INTER-AMERICAN TROPICAL TUNA COMMISSION
COMISION INTERAMERICANA DEL ATUN TROPICAL

INTERNAL REPORT--INFORME INTERNO

No. 19

A STUDY OF THE SIZE COMPOSITION OF YELLOWFIN TUNA, BY AREA AND TIME, IN THE EASTERN PACIFIC OCEAN

by

Arturo F. Muhlia-Melo

La Jolla, California

1986

PREFACE

The Internal Report series is produced primarily for the convenience of staff members of the Inter-American Tropical Tuna Commission. It contains reports of various types. Some will eventually be modified and published in the Commission's Bulletin series or outside journals. Others are methodological reports of limited interest or reports of research which yielded negative or inconclusive results.

These reports are not to be considered as publications. Because they are in some cases preliminary, and because they are subjected to less intensive editorial scrutiny than contributions to the Commission's Bulletin series, it is requested that they not be cited without permission from the Inter-American Tropical Tuna Commission.

PREFACIO

Se ha producido una serie de Informes Internos con el fin de que sean útiles a los miembros del personal de la Comisión Interamericana del Atún Tropical. Esta serie incluye varios clases de informes. Algunos serán modificados eventualmente y publicados en la serie de Boletines de la Comisión o en revistas exteriores de prensa. Otros son informes metodológicos de un interés limitado o informes de investigación que han dado resultados negativos o inconclusos.

Estos informes no deben considerarse como publicaciones, debido a que en algunos casos son datos preliminares, y porque están sometidos a un escrutinio editorial menos intenso que las contribuciones hechas en la serie Boletines de la Comisión; por lo tanto, se ruega que no sean citados sin permiso de la Comisión Interamericana del Atún Tropical.

EDITOR'S NOTE

There seems to have been an error in some of the calculations in this report. When there is one sample for a group, and the number of fish in that sample is 50, the values under Relative length frequencies in Table 1 should be multiples of 20. This is not always the case. This error would affect the values in Table 2, of course. Since this report is essentially an exploration of methods which might be used for analysis of the data, rather than an analysis followed by conclusions regarding the distribution of the fish, no attempt has been made to correct the error.

Furthermore, it is suggested that for future analyses of this type the values under Relative length frequencies (as in Table 1) be expressed as proportions of the weights, instead of proportions of the numbers, of fish in each length-frequency interval.

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INTRODUCTION

In 1954 the staff of the Inter-American Tropical Tuna Commission (IATTC) began collecting length-frequency data of tunas caught in the eastern Pacific Ocean, and this program has remained an important part of its research since that time. In addition, the staff has had access to length-frequency data collected during 1951-1954 by the California Department of Fish and Game. Length-frequency data are useful for studies of the schooling behavior, recruitment, growth, and mortality of the fish, and can often be used, in conjunction with other information, to make inferences about other aspects of their life histories.

Hennemuth (1957) made a study of methods for obtaining samples of yellowfin, Thunnus albacares, and skipjack, Katsuwonus pelamis, tuna from fish unloaded at canneries. He concluded that 50-fish samples are adequate, and made recommendations regarding the numbers of samples to be taken and the methods for obtaining them.

Broadhead and Orange (1960) studied the species and size relationships within schools of yellowfin and skipjack, using samples from single schools caught by purse seiners and baitboats during 1956-1958. They found that yellowfin and skipjack tended to school by species and that both species tended to school by size. Yellowfin from pure schools tended to be larger than yellowfin from mixed schools, but skipjack from pure and mixed schools tended to be about the same size. Yellowfin from pure schools tended to be more variable in size than did yellowfin from mixed schools. Calkins (1965) carried out a similar study for yellowfin caught by purse seiners during 1959-1962. His results confirmed those of the previous study and, in addition, he showed that yellowfin from schools associated with porpoises tended to vary more in size than did yellowfin from other types of schools. The information derived from these studies has been useful generally in combination with other types of information to make inferences regarding the life histories of these species and specifically to make decisions as to the feasibility of various schemes for regulation of the fishery.

Analyses of the year-class composition of the yellowfin catches have been made by Hennemuth (1961a and 1961b), Davidoff (1963, 1965, and 1969), Díaz (1963), and Anonymous (1974 and 1982). In addition to studies of recruitment, these data were also used for analyses of growth (Hennemuth, 1961a; Davidoff, 1963; Díaz, 1963; Anonymous, 1974) and mortality (Hennemuth, 1961b; Davidoff, 1965). Information on recruitment, growth, and mortality is necessary for yield-per-recruit and cohort analyses, which are used to evaluate the condition of the yellowfin and skipjack stocks in the eastern Pacific Ocean (Anonymous, 1982).

Studies of the size distribution of yellowfin by area have been conducted by Anonymous (1974 and 1975) and Suzuki, Tomlinson, and Honma (1978). These studies showed, among other things, that the fish caught by the surface fishery far from land tend to be larger than those caught near the coast of the Americas. This information is useful for defining population structure and making management decisions based on yield-per-recruit and cohort analyses. The present study is concerned with the areal and temporal distribution of different sizes of yellowfin in the eastern Pacific Ocean. It is essentially an exploration of methods which might be used for analysis of the data, rather than an analysis followed by conclusions regarding the distribution of the fish.

COLLECTION AND PRELIMINARY PROCESSING OF THE DATA

The market-measurement program of the IATTC was designed to obtain samples of tunas representing the sizes of fish caught by the vessels. The major objectives of this program are to collect length samples from fish of all species-measurement area-month-gear strata in which fish are caught and to obtain measurements of fish from every vessel which unloads tunas. The original goal was to obtain 3 50-fish samples of yellowfin from each area-month-gear stratum if the distribution was unimodal and 13 such samples if it was polymodal.

When the IATTC's sampling program was begun in 1954 12 sampling areas were designated "on the basis of the distribution of total catch" (Hennemuth, 1957). These areas are shown in Figure 1. Since then these have been modified in accordance with expansion of the fishing area (Alverson, 1960 and

1963; Calkins and Chatwin, 1967 and 1971; Calkins, 1975; Orange and Calkins, 1981) and increased knowledge of the biology of the fish (Figures 2, 3, 4, and 5).

The sampling recommendations made by Hennemuth (1957 and 1961a) have generally been followed. First, decisions as to which fish to sample must be made. The typical trip by a fishing vessel lasts about 1 to 4 months. Fishing is usually conducted over a wide geographical area, and fish are caught on roughly one third of the days the vessel is absent from port. These fish are stored frozen in brine wells until the vessel returns to port. The typical vessel has five to nine pairs of wells and a capacity of about 100 to 1,500 tons of frozen fish. The location and date of capture of each school of fish, its species composition, and usually the well or wells in which they were stored, are recorded in the bridge logbook, and the dates of capture and wells are also recorded in the engine room logbook. This information is generally available at the time of unloading, so areas and dates of capture can be assigned to the fish in each well. First preference in sampling is given to wells which contain fish from only one area-time stratum and to area-time strata which to date have been inadequately sampled.

The sampling unit is an individual well or, less commonly, two wells. The length of each fish is measured in millimeters "from the tip of the snout ..., with the jaws closed, to the cartilaginous median part of the caudal fork" (Marr and Schaefer, 1949). Marr and Schaefer called this measurement the "total length," but most subsequent workers have referred to it as the "fork length." Samples are taken by either of two methods, systematic (selecting every nth, e.g. every 10th, fish) or grab ("selecting, as arbitrarily as possible, a somewhat varying number of fish from buckets," the buckets having been previously "either arbitrarily or systematically selected")(Hennemuth, 1957). Both sampling techniques "appear to provide equivalent and unbiased estimates of the size of fish within the units" (Hennemuth, 1961a).

During the 1960's and 1970's many larger tuna vessels were built. The increased size of the vessels and the wells caused a greater portion of the wells to contain fish from mixed areas and/or months. In 1975 several modifications were made to the market-measurement program to prevent undersampling the catches from various areas and months (Orange, personal communication). Essentially, if 50 percent or more of the weight of fish aboard a vessel did not meet the sampling requirements, i.e. those fish were in wells which contained fish from more than one area-time stratum, two 25-fish samples were to be taken from wells which did not meet the sampling requirements. The 25-fish samples which contained fish from widely scattered areas or fish taken over long periods of time were not used in any subsequent analyses. The collection of the 25-fish samples was discontinued in 1979.

The data for each length-frequency sample are recorded on a form, with identification as to the species, area, year, and month of catch, gear employed, and sampling method. For this study the length frequencies are grouped into 20-mm intervals, e.g. 300-319 mm = 30 cm, 320-339 mm = 32 cm, etc. Each sample is assigned to a 1- or 5-degree area. If all or nearly all of the catch came from a single 1-degree area a code corresponding to that area was added to the form. If significant parts of it came from more than one 1-degree area the code for the 5-degree area which contributed the most to the sample is added to the form. The system of coding for the areas is described by Shimada and Schaefer (1956). Each 5-degree area is identifed by a six-digit number. The first digit designates that the area is north (0) or south (2) of the equator in the eastern Pacific Ocean. The next five digits identify the latitide and longitude at the lower right corner of the 5-degree area (these numbers are always divisible by 5). Within each 5-degree area the 1-degree areas are numbered from 1 to 25, starting in the lower right corner and proceeding from east to west and south to north in sequence. Information from the sample sheets is then converted into computer records for use in analyses of various types.

The statistical methods which are used for estimating the portions of fish in each length interval are described by Shingu, Tomlinson, and Peterson (1974).

Only data for fish caught by purse-seine vessels are used in the present study.

RESULTS

Distribution of lengths by area

It is of interest to examine the distributions by area of the catches of fish of different lengths. Organization of the data in this manner can be useful for evaluation of the choice of sampling areas, as discussed earlier in this report. In addition, such knowledge is important for life history studies. For example, if the examination reveals that small fish are caught in Area A and large fish in Area B, an investigator would then probably wish to determine whether this was because the fish migrate from Area A to Area B as they grow larger or because small fish are more vulnerable to to the fishery in Area A and large fish are more vulnerable to the fishery in Area B.

The data selected for this study consisted of all the length-frequency samples for 1976-1978 which had been assigned to 1-degree areas. The analysis was begun with the data in the form of tabulations of the numbers of fish in each 2-cm length group of each sample. Based on visual inspection of graphs of these distributions, the following ranges, which in most cases included distinct modal groups, were selected: 1, 300-459 mm; 2, 460-674 mm; 3, 675-1054 mm; 4, over 1054 mm. Next the percentages of fish occurring in each of the four ranges were calculated for each sample and a dominant modal group corresponding to the interval with the greatest percentage of fish was designated for each. These dominant modal groups were given the following codes:

A - Group 1
B - Group 2
C - Group 3
D - Group 4
E - Groups 1 and 2
F - Groups 1 and 3
G - Groups 1 and 4
H - Groups 2 and 3
I - Groups 2 and 4
J - Groups 3 and 4
K - Groups 1, 2, and 3
L - Groups 1, 2, and 4

M - Groups 1, 3, and 4

N - Groups 2, 3, and 4

O - Groups 1, 2, 3, and 4

The geographical distributions of the various dominant modal groups in each of the three years are indicated by letters in Figures 6, 7, and 8. An A in a 1-degree area indicates that Group 1 was the only dominant modal group in all the samples assigned to that area. An E in a 1-degree area indicates the presence of at least one sample in which Group 1 was the dominant modal group and at least one sample in which Group 2 was the dominant modal group.

Lines defining areas which were judged to be more or less homogeneous with respect to the lengths of fish in the samples of the catches were drawn on these maps. These areas were defined as those which include one or two combinations of the modal groups which were consistently present and more or less evenly distributed within these areas.

Separation of modal groups

Simple inspection method

The method of simple inspection of length-frequency distributions was developed by Petersen (1891), who used data for a population of Zoarces viviparus to identify age groups. This method has been used subsequently by many workers for a wide variety of species (e.g. Tesch, 1968; Royce, 1972; Everhart, Eipper, and Youngs, 1975). In general, this method works best when the spawning periods are short and there are only a few modal groups involved.

Previous to the present study, this was the only method which had been used for separation of modal groups of yellowfin in the eastern Pacific Ocean (Hennemuth, 1961a; Davidoff, 1963, 1965, and 1969; Díaz, 1963; Anonymous, 1974). These results are of limited value, except for the youngest fish, due to overlapping of the modes. Wild and Foreman (1980) determined that increments are formed on the otoliths of yellowfin between about 40 and 110 cm in length at the rate of one per day, but their method is of limited usefulness for verification of the results of modal group analyses because such a large portion of the catch of yellowfin consists of fish greater than

110 cm in length, and these are the ones which are the most difficult to assign to modal groups by analysis of length-frequency distributions.

Graphical methods

Graphical methods for separating modes, assuming them to be normally distributed or easily transformed to normal, were described by Buchanon-Wollaston and Hodgson (1929), Harding (1949), and Cassie (1954). Elaborations of this technique have been published by Hald (1952), Oka (1954), Tanaka (1962), Taylor (1965), Bhattacharya (1967), and Harris (1968). According to Macdonald and Pitcher (1979), however, "the interpretation of the graphs still leaves much to the imagination of the user, especially when the original size-frequency distribution is not clearly polymodal." McCammon (1976) developed an interactive computer graphics program based on this principle, but the "results are not reproducible and it is quite possible for two workers to obtain very different answers from the same set of data" (Macdonald and Pitcher, 1979).

Method of moments

Statistical treatment of the problem of overlapping distributions was originated by Pearson (1894) for the normal distribution. This method was later applied to a mixture of exponential distributions (Rider, 1961a) and to mixtures of binomial and of Poisson distributions (Rider, 1961b). These procedures are applicable only to the case of two modal groups, but Blischke (1964) devised a method applicable to any finite number of binomial distributions.

Minimum distance method

The minimum distance method was first used by Choi and Bulgren (1968), but Macdonald (1969 and 1971) showed that it was inferior to the maximum likelihood method described below.

Maximum likelihood method

The maximum likelihood method of separating modal groups was developed by Hasselblad (1966) for the normal distribution and Hasselblad (1969) for the Poisson, binomial, and exponential distributions. This method was discussed and used by Hosmer (1973) for Pacific halibut, Hippoglossus stenolepis, and by McNew and Summerfelt (1978) for largemouth bass, Micropterus salmoides, in both cases assuming the distributions to be normal. Macdonald and Pitcher (1979) described an interactive computer program which assists the user in estimating and determining the parameters of the components of a set of data, and used it with data for northern pike, Esox lucius, and European minnows, Phoxinus phoxinus. They pointed out that "fitting is made easier by employing a subsample aged by biological methods for the preliminary starting values of parameters, and that the best fit may involve a trade-off between statistical precision and biological plausibility." Schnute and Fournier (1980) devised "a single procedure [which, when] applied to length-frequency data [,] gives both the age composition of the stock and the parameters for growth." This method tended to produce less ambiguous results. They used this technique for data for northern pike and northern abalone, Haliotis kamschatkana.

The maximum likelihood method was used with the 1976 length-frequency data for yellowfin. The first calculations were performed with the 185 samples which had been assigned to 1-degree areas. Those for the same 1-degree area-month strata were combined into 125 groups, which are listed in Table 1. Then, for each each group, the numbers of fish of each 2-cm length class which were caught in the 1-degree area-month stratum by the vessels from which samples were obtained were estimated by

$$N_{i.} = \sum_{j=1}^{J} N_{ij} = \sum_{j=1}^{J} \frac{n_{ij}W_{.j}}{\sum_{i=1}^{I} n_{ij}w_{i}}$$

where

$N_{i.}$ = number of fish of length i caught in the stratum by all boats from which samples were obtained,

N_{ij} = number of fish of length i caught in the stratum by vessel j,

n_{ij} = number of fish of length i caught in the stratum sampled from boat j,

$W_{.j}$ = total weight of fish caught in the stratum by boat j, and

w_i = average weight of fish of length i,

and the portions of fish in each length class are estimated by

$$f_i = \frac{N_{i.}}{N_{..}} = \frac{N_{i.}}{\sum_{i=1}^{I} N_{i.}}$$

where

f_i = portion of catch in the stratum in length-class i and

$N_{..}$ = total number of fish caught in the stratum by all boats from which samples were obtained.

For the first line of Table 1 there are two samples of 50 fish each. There was 1 58-cm fish in the sample of the first boat (n_{ij}), from which it was estimated that it had caught 49 58-cm fish (N_{ij}), and 6 and 1 60-cm fish in the samples of the first and second boats, respectively, from which it was estimated that together they had caught 369 60-cm fish ($N_{i.}$), and so on. The estimate of the total number of fish caught in the 1-degree area-month stratum by the two boats is 6,119 ($N_{..}$), so the estimated portion of 58-cm fish in the stratum (f_i) is 0.008, that for the 60-cm fish is 0.060, and so on. These values (multiplied by 1,000) are given in the right side of Table 1 under "Relative length frequencies."

Next the January-December 1976 data by 5-degree areas (658 samples, 181 area-month strata) were subjected to similar computations, and the length frequencies were graphed. Because the 5-degree data include some samples which could not be assigned to 1-degree areas and because they encompass a period of 12 months, rather than 6, better decisions as to the validity of the modes can be made. From these data it was determined that during the first 6 months of the year there were seven modes with the following ranges:

1 - 30-49.9 cm

2 - 50-67.4 cm

3 - 67.5-86.4 cm

4 - 86.5-99.9 cm

5 - 100-119.9 cm

6 - 120-129.9 cm

7 - 130-160 cm

This information was used with the interactive computer program of Macdonald and Pitcher (1979) to determine, for the 125 groups of 1-degree area-month samples for January-June 1976, the portions of fish within each modal group and their means and variances. These data--essentially all the important information on lengths which is available--are listed in Table 2. They can be used with various statistical programs to measure the similarities and differences among the various groups. Unfortunately, however, the Macdonald-Pitcher program in its present form uses so much storage space and takes so long to run that it would not be practical to employ it with volumes of data sufficiently large to obtain useful results.

Cluster analysis

Cluster analysis consists essentially of comparing n groups to find those which are most similar, combining them, comparing the remaining groups and combinations of groups to find those which are most similar, combining those, and so on. Eventually, if the process is not interrupted, only one group, consisting of a combination of all the original groups, remains. The process is normally interrupted before that happens, however, on the basis of some decision reached by the investigator in accordance with his knowledge and intuition.

The original groups selected for the cluster analysis were the 125 combinations of samples from fish caught during January-June 1976, described in the previous section. There are several methods of computing indices of similarity between groups of data. For this study the Euclidean distance, which is used for measured data, is appropriate. The Euclidean distance is the square root of the sum of the squares of the differences between the values of the variables for the two groups. For example, for Groups 1 and 2 of Table 1 the Euclidean distance is $((8 - 0)^2 + (60 - 20)^2 + (84 - 20)^2 + (252 - 260)^2 + (323 - 280)^2 + (188 - 280)^2 + (72 - 80)^2 + (12 - 40)^2 + (0 - 20)^2)^{1/2} = (64 + 1{,}600 + 4{,}096 + 64 + 1{,}849 + 8{,}464 + 64 + 784 + 400)^{1/2} = 17{,}385^{1/2} = 131.85$.

A computer program called Cluster Analysis, issued as a supplement to Anonymous (1983), was used to carry out the calculations. The output from this program included the dendrogram shown in Figure 9. The 125 numbers in the dendrogram correspond to the 125 groups listed in Tables 1 and 2. Dashed lines were arbitrarily drawn on the dendrogram to divide the groups into seven major groups, as shown in the figure. The locations of capture of the fish corresponding to the seven major groups are shown in Figure 10. It is obvious that there is considerable overlap in the locations of capture of the fish of the various major groups. It is not surprising that such is the case, since the data for six different months are mixed, and it is known that yellowfin grow at the rate of roughly 1 mm per day or 3 cm per month. Accordingly, the fish were segregated by month, and the calculations redone. The dendrograms and maps appear in Figures 11 and 12. Again there is considerable overlap in the locations of capture of the fish of the various major groups. (It should be noted that the numbers of the major groups in Figures 10 and 12 do not correspond to one another. For example, Major Group 2 in Figure 10 includes Groups 3, 6, and 11, plus four other groups (see Figure 9), but Groups 3, 6, and 11 are all in Major Group 3 in Figure 12a (see Figure 11a).)

DISCUSSION

This report is a study of the lengths of yellowfin occurring in different parts of the eastern Pacific Ocean. Three methods were considered. For the first method, discussed under Distribution of lengths by area, 4 length groups and 11 combinations of length groups were recognized, and the presence of each was indicated on maps. Then lines were drawn on the maps defining the areas which were judged to be more or less homogeneous with respect to the lengths of fish in the samples of the catches. For the second method, discussed under Maximum likelihood method, seven length groups were recognized, and the means, standard deviations, and proportions of samples occurring within each were tablulated for each group. These results could be used for statistical comparisons, but none were performed for this report. The third method is discussed under Cluster analysis. For this method all the information on the lengths which is furnished is automatically considered in a single analysis, making it the most subjective of the three methods.

Neither the maps of the distributions of the lengths by area nor the cluster analyses reveal marked areal segregation of the fish by lengths. However, further investigation with larger amounts of data is suggested.

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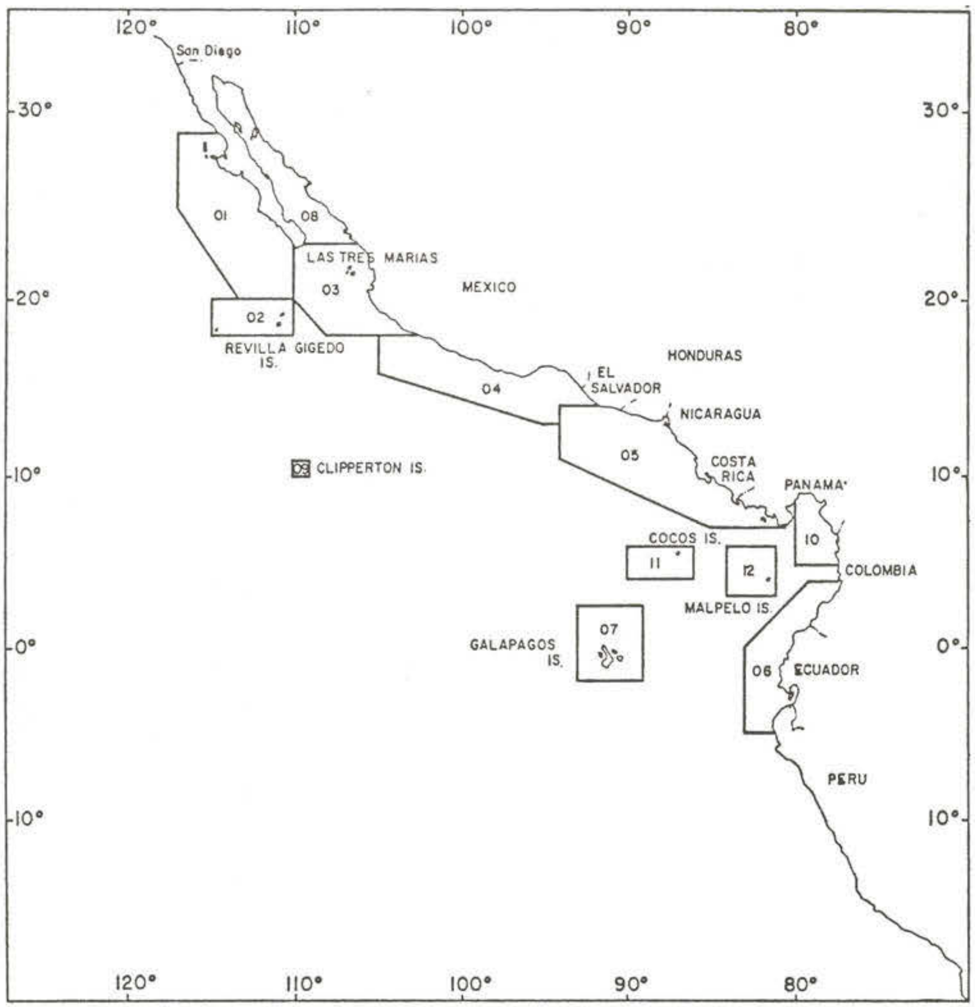

FIGURE 1. Sampling areas designated by Hennemuth (1957).

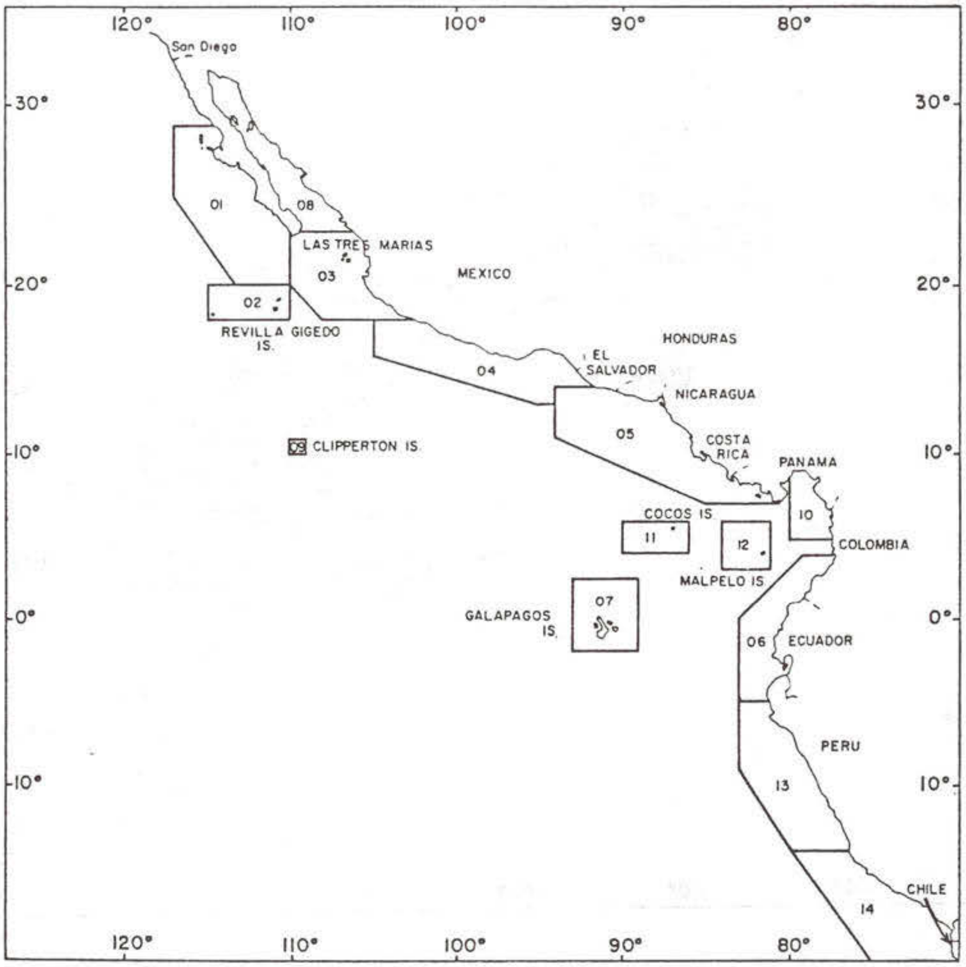

FIGURE 2. Sampling areas designated by Hennemuth (1961a).

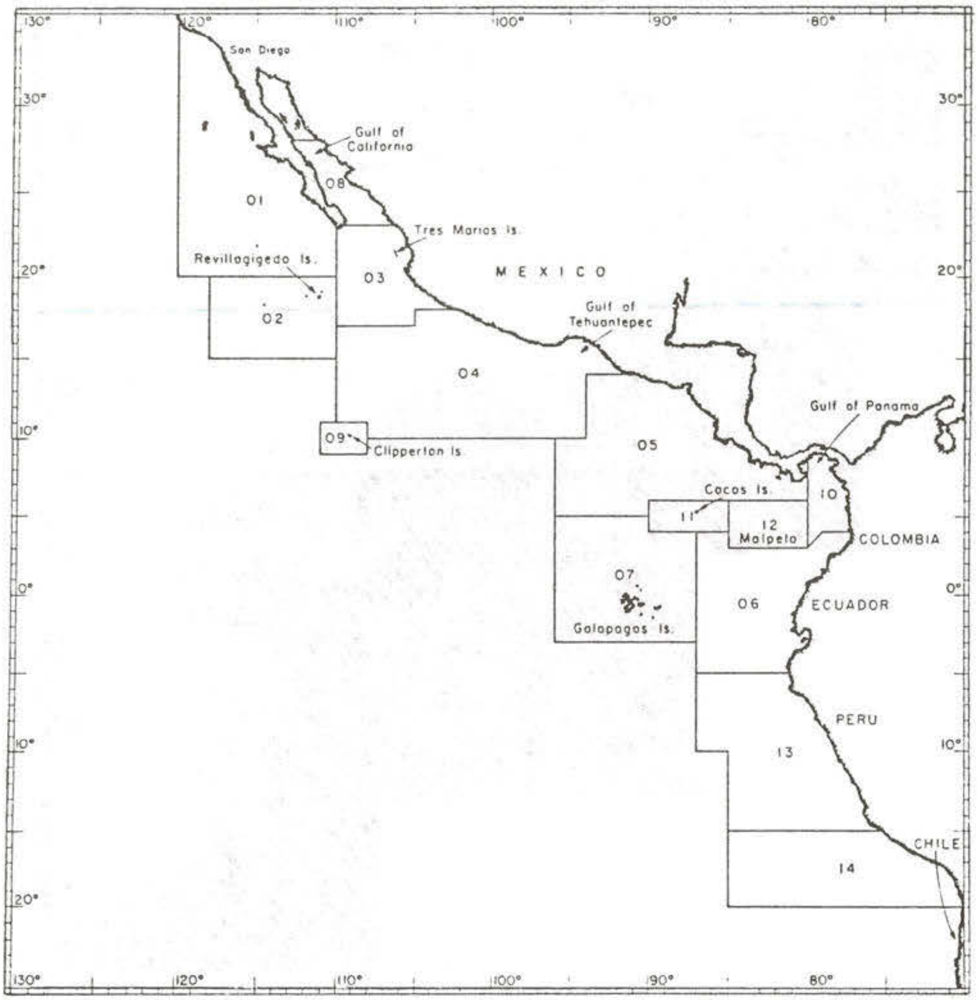

FIGURE 3. Sampling areas designated by Davidoff (1963).

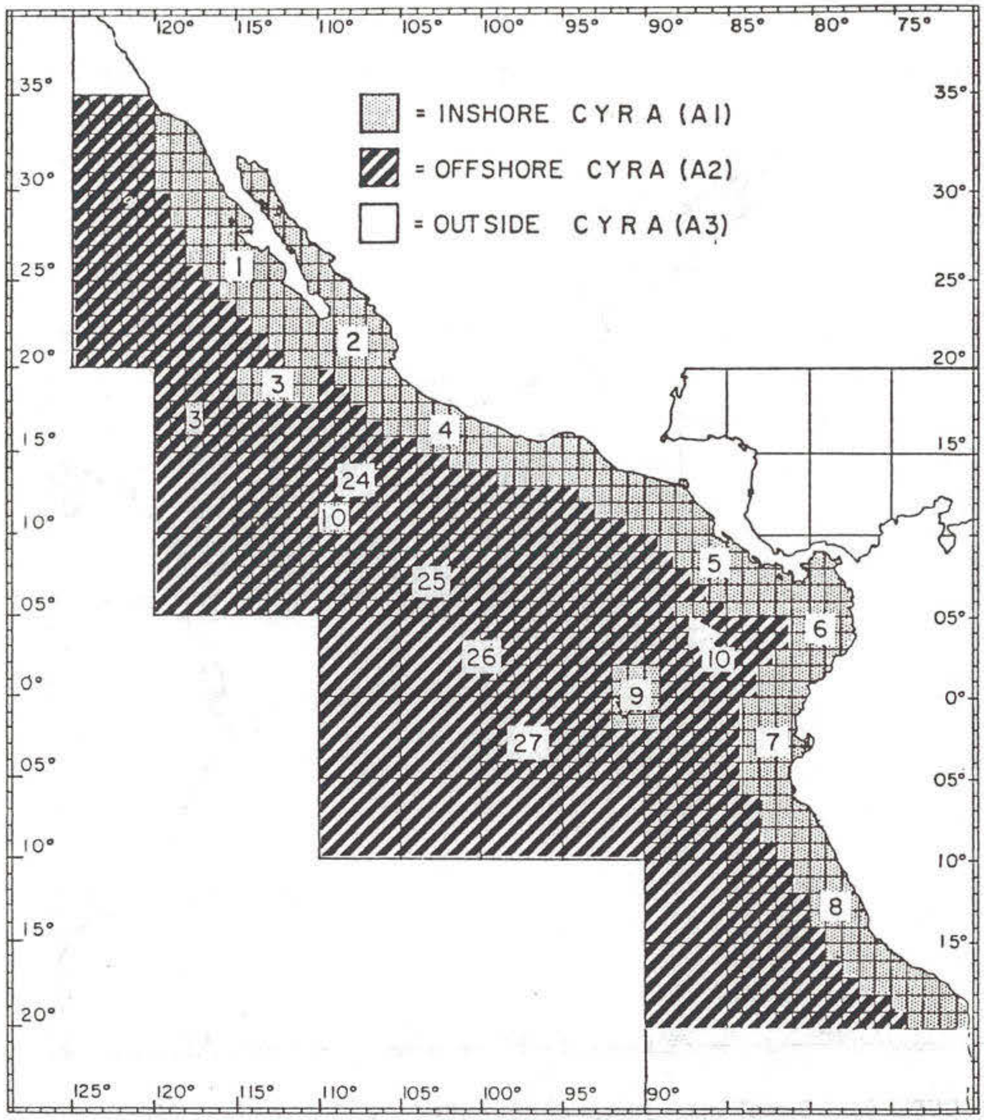

FIGURE 4. Sampling areas designated by Anonymous (1974).

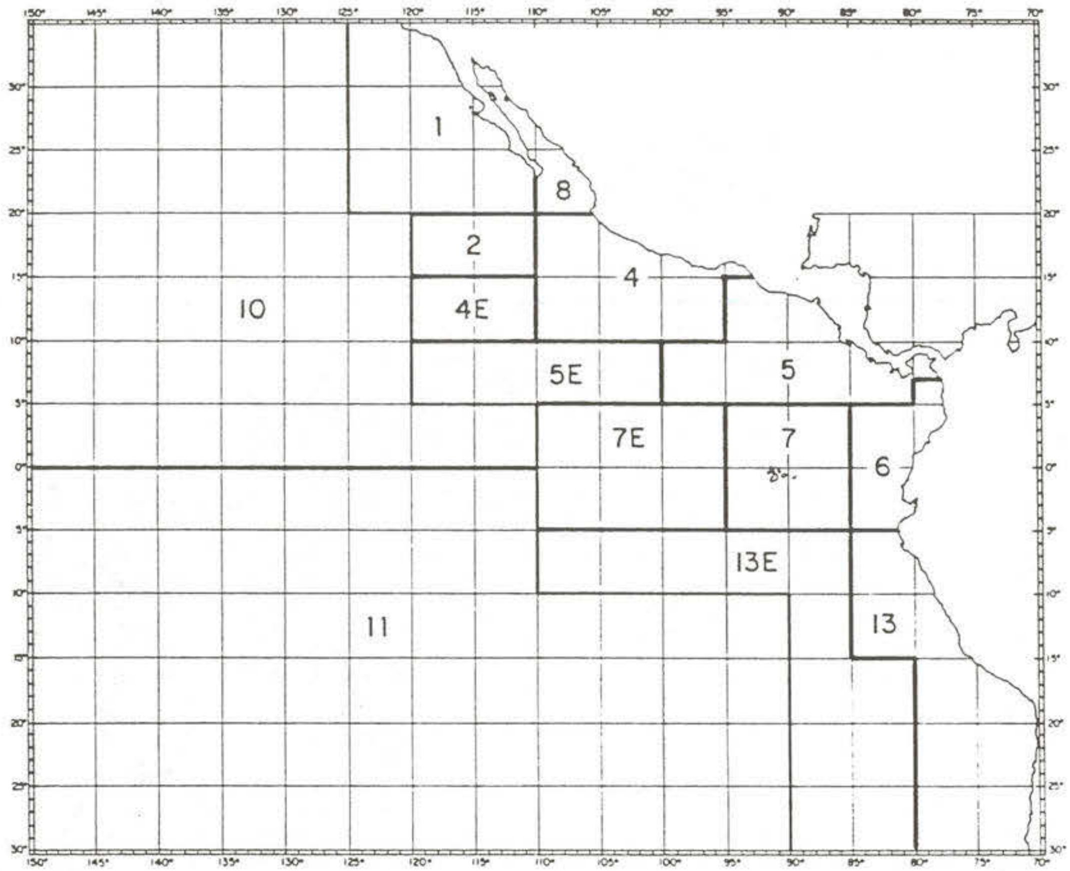

FIGURE 5. Sampling areas designated by Anonymous (1982).

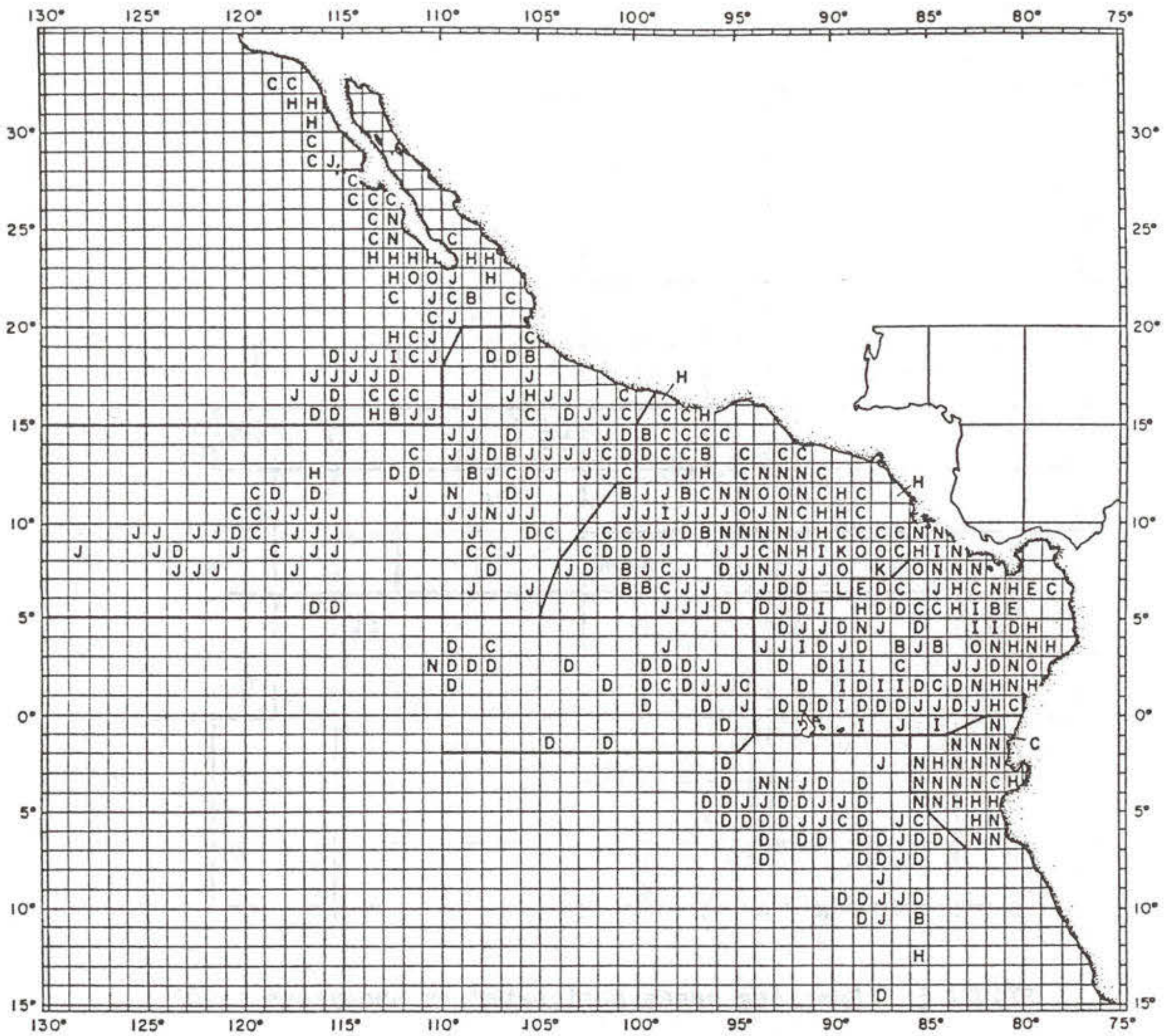

FIGURE 6. Areas in which yellowfin of various lengths and combinations of lengths occurred in 1976. The figure is explained further in the text.

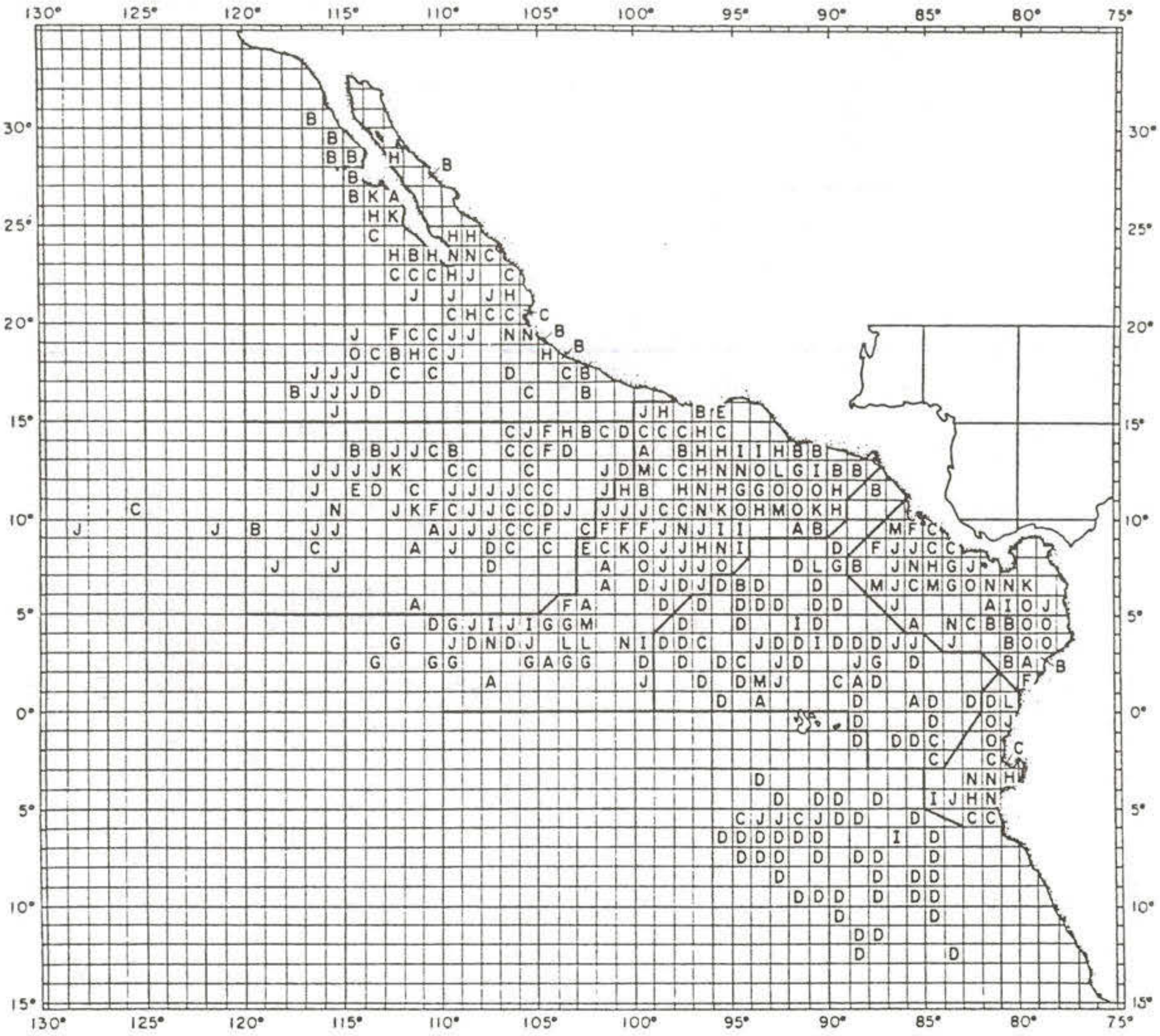

FIGURE 7. Areas in which yellowfin of various lengths and combinations of lengths occurred in 1977. The figure is explained further in the text.

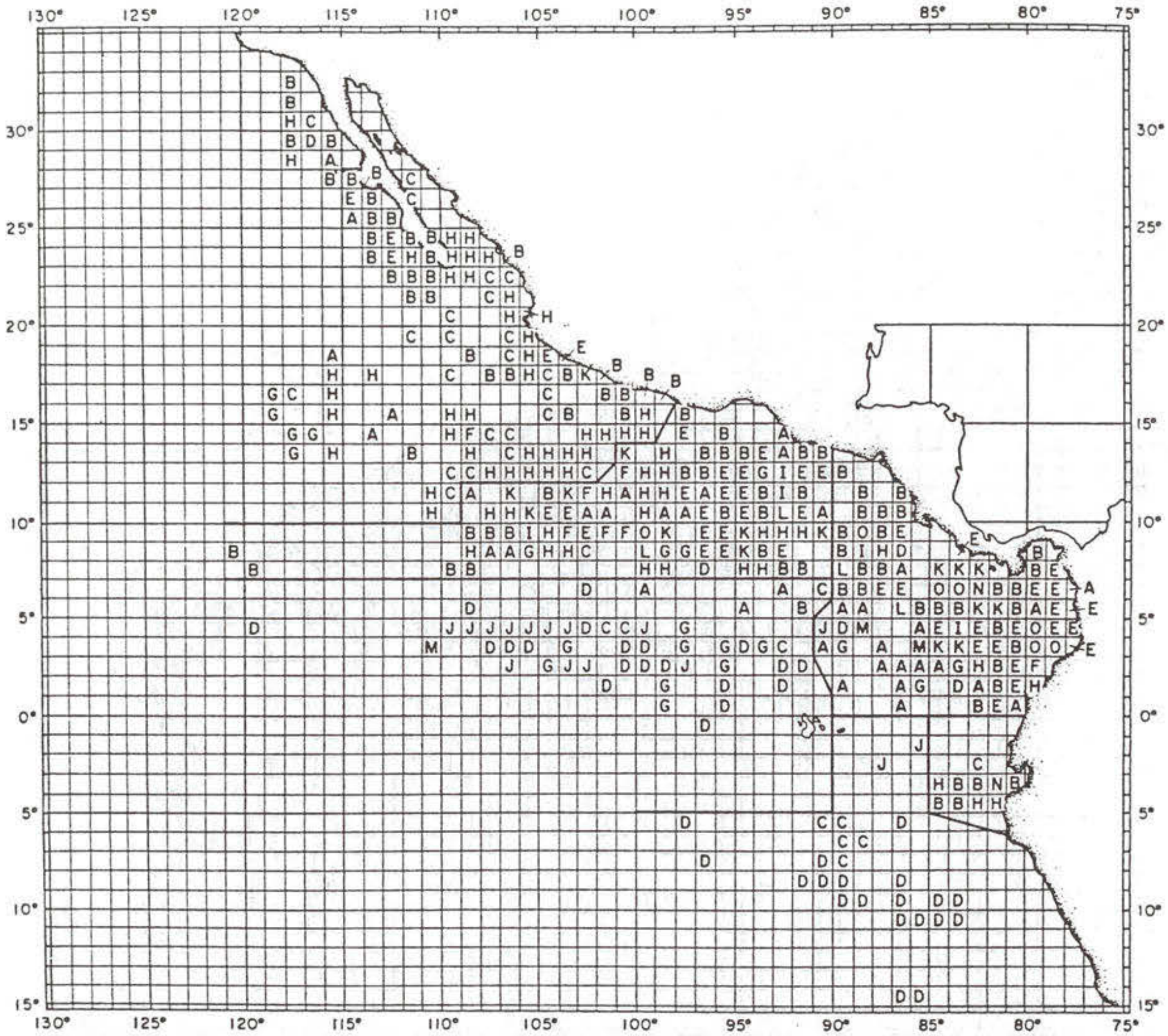

FIGURE 8. Areas in which yellowfin of various lengths and combinations of lengths occurred in 1978. The figure is explained further in the text.

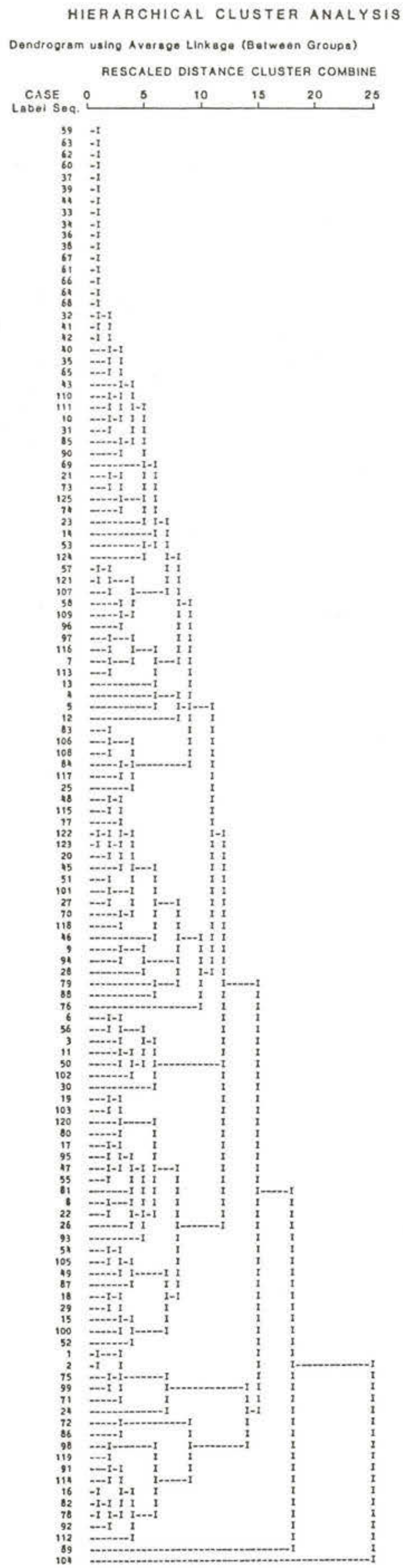

FIGURE 9. Cluster analysis dendrogram for the 125 groups of fish listed in Table 1. The numbers under "Seq" correspond to the numbers of the groups in the order listed in that table.

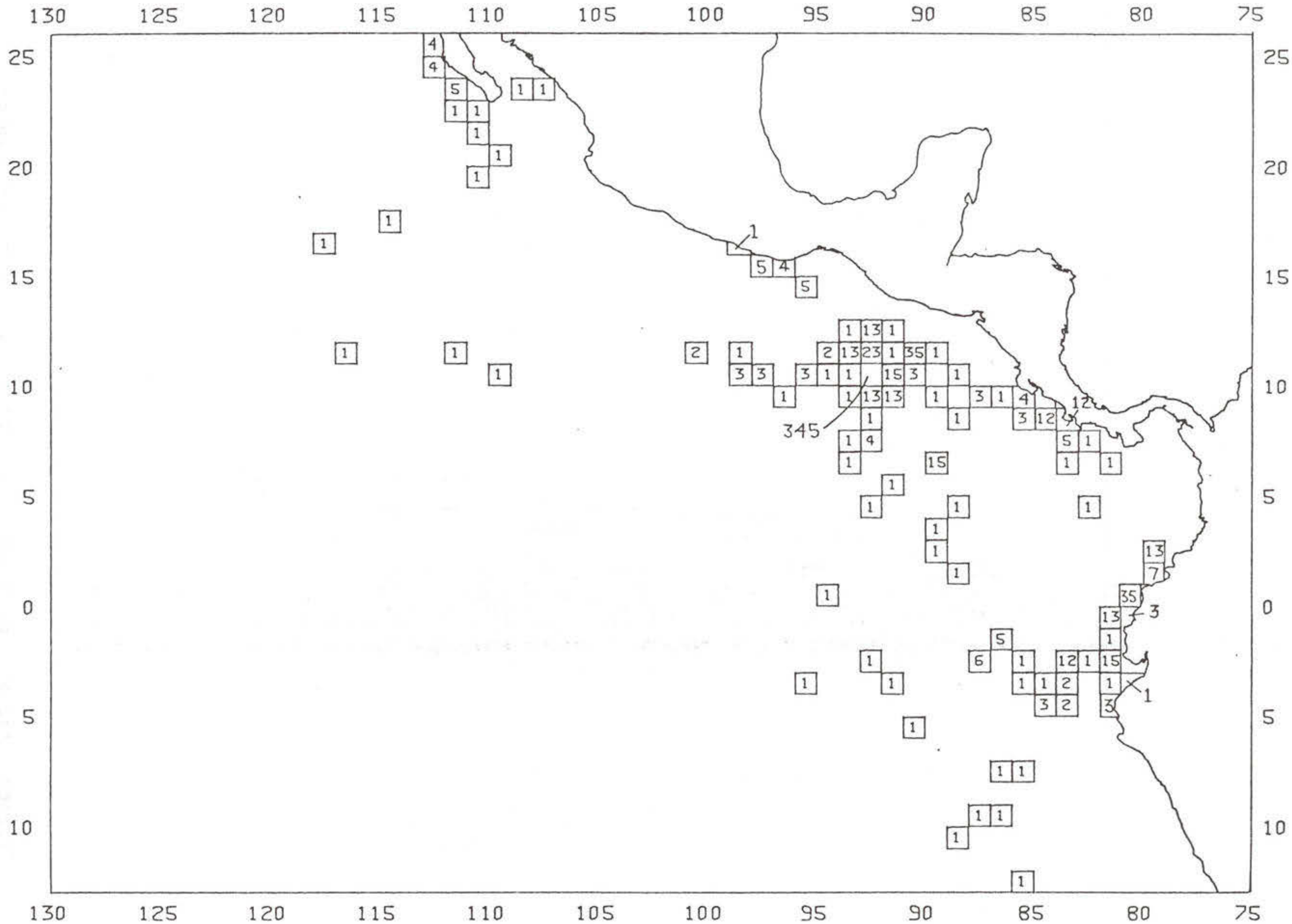

FIGURE 10. Locations of catches of fish of the seven major groups listed in Figure 9.

*****HIERARCHICAL CLUSTER ANALYSIS*****

Dendrogram using Average Linkage (Between Groups)

```
                       Rescaled Distance Cluster Combine

   C A S E    0         5         10        15        20        25
 Label  Seq   +---------+---------+---------+---------+---------+

          1    -I-----------------------------------------------I
          2    -I                                               I
          7    -----I---------------------I                     I
         13    -----I                     I                     I
          6    -----I                     I                     I
          8    -----I-----I               I---------------------I
          3    -----I     I-----I         I
         11    -----------I     I-------I I
         12    -----------------I       I I
          4    -------I-----I           I-I
         10    -------I     I-----I     I
          5    -------------I     I-----I
          9    -------------------I
```

FIGURE 11a. Cluster analysis dendrogram for the 13 groups of fish listed in Table 1 for January. The numbers under "Seq" correspond to the numbers of groups in the order listed in that table.

*****H I E R A R C H I C A L   C L U S T E R   A N A L Y S I S*****

Dendrogram using Average Linkage (Between Groups)

```
                        Rescaled Distance Cluster Combine

 C A S E     0         5        10        15        20        25
 Label  Seq  +---------+---------+---------+---------+---------+

         24   -I
         26   -I
         31   -I
         20   -I
         21   -I
         23   -I-I
         25   -I I
         19   -I I
         28   -I I-I
         29   ---I I-I
         27   ---I I I-I
         22   -----I I I-I
         30   -------I I I-I
         18   ---------I I I
          8   -----------I I-------I
          1   -------------I       I
         10   -------------I       I-I
          4   ---------I---I       I I
         14   ---------I   I-------I I-I
          7   -------------I         I I
         15   -----------------------I I
          5   ---I---I                 I-------I
         16   ---I   I-------------I   I       I
          2   -------I             I   I       I
          6   ---------I           I---I       I---I
         13   ---------I---I       I           I   I
          9   ---------I   I-------I           I   I-----------I
          3   -------------I                   I   I           I
         11   ---------------------------------I   I           I
         12   -------------------------------------I           I
         17   -------------------------------------------------I
```

FIGURE 11b. Cluster analysis dendrogram for the 31 groups of fish listed in Table 1 for February. The numbers under "Seq" correspond to the numbers of groups in the order listed in that table.

* * * * * H I E R A R C H I C A L   C L U S T E R   A N A L Y S I S * * * * *

Dendrogram using Average Linkage (Between Groups)

```
                           Rescaled Distance Cluster Combine

 C A S E      0         5        10        15        20        25
Label  Seq    +---------+---------+---------+---------+---------+

        15     -I
        19     -I
        18     -I
        16     -I
        23     -I
        17     -I
        22     -I
        20     -I-------I
        24     -I       I---------------------I
        21     ---------I                     I-------I
        13     ---------------I-----I         I       I
        14     ---------------I     I---------I       I-I
         9     ---------------------I                 I I
         5     -----------I-----------I               I I
        10     -----------I           I---------------I I
         3     -------I---------I     I                 I-------I
        11     -------I         I-----I                 I       I
         2     -----------------I                       I       I
         6     -------------I---------------------I     I       I
        12     -------------I                     I-----I       I
         8     -----------------------------------I             I
         1     ---------------I-------I                         I
         4     ---------------I       I-------------------------I
         7     -----------------------I
```

FIGURE 11c. Cluster analysis dendrogram for the 24 groups of fish listed in Table 1 for March. The numbers under "Seq" correspond to the numbers of groups in the order listed in that table.

* * * * * H I E R A R C H I C A L   C L U S T E R   A N A L Y S I S * * * * *

Dendrogram using Average Linkage (Between Groups)

```
                      Rescaled Distance Cluster Combine

  C A S E     0         5        10        15        20        25
  Label  Seq  +---------+---------+---------+---------+---------+

          10   -I---I
          14   -I   I-----------I
          12   -----I           I---------------I
           4   -----I-----------I               I
          18   -----I                           I
          11   ---------I-----------I           I---------I
          20   ---------I           I-----I     I         I
           8   ---------------------I     I     I         I
           5   ---I---------I             I     I         I
           6   ---I         I---------I   I-----I         I
          15   -----I---I   I         I   I               I
          16   -----I   I---I         I   I               I
          17   ---------I             I---I               I-----I
           1   ---I-----I             I                   I     I
           9   ---I     I-----I       I                   I     I
           3   -I-------I     I       I                   I     I
           7   -I       I     I-------I                   I     I
           2   ---------I     I                           I     I
          13   ---------------I                           I     I
          21   -------------------------------------------I     I
          19   -------------------------------------------------I
```

FIGURE 11d. Cluster analysis dendrogram for the 21 groups of fish listed in Table 1 for April. The numbers under "Seq" correspond to the numbers of groups in the order listed in that table.

* * * * * H I E R A R C H I C A L   C L U S T E R   A N A L Y S I S * * * * *

Dendrogram using Average Linkage (Between Groups)

```
                            Rescaled Distance Cluster Combine

  C A S E  0         5        10        15        20        25
Label  Seq +---------+---------+---------+---------+---------+

       17   -I-I
       19   -I I-------------I
        1   ---I             I-----I
        8   -----------------I     I-------------I
        7   ---I---I               I             I
       20   ---I   I---------------I             I---I
       18   -------I                             I   I
       10   ---------------------I---------------I   I
       12   ---------------------I                   I-------I
       11   ---------------------I-----------I       I       I
       13   ---------------------I           I       I       I
       14   -------I-----I                   I-------I       I
       16   -------I     I---------------I   I               I
       15   -------------I               I   I               I
        3   -I-I                         I---I               I
        6   -I I-----I                   I                   I
        2   ---I     I---I               I                   I
        4   ---------I   I---------------I                   I
        9   -------------I                                   I
        5   -------------------------------------------------I
```

FIGURE 11e. Cluster analysis dendrogram for the 20 groups of fish listed in Table 1 for May. The numbers under "Seq" correspond to the numbers of groups in the order listed in that table.

* * * * * H I E R A R C H I C A L   C L U S T E R   A N A L Y S I S * * * * *

Dendrogram using Average Linkage (Between Groups)

```
                      Rescaled Distance Cluster Combine

 C A S E    0         5        10        15        20        25
 Label   Seq +---------+---------+---------+---------+---------+

        13   -I---I
        14   -I   I---I
         6   -----I   I-----------------I
         1   -I-----I I                 I
         2   -I     I-I                 I---I
         9   -------I                   I   I
         4   -----I-----------------I   I   I
         7   -----I                 I---I   I-----------------I
        15   ---------------I-----I I       I                 I
        16   ---------------I     I-I       I                 I
        12   ---------------------I         I                 I
         8   -------------------------------I                 I
         3   -------I-----------I                             I
        10   -------I           I-I                           I
        11   -------------------I I---------------------------I
         5   ---------------------I
```

FIGURE 11f. Cluster analysis dendrogram for the 16 groups of fish listed in Table 1 for June. The numbers under "Seq" correspond to the numbers of groups in the order listed in that table.

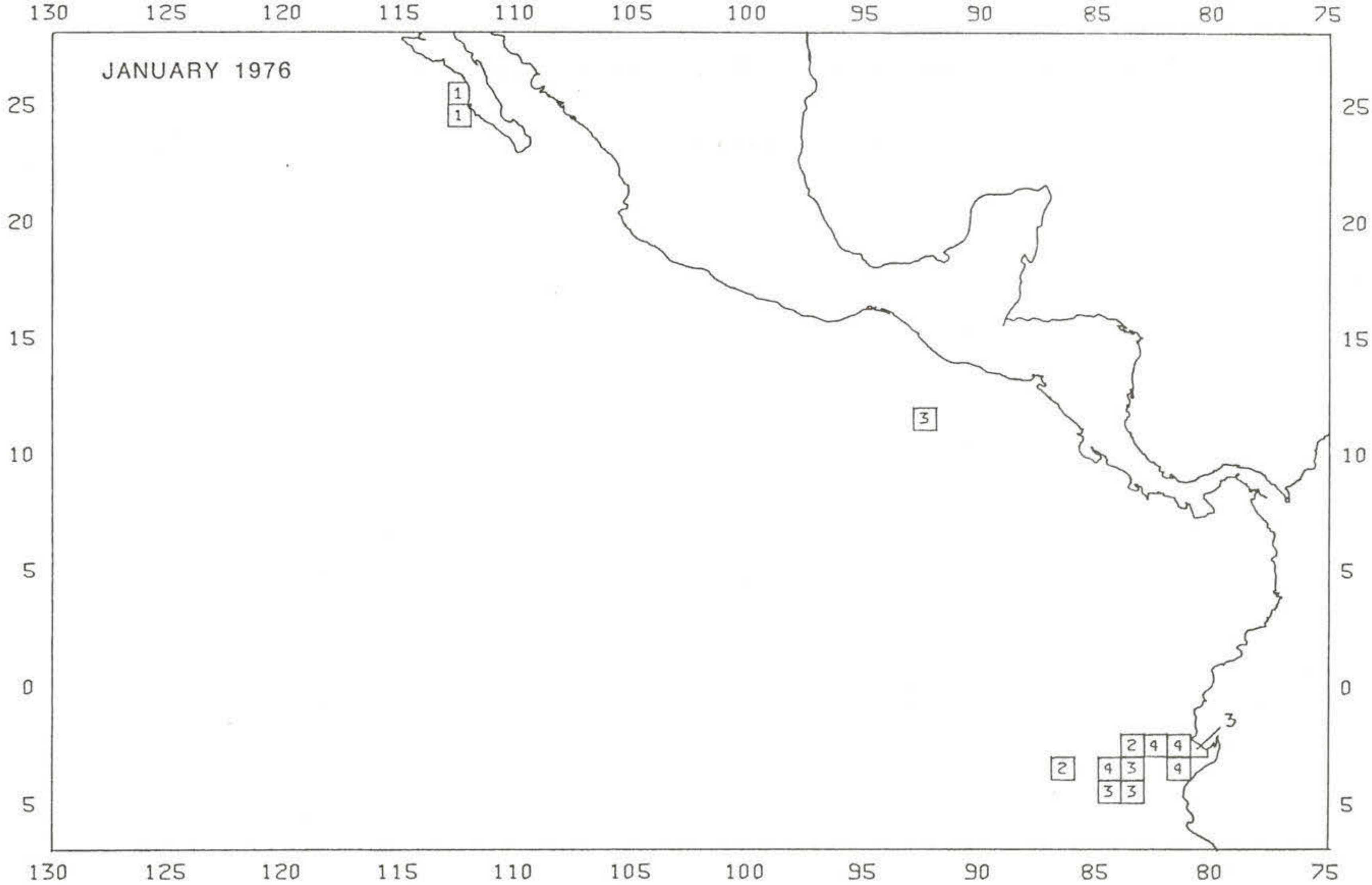

FIGURE 12a. Locations of catches of fish of the four major groups listed in Figure 11a.

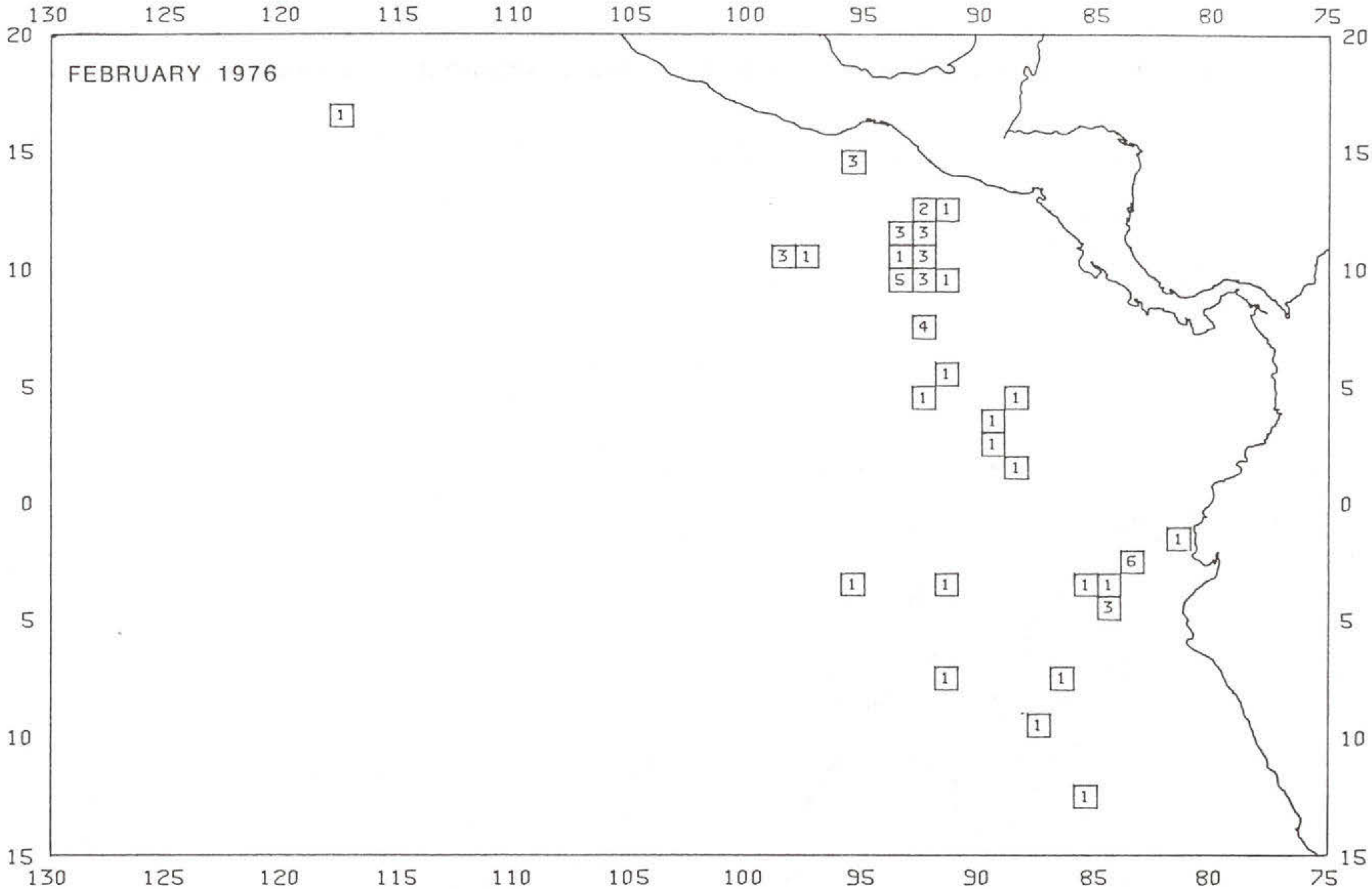

FIGURE 12b. Locations of catches of fish of the six major groups listed in Figure 11b.

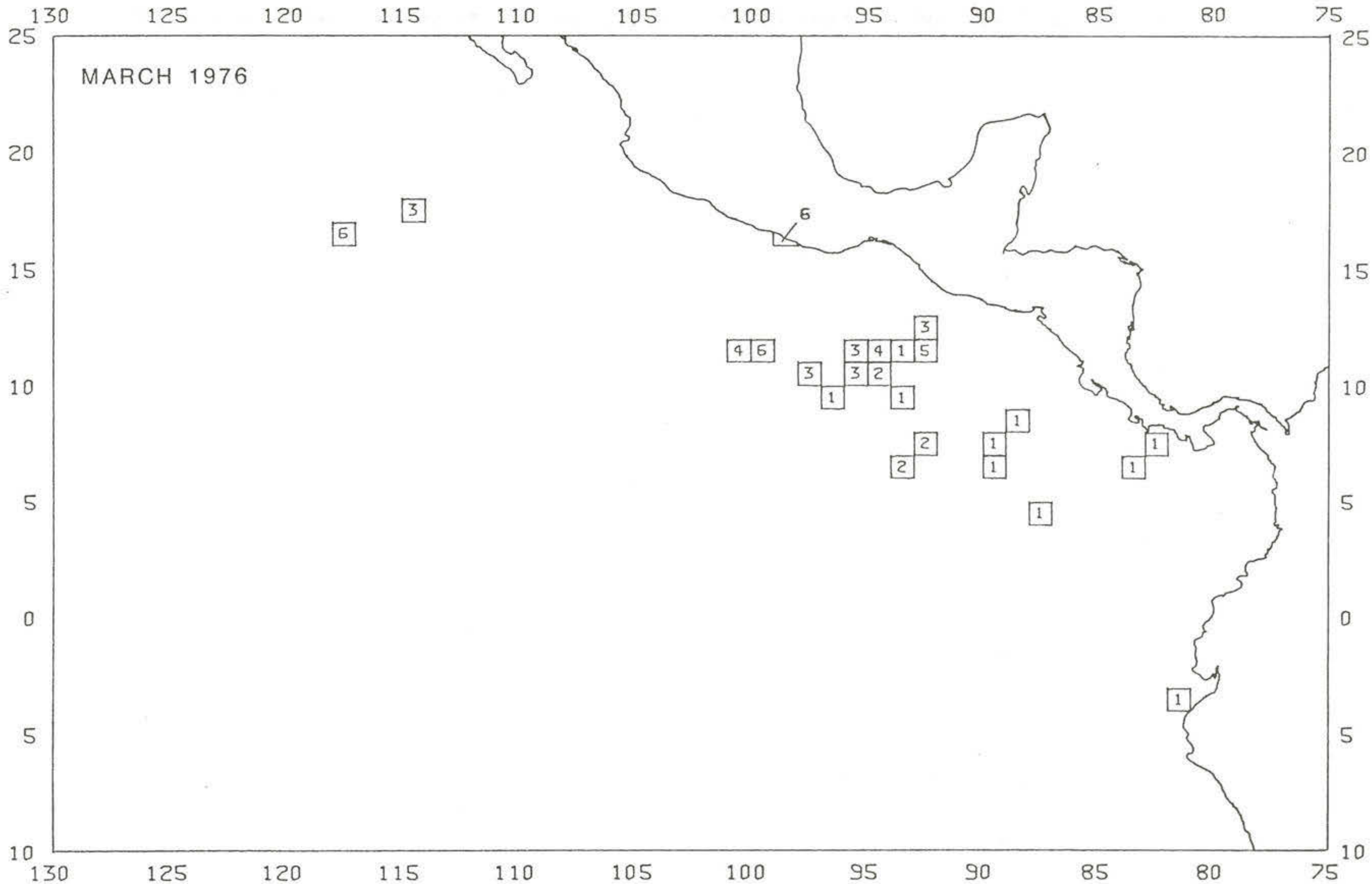

FIGURE 12c. Locations of catches of fish of the six major groups listed in Figure 11c.

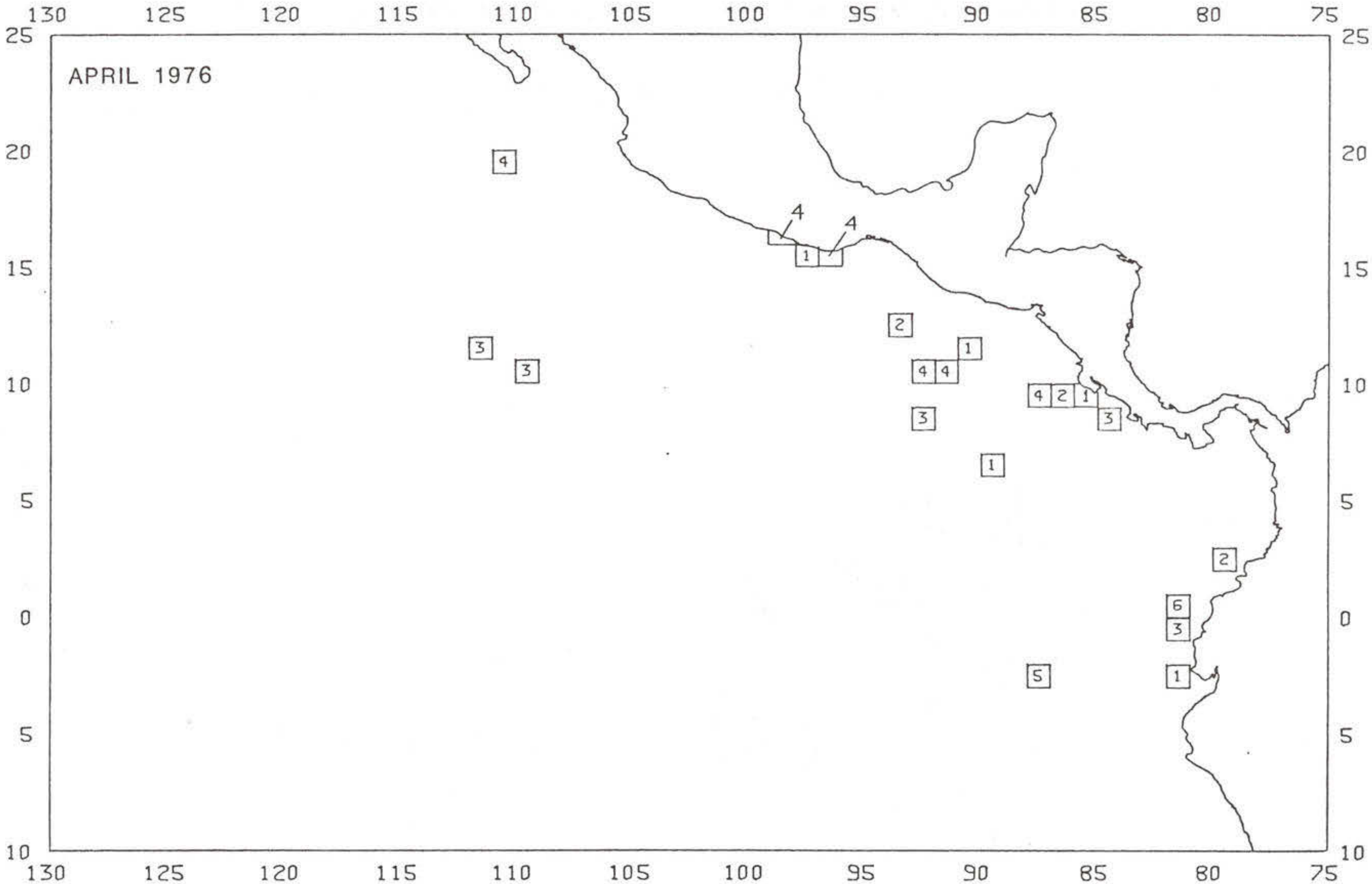

FIGURE 12d. Locations of catches of fish of the six major groups listed in Figure 11d.

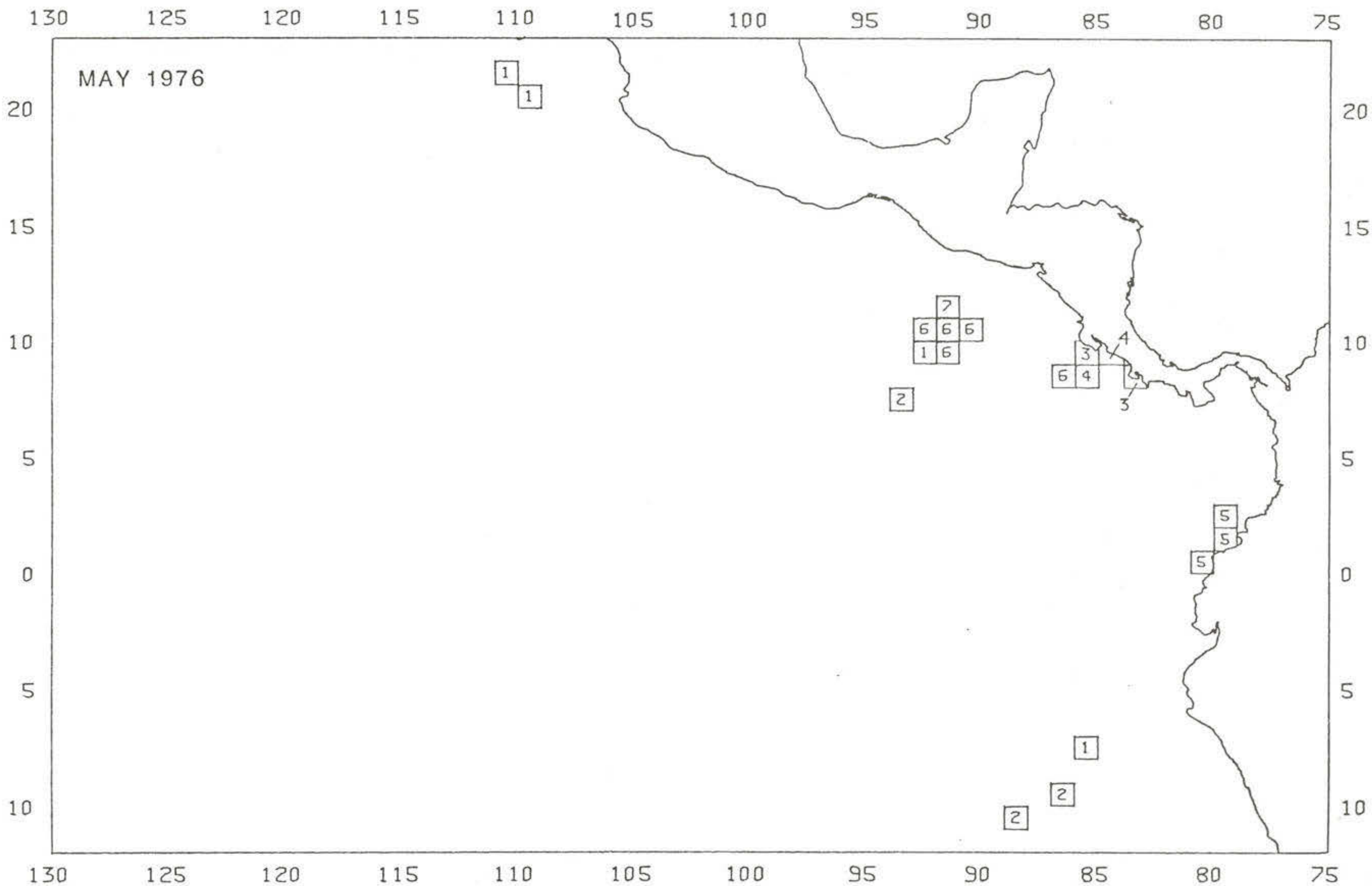

FIGURE 12e. Locations of catches of fish of the six major groups listed in Figure 11e.

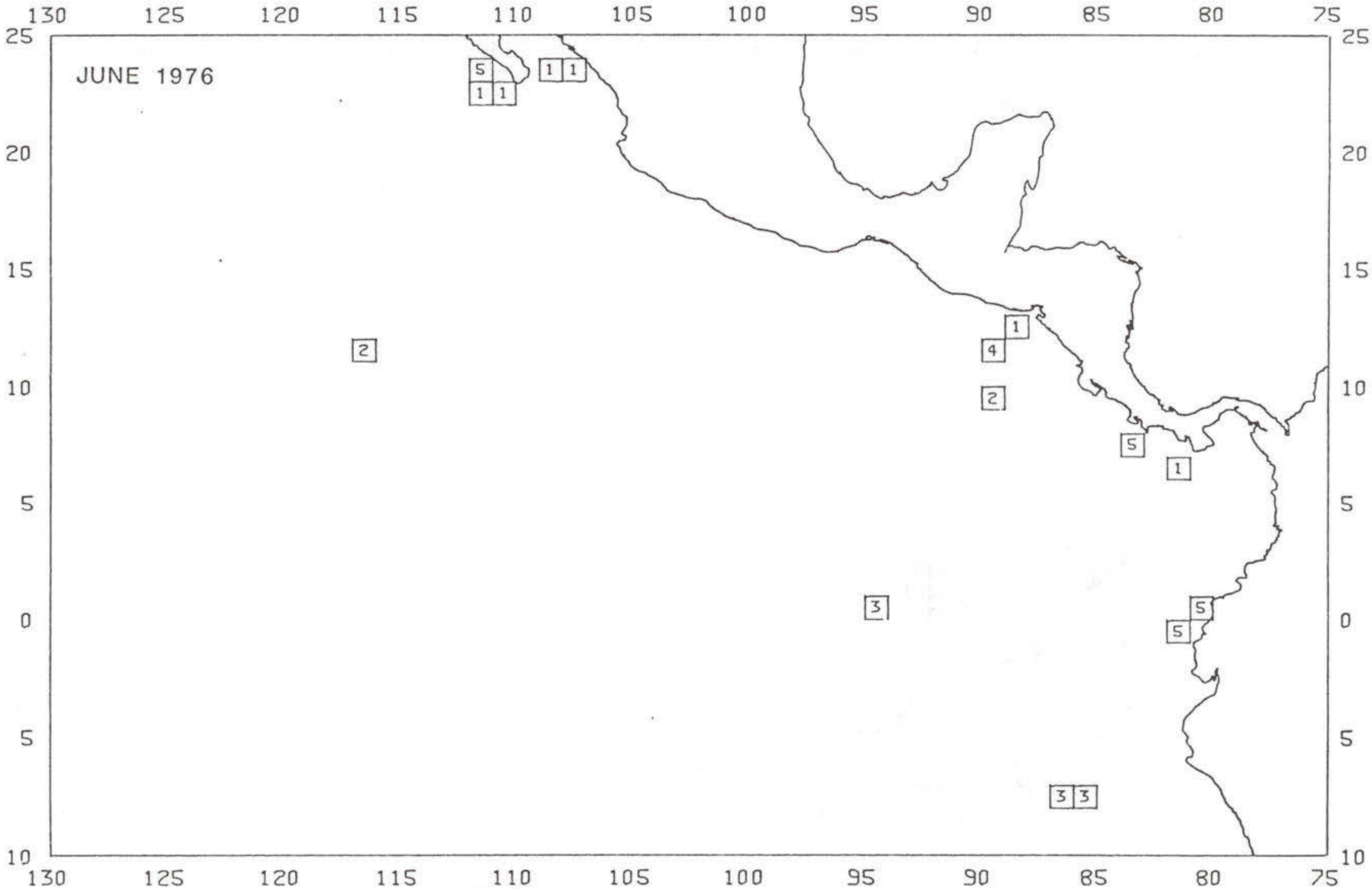

FIGURE 12f. Locations of catches of fish of the seven major groups listed in Figure 11f.

TABLE 1. Length-frequency samples of yellowfin for January-June 1976 which were allocated to 1-degree areas. Catch indicates the catch of yellowfin in the strata in question by the boats from which the samples were taken. Stan. dev. indicates the standard deviation of the lengths. Initial length indicates the length of the first group under Relative length frequencies, i. e. the values of 8, 60, 84, ... in the first line correspond to lengths of 58 cm, 60 cm, 62 cm, ... The samples usually consisted of 50 fish.

Month	Area	Catch (short tons)	Average length (mm)	Stan. dev. (mm)	Initial length (cm)	Number of samples	Relative length frequencies (cm)														
1	0-25-110- 3	40	662	27	58	2	8	60	84	252	323	188	72	12	0	0	0	0	0	0	0
1	0-20-110-23	11	682	61	60	1	20	20	260	280	280	80	40	0	0	0	0	0	0	0	0
1	0-20-110-23	11	682	61	90	1	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
1	0-10-090- 8	190	752	261	48	1	20	240	140	-100	0	20	0	40	0	0	0	0	0	0	0
1	0-10-090- 8	190	752	261	78	1	0	0	20	0	20	40	20	0	20	20	0	0	20	80	20
1	0-10-090- 8	190	752	261	108	1	100	20	0	0	20	40	0	0	0	0	0	0	0	0	0
1	2-05-080-12	47	706	203	46	1	100	160	0	60	40	60	20	0	0	0	0	0	20	20	40
1	2-05-080-12	47	706	203	76	1	80	200	20	0	0	40	0	0	0	0	0	0	0	0	60
1	2-05-080-12	47	706	203	106	1	20	0	40	20	0	0	0	0	0	0	0	0	0	0	0
1	2-05-080-13	5	595	147	44	1	199	179	60	20	60	80	20	0	0	0	20	0	0	40	40
1	2-05-080-13	5	595	147	74	1	0	80	80	80	20	20	0	0	0	0	0	0	0	0	0
1	2-05-080- 9	120	695	220	40	5	7	0	7	36	137	281	178	130	84	32	17	24	4	0	0
1	2-05-080- 9	120	695	220	70	5	0	1	1	1	8	5	4	5	2	1	0	1	0	1	1
1	2-05-080- 9	120	695	220	100	5	3	8	7	5	5	1	2	0	0	0	1	1	0	0	0
1	2-05-080-14	531	981	225	40	6	3	0	6	28	41	16	9	9	25	16	0	0	0	0	4
1	2-05-080-14	531	981	225	70	6	4	2	0	7	0	0	0	0	3	4	22	12	17	14	35
1	2-05-080-14	531	981	225	100	6	31	41	61	101	102	91	101	56	40	26	33	27	8	0	4
1	2-05-080- 5	507	756	281	46	3	35	77	138	117	90	125	87	96	17	0	0	0	0	0	0
1	2-05-080- 5	507	756	281	76	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	31
1	2-05-080- 5	507	756	281	106	3	33	31	28	33	24	14	21	3	0	0	0	0	0	0	0
1	2-05-080- 6	105	746	46	64	1	60	80	40	80	120	100	300	120	100	0	0	0	0	0	0
1	2-05-080-10	678	811	229	40	6	4	2	0	2	32	79	13	33	61	44	15	27	27	19	1
1	2-05-080-10	678	811	229	70	6	81	27	46	58	137	78	49	10	27	0	0	0	0	2	5
1	2-05-080-10	678	811	229	100	6	7	10	3	27	21	11	14	13	5	3	0	0	1	0	0
1	2-05-080-10	678	811	229	130	6	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0
1	2-05-080- 4	68	509	33	44	1	20	200	240	180	140	140	80	0	0	0	0	0	0	0	0
1	2-05-085-11	50	796	299	46	1	140	220	60	60	0	0	0	0	0	0	0	0	0	0	0
1	2-05-085-11	50	796	299	76	1	0	0	0	0	0	0	0	0	0	0	100	0	0	0	20
1	2-05-085-11	50	796	299	106	1	80	160	80	20	20	0	40	0	0	0	0	0	0	0	0
1	2-05-085- 6	105	1082	54	94	1	20	20	100	0	60	140	100	60	180	220	100	0	0	0	0

TABLE 1. (continued)

2	0-15-115- 8	5	988	194	66	1	57	77	96	0	38	0	0	0	0	0	0	19	0	19	38
2	0-15-115- 8	5	988	194	96	1	0	19	19	19	19	38	120	19	139	38	96	77	19	0	0
2	0-10-095- 4	110	570	53	44	1	20	20	0	40	220	200	220	20	80	60	60	20	20	0	20
2	0-10-095-21	107	612	40	50	1	20	20	20	100	220	260	160	60	100	0	40	0	0	0	0
2	0-10-095- 3	83	634	77	46	1	20	0	40	40	60	140	80	100	100	20	20	80	120	120	40
2	0-10-095- 3	83	634	77	76	1	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0-10-090- 9	18	550	54	40	2	23	20	0	3	0	105	254	296	81	11	118	33	0	16	0
2	0-10-090- 9	18	550	54	70	2	0	20	16	0	0	0	0	0	0	0	0	0	0	0	0
2	0-10-090- 8	10	583	46	48	1	20	60	80	120	220	200	140	20	80	20	20	20	0	0	0
2	0-10-090- 4	10	732	75	56	1	20	20	20	0	0	40	120	259	120	120	159	79	20	0	0
2	0-10-090- 4	10	732	75	86	1	0	0	0	0	0	0	0	0	0	0	0	0	0	20	0
2	0-10-090-12	20	1282	190	68	1	38	0	0	0	0	0	0	0	0	0	0	0	0	0	18
2	0-10-090-12	20	1282	190	98	1	18	38	0	0	0	18	38	38	0	18	18	0	38	18	78
2	0-10-090-12	20	1282	190	128	1	0	58	58	98	58	18	118	18	0	78	0	18	38	18	0
2	0-10-090- 3	11	827	275	48	2	12	12	109	97	109	73	97	84	12	0	0	0	8	0	0
2	0-10-090- 3	11	827	275	78	2	8	0	16	23	0	8	23	0	0	8	8	23	0	0	0
2	0-10-090- 3	11	827	275	108	2	47	16	47	54	23	16	16	8	8	16	0	0	0	8	0
2	0-10-090- 3	11	827	275	138	2	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0-05-090- 2	105	1395	145	114	1	39	39	19	19	39	58	19	19	39	117	39	78	78	19	19
2	0-05-090- 2	105	1395	145	144	1	0	0	0	98	39	39	0	157	0	0	0	0	0	0	19
2	0-05-090-13	68	649	36	58	1	40	280	120	120	140	260	40	0	0	0	0	0	0	0	0
2	0-05-090-24	5	874	54	64	1	18	18	0	0	0	0	0	0	39	39	138	177	259	177	117
2	0-05-090-23	5	602	81	48	1	140	19	40	119	100	100	119	59	159	0	0	40	40	19	0
2	0-05-090-23	5	602	81	78	1	0	19	19	0	0	0	0	0	0	0	0	0	0	0	0
2	0-05-090-22	12	676	55	50	1	20	0	40	20	20	40	80	80	120	160	200	180	40	0	0
2	0-10-090-13	50	692	82	54	1	60	60	160	20	20	20	40	40	20	80	240	200	40	0	0
2	2-05-080- 5	52	545	34	46	1	41	20	102	327	224	122	82	61	20	0	0	0	0	0	0
2	2-05-080-14	20	504	23	40	1	20	0	0	100	240	400	240	0	0	0	0	0	0	0	0
2	2-05-080-10	141	805	215	46	4	16	32	97	90	37	28	35	14	15	62	39	31	8	85	31
2	2-05-080-10	141	805	215	76	4	23	77	15	7	24	24	38	17	10	11	25	10	3	14	6
2	2-05-080-10	141	805	215	106	4	17	28	9	17	4	2	0	0	0	0	0	0	0	0	0

TABLE 1. (continued)

2	2-05-080-17	15	1061	137	70	1	19	0	0	19	19	0	0	19	19	19	0	39	99	39	60
2	2-05-080-17	15	1061	137	100	1	60	19	60	0	0	39	60	78	120	60	60	60	0	0	0
2	2-05-080-17	15	1061	137	130	1	0	19	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2-05-090- 7	180	1298	112	108	1	20	0	0	60	80	40	60	60	60	120	40	60	60	60	100
2	2-05-090- 7	180	1298	112	138	1	20	20	60	20	0	0	20	0	0	20	0	0	20	0	0
2	0-00-085-20	185	999	375	48	1	20	20	100	60	20	20	20	40	0	20	40	40	40	0	0
2	0-00-085-20	185	999	375	78	1	0	0	0	0	0	20	0	0	0	0	0	0	0	0	0
2	0-00-085-20	185	999	375	108	1	0	0	40	20	20	20	0	40	20	80	0	20	60	40	0
2	0-00-085-20	185	999	375	138	1	40	0	20	0	0	60	40	0	20	0	0	0	0	0	0
2	0-00-085-24	17	1242	101	98	1	19	0	58	0	58	19	19	0	19	0	40	19	98	58	80
2	0-00-085-24	17	1242	101	128	1	160	120	98	120	0	0	0	0	0	0	0	0	0	0	0
2	0-00-085- 9	80	1009	120	80	1	20	80	60	60	0	20	40	20	20	80	200	60	40	60	20
2	0-00-085- 9	80	1009	120	110	1	40	40	40	20	0	20	20	20	0	0	20	0	0	0	0
2	0-00-085-15	85	1304	24	124	1	20	140	280	280	219	60	0	0	0	0	0	0	0	0	0
2	0-00-090-23	55	1370	155	110	1	20	20	59	59	20	39	119	0	0	39	0	20	80	39	20
2	0-00-090-23	55	1370	155	140	1	20	20	39	20	99	39	59	20	59	80	0	0	0	0	0
2	2-05-085- 6	80	1120	47	96	1	20	0	0	20	40	100	140	140	180	160	120	60	0	20	0
2	2-05-095- 6	85	1398	131	108	1	39	0	0	0	0	19	0	59	19	19	19	59	19	99	79
2	2-05-095- 6	85	1398	131	138	1	140	39	79	19	19	59	19	0	19	39	59	19	19	0	0
2	2-05-095- 6	85	1398	131	168	1	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2-10-085- 3	155	1111	51	100	1	120	20	20	60	100	160	220	140	100	60	0	0	0	0	0
2	2-10-085-12	243	1066	199	80	2	120	147	53	67	80	27	40	40	27	0	33	27	20	0	0
2	2-10-085-12	243	1066	199	110	2	0	13	7	0	20	27	47	47	47	40	20	20	27	7	0
2	2-15-085-11	25	807	188	42	1	40	0	0	20	0	20	20	0	20	0	0	0	0	140	140
2	2-15-085-11	25	807	188	72	1	180	40	0	0	0	0	0	0	0	0	0	0	20	79	120
2	2-15-085-11	25	807	188	102	1	60	40	0	40	0	20	0	0	0	0	0	0	0	0	0
2	2-10-090-21	94	858	225	66	1	20	20	60	100	200	160	220	20	0	0	20	0	0	0	20
2	2-10-090-21	94	858	225	96	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40
2	2-10-090-21	94	858	225	126	1	20	20	0	20	0	0	20	20	0	0	0	0	0	0	0
2	2-10-090-21	94	858	225	156	1	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 1. (continued)

3	0-15-115- 8	278	878	165	56	2	16	32	0	32	16	32	48	176	160	80	24	100	48	0	16
3	0-15-115- 8	278	878	165	86	2	0	0	16	0	4	8	12	32	44	44	24	12	0	8	16
3	0-15-110-15	83	743	147	54	1	140	0	40	20	0	20	60	80	120	60	20	140	80	40	80
3	0-15-110-15	83	743	147	84	1	0	0	20	0	0	0	0	0	0	0	0	0	20	0	20
3	0-15-110-15	83	743	147	114	1	20	20	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0-10-095- 1	30	642	80	52	1	80	160	100	20	60	60	60	100	80	40	120	40	60	20	0
3	0-10-095- 9	180	716	55	52	1	20	0	0	20	60	0	40	80	20	140	240	200	120	60	0
3	0-10-095- 6	23	608	86	46	3	28	19	63	87	230	134	134	38	16	16	21	40	63	56	27
3	0-10-095- 6	23	608	86	76	3	21	2	0	2	0	0	0	0	0	0	0	0	0	0	0
3	0-10-100- 6	6	549	89	42	1	40	0	120	219	160	120	20	20	59	59	0	0	59	0	20
3	0-10-100- 6	6	549	89	72	1	59	20	20	0	0	0	0	0	0	0	0	0	0	0	0
3	0-15-095- 9	69	700	39	58	1	20	40	40	40	80	160	300	260	40	0	20	0	0	0	0
3	0-10-090- 8	39	590	181	40	3	158	53	18	0	27	54	257	129	91	35	3	76	7	54	0
3	0-10-090- 8	39	590	181	70	3	1	23	6	1	0	0	0	0	0	0	0	0	0	0	0
3	0-10-090- 8	39	590	181	100	3	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
3	0-10-090- 8	39	590	181	130	3	0	1	1	0	0	1	0	1	0	0	0	0	0	1	0
3	0-10-090- 5	34	998	223	46	2	10	10	0	0	0	10	10	0	21	0	0	0	0	72	41
3	0-10-090- 5	34	998	223	76	2	41	0	0	31	134	114	21	0	0	0	0	0	0	0	0
3	0-10-090- 5	34	998	223	106	2	0	0	0	0	10	77	116	106	97	67	10	0	0	0	0
3	0-10-090-13	38	659	96	52	2	101	239	270	67	17	49	3	37	20	45	22	45	65	0	3
3	0-10-090-13	38	659	96	82	2	9	6	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0-10-090- 3	105	684	81	46	3	13	0	0	48	85	126	73	50	13	53	45	25	83	178	53
3	0-10-090- 3	105	684	81	76	3	63	38	13	30	13	0	0	0	0	0	0	0	0	0	0
3	0-10-090-10	10	637	163	40	2	8	0	42	23	114	202	168	34	11	8	17	43	8	0	0
3	0-10-090-10	10	637	163	70	2	34	25	8	17	43	25	34	51	8	8	25	0	0	8	8
3	0-10-090-10	10	637	163	100	2	8	0	0	0	0	0	8	0	0	0	0	0	0	0	0
3	0-05-090-13	100	1188	100	88	1	40	0	0	0	0	0	0	0	0	20	20	40	80	120	160
3	0-05-090-13	100	1188	100	118	1	160	140	60	40	20	0	0	0	0	20	40	0	40	0	0
3	0-05-090- 9	218	1234	68	110	2	37	19	37	69	179	110	152	113	104	28	19	28	37	37	19
3	0-05-090- 9	218	1234	68	140	2	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0
3	0-05-090-24	5	752	38	64	1	19	19	59	59	158	238	238	78	99	19	0	0	0	0	0
3	0-05-095-22	5	534	43	40	1	20	20	40	40	40	80	240	299	139	40	0	40	0	0	0
3	0-05-080-13	120	1104	148	90	1	40	40	120	120	40	20	0	120	80	0	0	40	20	40	20
3	0-05-080-13	120	1104	148	120	1	20	20	40	0	40	40	80	60	0	0	0	0	0	0	0

TABLE 1. (continued)

3	0-05-080- 9	118	884	72	72	1	20	60	0	20	100	80	100	120	60	100	80	40	120	100	0
3	0-10-090- 9	72	711	138	44	2	18	0	0	18	146	292	146	55	37	0	55	37	18	0	37
3	0-10-090- 9	72	711	138	74	2	2	43	25	14	17	12	14	14	0	0	0	0	0	0	0
3	0-05-085-19	120	840	145	64	1	60	20	80	60	40	40	60	120	60	80	60	40	20	40	0
3	0-05-085-19	120	840	145	94	1	20	0	0	20	80	40	0	0	0	0	20	20	0	0	0
3	0-05-085-19	120	840	145	124	1	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0-05-085-15	80	783	71	52	1	20	0	0	0	0	40	40	0	0	20	20	120	160	160	80
3	0-05-085-15	80	783	71	82	1	160	120	20	0	40	0	0	0	0	0	0	0	0	0	0
3	0-05-085-10	80	1333	164	94	1	40	0	0	0	0	19	19	40	19	40	0	19	40	40	0
3	0-05-085-10	80	1333	164	124	1	0	40	40	19	40	40	60	80	40	40	40	80	80	19	40
3	0-05-085-10	80	1333	164	154	1	40	19	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0-00-080-23	25	1337	68	114	1	19	19	39	0	19	19	19	78	100	100	139	238	39	78	39
3	0-00-080-23	25	1337	68	144	1	39	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	2-05-080- 7	140	902	157	58	1	20	0	20	140	40	0	0	0	0	0	0	0	60	20	40
3	2-05-080- 7	140	902	157	88	1	60	40	20	100	20	220	0	0	60	40	60	0	0	20	20

TABLE 1. (continued)

4	0-15-110-21	35	786	138	58	1	40	0	140	40	20	60	60	100	120	40	0	0	20	20	60
4	0-15-110-21	35	786	138	88	1	20	80	20	60	20	0	0	20	0	20	20	20	0	0	0
4	0-15-095- 9	39	707	35	60	1	20	0	40	180	180	200	160	200	0	20	0	0	0	0	0
4	0-15-095- 2	95	676	34	60	1	20	100	240	260	80	160	120	20	0	0	0	0	0	0	0
4	0-15-095- 3	109	651	42	58	1	40	140	340	220	60	0	80	80	40	0	0	0	0	0	0
4	0-10-105- 5	149	1292	130	98	1	20	0	0	0	0	40	20	40	40	60	80	60	40	20	40
4	0-10-105- 5	149	1292	130	128	1	20	60	60	60	40	60	120	0	20	20	20	20	20	20	0
4	0-10-110- 7	50	1139	237	48	1	19	0	0	0	0	0	0	0	0	0	0	0	0	19	19
4	0-10-110- 7	50	1139	237	78	1	19	60	19	19	0	80	19	19	0	0	19	0	19	0	0
4	0-10-110- 7	50	1139	237	108	1	0	0	0	0	19	39	120	100	39	39	19	39	19	80	39
4	0-10-110- 7	50	1139	237	138	1	0	39	0	0	39	0	19	0	0	0	0	0	0	0	0
4	0-10-090- 3	15	674	54	48	1	20	0	0	0	20	0	80	120	140	180	140	100	80	60	60
4	0-10-090-14	100	747	23	68	1	20	100	200	460	100	120	0	0	0	0	0	0	0	0	0
4	0-10-090- 2	5	684	59	56	1	39	80	59	99	80	59	80	119	199	119	59	0	0	0	0
4	0-10-090- 6	211	619	55	52	1	20	20	100	220	320	100	100	40	20	20	0	20	0	0	0
4	0-10-090- 6	211	619	55	82	1	0	0	0	20	0	0	0	0	0	0	0	0	0	0	0
4	0-05-085-22	225	772	56	62	1	20	0	20	20	60	220	200	60	0	160	100	100	20	20	0
4	0-05-085-21	4	590	30	52	1	40	142	203	163	326	81	40	0	0	0	0	0	0	0	0
4	0-05-085-23	28	610	75	46	1	20	0	40	120	120	200	40	20	40	40	180	60	20	80	0
4	0-05-085-23	28	610	75	76	1	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0-05-085-10	25	625	51	52	1	20	40	60	220	220	140	80	100	40	20	20	0	40	0	0
4	0-05-080-20	91	922	69	80	1	80	60	80	60	100	120	140	40	120	60	40	40	40	20	0
4	0-05-090-18	109	878	51	80	1	120	120	220	140	100	60	80	80	40	40	0	0	0	0	0
4	2-05-080-22	2	825	170	52	1	35	56	14	14	0	35	0	35	35	35	35	14	56	0	14
4	2-05-080-22	2	825	170	82	1	56	56	0	35	35	56	134	0	35	0	0	14	14	14	0
4	2-05-080-22	2	825	170	112	1	56	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	2-05-080-12	1	632	25	58	1	39	314	314	197	39	79	0	0	0	0	0	0	0	0	0
4	0-00-080- 2	3	613	150	50	1	20	40	439	300	59	0	20	0	0	0	0	0	0	0	0
4	0-00-080- 2	3	613	150	80	1	0	0	0	0	0	0	0	20	40	0	20	0	20	0	0
4	0-00-080- 2	3	613	150	110	1	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0-00-075-15	33	792	44	60	1	20	0	0	0	0	0	40	140	160	180	220	120	80	40	0
4	2-05-085-13	1	1103	64	94	1	30	0	0	30	121	30	30	0	0	182	394	30	0	0	0

TABLE 1. (continued)

5	0-20-110- 6	138	999	145	66	2	7	7	0	7	14	0	21	0	26	14	48	60	85	73	80
5	0-20-110- 6	138	999	145	96	2	47	118	21	33	34	7	14	26	26	7	53	7	20	91	41
5	0-20-110- 6	138	999	145	126	2	0	0	13	0	0	0	0	0	0	0	0	0	0	0	0
5	0-10-090- 2	80	623	41	48	2	16	0	0	0	87	247	234	258	80	31	35	4	4	0	4
5	0-10-090- 3	90	637	63	40	2	5	0	0	0	0	5	5	0	63	212	135	145	109	69	86
5	0-10-090- 3	90	637	63	70	2	86	9	15	20	15	15	5	0	0	0	0	0	0	0	0
5	0-10-090- 1	30	608	56	42	1	20	0	20	0	0	39	98	157	59	196	39	157	176	20	20
5	0-10-090- 7	55	764	31	66	1	20	0	40	100	260	360	140	20	40	20	0	0	0	0	0
5	0-05-090-22	58	633	71	50	1	20	20	60	140	140	140	140	80	20	0	60	100	20	40	0
5	0-05-090-22	58	633	71	80	1	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0-05-090-14	142	1221	109	104	1	20	20	60	80	80	60	80	60	80	160	20	60	20	0	60
5	0-05-090-14	142	1221	109	134	1	0	40	0	40	0	20	0	40	0	0	0	0	0	0	0
5	0-05-090-23	75	1037	43	92	1	20	40	40	100	120	180	160	140	180	20	0	0	0	0	0
5	0-05-085-17	40	602	31	56	1	180	420	240	40	20	80	0	20	0	0	0	0	0	0	0
5	0-05-085-21	47	669	35	60	1	60	160	200	200	260	20	60	20	20	0	0	0	0	0	0
5	0-05-085-16	38	559	32	50	1	60	340	140	180	100	180	0	0	0	0	0	0	0	0	0
5	0-05-080-19	49	721	35	66	1	100	200	220	260	60	80	60	20	0	0	0	0	0	0	0
5	0-05-080-20	65	497	51	40	1	40	160	20	180	80	160	180	120	20	0	0	40	0	0	0
5	0-00-075-15	42	594	74	40	1	40	0	0	20	0	0	0	140	280	200	140	20	20	40	0
5	0-00-075-15	42	594	74	70	1	20	0	20	20	40	0	0	0	0	0	0	0	0	0	0
5	0-00-075-10	15	567	16	52	1	20	280	560	100	40	0	0	0	0	0	0	0	0	0	0
5	0-00-080- 1	15	652	157	52	1	40	320	240	120	0	0	0	0	0	0	20	0	40	0	40
5	0-00-080- 1	15	652	157	82	1	0	60	20	0	20	0	0	0	20	0	40	0	0	20	0
5	0-20-105- 5	43	951	137	62	2	6	0	12	0	6	6	0	12	0	12	62	48	96	203	110
5	0-20-105- 5	43	951	137	92	2	112	56	57	14	35	35	26	0	12	6	0	12	12	6	0
5	0-20-105- 5	43	951	137	122	2	0	6	12	18	6	0	0	0	0	0	0	0	0	0	0
5	2-10-085- 2	117	1176	40	110	1	100	60	200	200	160	120	80	80	0	0	0	0	0	0	0
5	2-10-085-11	60	922	82	80	1	80	80	120	100	140	40	60	40	40	80	60	80	20	20	40
5	2-15-085-24	232	1241	66	110	1	20	20	40	140	80	80	160	80	80	120	20	20	140	0	0

TABLE 1. (continued)

6	0-20-110-12	290	853	270	40	4	5	0	23	26	51	15	1	5	22	30	28	14	14	57	101
6	0-20-110-12	290	853	270	70	4	21	68	21	18	35	56	23	25	15	18	12	22	32	28	20
6	0-20-110-12	290	853	270	100	4	15	7	0	10	6	7	15	4	4	10	15	28	11	14	12
6	0-20-110-12	290	853	270	130	4	25	8	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0-20-110-11	1092	783	196	42	10	7	3	14	7	7	2	8	14	22	31	35	35	31	44	66
6	0-20-110-11	1092	783	196	72	10	59	105	43	74	38	22	15	20	7	23	47	27	39	28	19
6	0-20-110-11	1092	783	196	102	10	17	8	17	9	12	7	3	7	0	3	9	9	4	1	1
6	0-20-110-17	69	605	27	46	1	20	0	0	0	0	40	300	400	180	60	0	0	0	0	0
6	0-10-115- 7	50	1130	124	98	1	100	120	40	80	100	80	100	20	20	80	20	0	40	20	20
6	0-10-115- 7	50	1130	124	128	1	20	20	40	20	0	0	40	20	0	0	0	0	0	0	0
6	0-05-080-14	24	611	31	52	1	20	40	120	120	240	300	140	20	0	0	0	0	0	0	0
6	0-05-080- 7	30	734	70	52	1	20	20	0	0	20	40	40	40	0	100	300	120	100	40	40
6	0-05-080- 7	30	734	70	82	1	60	40	20	0	0	0	0	0	0	0	0	0	0	0	0
6	0-05-085-25	80	1056	50	90	1	20	0	0	20	80	100	160	160	80	180	160	20	0	0	20
6	0-10-085-10	35	872	45	80	1	120	220	100	80	200	100	80	100	0	0	0	0	0	0	0
6	0-10-085- 4	90	721	63	60	1	20	98	20	118	137	157	78	157	78	20	0	59	20	39	0
6	0-00-080- 1	70	596	18	52	2	19	1	104	473	309	76	19	0	0	0	0	0	0	0	0
6	2-05-080-22	20	742	282	56	1	280	200	240	0	0	0	0	0	20	20	0	0	0	0	20
6	2-05-080-22	20	742	282	86	1	0	0	0	0	20	0	20	20	0	0	0	0	0	0	0
6	2-05-080-22	20	742	282	116	1	0	0	20	0	40	0	0	0	20	20	20	0	0	20	0
6	2-05-080-22	20	742	282	146	1	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0-00-090- 5	90	1184	69	100	1	20	0	0	0	0	60	160	140	140	120	140	120	40	20	0
6	0-00-090- 5	90	1184	69	130	1	0	0	0	0	0	0	40	0	0	0	0	0	0	0	0
6	0-20-105-18	433	725	73	42	6	2	0	28	0	7	15	19	8	3	4	10	14	53	88	156
6	0-20-105-18	433	725	73	72	6	151	127	138	70	68	22	0	7	1	0	0	7	0	0	0
6	0-20-105-19	234	731	69	42	3	4	0	11	0	11	15	11	11	15	36	11	21	15	65	79
6	0-20-105-19	234	731	69	72	3	167	185	189	76	59	11	11	0	0	0	0	0	0	0	0
6	2-10-085-11	161	1100	184	80	2	44	44	55	88	111	11	0	11	22	44	0	0	11	33	0
6	2-10-085-11	161	1100	184	110	2	0	22	22	0	0	47	64	172	89	45	35	27	0	0	0
6	2-10-085-12	95	1335	85	114	1	20	0	0	80	80	60	20	40	120	120	80	80	20	140	40
6	2-10-085-12	95	1335	85	144	1	20	0	60	20	0	0	0	0	0	0	0	0	0	0	0

TABLE 2. Estimated length parameters, obtained by the maximum likelihood method, for the 125 groups of fish listed in Table 1. The boundaries of the seven length groups are given in the text.

Month	Area	Means (mm)							Standard deviations (mm)							Proportions						
		1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
1	0-25-110- 3	0	662	0	0	0	0	0	0	27	0	0	0	0	0	.000	.950	.000	.000	.000	.000	.000
1	0-20-110-23	0	0	682	0	0	0	0	0	0	50	0	0	0	0	.000	.000	.950	.000	.000	.000	.000
1	0-10-090- 8	497	0	856	0	1061	0	0	46	0	37	0	72	0	0	.550	.000	.100	.000	.340	.000	.000
1	2-05-080-12	492	0	765	0	1074	0	0	46	0	38	0	48	0	0	.410	.000	.410	.000	.160	.000	.000
1	2-05-080-13	467	0	759	0	0	0	0	48	0	51	0	0	0	0	.590	.000	.400	.000	.000	.000	.000
1	2-05-080- 9	0	506	792	0	1040	0	0	0	37	25	0	33	0	0	.000	.890	.013	.000	.100	.000	.000
1	2-05-080-14	495	0	714	0	1078	0	0	47	0	45	0	87	0	0	.150	.000	.016	.000	.830	.000	.000
1	2-05-080- 5	0	528	0	0	1104	0	0	0	45	0	0	59	0	0	.000	.760	.000	.000	.230	.000	.000
1	2-05-080- 6	0	0	746	0	0	0	0	0	0	46	0	0	0	0	.000	.000	.950	.000	.000	.000	.000
1	2-05-080-10	0	542	758	0	1098	0	0	0	58	49	0	79	0	0	.000	.340	.510	.000	.140	.000	.000
1	2-05-080- 4	0	509	0	0	0	0	0	0	33	0	0	0	0	0	.000	.950	.000	.000	.000	.000	.000
1	2-05-085-11	473	0	0	950	1081	0	0	24	0	0	13	39	0	0	.460	.000	.000	.100	.430	.000	.000
1	2-05-085- 6	0	0	0	0	1032	1108	0	0	0	0	0	50	20	0	.000	.000	.000	.000	.600	.400	.000
2	0-15-115- 8	0	0	683	933	1111	0	0	0	0	29	44	52	0	0	.000	.000	.260	.110	.620	.000	.000
2	0-10-095- 4	0	570	0	0	0	0	0	0	53	0	0	0	0	0	.000	.950	.000	.000	.000	.000	.000
2	0-10-095-21	0	612	0	0	0	0	0	0	40	0	0	0	0	0	.000	.950	.000	.000	.000	.000	.000
2	0-10-095- 3	0	564	701	0	0	0	0	0	47	31	0	0	0	0	.000	.600	.400	.000	.000	.000	.000
2	0-10-090- 9	0	528	728	0	0	0	0	0	45	32	0	0	0	0	.000	.945	.055	.000	.000	.000	.000
2	0-10-090- 8	0	583	0	0	0	0	0	0	46	0	0	0	0	0	.000	.950	.000	.000	.000	.000	.000
2	0-10-090- 4	0	0	732	0	0	0	0	0	0	75	0	0	0	0	.000	.000	.950	.000	.000	.000	.000
2	0-10-090-12	0	0	0	0	0	1282	0	0	0	0	0	0	19	0	.000	.000	.000	.000	.000	.800	.000
2	0-10-090- 3	0	556	0	0	1135	0	0	0	40	0	0	54	0	0	.000	.700	.000	.000	.290	.000	.000
2	0-05-090- 2	0	0	0	0	1203	1337	1536	0	0	0	0	55	37	46	.000	.000	.000	.000	.250	.380	.350
2	0-05-090-13	0	649	0	0	0	0	0	0	36	0	0	0	0	0	.000	.950	.000	.000	.000	.000	.000
2	0-05-090-24	0	0	0	874	0	0	0	0	0	0	54	0	0	0	.000	.000	.000	.950	.000	.000	.000
2	0-05-090-23	0	577	813	0	0	0	0	0	72	24	0	0	0	0	.000	.950	.050	.000	.000	.000	.000
2	0-05-090-22	0	676	0	0	0	0	0	0	55	0	0	0	0	0	.000	.900	.000	.000	.000	.000	.000
2	0-10-090-13	0	579	734	0	0	0	0	0	41	27	0	0	0	0	.000	.370	.620	.000	.000	.000	.000
2	2-05-080- 5	0	545	0	0	0	0	0	0	34	0	0	0	0	0	.000	.900	.000	.000	.000	.000	.000
2	2-05-080-14	0	504	0	0	0	0	0	0	23	0	0	0	0	0	.000	.900	.000	.000	.000	.000	.000
2	2-05-080-10	0	501	702	931	0	0	0	0	25	11	58	0	0	0	.000	.270	.630	.100	.000	.000	.000
2	2-05-080-17	0	0	803	959	1154	0	0	0	0	77	44	55	0	0	.000	.000	.100	.360	.520	.000	.000
2	2-05-090- 7	0	0	0	0	1202	0	1340	0	0	0	0	59	0	56	.000	.000	.000	.000	.550	.000	.440
2	0-00-085-20	507	650	0	0	0	1284	0	25	57	0	0	0	74	0	.260	.280	.000	.000	.000	.450	.000
2	0-00-085-24	0	0	0	0	1046	1266	0	0	0	0	0	43	49	0	.000	.000	.000	.000	.180	.810	.000
2	0-00-085- 9	0	0	824	999	1032	0	0	0	0	21	16	11	0	0	.000	.000	.170	.210	.610	.000	.000
2	0-00-085-15	0	0	0	0	0	1304	0	0	0	0	0	0	24	0	.000	.000	.000	.000	.000	.950	.000
2	0-00-090-23	0	0	0	0	1177	1335	1497	0	0	0	0	49	27	57	.000	.000	.000	.000	.360	.170	.460
2	2-05-085- 6	0	0	0	0	1120	0	0	0	0	0	0	47	0	0	.000	.000	.000	.000	.950	.000	.000
2	2-05-095- 6	0	0	0	0	0	0	1398	0	0	0	0	0	0	13	.000	.000	.000	.000	.000	.000	.950
2	2-10-085- 3	0	0	0	0	1111	0	0	0	0	0	0	51	0	0	.000	.000	.000	.000	.950	.000	.000
2	2-10-085-12	0	0	820	916	0	1246	0	0	0	31	75	0	59	0	.000	.000	.330	.330	.000	.330	.000
2	2-15-085-11	0	0	693	0	1007	0	0	0	0	26	0	45	0	0	.000	.000	.560	.000	.420	.000	.000
2	2-10-090-21	0	0	745	0	0	1254	0	0	0	47	0	0	32	0	.000	.000	.900	.000	.000	.100	.000

TABLE 2. Estimated length parameters, obtained by the maximum likelihood method, for the 125 groups of fish listed in Table 1. The boundaries of the seven length groups are given in the text.

Month	Area	Means (mm)							Standard deviations (mm)							Proportions						
		1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
1	0-25-110- 3	0	662	0	0	0	0	0	0	27	0	0	0	0	0	.000	.950	.000	.000	.000	.000	.000
1	0-20-110-23	0	0	682	0	0	0	0	0	0	50	0	0	0	0	.000	.000	.950	.000	.000	.000	.000
1	0-10-090- 8	497	0	856	0	1061	0	0	46	0	37	0	72	0	0	.550	.000	.100	.000	.340	.000	.000
1	2-05-080-12	492	0	765	0	1074	0	0	46	0	38	0	48	0	0	.410	.000	.410	.000	.160	.000	.000
1	2-05-080-13	467	0	759	0	0	0	0	48	0	51	0	0	0	0	.590	.000	.400	.000	.000	.000	.000
1	2-05-080- 9	0	506	792	0	1040	0	0	0	37	25	0	33	0	0	.000	.890	.013	.000	.100	.000	.000
1	2-05-080-14	495	0	714	0	1078	0	0	47	0	45	0	87	0	0	.150	.000	.016	.000	.830	.000	.000
1	2-05-080- 5	0	528	0	0	1104	0	0	0	45	0	0	59	0	0	.000	.760	.000	.000	.230	.000	.000
1	2-05-080- 6	0	0	746	0	0	0	0	0	0	46	0	0	0	0	.000	.000	.950	.000	.000	.000	.000
1	2-05-080-10	0	542	758	0	1098	0	0	0	58	49	0	79	0	0	.000	.340	.510	.000	.140	.000	.000
1	2-05-080- 4	0	509	0	0	0	0	0	0	33	0	0	0	0	0	.000	.950	.000	.000	.000	.000	.000
1	2-05-085-11	473	0	0	950	1081	0	0	24	0	0	13	39	0	0	.460	.000	.000	.100	.430	.000	.000
1	2-05-085- 6	0	0	0	0	1032	1108	0	0	0	0	0	50	20	0	.000	.000	.000	.000	.600	.400	.000
2	0-15-115- 8	0	0	683	933	1111	0	0	0	0	29	44	52	0	0	.000	.000	.260	.110	.620	.000	.000
2	0-10-095- 4	0	570	0	0	0	0	0	0	53	0	0	0	0	0	.000	.950	.000	.000	.000	.000	.000
2	0-10-095-21	0	612	0	0	0	0	0	0	40	0	0	0	0	0	.000	.950	.000	.000	.000	.000	.000
2	0-10-095- 3	0	564	701	0	0	0	0	0	47	31	0	0	0	0	.000	.600	.400	.000	.000	.000	.000
2	0-10-090- 9	0	528	728	0	0	0	0	0	45	32	0	0	0	0	.000	.945	.055	.000	.000	.000	.000
2	0-10-090- 8	0	583	0	0	0	0	0	0	46	0	0	0	0	0	.000	.950	.000	.000	.000	.000	.000
2	0-10-090- 4	0	0	732	0	0	0	0	0	0	75	0	0	0	0	.000	.000	.950	.000	.000	.000	.000
2	0-10-090-12	0	0	0	0	0	1282	0	0	0	0	0	0	19	0	.000	.000	.000	.000	.000	.800	.000
2	0-10-090- 3	0	556	0	0	1135	0	0	0	40	0	0	54	0	0	.000	.700	.000	.000	.290	.000	.000
2	0-05-090- 2	0	0	0	0	1203	1337	1536	0	0	0	0	55	37	46	.000	.000	.000	.000	.250	.380	.350
2	0-05-090-13	0	649	0	0	0	0	0	0	36	0	0	0	0	0	.000	.950	.000	.000	.000	.000	.000
2	0-05-090-24	0	0	0	874	0	0	0	0	0	0	54	0	0	0	.000	.000	.000	.950	.000	.000	.000
2	0-05-090-23	0	577	813	0	0	0	0	0	72	24	0	0	0	0	.000	.950	.050	.000	.000	.000	.000
2	0-05-090-22	0	676	0	0	0	0	0	0	55	0	0	0	0	0	.000	.900	.000	.000	.000	.000	.000
2	0-10-090-13	0	579	734	0	0	0	0	0	41	27	0	0	0	0	.000	.370	.620	.000	.000	.000	.000
2	2-05-080- 5	0	545	0	0	0	0	0	0	34	0	0	0	0	0	.000	.900	.000	.000	.000	.000	.000
2	2-05-080-14	0	504	0	0	0	0	0	0	23	0	0	0	0	0	.000	.900	.000	.000	.000	.000	.000
2	2-05-080-10	0	501	702	931	0	0	0	0	25	11	58	0	0	0	.000	.270	.630	.100	.000	.000	.000
2	2-05-080-17	0	0	803	959	1154	0	0	0	0	77	44	55	0	0	.000	.000	.100	.360	.520	.000	.000
2	2-05-090- 7	0	0	0	0	1202	0	1340	0	0	0	0	59	0	56	.000	.000	.000	.000	.550	.000	.440
2	0-00-085-20	507	650	0	0	0	1284	0	25	57	0	0	0	74	0	.260	.280	.000	.000	.000	.450	.000
2	0-00-085-24	0	0	0	0	1046	1266	0	0	0	0	0	43	49	0	.000	.000	.000	.000	.180	.810	.000
2	0-00-085- 9	0	0	824	999	1032	0	0	0	0	21	16	11	0	0	.000	.000	.170	.210	.610	.000	.000
2	0-00-085-15	0	0	0	0	0	1304	0	0	0	0	0	0	24	0	.000	.000	.000	.000	.000	.950	.000
2	0-00-090-23	0	0	0	0	1177	1335	1497	0	0	0	0	49	27	57	.000	.000	.000	.000	.360	.170	.460
2	2-05-085- 6	0	0	0	0	1120	0	0	0	0	0	0	47	0	0	.000	.000	.000	.000	.950	.000	.000
2	2-05-095- 6	0	0	0	0	0	0	1398	0	0	0	0	0	0	13	.000	.000	.000	.000	.000	.000	.950
2	2-10-085- 3	0	0	0	0	1111	0	0	0	0	0	0	51	0	0	.000	.000	.000	.000	.950	.000	.000
2	2-10-085-12	0	0	820	916	0	1246	0	0	0	31	75	0	59	0	.000	.000	.330	.330	.000	.330	.000
2	2-15-085-11	0	0	693	0	1007	0	0	0	0	26	0	45	0	0	.000	.000	.560	.000	.420	.000	.000
2	2-10-090-21	0	0	745	0	0	1254	0	0	0	47	0	0	32	0	.000	.000	.900	.000	.000	.100	.000

TABLE 2. (continued)

3	0-15-115- 8	0	0	703	0	1025	0	0	0	0	58	0	43	0	0	.000	.000	.800	.000	.200	.000	.000
3	0-15-110-15	0	541	724	0	1130	0	0	0	25	60	0	27	0	0	.000	.150	.770	.000	.070	.000	.000
3	0-10-095- 1	532	634	721	0	0	0	0	19	49	39	0	0	0	0	.290	.430	.270	.000	.000	.000	.000
3	0-10-095- 9	0	620	720	0	0	0	0	0	41	31	0	0	0	0	.000	.200	.800	.000	.000	.000	.000
3	0-10-095- 6	0	535	696	0	0	0	0	0	34	60	0	0	0	0	.000	.710	.290	.000	.000	.000	.000
3	0-10-100- 6	477	610	0	0	0	0	0	26	10	0	0	0	0	0	.570	.430	.000	.000	.000	.000	.000
3	0-15-095- 9	0	0	700	0	0	0	0	0	0	39	0	0	0	0	.000	.000	.950	.000	.000	.000	.000
3	0-10-090- 8	400	518	618	0	0	0	0	19	25	38	0	0	0	0	.200	.600	.200	.000	.000	.000	.000
3	0-10-090- 5	0	0	726	838	1191	0	0	0	0	22	20	35	0	0	.000	.000	.160	.310	.520	.000	.000
3	0-10-090-13	0	540	689	0	0	0	0	0	21	84	0	0	0	0	.000	.630	.370	.000	.000	.000	.000
3	0-10-090- 3	0	549	709	0	0	0	0	0	28	58	0	0	0	0	.000	.360	.630	.000	.000	.000	.000
3	0-10-090-10	490	0	810	0	0	0	0	32	0	50	0	0	0	0	.730	.270	.000	.000	.000	.000	.000
3	0-05-090-13	0	0	0	0	1149	0	1389	0	0	0	0	70	0	37	.000	.000	.000	.000	.900	.000	.100
3	0-05-090- 9	0	0	0	0	1193	1264	0	0	0	0	0	40	99	0	.000	.000	.000	.000	.630	.370	.000
3	0-05-090-24	0	0	0	752	0	0	0	0	0	0	38	0	0	0	.000	.000	.000	.950	.000	.000	.000
3	0-05-095-22	0	534	0	0	0	0	0	0	43	0	0	0	0	0	.000	.950	.000	.000	.000	.000	.000
3	0-05-080-13	0	0	0	937	1039	1303	0	0	0	0	26	22	29	0	.000	.000	.000	.440	.270	.280	.000
3	0-05-080- 9	0	0	849	953	0	0	0	0	0	48	20	0	0	0	.000	.000	.740	.260	.000	.000	.000
3	0-10-090- 9	0	532	678	0	0	0	0	0	22	96	0	0	0	0	.000	.630	.370	.000	.000	.000	.000
3	0-05-085-19	0	0	675	787	1013	0	0	0	0	33	39	19	0	0	.000	.000	.300	.540	.160	.000	.000
3	0-05-085-15	0	619	778	0	0	0	0	0	17	42	0	0	0	0	.000	.080	.920	.000	.000	.000	.000
3	0-05-085-10	0	0	0	999	1268	1353	1460	0	0	0	34	24	31	45	.000	.000	.000	.150	.110	.250	.380
3	0-00-080-23	0	0	0	0	0	1337	0	0	0	0	0	0	68	0	.000	.000	.000	.000	.000	.950	.000
3	2-05-080- 7	0	628	869	963	1053	0	0	0	22	46	21	24	0	0	.000	.220	.300	.300	.160	.000	.000
4	0-15-110-21	0	614	712	884	0	0	0	0	25	28	43	0	0	0	.000	.263	.410	.325	.000	.000	.000
4	0-15-095- 9	0	0	707	0	0	0	0	0	0	35	0	0	0	0	.000	.000	.950	.000	.000	.000	.000
4	0-15-095- 2	0	676	0	0	0	0	0	0	34	0	0	0	0	0	.000	.950	.000	.000	.000	.000	.000
4	0-15-095- 3	0	614	704	0	0	0	0	0	23	20	0	0	0	0	.000	.800	.200	.000	.000	.000	.000
4	0-10-105- 5	0	0	0	0	1149	0	1351	0	0	0	0	49	0	86	.000	.000	.000	.000	.370	.000	.630
4	0-10-110- 7	0	0	780	878	1199	0	1324	0	0	33	28	28	0	44	.000	.000	.160	.150	.380	.000	.290
4	0-10-090- 3	0	674	0	0	0	0	0	0	54	0	0	0	0	0	.000	.950	.000	.000	.000	.000	.000
4	0-10-090-14	0	0	747	0	0	0	0	0	0	23	0	0	0	0	.000	.000	.950	.000	.000	.000	.000
4	0-10-090- 2	0	610	709	0	0	0	0	0	39	26	0	0	0	0	.000	.450	.540	.000	.000	.000	.000
4	0-10-090- 6	0	619	0	0	0	0	0	0	55	0	0	0	0	0	.000	.950	.000	.000	.000	.000	.000
4	0-05-085-22	0	717	808	0	0	0	0	0	22	28	0	0	0	0	.000	.570	.430	.000	.000	.000	.000
4	0-05-085-21	0	590	0	0	0	0	0	0	30	0	0	0	0	0	.000	.950	.000	.000	.000	.000	.000
4	0-05-085-23	0	533	660	0	0	0	0	0	30	35	0	0	0	0	.000	.560	.430	.000	.000	.000	.000
4	0-05-085-10	0	625	0	0	0	0	0	0	51	0	0	0	0	0	.000	.950	.000	.000	.000	.000	.000
4	0-05-080-20	0	0	0	922	0	0	0	0	0	0	69	0	0	0	.000	.000	.000	.950	.000	.000	.000
4	0-05-090-18	0	0	0	878	0	0	0	0	0	0	51	0	0	0	.000	.000	.000	.950	.000	.000	.000
4	2-05-080-22	528	697	823	920	1093	0	0	18	71	18	29	34	0	0	.100	.350	.110	.320	.100	.000	.000
4	2-05-080-12	0	632	0	0	0	0	0	0	25	0	0	0	0	0	.000	.950	.000	.000	.000	.000	.000
4	0-00-080- 2	0	536	0	966	0	0	0	0	21	0	37	0	0	0	.000	.900	.000	.100	.000	.000	.000
4	0-00-075-15	0	0	792	0	0	0	0	0	0	44	0	0	0	0	.000	.000	.950	.000	.000	.000	.000
4	2-05-085-13	0	0	0	0	1013	1124	0	0	0	0	0	24	17	0	.000	.000	.000	.000	.260	.730	.000

TABLE 2. (continued)

5	0-20-110- 6	0	0	0	927	1181	0	0	0	0	0	68	52	0	0	.000	.000	.000	.710	.280	.000	.000
5	0-10-090- 2	0	623	0	0	0	0	0	0	41	0	0	0	0	0	.000	.950	.000	.000	.000	.000	.000
5	0-10-090- 3	0	637	0	0	0	0	0	0	63	0	0	0	0	0	.000	.950	.000	.000	.000	.000	.000
5	0-10-090- 1	0	608	0	0	0	0	0	0	56	0	0	0	0	0	.000	.950	.000	.000	.000	.000	.000
5	0-10-090- 7	0	0	764	0	0	0	0	0	0	31	0	0	0	0	.000	.000	.950	.000	.000	.000	.000
5	0-05-090-22	0	633	0	0	0	0	0	0	71	0	0	0	0	0	.000	.950	.000	.000	.000	.000	.000
5	0-05-090-14	0	0	0	0	1104	1202	1324	0	0	0	0	38	31	49	.000	.000	.000	.000	.410	.410	.180
5	0-05-090-23	0	0	0	0	1037	0	0	0	0	0	0	43	0	0	.000	.000	.950	.000	.000	.000	.000
5	0-05-085-17	0	575	646	0	0	0	0	0	20	23	0	0	0	0	.000	.870	.130	.000	.000	.000	.000
5	0-05-085-21	0	0	669	0	0	0	0	0	0	35	0	0	0	0	.000	.000	.950	.000	.000	.000	.000
5	0-05-085-16	0	559	0	0	0	0	0	0	32	0	0	0	0	0	.000	.950	.000	.000	.000	.000	.000
5	0-05-080-19	0	0	721	0	0	0	0	0	0	35	0	0	0	0	.000	.000	.950	.000	.000	.000	.000
5	0-05-080-20	497	0	0	0	0	0	0	51	0	0	0	0	0	0	.950	.000	.000	.000	.000	.000	.000
5	0-00-075-15	0	560	684	0	0	0	0	0	25	74	0	0	0	0	.000	.810	.189	.000	.000	.000	.000
5	0-00-075-10	0	567	0	0	0	0	0	0	16	0	0	0	0	0	.000	.950	.000	.000	.000	.000	.000
5	0-00-080- 1	0	542	805	0	1017	0	0	0	22	51	0	34	0	0	.000	.730	.200	.000	.070	.000	.000
5	0-20-105- 5	0	0	876	998	1142	1260	0	0	0	41	42	25	22	0	.000	.000	.760	.160	.030	.040	.000
5	2-10-085- 2	0	0	0	0	1176	0	0	0	0	0	0	40	0	0	.000	.000	.000	.000	.950	.000	.000
5	2-10-085-11	0	0	848	983	0	0	0	0	0	39	39	0	0	0	.000	.000	.630	.370	.000	.000	.000
5	2-15-085-24	0	0	0	0	1170	1246	0	0	0	0	0	37	31	0	.000	.000	.000	.000	.570	.420	.000
6	0-20-110-12	464	673	790	938	0	1239	0	32	33	40	45	0	46	0	.150	.320	.210	.170	.000	.130	.000
6	0-20-110-11	0	602	728	943	0	0	0	0	39	48	74	0	0	0	.000	.170	.510	.320	.000	.000	.000
6	0-20-110-17	0	605	0	0	0	0	0	0	27	0	0	0	0	0	.000	.950	.000	.000	.000	.000	.000
6	0-10-115- 7	0	0	0	987	1055	1134	1303	0	0	0	20	25	61	25	.000	.000	.000	.240	.280	.300	.100
6	0-05-080-14	0	611	0	0	0	0	0	0	31	0	0	0	0	0	.000	.950	.000	.000	.000	.000	.000
6	0-05-080- 7	0	623	715	799	0	0	0	0	23	23	32	0	0	0	.000	.130	.630	.230	.000	.000	.000
6	0-05-085-25	0	0	0	0	1056	0	0	0	0	0	0	50	0	0	.000	.000	.000	.000	.950	.000	.000
6	0-10-085-10	0	0	0	872	0	0	0	0	0	0	45	0	0	0	.000	.000	.000	.950	.000	.000	.000
6	0-10-085- 4	0	0	721	0	0	0	0	0	0	63	0	0	0	0	.000	.000	.950	.000	.000	.000	.000
6	0-00-080- 1	0	596	0	0	0	0	0	0	18	0	0	0	0	0	.000	.950	.000	.000	.000	.000	.000
6	2-05-080-22	0	572	724	970	0	1220	1331	0	21	14	30	0	23	20	.000	.750	.040	.066	.000	.068	.067
6	0-00-090- 5	0	0	0	0	1184	0	0	0	0	0	0	69	0	0	.000	.000	.000	.000	.950	.000	.000
6	0-20-105-18	0	518	718	0	0	0	0	0	34	46	0	0	0	0	.000	.060	.940	.000	.000	.000	.000
6	0-20-105-19	0	587	731	0	0	0	0	0	51	38	0	0	0	0	.000	.140	.860	.000	.000	.000	.000
6	2-10-085-11	0	0	842	985	0	1239	0	0	0	29	65	0	32	0	.000	.000	.350	.140	.000	.500	.000
6	2-10-085-12	0	0	0	0	1206	1300	1355	0	0	0	0	21	19	72	.000	.000	.000	.000	.194	.152	.652