#4

SOUTHWEST FISHERIES CENTER

NATIONAL MARINE FISHERIES SERVICE SOUTHWEST FISHERIES CENTER P.O. BOX 271 LA JOLLA, CA 92038

MAY 1987

SUMMARY OF THE 1986 NORTH PACIFIC ALBACORE FISHERY DATA

by

Anthony P. Majors and Forrest R. Miller

ADMINISTRATIVE REPORT LJ-87-12

SUMMARY OF THE 1986 NORTH PACIFIC ALBACORE FISHERY DATA

Anthony P. Majors
Southwest Fisheries Center
National Marine Fisheries Service, NOAA
La Jolla, California 92038

and

Forrest R. Miller
Inter-American Tropical Tuna Commission
La Jolla, California 92038

May 1987

ADMINISTRATIVE REPORT LF-87-12

CONTENTS

LIST OF TABLES

LIST OF FIGURES

SUMMARY OF THE 1986 NORTH PACIFIC ALBACORE FISHERY DATA

Anthony P. Majors and Forrest R. Miller

INTRODUCTION

For the 13th successive year, state and federal agencies have worked together to collect information on catch and length-frequency for the U.S. North Pacific albacore fishery. During the 1986 albacore fishing season, the California Department of Fish and Game, Oregon Department of Fish and Wildlife, Washington Department of Fisheries, Pacific Marine Fisheries Commission (PMFC), Western Fishboat Owners Association (WFOA) and the Honolulu Laboratory of the Southwest Fisheries Center (SWFC) distributed logbooks to fishermen and sampled size composition of albacore catches from fishing vessels when they returned to ports.

In early June, before the start of the 1986 fishing season, more than 350 albacore logbooks were sent by mail to fishermen who are members of WFOA. An additional 400 logbooks were distributed from June to September at dock sites in ports throughout California, Hawaii, Oregon and Washington by field biologists to interested fishermen. These fishermen participated voluntarily in this sampling project. They recorded daily fishing effort, numbers of fish caught, types of gear used, and environmental data during fishing activities. The completed logsheets were submitted by fishermen to state samplers assigned to the dock sites during the fishing season or sent directly to the SWFC. If the fishermen did not have access to logbooks, samplers conducted interviews for the necessary information when returning vessels unloaded their catches. These samplers also collected length-frequency samples from the unloaded vessel catches.

In this report, we present a summary of the catch and environmental data collected during the 1986 U.S. North Pacific albacore fishing season. Areas covered include the traditional fishing grounds off the North American west coast from central Baja California to British Columbia, areas in the central north Pacific, and those around Midway Island. The data are summarized and compared with those collected during the 1985 fishing season.

SAMPLING COVERAGE

Sampling coverage for the U.S. North Pacific albacore fishery in 1985 and 1986 was measured as the ratio of sampled landings to total landings in weight. Sampled landings in weight by states were estimated by multiplying the numbers of fish sampled by the average weight of these fish. During the 1986 U.S. North Pacific albacore fishing season, an estimated 11,338,940 lbs (5,143 mt) of albacore were landed in ports throughout California, Oregon, and Washington. There were no albacore landings reported from Hawaii for 1986 (Tables 1a-1b). Of this total, approximately 59% (6,637,770 lbs; 3,011 mt) was sampled for catch and effort (information collected from logbooks and interviews), and 2% (270,855 lbs; 123 mt) was sampled for length-frequency. Catch and effort coverage rates, as estimated from sampled landings in weight, decreased slightly from 61% in 1985 to 59% in 1986. Coverage rates for length-frequency samples also decreased from 3% in 1985 to 2% in 1986. Approximately 62% of the U.S. North Pacific albacore sampled catch for 1986 was landed in California, 22% in Oregon, and 16% in Washington. Compared with albacore landings in 1985, landings in 1986 for Oregon increased 62% and for Washington 422%; landings for California decreased 51% (Tables 1a-1b).

Table 1a. Sampling coverage for the U.S. North Pacific albacore fishery by state in 1986.

State	Total Landings (lbs)	Landings Sampled (lbs)	Percent Coverage	Number Vessel Landings	Number Vessels Sampled
			Catch and Effort		
California	7,017,924	3,498,818	50%	189	165
Hawaii	0	0	0%	0	0
Oregon	2,459,472	1,899,774	77%	156	59
Washington	1,861,544	1,239,176	67%	72	36
Total	11,338,940	6,637,768	59%	417	260
			Length Frequency		
California	7,017,924	203,449	3%	189	174
Hawaii	0	0	0%	0	0
Oregon	2,459,472	44,583	2%	156	26
Washington	1,861,544	22,822	1%	72	13
Total	11,338,940	270,854	2%	417	213

Table 1b. Sampling coverage for the U.S. North Pacific albacore fishery by state in 1985.

State	Total Landings (lbs)	Landings Sampled (lbs)	Percent Coverage	Number Vessel Landings	Number Vessels Sampled
		Catch and Effort			
California	14,370,000	8,642,295	60%	500	369
Hawaii	1,236,000	817,196	66%	9	6
Oregon	1,522,183	869,365	57%	54	50
Washington	356,637	279,212	78%	28	26
Total	17,484,820	10,608,068	61%	591	448
		Length Frequency			
California	14,370,000	330,584	2%	500	331
Hawaii	1,236,000	4,524	<1%	9	6
Oregon	1,522,183	114,228	8%	54	38
Washington	356,637	9,198	3%	28	6
Total	17,484,820	458,534	3%	591	381

CATCH

Total reported commercial landings for the 1986 U.S. North Pacific albacore fishery were 11,338,940 lbs (5,143 mt). This total represents a 35% decrease from the 17,484,820 lbs (7,931 mt) recorded for 1985 (Tables 1a-1b). Total albacore catch for the entire North Pacific in 1986 is unavailable at this time; however, historical data for the four major fisheries are presented for comparison purposes (Table 3, Figure 1).

From the late 1970s until the present, the U.S. North Pacific albacore fishery operated progressively farther from the North American coast to areas in the central and western Pacific. To simplify the presentation of information discussed and compared in this report, we have arbitrarily divided the fishery for 1985 and 1986 into two longitudinal areas: (1) the inshore area, from the North American coastline to 140° W longitude, and (2) the offshore area, west of 140° W longitude.

The U.S. North Pacific albacore jigboat fleet in 1986, like the fleet in 1985, fished in areas west of 140° W longitude from May to early September (Figures 2a-2e). Fishing in these offshore areas in 1986 was fairly good during the early months, but was rather poor midway through the season, especially in early July (Figure 2c). Jigboats (>55-foot length; 16.8 meter) fishing in these offshore areas early in the season reported good fishing in a 10° quadrangle area, 30° N latitude and 165° W longitude approximately 450 nautical miles (nm) northeast of Midway Island from late May through June (Figures 2a-2b). Excellent fishing was also reported from a 10° quadrangle area 40° N and 135° W longitude approximately 650 nm west of Newport, Oregon from late July through September (Figures 2c-2e). Fishing inshore started in late June 1986, and significant catches were recorded in early July in areas between 50 and 250 nm off southern California and in areas between 50 and 900 nm west of Cape Mendocino, California.

Although the distribution of catches inshore and offshore for 1985 and 1986 was geographically similar, there were significant differences in the numbers of fish caught by areas. In 1986, the inshore sampled catch was 61% of the total landings and the offshore catch was 39%. In 1985, the inshore sampled catch was 82% of the total landings and the offshore catch was 18%. The most productive offshore fishing in 1986 was reported from areas south of 40° N latitude early in the season throughout May and June between 30° and 35° N latitude. Best fishing during the season was found nearshore in a 10° quadrangle area 40° N and 135° W longitude from late July to mid-September. Fishing in 1986 was productive in very much the same areas that were productive in 1985.

EFFORT

Sampled effort (days fished) for the 1986 U.S. North Pacific albacore fishery was significantly lower than in 1985. There was a decrease of 45% from the reported 7,725 days fished in 1985 to the 4,253 days fished in 1986. This dramatic decrease in fishing effort affected the total catch. In 1986, 78% of the sampled effort (3,320 days fished) spent in the inshore area yielded 61% of the sampled catch (3,932,082 lbs) and 22% (933 days fished) spent in the offshore area yielded 39% (2,537,458 lbs). In 1985, 82% of the sampled effort (6,341 days fished) spent in the inshore area yielded 80% of the sampled catch (8,490,146 lbs) and 18% (1,384 days fished) spent in the offshore area yielded 20% (3,309,918 lbs). In both years, the 55-foot jigboats expended the most effort (days fished) in the fishery. Although fishing effort by all vessels for the season decreased 45%, participation by the larger jigboats (65- and 75-foot classes) was proportionally higher in 1986 than in 1985 (Figure 3). Most of the smaller fishing vessels (<55-foot class) either did not participate in the albacore fishery or they fished in the salmon fishery, which was quite successful in 1986.

CATCH-PER-UNIT EFFORT BY JIGBOATS

Estimated annual catch-per-unit effort (CPUE), in numbers of fish caught for one day of fishing by a standard 45-foot (14 meter) jigboat, increased from 82.0 fish per day in 1985 to 117.0 fish per day in 1986 (Table 2; Figure 4). The areas approximately 450 nm northeast of Midway Island that yielded 221 to 225 fish per day (calculated in half-month periods) in May 1985, yielded 12 to 99 fish per day in May 1986. Highest CPUEs in 1986 of 149 to 183 fish per day for a standard jigboat were reported from a 10° quadrangle area 40° N latitude and 135° W longitude approximately 650 nm west of Newport from early August to mid-September (Figures 5f-5j). In this same area, CPUEs of 70 to 115 fish per day were reported for a standard jigboat during the same period in 1985 (Table 2). Monthly catch rates of 67 fish per day for July 1986 were slightly higher than the 61 fish per day recorded for the same period in 1985. The most successful fishing in 1986 was reported from nearshore areas (40° N and 135° W) in late July to early September, and in 1985 from offshore areas (35° N and 165° W) in early May to June.

Table 2. Standardized fishing effort in days fished, catch in numbers of fish caught, and CPUEs (average number of fish caught per day) by half-month for 1986 and 1985.

Year		1986			1985		
Month	Time Period	Sampled Effort	Sampled Catch	CPUE	Sampled Effort	Sampled Catch	CPUE
April	1-15	0	0	0	1	0	0
	16-30	5	0	0	17	45	3
May	1-15	54	625	12	53	11,721	221
	16-31	125	12,340	99	86	19,380	225
June	1-15	147	7,838	53	147	27,269	185
	16-30	159	13,899	87	522	47,067	90
July	1-15	205	2,739	13	497	27,497	55
	16-31	407	38,545	95	735	48,275	66
August	1-15	682	124,647	183	930	100,156	107
	16-31	556	98,100	176	899	103,043	115
September	1-15	412	61,304	149	1,076	75,409	70
	16-30	222	12,245	55	578	21,550	37
October	1-15	170	1,697	10	394	14,948	38
	16-31	45	144	3	261	10,031	38
Annual		3,189	374,125	117	6,196	506,391	82

In 1986, there was an increase from 1985 of 20 1° quadrangles that had CPUEs greater than 200 fish per day. Unlike 1985, when most of the 1° quadrangles with CPUEs greater than 200 were located south of 40° N latitude, most of the 1° quadrangles with CPUEs greater than 200 in 1986 were located north of 40° N latitude. In both years, the majority of 1° quadrangles with CPUEs over 200 were located offshore (Figures 5a-5l).

LENGTH FREQUENCY

During the 1986 albacore fishing season, 18,424 fork length measurements were taken of fish caught by the U.S. North Pacific albacore fleet. Of these samples, approximately 64% were taken from catches in the inshore area, 16% offshore, and 20% unclassified. Approximately 8% of the measured fish were taken from baitboats, 81% from jigboats, 3% from vessels using a combination of jig and bait, 4% gillnet, 1% purse seine and 3% unclassified (Figure 7). The average fork length (from tip of the mandible to fork of the tail) of albacore measured in 1986 was 69.8 centimeters (cm). This was slightly higher than the 69.0 cm average fork length recorded for 1985. Fish sampled inshore in both years were mostly within the range of 60 to 84 cm (Figures 6a-6c). There were more fish in the 72 to 84 cm range caught by jigboats inshore and south of 40° N latitude in 1986 than in 1985 (Figure 6b). In both years, these larger fish were especially vulnerable to baitboats and vessels using a combination of bait and jig in inshore areas (Figures 6a and 6c). In areas north of 40° N latitude, most of the fish sampled were in the range of 56 to 68 cm. The majority of albacore caught offshore and south of 40° N latitude by the larger jigboats in 1986 were in the 72 to 78 cm range; fish of the same size range were caught in these areas in 1985 (Figure 6c). Fish sampled in areas south of 40° N latitude inshore and offshore during the season were predominantly larger than those sampled north of 40° N latitude in 1986 (Figures 6a-6c).

SEA-SURFACE TEMPERATURE

Sea-surface temperatures (SSTs) recorded by commercial transport vessels, fishing boats and research vessels were compiled into monthly means and plotted on charts with 1° quadrangle resolutions. Analyses of these charts (Figures 8a-8h) show the distribution of sea-surface isotherms and the location of surface ocean fronts.

Early in May 1986, when fishing activity began north of Midway Island, SSTs were 15° to 18° C (59° to 60.5° F) and were 1° C (1.8° F) below normal between 30° and 35° N latitude. The fleet was fishing in areas south of a sub-arctic ocean front and north of a fairly weak sub-tropical front (Figure 8b). Early in June, most of the fishing activities moved north of 35° N where SSTs were 1° to 2° C (1.8° to 3.6° F) below normal. SSTs were warming at lower than seasonal rates in this area as a result of frequent storms with strong winds that caused extensive ocean mixing. During June, the fleet was fishing on the northern boundary of a rather defused, sub-tropical front (Figure 8c). In early July, fishing moved northeastward to 40° N where SSTs were beginning to warm at seasonal rates, with SSTs less than 1° C (1.8° F) below normal. By the last half of July, SSTs were warming at greater than seasonal rates in the offshore fishing area. This was due, in part, to lighter winds in the eastern Pacific high pressure system whose center was near the heaviest offshore fishing activity (10° quadrangle; 40° N lat. and 135° W long.) in areas 650 nm west of Newport. During this period, the inshore fishing activity expanded northward in July along the coasts of California and Oregon as coastal upwelling developed in these areas. There were sharp frontal boundaries (edges) forming along the western periphery of the upwelling at this time in these areas (Figure 8d).

During August, SSTs offshore in areas where fishing activities occurred were 1° C (1.8° F) or more above normal. This was the area of light winds and seas associated with a high pressure center that remained offshore from Oregon during most of August. Along the east side of the high pressure system, strong northerly winds intensified the coastal upwelling from Cape Blanco to Point Conception. As a result good sea-temperature edges developed from 60 to 150 nm nearshore and the coastal fishing activity improved (Figure 5g-5h).

In September, SSTs remained more than 1° C (1.8° F) above normal in the offshore fishing areas between 45° and 48° N. The high pressure center was located north of its normal position during most of September. This resulted in a continuation of good fishing weather (Figure 5i and 8f). Also during this period, nearshore SSTs were 1° to 2° C (1.8° to 3.6° F) below normal because of strong coastal upwelling which maintained good temperature edges for the fishing fleet between Cape Blanco and Point Conception. In early October, SSTs began to cool rapidly as frequent Pacific storms, accompanied by strong winds and rough seas, created adverse fishing conditions frequently. Good temperature edges disappeared as upwelling was reduced. By late October, fishing activity was confined to the coastal area south of Monterey where fishing weather and SSTs were more favorable (Figure 8g).

SUMMARY

Although albacore landings were significantly less in 1986 than in 1985, good offshore fishing was reported early in the season throughout May and June in areas 450 nm northeast of Midway Island and from late July to late September in nearshore areas 650 nm west of Newport. Fishing inshore in 1986 started late in June with significant catches reported late in July in areas between 50 and 250 nm off southern California. In contrast, fishing inshore in 1985 started early in June with significant catches reported from these same areas late in June. In both years, the offshore fishing was good from early May to late June in areas northeast of Midway Island. Fish caught earlier in the season in April 1985 and in May 1986 were taken west of Erben Bank (33° N lat. and 145° W long.) by the larger jigboats leaving for areas in the central north Pacific and Midway Island.

Favorable SSTs of 15° to 18° C (59° to 60.5° F) offshore from May to June 1986 may have contributed to the success of the larger jigboats fishing 450 nm northeast of Midway Island early in the season. SSTs warming at greater than seasonal rates in areas 650 nm west of Newport may have created favorable conditions for best fishing of the season in these areas in 1986. Strong coastal upwelling inshore in late July to September may have contributed to the success of vessels fishing in areas inshore from Point Conception to Cape Blanco late in the season.

The average size of albacore sampled in 1986 was 69.8 cm in length (15.4 lbs), which was slightly larger than the 1985 average size of 69.0 cm (15.0 lbs). Estimated annual CPUE for a standard vessel in 1986 was 117.0 fish per day, which was much higher than the 82.0 fish per day in 1985. There was a decrease in sampled effort from a high of 7,725 days fished in 1985 to a low of 4,253 in 1986. On the average, the price paid for albacore ($950/ton) in 1986 was significantly less than for each of the previous five years. There were also fewer buyers available in 1986 to the fleet in California, Hawaii, Oregon and Washington. The gradual decline in price paid for albacore and the diminishing numbers of buyers may have contributed to the 45% decrease in fishing effort for 1986.

Highlights of the 1986 fishing season include: 1) the amount of catch in 1986 decreased by 35%; 2) the amount of sampled effort decreased 45%; 3) the largest number of 1° quadrangles with CPUEs greater than 200 were located north of 40° N latitude; 4) offshore fishing lasted until early September; 5) significant catches inshore were made throughout July in areas off southern and central California; 6) good catches offshore were made in May and June in areas 450 nm northeast of Midway Island; 7) best catches for the season were made in nearshore areas 650 nm west of Newport; 8) fish of 74 to 82 cm in fork length were caught in higher percentage in areas south of 40° N latitude; 9) fish of 64 to 72 cm were caught in higher percentage in areas north of 40° N latitude; 10) a weak sub-tropical front existed early in the season (May-June) in offshore areas and south of 40° N latitude; 11) SSTs were warming at greater than seasonal rates in nearshore areas and north of 40° N latitude in late July; and 12) coastal upwelling was strong in inshore areas from Point Conception to Cape Blanco late in the season.

ACKNOWLEDGMENTS

We thank William Perkins of WFOA, captains and crews of the U.S. North Pacific albacore fishing fleet for their cooperation and continuous support for this program. We also thank Russ Porter of PMFC, Brian Culver of WDF, Karen Worcester and Terri Palmisano of CDFG, Larry Hreha of ODFW, and members of their staffs for distributing logbooks and collecting albacore fishing information during the fishing season. Norman Bartoo, Atilio Coan, Robert Nishimoto and Gary Sakagawa of SWFC reviewed drafts of this report and provided useful comments. Jean Michalski edited the manuscript and provided technical support on the text as needed. Shirley Gray typed drafts of the manuscript. Christina Perrin and Aaron Weinfield helped in editing the data and provided programming support for the compilation of data used in this report. Kenneth Raymond, Roy Allen and Henry Orr illustrated the maps and figures.

Table 3. Catches in metric tons for North Pacific albacore, 1952-1986

Year	Japan Bait-boat	Japan Long-line	Japan Gill net	Japan Other gear	Japan Total	Taiwan Long-line	United States Bait-boat	United States Jig-boat	United States Sport	United States Total	Canada Jig-boat	Grand Total
1952	41,386	26,687	-	237	68,310	-	-	23,843	1,373	25,216	71	93,597
1953	32,921	27,777	-	132	60,830	-	-	15,740	171	15,911	5	76,746
1954	28,069	20,958	-	38	49,065	-	-	12,246	147	12,393	-	61,458
1955	24,236	16,277	-	136	40,649	-	-	13,264	577	13,841	-	54,490
1956	42,810	14,341	-	57	57,208	-	-	18,751	482	19,233	17	76,458
1957	49,500	21,053	-	151	70,704	-	-	21,165	304	21,469	8	92,181
1958	22,175	18,452	-	124	40,751	-	-	14,855	48	14,903	74	55,728
1959	14,252	15,502	-	67	29,821	-	-	20,990	0	20,990	212	51,023
1960	23,156	17,369	-	76	40,601	-	-	20,100	557	20,657	5	61,263
1961	18,636	15,764	-	268	34,668	-	2,837	12,061	1,355	16,253	4	50,925
1962	8,729	13,464	-	191	22,384	-	1,085	19,760	1,681	22,526	1	44,911
1963	26,420	15,458	-	218	42,096	-	2,432	25,147	1,161	28,740	5	70,841
1964	23,858	13,701	-	319	37,879	26	3,411	18,392	824	22,627	3	60,535
1965	41,491	25,050	-	121	56,662	16	417	16,545	731	17,693	15	74,386
1966	22,830	28,869	-	585	52,284	16	1,600	15,342	588	17,530	44	69,874
1967	30,481	23,961	-	520	54,962	17	4,113	17,826	707	22,646	161	77,786
1968	16,597	23,061	-	1,109	40,767	15	4,906	20,444	951	26,301	1,028	68,111
1969	32,107	18,006	-	1,480	51,593	21	2,996	18,839	358	22,193	1,365	75,172
1970	24,378	15,372	-	956	40,706	23	4,416	21,041	822	26,279	345	67,353
1971	53,198	11,035	-	1,262	65,495	24	2,071	20,537	1,175	23,783	1,587	90,889
1972	60,762	12,649	1	921	74,333	25	3,750	23,608	637	27,995	3,558	105,911
1973	69,811	16,059	39	1,883	87,792	35	2,236	15,667	84	17,987	1,270	107,084
1974	73,576	13,053	224	1,065	87,918	40	4,777	20,187	94	25,058	1,207	114,223
1975	51,157	10,060	166	402	61,785	28	3,243	18,975	640	22,858	101	84,772
1976	83,336	15,896	1,070	1,394	101,696	37	2,700	15,932	713	19,345	252	121,330
1977	31,934	15,737	688	1,039	49,398	61	1,497	10,005	537	12,039	53	61,551
1978	59,877	13,061	4,029	3,209	80,176	53	950	16,682	810	18,442	23	98,694
1979	44,662	14,249	2,856	1,280	63,047	81	303	6,801	74	7,178	289	70,595
1980	46,743	14,743	2,986	1,516	65,988	-	382	7,574	168	8,124	212	74,324
1981	27,426	18,020	17,425	956	63,827	-	748	12,694	195	13,637	98	77,562
1982	29,615	16,762	17,947	1,054	65,378	-	425	6,661	257	7,343	1	72,722
1983	21,098	15,103	9,160	471	45,832	-	607	9,512	87	10,206	64	56,102
1984	26,015	15,013	7,389	3,380	55,593	-	832	9,576	1,427	15,5637	18	71,174
1985	20,714	14,235	9,794	1,533	50,106	-	872	7,059	1,176	9,107	1	59,214
1986	12,000	-	-	-	-	-	309	4,834	196	5,339	<1	-

Remarks:

1. Figures for 1985-86 are preliminary.
2. Japanese longline catches for 1952-60 exclude minor amounts taken by vessels under 20 tons. Longline catches in weight are estimated by multiplying annual number of fish caught by average weight statistics.
3. Japanese baitboat catches include catches by research vessels.
4. U.S. Jigboat catches for years 1952-60 include baitboat catches.
5. United States sport catch is a minimum estimate based on partial coverage.
6. U.S. catches from 1961 to 1985 include Hawaii.
7. United States total for 1984 include catches (3,728 mt) by purse seines.

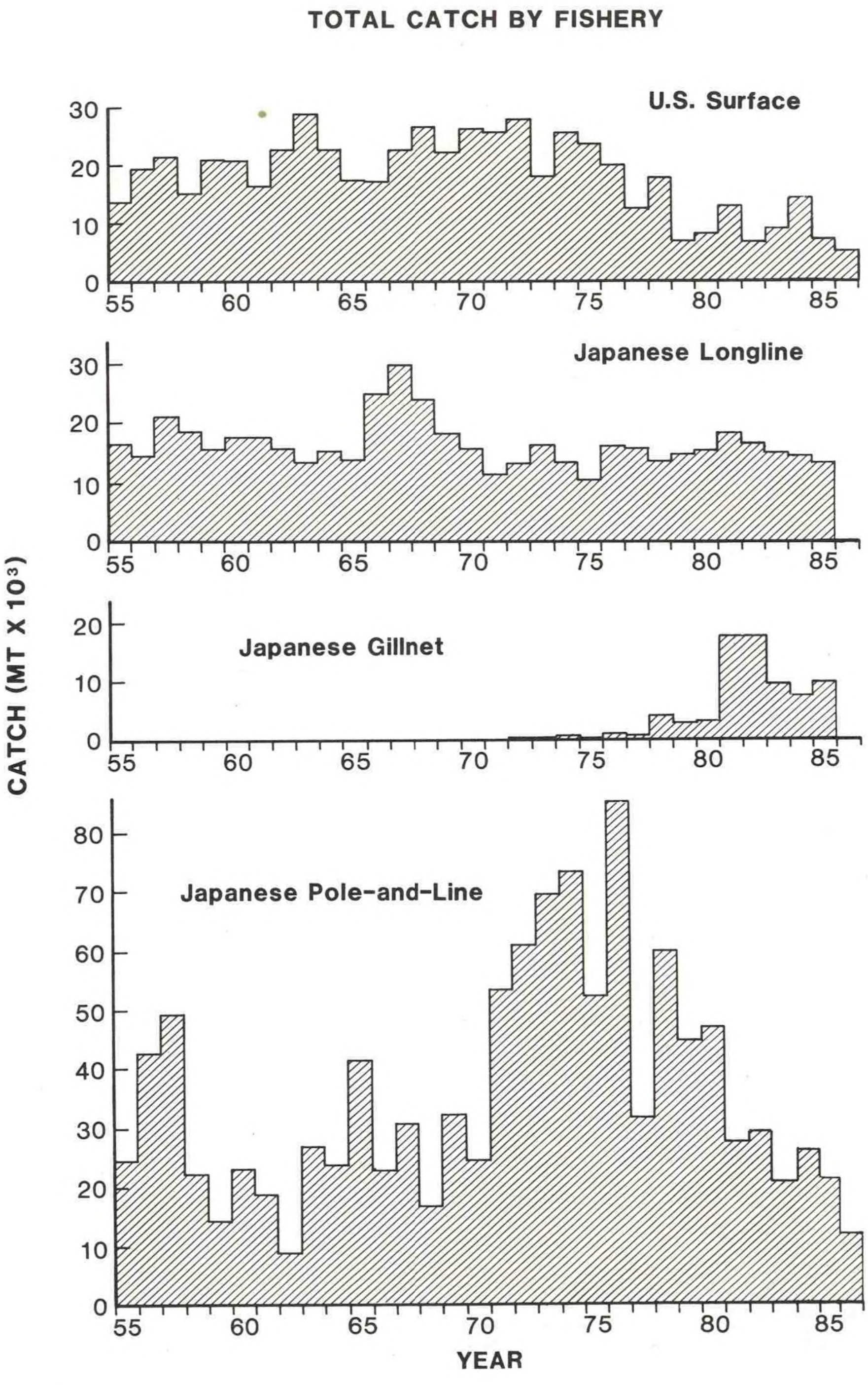

Figure 1. Total catch in metric tons by fishery and gear.

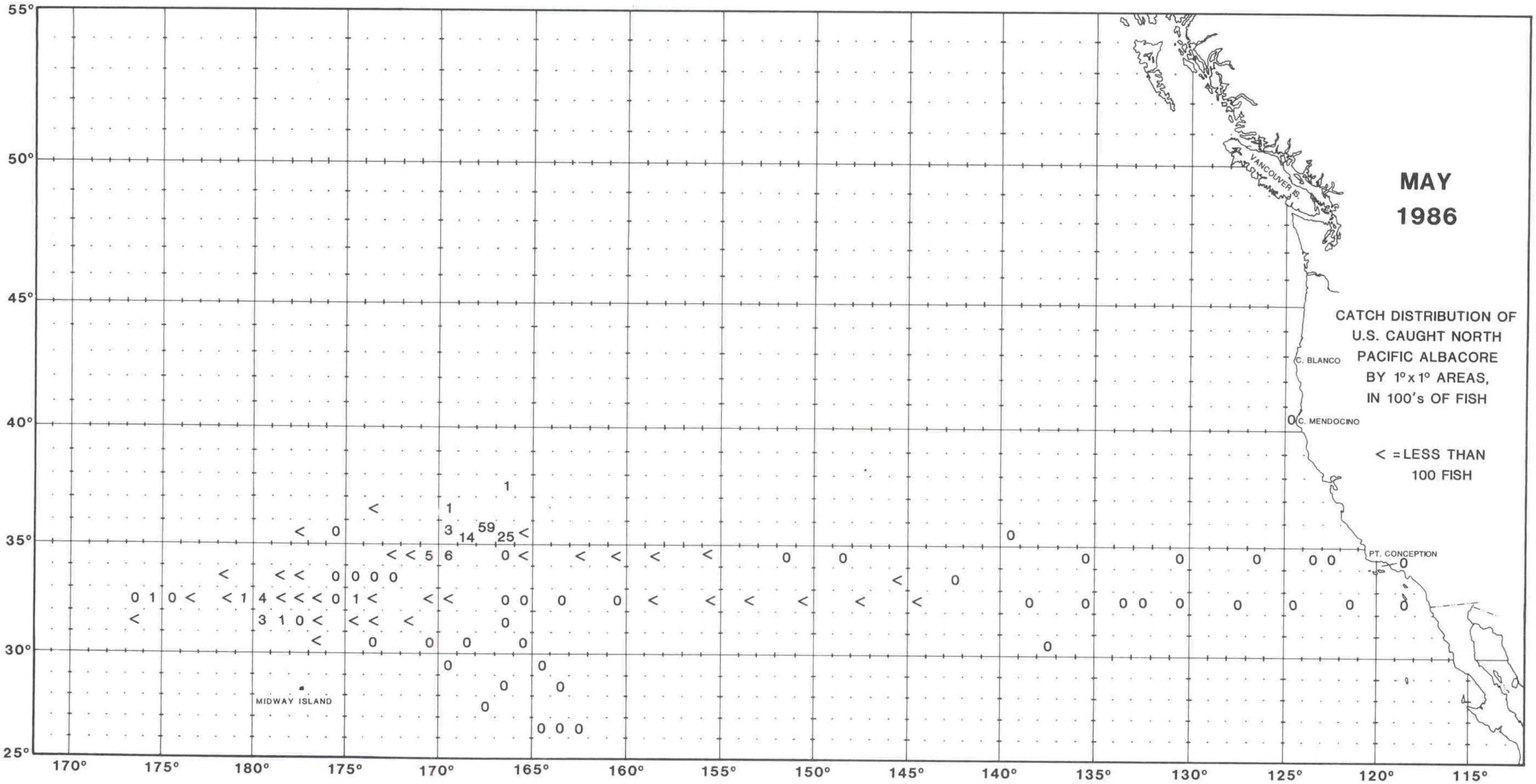

Figure 2a. Combined jigboat and baitboat fishery catches (in numbers of fish) by 1^{o} square area, May 1986.

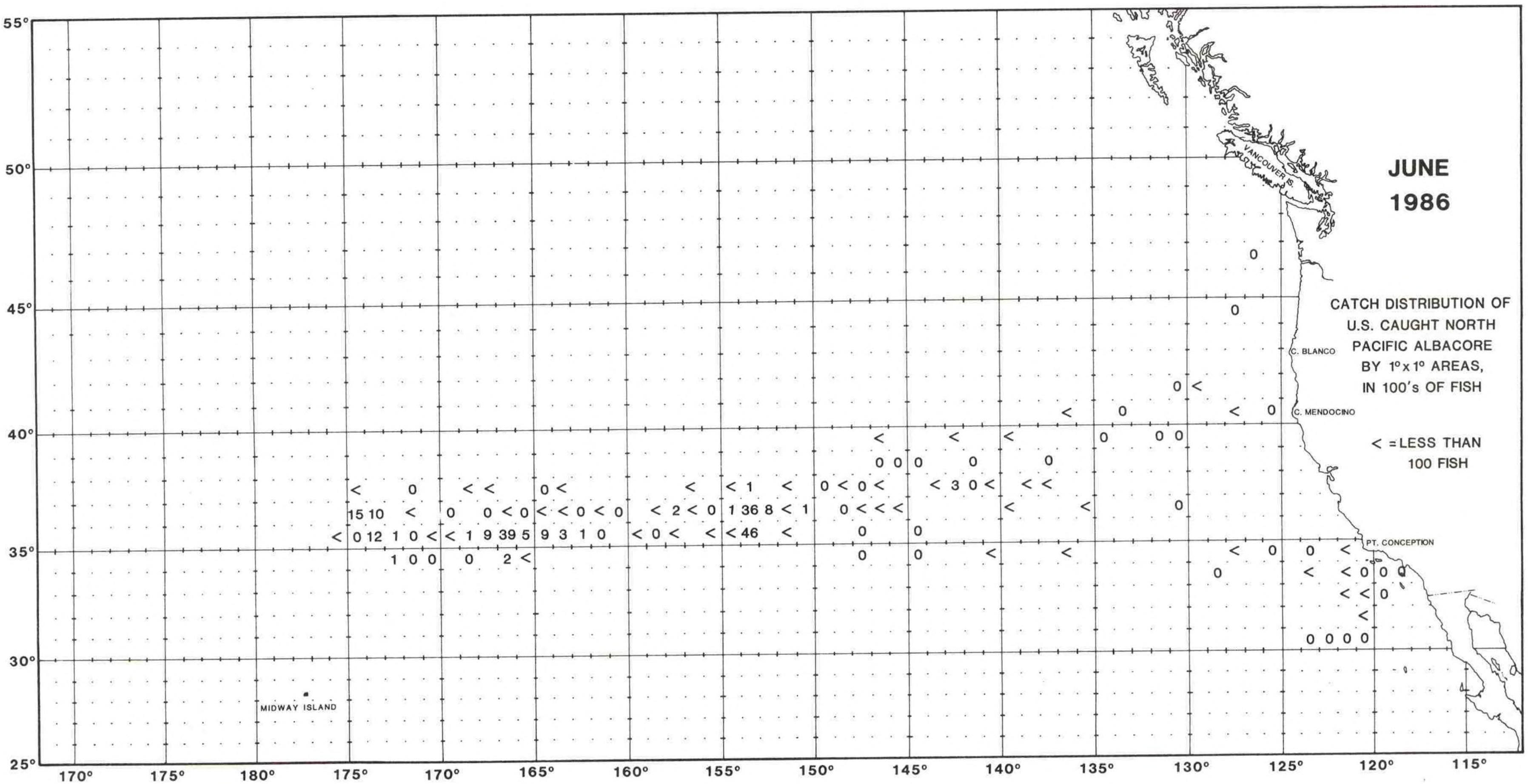

Figure 2b. Combined jigboat and baitboat fishery catches (in numbers of fish) by 1^{o} square area, June 1986.

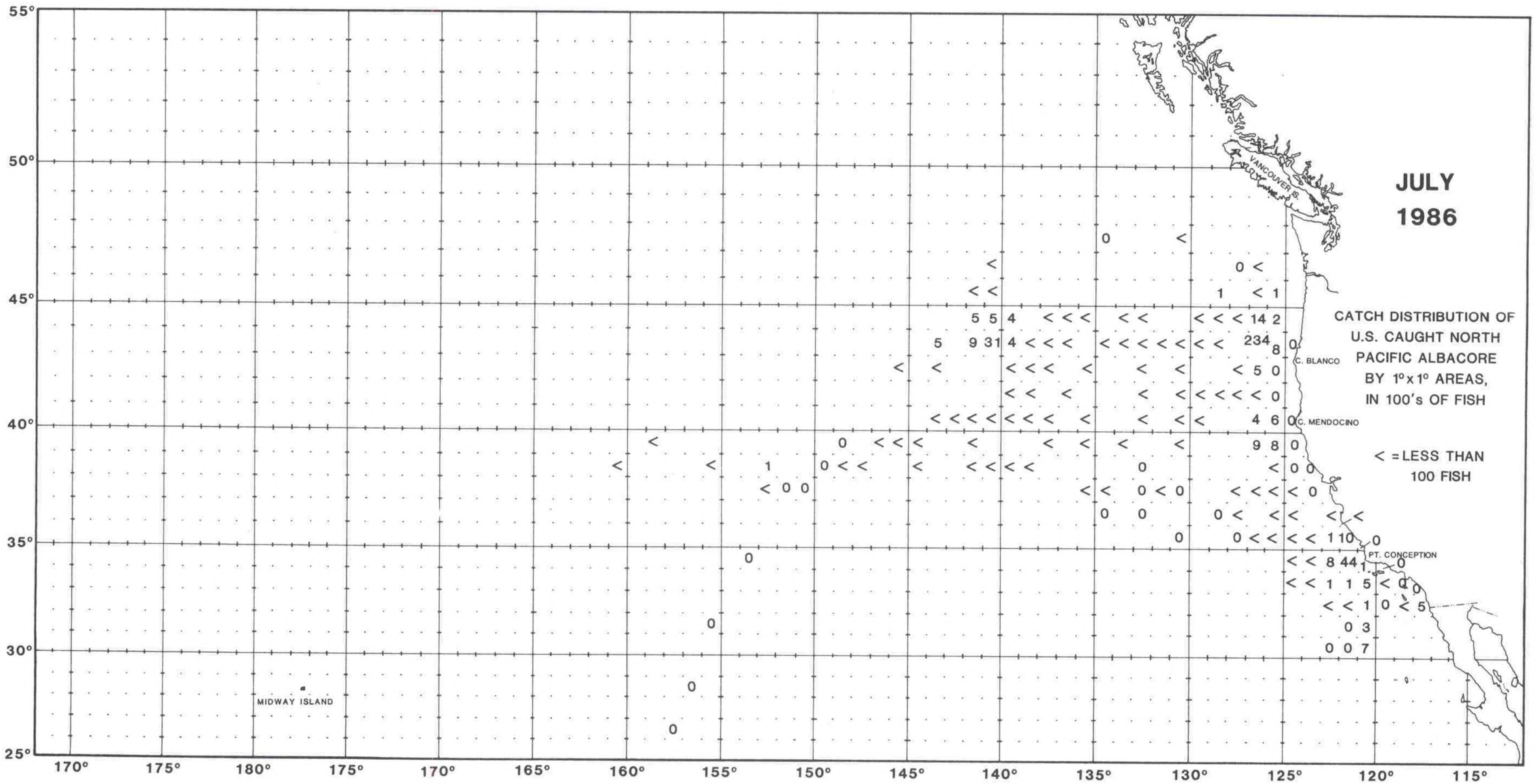

Figure 2c. Combined jigboat and baitboat fishery catches (in numbers of fish) by 1^{o} square area, July 1986.

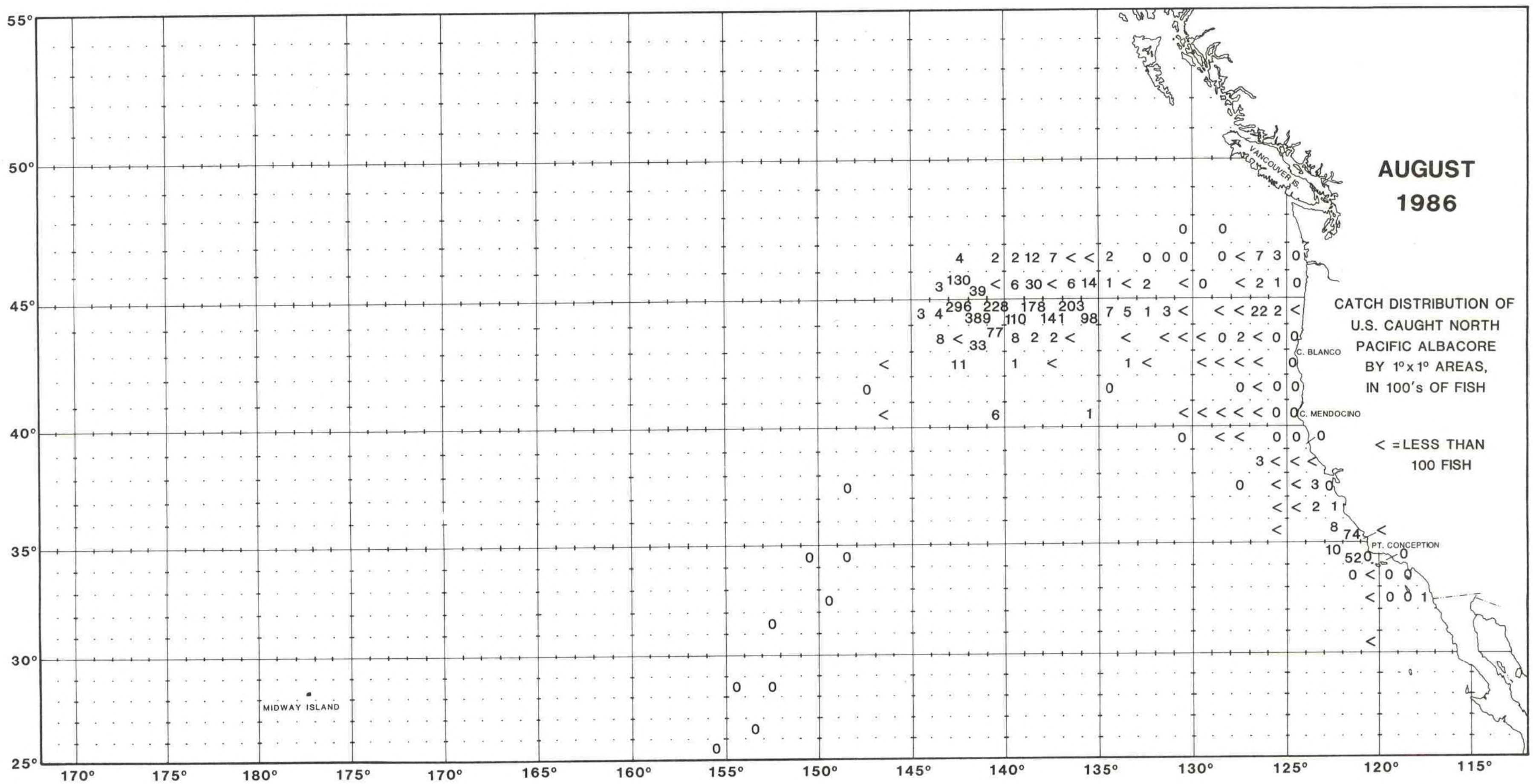

Figure 2d. Combined jigboat and baitboat fishery catches (in numbers of fish) by 1^{o} square area, August 1986.

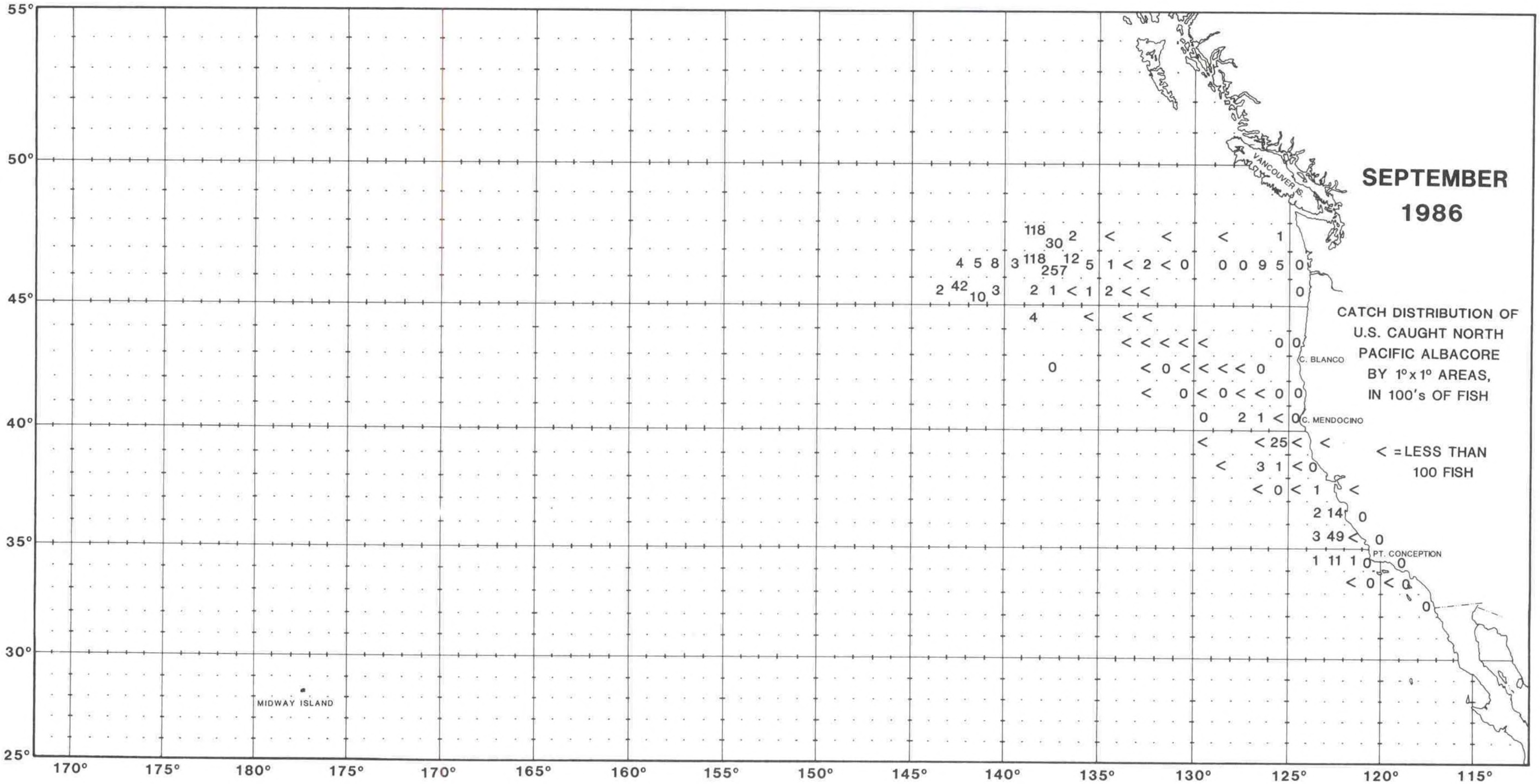

Figure 2e. Combined jigboat and baitboat fishery catches (in numbers of fish) by 1° square area, September 1986.

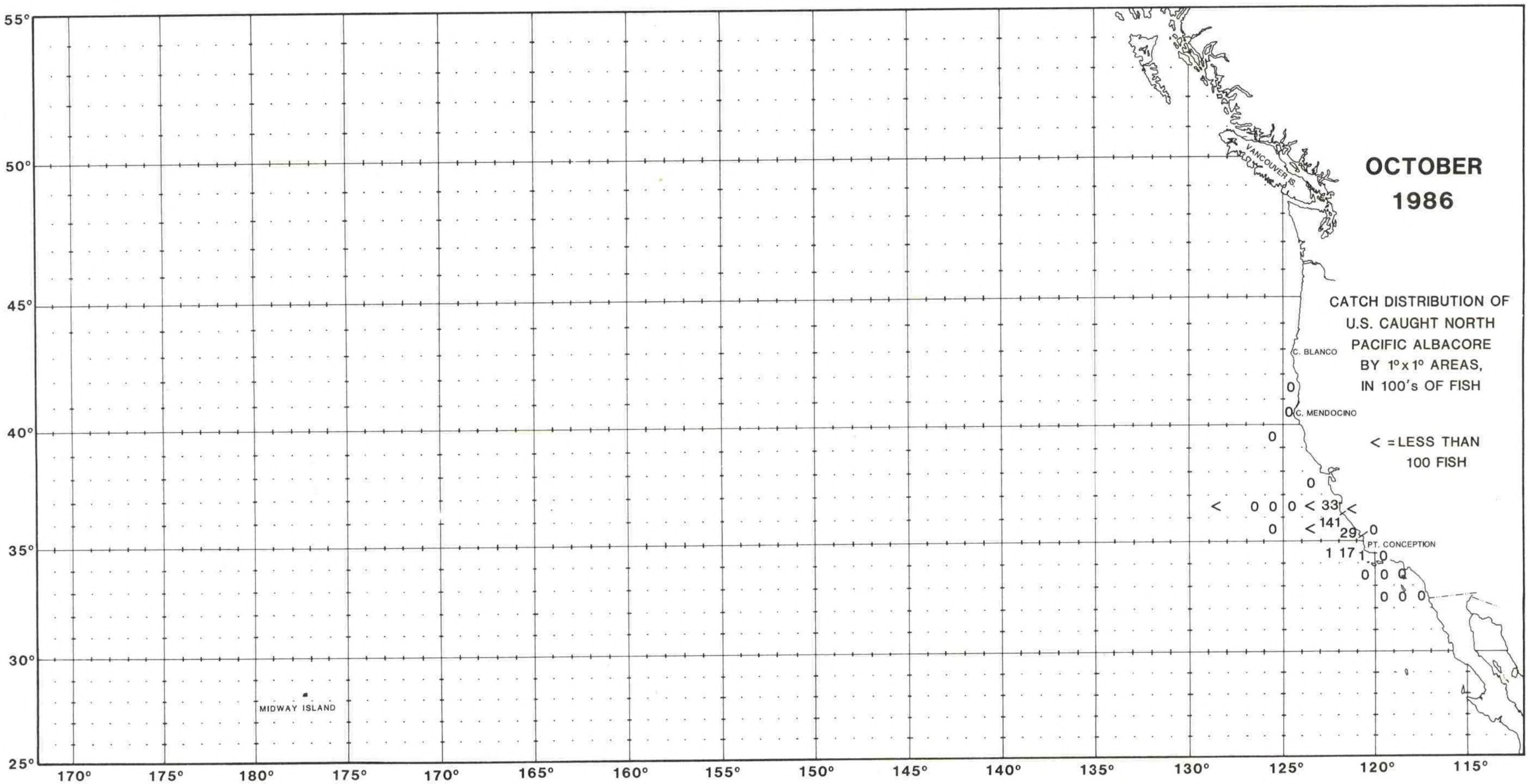

Figure 2f. Combined jigboat and baitboat fishery catches (in numbers of fish) by 1^{o} square area, October 1986.

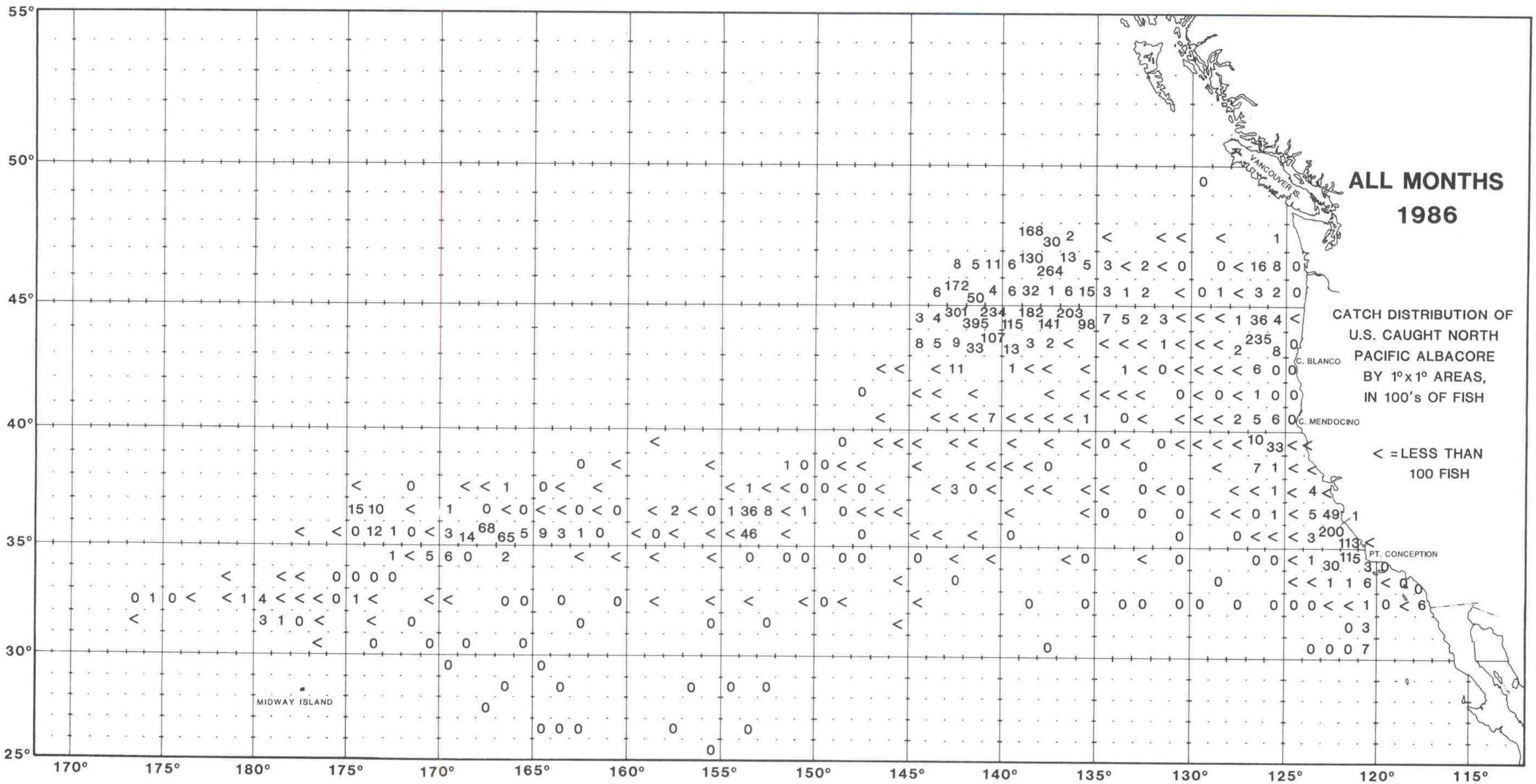

Figure 2g. Combined jigboat and baitboat fishery catches (in numbers of fish) by 1^{o} square area, all months 1986.

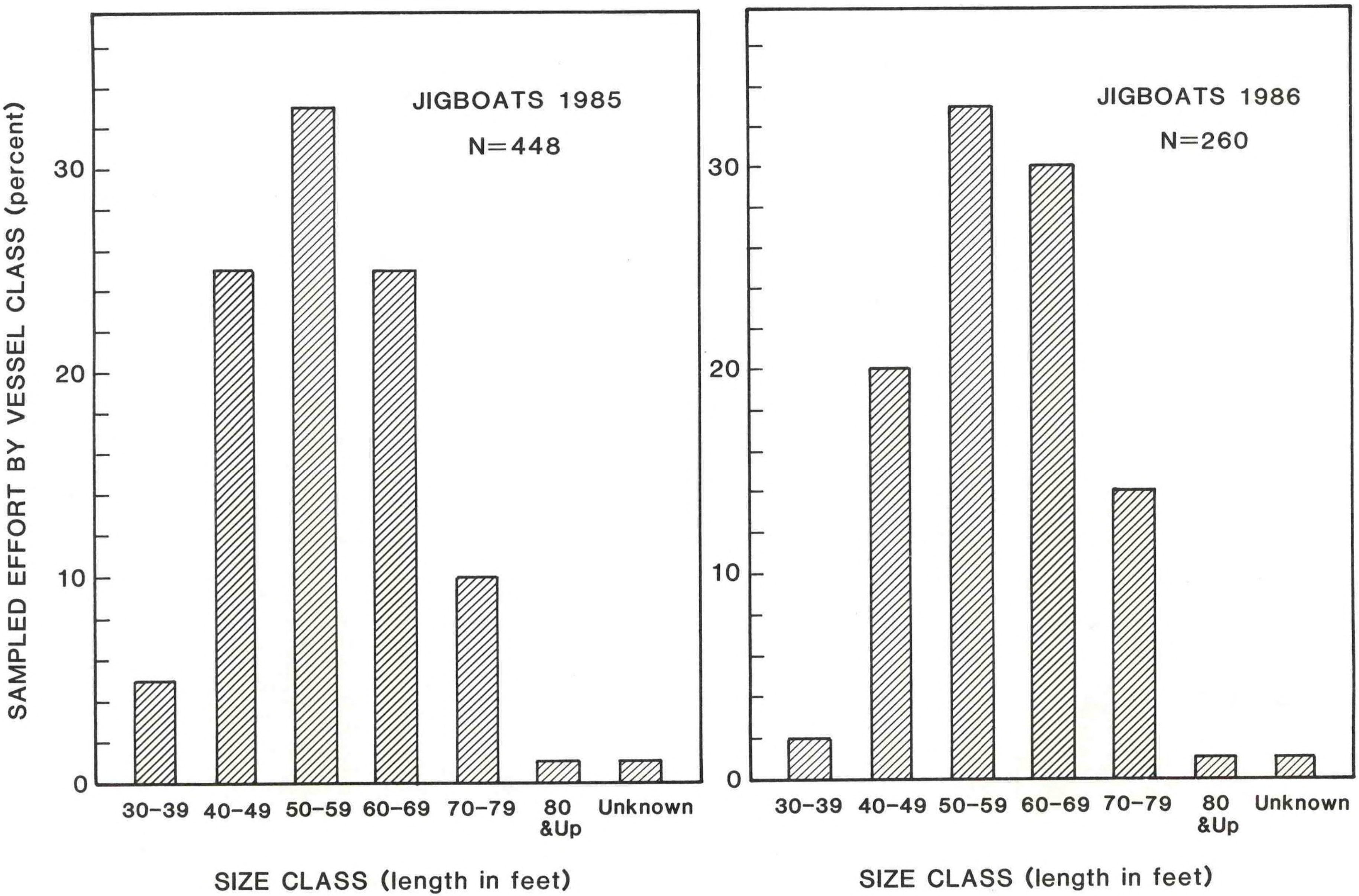

Figure 3. Sampled effort by vessel class (jigboats) and year.

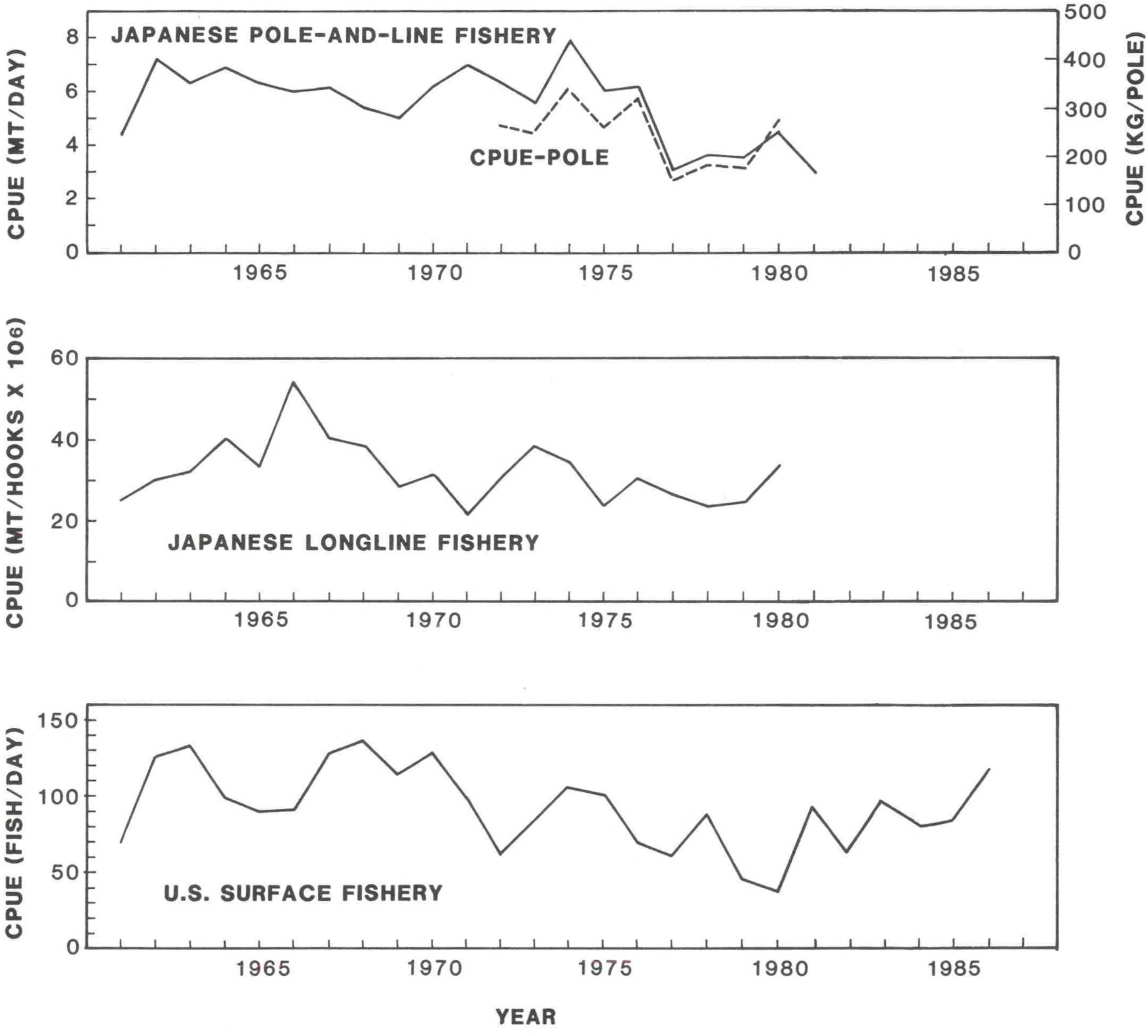

Figure 4. North Pacific albacore catch-per-unit effort (CPUE) by fishery and gear.

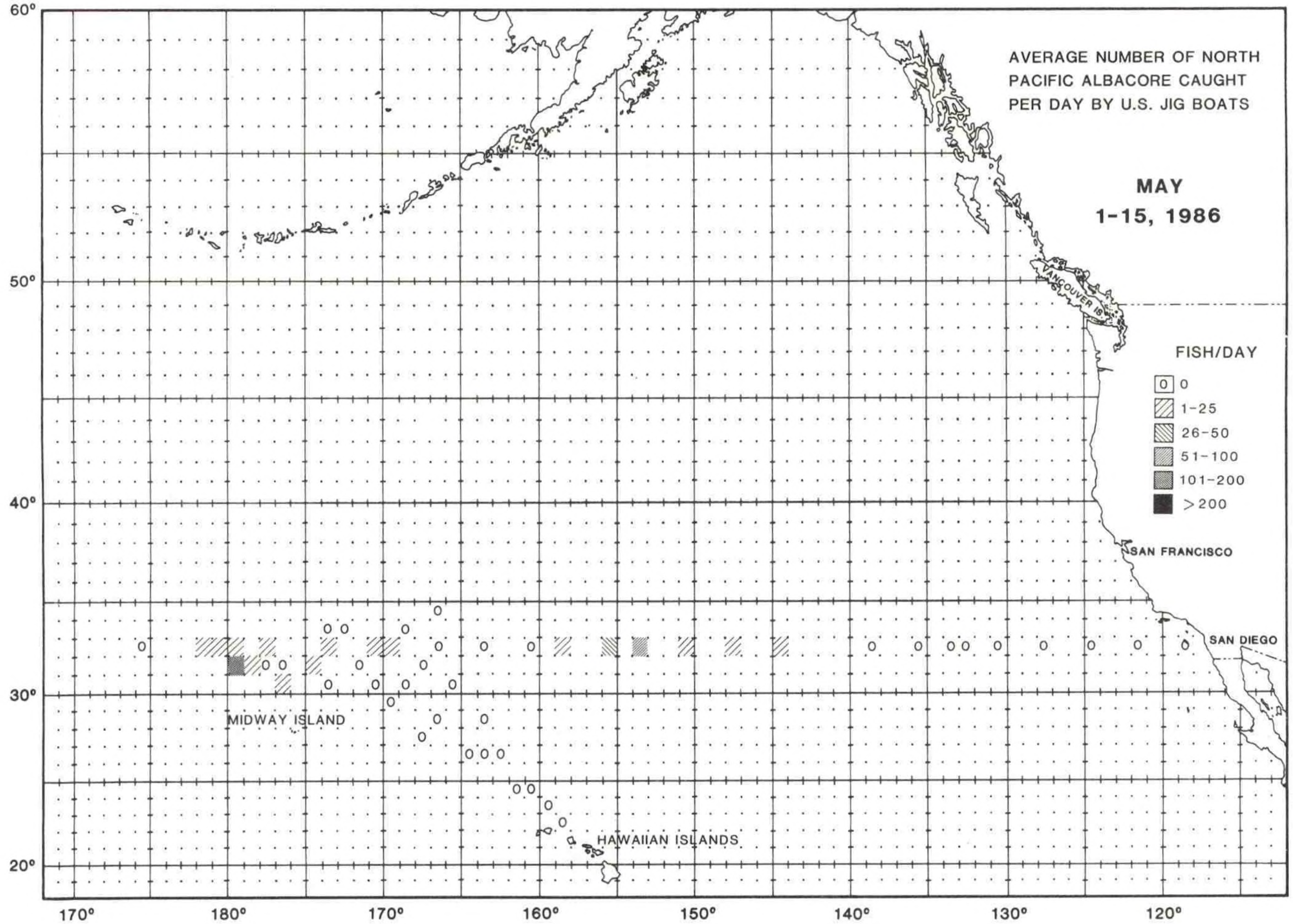

Figure 5a. Jigboat catch-per-standard day fishing by 1^{o} square area and half-month, May 1-15, 1986.

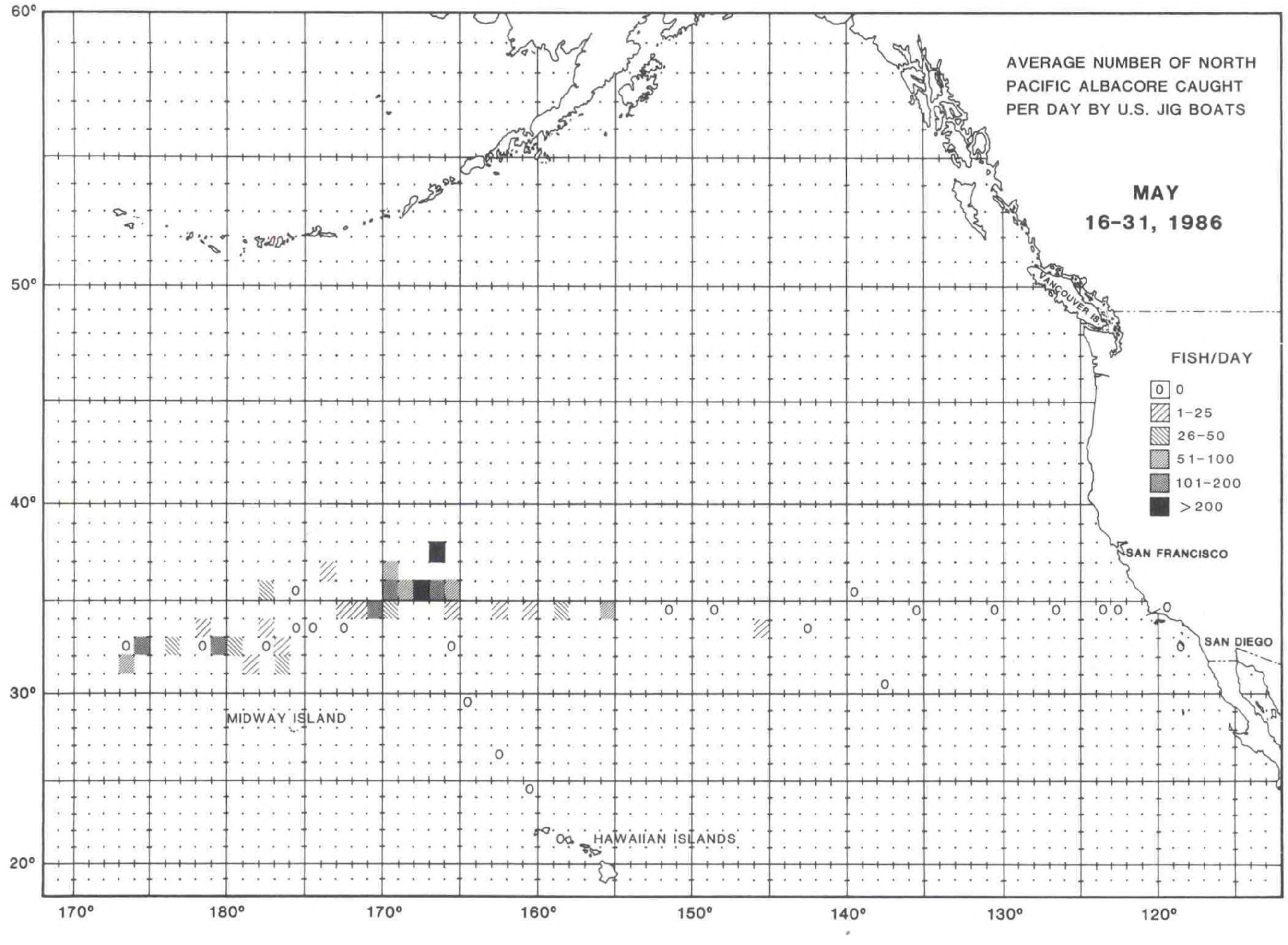

Figure 5b. Jigboat catch-per-standard day fishing by 1^{o} square area and half-month, May 16-31, 1986.

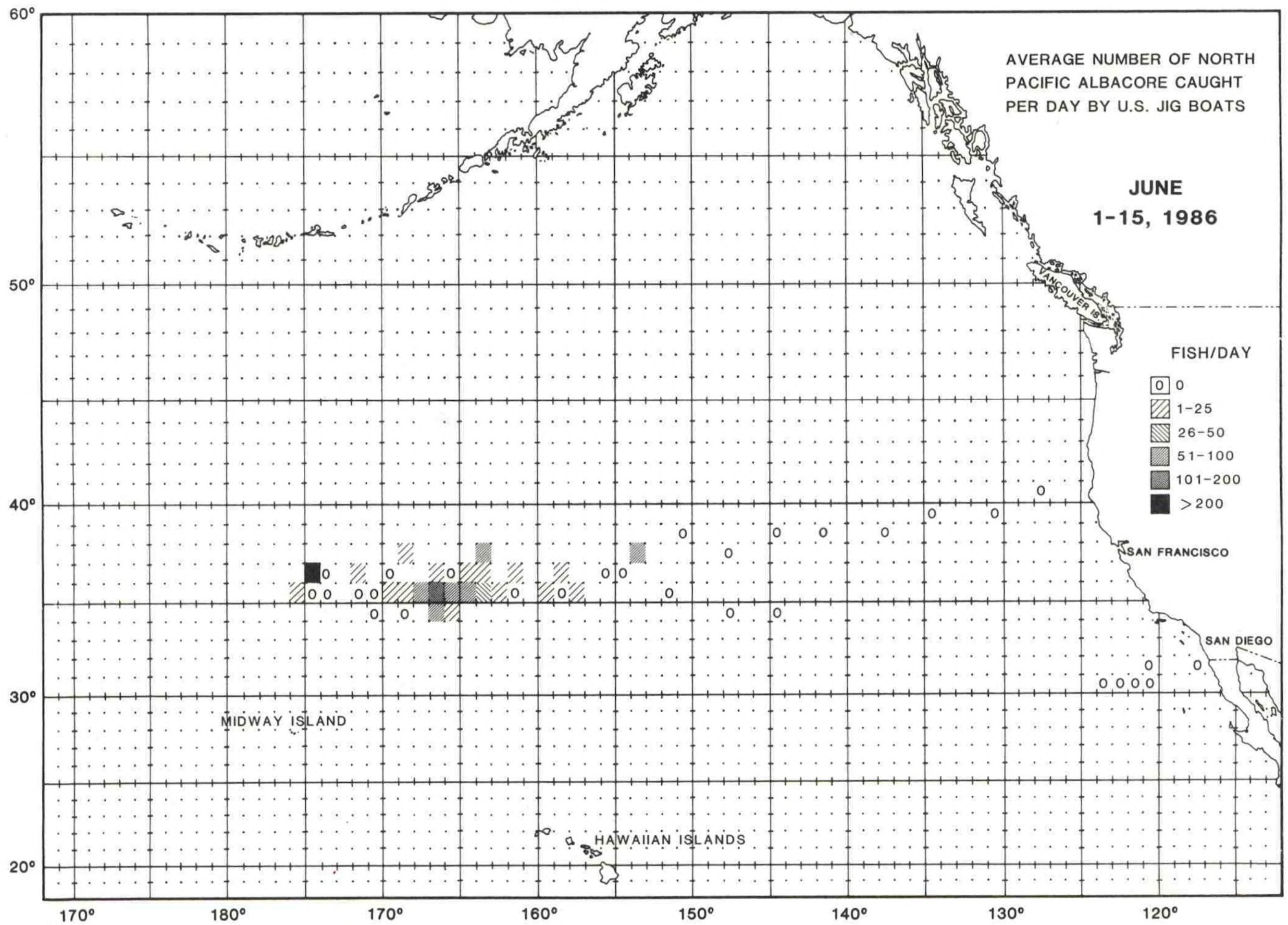

Figure 5c. Jigboat catch-per-standard day fishing by 1° square area and half-month, June 1-15, 1986.

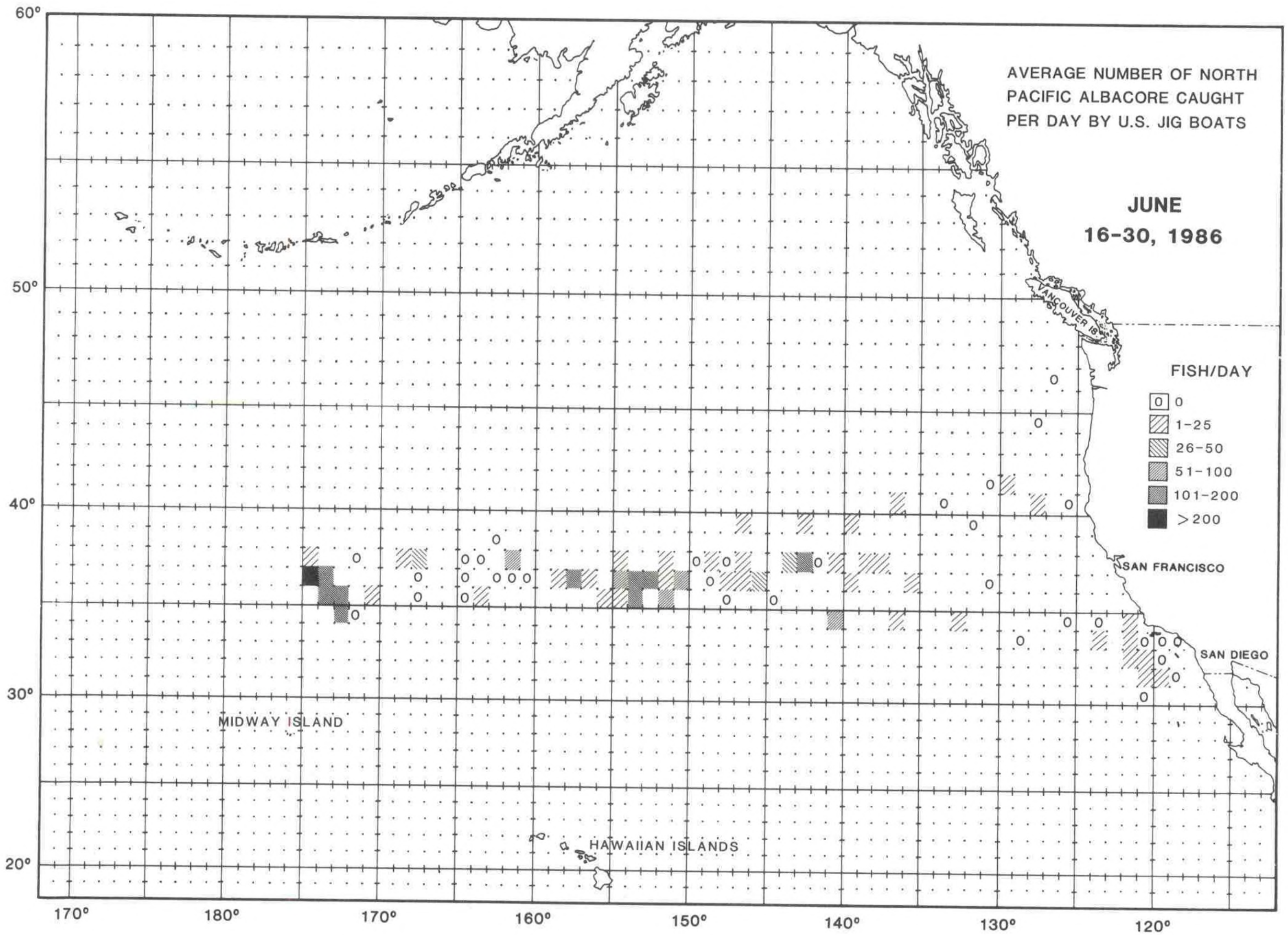

Figure 5d. Jigboat catch-per-standard day fishing by 1° square area and half-month, June 16-30, 1986.

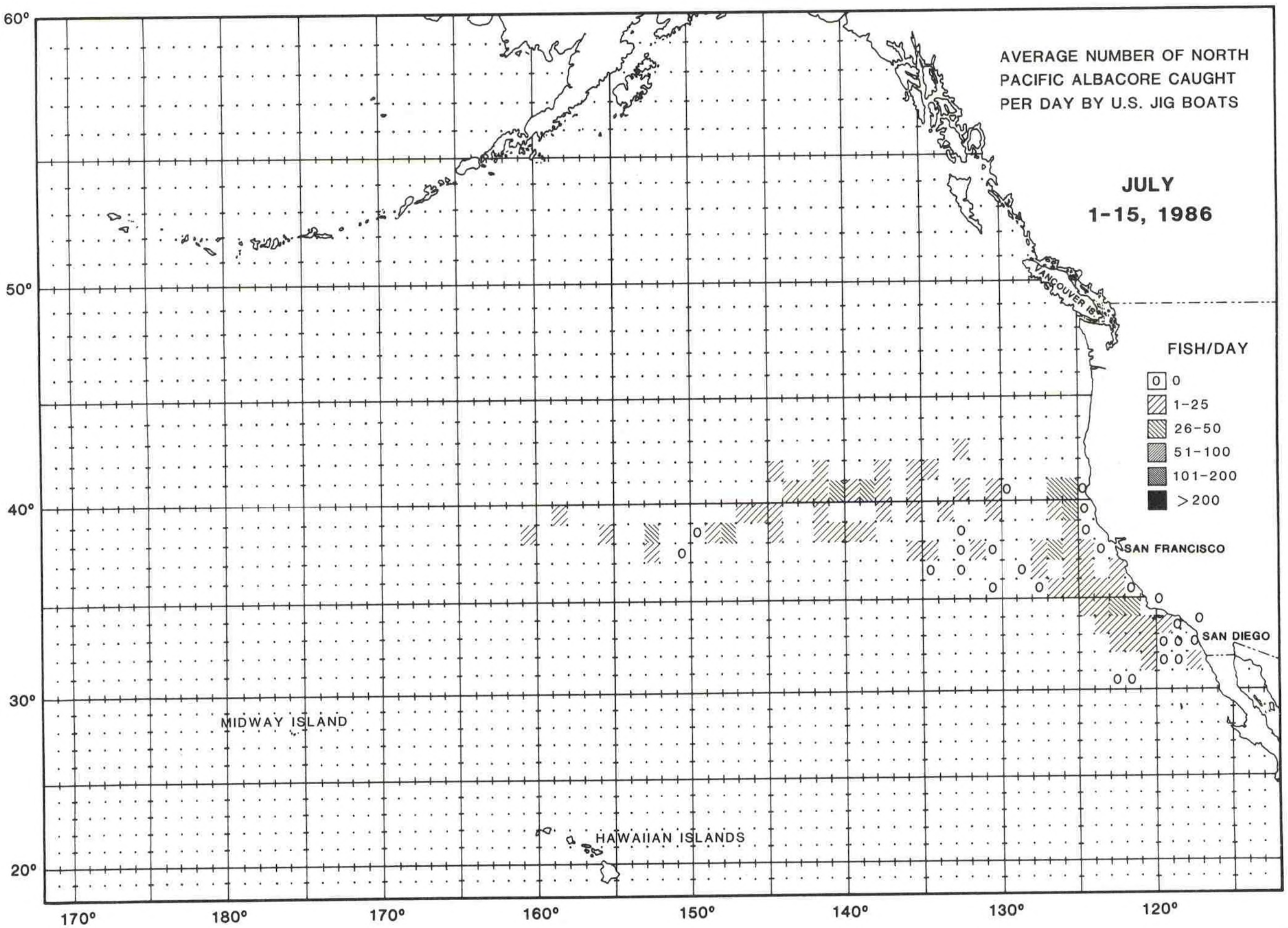

Figure 5e. Jigboat catch-per-standard day fishing by 1^{o} square area and half-month, July 1-15, 1986.

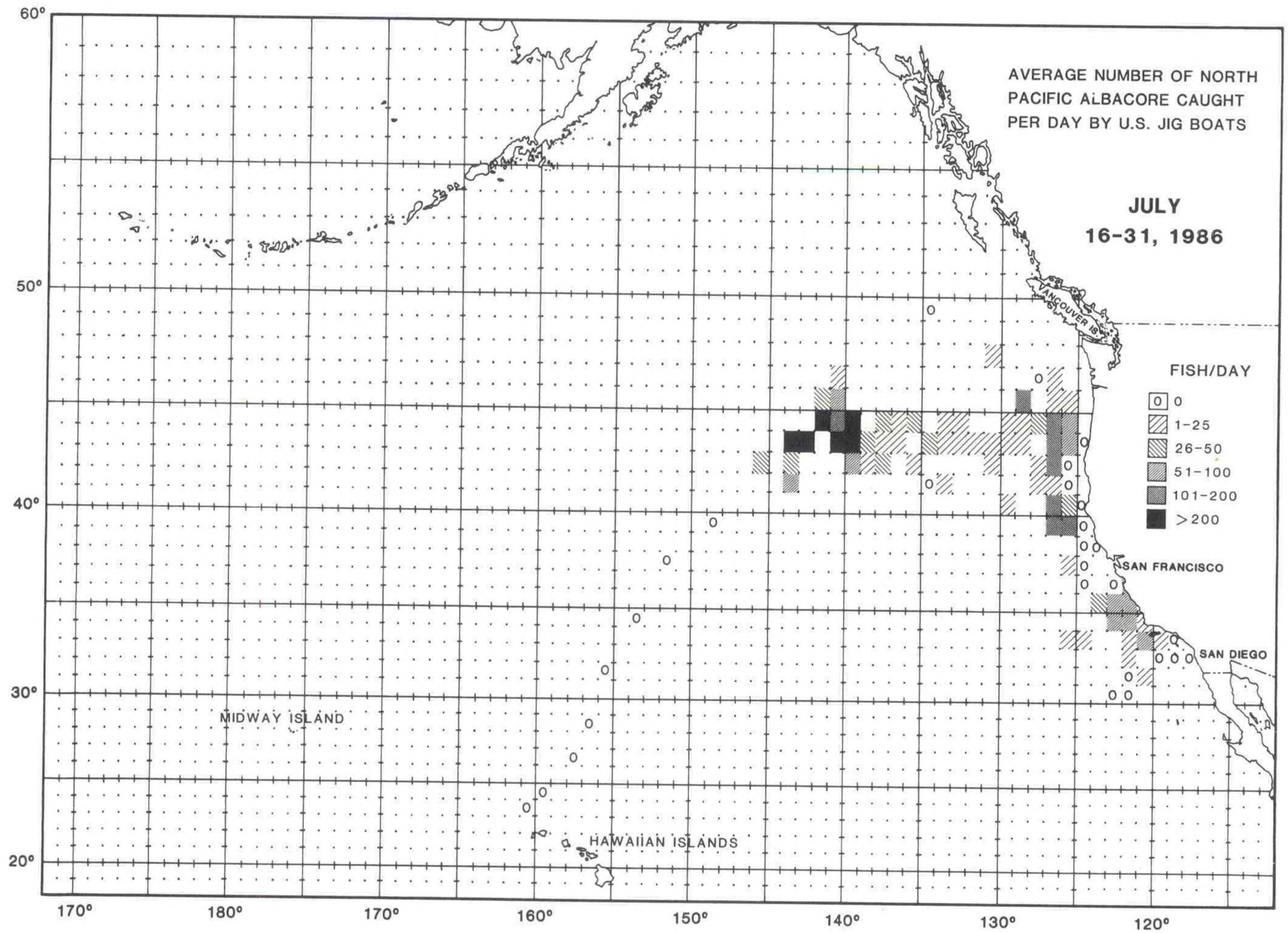

Figure 5f. Jigboat catch-per-standard day fishing by 1^{o} square area and half-month, July 16-31, 1986.

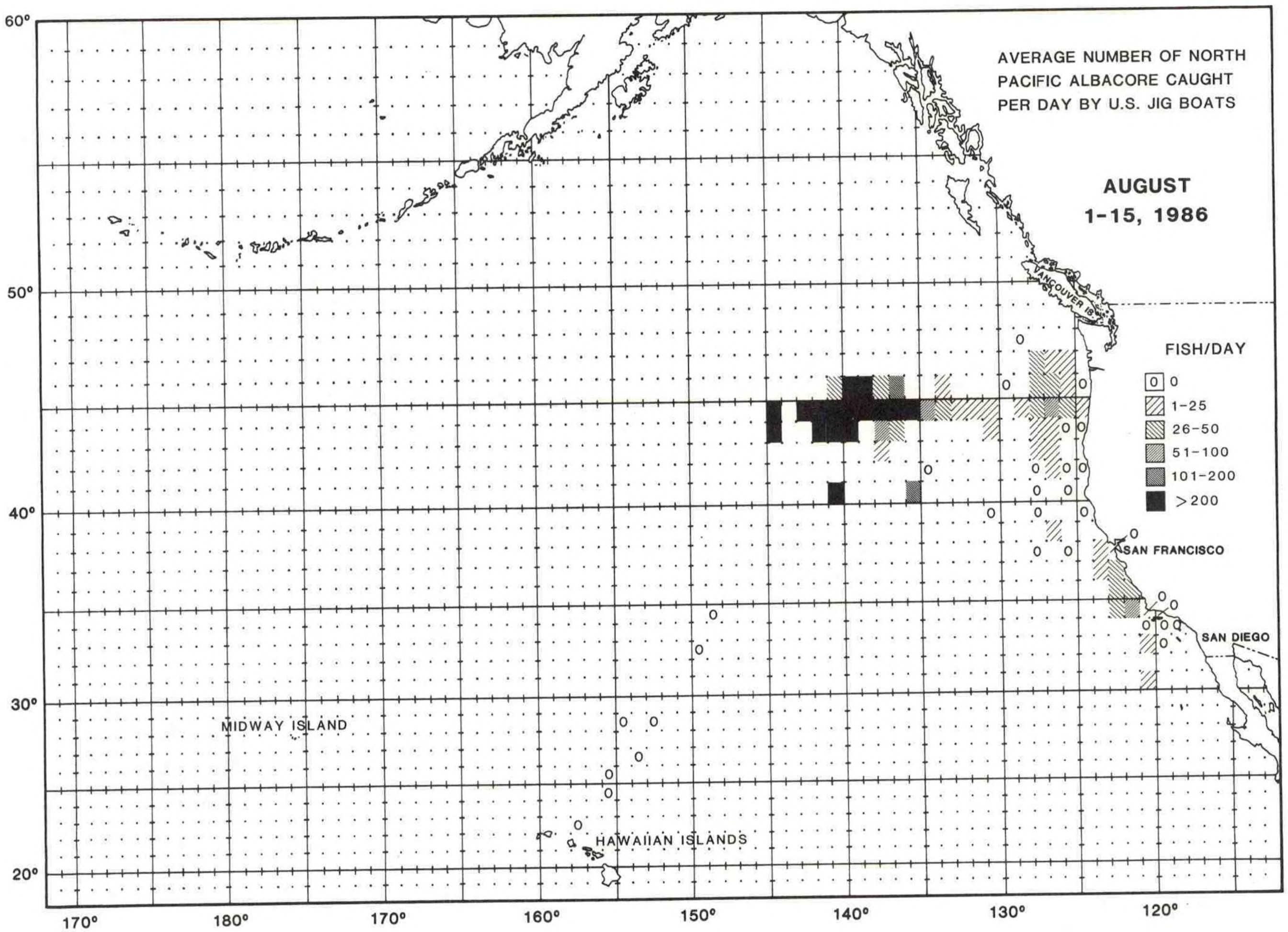

Figure 5g. Jigboat catch-per-standard day fishing by 1^{O} square area and half-month, August 1-15, 1986.

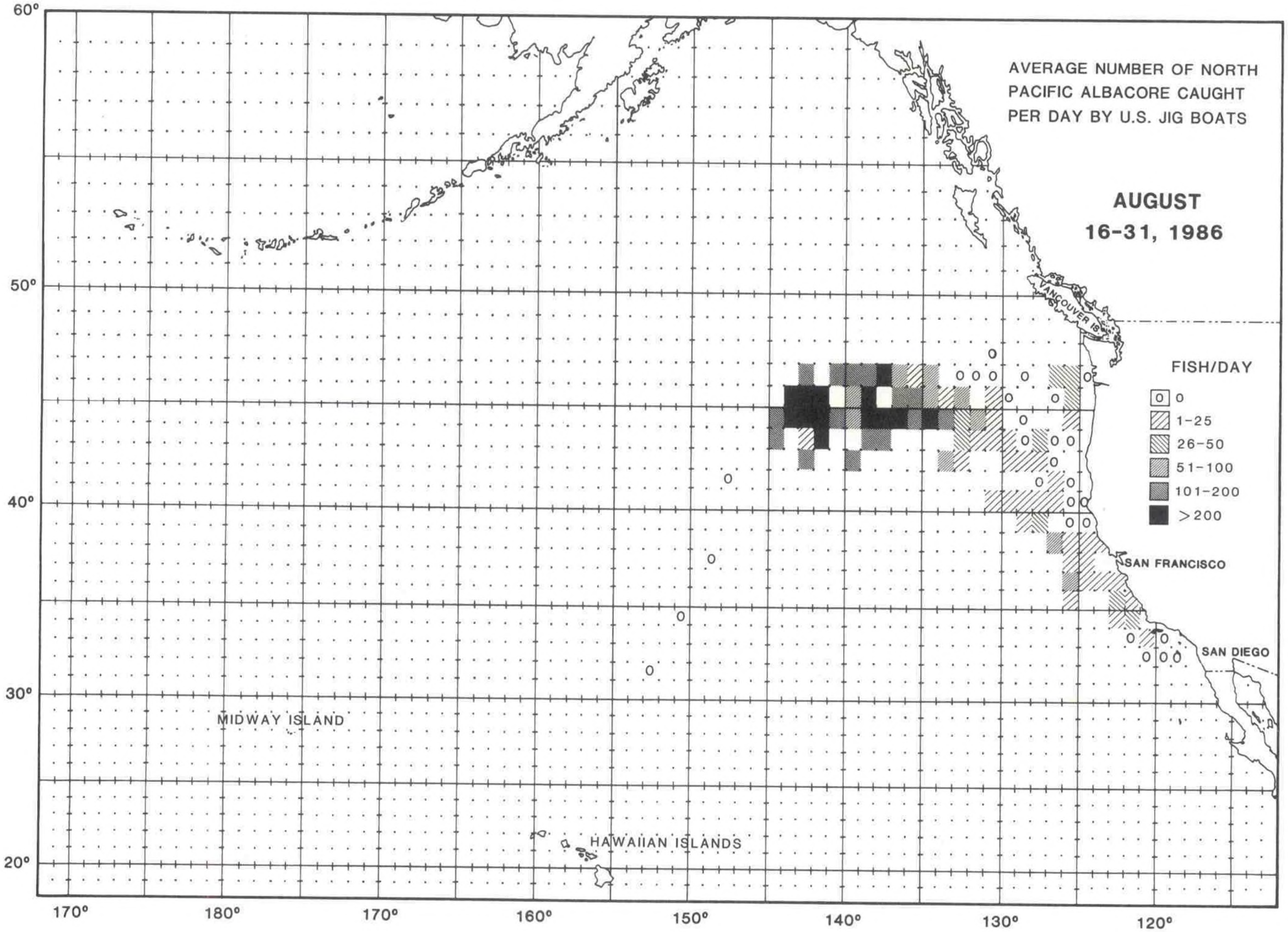

Figure 5h. Jigboat catch-per-standard day fishing by 1° square area and half-month, August 16-31, 1986.

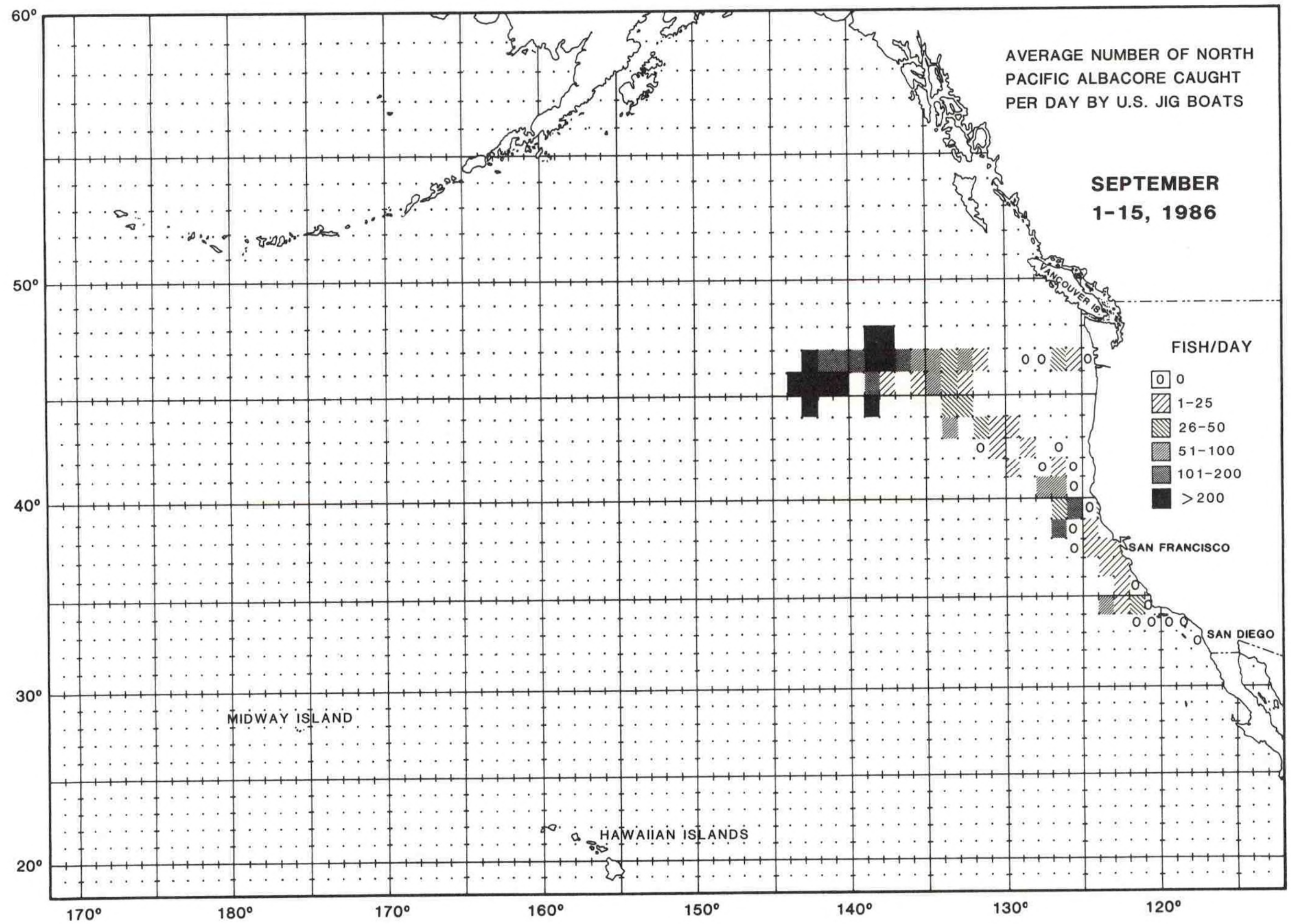

Figure 5i. Jigboat catch-per-standard day fishing by 1^{o} square area and half-month, September 1-15, 1986.

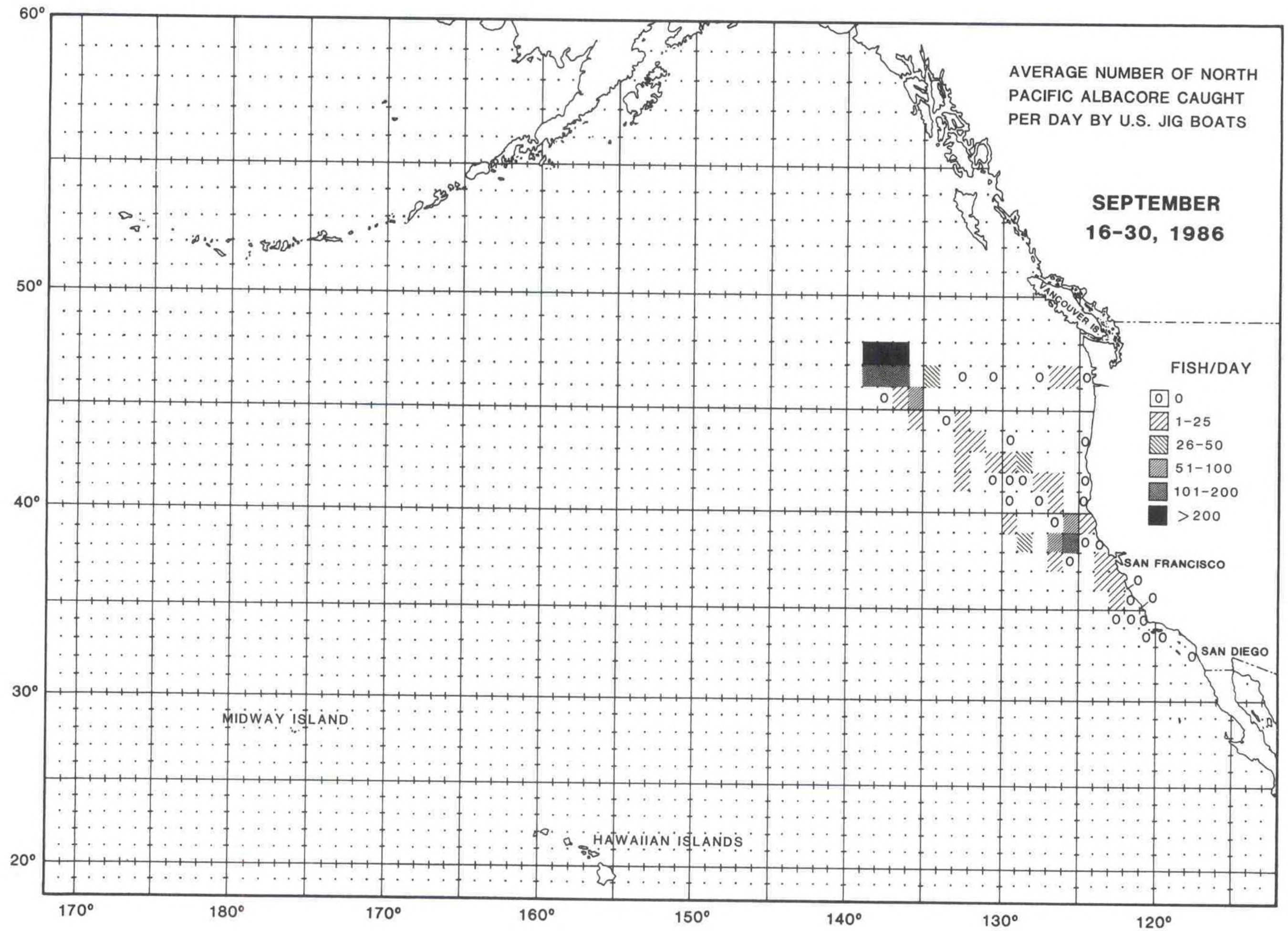

Figure 5j. Jigboat catch-per-standard day fishing by 1^{o} square area and half-month, September 16-30, 1986.

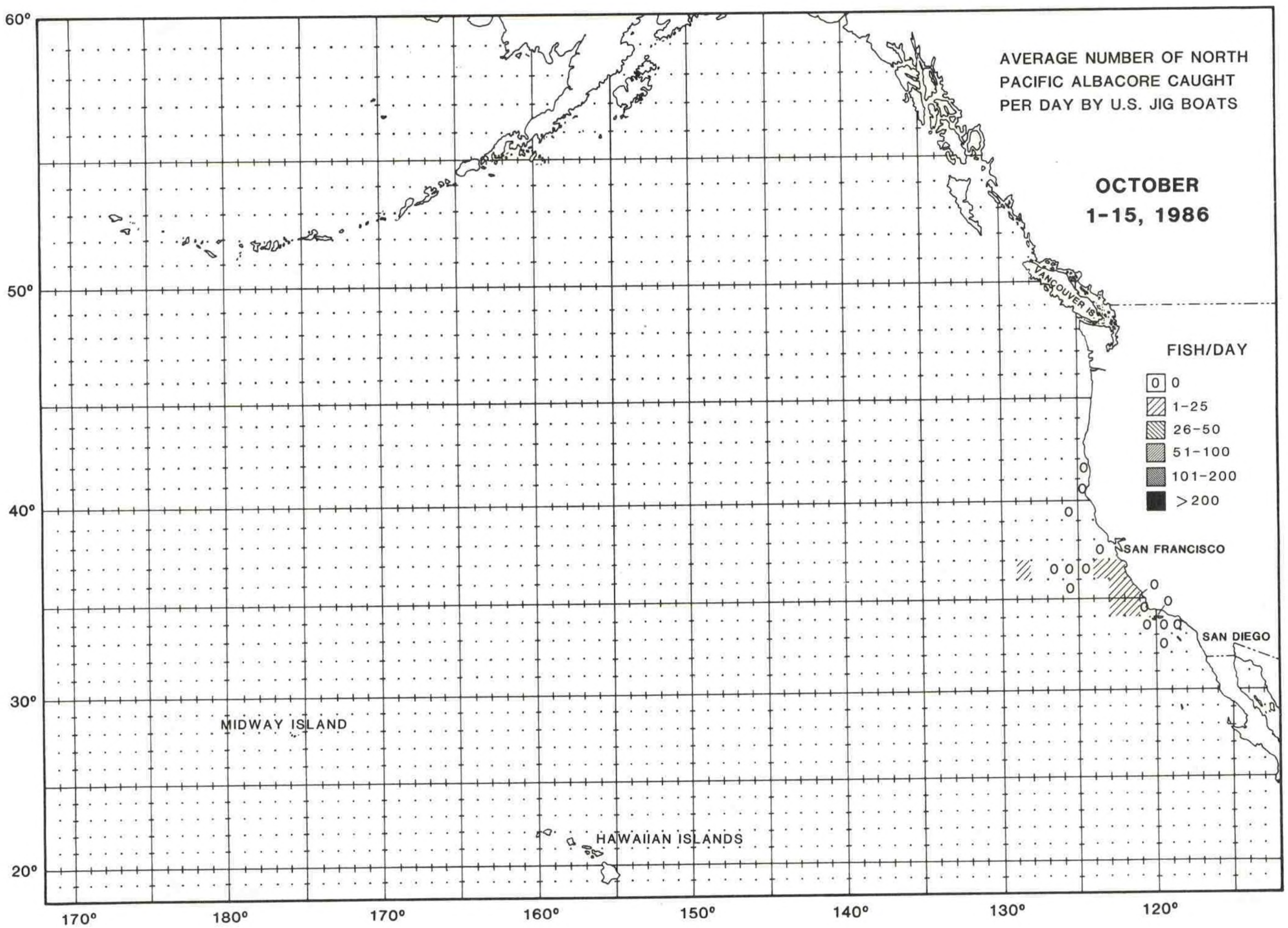

Figure 5k. Jigboat catch-per-standard day fishing by 1^{o} square area and half-month, October 1-15, 1986.

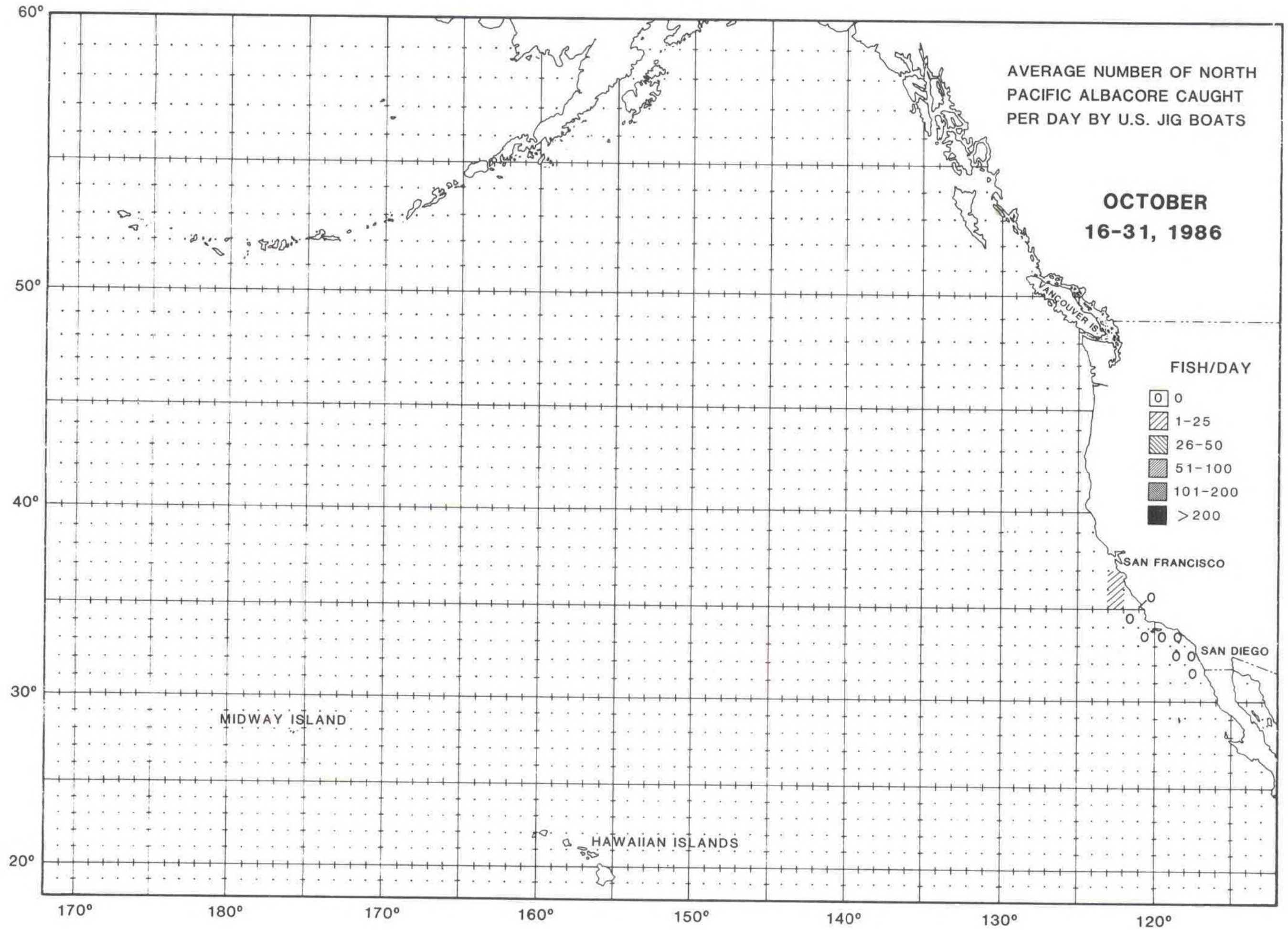

Figure 51. Jigboat catch-per-standard day fishing by 1° square area and half-month, October 16-31, 1986.

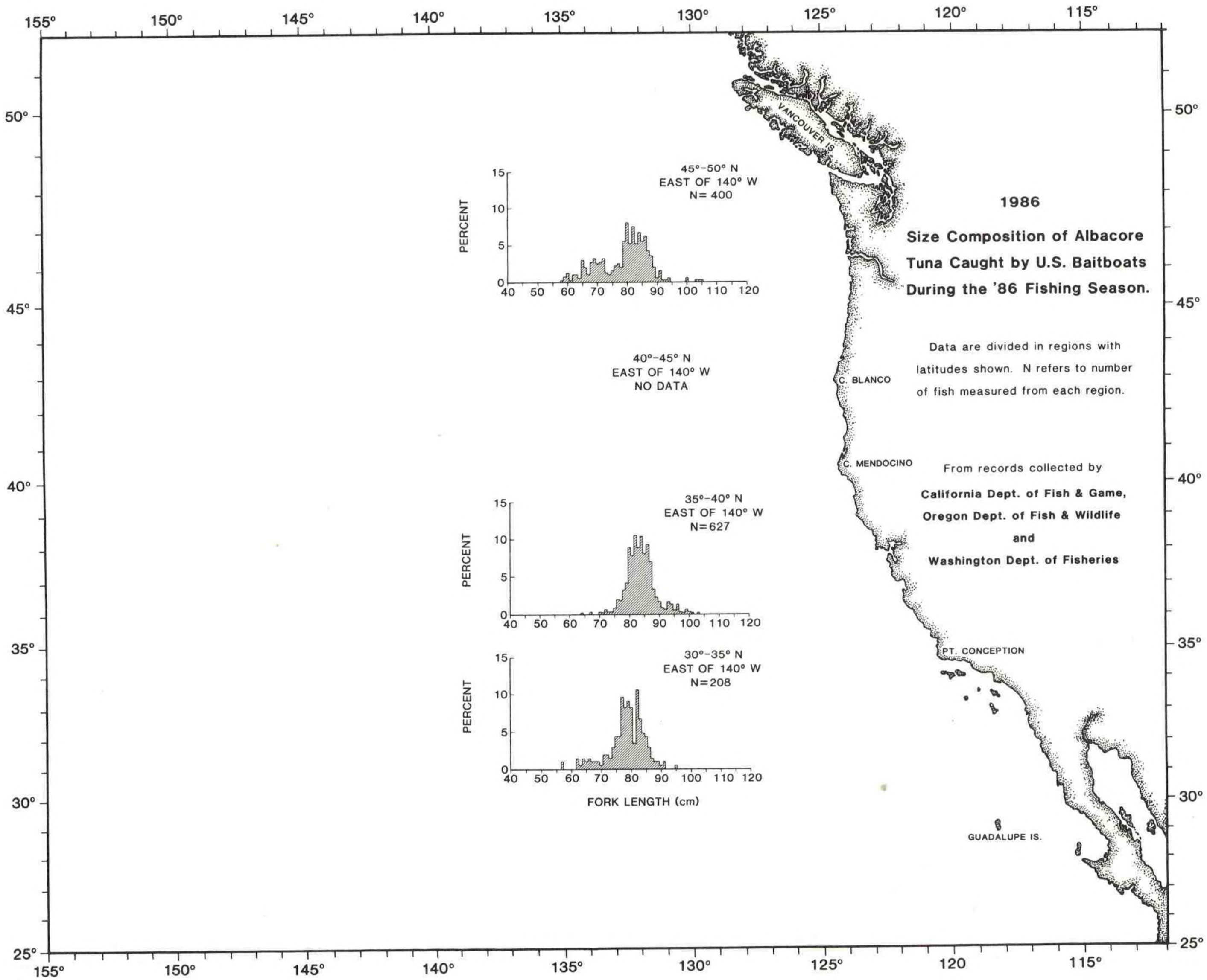

Figure 6a. Length-frequency histograms of the 1986 North Pacific albacore caught by the U.S. baitboat fishery.

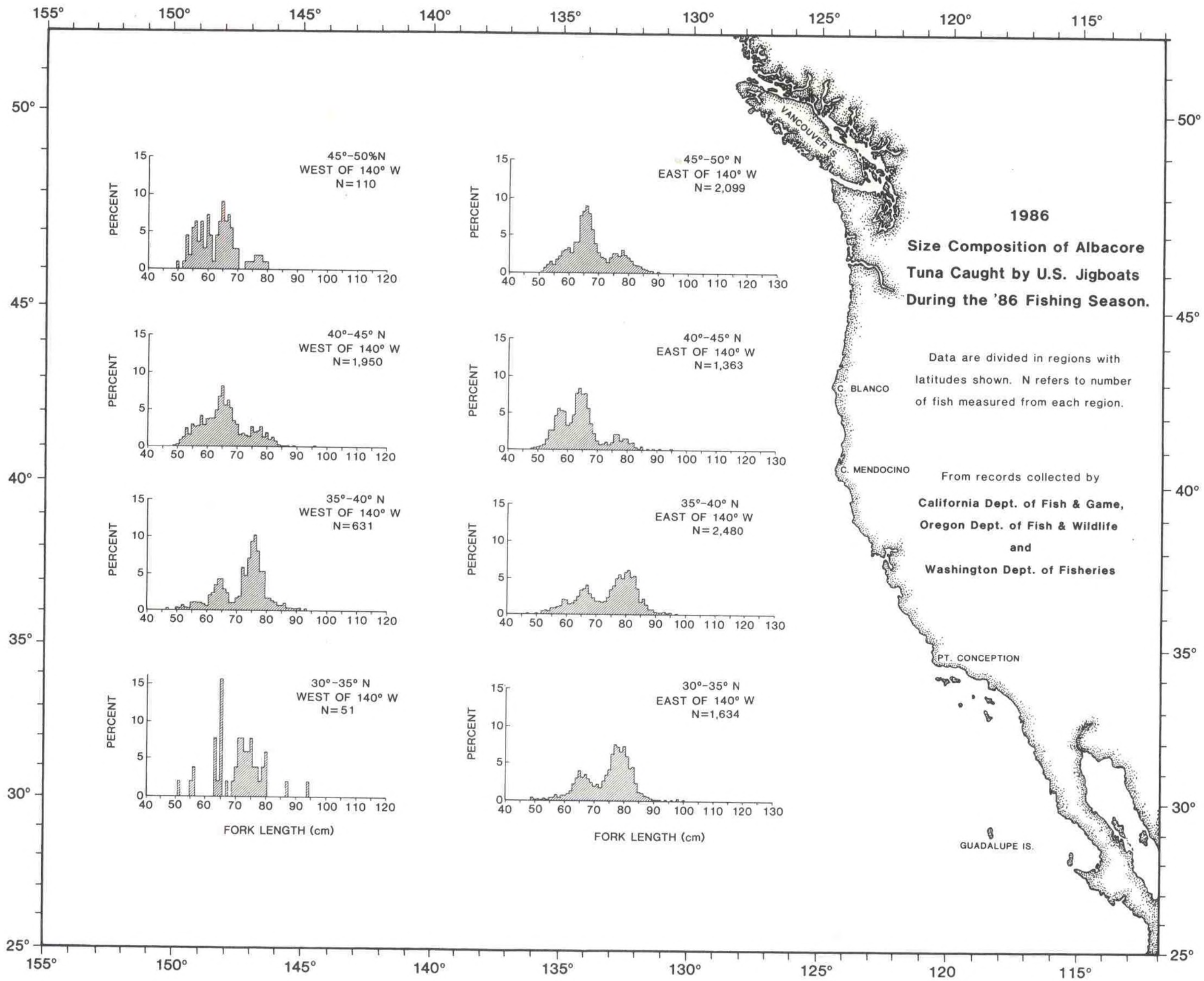

Figure 6b. Length-frequency histograms of the 1986 North Pacific albacore caught by the U.S. jigboat fishery.

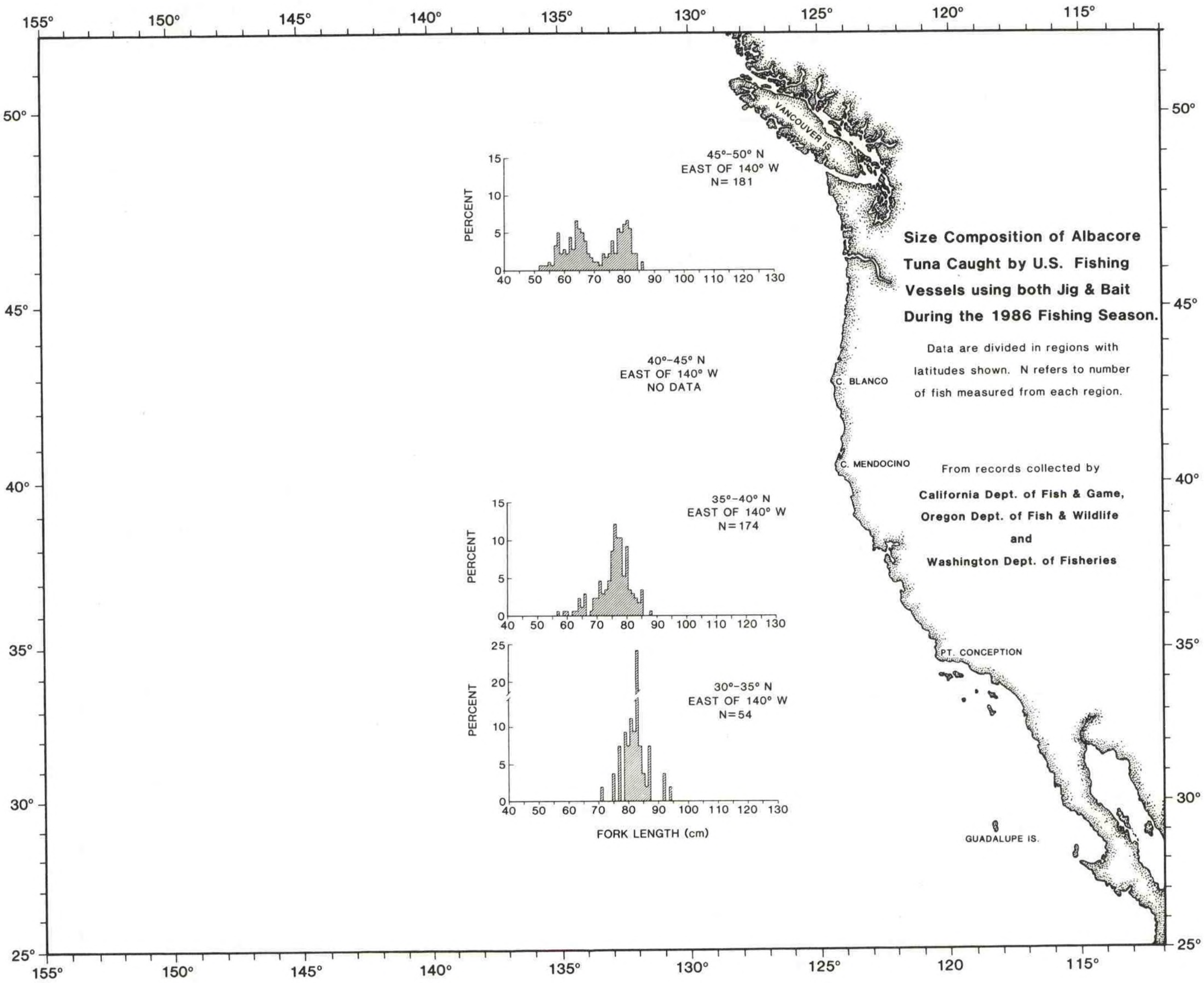

Figure 6c. Length-frequency histograms of the 1986 North Pacific albacore caught by U.S. vessels using both bait and jig.

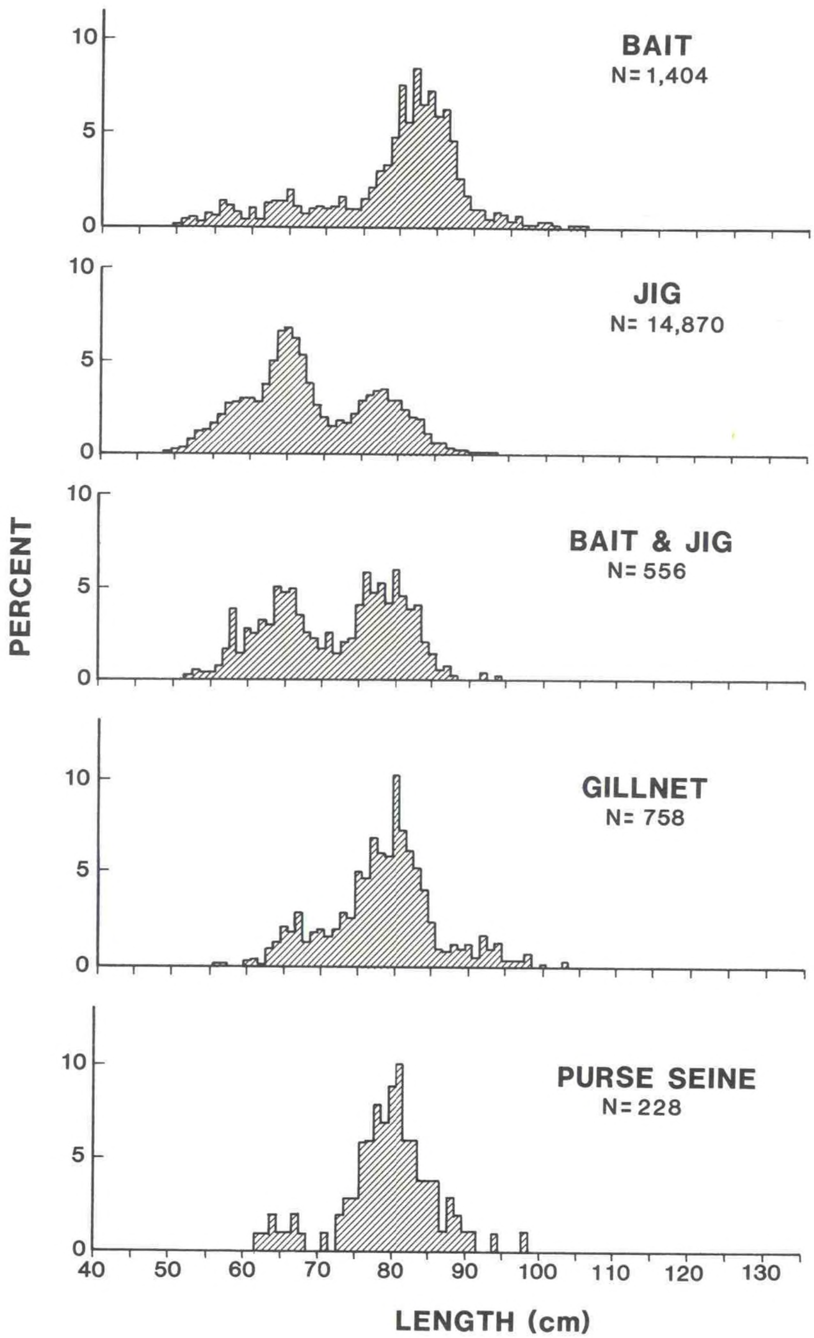

Figure 7. Size composition of albacore tuna caught by the U.S. fleet for 1986 by gear

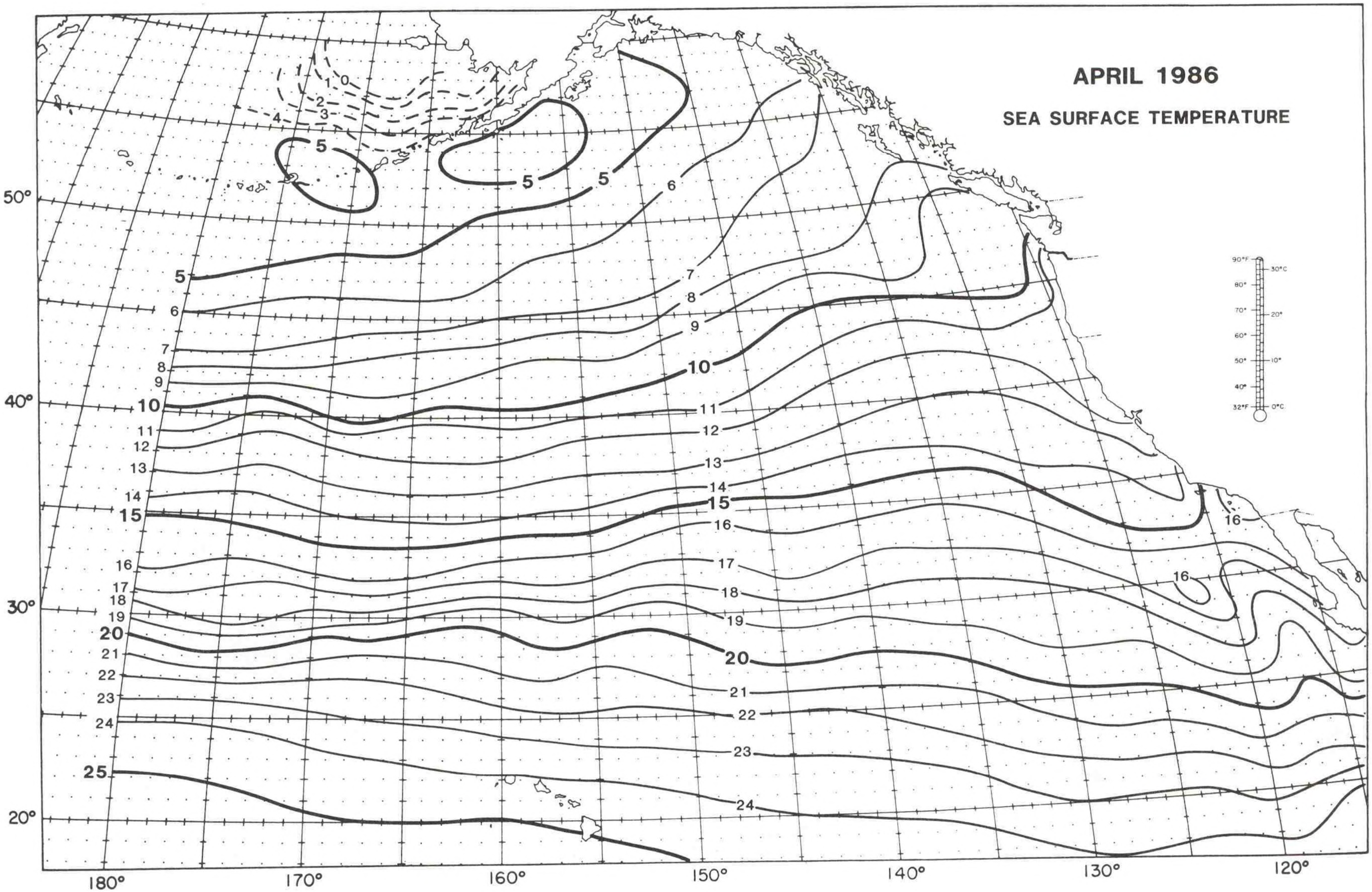

Figure 8a. Average sea-surface temperature (SST) isopleths (^{O}C) by month for the eastern Pacific Ocean, April 1986.

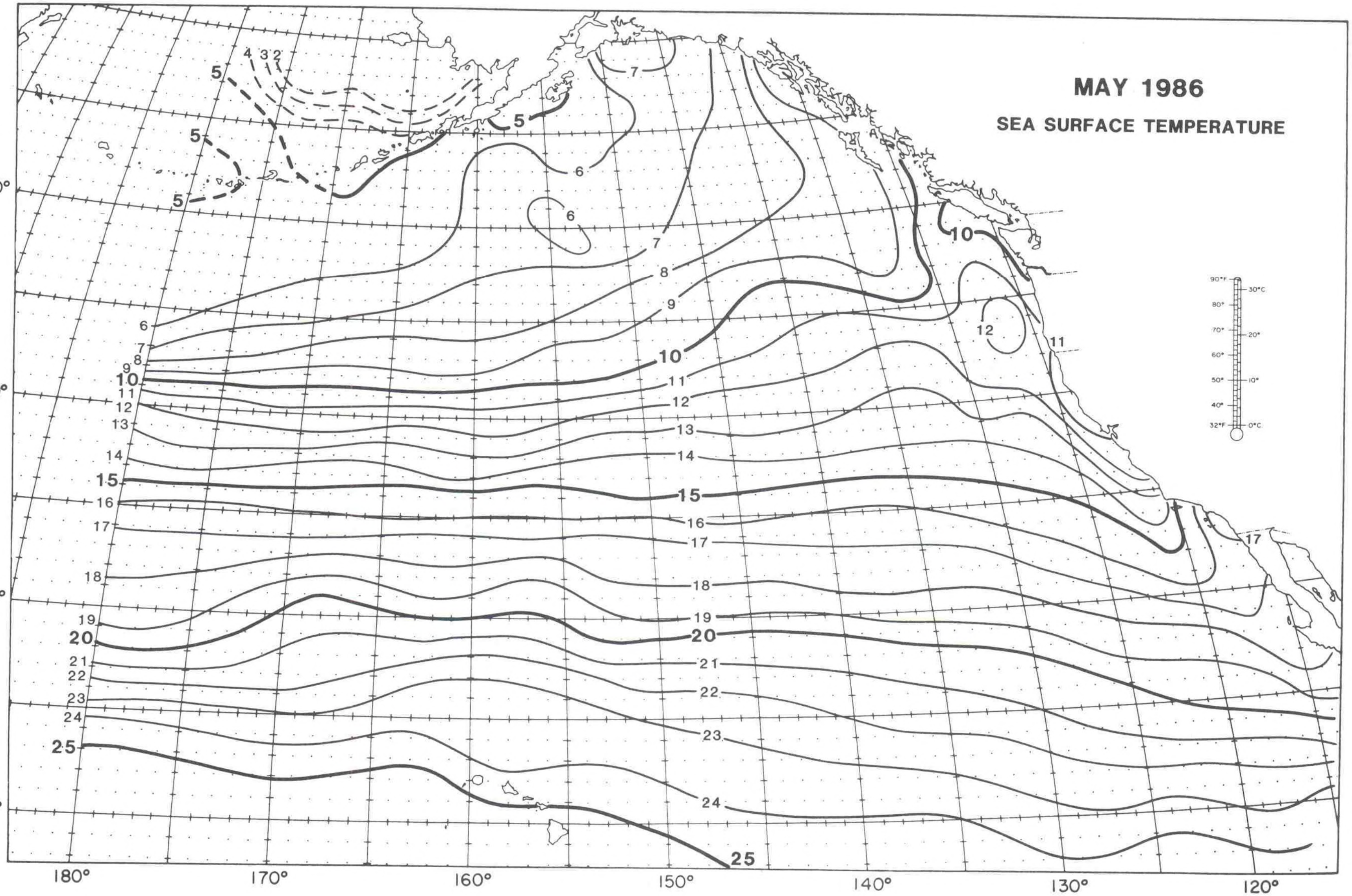

Figure 8b. Average sea-surface temperature (SST) isopleths (^oC) by month for the eastern Pacific Ocean, May 1986.

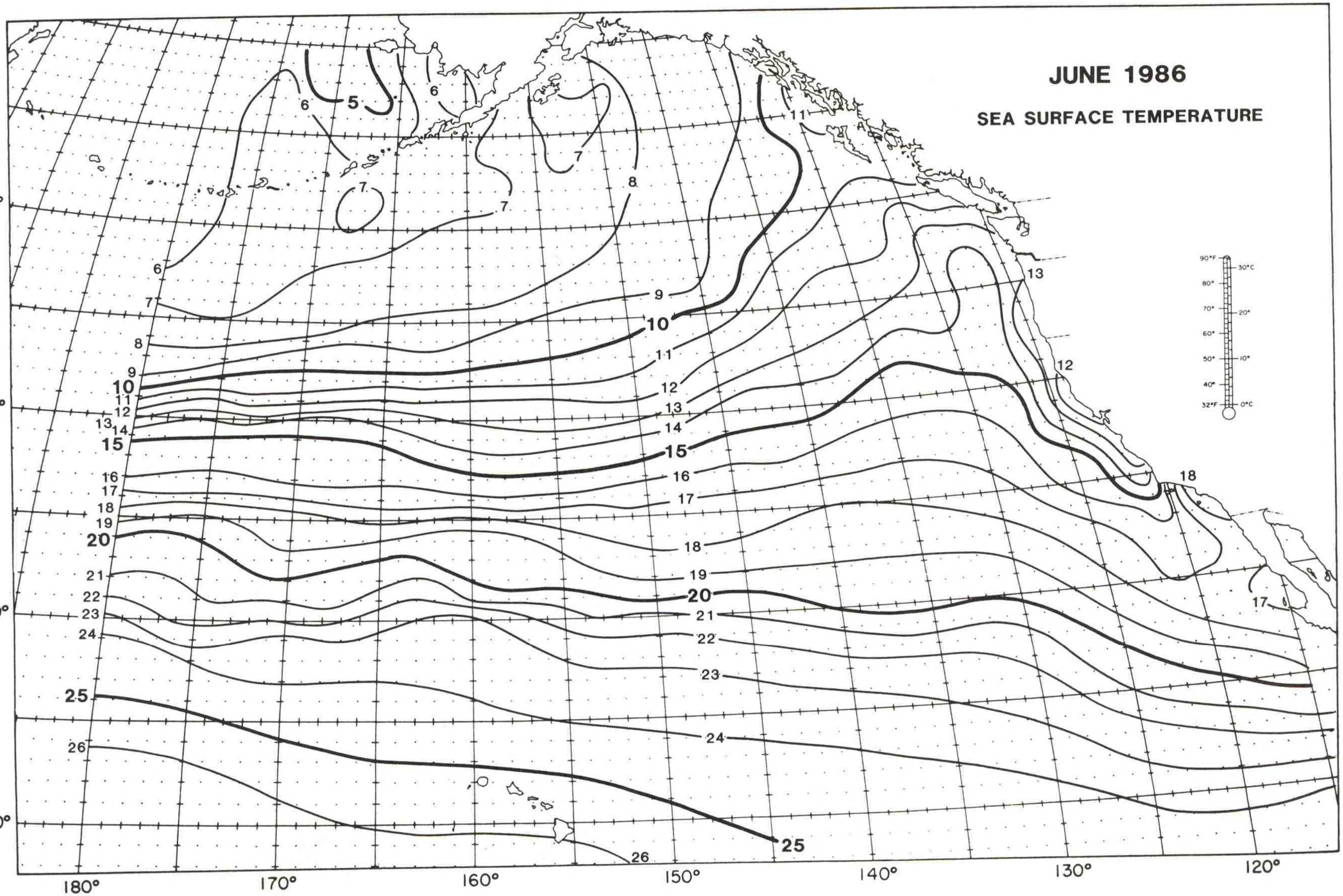

Figure 8c. Average sea-surface temperature (SST) isopleths (^{O}C) by month for the eastern Pacific Ocean, June 1986.

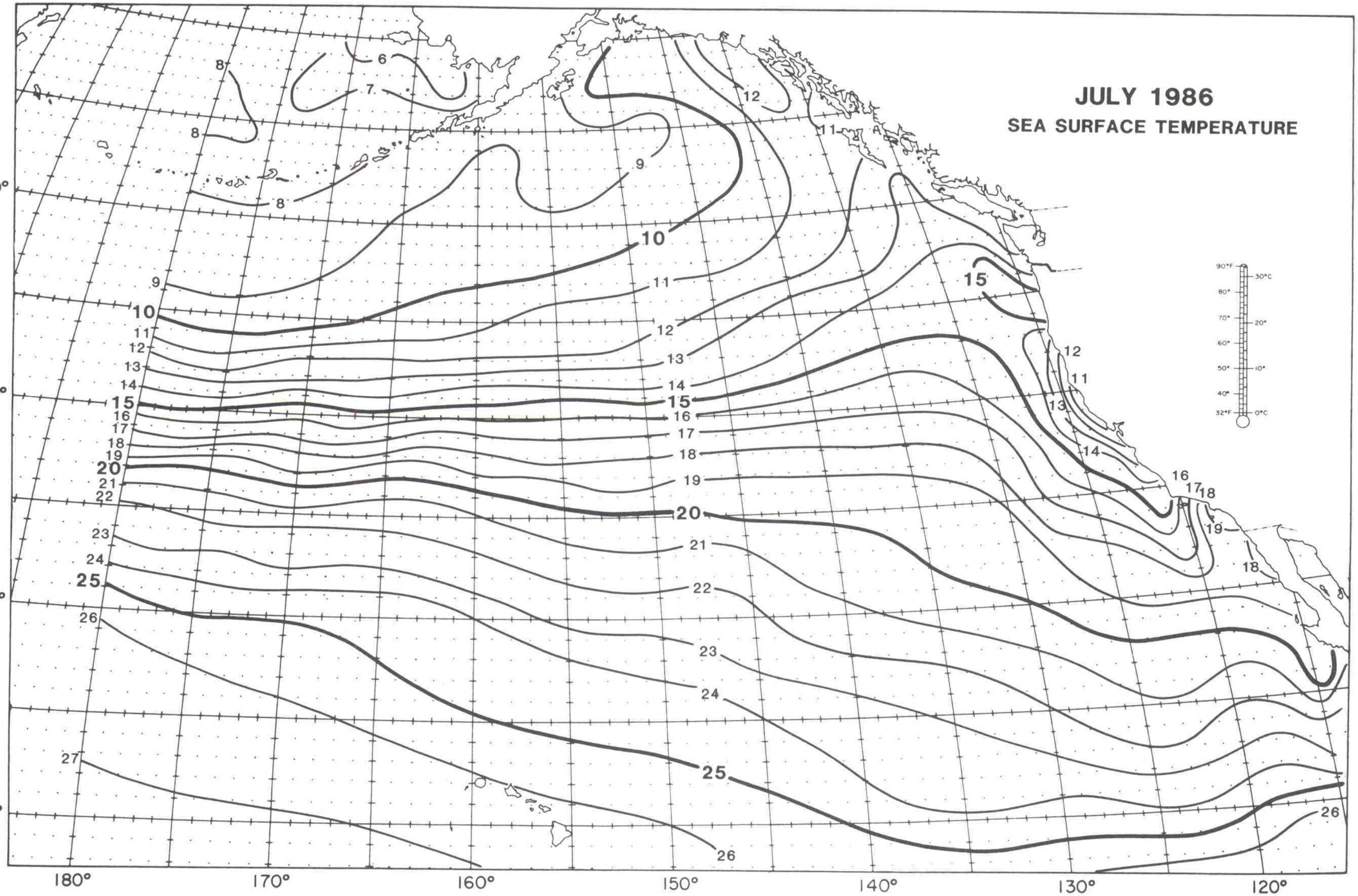

Figure 8d. Average sea-surface temperature (SST) isopleths (^{O}C) by month for the eastern Pacific Ocean, July 1986.

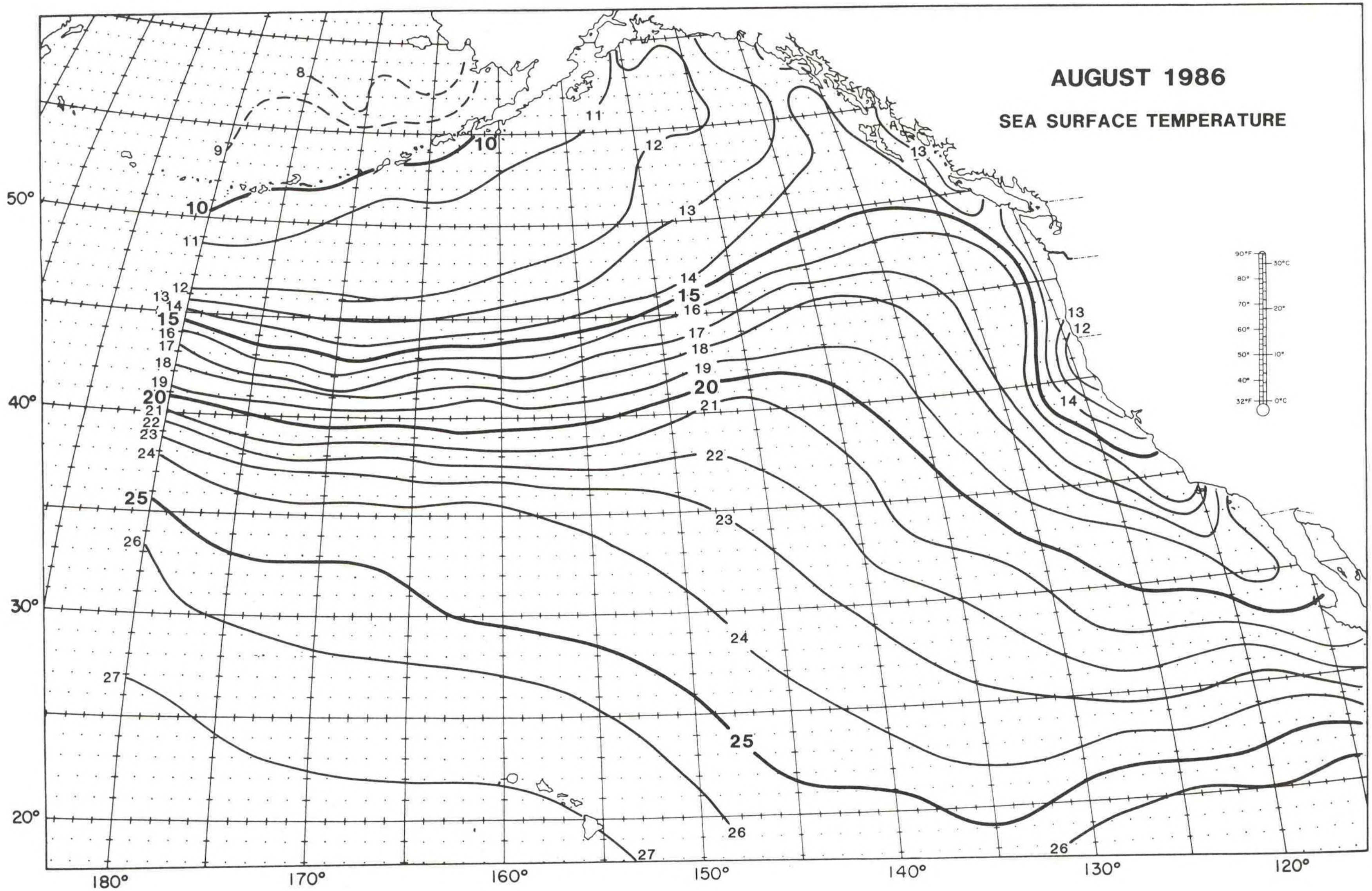

Figure 8e. Average sea-surface temperature (SST) isopleths (^{o}C) by month for the eastern Pacific Ocean, August 1986.

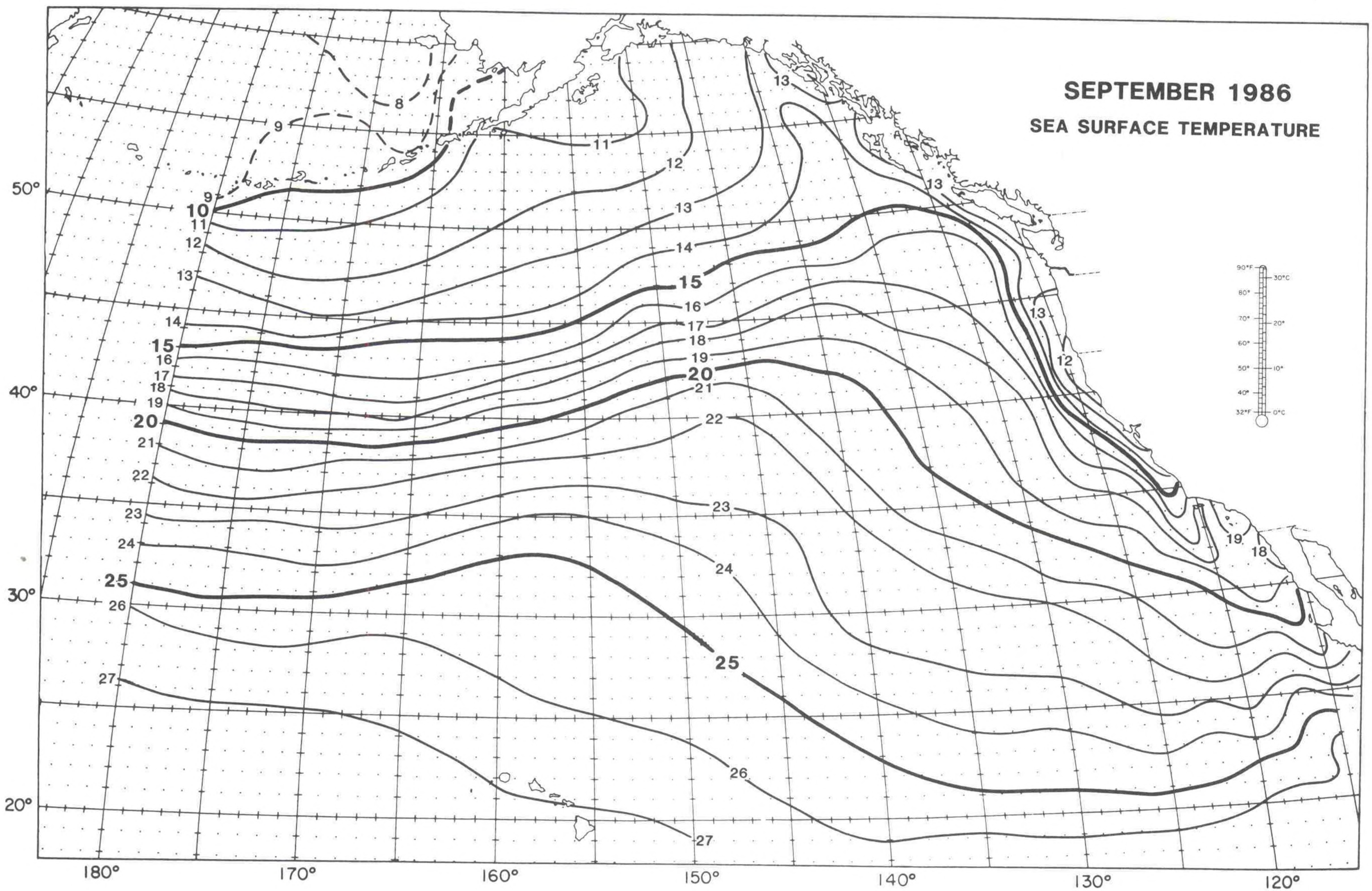

Figure 8f. Average sea-surface temperature (SST) isopleths (^{O}C) by month for the eastern Pacific Ocean, September 1986.

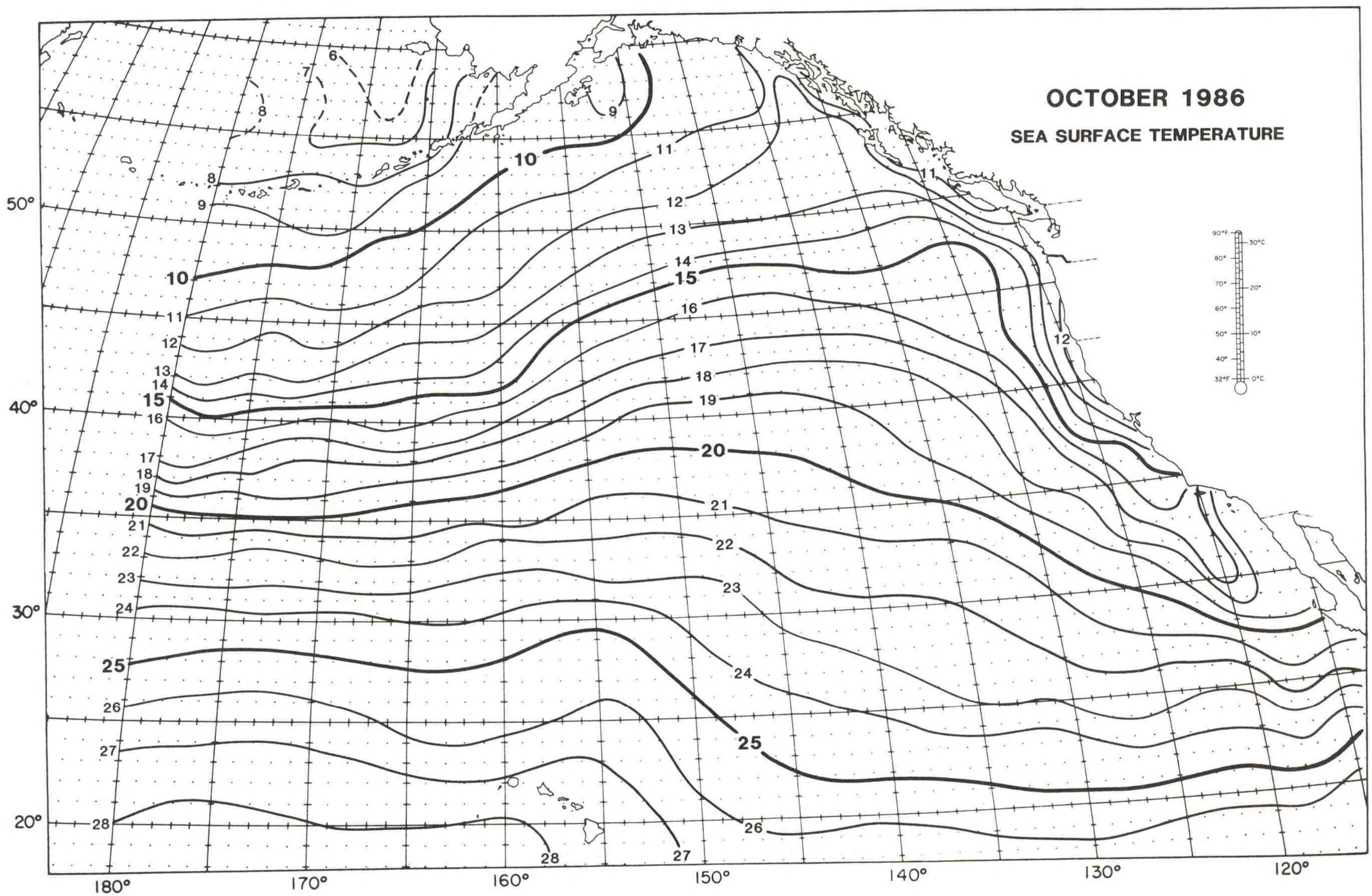

Figure 8g. Average sea-surface temperature (SST) isopleths (^{o}C) by month for the eastern Pacific Ocean, October 1986.

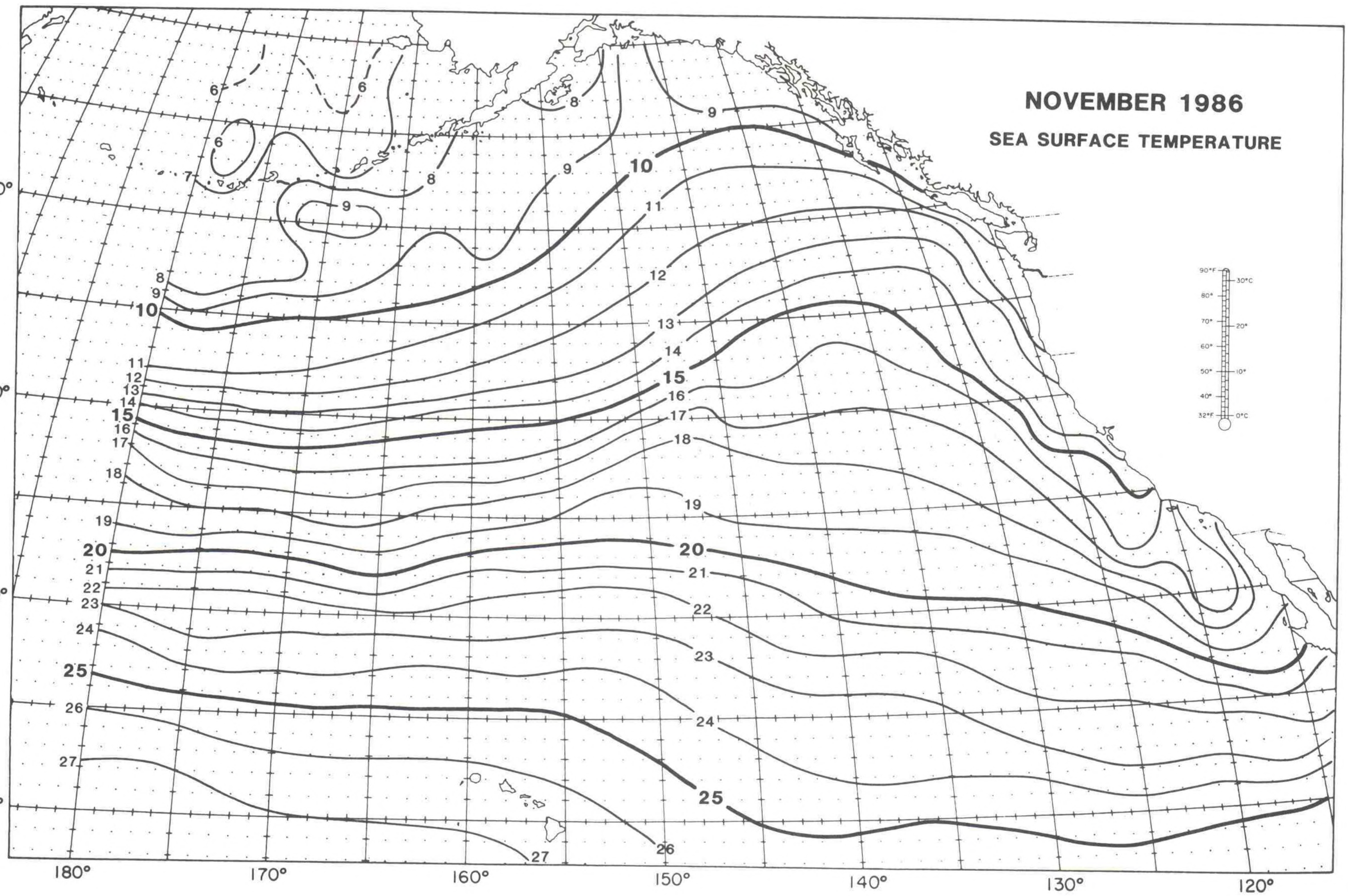

Figure 8h. Average sea-surface temperature (SST) isopleths (^{o}C) by month for the eastern Pacific Ocean, November 1986.