

**THE NORTHERN ANCHOVY  
REDUCTION FISHERY FOR THE  
1978-79 THROUGH 1981-82  
SEASONS**



by  
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and  
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**MARINE RESOURCES  
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## ABSTRACT

Nearly 49,000 metric tons (MT) of anchovies were taken during the 1978-79 season, followed by 32,390 MT in 1979-80, 60,678 MT in 1980-81 and 45,150 MT in 1981-82. A total of 14,076 fish was sampled during the four seasons for age, length and sex. The fishery during the four seasons consisted mainly of young-of-the-year and age groups I and II fish. The 1978 and 1979 yr classes comprised the major share of the catch. Seasonal mean lengths varied from 112 mm standard length (SL) in the 1979-80 season to 122 mm SL for the 1981-82 season. Female to male sex ratios ranged from 1.17:1 (1978-79 season) to 1.59:1 (1979-80 season).

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## INTRODUCTION

The California Department of Fish and Game (DFG) has monitored the northern anchovy (Engraulis mordax) reduction fishery every season since the 1965-66 season. This is the 12th in a series of reports concerning the catch, age, length, and sex composition of anchovy landings for reduction in California and covers the 1978-79 through 1981-82 seasons.

The anchovy reduction fishery began in 1965 when the State Legislature authorized the Fish and Game Commission to develop regulations covering a commercial reduction fishery. The State is divided into two permit areas, the northern permit area, north of Point Buchon, and south of Point Buchon as the southern area (Figure 1). The major fishing ports and fleets are located in Monterey, Port Hueneme, San Pedro and Terminal Island. The fishing season was initially established from October 15 to April 15, but was later extended to September 15 through May 15 in the southern permit area, and from August 1 to May 15 in the northern permit area. The month of February was closed to reduction fishing in some years. A minimum size limit of 5 in. total length (TL) was established along with a percentage allowance (15% by weight) for undersized anchovy. Each year, prior to the season opening, the Fish and Game Commission receives testimony from government agencies, the general public and the industry regarding the anchovy fishery and anchovy stock assessment. A reduction quota is then set by the Fish and Game Commission, based upon the information presented during the hearings. During the course of a fishing season, the quota can be increased by the Fish and Game Commission when the cumulative landings approach the quota.

The Fishery Conservation and Management Act of 1976 established the regional Pacific Fishery Management Council (PFMC), which assumed management responsibilities for the anchovy when it adopted the Anchovy Management Plan (PFMC 1978). However, the State continued to assert control over the landing and processing of anchovies for reduction.

## METHODS AND MATERIALS

DFG personnel monitored anchovy landing records and sampled the catch at the major reduction port of Terminal Island, Los Angeles Harbor. Anchovy taken in random samples were measured and weighed, sex was determined along with sexual maturity, and otoliths were removed for age determination (Collins 1971). Methods and materials for assigning age and determining sexual development were described by Collins and Spratt (1969) and Sunada (1977). Data analysis for this report is based on seasonal samples of 4069, 2314, 4689, and 3004 fish taken 1978-79 through 1981-82, respectively. The northern California



fishery samples were not large enough to be included in the analysis.

## THE FISHERY

### Review of the 1978-79 Fishing Season

The 1978-79 fishing season was the first to be regulated by the newly installed Pacific Fishery Management Council (PFMC) under the U.S. Department of Commerce (DOC). Prior to this, the fishery was regulated by the California Fish and Game Commission. Several changes were made in the switch to federal management. A split season was introduced by closing the fishery during February and March. The opening dates for the northern and southern areas remained August 1 and September 15, respectively, with the fishery continuing to June 30, unless the quota was reached. The PFMC Fishery Management Plan required quotas to be set on the basis of a current estimate of anchovy spawning biomass. This estimate was derived from larvae surveys conducted by the National Marine Fisheries Service (NMFS), Southwest Center (SWC), La Jolla. Based upon a spawning biomass estimate of 1,179,340 MT (1,304,000 tons), the 1978-79 season quota was set at 52,919 MT (58,333 tons), of which 5292 MT (5833 tons) were allocated to the northern area and 47,627 MT (52,500 tons) to the southern area (Stauffer and Parker 1980).

Fishermen began searching for fish in the northern area soon after the August 1 opening date, but were unable to find schools of fish until the end of August. Only 233 MT (256 tons) had been landed by the end of 1978. Fishing resumed in early January and again in late April and May. Only 1080 MT (1191 tons) were landed by the June 30 closing date (Table 1A). The catch was far below that of the previous two seasons. The low catch may be explained by anchovy fishermen being attracted to good squid fishing in Monterey Bay during the fall and spring, or the lucrative Pacific herring (Clupea harengus pallasii) fishery in January. Anchovies in Monterey Bay were scarce and small during the fall. Nine boats were actively engaged in the fishery at sometime during the season when the ex-vessel price ranged between \$44.50 to \$51.00 per ton.

The southern permit area opened on September 15, but fall and winter fishing was not successful due to the low availability of fish schools and an abundance of small fish (less than 5 in.). When the season reopened on April 1, fishing conditions had improved greatly and landings in southern California averaged over 3628 MT (4063 tons) per week until the season was closed June 8, when the quota was reached. The seasonal total was 47,856 MT (52,762 tons) (Table 1A). Only 24 vessels had been actively engaged in the fishery, compared to 33 the previous season. The ex-vessel price ranged from \$42.75 to \$53.00 per ton during the season.

## Review of the 1979-80 Fishing Season

The Pacific Fishery Management Council established quotas for the 1979-80 season as 9078 MT (10,000 tons) for the northern area and 132,630 MT (146,100 tons) for the southern area, on the basis of an estimated biomass of 1,564,139 MT (1,723,000 tons) derived by Stauffer (1980).

In the northern permit area, the season opened on August 1, but landings were not made until the last week of October. The fishermen enjoyed moderate fishing success, and landings of anchovies continued through December. After the season reopened in April, anchovies were reported to be unavailable in the Monterey Bay area. Total landings for the season were 2110 MT (2327 tons) (Table 1A). Only four vessels were active in the fishery because of the excellent fall squid fishing and the lucrative winter herring fishery. The ex-vessel price ranged from \$46.00 to \$49.25 per ton during the season.

In the southern permit area, the Port Hueneme fleet began fishing soon after the season opened and caught anchovies through October. Little fishing success occurred in November and December, while January was a successful month. Meanwhile, the San Pedro anchovy reduction fleet found few concentrations of anchovies during the fall, so they directed their efforts towards the Pacific and jack mackerel fishery. By the end of January, only 7257 MT (8000 tons) of anchovies had been landed in the southern area. After the season reopened in April, fishing success increased substantially with the fleet landing an average of 2000 to 3000 MT (2204 to 3307 tons) a week in April and, up to 7330 MT (8080 tons) during the last week in May. In early June, a large number of fish under the size limit began to appear in the catches, and a number of San Pedro boats were cited for excess amounts of undersized fish. The San Pedro fleet halted fishing rather than risk further citations. The total landings for the southern area was 30,279 MT (33,383 tons) (Table 1A). Twenty-five vessels participated in the fishery, and ex-vessel prices ranged from \$46.00 to \$49.25 per ton during the season.

The total landings for both areas was 32,389 MT, (35,710 tons), the lowest seasonal harvest since the 1968-69 season.

## Review of the 1980-81 Fishing Season

The 1980-81 season quotas established by the PFMC were based on a modified larval census estimate of a spawning biomass of 1,610,00 MT (1,775,000 tons) (Stauffer and Piquelle 1981). These quotas were 9078 MT (10,000 tons) for the northern permit area, and 141,980 MT (156,400 tons) for the southern permit area. However, on August 28 the State Fish and Game Commission initiated more restrictive measures, temporarily setting a

13,617 MT (15,000 tons) quota for the season for both permit areas. This was modified on November 7, when the Commission revised the quota up to 72,624 MT (80,000 tons) after hearing testimony from members of the Anchovy Management Plan team.

In the northern permit area, fishing began at a brisk pace. By the end of October, 2442 MT (2692 tons) had been landed. The fleet had difficulty finding legal size fish in early November, and fishing stopped when one vessel was cited for having too many undersized fish. Schools of legal size fish were located in mid-December, and fishing resumed at a slower level until the season closed on January 31. When the season reopened, the fleet regularly made landings until mid-May, when anchovy schools were no longer available, while squid was abundant. Total landings for the northern area were 4296 MT (4736 tons) (Table 1B). During the season, five boats were actively engaged in the fishery, and the ex-vessel price ranged from \$46.00 to \$60.50 per ton.

When the season opened in the southern permit area, only the Port Hueneme fleet began fishing for anchovies. But they switched to Pacific mackerel and squid when anchovy schools could not be located. Port Hueneme boats resumed anchovy fishing in November, while the San Pedro boats held off until early December. Southern area landings increased in December and remained steady through January. Interest in anchovy was high, and by the end of January 24,453 MT (26,954 tons) had been landed.

In the second part of the season, both Port Hueneme and San Pedro boats fished steadily until the end of the season. Weekly landings ranged from 1179 to 6169 MT (1300-6801 tons). In April, fishing halted briefly after some boats were cited for undersized fish, but schools of legal size anchovies were found elsewhere and fishing resumed. At one point, it appeared that the southern area quota would be reached, and on May 26, 1981, the Fish and Game Commission authorized the Director of the Department of Fish and Game to increase the southern area quota up to 81,702 MT (90,000 tons). However, this action proved to be unnecessary when landings dropped off dramatically in early June. Anchovy availability remained poor until the season closed. The total southern area landings was 56,382 MT (62,161 tons) (Table 1B). During the season, 24 boats fished, and the ex-vessel price ranged from \$46.00 to \$60.50 per ton.

#### Review of the 1981-82 Fishing Season

On July 1, 1981, the PFMC announced reduction quotas for the 1981-82 season of 9078 MT (10,000 tons) and 361,395 MT (398,100 tons) for the northern and southern permit areas, respectively. These quotas were based upon a spawning biomass estimate of

2,540,000 MT (2,803,000 tons) (Stauffer and Charter 1982). However, the Fish and Game Commission, on August 28, established landing quotas of 9078 MT (10,000 tons) and 127,092 MT (140,000 tons) for the northern and southern permit areas, respectively. In the northern permit area the season opened with fishermen showing little interest in fishing for anchovies. Two boats finally landed fish on September 22, and they were joined by a third vessel in November. Fishing was good until the middle of November, when it declined considerably, except for a good week at the beginning of December. As the year ended, 2907 MT (3204 tons) of anchovies had been landed. Fishing success remained at a low level after the season reopened on April 1. Undersized fish began to show up in May's catches. By the middle of June, most of the local fishermen had gone to Alaska for the salmon season. Season landings for the northern area were 4227 MT (4660 tons) (Table 1B). Inclement weather conditions, the absence of anchovies in Monterey Bay and the lucrative herring and squid fisheries depressed the landings of anchovies. Only three vessels were active in the fishery, and the ex-vessel price ranged from \$41.50 to \$49.00 per ton during the season.

The season opened in the southern area with no interest shown in anchovies by either the processors or the fishermen. In early September, the two Terminal Island processors had announced they would not place their orders through the Fisherman's Co-operative Association, but would only accept fish from selected boats they had contracted with. A long dispute ensued, between fishermen, boat owners and canneries, over anchovy price and unloading rules. San Pedro and Port Hueneme fleets concentrated on fishing Pacific and jack mackerel.

In the middle of November, the smaller Terminal Island processor agreed to receive fish at \$46.00 per ton, and four of its boats began fishing for anchovies. Port Hueneme's fleet began fishing for anchovies in early November and made modest landings through the end of January.

Renewed negotiations over a new price formula and port rules between the processors, the boat owners and unions, delayed fishing until late April, when a new price of \$41.50 per ton was agreed to. Fishing effort for anchovies steadily increased, and on May 22, the fishermen decided to suspend port rules and fish every day (with the exception of the Memorial Day weekend) until the end of the season. Total landings for the southern area were only 40,923 MT (45,117 tons) (Table 1B). The disputes had depressed the total landings of anchovy. During the season, 18 boats were actively fishing for anchovies.

## AGE COMPOSITION OF THE CATCH

### Southern California

The mainstay of the fishery during the 1978-79 through 1981-82 reduction seasons was primarily young-of-the-year and age groups I and II fish. Fish of the older age groups III, IV, and V (with the exception of the 1978 yr class at age group III) contributed only a small proportion to the landings.

Anchovies of the 1978 yr class were the largest contributor to the fishery during these four consecutive seasons. This cohort dominated the 1978-79 fishery, contributing 65% by number and 56% by weight of the total catch (Table 2). The 1978 yr class made a strong showing early in the season, and by June of 1979, made up over 80% of the month's catch (Figure 2). It maintained this abundance by contributing 50% by number and 60% by weight to the 1979-80 season catch (Table 3). Their dominance continued into the spring of 1980; but by June, numbers of 1978 yr class fish diminished noticeably (Figure 3). By the 1980-81 season, the 1978 yr class still contributed significantly to the fishery with, 27% by number and 33% by weight (Table 4). By the 1981-82 season, this cohort was still sufficiently abundant to account for 10% of the catch by number (Table 5).

The 1979 yr class was also a major contributor to the fishery, though not as strong as the 1978 cohort. It contributed over 41% by number of the fish landed during the 1979-80 through the 1981-82 seasons (Tables 3, 4 and 5). During the 1979-80, season this cohort first appeared in January, and by June, it dominated the catch (Figure 3). During the 1980-81 season, the 1979 yr class began to decline in numbers by April, when the 1980 yr class made its strong showing (Figure 4). The 1979 yr class was the major contributor in 1981-82, as it appeared in large proportions throughout that season (Figure 5).

The 1980 cohort was less abundant when compared to the 1978 and 1979 yr classes. It contributed 29% by number and 24% by weight of the 1980-81 landings (Table 4). This cohort first appeared in December of 1980, and by April, dominated the catches (Figure 4). Although this year class was a substantial contributor in the 1981-82 season, totaling 32% by number and 31% by weight, it did not dominate the catch (Table 5). Other year classes contributed only minor amounts to the fishery during these seasons. The previously abundant 1976 yr class totaled a mere 15% during the 1978-79 season, and declined to less than 3% for the remaining seasons. Fish of the 1977 yr class totaled only 19% by number as age group I during the 1978-79 season. Three seasons later as age group IV, the 1977 yr class was almost absent, totaling less than 1% by number in the 1981-82 season (Tables 2 and 4).

The 1981 yr class demonstrated poor recruitment as young-of-the-year fish in the 1981-82 season, totaling only 15% by number (Table 4).

#### LENGTH COMPOSITION OF THE CATCH

Length data derived from Terminal Island samples showed the seasonal mean lengths to vary from a minimum of 112 mm standard length (SL) during 1979-80 season to a maximum of 122 mm SL for the 1981-82 season (Table 6).

In three of the seasons (1978-79, 1979-80, and 1980-81), the preponderance of young-of-the-year fish had a significant effect in size composition of the catch. This became noticeable early in the 1978-79 season; and by spring 1979, a sizable percentage of the catch bordered the minimum 5 in. length restriction (Figure 6). Again, in the 1979-80 season, the influx of young-of-the-year fish became evident by January, and by the spring, resulted in appreciable numbers of fish landed which were below the 5 in. size limit (Figure 7). Undersized fish were more numerous during this season, than during the previous three seasons, as they totaled over 29% of the sampled catch (Table 6). Undersized fish appeared in December of the 1980-81 season and continued to appear throughout most of the spring (Figure 8). Only in the 1981-82 season were most of the fish above the legal size limit (Figure 9).

Mean length at age data of anchovies sampled at Terminal Island were uniform for most age groups during the four seasons. Only age groups 0 and I displayed great variations, ranging from 102 to 111 mm and 113 to 121 mm SL, respectively (Table 7).

#### SEX RATIO OF THE CATCH

Females outnumbered and outweighed males throughout these four fishery seasons. The ratios of number and weight showed considerable variation, ranging from 1.17:1 (1978-79 season) to 1.59:1 (1979-80 season) by number and from 1.27:1 to 1.70:1 by weight, over the same period (Table 8). The 11 yr average since the fishery began, prior to this report, was 1.48:1 by number and 1.62:1 by weight (Table 9). A higher preponderance of young-of-the-year fish during the 1978-79 season may account for the more nearly 1:1 ratio by number compared to the other three seasons. It has been suggested in previous reports that there is a higher percentage of females in older age groups (Sunada 1979a,b).

#### DISCUSSION

The northern anchovy reduction fishery in California appears to be going through a troubled period in its history. During the

period covered by this report, landings ranged from a low of 32,390 MT (35,710 tons) for the 1979-80 season to a high of 60,678 MT (66,897 tons) for the 1980-81 season. The landed tonnage has continued to decline from the 90,718-MT (100,000-ton) seasons of the mid-1970's. Economic factors that encouraged the large landings of the mid-1970's no longer exist. When anchovy meal prices were not profitable, fishermen concentrated their fishing efforts on other fisheries. The number of vessels involved in the fishery has fluctuated during this report period, but the "basic" fleet has numbered about 20 boats. Reduction processing capacity has also remained constant, and given more favorable market conditions, the reduction fishery could approach the 90,718 MT (100,000 ton) landings of the past.

Age composition analyses show the fishery was heavily dependent on young-of-the-year and age group I and II fish. Few older cohorts were exploited by the fishery. Mais (1981) described recent age composition trends in the anchovy population, from one composed of numerous older cohorts to one composed of younger and fewer cohorts. This trend was also evident in the fishery during the period of this report. The fishery's dependence on younger and fewer cohorts could portend trouble if there were poor survival for several successive year classes. The likelihood of this, coupled with the rapidly increasing harvest by the unregulated Mexican reduction fishery, could have dire consequences for the health and stability of the anchovy population exploited by the reduction fishery.

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TABLE 1A. Anchovy Reduction Landings by Season and Port in Metric Tons.

Month	1978-79 Season			1979-80 Season		
	Monterey	Port Hueneme	Terminal Island	Monterey	Port Hueneme	Terminal Island
August	121.5	-	-	-	-	-
September	111.3	1590.8	825.4	-	1924.5	-
October	-	220.9	-	145.1	2625.8	550.6
November	-	1747.2	1588.2	884.4	162.2	-
December	-	1296.4	1591.4	1081.2	-	-
January	181.7	-	-	-	1672.9	362.8
February	closed	closed	closed	closed	closed	closed
March	closed	closed	closed	closed	closed	closed
April	250.0	755.0	11,142.4	-	-	7883.2
May	416.0	1774.9	19,595.2	-	844.1	6373.2
June	-	235.4	5493.2	-	2518.0	5361.9
Area Total (Tons)	1080.5 (1191.3)	7620.6 (8401.7)	40,235.8 (44,359.9)	2110.7 (2327.0)	9747.5 (10,746.6)	20,531.7 (22,636.2)
Season Total		48,936.9 (53,952.9)			32,389.9 (35,709.9)	

TABLE 1B. Anchovy Reduction Landings by Season and Port in Metric Tons.

Month	1980-81 Season			1981-82 Season		
	Monterey	Port Hueneme	Terminal Island	Monterey	Port Hueneme	Terminal Island
August	430.8	-	-	-	-	-
September	533.3	101.9	-	637.2	-	-
October	1477.6	402.5	-	872.1	-	-
November	149.7	587.3	-	831.9	1909.8	810.4
December	316.6	4217.1	8321.5	565.8	147.0	1363.0
January	-	1548.5	9274.6	-	320.9	1305.2
February	closed	closed	closed	closed	closed	closed
March	closed	closed	closed	closed	closed	closed
April	1366.8	599.1	10,279.8	283.2	475.4	1159.2
May	21.0	2702.5	13,160.1	527.4	1038.1	15,209.2
June	-	1869.3	3317.9	509.5	2540.7	14,644.0
Area Total (Tons)	4295.8 (4736.1)	12,028.2 (13,261.1)	44,353.9 (48,900.2)	4227.1 (4660.4)	6431.9 (7091.2)	34,491.0 (38,026.3)
Season Total		60,677.9 (66,897.4)			45,150.0 (49,777.9)	

TABLE 2. Estimated Number and Weight of Northern Anchovies Landed  
at Terminal Island by Year Class During 1978-79 Season.

Year class	1978	1977	1976	1975	1974	1973	Total
Estimated numbers (millions)	1562.2	469.4	314.1	39.5	12.6	1.0	2399.2
Standard deviation (millions)	40.7	16.9	15.2	4.5	2.6	0.7	
Percent	65.2	19.6	13.1	1.6	0.5	0.0	
Estimated weight (MT)	22,739	9117	7163	1028	307	25	40,379
Standard deviation (MT)	537	334	351	120	64	18	
Percent	56.3	22.6	17.7	2.5	0.8	0.1	

TABLE 3. Estimated Number and Weight of Northern Anchovies Landed at Terminal Island by Year Class During 1979-80 Season.

Year Class	1979	1978	1977	1976	1975	Total
Estimated numbers (millions)	599.5	700.7	90.7	14.7	1.1	1406.7
Standard deviation (millions)	42.6	19.4	8.0	3.0	0.7	
Percent	42.6	49.8	6.4	1.0	0.0	
Estimated weight (MT)	6189	12,378	1806	331	27	20,731
Standard deviation (MT)	393	362	167	68	17	
Percent	29.8	59.7	8.7	1.5	0.0	

TABLE 4. Estimated Number and Weight of Northern Anchovies Landed at Terminal Island by Year Class During 1980-81 Season.

Year Class	1980	1979	1978	1977	1976	Total
Estimated Numbers (millions)	812.2	1148.4	749.7	75.5	5.8	2791.6
Standard deviation (millions)	30.7	31.7	23.2	7.5	1.7	
Percent	29.1	41.1	26.8	2.7	0.2	
Estimated Weight (MT)	10,876	17,198	14,580	1655	146	44,455
Standard deviation (MT)	410	419	469	170	44	
Percent	24.5	38.7	32.8	3.7	0.3	

TABLE 5. Estimated Number and Weight of Northern Anchovies Landed at Terminal Island by Year Class During 1981-82 Season.

Year Class	1981	1980	1979	1978	1977	Total
Estimated Number (millions)	253.2	519.7	684.2	167.0	1.9	1,626.0
Standard deviation (millions)	28.1	19.2	19.3	10.3	1.1	
Percent	15.6	32.0	42.0	10.3	0.1	
Estimated Weight (MT)	3915	10,116	14,406	3958	55	32,450
Standard deviation (MT)	379	340	401	233	28	
Percent	12.0	31.1	44.4	12.2	0.2	

TABLE 6. Length-Frequency by Percent from Sampled Landings at Terminal Island.

Season	Standard length increments (mm)									Mean length
	85-94	95-104	105-114	115-124	125-134	135-144	145-154	155-164	>165	
1978-79 N=4069	0.4	8.0	38.6	32.3	15.7	4.6	0.3	0.1	-	116
1979-80 N=2314	4.9	24.5	20.9	26.4	21.0	2.1	0.1	-	-	112
1980-81 N=4689	0.8	10.9	40.4	31.1	14.1	2.7	0.1	-	0.1	115
1981-82 N=3004	0.2	3.7	16.4	42.5	30.2	6.7	0.3	-	-	122

TABLE 7. Anchovy Mean Standard Length in mm at Each Age by Season.

Season	Age group					
	0	I	II	III	IV	V
1978-79						
Year Class	1978	1977	1976	1975	1974	1973
Mean Length	111	121	128	134	131	145
1979-80						
Year Class	1979	1978	1977	1976	1975	----
Mean Length	102	121	126	131	136	----
1980-81						
Year Class	1980	1979	1978	1977	1976	----
Mean Length	109	113	123	127	133	----
1981-82						
Year Class	1981	1980	1979	1978	1977	----
Mean Length	111	121	124	129	131	----

Note: There were no age group V fish sampled during the 1979-80 through 1981-82 seasons.



TABLE 8. Sex Ratio by Number and Weight for 1978-79 through 1981-82 Season.

Sex Ratio by Number	1978-79	1979-80	1980-81	1981-82
<u>Males</u>				
Number (millions)	1012.4	484.1	1045.9	644.6
Percent	42.2	34.4	37.4	39.6
<u>Females</u>				
Number (millions)	1188.8	771.0	1473.4	883.0
Percent	49.5	54.8	52.8	54.3
<u>Unknown</u>				
Number (millions)	198.2	151.7	272.3	98.4
Percent	8.3	10.8	9.8	6.0
Season Total	2399.4	1406.8	2791.6	1626.0
Sex Ratio F:M	1.17:1	1.59:1	1.40:1	1.37:1
<u>Sex Ratio by Weight (MT)</u>				
<u>Males</u>				
Weight	16,656.0	7094.1	16,080.7	12,338.8
Percent	41.3	34.3	36.2	38.0
<u>Females</u>				
Weight	21,152.0	12,084.9	24,818.9	18,302.0
Percent	52.4	58.4	55.8	56.4
<u>Unknown</u>				
Weight	2570.0	1503.0	3556.3	1808.8
Percent	6.4	7.3	8.0	5.6
Season Total	40,378.0	20,682.0	44,455.9	32,449.6
Sex Ratio F:M	1.27:1	1.70:1	1.54:1	1.48:1

TABLE 9. Anchovy Sex Ratio from 1966-67 to 1977-78.

Season	Sex ratio by number F:M	Sex ratio by weight F:M
1966-67	1.6:1	1.8:1
1967-68	no data	no data
1968-69	1.4:1	1.5:1
1969-70	1.1:1	1.3:1
1970-71	1.6:1	1.7:1
1971-72	1.3:1	1.6:1
1972-73	2.0:1	2.1:1
1973-74	2.0:1	2.2:1
1974-75	1.6:1	1.7:1
1975-76	1.5:1	1.6:1
1976-77	1.1:1	1.2:1
1977-78	1.1:1	1.2:1
11 yr mean	1.5:1	1.6:1

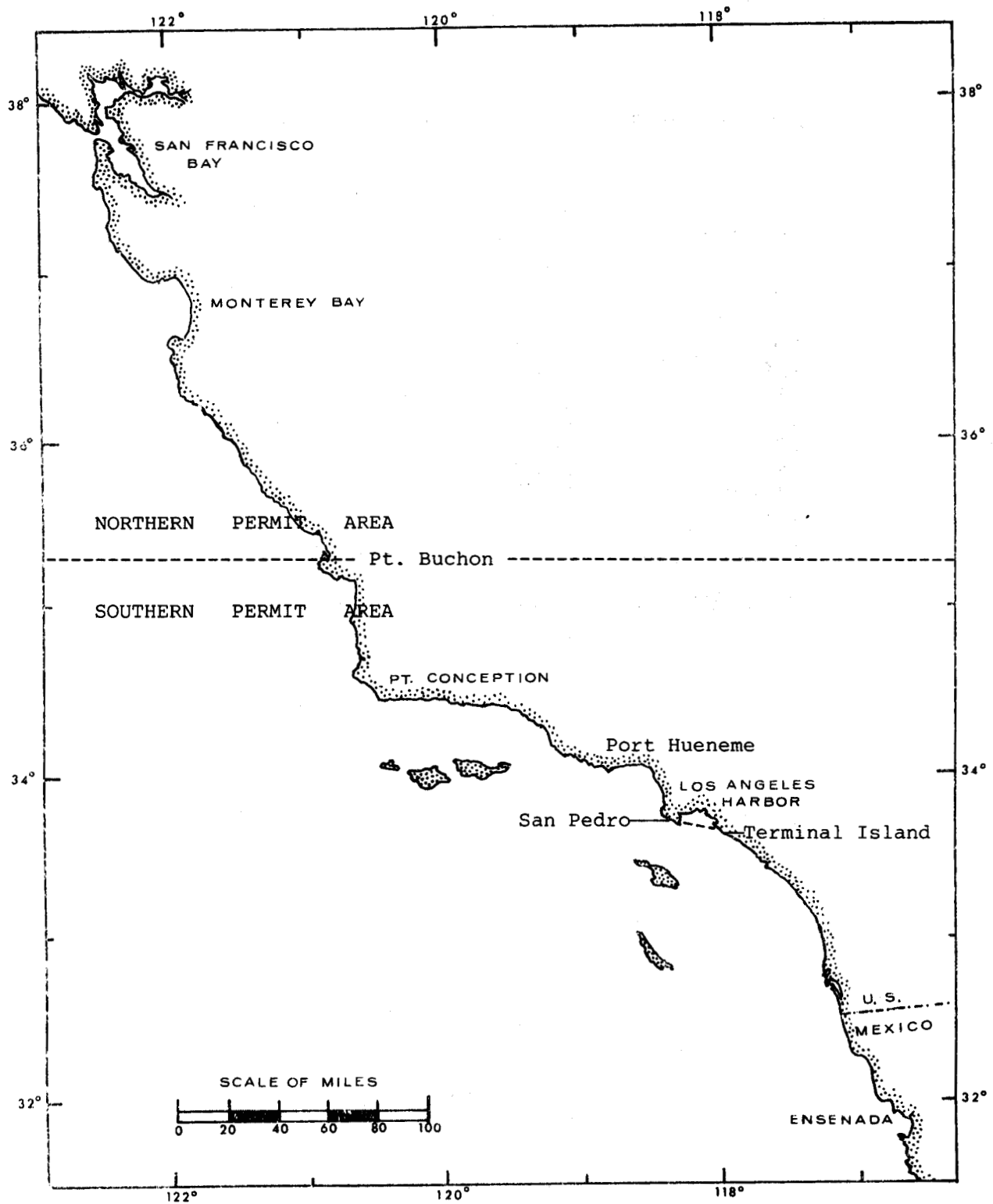


FIGURE 1. Major fishing ports and boundary for northern permit area and southern permit area.

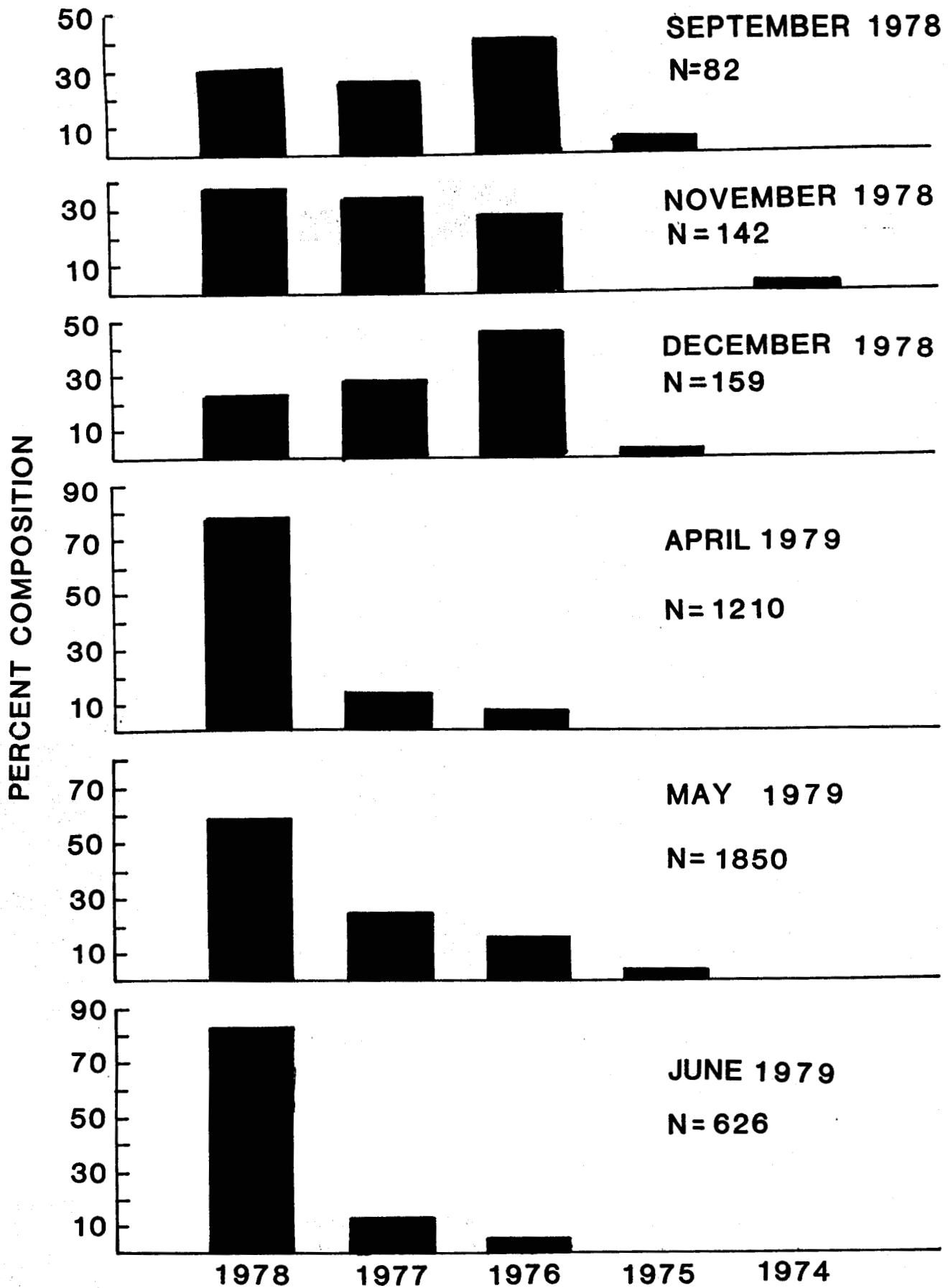


FIGURE 2. Monthly anchovy age composition from Terminal Island during the 1978-79 season.

PERCENT COMPOSITION

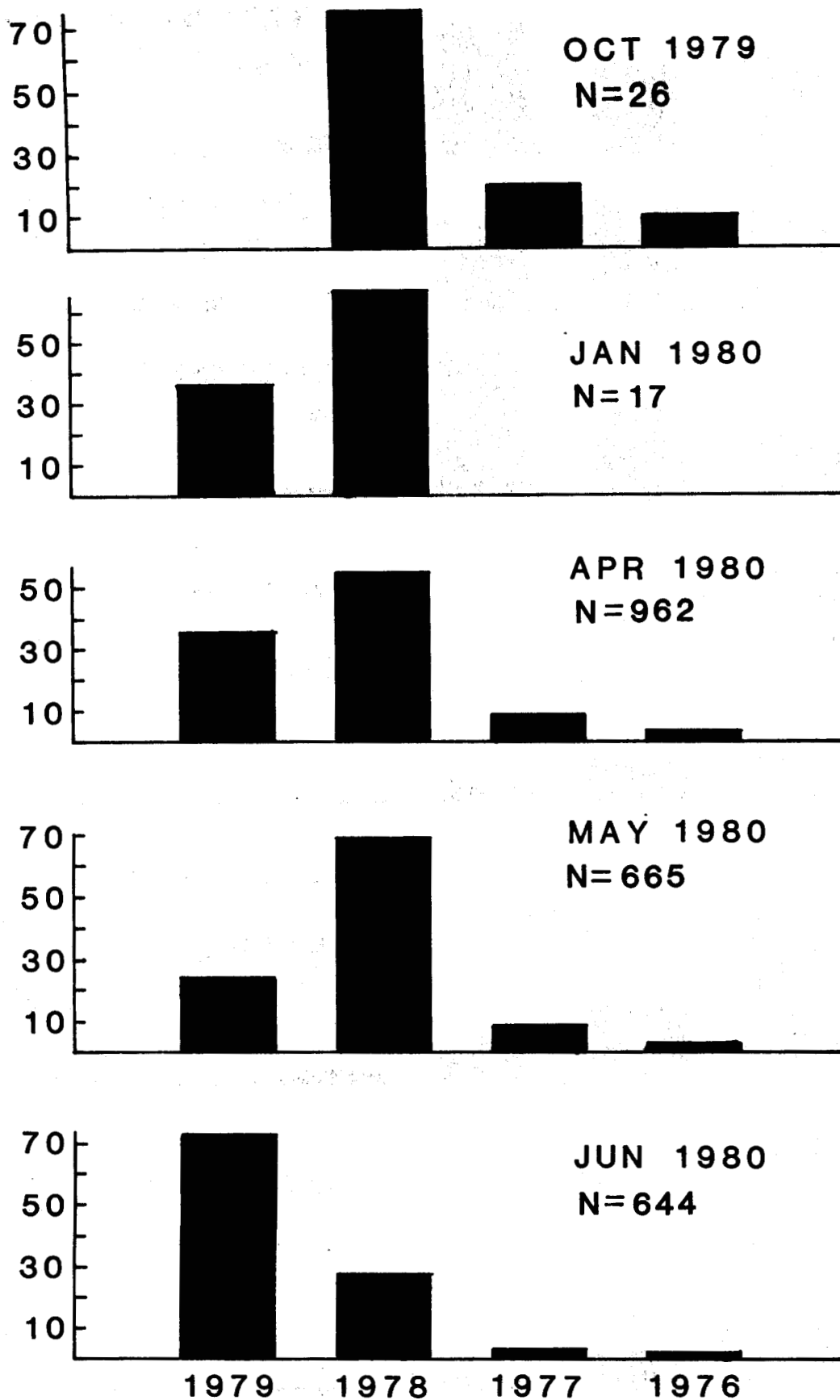


FIGURE 3. Monthly anchovy age composition from Terminal Island during the 1979-80 season.

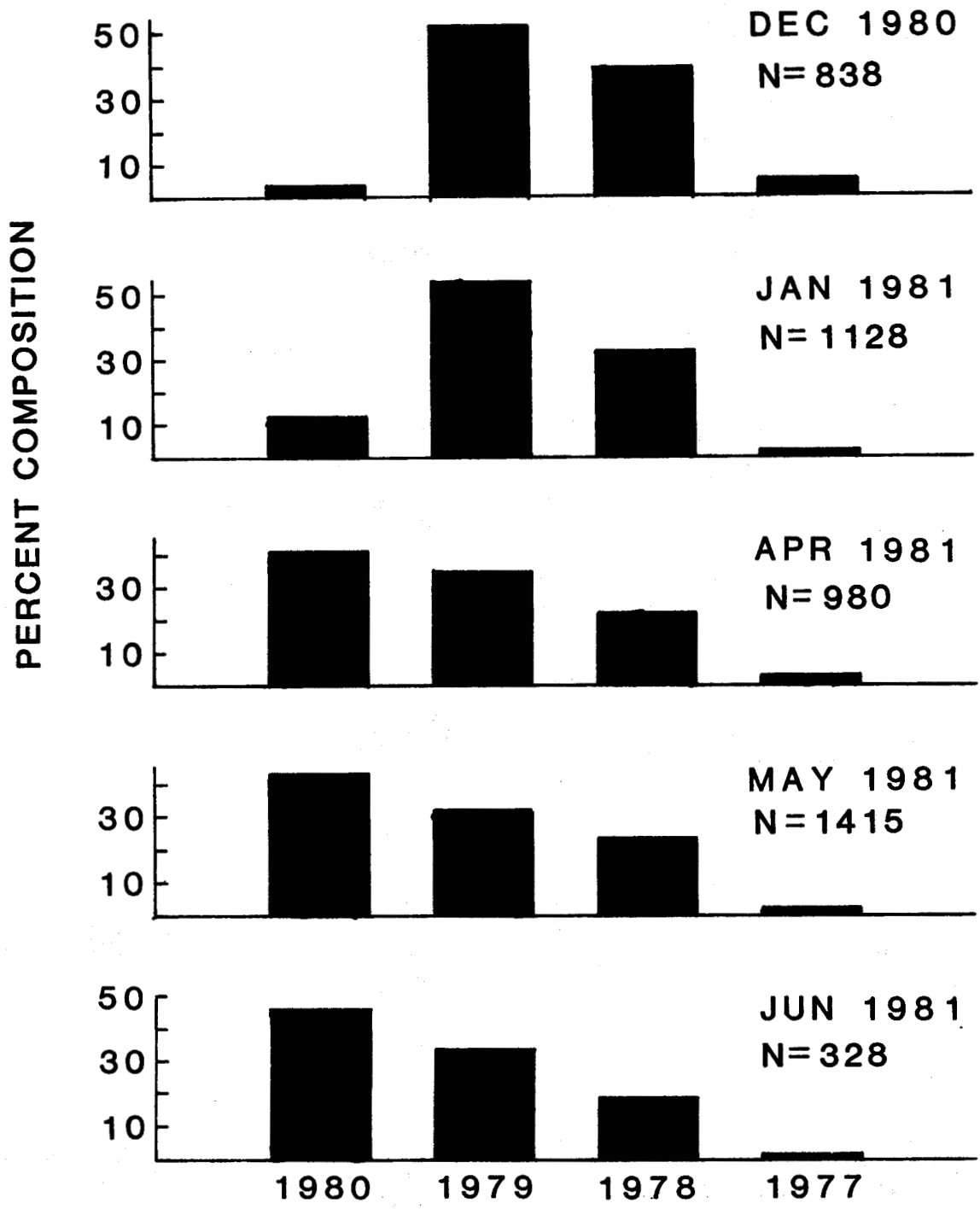


FIGURE 4. Monthly anchovy age composition from Terminal Island during the 1980-81 season.

PERCENT COMPOSITION

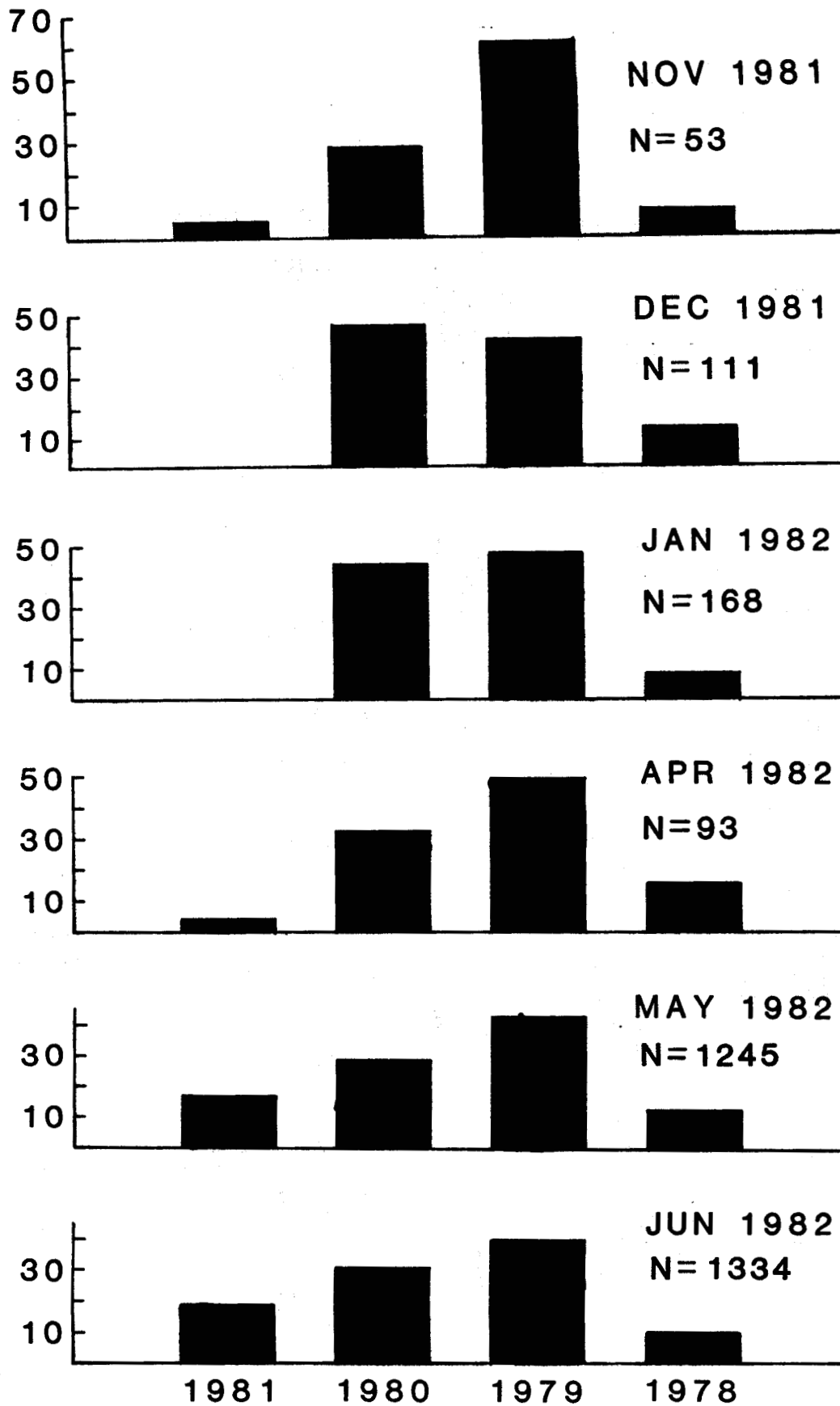


FIGURE 5. Monthly anchovy age composition from Terminal Island during the 1981-82 season.

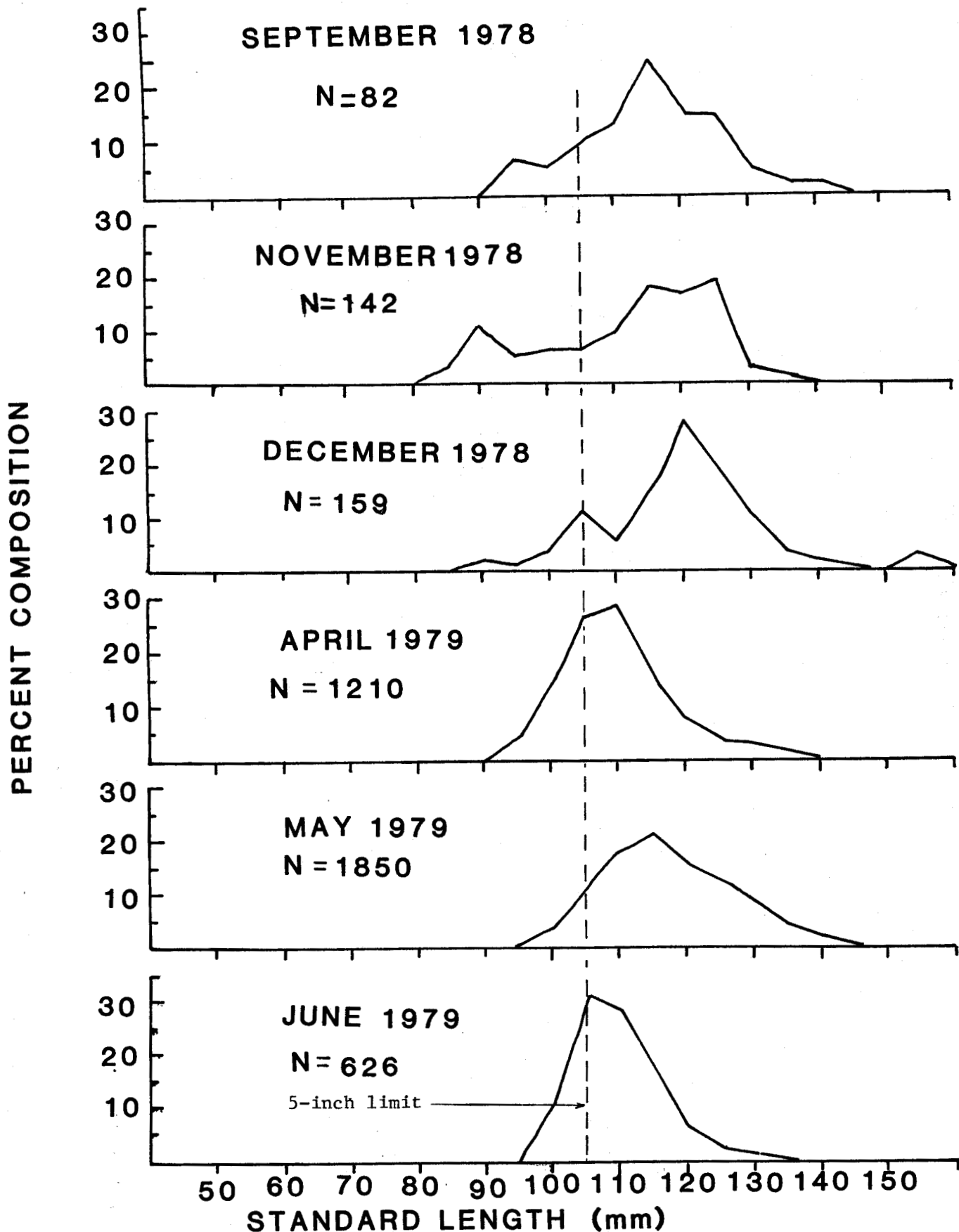


FIGURE 6. Monthly length frequency distribution of anchovies landed at Terminal Island during the 1978-79 season.



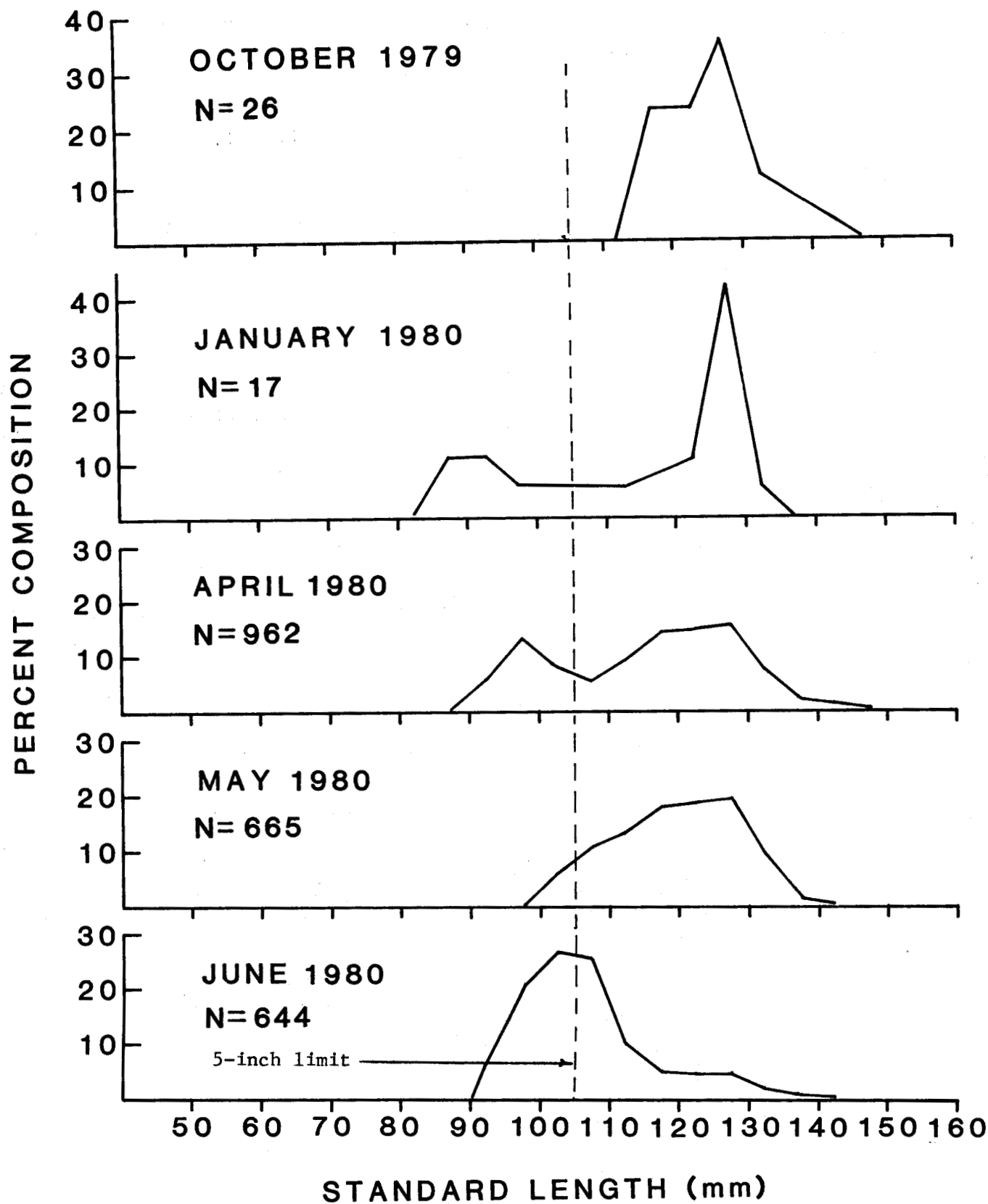


FIGURE 7. Monthly length frequency distribution of anchovies landed at Terminal Island during the 1979-80 season.

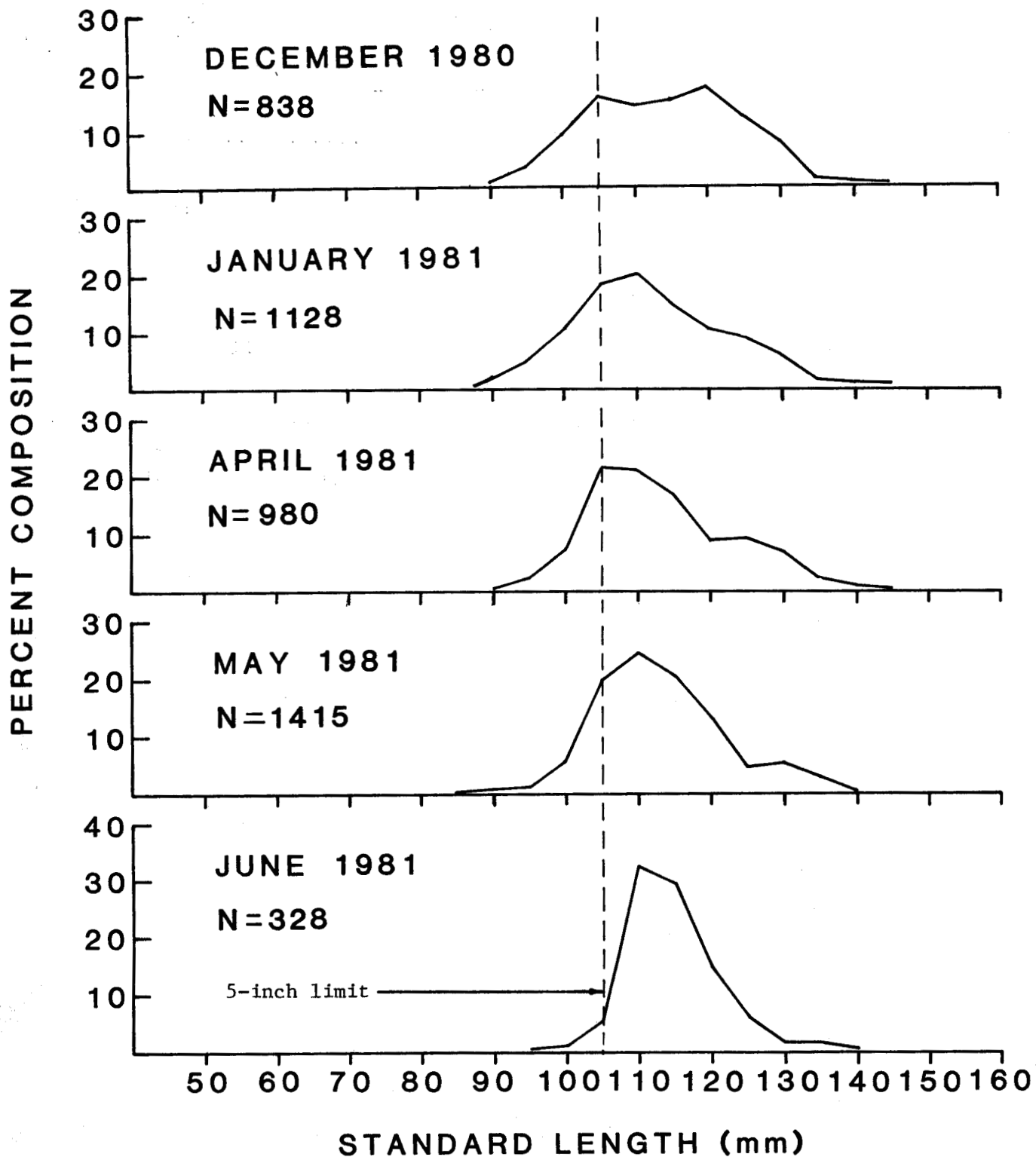


FIGURE 8. Monthly length frequency distribution of anchovies landed at Terminal Island during the 1980-81 season.

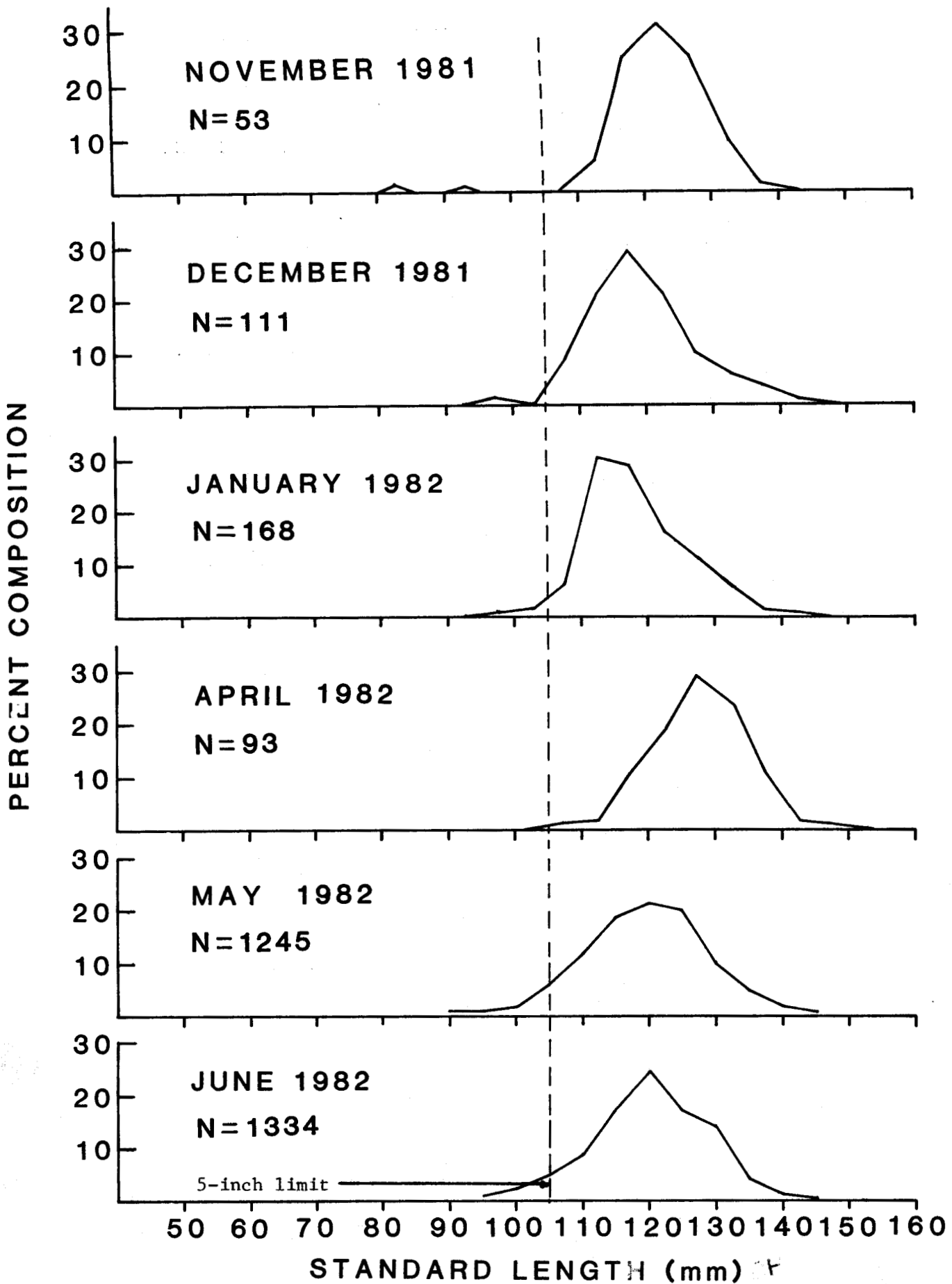


FIGURE 9. Monthly length frequency distribution of anchovies landed at Terminal Island during the 1981-82 season.

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