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OVERVIEW OF PELAGIC FISH SURVEYS, 1950–1989, IN THE CALIFORNIA CURRENT REGION AND DOCUMENTATION OF THE LEGACY DATABASE

Christina Show
Kevin T. Hill

NOAA Fisheries
SWFSC Fisheries Resources Division
8901 La Jolla Shores Drive
La Jolla, CA 92037

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Overview of Fisheries Resources Sea Surveys, 1950–1989, in the California Current Region and Documentation of the Legacy Database

1. General Overview of the Fisheries Resources Sea Surveys

Between 1950 and 1989, the California Department of Fish and Game (CDFG; now California Department of Fish and Wildlife) conducted an extensive series of pelagic fish survey cruises. The original purpose of these surveys was to determine the total pelagic Fisheries resources available in the California Current System, as well as their abundance, distribution, and potential yield. The U.S. Federal Government provided a major portion of funds for this work (Mais 1974a). A midwater trawl was made at most stations and most trawling was conducted at night. Biological data (length, sex, maturity, and age) were collected from samples of Pacific Sardine (*Sardinops sagax*), anchovies (at least predominantly Northern Anchovy, *Engraulis mordax*), Pacific Mackerel (*Scomber japonicas*), and Jack Mackerel (*Trachurus symmetricus*). Length frequencies were recorded and total count determined for all other species. Bathythermograph casts and turbidity measurements were made whenever possible. In addition to the trawl stations, from 1950 through 1962 the survey used light to attract fish and dynamite or a blanket net (Radovich and Gibbs, 1954) to collect samples in certain locations to provide live sardines for genetic studies and for comparison to midwater trawl results. Starting in 1963, a midwater trawl was the primary sampling tool (K. F. Mais, Report for the month of January 1964, Marine Resources Operations, CDFG.)

In the latter half of 1966, the scope and methodology of the cruises changed and the areas covered broadened. These surveys, titled Fisheries Resources Sea Surveys, were accomplished by a line transect method using echo sounder or sonar to detect and determine fish biomass, with a primary focus on Northern Anchovy. Mid–water trawling, echogram characteristics, and visual sightings were used to identify fish species. The expanded 'Sea Surveys' were created under a federal aid program (Commercial Fisheries Research and Development Act of 1964, Public Law No. 88–309).

Survey data collected from 1950 – 1989 were compiled and presented yearly in the California Cooperative Oceanic Fisheries Investigations (CalCOFI) Data Reports, Numbers 1 – 39 (Number 7 contained data for both 1956 and 1957). These hard copy reports present the basic raw data in tabular form and are the sole source for this legacy database. This Technical Memorandum will provide a brief overview of the pelagic fish survey cruises, describe the structure and content of the legacy databases, and summarize a portion of the data without scientific interpretation.

2. The History of the Data Rescue Stages

In 1995, data collected during the Sea Survey cruises from 1966 to 1989 were recovered from spreadsheets without their respective column headings. We extracted and decoded most of

the information through systematic exploration of the yearly data files and from their related CalCOFI Data Reports (Numbers 16 – 39). These data are digitally available in a Microsoft Access relational database and have been widely distributed through electronic methods since 1995.

The cost to recover historical data prior to 1966 is less than 0.5% of the cost of the original surveys conducted to collect these data (Zeller et al. 2005). To prevent the loss of these valuable historical data, we applied for and received funding from the Climate Data Modernization Program (CDMP) in 2007 to rescue data collected from 1950-1965 that were archived only on paper within the CalCOFI Data Report Numbers 1 – 15.

Towards the end of the keying process for Data Report Numbers 1 – 15 in 2008, we were notified that funds remained. We took this opportunity to submit the hard copies of Numbers 16 – 39 (1966-1989) for data rekeying. This provided a complete data set rescued under a uniform method.

The data were converted from an Access database to a relational SQL database beginning in 2018. During this process, data were analyzed and visualized with the help of graphing tools. We were able to catch the obvious errors (e.g. sampling locations that fall on land). A few of the errors were keypunching errors, but most errors existed in the original hard copy reports. Although the steps in the quality control process were laborious and repetitive, we were able to correct these errors to the best of our judgement and using analysis results.

Two sets of species codes were used for the entire survey. In some cases, the same codes used to represent certain species for the earlier years from 1950 – 1965 were used to represent different species for the later years (1966– 1989). We adopted the most logical species codes used from both sets. Therefore, the species codes used for this database are unique and each code represents only one Taxon. The species table lists the different codes used from different years in the original hard copy reports (Table 7). To clarify these species codes, we added the equivalent Integrated Taxonomic Information System (ITIS) code to the species code table.

According to Zeller (2005), “Datasets are the fuel that keeps the scientific engine running, and we should do more to ensure that our tanks remain full, especially with historic datasets.” This document was produced to describe these data, make them visible, accessible and independently understandable to the public.

Today, data science, artificial intelligence, and data mining are important issues discussed among the scientists of all fields. They drive our decision-making. To this end, we need to address the most basic questions: what data are available, where are they stored, who can access them and how to access them. We hope this report answers some of these questions about the CDFW pelagic Fish Survey data.

3. The National Marine Fisheries Services (NMFS) PARR Requirements

PARR (Public Access to Research Results) requires that all federally funded scientific research results, publications, or digital data be accessible to the public. This is a response to the White House Office of Science and Technology Policy memorandum 'Increasing access to the results of Federal funded scientific research' issued February 22, 2013. Making these data publicly accessible in a machine–readable format fulfills our obligation to implement the PARR plan.

4. Online Data Repositories

The newly restructured Sea Survey database currently is stored and maintained at two locations:

- On the Southwest Fisheries Science Center (SWFSC) Microsoft SQL 2018 server named SWC–ESTRELLA–S running Microsoft Windows NT version 6.3. SWFSC staff can request permission for database access.

- On the SWFSC ERDDAP server, a data server that provides a simple, consistent way to download subsets of gridded and tabular scientific datasets in common file formats (for example, .html table, .txt, .csv and so forth). To access these data, log in to: https://coastwatch.pfeg.noaa.gov/erddap/index.html and search for the Sea Survey Data.

These are historical data; no more survey data of the same nature will be added in the future. We separated the data into nine tables on the SQL server and into nine data sets on the ERDDAP website. The content of these nine tables/datasets are the same for both sites; only the methods of data storage, retrieval and manipulation are different. Both sites allow users to define desired criteria to generate an unlimited number of outputs by using SQL scripts or criteria set up by ERDDAP. Users can download some or all of the data to their personal computers and do further analysis with various tools such as R, Excel, Matlab, Python, C, Java, etc.

5. Description of Nine Individual SQL Tables, their Fields, and Associated Information

The relational database is organized into nine tables/datasets as depicted in the diagram below. The nine table names are Station, AgeData, AnchovySchool, BathythermographData, LengthFrequencies, NightScoutData, SpeciesComposition, SpeciesCode, and VisualScoutData. All nine tables/datasets are related to each other through primary and foreign keys. The primary keys serve to ensure data values in a specified column are unique without duplication. The foreign keys allow us to map the data to the primary key as well as keep data consistent within the tables.

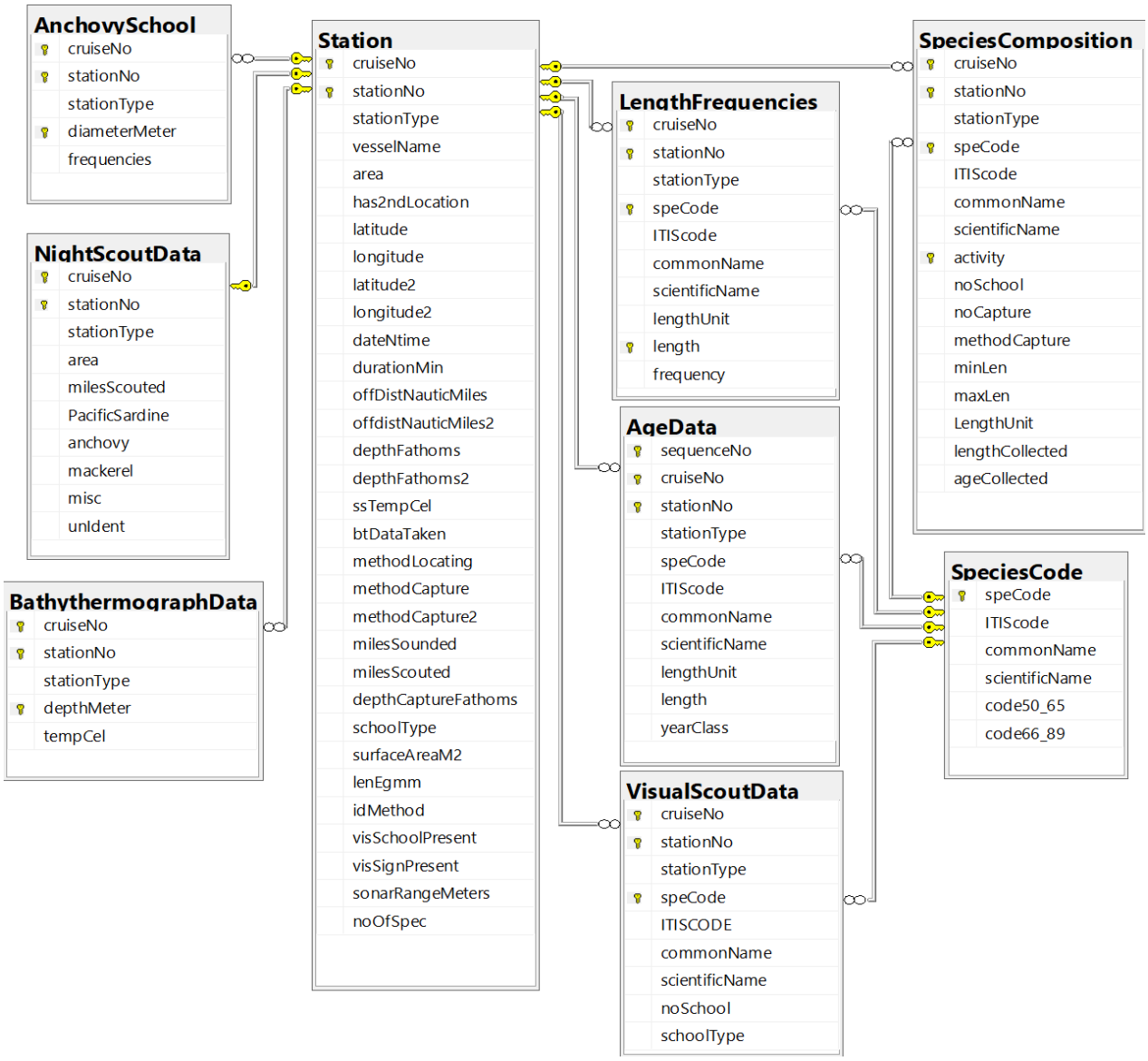

Figure 1. Entity-Relationship Diagram of the Sea Survey Database. Visual representation of the nine SQL tables and their relationships. Each box (table) under the title lists what kind of data it contains.

Table 1. Station Table. The following table describes the basic data structure for the Station Table. Each record in the Station Table contains the listed fields in the order listed with the exact data types and field descriptions. There are 21,562 records, which equals the 21,562 number of stations.

Column Name	Data Type	Field Description
cruiseNo	Varchar(5)	A 5–character code consists of the last two digits of the year, the initial of the vessel, and the number of the cruise in that year. For example, 86X01, 66A01.
stationNo	Decimal(6,2)	A six-digit value that consists of a whole number followed by two decimal digits. The whole number parts are numbered consecutively from the start of each cruise. The decimal digit is used to indicate a different activity at the same location. The whole number part of these stations usually remains the same for each day. The zero numbers of the decimal parts usually denote midwater trawl or other type of stations. For example, 33.00, 101.00.
stationType	Varchar(15)	The principle activity performed on the station: Acoustic, Bottom Trawl, Hook and Line, Midwater, Night Light, Other, Troll, or Unspecified.
vesselName	Varchar(20)	The name of the vessel used for the survey: Alaska, Chartered Vessels, N.B. Scofield, Paolina T., Yellowfin.
Area	Varchar(50)	The general area where a station was located. Fifteen designated areas were used only for years from 1950 – 1965.
has2ndLocation	Varchar(3)	A Yes or No indication of whether the station activities covered a distance and therefore have an ending position different from the posted starting location. The stations that did not cover a distance have the same latitude and longitude coordinates posted twice.
Latitude	Decimal(8, 4)	North Latitude in degrees with 4 decimal digits.
Longitude	Decimal(8,4)	West longitude in degrees only format. Negative numbers are used to refer to west of the Greenwich meridian.
latitude2	Decimal(8, 4)	2nd north latitude in degrees for stations with activities covering distances.
longitude2	Decimal(8, 4)	2nd west longitude in degrees for stations with activities covering distances.
dateNtime	Datetimeoffset (7)	Date and ship's time at beginning of station. (yyyy–mm–dd hh:mm:ss.0000000 –offset, for example, 1973–03–02 10:01:00.0000000 –08:00)
durationMin	Int	Duration of each station in minutes.
offDistNauticMiles	Decimal(6,1)	Starting offshore distance from the closest mainland or island shoreline measured to the nearest tenth of a nautical mile. (Minimum distance). Distances of 100 nautical miles or more are listed as 99.9.
offDistNauticMiles2	Decimal(6,1)	Ending offshore distance from the closest mainland or island shoreline measured to the nearest tenth of a nautical mile. (Maximum distance for stations covering distance). Distances of 100 nautical miles or more are listed as 99.9.
depthFathoms	Int	Starting depth of water to the bottom in fathoms. It is a minimum if a second depth of range is present. A zero depth indicates a shore or tide pool station.
depthFathoms2	Int	Ending depth of water to the bottom in fathoms.
ssTempCel	Decimal(5, 1)	Sea Surface Temperature from bucket thermometer to the nearest tenth of a degree Celsius.

Column Name	Data Type	Field Description
btDataTaken	Varchar(7)	A Yes or No indication of whether a Bathythermograph cast was made for this station and data recorded.
methodLocating	Varchar(15)	Method used to locate or attract animals whether successful or not. These methods are Visual, Light, Fathometer, and Sonar.
methodCapture	Varchar(15)	Gear used to capture animals: Blanket Net, Dip Net, Dynamite, Gill net, Midwater trawl, Otter trawl, Round haul net, Trolling and Other (bottom trawls, beach seines, and traps)
methodCapture2	Varchar(15)	The second gear used to capture animals.
milesSounded	Decimal (5, 1)	Miles sounded to the nearest nautical miles. (Value for this field equals to Miles Scouted for Visual Scouting event).
milesScouted	Decimal (5, 1)	Miles scouted in nautical miles. The distance during which a visual watch was maintained for surface schools.
depthCaptureFathom	Int	For trawl stations, it is the depth of capture in fathoms or depth that trawl was fished. For Echo sounder stations, it is the mean depth from the surface of all schools detected at this station.
schoolType	Varchar(30)	School types appearing on echo sounder during trawl tow: Comets, Shallow Layer <=40 fathoms, Deep Layer > 40 fathoms, Large Single Globular, Deep Plume >40 fathoms, Shallow Plume <=40 fathoms, Continuous Surface Scatter, Scattered Groups.
surfaceAreaM2	Int	Calculated school surface area of all anchovy schools on station in square miles. Each school was considered to have circular shape. Diameter considered to be the horizontal range from the near to the far side of the school as measured from sonar gram recording paper.
lenEgmm	Int	Length of echogram registered by fish school in millimeters measured horizontally in a plane parallel to the sea surface. The school depth factor was minimized by measuring only schools shallower than 40 fathoms. This length varies with recorder paper speed, vessel speed, school depth, transducer beam width, exposure to sonic beam, and school size. Paper feed rate is 12.5 mm per minute during which the vessel travels approximately 1000 feet at a 10–knot speed. Fish school sizes are represented on an approximate relative scale by their echogram lengths.
idMethod	Varchar(30)	Species identification method: Echo characteristic, Trawl catches nearby, Hook and Line, Visible from Surface.
visSchoolPresent	Varchar(7)	A "Yes" or "No" designation if schools of fish sighted at or near surface during a station.
visSignPresent	Varchar(7)	A ‘Yes’ or ‘No’ designation indicating fish present during a station. Signs include birds, porpoises, sea lions and predator fishes
sonarRangeMeters	Int	Horizontal range in meters over which sonar was most effective in detecting schools. This range may be any interval within total range of equipment and is the range from which all school counts were made.
noOfSpec	Int	Number of species caught, observed or detected at the station.

Table 2. Age Data Table. Individual fish length, length unit, and four-digit year–class information.

Column Name	Data Type	Field Description
sequenceNo	Int	Automated sequence number to identify each measured age at a specified station and species code.
cruiseNo	Varchar(5)	Refer to Station Table
stationNo	Decimal(6, 2)	Refer to Station Table
stationType	Varchar(15)	Refer to Station Table
speCode	Int	A 4–digit Sea Survey species Code
ITISCode	Int	A unique and persistent identification number assigned for a scientific name in the Integrated Taxonomic Information System – ITIS.
commonName	Varchar(50)	Common name for the species, e.g., Market Squid.
scientificName	Varchar(50)	Species Scientific Name, e.g. Doryteuthis opalescens.
lengthUnit	Varchar(10)	Measurement units: millimeter standard length (MMSL), millimeter fork length (MM–FL), millimeter dorsal mantle length (MM-DML).
Length	Int	Actual length of the animal in units specified in the lengthUnit field.
yearClass	Int	List each fish age by its year class.

Example of an Age Data Table includes the following six species.

SpeCode	ITIS Code	Species Name	Scientific Name	Length Unit	Record Count
410	161828	N. Anchovy	*Engraulis mordax*	MM–SL	30350
380	161729	Pacific Sardine	*Sardinops sagax*	MM–SL	8942
1050	168586	Jack Mackerel	*Trachurus symmetricus*	MM–FL	2112
1525	172412	Pacific Mackerel	*Scomber japonicus*	MM–FL	2179
750	165609	Pacific Saury	*Cololabis saira*	MM–FL	185
830	164792	Pacific Hake	*Merluccius productus*	MM–SL	30

Table 3. Anchovy School Table. Diameters and frequencies of 7155 anchovy schools detected during acoustic surveys from 1974 to 1979. Listed diameter is the lower limit of each 5–meter interval.

Column Name	Data Type	Field Description
cruiseNo	Varchar(5)	Refer to Station Table.
stationNo	Decimal(6,2)	Refer to Station Table.
stationType	Varchar(15)	Refer to Station Table.
diameterMeter	Int	The estimated diameter of the anchovy school.
Frequencies	Int	The number of occurrences.

Example of one record showing a measured school at the specified station.

cruiseNo	stationNo	stationType	diameter/Meter	frequencies
74A03	1.01	Acoustic	10	12

Table 4. Length Frequency Table. 32,408 length frequencies and a total 177,775 fish measured for the following seven species caught during cruises from 1950 – 1989: Northern Anchovy, Jack Mackerel, Pacific Mackerel, market squid (*Doryteuthis opalescens*), Pacific Hake (*Merluccius productus*), Pacific Saury (*Cololabis saira*) and Pacific Sardine. About 60% of the fish were Northern Anchovy.

Column Name	Data Type	Field Description
cruiseNo	Varchar(5)	See 1. Station Table.
stationNo	Decimal(6,2)	See 1. Station Table
stationType	Varchar(15)	See 1. Station Table
speCode	Int	A 4–digit Sea Survey species Code
ITIScode	Int	A unique and persistent identification number assigned for a scientific name in the Integrated Taxonomic Information System (ITIS).
commonName	Varchar(50)	Common name for the species, e.g., Market Squid.
scientificName	Varchar(50)	Scientific name for the species, e.g. Doryteuthis opalescens.
lengthUnit	Varchar(10)	Measurement units: Millimeter Standard length (MM–SL), Millimeter Fork Length (MM–FL), Millimeter Dorsal Mantle length (MM-DML).
Length	Decimal(6,1)	Actual length of the animal in unit specified in length Unit.
frequency	Int	The number of animals measured at this length.

Table 5. Bathythermograph Data Table. Temperatures in degrees Celsius at selected depths for each station where a bathythermograph cast was made. The entries are derived from readings of depth and temperatures at inflection points on the original traces; these are converted to meters and degrees Celsius where necessary. The final entries are then calculated by interpolation between inflection points. A total 41,692 temperatures were reported from 1955 – 1979.

Column Name	Data Type	Filed Description
cruiseNo	Varchar(5)	Refer to Station Table.
stationNo	Decimal(6,2)	Refer to Station Table.
stationType	Varchar(15)	Refer to Station Table.
depthMeter	Int	At selected depth in meters.
tempCel	Decimal(4,1)	Calculated temperature in degrees Celsius at selected depth.

Table 6. Night Scouting Data Table. Miles scouted and the number of schools for the listed fishes seen in each area covered by 312 stations during the years from 1950 to 1965.

Column Name	Data Type	Field Description
cruiseNo	Varchar(5)	See 1. Station Table
stationNo	Decimal(6,2)	See 1. Station Table
stationType	Varchar(15)	See 1. Station Table
Area	Varchar(50)	See 1. Station Table
milesScouted	Int	The miles scouted during a cruise.
PacificSardine	Int	The number of Pacific Sardine schools seen.
anchovy	Int	The number schools seen includes Northern Anchovy & unidentified anchovies.
mackerel	Int	The number schools seen includes Pacific Mackerel, Jack Mackerel, and unidentified mackerel.
Misc	Int	The number schools seen includes all other identified schools.
unident	Int	The number schools seen includes schools that were not identified.

Table 7. Species Code Table. Contains the species codes used by the Sea Survey Database System, the scientific names, the common names, and the ITIS Taxonomic Serial Number (TSN). Each TSN number/code used is unique, persistent, non–intelligent identifier for a scientific name in the context of the ITIS. There are duplicate ITIS numbers for one Sea Survey species code: sardine or sardine larvae are listed under different Sea Survey Data base speCodes but they have the same ITIS code.

Two sets of species codes were used for the entire survey. Some codes used to represent some species from 1950 – 1965 were used again to represent different species for 1966- 1989. We list both original species codes used in the Data Reports as code50_65 and code66_89.

Column Name	Data Type	Field Description
speCode	Int	A maximum of 5–digit numeric species codes used by the Sea Survey data system throughout the years.
ITIScode	Int	Species code used in the Integrated Taxonomic Information System.
commonName	Varchar(50)	Common name for the species, e.g., Market Squid.
scientificName	Varchar(50)	Scientific name for the species, e.g., Doryteuthis opalescens.
code50_65	Int	5 digit numeric codes used for 1950–1965 in the hard copy Data Reports.
code66_89	Int	A 5 digit numeric codes used from 1966–1989 in the hard copy Data Reports.

Table 8. Species Composition Table. This table contains the field names with their data types and field descriptions. It reports the number of catches in the NoCapture column, or number of schools detected/observed, mostly from acoustic stations, in the NoSchool column.

Column Name	Data Type	Field Description
cruiseNo	Varchar(5)	See Station Table.
stationNo	Decimal(6,2)	See Station Table.
stationType	Varchar(15)	See Station Table.
speCode	Int	Species code used by the Sea Survey Data System.
ITIScode	Int	Unique Taxonomic code used in ITIS system.
commonName	Varchar(50)	Common name for the listed species.
scientificName	Varchar(50)	Scientific name for the listed species.
Activity	Varchar(15)	Species are identified under this activity.
noSchool	Int	Number of schools by count or estimate. Zero entries signify species visually sighted or detected acoustically.
noCapture	Int	Number of fish captured or number of schools (for midwater trawl stations) by actual count or estimates. Zero entries signify species visually sighted or detected acoustically.
methodCapture	Varchar(50)	Gear used to capture animals.
minLen	Int	Minimum actual or estimated size of fish captured.
maxLen	Int	Maximum actual or estimated size of fish captured.
lengthUnit	Varchar(7)	Fish length measurement units.
lengthCollected	Varchar(7)	A ‘Yes’ or ‘No’ indication of whether fish length collected.
ageCollected	Varchar(7)	A ‘Yes’ or ‘No’ indication of whether age data collected.

Table 9. Visual Scouting Data Table. Lists of species found during visual scouting activities over the years after 1966.

Column Name	Data Type	Field Description
cruiseNo	Varchar(5)	See Station Table.
stationNo	Decimal(6,2)	See Station Table.
stationType	Varchar(15)	See Station Table.
speCode	Int	Species code used by the Sea Survey Data System.
ITIScode	Int	Unique Taxonomic code used in ITIS system.
commonName	Varchar(50)	Common name for the listed species.
scientificName	Varchar(50)	Scientific name for the listed species.
noSchool	Int	Number of schools detected acoustically or visually by actual count or estimate. Zero entries signify species visually sighted or detected acoustically.
SchoolTypeSighted	Int	The dominant type of schools sighted. The number code designations are: 0 : Non-schooling species; 1: Surface breeze; 2: Surface flippers; 3: dark spots; 4: Jumpers; 5: Large, compact bioluminescent “fireballs”; 6: Small bioluminescent spots or strings; 7: Light surface scatter.

6. Information Extracted from the Survey Reports/Database.

Table 10. Vessels Participated in the Survey. Five different research vessels/vessel types participated in the survey over the years. Each cruise is given a unique 5-character identifying number which is derived from the last two digits of the year, the initial of the vessel, and the number of the cruise in that year, for example, 86X01, 66A01. The following table lists the initials with their corresponding vessel names along with the years each participated the Sea Survey cruises.

Initial	Vessel Name	Survey Years	Origin of the Vessel and Other Information
Y	Yellowfin	1950–1955	Scripps Institute of Oceanography
P	Paolina T	1953	Scripps Institute of Oceanography
S	Scofield	1956–1958	Department of Fish & Game
A	Alaska	1958–1980	Alaska Fisheries Science Center
X	Chartered	1980–1989	Various chartered vessels

Table 11. Data Types Used in the Database. Four data types have been used to store values in the database. The following table describes the types and the restricted values that they can take.

Data Type	Contained Values
Int	A value that is an integer.
Varchar(5)	A value that can hold up to 5 bytes of any specified number in any combination of characters or numbers. A Varchar (15) data type would hold data values up to 15 bytes in length.
Decimal(6, 2)	A 6–digit numeric value with 2 digits in decimal places (after the decimal point). Therefore, a number will be in the range 0.00 – 9999.99.
Datetimeoffset(7)	A date string in this format: YYYY–MM–DD hh:mm:ss[.nnnnnnn] [{+/−}hh:mm] which can provide fractional seconds precision; however, the finest reported starting and ending time for an activity at a survey station is in minutes. For example, January 9, 1950, at 6:30 pm Pacific Standard Time (PST) is represented as 1950–01–09 18:30:00.0000000 −08:00 where −08:00 is the California Pacific time zone offset from the Greenwich Mean Time (GMT). California's time is 8 hours behind GMT, or GMT−8. This special date field allows users to add or subtract either dates or time intervals from a particular field value. User can also retrieve the value of a particular Datetimeoffset component, such as its year or its month.

Table 12. Overall Cruise Statistics. The Fisheries Resource Sea Survey Project lasted 40 years from 1950 to 1989. The following table presents brief overall statistics.

Statistic	Measurement
Total Number cruises	248 cruises
Total sampling stations.	21,562 stations
Total sampling days excluding traveling time. Cruises 53P02 and 53Y07 overlap 17 days, 88X06 and 88X08 overlapped 3 days, and Cruises 77A04 and 71A05 both sampled on June 2nd 1971.	3,768 days
The longest cruise: 62A01 from Feb 24 – March 27.	31 days
The shortest cruise: 52y02 from Feb 21 – Feb 21.	1 day
Average cruise duration excluding travel.	15 days
Total number of cruises/stations collecting 'Acoustic' data (1966–1989).	83 cruises
Total number of cruises/stations collecting 'Acoustic' data (1966–1989).	6545 stations
Total number of cruises/stations conducting 'Midwater trawl' (1966–1989).	106 cruises
Total number of cruises/stations conducting 'Midwater trawl' (1966–1989).	5710 stations
Number of 'night light' survey cruises/stations (1966–1989).	58 cruises
Number of 'night light' survey cruises/stations (1966–1989).	1285 stations
Total number of taxa identified (1950-1989).	710 taxa
The northernmost latitude surveyed.	49.87° N.
The southernmost latitude surveyed.	22.72° N.
The westernmost location surveyed.	126.89° W.
The easternmost location surveyed.	106.43° W.

Table 13. Abbreviated Individual Cruise Information From 1950 – 1989. Information provided in this table has been extracted from each of the 40 hard copy Data Reports. Station and Sea Day counts are actual working days calculated from the Sea Survey Database excluding the traveling time.

Cruise Number	Total SEA DAY	Total Station	Dates	Area covered	Nature of the survey & Techniques used
50Y01	10	27	Jan 9 – Jan 18	Point Conception Mexican Boundary	Systematic surveys of the sardine population in Calif. & Baja Calif. Scouting through an area, sampling schools seen with dynamite and a few light stations and gill net sets.
50Y02	6	8	Feb 21– Mar 3	Point Conception Mexican Boundary	Systematic surveys of the sardine population in Calif. & Baja Calif. Scouting through an area, sampling schools seen with dynamite and a few light stations and gill net sets.
50Y03	6	10	Mar 14 – Mar 20	Point Conception Mexican Boundary	Systematic surveys of the sardine population in Calif. & Baja Calif. Scouting through an area, sampling schools seen with dynamite and a few light stations and gill net sets.
50Y04	14	42	Apr 4 – Apr 17	Cent. & S. Baja Calif.	To establish sardine distribution in winter and spring. Used a variety of techniques, but with emphasis on gill nets.
50Y05	17	45	May 8 – May 24	Cent. & S. Calif.	To establish sardine distribution in winter and spring. Scouting and using dynamite to obtain samples.
50Y06	11	44	Jun 7 – Jun 18	Cent. & S. Calif. Farther offshore	To establish sardine distribution in winter and spring. Scouting and using dynamite to obtain samples. Collected considerable oceanographic data.
50Y07	17	110	Jul 18 – Aug 3	Between Punta San Juanico, Baja Calif. & Bodega Head. S to N.	To establish distribution & abundance of young sardines. Night scouting, visual observation, by traces on fathometer, attract fish with light and used dynamite.
50Y08	10	47	Aug 15 – Aug 24	Between Punta San Juanico, Baja Calif. & Bodega Head. S to N.	To establish distribution & abundance of young sardines. Night scouting, visual observation, by traces on fathometer, attract fish with light and used dynamite.
50Y09	17	69	Sep 5 – Sep 22	Between Punta San Juanico, Baja Calif. & Bodega Head. S to N.	To establish distribution & abundance of young sardines. Night scouting, locate fish by visual observation, by traces on fathometer, attract fish with light and used dynamite.
50Y10	17	113	Oct 2– Oct 19	Between Punta San Juanico, Baja Calif. & Bodega Head. S to N.	To establish distribution & abundance of young sardines. Night scouting, locate fish by visual observation, by traces on fathometer, attract fish with light and used dynamite.
50Y11	15	51	Nov 8 – Nov 22	S. & Cent. Calif.	Major emphasis was to measure environmental conditions in areas where sardines were found.

Cruise Number	Total SEA DAY	Total Station	Dates	Area covered	Nature of the survey & Techniques used
50Y12	13	54	Dec 2 – Dec 14	S. & Cent. Calif.	Major emphasis was to measure environmental conditions in areas where sardines were found.
51Y01	7	14	Jan 10– Jan 19	S. Calif.	To measure environmental conditions associated with sardine occurrence. Night scout, locate fish by visual obs., by traces on Fathometer, or attract fish with a light. Catch fish by dynamite.
51Y02	13	36	Jan 29 – Feb 10	S. Calif.	To measure environmental conditions associated with sardine occurrence. Night scout, locate fish by visual obs., by traces on Fathometer, or attract fish with a light. Catch fish by dynamite.
51Y03	9	15	Feb 26 – Mar 9	S. Calif.	To measure environmental conditions associated with sardine occurrence. Night scout, locate fish by visual obs., by traces on Fathometer, or attract fish with a light. Catch fish by dynamite.
51Y04	14	35	Mar 28 – Apr 10	Cent. & S. Baja Calif.	To measure environmental conditions associated with sardine occurrence. Night scout, locate fish by visual obs., by traces on Fathometer, or attract fish with a light. Catch fish by dynamite.
51Y05	9	15	May 1 – May 10	Cent. & S. Baja Calif.	To measure environmental conditions associated with sardine occurrence. In addition, to obtain spawning sardines for fecundity studies & to make plankton tows in inshore areas.
51Y07	7	19	Aug 7 – Aug 13	S. Calif.	To measure environmental conditions associated with sardine distribution.
51Y08	20	74	Aug 21 – Sep 11	Punta San Juanico in Baja Cal to Bodega Head Calif.	To assess the distribution & abundance of young sardines. Ship departed from and returned to San Pedro.
51Y09	19	90	Sep 24 – Oct 12	Punta San Juanico in Baja Cal to Bodega Head Calif.	To assess the distribution & abundance of young sardines. Ship departed from and returned to San Pedro.
51Y10	18	86	Oct 20 – Nov 8	Punta San Juanico in Baja Cal to Bodega Head Calif.	To assess the distribution & abundance of young sardines. Ship departed from and returned to San Pedro.
52Y02	1	1	21-Feb	Point Conception – Mexican Boundary	To scout at night, to locate fish by visual obs., by traces on the Fathometer, or attract fish by light. Catch fish by dynamite.
52Y03	17	80	Mar 21 – Apr 6	Cent. & S. Baja Calif.	To compare results with the regular fall survey.
52Y04	9	34	Apr 17 – Apr 25	Cent. & S. Baja Calif.	To compare results with the regular fall survey. Made intensive survey of an area of sardine spawning

Cruise Number	Total SEA DAY	Total Station	Dates	Area covered	Nature of the survey & Techniques used
52Y05	11	31	May 13 – May23	S. Calif.	To obtain sardines and jack mackerel for food habit studies. Captured samples during the day and at night.
52Y07	19	83	Aug 7 – Aug 25	Coast of Magdalena Bay, Baja Cal to Point Reyes, Calif.	To assess the abundance of young sardines resulting from 1952 spawning. Obtained adult sardine and other pelagic species also.
52Y08	16	81	Sep 9 – Sep 23	Coast of Magdalena Bay, Baja Cal to Point Reyes, Calif.	To assess the abundance of young sardines resulting from 1952 spawning. Obtained adult sardine and other pelagic species also.
52Y09	18	85	Oct 10 – Oct 27	Coast of Magdalena Bay, Baja Cal to Point Reyes, Calif.	To assess the abundance of young sardines resulting from 1952 spawning. Obtained adult sardine and other pelagic species also.
52Y10	13	50	Nov 8 – Nov 23	Coast of Magdalena Bay, Baja Cal to Point Reyes, Calif.	To assess the abundance of young sardines resulting from 1952 spawning. Obtained adult sardine and other pelagic species also.
53P01	11	39	Jan 9 – Jan 20	Cent. Baja Calif.	Young fish survey. Used a light to attract fish and dynamite to obtain samples.
53Y03	12	44	Mar 7 – Mar 18	Cent. Baja Calif.	To assess the distribution & abundance of spawning sardines. Used light and dynamic exclusively. Collected few samples by visual scouting.
53Y04	15	50	Apr 4 – Apr 22	S. Calif.	To assess the distribution & abundance of spawning sardines. Used light and dynamic exclusively. Collected few samples by visual scouting
53P02	17	49	Aug 1 – Aug 19	Baja Calif. Punta Eugenia to Punta Abreojos.	Supplement the other surveys to offer more complete coverage than usual including enough time to make stations further off shores at preselected locations.
53P03	19	72	Aug 29 – Sep 16	Baja Calif. Punta Eugenia to Punta Abreojos.	Supplement the other surveys to offer more complete coverage than usual including enough time to make stations further off shores at preselected locations.
53Y07	18	84	Jul 31 – Aug 18	Cent. Baja Calif.	More complete coverage at preselected locations on a grid pattern. Used Dynamite to obtain samples.
53Y08	16	78	Sep 2 – Sept 17	Cent. Baja Calif.	More complete coverage at preselected locations on a grid pattern. Used Dynamite to obtain samples.
53Y09	6	30	Sep 28 – Oct 3	S. Calif.	Explosive seriously injured a biologist and the cruise was cut short; thus, the survey covered only half of S. Calif. as planned.
53Y10	6	17	Oct 27 – Nov 1	Point Concept Mexican Boundary	To test a trap lift net for sampling fish attracted to a light – not practical for use on the open sea, and survey terminated early.

Cruise Number	Total SEA DAY	Total Station	Dates	Area covered	Nature of the survey & Techniques used
53Y11	8	27	Nov 9 – Nov 17	Point Conception to Punta San Juanico.	To test blanket net as a survey tool to sample fish attracted by a light. The results were quite rewarding.
54Y01	10	36	Jan 5 – Jan 15	Cent. Baja Calif.	To develop and test the blanket net to sample fish attracted by light. The net proved to be an excellent tool for sampling fish attracted by light. Yellowtail tagging during the day and gear experimented at night.
54Y02	17	61	Jan 28 – Feb 13	Cent. Baja Calif.	To develop and test the blanket net to sample fish attracted by light. The net proved to be an excellent tool for sampling fish attracted by light. Yellowtail tagging during the day and gear experimented at night.
54Y04	12	44	Mar 27 – Apr 7	Cent. Baja Calif.	To develop and test the blanket net to sample fish attracted by light. The net proved to be an excellent tool for sampling fish attracted by light. Yellowtail tagging during the day and gear experimented at night.
54Y06	13	41	May 30 – Jun 11	Cent. and S. Calif.	Tested blanket net with synthetic webbing (Marion) rather than cotton. It was successful.
54Y07	9	29	Aug 1 – Aug 9	S. Calif.	Survey technique check including a sea scanner (sonar device) to locate fish.
54Y08	13	53	Aug 19 – Aug 31	Magdalena Bay, Baja Calif. to Bodega Head Calif.	Young fish survey. Utilized night light to attract fish and blanket net to obtain samples. Yellowtail tagging during the day.
54Y09	21	105	Sep 16 – Oct 6	Magdalena Bay, Baja Calif. to Bodega Head Calif.	Young fish survey. Utilized night light to attract fish and blanket net to obtain samples. Yellowtail tagging during the day.
54Y10	19	90	Oct 17 – Nov 4	Magdalena Bay, Baja Calif. to Bodega Head Calif.	Young fish survey. Utilized night light to attract fish and blanket net to obtain samples. Yellowtail tagging during the day.
54Y11	16	63	Nov 16 – Dec 5	Magdalena Bay, Baja Calif. to Bodega Head Calif.	Young fish survey. Utilized night light to attract fish and blanket net to obtain samples. Yellowtail tagging during the day. Resurveyed S. Calif. north of San Pedro.
55Y02	13	49	Mar 6 – Mar 21	S. Calif.	Assess the distribution & relative abundance of sardines, anchovies, P. Mackerel & J. Mackerel. Utilized the night light and blanket net as major survey tools.
55Y04	17	56	May 22 – Jun 8	Baja Calif.	Assess the distribution & relative abundance of sardines, anchovies, P. Mackerel & J. Mackerel. Utilized the night light and blanket net as major survey tools.

Cruise Number	Total SEA DAY	Total Station	Dates	Area covered	Nature of the survey & Techniques used
55Y05	15	51	Jul 15 – Jul 29	S. Calif.	Assess the distribution & relative abundance of sardines, anchovies, P. Mackerel & J. Mackerel. Utilized the night light and blanket net as major survey tools.
55Y06	15	77	Aug 11 – Aug 25	Magdalena Bay, Baja Calif. - Bodega Bay, Calif.	Assess the distribution & relative abundance of sardines, anchovies, P. Mackerel & J. Mackerel. Utilized the night light and blanket net as major survey tools.
55Y07	17	80	Sep 8 – Sep 24	Magdalena Bay, Baja Calif. - Bodega Bay, Calif.	Assess the distribution & relative abundance of sardines, anchovies, P. Mackerel & J. Mackerel. Utilized the night light and blanket net as major survey tools.
55Y08	20	135	Oct 5 – Oct 24	Magdalena Bay, Baja Calif. - Bodega Bay, Calif.	Assess the distribution & relative abundance of sardines, anchovies, P. Mackerel & J. Mackerel. Utilized the night light and blanket net as major survey tools.
55Y09	16	69	Nov 3 – Nov 21	Magdalena Bay, Baja Calif. - Bodega Bay, Calif.	Assess the distribution & relative abundance of sardines, anchovies, P. Mackerel & J. Mackerel. Utilized the night light and blanket net as major survey tools.
56S04	15	63	Jul 31 – Aug 14	Baja Calif.	Utilized night light and blanket net as major tools to assess the distribution and relative abundance of sardines, anchovies, P. Mackerel, and J. Mackerel
56S05	17	78	Aug. 27 – Sep. 12	Baja Calif.	Utilized night light and blanket net as major tools to assess the distribution and relative abundance of sardines, anchovies, P. Mackerel, and J. Mackerel
56S06	18	103	Sept 25 – Oct 12	S. Calif.	Utilized night light and blanket net as major tools to assess the distribution and relative abundance of sardines, anchovies, P. Mackerel, and J. Mackerel
56S07	14	74	Oct 25 – Nov 11	S. Calif.	Special effort to catch rockfish for taxonomic studies during daytime anchorages on this cruise.
56S08	15	73	Nov 25 – Dec 10	Cent. Calif. & parts of S. Calif.	Special effort to catch rockfish for taxonomic studies during daytime anchorages on this cruise.
57S03	13	54	Sep 20 – Oct 2	S. & Cent. Baja Calif.	Sardine were scattered. Poor weather, flighty fish, and a curtailed coverage limited collections to a comparatively few samples.
57S04	17	75	Oct 16 – Nov 2	N. Baja Calif. & all of S. Calif.	Sardine were scattered. Poor weather, flighty fish, and a curtailed coverage limited collections to a comparatively few samples.
57S05	8	31	Nov 16 – Nov 23	Cent. Calif.	Purchased live sardines from a purse seiner for transport to S. F. Limited attempts to use a lampara net to sample fish schools spotted from air. Results were poor.
58S01	14	57	Feb 12 – Feb 25	Baja Calif.	Spawning survey. Made plankton tows to locate and sample adult population during spawning season. Collected live sardines & blood serum for genetic studies. Used various colors of light.

Cruise Number	Total SEA DAY	Total Station	Dates	Area covered	Nature of the survey & Techniques used
58S02	16	62	Mar 12 – Mar 28	S. Calif.	To catch fish where fish were located visually or detected with an echo sounder. Used plankton tows to locate spawning areas. Used light stations in areas of known concentrations and at random location.
58A01	18	73	Apr 12 – Apr 30	S. Calif. Cent. Baja Calif.	To catch fish where fish were located visually or detected with an echo sounder. Used plankton tows to locate spawning areas. Used light stations in areas of known concentrations and at random location. To sample the summer stock of sardines in and around Sabastian Vizcaino Bay. Used sardine for racial studies.
58A02	17	76	May 12 – May 28	S. Calif. Cent. Baja Calif.	To catch fish where fish were located visually or detected with an echo sounder. Used plankton tows to locate spawning areas. Used light stations in areas of known concentrations and at random location
58A04	13	54	C	Cent. Baja Calif.	Young fish survey. To sample the summer spawning stock of sardines in and around Sebastian Vizcaino Bay. Obtain sardines for racial studies.
58A05	16	71	Sept 5 – Sept 20	Cent. Baja Calif.	Young fish survey. To sample the summer spawning stock of sardines in and around Sebastian Vizcaino Bay. Obtained sardines for racial studies. Experiments with different number of lights were conducted. To test improved blanket net.
59A01	14	62	Jan 29 – Feb 12	Ballenas Bay, Baja Calif. – Point Reyes, Cent. Calif.	To sample spring spawning sardines throughout their range and to sample young sardines from the previous fall's spawning. Used four 750 and one 1500-watt lamp. Tagged barracuda and kept them alive for obs. in the bait wells.
59A02	17	86	Mar 1 – Mar 17	Ballenas Bay, Baja Calif. – Point Reyes, Cent. Calif.	To sample spring spawning sardines throughout their range and to sample young sardines from the previous fall's spawning. Used three 750 watt and one 1500 watt lamp. Tagged barracuda and kept them alive for obs. in the bait wells.
59A03	17	82	Mar31 – Apr 16	Santa Barbara to Mexican border.	To sample spring spawning sardines throughout their range and to sample young sardines from the previous fall's spawning. Used four 750 and one 1500-watt lamp.
59A04	19	88	Apr 28 – May 18	Santa Barbara to Mexican border. San Francisco to Point Conception.	To sample spring spawning sardines throughout their range and to sample young sardines from the previous fall's spawning.
59A05	15	49	May 29 – Jun 14	Santa Barbara to Mexican border.	Sardines were wild and hard to sample. Rough weather also made sampling difficult at times. Some samples had to be collected with hook and line when the fish remained deep. Anchovy schools were abundant.
59A06	15	76	Jul 27– Aug 10	Ballenas Bay, Baja Calif. – Point Reyes, Cent. Calif.	To sample young sardines from the 1959 spring spawning. To assess the distribution and relative abundance of sardines, anchovies, Pacific Mackerel, and

Cruise Number	Total SEA DAY	Total Station	Dates	Area covered	Nature of the survey & Techniques used
					Jack Mackerel and to collect live sardines for genetic studies.
59A07	17	71	Aug 24 – Sep 9	Ballenas Bay, Baja Calif. – Point Reyes, Cent. Calif.	To sample young sardines from the 1959 spring spawning. To assess the distribution and relative abundance of sardines, anchovies, Pacific Mackerel, and Jack Mackerel and to collect live sardines for genetic studies. The survey area were abundant with young sardines. Several light stations were made in this area to obtain samples.
59A08	18	114	Sept 22 – Oct 9	Ballenas Bay, Baja Calif. – Point Reyes, Cent. Calif.	To sample young sardines from the 1959 spring spawning. Collected many samples. Light stations made close to commercial vessels setting on sardines, failed to attract fish on this cruise. Pacific Mackerel were particularly abundant.
59A09	15	83	Oct 25 – Nov 8	Ballenas Bay, Baja Calif. – Point Reyes, Cent. Calif.	To sample young sardines from the 1959 spring spawning. Unusual good weather allowed a thorough coverage in this area.
60A02	12	48	Feb 19 – Mar 3	Todos Santos Bay, Cape Colnett-Punta Baja, Blanca Bay, East Cedros Island, Santa Narua Bat-Magdalena Bay area.	To collect sardines for racial and fecundity studies. Light stations were made in these areas to obtain samples.
60A03	16	66	Mar 19 – Apr 4	Playa Maria Bay to San Diego.	Collected sardines for racial studies; conducted new gear experiments.
60A04	16	63	Apr 17 – May 2	Los Angeles – Long Beach Harbor and Santa Catalina Island.	Stayed at a station for several hours to test the effectiveness of several types of lights and to experiment with new methods of setting sampling nets.
60A05	19	47	May 16– Jun 3	Los Angeles – Long Beach Harbor and Santa Catalina Island.	Stayed at a station for several hours to test the effectiveness of several types of lights and to experiment with new methods of setting sampling nets.
60A06	14	67	Jul 16 – Jul 29	Magdalena Bay and Point Reyes, not in normal order. S. Baja Calif.	To survey the sardine population in order to measure recruitment and population density. To sample P. Mackerel, Jack Mackerel and anchovies for age and distribution studies. Used standard light stations with blanket net sets. Serological tests showed the sardines were from the “southern” stock.
60A07	18	78	Aug 13 – Aug 30	N. Baja Calif. and parts of S. Calif.	To survey the sardine population in order to measure recruitment and population density. To sample P. Mackerel, jack Mackerel and anchovies for age was conducted using standard light station with blanket net sets. S. stock sardines were caught. Found N. sardine

Cruise Number	Total SEA DAY	Total Station	Dates	Area covered	Nature of the survey & Techniques used
					stock in a resting stage, near Santa Cruz Island. Fish from S. stock,near spawning were found in LA bay
60A08	17	84	Sep 11 – Sep 27	Cent. Baja Calif. Coronado Island to Point Dume.	Joined in a special ecological study of Sebastian Vizcaino Bay. "Southern" sardines were taken at a couple of stations.
60A09	20	119	Oct 8 – Oct 27	All S. Calif. Coronado Island to Point Dume.	To survey the sardine population; both "northern" and "southern" stocks were found.
60A10	17	94	Nov 7 – Nov 23	Point Reyes.	To survey the sardine population but no sardines were found.
61A02	18	82	Mar 7 – Mar 24	Cent. Baja Calif., near Punta Eugenia to Santa Barbara, Calif.	To sample the sardine spawning population. Utilized light stations and blanket net as the primary survey tools. To locate the transition area of N. and S. stock. No sardines were taken.
61A03	17	79	Apr 7 – Apr 23	Cent. Baja Calif., near Punta Eugenia to Santa Barbara, Calif.	Utilized light stations and blanket net as the primary survey tool. Southern varieties of kelp from near Punta Eugenia were transported to southern Calif. for experimental planting. Used a 500–watt underwater light in conjunction with regular light, detected no significant difference for its effectiveness.
61A05	23	111	Jul 27 – Aug 18	Magdalena Bay, Baja Calif.– Point Reyes, Calif.	Utilized light stations and blanket net as the primary survey tool. To determine the relationship of sardines in the Gulf to those along the outer coast of Baja Calif. Sardine sample turned out to be from a previously unknown "Gulf" stock, genetically distinct from the 'Northern" and "southern" stocks. (Vrooman, 1964). Sardines scarce and anchovies abundant.
61A06	12	62	Sep 3 – Sep 14	Magdalena Bay, Baja Calif.– Point Reyes, Calif.	To assess the recruitment of population density of the sardine population and to sample P. Mackerel, Jack Mackerel, and anchovies for size and distribution studies. Use a deep-water trap at 2 stations. Sardines scarce and anchovies abundant.
61A07	17	91	Oct 4 – Oct 20	Magdalena Bay, Baja Calif.– Point Reyes, Calif.	To assess the recruitment of population density of the sardine population and to sample P. Mackerel, Jack Mackerel, and anchovies for size and distribution studies. Used a beach seine at a station. Sardines scarce and anchovies abundant
61A08	19	109	Oct 30 – Nov 17	S. Calif. and Cent. Calif.	To assess the recruitment of population density of the sardine population and to sample P. Mackerel, Jack Mackerel, and anchovies for size and distribution studies. Sardines were very scarce and anchovies somewhat more abundant than in 1960.

Cruise Number	Total SEA DAY	Total Station	Dates	Area covered	Nature of the survey & Techniques used
61A09	15	62	Nov 29 – Dec 14	S. Calif. and Cent. Calif.	To assess the recruitment of population density of the sardine population and to sample P. Mackerel, Jack Mackerel, and anchovies for size and distribution studies. Sardines were scarce for this cruise.
62A01	28	127	Feb 24 – Mar 27	Gulf of Calif.	To collect Pacific Sardines for racial studies and to determine the abundance and distribution of this and other pelagic species in the Gulf of Calif.
62A03	18	43	Jul 21 – Aug 13	Vancouver Island to Cent. Calif.	To locate & sample possible remnants of the P. Sardine population that formerly migrated into the Pacific northwest during summer. No sardines observed.
62A04	15	39	Aug 23 – Sep 6	S. Calif.	To test a large midwater trawl as a sampling device for future Sea Surveys. This net showed considerable promise as a sampling tool.
62A05	16	70	Sep 20 – Oct 5	Cent. Baja Calif.	Regular fall young fish surveys using the night light and blanket net. The large mid–water trawl was used as a secondary sampling device. It was proved highly effective for catching anchovies.
62A06	17	95	Oct 21 – Nov 6	N. Baja Calif.	Regular fall young fish surveys using the night light and blanket net. The large mid–water trawl was used as a secondary sampling device. It was proved highly effective for catching anchovies. Used extensively the midwater trawl and resulted in a large variety of species. A few night–light stations.
62A07	16	83	Nov 21 – Dec 6	S. Calif.	Regular fall young fish surveys using the night light and blanket net. The large mid–water trawl was used as a secondary sampling device. It was proved highly effective for catching anchovies.
63A03	18	64	May 13 – May 31	N. Calif.	The midwater trawl was used extensively and resulted in a large variety of species. A few night light stations were occupied in Monterey Bay in an unsuccessful attempt to sample Pacific Sardines.
63A04	17	65	Jun 14 – Jul 1	Cent. Calif.	Lost the midwater trawl early in the cruise, reverted to blanket net method.
63A05	16	69	Aug 9 – Aug 24	S. Baja Calif.	Used extensively the midwater trawl. Bad weather reduced survey coverage to S. Baja Calif.
63A06	16	57	Sep 8 – Sep 23	Cent. Baja Calif.	Used midwater trawl and it proved its superiority over the night light and blanket net as a survey tool.
63A07	12	56	Oct 8 – Oct 20	N. Baja Calif.	Used midwater trawl and it proved its superiority over the night light and blanket net as a survey tool. General survey of the pelagic environment. Large midwater trawl was the principal sampling device supplemented by the night light and blanket net.
63A08	18	77	Nov 4 – Nov 21	S. Calif.	Used midwater trawl and it proved its superiority over the night light and blanket net as a survey tool.

Cruise Number	Total SEA DAY	Total Station	Dates	Area covered	Nature of the survey & Techniques used
64A03	15	48	May 9 – May 23	N. and Cent. Calif.	General survey of the pelagic environment. Large midwater trawl was the principal sampling device supplemented by the night light and blanket net.
64A04	16	57	Jun 2 – Jun 21	S. Calif.	General survey of the pelagic environment. Large midwater trawl was the principal sampling device supplemented by the night light and blanket net
64A05	17	66	Jul 30 – Aug 15	S. Baja Calif.	General survey of the pelagic environment. Large midwater trawl was the principal sampling device supplemented by the night light and blanket net
64A06	17	66	Aug 29 – Sep 14	Cent. Baja Calif.	General survey of the pelagic environment. Large midwater trawl was the principal sampling device supplemented by the night light and blanket net
64A07	17	72	Sep 27 – Oct 13	N. Baja Calif.	General survey of the pelagic environment. Large midwater trawl was the principal sampling device supplemented by the night light and blanket net
64A08	18	93	Oct 26 – Nov 15	S. Calif.	General survey of the pelagic environment. Large midwater trawl was the principal sampling device supplemented by the night light and blanket net
64A09	15	65	Nov 29 – Dec 14	Cent. Calif.	General survey of the pelagic environment. Large midwater trawl was the principal sampling device supplemented by the night light and blanket net
65A02	4	5	Apr 4 – Apr 8	S. Calif.	A short gear experiment cruise. Various net spreading devices were tried in an attempt to get an optimum mouth opening of the midwater trawl used for surveys. A new depth telemetering system was tested for determining trawl-fishing depths.
65A03	10	21	Apr 21 – May 2	S. Calif.	To explore a new survey method with acoustic gear. Made a transect survey using an echo sounder to detect and count schools. Found it to be excellent possibilities for surveying anchovies.
65A06	13	53	Jul 24 – Aug 5	S. Baja Calif.	Regular fall survey. The midwater trawl was the principal sampling gear with the night light & blanket net supplementing it.
65A07	13	40	Aug 19 – Sep 1	Cent. Baja Calif.	Regular fall survey. The midwater trawl was the principal sampling gear with the night light & blanket net supplementing it.
65A08	17	82	Sep 17 – Oct 3	N. Baja Calif.	Regular fall survey. The midwater trawl was the principal sampling gear supplemented with the night light & blanket net.
65A09	18	86	Oct 14 – Nov 2	S. Calif.	Regular fall survey. The midwater trawl was the principal sampling gear supplemented with the night light & blanket net

Cruise Number	Total SEA DAY	Total Station	Dates	Area covered	Nature of the survey & Techniques used
65A10	10	50	Nov. 20 – Dec 1	Cent. Calif.	Regular fall survey. The midwater trawl was the principal sampling gear with the night light & blanket net supplementing it.

Note: The surveys initiated in 1950 were terminated at the end of 1965. A new expanded survey funded by the Federal Aid replaced them in 1966. The scope and methodology of these later cruises changed completely. These surveys, titled Fisheries Resources Sea Surveys, are accomplished by a line transect method using echo sounder or sonar to detect and count fish schools. Identification was made by midwater trawling, echogram characteristics, and visual sightings. This project was directed toward determining the total pelagic fisheries resources available in the California Current System, their abundance, distribution, and potential yield.

Cruise Number	Total- Sea Day Count	Midwater- Sea Day Count	Acoustic- Sea Day Count	Nightlight- Sea Day Count	Total- Station Count	Midwater- Station Count	Acoustic- Station Count	Nightlight- Station Count	Dates	Area Covered	Nature of the survey
66A01	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	Apr 19 – May 4	S. Calif.	To sample spawning hake but none was seen
66A03	15	8	0	7	34	18	0	12	Apr 19 – May 4	S. Calif.	Gear exp. & anchovy tagging.
66A05	17	6	17	0	198	11	187	0	Jun 8 – Jun 28	N. Baja Calif. – S. Calif.	Echo sounder-transect surveys.
66A06	14	7	14	0	141	13	127	0	Jul 13 – Jul 26	Cent. and S. Calif.	Echo sounder-transect surveys.
66A07	15	13	11	10	145	47	70	28	Sep 4 – Sep 19	S. & Cent. Baja Calif.	Echo sounder-transect surveys.
66A08	17	15	17	0	168	50	118	0	Oct 3 – Oct 22	N. Baja Calif. – S. Calif.	Echo sounder-transect surveys.
66A09	16	14	14	0	136	48	87	0	Nov 3 – Nov 22	Cent. Calif.	Echo sounder-transect surveys.
67A01	7	2	7	0	49	2	47	0	Mar 5 – Mar 20	Cent. Calif.	Acoustic & midwater trawl survey.
67A02	18	14	17	0	157	39	117	0	Apr 1 – 20	S. Calif.	Acoustic & midwater trawl survey.
67A03	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	May 1 - May 14	S. Calif.	An experimental cruise during which a variety of gear evaluations and measurements were performed
67A04	15	8	15	0	150	23	127	0	May 22 – Jun 9	N. Baja. Calif., S. Calif.	Acoustic & midwater trawl survey.
67A05	13	8	11	0	84	16	68	0	Jun 21 – Jul 8	Cent. Calif.	Acoustic & midwater trawl survey.
67A06	14	11	10	0	90	29	60	0	Aug 25 – Sep 13	Northern Calif.	Acoustic & midwater trawl survey.
67A07	16	13	14	0	120	34	86	0	Sep 21 – Oct 13	Cent. Calif.	Acoustic & midwater trawl survey.
67A08	17	16	16	0	137	43	94	0	Oct 2 – Nov 12	N. Baja Calif. – S. Calif.	Acoustic & midwater trawl survey.
67A09	12	12	11	7	112	44	53	13	Nov 20 – Dec 9	S. and Cent. Baja Calif.	Acoustic & midwater trawl survey.
68A01	17	11	16	0	142	27	115	0	Jan 18 – Feb 6	S. Calif.	Routine acoustic and midwater trawl surveys. Northern Anchovies were the principal species studied.
68A02	16	9	14	0	99	27	70	0	Feb 18 – Mar 8	Cent. Calif.	Routine acoustic and midwater trawl surveys. Northern Anchovies were the principal species studied.
68A03	14	12	13	0	148	37	111	0	Mar 19 – Apr 7	S. & Cent. Baja Calif.	Routine acoustic and midwater trawl surveys. Northern Anchovies were the principal species studied.
68A04	19	17	16	0	228	71	157	0	Apr 18 – May 7	N. Baja Calif. – S. Calif.	Routine acoustic and midwater trawl surveys. Northern Anchovies were the principal species studied.
68A05	9	2	9	0	57	4	53	0	May 30 – Jun 9	Cent. Calif.	Routine acoustic and midwater trawl surveys. Northern Anchovies were the principal species studied.
68A06	16	11	8	0	114	24	90	0	Jun 16 – Jul 3	S. Calif.	Routine acoustic and midwater trawl surveys. Northern Anchovies were the principal species studied.
68A07	18	7	18	0	157	10	147	0	Aug 3 – Aug 27	N. & Cent. Calif.	Routine acoustic and midwater trawl surveys. Northern Anchovies were the principal species studied.
68A08	27	22	25	2	216	67	142	3	Sep 12 – Oct 11	N. Baja Calif. – S. Calif.	Routine acoustic and midwater trawl surveys. Northern Anchovies were the principal species studied.
68A09	21	11	20	0	173	21	152	0	Nov 1 – Nov 25	N. Baja Calif. – S. Calif.	Routine acoustic and midwater trawl surveys. Northern Anchovies were the principal species studied.
68A10	13	4	10	0	43	4	32	0	Dec 5 – Dec 19	S. Calif.	Experimental nature. Midwater trawl configuration, anchovy schooling behavior, and Jack Mackerel concentration studies.
69A01	22	16	19	2	162	44	116	2	Jan 9 – Feb 7	S. & Cent. Baja Calif.	Acoustic & midwater trawl survey.
69A04	1	See Note 69A04 below	See Note 69A04 below	See Note 69A04 below	See Note 69A04 below	See Note 69A04 below	See Note 69A04 below	See Note 69A04 below	18-Feb-69	Santa Barbara Channel.	Brief special purpose cruise.
69A05	3	See Note 69A05 below	See Note 69A05 below	See Note 69A05 below	See Note 69A05 below	See Note 69A05 below	See Note 69A05 below	See Note 69A05 below	Apr 30 – May 3	S. Calif.	To determine anchovy school sizes from sonar and echo sounder.
69A06	24	19	24	0	173	64	109	0	May 12 – Jun 10	S. Calif.	Acoustic & midwater trawl survey.
69A07	13	2	13	0	43	4	39	0	Jun 20 – Jul 8	Cent. Calif.	Acoustic & midwater trawl survey.
69A08	23	20	19	3	108	59	43	6	Aug 5 – Sep 1	N. Baja Calif. – S. Calif.	Acoustic & midwater trawl survey.
69A09	11	8	9	1	61	23	37	1	Sep 16 – Oct 1	C. Calif.	Acoustic & midwater trawl survey.
69A10	13	8	12	1	107	31	74	2	Oct 8 – Oct 27	C. Calif.	Acoustic & midwater trawl survey.
69A11	25	19	23	0	144	58	85	0	Nov 10 – Dec 8	C. Calif.	Acoustic & midwater trawl survey.
70A01	25	17	24	0	126	49	73	0	Jan 22 – Feb 18	N. Baja Calif, S. Calif.	Anchovy survey.

Cruise Number	Total- Sea Day Count	Midwater- Sea Day Count	Acoustic- Sea Day Count	Nightlight- Sea Day Count	Total- Station Count	Midwater- Station Count	Acoustic- Station Count	Nightlight- Station Count	Dates	Area Covered	Nature of the survey
70A02	2	2	1	0	15	6	9	0	18-Feb-70	Santa Barbara Channel.	Oil spill survey.
70A03	23	18	21	0	123	54	67	0	Apr 1 – Apr 30	S. & Cent. Baja Calif.	Anchovy survey.
70A04	22	19	22	1	145	49	91	1	May 22 – Jun 14	N. Baja Calif. & S. Calif.	Anchovy survey.
70A05	8	0	0	7	29	0	0	24	Aug 10 – Aug 19	N. Baja Calif. & S. Calif.	Saury-Jack Mackerel survey.
70A06	17	0	0	17	72	0	0	69	Aug 26 – Sep 4; Sept. 8–17	C. Baja Calif. & S. Calif.	Sardine & P. Mackerel survey.
70A07	22	18	20	1	134	47	69	1	Sep 28 – Oct 22	C. Baja Calif. & S. Calif.	Anchovy survey.
70A08	16	1	9	9	88	1	42	33	Nov 9 – Nov 29	C. Calif. & S. Calif.	Saury survey & anchovy behavior.
71A01	17	15	15	0	133	56	76	0	Feb 1 – Feb 19	S. Calif.	Sardine & Pacific Mackerel survey.
71A02	8	5	2	0	18	7	6	0	Mar 8 – Mar 18	S. Calif.	Anchovy survey.
71A03	19	13	17	1	115	37	68	2	May 18 – Jun 30	N. & S. Baja Calif.	Anchovy school behavior & size estimation.
71A04	17	13	15	0	96	37	59	0	May 18 – Jun 6	S. & Cent. Baja Calif.	Saury & squid exploration.
71A05	11	9	10	6	77	20	36	6	Jun 17 – Jun 30	S. & Cent. Baja Calif.	Anchovy survey.
71A06	18	0	0	18	96	0	0	92	Aug 12 – Aug 31	C. Baja Calif. – S. Calif.	Sardine and P. Mackerel survey.
71A07	14	13	12	5	102	36	61	5	Sep 13 – Sep 28	S. Calif.	Anchovy survey.
71A09	8	8	6	0	47	19	28	0	Nov 14 – Nov 19 Nov 21 – Nov 24	S. Calif.	Anchovy school behavior & school size estimation.
71A10	14	0	0	14	66	0	0	63	Dec 6 – Dec 21	C. and S. Calif.	Saury and Squid exploration.
72A01	Data not in the Report.	Data not in the Report.	Data not in the Report.	Data not in the Report.	Data not in the Report.	Data not in the Report.	Data not in the Report.	Data not in the Report.	Feb 7 – Feb 27	S. Calif. & N. Baja Calif.	Egg and larvae survey.
72A02	Data not in the Report.	Data not in the Report.	Data not in the Report.	Data not in the Report.	Data not in the Report.	Data not in the Report.	Data not in the Report.	Data not in the Report.	Mar 18 – Mar 24	S. Calif.	Data are not contained in the Data
72A03	21	12	20	7	133	30	96	7	Apr 5 – Apr 28	N. Baja Calif. – S. Calif.	Anchovy survey.
72A04	11	0	2	11	39	0	3	36	May 8 – May 19	S. Calif.	Saury exploration.
72A05	14	4	13	2	87	11	74	2	Jun 5 – Jun 23	C. Calif.	Anchovy survey.
72A06	Data not in the Report.	Data not in the Report.	Data not in the Report.	Data not in the Report.	Data not in the Report.	Data not in the Report.	Data not in the Report.	Data not in the Report.	Jul 5 – Jul 19	C. and S. Calif.	Egg and larvae survey.
72A07	17	7	14	15	122	13	61	48	Aug 25 – Sep 14	N. and Cent. Calif.	Hake, saury, squid exploration.
72A08	16	4	3	13	95	18	5	72	Sep 25 – Oct 13	S. Calif & C. Baja Calif.	Sardine, P. Mackerel survey.
72A09	16	12	16	0	121	28	93	0	Oct 30 – Nov 21	S. Calif. & N. Baja Calif.	Anchovy survey.
73A01	See Note 73A01 below.	See Note 73A01 below.	See Note 73A01 below.	See Note 73A01 below.	See Note 73A01 below.	See Note 73A01 below.	See Note 73A01 below.	See Note 73A01 below.	Jan 29 – Feb 9	S. Calif. & N. Baja Calif.	Experimental acoustic survey.
73A02	19	14	17	3	132	33	95	4	Feb 20 – Mar 14	N. Baja Calif.; S. Calif.	Anchovy acoustic survey.
73A03	17	11	16	3	125	23	95	7	Apr 23 – May 15	N. Baja Calif.; S. Calif.	Anchovy acoustic survey.
73A04	15	10	2	1	102	29	15	2	May 22 – Jun 8	C. Calif. & S. Calif.	Squid survey. Mackerel tagging.
73A05	8	4	8	4	67	6	55	6	Jun 18 – Jul 2	C. Calif.	Anchovy acoustic survey.
73A06	17	0	12	14	83	0	57	26	Aug 10 – Aug 31	N. Baja Calif.; S. Calif.	Anchovy acoustic survey. P. mackerel tagging.
73A08	20	14	20	3	149	49	96	3	Oct 02 – Oct 25	N. Baja Calif.; S. Calif.	Anchovy acoustic survey.
73A09	14	0	0	14	61	0	0	61	Nov 14 – Dec 1	S. Calif.	Sardine-mackerel survey.
73A10	5	See Note 73A10 below	See Note 73A10 below	See Note 73A10 below	See Note 73A10 below	See Note 73A10 below	See Note 73A10 below	See Note 73A10 below	Dec 10–14, Dec 17 – 19	S. Calif.	Experimental acoustic survey.
74A01	9	See Note 74A01 below	See Note 74A01 below	See Note 74A01 below	See Note 74A01 below	See Note 74A01 below	See Note 74A01 below	See Note 74A01 below	Feb 13 – Feb 22	S. Calif.	Experimental acoustics.

Cruise Number	Total- Sea Day Count	Midwater- Sea Day Count	Acoustic- Sea Day Count	Nightlight- Sea Day Count	Total- Station Count	Midwater- Station Count	Acoustic- Station Count	Nightlight- Station Count	Dates	Area Covered	Nature of the survey
74A02	5	See Note 74A02 below	See Note 74A02 below	See Note 74A02 below	See Note 74A02 below	See Note 74A02 below	See Note 74A02 below	See Note 74A02 below	Mar 4 – Mar 9	S. Calif. & Baja Calif.	Mackerel tagging.
74A03	21	16	20	3	145	39	97	6	Apr 15 – May 8	N. Baja Calif. – S. Calif.	Anchovy acoustic survey.
74A04	4	See Note 74A04 below	See Note 74A04 below	See Note 74A04 below	See Note 74A04 below	See Note 74A04 below	See Note 74A04 below	See Note 74A04 below	May 20– May 24	S. Calif.	Mackerel tagging.
74A05	20	12	0	20	93	19	0	66	Jun 5 – Jun 25	S. Calif. & Cent Calif.	Squid survey.
74A06	16	See Note 74A06 below	See Note 74A06 below	See Note 74A06 below	See Note 74A06 below	See Note 74A06 below	See Note 74A06 below	See Note 74A06 below	May 20– May 24	S. Calif. & Baja Calif.	Mackerel tagging.
74A07	10	See Note 74A07 below	See Note 74A07 below	See Note 74A07 below	See Note 74A07 below	See Note 74A07 below	See Note 74A07 below	See Note 74A07 below	May 20–May 24	S. Calif.	Mackerel tagging.
74A08	18	0	0	17	89	0	0	85	Oct 7 – Oct 25	Cent. – S. Calif.	Sardine-mackerel survey.
74A09	21	13	21	3	157	41	105	10	Nov 4 – Nov 27	S. Calif.; N. Baja Calif.	Anchovy acoustic survey.
75A01	20	14	19	1	173	44	128	1	Feb 3 – Feb 27	N. Baja Calif. – S. Calif.; N., Cent., and S. Calif.	Anchovy acoustic survey; Sardine–mackerel survey.
75A02	13	9	12	1	72	20	50	2	Apr 7 – May 1	Cent. – S. Calif.	Anchovy acoustic survey.
75A03	22	17	3	18	93	28	19	43	May 23 – Jun 25	N. Baja Calif. – S. Calif.	Anchovy and squid survey.
75A04	17	0	0	15	44	0	0	36	Aug 4 –Aug 22	S. Calif. – Baja Calif.	Pacific Mackerel tagging.
75A05	9	9	7	0	80	29	51	0	Sep 3 – Sep 15	N. Baja Calif	Anchovy acoustic survey.
75A06	16	15	15	5	152	41	106	5	Sep 25 –Oct 13	S. Calif.	Anchovy acoustic survey.
75A07	18	0	0	18	86	0	0	86	Oct 23 –Nov 12	S. Calif. – N. Baja Calif.	Sardine-mackerel survey.
75A08	7	See Note 75A08 below	See Note 75A08 below	See Note 75A08 below	See Note 75A08 below	See Note 75A08 below	See Note 75A08 below	See Note 75A08 below	Dec 1 – Dec 5; Dec 9 – Dec 12	S. Calif.	Experimental –acoustics.
76A01	10	No data reported.	No data reported.	No data reported.	No data reported.	No data reported.	No data reported.	No data reported.	Mar 1 – Mar 5, Mar 8 – Mar 12	S. Calif.	Acoustic calibration.
76A03	14	13	14	0	139	46	93	0	Apr 20 – May 7	N. Baja Calif. – S. Calif.	Anchovy acoustic survey.
76A4A	24	15	0	0	95	38	0	0	May 28–Jun 20	S. Calif.	Anchovy young fish survey.
76A4B	8	8	0	0	54	54	0	0	Jun 20 – Jun 29	S. Calif.	Anchovy young fish survey.
76A07	11	11	0	0	72	72	0	0	Sep 14 – Oct 2	N. Baja Calif. – S. Calif.	Anchovy young fish survey.
76A08	9	8	9	0	75	32	43	0	Oct 14 – Oct 25	N. Baja Calif.	Anchovy acoustic survey.
76A09	17	14	15	0	164	70	94	0	Nov 5 –Nov 23	S. Calif.	Anchovy acoustic survey.
76A11	4	See Note 76A11 below	See Note 76A11 below	See Note 76A11 below	See Note 76A11 below	See Note 76A11 below	See Note 76A11 below	See Note 76A11 below	Dec 5 – Dec 9	S. Calif.	Acoustic calibration.
77A01	8	6	8	0	71	18	53	0	Jan 13 – Jan 24	N. Baja Calif.	Anchovy acoustic survey.
77A03	17	15	16	1	158	55	102	1	Feb 10– Mar 03	S. Calif.	Anchovy acoustic survey.
77A04	9	0	9	0	54	0	54	0	Mar 16–Mar 26	S. Calif.	Anchovy acoustic survey.
77A06	10	8	10	0	85	28	57	0	Apr 14– Apr 25	N. Baja Calif.	Anchovy acoustic survey.
77A09	9	9	8	0	87	22	65	0	Jun 20 – Jun 29	Cent. Calif.	Anchovy acoustic survey.
77A12	10	10	10	0	98	37	61	0	Oct 5 – Oct 17	N. Baja Calif.	Anchovy acoustic survey.
77A13	16	14	16	0	158	63	95	0	Oct 31 –Nov 17	S. Calif.	Anchovy acoustic survey.
77A14	18	See Note 77A14 below	See Note 77A14 below	See Note 77A14 below	See Note 77A14 below	See Note 77A14 below	See Note 77A14 below	See Note 77A14 below	Nov 14 – Dec 2	S. Calif.	Acoustic calibration.
78A02	10	10	10	0	96	39	57	0	Jan 26 – Feb 7	N. Baja Calif.	Anchovy acoustic survey.
78A03	13	13	13	0	156	63	93	0	Feb 13 –Feb 28	S. Calif.	Anchovy acoustic survey.
78A06	7	7	7	0	75	13	62	0	May 30 – Jun 8	Cent. Calif.	Anchovy acoustic survey.
79A01	21	15	21	0	175	60	115	0	Jan 24 – Feb 21	N. Baja Calif. – S. Calif	Anchovy acoustic survey.
79A02	14	14	0	0	68	68	0	0	Apr 1 – Apr 14	S. Calif.	Spawning anchovy trawl survey.
79A11	17	17	0	0	134	134	0	0	Nov 1 –Nov 20	N. Baja Calif. – S. Calif	Anchovy recruitment trawl survey.
80A01	19	18	17	0	180	81	99	0	Jan 30 – Feb 22	N. Baja Calif. – S. Calif	Anchovy acoustic survey.
80X08	18	17	1	0	111	106	2	0	Sep 2 – Sep 21	S. Calif.	Mackerel recruitment survey.

Cruise Number	Total- Sea Day Count	Midwater- Sea Day Count	Acoustic- Sea Day Count	Nightlight- Sea Day Count	Total- Station Count	Midwater- Station Count	Acoustic- Station Count	Nightlight- Station Count	Dates	Area Covered	Nature of the survey
80X14	18	18	0	0	147	147	0	0	Oct 22 –Nov 11	N. Baja Calif. – S. Calif	Anchovy recruitment survey.
81X01	25	24	23	0	225	108	117	0	Feb 4 – Mar 9	N. Baja Calif. – S. Calif	Anchovy acoustic survey.
81X02	19	19	0	0	118	118	0	0	Mar 30–Apr 19	N. Baja Calif. – S. Calif	Anchovy spawn survey.
81X04	18	18	0	3	137	134	0	3	Oct 16 – Nov 4	N. Baja Calif. – S. Calif	Anchovy recruitment survey.
81X05	18	18	0	1	120	119	0	1	Nov 19 – Dec 8	S. Calif	Mackerel recruitment survey.
82X01	28	25	27	1	290	149	140	1	Feb 1– 18; Feb 22–Mar 9	N. Baja Calif. – S. Calif	Anchovy acoustic survey.
82X03	19	19	0	0	101	101	0	0	Aug 4 –Aug 23	S. Calif	Mackerel recruitment survey.
82X04	18	18	0	0	153	153	0	0	Oct 4 – Oct 23	S. Calif.	Anchovy recruitment.
83X01	25	16	22	6	210	85	91	34	Feb 4 – Mar 8	N. Baja Calif. – S. Calif.	Anchovy acoustic survey.
83X07	18	18	0	1	136	135	0	1	Sep 23 –Oct 12	N. Baja Calif. – S. Calif.	Anchovy recruitment survey.
83X08	18	17	0	6	105	99	0	6	Nov 2– Nov 21	S. Calif.	Mackerel recruitment survey.
84X01	26	25	26	2	266	129	135	2	Feb 1 – Mar 3	N. Baja Calif. – S. Calif.	Anchovy acoustic survey.
84X05	15	15	0	0	101	101	0	0	Sep 6 –Sep 24	N. Baja Calif. – S. Calif.	Anchovy recruitment.
84X06	18	18	0	0	129	129	0	0	Nov 13 – Dec 3	S. Calif.	Mackerel recruitment survey.
85X01	25	24	21	0	242	124	118	0	Feb 2 – Mar 2	S. Calif.	Anchovy acoustic survey.
85X09	10	10	0	2	66	64	0	2	Jul 15 – Jul 24	S. Calif.	Mackerel recruitment survey.
85X12	10	10	0	2	55	52	0	2	Aug 14–Aug 23	S. Calif.	Mackerel recruitment survey.
85X13	19	19	0	1	140	139	0	1	Sep 4 – Sep 23	S. Calif.	Anchovy, sardine, mackerel recruitment survey.
86X04	18	18	0	1	123	122	0	1	Feb 21– Mar 12	S. Calif.	Anchovy survey.
86X10	5	5	0	0	23	23	0	0	Jun 23 – Jun 27	S. Calif.	Spawning sardine survey.
86X14	7	0	0	0	16	0	0	0	Aug 5– Aug 14	S. Calif.	Spawning sardine survey. St type=other
86X15	8	8	0	0	38	38	0	0	Aug 5– Aug 14	S. Calif.	Spawning sardine survey.
86X19	19	19	0	0	160	160	0	0	Sep 24– Oct 13	S. Calif.	Pelagic young fish survey.
87X02	10	0	0	10	54	0	0	54	Feb 23 – Mar 4	S. Calif.	Mackerel recruitment survey.
87X04	10	0	0	10	65	0	0	65	Mar 24 – Apr 2	S. Calif.	Mackerel recruitment survey.
87X06	10	0	0	10	68	0	0	39	Apr 21– Apr 30	S. Calif.	Mackerel recruitment survey
87X14	12	0	0	0	17	0	0	0	Jul 19 – Aug 1	S. Calif.	Spawning sardine survey.
88X03	10	0	0	9	56	0	0	34	Mar 14–Mar 23	S. Calif.	Mackerel recruitment survey.
88X04	9	0	0	9	51	0	0	34	Apr 12– Apr 20	S. Calif.	Mackerel recruitment survey.
88X06	11	0	0	0	23	0	0	0	May 6 –May 21	S. Calif.	Spawning sardine survey.
88X08	6	0	0	0	7	0	0	0	May10–May 15	S. Calif.	Spawning sardine survey.
88X16	15	15	0	0	120	120	0	0	Oct 12 – Oct 27	S. Calif.	Anchovy, sardine, mackerel recruitment survey.
89X01	7	0	0	0	47	0	0	0	Apr. 7 – Apr 13	S. Calif.	Mackerel recruitment
89X04	10	0	0	0	75	0	0	0	May 1 – May 10	S. Calif.	Mackerel recruitment survey.
89X12	19	19	0	0	151	151	0	0	Sept 19 – Oct 8	S. & N. Calif.	Anchovy, sardine, mackerel recruitment survey.

Notes on Special Surveys: The following surveys were unique for the reasons cited, and thus data and results from them were not included in the legacy database.

52Y01, 52Y06:
Two special cruises were conducted as part of the CalCOFI program, but these were strictly oceanographic and are not considered nor date included in the Data Report.

69A04:
One-day acoustic-midwater trawl survey of pelagic fishes near the Santa Barbara oil leak. Data cannot be presented in the usual tabular form.

69A05:
The purpose of the cruise was to determine anchovy school sizes from sonar and echo sounder recordings. Echograms of each type of equipment were compared to purse seine catches or aircraft spotter estimates of the same schools. Schools were first monitored by sonar and echo sounder; then school size was determined by purse seine catch or spotter estimate. The determination of school size from acoustic recordings was difficult and subject to considerable error. The most important factor appeared to be school compaction or density, which cannot be effectively measured at this time.

73A01:
The purpose of the cruise was to develop methods and techniques for acoustically estimating Northern Anchovy school biomass and evaluating a large midwater trawl for commercially fishing anchovies. Data of this experimental nature cannot be presented in the usual tabular form. The anchovy schools measured 10 to 150 m horizontally and 4 to 37 m vertically and consisted of thin loosely packed layers of fish covering a relatively large surface area. Commercial purse seine vessels did not consider these schools large and compact enough to set their seines. A subjective estimate of 50-75 fish per cubic meter. Midwater trawl tows produced a maximum catch rate of 800 lbs. per hour.

73A10:
The purpose of this cruise was to make visual and acoustic measurements of anchovy schools in areas where commercial fishing operations were occurring and to accurately determine anchovy school biomass from acoustic records. Data cannot be presented in tabular form.

74A01:
Objectives of the cruise were to calibrate anchovy school densities with echo sounder oscilloscope readings and to measure anchovy school volumes in a heavily fished area to better estimate school biomass from acoustic records. Calibration results were invalidated due to unnatural behavior of enclosed fish in an acoustically neutral cage. The heavily commercially fished area showed a much higher percentage of large anchovy schools than elsewhere. Purse seiner catches of two schools that were intensely monitored by sonar and echo sounder produced school packing densities of 25 and 87 fish per meter. Data cannot be presented in the usual tabular form.

74A02:
This cruise was designed to tag Pacific and Jack Mackerel and to collect the latter species for subpopulation studies. Nightlight stations resulted in capture of 1100 Jack Mackerel, 900 of which were taken at Guadalupe Island and the remainder at Cedros Island, Mexico. Blood samples were taken from 500 fish and the remainder were tagged and released.

74A04:
This cruised was designed to tag and release Pacific and Jack Mackerel. Hook and line fishing under a nightlight produced 143 fish tagged at Santa Catalina Island. Blood samples for subpopulation studies were taken from 15 Jack Mackerel at San Clemente Island.

74A06:
The objective of this cruise was to tag Pacific and Jack Mackerel. A total of 316 Pacific Mackerel and 60 Jack Mackerel were tagged and release in Mexico at Cedros Island, Blanca Bay, Geronimo Island and the Coronado Islands. A 240-fish Jack Mackerel sample for subpopulation studies was obtained at San Clemente Island.

74A07:
The objective of this cruise was to calibrate measurements made on anchovy schools by sonar and echo sounder with biomass, which was determined by catching the schools with a chartered purse seiner. Data were collected on eight schools all from the Santa Barbara Channel area. A special underwater camera was used to photograph packing densities within anchovy schools.

75A08:
The objective of this cruise was to calibrate acoustic measurements of anchovy schools to biomass as determined from purse seine catches or estimates by experienced anchovy fishermen.

76A11:
This cruise was of an experimental nature and was designed to compare acoustic survey methods and gears of the CDFG, the NMFS, and the Instituto Nacional de Pesca of Mexico. Data could not be presented in the regular form used on routine surveys.

77A14:
This cruise was of an experimental nature and designed to calibrate anchovy school biomass to acoustic parameters. Data could not be presented in the form of routine surveys.

Table 14. Cruise Count by Year. Yearly Cruise Count by Station Type. A cruise often conducted more than one type of activity.

Year	Acoustic	Bottom	HooknLine	Midwater	Night Light	Other	Trolling	Unspecified	Total
1950	-	-	-	-	-	-	-	12	12
1951	-	-	-	-	-	-	-	9	9
1952	-	-	-	-	-	-	-	8	8
1953	-	-	-	-	-	-	-	10	10
1954	-	-	-	-	-	-	-	9	9
1955	-	-	-	-	-	-	-	7	7
1956	-	-	-	-	-	-	-	5	5
1957	-	-	-	-	-	-	-	3	3
1958	-	-	-	-	-	-	-	6	6
1959	-	-	-	-	-	-	-	9	9
1960	-	-	-	-	-	-	-	9	9
1961	-	-	-	-	-	-	-	7	7
1962	-	-	-	-	-	-	-	6	6
1963	-	-	-	-	-	-	-	6	6
1964	-	-	-	-	-	-	-	7	7
1965	-	-	-	-	-	-	-	7	7
1966	5	0	0	6	2	3	0	-	6
1967	8	0	1	8	1	1	1	-	8
1968	10	0	2	10	1	2	0	-	10
1969	7	0	1	7	4	0	0	-	7
1970	6	1	5	6	5	2	1	-	8
1971	7	1	6	7	5	4	0	-	9
1972	6	0	0	5	5	0	0	-	6
1973	6	1	1	5	7	0	0	-	7
1974	2	1	3	3	4	0	1	-	4
1975	5	0	1	5	6	2	0	-	7
1976	3	0	0	6	1	1	0	-	6
1977	7	0	0	6	1	1	0	-	7
1978	3	0	0	3	0	0	0	-	3
1979	1	0	0	3	0	0	0	-	3
1980	2	0	1	3	0	0	0	-	3
1981	1	0	0	4	2	0	0	-	4
1982	1	0	0	3	1	0	0	-	3
1983	1	0	0	3	3	0	0	-	3
1984	1	0	0	3	1	0	0	-	3
1985	1	0	1	4	3	0	0	-	4
1986	0	0	0	4	1	1	0	-	5
1987	0	0	1	0	3	1	0	-	4
1988	0	0	2	1	2	2	0	-	5
1989	0	0	2	1	0	0	0	-	3
Total	83	4	27	106	58	19	3	120	248

Table 15. Station Count by Year by Month

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total
1950	27	5	13	42	45	44	91	66	69	113	51	54	620
1951	19	33	23	25	15	0	0	51	81	93	44	0	384
1952	0	1	58	56	31	0	0	83	81	85	50	0	445
1953	39	0	44	50	0	0	4	135	161	28	29	0	490
1954	37	48	20	24	2	39	0	82	73	107	60	18	522
1955	0	0	49	0	39	17	51	77	80	135	69	0	517
1956	0	0	0	0	0	0	2	80	92	90	74	53	391
1957	0	0	0	0	0	0	0	0	47	75	38	0	160
1958	0	57	62	73	76	0	0	54	71	0	0	0	393
1959	4	58	87	94	76	48	21	83	100	85	55	0	711
1960	0	34	58	81	47	4	67	78	84	119	94	0	666
1961	0	0	82	79	0	0	22	89	62	103	104	55	596
1962	0	11	116	0	0	0	18	52	66	78	78	38	457
1963	0	0	0	0	64	62	3	69	57	56	77	0	388
1964	0	0	0	0	48	57	2	77	68	76	77	62	467
1965	0	0	0	20	6	0	34	58	72	85	57	5	337
1966	0	0	0	25	9	198	141	0	145	168	136	0	822
1967	0	0	49	157	77	108	49	29	91	139	143	57	899
1968	104	100	156	196	63	158	11	157	144	72	173	43	1377
1969	133	29	0	0	154	39	23	107	62	107	108	36	798
1970	33	108	0	123	65	80	0	53	49	133	88	0	732
1971	0	133	18	115	76	97	0	96	102	0	47	66	750
1972	0	0	0	133	39	87	0	20	122	75	121	0	597
1973	0	54	78	42	146	106	0	83	0	149	59	2	719
1974	0	0	0	90	55	93	0	0	0	89	157	0	484
1975	0	173	0	72	4	89	0	44	136	131	51	0	700
1976	0	0	0	97	49	142	0	0	72	75	164	0	599
1977	71	158	54	85	0	87	0	0	0	98	158	0	711
1978	41	211	0	0	0	75	0	0	0	0	0	0	327
1979	45	130	0	68	0	0	0	0	0	0	134	0	377
1980	11	169	0	0	0	0	0	0	111	71	76	0	438
1981	0	170	55	118	0	0	0	0	0	122	82	53	600
1982	0	237	53	0	0	0	0	101	0	153	0	0	544
1983	0	178	32	0	0	0	0	0	39	97	105	0	451
1984	0	242	24	0	0	0	0	0	101	0	117	12	496
1985	0	233	9	0	0	0	66	55	140	0	0	0	503
1986	0	51	72	0	0	23	0	54	56	104	0	0	360
1987	0	26	81	80	0	0	16	1	0	0	0	0	204
1988	0	0	56	51	30	0	0	0	0	120	0	0	257
1989	0	0	0	47	75	0	0	0	94	57	0	0	273
Total	576	2649	1349	2043	1291	1653	621	1934	2728	3288	2876	554	21562

7. Effort Statistics with Graphs and Charts

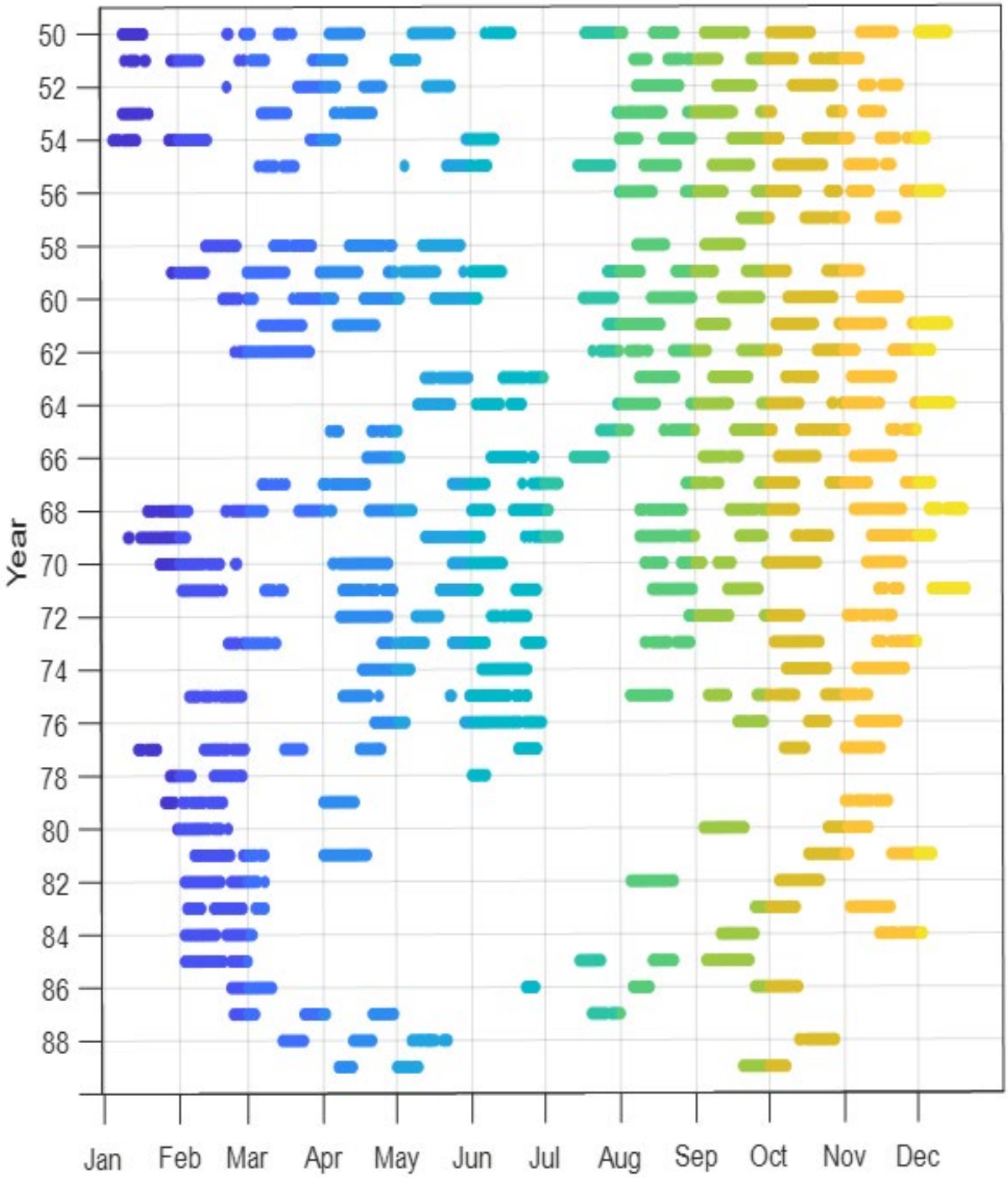

Figure 2. Cruise Schedule and Duration by Year by Month. Sea Survey Cruise Schedule and Duration by Year and by color-coded Month. Length of each color bar represents a cruise's relative length to other cruises.

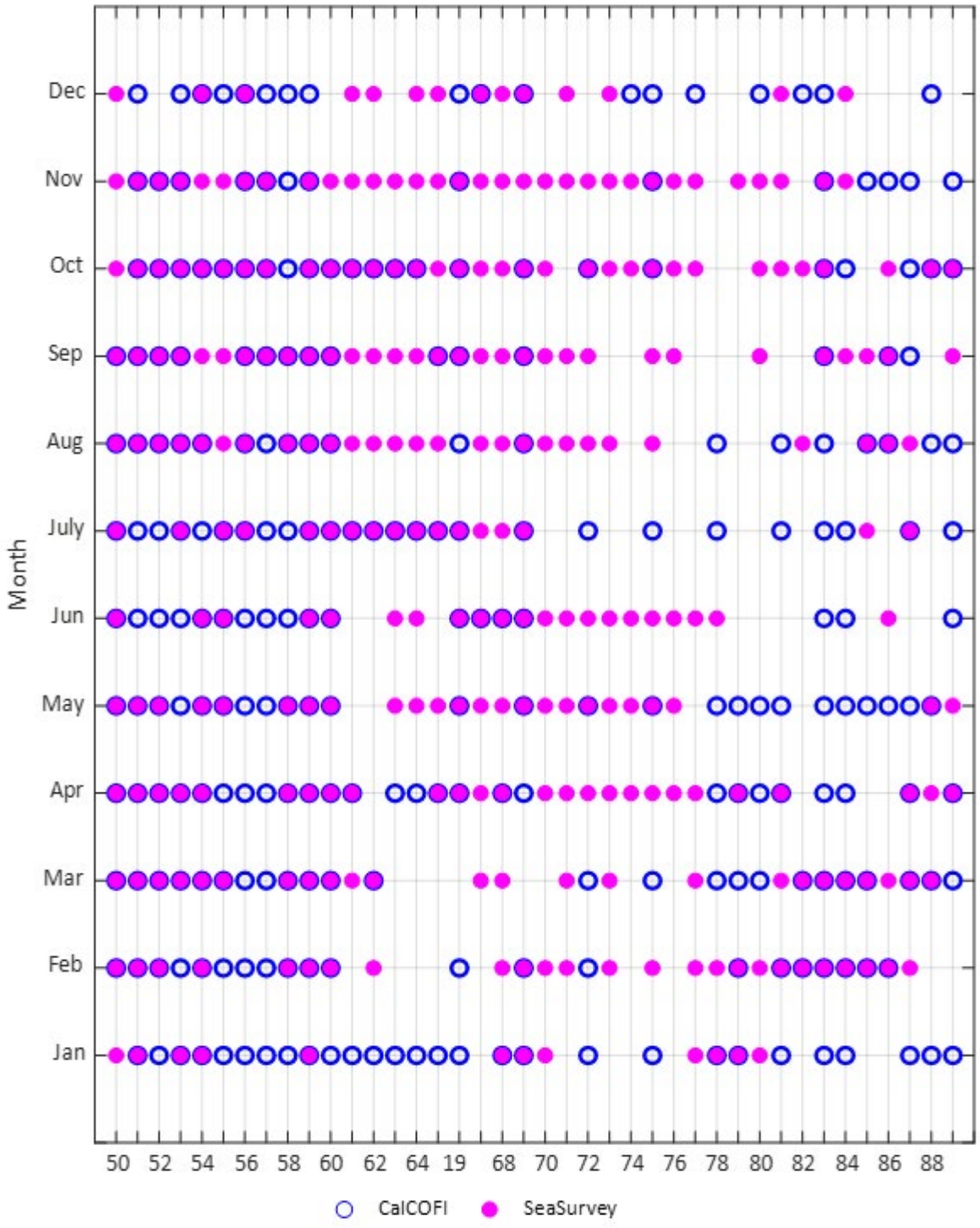

Figure 3. Cruise Schedule for Sea Survey and CalCOFI Cruises by Year and by Month. Blue colored circles are CalCOFI cruises and magenta color filled circles are Sea Survey cruises. Color-filled blue circles indicate that both CalCOFI and Sea Survey Cruises were ongoing during the indicated months and years.

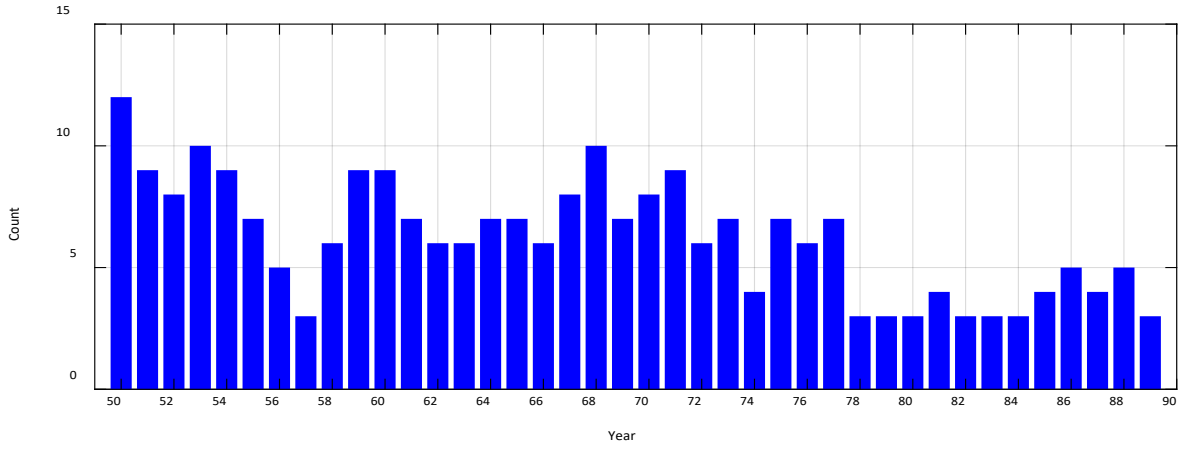

Figure 4. Total Cruise Count by Year. Bar graph of total cruise count by year from 1950 – 1989.

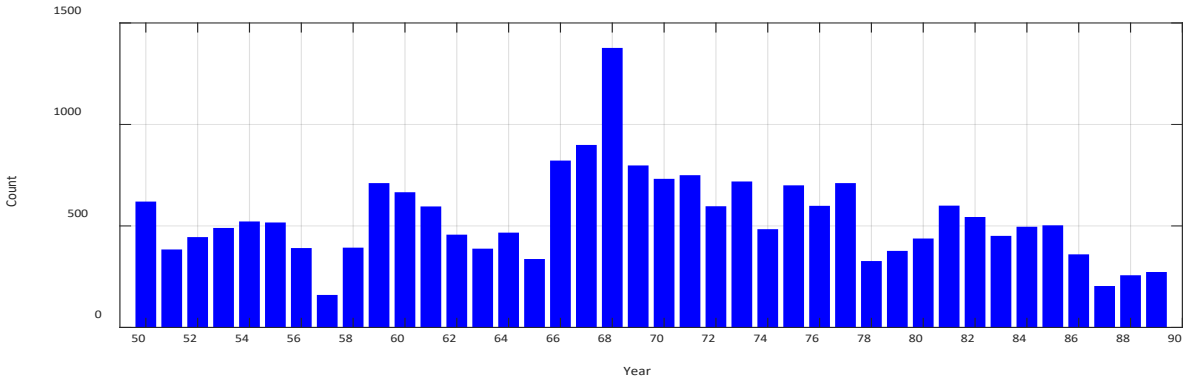

Figure 5. Total Station Count by Year. Bar graph of total station count by year from 1950 – 1989.

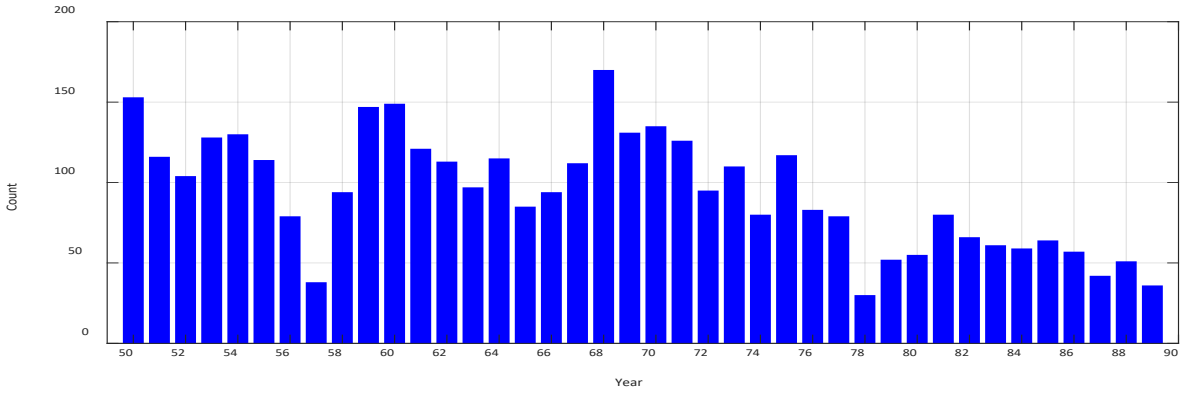

Figure 6. Total Sea Day Count by Year. Bar graph of total sea day count by year from 1950 - 1989.

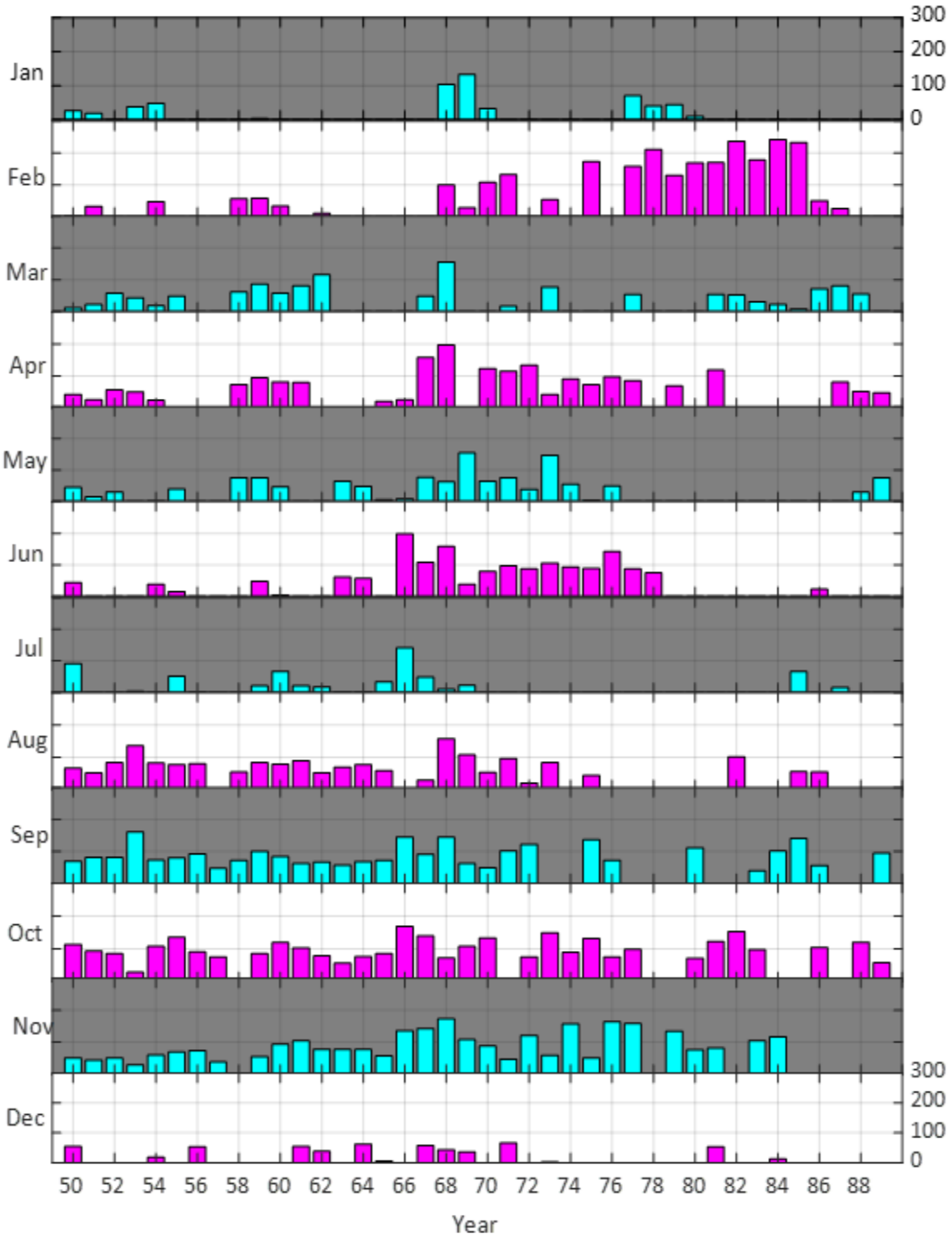

Figure 7. Monthly Station Count by Year. Bar graph of monthly station count by year.

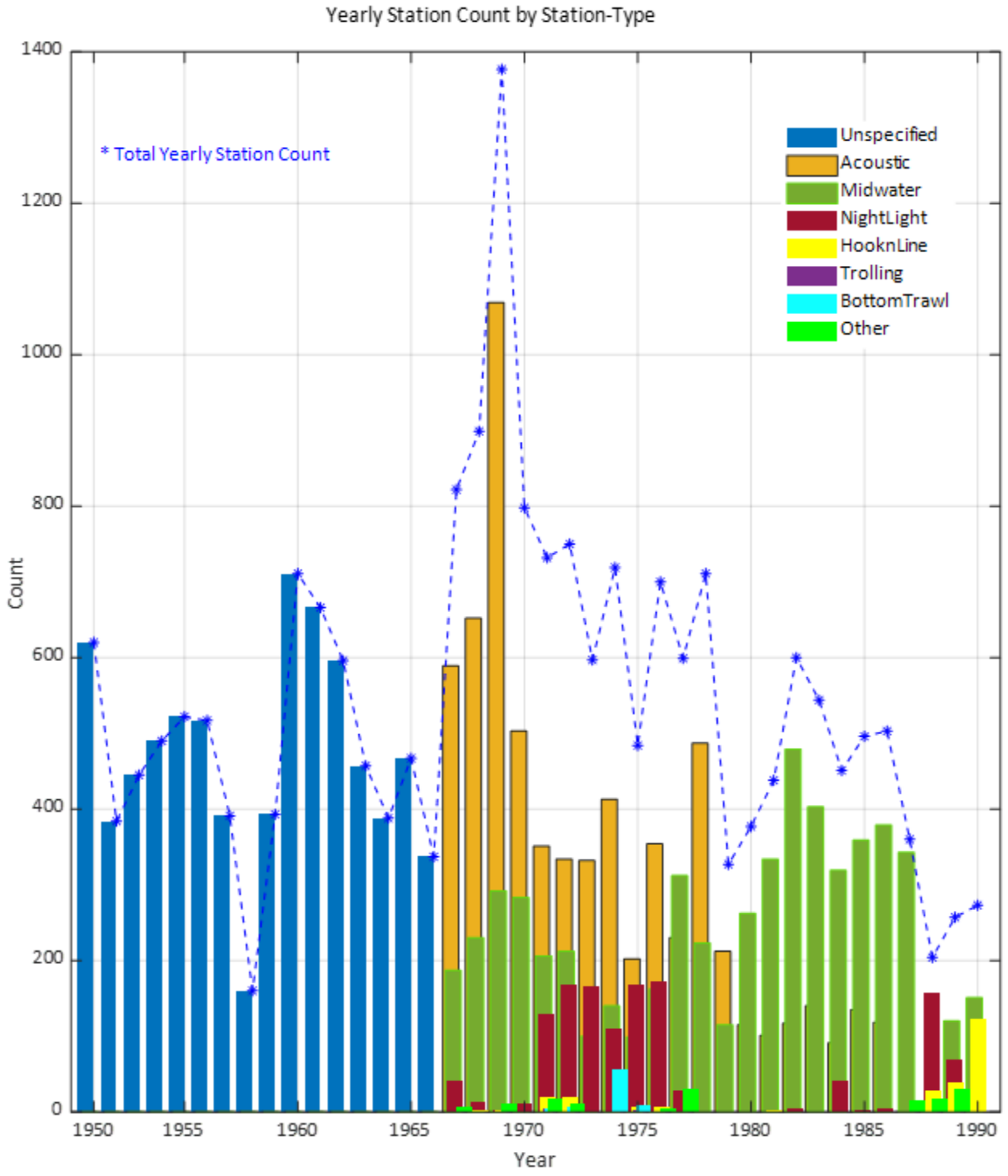

Figure 8. Yearly Station Count by Station Type. Color-coded bar graph of yearly station count by eight (8) station types. Yearly total station counts are plotted with blue asterisks. For years 1950 – 1965, station type was not specified, all stations are grouped under 'Unspecified Type'.

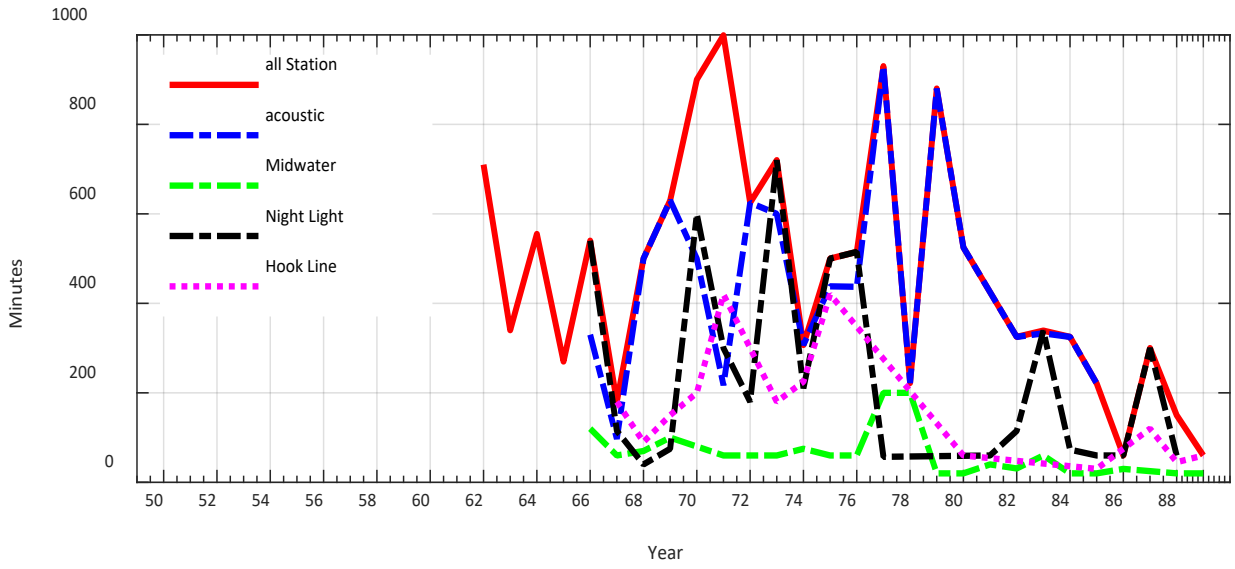

Figure 9. Maximum Sampling Durations in Minutes by Year by Station Type. Line plot- 'All types', 'Acoustic', 'Midwater Trawl', 'Night Light', and 'Hook and Line' stations. Station types were determined by the principal activity performed on the station.

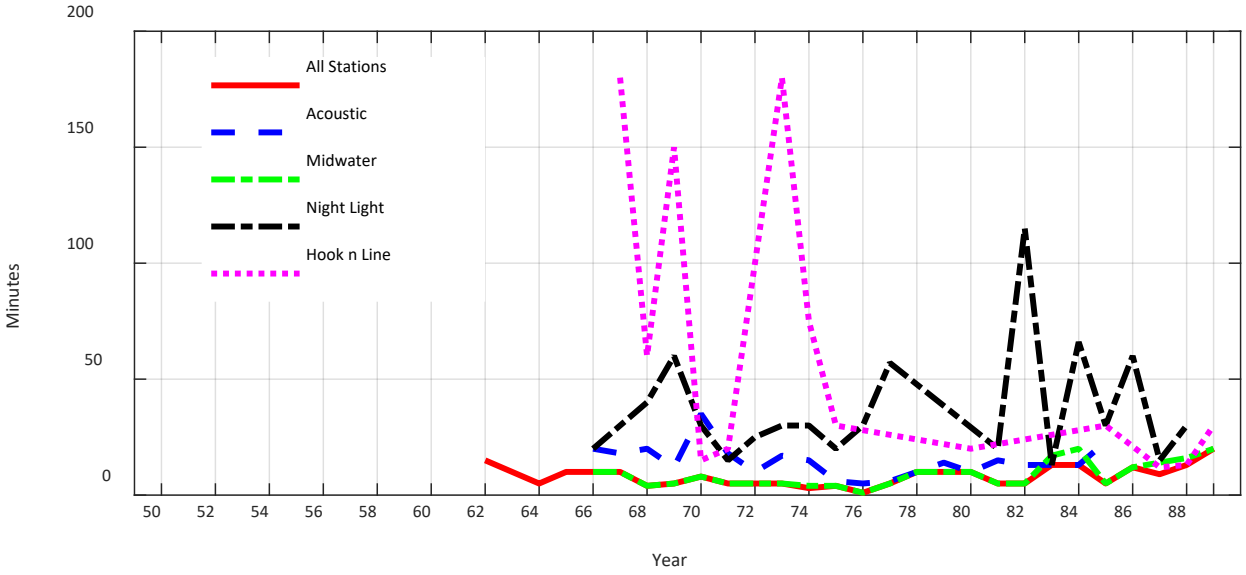

Figure 10. Minimum Sampling Durations in Minutes by Year by Station Type. Line plot –Color-coded lines represent different station types.

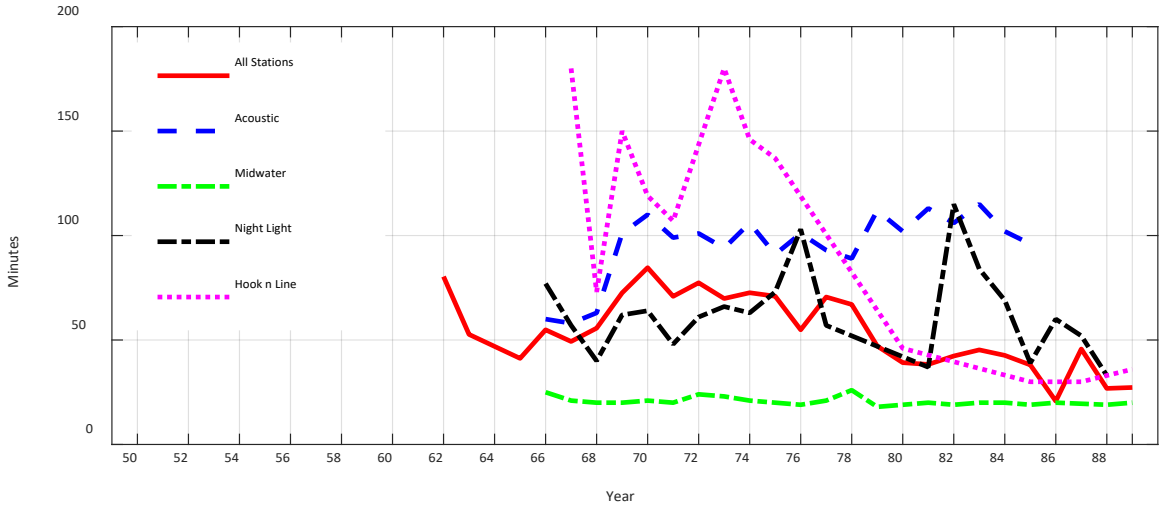

Figure 11. Average Sampling Durations in Minutes by Year by Station Type. Line Graph - From 1966 and on, the midwater trawl and acoustic work were the dominant activities of all cruises. The average duration per station for midwater trawl stations was 20 minutes. Acoustic stations usually consisted of 1 to 2 hours of sounding at a vessel speed of 7 – 19 knots.

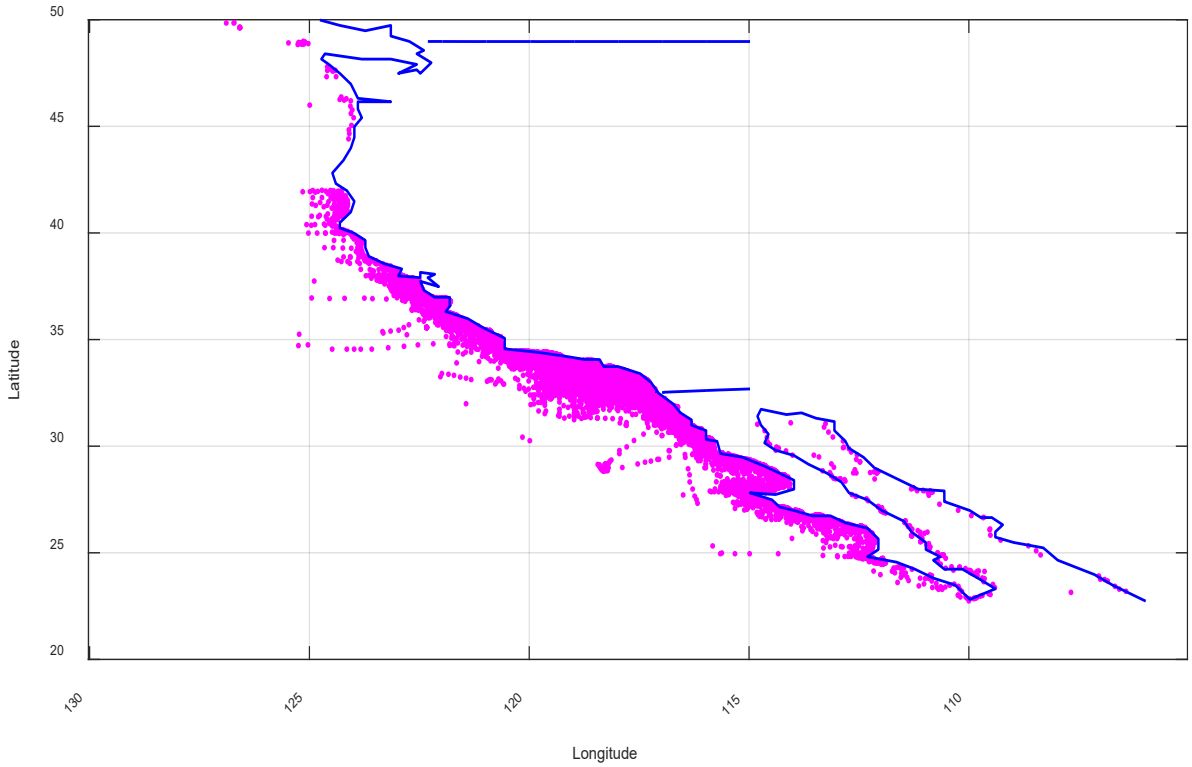

Figure 12. Geographical Station Location Plot for All Years: 1950 – 1989. Geographical station location map for all years (1950 – 1989) with longitude and latitude readings.

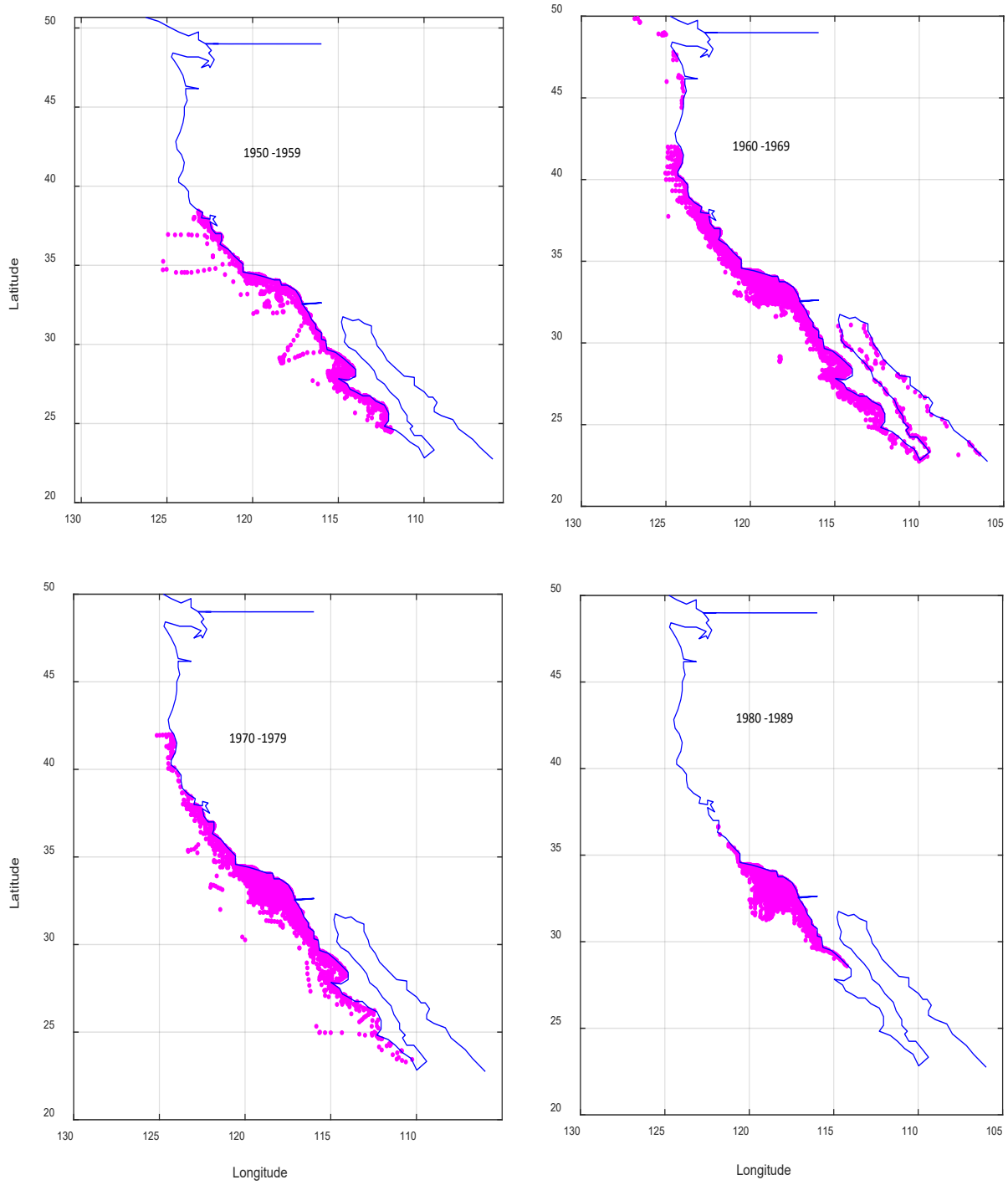

Figure 13. Geographical Station Locations Grouped by 10 Years. Geographical station location plot. Survey stations grouped by 10 years.

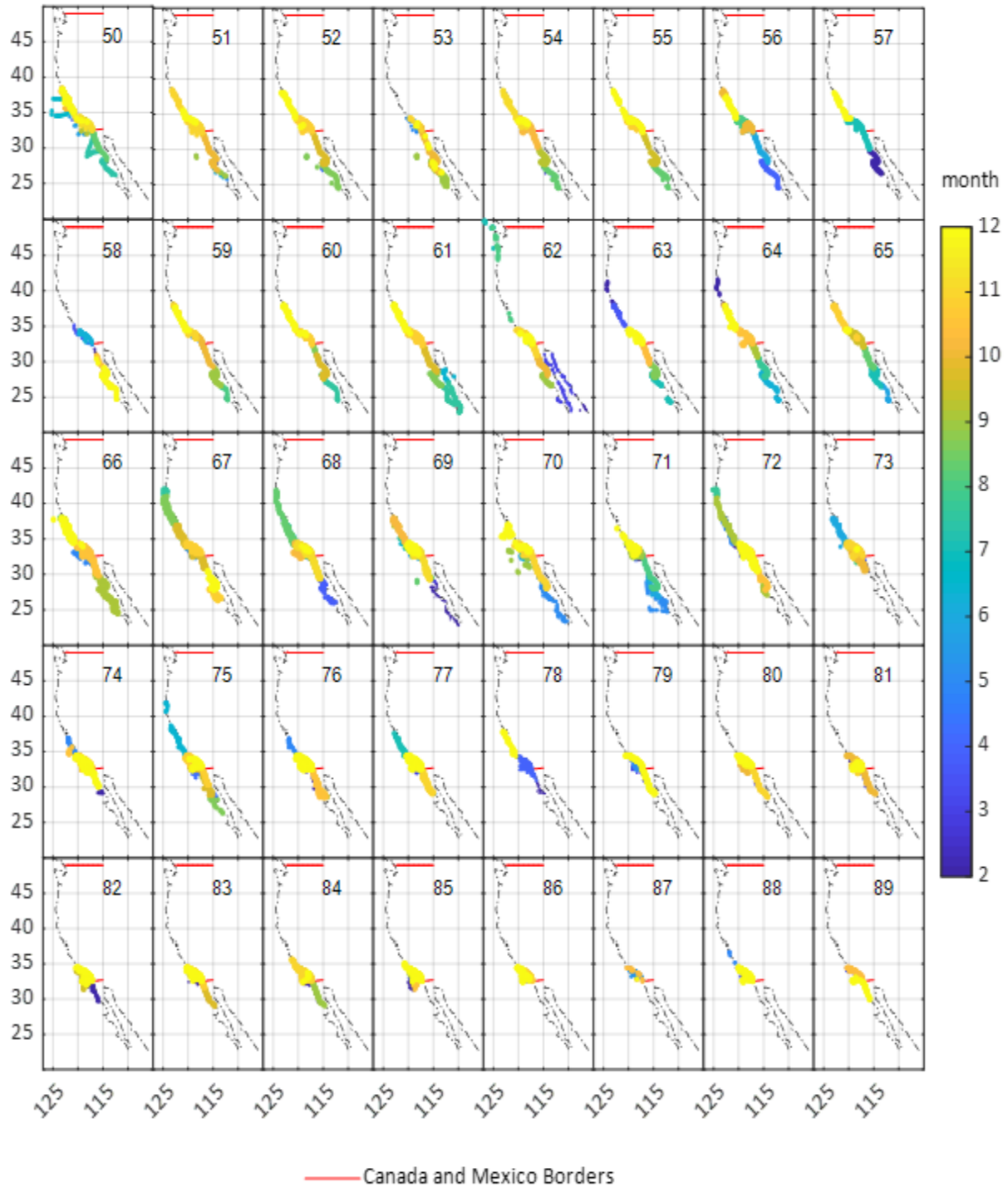

Figure 14. Monthly Geographical Station Location Plot by Year. Survey locations by month by Year. Month presented by shades of color.

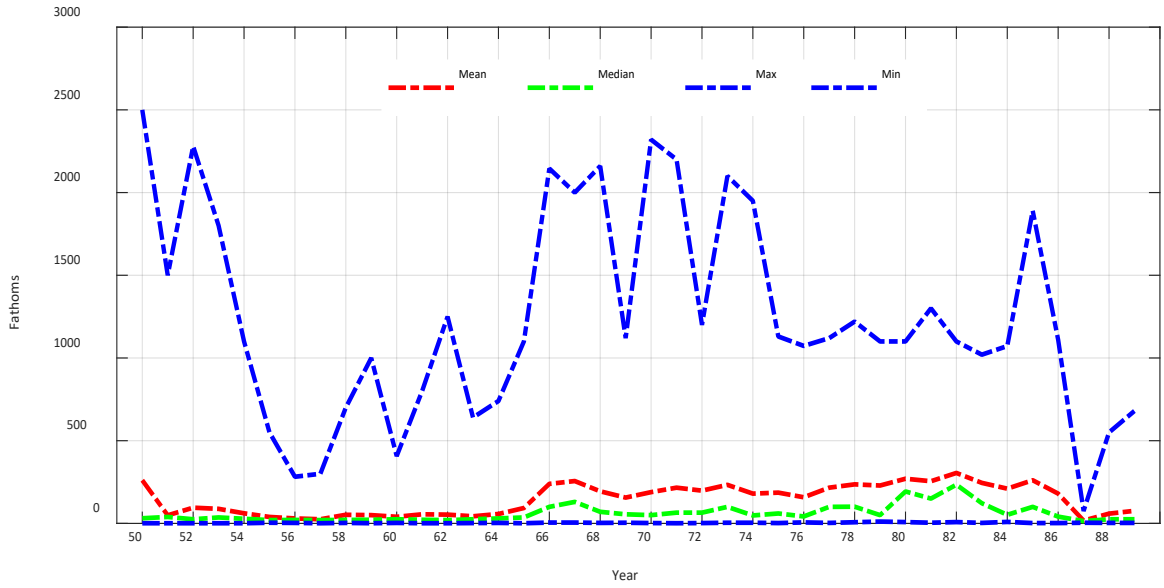

Figure 15. Depths of Samples Taken by Year. Line plot of depths of capture in fathoms by year. Four lines plotted for mean, median, maximum and minimum depths. Echo sounding stations recorded depth range with low and high values for each station, where midwater trawl stations have only one value recorded for each station.

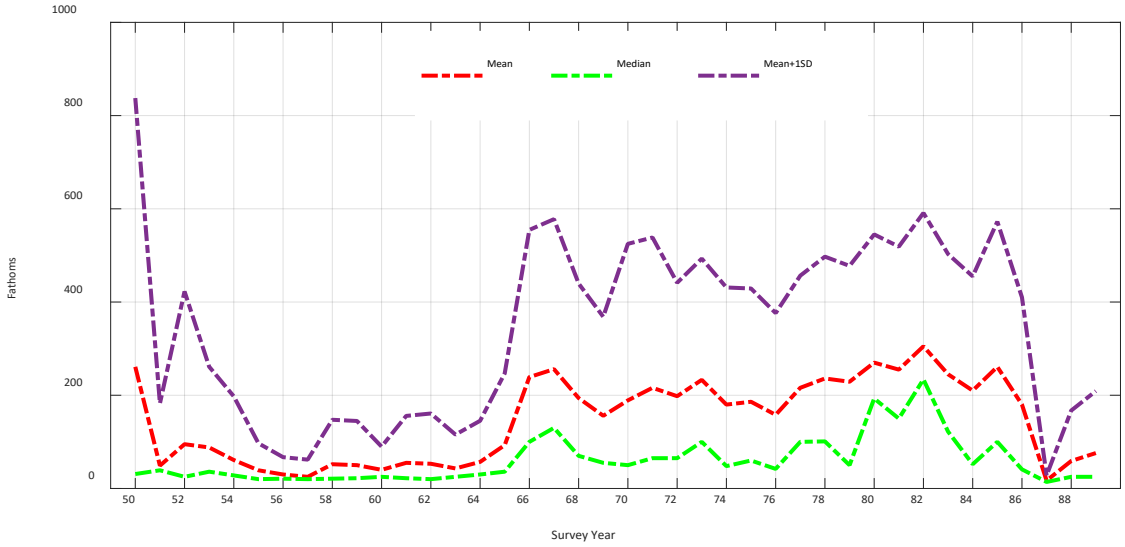

Figure 16. Mean Depth of Sample Taken with Confidence Intervals. Line plot of depths of capture in fathoms by year with one S.D. line plotted around the mean. Figure portrays a magnified Figure 14 without the maximum and minimum data plotted.

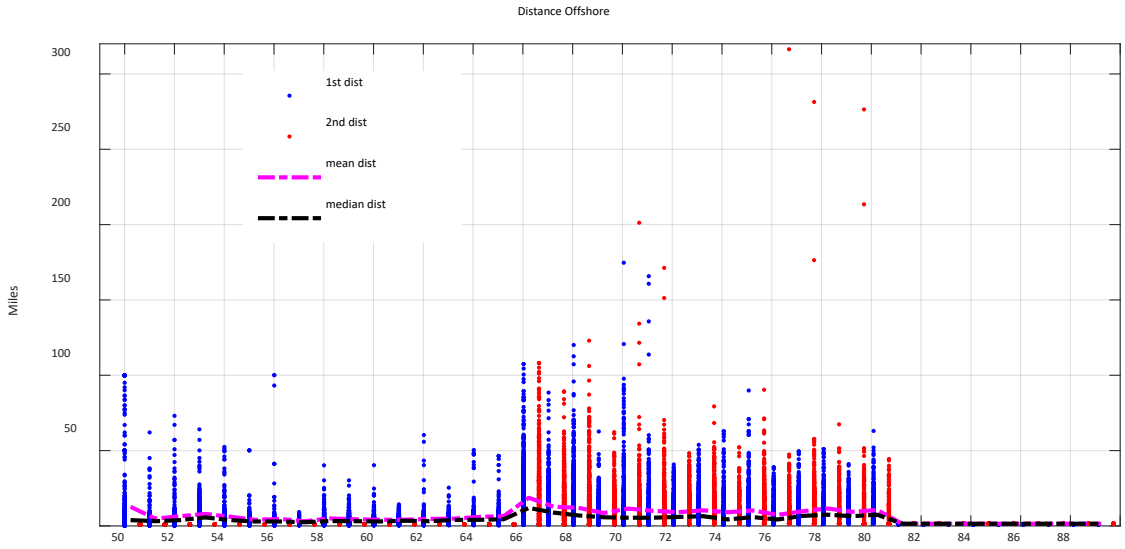

Figure 17. Distance Travelled Offshore by Sampling Year. Distance to the nearest land (mainland or island). Stations covering distances (1st distance and 2nd distance) have a minimum and maximum tabulated. No data were collected from 1981 – 1989.

8. Environmental Statistics:

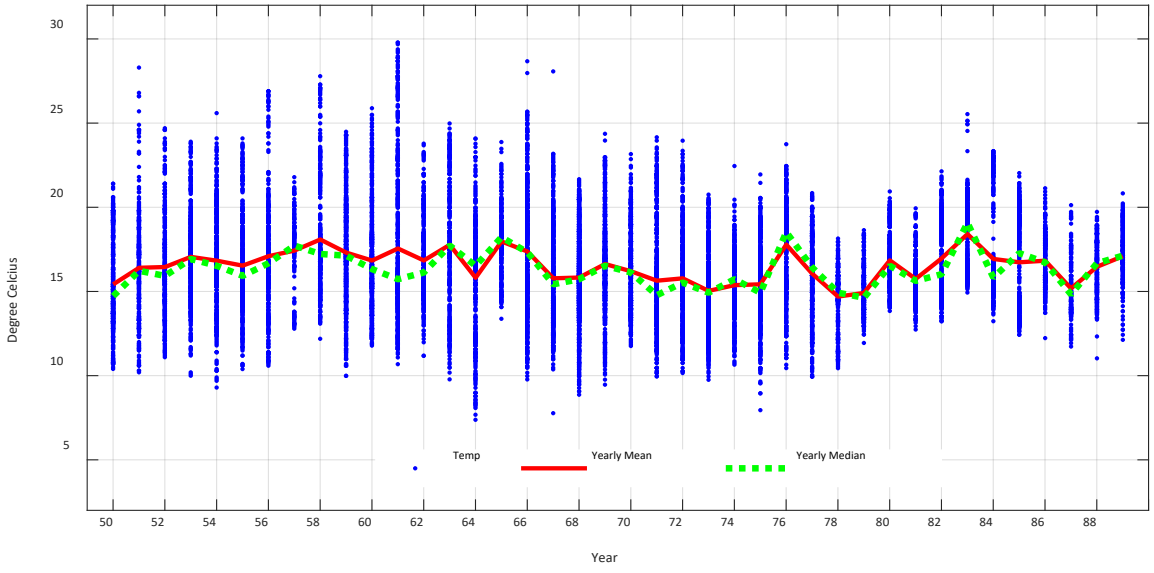

Figure 18. Yearly Sea Surface Temperature (SST) Taken at Stations. All sea surface temperature readings are recorded to the nearest one-tenth of a degree Celsius. All temperature readings taken at all stations plotted by year. Yearly averages are plotted with red colored line and the medians in green dotted line.

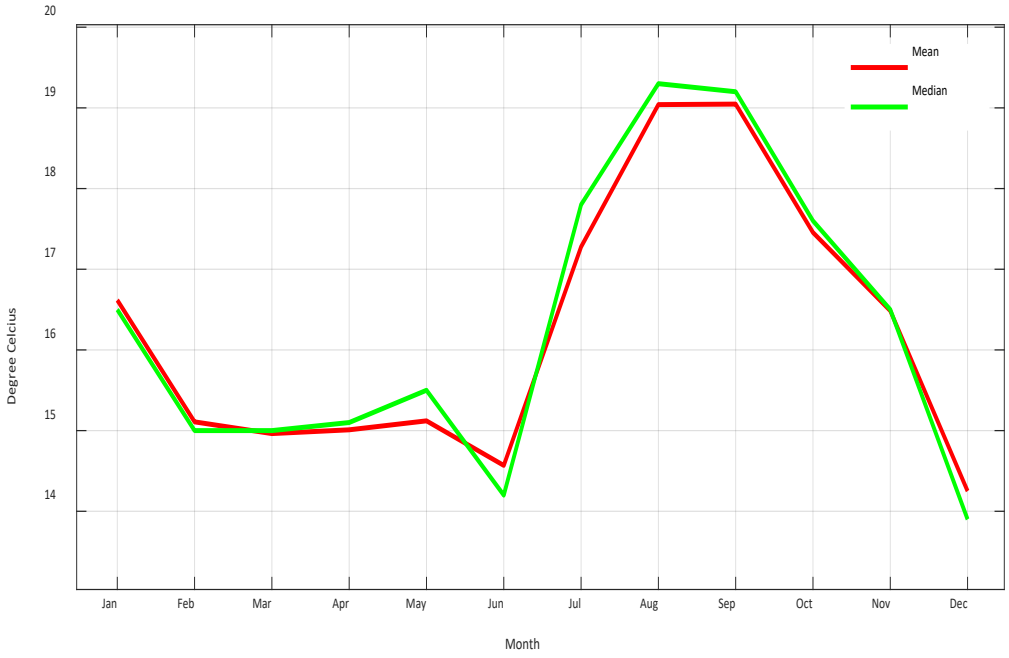

Figure 19. Monthly Mean and Median SST of All Survey Years, 1950 – 1989. Monthly mean (red line) and median (green line) of sea surface temperature for all years (1950 – 1989).

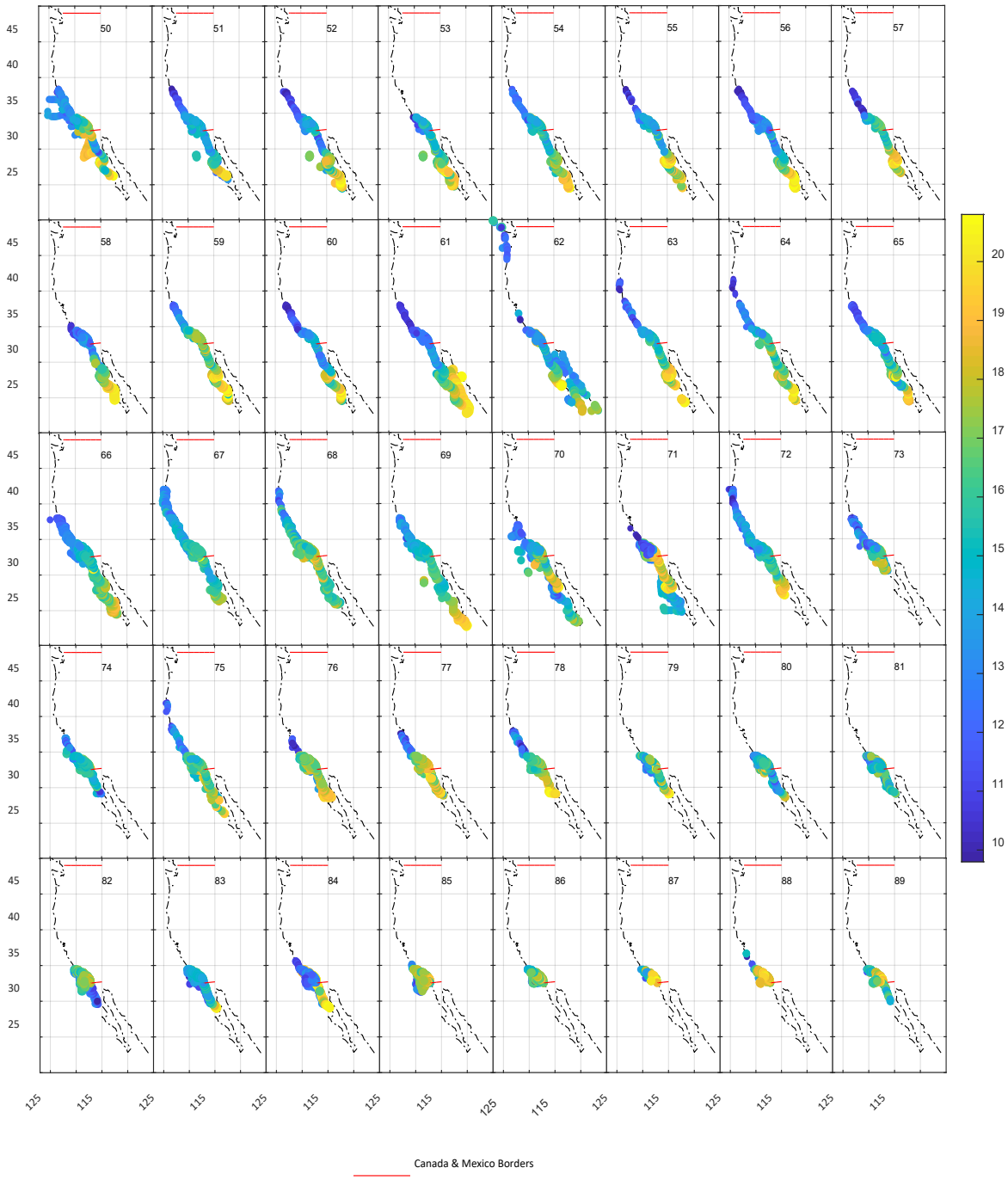

Figure 20. Sea Surface Temperature (°C) Measured at Station Locations. Yearly map plot of Sea Surface Temperature (SST) measured in Celsius degree at each station location.

9. Catch Statistics

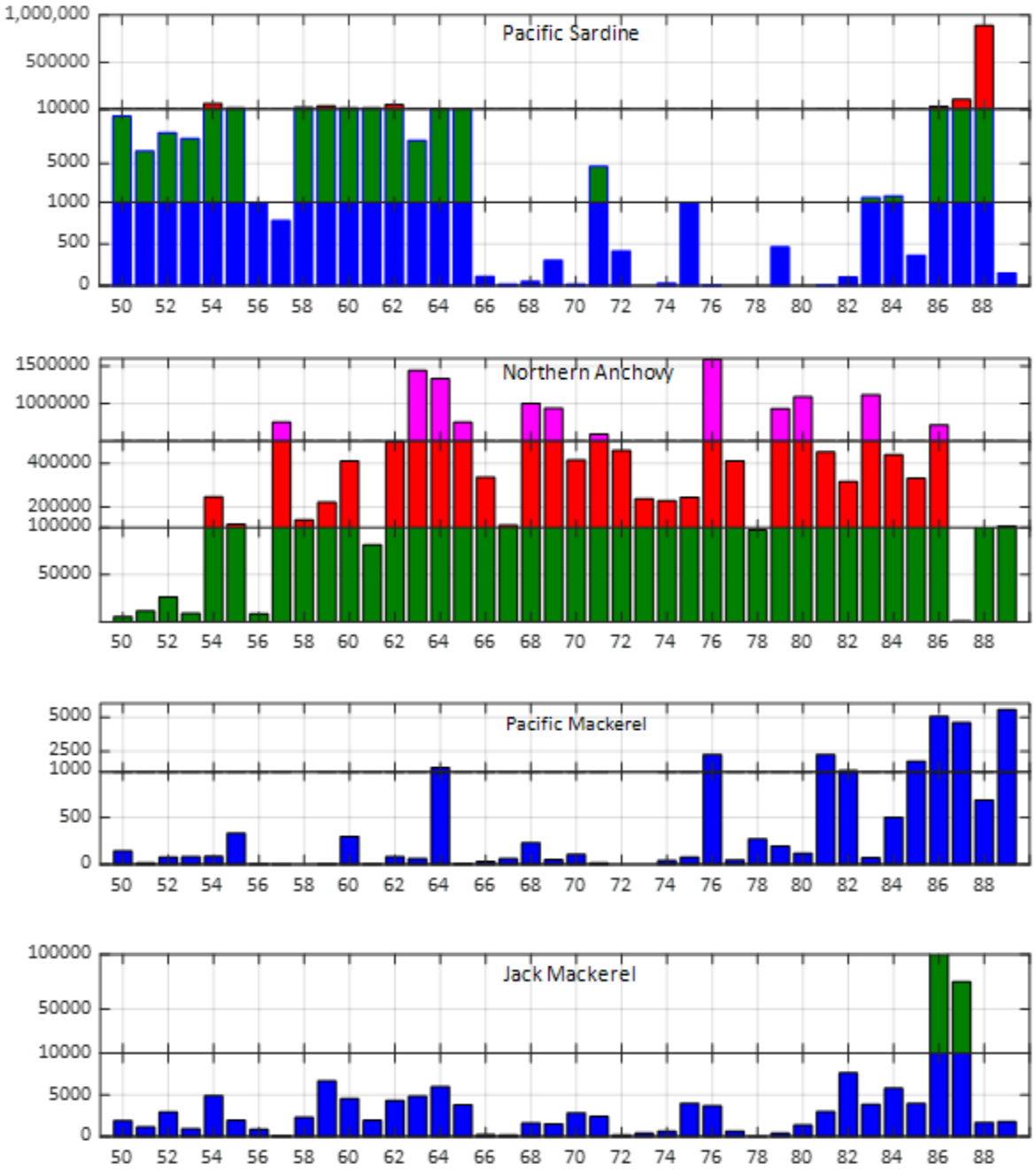

Figure 21. Yearly Total Catch Count by Species. Bar graphs of yearly total catches for the most four abundant species from the collected data within the survey region: namely the Pacific Sardine (*Sardinops sagax*), Northern Anchovy (*Engraulis mordax*), Pacific Mackerel (*Scomber japonicus*) and Jack Mackerel (*Trachurus symmetricus*).

Table 16. Catch statistics by Year by Species Table. 710 taxon have been caught, identified, or observed over the years. A 'Y' indicates the presence of the Taxon, and an 'N' represents its absence. The last column is the number of taxa present for that year, and the last row shows the number of years a particular taxon was observed. Due to space limitations, not all taxon are presented here. Listed are the 19 most frequently found species.

-	N. ANCHOVY	J. MACKEREL	PAC. MACKEREL	PAC. SARDINE	PAC. HAKE	MARKET SQUID	CAL. LIZARDFISH	WHITE CROAKER	QUEEN FISH	UNIDEN. FISH	UNIDEN. ROCKFISH	CAL. BARRACUDA	PAC. SAURY	UNIDEN. PIPEFISH	PAC. POMPANO	PELAGIC RED CRAB	PAC. BONITO	UNIDEN. PORPOISE	BLUE SHARK	# UNIQUE SPECIES
1950	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	N	161
1951	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	77
1952	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	168
1953	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	93
1954	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	126
1955	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	N	Y	88
1956	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	N	Y	N	N	N	Y	104
1957	Y	Y	Y	Y	N	N	N	Y	Y	Y	Y	N	Y	Y	N	Y	Y	N	N	46
1958	Y	Y	Y	Y	N	N	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	70
1959	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	N	132
1960	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	99
1961	Y	Y	Y	Y	N	N	Y	Y	Y	Y	N		Y	Y	N	Y	Y	Y	N	139
1962	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	160
1963	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	142
1964	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	131
1965	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	N	149
1966	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	132
1967	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	164
1968	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	180
1969	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	189
1970	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	245
1971	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	229
1972	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	142
1973	Y	Y	Y	N	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	Y	N	Y	Y	182
1974	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	142
1975	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	216
1976	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	184
1977	Y	Y	Y	N	Y	Y	Y	N	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	118
1978	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	117
1979	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	87
1980	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	N	Y	N	Y	N	Y	Y	73
1981	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	N	Y	Y	88
1982	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	N	Y	Y	76
1983	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	Y	N	Y	Y	Y	Y	N	62

-	N. ANCHOVY	J. MACKEREL	PAC. MACKEREL	PAC. SARDINE	PAC. HAKE	MARKET SQUID	CAL. LIZARDFISH	WHITE CROAKER	QUEEN FISH	UNIDEN. FISH	UNIDEN. ROCKFISH	CAL. BARRACUDA	PAC. SAURY	UNIDEN. PIPEFISH	PAC. POMPANO	PELAGIC RED CRAB	PAC. BONITO	UNIDEN. PORPOISE	BLUE SHARK	# UNIQUE SPECIES
1984	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	N	N	Y	Y	Y	Y	Y	67
1985	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	97
1986	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y	N	Y	Y	Y	Y	N	Y	90
1987	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	N	Y	46
1988	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	-	Y	Y	Y	Y	N	Y	N	Y	82
1989	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	-	Y	Y	Y	Y	N	N	N	Y	76
Total	40	40	39	36	31	23	38	37	37	37	35	35	34	34	34	34	32	32	31	-

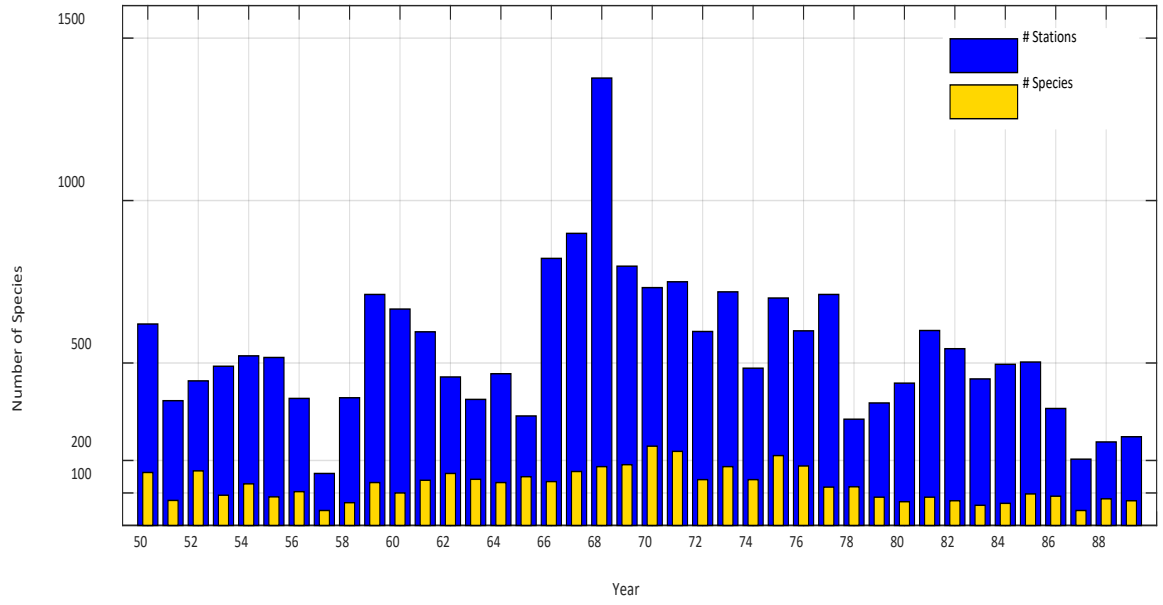

Figure 22. The Richness of the California Current. Bar plot – Yearly number of distinct taxa found using presence and absence data from the Species Composition Table. Total number of station counts plotted for each year.

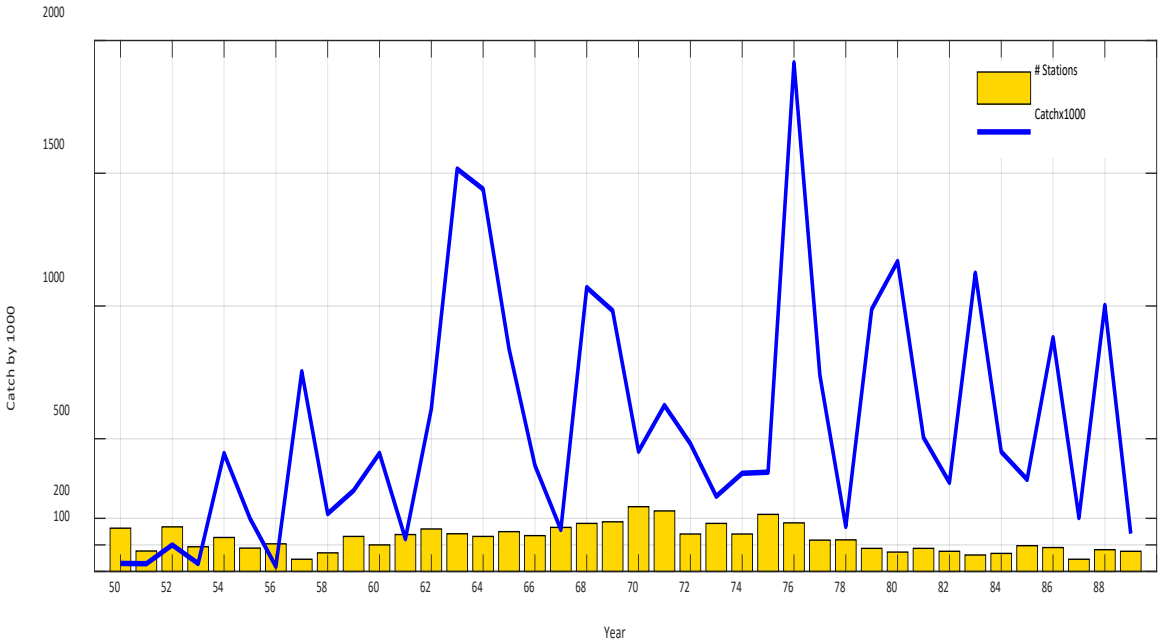

Figure 23. Catch and Effort Statistics. Yearly total catch count with total station count. Includes all occurrences of all taxa, and some occurrences of birds and mammals.

10. Species Size and Age Distribution.

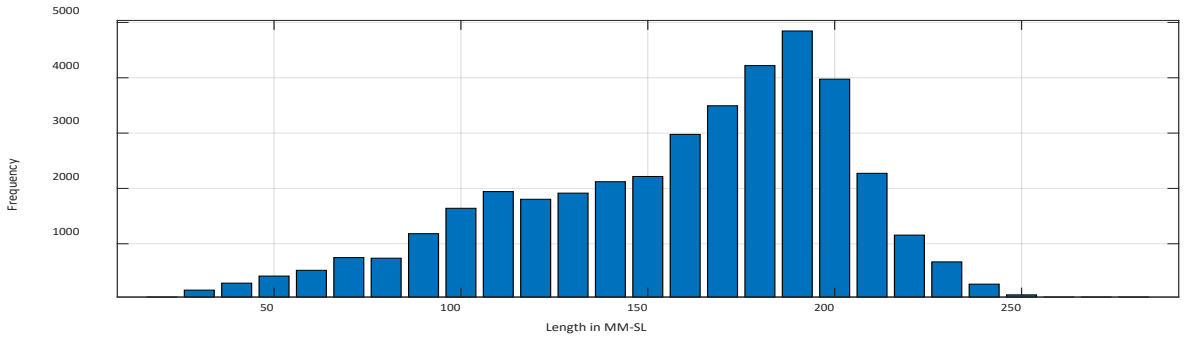

Figure 24. Pacific Sardine Length Distribution. Length frequency distribution for Pacific Sardine caught throughout the survey years, 1950 - 1989. Length measured in minimeters, standard length (MM-SL). Note: No sardine were caught in 1966, 1970, and from 1973 to 1981.

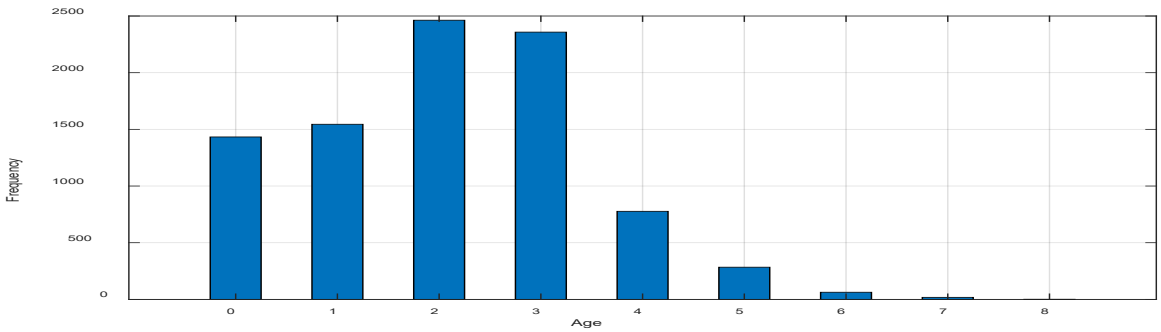

Figure 25. Pacific Sardine Age Distribution. Bar Plot – Distribution of Pacific Sardine –age. Note: No sardine were caught in 1966, 1970, and from 1973 to 1981.

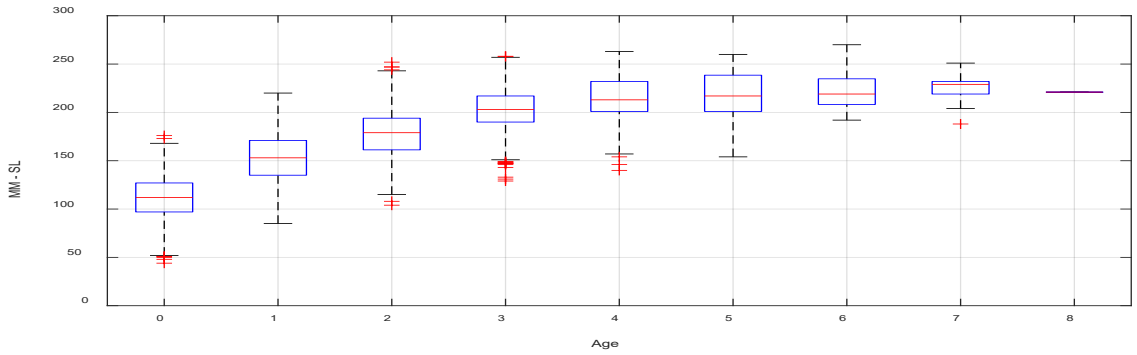

Figure 26. Pacific Sardine Age and Length Relationship. Boxplot - Pacific Sardine age and length relationship plot. Note: No sardine were caught in 1966, 1970, and from 1973 to 1981.

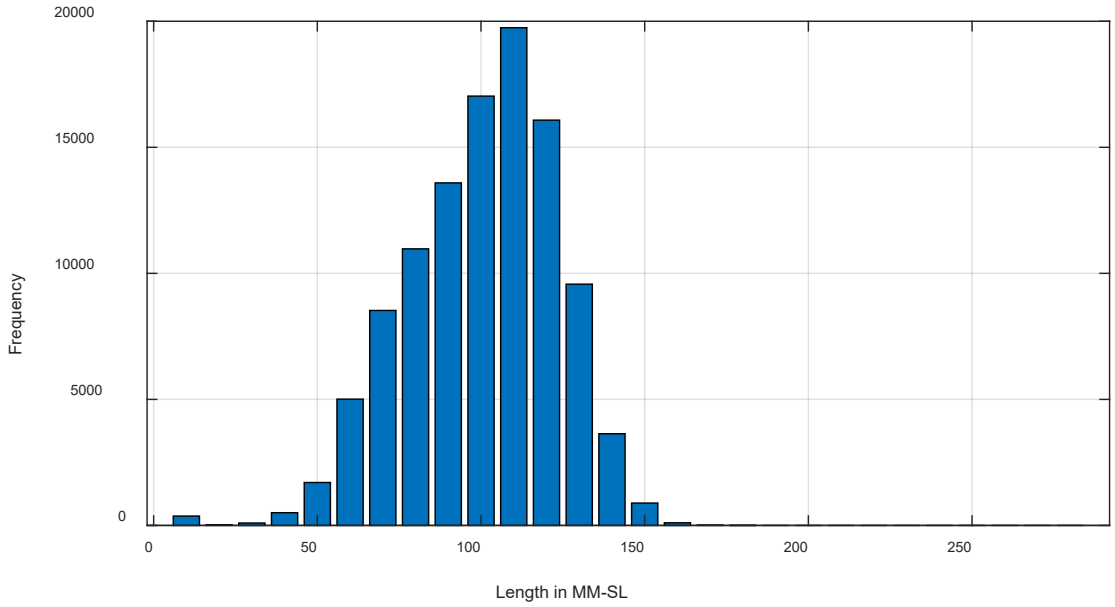

Figure 27. Northern Anchovy Length Distribution for All Years. Bar plot - Length frequency plot for Northern anchovy 1953 - 1989.

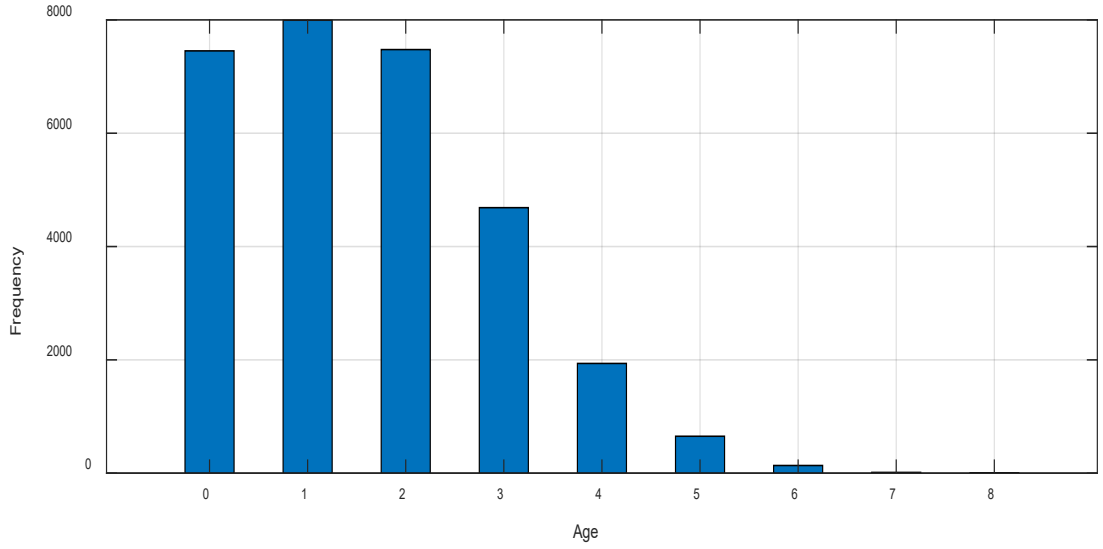

Figure 28. Northern Anchovy Age Distribution for All Years. Bar Plot - Northern anchovy age distribution 1953 – 1989.

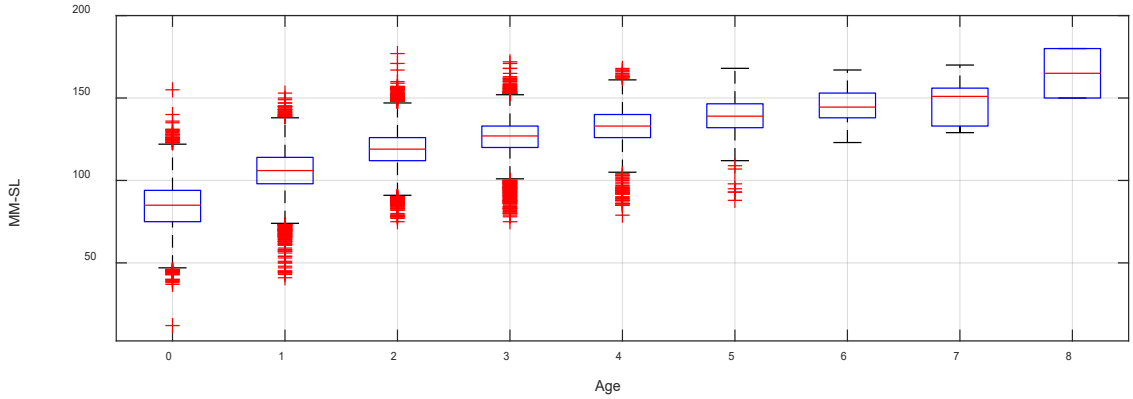

Figure 29. Northern Anchovy Age and Length Relationship. Boxplot - Northern anchovy age and length relationship

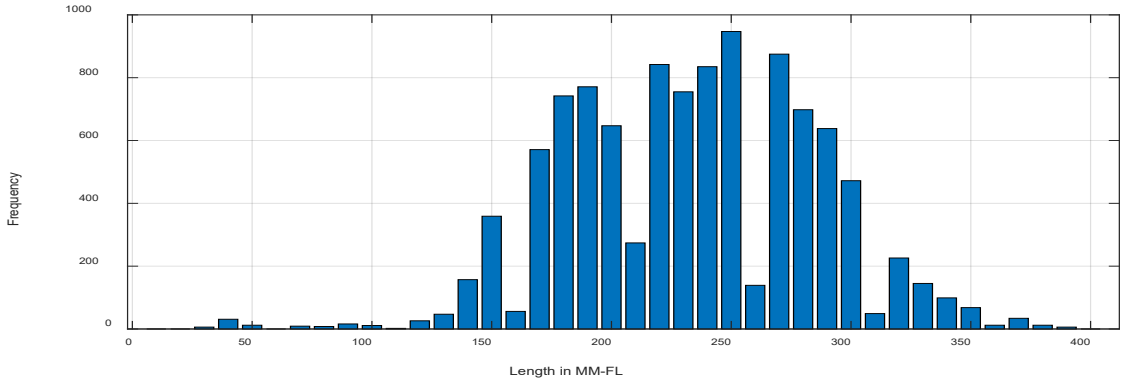

Figure 30. Pacific Mackerel Length Distribution for All Years. Bar Plot - Pacific Mackerel length Distribution for 1950 – 1965 and 1976 – 1989.

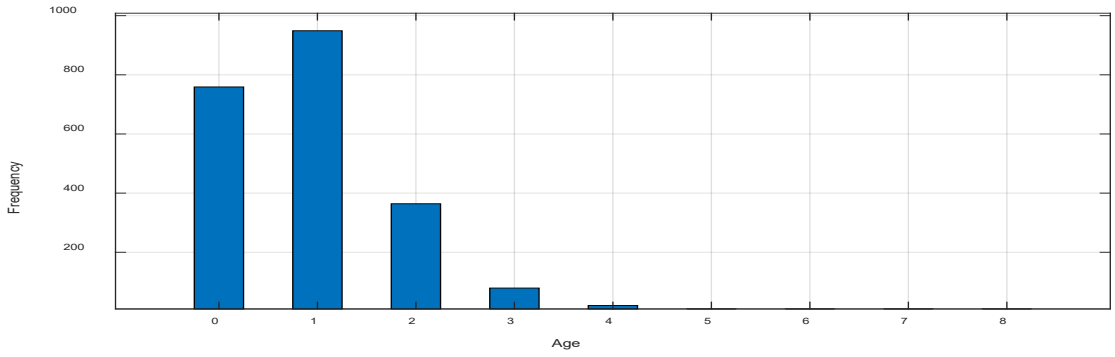

Figure 31. Pacific mackerel Age Distribution for All Years. Bar Plot - Pacific Mackerel age distribution 1950 – 1965 and 1976 – 1989.

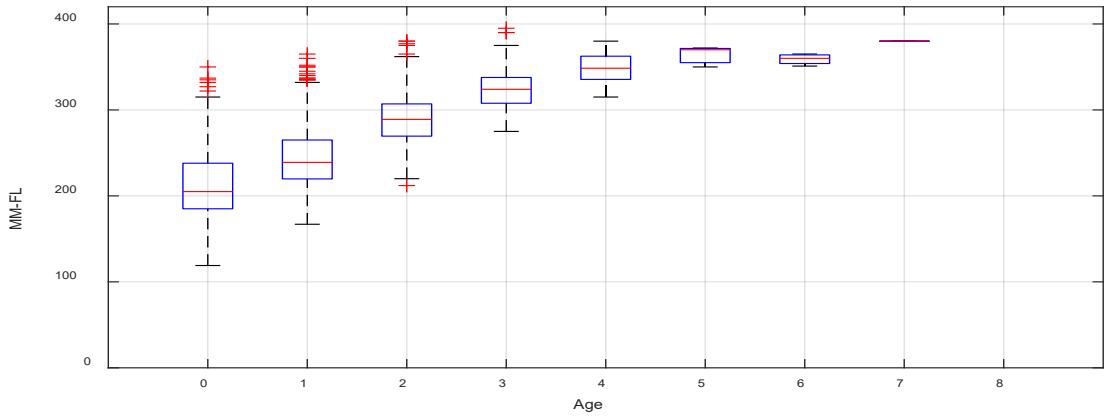

Figure 32. Pacific Mackerel Age and Length Relationship. Box Plot - Pacific Mackerel age and length relationship

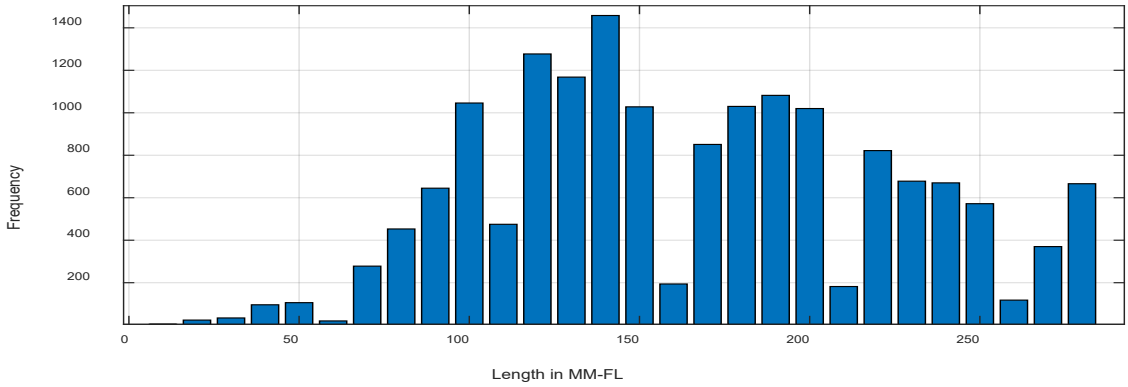

Figure 33. Jack Mackerel Length Distribution for All Years. Bar Plot - Jack Mackerel length frequency distribution. Missing data for 1978.

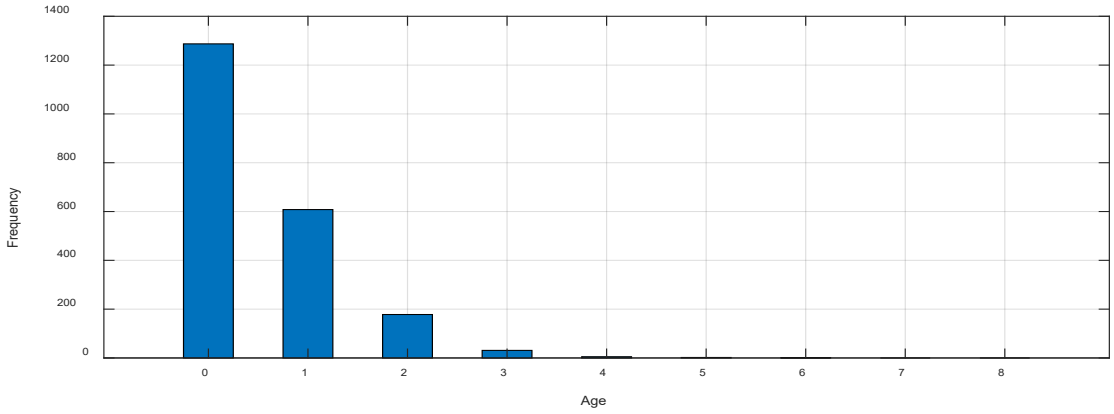

Figure 34. Jack Mackerel Age Distribution for All Years. Bar Plot - Jack Mackerel length frequency distribution for 1953 – 1985. Missing data for years: 1966,1967,1968,1973, 1978.

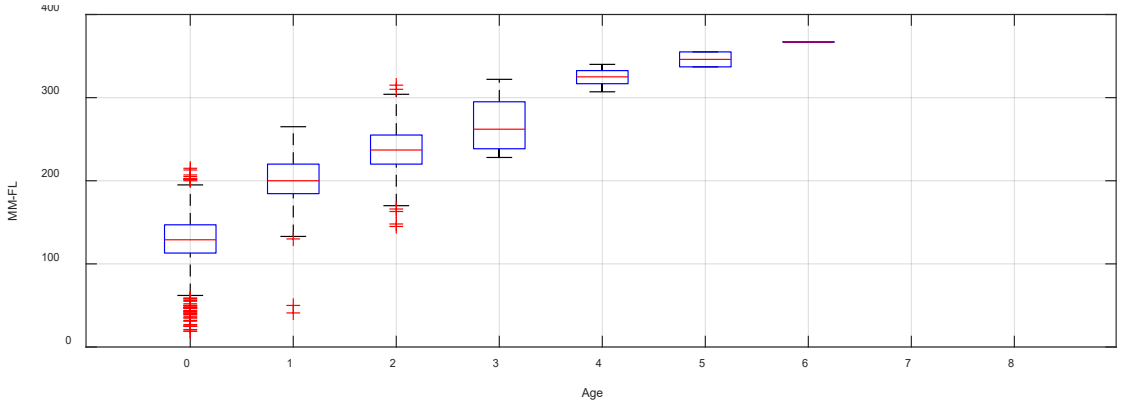

Figure 35. Jack Mackerel Age and Length Relationship. Box Plot - Jack Mackerel age and length relationship

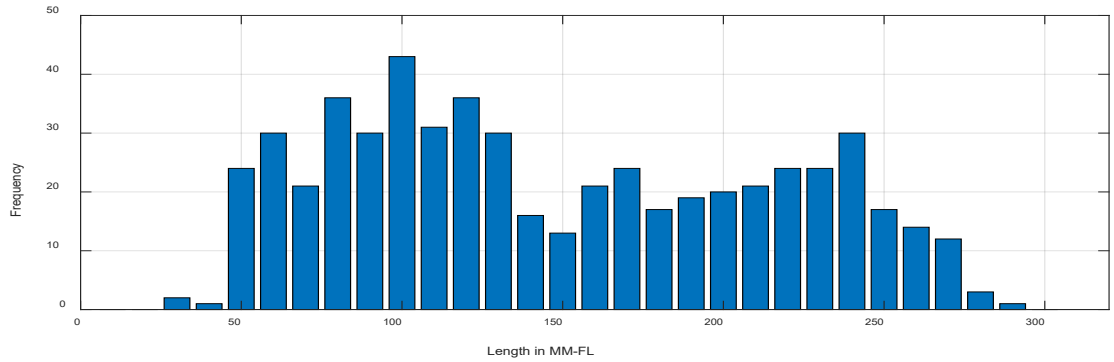

Figure 36. Pacific Saury Length Distribution for 1971 – 1973. Bar Plot- Pacific Saury length distribution. Data collected for 1970-1974.

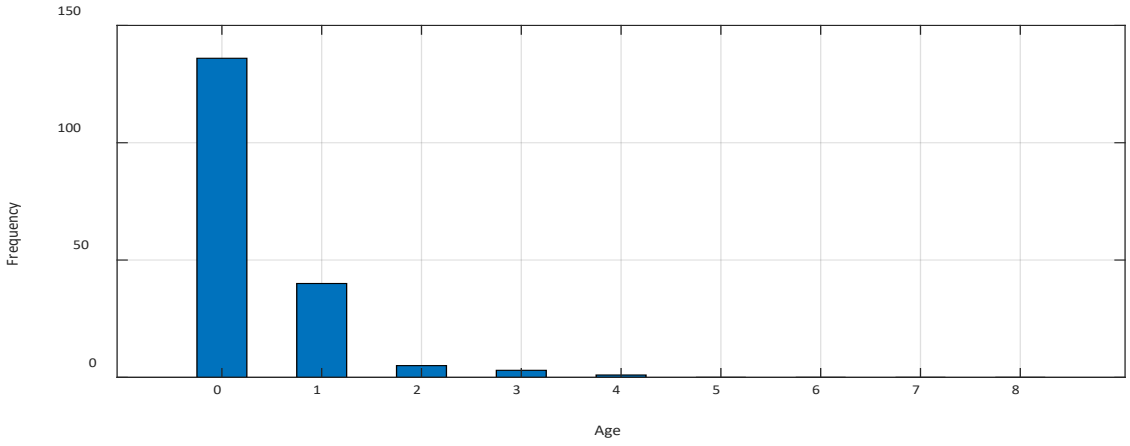

Figure 37. Pacific Saury Age Distribution for 1971 – 1973. Bar Plot - Pacific Saury age distribution for 1970 - 1974.

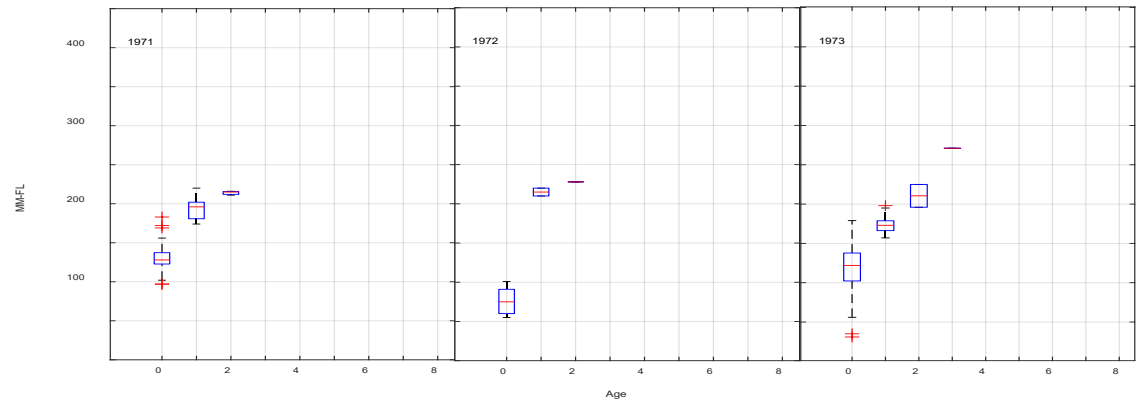

Figure 38. Pacific Saury Age and Length Relationship. Three Pacific Saury age and length relationship box plots for 1971, 1972, and 1973.

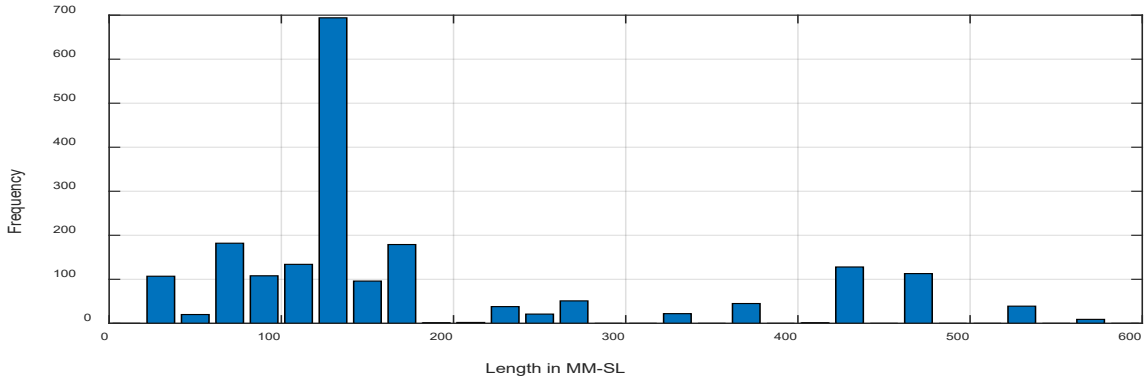

Figure 39. Pacific Hake Length Distribution. Bar Plot - Pacific Hake length distribution for data collected 1966 – 1976 (1972 missing), and 1984 – 1989 (1987 missing).

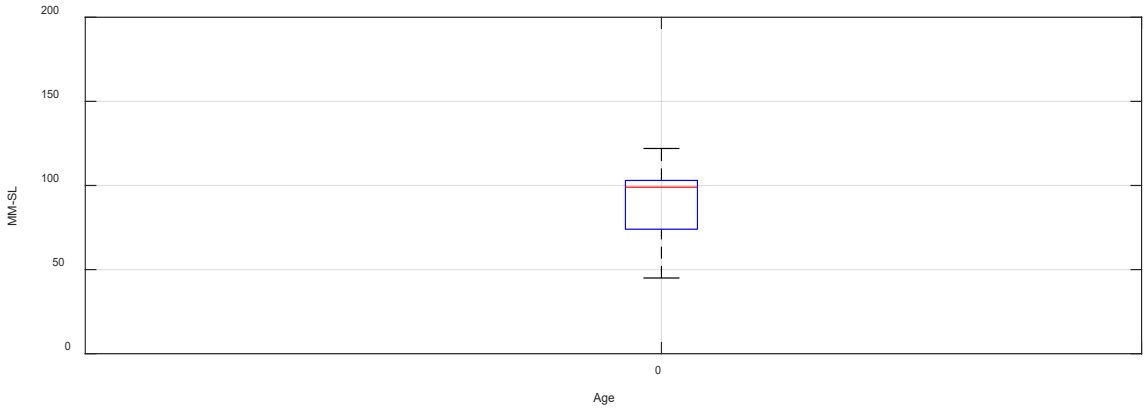

Figure 40. Pacific Hake Age and Length Relationship. Box Plot - Pacific Hake age and length relationship for data collected in 1985.

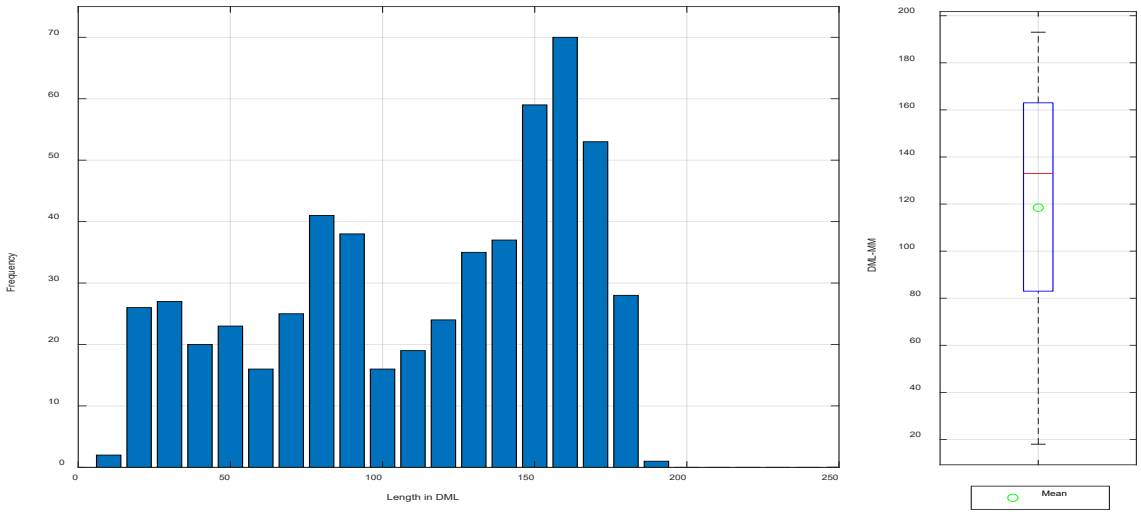

Figure 41. Market Squid Length Distribution. Left Plot: Market Squid length distribution Bar Plot. Right plot: Market Squid Length distribution Box Plot. Data from cruise 74A05.

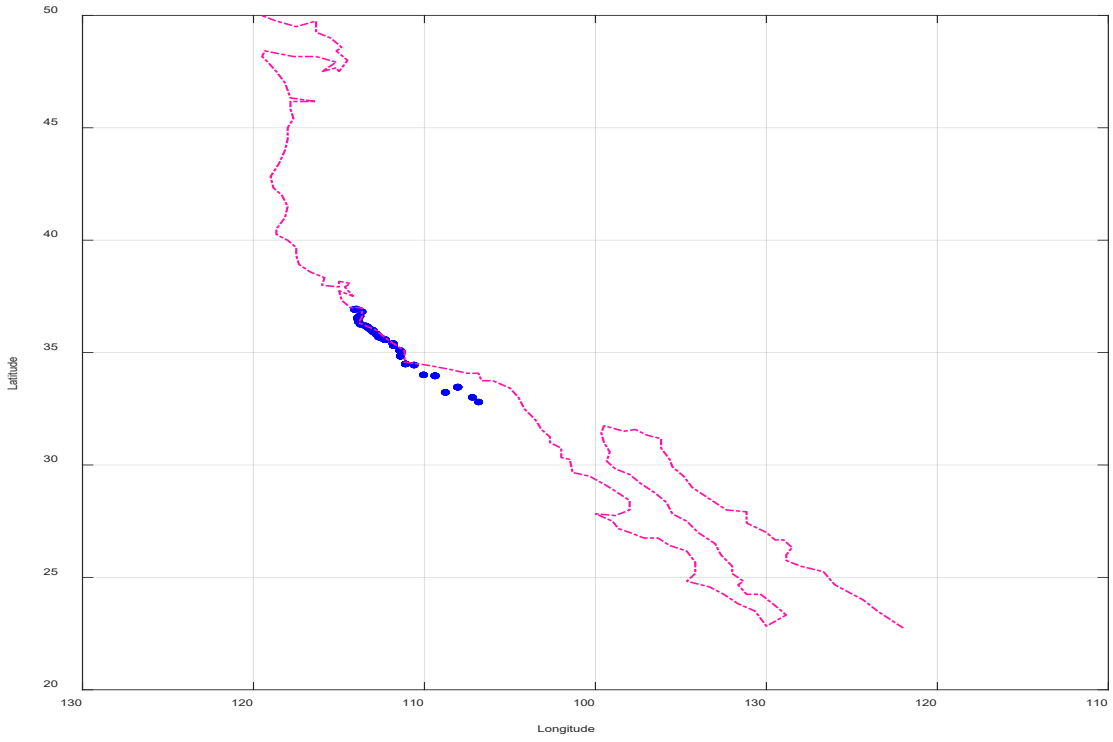

Figure 42. Market Squid Location Distribution. Station location map where Market Squid were caught on one cruise in 1974.

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We extend special thanks to William Watson for lending his expertise in Taxonomy throughout the data reorganization and analyses phase. We thank Lynn deWitt for getting the data ready and served on ERD's ERDDAP server. We thank Stephanie Flores for her contribution in the final manuscript formatting. We also thank colleagues in the CalCOFI group for their encouragement and guidance.

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