

AN OVERVIEW OF AVAILABLE INFORMATION PERTINENT TO INTERPRETING POSSIBLE STOCK STRUCTURE
OF SWORDFISH IN THE ATLANTIC OCEAN

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SUMMARY

This working document provides an overview of available information pertinent to interpreting swordfish stock structure in the Atlantic Ocean. Both published research results and data sources are reviewed. Topics addressed include mark-recapture data, larval spawning data, electrophoresis, and high-seas longline CPUE data. No stock structure hypotheses are presented.

RESUME

Le présent document de travail fournit une vue d'ensemble de l'information disponible relative à l'interprétation de la structure des stocks d'espadon dans l'Atlantique. On y examine les résultats de recherche publiés, comme les sources de données. Les sujets abordés comprennent les données sur le marquage-recapture, sur la ponte et les larves, sur l'électrophorèse, et sur la CPUE palangrière de haute mer. Aucune hypothèse n'est présentée en ce qui concerne la structure des stocks.

RESUMEN

Este documento de trabajo da una visión de conjunto de la información disponible necesaria para interpretar la estructura del stock de pez espada en el Atlántico. Se examinan los resultados de investigación que han sido publicados y las fuentes de datos. Los temas tratados incluyen los datos de marcado-recaptura, datos de desove de larvas, electroforesis y datos de CPUE del palangre en alta mar. No se presentan hipótesis sobre estructura del stock.

Introduction

The stock structure of swordfish in the Atlantic Ocean is poorly understood. No definitive work has been presented. Various sources of inconclusive and conflicting evidence are available. Most recently, the 1986 SCRS Meeting reviewed the Report of the Swordfish Assessment Workshop held in April, 1986 in Miami, Florida. The workshop addressed stock structure by reviewing mark-recapture data, geographic distribution of swordfish bycatch in the Japanese longline fishery, and geographic distribution of swordfish larvae. Stock structure was addressed from the standpoint of defining a manageable resource, not from the standpoint of establishing absolute geographic bounds on movements of individuals or from the standpoint of genetic isolation. The workshop consensus stated that available information indicated that: (1) fish are continuously distributed across the Atlantic; (2) trans-Atlantic movement in the North Atlantic is probably negligible; (3) north-south movement in the North Atlantic is extensive; and (4) separate spawning areas exist on both sides of the Atlantic and in the Mediterranean. Further, it stated that findings support the working hypothesis of a separate northwest Atlantic stock north of 10°N latitude and west of 35°W longitude that spawns during the winter in the Caribbean Sea. However, the participants recognized that the existence of a single Atlantic-wide stock was possible (SEFC 1987).

The SCRS supported the conclusions of the stock assessment panel that the multi-stock hypothesis is useful from the standpoint of defining a manageable resource in the western North Atlantic, that absolute boundaries between stocks are not supportable, and that a single Atlantic-wide stock or a more complex stock structure is possible (ICCAT 1987).

Based on the conclusions of both the Workshop and the SCRS it is evident that existing data are insufficient to resolve the issue of swordfish stock structure in the Atlantic.

This working paper reviews the areas of research and available data sources pertinent to interpreting possible stock structure of swordfish in the Atlantic Ocean. The specific topics addressed are: (1) mark-recapture data; (2) larval and spawning data; (3) electrophoresis; and (4) high-seas longline CPUE data. Other than some additional recapture information that extended the documented east-west range of swordfish tagged in the northwest Atlantic and limited electrophoretic analysis, the information presented was available to the 1986 Workshop. This paper brings together, in one document, these various data sources and research findings. Conclusions reached by looking at each topic separately are often divergent.

The identified sources of information are limited to those familiar to the author and in-house reviewers and co-workers. There are possible omissions of pertinent literature, data sources, or citations. Therefore, the author gladly welcomes additional relevant references and comments that would help shed light on the subject of the stock structure of Atlantic swordfish.

I. Mark-Recapture Data

A total of at least 2,253 swordfish have been tagged and released in the northwest Atlantic by the United States and Canada over the period 1961-1987 (pers. comm. Ed Scott, NMFS, SEFC, Miami; Casey et al. 1985; Burnett et al. In press). There have been a total of 109 recaptures through mid-1987 (this does not include recapture data from NMFS, NEFC for 1987). In looking at all the tagging data (i.e. U.S. plus Canadian) the vast majority of releases have been from the east coast of North America -- from southeast Florida through the Scotian Shelf. There have been 240 releases from within the Gulf of Mexico during the period 1978-87. There have been only 11 releases from the Caribbean, one from the Virgin Islands in 1971 and 10 from Cuba/Venezuela/Puerto Rico/Virgin Islands during 1985-1987. The majority of returns have been from southeast Florida through Georges Bank. The overall return rate for the U.S. releases (83 of 1,960) is 4.2%; and for the Canadian releases (26 of 293) is 8.9%.

Most of the 1,960 U.S. releases have occurred since 1978 and are attributed to U.S. observers aboard Japanese longline vessels and by U.S. commercial longline fishermen. There was some tagging by NMFS scientists aboard research cruises and by recreational fishermen. The 293 Canadian tag releases were during the period 1964-76 and 1980. The Japanese longline fleet has shown greatly reduced effort in the central-eastern Atlantic since 1978 (Farber 1986), therefore the probability of a tag recovery from that area is very small. No tags have been returned from the Caribbean, but it must be noted that significant longline activity for swordfish in that area began in late 1984.

Annual fishing effort by Brazilian longliners fishing off the south and southeast coast of Brazil during 1971-81 increased approximately three-fold (Arfelli and Amorim 1985). There have been no returns from the Brazilian fleet. Through the mid-1970's the Spanish longline fleet fishing off the coast of Spain remained close to the coast, between 35°-45°N, 05°-20°W. By the late 1970's, effort began increasing and expanded more westerly each year reaching 45°W in 1986. At the same time, the fleet fishing southwest of Spain expanded effort along the African coast to encompass the area 00-35°N, 05°-25°W (unpublished data; Hoey et al. 1987). There have been no returns from either the Atlantic Spanish longline fleet or the smaller Mediterranean Spanish longline fishery. Neither have there been any tag returns from the very large Italian swordfish fisheries.

Tagged swordfish have demonstrated movement between areas of the Gulf of Mexico, Florida east coast, Mid-Atlantic Bight and Georges Bank in both "northern" and "southern" directions (Figures 1-2). Returns from the Scotian Shelf/Grand Banks areas have been documented from both the Mid-Atlantic Bight and Georges Bank areas. Movement has been documented (U.S. database) to as far east as 44°N, 55°W for a swordfish tagged off the northeast U.S. 13 months earlier (noted on Figure 2). Movement has been documented (U.S. database) from as far east as the tail of the Grand Banks (approximately 43°N, 48°W) by two fish tagged in 1981; both were recaptured in 1984, one off of Nantucket, Massachusetts and the other off Ft. Pierce, Florida (noted on Figure 2). The latter represents the maximum distance between release and recapture in the southern direction. A Canadian tagged fish in 1968 demonstrated similar movement from the Scotian Shelf to its

recapture 11 years later off the East Coast of Florida (noted on Figure 2). The maximum distance in the northern direction was for a 1974 release near the Mississippi Delta in the Gulf of Mexico which was recaptured in 1977 on Georges Bank. The maximum time at liberty for a U.S. tagged fish was 6.1 years, released in 1980 in the mid-Atlantic Bight and recaptured off the Scotian Shelf. The maximum time at liberty for a Canadian tagged swordfish was 15 years - from the 1967 release off the tail of the Grand Banks to its recapture off northeast Nova Scotia (noted on Figure 2). This also represents the most northern recapture location for a tagged swordfish.

Berkeley (1983) estimated a maximum exchange rate of 5.8% for swordfish from the northwest Atlantic to the northeast Atlantic coastal fisheries. He calculated this rate based on the following assumptions: (1) 50 tag recaptures; (2) at least as many swordfish had been caught in the northeast Atlantic as in the northwest Atlantic; (3) the probability of a tag being returned is the same for all areas; (4) all tagged fish are northwest Atlantic swordfish; and (5) tagged fish had been at large long enough to become distributed throughout their range.

Beckett (1974) reported the tagging data for the 13 fish recaptured from a total of 206 tagged. He concluded the data suggest that swordfish return to the same part of the summer feeding area in subsequent years. Hurley and Iles (1981) stated that 22 of 23 tag returns (which includes the 13 reported by Beckett) from the Canadian swordfish fishery were from fish recaptured on the same summer feeding ground as they were released from.

In summary, all tag recaptures of swordfish tagged by the U.S. and Canada, in the northwest Atlantic, have been in the northwest Atlantic. These tagged fish exhibited movement between the areas of the Gulf of Mexico and the Scotian Shelf, with a few individuals extending this range to include the tail of the Grand Banks. There have been no documented transatlantic recaptures of fish tagged in the northwest Atlantic by either the Spanish or the Brazilian fisheries. There has been no known documented tagging of swordfish by either the Spanish or Brazilian fleets, though some informal exchange of information indicates there has been some tagging of swordfish by both nations.

II. Larval and Spawning Data

The Swordfish Assessment Workshop, held at the NMFS, Southeast Fisheries Center, Miami, Florida, April 1986, reviewed the available information on larval distribution (SEFC 1987). As did the Workshop, I consider the geographical distribution and abundance of swordfish larvae in plankton samples as an indication of spawning concentrations. A more detailed review now follows.

During the period 1965-1972, eight cruises were made by the Fisheries Research Board of Canada. Five were to the Caribbean and adjacent seas, three were to the Gulf Stream north of 25°N. Most of them were carried out during the months of January-March. Two of the Gulf Stream cruises were in April-May. In all, 280 stations were occupied and a total of 119 swordfish larvae were captured (Figure 3). Markle (1974) reported many larvae were caught in the Gulf Stream from the Florida Straits to Cape Hatteras during

January-March. Specimens were taken in the northeastern Gulf of Mexico (early March) and south of Cuba (late February). The regions west of the Lesser Antilles and southwest of Barbados were sampled in January and in March, yet larvae were found only in late March. Specimens were obtained in the Virgin Islands-Leeward Islands area from January to March. Sampling in the following areas produced no larvae: Bermuda (January, May); northeast of Cape Hatteras (January, February, April, May); southern Caribbean (late February, early March); southwestern and central Sargasso Sea (January, February). Markle concluded that the data from the eight cruises were insufficient to establish spawning seasons and areas. When those data were pooled with similar data from other sources (Figure 4), the greatest densities of larvae were seen to occur in the Straits of Florida-Cape Hatteras area, and the Virgin Islands-Leeward Islands area.

Arata (1954) proposed a large spawning area and an extended spawning period. Making back calculations based on larval size and current speeds, he estimated an overall spawning period from late December through late September over the area from the lower Caribbean through the Yucatan Channel, the Straits of Florida and the Gulf Stream system northwards to the South Carolina coast, i.e. from about 15°N to about 32°N. Ripe females have been reported off Cuba during the winter months (Arata 1954; Guitart-Manday 1975). Markle (1974) concludes that a single spawning area cannot account for the widespread distribution of larvae. She surmises that there are probably two other distinct spawning areas, one southeast of Barbados and the other in the Virgin Islands-southern Sargasso Sea region.

Grall et al. (1983) compiled information about larval swordfish from several sources, including published and unpublished papers, personal communications, and previously unreported collections. Data from the Atlantic Ocean total 657 swordfish larvae (Table 1, Figure 5). The abundance of larvae appeared to be greatest in the eastern Gulf of Mexico (Area 5), Straits of Florida (Area 6), and the Gulf Stream north of Florida to Cape Hatteras (Area 10) (Figure 6). When abundance was adjusted for sampling effort, the Straits of Florida, the eastern Caribbean near the Lesser Antilles (Area 2), and the western Caribbean near the Straits of Yucatan (Area 3) had the highest numbers of larvae per station.

Seasonality of larvae within individual areas were examined (Figure 7). Large larvae (> 10 mm) were most abundant in December-February in the Caribbean, Straits of Florida and the Gulf Stream north of Florida, and during March-May in the western Gulf of Mexico. During September-November many larvae of all lengths were found in the western Caribbean. Swordfish larvae occurred year-round in the eastern Gulf of Mexico, Straits of Florida, and the Gulf Stream. Due to unequal collecting effort by season and area, they concluded peak spawning seasons were not well defined. However, the largest concentrations of small larvae (<10 mm) occurred during late fall and winter, indicating some seasonality in spawning in the western north Atlantic. Grall et al. (1983) concluded that the information in their study supported Arata's (1954) conclusions that swordfish spawn over a wide area in the western north Atlantic and have an extended spawning season. Further evidence for either single or multiple stocks of swordfish in any of the major oceans was inconclusive.

In 1983 an ichthyoplankton survey was conducted in the U.S. waters of the Gulf of Mexico during all months except January, February and August but mostly over the continental shelf except during the spring. Swordfish larvae occurred in low abundance (13 total) in the oceanic waters of the central Gulf of Mexico during May only (Kelley et al. 1986). In 1982 a similar survey was conducted in the spring and early summer in the Gulf of Mexico (Richards et al. 1984). Twenty-six swordfish larvae were captured over a wide area of the oceanic waters of the Gulf (Figure 8).

Palko et al. (1981) compiled references reporting additional spawning areas in the Mediterranean Sea off Sicily and the Straits of Messina (between southern Italy and northeast Sicily) from June through August, with peak spawning in early July. Also, in the Sea of Marmara (northwest Turkey between the Black Sea and Aegean Sea) where there was reported evidence that swordfish spawn in coastal waters during April through June.

Nishikawa et al. (1978) reported results from larval surveys during the years 1956-75. Sampling was limited spatially over the 20 year period. Therefore care must be taken when interpreting their maps of larval distributions. Although no swordfish larvae were found in the Mediterranean, sampling occurred there only during October-December, a period not corresponding to the months of reported spawning in the area in Palko et al. (1981). Sampling occurred in the Atlantic during October-December and January-March (Figure 9). Distribution maps of larvae show several spawning concentrations: south of Cuba (October-March); equatorial waters off northeast Brazil (January-March); waters off eastern Brazil (January-March); and in the central Atlantic midway between Cuba and Africa (Figure 10). The last location corresponds to the lower right corner of area 8, Figure 5 which they identified as an area of larval occurrence. Arfelli and Amorim (1985) reported that spawning occurs mainly in January and February off the southeast coast of Brazil in the area of 20°-28°S, 39°-48°W.

In summary, spawning is widespread and most concentrations of larvae indicate concentrated sampling effort rather than extraordinary abundances. However, the general areas in which swordfish larvae are found are: (1) the Gulf of Mexico, Straits of Florida, Caribbean, and mid sub-tropical Atlantic; (2) the Mediterranean Sea; and (3) the waters off Brazil.

III. Electrophoresis

The only electrophoretic study found in the literature is that of Johnson (1987). Swordfish muscle tissue samples were collected from three areas: northwest Gulf of Mexico (n = 62), southeastern Florida (n = 148) and the Caribbean Sea (n = 37). No significant difference was found between collections of swordfish from the three locations. The collection had a genetic similarity value of 0.98 or greater, therefore leading to no conclusion being made concerning the discreteness of swordfish in these three areas.

Tissue samples for electrophoretic analysis were collected and frozen from a 50-day swordfish longline research survey conducted in 1980 from Cape Hatteras to the Grand Banks (Hurley 1982). No report of any analysis of these samples has been published (personal communication - Peter Hurley, Bedford Institute of Oceanography, Dartmouth, Nova Scotia).

In summary, the lack of any cooperative electrophoretic study among highly geographically diverse regions precludes the use of biochemical analysis to resolve possible genetic differences among groups of fish.

IV. High-Seas Longline CPUE Data

Catch rates of the swordfish by-catch from the Japanese tuna longline fishery can be considered as an indicator of possible geographical discreteness. Swordfish CPUE data (numbers per million hooks) were compiled by month, across years 1957-83 for each 5° latitude by 5° longitude area. These were scaled by the transformation $3 \ln(\text{CPUE} + 1)$, plotted on maps of the Atlantic Ocean, and presented at the Swordfish Assessment Workshop in 1986 (SEFC 1987 - Appendix 2). A blank on the map represents no effort in that area. The workshop concluded that, based on the CPUE distribution, there was no indication of a distinct delineation between stocks in the Atlantic. No clear boundaries are evident; the CPUE data being generally continuous across the ocean from east to west and north to south. However, concentrations of swordfish do occur in some areas, which vary by month. This is evident by sketching contours on these plots over a range of densities (Figures 11-22). By choosing CPUE ranges of roughly 800-3000 fish/million hooks and greater than 3000 fish/million hooks these areas of relatively higher concentrations become more visually apparent.

The region of highest CPUE has been off southeast Brazil/Uruguay. This high concentration appears to remain in the general area -- expanding or contracting, depending on the time of the year. The concentrations along the northwest Atlantic, northeast Atlantic, and Gulf of Guinea appear to show considerable movement temporally. A brief description of the temporal geographical characteristics of these concentrations follows. Note that beginning the sequencing of Figures 11-22 with January is arbitrary. Therefore, for ease of discussion, I begin with November (Figure 21).

The distribution pattern for November exhibits three distinct concentrations: (1) from North America to northern Spain and southward along northern west Africa; (2) the Gulf of Guinea; and (3) off southern Brazil/Uruguay. In December (Figure 22), the North Atlantic concentration begins a split between west and east which continues into January (Figure 11). The Gulf of Guinea December mass appears to contract and split in January, forming a concentration east of Brazil. Another explanation for this new concentration could be that part of the Brazil/Uruguay mass moved eastward and split. During December-January, the Brazil/Uruguay aggregation shows some demarcation. By February (Figure 12) the mass along west Africa has moved farther east and south, almost joining with the Gulf of Guinea concentration. The Brazil/Uruguay concentration has unified again in February and remains so through November, growing to a very large area with extremely high densities during June-August, the winter of the Southern Hemisphere. A concentration along the southern tip of Africa becomes apparent in February and is traceable through October (except in July). The large concentration east of Brazil remains identifiable through February-March, distinct from the Gulf of Guinea and Brazil/Uruguay concentrations. In March (Figure 13) the west Africa and Gulf of Guinea concentrations appear to form one large equatorial band and concentrations appear in the western Caribbean south of Cuba and along the U.S. east coast. In April (Figure

14) the equatorial mass may have separated showing a new distinct concentration centered around the Lesser Antilles. During May to June (Figures 15-16) little is noted throughout the entire North Atlantic, with the equatorial mass shrinking, moving eastward and joining with the Gulf of Guinea concentration in July (Figure 17). Also in July, concentrations exist eastward off the northeast U.S. and along the west coast of north Africa. There is little change in August-September (Figures 18-19) with the noted exception of a large concentration in the western Mediterranean identifiable in September-October. By October (Figure 20), the concentrations across the North Atlantic and along the northern coast of west Africa become evident.

Koido and Yonemori (1987) examined trends in CPUE from the Japanese longline data over the period 1970-1984. They concluded that swordfish appear widely distributed over the Atlantic exhibiting seasonal differences in their distribution.

CPUE data from the U.S. and Canadian longline fleets indicate that swordfish are generally concentrated around loop currents in the Gulf of Mexico, along the western wall of the Gulf Stream, along the edge of the Continental Shelf, and on sea mounts (unpublished data). The Workshop concluded that continuous emigration from the open Atlantic into areas of concentration is considered possible (SEFC 1987).

In summary, swordfish CPUE bycatch data from the Japanese tuna longline fishery show that swordfish are widely distributed across the entire North and South Atlantic Ocean, roughly between 40°N and 40°S. There are apparent areas of high densities that change temporally. The movement of these regions of concentrations may be indicative of broad-scale movement of large masses of swordfish.

Conclusions

Little new data are presented in this document that were not available to the 1986 Workshop or at the 1986 SCRS Meeting other than a few more recent tag returns and the results of a limited electrophoretic study. Hence, no other conclusions are drawn based on available information. Existing data are conflicting and insufficient to resolve the swordfish stock structure issue. When viewed in isolation the limited mark-recapture data favor a separate northwest Atlantic stock hypothesis; the larval data apparently indicate separate geographically distinct spawning areas; and the high-seas longline CPUE data imply an Atlantic-wide stock hypothesis with concentrations of swordfish varying temporally and spatially.

In order to resolve or at least gain more insight into the swordfish stock structure problem, carefully designed and jointly implemented studies, such as expanded tagging and electrophoresis, are needed.

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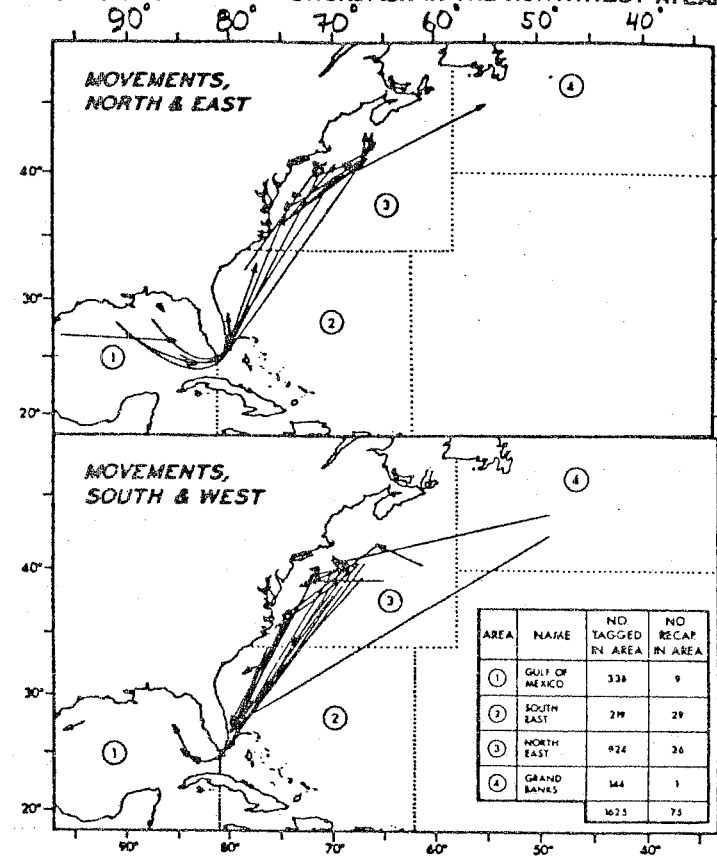
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Table 1.--Stations, numbers of larvae , and apparent abundances of swordfish larvae collected in 15 geographic areas.

Geographic area	Number of stations	Number of larvae collected	Larvae per station
1 Northwest Atlantic	*	3	
2 Eastern Caribbean	190	87	0.458
3 Western Caribbean	99	46	0.456
4 Western Gulf of Mexico	140	30	0.214
5 Eastern Gulf of Mexico	620	224	0.361
6 Straits of Florida	263	138	0.525
7 Western Sargasso Sea	132	13	0.098
8 Eastern Sargasso Sea	56	7	0.125
9 Northwest Atlantic, west of Bermuda	6	0	0.000
10 Gulf Stream	408	109	0.267

*Number of stations unknown or incomplete.
(Source: Grall et al., 1983 - Table 3)

Figure 1 - RETURNS FROM TAGGED SWORDFISH IN THE NORTHWEST ATLANTIC



NMFS SWORDFISH TAG AND RECAPTURE SUMMARY

(Source: Casey et al. 1985)

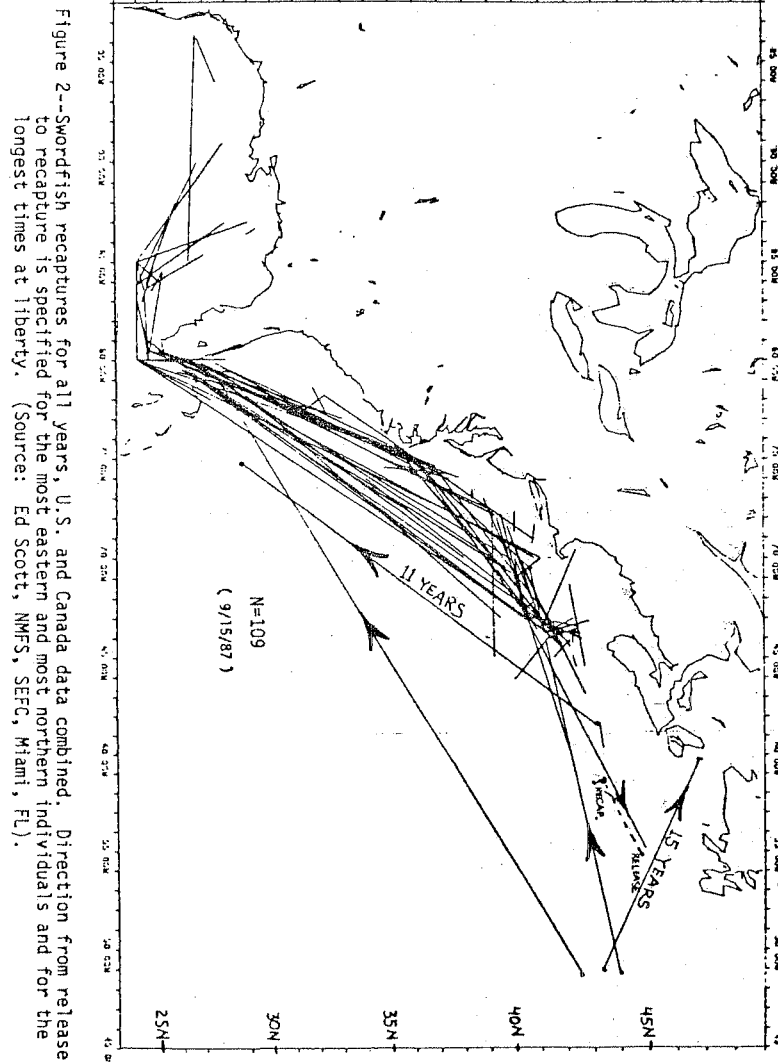


Figure 2--Swordfish recaptures for all years, U.S. and Canada data combined. Direction from release to recapture is specified for the most eastern and most northern individuals and for the longest times at liberty. (Source: Ed Scott, NMFS, SEFC, Miami, FL).

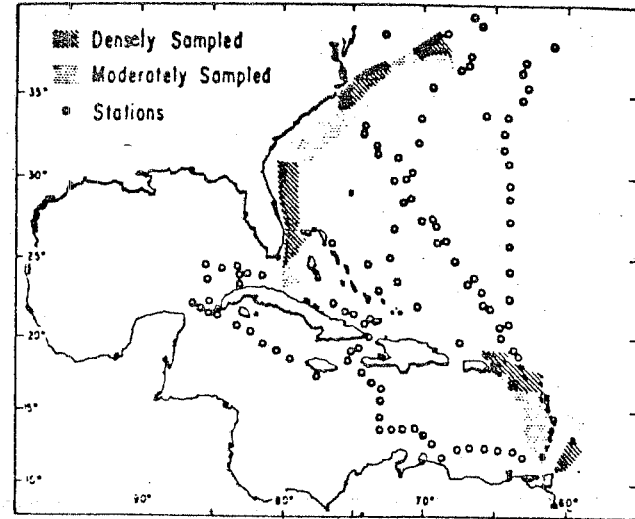


Figure 3--Sampling areas and stations for Fisheries Research Board of Canada cruises. (Source: Markle, 1974 - Figure 1)

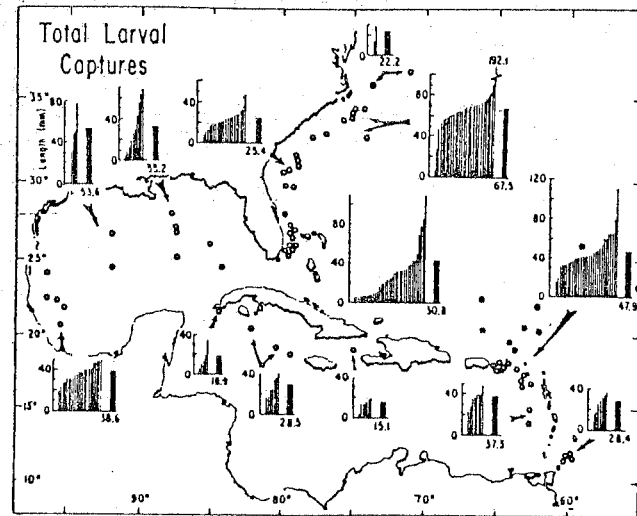


Figure 4--Numbers, size ranges, and mean lengths of swordfish larvae--collections from various sources including Fisheries Research Board of Canada. (Source: Markle, 1974 - Figure 3)

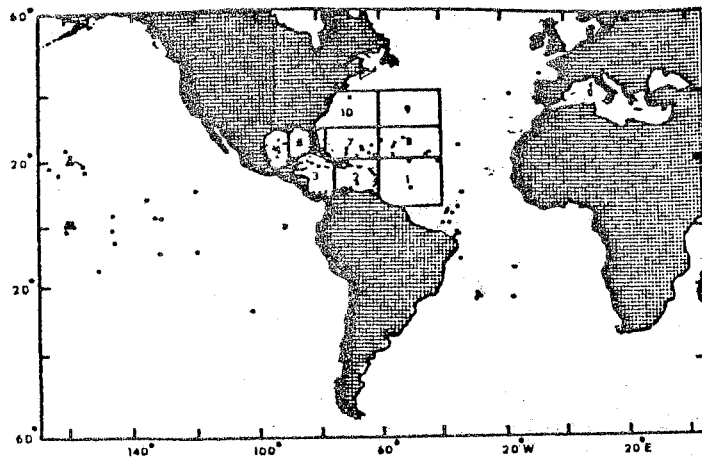


Figure 5--Occurrences (dots) of larval swordfish in the western hemisphere. Numbered geographical areas are based on those of FAO (1981). The stippled areas denote areas of great abundance.

(Source: Grall et al., 1983 - Figure 1)

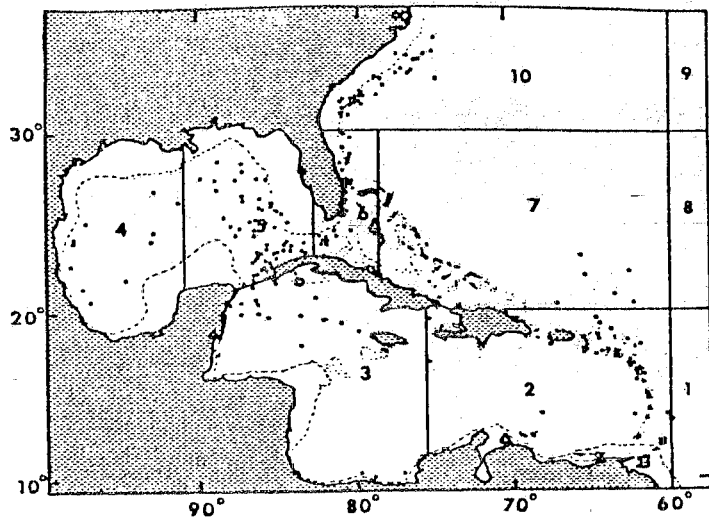


Figure 6--Distribution (dots) of larval swordfish by numbered geographical area (after FAO 1981) in the western north Atlantic. The dotted line denotes the 200-m depth contour. (Source: Grall et al., 1983 - Figure 3)

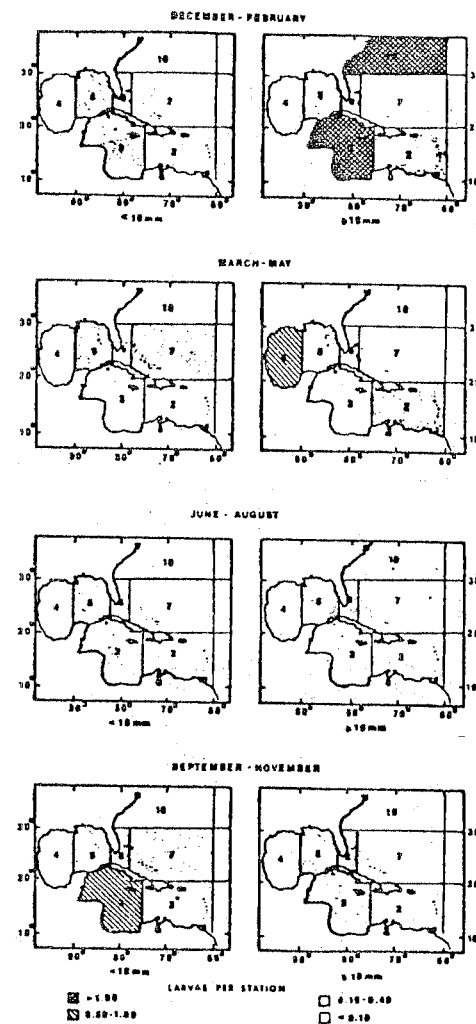
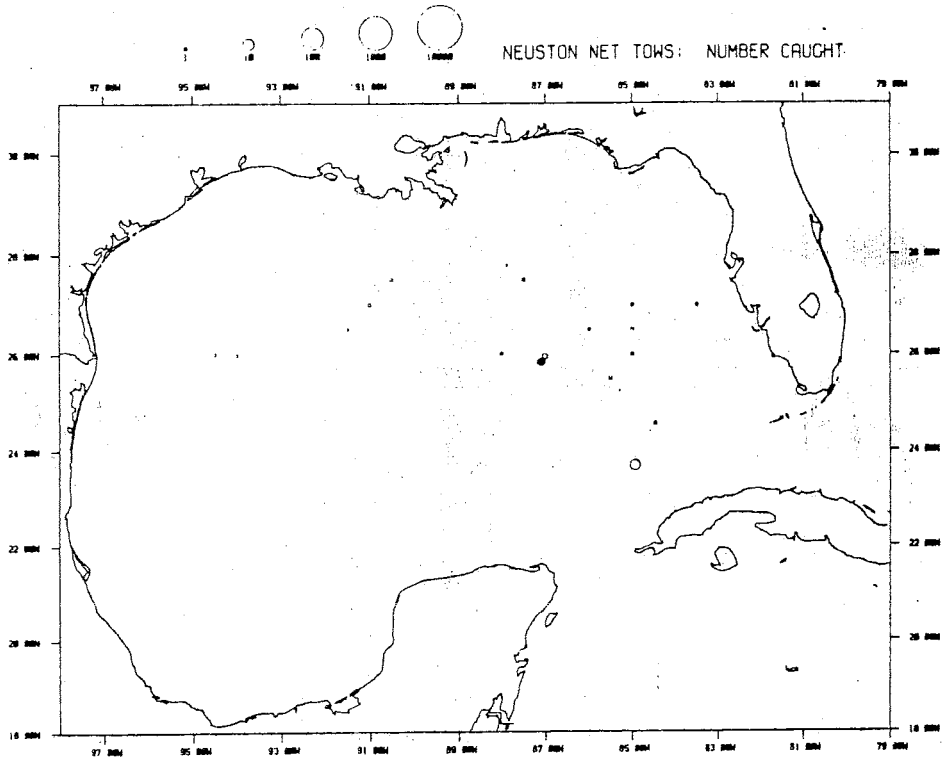


Figure 7--Seasonality of larval swordfish by length class and geographic area in the western north Atlantic. Data for Area 7 include larvae of all lengths. Asterisk (*) denotes no sampling during those months. (Source: Grall et al., 1983 - Figure 6)

Figure 8--Distribution of swordfish larvae captured in 1 by 2 m neuston net tows.
 (Source: Richards et al. 1984)



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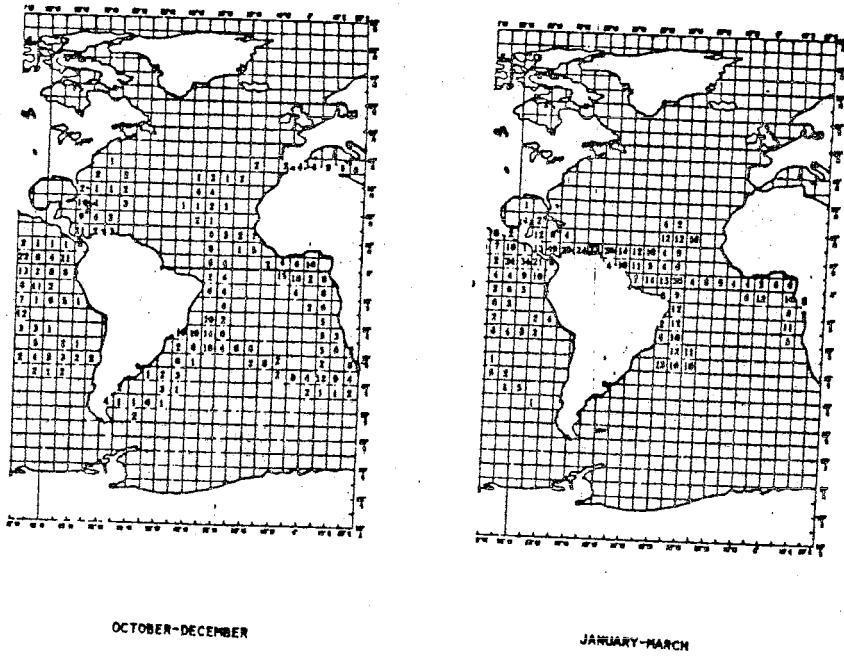


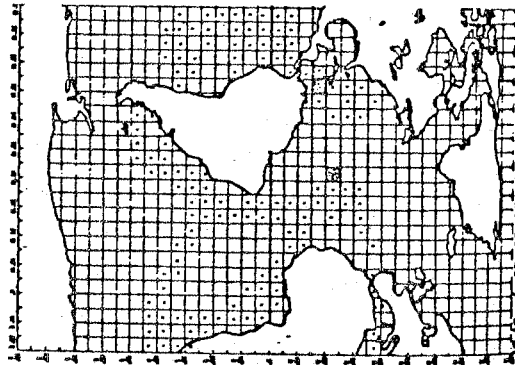
Figure 9--Number of larval net tows by 5-degree areas and quarters of the year.
 (Source: Nishikawa et al. 1978)

Figures 11-22: Monthly swordfish CPUE compiled by month, across years 1957-83 from the Japanese longline tuna fishery. Quantities are scaled by the transformation $31n (CPUE + 1)$. Outlined contours represent densities K-0 which correspond to approximately 800-3000 fish/million hooks. Shaded contours represent densities of P or greater.

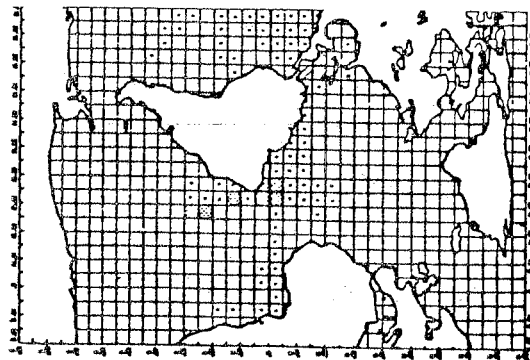
(Source: SEFC 1987, Document 86/3)

Legend: A 'blank' represents no effort.

Character	Scaled Value	CPUE (# fish/million hooks)
1	1	.4
2	2	1
3	3	2
4	4	3
5	5	4
6	6	6
7	7	9
8	8	13
9	9	19
A	10	27
B	11	38
C	12	54
D	13	75
E	14	105
F	15	147
G	16	206
H	17	288
I	18	402
J	19	562
K	20	785
L	21	1,096
M	22	1,529
N	23	2,135
O	24	2,980
P	25	4,160
Q	26	5,805
R	27	8,102
S	28	11,307
T	29	



OCTOBER-DECEMBER

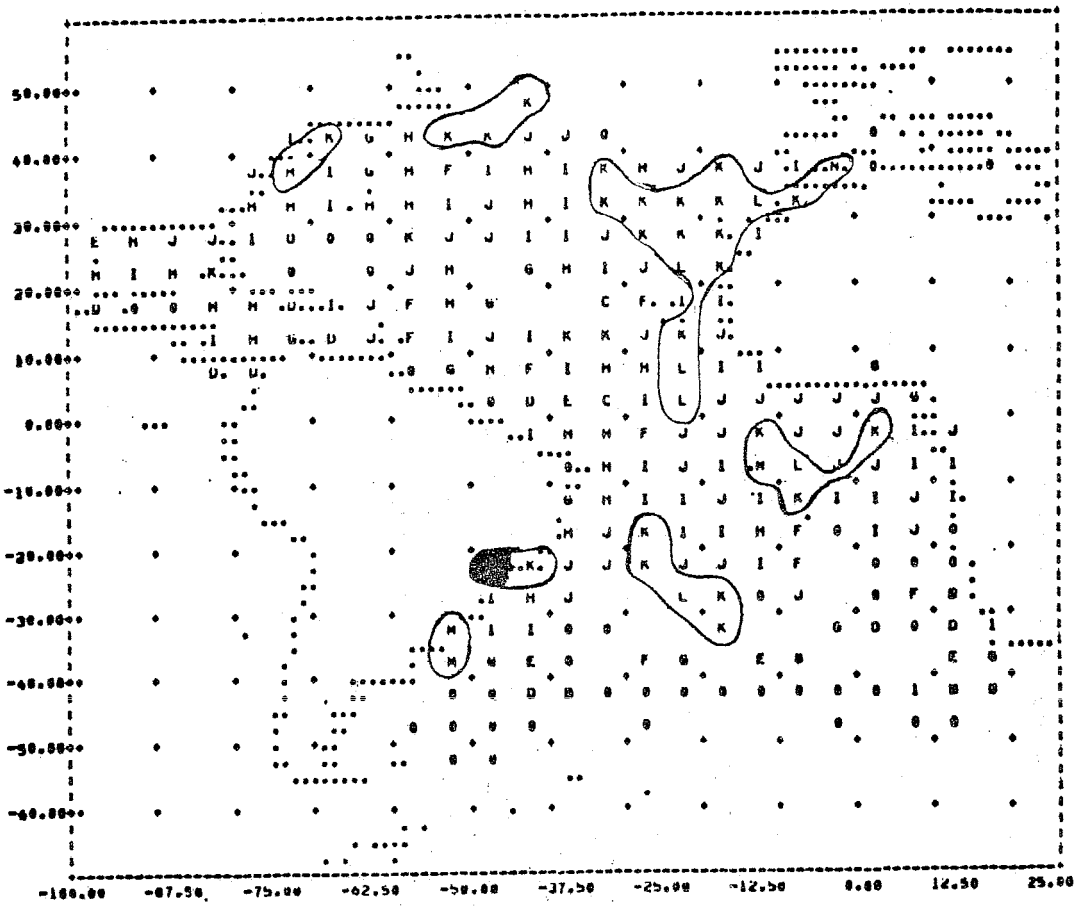


JANUARY-MARCH

Figure 10--Number of larvae per tow by 5-degree areas and quarters of the year.
(Source: Nishikawa et al. 1978)

Legend:

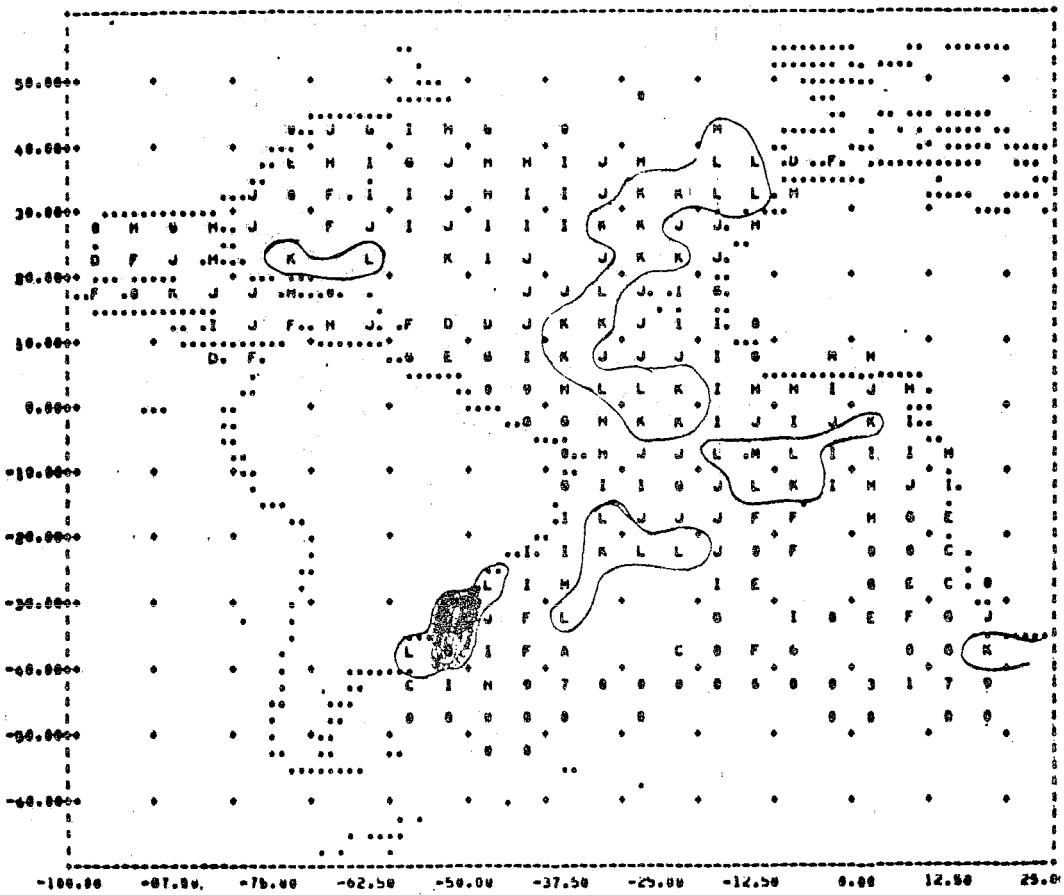
- No larvae collected.
- ▨ Less than 0.9 fish per tow.
- ▧ 0.1 - 1.0 fish per tow.
- ▦ 1.1 - 5.0 fish per tow.
- ▥ 5.1 - 10.0 fish per tow.
- ▤ More than 10.1 fish per tow.



JANUARY

Figure 11.

250



FEBRUARY

Figure 12.

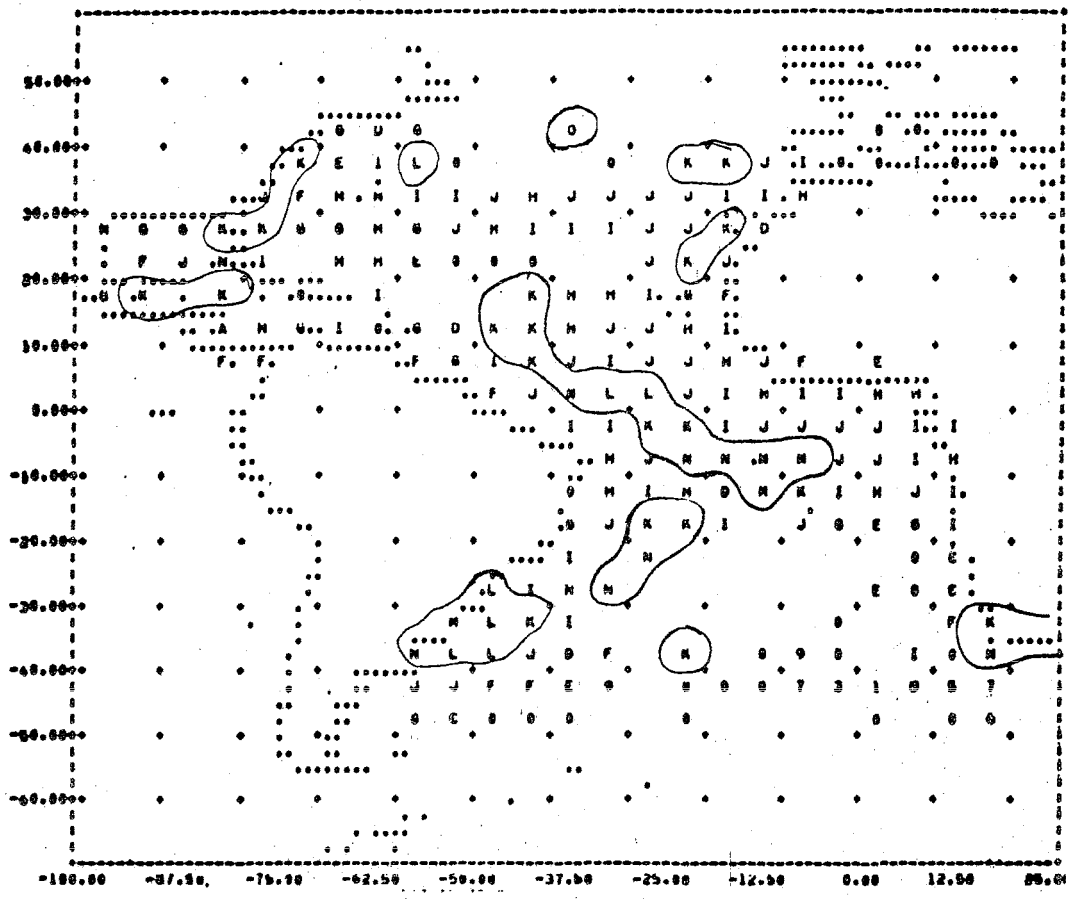


Figure 13.

MARCH

152

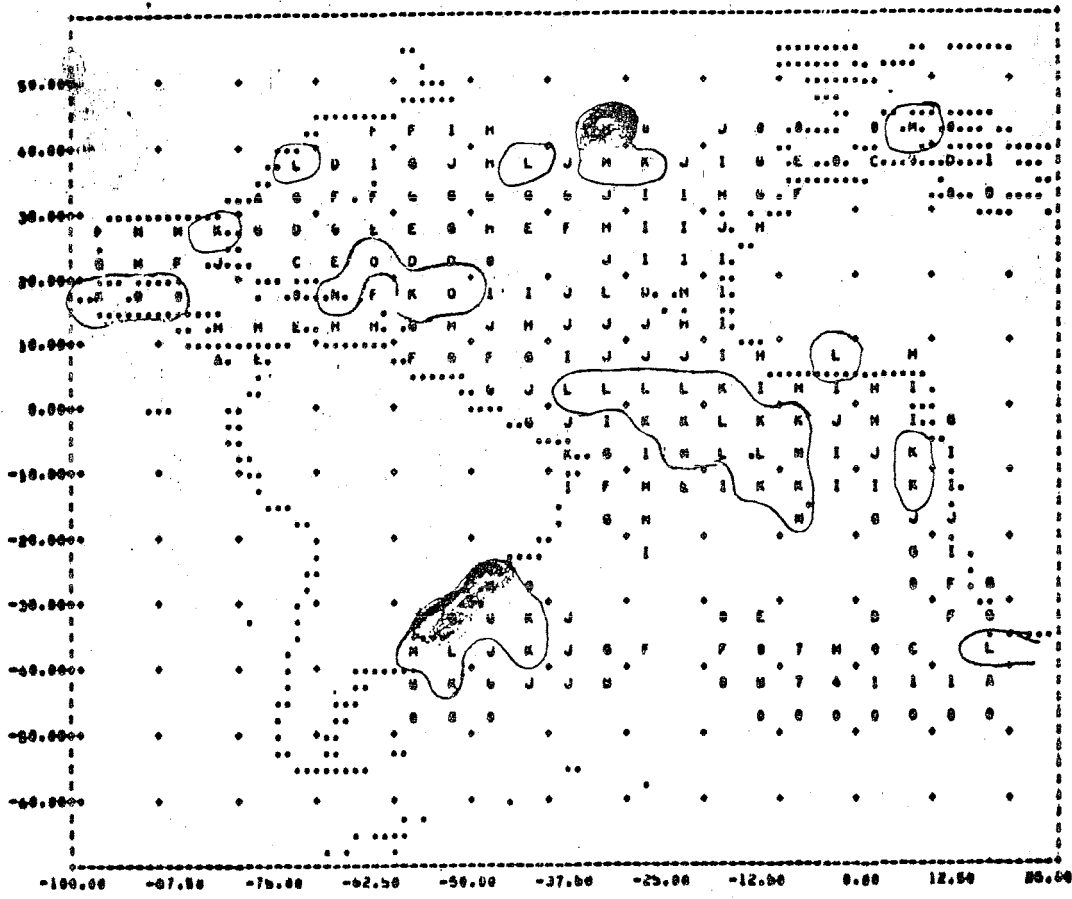


Figure 14.

APRIL

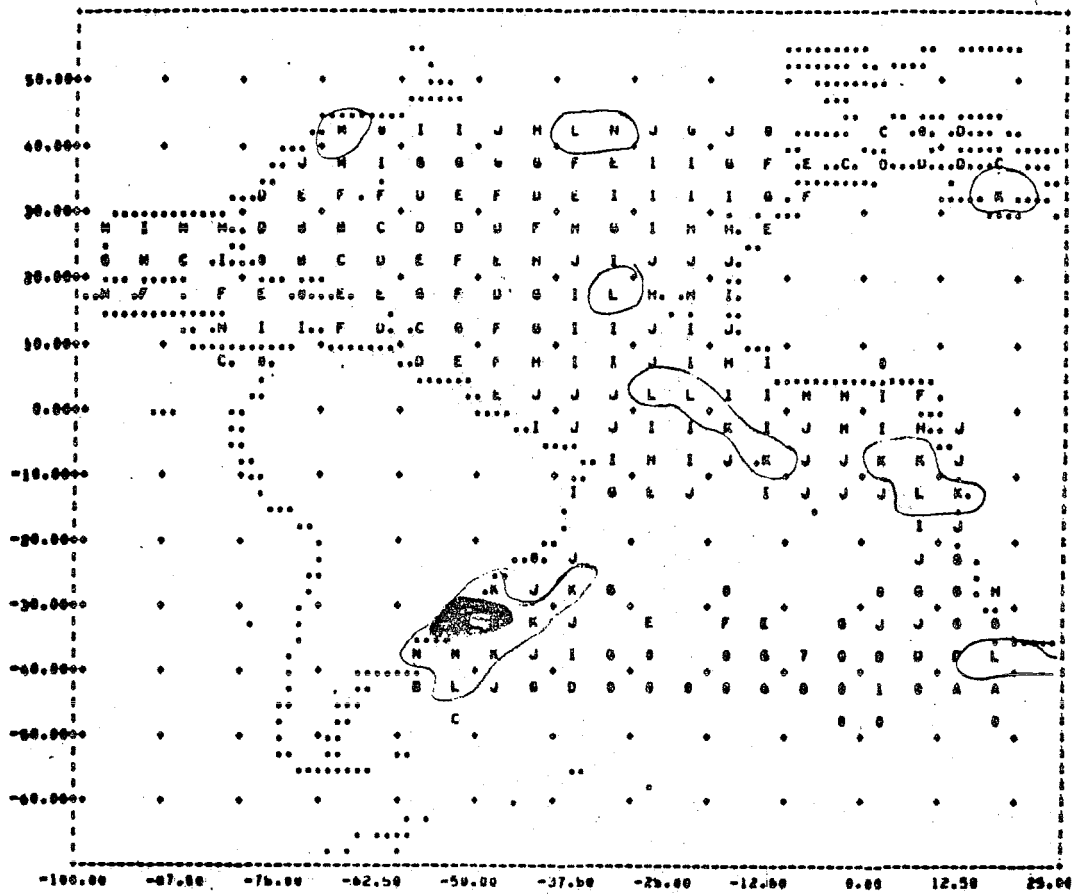


Figure 15.

252

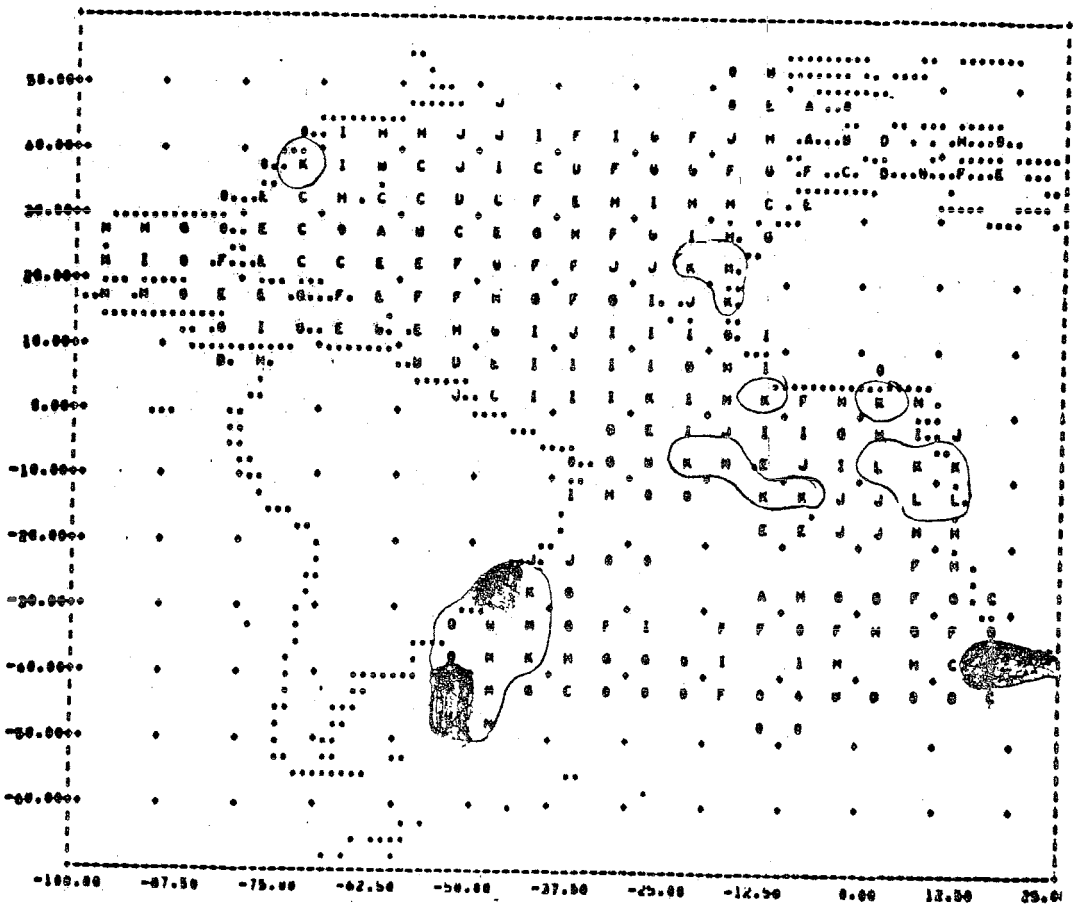


Figure 16.

MAY

JUNE

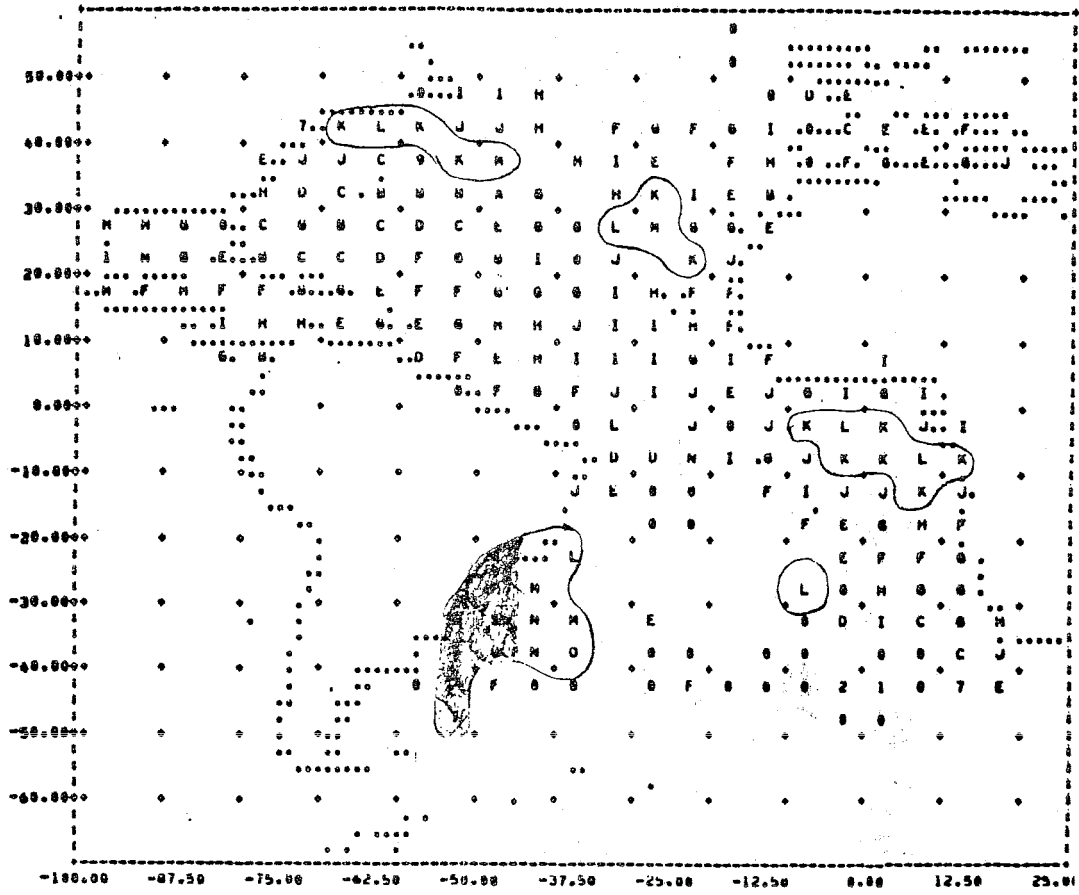


Figure 17.

JULY

253

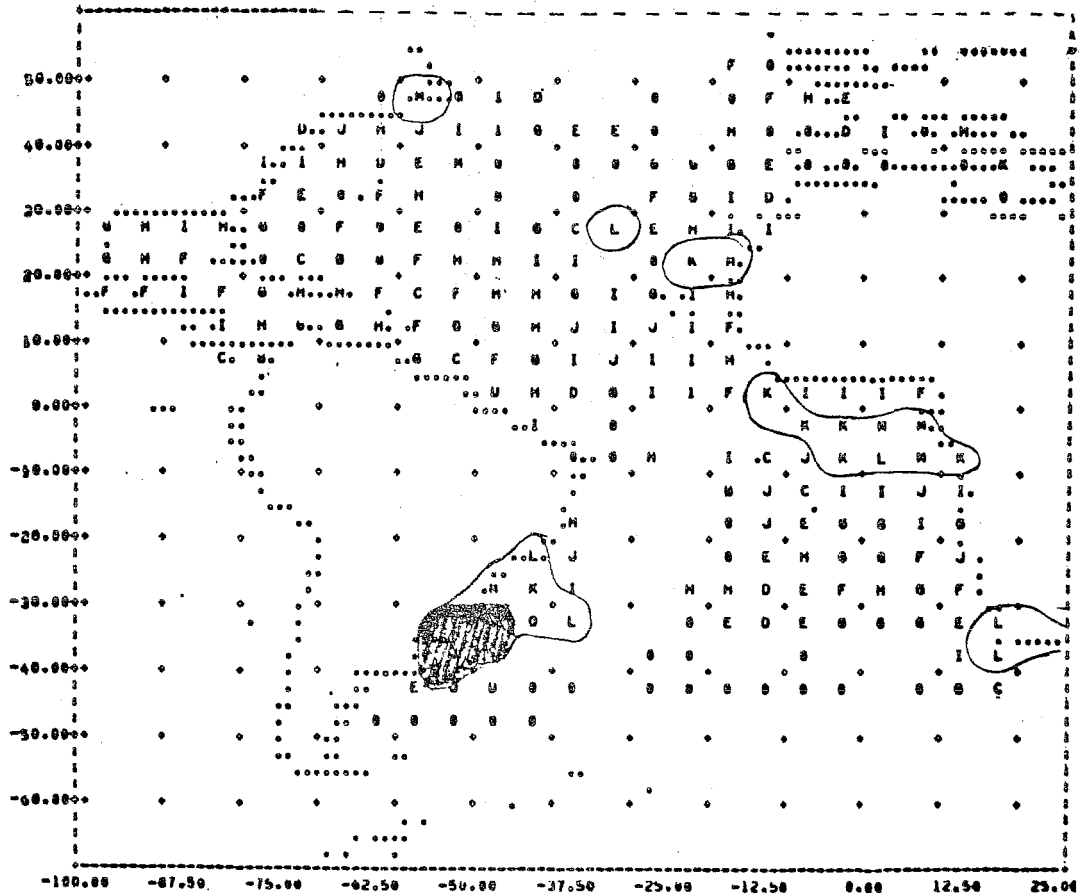


Figure 18.

AUGUST

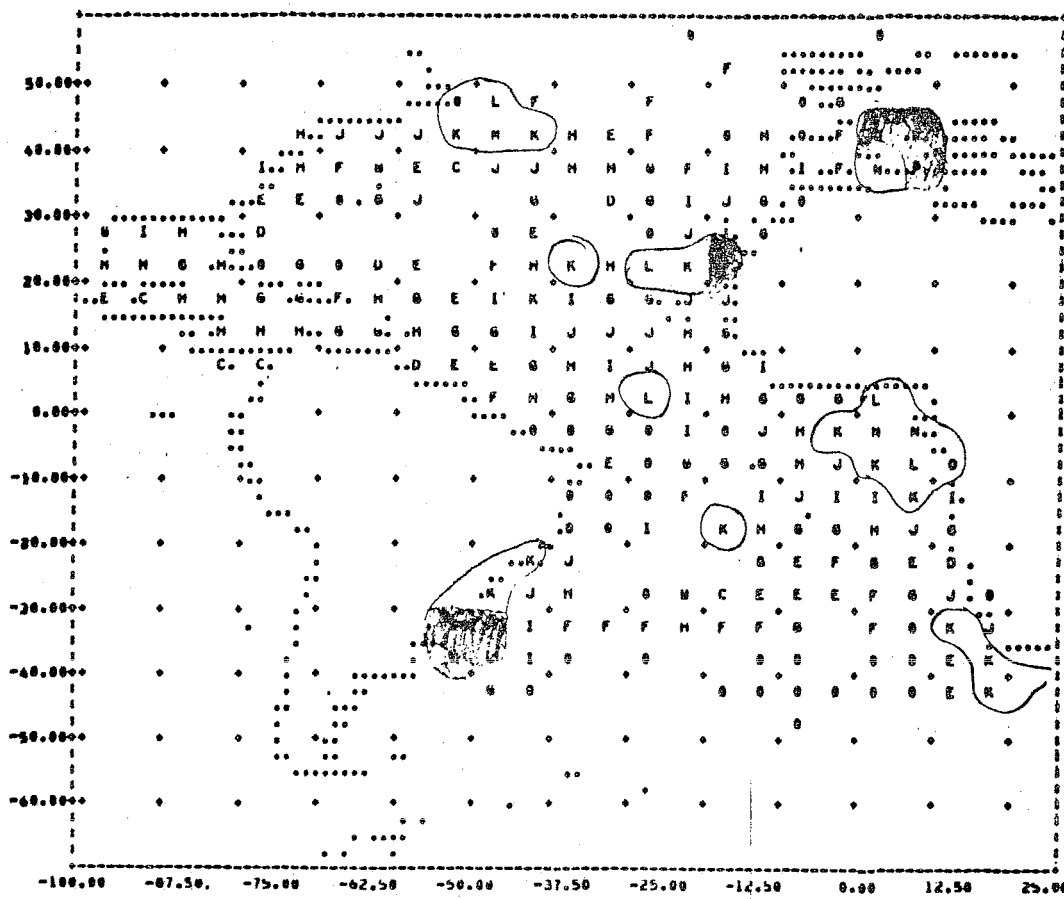


Figure 19.

254

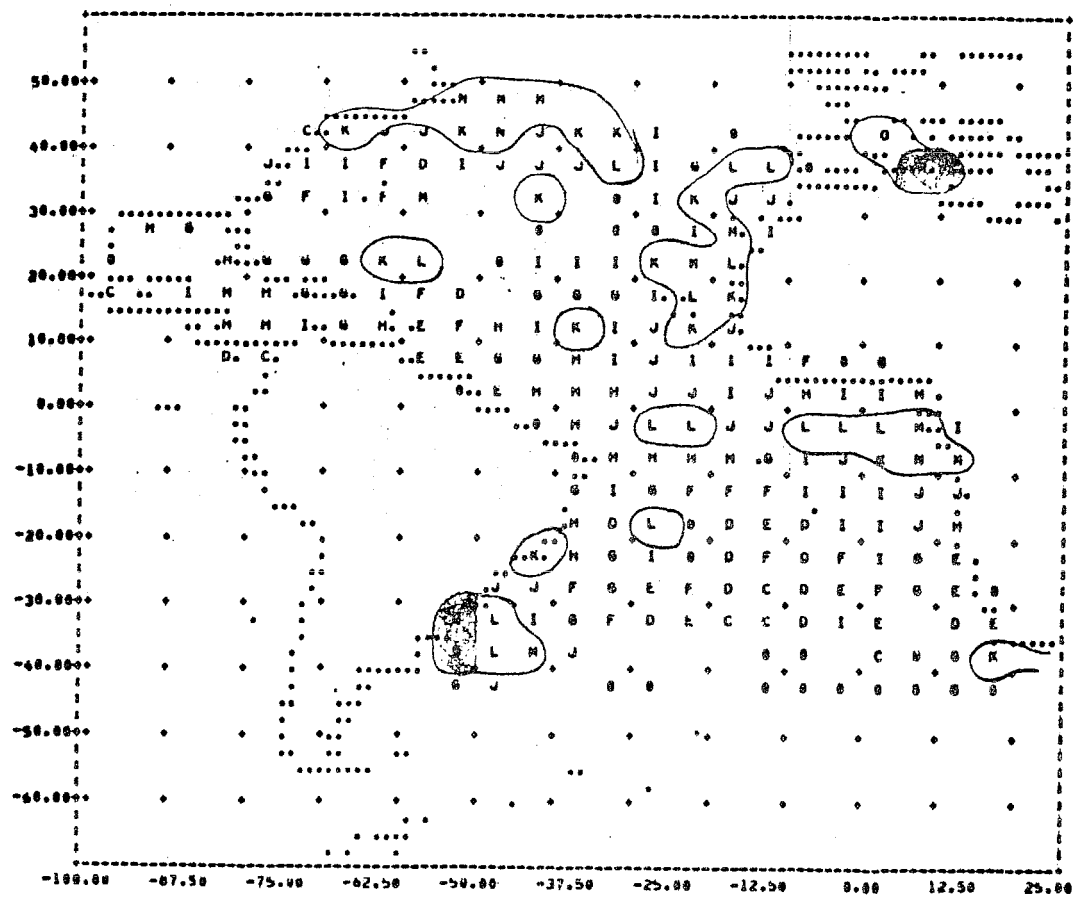


Figure 20.

SEPTEMBER

OCTOBER

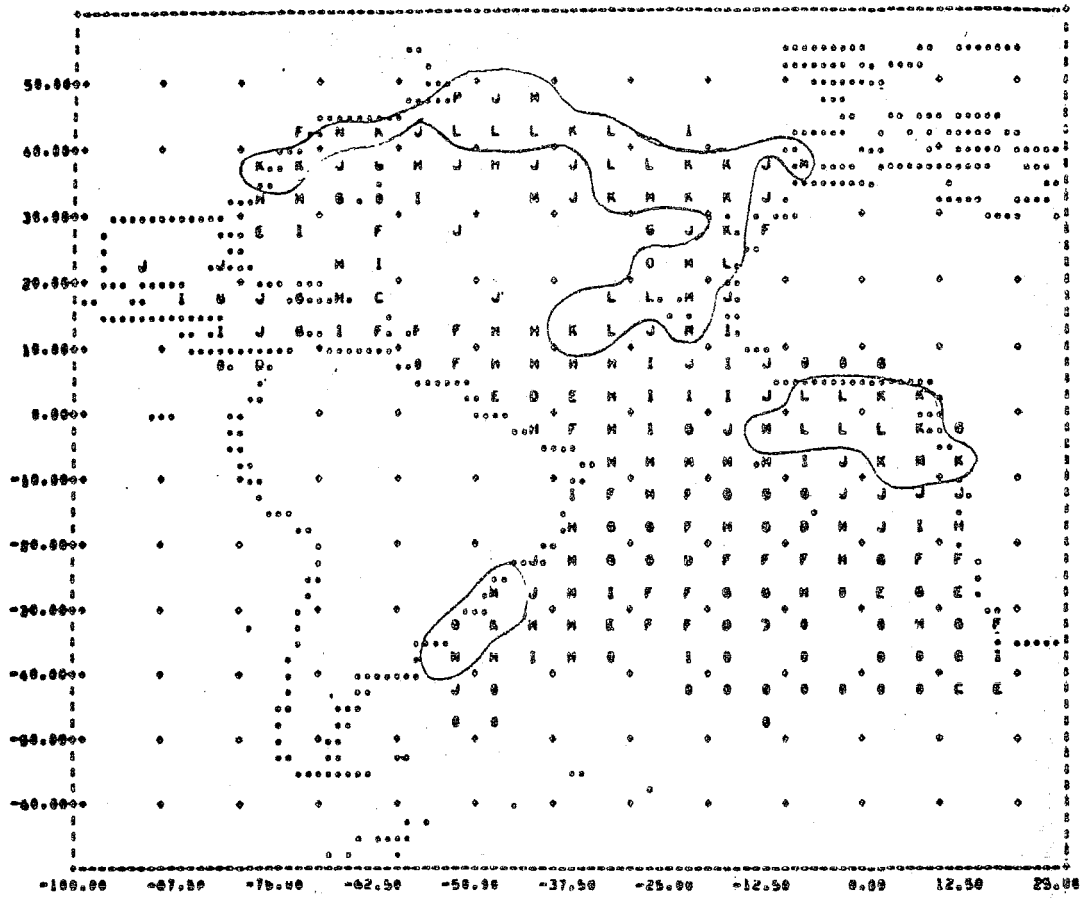


Figure 21.

NOVEMBER

252

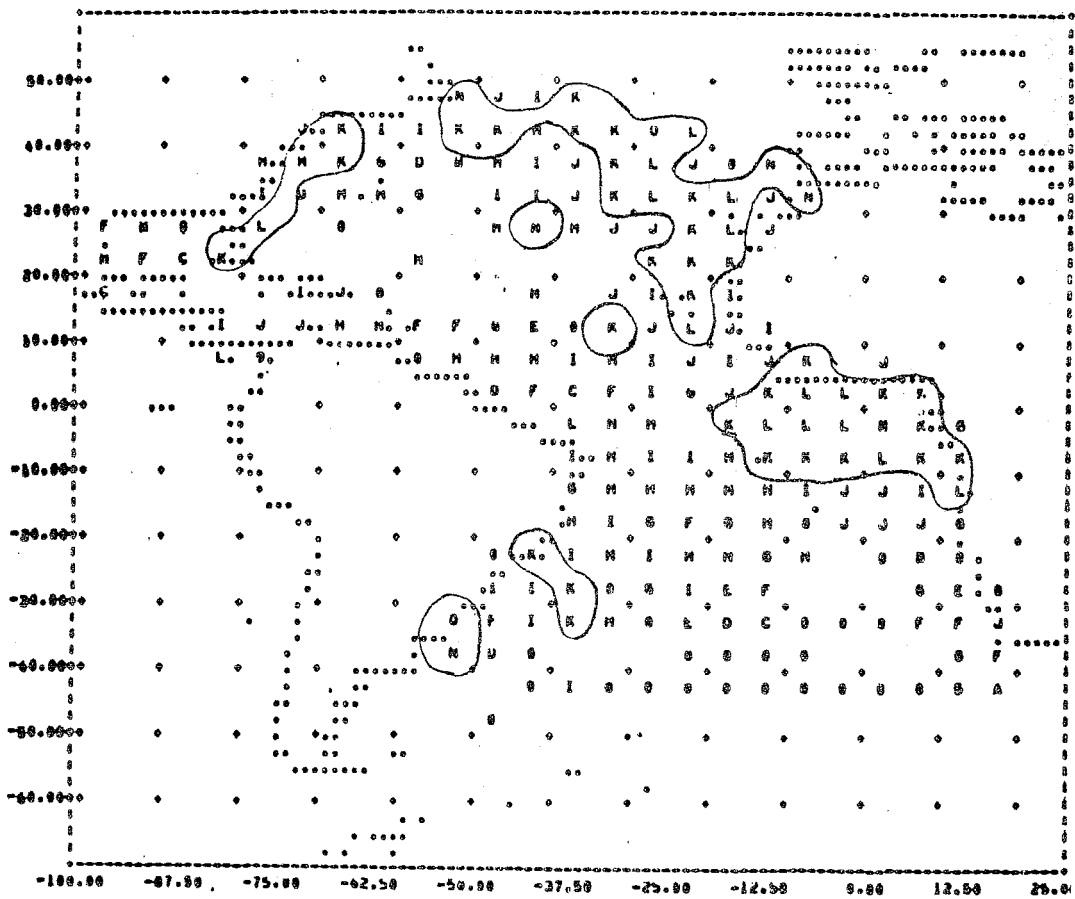


Figure 22.

DECEMBER