# THE ANCHOVY REDUCTION FISHERY FOR THE 1977-78 SEASON


by

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## ABSTRACT

Landings for the 1977-78 season were 62,118 metric tons (68,476 tons) in southern California and 6,541 metric tons (7,212 tons) in central California. The southern area's samples were characterized by the dominance of the 1976 year class (38%) while central California data indicated the 1977 year class (38%) as the most abundant year class. Sex ratios indicated a near 1:1 ratio for both southern and central California.

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Special thanks goes to Paula Riley and Charel Cueva for their patience for typing numerous revisions.

## INTRODUCTION

This report results from monitoring the anchovy reduction fishery during the 1977-78 season and describes the catch, age, sex and size of the sampled anchovy population. Estimated numbers were derived from 2,829 fish sampled at San Pedro and 546 fish at Moss Landing. Methods for age determination and sexual development were related previously by Collins and Spratt (1969) and Sunada (1977).

## THE FISHERY

### Southern California

The fishing season commenced on September 15, 1977 and terminated May 15, 1978 with a seasonal quota of 90,718 metric tons (100,000 tons). This was the last season to be regulated by the California Fish and Game Commission. Subsequent seasons will be under the jurisdiction of the Pacific Fishery Management Council. Two fishing fleets operate within the Southern California Bight; the Port Hueneme fleet numbering three purse seiners and the main San Pedro fleet totaling 30 purse seiners.

Ex-vessel prices for anchovies fluctuated between $38 to $45 per short ton with the highest prices quoted at season's end.

Of the season's total of 62,118 metric tons (68,476 tons), 12,519 mt (13,801 tons) were landed at Port Hueneme, while 49,599 mt (54,675 tons were unloaded at Terminal Island (Table 1). This southern area total was the lowest since the 1971-72 season when 47,572 mt (52,440 tons) were landed (Spratt, 1973).

The season began with numerous problems associated with labor, price and cannery maintenance. Once these problems were resolved, fishing improved considerably resulting in peak landings in October and November, (Table 2). Largely as a result of price dispute between processors and

TABLE 1. Anchovy Reduction Landings for 1977-78 Season by Port-Weight in Metric Tons.

| Month | Central Calif. Moss Landing | Southern California Port Hueneme | Terminal Island | Total | % |
|---|---|---|---|---|---|
| August | 375 | 0 | 0 | 375 | 0.5 |
| September | 1,278 | 2,450 | 5,882 | 9,610 | 14.0 |
| October | 1,132 | 4,490 | 19,379 | 25,001 | 36.4 |
| November | 1,412 | 4,246 | 17,835 | 23,493 | 34.2 |
| December | 2,276 | 378 | 6,495 | 9,149 | 13.4 |
| January | 48 | 0 | 0 | 48 | 0.1 |
| February | 0 | 27 | 0 | 27 | 0.1 |
| March | 0 | 118 | 0 | 118 | 0.2 |
| April | 0 | 491 | 8 | 499 | 0.7 |
| May | 20 | 319 | 0 | 339 | 0.4 |
| Total | 6,541 | 12,519 | 49,599 | 68,659 | 100.0 |
| % | 9.5 | 18.2 | 72.3 | 100.0 | |

fishermen, the unavailability of commercial fish schools, and the severe weather of early 1978 the usual spring fishery failed to develop.

Nearly 40% of the season's landings was caught in fishing grounds off San Pedro while the Santa Barbara region yielded a third of the catch, (Table 2). Majority of catches made during September and November occurred off the Santa Barbara region, with San Pedro area yielding the major share of October and December landings (Table 2).

### Central California

This area opened on August 1, 1977 and closed on May 15, 1978 with a seasonal quota of 13,608 mt (15,000 tons). Landings reached 6,541 mt (7,212 tons) with nearly all of this being caught during the autumn months (Table 1). Fishing continued up to January when the herring fishery in San Francisco Bay commenced. Only a single purse seiner remained in Monterey during the remainder of the season.

The fleet numbered five purse seiners and five lampara boats with the purse seiners landing the bulk of the catch. Fishing occurred predominantly in Monterey Bay. Ex-vessel price of anchovies fluctuated between $34.50 to $40.25 per ton.

## AGE COMPOSITION OF THE CATCH

### Southern California

Nearly 38% of the estimated 2.5 billion fish landed were the 1976 year class (age group I) while the 1975 year class accounted for 20% of the fish landed (Table 3). The abundance of the 1976 cohort was evident throughout the season, while the 1975 year class remained in below average numbers (Figure 1). Fish of the 1977 year class, constituting 10.6% by number appeared relatively early in the season for young-of-the-year fish (Figure 1). Older age groups III-VI (1974 through 1971 year classes) totaled nearly 31% by number. The 1973 year class appeared to be the last successful year class prior to the 1976 year class (Table 3).

**TABLE 2. Southern California Landings by Block Origin and Area. Weight in Metric Tons.**

| Area | Block # | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May | Total | Percent |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Santa Barbara | 653-670 | 7,207 | 4,490 | 8,563 | 668 | - | 27 | 118 | 209 | 319 | 21,601 | 34.8 |
| Port Hueneme | 682-688 | 300 | 128 | 463 | - | - | - | - | - | - | 891 | 1.4 |
| Point Dume | 700-707 | 530 | 7,675 | 4,832 | 1,363 | - | - | - | 282 | - | 14,682 | 23.6 |
| San Pedro Channel | 719-743 | 231 | 11,536 | 8,128 | 4,821 | - | - | - | 8 | - | 24,724 | 39.8 |
| Catalina Island | 758-762 805-807 | - | 41 | 96 | 22 | - | - | - | - | - | 159 | 0.3 |
| Oceanside | 757,802,849 | 61 | - | - | - | - | - | - | - | - | 61 | 0.1 |
| Total | | 8,332 | 23,870 | 22,082 | 6,874 | - | 27 | 118 | 499 | 319 | 62,118 | |
| % | | 13.4 | 38.4 | 35.6 | 11.0 | | 0.1 | 0.2 | 0.8 | 0.5 | | 100.0 |

TABLE 3. Estimated Number and Weight of Anchovies Landed at Terminal Island by Age and Year Class for 1977-78 Season.

| AGE<br>Year class | 0<br>1977 | 1<br>1976 | 2<br>1975 | 3<br>1974 | 4<br>1973 | 5<br>1972 | 6<br>1971 | 7<br>1970 | 10<br>Unknown | 13<br>Total |
|---|---|---|---|---|---|---|---|---|---|---|
| Estimated numbers | 259,527,000 | 924,896,000 | 496,559,000 | 343,442,000 | 346,717,000 | 58,433,000 | 5,375,000 | 2,705,000 | 13,147,000 | 2,450,801,000 |
| Standard deviation | 18,498,716 | 25,400,287 | 17,612,911 | 16,406,073 | 15,456,026 | 6,939,727 | 2,107,859 | 1,487,942 | 2,985,935 | |
| Percent | 10.6 | 37.7 | 20.3 | 14.0 | 14.1 | 2.4 | 0.2 | 0.1 | 0.5 | 100.0 |
| Estimated metric tons | 3,093 | 17,916 | 10,492 | 7,865 | 8,129 | 1,562 | 156 | 62 | 324 | 49,599 |
| Standard deviation | 218 | 489 | 385 | 383 | 368 | 190 | 63 | 34 | 74 | |
| Percent | 6.2 | 36.1 | 21.2 | 15.9 | 16.4 | 3.1 | 0.3 | 0.1 | 0.7 | 100.0 |

TABLE 4. Estimated Number and Weight of Anchovies Landed at Moss Landing by Age and Year Class for 1977-78 Season.

| AGE<br>Year class | 0<br>1977 | 1<br>1976 | 2<br>1975 | 3<br>1974 | 4<br>1973 | 5<br>1972 | 6<br>1971 | 7<br>1970 | Unknown | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| Estimated numbers | 89,327,000 | 20,425,000 | 54,185,000 | 33,893,000 | 19,754,000 | 9,560,000 | 3,890,000 | 454,000 | - | 231,488,000 |
| Standard deviation | 16,019,496 | 4,064,379 | 14,854,014 | 6,090,281 | 3,550,024 | 4,536,717 | 2,439,933 | 487,500 | - | - |
| Percent | 38.6 | 8.8 | 23.4 | 14.6 | 8.5 | 4.2 | 1.7 | 0.2 | | 100.0 |
| Estimated metric tons | 1,354 | 436 | 1,389 | 941 | 675 | 375 | 182 | 25 | | 5,377 |
| Standard deviation | 229 | 84 | 384 | 181 | 124 | 169 | 114 | 26 | | - |
| Percent | 25.2 | 8.0 | 25.8 | 17.5 | 12.6 | 7.0 | 3.4 | 0.5 | | 100.0 |

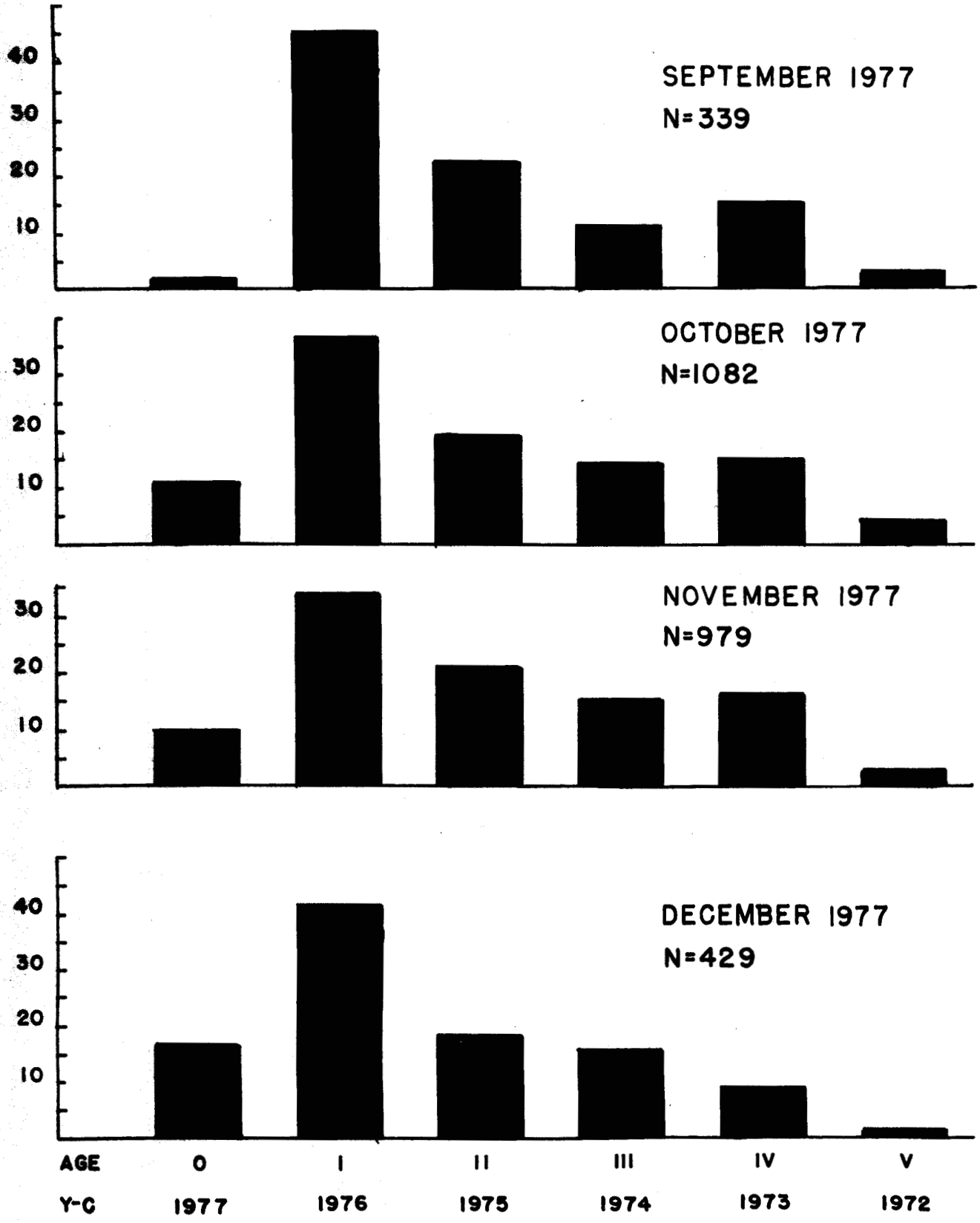



FIGURE 1 Anchovy age composition by month for Southern California 1977-78 Season

### Central California

The 1977 year class (young-of-the-year) fish were numerically dominant (38.6% of the 231 million fish) while the 1975 cohort (age group II) contributed 23% by number (Table 4). The 1976 year class (age group I) totaled only 9% by number while this year class dominated southern California's catches. Older age groups (III - VI) totaled only 29% by number compared to the previous season's totals of 77% by number weight (Sunada, 1979). The younger age groups dominated the catch throughout most of the season (Figure 2).

## LENGTH COMPOSITION OF THE CATCH

### Southern California

The length composition derived from the sampled catch indicated 55% of the 2.5 billion fish to be below 125 mm standard length (Table 5) which was similar to previous seasons' results. A single mode near 120 mm (4.7 inches) SL was present throughout the season and a slight mode near 90 mm (3.5 inches) SL (1977 year class) appeared in December (Figure 3). Females were again larger than males in all age groups (Table 6).

### Central California

Only 54% of the estimated 231 million fish were greater than 125 mm (5 inches) SL as compared to 94% the previous season (Sunada, 1979) (Table 4). Large numbers of 1977 year class fish were apparent during November when most of the fish were smaller than 125 mm (5 inches) SL (Figure 4). The 1977 cohorts reduced the average length; 125 mm (5 inches) SL from mean length of 139 mm (5.5 inches) SL of the preceding season (Table 6).

## SEXUAL DEVELOPMENT AND SEX RATIO

### Southern California

Near mature and maturing (stages 4-6) fish appeared in October and

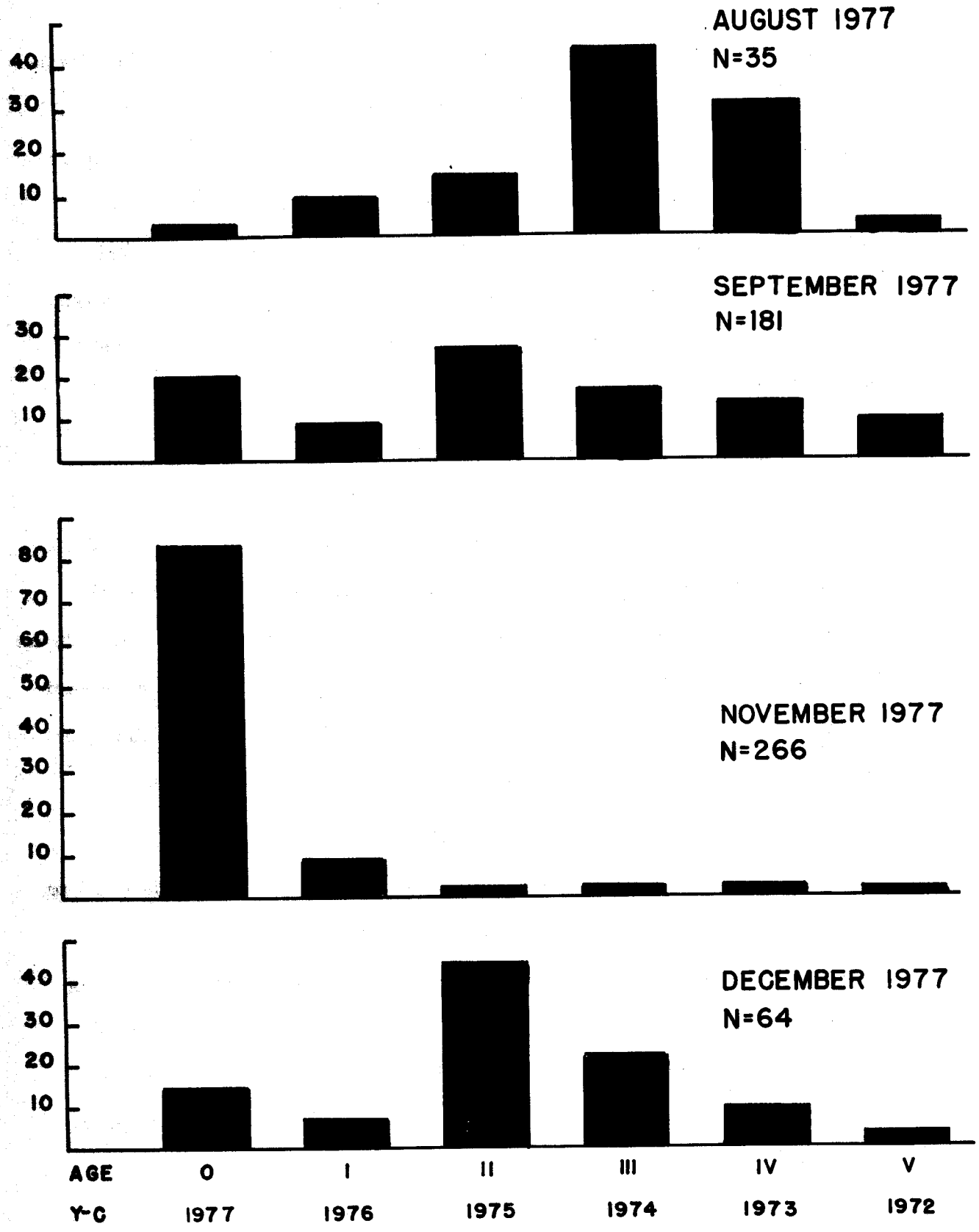



FIGURE 2 Anchovy age composition by month for Central California 1977-78 Season

**TABLE 5. Estimated Numbers by Length of Anchovies Landed at Terminal Island and Moss Landing During 1977-78 Season.**

| Length Group (mm SL) | TERMINAL ISLAND | | | MOSS LANDING | | |
|---|---|---|---|---|---|---|
| | Estimated Number | Standard Deviation | Percent of Total | Estimated Number | Standard Deviation | Percent of Total |
| 75-84 | 6,241,000 | 2,842,175 | 0.3 | 350,000 | 387,096 | 0.2 |
| 85-94 | 36,630,000 | 6,905,081 | 1.5 | 887,000 | 579,164 | 0.4 |
| 95-104 | 74,231,000 | 8,384,829 | 3.0 | 11,703,000 | 5,703,224 | 5.1 |
| 105-114 | 201,829,000 | 15,525,085 | 8.2 | 49,602,000 | 6,486,961 | 21.4 |
| 115-124 | 1,029,384,000 | 28,097,124 | 42.0 | 45,179,000 | 9,324,612 | 19.5 |
| 125-134 | 849,929,000 | 20,653,352 | 34.7 | 55,786,000 | 4,544,794 | 24.1 |
| 135-144 | 218,961,000 | 13,384,543 | 8.9 | 44,925,000 | 7,417,027 | 19.4 |
| 145-154 | 31,059,000 | 5,293,626 | 1.3 | 13,701,000 | 4,485,438 | 5.9 |
| 155-164 | 2,537,000 | 1,466,703 | 0.1 | 8,588,000 | 2,867,607 | 3.7 |
| 165-174 | - | - | - | 767,000 | 545,304 | 0.3 |
| Total | 2,450,801,000 | | 100.0 | 231,488,000 | | 100.0 |

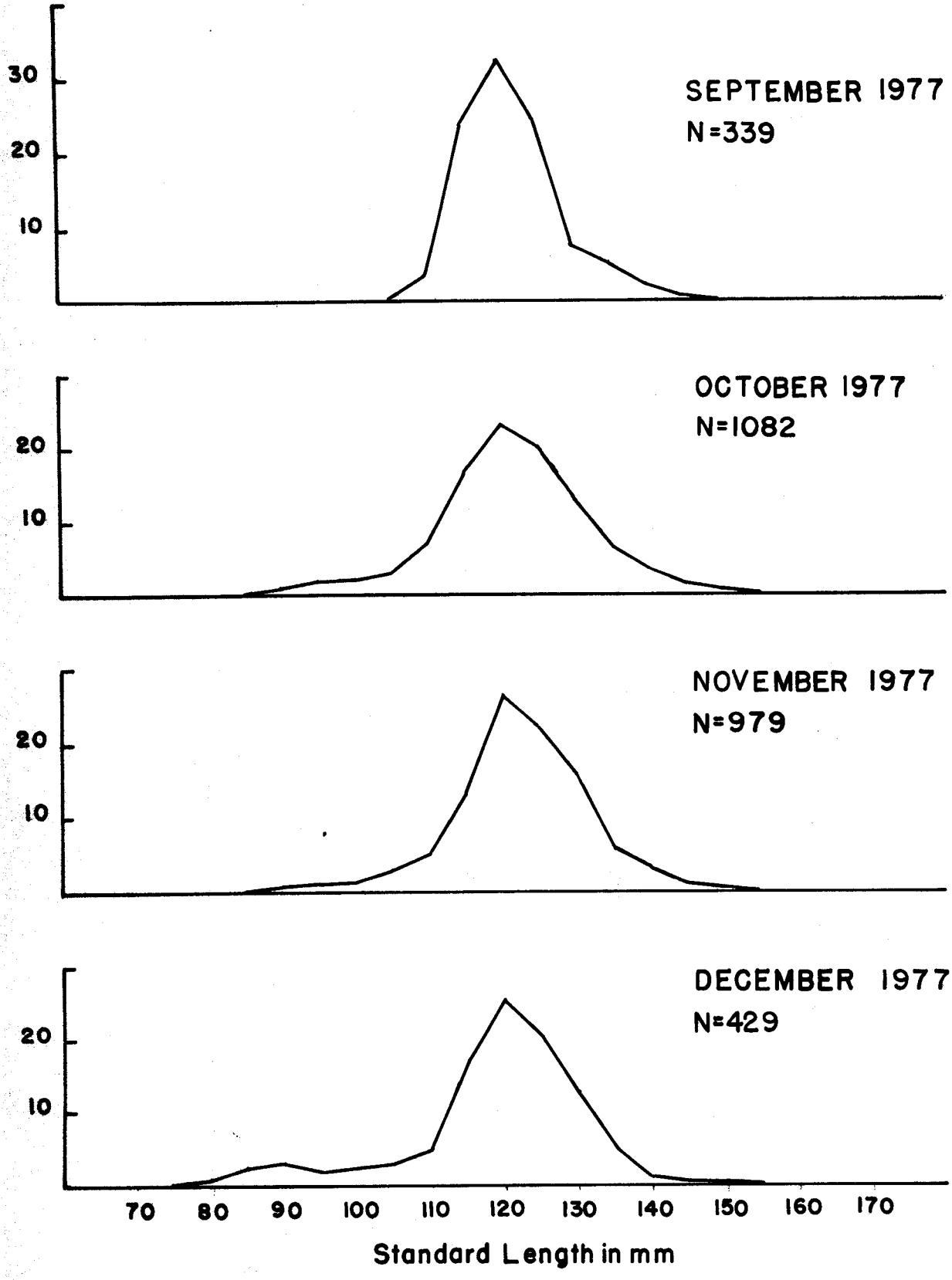



FIGURE 3 Anchovy length distribution by month for Southern California 1977-78 Season

TABLE 6. Mean Length (mm SL) of Males and Females Landed at Terminal Island and Moss Landing by Year Class.

| Year Class | 1977 | 1976 | 1975 | 1974 | 1973 | 1972 | 1971 | 1970 | Length of All Year Classes |
|---|---|---|---|---|---|---|---|---|---|
| Age group | 0 | I | II | III | IV | V | VI | VII | |
| Terminal Island | | | | | | | | | |
| Males | | | | | | | | | |
| Length | 107 | 121 | 124 | 126 | 128 | 134 | 132 | 124 | 122 |
| Females | | | | | | | | | |
| Length | 108 | 123 | 127 | 131 | 132 | 137 | 143 | - | 126 |
| Moss Landing | | | | | | | | | |
| Males | | | | | | | | | |
| Length | 112 | 123 | 130 | 137 | 147 | 152 | 158 | 157 | 124 |
| Females | | | | | | | | | |
| Length | 112 | 122 | 135 | 139 | 145 | 153 | 162 | 166 | 127 |

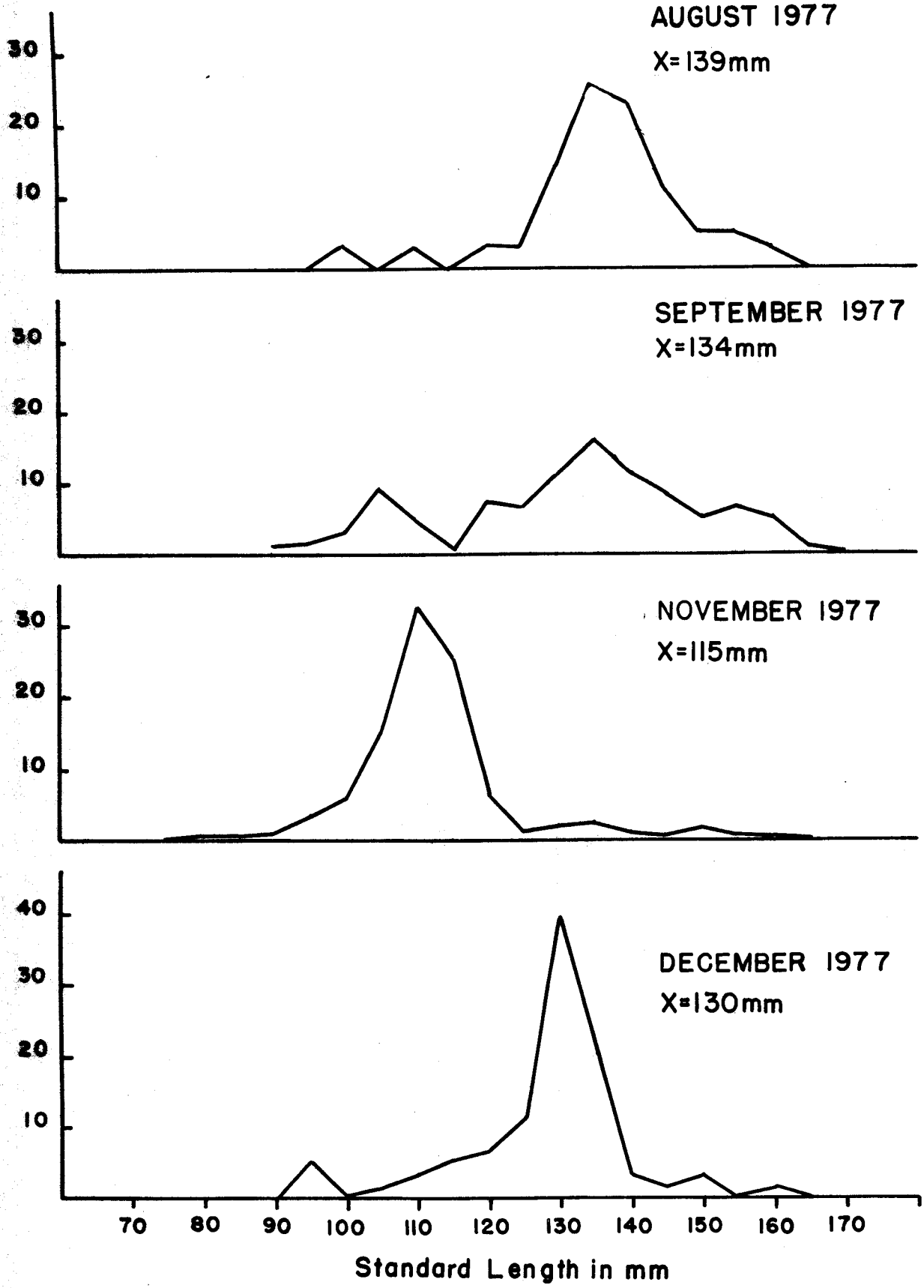



**FIGURE 4** Anchovy length distribution by month for Central California 1977-78 Season

continued to increase in December (Figure 5).

Females were slightly more numerous than males by a 1.09:1 ratio by number (Table 7). When compared on an age group basis, males outnumbered females in age group 0, while females prevailed in older age groups (Figure 6). Previous season's results indicate similar findings in age group 0 when males dominated the sex composition (Sunada, 1979).

### Central California

Maturing fish were present during September when 20% of the males and 10% of the females were noted at stage 4 development (Figure 7). Samples from succeeding months displayed scant signs of advanced stages.

Sex ratios were almost a 1:1 ratio by number (Table 7). Comparison of sex ratios by age groups showed slightly greater numbers of females among age groups 0 to I (1977 and 1976 year classes) (Figure 6). The near 1:1 ratio can be attributed to increased numbers of young fish, whereas the previous season's catches were dominated by older age groups (Sunada, 1979).

## CONCLUSION

The southern California catch of 62,118 mt (68,476 tons) was the lowest since the 1971-72 season as a result of poor fish availability, unfavorable weather and labor problems. Another alarming fact was the continued low numbers of 1975 and 1974 year class fish, which constituted 20% and 14% respectively of the catch. The 1976 cohort remained the dominant year class, while the 1977 year class appeared relatively early in the season. Mais (1977, 1978) in his sea survey trawl samples derived similar age compositions (Figure 8).

Central California samples were dominated numerically by the 1977 year class (age group 0) while older age groups were in below average numbers.

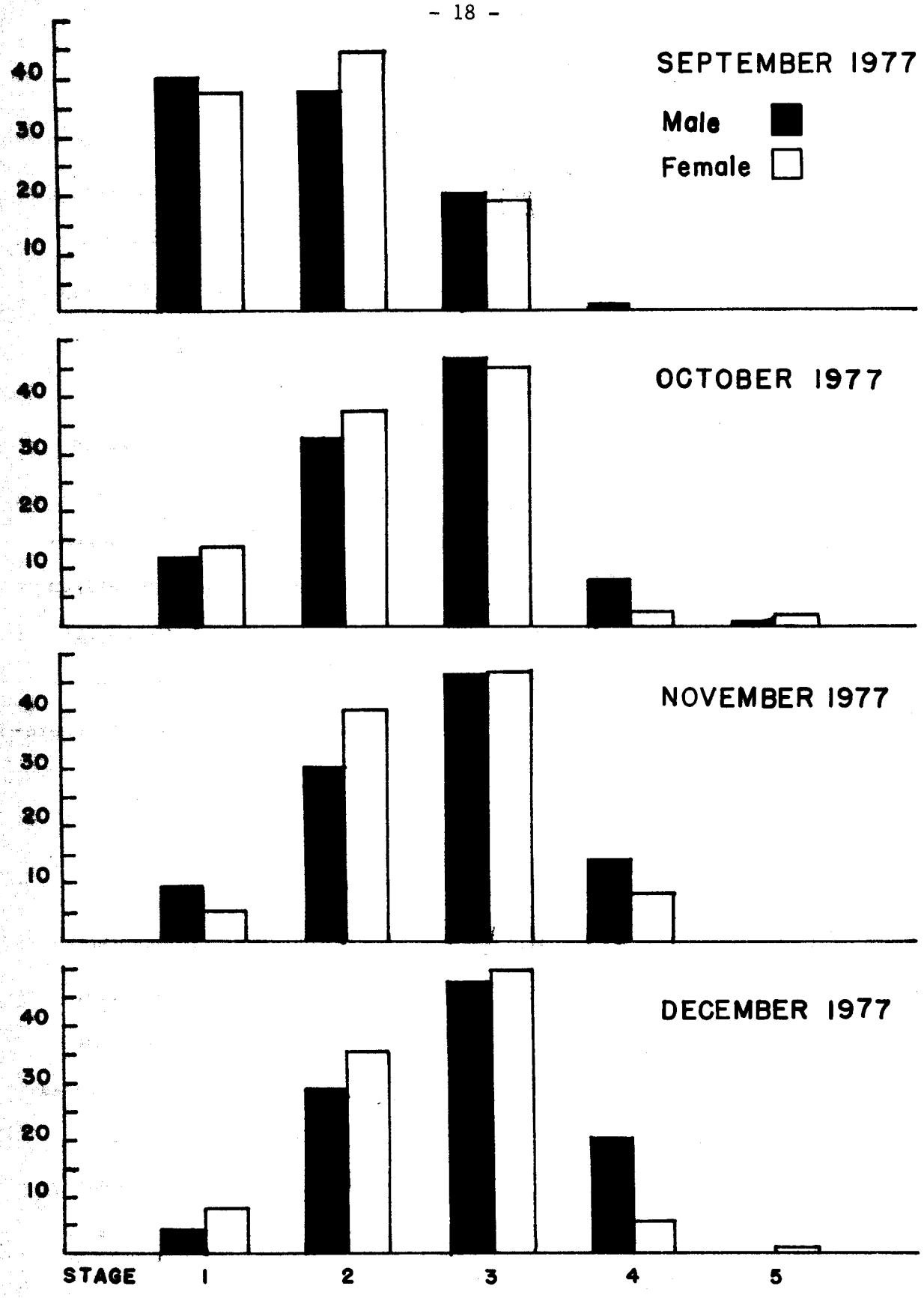
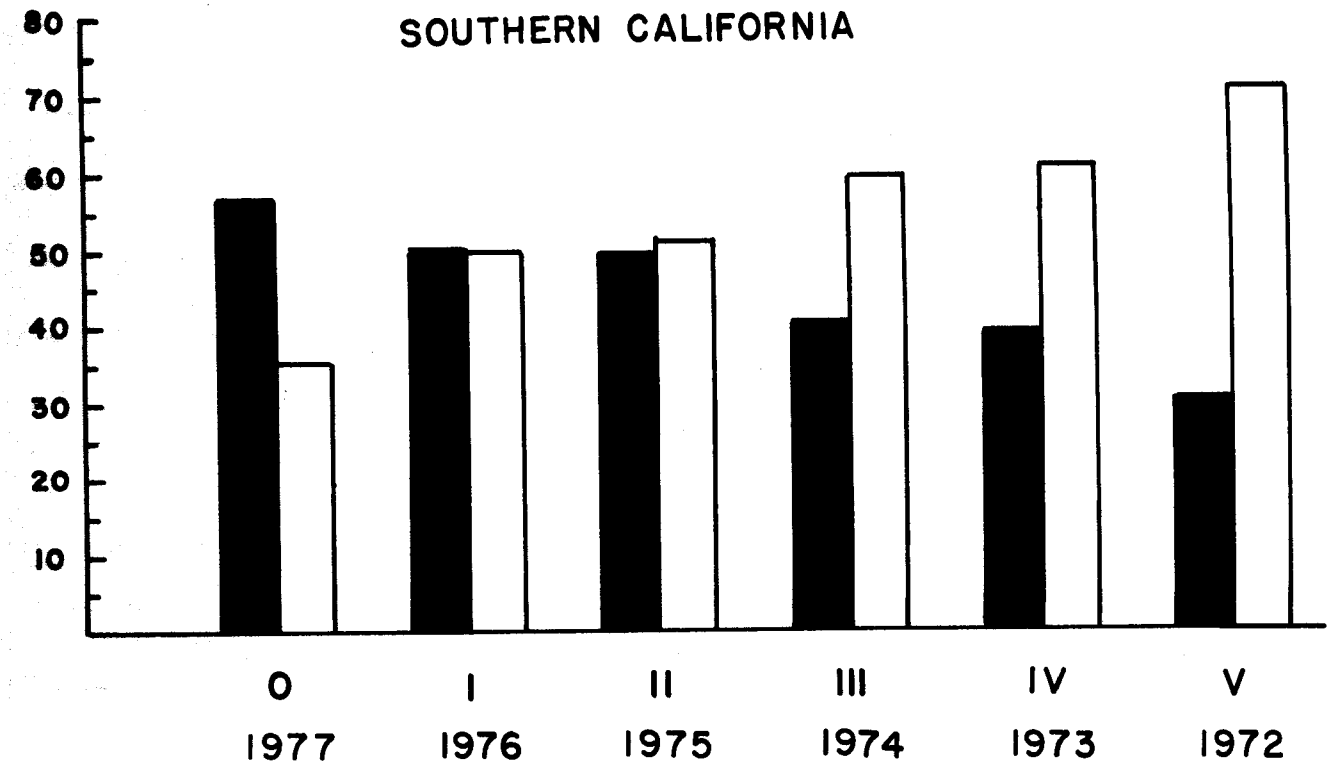



FIGURE 5 Sexual maturity of anchovies for Southern California during 1977-78 Season

TABLE 7. Sex Ratio by Number and Weight of Anchovies for 1977-78 Season.

| Sex ratio by number | Terminal Island | Moss Landing |
|---|---|---|
| **Males** | | |
| Number | 1,088,840,000 | 108,294,000 |
| Percent | 44.4 | 46.8 |
| **Females** | | |
| Number | 1,189,152,000 | 108,613,000 |
| Percent | 48.5 | 46.9 |
| **Unknown** | | |
| Number | 172,809,000 | 14,581,000 |
| Percent | 7.1 | 6.3 |
| **Total sex ratio** | 2,450,801,000 | 231,488,000 |
| **Female:Male** | 1.09:1 | 1.00:1 |

| Sex ratio by weight (weight in metric tons) | Terminal Island | Moss Landing |
|---|---|---|
| **Males** | | |
| Weight | 21,193 | 2,492 |
| Percent | 42.7 | 46.4 |
| **Females** | | |
| Weight | 25,786 | 2,694 |
| Percent | 52.0 | 50.1 |
| **Unknown** | | |
| Weight | 2,620 | 191 |
| Percent | 5.3 | 3.6 |
| **Total sex ratio** | 49,599 | 5,377 |
| **Female:Male** | 1.22:1 | 1.08:1 |



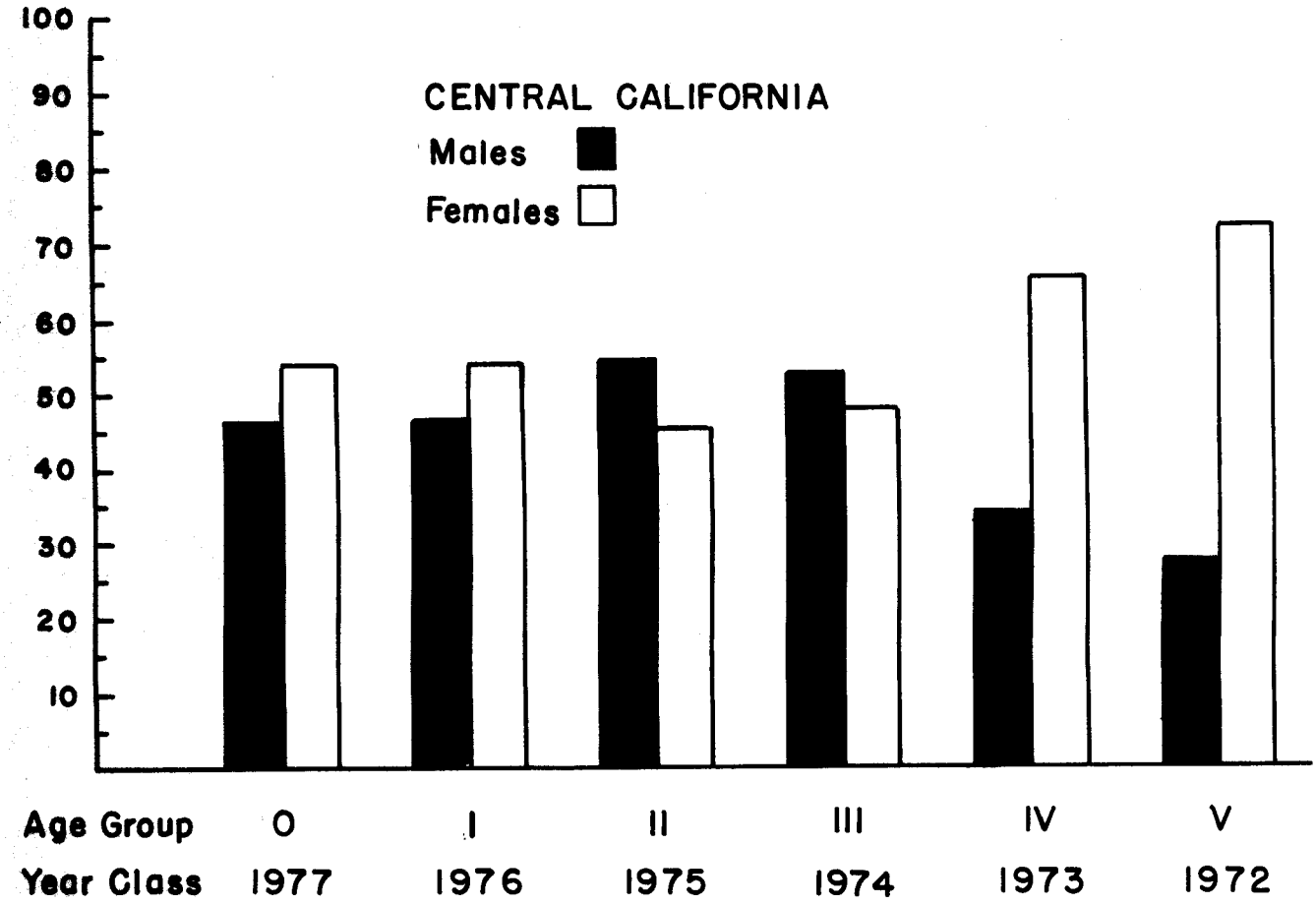




FIGURE 6 Percentage of males and females by age group

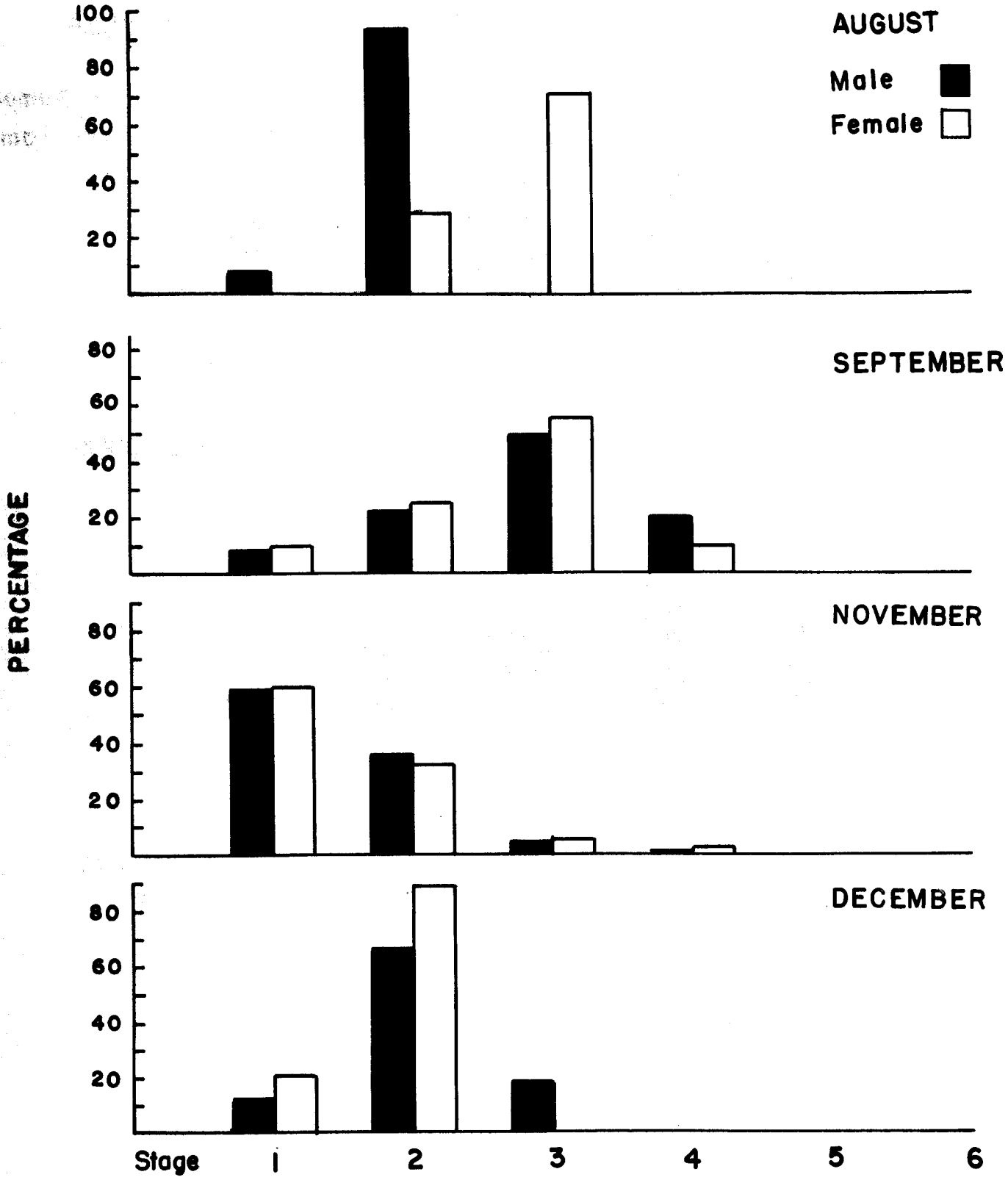



FIGURE 7 Sexual maturity of anchovies from Central California during 1977-78 Season

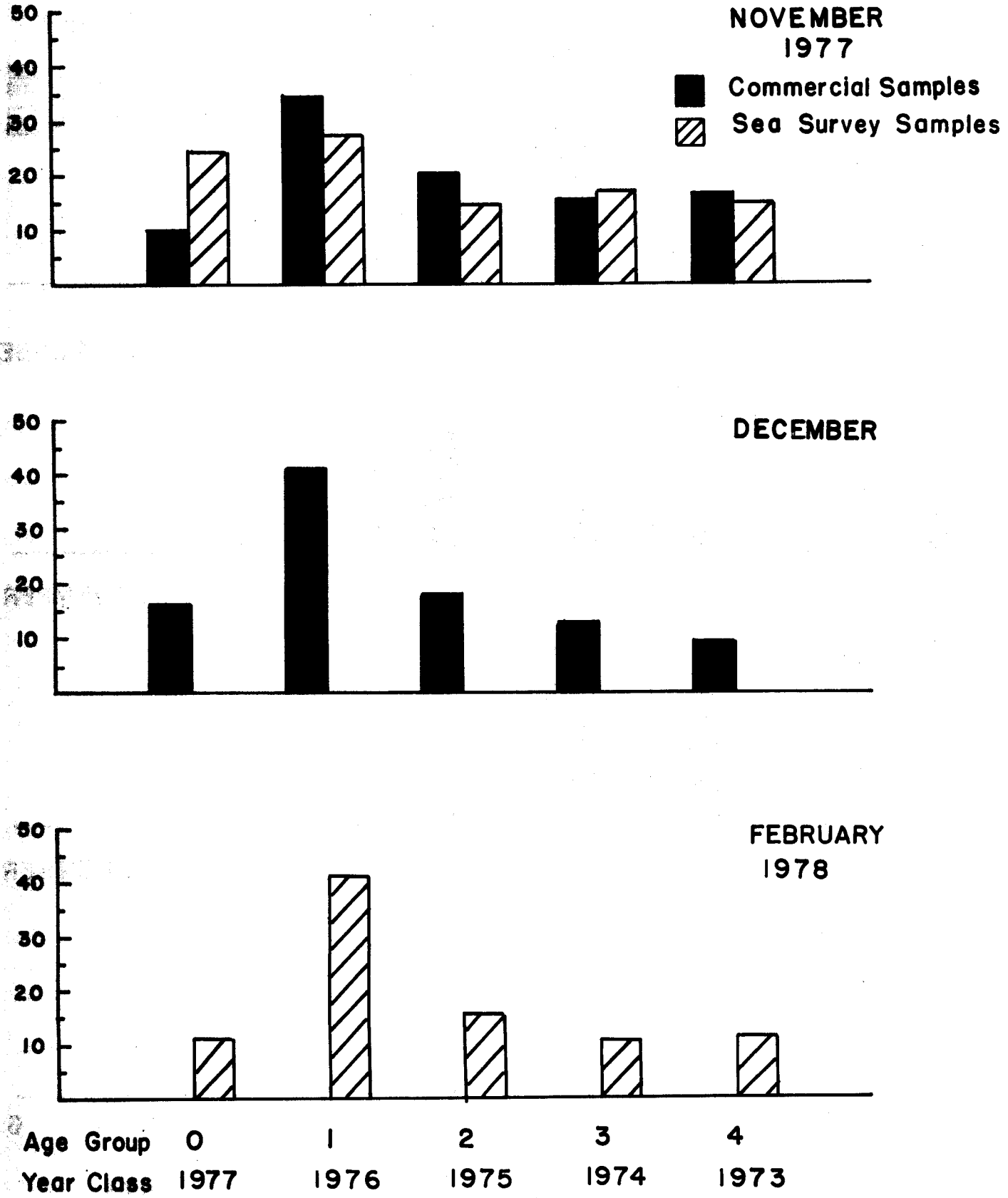



FIGURE 8 Anchovy age composition by month for Southern California

Anchovy sex ratios in both regions were nearly 1:1, possibly as a result of the large numbers of young fish in the sampled population. Central California fish appeared to mature sexually earlier in the fall than southern California fish.

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