

State of California  
The Resources Agency  
Department of Fish and Game

REVIEW OF THE BI-MONTHLY BIRD  
COUNTS OF SAN FRANCISCO BAY<sup>1/</sup>  
FEBRUARY 1964 - DECEMBER 1965<sup>1/</sup>

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ABSTRACT

Bi-monthly census was conducted at selected observation points throughout San Francisco Bay, February 1964 - December 1965. A total of 7.3 million birds was counted during the survey period. This report reviews the observations reported for 28 different bird species from 13 census areas to document population indices, seasonal distribution and movements of water-associated birds. Of these 28 species, 1,855,013 birds were reported. The western sandpiper was the most abundant species. Other species reported in large numbers were least sandpiper, willet, American avocet, marbled godwit and dunlin. Definite fall and spring movements were detected in most species. Three census areas accounted for 70 percent of the birds reported.

<sup>1/</sup> Wildlife Management Branch Administrative Report No. 72-8 (August 1972). Supported by Federal Aid in Wildlife Restoration Project W-54-R, "Special Wildlife Investigations."

## INTRODUCTION

Little information is available on annual shorebird and water-associated bird utilization of San Francisco Bay, California. Limited information is found in journals or manuals. Annual Audubon Society Christmas Bird Counts provide good information on only wintering species and their numbers. The first major study towards assessing the importance of San Francisco Bay for bird life was conducted by California Department of Fish and Game 1964-1965 (Bollman, Thelin & Forester 1970). This study involved a bi-monthly census for a two-year period at selected observation points throughout San Francisco Bay. Study object was to document numbers of birds, categorized into two bird types, which were using San Francisco Bay on an annual cycle. Further refinement of data on an individual species basis is needed for management purposes.

This study is a review of the original bi-monthly bird count data for 1964-1965 and data was compiled for each individual species so that numbers and seasonal distributions could be established for a number of water-associated birds utilizing San Francisco Bay.

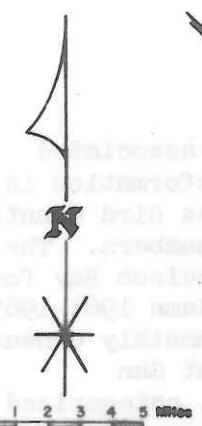
## SCOPE OF STUDY

As previously stated, a two-year study from February 1964 to December 1965 was conducted by the Department of Fish and Game to obtain reliable data on the species composition and abundance of bird life utilizing San Francisco Bay. Assisting the Department were sixty highly qualified volunteers, most of which were members of the National Audubon Society. Study area was divided into 13 census areas (Figure 1). Each area in turn was divided into sub-units where birds could be counted from selected observation points. The number of observation points varied from 1 to 26, depending on the area, and totaled 139. Total acreage under observation was 153,235 acres. Specific habitat acreages are as follows: mudflat 44,690 acres, marsh 26,240 acres, salt ponds 14,350 acres, and open water 67,955 acres. Observations were scheduled as near to the first and fifteenth of each month as possible. These counting periods were usually conducted on outgoing tides. A total of 50 days was scheduled for observation over the two-year period, but because of unforeseen and unavoidable circumstances observations were conducted on only 56 percent of the scheduled days. This represented approximately 6,500 man hours with additional time being devoted to working up field notes. Two different census forms were used during the original study. It was found that the form used in 1964 was too general in some of the bird categories so a more inclusive form was used in 1965. Observers were asked to record, by habitat type, all water-associated birds and their numbers for that particular census area. Birds were grouped into eleven different types on the observation sheets. These in turn were broken down by species.

The purpose of this study was to document population indices, seasonal distribution, and movement trends of water-associated birds in San Francisco

Figure 1. SAN FRANCISCO BAY BIRD

CENSUS AREA  
CALIFORNIA  
DEPARTMENT OF FISH AND GAME



SCALE  
Aug 1972

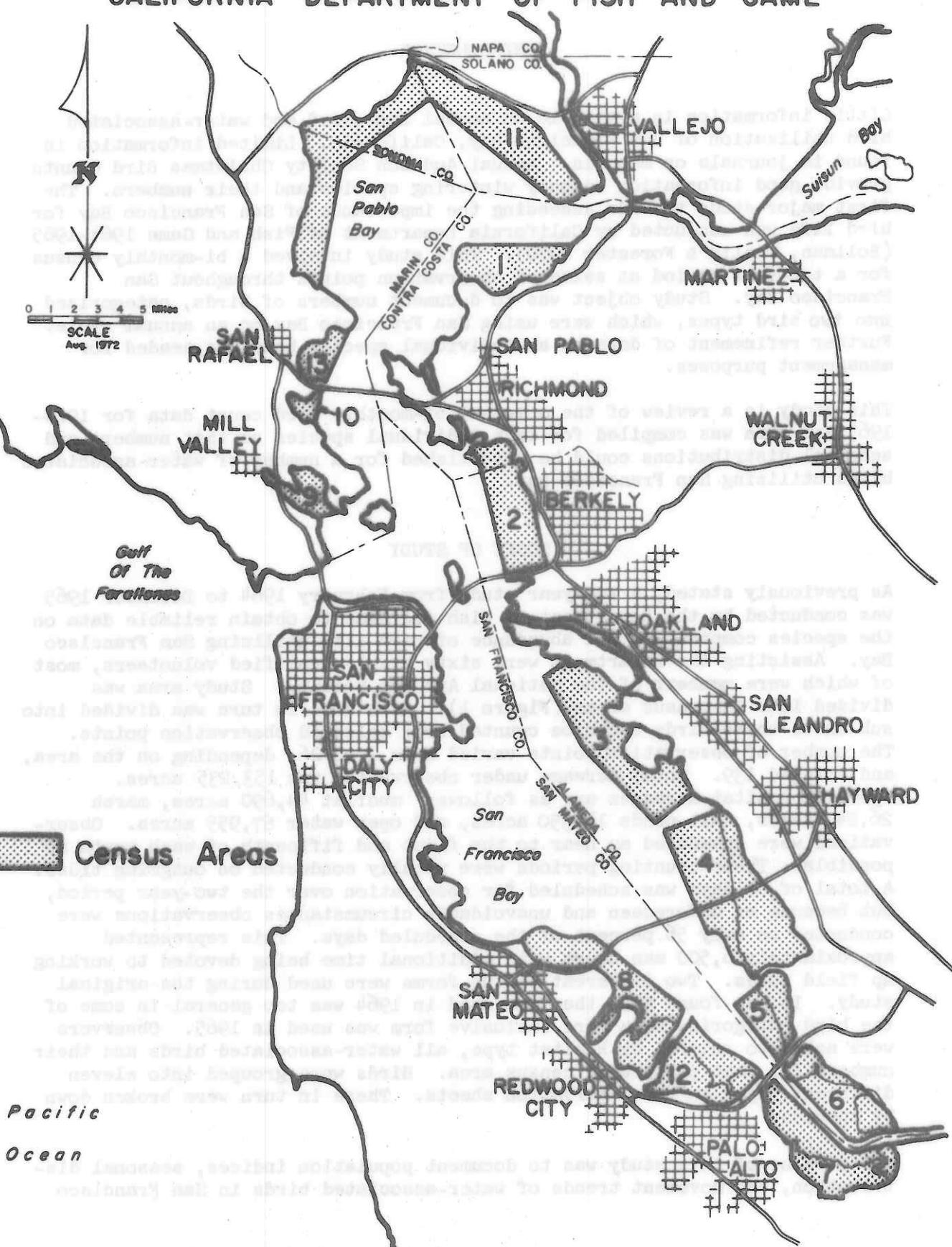
0 1 2 3 4 5 MILES

Gulf  
Of The  
Farallones

**Census Areas**

Pacific

Ocean



Bay for the two-year period. Field data was obtained from the original observer report forms.

#### METHODS

Twenty-eight different bird species were selected for detailed evaluation from those observed during the 1964-1965 census. Selection was based on a number of factors. All waterfowl were excluded because of the available information regarding this group. Other species were excluded because they are rare visitors in the Bay. All data pertinent to the selected species was extracted from over 3,500 of the original observer field report sheets. These sheets were arranged by date and census area to facilitate tabulation. Data for developing population trends and movements was selected from 7 to 13 of the census areas. In most cases, sufficient qualitative information could be gathered from the larger census areas thereby making it unnecessary to incorporate all census areas into each species report. Bird population figures were plotted by month. Observations on most census areas were started in February 1964, some were delayed until April. All graphs start with the first report of observation for that species in 1964 and continue on a monthly basis through December, 1965.

#### RESULTS

Bird numbers and their seasonal distribution are summarized for 28 species reported for a 23-month period in San Francisco Bay. Each summary includes the number of census areas included, the total number of birds reported and a description of that species' seasonal movements during the census.

Of the 28 species the western sandpiper was the most abundant. Other species which were reported in large numbers were least sandpiper, willet, American avocet, marbled godwit and dunlin. Definite fall and spring movements could be detected in most species. There was considerable overlap in seasonal movements among species which is attributed to differential migration patterns and different age groups. Fall migration occurred July to November with the spring migration occurring from March to May. Species such as the dunlin, Wilson's and northern phalaropes, and western, eared, and horned grebes exhibited the most pronounced seasonal fluctuations.

A total of 7.3 million birds was counted during the two-year census. Most of the birds identified were shorebirds (55 percent), while waterfowl were the second largest group of birds observed (34 percent). Bird densities were found highest on tidal flats and salt ponds. Census areas 4, 7, and 12 accounted for 70 percent of the bird numbers observed for 28 species in this report.

Species summaries is included in Tables 1 and 2 and Figures 2-6.

## LITERATURE CITED

Bollman, Frank H., Peter K. Thelin and Richard T. Forester. 1970. Bi-monthly bird counts at selected observation points around San Francisco Bay, February 1964 to January 1966. Calif. Fish and Game 56(4): 224-239.

## DISCUSSION

The following sections will describe the changes that occurred during the period of the study. These changes were not necessarily caused by the project itself, but rather reflect the general trend of bird populations in the area over time. The first section describes the overall trends in bird populations, while subsequent sections focus on specific groups of birds, such as waterfowl, shorebirds, and land birds.

## DISCUSSION

During the 1960s, bird populations in the study area increased significantly. This was particularly true of waterfowl, which increased from approximately 10,000 birds in 1960 to over 40,000 in 1969. The most significant increase was in the number of mallards, which increased from about 5,000 in 1960 to nearly 20,000 in 1969. Other species that showed significant increases included the American wigeon, green-winged teal, and northern pintail. In contrast, the number of Canada geese decreased from about 2,000 in 1960 to less than 1,000 in 1969. The reasons for these changes are not fully understood, but they may be related to changes in habitat availability and quality, as well as changes in hunting regulations and hunting pressure.

The second section focuses on the changes in bird populations that occurred between 1969 and 1979. During this period, bird populations in the study area declined significantly. This was particularly true of waterfowl, which decreased from about 35,000 birds in 1969 to less than 20,000 in 1979. The most significant decrease was in the number of mallards, which decreased from about 18,000 in 1969 to less than 10,000 in 1979. Other species that showed significant decreases included the American wigeon, green-winged teal, and northern pintail.

The third section focuses on the changes in bird populations that occurred between 1979 and 1989. During this period, bird populations in the study area remained relatively stable, with only minor fluctuations. The most significant change was a slight increase in the number of Canada geese, which increased from about 1,500 in 1979 to nearly 2,000 in 1989.

TABLE 1

Numbers & Seasonal Distribution of Twenty-Eight  
Water-Associated Bird Species  
San Francisco Bay - February 1964-December 1965

| SPECIES   | NO. OF AREAS REPORTING | T. BIRD COUNT |        | OBSERVATIONS   |
|---|------------------------|---------------|--------|--|
|   |                        | 1964          | 1965   |  |
| 1. Horned grebe ( <i>Podiceps auritus</i> )           | 9                      | 54            | 893    | This species is in much lower numbers than other species of grebes common to San Francisco Bay. Small numbers present in August 1964. Bird numbers build up in November and peak in February. A decline begins in April with birds absent from May to late July. Largest concentrations were reported in areas 4 & 12 with 800 being the high count for Feb-Mar. 1965. (Figure 2). |
| 2. Eared grebe ( <i>Podiceps caspicus</i> )           | 10                     | 2,691         | 20,068 | Most common grebe found in association with evaporator salt ponds. Birds were absent from June to September in 1964-65. Build up in numbers began in December with peak numbers in April and May. Area 4 & 12 accounted for 85% of all eared grebe sightings during 1964-65. High count of 12,000 for area 4 during April, 1965. (Figure 2).                                       |
| 3. Western grebe ( <i>Aechmophorus occidentalis</i> ) | 12                     | 1,361         | 20,346 | Build up in bird numbers began in early September in both 1964 and 1965. Peaks were reached in December-February. A decline began in March with birds absent during July and August. A high count of over 8,000 birds was recorded on area 9 for the period January-February. 1965. (Figure 2).  |
| 4. Pied-billed grebe ( <i>Podilymbus podiceps</i> )   | 10                     | 125           | 472    | This species was generally found in association with fresh water, has been reported as breeding in San Francisco Bay. Small numbers seen during winter months. Peak populations recorded during February and October 1965. Area 7 accounted for most counts during 1964-65. (Figure 2).  |
| 5. White pelican ( <i>Pelecanus erythrorhynchos</i> ) | 10                     | 10,318        | 11,611 | This species is much more common than the brown pelican in San Francisco Bay. Present year around in 1965. Build up in numbers began in July during both 1964-65 with peak numbers occurring in September and October. Most frequently found in association with salt ponds. Highest count was 5,600 during September 1964. (Figure 2).  |
| 6. Brown pelican ( <i>Pelecanus occidentalis</i> )    | 11                     | 121           | 171    | Birds were regularly reported between September and December in 1964-65. Numbers peaked in November 1964 and September 1965. Birds were absent between January and August both years. Birds were most frequently reported in areas 12 and 13. Highest count was 75 in September 1965, area 12. (Figure 3).   |

TABLE 1 - Con't.

|  |    |       |       |  |
|--|----|-------|-------|--|
| 7. Great blue heron ( <u>Ardea herodias</u> )                | 9  | 376   | 1,156 | Species was reported both 1964 and 1965. Small breeding colony located in area 3. Low numbers present during summer months with build up beginning in September. Peak numbers in 1964 occur in December and remain until February. Decline began in March with low numbers in May. Build up began again in June, and numbers peaked in September and October. South San Francisco Bay accounted for most sightings both years. (Figure 3). |
| 8. Common egret ( <u>Casmerodium albus</u> )                 | 9  | 1,127 | 1,441 | Species seen throughout both years. Small breeding colonies present in areas 8 & 10 in 1964-65. They are no longer breeding in south San Francisco Bay. Winter populations began to build up in July peaking in October, 1964 and September, 1965. In much lower numbers from April-July. The high count was 310 during October 1961. (Figure 3).  |
| 9. Snowy egret ( <u>Leucophoyx thula</u> )                   | 10 | 1,246 | 4,052 | This species is common throughout the year in San Francisco Bay area. Active breeding colonies are found in both north and south S. F. Bay. Numbers of birds began to build up in July 1964 with peak numbers between October-December 1964, much larger peak in September 1965. High count of 1,200 snowy egrets in September 1965. Area 6 & 7 accounted for 70% of all sightings during 1964-65. (Figure 3).                             |
| 10. Black-crown night heron ( <u>Nycticorax nycticorax</u> ) | 10 | 347   | 1,543 | This heron is a common resident throughout the year. Winter movements through the area began in September 1964. Build up continued with peak numbers occurring from December to February 1965. In 1965 a larger population was reported in the bay area. Numbers built up in June and continued through December. High count for this period was 900. Area 4 reported most sightings both years. (Figure 3).                               |
| 11. California clapper rail ( <u>Rallus longirostris</u> )   | 13 | 66    | 172   | This non-migratory resident is classified as endangered species found in association with salt marshes and largest numbers are located in South San Francisco Bay, areas 5, 6, & 12. High numbers recorded during winter months when high tides force rails into the open. Low numbers recorded during late spring and summer. Population projection for south San Francisco Bay based on 1971 surveys are apx. 1300 pairs. (Figure 3).    |
| 12. Killdeer ( <u>Charadrius vociferus</u> )                 | 10 | 987   | 1,810 | This is a common resident of San Francisco Bay. One of two species of plovers breeding in the bay area. Increase in numbers of birds in September 1964 and peak numbers remained from October 1964 to March 1965. Decline in numbers occurred in May of both years. Peak in September of 1965. (Figure 4).   |

TABLE 1 - Cont.

|   |    |         |         |   |
|---|----|---------|---------|---|
| 13. Black-bellied plover ( <i>Squatarola squatarola</i> ) | 7  | 9,510   | 5,930   | Plover numbers increased in August with a peak in October 1964. High numbers stayed through the winter, declined in May 1965 and remaining low until fall build up starting in August. Much smaller peak noted in September 1965. Areas 7 & 8 reported over 90% of all birds recorded both years. (Figure 4).   |
| 14. Long-billed curlew ( <i>Numenius americanus</i> )     | 7  | 2,519   | 14,410  | High numbers of this species occurred in January, April, and September 1965. Seen in low numbers from May-July both years and peaking again in September which did not occur in 1964, area 12 accounted for over 12,000 curlew sightings during 1964-65. (Figure 4).  |
| 15. Whimbrel ( <i>Numenius phaeopus</i> )                 | 7  | 654     | 1,322   | This species was present throughout 1965 but never present in large numbers. Absent during July and August 1964. A build up of bird numbers occurred in 1965. Peak in October 1965 with a decline in birds in November and December. Most commonly found in association with salt ponds and feeding on tidal flats. Highest numbers recorded was 288 during October 1964. (Figure 4).   |
| 16. Willet ( <i>Catoptrophorus semipalmatus</i> )         | 8  | 128,185 | 143,544 | This is the most common large shorebird found in the San Francisco Bay area and reported throughout the year. Numbers increase in late June 1964 with a population build up in late September. Peak numbers were reported in November 1964. Large numbers remained throughout winter months and low numbers were present from May-July 1965 with winter build up in August. Highest count of 102,000 birds were recorded between October-December 1964. (Figure 5).                       |
| 17. Least sandpiper ( <i>Erolia minutilla</i> )           | 10 | 237,339 | 88,494  | Spring bird counts during 1964 reflect high numbers were present in April with over 100,000 least sandpipers reported. Numbers were low during the summer with fall build up beginning in September and peaking in December. Numbers declined to only 4,000 during January 1965 and began a spring build up peaking in April. Fall counts were extremely low in 1965 with only 15,000 recorded between September-December. (Figure 5).  |
| 18. Dunlin ( <i>Erolia alpina</i> )                       | 7  | 57,041  | 65,186  | Birds moved into the area in late September 1964 with peak numbers recorded in October. Spring movement of birds started in late March with a peak in April. Low numbers were present throughout the summer of 1965 with fall build up starting in September. A much smaller peak was recorded in the fall of 1965 as birds moved through the Bay area. Highest number recorded was 55,000 between October-December 1964. Areas 4 & 7 recorded the highest counts both years. (Figure 5). |
| 19. Dowitcher spp. ( <i>Limnodromus</i> spp.)             | 7  | 28,728  | 30,099  | Long-billed and short-billed dowitchers were combined because of difficulty in distinguishing species in the field. Fall bird populations started to arrive in August 1964, peaking out in October. Birds moving north began arriving in March 1965 with a peak in April. Low numbers were present throughout the summer months in 1965 with a winter population build up starting in August and peaking in October 1965. (Figure 5).   |

TABLE 1 - Cont.

|  |    |         |         |  |
|--|----|---------|---------|--|
| 20. Western sandpiper ( <u>Ereunetes mauri</u> )           | 9  | 258,100 | 146,698 | This is the most numerous shorebird occurring the bay area. Fall numbers begin to build up in August with a peak (100,000) in November 1965. Spring bird numbers began to increase in March with a peak in April 1965. Fall numbers in 1965 were much lower than 1964. Peak occurred in October with 22,000 counted. Area 4 recorded the highest counts for this species. (Figure 5).  |
| 21. Marbled godwit ( <u>Limosa fedoa</u> )                 | 7  | 101,763 | 96,077  | This species is associated with tidal mud flats and salt ponds. Winter populations build up beginning in July with peak in November 1964. Numbers of birds started declining in January and summer populations were low from May-July 1965. Peak was recorded in November 1965 but noticeably fewer birds were recorded. Highest count of 70,000 was recorded in November-December 1964. (Figure 6).   |
| 22. American avocet ( <u>Recurvirostra americana</u> )     | 6  | 115,714 | 115,558 | The avocet is one of the most common wintering species. Present throughout the year and substantial numbers breed in the bay area. A build up was recorded which began in July 1964 and peaked in November when 49,000 avocets were counted. A smaller peak was recorded in October 1965 when 17,000 were counted. Declines began in December of both years reaching summer lows by April. (Figure 6).                                       |
| 23. Black-necked stilt ( <u>Himantopus mexicanus</u> )     | 7  | 2,537   | 6,183   | This species is not as common as the avocet. Species tends to prefer salt ponds more than avocets. Small breeding population is present through spring and summer. Fall population started to arrive in July 1964 with a peak occurring in November. Numbers declined in December with small peaks in March and May. Fall populations began to arrive in June 1965 with peak numbers in September when 1,500 birds were counted. (Figure 6). |
| 24. Wilson's phalarope ( <u>Steganocephalus tricolor</u> ) | 11 | 402     | 27,396  | This species was recorded in much larger numbers in 1965. Small numbers were noted in July and September 1964. Small numbers were present during April and May 1965 with a build up in numbers beginning in July and reaching a peak in August. Numbers declined in September and were absent from October to March. Highest count was 27,000 birds recorded between July-September 1965. (Figure 6).  |
| 25. Northern phalarope ( <u>Lobipes lobatus</u> )          | 10 | 9,759   | 89,059  | This is the most common phalarope found in San Francisco Bay. Fall populations started to arrive in July 1964 and May 1965. Peak numbers occurred in September 1964 and in August 1965. Most birds had left the area by late October. High count for the fall was 65,000 birds July-September 1965. Like the Wilson's phalarope this species is found in association with salt ponds. (Figure 6).  |

TABLE 1 - Cont.

26. Forster's tern (*Sterna forsteri*)      9      16,623      12,938  
 This term may be seen throughout the year in the bay area. Scattered breeding colonies are present in the census areas 4, 5, 6, 7, 8, & 12. Numbers of birds are stable from April to November. Low numbers are present from December-March. Peaks occurred in June and September 1965. Number of birds averaged 1,500 a month during the period April-October 1965. (Figure 7).
27. California least tern (*Sterna albifrons*)      10      0      163  
 Least terns were not recorded in 1964. Low numbers were recorded from May to July 1965 with a higher fall population beginning in August and reaching a peak in October. Least terns were not recorded after November in 1965. High number of 146 was recorded during August-October 1965. Areas in which least terns were recorded are: 4, 6, 7, 8, 10, 11, 12, & 13. First nesting reported for this species in San Francisco Bay area was in 1967. Breeding activity cannot be discounted in 1965 because of the limited numbers present from May-July. (Figure 7).
28. Caspian tern (*Hydroprogne caspia*)      8      880      812      831  
 This term may be seen throughout the year in the San Francisco Bay area. Nesting colonies are present in areas 8 and 6 and formerly recorded for area 5. Spring and fall movements much more pronounced than the Forster's term. Spring numbers began to increase in April and peak in May 1964 and June 1965. Fall population is of much smaller magnitude, occurring in September both years. High count of 579 during May 1964. (Figure 7).

TABLE 2

Numbers of Water-Associated Birds  
Reported by Census Areas - San Francisco Bay  
February 1964 - December 1965

| SPECIES                             | CENSUS AREAS |        |       |       |     |     |        |     |       |     | TOTAL  |
|-------------------------------------|--------------|--------|-------|-------|-----|-----|--------|-----|-------|-----|--------|
|                                     | 1&2          | 3      | 4     | 5     | 6   | 7   | 8      | 9   | 10    | 11  |        |
| Horned grebe - 1964                 | 0            | 510    | 0     | 0     | 19  | 4   | 5      | 3   | 1     | 0   | 542    |
| - 1965                              | 30           | 74     | 0     | 0     | 33  | 16  | 3      | 0   | 667   |     | 893    |
| Eared grebe - 1964                  | 11           | 1,908  | 93    | 20    | 19  | 10  | 0      | 335 | 305   |     | 2,691  |
| - 1965                              | 19           | 15,068 | 1,560 | 4     | 149 | 73  | 25     | 29  | 3,141 |     | 20,068 |
| Western grebe - 1964                | 74           | 9      | 42    | 5     | 131 | 163 | 755    | 81  | 98    | 5   | 1,361  |
| - 1965                              | 536          | 902    | 45    | 169   | 155 | 389 | 17,555 | 153 | 27    | 415 | 20,346 |
| Pied-billed<br>grebe - 1964         | 5            | 1      | 0     | 0     | 88  | 5   | 0      | 8   | 18    |     | 125    |
| - 1965                              | 16           | 89     | 0     | 0     | 311 | 6   | 5      | 18  | 24    |     | 472    |
| White pelican - 1964                | 1,800        | 1,800  | 115   | 4,653 | 130 | 3   | 4      | 0   | 1,034 |     | 10,318 |
| - 1965                              | 3,044        | 504    | 247   | 7,164 | 597 | 7   | 9      | 14  | 20    |     | 11,611 |
| Brown pelican - 1964                | 0            | 0      | 0     | 0     | 4   | 16  | 30     | 0   | 0     | 71  | 121    |
| - 1965                              | 0            | 0      | 0     | 0     | 0   | 5   | 30     | 3   | 79    | 54  | 171    |
| Great blue<br>heron - 1964          | 22           | 2      | —     | 138   | 81  | —   | —      | 32  | —     |     | 101    |
| - 1965                              | 188          | 14     | —     | 523   | 98  | —   | —      | 41  | —     |     | 263    |
| Common egret - 1964                 | 62           | 79     | 280   | 100   | 294 | 50  | —      | 192 | —     |     | 190    |
| - 1965                              | 394          | 1      | 275   | 275   | 124 | —   | —      | 121 | —     |     | 252    |
| Snowy egret - 1964                  | 93           | 111    | —     | 566   | 214 | —   | —      | 104 | —     |     | 157    |
| - 1965                              | 838          | 82     | —     | 2,276 | 113 | —   | —      | 415 | —     |     | 335    |
| Black-crowned<br>night heron - 1964 | 51           | 15     | —     | 216   | 18  | 0   | 0      | 47  | 0     |     | 347    |
| - 1965                              | 532          | 84     | —     | 451   | 19  | 0   | 0      | 458 | 0     |     | 1,543  |

TABLE 2 - Cont.

## CENSUS AREAS

| SPECIES              | 182    | 3       | 4               | 5      | 6      | 7      | 8      | 9       | 10     | 11     | 12     | 13    | TOTAL   |
|----------------------|--------|---------|-----------------|--------|--------|--------|--------|---------|--------|--------|--------|-------|---------|
| Calif. clapper rail  | - 1964 | 0       | 0               | 0      | 1      | 0      | 52     | 3       | 0      | 0      | 10     | 0     | 66      |
|                      | - 1965 | 0       | 0               | 18     | 0      | 0      | 59     | 3       | 0      | 0      | 89     | 0     | 172     |
| Killdeer             | - 1964 | 100     | 5               | 7      | 360    | 61     |        |         |        |        | 354    |       | 887     |
|                      | - 1965 | 377     | 15              | 22     | 485    | 174    |        |         |        |        | 737    |       | 1,810   |
| Black-bellied plover | - 1964 | 35      | 39              | 6,439  | 2,289  |        |        |         |        | 727    |        | 9,510 |         |
|                      | - 1965 | 73      | 24 <sub>4</sub> | 1,835  | 3,193  |        |        |         |        | 1,322  |        | 5,930 |         |
| Long-billed curlew   | - 1964 | 383     | 15              | 6      | 102    | 550    |        |         |        |        | 1,846  |       | 2,519   |
|                      | - 1965 | 871     | 58              | 11     | 225    | 2,441  |        |         |        |        | 11,478 |       | 14,410  |
| Whimbrel             | - 1964 | 1       | 0               | 0      | 21     | 80     |        |         |        |        | 170    |       | 654     |
|                      | - 1965 | 188     | 61              | 15     | 37     | 175    |        |         |        |        | 172    |       | 1,322   |
| Willet               | - 1964 | 15,584  | 4,121           | 3,035  | 41,429 | 18,854 |        |         |        |        | 25,165 |       | 108,188 |
|                      | - 1965 | 19,669  | 15,787          | 9,369  | 29,971 | 21,011 |        |         |        |        | 45,591 |       | 141,498 |
| Least sandpiper      | - 1964 | 19,664  | 925             | 1,130  | 36,200 | 15,025 | 12,945 | 134,475 | 16,722 |        |        |       | 237,086 |
|                      | - 1965 | 8,463   | 220             | 325    | 8,010  | 3,494  | 2,415  |         | 27,150 | 28,925 |        |       | 79,002  |
| Dunlin               | - 1964 | 15,139  | 3,598           | 2,112  | 21,410 | 2,986  |        |         |        |        | 11,786 |       | 57,051  |
|                      | - 1965 | 17,513  | 8,146           | 5,476  | 6,048  | 3,570  |        |         |        |        | 24,385 |       | 65,138  |
| Dowitcher sp.        | - 1964 | 4,075   | 1,478           | 1,094  | 15,517 | 1,922  |        |         |        |        | 1,613  |       | 28,699  |
|                      | - 1965 | 5,039   | 2,563           | 1,231  | 13,900 | 2,103  |        |         |        |        | 5,425  |       | 30,351  |
| Western sandpiper    | - 1964 | 146,840 | 2,550           | 4,910  | 58,400 | 9,870  | 10,100 |         |        |        | 3,000  |       | 261,056 |
|                      | - 1965 | 35,647  | 6,950           | 2,920  | 21,824 | 1,135  | 0      |         |        |        | 30,875 |       | 146,532 |
| Marbled godwit       | - 1964 | 7,427   | 165             | 490    | 59,843 | 8,350  |        |         |        |        | 25,488 |       | 101,763 |
|                      | - 1965 | 19,442  | 4,312           | 1,991  | 28,757 | 7,473  |        |         |        |        | 34,122 |       | 96,997  |
| American avocet      | - 1964 | 12,118  | 14,664          | 419    | 32,519 | 16,411 |        |         |        |        | 39,613 |       | 115,744 |
|                      | - 1965 | 24,563  | 12,924          | 10,031 | 22,763 | 5,603  |        |         |        |        | 39,779 |       | 115,668 |
| Black-necked stilt   | - 1964 | 86      | 30 <sub>2</sub> | 387    | 716    | 91     |        |         |        |        | 948    |       | 2,537   |
|                      | - 1965 | 1,489   | 1,041           | 716    | 777    | 25     |        |         |        |        | 2,135  |       | 6,183   |
| Wilson's phalarope   | - 1964 | 0       | 0               | 300    | 102    | 0      |        |         |        |        | 0      |       | 402     |
|                      | - 1965 | 19,633  | 0               | 2,630  | 10     | 0      |        |         |        |        | 0      |       | 27,396  |

TABLE 2 - Con't.

| SPECIES            | CENSUS AREAS |        |       |         |         |        |         |         |        |        | TOTAL     |
|--------------------|--------------|--------|-------|---------|---------|--------|---------|---------|--------|--------|-----------|
|                    | 1&2          | 3      | 4     | 5       | 6       | 7      | 8       | 9       | 10     | 11     |           |
| Northern phalarope | 1964         | 130    | 8,615 | 995     | 324     | 0      | 0       | 0       | 0      | 112    | 0         |
| -                  | 1965         | 30,565 | 5,570 | 16,682  | 155     | 23     | 0       | 0       | 0      | 36,185 | 0         |
| Forster's tern     | 1964         | 947    | 224   | 340     | 2,380   | 1,098  | 62      | 681     | 891    | 6,623  | 12,938    |
| -                  | 1965         | 4,699  | 517   | 392     | 4,381   | 892    | 0       | 0       | 0      | 2,054  |           |
| Calif. least tern  | 1964         | 0      | 0     | 0       | 0       | 0      | 0       | 0       | 0      | 0      | 0         |
| -                  | 1965         | 33     | 0     | 14      | 15      | 22     | 17      | 54      | 4      | 4      | 163       |
| Caspian tern       | 1964         | 3      | 639   | 44      | 130     | 60     | 0       | 0       | 72     | 0      | 880       |
| -                  | 1965         | 148    | 282   | 61      | 115     | 153    | 0       | 0       | 4      | 0      | 831       |
| <br>SUB TOTAL      |              |        |       |         |         |        |         |         |        |        |           |
| -                  | 1964         | 74     | 0     | 226,953 | 39,485  | 15,663 | 284,607 | 78,329  | 23,983 | 205    | 155,554   |
| -                  | 1965         | 661    | 0     | 209,586 | 60,809  | 54,450 | 149,169 | 52,928  | 17,776 | 230    | 59,133    |
| TOTAL              |              | 735    | 0     | 436,539 | 100,297 | 70,113 | 433,776 | 131,257 | 41,759 | 435    | 195,037   |
|                    |              |        |       |         |         |        |         |         |        |        | 445,523   |
|                    |              |        |       |         |         |        |         |         |        |        | 542       |
|                    |              |        |       |         |         |        |         |         |        |        | 1,855,013 |

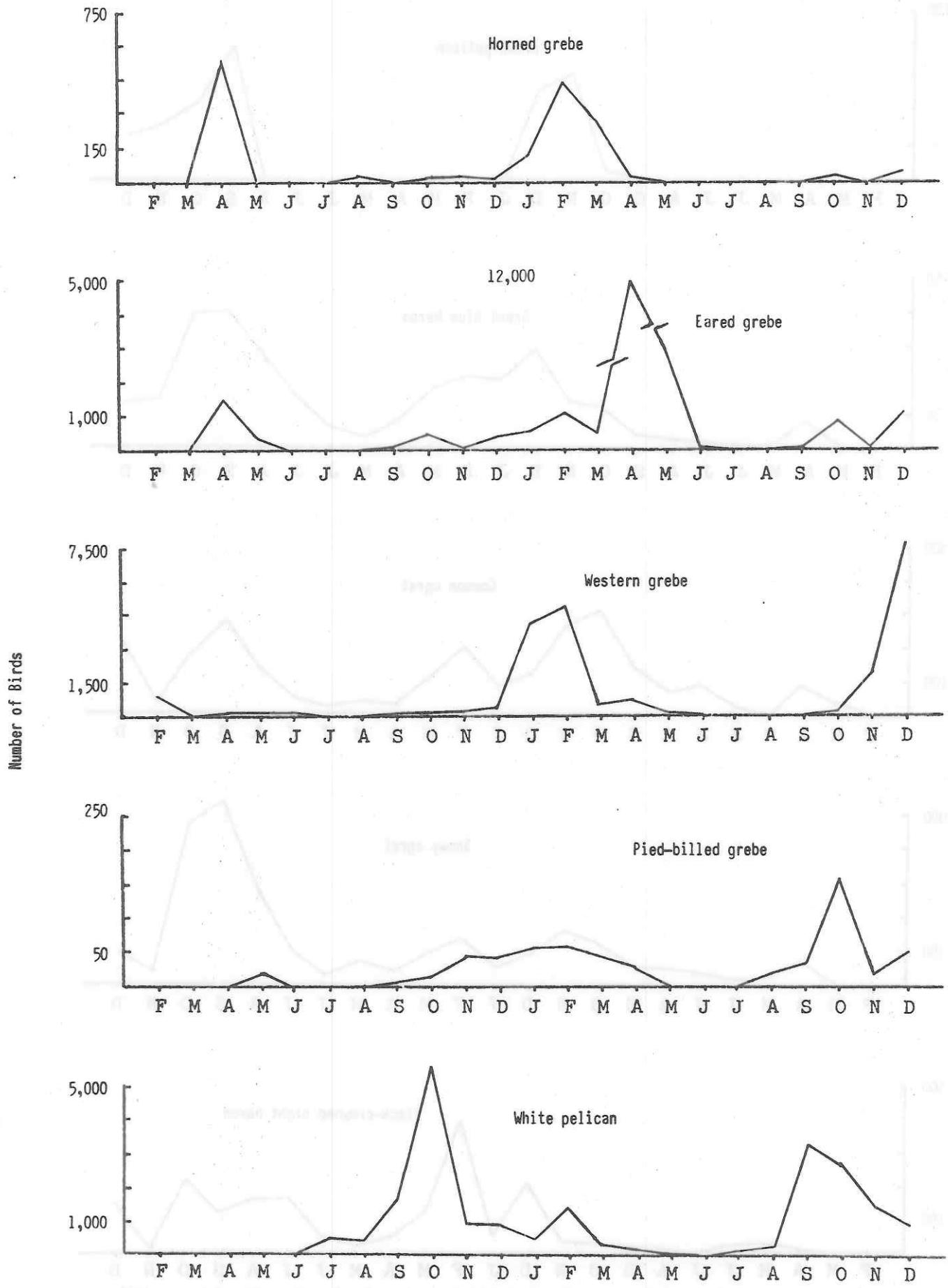


Figure 2. Seasonal distribution and abundance of selected bird species, San Francisco Bay, February 1964–December 1965.

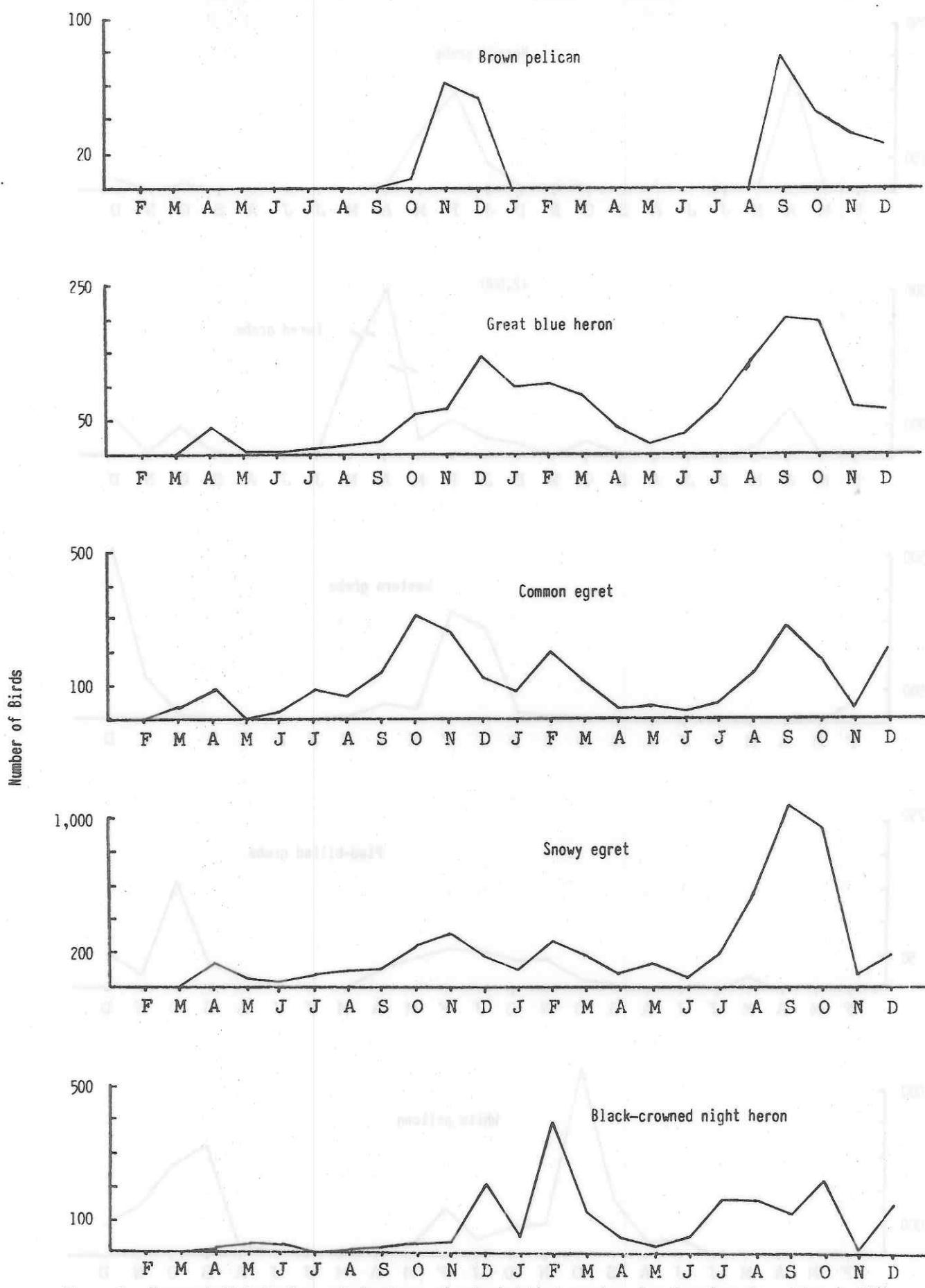


Figure 3. Seasonal distribution and abundance of selected bird species, San Francisco Bay, February 1964–December 1965.

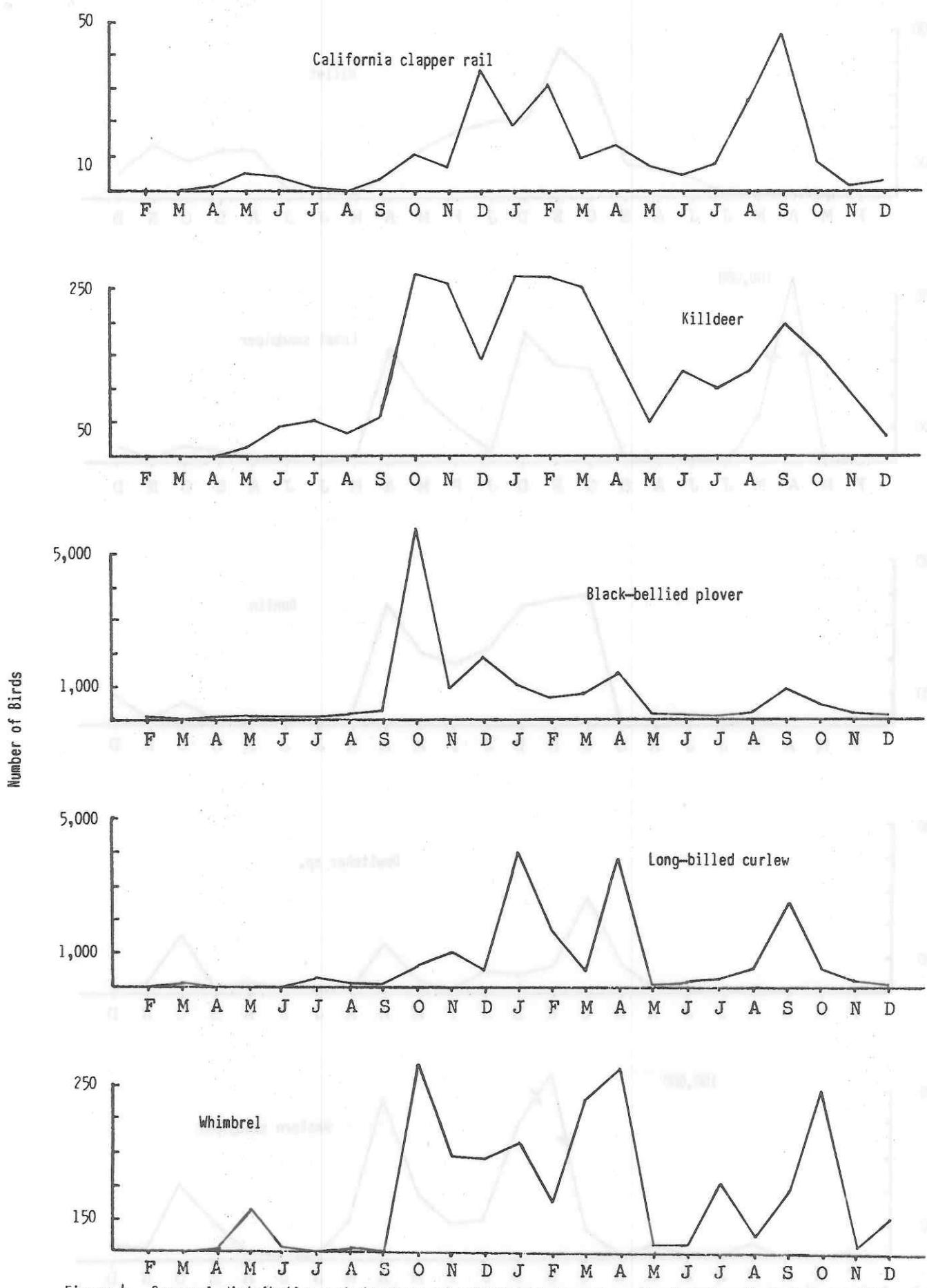


Figure 4. Seasonal distribution and abundance of selected bird species, San Francisco Bay, February 1964–December 1965.

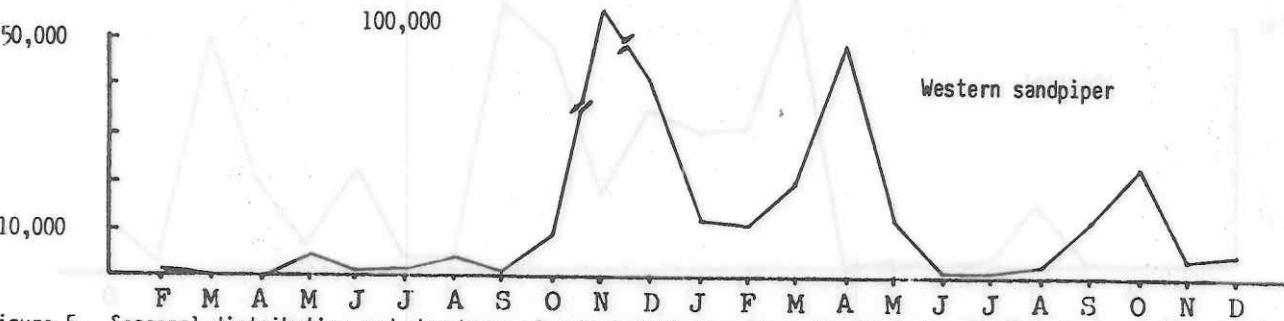
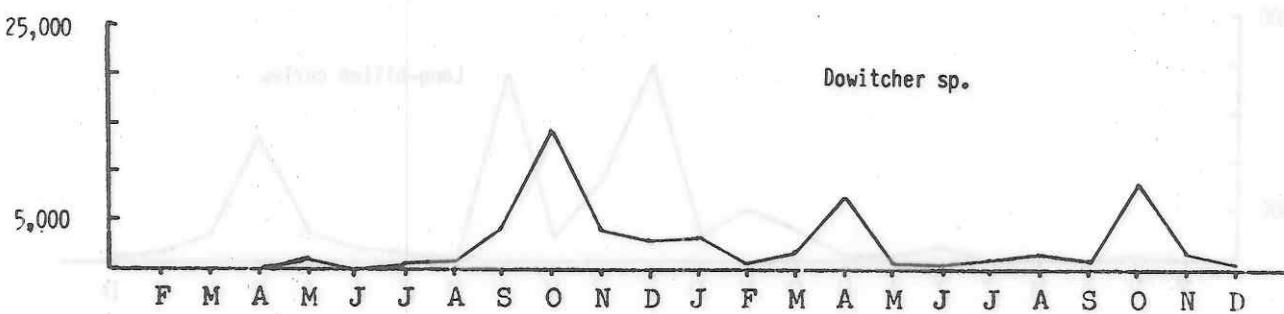
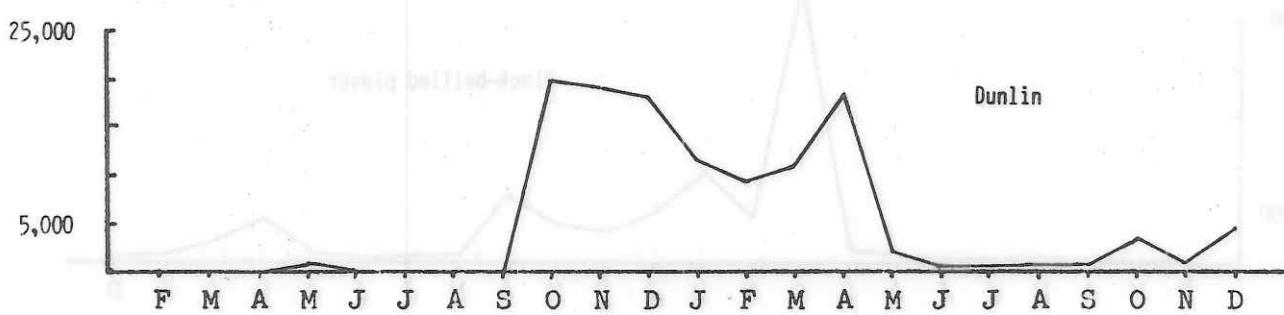
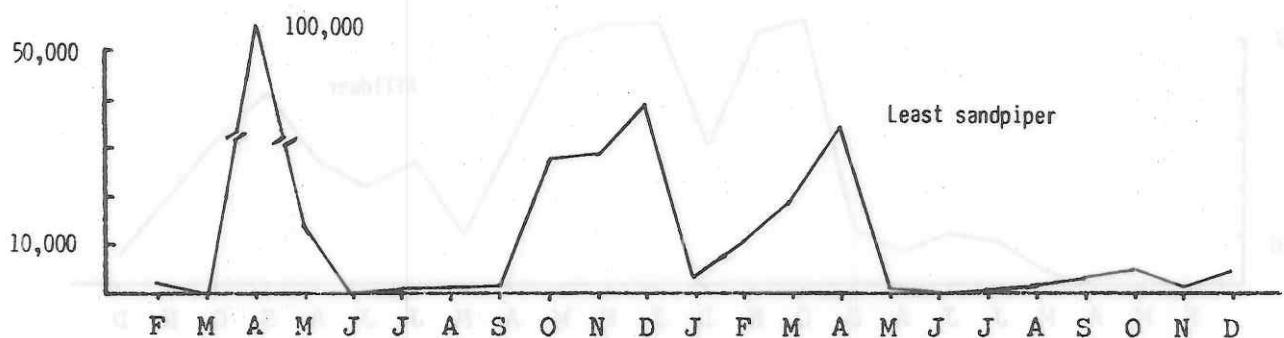
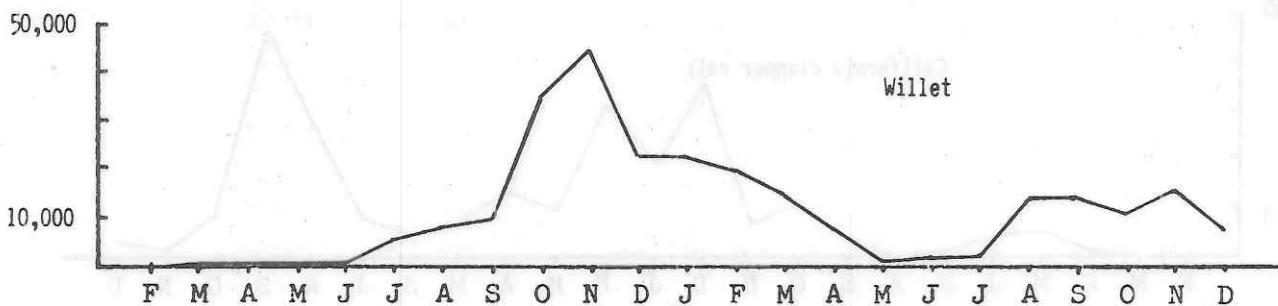


Figure 5. Seasonal distribution and abundance of selected bird species, San Francisco Bay, February 1964-December 1965.

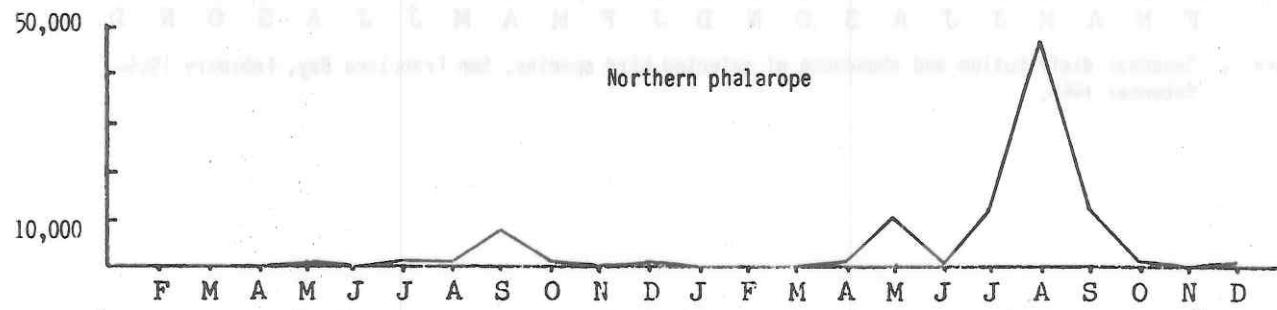
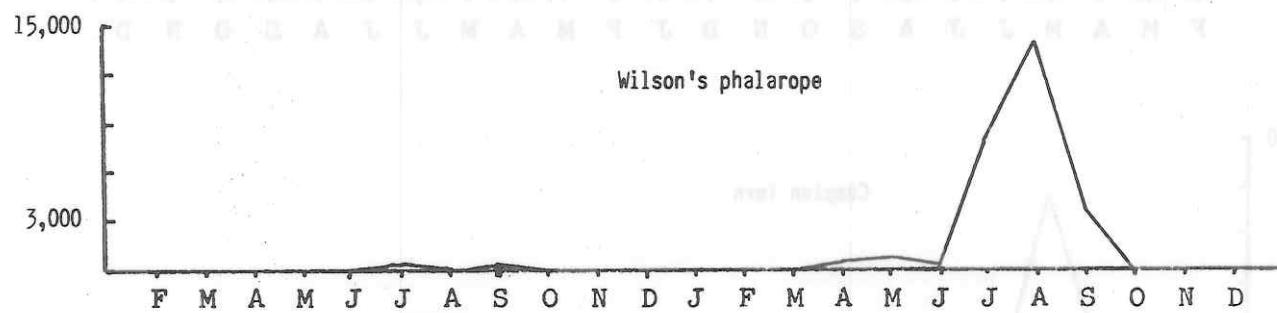
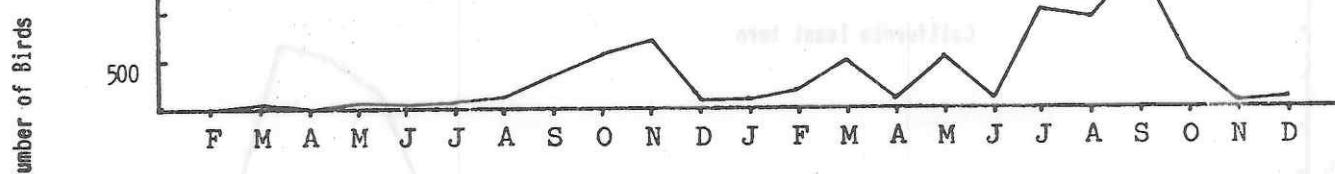
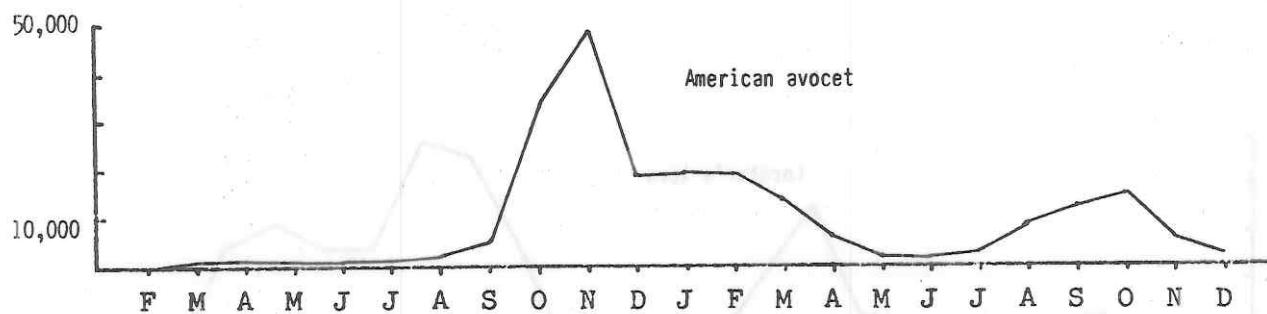
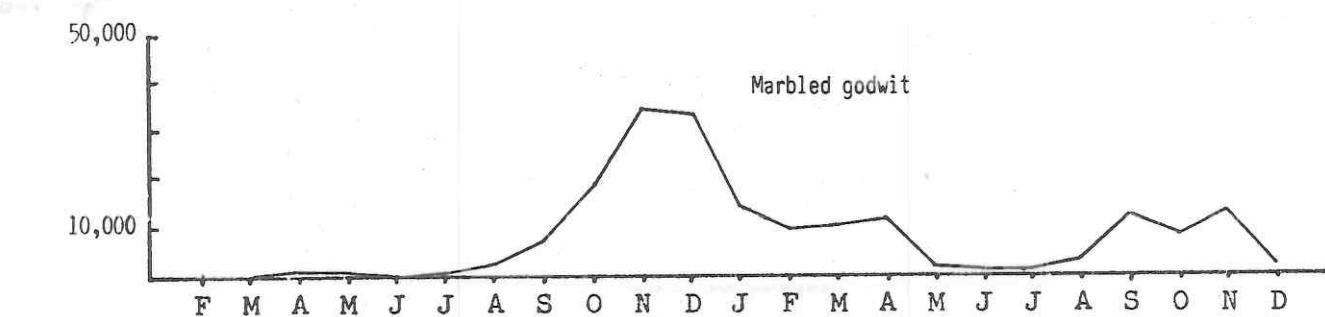


Figure 6. Seasonal distribution and abundance of selected bird species, San Francisco Bay, February 1964-December 1965.

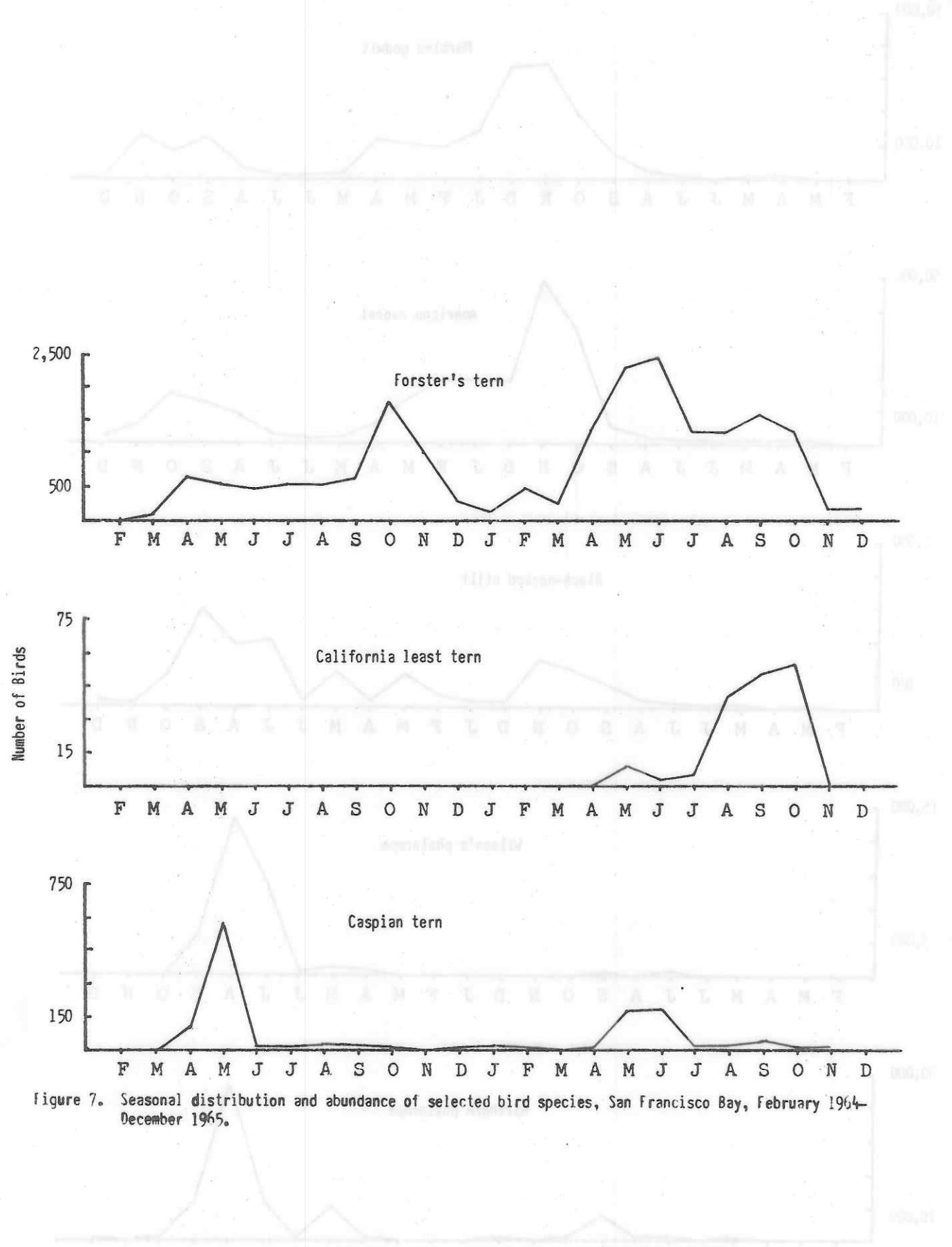


Figure 7. Seasonal distribution and abundance of selected bird species, San Francisco Bay, February 1964-December 1965.