

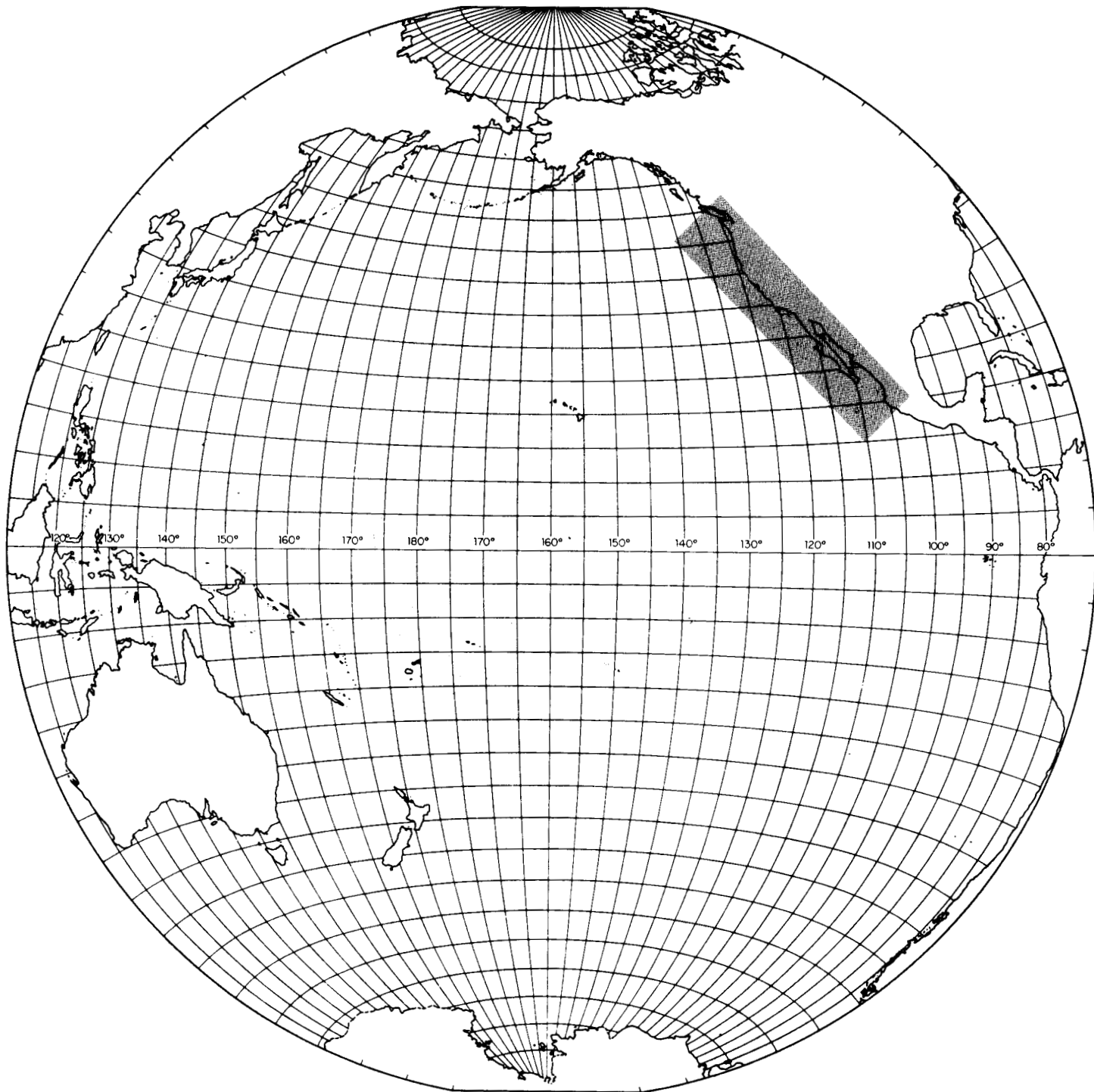
Atlas 12: Kramer, D. Distributional atlas of fish eggs and larvae in the California Current region: Pacific sardine, *Sardinops caerulea* (Girard), 1951-1966. Published June 1970.

23 May 2007

References to the data, published in annual ichthyoplankton data reports are given in the introduction to the Atlas. In addition, these data are available in PDF format on the SWFSC web site at <http://swfsc.noaa.gov/publications/swcpub/qryPublications.asp>, enter "ichthyoplankton" in the Subject line and "California Cooperative Oceanic Fisheries Investigations" in the Title line. Checking the ALL YEARS button will produce the entire list of available data.

The report for each year usually is published about 7-9 months after the fall cruise, and includes notes about nomenclature changes, etc. The ultimate goal is to update the old ichthyoplankton identifications to current standards; the database is updated as re-identifications for each cruise are completed.

STATE OF CALIFORNIA  
MARINE RESEARCH COMMITTEE

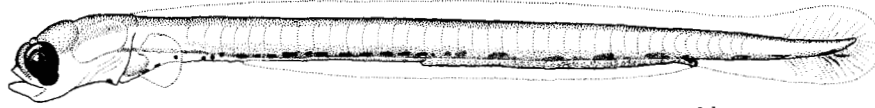


# **CALIFORNIA COOPERATIVE OCEANIC FISHERIES INVESTIGATIONS**

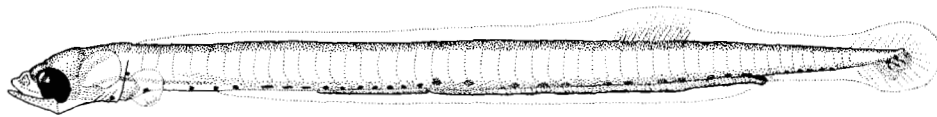
ATLAS No. 12



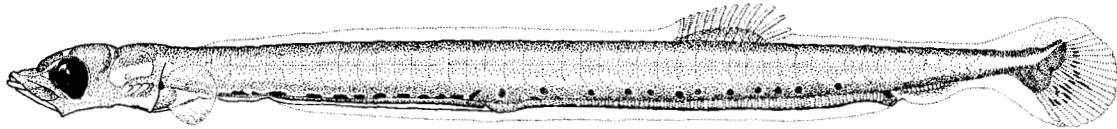
3.0 mm.



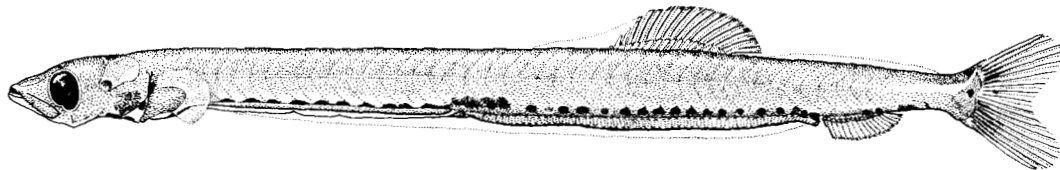
6.1 mm.



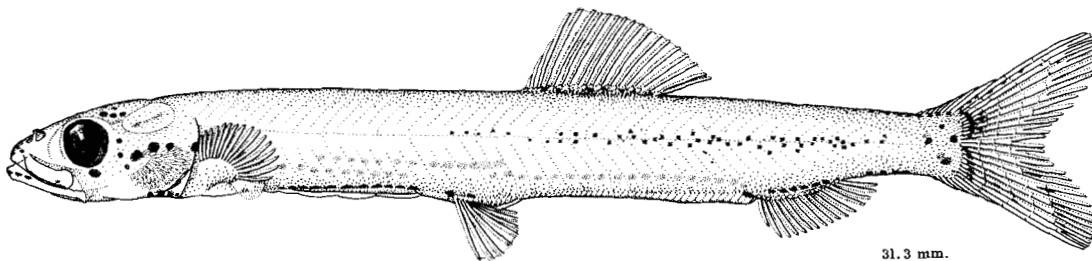
9.1 mm.



14.0 mm.



19.7 mm.



31.3 mm.

Pacific Sardine  
*Sardinops caerulea*

CALIFORNIA  
COOPERATIVE  
OCEANIC  
FISHERIES  
INVESTIGATIONS

*Atlas No. 12*

STATE OF CALIFORNIA  
MARINE RESEARCH COMMITTEE

*Cooperating Agencies:*

CALIFORNIA ACADEMY OF SCIENCES  
CALIFORNIA DEPARTMENT OF FISH AND GAME  
STANFORD UNIVERSITY, HOPKINS MARINE STATION  
U. S. FISH AND WILDLIFE SERVICE, BUREAU OF COMMERCIAL FISHERIES  
UNIVERSITY OF CALIFORNIA, SCRIPPS INSTITUTION OF OCEANOGRAPHY

June, 1970

THE CALCOFI ATLAS SERIES

This is the twelfth in a series of atlases containing data on the hydrography and plankton from the region of the California Current. The field work was carried out by the California Cooperative Oceanic Fisheries Investigations,<sup>1</sup> a program sponsored by the State of California under the direction of the State's Marine Research Committee. The cooperating agencies in the program are:

California Academy of Sciences  
California Department of Fish and Game  
Stanford University, Hopkins Marine Station  
U. S. Fish and Wildlife Service, Bureau of Commercial Fisheries  
University of California, Scripps Institution of Oceanography

CalCOFI atlases<sup>2</sup> are issued as individual units as they become available. They provide processed physical, chemical and biological measurements of the California Current region. Each number may contain one or more contributions. A general description of the CalCOFI program with its objectives appears in the preface of Atlas No. 2.

This atlas was prepared by the Data Collection and Processing Group of the Marine Life Research Program, Scripps Institution of Oceanography.

CalCOFI Atlas Editorial Staff:

Abraham Fleminger and Hans T. Klein, Editors  
John G. Wyllie, Cartographer

Atlases in this series, through June 1969, are:

- CalCOFI Atlas No. 1  
Anonymous      CalCOFI atlas of 10-meter temperatures and salinities 1949 through 1959.
- CalCOFI Atlas No. 2  
Fleminger, A.      Distributional atlas of calanoid copepods in the California Current region, Part I.
- CalCOFI Atlas No. 3  
Alvarifio, A.      Distributional atlas of Chaetognatha in the California Current region.
- CalCOFI Atlas No. 4  
Wyllie, J. G.      Geostrophic flow of the California Current at the surface and at 200 meters.
- CalCOFI Atlas No. 5  
Brinton, E.      Distributional atlas of Euphausiacea (Crustacea) in the California Current region, Part I.
- CalCOFI Atlas No. 6  
McGowan, J. A.      Distributional atlas of pelagic molluscs in the California Current region.
- CalCOFI Atlas No. 7  
Fleminger, A.      Distributional atlas of calanoid copepods in the California Current region, Part II.
- CalCOFI Atlas No. 8  
Bernier, L.      Distributional atlas of Thaliacea in the California Current region.
- CalCOFI Atlas No. 9  
Kramer, D., and E. H. Ahlstrom.      Distributional atlas of fish larvae in the California Current region: Northern Anchovy, Engraulis mordax Girard, 1951 through 1965.
- CalCOFI Atlas No. 10  
Isaacs, J. D., A. Fleminger and J. K. Miller.      Distributional atlas of zooplankton biomass in the California Current region: Spring and Fall 1955 - 1959.
- CalCOFI Atlas No. 11  
Ahlstrom, Elbert H.      Distributional atlas of fish larvae in the California Current region: jack mackerel, Trachurus symmetricus, and Pacific hake, Merluccius productus, 1951 through 1966.
- CalCOFI Atlas No. 12  
Kramer, David      Distributional atlas of fish eggs and larvae in the California Current region: Pacific sardine, Sardinops caerulea (Girard), 1951 through 1966.

<sup>1</sup> Usually abbreviated CalCOFI, sometimes CALCOFI or CCOFI.

<sup>2</sup> For citation this issue in the series should be referred to as CalCOFI Atlas No. 12.

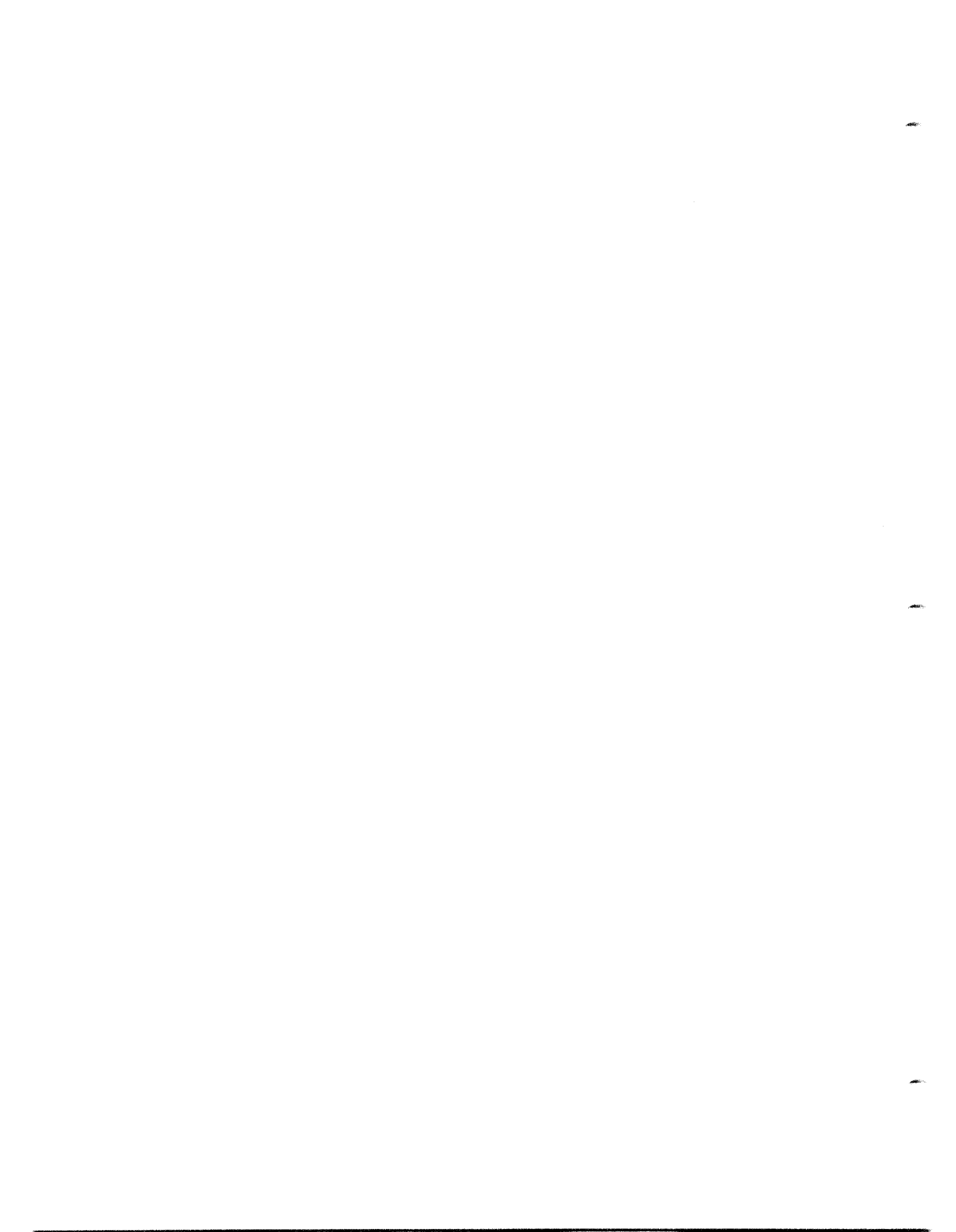
DISTRIBUTIONAL ATLAS OF FISH EGGS AND LARVAE IN THE CALIFORNIA  
CURRENT REGION: PACIFIC SARDINE, SARDINOPS CAERULEA (GIRARD),  
1951 THROUGH 1966

David Kramer

CALCOFI ATLAS NO. 12

Data Collection and Processing Group  
Marine Life Research Program  
Scripps Institution of Oceanography  
La Jolla, California

June 1970



DISTRIBUTIONAL ATLAS OF FISH EGGS AND LARVAE IN THE CALIFORNIA

CURRENT REGION: PACIFIC SARDINE, SARDINOPS CAERULEA (GIRARD),

1951 THROUGH 1966

David Kramer<sup>1</sup>

This atlas illustrates the distribution and relative abundance of the eggs and larvae of the Pacific sardine, Sardinops caerulea (Girard), off the coasts of California and Baja California in the region of the California Current during the years 1951 through 1966. The data were collected by the California Cooperative Oceanic Fisheries Investigations on surveys covering selected portions of the pattern shown in Chart 1. The surveys were conducted monthly in 1951 through 1960 and again in 1966, and quarterly in 1961 through 1965. Sampling methods and collecting apparatus have been described in detail by Fleminger (1964) and Ahlstrom (1966). In brief, each sample was collected by lowering a plankton net of 0.55 mm silk mesh, and a mouth opening one meter in diameter, to a depth of about 140 meters (200 meters of wire out, depth permitting) and retrieving it at 20 meters per minute, while maintaining a wire angle of 45 degrees and a ship speed of about two knots. In shallow water, samples were taken to within 15 meters of the bottom. Data on vertical distribution (Ahlstrom, 1959a) indicate that this standard net tow samples the entire stratum occupied by sardine eggs and larvae.

Samples were sorted in the laboratory for all fish eggs and larvae. Very large samples were fractionated with the Folsom Plankton Sample Splitter (McEwen, Johnson and Folsom, 1954).

Estimates of abundance of fish eggs and larvae were made comparable between samples by standardizing the values to a unit of 10 square meters of sea surface. Details of this standardizing procedure were described by Kramer and Ahlstrom (1968). The abundance of other planktonic organisms dealt with in previous CalCOFI atlases has been standardized by estimating the number in 1000 cubic meters of water strained.

Standardized data for sardine eggs and larvae from CalCOFI cruises of 1951 through 1957 and for larvae in the years 1958 through 1962 have been issued previously elsewhere (Ahlstrom, 1953, 1954, 1958, 1959b, 1966; Ahlstrom and Kramer, 1955, 1956, 1957). Standardized data for eggs from 1958 through 1966 and for larvae from 1963 through 1966 have not yet been published.

---

<sup>1</sup>Fishery-Oceanography Center, Bureau of Commercial Fisheries, La Jolla, California.



No charts are presented for those cruises in which both eggs and larvae were absent. These cruises are indicated in the pagination tables by the term "no occurrences." Tables 1 and 2 give the pagination of egg and larvae charts, respectively.

#### REFERENCES CITED

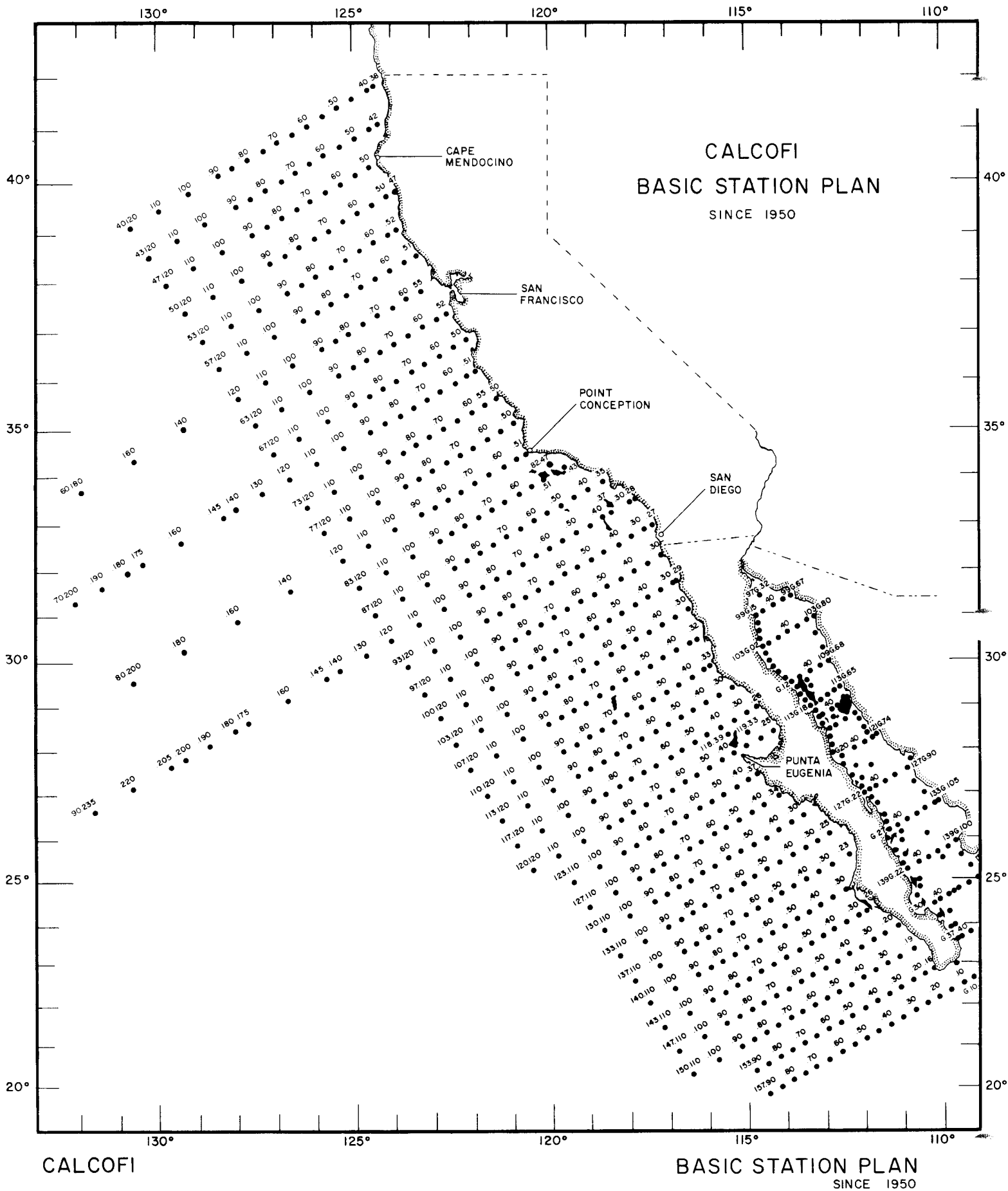
- Ahlstrom, E. H., 1953. Pilchard eggs and larvae and other fish larvae, Pacific coast, 1951. U. S. Fish Wildl. Serv., Spec. Sci. Rep., Fish. No. 102: 55 pp.
- \_\_\_\_\_, 1954. Pacific sardine (pilchard) eggs and larvae and other fish larvae, Pacific coast--1952. U. S. Fish Wildl. Serv., Spec. Sci. Rep., Fish. No. 123: 76 pp.
- \_\_\_\_\_, 1958. Sardine eggs and larvae and other fish larvae, Pacific coast, 1956. U. S. Fish Wildl. Serv., Spec. Sci. Rep., Fish. No. 251: 84 pp.
- \_\_\_\_\_, 1959a. Vertical distribution of pelagic fish eggs and larvae off California and Baja California. U. S. Fish Wildl. Serv., Fish. Bull. 60(161): 107-146.
- \_\_\_\_\_, 1959b. Sardine eggs and larvae and other fish larvae, Pacific coast, 1957. U. S. Fish Wildl. Serv., Spec. Sci. Rep., Fish. No. 328: 99 pp.
- \_\_\_\_\_, 1966. Distribution and abundance of sardine and anchovy larvae in the California Current region off California and Baja California, 1951-64: A summary. U. S. Fish Wildl. Serv., Spec. Sci. Rep., Fish. No. 534: 71 pp.
- Ahlstrom, E. H., and D. Kramer, 1955. Pacific sardine (pilchard) eggs and larvae and other fish larvae, Pacific coast, 1953. U. S. Fish Wildl. Serv., Spec. Sci. Rep., Fish. No. 155: 74 pp.
- \_\_\_\_\_, 1956. Sardine eggs and larvae and other fish larvae, Pacific coast, 1954. U. S. Fish Wildl. Serv., Spec. Sci. Rep., Fish. No. 186: 79 pp.
- \_\_\_\_\_, 1957. Sardine eggs and larvae and other fish larvae, Pacific coast, 1955. U. S. Fish Wildl. Serv., Spec. Sci. Rep., Fish. No. 224: 99 pp.
- Fleminger, A., 1964. Distributional atlas of calanoid copepods in the California Current region, Part I. CalCOFI Atlas No. 2: ix-xvi, 1-313.
- Kramer, D., and E. H. Ahlstrom, 1968. Distributional atlas of fish larvae in the California Current region: northern anchovy, *Engraulis mordax* Girard, 1951 through 1965. CalCOFI Atlas No. 9: vii-xi, 1-269.
- McEwen, G. F., M. W. Johnson and T. R. Folsom, 1954. A statistical analysis of the performance of the Folsom Plankton Sample Splitter, based on test observations. Arch. f. Meteor., Geophys. Bioklim., Ser. A: Meteor. and Geophys., Bd. 7: 502-527.

Table 1. Pagination of charts showing the distributions of sardine eggs.  
(O) No occurrences. (-) No cruise. (\*) Distribution for early  
and late March cruises are shown on the same chart.

	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66
Jan. 01	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32
Feb. 02	34	36	38	40	42	44	46	48	50	52	-	-	-	-	-	54
Mar. 03	56	58*	60*	62	64	66	68	70	72	74	-	-	-	-	-	-
Apr. 04	76	78	80	82	84	86	88	90	92	94	96	98	100	102	104	106
May 05	108	110	112	114	116	118	120	122	124	126	-	-	-	-	-	128
June 06	130	132	134	136	138	140	142	144	146	148	-	-	-	-	-	150
July 07	152	154	156	158	160	162	164	166	168	170	172	174	176	178	180	182
Aug. 08	184	186	188	190	O	192	194	196	198	200	-	-	-	-	-	202
Sept. 09	204	206	208	O	O	210	212	214	216	218	-	-	-	-	220	222
Oct. 10	224	226	228	230	232	234	236	238	240	242	244	246	248	250	-	252
Nov. 11	254	256	O	O	O	O	258	O	260	-	-	-	-	-	-	262
Dec. 12	264	-	266	268	270	O	O	272	274	-	-	-	-	-	-	276

Table 2. Pagination of charts showing the distributions of sardine larvae.  
(O) No occurrences. (-) No cruise. (\*) Distribution for early  
and late March cruises are shown on the same chart.

	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66
Jan. 01	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33
Feb. 02	35	37	39	41	43	45	47	49	51	53	-	-	-	-	-	55
Mar. 03	57	59*	61*	63	65	67	69	71	73	75	-	-	-	-	-	-
Apr. 04	77	79	81	83	85	87	89	91	93	95	97	99	101	103	105	107
May 05	109	111	113	115	117	119	121	123	125	127	-	-	-	-	-	129
June 06	131	133	135	137	139	141	143	145	147	149	-	-	-	-	-	151
July 07	153	155	157	159	161	163	165	167	169	171	173	175	177	179	181	183
Aug. 08	185	187	189	191	O	193	195	197	199	201	-	-	-	-	-	203
Sept. 09	205	207	209	O	O	211	213	215	217	219	-	-	-	-	221	223
Oct. 10	225	227	229	231	233	235	237	239	241	243	245	247	249	251	-	253
Nov. 11	255	257	O	O	O	O	259	O	261	-	-	-	-	-	-	263
Dec. 12	265	-	267	269	271	O	O	273	275	-	-	-	-	-	-	277



JANUARY



FEBRUARY



MARCH



APRIL



MAY



JUNE



JULY



AUGUST



SEPTEMBER



OCTOBER

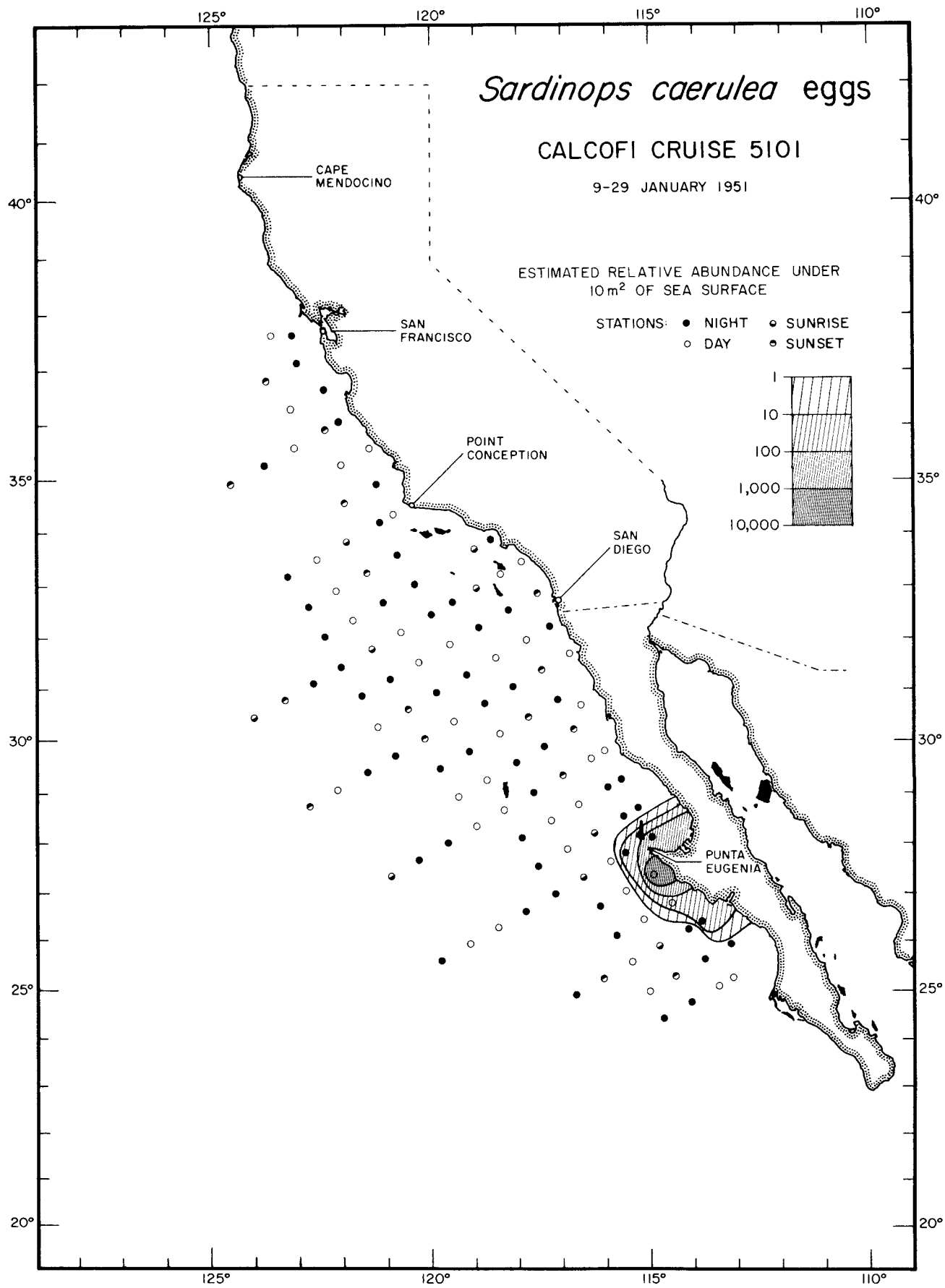


NOVEMBER



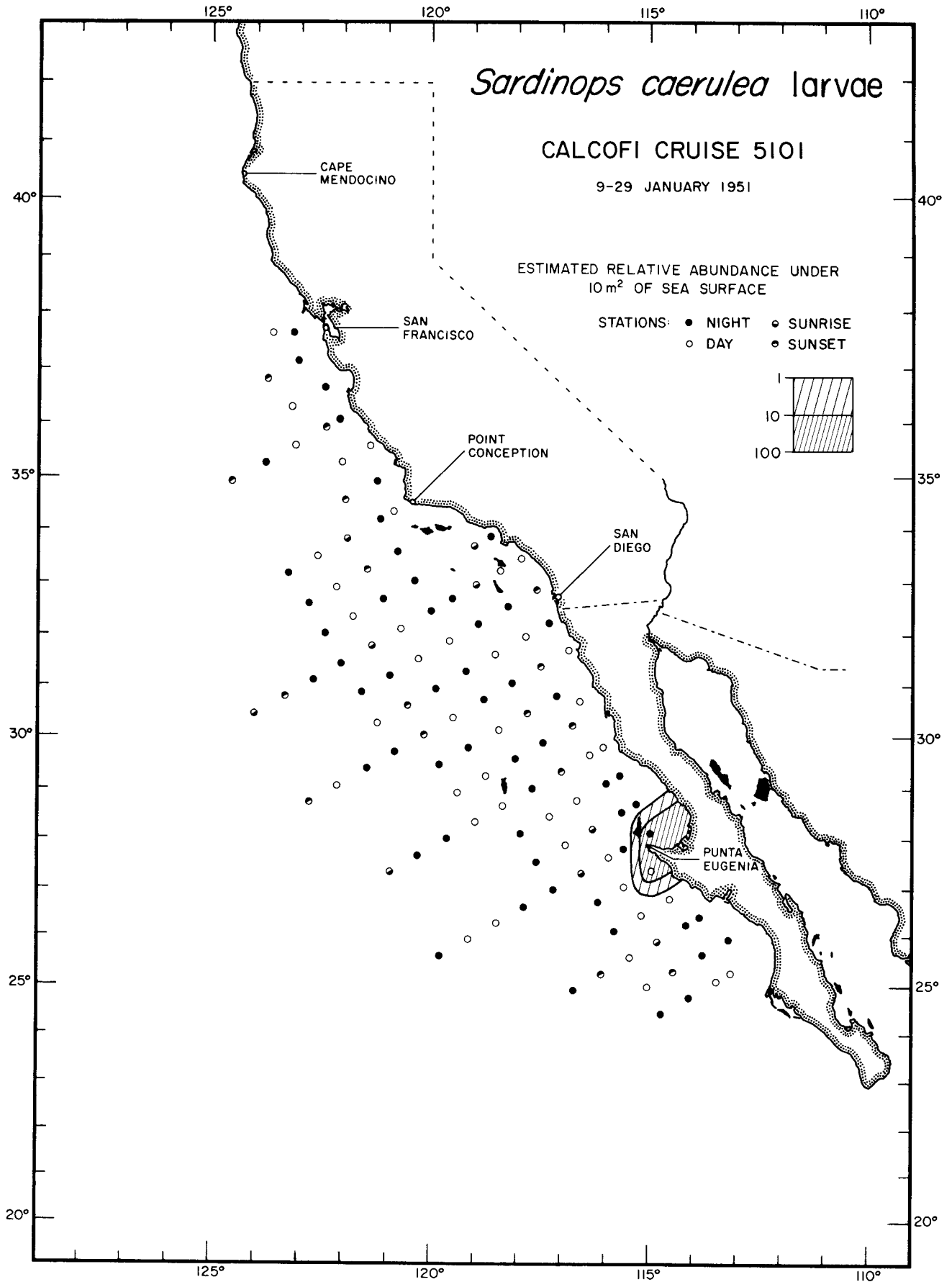
DECEMBER





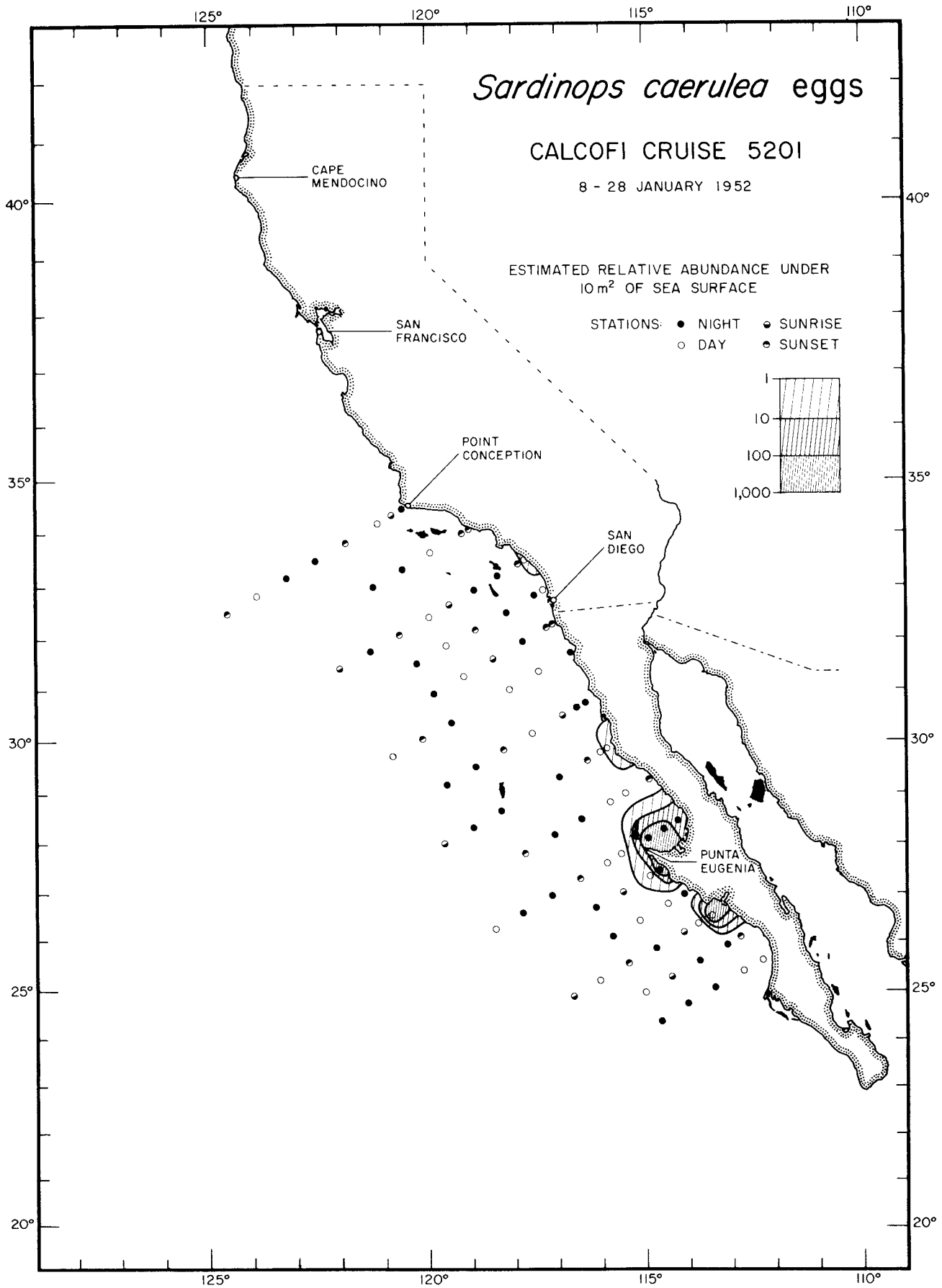
*Sardinops caerulea* eggs

5101



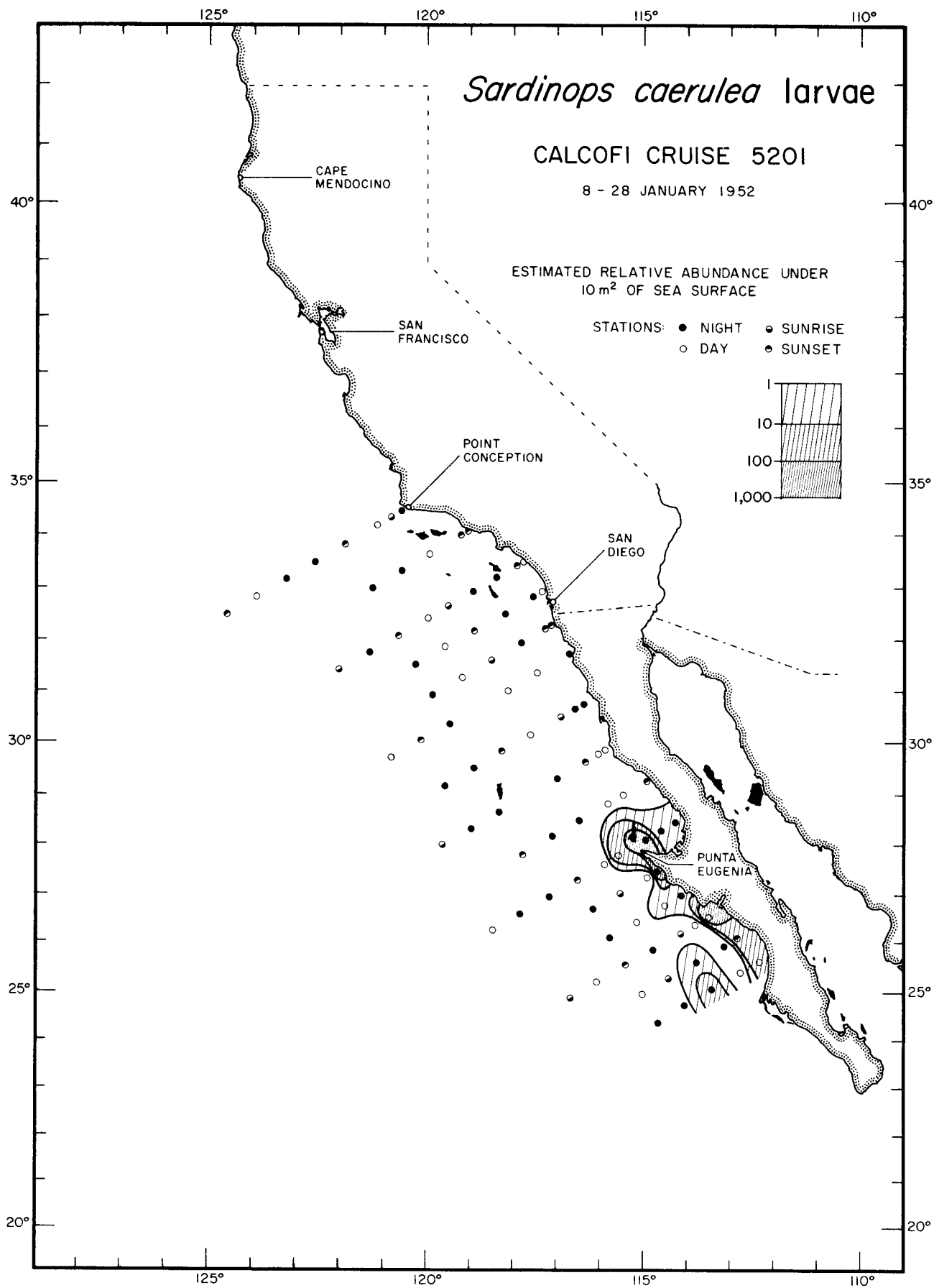
*Sardinops caerulea* larvae

5101



*Sardinops caerulea* eggs

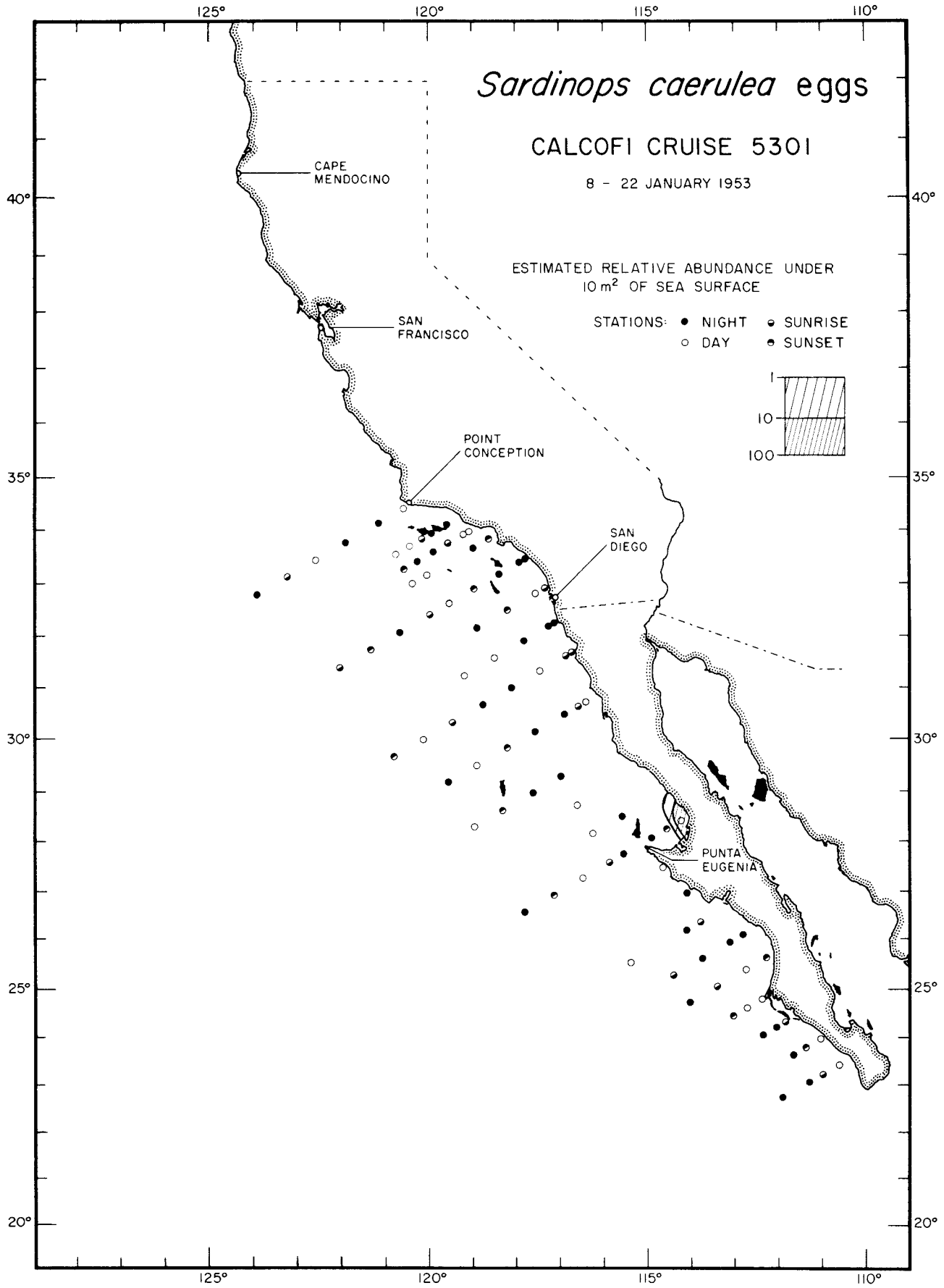
5201



*Sardinops caerulea* larvae

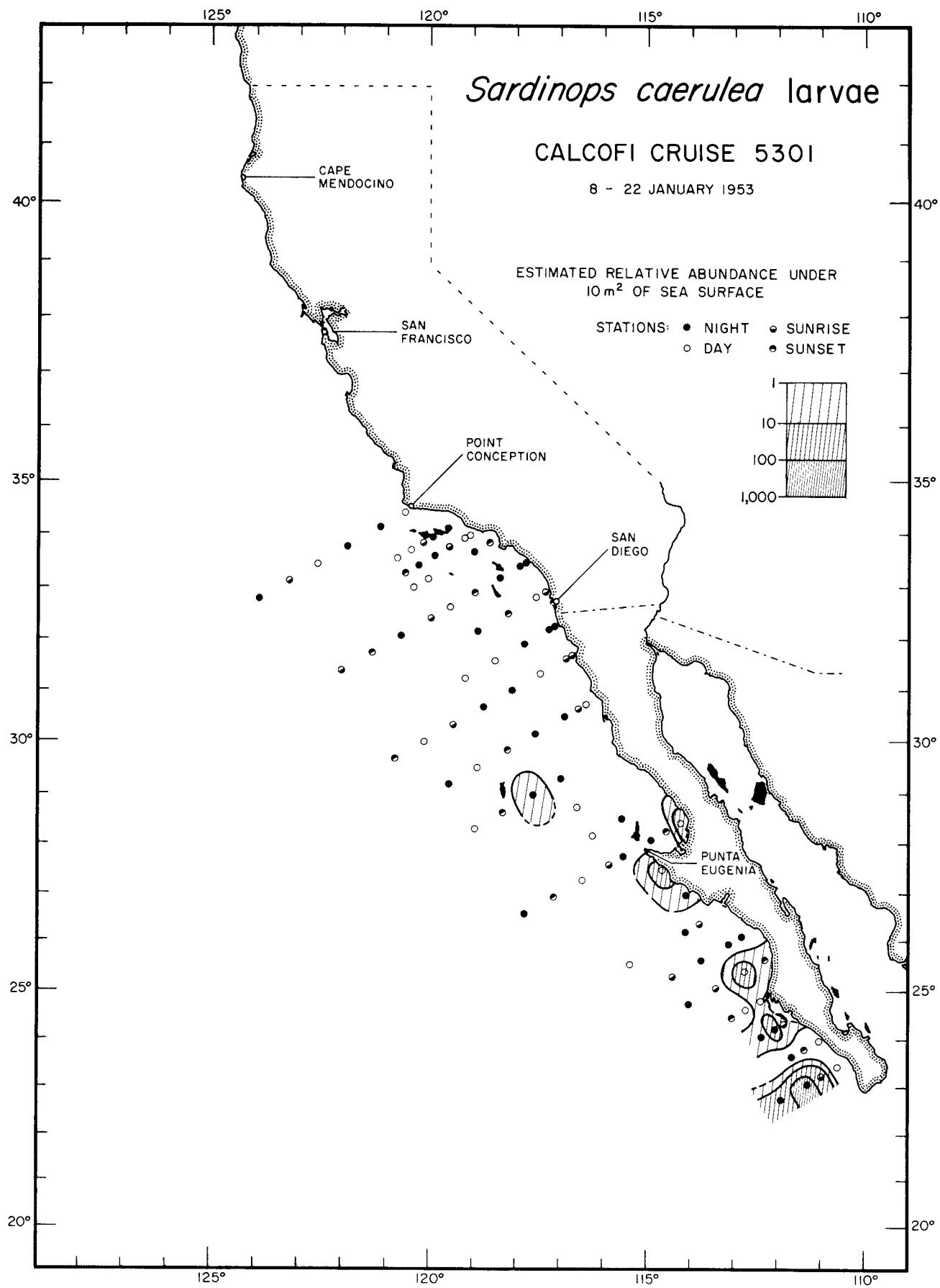
5201





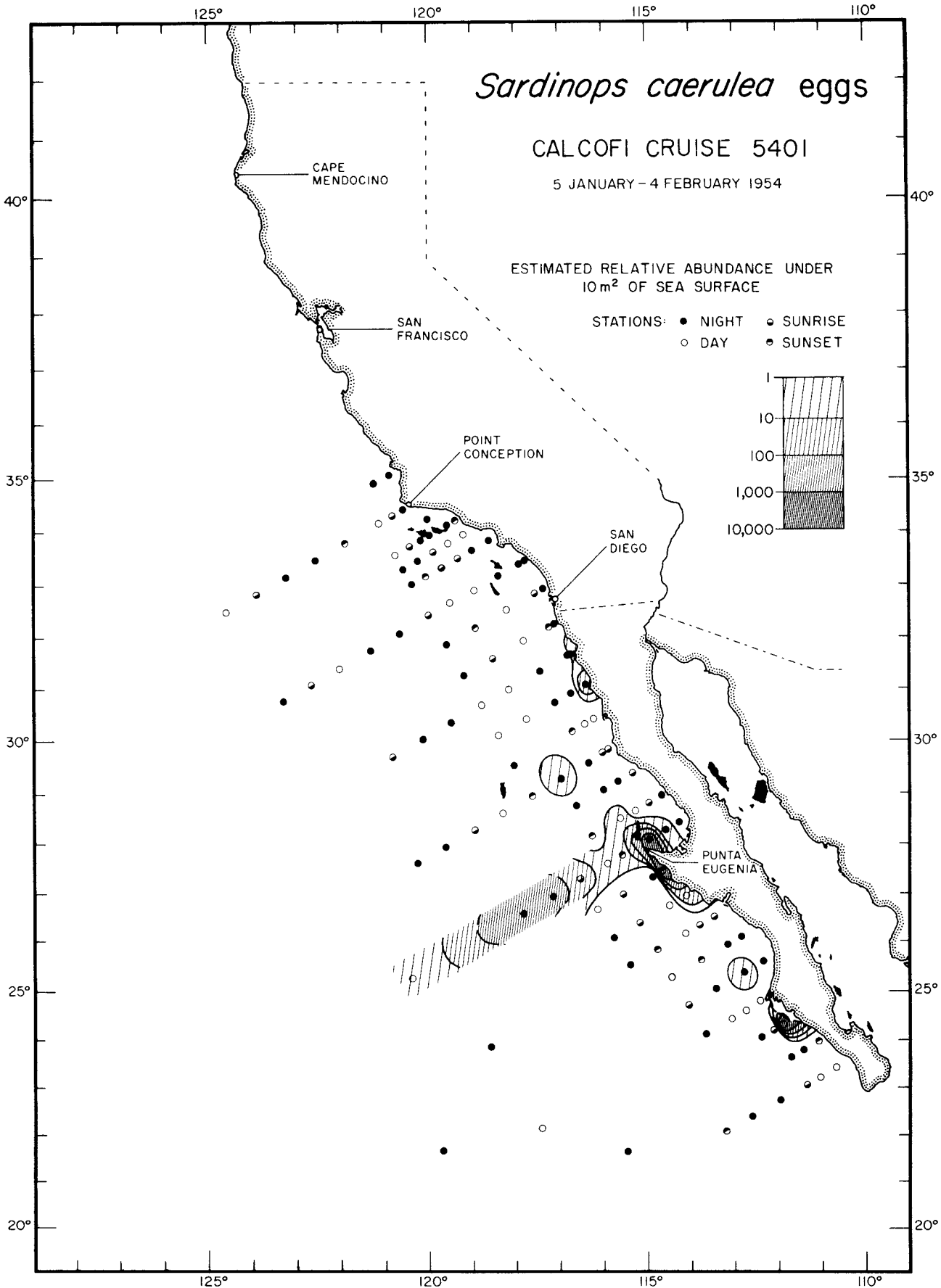
*Sardinops caerulea* eggs

5301

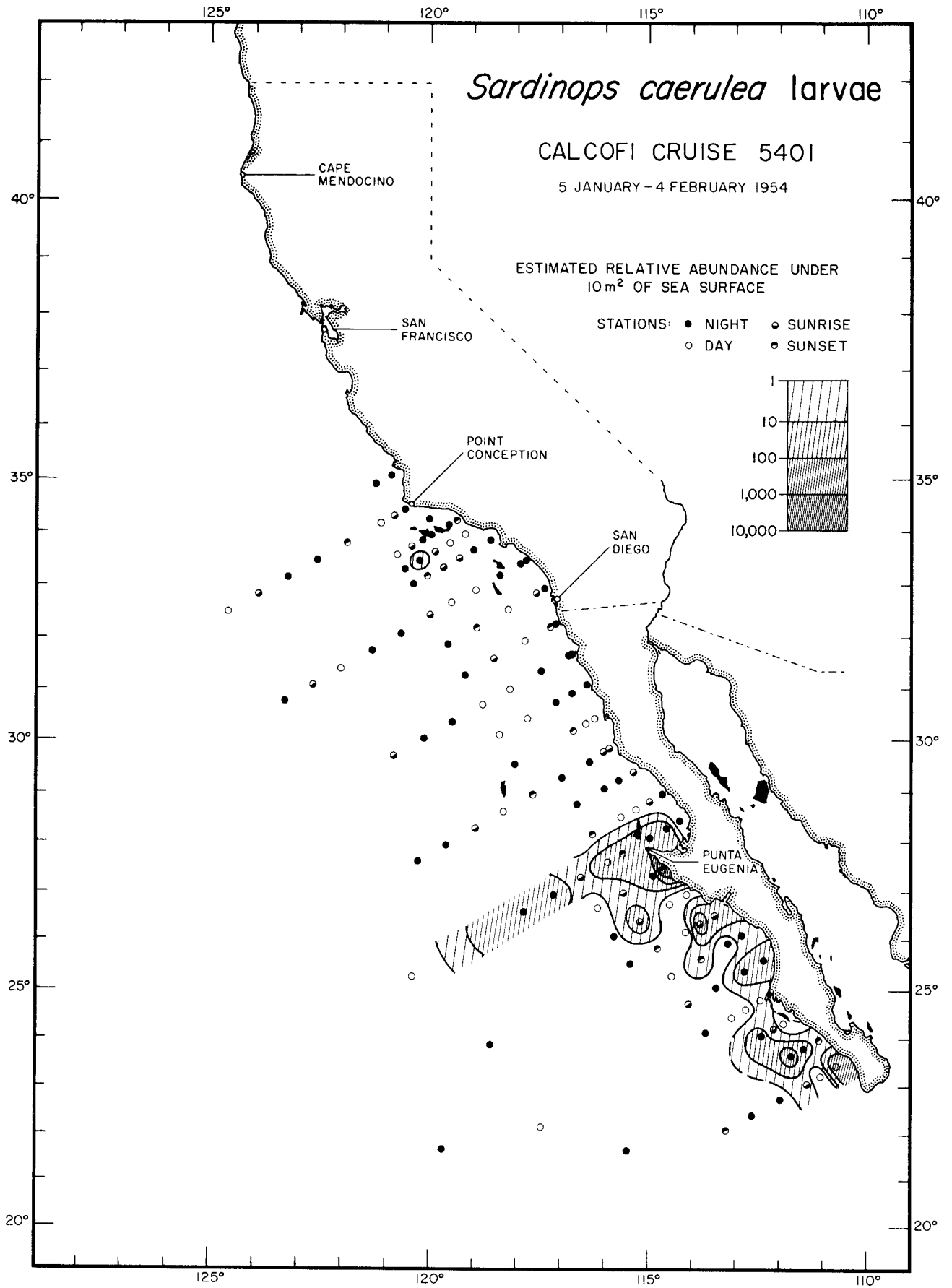


*Sardinops caerulea* larvae

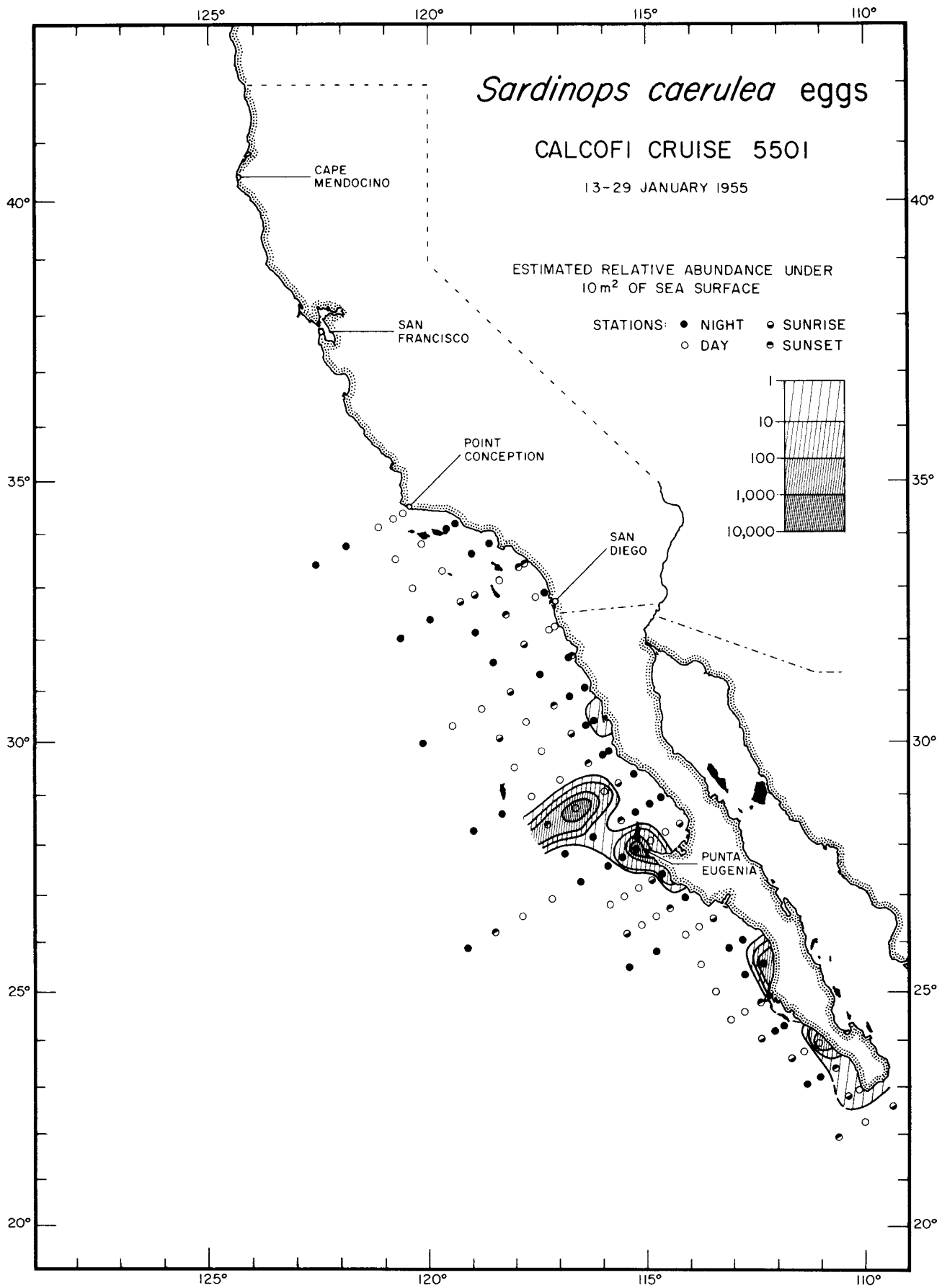
5301



*Sardinops caerulea* eggs  
5401

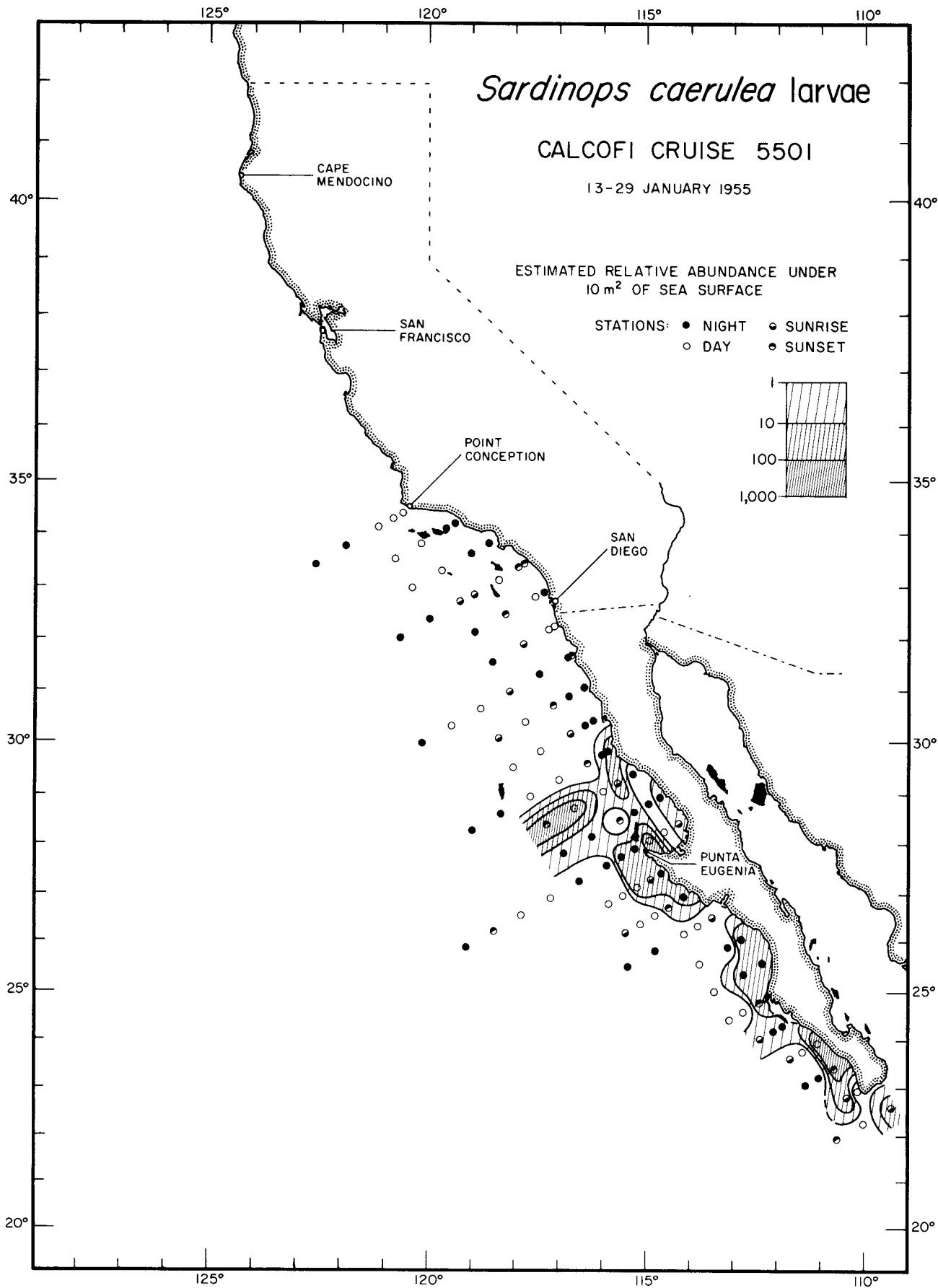


*Sardinops caerulea* larvae  
5401



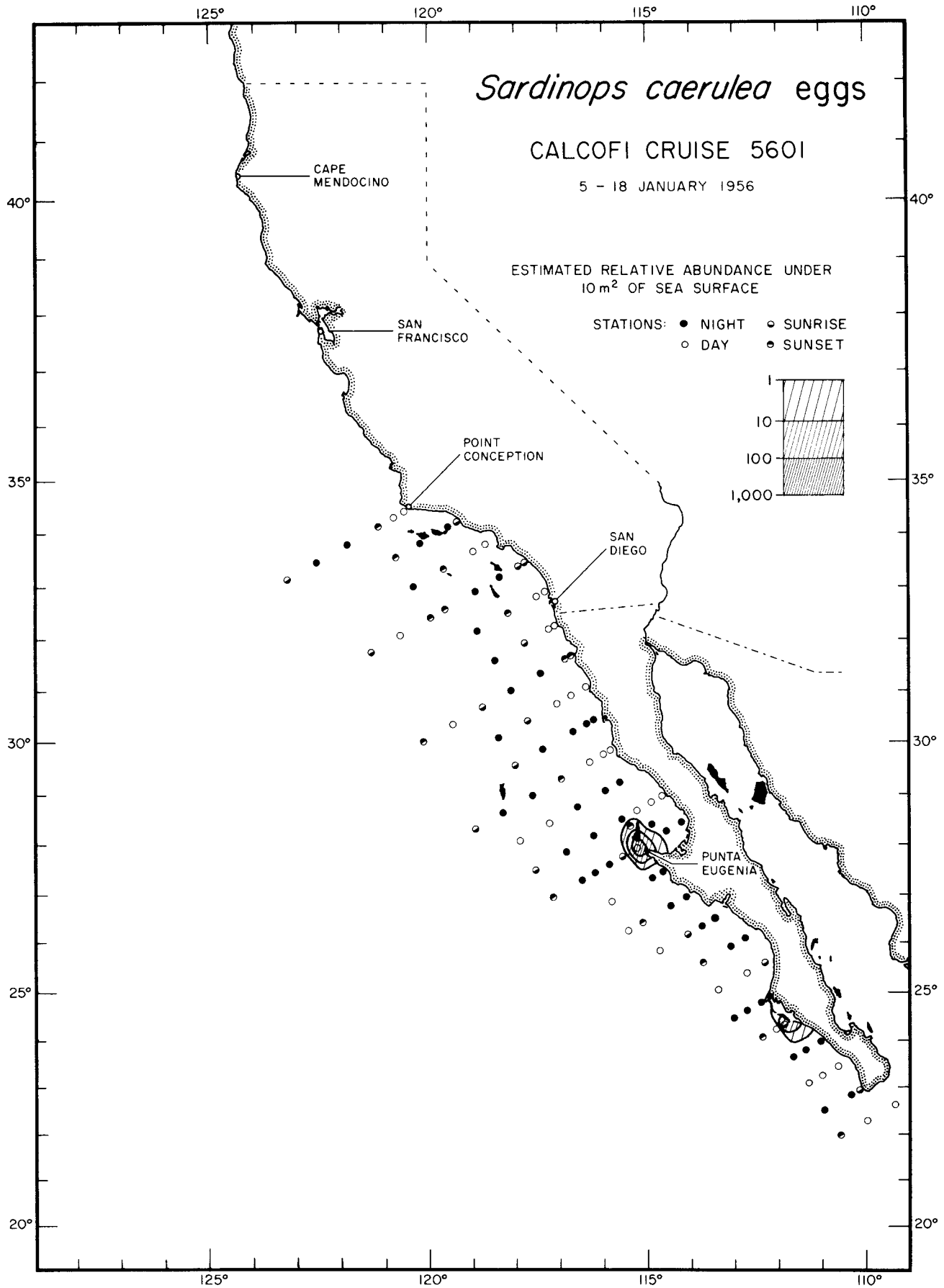
*Sardinops caerulea* eggs

5501



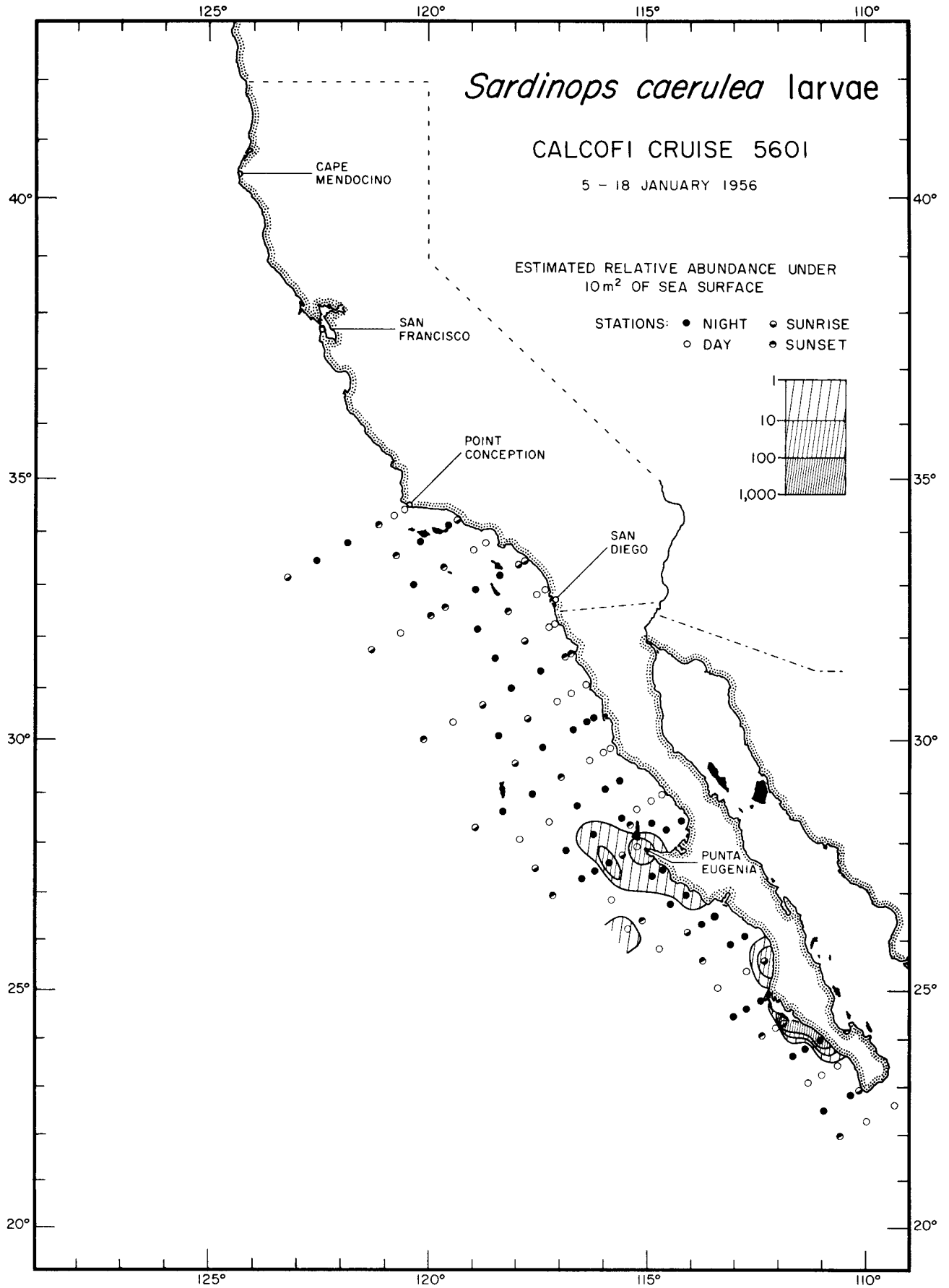
*Sardinops caerulea* larvae

5501



*Sardinops caerulea* eggs

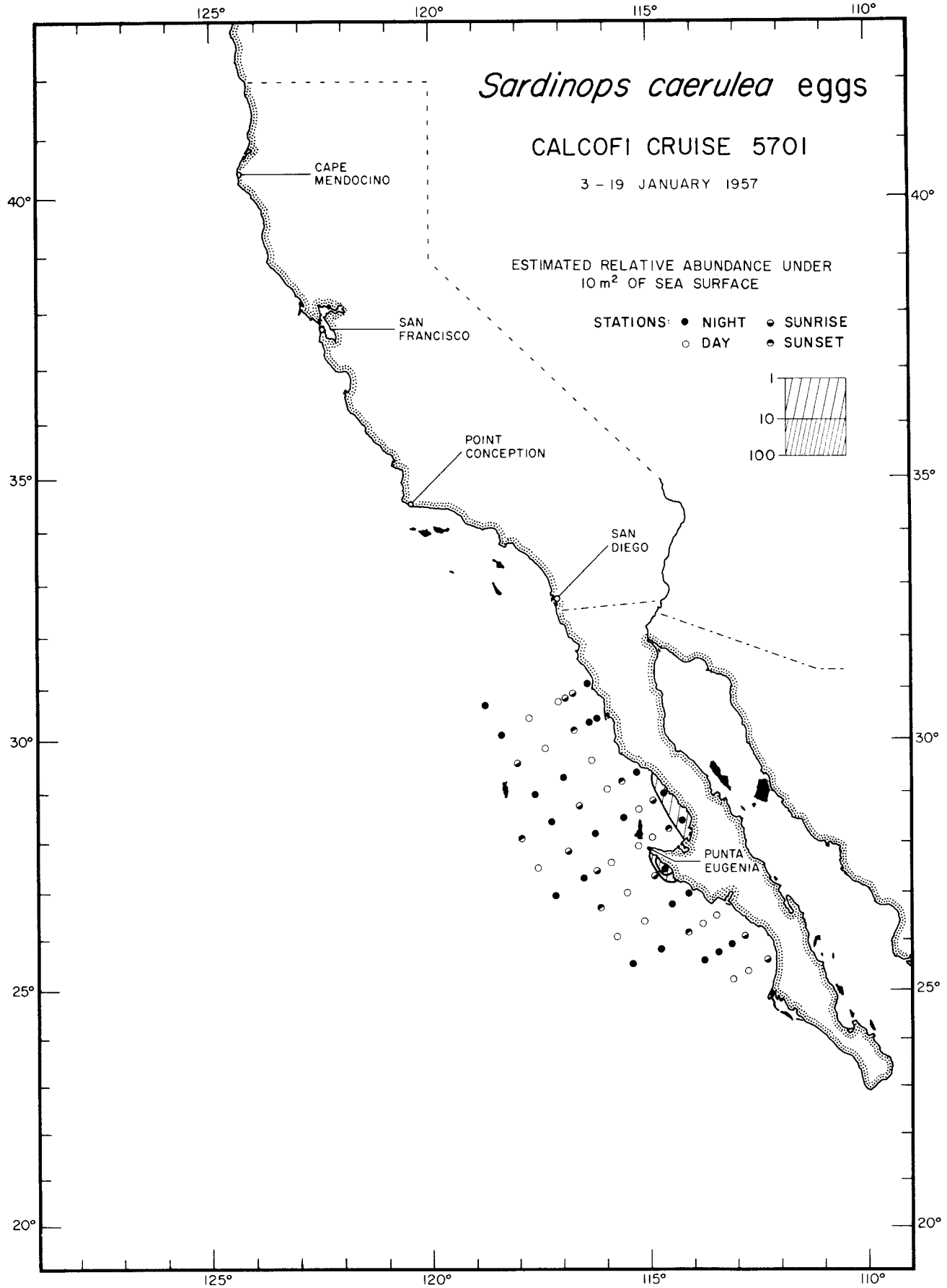
5601



*Sardinops caerulea* larvae

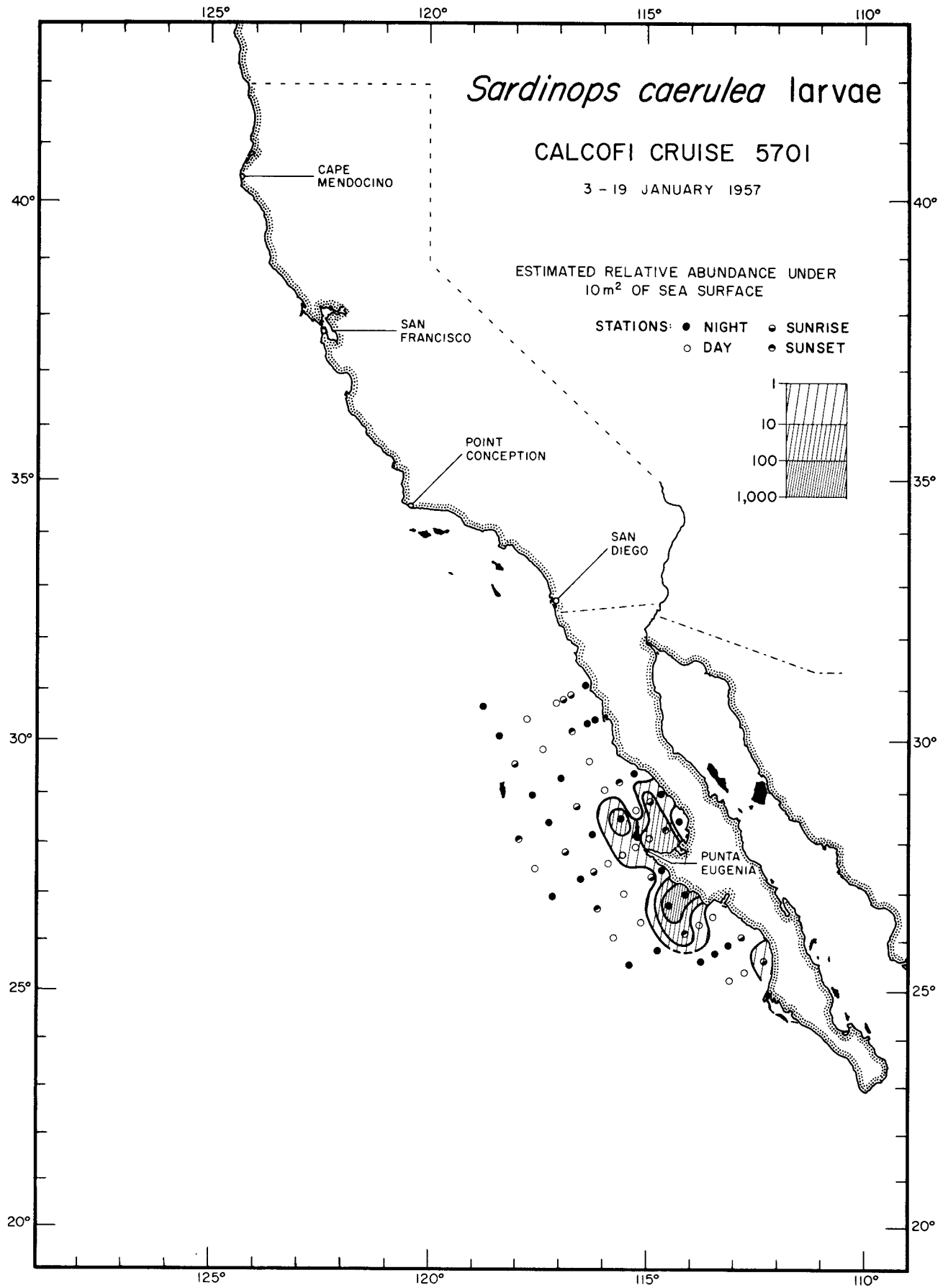
5601





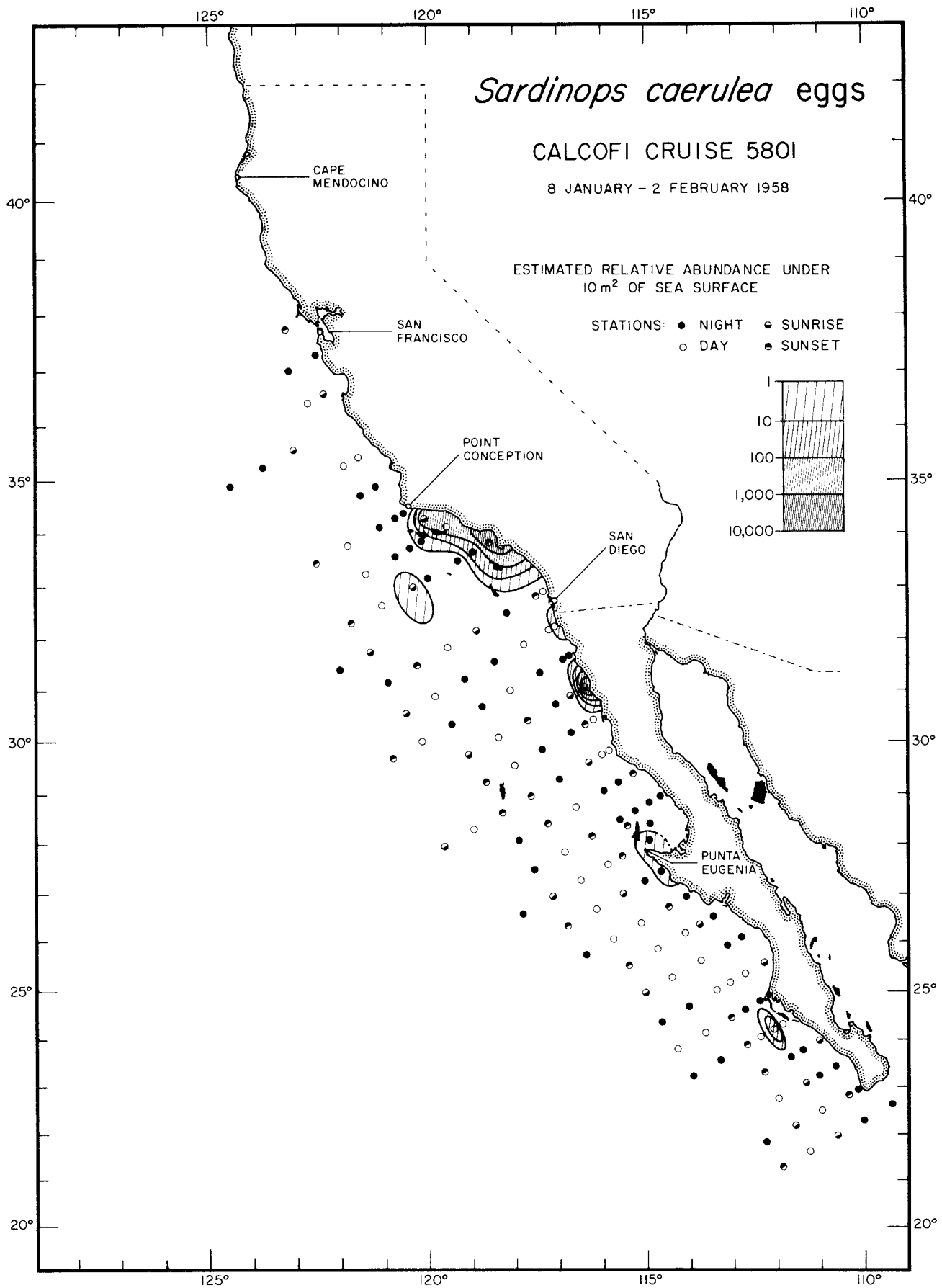
*Sardinops caerulea* eggs

5701



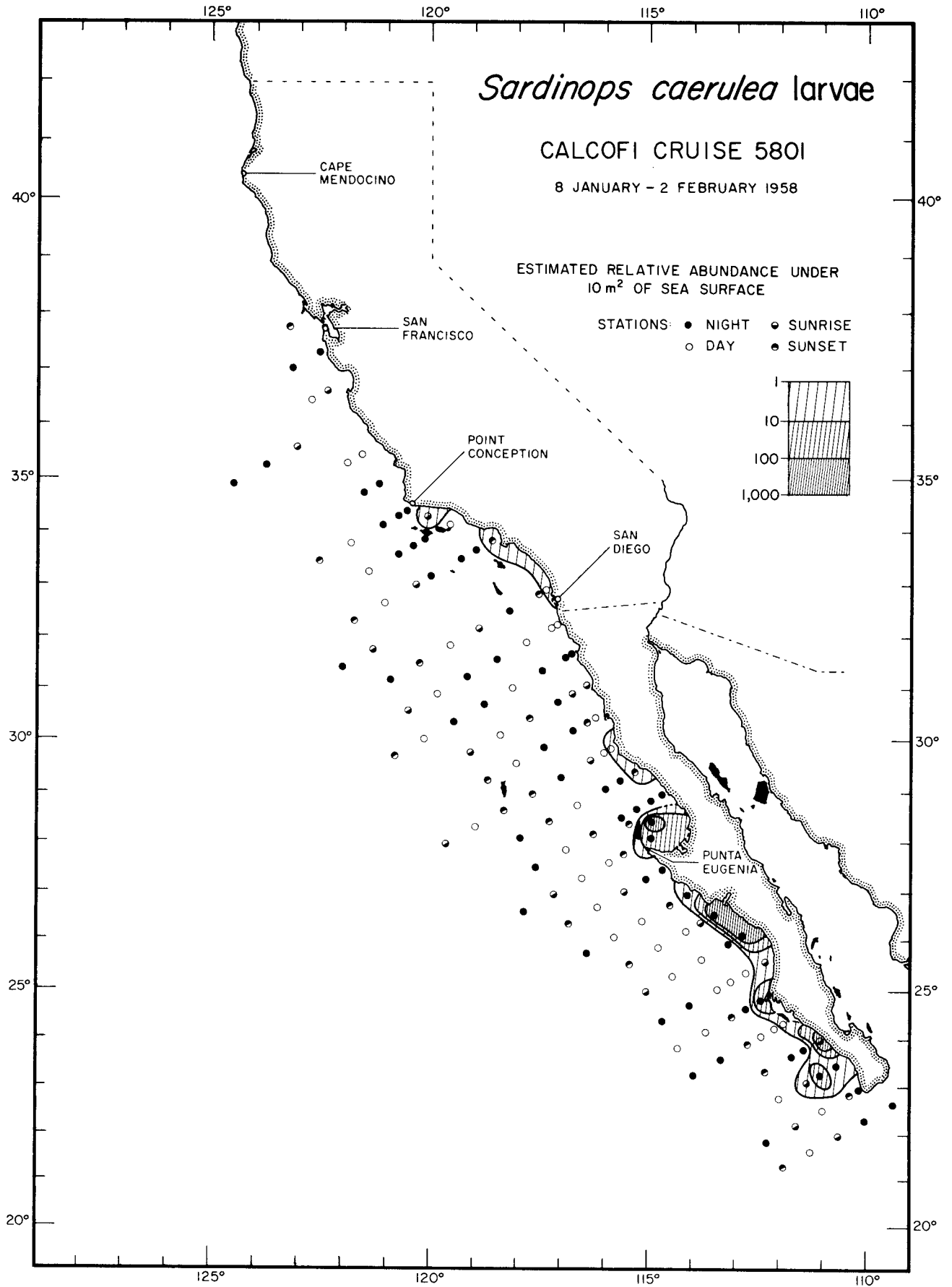
*Sardinops caerulea* larvae

5701



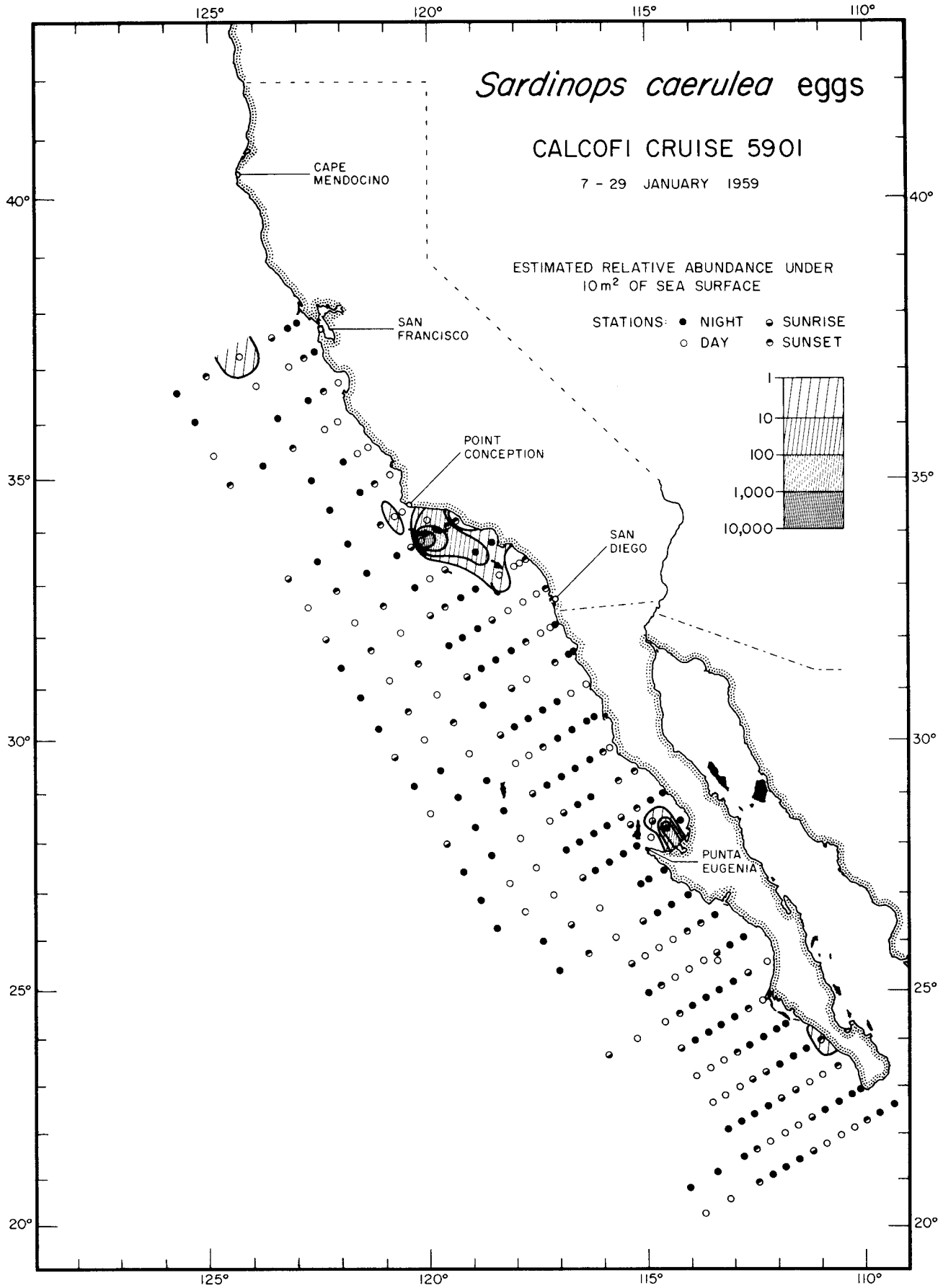
*Sardinops caerulea* eggs

5801



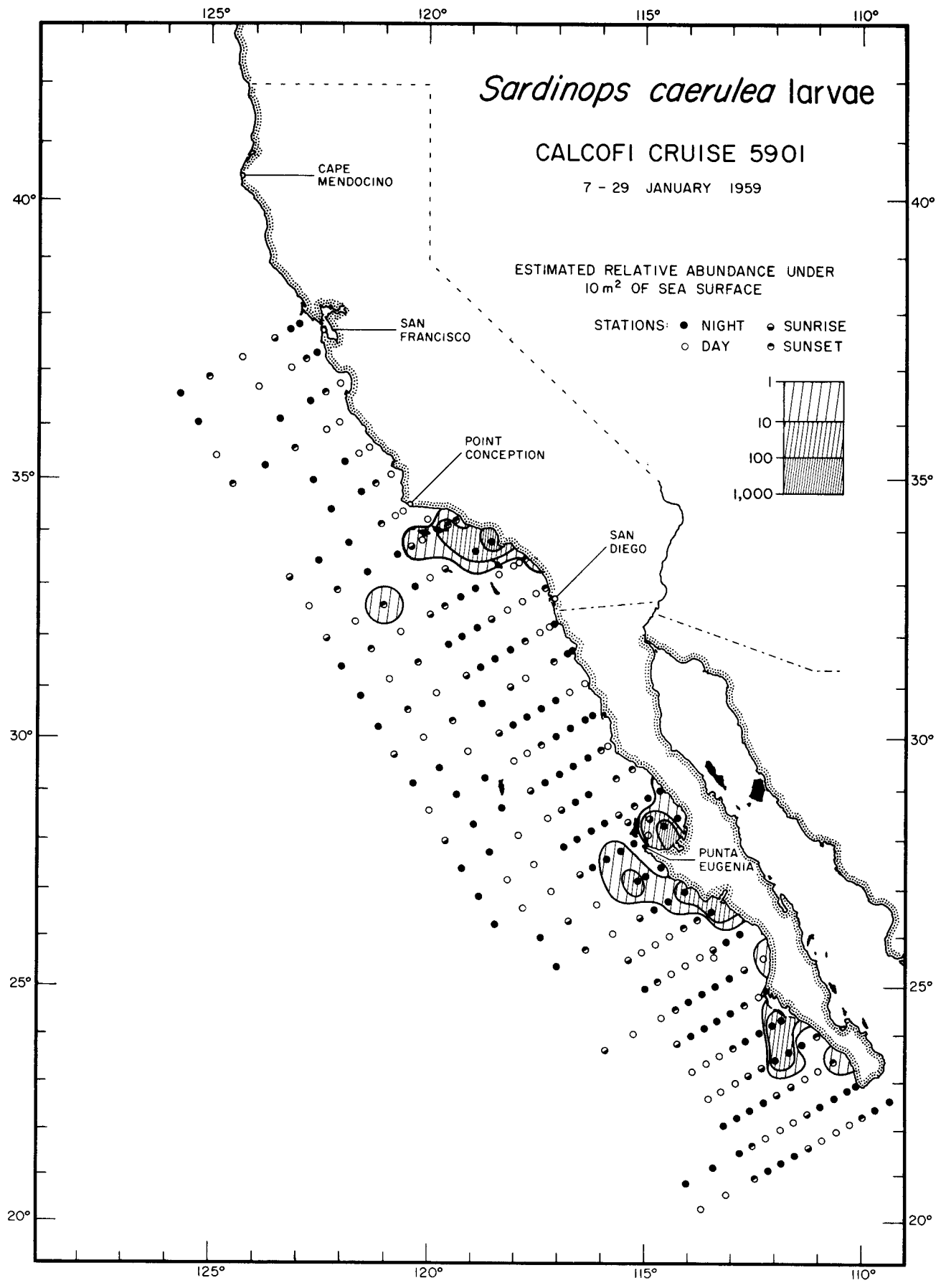
*Sardinops caerulea* larvae

5801



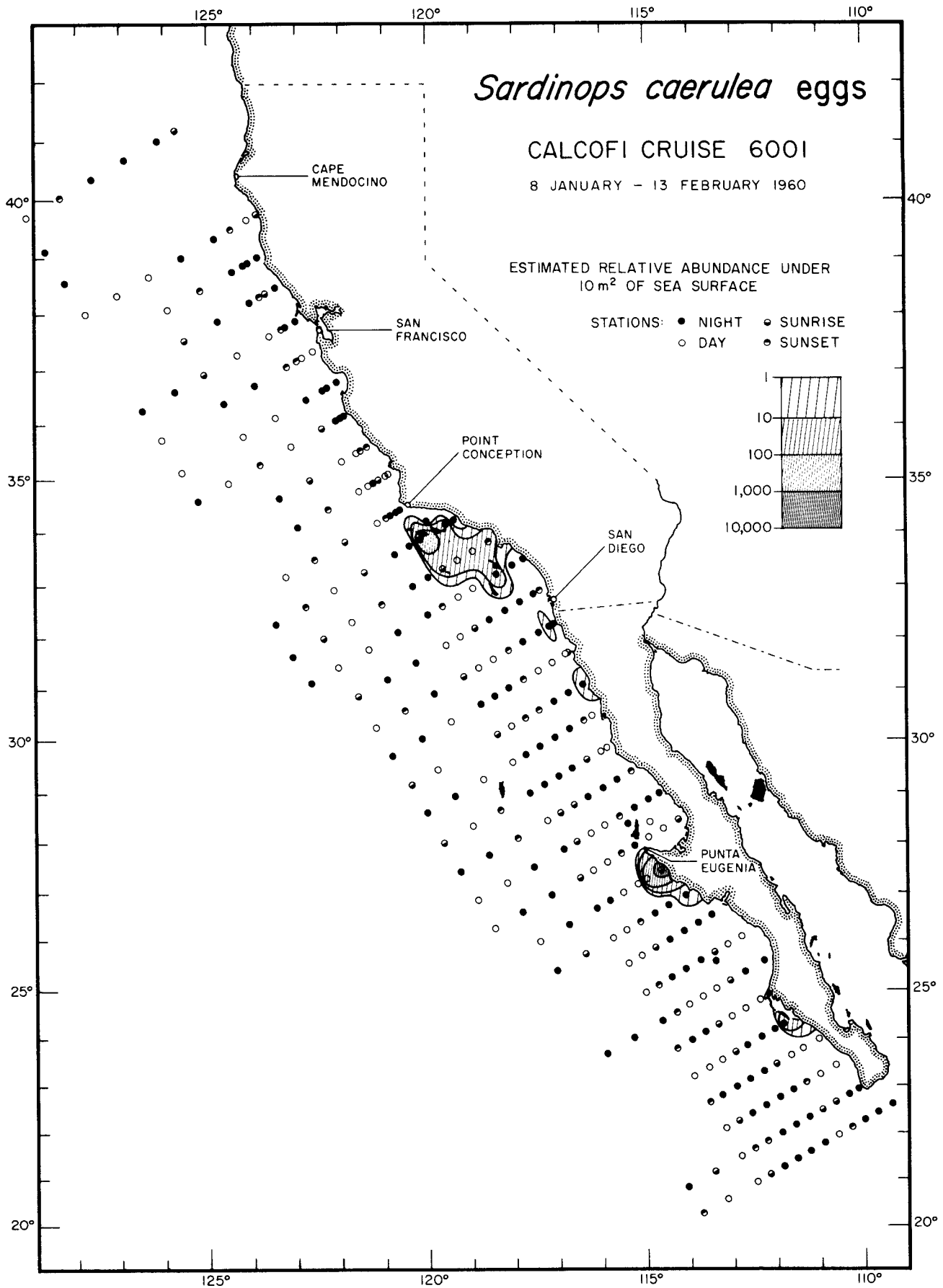
*Sardinops caerulea* eggs

5901



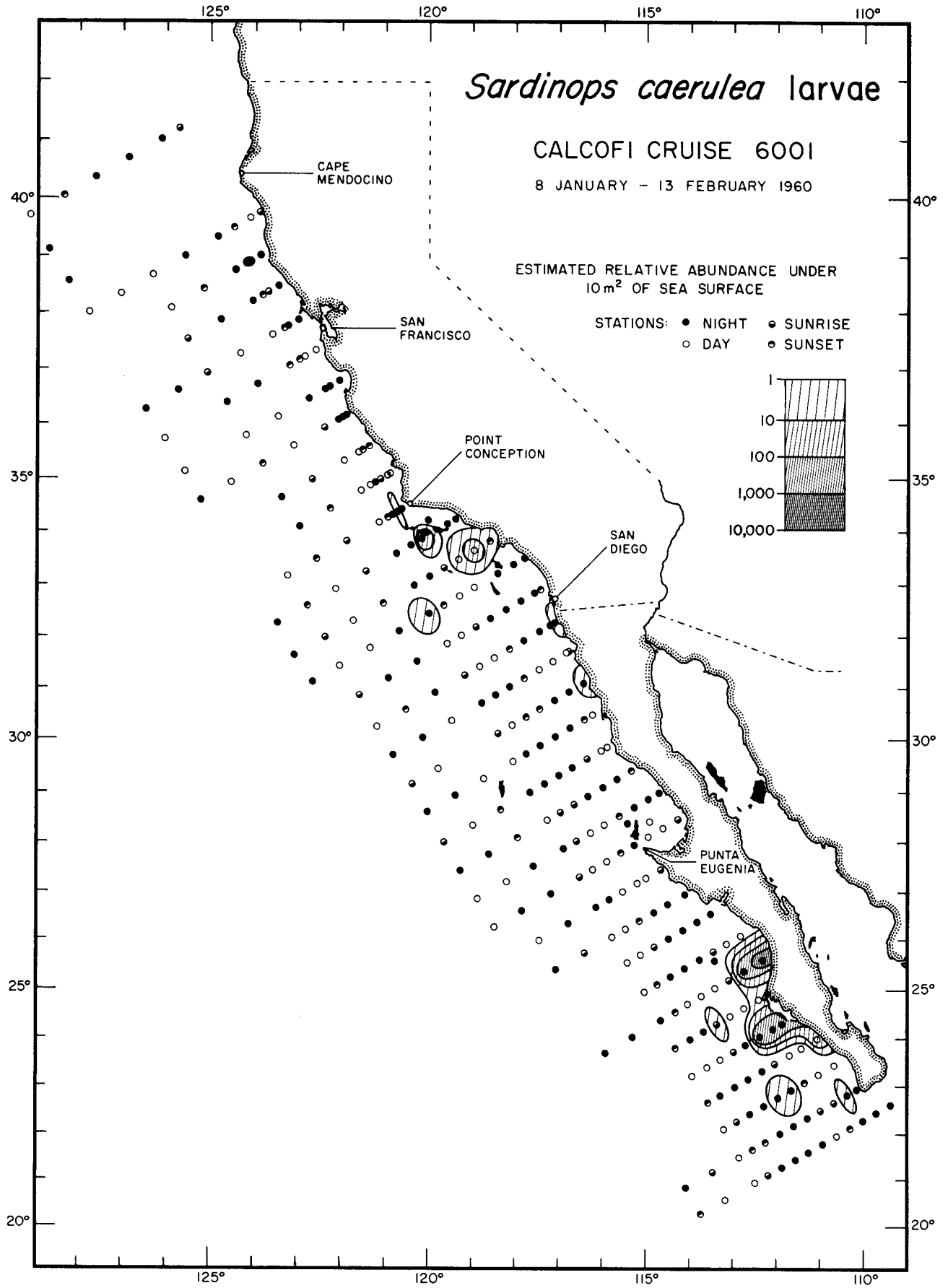
*Sardinops caerulea* larvae

5901



*Sardinops caerulea* eggs

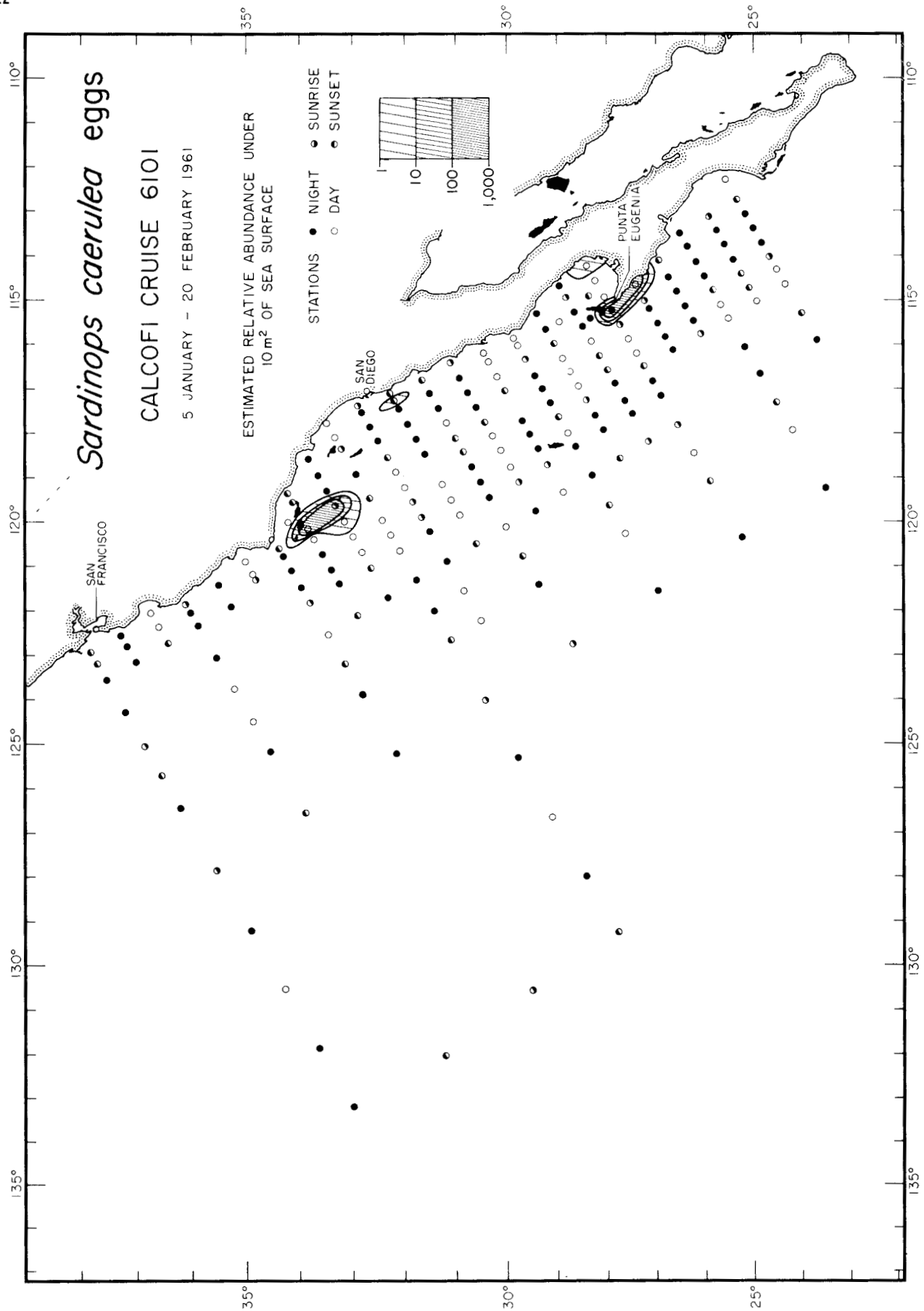
6001



*Sardinops caerulea* larvae

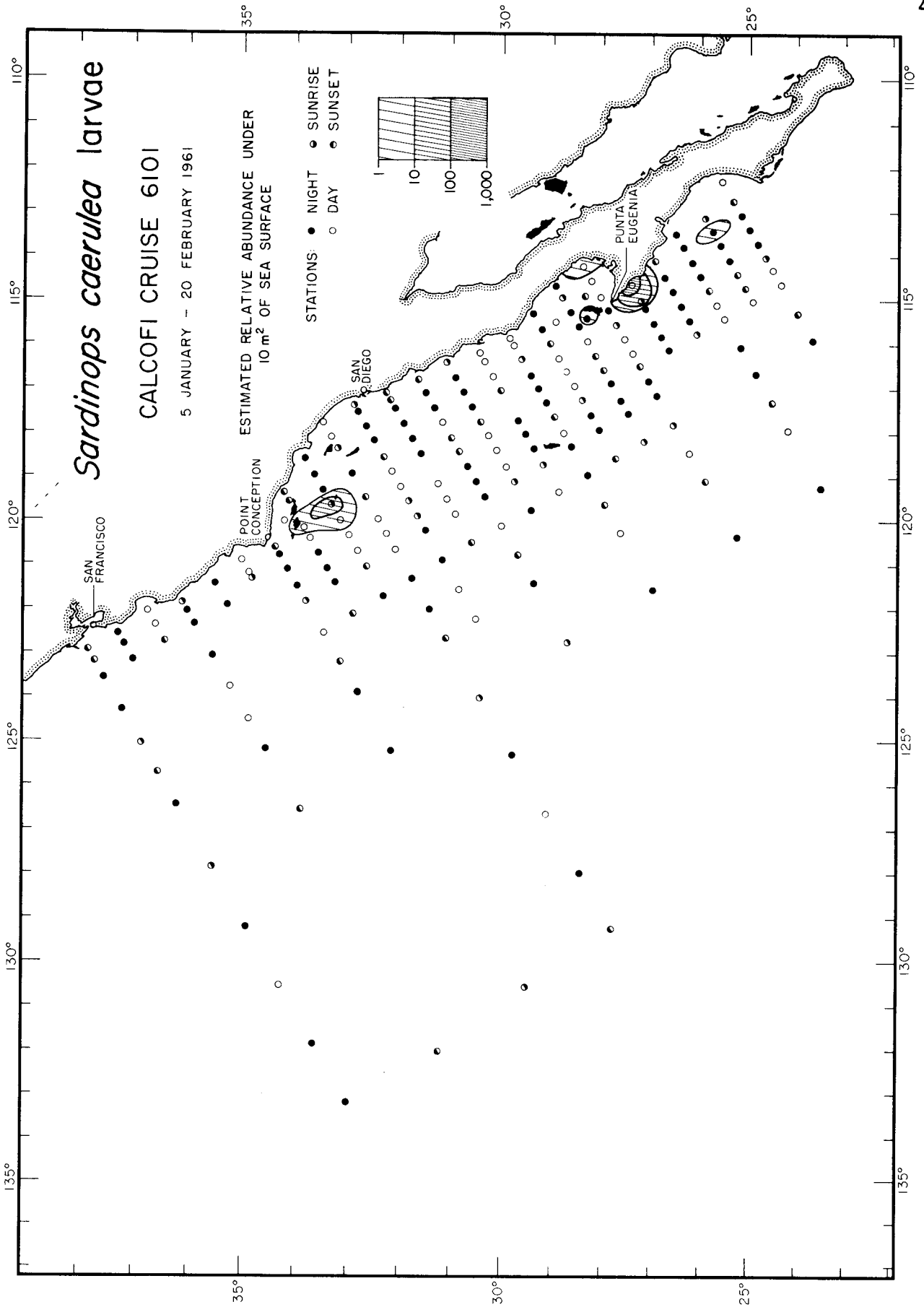
6001





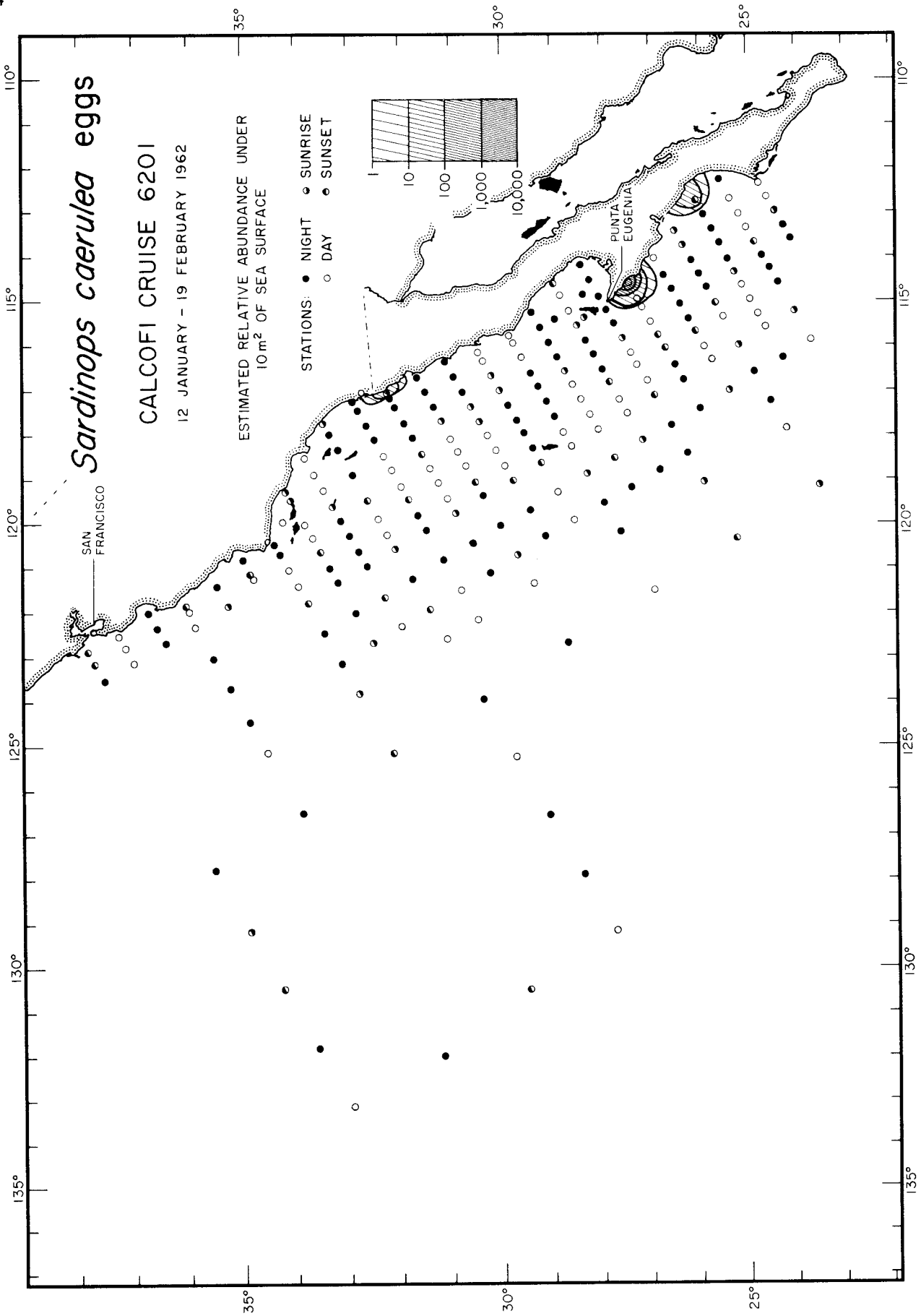
*Sardinops caerulea* eggs

6101



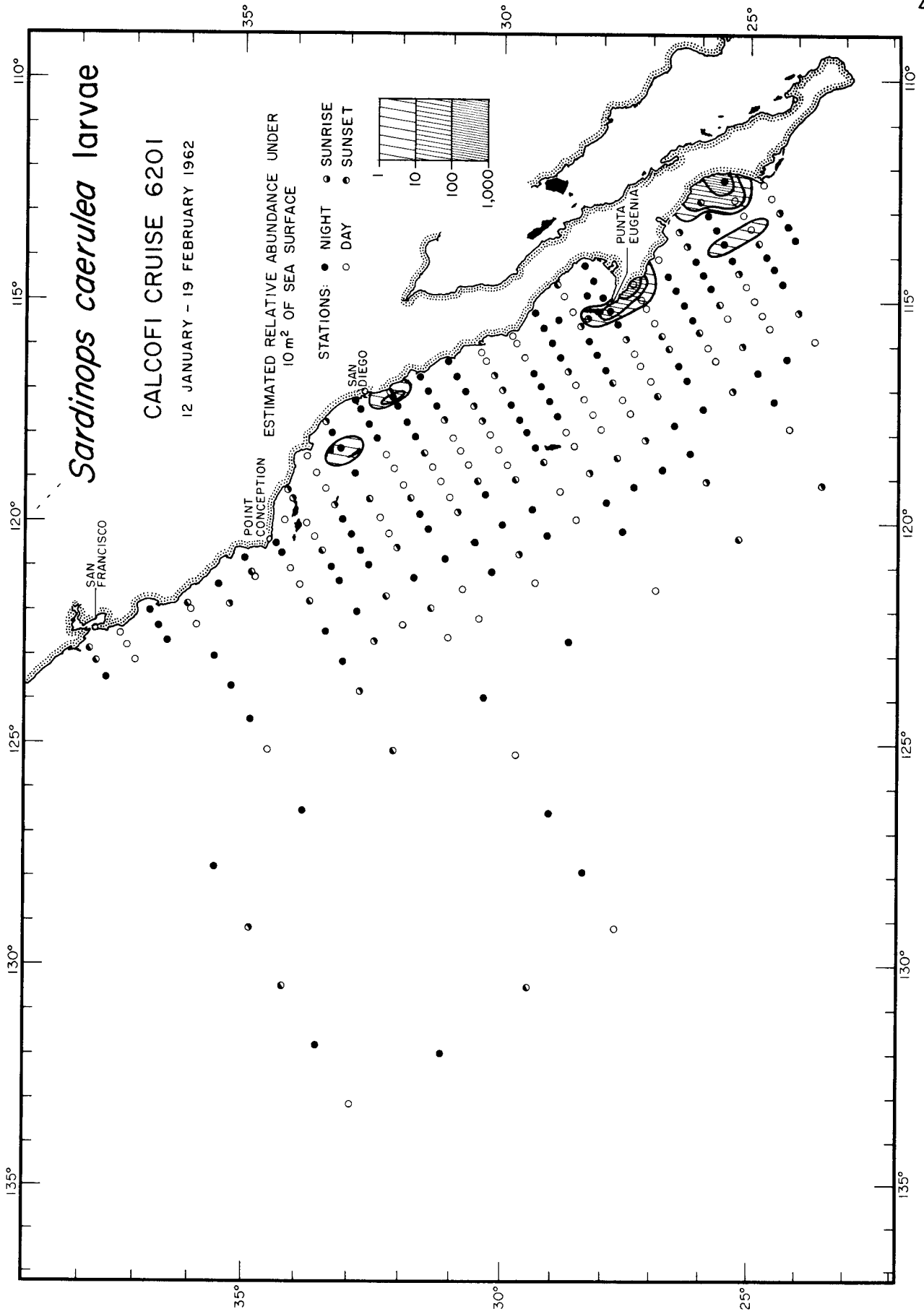
*Sardinops caerulea* larvae

6101



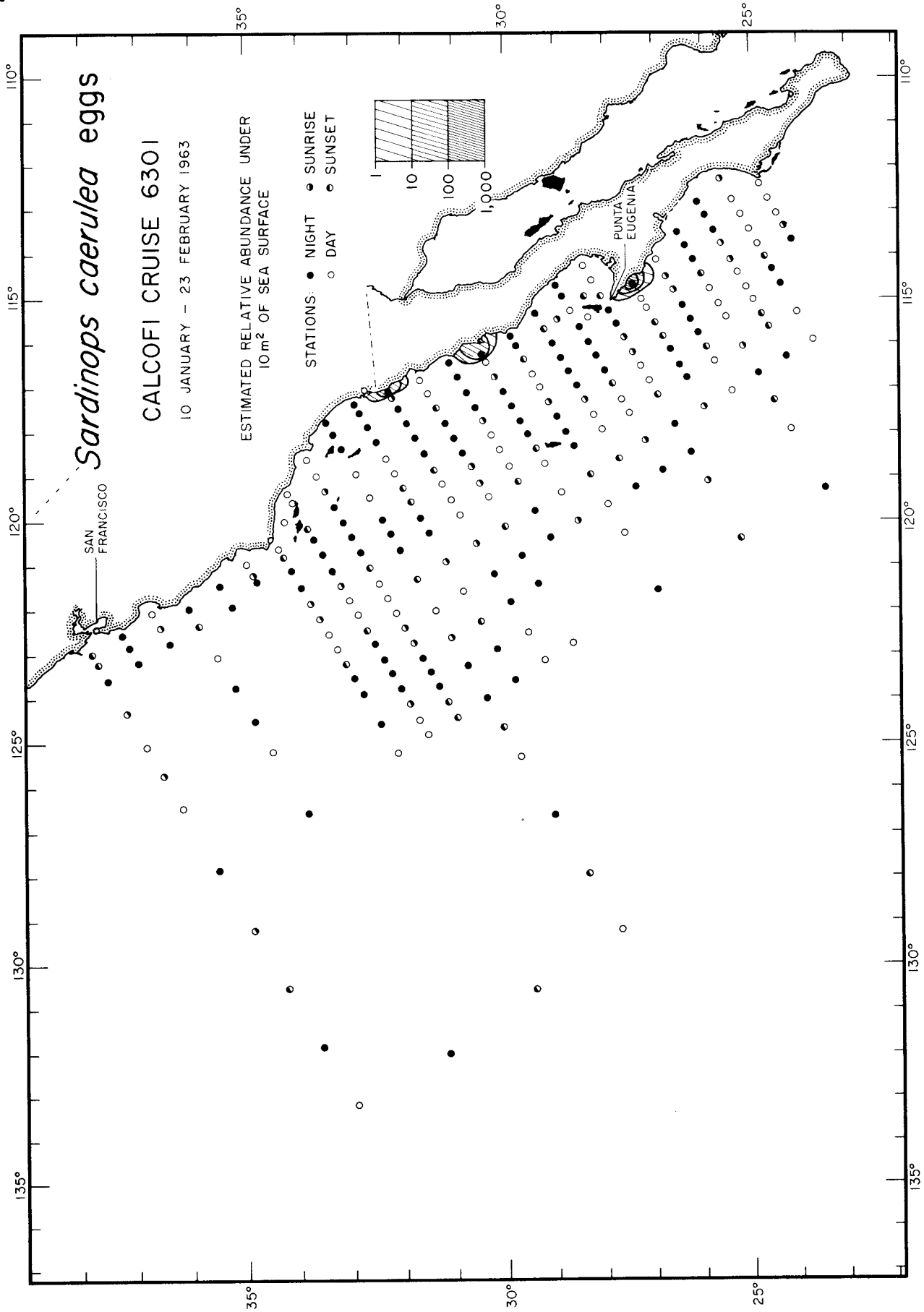
*Sardinops caerulea* eggs

6201



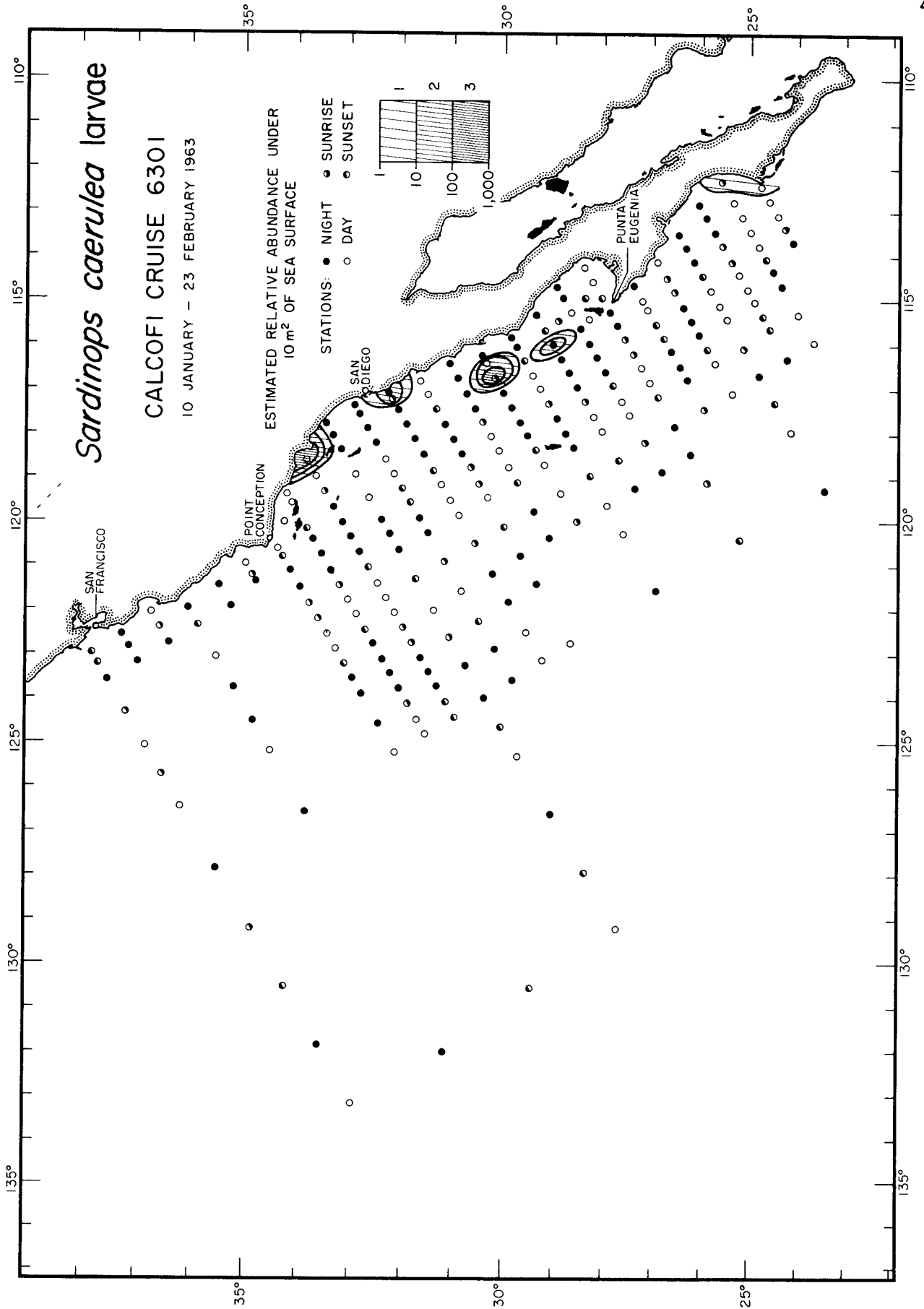
*Sardinops caerulea* larvae

6201



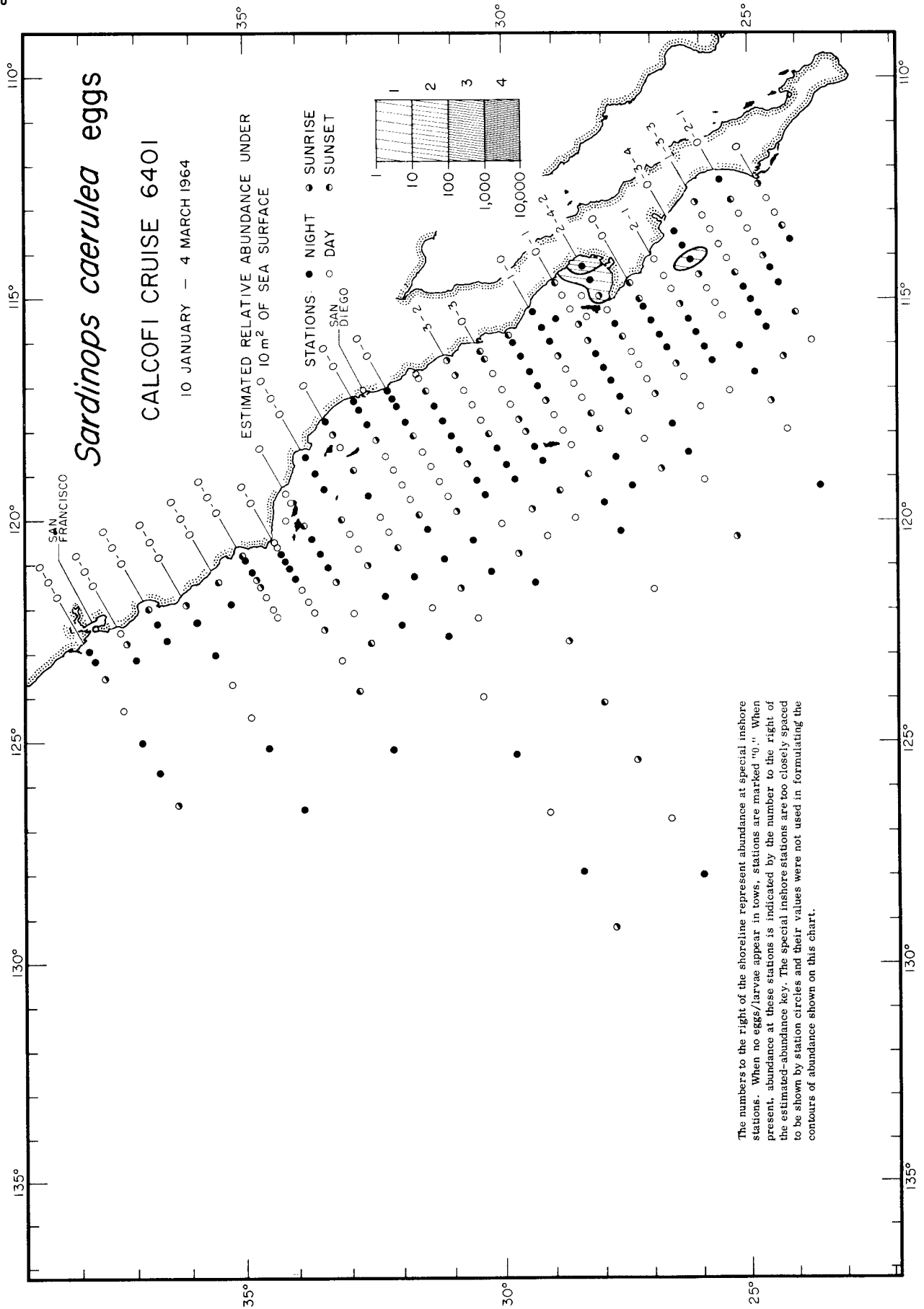
*Sardinops caerulea* eggs

6301

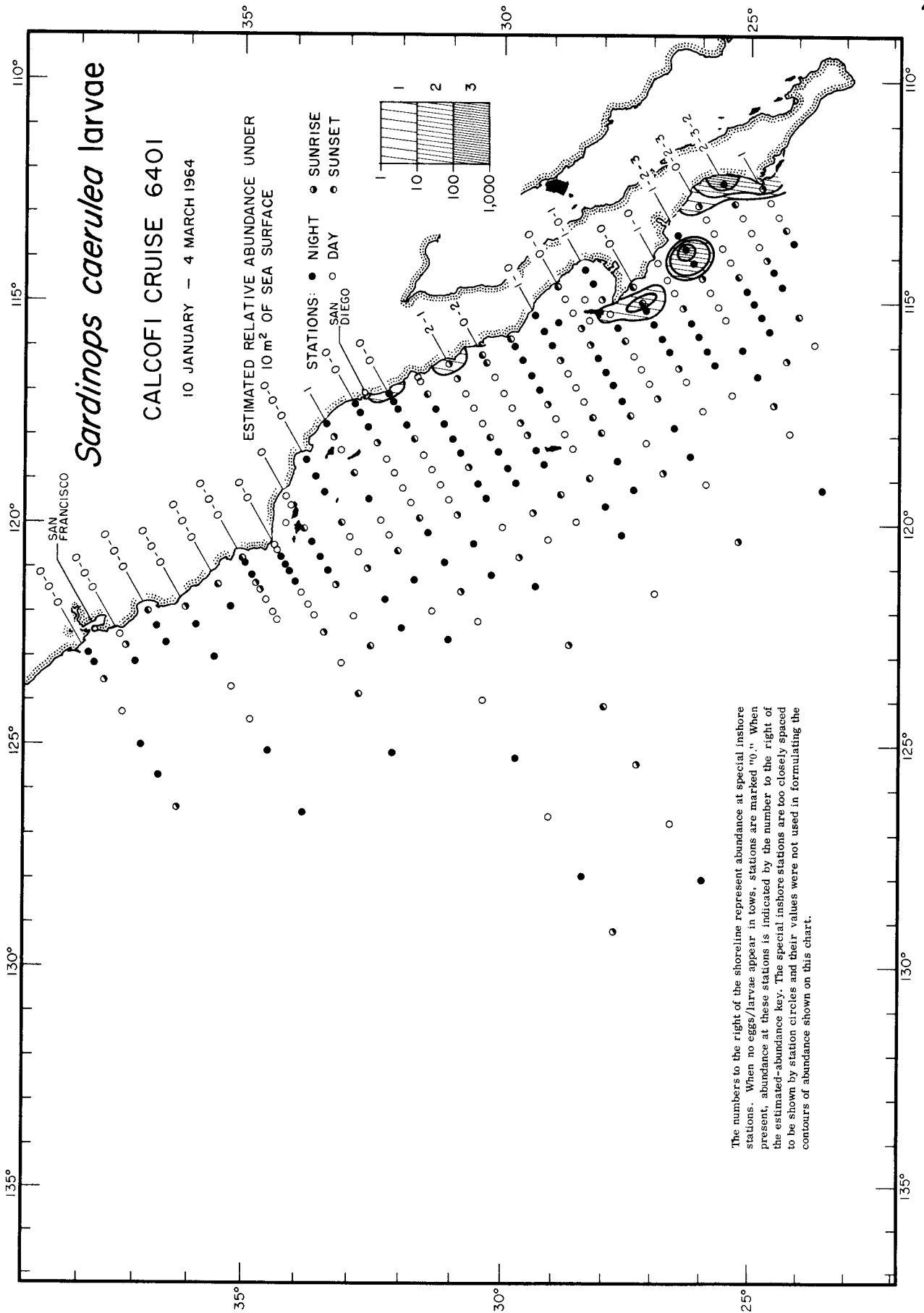


*Sardinops caerulea* larvae

6301

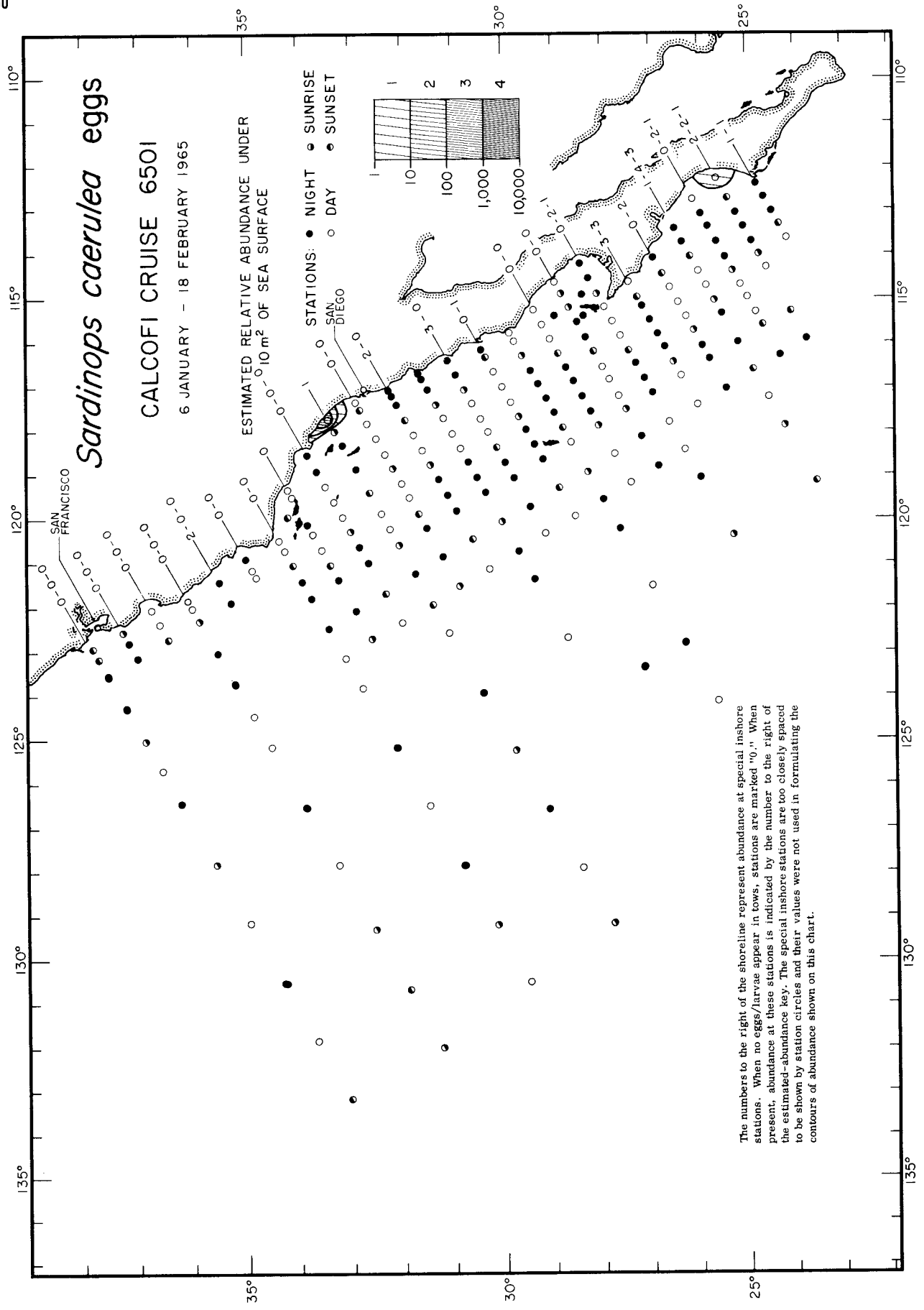


The numbers to the right of the shoreline represent abundance at special inshore stations. When no eggs/larvae appear in tows, stations are marked "0." When present, abundance at these stations is indicated by the number to the right of the estimated-abundance key. The special inshore stations are too closely spaced to be shown by station circles and their values were not used in formulating the contours of abundance shown on this chart.



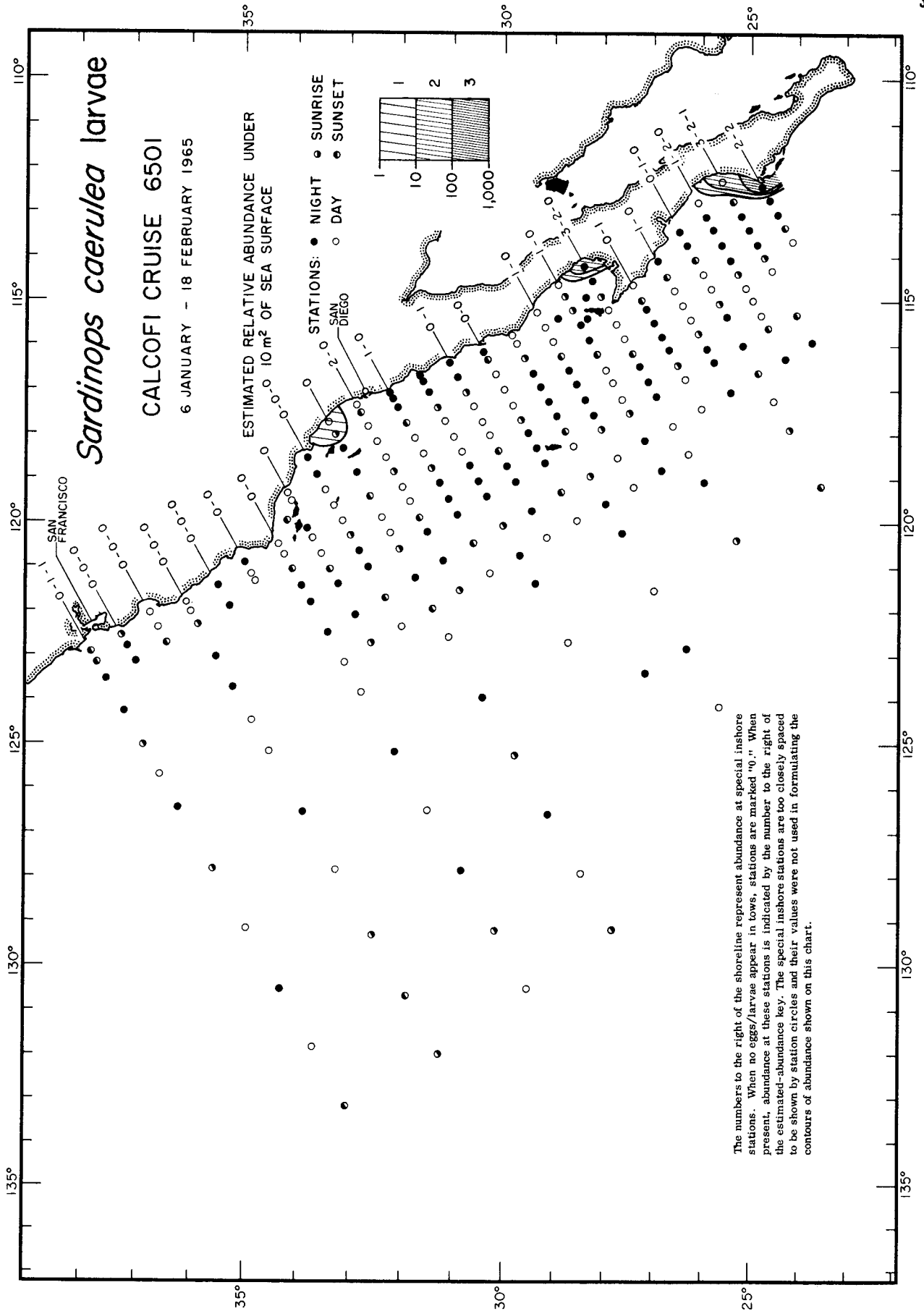
The numbers to the right of the shoreline represent abundance at special inshore stations. When no eggs/larvae appear in tows, stations are marked "0." When present, abundance at these stations is indicated by the number to the right of the estimated-abundance key. The special inshore stations are too closely spaced to be shown by station circles and their values were not used in formulating the contours of abundance shown on this chart.





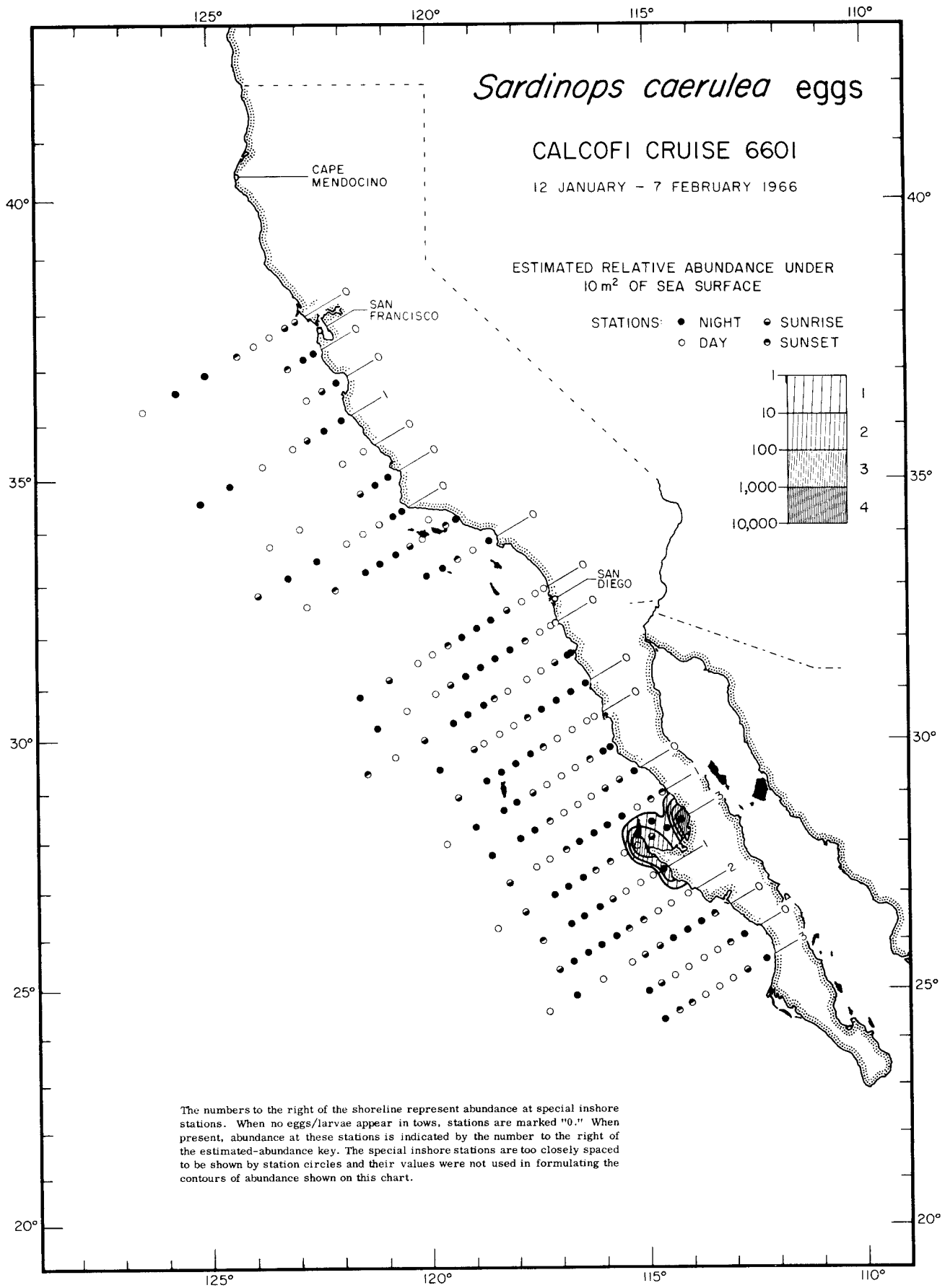
The numbers to the right of the shoreline represent abundance at special inshore stations. When no eggs/larvae appear in tows, stations are marked "0." When present, abundance at these stations is indicated by the number to the right of the estimated-abundance key. The special inshore stations are too closely spaced to be shown by station circles and their values were not used in formulating the contours of abundance shown on this chart.

*Sardinops caerulea* eggs  
6501



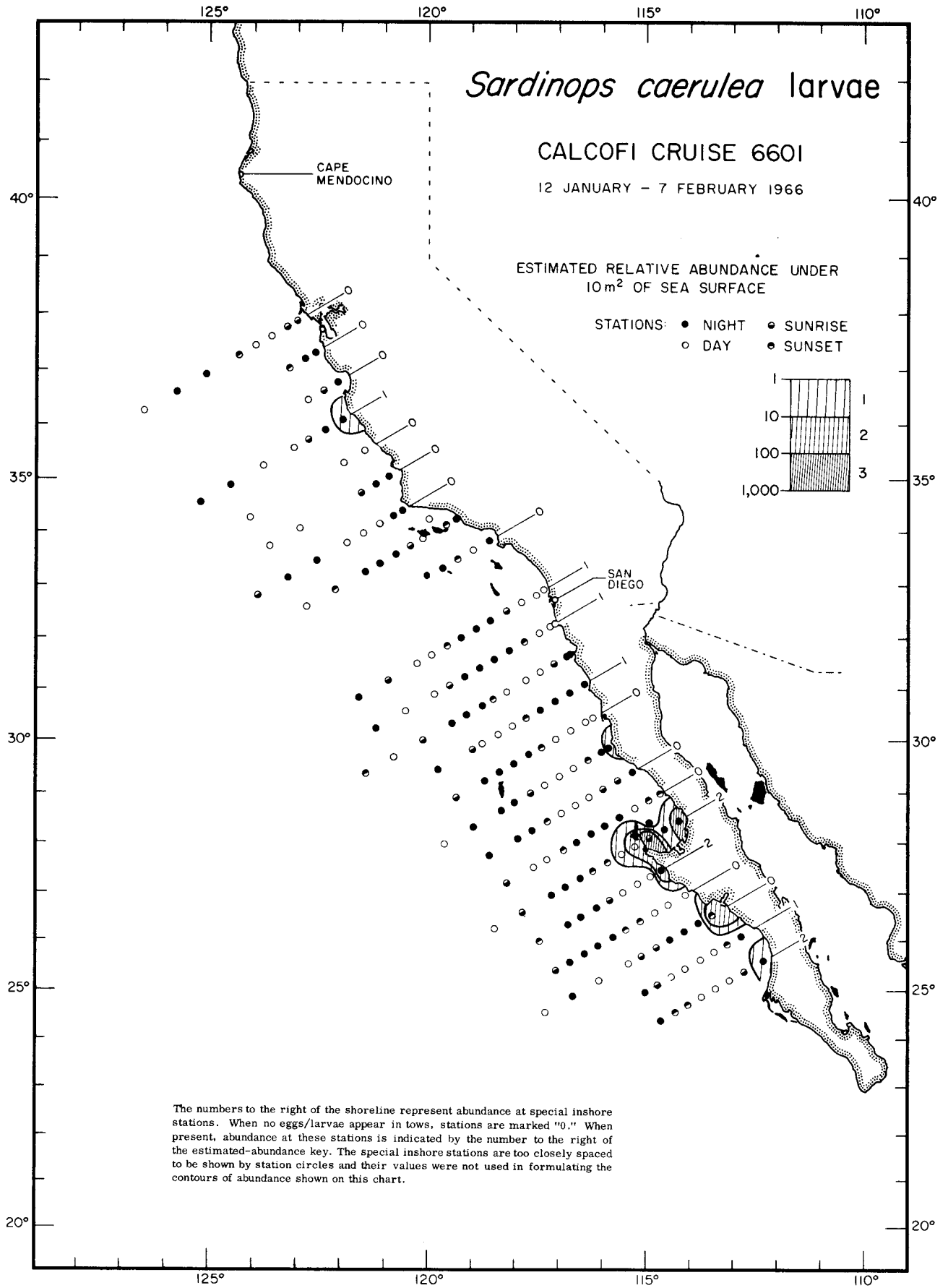
*Sardinops caerulea* larvae

6501



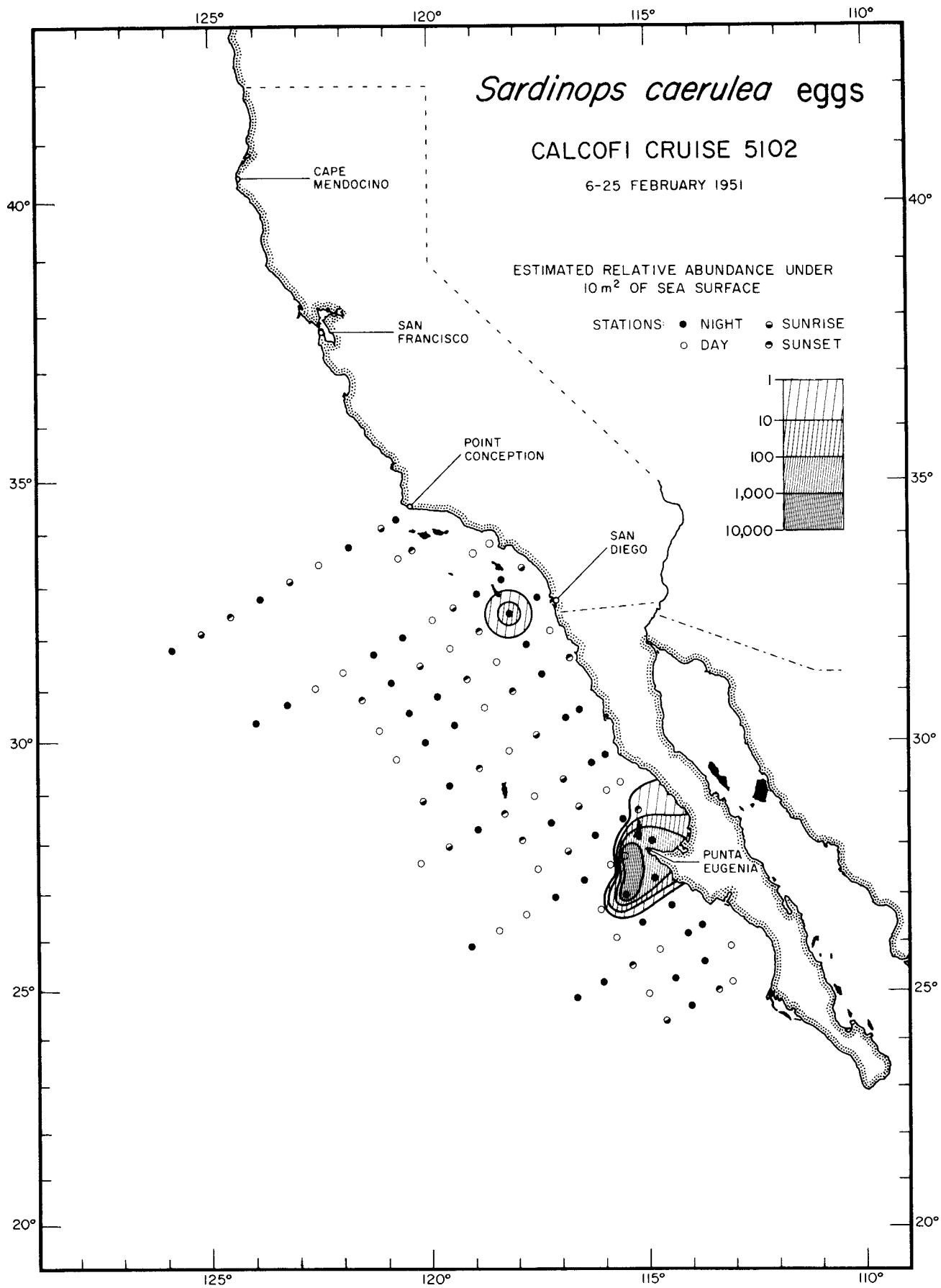
*Sardinops caerulea* eggs

6601



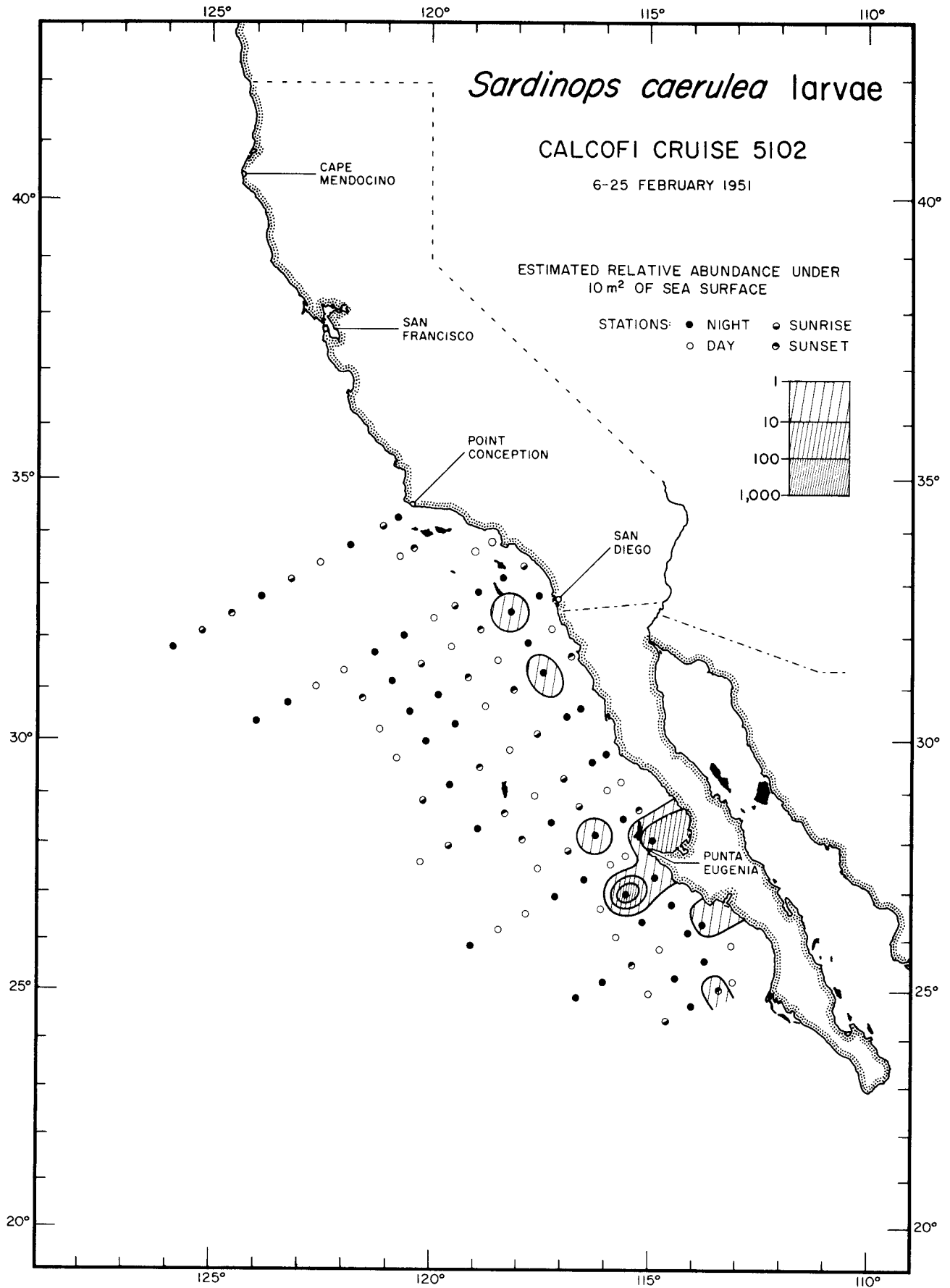
*Sardinops caerulea* larvae

6601



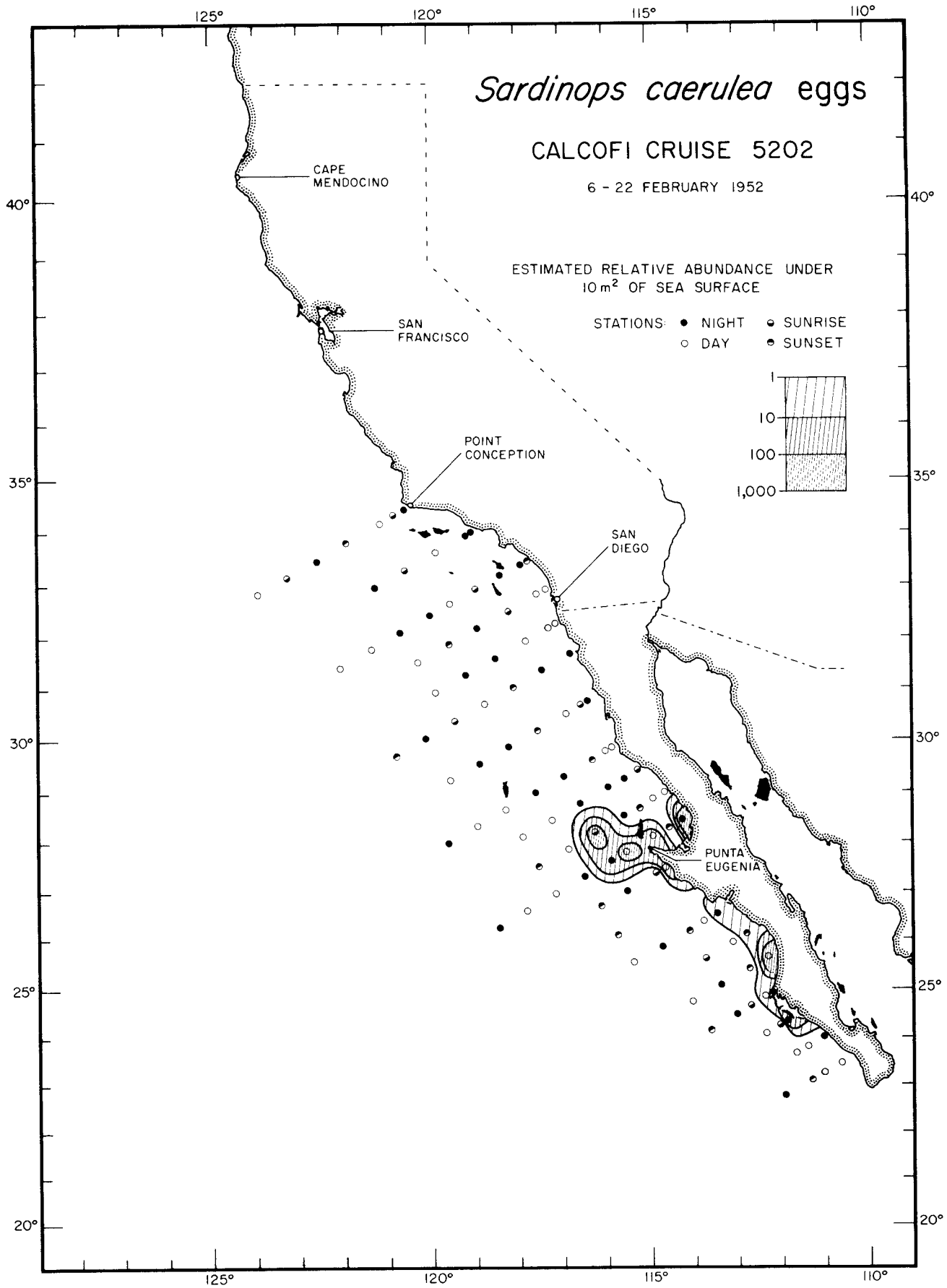
*Sardinops caerulea* eggs

5102



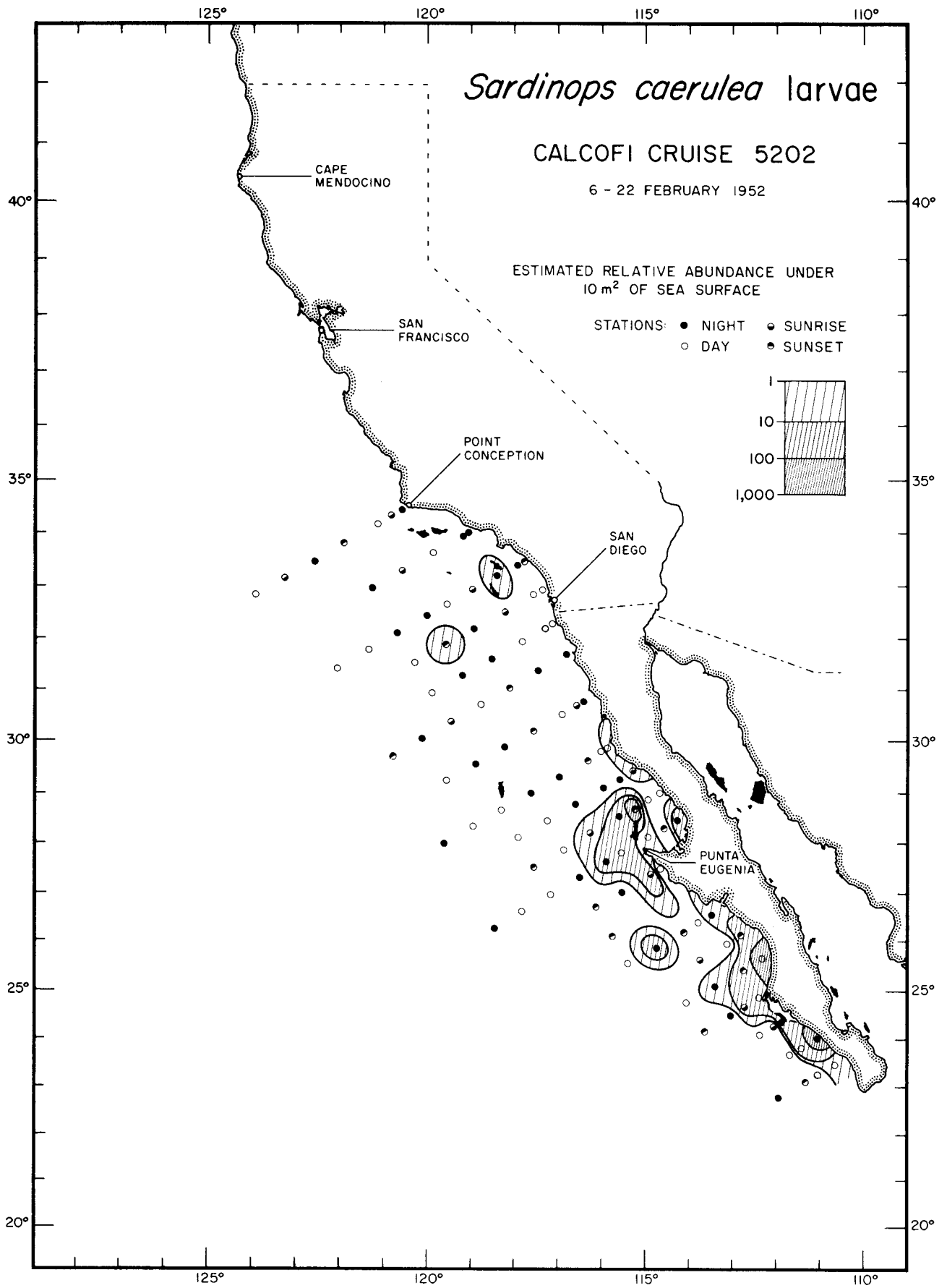
*Sardinops caerulea* larvae

5102



*Sardinops caerulea* eggs

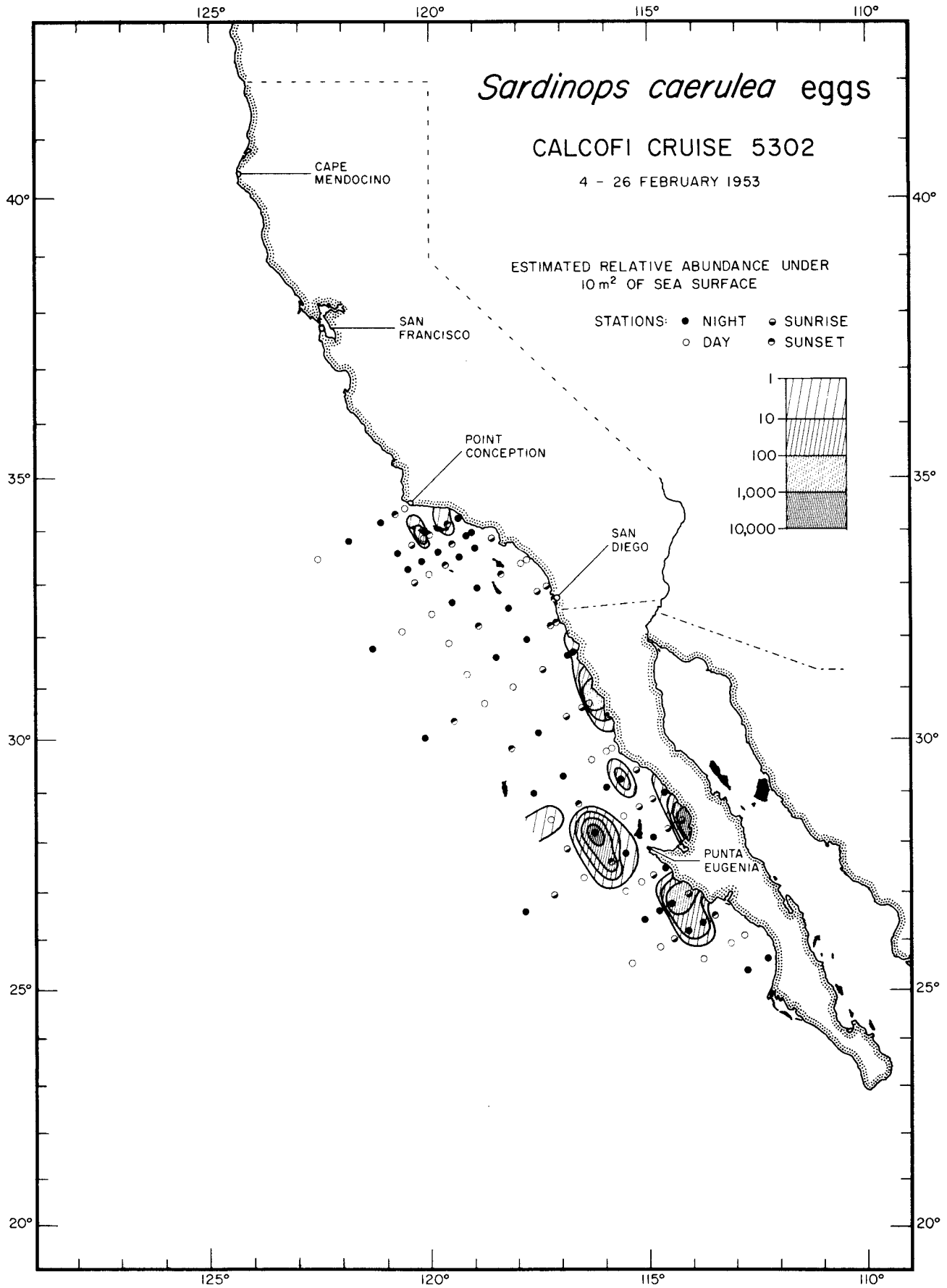
5202



*Sardinops caerulea* larvae

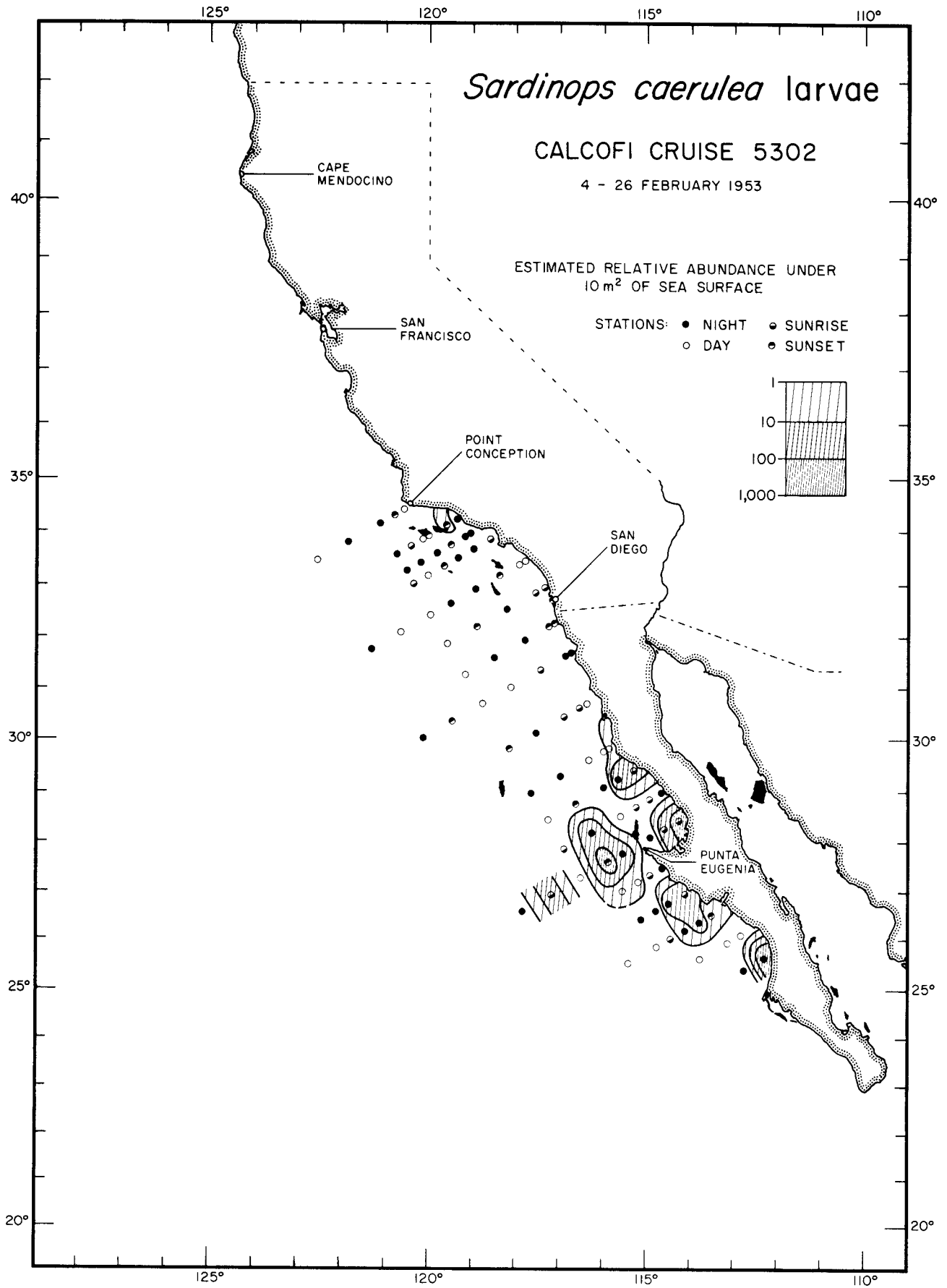
5202





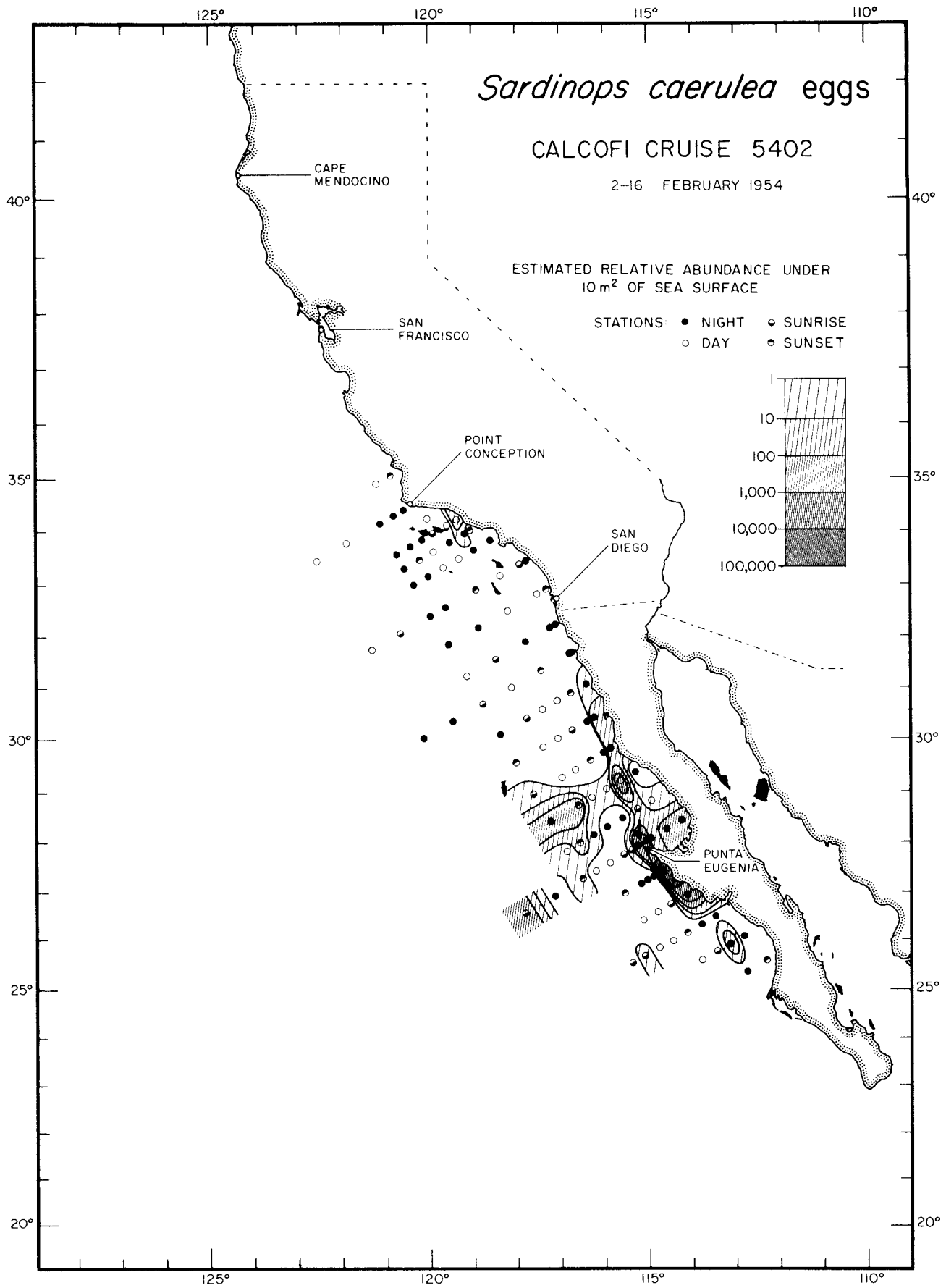
*Sardinops caerulea* eggs

5302



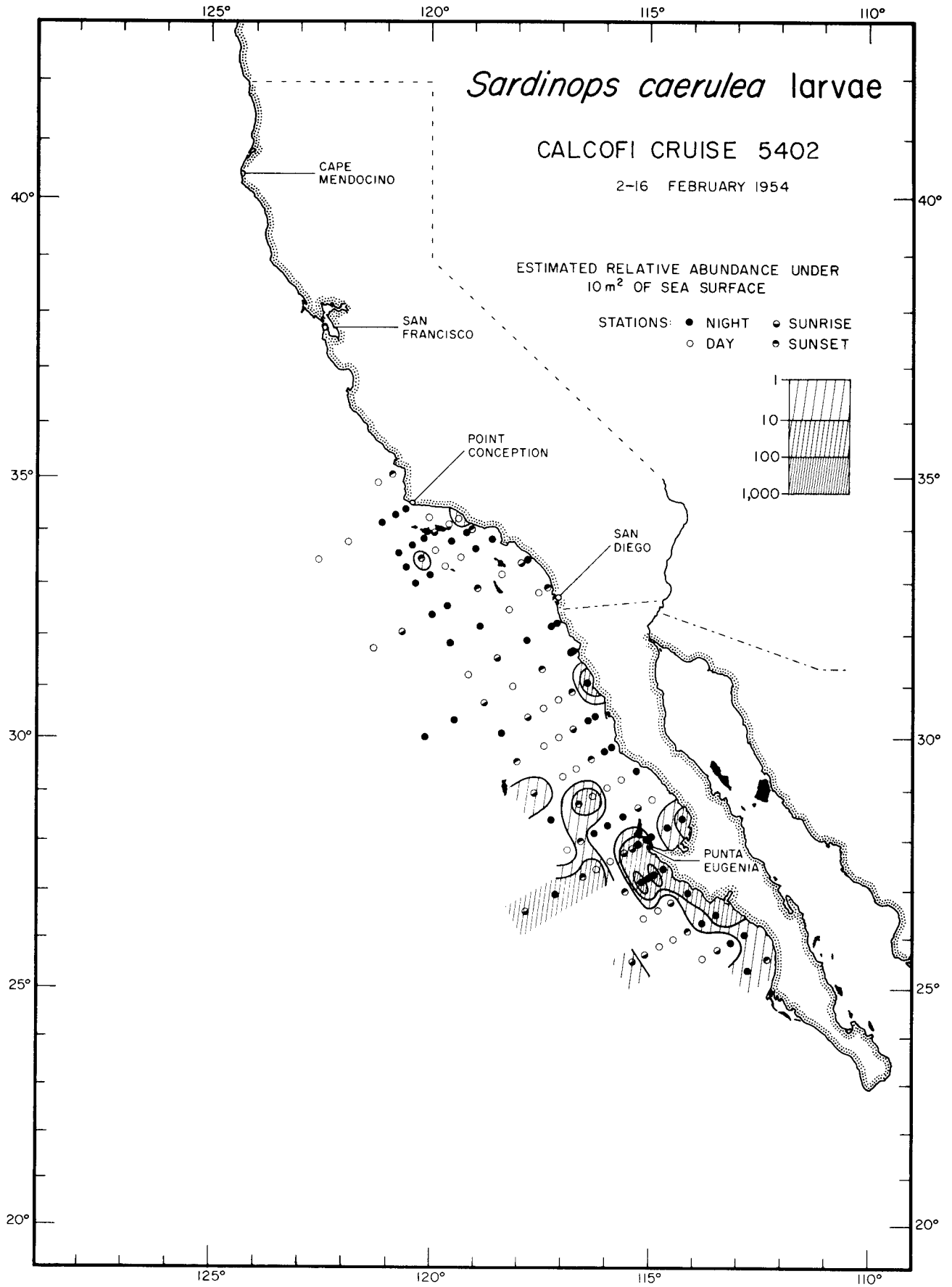
*Sardinops caerulea* larvae

5302



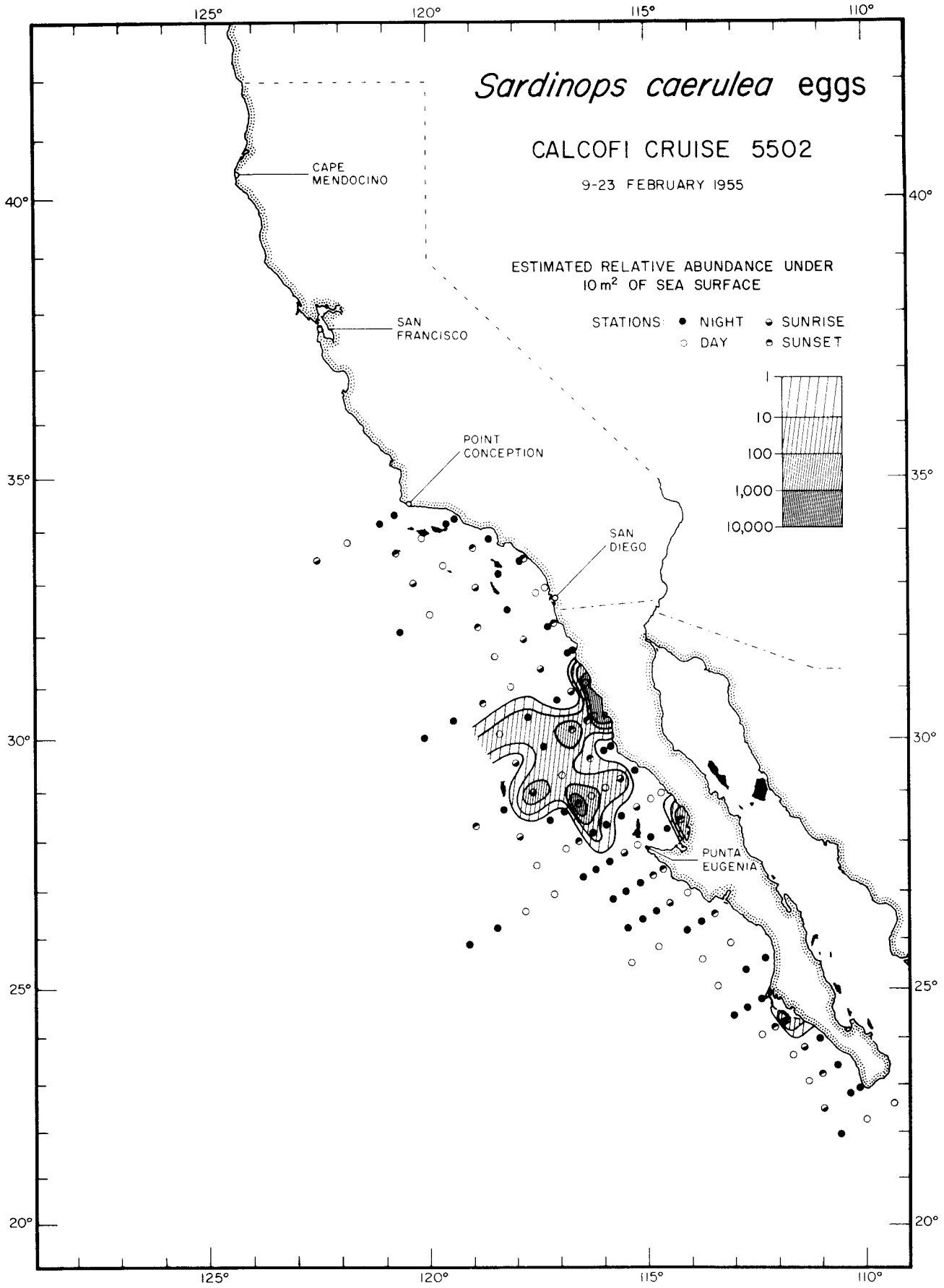
*Sardinops caerulea* eggs

5402



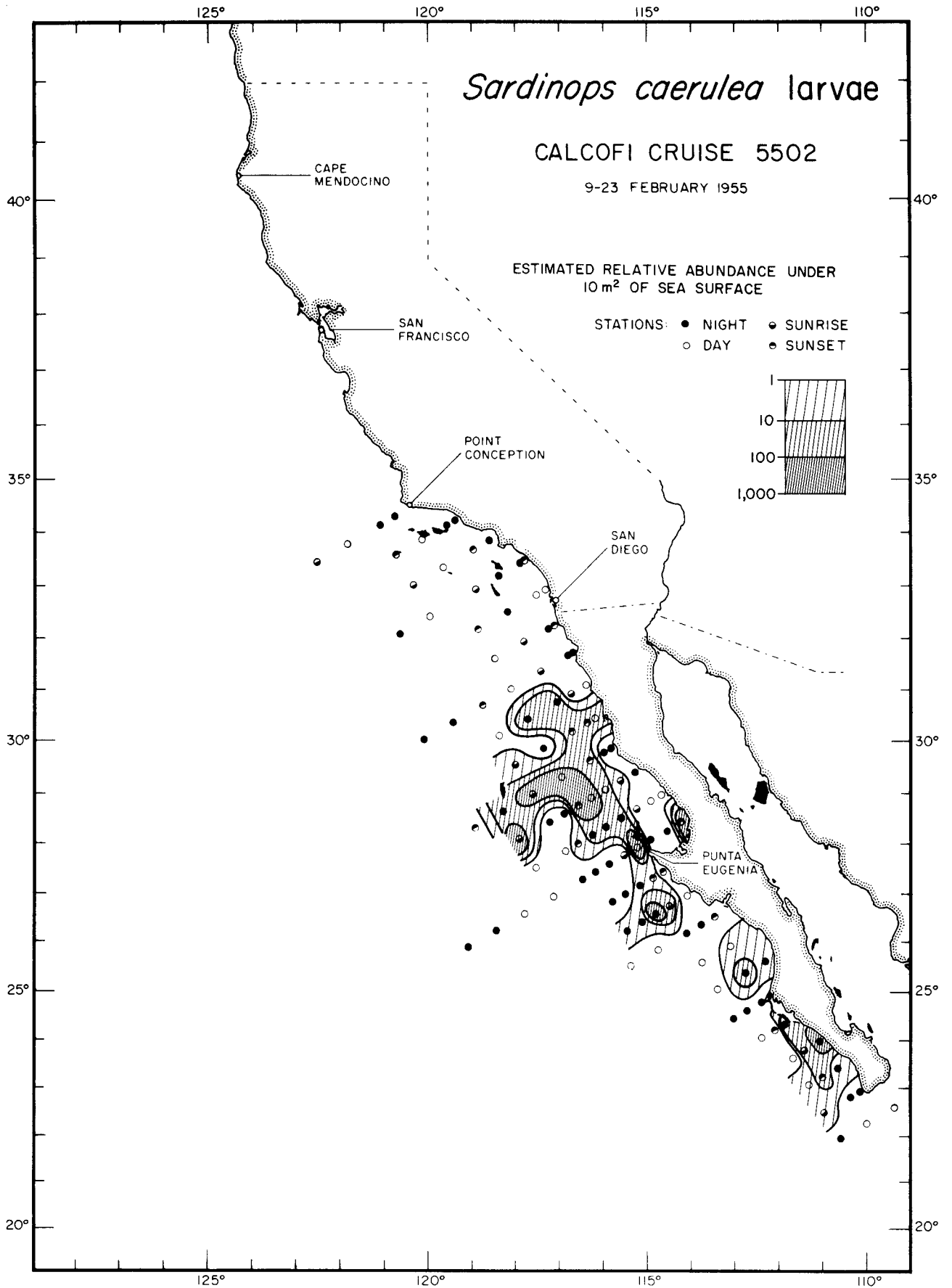
*Sardinops caerulea* larvae

5402



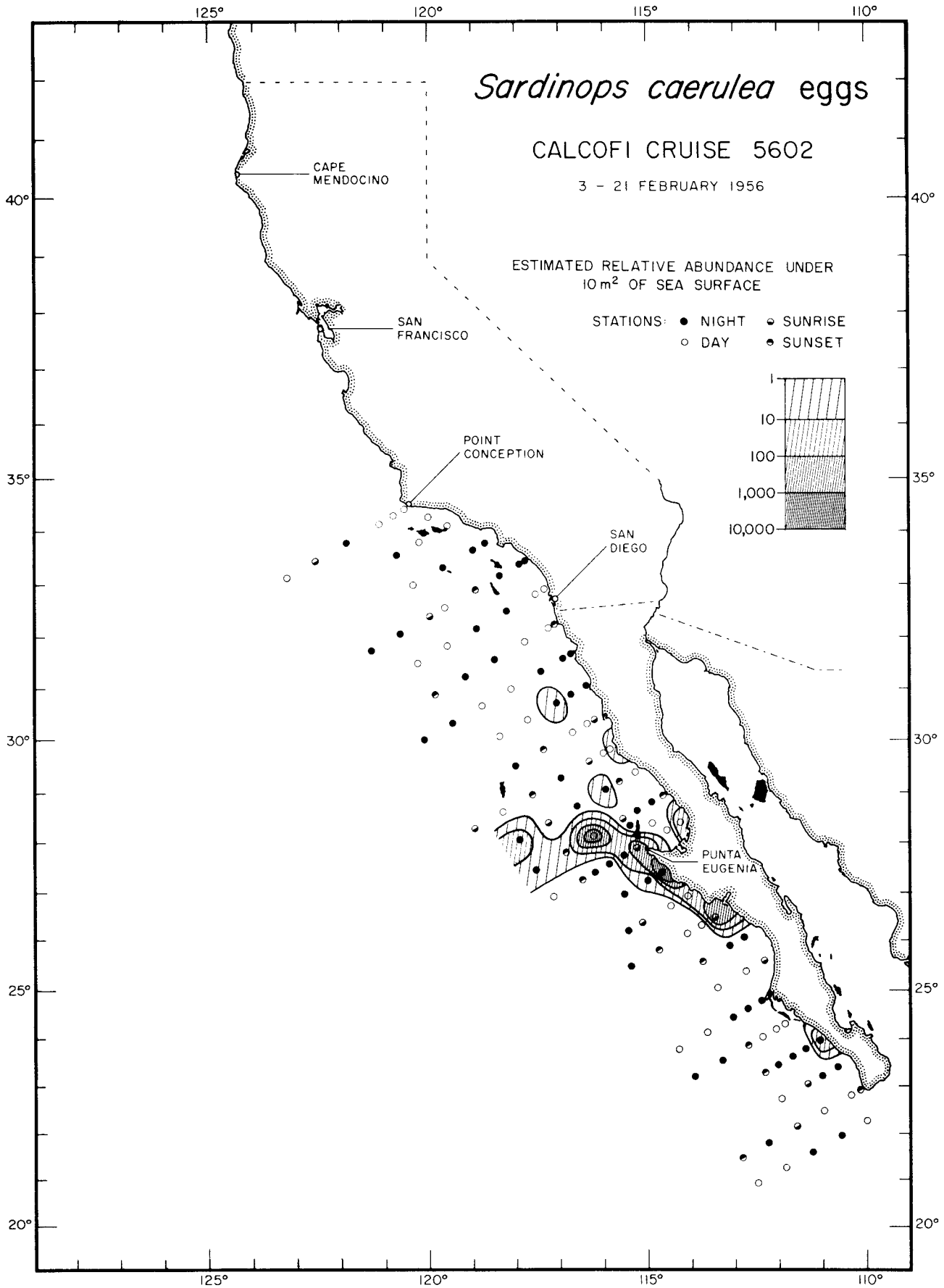
*Sardinops caerulea* eggs

5502



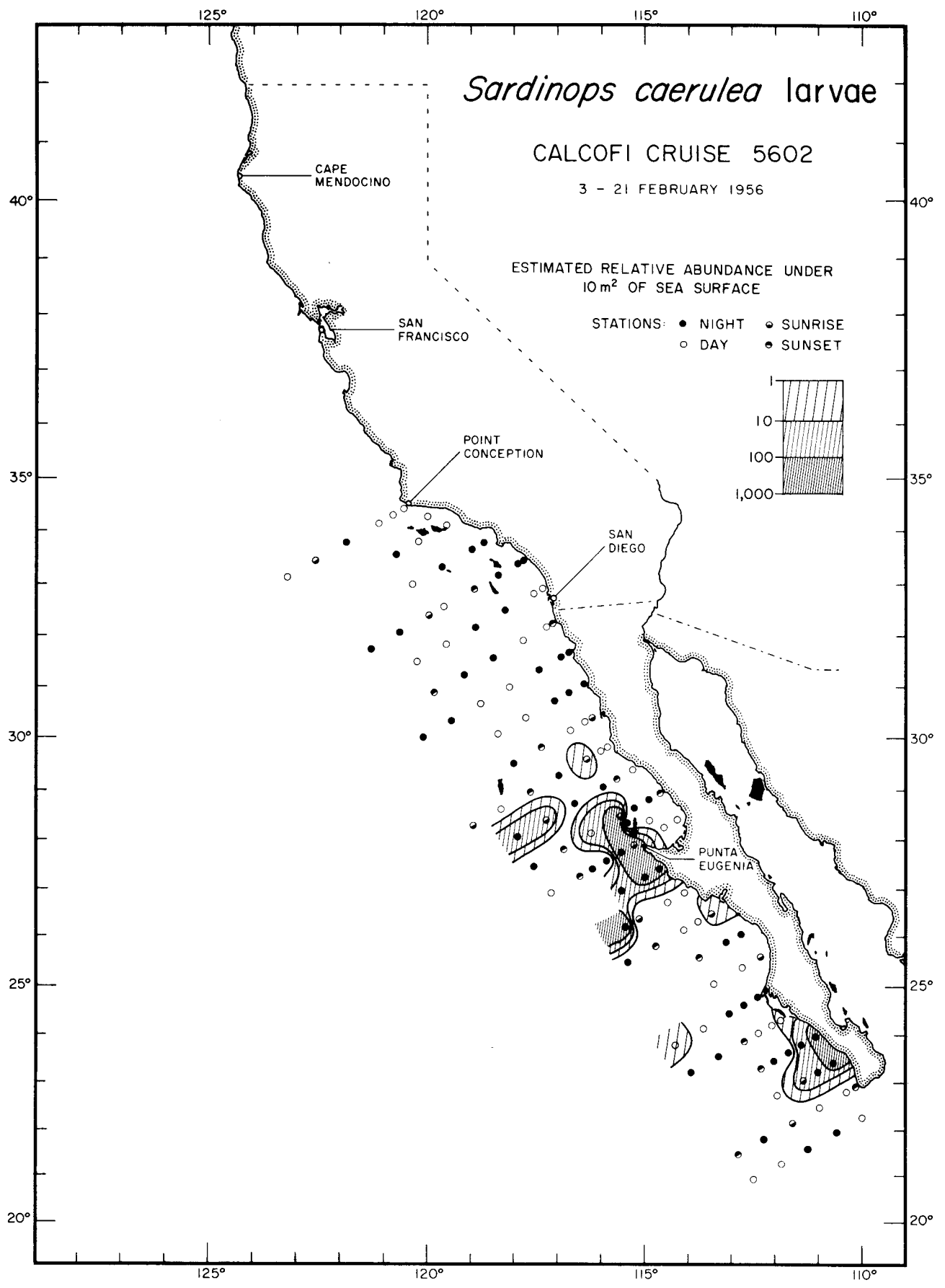
*Sardinops caerulea* larvae

5502



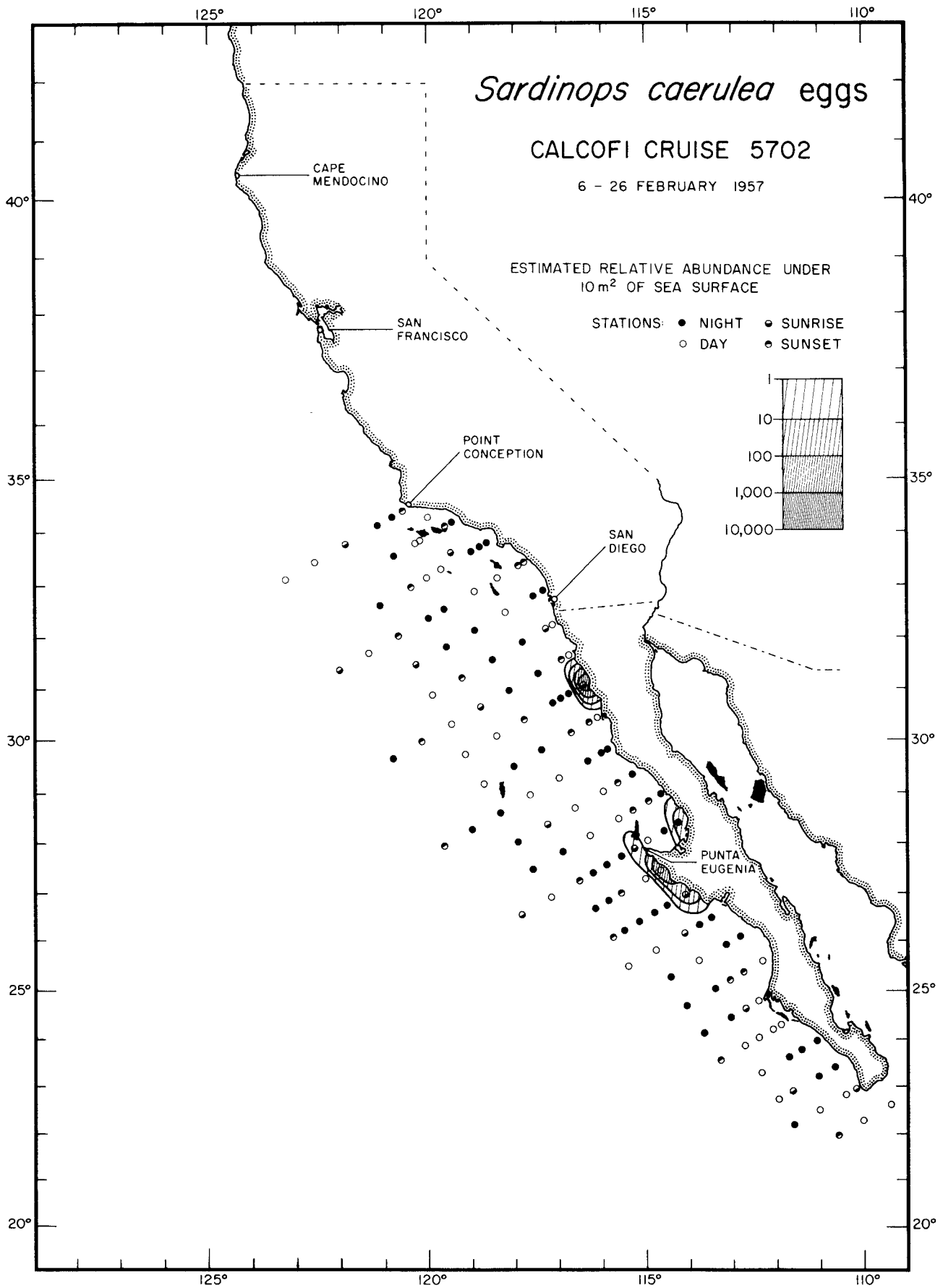
*Sardinops caerulea* eggs

5602



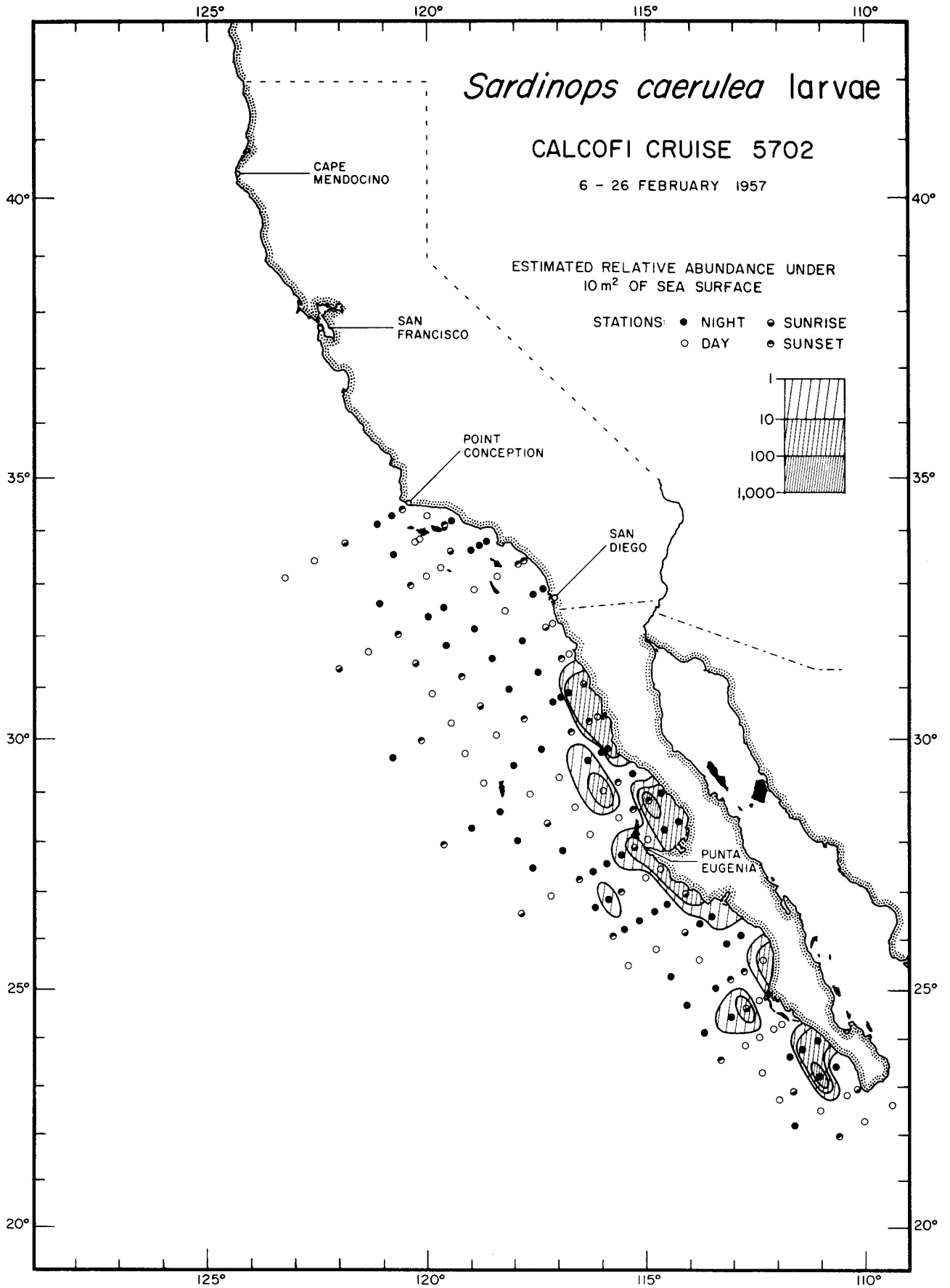
*Sardinops caerulea* larvae  
5602



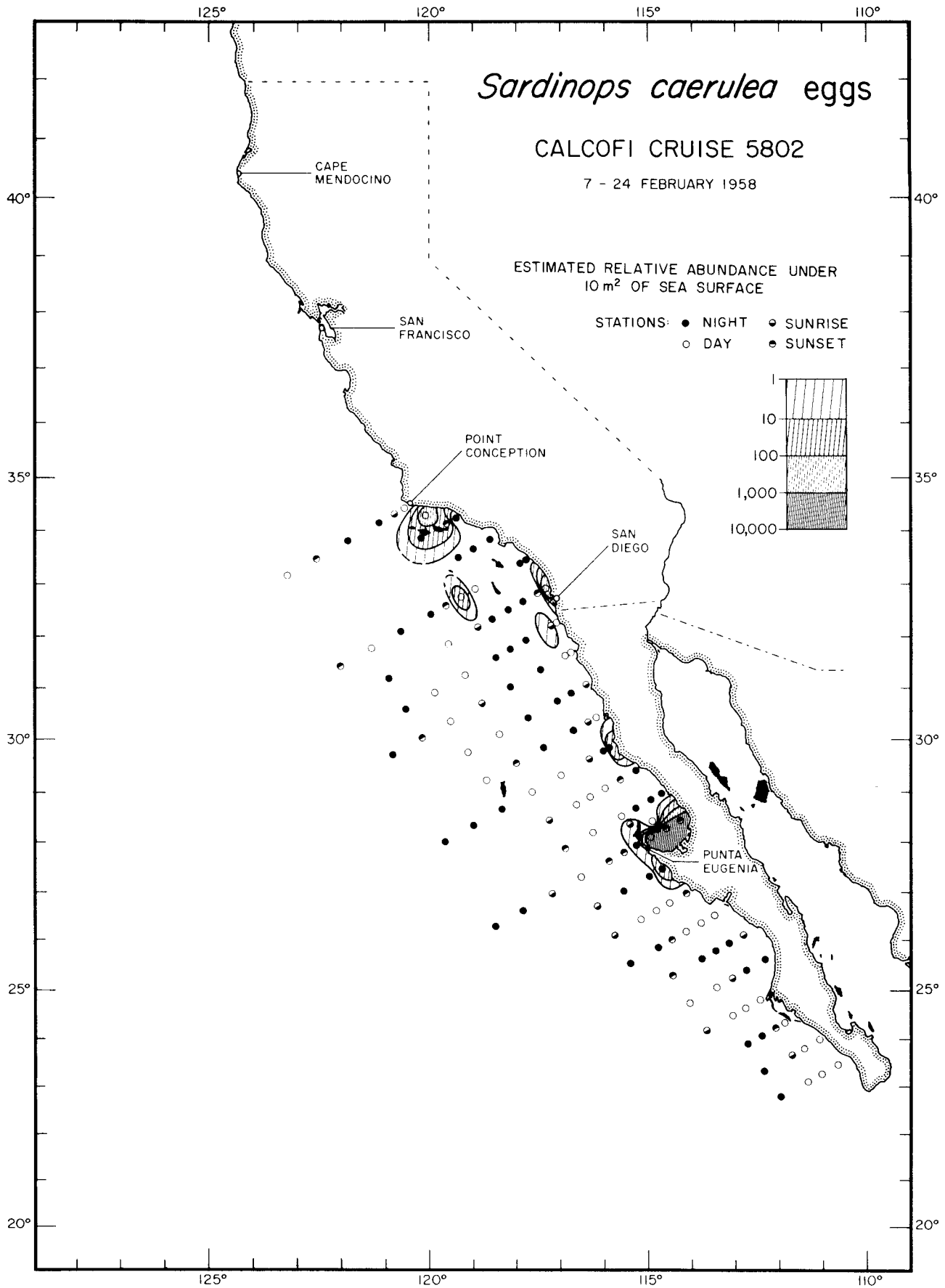


*Sardinops caerulea* eggs

5702

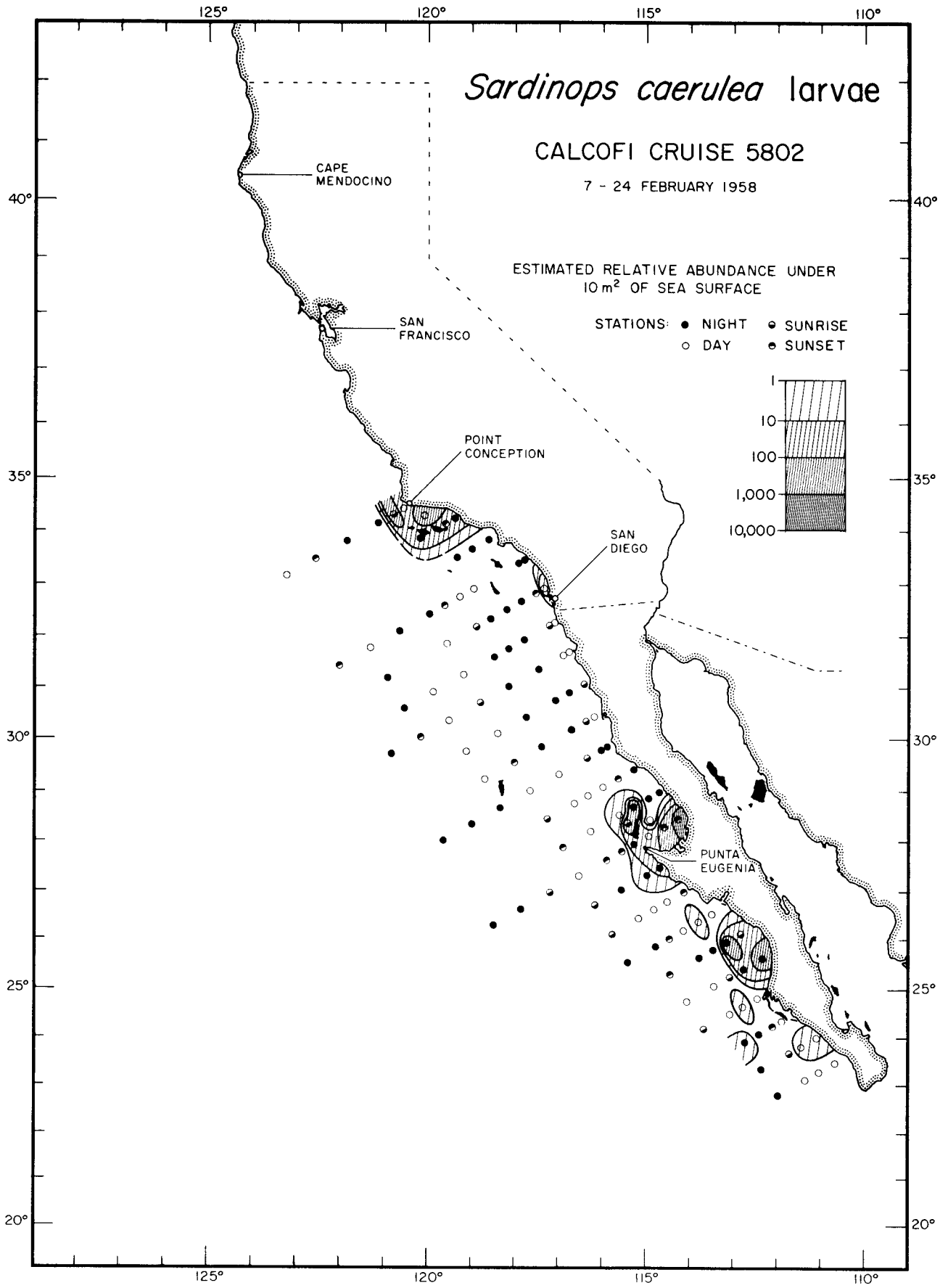


*Sardinops caerulea* larvae  
5702

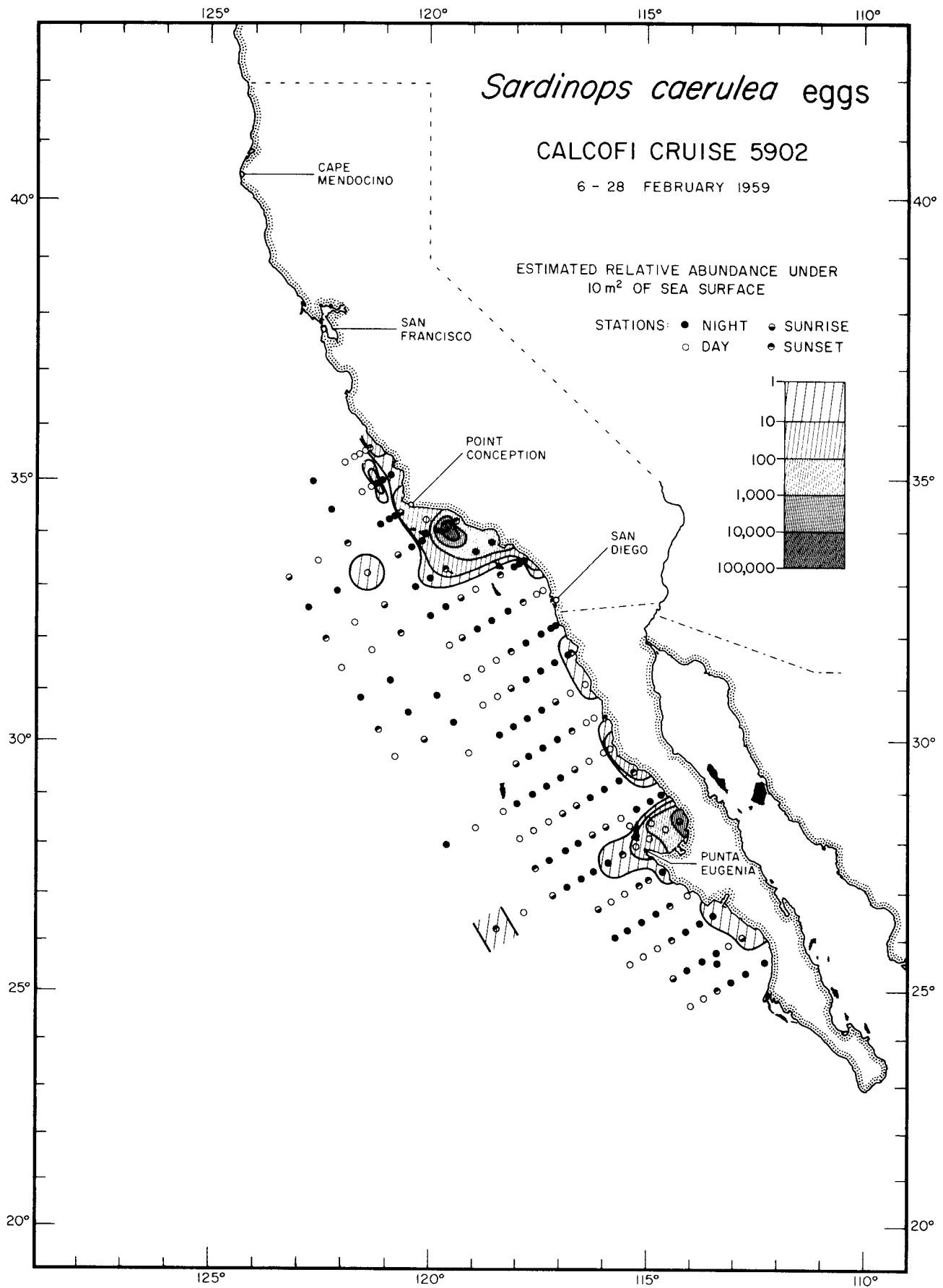


*Sardinops caerulea* eggs

5802

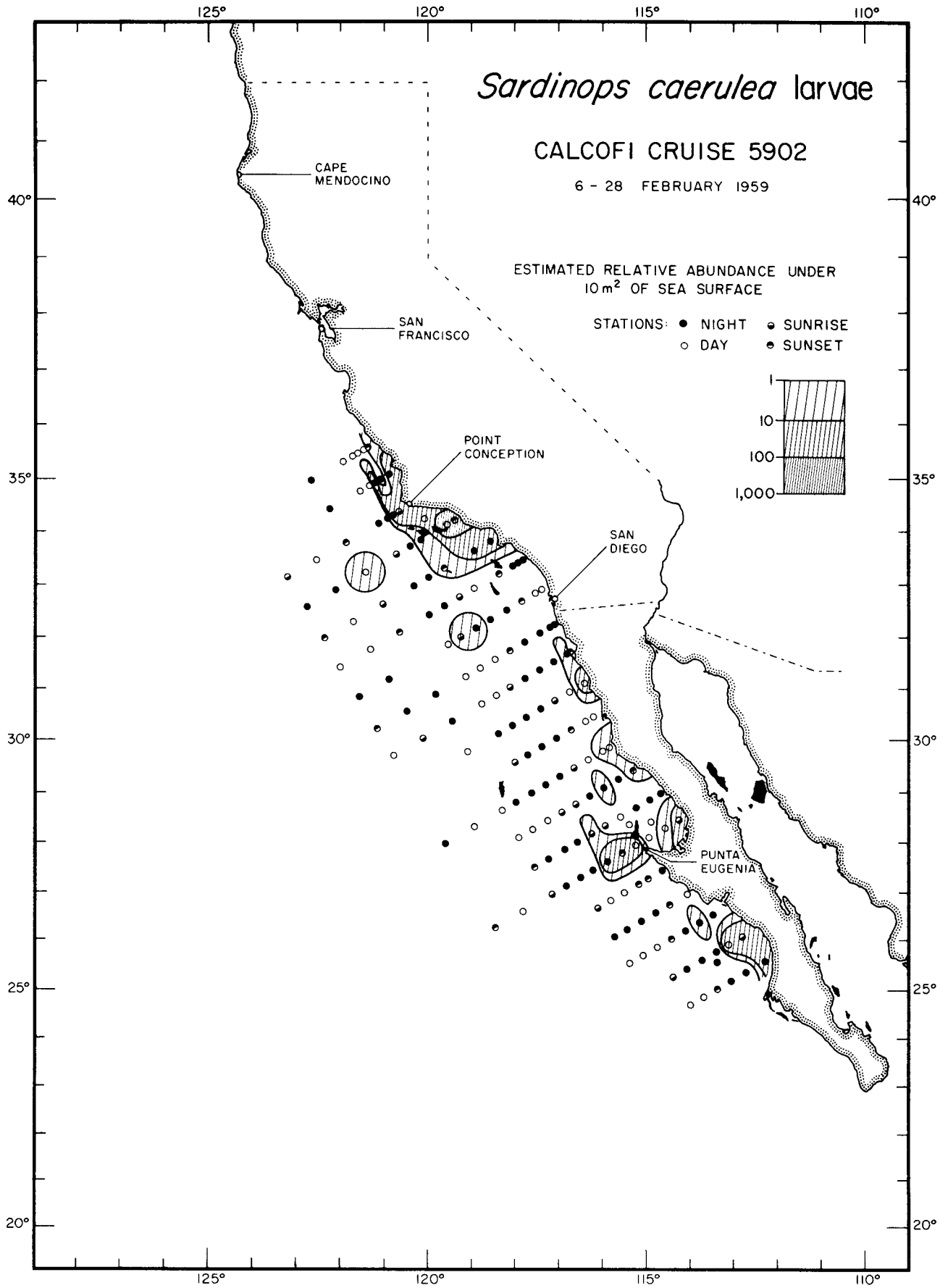


*Sardinops caerulea* larvae  
5802



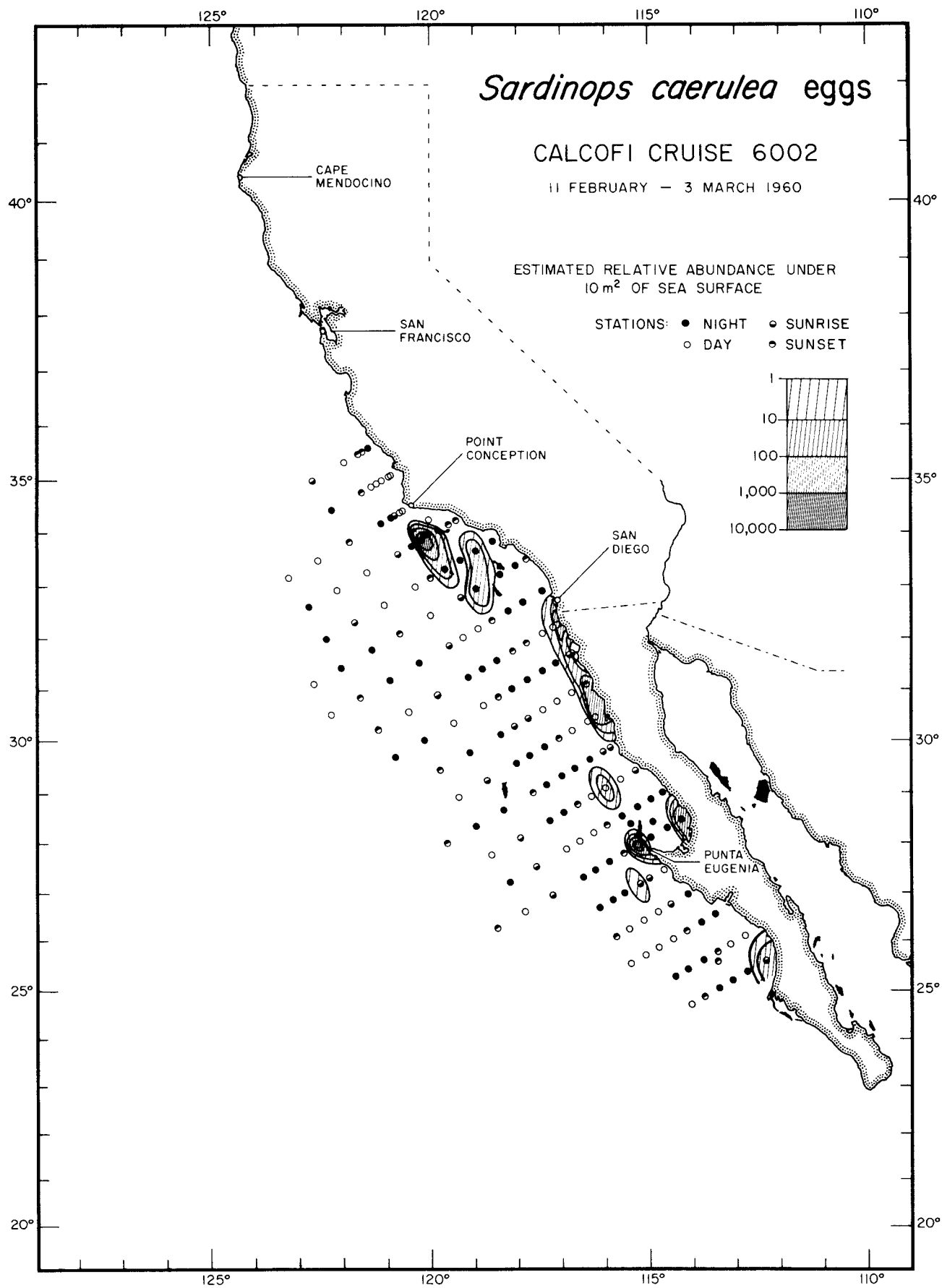
*Sardinops caerulea* eggs

5902



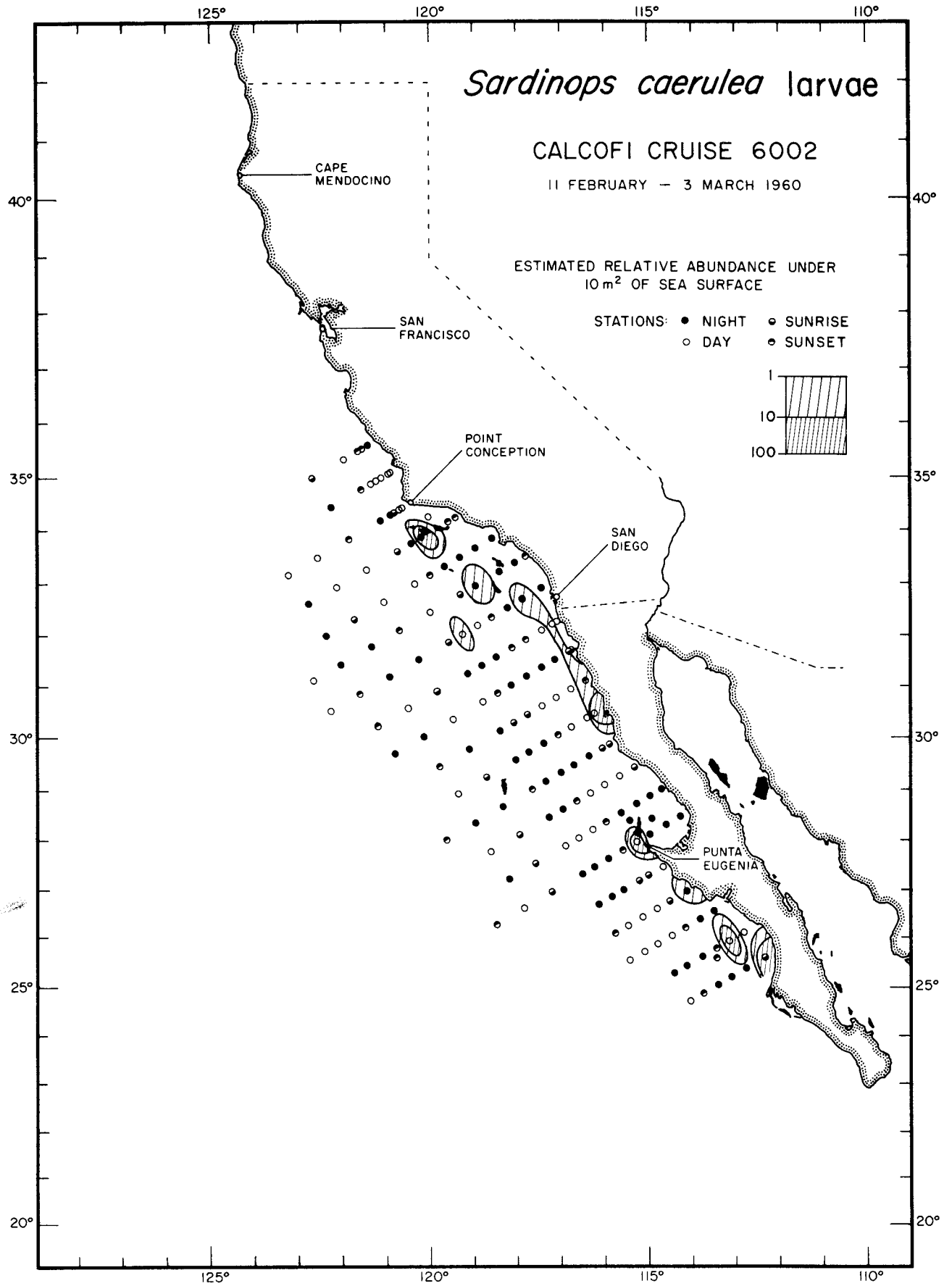
*Sardinops caerulea* larvae

5902



*Sardinops caerulea* eggs

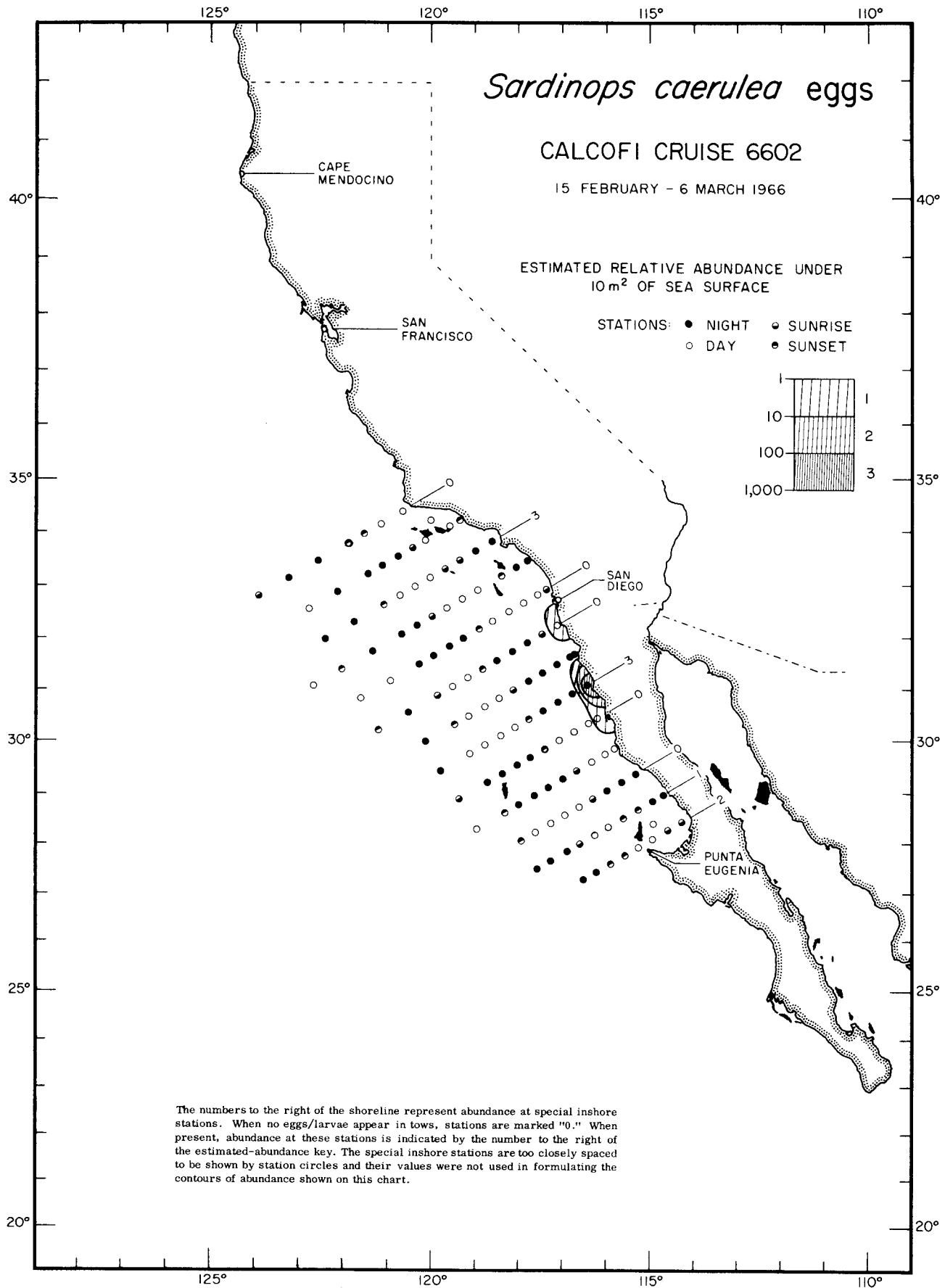
6002



*Sardinops caerulea* larvae

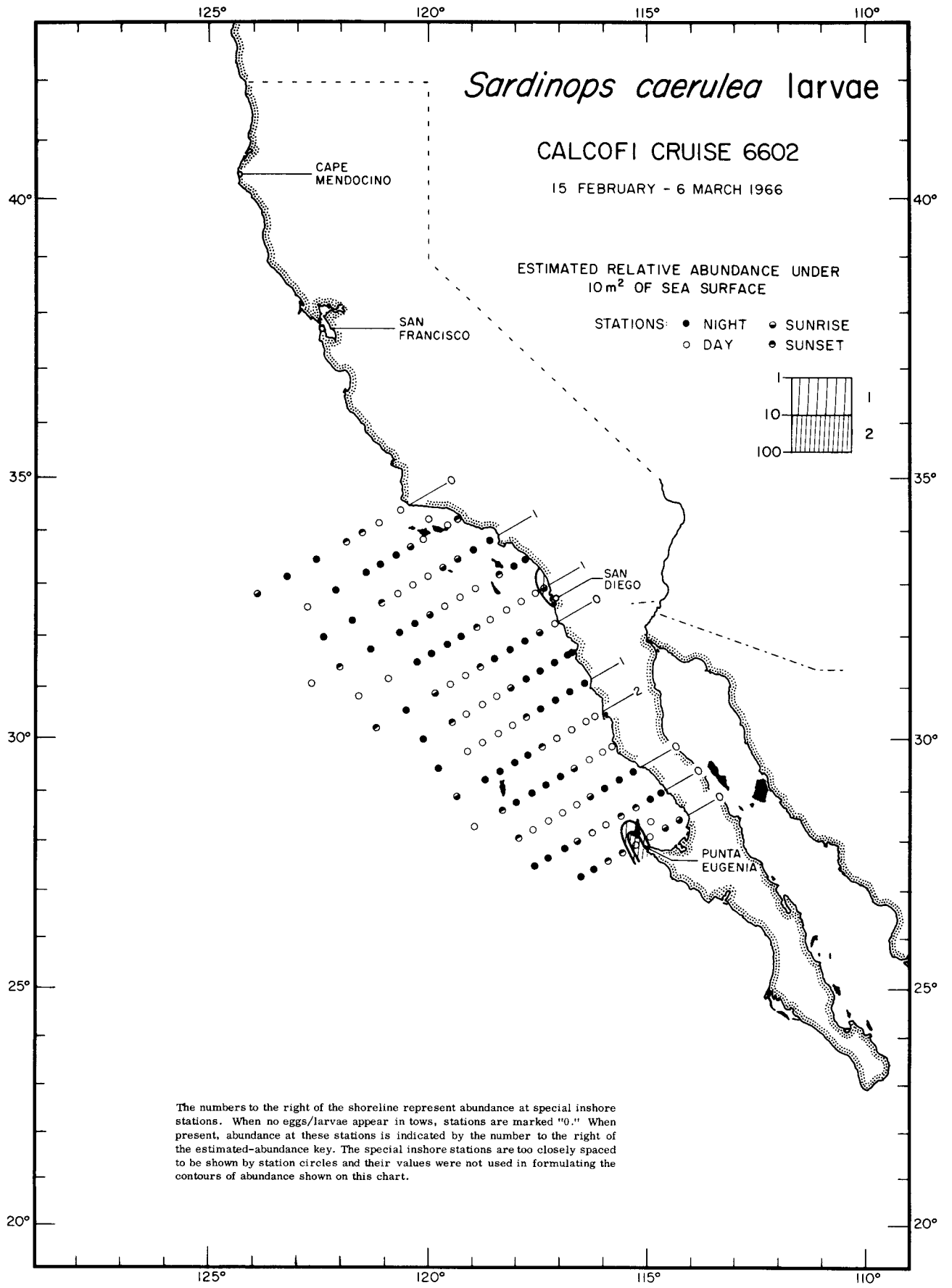
6002





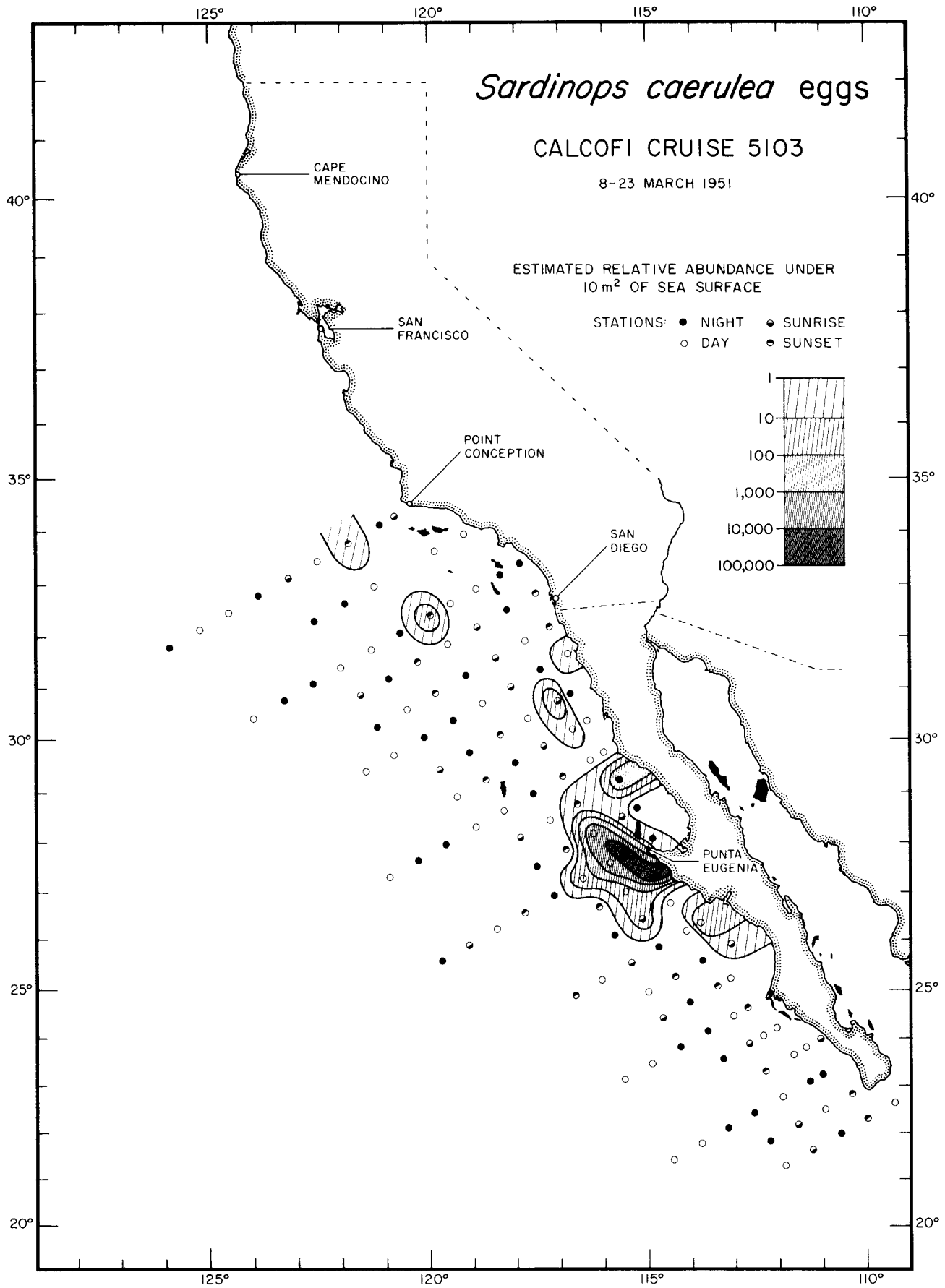
*Sardinops caerulea* eggs

6602



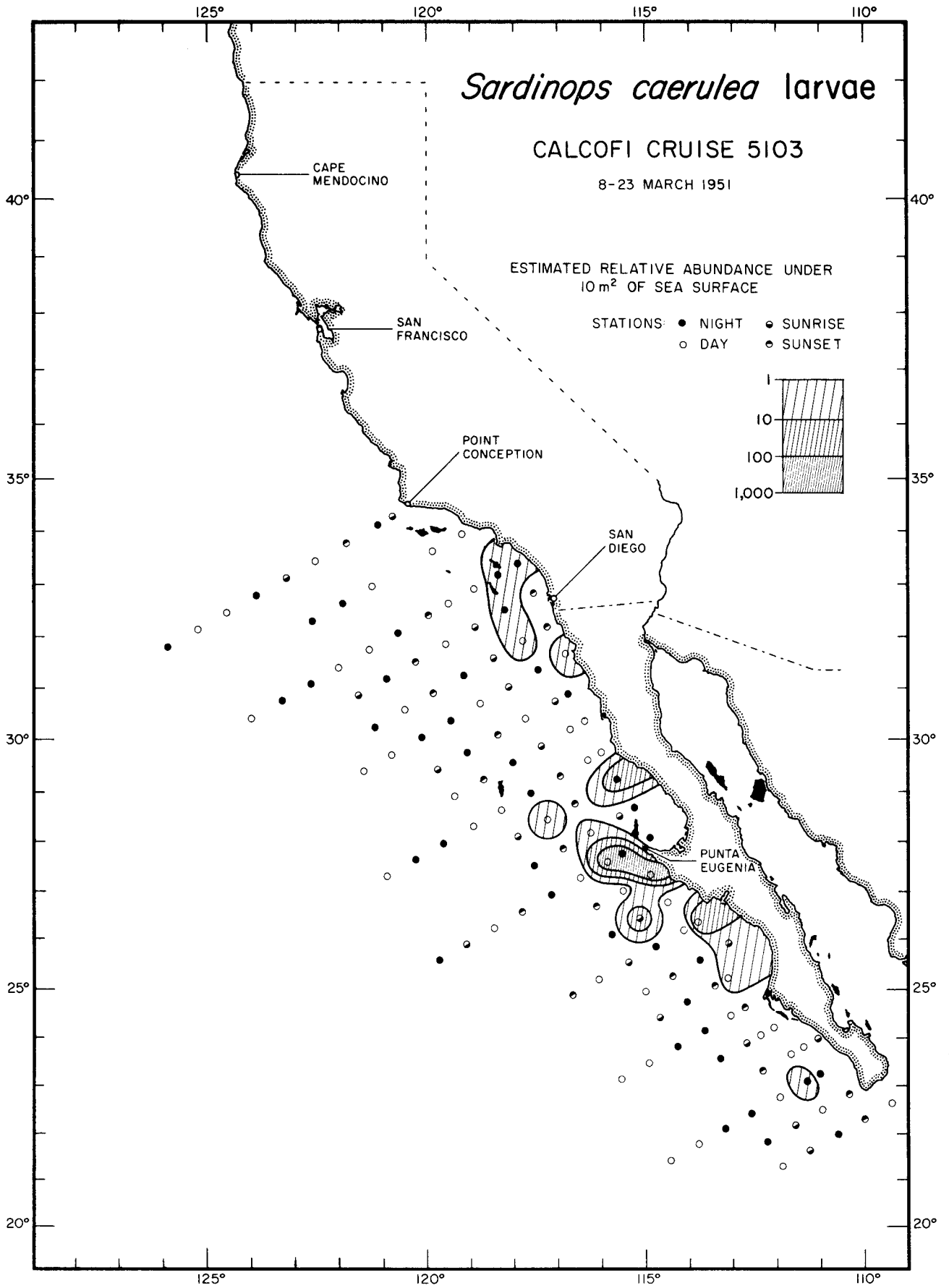
*Sardinops caerulea* larvae

6602



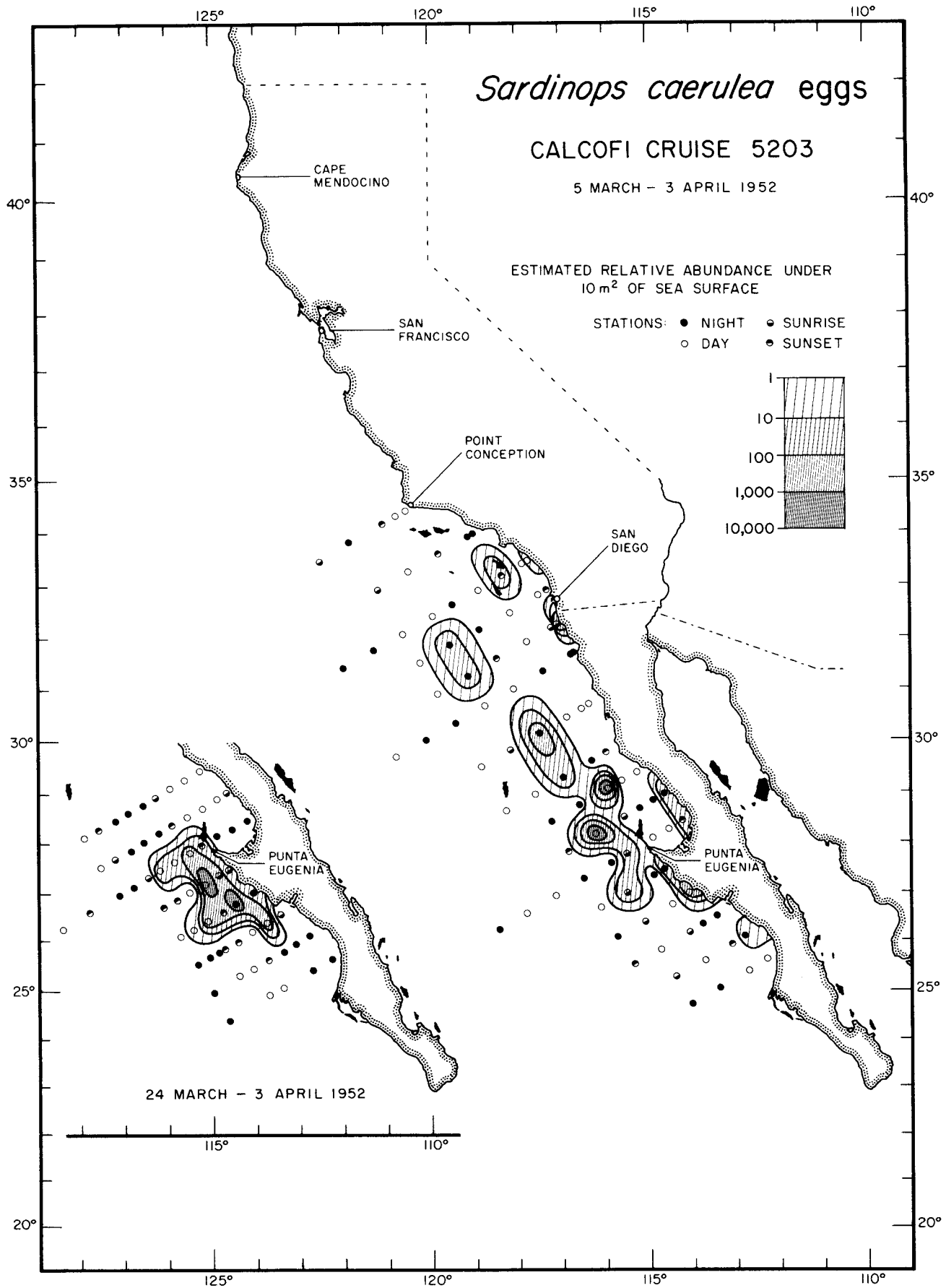
*Sardinops caerulea* eggs

5103



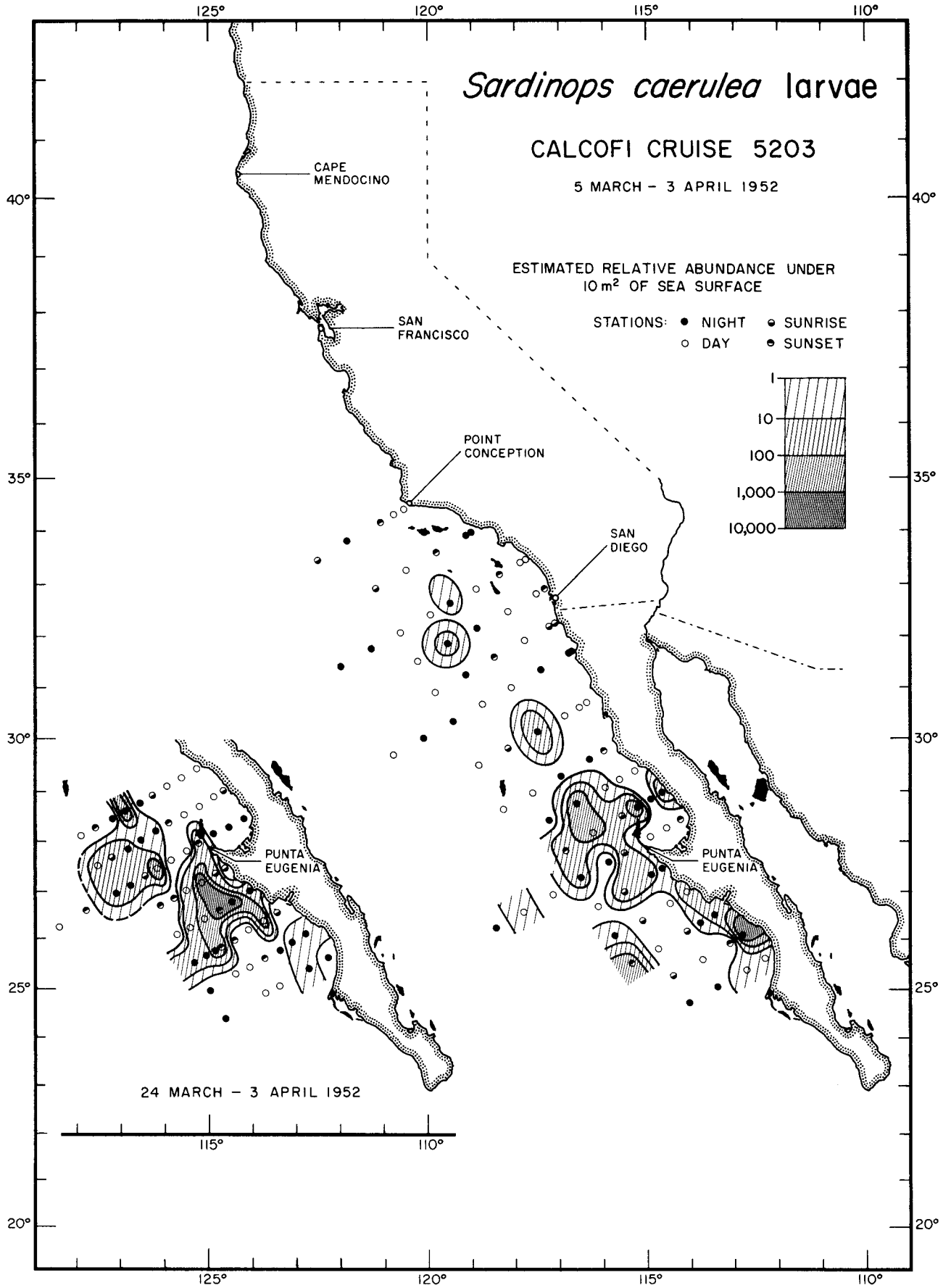
*Sardinops caerulea* larvae

5103



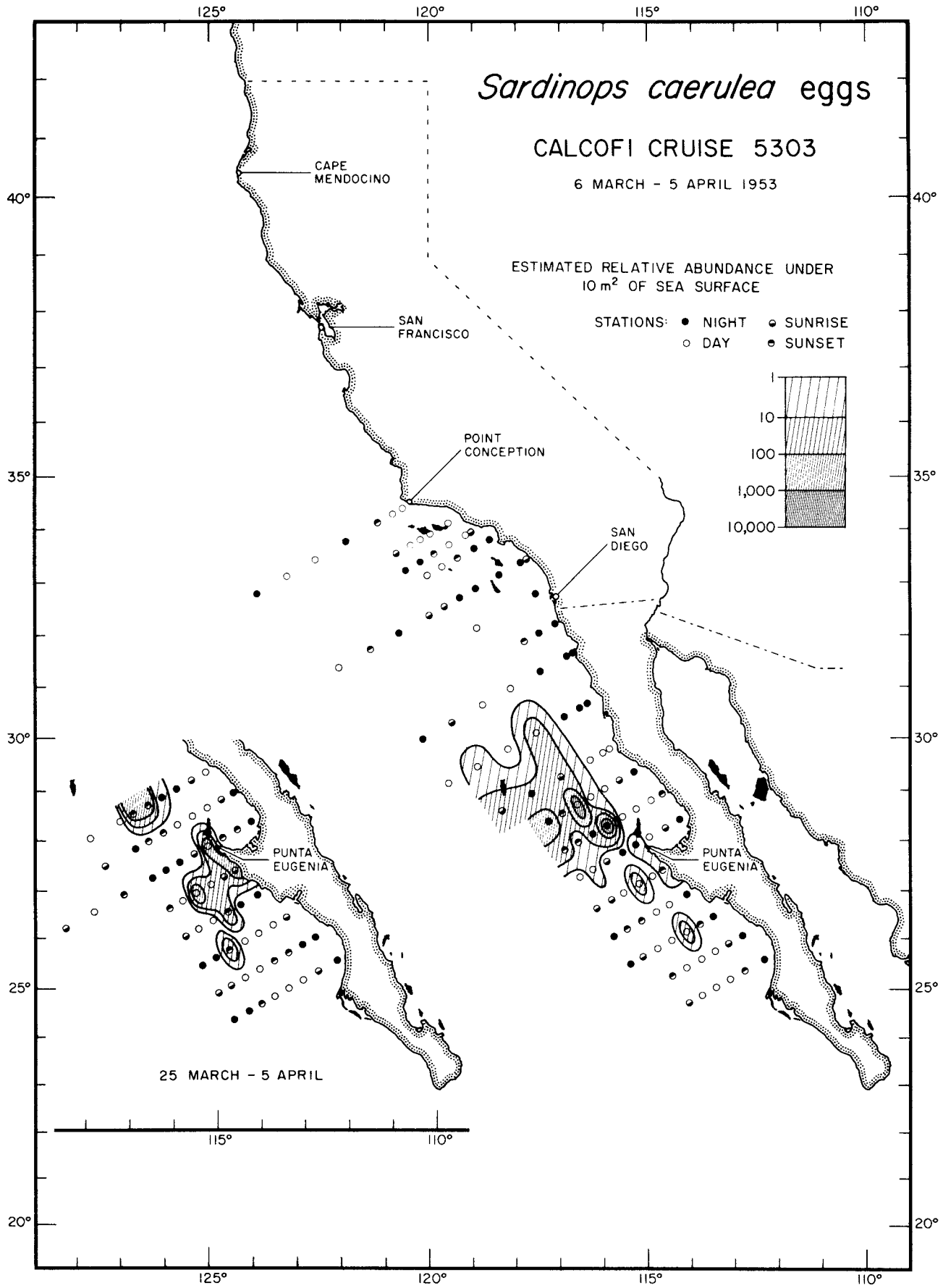
*Sardinops caerulea* eggs

5203



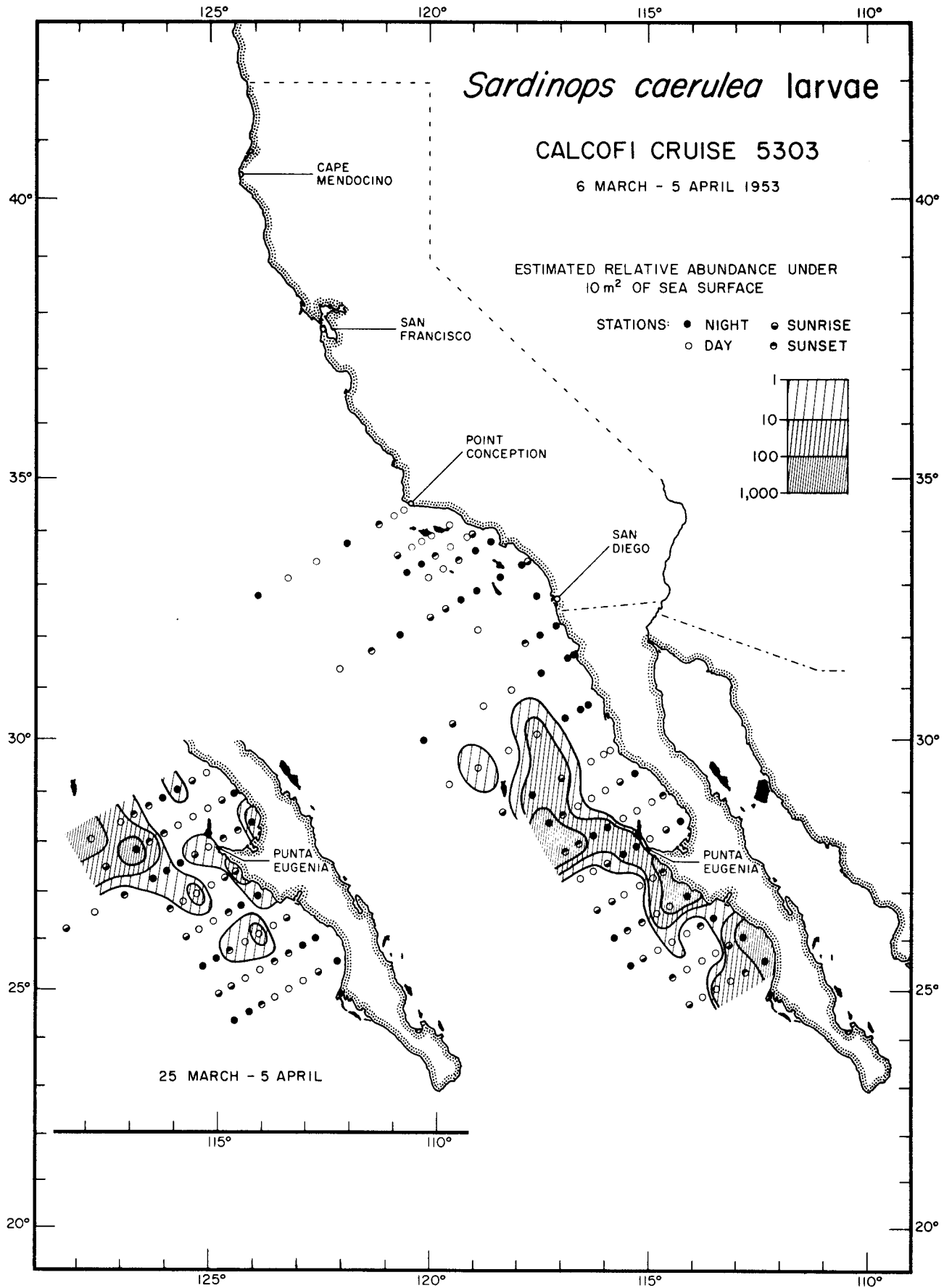
*Sardinops caerulea* larvae

5203



*Sardinops caerulea* eggs

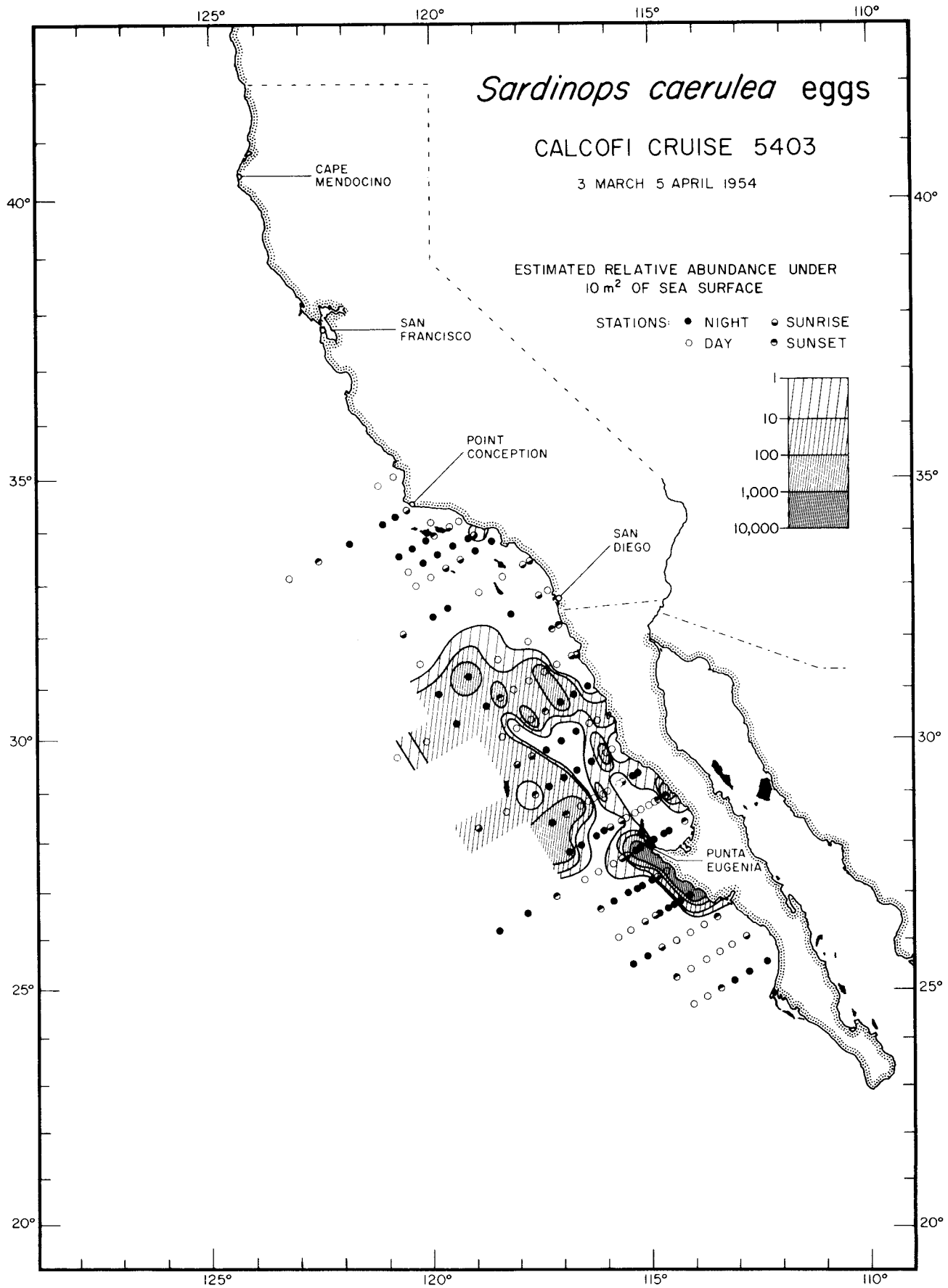
5303



*Sardinops caerulea* larvae

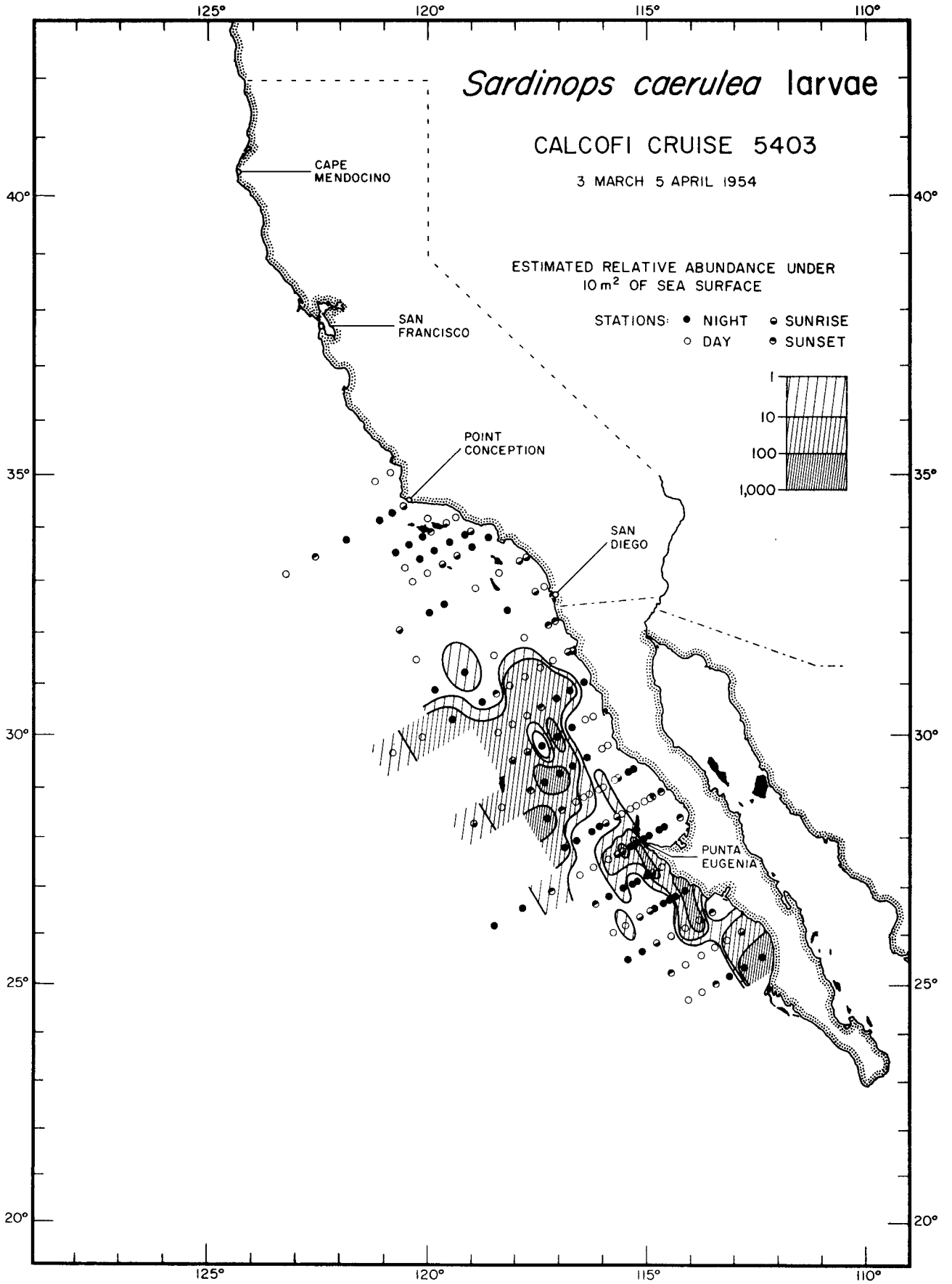
5303





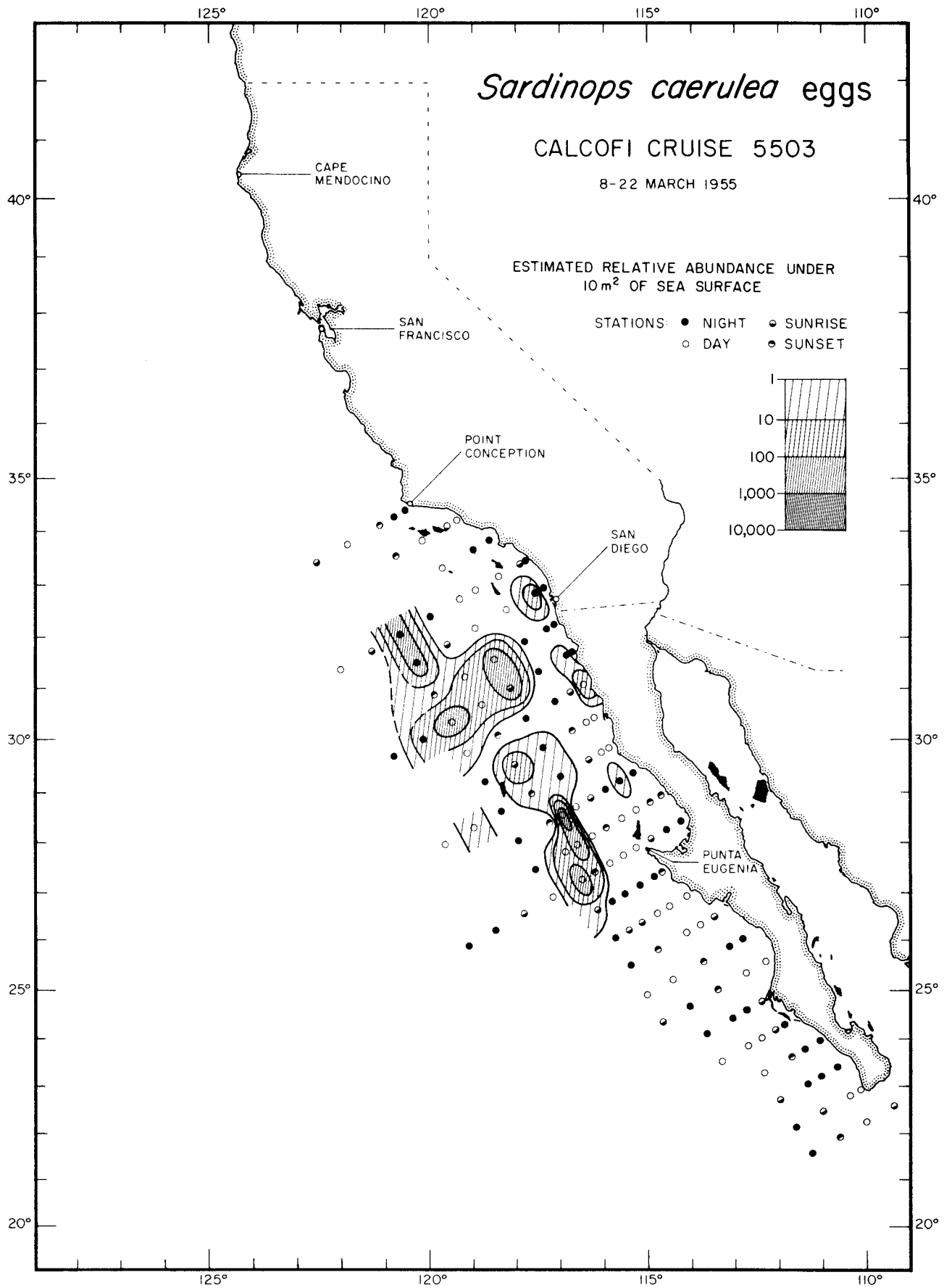
*Sardinops caerulea* eggs

5403



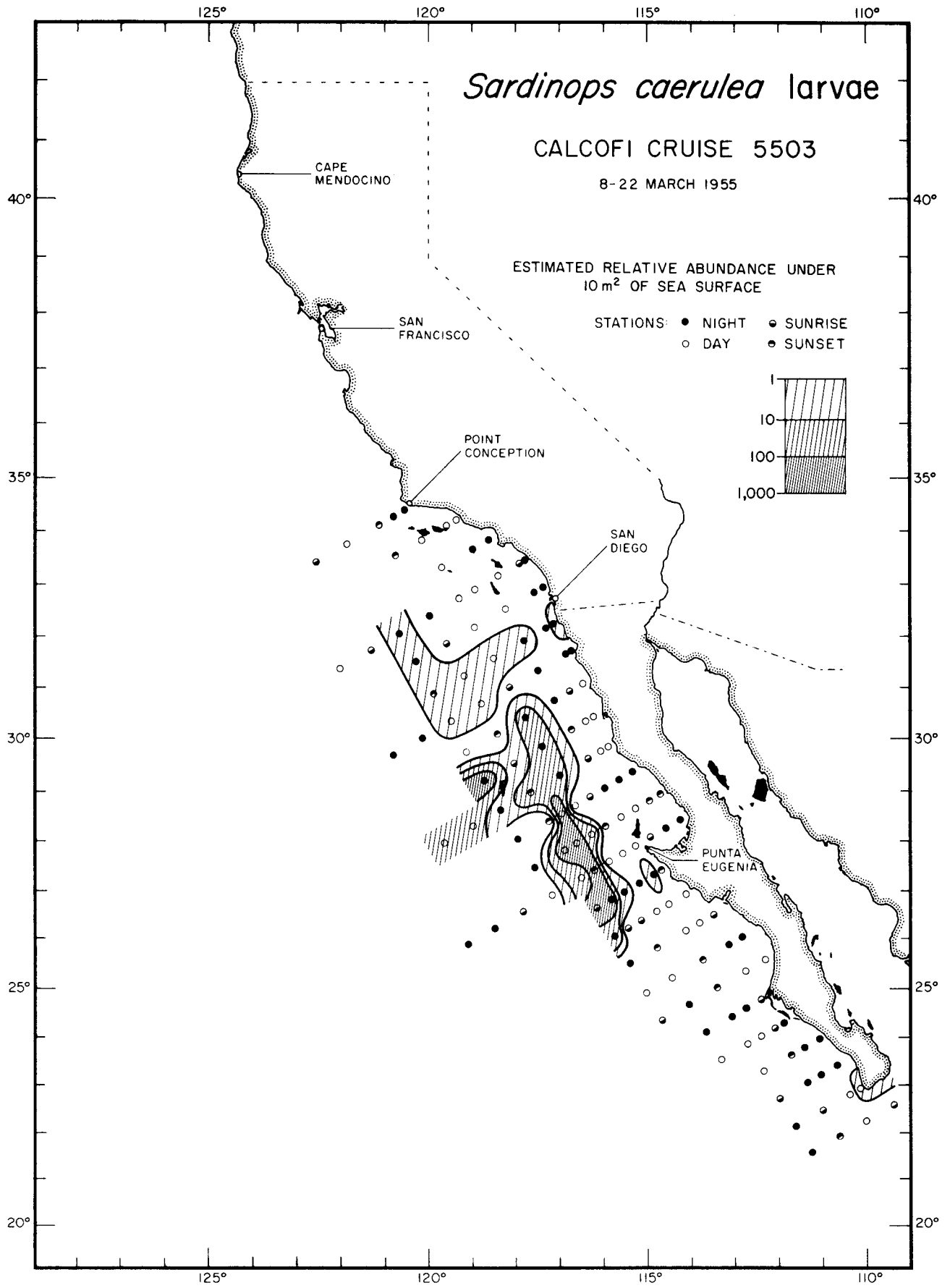
*Sardinops caerulea* larvae

5403



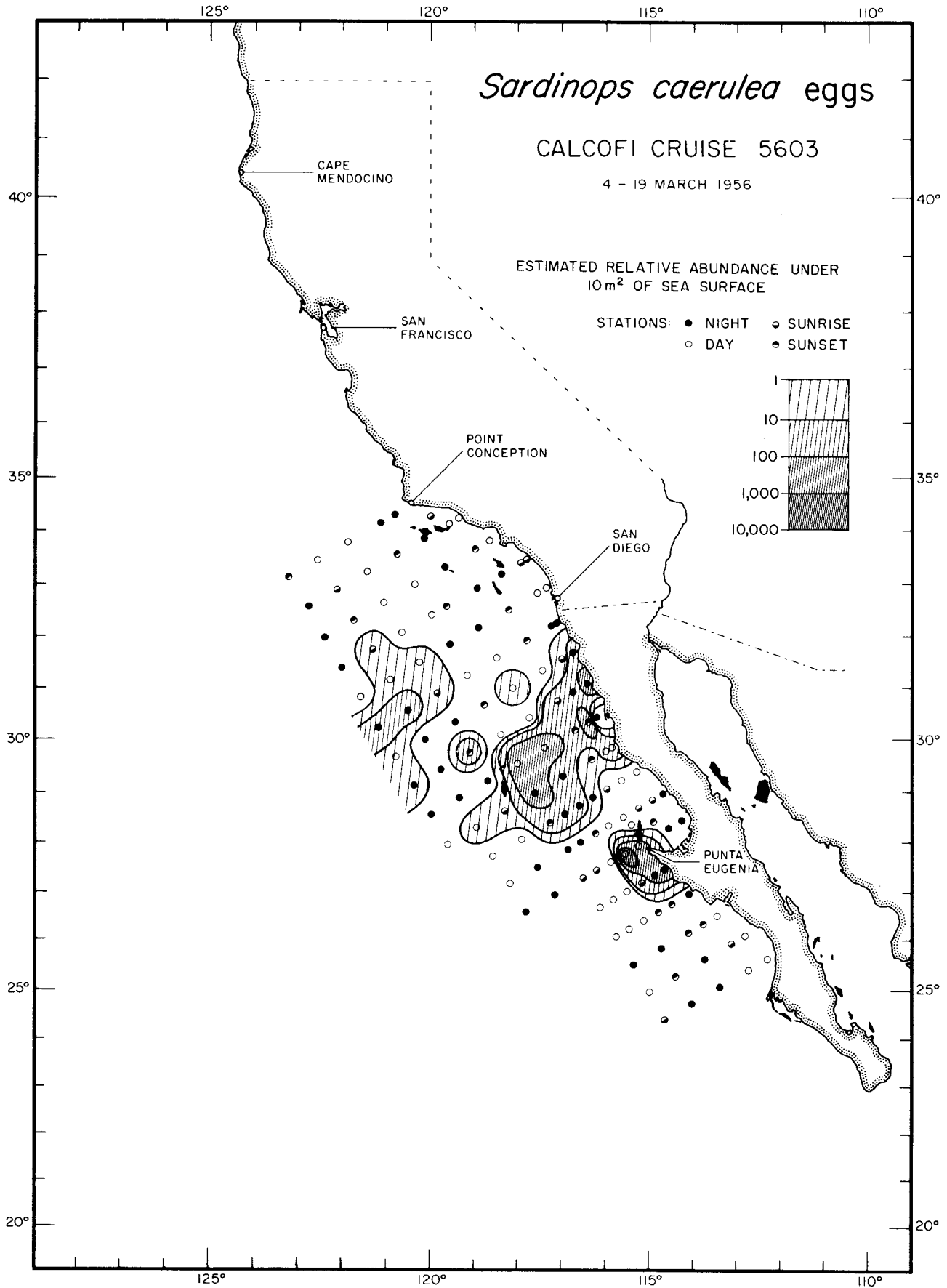
*Sardinops caerulea* eggs

5503



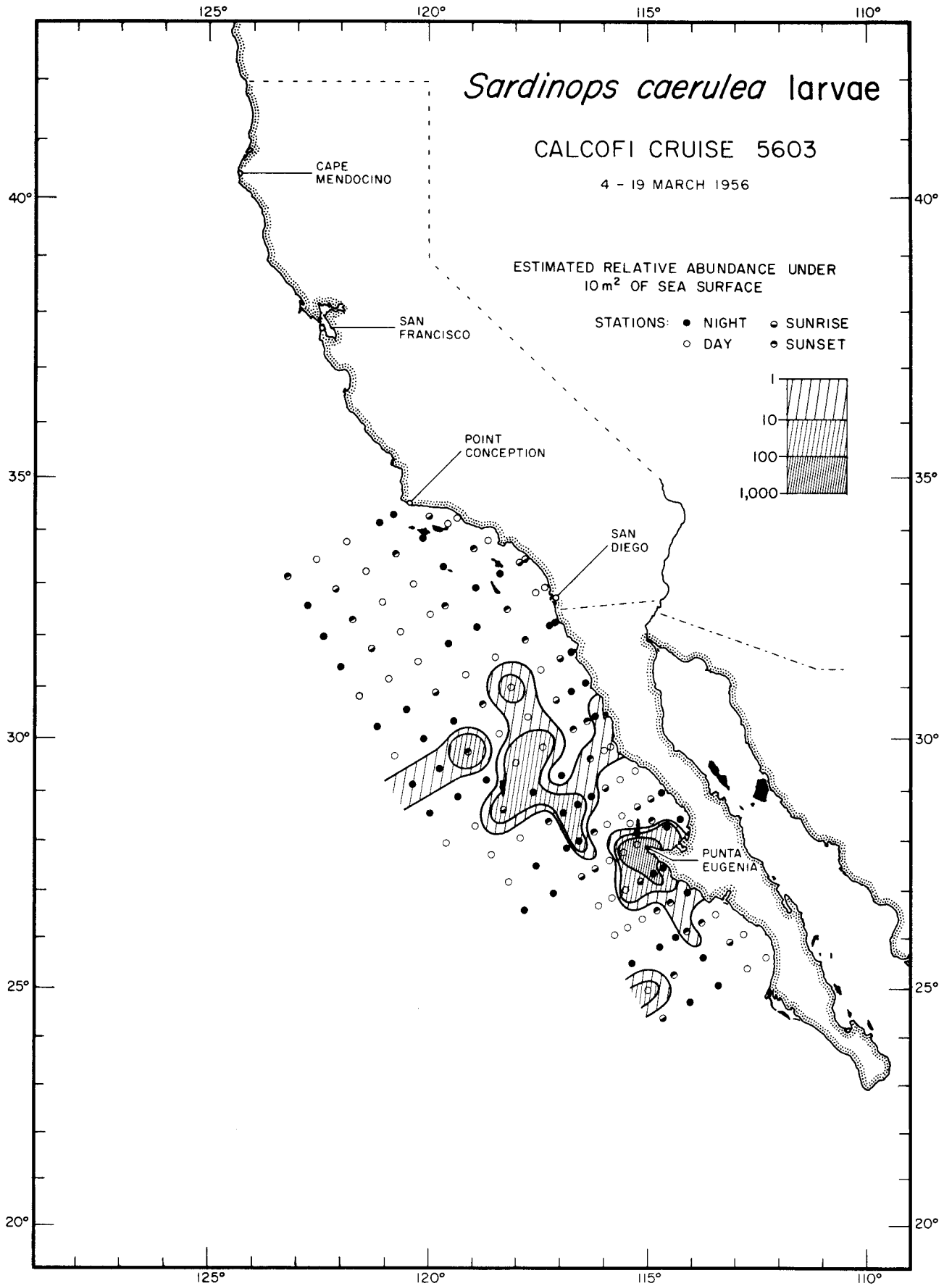
*Sardinops caerulea* larvae

5503



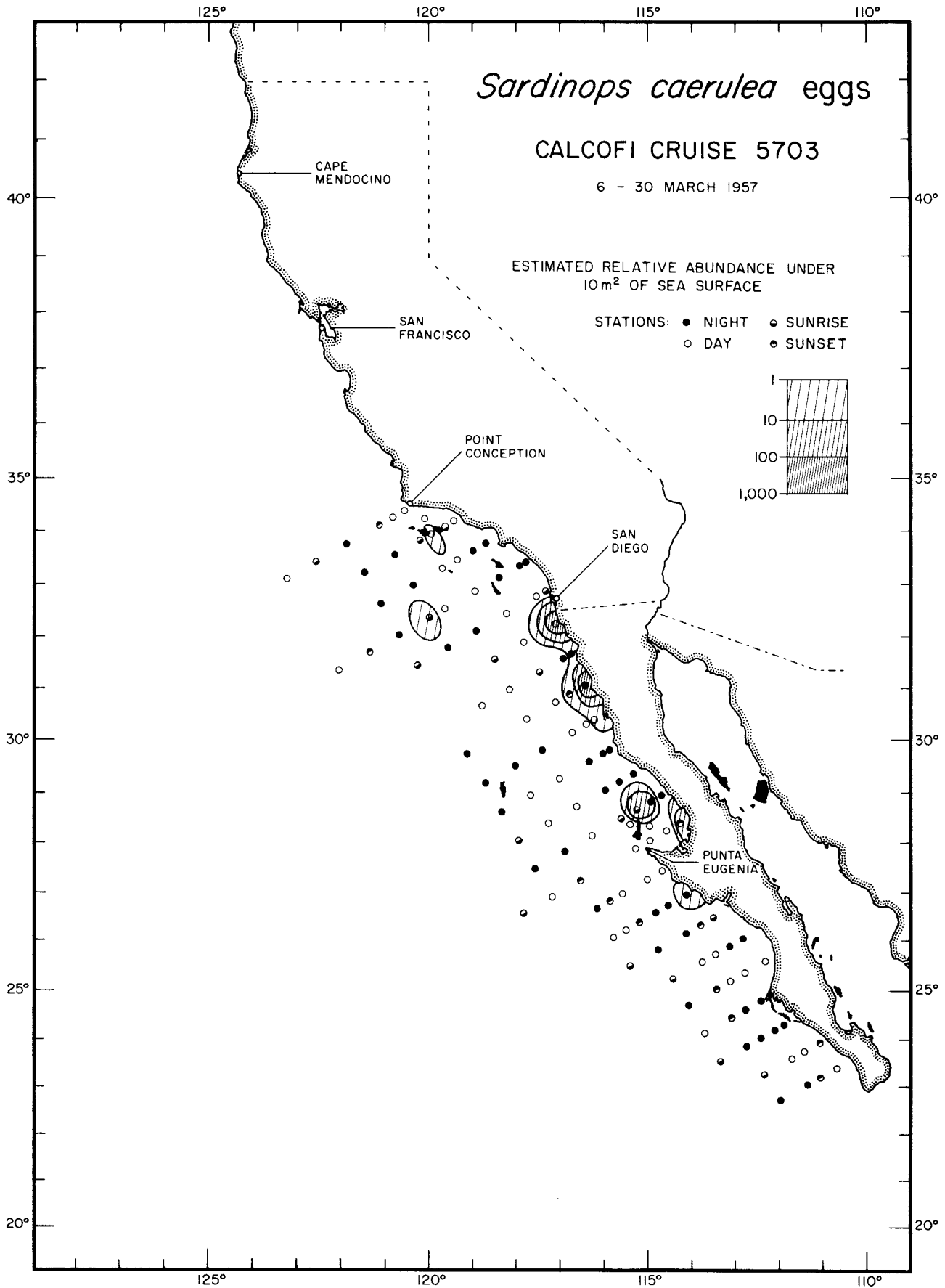
*Sardinops caerulea* eggs

5603



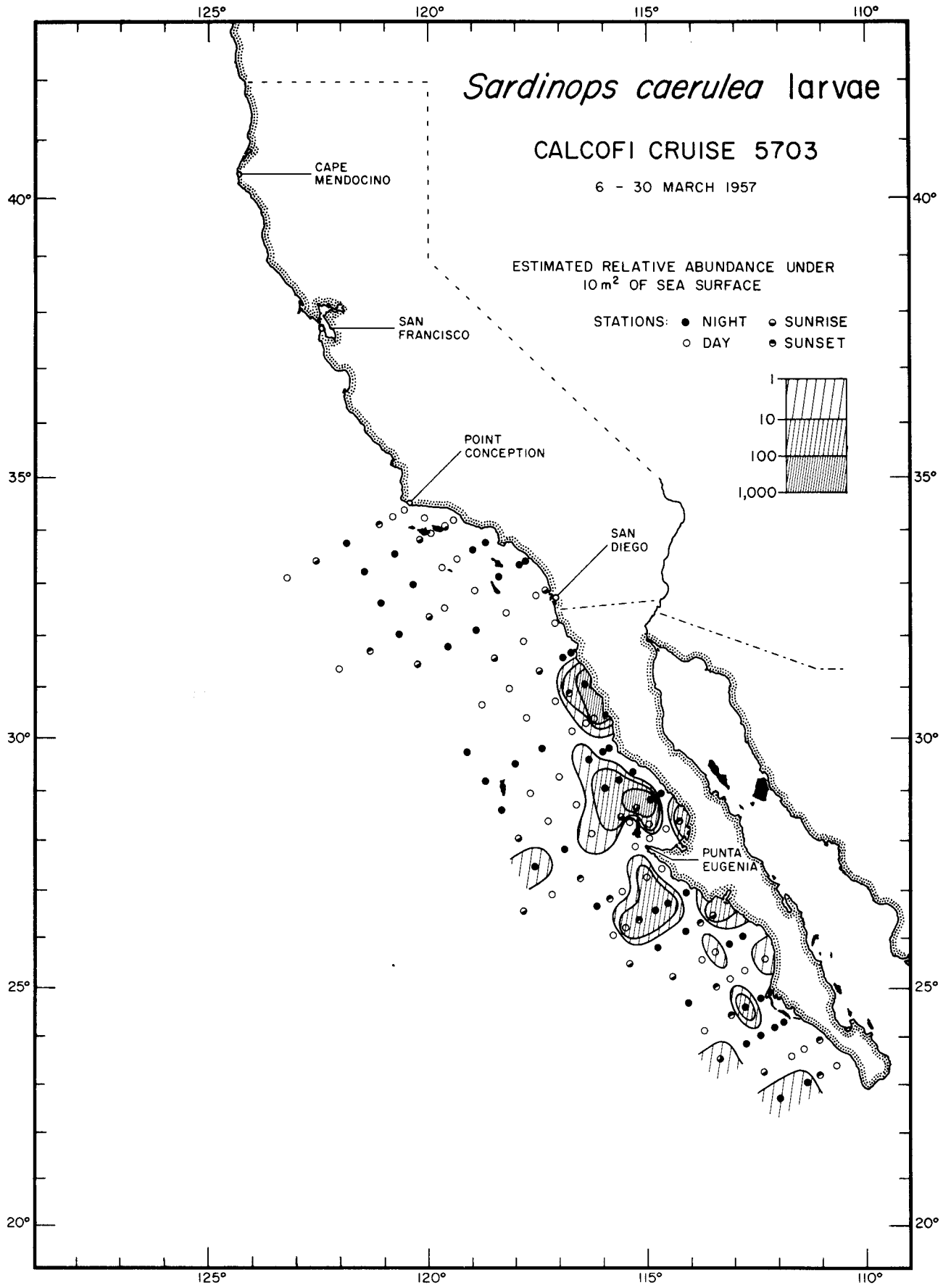
*Sardinops caerulea* larvae

5603



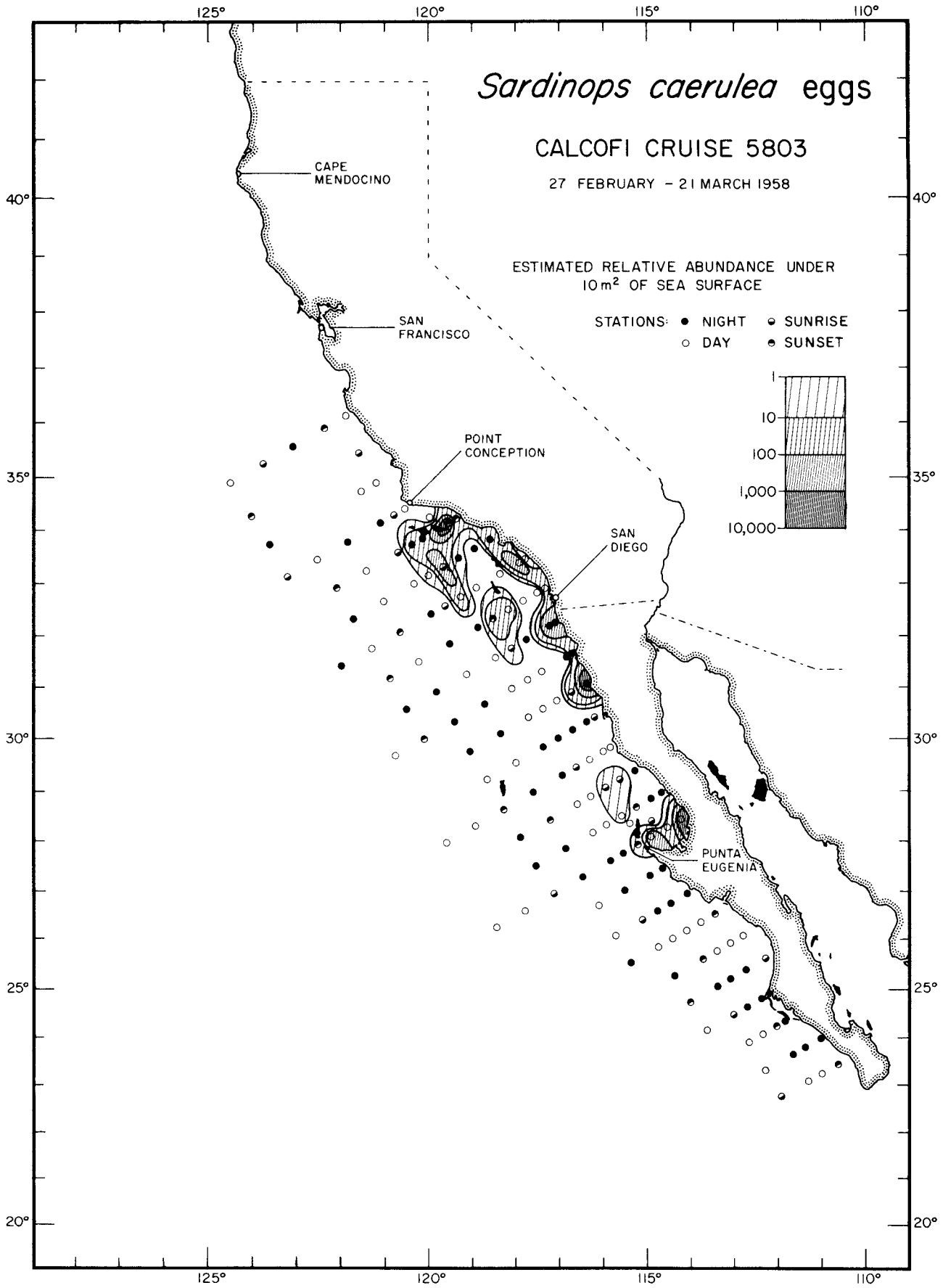
*Sardinops caerulea* eggs

5703

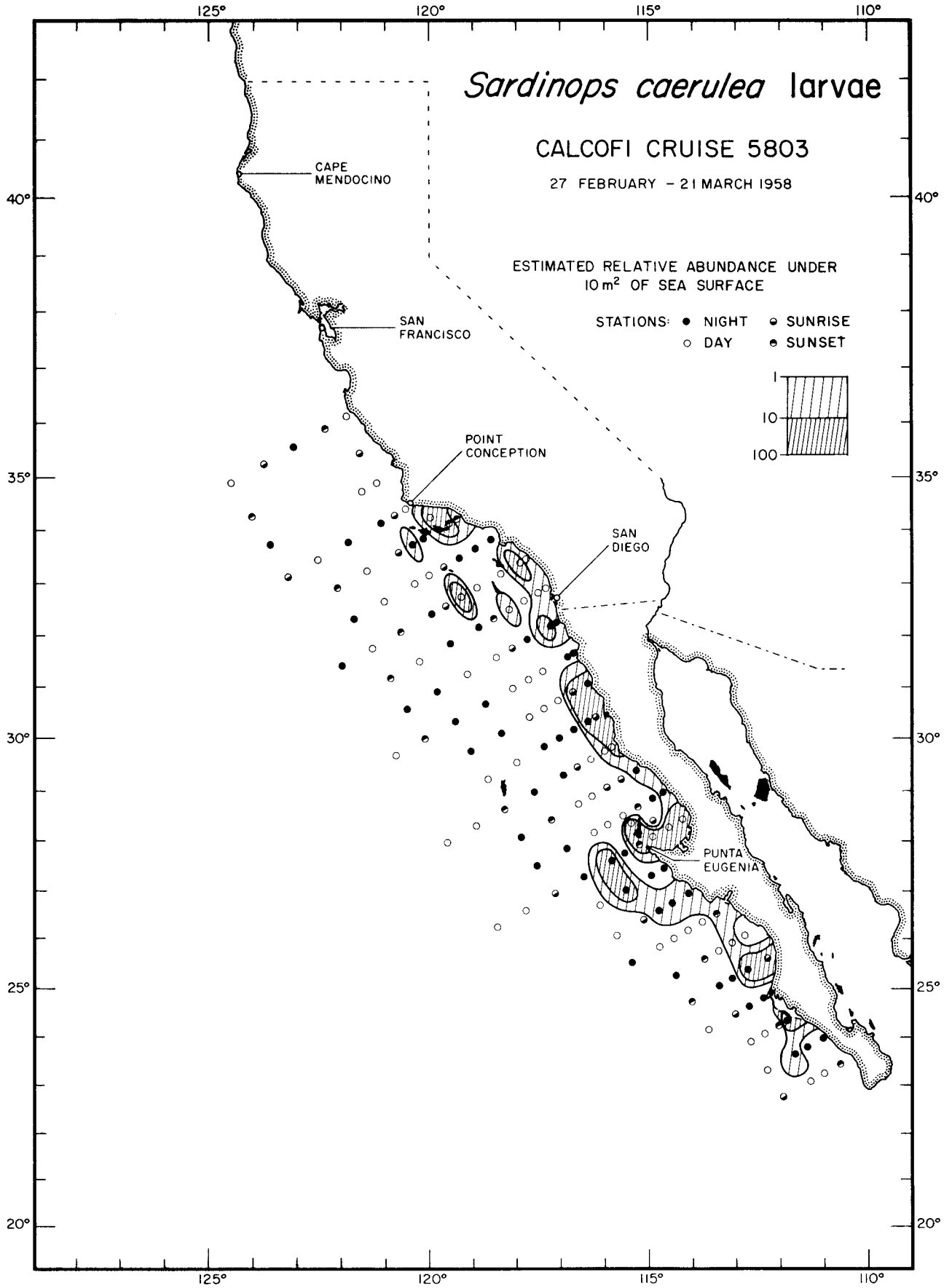


*Sardinops caerulea* larvae  
5703



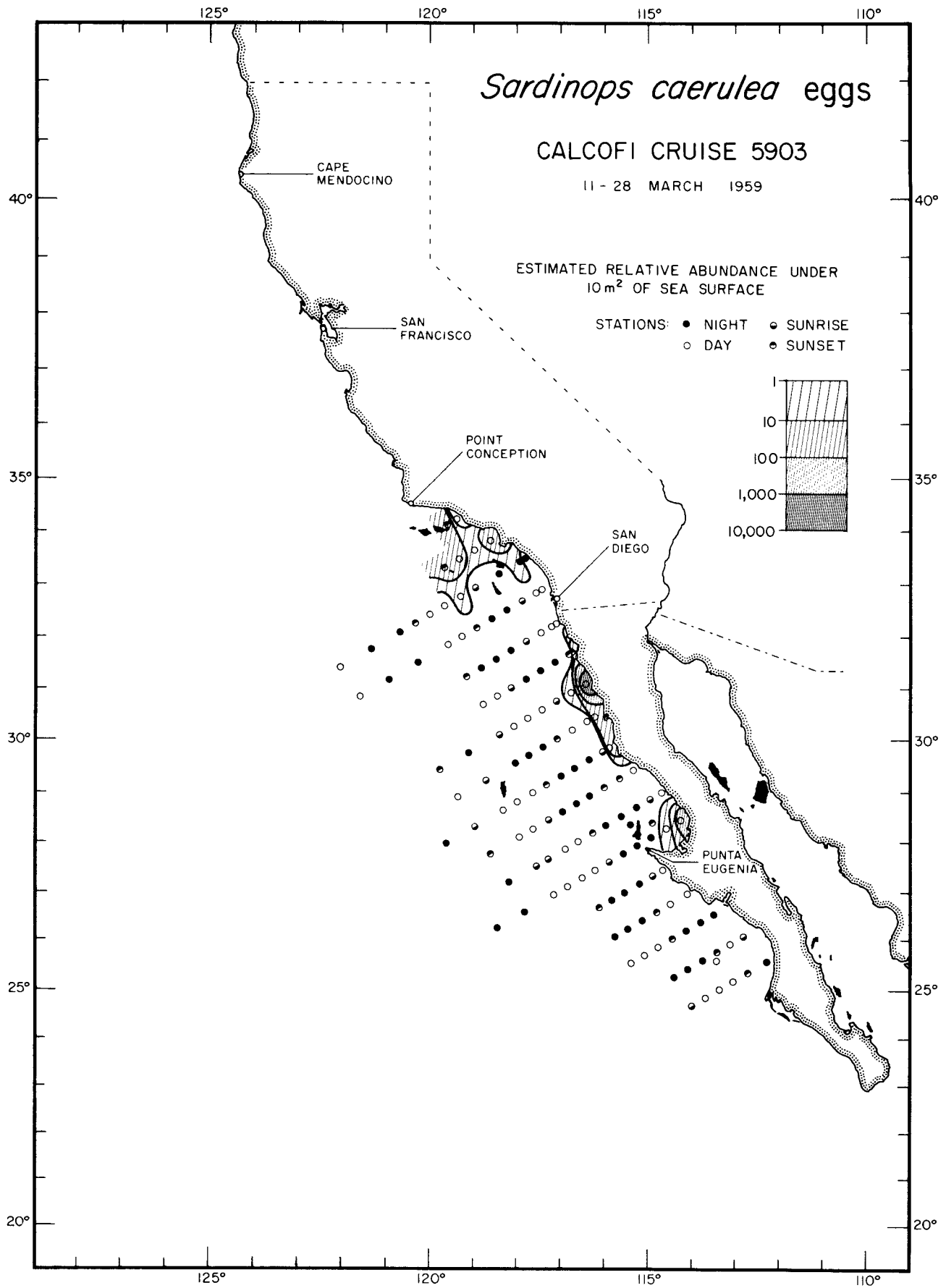


*Sardinops caerulea* eggs  
5803



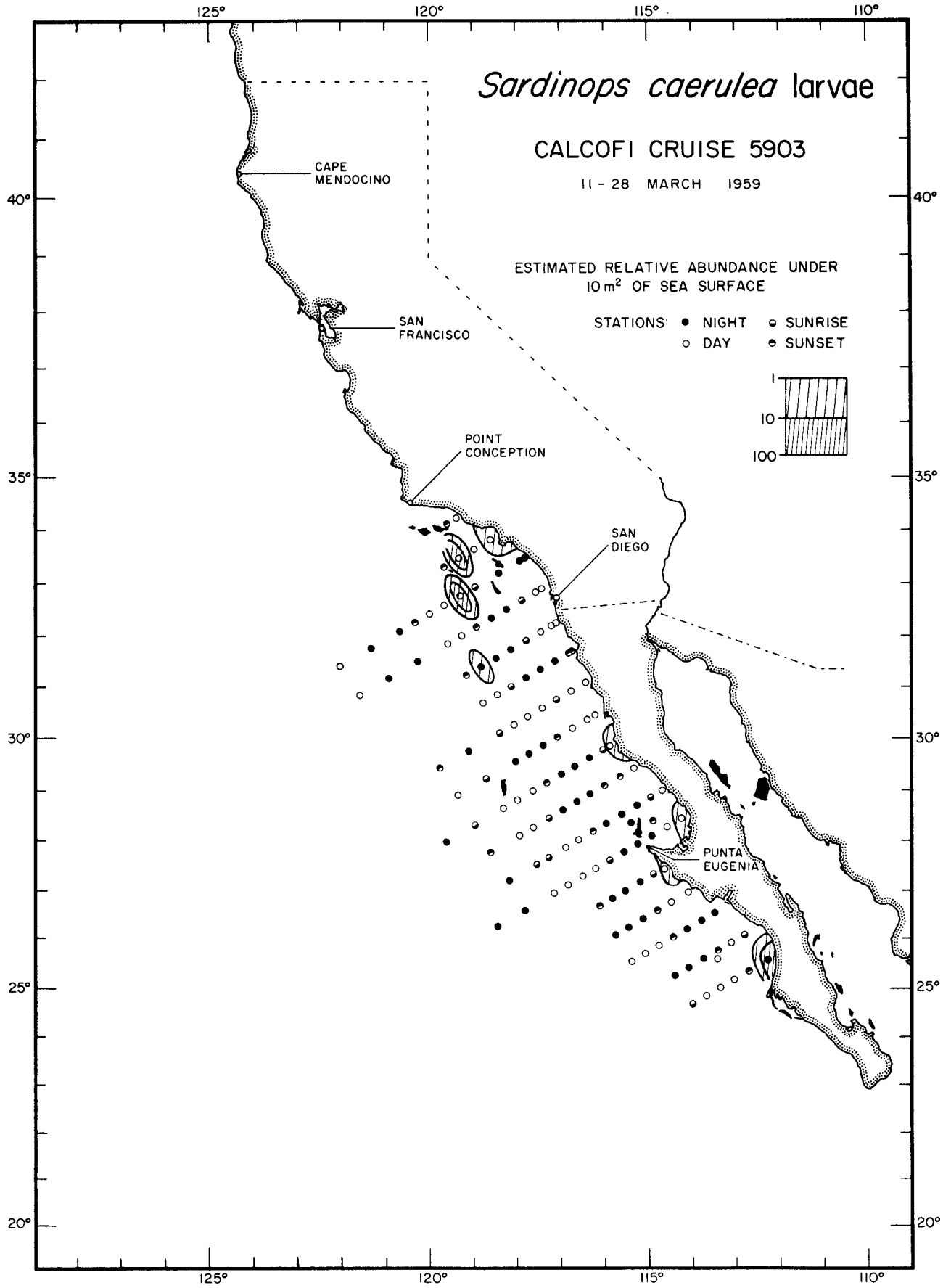
*Sardinops caerulea* larvae

5803



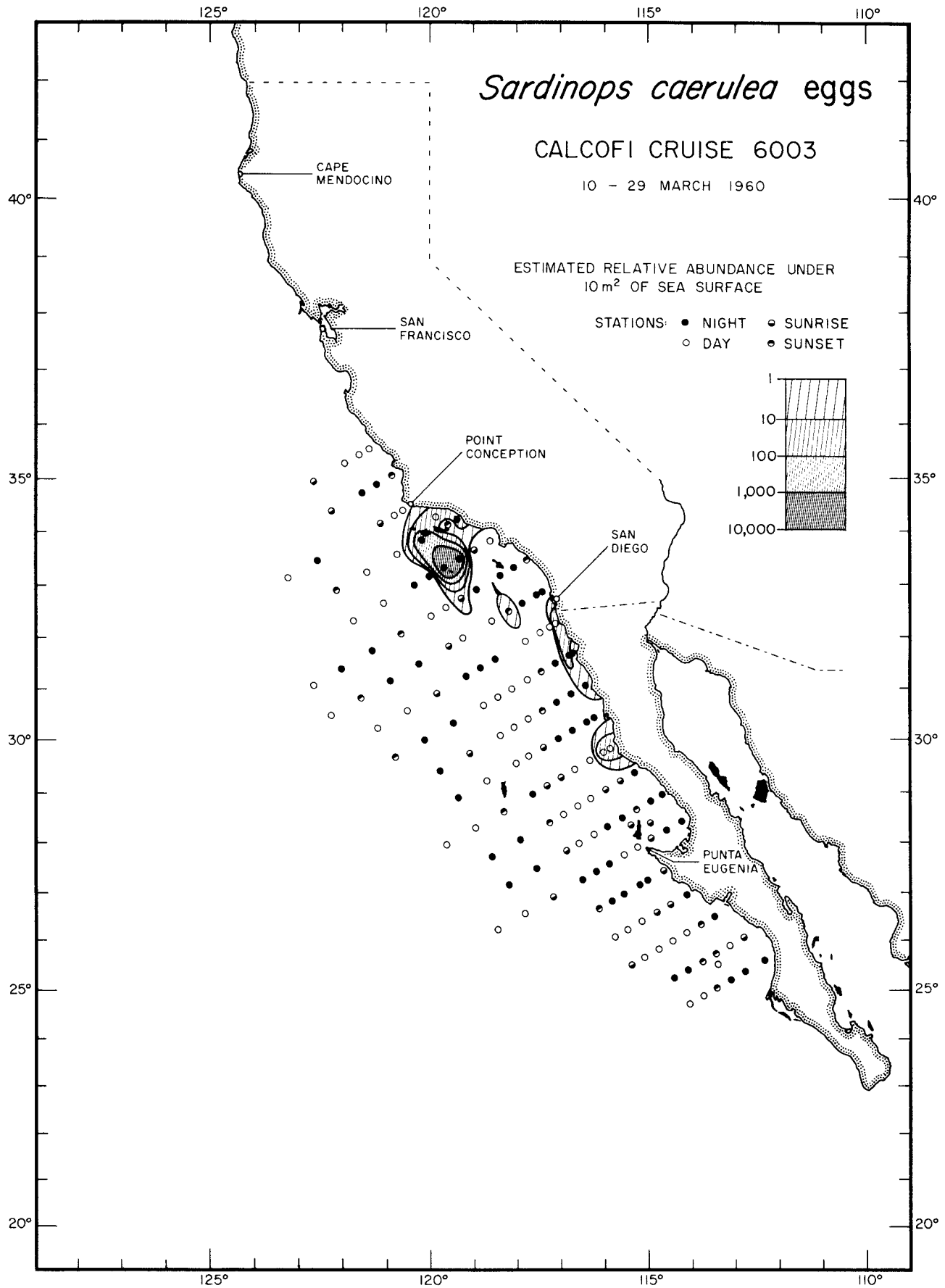
*Sardinops caerulea* eggs

5903



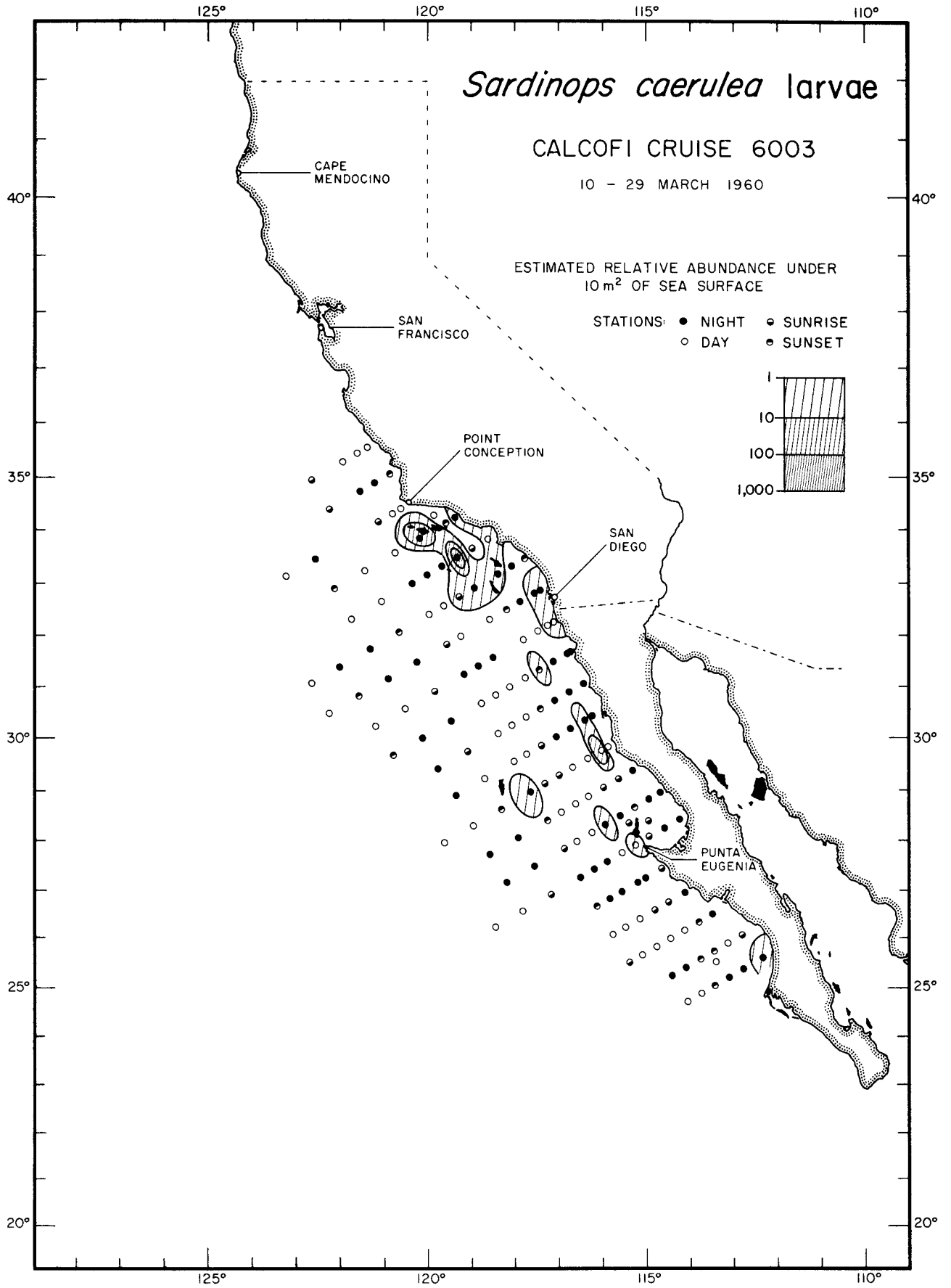
*Sardinops caerulea* larvae

5903



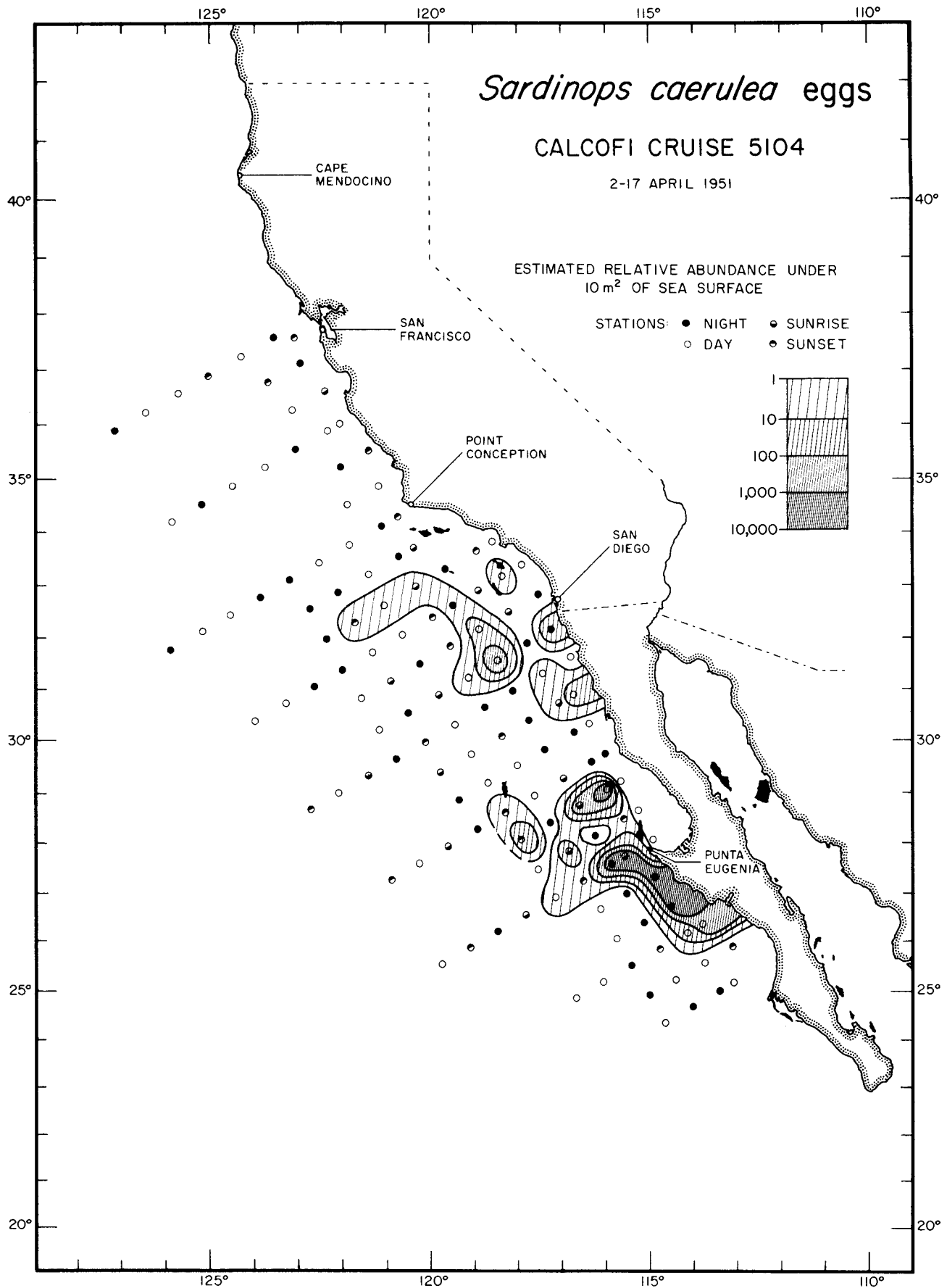
*Sardinops caerulea* eggs

6003



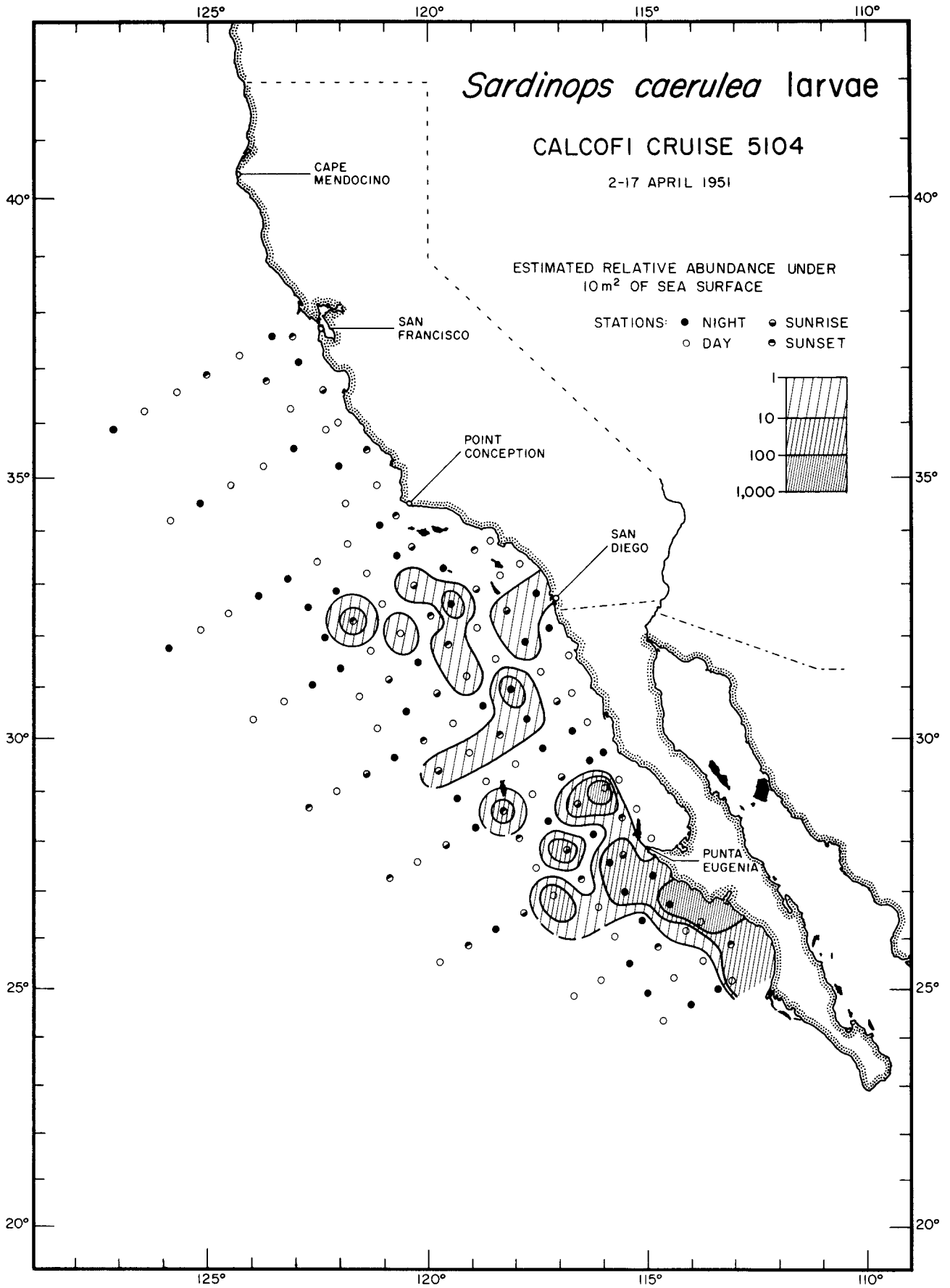
*Sardinops caerulea* larvae

6003



*Sardinops caerulea* eggs

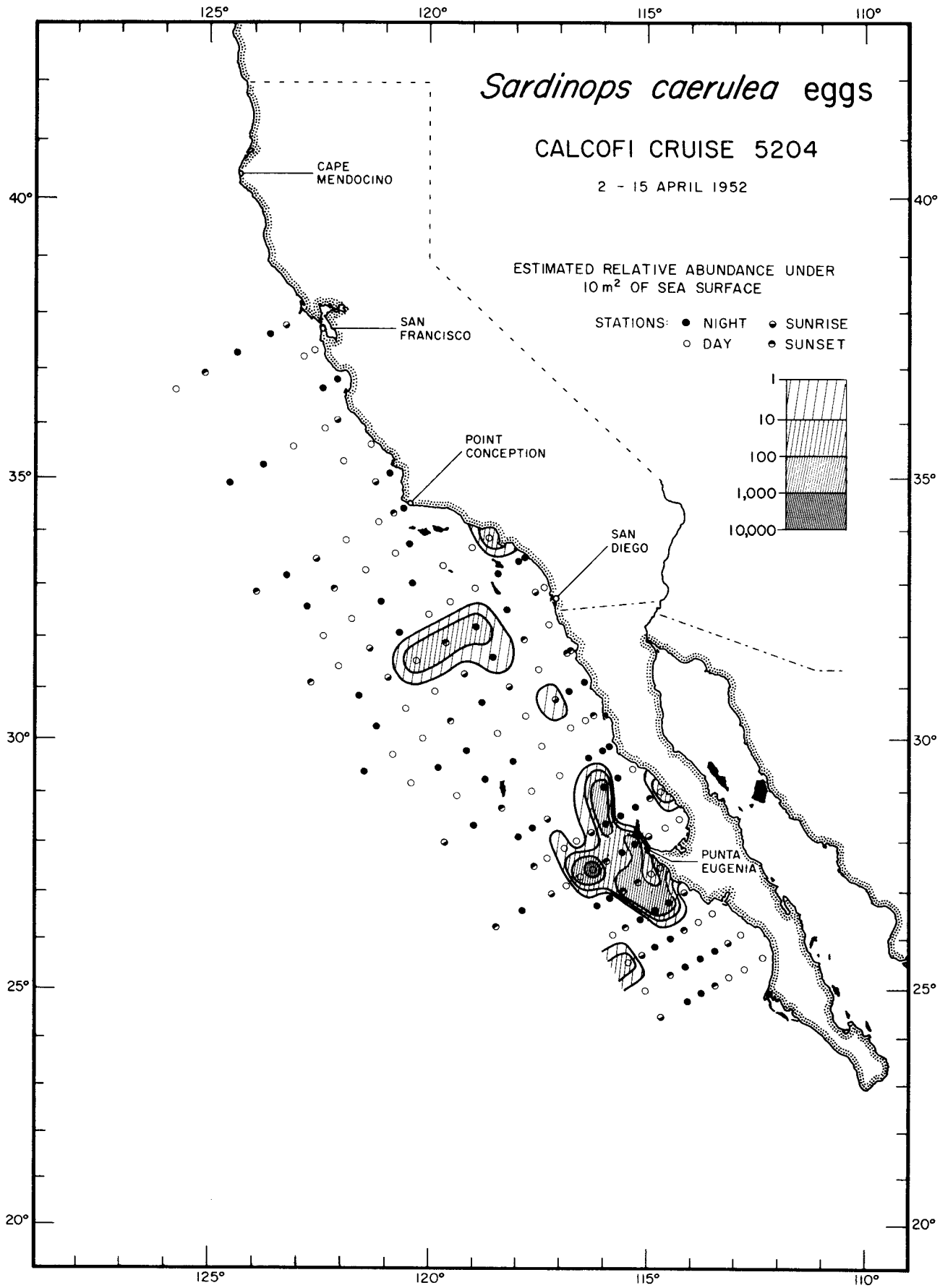
5104



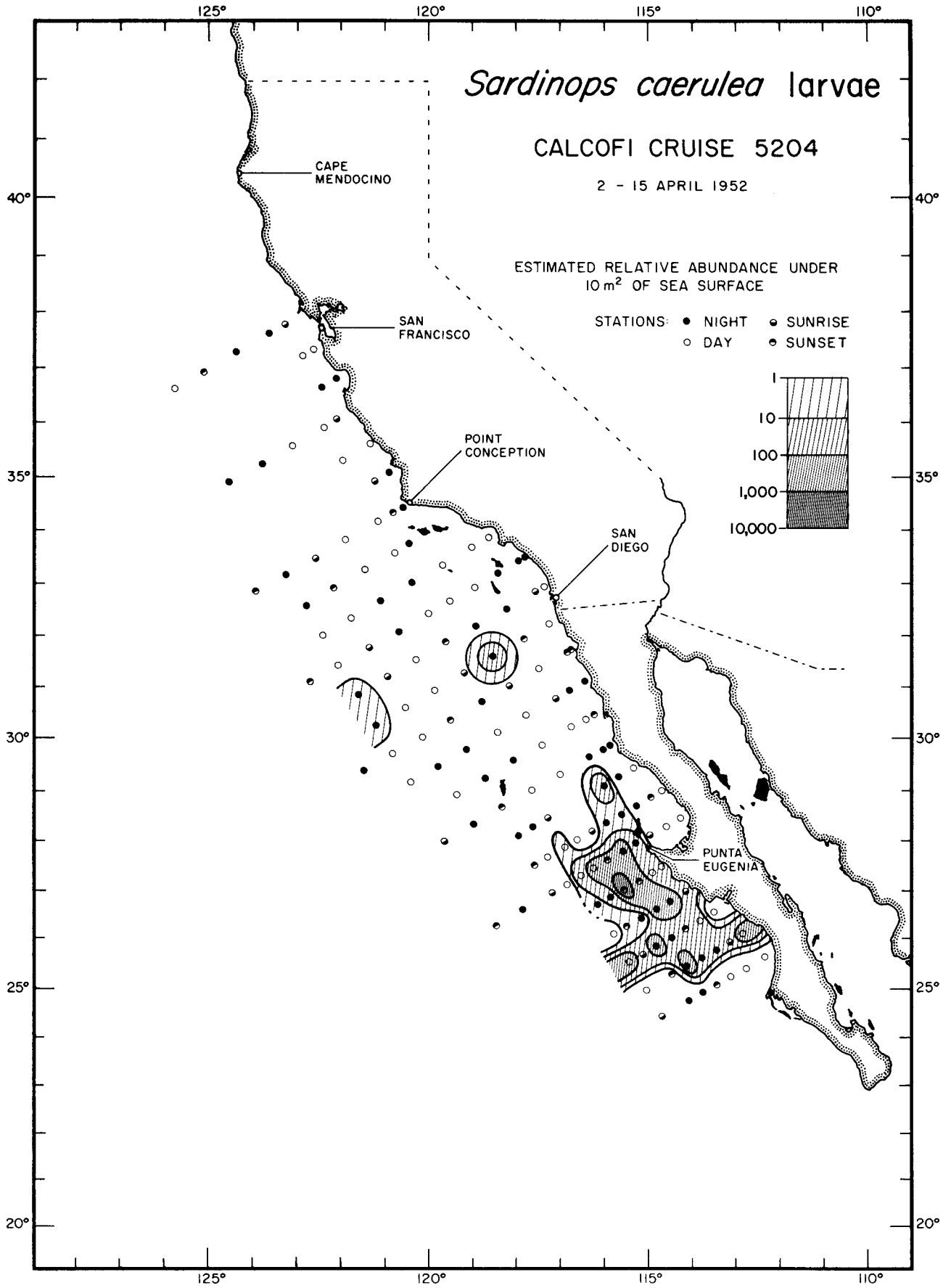
*Sardinops caerulea* larvae

5104



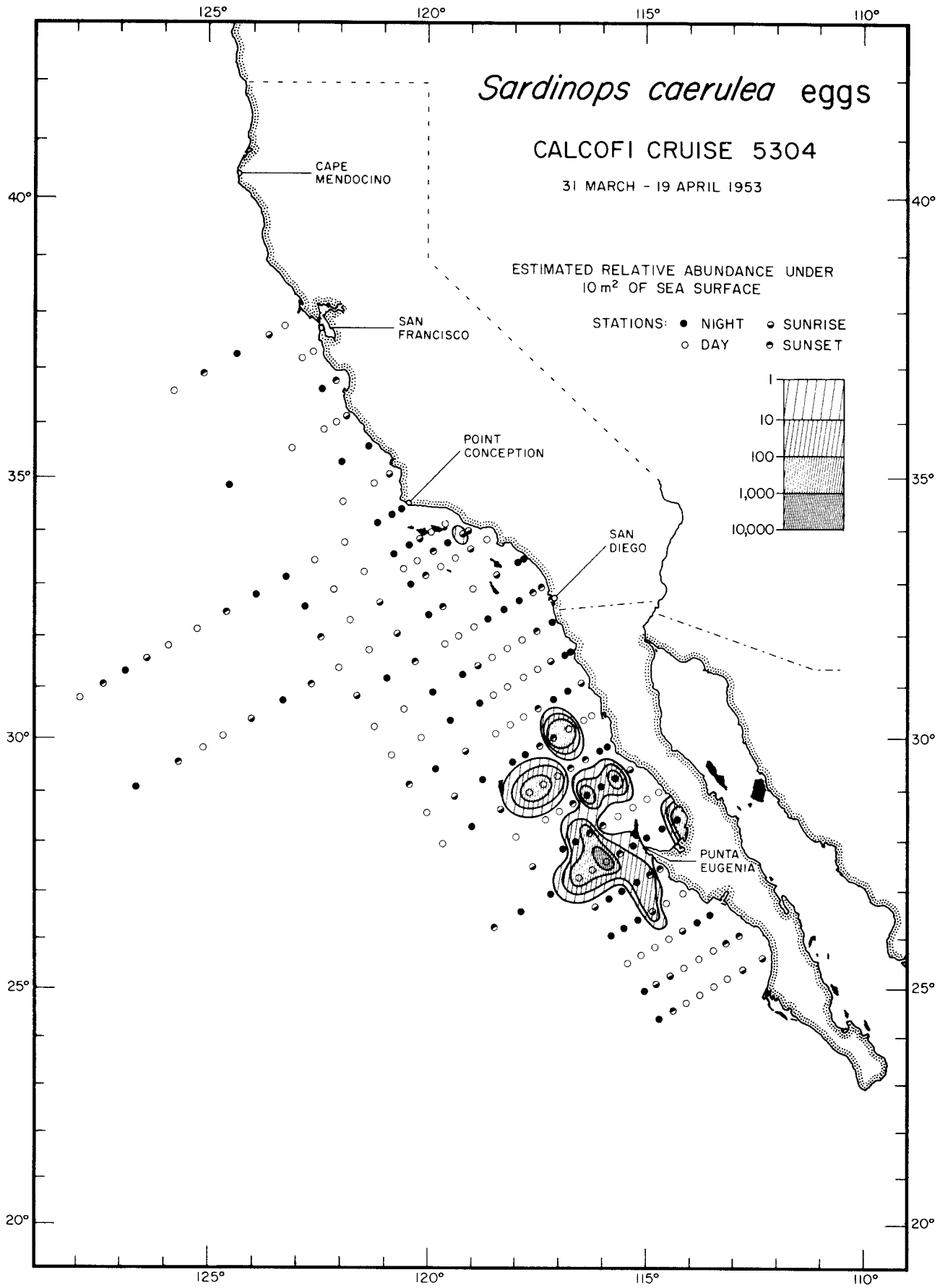


*Sardinops caerulea* eggs  
5204



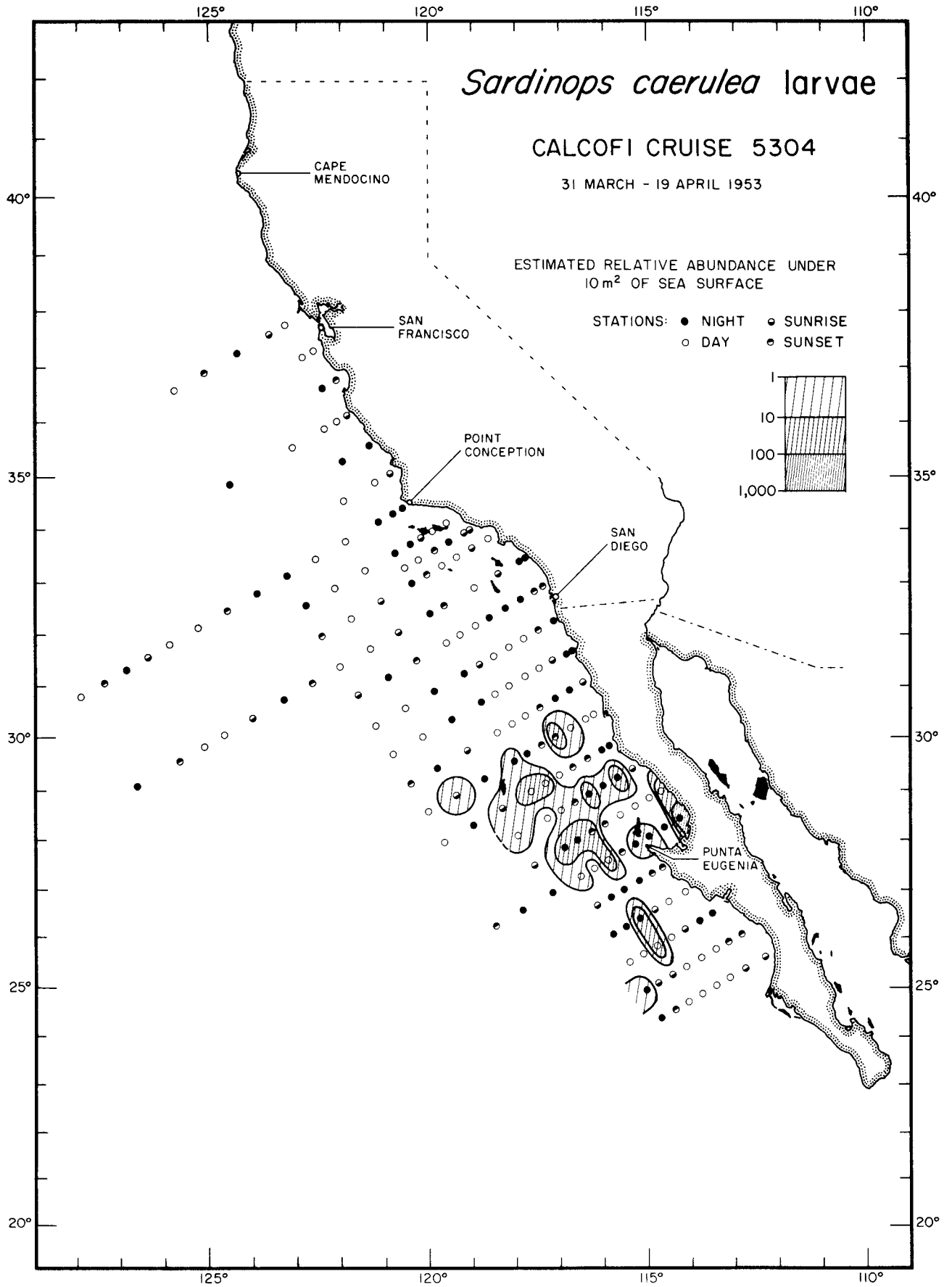
*Sardinops caerulea* larvae

5204



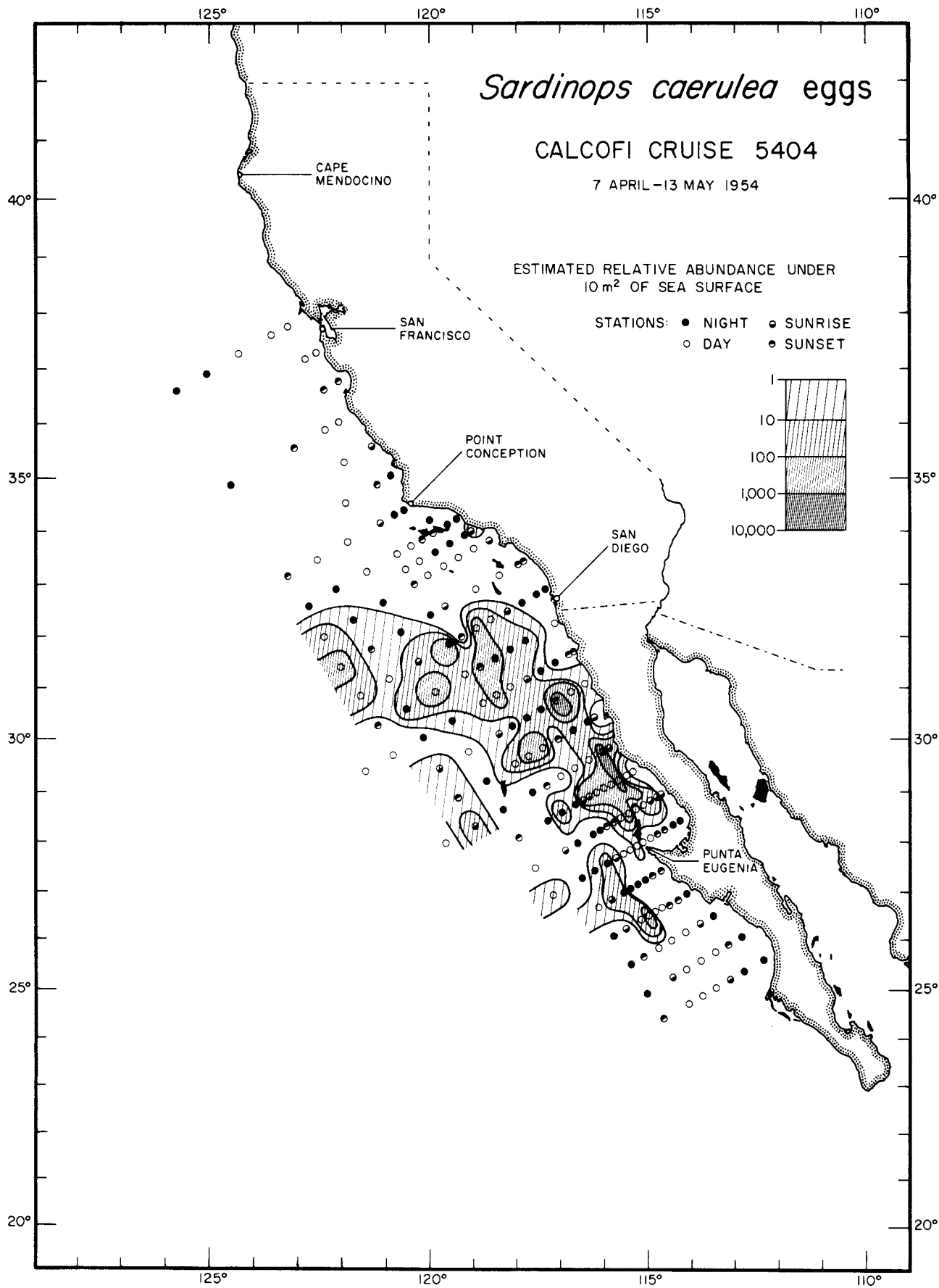
*Sardinops caerulea* eggs

5304



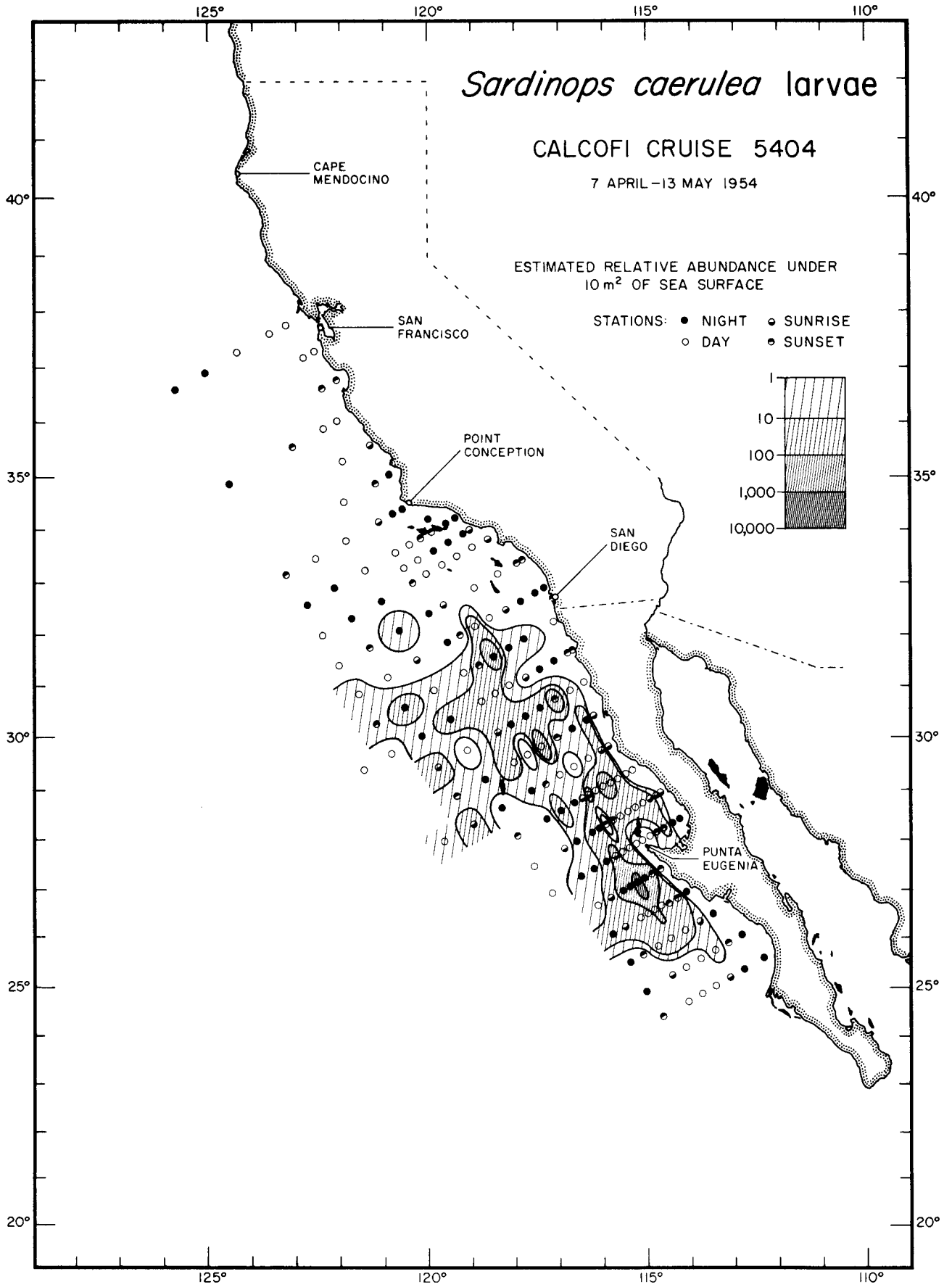
*Sardinops caerulea* larvae

5304



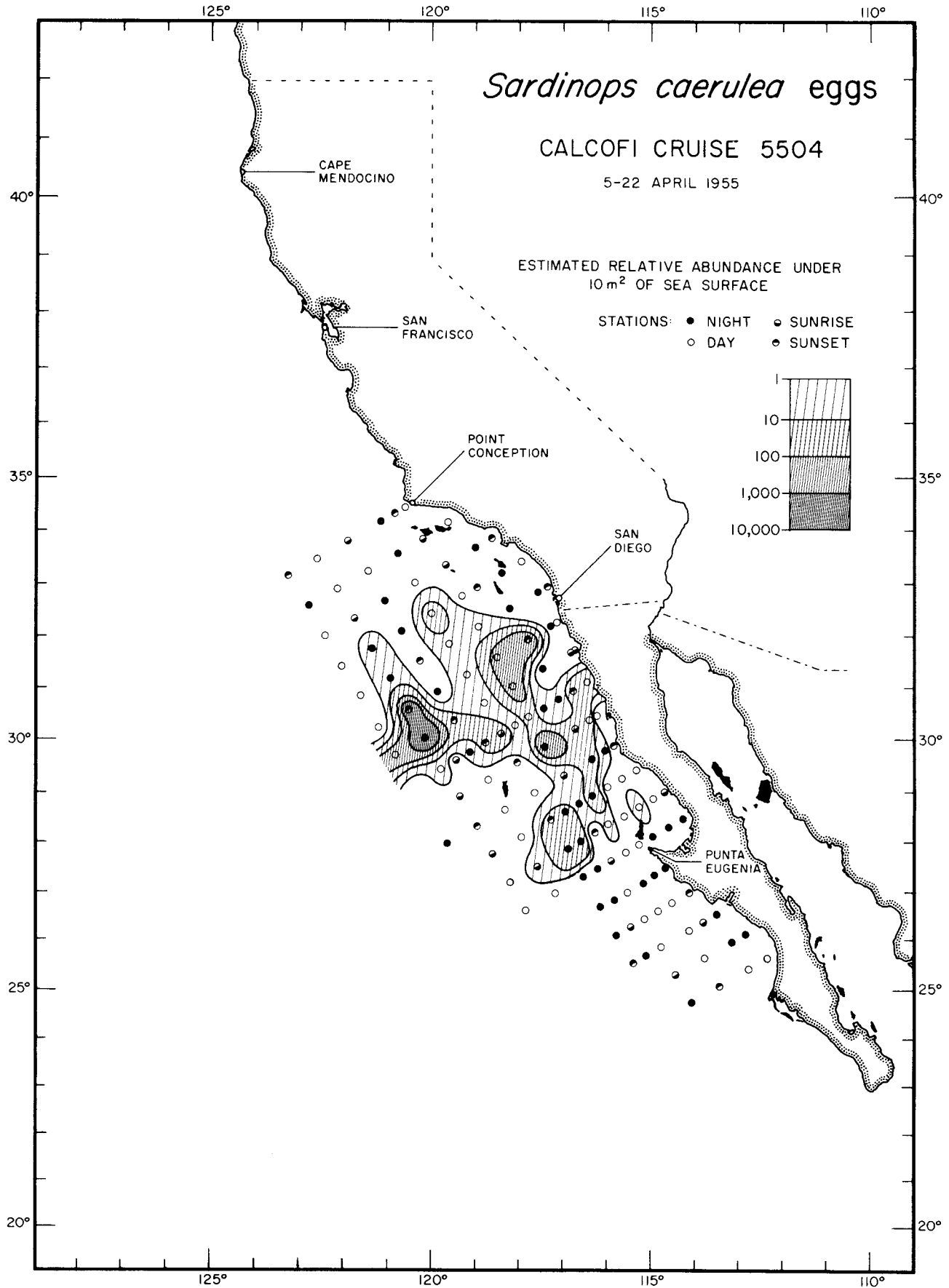
*Sardinops caerulea* eggs

5404



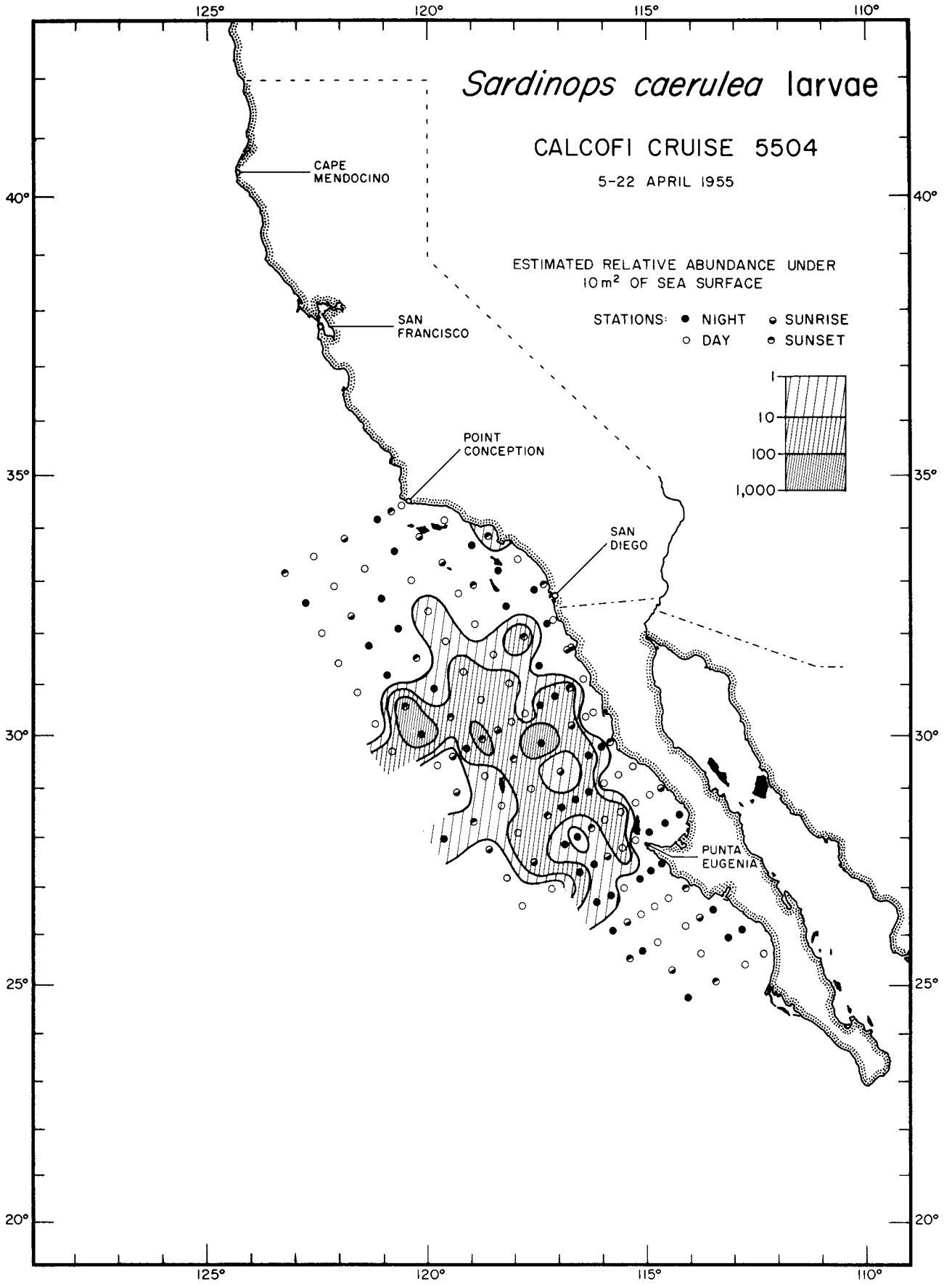
*Sardinops caerulea* larvae

5404



*Sardinops caerulea* eggs

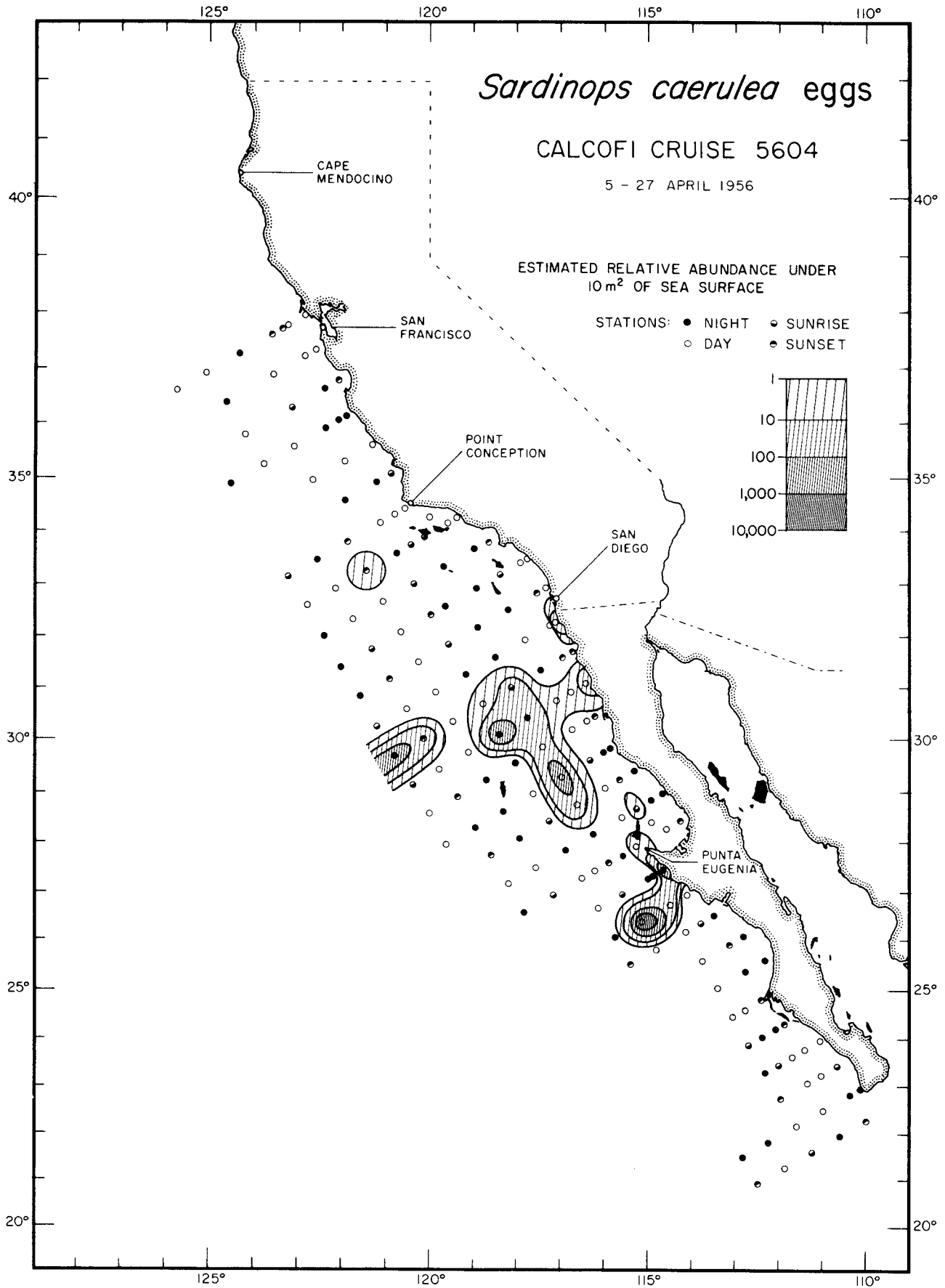
5504



*Sardinops caerulea* larvae

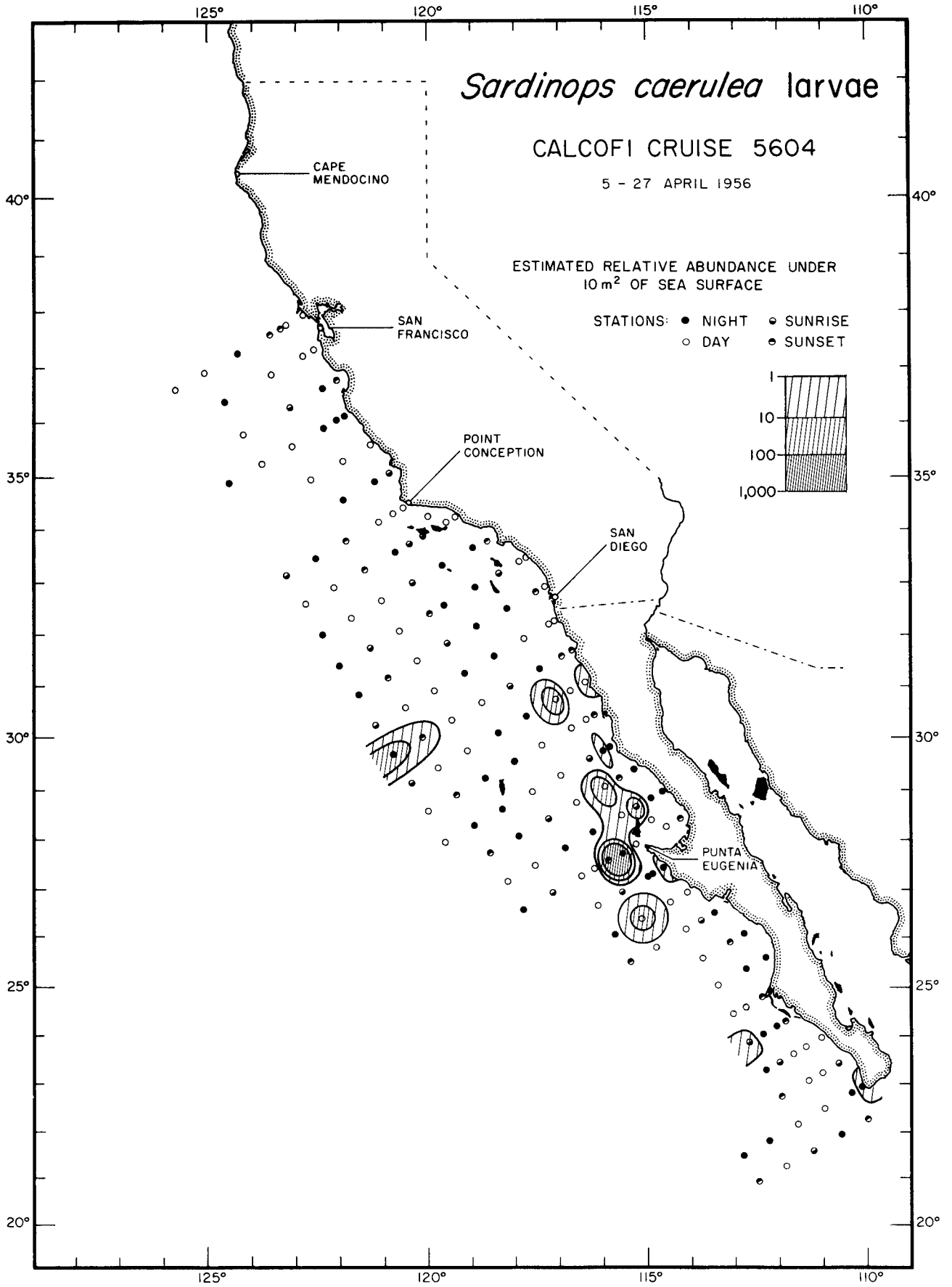
5504



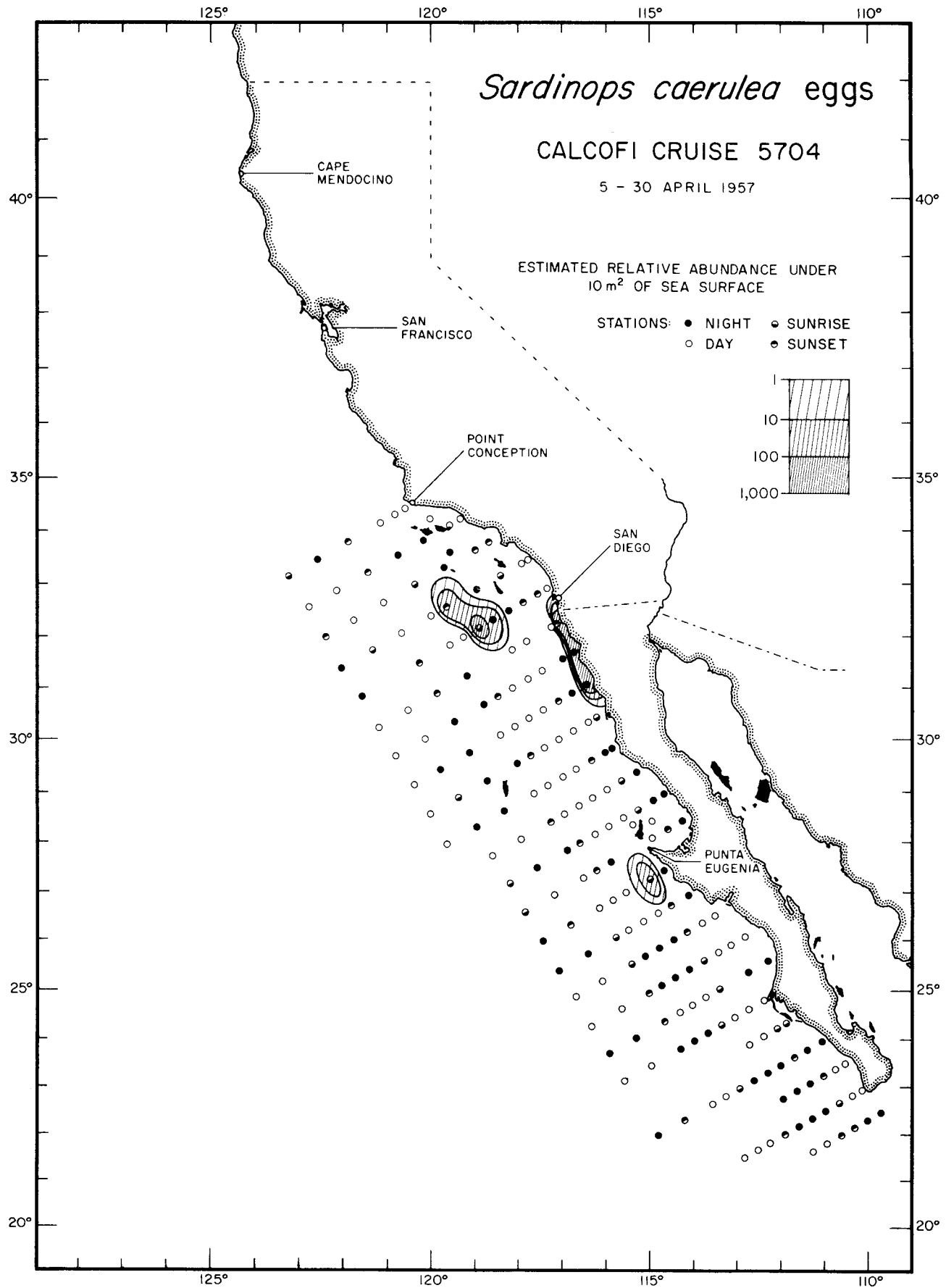


*Sardinops caerulea* eggs

5604

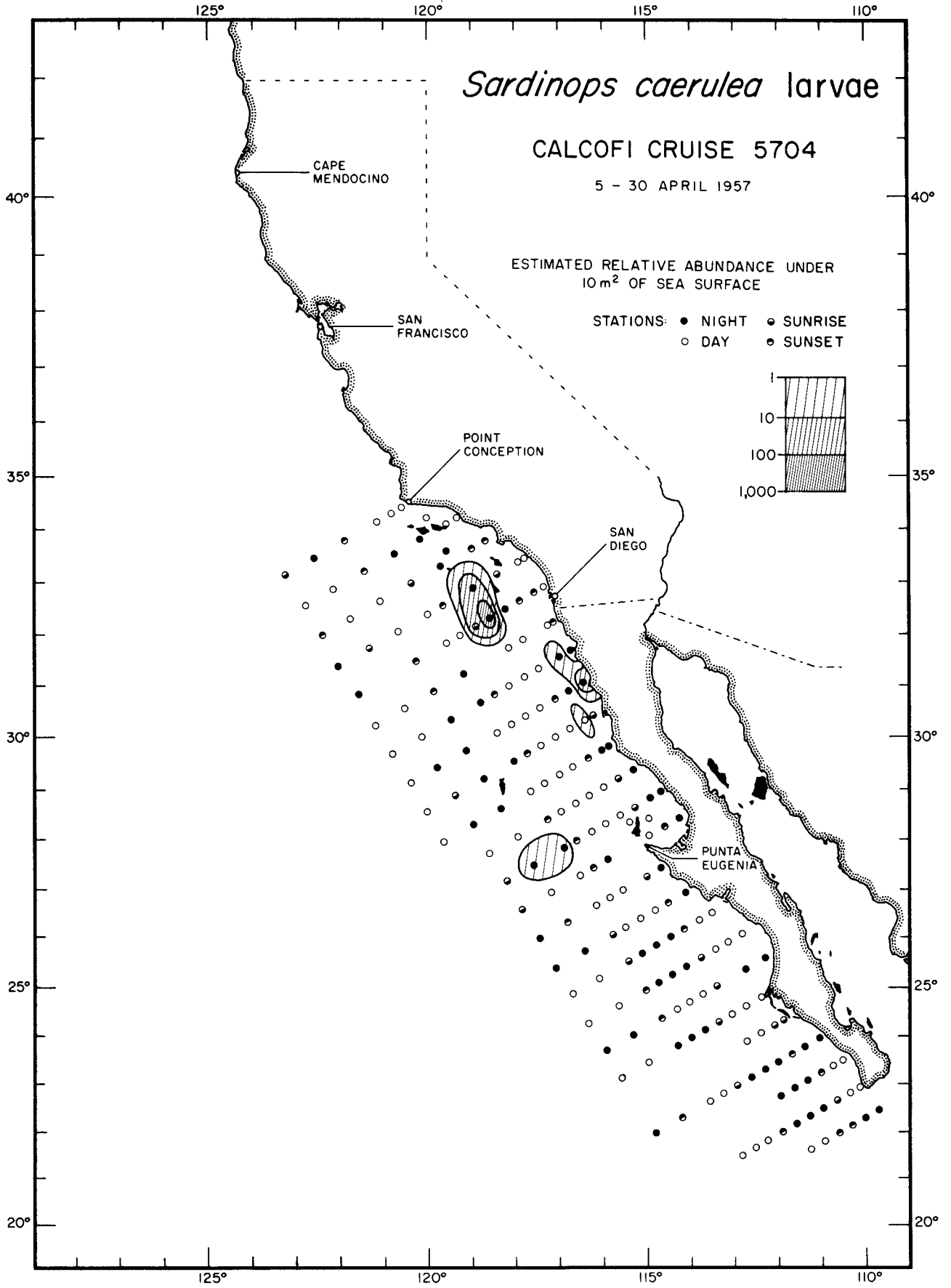


*Sardinops caerulea* larvae  
5604



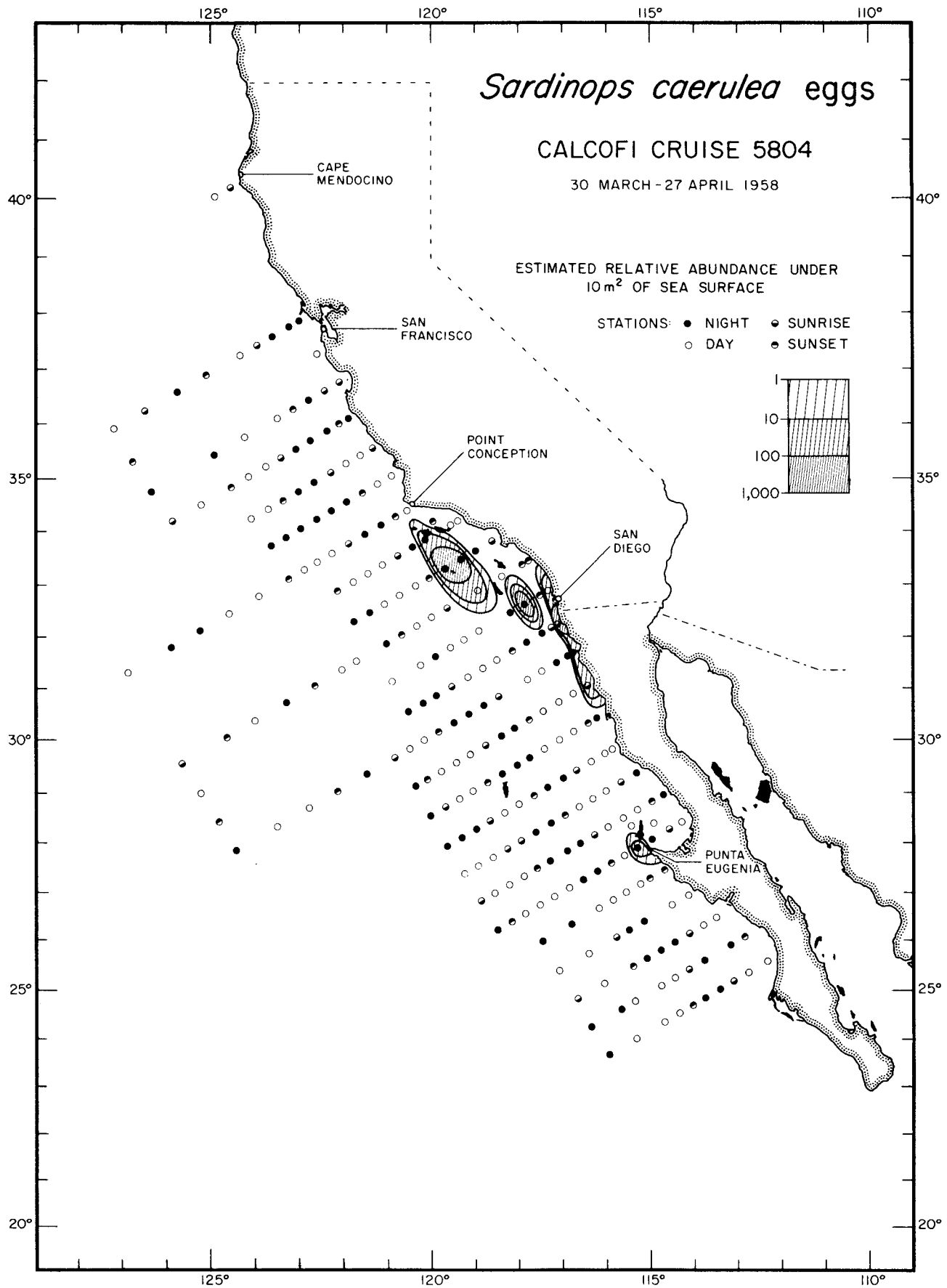
*Sardinops caerulea* eggs

5704



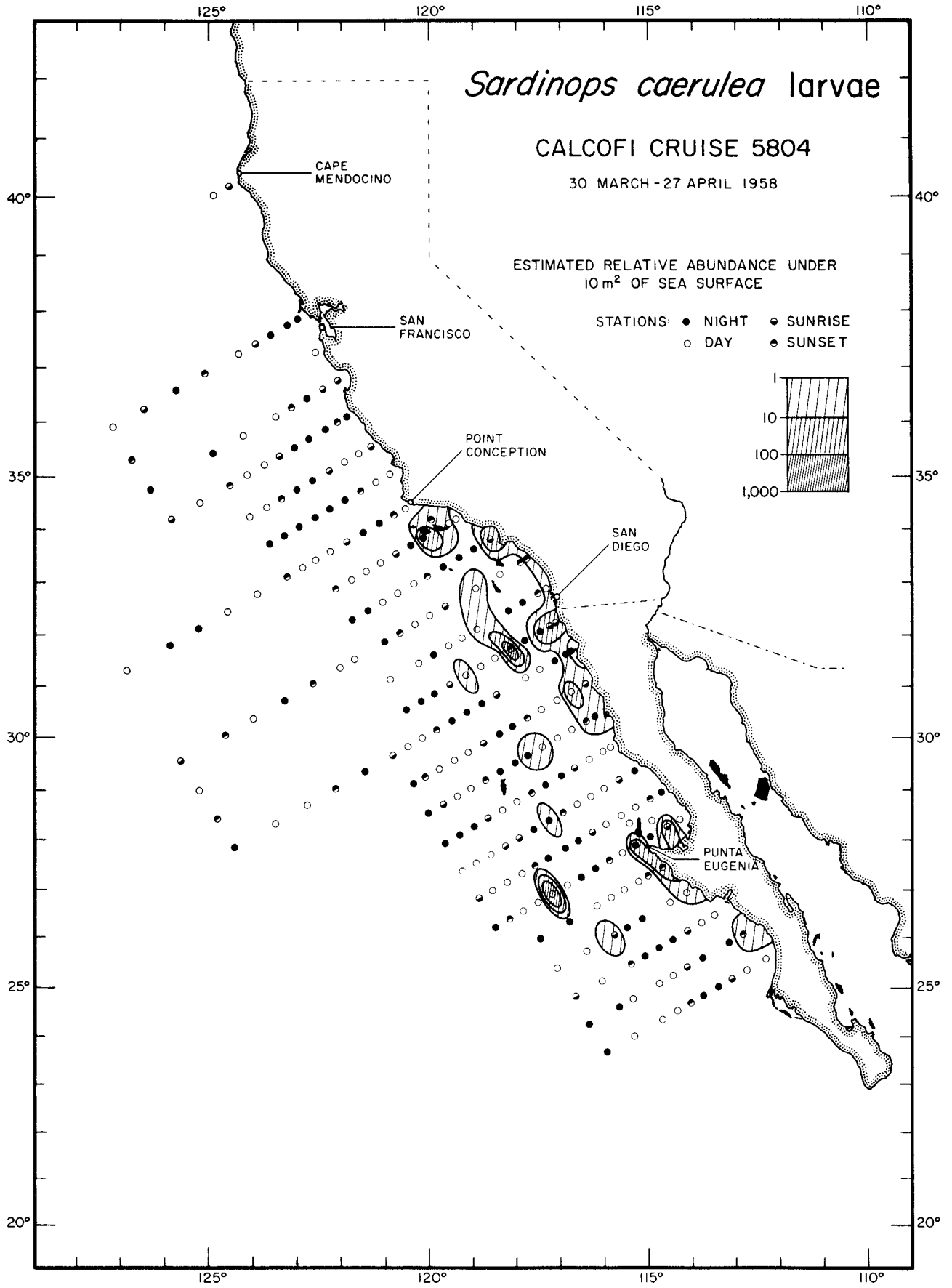
*Sardinops caerulea* larvae

5704



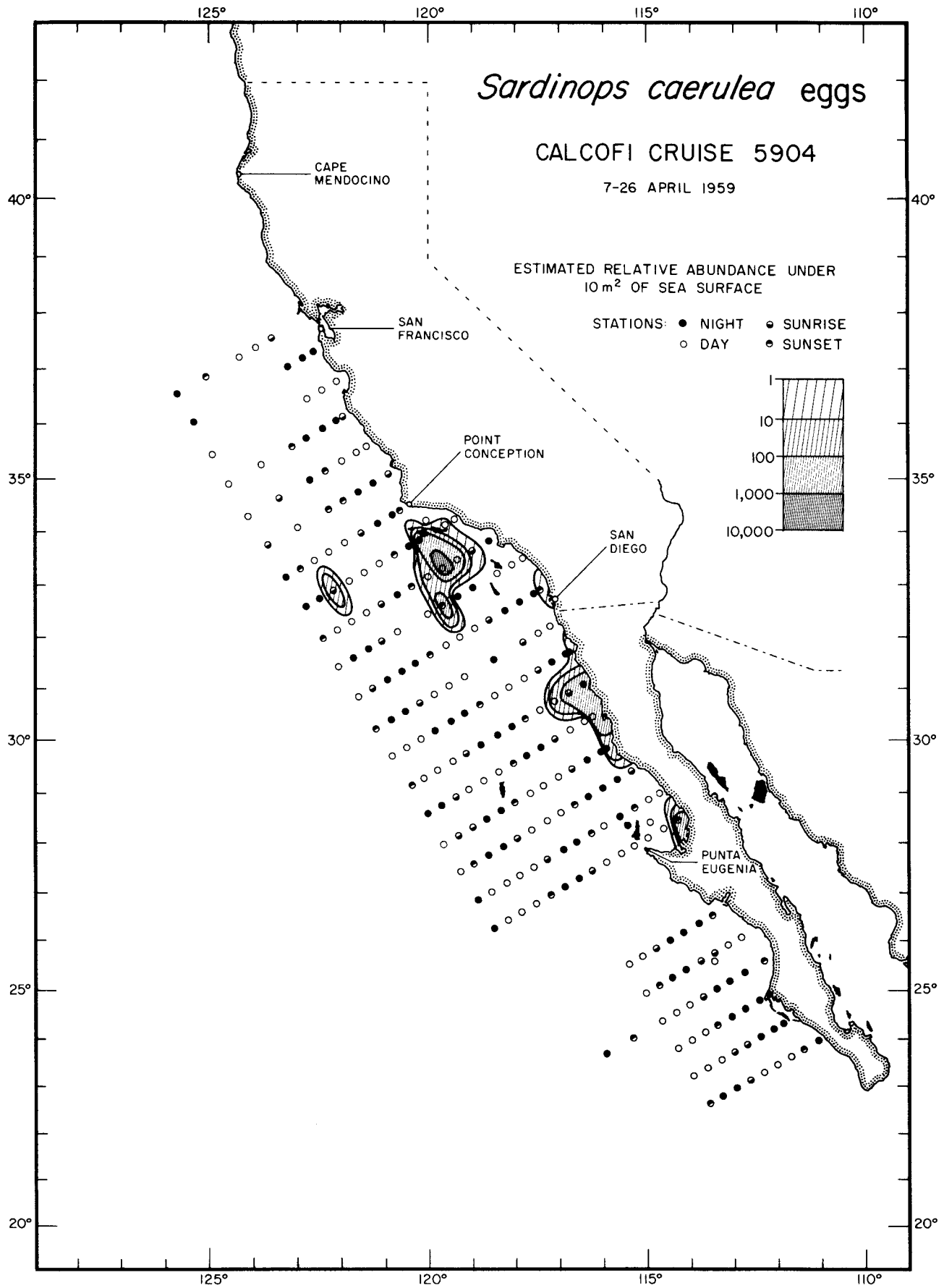
*Sardinops caerulea* eggs

5804



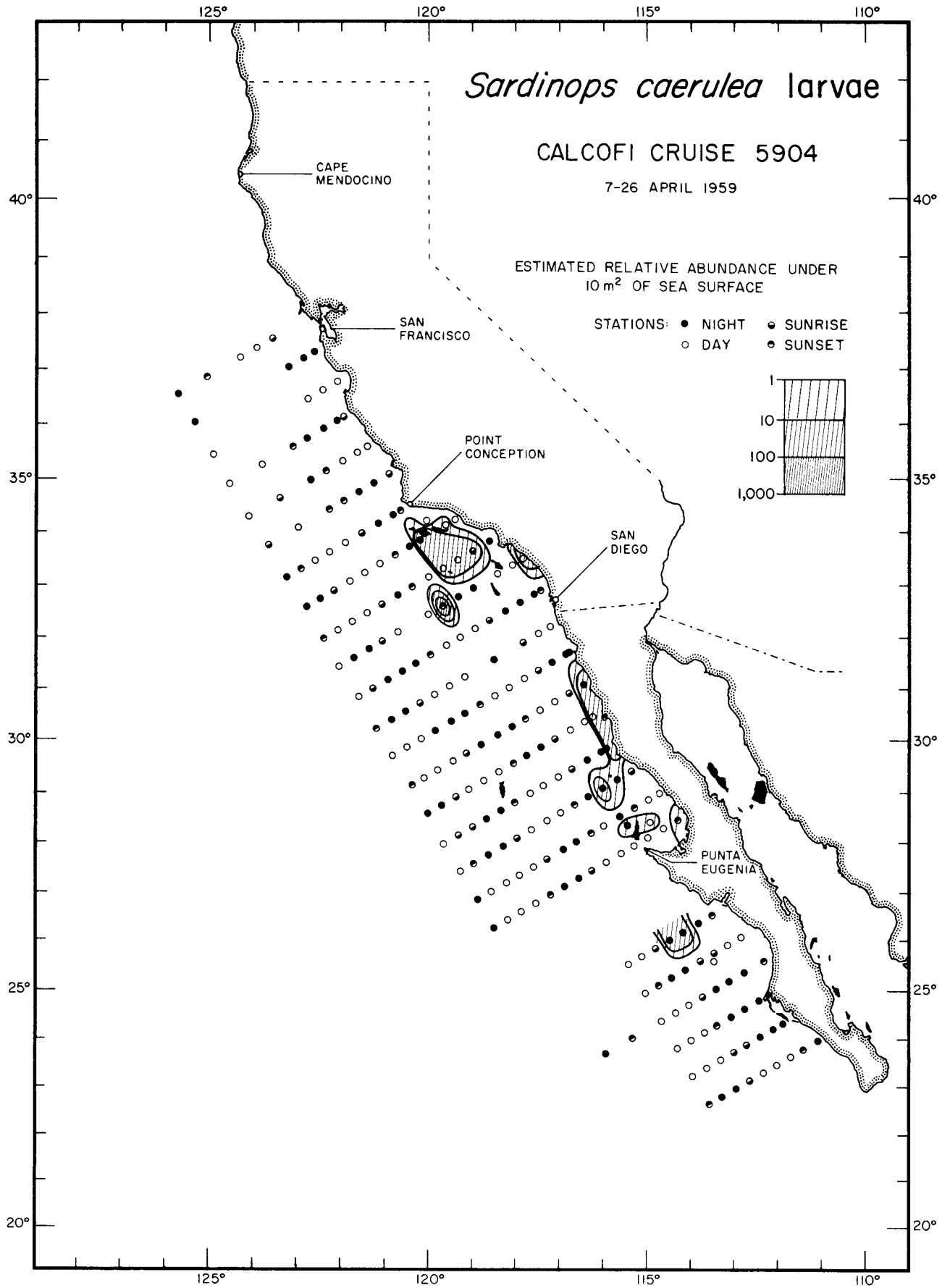
*Sardinops caerulea* larvae

5804



*Sardinops caerulea* eggs

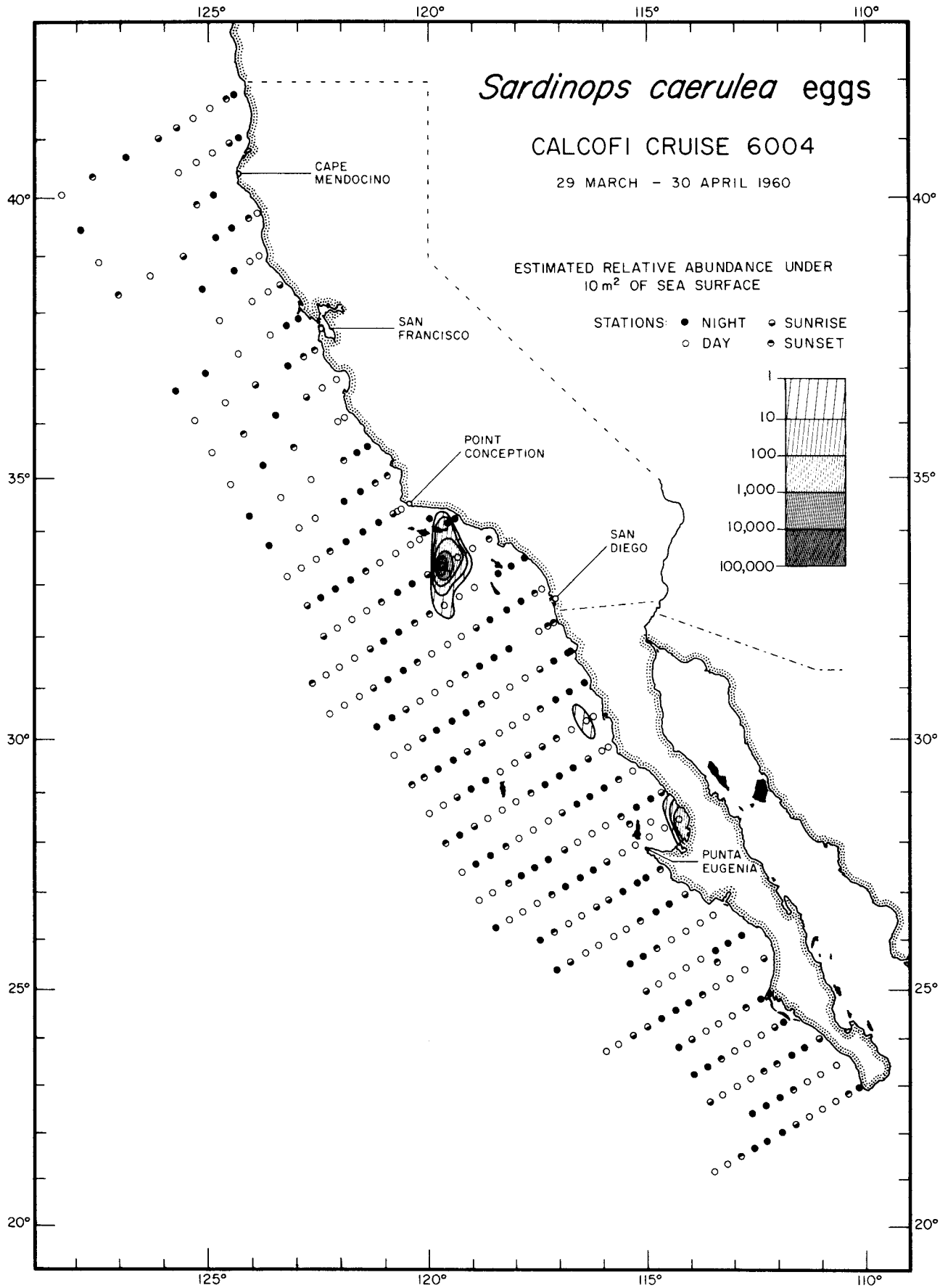
5904



*Sardinops caerulea* larvae

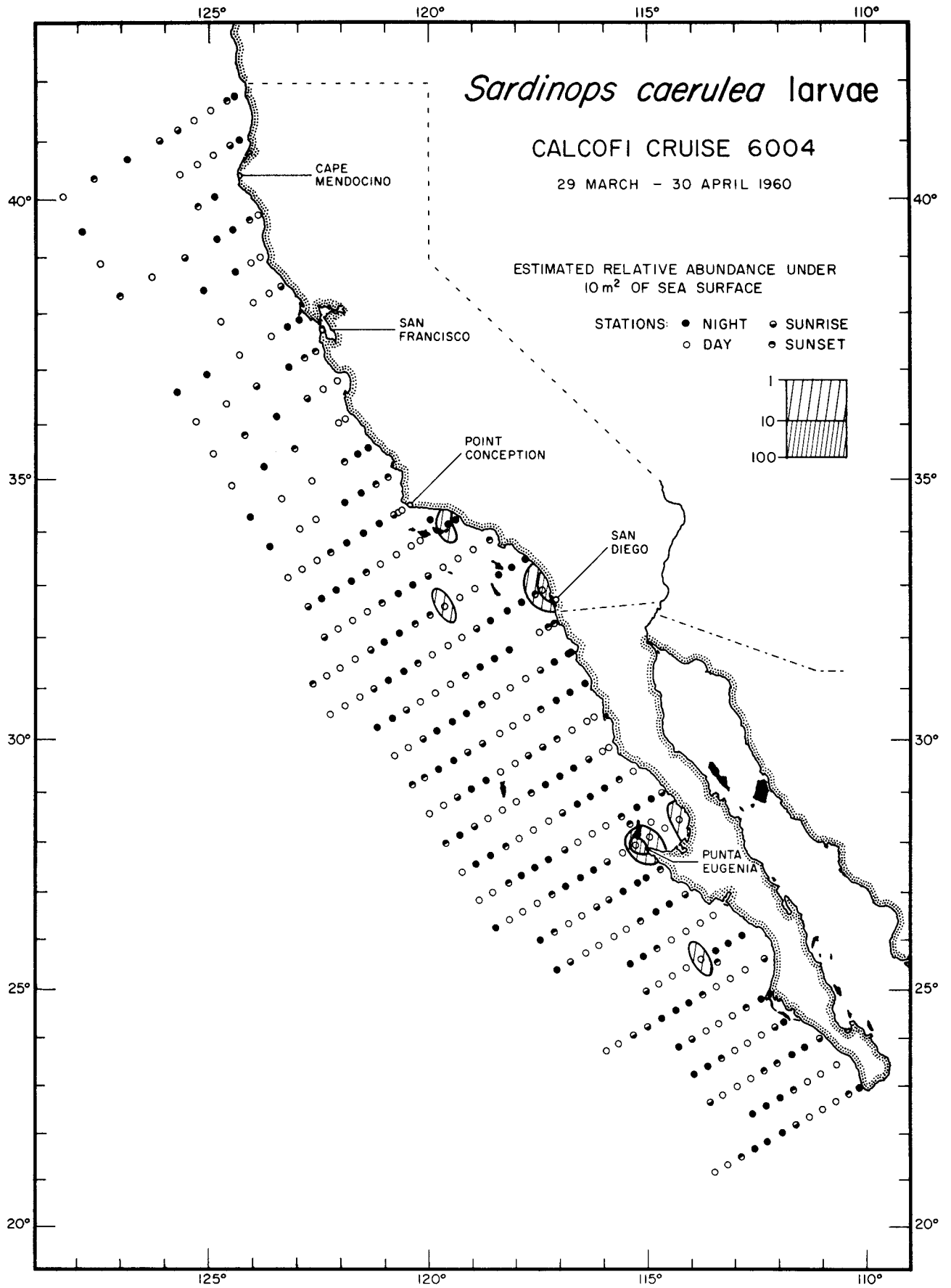
5904





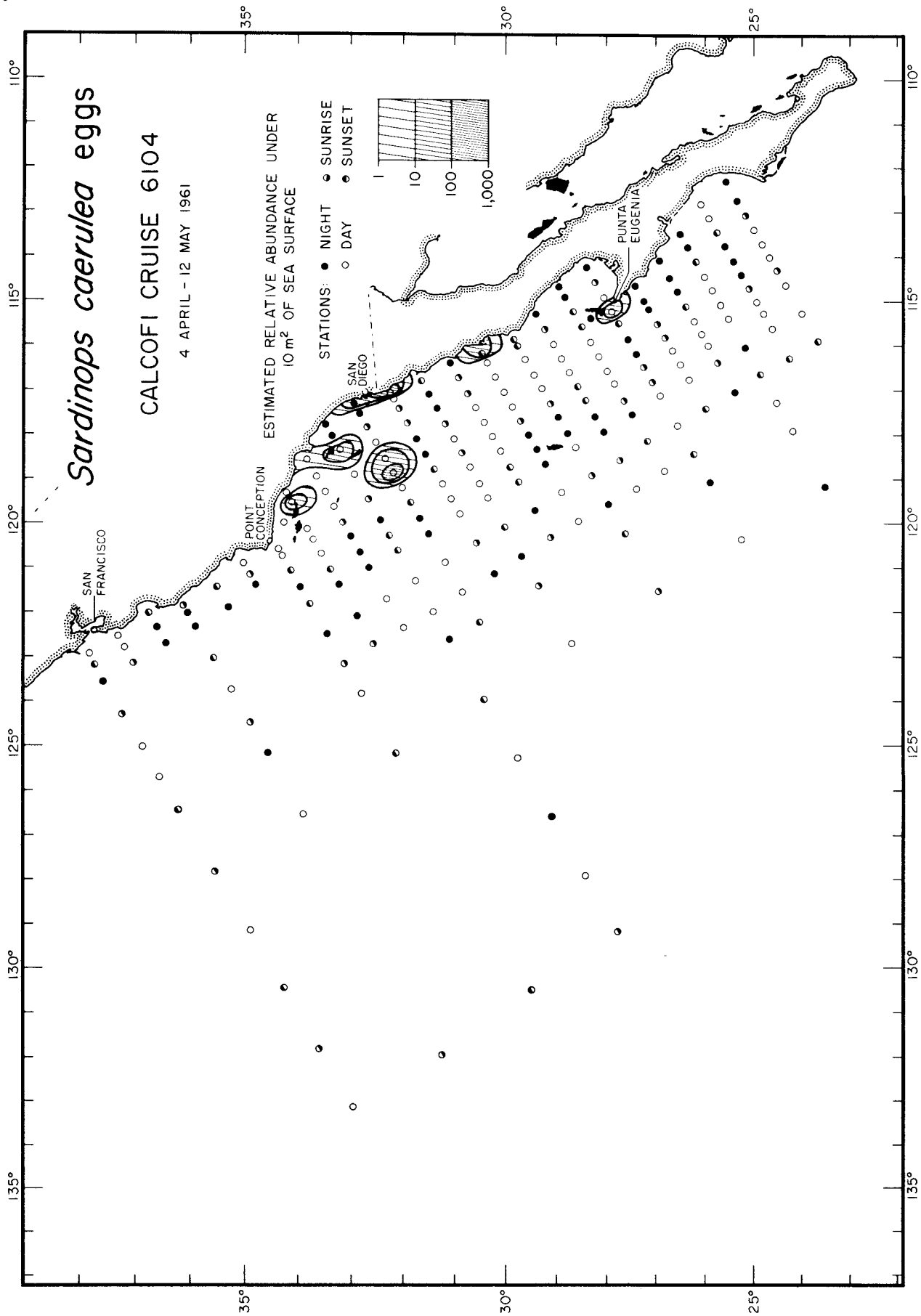
*Sardinops caerulea* eggs

6004

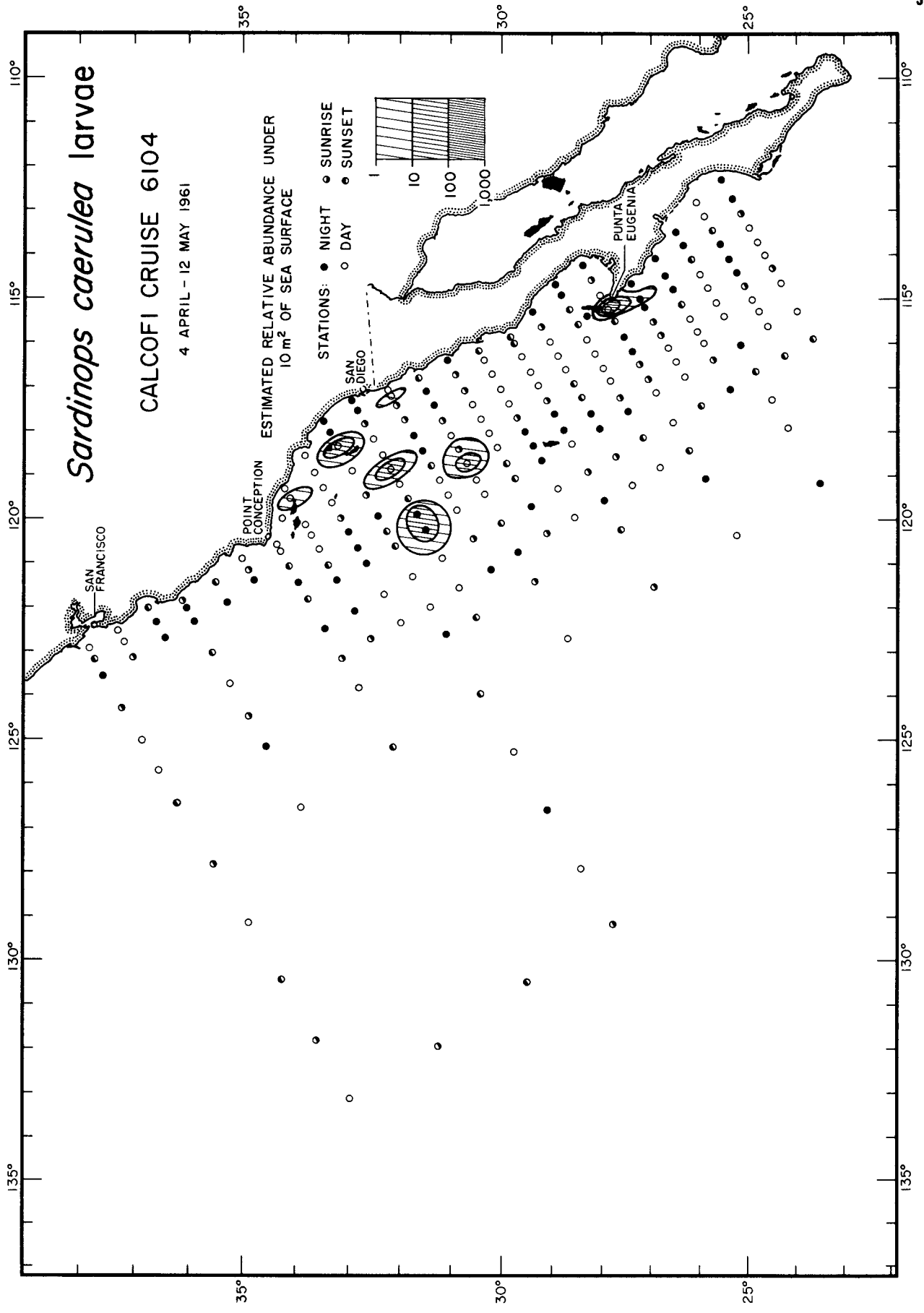


*Sardinops caerulea* larvae

6004

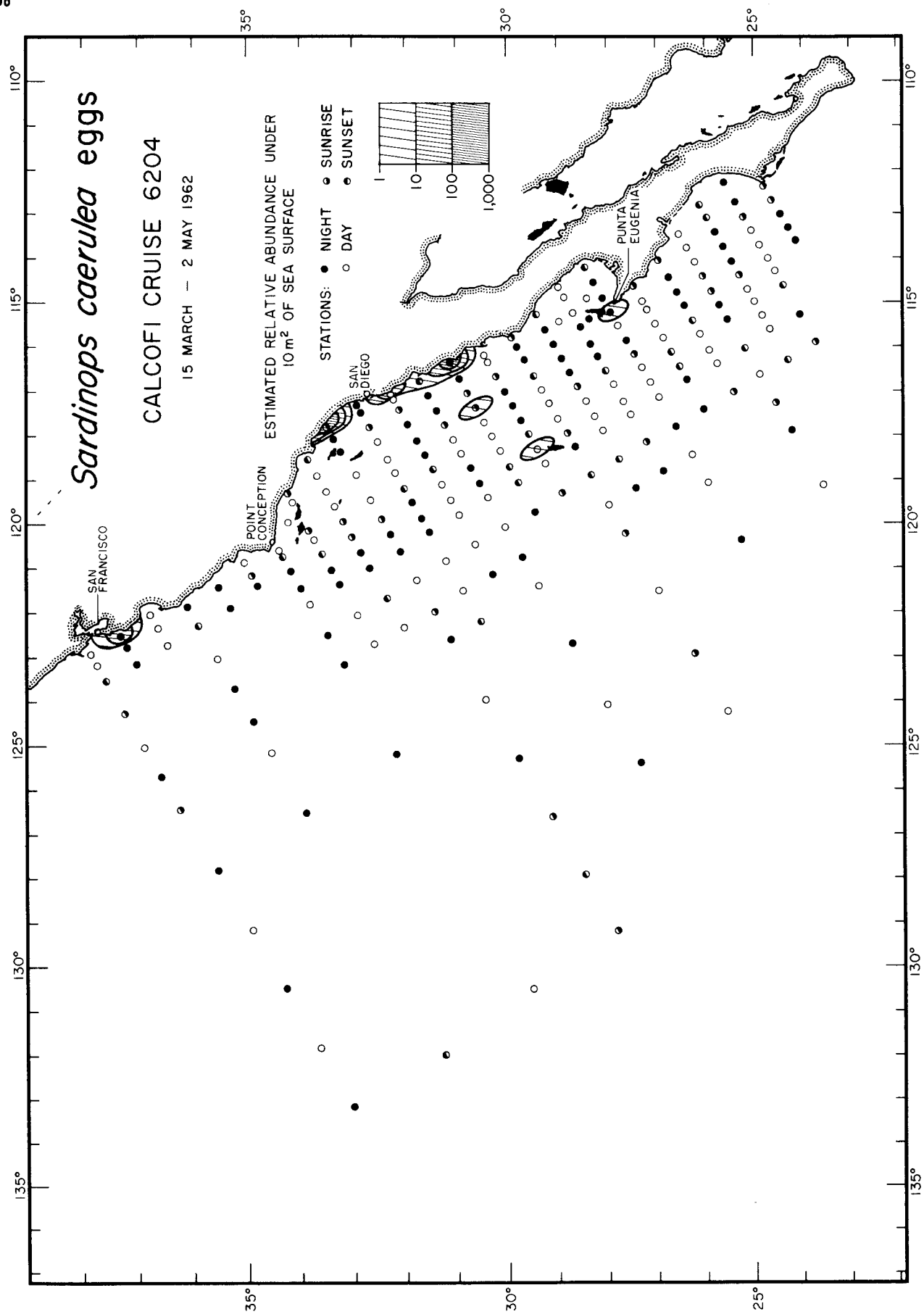


*Sardinops caerulea* eggs  
6104



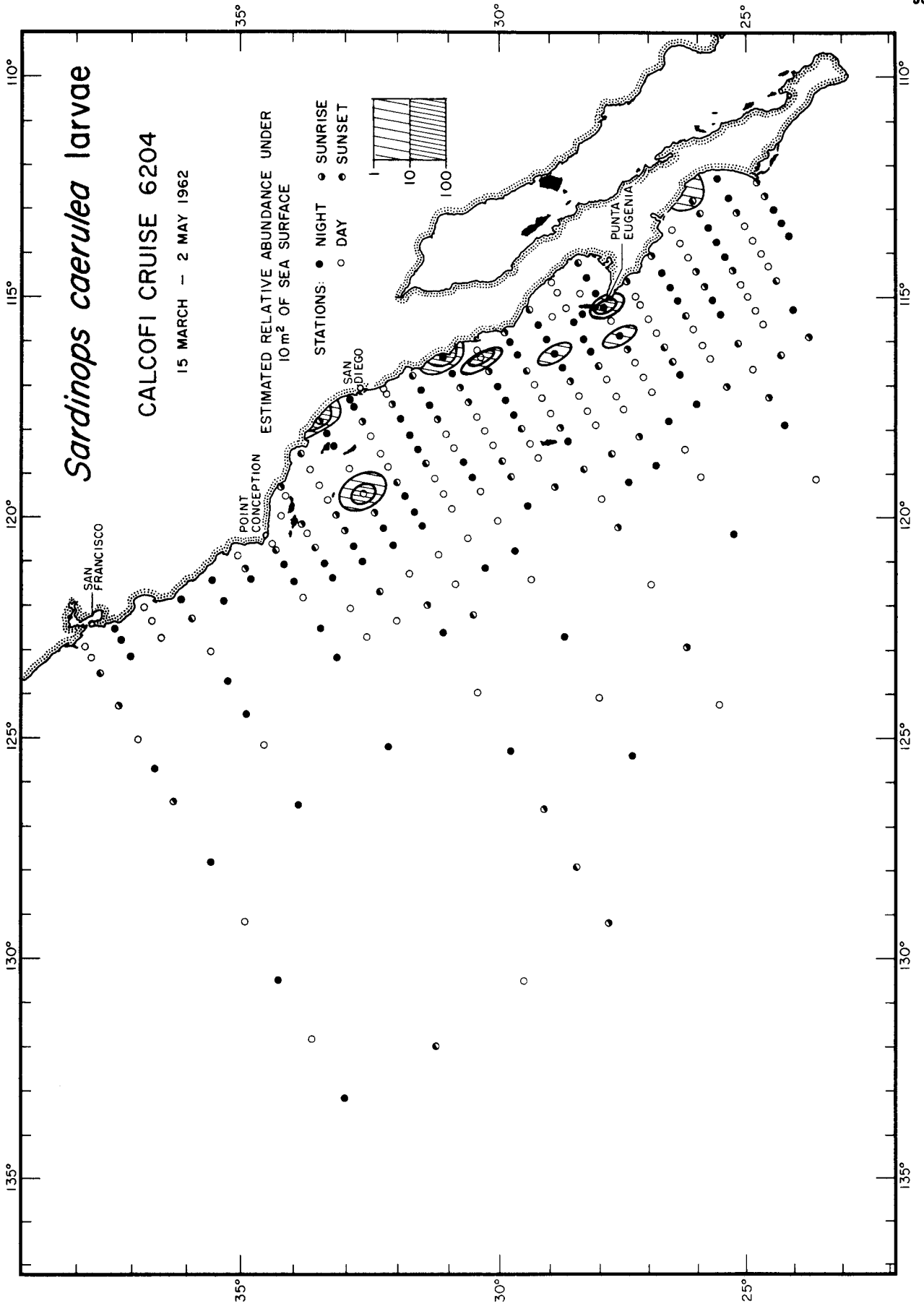
*Sardinops caerulea* larvae

6104



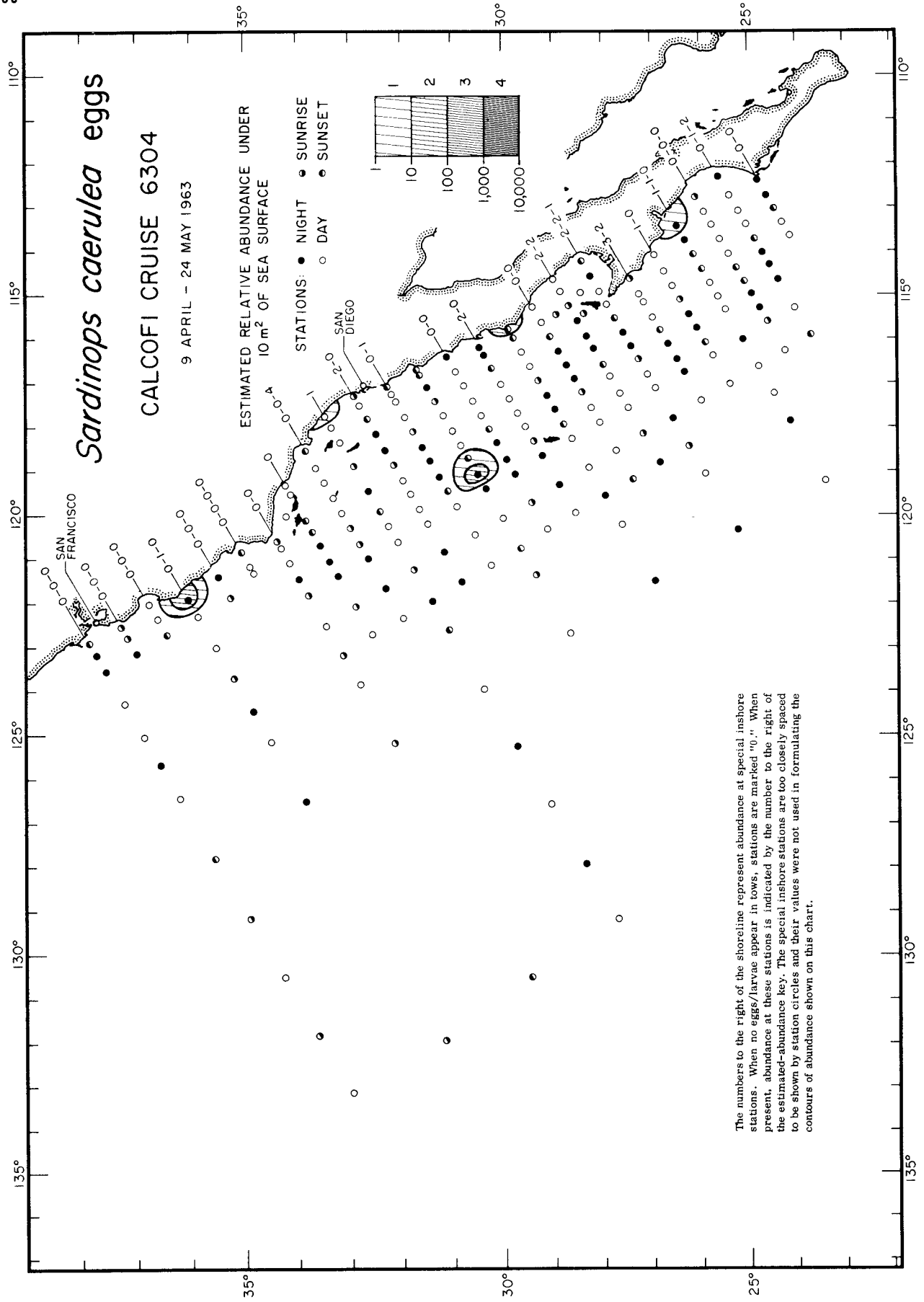
*Sardinops caerulea* eggs

6204

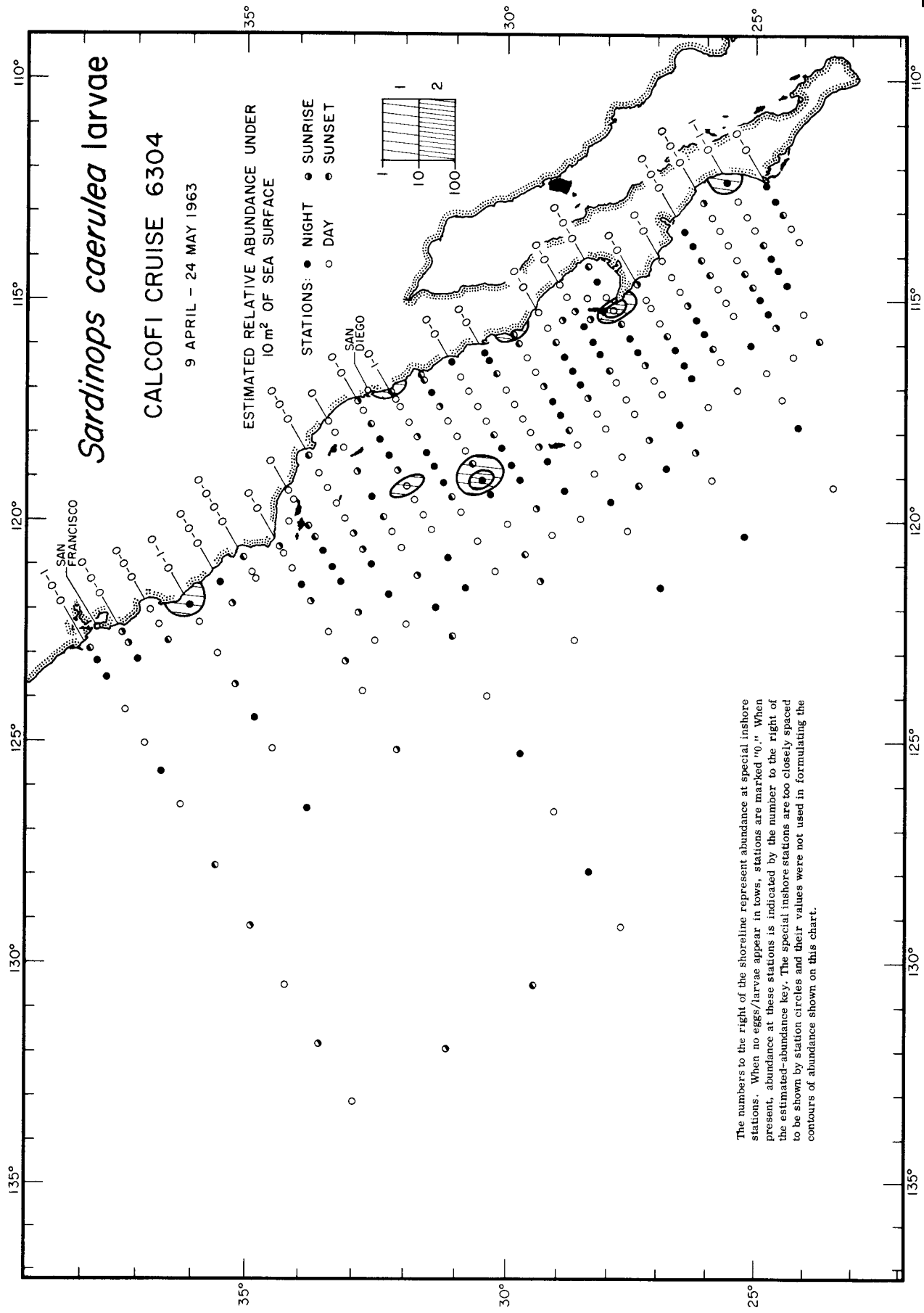


*Sardinops caerulea* larvae

6204



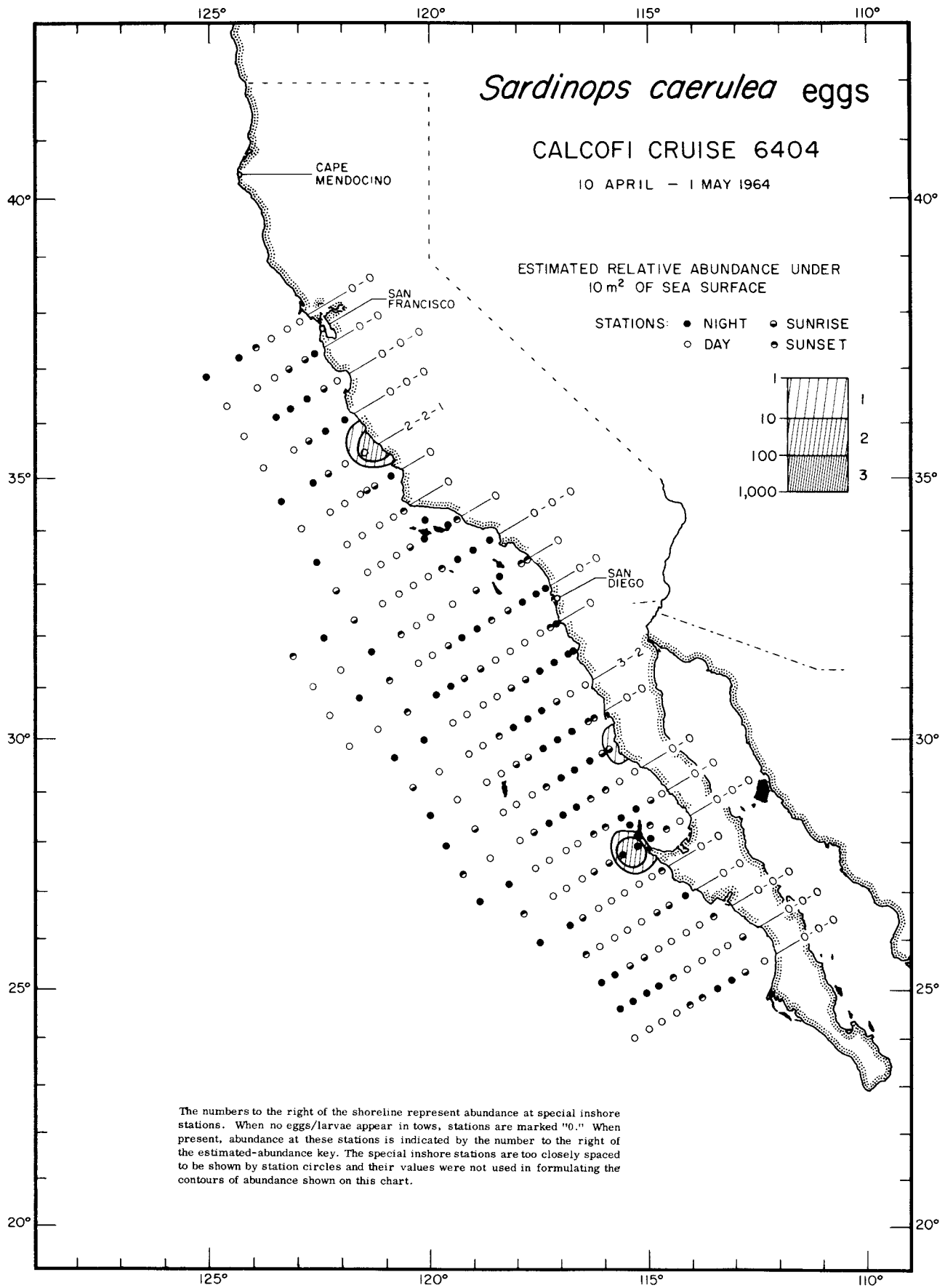
The numbers to the right of the shoreline represent abundance at special inshore stations. When no eggs/larvae appear in tows, stations are marked "0." When present, abundance at these stations is indicated by the number to the right of the estimated-abundance key. The special inshore stations are too closely spaced to be shown by station circles and their values were not used in formulating the contours of abundance shown on this chart.

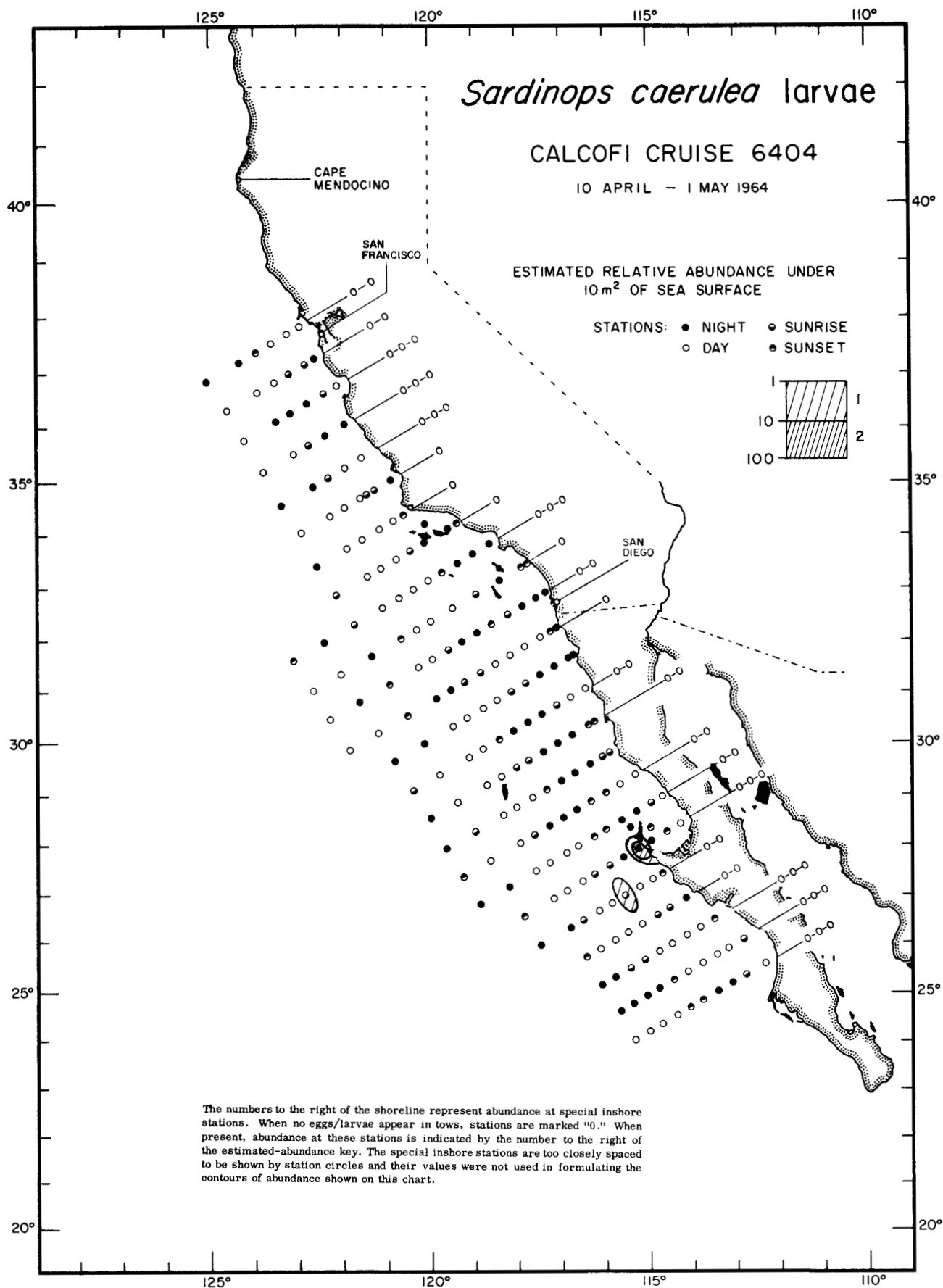


*Sardinops caerulea* larvae

6304

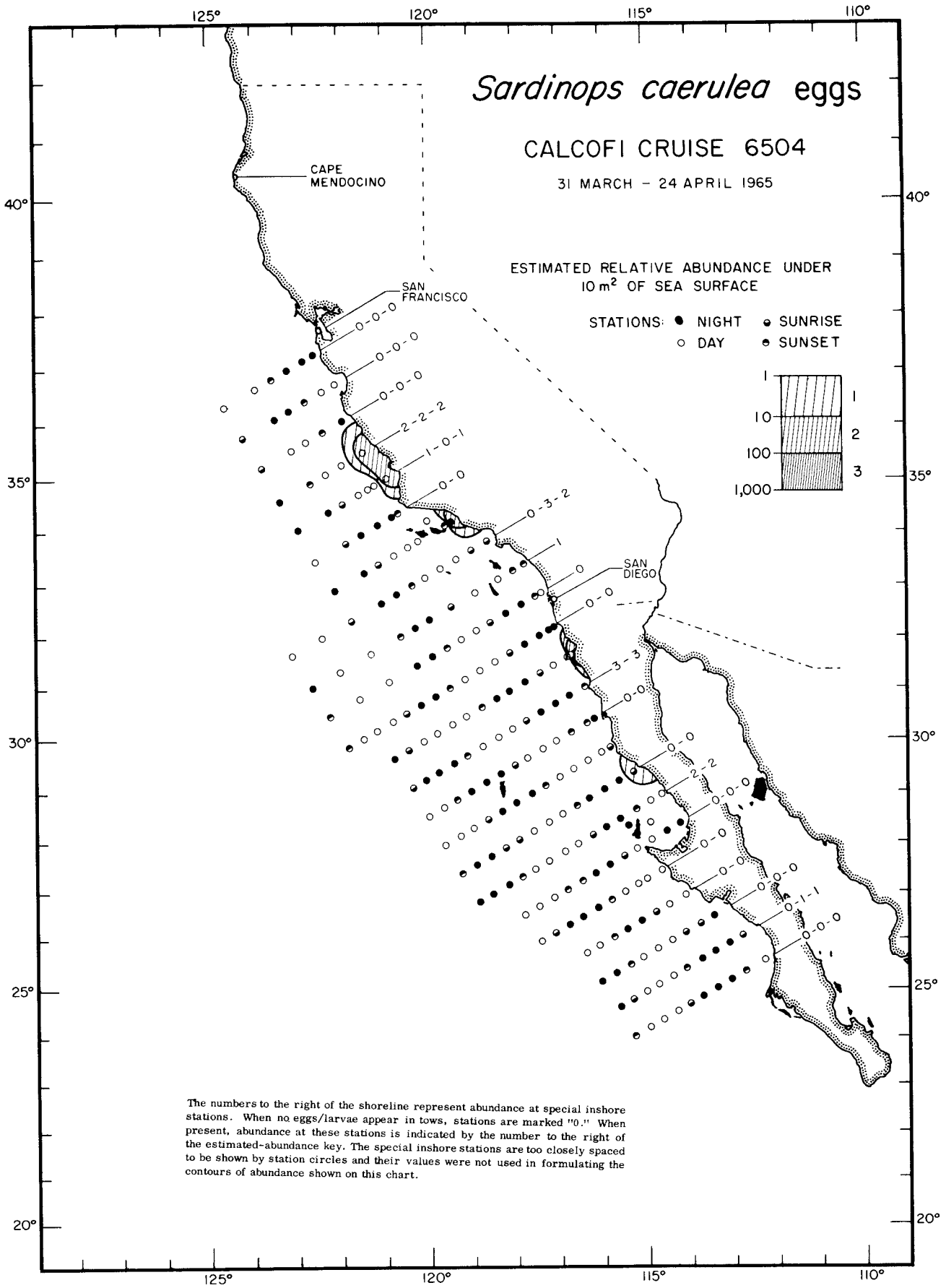






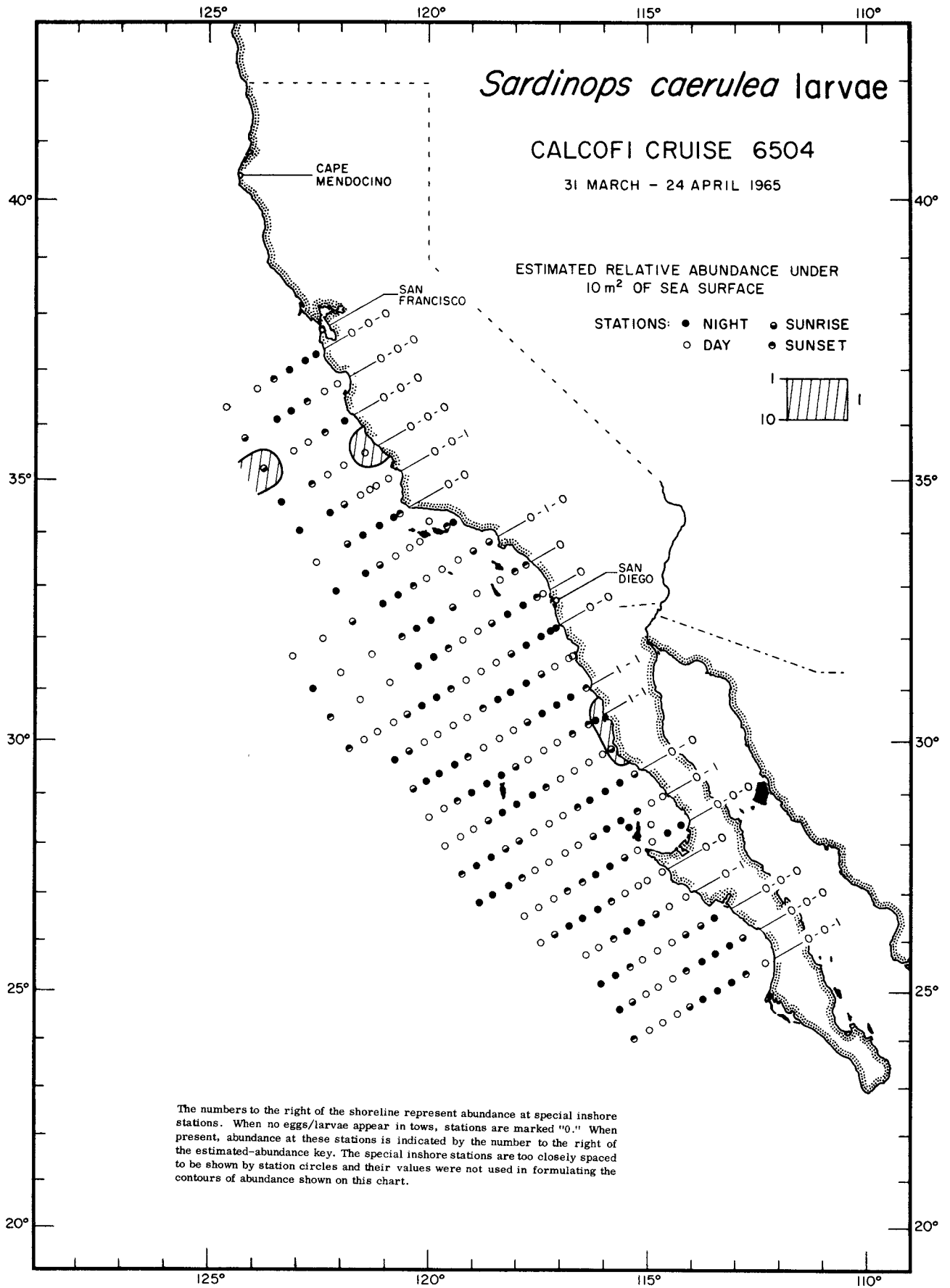
*Sardinops caerulea* larvae

6404



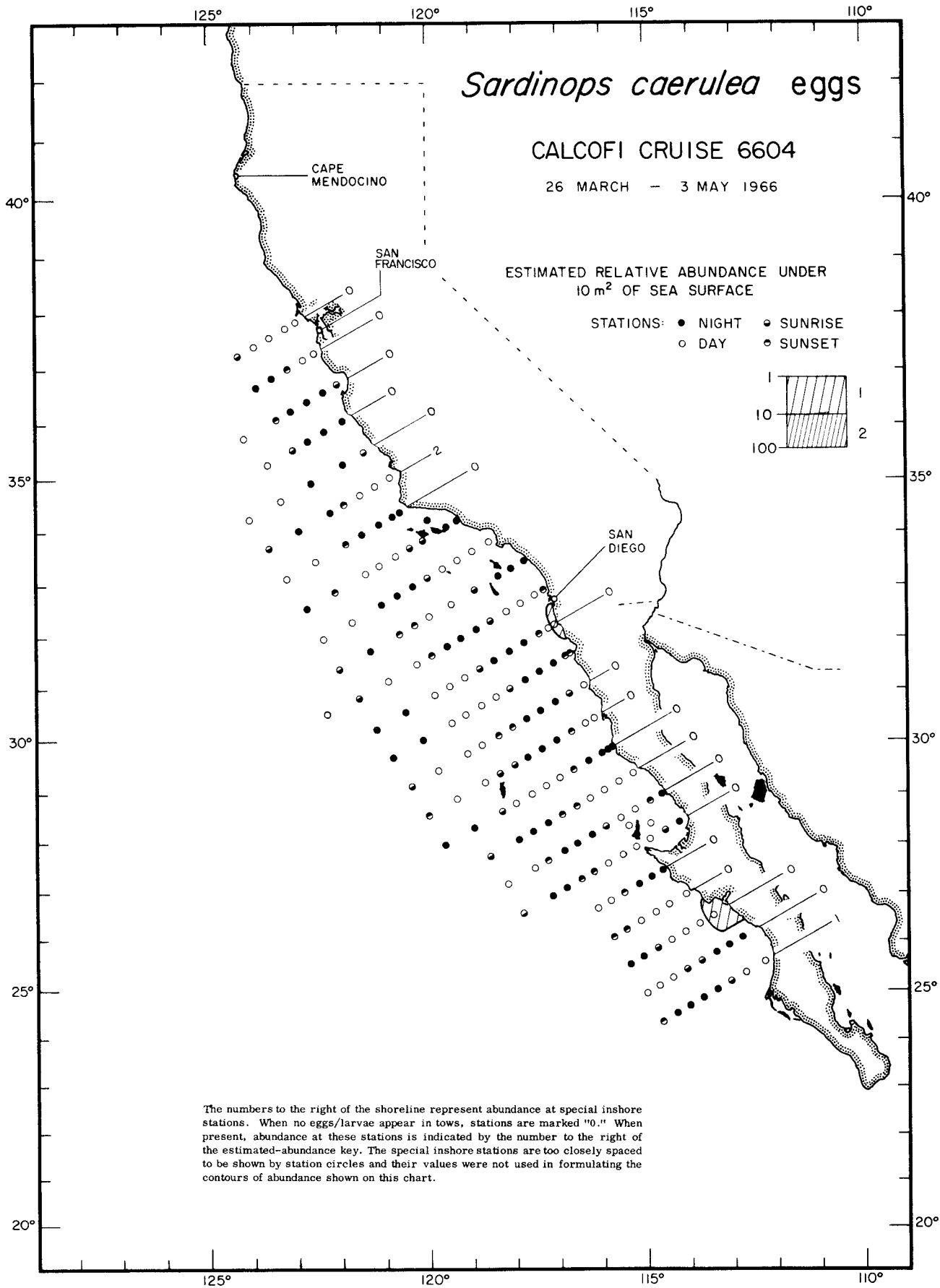
*Sardinops caerulea* eggs

6504



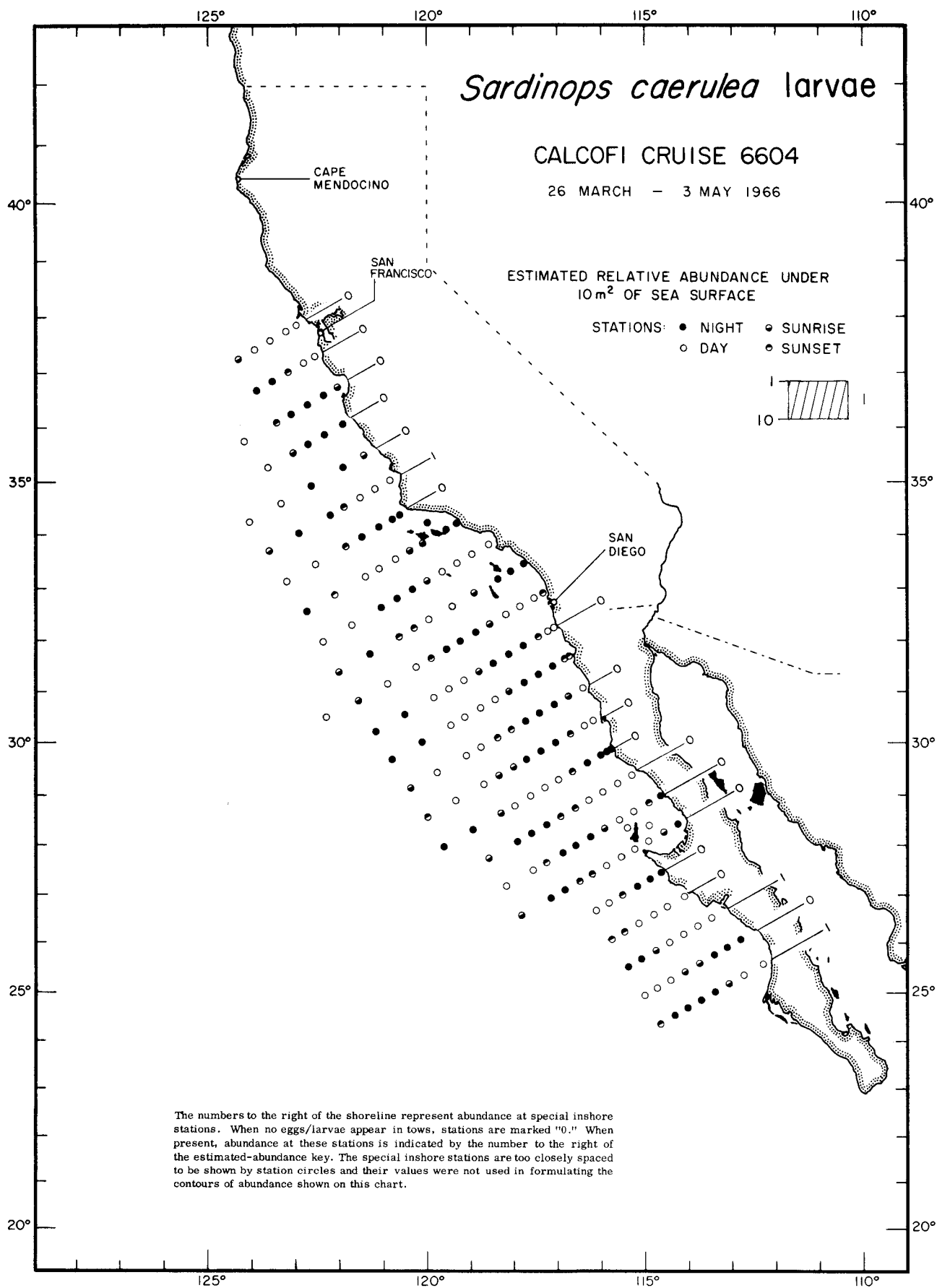
*Sardinops caerulea* larvae

6504



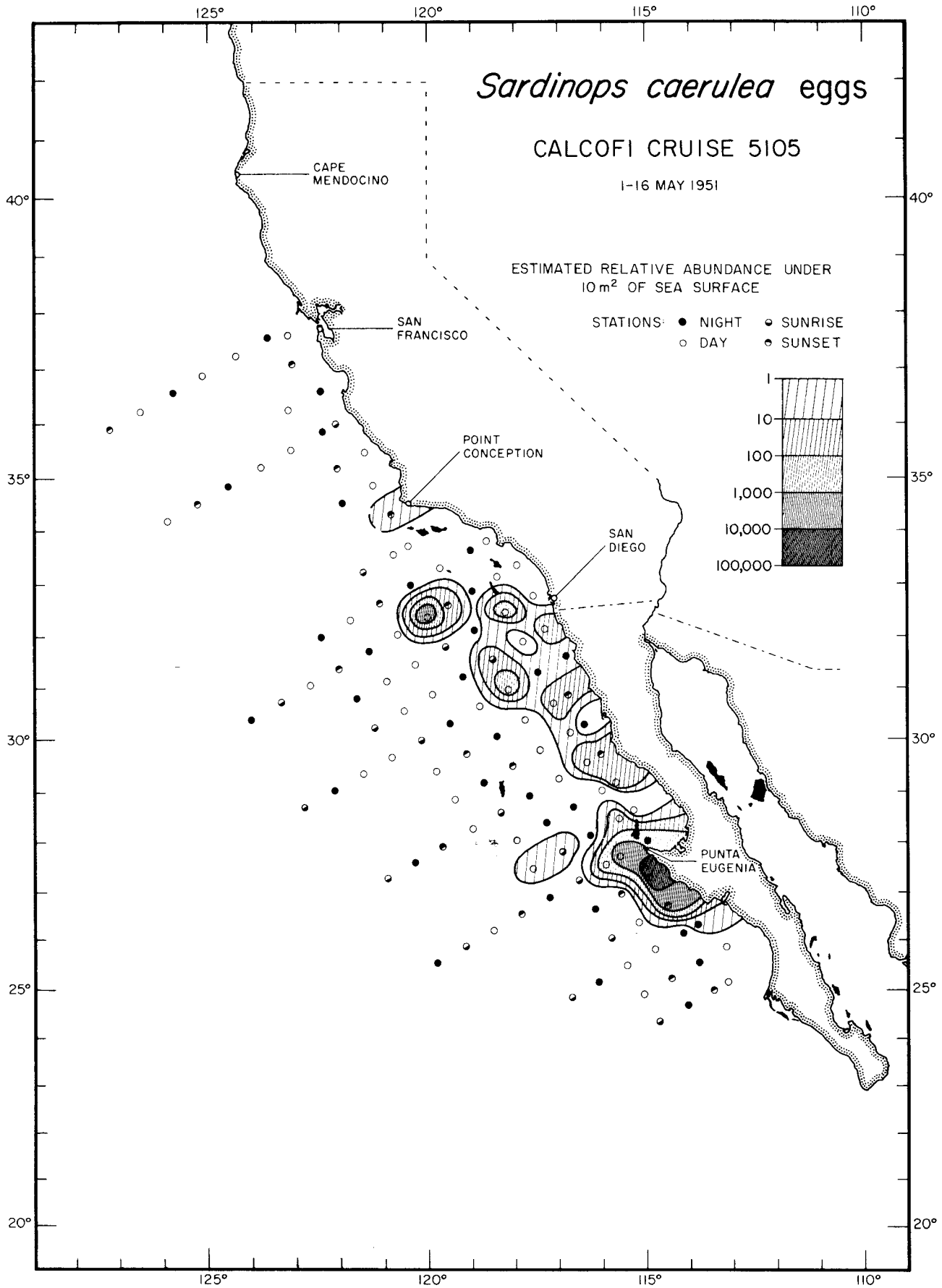
*Sardinops caerulea* eggs

6604



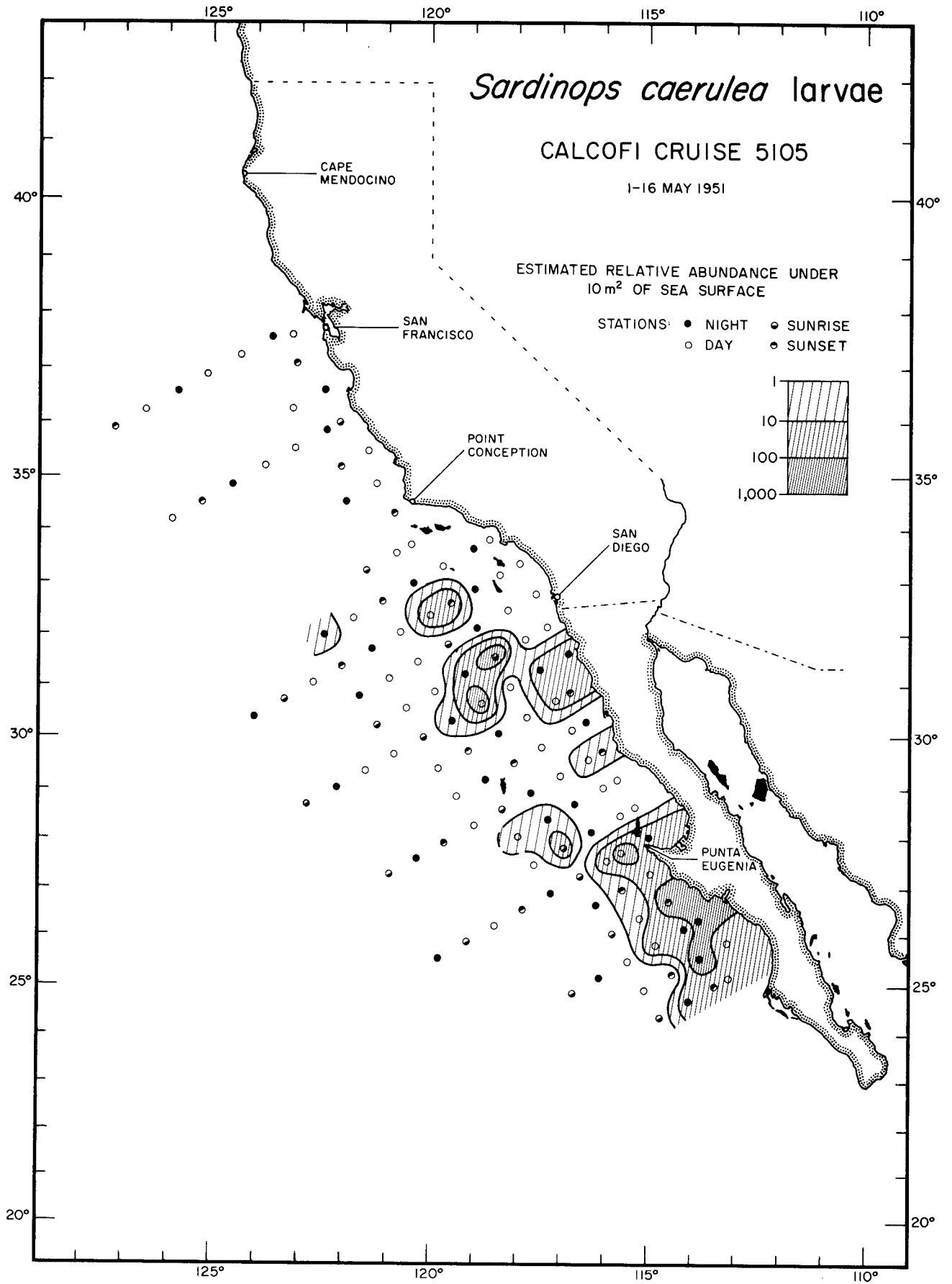
*Sardinops caerulea* larvae

6604



*Sardinops caerulea* eggs

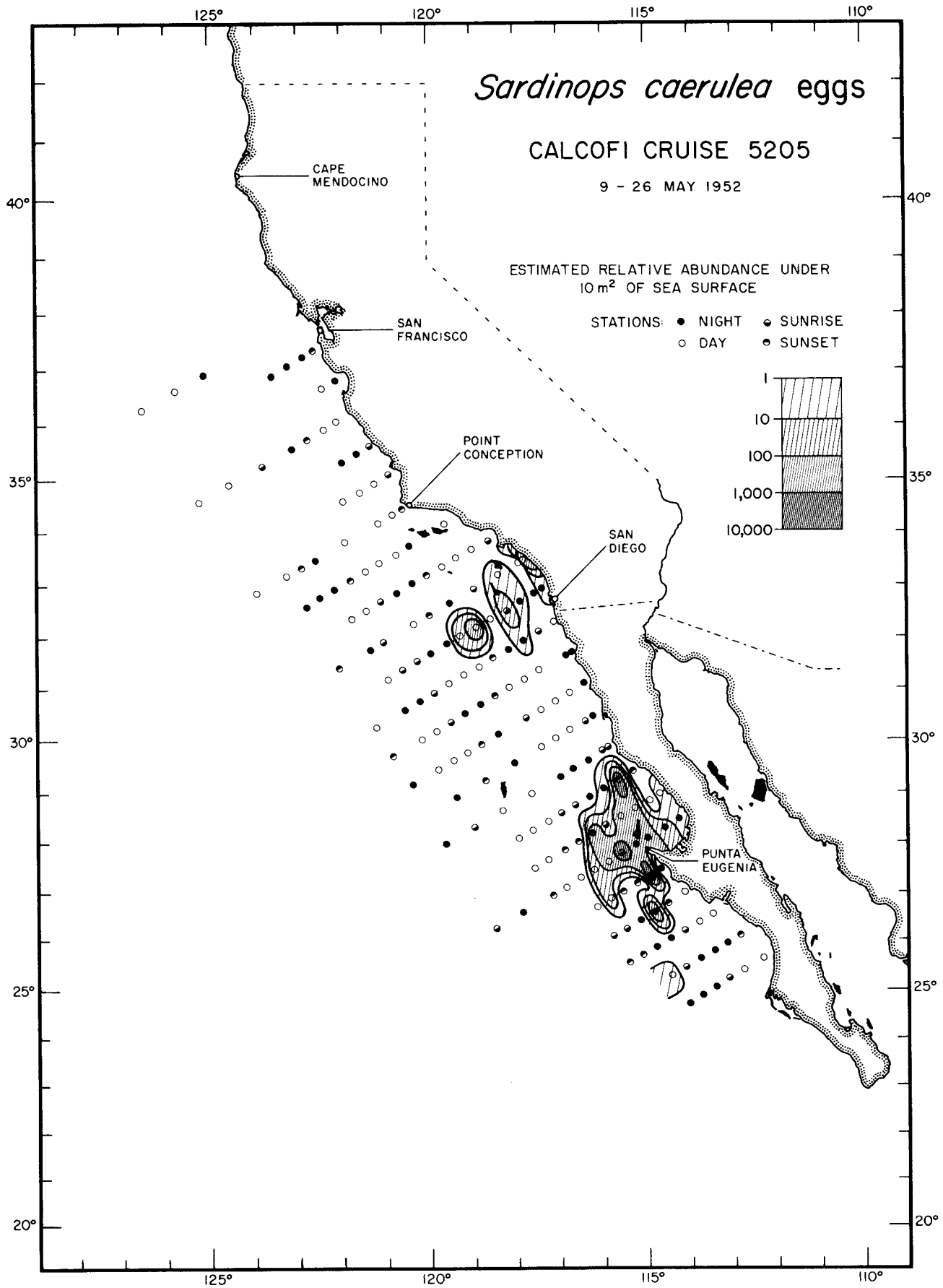
5105



*Sardinops caerulea* larvae

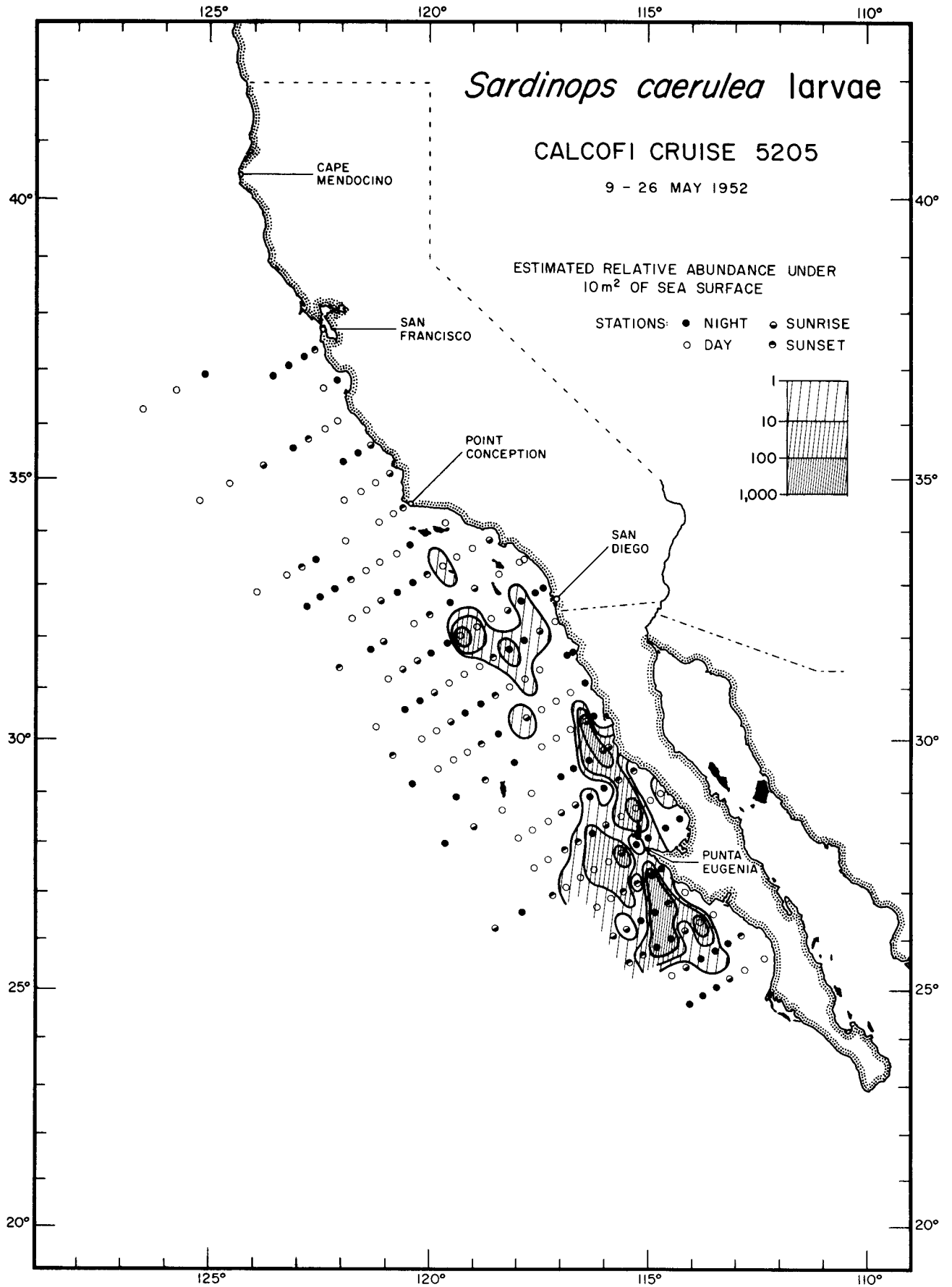
5105





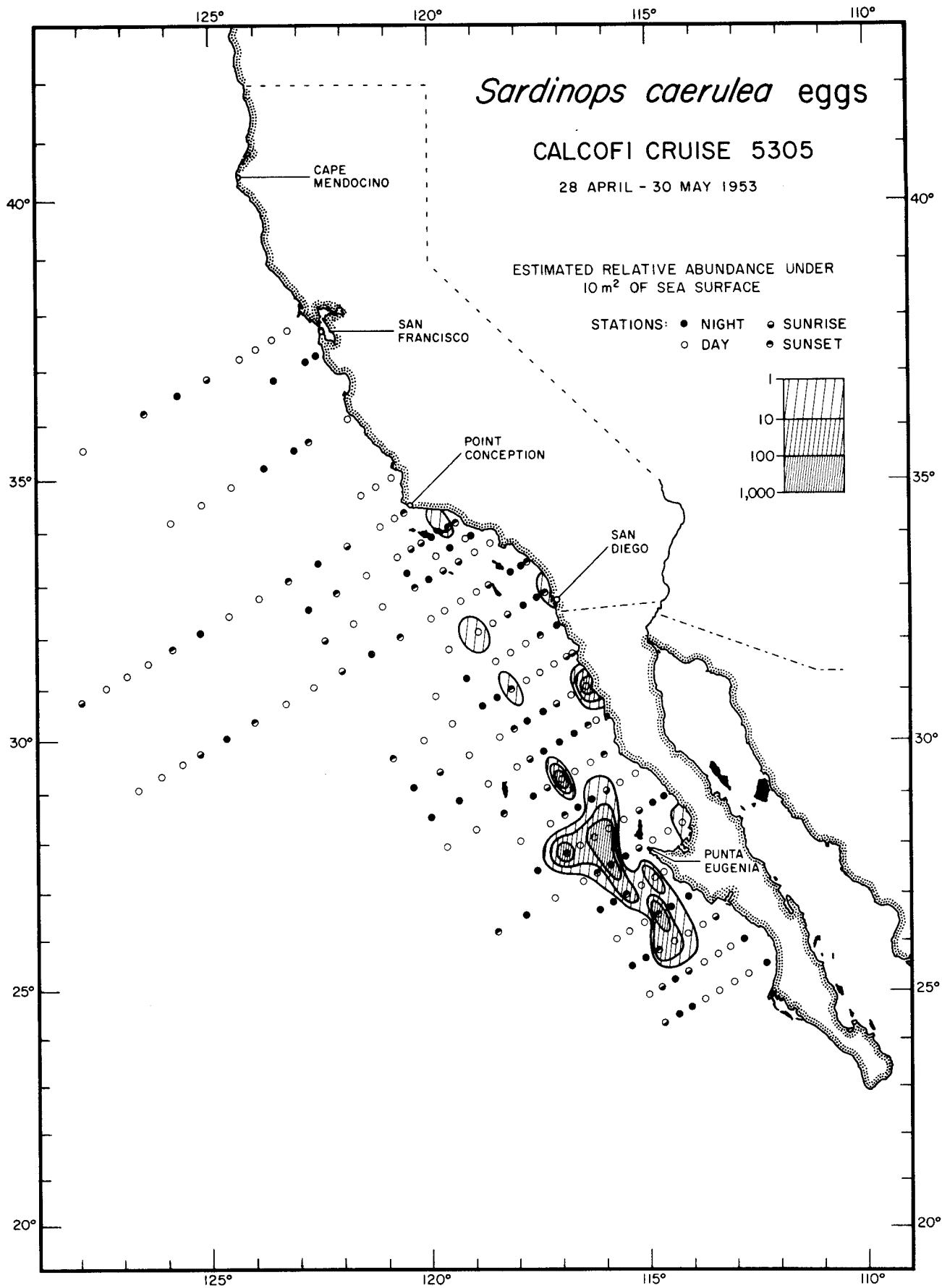
*Sardinops caerulea* eggs

5205



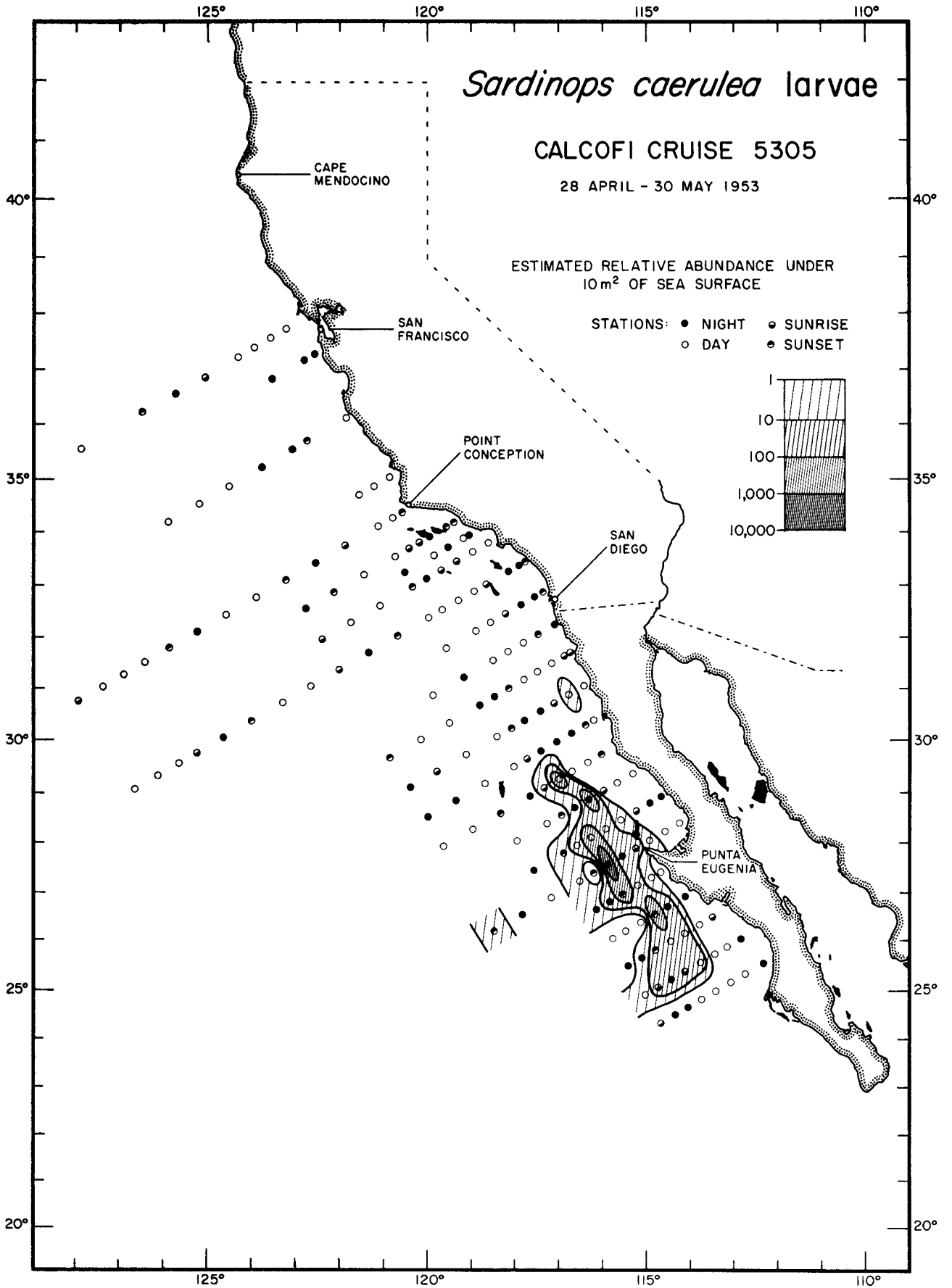
*Sardinops caerulea* larvae

5205



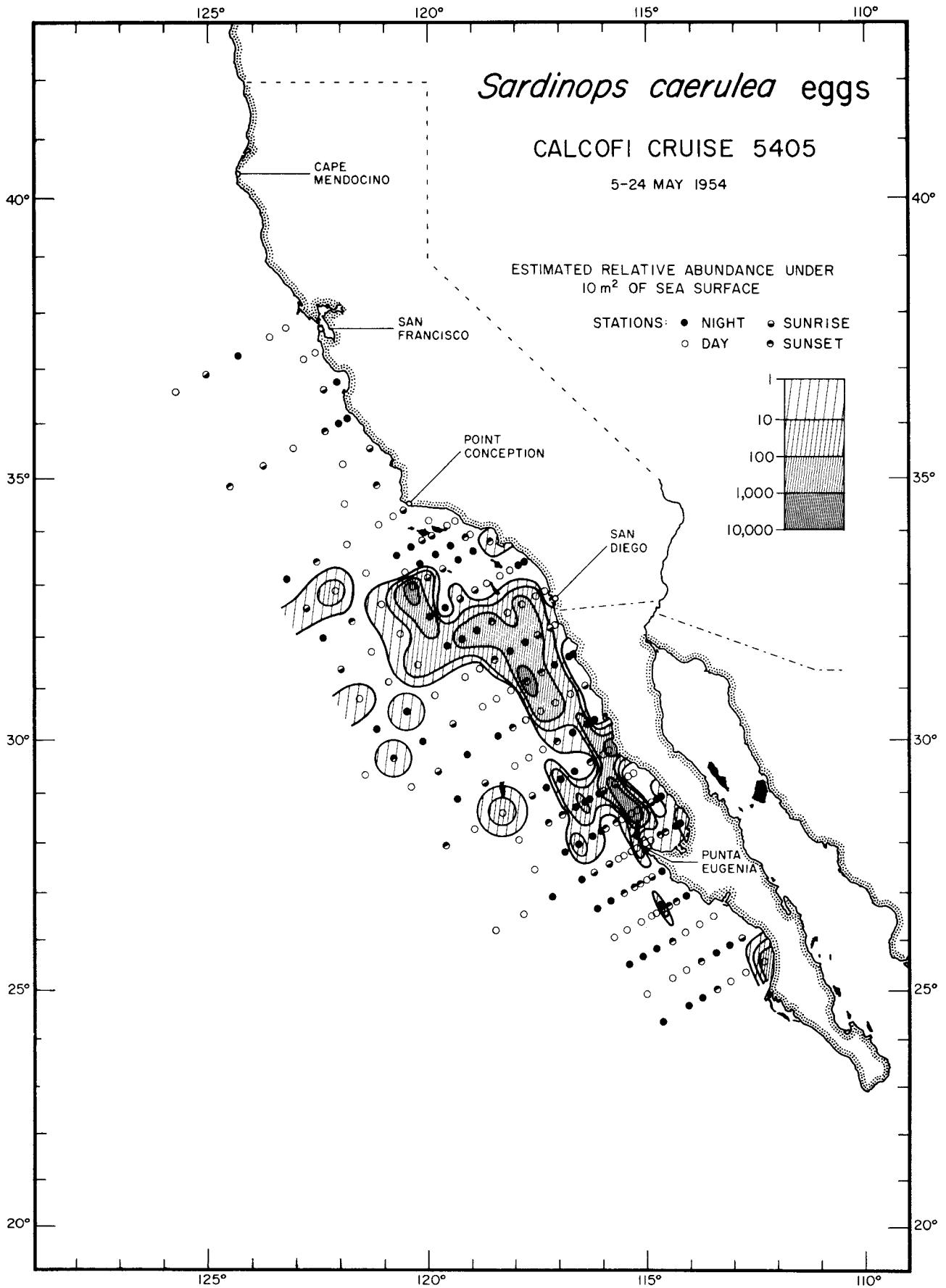
*Sardinops caerulea* eggs

5305



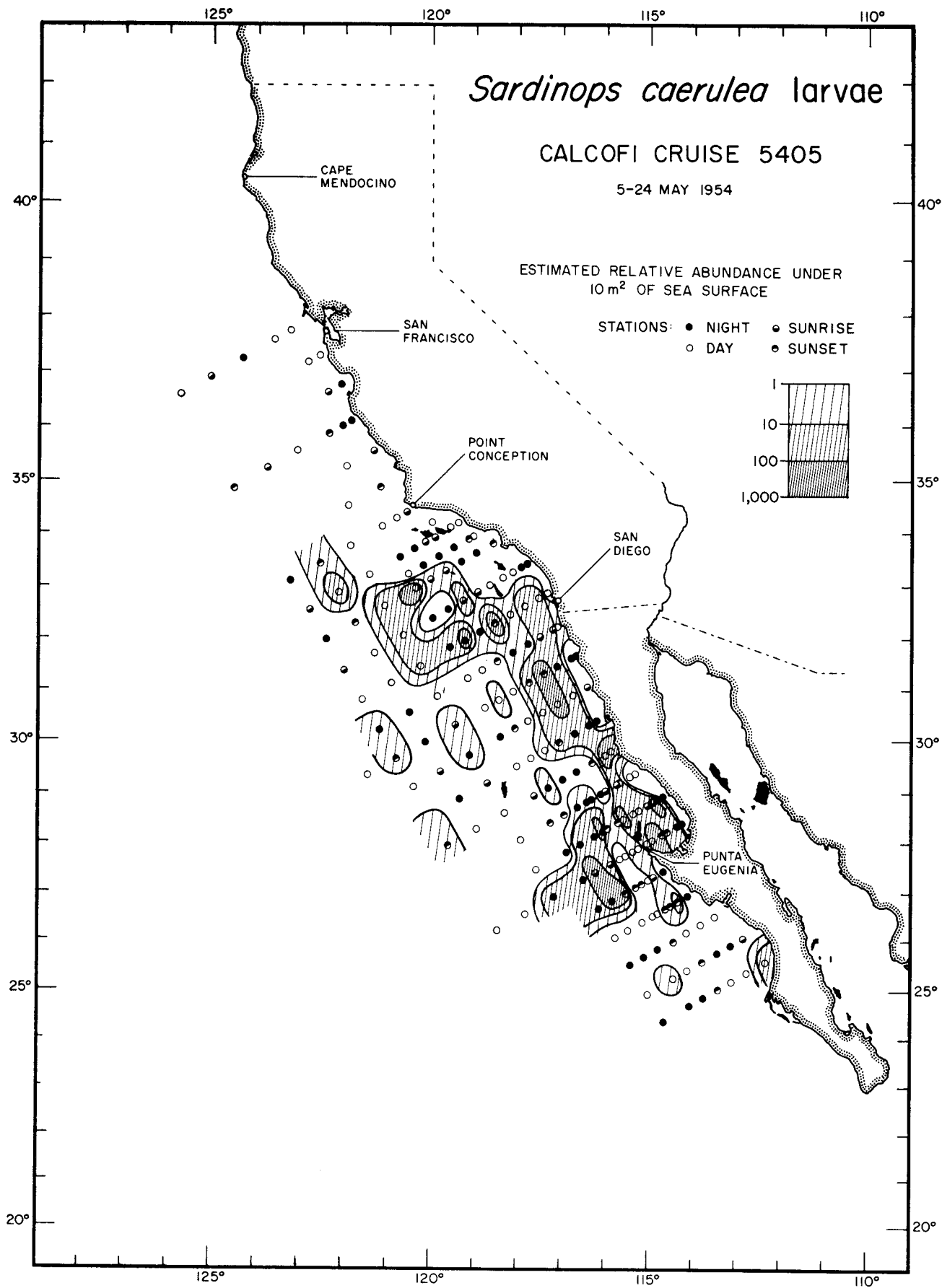
*Sardinops caerulea* larvae

5305



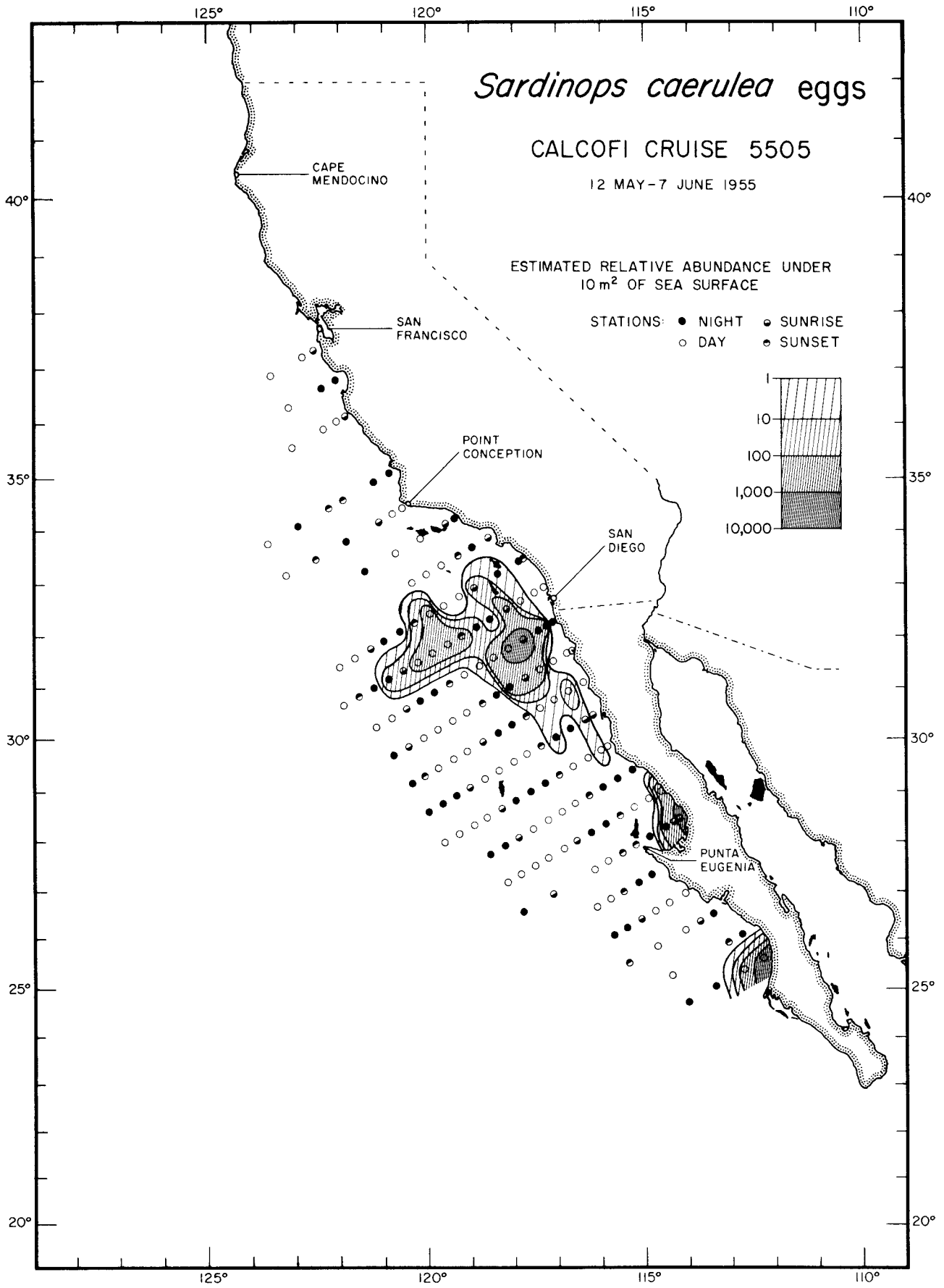
*Sardinops caerulea* eggs

5405



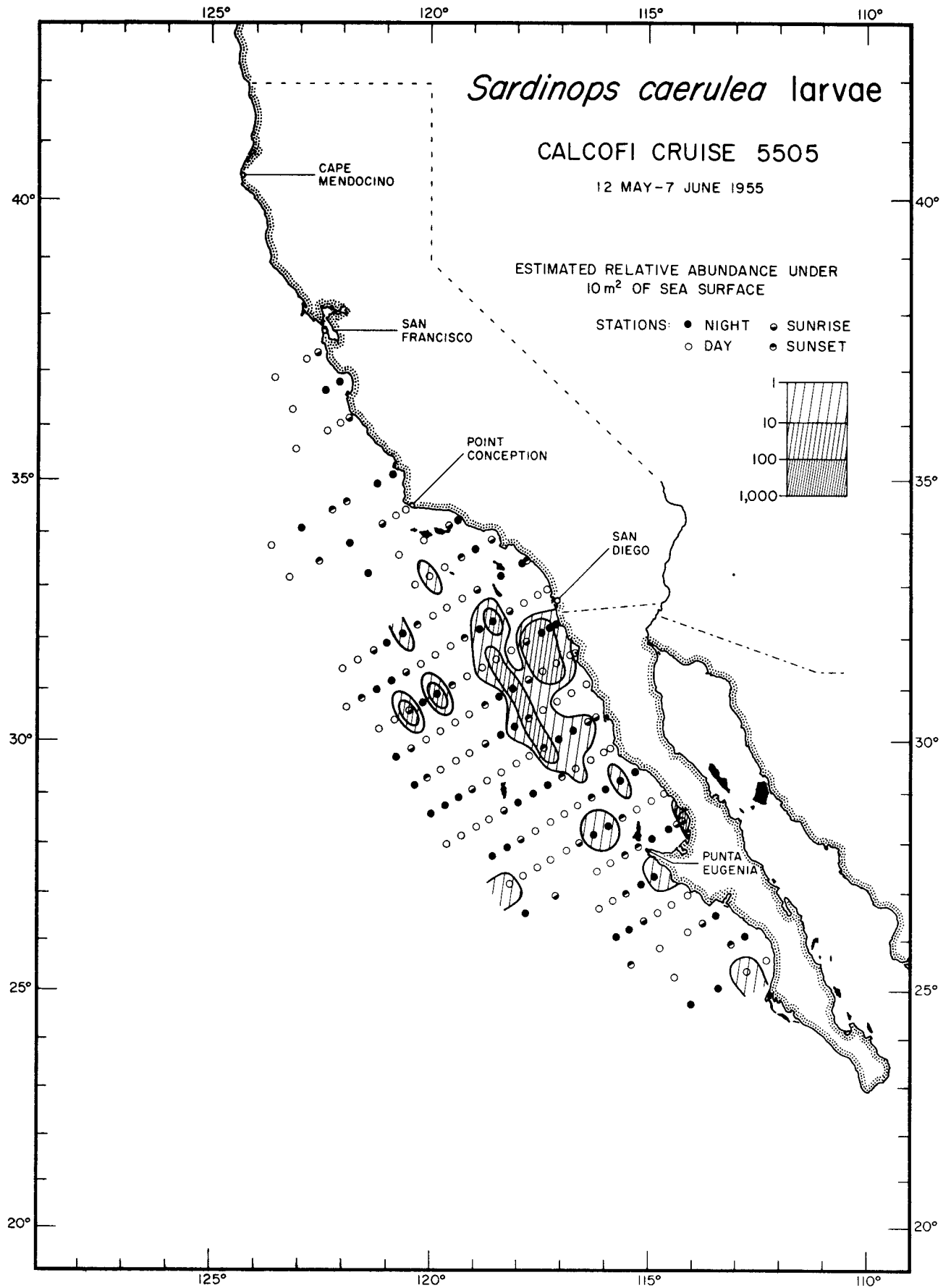
*Sardinops caerulea* larvae

5405



*Sardinops caerulea* eggs

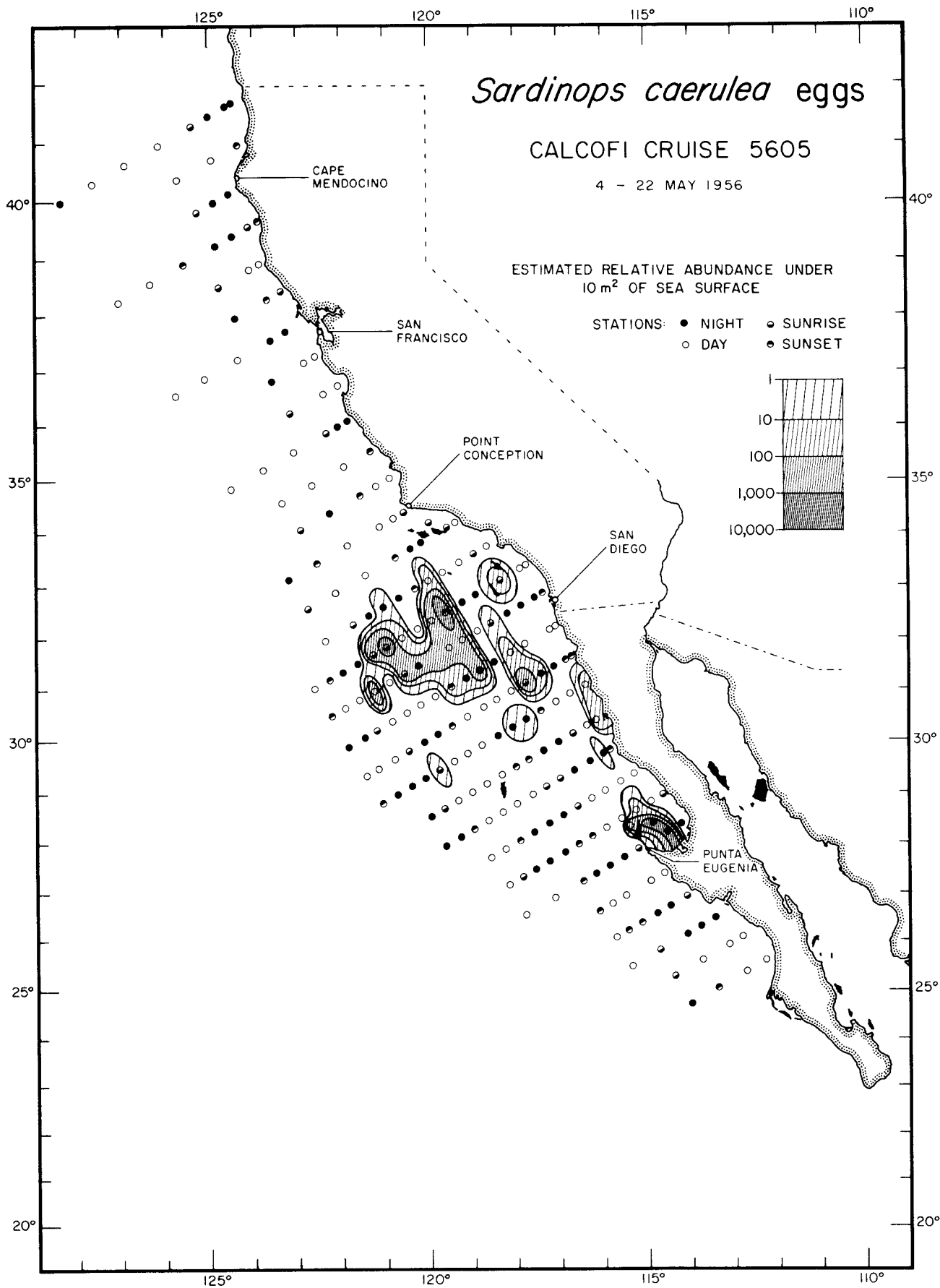
5505



*Sardinops caerulea* larvae

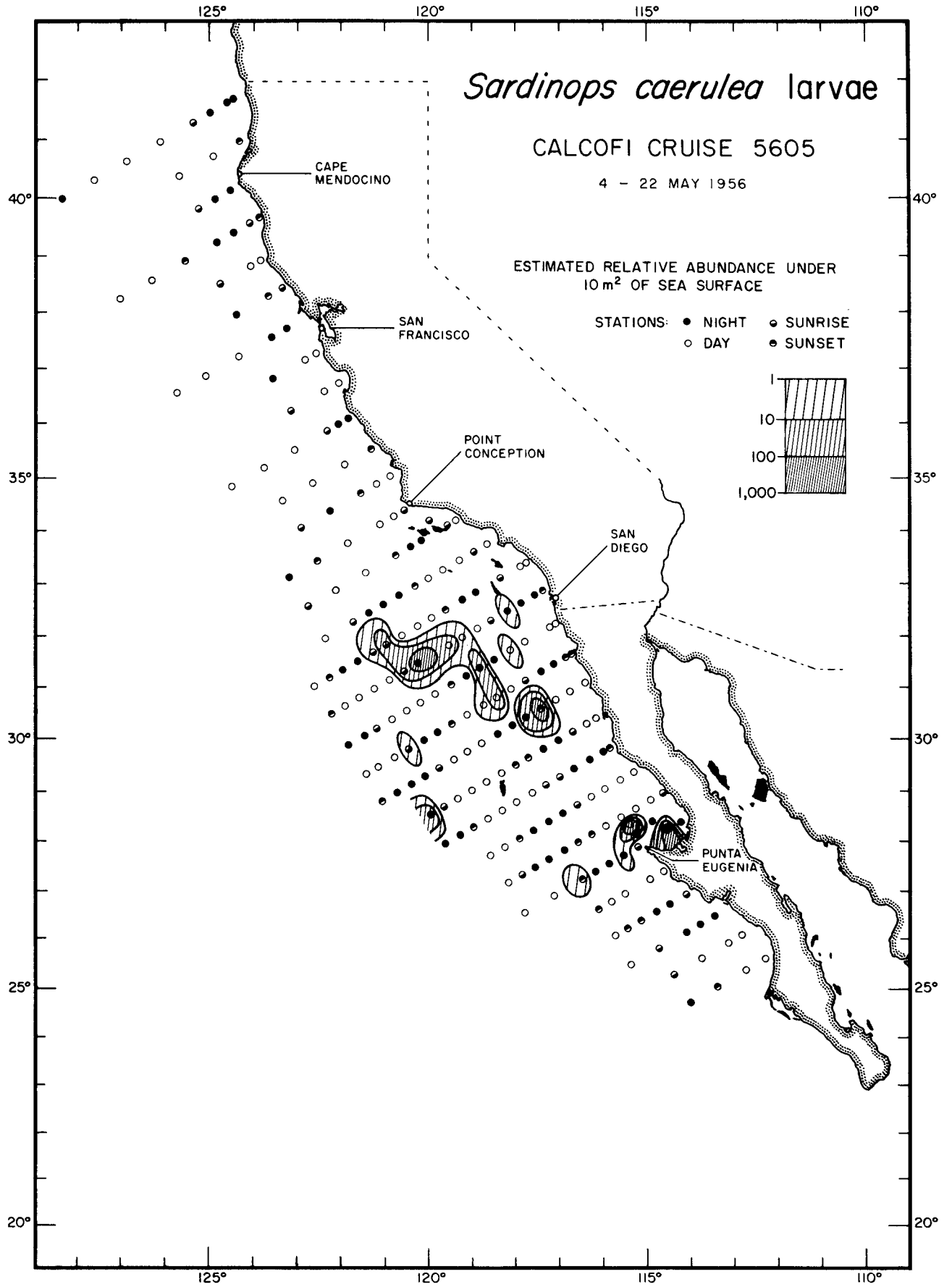
5505





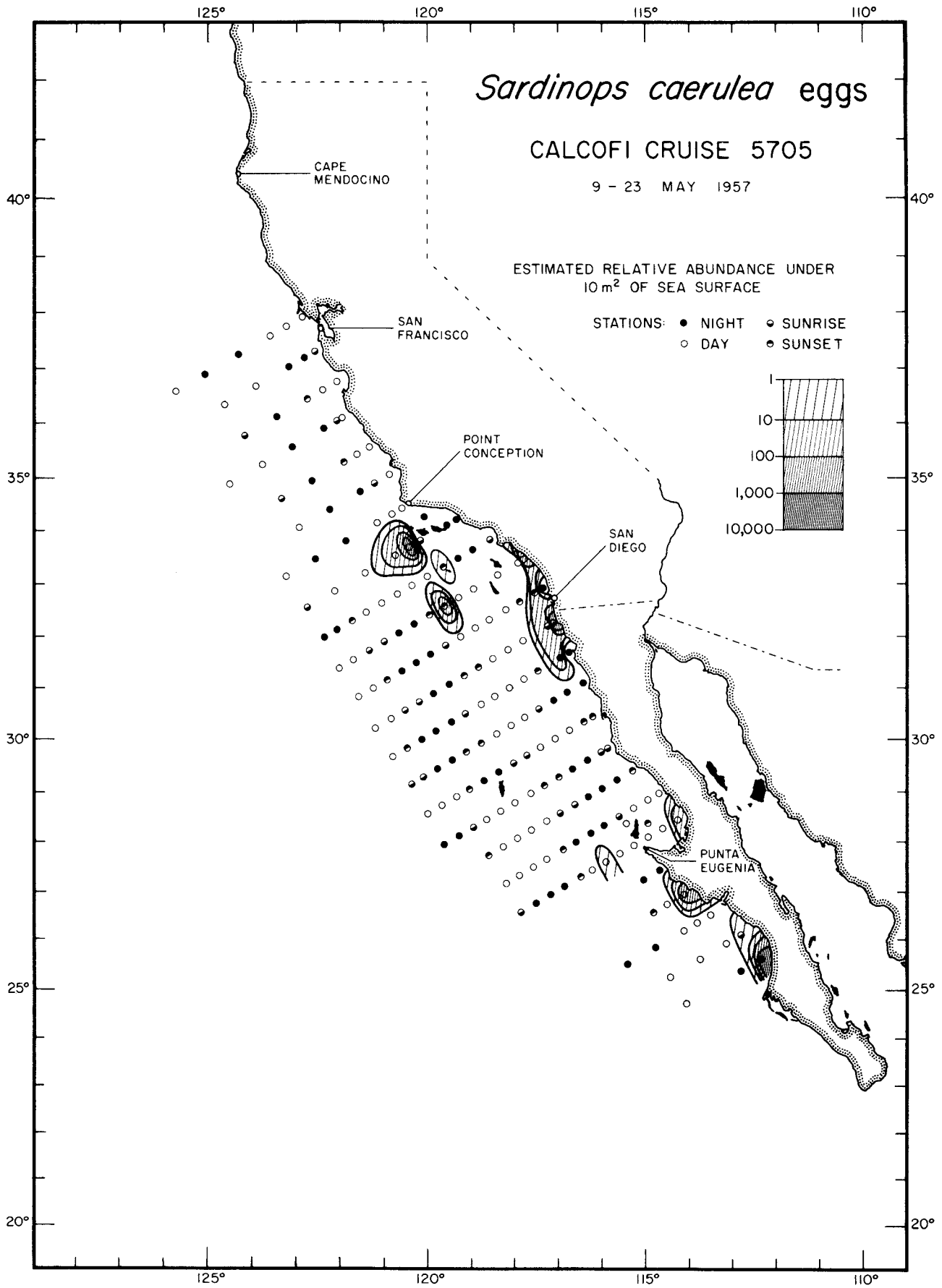
*Sardinops caerulea* eggs

5605

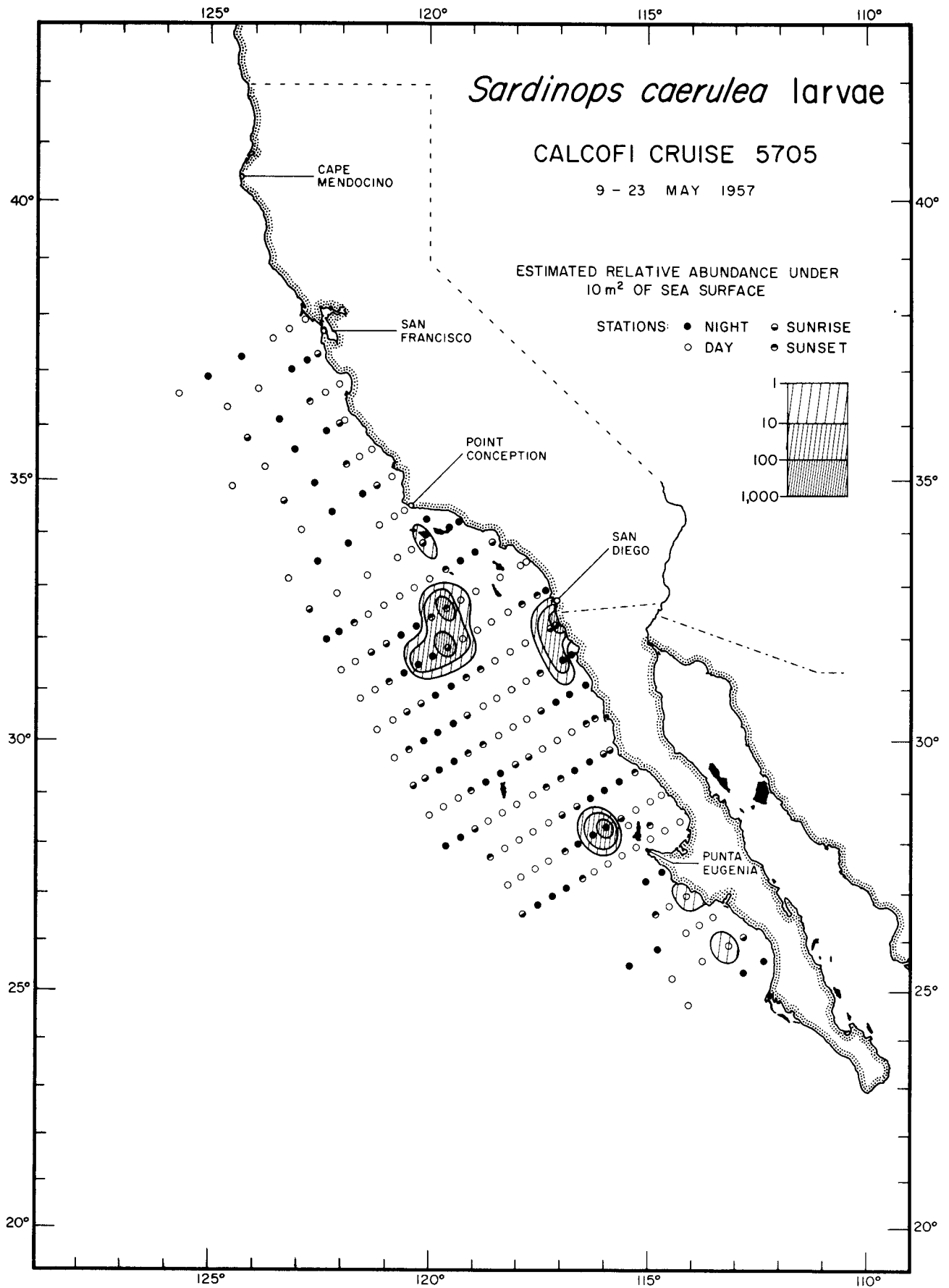


*Sardinops caerulea* larvae

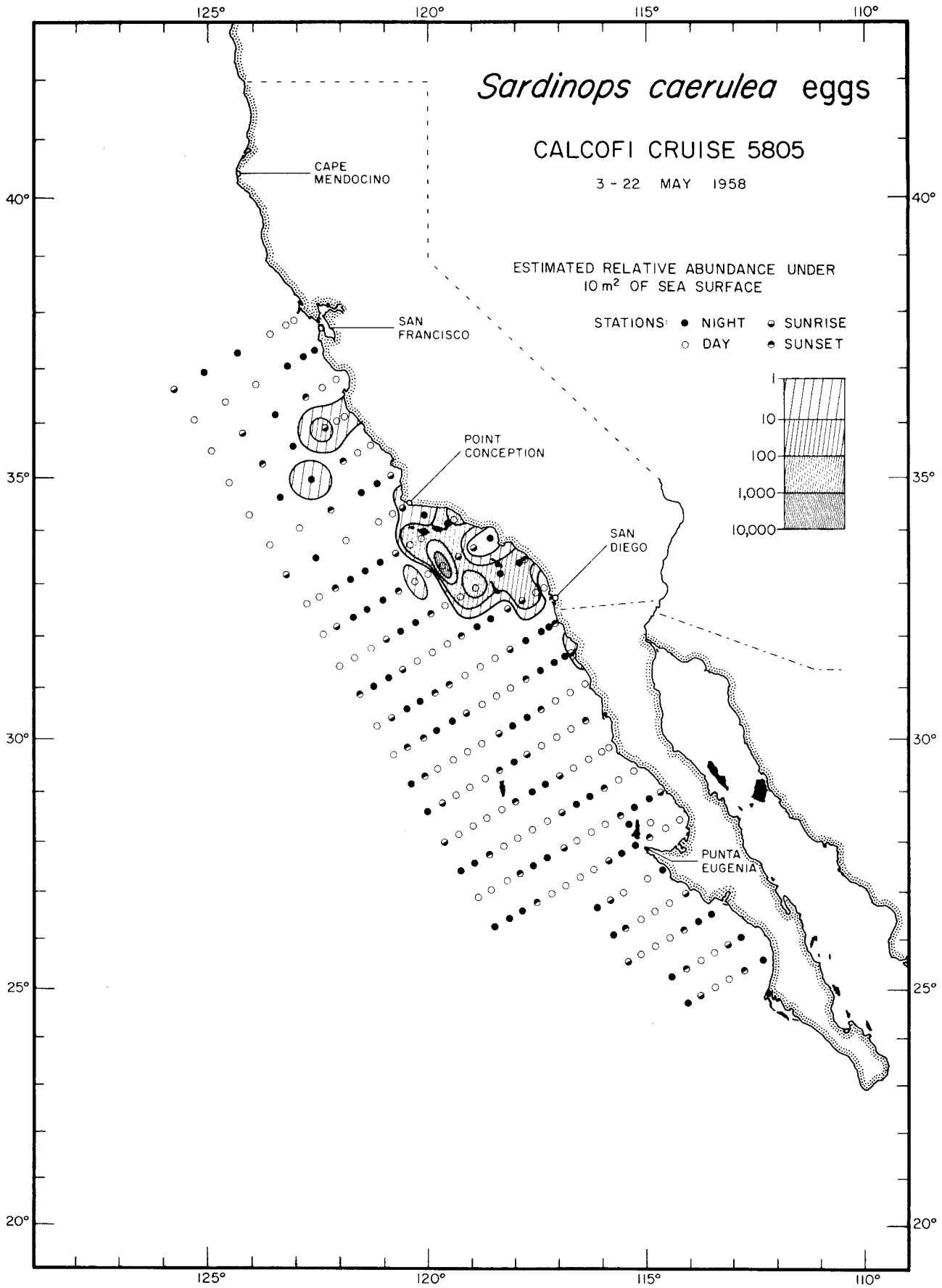
5605



*Sardinops caerulea* eggs  
5705

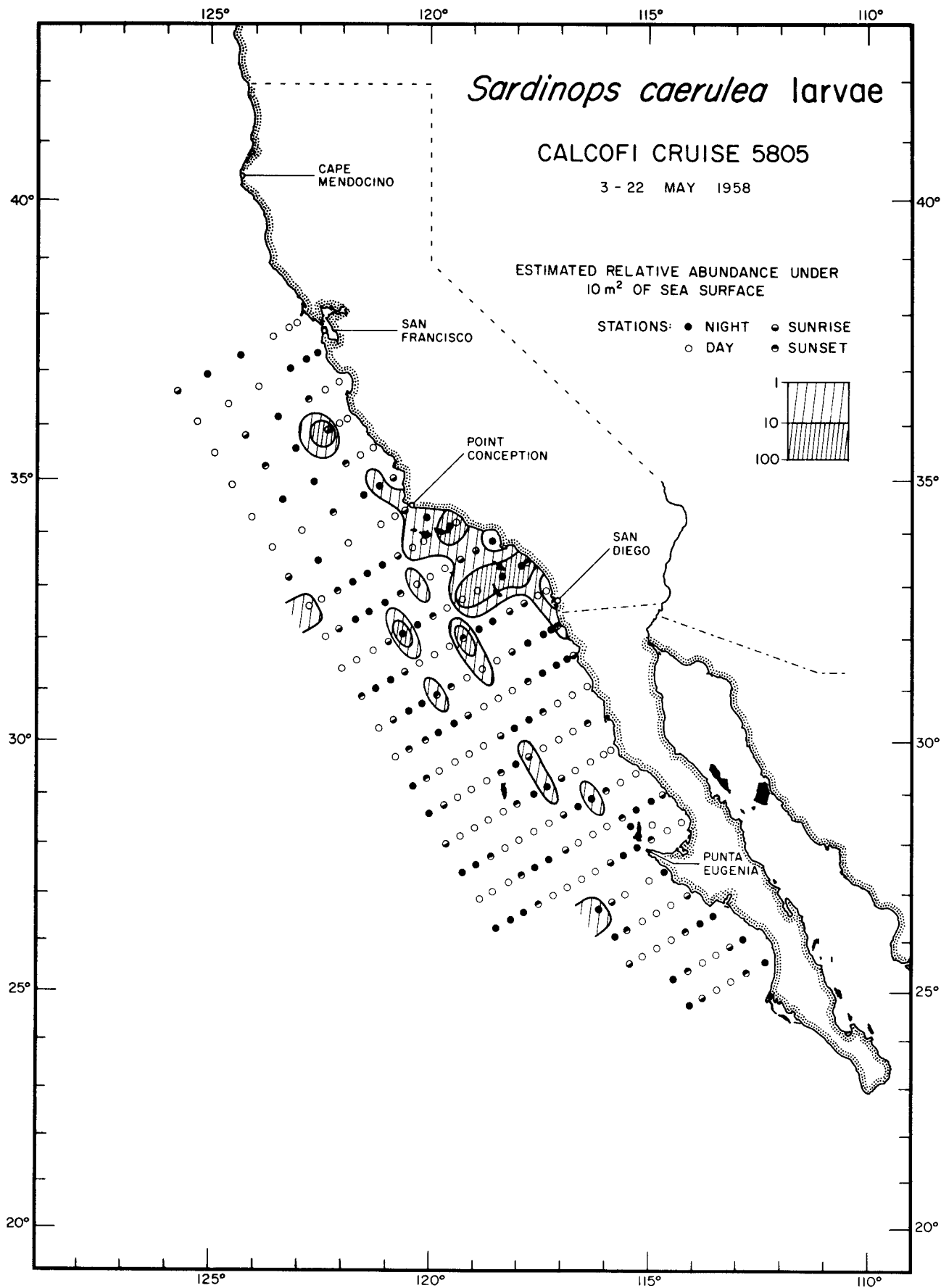


*Sardinops caerulea* larvae  
5705



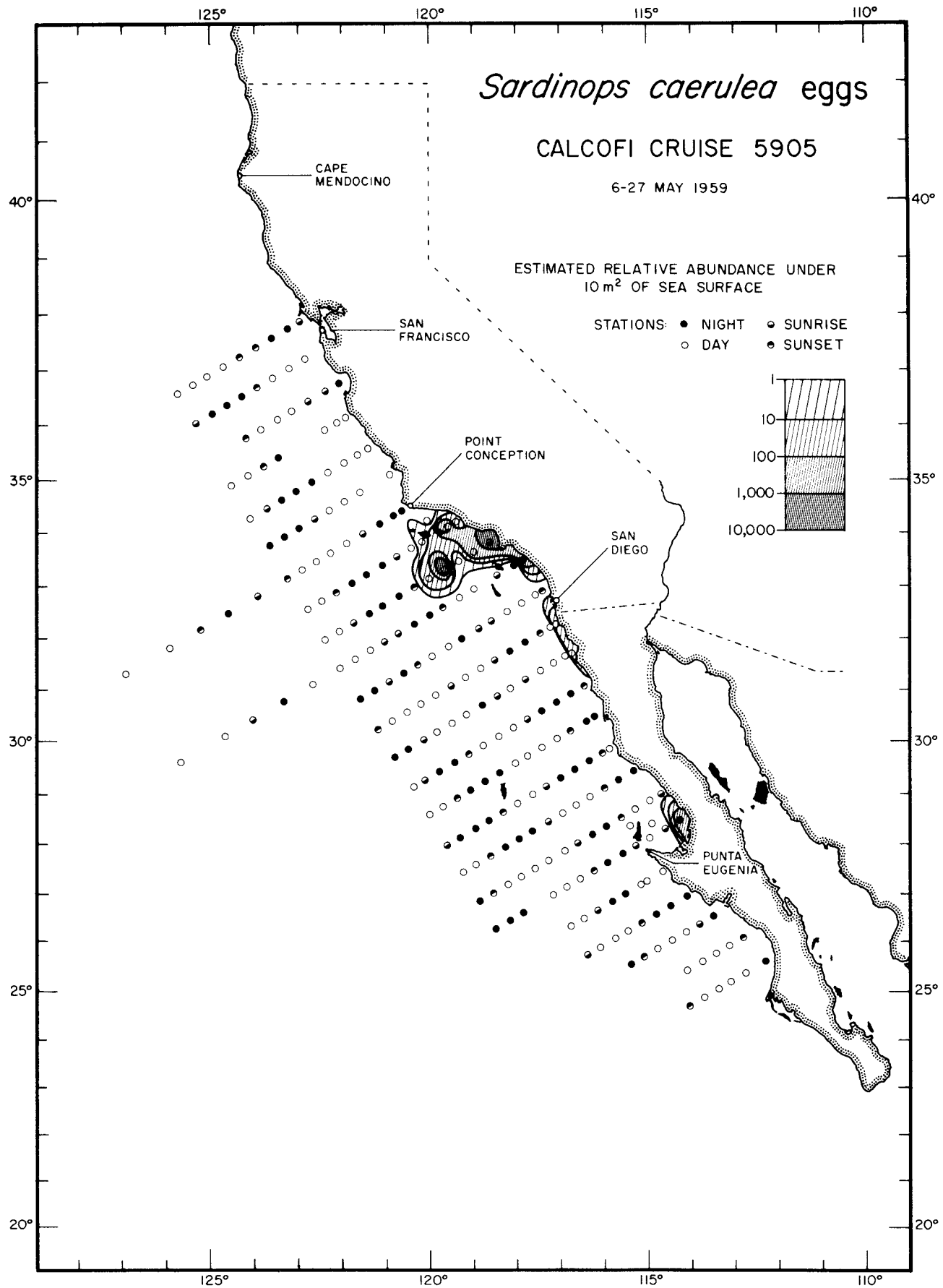
*Sardinops caerulea* eggs

5805



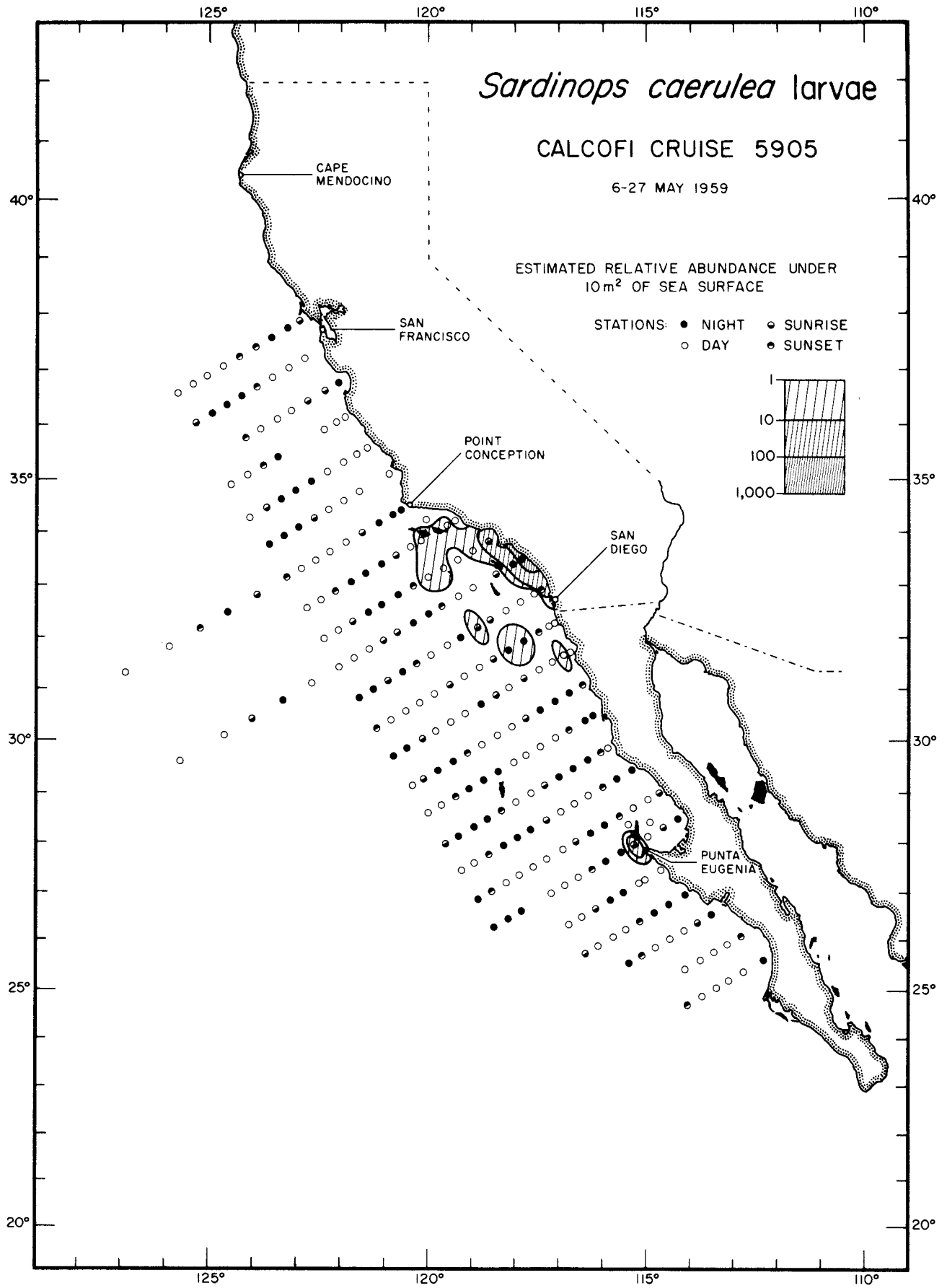
*Sardinops caerulea* larvae

5805



*Sardinops caerulea* eggs

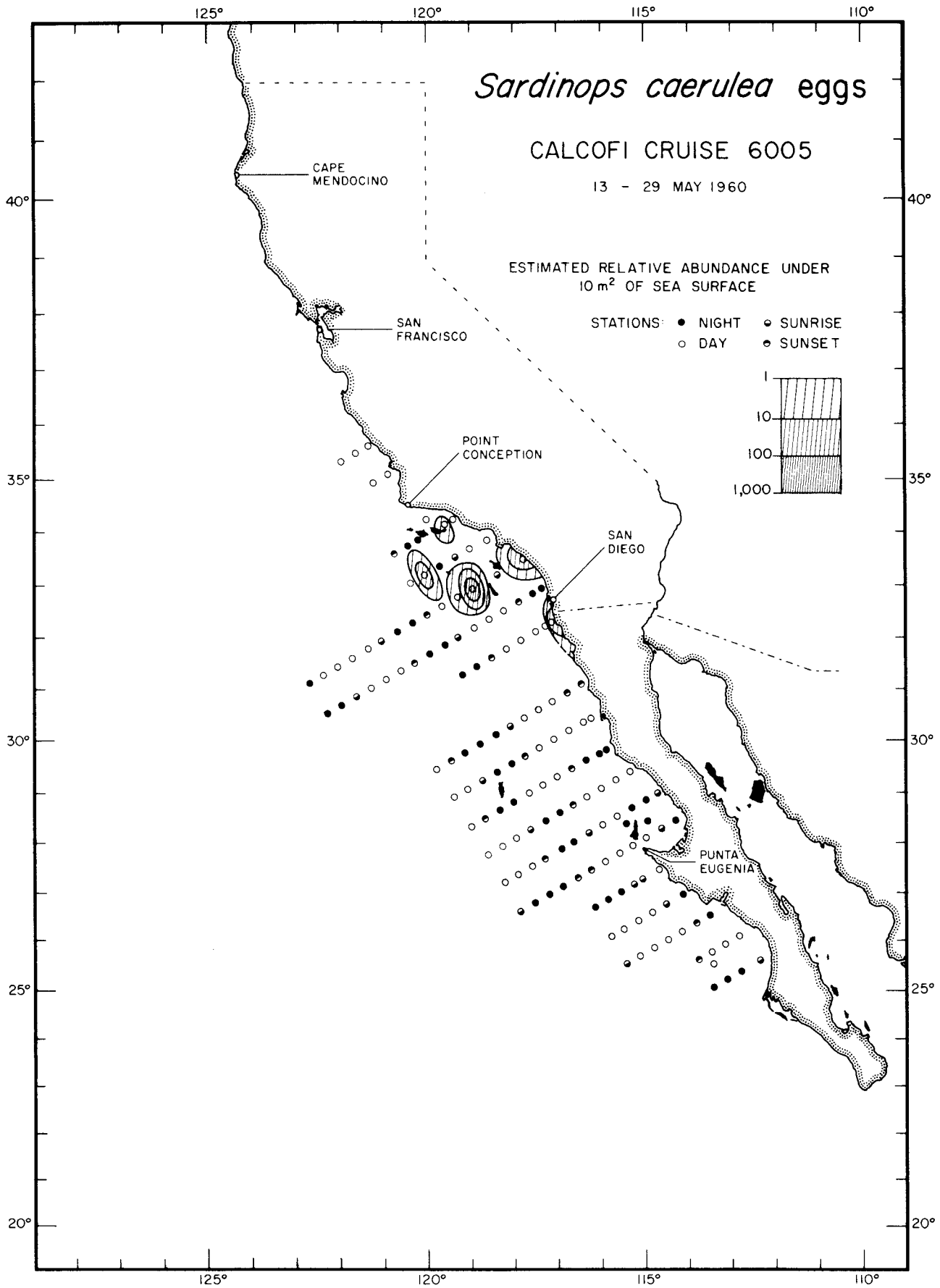
5905



*Sardinops caerulea* larvae

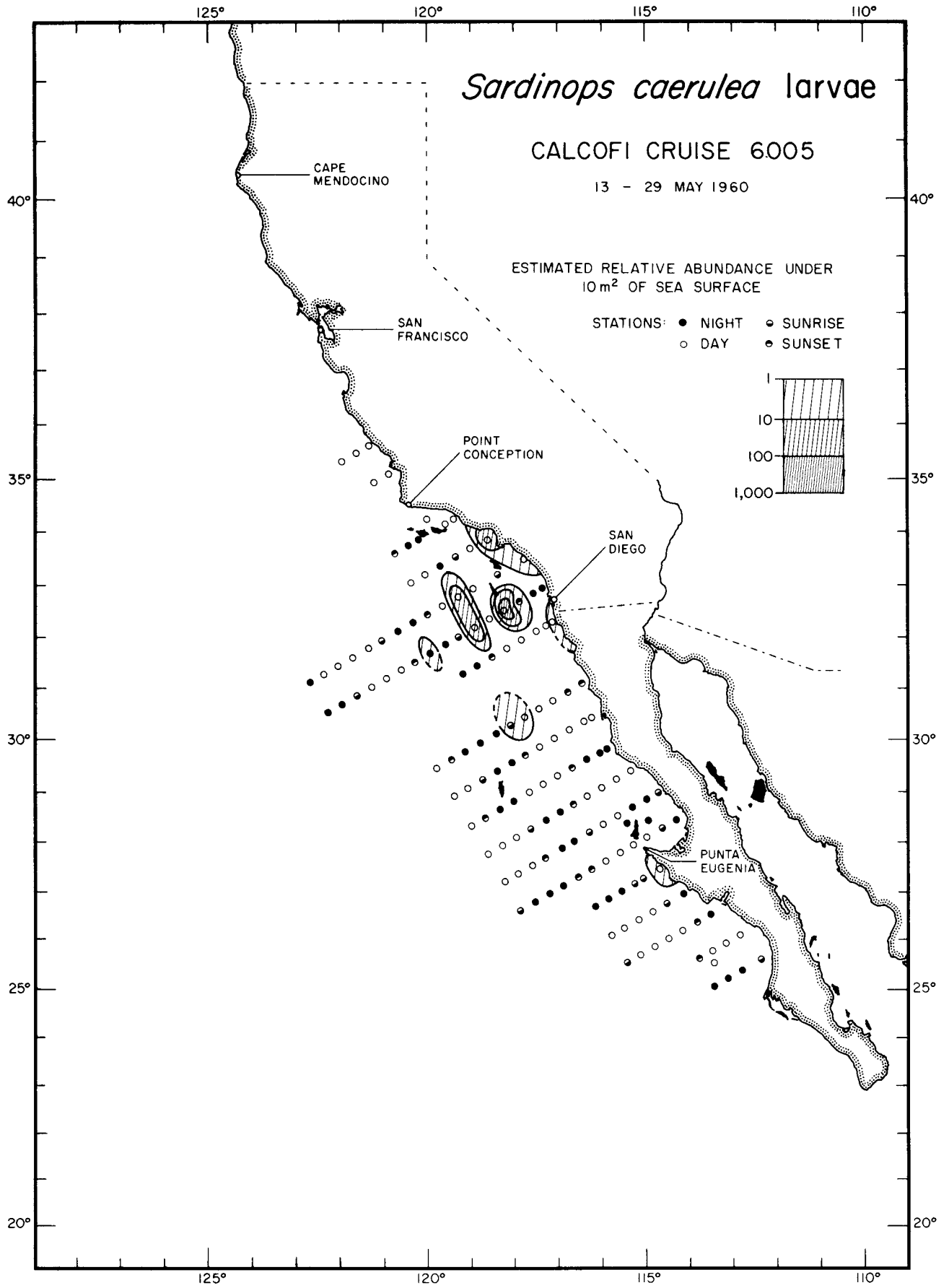
5905





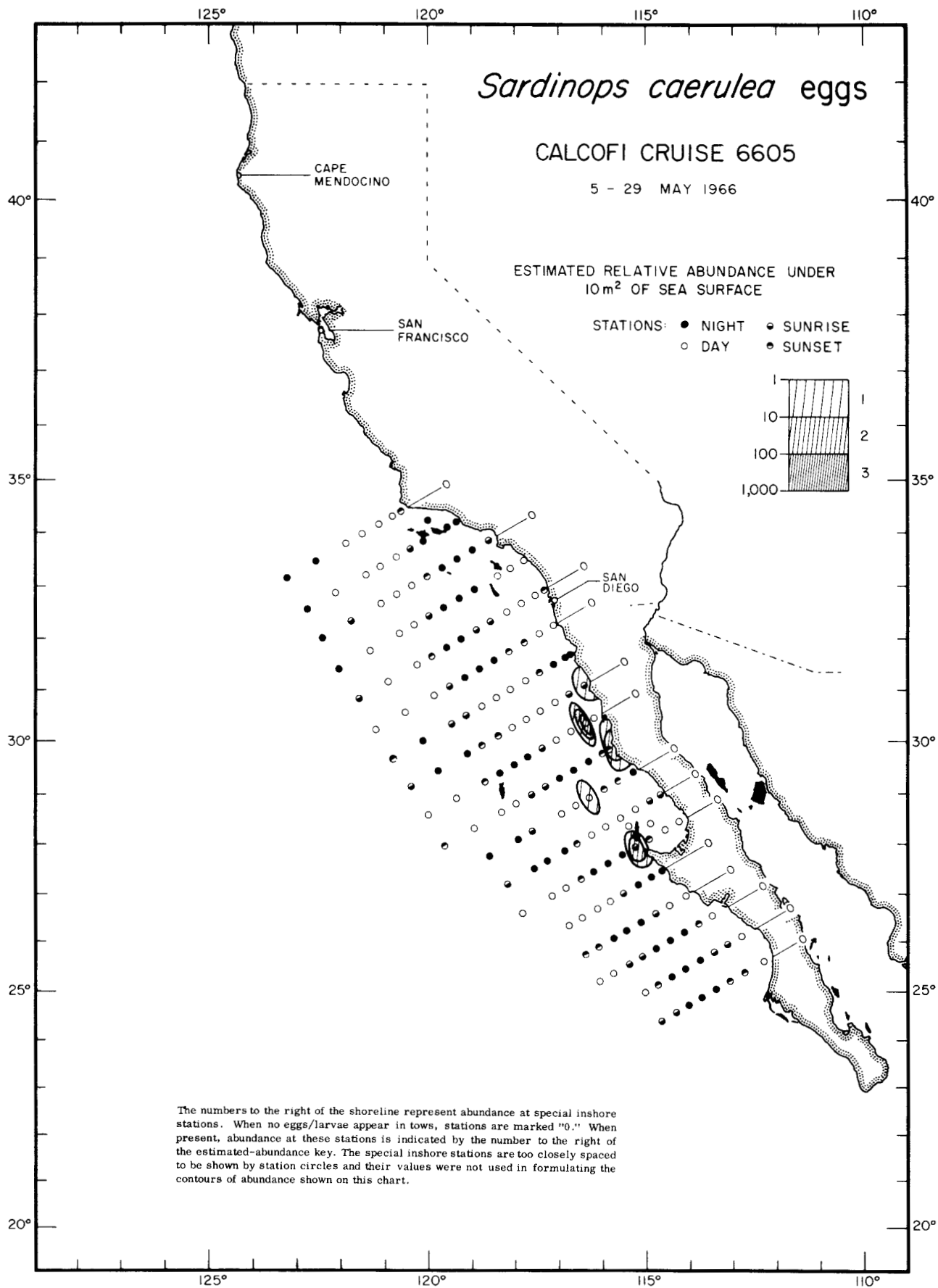
*Sardinops caerulea* eggs

6005



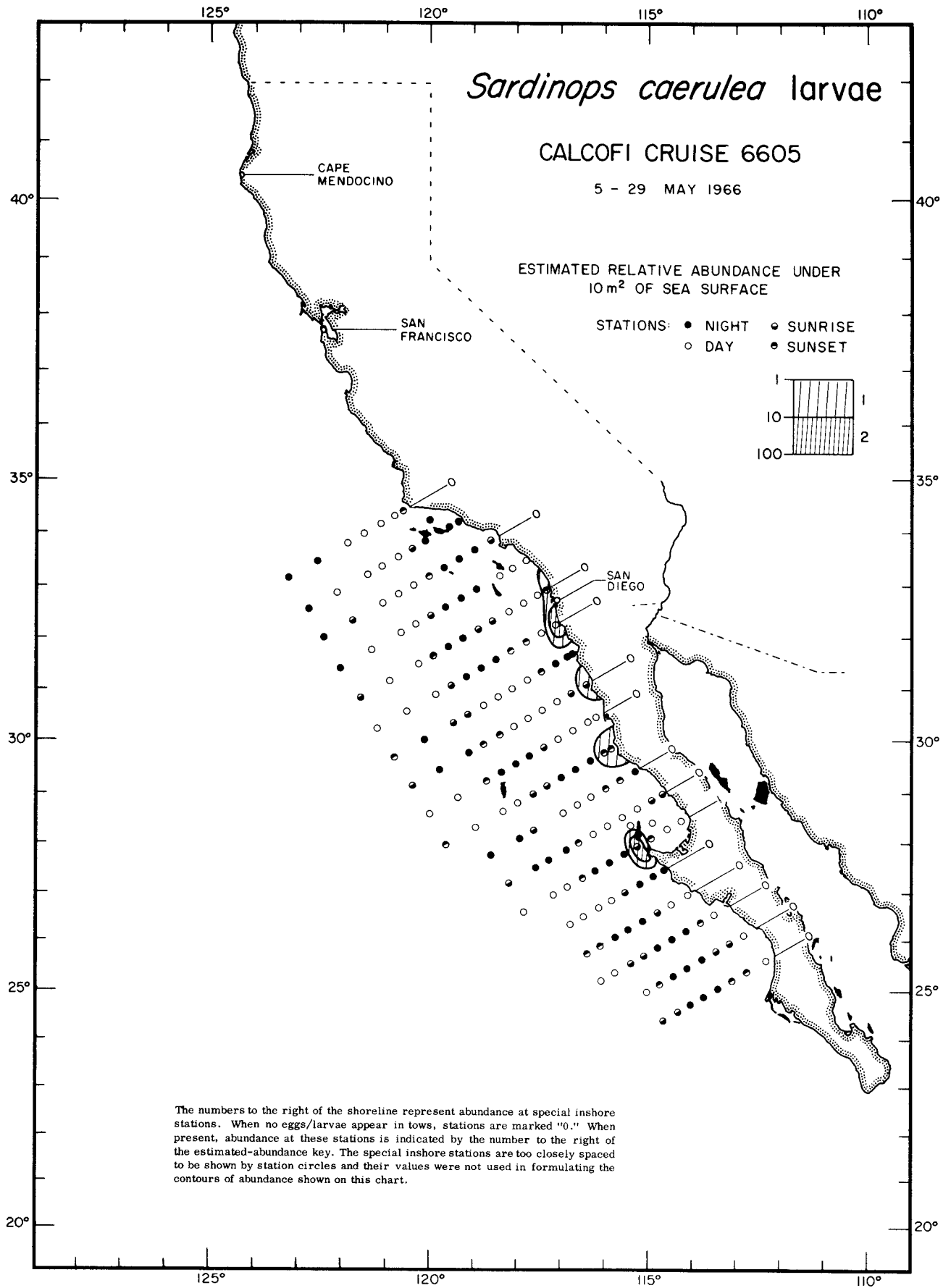
*Sardinops caerulea* larvae

6005



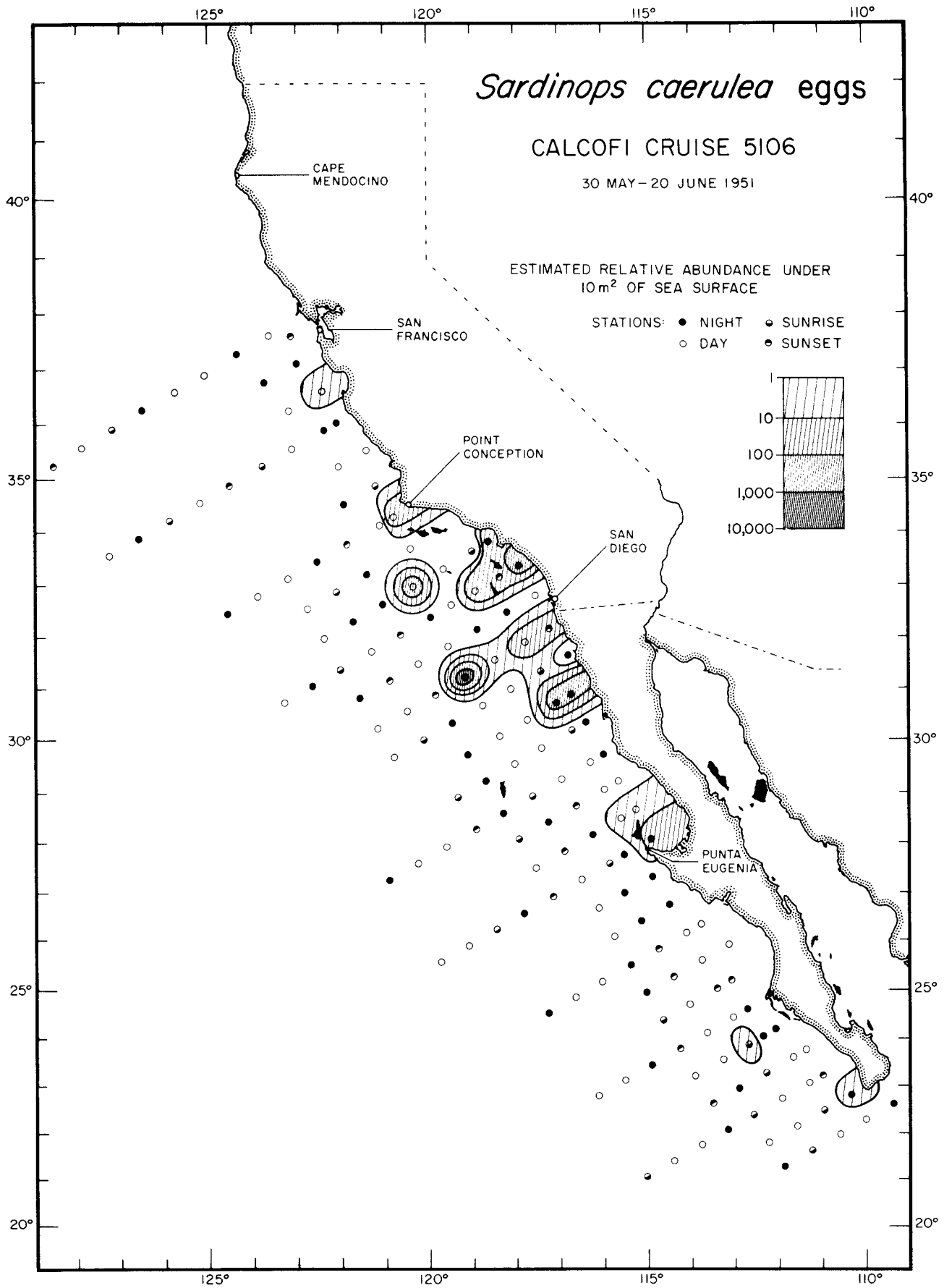
*Sardinops caerulea* eggs

6605



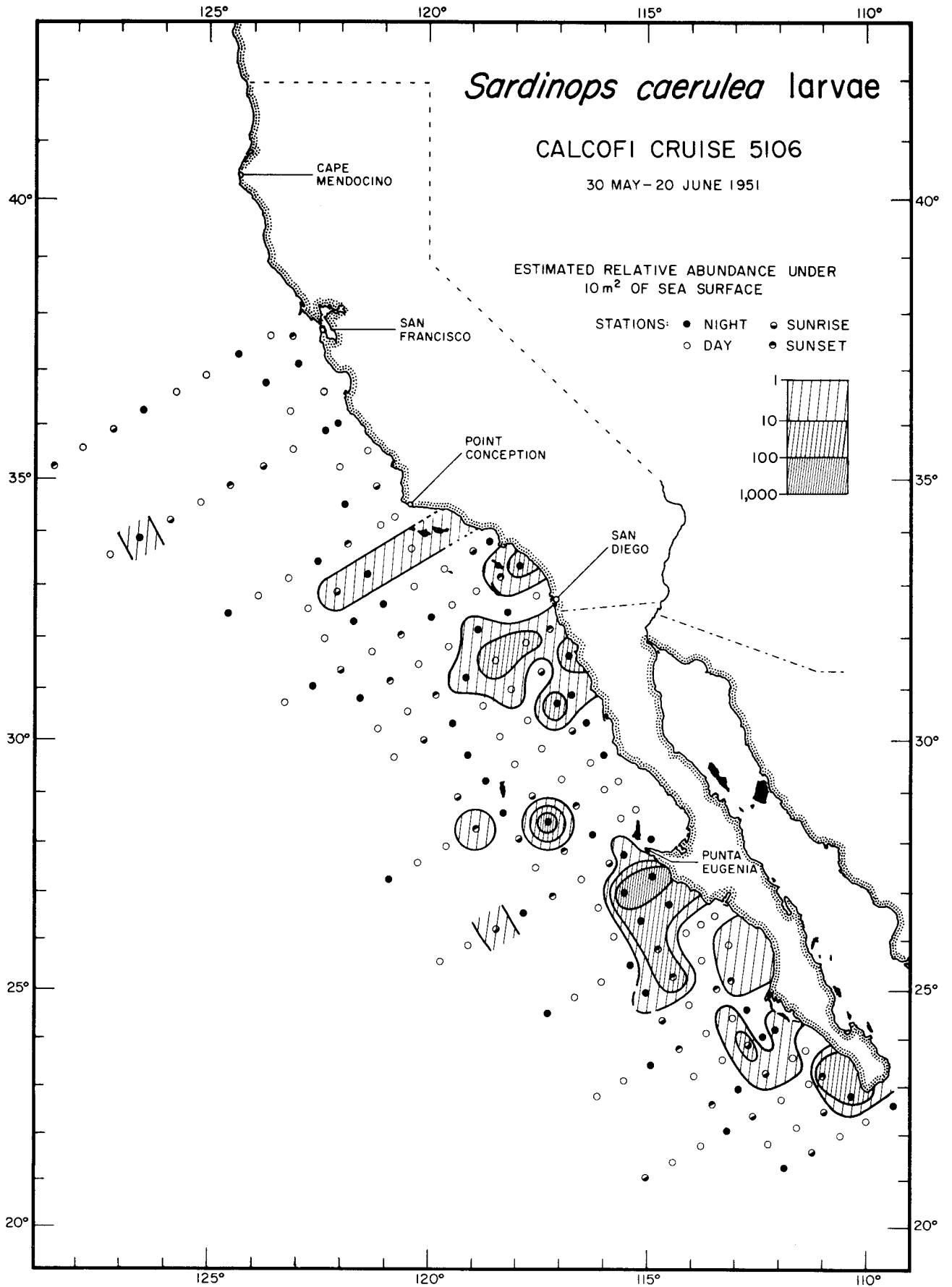
*Sardinops caerulea* larvae

6605



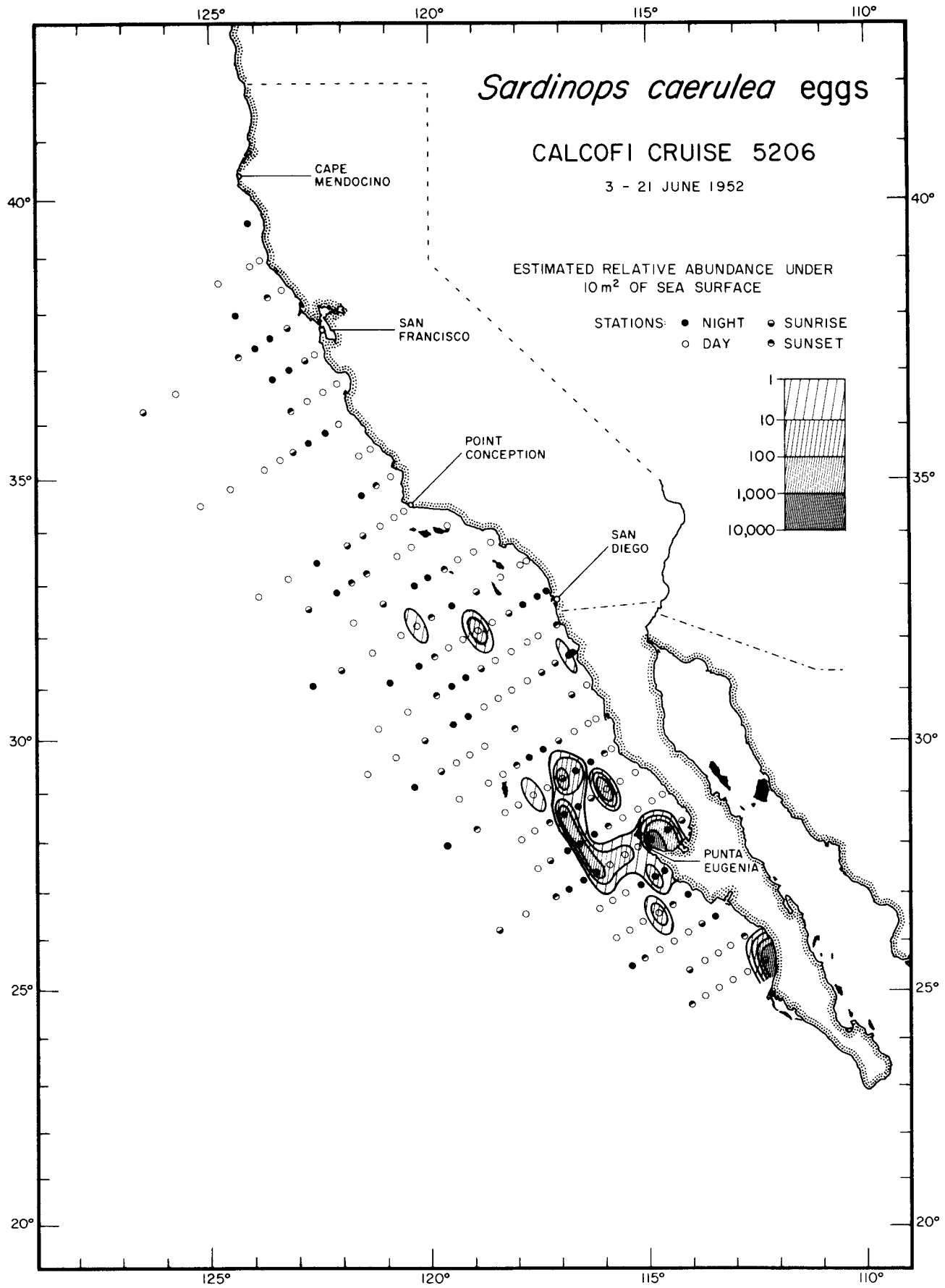
*Sardinops caerulea* eggs

5106

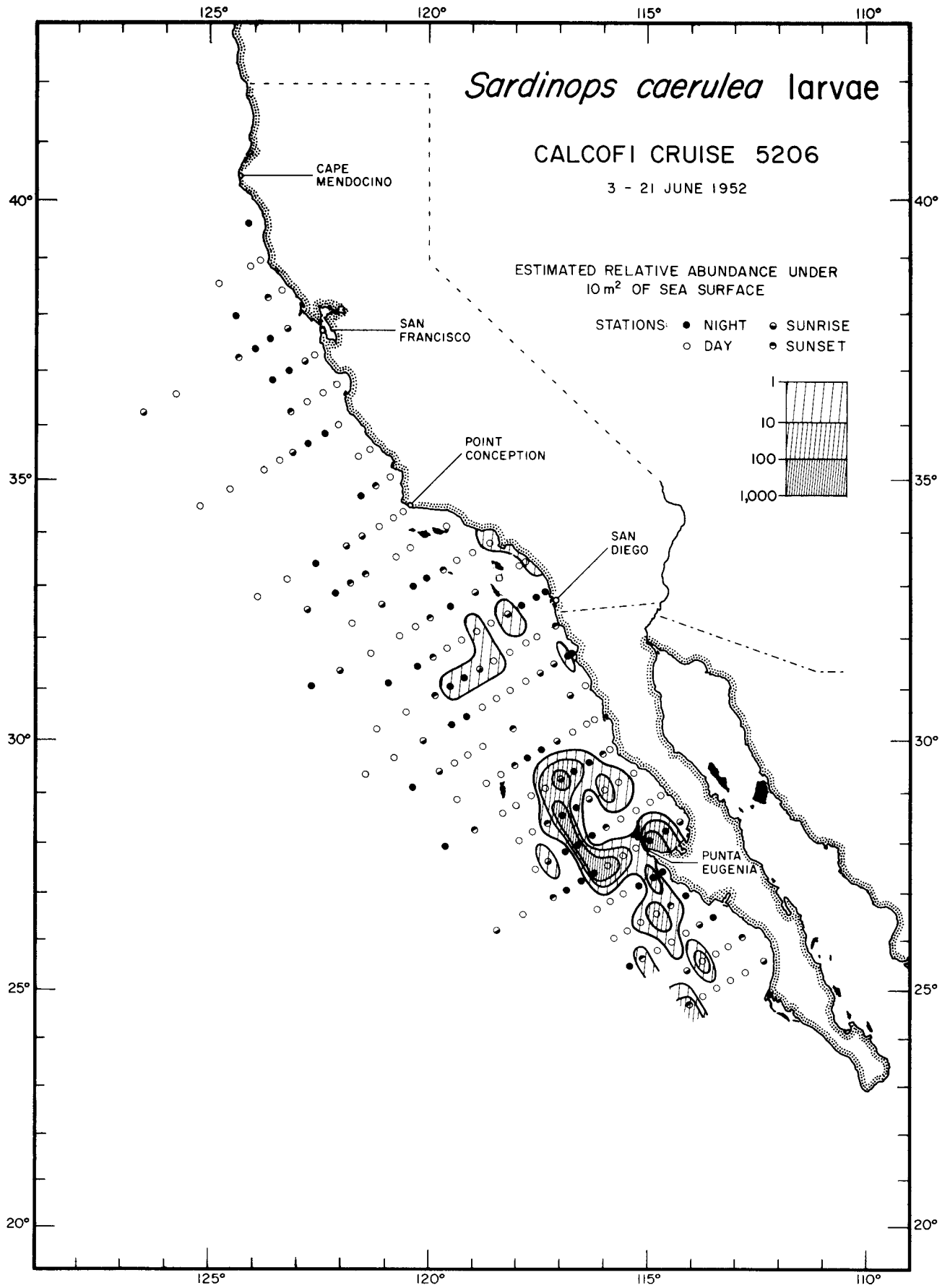


*Sardinops caerulea* larvae

5106

*Sardinops caerulea* eggs

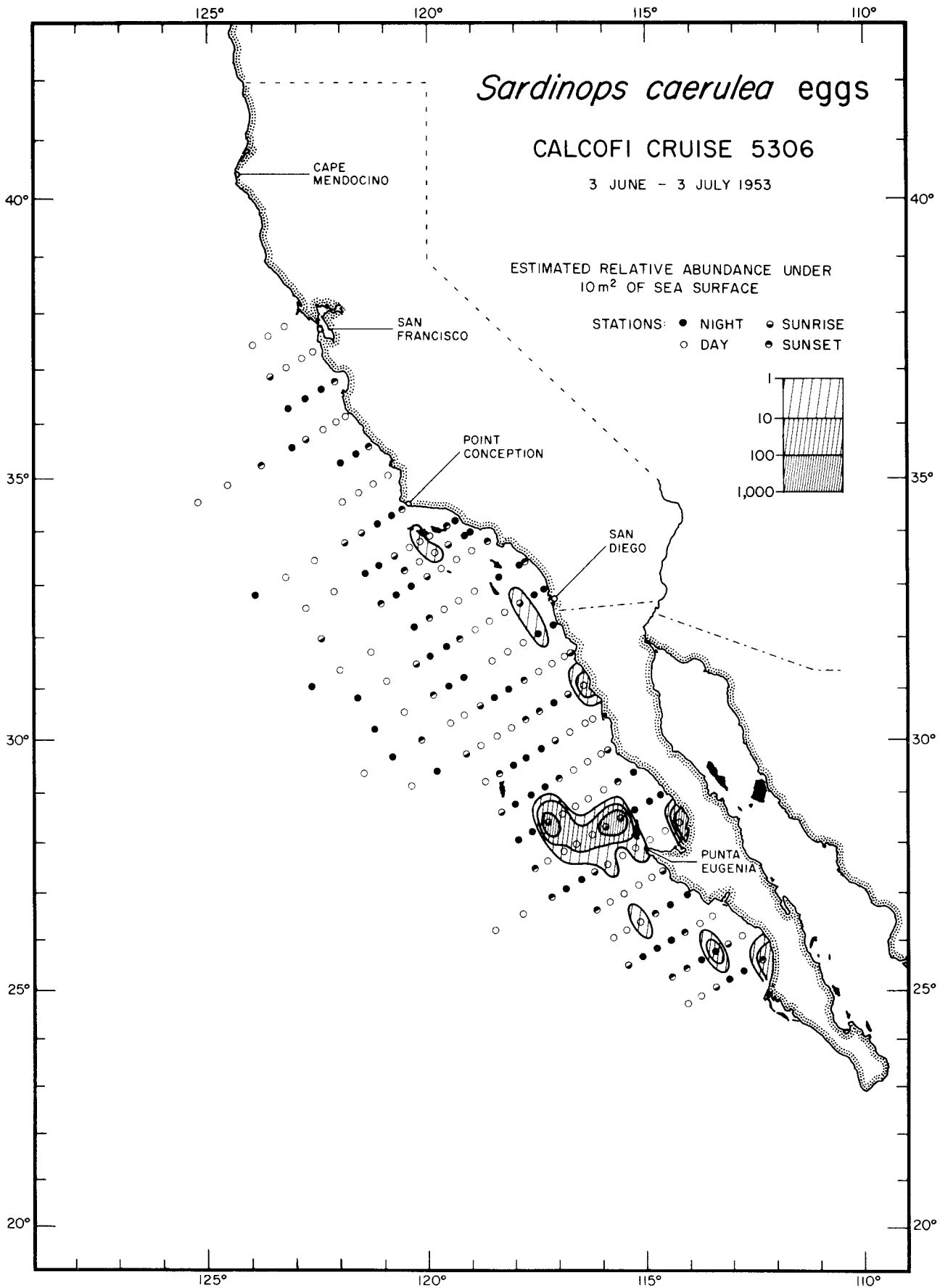
5206



*Sardinops caerulea* larvae

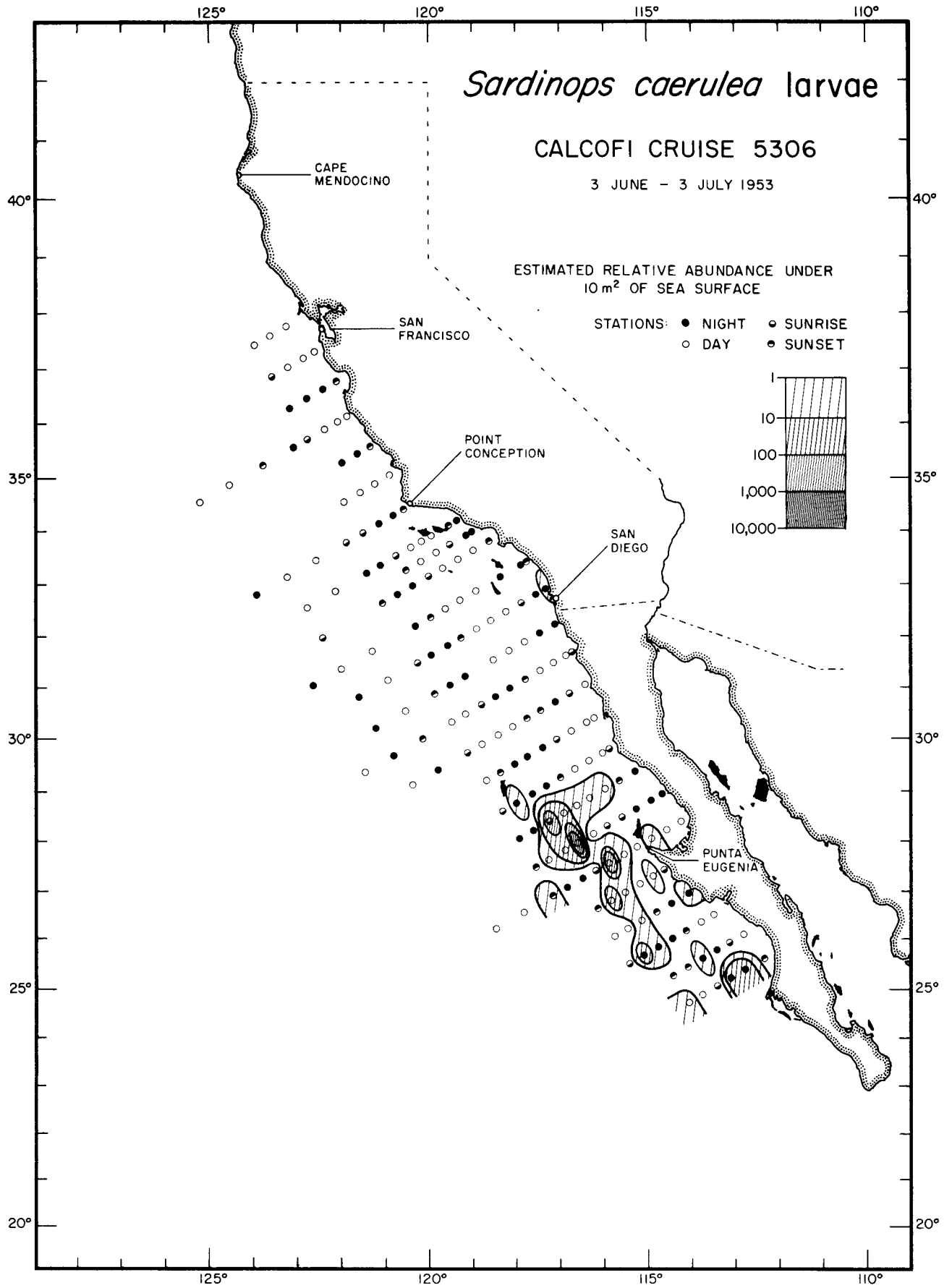
5206





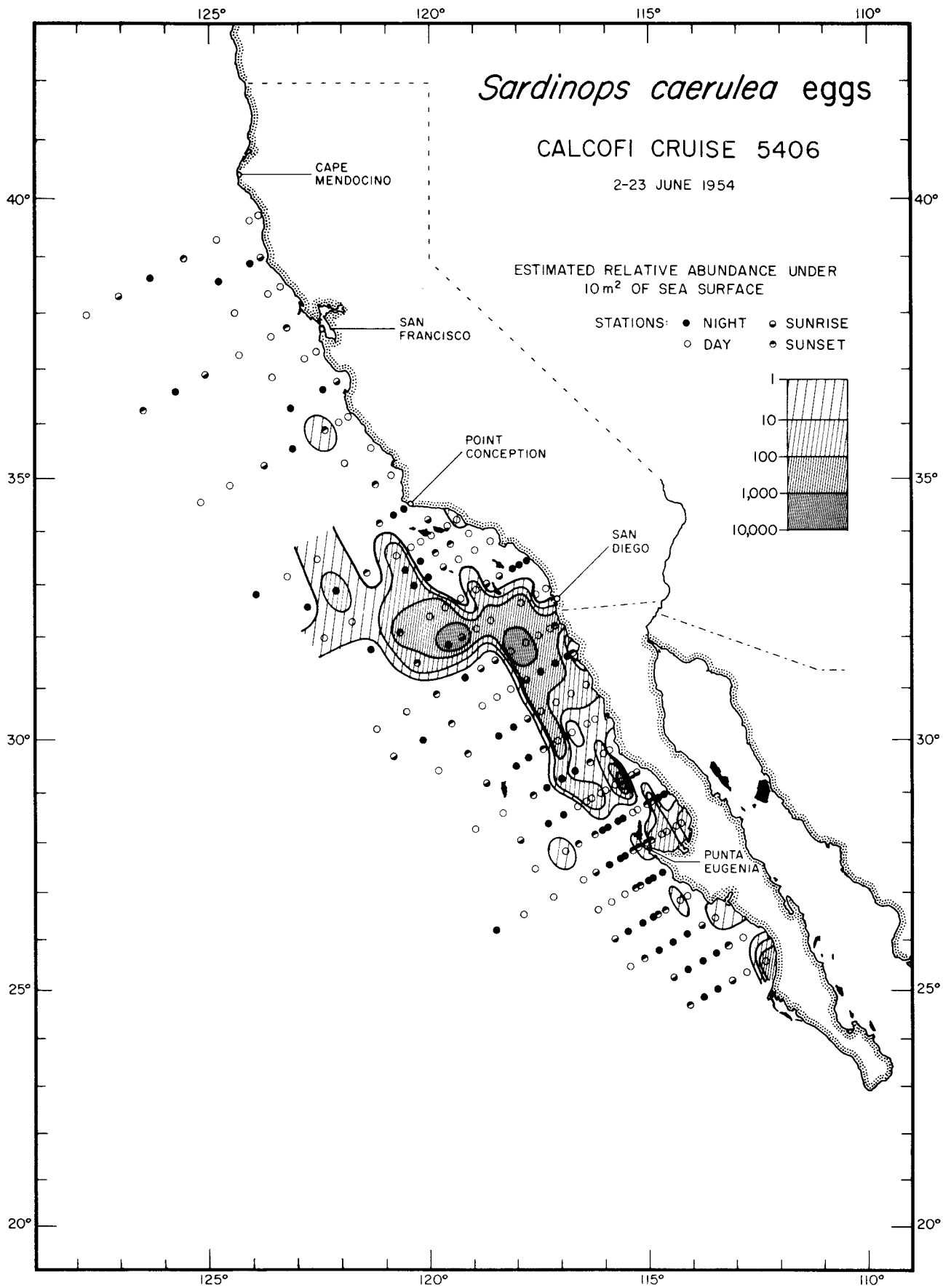
*Sardinops caerulea* eggs

5306

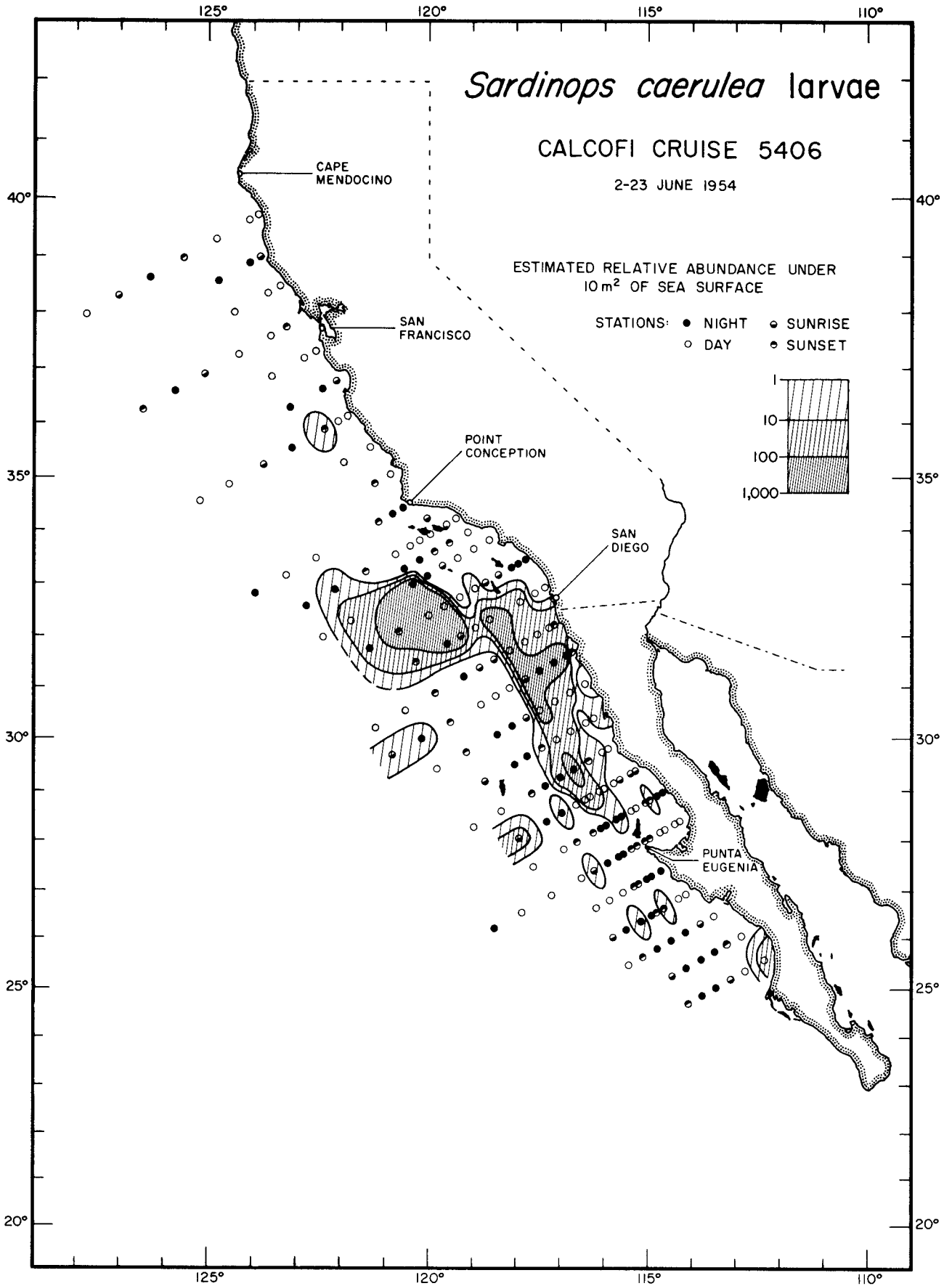


*Sardinops caerulea* larvae

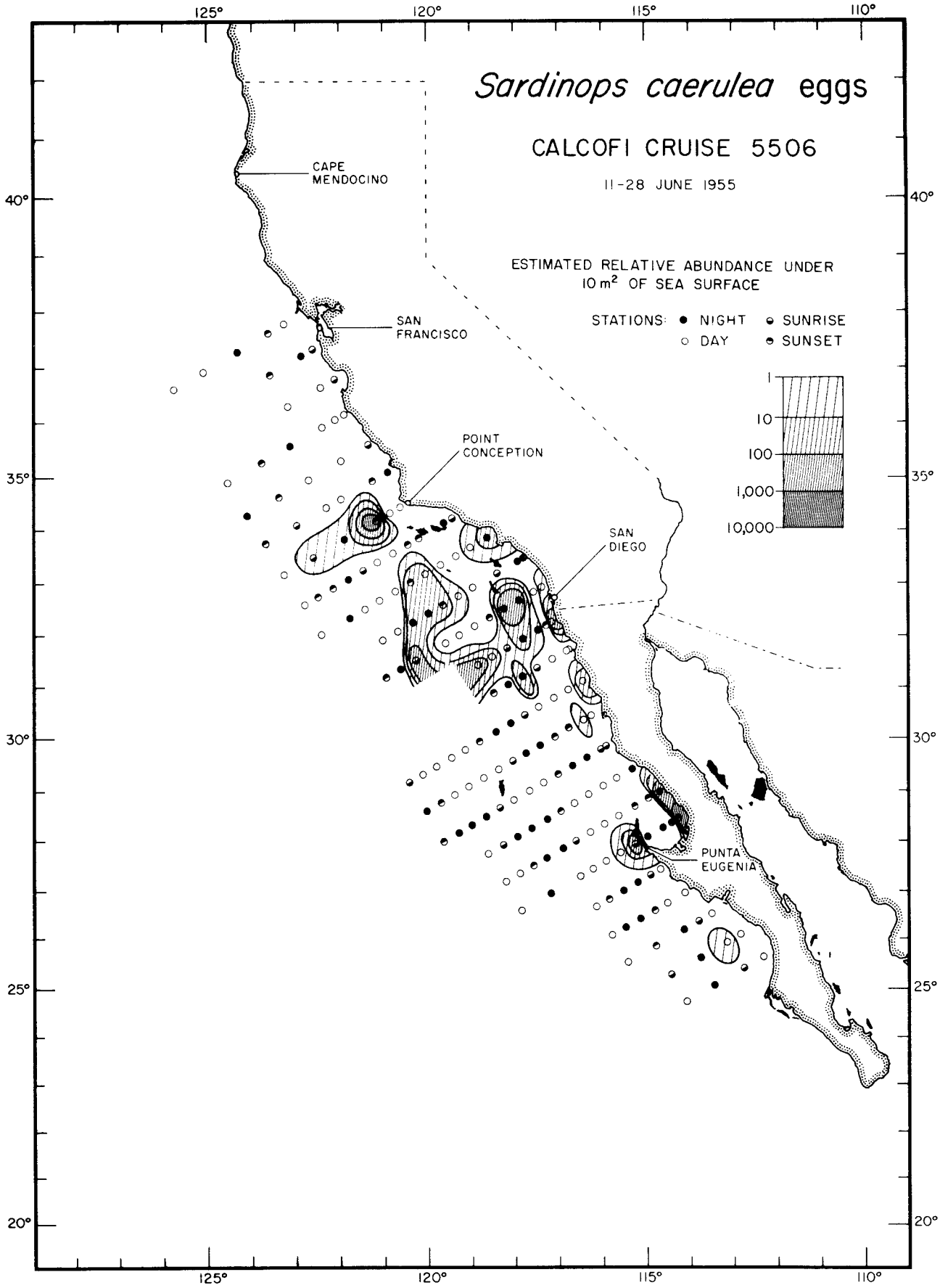
5306



*Sardinops caerulea* eggs  
5406

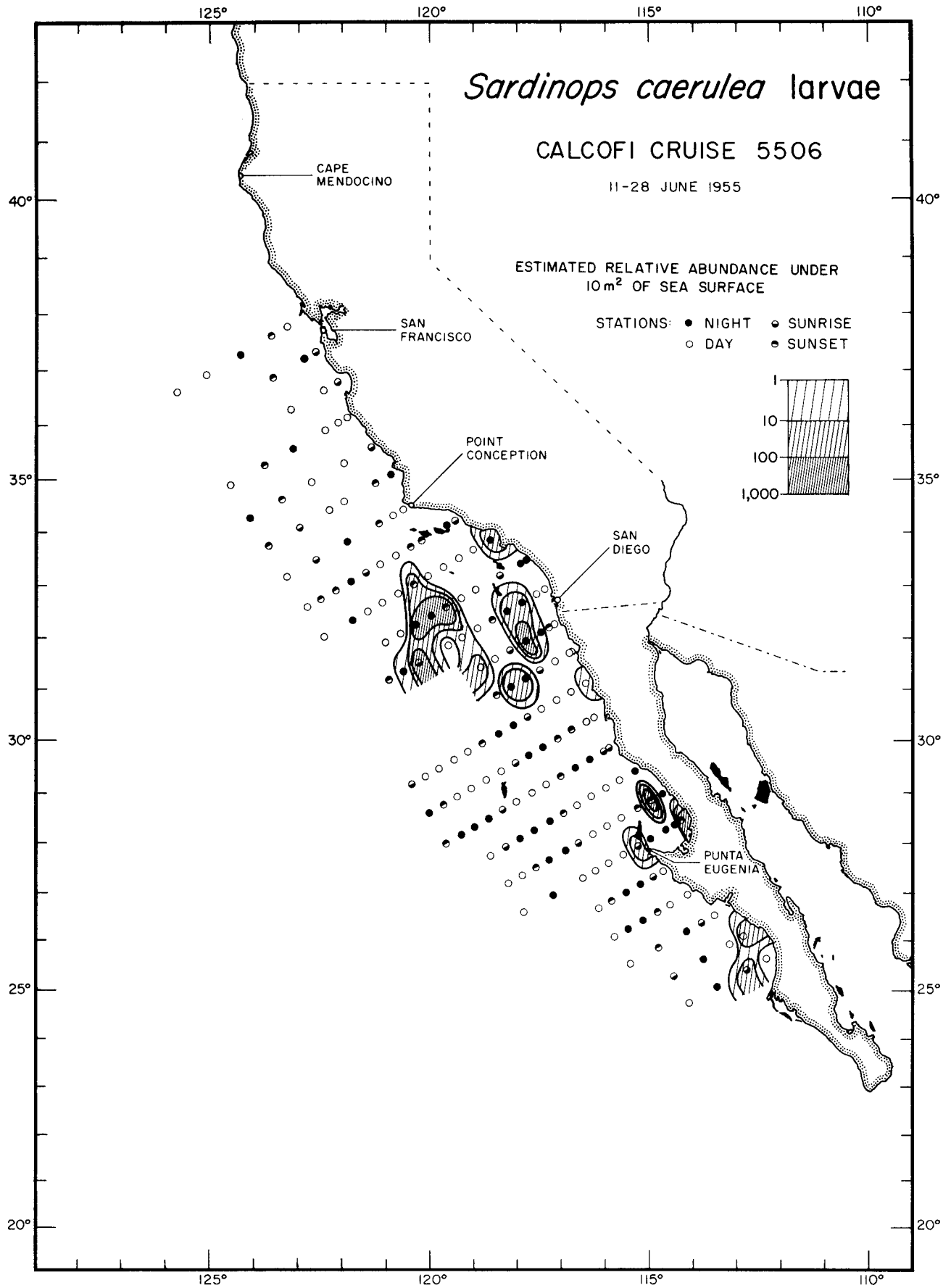


*Sardinops caerulea* larvae  
5406



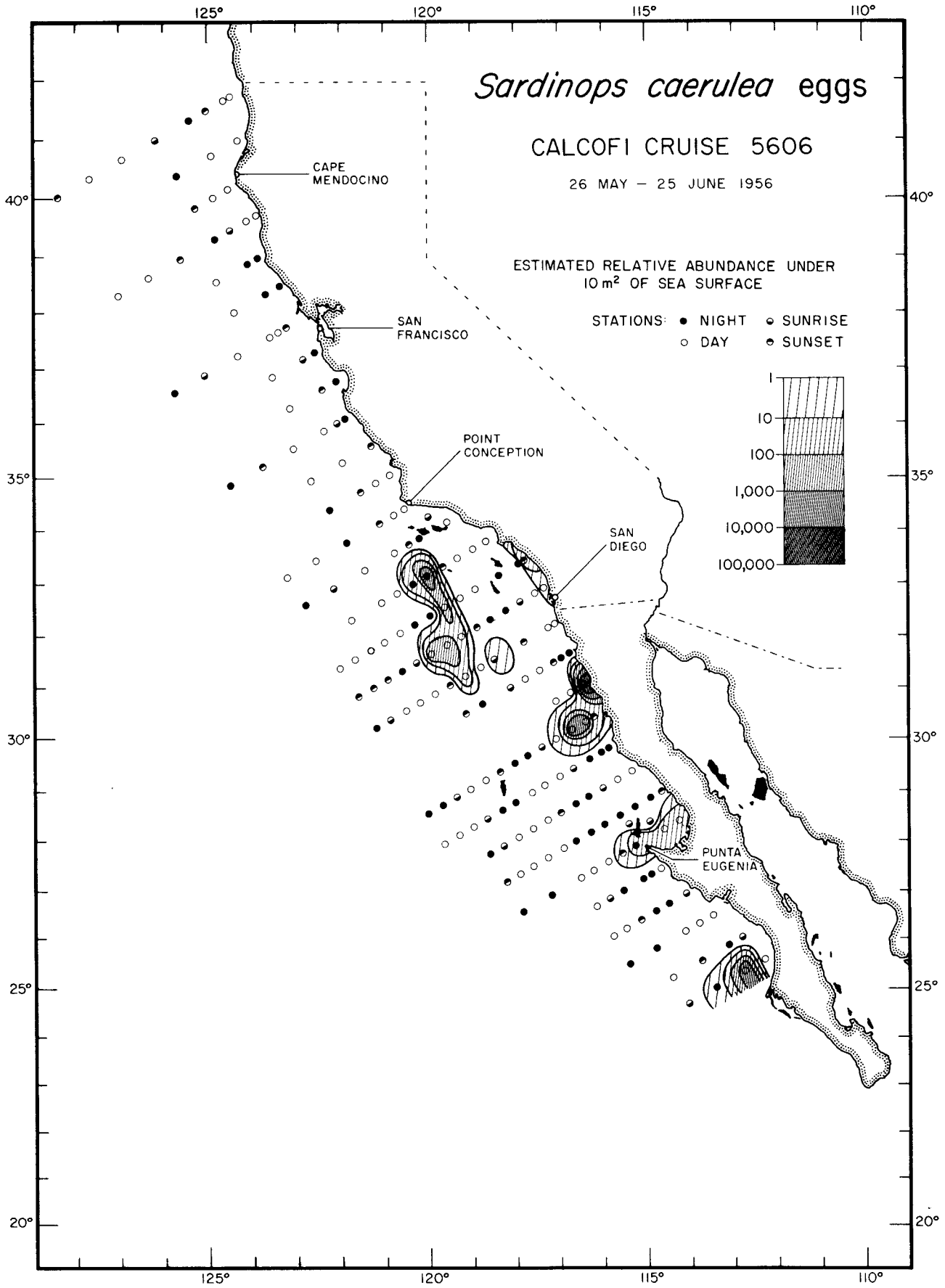
*Sardinops caerulea* eggs

5506



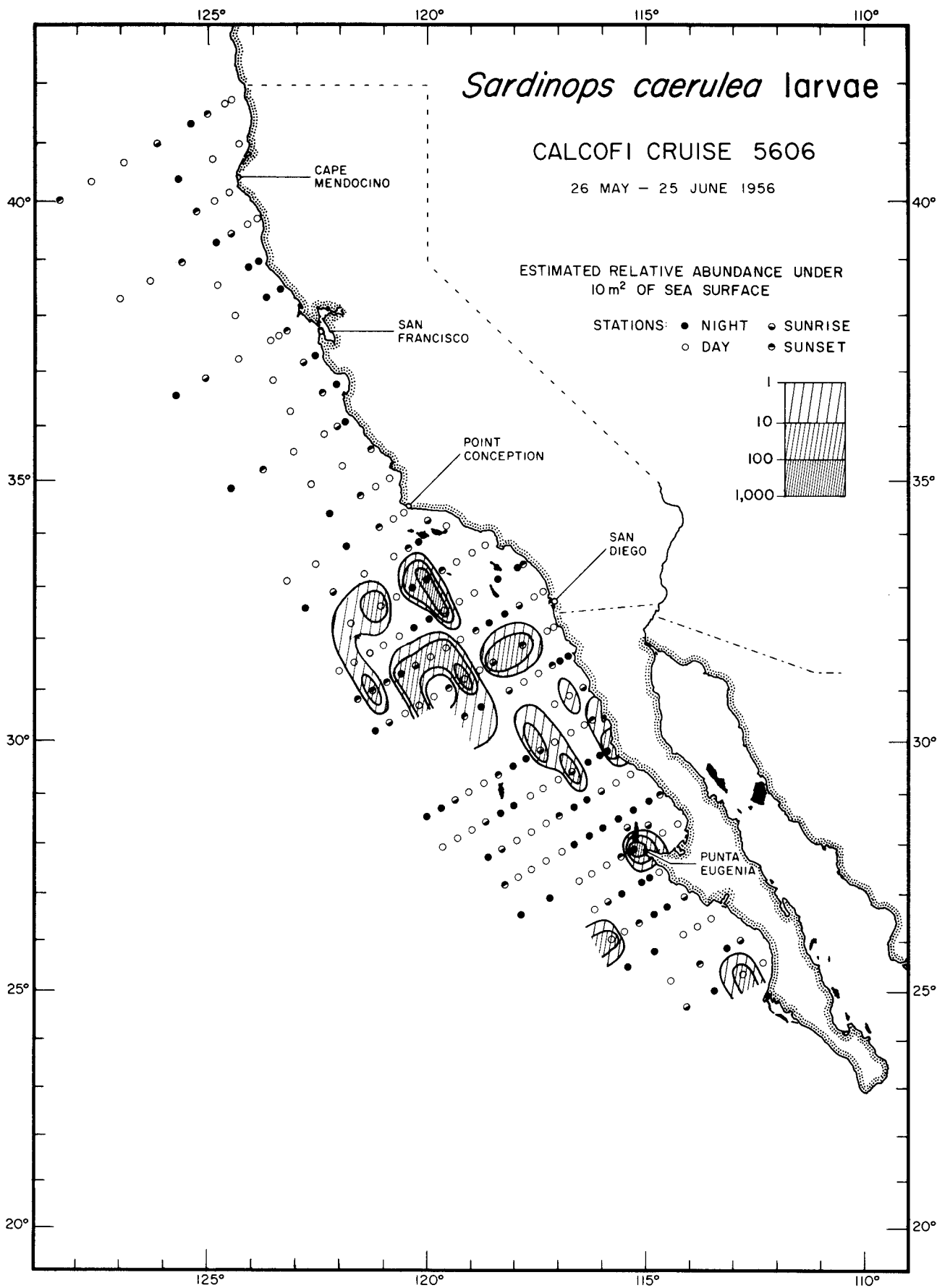
*Sardinops caerulea* larvae

5506



*Sardinops caerulea* eggs

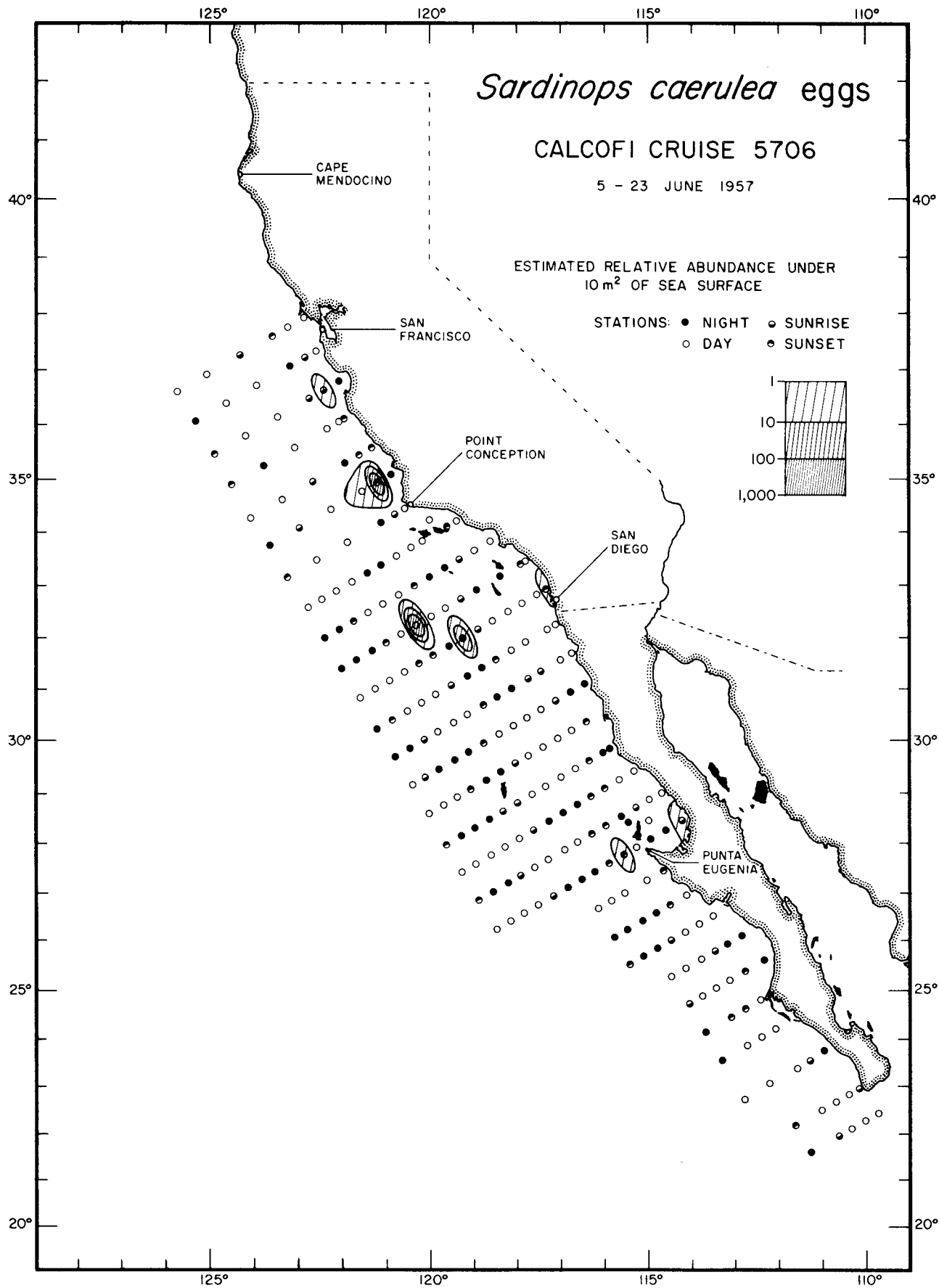
5606



*Sardinops caerulea* larvae

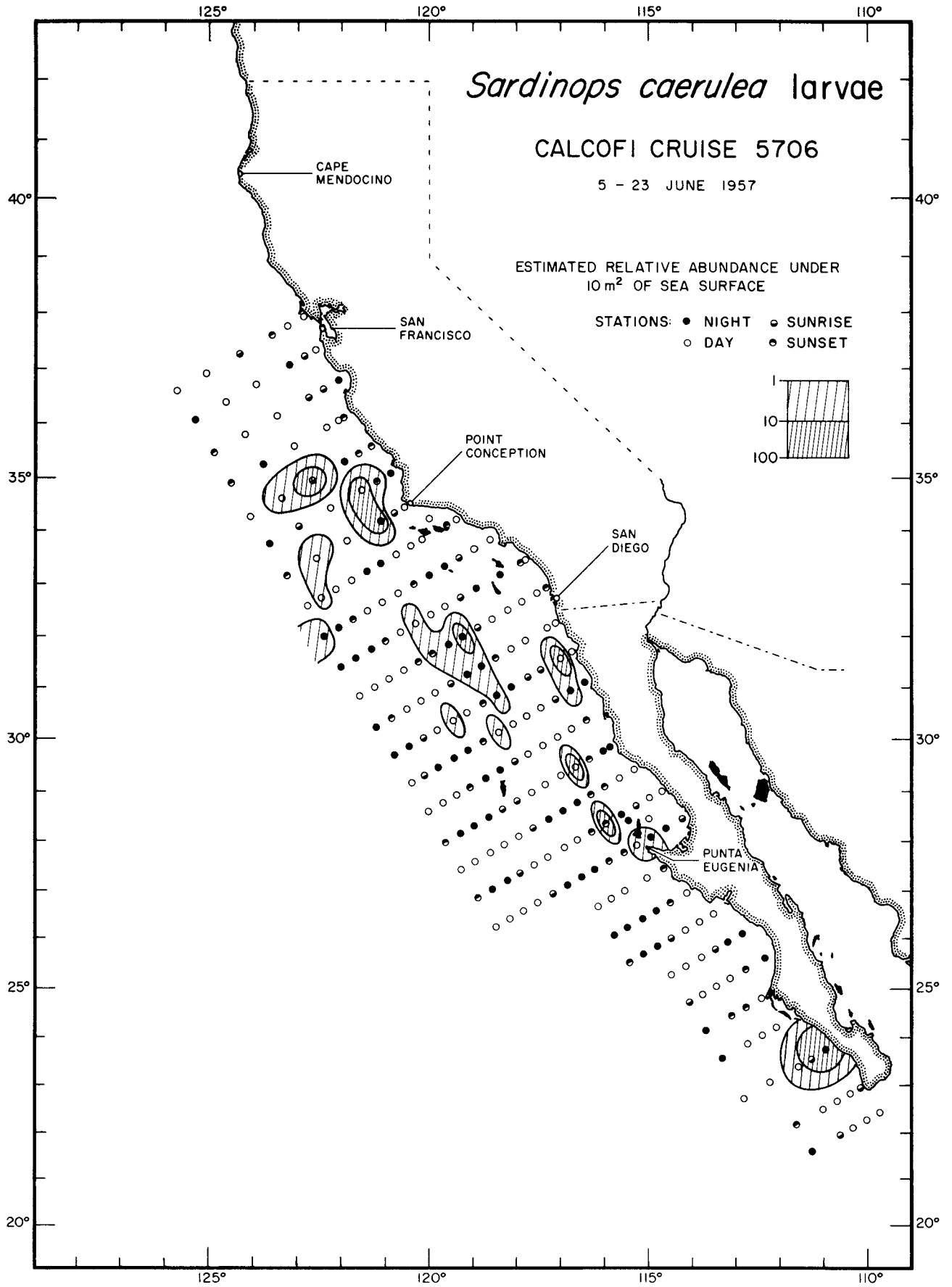
5606



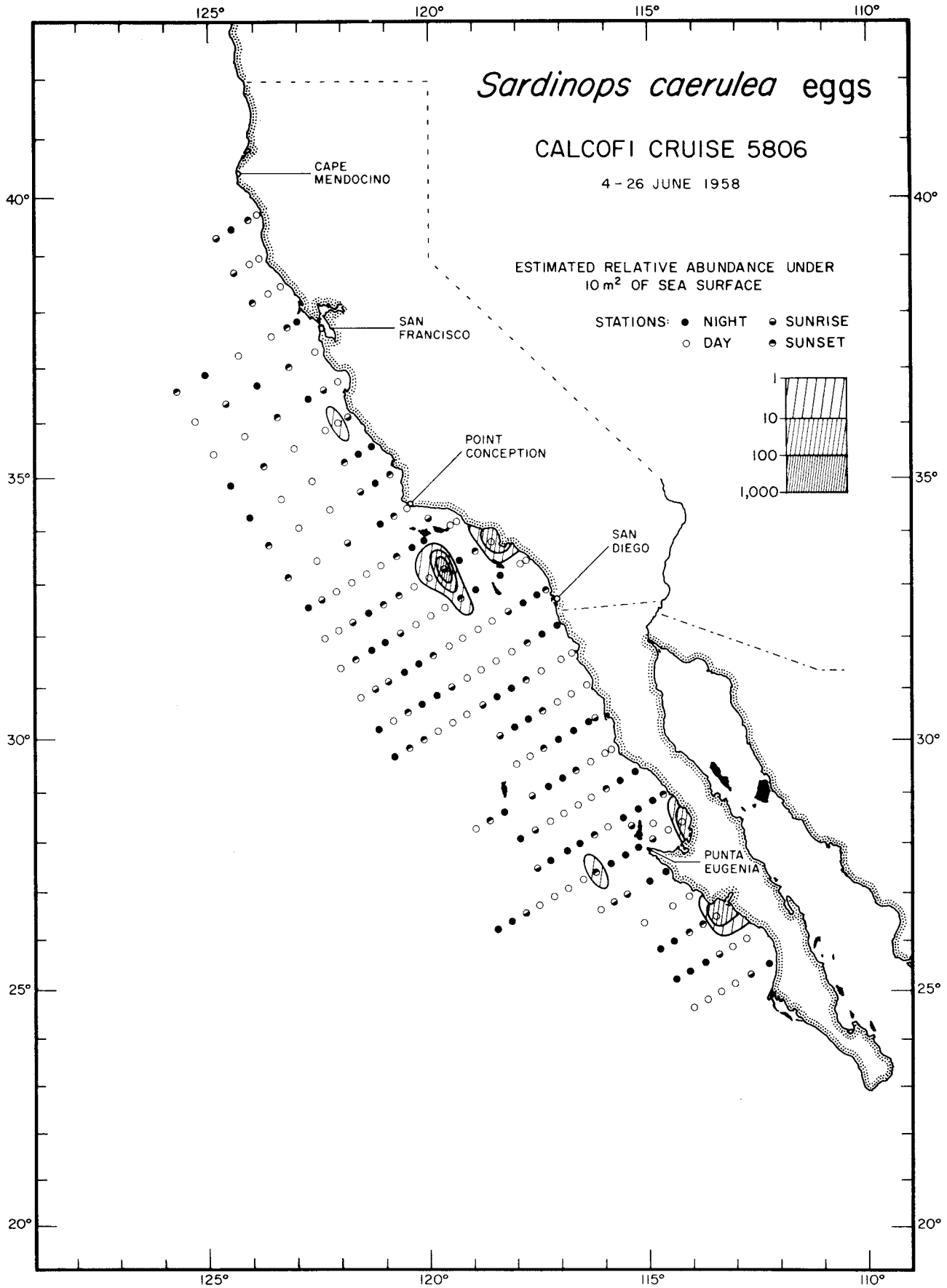


*Sardinops caerulea* eggs

5706

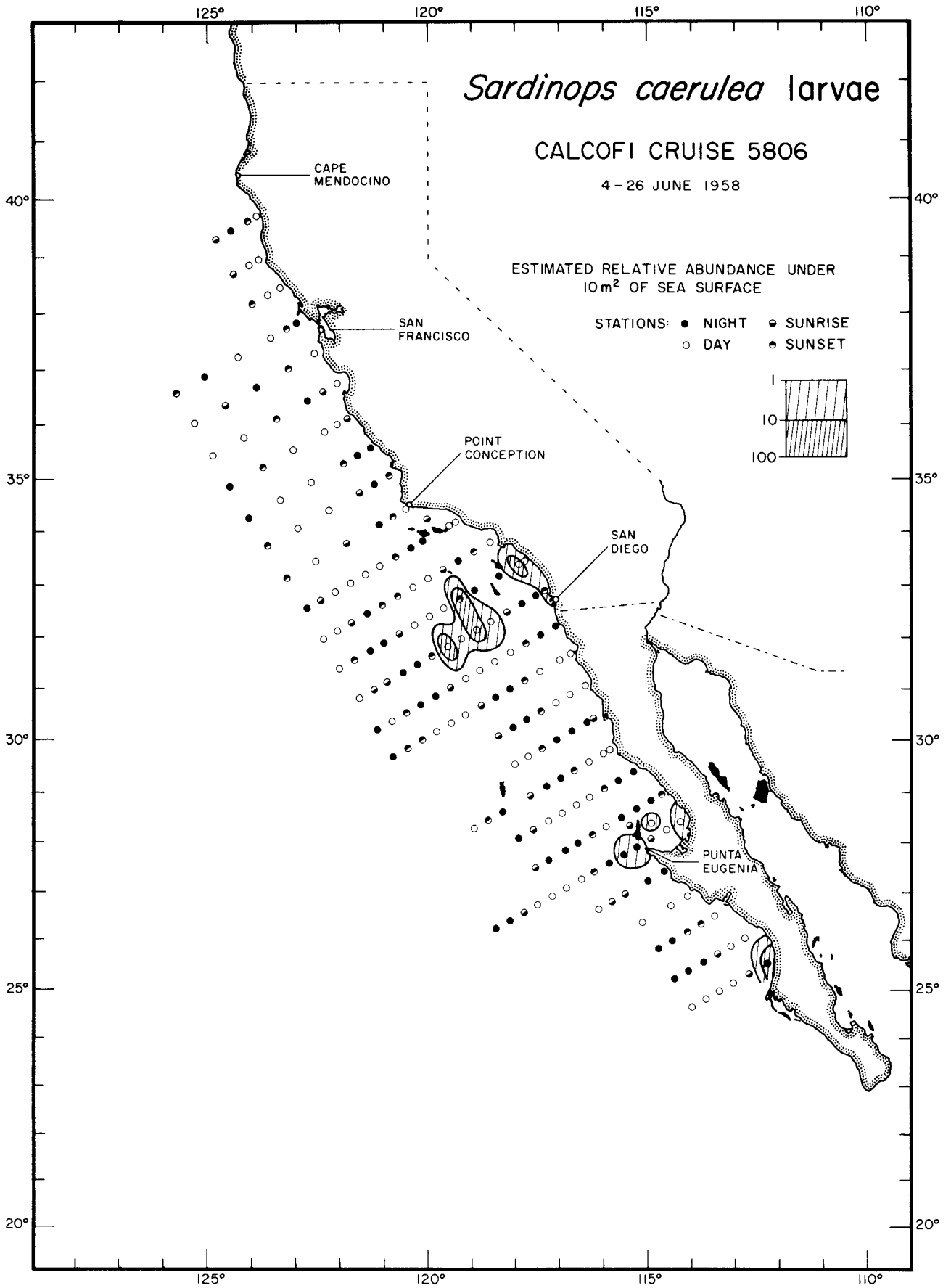


*Sardinops caerulea* larvae  
5706



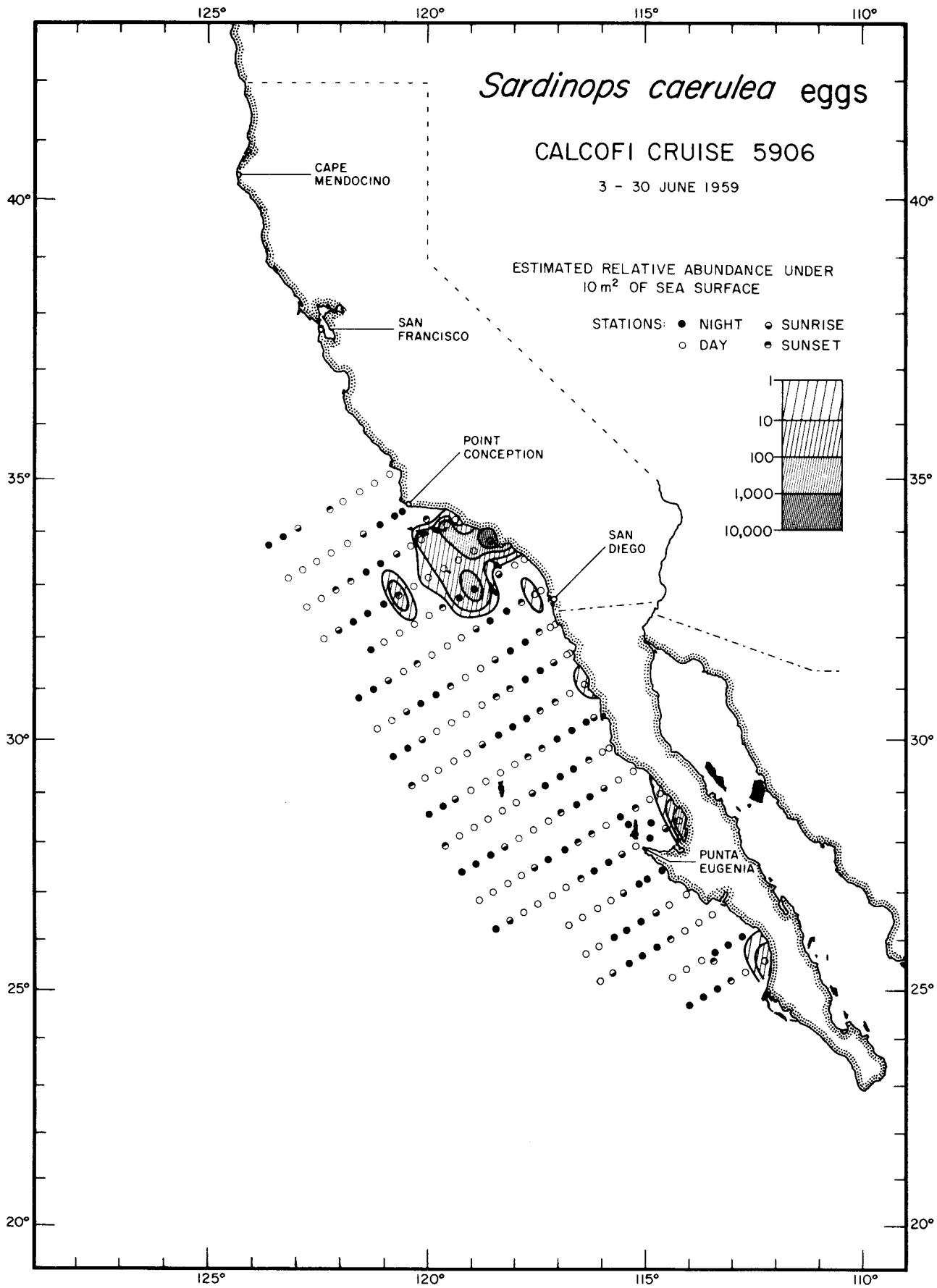
*Sardinops caerulea* eggs

5806



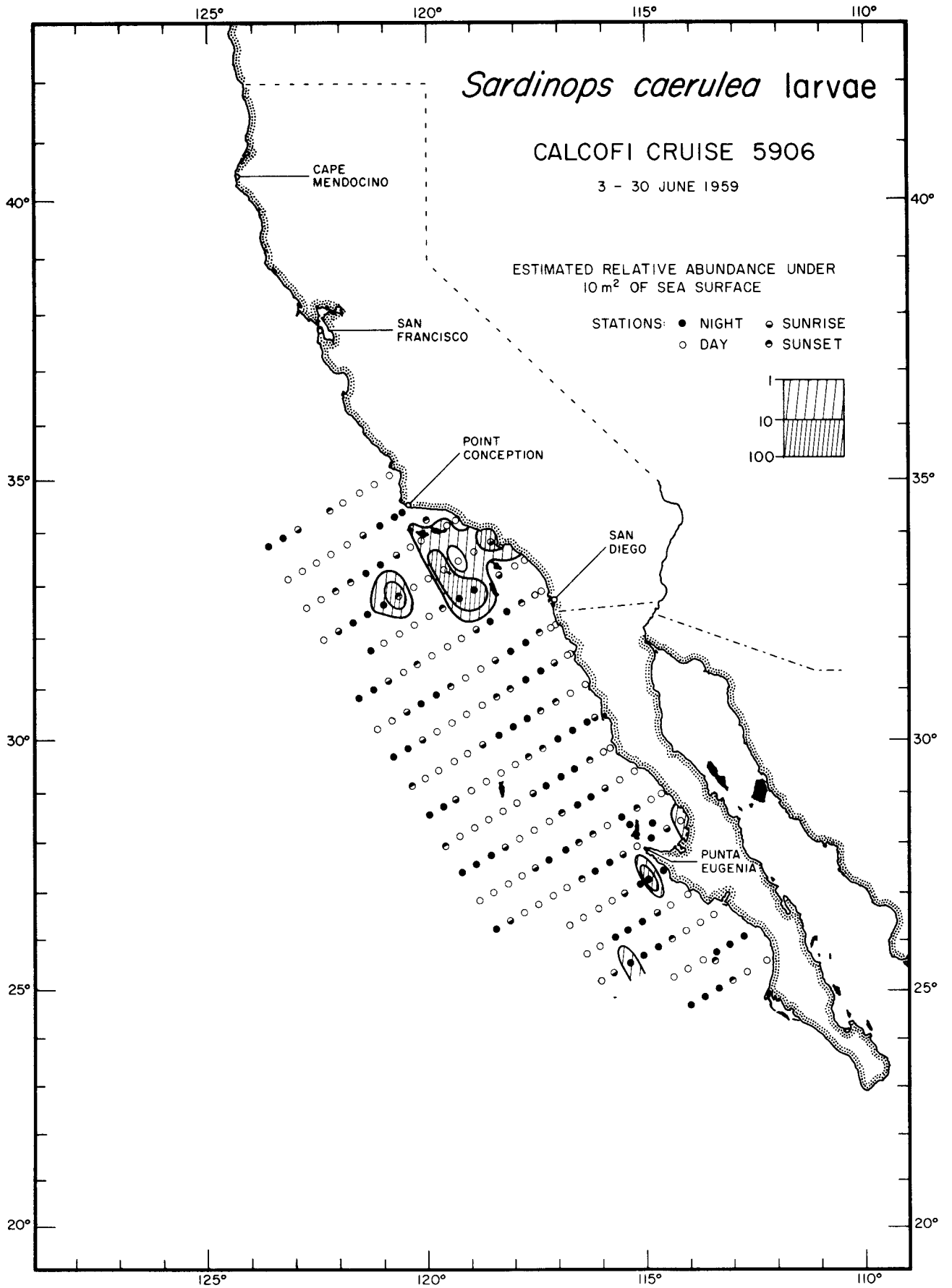
*Sardinops caerulea* larvae

5806



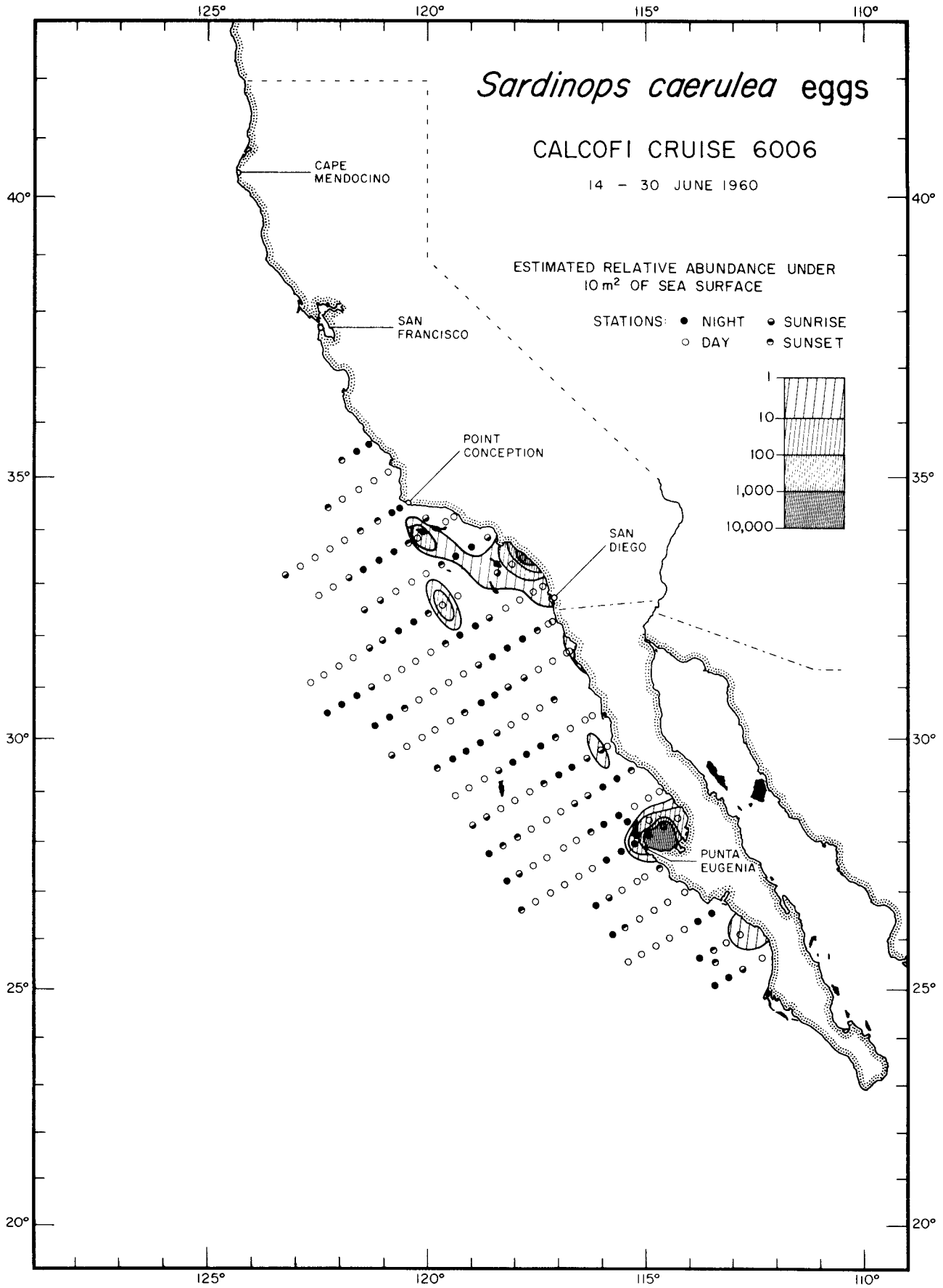
*Sardinops caerulea* eggs

5906



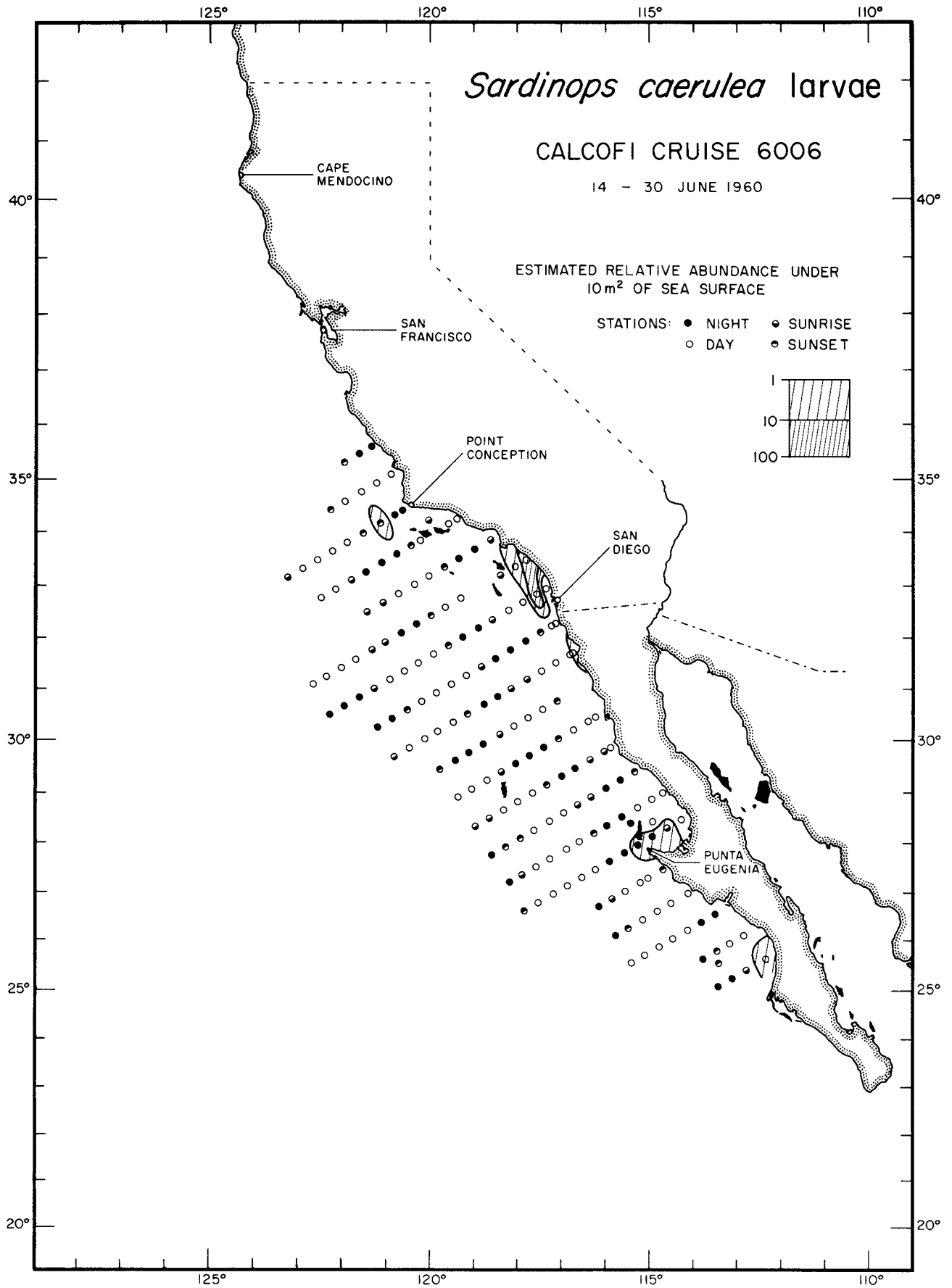
*Sardinops caerulea* larvae

5906



*Sardinops caerulea* eggs

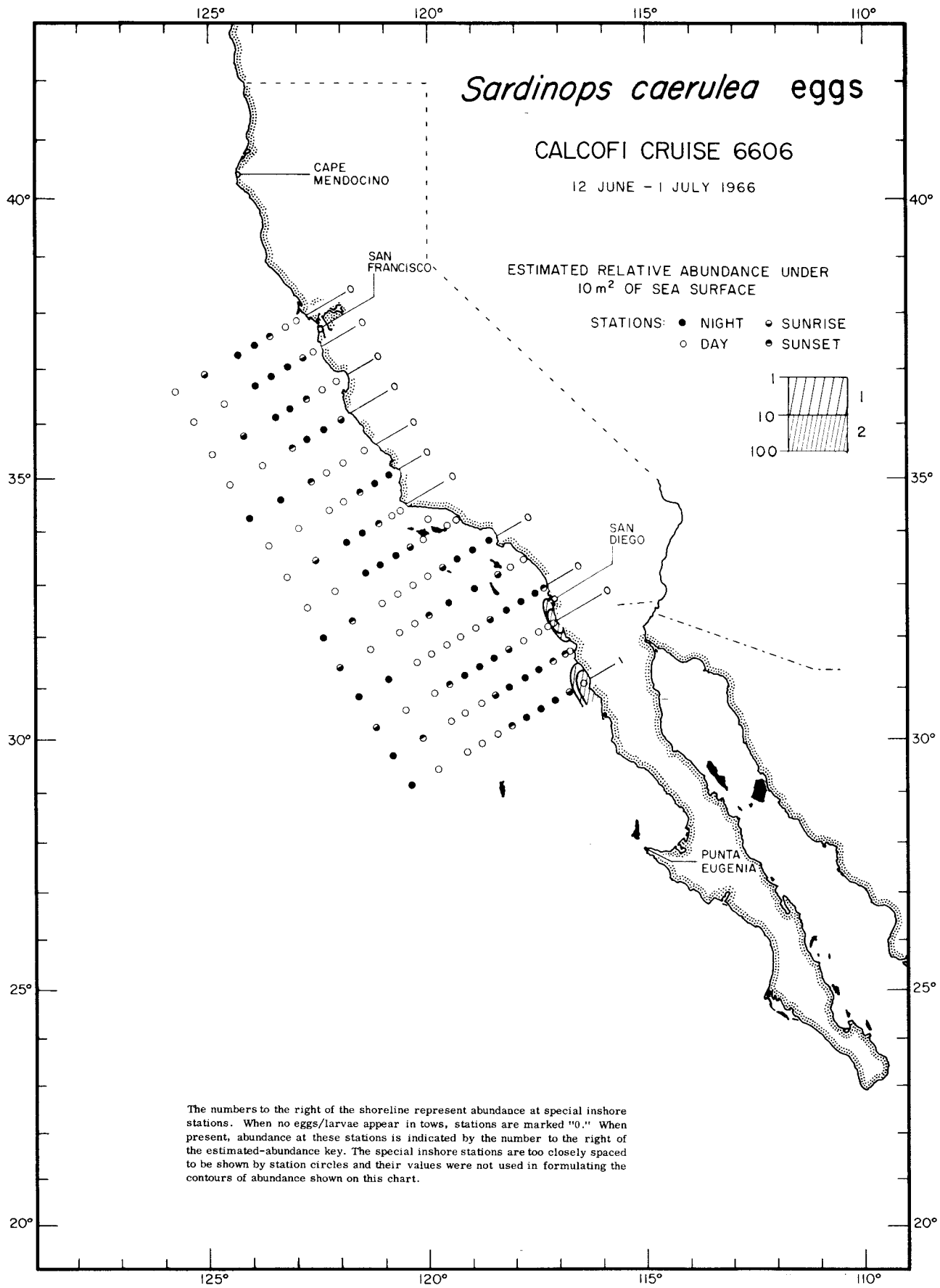
6006



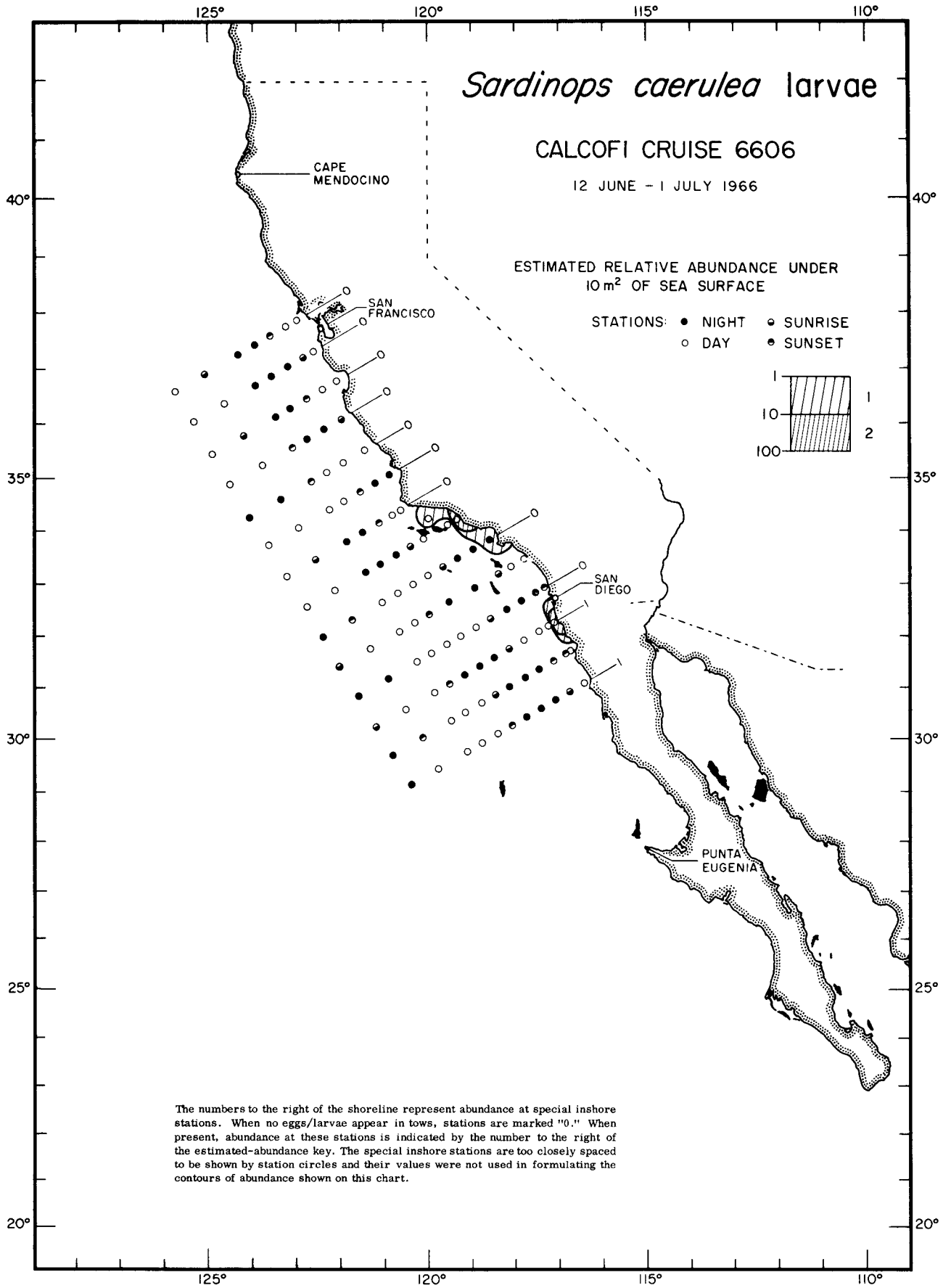
*Sardinops caerulea* larvae

6006



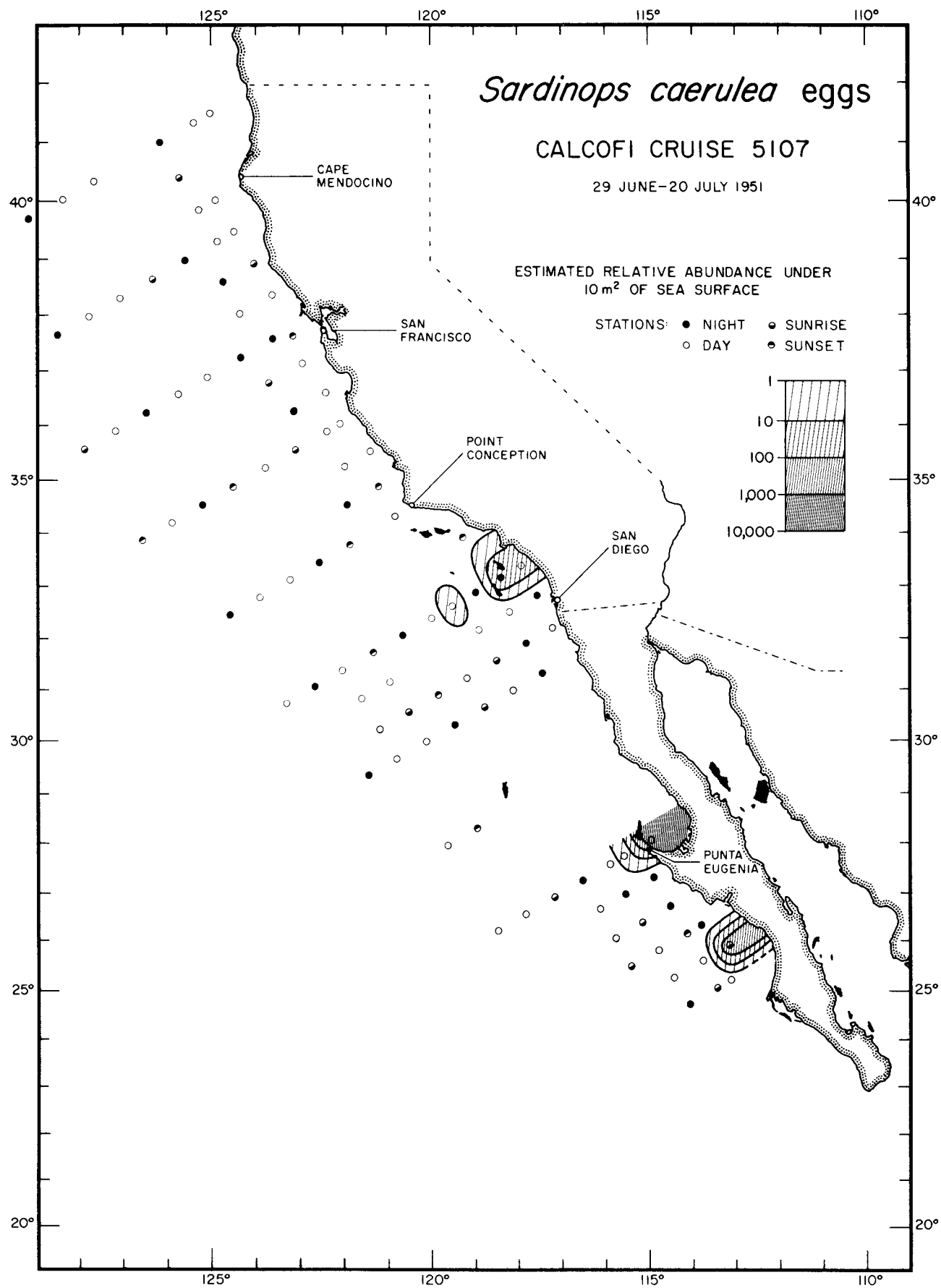


The numbers to the right of the shoreline represent abundance at special inshore stations. When no eggs/larvae appear in tows, stations are marked "0." When present, abundance at these stations is indicated by the number to the right of the estimated-abundance key. The special inshore stations are too closely spaced to be shown by station circles and their values were not used in formulating the contours of abundance shown on this chart.



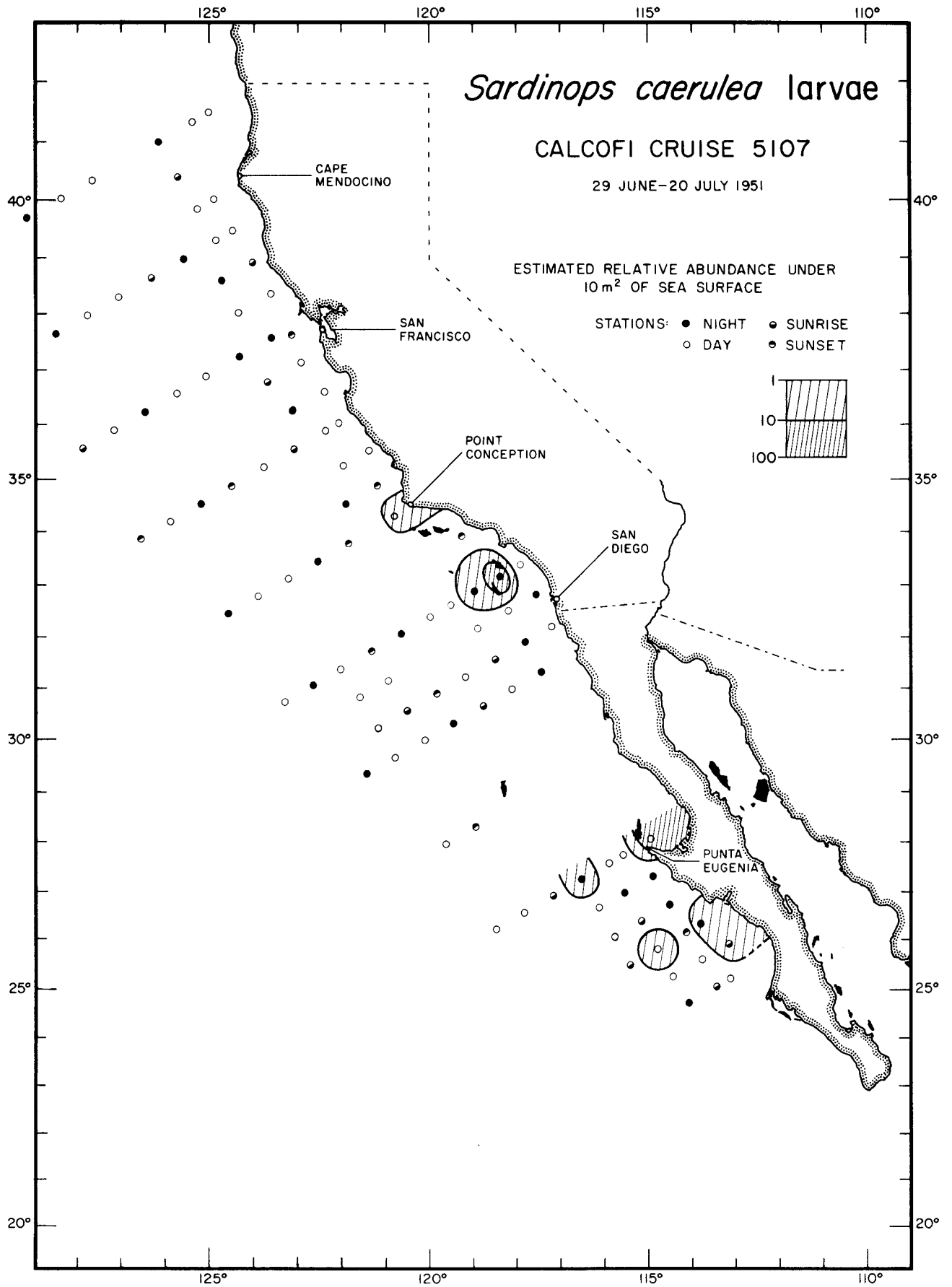
*Sardinops caerulea* larvae

6606



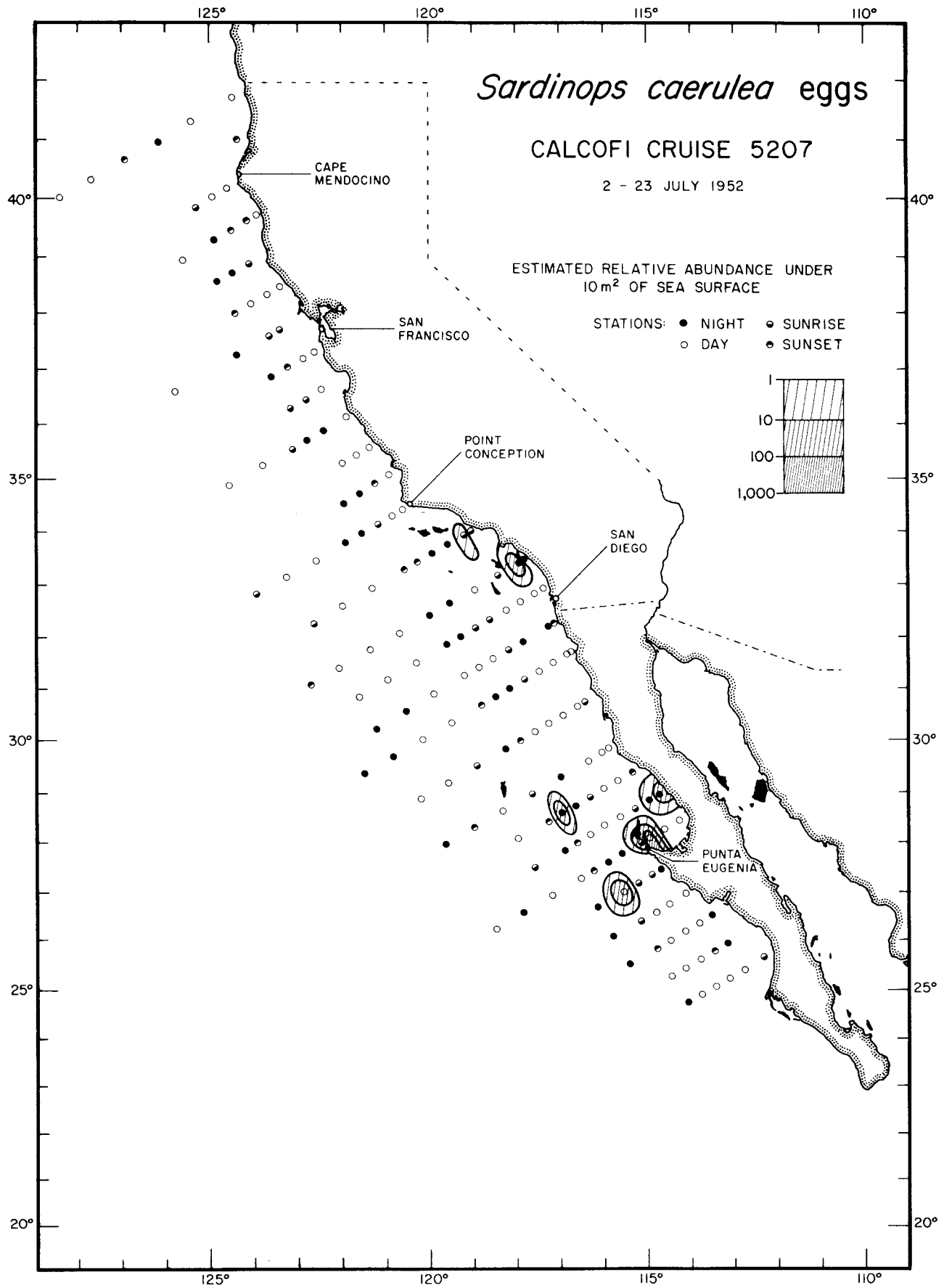
*Sardinops caerulea* eggs

5107



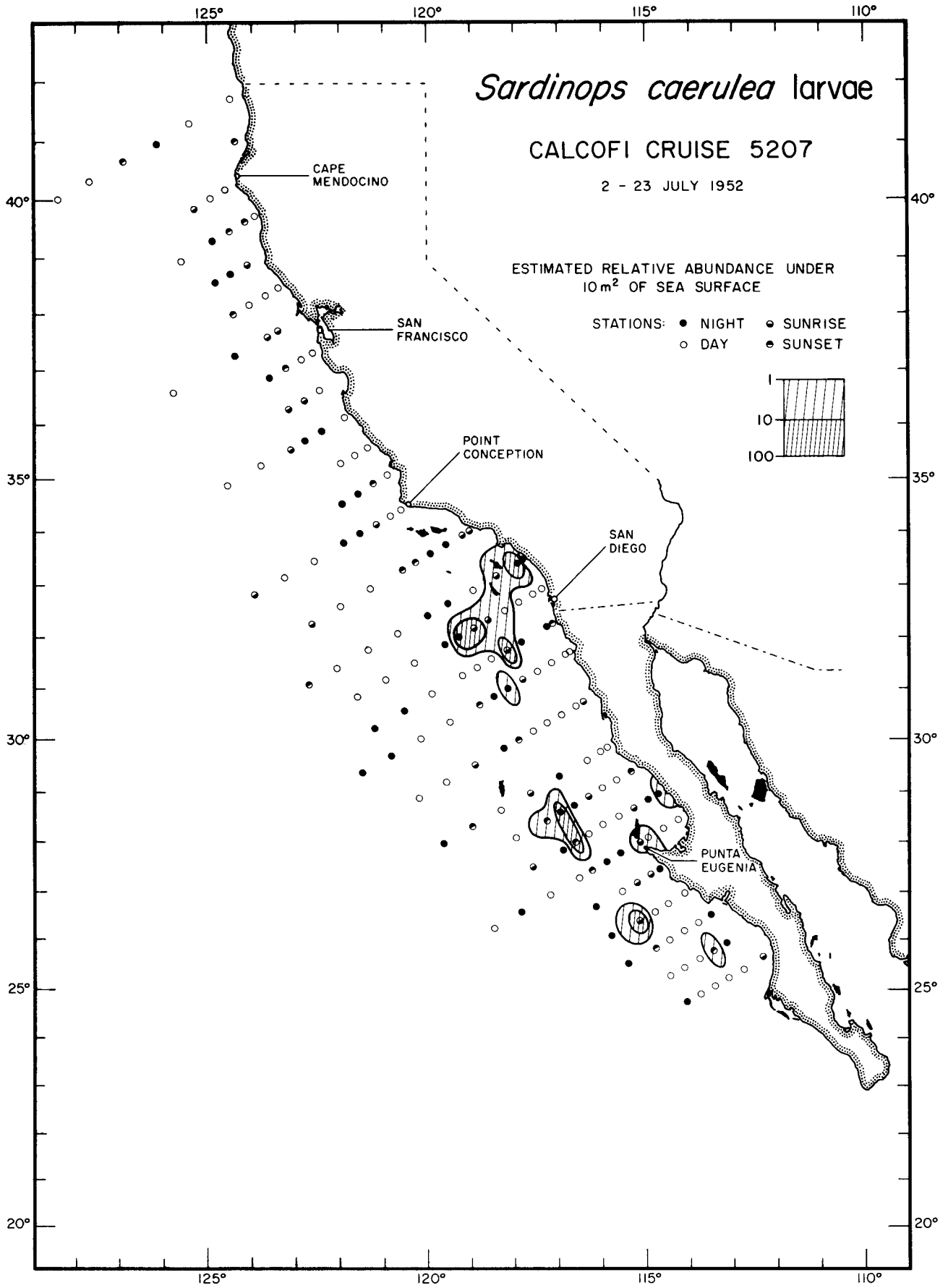
*Sardinops caerulea* larvae

5107



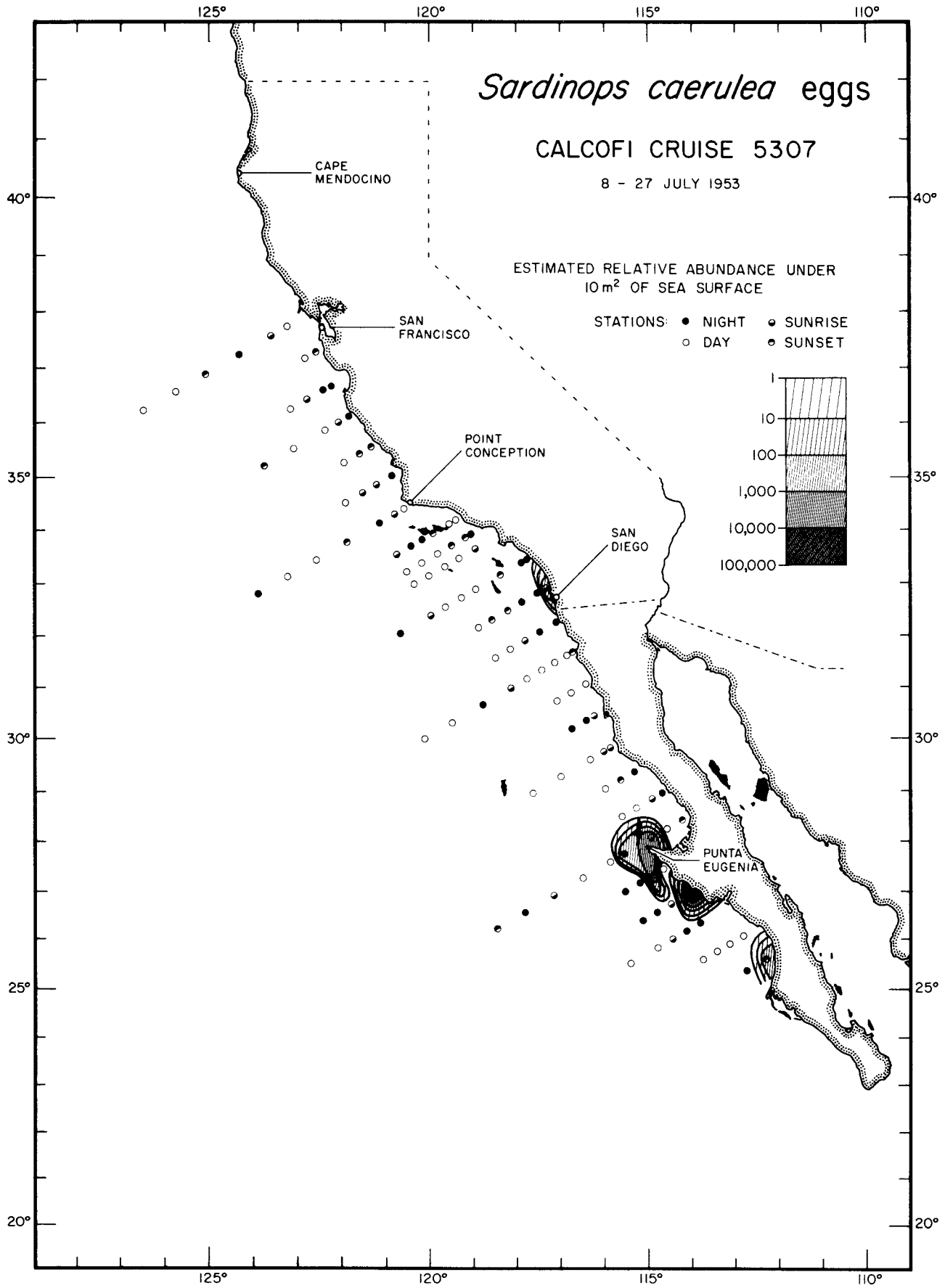
*Sardinops caerulea* eggs

5207



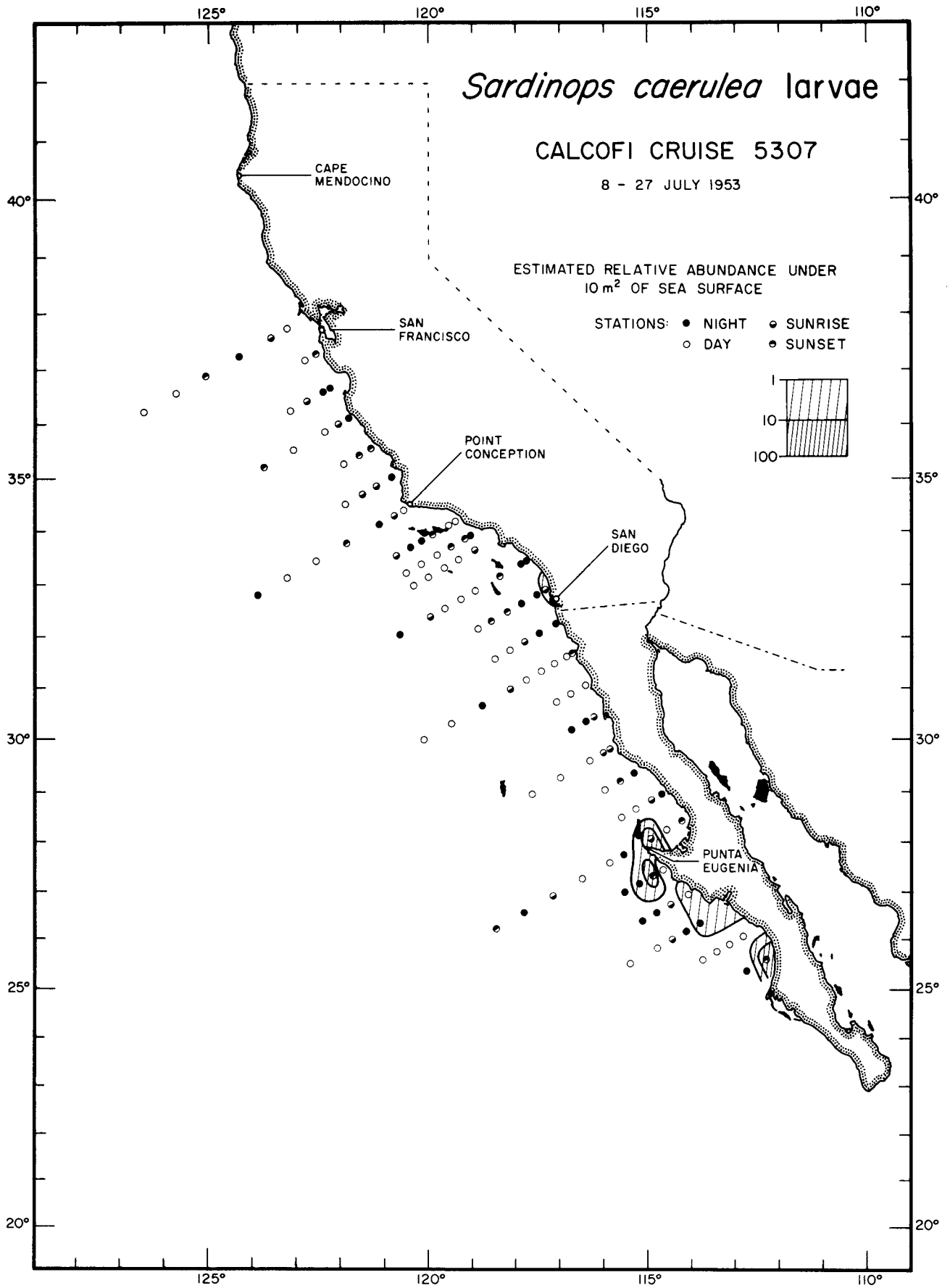
*Sardinops caerulea* larvae

5207



*Sardinops caerulea* eggs

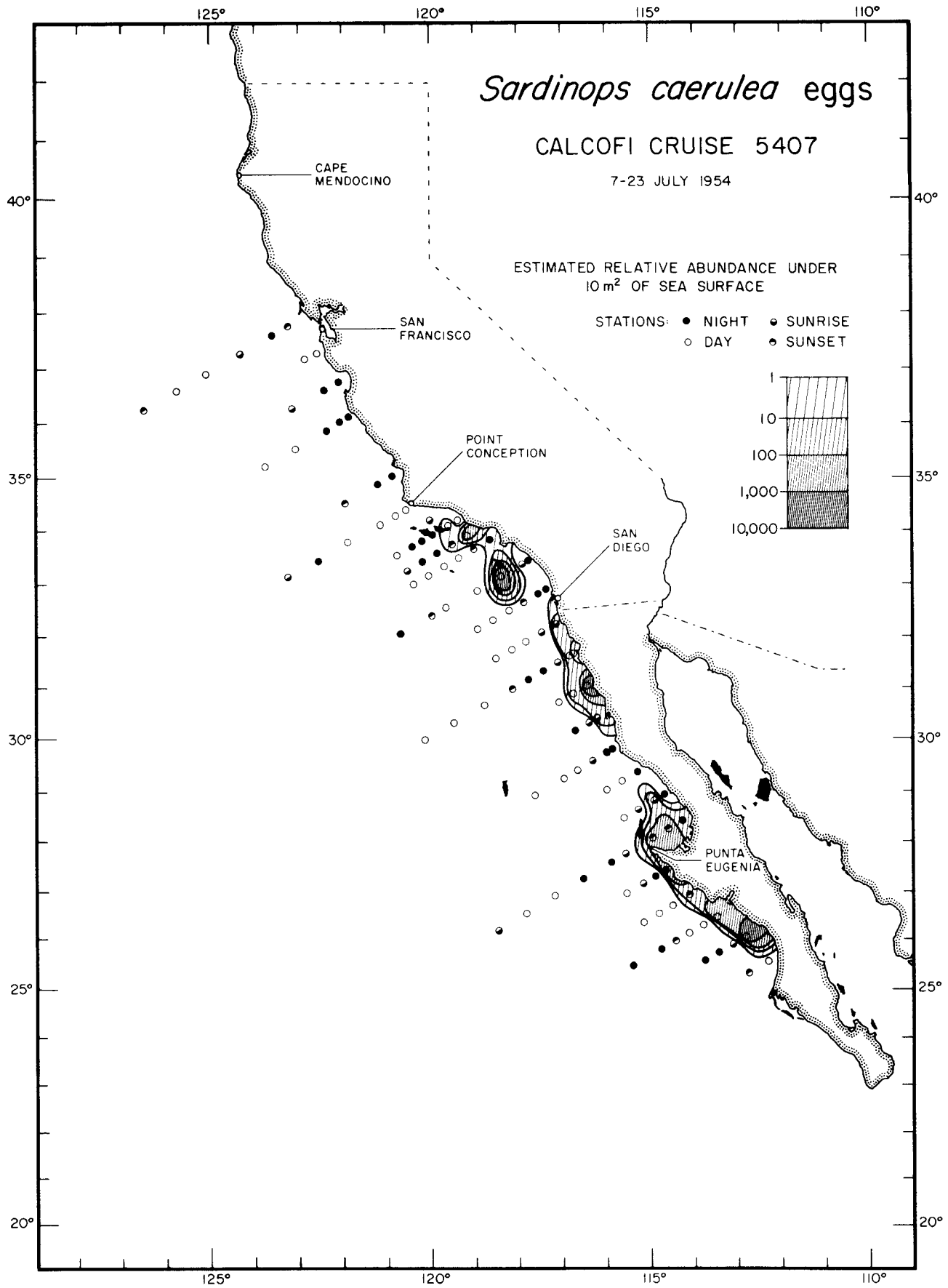
5307



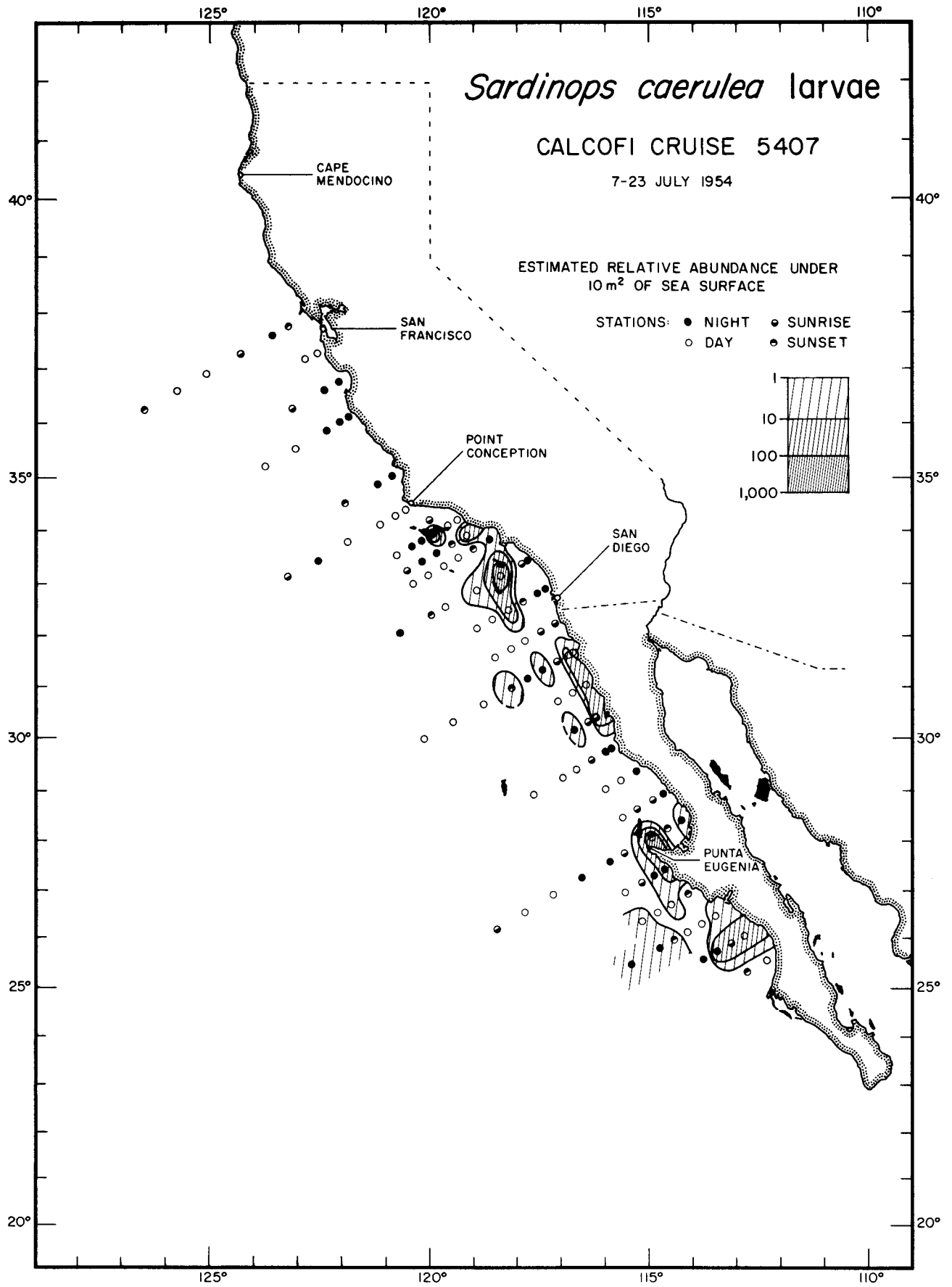
*Sardinops caerulea* larvae

5307



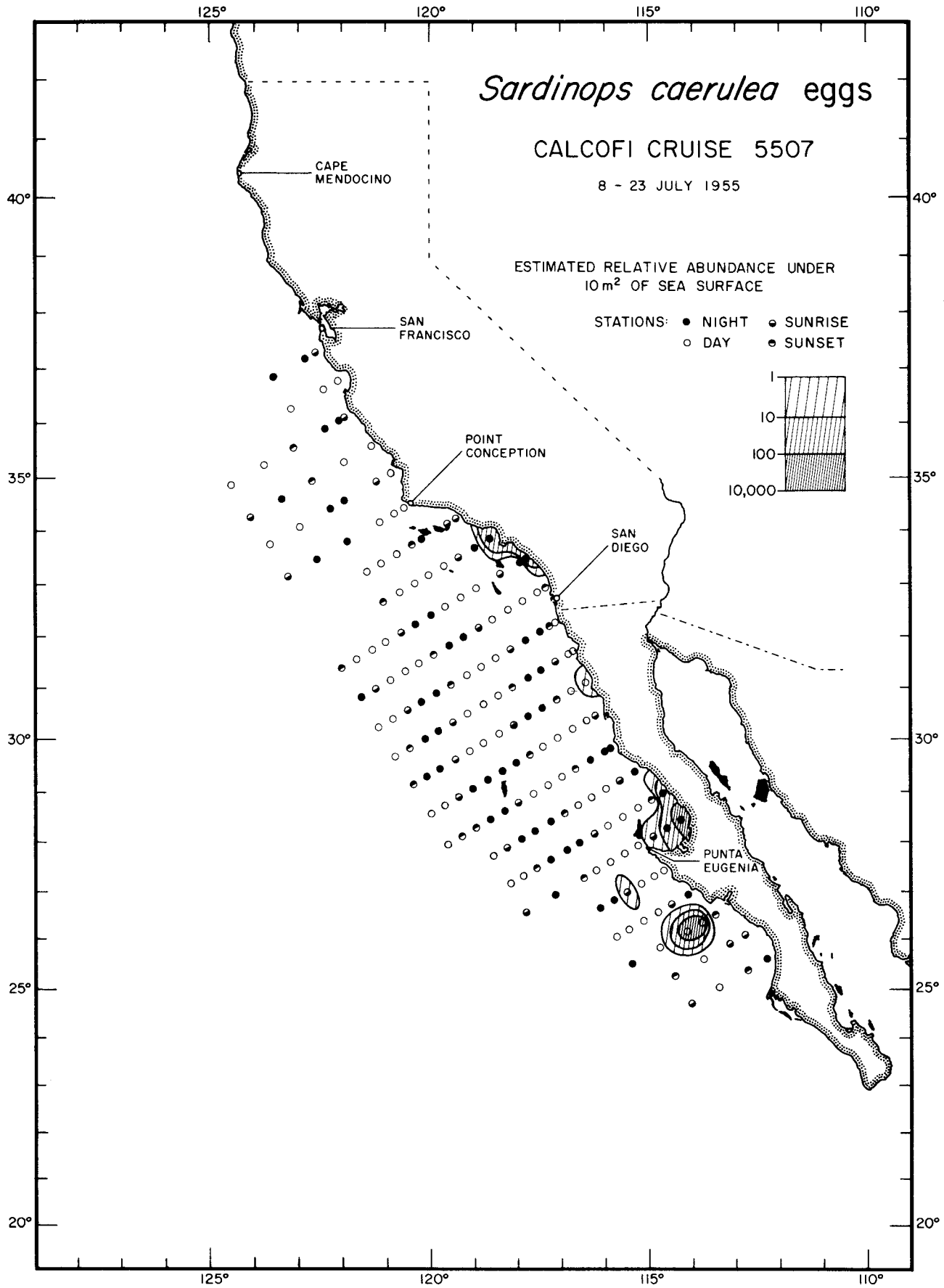


*Sardinops caerulea* eggs  
5407



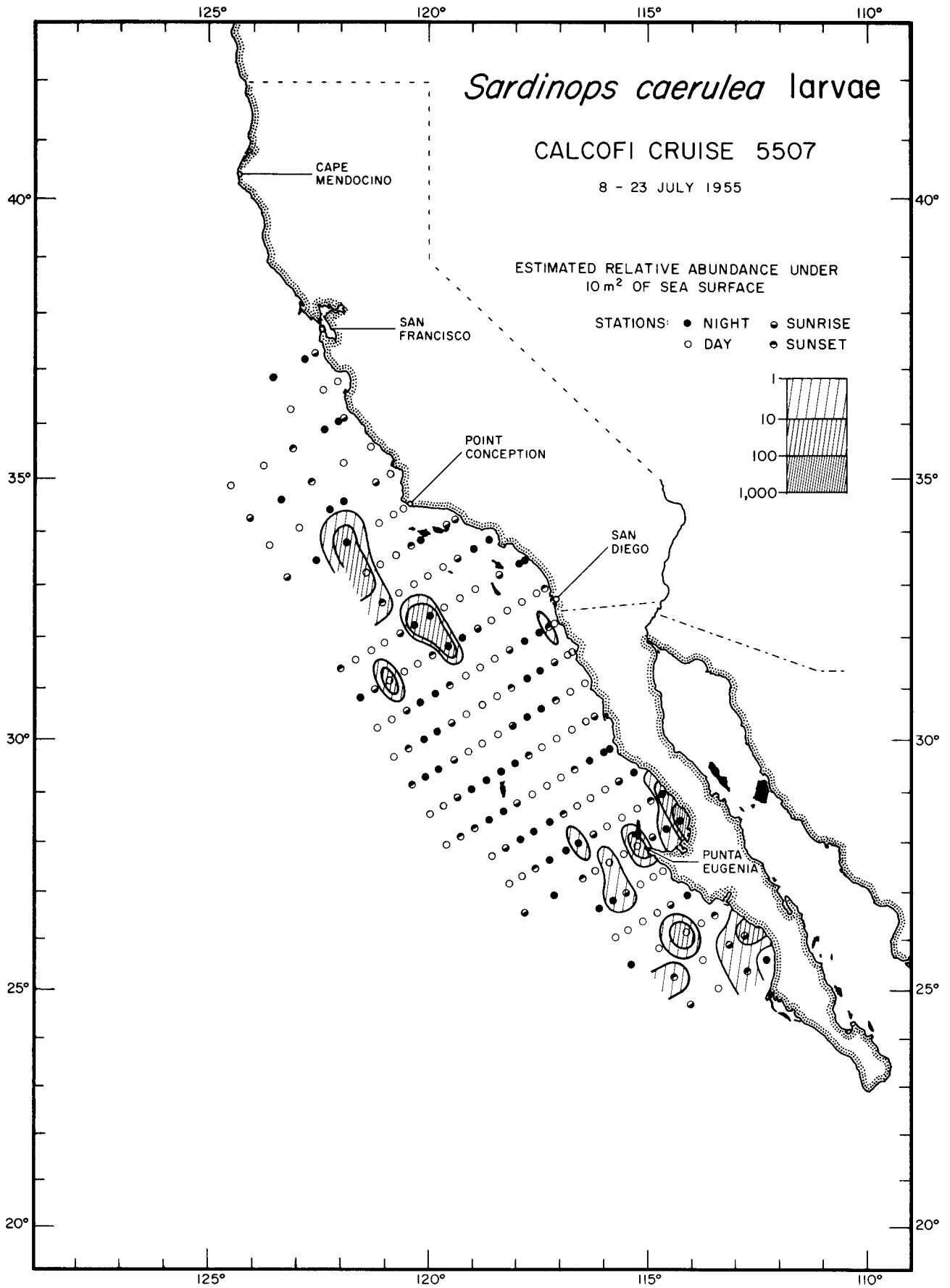
*Sardinops caerulea* larvae

5407



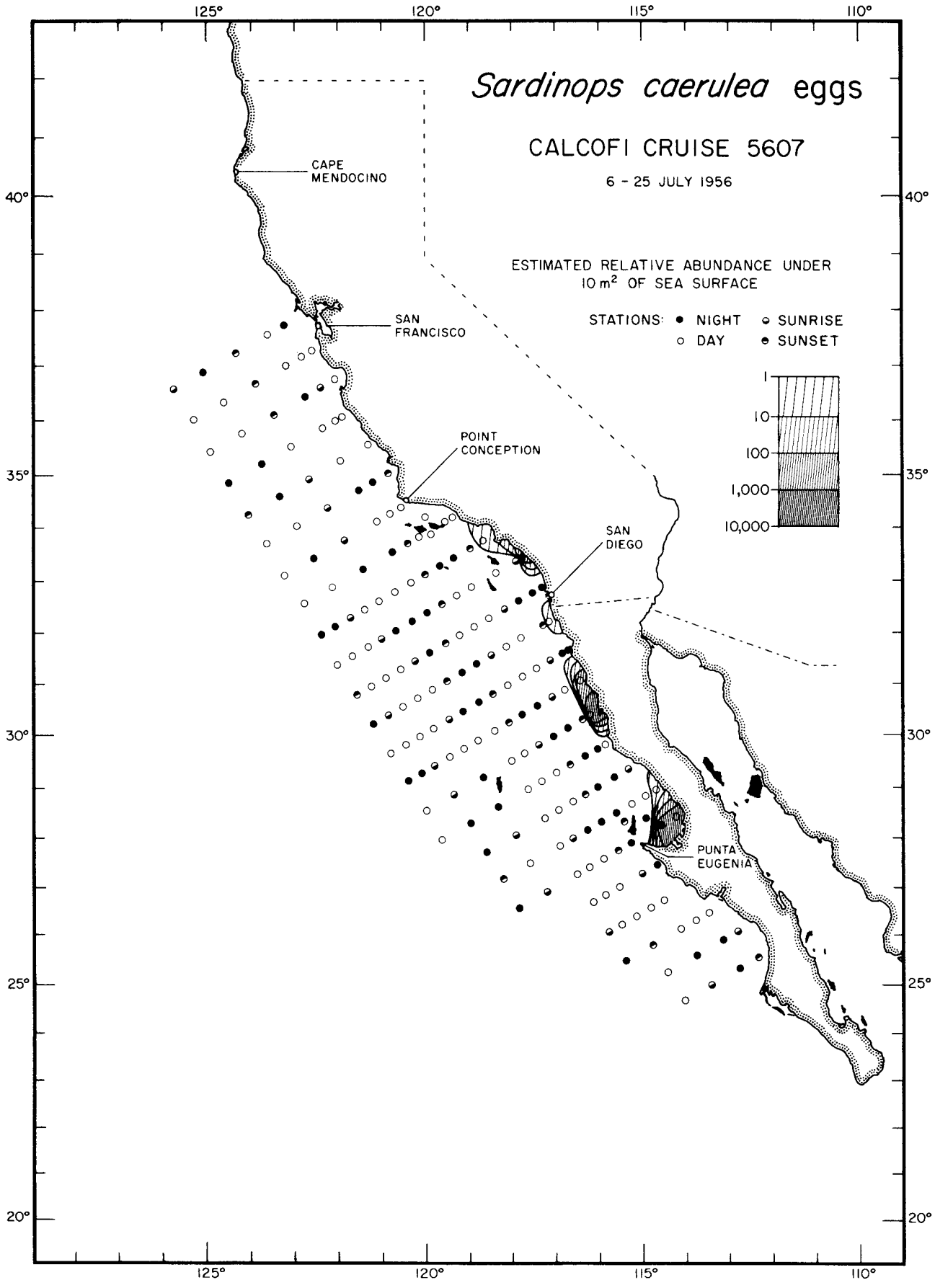
*Sardinops caerulea* eggs

5507



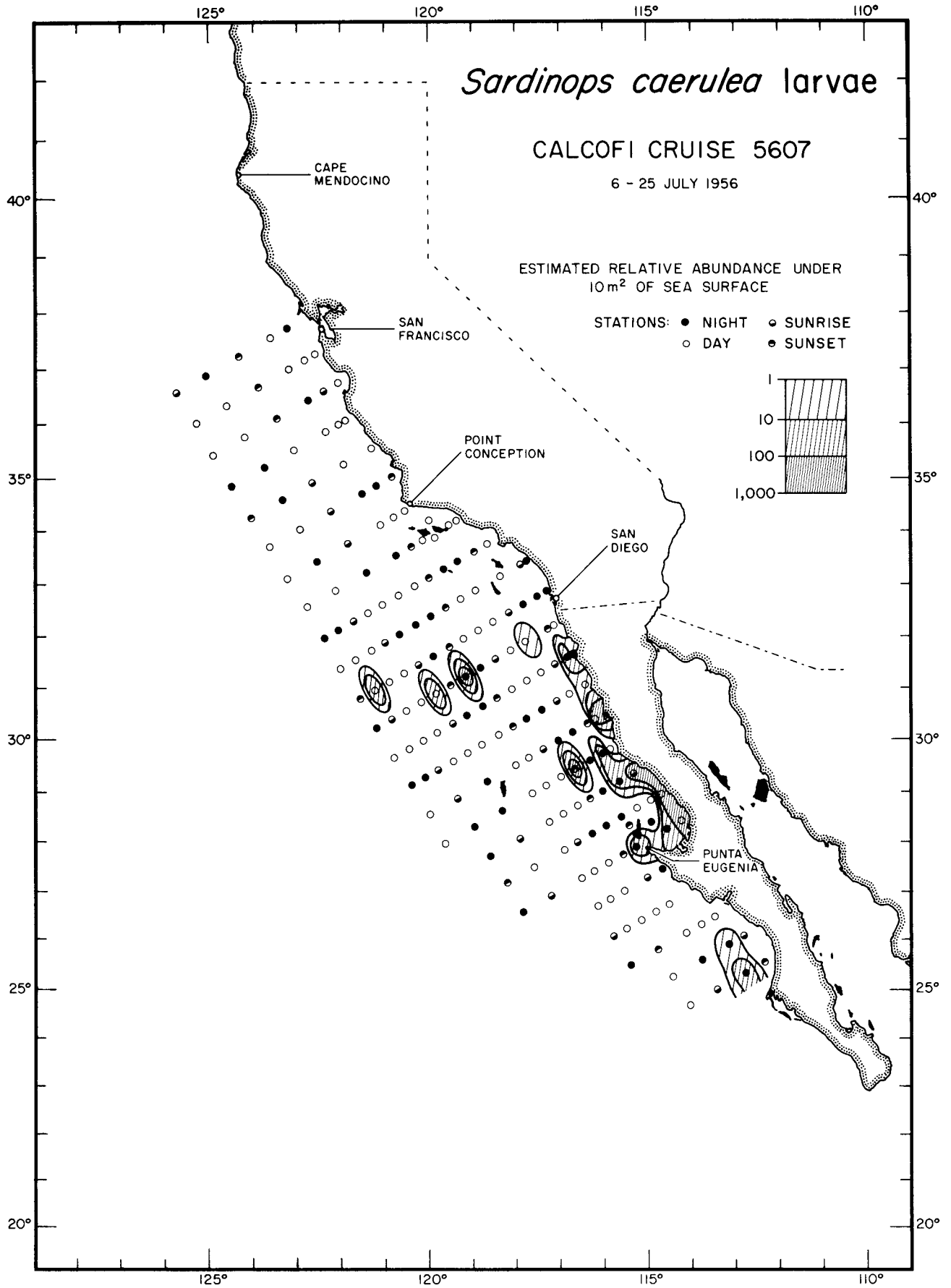
*Sardinops caerulea* larvae

5507



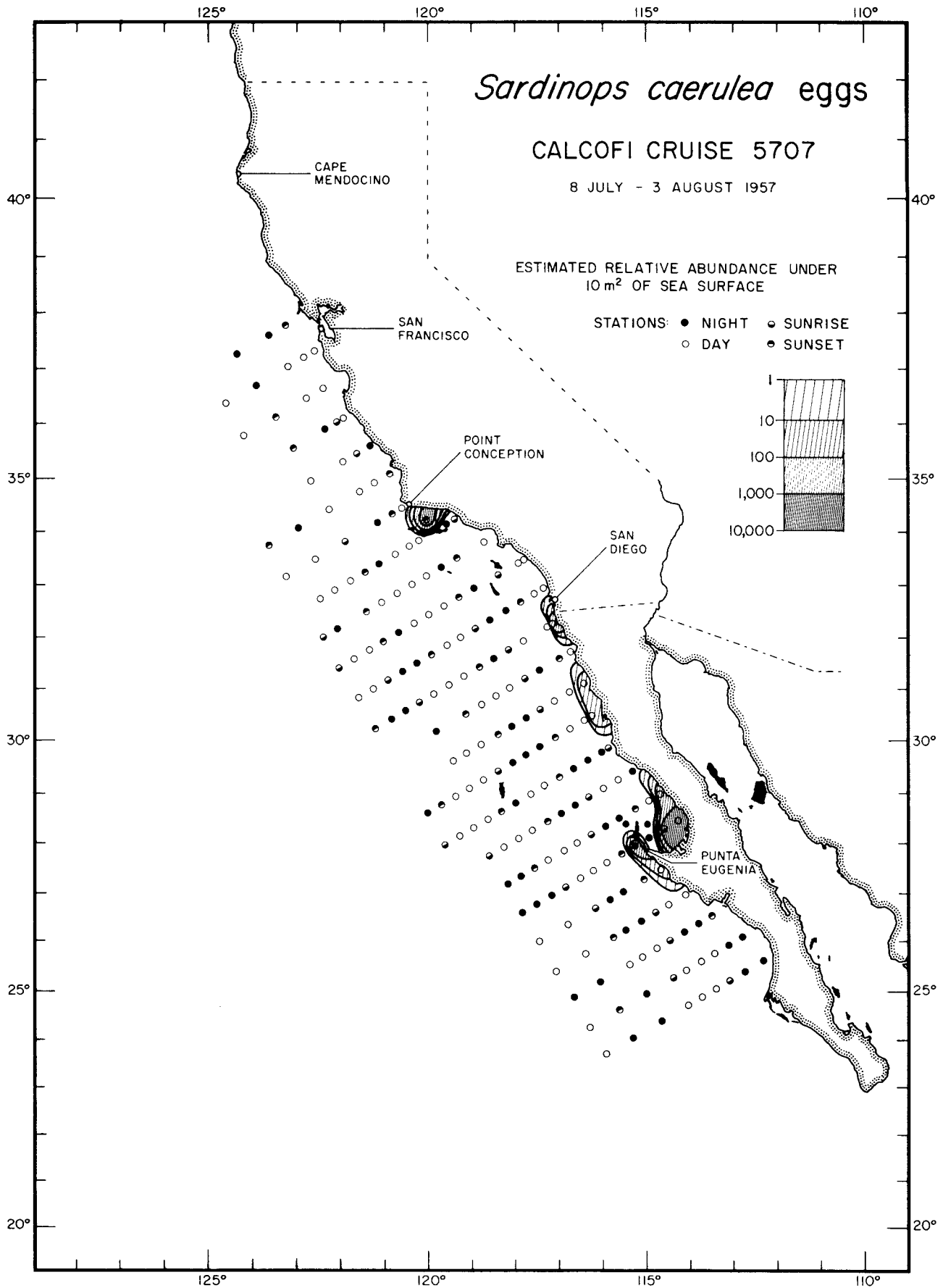
*Sardinops caerulea* eggs

5607



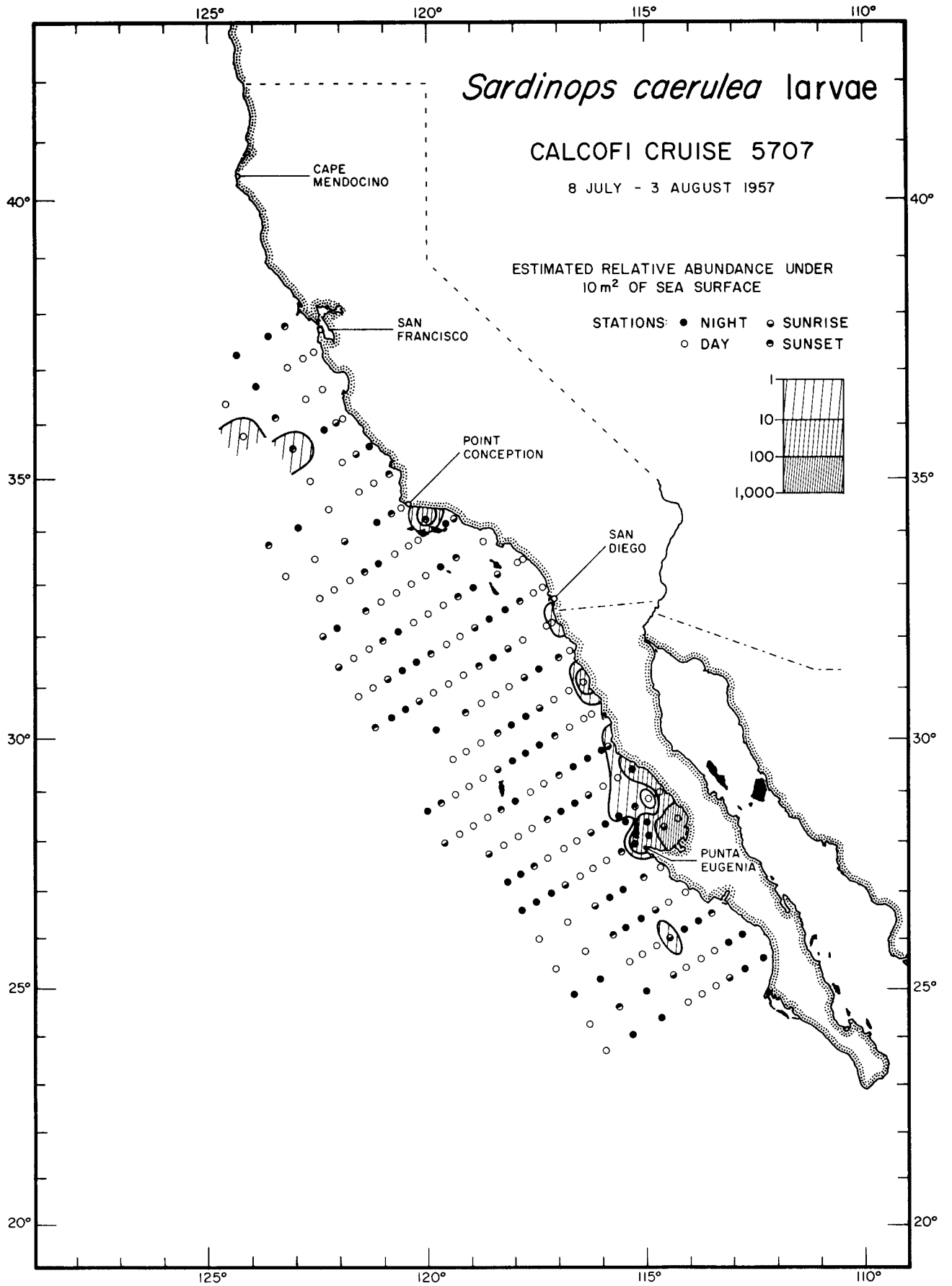
*Sardinops caerulea* larvae

5607



*Sardinops caerulea* eggs

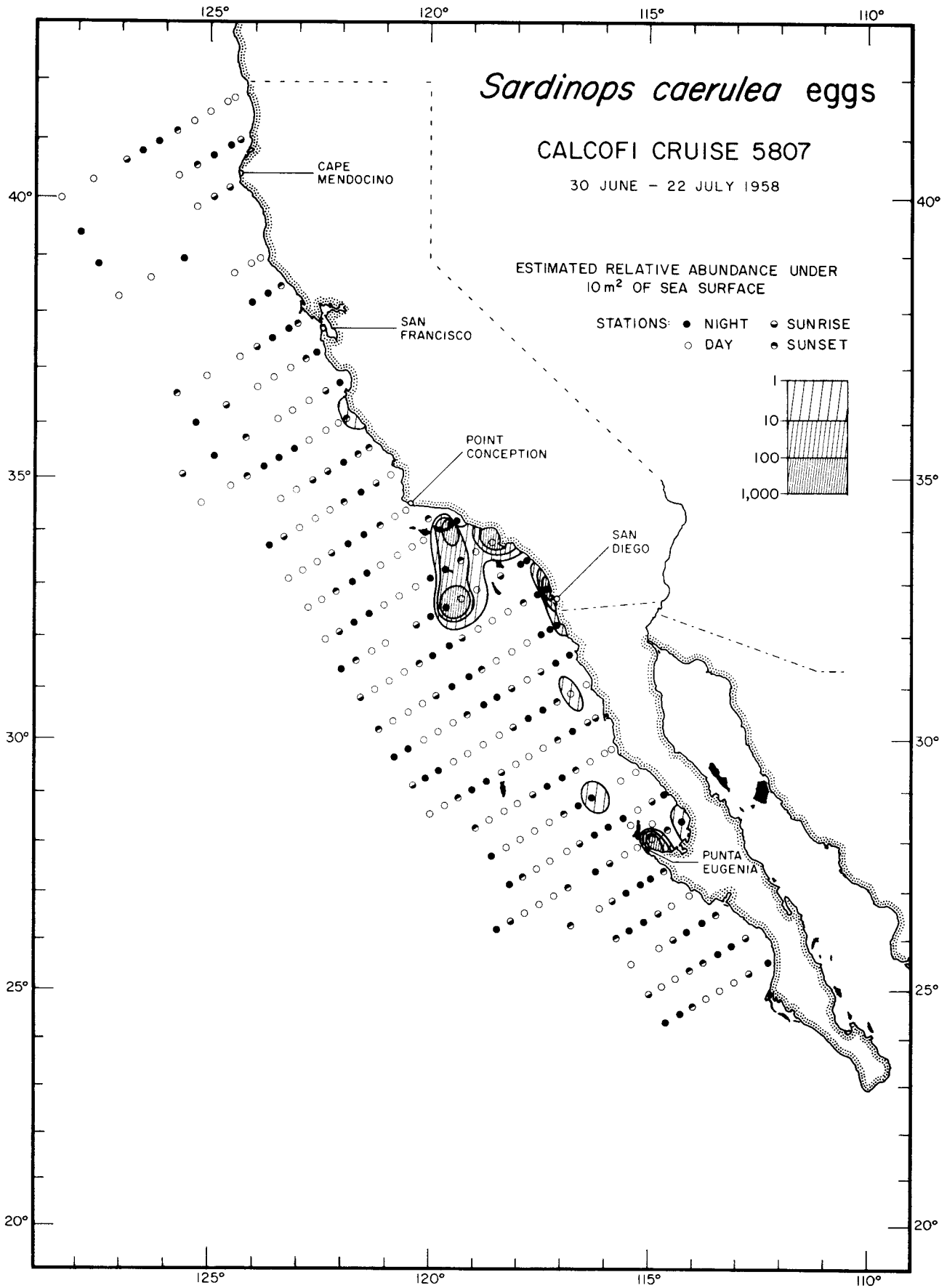
5707



*Sardinops caerulea* larvae

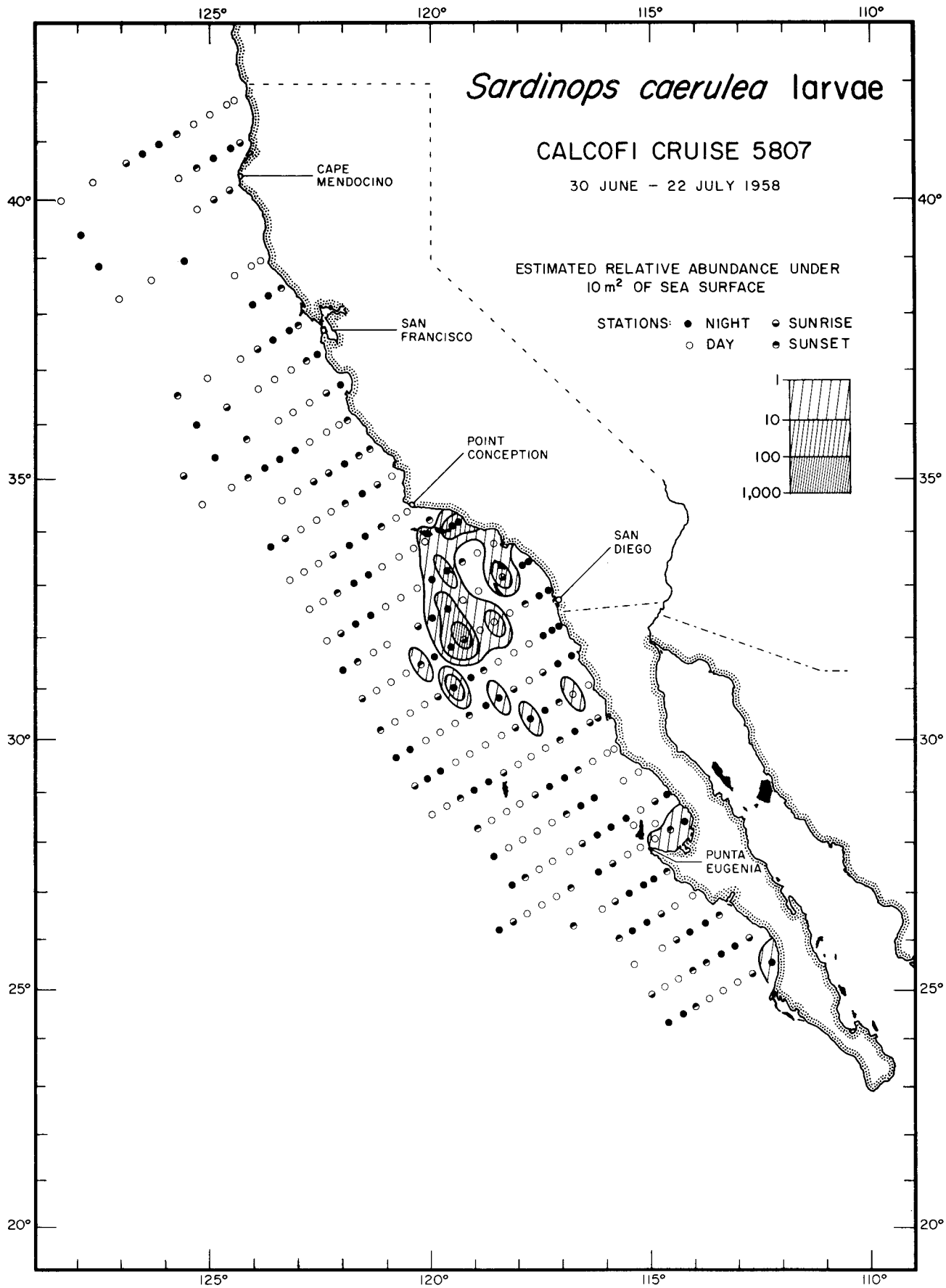
5707





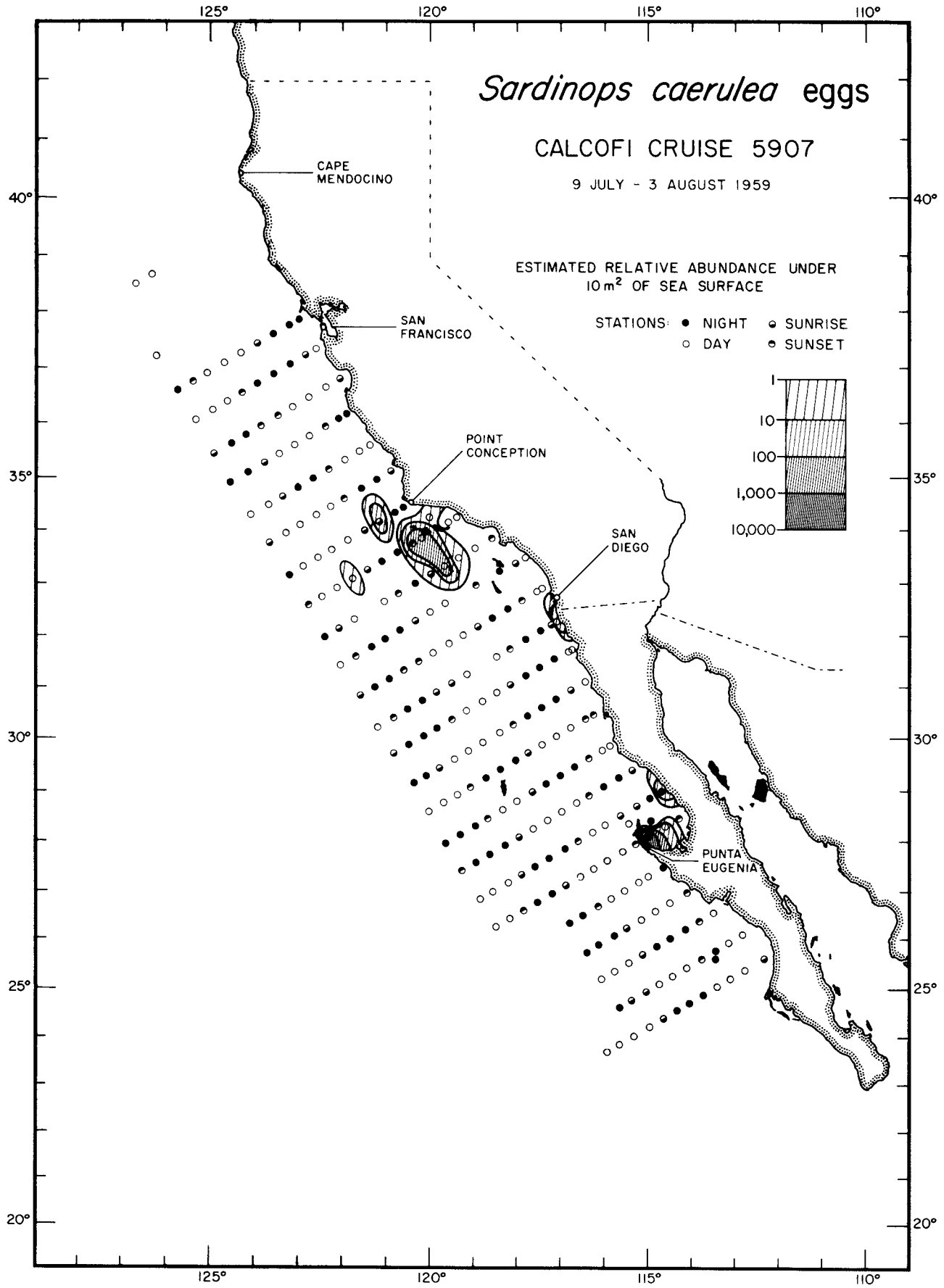
*Sardinops caerulea* eggs

5807



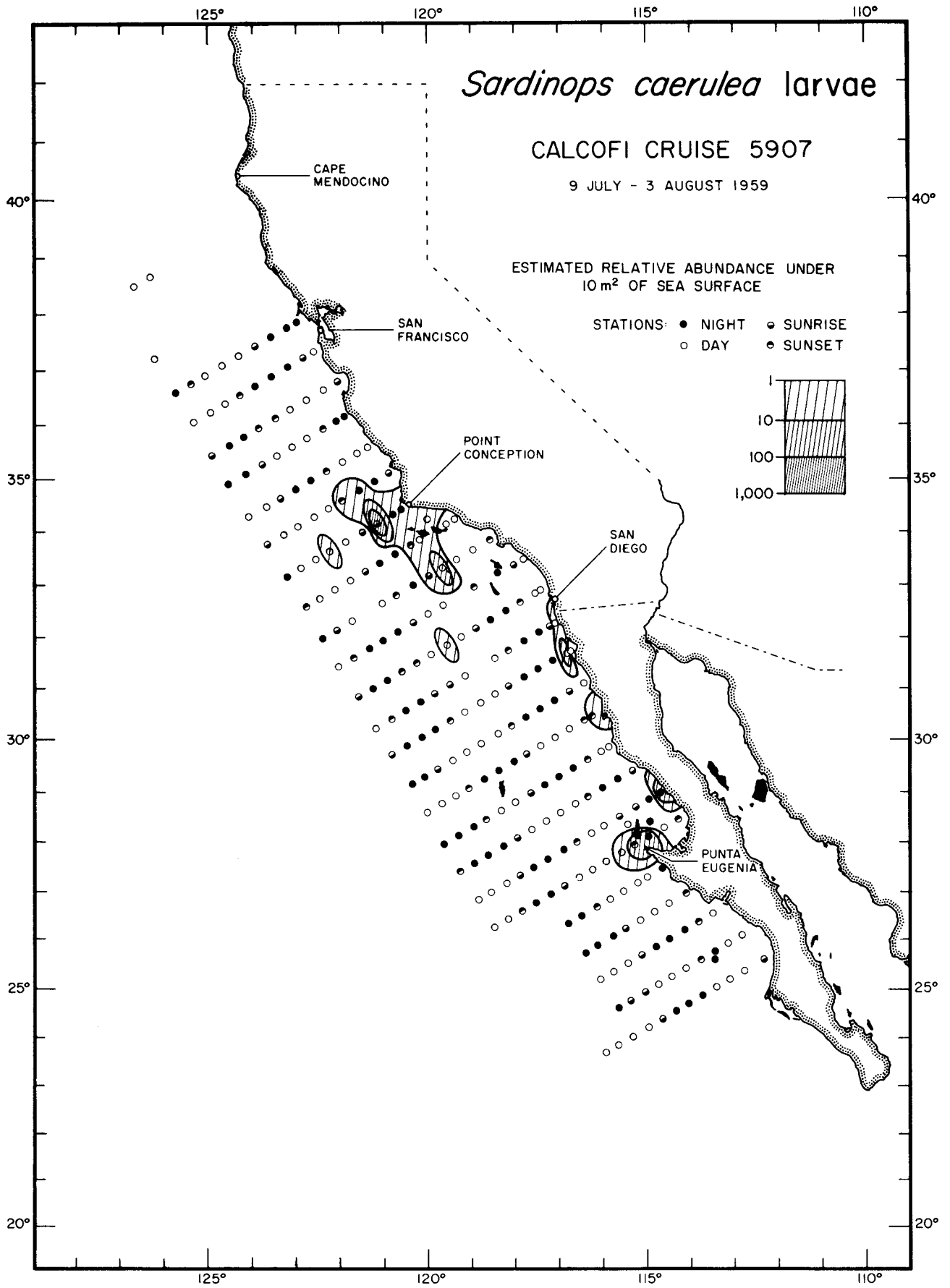
*Sardinops caerulea* larvae

5807



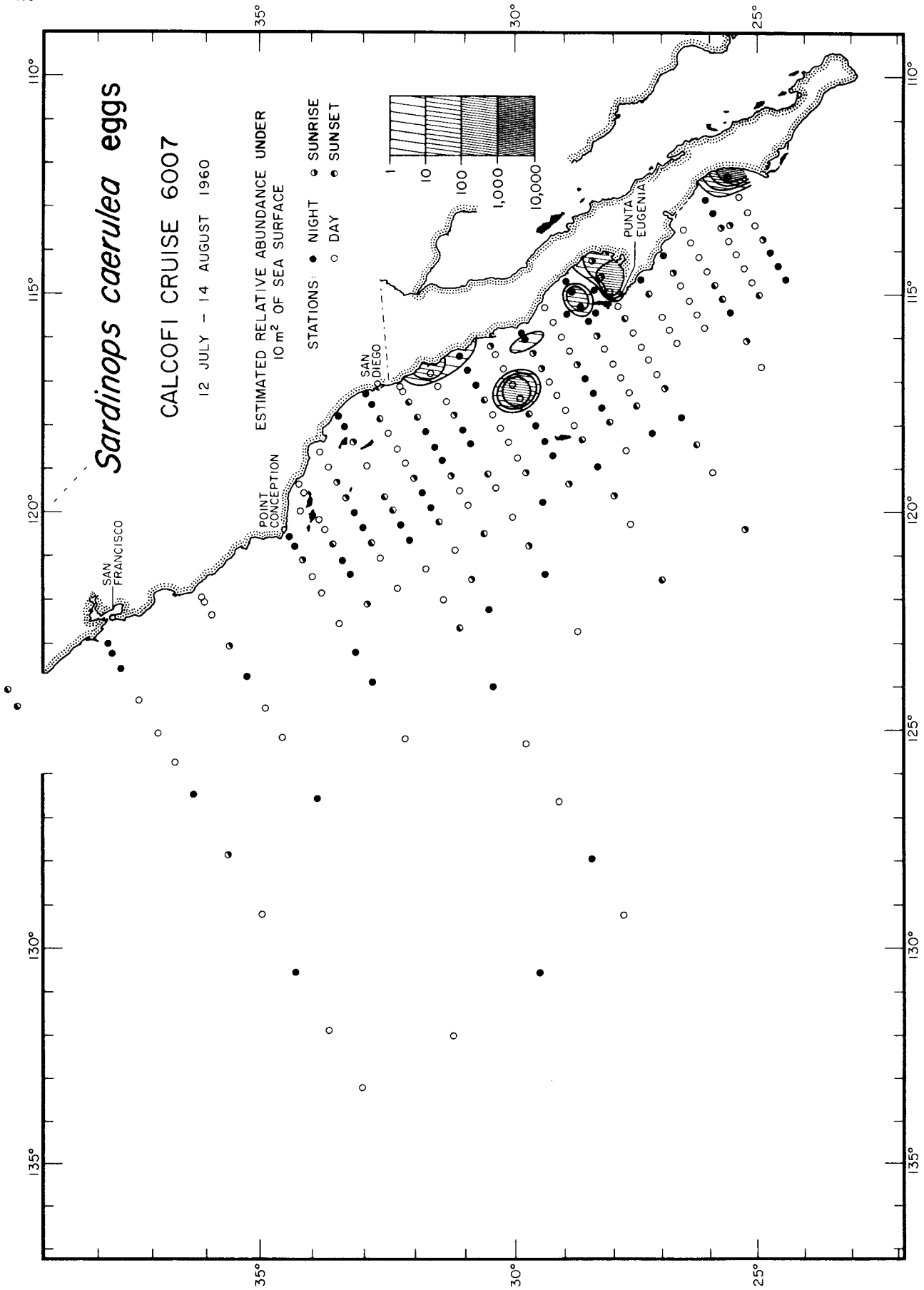
*Sardinops caerulea* eggs

5907



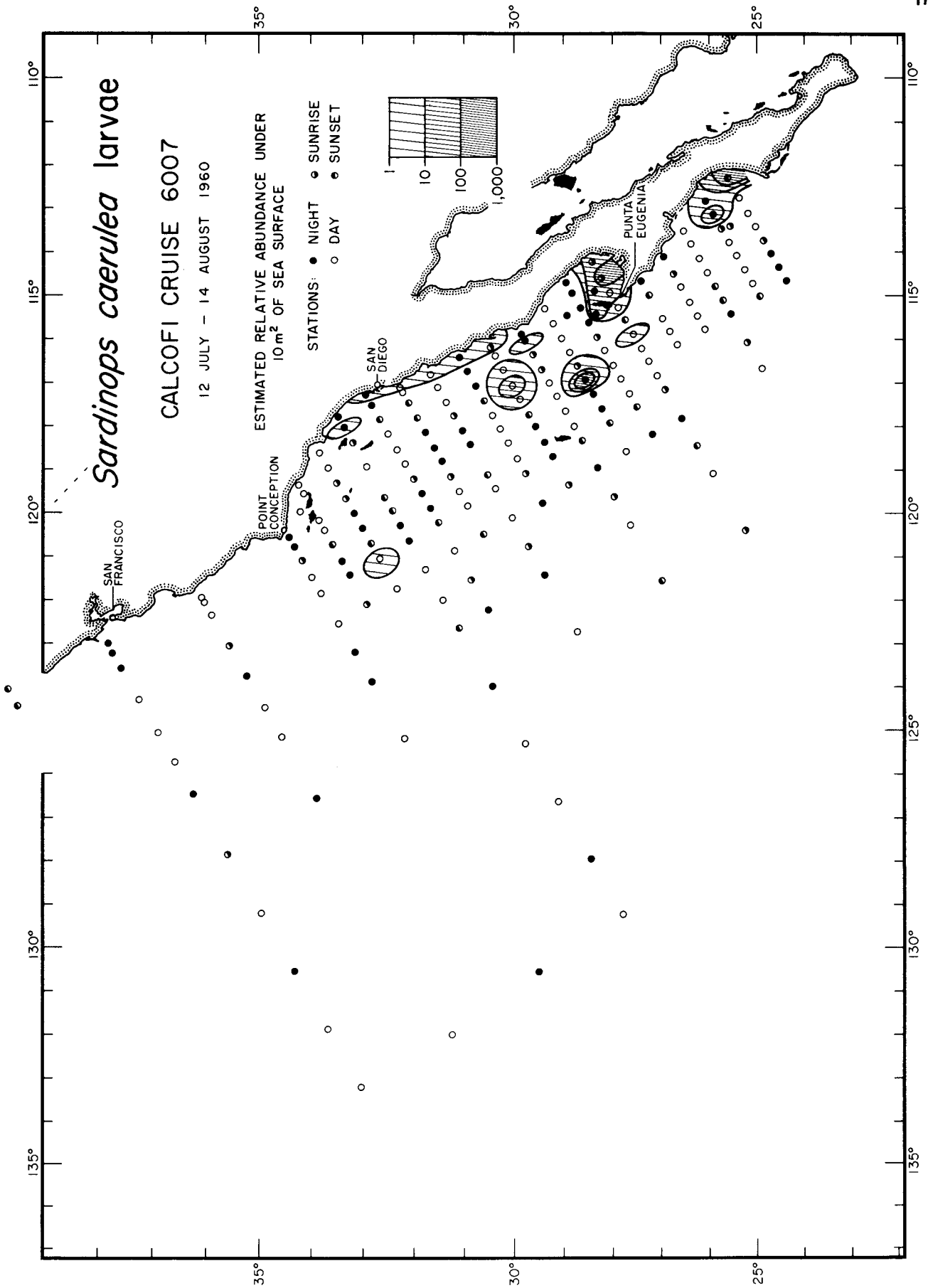
*Sardinops caerulea* larvae

5907

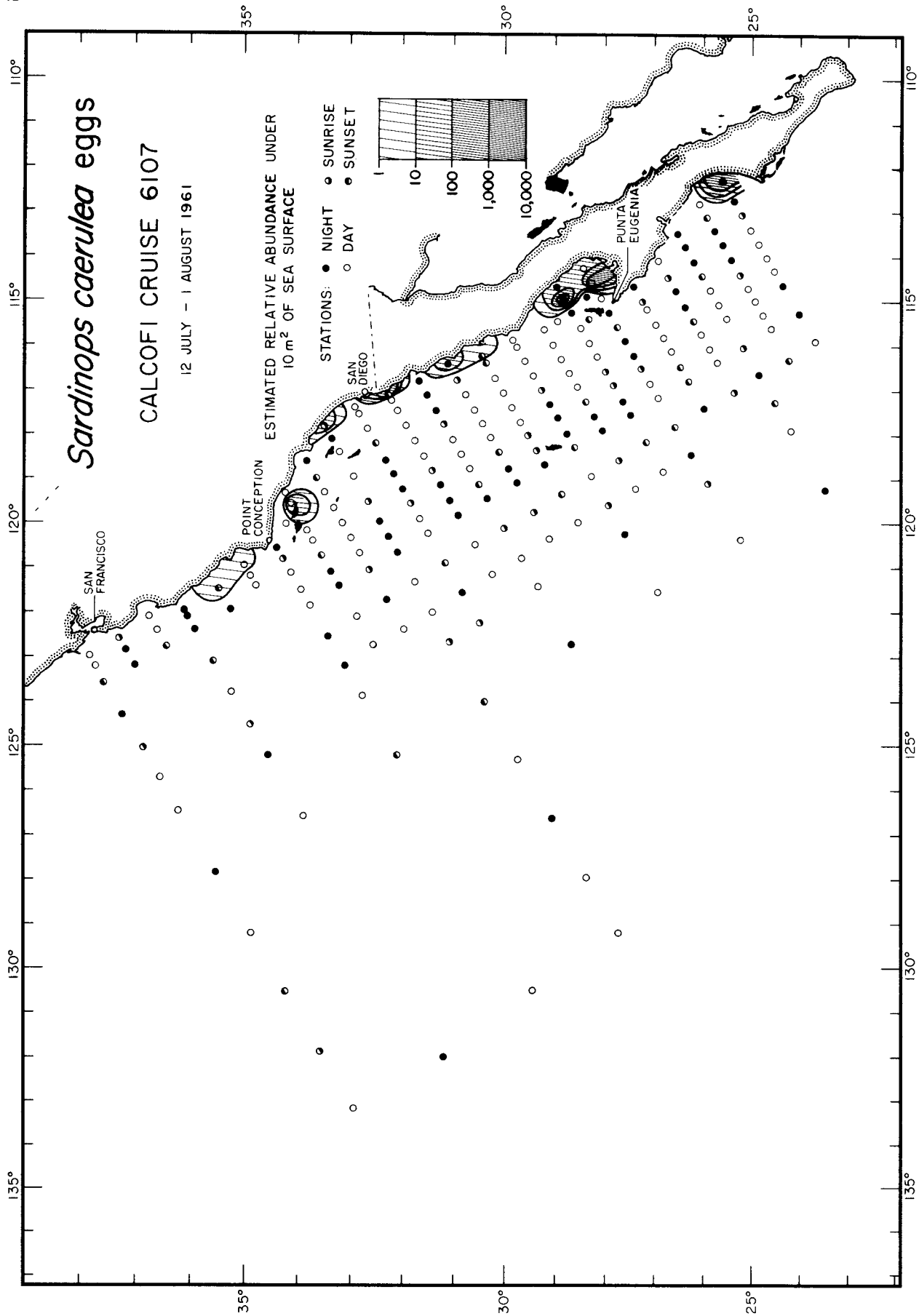


*Sardinops caerulea* eggs

6007

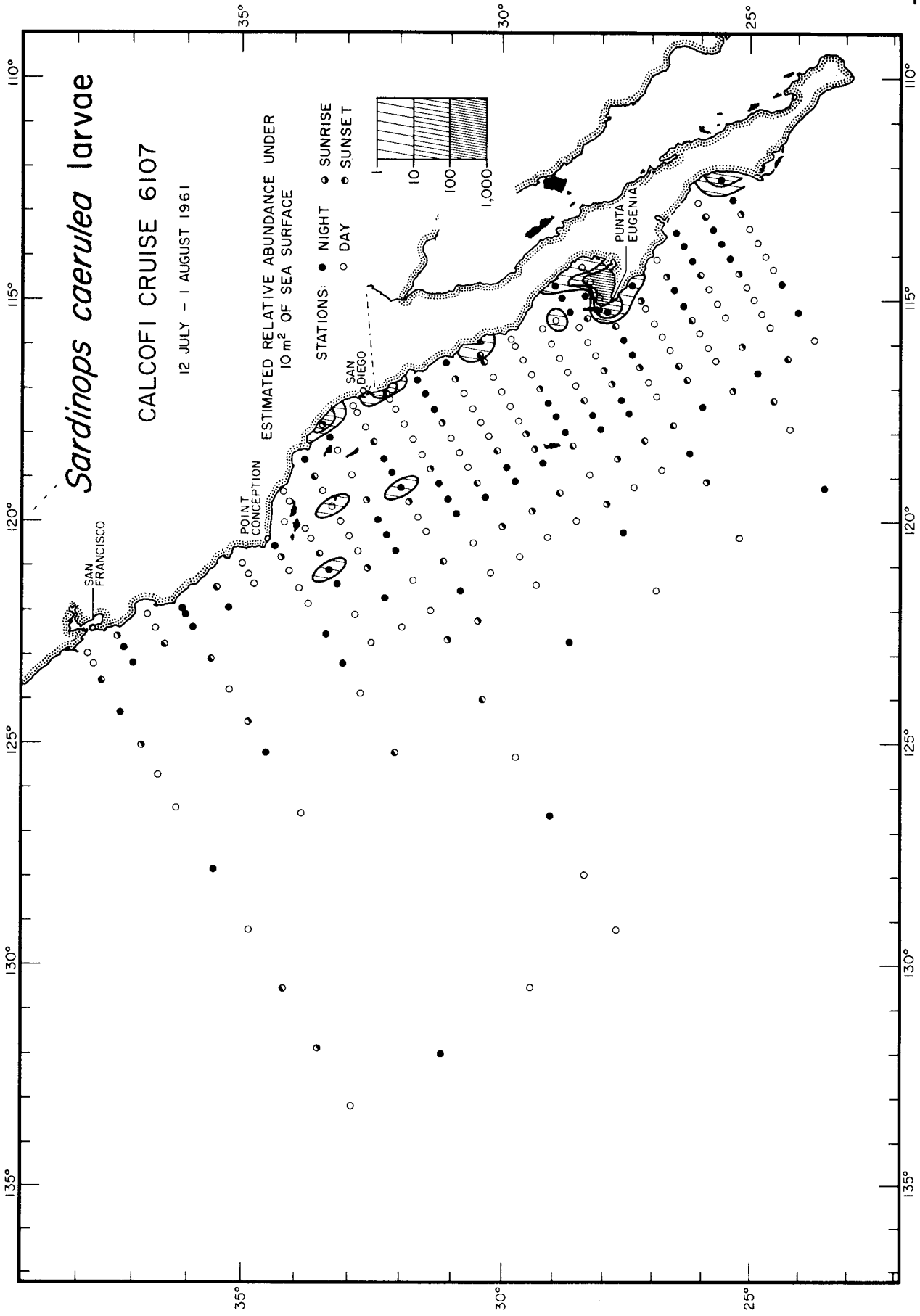


*Sardinops caerulea* larvae  
6007



*Sardinops caerulea* eggs

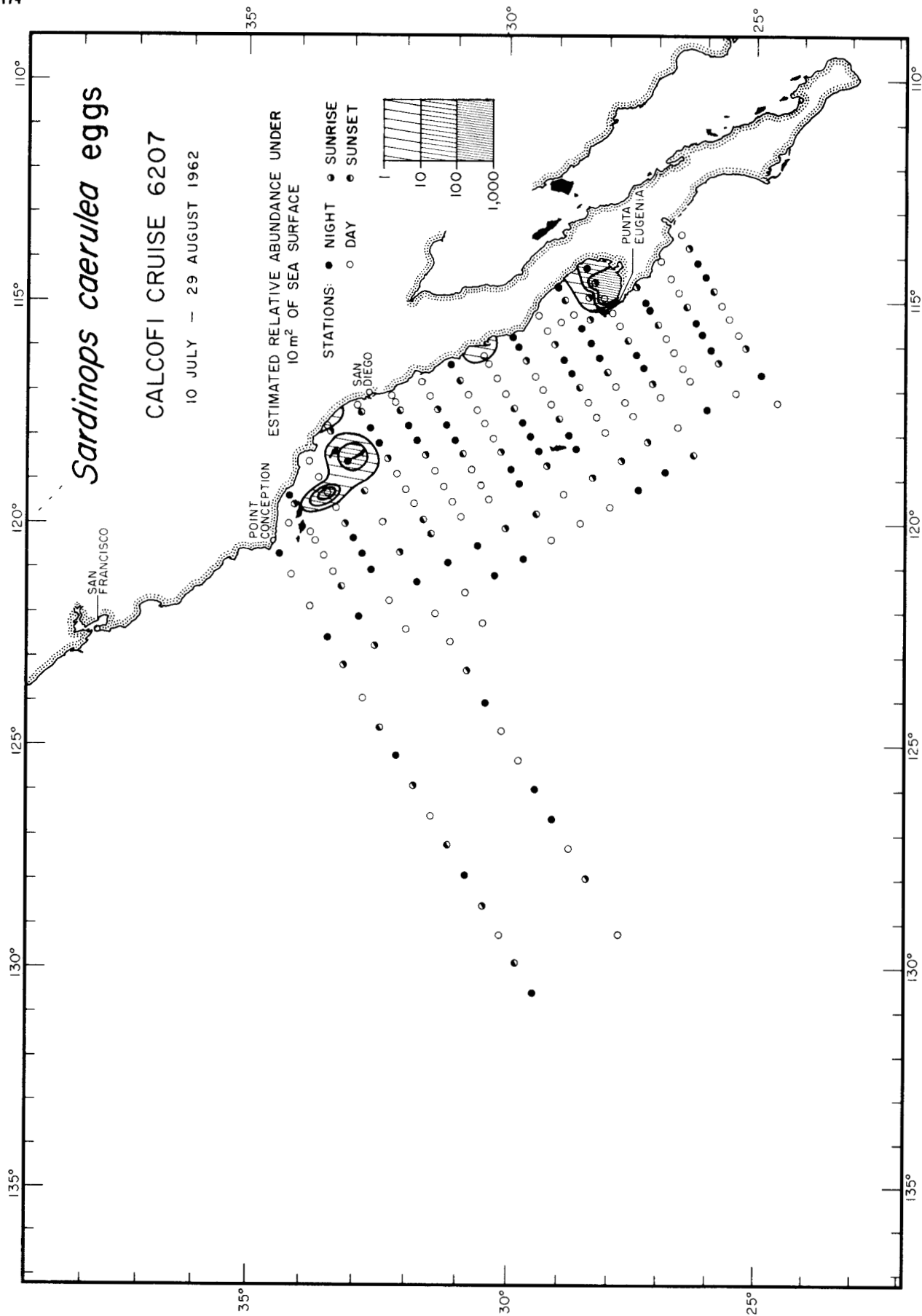
6107



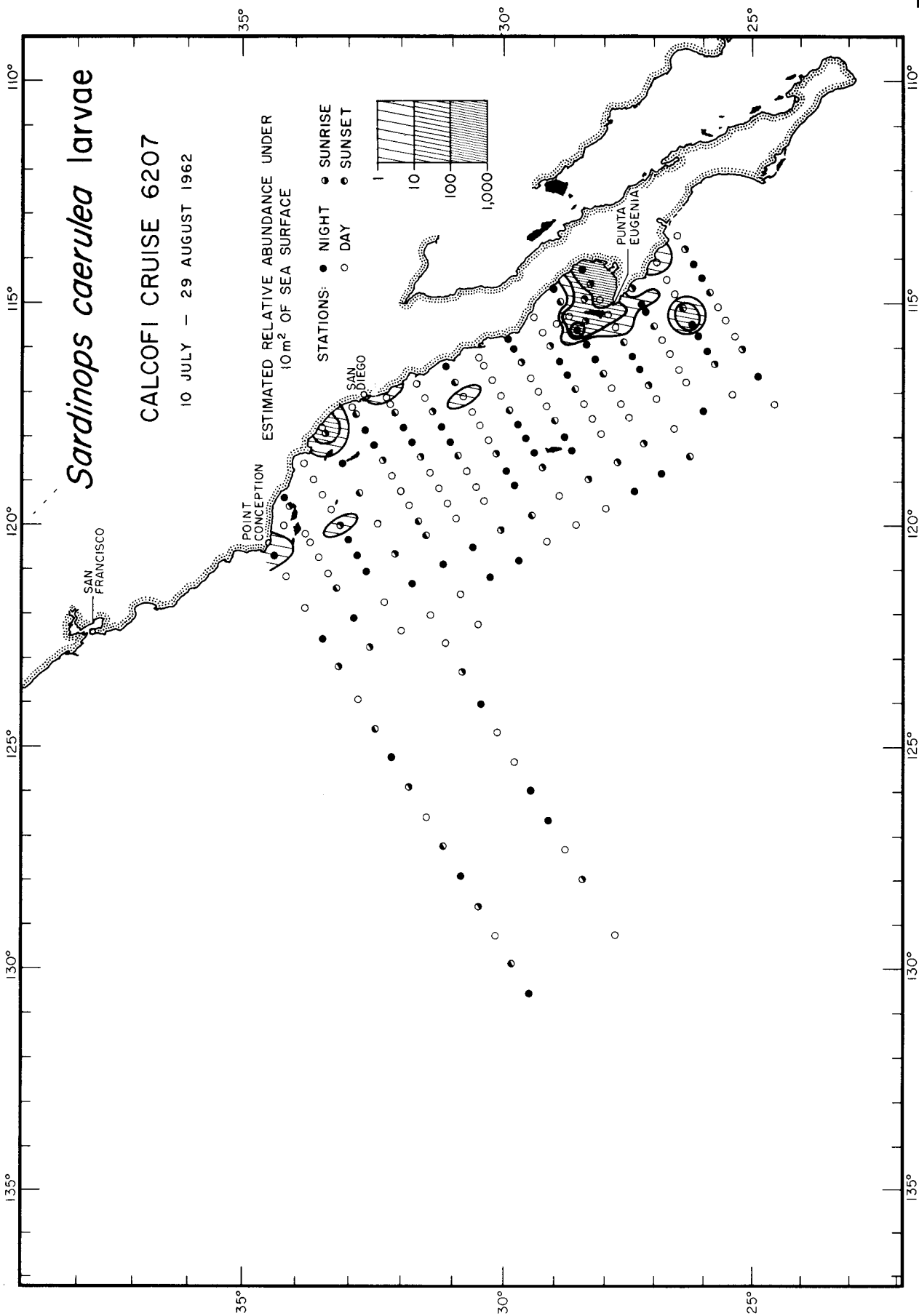
*Sardinops caerulea* larvae

6107



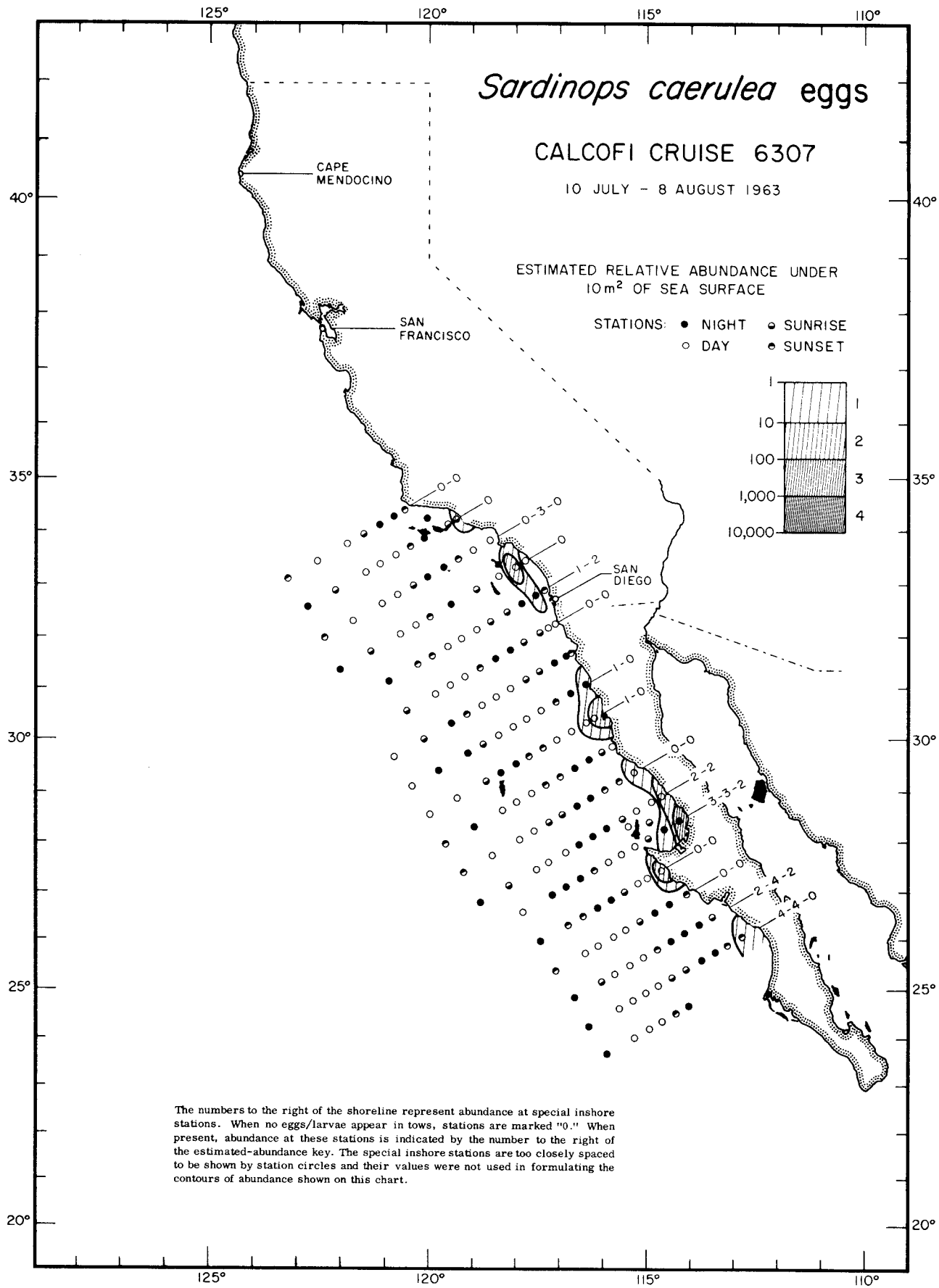
*Sardinops caerulea* eggs

6207

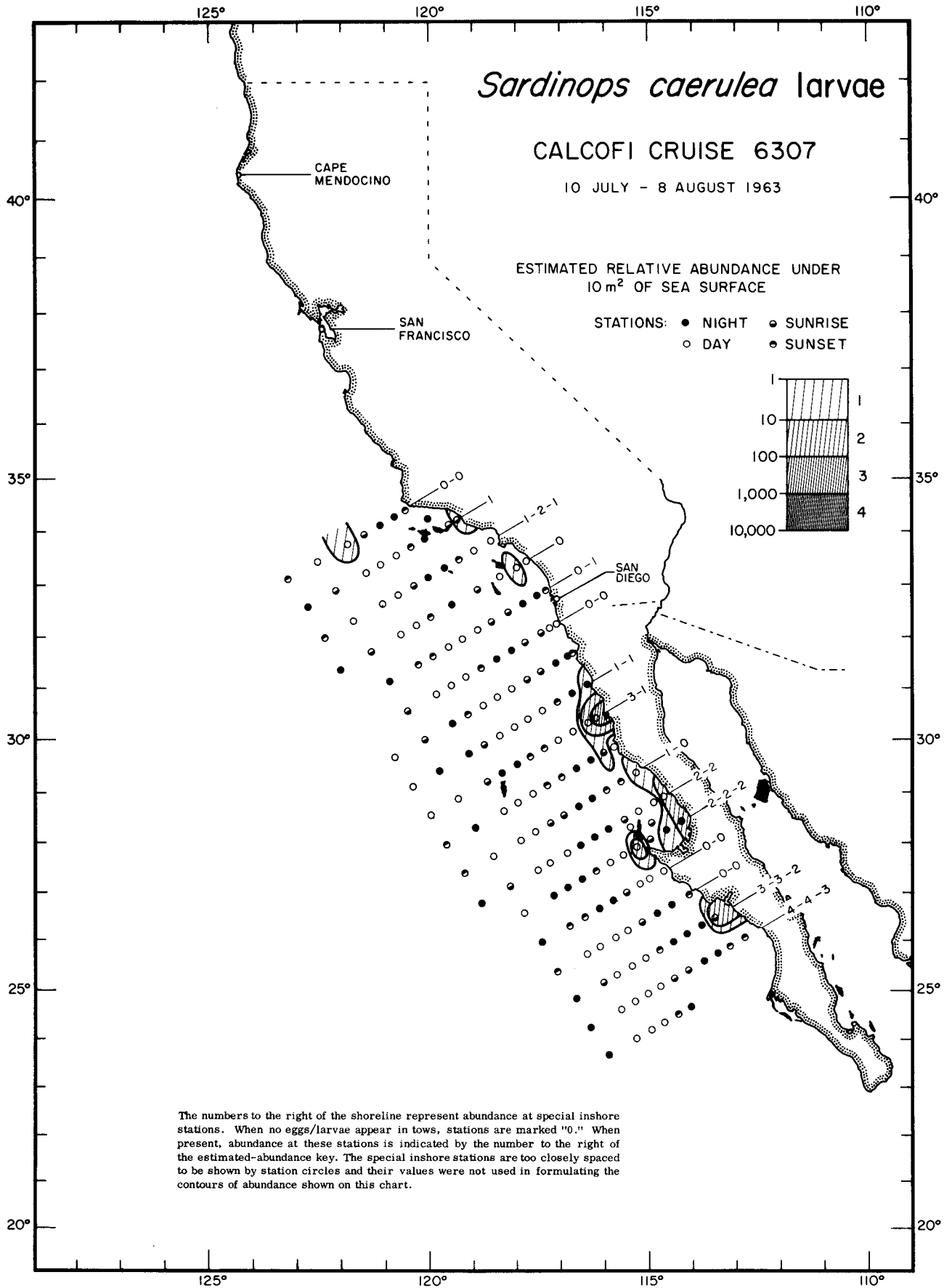


*Sardinops caerulea* larvae

6207

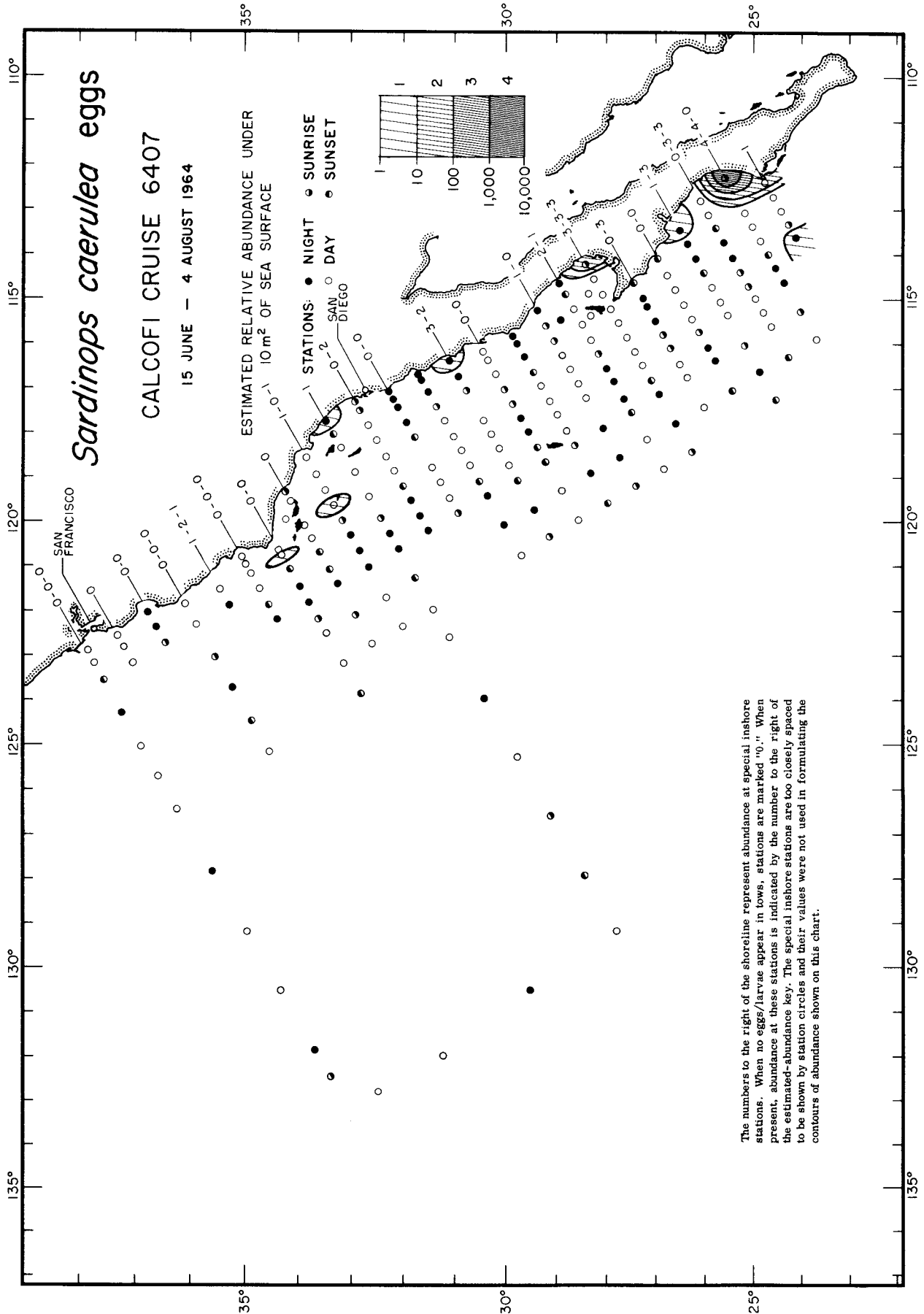


*Sardinops caerulea* eggs  
6307



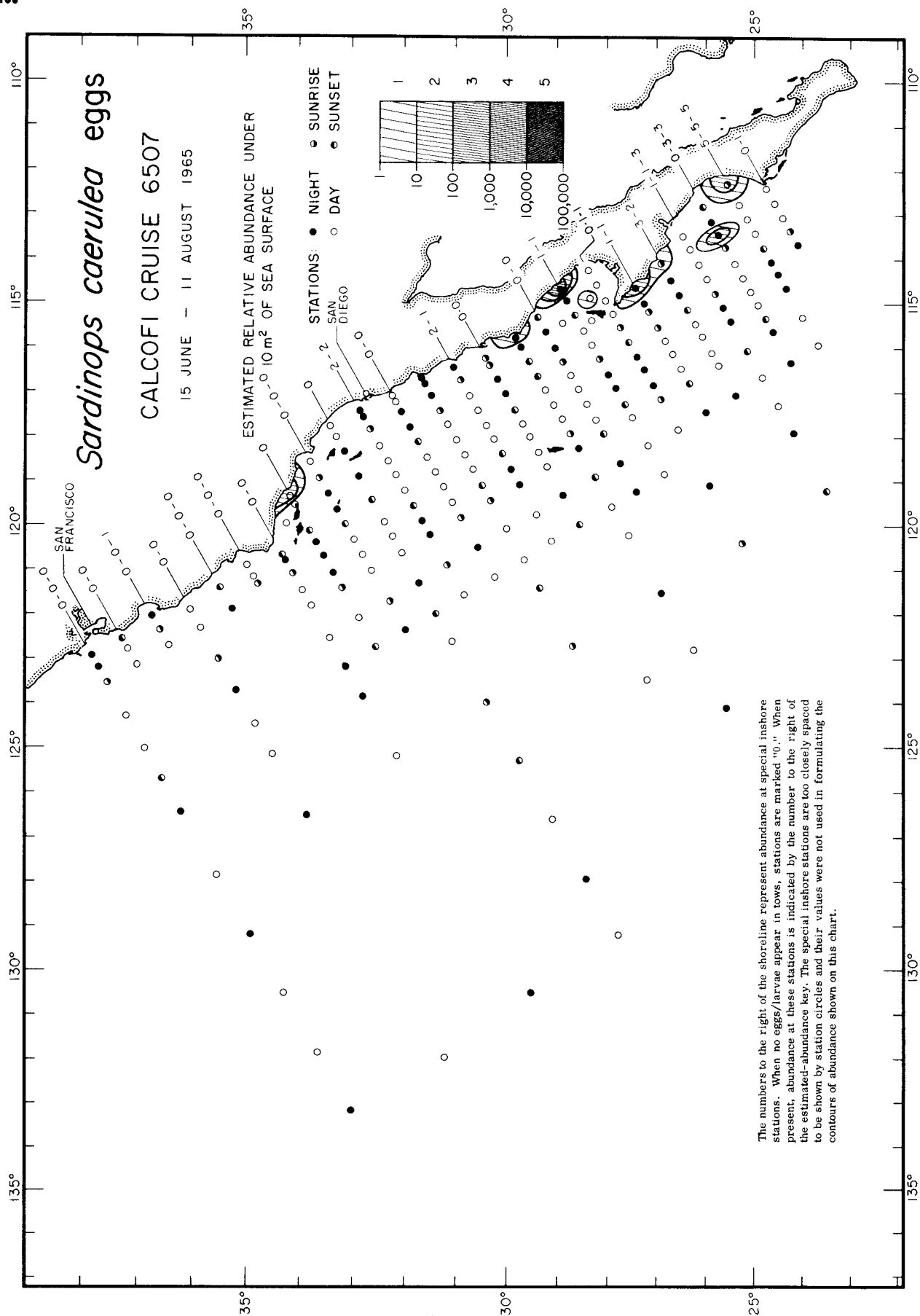
*Sardinops caerulea* larvae

6307



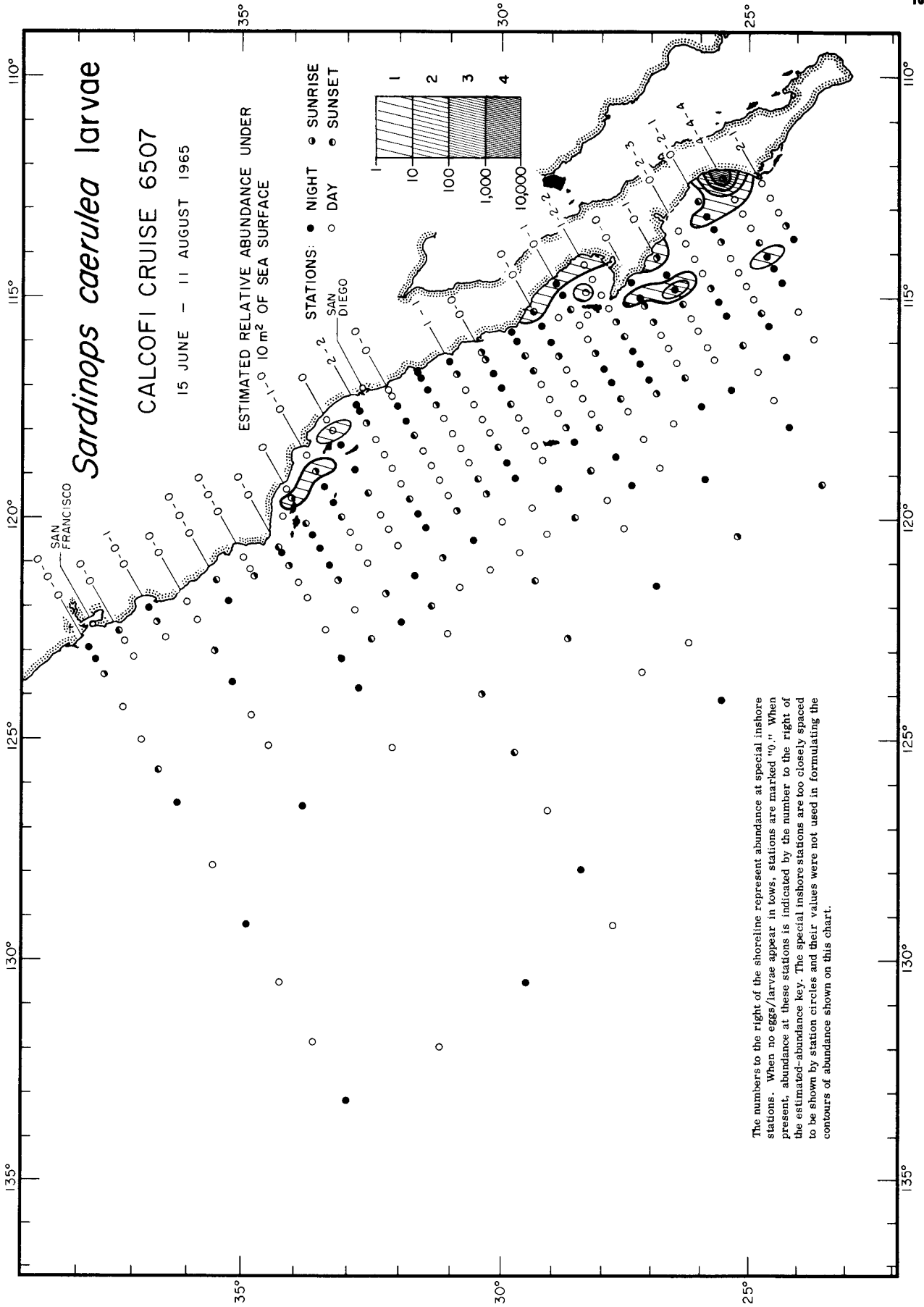
The numbers to the right of the shoreline represent abundance at special inshore stations. When no eggs/larvae appear in lows, stations are marked "0." When present, abundance at these stations is indicated by the number to the right of the estimated-abundance key. The special inshore stations are too closely spaced to be shown by station circles and their values were not used in formulating the contours of abundance shown on this chart.





*Sardinops caerulea* eggs

6507

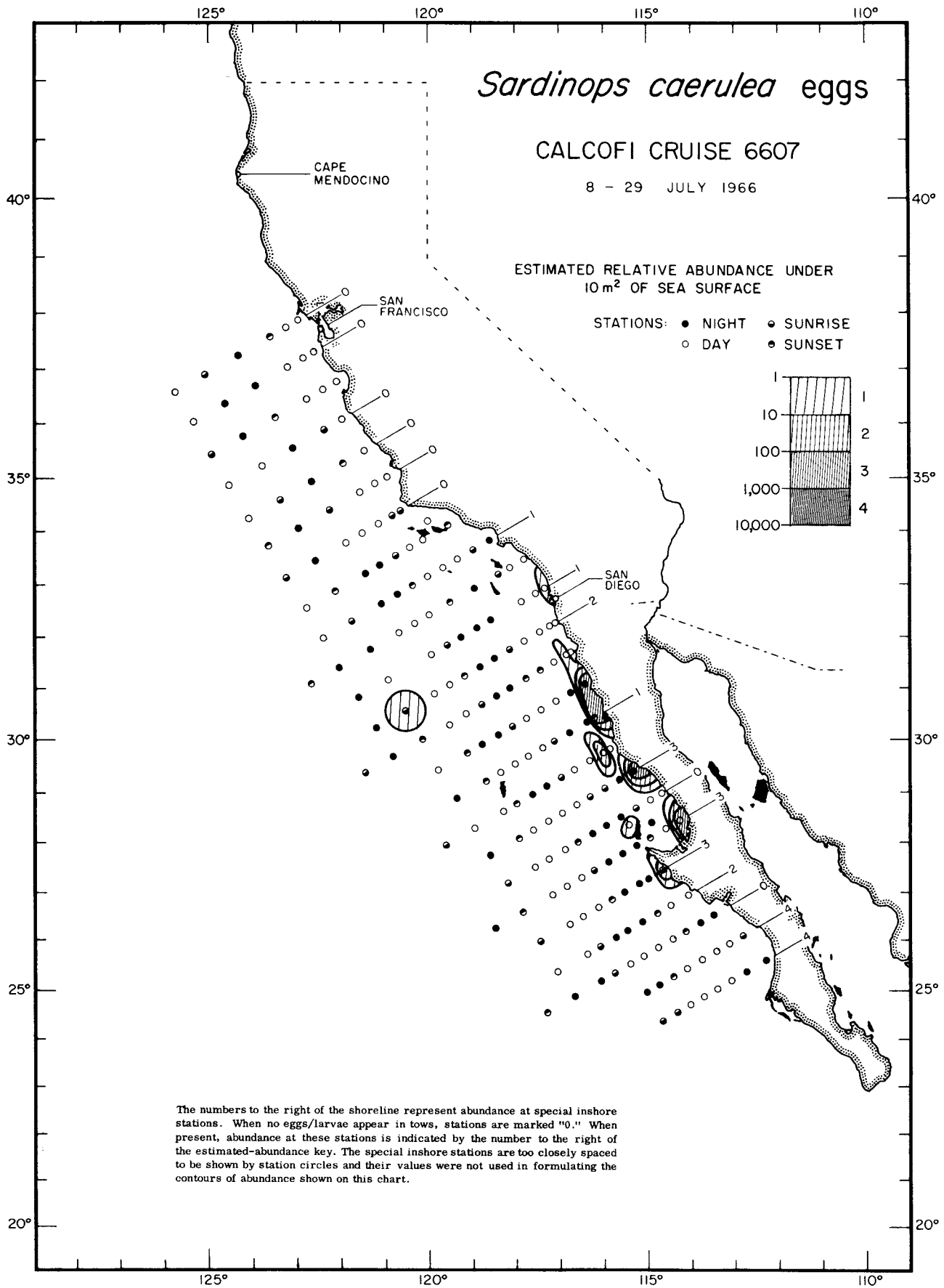


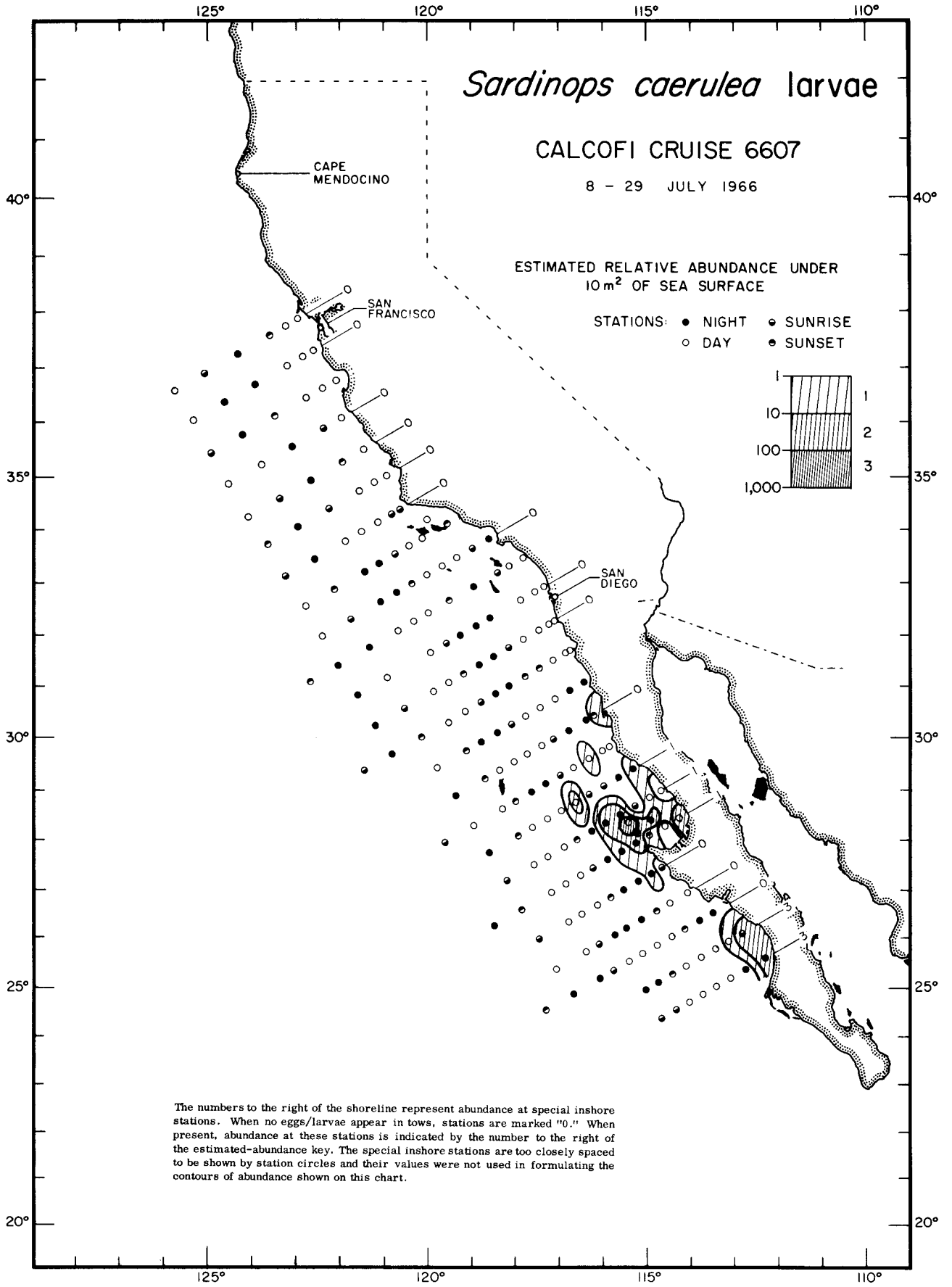
The numbers to the right of the shoreline represent abundance at special inshore stations. When no eggs/larvae appear in tows, stations are marked "0." When present, abundance at these stations is indicated by the number to the right of the estimated-abundance key. The special inshore stations are too closely spaced to be shown by station circles and their values were not used in formulating the contours of abundance shown on this chart.

*Sardinops caerulea* larvae

6507

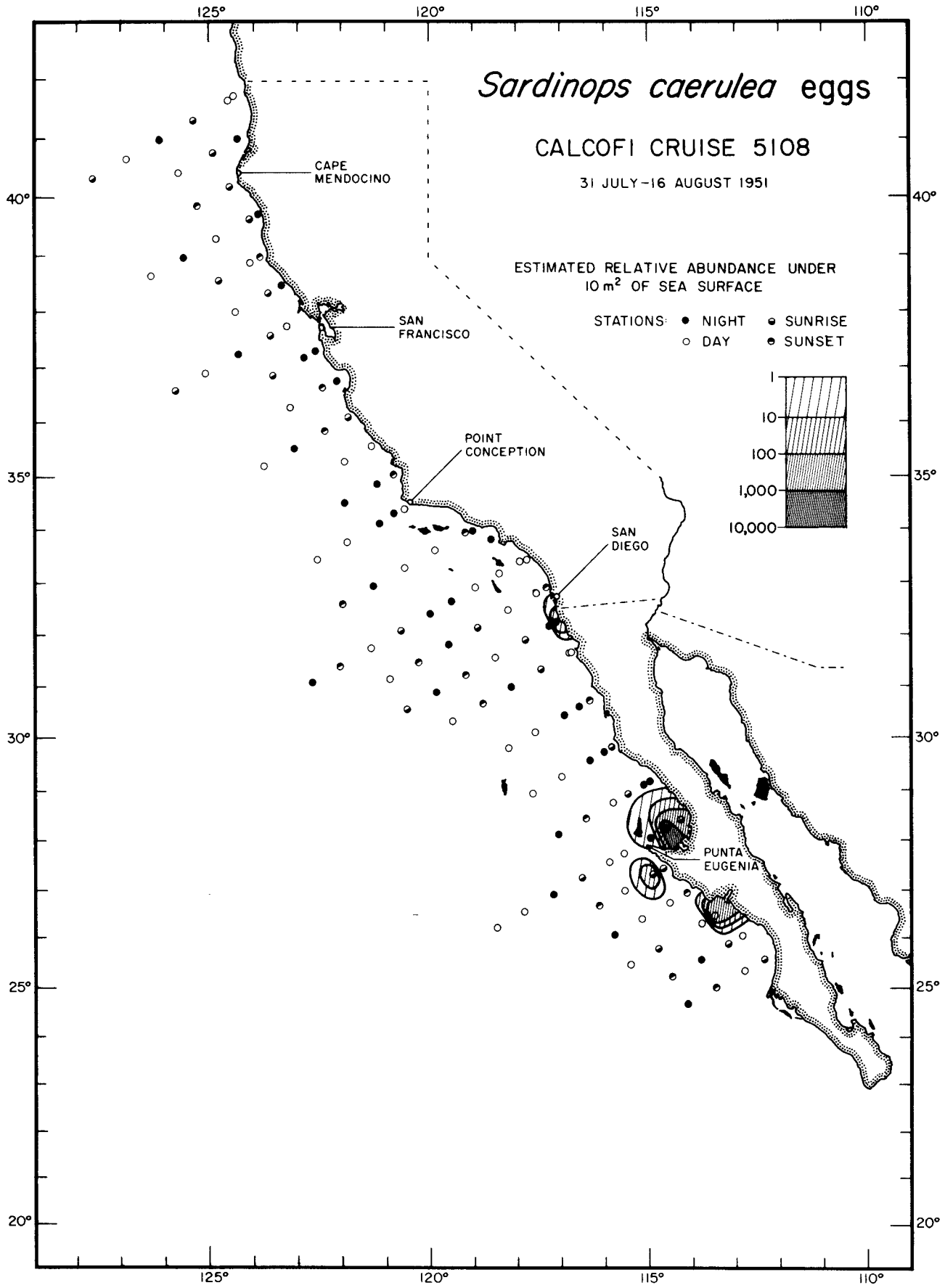






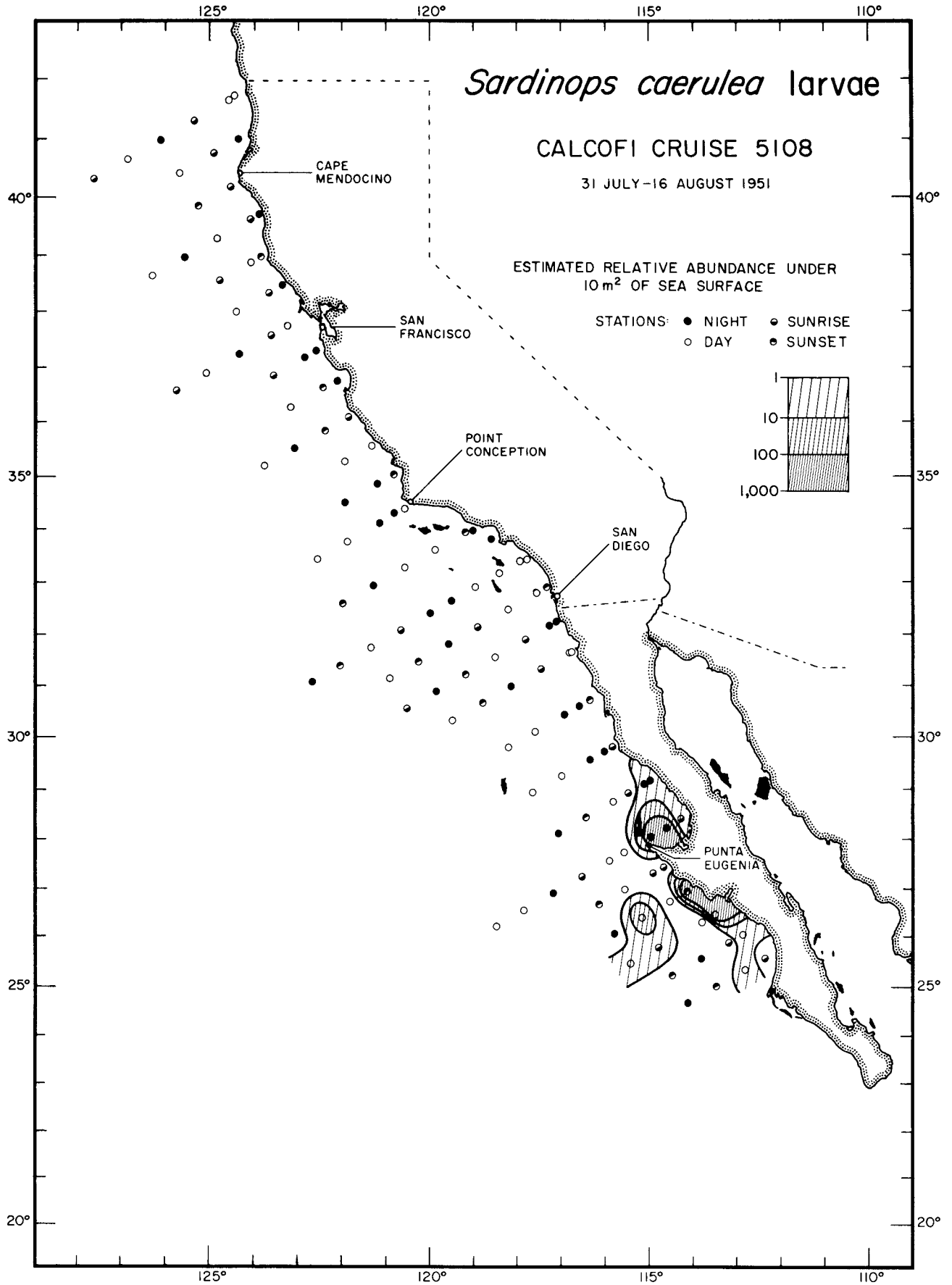
*Sardinops caerulea* larvae

6607



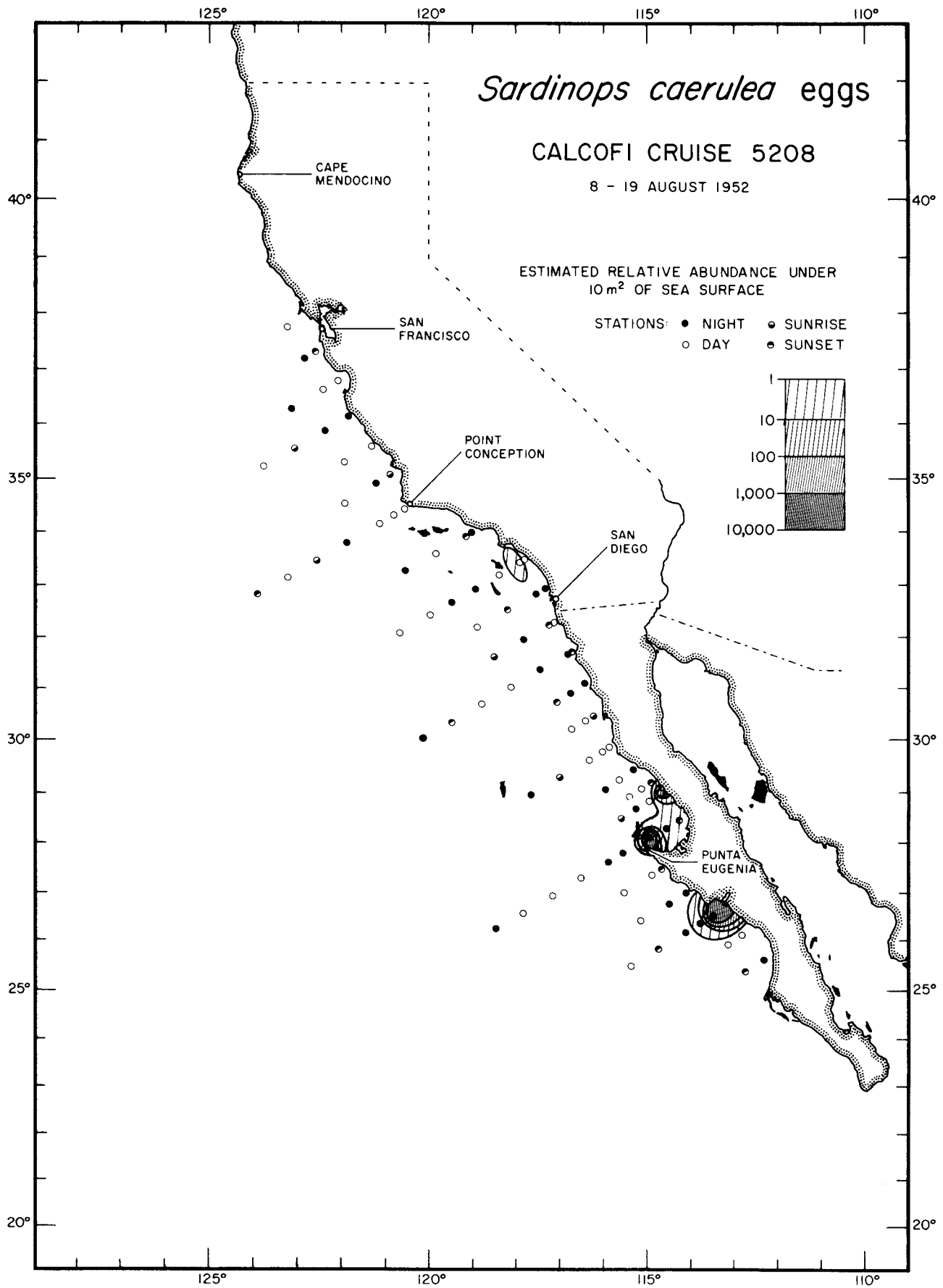
*Sardinops caerulea* eggs

5108



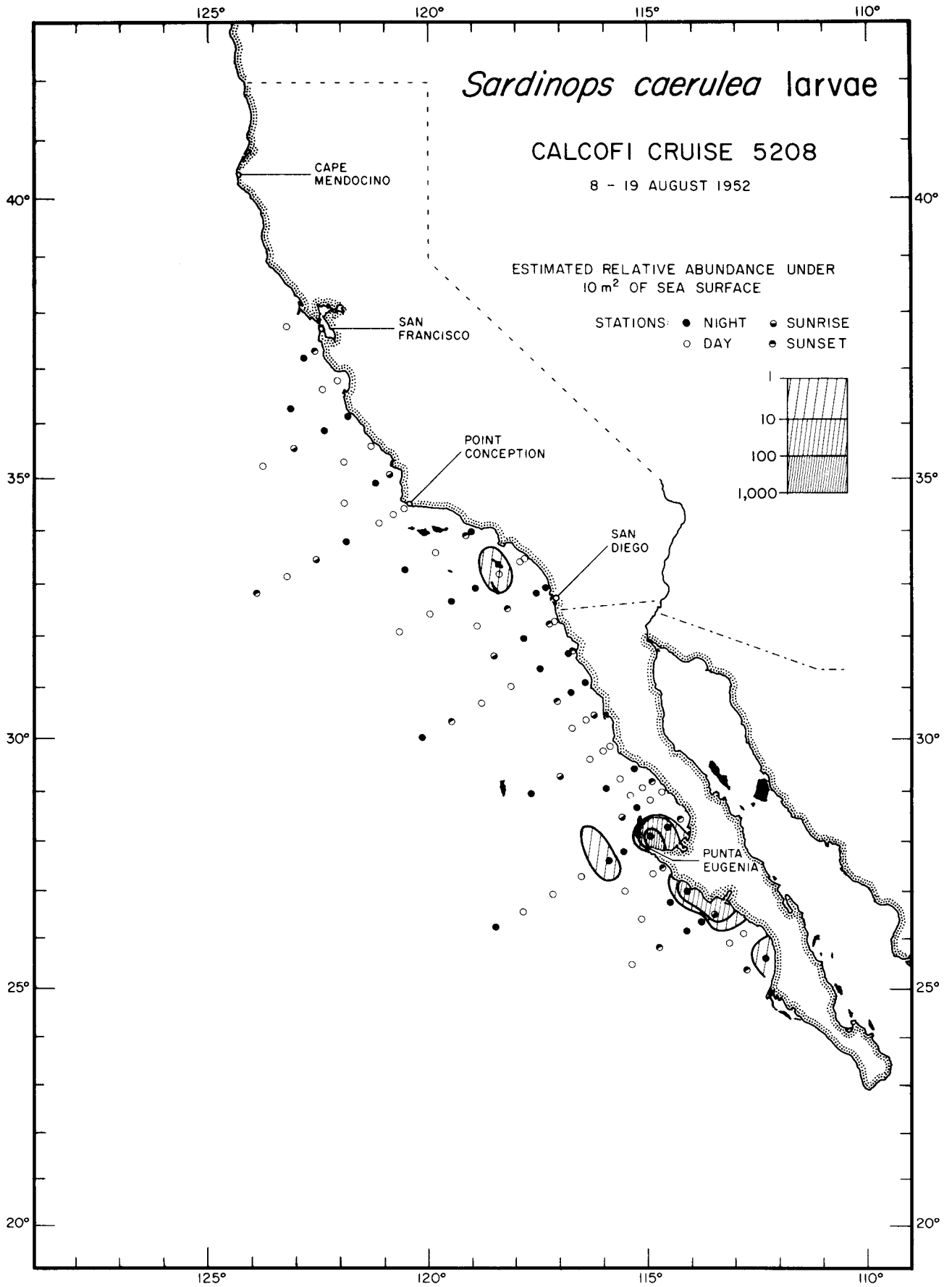
*Sardinops caerulea* larvae

5108



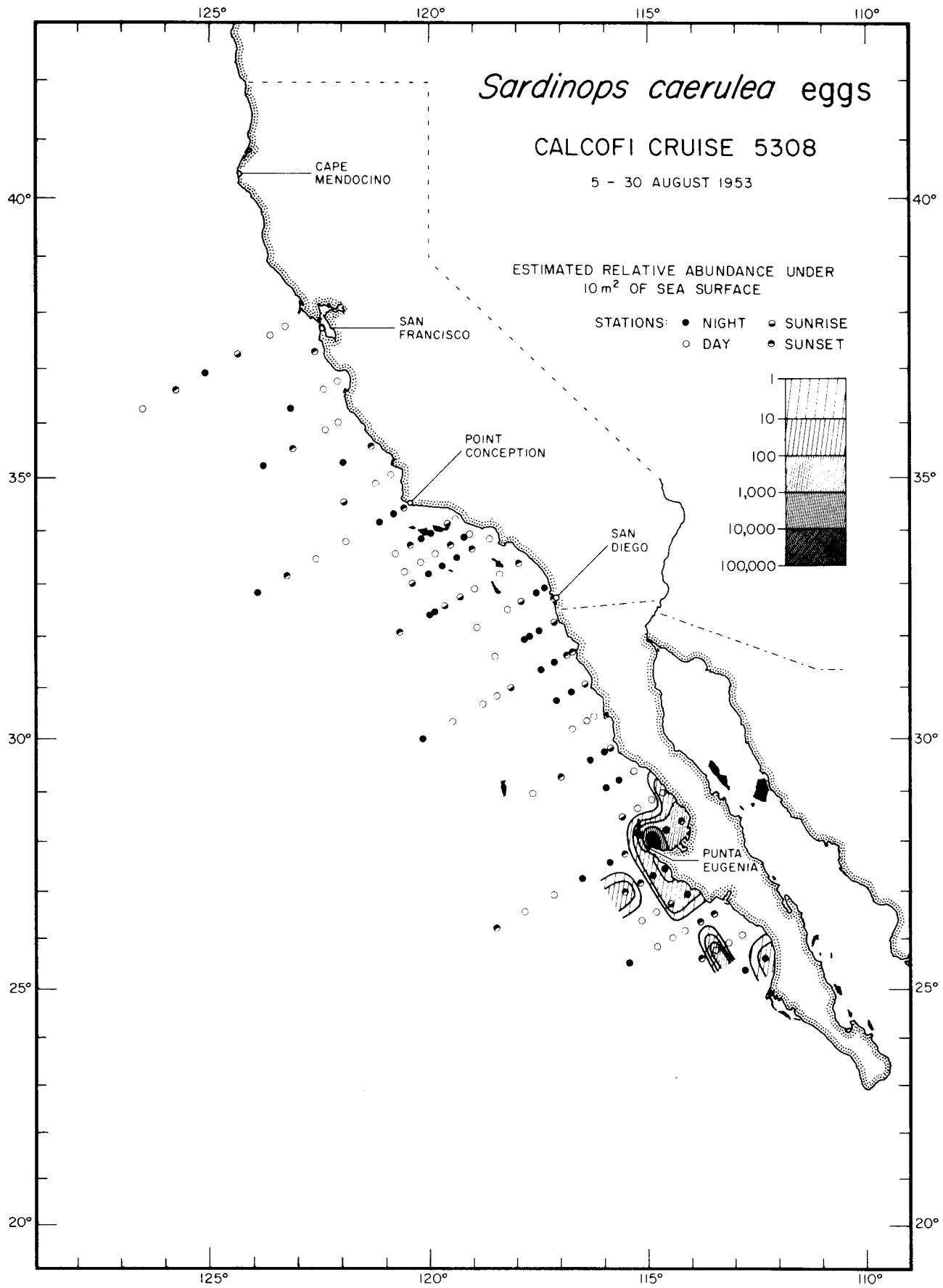
*Sardinops caerulea* eggs

5208



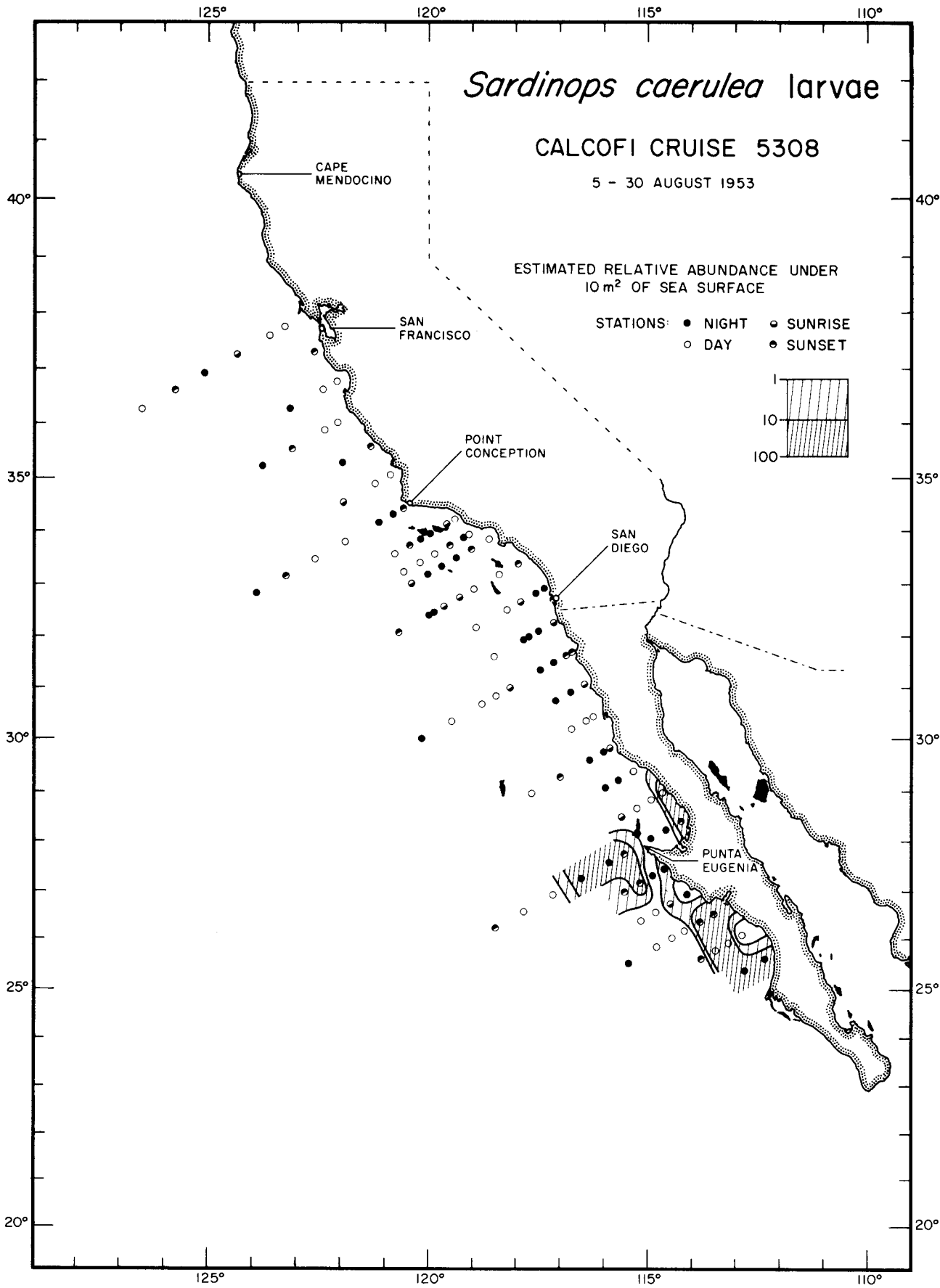
*Sardinops caerulea* larvae

5208



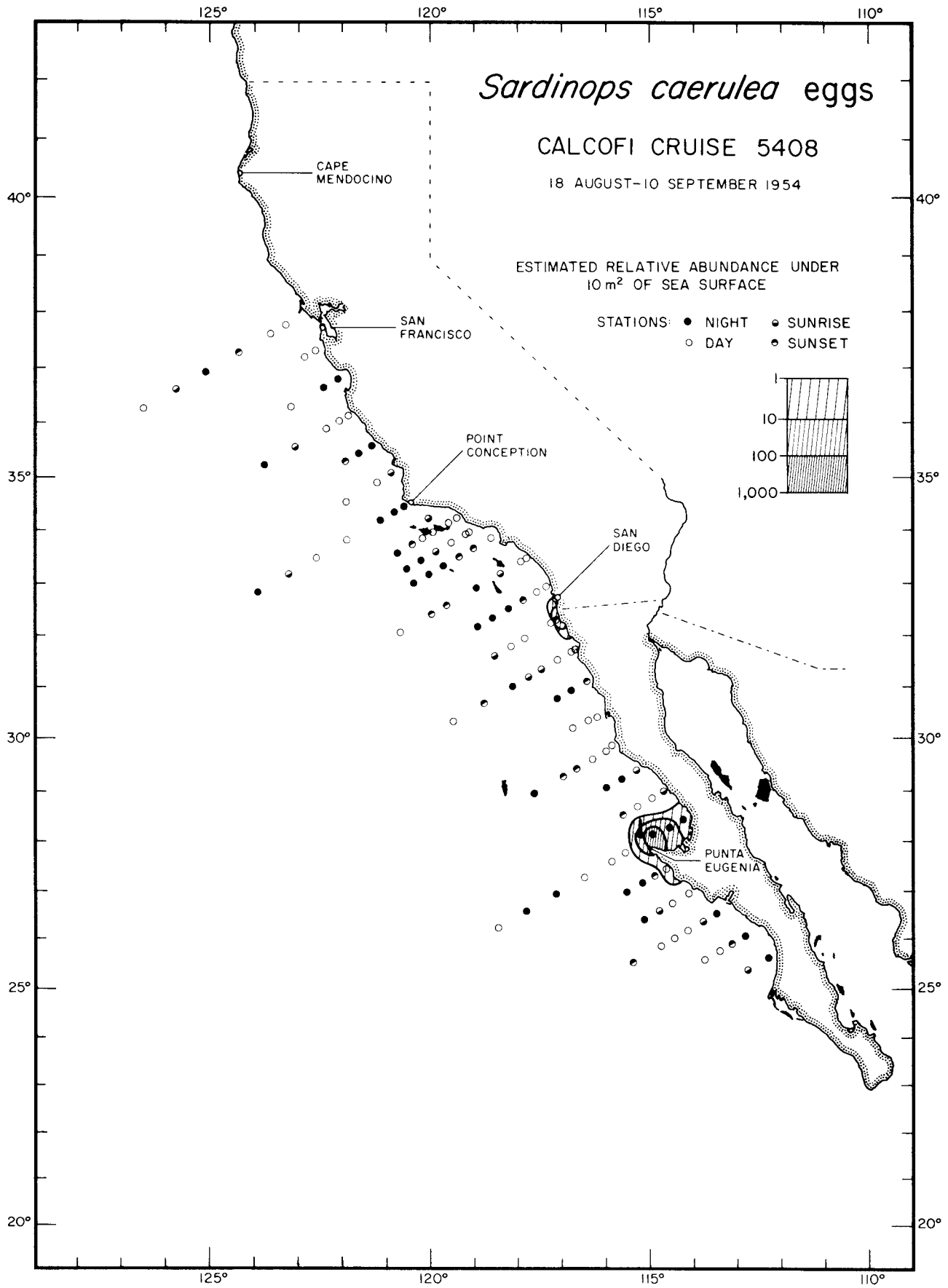
*Sardinops caerulea* eggs

5308

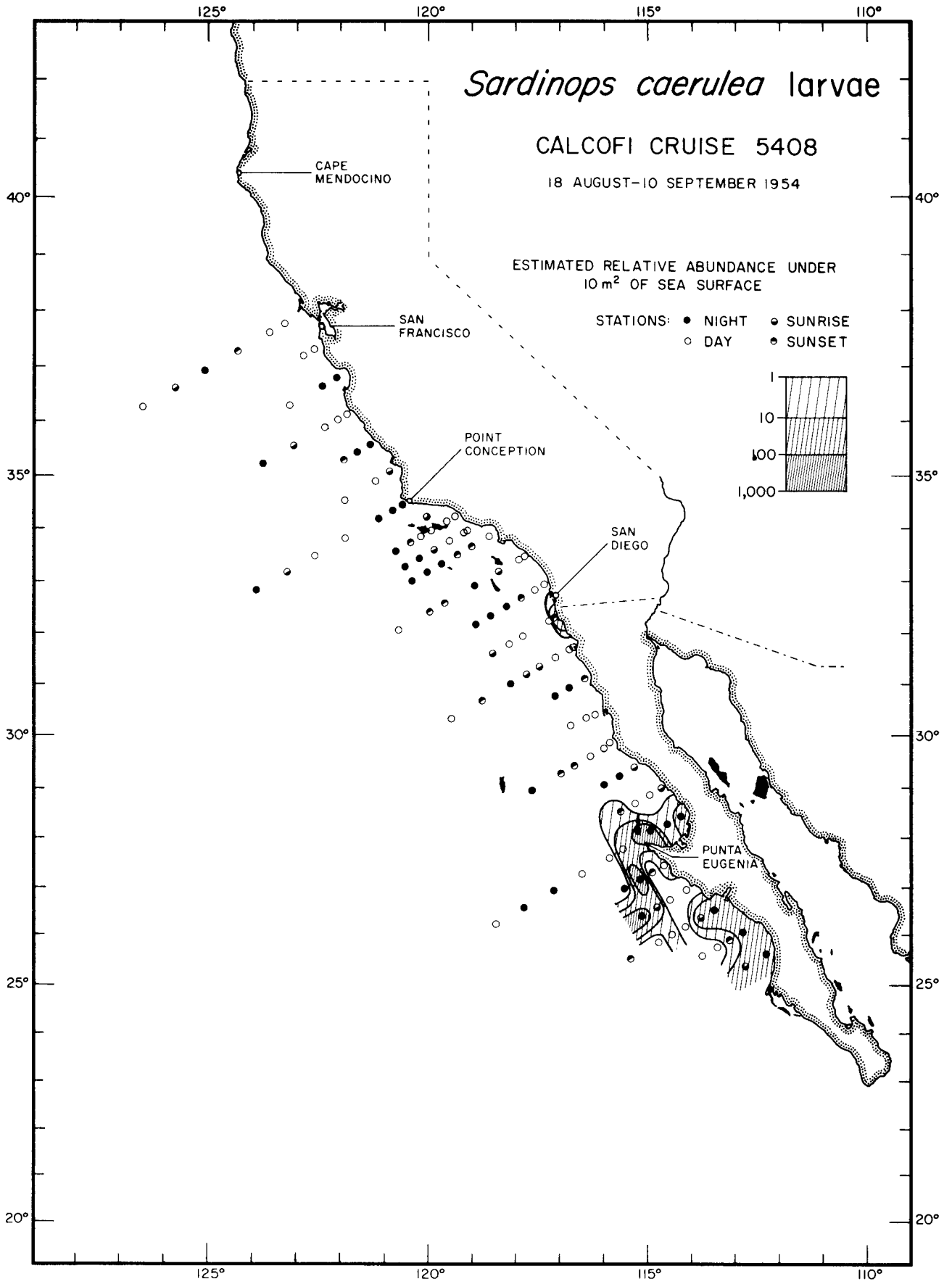


*Sardinops caerulea* larvae  
5308



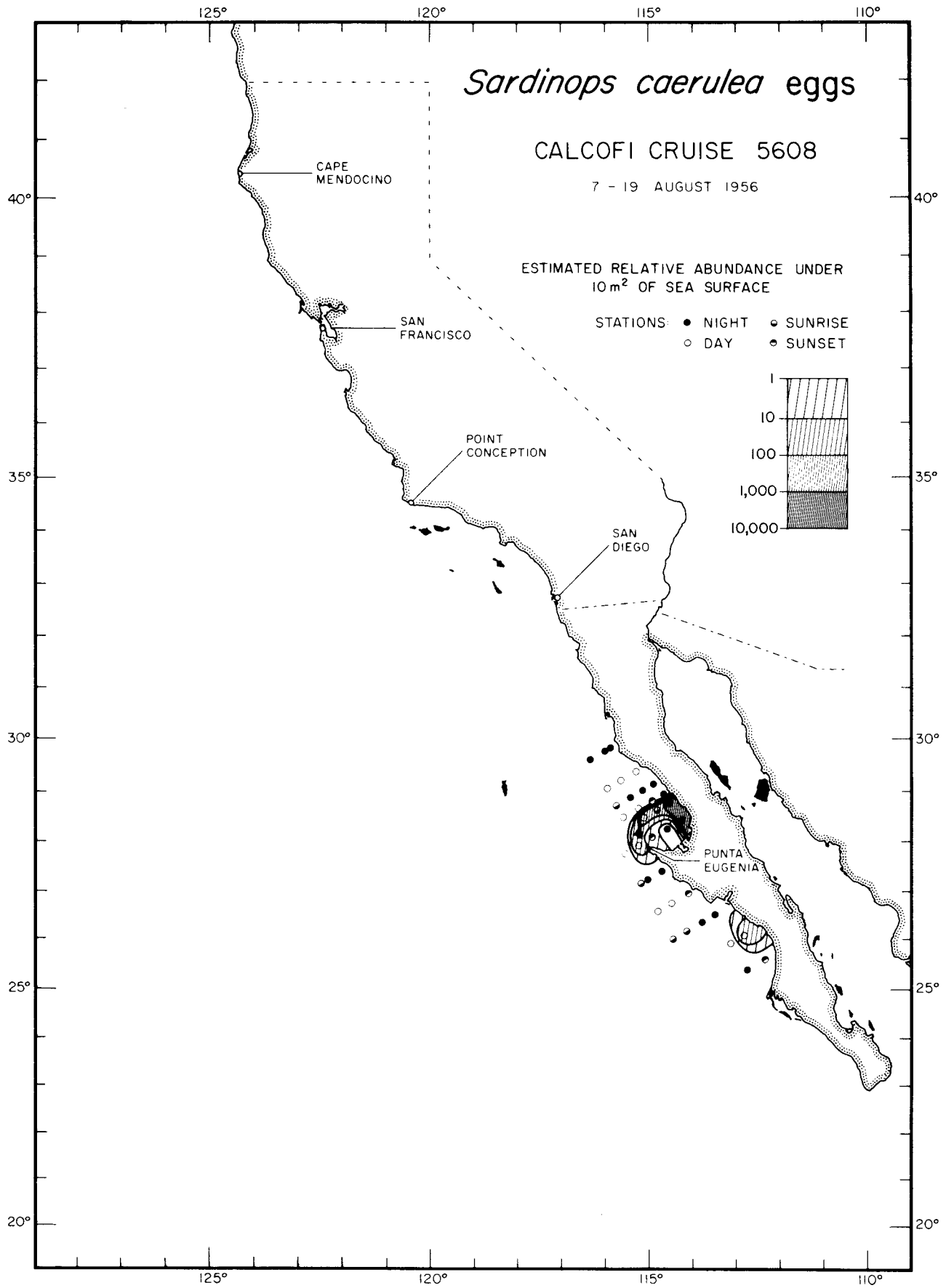


*Sardinops caerulea* eggs  
5408



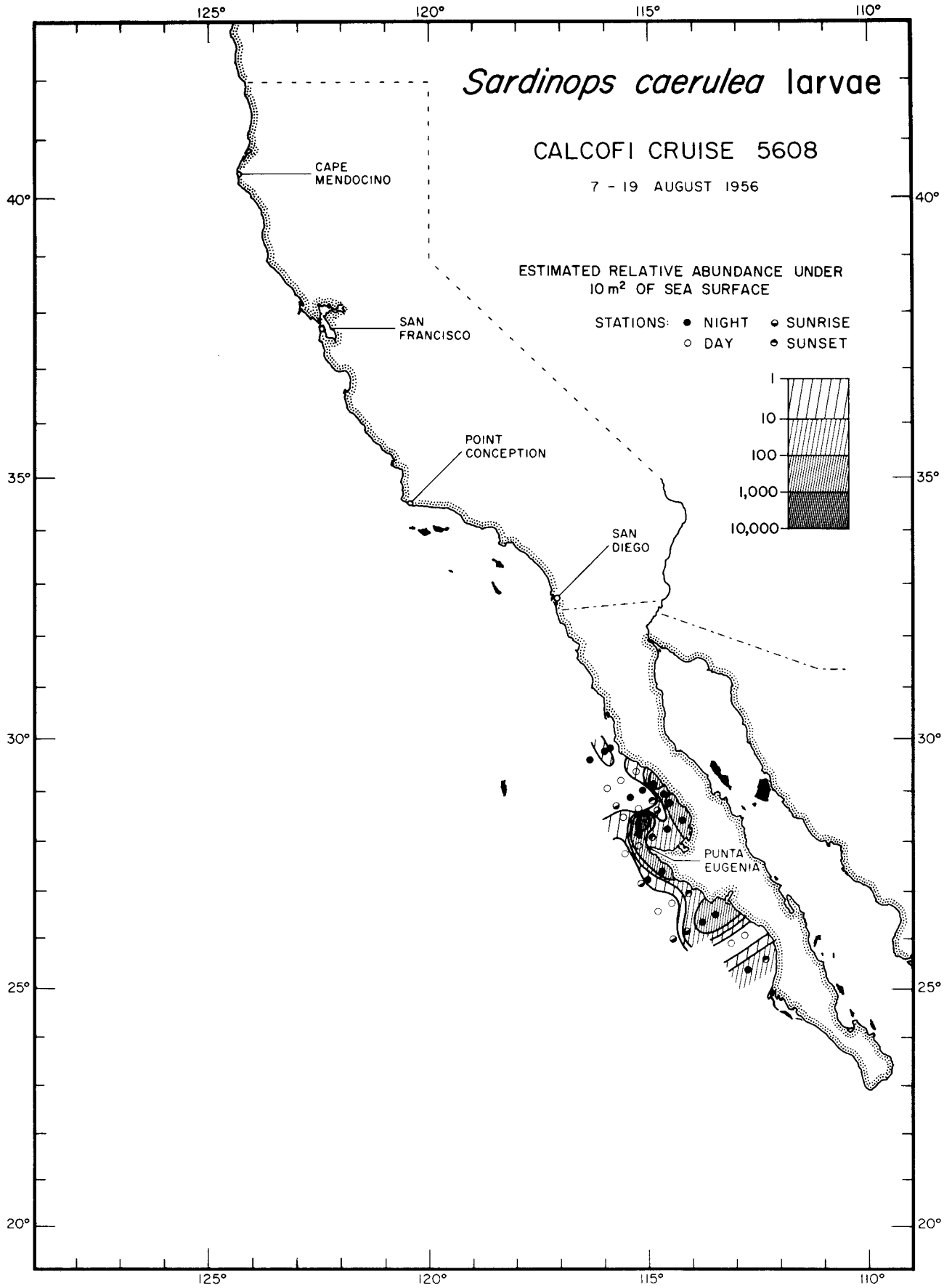
*Sardinops caerulea* larvae

5408



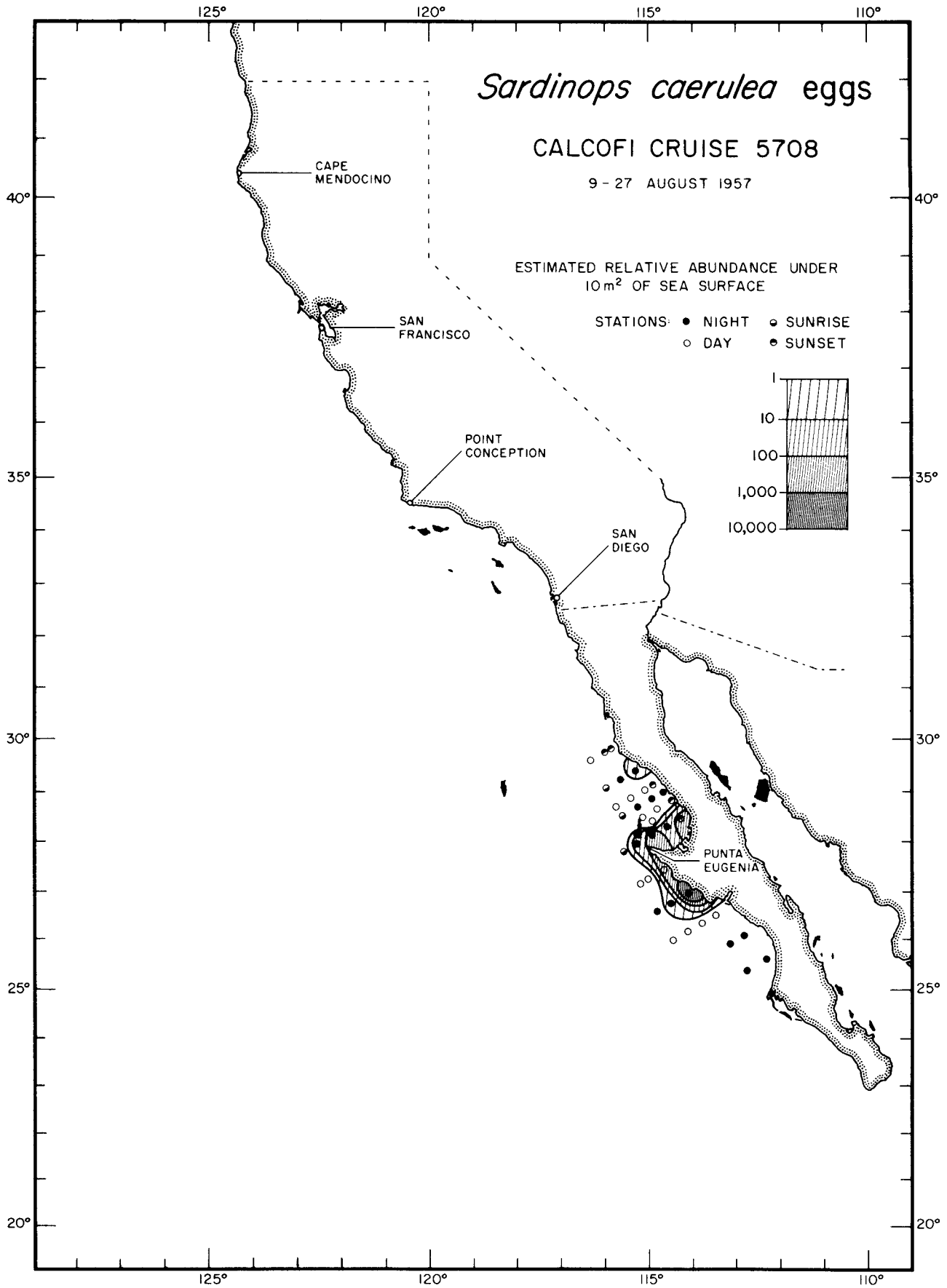
*Sardinops caerulea* eggs

5608



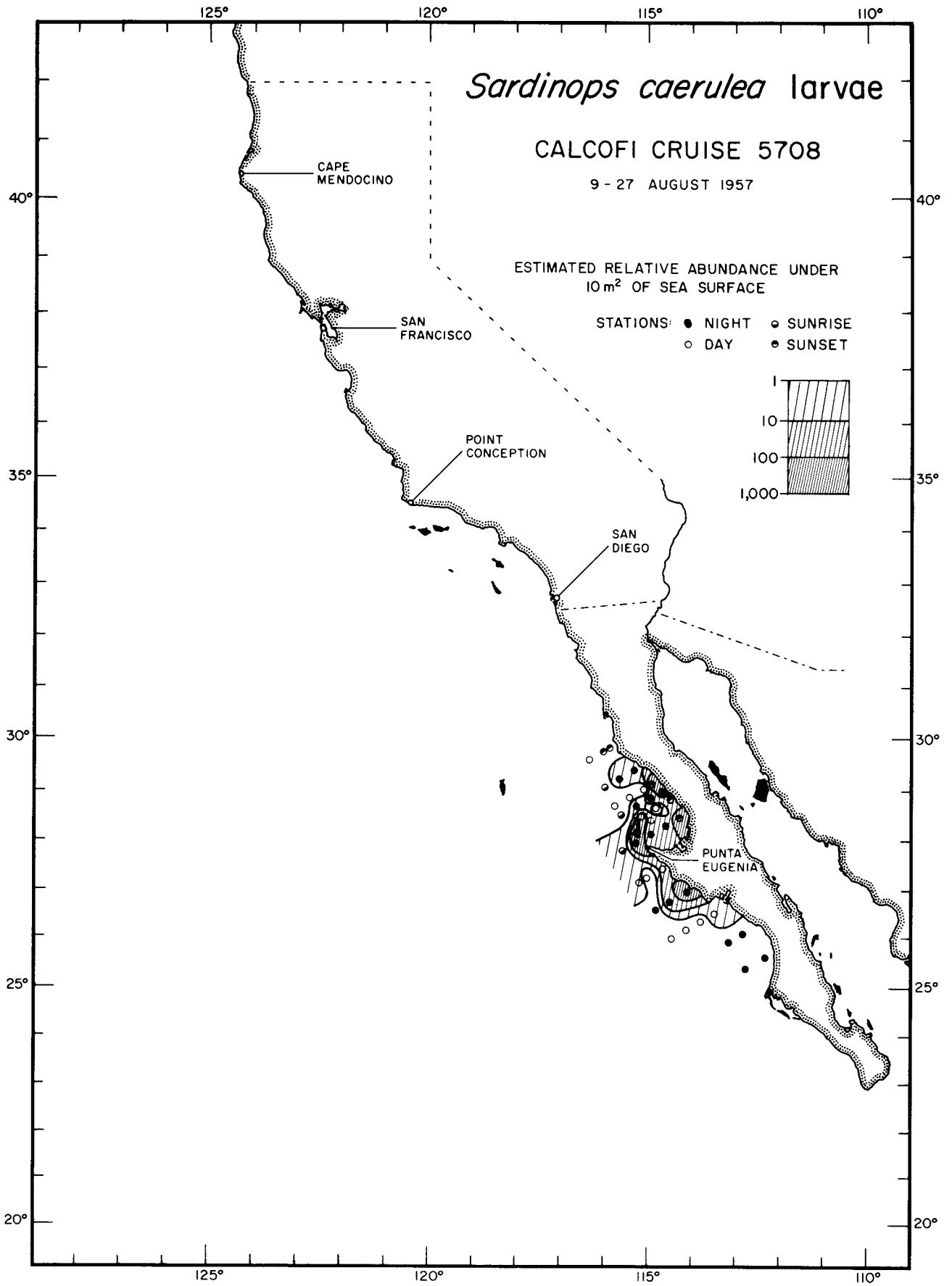
*Sardinops caerulea* larvae

5608



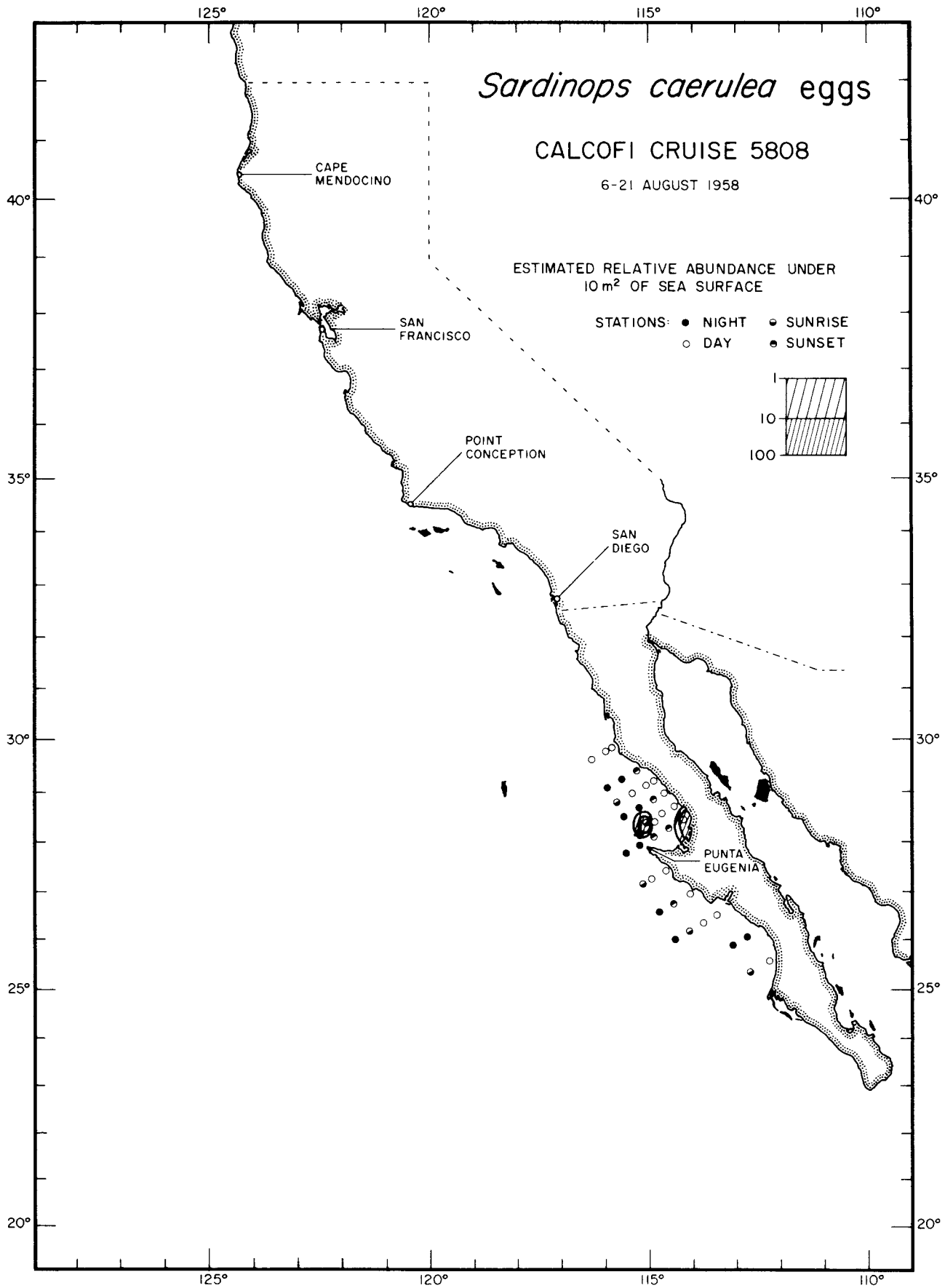
*Sardinops caerulea* eggs

5708



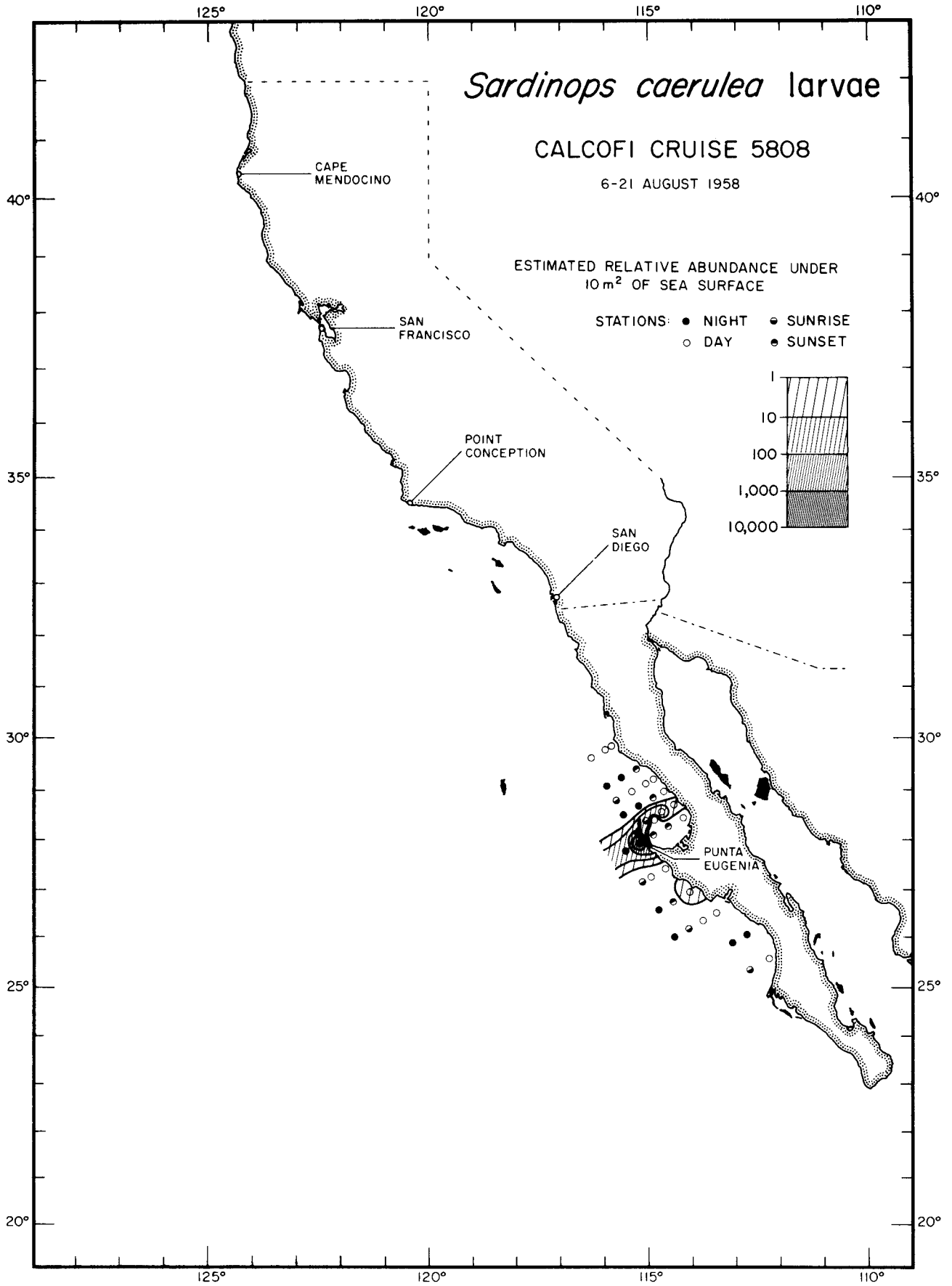
*Sardinops caerulea* larvae

5708



*Sardinops caerulea* eggs

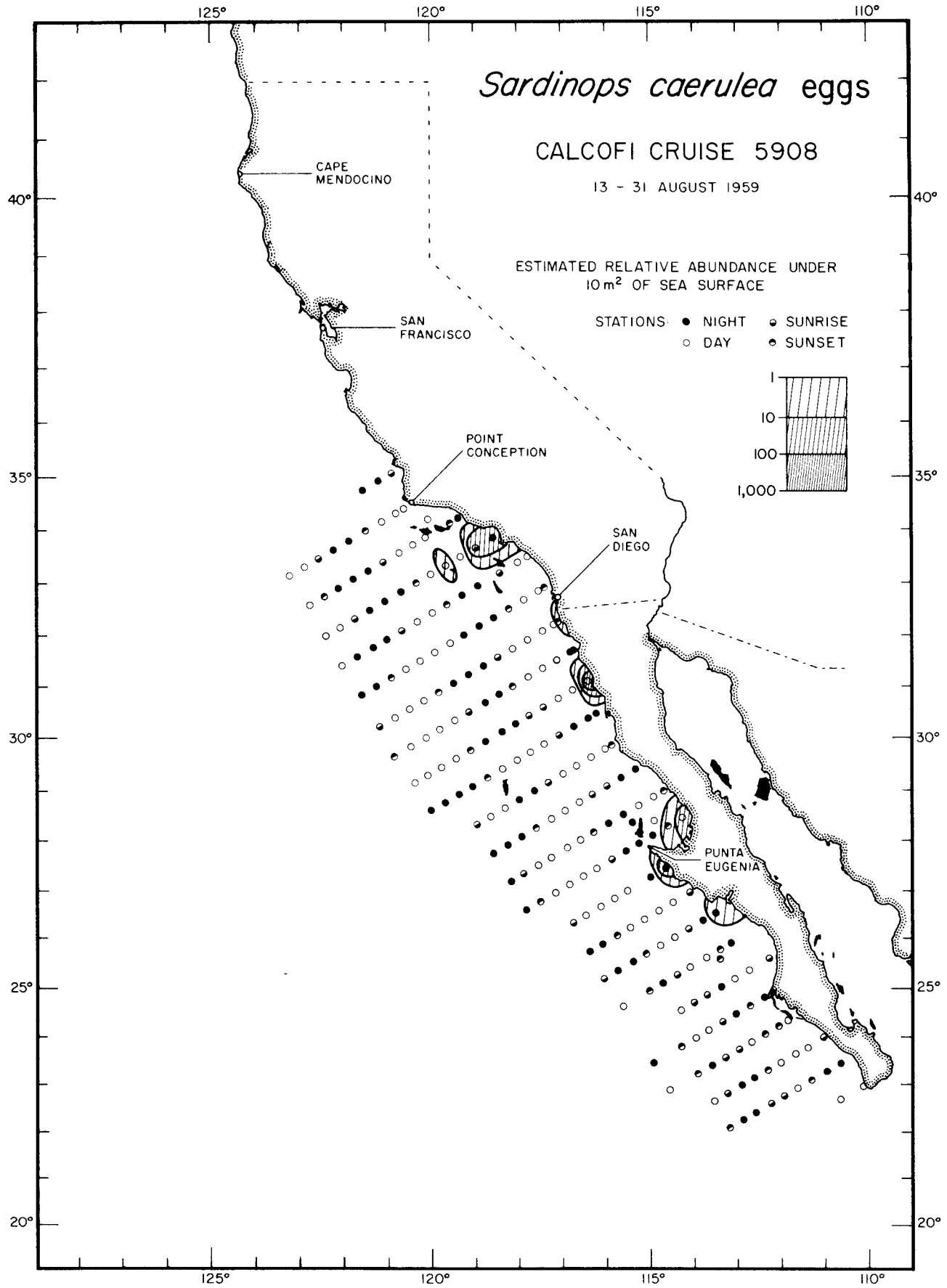
5808



*Sardinops caerulea* larvae

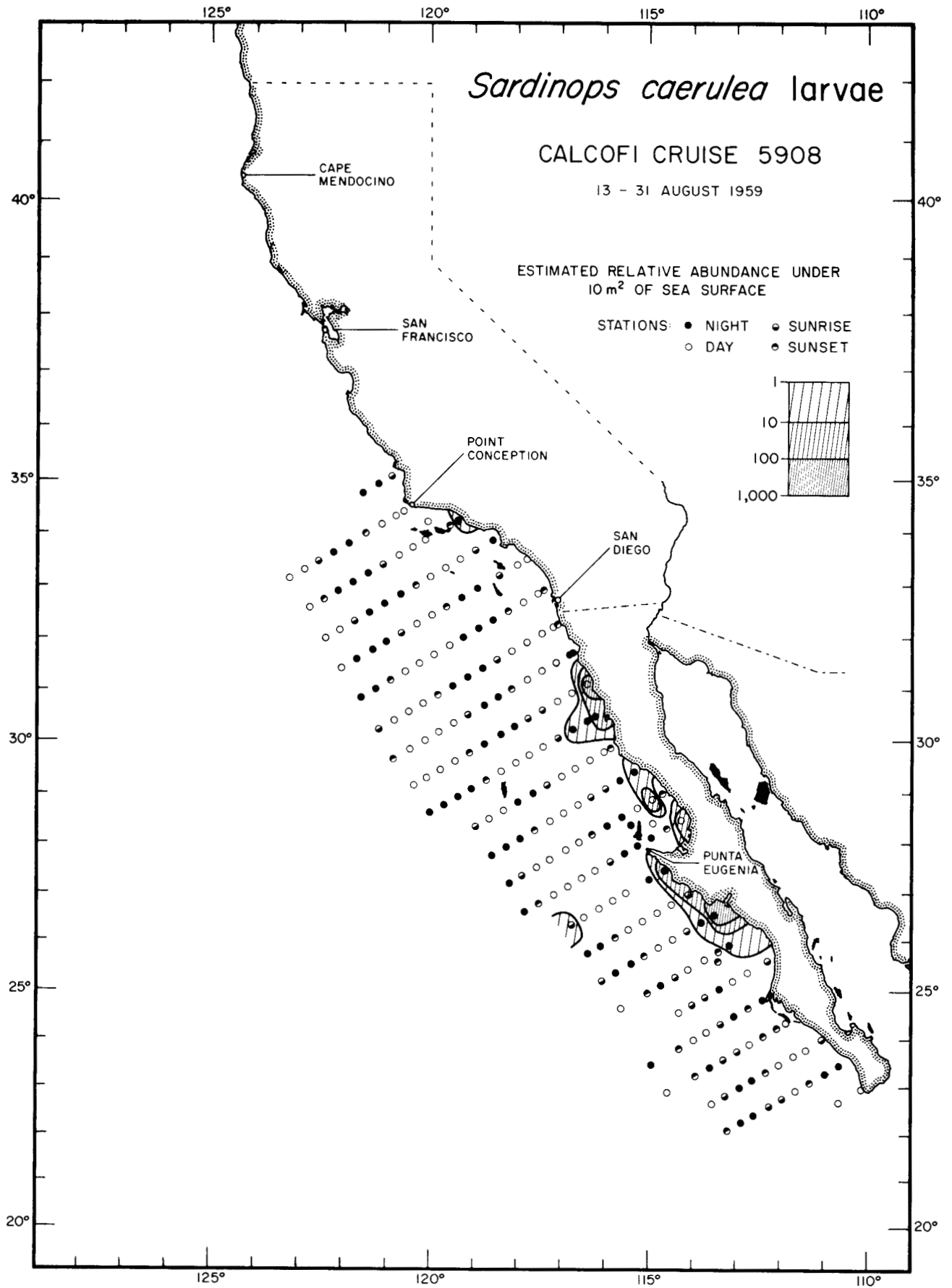
5808





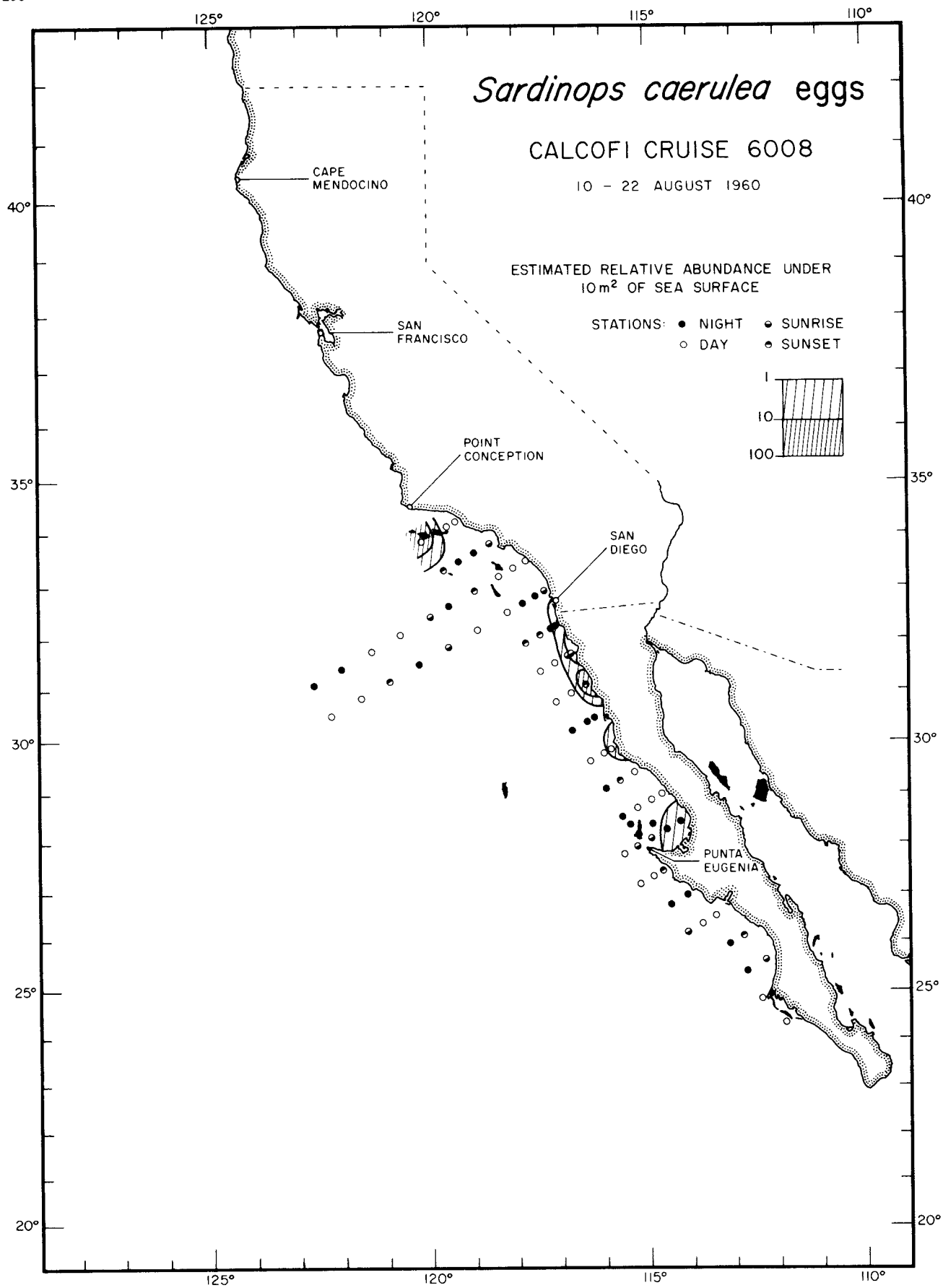
*Sardinops caerulea* eggs

5908



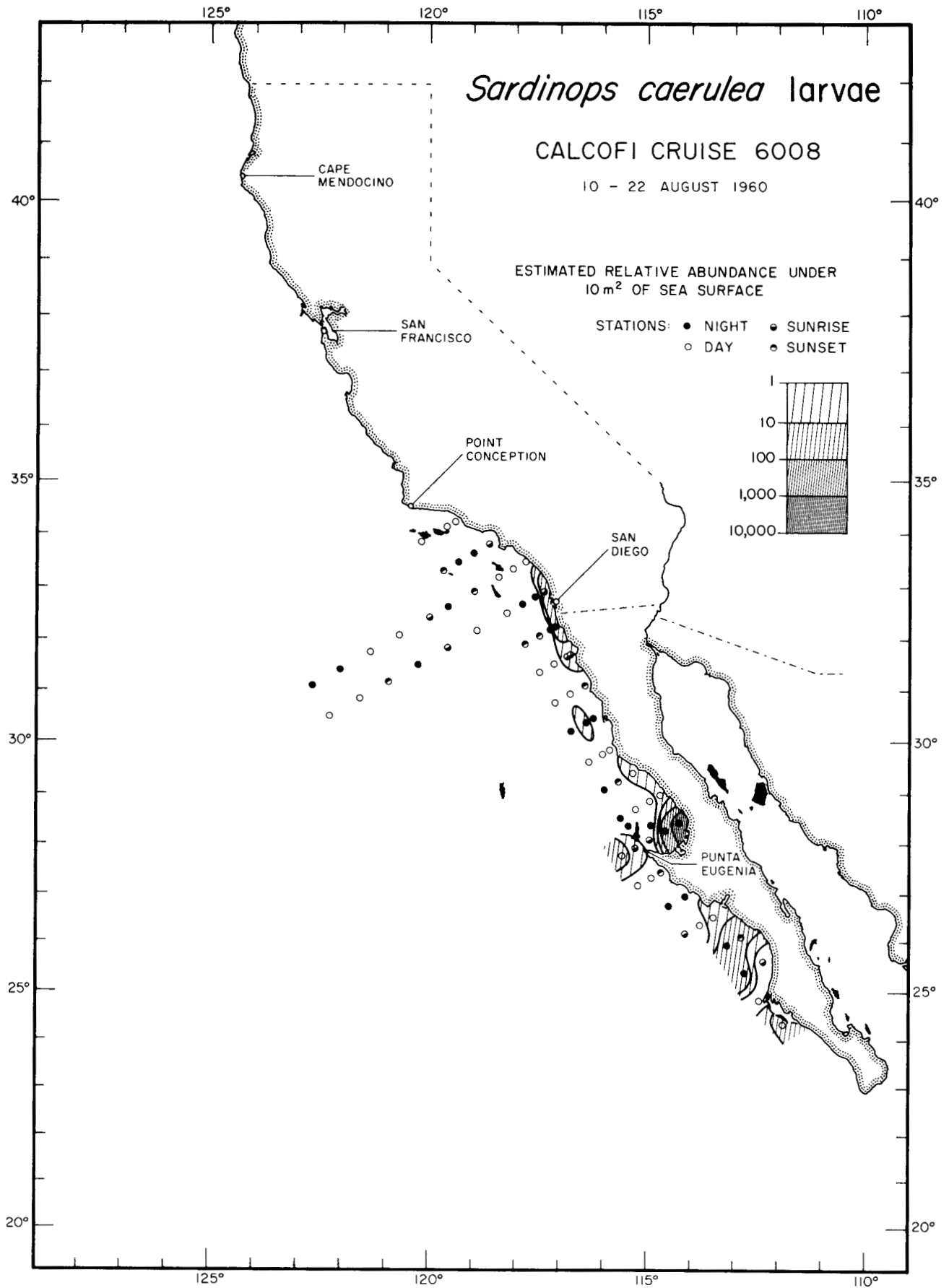
*Sardinops caerulea* larvae

5908



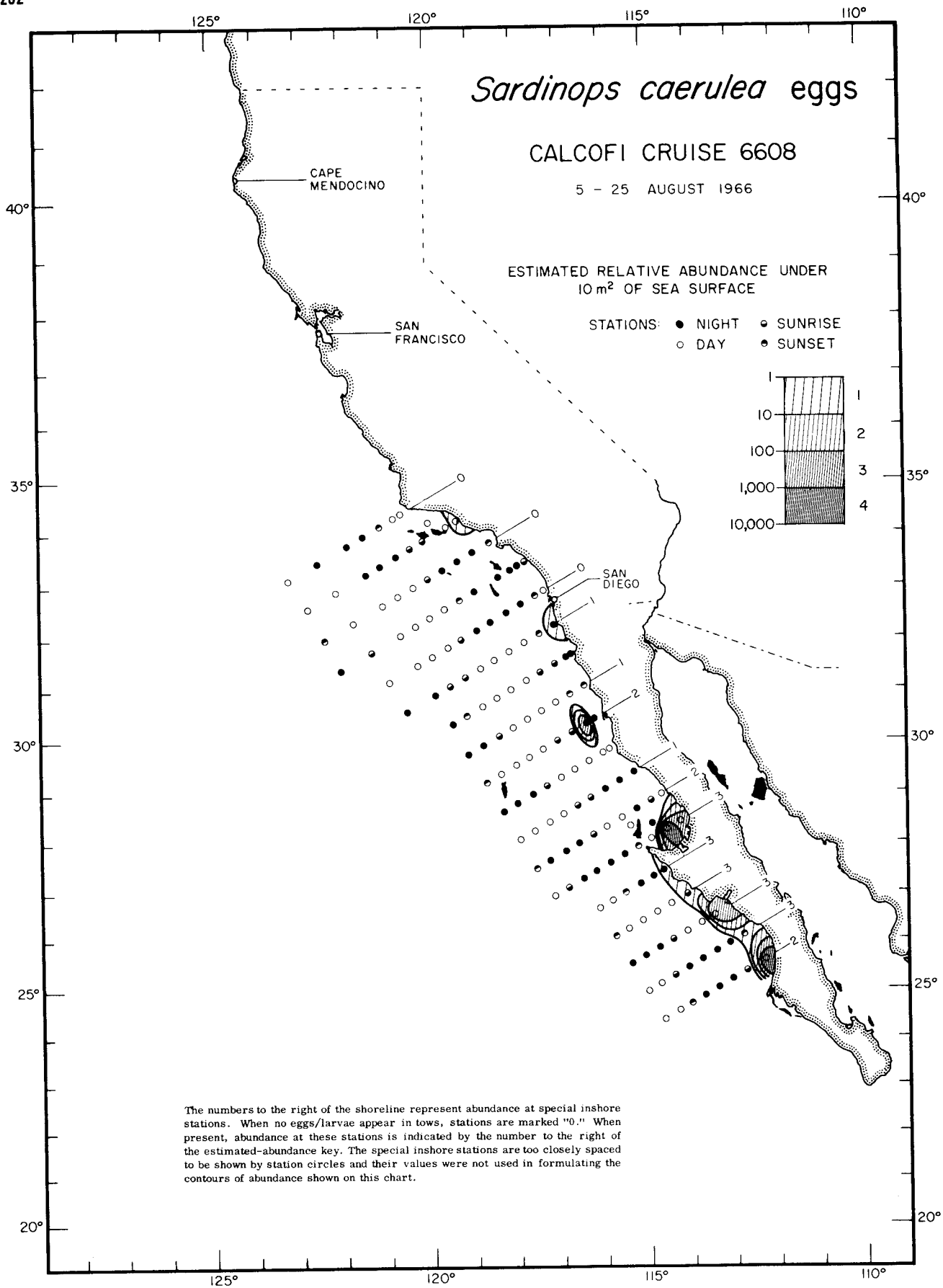
*Sardinops caerulea* eggs

6008



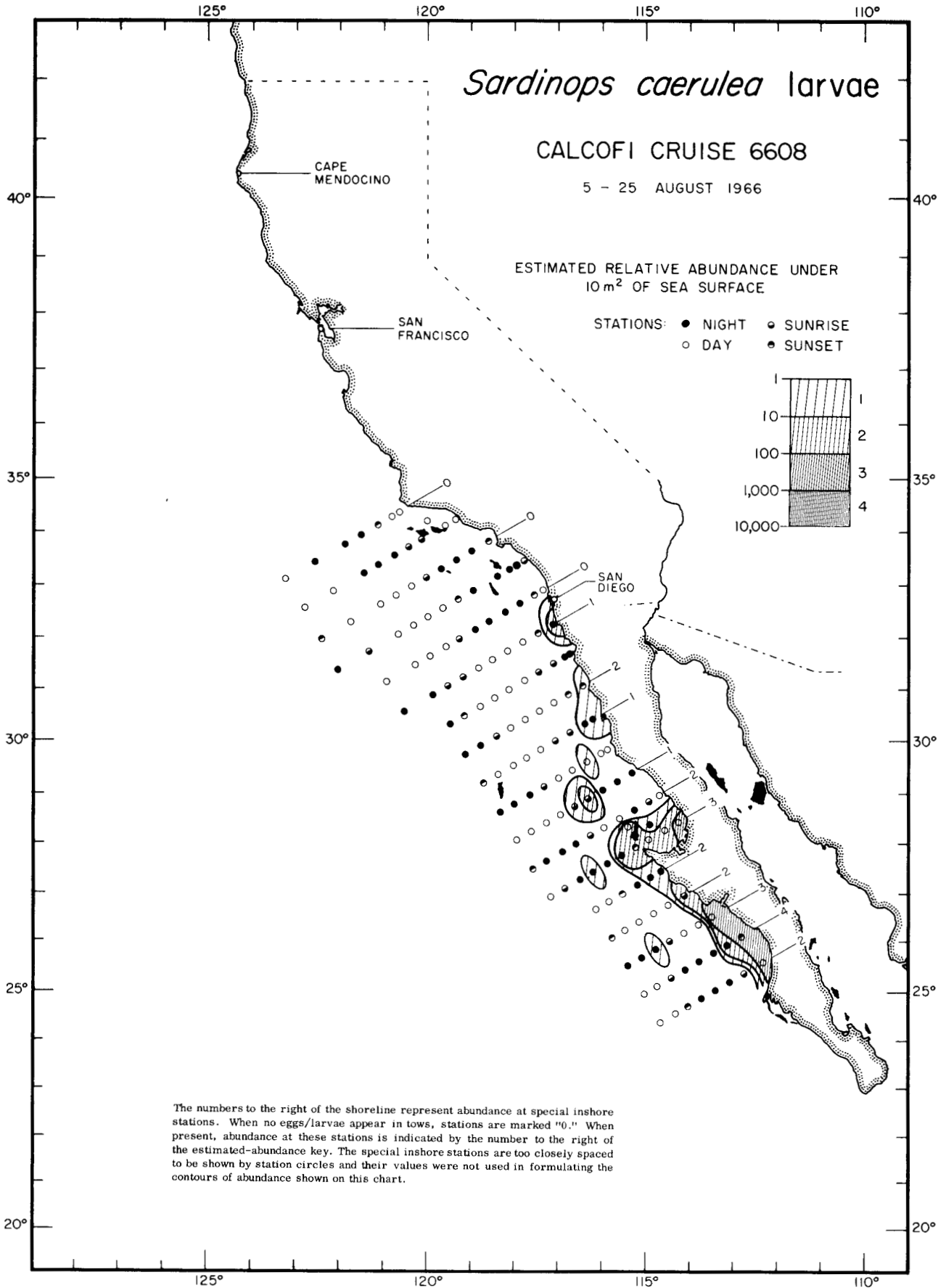
*Sardinops caerulea* larvae

6008



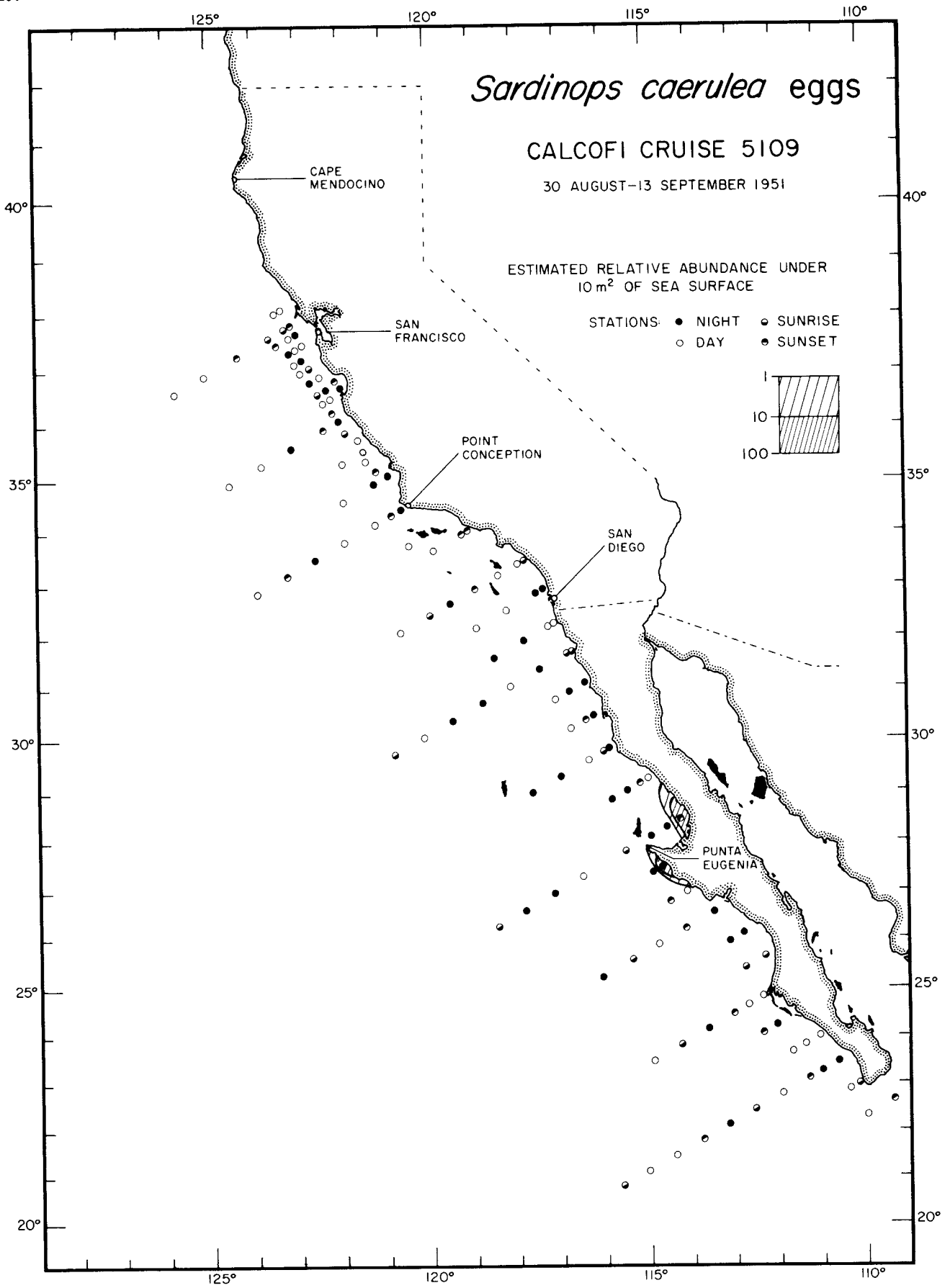
*Sardinops caerulea* eggs

6608



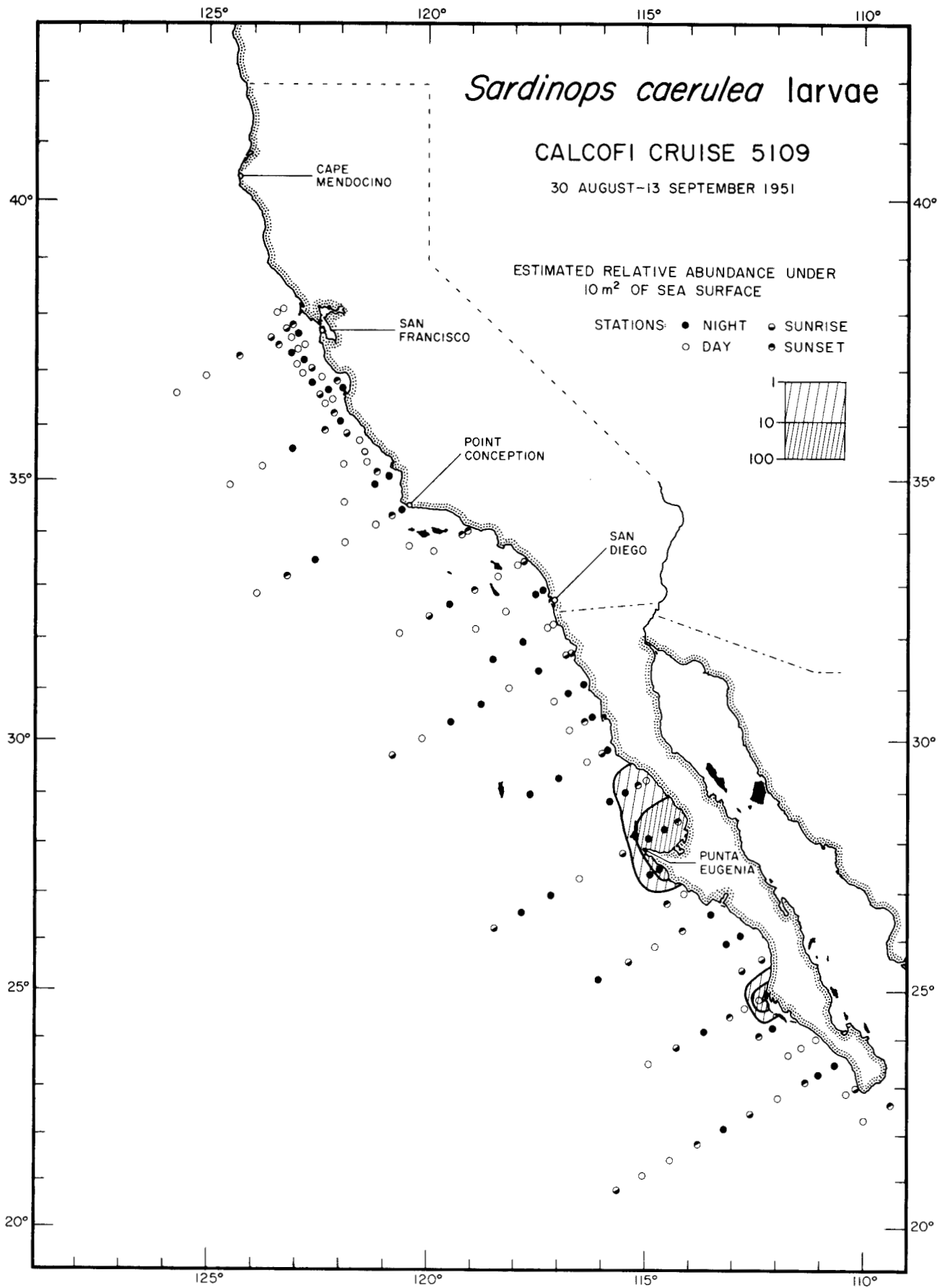
*Sardinops caerulea* larvae

6608



*Sardinops caerulea* eggs

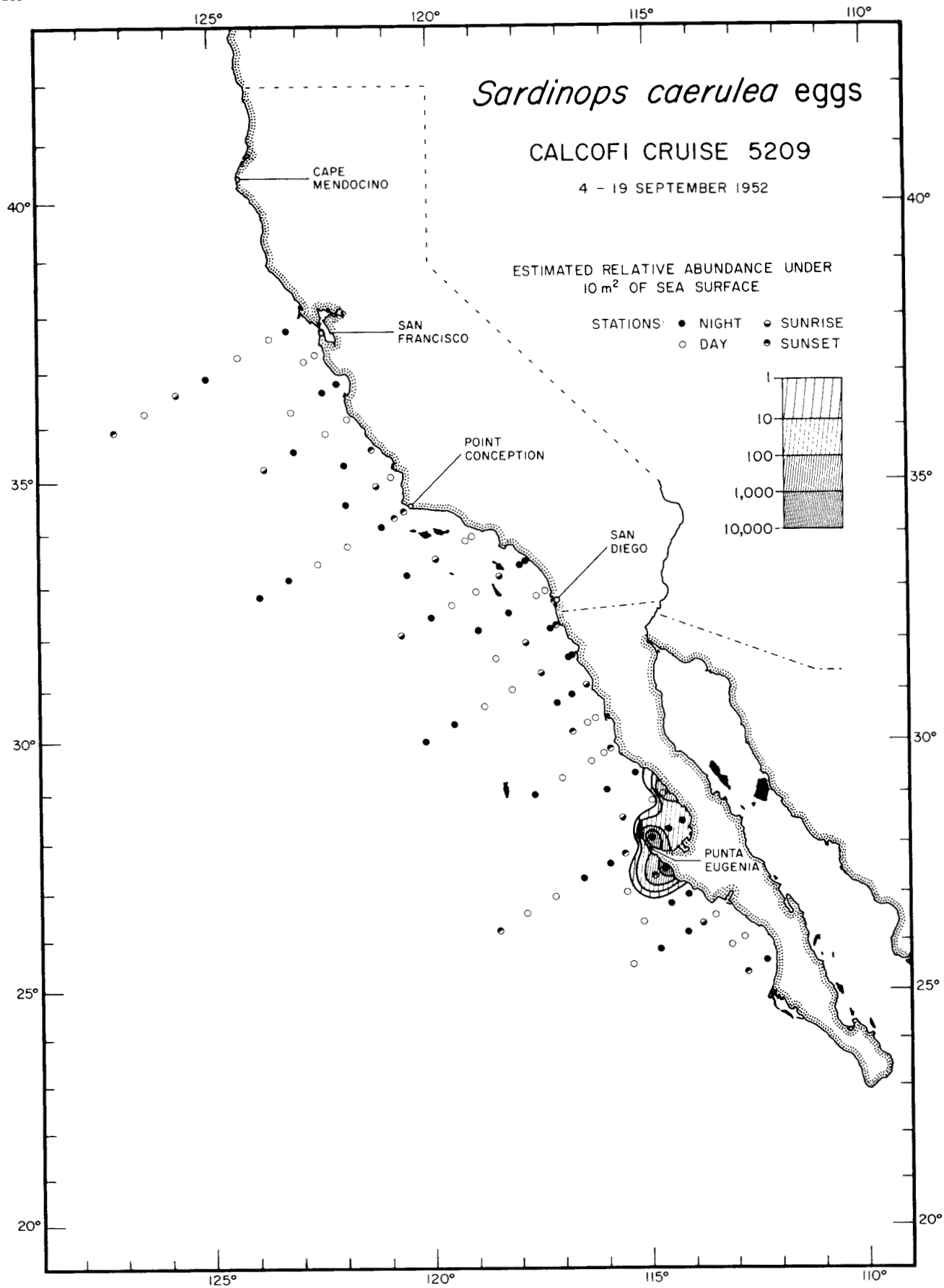
5109



*Sardinops caerulea* larvae

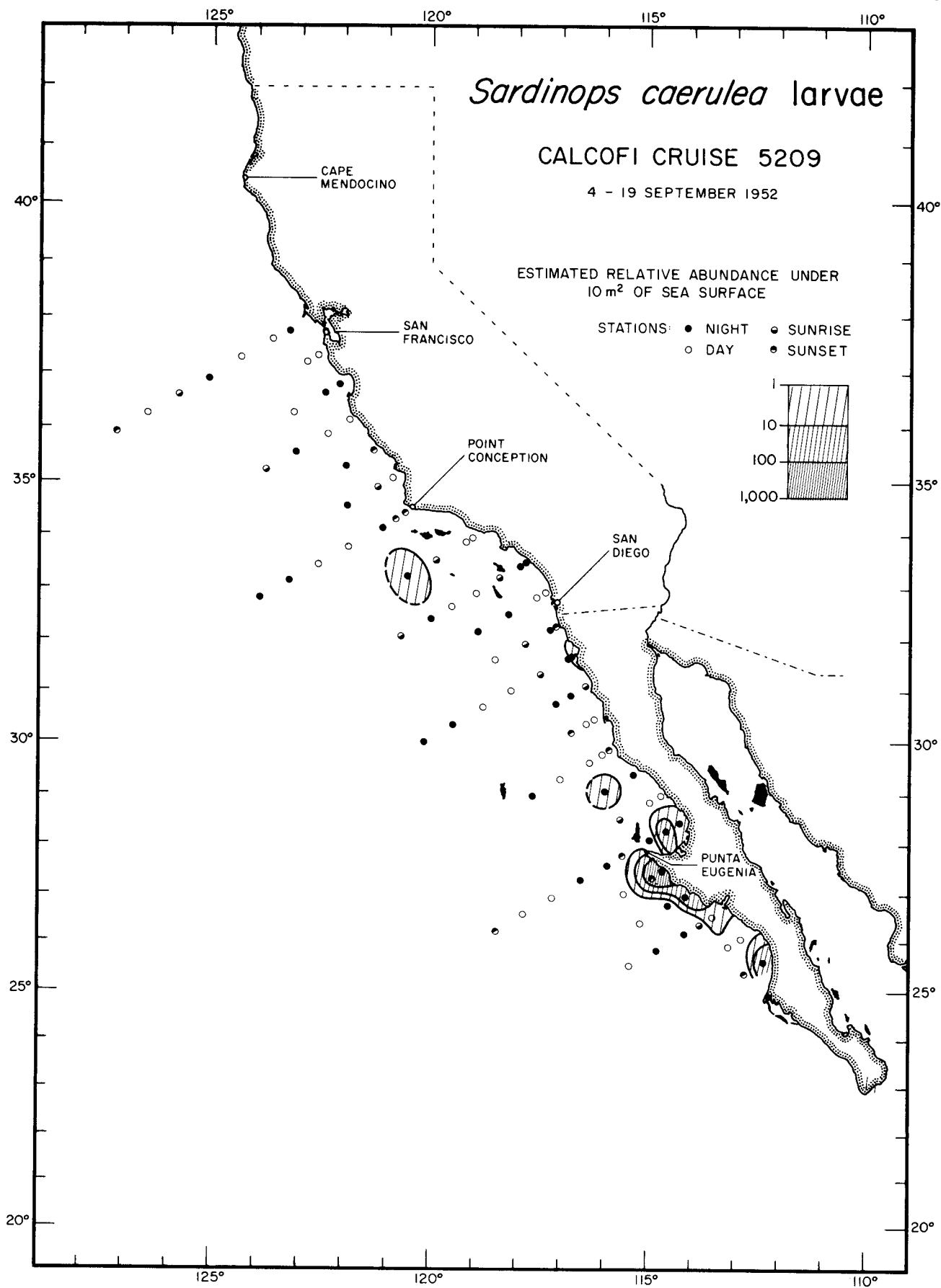
5109





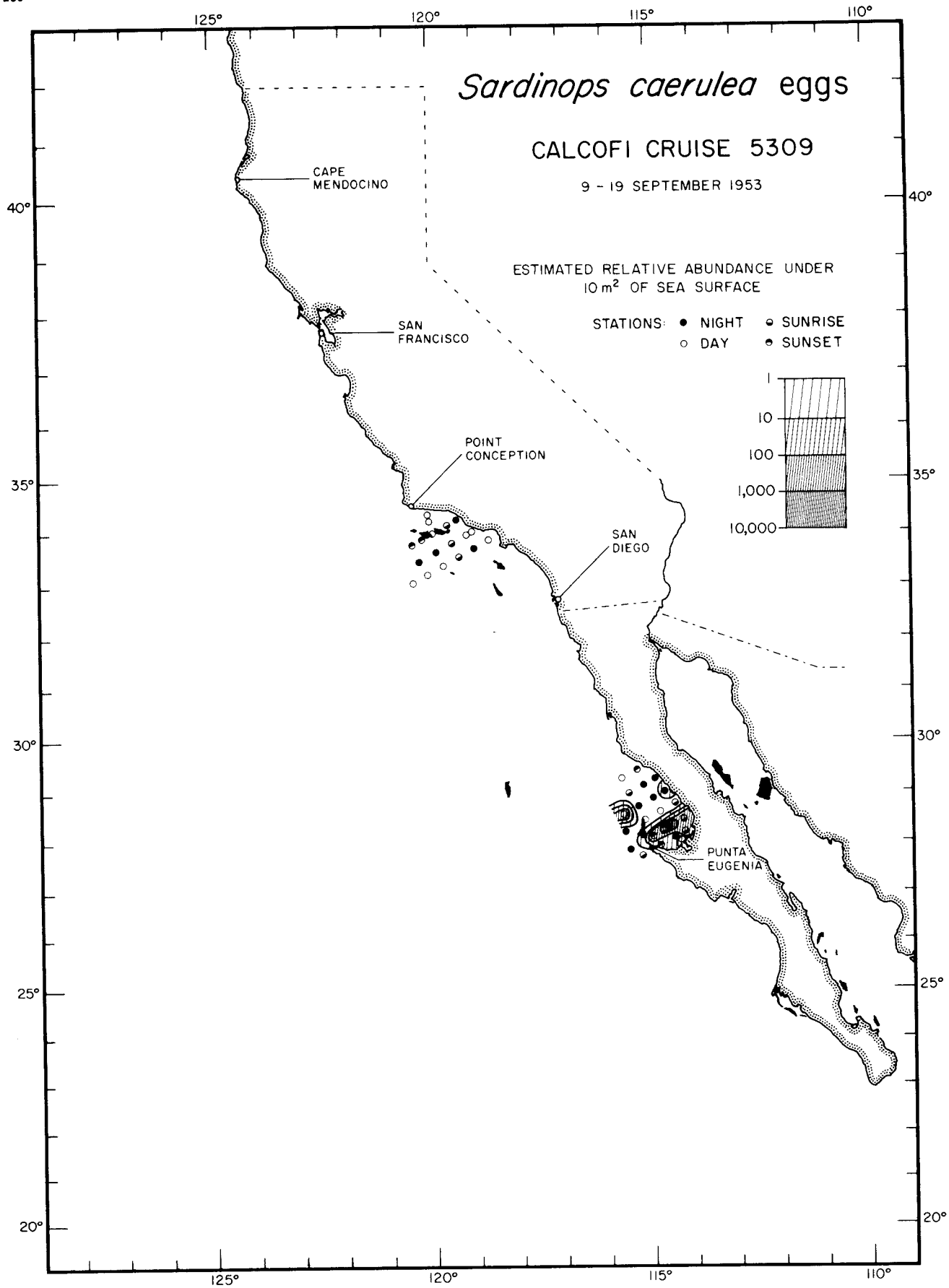
*Sardinops caerulea* eggs

5209

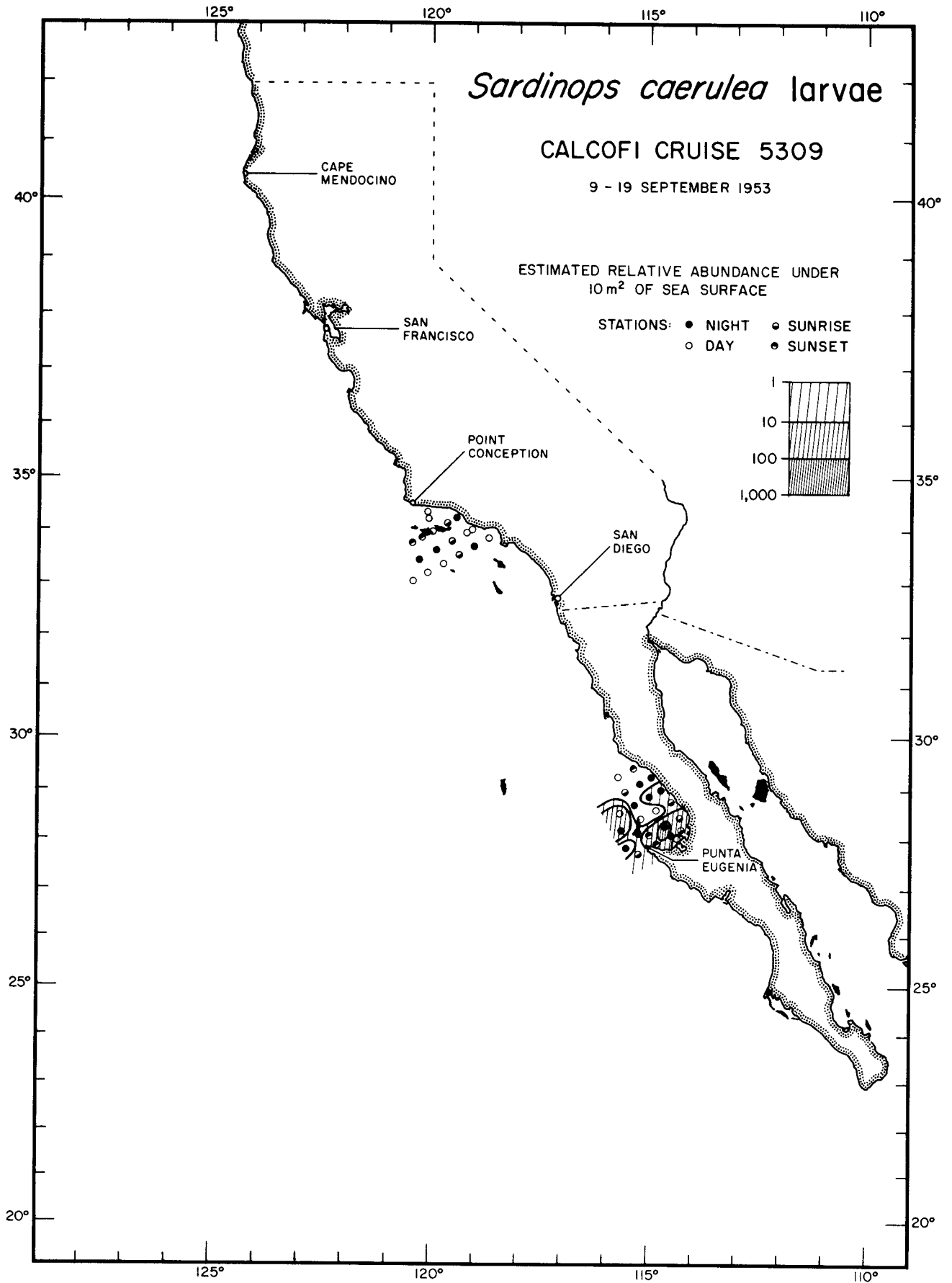


*Sardinops caerulea* larvae

5209

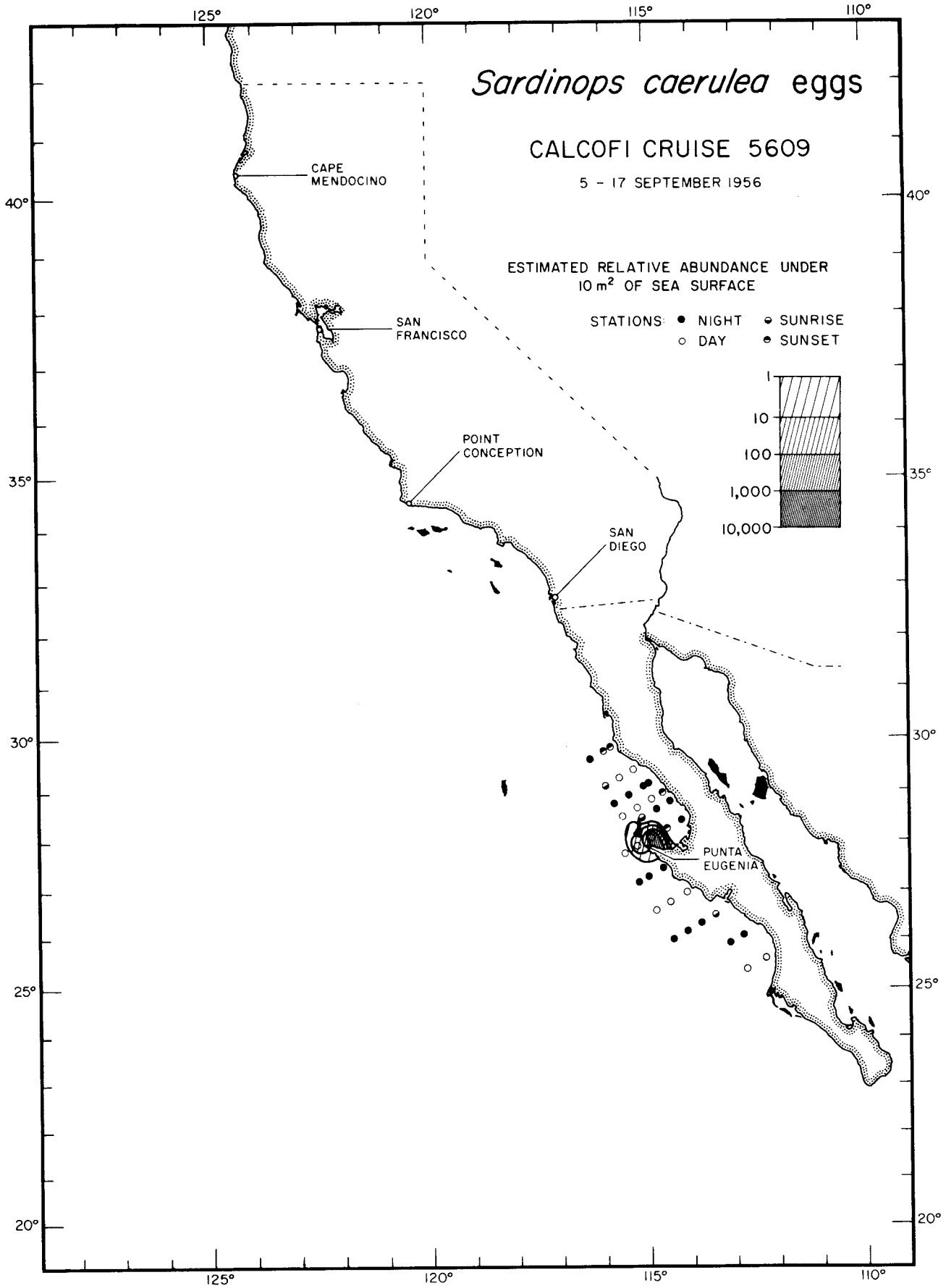


*Sardinops caerulea* eggs  
5309



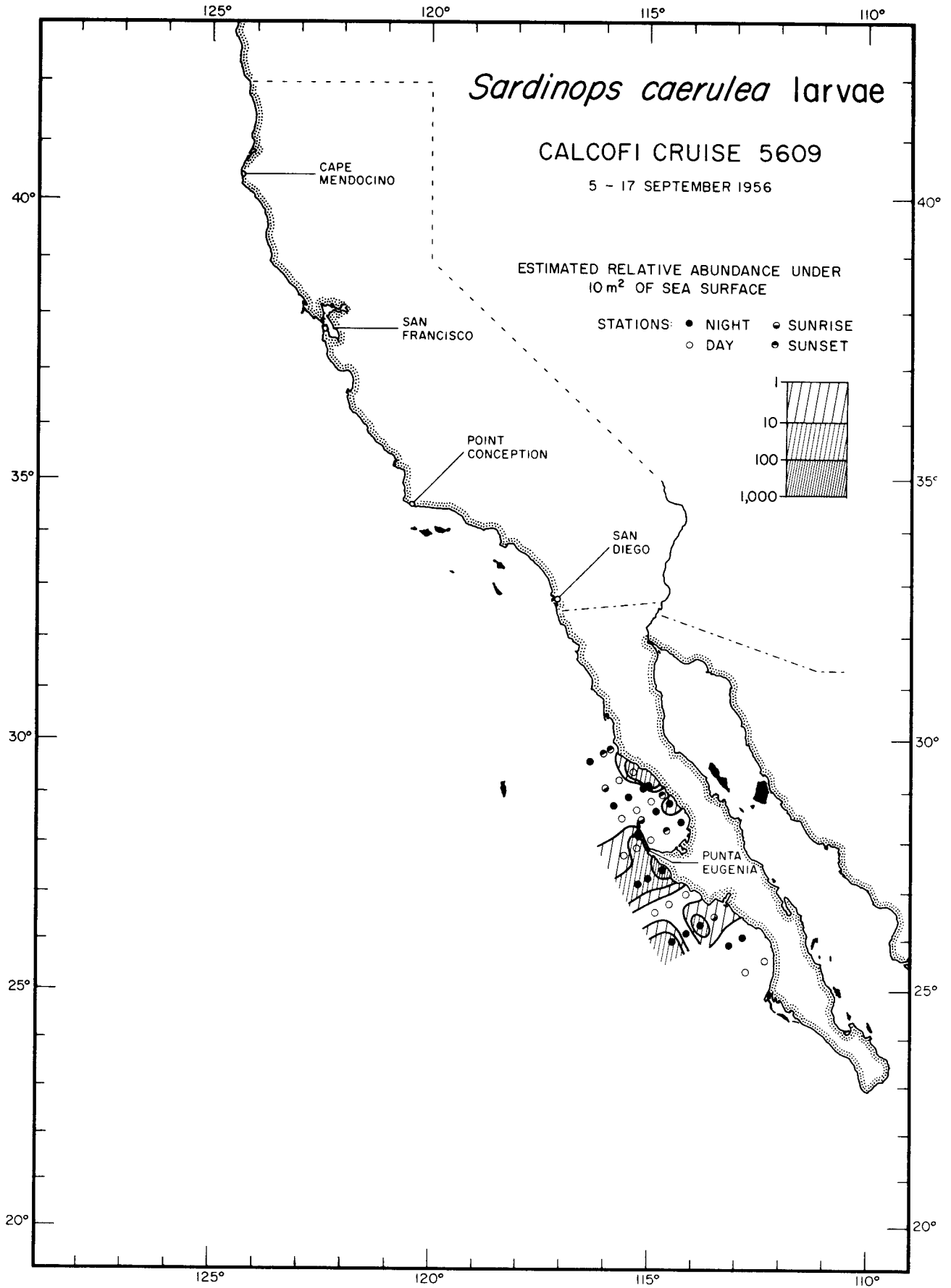
*Sardinops caerulea* larvae

5309



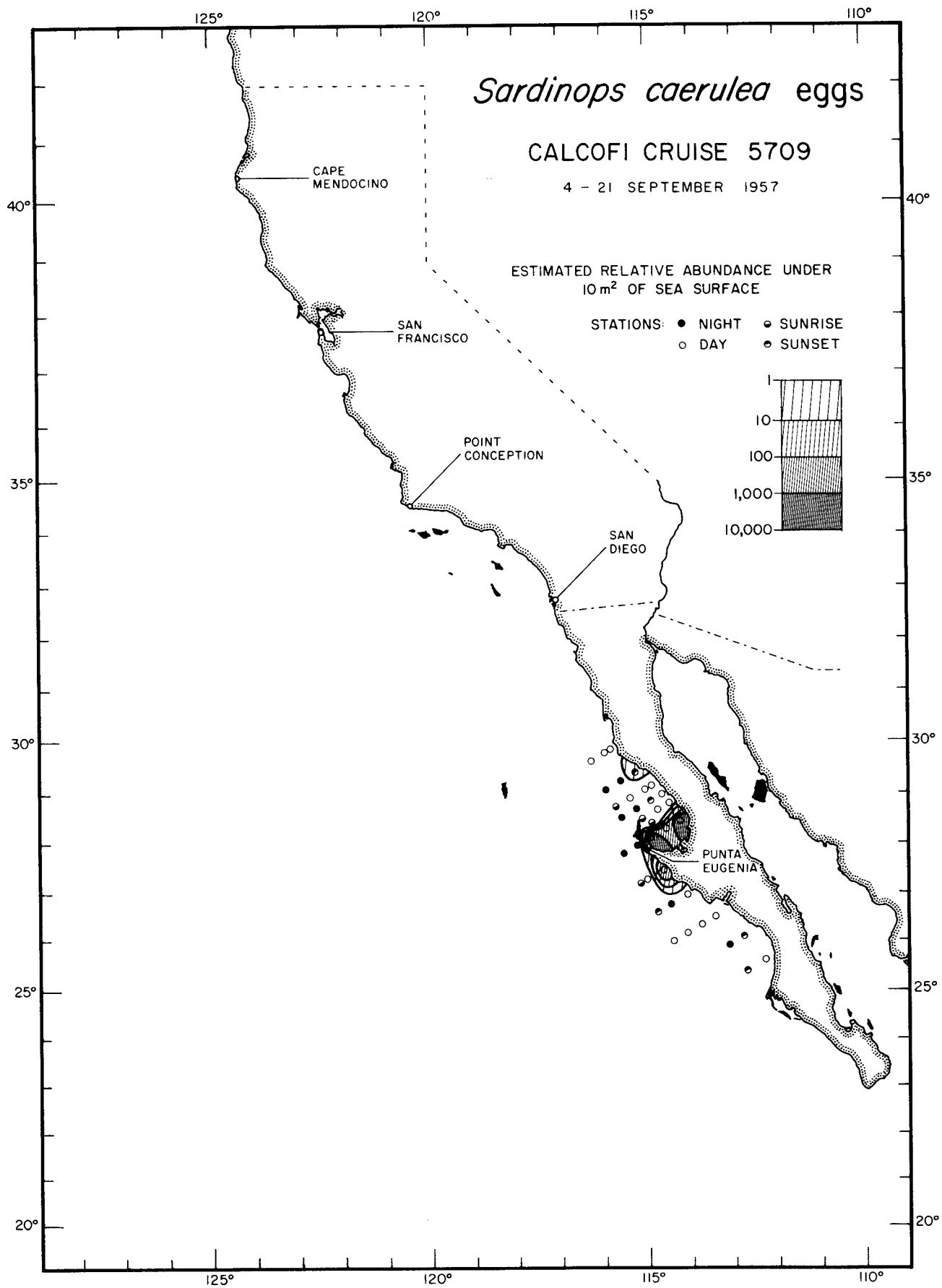
*Sardinops caerulea* eggs

5609



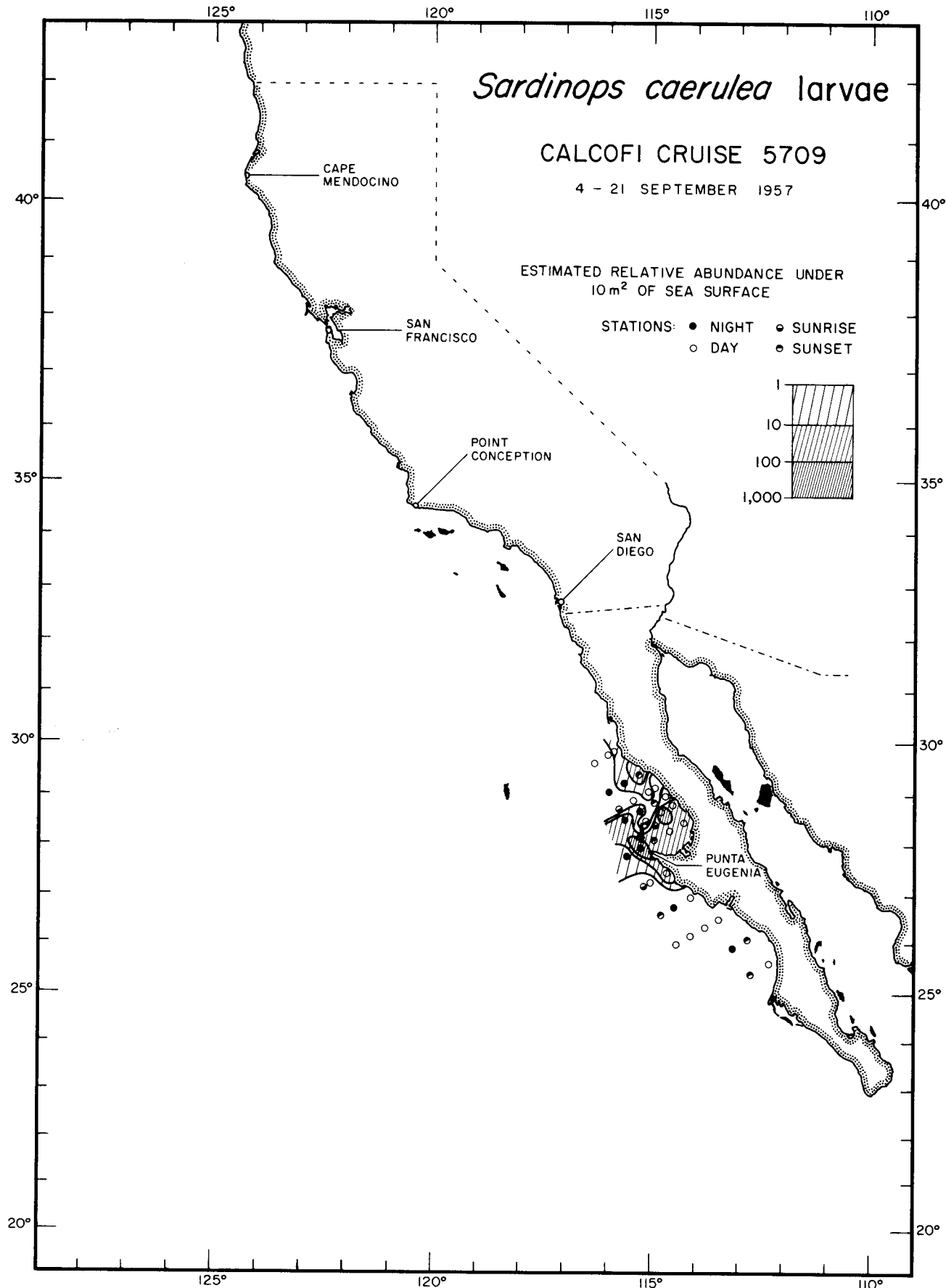
*Sardinops caerulea* larvae

5609



*Sardinops caerulea* eggs

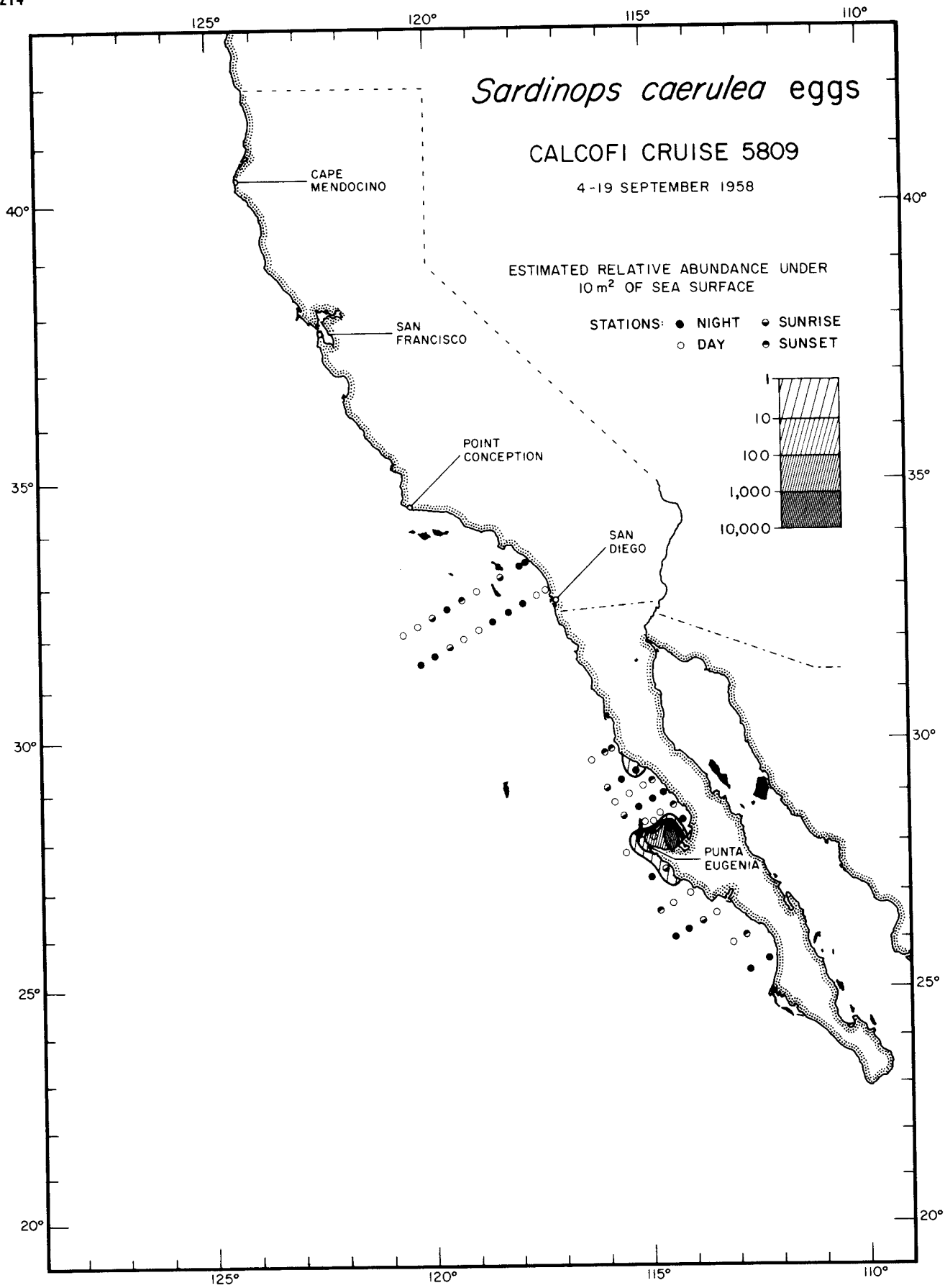
5709



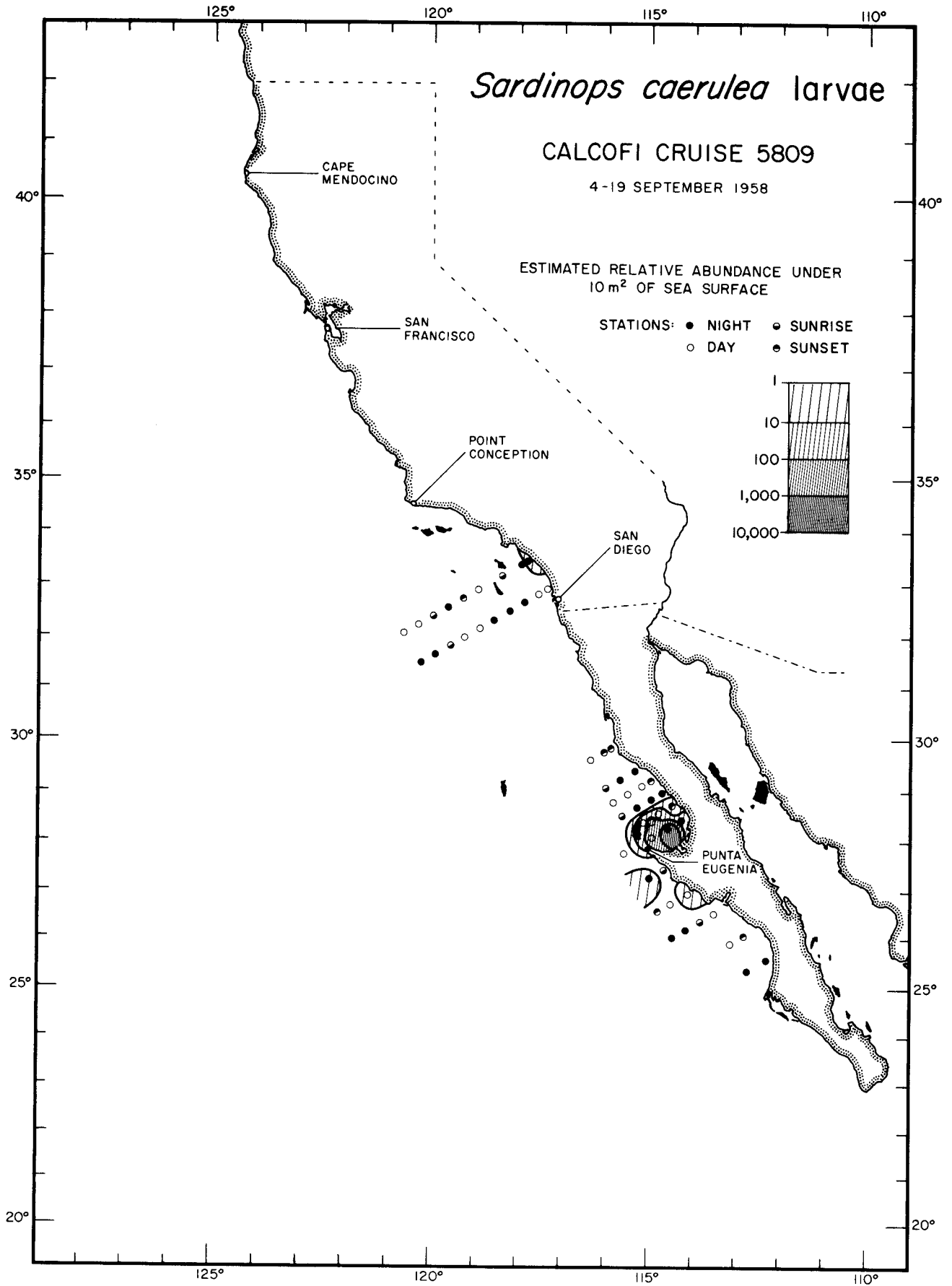
*Sardinops caerulea* larvae

5709



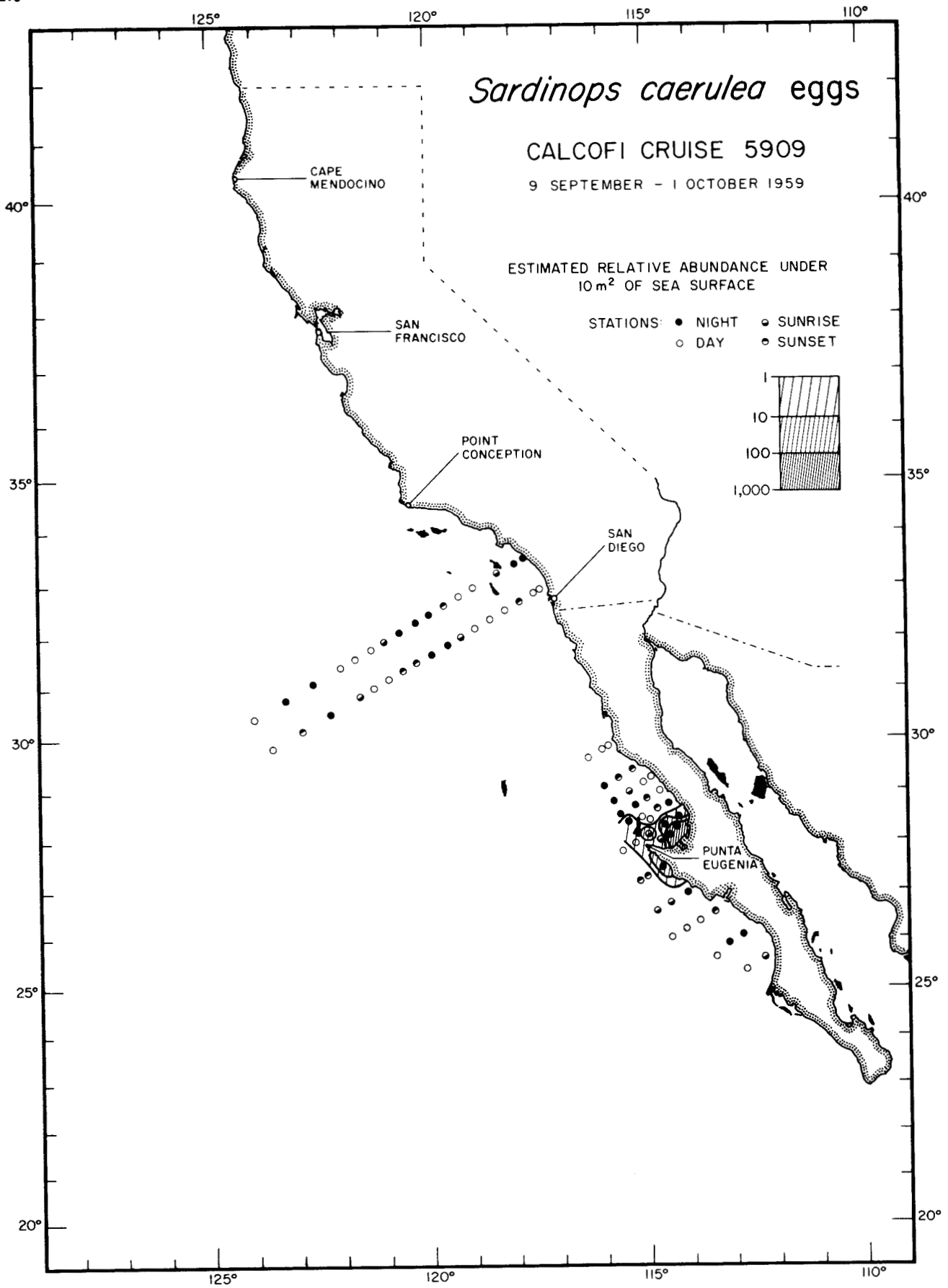
*Sardinops caerulea* eggs

5809



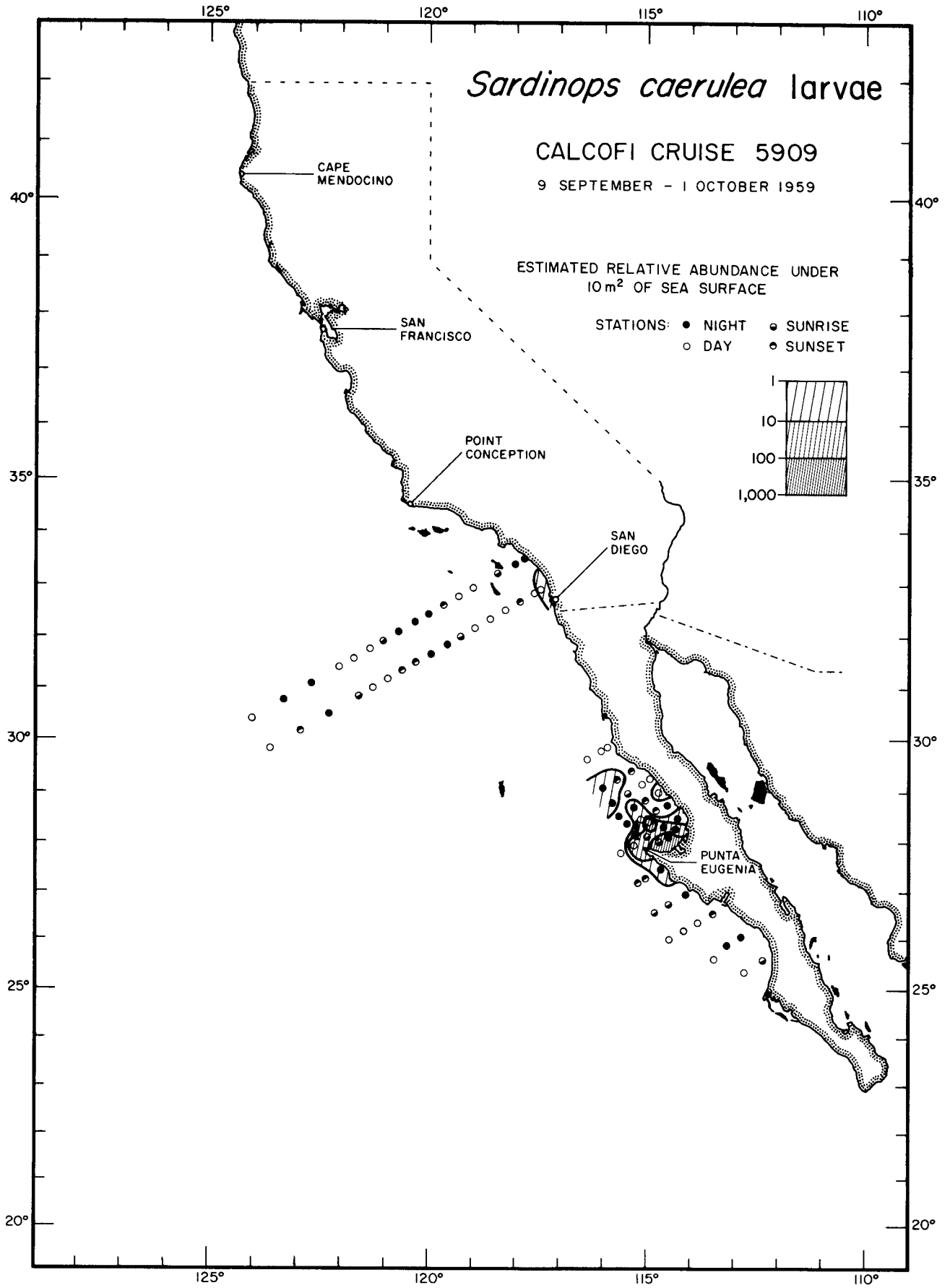
*Sardinops caerulea* larvae

5809



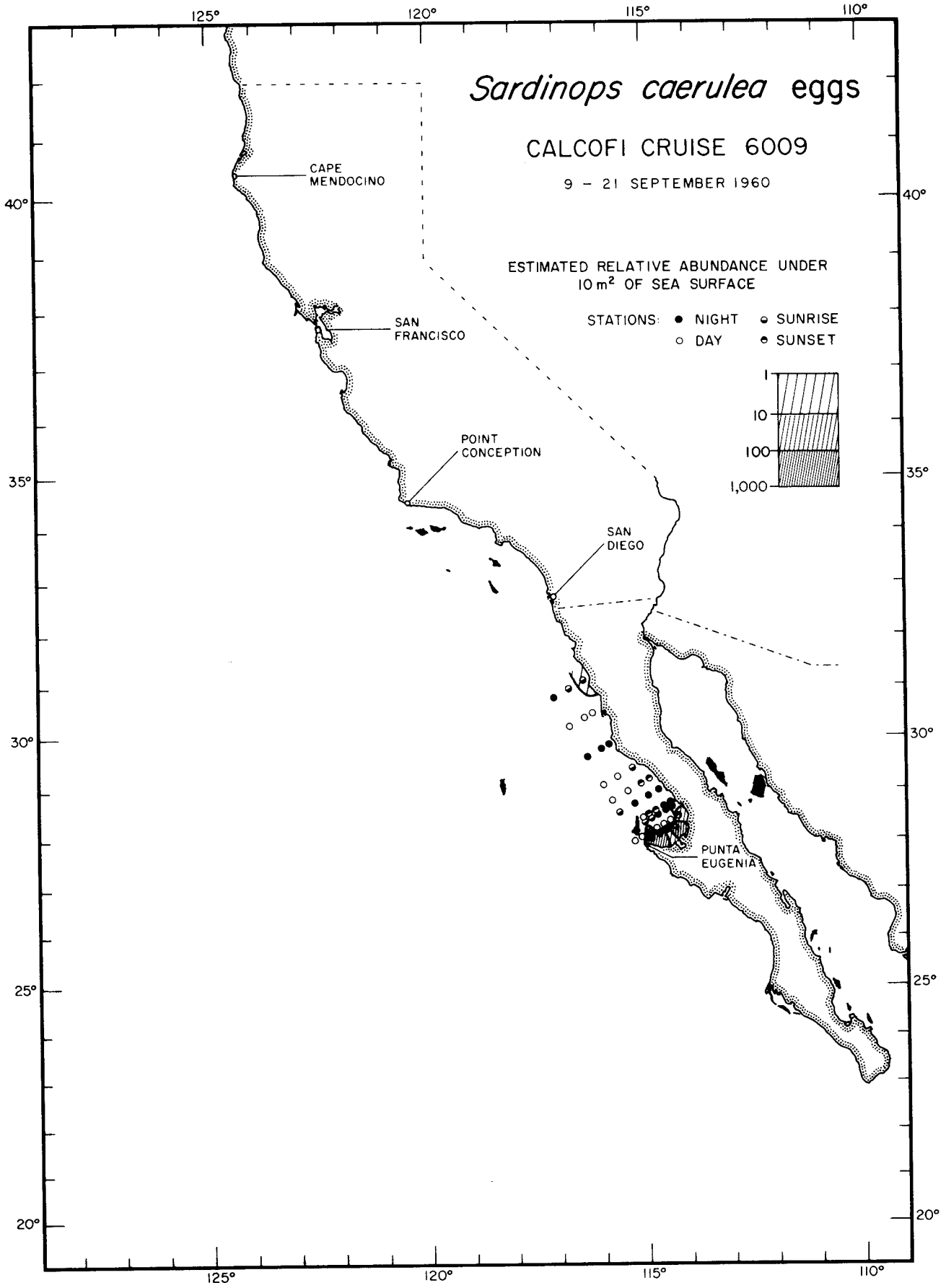
*Sardinops caerulea* eggs

5909

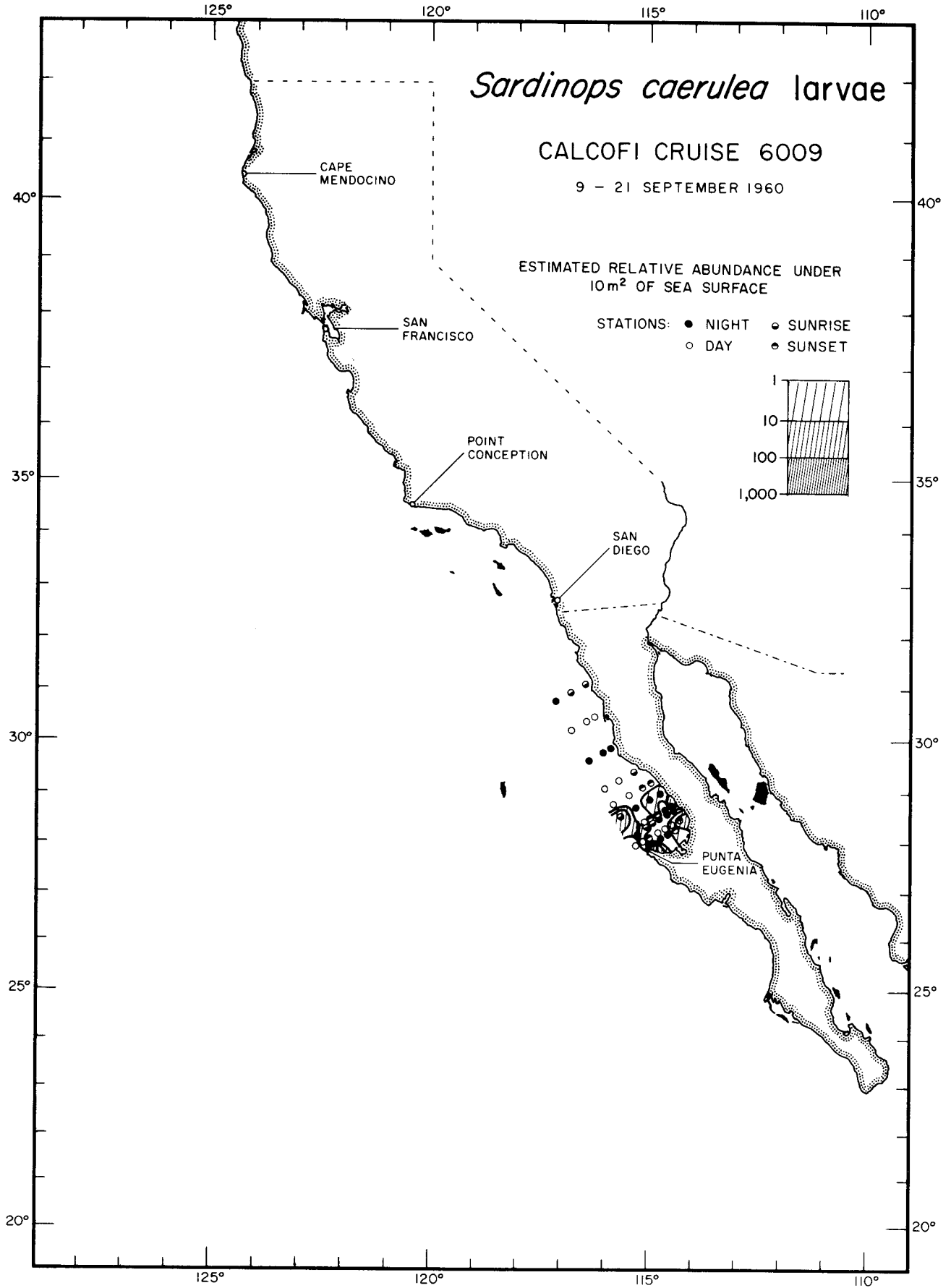


*Sardinops caerulea* larvae

5909

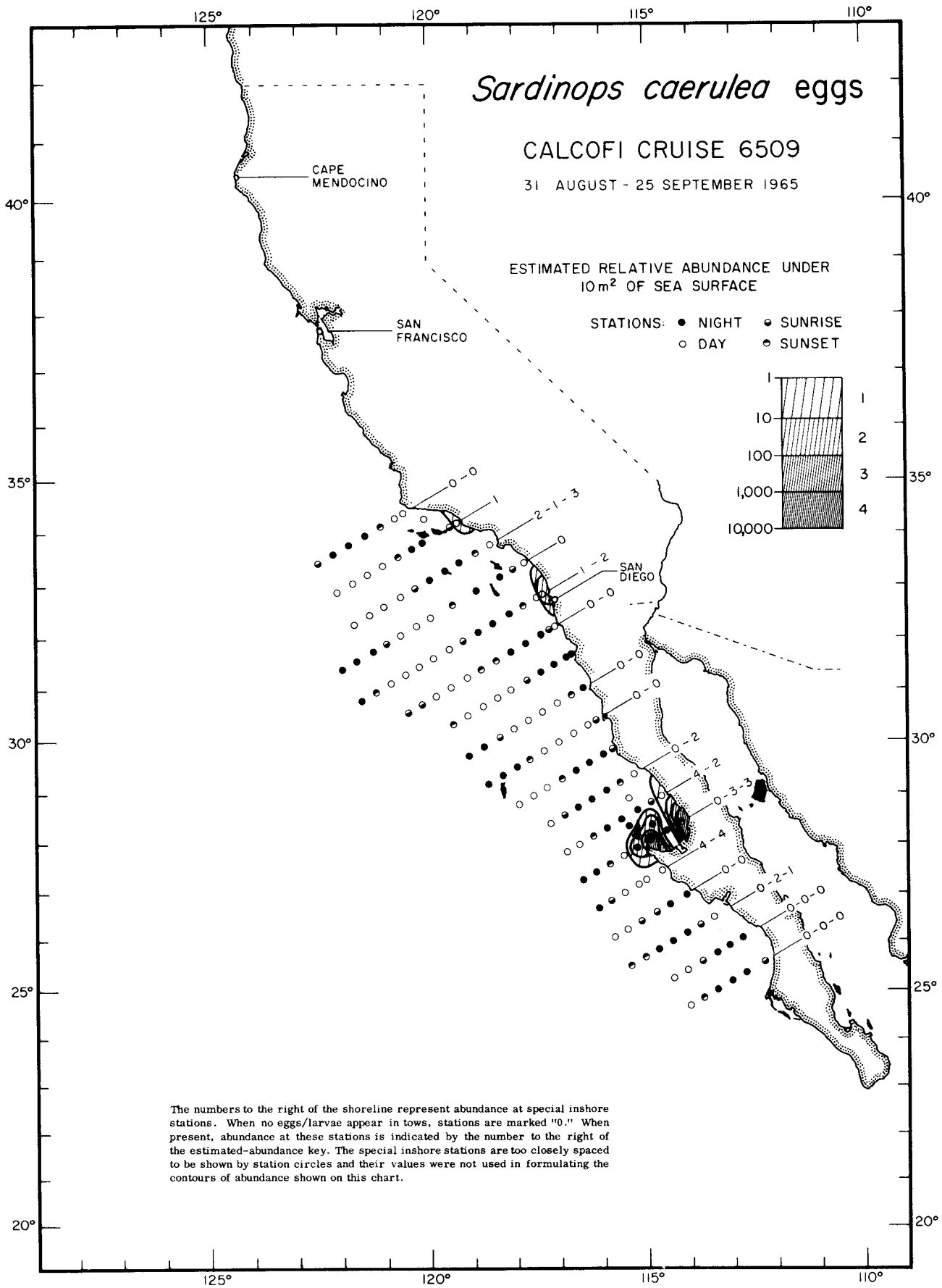


*Sardinops caerulea* eggs  
6009



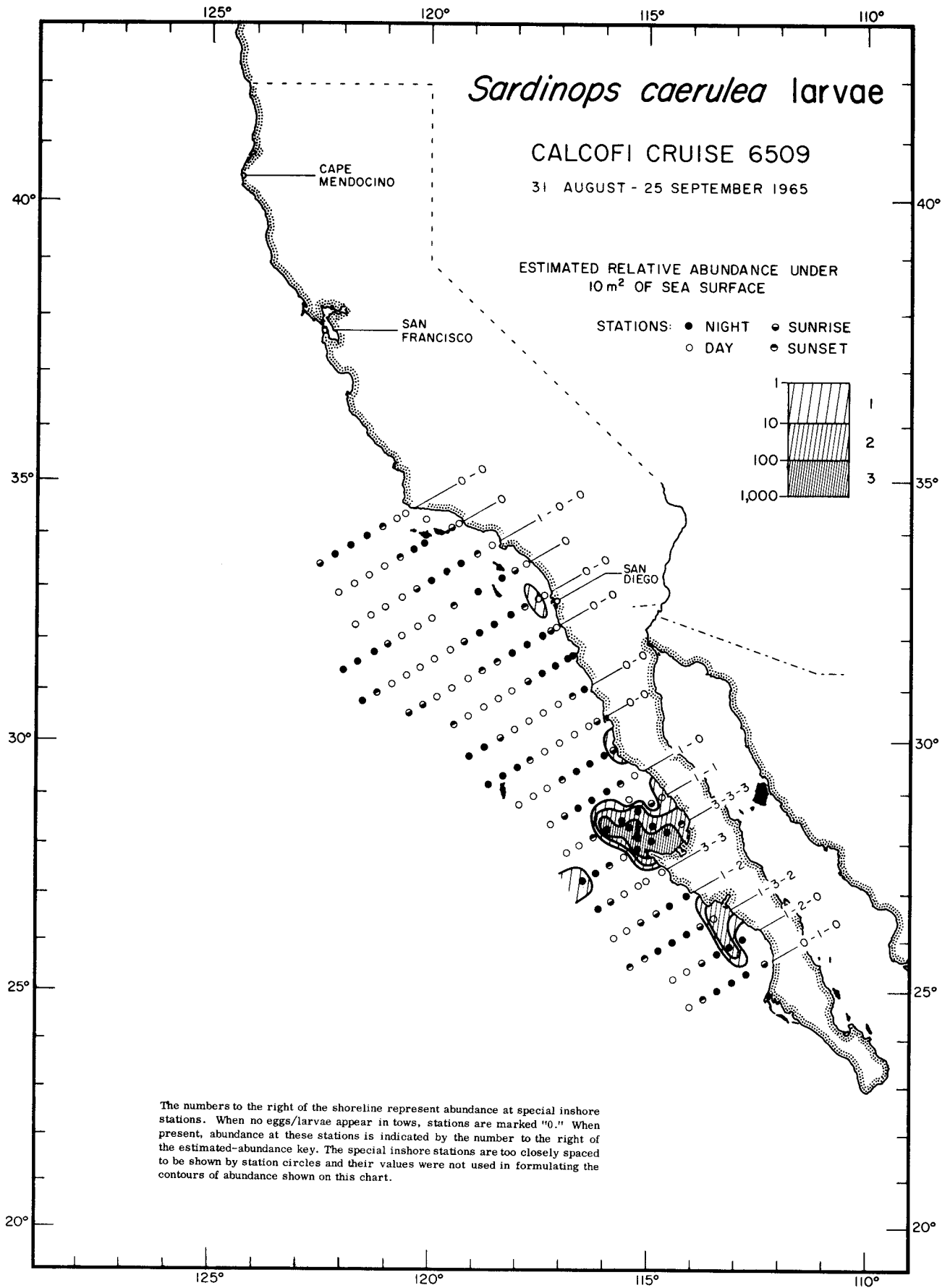
*Sardinops caerulea* larvae

6009



*Sardinops caerulea* eggs

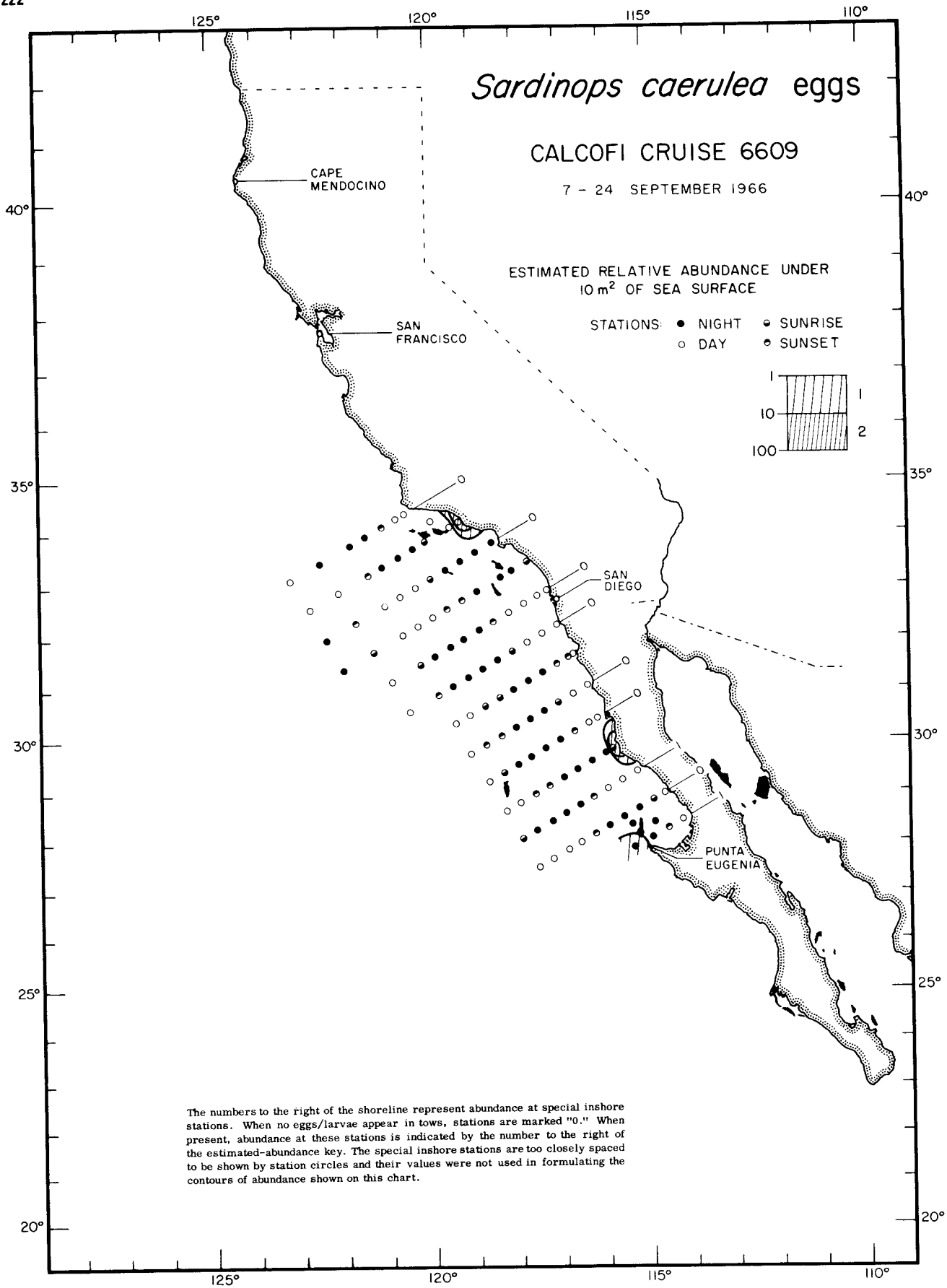
6509



*Sardinops caerulea* larvae

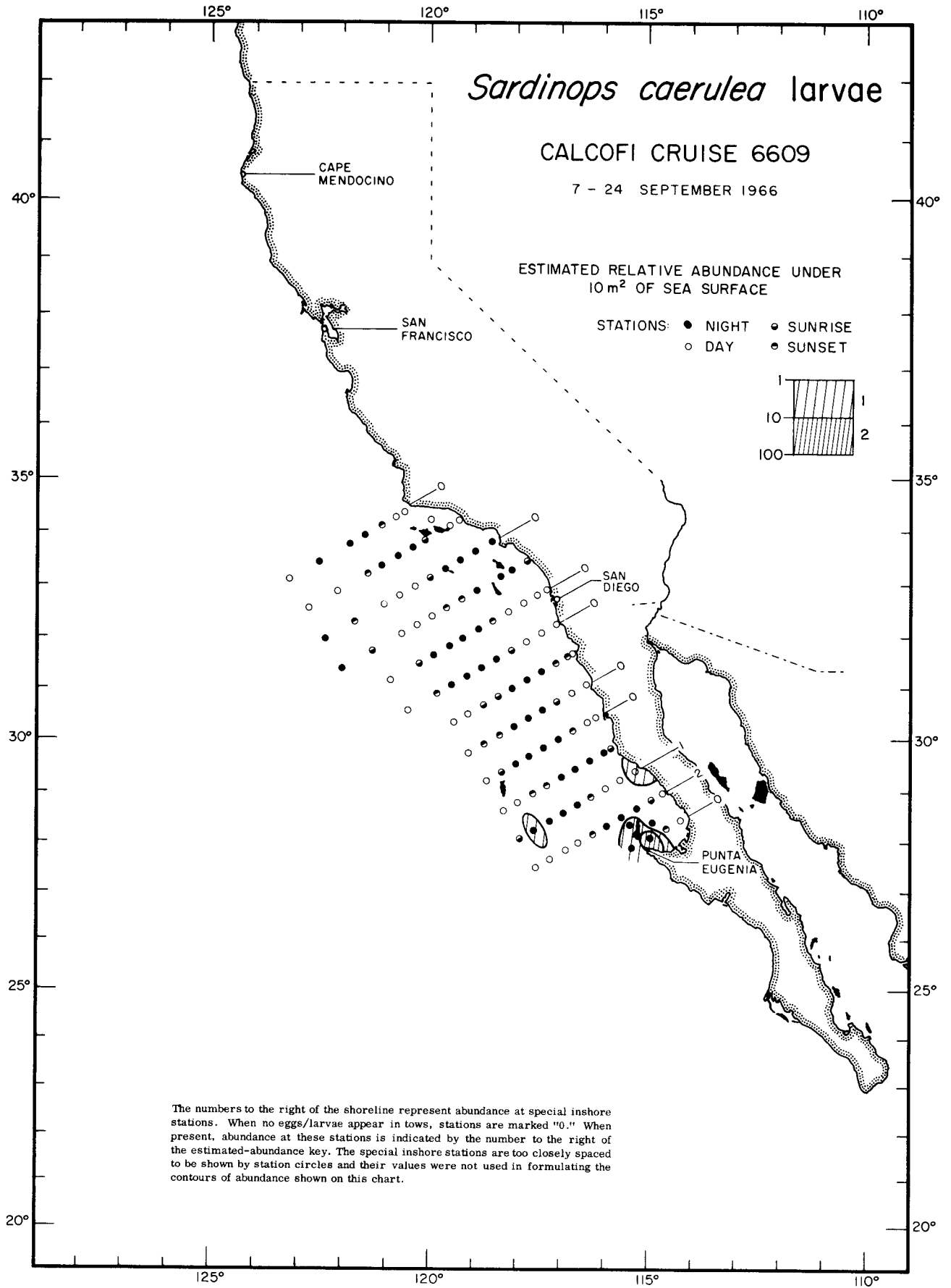
6509





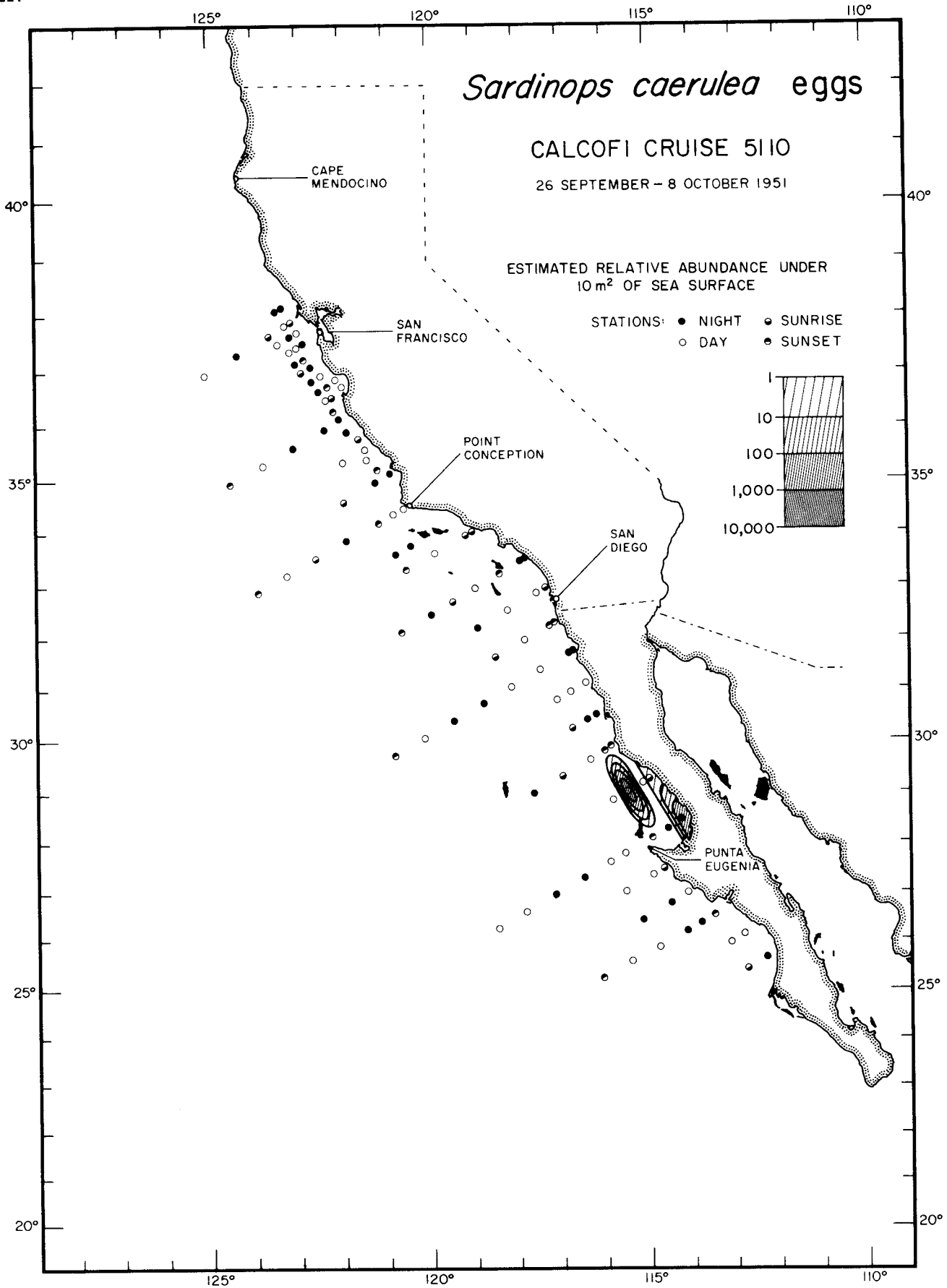
*Sardinops caerulea* eggs

6609



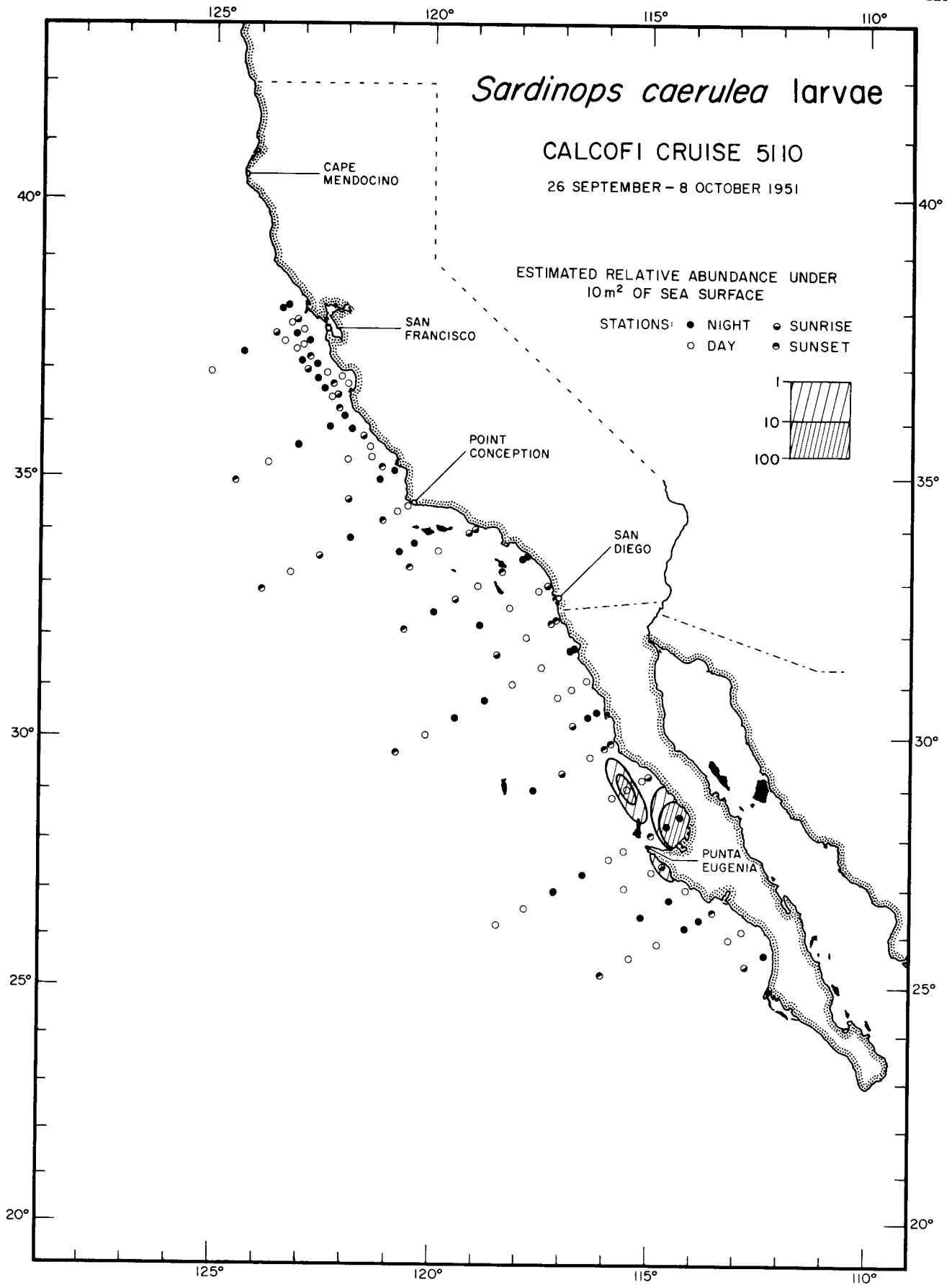
*Sardinops caerulea* larvae

6609



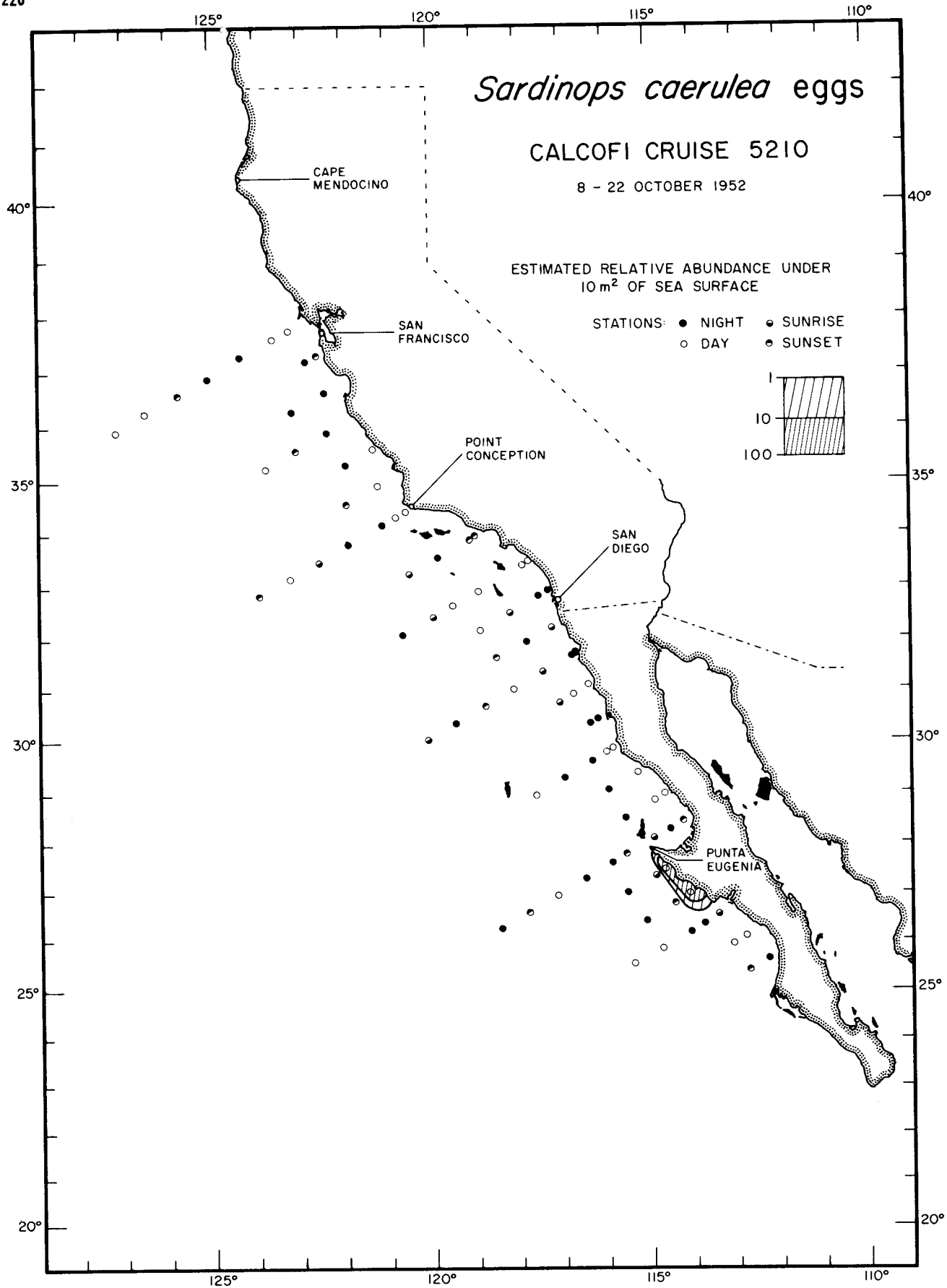
*Sardinops caerulea* eggs

5110

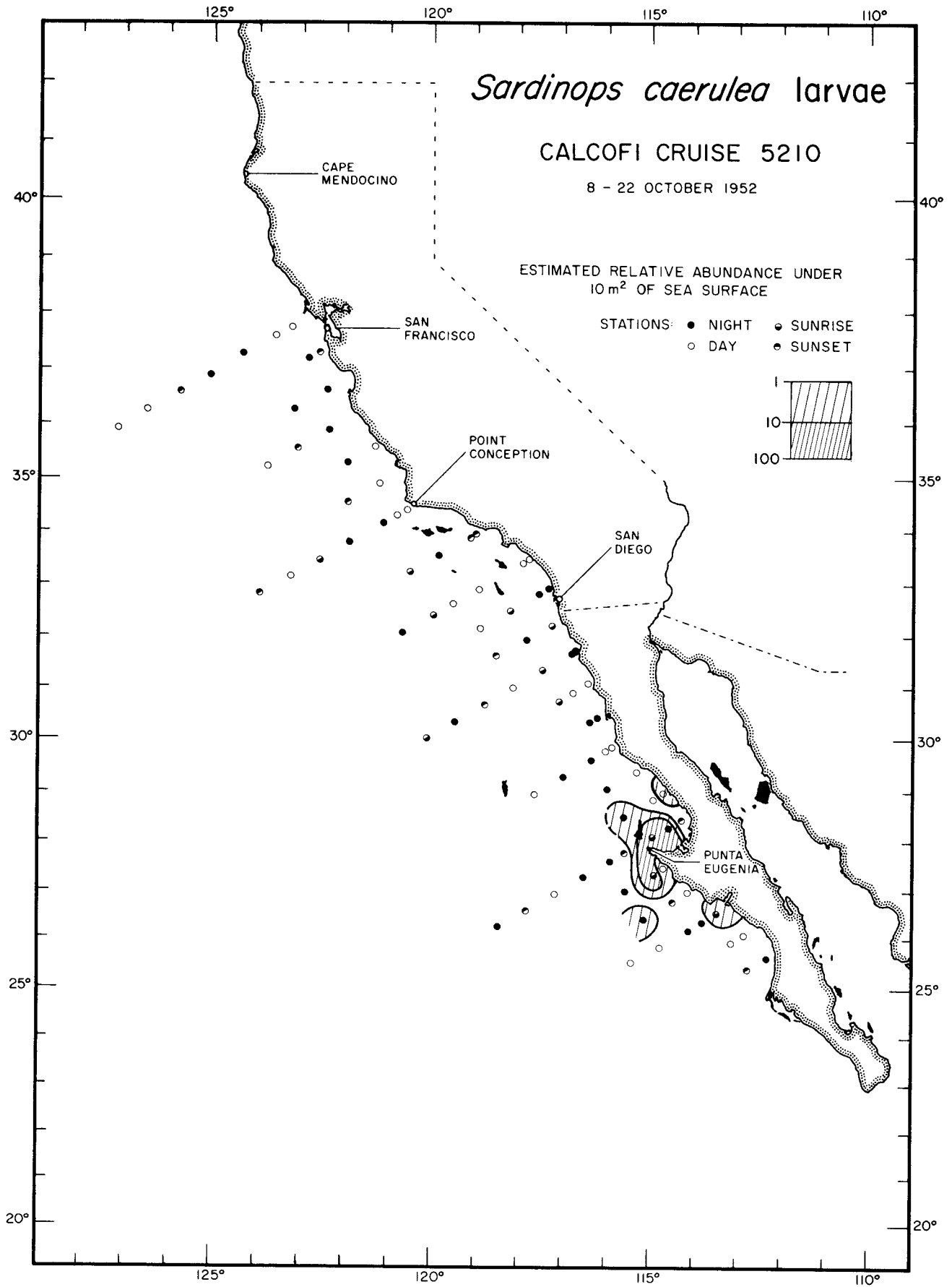


*Sardinops caerulea* larvae

5110

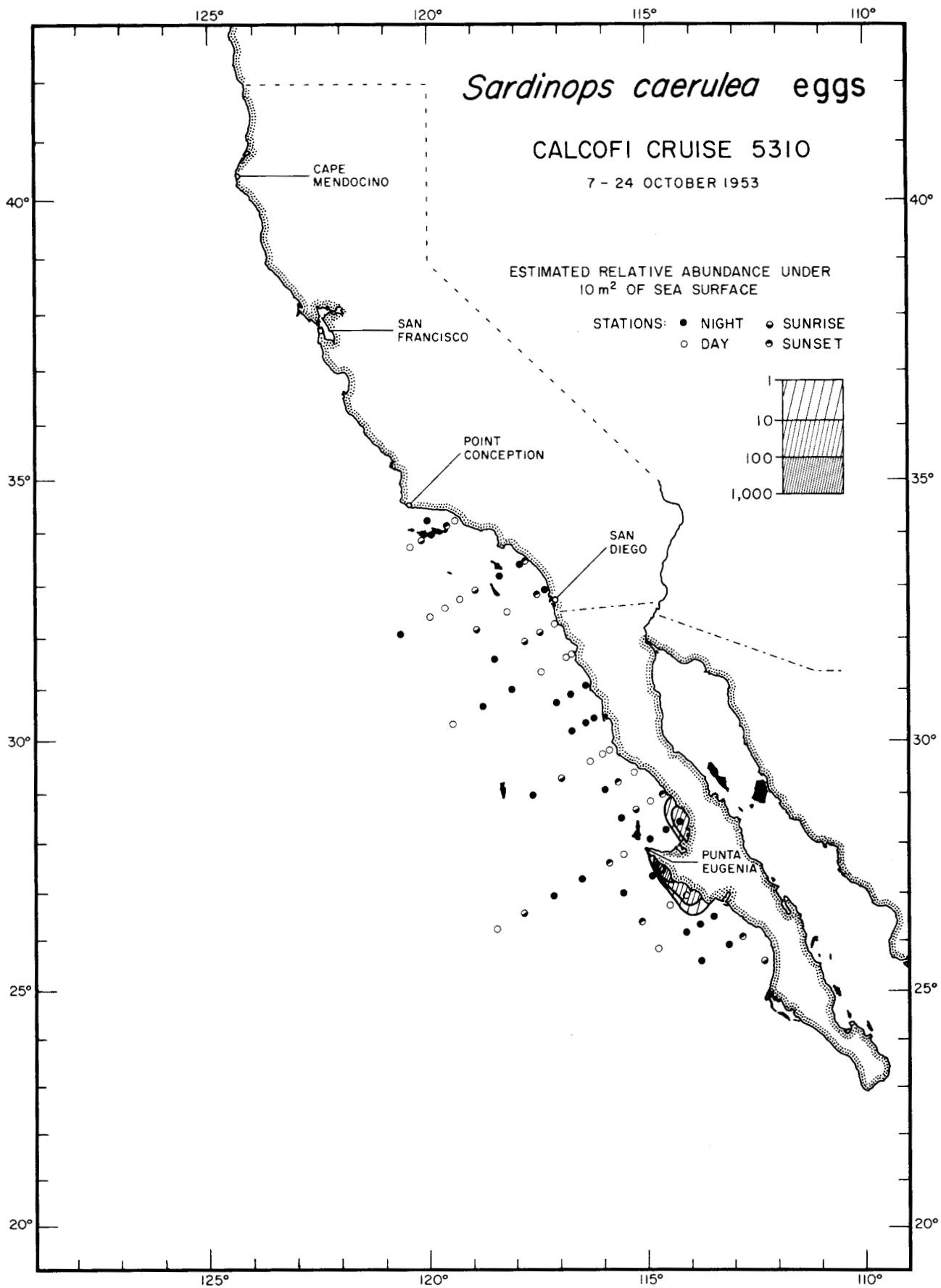
*Sardinops caerulea* eggs

5210



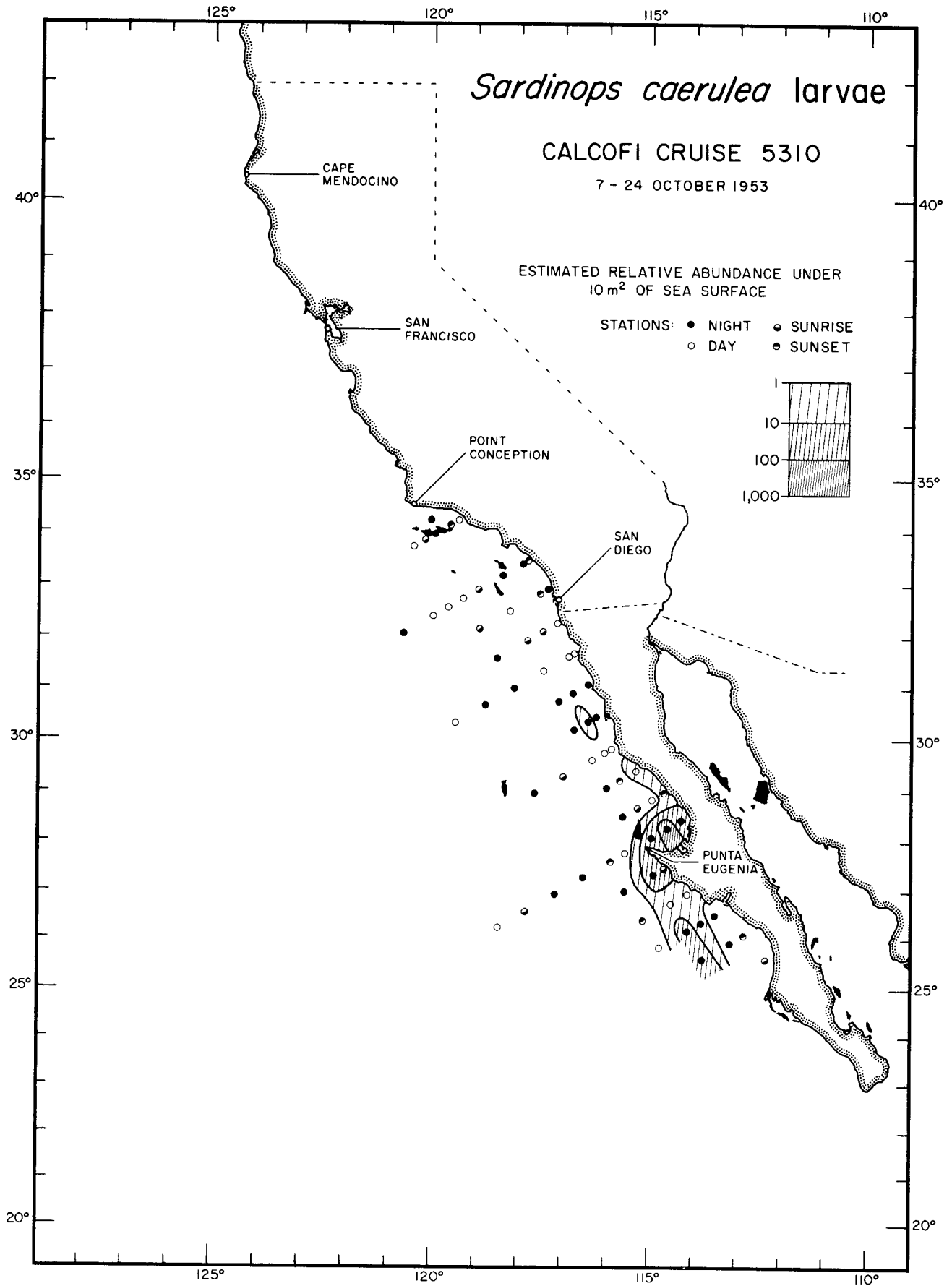
*Sardinops caerulea* larvae

5210



*Sardinops caerulea* eggs

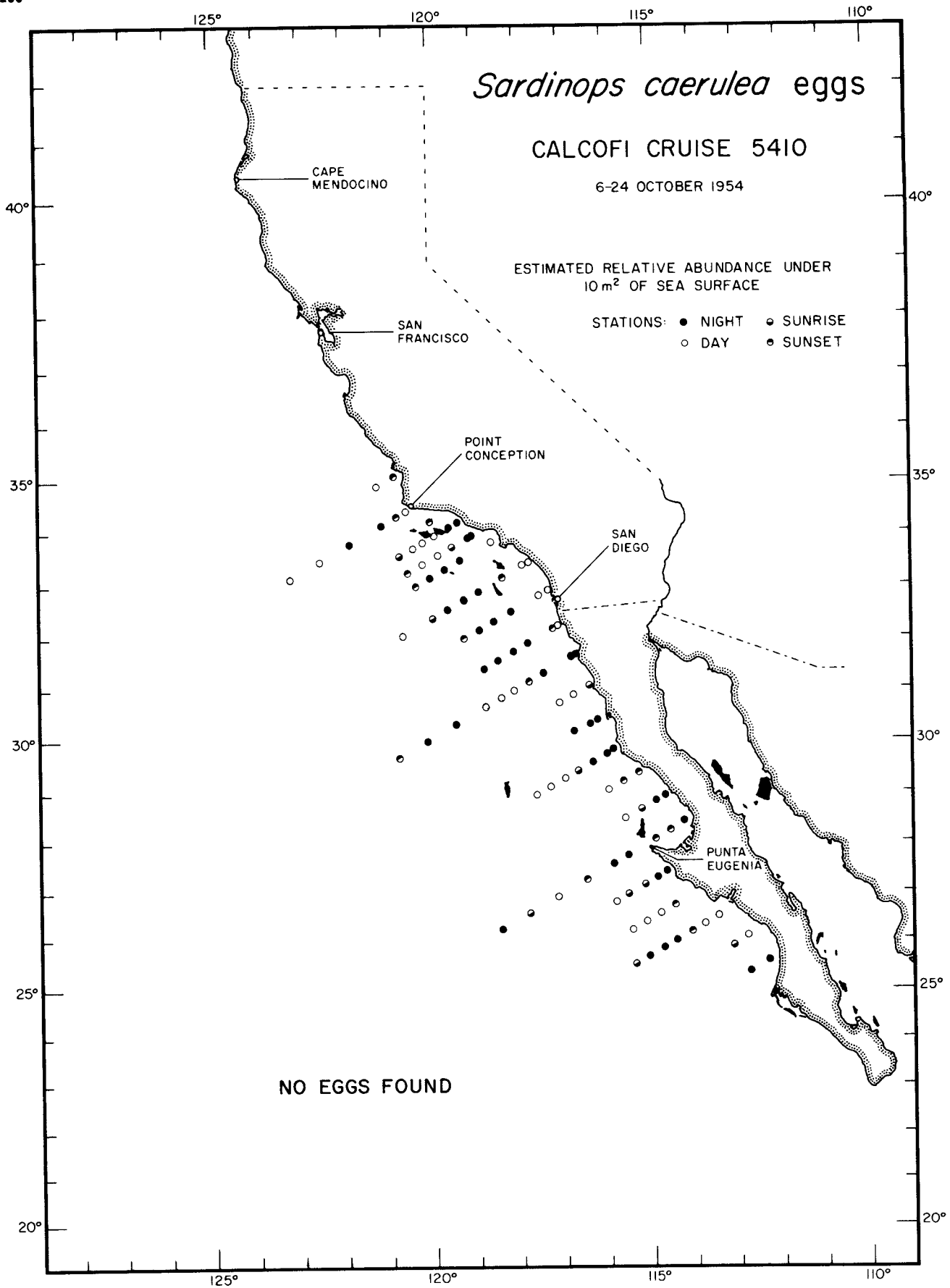
5310



*Sardinops caerulea* larvae

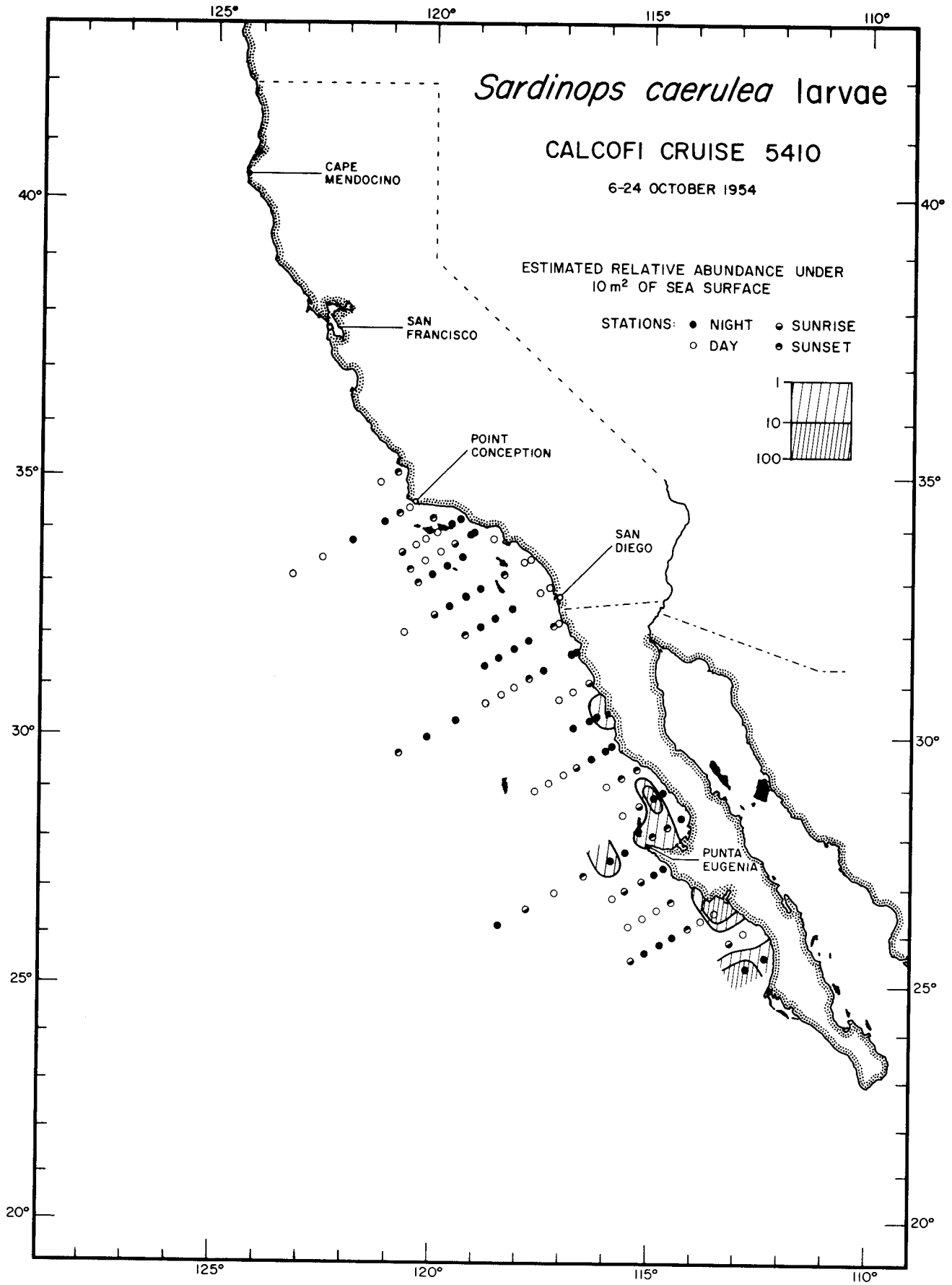
5310



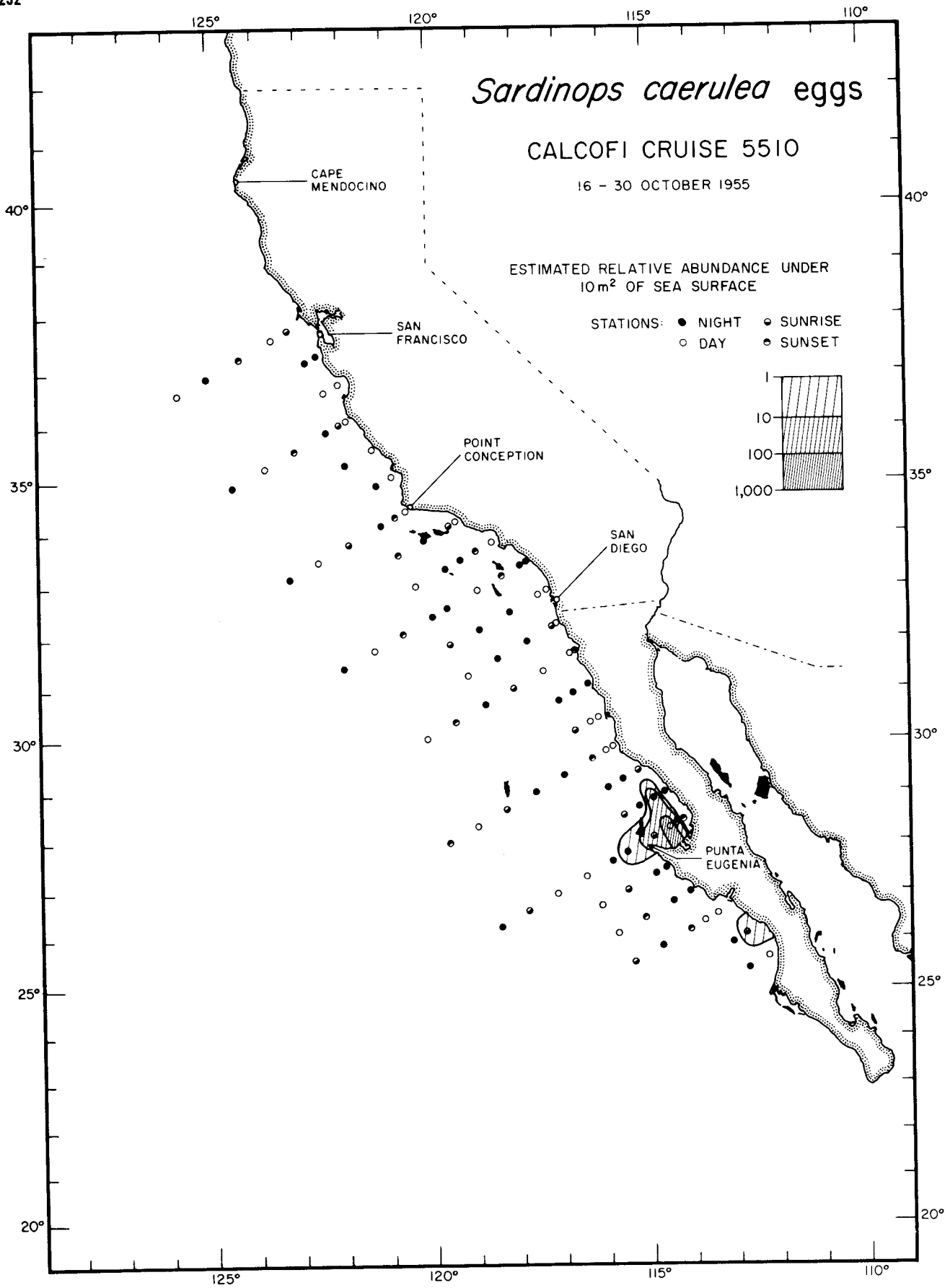


*Sardinops caerulea* eggs

5410

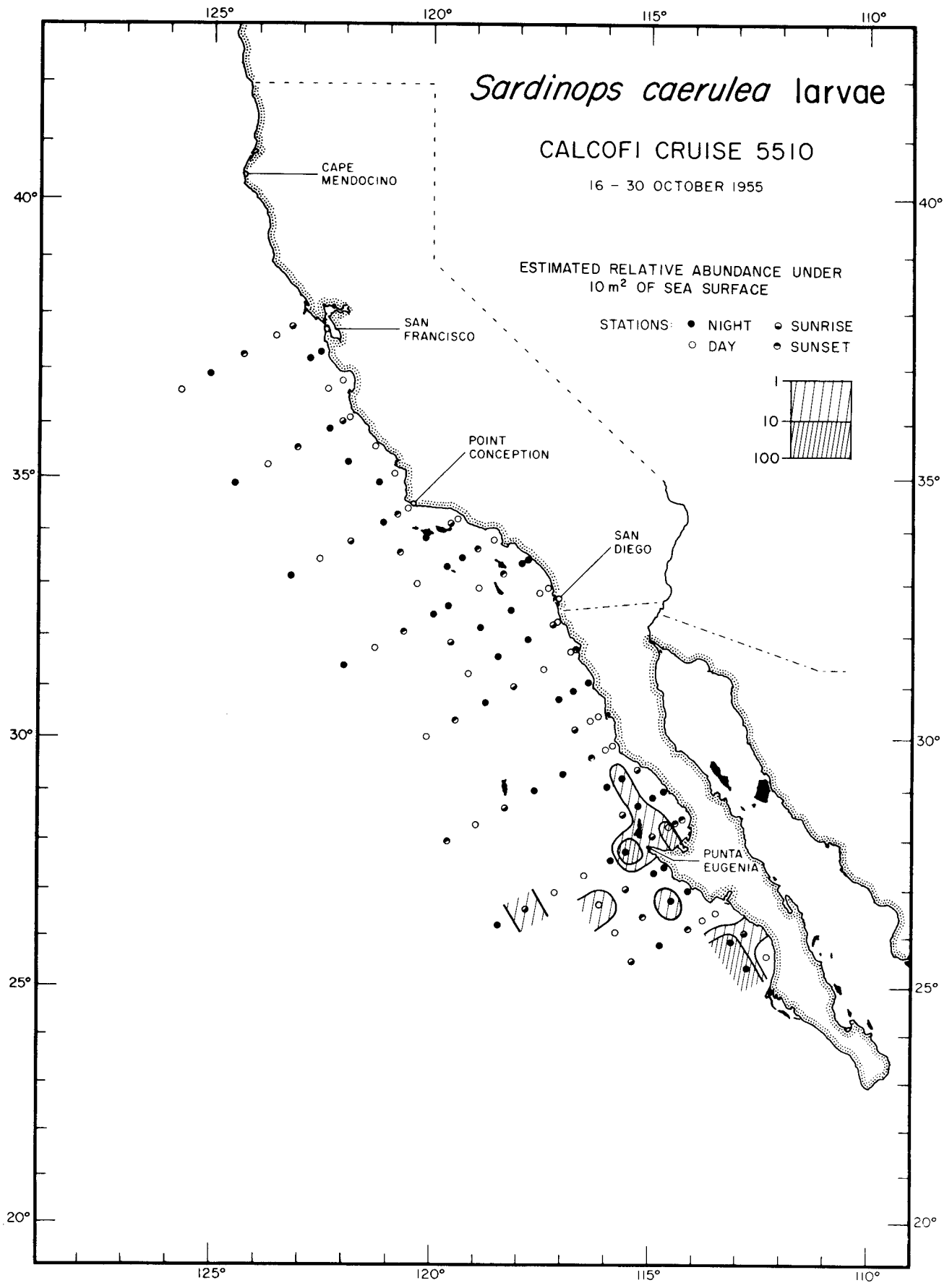


*Sardinops caerulea* larvae  
5410



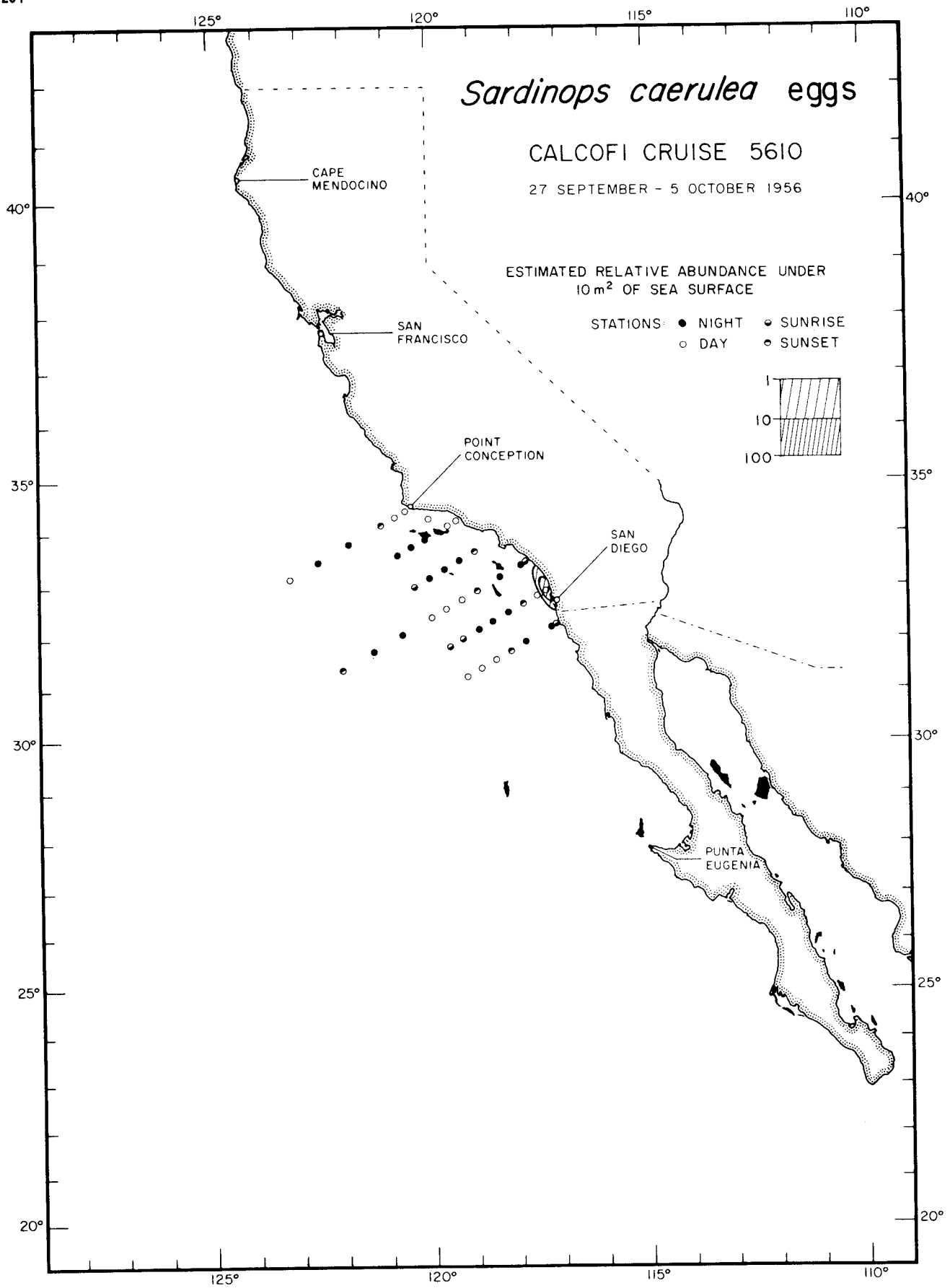
*Sardinops caerulea* eggs

5510

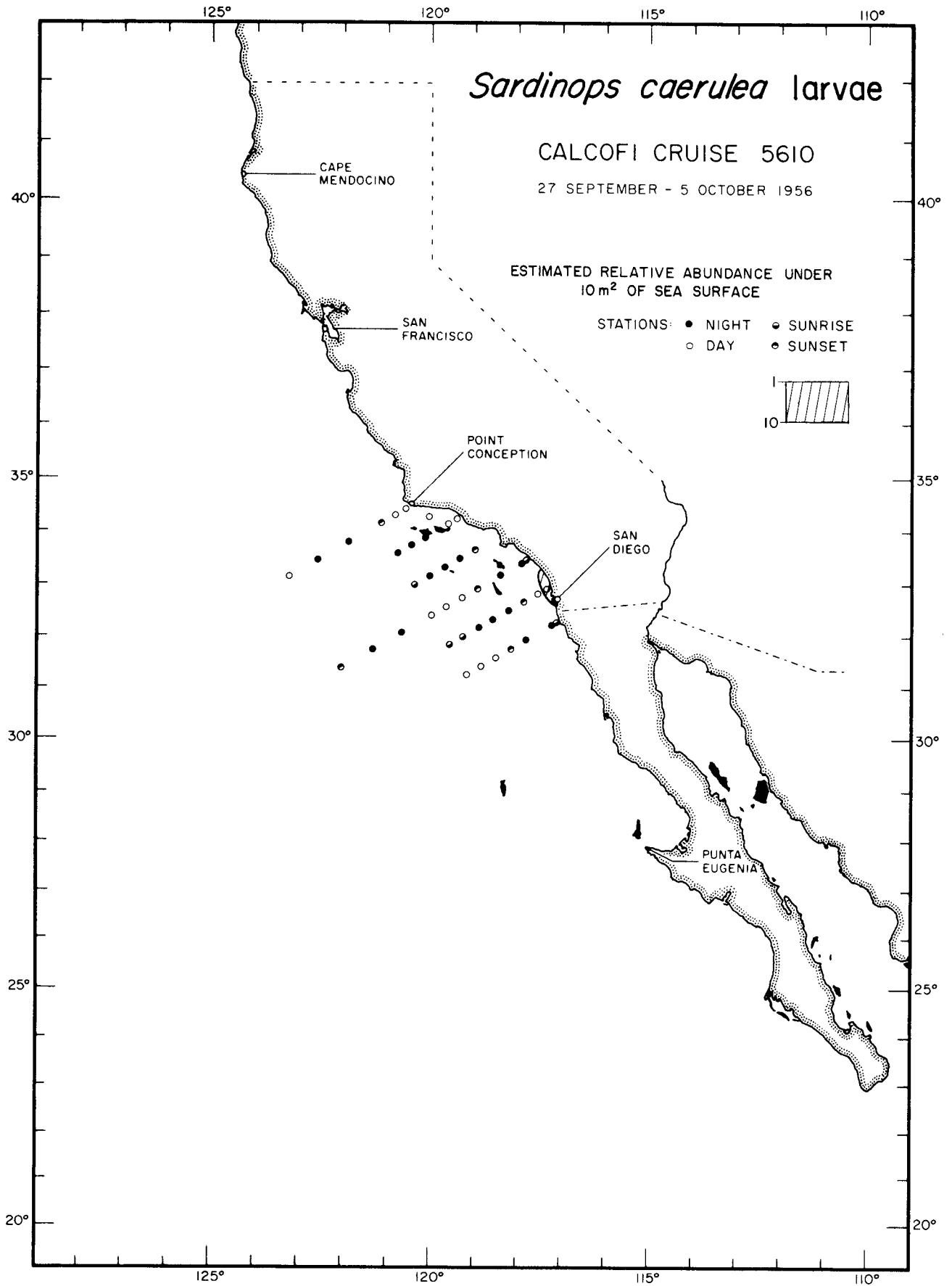


*Sardinops caerulea* larvae

5510

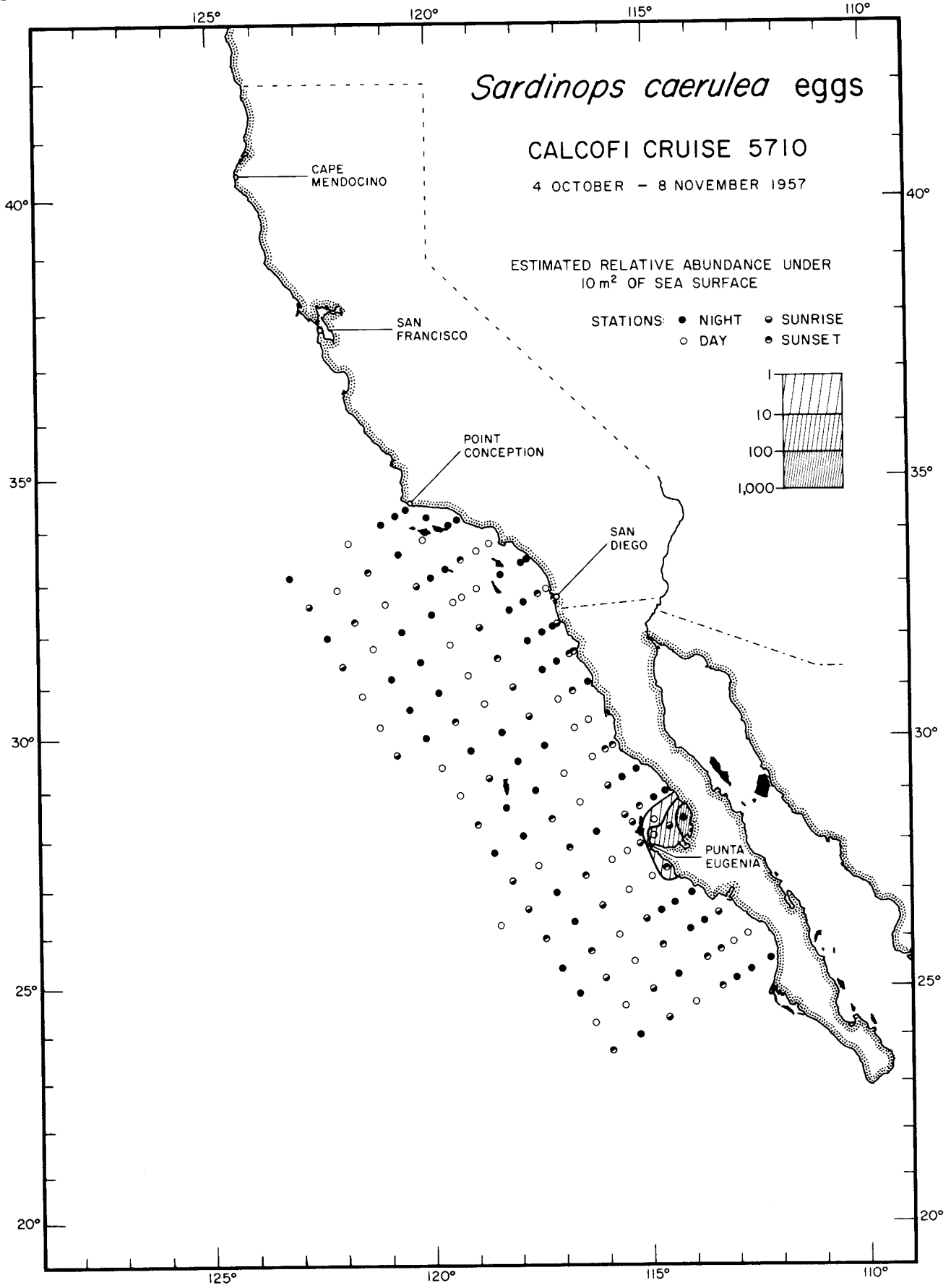
*Sardinops caerulea* eggs

5610

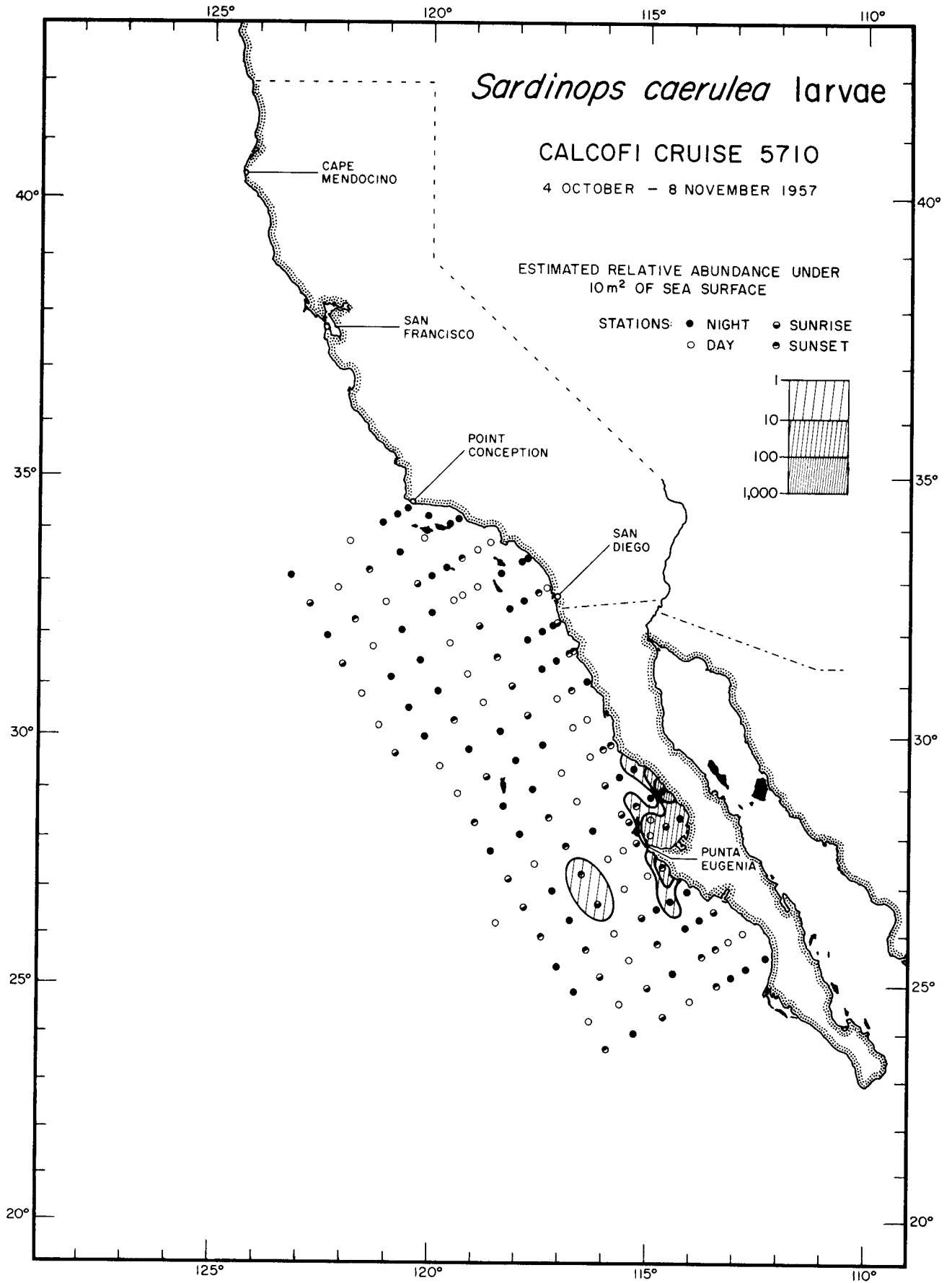


*Sardinops caerulea* larvae

5610



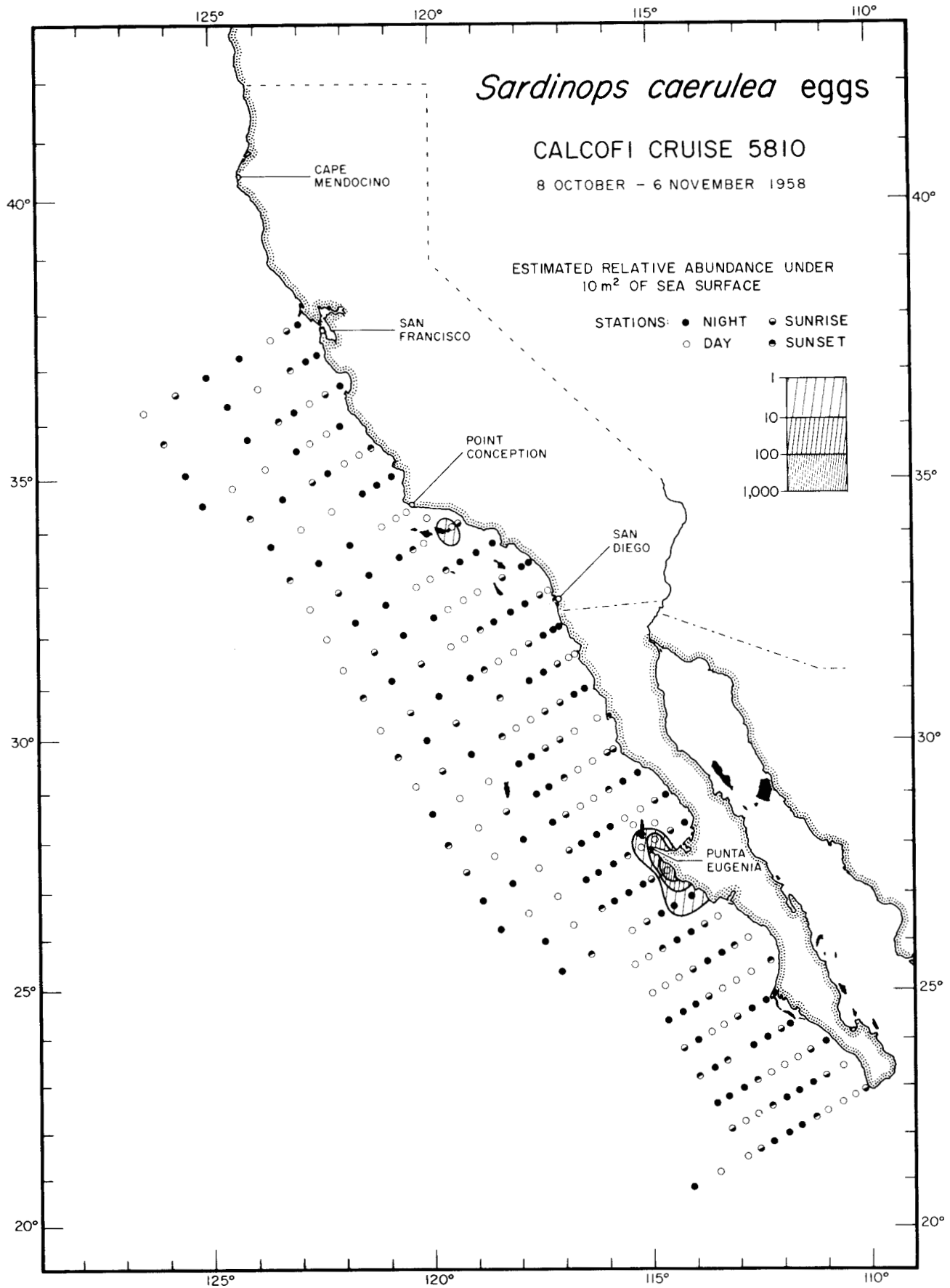
*Sardinops caerulea* eggs  
5710



*Sardinops caerulea* larvae

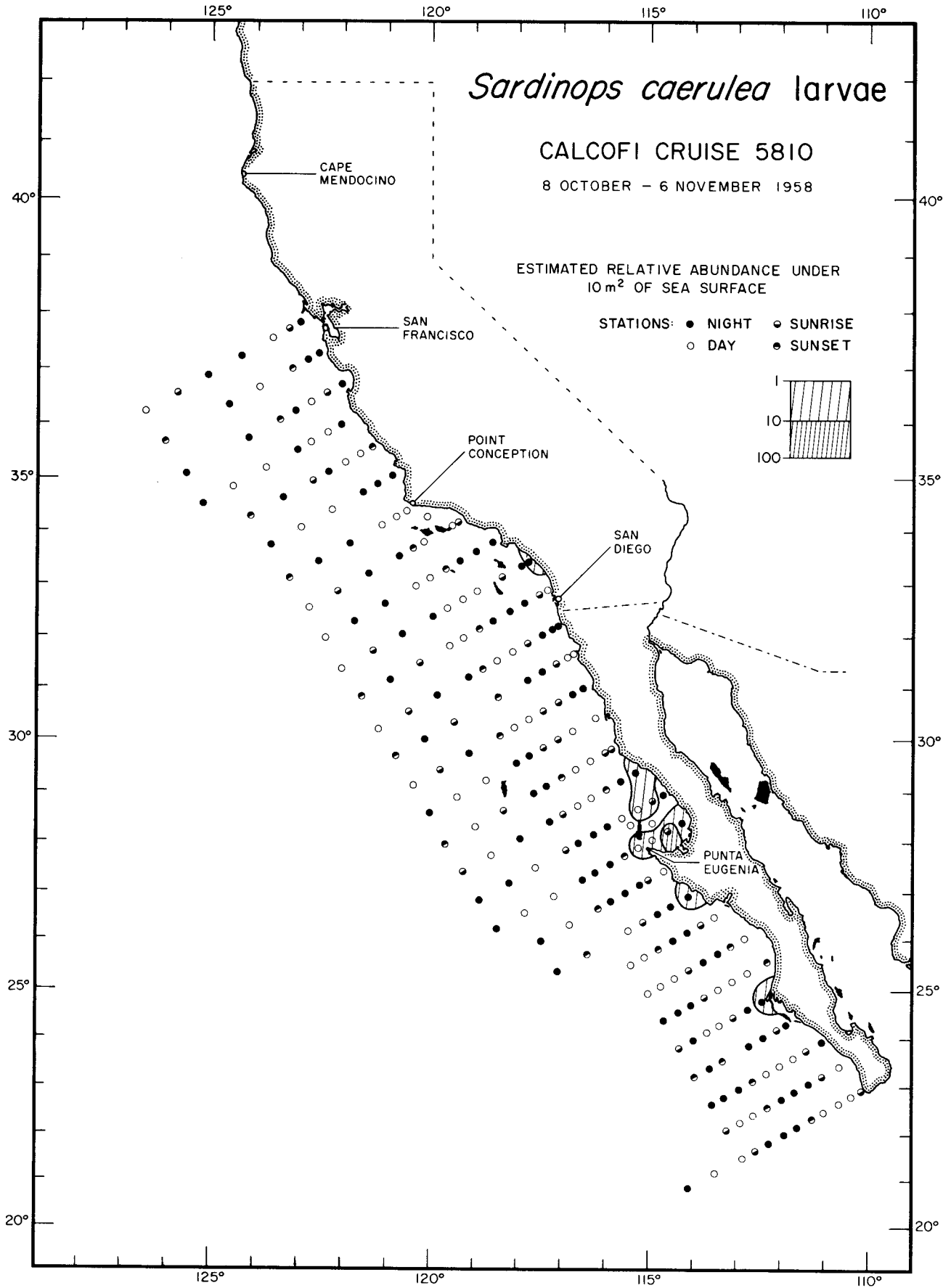
5710



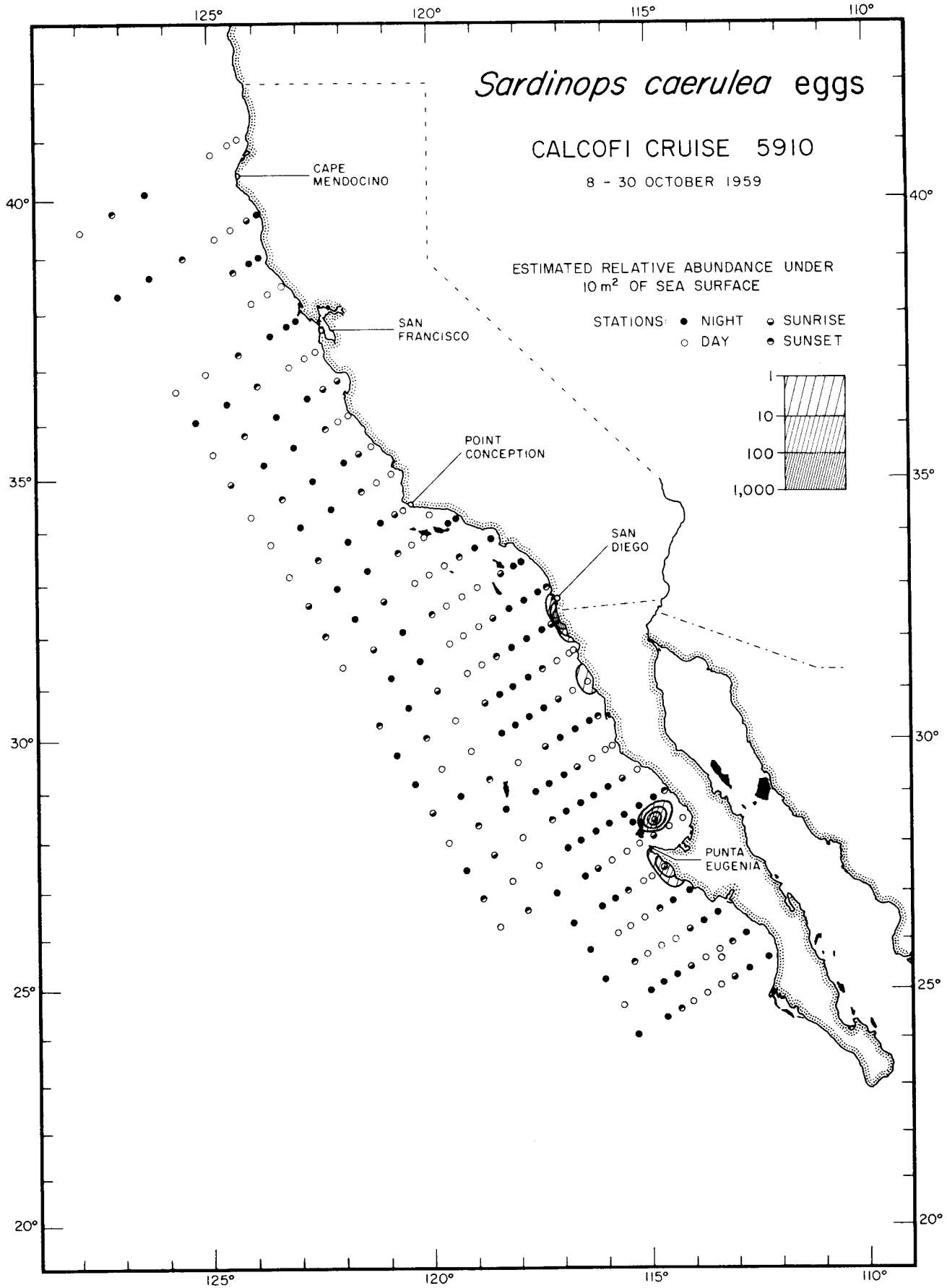


*Sardinops caerulea* eggs

5810

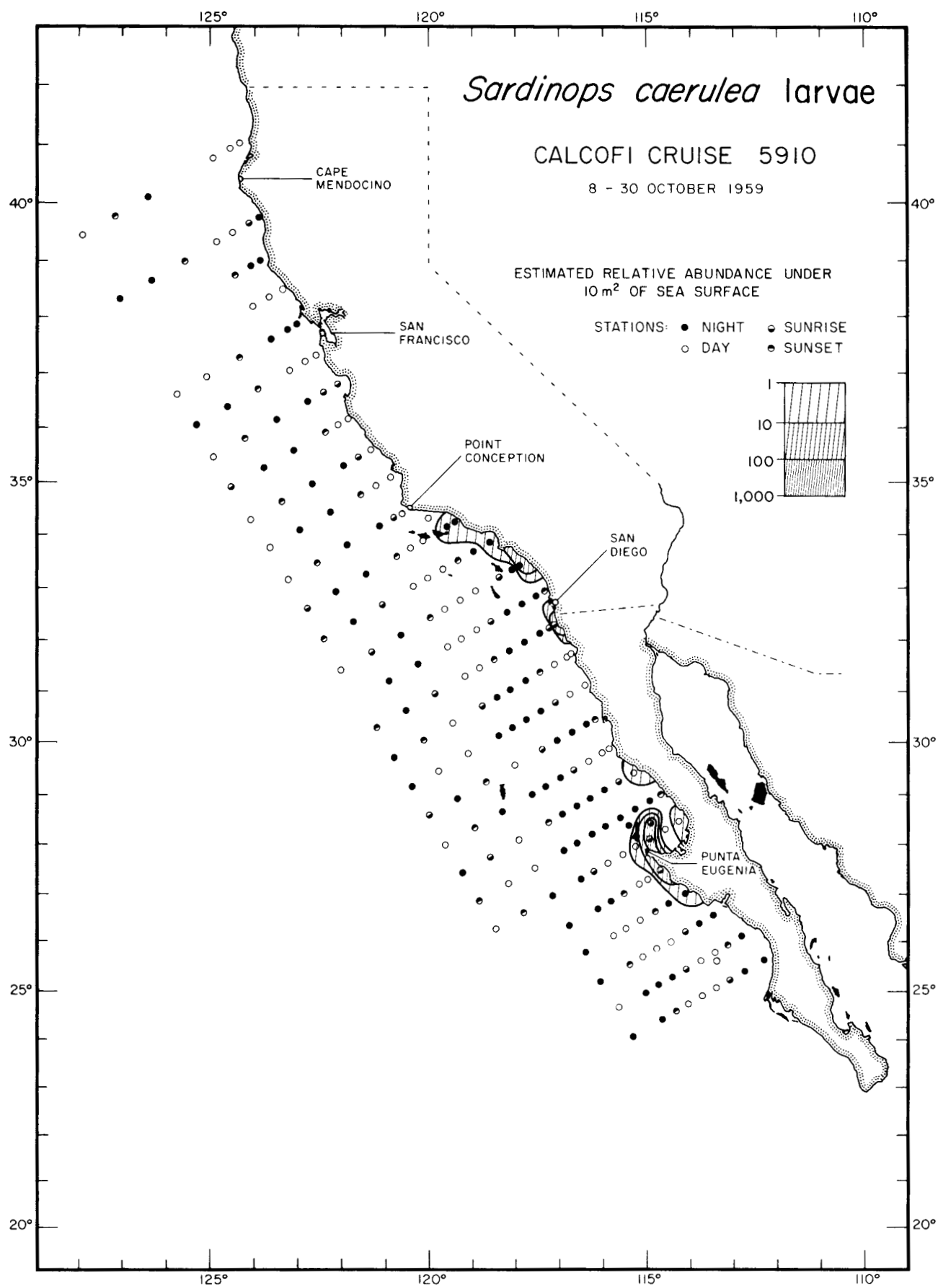


*Sardinops caerulea* larvae  
5810



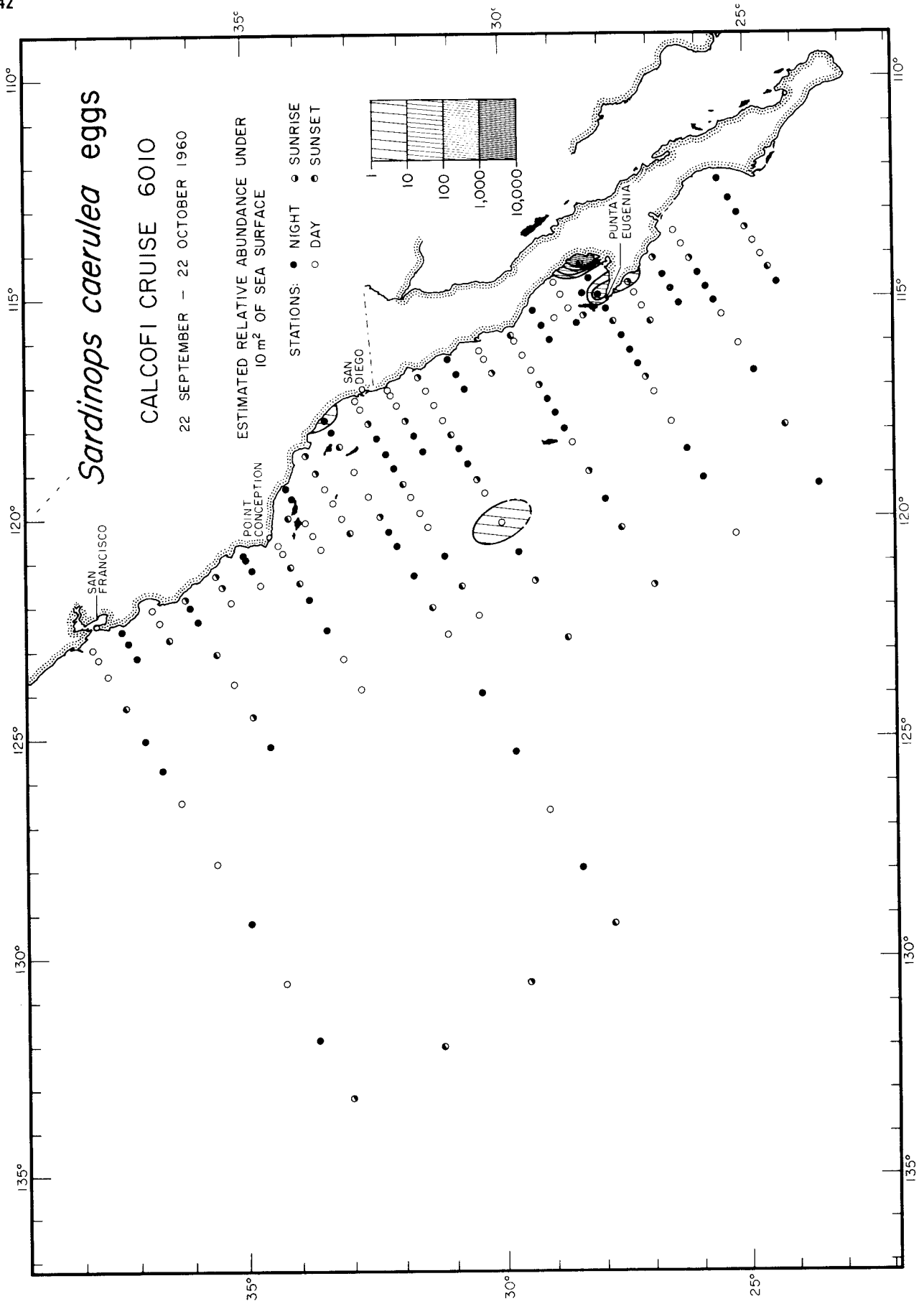
*Sardinops caerulea* eggs

5910



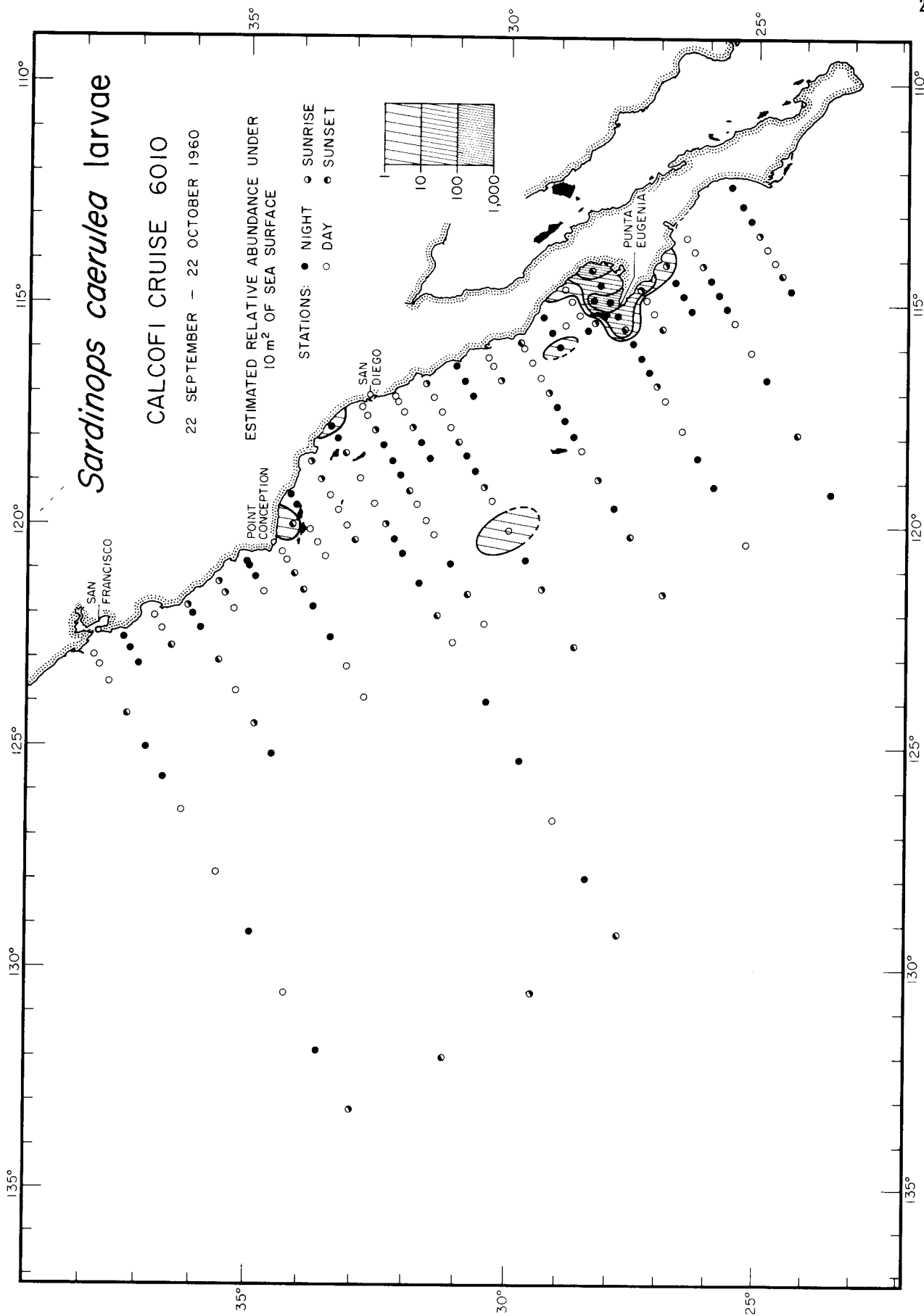
*Sardinops caerulea* larvae

5910



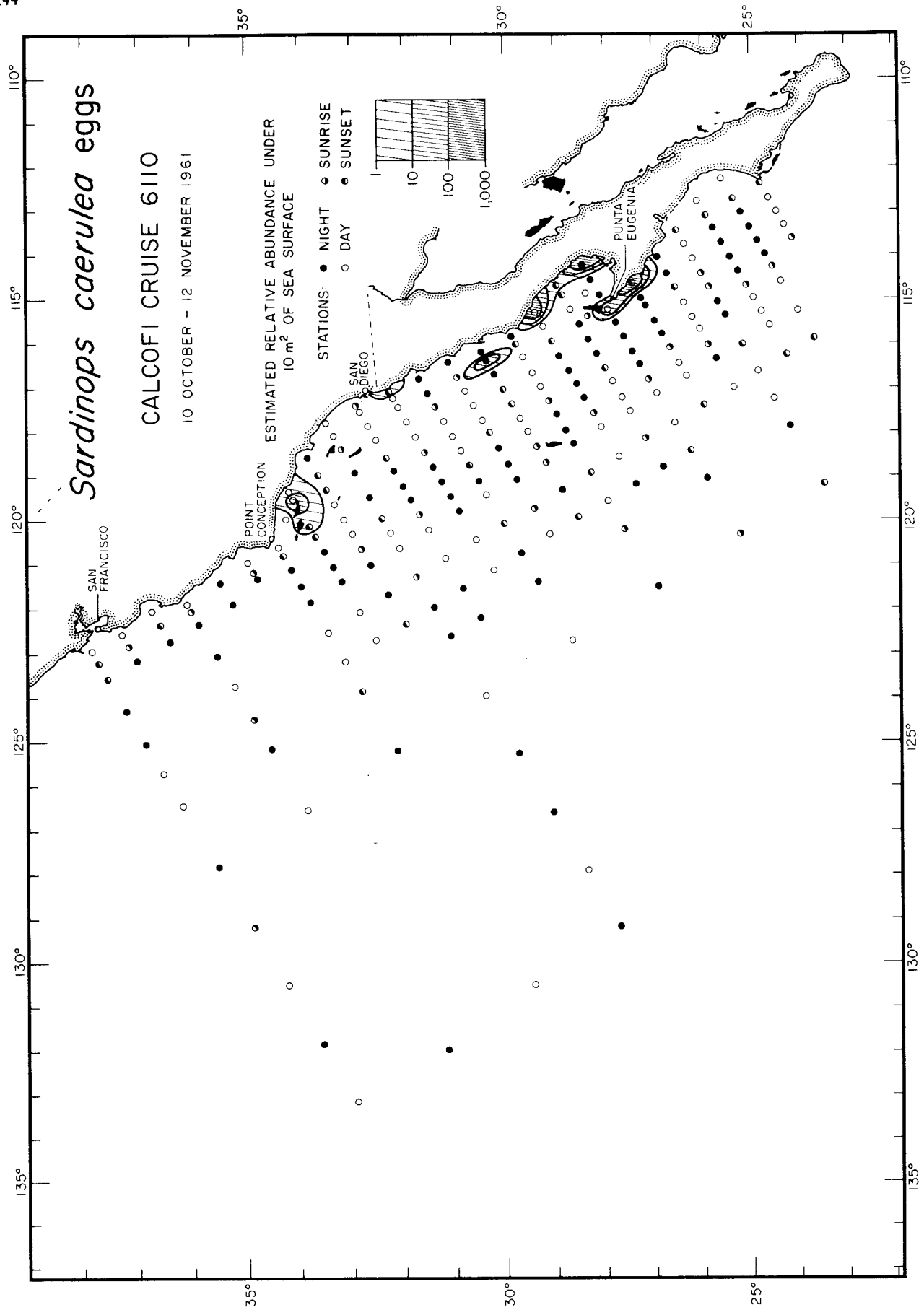
*Sardinops caerulea* eggs

6010



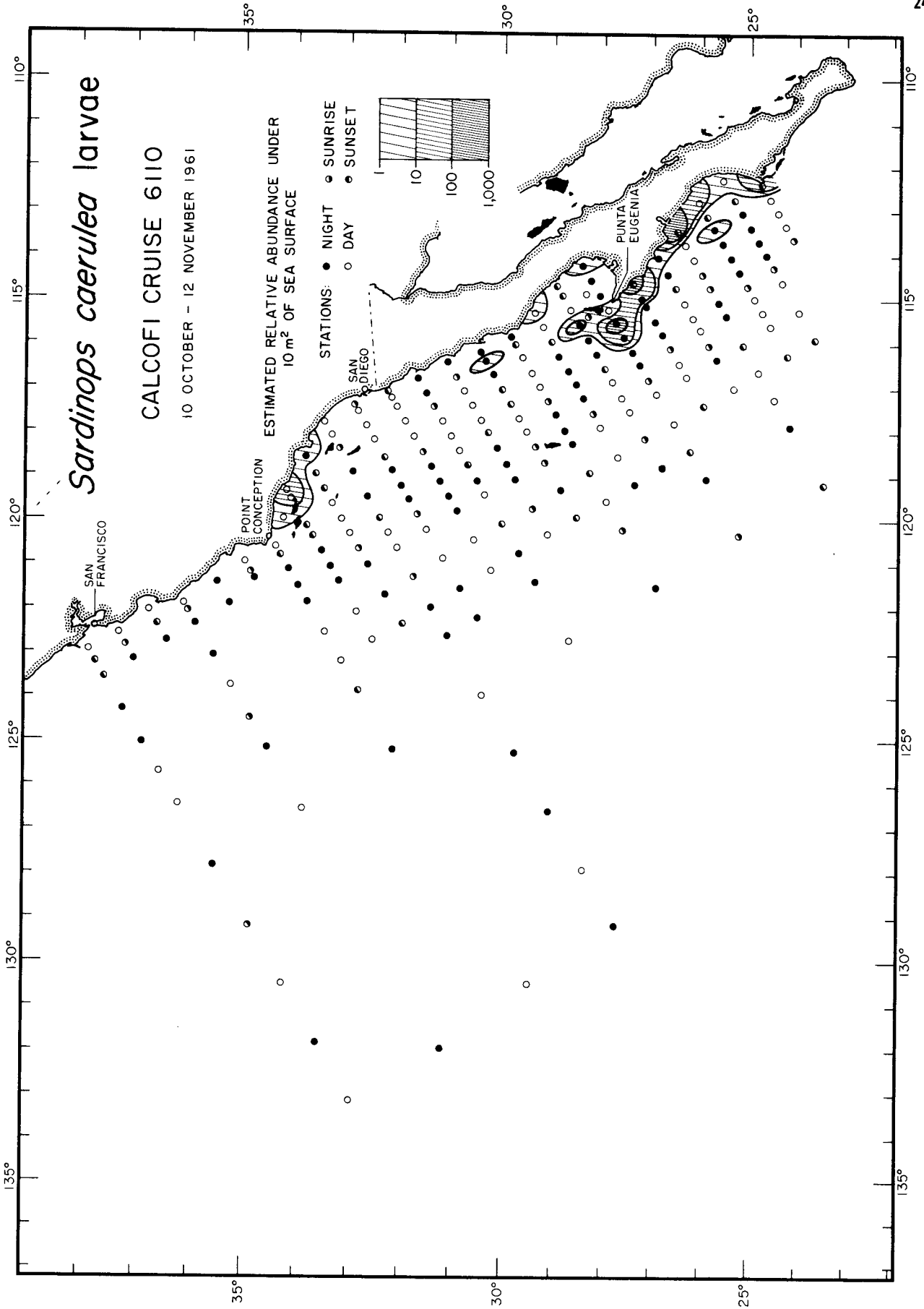
*Sardinops caerulea* larvae

6010



*Sardinops caerulea* eggs

6110

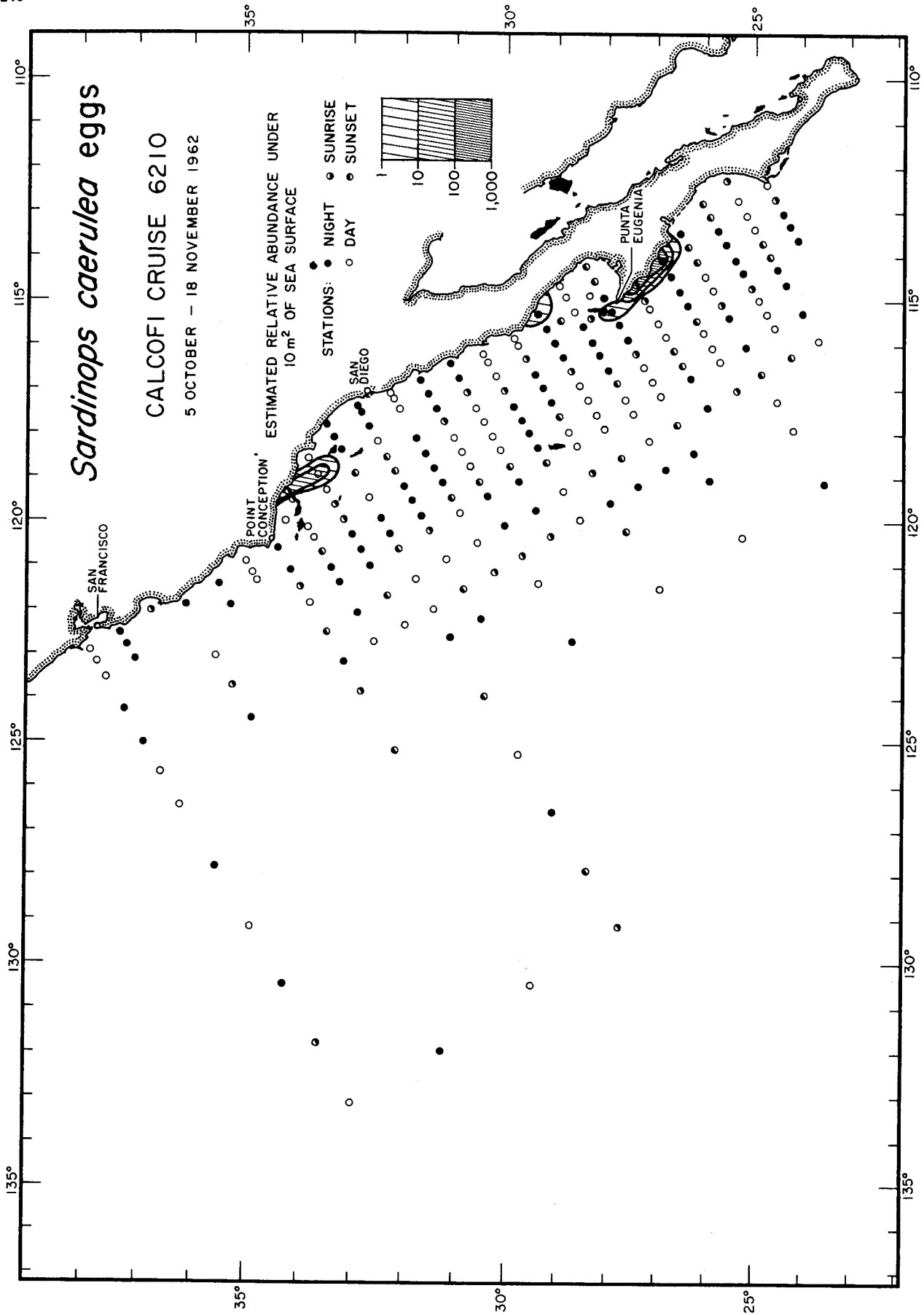


*Sardinops caerulea* larvae

6110

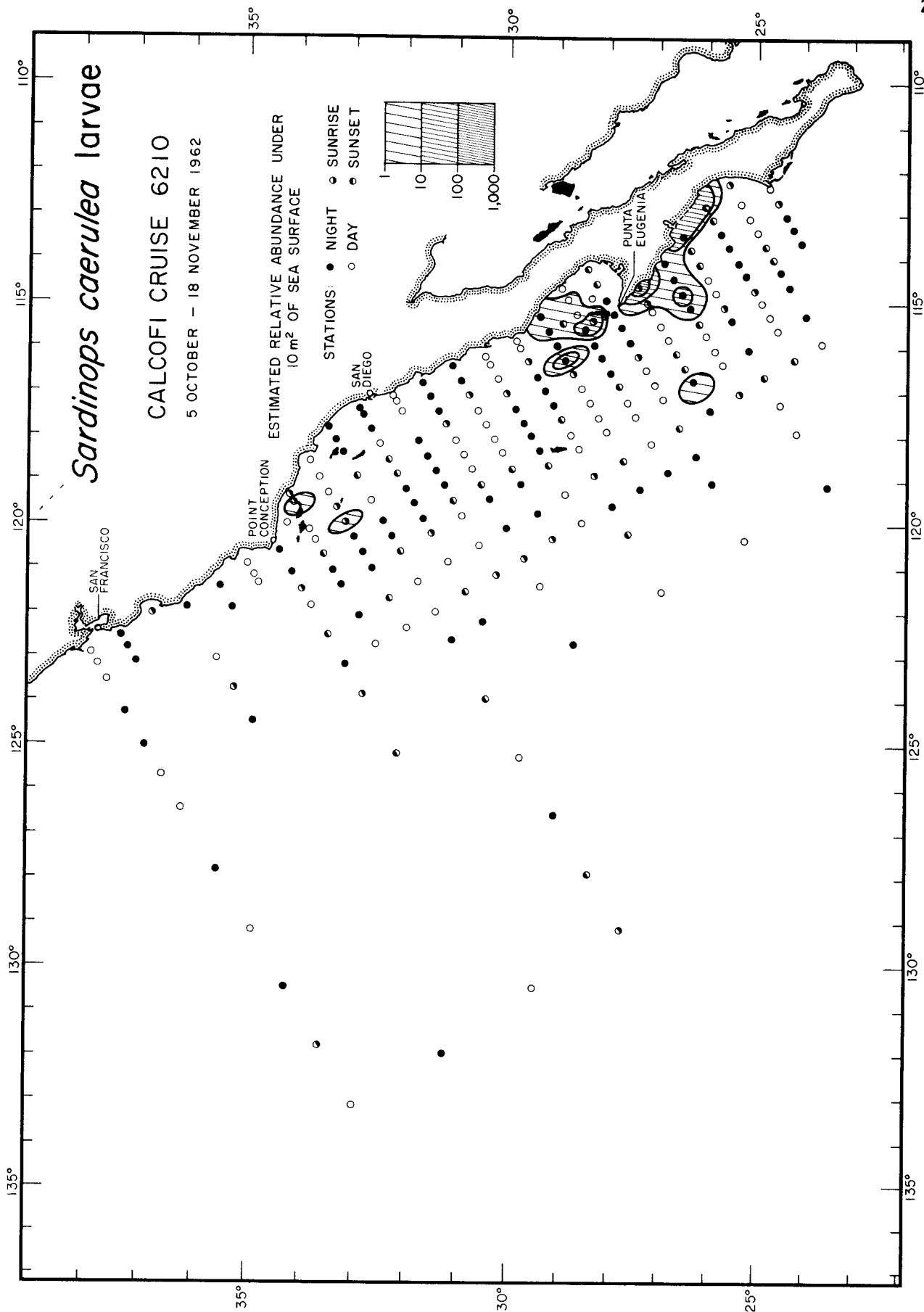






*Sardinops caerulea* eggs

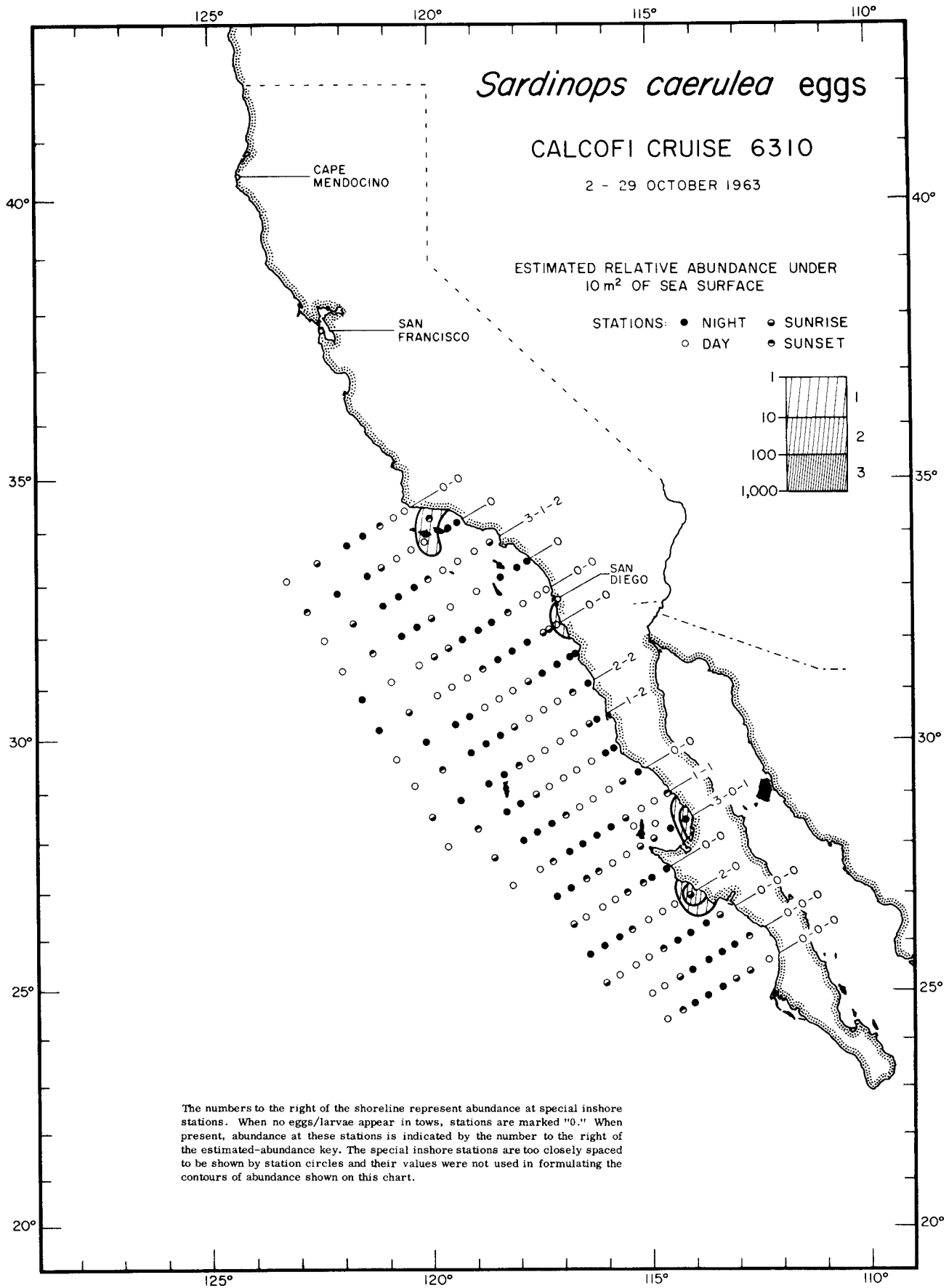
6210



*Sardinops caerulea* larvae

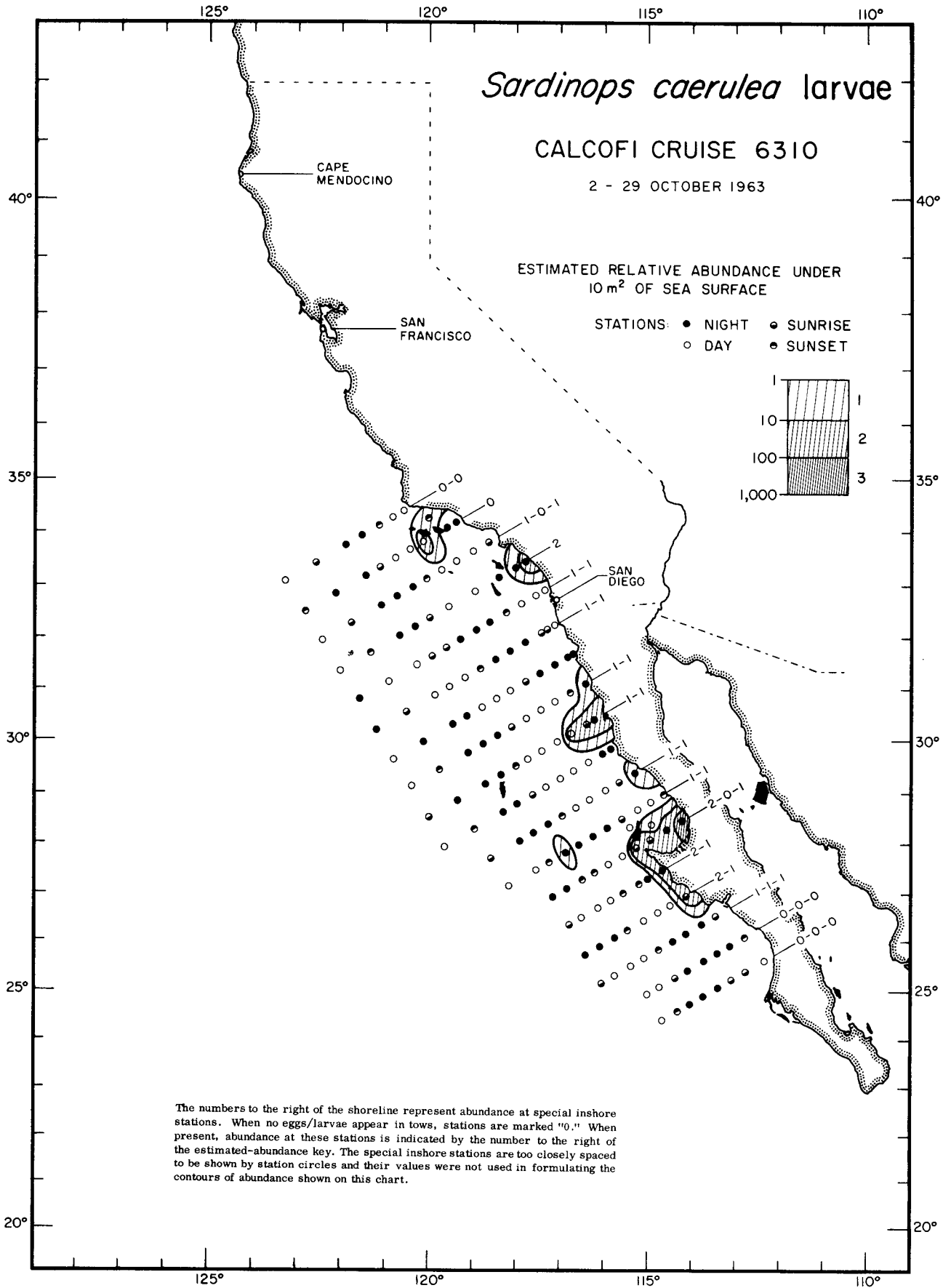
6210





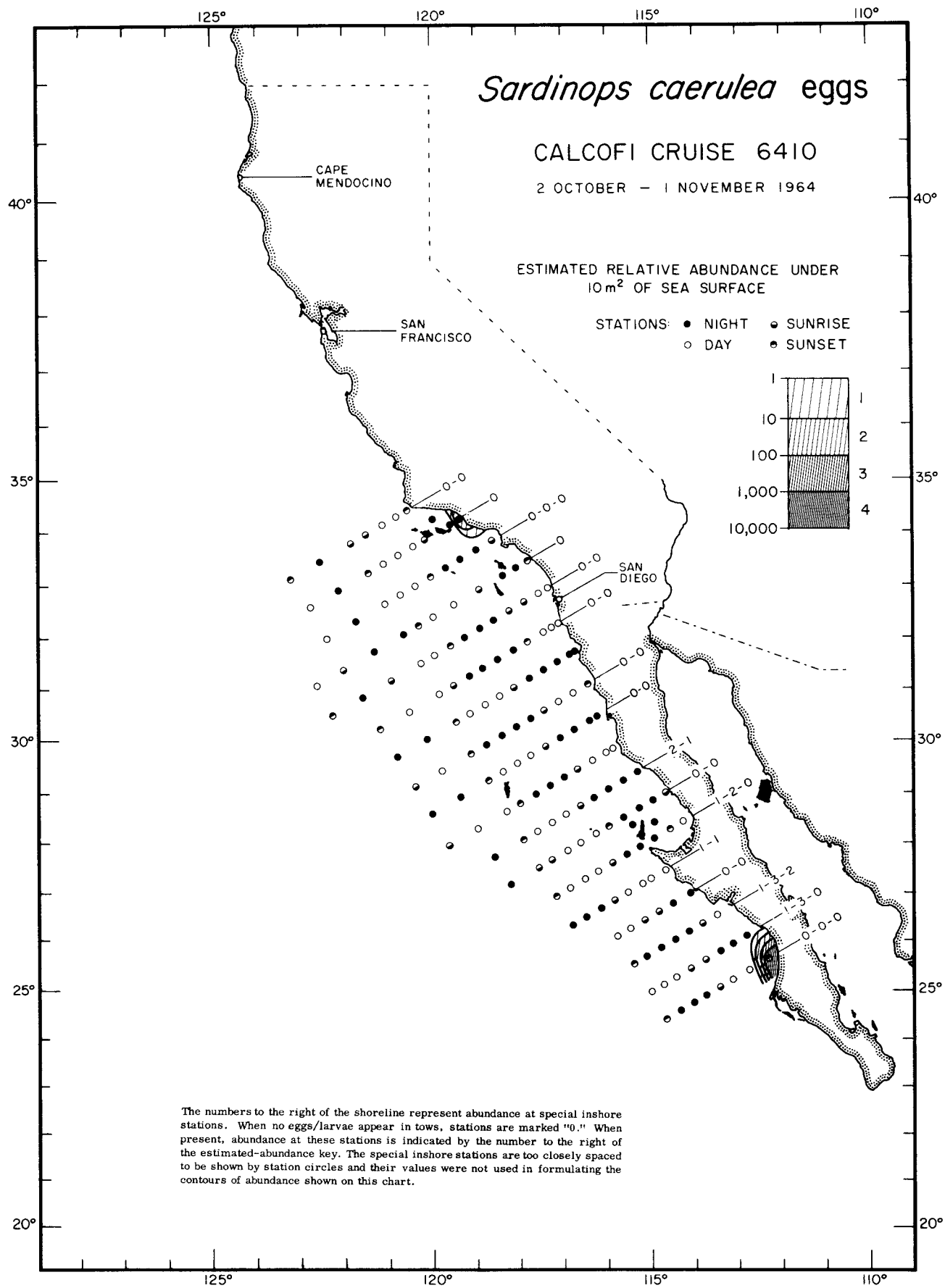
*Sardinops caerulea* eggs

6310



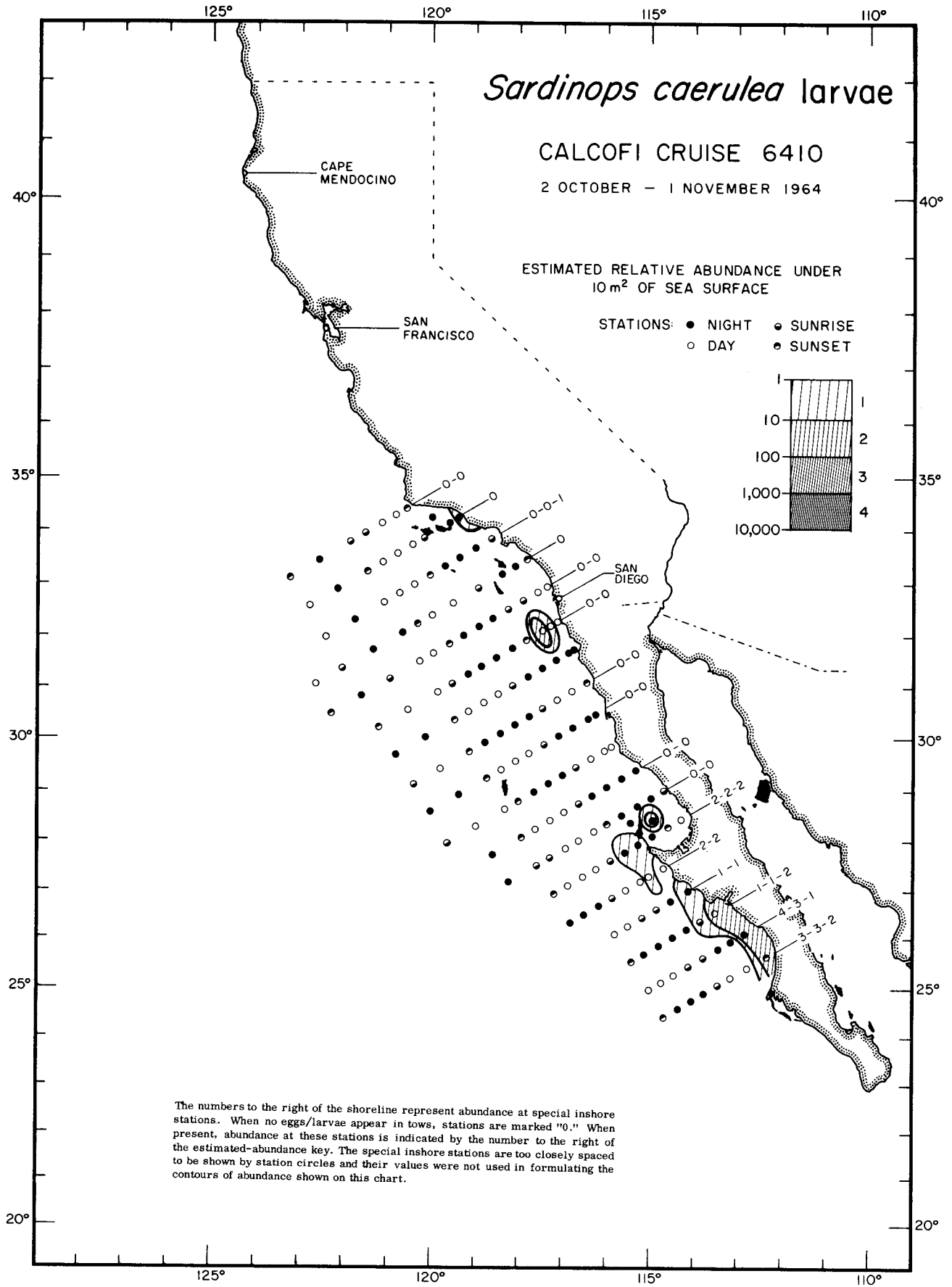
*Sardinops caerulea* larvae

6310



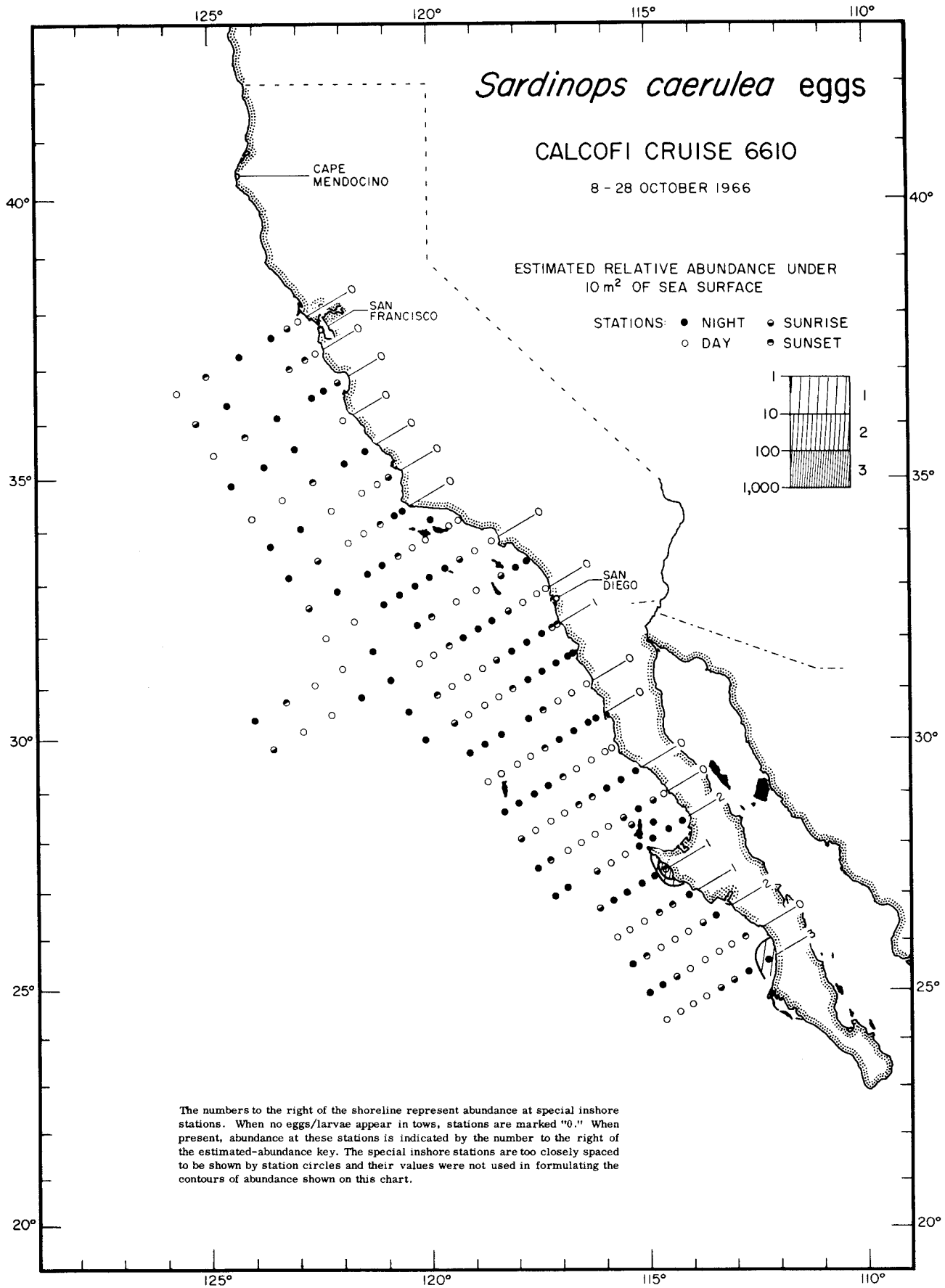
*Sardinops caerulea* eggs

6410



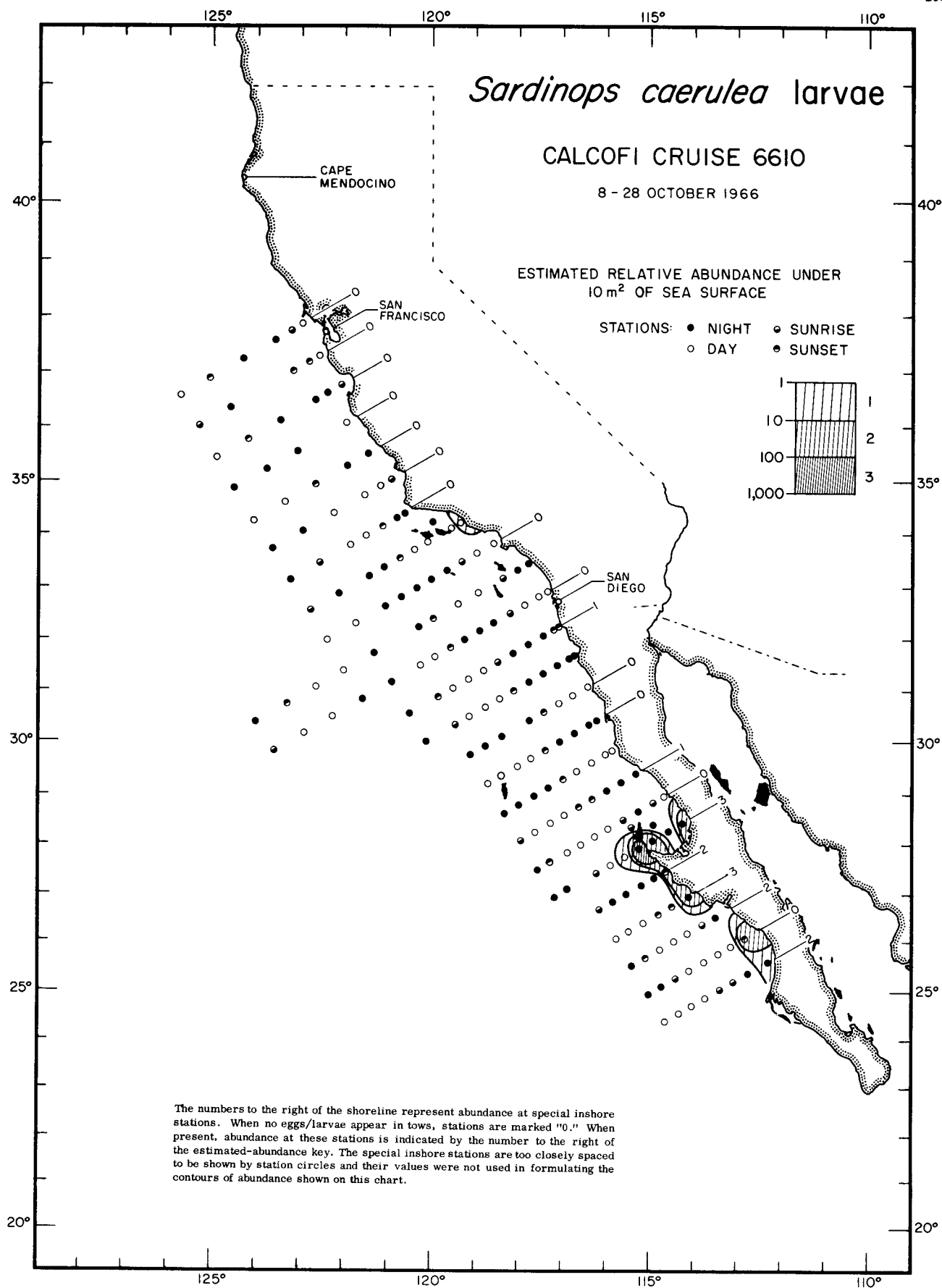
*Sardinops caerulea* larvae

6410



*Sardinops caerulea* eggs

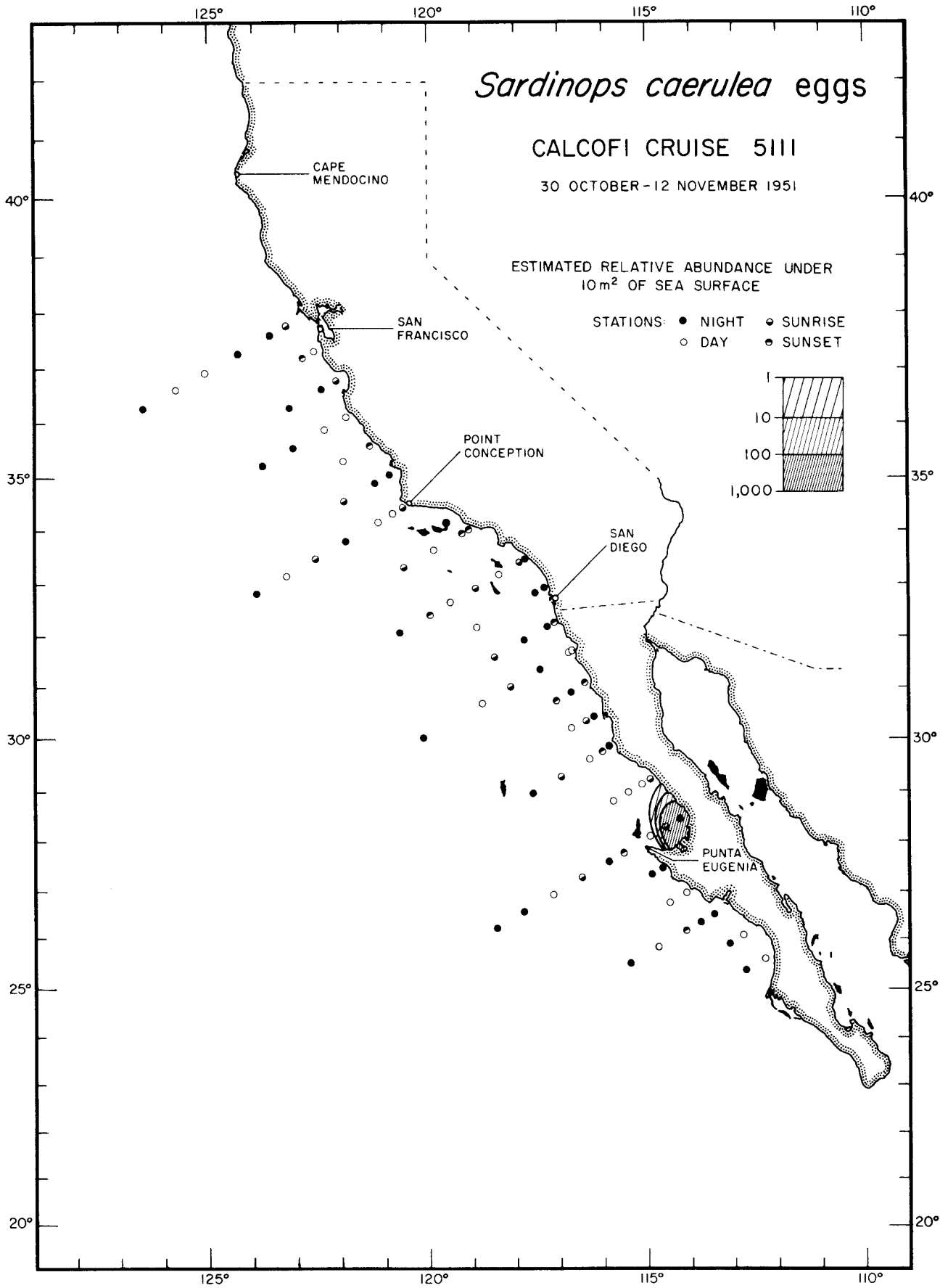
6610



*Sardinops caerulea* larvae

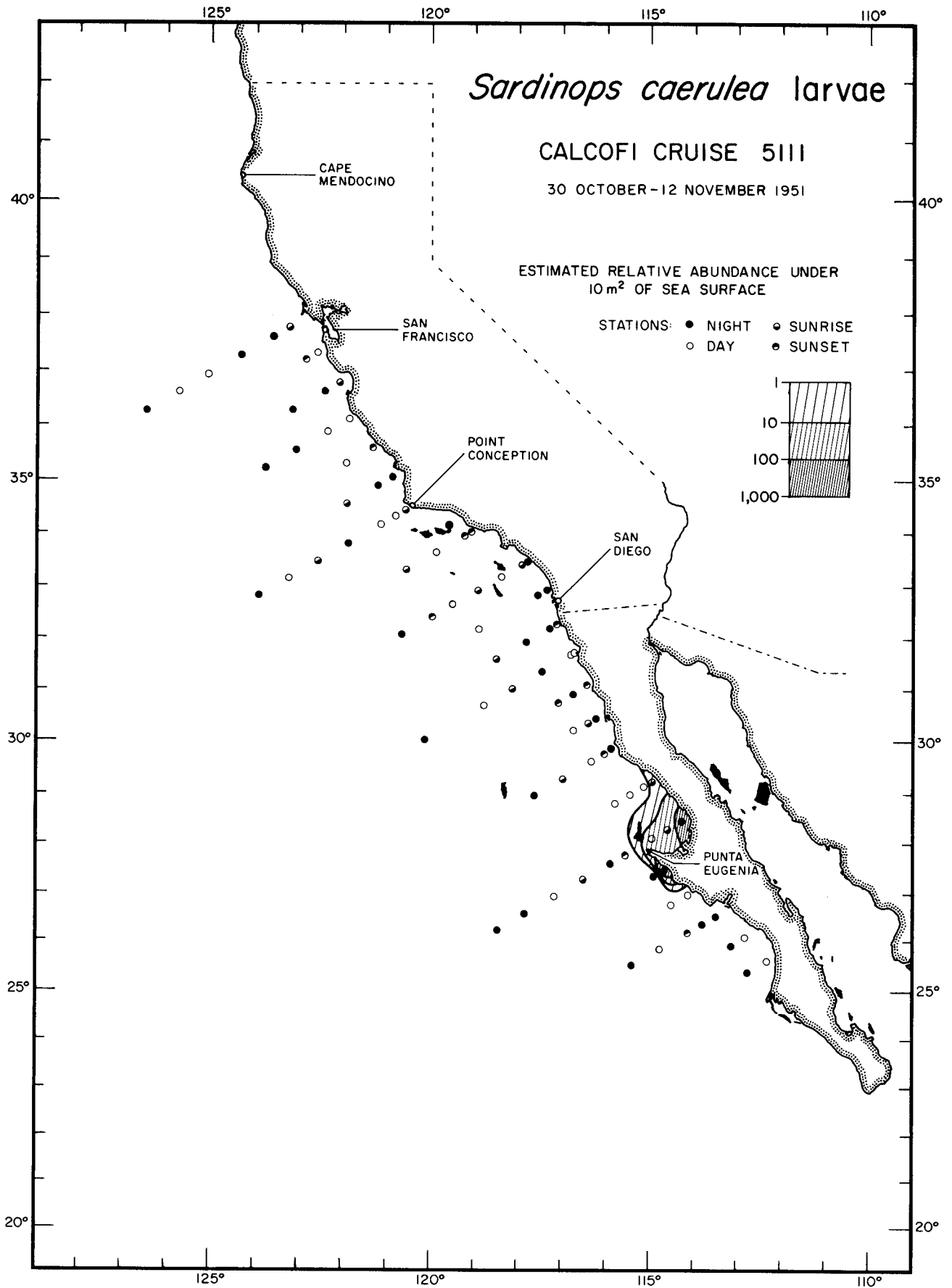
6610





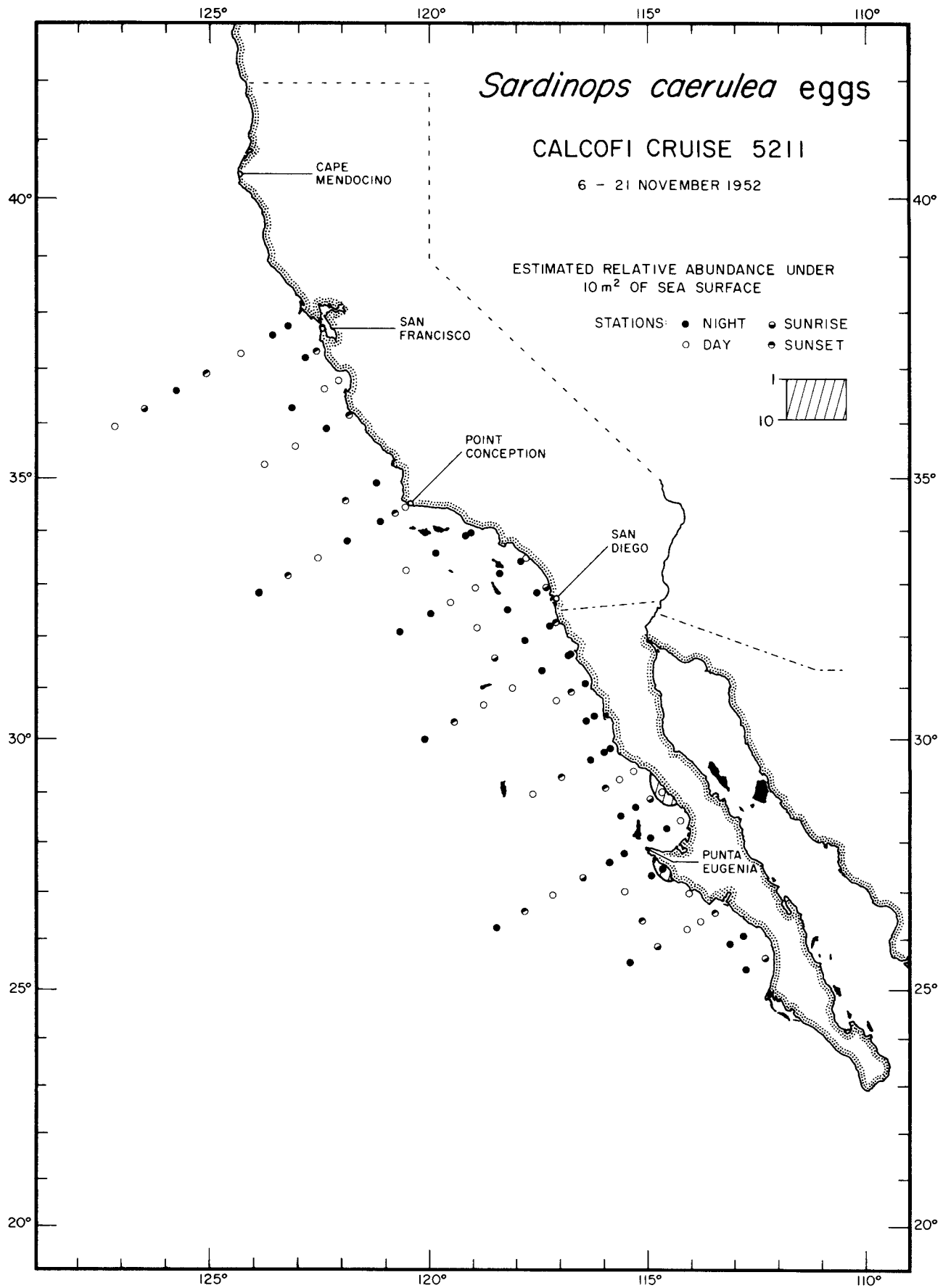
*Sardinops caerulea* eggs

5111

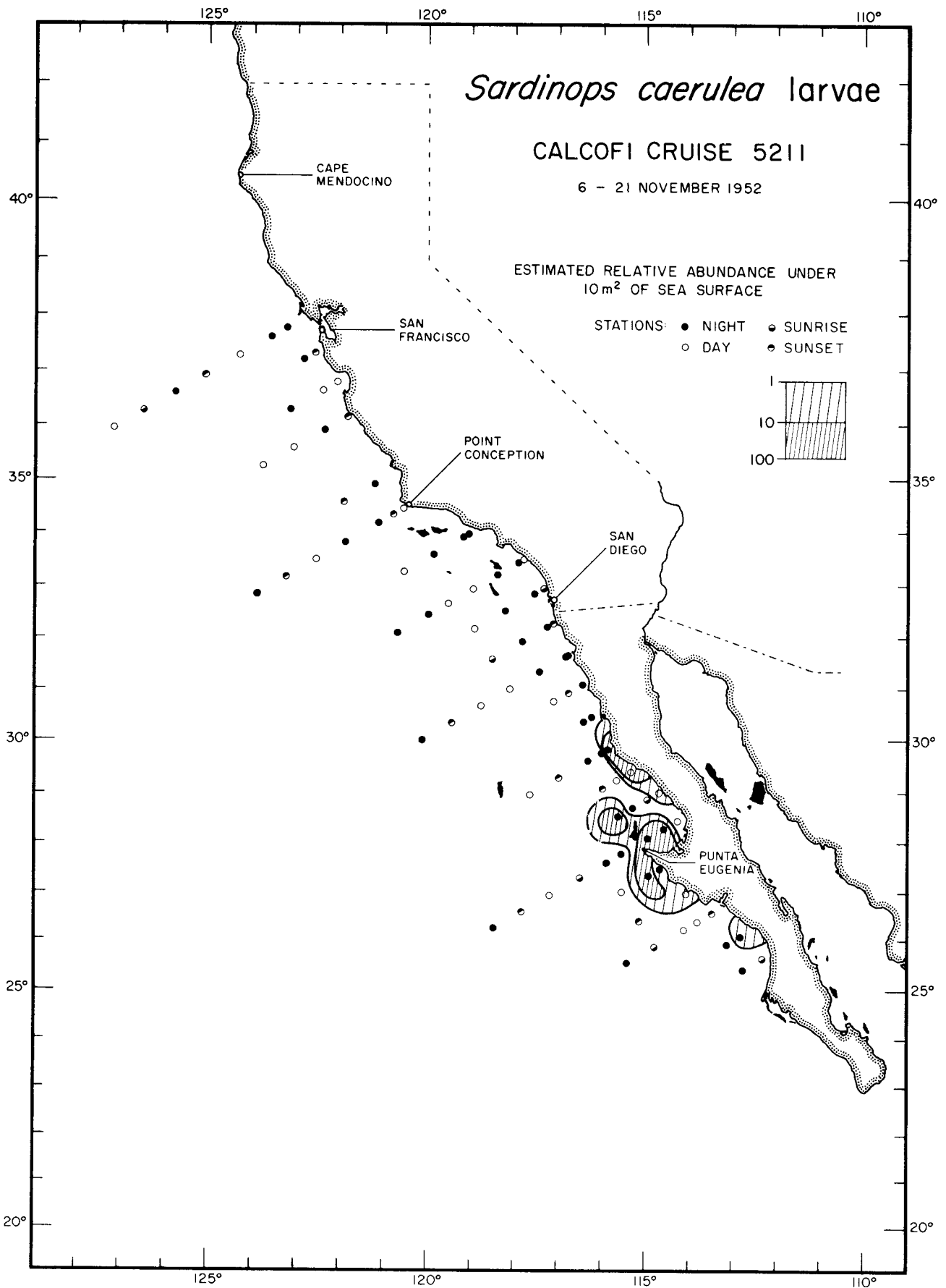


*Sardinops caerulea* larvae

5111

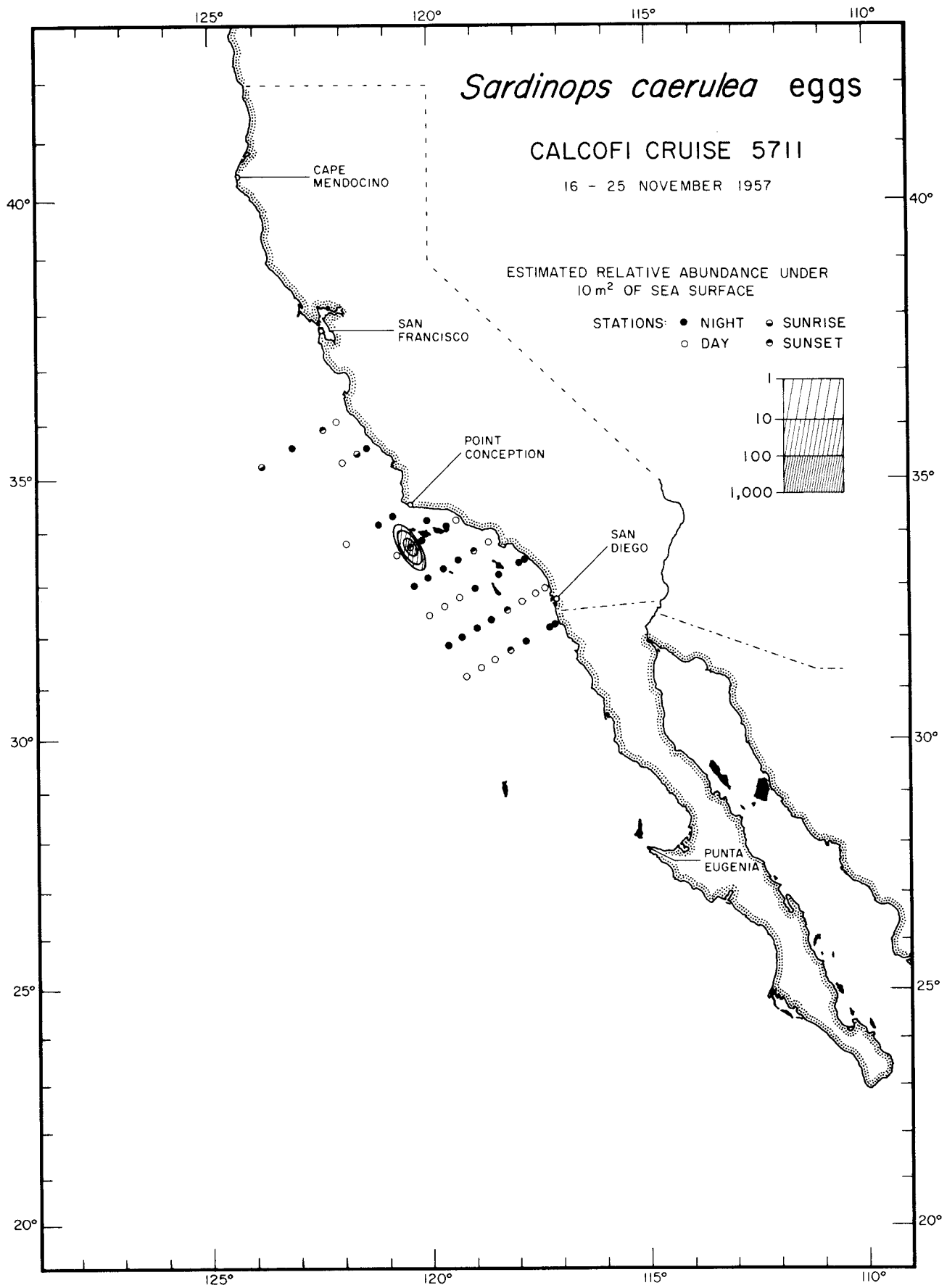
*Sardinops caerulea* eggs

5211



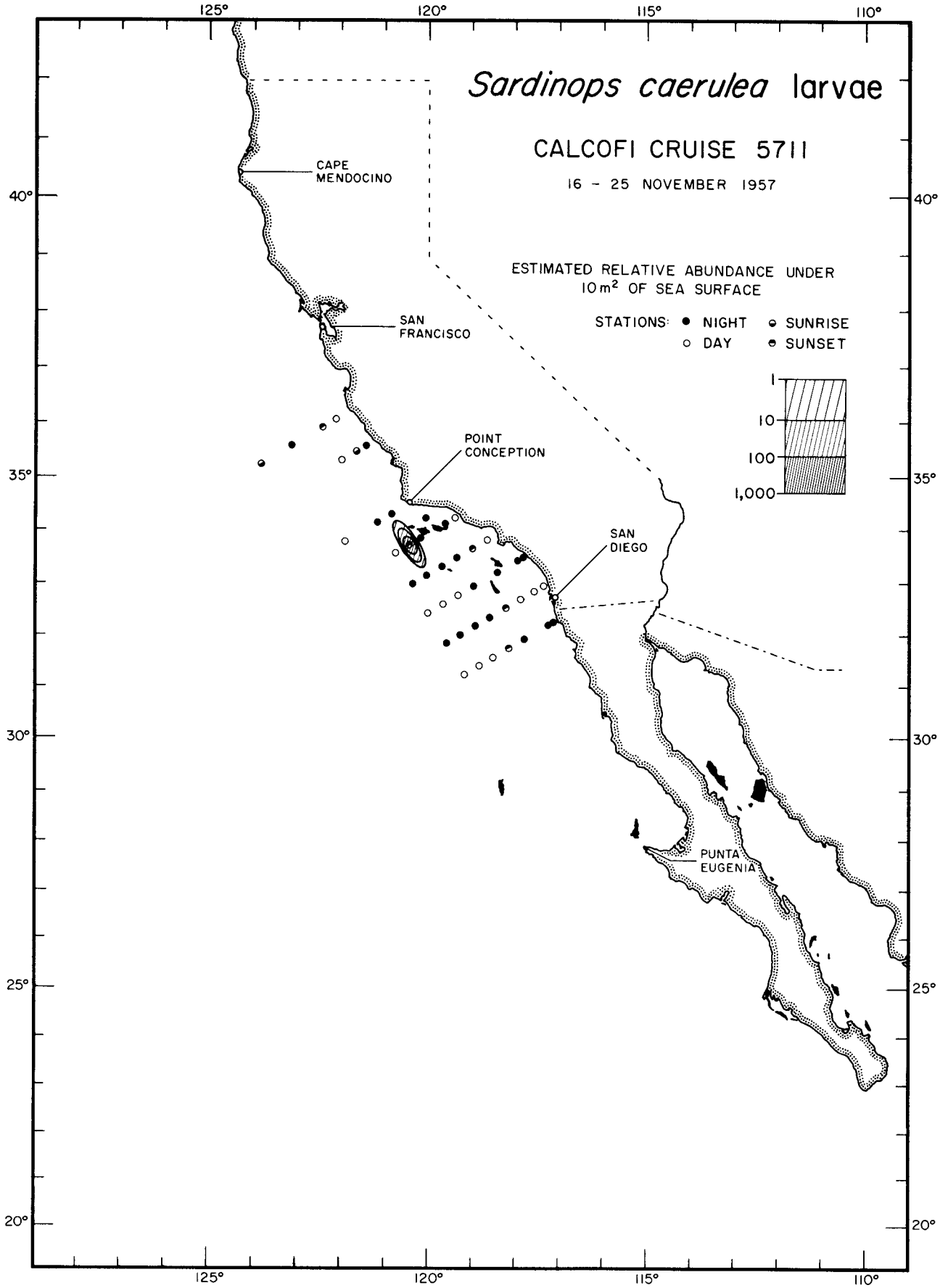
*Sardinops caerulea* larvae

5211

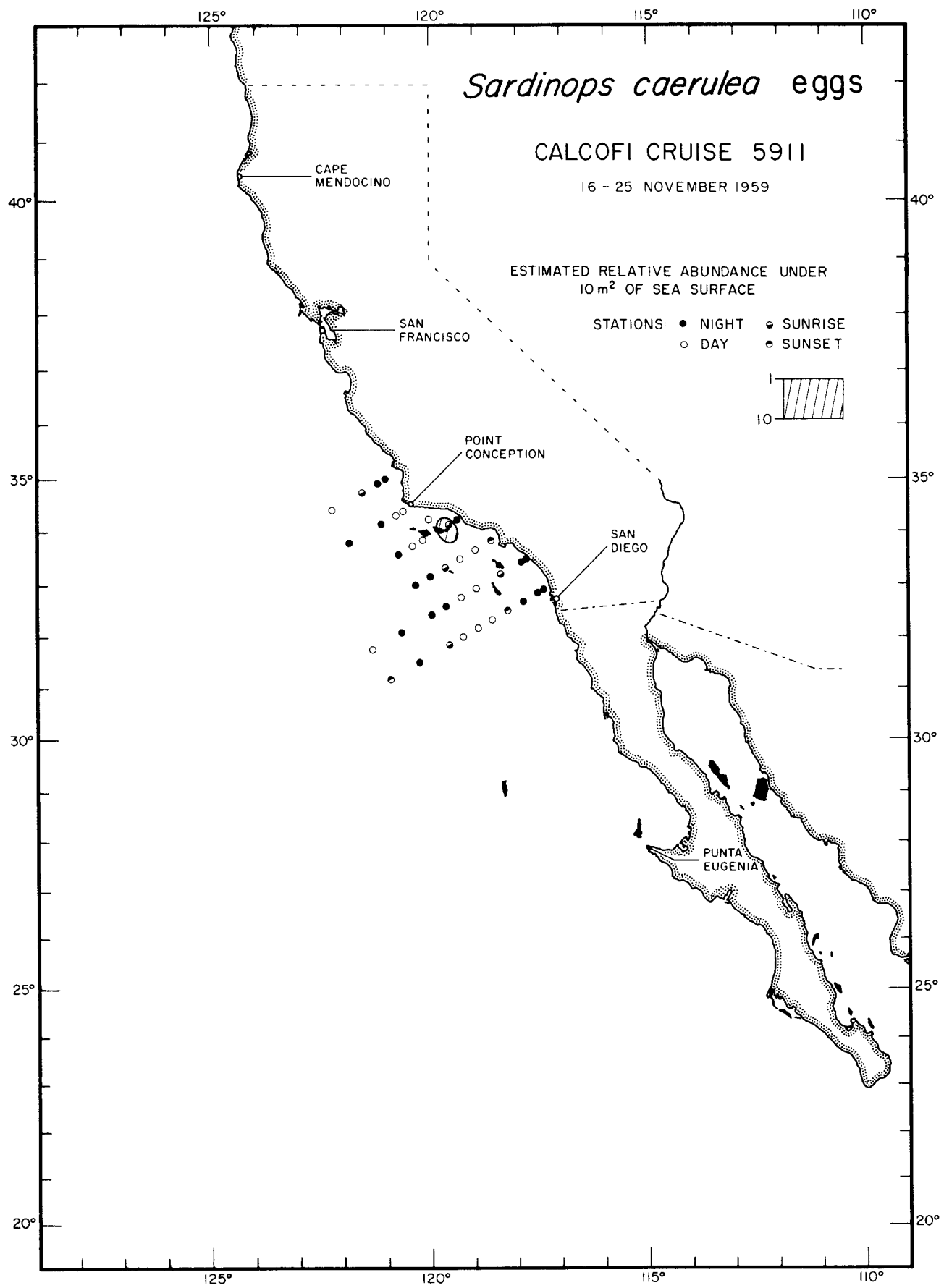


*Sardinops caerulea* eggs

5711

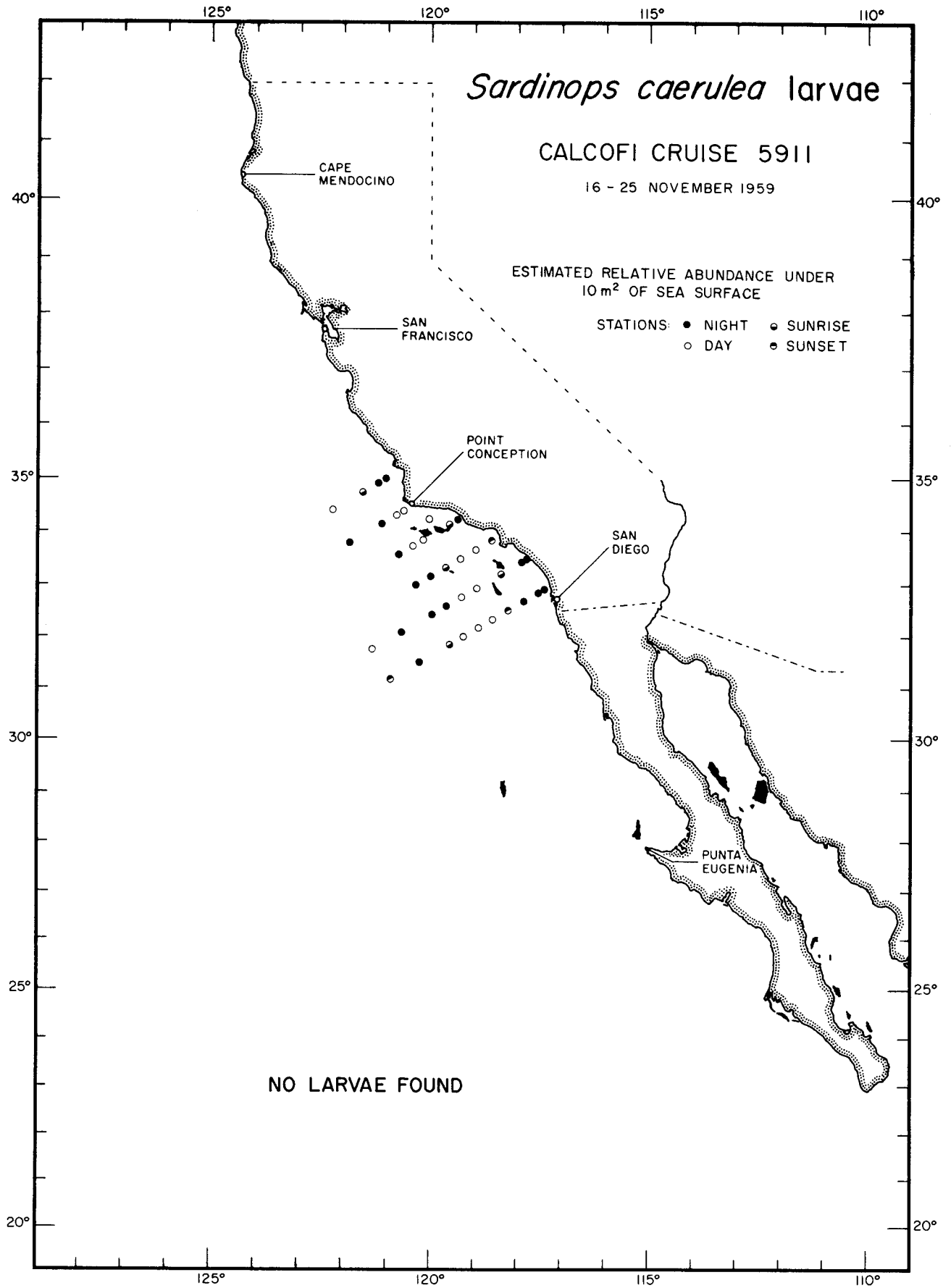


*Sardinops caerulea* larvae  
5711



*Sardinops caerulea* eggs

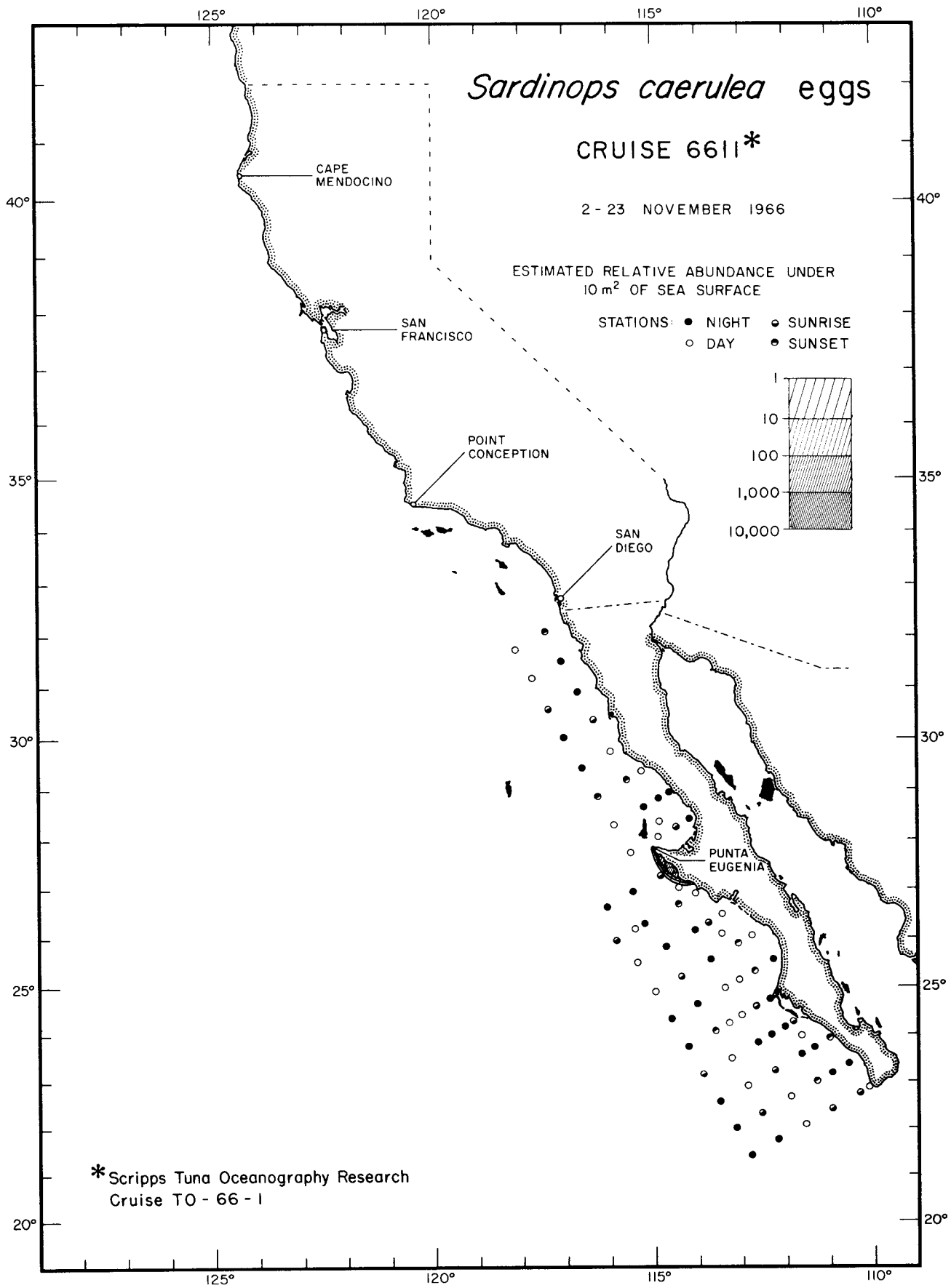
5911



*Sardinops caerulea* larvae

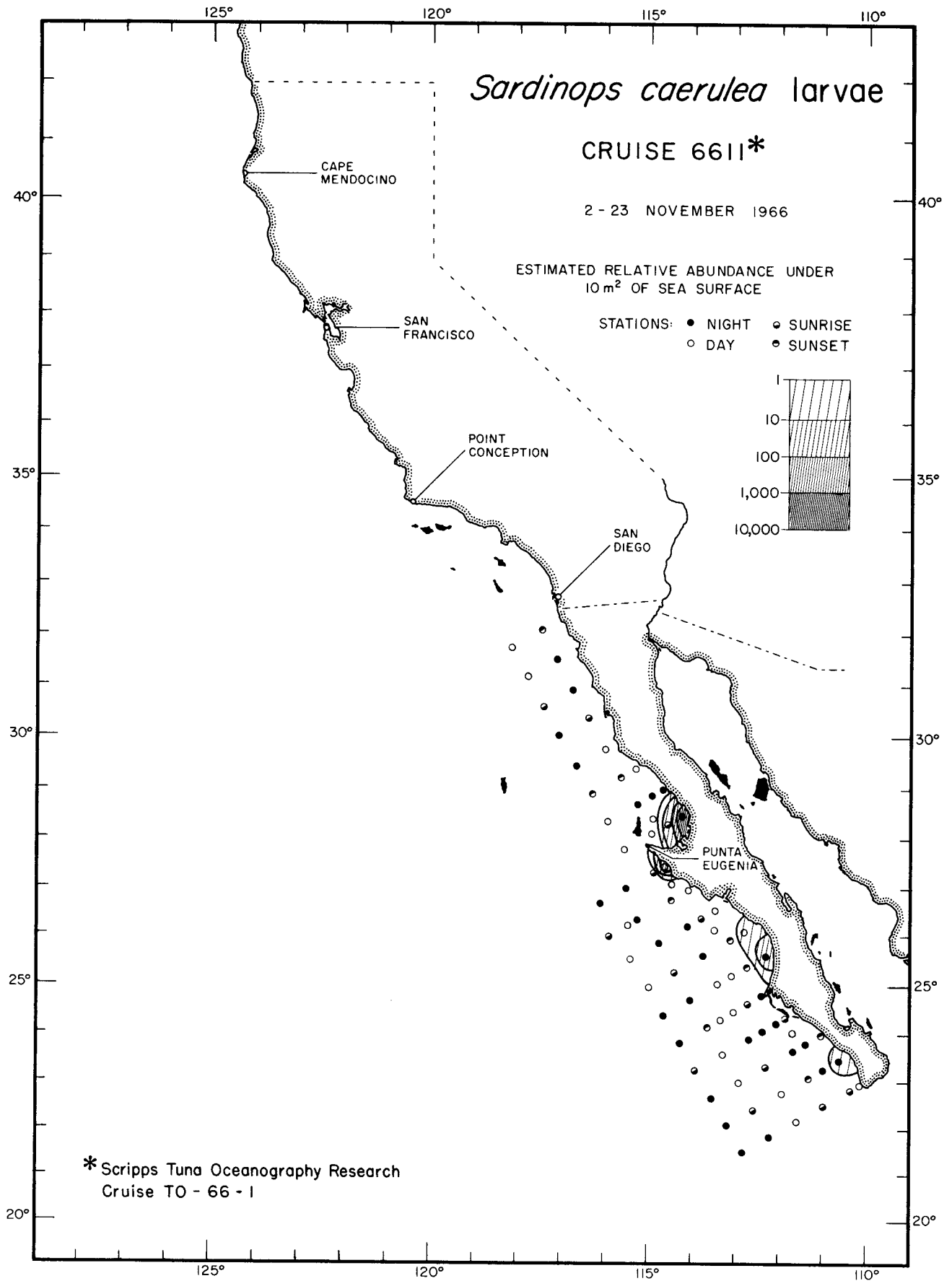
5911





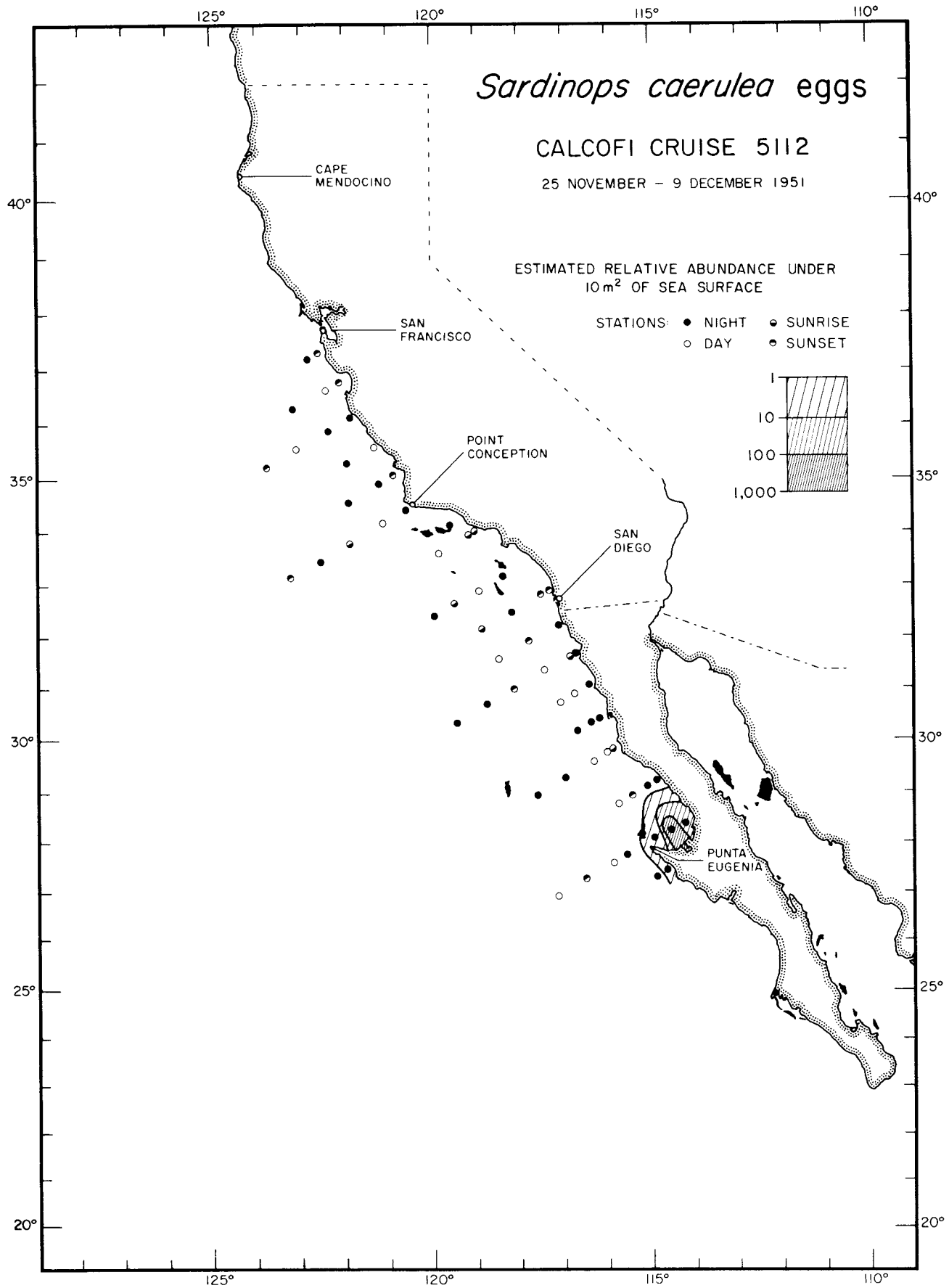
*Sardinops caerulea* eggs

6611



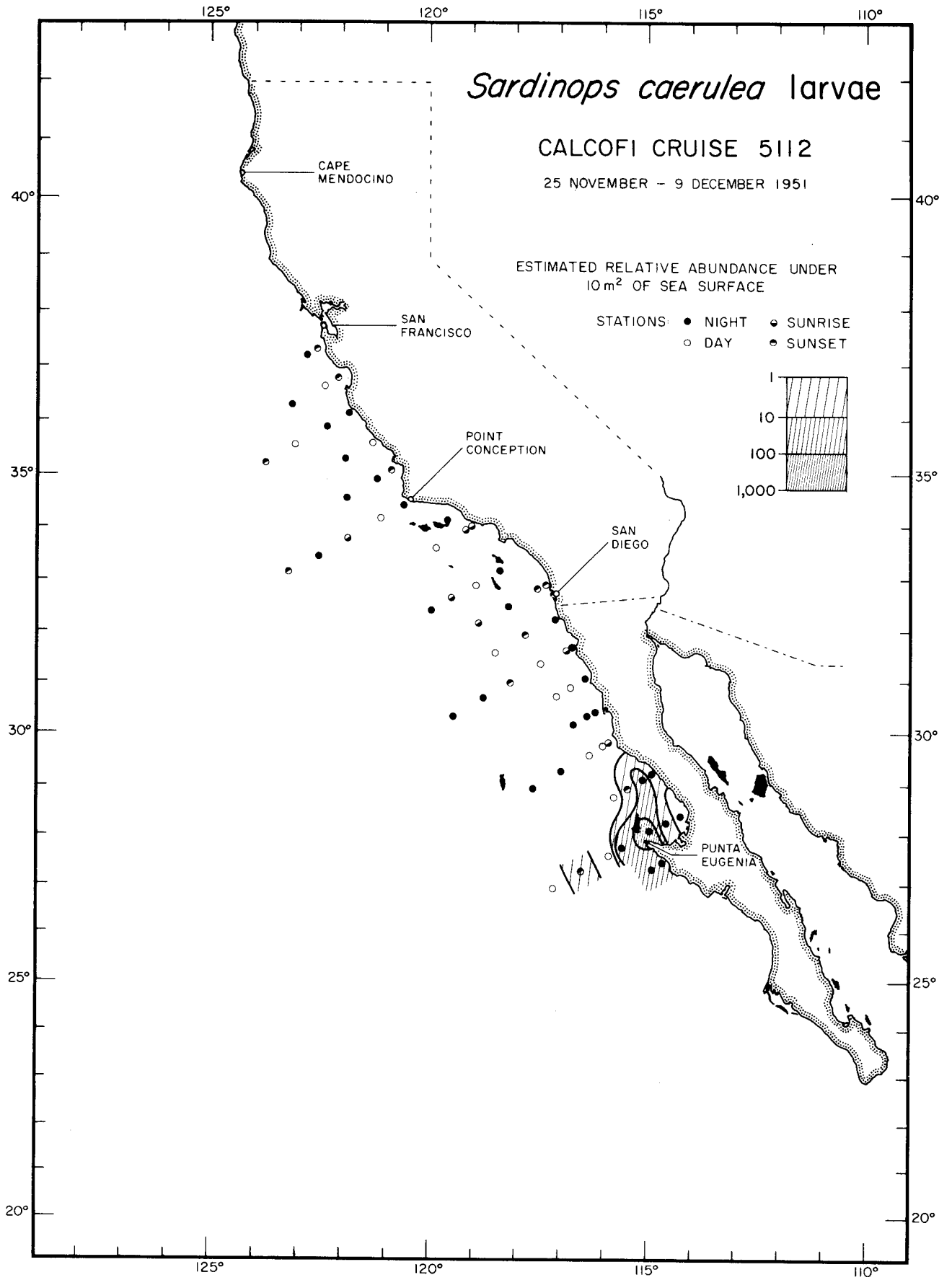
*Sardinops caerulea* larvae

6611



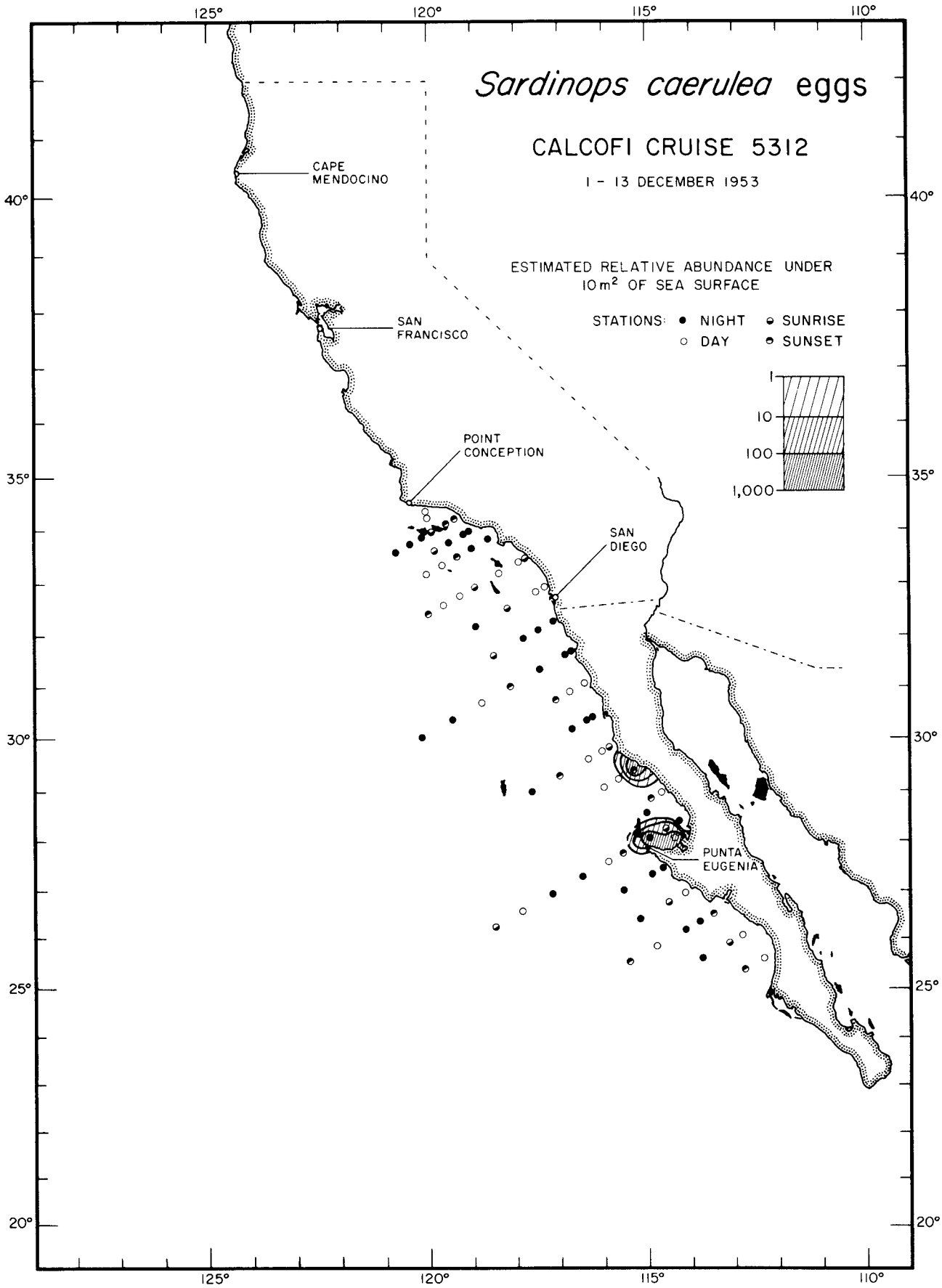
*Sardinops caerulea* eggs

5112

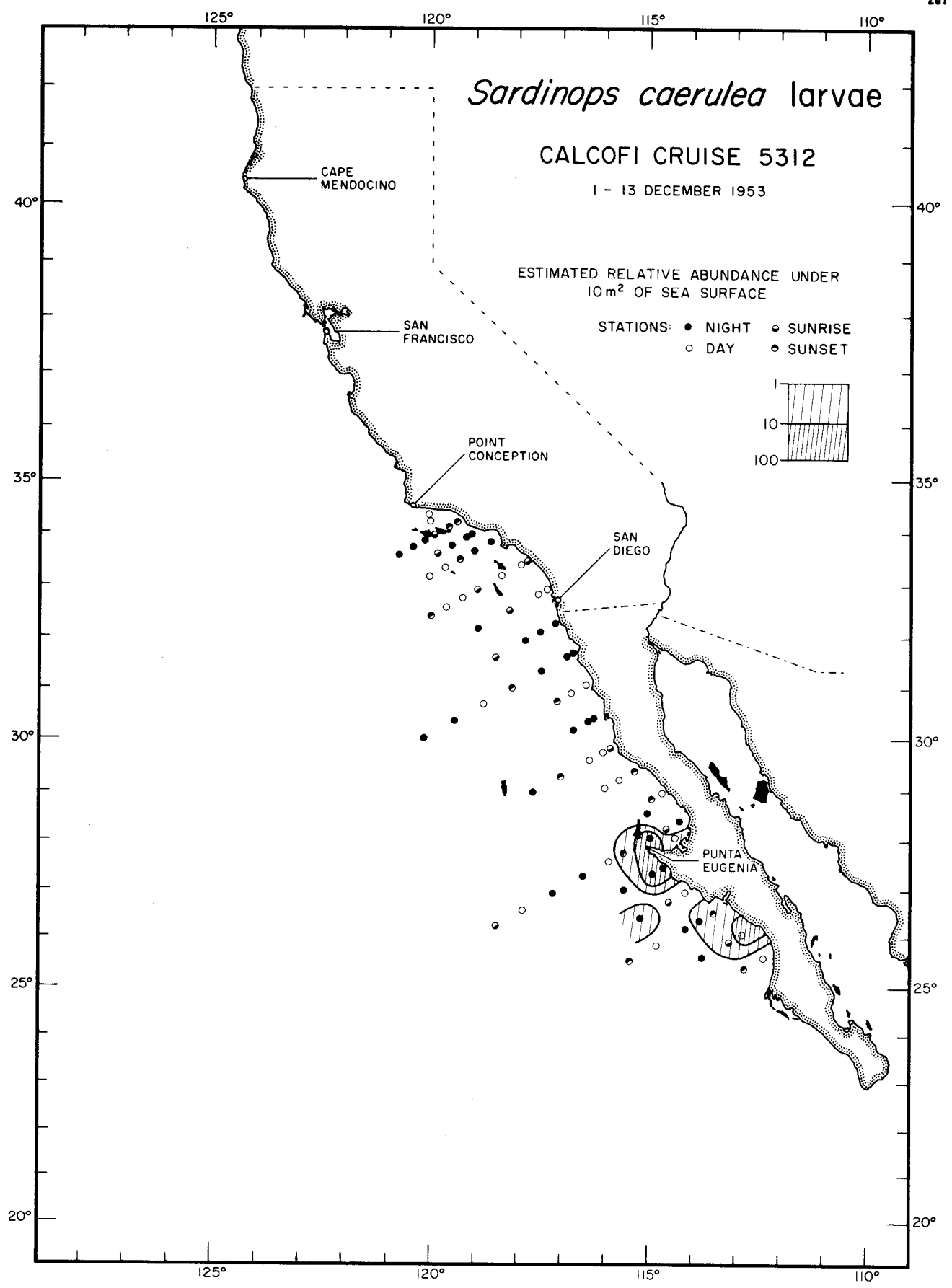


*Sardinops caerulea* larvae

5112

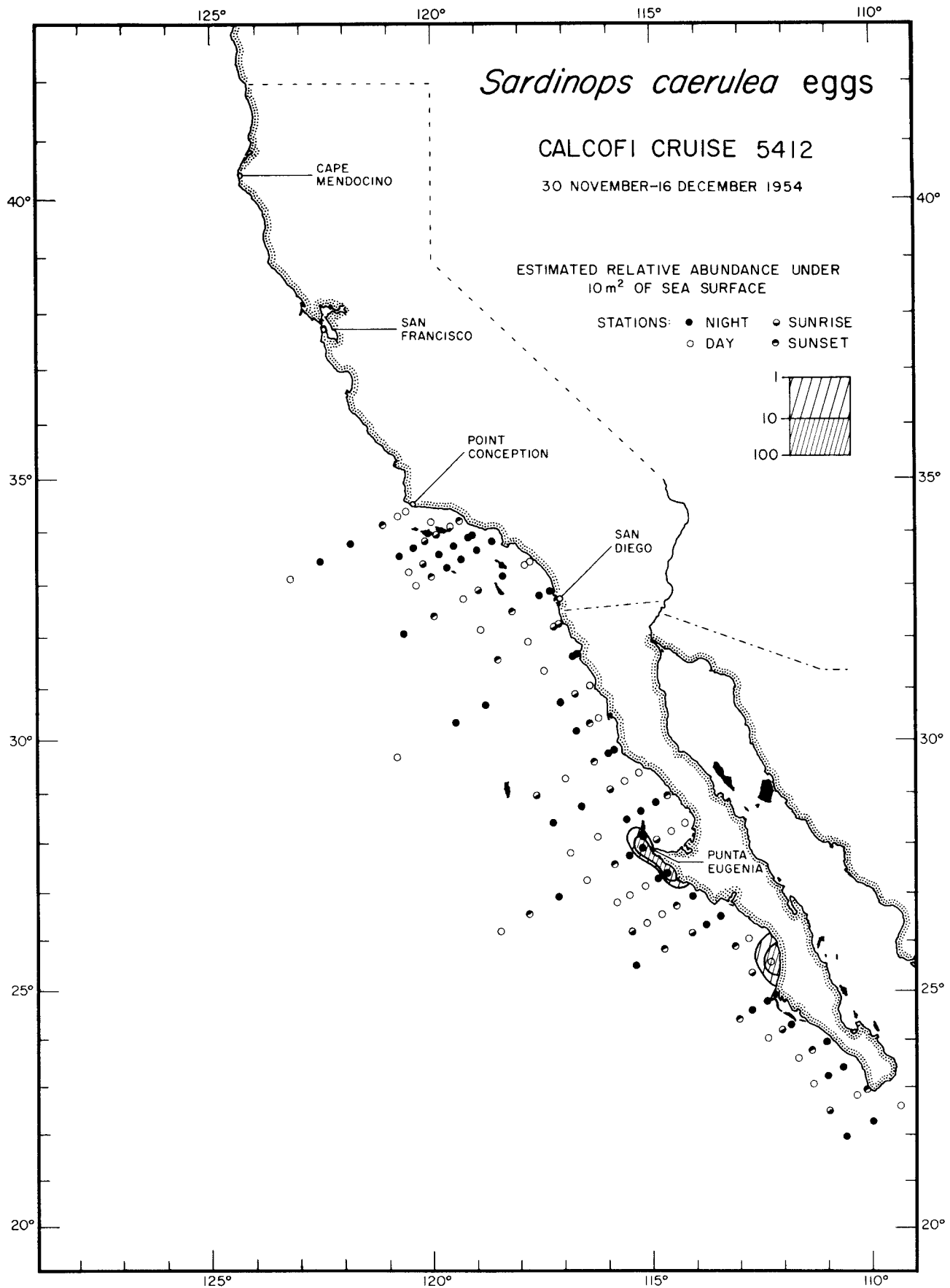


*Sardinops caerulea* eggs



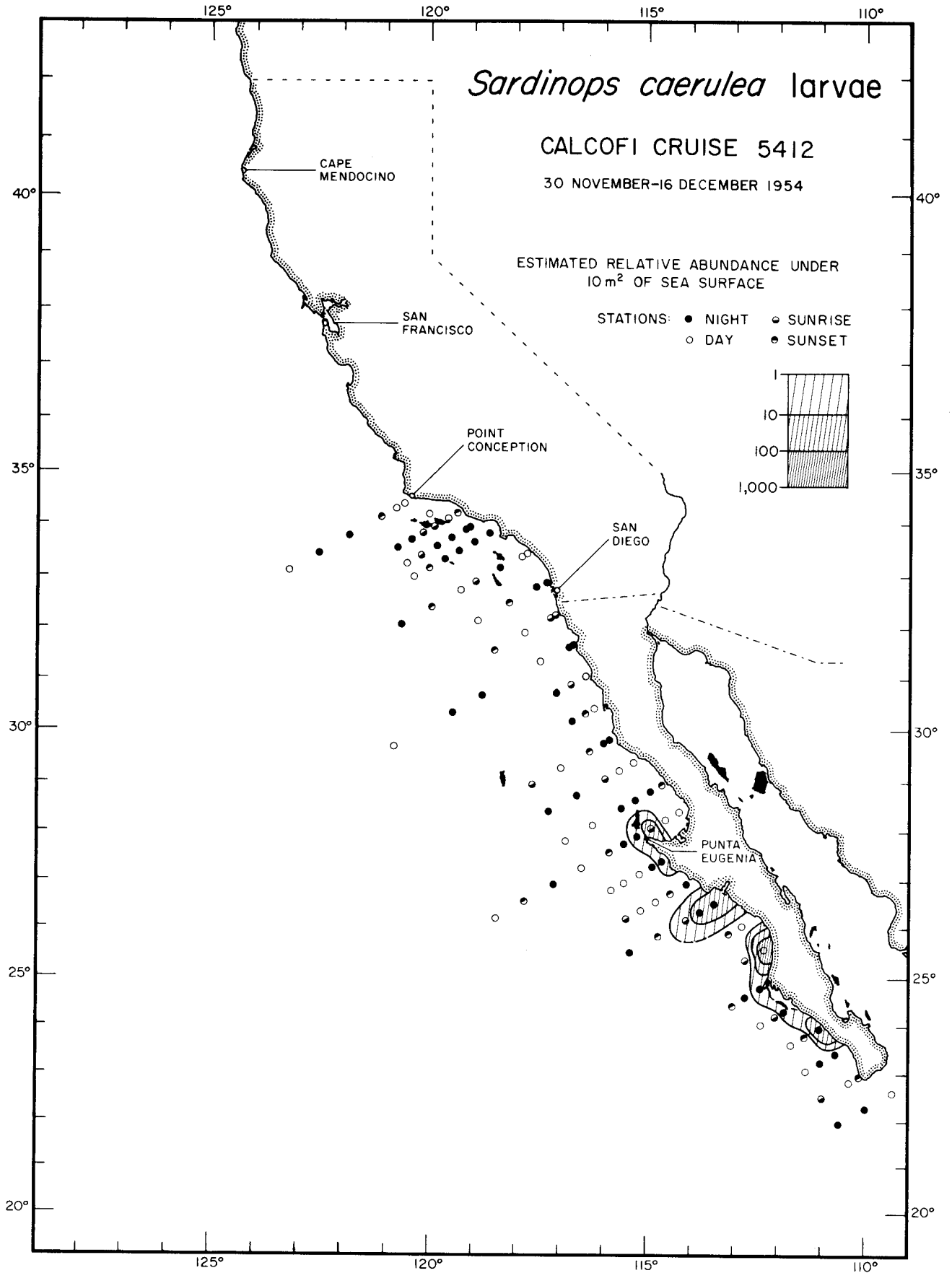
*Sardinops caerulea* larvae

5312



*Sardinops caerulea* eggs

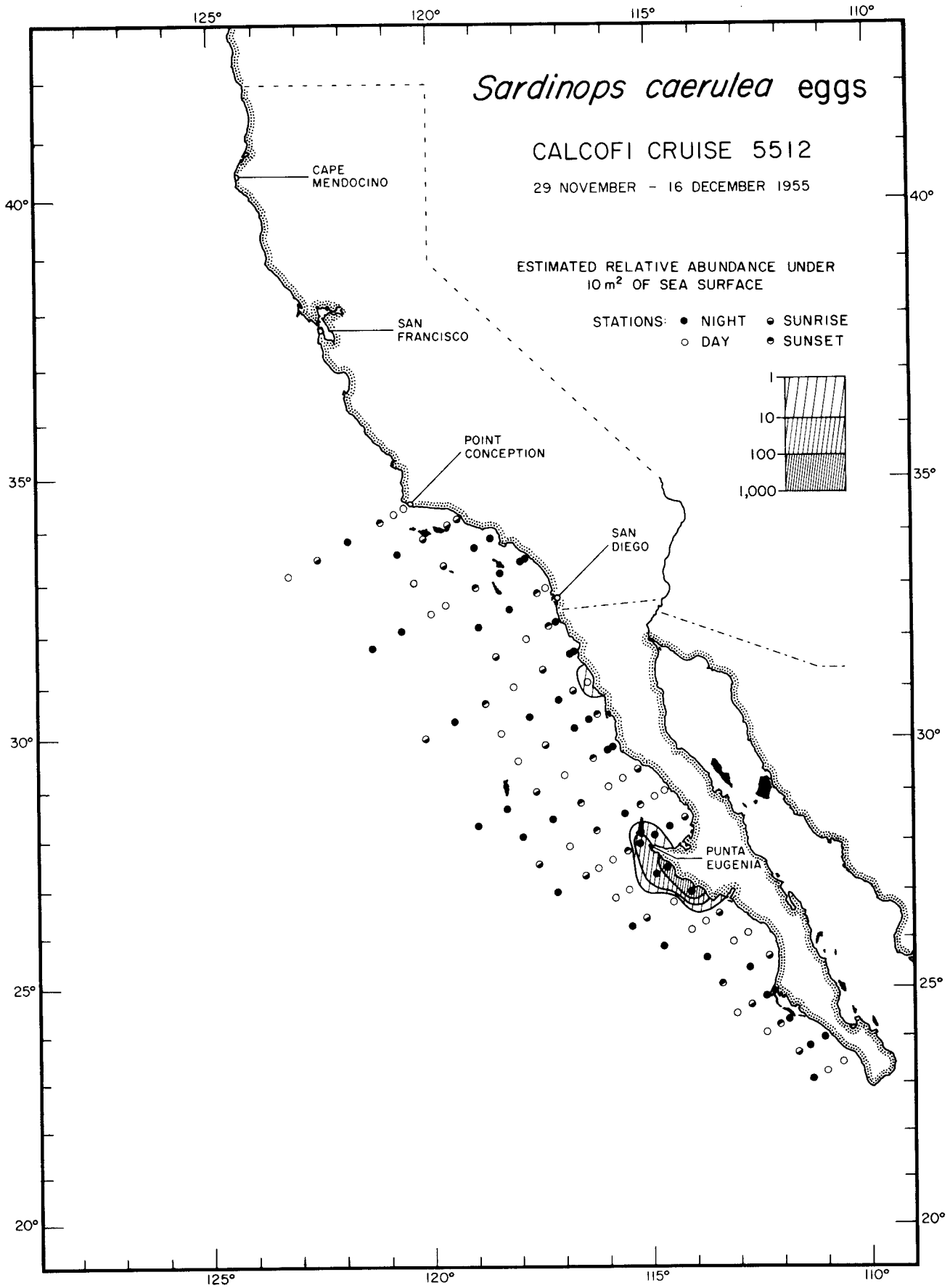
5412



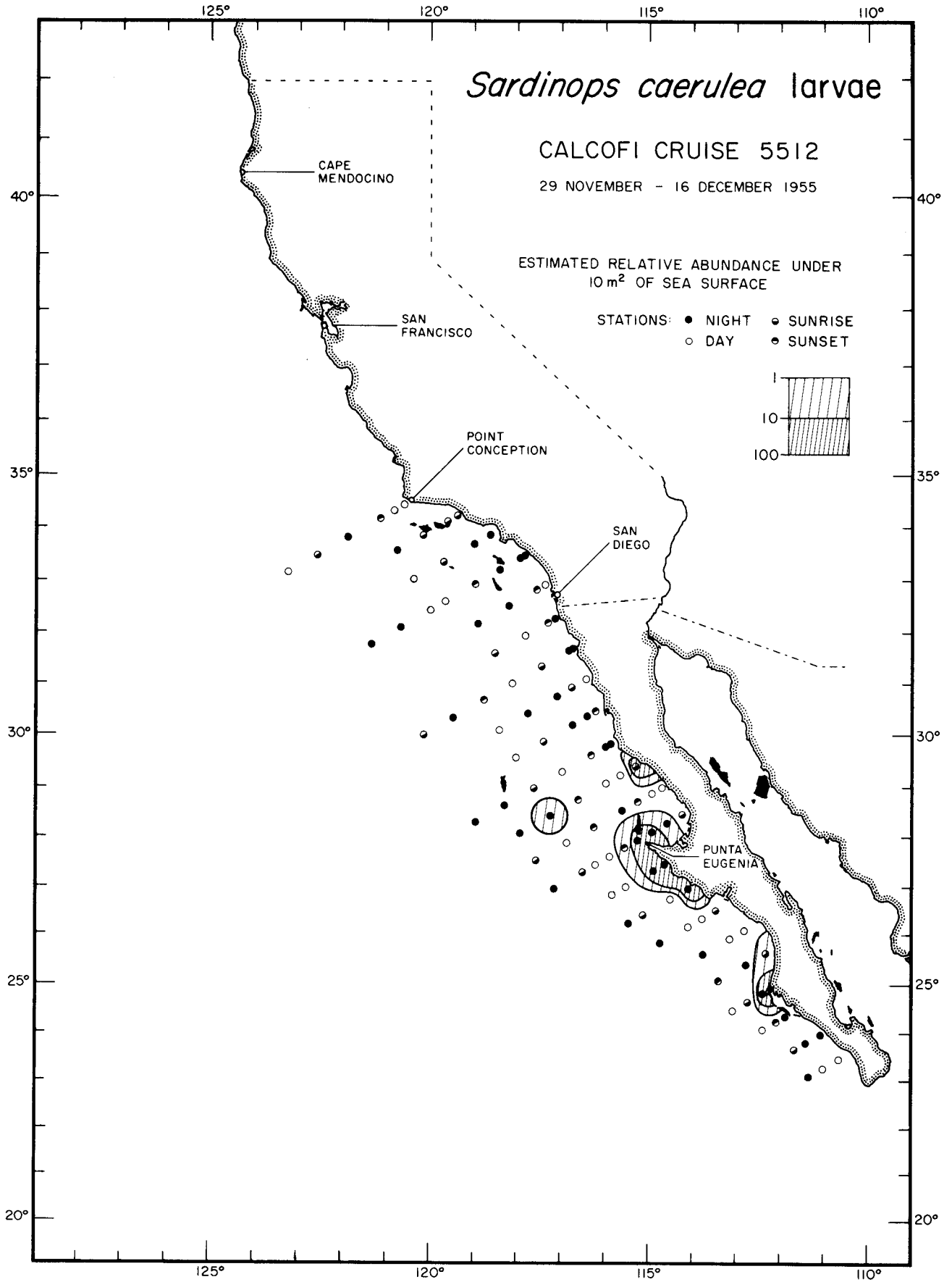
*Sardinops caerulea* larvae

5412



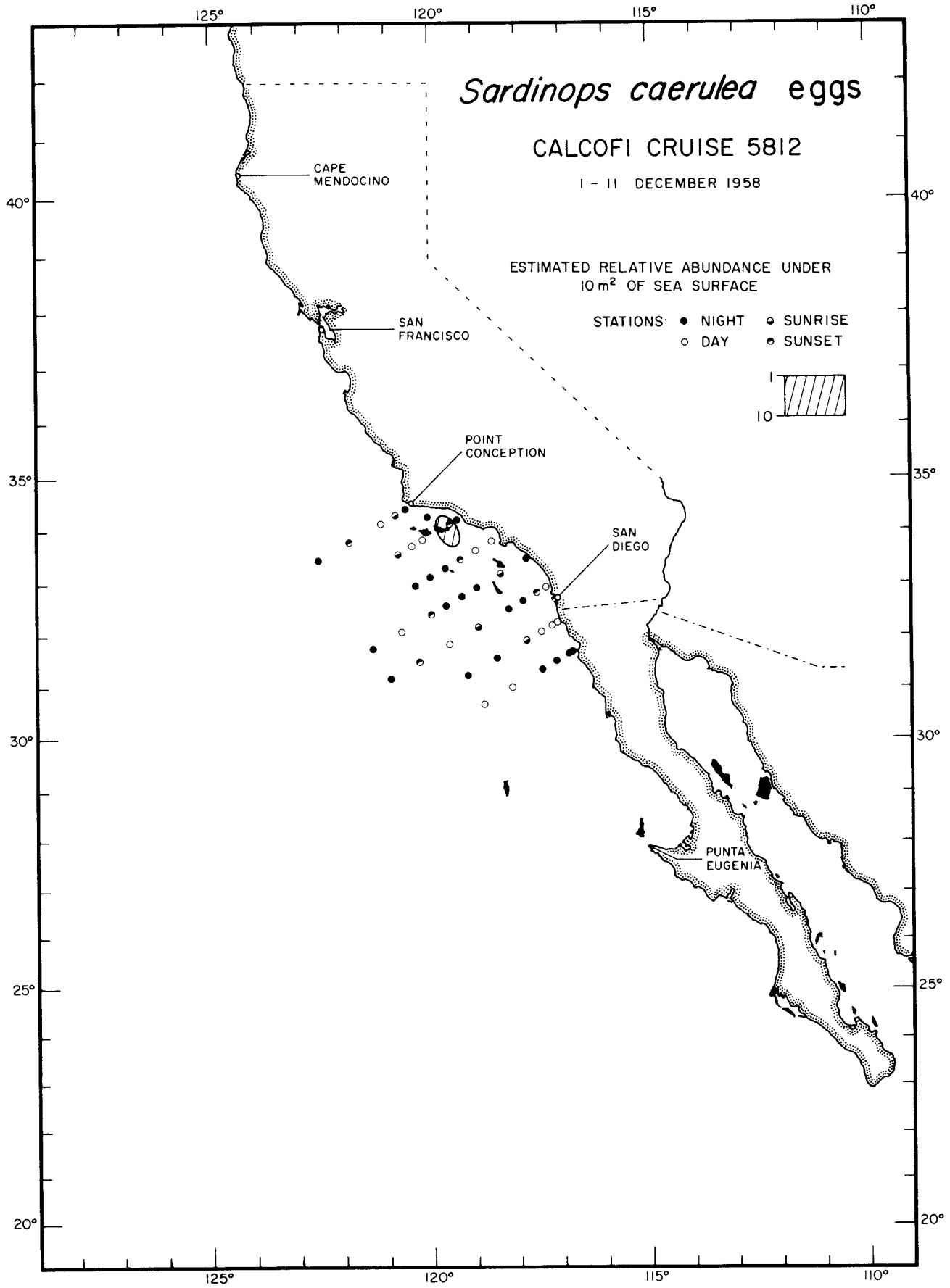
*Sardinops caerulea* eggs

5512



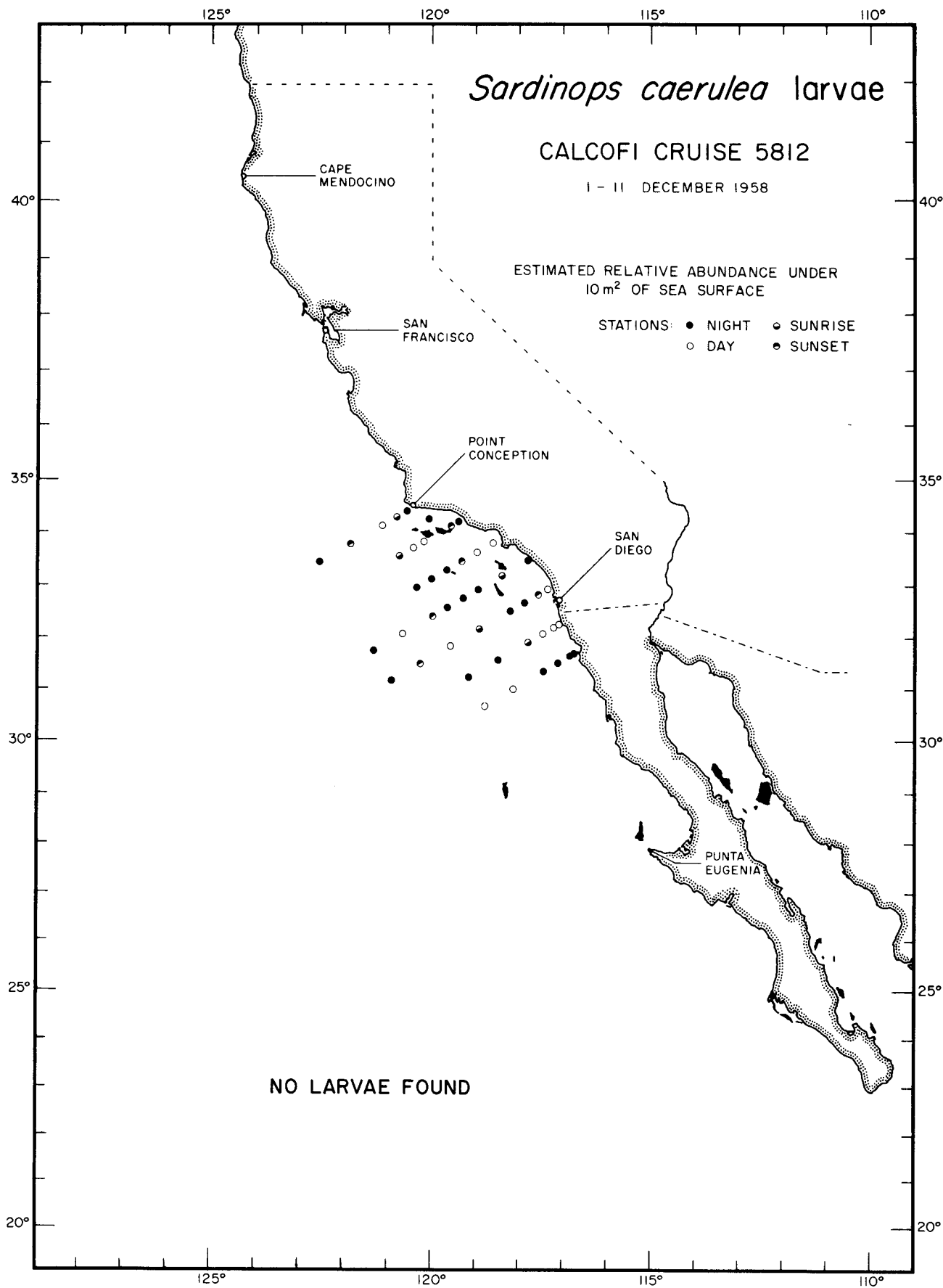
*Sardinops caerulea* larvae

5512



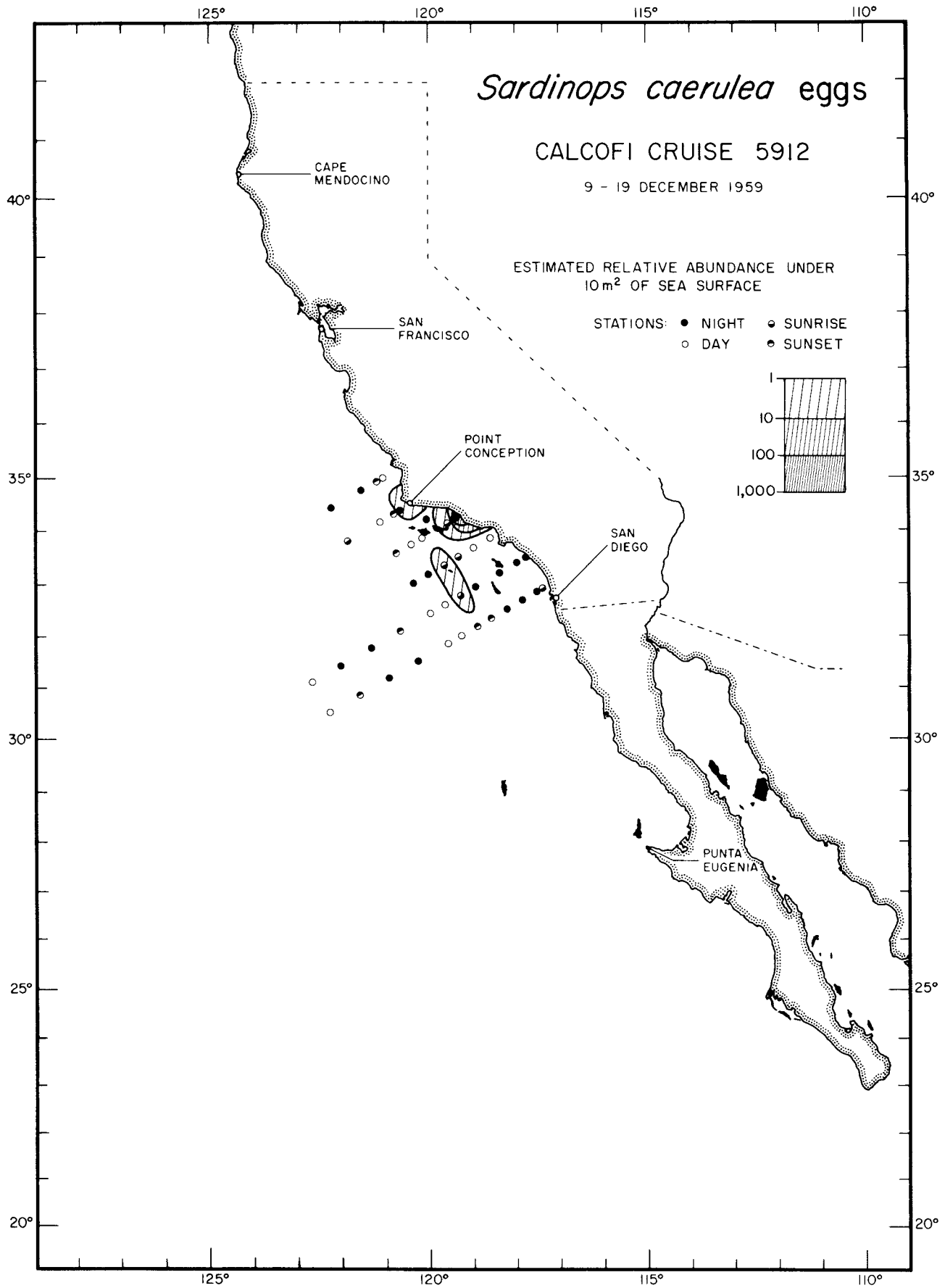
*Sardinops caerulea* eggs

5812

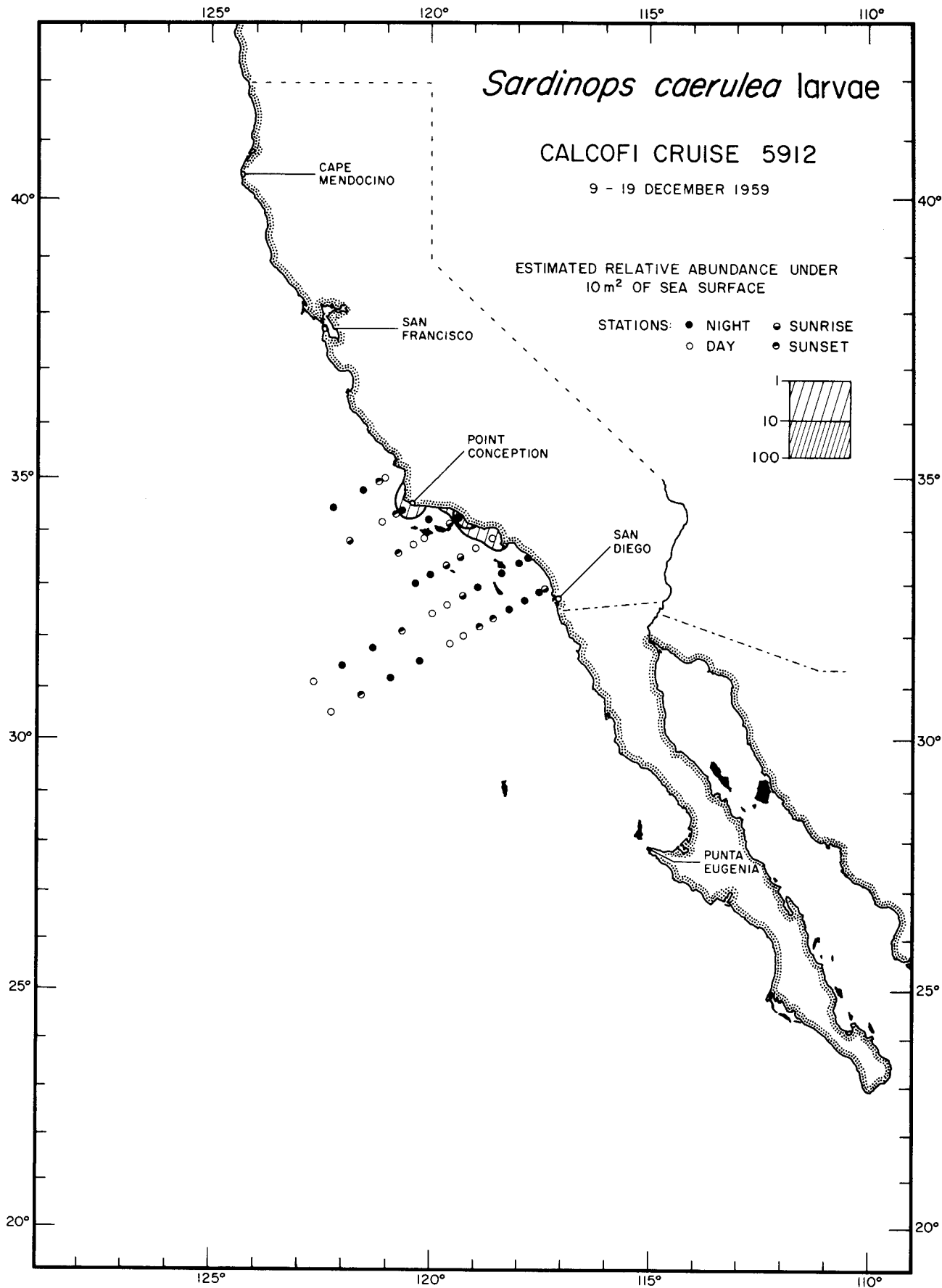


*Sardinops caerulea* larvae

5812

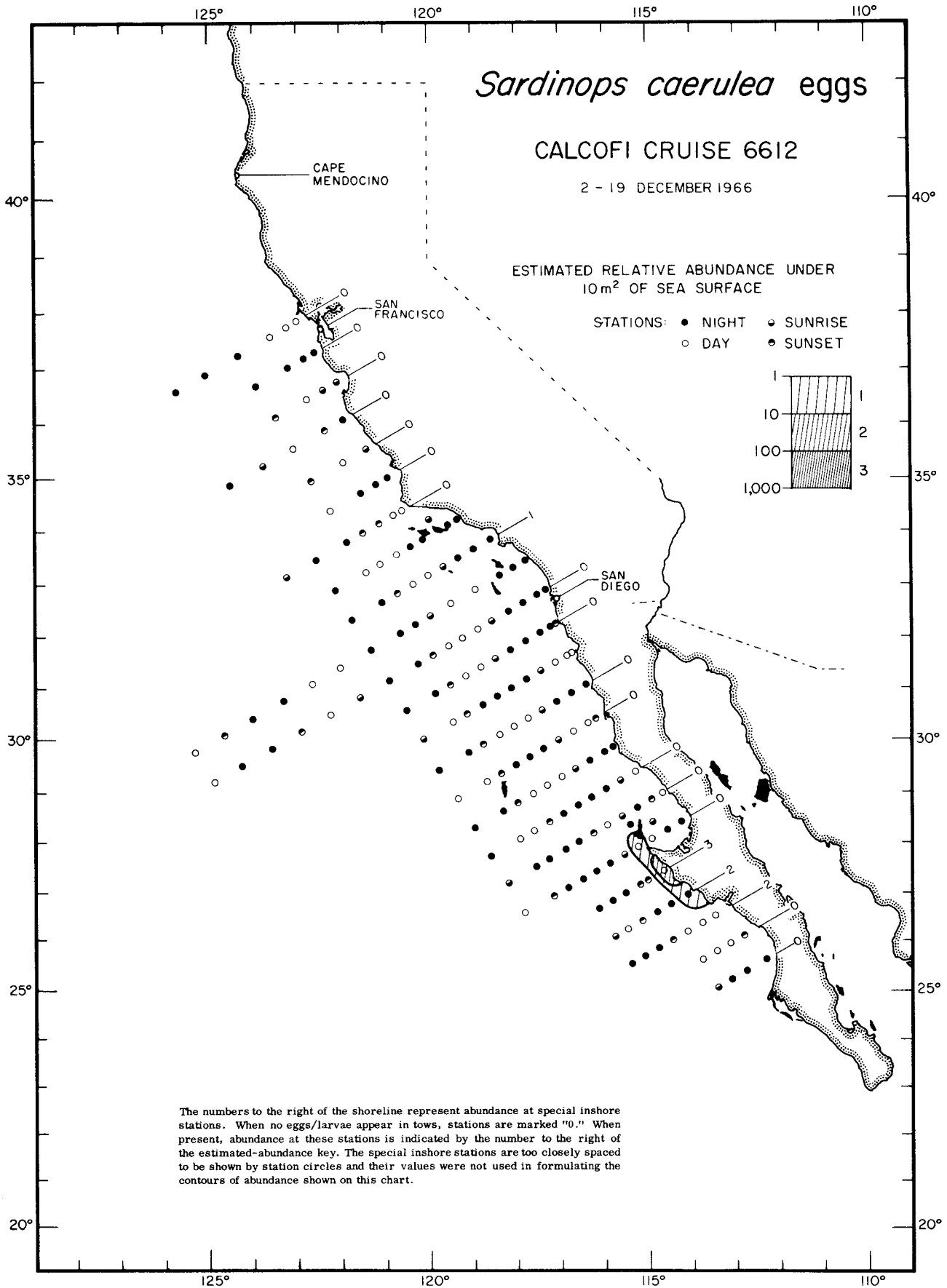
*Sardinops caerulea* eggs

5912



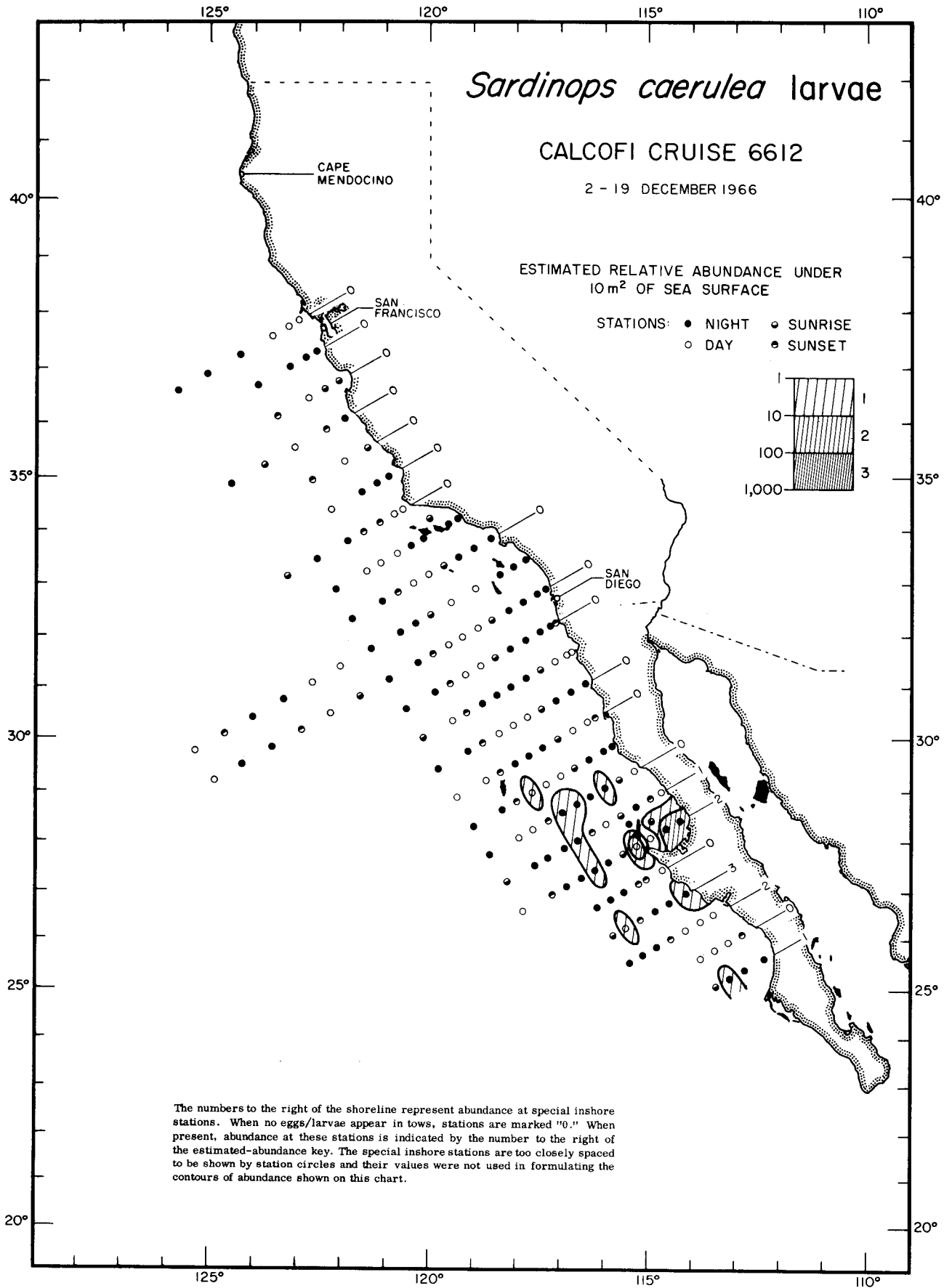
*Sardinops caerulea* larvae

5912



*Sardinops caerulea* eggs

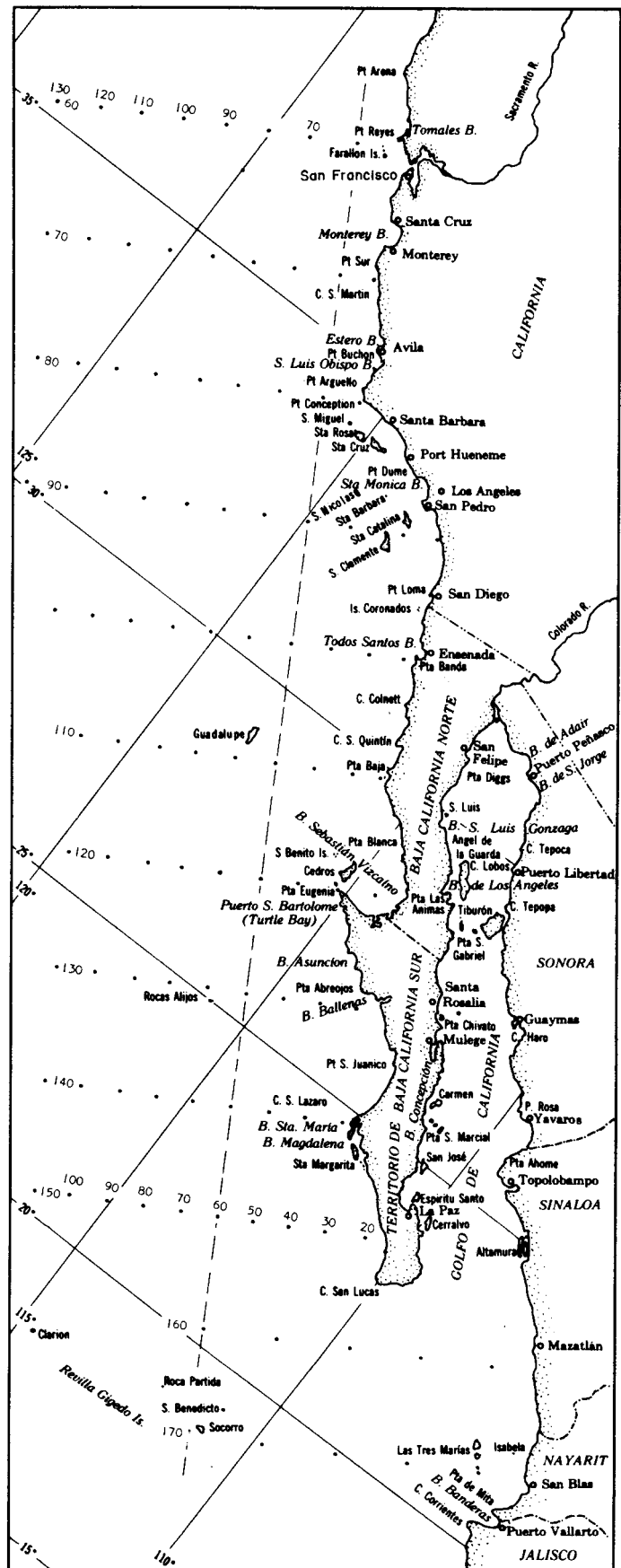
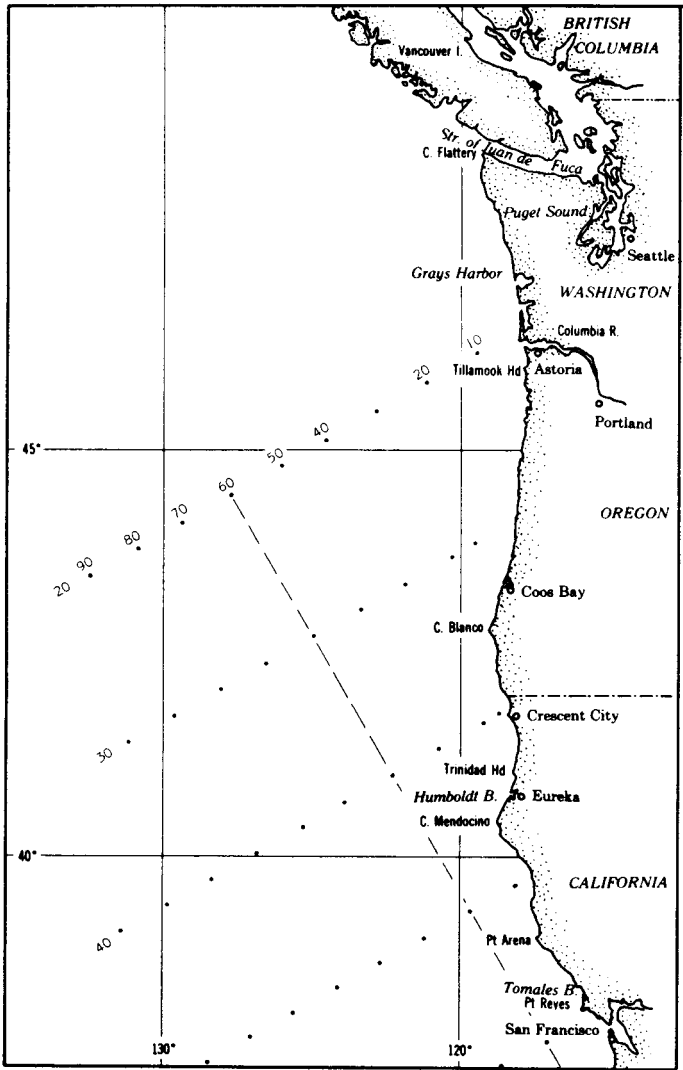
6612



*Sardinops caerulea* larvae

6612





These maps are designed to show essential details of the area most intensively studied by the California Cooperative Oceanic Fisheries Investigations. This is approximately the same area as is shown in color on the front cover. Geographical place names are those most commonly used in the various publications emerging from the research. The cardinal station lines extending southwestward from the coast are shown. They are 120 miles apart. Additional lines are utilized as needed and can be as closely spaced as 12 miles apart and still have individual numbers. The stations along the lines are numbered with respect to the station 60 line, the numbers increasing to the west and decreasing to the east. Most of them are 40 miles apart, and are numbered in groups of 10. This permits adding stations as close as 4 miles apart as needed. An example of the usual identification is 120.65. This station is on line 120, 20 nautical miles southwest of station 60.

The projection of the front cover is Lambert's Azimuthal Equal Area Projection. The detail maps are a Mercator projection.

CONTENTS

David Kramer

Distributional atlas of fish eggs and larvae in the California  
Current region: Pacific sardine, Sardinops caerulea  
(Girard), 1951 through 1966

v

Charts

2-277