PRELIMINARY REPORT ON THE DISTRIBUTION OF SMALL-SIZED MARINE DEBRIS IN SURUGA BAY

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ABSTRACT

From 17 to 29 March 1988, a survey to collect small marine debris was conducted in Suruga Bay. Tows (10-min) were made at 24 stations using a circular tow net with a diameter of 1.4 m and mesh size of 1.7 mm at the mouth and 0.5 mm at the cod end.

A total of 665 pieces of debris were collected during the survey. Of these, terrestrial debris and plants such as wood made up 50.1% of the total, followed in decreasing order by seaweed (19.5%), Styrofoam (13.8%), plastic sheets (13.2%), and other plastic pieces (3.3%).

Plastic sheet debris was found at most stations, whereas Styrofoam showed a tendency to accumulate in specific areas.

The distribution of each type of small debris corresponded well to the distribution of large debris observed by sightings conducted during the same cruise.

INTRODUCTION

Petrochemical products flowing and thrown into the sea are causing a number of problems. It has been pointed out that marine organisms swallow debris fragments together with their food. These fragments are generated when drifting petrochemical products in the sea are, in the process of their deterioration, broken up by physical factors such as waves. It is necessary to examine these small floating objects in order to understand the changes in size as well as the distribution and movement of drifting petrochemical products over the course of time.

In R. S. Shomura and M. L. Godfrey (editors), Proceedings of the Second International Conference on Marine Debris, 2-7 April 1989, Honolulu, Hawaii. U.S. Dep. Commer., NOAA Tech. Memo. NMFS, NOAA-TM-NMFS-SWFSC-154. 1990.

METHODS

This research was carried out at 24 stations in Suruga Bay from 17 to 29 March 1988 (Fig. 1). The nets used for collecting debris were 1.4 m in diameter. The first two-thirds of the net had a mesh size of 1.7 mm; the remaining third a mesh size of 0.5 mm. The net was towed for 10 min at a speed of 3 kn with the mouth of the net half submerged. Collected objects were immediately preserved in formalin and brought back to the laboratory, where they were counted and weighed and the information recorded. Those with maximal dimensions of 5 cm were excluded.

RESULTS

Major petrochemical products collected in this survey were fragments of plastic, plastic sheeting, and Styrofoam. Among the natural debris was terrestrial debris such as wood fragments and straw as well as drifting seaweed (Table 1). A total of 665 pieces of debris were collected. Debris deriving from petrochemical products accounted for 30.4% of the total (Styrofoam fragments 13.8%, fragments of plastic sheeting 13.3%, and plastic fragments 3.3%). Debris of terrestrial origin accounted for 50% of the total (the largest percentage), and seaweed for 19.5%. Plastic sheet fragments were extensively distributed, being collected at 66.7% of the 24 research stations (Fig. 1). The distribution of other plastic and Styrofoam was limited, occurring at only 29.2 and 20.8% of the stations, respectively. Natural debris of terrestrial origin was collected at 66.7% of the stations and seaweed at 62.5% of the stations.

Plankton, mainly Copepoda, sardine fry, and fish eggs were collected at all the research stations. These types of plankton numbered more than 1,000 at each station.

The highest densities of marine debris were found all across the middle of Suruga Bay. Research stations with high densities of plastic sheet fragments were continuous, as seen in the case of stations 12, 13, 22, and 17. A similar distribution pattern was observed for all drifting objects. The distribution of Styrofoam fragments was limited, but high densities were found in geographical positions similar to stations 7, 6, and 1.

Currents and winds were considered to be major factors in moving this debris. It has been reported that the surface current in Suruga Bay can be affected by the Kuroshio, which flows eastward off the bay. As shown in Figure 2, Inaba (1988) pointed out two such instances. The course of the Kuroshio during the survey period was more offshore, corresponding to Case 2 in Figure 2 (Meteorological Agency of Japan 1988). It is assumed that the flow of outer oceanic water is from west of the mouth of the bay and divides into two currents near the center of the bay, with one current moving around the mouth of the bay clockwise and the other moving counterclockwise toward the inner side of the bay. The area of the highest densities of marine debris is on the boundary between these currents, which would represent a front. Strong northeast winds were blowing for several days during the survey period, but the distribution of marine debris was considered to be affected more by surface currents than by the winds.

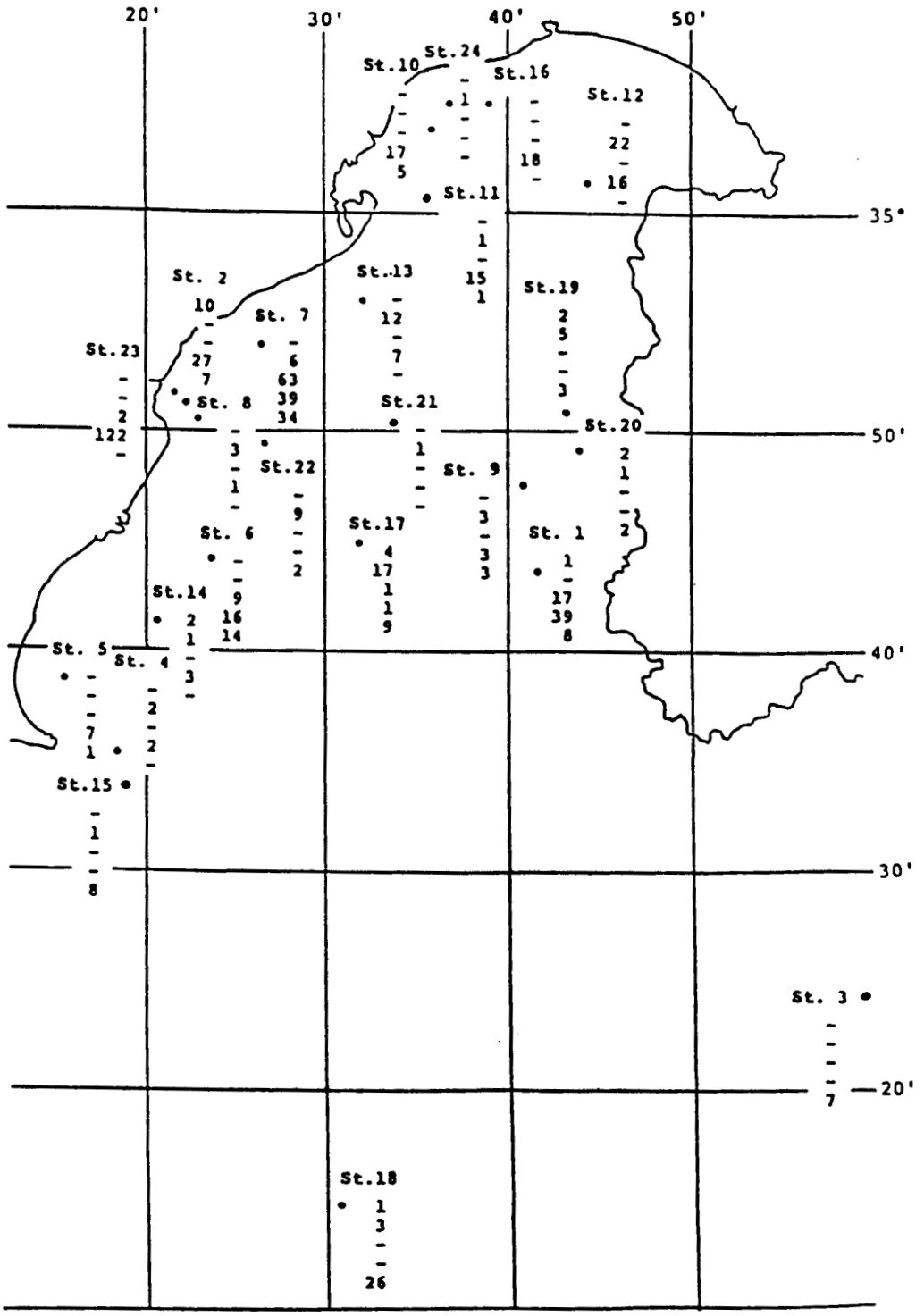

Figure 1.--Stations (St.) and data collected in minute marine debris survey. At each station, numbers from the top down indicate plastic pieces, plastic sheets, Styrofoam, land plants, and seaweed, in that order.

Table 1.--Sampling location and composition of minute marine debris in Suruga Bay.

Station	Time	Latitude N	Longitude E	Plastic pieces	Plastic sheets	Styrofoam	Land plants	Seaweed	Copepoda	Eggs	Larvae
1	12.50	34°43.72′	138°41.68′	1	--	17	39	8	42	10	--
2	7.17	34°51.19′	138°22.56′	10	--	--	27	7	--	--	--
3	11.56	34°24.30′	138°59.13′	--	--	--	--	7	--	3,230	--
4	16.42	34°36.32′	138°18.60′	--	2	--	2	--	58	--	7
5	7.10	34°37.30′	138°16.22′	--	--	--	7	1	1,120	84	--
6	11.04	34°43.58′	138°22.92′	--	--	9	16	14	15	--	--
7	16.40	34°54.90′	138°28.68′	--	6	63	39	34	--	--	--
8	7.17	34°50.75′	138°22.01′	--	3	--	1	--	37	--	--
9	11.35	34°47.72′	138°40.85′	--	3	--	3	3	25	154	--
10	14.42	35°04.05′	138°34.32′	--	--	--	17	5	--	--	--
11	9.11	35°02.33′	138°32.60′	--	1	--	15	1	26	15	--
12	10.31	35°02.70′	138°44.63′	--	22	--	16	--	15	46	--
13	12.45	34°57.33′	138°32.44′	--	12	--	7	--	25	12	--
14	17.05	34°41.56′	138°20.30′	2	1	--	3	--	43	82	--
15	7.44	34°34.05′	138°19.06′	--	1	--	--	8	--	--	--
16	11.54	35°05.48′	138°37.65′	--	--	--	18	--	22	57	--
17	17.03	34°45.49′	138°32.08′	4	17	1	1	9	121	15	--
18	12.02	34°14.81′	138°30.55′	1	3	--	--	26	--	19	34
19	16.32	34°51.26′	138°43.14′	2	5	--	--	3	12	38	--
20	7.11	34°48.68′	138°44.37′	2	1	--	--	2	--	--	1,540
21	7.25	34°50.28′	138°37.42′	--	1	--	--	--	--	3	--
22	12.08	34°49.17′	138°26.96′	--	9	--	--	2	--	--	6
23	7.14	34°51.66′	138°22.70′	--	--	2	122	--	--	--	6
24	13.03	34°05.22′	138°36.72′	--	1	--	--	--	--	--	5

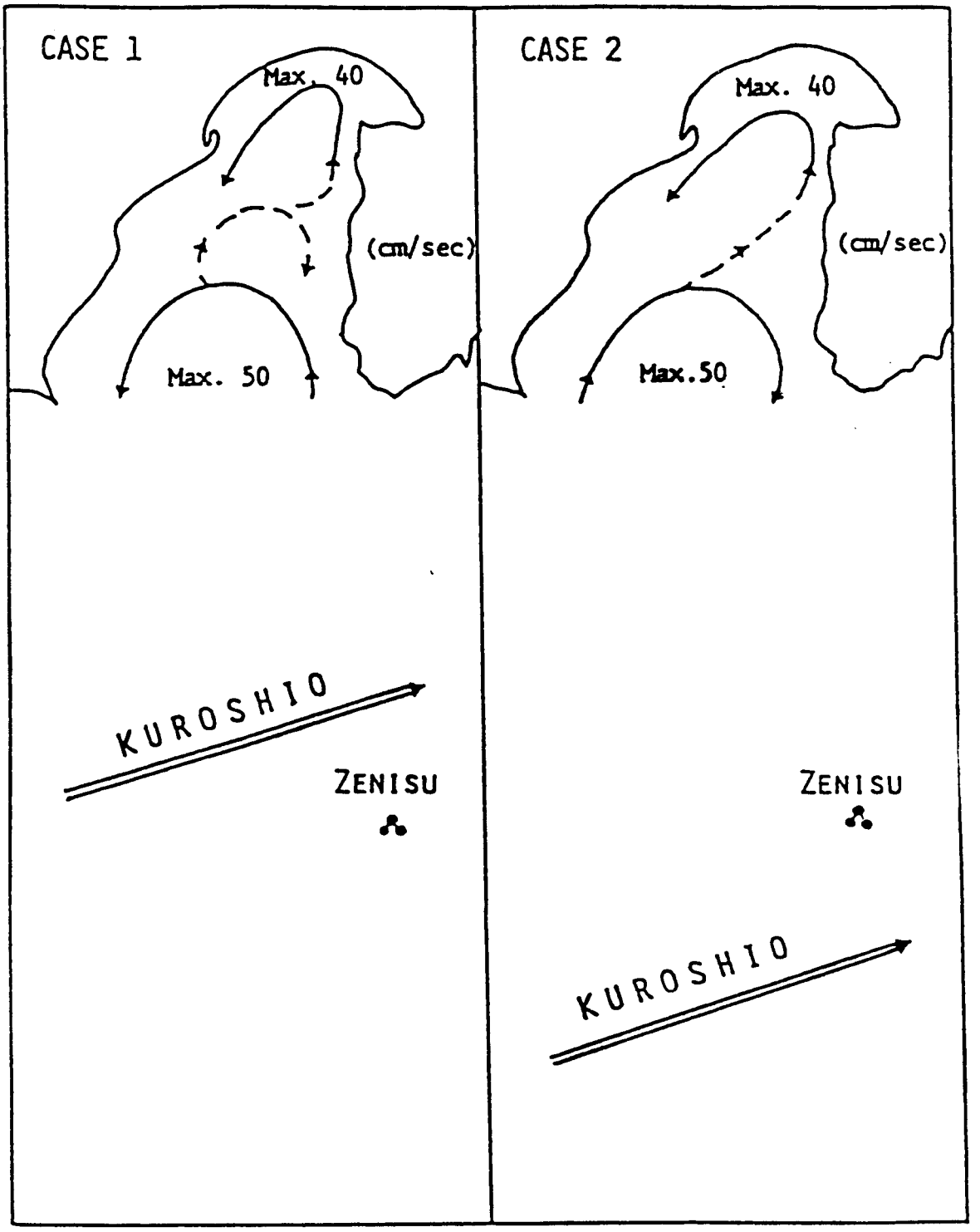

Figure 2.--Diagram showing the relationship of the Kuroshio to the surface current of Suruga Bay (Inaba 1988).

Plankton and marine debris showed an inverse correlation. Areas where plankton were found in large quantities were influenced a great deal by the open ocean. It is reasonable to assume that plankton and marine debris showed different distributions because the plankton, being totally submerged are not influenced at all by the wind.

Small floating objects were found most frequently in areas influenced heavily by coastal currents. The distribution of drifting petrochemical product fragments corresponded well to that of the larger floating objects. It is therefore conjectured that petrochemical products drifting in the sea gradually deteriorate and are broken into small fragments.

More detailed studies will be needed to find out the distribution and abundance of Styrofoam fragments.

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