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# SOUTHWEST FISHERIES SCIENCE CENTER

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

JULY 1995

## SUMMARY OF THE 1994 U.S. NORTH AND SOUTH PACIFIC ALBACORE TROLL FISHERIES

By

John Childers and Forrest R. Miller

ADMINISTRATIVE REPORT LJ-95-15



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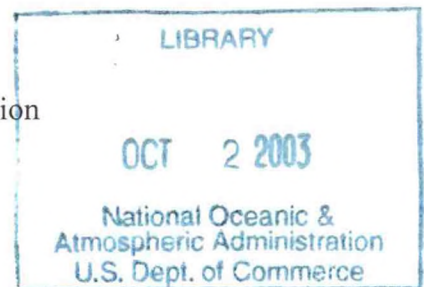
# SUMMARY OF THE 1994 U.S. NORTH AND SOUTH PACIFIC ALBACORE TROLL FISHERIES

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With support from  
American Fishermen's Research Foundation



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## INTRODUCTION

Each year the U.S. troll fishery for albacore (*Thunnus alalunga*) in the North Pacific catches 15% to 25% of the total amount of albacore caught by all North Pacific fisheries (Table 1). During the past forty years, the U.S. fishery has undergone a number of changes: The distribution of the coastal fishery has shifted northward to the coasts of Oregon, Washington, and Canada as catches off central and southern California have decreased; larger troll vessels with increased carrying capacity and increased range have joined the fleet; and the traditional North Pacific albacore fishing grounds have expanded westward from the coasts of California, Oregon, and Washington, to west of the International Date Line. In recent years, the North Pacific albacore season has begun in May, northwest of Hawaii between latitudes 30°N and 40°N. U.S. troll vessels that operate in these offshore areas fish farther east as the season progresses.

Exploratory troll fishing in areas east of New Zealand in 1986 resulted in the development of a U.S. South Pacific albacore troll fishery (Laur, 1986). This fishery annually takes less than 10% of the total amount of albacore caught by all South Pacific fisheries (Table 2). Many large, long-range U.S. troll vessels depart the U.S. west coast after the end of the North Pacific season for the fishing grounds of the southern hemisphere where albacore are caught during the austral summer months (December through April). The southern fishing grounds extend from the west coast of Australia to approximately 110°W between 30°S and 45°S. Most U.S. troll vessels depart the southern hemisphere in April when catches decrease and weather conditions worsen. These vessels run to Hawaii or the U.S. West Coast to prepare for the next North Pacific fishing season.

The Southwest Fisheries Science Center (SWFSC) of the National Marine Fisheries Service (NMFS), in cooperation with the American Fishermen's Research Foundation (AFRF), Western Fishboat Owners Association (WFOA), and the state fisheries agencies of California,



Oregon, and Washington, maintains a program for sampling catch, effort, and length-frequency information from the U.S. albacore fisheries in both hemispheres. Catch/effort data are obtained from completed copies of the *U.S. Pacific Albacore Logbook* that are voluntarily submitted by fishermen or completed by port samplers who collect the information from cooperating fishermen. Over five hundred logbooks were distributed to albacore fishermen prior to, and during the 1994 North Pacific albacore season and the 1993-94 South Pacific albacore season by the SWFSC's La Jolla and Honolulu laboratories, the Southwest Regional (SWR) Office in American Samoa, and the above-mentioned agencies. Four biologists accompanied four fishing vessels during the 1994 North Pacific season to collect catch/effort, length-frequency, and biological information. Catch/effort and length-frequency information from the 1993-94 U.S. South Pacific albacore fishery were collected by the SWR office in American Samoa. U.S. catches landed in foreign ports were supplied by scientists in New Zealand, Fiji and French Polynesia.

This report summarizes information collected from the 1994 North Pacific albacore season and the 1993-94 South Pacific albacore season. Data from the 1993 North Pacific season, 1992-93 South Pacific season, and landings of albacore by other nations (where available) are included for comparison.

### **LOGBOOK SAMPLING COVERAGE**

Nearly four hundred trips (of the estimated 1,935 trips completed during the season) were sampled for logbook information during the 1994 North Pacific season. These sampled trips caught a combined total of 4,720 t of albacore. Logbook sampling coverage rates are calculated as the ratio of catch weights from sampled vessels to the total catch weights from all troll vessels. The 1994 North Pacific logbook sampling coverage rate is 45%, significantly more than the 1993 season's logbook sampling coverage rate of 18% (Table 3).

Logbook information for the 1993-94 South Pacific season was collected from 7 trips of the 19 trips completed by U.S. troll vessels. These 7 vessel trips caught a combined total of 268 t of albacore. The logbook sampling coverage rate for the 1993-94 South Pacific season is 44% compared to 17% for the 1992-93 season (Table 4). The increased logbook sampling coverage rate in the South Pacific fishery is due in part to the smaller number of vessels participating in the fishery.

### **LENGTH-FREQUENCY SAMPLING COVERAGE**

Nearly all albacore that were sampled for fork lengths during the 1994 U.S. North Pacific season were caught with troll gear. Length-frequency samples were collected by four biologists from the SWFSC who accompanied four U.S. troll vessels. Port sampling of length-frequency data was opportunistic during the 1994 North Pacific season due to lack of funding. Only four trips (716 fish) were sampled for length-frequency data as the vessels unloaded. Approximately 18,430 albacore were sampled for fork lengths during the 1994 North Pacific season compared to 10,885 fish that were measured (by port samplers and biologists at sea) during the 1993 season. The length-frequency samples collected during the 1994 North Pacific

season represent all months of the season and a high percentage of the areas fished by U.S. troll vessels.

Coverage rates of length-frequency sampling are calculated as the ratio of the number of fish sampled to the estimated total number of fish caught for the season (estimated as total catches divided by average weight). The length-frequency sampling coverage for the 1994 North Pacific season is 1.3% compared to 1.2% coverage in 1993 (Table 3). The continued suspension of length-frequency sampling at landing ports has kept length-frequency sampling coverage low, however, at-sea sampling has resulted in more representative samples and more precise data being collected.

Length-frequency sampling of albacore caught by U.S. troll vessels during the 1993-94 South Pacific season was conducted by port samplers from the NMFS, SWR American Samoa office. Port samplers in American Samoa measured 996 albacore during the 1993-94 South Pacific season, resulting in a length-frequency sampling coverage rate of 1.1%. The length-frequency coverage rate for the 1992-93 South Pacific albacore season is 1.0% (Table 4). The collection of length-frequency data from U.S. South Pacific albacore catches continues to be hampered by the frequent transshipment of catches and few direct landings that are available to be sampled for length-frequency information.

## TOTAL CATCH AND EFFORT

U.S. troll vessels fished an estimated 23,670 days during the 1994 North Pacific season (calculated as total landings divided by average stratified catch rate divided by average weight). This is a 3% decrease from the 24,470 days fished during the 1993 season (Table 3). Total catches from the 1994 North Pacific albacore season increased 68% to 10,535 t, the highest catch by U.S. troll vessels since 1981. The 1994 season represents the third consecutive year of increased catches. The cessation of high seas drift gill net fishing for albacore in the North Pacific and the diminishing effects of the last El Niño event may have contributed to this recent upward trend in annual albacore catches by the U.S. troll fleet. The preliminary estimate of the total amount of albacore caught by the Japanese pole and line fleet in 1994 is 31,038 t, a dramatic increase of 148% over the previous year's estimated catch of 12,528 t.

Although some catches were made in April, as vessels were in transit from the U.S. West Coast to Hawaii, the 1994 North Pacific albacore season really began in May when vessels started fishing north of Midway Island (Figures 1a and 1b). Incidental catches of skipjack (*Katsuwonus pelamis*), mahi mahi (*Coryphaena hippurus*), and billfishes were occasionally made en route to the fishing grounds. Fish were abundant near 36°N, 171°W and 37°N, 174°E in June (Figure 1c). Catches in July exceeded 5,000 fish per 1° square near 37°N, 175°E and 42°N, 145°W (Figure 1d). Fishing progressed eastward throughout July and by August high catches were made between 131°W and 148°W from 41°N to 45°N (Figure 1e). Excellent catches were also made off the coasts of Vancouver Island, Washington, and Oregon in August. Coastal fishing began to decrease in September with the best catches made off the northern end of Vancouver Island and approximately 150 nm off the Columbia River (Figure 1f). Fishing remained excellent, however, in the offshore area centered at 45°N, 144°W in

September. October brought harsh weather conditions and the fishing success diminished as the month progressed. Most catches were made in the offshore area centered at 45°N, 144°W (Figure 1g). A few boats continued to fish into early November in the same vicinity until weather and poor catches forced them to end the season (Figure 1h). The highest catches during the 1994 North Pacific season occurred in four general areas (Figure 1i):

1. West of 175°E, from 36°N to 39°N (in June and July).
2. Between 170°W and 174°W from 34°N to 37°N (in May and June).
3. Between 141°W and 147°W from 41°N to 46°N (from July through October).
4. Between 125°W and 130°W from 44°N to 51°N (mostly in August).

Fourteen U.S. troll vessels participated in the 1993-94 South Pacific albacore fishery compared to 47 vessels in the 1992-93 fishery. These vessels fished an estimated 1,135 days, a decrease of 70% from 3,846 days fished in the 1992-93 season (Table 4). Total catches for the 1993-94 South Pacific season decreased to 603 t, 41% less than the 1,028 t caught in the 1992-93 season.

The 1993-94 South Pacific albacore season began in December, 1993, in the Tasman Sea where a chartered U.S. troll vessel tagged and released approximately 460 albacore. A few vessels also began fishing about 1,500 nm east of New Zealand's North Island (Figure 2a). The highest sampled catches in January were between 155°W and 170°W from 35°S to 40°S (Figure 2b). Sampled catches in February increased significantly with the highest sampled catches taken between 145°W and 155°W from 40°S to 45°S (Figure 2c). Sampled catches in March were concentrated in a 10° block centered at 40°S, 150°W (Figure 2d). Catches diminished in April and fishing was again localized near 40°S, 150°W (Figure 2e). The distribution of sampled albacore catches from the 1993-94 South Pacific season shows that most catches occurred between 145°W and 170°W from 35°S to 40°S (Figure 2f). The effects of an unusually strong El Niño phenomenon, which had an adverse effect on fishing in the 1992-93 season, seemed to be dissipating and catches improved for the few vessels that ventured south for the 1993-94 season.

## CATCH RATES

Stratified catch rates (CPUE expressed as number of fish caught per day of fishing) for U.S. troll vessels are an indication of relative abundance of albacore available to troll gear. Catch/effort data for U.S. troll vessels were summarized by 10-day, 1°-square strata (Kleiber and Perrin, 1991). Monthly catch rates for the 1994 North Pacific season are calculated by averaging the catch rates for all strata in each month. The general equation for the calculation of stratified catch rates is:

$$\text{Average stratified catch rate} = 1/n \sum (\sum C_i / \sum E_i)$$

Where C is the total sampled catch in the  $i^{\text{th}}$  strata, E is the total sampled effort in the  $i^{\text{th}}$  strata, and n is the total number of strata.

The average stratified catch rate for the 1994 North Pacific season is 60 fish/day. This is a 58% increase over the 1993 season's average of 38 fish/day.

The distributions of monthly stratified catch rates for the 1994 North Pacific season (Figures 3a through 3h) display roughly the same distribution pattern as sampled catches (Figures 1a through 1h). Catch rates in April only exceeded 10 fish/day at 33°N, 154°W (Figure 3a). In May, catch rates greater than 50 fish/day were located between 172°W and 179°E from 33°N to 35°N (Figure 3b). Catch rates in June were best between 173°E and 178°E from 36°N to 38°N (Figure 3c). Moderate catch rates (between 10 and 100 fish/day) were scattered between 171°W and 177°W from 32°N to 38°N and between 134°W and 148°W along the same latitudes. Catch rates improved in July when catch rates greater than 100 fish/day were distributed between 173°E and 176°E from 38°N to 41°N and between 142°W and 150°W from 41°N to 45°N. Catch rates between 50 and 100 fish/day were distributed between 126°W and 128°W from 43°N to 47°N (Figure 3d). The highest catch rates in August were concentrated in two regions. One region is between 140°W and 148°W from 41°N to 47°N while the second region extends between 126°W and 132°W from 44°N to 51°N (Figure 3e). These two regions continued to produce good catch rates in September, but their boundaries shifted slightly to between 141°W and 146°W from 43°N to 46°N and between 127°W and 131°W from 49°N to 51°N, respectively (Figure 3f). Catch rates along the coast diminished in October but the area between 141°W and 146°W from 42°N to 46°N continued to produce catch rates greater than 100 fish/day (Figure 3g). Catch rates greater than 50 fish/day in November were reported between 137°W and 141°W from 39°N to 41°N (Figure 3h). Catch rates summarized for the 1994 North Pacific season display three main areas of high abundance (Figure 3i). The western-most area extends between 173°E and 177°E from 36°N to 41°N. The central area extends between 141°W and 149°W from 41°N to 46°N. The most productive coastal area is between 129°W and 132°W from 48°N to 51°N.

The average stratified catch rate for the 1993-94 South Pacific season is 79 fish/day, compared to a catch rate of 45 fish/day for the 1992-93 South Pacific season (Table 4). The 1993-94 stratified catch rate increased by 76% despite a significant decrease in fleet size and total catches. The distribution of stratified catch rates follows the same general distribution pattern as catches. Catch rates in December, 1993 were less than 50 fish/day between 150°W and 160°W from 35°S to 40°S and in the Tasman Sea between 150°E and 170°E from the 35°S to 40°S (Figure 4a). Fishing improved in January, 1994 when catch rates were greater than 100 fish/day between 165°W and 170°W from 35°S to 45°S (Figure 4b). The most productive fishing was during the month of February when catch rates exceeded 200 fish/day between 145°W and 155°W from 40°S to 45°S and between 160°W and 165°W from 40°S to 45°S (Figure 4c). Catch rates in March remained greater than 100 fish/day between 145°W and 155°W from 35°S to 45°S (Figure 4d). Catch rates decreased in April 1994, exceeding 100 fish/day only between 140°W and 145°W from 35°S to 40°S (Figure 4e). The highest catch rates (greater than 200 fish/day) for the 1993-94 season were between 160°W and 165°W from 40°S to 45°S (Figure 4f).

## LENGTH-FREQUENCIES

A total of 18,433 albacore were measured during the 1994 North Pacific season. The average fork length of these fish is 71 cm (16 lbs or 7.4 kg) compared to an average fork length of 69 cm (15 lbs or 6.8 kg) for the 1993 season (length-weight conversions from Clemens, 1961). Fork lengths of sampled North Pacific albacore range from 42 cm to 99 cm. Four length-frequency modes are evident in the sample, centered at 54 cm, 66 cm, 77 cm, and 85 cm (Figure 5). The largest mode is centered at 66 cm, which approximately corresponds to 3 year-old fish (length-age conversions from Clemens, 1961; modified by Bartoo, pers. comm.). Length-frequency data from the 1994 North Pacific season were summarized by 5°x10° quadrangles. Larger fish are more evident west of 170°W (Figure 6).

Albacore sampled from U.S. troll vessels during the 1993-94 South Pacific season were measured by port samplers in American Samoa. Only 996 albacore were measured from ten U.S. troll vessels. The average fork length of sampled albacore from the 1993-94 season is 66 cm (15 lbs or 6.7 kg) compared to an average fork length of 63 cm (13 lbs or 5.9 kg) for albacore sampled during the 1992-93 South Pacific season (length-weight conversions from Nakamura and Uchiyama, 1966). Sampled albacore from the 1993-94 South Pacific season range from 46 cm to 95 cm. Two modes are evident in the sample, centered at 61 cm and 69 cm (Figure 7). These fork lengths approximately correspond to 3 year-old fish and 4 year-old fish, respectively (length-age conversion from Labelle, 1993). Fish sampled for length-frequency were caught within three 5°x10° blocks between 140°W and 170°W from 30°S to 35°S (Figure 8). Larger fish are more abundant in the samples of fish caught farther east.

## SEA SURFACE TEMPERATURES AND SAMPLED CATCH LOCATIONS

North Pacific sea surface temperatures (SSTs) recorded from commercial transport ships, fishing vessels, and research vessels were compiled into monthly means and plotted as 1° C isotherms (Figures 9a through 9g). Areas of tightly-grouped isotherms indicate strong thermal gradients. Fishermen target these areas where albacore may aggregate in large schools. General catch areas for each month of the 1994 North Pacific season were overlaid on monthly SST plots to illustrate the correlation between areas of catch and SST distribution patterns (Figures 9a through 9h).

Albacore catches in April were limited to an area bounded by the 15°C and the 16°C isotherms from 128°W to 155°W (Figure 9a). Catches in May were more widely dispersed, occurring between the 12°C and 20°C isotherms west of 160°W (Figure 9b). Catch areas east of 160°W were distributed in a narrow band between 17°C and 19°C. Catches in June were closely correlated with the 15°C isotherm from 140°W to west of the international dateline with some of the highest sampled catches occurring near strong gradients at 170°W (Figure 9c). Catches in July were distributed between the 15°C and 20°C isotherms west of 150°W while catch areas east of 150°W were more widely-dispersed and extended northward along the Canadian coast as did the 15°C isotherm (Figure 9d). Catches in August were distributed in smaller areas. Good catches were made near 145°W where the 20°C isotherm crossed 40°N (Figure 9e). Catch areas along the Washington and Oregon coasts were strongly correlated with frontal zones associated with coastal upwelling. Catches in September were centered near

45°N, 145°W between the 16°C and 19°C isotherms (Figure 9f). Good catches were made along the Canadian and Washington coasts where coastal upwelling continued to create strong thermal gradients. High catches in October were localized near 45°N, 145°W where the 15°C and 16°C isotherms turned northward (Figure 9g). Scattered catches also occurred in areas near the international dateline near the 15°C isotherm. Catches in November were centered at 41°N, 139°W on the 15°C isotherm and off the Oregon coast where temperature gradients were strong (Figure 9h).

Sea surface temperature data are not available for the albacore fishing grounds in the southern hemisphere.

## SUMMARY

Catch/effort sampling coverage and length-frequency sampling coverage for the 1994 North Pacific albacore fishery increased to 45% and 1.3%, respectively. Reductions in the funding for the collection of albacore fisheries data continued to hamper sampling efforts. U.S. vessels expended 23,670 days of effort and caught a total of 10,535 t during the 1994 North Pacific season. Total annual catches for the North Pacific albacore fishery increased for the third consecutive year. The average stratified catch rate for the 1994 North Pacific season increased to 60 fish/day from 38 fish/day during the 1993 season. The 1994 North Pacific albacore season began in May, when vessels began searching for fish north of Midway Island, and ended in November, off the coasts of Oregon and Washington. The highest sampled catches were centered in three regions:

1. West of the International Date Line between 173°E and 180° from 36°N to 41°N (in June and July).
2. Between 141°W and 147°W from 41°N to 46°N (from July through October).
3. Between 125°W and 130°W from 44°N to 51°N (in August).

Fork length measurements were collected from 18,433 albacore during the 1994 North Pacific season. The average length of sampled fish is 71 cm (16 lbs or 7.4 kg) with a range of 42 cm to 99 cm. Well-defined modes are evident at 54 cm, 66 cm, 77 cm, and 85 cm. Catch areas are strongly correlated with SST distributions. Many catches were located near strong thermal gradients between 15°C and 20°C. Coastal upwelling was well-developed in July and August, creating areas of well-developed temperature fronts.

Catch/effort sampling coverage and length-frequency sampling coverage for the 1993-94 South Pacific albacore fishery were 44% and 1.1%, respectively. The 1993-94 South Pacific albacore fishery was composed of 14 U.S. troll vessels that expended 1,135 days of effort and caught a record low 603 t of albacore. The average stratified catch rate for the 1993-94 South Pacific albacore fishery increased to 79 fish/day from 45 fish/day during the 1992-93 season. A total of 996 albacore were measured during the 1993-94 South Pacific fishery. Sampled fish range from 46 cm to 95 cm fork length, with an average length of 66 cm (15 lbs or 6.7 kg). Two length-frequency modes are centered at 61 cm and 69 cm. The 1993-94 South Pacific season began in December, 1993 and ended in April, 1994.

## ACKNOWLEDGEMENTS

We thank the U.S. albacore fishermen whose active participation in the sampling program make these fisheries' summaries possible. The American Fisherman's Research Foundation and the Western Fishboat Owners Association provided financial support for keypunching of the data. Rhonda Haynes of Oregon Department of Fish & Wildlife, Marija Vojkovich of California Department of Fish & Game, Farron Wallace of Washington Department of Fisheries, Russell Porter of Pacific Marine States Fisheries Commission, and Gordon Yamasaki of the SWR office in Pago Pago, American Samoa, coordinated the sampling of logbook data and the collection of sampling statistics. We thank Talbot Murray, New Zealand (MAFF); Stephen Yen, French Polynesia (EVAAM); and Subodh Sharma, Fiji (FDMPI) who provided information on U.S. landings in their countries. We also thank all port samplers for the collection of catch/effort, length-frequency and landings information and the distribution of *Pacific Albacore Logbooks*.

Karen Handschuh typed and formatted the manuscript. Roy Allen and Henry Orr (NMFS La Jolla laboratory) produced the illustrations. Atilio Coan, Jr., Robert Nishimoto, Norman Bartoo, Al Jackson and Gary Sakagawa provided helpful directions, comments and critiques of the manuscript.

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**Table 1.** Catches of albacore (in metric tons) in the North Pacific by nation and gear, 1952-1994.

Provisional estimates are given in parentheses.

-- indicates data not available. (0) indicates less than 1 metric ton.

YEAR	JAPAN <sup>1</sup>				TAIWAN <sup>4</sup>		KOREA <sup>2</sup>		UNITED STATES <sup>3</sup>					CANADA		MEXICO		GRAND TOTAL
	POLE & LINE	LONG LINE	GILL NET	PURSE SEINE	OTHER GEAR	LONG LINE	GILL NET	LONG LINE	GILL NET	BAIT BOAT	TROLL	SPORT	GILL NET	PURSE SEINE	OTHER GEAR	TROLL	OTHER GEAR	
1952	41,786	26,687		154	237						23,843	1,373				71		94,151
1953	32,921	27,777		38	132						15,740	171				5		76,784
1954	28,069	20,958		23	38						12,246	147						61,481
1955	24,236	16,277		8	136						13,264	577						54,498
1956	42,810	14,341			57						18,751	482				17		76,458
1957	49,500	21,053		83	151						21,165	304				8		92,264
1958	22,175	18,432		8	124						14,855	48				74		55,716
1959	14,252	15,802			67						20,990	0				212		51,328
1960	25,156	17,369			76						20,100	557				5		63,267
1961	18,636	17,437		7	268					2,837	12,055	1,355				4		52,605
1962	8,729	15,764		53	191					1,085	19,752	1,681				4		47,264
1963	26,420	13,464		59	218					2,432	25,140	1,161				5		68,906
1964	23,858	15,458		128	319					3,411	18,388	824				5		62,419
1965	41,491	13,701		11	121	26				417	16,542	731				3		73,293
1966	22,830	25,050		111	585	261				1,600	15,333	588				15		66,421
1967	30,481	28,869		89	520	271				4,113	17,814	707				161		83,401
1968	16,597	23,961		267	1,109	635				4,906	20,434	951				10		69,961
1969	32,107	18,006		521	1,480	634				2,996	18,827	358				12		76,306
1970	24,376	15,372		317	794	1,516				4,416	21,032	822				9		69,008
1971	53,198	11,035		902	367	1,759				2,071	20,526	1,175				11		92,631
1972	60,762	12,649		277	646	3,091				3,750	23,600	637				8		109,079
1973	69,811	16,059		1,353	533	128				2,236	15,653	84				14		107,180
1974	73,576	13,053		161	959	570				4,777	20,178	94				9		114,809
1975	52,157	10,060		159	254	1,494				3,243	18,932	640				43		89,713
1976	85,336	15,896		1,109	285	1,251				2,700	15,905	713				27		125,439
1977	31,934	15,737		669	379	873				1,497	9,969	537				36		63,164
1978	59,877	13,061		1,115	2,097	284				950	16,613	810				23		99,157
1979	44,662	14,249		125	1,158	187				303	6,781	74				31		(71,207)

<sup>1</sup> Japanese pole & line catches include fish caught by research vessels. Longline catches for 1952-1960 exclude minor amounts taken by vessels under 20 tons; catches are estimated by multiplying annual number of fish caught by average weight statistics. Pole & line and purse seine data for 1992, 1993 from Y. Uozumi, et. al. gear data for 1952-1991 from Y. Uozumi, et. al. Pole & line and purse seine data for 1992, 1993 from Y. Warashina, et.al.

<sup>2</sup> Korean longline catches calculated from Y. Gong using the ratio of catches, in numbers, from the North Pacific. Gillnet catches for 1979-1990 are calculated by multiplying the 1991 CPUE (# fish per pok) by effort (# poks) then multiplying by average weight (1991, 1992: 4.13 kg/fish).

<sup>3</sup> U.S. troll boat catches for 1952-1960 include fish caught by bait boats. U.S. troll boat catches for 1984-1988 include gillnet catches. "Other gear" include catches from Hawaii (mostly longline). "Other gear" catches for 1979-1986 are raised from data with very low coverage rates.

<sup>4</sup> Data provided by H. Liu.

Table 1. (continued)

YEAR	JAPAN <sup>1</sup>				TAIWAN <sup>4</sup>		KOREA <sup>2</sup>		UNITED STATES <sup>3</sup>					CANADA		MEXICO		GRAND TOTAL
	POLE & LINE	LONG LINE	GILL NET	PURSE SEINE	OTHER GEAR	LONG LINE	GILL NET	LONG LINE	GILL NET	BAIT BOAT	TROLL	SPORT NET	GILL NET	PURSE SEINE	OTHER GEAR	TROLL	OTHER GEAR	
1980	46,743	14,743	2,986	329	1,209	318	--	597	(6)	382	7,556	168			24	212	31	(75,304)
1981	27,426	18,020	10,348	252	904	339	--	459	(16)	748	12,637	195			60	200	8	(71,612)
1982	29,615	16,762	12,511	561	732	559	--	387	(113)	425	6,609	257			84	104	7	(68,726)
1983	21,098	15,103	6,852	350	125	520	--	454	(233)	607	9,359	87			213	225	33	(55,259)
1984	26,015	15,111	8,988	3,380	518	471	--	136	(516)	1,030	9,304	1,427			138	50	113	(70,925)
1985	20,714	14,320	11,204	1,533	407	109	--	291	(576)	1,498	6,415	1,176	2		83	56	49	(58,433)
1986	16,096	12,945	7,813	1,542	650	--	--	241	(726)	432	4,708	196	3		106	30	3	(45,491)
1987	19,091	14,642	6,698	1,205	189	--	2,514	182	(817)	158	2,766	74	5		136	104	7	(48,588)
1988	6,216	13,904	9,074	1,208	177	38	7,389	109	(1,016)	598	4,212	64	15		318	155	15	(44,508)
1989	8,629	13,194	7,437	2,521	466	544	8,350	81	(1,023)	54	1,860	160	4		272	200	2	(44,797)
1990	8,532	15,928	6,064	1,995	253	287	16,701	20	(1,016)	115	2,603	24	29		71	302	2	(54,123)
1991	7,103	10,379	3,401	2,652	399	353	3,398	3	(852)	0	1,845	6	17		0	139	--	(30,931)
1992	13,888	19,149	2,721	4,104	1,534	300	7,866	43	(271)	0	4,572	(2)	0		0	363	--	(55,221)
1993	(12,528)	(19,730)	(100)	(1,835)	(1,534)	(300)	0	(43)	0	--	6,254	(25)	0		--	329	--	(43,009)
1994	(31,038)	(10,379)	--	(1,704)	(1,534)	(300)	0	(43)	0	0	(10,535)	(107)	0		--	(68)	--	(56,330)

<sup>1</sup> Japanese pole & line catches include fish caught by research vessels. Longline catches for 1952-1960 exclude minor amounts taken by vessels under 20 tons; catches are estimated by multiplying annual number of fish caught by average weight statistics. Pole & line and purse seine data for 1992, 1993 from Y. Marashina, et.al.

<sup>2</sup> Korean longline catches calculated from Y. Uozumi, et. al. Pole & line and purse seine data for 1992, 1993 from Y. Marashina, et.al.

<sup>3</sup> Korean longline catches calculated from Y. Gong using the ratio of catches, in numbers, from the North Pacific. Gillnet catches for 1979-1990 are calculated by multiplying the 1991 CPUE (# fish per pok) by effort (# poks) then multiplying by average weight (1991, 1992: 4.13 kg/fish).

<sup>4</sup> U.S. troll boat catches for 1952-1960 include fish caught by bait boats. U.S. troll boat catches for 1984-1988 include gillnet catches. "Other gear" include catches from Hawaii (mostly longline). "Other gear" catches for 1979-1986 are raised from data with very low coverage rates.

Data provided by H. Liu.

**Table 2.** Catches of albacore (in metric tons) in the South Pacific by nation and gear, 1952-1994. Provisional estimates are given in parentheses. (0) indicates less than 1 metric ton. -- indicates data not available.

YEAR	JAPAN		TAIWAN		KOREA		UNITED STATES	NEW ZEALAND		FRENCH POLYNESIA	FIJI	AUSTRALIA	NEW CALEDONIA	TONGA	OTHER	GRAND TOTAL
	POLE <sup>1</sup> LINE	LONG LINE	GILL NET	LONG LINE	GILL NET	LONG LINE	TROLL	TROLL <sup>2</sup> LINE	LONG <sup>3</sup> LINE	TROLL <sup>4</sup> LINE	LONG LINE	LONG LINE TROLL <sup>5</sup>	LONG LINE	LONG LINE	TROLL <sup>6</sup> LONG <sup>7</sup> LINE	
1952		210														210
1953		1,091														1,091
1954		10,200														10,200
1955		8,420														8,420
1956		6,220														6,220
1957		9,764														9,764
1958		21,558			146											21,704
1959		19,344			456											19,800
1960		23,756			610											24,411
1961	45	25,628			330											25,958
1962		29,044			599											29,643
1963	16	21,575			1,367											22,958
1964		14,436			2,911											17,347
1965		15,501			3,010											18,511
1966		18,258			10,062											28,320
1967		13,626		13,824	12,814			5								40,269
1968		7,353		14,893	9,374			14								31,634
1969		5,181		9,750	9,460			--								24,391
1970		5,584		15,855	10,320			50								32,009
1971		4,621		18,580	11,094			--								34,495
1972		3,516		20,684	13,416			268								38,084
1973		2,909		24,810	13,790			484							4	42,197
1974		3,289		18,328	8,283			898								30,998
1975		2,057		18,821	6,342			646								28,066
1976		2,482		18,468	8,981			25							6	30,162
1977		1,427		22,345	11,445			621							9	36,047
1978		1,676		15,750	11,315			1,686							9	30,636
1979		2,162		11,401	11,036			814							21	25,634

All data are from working paper 2, 7th Standing Committee on Tuna and Billfish, July 1994, except as noted.

- 1 Japanese Pole & Line data for 1952 to 1993 from Fourth South Pacific Albacore Research Workshop Report, November 1991.
- 2 New Zealand Troll data for 1967 to 1973 from Fourth South Pacific Albacore Research Workshop, working paper 11, November 1991.
- 3 New Zealand Longline catches for 1989 from Fourth South Pacific Albacore Research Workshop Report, November 1991.
- 4 French Polynesia Longline catches for 1991 from Seventh Standing Committee on Tuna and Billfish working paper 2, June 1993.
- 5 Australian Troll catches for 1970 to 1980 from Fifth South Pacific Albacore Research Workshop working paper 8, March 1993.
- 6 Other Troll includes Canada and Fiji.
- 7 Other Longline includes Solomon Islands and Peoples Republic of China.

Table 2. (continued)

YEAR	JAPAN		TAIWAN		KOREA		UNITED STATES		NEW ZEALAND		FRENCH POLYNESIA		FIJI		AUSTRALIA		NEW CALEDONIA		TONGA		OTHER		GRAND TOTAL
	POLE <sup>1</sup> LINE	LONG LINE	GILL NET	LONG LINE	GILL NET	LONG LINE	GILL NET	TROLL	TROLL <sup>2</sup> LINE	LONG LINE	TROLL <sup>4</sup> LINE	TROLL <sup>5</sup> LINE	LONG LINE	LONG LINE	LONG LINE	TROLL <sup>6</sup> LINE	LONG LINE	LONG LINE	TROLL <sup>7</sup> LINE	LONG LINE	TROLL <sup>6</sup> LINE		
1980	19	3,078		25,595		9,641			1,468			100							25				39,926
1981	8	4,814		11,008		14,958			2,085			50							2				32,925
1982	1	5,455		9,322		12,473			2,434			50							8				29,849
1983	2	4,815	32	7,452		7,074			744			50							19				20,343
1984		3,288	1,581	6,448		5,194			2,773			50							19				19,600
1985		3,498	1,928	5,365		13,041			3,253			50							12				27,452
1986		4,161	1,936	8,316		15,528	89		1,911			50											32,416
1987		3,282	919	9,633		6,722	751		1,227			50											23,599
1988		4,971	4,271	12,307	1,000	6,045	3,253		330			50									140		33,393
1989		4,610	13,263	7,399	8,520	4,297	3,068	172	5,161	19		50									162		48,205
1990		4,561	5,567	7,410	1,859	2,780	3,898	--	2,525	249		50							--				31,211
1991		3,267	0	9,366	821	1,317	5,540	--	2,464	325		50							103				25,571
1992		3,813	0	28,745	0	187	3,016	--	3,856	706		100							0				41,797
1993		(3,816)	0	(28,746)	0	(187)	1,028	--	(3,856)	(706)		34							0				40,802
1994			(0)	(28,746)	(0)	(187)	603	(0)	(3,856)	(706)		(34)							--				40,315

All data are from working paper 2, 7th Standing Committee on Tuna and Billfish, July 1994, except as noted.

- 1 Japanese Pole & Line data for 1952 to 1993 from Fourth South Pacific Albacore Research Workshop Report, November 1991.
- 2 New Zealand Troll data for 1967 to 1973 from Fourth South Pacific Albacore Research Workshop, working paper 11, November 1991.
- 3 New Zealand Longline catches for 1989 from Fourth South Pacific Albacore Research Workshop Report, November 1991.
- 4 French Polynesia Longline catches for 1991 from Seventh Standing Committee on Tuna and Billfish working paper 2, June 1993.
- 5 Australian Troll catches for 1970 to 1980 from Fifth South Pacific Albacore Research Workshop working paper 8, March 1993.
- 6 Other Troll includes Canada and Fiji.
- 7 Other Longline includes Solomon Islands and Peoples Republic of China.

**Table 3.** Sampling results of the 1993 and 1994 U.S. North Pacific albacore troll fisheries.

	NO. OF VESSEL TRIPS		LANDING (mt)		LANDING (No. of Fish)		COVERAGE RATE		AVG FORK LENGTH (cm)	TOTAL DAYS OF EFFORT	CATCH RATE (fish/day)
	TOTAL	WITH SAMPLED LOGBOOKS	TOTAL	WITH SAMPLED LOGBOOKS	TOTAL	MEASURED	LOGBOOK	LENGTH-FREQUENCY			
1993	1,887	169	6,254	1,119	917,941	10,885	18%	1.2%	69	24,470	38
1994	1,935	357	10,535	4,720	1,419,461	18,433	45%	1.3%	71	23,670	60

**Table 4.** Sampling results of the 1992-93 and 1993-94 U.S. South Pacific albacore troll fisheries.

	NO. OF VESSEL TRIPS		LANDED (mt)		LANDING (No. of fish)		COVERAGE RATE		AVG FORK LENGTH (cm)	TOTAL DAYS OF EFFORT	CATCH RATE (fish/day)
	TOTAL	WITH SAMPLED LOGBOOKS	TOTAL	WITH SAMPLED LOGBOOKS	TOTAL	MEASURED	LOGBOOK	LENGTH-FREQUENCY			
1992-93	62	10	1,028	172	173,081	1,720	17%	1.0%	63	3,846	45
1993-94	19	7	603	268	89,891	996	44%	1.1%	66	1,135	79

APRIL 1994

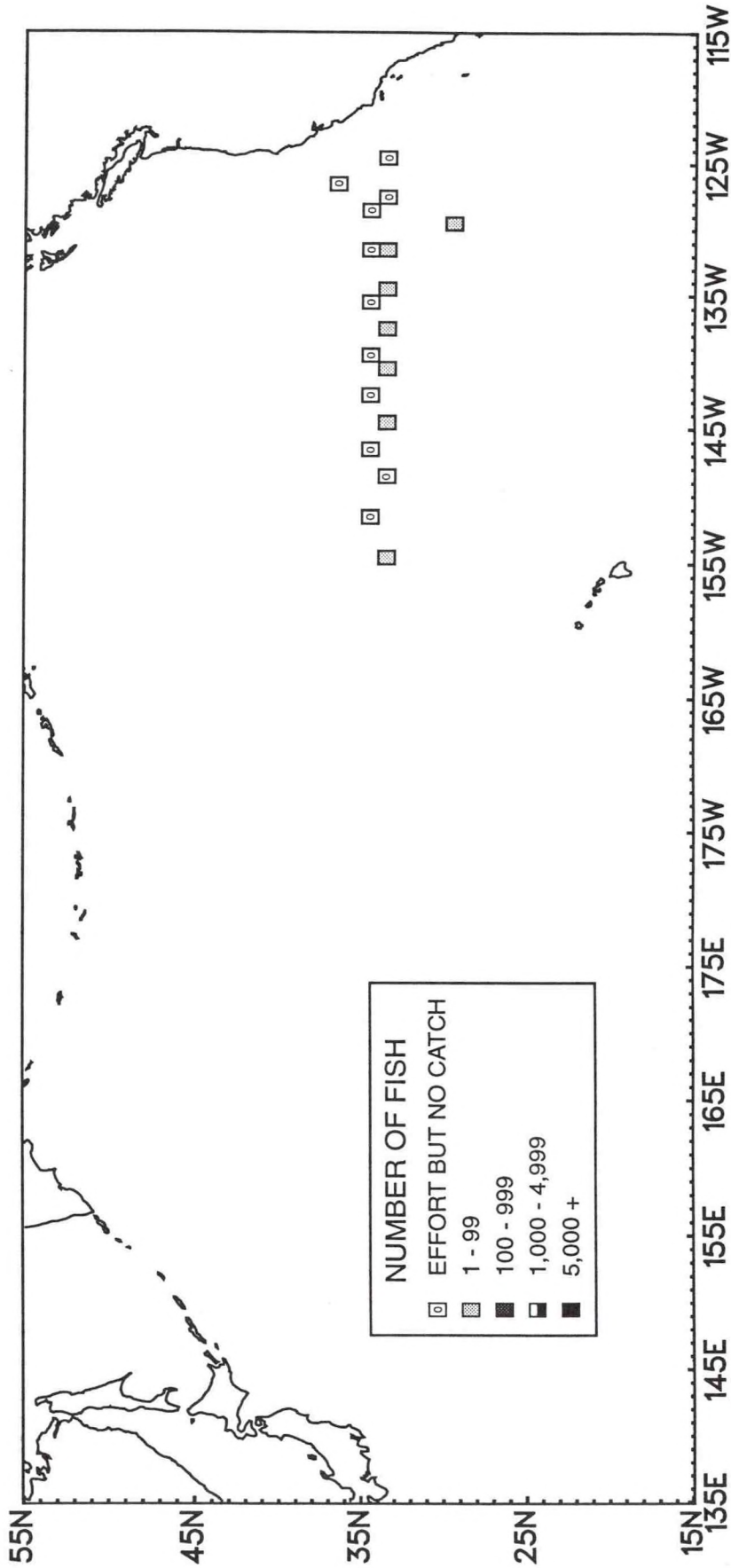


Figure 1a. Sampled U.S. North Pacific albacore catches for April, 1994.

MAY 1994

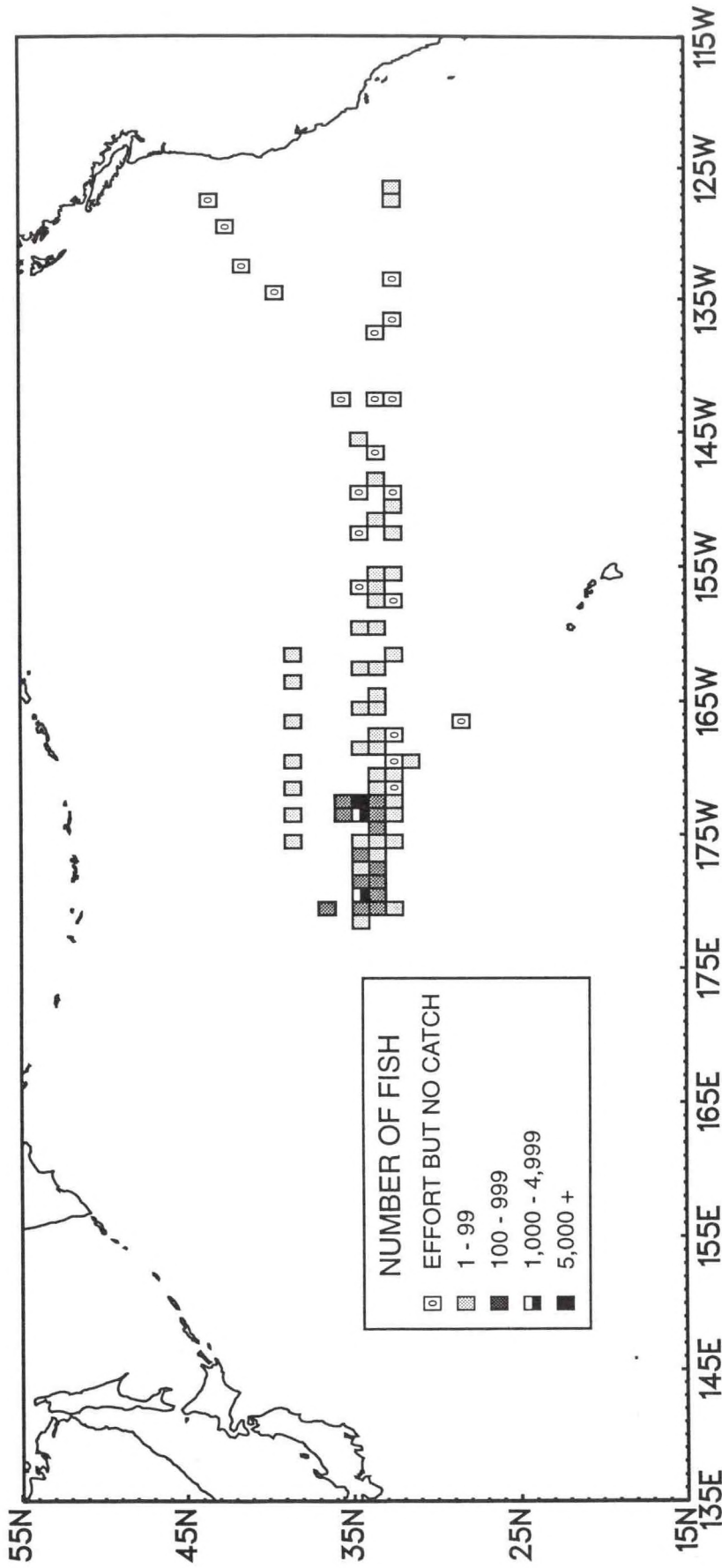


Figure 1b. Sampled U.S. North Pacific albacore catches for May, 1994.

JUNE 1994

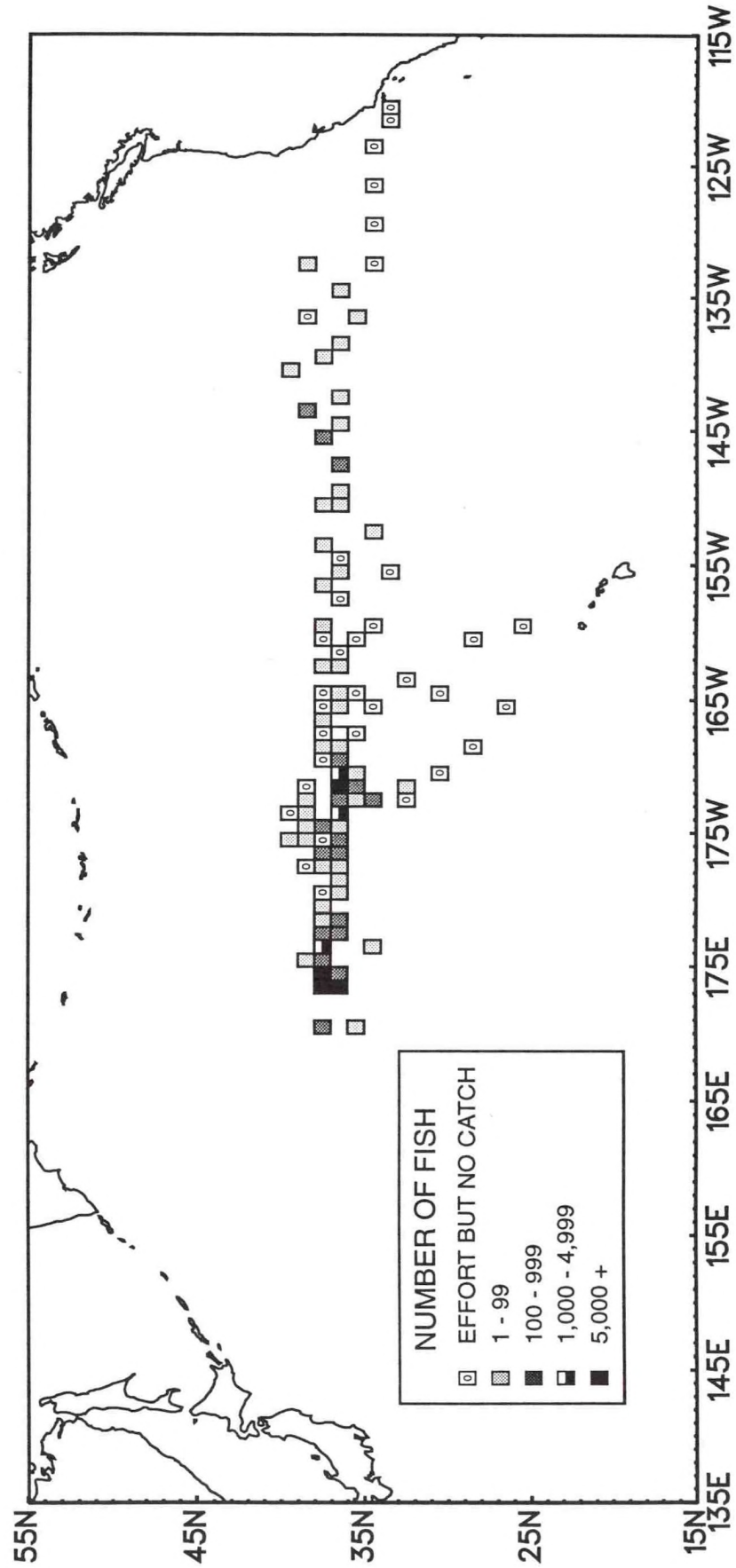


Figure 1c. Sampled U.S. North Pacific albacore catches for June, 1994.



JULY 1994

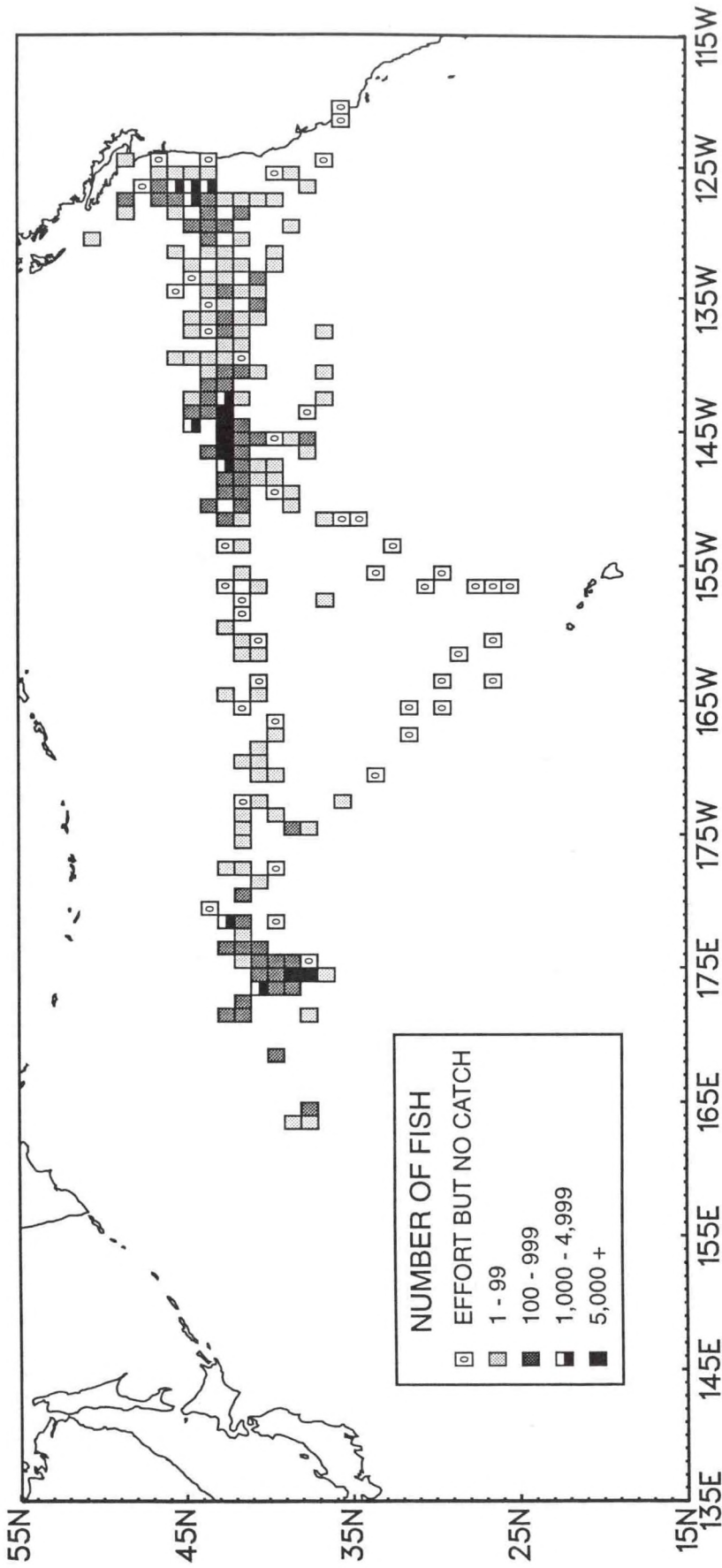


Figure 1d. Sampled U.S. North Pacific albacore catches for July, 1994.

AUGUST 1994

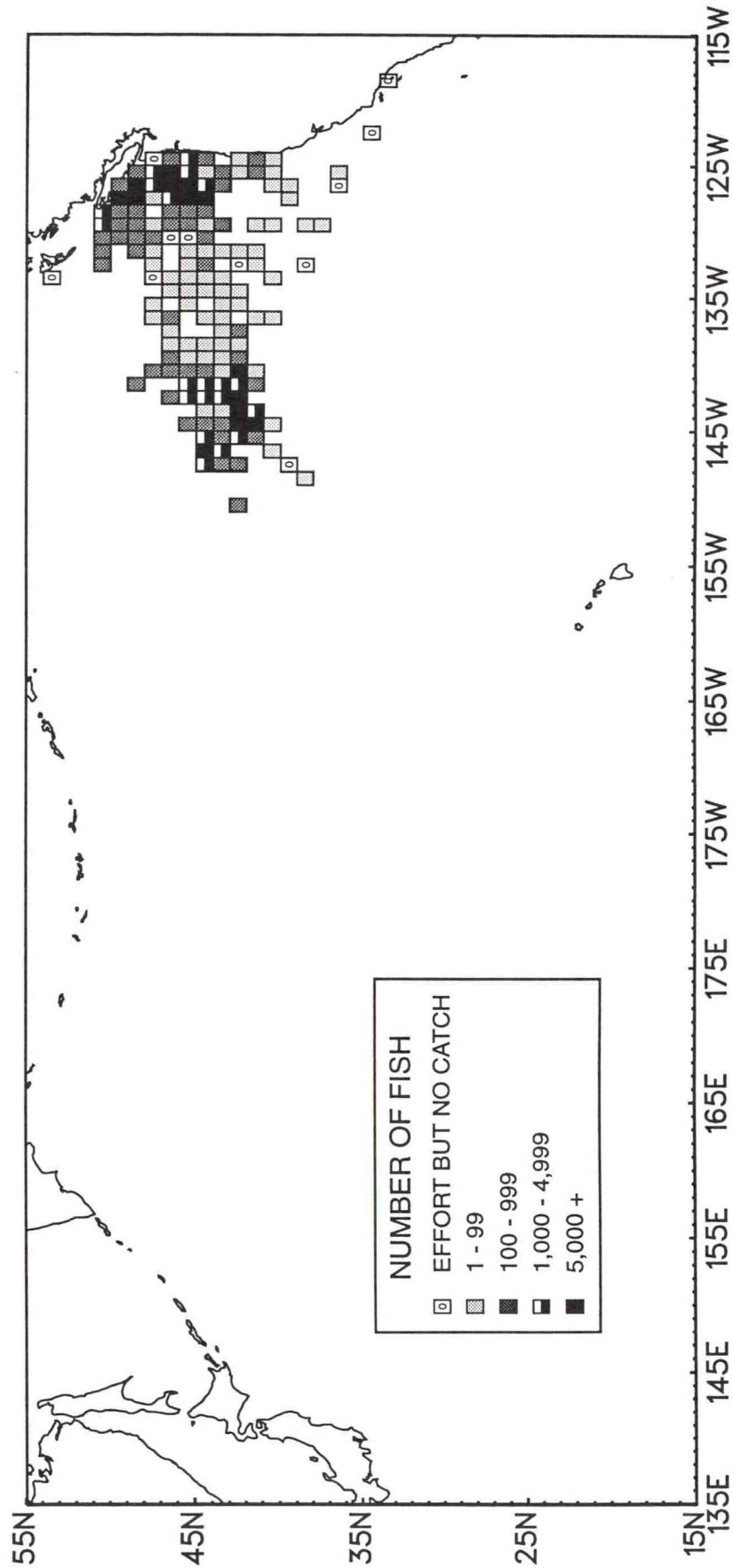


Figure 1e. Sampled U.S. North Pacific albacore catches for August, 1994.

SEPTEMBER 1994

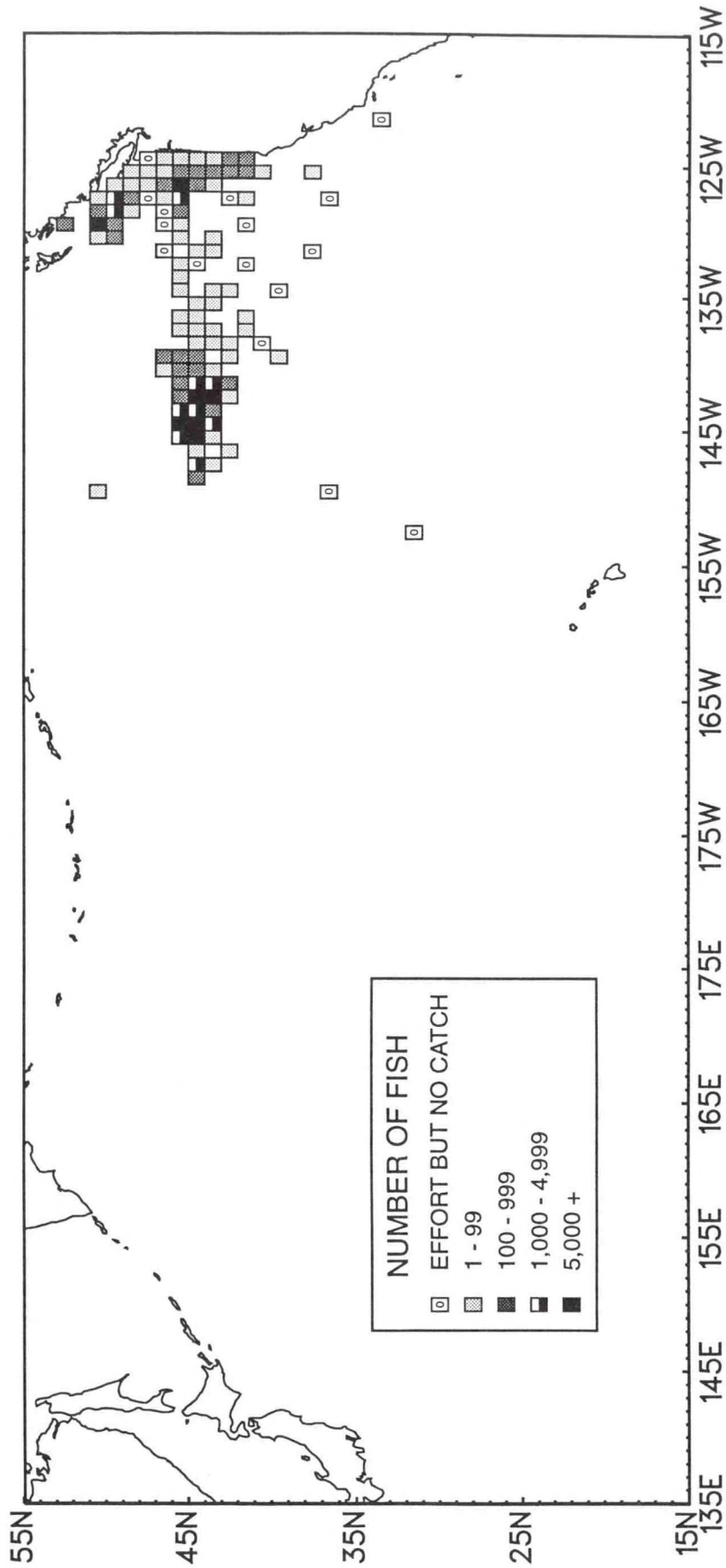
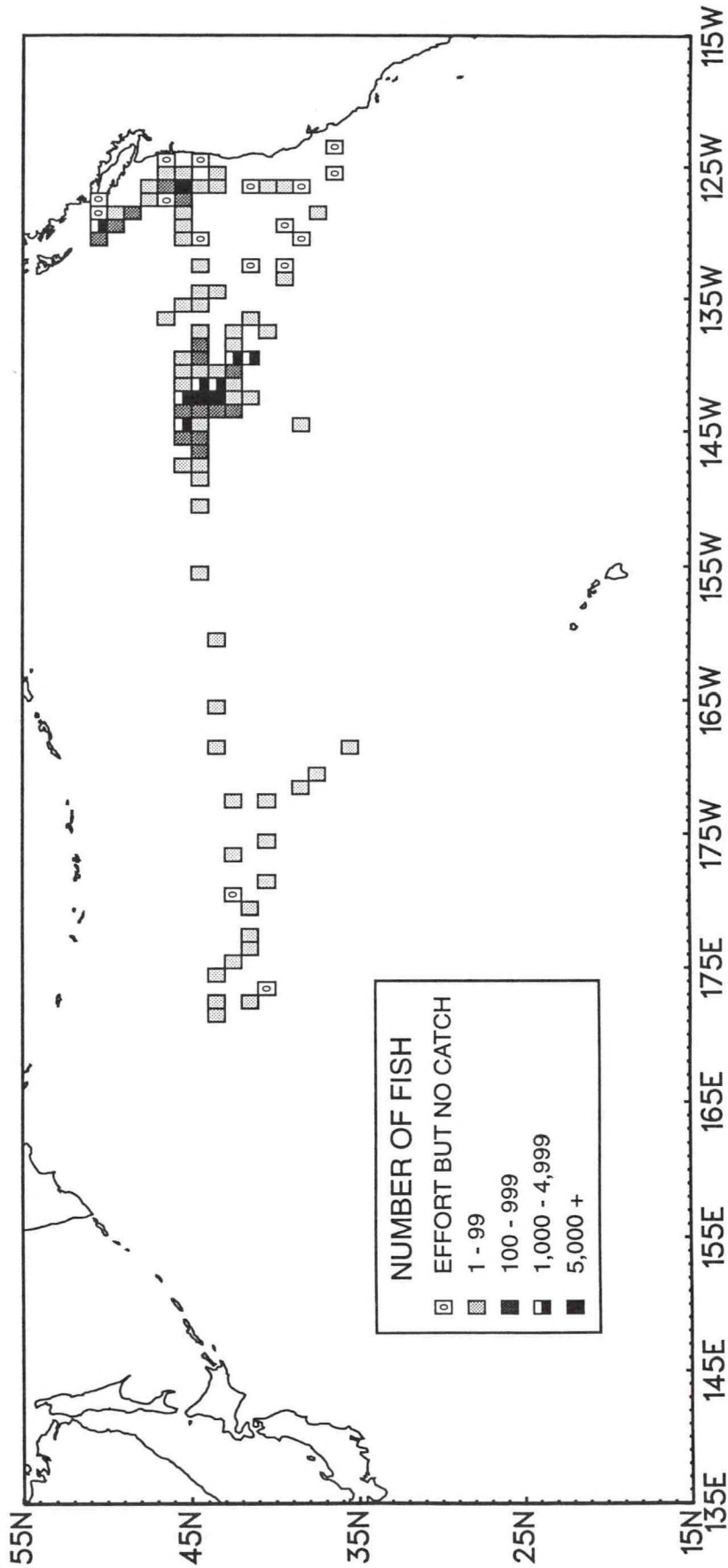


Figure 1f. Sampled U.S. North Pacific albacore catches for September, 1994.

# OCTOBER 1994



**Figure 1g.** Sampled U.S. North Pacific albacore catches for October, 1994.

# NOVEMBER 1994

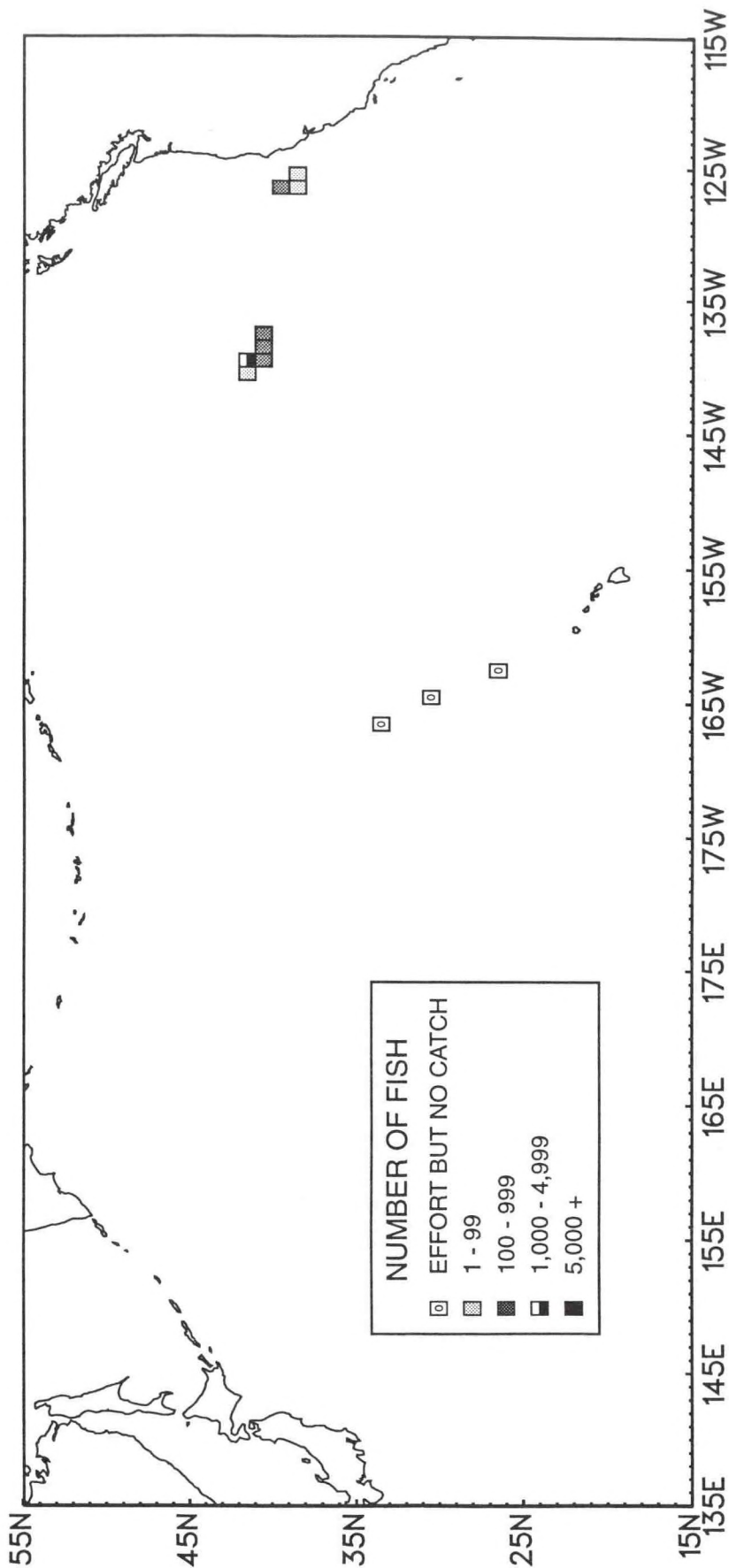


Figure 1h. Sampled U.S. North Pacific albacore catches for November, 1994.

# TOTAL CATCH 1994

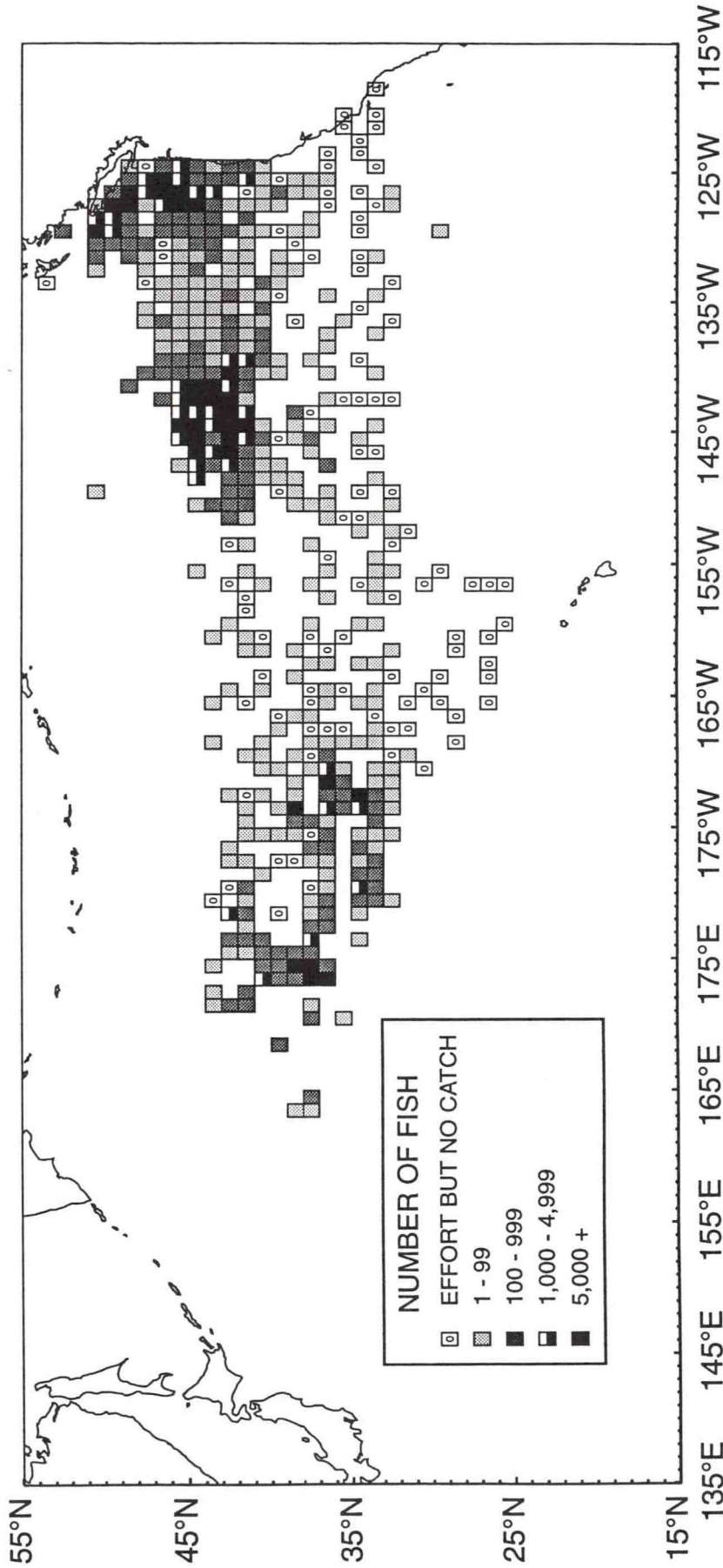


Figure 1i. Sampled U.S. North Pacific albacore catches for the 1994 season.

# DECEMBER 1993

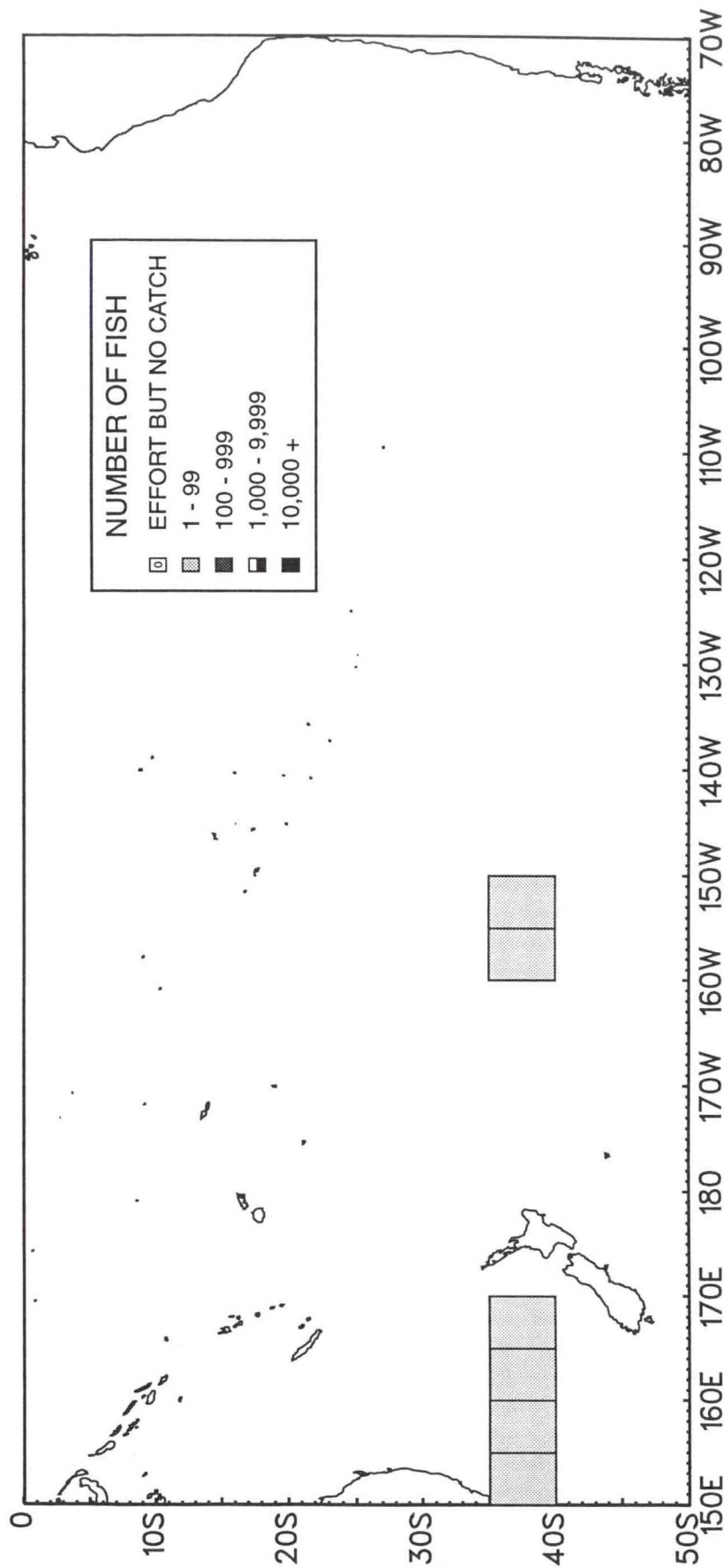


Figure 2a. Sampled U.S. South Pacific albacore catches for December, 1993.

JANUARY 1994

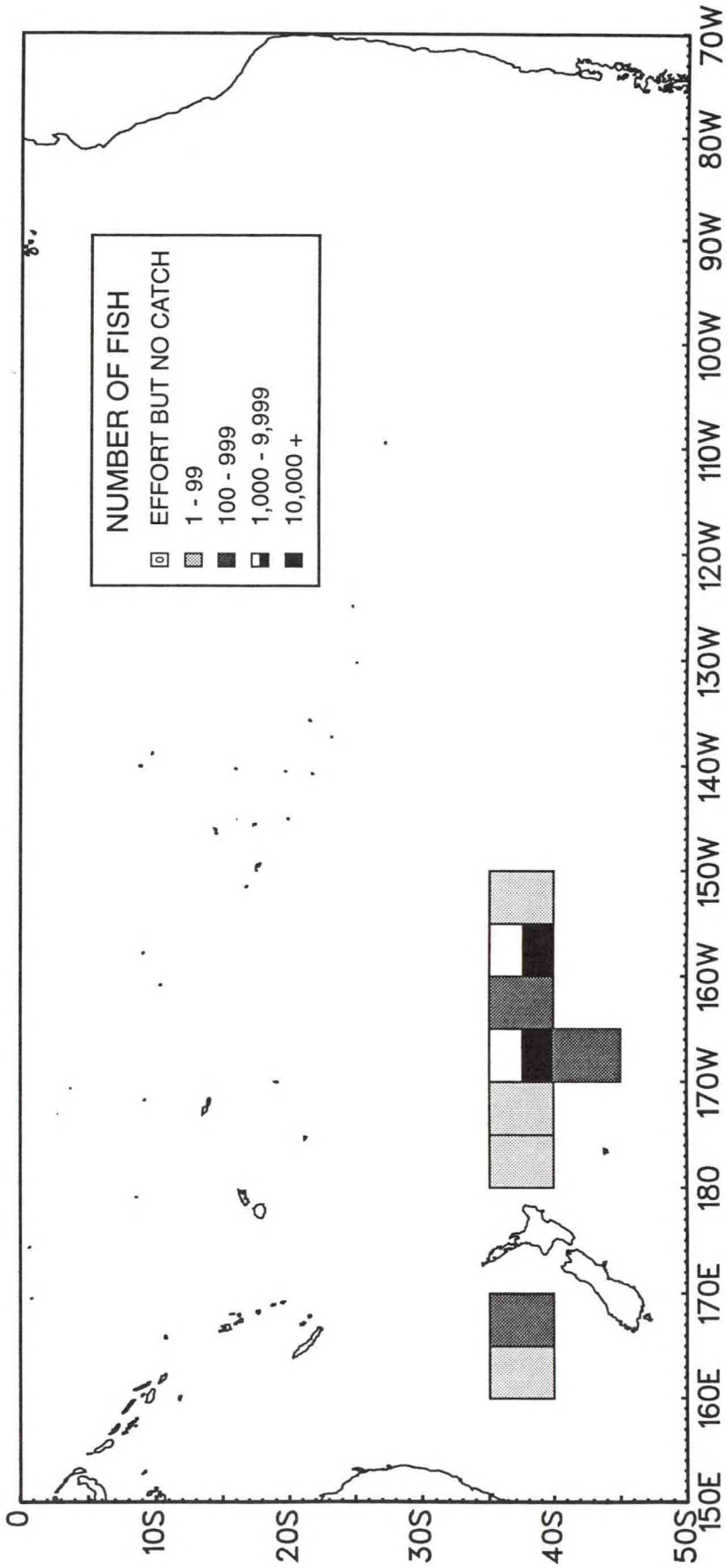


Figure 2b. Sampled U.S. South Pacific albacore catches for January, 1994.



# FEBRUARY 1994

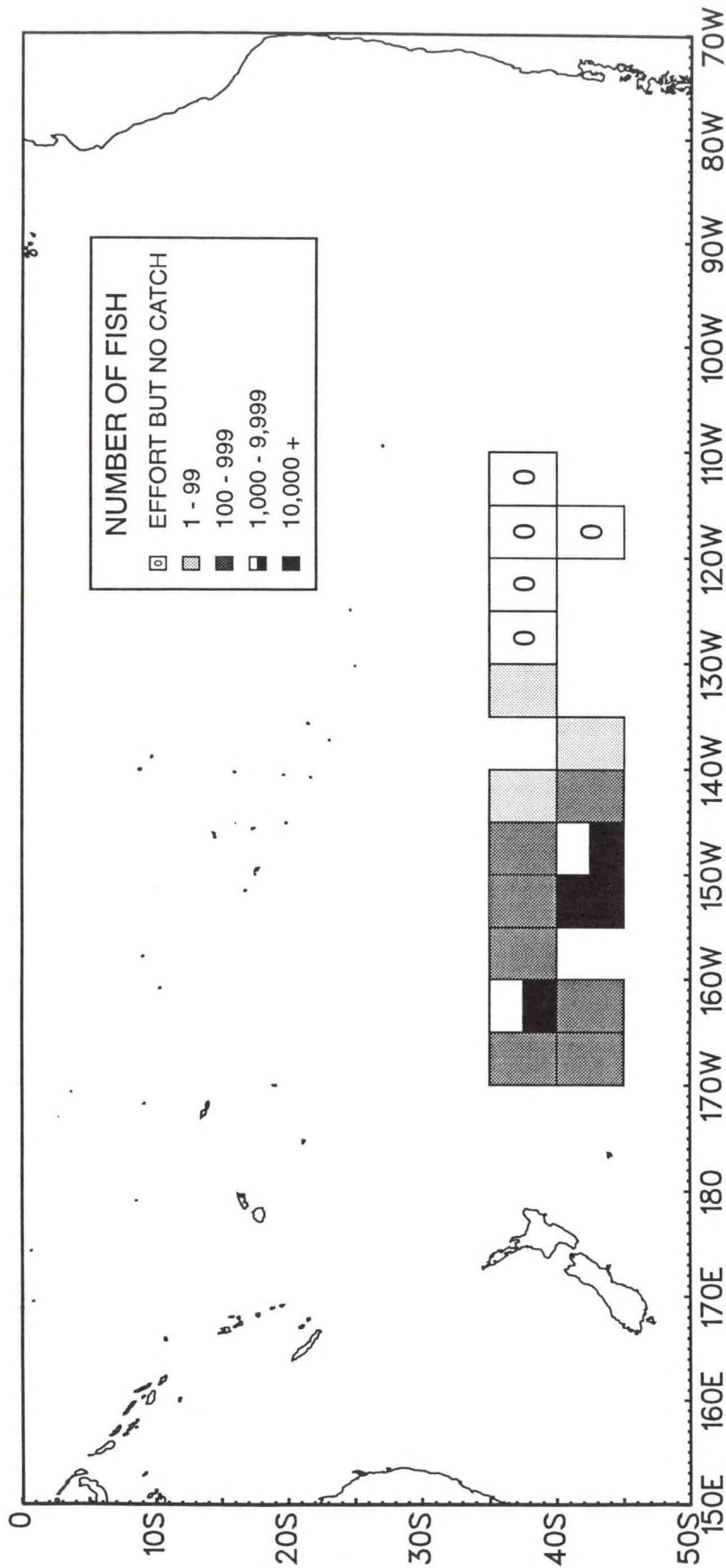


Figure 2c. Sampled U.S. South Pacific albacore catches for February, 1994.

MARCH 1994

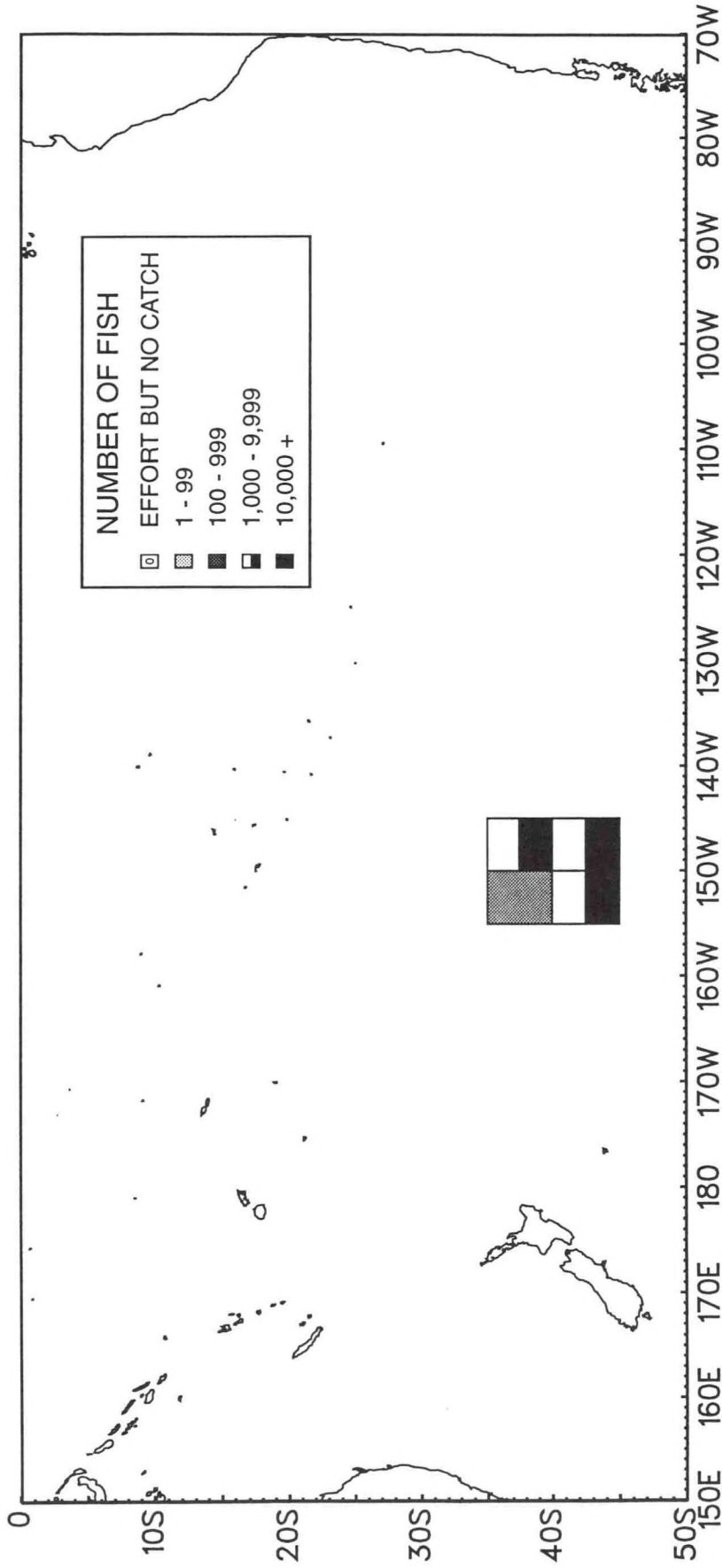


Figure 2d. Sampled U.S. South Pacific albacore catches for March, 1994.

APRIL 1994

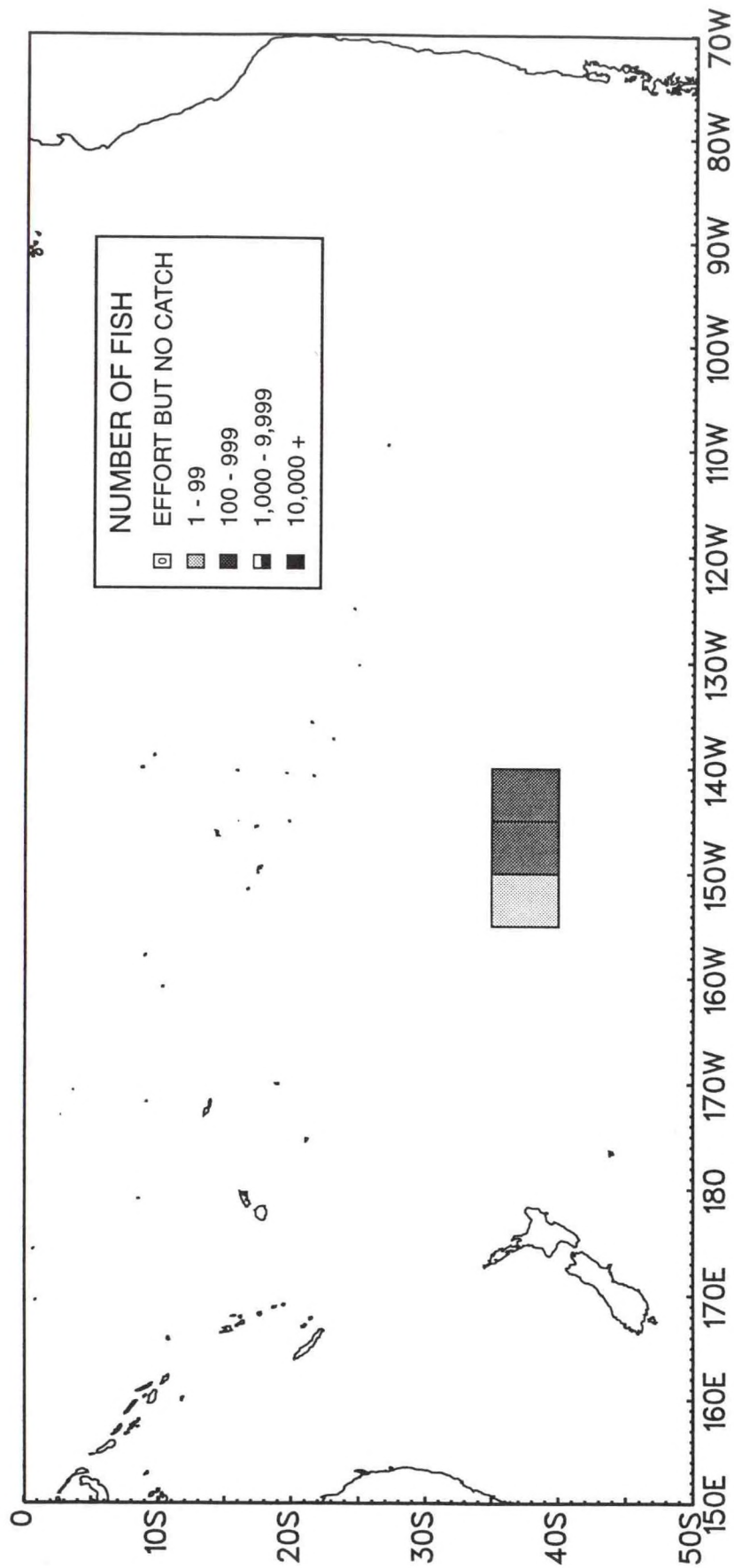


Figure 2e. Sampled U.S. South Pacific albacore catches for April, 1994.

# TOTAL CATCH 1993-94

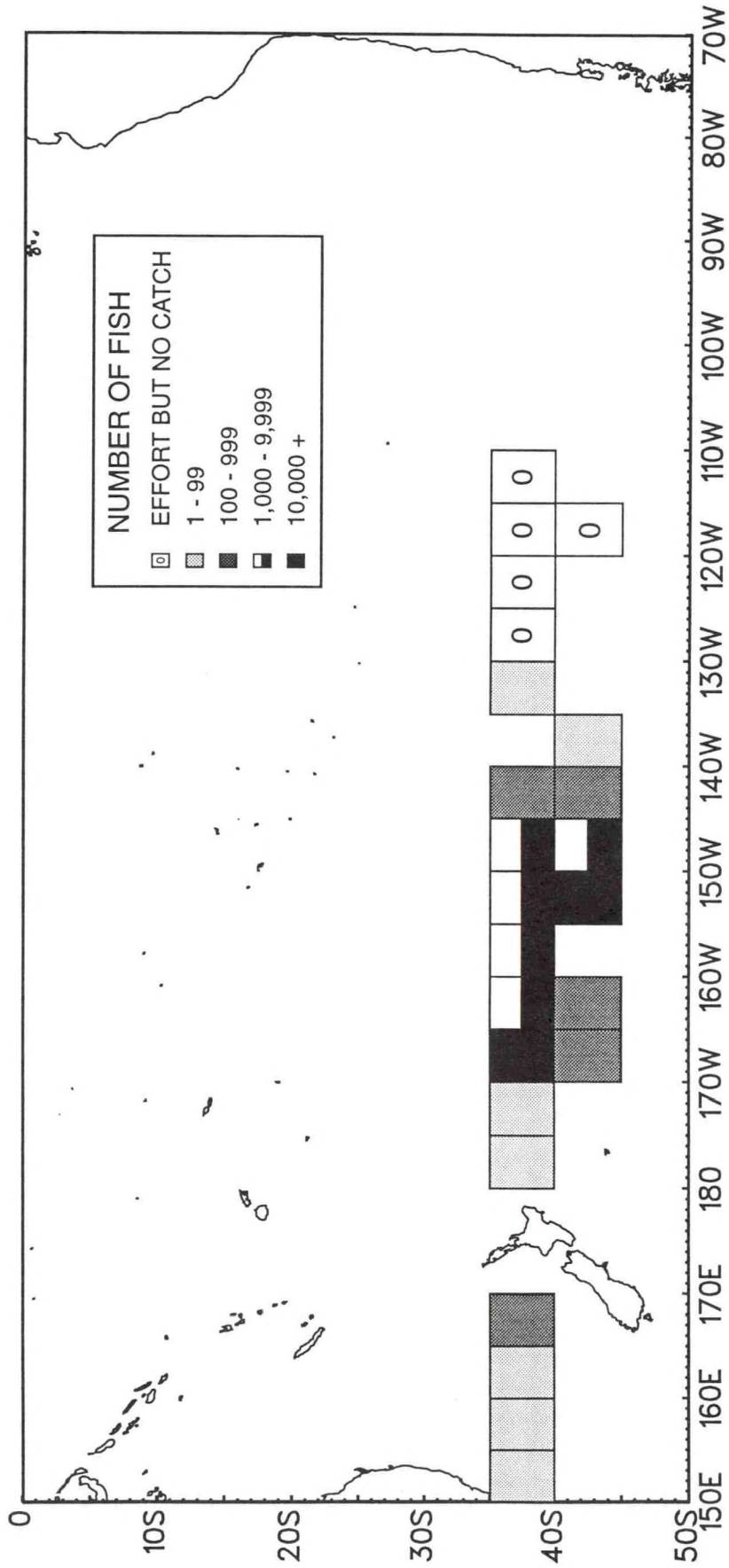


Figure 2f. Sampled U.S. South Pacific albacore catches for the 1993-94 season.

APRIL 1994

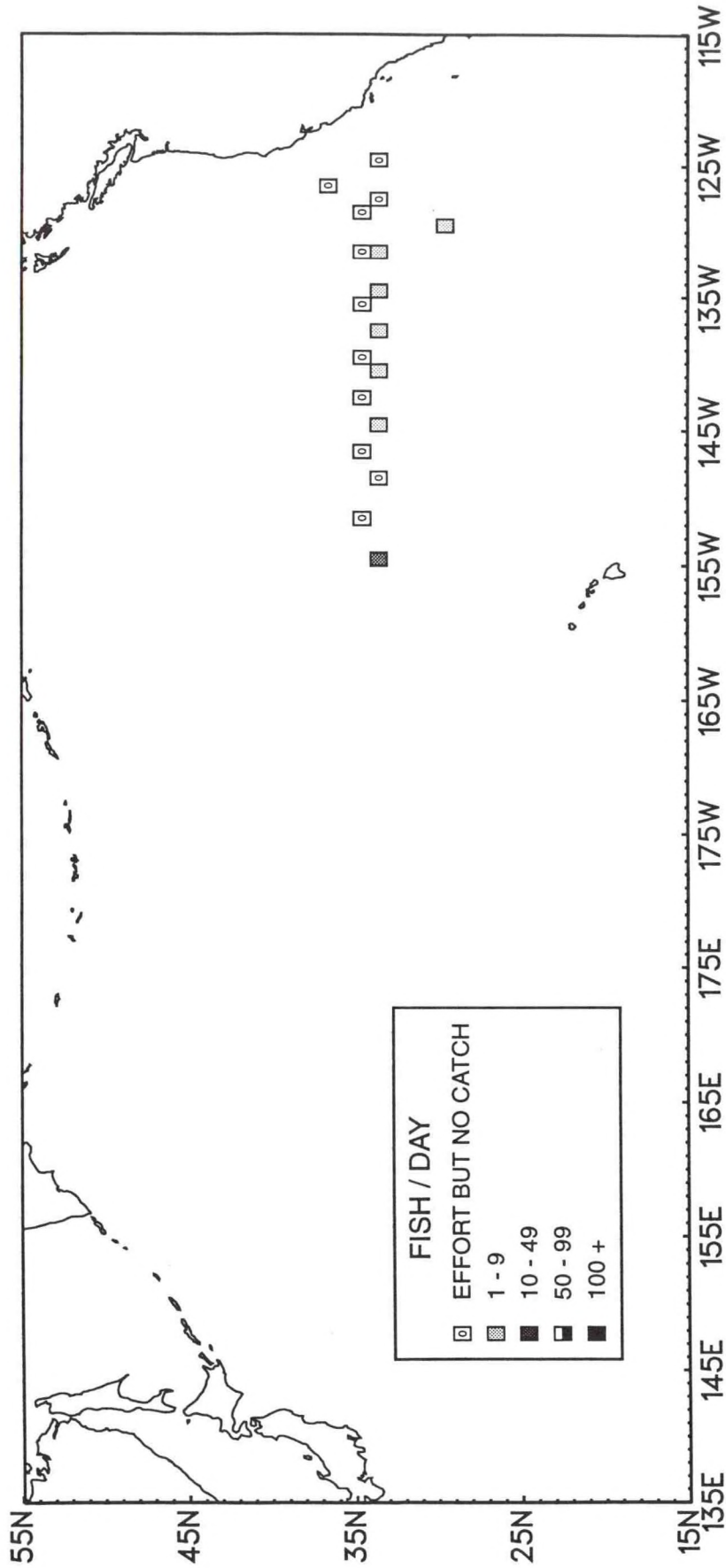


Figure 3a. U.S. North Pacific albacore catch rates for April, 1994.

MAY 1994

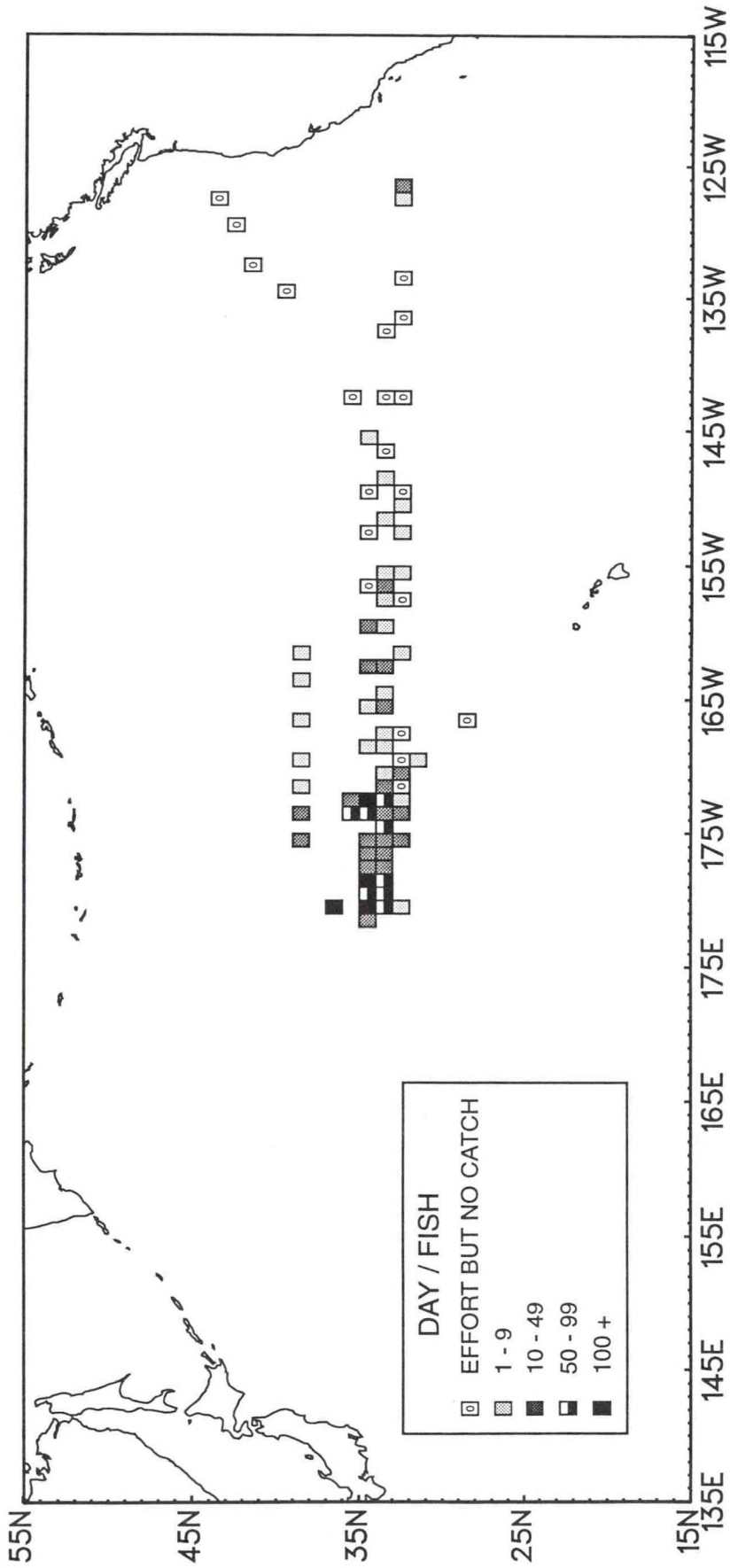


Figure 3b. U.S. North Pacific albacore catch rates for May, 1994.

JUNE 1994

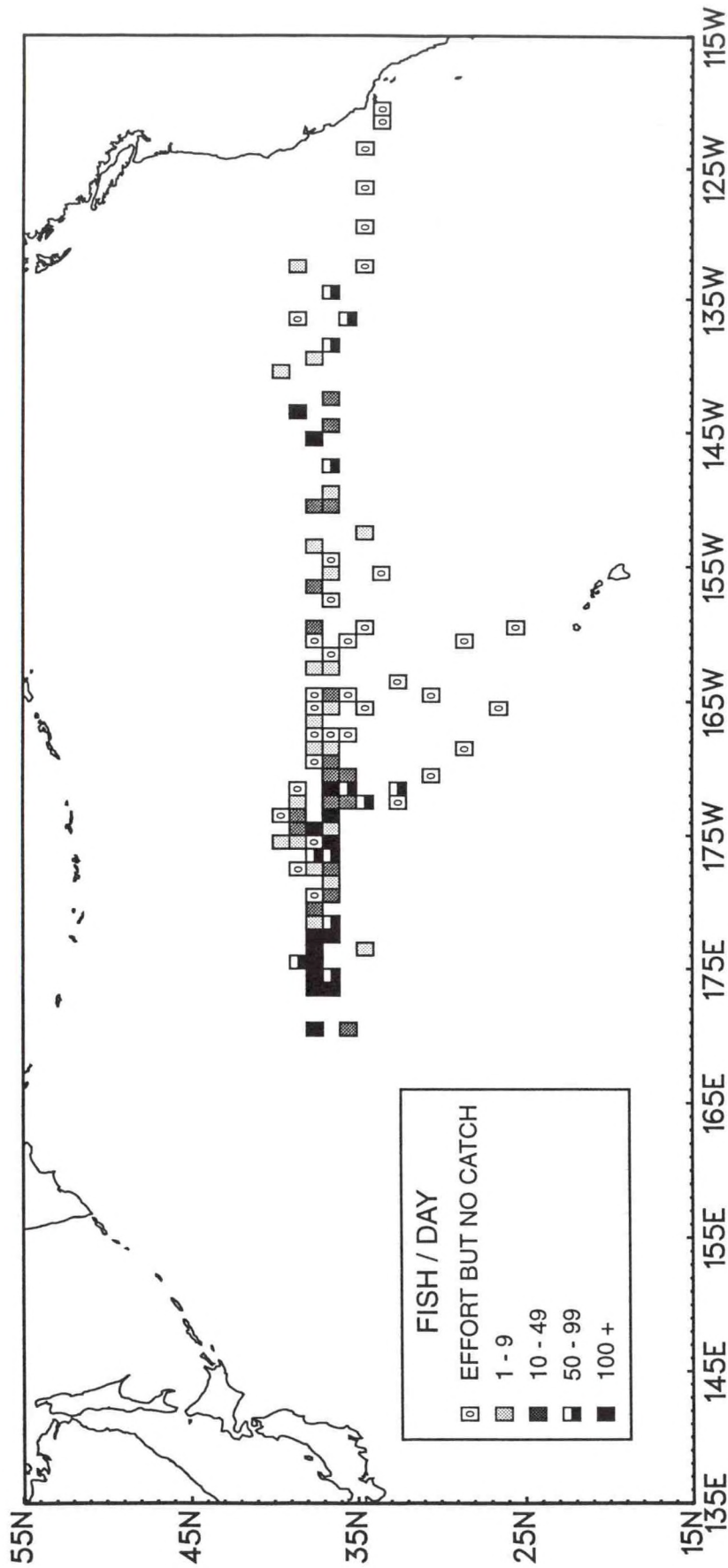


Figure 3c. U.S. North Pacific albacore catch rates for June, 1994.

JULY 1994

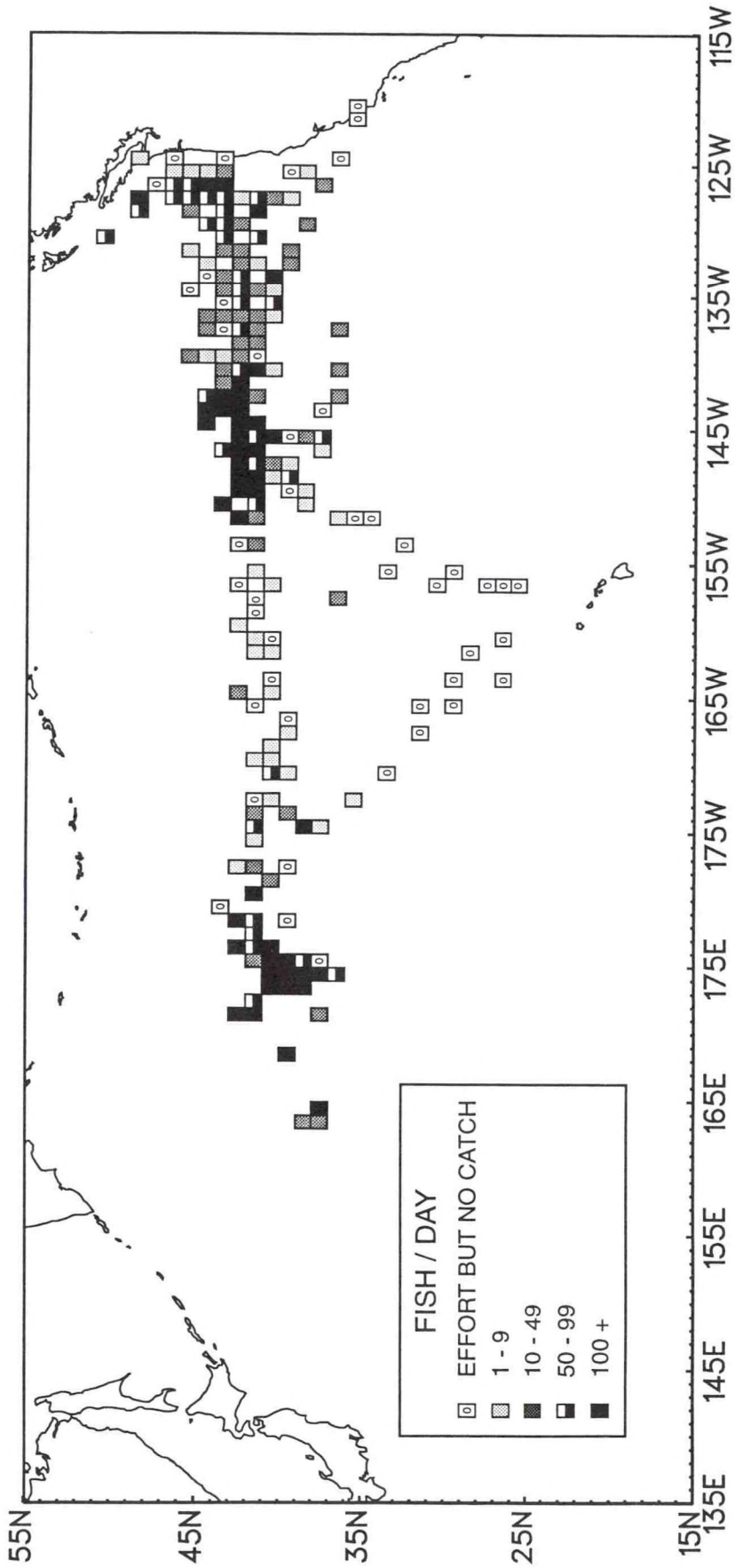
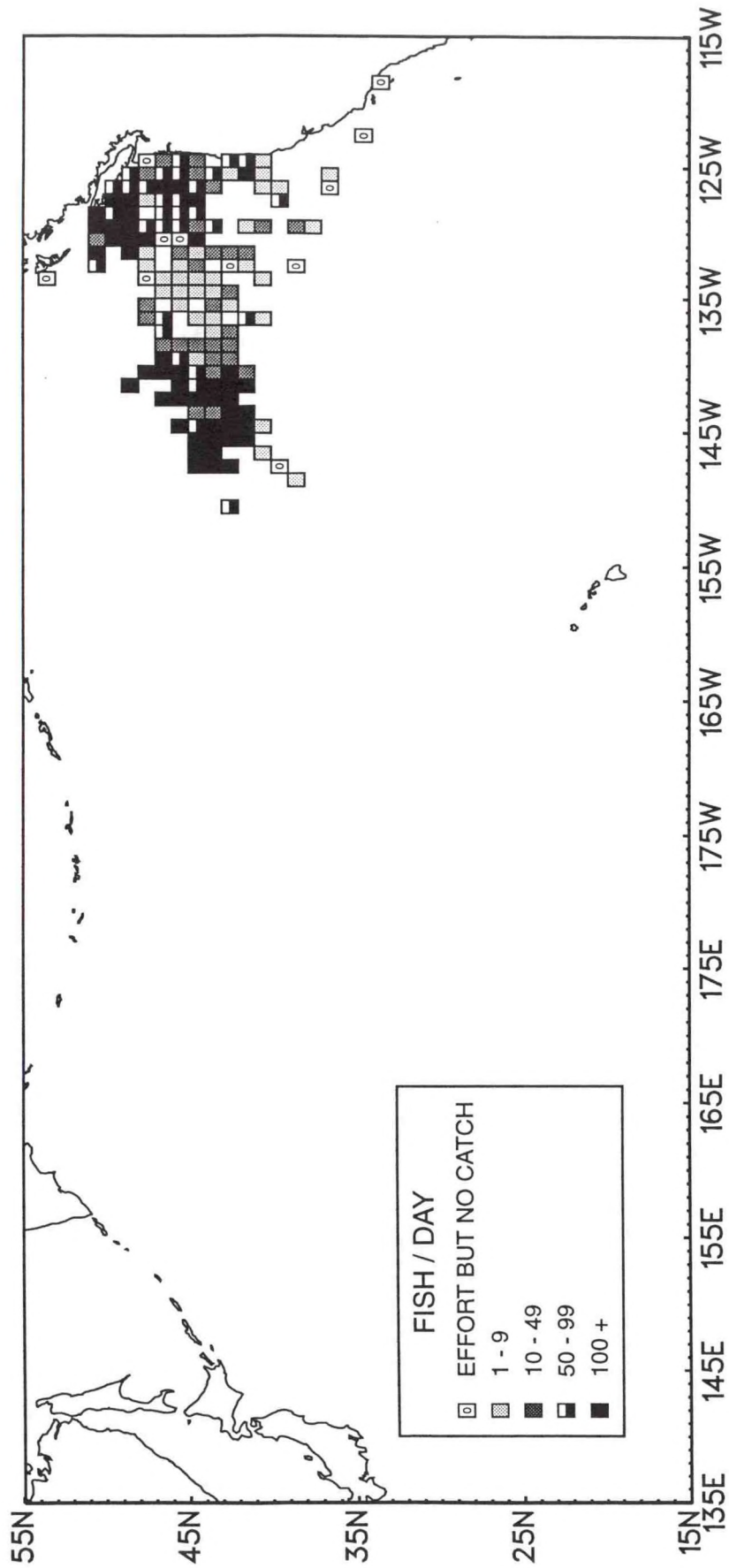


Figure 3d. U.S. North Pacific albacore catch rates for July, 1994.



# AUGUST 1994



**Figure 3e.** U.S. North Pacific albacore catch rates for August, 1994.

SEPTEMBER 1994

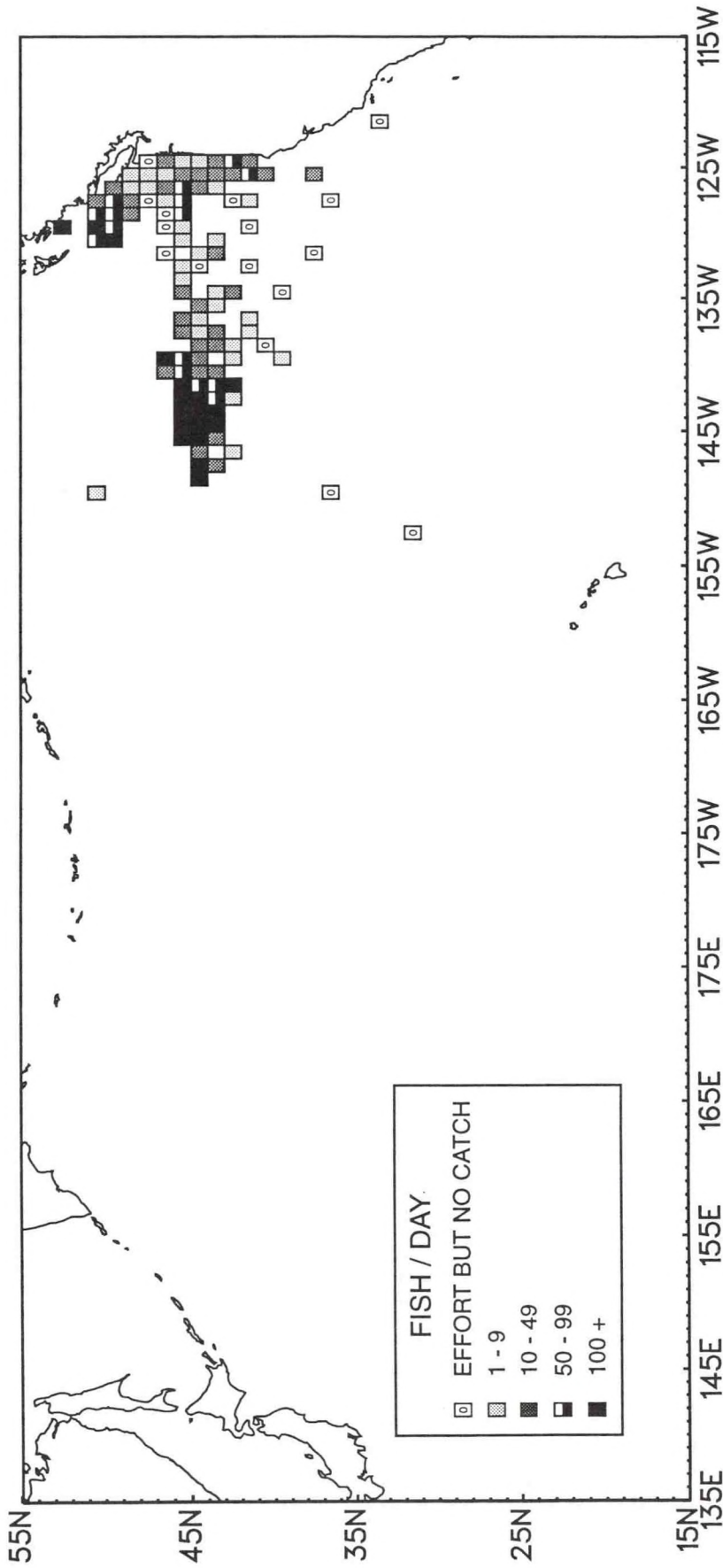


Figure 3f. U.S. North Pacific albacore catch rates for September, 1994.

OCTOBER 1994

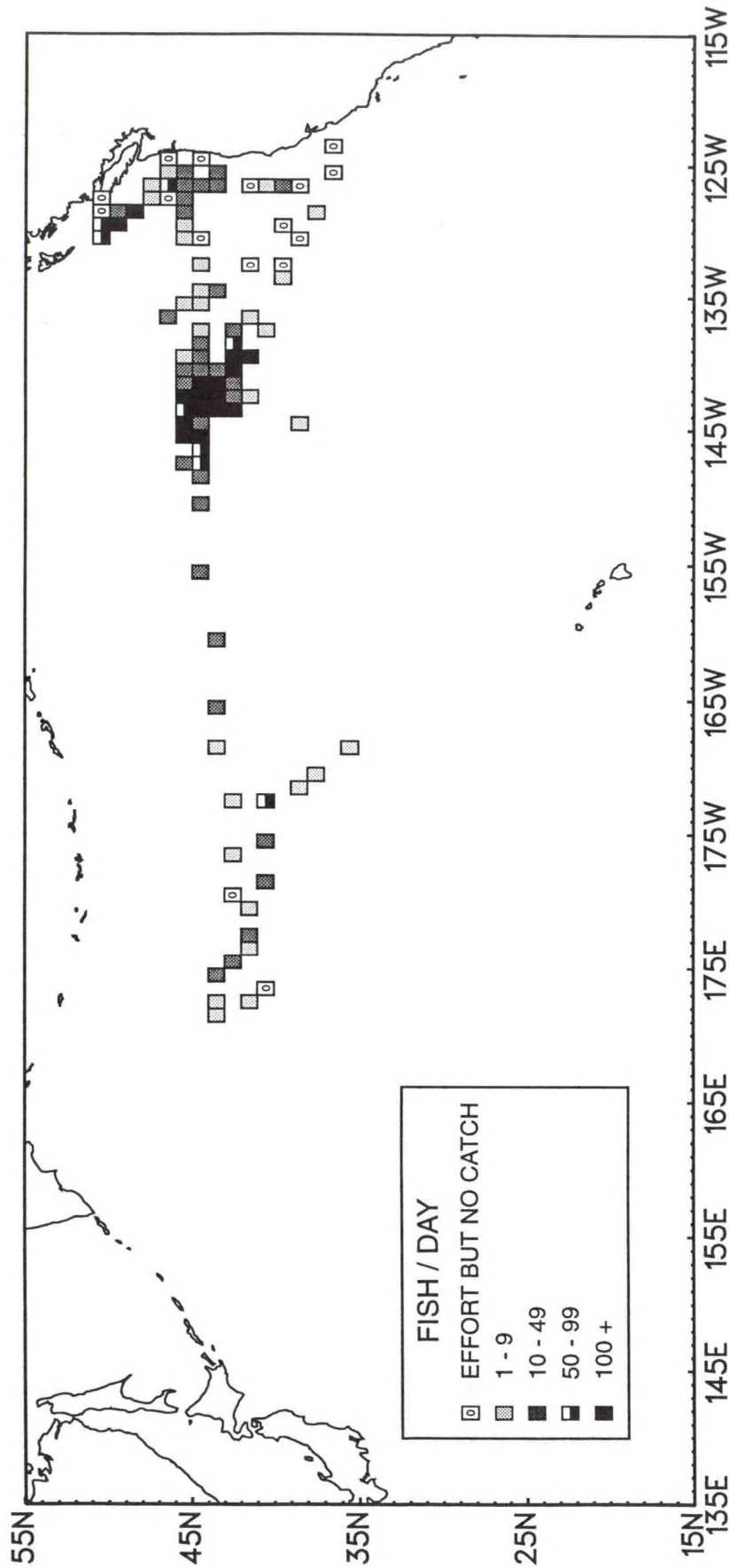


Figure 3g. U.S. North Pacific albacore catch rates for October, 1994.

NOVEMBER 1994

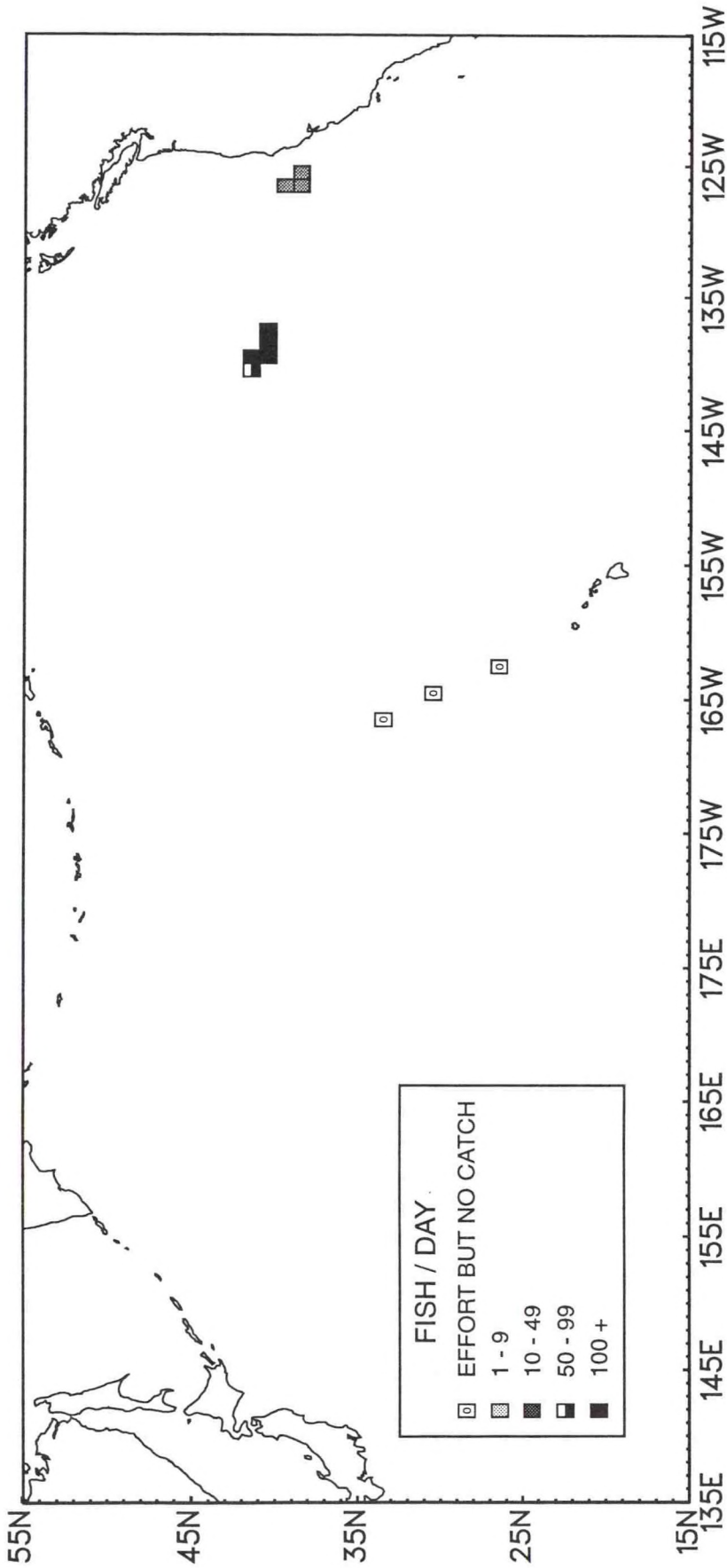


Figure 3h. U.S. North Pacific albacore catch rates for November, 1994.

# TOTAL CATCH RATE 1994

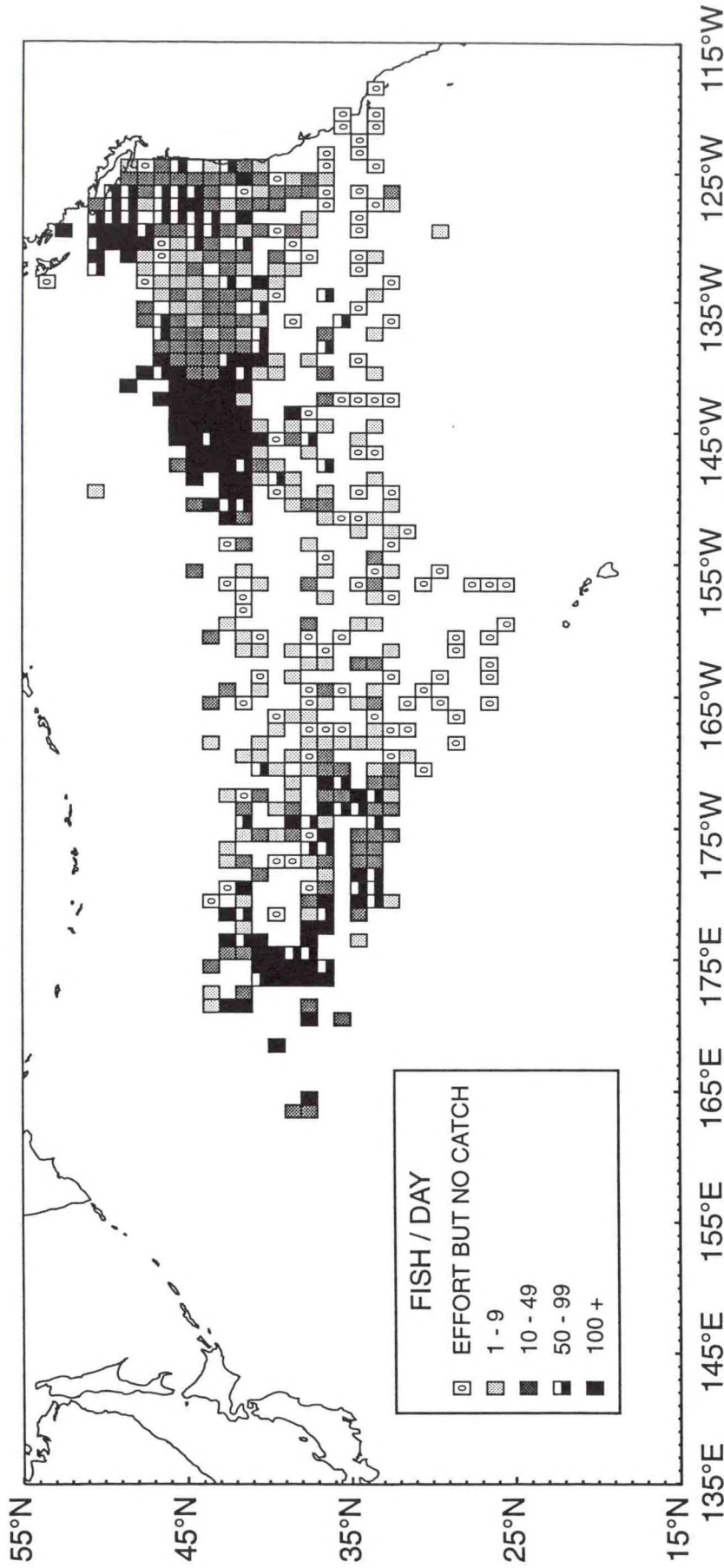


Figure 3i. U.S. North Pacific albacore catch rates for the 1994 season.

DECEMBER 1993

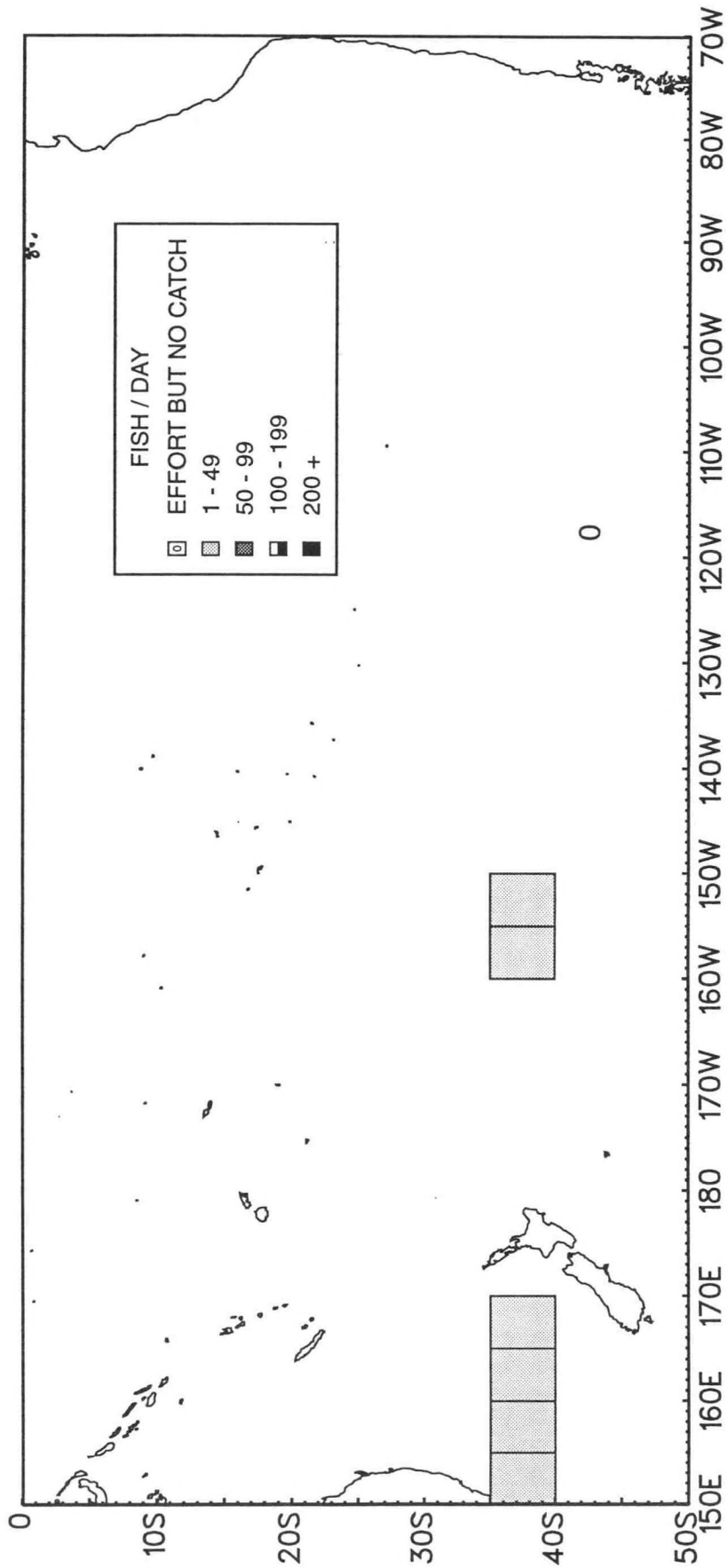


Figure 4a. U.S. South Pacific albacore catch rates for December, 1993.

JANUARY 1994

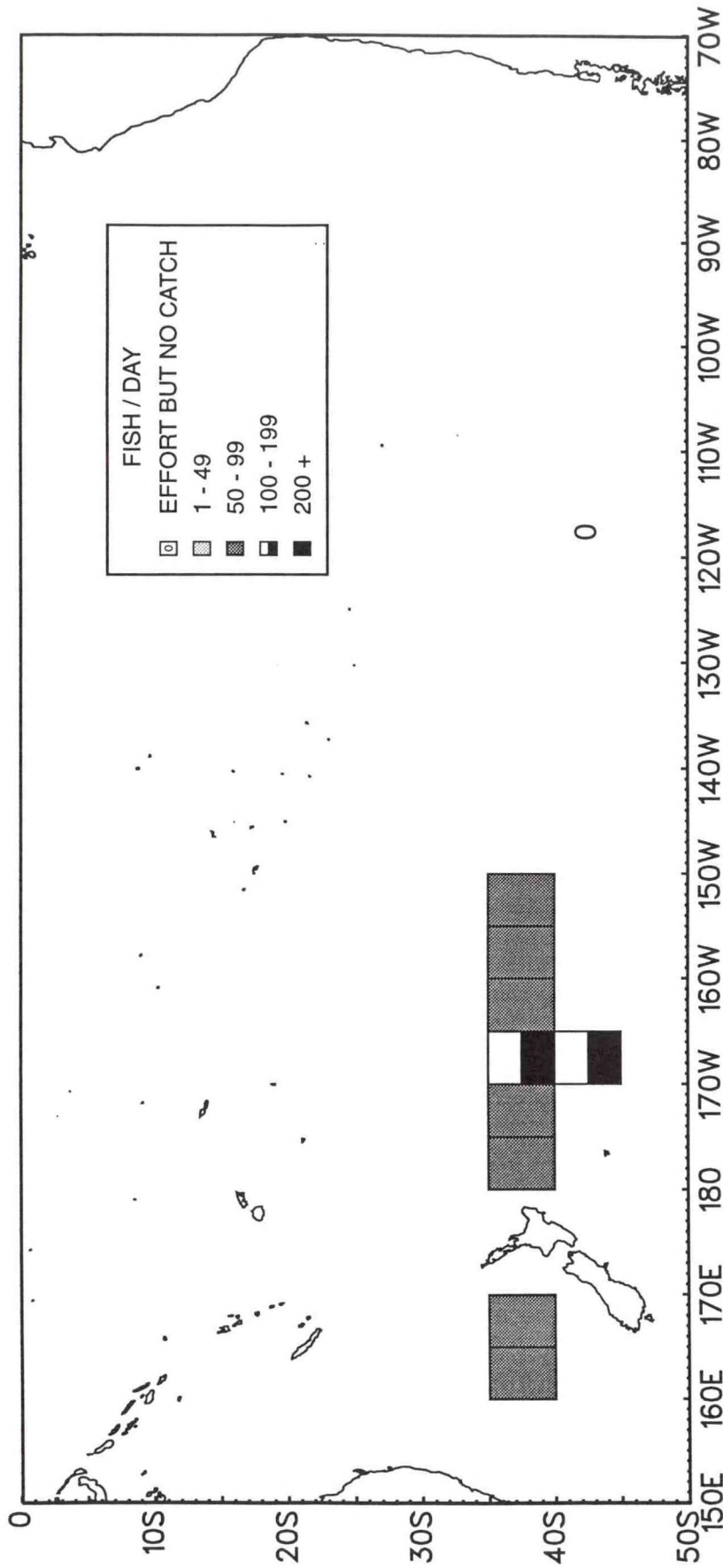
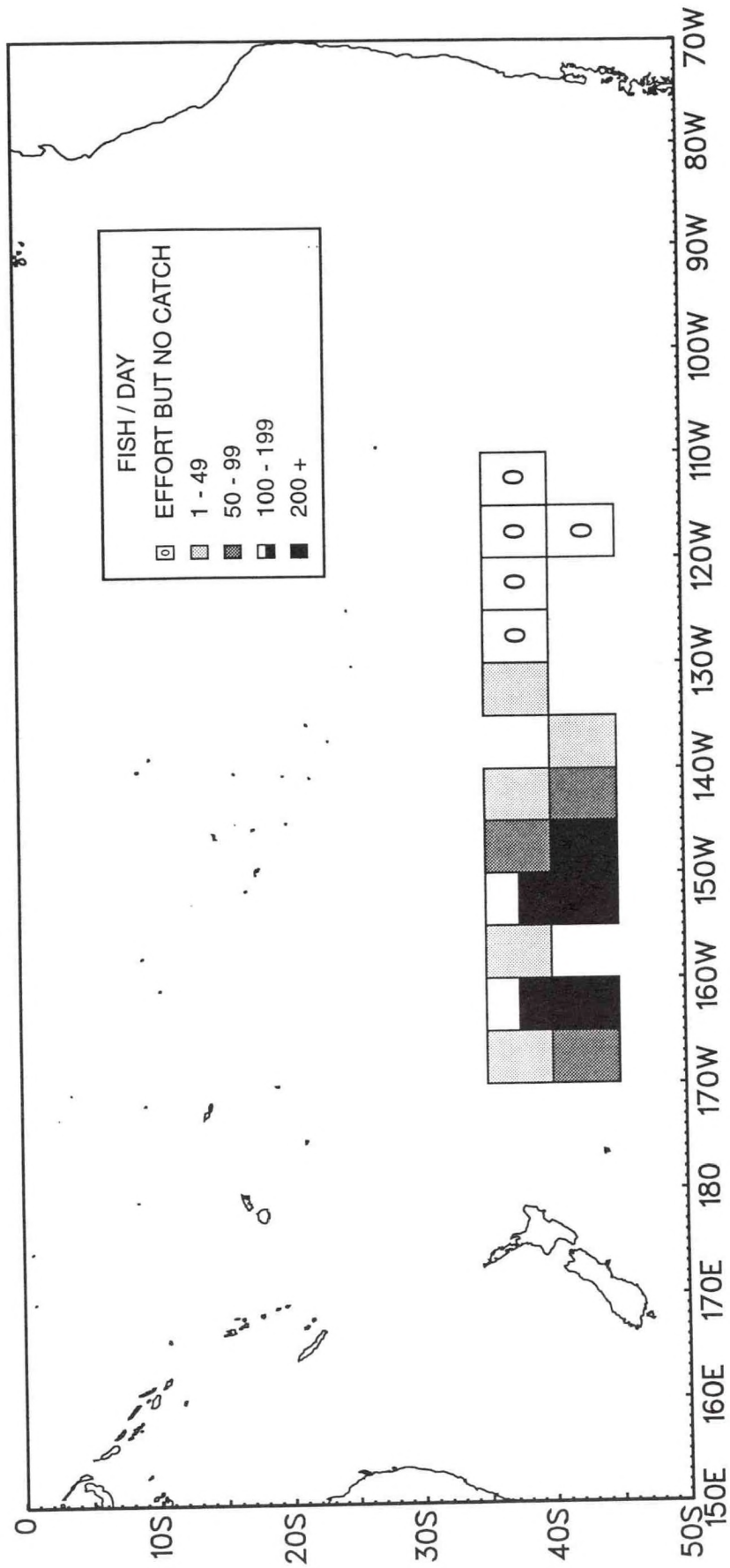


Figure 4b. U.S. South Pacific albacore catch rates for January, 1994.

# FEBRUARY 1994



**Figure 4c.** U.S. South Pacific albacore catch rates for February, 1994.



MARCH 1994

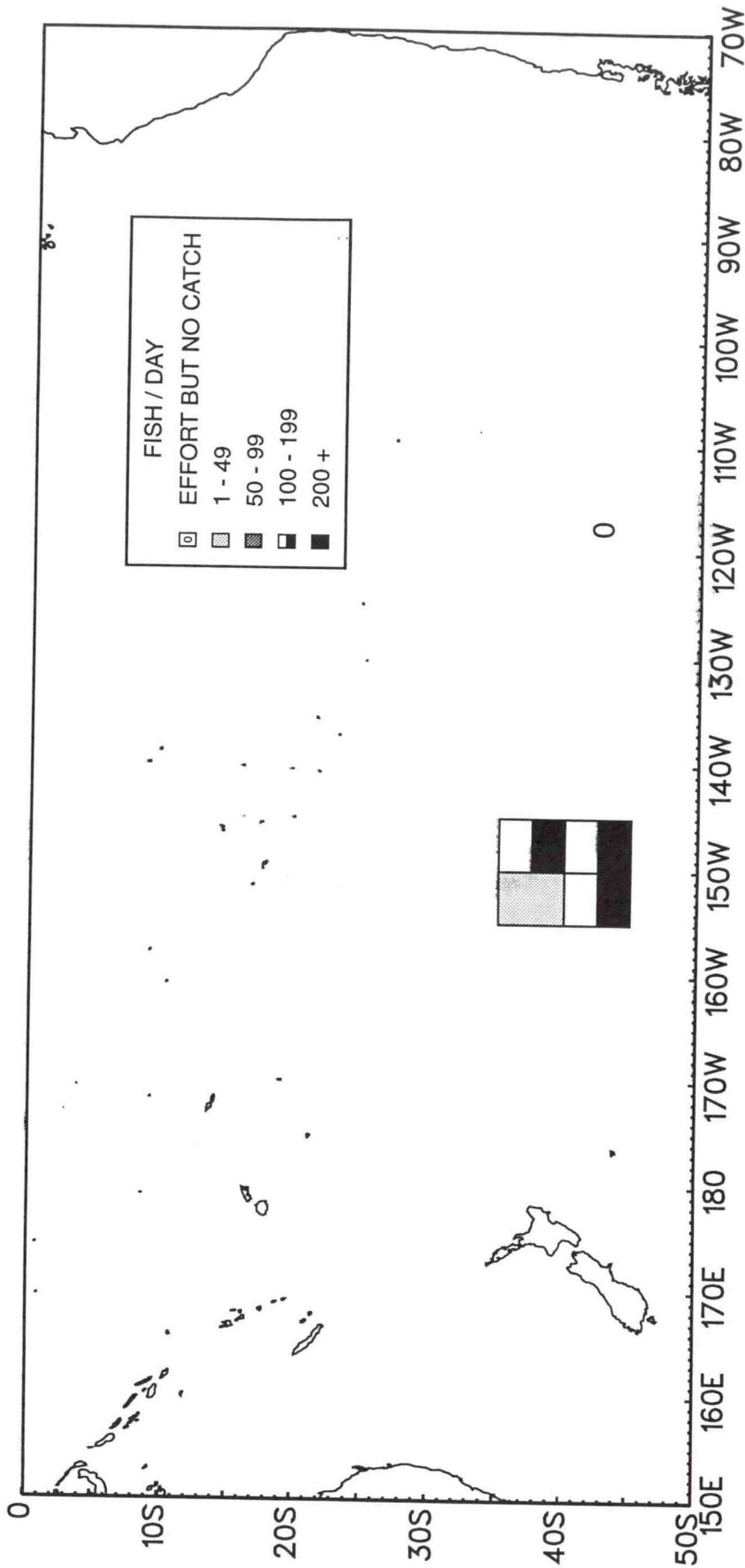


Figure 4d. U.S. South Pacific albacore catch rates for March, 1994.

APRIL 1994

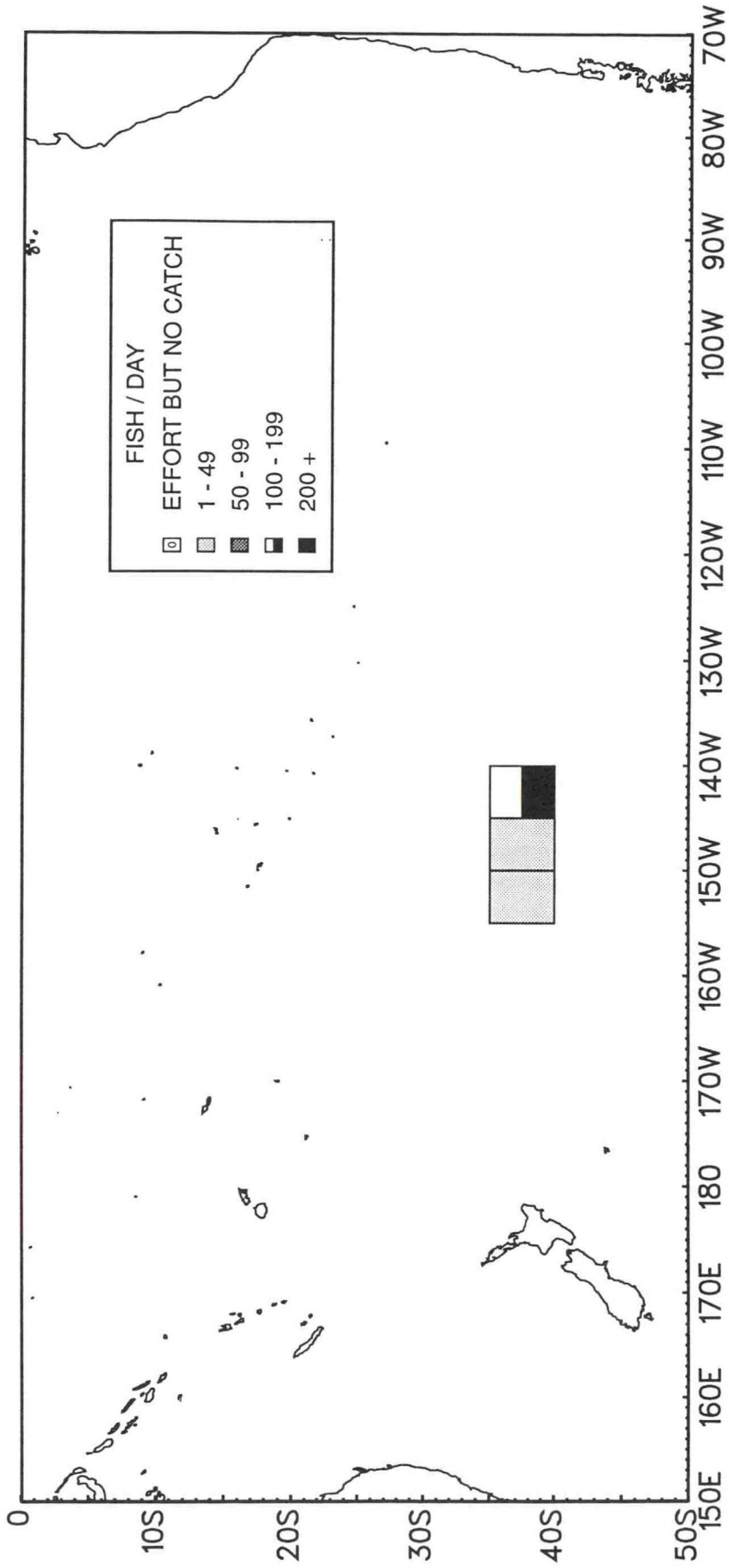


Figure 4e. U.S. South Pacific albacore catch rates for April, 1994.

# TOTAL CATCH RATE 1993-94

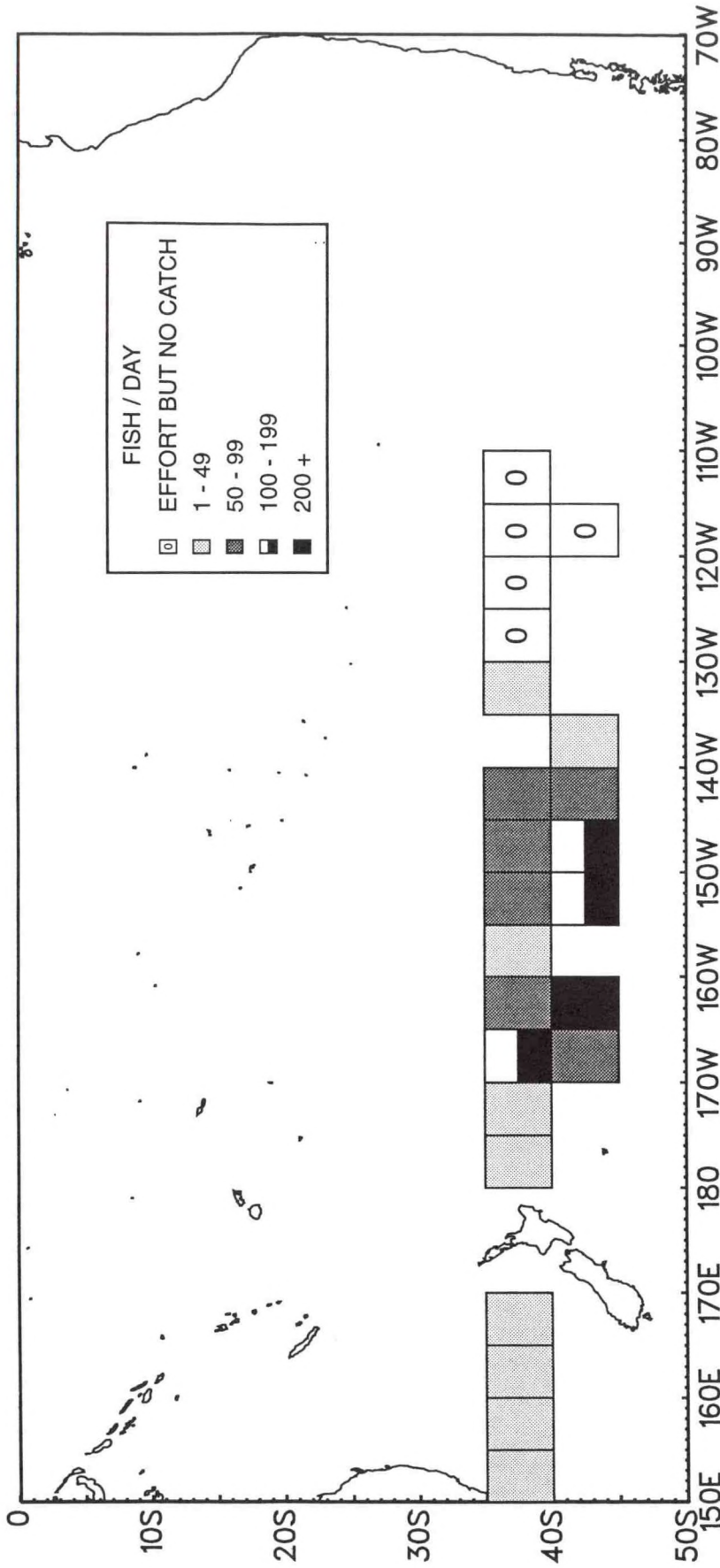
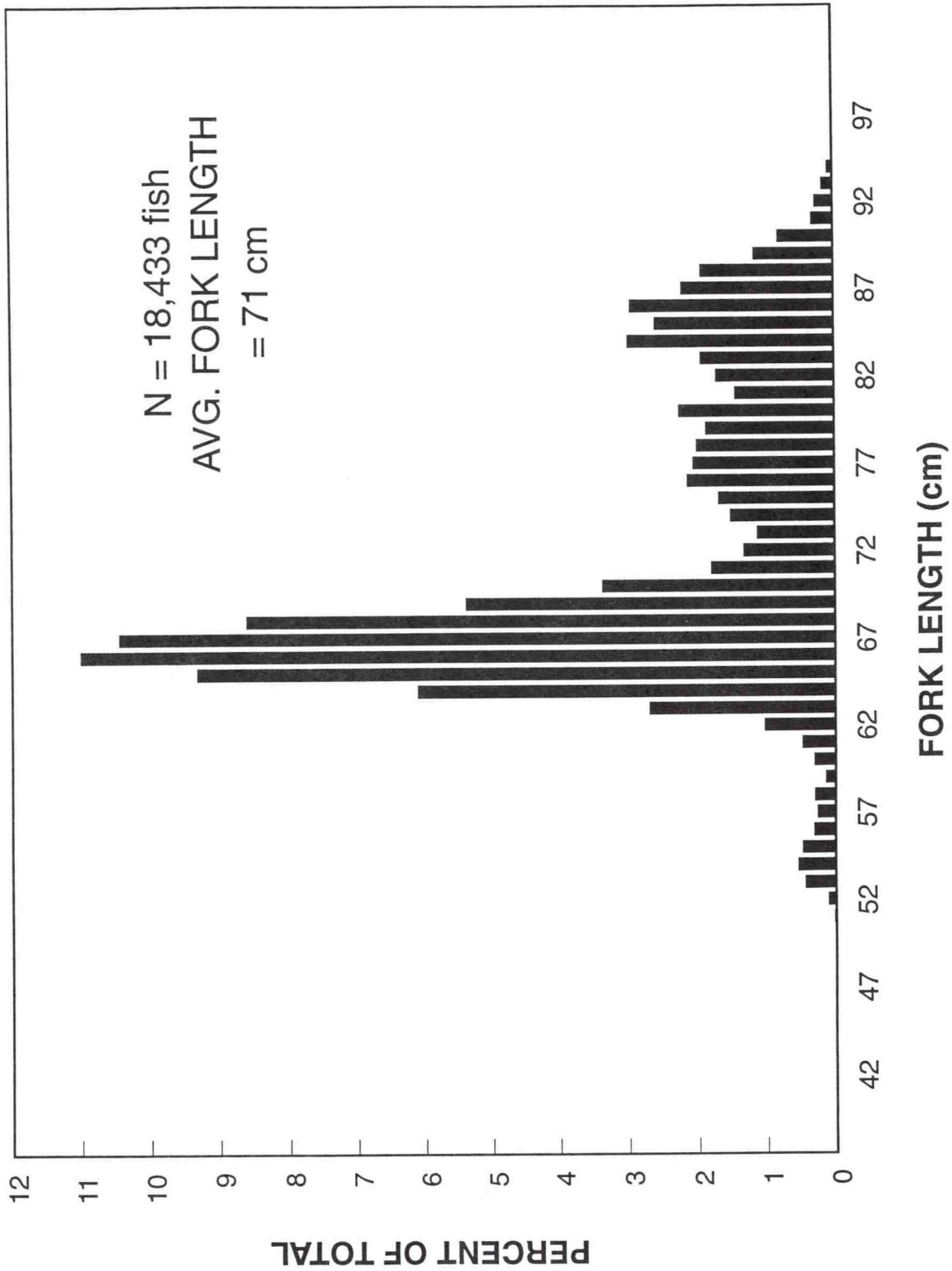
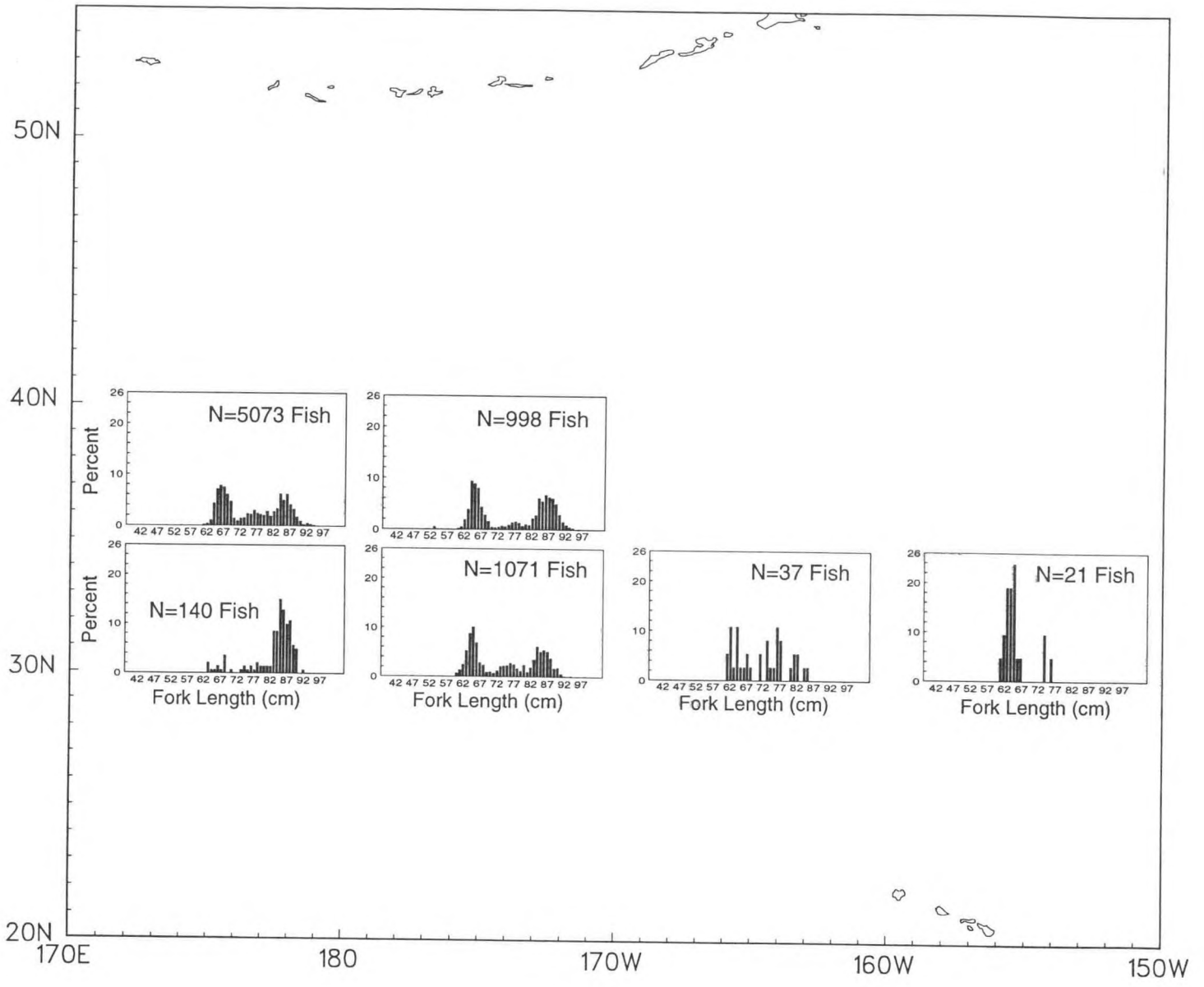


Figure 4f. U.S. South Pacific albacore catch rates for the 1993-94 season.



**Figure 5.** Length-frequencies of albacore sampled from the 1994 U.S. North Pacific troll fishery.



**Figure 6.** Size distribution of albacore sampled from the 1994 U.S. North Pacific troll fishery summarized by 5°x10° quadrangles.

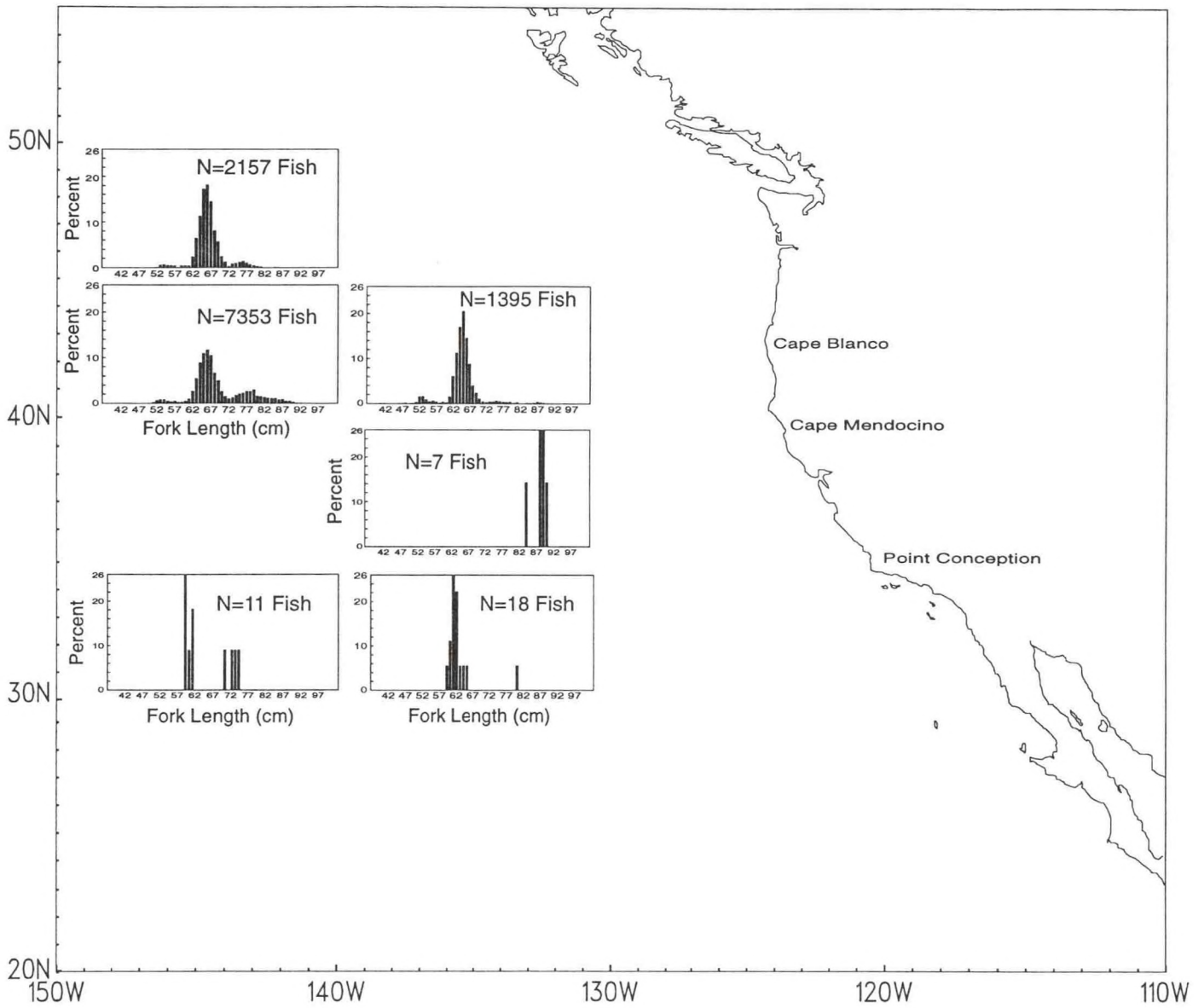


Figure 6. Continued.

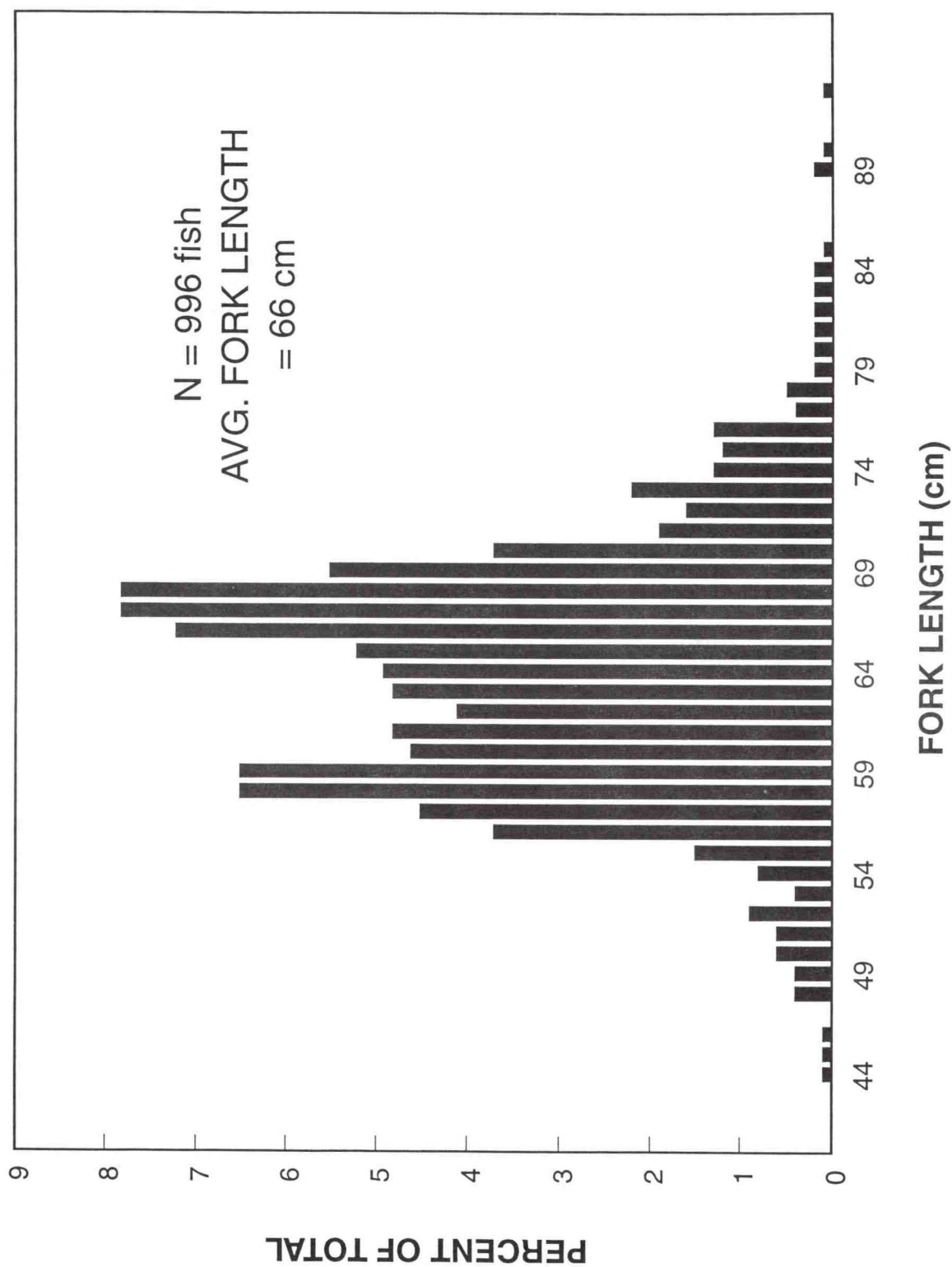
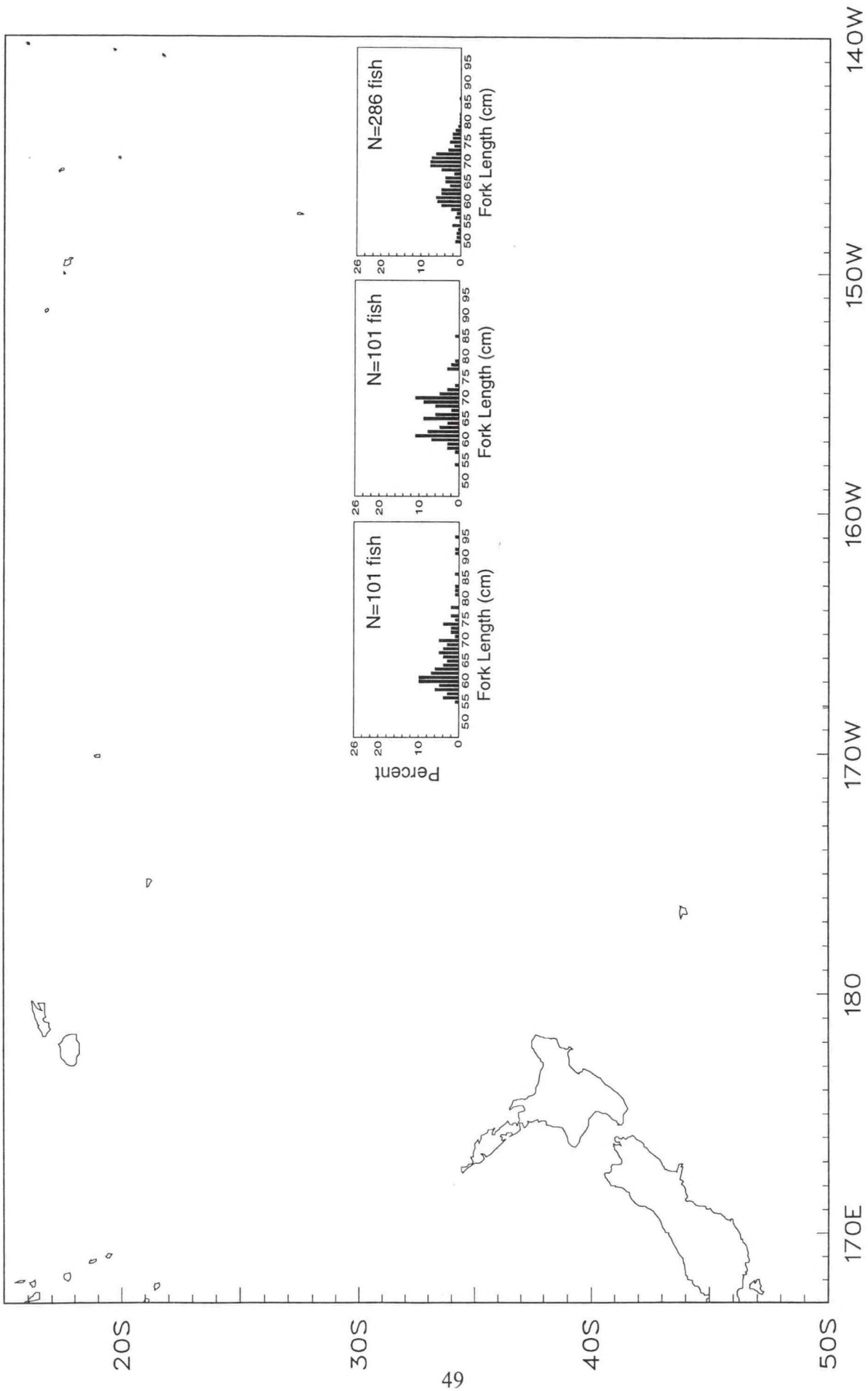
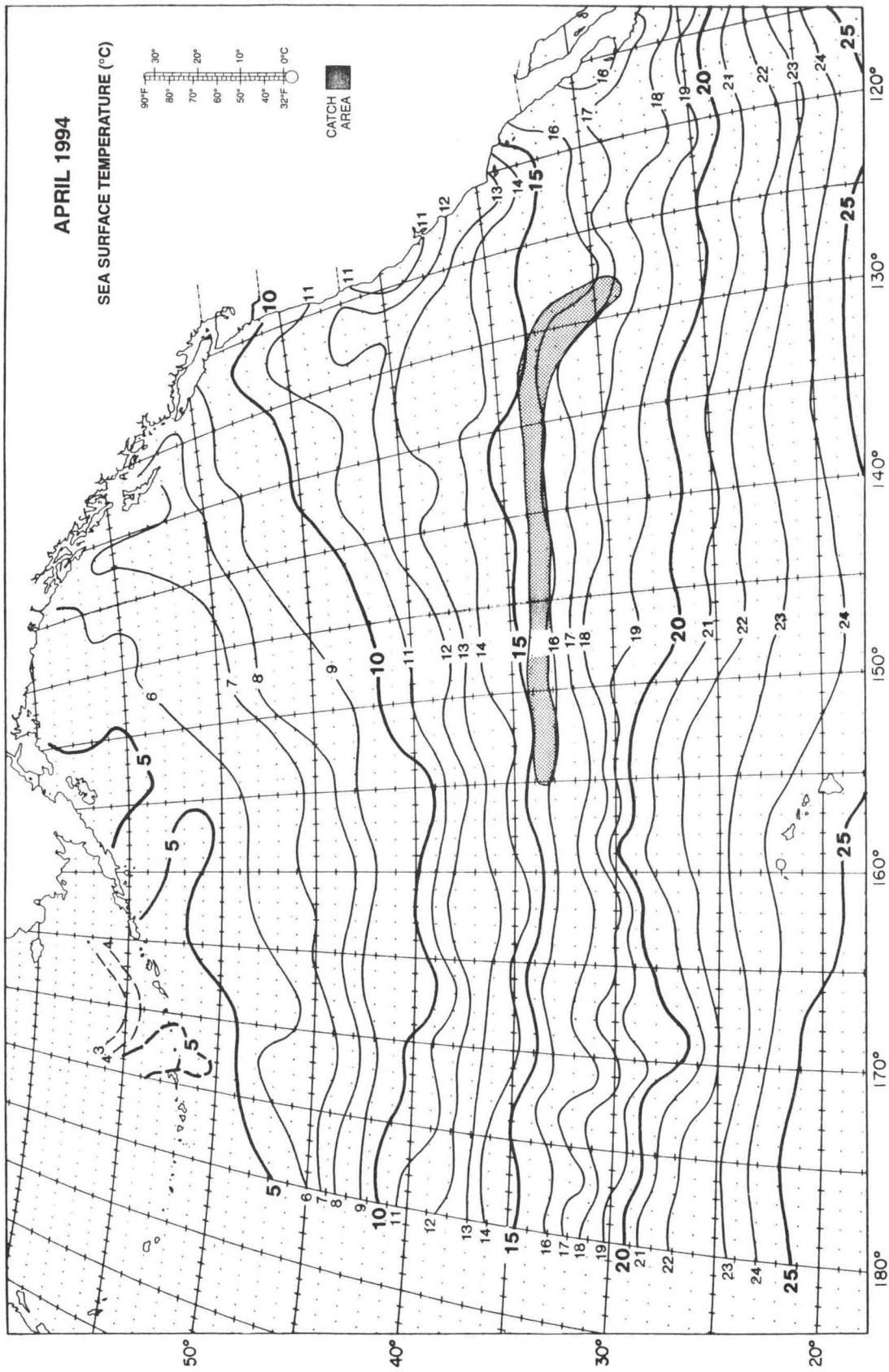


Figure 7. Length-frequencies of sampled albacore from the 1993-94 U.S. South Pacific troll fishery.

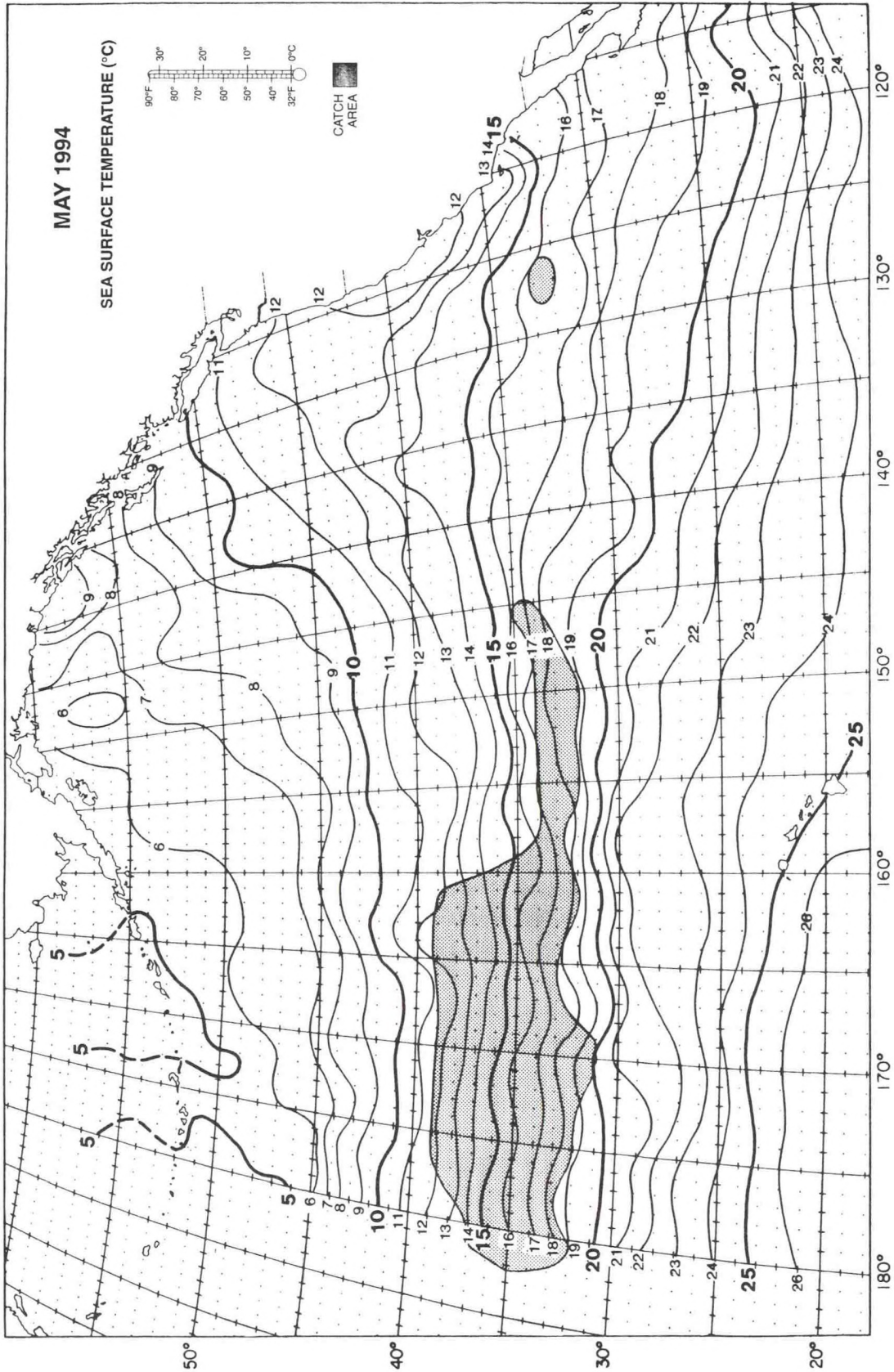


**Figure 8.** Size distribution of albacore sampled from the 1993-94 U.S. South Pacific troll fishery summarized by 5°x10° quadrangles.

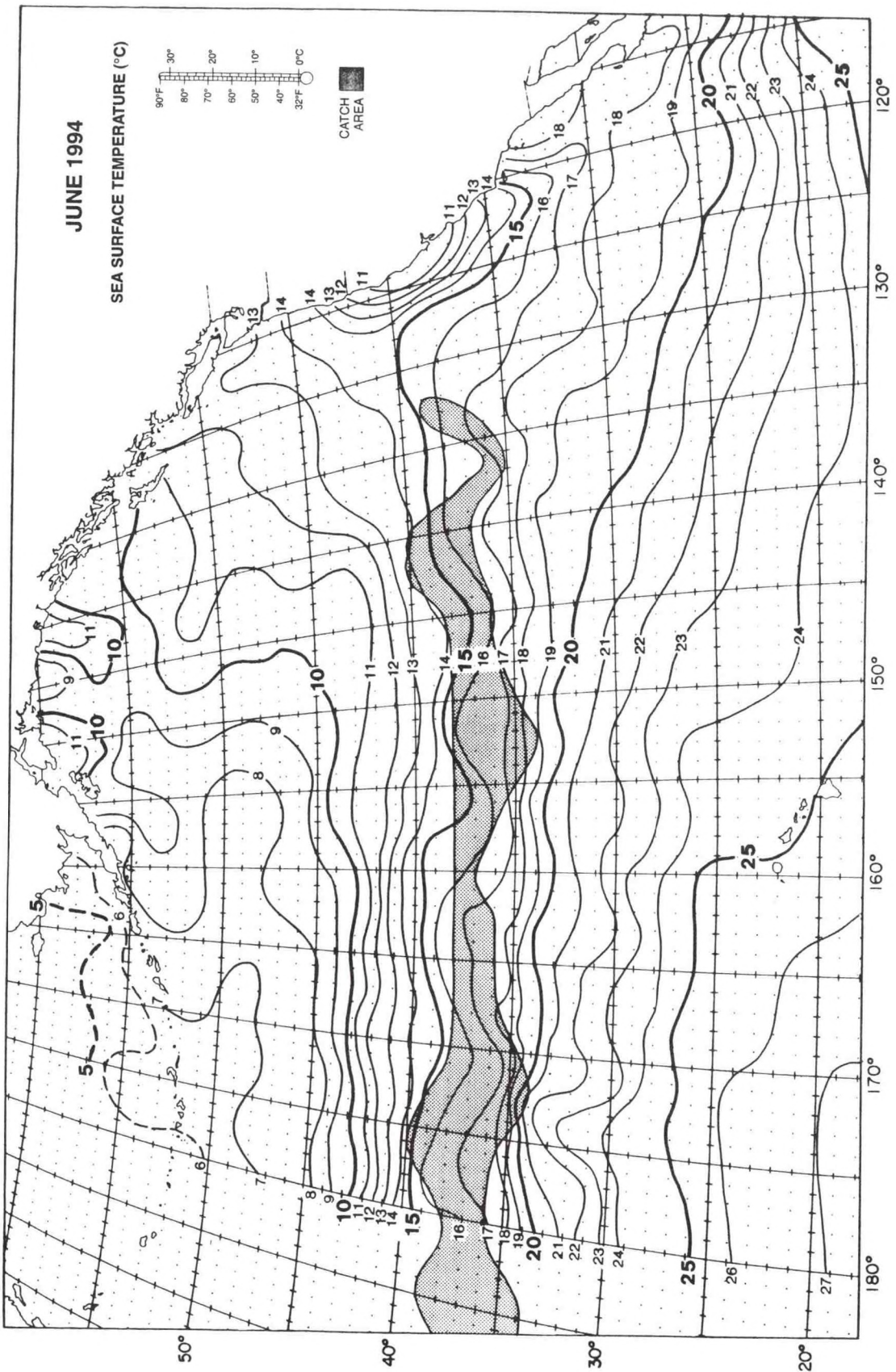




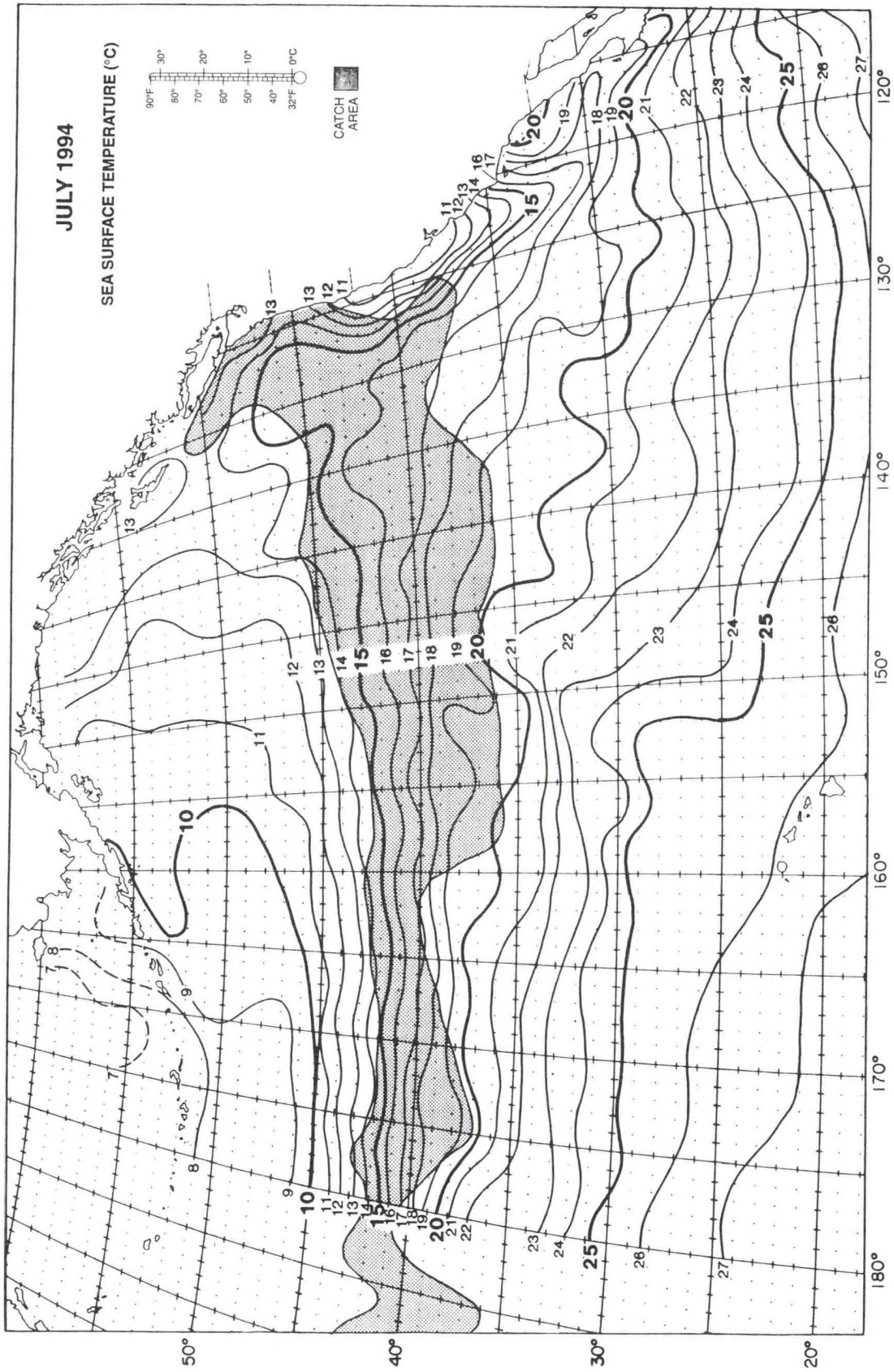
**Figure 9a.** Average SST isotherms and general catch area of U.S. North Pacific albacore troll fleet for April, 1994.



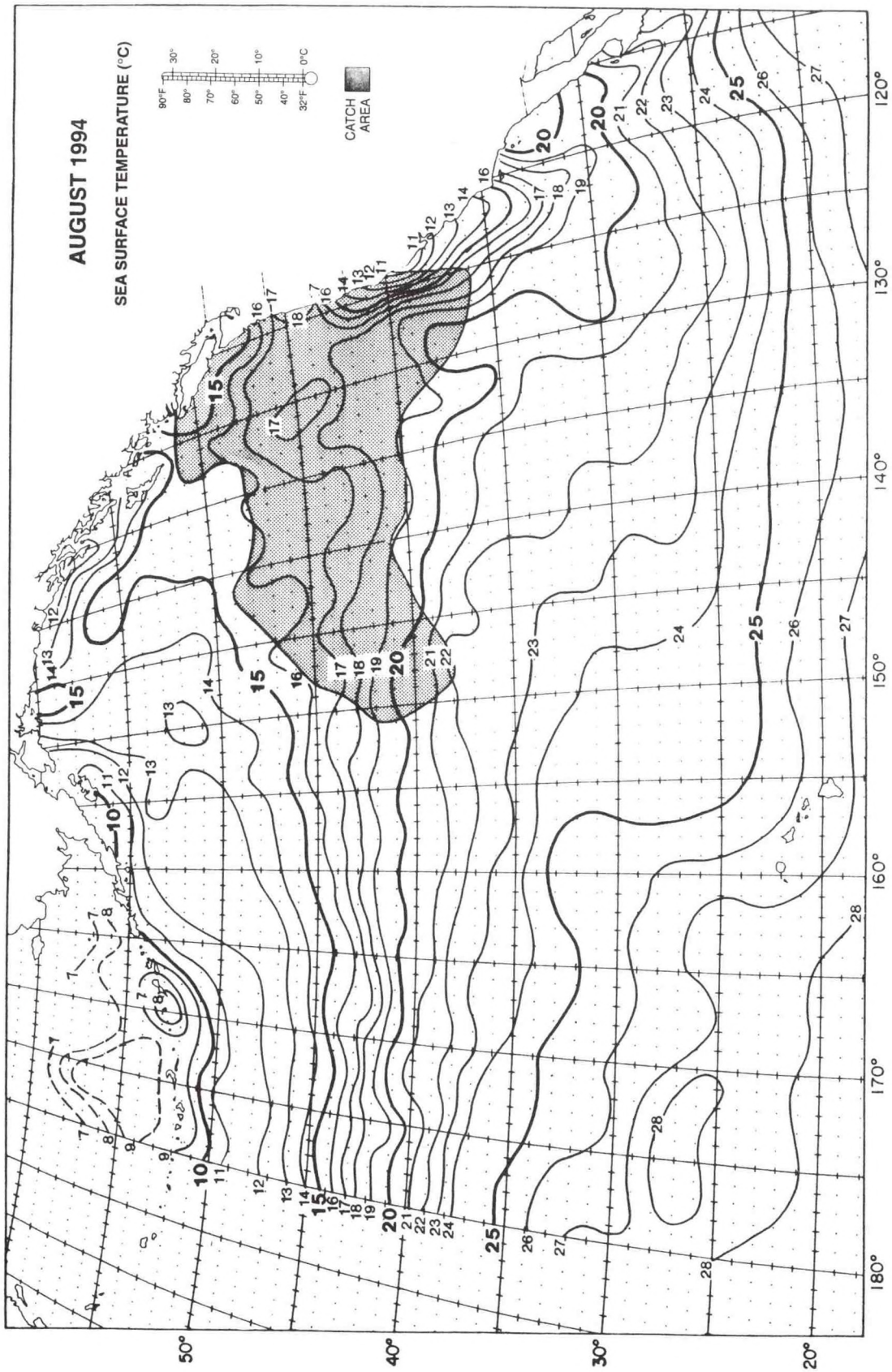
**Figure 9b.** Average SST isotherms and general catch area of U.S. North Pacific albacore troll fleet for May, 1994.



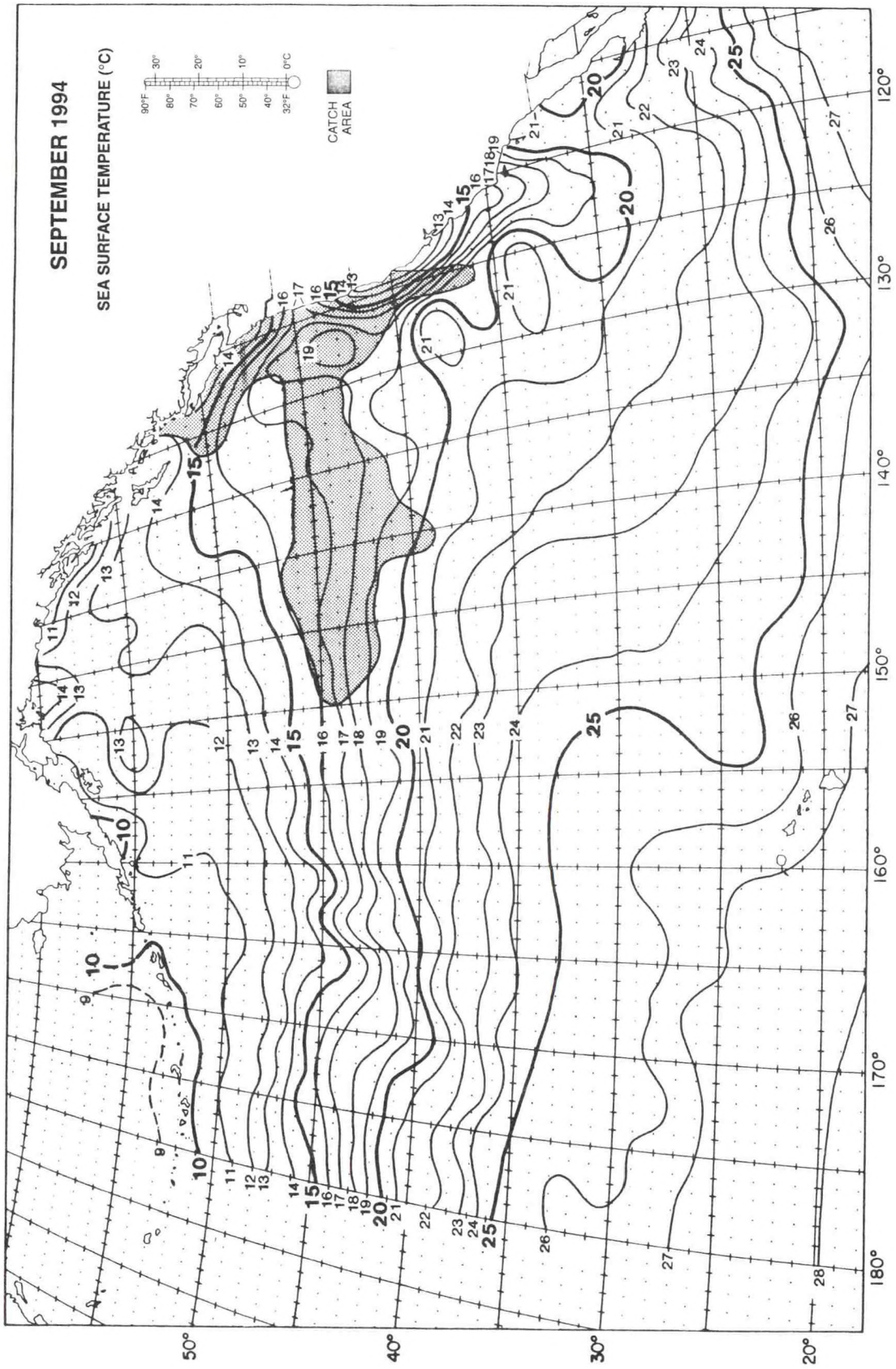
**Figure 9c.** Average SST isotherms and general catch area of U.S. North Pacific albacore troll fleet for June, 1994.



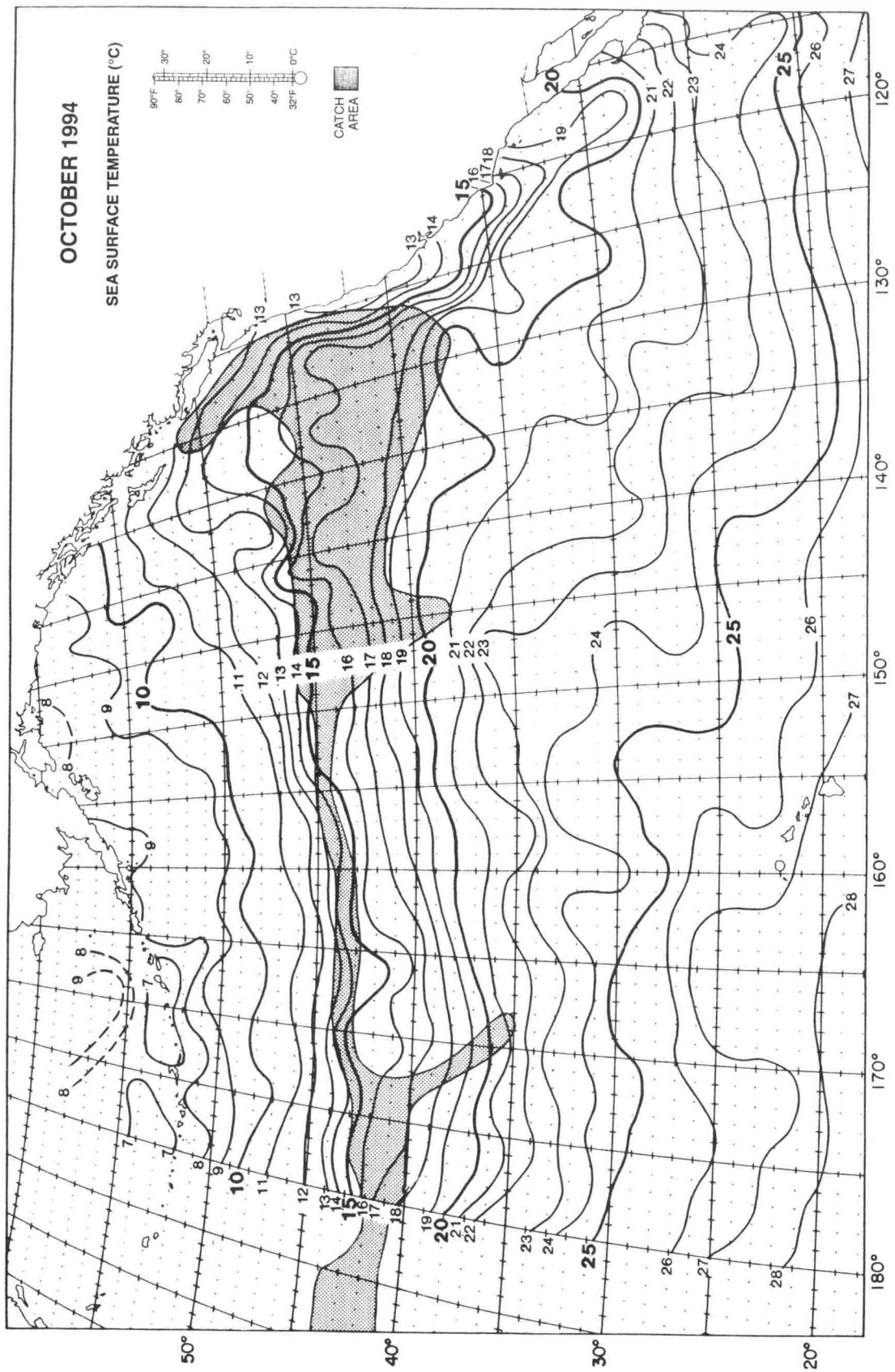
**Figure 9d.** Average SST isotherms and general catch area of U.S. North Pacific albacore troll fleet for July, 1994.



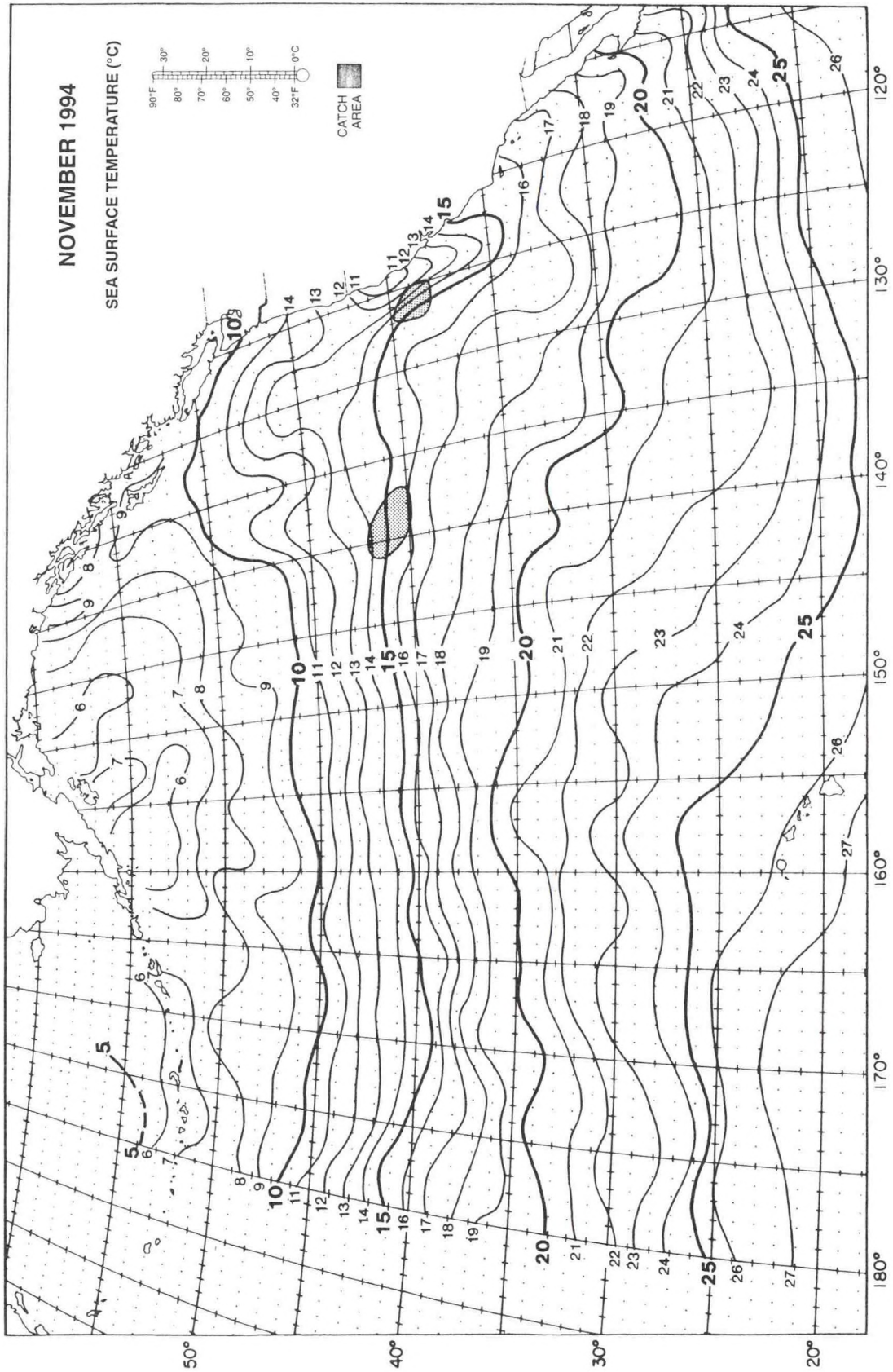
**Figure 9e.** Average SST isotherms and general catch area of U.S. North Pacific albacore troll fleet for August, 1994.



**Figure 9f.** Average SST isotherms and general catch area of U.S. North Pacific albacore troll fleet for September, 1994.



**Figure 9g.** Average SST isotherms and general catch area of U.S. North Pacific albacore troll fleet for October, 1994.



**Figure 9h.** Average SST isotherms and general catch area of U.S. North Pacific albacore troll fleet for November, 1994.