-33-00 E. 129-31-00 E. 129-17-08 E. 129-35-02 E. 130-01-00 E.	Tsushima Straits Off Hirato Off Nagasaki Tachibana Bay	21.8 23.0 21.0 20.4	
# # #	31 32 33 34 35	# # #	7 9 15 //	20:15-20:30 23:45-00:15 11:45-12:15 15:45-16:15 19:45-20:15	32-29-02 N. 31-15-08 N. 31-10-01 N. 31-06-00 N. 31-27-00 N.	129-42-02 E. 130-07-01 E. 130-42-01 E. 130-58-00 E. 131-26-08 E.	Off Cape-Nomo Off Makurasaki Kagoshima Bay Ohsumi Straits Off Aburatsu	17.0 20.4 22.5 21.9 23.0	Empty
# # #	36 37 38 39 40	"	16 " " 21	23:45-00:15 03:45-04:15 11:45-12:15 07:45-08:15 16:30-17:70	31-59-02 N. 32-29-01 N. 33-33-02 N. 34-20-06 N. 34-37-00 N.	131-41-08 E. 131-52-06 E. 132-12-00 E. 133-43-00 E. 135-10-04 E.	Off Miyazaki Off Nobeoka Iyo-Nada Bingo-Nada Izumi-Nada	23.0 23.0 21.0 19.8 19.6	Empty
# #	41 42 43 44 45	"	25 1/ 26 1/ 29	11:45-12:15 19:45-20:15 23:45-00:15 03:45-04:15 16:00-16:30	34-13-01 N. 34-02-01 N. 33-25-05 N. 33-13-06 N. 33-16-06 N.	134-55-09 E. 134-48-08 E. 134-28-00 E. 133-57-08 E. 133-19-00 E.	Off Wakayama Kii Channel East of Cape Muroto Off Cape Muroto Tosa Bay	19.5 19.4 21.4 22.5 22.4	
#	46 47 48 49 50 I	" " December	# 30 # # ?	19:45-20:00 23:45-00:15 07:45-08:15 11:45-12:15 07:45-08:15	33-12-04 N. 33-14-02 N. 33-33-02 N. 34-05-05 N.	134-00-00 E. 134-38-00 E. 135-59-06 E. 136-17-00 E. 136-26-01 E.	West of Cape Muroto Off Kii Channel Off Cape Shionomisaki Off Owase	22.5 21.4 22.1 19.0 21.0	
n n	51 52 53 54 55	# # #	3 4 8 13	19:45-20:15 23:45-00:15 03:45-08:15 07:45-08:15 15:45-16:15	34-29-00 N. 34-33-01 N. 34-38-02 N. 35-06-08 N. 35-13-06 N.	137-33-02 E. 138-24-00 E. 139-05-05 E. 139-36-08 E. 140-32-03 E.	Enshu-Nada Off Omaezaki Off Shimoda Sagami Bay Off Katsuura	19.8 19.0 16.6 19.1 20.0	
	5 6 5 7	,	"	19:45-20:15	35-48-05 N.	140-58-05 E.	Off Cape Inubosaki	17.5	No samulin
7 !	58 59 60	"	14 14	23:45-00:15 03:45-04:15 07:45-08:15	36-26-00 N. 37-03-07 N. 37-40-05 N.	141-15-00 E. 141-12-05 E. 141-23-05 E.	Off Mito Off Cape Shioyasaki Off Haranomachi	17.1 15.5 14.2	No samplin
7 (7 (61 62 63 64 65	# # #	" " 15 "	11:45-12:15 15:45-16:15 19:45-20:15 23:45-00:15 03:45-04:15	38-16-01 N. 38-52-00 N. 39-27-05 N. 40-20-00 N. 40-39-02 N.	141-39-03 E. 141-52-06 E. 142- E. 142-08-02 E. 142-06-00 E.	Off Kinkazan Off Kesennuma Off Kamaishi Off Kuji Off Hachinohe	12.5 11.8 12.0 12.3 12.0	
, (66	,	#	07:45-08:15	41-19-02 N.	141-31-07 E.	Off Cape Shiriyasaki	14.0	

(5) St. 22 (Genkai-Nada)

Total cell number is very large, amounting to 1,217,400, and species number is thirty-nine. *Chaetoceros radicans* is the most prevalent species, occupying 34 % of total cells. *Ch. lorenzianus*, *Ch. compressus*, *Ch. messanensis*, *Ch. curvisetus* and *Lauderia borealis* are also important constituents of the take.

(6) St. 23 27 (Tsushima Straits)

Total cell number is between 162,000 and 273,000 per haul in the straits, while it is between 450,000 and 1,445,000 on the coast of Tsushima Island, averaging 513,000. Species number is sixty eight. Chartoceros decipiens, Ch. lorenzianus, Ch. didymus, Ch. compressus, Ch. curvisetus, Ch. radicans and Ch. messanensis are dominant, being followed by Ch. atlanticus v. neapolitana, Ch. rostratus and Lauderia borealis. Eucampia zoodiacus is reported to be prevalent in the straits in the fourth quarter of the year (Kokubo, 1931-40, 1937), but in the present observations this species is not found in the straits, but in the Hirato Channel.

(7) St. 28 and 29 (Hirato Channel)

Total cell number is 127,200 at St. 29 and 457,800 at St. 28, averaging 292,500. Species number is fifty-four. The leading species is *Eucampia zoodiacus*, being followed by *Chaetoceros decipiens* and *Ch. lorenzianus*.

(8) St. 30 and 31 (Amakusa-Nada)

Diatoms are abundant both in total cell number and species number. Total cell number is 792,000 at St. 30 and 5,064,000 at St. 31. The latter value is the largest one among the data obtained from all stations in the present observations. Average of cell number is 2,928,000. Species number is forty-one. Skeletonema costatum (21 %) and Asterionella japoniea (19 %) are dominant at St. 31, while Chaetoceros pseudocruvisetus (34 %) and Melosira nummuloides (19 %) are dominant at St. 30. Next to the above four species, Ch. curvisetus and Eucampia zoodiacus are important constituents. The complicated coastal currents which might be associated with the topographic contours are possibly responsible for the high production of diatoms (cf. Aikawa, 1934).

(9) St. 32 (Southwest coast cf Kyushu)

Total cell number is 2,742,000, and species number is fifty-seven. The most prevalent species is *Chaetoceros messanensis*, being followed by *Ch. compressus*, *Ch. pseudocruvisetus*, *Ch. didymus*, *Ch. radicans*, *Lauderia borealis*, *Bacteriastrum comosum* and *Rhizosolenia Stolterfothii*.

(10) St. 33 (Kagoshima Bay)

The station is located at the entrance of Kagoshima Bay. Total cell number is as large as 3,367,200, and species number is fifty two. The components of diatoms are fairly different from those at other localities of west coast of Kyushu. *Thalassionema nitzschiodes* and *Chaetoceros pseudocruvisetus* are dominant, being followed by *Ch. compressus*, *Nitzschia seriata*, *Biddulphia sinensis*, *Hemiaulus sinensis*, *H. indica*, and *Climacodium*. *Planktoniella sol* and *Gossleriella tropica* are also found in a certain abundance. The occurrence of tropical or warm-water species is notable; the influence of the Kuroshiwo Current is apparently indicated in diatom associations at the entrance of this bay.

(11) St. 34 and 37 (Hyuga-Nada)

Diatoms are rather poor both in total cell number and in species number. Total cell number is 18,300 at St. 34 and only 2,940 at St. 37, averaging two stations 10,620 cells. Species number is twenty-nine. The leading species is *Thalassionema nitzschioides*, occupying 50 % at St. 34 and 38 % at St. 37. *Climacodium biconcavum* (18.3%) and *Melosira nummuloides* (18 %) are also important. This region is supposed to be under the influence of the Kuroshiwo Current, as is reflected in high temperature and in the prevalence of tropical diatoms as well.

(12) St. 38 (Iyo-Nada)

This station is located in the Inland Sea (Seto-Naikai). The diatom associations are distinct from those of Hyuga-Nada. Total cell number is 34,110 and species number is more than nine. *Coscinodiscus* is the most prevalent group, occupying 86 % of total cells, while *Eucampia zoodiacus* and *Hemidiscus cuneiformis* follow. Kokubo (1931-40) and Maekawa et al. (1953) reported the predominance of *Coscinodiscus* in the more western part in the Inland Sea in winter.

(13) St. 39 (Bingo-Nada)

Total cell number is 262,800 and species number is more than nineteen. Coscinodiscus is the most prevalent group, occupying 52 % of the total cells. In addition, the following diatoms are important constituents; Hemidiscus cuneiformis, Stephanopyxis palmeriana, Skeletonema costatum, Lauderia borealis, Rhizosolenia Bergonii, Bacteriastrum hyalinum, B. mediterraneum, Ch. decipiens, Hemiaulus indica and Pleurosigma spp. Kokubo (1934-40) reported the predominance of Coscinodiscus at Ohcho, Hiroshima Pref. near the present station, in early winter.

(14) St. 40 (Osaka Bay)

Total cell number is 180,000 and species number is more than twenty-four. Thalassionema nitzschioides, Thalassiothrix Frauenfeldii, and Coscinodiscus are dominant. The first two forms together occupy 40 %, whilst Ch. lorenzianus, Ch. pseudocurvisetus, Eucampia zoodiacus, Ditylum Brightwellii and Rhizosolenia alata are following.

(15) St. 41-43 (Kii Channel)

Total cell number is from 18,900 (St. 41) to 101,900 (St. 43), exceptionally rich, as large as 2,970,000 cells at St.42, and 1,017,000 in average. Species number is thirty-six. Thalassionema nitzschioides, Thalassiothrix Frauenfeldii, and Coscinodiscus are prevalent at St. 41 and 43; altogether the first two forms occupy above 37 %. Chaetoceros pseudocurvisetus is also prevalent at St. 42, occupying 67 % of the total cells. This species was reported to be a remarkable species in the inner part of Osaka Bay in December, 1952 (Ueno, 1953). The abundant diatoms at St. 42 may be associated with supply of rich nutrients from Osaka Bay which is transported to the region of St. 42 by tidal currents.

(16) St. 44 and 46 (Off Cape Muroto)

Total cell number is from 59,000 (St. 46) to 200,280 (St. 44) and 129,640 in average. Species number is forty-seven. The dominant forms are *Ch. pseudocurvisetus*, *Ch. decipiens*, *Coscinodiscus*, *Bacteriastrum*, *Thalassionema nitzschioides*, *Thalassiothrix Frauenfeldii* and *Skeletonema costatum*. The diatom associations are more or less influenced by Kuroshiwo water.

(17) St. 45 (Tosa Bay)

Total cell number is 135,240 and species number is twenty-five. Thalassionema nitzschioides (25 %), Thalassiothrix Frauenfeldii (17.5 %) and Synedra spp. (20 %) are dominant forms. Chaetoceros pseudocurvisetus, Ch. didymus, Ch. atlanticus v. neapolitana and Skeletonema costatum are also important constituents. Among these forms warm oceanic species number six and 5 % in cell number of total haul; neritic diatoms are rather prevalent, thus this sample shows neritic characters to a certain extent rather than the character of oceanic Kuroshiwo water.

(18) St. 47 (Off Kii Channel)

Diatoms are poor both in total cell number and in species number; total cell number is 8,040 and species number is nineteen. Coscinodiscus, Thalassionema nitzschioides, Chaetoceros lorenzianus, Ch. decipiens, and Ch. coarctatus are main constituents.

Planktoniella sol and Gossleriella tropica are also found. It is indicated that diatom population is fairly influenced by the Kuroshiwo Current. Characters of Kuroshiwo water as observed by diatom associations are more emphasized here than off Cape Muroto, because warm oceanic or tropical species are present to the number of 11 and occupy about 27.7 % of total cells in this station, while similar species off Cape Muroto number 12, but occupy only 5 % of total cell number.

(19) St. 48 50 (Kumano-Nada)

Diatoms are comparatively abundant in respect both to total cell number and to species number. Total cell number is between 27,500 and 333,000, averaging 224,600. Species number is fifty-one. The leading species are *Chaetoceros pseudocurvisetus* and *Skeletonema costatum*. The former species occupies above 35 % (St. 48 and 50), and the latter does 44 % (St. 49). In addition, *Ch. decipiens*, *Ch. didymus*, *Thalassionema nitzschioides* and *Nitzschia seriata* are also important forms. Marumo (1954a) reported that diatom communities were composed of *Hyalochaete*, *Rhizosolenia* and *Nitzschia seriata* in the south of Shiono-Misaki. In the present data the diatom associations off Shiono-Misaki are mainly composed of *Hyalochaete*, but show a difference from the data of Marumo (1954a) in other constituents of less importance.

(20) St. 51-57 (From Enshu-Nada to Kashima-Nada)

Total cell number is between 69,000 and 1,276,200, excluding the datum of extremely poor haul at St. 55 (2,850 cells). Average cell number is 369,000. Species number is seventy-five. The leading species are *Chaetoceros decipiens* (St. 52,53 and 56), Skeletonema costatum (St. 51 and 54) and Thalassionema nitzschioides (St. 55). In addition, Ch. pseudocurvisetus, Ch. messanensis and Ch. didymus are important. According to the observations of preceding workers (Marumo, 1951; Kawarada, 1954; Asaoka, 1955), Skeletonema costatum is more abundant near the Miura Channel than at other localities of Sagami Bay in winter when the water of Tokyo Bay, less haline than that in Sagami Bay, flows out into the present region. A large concentration of diatoms is found at St. 52. The major constituents of this concentration are Chaetoceros decipiens, Ch. lorenzianus, Ch. didymus, Ch. messanensis, Ch. affinis, Ch. compressus, Ch. socialis, Skeletonema costatum and Thalassionema nitzschioides. Outflow of land drainage from the Ohi River might be suggested to be responsible for the local production of diatoms at this region. Skeletonema costatum is very much increased at St. 51 and 54-55, indicating the spread of coastal water to these stations, but there is an indication of some influence of Kuroshiwo water at St. 55 by the occurrence of Climacodium biconcavum (8.6 %). On the other hand, in the region extending from St. 52 to 53 the diatom associations are represented mainly by Chaetoceros decipiens together with

warm-water-preferring *Hyalochaete*, as was reported by Marumo (1955) off Sanriku District, in spite of the fact that surface temperature is lower than at other stations.

(21) St. 58-60 (Pacific coast of northern Honshu)

Diatoms are considerably poor in total cell number, except the abundant population at St. 60. Total cell number is 6,060 at St. 58, below 200 at St. 59 and 143,000 at St. 60, averaging 50,000. Species number is thirty-five. In the localities of poor diatoms, Thalassionema nitzschioides, Thalassiosira sp. and Rhizosolenia Stolterfothii are main constituents. At. St. 60 Chaetoceros Eibenii is the most prevalent species, occupying more than a half of the diatom population, being followed by Ch. coarctatus, Ch. pseudocurvisetus, Thalassiosira sp., Lauderia borealis and Ditylum Brightwellii. Surface temperature falls northwards from 17.1°C at St. 58 to 14.2°C at St. 60 and 15.6°C in average. This temperature is similar to that of the area of the mixing of Kuroshiwo and Oyashiwo waters as reported by Shimomura (1953) in December. From diatom associations this region is considered to be a transitional region from warm Kuroshiwo water to the mixing area at the north of Kinkazan.

(22) St. 61-66 (Pacific coast of more northern Honshu)

Diatoms are poor in total cell number which ranges between 12,500 and 33,000, averaging 20,700. Species number is forty-one. Predominant species are Coscinodiscus granii, C. wailesii, Thalassionema nitzschioides, and Chaetoceros affinis. In addition, Biddulphia sinensis, Hemidiscus cuneiformis, Stephanopyxis palmeriana are also important constituents. Chaetoceros, Thalassionema nitzschioides and Coscinodiscus spp. have been reported as important components of diatoms in the Oyashiwo water in this region (Marumo, 1954b, 1955; Shimomura, 1953). Chaetoceros socialis and Ch. debilis are also important species to which is owed the high abundance of diatoms (Shimomura, 1953). In the present observations, Chaetoceros occupies from 13.3 to 37 % of total cells, increasing northwards. Associated species are commonly Chaetoceros affinis, Ch. decipiens and Ch. didymus, and in some localities Ch. socialis, Ch. debilis, and Ch. convolutus. However, Chaetoceros species which belong either to Phaeoceros or Hyalochaete, that have been reported as characteristic indicators of the Ovashiwo Current are rare in the present data. On the contrary, Coscinodiscus decreases in number northwards from 42.2 to 3 %. Thalassionema nitzschioides is remarkably dominant at St. 66, occupying more than a half of the diatom population. It is noticed that at St. 63 Hemidiscus cuneiformis, Biddulphia sineisis and Stephanopyxis palmeriana occupy a considerably higher portion of the population than in other localities, and also Corethron hystrix (11.5 %), Ditylum Brightwellii and Thalassiosira sp. occur rather often. Tamura (1951) reported similar diatom associations to the present data from Tsugaru Straits in January, 1951.

In the present cruise the stations are located close to the coast, so that diatom associations may have been influenced by neritic waters, and, in addition, the influence of southwards warm Tsugaru Current (a tributary of Tsushima Current) from Tsugaru Straits flowing in the comparatively inshore area and that of northwards cold Oyashiwo Current in the offing are mixed to a certain extent, exerting influence upon the associations of diatoms in the present stations.

IV. Discussion

It is still a perplexed matter to decide what plankton forms should be selected for indicating what nature of water, though accumulated works have contributed to generalize the ecological situation of the various forms in relation to the environmental characteristics, especially to the temperature of habitat, and in less completeness to the salinity.

Ocean currents may be evidently traced by the existence of most intolerant oceanic species which are transported by the current from their original propagative area. However, strictly intolerant forms, if they occur, are usually present in very small number out of their birth place; in most cases their presence or absence is only recorded, and the difficulty in accurate numerical expression is often involved. On the other hand, there is no evidence, in phytoplanktons, that they do not reproduce in favorable circumstances where-scever during their drift, so that even though a large concentration of such forms is found in some locality out of their original area, it does not necessarily indicate the prevalence of the current itself in this locality.

It is known that the characterization of plankton associations obtained from one place cannot be adopted for other localities; a species associating with a particular nature of water does not always do so in water of similar nature in other regions. It is natural that, for instance, some of the neritic species which widely inhabit the tropics or subtropics might be drifted with the current toward a high latitude with resistance to the changing environments; thus they would become apparent indicators of oceanic warm current in high latitude. Chaetoceros lorenzianus and Ch. distans are such forms which are considered to be indicators of the Tsushima Current in northern Japan. Such regionality of plankton characteristics forces planktologists to make more efforts in charting the characteristic associations at various localities in various seasons in as great detail as possible.

The greatest usefulness of plankton indication of water masses would be involved in the ascertainment of mixing rate of two or more water masses of different nature, e. g., oceanic and neritic water, or warm and cold current, with an accuracy that physical, or even chemical, determination would not be able to manifest.

Many preceding workers have presented accounts of diatom associations on the coast and in the offing of Japan, discussing their characteristics which apparently associate with the water masses in which they are distributed. However, differences in times and positions of samplings from the present observations, though in some cases to a very slight extent, make it difficult to make reference to the earlier reports or comparison with them. So far as possible to summarize the present data the knowledge accumulated by the many preceding authors is adopted for classifying the plankton forms into warm or cold and oceanic or neritic preference, though some should be valued as tentative decisions.

In the present observations, the track of the ship along the Japan Sea coast of Honshu was populated by such tropical or subtropical species as Chaetoceros coarctatus, Climacodium Frauenfeldianum and C. beconcavum. Even in the region near the coast, tropical diatoms such as Chaetoceros diversus, Ch. paradoxum and Ch. messanensis were prevalent. Along the track on the coast of Kyushu neritic species, viz., Skeletonema costatum, Asterionella japonica and Eucampia zoodiacus were most prevalent forms among the population. Thalassionema nitzschioides was widely distributed covering the area from Osaka Bay to Kii Channel. Skeletonema costatum which is known as a wide spread species and as making remarkable increase in certain neritic conditions occurred in large number on the Pacific coast from Kii Peninsula to Boso Peninsula. Climacodium biconcavum was found frequently in certain areas of the Pacific coast reflecting the presence of Kuroshiwo water. In such area the total cells were comparatively decreased. The area in which predominance of Chaetoceros pseudocurvisetus was found was also considered to be bathed with Kuroshiwo water. In the coastal region of the Pacific side occurrence of Planktoniella sol, Cossleriella tropica, Guinardia flaccida, Hemiaulus indica. Chaetoceros coarctatus and Ch. atlanticus v. neapolitana, though in comparatively small number, indicated that there the water was mixed with Kuroshiwo water to a certain extent. The diatom population off Cape Omae-Zaki (St. 52) was composed of Chaetoceros decipiens and warm-water-preferring Hyalochaete. This probably reflects the effects of lowering temperature. On the northern coast of Honshu on the Pacific side the track of the ship covered a region of coastal water embodying the Chaeto-plankton, but the flow of Oyashiwo is reflected in the occurrence of cold-water-preferring Hyalochaete, such as Chaetoceros decipiens, Ch. debilis, Ch. socialis, Ch. convolutus and Corethron hystrix. The prevalence of Chaetoceros Eibenii at St. 60 suggested that there is mixing of the Oyashiwo water with the Kuroshiwo water.

V. Summary

The materials of diatoms were collected by underway samplings aboard the "Oshoro Maru" during her round-Japan cruise from October 14 to December 15, 1952.

Diatom associations in neritic region along Japan Sea coast are mainly composed of Chaeto-plankton; warm-water Hyalochaete, Rhizosolenia and Thalassionema nitzschioides, while in the offings Chaetoceros coarctatus and Climacodium are prevalent, though the above mentioned neritic forms are also included.

On the northwest coast of Kyushu, *Eucampia zoodiacus* and *Hyalochaete* are predominant, and on the west coast, such neritic diatoms as *Skeletonema costatum*, *Asterionella japonica* and warm-water *Hyalochaete* are abundantly collected.

In Kagoshima Bay on the south coast of Kyushu, warm-water *Hyalochaete* and *Thalassionema* are dominant, and other forms even more preferring warm-water are found, indicating the direct influence of the Kuroshiwo Current.

Diatom associations in the Inland Sea are different from those in other localities; Coscinodiscus is prevalent, occupying half or more of total diatom population.

Thalassionema nitzschioides, Thalassiothrix Frauenfeldii and Coscinodiscus are dominant in the area from Osaka Bay to Kii Channel; in addition, Chaetoceros pseudocurvisetus is abundantly distributed off Wakayama.

From off Cape Muroto to Tosa Bay, the above forms also occurred prevalently, and in addition, several other warm-water diatoms are found together, indicating the influence of Kuroshiwo water.

Characteristic Kuroshiwo diatoms, e. g., warm-water *Hyalochaete* and other several tropical forms, prevail in the offing of Kii Channel, but *Chaetoceros decipiens* is also there abundantly included.

Skeletonema costatum and Ch. pseudocurvisetus and other neritic diatoms are dominant on the east coast of the Kii Peninsula.

Either Skeletonema costatum or Hyalochaete and Ch. decipiens are leading forms in the area extending from Enshu-Nada to Kashima-Nada; the former may be the indicator species of prevalent coastal water.

On the Pacific coast of northern Honshu, *Chaetoceros Eibenii* and other *Chaetoceros* spp. are dominant to the south of Kinkazan, but in other localities, diatoms are extremely poor, represented by such forms as *Thalassionema nitzschioides*, *Rhizosolenia* and *Thalassiosira*.

On the more northern coast of Honshu, Coscinodiscus, Thalassionema, Chaetoceros affinis, and Ch. decipiens are dominant. Only a few cold species of Hyalochaete and Coscinodiscus are collected there.

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Table 2. Relative abundance of leading species occupying more than 10 percent in cell number for total population of diatoms

Station	1 2 3	4 5	6 7	' 8 9	10 1	1 12 1	3 14 1	5 16 1	7 18 19	9 20 21	22 25	3 24 2	5 26 2	27 28 2	29 30 3	1 32	33 34	37 38	39 40) 41 42	2 43 4	4 45	46 47	48 49	50 51	52 53	54 55 5	56 58	59 60	61 62 (63 64 65 (
Asterionella japonica Bacteriastrum varians B, elongatum B, comosum Biddulphia sinensis								10	Ó						1	9							10 24					15	29	:	11
Chaetoceros Eibenii					-															,									48		
C. coarctatus C. decipiens C. lorenzianus C. compressus	57 33	13 10 9		12 10) 20 2 14	20 9 9 1	94 59 4		2 2 12 1 1	10 1	10	0 18	13	14 1 13	13 12								10 18		14	21 23	2	23	14		
C. didymus C. affinis	12 23 21	14	22 17	10 19	12 1	7 12 1	3	11																						<u> </u>	11 10
C. didymus C. affinis C. distans C. messanensis C. curvisetus			9 11	. 13					20	0 14		13	0 13			11								13		11					11 12
C. pseudocurvisetus C. radicans C. socialis									13	3	34 16	6			34					6	7 2	9		53 13	35]	14		······································	13
Climacodium biconcavum C. Frauenfeldianum		10					1:	1										18													10
Coscinodiscus granii C. wailesii C. spp. Corethron hystrix Ditylum Brightwellii															-			86	52 20	18	19 1	5	17 21						14	37 18 10	10 11 11
Eucampia zoodiacus Melosira nummuloides Nitzschia seriata Hemidiscus cuneiformis Rhizosolenia alata		20							22	,				56 1	17 19			18			, , , , , , , , , , , , , , , , , , ,		· · · · · · · · · · · · · · · · · · ·	21						10 1	12
R. Stolterfothii Skeletonema costatum Stephanopyxis palmeriana Synedra spp.															2	1					· · · · · · · · · · · ·	20		44	44		81 16	25			
Syneara spp. Thalassionema nitzschioides			13 12	22 20)	12	7	-				1	7 14				31 50	38	21	l	41	25	17				19		57	29	16 11 18 (
Thalassiosira spp. Thalassiothrix Frauenfeldii							•	-						·					19	9 25	1	1 20			. ,			15			Andrew Control of the
Sum of other unimporant species	31 44 79	61 63	56 60	43 51	54 5	4 47 6	6 6 30	72 56	66 56	86 90	66 74	4 69 6	3 60 7	73 44 5	8 47 6	0 89	69 50	26 14	48 40	57 33	3 40 4	5 35	39 46	44 22	51 56	79 66	19 65 6	63 45	38	63 33 5	50 68 46 3
Total	100 100 100	100 100	100 100	100 100	100 100	100 100	100 100	100 100	100 100	100 100	100 100	100 10	0 100 10	0 100 10	0 100 100	0 100	100 100	100 100	100 100	100 100	100 10	0 100 1	100 100 1	100 100 1	100 100	100 100 1	.00 100 10	00 100	100 100 1	00 100 10	00 100 100 10

Chatten	1 2	3 4	5	6 7	8	9 10) 11 12	12 13	14 15	16 1	17 18	19 20	21	22 23	24	26	27 28	29 3	0 31 3	32 33	34 37	38 39	40 41	42 4	3 44	45 46	47	18 49	50 5	1 52	53	54 55	56	58 59	9 60	61 62	63 64	4 65 66
Station Advantage Innaines		3 4				1								30	30							1		780	540	480		120			90	4	45					
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Asteromphalus flabellatus Asterionella japonica	30	330			010 2520	402		1920 420 14640	450		1500 750 3300			19440 1320 24	1380 40 3120	2430		-	950760 33 63600	3000	1080	1.		29580		546	0	3150			9950		9590				390 6	690 5
Bacteriastrum varians B. hyalinum B. delicatulum	210	2	120 350	330	570	7650 4500	20 210	420 14040	100		600 300 1200 900		1080 570	540 330 660	00 8400 38 00 4800	940 3520 4320	1680 117 7440		020 62460 84		189	4200		156600 3	6900	400		1260	23	280 18900 310 100 16350	1080	2880	2520 630				390	090
B, elongatum	84	0 2730	100	360	360	600					420 1050	2880 26	930 570	16560 2160 27	70 7800 15 70 7800 7800	5180 10440 1140 21600	7440 6480 600	3360	46920 33 75000 13	3200 21600	600	ì	-		1050 750	408	0		2100 2.	8490			1680 840		2520			
B. mediterraneum			600 600		225	10950 60	360	15840	300	4470	1230 7200	2400 7 5100 15	780 590 1290	84240 1419 693	96 2925 30 26910 9	2460 3060	780 7440 330		89040 99 30210 189	9750 12000	360	8970		6960 22620	300 600		60	600 1050		12660 29040 320			30 60 420	720	30	720 950	1410 12	290 1050 30
B. comosum Biddulphia sinensis B. mobiliensis	15	630 3 0 150 0 150	300		45		170 150				60	480	60			2160 720	39	1470 2	250 3180 3060	3300 4800 3150 4440 120000	300	1620	2440	22620	1800			840		330	400		120		1680	/20		150 300
B. longicruris			-	90 8	870 1140	3900 9	990 75	60 720			420 2400		75							12000	300												120	135	3570	6480 5610	1140 1	740 1350 3
B. pulchella Coscinodiscus granii C. wailesii						1									150	390			400	7200	1260	9640 137670	36210 50	70 154710 17	490 29250	7200 924	0 1650	2160 1260	23	100 4410	600 1	2060 2	120 90	90	1680	6480 5610 1020 3150 90	1140 17 0 960 8	840 360 2 90 3
C. spp. Coscinosira polychorda	45	630	450 750 150	1 1	90						1000		510	4000			700 050			6600 8940		1.			450			360 420	2700 2	970 6930	180 1620	180	1050	270	210	63	0 1140	120 150
Corethron hystrix		4770	600			2700 3	330	400		5460	1200	2400 1	120 510 270	4920 27		1040 1080 7380 10260		420		0000 0540				-	430	3780 168	80		2.00							,		
Ch. atlanticus v. neapolitana Ch. atlanticus v. skeleton		900		2970		4650	570	480			1200	240	270	240 24	40 225 40 90	630 540													60	90 60		60			330			1020 5
Ch. atlanticus v. neapolitana Ch. atlanticus v. skeleton Ch. densus Ch. Eibenii				040	200 0000	2450 1	500 240	030	7380 19200	17550	300		285		390 2535		3840		5700				1200	24390 21750	150 120	1620	690		2	250			1050		68550 5460		0 1	1020 3
Ch. coarctatus Ch. tetrastichon Ch. dadayi Ch. denticulatus	2160 840	00 17650	600 615	840	360 3090	3450 15	60	930	7300 13200	17330				1						120			1000	00010	1000	540		540 1680	19150 18	150 23940	2160 2	21600	3960	90	630		1	1560
Ch. dadayı Ch. denticulatus	75		300				105 210	90 45		1560	480 450		570 180	105	60	1440	2640 13	50 1476 4	5600 108180 3	4650 24000	60		1200	20010	1800	540		540 1000	12130 16	23540	2100 2	21000						
Ch. indicum Ch. Okamural			.9	,				30			60				360		330		81000	4900			6000 1200			120	20			45990		1800						
Ch. danicus Ch. rostratus Ch. borealis					210	1650 22	2280			1950	120 360 450	1440 2	210 60	2880 2880	5355 2340	9660 360 720		30	31800	8250 4800 7200			1200				lo l			610	540	1260		-		180	315 1	1170
Ch compolutus	210 3	30 1890	150 120	1350	180 210	450 3600 6	660 1140	90 2160	150	14040 9360	300 60 900	480	20 150	2850 33	1950 1200	4140	1920 480 18	80 630	5700 18660	1650 9600		4860				540	300	420		1890	180		30			30	45	
Ch. pervienus Ch. Castracanei Ch. decipiens Ch. lorenzianus			9000		FIGE 222	18900 131	8110 6720	450 25920	,	11700 61620	2040 2550		180 1650 1040 3750		240 13650 2 070 19050 10		8640 1813 22660 1950	20 16800 1 00 14880 1	1400 145680 14 1400 139920 10	1900 40800 0500 52800	600 1020	7290	9000 8	50 136890 10 5220	840 10500 1650		630 60 1440	720 10500 330 1680	46170 3 17550 14	960 261450 850 89460	17640 6750	540	15960 3360	150 120	19530 2130			1320 1050 240 150
Ch. lorenzianus Ch. Lauderi Ch. Weissflogii	5.	10 11550	7800 225	3120	765 660	19900 13)	0/20	180		01020	2000	210	90	1	240	390		1												360						400		
Ch. compressus	450		4200 300 2550 675	3150 9600 2	270 630 2430 5250	14700 93 36000 79	9330 7920 3960	30 8400 600 22560	120	41730 30690	3780 19200 480 2550	45120 44 9600 23	1800 1950 1230 1230	76320 2377 20700 1089		6750 7560 8680 12240		10 6720 30 1260 1	1700 222140 15	9650 273600 60150 8400	300 135		1200	6090	2550	3240 25	20	3780 7560	25110 26	730 51600 94500	540 4140 4590		5610	45	840 450		270	180
Ch. didymus Ch. constrictus	*200 000				3250	73		60				120	900 570	69	130	1290		70	82680									0040 1500	10000	000 04000	,		2520			177	0 660 1	1920 1440 2
Ch. Van Heurckii Ch. affinis Ch. affinis v. circularis	120	20 180 2850	1500 54		765	150	510 1830	8160 270		30420	120 6300		3210 210 180	25200 115 3	550 8580 3 330	3800 4680 120 180		60 6480	5700 95400 4	4550 96000 630	150			10440	120			2340 1500	13770 33	6000 64260 540 90			2520			177		
Ch. affinis v. willei Ch. paradoxum			· .	1560	420	450 1	1170 300			4680	900				540				4500	19000	400									45990	720			-				
Ch. distans Ch. messanensis		1260	750 1500	3810	1590 3510		1830 1875 660	150 4680 8400		12090	5850	85200 6	3210 1650 5750 2420	58260 267 54720 122	210 35295 28		12000 9	20 2310 90 7980	54060 4 273480 31		420 600 111				120	1620	270	3600 2520				720	840					
Ch. diversus Ch. curvisetus	4	20 11400 5280	2850 135 45	990 540	315 620 570		1170 4200 225	1680	+	8190 2700	1950 2100		540 2430		560 1200 580 56160	3330 1200 3800 4440			15900 302100 50700		1200		4800	1993470	57750	2700 5400 50	40	2100 39900	2700 115020 7	330 34650 920 97650		600 5220	30 1470 8820	120	1320 5550	42	80	
Ch. pseudocurvisetus Ch. debilis			450			2750	-	270			3150 5400		1770 1710	19440 82 374400 442	250 4680 220 9000	75900 2340	17	40	216000 37860 18									630	2700	5670 12600	1	8100	4500		4200	600	450	330 930
Ch. radicans Ch. tortissimus						1050				2100	5400	56550		442	4875				216060 10	07250		3						630	2550	1260	i - [6720			103	35	1560
Ch. socialis Cerataurina Bergonii	60	300	150	370			2040 205	1920	60 3600	1560	600	240	456 150	1440	2340	360 360		420		912000	540	810	600	3480	1950		-	630				2	240 2520	,				
Climacodium biconcavum C. Frauenfeldianum		90 3300 50 3300 7800	300 45 135	780	75		3840 285 210 510 720	255 60 720 90 4800			900		750 210	2880	570	6900 720	,20	630	6720	74400											450		60					
Dactyliosolen mediterraneum Diploneis splendida Ditylum Brightwellii			300 1650		75		336	30 240	60 90	390	6150	480	210 270	2880 2	270 390	2130 900	1440 13	365 1680	2250 22260	11550 2400	60	90	9000 3	850 5190	5940 4350	2160 4	20 90	840	4320	960 12600	2340	180	1050	360	15 1260	180	225	210 150
D. sol Ethmodiscus sp.		30		30										2				20000		-4550		1500	12000	120 80040	4650	1620		210	810	13230	150	1	120 1890	360	1050	180		
Eucampia zoodiacus E. cornuta			8000		,			720	60	2000	150				460 320 180	2160 2700 5520	7440 2548 240 660 19		5750 385380	4950 24000		1560	12000 4	20 00040	2030	1020		450		2520								
Fragilaria spp. Gossleriella tropica	3	60 1740	1050 15	0		-	480	480		3900										4800 9600			-	240 4350	390 1350		60	630	10800	990 2520	180	1260	840)	270	,		
Guinardia flaccida Grammatophora spp. Hemiaulus Hauckii		1110	750 45			1.5	60	30 960	1	7410	1500	1920		600 3	300 1170	540 1440	200	290 1470	1140	3300 12000				40 4550	1050		50	240										150
Hemiaulus Hauckii H. sinensis	1	.50	750 120 2100	0 420	90 210	2550	960	10800		7410		1	1800	8640	3315	5400		160 5700		177600 172800		8100							2370		180							150
H. indica H. membranacus			2100		90 210	+			1 1		1 1	i l	690			1	1 1) !	2610					1 1	i	1 1				i J		1	1530 840
Hemidiscus cuneiformis	30 1	.65	180	0	90 210	1														19650		2250 4150		2610 4350	270			2220			i		30 210	1	5250	300 304	1350	1530 840
Hvalodiscus stelliger	30 1	.65		0	50 24													420							270							2	240				1350	120 840
Hyalodiscus stelliger Isthmia nervosa Lauderia borealis	30 1	300	186 300 1200	00	360			1680	-	3120		1	1610 240	62640 92 14400	240 3900 180	8250 3060	3120 113		3320 15360 1		360			4350	270 1110 4800	1620	120	90 1050	12150	5610 6960 5670	6210	6120	30 210 240 75 1680			300 304	45 1350	120
Hyalodiscus stelliger Isthmia nervosa Lauderia borealis Leptocylindrus danicus	30 1		300 180 300	540	360	600		1680 2400		3120		11520	1610 240	14400	240 3900 180		35	310 2310 1 510 630	3320 15360 1 18900	19650 57400 26400	360 540	2250 4150		4350		4	120	90	12150			6120	240				45 1350 1	120
Hyalodiscus stelliger Isthmia nervosa Lauderia borealis Leptocylindrus danicus Licmophora abbreviata Melosira nummuloides M. Borreri	30 1		186 300 1200 600	540	360	600		2400		3120			270	14400	300 180	1800	35	310 2310 1 510 630 1	3320 15360 1 18900	57400 26400 52800 12000 14850	360 540	2250 4150 8910	0 1200	52200 73950	1110 4800 3300 2250		120	90 1050	12150	5670	D	6120	240			600		120
Hyalodiscus stelliger Isthmia nervosa Lauderia borealis Leptocylindrus danicus Licmophora abbreviata Melosira nummuloides M. Borreri Navicula membranacea Nitzschia seriata N. longissima	30 1	300	186 300 1200 600	540	360 270 150 30	600	3690			3120	180 4650		270	14400	180	1800	35 35 3120 445	310 2310 1 510 630 1 510 11	3320 15360 1 18900	57400 26400 52800 12000	360 540	2250 4150	0 1200	52200 73950	1110 4800 3300		120	90	720		0 630		240		4830	600		120
Hyalodiscus stelliger Isthmia nervosa Lauderia borealis Leptocylindrus danicus Licmophora abbreviata Melosira nummuloides M. Borreri Navicula membranacea Nitzschia seriata N. longissima N. closterium N. paradoxa		300	300 186 300 1200 600 150	540	360	600	1690	2400		3120	180 4650		270	14400	300 180	1800 49920 3780	35 35 3120 445	310 2310 1 510 630 1 510 150 150 150 150 150 150 150 150 150	3320 15360 1 18900 1650 89100 3420	57400 26400 52800 12000 14850	360 540	2250 4150 8910 3 2430	1200	4350 52200 73950 . 6090	1110 4800 3300 1110 630 1230 750	540	120	90 1050 67200 1050	720	2700 1890	0 630		240		4830	600		120
Hyalodiscus stelliger Isthmia nervosa Lauderia borealis Leptocylindrus danicus Licmophora abbreviata Melosira nummuloides M. Borreri Navicula membranacea Nitzschia seriata N. longissima N. closterium N. paradoxa Pleurosigma spp. Planktoniella sol		300 510 300	300 186 300 1200 600 150 1050	540	360	600	3690	2400		3120	180 4650		270	14400	300 180	1800	35 35 3120 445	310 2310 1 510 630 1 510 150 150 150 150 150 150 150 150 150	3320 15360 1 18900 2540 89100 3420 150	57400 26400 52800 12000 14850	360 540	2250 4150 8910	1200	4350 52200 73950 . 6090	1110 4800 3300 1110 630 1230 750 1230 450 150	540	120	90 1050	720	2700 1890 2460	630		240		4830	600		120
Hyalodiscus stelliger Isthmia nervosa Lauderia borealis Leptocylindrus danicus Licmophora abbreviata Melosira nummuloides M. Borreri Navicula membranacea Nitzschia seriata N. longissima N. closterium N. paradoxa Pleurosigma spp. Planktoniella sol Pseudoeunotia doliolus Rhizosolenia alata	30	300 510 300 120 1290	180 300 1200 600 150 1050 150 1050 750 6	540	360 270 30 90	1800		2400	300	5040	180 4650 360 34650 240 1950	11520	270	14400 3 64800 97 	300 180 750 10725	1800 49920 3780 360	35 45 3120 44 1 1 0 3300	310 2310 1 510 630 1 510 150 150 150 150 150 150 150 150 150	3320 15360 1 18900 2540 89100 3420 150 7980 6720	19650 57400 26400 52800 12000 14850 72000		2250 4150 8910 3 2430	0 1200 0 540 4200	4350 52200 73950 . 6090	1110 4800 3300 1110 630 1230 750 1230 450	540		90 1050 67200 1050	720	2700 1890	630	2700	240	0 450	4830	540 23		120
Hyalodiscus stelliger Isthmia nervosa Lauderia borealis Leptocylindrus danicus Licmophora abbreviata Melosira nummuloides M. Borreri Navicula membranacea Nitzschia seriata N. longissima N. closterium N. paradoxa Pleurosigma spp. Planktoniella sol Pseudoeunotia doliolus Rhizosolenia alata R. Stolterfothii R. cylindrus	30	300 510 300 120 1290 330	300 1200 600 150 1050	540	360	1800 900 1200	510 225 480	2400 10920 30 1200	300	0 5040 0 1560 390	360 34650 240 1950 60	240	270 1165	14400 3 64800 97 8 9900 9900 7200 16	750 10725 990 780 5070	1800 49920 3780 4140 360 4140 20700 3420	35 45 3120 44 1 1 0 3300 1920 7	310 2310 1 510 630 1 510 11 510 120 1 1470 2280	3320 15360 1 18900 2540 89100 3420 150 7980 5700 95400	19650 57400 26400 52800 12000 14850 72000 1650 4800 6150 21600		2250 4150 8910 2430 120 16200	1200 1200 0 540 0 4200 0 1200	4350 52200 73950 6090	1110 4800 3300 1110 630 1230 750 1230 450 1200 300 60 1350	540	120	90 1050 67200 1050 210 2100	12150 720 1080	5670 2700 1890 2460 5940 2490 660 2520 330 1980 2460	630 300 900 0 450	2700	240 75 1680 90	0 450	1080	540 23	10	120 600 45 240
Hyalodiscus stelliger Isthmia nervosa Lauderia borealis Leptocylindrus danicus Licmophora abbreviata Melosira nummuloides M. Borreri Navicula membranacea Nitzschia seriata N. longissima N. longissima N. losterium N. paradoxa Pleurosigma spp. Planktoniella sol Pseudoeunotia doliolus Rhizosolenia alata R. Stolterfothii R. cylindrus R. robusta R. setigera	30 3	300 510 300 120 120 1290 330	180 300 1200 600 150 1050 750 1950 4 300 1	540 510 0 2100 840 0 240	360 270 30 90	1800 900 1200 150 5 750		2400 10920 30 1200	300 60	0 5040 0 1560 390	360 34650 240 1950	240 240 960	270 1165 120 570 1020 120	14400 3 64800 97 360 9900 97 7200 16	750 10725 990 780 5070	1800 49920 3780 4140 360 4140 20700 3420 6900 3240	35 45 3120 44 1 1 1 3300 1920 720 1	310 2310 1 510 630 1 510 15 510 15 1470 2280 050	3320 15360 1 18900 2540 89100 3420 150 7980 5700 95400 5850 3180	19650 26400 52800 12000 14850 72000 1650 4800 6150 21600 66300 192000 4950 12000		2250 4150 8910 2430 120 16200 486	0 1200 0 540 0 4200 0 1200	4350 52200 73950 6090 640 600 13950	1110 4800 3300 1110 630 1230 750 1230 450 90 1200 300 60 1350	540	120 90 120	90 1050 67200 1050 210	720 1080	5670 2700 1890 2460 5940 2490 660 2520 330 1980 2460 330 630 1890	630 300 900 450	900	240 75 1680 90	0 450	1080 1680 840	540 23 0 600 0 60 33 30 5	10	120 600 45 240
Hyalodiscus stelliger Isthmia nervosa Lauderia borealis Leptocylindrus danicus Licmophora abbreviata Melosira nummuloides M. Borreri Navicula membranacea Nitzschia seriata N. longissima N. closterium N. paradoxa Pleurosigma spp. Planktoniella sol Pseudoeunotia doliolus Rhizosolenia alata R. Stolterfothii R. cylindrus R. robusta R. setigera R. styliformis R. styliformis R. styliformis V. latissima	30 30 30 8	300 510 300 120 1290 130 1290 130 140 150 300 300	180 300 1200 600 150 1050 1050 750 1950 4 300 150 28 4	540 510 0 2100 840 0 240 0 660 0 0	360 270 30 90 180 210 90 285 30 60	1800 900 1200 150 750 2850	510 225 480 225 330 210 510 75 840 810	30 1200 45 3120 30 960 90 1200 30	300 60 150 90 2400 450	5040 0 1560 390 0 7020	360 34650 240 1950 60 300 60 300 60 2400	240 2400 960	120 570 1020 120 75 90 360	3600 3600 3600 3600 3600 3600 3600 3600	180 180 180 180 180 1925 1975 1975 1975 1976 1976 1977 1977 1977 1978	1800 49920 3780 4140 360 4140 20700 3420 6900 3240 2760 540 1350 1830 17940 1260 180	35 45 3120 44 1 1 1 3300 1920 720 1	310 2310 1 510 630 1 510 150 150 150 150 150 150 150 150 150	3320 15360 1 18900 2540 89100 3420 150 7980 6720 5700 95400 5850 3180 900 3120	19650 26400 52800 12000 14850 72000 1650 4800 6150 21600 66300 192000 4950 12000 4800 1500 3300		2250 4150 8910 2430 120 16200 486	0 1200 0 540 0 4200 0 1200 0 1200 1140 1800	4350 52200 73950 6090 640 600 13950 24900	1110 4800 3300 1110 630 1230 750 1230 450 1200 300 60 1350	540 540 22	120 90 120 120 240 90	90 1050 67200 1050 210 2100 210	12150 720 1080 1620 480	5940 2490 660 2520 330 630 630 360 960	630 300 900 450	900 :	240 75 1680 90	0 450	1080	540 23 0 600 0 60 33 30 5	10	120 600 45 240
Hyalodiscus stelliger Isthmia nervosa Lauderia borealis Leptocylindrus danicus Licmophora abbreviata Melosira nummuloides M. Borreri Navicula membranacea Nitzschia seriata N. longissima N. closterium N. paradoxa Pleurosigma spp. Planktoniella sol Pseudoeurotia doliolus Rhizosolenia alata R. Stolter fothii R. cylindrus R. robusta R. setigera R. styliformis R. styliformis R. styliformis v. latissima R. calcar-avis R. hebetata f. semispina	30 30 30 8	300 510 300 120 120 1290 330	180 300 1200 600 150 1050 750 1950 4 300 150 28 4 33	540 510 0 2100 840 0 240 0 660 0 0	360 270 150 90 180 210 75	1800 900 1200 150 750 2850	510 225 480 225 330 210 510 75 840 810	30 1200 45 3120 30 960	300 60 150 90 2400 450 90 1050	5040 1560 390 0 7020 0 5460 390	360 34650 240 1950 60 300 60 300	240 2400 960	270 1165 120 570 1020 120 75	3600 3600 3600 3600 3600 3600 3600 3600	750 10725 990 780 5070 330 570 330 195	1800 49920 3780 4140 360 20700 3420 6900 3240 2760 540 1350 1830 17940 1260 180 8280 2160	35 45 3120 44 1 1 1 3300 1920 720 1 2640	310 2310 1 510 630 1 510 11 510 12 1460 1 150 120 1 780 2280 1 550 630 180 210 420	3320 15360 1 18900 2540 89100 3420 150 7980 5700 95400 5850 3180 900 900 3120	1650 26400 52800 12000 14850 72000 1650 4800 6150 21600 66300 192000 4950 12000 4800 1500 3300 1500 32400 2400		2250 4150 8910 2430 120 1620 486 120 162	1200 1200 0 540 0 1200 0 1200 0 1400 1400 1800	4350 52200 73950 6090 640 600 13950 24900	1110 4800 3300 1110 2250 630 1230 750 1230 450 90 1200 300 60 1350 540	540 540 22 540	120 90 120 120 240 90	90 1050 67200 1050 210 2100 2100	12150 720 1080 1620 480	5670 2700 1890 2460 5940 2490 660 2520 330 630 1890 360 960 300	300 900 120 60	2700 900 360	240 75 1680 90 120 3150 30 30	0 450	1080 1680 840	540 23 0 600 0 60 33 30 5	10	120 600 45 240
Hyalodiscus stelliger Isthmia nervosa Lauderia borealis Leptocylindrus danicus Licmophora abbreviata Melosira nummuloides M. Borreri Navicula membranacea Nitzschia seriata N. longissima N. closterium N. paradoxa Pleurosigma spp. Planktoniella sol Pseudoeunotia doliolus Rhizosolenia alata R. Stolterfothii R. cylindrus R. robusta R. setigera R. styliformis R. styliformis R. calcar-avis R. hebetata f. semispina R. acuminata R. Bergonii R. Castracanei	30 30 8	300 510 300 120 1290 130 1290 130 140 150 300 300	180 300 1200 600 150 1050 750 1950 4 300 150 28 4 33 150 150	540 510 0 2100 840 0 660 0 540	360 270 30 90 180 210 90 285 30 60	1800 900 1200 150 750 2850	510 225 480 330 210 510 75 840 810	30 1200 45 3120 30 960 90 1200 30 270 960	300 60 150 90 2400 450 90 1050	5040 1560 390 0 7020 0 5460 390	360 34650 240 1950 60 300 60 300 60 2400	240 2400 960	120 570 1020 120 75 90 360	360 9900 7200 360 9900 9900 9900 9900 9900 9900 990	990 780 990 330 195 2145 980 780 330 330	1800 49920 3780 4140 360 20700 3420 6900 3240 2760 540 1350 1830 17940 1260 180 8280 2160	35 45 3120 44 1 1 1 3300 1920 720 1 2640 480	310 2310 1 510 630 1 510 150 150 120 1 780 2280 050 630 210 420 6600 240	3320 15360 1 18900 2540 89100 3420 150 7980 5700 95400 5850 3180 900 900 3120	1650 26400 52800 12000 14850 72000 1650 4800 6150 21600 66300 192000 4950 12000 4800 1500 3300 1500 32400	135 180 60 60 120	2250 4150 8910 2430 120 1620 486	1200 1200 0 540 0 4200 1200 0 1200 1140 1800	4350 52200 73950 6090 640 600 13950 24900	1110 4800 3300 1110 2250 630 1230 750 1230 450 90 1200 300 60 1350 540	540 540 22	120 90 120 120 140 90	90 1050 67200 1050 210 2100 210	12150 720 1080 1620 480	5940 2490 660 2520 330 630 630 360 960	300 900 120 60	2700 900 360	240 75 1680 90 120 3150 30	0 450	1080 1680 840	540 23 0 600 0 60 33 30 5	10	120 600 45 240
Hyalodiscus stelliger Isthmia nervosa Lauderia borealis Leptocylindrus danicus Licmophora abbreviata Melosira nummuloides M. Borreri Navicula membranacea Nitzschia seriata N. longissima N. closterium N. paradoxa Pleurosigma spp. Planktoniella sol Pseudoeunotia doliolus Rhizosolenia alata R. Stolterfothii R. cylindrus R. robusta R. setigera R. styliformis R. styliformis v. latissima R. calcar-avis R. hebetata f. semispina R. acummata R. Bergonii R. Castracanei R. flagillissima Schrödella Schröderi	30 30 8	300 510 300 120 1290 330 120 150 300 960 510 1590 165 330 5700	180 300 1200 600 150 1050 750 1950 4 300 150 150 28 4 33 150 150 30 30 30 30 30 30 30 30 30 3	540 510 0 2100 840 0 240 660 0 540	360 270 30 150 90 180 210 75 285 30 60 150 45	1800 900 1200 150 750 2850	510 225 480 330 210 510 75 840 810	30 1200 45 3120 30 960 90 1200 30 240 30	300 60 150 90 2400 450 90 1050 450 75	5040 1560 390 0 7020 0 5460 390 0 0	360 34650 240 1950 60 300 60 300 60 2400	240 2400 960 300	270 1165 120 570 1020 120 75 90 360 210 1950 210 60	360 9900 7200 3600 9900 7200 16 3600 36 3600 36 3600 36 3600	300 180 750 10725 990 780 5070 570 330 195 990 2145 980 780 330 330 330 585	1800 49920 3780 4140 360 4140 20700 3420 6900 3240 2760 540 1350 1830 17940 1260 180 8280 2160 1350 720	35 45 3120 44 1 1 1 3300 1920 720 1 2640 480	310 2310 1 510 630 1 510 150 150 120 1 780 2280 050 630 210 420 600 240	3320 15360 1 18900 2540 89100 3420 150 7980 6720 5700 95400 5850 3180 900 3120 960 6120	1650 26400 12000 12000 14850 72000 14850 4800 6150 21600 192000 4800 1500 3300 1200 32400 2400 26400 1620	135 180 60 60 120	2250 4150 8910 2430 120 1620 486 120 162 120 75 324	1200 1200 0 1200 0 1200 0 1200 0 1200 0 13120 2	4350 52200 73950 6090 640 600 13950 24900 630 780	1110 4800 3300 1110 630 1230 750 1230 450 90 1200 300 60 1350 540 1500	540 540 22 540	120 90 120 120 240 90 300 180	90 1050 67200 1050 210 2100 210 210 150 120	12150 720 1080 1620 480	5670 2700 1890 2460 5940 2490 660 2520 330 1890 360 960 300 1830 3960 7770 60300	300 300 900 450 0 120 60 0 240	900 : 360	240 75 1680 90 120 3150 30 30 30 90	0 450	1080 1080 1680 840 720 2310	600 540 23 540 33 50 30 50 30 720	30 45 90 45 30 30	120 600 45 240 360 390 45
Hyalodiscus stelliger Isthmia nervosa Lauderia borealis Leptocylindrus danicus Licmophora abbreviata Melosira nummuloides M. Borreri Navicula membranacea Nitzschia seriata N. longissima N. closterium N. paradoxa Pleurosigma spp. Planktoniella sol Pseudoeunotia doliolus Rhizosolenia alata R. Stolter fothii R. cylindrus R. robusta R. setigera R. styliformis R. styliformis R. styliformis v. latissima R. calcar-avis R. hebetata f. semispina R. acummata R. Bergonii R. Castracanei R. flagillissima Schrödella Schröderi Skeletonema costatum	30 3 30 30 8	300 510 300 120 1290 330 120 150 300 340 960 510 1590 165 330 5700	180 300 1200 600 150 1050 1050 750 1950 4 300 150 28 4 33 150 300 300 3930 9	540 510 510 0 2100 840 0 240 0 660 0 540 0 300	360 270 30 90 180 210 90 285 30 60 150 45	1800 900 1200 150 750 2850 3000	510 225 480 330 210 510 75 840 810 1140 990 75	30 1200 45 3120 30 960 90 1200 30 270 960	300 60 150 90 2400 450 90 1050 450 75 150	0 5040 1560 390 0 7020 0 5460 390 0 11550	360 34650 240 1950 60 300 60 300 60 2400	240 2400 960 300	270 1165 120 570 1020 120 75 90 360 210 1950 210 60	360 970 16 3600 36 3600 36 3600 19 5700 19	990 780 990 330 195 2145 980 780 330 330	1800 49920 3780 4140 360 4140 20700 3420 6900 3240 2760 540 1350 1830 17940 1260 180 8280 2160 1350 720	35 45 3120 44 1 1 3300 1920 720 1 2640 480 1580 1580 1580	310 2310 1 510 630 1 510 150 150 120 1 780 2280 050 630 210 420 600 240	3320 15360 1 18900 2540 89100 3420 150 7980 6720 5700 95400 5850 3180 900 3120 960 6120	1650 26400 12000 12000 14850 72000 14850 4800 6150 21600 192000 4800 1500 3300 1200 32400 2400 26400 1620	135 180 60 60 120	2250 4150 8910 2430 120 1620 486 120 162	1200 1200 1200 0 540 4200 1200 1200 1140 1800 0 3120 2	4350 52200 73950 6090 640 600 13950 24900 630 780	1110 4800 3300 1110 630 11230 750 1230 450 90 1200 300 60 1350 540 1500 1500 1500 1500 300	540 540 22 540 1080 3780 2700	120 90 120 120 240 90	90 1050 67200 1050 210 2100 210 210 150 120	12150 720 1080 1620 480	5670 2700 1890 2460 5940 2490 660 2520 330 1890 360 960 300 1830 3960 7770 60300	300 300 900 450 0 120 60 0 240	900 : 360	240 75 1680 90 120 3150 30 30 30 90	0 450	1080 1080 1680 840 720 2310	600 540 23 540 33 50 30 50 30 720	30 45 90 45 30 30	120 600 45 240
Hyalodiscus stelliger Isthmia nervosa Lauderia borealis Leptocylindrus danicus Licmophora abbreviata Melosira nummuloides M. Borreri Navicula membranacea Nitzschia seriata N. longissima N. closterium N. paradoxa Pleurosigma spp. Planktoniella sol Pseudoeunotia doliolus Rhizosolenia alata R. Stolterfothii R. cylindrus R. robusta R. setigera R. styliformis v. latissima R. calcar-avis R. hebetata f. semispina R. acumnata R. Bergonii R. Castracanei R. flagillissima Schrödella Schröderi Skeletonema costatum Stephanopyxis palmeriana Streptotheca thamensis	30 3 30 3 30 8	300 510 300 120 1290 130 120 150 300 960 510 1590 165 130 5700 160 4440	180 300 1200 600 150 1050 1050 750 1950 4 300 150 28 4 33 150 300 300 300 3930 9 3	540 510 510 0 2100 840 0 660 0 540 0 300 0 300	360 270 150 90 180 210 90 285 30 60 150 45 630 570 210	1800 900 1200 150 750 2850 3000	510 225 480 330 210 510 75 840 810 990 75	30 1200 45 3120 30 960 90 1200 30 240 30 7680	300 60 150 90 2400 450 90 1050 450 75 150	5040 1560 390 0 7020 0 5460 390 0 11550 0 780	360 34650 240 1950 60 300 60 300 60 2400 1050	240 2400 960 300	270 1165 120 570 1020 120 75 90 360 210 1950 210 60 1590 750	360 9900 19 3600 3600 3600 3600 3600 3600 3600 360	300	1800 49920 3780 4140 360 4140 20700 3420 6900 3240 2760 540 1350 1830 17940 1260 180 8280 2160 1350 720 1380 25840 1440	35 45 3120 44 1 1 1 3300 1920 720 1 2640 480 1680 156 5	310 2310 1 510 630 1 510 150 150 120 1 780 2280 050 630 210 420 600 240 560 1890 3240 4390	3320 15360 1 18900 1650 2540 89100 3420 150 7980 6720 95400 5850 3180 900 900 3120 960 6120 4560 1068300 780	1650 26400 12000 12000 14850 72000 14850 72000 14850 12000 4800 1500 3300 1500 1200 2400 2400 26400 1620 29700 9600	180 135 60 60 120 30 30	2250 4150 8910 2430 120 16200 486 120 162 120 75	1200 1200 1200 0 540 0 1200 0 1200 1140 1800 0 3120 2	4350 52200 73950 6090 640 600 13950 24900 630 780 670 62400 22500	1110 4800 3300 1110 630 11230 750 1230 450 90 1200 300 60 1350 540 1500 1500 1500 1500 300	540 540 22 540 1080 3780 2700	120 90 120 120 240 90 300 180 270 120	90 1050 67200 1050 210 2100 210 210 150 120 540 2250 139230 1260	12150 720 1080 1620 480	5670 2700 1890 2460 5940 2490 660 2520 330 1890 360 960 300 1830 3960 7770 60300 6300 6530 113400	630 630 300 900 450 120 60 240 60 240	900 : 360 180	240 75 1680 90 120 3150 30 30 30 90 480	0 450 0 1200 0 600	1080 1080 1680 840 720 2310 420	600 540 23 30 30 30 30 30 240 720 1620 103 0 600 89	30 45 90 45 30 50 1950 40 210	120 600 45 240 360 390 45 360 2 1950 2190 26
Hyalodiscus stelliger Isthmia nervosa Lauderia borealis Leptocylindrus danicus Licmophora abbreviata Melosira nummuloides M. Borreri Navicula membranacea Nitzschia seriata N. longissima N. closterium N. paradoxa Pleurosigma spp. Planktoniella sol Pseudoeunotia doliolus Rhizosolenia alata R. Stolter fothii R. cylindrus R. robusta R. setigera R. styliformis R. styliformis R. calcar-avis R. hebetata f. semispina R. acumnata R. Bergonii R. Castracanei R. flagillissima Schröderla Schröderi Skeletonema costatum Stephanopyxis palmeriana Streptotheca thamensis Synedra spp. Thalassionema nitzschioides Thalassionera spp.	30 30 8 30 8 30 8 30 8 30 8 30 8 30 8 3	300 510 300 120 1290 330 120 150 300 960 510 1590 165 330 5700 160 4440 500 15240	180 300 1200 600 150 1050 1050 750 1950 4 300 150 28 4 33 150 300 300 300 3930 9 3	540 510 510 0 2100 840 0 660 0 540 0 300 0 5580	360 270 30 90 180 210 90 285 30 60 150 45	1800 900 1200 150 750 2850 3000	510 225 480 330 210 510 75 840 810 990 75	30 1200 45 3120 30 960 90 1200 30 240 30	300 60 150 90 2400 450 90 1050 450 75 150	5040 1560 390 0 7020 0 5460 390 0 11550 780	360 34650 240 1950 60 300 60 300 60 2400 1050 4650	240 2400 960 300	270 1165 120 570 1020 120 75 90 360 210 1950 210 60	360 9700 1950 1950 1950 1950 1950 1950 1950 19	300	1800 49920 3780 4140 20700 3420 6900 3240 2760 540 1350 1830 17940 1260 180 8280 2160 1350 720 1380 25840 1440 41860 30240	355 450 3120 441 11 11 11 11 11 11 11 11 1	310 2310 1 510 630 1 510 150 150 150 150 120 1470 2280 150 630 210 420 1600 240 1600 3240 420 1600 3240 420 1600 3240 420 1600 3240 420 1600 3240 420 1600 1890 3240 420 1600 1890 3240 420 1890 42	3320 15360 1 18900 1650 2540 89100 3420 150 7980 6720 95400 5850 3180 900 960 6120 4560 1068300 780 67000 25500	1650 26400 12000 12000 14850 72000 14850 72000 4800 192000 4800 1500 1200 2400 1530 26400 1620 29700 9600 858500 1056000 64800 19200 64800	180 135 60 60 120 30 30	2250 4150 8910 2430 120 16200 486 120 162 120 75	1200 1200 1200 0 540 0 4200 1200 1140 1800 0 3120 2 37800 1 1	4350 52200 73950 6090 640 600 13950 24900 630 780 670 62400 22500	1110 4800 3300 1110 630 11230 750 11230 450 90 1200 300 60 1350 540 1500 1500 1500 1500 17700 17650 17700	540 540 22 540 1080 3780 2700	120 90 120 120 240 90 300 180 270 120	90 1050 67200 1050 210 2100 210 210 150 120 540 2250 139230 1260	12150 720 1080 1620 480 1890 1620 5400	5670 2700 1890 2460 5940 2490 660 2520 330 1980 2460 330 630 960 300 1830 360 7770 60300 1980 6300 6530 113400 66	300 300 900 450 0 240 0 6840 2	900 : 360 180	240 75 1680 90 120 3150 30 30 30 90 480	0 450 0 1200 0 600	1080 1080 1680 840 720 2310	600 540 23 30 30 30 30 30 240 720 1620 103 0 600 89	30 45 90 45 30 30 50 1950	120 600 45 240 360 390 45
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