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Radioactivity Survey of the mid Pacific Area, 1962

I Outline

AUGUST 1963

RADIOACTIVITY SURVEY OF THE MID PACIFIC AREA, 1962

I OUTLINE

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HISTORICAL

On the 4th of April 1962, the United States issued a statement that testing of nuclear devices would take place on the 5th of April in the Pacific area. Along with this announcement, the testing area, near Christmas Island, was outlined. On the 9th of April, the original test area was partially enlarged and another test area, near Johnston Island, established.

During the test period, a total of 36 nuclear devices were detonated. In view of the [redacted] detonations, the Radioactivity Countermeasure Headquarters of Japan held a meeting and decided, as a part of the radiological safety program during the resumption of nuclear tests, to conduct a survey of fish, available in Japan, that were acquired near the test area. Also, discussions were held with the Fisheries Agency, concerning plans to send a radiological survey vessel to the test area in order to determine the exact amount and extent of radioactive fallout and contamination within the mid Pacific area. To fulfill the first requirement, the Tokyo Metropolitan Government, started a sample survey of fish acquired from the test area subsequent to 25 April, at the Tsukiji Fish Market.

During this period the Radioactivity Countermeasure Headquarters, in conjunction with the Fisheries Agency, decided to send one of the Agency's survey vessels, the Shoyo-Maru, to the test area to perform the surveys and tests necessary to fulfill the second requirement.

In order to complete executive planning and to promote the survey trip, the Survey Vessel Dispatch Group was organized on the 15th of May by the Ministries and Agencies concerned, aided by individuals possessing knowledge and experience within this field.

The operation unit of this group, gradually formulated recommendations in regards to the operational aspects of the Survey trip, preparation of manuals covering radiation measurement and regulations pertaining to public dissemination of the survey results. These recommendations were finalized by the Radioactivity Countermeasure Headquarters.

The S.V. Shoyo-Maru was renovated and equipped with the necessary instruments and equipment. On the 27th of July 1962, the S.V. Shoyo-Maru with a specially assigned Survey team, departed from Takeshiba Pier, Tokyo, for the scheduled 55 day trip.

OPERATIONAL

The operational cruise, conducted in the waters adjacent to Johnston and Christmas Islands, was designed to survey radiation contamination and to collect biological, oceanographical and meteorological samples for radiochemical analysis.

Scientific Personnel Assigned to the Ship

Name	Parent Organization	Duties
	Naikai Regional Fisheries Research Laboratory, Fisheries Agency	Director of operation
	Institute of Physical and Chemical Research	Measurements of environmental radioactivity
	Japan Hydrographic Office	Sampling and radioactivity measurements of sea water and oceanographic observations
	National Institute of Radiological Sciences	Radioactivity measurements of air and rainwate
	Seikai Regional Fisheries Research Laboratory, Fisheries Agency	Sampling and radioactivity measurements in plankton and other marine biological specimens
	National Institute of Radiological Sciences	Ship doctor and radiation health physicist

Captain and members of the crew assisted the survey team members in oceanographic observations as well as biological sampling.

Equipment for Operation Cruise

To keep the interior of the ship safe from radiation contamination, absolute filters for the inherent openings in the air-conditioning system and asbestine filters for ventilators were installed. Furthermore, a special compartment for radiation detection and decontamination of personnel was built in the area of the doorway leading from the residential quarters to the upper deck.

The Radiochemical Laboratory, located in the forcastle, was equipped with a chemical hood, two muffle furnaces and other apparatuses. The Counting Laboratory, located in the stern, contained a Geiger-Muller counter fitted with an automatic sample changer and a 128-Channel Scintillation Spectrometer with a Scintillation Probe.
Other equipment and apparatuses were arranged as shown in Fig. 1.

Course and Itinerary

On the 27th of July 1962, the R.V. Shoyo-Maru departed from Tokyo for the Central Pacific. The ship track is shown in Fig. 2.

The ship sailed eastward on a straight course collecting water and plankton samples until its arrival at Honolulu on the 9th of August.

During the period 10-12th of August, while at Honolulu, the scientists aboard attended a meeting with the staffs of the Division of Operation Safety, U.S. Atomic Energy Commission; the U.S. Public Health Service; the Bureau of Commercial Fisheries, and the Laboratory of Radiation Biology, University of Washington to discuss the operational aspects of the cruise. Also, information on radiation contamination in the Central Pacific waters for safety purposes during the cruise, was received.

On the 13th of August, the R.V. Shoyo-Maru departed Honolulu, and conducted radiological surveys of sea water, plankton and fish caught by longline, together with routine oceanographic observation in the Christmas and Johnston Island areas, then, returned to Honolulu on the 31st of August. On the 4th of September, after refueling in Honolulu, the ship departed taking a westward course to Tokyo. Radiological surveys of surface water and plankton were conducted until the ship reached Tokyo on the 17th of September.

Measurements of the radiation dose rate and radioactivity in the air and rainwater were made each day during the entire trip.

Analytical Operation

Samples collected by the S.V. Shoyo-Maru were transfered to following organizations for radiochemical analysis.

Samples	Organizations
Rain water	Meteorological Research Institute.
Sea water	Hydrographic Division, Maritime Safety Board Agency. Meteorological Research Institute.
Fish	National Institute of Radiological Sciences. Japan Analytical Chemistry Research Institute.
Plankton	Tokai Regional Ficheries Research Laboratory.

RESULTANT

Radioactivity

Gross β-radioactivity in the air ranged from 0.1-5.9 $\mu\mu c/m^3$ and that in rainwater from 0.2-7.0 $\mu\mu c/m\ell$. These values were recognized to be of a low level. Composition of radio nuclides in rain water are developing by Meterological Research Institute.

Gross β-radioactivity in sea water from the South Equatorial Current was found to be less than $1^{\mu\mu c}/\ell$., while those from the North Equatorial Current and the Equatorial Countercurrent

registered 1-3 μμc/ℓ. The same tendency of regional difference in the concentration of nuclides was also observed. According to the results obtained by Hydrographic Division, Maritime Sofety Board Agency, the mean values for nuclides in the Equatorial Current were 0.1 μμc/ℓ for ^{90}Sr, 0.1 μμc/ℓ for ^{137}Cs and 0.5 μμc/ℓ of ^{144}Ce. On the other hand, the mean values found in the North Equatorial Current and Equatorial Countercurrent were 0.2 μμc/ℓ for ^{90}Sr, 0.4 μμc/ℓ for ^{137}Cs and 1.5 μμc/ℓ for ^{144}Ce. In the North Equatorial Current, higher concentrations of nuclides were found above the thermocline than below.

In general, it was recognized that the activity in the waters under survey were practically all of a low level.

Gross β-radioactivity in plankton ranged from 114 to 1172 dpm/0.5g of ash.
This was approximately equal to the data obtained in Japanese waters. Differences in radiation contamination among the types of organisms and currents was hardly observed. The predominance of ^{95}Zr-^{95}Nb in plankton was recognized with γ-ray spectrometer by Tokai Regional Fisheries Research Laboratry.
The radioactivity survey on fish surface was done with γ-ray scintilation surveymeter, and detectable radioactivity were not observed. Radiochemical analysis on sample fishes were carried out in two institutes as National Institute of Radiological Sciences and Japan Analytical Chemistry Research Institute. In fish muscles, concentrations of ^{137}Cs, varied from 6.0 to 22.5 μμc/Kg, and that of ^{90}Sr, were from 0.1 to 0.2 μμc/Kg of wet sample. Concentrations of ^{90}Sr in hard tissues were 1.07~9.54 μμc/Kg (0.05~0.43 s.u.) in the bone and 9.36~18.54 μμc/Kg (0.29~0.58 s.u.) in the scales with skin. In the intestinal organs, 146~357 μμc/Kg of ^{65}Zn and 60~147 μμc/Kg of ^{60}Co, were determined.
According to the results obtained by gamma-ray puls hight analysis, ^{95}Zr - ^{95}Nb, was easily detected with ^{65}Zn and ^{40}K in the plankton and the gill, intestine and stomach content of fishes. On the other hand, no appreciate amount of ^{95}Zr - ^{95}Nb was found in other organs of fishes.

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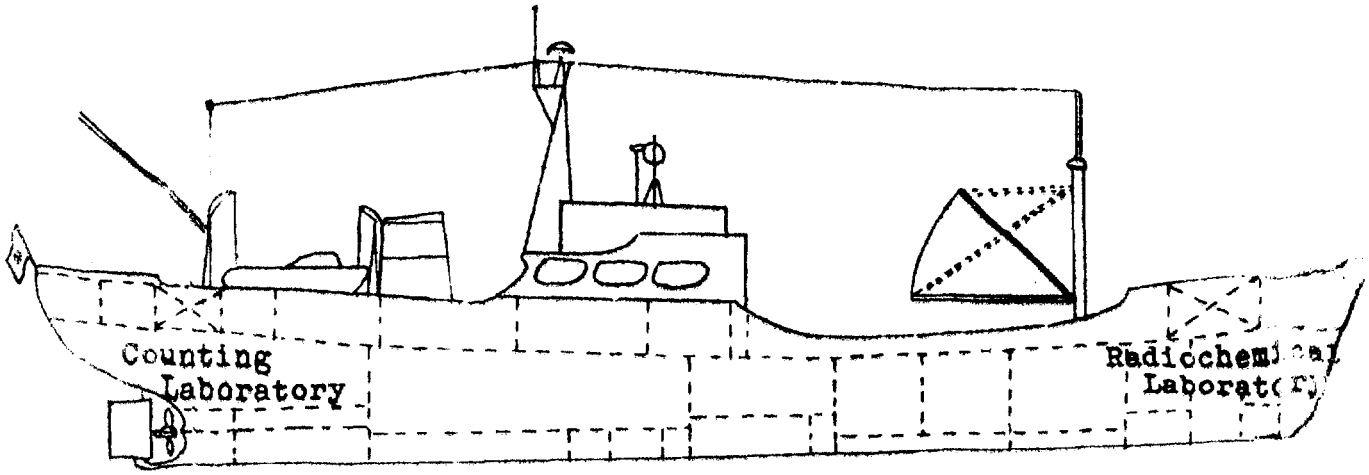
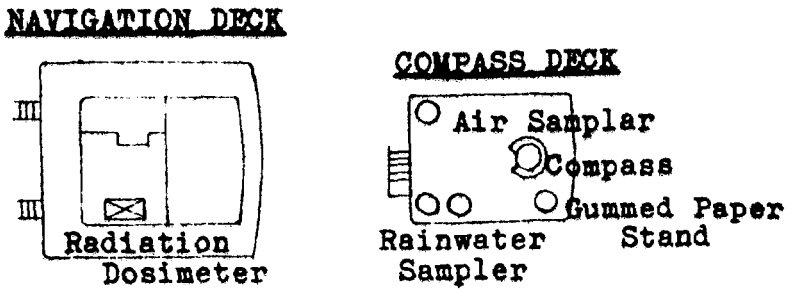
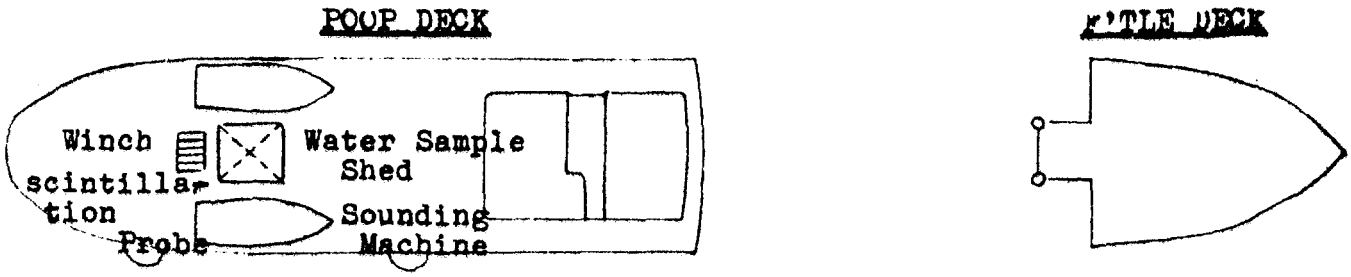
Based on measurements made with film badges, individual radiation exposure doses during the entire cruise was less than 30 mr. The comparative results of all types of physical and biochemical examinations of the crew before and after the cruise did not reveal any significant symptoms which could be regarded as products of radiation.

Particulars of the S.V. Shoyo-Maru.

Length	51.00 m
Width	8.50 m
Depth	4.30 m
Gross Tonnage	602.95 tons
Net Tonnage	190.67 tons
Main Engine Power	1200 HP
Speed in Trial (Max)	13.305 knots
Sea Speed	11.977 knots
Fish Hold Capacity	120.2 m^3
Fuel Oil Tank Capacity	268.7 m^3
Fresh Water Tank Capacity	117.2 m^3







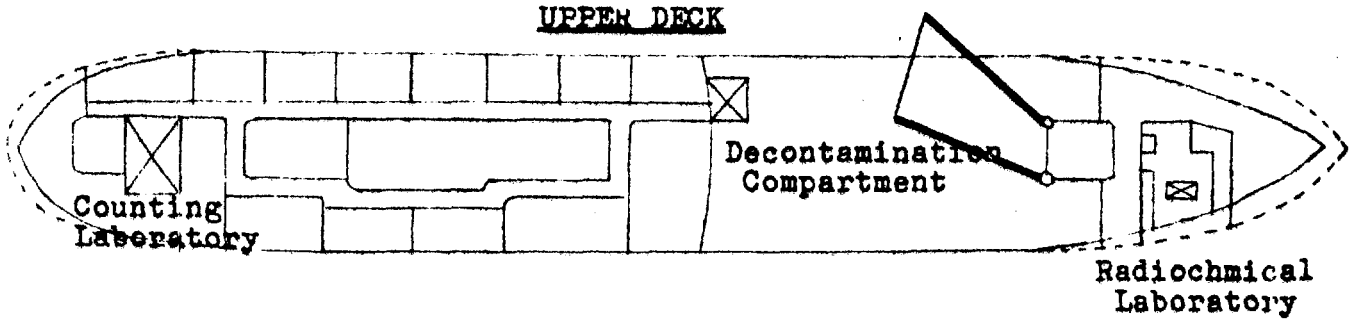


Figure 1. Arrangement of the equipments on board of the S.V. Shoyo-Maru

CRUISE STATION LIST

Station	Latitude / Longitude	Date/Time (JST)	Weather	Atomospheric temp. (°C.)	Surface water temp. (°C.)
0-Water sampling	34°58.0' N 155°50.0' E	7/30 0745 0923	Cloudy	27.0	24.3
0-1 Plankton tow	34°52.6' N 157°47.0' E	" 1715 1755	Cloudy	25.8	26.0
1 Water sampling	33°08.9' N 172°41.2' E	8/2 0630 0747	Cloudy	26.1	25.3
2 Plankton tow	32°46.0' N 174°26.5' E	" 1600 1643	Cloudy Overcast	25.8	25.4
3 Plankton tow	31°31.0' N 179°20.0' E	8/3 1530	Cloudy	25.5	24.9
4 Water sampling	30°50.6' N 178°06.0' W	8/4 0530 0620	Cloudy	28.0	25.2
5 Plankton tow	30°10.5' N 176°25.0' W	" 1457 1537	Cloudy	26.6	25.9
6 Plankton tow	28°22.0' N 172°15.0' W	8/5 1528 1613	Cloudy Overcast	26.0	26.2

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Station	Lat., Long.	Date/Time (JST)	Weather	Atomospheric temp. (C.)	Surface water temp. (C.)
7 Plankton tow	26°37.5' N 168°16.5' W	8/6 1327 1407	Cloudy	26.1	26.4
8 Longline fishing Water sampling	13°26.0' N 162°28.0' W	8/15 0432 1015	Cloudy	27.3	26.2
9 Plankton tow	12°25.5' N 162°56.1' W	" 1557 1640	Cloudy	26.4	26.9
10 Water sampling	10°22.0' N 163°53.0' W	8/16 0430 0537	Clear	28.4	27.5
11 Plankton tow	8°36.0' N 164°37.0' W	" 1600 1700	Cloudy	27.0	28.0
12 Longline fishing Water sampling	7°09.7' N 165°08.5' W	8/17 0430 1017	Cloudy	28.8	28.3
13 Plankton tow	6°10.8' N 164°57.3' W	" 1600 1700	Squall	27.2	27.7
14 Longline fishing Water sampling	4°32.0' N 165°24.0' W	8/18 0430 1126	Cloudy	29.3	27.9
15 Plankton tow	3°47.0' N 165°30.5' W	" 1500 1600	Clear	28.0	27.8

Station	Lat., Long.	Date/Time (JST)	Weather	Atomospheric temp. (C.)	Surface water temp. (C.)
16 Water sampling	1°08.8' N 165°09.9' W	8/19 0605 0807	Clear	29.8	28.1
17 Plankton tow	0°15.5' S 165°04.5' W	" 1558 1658	Clear	26.8	27.4
18 Longline fishing	1°55.0' S 165°00.0' W	8/20 0430 1019	Cloudy	28.3	27.5
19 Plankton tow	1°28.5' S 164°31.5' W	" 1603 1705	Clear	26.8	27.5
20 Water sampling	0°00.0' 162°35.0' W	8/21 0500 0545	Cloudy	29.0	27.1
21 Plankton tow	1°01.5' N 161°23.0' W	" 1500 1700	Cloudy	26.5	27.1
22 Plankton tow	1°48.4' N 160°21.2' W	8/22 0048 0158	Cloudy	26.2	26.8
23 Longline fishing Water sampling	1°55.0' N 160°25.0' W	" 0430 1011	Cloudy	28.0	26.7
24 Plankton tow	1°28.5' N 160°25.0' W	" 1500 1640	Cloudy	26.4	26.9

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Station	Lat., Long.	Date/Time (JST)	Weather	Atomospheric temp. (°C.)	Surface wate temp. (°C.)
25 Longline fishing Water sampling	0°06.5' N 158°57.0' W	8/23 0430 1015	Cloudy	27.8	26.4
26 Plankton tow	0°46.0' S 158°10.0' W	" 1600 1700	Cloudy	26.0	26.4
27 Water sampling	2°00.0' S 157°00.0' W	8/24 02-50 0420	Clear	26.3	26.6
28 Plankton tow	0°01.5' N 157°10.0' W	" 1557 1703	Cloudy	26.1	26.8
29 Longline fishing Water sampling	1°35.4' N 157°24.0' W	8/25 0430 1018	Cloudy	30.3	27.3
30 Plankton tow	2°07.5' N 157°34.0' W	" 1410 1613	Cloudy	26.5	27.5
31 Water sampling	4°15.5' N 156°57.0' W	8/26 0430 0540	Cloudy	29.1	28.1
32 Bathythermograph	5°01.0' N 156°48.5' W	" 0925 0932	Cloudy	30.0	28.2
33 Plankton tow Bathythermograph	5°43.5' N 156°49.0' W	" 1330 1600	Cloudy Overcast	27.2	28.4

Station	Lat., Long.	Date/Time (JST)	Weather	Atomospheric temp. (°C.)	Surface water temp. (°C.)
34 Bathythermograph	7°09.0' N 156°51.0' W	8/26 2200 2207	Cloudy	25.9	28.1
35 Water sampling	8°16.0' N 157°03.0' W	8/27 0430 0530	Cloudy Overcast	25.4	28.0
36 Bathythermograph	8°53.0' N 157°06.5' W	" 0930 0940	Cloudy	27.0	28.2
37 Plankton tow	9°49.0' N 157°12.0' W	" 1330 1530	Cloudy	27.5	27.6
38 Bathythermograph	10°55.0' N 157°20.5' W	" 2227 2240	Cloudy	25.0	27.1
39 Water sampling	11°53.0' N 157°28.0' W	8/28 0400 0513	Cloudy Overcast	28.9	27.1
40 Plankton tow	13°23.5' N 157°45.4' W	" 1302 1500	Cloudy	27.5	26.9
41 Water sampling	15°43.0' N 158°04.0' W	8/29 0330 0450	Clear	26.3	26.3
42 Plankton tow	16°41.5' N 157°55.6' W	" 1230 1430	Cloudy	25.6	25.9

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Station	Lat., Long.	Date/Time (JST)	Weather	Atomospheric temp. (°C.)	Surface water temp. (°C.)
43 Water sampling	18°57.0' N 157°54.0' W	8/30 0330 0440	Squall	24.9	26.6
44 Plankton tow	19°54.0' N 157°45.3' W	" 1230 1430	Cloudy	26.1	25.8
45 Plankton tow	25°48.0' N 167°29.0' W	9/6 1400 1500	Cloudy	27.4	26.9
46 Plankton tow	29°22.0' N 177°24.0' W	9/8 1445 1555	Cloudy	28.2	27.5
47 Plankton tow	32°00.0' N 172°31.5' E	9/10 1527 1630	Cloudy Overcast	24.0	25.6
48 Plankton tow	33°55.5' N 161°52.5' E	9/12 1558 1658	Cloudy	25.1	24.9
49 Plankton tow	34°43.0' N 151°23.0' E	9/14 1657 1734	Cloudy Overcast	25.5	25.8

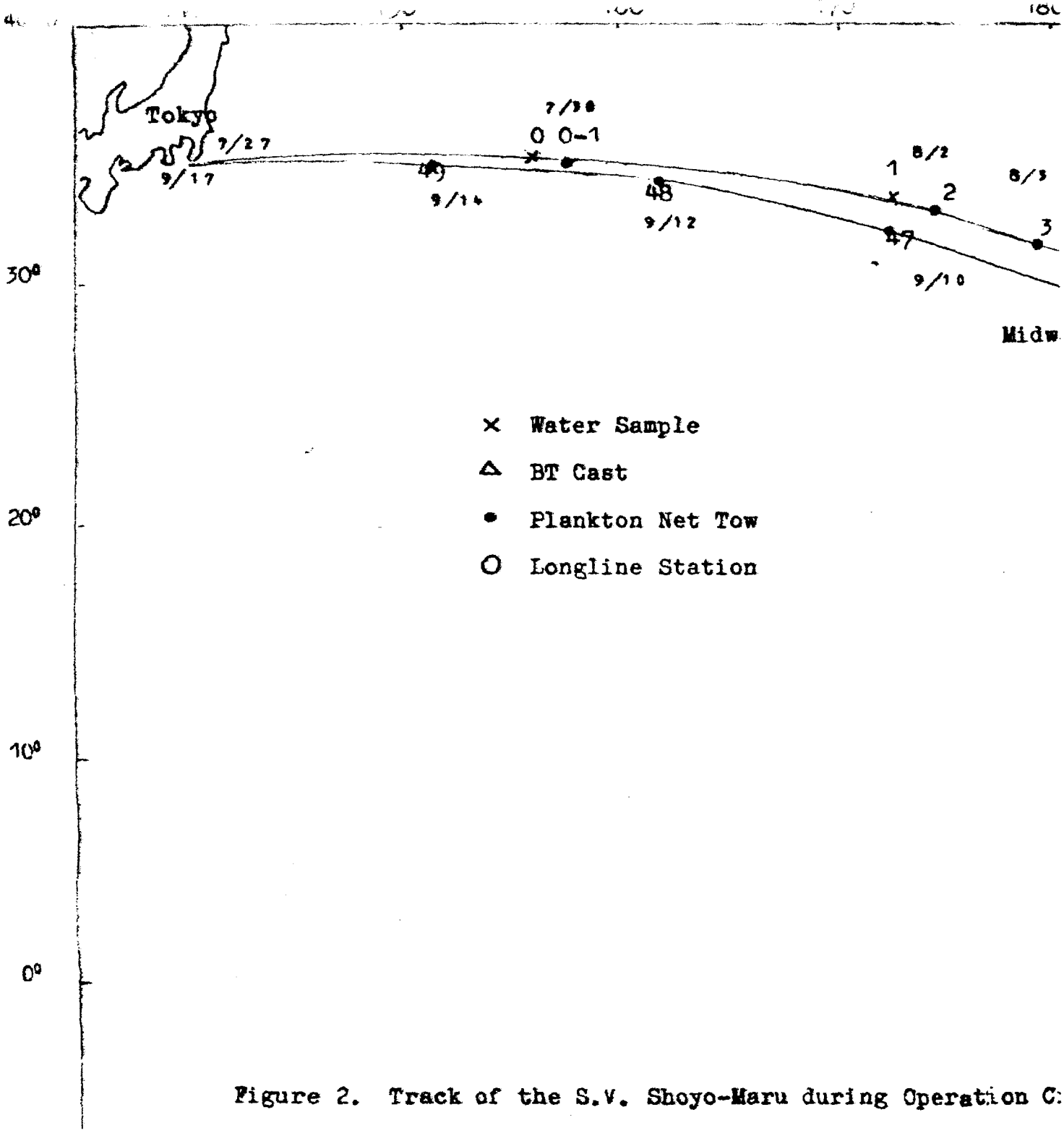
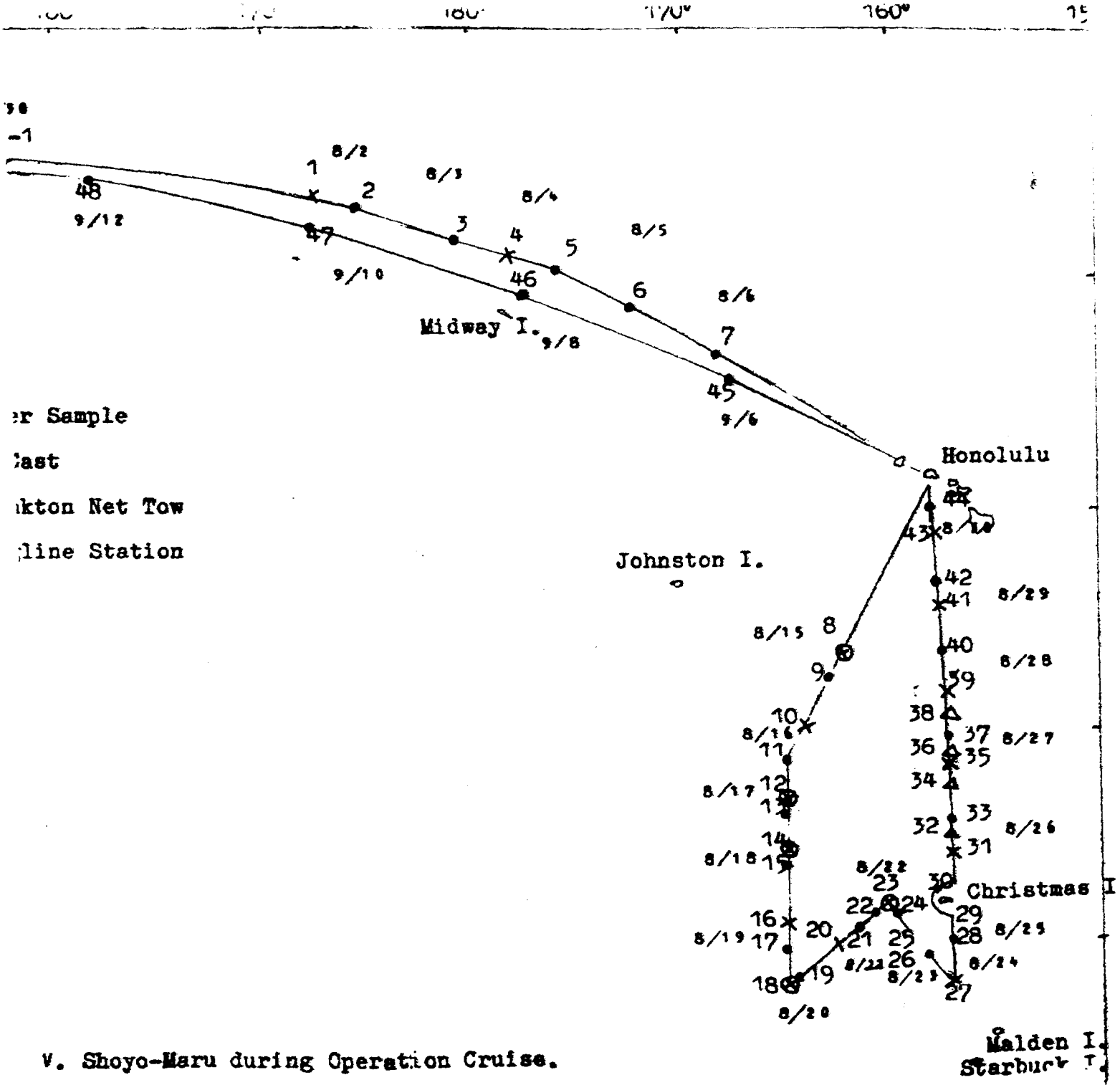


Figure 2. Track of the S.V. Shoyo-Maru during Operation C



V. Shoyo-Maru during Operation Cruise.