

THE SAURY AS A LATENT RESOURCE OF THE CALIFORNIA CURRENT

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INTRODUCTION

An American fishery on the Pacific saury (*Cololabis saira* Brevoort) of the California Current has been considered intermittently over the last three decades. Recently, interest in the eastern Pacific stocks has increased due to rising prices and diminished catches of this species in the western Pacific. Japanese, Soviet, and American exploratory research on this species in the eastern Pacific has been intensified during the past several years. As yet no fishery has developed on this species in the California Current region. It is the purpose of this paper to review two bodies of data on saury abundance collected on cruises of the California Cooperative Oceanic Fisheries Investigations (CalCOFI) conducted jointly by the University of California, Scripps Institution of Oceanography and the U.S. Department of Commerce's National Marine Fisheries Service Laboratory, La Jolla, California. Night-light observations of juvenile and adult sauries were recorded from September 1950 through December 1958 and have been published through December 1955 (Ahlstrom and Casey, 1956). In addition, saury eggs have been sorted from oblique plankton tows since February 1950, and the results to December 1955 have been published in the same report. That portion of the saury data on observations and planktonic eggs which has not yet been published is appended to this paper (Appendix Tables I and II). Sea survey cruises conducted since 1950 (Heimann, 1969) have yielded information on saury observations (Eberhart, 1954). Basic oceanographic data related to the plankton tows and night-light stations are in "Observations of the Pacific Ocean" series (Staff, Scripps Institution of Oceanography) and specific information on the plankton tow data are available by reference to Thraillkill (1969). Information on saury eggs from eight cruises in the mid-Pacific between 1956-57 have been provided by the National Marine Fisheries Service Biological Laboratory, Honolulu, Hawaii (Appendix Table III).

In addition to summarizing current data collected by surveys in the California Current area, we will attempt to answer the following questions:

What is the range of natural fluctuations in abundance of Pacific saury in the California Current survey area, and what seasons or areas within the California Current area are the most

likely for scouting for fishable saury concentrations?

We will first deal with estimates of abundance of the saury spawning population as determined from collections of their eggs on CalCOFI surveys.

DISTRIBUTION OF SAURY EGGS WITHIN THE CALCOFI SURVEY AREA OFF CALIFORNIA AND BAJA CALIFORNIA

Our data on occurrence and abundance of saury eggs has been obtained from plankton hauls on CalCOFI survey cruises between February 1950 and December 1966. Data on occurrence of saury eggs are summarized for these years in a composite map (Figure 1). Frequency of occurrence is shown for stations occupied most frequently in the CalCOFI pattern: these lie between station lines 60-137, with offshore coverage to station 90 on lines 60-120 and to station 60 on lines 123-137. In the remainder of the pattern only positive and negative stations for saury eggs are indicated.

Information summarized on this map is based on 23,284 plankton hauls of which 2,429, or 10.4%, contained saury eggs. Total standardized number of saury eggs was 51,900 or 21.37 per positive haul.

Sampling and survey techniques have been most recently summarized by Ahlstrom (1966, p. 1-5). Briefly, a 1-m diameter net with 0.55-mm apertures is towed obliquely from approximately 140-m to the surface at a vessel speed of about 2 knots. During a haul the net moves 3-4-m forward for each meter of ascent. A flow meter in the mouth of the net is used to estimate the volume of water strained during each haul. For comparability, fish eggs and larvae obtained in each haul are standardized to the number under 10 square meters of sea surface. The standard haul factor usually is about three.

The area represented by a station in the CalCOFI grid, most commonly, is 20x40 nautical miles. Inshore stations, however, are more closely spaced and may represent as small an area as 4x40 nautical miles, offshore stations, particularly those seaward of station 70 usually represent an area of 40x40 nautical miles, or even a greater area if seaward of station 90.

Saury eggs did not occur with equal frequency throughout the CalCOFI survey area (Figure 1). They were taken less frequently at inshore stations in all parts of the pattern and at stations occupied off central and southern Baja California.

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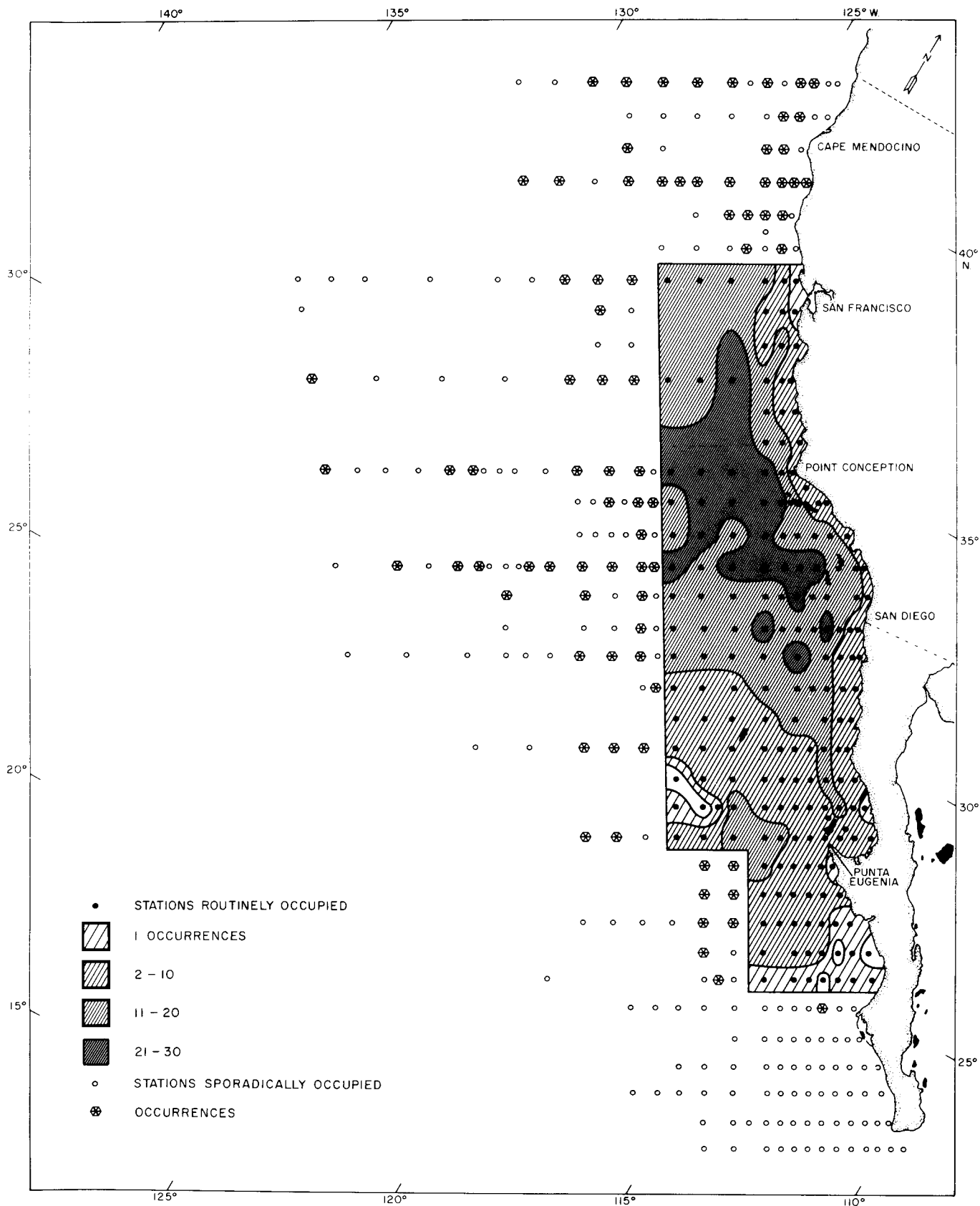


FIGURE 1. Saury egg occurrences 1950-1966.

TABLE 1
Occupancies of plankton stations made on CalCOFI survey cruises, 1950-66,
summarized by area and month.

Station lines	Month												Total all months
	01	02	03	04	05	06	07	08	09	10	11	12	
40-47	7	--	12	32	25	19	54	29	13	6	--	--	197
50-57	20	10	10	25	23	56	50	26	13	13	--	--	246
60-67	147	10	10	216	126	145	229	54	47	155	23	22	1184
70-77	146	33	29	224	149	169	231	56	32	138	26	28	1261
80-87	366	230	186	460	306	325	444	160	100	346	143	150	3216
90-97	432	286	243	565	440	410	579	192	139	463	130	183	4062
100-107	403	233	222	536	386	335	493	139	73	361	38	96	3315
110-119	429	269	266	555	388	340	503	188	171	375	34	91	3609
120-127	367	213	228	429	276	250	416	165	113	334	56	88	2935
130-137	345	146	172	403	201	174	352	130	57	295	54	47	2376
140-147	122	60	52	94	--	30	10	31	11	33	40	18	501
150-157	109	43	36	66	--	27	--	19	14	21	35	12	382
Total	2893	1533	1466	3605	2320	2280	3361	1189	783	2540	579	735	23,284

TABLE 2
Occurrence (positive hauls) for saury eggs on CalCOFI survey cruises, 1950-66,
summarized by area and month.

Station lines	Month												Total all months
	01	02	03	04	05	06	07	08	09	10	11	12	
40-47	1	--	0	2	0	3	11	0	3	1	--	--	21
50-57	0	1	1	5	0	16	5	3	1	1	--	--	33
60-67	3	0	1	42	42	45	26	7	0	1	0	0	167
70-77	8	4	6	81	65	60	19	5	1	1	0	0	250
80-87	36	31	30	157	120	73	28	6	9	15	3	5	513
90-97	42	52	53	168	141	83	33	13	2	12	4	2	605
100-107	41	39	36	113	57	43	12	6	1	11	2	0	361
110-119	32	26	29	74	35	42	7	2	0	3	2	2	254
120-127	34	16	20	36	36	17	10	4	0	0	2	0	175
130-137	12	0	4	11	10	7	5	0	0	0	0	0	49
140-147	1	0	0	0	--	0	0	0	0	0	0	0	1
150-157	0	0	0	0	--	0	0	0	0	0	0	0	0
Totals	210	169	180	689	506	389	156	46	17	45	13	9	2429

TABLE 3
Percentage of positive hauls for saury eggs on CalCOFI survey cruises, 1950-66,
summarized by area and month.

Station lines	Month												Total all months
	01	02	03	04	05	06	07	08	09	10	11	12	
40-47	14.3	--	0	6.2	0	15.8	20.4	0	23.1	16.7	--	--	10.7
50-57	0	10.0	10.0	20.0	0	28.6	10.0	11.5	7.7	7.7	--	--	13.4
60-67	2.0	0	10.0	19.4	33.3	31.0	11.4	13.0	0	0.6	0	0	14.1
70-77	5.5	12.1	20.7	36.2	43.6	35.5	8.2	8.9	3.1	0.7	0	0	19.8
80-87	9.8	13.5	16.1	34.1	39.2	22.5	6.3	3.8	9.0	4.3	2.1	3.3	16.0
90-97	9.7	18.2	21.8	29.7	32.0	20.2	5.7	6.8	1.4	2.6	3.1	1.1	14.9
100-107	10.2	16.7	16.2	21.1	14.8	12.8	2.4	4.3	1.4	3.0	5.3	0	10.9
110-119	7.5	9.7	10.9	13.3	9.0	12.4	1.4	1.1	0	0.8	5.9	2.2	7.0
120-127	9.3	7.5	8.8	8.4	13.0	9.8	2.4	2.4	0	0	3.6	0	6.0
130-137	3.5	0	2.3	2.7	3.6	4.0	1.4	0	0	0	0	0	2.0
140-147	0.8	0	0	0	--	0	0	0	0	0	0	0	0.2
150-157	0	0	0	0	--	0	--	0	0	0	0	0	0
All hauls	7.3	11.0	12.3	19.1	21.8	17.1	4.6	3.9	2.2	1.8	2.2	1.2	10.4

TABLE 4
Numbers of saury eggs (standard haul summations) obtained on CalCOFI survey cruises, 1950-1966, summarized by cruise.

Month of cruise	Year																	Total
	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	
January	--	62	28	240	297	38	219	0	7	40	319	89	142	194	189	244	3391	5,499
February	925	594	265	219	491	444	401	315	49	15	135	--	--	--	--	--	83	3,936
March	104	521	95	260	366	39	387	0	20	39	84	--	--	--	--	--	--	1,915
April	827	187	580	606	404	1339	532	4600	671	192	748	322	158	132	877	619	250	13,044
May	149	271	1032	881	1137	2469	615	737	909	511	30	--	--	--	--	--	2666	11,407
June	110	248	408	1040	476	267	270	161	4050	208	9	--	--	--	--	--	401	7,648
July	25	125	186	460	57	3775	5	63	38	114	3	155	23	64	161	77	77	5,408
August	97	7	5	226	0	70	0	0	0	35	50	--	--	--	--	--	0	490
September	59	12	23	22	--	599	0	0	0	0	0	--	--	--	--	--	0	715
October	0	28	2	3	0	82	56	0	0	33	442	66	92	205	79	6	0	1,094
November	498	3	6	4	--	4	5	5	0	9	--	--	--	--	--	--	0	534
December	--	0	--	0	97	0	46	0	0	64	--	--	--	--	--	--	3	210
Total	2794	2058	2630	3961	3325	9126	2536	5881	5744	1260	1820	632	415	1595	11306	1946	6871	51,900

¹ Many special inshore stations included in appendix tables are omitted in these totals.

In order to more quantitatively document areal differences in occurrence and abundance of saury eggs, the CalCOFI grid was subdivided into 12 regional groupings, each comprising a cardinal and two ordinal lines. Thus lines 40, 43, and 47 were grouped together, lines 50, 53, and 57, etc.

These data are presented in three tables: Table 1 summarizes the areal and temporal distribution of station occupancies, Table 2, the areal and temporal distribution of occurrences (positive hauls) for saury eggs, and Table 3 summarizes the frequency of occurrences of saury eggs (percentage of positive hauls) by month and area. Frequency of occurrence of saury eggs is highest off central and southern California (station lines 60-67 through 90-97), decreasing progressively off Baja California to 2% positive hauls on lines 130-137, 0.2% positive hauls on lines 140-147, and 0% positive hauls on lines 150-157.

Temporally, the frequency of occurrences of saury eggs was highest during the spring months. April-June (19.4%) and lowest during the fall months, October-December (1.7%). The month with the highest frequency of occurrence on the average was May

(21.8%). During January through July saury eggs were taken on all cruises made with the exception of 5701 and 5703. During August through December saury eggs were obtained on about 60% of the cruises, although only in 2.3% of the collections.

Data on the number of saury eggs collected during each monthly cruise (Std haul totals) are given in Table 4, and a companion table summarizes the number of occurrences (positive hauls) of saury eggs, Table 5.

Tables 1-5 summarize data from all stations occupied on regular CalCOFI cruises during 1950-1966. In Figure 1, we delimited a smaller area as that occupied on CalCOFI cruises with greatest regularity. This area extends between station lines 60-137 and from shore to station 90 on all lines except 123-137; for the latter, coverage was from shore to station 60. This area covers approximately 209,150 square miles. In the analysis that follows our detailed estimates of abundance of sauries are for this basic CalCOFI area. Most CalCOFI stations fall within this area (20,645 of 23,284), Table 6.

TABLE 5
Numbers of positive hauls for saury eggs obtained on CalCOFI survey cruises, 1950-1966, summarized by cruise.

Month of cruise	Year																	Total
	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	
January	--	10	8	10	14	2	14	0	1	9	32	18	13	23	9	26	21	210
February	13	25	10	11	19	16	25	3	8	5	20	--	--	--	--	--	14	169
March	12	29	18	20	32	6	34	0	4	2	23	--	--	--	--	--	--	180
April	17	32	47	57	54	22	37	33	68	29	56	54	32	26	25	73	27	689
May	24	39	42	61	49	35	38	53	68	57	4	--	--	--	--	--	36	506
June	26	42	43	67	35	12	24	14	55	27	3	--	--	--	--	--	41	389
July	8	26	17	24	6	3	2	8	7	16	1	5	3	1	7	14	8	156
August	7	1	2	22	0	3	0	0	0	7	4	--	--	--	--	--	0	46
September	6	1	2	3	--	5	0	0	0	0	0	--	--	--	--	--	0	17
October	0	2	1	1	0	3	2	0	0	9	2	7	7	2	7	2	0	45
November	3	1	2	1	--	2	2	1	0	1	--	--	--	--	--	--	0	13
December	--	0	--	0	2	0	2	0	0	4	--	--	--	--	--	--	1	9
Total	116	208	192	277	211	109	180	112	211	166	145	84	55	152	148	1115	148	2,429

¹ Many special inshore stations included in appendix tables are omitted in these totals.

TABLE 6

Summary of number of stations occupied and number of positive hauls for saury eggs on CalCOFI survey cruises, 1950-66, in the basic CalCOFI pattern and in adjacent areas.

Area	Total number stations occupied	Number positive hauls(P)	Percent positive hauls
Basic CalCOFI pattern: lines 60-137-----	20,645	2,255	10.9
Lines 40-57 (all stations)-----	443	54	12.2
Lines 60-120 (stations seaward of station 90) ---	881	103	11.7
Lines 123-137 (stations seaward of station 60) ---	432	16	3.7
Lines 140-157 (all stations)-----	883	1	0.1
	23,284	2,429	10.4

The eggs of the Pacific saury are quite distinctive. Their shape is unusual for pelagic fish eggs, being ovoid rather than round. They are spawned in clusters, the eggs being held together by filaments characteristic of the species.

Saury eggs are neither evenly nor randomly distributed. A number of factors contribute to patchiness in their distribution. The saury is a schooling fish that sometimes occurs in massive concentrations. Although the size of spawning aggregations of sauries are not

known, they probably remain in schools during spawning—hence spawning fish are clustered rather than randomly dispersed. The eggs are spawned in clusters, and although the eggs tend to become disassociated during their long incubation period, large clusters of eggs are sometimes collected. Hence, patchiness is likely to be on at least two scales.

The consequences of this are that 1) a sample can be taken in an 800 square mile area which has a number of eggs per 10 square meters which is too large to be characteristic of the entire 800 square miles, and 2) a sample from an area can be taken which contains no eggs even though that same 800 square mile area does contain eggs. Since we want some idea of the amount of variation from each source, we have separately identified the proportion P of the samples which have saury eggs and D the number of saury eggs per positive sample. The rationale behind this separation is that the precision of the proportion P can be evaluated by the binomial distribution. The density D has a frequency distribution which is complicated by adherence of some eggs, dispersal of some others, and schooled spawning behavior of the adults. To further complicate the frequency distribution the long incubation time (see below) implies that this distribution will change with time.

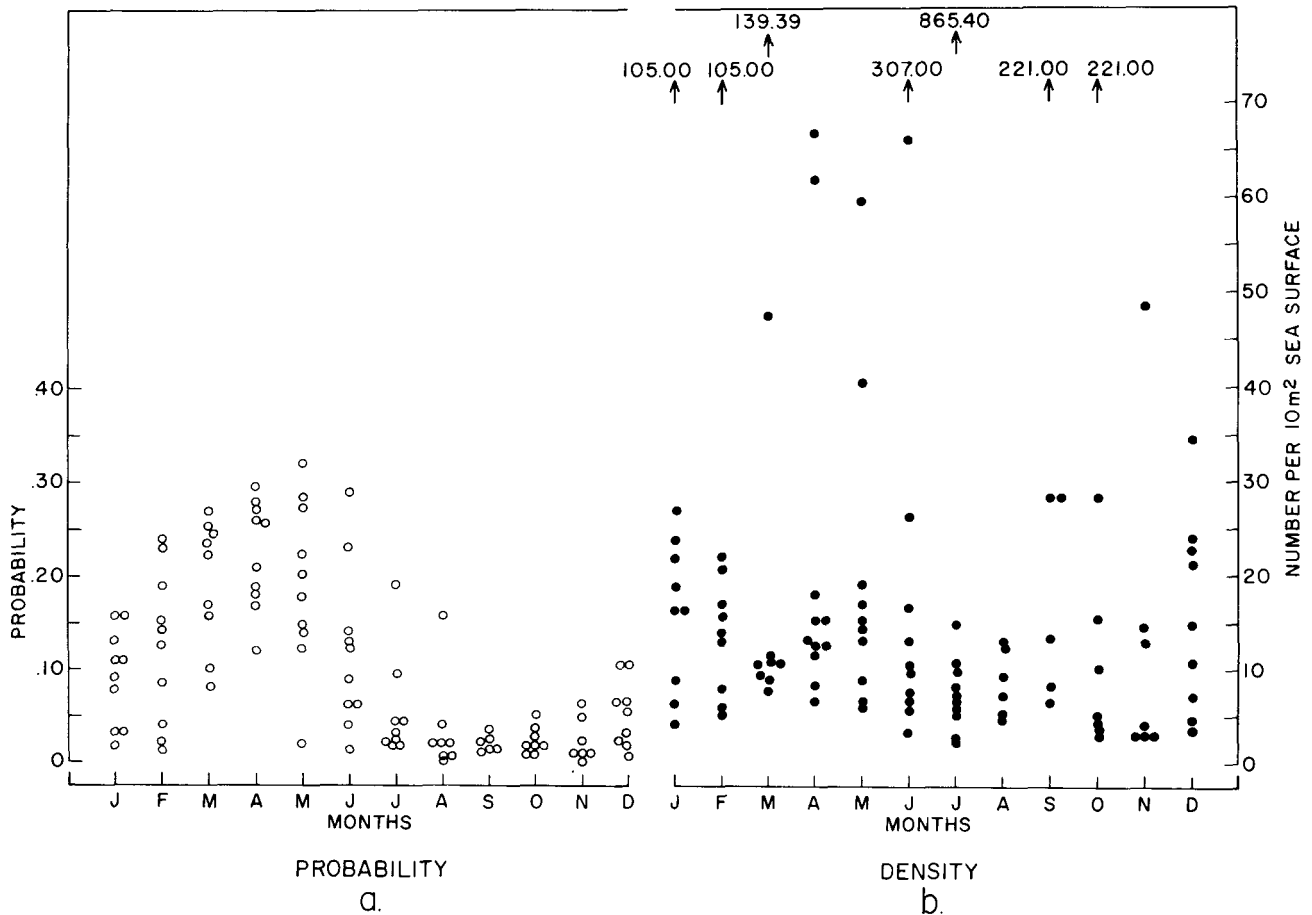


FIGURE 2. The seasonal succession of bimonthly average probability of occurrence (a) and bimonthly average density of eggs per 10 m² in positive tows (b).

The probability P is usually less than 0.05 (Table 3) during several months in the autumn of each year and is usually greater than 0.15 several months in the spring. An example of the 95% confidence limits of these probabilities with 250 samples is approximately

P	Limits
0.05	0.03-0.09
0.15	0.10-0.20
0.25	0.20-0.31

(Snedecor and Cochran, 1967, page 6). The seasonal succession of "P" is shown in Figure 2a.

In Figure 2b D, the density of eggs per 10 m² in positive samples, is shown to be rather erratic and the seasonality is not as pronounced as is the probability of positive sample (2a). The occurrence of samples with a large density are neither frequent nor regular. The large individual samples are not anomalous; they are here assumed to be too infrequent to be properly represented in the bimonthly density averages. These large rare samples usually coincide with periods with high probability of positive samples. This is as would be expected but there is no indication from Figure 2b that the preponderance of high density samples occurs at any one time of year. For these reasons we will stabilize the average number of eggs per 10 m² sea surface for positive samples.

FECUNDITY

A thorough study of the fecundity of the Pacific saury in our region has not been made. MacGregor (pers. comm.) has estimated from a few samples that females contain 22.7 eggs in the *maturing size mode* per gram of body weight. There is no evidence that the male-female number or weight ratio varies from unity, so we assume the fecundity per spawning batch to be 11.35 eggs per gram of adult in the CalCOFI area. If the fecundity is too high, our biomass estimates will be proportionately low, or vice versa. If the biomass of males is less than that of females, our spawning biomass estimates will be too high.

An important consideration in treating fecundity data is the number of spawning batches matured per female per year. Hatanaka (1956a, pages 235-237) found three size modes of ova in fully matured ovaries, with modal sizes of 0.6, 1.1, and 1.9 mm. The time required to mature the middle batch after the largest was spawned was assumed by Hatanaka to require approximately 2 months. Lacking more precise information on the average maturation times between spawning batches, we are accepting Hatanaka's determination of approximately 2 months. This is perhaps the most critical datum in converting estimates of egg abundance to estimates of spawning population biomass. Although each monthly cruise is assumed to represent 30 days, and two adjacent cruises 60 days—actual coverage of stations are made about 1 month apart, on the average. Since it is unlikely that successive modes of ova would mature as rapidly as 30 days, we undoubtedly are sampling different segments of the spawning population during any two successive monthly cruises.

DEFINITION OF SYMBOLS

N—Number of stations occupied during a cruise within a specified survey area, such as the basic CalCOFI area.

P—Number of positive hauls for saury eggs obtained during a cruise within a specified area.

S—Standard haul total of saury eggs obtained in a collection.

D—The number of saury eggs spawned per day in a standard area, representing 10 m² of sea surface.

A—Weighting factor for area. For the purposes of this paper we use an average weighting factor for area. For the basic CalCOFI survey area, this is derived by dividing 7.17 × 10¹⁰ by N.

T—Weighting factor for time. For the purposes of this report, a cruise is assumed to represent 30 days.

C—Estimate of the number of saury eggs in a specified survey area during a given cruise.

I—Incubation time of saury eggs in days. Precise information on incubation time as related to temperature is not available. Dr. Grace Orton (pers. comm.) observed that saury eggs required 9-10 days to develop to hatching when kept in the laboratory in a finger bowl. We are assuming that saury eggs require 10 days incubation time on the average.

B—Estimate of the biomass of spawning fish (males and females) in metric tons.

ESTIMATING ABUNDANCE OF SAURY EGGS

The primary estimate of abundance of saury eggs we wish to make is abundance in the basic CalCOFI area. This area covers 209,150 square miles or 7.17 × 10¹⁰ standard areas.

The formula for calculating abundance of eggs within a specified survey area during a given cruise is

$$C = D \cdot P \cdot A \cdot T$$

We have used two estimates of D in our calculations, both averages. The estimate we consider the more reliable is that based on total collections made over a 17-year period.

$$D_t = \Sigma S \text{ for all cruises} / \Sigma P \text{ for all cruises times I,}$$

$$\text{or } D_t = \frac{51,900}{2429 \times 10} = 2.137$$

$$D_y = \Sigma S \text{ for a given year} / \Sigma P \text{ for the same year times I.}$$

ESTIMATES OF SAURY EGG ABUNDANCE AND BIOMASS OF SPAWNERS IN THE BASIC CALCOFI AREA, 1950-1966

Estimates of egg abundance are made for the two best adjacent months of each year. During the period of quarterly cruises 1961-1965, the April estimate has been doubled, to obtain a 2-month abundance estimate. The basic CalCOFI area with respect to station lines (60-137) was covered on most cruises used for abundance estimates, exceptions being 5504, 5704, 6004, 6605, and 6606. When a portion of the CalCOFI area, usually lines 60-77, was covered on only one of

the two cruises, we have adjusted for the missing coverage by assuming occupancies and positive hauls to be identical to those obtained on the more complete cruise. Hence, all estimates are based on coverage of the complete basic CalCOFI area. However, stations occupied outside the basic CalCOFI area, such as on lines 40-57 or 140-157 are not used; for this reason adjusted N, is usually smaller than the original N value of a cruise, and similarly adjusted P is usually smaller than the original P value of a cruise.

The estimates of egg abundance contained in Table 7, use the formulation $C = DPAT$ in the following manner.

D is standardized to 2.137 eggs per standard area per day of spawning (D_t as previously defined).

P—positive hauls for saury eggs, adjusted as above described.

A—weighting factor for area. This basic CalCOFI pattern contains a surface area of ca. 7.17×10^{11} m² or 7.17×10^{10} standard areas. For a given cruise $A = 7.17 \times 10^{10}$ /adjusted N.

T—weighting factor for time: 30 days.

As previously noted, the number of saury eggs spawned per batch per metric ton of males and females is standardized at 1.135×10^7 . Hence, an estimate of the spawning biomass is obtained by dividing the estimates of egg abundance for two consecutive months by the value for fecundity.

Estimates of the spawning population biomass range from 88.6 thousand metric tons to 266,000 metric tons, a range of three times. Average biomass during the 17-year period was 182.0 thousand metric tons. Estimates based on years with monthly cruises are somewhat less variable, ranging from 142,000 metric tons to 266,000 metric tons, and average 198,000 metric tons or approximately 220,000 short tons.

We are making several assumptions in equating estimates of number of saury eggs in the CalCOFI area to the biomass of spawners. We assume that the total saury spawning population in the survey area will spawn during the peak 2-month period. We also are assuming that during a 2-month period, each female will have spawned only one batch of eggs.

$B = \frac{C_1 + C_2}{1.135 \times 10^7}$ in which C_1 and C_2 are monthly estimates of egg abundance for the two adjacent months of each year with the highest number of occurrences (positive hauls) of saury eggs.

One important factor, egg mortality, is not applied in this formulation, because we have no reasonable estimate of this rate. The effect of its omission will be to underestimate the number of eggs spawned. To adjust for mortality during the embryonic period, the eggs would have to be aged and corrected to the number at the instant of spawning.

TABLE 7
Estimates of number of saury eggs spawned within the basic CalCOFI area during the two best months of each year, and of the biomass of spawners, 1950-66.

Year	Month	Lines occupied	Total stations N	Adjusted N	Positive stations P	Adjusted P	A (standard areas $\times 10^8$)	C (estimate of number eggs $\times 10^{10}$)	Estimate of biomass of spawners $\times 10^3$ metric tons
1950	May	40-130	129	84	24	20	8.51	109.1	217.5
	June	40-130	106	73	26	22	9.77	137.8	
1951	May	60-137	127	111	39	30	6.42	123.5	242.8
	June	60-157	170	117	42	39	6.09	152.1	
1952	April	60-137	155	152	47	47	4.69	141.4	216.3
	May	60-137	187	184	42	42	3.87	104.2	
1953	May	60-137	203	162	61	57	3.92	143.4	266.5
	June	60-137	196	192	67	67	3.70	159.1	
1954	April	60-137	196	195	54	54	3.65	126.4	207.8
	May	60-137	205	204	49	49	3.48	109.5	
1955	April	80-137	134	149	22	27	4.72	81.7	149.0
	May	60-137	184	183	35	35	3.90	87.4	
1956	April	60-157	178	151	37	37	4.72	112.0	172.7
	May	40-137	239	202	38	37	3.54	84.0	
1957	April	80-157	207	183	33	48	3.90	119.9	210.0
	May	60-137	205	205	53	53	3.48	118.4	
1958	April	60-137	267	233	68	64	3.07	126.1	229.2
	May	60-137	232	232	68	68	3.07	134.0	
1959	April	60-147	250	224	29	29	3.18	59.2	141.7
	May	60-137	261	247	57	55	2.88	101.6	
1960	March	73-137	163	184	23	31	3.87	76.9	146.4
	April	40-157	342	240	56	47	2.96	89.3	
1961	April	60-137	240	199	54	44	3.60	101.4	178.7
1962	April	60-140	247	202	32	27	3.54	61.3	108.0
1963	April	60-140	245	200	26	22	3.57	50.3	88.6
1964	April	60-137	224	211	25	24	3.38	51.9	91.5
1965	April	63-137	237	220	73	70	3.24	145.3	256.0
1966	May	80-137	195	235	36	52	3.05	101.6	170.4
	June	60-103	135	235	41	47	3.05	91.8	
									182.0

Spawning Outside the Basic CalCOFI Area

We have a number of sources of information on saury spawning outside the basic CalCOFI area. On some cruises stations were occupied off southern Baja California (station lines 140-157), on many cruises stations were occupied seaward of the basic CalCOFI pattern on station lines 60-137 (Figure 1 and Table 6), and on about 10 percent of the cruises stations were occupied off northern California (station lines 40-57). Only one haul of 883 made off southern Baja California contained saury eggs, hence spawning in this area is inconsequential. Stations occupied seaward of station 60 on lines 123-137 were only slightly better—3.7 percent contained saury eggs. The area seaward of station 90 on lines 60-120 is an important spawning area for the saury. We propose to divide this extensive area into two subareas for deriving estimates of abundance: 1) Area A—station lines 60-120,

stations 95-120; 2) Area B—station lines 60-100, stations 130-200. Average size of the saury spawning population is estimated at 100,000 metric tons in Area A, 70,000 metric tons in Area B during the two spring months, April-May (Table 8). The average size of the saury spawning populations in the basic CalCOFI area during April-May is estimated to be 173,000 tons. Inasmuch as these estimates cover the same time period, the offshore population can be assumed to be distinct from that in the basic CalCOFI area, hence these estimates are additive.

The two best months for saury eggs off northern California (station lines 40-57) are June and July. The average size of spawning populations during these months is estimated to be 62,000 metric tons. The spawning population could be made up, in part, of fish which have migrated into this area from the south or offshore subsequent to the April-May spawning.

TABLE 8
Estimates of average saury egg abundance and biomass of spawning populations in areas seaward of basic CalCOFI area or off northern California.

	Number stations	P	Area ($\times 10^3$) sq. miles	A	DPAT ($\times 10^{10}$)	Biomass $\times 10^3$ metric tons
Areas seaward of basic CalCOFI area						
Area A (station lines 60-120, stations 95-120)						
April.....	174	32	91.2	2.674	54.9\	100
May.....	64	19	91.2	4.888	59.5f	
Area B (station lines 60-100, stations 130-200)						
April.....	51	8	166.4	11.192	57.4\	70
May.....	17	1	166.4	33.576	21.5f	
Areas off northern California						
Northern California (station lines 40 to 57)						
June.....	75	19	78.8	3.602	43.9\	62
July.....	104	16	78.8	2.597	26.6f	

TABLE 9
Saury spawning off Oregon, 1949.

	April	May	June	July	August	September	Total
Stations occupied off Oregon on CalCOFI cruises in 1949							
Station line 1.....	--	5	--	10	10	--	25
Station line 2.....	--	6	--	10	10	10	36
Station line 3.....	10	10	--	9	10	10	49
	10	21	--	29	30	20	110
Positive hauls for saury eggs off Oregon in 1949							
Station line 1.....	--	0	--	0	7	--	7
Station line 2.....	--	0	--	1	4	3	8
Station line 3.....	0	2	--	1	2	1	6
	0	2	--	2	13	4	21

Estimate of abundance of saury eggs off Oregon in 1949.

Month	Number stations occupied	P	Area $\times 10^3$ sq. miles	A	PADT	Biomass $\times 10^3$ metric tons
July.....	29	2	96	11.35	14.6\	93
August.....	30	13	96	10.98	91.5f	

Ordinarily CalCOFI surveys do not extend to the north of California. However, three lines of stations off Oregon were occupied wholly or in part during five cruises of 1949. The majority of occurrences of saury eggs were obtained on the August cruise: 13 positive hauls out of 30. Only eight additional hauls contained saury eggs out of the remaining 80 obtained during 4904, 4905, 4907, and 4909. An estimate of the abundance of spawning fish off Oregon in July–August 1949 amounts to 93,000 metric tons. Inasmuch as the spawning season off Oregon is later in the year than off California, we cannot be certain that the spawning population is wholly distinct from that off California. More limited coverage off Oregon was obtained in 1950. Seven of 33 hauls made off Oregon in August and September 1950 contained saury eggs. (Table 9.)

The most systematic coverage of the eastern north Pacific to the north of 20° N latitude was obtained on the NORPAC Expedition of August 1955 (Figure 3). Saury eggs were obtained at 15 stations of 196 in the portion of NORPAC covered by CalCOFI research vessels. In addition, saury eggs and/or larvae were taken in hauls made by NMFS Honolulu Biological Laboratory's ships between 30° and 50° N and 155° and 180° W (Figure 4, Appendix III). About half of the positive records fall within the comprehensive CalCOFI pattern, illustrated in Figure 1: the remainder are interesting additions to our information on distribution of saury eggs.

In summary the average estimate of the size of the saury spawning population within the basic CalCOFI area between San Francisco, California, and Pt. San Eugenio, Baja California, is 182,000 metric tons when based on egg abundance during the two best months of each year, 173,000 metric tons if based on average abundance during April–May. The saury population offshore from the basic CalCOFI area (station lines 60–120) is estimated to be equally large, averaging 170,000 metric tons during April–May. An estimate of the average spawning population off northern California, station lines 40–57, during the two best months in that area amounts to 62,000 metric tons. Our best estimate from off Oregon of 93,000 metric tons is based on our coverage during July–August 1949. If the spawning population in all four regions were separate, the average biomass would exceed 500,000 metric tons. This does not include the offshore portions of the population between 40° to 50° N latitude that extends out to at least mid-ocean (180° W) and probably completely across the Pacific.

AVAILABILITY

One of the authors (Casey) has prepared a draft of a manuscript in which arbitrary quantities have been assigned each kind of observation recorded on night stations under working lights. The senior author (Smith) has conducted personal night-light observations in November 1968 and May 1969 over

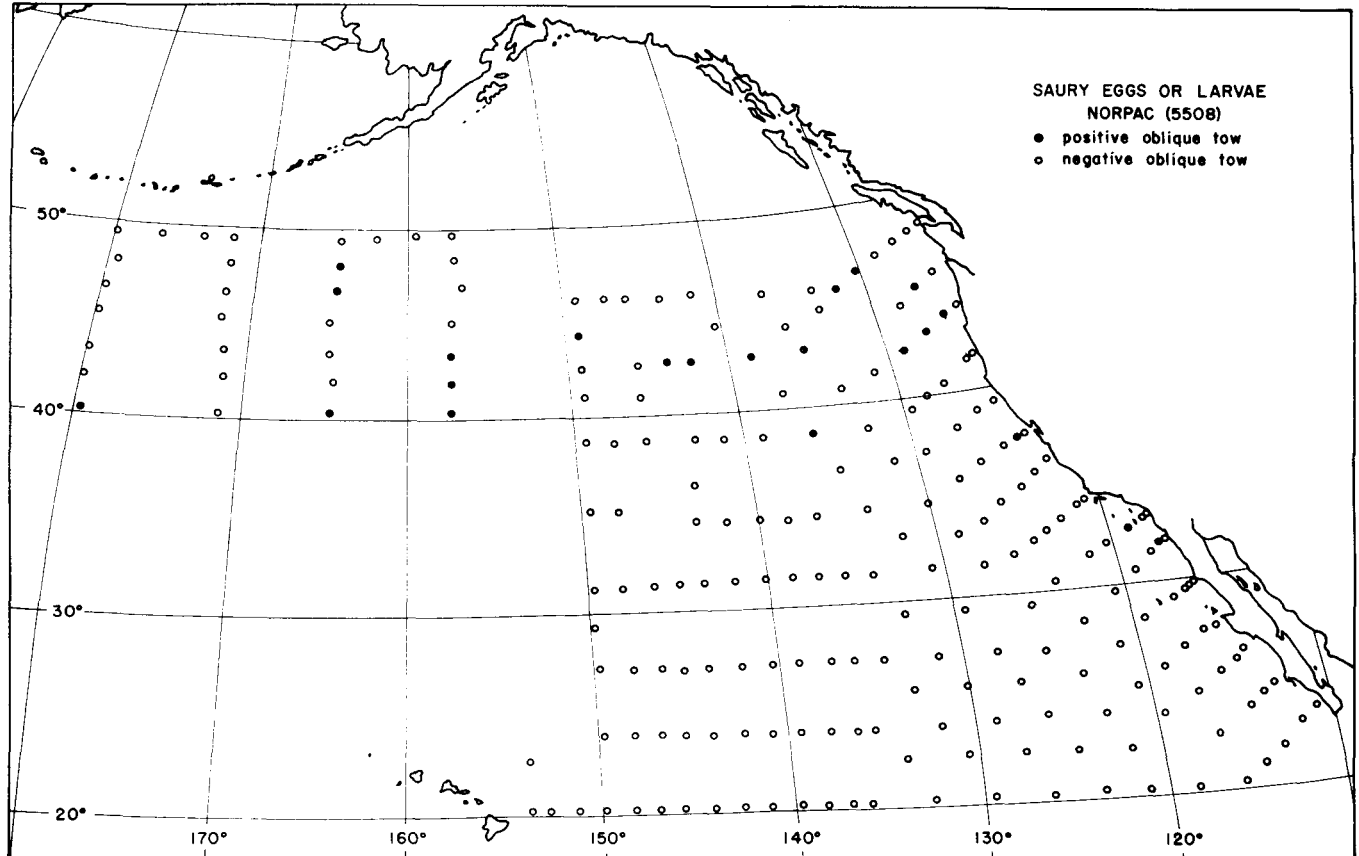


FIGURE 3. The occurrence of saury eggs or larvae in the NORPAC Expedition, August 1955.

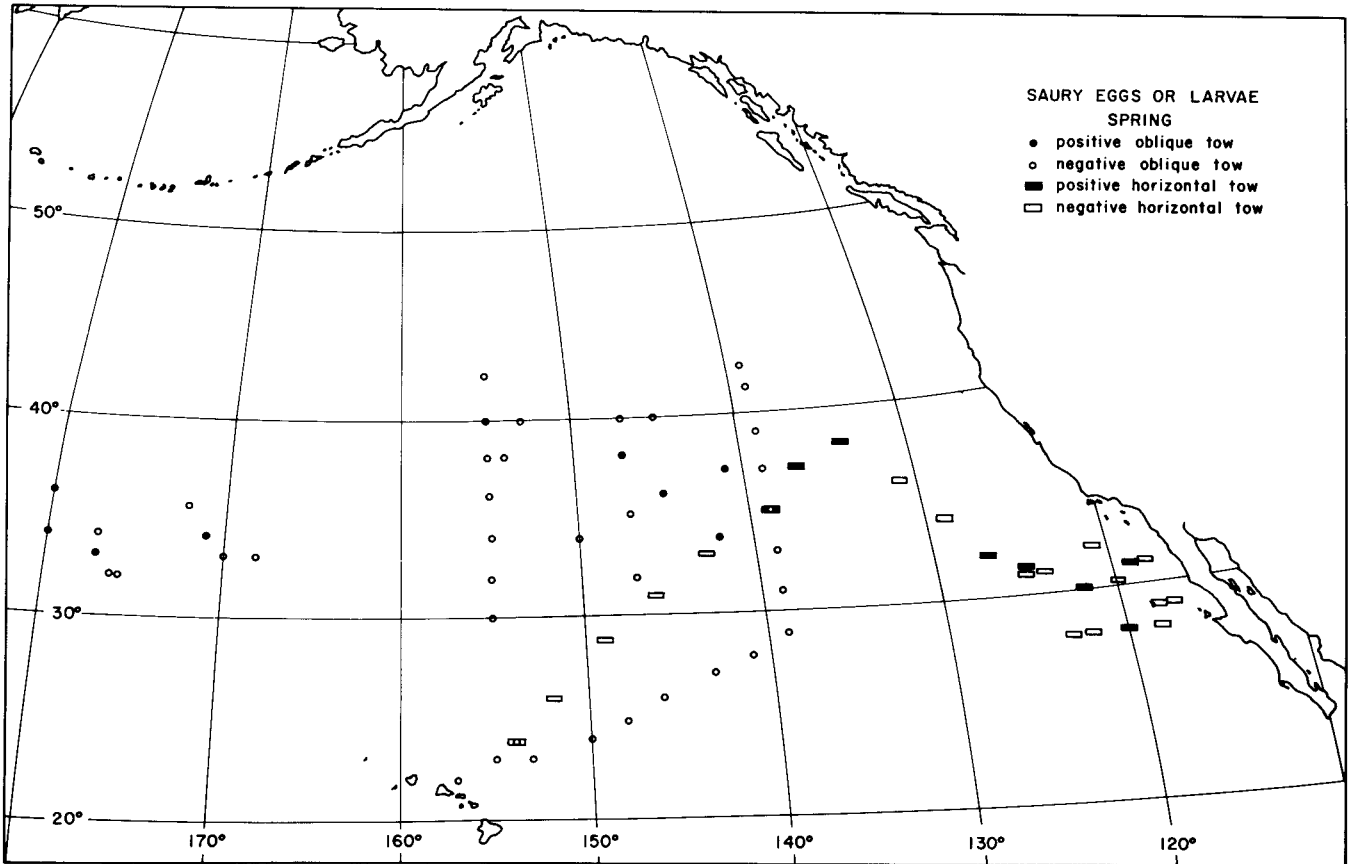
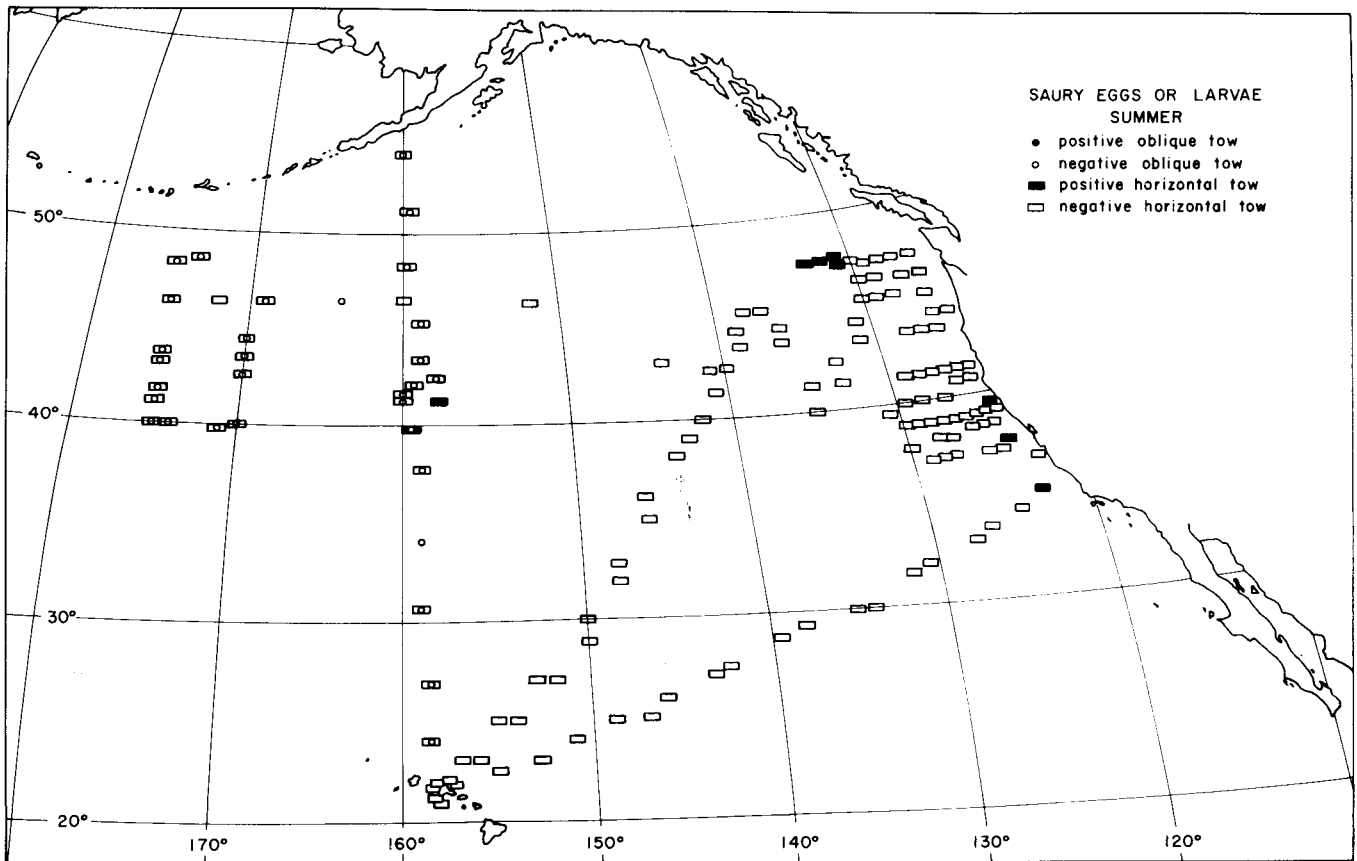
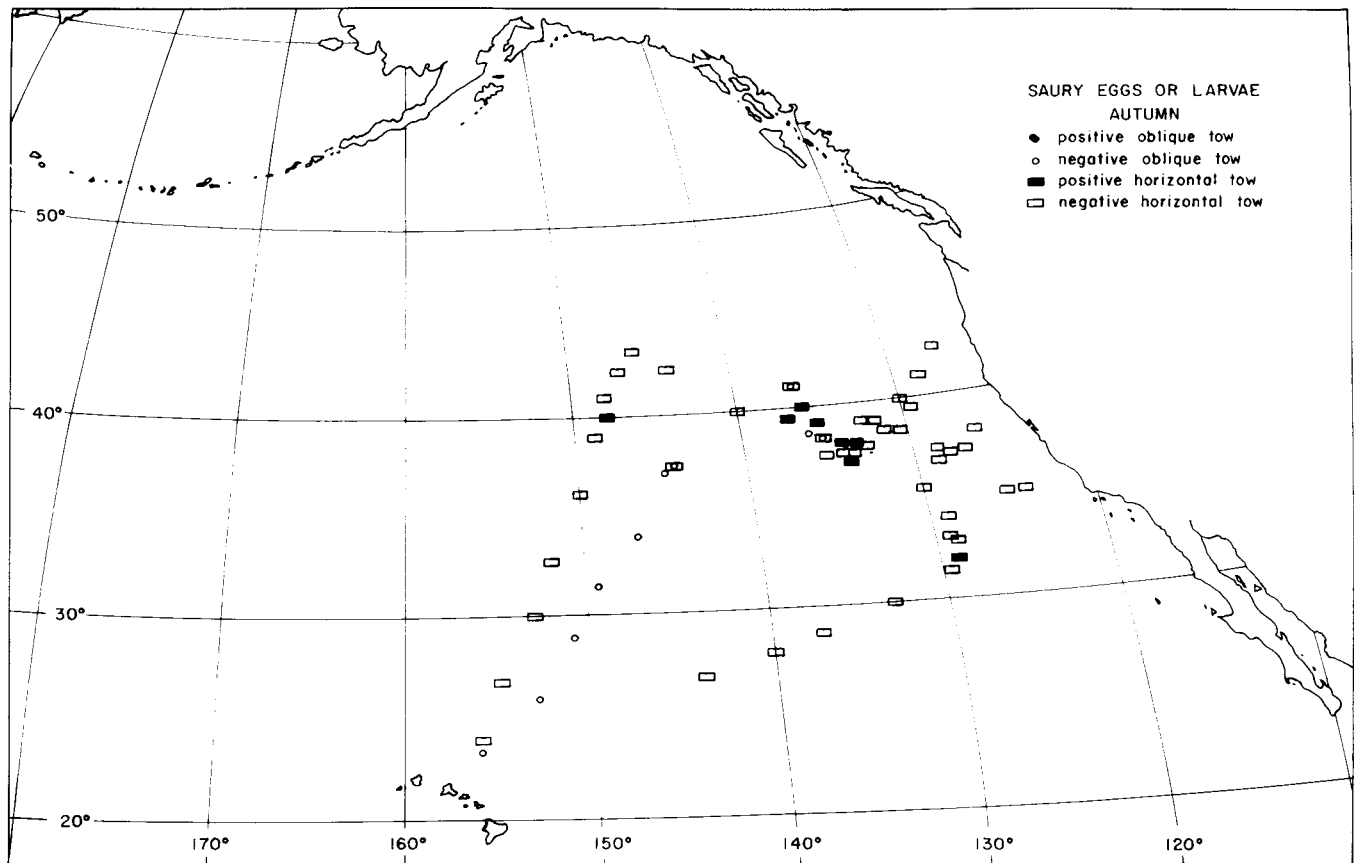


FIGURE 4. The incidence of saury eggs or larvae in samples taken by ships of the Honolulu Biological Laboratory of the Bureau of Commercial Fisheries, arranged by season: spring (a), summer (b), and autumn (c).





the same survey area. We find that the quantities and statistical treatment of them do little more than indicate trends and it is likely that summaries of that kind will be neither stable nor linear parametrically. Even if the quantities were both stable and the trends linear, the conditions of a commercial fishery are so different (Inoue, 1969) that the quantities derived from oceanographic night-light stations would not be applicable. Nevertheless, the seasons and positions at which the observations were made (Appendix II) may furnish information useful for exploratory fishing. Also, the importance of size in the commercial market makes it useful to separate some observations by size. Observations will be discussed by area, season, and seasonal changes in area.

Area

In this subsection we will separately discuss the north-south and the onshore-offshore distributions. Nearshore observations have been summarized by Eberhardt (1954) and the sea surveys of the California Department of Fish and Game have continued. These data reports are published and references to the series may be found in Heimann (1969).

The incidence of saury observations decreased strongly from north to south. Northern California appears strongly favorable for searching purposes and the area from the Mexican border to San Francisco are nearly identical. The incidence of sightings is slight below Guadalupe Island.

Observations within 40 miles of the coast appear to be somewhat less frequent than those in a band 40–120 miles offshore. This appears to be true of all sizes of saury. The large and medium sized saury are, if anything, somewhat nearer the coastline than the very smallest group.

Season

A summary of 3,485 night-light observations is presented in Table 10. It is interesting to note that the maximum likelihood of saury observations occurs in November which coincides with the height of the fishery in the western temperate Pacific. The minimum probability of night-light observations coincides with the maximum probability of sampling eggs.

The maximum likelihood of saury observations occurs at a time when the standing crop of zooplankton is lowest. The minimum likelihood of observation co-occurs with a period of zooplankton standing crop increase (see Lasker, 1970, page 279).

Even though these seasonal extremes coincide, the saury observation distribution is as ubiquitous as the spawning distribution, thus correlation with simple environmental parameters is difficult.

In one sample of 1,310 observations taken in 1954–55 saury were observed at 64% of the stations. The temperature range was from 9° to 26° C and the range of temperature with saury observations was from 10° to 22° C with a rather even maximum for all sizes of saury in temperature ranges from 13° to 17° C.

Saury observations seasonal maxima appear superficially to coincide with a period of rapid temperature change. One can see from monthly surface temperature isotherm graphs (Eber *et al.*, 1968) that the period from September to December is characterized by a vast southward movement of the 16° isotherm. An extreme example is furnished by September–December 1957 when the 16° isotherm coastal intercept moves from north of Pt. Arena in September to Pt. Vicente in December.

Summary—Availability

It appears likely that some saury will be available to any port in California at any season. However, examination of the biological observations shows that we used more information on the size of aggregations and individual sizes of fish in the aggregations to apply to commercial feasibility studies. It seems quite clear that a fishery which depends on attraction to lights would exclude the months March through June. Observations would indicate a maximum offshore 40 miles or more. The northern half of the CalCOFI grid (north of San Diego) is more likely to produce fishable concentrations of saury than the southern half. There is some indication that the area north of San Francisco would be more likely to yield fishable aggregations of saury.

There is some indication that frontal zone development is an important process in the aggregation of

saury (Hatanaka, 1956b). Optimum fishing areas and seasons could be determined by spatial and temporal gradients of oceanic features.

DISCUSSION

We think that useful answers to the original questions can be based on the data presented here. What is the range of natural fluctuation in the abundance of Pacific saury in the California Current survey area?

The bimonthly averages of spawning biomass range from 141,700 metric tons in 1959 to 266,500 metric tons in 1953, over an 11-year period from 1951–60 and 1966. Since the Pacific saury spawns outside of the CalCOFI grid area one can expect some of the variability to reflect different proportions of the spawning taking place within the survey area.

What seasons and areas within the California Current area are the most likely for scouting for fishable saury concentrations?

The appropriate season for searching for fishable saury aggregations probably extends from September through December at which time water temperature is falling rapidly and zooplankton is at a minimum. The optimum area of search is north of San Diego to at least Cape Mendocino with an indication that search will be more productive north of San Francisco and offshore 40 miles or more.

TABLE 10
Saury night-light observations, 1952–1958

Month	Obs	Percent +	Percent 0	Percent X	Percent R	Percent C	Percent A	Percent VA	Percent C+A+VA	Percent A+VA
January	326	33.4	66.6	14.1	8.6	5.5	3.4	1.8	10.7	5.2
February	326	38.0	62.0	10.7	13.5	8.6	3.1	2.1	13.8	5.2
March	317	37.5	62.5	12.6	15.8	6.9	1.6	0.6	9.1	2.2
April	477	24.3	75.7	12.4	8.4	3.1	0.0	0.4	3.5	0.4
May	445	25.8	74.2	8.7	8.1	7.2	1.8	0.0	9.0	1.8
June	364	30.8	69.2	12.1	7.4	7.7	2.2	1.4	11.3	3.6
July	343	37.3	62.7	9.3	8.7	10.6	6.1	2.6	19.3	8.7
August	135	41.5	58.5	15.6	11.1	9.6	3.7	1.5	14.8	5.2
September	131	32.1	67.9	16.8	5.3	5.3	1.5	3.2	10.0	4.7
October	273	27.8	72.2	8.8	4.8	6.6	5.9	1.7	14.2	7.6
November	151	66.9	33.1	27.2	17.2	12.6	6.6	3.3	22.5	9.9
December	197	42.6	57.4	16.8	7.0	13.7	4.6	0.5	18.8	5.1
Total	3485									

- Obs = number of night observations recorded.
- %+ = percent of night observations with sauries sighted.
- %0 = percent of night observations without sighting of sauries.
- %X = percent of night observations with sauries present, but not persistent under the lights.
- %R = percent of night observations with 1 to 10 sauries persistent under the lights.
- %C = percent of night observations with 11 to 100 sauries persistent under the lights.
- %A = percent of night observations with 101 to 1,000 sauries persistent under the lights.
- %VA = percent of night observations with more than 1,000 sauries persistent under the lights.

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APPENDIX I
Saury Eggs—Numbers by Stations, 1956

Station	Cruise and month												Total
	5601 Jan.	5602 Feb.	5603 Mar.	5604 Apr.	5605 May	5606 June	5607 July	5608 Aug.	5609 Sept.	5610 Oct.	5611 Nov.	5612 Dec.	
40.80	--	--	--	--	0	14	--	--	--	--	--	--	14
.90	--	--	--	--	0	55	--	--	--	--	--	--	55
50.80	--	--	--	--	0	3	--	--	--	--	--	--	3
57.55	--	--	--	--	0	3	--	--	--	--	--	--	3
.65	--	--	--	--	0	7	--	--	--	--	--	--	7
60.57	--	--	--	0	--	3	--	--	--	--	--	--	3
.60	--	--	--	0	12	2	0	--	--	--	--	--	14
.80	--	--	--	0	0	10	0	--	--	--	--	--	10
67.55	--	--	--	0	0	6	0	--	--	--	--	--	6
.65	--	--	--	0	20	2	--	--	--	--	--	--	22
70.52	--	--	--	0	4	0	0	--	--	--	--	--	4
.55	--	--	--	0	0	10	0	--	--	--	--	--	10
.60	--	--	--	0	0	3	0	--	--	--	--	--	3
.90	--	--	--	0	0	4	0	--	--	--	--	--	4
73.70	--	--	--	0	0	10	0	--	--	--	--	--	10
77.60	--	--	--	--	21	0	0	--	--	--	--	--	21
.80	--	--	--	--	24	--	0	--	--	--	--	--	24
80.55	0	0	NS ¹	0	42	0	0	--	--	0	0	0	42
.60	0	0	0	0	12	0	0	--	--	47	0	0	59
.70	0	0	13	0	62	0	0	--	--	0	0	0	75
.80	0	0	7	4	0	0	0	--	--	0	0	0	11
.90	0	0	3	15	0	0	0	--	--	0	0	0	18
82.47	0	0	6	0	5	0	0	--	--	0	0	0	11
83.40	--	NS ¹	0	0	0	0	0	--	--	0	2	--	2
.51	0	0	0	3	64	0	0	--	--	0	0	0	67
.55	--	--	--	3	56	0	0	--	--	0	0	0	59
.60	0	3	0	0	25	0	0	--	--	0	0	0	28
.70	--	--	14	4	0	0	0	--	--	0	0	0	18
87.45	--	--	--	--	3	0	0	--	--	0	0	30	33
.50	0	0	0	3	0	0	0	--	--	0	0	0	3
.55	--	--	--	--	0	0	0	--	--	0	0	16	16
.60	0	6	3	0	2	0	0	--	--	0	0	0	11
.70	--	--	0	7	10	0	0	--	--	--	--	--	17
.75	--	--	--	--	4	--	3	--	--	--	--	--	7
.80	--	--	6	22	0	0	0	--	--	--	--	--	28
.90	--	--	3	6	0	0	0	--	--	--	--	--	9
90.30	0	0	38	0	3	0	0	--	--	0	0	0	41
.37	0	0	0	7	0	0	0	--	--	0	0	0	7
.45	0	0	0	50	0	0	0	--	--	9	0	0	59
.50	--	--	--	--	0	24	0	--	--	0	0	0	24
.55	0	0	0	9	0	0	0	--	--	0	0	0	9
.60	0	0	0	24	31	0	0	--	--	0	0	0	55
.70	0	0	0	7	0	0	0	--	--	0	0	0	7
.80	0	0	0	37	10	0	0	--	--	0	--	0	47
.90	--	--	0	0	32	0	0	--	--	0	--	0	32
93.30	0	0	0	0	33	7	2	--	--	0	0	0	42
.35	--	--	--	--	5	0	0	--	--	0	0	0	5
.40	0	11	3	37	0	0	0	--	--	0	0	0	51
.45	--	--	--	--	0	0	0	--	--	0	3	0	3
.50	0	19	0	16	4	0	0	--	--	0	0	0	39
.55	--	--	--	--	5	0	0	--	--	0	0	0	5
.60	--	3	0	0	0	0	0	--	--	0	0	0	3
.70	--	0	0	20	0	0	0	--	--	--	--	--	20
.75	--	--	--	--	7	0	0	--	--	--	--	--	7
.80	--	--	12	3	0	0	0	--	--	--	--	--	15
.90	--	--	6	0	0	0	0	--	--	--	--	--	6
97.40	0	0	0	11	3	10	0	--	--	0	0	0	24
.50	0	0	0	4	0	0	0	--	--	0	0	0	4
.60	--	3	15	57	13	0	0	--	--	0	0	0	88
.70	--	0	0	8	0	0	0	--	--	--	--	--	8
.80	--	--	3	0	0	0	0	--	--	--	--	--	3
100.33	--	0	0	19	--	0	--	--	--	--	--	--	19
.35	--	--	--	--	0	3	0	--	--	--	--	--	3
.40	0	8	3	0	0	8	0	--	--	--	--	--	19
.50	0	0	6	77	0	0	0	--	--	--	--	--	83
.60	0	3	16	7	6	6	0	--	--	--	--	--	38
.65	--	--	--	--	0	9	0	--	--	--	--	--	9
.70	24	0	22	0	0	--	0	--	--	--	--	--	46
.75	--	--	--	--	9	--	0	--	--	--	--	--	9
.80	0	0	9	0	0	--	0	--	--	--	--	--	9
.90	--	--	15	0	0	--	0	--	--	--	--	--	15
103.40	0	0	0	0	6	0	0	--	--	--	--	--	6
.45	--	--	--	--	3	--	0	--	--	--	--	--	3
.50	0	0	{12 6}	0	0	--	0	--	--	--	--	--	{12 6}
.60	0	0	0	7	3	--	0	--	--	--	--	--	10
.70	--	--	{12 7}	0	0	--	0	--	--	--	--	--	{12 7}

¹ NS—sample spoiled or spilled.

CALIFORNIA COOPERATIVE OCEANIC FISHERIES INVESTIGATIONS

APPENDIX I—Continued

Saury Eggs—Numbers by Stations, 1956—Continued

Station	Cruise and month												Total
	5601 Jan.	5602 Feb.	5603 Mar.	5604 Apr.	5605 May	5606 June	5607 July	5608 Aug.	5609 Sept.	5610 Oct.	5611 Nov.	5612 Dec.	
.80-----	--	--	{ 3 16 }	0	0	--	0	--	--	--	--	--	{ 3 16 }
.90-----	--	--	3	0	0	--	0	--	--	--	--	--	3
.95-----	--	--	--	--	5	--	--	--	--	--	--	--	5
107.35-----	0	113	0	5	0	0	0	--	--	--	--	--	118
.40-----	0	3	0	7	0	0	0	--	--	--	--	--	10
.60-----	6	11	0	0	0	0	0	--	--	--	--	--	17
.80-----	--	--	0	4	0	0	0	--	--	--	--	--	4
110.33-----	0	2	0	0	0	32	0	0	0	--	--	--	34
.35-----	0	11	0	0	0	0	0	0	0	--	--	--	11
.40-----	3	84	0	0	0	0	0	0	0	--	--	--	87
.50-----	3	0	0	0	0	0	0	--	--	--	--	--	3
.70-----	4	9	6	0	0	0	0	--	--	--	--	--	19
.90-----	--	--	3	0	0	0	0	--	--	--	--	--	3
113.35-----	4	28	0	0	0	0	0	0	0	--	--	--	32
.40-----	41	12	0	2	28	0	0	0	0	--	--	--	83
.50-----	72	6	0	0	0	32	0	--	--	--	--	--	110
.60-----	25	3	0	0	0	0	0	--	--	--	--	--	28
.70-----	0	20	0	0	0	0	0	--	--	--	--	--	20
117.26-----	0	4	0	0	0	0	0	0	0	--	--	--	4
.30-----	0	0	24	0	0	0	0	0	0	--	--	--	24
.35-----	0	6	0	0	23	0	0	0	0	--	--	--	29
.40-----	0	0	0	0	0	7	0	0	0	--	--	--	7
.45-----	--	--	3	--	0	0	0	--	--	--	--	--	3
.50-----	10	0	0	20	0	0	0	--	--	--	--	--	30
.55-----	--	--	14	--	0	0	0	--	--	--	--	--	14
.60-----	0	0	0	7	0	0	0	--	--	--	--	--	7
118.39-----	0	0	16	NS ¹	0	0	0	--	--	--	--	--	16
119.33-----	9	15	0	5	0	0	0	--	--	--	--	--	29
120.25-----	0	0	0	11	0	0	0	0	0	--	--	--	11
.30-----	3	0	0	0	0	0	0	0	0	--	--	--	3
.40-----	0	0	0	2	0	0	0	0	0	--	--	--	2
.45-----	0	0	0	0	7	0	0	0	0	--	--	--	7
.50-----	9	0	0	0	0	0	0	--	--	--	--	--	9
.55-----	6	5	0	2	0	0	0	--	--	--	--	--	13
.60-----	0	13	0	0	0	0	0	--	--	--	--	--	13
.70-----	0	0	0	0	3	0	0	--	--	--	--	--	3
123.42-----	--	0	--	0	10	0	0	0	0	--	--	--	10
127.60-----	--	--	37	0	0	0	0	--	--	--	--	--	37
130.60-----	--	0	3	0	0	0	0	--	--	--	--	--	3
133.40-----	0	0	25	0	0	0	0	--	--	--	--	--	25
.50-----	--	--	22	--	0	0	0	--	--	--	--	--	22
Total-----	219	401	415	532	615	270	5	0	0	56	5	46	2,564
Occurrences-----	14	25	37	37	38	24	2	0	0	2	2	2	183

¹ NS—sample spoiled or spilled.

Saury Eggs—Numbers by Stations, 1957

Station	Cruise and month												Total
	5701 Jan.	5702 Feb.	5703 Mar.	5704 Apr.	5705 May	5706 June	5707 July	5708 Aug.	5709 Sept.	5710 Oct.	5711 Nov.	5712 Dec.	
60.55-----	--	--	--	--	15	0	0	--	--	--	--	--	15
.60-----	--	--	--	--	19	0	0	--	--	--	--	--	19
.70-----	--	--	--	--	9	11	0	--	--	--	--	--	20
.90-----	--	--	--	--	0	4	--	--	--	--	--	--	4
63.55-----	--	--	--	--	8	0	0	--	--	--	--	--	8
.60-----	--	--	--	--	13	0	0	--	--	--	--	--	13
.70-----	--	--	--	--	18	13	4	--	--	--	--	--	35
.80-----	--	--	--	--	8	0	0	--	--	--	--	--	8
67.55-----	--	--	--	--	21	0	0	--	--	--	--	--	21
.60-----	--	--	--	--	39	0	0	--	--	--	--	--	39
.80-----	--	--	--	--	4	0	0	--	--	--	--	--	4
70.52-----	--	--	--	--	7	0	0	--	--	--	--	--	7
.60-----	--	--	--	--	95	0	0	--	--	--	0	--	95
.90-----	--	--	--	--	7	0	--	--	--	--	--	--	7
73.60-----	--	--	--	--	18	0	0	--	--	--	0	--	18
77.55-----	--	--	--	--	75	0	0	--	--	--	--	--	75
.70-----	--	--	--	--	0	0	8	--	--	--	--	--	8

APPENDIX I—Continued

Saury Eggs—Numbers by Stations, 1957—Continued

Station	Cruise and month												Total
	5701 Jan.	5702 Feb.	5703 Mar.	5704 Apr.	5705 May	5706 June	5707 July	5708 Aug.	5709 Sept.	5710 Oct.	5711 Nov.	5712 Dec.	
80.51	--	0	0	0	0	25	21	--	--	0	--	0	46
.60	--	0	0	29	12	22	0	--	--	0	0	0	63
.70	--	0	0	26	29	0	0	--	--	0	0	0	55
.80	--	0	0	0	0	0	5	--	--	NS ¹	--	0	5
.90	--	233	0	12	0	6	0	--	--	0	--	0	251
83.51	--	0	--	5	0	0	0	--	--	0	0	--	5
.55	--	--	--	--	7	0	0	--	--	--	0	--	7
.60	--	14	0	82	9	14	0	--	--	0	0	--	119
.70	--	--	0	15	0	0	0	--	--	0	0	--	15
.80	--	--	--	0	9	0	0	--	--	0	--	--	9
87.50	--	0	0	28	0	0	0	--	--	0	0	--	28
.55	--	0	--	--	0	0	11	--	--	0	0	--	11
.60	--	0	0	72	0	0	5	--	--	0	0	--	77
.65	--	--	--	--	3	11	0	--	--	--	--	--	14
.70	--	0	0	136	46	0	0	--	--	0	--	--	182
.75	--	--	--	--	17	0	0	--	--	--	--	--	17
.85	--	--	--	--	3	0	0	--	--	--	--	--	3
.90	--	--	--	0	3	0	0	--	--	0	--	0	3
90.30	--	0	0	0	23	0	0	--	--	0	0	0	23
.37	--	0	0	0	10	0	0	--	--	0	0	0	10
.55	--	0	0	54	0	0	0	--	--	0	0	0	54
.60	--	0	0	3,794	0	0	0	--	--	0	0	0	3,794
.65	--	--	--	--	28	0	0	--	--	--	--	--	28
.70	--	0	0	122	16	3	0	--	--	0	--	0	141
.75	--	--	--	--	3	0	0	--	--	--	--	--	3
.80	--	0	0	0	3	0	0	--	--	0	--	0	3
.85	--	--	--	--	2	0	0	--	--	--	--	--	2
.90	--	0	0	20	30	0	0	--	--	0	--	0	50
93.27	--	0	0	0	9	0	0	--	--	0	0	--	9
.30	--	0	0	0	8	0	0	--	--	0	0	--	8
.35	--	--	--	0	2	6	0	--	--	0	0	--	8
.40	--	0	0	0	3	12	0	--	--	0	0	--	15
.45	--	--	--	0	3	22	0	--	--	0	0	--	25
.50	--	0	0	0	9	0	0	--	--	0	0	--	9
.55	--	--	--	5	6	0	0	--	--	--	0	--	11
.60	--	0	0	0	3	0	0	--	--	0	0	--	3
.70	--	0	0	0	3	0	0	--	--	0	--	--	3
.80	--	--	--	NS ¹	14	0	0	--	--	0	--	--	14
.90	--	--	--	6	0	0	0	--	--	0	--	--	6
97.32	--	0	--	0	10	0	0	--	--	0	0	0	10
97.40	--	0	0	0	16	0	2	--	--	0	0	--	18
.45	--	--	--	6	5	0	0	--	--	--	0	--	11
.50	--	0	0	NS ¹	9	0	0	--	--	0	0	--	9
.60	--	0	--	0	4	0	0	--	--	0	5	--	9
.80	--	--	--	0	4	6	0	--	--	0	--	--	10
.85	--	--	--	--	6	0	0	--	--	--	--	--	6
.90	--	--	--	31	2	0	0	--	--	0	--	--	33
100.33	--	0	0	21	0	0	0	--	--	--	--	--	21
.45	--	--	--	16	0	0	0	--	--	--	--	--	16
.50	--	0	0	9	0	0	0	--	--	0	--	--	9
.55	--	--	--	7	9	0	0	--	--	--	--	--	16
.60	0	0	0	19	0	0	0	--	--	0	--	--	19
.70	--	0	--	2	0	0	--	--	--	0	--	--	2
.90	--	--	--	5	0	0	--	--	--	0	--	--	5
103.35	0	0	0	19	0	0	0	--	--	0	--	--	19
.40	0	0	0	3	0	0	0	--	--	0	--	--	3
.45	--	--	--	18	3	0	0	--	--	--	--	--	21
.50	0	0	0	11	0	0	0	--	--	0	--	0	11
107.60	0	68	NS ¹	0	0	0	0	--	--	0	--	--	68
.70	--	0	0	0	0	6	0	--	--	0	--	--	6
.80	--	--	--	3	0	0	--	--	--	0	--	--	3
110.35	--	0	0	6	0	0	0	0	0	0	--	--	6
.40	0	0	0	7	0	0	0	0	0	0	--	--	7
.45	--	--	--	9	0	0	0	--	--	--	--	--	9
120.30	0	0	0	2	0	0	0	0	0	0	--	--	2
127.70	--	--	--	0	--	--	7	--	--	0	--	--	7
Total	0	315	0	4,600	737	161	63	0	0	0	5	0	5,881
Occurrences	0	3	0	33	53	14	8	0	0	0	1	0	112

¹ NS—sample spoiled or spilled.

CALIFORNIA COOPERATIVE OCEANIC FISHERIES INVESTIGATIONS

APPENDIX I—Continued

Saury Eggs—Numbers by Stations, 1958

Station	Cruise and month												Total
	5801 Jan.	5802 Feb.	5803 Mar.	5804 Apr.	5805 May	5806 June	5807 July	5808 Aug.	5809 Sept.	5810 Oct.	5811 Nov.	5812 Dec.	
43.55	--	--	--	--	--	--	7	--	--	--	--	--	7
47.60	--	--	--	--	--	--	3	--	--	--	--	--	3
50.47	--	--	--	--	--	6	--	--	--	--	--	--	6
.50	--	--	--	--	--	13	--	--	--	--	--	--	13
.70	--	--	--	--	--	--	3	--	--	--	--	--	3
53.55	--	--	--	--	--	13	0	--	--	--	--	--	13
.60	--	--	--	--	--	6	0	--	--	--	--	--	6
57.55	--	--	--	--	--	3	0	--	--	--	--	--	3
60.55	0	--	--	7	3	3	0	--	--	0	--	--	13
.60	--	--	--	0	6	0	0	--	--	0	--	--	6
.65	--	--	--	8	--	--	0	--	--	--	--	--	8
60.70	--	--	--	0	0	3	0	--	--	0	--	--	3
.80	--	--	--	9	8	6	0	--	--	0	--	--	23
.90	--	--	--	10	0	0	0	--	--	0	--	--	10
63.52	0	--	--	0	10	0	0	--	--	0	--	--	10
.55	--	--	--	--	8	NS ¹	0	--	--	0	--	--	8
.60	0	--	--	--	12	12	0	--	--	0	--	--	24
.70	--	--	--	--	19	0	0	--	--	0	--	--	19
.80	--	--	--	--	0	9	0	--	--	0	--	--	9
.90	--	--	--	--	3	3	0	--	--	--	--	--	6
.110	--	--	--	3	--	--	--	--	--	--	--	--	3
67.50	--	--	--	0	3	3	0	--	--	0	--	--	6
.55	0	--	--	3	28	0	0	--	--	0	--	--	31
.60	0	--	--	22	22	12	0	--	--	0	--	--	56
.65	--	--	--	7	--	--	0	--	--	0	--	--	7
.70	--	--	--	0	0	12	0	--	--	0	--	--	12
.80	--	--	--	23	30	0	0	--	--	0	--	--	53
.90	--	--	--	4	32	3	0	--	--	--	--	--	39
70.52	--	--	0	5	18	12	0	--	--	--	--	--	35
.55	--	--	--	0	0	16	0	--	--	0	--	--	16
.60	--	--	0	7	26	12	0	--	--	0	--	--	45
.65	--	--	--	7	--	--	0	--	--	0	--	--	7
.70	0	--	3	7	22	12	0	--	--	0	--	--	44
.75	--	--	--	13	--	--	0	--	--	--	--	--	13
.80	0	--	0	17	17	0	0	--	--	0	--	--	34
.85	--	--	--	20	--	--	0	--	--	--	--	--	20
.90	0	--	0	12	5	3	0	--	--	0	--	--	20
.110	--	--	--	4	--	--	--	--	--	--	--	--	4
73.51	--	--	--	0	5	0	0	--	--	0	--	--	5
.55	0	--	0	19	41	40	0	--	--	0	--	--	100
.60	0	--	--	0	24	17	0	--	--	0	--	--	41
.65	--	--	--	10	--	--	0	--	--	0	--	--	10
.70	--	--	--	25	24	12	0	--	--	0	--	--	61
.75	--	--	--	8	--	--	0	--	--	--	--	--	8
.80	--	--	--	30	12	6	0	--	--	0	--	--	48
.85	--	--	--	6	--	--	--	--	--	--	--	--	6
.90	--	--	0	17	6	0	0	--	--	0	--	--	23
77.50	--	--	--	3	6	0	0	--	--	0	--	--	9
.60	0	--	0	0	32	3	0	--	--	0	--	--	35
.65	--	--	--	5	--	--	8	--	--	--	--	--	13
.70	--	--	--	0	3	6	0	--	--	0	--	--	9
.75	--	--	--	9	--	--	0	--	--	--	--	--	9
.80	--	--	--	6	5	0	0	--	--	0	--	--	11
.90	--	--	0	3	0	0	0	--	--	0	--	--	3
80.55	0	0	0	0	3	0	0	--	--	0	0	0	3
.60	0	0	0	9	4	0	0	--	--	0	0	0	13
.65	--	--	--	16	--	--	0	--	--	--	--	--	16
.70	0	0	0	12	15	0	0	--	--	0	--	0	27
.75	--	--	--	9	--	--	0	--	--	--	--	--	9
.80	0	0	0	0	3	3	0	--	--	0	--	0	6
.85	--	--	--	3	--	--	0	--	--	--	--	--	3
.90	--	5	0	3	12	3	0	--	--	0	--	--	23
.120	--	--	--	8	--	--	--	--	--	--	--	--	8
83.51	0	0	0	21	0	3	0	--	--	0	0	0	24
.55	0	--	0	11	0	44	0	--	--	0	NS ¹	0	55
.60	0	--	0	26	34	20	0	--	--	0	0	0	80
.65	--	--	--	3	72	0	0	--	--	--	--	--	75
.70	0	--	0	7	27	0	0	--	--	0	--	--	34
83.75	--	--	--	4	8	6	0	--	--	--	--	--	18
.80	--	--	0	0	3	3	0	--	--	0	--	--	6
.85	--	--	--	--	3	6	0	--	--	--	--	--	9
.90	--	--	--	--	3	6	0	--	--	0	--	--	9
87.55	0	--	0	0	29	64	0	--	--	0	NS ¹	0	93
.60	0	--	0	0	0	0	3	--	--	0	0	0	3
.65	--	--	--	3	3	0	0	--	--	--	--	--	6
.75	--	--	--	0	3	0	0	--	--	--	--	--	3
.80	0	--	0	3	6	7	0	--	--	0	--	--	16
.85	--	--	--	--	8	0	0	--	--	--	--	--	8
.90	--	--	--	--	12	0	0	--	--	0	--	--	12

¹ NS—sample spoiled or spilled.

APPENDIX I—Continued
Saury Eggs—Numbers by Stations, 1958—Continued

Station	Cruise and month												Total
	5801 Jan.	5802 Feb.	5803 Mar.	5804 Apr.	5805 May	5806 June	5807 July	5808 Aug.	5809 Sept.	5810 Oct.	5811 Nov.	5812 Dec.	
90.37	--	NS ¹	0	0	3	0	0	--	0	0	0	0	3
.45	--	0	0	0	6	18	0	--	0	0	0	0	24
.50	--	0	0	--	8	6	0	--	0	0	0	0	14
.55	--	0	0	35	50	6	0	--	0	0	0	0	91
.60	--	0	0	0	28	0	0	--	0	0	0	0	28
.65	--	--	--	0	18	3	0	--	0	--	--	--	21
.70	--	0	0	0	13	0	NS ¹	--	0	0	0	0	13
.75	--	--	--	2	7	0	0	--	--	--	--	--	9
.80	0	13	0	NS ¹	6	0	0	--	--	0	0	0	19
.85	--	--	--	4	3	0	0	--	--	--	--	--	7
.90	0	7	0	6	7	0	0	--	--	0	--	--	20
93.35	--	0	0	12	0	0	0	--	0	0	0	0	12
.45	--	0	0	NS ¹	0	3,377	0	--	0	0	--	--	3,377
.50	0	0	0	0	21	58	0	--	0	0	0	0	79
.55	--	--	--	0	22	3	3	--	0	0	--	--	28
.60	0	0	0	3	0	0	0	--	0	0	0	0	3
.65	--	--	--	0	0	3	0	--	0	--	--	--	3
.70	0	NS ¹	10	3	0	0	0	--	0	0	0	0	13
.80	7	0	0	0	6	0	0	--	--	0	0	0	13
.85	--	--	--	--	6	0	0	--	--	--	--	--	6
.145	--	--	--	3	--	--	--	--	--	--	--	--	3
97.30	0	2	0	0	0	2	0	--	0	0	0	0	4
.32	0	10	0	0	0	--	0	--	--	0	0	0	10
.35	--	--	--	0	0	9	0	--	--	0	0	0	9
.40	0	0	0	3	3	0	0	--	--	0	0	0	6
.45	--	0	0	0	0	3	0	--	--	0	--	--	3
.55	--	--	--	0	6	3	0	--	--	0	--	--	9
.65	--	--	--	6	0	0	0	--	--	--	--	--	6
.70	0	0	0	3	3	0	0	--	--	0	--	--	6
.75	--	--	--	10	0	0	0	--	--	--	--	--	10
.80	0	6	0	0	2	0	0	--	0	--	--	--	8
100.40	0	0	0	0	0	17	0	--	--	0	0	0	17
.55	--	--	--	0	0	3	0	--	--	0	--	--	3
.60	0	0	0	9	3	0	0	--	--	0	0	0	12
.65	--	--	--	51	0	0	0	--	--	--	--	--	51
.70	0	0	0	6	0	0	0	--	--	0	--	--	6
.75	--	--	--	3	0	0	0	--	--	--	--	--	3
.85	--	--	--	3	0	0	0	--	--	--	--	--	3
.90	0	3	0	0	0	0	0	--	--	0	--	--	3
103.50	0	0	0	0	0	0	11	--	--	0	--	--	11
107.40	0	3	0	0	0	0	0	--	--	0	--	--	3
.50	0	0	4	0	4	0	0	--	--	0	--	--	8
.85	--	--	--	0	6	--	0	--	--	--	--	--	6
110.45	--	--	0	14	0	6	0	--	--	0	--	--	20
.60	0	0	3	6	0	0	0	--	--	0	--	--	9
113.40	0	0	0	0	0	3	NS ¹	0	0	0	--	--	3
113.55	--	--	--	11	0	0	0	--	--	0	--	--	11
.60	0	0	0	7	0	0	0	--	--	0	--	--	7
117.40	0	0	0	4	0	0	0	0	0	0	--	--	4
120.25	--	0	0	0	0	0	116	0	0	0	--	--	116
123.50	0	0	0	0	0	3	0	--	--	0	--	--	3
Total	7	49	20	671	909	4,050	38	0	0	0	0	0	5,744
Occurrences	1	8	4	68	68	55	7	0	0	0	0	0	211

¹ NS—sample spoiled or spilled.

Saury Eggs—Numbers by Stations, 1959

Station	Cruise and month												Total
	5901 Jan.	5902 Feb.	5903 Mar.	5904 Apr.	5905 May	5906 June	5907 July	5908 Aug.	5909 Sept.	5910 Oct.	5911 Nov.	5912 Dec.	
43.50	--	--	--	--	--	--	--	--	--	5	--	--	5
50.70	--	--	--	--	--	--	--	--	--	3	--	--	3
60.52	3	--	--	--	0	--	0	--	--	0	--	--	3
.60	0	--	--	12	0	--	3	--	--	0	--	--	15
.65	--	--	--	27	0	--	0	--	--	--	--	--	27
.75	--	--	--	--	17	--	0	--	--	--	--	--	17
.80	0	--	--	5	5	--	0	--	--	0	--	--	10
.90	0	--	--	7	3	--	0	--	--	0	--	--	10

APPENDIX I—Continued

Saury Eggs—Numbers by Stations, 1959—Continued

Station	Cruise and month												Total
	5901 Jan.	5902 Feb.	5903 Mar.	5904 Apr.	5905 May	5906 June	5907 July	5908 Aug.	5909 Sept.	5910 Oct.	5911 Nov.	5912 Dec.	
63.55	0	--	--	3	0	--	4	--	--	0	--	--	7
.60	0	--	--	7	0	--	17	--	--	0	--	--	24
.65	--	--	--	--	23	--	0	--	--	--	--	--	23
.70	0	--	--	--	24	--	0	--	--	0	--	--	24
.80	--	--	--	--	6	--	0	--	--	--	--	--	6
.85	--	--	--	--	0	--	7	--	--	--	--	--	7
.90	0	--	--	6	0	--	0	--	--	0	--	--	6
67.50	0	--	--	0	6	--	0	--	--	0	--	--	6
.55	0	--	--	0	0	--	22	--	--	0	--	--	22
.60	0	--	--	0	0	--	3	--	--	0	--	--	3
.70	3	--	--	--	0	--	10	--	--	0	--	--	13
.80	--	--	--	--	6	--	0	--	--	--	--	--	6
70.55	0	--	--	0	9	--	0	--	--	0	--	--	9
.60	0	--	--	15	3	--	0	--	--	0	--	--	18
.70	8	--	--	5	--	--	0	--	--	0	--	--	13
.75	--	--	--	--	8	--	0	--	--	--	--	--	8
.80	0	--	--	5	20	--	0	--	--	0	--	--	25
.85	--	--	--	--	4	--	0	--	--	--	--	--	4
73.51	3	0	--	0	0	--	0	--	--	0	--	--	3
.55	0	0	--	0	8	--	0	--	--	0	--	--	8
.60	3	0	--	3	6	--	0	--	--	0	--	--	12
.65	--	--	--	20	3	--	0	--	--	--	--	--	23
.70	0	0	--	0	27	--	0	--	--	0	--	--	27
.75	--	--	--	--	3	--	0	--	--	--	--	--	3
.80	--	--	--	12	0	--	0	--	--	0	--	--	12
.90	--	--	--	6	18	--	0	--	--	0	--	--	24
77.55	0	0	--	3	--	0	0	0	--	0	0	0	3
.60	0	0	--	3	3	3	0	0	--	0	0	0	9
.65	--	--	--	0	3	7	0	--	--	--	--	--	10
.70	0	0	--	3	0	17	0	--	--	0	0	0	20
.75	--	--	--	--	6	--	9	--	--	--	--	--	15
.80	--	--	--	9	6	0	0	--	--	0	--	--	15
.85	--	--	--	--	14	19	0	--	--	--	--	--	33
.90	--	--	--	3	6	0	0	--	--	0	--	--	9
80.55	0	0	--	0	0	0	0	0	--	3	0	53	56
.60	0	0	--	0	3	0	0	0	--	0	0	0	3
.65	--	--	--	0	5	3	0	NS ¹	--	--	--	--	8
.70	0	0	--	3	14	0	0	0	--	0	0	0	17
.75	--	--	--	0	14	0	11	0	--	--	--	--	25
.80	0	0	--	3	16	7	0	0	--	0	--	--	26
.100	--	--	--	--	9	--	--	--	--	--	--	--	9
.110	--	--	--	--	6	--	--	--	--	--	--	--	6
83.40	0	0	0	0	2	0	0	0	--	2	0	0	4
.51	0	0	NS ¹	3	0	0	0	0	--	0	0	0	3
.55	0	0	--	3	3	3	0	0	--	2	0	0	11
.60	0	0	--	0	3	3	0	0	--	7	0	0	13
.65	--	--	--	0	6	6	0	0	--	--	--	--	12
.70	0	0	--	6	3	0	0	0	--	2	--	--	11
.75	--	--	--	3	3	0	0	NS ¹	--	--	--	--	6
.80	0	0	--	0	7	3	0	9	--	0	--	--	19
.85	--	--	--	0	0	9	0	NS ¹	--	--	--	--	9
.90	0	0	--	6	21	0	0	0	--	0	--	--	27
87.50	0	0	0	0	0	0	0	0	--	0	0	5	5
.55	0	0	--	0	3	0	0	0	--	0	0	0	3
.60	0	0	--	3	3	0	0	0	--	0	0	0	6
.65	--	--	--	0	3	0	6	8	--	--	--	--	17
.70	0	0	--	3	10	3	0	0	--	0	--	--	16
.75	--	--	--	0	0	11	NS ¹	0	--	--	--	--	11
.80	0	0	--	0	0	0	0	3	--	0	--	--	3
.90	0	0	--	0	0	6	0	0	--	0	--	--	6
90.50	0	0	0	0	0	11	NS ¹	0	0	0	0	0	11
.55	0	0	0	0	0	12	0	0	0	0	0	0	12
.60	0	0	0	0	0	2	0	0	0	0	0	0	2
.65	--	--	0	NS ¹	0	20	0	0	0	0	--	--	20
.70	0	0	0	0	0	16	0	0	0	0	0	3	19
.75	--	--	--	0	15	6	0	0	0	0	--	--	21
.90	6	0	0	0	0	0	0	0	0	0	0	0	6
93.50	0	0	0	0	0	3	0	0	0	0	0	0	3
.70	0	NS ¹	0	0	3	0	0	0	0	0	9	0	12
.75	--	--	--	0	0	14	0	0	0	0	--	--	14
.80	0	3	0	0	0	0	0	0	0	0	0	3	6
97.32	0	0	0	0	0	0	0	0	--	3	--	--	3
.35	0	0	0	0	8	0	0	0	--	0	--	--	8
.55	0	0	0	NS ¹	9	6	NS ¹	0	--	0	--	--	15
.65	--	--	--	0	0	0	0	6	--	--	--	--	6
.70	0	0	--	0	3	0	0	0	--	0	--	--	3
.75	--	--	--	0	0	0	3	0	--	--	--	--	3
.85	--	--	--	0	6	0	0	3	--	--	--	--	9
.90	2	0	--	0	0	0	0	0	--	0	--	--	2

¹ NS—sample spoiled or spilled.

APPENDIX I—Continued

Saury Eggs—Numbers by Stations, 1959—Continued

Station	Cruise and month												Total
	5901 Jan.	5902 Feb.	5903 Mar.	5904 Apr.	5905 May	5906 June	5907 July	5908 Aug.	5909 Sept.	5910 Oct.	5911 Nov.	5912 Dec.	
100.35	0	0	0	0	3	0	0	0	--	0	--	--	3
.40	NS ¹	0	0	0	3	0	0	0	--	0	--	--	3
.45	0	0	0	0	3	0	0	0	--	0	--	--	3
.50	0	0	0	0	6	0	0	0	--	0	--	--	6
.70	0	5	--	0	0	0	0	0	--	0	--	--	5
100.90	0	0	--	0	3	0	0	0	--	0	--	--	3
103.40	6	0	0	0	0	0	0	0	--	0	--	--	6
.45	0	0	0	0	59	3	0	0	--	0	--	--	62
.50	0	0	0	0	0	3	0	0	--	0	--	--	3
.60	0	0	3	0	0	0	0	0	--	0	--	--	3
.70	0	0	0	0	0	0	0	3	--	0	--	--	3
.85	--	--	--	0	0	0	0	3	--	--	--	--	3
107.32	0	0	0	0	0	6	0	0	--	0	--	--	6
.40	0	2	0	0	0	0	0	0	--	0	--	--	2
.45	0	2	0	0	0	0	0	0	--	0	--	--	2
.50	0	0	0	0	0	0	5	0	--	6	--	--	11
.70	6	NS ¹	0	0	0	0	0	0	--	0	--	--	6
110.40	0	0	0	0	0	3	0	0	--	0	--	--	3
.45	0	0	0	0	0	6	0	0	--	0	--	--	6
.50	0	3	0	0	0	0	0	0	--	0	--	--	3
113.30	0	0	0	5	0	0	NS ¹	0	--	0	--	--	5
117.40	0	0	36	0	0	0	0	0	--	0	--	--	36
120.60	0	0	0	0	19	0	0	0	--	0	--	--	19
137.30	0	0	0	0	0	0	2	NS ¹	--	0	--	--	2
.45	0	0	0	0	0	0	6	0	--	0	--	--	6
.75	--	--	--	--	--	--	3	--	--	--	--	--	3
Total	40	15	39	192	511	208	114	35	0	33	9	64	1,260
Occurrences	9	5	2	29	57	27	16	7	0	9	1	4	166

¹ NS—sample spoiled or spilled.

Saury Eggs—Numbers by Stations, 1960

Station	Cruise and month												Total
	6001 Jan.	6002 Feb.	6003 Mar.	6004 Apr.	6005 May	6006 June	6007 July	6008 Aug.	6009 Sept.	6010 Oct.	6011 Nov.	6012 Dec.	
40.60	0	--	--	3	--	--	--	--	--	--	--	--	3
47.100	5	--	--	--	--	--	--	--	--	--	--	--	5
50.70	0	--	--	3	--	--	--	--	--	--	--	--	3
.80	0	--	--	7	--	--	--	--	--	--	--	--	7
.90	0	--	--	2	--	--	--	--	--	--	--	--	2
53.60	0	--	--	3	--	--	--	--	--	--	--	--	3
.70	0	--	--	2	--	--	--	--	--	--	--	--	2
60.55	0	--	--	4	--	--	0	--	--	0	--	--	4
.60	0	--	--	4	--	--	0	--	--	0	--	--	4
.80	0	--	--	10	--	--	0	--	--	0	--	--	10
.90	0	--	--	0	--	--	3	--	--	0	--	--	3
.100	0	--	--	--	--	--	0	--	--	6	--	--	6
63.70	0	--	--	6	--	--	--	--	--	--	--	--	6
.80	0	--	--	10	--	--	--	--	--	--	--	--	10
.90	--	--	--	5	--	--	--	--	--	--	--	--	5
67.80	0	--	--	5	--	--	--	--	--	--	--	--	5
70.70	0	--	--	5	--	--	0	--	--	0	--	--	5
.90	0	--	--	5	--	--	0	--	--	0	--	--	5
73.51	0	3	0	0	0	0	--	--	--	0	--	--	3
.53	0	18	--	--	--	--	--	--	--	--	--	--	18
.55	0	26	0	0	0	0	--	--	--	0	--	--	26
.60	0	0	2	2	0	0	--	--	--	0	--	--	4
.70	0	0	3	0	--	--	--	--	--	--	--	--	3
.80	0	--	--	2	--	--	--	--	--	--	--	--	2
77.60	0	11	7	0	--	0	--	--	--	0	--	--	18
.75	--	--	--	12	--	--	--	--	--	--	--	--	12
.90	--	--	--	5	--	--	--	--	--	--	--	--	5
80.57	2	0	--	--	--	--	--	--	--	--	--	--	2
.60	0	0	2	2	--	0	0	--	--	0	--	--	4
.65	--	--	--	10	--	0	0	--	--	0	--	--	10
.75	--	--	--	7	--	0	--	--	--	--	--	--	7
.85	--	--	--	4	--	0	--	--	--	--	--	--	4
.90	2	0	0	3	--	3	0	--	--	0	--	--	8

APPENDIX I—Continued

Saury Eggs—Numbers by Stations, 1960—Continued

Station	Cruise and month												Total
	6001 Jan.	6002 Feb.	6003 Mar.	6004 Apr.	6005 May	6006 June	6007 July	6008 Aug.	6009 Sept.	6010 Oct.	6011 Nov.	6012 Dec.	
82.47	0	0	0	2	0	0	0	--	--	0	--	--	2
83.60	2	0	0	0	0	0	0	--	--	0	--	--	2
.70	0	0	0	97	--	0	0	--	--	--	--	--	97
87.40	53	0	0	0	0	0	0	0	--	0	--	--	53
.45	54	0	0	3	0	0	0	0	--	0	--	--	57
.50	17	0	0	0	0	0	0	0	--	0	--	--	17
.60	0	0	0	4	0	0	0	--	--	0	--	--	4
.75	--	--	--	0	--	3	--	--	--	--	--	--	3
.85	--	--	--	2	--	0	--	--	--	--	--	--	2
.90	0	0	--	2	--	0	--	--	--	--	--	--	2
90.50	0	0	2	0	0	0	--	--	--	--	--	--	2
.60	0	0	0	3	0	0	0	0	--	0	--	--	3
.65	--	--	--	341	0	0	0	--	--	0	--	--	341
.70	0	11	3	57	0	0	0	0	--	0	--	--	71
.80	0	6	0	0	0	0	0	0	--	0	--	--	6
.85	--	--	--	3	0	0	--	--	--	--	--	--	3
.90	0	0	0	7	0	0	0	0	--	0	--	--	7
.95	--	--	--	5	0	0	--	--	--	--	--	--	5
.100	0	0	2	5	0	0	0	--	--	0	--	--	7
93.28	0	0	0	0	0	0	0	31	--	0	--	--	31
.40	0	0	2	0	0	0	0	0	--	0	--	--	2
.45	0	0	3	0	0	0	0	--	--	0	--	--	3
.50	5	0	0	3	0	0	0	0	--	0	--	--	8
.60	14	11	0	0	0	0	0	0	--	0	--	--	25
.70	3	0	5	0	12	0	0	0	--	0	--	--	20
.75	--	--	--	3	0	0	--	--	--	--	--	--	3
.80	0	0	0	7	0	0	0	3	--	0	--	--	10
.85	--	--	--	12	0	0	--	--	--	--	--	--	12
.100	--	2	0	0	0	0	0	0	--	0	--	--	2
97.32	3	0	0	6	0	0	0	0	--	0	--	--	9
.35	2	0	0	0	9	0	0	0	--	0	--	--	11
.40	17	6	2	0	0	0	0	10	--	0	--	--	35
.50	3	0	0	0	6	0	0	0	--	0	--	--	9
.60	3	3	13	0	0	0	0	--	--	--	--	--	19
.70	11	0	3	0	0	0	0	--	--	--	--	--	14
.90	0	3	0	0	--	0	--	--	--	--	--	--	3
100.29	3	0	0	2	--	0	--	0	--	--	--	--	5
.35	0	0	6	0	--	0	0	0	--	0	--	--	6
.50	4	3	0	2	--	0	0	--	--	0	--	--	9
.55	9	3	0	0	--	0	0	--	--	0	--	--	12
.60	3	0	0	0	--	0	0	--	--	0	--	--	3
.70	0	0	0	20	--	0	0	--	--	0	--	--	20
100.75	--	--	--	6	--	0	--	--	--	--	--	--	6
.85	--	--	--	5	--	0	--	--	--	--	--	--	5
.90	0	13	0	0	--	0	0	--	--	0	--	--	13
103.35	0	0	0	6	0	--	0	0	0	0	--	--	6
.40	0	2	0	3	0	0	0	0	0	0	--	--	5
.45	3	4	0	0	0	0	0	--	--	--	--	--	7
.50	3	4	0	0	0	0	0	--	--	--	--	--	7
.60	3	2	3	0	0	0	0	--	--	--	--	--	8
.80	3	0	3	0	0	0	0	--	--	--	--	--	6
.90	0	--	--	2	--	--	--	--	--	--	--	--	2
107.32	3	0	0	3	0	0	0	0	0	0	--	--	6
.45	24	2	3	0	0	0	0	--	--	--	--	--	29
.50	0	2	0	0	3	0	0	--	--	--	--	--	5
.55	0	0	3	0	0	0	0	--	--	--	--	--	3
.80	0	0	3	0	0	0	0	--	--	--	--	--	3
110.55	3	0	0	0	0	0	0	--	--	0	--	--	3
.60	0	0	3	0	0	3	0	--	--	0	--	--	6
.80	0	0	0	3	0	0	0	--	--	0	--	--	3
113.85	--	--	--	6	--	--	--	--	--	--	--	--	6
117.35	0	0	0	0	0	0	0	6	0	436	--	--	442
.70	0	0	5	0	0	0	0	--	--	--	--	--	5
120.55	0	0	0	3	0	0	0	--	--	0	--	--	3
123.55	0	0	3	0	0	0	0	--	--	--	--	--	3
.60	0	0	3	0	0	0	0	--	--	--	--	--	3
.65	--	--	--	2	--	--	--	--	--	--	--	--	2
127.50	12	0	0	0	0	0	0	--	--	0	--	--	12
.55	33	0	0	0	0	0	0	--	--	--	--	--	33
.70	6	--	--	0	--	--	--	--	--	--	--	--	6
133.55	8	--	--	0	--	--	0	--	--	--	--	--	8
143.40	3	--	--	0	--	--	--	--	--	--	--	--	3
Total	319	135	84	748	30	9	3	50	0	442	--	--	1,820
Occurrences	32	20	23	56	4	3	1	4	0	2	--	--	145

APPENDIX I—Continued

Saury Eggs—Numbers by Stations, 1961–62

Station	Cruise and month, 1961					Cruise and month, 1962				
	6101-02 Jan.- Feb.	6104-05 Apr.- May	6107 July	6110-11 Oct.- Nov.	Total	6201-02 Jan.- Feb.	6203-04 Mar.- Apr.	6207-08 July- Aug.	6210-11 Oct.- Nov.	Total
70.70	0	0	0	0	0	0	2	--	0	2
.90	0	0	0	0	0	0	8	--	0	8
.120	0	3	0	0	3	0	0	--	0	0
.200	0	6	0	3	9	0	3	--	0	3
77.55	0	0	0	0	0	0	11	--	0	11
80.55	3	0	0	0	3	0	0	--	0	0
.65	13	6	0	0	19	0	0	--	0	0
.70	5	3	0	0	8	0	0	0	0	0
.80	0	0	0	0	0	18	0	0	0	18
.100	0	4	0	3	7	0	0	0	0	0
.120	0	4	0	0	4	0	0	0	0	0
.200	17	0	0	0	17	0	0	0	0	0
82.47	0	0	0	5	5	0	0	0	0	0
83.60	0	8	0	0	8	0	0	0	0	0
.65	3	0	0	0	3	0	3	0	0	3
.80	0	3	0	0	3	0	3	0	0	3
87.55	3	0	9	0	12	0	0	0	0	0
.60	0	6	0	0	6	0	0	0	0	0
.65	0	0	0	0	0	0	0	0	2	2
.80	3	0	0	0	3	0	3	0	11	14
.90	--	0	0	0	0	0	0	0	10	10
90.28	0	0	2	0	2	0	0	0	0	0
.37	0	0	20	0	20	0	0	--	0	0
.45	0	0	113	0	113	0	0	--	8	8
.53	0	0	0	0	0	0	0	--	14	14
.60	0	0	0	0	0	2	0	0	0	2
.65	3	0	0	0	3	77	0	--	0	77
.80	0	6	0	0	6	0	0	0	0	0
.90	0	0	0	0	0	0	6	0	0	6
.100	0	25	0	0	25	0	0	0	6	6
.120	0	0	0	0	0	0	6	0	0	6
.140	0	0	0	0	0	0	3	0	0	3
.160	0	2	0	0	2	0	0	0	0	0
93.40	0	0	11	0	11	0	0	0	0	0
.50	3	4	0	0	7	0	0	5	0	5
.55	0	7	0	0	7	0	0	0	0	0
.60	6	3	0	0	9	0	0	0	0	0
.65	0	9	0	0	9	0	0	0	0	0
.70	0	0	0	0	0	0	6	0	0	6
.80	6	10	0	0	16	0	0	0	0	0
.100	6	3	0	0	9	0	0	0	0	0
97.35	0	6	0	0	6	6	0	0	0	6
.45	0	3	0	0	3	0	0	0	0	0
.50	0	3	0	0	3	0	0	0	0	0
.55	NS ¹	9	0	0	9	0	0	3	0	3
.65	0	3	0	0	3	0	9	0	0	9
.90	--	4	0	0	4	0	0	0	0	0
100.45	0	0	0	0	0	0	0	0	41	41
.60	0	10	0	0	10	0	0	0	0	0
.65	0	3	0	0	3	0	3	0	0	3
.70	0	10	0	0	10	3	0	0	0	3
.80	0	4	0	0	4	0	0	0	0	0
.100	3	0	0	0	3	8	0	--	0	8
103.30	0	2	0	0	2	0	0	0	0	0
103.35	0	0	0	0	0	0	12	0	0	12
.40	0	3	0	0	3	0	6	0	0	6
.50	0	3	0	0	3	3	3	0	0	6
.60	0	3	0	0	3	0	3	0	0	3
.70	0	0	0	9	9	0	0	0	0	0
.80	0	11	0	0	11	0	0	0	0	0
.90	--	0	0	8	8	0	--	0	0	0
107.32	0	0	0	0	0	6	0	0	0	6
.35	0	6	0	0	6	0	0	0	0	0
.40	0	3	0	0	3	0	6	0	0	6
.45	0	5	0	0	5	0	6	0	0	6
.50	NS ¹	12	0	0	12	0	3	0	0	3
.55	0	6	0	0	6	0	0	0	0	0
.60	0	12	0	0	12	0	0	0	0	0
.65	3	0	0	0	3	0	0	0	0	0
.70	0	2	0	0	2	0	0	0	0	0
.80	0	0	0	3	3	0	6	0	0	6

¹ NS—sample spoiled or spilled.

APPENDIX I—Continued

Saury Eggs—Numbers by Stations, 1961-62—Continued

Station	Cruise and month, 1961					Cruise and month, 1962				
	6101-02 Jan.- Feb.	6104-05 Apr.- May	6107 July	6110-11 Oct.- Nov.	Total	6201-02 Jan.- Feb.	6203-04 Mar.- Apr.	6207-08 July- Aug.	6210-11 Oct.- Nov.	Total
110.33	0	0	0	35	35	0	--	--	--	0
.45	0	0	0	0	0	0	6	0	0	6
.50	0	7	0	0	7	0	0	0	0	0
.55	0	14	0	0	14	0	0	0	0	0
.60	0	0	0	0	0	0	5	0	0	5
.65	0	3	0	0	3	3	10	0	0	13
.70	0	6	0	0	6	0	0	0	0	0
.80	3	0	0	0	3	0	0	0	0	0
.120	0	10	0	0	10	0	0	--	0	0
113.40	0	3	0	0	3	0	0	0	0	0
.45	0	0	0	0	0	0	3	0	0	3
.65	0	0	0	0	0	0	3	0	0	3
.70	0	8	0	0	8	0	0	0	0	0
117.35	0	3	0	0	3	0	0	0	0	0
.45	0	3	0	0	3	6	0	0	0	6
.50	0	0	0	0	0	0	6	0	0	6
.60	0	0	0	0	0	3	0	0	0	3
.65	3	0	0	0	3	0	0	0	0	0
.70	0	3	0	0	3	0	3	0	0	3
120.55	0	0	0	0	0	2	2	0	0	4
.60	0	0	0	0	0	5	0	0	0	5
.70	0	8	0	0	8	0	0	0	0	0
.120	0	0	0	0	0	0	3	--	0	3
123.55	3	0	0	0	3	0	0	0	0	0
127.40	0	0	0	0	0	0	0	15	0	15
.45	0	13	0	0	13	0	0	0	0	0
.70	--	0	0	0	0	0	3	0	0	3
130.45	0	0	0	0	0	0	3	0	0	3
.80	0	3	0	0	3	0	0	0	0	0
133.45	3	0	0	0	3	0	0	--	0	0
.80	--	3	0	0	3	0	0	--	0	0
Total	89	322	155	66	632	142	158	23	92	415
Occurrences	18	54	5	7	84	13	32	3	7	55

Saury Eggs—Numbers by Stations, 1963-64

Station	Cruise and month, 1963					Cruise and month, 1964				
	6301-02 Jan.- Feb.	6304-05 Apr.- May	6307-08 July- Aug.	6310 Oct.	Total	6401-02 Jan.- Feb.	6404 Apr.	6406-07 June- July	6410 Oct.	Total
60.70	0	5	--	--	5	0	0	12	--	12
.80	0	2	--	--	2	0	0	0	--	0
63.70	--	--	--	--	--	--	3	--	--	3
70.52	--	0	--	--	0	0	3	0	--	3
.70	0	0	--	--	0	3	8	0	--	11
.80	0	3	--	--	3	0	0	6	--	6
.100	0	2	--	--	2	0	--	0	--	0
73.51	--	6	--	--	6	0	0	0	--	0
.53	0	3	--	--	3	0	0	0	--	0
.70	--	--	--	--	--	--	6	--	--	6
77.55	0	3	--	--	3	0	0	0	--	0
.57	0	14	--	--	14	0	3	--	--	3
.80	--	--	--	--	--	--	6	--	--	6
77.770	--	--	--	--	--	0	--	9	--	9
80.667	--	--	--	--	--	149	--	0	--	149
.70	0	9	0	0	9	0	6	--	0	6
.80	8	3	0	0	11	0	0	0	0	0
.90	26	0	0	0	26	0	--	0	0	0
.100	0	6	--	--	6	3	--	0	--	3
.120	0	3	--	--	3	0	--	--	--	0
80.760	--	--	--	--	--	0	--	5	--	5
82.760	--	--	--	--	--	0	--	6	--	6
83.51	0	0	0	0	0	0	0	3	0	3
.65	0	6	0	3	9	0	100	0	0	100
.70	0	3	0	0	3	0	9	0	0	9
.80	0	9	0	0	9	0	0	0	0	0
.95	34	--	--	--	34	--	--	--	--	--
.100	3	--	--	--	3	--	--	--	--	--
.110	23	--	--	--	23	--	--	--	--	--

APPENDIX I—Continued

Saury Eggs—Numbers by Stations, 1963–64

Station	Cruise and month, 1963					Cruise and month, 1964				
	6301-02 Jan.- Feb.	6304-05 Apr.- May	6307-08 July- Aug.	6310 Oct.	Total	6401-02 Jan.- Feb.	6404 Apr.	6406-07 June- July	6410 Oct.	Total
85.53	--	--	--	--	--	--	--	3	--	3
.55	--	--	--	--	--	--	--	15	--	15
.60	--	--	--	--	--	--	--	3	--	3
87.40	0	0	0	0	0	0	6	0	0	6
.45	0	3	0	0	3	0	0	0	0	0
.50	0	0	0	202	202	0	0	0	0	0
.65	0	4	0	0	4	0	0	0	0	0
.70	3	0	0	0	3	0	0	0	0	0
.80	7	3	0	0	10	0	41	0	0	41
.90	3	6	0	0	9	0	0	0	0	0
90.27 ^s	--	0	0	0	0	0	0	1	0	1
.45	0	0	0	0	0	0	158	0	0	158
.53	0	0	0	0	0	0	0	8	0	8
.60	0	0	0	0	0	0	6	0	0	6
.65	0	2	0	0	2	0	6	0	0	6
.80	0	0	0	0	0	0	14	0	0	14
.90	0	0	0	0	0	0	3	0	0	3
.100	0	0	--	--	0	0	6	126	0	132
.130	6	--	--	--	6	--	--	--	--	--
.140	23	0	--	--	23	0	--	0	--	0
.180	3	0	--	--	3	0	--	0	--	0
93.26 ^s	--	0	0	0	0	0	0	0	1	1
.30	0	0	0	0	0	0	0	0	3	3
.35	0	0	0	0	0	0	0	0	3	3
.65	0	3	0	0	3	0	0	0	0	0
.70	0	0	0	0	0	0	0	3	0	3
.80	0	0	0	0	0	0	6	--	0	6
.90	0	0	--	0	0	0	5	--	0	5
.120	9	--	--	--	9	--	--	--	--	--
96.828 ⁷	--	1	0	0	1	--	--	0	0	0
97.45	0	3	0	0	3	0	0	0	0	0
.65	0	3	0	0	3	0	3	0	0	3
.70	0	0	0	0	0	0	464	0	0	464
.90	0	0	--	0	0	0	3	--	0	3
100.29	--	0	0	0	0	0	0	0	3	3
.50	0	0	0	0	0	7	0	0	0	7
.60	0	0	0	0	0	0	6	0	0	6
.80	0	0	0	0	0	3	0	0	0	3
.120	0	2	--	--	2	0	--	--	--	0
103.40	0	0	0	0	0	0	0	0	46	46
.50	0	0	0	0	0	0	0	0	12	12
.55	0	3	0	0	3	0	0	0	0	0
.70	3	0	0	0	3	0	3	0	0	3
.80	0	0	0	0	0	3	0	0	0	3
.90	3	0	0	0	3	0	0	0	3	3
107.65	0	0	0	0	0	9	0	0	0	9
.80	6	0	0	0	6	6	0	0	9	15
110.60	3	0	0	0	3	0	0	0	0	0
113.65	6	0	0	0	6	0	0	NS ¹	0	0
.70	3	0	0	0	3	0	0	0	0	0
.80	3	0	0	0	3	0	0	0	0	0
117.24 ^s	--	1	0	0	1	0	0	0	0	0
.50	10	0	0	0	10	0	0	0	0	0
.60	0	11	0	0	11	0	0	0	0	0
.65	0	0	0	0	0	0	3	0	0	3
.70	0	18	0	0	18	6	0	0	0	6
120.60	3	0	0	0	3	0	0	0	0	0
.70	3	0	0	0	3	0	0	0	0	0
123.42	0	0	0	0	0	0	0	3	0	3
.80	0	0	64	--	64	0	0	0	--	0
127.80	3	0	0	--	3	0	--	0	--	0
Total	194	140	64	205	603	189	877	203	80	1,349
Occurrences	23	29	1	2	55	9	25	14	8	56

¹ NS—sample spoiled or spilled.

APPENDIX I—Continued

Saury Eggs—Numbers by Stations, 1965

Station	Cruise and month, 1965					Station	Cruise and month, 1965				
	6501-02 Jan.-Feb.	6504 Apr.	6506-08 June-Aug.	6509 Sept.	Total		6501-02 Jan.-Feb.	6504 Apr.	6506-08 June-Aug.	6509 Sept.	Total
60.60	0	--	17	--	17	97.45	0	7	0	0	7
63.55	0	2	0	--	2	.55	0	13	9	0	22
.60	0	0	3	--	3	.60	0	0	3	0	3
.70	--	7	--	--	7	.65	0	3	0	0	3
67.48	0	1	0	--	1	.70	0	4	0	0	4
.55	0	43	3	--	46	.75	--	9	--	0	9
.60	0	6	0	--	6	.80	10	4	6	0	20
.65	--	35	--	--	35	.85	--	4	--	--	4
.70	--	3	--	--	3	.100	--	4	--	--	4
.80	--	5	--	--	5	100.50	0	3	0	0	3
70.53	0	8	0	--	8	.60	0	3	0	0	3
.60	0	14	0	--	14	.70	0	3	0	0	3
.65	--	8	--	--	8	.75	--	24	--	--	24
.70	0	12	0	--	12	.85	--	3	--	--	3
.80	0	8	0	--	8	103.40	0	3	0	0	3
.200	15	--	0	--	15	.45	0	3	0	0	3
73.50	0	0	9	--	9	.55	0	3	0	0	3
.51	0	8	0	--	8	.85	--	3	--	--	3
.60	0	25	8	--	33	107.32	0	3	0	0	3
.70	--	3	--	--	3	.60	0	3	0	0	3
.80	--	5	--	--	5	.80	3	0	0	--	3
77.57	0	2	0	--	2	.90	3	0	0	--	3
.65	--	15	--	--	15	110.50	0	3	0	0	3
.70	--	44	--	--	44	.75	--	3	--	--	3
.80	--	20	--	--	20	.90	0	3	0	--	3
80.65	0	3	0	0	3	113.40	0	3	0	0	3
.80	0	13	0	0	13	.45	0	3	0	0	3
.160	9	--	--	--	9	.55	0	0	3	0	3
83.55	0	25	0	0	25	.65	3	0	0	--	3
.60	0	9	0	0	9	.70	3	0	0	--	3
.65	0	41	0	0	41	117.65	0	3	3	--	6
.70	0	6	0	0	6	.75	--	3	--	--	3
.80	0	23	4	0	27	.90	3	0	0	--	3
.90	0	--	3	--	3	120.45	78	0	0	0	78
87.40	0	0	3	0	3	.50	25	0	0	0	25
.45	0	3	0	0	3	.55	3	0	0	0	3
.55	0	3	6	0	9	.60	9	0	0	0	9
.60	0	2	0	0	2	.65	14	0	0	--	14
.65	0	13	0	0	13	.70	9	3	0	--	12
.70	0	3	6	0	9	.80	3	0	0	--	3
.80	0	24	0	0	24	.90	3	--	0	--	3
.100	--	3	--	--	3	.120	3	--	0	--	3
90.32	0	3	0	0	3	123.45	6	0	0	0	6
.70	0	3	0	0	3	.60	9	NS ¹	0	0	9
.80	0	3	0	0	3	.65	3	0	0	--	3
.90	0	3	0	0	3	.70	3	0	0	--	3
.100	0	9	0	--	9	127.40	11	0	0	0	11
93.28	0	3	0	0	3	.65	6	0	0	--	6
.30	0	0	0	3	3	130.26	1	0	0	0	1
.40	0	0	0	3	3	.70	3	0	0	--	3
.45	0	3	0	0	3	Total	244	620	86	6	956
.55	0	4	0	0	4	Occurrences	26	74	15	2	117
.60	0	3	0	0	3						
.65	0	9	0	0	9						
.70	0	3	0	0	3						
.80	0	3	0	0	3						
.90	6	0	0	0	6						

¹ NS—sample spoiled or spilled.

APPENDIX I—Continued

Saury Eggs—Numbers by Stations, 1966

Station	Cruise and month												Total
	6601 Jan.	6602 Feb.	6603 Mar.	6604 Apr.	6605 May	6606 June	6607 July	6608 Aug.	6609 Sept.	6610 Oct.	6611 Nov.	6612 Dec.	
60.60	0	--	--	3	--	0	22	--	--	0	--	0	25
.70	0	--	--	3	--	0	0	--	--	0	--	0	3
63.60	0	--	--	0	--	0	13	--	--	0	--	0	13
67.60	0	--	--	0	--	3	4	--	--	--	--	0	7
.80	--	--	--	0	--	3	0	--	--	0	--	--	3
70.51	0	--	--	0	--	6	0	--	--	0	--	0	6
.65	0	--	--	3	--	13	--	--	--	--	--	--	16
.70	0	--	--	5	--	6	0	--	--	0	--	0	11
.90	0	--	--	--	--	15	0	--	--	0	--	0	15
73.60	0	--	--	0	--	19	0	--	--	0	--	0	19
.70	--	--	--	6	--	10	0	--	--	0	--	0	16
.80	0	--	--	0	--	3	0	--	--	0	--	--	3
.90	NS ¹	--	--	0	--	3	0	--	--	--	--	--	3
77.51	0	--	--	6	--	3	0	--	--	0	--	0	9
.55	0	--	--	0	--	46	0	--	--	0	--	0	46
.60	0	--	--	5	--	19	0	--	--	0	--	0	24
.65	--	--	--	0	--	27	--	--	--	0	--	--	27
.70	--	--	--	0	--	3	3	--	--	0	--	0	6
.80	0	--	--	6	--	17	0	--	--	0	--	--	23
.90	7	--	--	3	--	0	0	--	--	0	--	--	10
80.55	0	--	--	0	21	0	0	0	0	0	--	0	21
.60	0	0	--	0	0	3	0	0	0	0	--	0	3
.65	0	3	--	0	23	27	25	0	0	0	--	0	78
.80	0	0	--	0	10	6	0	0	0	0	--	0	16
.90	0	0	--	0	3	0	0	0	0	0	--	0	3
83.43	0	0	--	0	3	0	0	0	0	0	--	0	3
.60	3	3	--	0	0	6	0	0	0	0	--	0	12
.65	3	0	--	0	0	6	3	0	0	0	--	0	12
.70	31	26	--	6	3	14	0	0	0	0	--	0	80
.80	0	6	--	0	3	9	0	0	0	0	--	0	18
.90	0	0	--	3	0	0	0	0	0	0	--	0	3
87.33	4	0	--	--	0	3	0	0	0	0	--	0	7
.40	0	0	--	0	0	6	0	0	0	0	--	0	6
.55	9	0	--	0	3	0	0	0	0	0	--	0	12
.60	--	0	--	0	0	12	0	0	0	0	--	0	12
.65	--	0	--	0	16	0	0	0	0	0	--	0	16
.80	--	0	--	0	4	0	0	0	0	0	--	3	7
.90	--	0	--	6	4	0	0	0	0	0	--	--	10
90.32	--	0	--	0	0	7	0	0	0	0	--	0	7
.45	--	0	--	9	13	8	0	0	0	0	--	0	30
.53	--	--	--	3	--	9	0	--	--	0	--	0	12
.60	--	0	--	12	4	6	0	0	0	0	--	0	22
.65	--	6	--	40	0	5	0	0	0	0	--	0	51
.70	--	0	--	24	4	0	0	0	0	NS ¹	--	0	28
.90	--	3	--	0	0	0	0	0	0	0	--	0	3
93.27	0	3	--	--	0	0	0	0	0	0	--	0	3
.30	0	0	--	22	0	0	0	0	0	0	--	0	22
.40	0	0	--	0	3	0	0	0	0	0	--	0	3
.45	0	0	--	36	3	0	0	0	0	0	--	0	39
.50	0	0	--	10	0	0	0	0	0	0	--	0	10
.55	0	0	--	13	0	22	0	0	0	0	--	0	35
.60	0	0	--	0	0	15	0	0	0	0	--	0	15
.65	0	0	--	0	17	0	0	0	0	0	--	0	17
.70	0	0	--	0	14	3	NS ¹	0	0	0	--	0	17
.80	9	0	--	0	0	0	0	0	0	--	--	0	9
.90	3	0	--	0	0	0	0	--	--	0	--	0	3
97.40	0	0	--	--	2,392	0	0	0	0	0	--	0	2,392
.45	0	0	--	3	0	0	0	0	0	0	--	0	3
97.50	0	3	--	0	6	6	0	0	0	0	--	0	15
.55	0	0	--	0	12	3	0	0	0	0	--	0	15
.65	0	0	--	9	4	6	0	0	0	0	--	0	19
.70	0	0	--	0	4	0	0	0	0	0	--	0	4
100.35	0	0	--	0	6	0	0	0	0	0	--	0	6
.40	0	0	--	0	6	7	0	0	0	0	--	0	13
.45	0	0	--	0	16	6	0	0	0	0	--	0	22
.50	0	0	--	3	0	0	0	0	0	0	--	0	3
.70	0	0	--	0	0	0	4	0	0	0	--	0	4
.80	0	9	--	0	0	0	0	--	--	0	--	0	9
.90	0	--	--	4	0	0	0	--	--	--	--	0	4
103.35	0	0	--	0	0	3	0	0	0	0	--	0	3
.40	0	0	--	0	6	0	0	0	0	0	--	0	6
.45	0	0	--	0	11	7	0	0	0	0	--	0	18
.50	0	0	--	0	6	0	0	0	0	0	--	0	6
.60	0	0	--	0	16	0	0	0	0	0	--	0	16
.70	0	6	--	0	0	0	0	0	0	0	--	0	6

¹ NS—sample spoiled or spilled.

APPENDIX I—Continued

Saury Eggs—Numbers by Stations, 1966—Continued

Station	Cruise and month												Total
	6601 Jan.	6602 Feb.	6603 Mar.	6604 Apr.	6605 May	6606 June	6607 July	6608 Aug.	6609 Sept.	6610 Oct.	6611 Nov.	6612 Dec.	
107.35	0	0	--	0	4	--	0	0	0	0	0	0	4
.40	0	3	--	0	3	--	0	0	0	0	--	0	6
.45	0	3	--	0	0	--	0	0	0	0	0	0	3
110.35	0	0	--	0	14	--	0	0	0	0	0	0	14
.40	0	0	--	0	3	--	0	0	0	0	--	0	3
.65	3	0	--	0	0	--	0	0	0	0	--	0	3
.80	0	0	--	3	0	--	0	--	--	--	--	0	3
113.45	0	0	--	0	3	--	0	0	0	0	--	0	3
.60	6	0	--	0	0	--	0	0	0	0	--	0	6
.80	2	--	--	0	0	--	3	--	--	--	--	0	5
117.50	0	3	--	0	0	--	0	0	0	0	--	0	3
.60	0	0	--	4	0	--	0	0	0	0	--	0	4
.65	0	6	--	0	0	--	0	0	0	0	--	0	6
120.80	3	--	--	0	3	--	0	--	--	--	--	0	6
127.65	3,223	--	--	--	0	--	0	--	--	--	--	--	3,223
.70	59	--	--	--	0	--	0	--	--	--	--	--	59
.80	3	--	--	--	--	--	0	--	--	--	--	--	3
130.40	3	--	--	0	0	--	0	0	--	0	0	0	3
.50	3	--	--	0	0	--	0	0	--	0	0	0	3
133.40	6	--	--	0	0	--	0	0	--	0	0	0	6
.60	6	--	--	0	0	--	0	0	--	0	0	--	6
137.22	2	--	--	0	0	--	0	0	--	0	0	0	2
.35	3	--	--	0	0	--	0	0	--	0	0	0	3
Total	3,391	83	--	250	2,666	401	77	0	0	0	0	3	6,871
Occurrences	21	14	--	27	36	41	8	0	0	0	0	1	148

0 = station occupied—no saury eggs taken.

-- = station not occupied.

{1} = indicates more than one occupancy of the same station on a cruise.

APPENDIX II
Visual Observations of Saury Abundance, 1956

Night stations occupied	Cruise and month											
	5601 Jan.	5602 Feb.	5603 Mar.	5604 Apr.	5605 May	5606 June	5607 July	5608 Aug.	5609 Sept.	5610 Oct.	5611 Nov.	5612 Dec.
40.38.....	--	--	--	--	0	--	--	--	--	--	--	--
.40.....	--	--	--	--	0	--	--	--	--	--	--	--
.45.....	--	--	--	--	0	+	--	--	--	--	--	--
.50.....	--	--	--	--	0	0	--	--	--	--	--	--
.90.....	--	--	--	--	0	0	--	--	--	--	--	--
43.60.....	--	--	--	--	--	0	--	--	--	--	--	--
47.50.....	--	--	--	--	0	--	--	--	--	--	--	--
.55.....	--	--	--	--	0	--	--	--	--	--	--	--
.60.....	--	--	--	--	--	0	--	--	--	--	--	--
50.55.....	--	--	--	--	0	--	--	--	--	--	--	--
.60.....	--	--	--	--	0	0	--	--	--	--	--	--
.70.....	--	--	--	--	0	--	--	--	--	--	--	--
53.52.....	--	--	--	--	--	0	--	--	--	--	--	--
.55.....	--	--	--	--	--	0	--	--	--	--	--	--
57.51.....	--	--	--	--	--	0	--	--	--	--	--	--
.55.....	--	--	--	--	--	0	--	--	--	--	--	--
.65.....	--	--	--	--	0	--	--	--	--	--	--	--
60.50.....	--	--	--	--	0	--	--	--	--	--	--	--
.55.....	--	--	--	0	0	--	0	--	--	--	--	--
.60.....	--	--	--	0	--	--	--	--	--	--	--	--
.70.....	--	--	--	0	--	--	+	--	--	--	--	--
.80.....	--	--	--	--	--	--	+	0	--	--	--	--
.90.....	--	--	--	--	--	--	+	0	--	--	--	--
63.52.....	--	--	--	--	--	0	--	--	--	--	--	--
.55.....	--	--	--	--	--	0	--	--	--	--	--	--
.65.....	--	--	--	--	+	--	--	--	--	--	--	--
.80.....	--	--	--	0	--	--	--	--	--	--	--	--
67.50.....	--	--	--	0	--	0	--	--	--	--	--	--
.55.....	--	--	--	0	--	0	--	+	--	--	--	--
.60.....	--	--	--	--	--	--	--	+	--	--	--	--
.65.....	--	--	--	0	0	--	--	--	--	--	--	--
.70.....	--	--	--	--	--	--	--	0	--	--	--	--
70.52.....	--	--	--	0	+	--	--	--	--	--	--	--
.55.....	--	--	--	0	0	0	--	--	--	--	--	--
.60.....	--	--	--	0	--	--	--	--	--	--	--	--
.80.....	--	--	--	0	--	0	--	--	--	--	--	--
.90.....	--	--	--	0	--	0	--	0	--	--	--	--
73.50.....	--	--	--	--	0	--	--	--	--	--	--	--
.65.....	--	--	--	0	--	--	--	--	--	--	--	--
.80.....	--	--	--	--	--	--	0	--	--	--	--	--
77.55.....	--	--	--	0	--	--	+	--	--	--	--	--
.60.....	--	--	--	--	--	--	+	0	--	--	--	--
.70.....	--	--	--	--	0	--	--	--	--	--	--	--
.80.....	--	--	--	--	0	--	--	--	--	--	--	--
80.51.....	--	--	0	--	--	--	--	--	--	--	--	--
.55.....	--	--	0	--	--	--	--	--	--	--	--	--
.60.....	--	+	0	--	--	--	--	--	--	--	0	0
.70.....	+	+	--	--	--	+	0	--	--	0	0	0
.80.....	+	--	--	+	0	--	0	--	--	0	0	0
.90.....	--	--	0	--	0	--	--	--	--	--	+	--
82.47.....	--	--	0	--	--	--	--	--	--	--	+	--
83.40.....	--	--	--	--	--	--	--	--	--	--	+	--
.43.....	0	--	--	--	--	--	--	--	--	--	+	--
.51.....	0	--	0	--	+	+	--	--	--	+	--	--
.55.....	--	--	--	0	+	--	--	+	--	+	--	+
.60.....	--	+	0	0	0	--	--	--	--	+	--	0
.70.....	--	--	--	0	--	--	+	0	--	--	--	--
.80.....	--	--	0	--	--	--	+	--	--	--	--	--
.90.....	--	--	0	--	--	--	+	--	--	--	--	--
87.36.....	--	0	--	0	--	--	--	--	--	--	+	+
.40.....	--	0	--	0	--	--	--	--	--	--	+	+
.45.....	--	--	--	--	--	--	--	+	--	--	--	0
.50.....	--	0	0	--	--	--	--	+	--	--	--	0
.55.....	--	--	--	--	--	--	+	--	--	+	--	--
.60.....	0	--	--	--	--	0	--	--	--	0	--	--
.65.....	--	--	--	--	0	--	--	--	--	--	--	--
.70.....	--	--	--	--	+	--	--	--	--	--	--	--
.75.....	--	--	--	--	0	--	--	--	--	--	--	--
.80.....	--	--	--	--	--	--	--	+	--	--	--	--
.85.....	--	--	--	--	--	--	--	0	--	--	--	--
.90.....	--	--	+	0	--	--	--	0	--	--	--	--

-- = no observation made.
 + = saury observed.
 0 = no saury observed.

APPENDIX II—Continued

Visual Observations of Saury Abundance, 1956—Continued

Night stations occupied	Cruise and month											
	5601 Jan.	5602 Feb.	5603 Mar.	5604 Apr.	5605 May	5606 June	5607 July	5608 Aug.	5609 Sept.	5610 Oct.	5611 Nov.	5612 Dec.
90.28.....	--	--	--	--	--	--	0	--	--	0	+	--
.30.....	0	--	--	--	--	+	0	--	--	+	0	--
.37.....	0	--	+	0	0	+	--	--	--	+	+	--
.45.....	--	--	+	0	0	--	--	--	--	0	--	+
.50.....	--	--	0	0	0	--	--	--	--	--	--	+
.55.....	--	--	0	0	--	--	--	--	--	--	--	0
.60.....	--	--	--	--	--	0	+	--	--	--	--	+
.65.....	--	--	--	--	--	0	+	--	--	--	--	--
.70.....	--	--	--	--	--	--	+	--	--	+	--	--
.80.....	--	--	--	--	+	+	--	--	--	+	--	--
.85.....	--	--	--	--	0	--	--	--	--	--	--	--
.90.....	--	--	0	+	0	--	--	--	--	0	--	0
.95.....	--	--	--	--	0	--	--	--	--	--	--	--
93.27.....	--	--	--	--	--	--	+	--	--	--	--	+
.30.....	--	--	--	--	0	--	+	--	--	--	--	+
.35.....	--	--	--	--	--	--	+	--	--	--	--	+
.40.....	--	+	--	0	+	0	--	--	--	0	+	+
.45.....	--	--	--	--	--	--	--	--	--	0	0	0
.50.....	+	+	+	0	--	+	--	--	--	0	+	--
.55.....	--	--	--	--	--	--	0	--	--	0	0	--
.60.....	--	--	+	--	--	--	+	--	--	0	+	--
.65.....	--	--	--	--	--	--	+	--	--	--	--	--
.70.....	--	--	--	--	0	+	+	--	--	--	--	--
.75.....	--	--	--	--	--	0	0	--	--	--	--	--
.90.....	--	--	--	--	--	0	--	--	--	--	--	--
.100.....	--	--	--	--	0	--	--	--	--	--	--	--
97.30.....	--	--	0	--	--	--	--	--	--	0	+	--
.32.....	--	--	+	--	--	--	--	--	--	+	0	+
.40.....	--	--	+	--	--	+	--	--	--	0	0	+
.45.....	--	--	--	--	--	--	--	--	--	0	0	0
.50.....	+	+	--	0	0	+	--	--	--	--	--	0
.55.....	--	--	--	--	0	--	--	--	--	--	--	0
.60.....	--	--	--	0	0	--	--	--	--	--	--	0
.65.....	--	--	--	--	0	--	--	--	--	--	--	--
.70.....	--	--	+	--	--	--	--	--	--	--	--	--
.90.....	--	--	+	--	--	--	--	--	--	--	--	--
.95.....	--	--	--	--	0	--	--	--	--	--	--	--
100.29.....	--	--	--	--	0	+	--	--	--	--	--	--
.30.....	--	--	0	--	0	--	+	--	--	--	--	--
.33.....	--	--	--	0	--	0	--	--	--	--	--	--
.35.....	--	--	--	--	0	--	+	--	--	--	--	--
.40.....	+	+	--	0	0	--	--	--	--	--	--	--
.45.....	--	--	--	--	0	--	--	--	--	--	--	--
.50.....	+	--	--	--	--	--	--	--	--	--	--	--
.60.....	--	--	0	--	--	--	0	--	--	--	--	--
.70.....	--	+	+	--	--	--	0	--	--	--	--	--
.80.....	--	+	0	0	0	--	--	--	--	--	--	--
.90.....	--	--	0	0	--	--	--	--	--	--	--	--
103.35.....	--	+	--	--	--	--	--	--	--	--	--	--
.40.....	--	+	--	--	--	--	0	--	--	--	--	--
.45.....	--	--	--	--	--	--	0	--	--	--	--	--
.50.....	--	--	0	+	0	--	0	--	--	--	--	--
.55.....	--	--	--	--	0	--	0	--	--	--	--	--
.60.....	--	--	0	--	0	--	--	--	--	--	--	--
.70.....	--	--	0	--	--	--	--	--	--	--	--	--
.80.....	--	--	--	--	--	--	0	--	--	--	--	--
.85.....	--	--	--	--	0	--	--	--	--	--	--	--
.90.....	--	--	+	--	--	--	+	--	--	--	--	--
.95.....	--	--	--	--	0	--	--	--	--	--	--	--
107.32.....	--	0	--	--	--	--	--	--	--	--	--	--
.40.....	--	--	--	--	0	--	0	--	--	--	--	--
.45.....	--	--	--	--	0	--	0	--	--	--	--	--
.50.....	--	--	--	--	0	--	--	--	--	--	--	--
.55.....	--	--	--	--	0	--	--	--	--	--	--	--
.60.....	--	+	--	--	0	0	--	--	--	--	--	--
.70.....	--	--	+	0	--	--	0	--	--	--	--	--
.85.....	--	--	--	--	--	0	--	--	--	--	--	--
.90.....	--	--	--	--	0	+	--	--	--	--	--	--
110.33.....	--	--	--	0	0	--	--	--	--	--	--	--
.35.....	--	--	--	+	+	+	+	--	0	--	--	--
.40.....	--	--	--	--	0	--	--	--	--	--	--	--
.45.....	--	--	--	--	0	--	--	--	--	--	--	--
.50.....	--	+	--	--	0	--	--	--	--	--	--	--
.65.....	--	--	--	--	--	0	--	--	--	--	--	--
.70.....	--	--	--	+	--	+	+	--	--	--	--	--
.80.....	--	--	--	+	--	--	0	--	--	--	--	--
.85.....	--	--	--	--	0	--	--	--	--	--	--	--
.90.....	--	--	--	--	0	--	--	--	--	--	--	--

APPENDIX II—Continued

Visual Observations of Saury Abundance, 1957—Continued

Night stations occupied	Cruise and month											
	5701 Jan.	5702 Feb.	5703 Mar.	5704 Apr.	5705 May	5706 June	5707 July	5708 Aug.	5709 Sept.	5710 Oct.	5711 Nov.	5712 Dec.
.60-----	--	0	--	--	0	--	--	--	--	--	--	--
.65-----	--	--	--	--	0	--	--	--	--	--	--	--
.70-----	--	--	--	--	0	--	0	--	--	0	--	0
.75-----	--	--	--	--	0	--	0	--	--	--	--	--
.80-----	--	--	--	--	--	0	--	--	--	--	--	+
.85-----	--	--	--	--	--	0	--	--	--	--	--	--
.90-----	--	--	--	--	--	0	--	--	--	0	--	--
93.27-----	--	+	--	--	0	--	--	--	--	--	--	--
.30-----	--	0	--	--	0	--	--	--	--	--	--	--
.35-----	--	--	--	0	--	--	--	--	--	0	--	--
.40-----	--	--	--	0	--	--	+	--	+	0	--	--
.45-----	--	--	--	0	--	--	+	--	--	--	+	--
.50-----	--	0	--	--	--	--	--	--	0	--	0	--
.55-----	--	--	--	--	--	--	+	--	--	--	+	--
.60-----	--	0	--	--	--	+	0	--	--	--	+	--
.65-----	--	--	--	--	0	--	--	--	--	--	+	--
.70-----	--	--	--	--	0	--	--	--	0	--	--	--
.75-----	--	--	--	--	0	--	--	--	--	0	--	--
.80-----	--	--	--	0	0	--	--	--	--	0	--	--
97.30-----	--	--	--	--	--	--	--	--	--	--	0	--
.32-----	--	--	--	--	--	--	--	--	--	0	+	+
.35-----	--	--	--	--	--	--	--	--	--	0	--	--
.40-----	--	+	--	--	--	--	--	--	0	0	+	--
.45-----	--	--	--	--	--	--	0	--	--	--	0	--
.50-----	--	+	--	--	--	0	0	--	0	--	+	--
.55-----	--	--	--	--	--	+	--	--	--	--	--	--
.60-----	--	--	--	0	0	+	--	--	--	0	--	--
.65-----	--	--	--	--	0	--	--	--	--	--	--	--
.70-----	--	--	--	--	0	--	--	--	--	--	--	--
.75-----	--	--	--	--	0	--	--	--	--	--	--	--
.80-----	--	--	--	--	0	--	--	--	--	0	--	--
100.29-----	--	--	--	--	--	--	--	--	--	--	0	--
.30-----	--	--	--	--	--	--	--	--	--	+	--	--
.33-----	--	--	+	0	0	--	+	--	--	0	--	--
.35-----	--	--	--	--	--	--	--	--	--	0	--	--
.40-----	--	0	--	--	0	--	+	--	--	0	--	+
.45-----	--	--	--	--	--	0	--	--	--	--	--	--
.50-----	--	0	--	--	--	+	--	--	--	--	--	--
.55-----	--	--	--	--	--	--	--	--	--	--	--	--
.60-----	0	0	--	0	--	--	--	--	--	--	--	--
.65-----	--	--	--	--	--	--	--	--	--	--	--	--
.70-----	--	--	--	0	0	--	--	--	--	--	--	--
.75-----	--	--	--	--	0	--	--	--	--	--	--	--
.80-----	--	--	--	--	0	--	--	--	--	0	--	--
.85-----	--	--	--	--	--	0	--	--	--	--	--	--
.90-----	--	--	--	--	--	0	--	--	--	--	--	--
103.30-----	--	0	--	--	0	0	0	--	--	0	--	--
.35-----	0	0	--	+	0	0	0	--	--	0	--	--
.40-----	--	0	--	0	0	0	0	--	--	--	--	--
.45-----	--	--	--	--	--	--	0	--	--	--	--	--
.50-----	--	0	--	--	--	--	0	--	--	--	--	0
.55-----	--	--	--	--	--	--	0	--	--	--	--	--
.60-----	0	--	--	--	--	--	--	--	--	0	--	--
.70-----	--	--	--	0	+	+	--	--	--	0	--	--
.75-----	--	--	--	--	+	0	--	--	--	--	--	--
.80-----	--	--	--	0	0	0	--	--	--	--	--	--
.85-----	--	--	--	--	0	--	--	--	--	--	--	--
107.32-----	0	--	--	--	0	--	--	--	--	--	--	--
.35-----	0	--	--	--	--	--	--	--	--	--	--	--
.40-----	0	+	--	--	--	--	--	--	--	--	--	--
.50-----	--	0	--	--	--	--	+	--	--	0	--	--
.55-----	--	--	--	--	--	--	0	--	--	--	--	--
.60-----	--	--	--	--	0	--	0	--	--	0	--	0
.65-----	--	--	--	--	0	--	0	--	--	--	--	0
.67-----	--	0	--	--	--	--	--	--	--	--	--	--
107.70-----	--	--	--	0	--	--	--	--	--	--	--	--
.75-----	--	--	--	--	--	+	--	--	--	--	--	--
.85-----	--	--	--	--	--	--	0	--	--	--	--	--
.90-----	--	--	--	--	--	--	0	--	--	--	--	--
110.33-----	--	0	--	--	--	0	--	+	--	0	--	--
.35-----	--	+	--	+	0	0	+	--	--	--	--	--
.40-----	--	+	--	0	0	--	0	--	--	--	--	--
.45-----	--	--	--	--	0	--	0	--	--	--	--	--
.50-----	0	--	--	--	0	--	--	--	--	--	--	--
.60-----	0	--	--	--	--	--	--	--	--	0	--	--
.65-----	--	--	--	--	--	--	0	--	--	--	--	--
.70-----	--	0	--	0	--	--	--	--	--	0	--	0
.80-----	--	0	--	+	--	0	--	--	--	--	--	--
.85-----	--	--	--	--	0	--	--	--	--	--	--	--
.90-----	--	+	--	--	0	--	0	--	--	--	--	--

APPENDIX II—Continued

Visual Observations of Saury Abundance, 1957—Continued

Night stations occupied	Cruise and month											
	5701 Jan.	5702 Feb.	5703 Mar.	5704 Apr.	5705 May	5706 June	5707 July	5708 Aug.	5709 Sept.	5710 Oct.	5711 Nov.	5712 Dec.
113.30	0	--	0	--	--	--	--	0	--	0	--	--
.35	--	--	0	--	0	--	--	0	--	0	--	--
.40	--	--	0	--	0	--	--	--	0	--	--	--
.45	--	--	--	--	0	0	--	--	--	--	--	--
.50	0	--	--	--	0	--	0	--	--	--	--	--
.55	--	--	--	--	--	--	0	--	--	--	--	--
.60	0	--	--	--	--	0	--	--	--	--	--	--
.70	0	0	--	--	--	--	--	--	--	0	--	--
.80	--	--	--	--	--	--	--	--	--	0	--	--
115.27	--	--	--	--	--	--	--	0	--	--	--	--
.40	--	--	--	--	--	--	--	--	0	--	--	--
117.26	0	--	0	0	--	--	--	0	--	0	--	--
.30	0	--	0	0	--	0	--	0	0	0	--	--
.35	--	--	0	--	--	--	--	0	0	--	--	--
.40	0	--	--	--	--	0	+	--	0	0	--	--
.45	--	--	--	--	+	0	0	--	--	--	--	--
.50	0	--	--	--	+	--	--	--	--	0	--	--
.55	--	--	--	--	0	--	--	--	--	--	--	--
.60	--	--	0	+	--	--	--	--	--	--	--	--
.70	--	--	--	+	--	--	--	--	--	--	--	--
.75	--	--	--	--	--	--	0	--	--	--	--	--
.80	--	--	--	--	--	--	0	--	--	--	--	--
.90	--	--	--	--	--	0	--	--	--	--	--	--
118.39	--	--	--	--	--	0	+	--	--	--	--	--
118.5.35	--	--	--	--	--	--	--	--	0	--	--	--
119.33	--	--	--	--	--	--	0	--	--	--	--	--
120.25	0	--	0	0	--	0	--	0	--	0	--	--
.30	0	0	--	0	--	0	--	0	--	--	--	--
.35	--	--	--	--	--	0	0	0	--	--	--	--
.40	--	--	--	--	--	0	0	0	--	--	--	--
.50	--	--	--	+	--	0	--	--	--	--	--	--
.55	--	--	--	--	--	0	--	--	--	--	--	--
.60	0	--	0	--	--	0	--	--	--	0	--	--
.65	--	--	--	--	0	0	--	--	--	--	--	--
.70	0	--	--	--	0	0	0	--	--	0	--	--
.75	--	--	--	--	0	--	0	--	--	--	--	--
.80	--	--	--	--	--	--	0	--	--	0	--	--
123.37	0	--	--	--	0	--	--	--	--	--	--	--
.42	--	--	--	--	0	--	0	--	--	--	--	--
.45	--	--	--	--	--	--	--	--	0	--	--	--
.50	--	--	--	--	--	--	0	--	--	--	--	--
.55	--	--	+	--	--	--	--	--	--	--	--	--
.60	--	0	0	--	--	--	--	--	--	0	--	--
.70	--	--	--	--	--	--	--	--	--	0	--	--
.80	--	--	--	+	--	--	--	--	--	0	--	--
127.20	--	--	--	--	--	--	--	--	--	0	--	--
.34	+	--	0	+	--	--	--	0	--	0	--	--
.37	--	--	--	0	--	--	--	--	--	--	--	--
.40	0	--	0	--	--	--	--	0	0	--	--	--
.42	--	--	--	0	--	--	--	--	--	--	--	--
.45	--	--	0	--	--	0	--	0	0	0	--	--
.50	--	--	0	--	--	--	0	--	--	--	--	--
.55	--	0	--	--	--	--	0	--	--	--	--	--
.60	--	0	--	--	--	0	0	--	--	--	--	--
.70	--	--	--	0	--	--	--	--	--	--	--	--
.80	--	--	--	0	--	--	--	--	--	0	--	--
130.30	--	0	0	--	--	--	0	--	--	0	--	--
.35	--	--	--	--	--	--	0	--	--	0	--	--
.40	--	--	0	--	--	--	0	--	--	0	--	--
.45	--	--	--	--	--	0	0	--	--	--	--	--
.50	0	--	0	0	0	0	0	--	--	--	--	--
.55	--	--	--	0	--	0	--	--	--	--	--	--
.60	0	--	--	--	0	0	--	--	--	--	--	--
.70	--	--	--	--	--	--	0	--	--	--	--	--
.80	--	--	--	--	--	--	0	--	--	0	--	--
133.25	0	0	0	--	0	0	0	0	--	--	--	--
.30	--	--	0	--	--	0	0	0	--	--	--	--
.35	0	--	--	--	--	--	--	--	--	--	--	--
.40	0	--	--	--	--	--	--	--	--	0	--	--
.45	--	--	--	0	--	--	--	--	--	--	--	--
.50	--	--	--	0	--	--	--	--	--	0	--	--
.55	--	--	--	--	--	--	--	--	--	--	--	--
.60	--	--	--	--	--	--	0	--	--	0	--	--
.70	--	--	--	--	--	--	0	--	--	--	--	--

APPENDIX II—Continued

Visual Observations of Saury Abundance, 1958—Continued

Night stations occupied	Cruise and month											
	5801 Jan.	5802 Feb.	5803 Mar.	5804 Apr.	5805 May	5806 June	5807 July	5808 Aug.	5809 Sept.	5810 Oct.	5811 Nov.	5812 Dec.
73.55-----	--	--	+	--	--	--	--	--	--	--	--	--
.70-----	--	--	--	--	0	--	--	--	--	--	--	--
.75-----	--	--	--	0	--	--	--	--	--	--	--	--
.80-----	--	--	--	0	0	--	--	--	--	--	--	--
.90-----	--	--	0	--	--	--	--	--	--	--	--	--
77.55-----	--	--	--	--	0	--	--	--	--	--	--	--
.60-----	--	--	+	0	+	--	--	--	--	--	--	--
.65-----	--	--	--	0	--	--	--	--	--	--	--	--
.70-----	--	--	--	0	--	--	--	--	--	--	--	--
.75-----	--	--	--	0	--	--	--	--	--	--	--	--
.85-----	--	--	--	0	--	--	--	--	--	--	--	--
.90-----	--	--	0	0	--	--	--	--	--	--	--	--
80.51-----	0	--	--	--	--	--	--	--	--	--	--	--
.55-----	--	0	+	--	--	--	--	--	--	--	--	--
.60-----	--	0	0	+	--	--	--	--	--	--	--	--
.65-----	--	--	--	0	--	--	--	--	--	--	--	--
.70-----	--	0	0	--	--	--	--	--	--	--	--	--
.80-----	--	--	--	--	+	--	--	--	--	--	--	--
.90-----	--	--	--	0	0	--	--	--	--	--	--	--
.120-----	--	--	--	0	--	--	--	--	--	--	--	--
.130-----	--	--	--	0	--	--	--	--	--	--	--	--
82.47-----	0	--	--	--	+	--	--	--	--	--	--	--
83.40-----	--	0	--	--	--	--	--	--	--	--	--	--
.43-----	--	0	0	--	+	--	--	--	--	--	--	--
.51-----	+	0	--	--	--	--	--	--	--	--	--	--
.55-----	+	--	0	0	--	--	--	--	--	--	--	--
.60-----	0	--	0	--	--	--	--	--	--	--	--	--
83.65-----	--	--	--	--	0	--	--	--	--	--	--	--
.70-----	--	--	--	--	0	--	--	--	--	--	--	--
.80-----	--	--	--	--	0	--	--	--	--	--	--	--
87.35-----	--	0	+	--	0	--	--	--	--	--	--	--
.40-----	0	0	+	--	+	--	--	--	--	--	--	--
.45-----	+	0	0	0	--	--	--	--	--	--	--	--
.50-----	--	--	--	0	--	--	--	--	--	--	--	--
.55-----	+	--	--	--	--	--	--	--	--	--	--	--
.70-----	--	--	--	--	0	--	--	--	--	--	--	--
.75-----	--	--	--	--	0	--	--	--	--	--	--	--
.80-----	--	--	0	0	0	--	--	--	--	--	--	--
90.28-----	--	0	--	--	0	--	--	--	--	--	--	--
.30-----	--	0	--	0	0	--	--	--	--	--	--	--
.37-----	--	0	--	--	0	--	--	--	--	--	--	--
.45-----	--	--	--	--	0	--	--	--	--	--	--	--
.50-----	--	--	--	--	0	--	--	--	--	--	--	--
.55-----	--	0	+	--	--	--	--	--	--	--	--	--
.60-----	--	+	0	--	--	--	--	--	--	--	--	--
.65-----	--	--	--	--	0	--	--	--	--	--	--	--
.70-----	--	0	0	--	0	--	--	--	--	--	--	--
.75-----	--	--	--	--	0	--	--	--	--	--	--	--
.80-----	0	--	--	--	--	--	--	--	--	--	--	--
.90-----	0	--	0	--	--	--	--	--	--	--	--	--
.100-----	--	--	--	0	--	--	--	--	--	--	--	--
.110-----	--	--	--	0	--	--	--	--	--	--	--	--
.130-----	--	--	--	0	--	--	--	--	--	--	--	--
.145-----	--	--	--	0	--	--	--	--	--	--	--	--
93.30-----	0	--	--	0	--	--	--	--	--	--	--	--
.35-----	--	0	--	0	--	--	--	--	--	--	--	--
.40-----	0	0	--	0	+	--	--	--	--	--	--	--
.45-----	--	+	0	--	0	--	--	--	--	--	--	--
.50-----	--	--	0	--	+	--	--	--	--	--	--	--
.60-----	--	--	0	--	--	--	--	--	--	--	--	--
.70-----	+	--	--	--	--	--	--	--	--	--	--	--
.80-----	0	+	0	--	0	--	--	--	--	--	--	--
.85-----	--	--	--	--	0	--	--	--	--	--	--	--
97.30-----	--	--	0	--	0	--	--	--	--	--	--	--
.32-----	--	--	0	0	0	--	--	--	--	--	--	--
.35-----	--	--	--	0	0	--	--	--	--	--	--	--
.40-----	--	+	+	0	0	--	--	--	--	--	--	--
.45-----	--	0	--	0	--	--	--	--	--	--	--	--
.50-----	0	0	--	--	--	--	--	--	--	--	--	--
.60-----	0	--	--	--	--	--	--	--	--	--	--	--
.70-----	--	--	0	0	+	--	--	--	--	--	--	--
.75-----	--	--	--	0	+	--	--	--	--	--	--	--
.80-----	--	+	0	+	0	--	--	--	--	--	--	--

APPENDIX II—Continued

Visual Observations of Saury Abundance, 1958—Continued

Night stations occupied	Cruise and month											
	5801 Jan.	5802 Feb.	5803 Mar.	5804 Apr.	5805 May	5806 June	5807 July	5808 Aug.	5809 Sept.	5810 Oct.	5811 Nov.	5812 Dec.
127.34.....	0	--	0	--	--	--	--	--	--	--	--	--
.40.....	--	--	0	--	--	--	--	--	--	--	--	--
.45.....	--	--	0	--	--	--	--	--	--	--	--	--
.50.....	--	--	--	0	--	--	--	--	--	--	--	--
.55.....	--	--	--	0	--	--	--	--	--	--	--	--
.60.....	--	--	--	0	0	--	--	--	--	--	--	--
.70.....	0	--	--	--	--	--	--	--	--	--	--	--
.80.....	--	--	--	0	--	--	--	--	--	--	--	--
130.30.....	0	--	0	--	+	--	--	--	--	--	--	--
.35.....	--	--	--	--	0	--	--	--	--	--	--	--
.40.....	--	--	--	--	0	--	--	--	--	--	--	--
.45.....	--	--	--	0	--	--	--	--	--	--	--	--
.50.....	--	--	--	0	--	--	--	--	--	--	--	--
.55.....	--	--	--	0	--	--	--	--	--	--	--	--
.60.....	0	--	0	--	--	--	--	--	--	--	--	--
133.25.....	0	--	--	0	0	--	--	--	--	--	--	--
.30.....	0	--	--	0	--	--	--	--	--	--	--	--
.40.....	--	--	--	0	--	--	--	--	--	--	--	--
.50.....	--	--	0	--	0	--	--	--	--	--	--	--
.60.....	0	--	--	--	--	--	--	--	--	--	--	--
.70.....	--	--	--	0	--	--	--	--	--	--	--	--
.80.....	--	--	--	0	--	--	--	--	--	--	--	--
137.23.....	0	--	--	--	0	--	--	--	--	--	--	--
.30.....	--	--	0	--	--	--	--	--	--	--	--	--
.35.....	--	--	--	0	--	--	--	--	--	--	--	--
.40.....	--	--	0	0	--	--	--	--	--	--	--	--
.45.....	--	--	--	0	0	--	--	--	--	--	--	--
.50.....	0	--	--	0	0	--	--	--	--	--	--	--
.60.....	0	--	--	--	--	--	--	--	--	--	--	--
.80.....	--	--	--	0	--	--	--	--	--	--	--	--
140.30.....	0	--	0	--	--	--	--	--	--	--	--	--
.35.....	0	--	0	--	--	--	--	--	--	--	--	--
.40.....	0	--	--	--	--	--	--	--	--	--	--	--
143.26.....	--	--	0	--	--	--	--	--	--	--	--	--
.30.....	--	--	0	--	--	--	--	--	--	--	--	--
.40.....	0	--	--	--	--	--	--	--	--	--	--	--
.50.....	0	--	--	--	--	--	--	--	--	--	--	--
.60.....	0	--	--	--	--	--	--	--	--	--	--	--
147.20.....	0	--	0	--	--	--	--	--	--	--	--	--
.25.....	0	--	0	--	--	--	--	--	--	--	--	--
.30.....	0	--	0	--	--	--	--	--	--	--	--	--
.40.....	0	--	--	--	--	--	--	--	--	--	--	--
150.19.....	0	--	--	--	--	--	--	--	--	--	--	--
153.16.....	0	--	--	--	--	--	--	--	--	--	--	--
.20.....	0	--	--	--	--	--	--	--	--	--	--	--
.40.....	0	--	--	--	--	--	--	--	--	--	--	--
.50.....	+	--	--	--	--	--	--	--	--	--	--	--
157.10.....	0	--	--	--	--	--	--	--	--	--	--	--
.20.....	0	--	--	--	--	--	--	--	--	--	--	--
.50.....	0	--	--	--	--	--	--	--	--	--	--	--
Total observations.....	81	31	71	103	91	0	0	0	0	0	0	0

APPENDIX III

Hugh M. Smith, Cruise 29—30-Minute Oblique Tows with Open 1-Meter Net

Station	Lat. N.	Long. W.	Date 1955	Time started (local)	Depth of tow (m.)	Water strained (m. ³)	Surface temp. (°C.)	Surface salinity (‰)	Saury	
									Eggs	Larvae
3.....	30°00'	155°00'	5/6	0756	158	1,457	19.9	35.17	--	--
5.....	31°54'	154°49'	5/7	0742	140	2,390	19.2	35.05	--	--
7.....	33°54'	154°45'	5/8	0722	140	1,674	18.3	34.77	--	--
9.....	35°52'	154°53'	5/9	0707	124	2,071	15.7	33.99	--	--
11.....	37°40'	154°53'	5/10	0748	140	1,447	14.9	34.12	--	--
13.....	38°23'	154°51'	5/11	0715	124	1,851	13.6	33.96	--	--
15.....	40°08'	155°02'	5/12	0721	120	1,844	11.9	33.74	--	1
16.....	42°20'	154°47'	5/13	0714	139	1,058	10.1	33.57	--	--
17.....	40°18'	153°12'	5/14	0813	120	1,345	12.5	33.70	--	--
18.....	34°37'	149°16'	5/16	0806	112	1,828	17.9	34.33	--	--
19.....	32°12'	147°17'	5/17	0715	124	2,037	19.1	34.84	--	--
23.....	35°36'	147°31'	5/19	0712	137	2,415	16.5	33.96	--	--
25.....	37°53'	147°00'	5/20	0710	110	2,218	15.6	33.93	--	2
27.....	39°53'	146°40'	5/21	0704	125	1,608	13.8	33.88	--	--
31.....	39°49'	145°19'	5/23	0814	116	1,803	13.9	33.73	--	--
32.....	36°29'	144°44'	5/24	0809	131	2,290	16.9	34.04	--	1
33.....	34°03'	142°09'	5/25	0800	107	2,067	17.2	34.43	--	2
34.....	37°21'	140°47'	5/26	0803	140	1,968	16.1	33.95	--	1
35.....	40°38'	139°07'	5/27	0804	138	1,702	13.9	33.35	--	--
36.....	41°48'	138°57'	5/30	0703	132	1,818	12.2	33.30	--	--
37.....	39°29'	139°02'	5/31	0712	141	1,229	13.6	33.43	--	--
39.....	37°18'	139°05'	6/1	0704	135	1,805	15.4	33.67	--	--
41.....	35°11'	138°54'	6/2	0702	151	1,944	16.2	34.04	--	--
42.....	33°01'	139°06'	6/3	0656	131	1,975	16.6	34.20	--	--
43.....	30°58'	139°08'	6/4	0655	131	1,626	17.2	34.70	--	--
44.....	28°55'	139°13'	6/5	0657	138	1,723	18.2	34.96	--	--
45.....	28°03'	141°23'	6/6	0658	135	2,254	19.2	35.25	--	--
46.....	26°53'	143°48'	6/7	0653	142	1,819	20.5	35.32	--	--
47.....	25°54'	145°47'	6/8	0658	139	2,029	21.0	35.37	--	--
48.....	25°12'	148°11'	6/9	0652	124	2,022	21.8	35.06	--	--
49.....	24°20'	150°17'	6/10	0700	145	2,149	21.9	35.03	--	--
50.....	23°28'	152°34'	6/11	0703	128	1,712	22.3	35.14	--	--
51.....	22°37'	154°47'	6/12	0655	204	922	29.2	34.59	--	--
52.....	22°07'	156°13'	6/13	0650	144	2,104	23.1	34.77	--	--

APPENDIX III—Continued

Charles H. Gilbert, Cruise 27—30-Minute Oblique Tows with 1-Meter Net

Station	Lat. N.	Long. W.	Date 1956	Time started (local)	Depth of tow (m.)	Water strained (m. ³)	Surface temp. (°C.)	Surface salinity (‰)	Saury	
									Eggs	Larvae
7.....	34°22'	179°59'	3/27	1408	142	4,092	16.8	34.74	--	1
9.....	36°16'	179°58'	3/28	1500	140	4,465	14.6	34.45	--	3
11.....	34°25'	177°40'	4/2	1230	140	4,299	16.6	34.81	--	--
13.....	33°11'	176°58'	4/3	1231	140	3,645	16.0	34.56	--	1
15.....	32°06'	176°24'	4/4	1227	140	3,495	17.6	34.78	--	--
17.....	32°00'	175°44'	4/5	1228	140	3,449	17.5	34.69	--	--
18.....	34°21'	173°34'	4/6	1231	140	--	--	--	--	--
19.....	35°39'	172°37'	4/7	1228	140	3,788	15.5	34.74	--	--
21.....	34°16'	170°46'	4/9	1236	140	3,994	16.5	34.69	--	1
23.....	33°12'	170°20'	4/10	1232	140	4,207	17.3	34.61	--	--
26.....	32°56'	167°57'	4/20	1220	140	3,713	16.5	34.72	--	--
27.....	36°00'	166°49'	4/22	1223	140	--	--	--	--	--
33.....	32°17'	163°04'	4/30	0850	140	--	--	--	--	--

John R. Manning, Cruise 32—30-Minute Oblique and Horizontal Tows with 1-Meter Net

Station	Lat. N.	Long. E.	Date 1956	Time started (local)	Depth of tow (m.)	Water strained (m. ³)	Surface temp. (°C.)	Surface salinity (‰)	Saury	
									Eggs	Larvae
9.....	40°01'	174°58'	7/24	2136	--	1,248	18.0	--	--	--
31.....	47°01'	175°00'	8/4	2206	--	--	--	--	--	--
35.....	48°59'	175°00'	8/14	2140	--	905	12.6	--	--	--
37.....	45°52'	171°51'	8/15	2137	--	1,681	14.9	--	--	--
42.....	46°28'	166°54'	8/19	2143	--	--	--	--	--	--
44.....	46°00'	160°16'	8/22	2057	--	994	12.1	32.77	--	--
48.....	46°05'	157°56'	8/25	2205	--	--	--	--	--	--
51.....	46°27'	152°15'	8/27	2203	--	1,060	12.4	--	--	--
55.....	46°32'	147°13'	8/29	2220	--	--	--	--	--	--
59.....	45°59'	145°02'	8/31	2200	--	--	--	--	--	--
61.....	44°57'	145°01'	9/1	2205	--	--	--	--	--	--
63.....	43°58'	144°58'	9/2	2140	--	--	--	--	--	--
64.....	42°22'	144°51'	9/3	2034	--	994	17.9	--	--	--
73.....	22°11'	157°25'	9/10	2210	--	2,682	25.2	--	--	--
74.....	21°36'	157°44'	9/11	0325	60	1,589	25.1	35.07	--	--
75.....	21°57'	157°44'	9/11	0720	60	1,384	25.1	35.03	--	--
76.....	22°15'	157°47'	9/11	0937	60	2,131	25.3	34.99	--	--
77.....	21°25'	158°56'	9/11	2325	60	1,485	26.1	34.78	--	--
78.....	21°25'	158°32'	9/12	0239	60	1,543	25.4	34.90	--	--
79.....	21°24'	158°18'	9/12	0504	60	--	--	--	--	--

APPENDIX III—Continued

Charles H. Gilbert, Cruise 31—30-Minute Horizontal and Oblique Tows with Open 1-Meter Net

Station	Lat. N.	Long. W.	Date 1956	Time started (local)	Depth of tow (m.)	Water strained (m. ³)	Surface temp. (° C.)	Surface salinity (‰)	Saury	
									Eggs	Larvae
1	23°25'	156°00'	10/23	1335	0-140	1,194	25.9	34.96	--	--
2	25°58'	153°43'	10/24	1340	0-140	1,481	24.9	35.16	--	--
3	28°42'	151°40'	10/25	1331	0-140	1,356	24.0	35.34	--	--
4	31°33'	149°30'	10/26	1403	0-140	1,260	22.9	35.30	--	--
5	34°16'	147°12'	10/27	1340	0-140	1,502	21.8	35.07	--	--
6	36°50'	144°51'	10/28	1400	0-140	1,781	19.7	34.40	--	--
7	37°22'	144°26'	10/28	1820	0	1,585	19.3	34.29	--	--
8	40°14'	136°15'	11/5	1808	0	1,535	16.6	33.68	--	1
9	38°56'	135°06'	11/7	1412	0-140	1,151	16.8	33.42	--	--
10	38°36'	134°42'	11/8	0838	0	1,161	16.6	33.33	--	--
12	37°48'	134°06'	11/9	0755	0	1,409	16.8	33.10	--	--
13	38°03'	133°26'	11/9	1305	0-140	1,426	16.8	33.10	--	--
14	38°31'	132°46'	11/10	0740	0	1,242	16.5	33.98	--	--
15	38°47'	131°58'	11/10	1400	0-140	1,594	16.7	33.06	--	--
16	39°07'	131°23'	11/11	0825	0	1,329	16.2	32.77	--	--
17	39°33'	130°52'	11/11	1300	0-140	1,123	15.7	32.68	--	--
18	39°59'	130°08'	11/12	0815	0	--	16.1	33.02	--	--
19	40°18'	129°39'	11/12	1300	0-140	1,309	15.9	32.77	--	--
20	37°18'	127°45'	11/15	1300	0-140	1,452	15.8	33.01	--	--
21	37°07'	127°44'	11/16	0855	0	1,338	15.9	33.03	--	--
22	36°43'	127°29'	11/16	1300	0-140	1,330	15.9	33.99	--	--
24	35°16'	124°00'	11/21	1300	0-140	1,199	12.1	33.44	--	--
25	38°00'	126°14'	11/28	1300	0-140	1,114	15.2	33.10	--	--
26	37°02'	129°32'	11/29	1300	0-140	1,357	15.6	32.86	--	--
27	35°26'	129°43'	11/30	1300	0-140	865	16.1	33.10	--	--
28	33°56'	129°39'	12/1	1300	0-140	1,067	16.4	33.24	--	--
29	33°17'	129°34'	12/2	0830	0	1,447	16.5	33.33	--	--
30	32°47'	129°35'	12/2	1300	0-140	1,229	16.6	33.33	--	--
31	32°09'	129°36'	12/3	0800	0	1,494	17.8	34.02	--	2
32	31°36'	129°47'	12/3	1300	0-140	1,474	18.2	34.02	--	--
33	30°02'	133°16'	12/4	1300	0-140	1,479	19.4	34.52	--	--
34	28°51'	137°16'	12/5	1300	0-140	1,348	20.7	35.25	--	--
35	28°10'	140°06'	12/6	1300	0-140	1,295	21.1	35.19	--	--
36	26°50'	143°40'	12/7	1300	0-140	1,541	22.1	35.37	--	--

John R. Manning, Cruise 33—30-Minute Horizontal Tow with Open 1-Meter Net

1	24°15'	156°19'	10/18	2015	0	1,556	25.2	--	--	--
2	27°09'	154°55'	10/19	2000	0	--	24.4	35.26	--	--
3	30°04'	153°15'	10/20	1955	0	1,944	23.2	35.44	--	--
4	32°56'	151°48'	10/21	2002	0	1,147	22.0	34.99	--	--
5	35°52'	150°22'	10/22	2000	0	1,604	20.6	34.85	--	--
6	38°54'	149°00'	10/23	1952	0	1,873	17.9	33.75	--	--
7	40°20'	148°07'	10/24	2025	0	1,366	17.8	33.93	--	4
8	41°02'	147°56'	10/25	2030	0	1,348	15.3	33.37	--	--
9	42°06'	147°15'	10/27	2044	0	1,782	14.4	33.26	--	--
10	42°54'	146°27'	10/28	2034	0	1,280	13.5	32.83	--	--
11	41°51'	127°52'	11/14	2001	0	1,392	13.4	32.21	--	--
12	40°52'	128°30'	11/15	2003	0	1,209	15.6	32.79	--	--
13	39°27'	129°23'	11/16	2003	0	1,585	15.9	--	--	--
14	38°42'	130°35'	11/17	2000	0	1,581	16.1	33.01	--	--
15	38°07'	133°46'	11/18	2045	0	1,989	16.3	33.30	--	1
16	37°10'	133°36'	11/19	1930	0	1,617	17.0	33.68	2	--
17	37°29'	135°08'	11/20	1940	0	--	17.1	33.77	--	--
18	39°13'	135°41'	11/21	1930	0	1,326	16.3	33.51	--	2
19	40°10'	136°04'	11/22	1930	0	1,204	15.8	33.66	--	2
20	41°05'	136°36'	11/23	1930	0	1,247	15.2	33.46	--	--
21	40°08'	140°13'	11/26	1937	0	944	16.4	33.82	--	--
22	42°11'	143°56'	11/30	2015	0	1,435	13.3	32.99	--	--

APPENDIX III—Continued

Hugh H. Smith, Cruise 40—30-Minute Horizontal Tow with Open 1-Meter Net

Station	Lat. N.	Long. W.	Date 1957	Time started (local)	Depth of tow (m.)	Water strained (m. ³)	Surface temp. (° C.)	Surface salinity (‰)	Saury	
									Eggs	Larvae
2	22°38'	156°43'	7/2	1330	0	931	24.8	--	--	
3	23°13'	156°14'	7/2	2146	0	1,058	24.8	--	--	
5	24°40'	154°47'	7/3	1339	0	1,152	24.4	--	--	
6	25°15'	154°06'	7/3	2145	0	2,009	24.3	--	--	
8	26°45'	152°35'	7/4	1319	0	1,238	23.9	35.52	--	
9	27°25'	151°50'	7/4	2132	0	1,905	24.4	35.39	--	
11	29°10'	150°32'	7/5	1317	0	1,264	23.4	35.43	--	
12	30°02'	149°55'	7/5	2124	0	2,117	23.2	--	--	
14	31°47'	148°30'	7/6	1308	0	1,042	23.1	34.97	--	
16	32°51'	147°44'	7/6	2205	0	2,182	22.8	34.83	--	
18	34°46'	146°19'	7/7	1314	0	892	24.1	34.42	--	
20	35°52'	145°33'	7/7	2204	0	2,477	21.8	34.23	--	
22	37°53'	144°00'	7/8	1313	0	1,058	19.6	33.75	--	
23	38°47'	143°20'	7/8	2203	0	2,279	18.9	33.66	--	
24	40°27'	142°06'	7/9	1300	0	1,125	17.3	33.21	--	
25	41°02'	141°30'	7/9	2152	0	2,540	16.9	33.19	--	
26	41°32'	141°00'	7/10	0152	0	1,244	15.7	32.97	--	
27	42°24'	140°06'	7/10	1301	0	1,262	15.5	32.95	--	
28	43°09'	139°25'	7/10	2154	0	2,201	15.0	32.86	--	
29	43°52'	138°44'	7/11	0322	0	1,222	14.3	32.88	--	
30	44°43'	137°52'	7/11	1256	0	1,362	14.2	32.66	--	
31	45°24'	137°12'	7/11	2209	0	1,564	13.8	32.66	--	
32	43°46'	136°24'	7/12	1433	0	773	14.8	32.77	--	
33	43°02'	136°10'	7/12	2123	0	1,670	15.2	32.77	--	
34	41°10'	135°20'	7/13	1254	0	1,241	16.8	33.22	--	
35	40°33'	134°37'	7/13	2324	0	2,205	17.1	33.26	--	
36	40°43'	133°18'	7/14	1321	0	1,022	16.8	33.04	--	
37	41°29'	132°46'	7/14	2215	0	1,224	16.5	33.01	--	
38	43°04'	131°34'	7/15	1346	0	810	16.1	32.83	--	
39	43°33'	131°09'	7/15	1934	0	1,032	15.8	32.83	--	
40	43°45'	130°59'	7/15	2215	0	2,105	15.4	32.81	--	
41	44°49'	130°02'	7/16	1110	0	1,187	14.9	32.68	--	
42	44°56'	130°00'	7/16	1323	0	939	14.9	32.68	--	
43	45°12'	129°03'	7/16	2215	0	2,067	15.6	32.38	--	
44	45°26'	128°06'	7/17	0530	0	998	15.7	31.98	--	
45	45°41'	127°04'	7/17	1315	0	1,102	16.1	31.74	--	
46	45°43'	126°48'	7/17	1512	0	1,250	16.2	32.52	--	
47	45°54'	125°58'	7/17	2215	0	1,832	16.5	31.83	--	
49	47°01'	126°18'	7/22	1328	0	1,129	16.6	31.15	--	
50	47°02'	126°35'	7/22	1619	0	926	16.6	31.40	--	
51	47°02'	126°53'	7/22	1852	0	1,129	16.6	31.65	--	
52	47°02'	127°08'	7/22	2100	0	1,965	16.1	30.81	--	
53	47°00'	127°07'	7/23	0513	0	1,181	16.1	31.38	--	
54	47°00'	127°18'	7/23	0728	0	1,264	16.1	31.38	--	
55	47°01'	127°48'	7/23	1207	0	1,265	16.2	31.71	--	
56	47°01'	127°48'	7/23	1350	0	1,015	15.4	32.38	--	
57	47°00'	129°08'	7/23	2210	0	2,172	15.1	32.18	--	
58	46°47'	130°22'	7/24	1317	0	1,115	15.1	32.50	--	
59	46°44'	130°49'	7/24	1715	0	2,393	15.1	32.54	--	
60	46°45'	131°04'	7/24	2151	0	2,584	15.5	32.48	--	
61	46°46'	130°49'	7/24	2322	0	2,684	15.0	32.48	2	
62	46°48'	132°07'	7/25	1324	0	885	14.6	32.52	1	
63	46°51'	132°46'	7/25	1722	0	778	14.4	32.54	--	
64	46°55'	133°23'	7/25	2139	0	1,937	14.3	32.54	1	
67	46°06'	130°04'	7/27	1318	0	1,312	15.3	32.57	--	
68	46°04'	129°48'	7/27	1525	0	1,290	15.7	32.61	--	
69	46°01'	128°55'	7/27	2306	0	2,460	15.8	32.52	--	
70	45°58'	127°29'	7/28	1316	0	1,247	16.4	32.43	--	
71	45°15'	126°52'	7/28	2150	0	2,353	17.3	31.71	--	
72	44°20'	125°54'	7/29	1347	0	1,002	18.0	30.28	--	
73	44°00'	125°07'	7/29	2133	0	2,562	16.0	30.62	--	
74	43°18'	126°00'	7/30	1319	0	1,375	16.9	31.94	--	
75	42°56'	126°59'	7/30	2236	0	1,592	17.8	32.07	--	
76	42°47'	127°15'	7/31	0617	0	1,180	17.6	32.28	--	
77	42°36'	127°53'	7/31	1126	0	1,385	17.5	32.14	--	
81	41°32'	131°05'	8/1	2205	0	--	--	--	--	
82	41°26'	129°26'	8/2	1318	0	1,131	17.4	32.93	--	
83	41°23'	129°02'	8/2	1623	0	1,286	17.7	32.84	--	
84	41°18'	128°25'	8/2	2141	0	1,462	17.1	32.86	--	
85	41°04'	126°56'	8/3	1432	0	1,044	15.3	32.60	--	
87	40°58'	126°01'	8/3	2142	0	1,233	15.7	32.12	--	
88	40°48'	125°00'	8/4	1050	0	718	12.3	33.04	--	
89	40°40'	125°19'	8/4	1317	0	664	12.6	32.90	--	
90	40°36'	125°30'	8/4	1456	0	979	13.5	32.84	--	
91	40°34'	125°36'	8/4	1603	0	948	15.8	34.07	--	
92	40°26'	126°16'	8/4	2117	0	1,105	15.4	32.64	--	
94	40°12'	127°23'	8/5	1313	0	1,053	16.9	32.68	--	
95	40°04'	128°20'	8/5	2134	0	997	17.1	32.74	--	
97	39°45'	129°29'	8/6	1320	0	1,126	17.5	32.87	--	
98	39°32'	130°42'	8/6	2132	0	1,090	18.0	32.98	--	
100	39°17'	129°45'	8/7	1321	0	1,224	17.8	33.00	--	

APPENDIX III—Continued

Hugh M. Smith, Cruise 40—30-Minute Horizontal Tow with Open 1-Meter Net—Continued

Station	Lat. N.	Long. W.	Date 1957	Time started (local)	Depth of tow (m.)	Water strained (m. ³)	Surface temp. (° C.)	Surface salinity (‰)	Saury	
									Eggs	Larvae
101	39°08'	128°40'	8/7	2130	0	1,310	17.7	32.92	--	--
102	39°02'	128°21'	8/8	0538	0	1,234	17.5	32.95	--	--
103	38°59'	127°56'	8/8	0946	0	1,186	17.6	32.96	--	--
104	39°00'	127°33'	8/8	1543	0	1,369	17.8	32.99	--	--
105	39°02'	127°01'	8/8	2208	0	1,258	16.2	32.86	--	--
106	39°10'	125°37'	8/9	1342	0	1,179	17.2	32.88	--	--
107	39°09'	125°26'	8/9	1508	0	--	17.1	32.89	--	--
108	39°00'	124°35'	8/9	2013	0	1,328	14.4	32.81	--	--
109	38°57'	124°24'	8/9	2123	0	762	13.4	33.17	20	--
111	38°43'	124°46'	8/10	0850	0	996	14.2	33.38	--	--
112	38°37'	125°01'	8/10	1126	0	785	14.2	33.30	--	--
113	38°31'	125°31'	8/10	1646	0	940	17.0	32.85	--	--
114	38°26'	126°00'	8/10	1928	0	952	17.1	32.86	--	--
116	38°10'	127°26'	8/11	0949	0	1,326	17.7	32.95	--	--
117	38°02'	127°51'	8/11	1400	0	1,232	17.7	33.04	--	--
118	37°53'	128°34'	8/11	1954	0	1,447	17.7	32.94	--	--
119	37°28'	130°12'	8/12	0614	0	1,402	18.5	33.06	--	--
120	37°19'	129°20'	8/12	1315	0	1,202	18.7	33.19	--	--
121	37°16'	129°08'	8/12	1524	0	1,191	17.9	33.10	--	--
122	37°11'	128°46'	8/12	1807	0	1,035	17.9	33.04	--	--
123	37°09'	128°34'	8/12	2112	0	1,128	17.9	33.10	--	--
124	37°02'	128°13'	8/13	0722	0	1,024	17.9	33.03	--	--
125	37°01'	127°30'	8/13	1310	0	1,342	17.5	32.95	--	--
127	37°00'	125°26'	8/14	1316	0	1,145	17.3	32.94	--	--
128	37°06'	125°04'	8/14	1725	0	1,247	16.3	32.97	--	--
130	37°26'	123°52'	8/15	0212	0	--	14.1	33.58	7	--
132	36°43'	122°24'	8/26	2146	0	1,277	15.2	33.40	--	--
134	35°14'	123°13'	8/27	1313	0	1,070	15.6	33.55	4	--
135	34°29'	124°17'	8/27	2132	0	894	17.2	33.31	--	--
137	33°36'	126°30'	8/28	1315	0	1,111	18.9	33.37	--	--
138	33°08'	127°47'	8/28	2010	0	2,266	19.1	33.22	--	--
140	32°10'	130°28'	8/29	1304	0	1,232	21.1	34.04	--	--
141	31°43'	131°44'	8/29	2059	0	2,458	21.7	34.09	--	--
143	30°44'	134°20'	8/30	1310	0	1,210	21.4	34.31	--	--
144	30°14'	135°33'	8/30	2100	0	1,975	21.9	34.25	--	--
146	29°12'	138°23'	8/31	1306	0	1,007	23.1	35.35	--	--
147	28°44'	139°36'	8/31	2055	0	2,147	22.9	35.42	--	--
149	27°43'	142°13'	9/1	1311	0	1,137	23.6	35.41	--	--
150	27°16'	143°27'	9/1	2058	0	2,255	23.4	35.32	--	--
152	26°09'	146°01'	9/2	1305	0	1,138	24.1	35.26	--	--
153	25°41'	147°10'	9/2	2054	0	2,232	23.5	35.30	--	--
155	24°38'	149°40'	9/3	1306	0	983	24.1	35.39	--	--
156	24°07'	150°51'	9/3	2056	0	2,002	24.5	35.25	--	--
158	23°04'	153°24'	9/4	1308	0	904	24.9	35.19	--	--
159	22°32'	154°39'	9/4	2056	0	2,051	24.8	35.17	--	--

Hugh M. Smith, Cruise 46—30-Minute Horizontal and Oblique Tows with 1-Meter Net

Station	Lat. N.	Long. W.	Date 1958	Time started (local)	Depth of tow (m.)	Water strained (m. ³)	Surface temp. (°C.)	Surface salinity (‰)	Saury	
									Eggs	Larvae
4	23°56'	158°28'	7/22	2127	142	1,623	25.4	--	--	--
4	23°56'	158°28'	7/22	2201	0	1,106	25.4	--	--	--
7	27°08'	158°38'	7/23	2150	130	1,951	23.9	--	--	--
10	30°36'	158°56'	7/24	2119	137	1,940	--	--	--	--
10	30°36'	158°56'	7/24	2201	0	1,229	24.2	--	--	--
13	34°03'	158°54'	7/25	2104	144	1,400	--	--	--	--
16	37°25'	159°09'	7/26	2145	141	1,847	--	--	--	--
16	37°25'	159°09'	7/26	2220	0	1,134	--	--	--	--
19	39°41'	159°24'	7/27	2158	140	1,892	14.8	--	--	--
19	39°41'	159°24'	7/27	2240	0	1,129	14.8	--	1	--
22	40°49'	159°38'	7/28	2145	150	1,327	17.5	--	--	--
22	40°49'	159°38'	7/28	2220	0	1,553	17.5	--	--	--
26	41°20'	159°56'	7/29	2141	109	2,403	16.3	--	--	--
26	41°20'	159°56'	7/29	2222	0	903	16.3	--	--	--
29	41°46'	159°24'	7/30	2051	142	1,708	14.8	--	--	--
29	41°46'	159°24'	7/30	2127	0	1,176	14.8	--	--	--
33	41°09'	158°24'	7/31	2040	123	1,598	16.3	--	1	--
33	41°09'	158°24'	7/31	2113	0	1,421	16.3	--	1	--
37	42°19'	158°22'	8/1	2045	140	1,345	--	--	--	--
37	42°19'	158°22'	8/1	2118	0	1,065	--	--	--	--
40	43°10'	158°47'	8/2	2052	140	1,746	13.7	--	--	--
40	43°10'	158°47'	8/2	2136	0	1,197	13.7	--	--	--
43	45°02'	159°23'	8/4	2120	143	1,770	--	--	--	--

APPENDIX III—Continued

Hugh M. Smith, Cruise 46—30-Minute Horizontal and Oblique Tows with 1-Meter Net—Continued

Station	Lat. N.	Long. W.	Date 1958	Time started (local)	Depth of tow (m.)	Water strained (m. ³)	Surface temp. (°C.)	Surface salinity (‰)	Saury	
									Eggs	Larvae
43	45°02'	159°23'	8/4	2155	0	1,089	--	--	--	--
46	48°06'	159°42'	8/5	2330	141	1,671	9.7	--	--	--
46	48°06'	159°42'	8/6	0006	0	1,158	9.7	--	--	--
48	50°56'	159°49'	8/6	2128	142	1,840	--	--	--	--
48	50°56'	159°49'	8/6	2207	0	1,382	--	--	--	--
50	54°00'	159°56'	8/7	2043	140	1,039	--	--	--	--
50	54°00'	159°56'	8/7	2112	0	1,121	--	--	--	--
53	48°03'	174°45'	8/12	0113	140	1,005	10.9	--	--	--
53	48°03'	174°45'	8/12	0144	0	893	10.9	--	--	--
56	46°12'	174°56'	8/12	2139	137	--	--	--	--	--
56	46°12'	174°56'	8/12	2220	0	1,572	--	--	--	--
60	45°12'	174°53'	8/13	2124	114	911	--	--	--	--
63	43°29'	174°48'	8/15	1926	145	1,098	--	--	--	--
63	43°29'	174°48'	8/15	2050	0	--	--	--	--	--
64	43°22'	174°43'	8/16	1835	142	1,644	14.9	--	--	--
67	42°48'	175°08'	8/17	1900	142	1,731	16.1	--	--	--
68	42°46'	175°08'	8/18	1920	0	--	--	--	--	--
69	41°35'	175°08'	8/19	2108	0	--	16.4	--	--	--
69	41°35'	175°08'	8/19	2143	143	1,078	16.4	--	--	--
71	41°35'	175°02'	8/22	1220	0	--	--	--	--	--
75	41°33'	175°01'	8/22	1839	137	2,267	16.5	--	--	--
79	40°29'	175°11'	8/23	1826	143	1,216	17.8	--	--	--
79	40°29'	175°11'	8/23	1852	0	1,385	17.8	--	--	--
85	39°50'	170°52'	8/25	2208	112	1,430	18.7	--	--	--
85	39°50'	170°52'	8/25	2242	0	1,775	18.7	--	--	--
88	40°15'	170°16'	8/26	1825	141	1,591	--	--	--	--
88	40°15'	170°16'	8/26	2159	0	1,257	--	--	--	--
90	42°21'	170°12'	8/28	2135	140	1,484	--	--	--	--
90	42°21'	170°12'	8/28	2210	0	1,265	--	--	--	--
91	42°50'	169°57'	8/29	2236	156	1,495	--	--	--	--
91	42°50'	169°57'	8/29	2314	0	1,569	--	--	--	--
94	43°57'	169°30'	8/30	1809	173	1,441	--	--	--	--
94	43°57'	169°30'	8/30	1841	0	1,314	--	--	--	--
96	45°46'	168°46'	8/31	1918	141	1,613	12.6	--	--	--
96	45°46'	168°46'	8/31	2023	0	1,308	12.6	--	--	--
98	46°34'	164°44'	9/1	1759	140	914	--	--	--	--

Hugh M. Smith, Cruise 52—30-Minute Horizontal Tows with 1-Meter Net

Station	Lat. N.	Long. E.	Date 1959	Time started (local)	Depth of tow (m.)	Water strained (m. ³)	Surface temp. (°C.)	Surface salinity (‰)	Saury	
									Eggs	Larvae
2	23°51'	154°40'	4/29	2015	--	1,252	22.8	35.00	--	--
4	26°12'	151°48'	4/30	2005	--	1,380	22.3	34.97	--	--
6	28°40'	148°48'	5/1	2005	--	1,393	20.0	35.11	--	--
8	31°06'	145°41'	5/2	2037	--	1,500	18.3	34.61	--	--
10	33°16'	142°50'	5/3	2032	--	1,579	17.1	34.12	--	--
14	35°53'	139°14'	5/5	2030	--	1,535	16.0	33.75	13	--
16	37°12'	137°31'	5/6	2030	--	1,594	16.1	33.57	5	--
20	37°47'	133°46'	5/8	2030	--	1,478	14.6	33.16	5	--
23	35°38'	131°05'	5/10	2005	--	1,506	15.4	33.22	--	--
25	33°45'	128°45'	5/11	2031	--	1,478	15.7	33.20	--	--
27	32°04'	127°24'	5/17	2030	--	1,607	16.4	33.40	5	--
29	30°48'	124°52'	5/18	2030	--	1,111	16.6	33.59	--	--
31	28°28'	123°04'	5/21	2027	--	1,671	17.6	33.96	--	--
39	27°33'	118°23'	5/25	2000	--	1,405	17.8	33.81	--	--
41	30°56'	117°47'	5/26	2000	--	1,342	16.1	33.60	--	--
48	32°07'	121°19'	6/1	2031	--	1,157	15.7	33.40	--	--
50	31°08'	124°22'	6/2	2032	--	1,274	16.5	33.60	--	--
52	31°28'	124°56'	6/3	2030	--	1,422	16.3	--	5	--
56	30°12'	122°08'	6/5	2030	--	1,227	16.8	33.56	13	--
58	29°51'	120°27'	6/6	2030	--	1,264	16.3	33.47	--	--
61	29°10'	117°53'	6/8	2030	--	1,019	17.9	33.85	--	--
67	28°37'	118°07'	6/11	2003	--	1,533	18.1	33.87	--	--
69	28°04'	120°08'	6/12	2028	--	1,548	18.8	34.10	1	--
73	28°24'	121°39'	6/14	2030	--	1,302	18.0	34.09	--	--
75	29°55'	120°20'	6/15	2035	--	1,161	16.7	33.55	--	--
78	31°21'	119°14'	6/17	2030	--	1,098	16.3	33.82	22	--