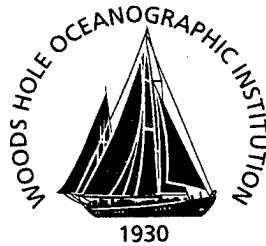


Woods Hole Oceanographic Institution



Numbers of Calling Whales in the North Pacific

by

William A. Watkins
Mary Ann Daher
Joseph E. George

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Woods Hole, MA 02543

November 2001

Technical Report

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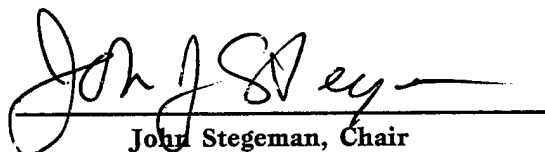
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John Stegeman, Chair

Department of Biology

NUMBERS OF CALLING WHALES IN THE NORTH PACIFIC

William A. Watkins, Mary Ann Daher, and Joseph E. George

Support is from CNO N45 Environmental Program and U.S. Army Corps of Engineers (DCA87-00-H-0026) with funding from the Department of Defense Legacy Resource Management Program.

Key words -- Numbers of calling whales, North Pacific whales, SOSUS arrays monitor whales, Seasonal distribution of North Pacific whales, Hydrophone array monitoring of whales.

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ABSTRACT

Since November 1995, the U.S. Navy's Sound Surveillance System (SOSUS) and other hydrophone arrays were used to regularly sample the occurrence of whale sounds in four Regions bordering the continental margins across the North Pacific. The numbers of whales heard calling varied with season and location for each species, blue whales (*Balaenoptera musculus*), fin whales (*Balaenoptera physalus*), and humpback whales (*Megaptera novaeangliae*). For blue whales, calling during the Fall season averaged 5 whales per event, Winter averaged 1.5 whales per event, Spring averaged 1 whale, and Summer averaged 1.5 whales. For fin whales, the numbers of whales heard ("F" calls from individuals) during Winter averaged 3 whales per event, Spring and Fall calling averaged 1.5 whales, and Summer averaged 1 whale. The "J" calling events, regardless of season, were judged to be from at least 6 fin whales. Humpback singing typically was from 3 whales. These numbers demonstrated seasonal variations in calling whales for each Region.

INTRODUCTION

The development of realistic assessments for the number of whales that are likely to be calling during a given period in the deep ocean requires long-term acoustic sampling, broad area coverage, and consistent methods of counting. The whale call monitoring program using hydrophone systems in deep water has fulfilled these requirements (Watkins et al. 2000a).

Since November 1995, acoustic data from the U.S. Navy's Sound Surveillance System (SOSUS) and other arrays have been regularly sampled to assess the extent of whale calling in four Regions bordering the continental margins across the North Pacific (Watkins et al. 2000b). This monitoring program has continued systematically over the past five and a half years, providing long-term data on the occurrence of calling by whales. The deepwater hydrophone systems allow relatively long-range listening, permitting coverage of broad regions of the ocean. Recognition of the characteristic call patterns produced by the different species allowed calls of individual whales to be systematically identified and realistic assessments made of the numbers of whales heard calling.

Previous descriptions of the occurrence of calling whales

across the North Pacific have included the following reports: the seasonal presence of calling blue, fin, and humpback whales were described for different North Pacific Regions from the 1996 and 1997 monitoring program data (Watkins et al. 2000a), the monthly occurrence of calling by the different species on different hydrophone arrays and the location of individual calling whales were identified from the data through July 1999 (Watkins et al. 2000b), the seasonal distribution of the different species was presented by Watkins et al. (2000c), and the variation in year to year calling by the different species were compared to environmental changes such as those from El Niño (Watkins et al. 2001).

Although little is known from direct observation about the whale populations in the open sea, regular monitoring of their calls makes it possible to assess the occurrence of the portion of these populations that are producing sounds and to judge their attendant behaviors. The non-disturbing, passive listening systems provide year-round, all weather, day and night monitoring of these offshore whales. The calls of the different species are known from previous study and cataloging of their

acoustic behaviors (Watkins and Wartzok 1985, Watkins et al. 1992). Therefore, we can estimate the likely numbers of whales of the various species that would be heard calling in different locations and seasons across the deep waters of the North Pacific.

METHODS

Whale calls in the North Pacific were monitored at the Naval Ocean Processing Facility on Whidbey Is., WA. Acoustic data from deep water hydrophone arrays of the SOSUS system and other hydrophone arrays have been sampled on a regular schedule to assess the occurrence of particular whale calls. Whale calls were identified by analysts experienced in recognition of the different whale call patterns. Ten bottom arrays were selected as providing representative data for four offshore Regions along the continental margins, labeled Northwest (NW), Northcentral (NC), Northeast (NE), and Southeast (SE). The Regions were divided at increments of 30° Longitude by 15° Latitude, see Figure 1.

Within these Regions, north-south detail was provided by the

use of two or three arrays at different latitudes. Two arrays were used in each of the NW and NC Regions, and three arrays in each of the NE and SE Regions. Individual arrays within Regions were labeled from the north (SE1 north of SE2 in SE, etc.). Beam-formed data from each hydrophone array were interpolated to give the equivalent of 40 line array beams for each array. This provided comparable information from all array systems, regardless of their composition. Array orientations were not considered for these analyses. Locations for many of the Navy hydrophone systems have remained protected, along with their characteristics and associated data processing.

Typically, there was no overlap in the calls from local whales recorded by the different arrays within Regions. When competing noise was absent, calls from very distant whales sometimes could be noted, but these normally were not a component of the primary call occurrence data. Counts of calling whales were tabulated separately for each array. The spectrographic data from all arrays were examined systematically over the same period during two, usually consecutive, 16-hour days every week, centered on 1200 hours GMT. This period spanned both daylight and darkness in each

Region. The calls of one to five whales of the same species distinguished on the same beam, generally within a period of about four hours, were considered one call occurrence event. No new occurrences were logged for that beam during that day, unless it was obvious that another set of calls had begun from markedly different whales (distinct difference in level and acoustic pattern). Whale call sequences often continued over much of the day, and therefore, were recorded as one occurrence. If similar call sequences were present on the same array beam on the second day, they were recorded as another occurrence. One dominant beam displaying the calls was identified for each call occurrence. Changes over time in the distribution of calling individuals and local groups of whales across different array beams showed the extent of their movements, over days or weeks.

COUNTS OF CALLING WHALES

Judgements as to the numbers of whales heard calling in these data were based on the previous experience with these continuing observations of calling whales (5 1/2 years to date). Each array beam represented a different direction to the source of incoming sound. In addition, there often were several whales calling from different local areas, and from different distances in the same direction.

To provide a realistic count the number of whales heard from each direction, relatively large amounts of data and considerable familiarity with the spectral representations of the whale sounds as well as noise patterns have been needed. It was anticipated that such estimates would be refined with continuing analyses of the call data. The counts of calling whales enumerated here represented assessments of the numbers of whales heard, the numbers of overlapping call sequences from different relatively local whales audible from the same direction for each calling event.

Call patterns for each whale species were consistently different, so that species distinctions could be made reliably (each with different repetition patterns, fundamental frequencies, harmonic sequences, and spectral ranges). Overlapping calls from several whales of the same species were common because of the broad distribution of blue whales and the clumped groups of fin and humpback whales. The counts of calling whales were different for each species, and they varied with season and Region.

Review of the call data to date confirm the number of whales that could be identified when calls were noted. These counts of calling whales were compared and averaged over each month, and then related to the seasonal variations in each Region. Whale calling seasons were offset consistently from the calendar year by one month, matching the apparent annual cycle of call occurrence for each species -- Spring (March - May), Summer (June - August), Fall (September - November), and Winter (December - February) (Watkins et al. 2000b).

For the comparisons presented here, monthly counts of the numbers of calling whales for each of the ten arrays in the four Regions were summed for each season and compared, season by season.

WHALES SPECIES MONITORED

Three species of whales were monitored systematically: blue whale (*Balaenoptera musculus*) and fin whale (*Balaenoptera physalus*) calls, as well as songs from humpback whales (*Megaptera novaeangliae*). Each species had different amounts of calling and variations in seasonal occurrences in each of the four Regions and local areas monitored by separate arrays.

BLUE WHALE call sequences identified in the acoustic data were their long series of repetitive, downswept tonal calls (cf. Cummings and Thompson 1971, Rivers 1997). These calls usually had fundamental frequencies below 19 Hz and had several harmonics. Calls were repeated variably at 3 to 10 min intervals, often continuing over several hours. Shorter calls and call series from this species were not consistently separable from noise, and so they were not a part of these analyses.

Blue whale calls during their Fall peak calling season usually were from three to eight or more whales during each calling event, averaging five whales for each calling event, and often from too many whales to separate. During Winter, as blue whale calls waned, calling was from one to three whales. Then, in Spring, their lowest calling season, only one whale usually was evident for each calling event. During the Summer, as calling increased again, one to three whales were audible. Therefore, for seasonal comparisons of the numbers of calling whales, Fall calling events were multiplied by 5, Winter by 1.5, Spring by 1, and Summer by 1.5.

FIN WHALE call sequences identified in the acoustic data were the repetitive, downswept "20 Hz" pulse series (cf. Watkins 1981, Watkins et al. 1987). These calls had most energy near 20 Hz, with little harmonic energy. Calls were composed of pulses of about 1 sec each, repeated regularly at rates of a few seconds in characteristic temporal patterns over periods of a few hours to a day or more. Other call types and shorter call sequences from this species were not as easily separated from noise, and were not a part of these analyses. Fin whale calls identified here included those that could be reliably distinguished as coming from individuals (labeled "F") and overlapping concentrations of calls from too many whales in a local area to allow separation (labeled "J"). When present, this "J" call component swamped concurrent "F" calls by individual whales, unless F calls were relatively close to arrays.

Individual fin whale calling (F calls) during the Winter season of peak calling usually was from one to five whales per event, averaging three fin whales calling at a time. During the intermediate Spring and Fall calling seasons, calls were from

one to three whales, and in the Summer period of lowest fin whale calling, only one whale was evident during most calling events. The "J" calls by fin whales, however, regardless of season, were judged to be from six to very many more fin whales. Combining the "F" and "J" calls likely provided the best assessment of the numbers of calling fin whales. Therefore, for seasonal comparisons of the numbers of calling fin whales, F calls and J calls were tabulated separately. For F calls, Winter calling events were multiplied by 3, Spring and Fall events by 1.5, and Summer by 1. The J calling events from fin whales, regardless of season, were multiplied by 6. The totals for the two call types were then added to provide the seasonal assessments of numbers of calling fin whales for each array.

HUMPBACK WHALE song could be recognized reliably, although only the frequencies below a few hundred Hertz were typically received from more distant whales (cf. Payne and McVay 1971, Payne et al. 1983). Songs were heard usually from groups of humpbacks, estimated at three or more individuals singing during each event. Singing typically lasted for several hours, and

usually was related to migration, even when whales remained in the area. Humpback singing events were multiplied by 3.

Individual calling whales of each of these species were likely to be associated with many more whales. Little is known of the number of calling individuals that normally associate in whale groups, or of the number of whales that accompany each calling whale of each species. Most such observations have been of inshore populations of these species which may have quite different patterns of activity compared to the offshore whales.

SEASONAL NUMBERS OF CALLING WHALES

The counts of calling blue, and fin whales, and singing humpback whales have been listed and plotted to provide seasonal comparisons for the different arrays in each Region. The counts of calling whales were tabulated for each of the three-month seasons for each array in the separate Regions: (1) the sum of the "actual" calling events for the three months, and (2) these seasonal counts multiplied by the average number of calling whales noted for each season. The "actual" call event count multiplied by the numbers of calling whales gave realistic numbers of calling whales of each species that occurred

seasonally in the different areas of each Region. See Tables 1-10 for (1) the calling event counts for each array and (2) these event counts multiplied by the seasonal average number of calling whales per event.

These seasonal numbers (event counts multiplied by seasonal averages) are plotted for each species -- blue whales in Figure 2, fin whale F calls in Figure 3, fin whale J calls in Figure 4, fin whale F+J calls in Figure 5, and humpback whale songs in Figure 6. Such counts of sampled calling provide the basis for useful assessments of the numbers of calling blue, fin, and humpback whales present in the different local areas of each of the four North Pacific Regions.

DIFFERENCES IN SEASONAL CALLING

Blue whales were heard most in the NW in the Fall season from whales scattered widely throughout the region. Calling was reduced, but not absent during Spring. The 1998 El Niño year had reduced calling in most areas during the peak Fall season (see Watkins et al. 2001). The NC Region was second in numbers of calling blue whales, and the arrays in the NE Region had the fewest calling whales (Figure 2).

Fin whale calling has had variations that appear related to population behavior, rather than to environmental changes. During the first years of the monitoring program, most fin whales calling during the peak Winter season were in the northern part of the NC Region. However, in 1999 there was a large increase in the numbers of calling fin whales in all Regions (Figures 3-5).

Humpback whale songs were noted most during the first years of monitoring in the SE Region, coincident with the December to May migration between Alaska and southern waters. Songs were also recorded in the NC Region, particularly in the Spring. The NW and NE Regions have had few singing Humpbacks. Then, again in 1999, there was a distinct change in the numbers of calling whales, with fewer whales calling in the SE and many more in the NC Region (Figure 6) -- note the scale change relative to the blue and fin whale figures).

SUMMARY

The numbers of calling whales of each species were derived from (1) the number of call occurrence events recorded for 40 beams of each of the 10 arrays, (2) the sum of these calling events occurring during each of the two 16-hour days sampled very week, (3) the sum of these daily totals for each month, (4) the product of these monthly totals multiplied by the average number of calling whales contributing to each call occurrence event during the month, and (5) the sum of these monthly numbers of calling whales totalled for three months of each season.

These call data draw their utility from the consistent, long-term regularity and comprehensive coverage of the sampling protocol. There have been no supplements for remaining hours of the sampling day, no additions for days not sampled each week, no extensions to compensate for calls not recorded from distant whales, and no extrapolations to accommodate variations in array coverage (180-degree, typical 40-beam pattern assumed). Comparisons of these seasonal numbers of calling whales provided realistic measures of the annual changes in the distribution of the vocalizing components of these offshore

whales. The variations demonstrated the dynamic changes in the seasonal calling -- different for each of the three species and the four Regions. The predictability of call occurrence has become more realistic. The large amount of call data over more than five and a half years of call monitoring have made forecasts of call occurrence more useful.

ACKNOWLEDGMENTS

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Army Corps of Engineers (DCA87-00-H-0026) with funding from

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Unpublished manuscript, 16 pp., 1 Table, 13 Figs.

CAPTIONS

(In order of occurrence)

FIGURE 1

Map of North Pacific Regions. NW, NC, NE, and SE Regions were monitored for calling whales.

TABLE 1 - 2

Blue whale calling, actual call occurrence events and totals multiplied by average number of whales calling.

FIGURE 2

Seasonal comparison of numbers of calling blue whales for the different arrays in the four Regions for each year.

TABLES 3 - 4

Fin whale "F" calling, actual call occurrence events and totals multiplied by average number of whales calling.

FIGURE 3

Seasonal comparison of numbers of "F" calling fin whales for the different arrays in the four Regions for each year.

TABLES 5 - 6

Fin whale "J" calling, actual call occurrence events and totals multiplied by average number of whales calling.

FIGURE 4

Seasonal comparison of numbers of "J" calling fin whales for the different arrays in the four Regions for each year.

TABLE 7

Fin whale "F" plus "J" calling, sum of multiplied totals of both types of calls.

FIGURE 5

Seasonal comparison of numbers of combined "F" plus "J" calling fin whales for the different arrays in the four Regions for each year -- sum of multiplied totals.

TABLES 8 - 9

Humpback whale singing, actual song occurrence events and totals multiplied by average number of whales singing.

FIGURE 6

Seasonal comparison of numbers of singing humpback whales for the different arrays in the four Regions for each year.

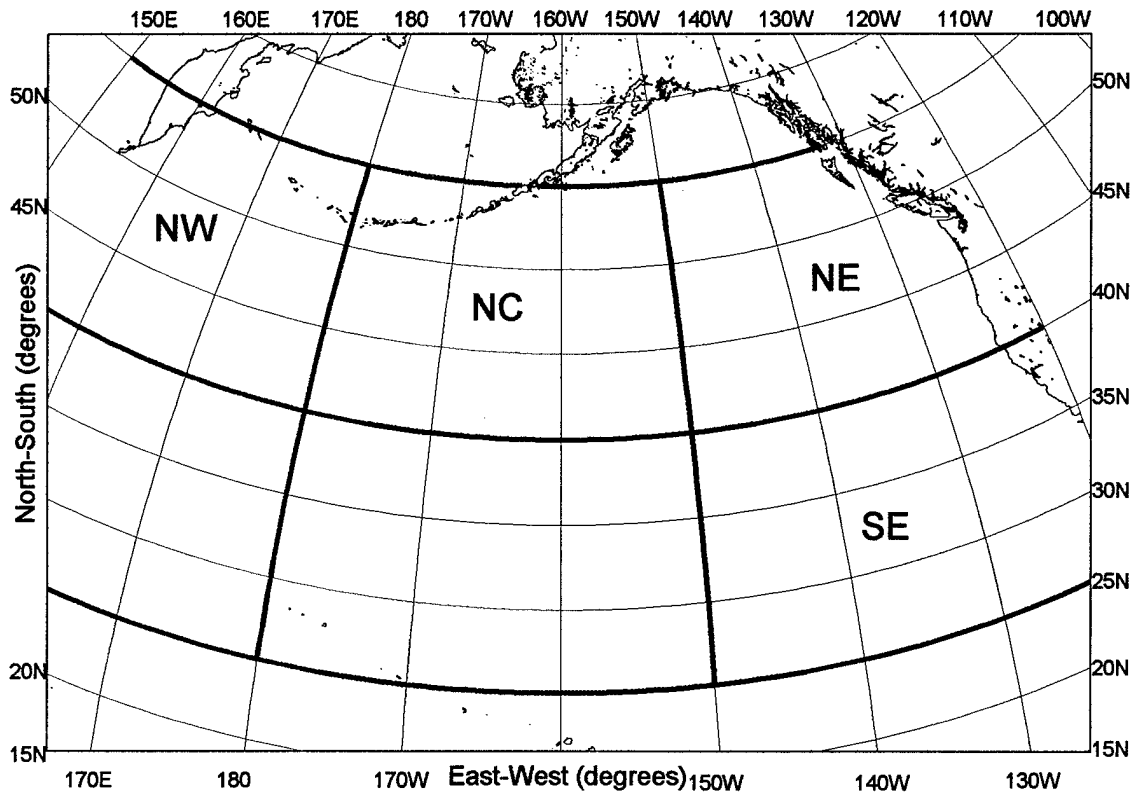


Fig. 1

Table 1

Blue Whale Totals

| | Jan | Jan | Feb | Feb | Mar | Mar | Apr | Apr | May | May | Jun | Jun |
|-------------|---------------|-------------|---------------|-------------|---------------|-----------|---------------|-----------|---------------|-----------|---------------|-------------|
| 1995 | ACTUAL | x1.5 | ACTUAL | x1.5 | ACTUAL | x1 | ACTUAL | x1 | ACTUAL | x1 | ACTUAL | x1.5 |
| NW1 | | | | | | | | | | | | |
| NW2 | | | | | | | | | | | | |
| NC1 | | | | | | | | | | | | |
| NC2 | | | | | | | | | | | | |
| NE1 | | | | | | | | | | | | |
| NE2 | | | | | | | | | | | | |
| NE3 | | | | | | | | | | | | |
| SE1 | | | | | | | | | | | | |
| SE2 | | | | | | | | | | | | |
| SE3 | | | | | | | | | | | | |
| 1996 | | | | | | | | | | | | |
| NW1 | 32 | 47 | 13 | 19 | 5 | 5 | 4 | 4 | 5 | 5 | 37 | 56 |
| NW2 | 73 | 109 | 51 | 76 | 6 | 6 | 5 | 5 | 19 | 19 | 55 | 83 |
| NC1 | 20 | 29 | 11 | 17 | 12 | 12 | 6 | 6 | 0 | 0 | 2 | 3 |
| NC2 | 32 | 47 | 42 | 62 | 15 | 15 | 1 | 1 | 7 | 7 | 18 | 26 |
| NE1 | 12 | 18 | 0 | 0 | 13 | 13 | 0 | 0 | 0 | 0 | 0 | 0 |
| NE2 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 12 |
| NE3 | 4 | 6 | 16 | 24 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | 20 |
| SE1 | | | | | | | 0 | 0 | 0 | 0 | 0 | 0 |
| SE2 | | | | | | | 0 | 0 | 0 | 0 | 0 | 0 |
| SE3 | | | | | | | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | | | | | | | | | | | | |
| NW1 | 36 | 54 | 15 | 22 | 22 | 22 | 13 | 13 | 25 | 25 | 42 | 63 |
| NW2 | 39 | 58 | 10 | 15 | 21 | 21 | 14 | 14 | 33 | 33 | 73 | 110 |
| NC1 | 33 | 49 | 12 | 18 | 7 | 7 | 5 | 5 | 1 | 1 | 4 | 6 |
| NC2 | 54 | 81 | 33 | 50 | 20 | 20 | 8 | 8 | 4 | 4 | 11 | 17 |
| NE1 | 2 | 3 | 0 | 0 | 0 | 0 | 6 | 6 | 0 | 0 | 0 | 0 |
| NE2 | 16 | 24 | 7 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 8 |
| NE3 | 34 | 51 | 7 | 11 | 0 | 0 | 3 | 3 | 0 | 0 | 6 | 9 |
| SE1 | 32 | 48 | 3 | 5 | 24 | 24 | 18 | 18 | 18 | 18 | 0 | 0 |
| SE2 | 36 | 54 | 28 | 42 | 34 | 34 | 6 | 6 | 2 | 2 | 0 | 0 |
| SE3 | 20 | 30 | 23 | 35 | 36 | 36 | 8 | 8 | 1 | 1 | 3 | 5 |
| 1998 | | | | | | | | | | | | |
| NW1 | 60 | 90 | 27 | 41 | 20 | 20 | 8 | 8 | 31 | 31 | 55 | 82 |
| NW2 | 32 | 48 | 5 | 8 | 4 | 4 | 9 | 9 | 42 | 42 | 98 | 147 |
| NC1 | 36 | 54 | 20 | 30 | 12 | 12 | 0 | 0 | 1 | 1 | 8 | 12 |
| NC2 | 99 | 168 | 43 | 64 | 29 | 29 | 6 | 6 | 13 | 13 | 24 | 35 |
| NE1 | 5 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NE2 | 3 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NE3 | 15 | 23 | 18 | 27 | 5 | 5 | 0 | 0 | 0 | 0 | 2 | 3 |
| SE1 | 29 | 44 | 28 | 42 | 26 | 26 | 22 | 22 | 0 | 0 | 21 | 32 |
| SE2 | 26 | 39 | 78 | 117 | 16 | 16 | 3 | 3 | 2 | 2 | 0 | 0 |
| SE3 | 52 | 78 | 41 | 62 | 7 | 7 | 0 | 0 | 2 | 2 | 0 | 0 |
| 1999 | | | | | | | | | | | | |
| NW1 | 53 | 80 | 20 | 29 | 11 | 11 | 22 | 22 | 22 | 22 | 34 | 50 |
| NW2 | 61 | 92 | 11 | 16 | 6 | 6 | 28 | 28 | 23 | 23 | 53 | 79 |
| NC1 | 40 | 60 | 22 | 33 | 12 | 12 | 0 | 0 | 0 | 0 | 16 | 24 |
| NC2 | 51 | 76 | 45 | 68 | 11 | 11 | 7 | 7 | 9 | 9 | 27 | 41 |
| NE1 | 3 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NE2 | 19 | 29 | 12 | 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NE3 | 22 | 33 | 15 | 23 | 7 | 7 | 0 | 0 | 0 | 0 | 0 | 0 |
| SE1 | 60 | 90 | 0 | 0 | 10 | 10 | 0 | 0 | 1 | 1 | 17 | 26 |
| SE2 | 102 | 153 | 0 | 0 | 37 | 37 | 0 | 0 | 0 | 0 | 0 | 0 |
| SE3 | 65 | 98 | 0 | 0 | 63 | 63 | 0 | 0 | 1 | 1 | 8 | 12 |
| 2000 | | | | | | | | | | | | |
| NW1 | 66 | 99 | 66 | 99 | 17 | 17 | 8 | 8 | 20 | 20 | 59 | 89 |
| NW2 | 40 | 61 | 16 | 24 | 8 | 8 | 13 | 13 | 19 | 19 | 37 | 56 |
| NC1 | 43 | 65 | 20 | 30 | 3 | 3 | 0 | 0 | 0 | 0 | 10 | 15 |
| NC2 | 81 | 122 | 95 | 143 | 26 | 26 | 1 | 1 | 5 | 5 | 20 | 30 |
| NE1 | 0 | 0 | 6 | 9 | 3 | 3 | 0 | 0 | 0 | 0 | 6 | 9 |
| NE2 | 12 | 18 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NE3 | 21 | 32 | 18 | 27 | 7 | 7 | 0 | 0 | 2 | 2 | 0 | 0 |
| SE1 | | | 10 | 15 | 33 | 33 | 0 | 0 | 0 | 0 | 0 | 0 |
| SE2 | | | 33 | 50 | 51 | 51 | 1 | 1 | 1 | 1 | 0 | 0 |
| SE3 | | | 33 | 50 | 27 | 27 | 15 | 15 | 0 | 0 | 2 | 3 |
| 2001 | | | | | | | | | | | | |
| NW1 | 60 | 89 | 27 | 41 | 11 | 11 | 0 | 0 | 6 | 6 | | |
| NW2 | 33 | 50 | 11 | 16 | 10 | 10 | 4 | 4 | 10 | 10 | | |
| NC1 | 87 | 131 | 78 | 116 | 21 | 21 | 2 | 2 | 8 | 8 | | |
| NC2 | 83 | 125 | 103 | 154 | 10 | 10 | 4 | 4 | 6 | 6 | | |
| NE1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | | |
| NE2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | | |
| NE3 | 34 | 51 | 12 | 18 | 12 | 12 | 2 | 2 | 1 | 1 | | |
| SE1 | 27 | 41 | 4 | 6 | 45 | 45 | 8 | 8 | 2 | 2 | | |
| SE2 | 40 | 60 | 37 | 56 | 80 | 80 | 20 | 20 | 0 | 0 | | |
| SE3 | 148 | 222 | 44 | 66 | 86 | 86 | 18 | 18 | 0 | 0 | | |

Table 2

Blue Whale Totals

| | Jul | Jul | Aug | Aug | Sept | Sept | Oct | Oct | Nov | Nov | Dec | Dec |
|-------------|---------------|-------------|---------------|-------------|---------------|-----------|---------------|-----------|---------------|-----------|---------------|-------------|
| 1995 | ACTUAL | x1.5 | ACTUAL | x1.5 | ACTUAL | x5 | ACTUAL | x5 | ACTUAL | x5 | ACTUAL | x1.5 |
| NW1 | | | | | | | | | 205 | 1025 | 97 | 145 |
| NW2 | | | | | | | | | 107 | 533 | 85 | 127 |
| NC1 | | | | | | | | | 86 | 428 | 47 | 71 |
| NC2 | | | | | | | | | 91 | 455 | 85 | 127 |
| NE1 | | | | | | | | | 21 | 105 | 17 | 26 |
| NE2 | | | | | | | | | 11 | 55 | 16 | 24 |
| NE3 | | | | | | | | | 61 | 305 | 14 | 21 |
| SE1 | | | | | | | | | | | | |
| SE2 | | | | | | | | | | | | |
| SE3 | | | | | | | | | | | | |
| 1996 | | | | | | | | | | | | |
| NW1 | 123 | 184 | 265 | 397 | 341 | 1705 | 204 | 1020 | 25 | 125 | 104 | 156 |
| NW2 | 125 | 187 | 165 | 247 | 261 | 1305 | 256 | 1278 | 29 | 145 | 108 | 162 |
| NC1 | 19 | 29 | 53 | 79 | 64 | 320 | 81 | 405 | 13 | 63 | 56 | 84 |
| NC2 | 53 | 80 | 140 | 210 | 231 | 1155 | 116 | 578 | 1 | 5 | 82 | 123 |
| NE1 | 8 | 12 | 31 | 47 | 0 | 0 | 3 | 15 | 37 | 185 | 0 | 0 |
| NE2 | 1 | 2 | 31 | 47 | 25 | 125 | 5 | 25 | 14 | 70 | 41 | 62 |
| NE3 | 21 | 32 | 51 | 77 | 67 | 335 | 46 | 230 | 60 | 300 | 29 | 44 |
| SE1 | 9 | 14 | 28 | 42 | 55 | 275 | 49 | 245 | 70 | 350 | 103 | 155 |
| SE2 | 4 | 6 | 28 | 42 | 38 | 190 | 37 | 185 | 44 | 220 | 105 | 158 |
| SE3 | 17 | 26 | 48 | 72 | 55 | 275 | 50 | 250 | 59 | 295 | 69 | 104 |
| 1997 | | | | | | | | | | | | |
| NW1 | 94 | 140 | 273 | 410 | 286 | 1430 | 262 | 1308 | 213 | 1065 | 125 | 188 |
| NW2 | 121 | 181 | 187 | 281 | 257 | 1285 | 299 | 1495 | 226 | 1128 | 190 | 284 |
| NC1 | 38 | 57 | 98 | 147 | 75 | 375 | 107 | 535 | 107 | 533 | 65 | 98 |
| NC2 | 47 | 70 | 174 | 261 | 219 | 1095 | 260 | 1300 | 279 | 1395 | 129 | 194 |
| NE1 | 2 | 3 | 17 | 26 | 33 | 165 | 30 | 150 | 21 | 105 | 5 | 8 |
| NE2 | 8 | 12 | 31 | 47 | 50 | 250 | 28 | 140 | 28 | 140 | 4 | 6 |
| NE3 | 16 | 24 | 63 | 95 | 70 | 350 | 130 | 650 | 96 | 480 | 31 | 47 |
| SE1 | 31 | 47 | 67 | 101 | 75 | 375 | 102 | 510 | 69 | 345 | 68 | 102 |
| SE2 | 9 | 14 | 80 | 120 | 76 | 380 | 43 | 215 | 62 | 310 | 61 | 92 |
| SE3 | 28 | 42 | 83 | 125 | 81 | 405 | 93 | 465 | 88 | 440 | 46 | 69 |
| 1998 | | | | | | | | | | | | |
| NW1 | 120 | 180 | 385 | 577 | 245 | 1225 | | | 300 | 1498 | 115 | 173 |
| NW2 | 158 | 237 | 312 | 468 | 184 | 920 | | | 176 | 880 | 144 | 216 |
| NC1 | 44 | 66 | 104 | 156 | 108 | 540 | | | 110 | 548 | 104 | 155 |
| NC2 | 56 | 84 | 311 | 467 | 129 | 645 | | | 139 | 695 | 159 | 238 |
| NE1 | 0 | 0 | 21 | 32 | 54 | 270 | 34 | 170 | 38 | 190 | 49 | 74 |
| NE2 | 3 | 5 | 22 | 33 | 21 | 105 | 54 | 270 | 32 | 160 | 18 | 27 |
| NE3 | 14 | 21 | 54 | 81 | 63 | 315 | 92 | 460 | 77 | 385 | 62 | 93 |
| SE1 | 28 | 42 | 86 | 129 | 77 | 385 | 123 | 615 | 90 | 450 | 115 | 173 |
| SE2 | 1 | 2 | 45 | 68 | 47 | 235 | 71 | 355 | 85 | 425 | 95 | 143 |
| SE3 | 23 | 35 | 61 | 92 | 43 | 215 | 90 | 450 | 105 | 525 | 91 | 137 |
| 1999 | | | | | | | | | | | | |
| NW1 | 122 | 183 | 122 | 183 | 428 | 2140 | 356 | 1780 | 324 | 1618 | 227 | 340 |
| NW2 | 141 | 212 | 141 | 212 | 340 | 1700 | 274 | 1370 | 282 | 1408 | 141 | 212 |
| NC1 | 59 | 89 | 59 | 89 | 137 | 685 | 102 | 508 | 105 | 523 | 90 | 134 |
| NC2 | 87 | 131 | 87 | 131 | 209 | 1045 | 217 | 1085 | 230 | 1150 | 224 | 335 |
| NE1 | 8 | 12 | 8 | 12 | 28 | 140 | 132 | 660 | 21 | 105 | 6 | 9 |
| NE2 | 0 | 0 | 0 | 0 | 30 | 150 | 7 | 35 | 7 | 35 | 9 | 14 |
| NE3 | 10 | 15 | 10 | 15 | 63 | 315 | 58 | 290 | 68 | 340 | 36 | 57 |
| SE1 | 12 | 18 | 12 | 18 | 160 | 800 | 87 | 435 | 35 | 175 | | |
| SE2 | 12 | 18 | 12 | 18 | 105 | 525 | 43 | 215 | 35 | 175 | | |
| SE3 | 46 | 69 | 46 | 69 | 121 | 605 | 80 | 400 | 42 | 210 | | |
| 2000 | | | | | | | | | | | | |
| NW1 | 141 | 212 | 405 | 608 | 339 | 1695 | 343 | 1715 | 390 | 1948 | 227 | 340 |
| NW2 | 83 | 125 | 280 | 420 | 247 | 1235 | 244 | 1220 | 337 | 1683 | 199 | 299 |
| NC1 | 45 | 68 | 106 | 159 | 148 | 740 | 125 | 625 | 223 | 1115 | 90 | 134 |
| NC2 | 64 | 95 | 300 | 450 | 210 | 1050 | 217 | 1083 | 306 | 1528 | 224 | 335 |
| NE1 | 8 | 12 | 16 | 24 | 28 | 140 | 22 | 110 | 24 | 120 | 0 | 0 |
| NE2 | 5 | 8 | 23 | 35 | 8 | 40 | 3 | 15 | 30 | 150 | 17 | 26 |
| NE3 | 7 | 11 | 38 | 57 | 105 | 525 | 112 | 560 | 129 | 645 | 113 | 170 |
| SE1 | 62 | 93 | 144 | 216 | 100 | 500 | 115 | 575 | 167 | 835 | 101 | 152 |
| SE2 | 19 | 29 | 68 | 102 | 75 | 375 | 122 | 610 | 103 | 515 | 92 | 138 |
| SE3 | 53 | 80 | 77 | 116 | 94 | 470 | 111 | 555 | 138 | 690 | 113 | 170 |

Occurrence of Blue Whale Calls from 1996-2001

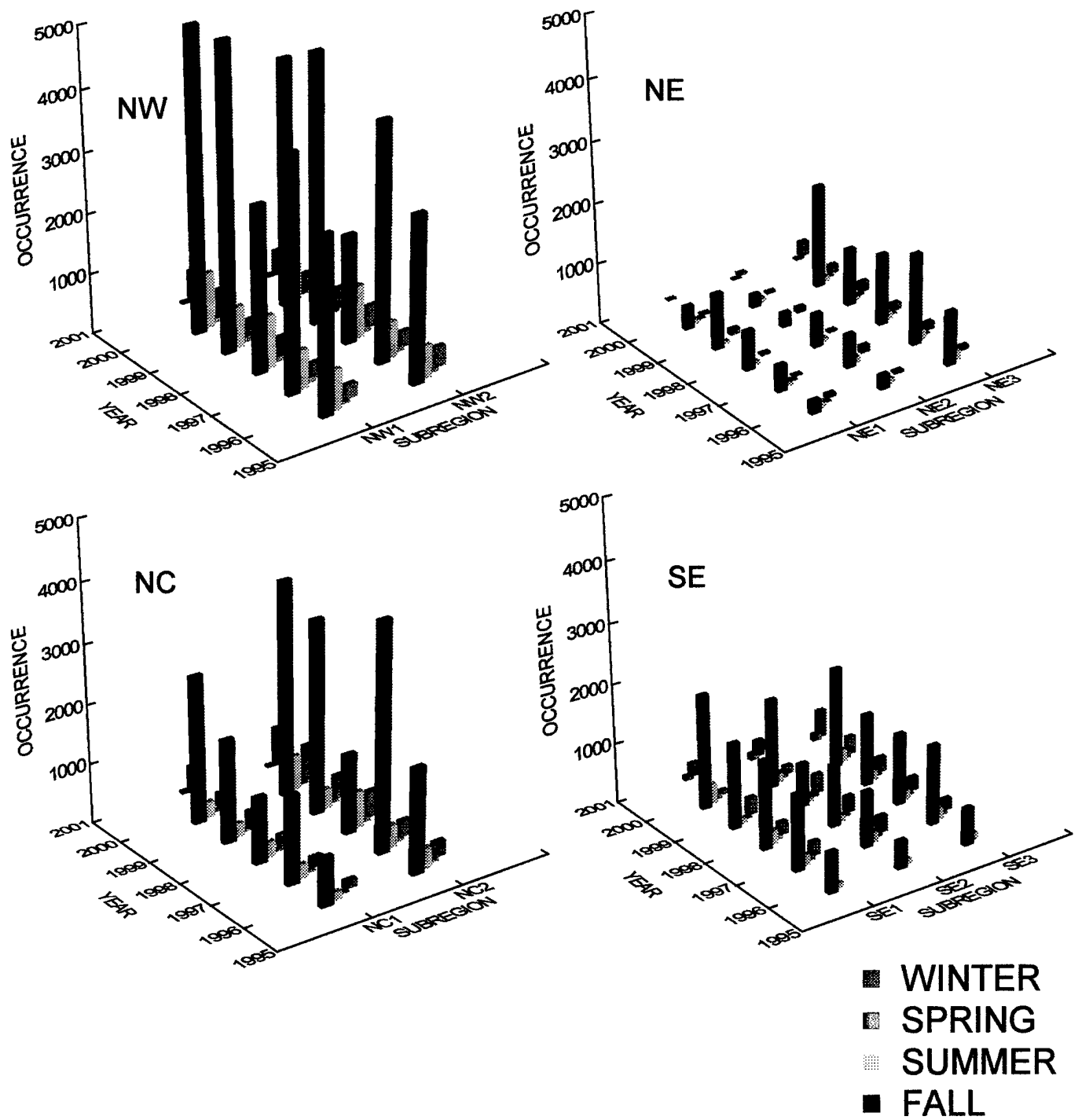


Fig. 2

Table 3

Fin Whale, F, Totals

| | Jan | Jan | Feb | Feb | March | March | April | April | May | May | Jun | Jun |
|-------------|--------|-----|--------|------|--------|-------|--------|-------|--------|------|--------|-----|
| | Actual | x3 | Actual | x3 | Actual | x1.5 | Actual | x1.5 | Actual | x1.5 | Actual | x1 |
| 1995 | | | | | | | | | | | | |
| NW1 | | | | | | | | | | | | |
| NW2 | | | | | | | | | | | | |
| NC1 | | | | | | | | | | | | |
| NC2 | | | | | | | | | | | | |
| NE1 | | | | | | | | | | | | |
| NE2 | | | | | | | | | | | | |
| NE3 | | | | | | | | | | | | |
| SE1 | | | | | | | | | | | | |
| SE2 | | | | | | | | | | | | |
| SE3 | | | | | | | | | | | | |
| 1996 | | | | | | | | | | | | |
| NW1 | 11 | 33 | 25 | 75 | 22 | 33 | 8 | 12 | 6 | 9 | 1 | 1 |
| NW2 | 10 | 30 | 13 | 39 | 23 | 35 | 6 | 9 | 22 | 33 | 2 | 2 |
| NC1 | 20 | 60 | 8 | 24 | 24 | 36 | 4 | 6 | 0 | 0 | 1 | 1 |
| NC2 | 2 | 6 | 16 | 48 | 25 | 38 | 2 | 3 | 3 | 5 | 0 | 0 |
| NE1 | 96 | 288 | 31 | 93 | 24 | 36 | 42 | 63 | 12 | 18 | 0 | 0 |
| NE2 | 58 | 174 | 40 | 120 | 117 | 176 | 65 | 98 | 7 | 11 | 0 | 0 |
| NE3 | 9 | 27 | 3 | 9 | 55 | 83 | 40 | 60 | 5 | 8 | 0 | 0 |
| SE1 | | | | | | | | | 0 | 0 | 0 | 0 |
| SE2 | | | | | | | | | 0 | 0 | 0 | 0 |
| SE3 | | | | | | | | | 0 | 0 | 0 | 0 |
| 1997 | | | | | | | | | | | | |
| NW1 | 22 | 66 | 30 | 90 | 13 | 20 | 17 | 26 | 0 | 0 | 0 | 0 |
| NW2 | 55 | 165 | 42 | 126 | 19 | 29 | 32 | 48 | 2 | 3 | 0 | 0 |
| NC1 | 36 | 108 | 26 | 78 | 17 | 26 | 4 | 6 | 6 | 9 | 7 | 7 |
| NC2 | 27 | 81 | 21 | 63 | 22 | 33 | 25 | 38 | 0 | 0 | 0 | 0 |
| NE1 | 113 | 339 | 60 | 180 | 35 | 53 | 11 | 17 | 11 | 17 | 8 | 8 |
| NE2 | 102 | 306 | 110 | 330 | 129 | 194 | 77 | 116 | 43 | 65 | 2 | 2 |
| NE3 | 85 | 255 | 67 | 201 | 51 | 77 | 41 | 62 | 13 | 20 | 0 | 0 |
| SE1 | 74 | 222 | 77 | 231 | 191 | 287 | 106 | 159 | 9 | 14 | 0 | 0 |
| SE2 | 113 | 339 | 164 | 492 | 69 | 104 | 33 | 50 | 0 | 0 | 2 | 2 |
| SE3 | 145 | 435 | 191 | 573 | 113 | 170 | 72 | 108 | 11 | 17 | 0 | 0 |
| 1998 | | | | | | | | | | | | |
| NW1 | 65 | 195 | 24 | 72 | 14 | 21 | 25 | 37 | 4 | 6 | 0 | 0 |
| NW2 | 85 | 255 | 38 | 114 | 19 | 29 | 14 | 21 | 22 | 33 | 0 | 0 |
| NC1 | 53 | 50 | 29 | 87 | 33 | 50 | 2 | 3 | 8 | 12 | 1 | 1 |
| NC2 | 30 | 90 | 5 | 15 | 21 | 32 | 23 | 34 | 3 | 5 | 0 | 0 |
| NE1 | 19 | 57 | 33 | 99 | 64 | 96 | 20 | 30 | | | | |
| NE2 | 28 | 84 | 19 | 57 | 56 | 84 | 19 | 29 | 2 | 3 | 0 | 0 |
| NE3 | 34 | 102 | 3 | 9 | 14 | 21 | 58 | 87 | 0 | 0 | 0 | 0 |
| SE1 | 83 | 249 | 89 | 267 | 106 | 159 | 63 | 95 | 20 | 30 | | |
| SE2 | 87 | 261 | 132 | 396 | 93 | 140 | 22 | 63 | 0 | 0 | 0 | 0 |
| SE3 | 130 | 390 | 159 | 477 | 150 | 225 | 45 | 68 | 3 | 5 | 0 | 0 |
| 1999 | | | | | | | | | | | | |
| NW1 | 46 | 138 | 37 | 111 | 46 | 69 | 44 | 66 | 7 | 11 | 0 | 0 |
| NW2 | 86 | 258 | 19 | 57 | 18 | 27 | 17 | 26 | 5 | 8 | 0 | 0 |
| NC1 | 125 | 375 | 106 | 318 | 89 | 134 | 40 | 60 | 4 | 6 | 2 | 2 |
| NC2 | 48 | 144 | 15 | 45 | 30 | 45 | 24 | 36 | 0 | 0 | 0 | 0 |
| NE1 | 105 | 315 | 86 | 258 | 84 | 126 | 42 | 63 | 2 | 3 | | |
| NE2 | 52 | 156 | 83 | 249 | 49 | 74 | 52 | 78 | 7 | 11 | 2 | 2 |
| NE3 | 85 | 255 | 49 | 147 | 109 | 164 | 58 | 87 | 2 | 3 | 0 | 0 |
| SE1 | 276 | 828 | 268 | 804 | 275 | 413 | 92 | 138 | 9 | 14 | 0 | 0 |
| SE2 | 321 | 963 | 146 | 438 | 126 | 189 | 42 | 63 | 2 | 3 | 0 | 0 |
| SE3 | 306 | 918 | 407 | 1221 | 250 | 375 | 234 | 351 | 11 | 17 | 4 | 4 |
| 2000 | | | | | | | | | | | | |
| NW1 | 38 | 114 | 56 | 168 | 61 | 91 | 30 | 45 | 9 | 14 | 0 | 0 |
| NW2 | 25 | 75 | 27 | 81 | 21 | 31 | 13 | 20 | 2 | 3 | 0 | 0 |
| NC1 | 52 | 156 | 63 | 189 | 86 | 129 | 18 | 27 | 5 | 8 | 3 | 3 |
| NC2 | 29 | 87 | 11 | 33 | 37 | 56 | 33 | 50 | 1 | 2 | 0 | 0 |
| NE1 | 21 | 63 | 67 | 201 | 69 | 104 | 31 | 47 | 16 | 24 | 3 | 3 |
| NE2 | 32 | 96 | 58 | 174 | 71 | 107 | 25 | 38 | 62 | 93 | 4 | 4 |
| NE3 | 42 | 126 | 56 | 168 | 76 | 114 | 22 | 33 | 15 | 23 | 10 | 10 |
| SE1 | | | 309 | 1127 | 450 | 675 | 134 | 201 | 20 | 30 | 0 | 0 |
| SE2 | | | 292 | 876 | 172 | 258 | 59 | 89 | 15 | 23 | 2 | 2 |
| SE3 | | | 356 | 1068 | 551 | 827 | 146 | 219 | 15 | 23 | 6 | 6 |
| 2001 | | | | | | | | | | | | |
| NW1 | 55 | 164 | 90 | 270 | 50 | 75 | 6 | 9 | 5 | 8 | | |
| NW2 | 39 | 117 | 44 | 132 | 24 | 35 | 7 | 10 | 5 | 8 | | |
| NC1 | 79 | 237 | 115 | 345 | 98 | 147 | 47 | 71 | 6 | 9 | | |
| NC2 | 36 | 108 | 9 | 26 | 35 | 53 | 9 | 13 | 3 | 5 | | |
| NE1 | 86 | 258 | 0 | 0 | 206 | 309 | 235 | 353 | 103 | 155 | | |
| NE2 | 180 | 540 | 0 | 0 | 85 | 128 | 141 | 212 | 38 | 57 | | |
| NE3 | 118 | 354 | 12 | 36 | 152 | 228 | 146 | 219 | 76 | 114 | | |
| SE1 | 119 | 357 | 197 | 591 | 371 | 557 | 172 | 258 | 47 | 71 | | |
| SE2 | 242 | 726 | 99 | 297 | 381 | 572 | 172 | 258 | 53 | 80 | | |
| SE3 | 249 | 747 | 254 | 762 | 362 | 543 | 252 | 378 | 103 | 155 | | |

Table 4

Fin Whale, F, Totals

| | Jul | Jul | Aug | Aug | Sept | Sept | Oct | Oct | Nov | Nov | Dec | Dec |
|------|--------|-----|--------|-----|--------|------|--------|------|--------|------|--------|-----|
| | Actual | x1 | Actual | x1 | Actual | x1.5 | Actual | x1.5 | Actual | x1.5 | Actual | x3 |
| 1995 | | | | | | | | | | | | |
| NW1 | | | | | | | | | 0 | 0 | 4 | 11 |
| NW2 | | | | | | | | | 0 | 0 | 12 | 35 |
| NC1 | | | | | | | | | 0 | 0 | 3 | 9 |
| NC2 | | | | | | | | | 0 | 0 | 0 | 0 |
| NE1 | | | | | | | | | 72 | 108 | 62 | 186 |
| NE2 | | | | | | | | | 59 | 89 | 33 | 99 |
| NE3 | | | | | | | | | 69 | 104 | 26 | 78 |
| SE1 | | | | | | | | | | | | |
| SE2 | | | | | | | | | | | | |
| SE3 | | | | | | | | | | | | |
| 1996 | | | | | | | | | | | | |
| NW1 | 1 | 1 | 2 | 2 | 3 | 5 | 19 | 28 | 1 | 2 | 10 | 29 |
| NW2 | 3 | 3 | 8 | 8 | 30 | 45 | 13 | 19 | 5 | 7 | 13 | 38 |
| NC1 | 4 | 4 | 0 | 0 | 37 | 56 | 65 | 98 | 3 | 5 | 30 | 90 |
| NC2 | 1 | 1 | 5 | 5 | 48 | 72 | 21 | 31 | 0 | 0 | 34 | 102 |
| NE1 | 0 | 0 | 0 | 0 | 69 | 104 | 104 | 156 | 57 | 86 | 37 | 111 |
| NE2 | 0 | 0 | 7 | 7 | 84 | 126 | 60 | 90 | 150 | 225 | 43 | 129 |
| NE3 | 2 | 2 | 11 | 11 | 74 | 111 | 123 | 185 | 69 | 104 | 31 | 96 |
| SE1 | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 2 | 40 | 60 | 77 | 231 |
| SE2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 23 | 118 | 354 |
| SE3 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 6 | 30 | 45 | 154 | 462 |
| 1997 | | | | | | | | | | | | |
| NW1 | 0 | 0 | 15 | 15 | 36 | 54 | 46 | 65 | 32 | 48 | 44 | 132 |
| NW2 | 3 | 3 | 13 | 13 | 24 | 36 | 39 | 58 | 58 | 87 | 50 | 150 |
| NC1 | 6 | 6 | 11 | 11 | 20 | 30 | 107 | 160 | 63 | 95 | 41 | 122 |
| NC2 | 0 | 0 | 20 | 20 | 42 | 63 | 74 | 110 | 38 | 56 | 30 | 90 |
| NE1 | 5 | 5 | 16 | 16 | 57 | 86 | 29 | 44 | 36 | 54 | 10 | 30 |
| NE2 | 9 | 9 | 33 | 33 | 90 | 135 | 62 | 93 | 97 | 146 | 12 | 36 |
| NE3 | 4 | 4 | 40 | 40 | 132 | 198 | 117 | 176 | 106 | 159 | 65 | 195 |
| SE1 | 0 | 0 | 3 | 3 | 0 | 0 | 10 | 15 | 24 | 36 | 83 | 249 |
| SE2 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 15 | 23 | 49 | 147 |
| SE3 | 0 | 0 | 0 | 0 | 2 | 3 | 2 | 3 | 25 | 38 | 76 | 228 |
| 1998 | | | | | | | | | | | | |
| NW1 | 0 | 0 | 7 | 7 | 59 | 89 | | | 34 | 51 | 83 | 249 |
| NW2 | 0 | 0 | 11 | 11 | 38 | 57 | | | 50 | 74 | 65 | 194 |
| NC1 | 12 | 12 | 9 | 9 | 47 | 71 | | | 151 | 226 | 92 | 275 |
| NC2 | 0 | 0 | 4 | 4 | 34 | 51 | | | 16 | 34 | 33 | 99 |
| NE1 | 2 | 2 | 0 | 0 | 9 | 14 | 25 | 38 | 31 | 47 | 27 | 81 |
| NE2 | 0 | 0 | 0 | 0 | 14 | 21 | 24 | 36 | 30 | 45 | 12 | 36 |
| NE3 | 0 | 0 | 2 | 2 | 48 | 72 | 97 | 146 | 239 | 359 | 125 | 375 |
| SE1 | 0 | 0 | 11 | 11 | 6 | 9 | 7 | 11 | 97 | 146 | 220 | 660 |
| SE2 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 14 | 66 | 99 | 323 | 969 |
| SE3 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 21 | 68 | 102 | 312 | 936 |
| 1999 | | | | | | | | | | | | |
| NW1 | 1 | 1 | 9 | 9 | 41 | 62 | 74 | 110 | 40 | 59 | 35 | 105 |
| NW2 | 0 | 0 | 3 | 3 | 46 | 69 | 79 | 119 | 90 | 134 | 60 | 180 |
| NC1 | 7 | 7 | 26 | 26 | 108 | 162 | 148 | 221 | 119 | 178 | 43 | 129 |
| NC2 | 0 | 0 | 6 | 6 | 81 | 122 | 57 | 86 | 44 | 66 | 28 | 84 |
| NE1 | 3 | 3 | 34 | 34 | 99 | 149 | 49 | 74 | 42 | 63 | 104 | 312 |
| NE2 | 2 | 2 | 6 | 6 | 14 | 21 | 20 | 30 | 52 | 78 | 54 | 162 |
| NE3 | 12 | 12 | 56 | 56 | 108 | 162 | 97 | 145 | 121 | 182 | 70 | 210 |
| SE1 | 9 | 9 | 88 | 88 | 81 | 122 | 51 | 77 | 144 | 216 | | |
| SE2 | 0 | 0 | 0 | 0 | 6 | 9 | 33 | 50 | 34 | 51 | | |
| SE3 | 0 | 0 | 0 | 0 | 14 | 21 | 0 | 0 | 144 | 216 | | |
| 2000 | | | | | | | | | | | | |
| NW1 | 2 | 2 | 14 | 14 | 43 | 65 | 37 | 55 | 56 | 84 | 61 | 183 |
| NW2 | 2 | 2 | 27 | 27 | 28 | 42 | 39 | 59 | 172 | 257 | 113 | 339 |
| NC1 | 6 | 6 | 45 | 45 | 103 | 155 | 133 | 199 | 272 | 407 | 275 | 825 |
| NC2 | 0 | 0 | 17 | 17 | 46 | 69 | 79 | 118 | 55 | 82 | 58 | 174 |
| NE1 | 6 | 6 | 58 | 58 | 135 | 203 | 140 | 210 | 258 | 387 | 215 | 645 |
| NE2 | 5 | 5 | 49 | 49 | 39 | 59 | 92 | 138 | 218 | 327 | 202 | 606 |
| NE3 | 86 | 86 | 267 | 267 | 127 | 191 | 228 | 342 | 224 | 336 | 215 | 645 |
| SE1 | 0 | 0 | 19 | 19 | 19 | 29 | 110 | 165 | 149 | 224 | 297 | 891 |
| SE2 | 2 | 2 | 5 | 5 | 12 | 18 | 25 | 38 | 70 | 105 | 224 | 672 |
| SE3 | 0 | 0 | 15 | 15 | 20 | 30 | 100 | 150 | 155 | 233 | 198 | 594 |

Occurrence of Fin Whale, F, Calls from 1996-2001

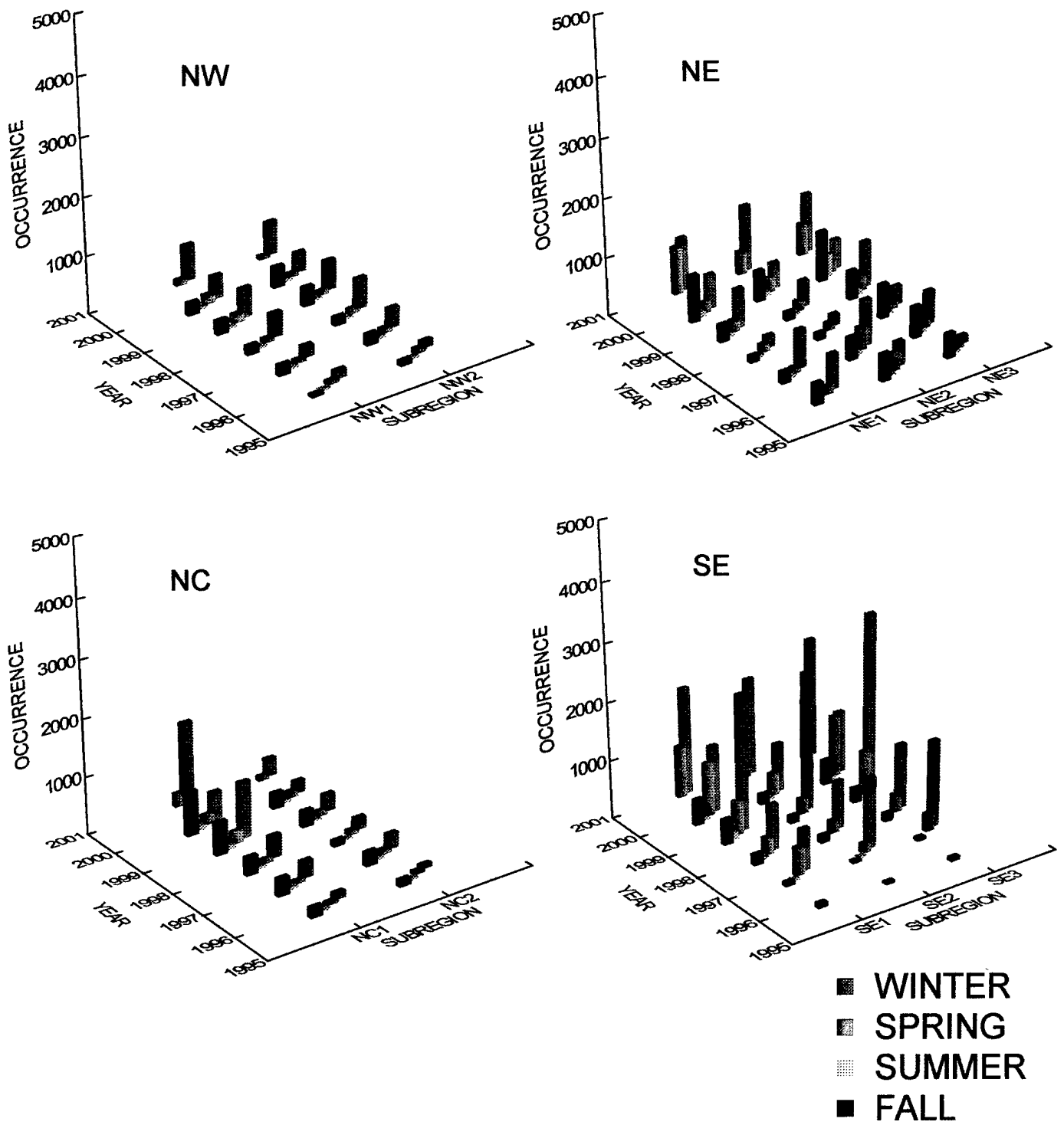


Fig. 3

Table 5

Fin Whale, J, Totals

| | Jan | Jan | Feb | Feb | March | March | April | April | May | May | Jun | Jun |
|-------------|--------|------|--------|------|--------|-------|--------|-------|--------|-----|--------|-----|
| | Actual | x6 | Actual | x6 | Actual | x6 | Actual | x6 | Actual | x6 | Actual | x6 |
| 1995 | | | | | | | | | | | | |
| NW1 | | | | | | | | | | | | |
| NW2 | | | | | | | | | | | | |
| NC1 | | | | | | | | | | | | |
| NC2 | | | | | | | | | | | | |
| NE1 | | | | | | | | | | | | |
| NE2 | | | | | | | | | | | | |
| NE3 | | | | | | | | | | | | |
| SE1 | | | | | | | | | | | | |
| SE2 | | | | | | | | | | | | |
| SE3 | | | | | | | | | | | | |
| 1996 | | | | | | | | | | | | |
| NW1 | 35 | 210 | 41 | 246 | 11 | 66 | 0 | 0 | 2 | 12 | 0 | 0 |
| NW2 | 57 | 342 | 35 | 210 | 8 | 48 | 0 | 0 | 0 | 0 | 0 | 0 |
| NC1 | 175 | 1050 | 138 | 828 | 43 | 258 | 31 | 186 | 31 | 186 | 29 | 174 |
| NC2 | 49 | 294 | 31 | 186 | 43 | 258 | 4 | 24 | 0 | 0 | 3 | 18 |
| NE1 | 23 | 138 | 3 | 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NE2 | 40 | 240 | 77 | 462 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NE3 | 72 | 432 | 47 | 282 | 5 | 30 | 2 | 12 | 0 | 0 | 2 | 12 |
| SE1 | | | | | | | | | 0 | 0 | 0 | 0 |
| SE2 | | | | | | | | | 0 | 0 | 0 | 0 |
| SE3 | | | | | | | | | 0 | 0 | 0 | 0 |
| 1997 | | | | | | | | | | | | |
| NW1 | 26 | 156 | 1 | 6 | 7 | 42 | 2 | 12 | 1 | 6 | 0 | 0 |
| NW2 | 22 | 132 | 3 | 18 | 6 | 36 | 4 | 24 | 4 | 24 | 3 | 18 |
| NC1 | 47 | 282 | 52 | 312 | 34 | 204 | 32 | 192 | 27 | 162 | 24 | 144 |
| NC2 | 22 | 132 | 16 | 96 | 8 | 48 | 3 | 18 | 1 | 6 | 1 | 6 |
| NE1 | 0 | 0 | 0 | 0 | 4 | 24 | 0 | 0 | 0 | 0 | 0 | 0 |
| NE2 | 3 | 18 | 0 | 0 | 3 | 18 | 0 | 0 | 9 | 54 | 11 | 66 |
| NE3 | 6 | 36 | 2 | 12 | 2 | 12 | 28 | 168 | 18 | 108 | 6 | 36 |
| SE1 | 50 | 300 | 4 | 24 | 6 | 24 | 0 | 0 | 0 | 0 | 0 | 0 |
| SE2 | 25 | 150 | 26 | 156 | 8 | 48 | 0 | 0 | 0 | 0 | 0 | 0 |
| SE3 | 6 | 36 | 0 | 0 | 10 | 60 | 3 | 18 | 0 | 0 | 0 | 0 |
| 1998 | | | | | | | | | | | | |
| NW1 | 10 | 60 | 8 | 48 | 7 | 42 | 2 | 12 | 0 | 0 | 0 | 0 |
| NW2 | 21 | 126 | 14 | 84 | 11 | 66 | 1 | 6 | 0 | 0 | 0 | 0 |
| NC1 | 67 | 402 | 74 | 444 | 46 | 276 | 26 | 156 | 25 | 150 | 23 | 138 |
| NC2 | 35 | 210 | 62 | 372 | 47 | 282 | 2 | 12 | 0 | 0 | 0 | 0 |
| NE1 | 4 | 24 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NE2 | 2 | 12 | 16 | 96 | 3 | 18 | 5 | 30 | 13 | 78 | 0 | 0 |
| NE3 | 44 | 264 | 9 | 54 | 49 | 294 | 33 | 198 | 20 | 120 | 10 | 60 |
| SE1 | 18 | 108 | 0 | 0 | 4 | 24 | 5 | 30 | 0 | 0 | 0 | 0 |
| SE2 | 35 | 210 | 3 | 18 | 11 | 66 | 3 | 18 | 0 | 0 | 0 | 0 |
| SE3 | 19 | 114 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | | | | | | | | | | | | |
| NW1 | 18 | 108 | 10 | 60 | 15 | 90 | 22 | 132 | 0 | 0 | 0 | 0 |
| NW2 | 4 | 24 | 9 | 54 | 12 | 72 | 16 | 96 | 0 | 0 | 0 | 0 |
| NC1 | 57 | 342 | 54 | 324 | 28 | 168 | 74 | 444 | 25 | 150 | 26 | 156 |
| NC2 | 43 | 258 | 17 | 102 | 12 | 72 | 30 | 180 | 3 | 18 | 0 | 0 |
| NE1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NE2 | 14 | 84 | 11 | 66 | 7 | 42 | 0 | 0 | 2 | 12 | 0 | 0 |
| NE3 | 40 | 240 | 84 | 504 | 35 | 210 | 72 | 432 | 14 | 84 | 5 | 30 |
| SE1 | 20 | 120 | 65 | 390 | 37 | 222 | 48 | 288 | 0 | 0 | 0 | 0 |
| SE2 | 45 | 270 | 106 | 636 | 75 | 450 | 18 | 108 | 0 | 0 | 0 | 0 |
| SE3 | 12 | 72 | 35 | 210 | 56 | 336 | 36 | 216 | 0 | 0 | 4 | 24 |
| 2000 | | | | | | | | | | | | |
| NW1 | 69 | 414 | 34 | 204 | 25 | 150 | 3 | 18 | 1 | 6 | 0 | 0 |
| NW2 | 57 | 342 | 43 | 258 | 6 | 36 | 2 | 12 | 0 | 0 | 0 | 0 |
| NC1 | 170 | 1020 | 126 | 756 | 82 | 492 | 43 | 258 | 52 | 312 | 34 | 204 |
| NC2 | 39 | 234 | 54 | 324 | 11 | 66 | 0 | 0 | 2 | 12 | 0 | 0 |
| NE1 | 20 | 120 | 6 | 36 | 16 | 96 | 5 | 30 | 4 | 24 | 0 | 0 |
| NE2 | 111 | 666 | 52 | 312 | 61 | 366 | 0 | 0 | 3 | 18 | 0 | 0 |
| NE3 | 150 | 900 | 158 | 948 | 108 | 648 | 22 | 132 | 12 | 72 | 4 | 24 |
| SE1 | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SE2 | | | 0 | 0 | 10 | 60 | 0 | 0 | 0 | 0 | 0 | 0 |
| SE3 | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2001 | | | | | | | | | | | | |
| NW1 | 78 | 465 | 91 | 543 | 33 | 195 | 3 | 150 | 9 | 54 | | |
| NW2 | 111 | 666 | 30 | 177 | 40 | 240 | 5 | 30 | 3 | 18 | | |
| NC1 | 128 | 765 | 159 | 954 | 73 | 435 | 45 | 267 | 36 | 216 | | |
| NC2 | 58 | 345 | 154 | 921 | 93 | 555 | 7 | 39 | 2 | 12 | | |
| NE1 | 205 | 1230 | 61 | 366 | 19 | 114 | 7 | 42 | 0 | 0 | | |
| NE2 | 208 | 1248 | 80 | 480 | 58 | 348 | 27 | 162 | 21 | 126 | | |
| NE3 | 204 | 1224 | 83 | 498 | 45 | 270 | 26 | 156 | 23 | 812 | | |
| SE1 | 149 | 894 | 69 | 414 | 10 | 60 | 40 | 240 | 90 | 540 | | |
| SE2 | 120 | 720 | 186 | 1116 | 18 | 108 | 47 | 282 | 12 | 72 | | |
| SE3 | 78 | 468 | 85 | 510 | 17 | 102 | 70 | 420 | 13 | 78 | | |

Table 6

Fin Whale, J, Totals

| | Jul | Jul | Aug | Aug | Sept | Sept | Oct | Oct | Nov | Nov | Dec | Dec |
|-------------|--------|-----|--------|-----|--------|------|--------|-----|--------|------|--------|------|
| | Actual | x6 | Actual | x6 | Actual | x6 | Actual | x6 | Actual | x6 | Actual | x6 |
| 1995 | | | | | | | | | | | | |
| NW1 | | | | | | | | | 50 | 300 | 115 | 690 |
| NW2 | | | | | | | | | 9 | 54 | 90 | 540 |
| NC1 | | | | | | | | | 10 | 60 | 187 | 1122 |
| NC2 | | | | | | | | | 14 | 84 | 93 | 558 |
| NE1 | | | | | | | | | 0 | 0 | 11 | 66 |
| NE2 | | | | | | | | | 4 | 24 | 79 | 474 |
| NE3 | | | | | | | | | 22 | 132 | 173 | 1038 |
| SE1 | | | | | | | | | | | | |
| SE2 | | | | | | | | | | | | |
| SE3 | | | | | | | | | | | | |
| 1996 | | | | | | | | | | | | |
| NW1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 36 | 75 | 450 |
| NW2 | 0 | 0 | 0 | 0 | 8 | 48 | 1 | 6 | 0 | 0 | 75 | 450 |
| NC1 | 10 | 60 | 0 | 0 | 39 | 234 | 122 | 732 | 30 | 180 | 214 | 1284 |
| NC2 | 0 | 0 | 0 | 0 | 5 | 30 | 6 | 18 | 0 | 0 | 79 | 474 |
| NE1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NE2 | 0 | 0 | 0 | 0 | 10 | 60 | 23 | 138 | 43 | 258 | 64 | 384 |
| NE3 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 18 | 31 | 186 | 173 | 1038 |
| SE1 | 0 | 0 | 0 | 0 | 13 | 78 | 22 | 132 | 54 | 324 | 93 | 558 |
| SE2 | 0 | 0 | 0 | 0 | 2 | 12 | 33 | 198 | 63 | 378 | 61 | 366 |
| SE3 | 0 | 0 | 0 | 0 | 12 | 72 | 53 | 318 | 66 | 396 | 91 | 546 |
| 1997 | | | | | | | | | | | | |
| NW1 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | 78 | 16 | 96 | 31 | 186 |
| NW2 | 3 | 18 | 0 | 0 | 0 | 0 | 0 | 0 | 19 | 114 | 11 | 66 |
| NC1 | 27 | 162 | 19 | 114 | 21 | 126 | 60 | 360 | 117 | 702 | 79 | 474 |
| NC2 | 0 | 0 | 0 | 0 | 0 | 0 | 17 | 102 | 10 | 60 | 79 | 474 |
| NE1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 18 |
| NE2 | 0 | 0 | 0 | 0 | 0 | 0 | 37 | 222 | 6 | 36 | 11 | 66 |
| NE3 | 0 | 0 | 2 | 12 | 6 | 36 | 14 | 84 | 2 | 12 | 10 | 60 |
| SE1 | 2 | 12 | 3 | 18 | 18 | 108 | 4 | 24 | 11 | 66 | 17 | 102 |
| SE2 | 0 | 0 | 0 | 0 | 0 | 0 | 21 | 126 | 13 | 78 | 43 | 258 |
| SE3 | 0 | 0 | 0 | 0 | 7 | 42 | 51 | 306 | 30 | 180 | 10 | 60 |
| 1998 | | | | | | | | | | | | |
| NW1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 29 | 174 | 51 | 306 |
| NW2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 31 | 186 | 55 | 330 |
| NC1 | 10 | 60 | 8 | 48 | 3 | 18 | 0 | 0 | 104 | 624 | 0 | 0 |
| NC2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 55 | 330 | 121 | 726 |
| NE1 | 2 | 12 | 0 | 0 | 0 | 0 | 3 | 18 | 6 | 36 | 0 | 0 |
| NE2 | 0 | 0 | 0 | 0 | 2 | 12 | 13 | 78 | 59 | 354 | 85 | 510 |
| NE3 | 10 | 60 | 0 | 0 | 13 | 78 | 3 | 18 | 8 | 48 | 37 | 222 |
| SE1 | 0 | 0 | 0 | 0 | 0 | 0 | 20 | 120 | 39 | 234 | 101 | 606 |
| SE2 | 0 | 0 | 8 | 48 | 0 | 0 | 27 | 162 | 48 | 288 | 47 | 282 |
| SE3 | 0 | 0 | 0 | 0 | 0 | 0 | 16 | 96 | 59 | 354 | 42 | 252 |
| 1999 | | | | | | | | | | | | |
| NW1 | 0 | 0 | 0 | 0 | 2 | 12 | 16 | 96 | 71 | 426 | 129 | 774 |
| NW2 | 0 | 0 | 0 | 0 | 0 | 0 | 22 | 129 | 22 | 129 | 125 | 750 |
| NC1 | 16 | 96 | 8 | 48 | 41 | 246 | 98 | 588 | 115 | 687 | 223 | 1338 |
| NC2 | 0 | 0 | 0 | 0 | 5 | 30 | 51 | 306 | 57 | 342 | 73 | 438 |
| NE1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 6 | 0 | 0 | 97 | 582 |
| NE2 | 0 | 0 | 0 | 0 | 26 | 156 | 38 | 228 | 86 | 516 | 132 | 792 |
| NE3 | 3 | 18 | 20 | 120 | 64 | 384 | 29 | 174 | 105 | 630 | 181 | 1086 |
| SE1 | 0 | 0 | 9 | 54 | 41 | 246 | 66 | 396 | 17 | 102 | | |
| SE2 | 0 | 0 | 0 | 0 | 34 | 204 | 27 | 162 | 30 | 180 | | |
| SE3 | 0 | 0 | 0 | 0 | 44 | 264 | 107 | 642 | 0 | 0 | | |
| 2000 | | | | | | | | | | | | |
| NW1 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 15 | 2 | 9 | 5 | 30 |
| NW2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28 | 165 |
| NC1 | 28 | 168 | 35 | 210 | 26 | 156 | 37 | 219 | 93 | 555 | 29 | 174 |
| NC2 | 2 | 12 | 6 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 51 |
| NE1 | 0 | 0 | 22 | 132 | 0 | 0 | 7 | 42 | 178 | 1068 | 176 | 1056 |
| NE2 | 0 | 0 | 0 | 0 | 16 | 96 | 61 | 366 | 241 | 1446 | 220 | 1320 |
| NE3 | 14 | 84 | 3 | 18 | 0 | 0 | 12 | 72 | 147 | 882 | 115 | 690 |
| SE1 | 0 | 0 | 13 | 78 | 6 | 36 | 31 | 186 | 55 | 330 | 80 | 480 |
| SE2 | 0 | 0 | 10 | 60 | 13 | 78 | 57 | 342 | 88 | 528 | 102 | 612 |
| SE3 | 0 | 0 | 13 | 78 | 9 | 54 | 43 | 258 | 42 | 252 | 113 | 678 |

Table 7

Fin Whale, J and F, Totals

| | Jan | Feb | March | April | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec |
|-------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| 1995 | F J Totals | F J Totals | F J Totals | F J Totals | F J Totals | F J Totals | F J Totals | F J Totals | F J Totals | F J Totals | F J Totals | F J Totals |
| NW1 | | | | | | | | | | | 300 | 701 |
| NW2 | | | | | | | | | | | 54 | 575 |
| NC1 | | | | | | | | | | | 60 | 1131 |
| NC2 | | | | | | | | | | | 84 | 558 |
| NE1 | | | | | | | | | | | 108 | 252 |
| NE2 | | | | | | | | | | | 113 | 573 |
| NE3 | | | | | | | | | | | 236 | 1116 |
| SE1 | | | | | | | | | | | | |
| SE2 | | | | | | | | | | | | |
| SE3 | | | | | | | | | | | | |
| 1996 | | | | | | | | | | | | |
| NW1 | 243 | 321 | 99 | 12 | 21 | 1 | 1 | 2 | 5 | 28 | 38 | 479 |
| NW2 | 372 | 249 | 83 | 9 | 33 | 2 | 3 | 8 | 93 | 25 | 7 | 488 |
| NC1 | 1100 | 852 | 294 | 192 | 186 | 175 | 64 | 0 | 290 | 830 | 185 | 1374 |
| NC2 | 300 | 234 | 296 | 27 | 5 | 18 | 1 | 5 | 102 | 49 | 0 | 576 |
| NE1 | 426 | 111 | 36 | 63 | 18 | 0 | 0 | 0 | 104 | 156 | 86 | 111 |
| NE2 | 414 | 582 | 176 | 98 | 11 | 0 | 0 | 7 | 186 | 228 | 483 | 513 |
| NE3 | 459 | 291 | 113 | 72 | 8 | 12 | 2 | 11 | 111 | 203 | 290 | 1134 |
| SE1 | | | | | | | | | 80 | 134 | 384 | 789 |
| SE2 | | | | | | | | | 12 | 198 | 401 | 720 |
| SE3 | | | | | | | | | 72 | 324 | 441 | 1008 |
| 1997 | | | | | | | | | | | | |
| NW1 | 222 | 96 | 62 | 38 | 6 | 0 | 0 | 15 | 54 | 143 | 144 | 318 |
| NW2 | 297 | 144 | 65 | 72 | 27 | 18 | 21 | 13 | 36 | 58 | 201 | 216 |
| NC1 | 390 | 390 | 230 | 198 | 171 | 151 | 168 | 125 | 156 | 520 | 797 | 596 |
| NC2 | 213 | 159 | 81 | 56 | 6 | 6 | 0 | 20 | 63 | 212 | 116 | 564 |
| NE1 | 339 | 180 | 77 | 17 | 17 | 8 | 5 | 16 | 86 | 44 | 54 | 48 |
| NE2 | 324 | 330 | 212 | 116 | 119 | 68 | 9 | 33 | 135 | 315 | 182 | 102 |
| NE3 | 291 | 213 | 89 | 230 | 128 | 36 | 4 | 52 | 234 | 260 | 171 | 255 |
| SE1 | 522 | 255 | 311 | 159 | 14 | 0 | 12 | 21 | 108 | 39 | 102 | 351 |
| SE2 | 489 | 648 | 152 | 50 | 0 | 2 | 0 | 0 | 0 | 129 | 101 | 405 |
| SE3 | 471 | 573 | 230 | 126 | 17 | 0 | 0 | 0 | 45 | 309 | 218 | 288 |
| 1998 | | | | | | | | | | | | |
| NW1 | 255 | 120 | 63 | 49 | 6 | 0 | 0 | 7 | 89 | | 225 | 555 |
| NW2 | 381 | 198 | 95 | 27 | 33 | 0 | 0 | 11 | 57 | | 260 | 524 |
| NC1 | 452 | 531 | 326 | 159 | 162 | 139 | 72 | 57 | 89 | | 850 | 275 |
| NC2 | 300 | 387 | 314 | 46 | 5 | 0 | 0 | 4 | 51 | | 364 | 825 |
| NE1 | 81 | 99 | 96 | 30 | 0 | 0 | 14 | 0 | 14 | 56 | 83 | 81 |
| NE2 | 96 | 153 | 102 | 59 | 81 | 0 | 0 | 0 | 33 | 114 | 399 | 546 |
| NE3 | 366 | 63 | 315 | 285 | 120 | 60 | 60 | 2 | 150 | 164 | 407 | 597 |
| SE1 | 357 | 267 | 183 | 125 | 30 | 0 | 0 | 11 | 9 | 131 | 380 | 1266 |
| SE2 | 471 | 414 | 206 | 81 | 0 | 0 | 0 | 48 | 0 | 176 | 387 | 1251 |
| SE3 | 504 | 477 | 225 | 68 | 5 | 0 | 0 | 0 | 0 | 117 | 456 | 1188 |
| 1999 | | | | | | | | | | | | |
| NW1 | 246 | 171 | 159 | 198 | 11 | 0 | 1 | 9 | 74 | 206 | 485 | 879 |
| NW2 | 282 | 111 | 99 | 122 | 8 | 0 | 0 | 3 | 69 | 248 | 263 | 930 |
| NC1 | 717 | 642 | 302 | 504 | 156 | 158 | 103 | 74 | 408 | 809 | 865 | 1467 |
| NC2 | 402 | 147 | 117 | 216 | 18 | 0 | 0 | 6 | 152 | 392 | 408 | 522 |
| NE1 | 315 | 258 | 126 | 63 | 3 | 0 | 3 | 34 | 149 | 80 | 63 | 894 |
| NE2 | 240 | 315 | 116 | 78 | 23 | 2 | 2 | 6 | 177 | 258 | 594 | 954 |
| NE3 | 495 | 651 | 374 | 519 | 87 | 30 | 30 | 176 | 546 | 319 | 812 | 1296 |
| SE1 | 948 | 1194 | 635 | 426 | 14 | 0 | 9 | 142 | 368 | 473 | 318 | |
| SE2 | 1233 | 1074 | 639 | 171 | 3 | 0 | 0 | 0 | 213 | 212 | 231 | |
| SE3 | 990 | 1431 | 711 | 567 | 17 | 24 | 0 | 0 | 285 | 642 | 216 | |
| 2000 | | | | | | | | | | | | |
| NW1 | 528 | 372 | 241 | 63 | 20 | 0 | 2 | 14 | 65 | 70 | 93 | 213 |
| NW2 | 417 | 339 | 67 | 32 | 3 | 0 | 2 | 27 | 42 | 59 | 257 | 504 |
| NC1 | 1176 | 945 | 621 | 285 | 320 | 207 | 174 | 255 | 311 | 418 | 962 | 999 |
| NC2 | 321 | 357 | 122 | 50 | 14 | 0 | 12 | 23 | 69 | 118 | 82 | 225 |
| NE1 | 183 | 237 | 200 | 77 | 48 | 3 | 6 | 190 | 203 | 252 | 1455 | 1701 |
| NE2 | 762 | 486 | 473 | 38 | 111 | 4 | 5 | 49 | 155 | 504 | 1773 | 1926 |
| NE3 | 1026 | 1116 | 762 | 165 | 95 | 34 | 170 | 285 | 191 | 414 | 1218 | 1335 |
| SE1 | | 1127 | 675 | 201 | 30 | 0 | 0 | 97 | 65 | 351 | 554 | 1371 |
| SE2 | | 876 | 318 | 89 | 23 | 2 | 2 | 65 | 96 | 380 | 633 | 1284 |
| SE3 | | 1068 | 827 | 219 | 23 | 6 | 0 | 93 | 84 | 408 | 485 | 1272 |
| 2001 | | | | | | | | | | | | |
| NW1 | 629 | 813 | 270 | 159 | 62 | | | | | | | |
| NW2 | 783 | 309 | 275 | 40 | 26 | | | | | | | |
| NC1 | 1002 | 1299 | 582 | 338 | 225 | | | | | | | |
| NC2 | 453 | 947 | 608 | 52 | 17 | | | | | | | |
| NE1 | 1488 | 366 | 423 | 395 | 155 | | | | | | | |
| NE2 | 1788 | 480 | 476 | 374 | 183 | | | | | | | |
| NE3 | 1578 | 534 | 498 | 375 | 926 | | | | | | | |
| SE1 | 1251 | 1005 | 617 | 498 | 611 | | | | | | | |
| SE2 | 1446 | 1413 | 680 | 540 | 152 | | | | | | | |
| SE3 | 1215 | 1272 | 645 | 798 | 233 | | | | | | | |

Occurrence of Fin Whale, F and J, Calls from 1996-2001

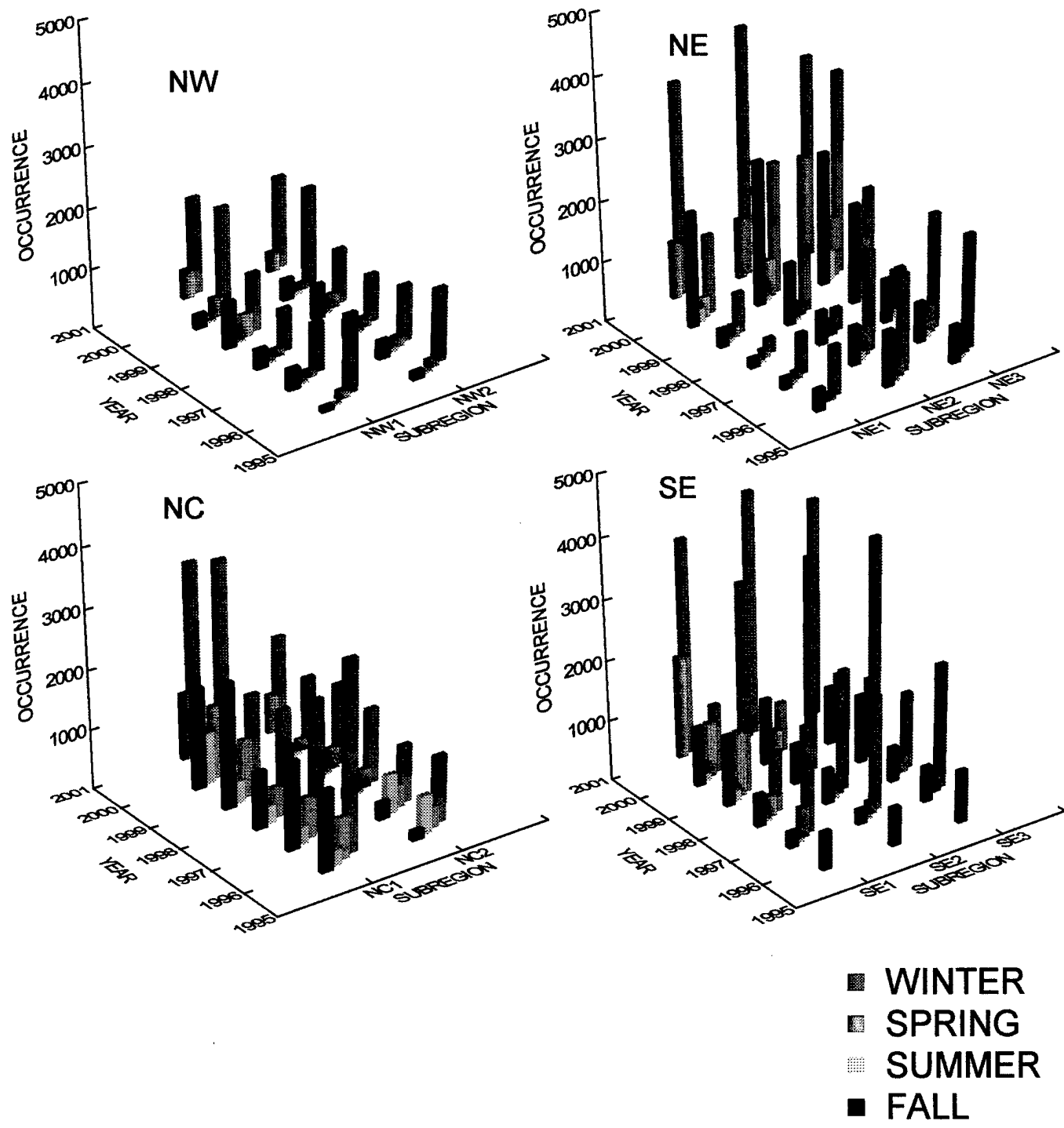


Fig. 5

Table 8

Humpback Whale Totals

| | Jan | Jan | Feb | Feb | Mar | Mar | Apr | Apr | May | May | Jun | Jun |
|-------------|--------|-----|--------|-----|--------|-----|--------|-----|--------|-----|--------|-----|
| | Actual | x3 | Actual | x3 | Actual | x3 | Actual | x3 | Actual | x3 | Actual | x3 |
| 1996 | | | | | | | | | | | | |
| NW1 | 0 | 0 | 2 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NW2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NC1 | 0 | 0 | 1 | 3 | 0 | 0 | 6 | 18 | 61 | 183 | 15 | 45 |
| NC2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NE1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NE2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 0 | 0 |
| NE3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 0 | 0 |
| SE1 | | | | | | | 1 | 3 | 33 | 99 | 0 | 0 |
| SE2 | | | | | | | 150 | 450 | 115 | 145 | 0 | 0 |
| SE3 | | | | | | | 195 | 585 | 151 | 453 | 0 | 0 |
| 1997 | | | | | | | | | | | | |
| NW1 | 1 | 3 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NW2 | 0 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NC1 | 76 | 228 | 4 | 12 | 1 | 3 | 14 | 42 | 37 | 111 | 8 | 24 |
| NC2 | 2 | 6 | 3 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NE1 | 3 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NE2 | 5 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NE3 | 2 | 6 | 2 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SE1 | 6 | 18 | 1 | 3 | 0 | 0 | 2 | 6 | 6 | 18 | 0 | 0 |
| SE2 | 100 | 300 | 39 | 117 | 13 | 39 | 95 | 285 | 20 | 60 | 20 | 60 |
| SE3 | 166 | 498 | 99 | 297 | 12 | 36 | 44 | 132 | 18 | 54 | 0 | 0 |
| 1998 | | | | | | | | | | | | |
| NW1 | 5 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NW2 | 4 | 12 | 3 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NC1 | 83 | 249 | 38 | 114 | 0 | 0 | 1 | 3 | 2 | 6 | 1 | 3 |
| NC2 | 0 | 0 | 1 | 3 | 0 | 0 | 2 | 6 | 0 | 0 | 0 | 0 |
| NE1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NE2 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NE3 | 20 | 60 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SE1 | 36 | 108 | 6 | 18 | 0 | 0 | 5 | 15 | 2 | 6 | 0 | 0 |
| SE2 | 188 | 564 | 79 | 237 | 90 | 270 | 53 | 159 | 1 | 3 | 1 | 3 |
| SE3 | 177 | 531 | 120 | 360 | 83 | 249 | 12 | 36 | 1 | 3 | 0 | 0 |
| 1999 | | | | | | | | | | | | |
| NW1 | 9 | 27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NW2 | 15 | 45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NC1 | 37 | 111 | 5 | 15 | 0 | 0 | 38 | 114 | 40 | 120 | 4 | 12 |
| NC2 | 9 | 27 | 2 | 6 | 0 | 0 | 2 | 6 | 0 | 0 | 0 | 0 |
| NE1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NE2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NE3 | 20 | 60 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SE1 | 35 | 105 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SE2 | 21 | 63 | 15 | 45 | 7 | 21 | 4 | 12 | 0 | 0 | 0 | 0 |
| SE3 | 35 | 105 | 45 | 135 | 6 | 18 | 0 | 0 | 2 | 6 | 0 | 0 |
| 2000 | | | | | | | | | | | | |
| NW1 | 4 | 12 | 3 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NW2 | 0 | 0 | 5 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NC1 | 48 | 144 | 83 | 249 | 0 | 0 | 8 | 24 | 55 | 165 | 19 | 57 |
| NC2 | 3 | 9 | 4 | 12 | 8 | 24 | 0 | 0 | 2 | 6 | 1 | 3 |
| NE1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NE2 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NE3 | 9 | 27 | 11 | 33 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SE1 | | | 8 | 24 | 2 | 6 | 1 | 3 | 0 | 0 | 0 | 0 |
| SE2 | | | 19 | 57 | 0 | 0 | 5 | 15 | 0 | 0 | 0 | 0 |
| SE3 | | | 45 | 135 | 69 | 207 | 7 | 21 | 0 | 0 | 0 | 0 |
| 2001 | | | | | | | | | | | | |
| NW1 | 7 | 20 | 1 | 3 | 0 | 0 | 0 | 0 | 1 | 3 | | |
| NW2 | 3 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| NC1 | 142 | 435 | 24 | 72 | 0 | 0 | 49 | 146 | 271 | 813 | | |
| NC2 | 3 | 9 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| NE1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| NE2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| NE3 | 41 | 123 | 12 | 36 | 1 | 3 | 0 | 0 | 0 | 0 | | |
| SE1 | 23 | 69 | 6 | 18 | 35 | 105 | 0 | 0 | 6 | 18 | | |
| SE2 | 36 | 108 | 4 | 12 | 54 | 162 | 6 | 18 | 44 | 132 | | |
| SE3 | 35 | 105 | 39 | 117 | 38 | 114 | 0 | 0 | 2 | 6 | | |

Table 9

Humpback Whale Totals

| | Jul | Jul | Aug | Aug | Sept | Sept | Oct | Oct | Nov | Nov | Dec | Dec |
|-------------|--------|-----|--------|-----|--------|------|--------|-----|--------|-----|--------|-----|
| | Actual | x3 | Actual | x3 | Actual | x3 | Actual | x3 | Actual | x3 | Actual | x3 |
| 1996 | | | | | | | | | | | | |
| NW1 | 0 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 6 |
| NW2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NC1 | 1 | 3 | 0 | 0 | 1 | 3 | 0 | 0 | 1 | 3 | 31 | 93 |
| NC2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NE1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NE2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NE3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 0 | 0 |
| SE1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SE2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SE3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | | | | | | | | | | | | |
| NW1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 |
| NW2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 12 |
| NC1 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 27 | 81 |
| NC2 | 0 | 0 | 0 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 1 | 3 |
| NE1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NE2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 27 |
| NE3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28 | 84 | 18 | 54 |
| SE1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SE2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SE3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | | | | | | | | | | | | |
| NW1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NW2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NC1 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 25 | 75 |
| NC2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NE1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NE2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 15 | 13 | 39 |
| NE3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 33 | 99 | 20 | 60 |
| SE1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SE2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SE3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | | | | | | | | | | | | |
| NW1 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 11 |
| NW2 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NC1 | 1 | 3 | 0 | 0 | 3 | 9 | 11 | 33 | 40 | 120 | 79 | 237 |
| NC2 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 41 | 0 | 0 | 1 | 3 |
| NE1 | 0 | 0 | 0 | 0 | 0 | 0 | 18 | 54 | 3 | 9 | 8 | 24 |
| NE2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NE3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 3 | 9 |
| SE1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| SE2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| SE3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| 2000 | | | | | | | | | | | | |
| NW1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 3 | 8 | 0 | 0 |
| NW2 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 18 | 0 | 0 | 0 | 0 |
| NC1 | 1 | 3 | 2 | 6 | 11 | 33 | 91 | 273 | 161 | 483 | 128 | 384 |
| NC2 | 0 | 0 | 0 | 0 | 0 | 0 | 17 | 50 | 0 | 0 | 0 | 0 |
| NE1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NE2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NE3 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 1 | 3 | 20 | 60 |
| SE1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 24 |
| SE2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SE3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 15 | 0 | 0 |

Occurrence of Humpback Whale Calls from 1996-2001

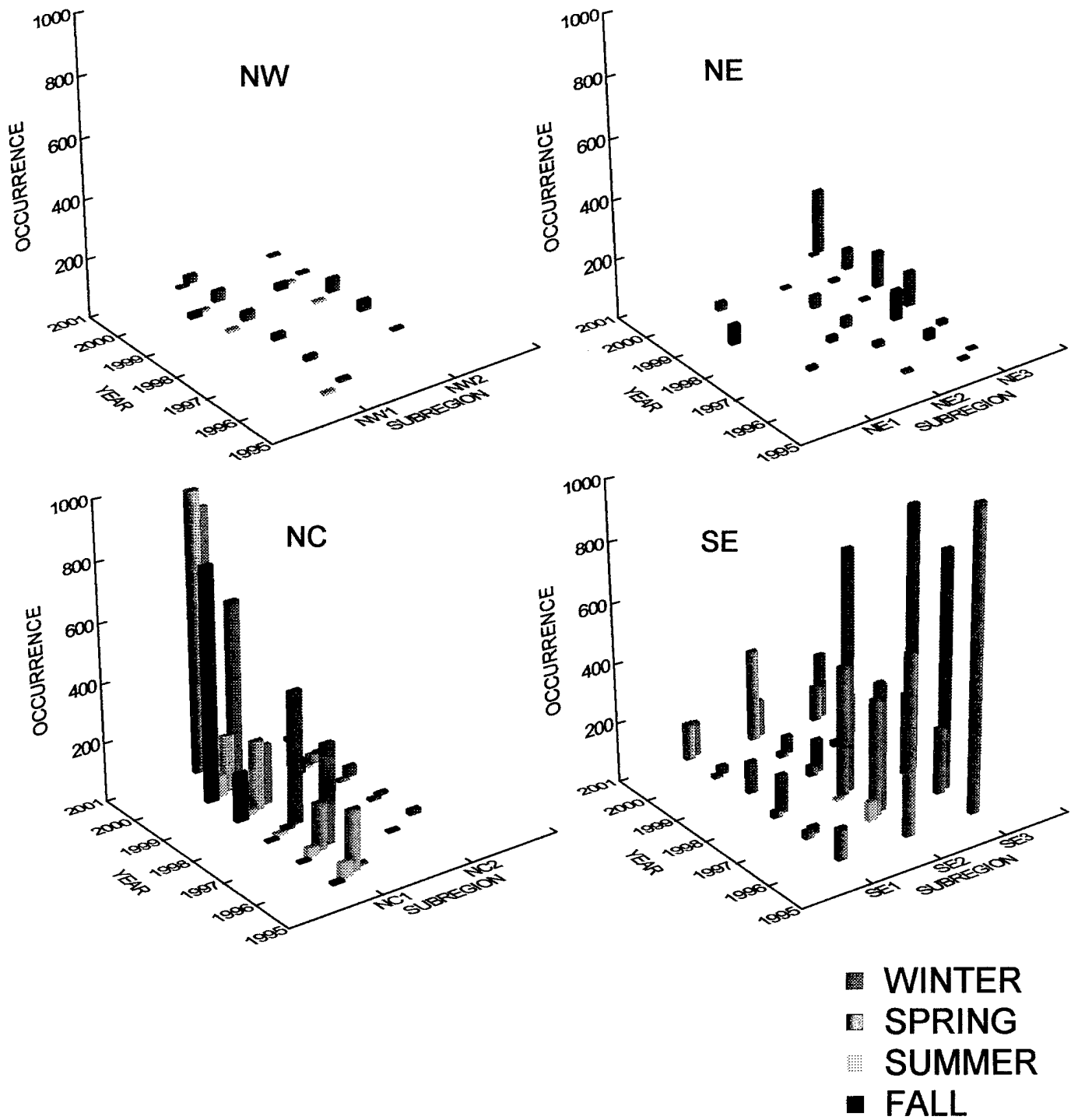


Fig. 6

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| 16. Abstract (Limit: 200 words) Since November 1995, the U.S. Navy's Sound Surveillance System (SOSUS) and other hydrophone arrays were used to regularly sample the occurrence of whale sounds in four regions bordering the continental margins across the North Pacific. The numbers of whales heard calling varied with season and location for each species, blue whales (<i>Balaenoptera musculus</i>), fin whales (<i>Balaenoptera physalus</i>), and humpback whales (<i>Megaptera novaeangliae</i>). For blue whales, calling during the fall season averaged 5 whales per event, winter averaged 1.5 whales per event, spring averaged 1 whale, and summer averaged 1.5 whales. For fin whales the numbers of whales heard ("F" calls from individuals) during winter averaged 3 whales per event, spring and fall calling averaged 1.5 whales, and summer averaged 1 whale. The "J" calling events, regardless of season, were judged to be from at least 6 fin whales. Humpback singing typically was from 3 whales. These number demonstrated seasonal variations in calling whales for each region. | | 13. Type of Report & Period Covered Technical Report | |
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