



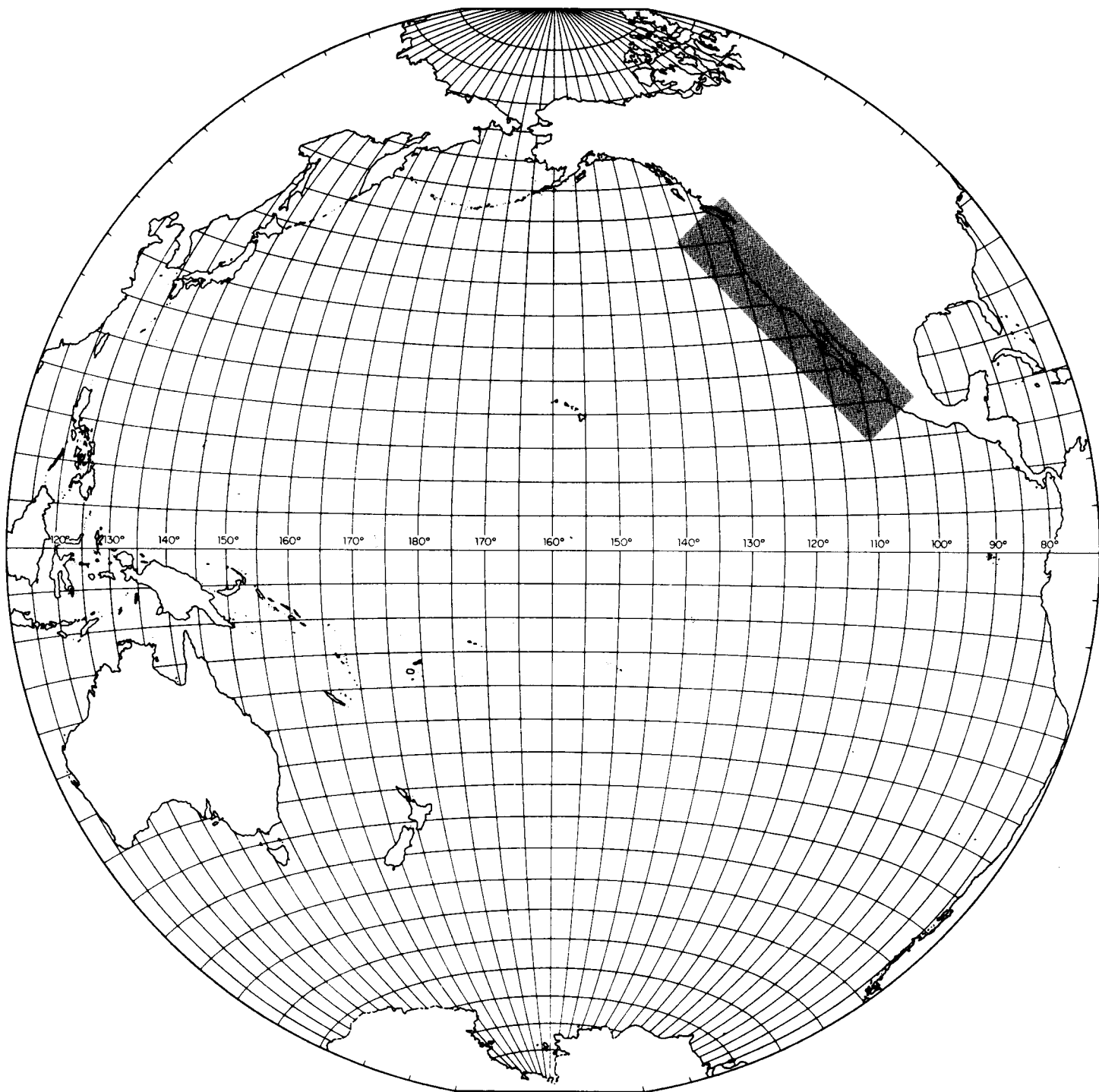
Atlas 11: Ahlstrom, E. H. Distributional atlas of fish larvae in the California Current region: jack mackerel, *Trachurus symmetricus*, and Pacific hake, *Merluccius productus*, 1951-1959. Published June 1969.

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.

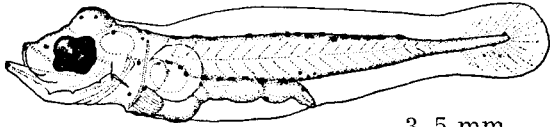
The report for each year usually is published about 7-9 months after the fall cruise, and includes notes about nomenclature changes, etc. The ultimate goal is to update the old ichthyoplankton identifications to current standards; the database is updated as re-identifications for each cruise are completed.

STATE OF CALIFORNIA
MARINE RESEARCH COMMITTEE

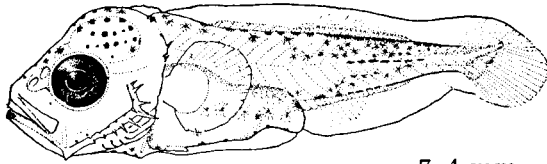


CALIFORNIA COOPERATIVE OCEANIC FISHERIES INVESTIGATIONS

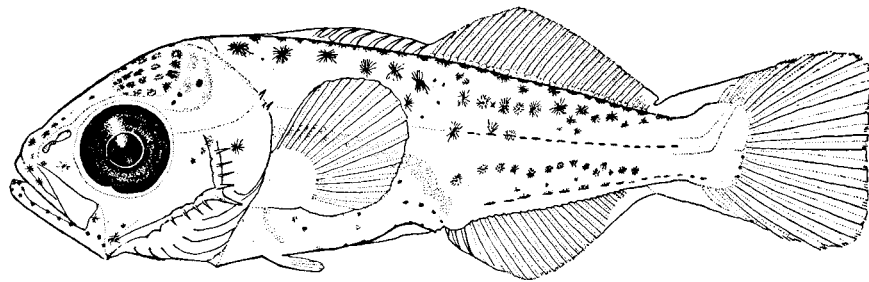
ATLAS No. 11



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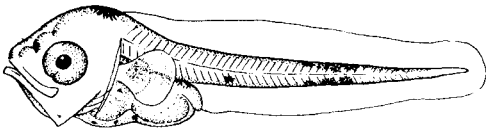


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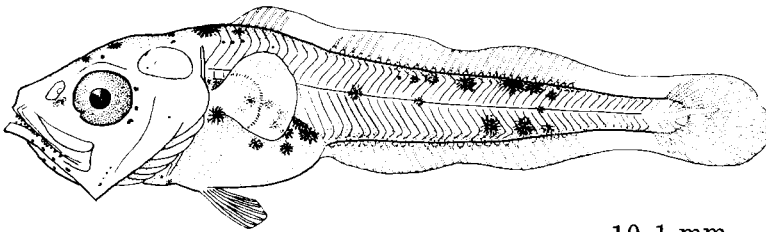


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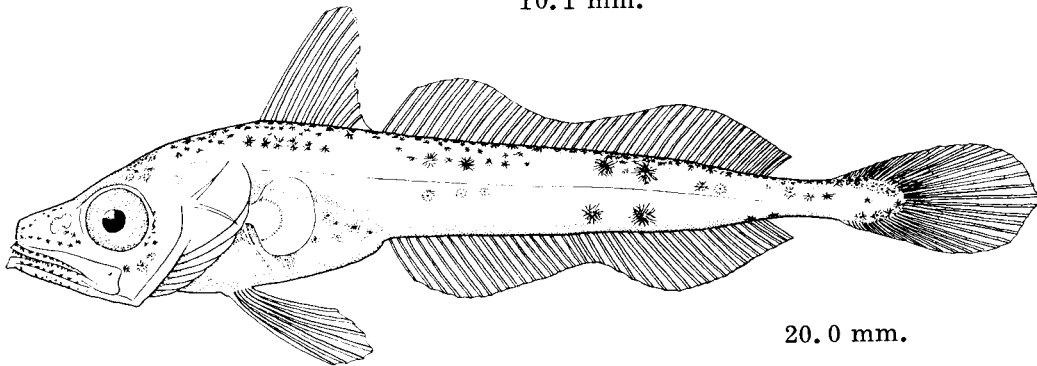
JACK MACKEREL
Trachurus symmetricus



4.3 mm.



10.1 mm.



20.0 mm.

PACIFIC HAKE
Merluccius productus

CALIFORNIA
COOPERATIVE
OCEANIC
FISHERIES
INVESTIGATIONS

Atlas No. 11

STATE OF CALIFORNIA
MARINE RESEARCH COMMITTEE

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UNIVERSITY OF CALIFORNIA, SCRIPPS INSTITUTION OF OCEANOGRAPHY

June, 1969

THE CALCOFI ATLAS SERIES

This is the tenth 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,¹ 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 atlases² 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
Alvariño, 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
Berner, 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.

¹ Usually abbreviated CalCOFI, sometimes CALCOFI or CCOFI.

² For citation this issue in the series should be referred to as CalCOFI Atlas No. 11.

DISTRIBUTIONAL ATLAS OF FISH LARVAE IN THE CALIFORNIA CURRENT
REGION: JACK MACKEREL, TRACHURUS SYMMETRICUS, AND PACIFIC
HAKE, MERLUCCIUS PRODUCTUS, 1951 THROUGH 1966

Elbert H. Ahlstrom

CALCOFI ATLAS NO. 11

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

June 1969

DISTRIBUTIONAL ATLAS OF FISH LARVAE IN THE CALIFORNIA CURRENT

REGION: JACK MACKEREL, TRACHURUS SYMMETRICUS, AND PACIFIC

HAKE, MERLUCCIUS PRODUCTUS, 1951 THROUGH 1966

Elbert H. Ahlstrom^{1/}

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Introduction

This atlas illustrates the distribution and abundance of larvae of two of the more abundant fishes in the region of the California Current off California and Baja California during the years 1951 through 1966. They are the jack mackerel, Trachurus symmetricus, a member of the jack family, Carangidae, and the Pacific hake, Merluccius productus, a member of the cod family, Gadidae.

The basic CalCOFI station plan is included as the first chart in this atlas (Chart 1). Only selected portions of this comprehensive station pattern were occupied on any given cruise. CalCOFI cruises were spaced at monthly intervals during the decade 1951 through 1960 and again in 1966. The cruises were made quarterly in the years 1961 through 1965. During the period of monthly cruises a sizable part of the CalCOFI area was monitored on cruises made during the first seven months of each year and also usually in October. In the remaining four months, August, September, November and December, sampling usually was restricted to a limited portion of the CalCOFI region such as off southern California or off central Baja California.

Fish eggs and larvae were obtained from plankton collections made with a standard CalCOFI net one meter in diameter at the mouth. Details of the net and of its deployment during a haul are given by Fleminger (1964) and Ahlstrom (1966). Each tow was made by lowering the net at a rate of 50 meters of wire per minute until 200 meters had been payed out, and then by retrieving it at 20 meters per minute while maintaining a wire angle of 45 degrees. The tow was taken at a vessel speed of about two knots. The usual depth reached by the net was about 140 meters. A flow-meter in the mouth of the net permitted calculation of the amount of water strained.

Standardized values for fish eggs and larvae are not directly comparable with the standardized values used by authors of other CalCOFI atlases. Our estimates of abundance of fish larvae and eggs were made comparable between samples by standardizing the values to a unit of ten square meters of sea surface. Details concerning the method of deriving the standardization factors appear in Kramer and Ahlstrom (1968).

We include data on larvae of jack mackerel and hake for all but one CalCOFI cruise made between 1951-1966; information is not available as yet for the cruise of July 1963 (6307). Charts are presented for all cruises in which five or more collections contained larvae of either jack mackerel or hake. The mean abundance is shown for stations sampled more than once during a given cruise. These stations are listed in the Appendix.

Larvae of jack mackerel

The early developmental stages of jack mackerel were described by Ahlstrom and Ball (1954); this paper contained charts showing the distribution and abundance of jack mackerel larvae for seven cruises of 1950 (5002-5008) and seven cruises of 1951 (5102-5108). Farris (1958) supplied information on numbers of jack mackerel eggs by station for the years 1951-1954. Farris (1961) also discussed the abundance and distribution of eggs and larvae of jack mackerel and survival of larvae for the years 1952-1954. Information on numbers of jack mackerel larvae, by station, were contained in a series of yearly reports that covered all CalCOFI cruises made between 1950-1957 (see Ahlstrom, 1959a for pertinent references). Data subsequent to 1957 have not been published previously except in summary form (Ahlstrom, 1968, Table 4).

The pagination of jack mackerel charts is given in Table 2. During the 16-year span, 93 cruises yielded five or more samples containing jack mackerel larvae. On 26 additional cruises, one to four samples per cruise contained jack mackerel larvae (Table 1). No jack mackerel larvae were taken on 28 cruises made during 1951-1966.

TABLE 1. List of samples containing jack mackerel from CalCOFI cruises yielding fewer than five positive records and omitted from the charted distributions.

Year	Cruise	Station	Number of larvae	Year	Cruise	Station	Number of larvae	
1951	5101	107.60	2	1957	5708	110.35	3	
	5109	100.70	3		"	"	133.35	5
	5110	90.30	2		5710	103.60	3	
	"	107.40	3		"	"	117.60	2
	5111	93.50	4	"	"	120.35	3	
	"	97.40	5	1958	5809	90.28	1	
"	100.40	3	"		"	110.33	6	
1952	5201	100.70	2		5810	103.45	2	
	5202	90.60	2	"	120.55	3		
	"	90.80	9	1959	5902	83.80	3	
	"	90.90	3		"	100.60	4	
	5210	85.38	2		5909	90.90	3	
	"	97.32	3	"	93.50	3		
"	107.35	3	"	93.75	3			
1953	5309	87.50	2	"	115.30	2		
1954	5401	130.60	4	5910	67.50	3		
	"	137.30	27	"	93.30	3		
	5410	93.55	23	"	93.70	7		
"	123.50	10	5911	87.55	42			
1955	5508	50.90	5	"	93.40	3		
	"	100.35	27	"	93.55	3		
	5510	100.80	2	1960	6010	117.35	3	
1956	5608	118.35	27	1961	6101	120.55	3	
	"	120.25	21	6110	87.40	3		
1957	5701	103.30	2	1964	6410	87.34	2	

TABLE 2. Pagination of charts showing the distribution of larvae of jack mackerel. (T) Occurred in one to four samples; details appear in TABLE 1. (O) No occurrences. (-) No cruise. (*) Distributions for early and late March cruises are presented on the same chart. (NA) Information not yet available.

Month	Year															
	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966
January	T	T	O	T	O	O	T	2	O	O	T	3	4	5	6	7
February	8	T	9	10	11	12	13	14	T	15	-	-	-	-	-	16
March	17	18*	19*	20	21	22	23	24	25	26	-	-	-	-	-	-
April	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
May	43	44	45	46	47	48	49	50	51	52	-	-	-	-	-	53
June	54	55	56	57	58	59	60	61	62	63	-	-	-	-	-	64
July	65	66	67	68	69	70	71	72	73	74	75	76	NA	77	78	79
August	80	81	82	83	T	T	T	O	84	O	-	-	-	-	-	85
September	T	86	T	-	O	O	O	T	T	O	-	-	-	-	87	88
October	T	T	89	T	T	O	T	T	T	T	T	90	91	T	-	92
November	T	O	O	-	O	O	O	O	T	-	-	-	-	-	-	O
December	O	-	O	O	O	O	O	O	O	-	-	-	-	-	-	O

TABLE 3. List of samples containing Pacific hake from CalCOFI cruises yielding fewer than five positive records and omitted from the charted distributions.

Year	Cruise	Station	Number of larvae	Year	Cruise	Station	Number of larvae
1951	5108	115.30	2	1958	5812	80.51	5
	5109	115.30	6		"	80.55	7
	"	115.35	8		"	87.40	3
	5110	90.60	4	1959	5907	103.35	3
	"	97.30	3		"	123.60	3
	"	110.35	3	1960	6007	70.55	3
	5111	80.55	3		"	120.30	3
	"	110.33	14		6008	93.80	3
1952	5207	97.50	3		"	120.30	2
	5208	117.30	2		6009	119.33	3
	"	117.40	3		6010	118.39	3
	5210	117.30	9		"	119.33	8
1953	5308	117.30	6	1961	6107	80.55	2
	"	117.35	2		"	80.65	4
	"	120.35	3		6110	110.33	6
	"	127.34	6		"	117.40	3
1955	5506	93.80	6	1962	6207	118.39	3
	"	110.50	3		"	120.35	4
	"	133.40	3		"	123.42	3
	"	137.30	7		6210	87.50	3
	5507	137.30	3		"	110.35	3
	5509	83.90	3		"	113.30	2
	5511	87.35	5		"	115.35	6
1956	5608	110.33	16	1963	6310	80.55	3
	"	115.27	24		"	137.23	5
	"	117.26	7	1965	6509	80.52	3
	5610	82.47	6		"	83.51	2
1957	5707	117.30	4		"	120.25	2
	"	120.30	6	1966	6608	80.51	2
	"	120.35	3		"	117.35	3
	"	130.55	3		"	117.40	6
	5708	117.35	3		6610	67.50	3
	5711	87.60	4		"	80.51	4
1958	5807	67.50	3		"	80.52	4
	"	90.28	2		"	87.45	4
	5808	127.40	3		6611	140.30	11
	5810	143.50	14		"	147.20	6
	"	150.50	3				

TABLE 4. Pagination of charts showing the distribution of larvae of the Pacific hake. (T) Occurred in one to four samples; details appear in TABLE 1. (O) No occurrences. (-) No cruise. (*) Distributions for early and late March cruises are presented on the same chart. (NA) Information not yet available.

Month	Year															
	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966
January	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108
February	109	110	111	112	113	114	115	116	117	118	-	-	-	-	-	119
March	120	121*	122*	123	124	125	126	127	128	129	-	-	-	-	-	-
April	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145
May	146	147	148	149	150	151	152	153	154	155	-	-	-	-	-	156
June	157	158	159	160	T	161	162	163	164	165	-	-	-	-	-	166
July	167	T	168	169	T	170	T	T	T	T	T	T	NA	171	172	173
August	T	T	T	174	O	T	T	T	O	T	-	-	-	-	-	T
September	T	O	175	-	T	O	O	O	O	T	-	-	-	-	T	O
October	T	T	176	177	178	T	O	T	O	T	T	T	T	179	-	T
November	T	O	180	-	T	O	T	O	181	-	-	-	-	-	-	T
December	182	-	183	184	185	186	O	T	O	-	-	-	-	-	-	187

Larvae of Pacific hake

The early developmental stages of Pacific hake eggs and larvae were described by Ahlstrom and Counts (1955); also included in this paper were distribution and abundance charts of Pacific hake larvae for the first six cruises, January through June of 1951 and 1952. Ahlstrom (1959b) discussed the vertical distribution of hake eggs and larvae as well as of other pelagic fishes from stations off California and Baja California. The eggs and larvae of the majority of pelagic fishes, including jack mackerel, Pacific sardine and northern anchovy were limited in their distribution to the upper mixed layer and the upper portion of the thermocline. In contrast, the eggs and larvae of the Pacific hake occurred mostly in and below the thermo-

cline. The largest collections of eggs and larvae were made at a depth of about 75 meters, but larvae were obtained in moderate abundance at the 138-meter level and a few were taken as deep as 215 meters. Standard CalCOFI hauls which typically reach a depth of 140 meters evidently do not encompass the complete vertical distribution of hake eggs and larvae at some stations. CalCOFI records of hake larvae and eggs up to 1957 have been issued as a series of annual reports (see Ahlstrom 1959a for references). Data subsequent to 1957 have not been published previously, except in summary form (Ahlstrom, 1968, Table 5).

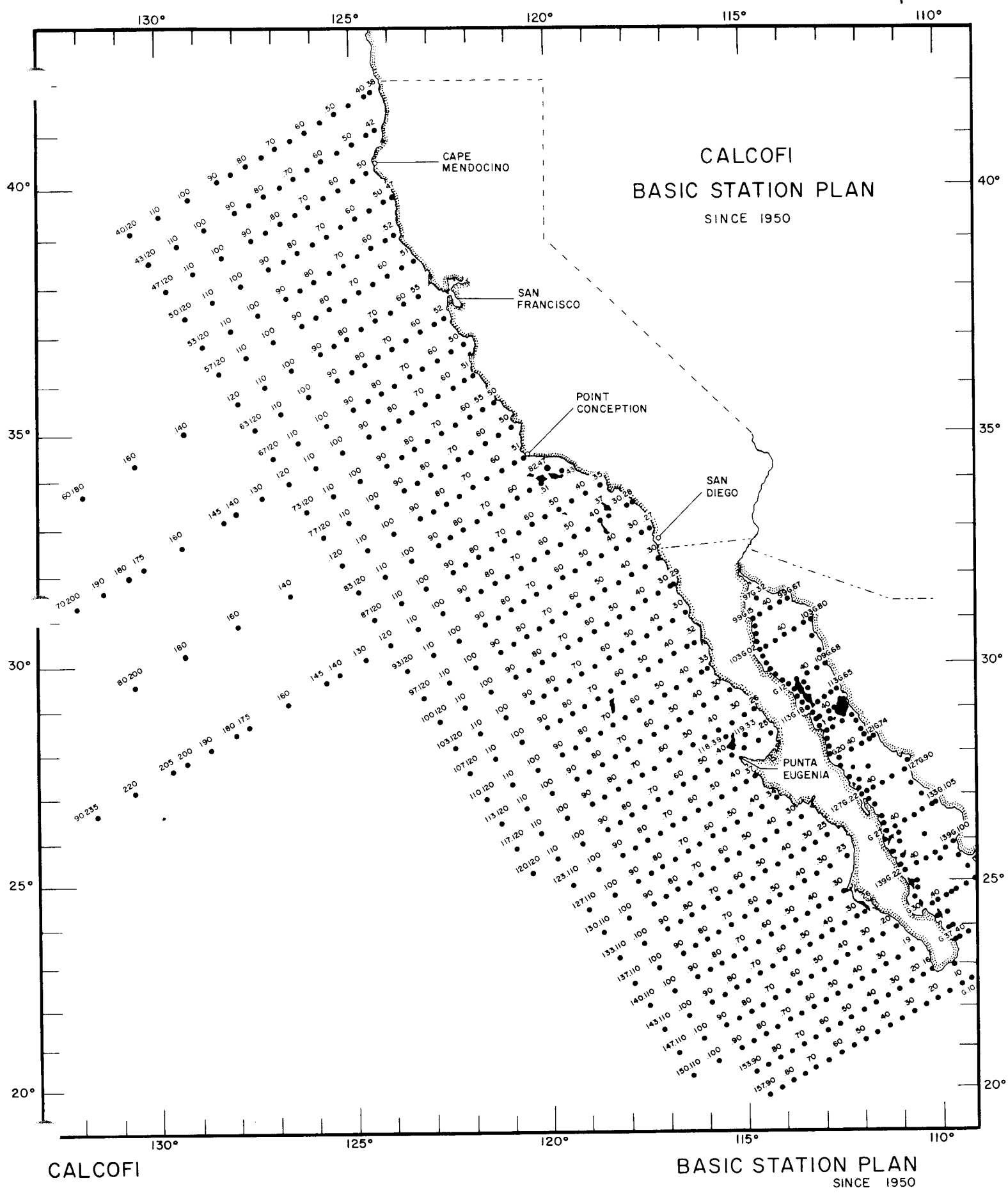
The pagination of Pacific hake charts is given in Table 4. During the 16 years, 1951-1966, five or more samples containing hake larvae were obtained on 97 CalCOFI cruises and one to four occurrences of hake larvae on 35 cruises (Table 3). No hake larvae were obtained on 15 cruises.

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APPENDIX. Stations sampled more than once on CalCOFI cruises, 1951-1966, that contained larvae of jack mackerel and hake (regular occupancy listed first). (X) Present. (O) Absent.

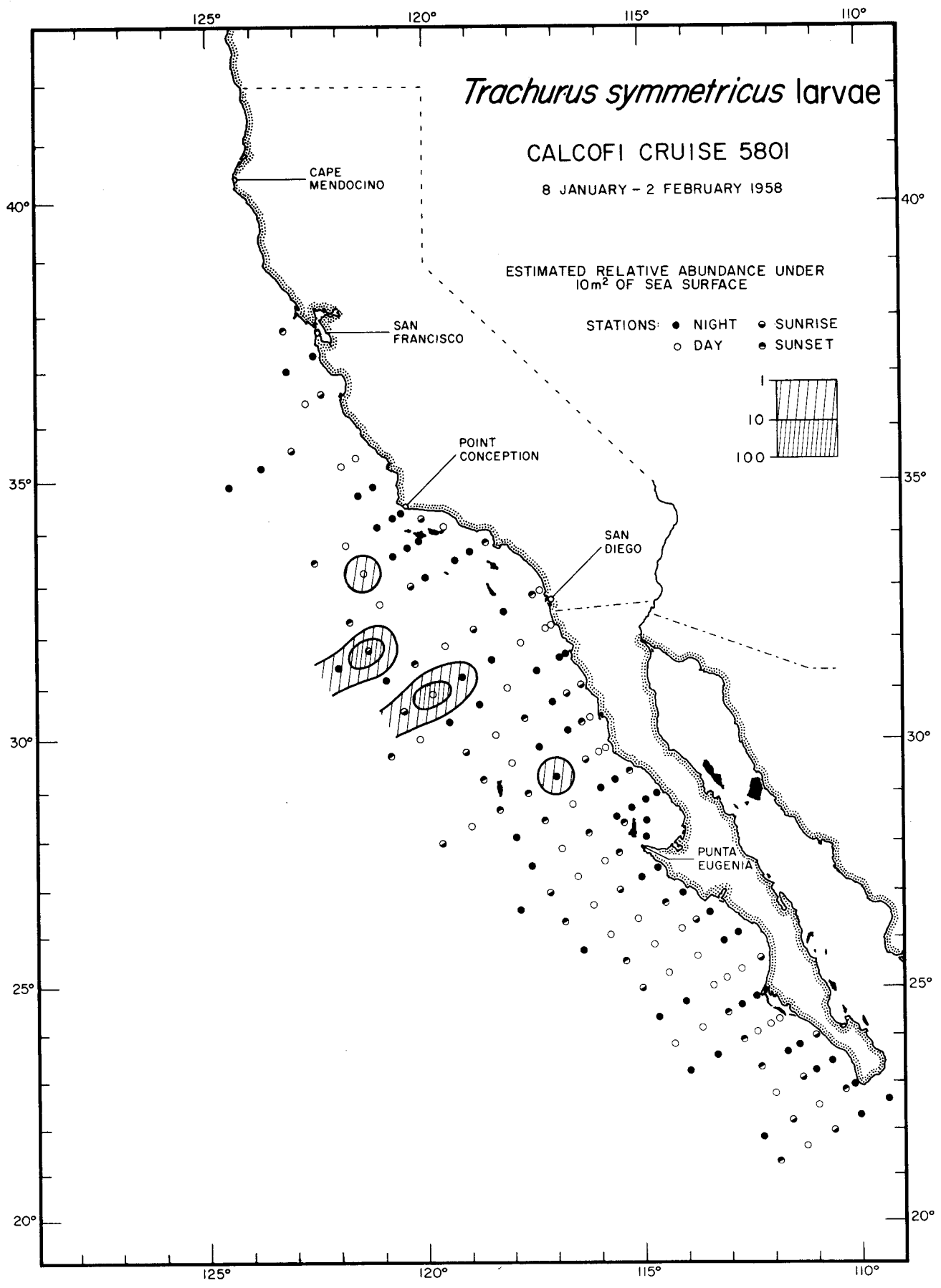
Cruise	Station	J. mackerel	Hake	Cruise	Station	J. mackerel	Hake	
5204	120.45	X O	O O	5504	120.70	X X	O O	
	123.40	O O	X O		123.50	X O	O O	
	.45	X O	X O		.60	X O	O O	
5206	90.30	X O O	O O O		127.50	X O	O O	
	.37	O X X	O O O		.60	O X	O O	
	.45	X X	O O	130.60	O O	X O		
	.53	X X	X X	5603	100.90	X X	X X	
	.60	X X	O O		103.50	X X	X X	
	93.30	X X	O O		.60	X X	X X	
	.40	X X	X O		.70	X X	X X	
	.50	O X	O X		.80	X X	X X	
	.60	X X	O O	.90	X X	X X		
	97.40	X O	X O	5606	90.75	X X	X O	
	.50	X X	X X		.80	X X	X O	
	.60	X X	O X	5801	73.55	O O	O X	
	100.35	O X	O O		5902	83.70	O O	X X
	.40	X X	O X			123.42	O O	X O
.50	X X	O O	6004	103.35	X O	X X		
.60	O X	O X		6101	80.52	O O	X O	
103.35	O X	O O	6104		120.40	O O	O X	
5208	117.30	O O		X X	6304	123.42	O O	O X
	.40	O O	O X	127.40		O O	X O	
5304	85.39	O O	X O	6401	83.51	O O	X X	
	87.35	O O	O X		.55	O O	O X	
5305	85.50	O O	X O		.60	O O	O X	
	87.60	O X	O X	6407	83.55	X O	O X	
5306	85.50	X O	O O		.60	X O	X O	
	5504	103.30	O O		O X	.65	X O	O O
.35		X X	X X	6501	123.42	O O	X X	
.40		X X	X X		127.40	O O	X O	
.50		X X	O X	6604	93.28	O X	X X	
.60		X X	X X		.30	O O	X X	
.70		X X	X X		.40	O O	X O	
.80		X X	X X		.50	O X	X X	
107.80		X X	X X		.60	O X	X X	
110.60		X X	X X		.70	X X	X O	
.80		X X	O O		.80	X X	X X	
113.60		X X	X X		.90	X O	X O	
117.60		X X	X O					
120.35		O O	X X					
.45		O O	X X					
.50	O X	O X						
.55	X O	X X						
.60	X X X	O X X						



CALCOFI
BASIC STATION PLAN
SINCE 1950

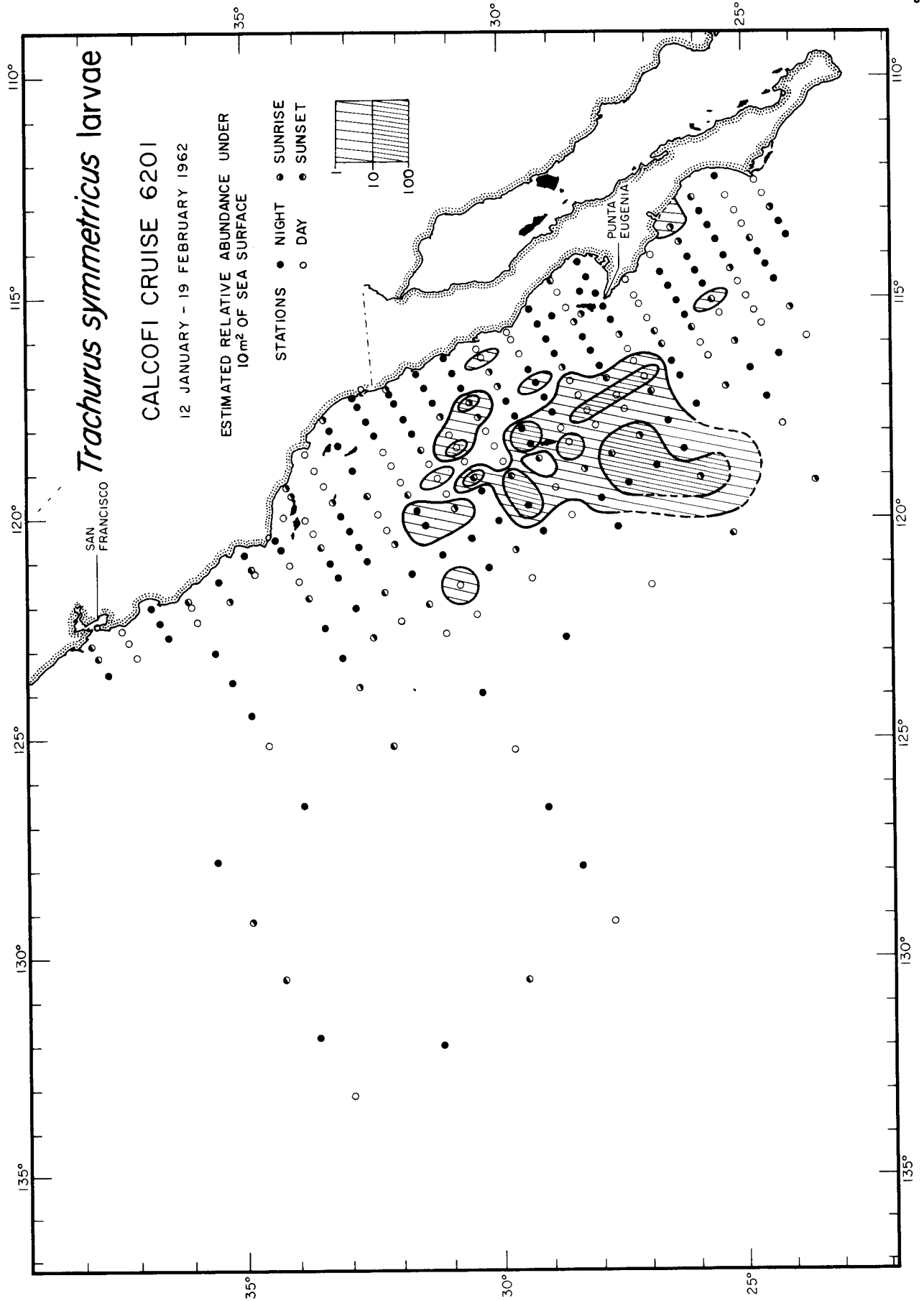
CALCOFI

BASIC STATION PLAN
SINCE 1950

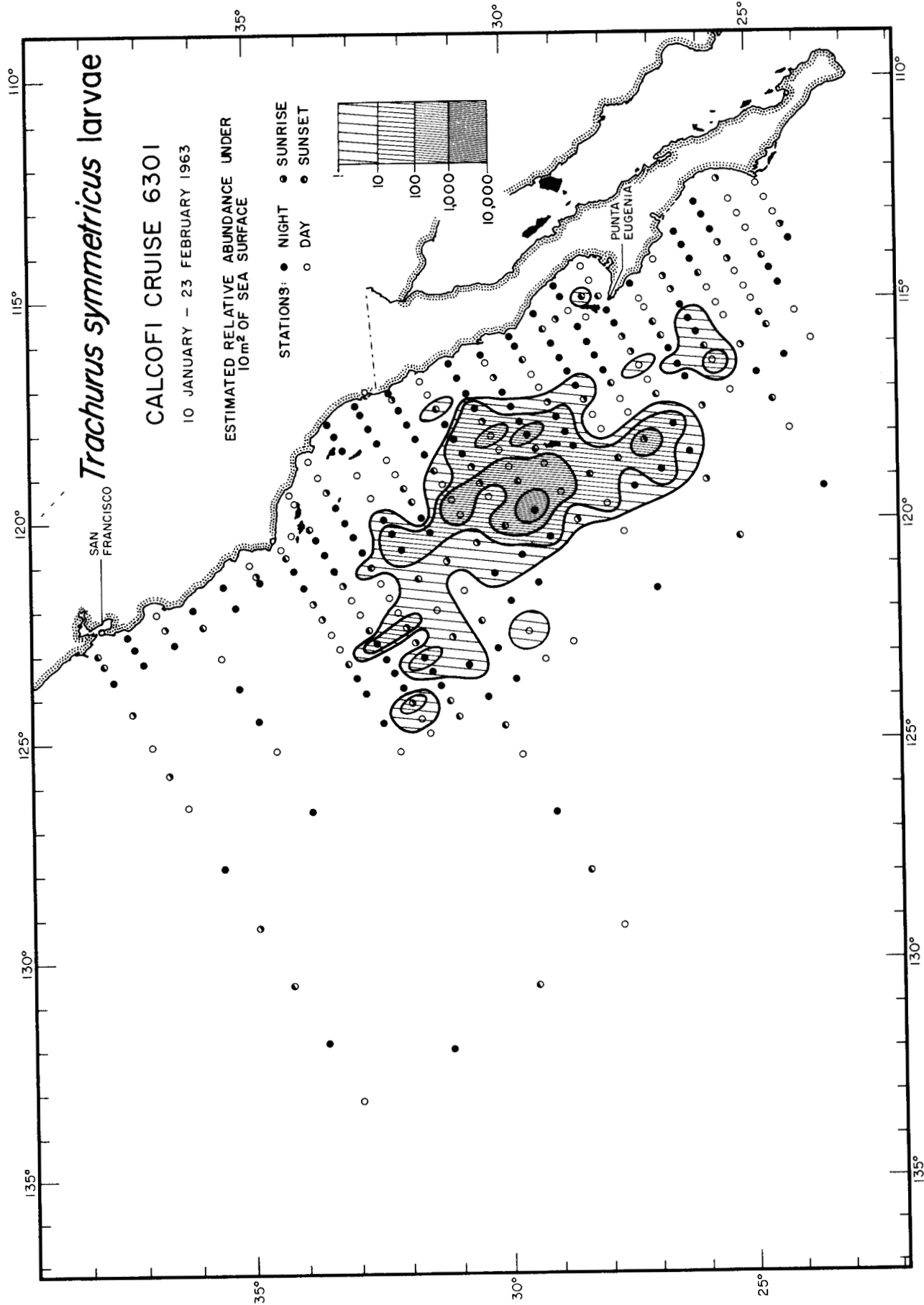


Trachurus symmetricus larvae

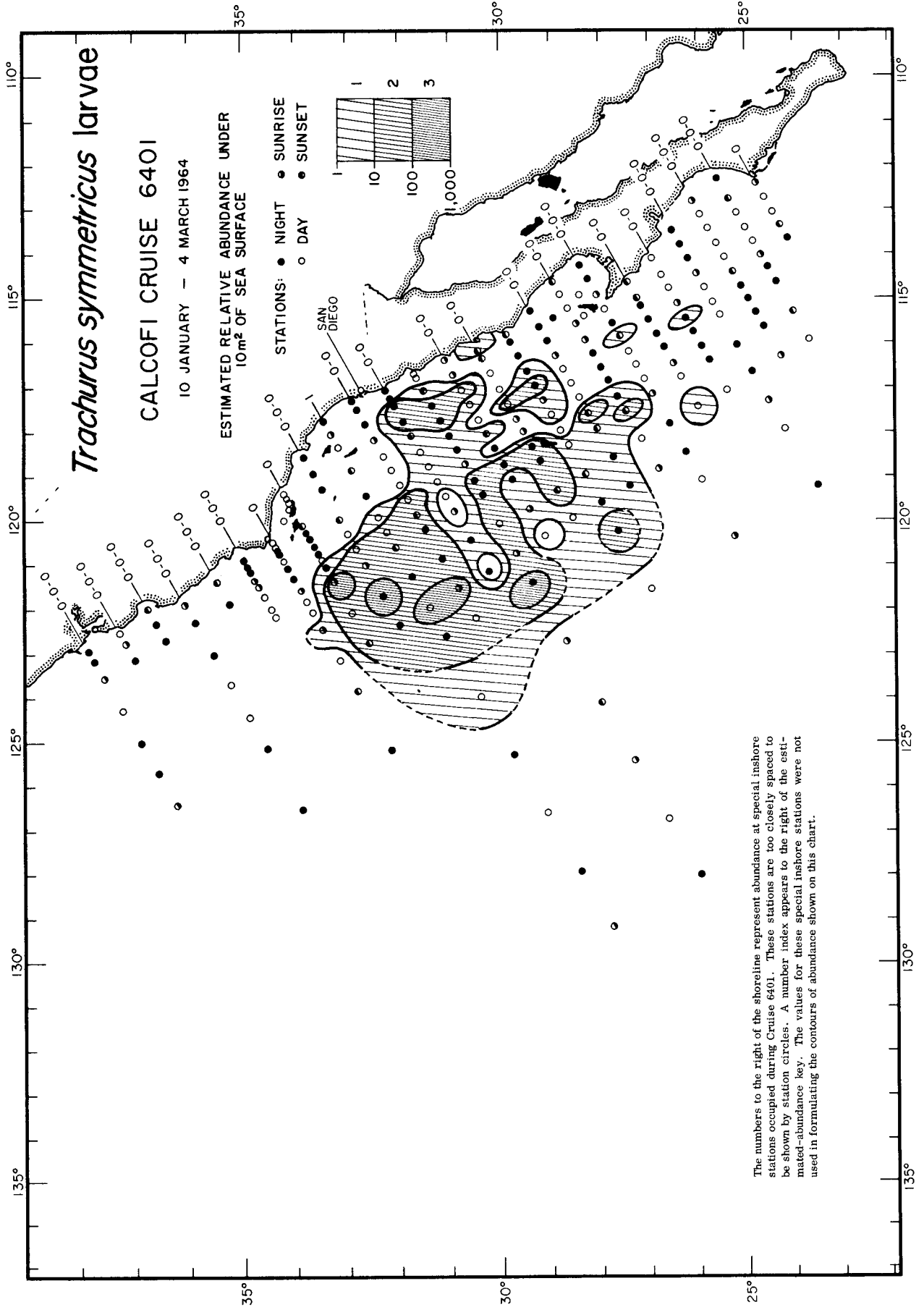
5801



Trachurus symmetricus larvae

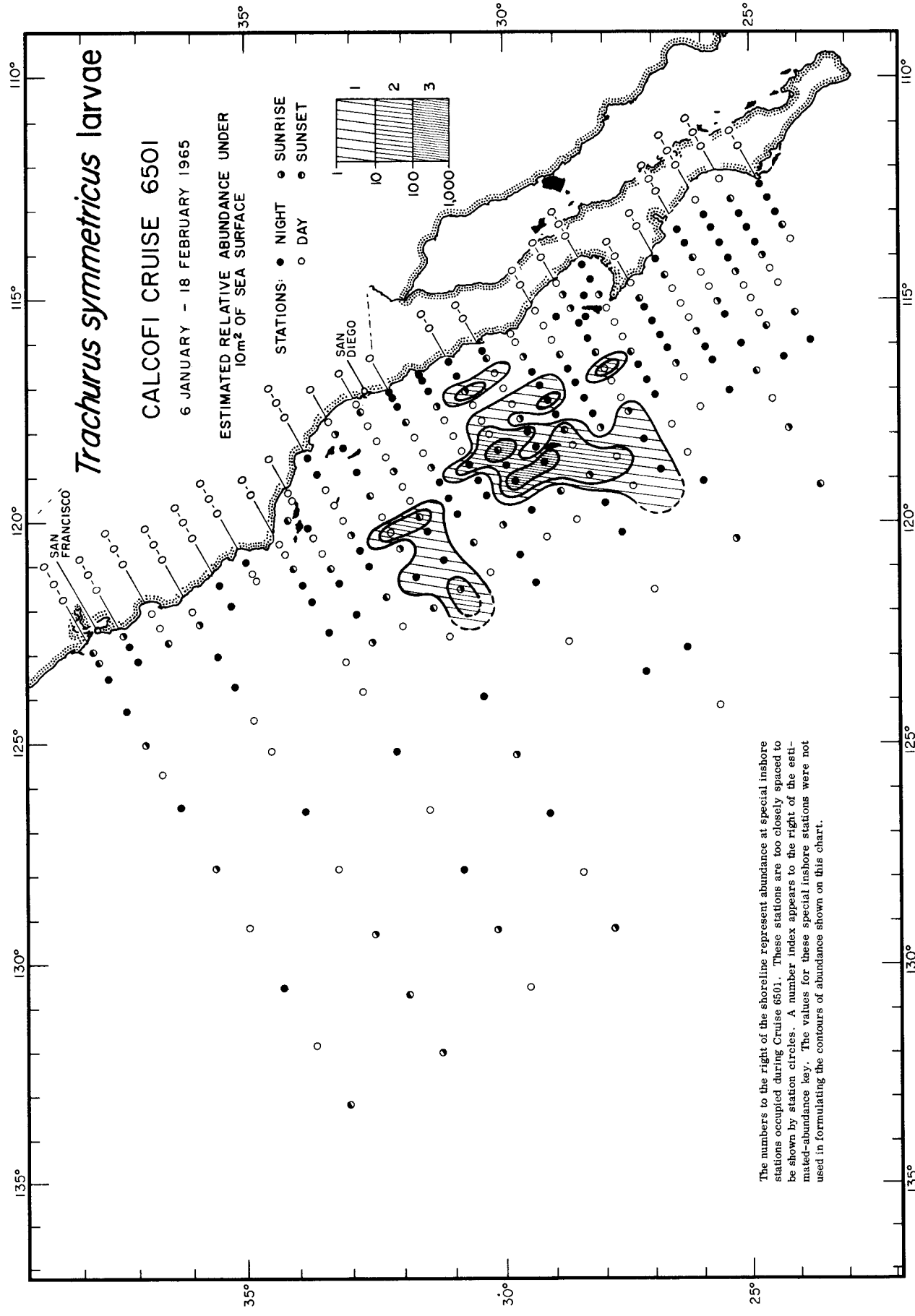


Trachurus symmetricus larvae
6301



Trachurus symmetricus larvae

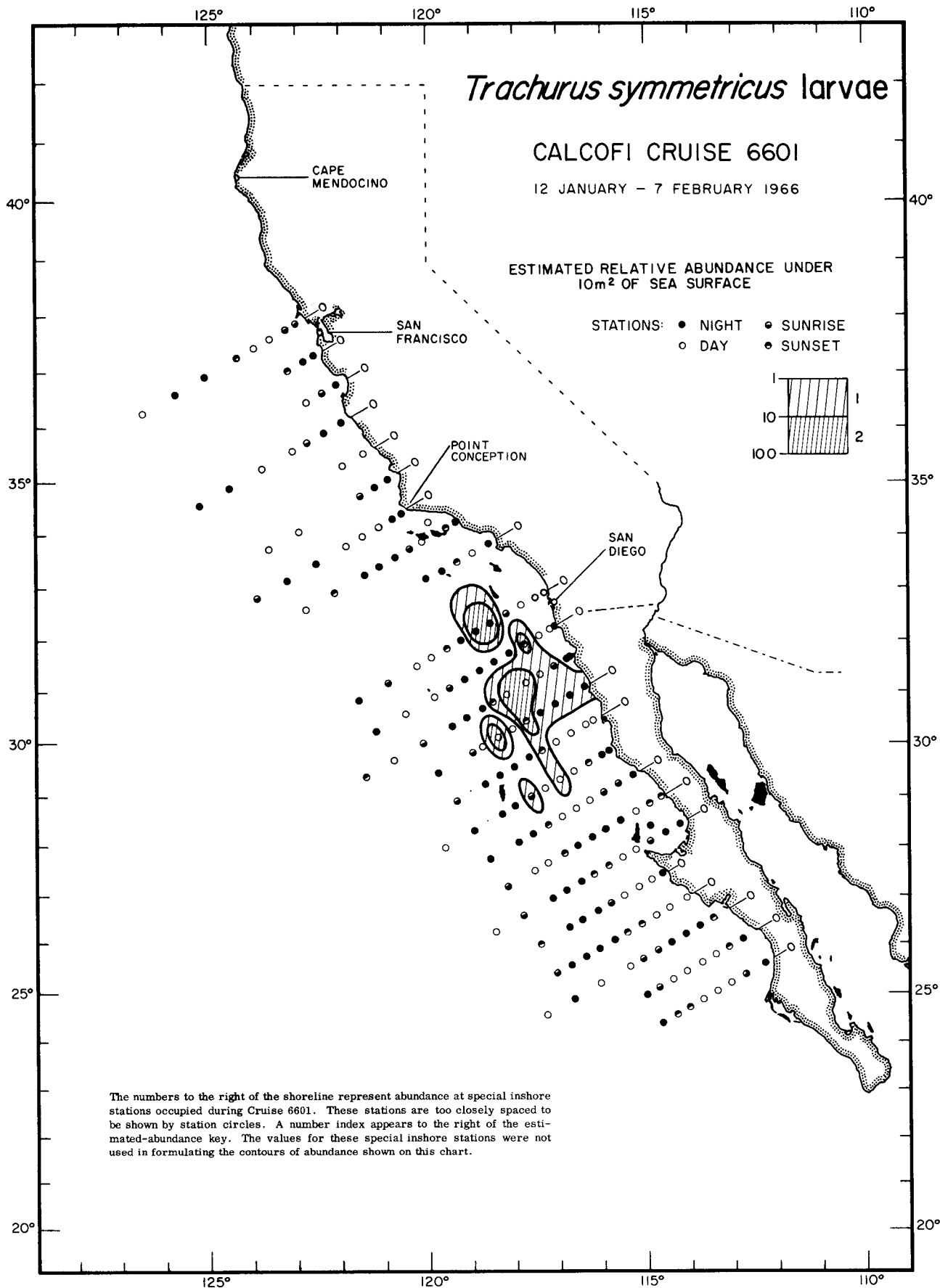
6401



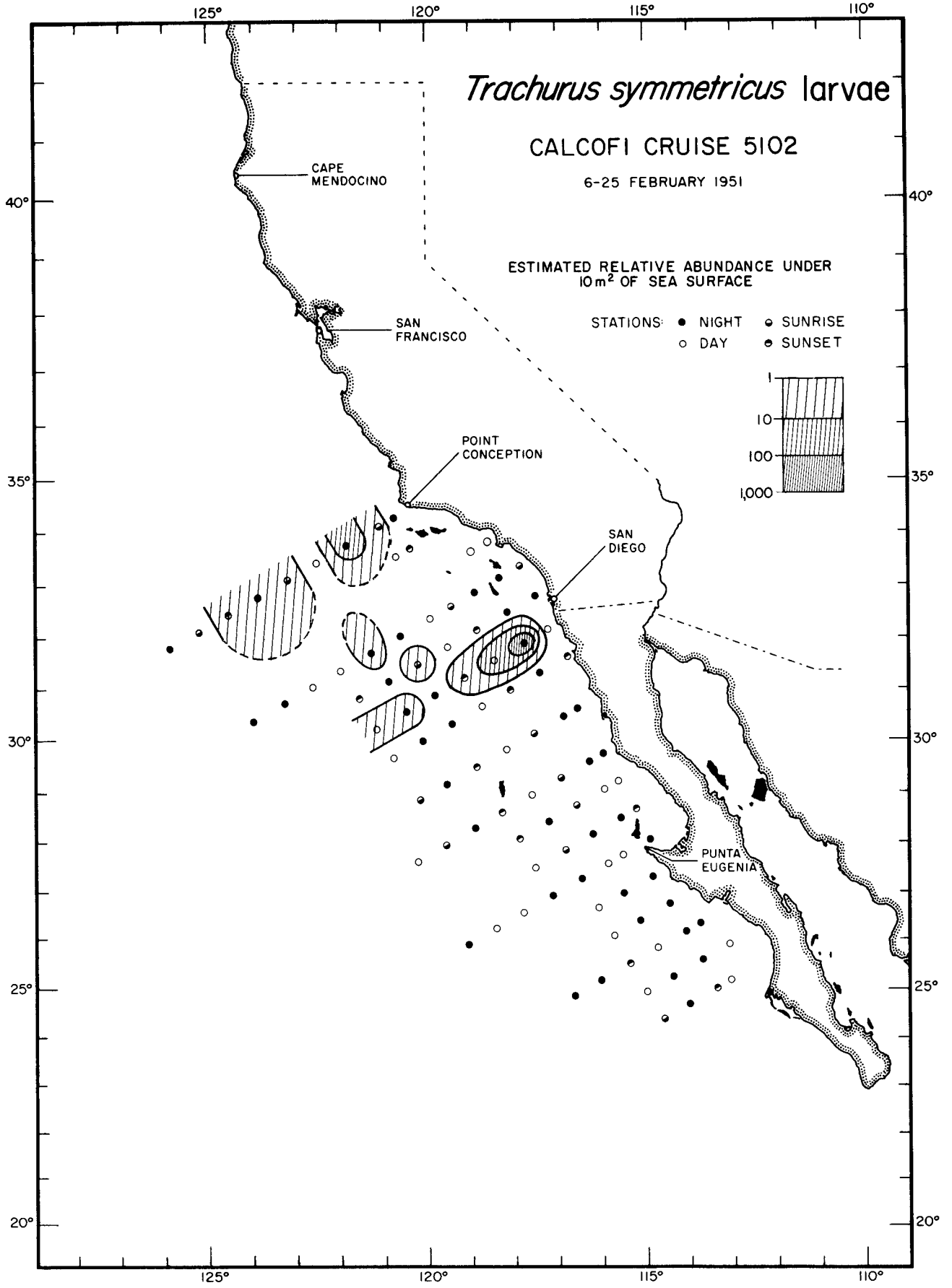
The numbers to the right of the shoreline represent abundance at special inshore stations occupied during Cruise 6501. These stations are too closely spaced to be shown by station circles. A number index appears to the right of the estimated-abundance key. The values for these special inshore stations were not used in formulating the contours shown on this chart.

Trachurus symmetricus larvae

6501

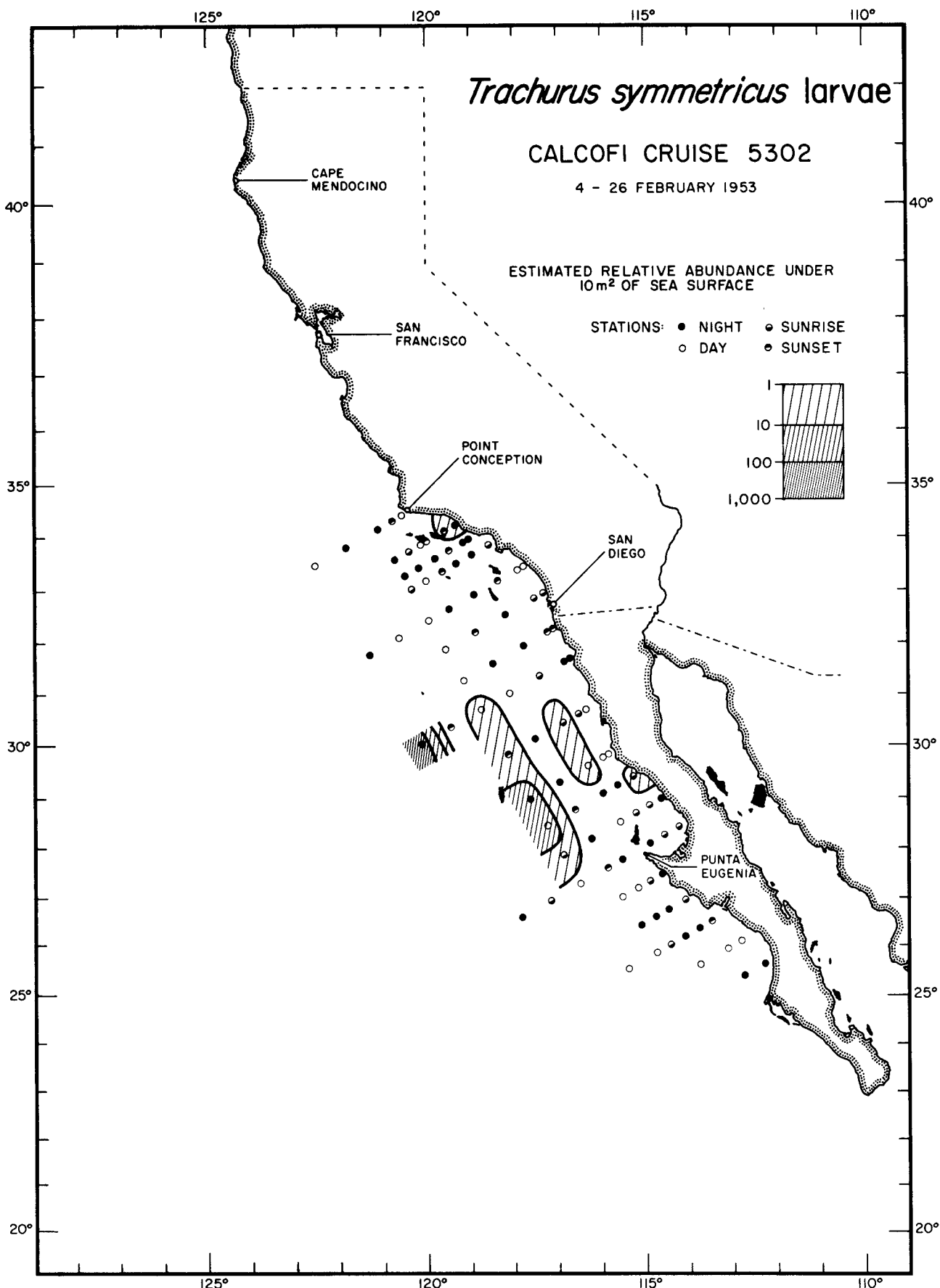


The numbers to the right of the shoreline represent abundance at special inshore stations occupied during Cruise 6601. These stations are too closely spaced to be shown by station circles. A number index appears to the right of the estimated-abundance key. The values for these special inshore stations were not used in formulating the contours of abundance shown on this chart.



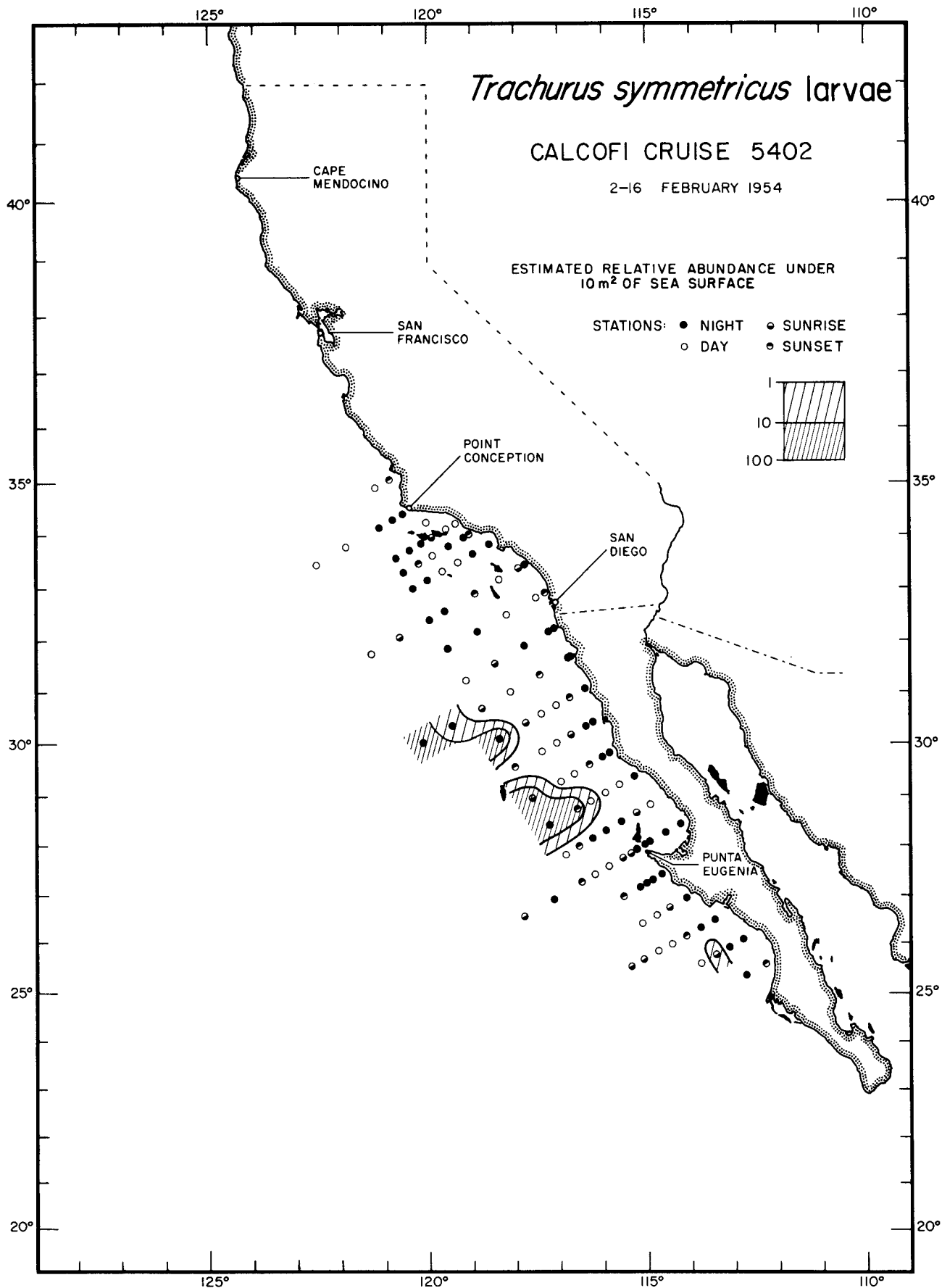
Trachurus symmetricus larvae

5102



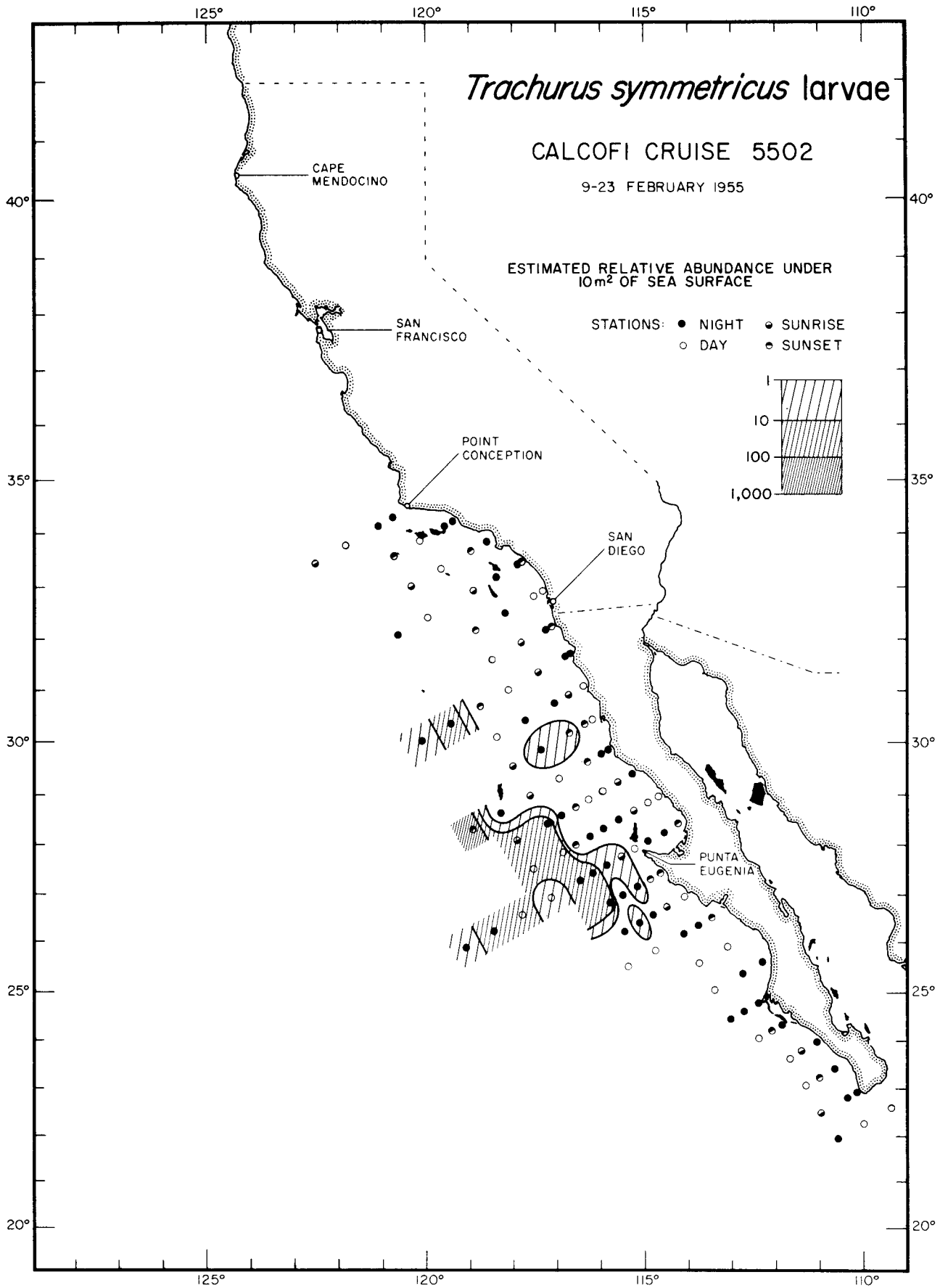
Trachurus symmetricus larvae

5302



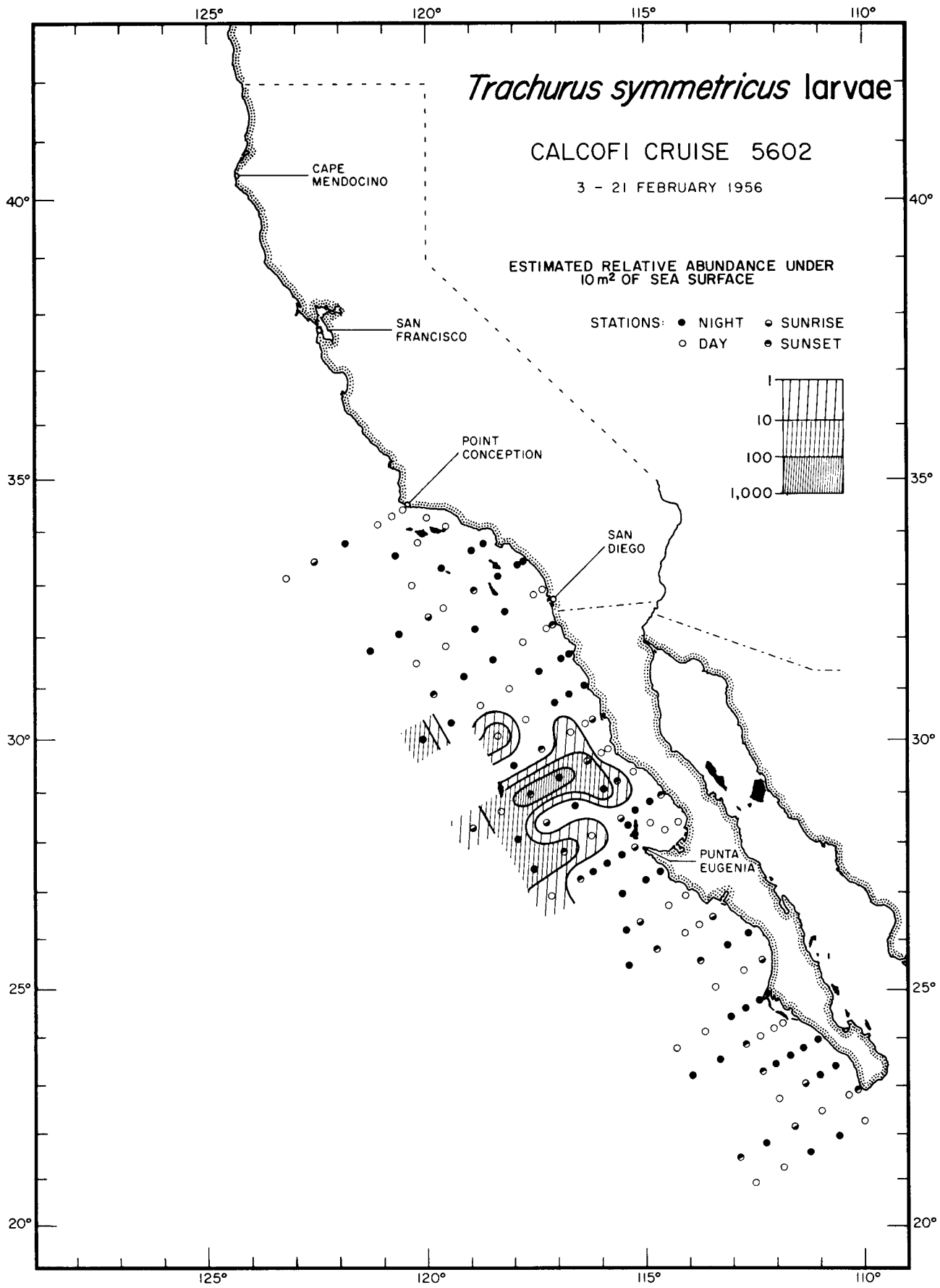
Trachurus symmetricus larvae

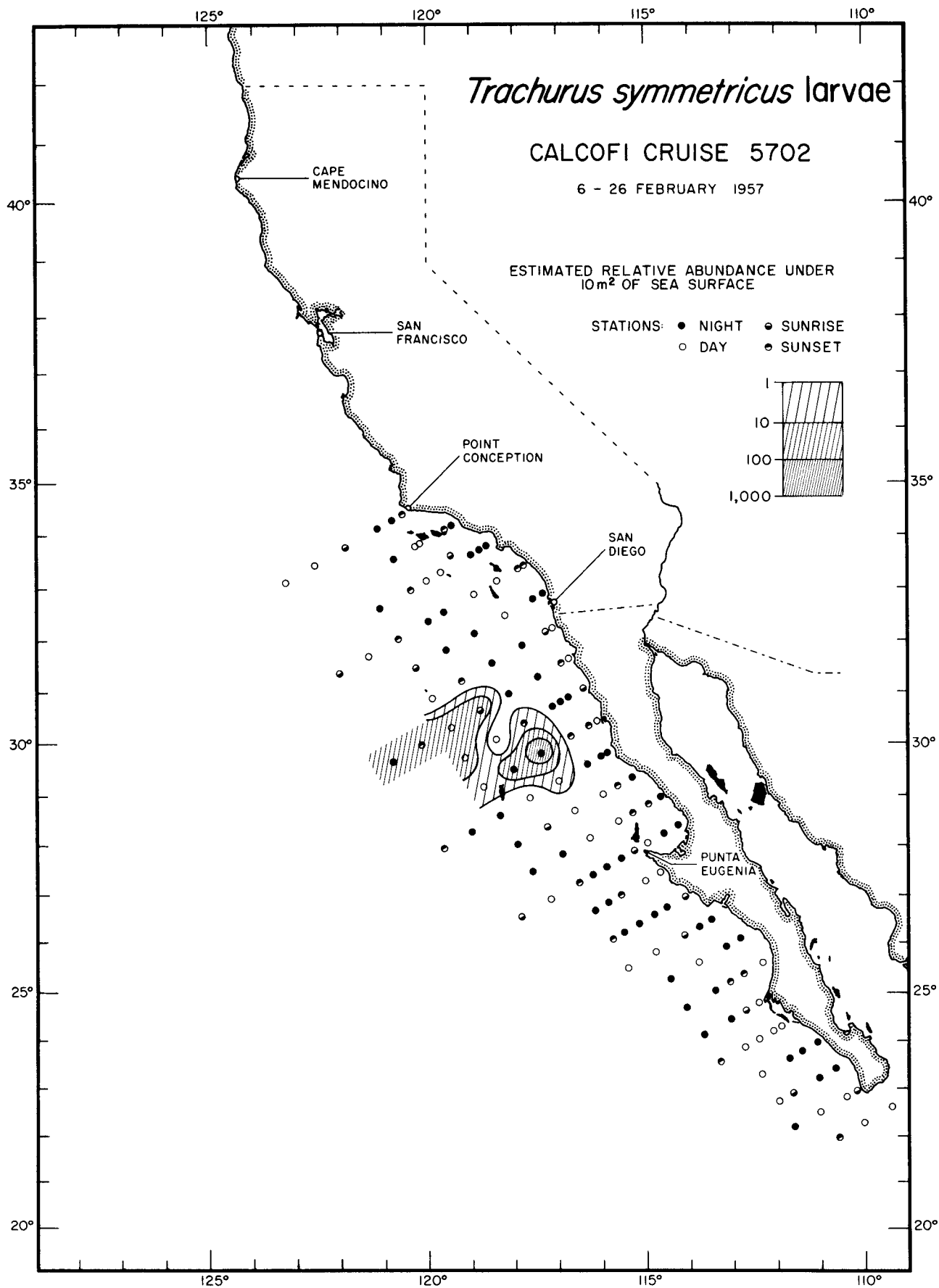
5402



Trachurus symmetricus larvae

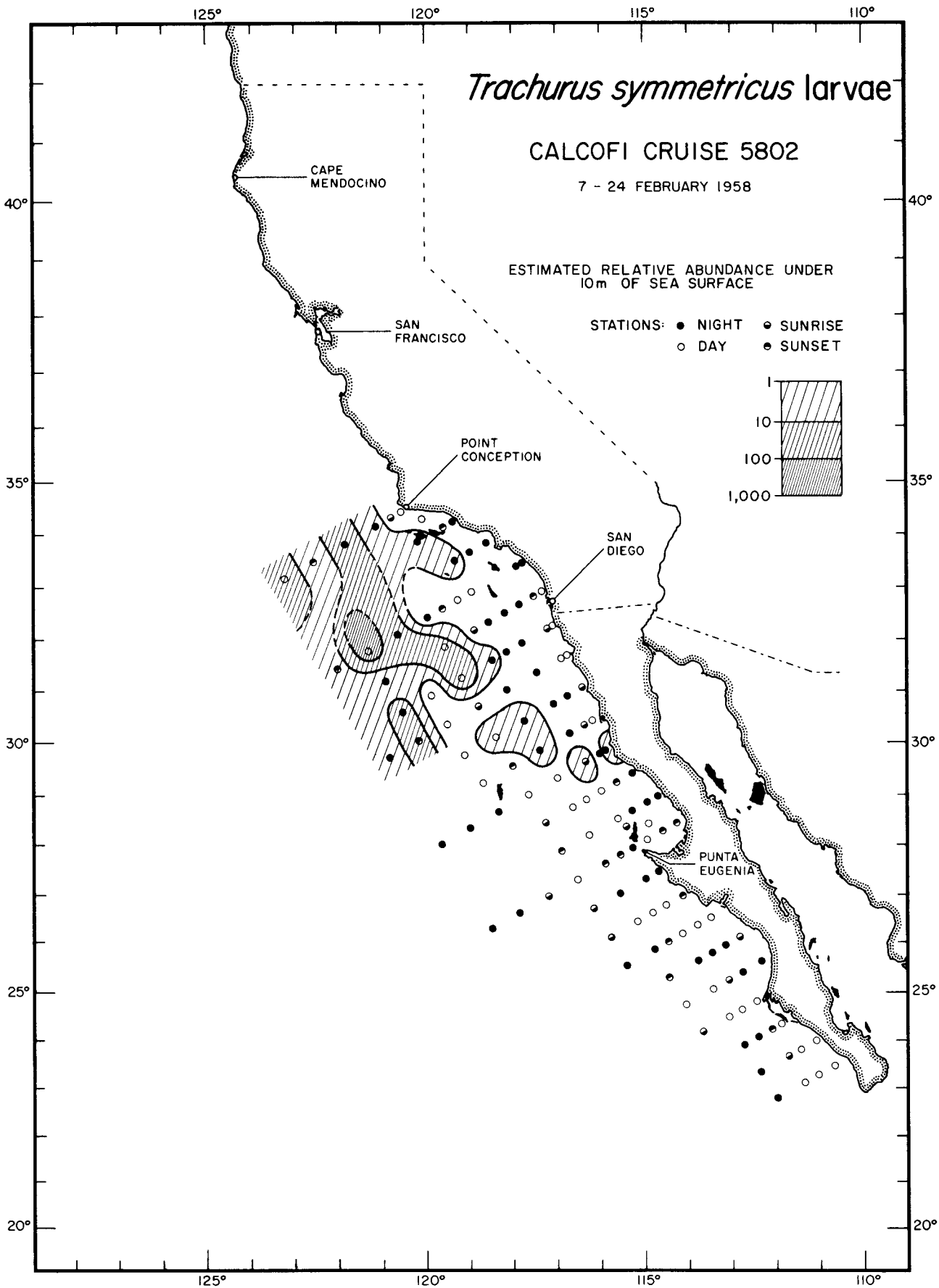
5502





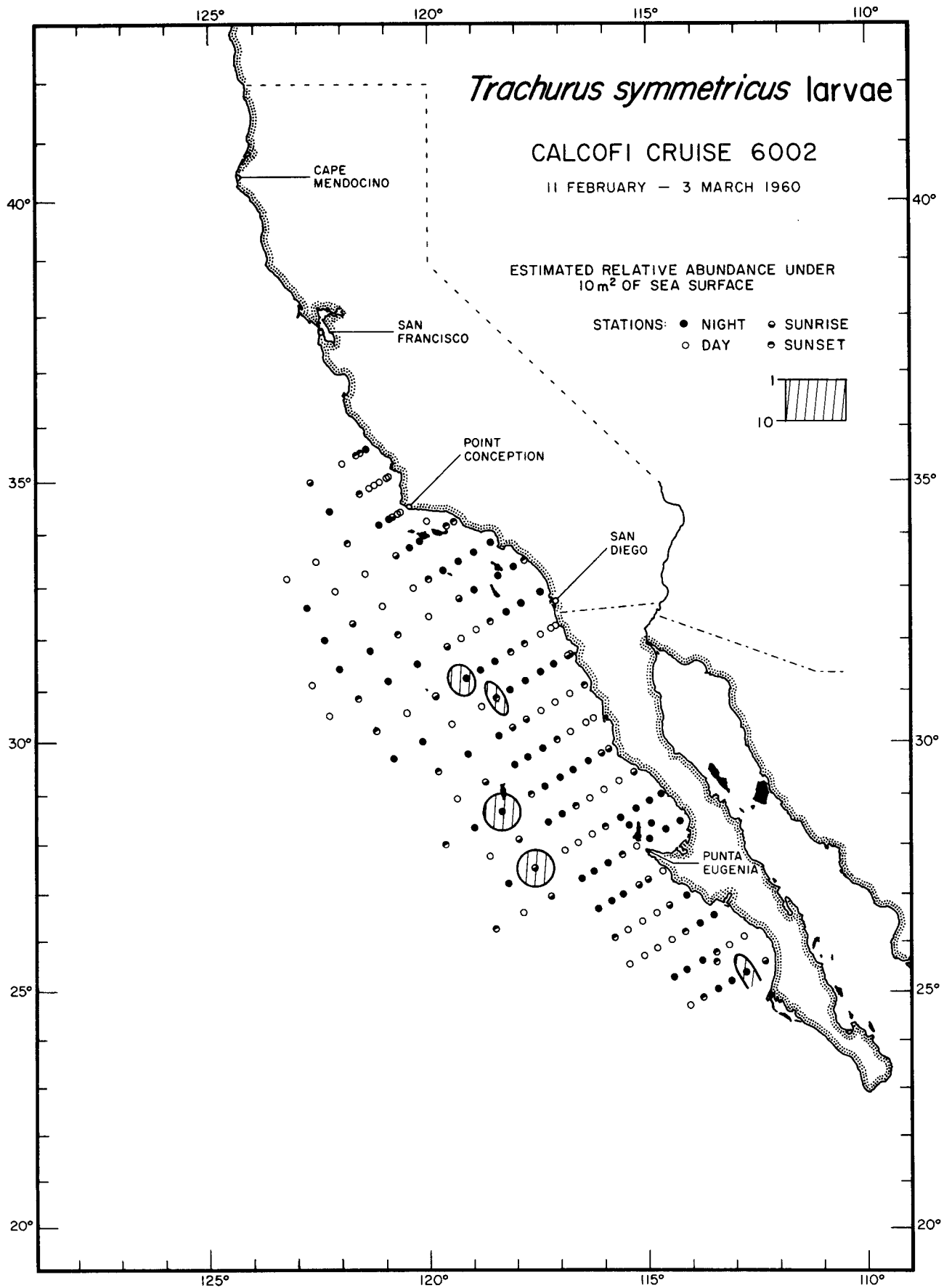
Trachurus symmetricus larvae

5702



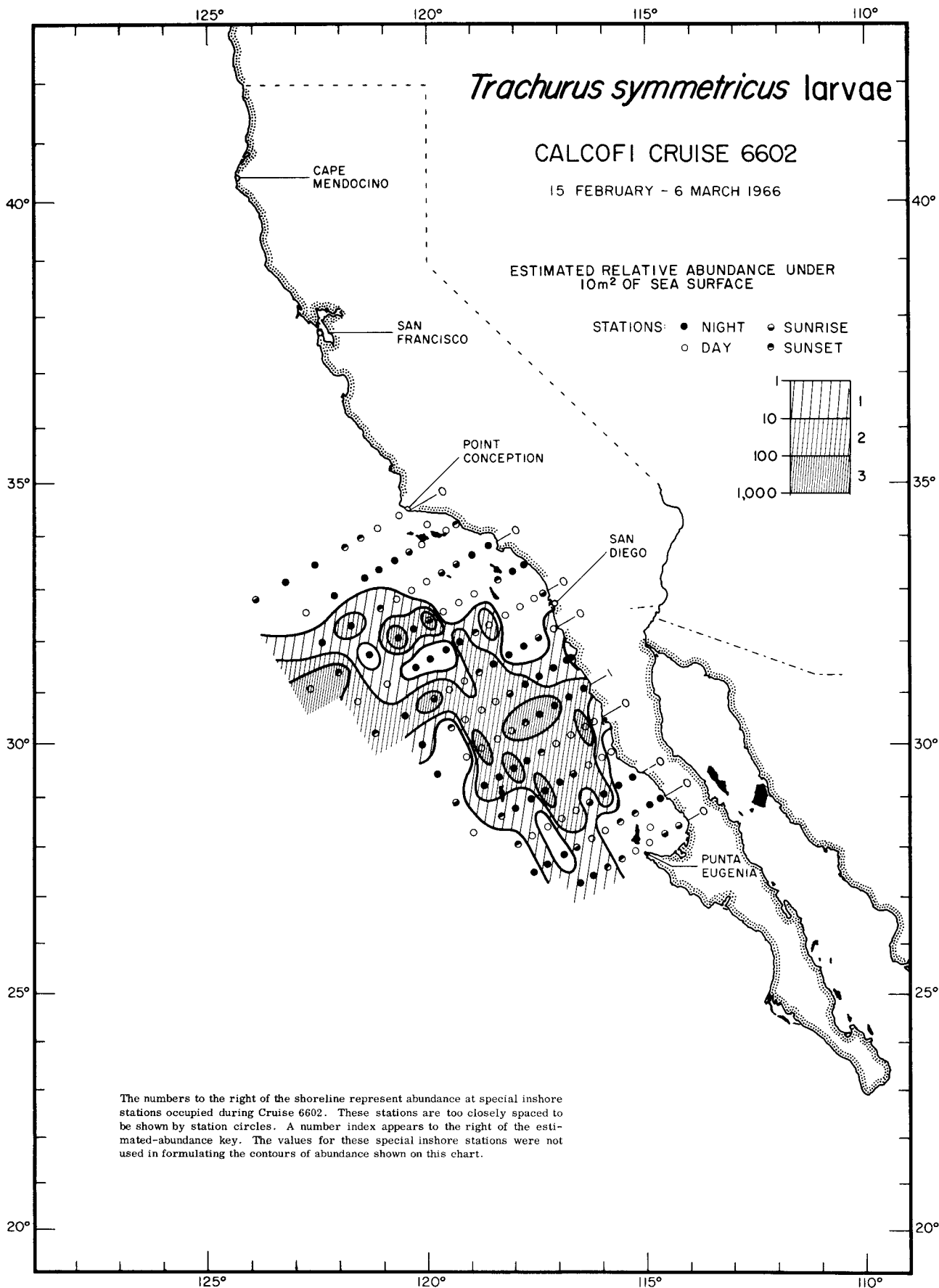
Trachurus symmetricus larvae

5802



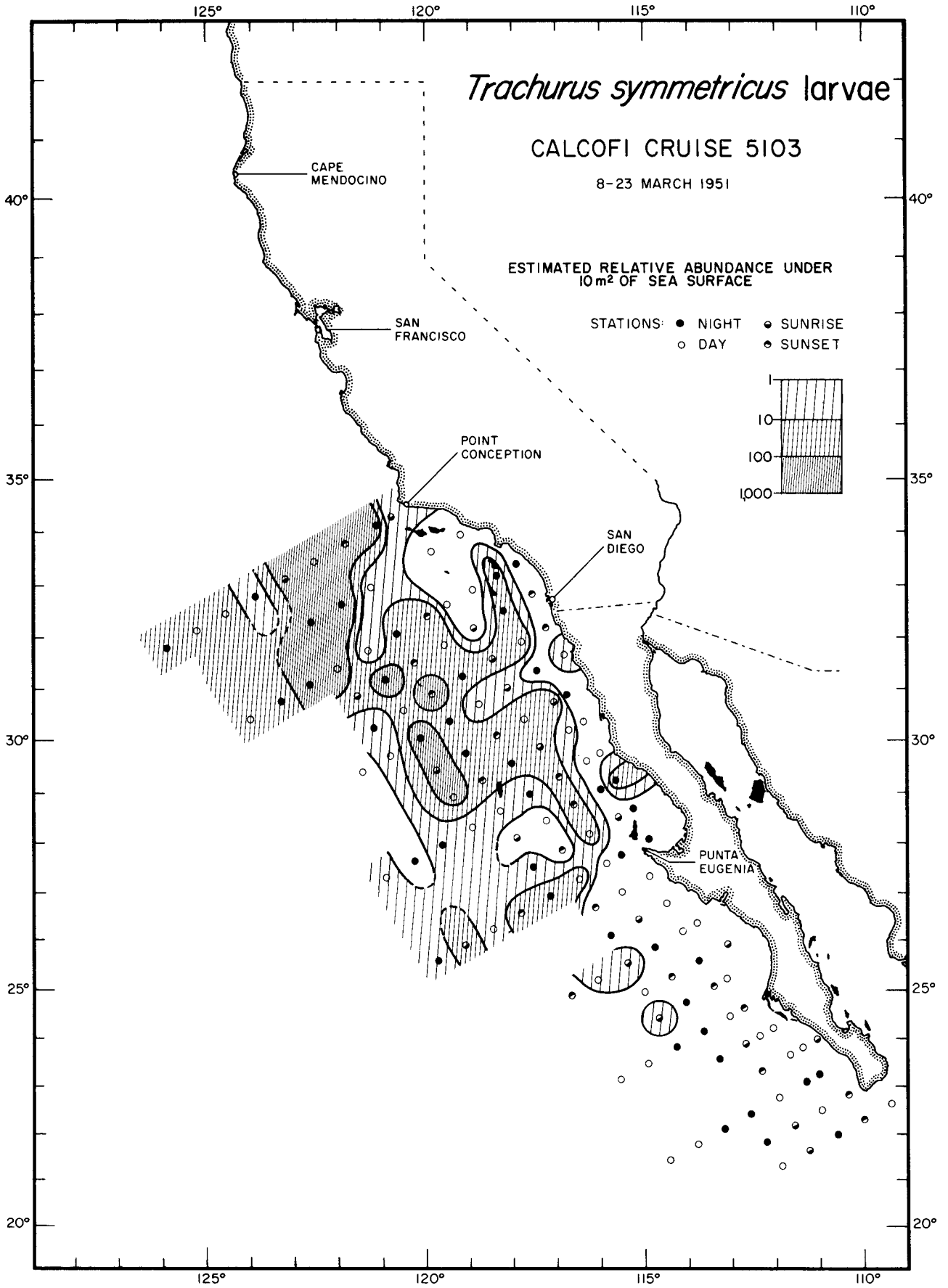
Trachurus symmetricus larvae

6002



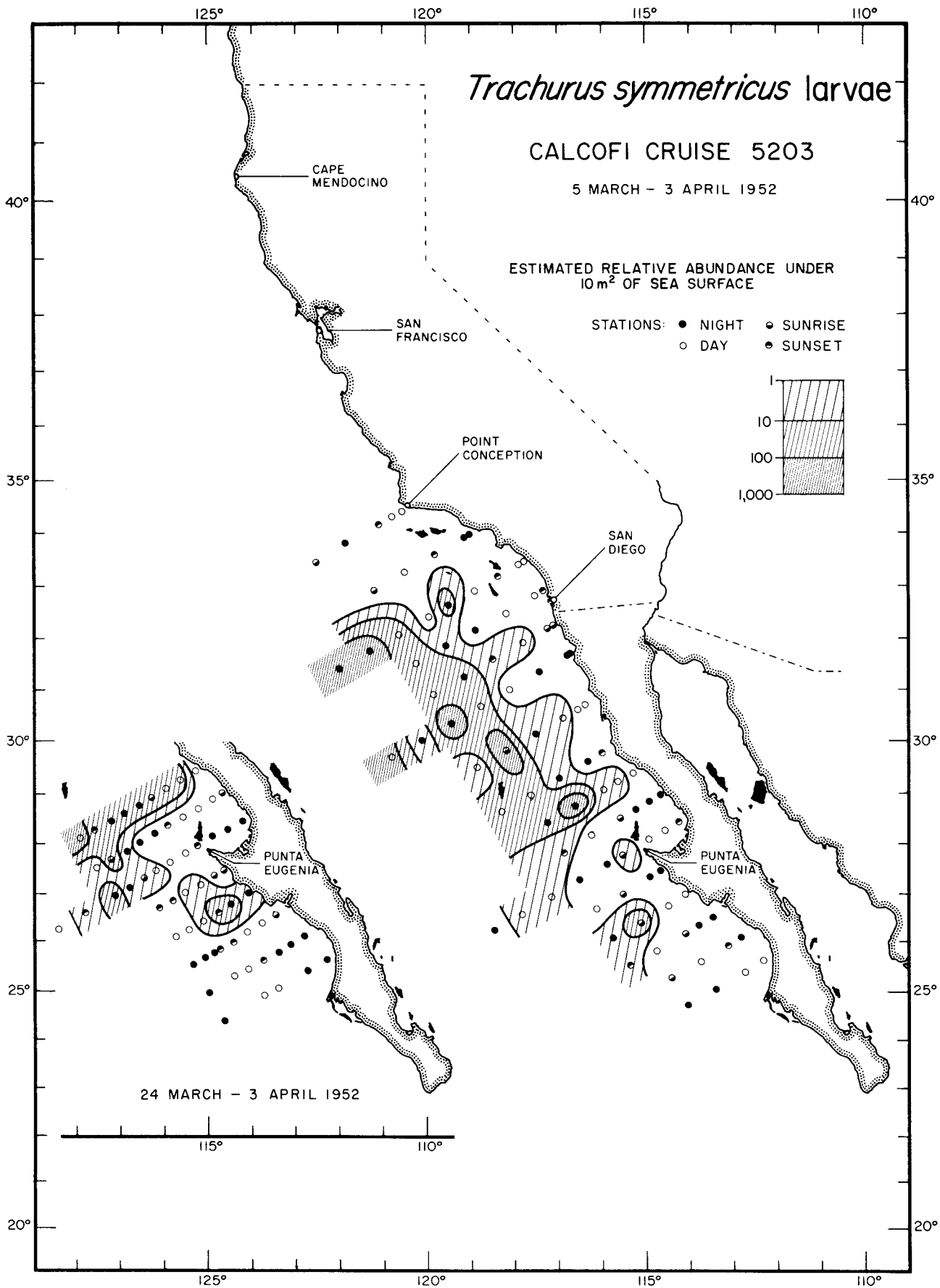
Trachurus symmetricus larvae

6602



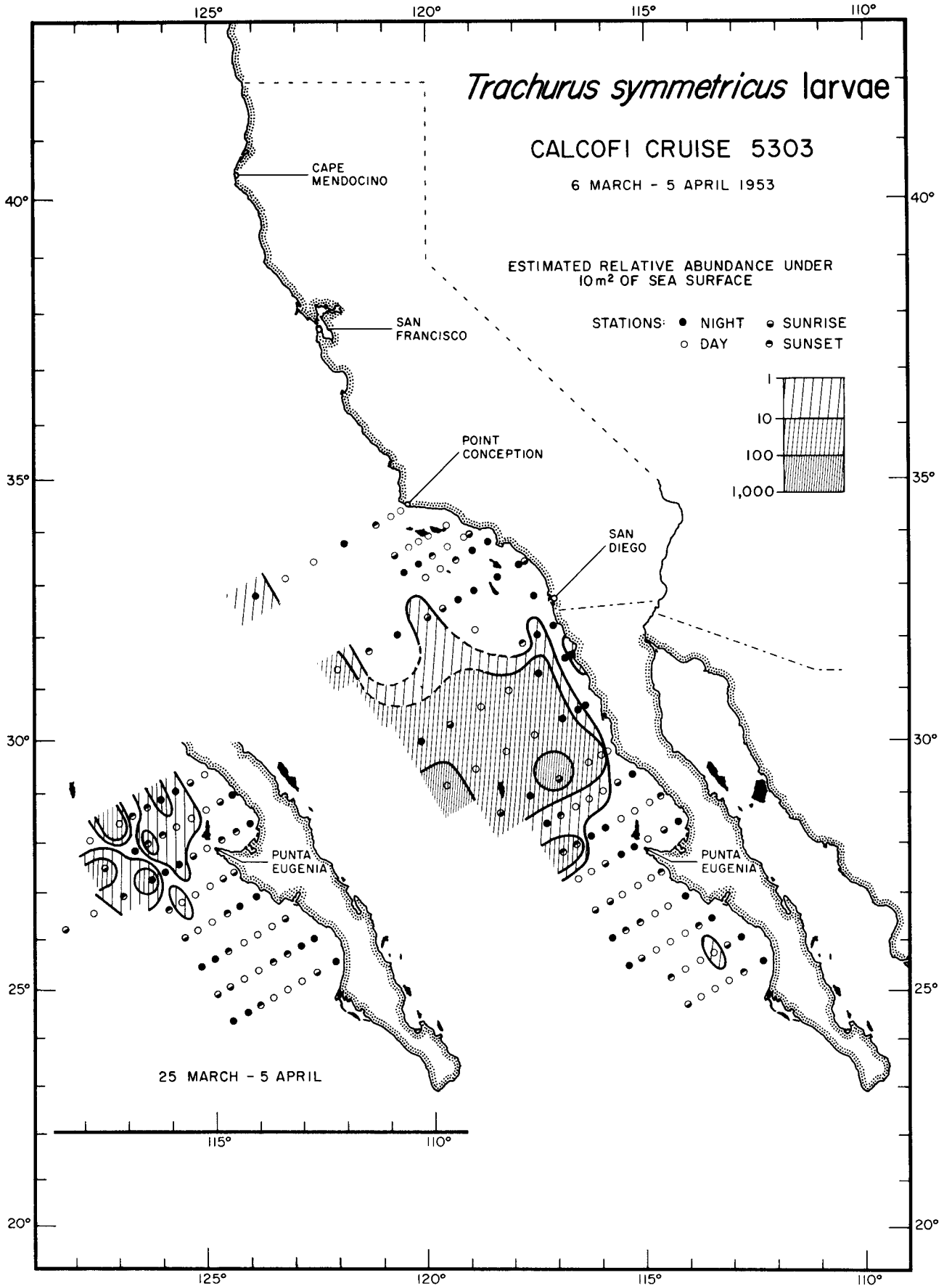
Trachurus symmetricus larvae

5103



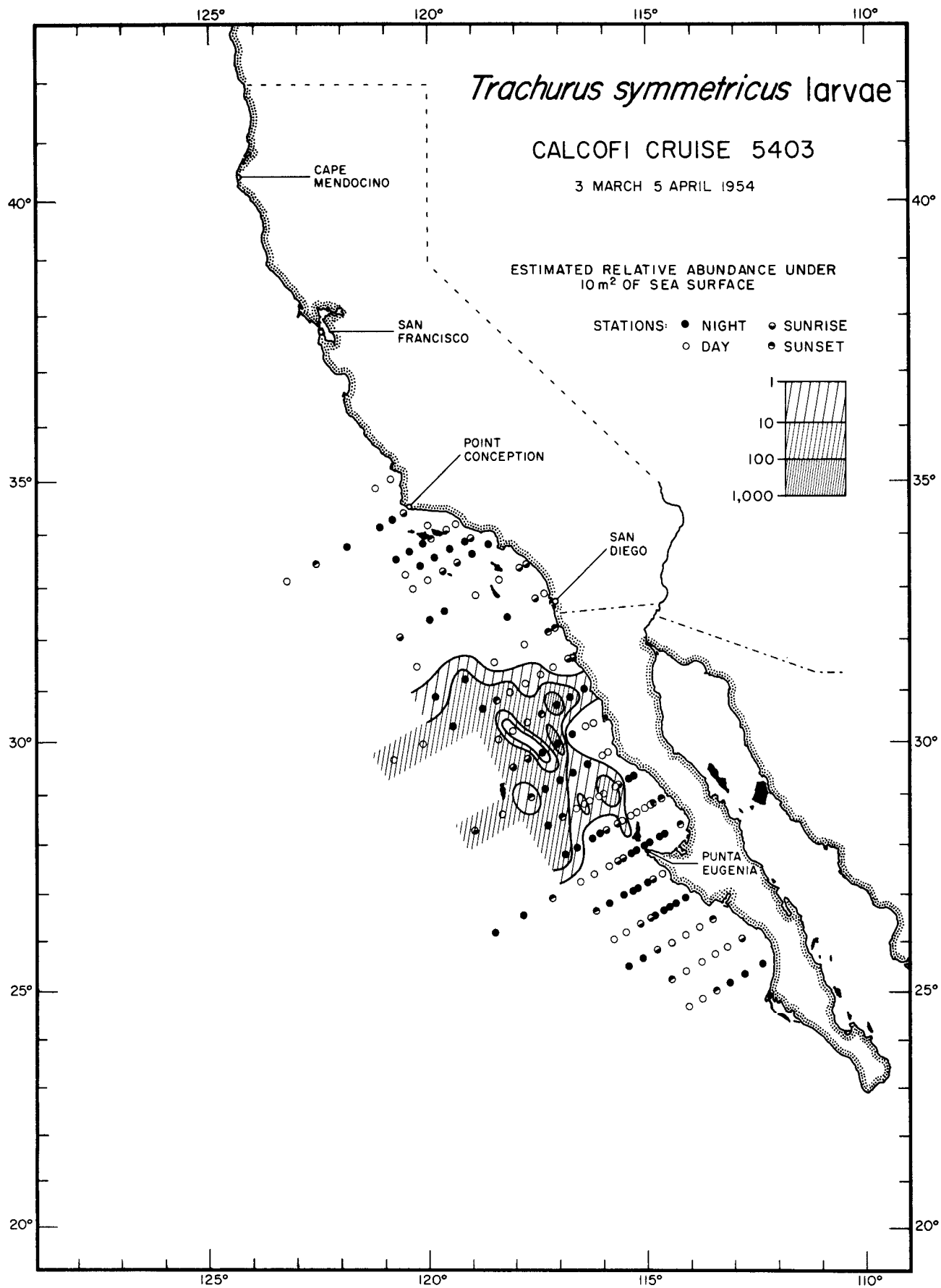
Trachurus symmetricus larvae

5203



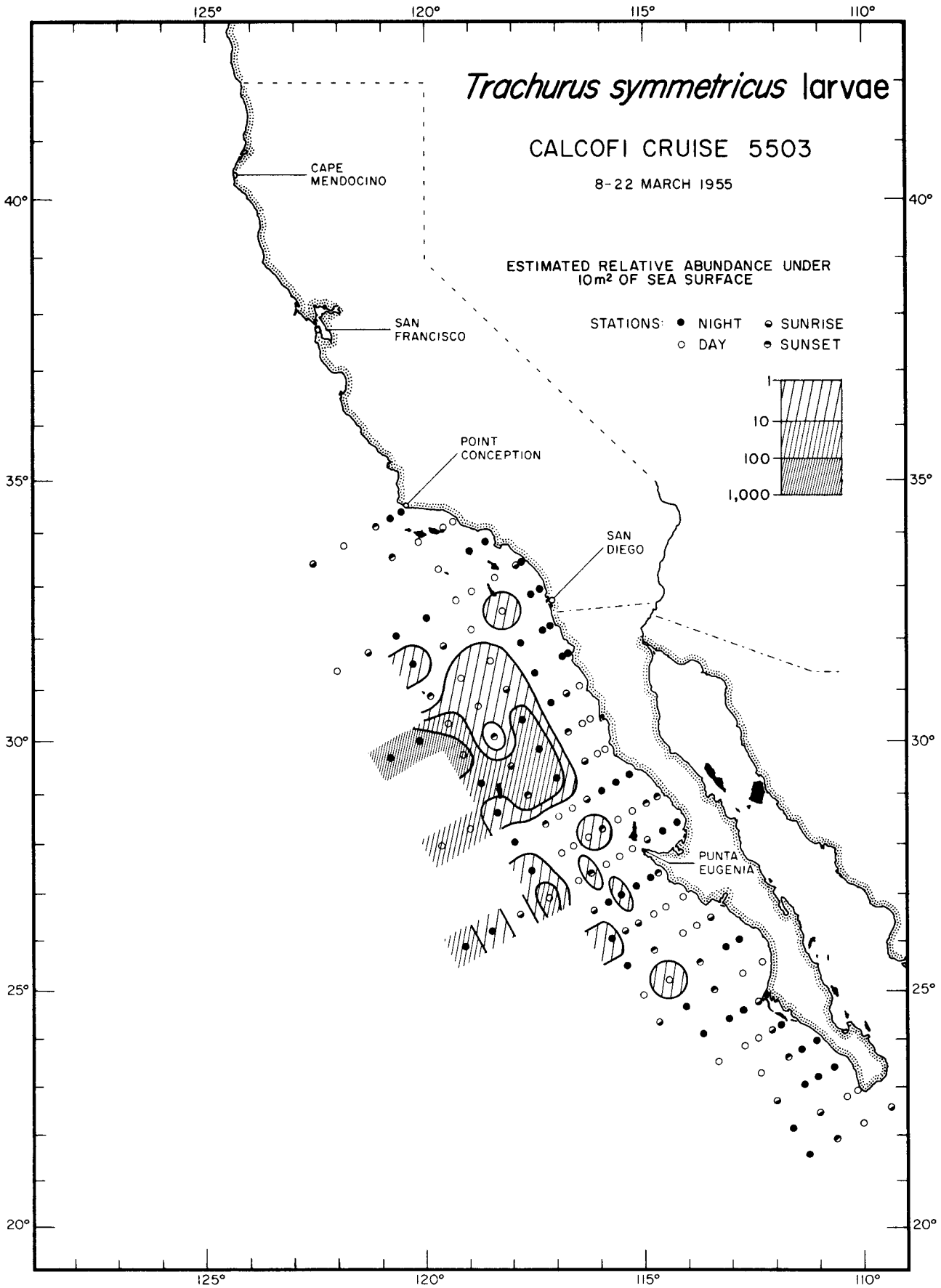
Trachurus symmetricus larvae

5303



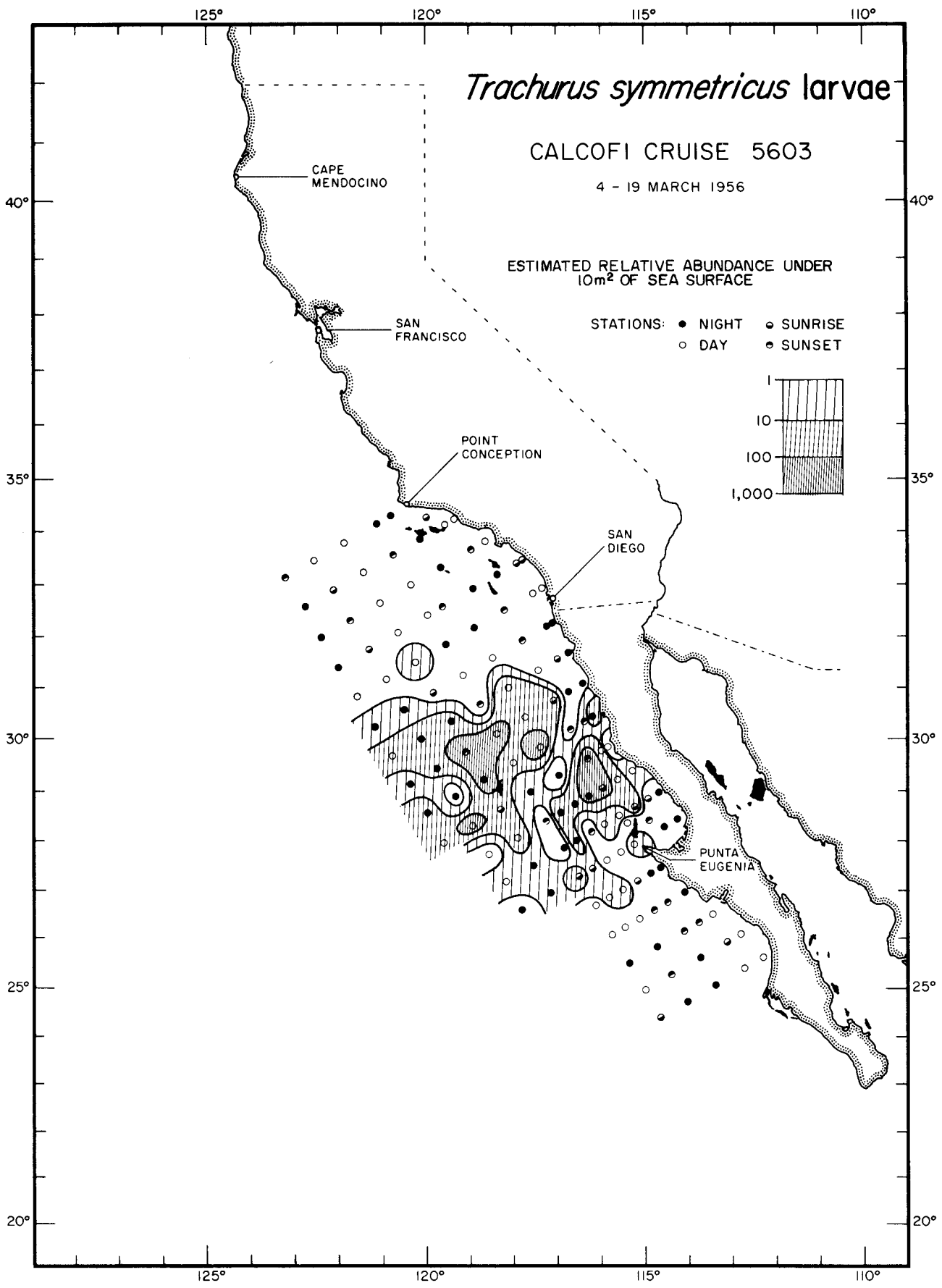
Trachurus symmetricus larvae

5403



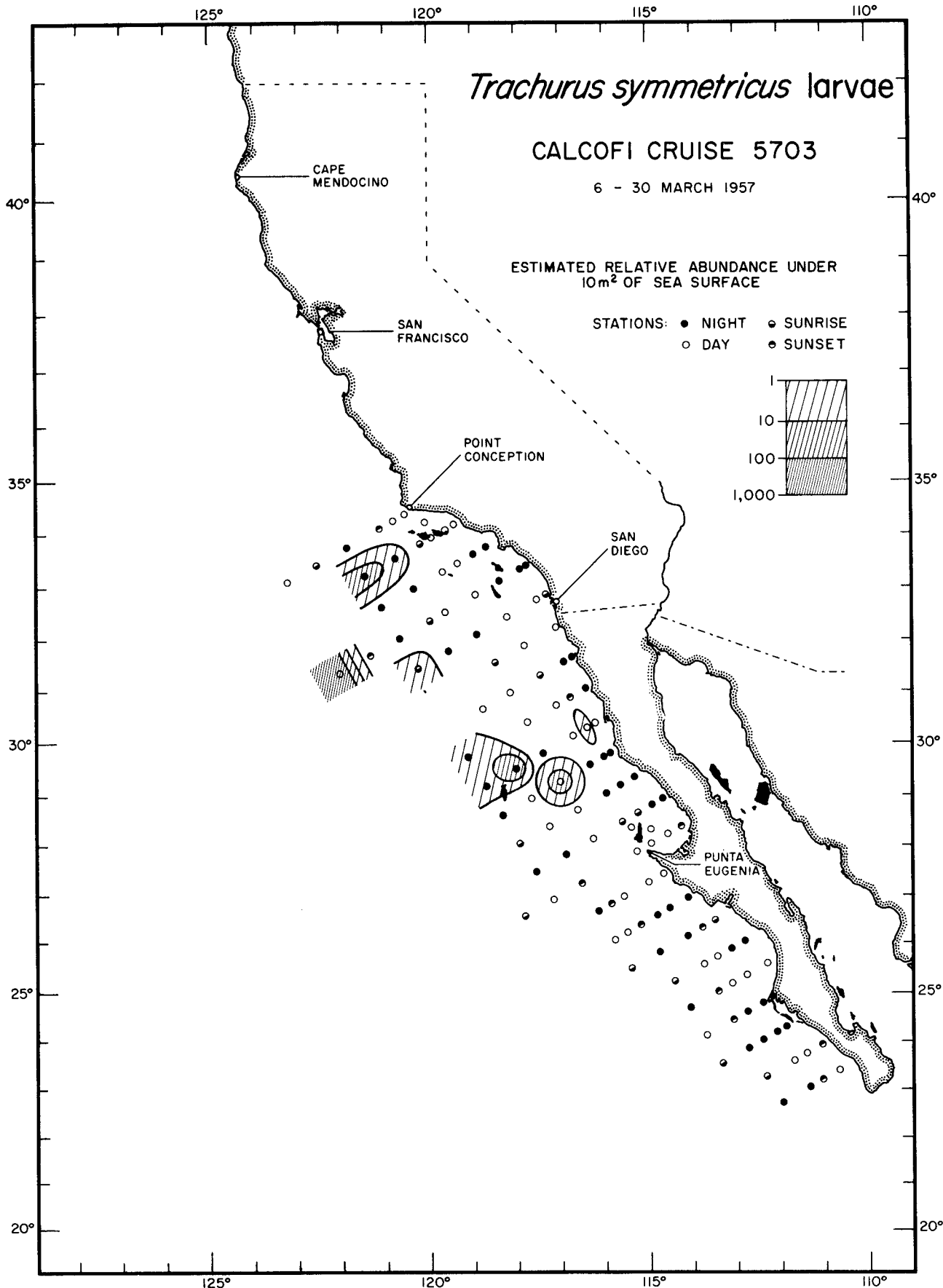
Trachurus symmetricus larvae

5503

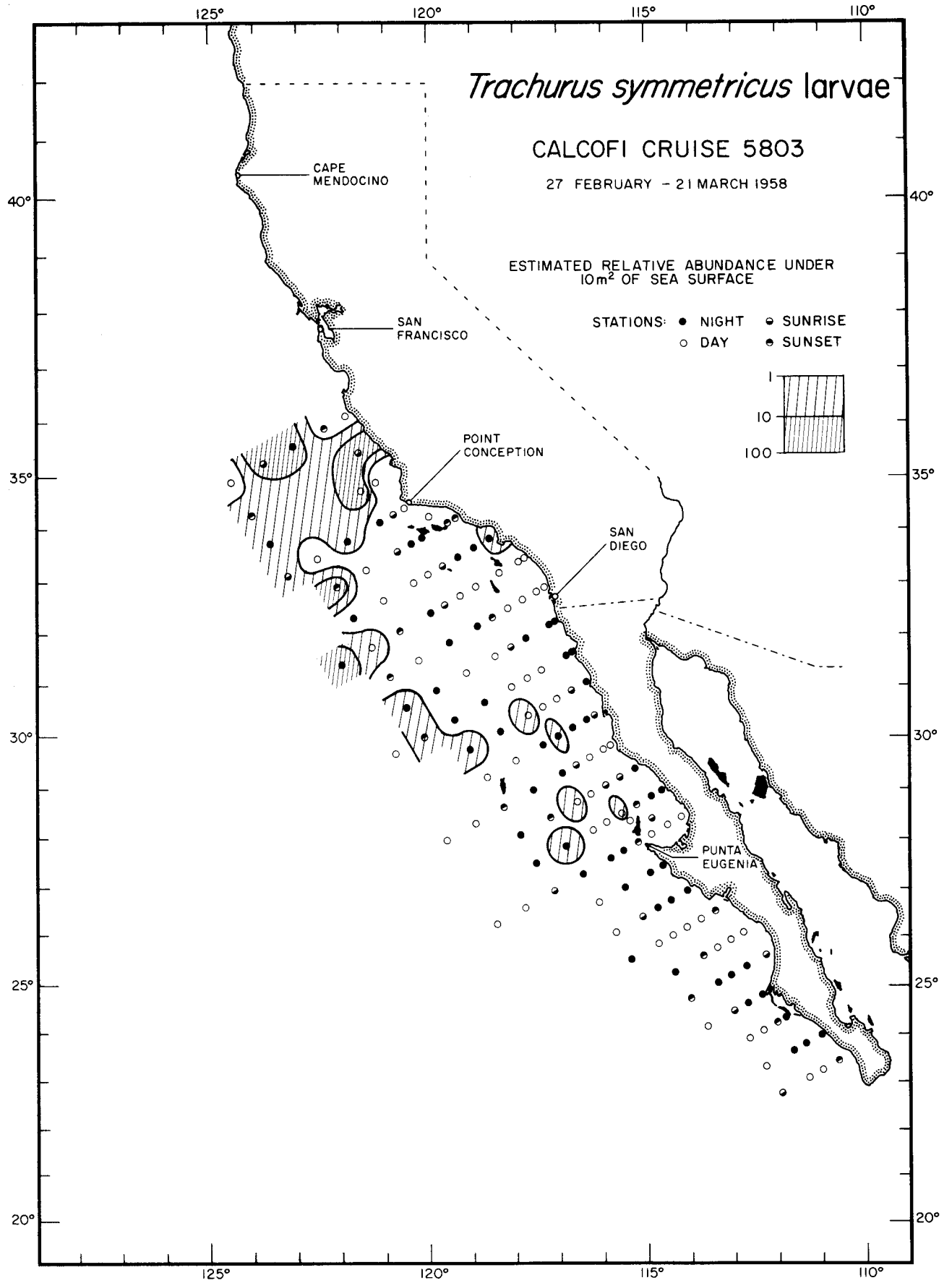


Trachurus symmetricus larvae

5603

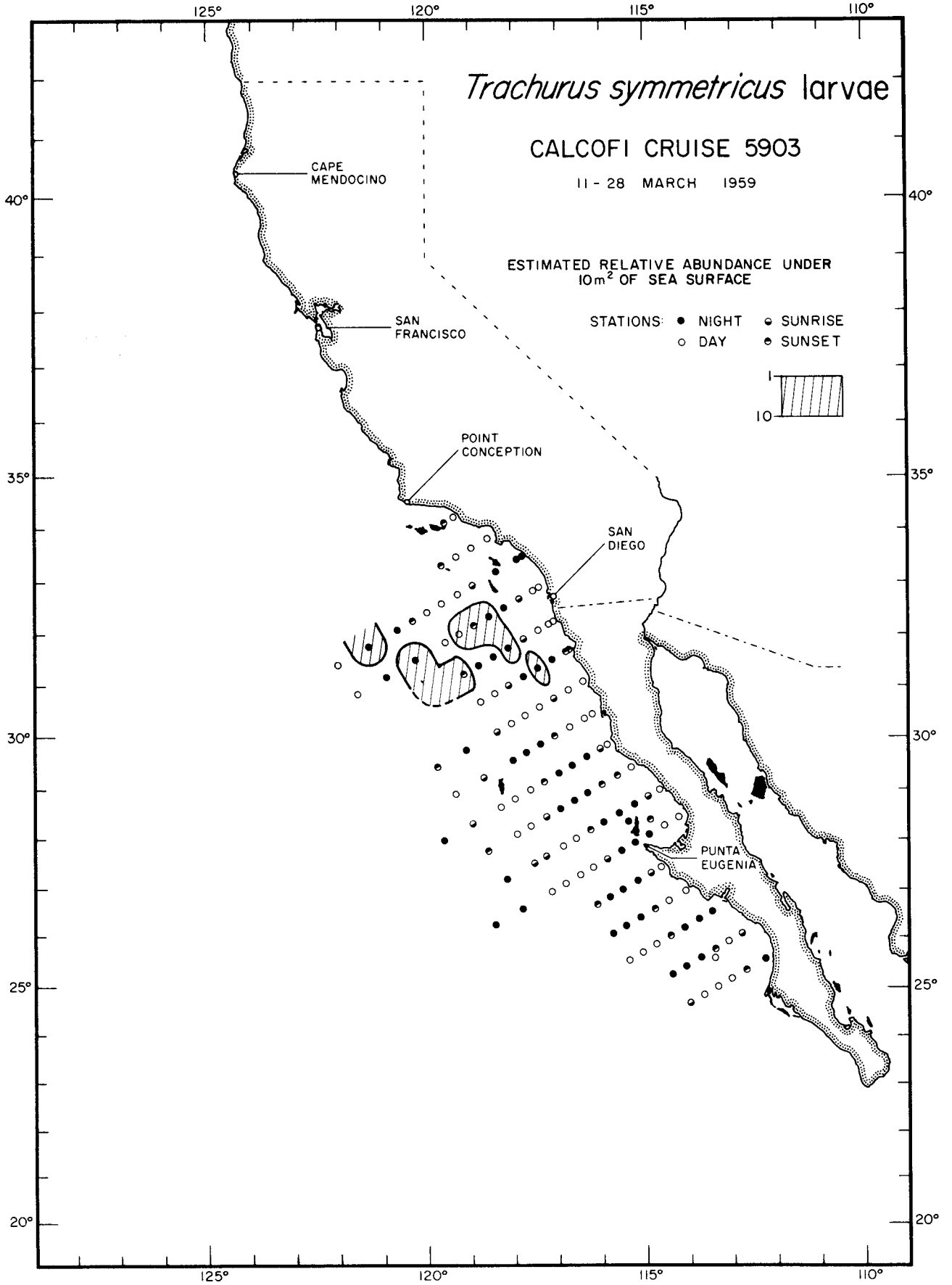


Trachurus symmetricus larvae



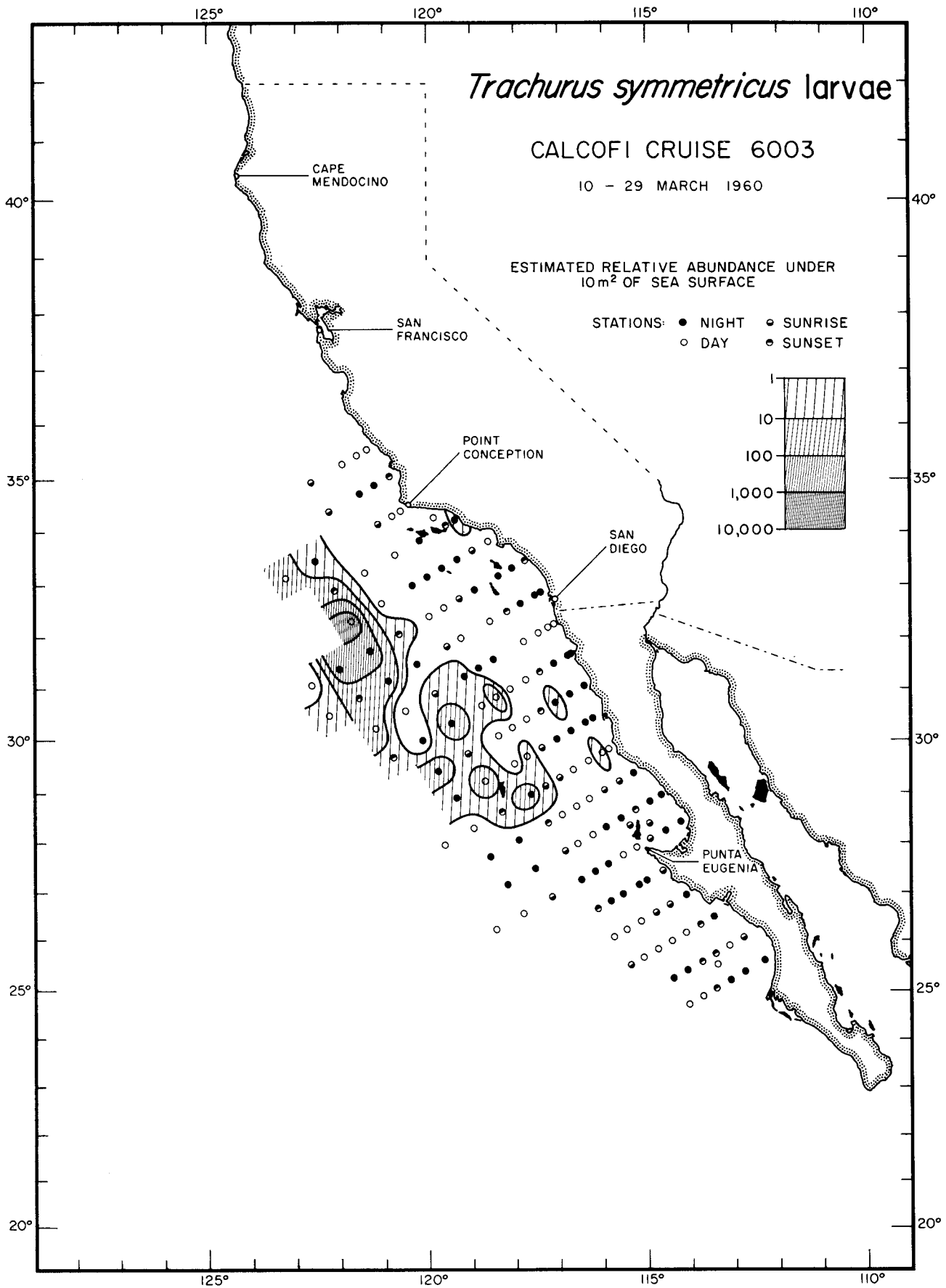
Trachurus symmetricus larvae

5803



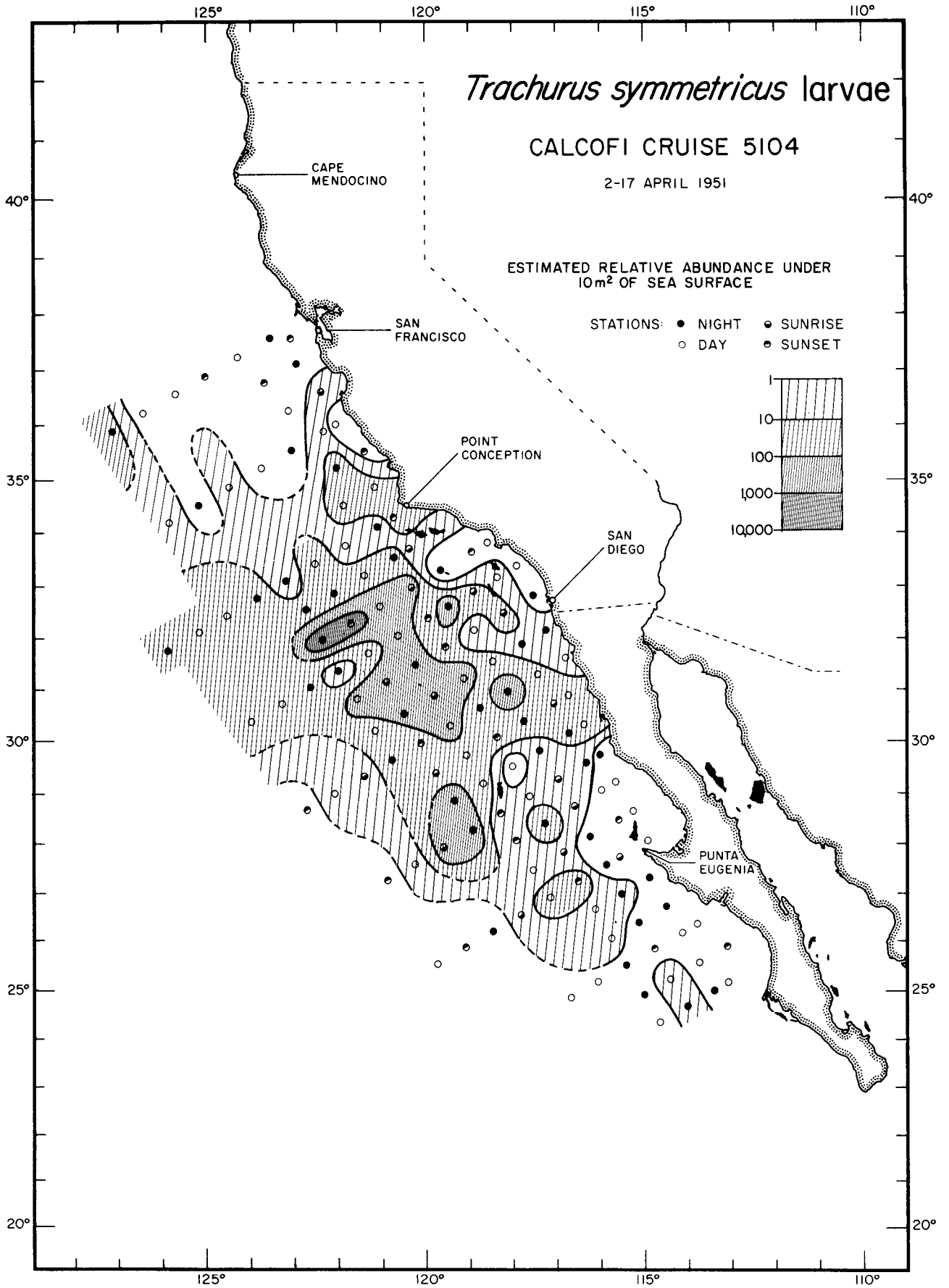
Trachurus symmetricus larvae

5903



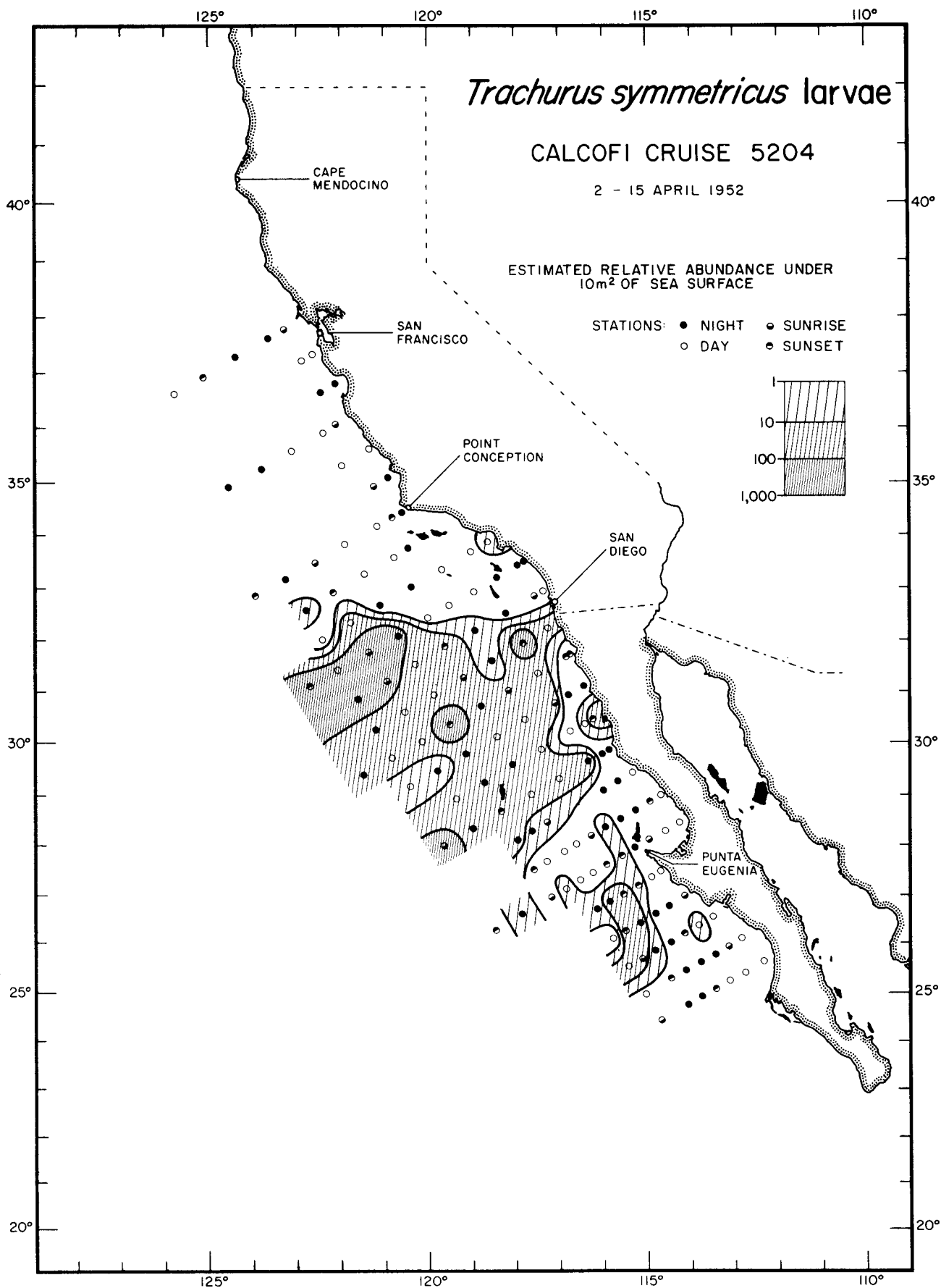
Trachurus symmetricus larvae

6003



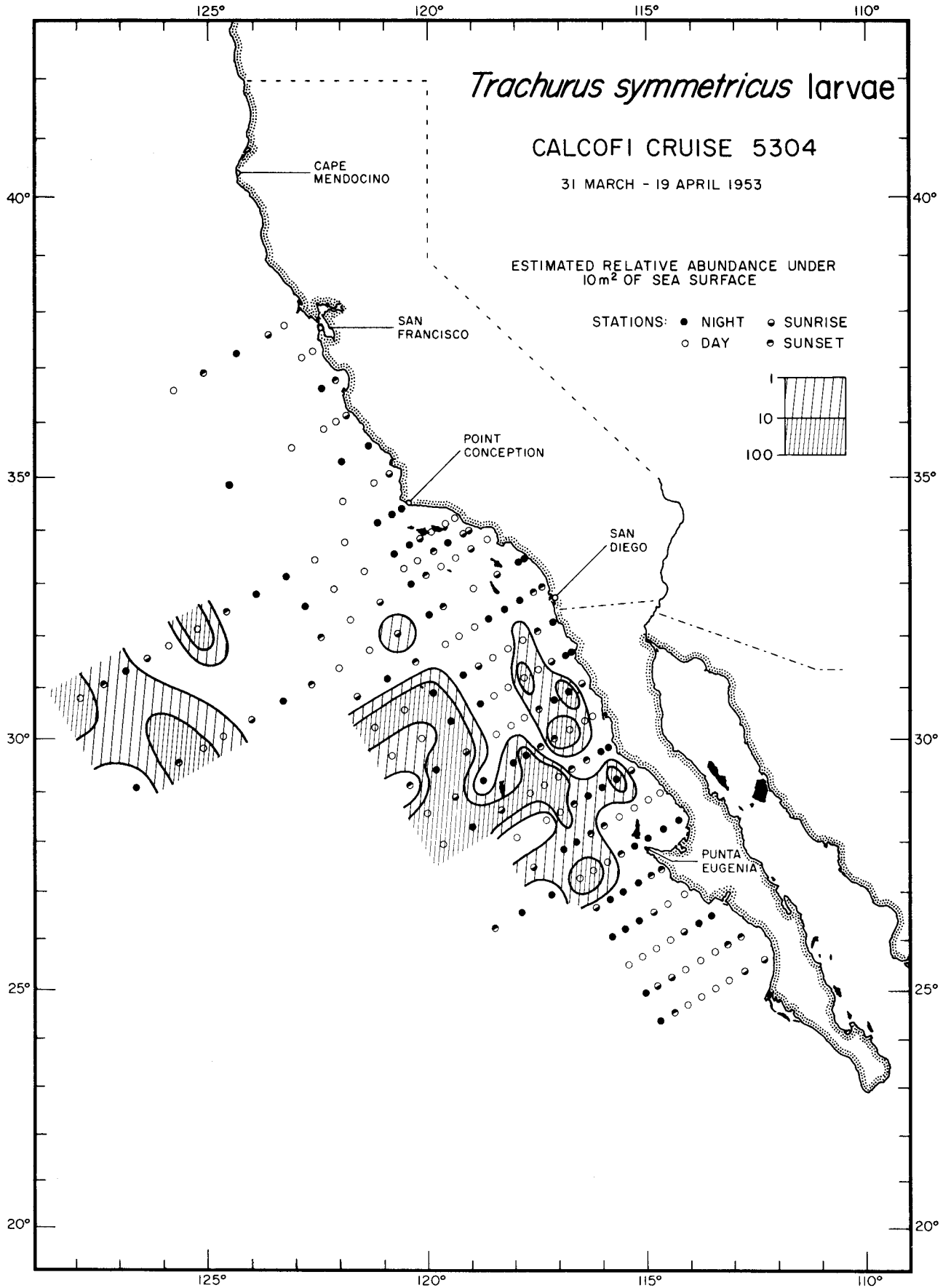
Trachurus symmetricus larvae

5104



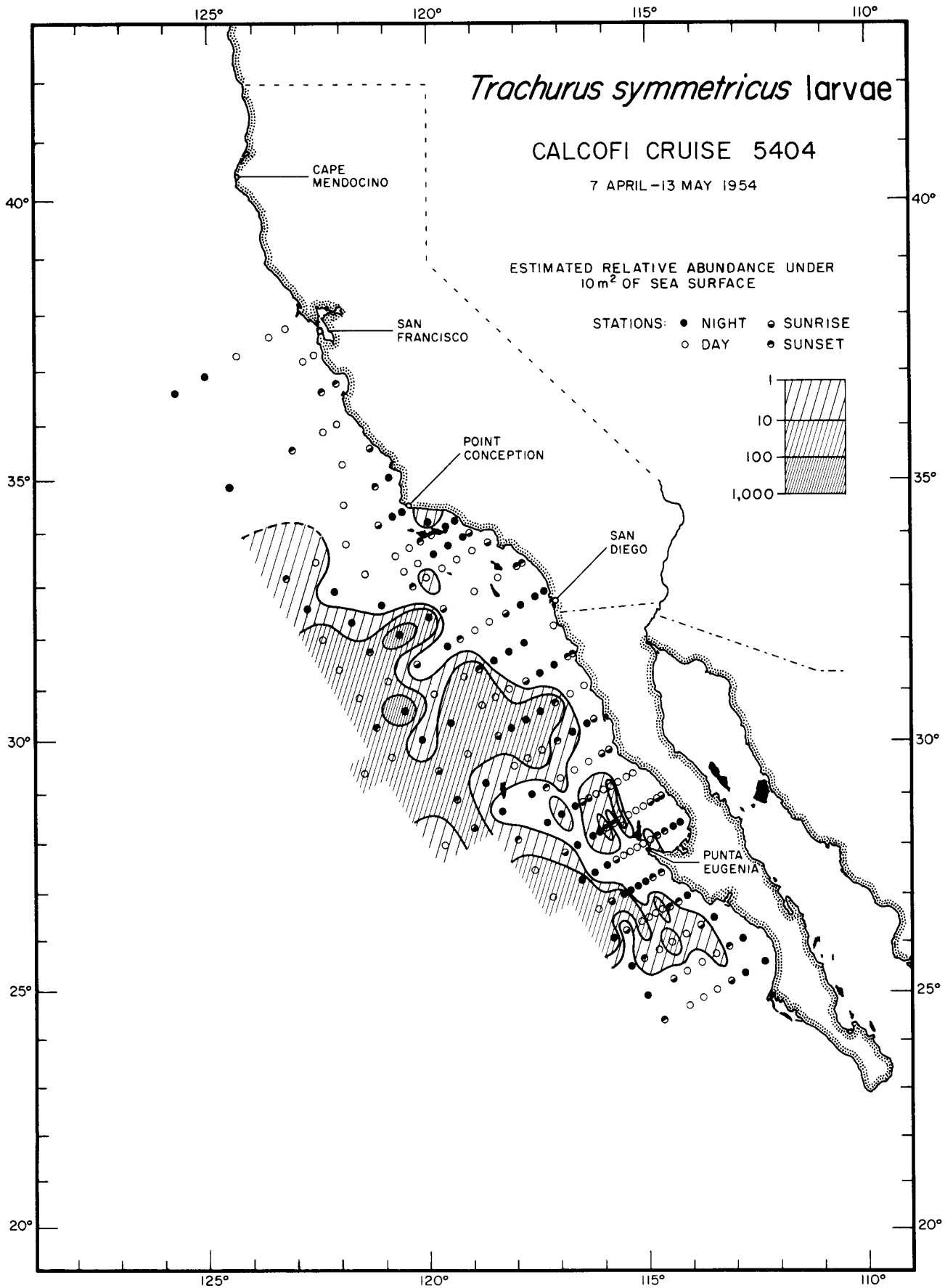
Trachurus symmetricus larvae

5204



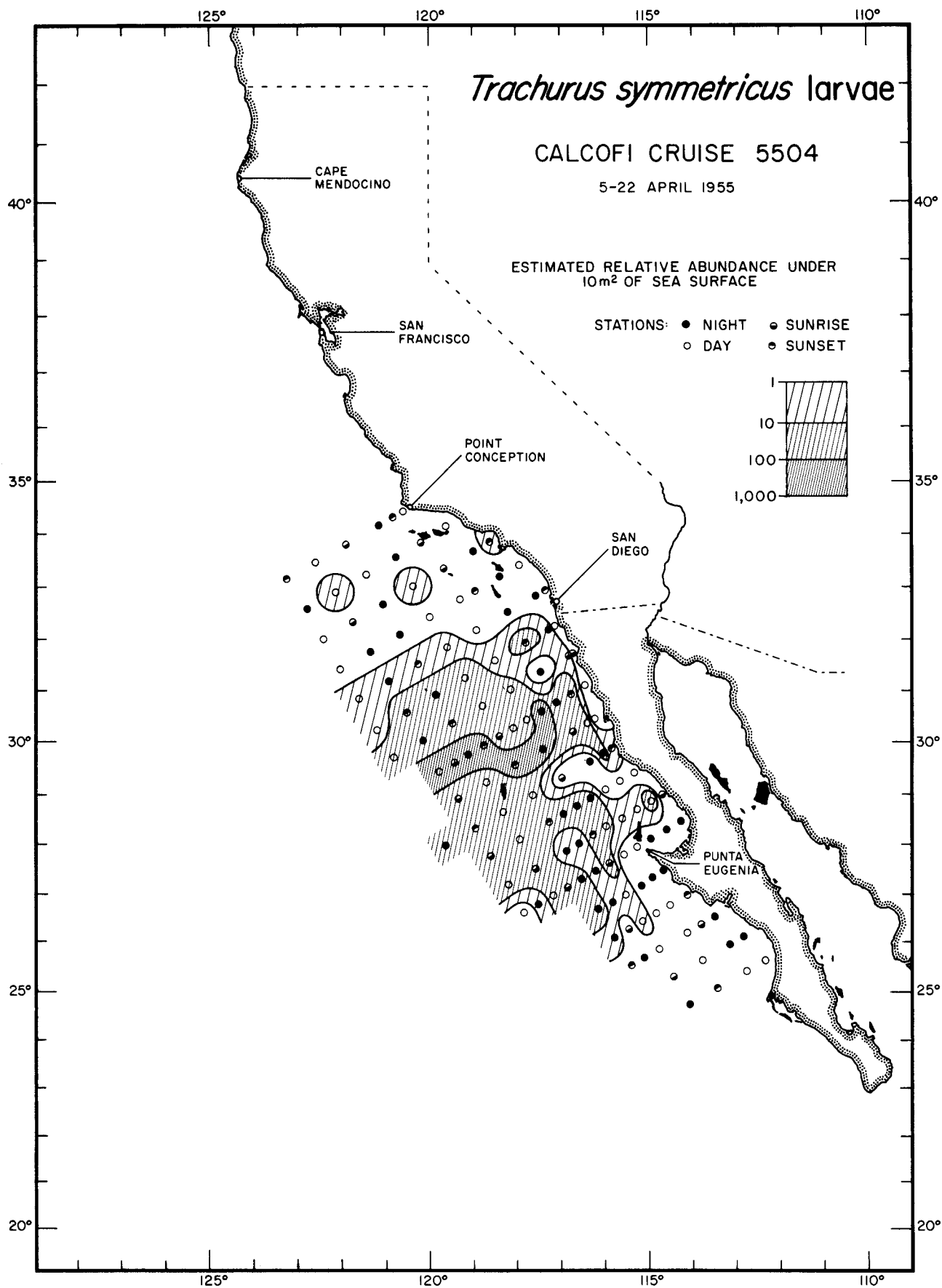
Trachurus symmetricus larvae

5304



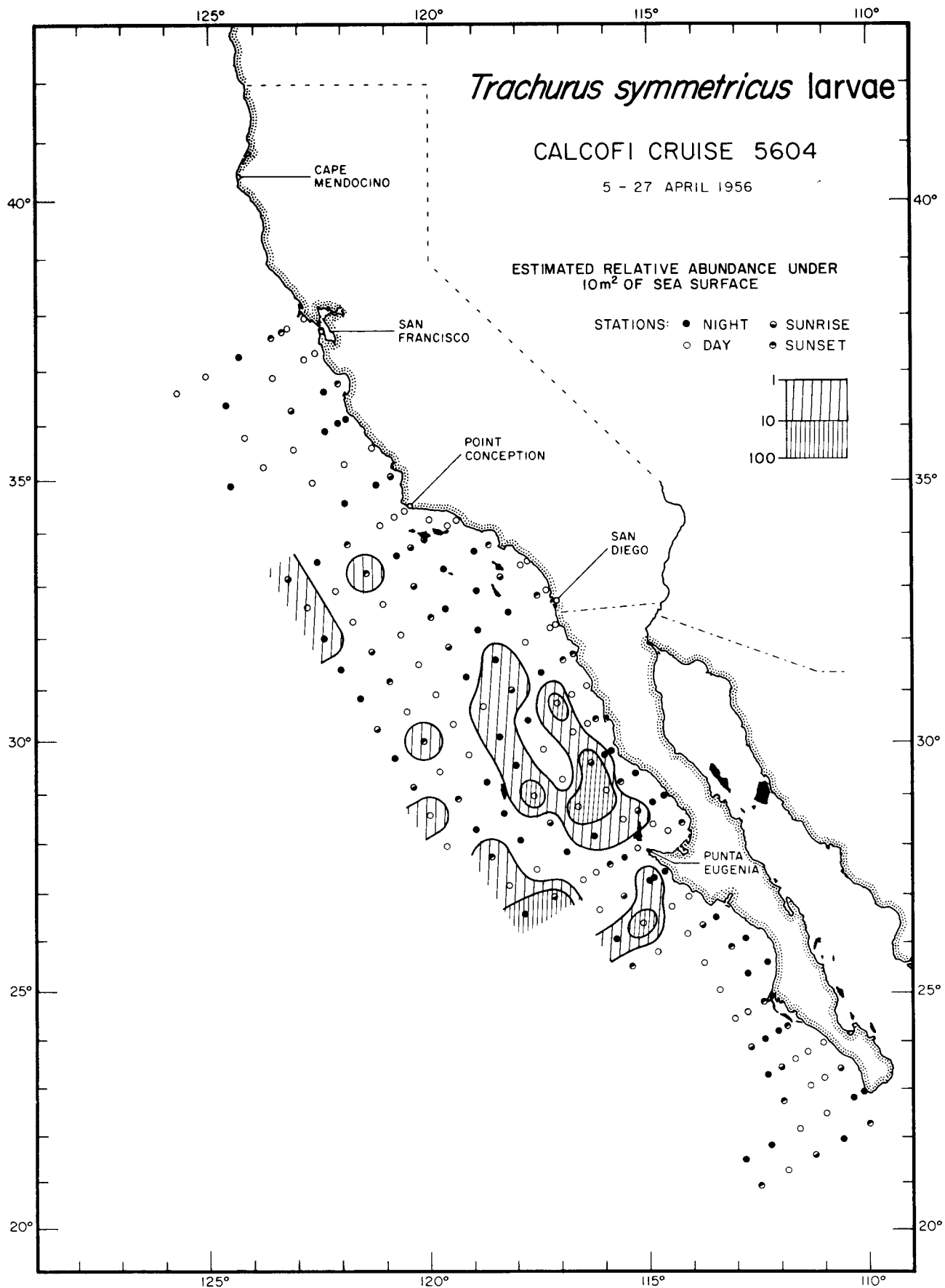
Trachurus symmetricus larvae

5404



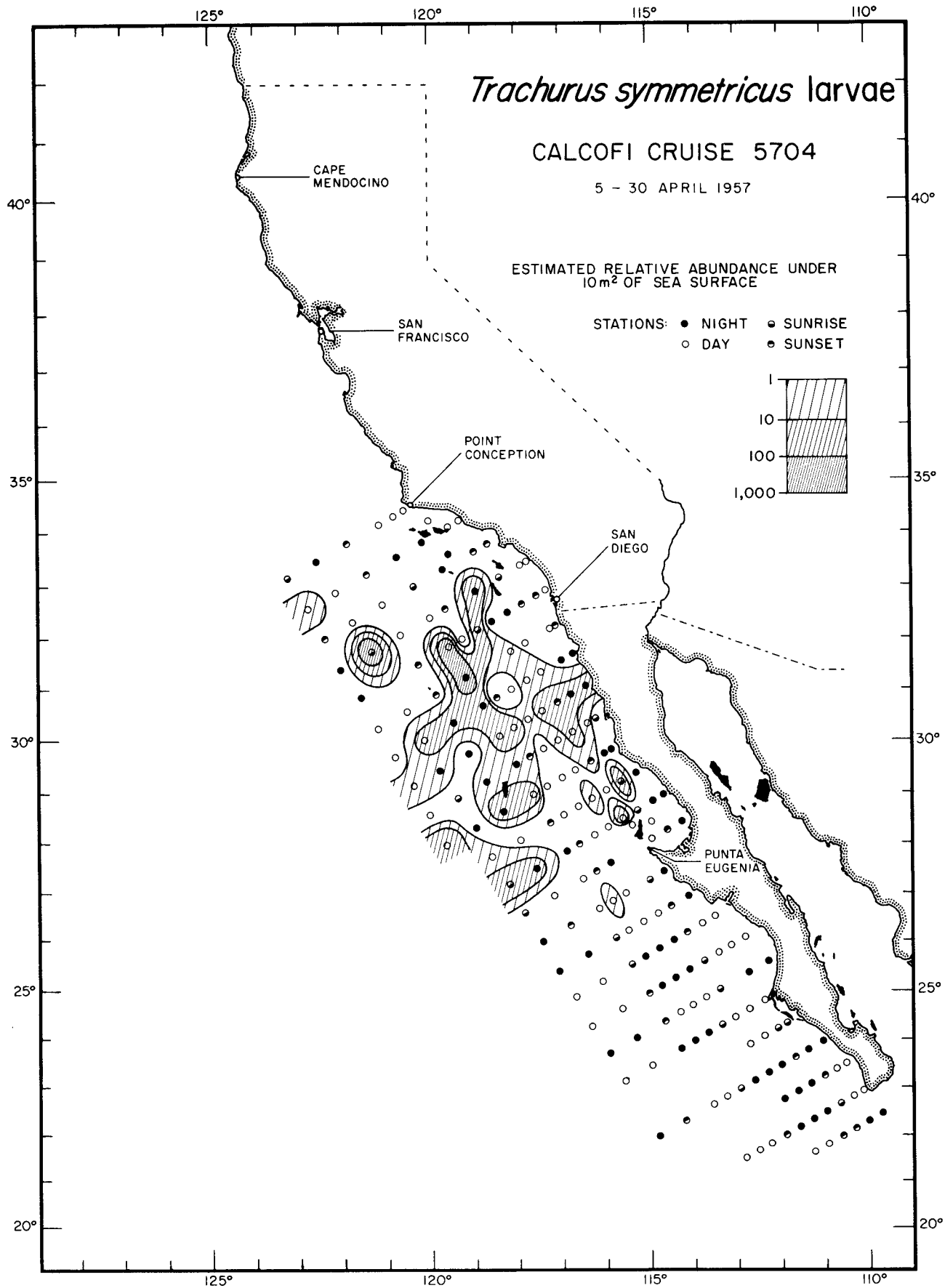
Trachurus symmetricus larvae

5504



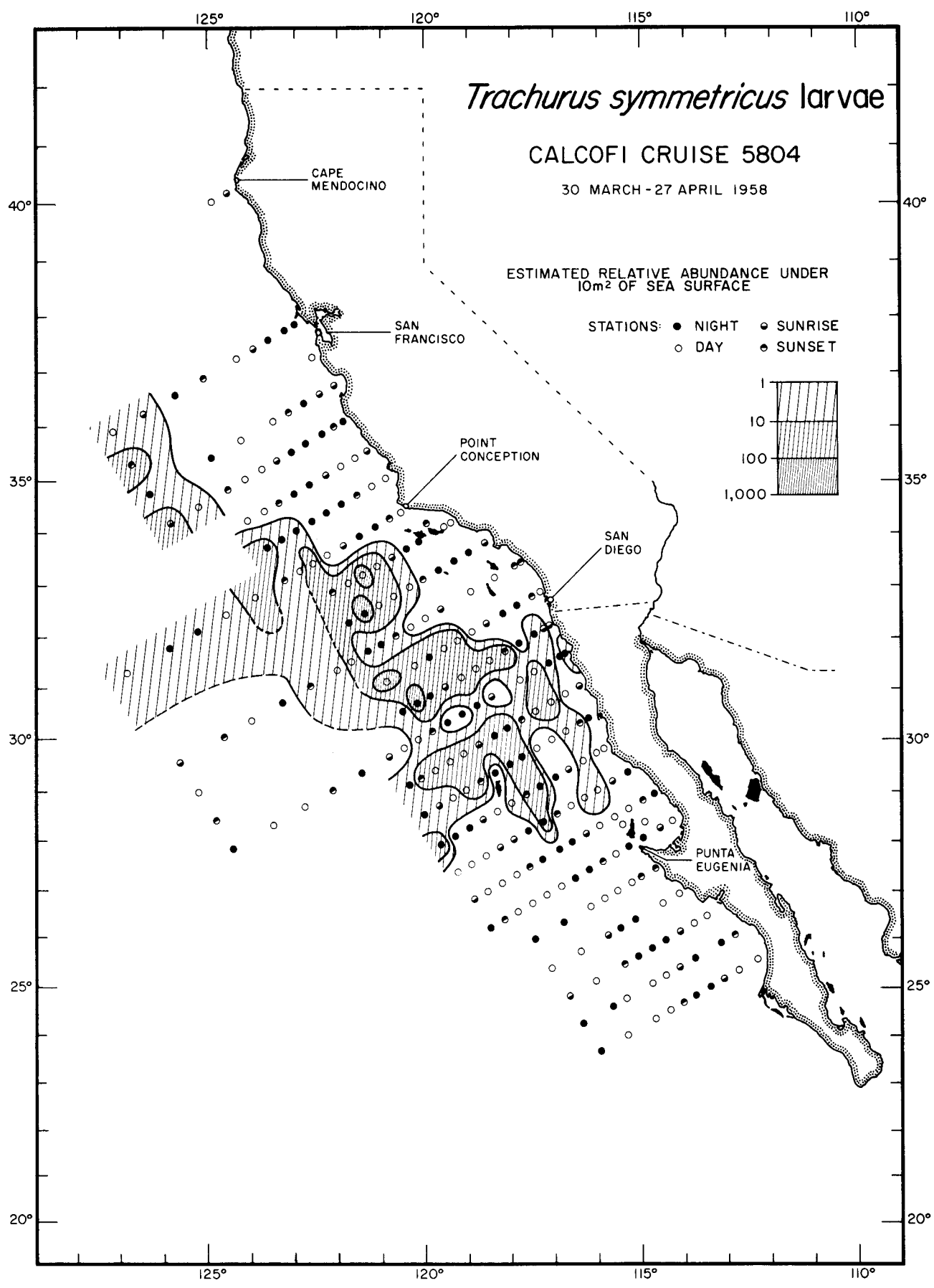
Trachurus symmetricus larvae

5604

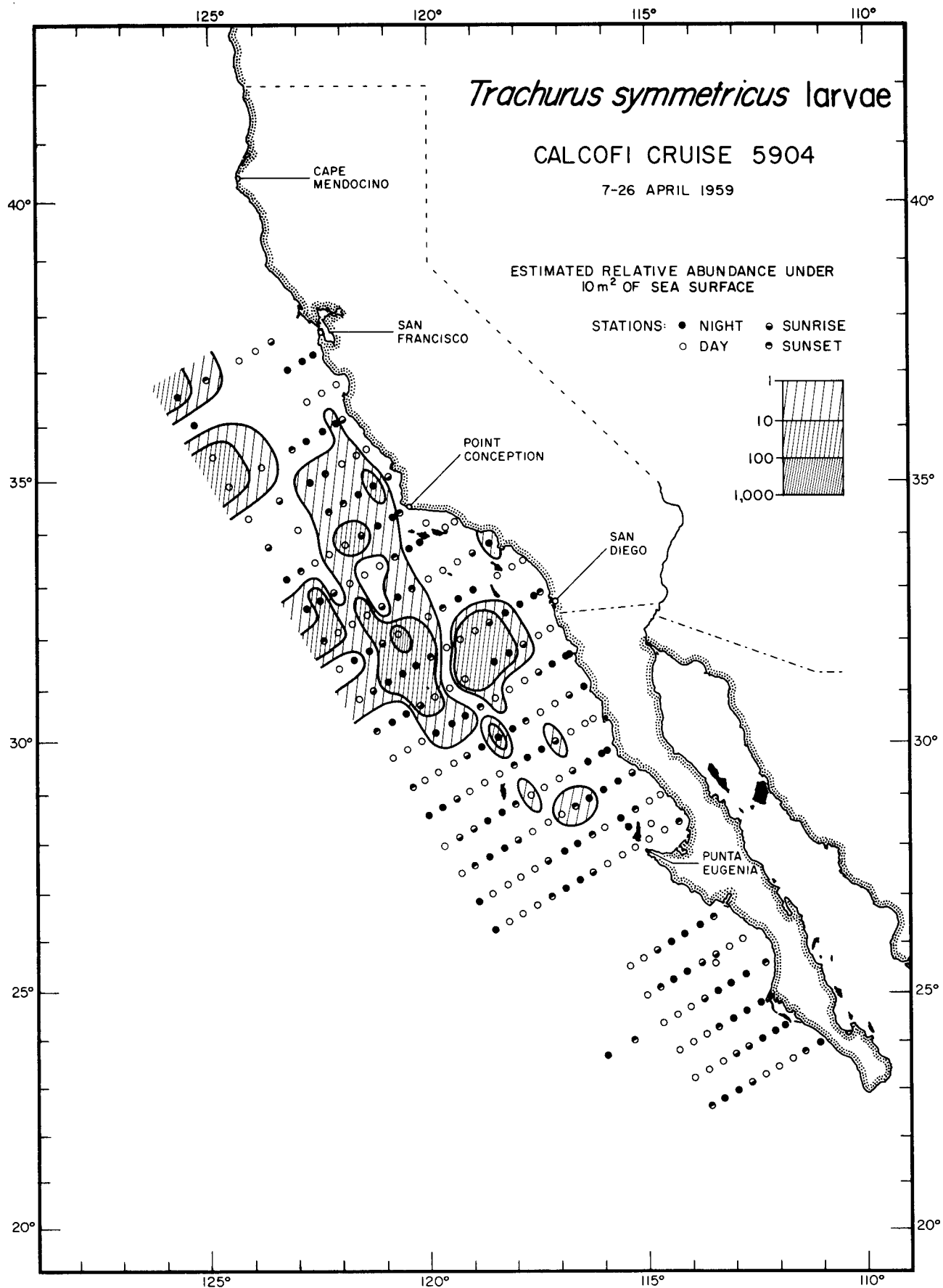


Trachurus symmetricus larvae

5704

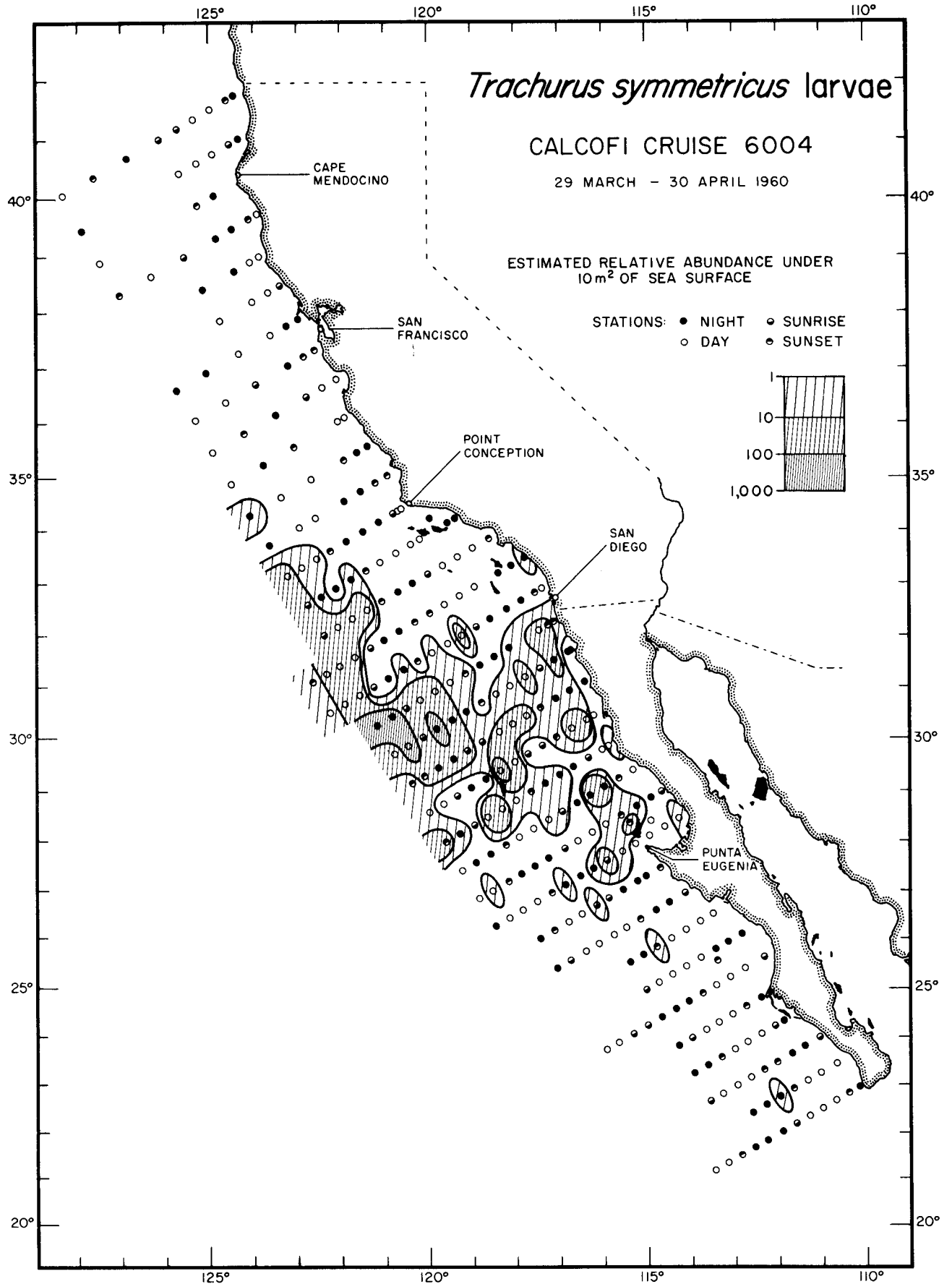


Trachurus symmetricus larvae



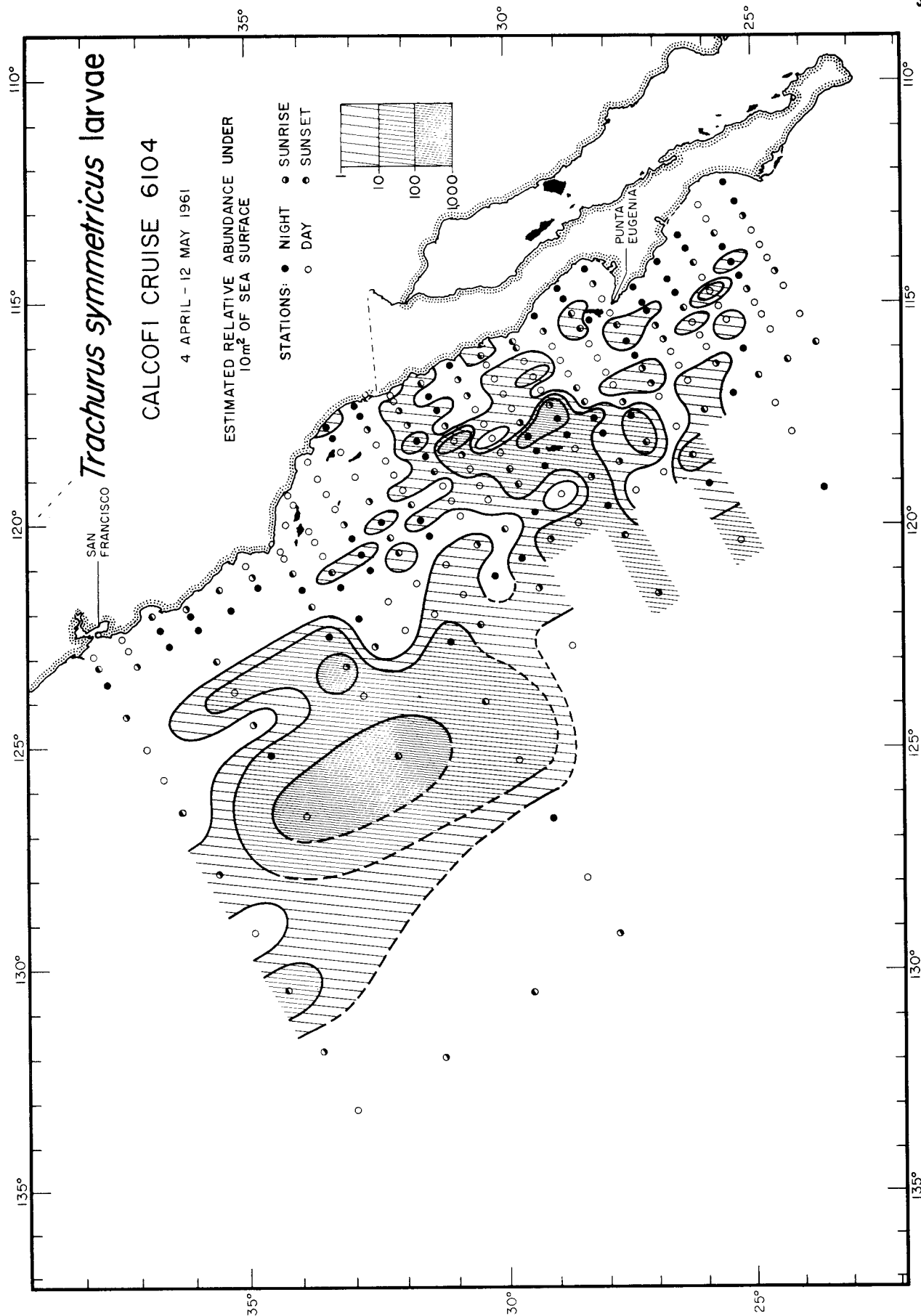
Trachurus symmetricus larvae

5904



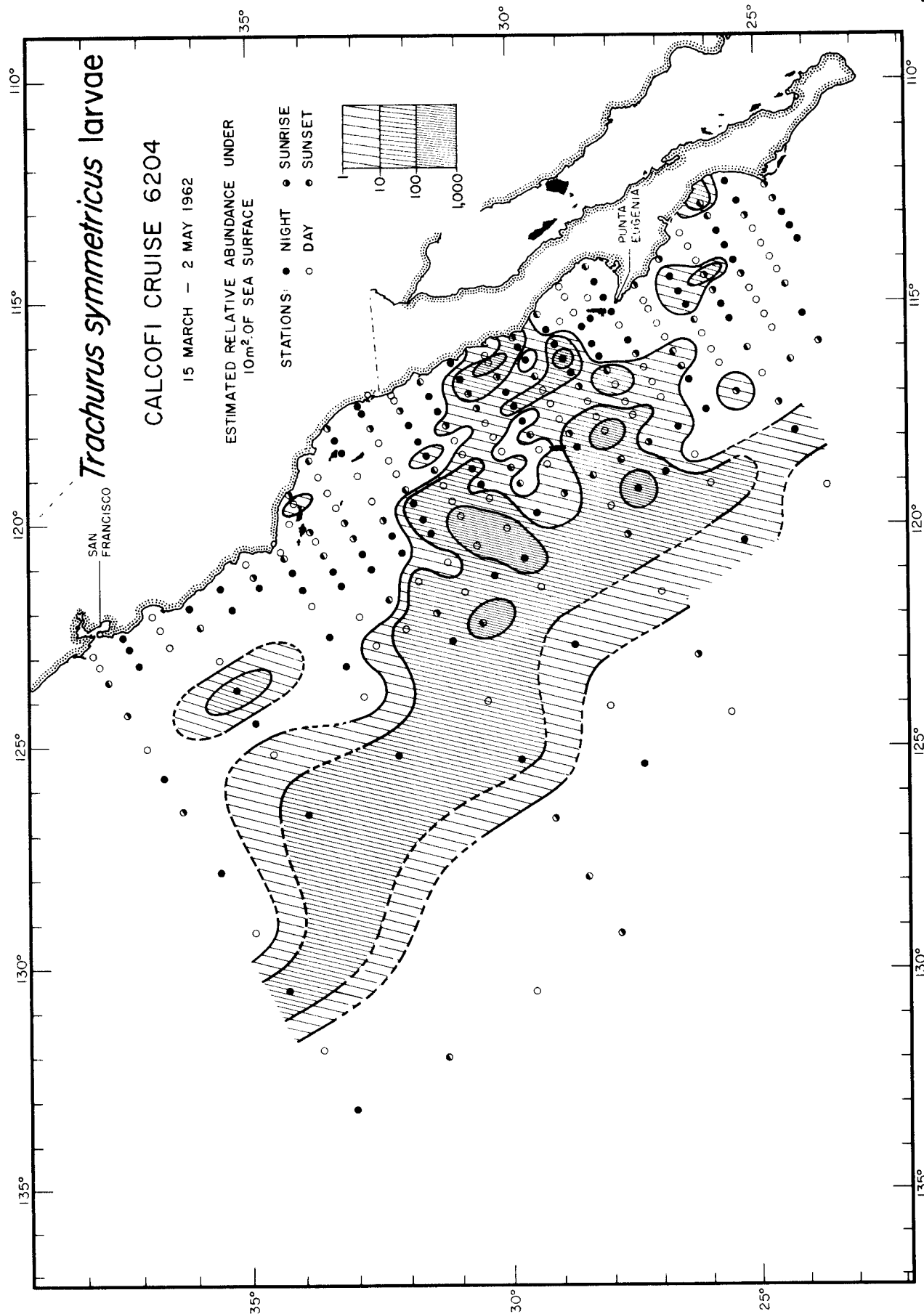
Trachurus symmetricus larvae

6004



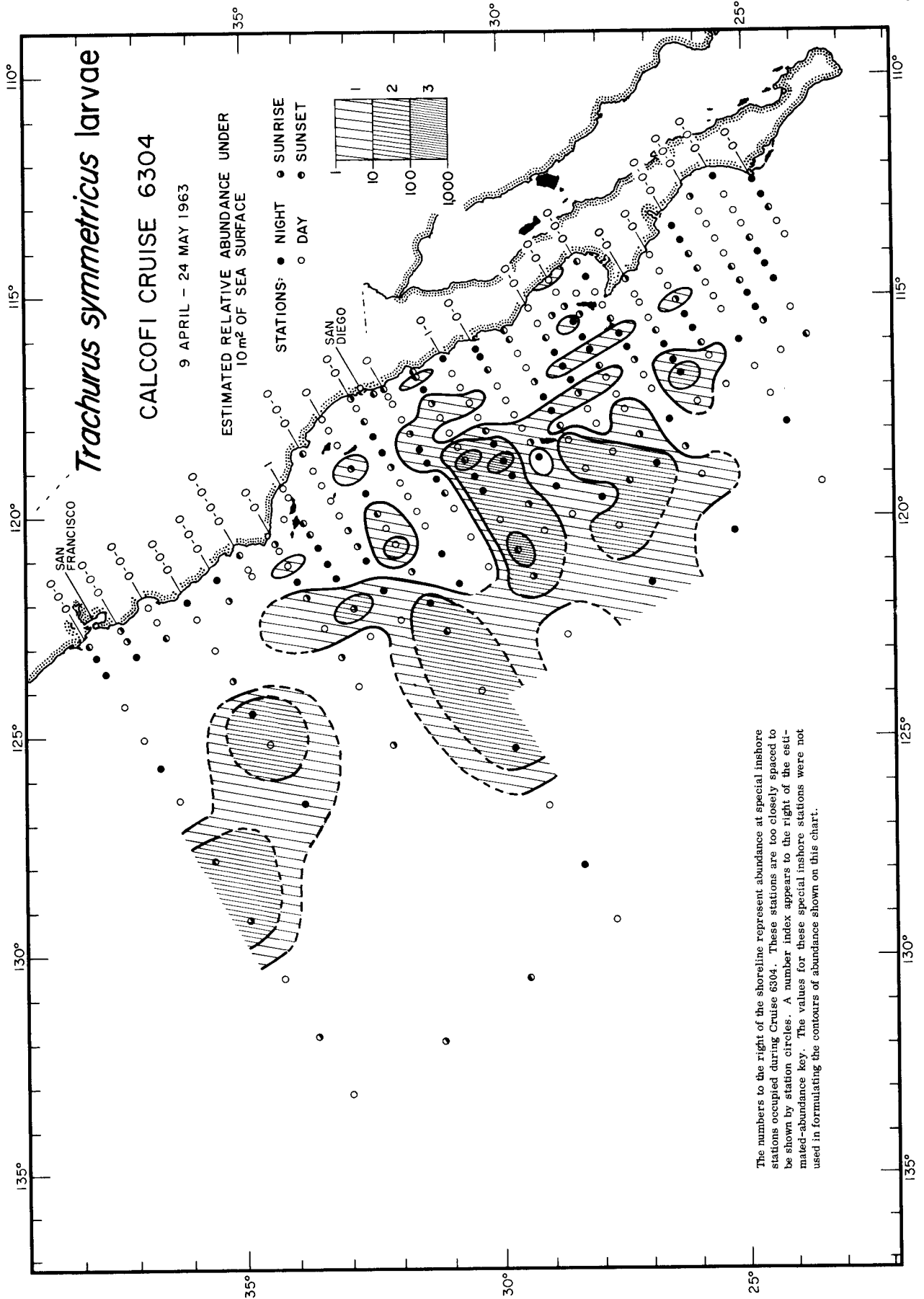
Trachurus symmetricus larvae

6104



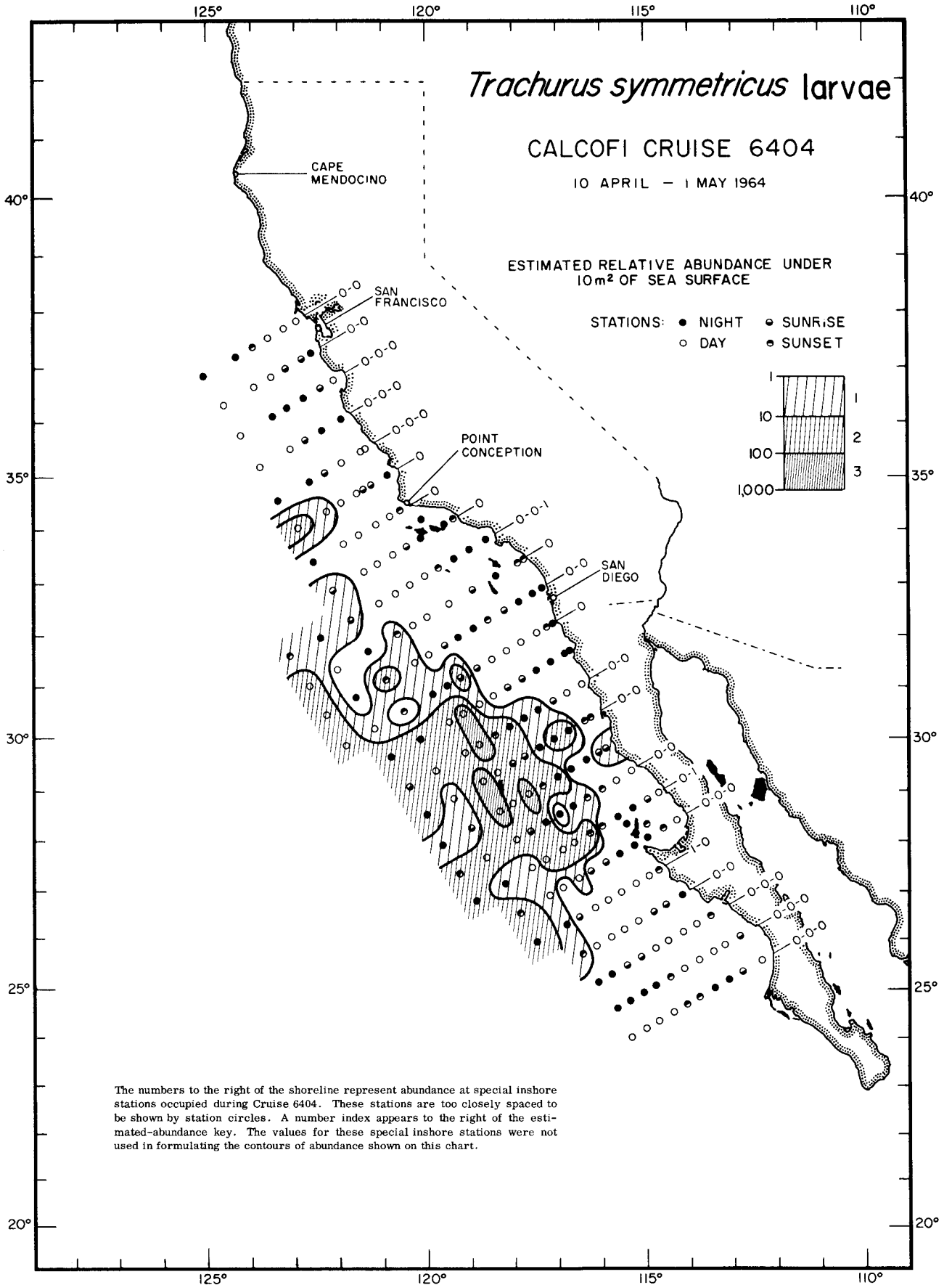
Trachurus symmetricus larvae

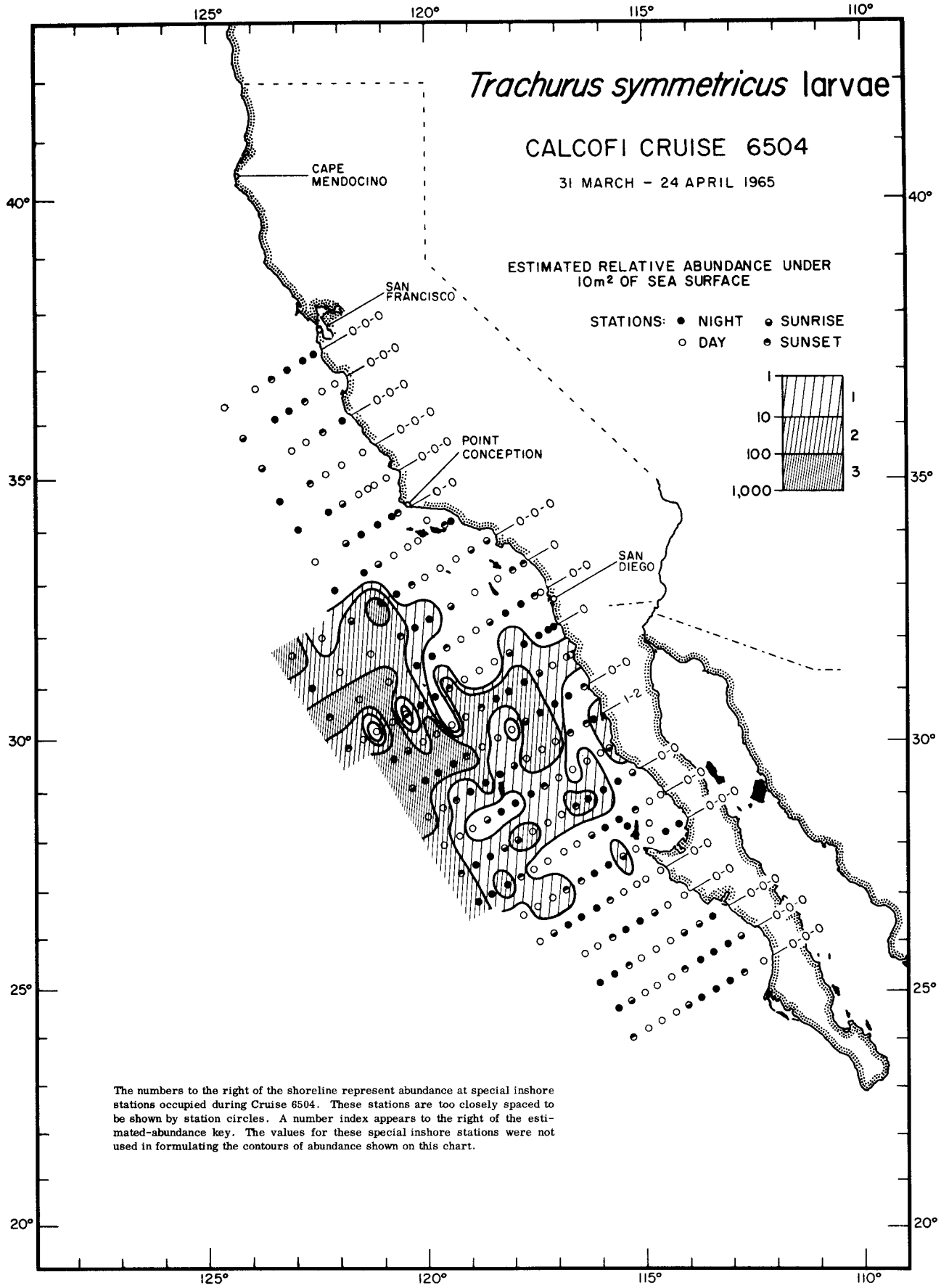
6204



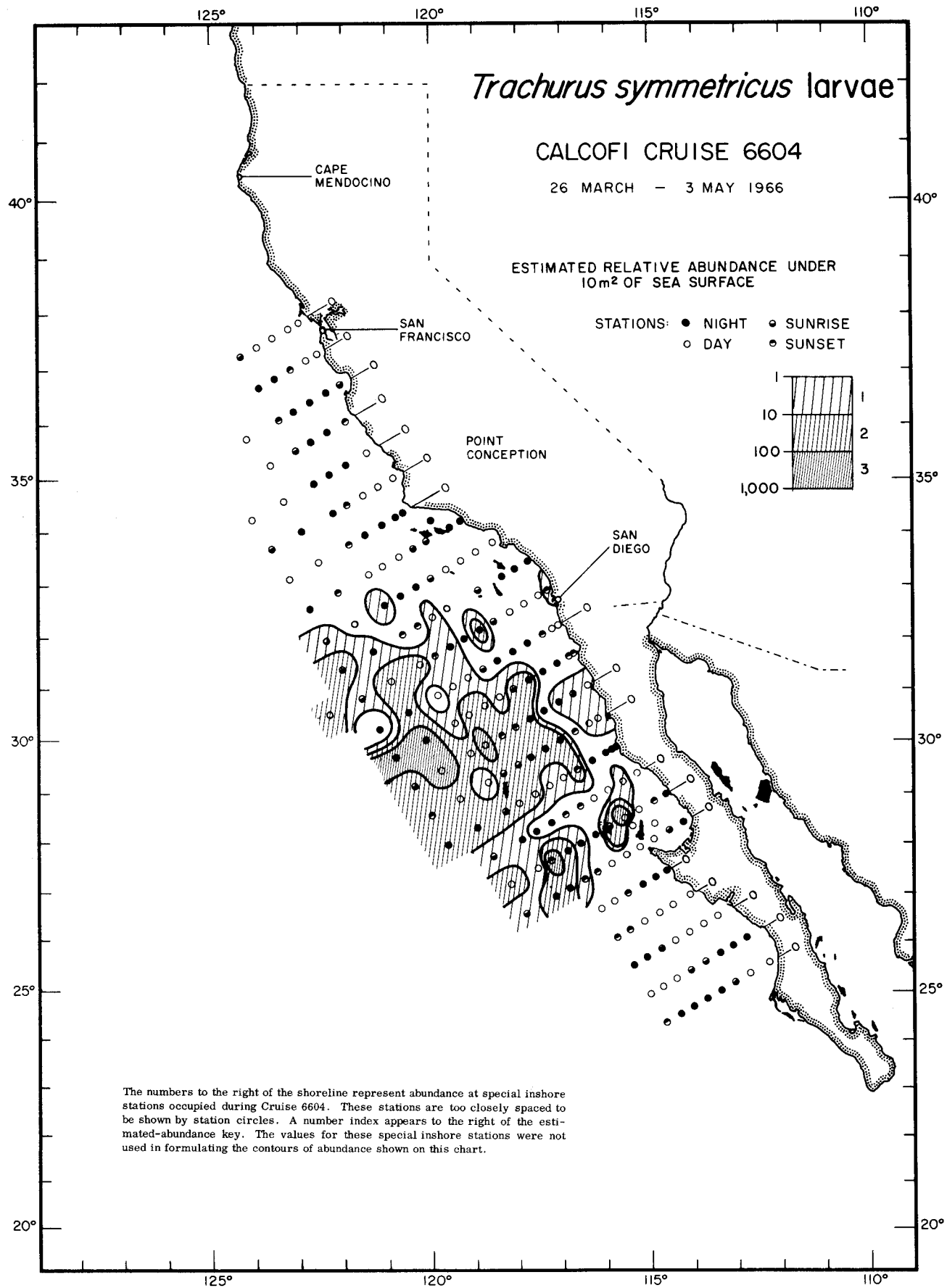
The numbers to the right of the shoreline represent abundance at special inshore stations occupied during Cruise 6304. These stations are too closely spaced to be shown by station circles. A number index appears to the right of the estimated-abundance key. The values for these special inshore stations were not used in formulating the contours of abundance shown on this chart.

Trachurus symmetricus larvae



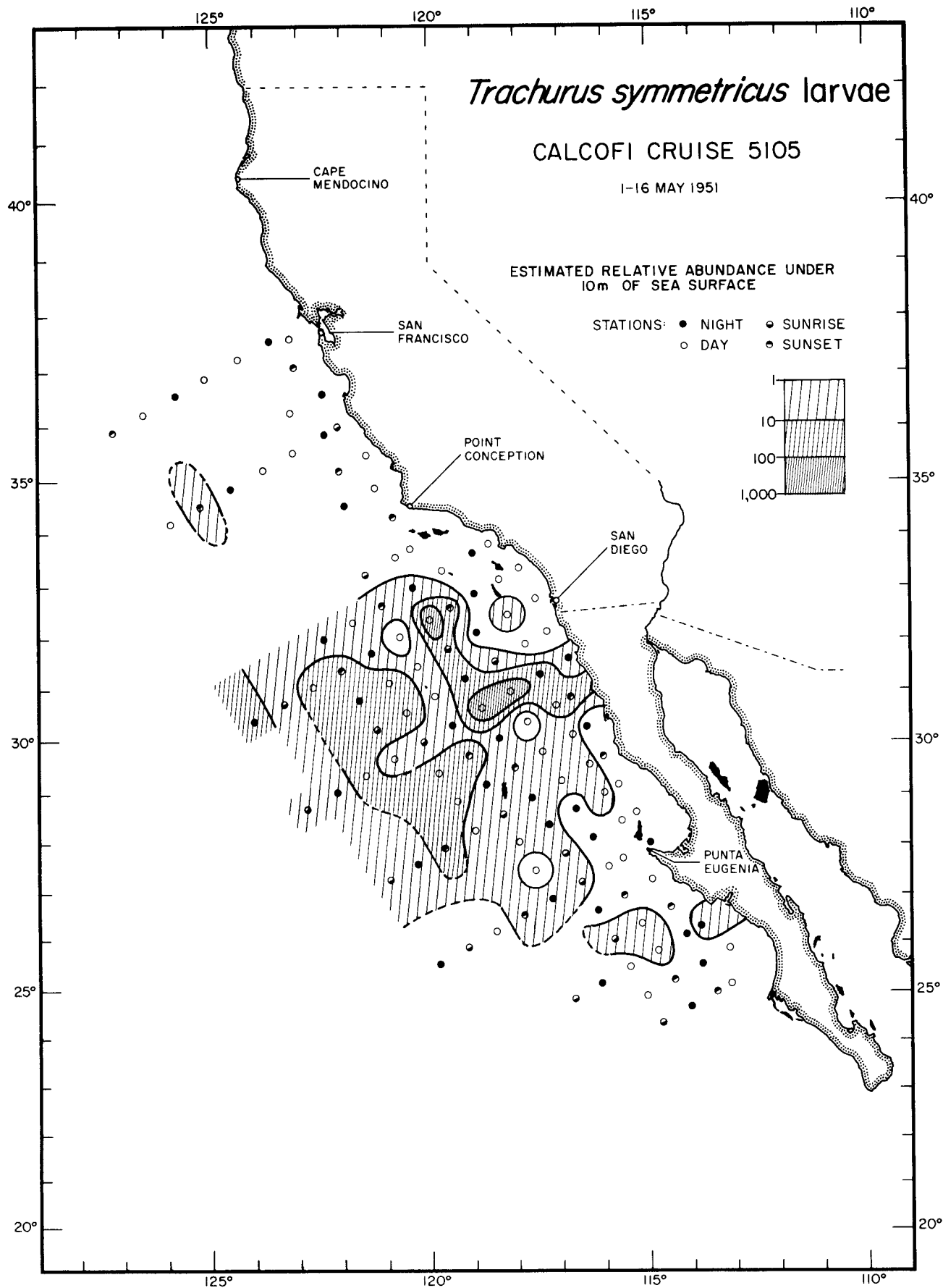


The numbers to the right of the shoreline represent abundance at special inshore stations occupied during Cruise 6504. These stations are too closely spaced to be shown by station circles. A number index appears to the right of the estimated-abundance key. The values for these special inshore stations were not used in formulating the contours of abundance shown on this chart.



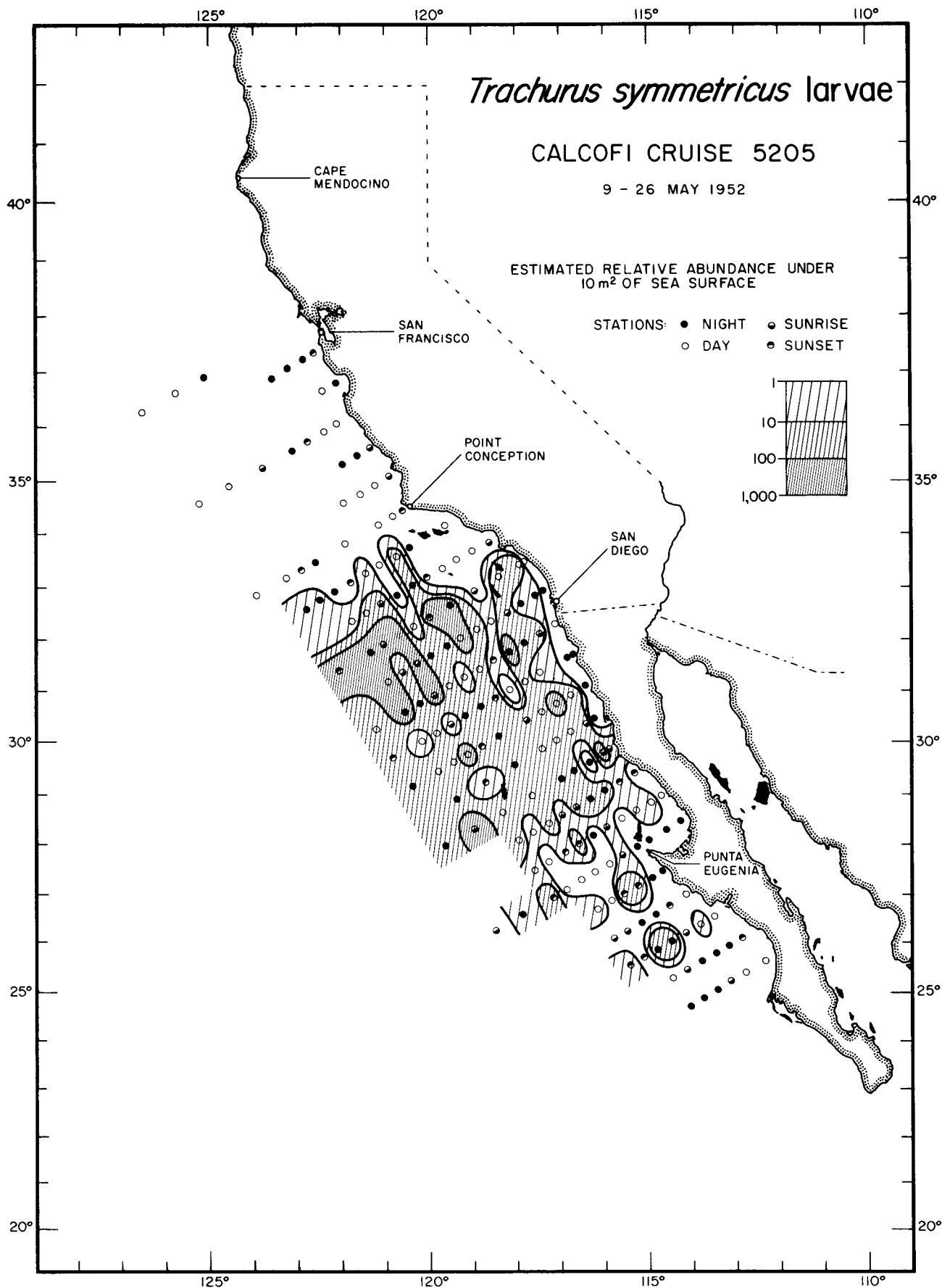
Trachurus symmetricus larvae

6604



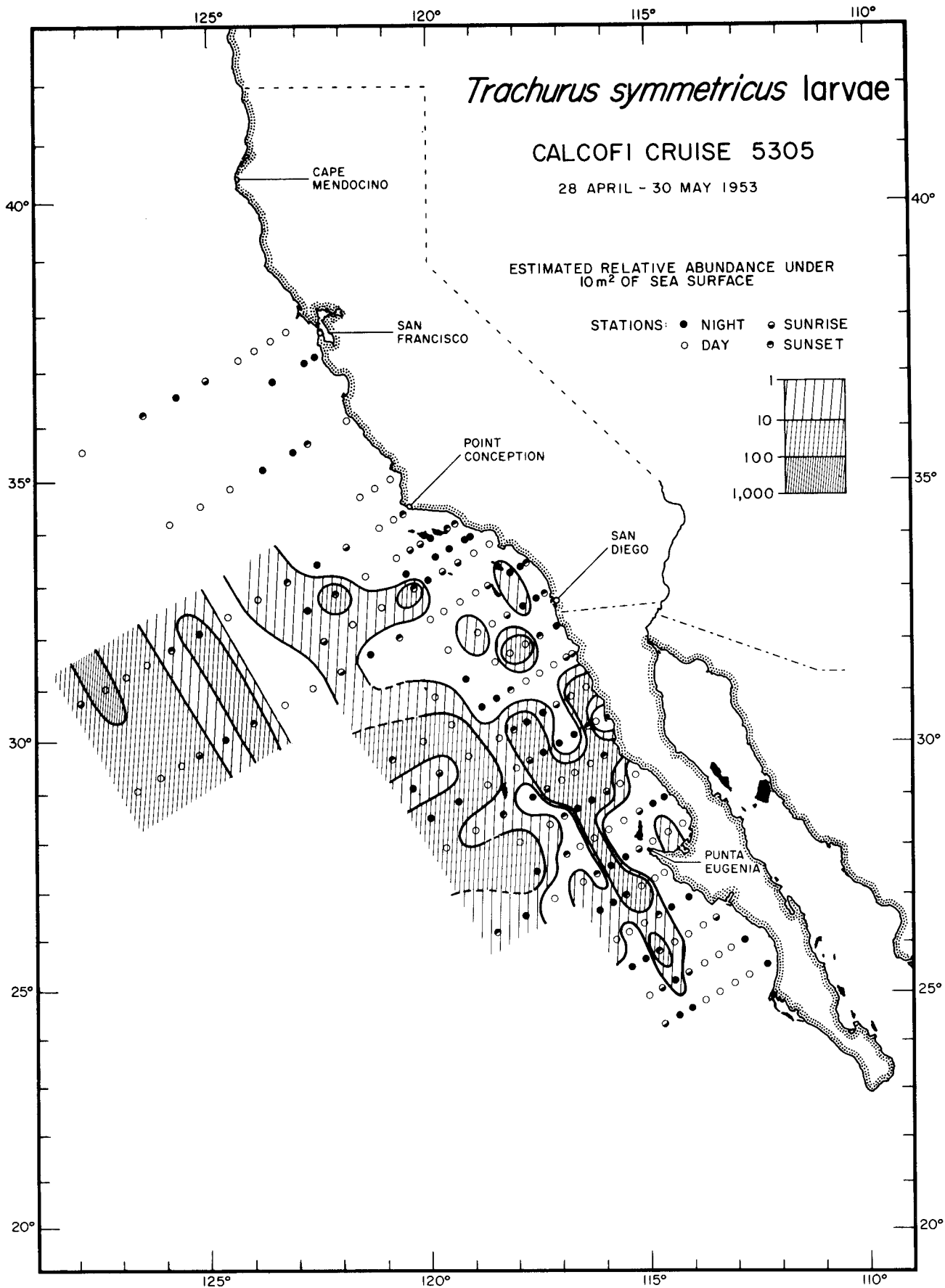
Trachurus symmetricus larvae

5105



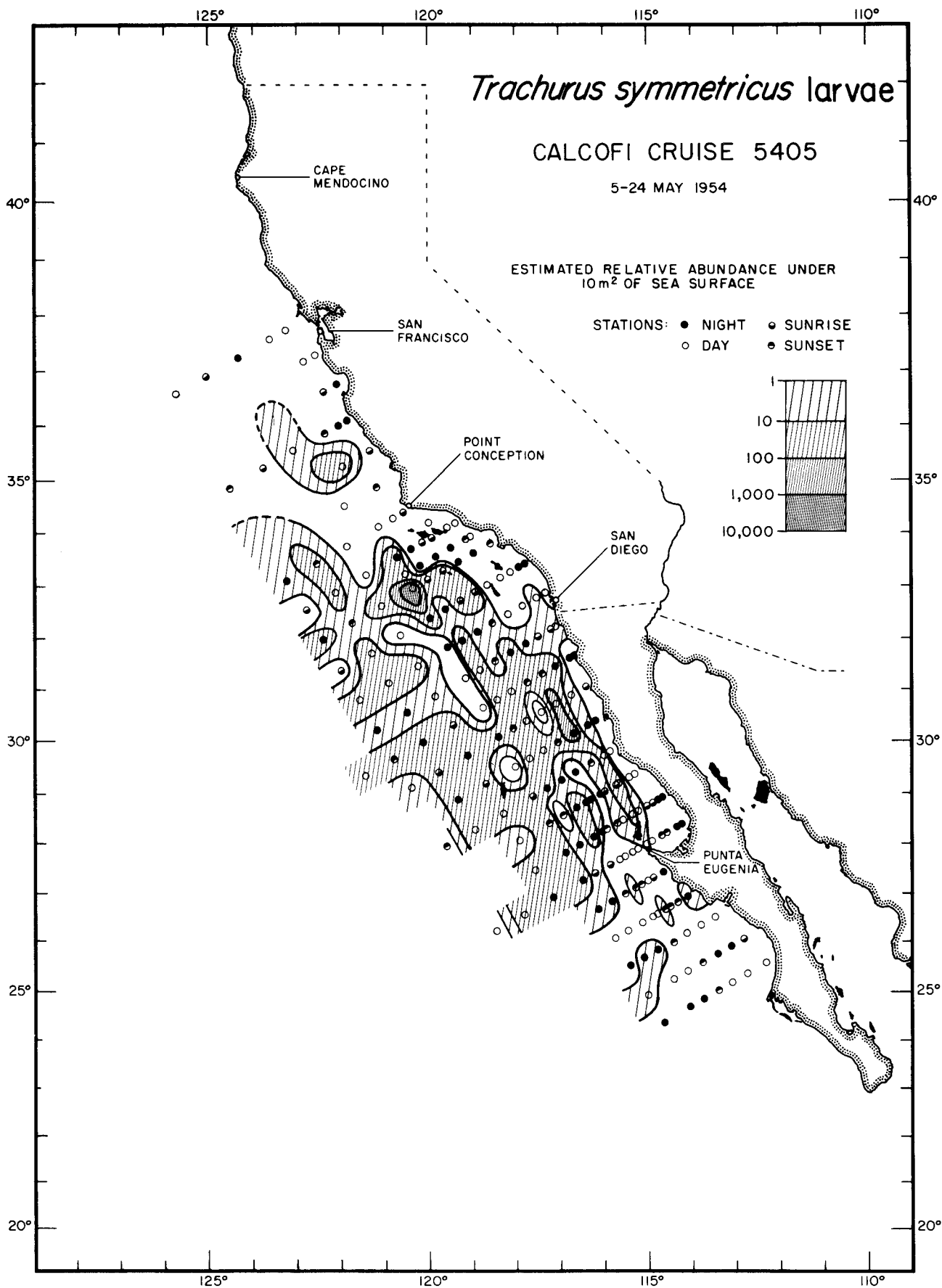
Trachurus symmetricus larvae

5205



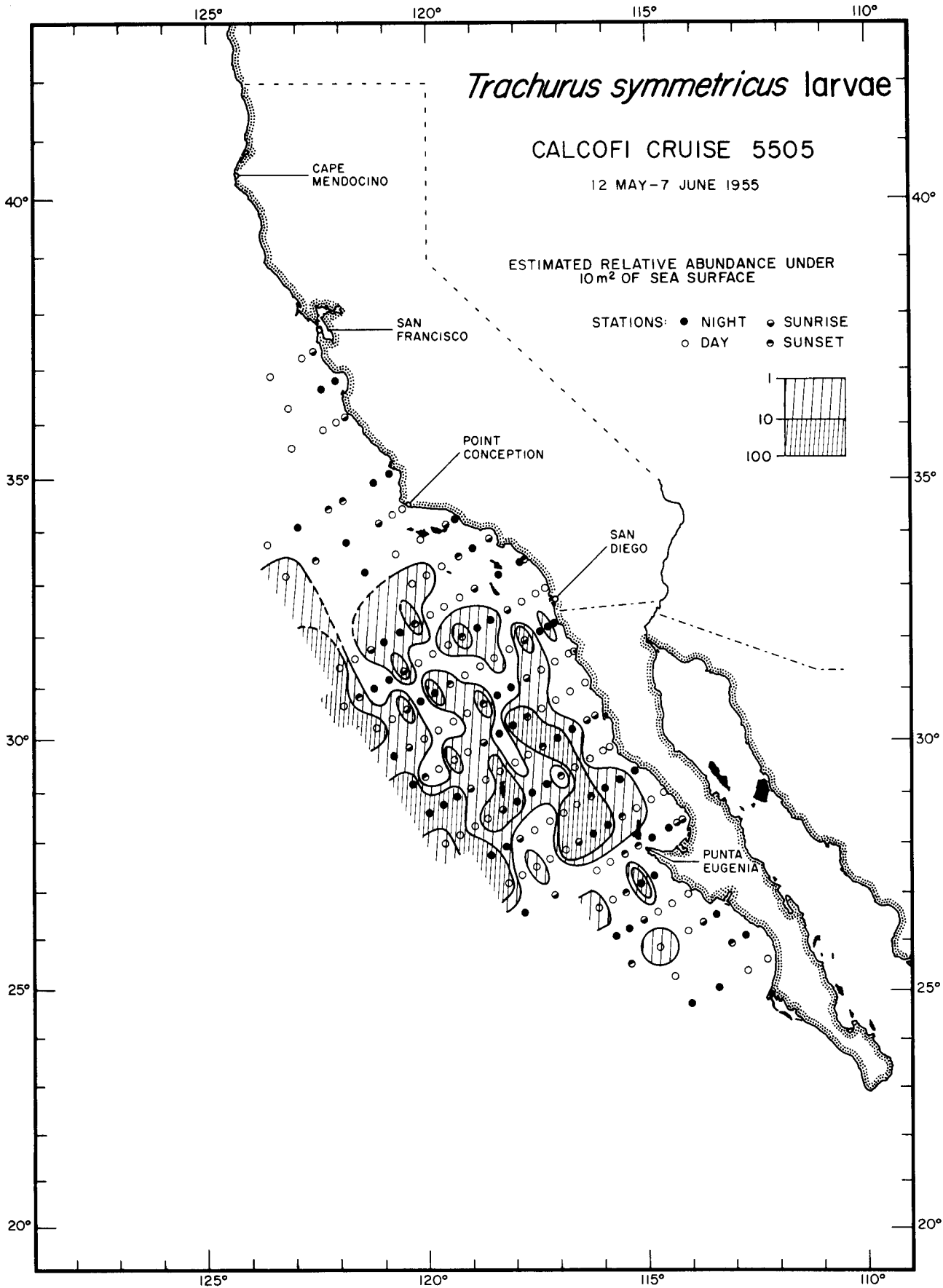
Trachurus symmetricus larvae

5305



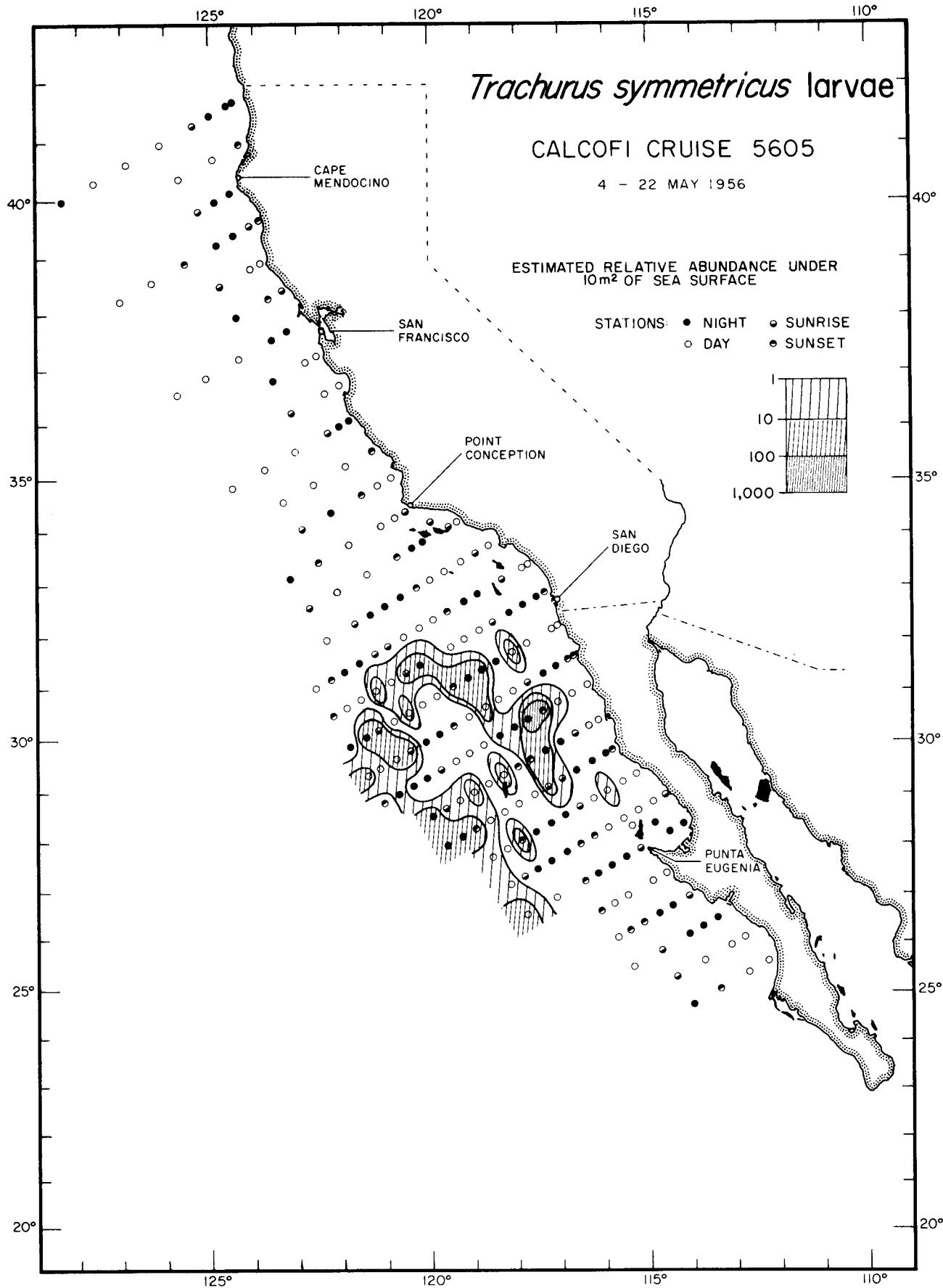
Trachurus symmetricus larvae

5405



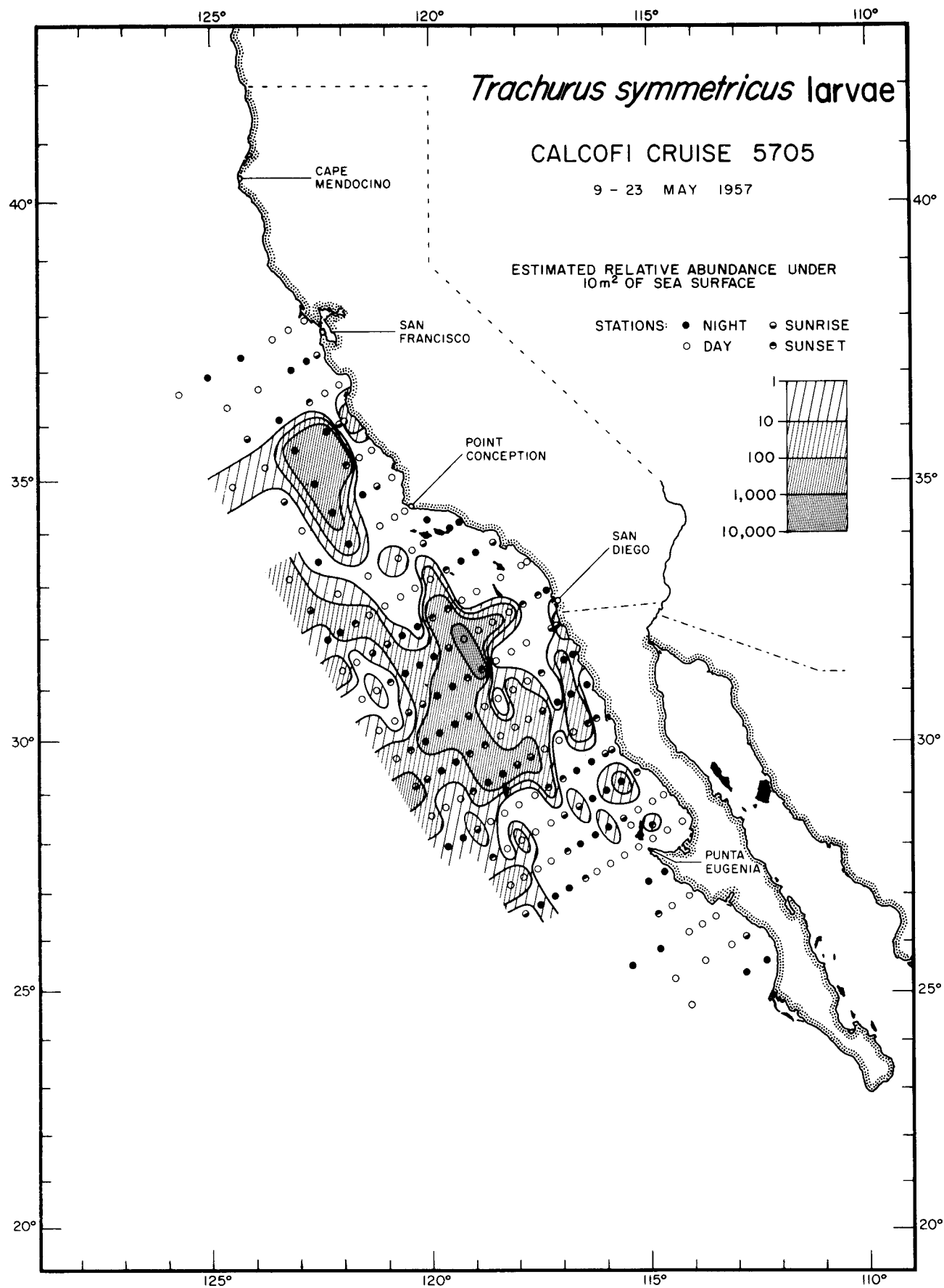
Trachurus symmetricus larvae

5505



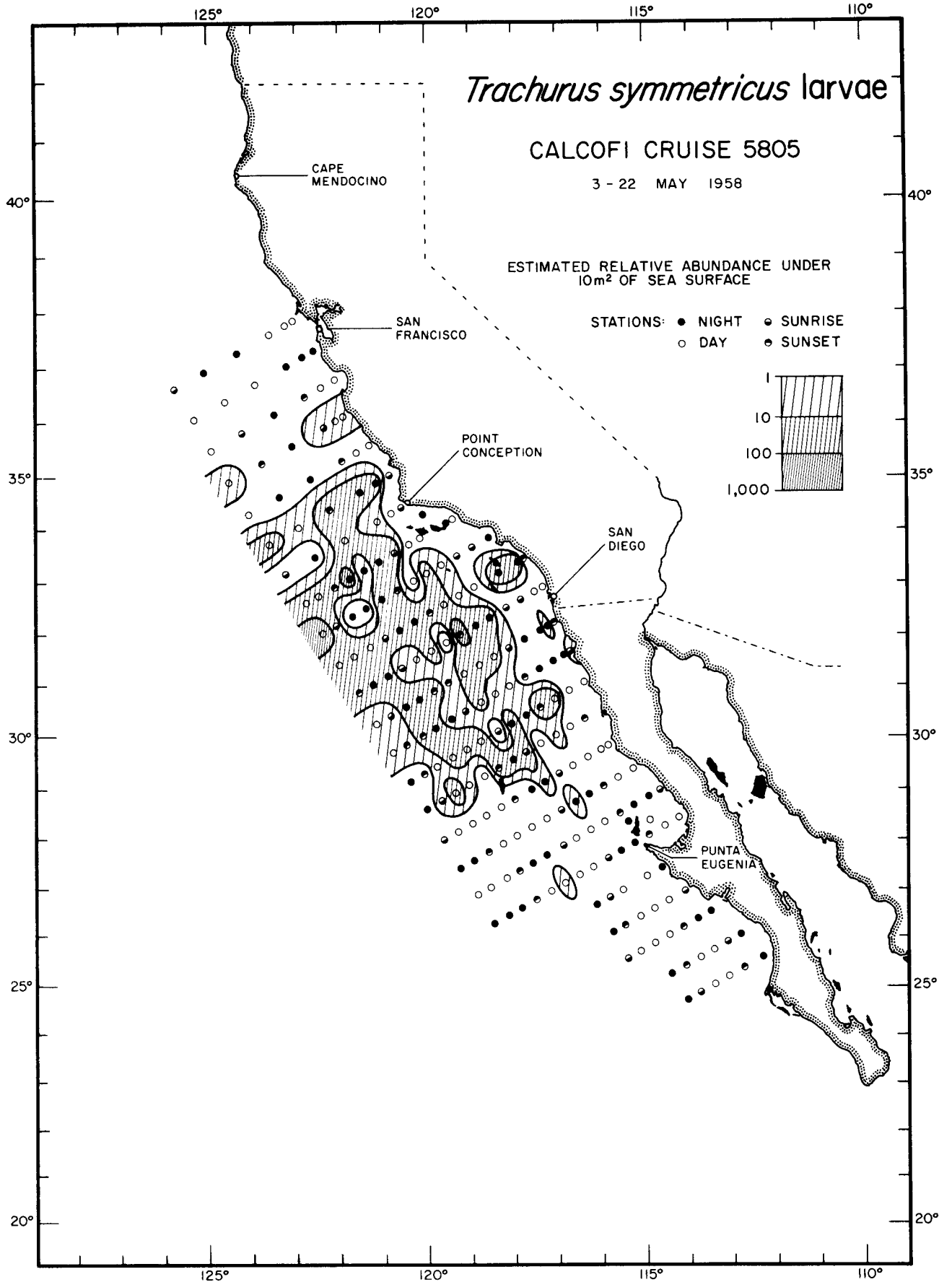
Trachurus symmetricus larvae

5605



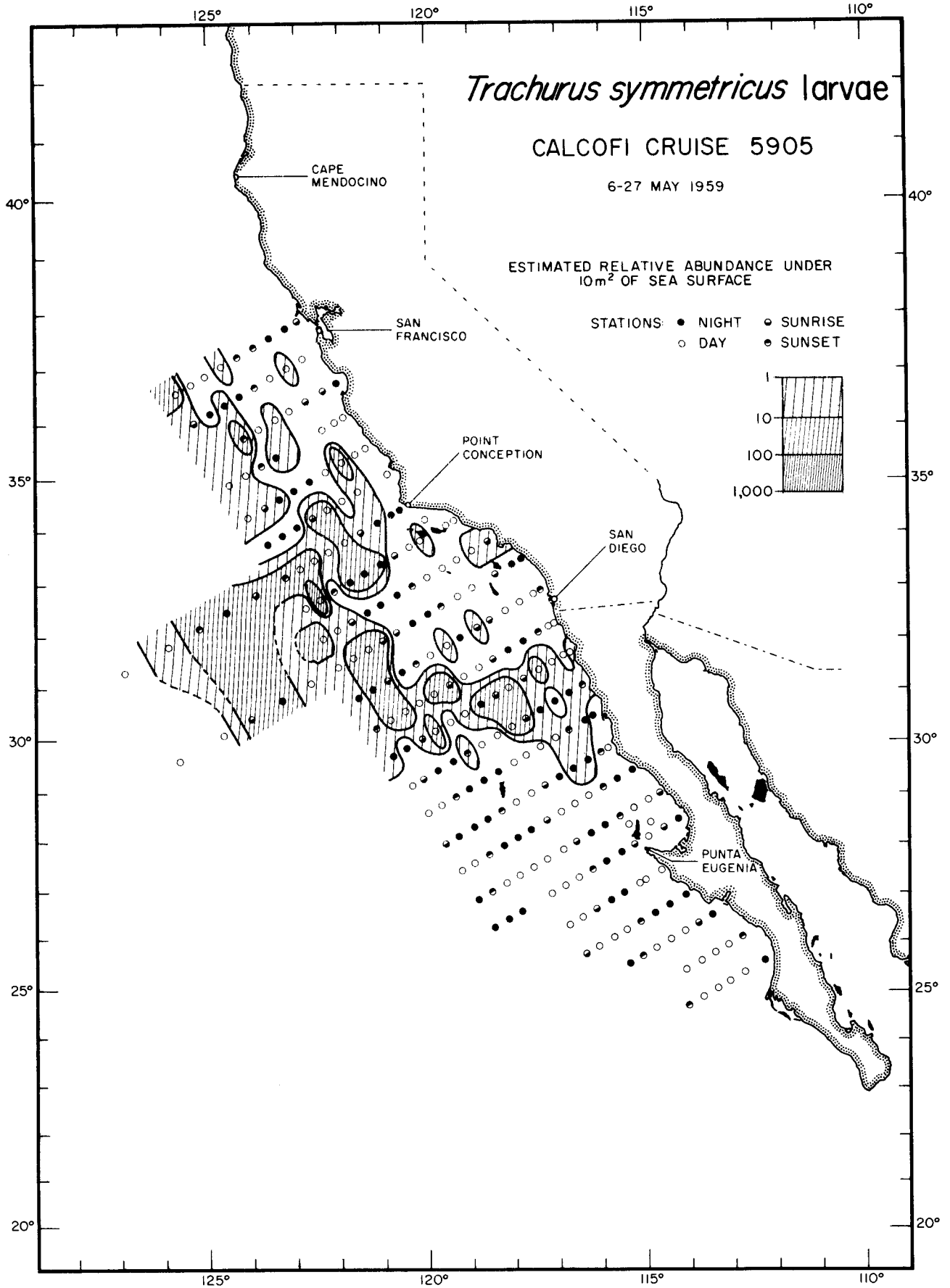
Trachurus symmetricus larvae

5705



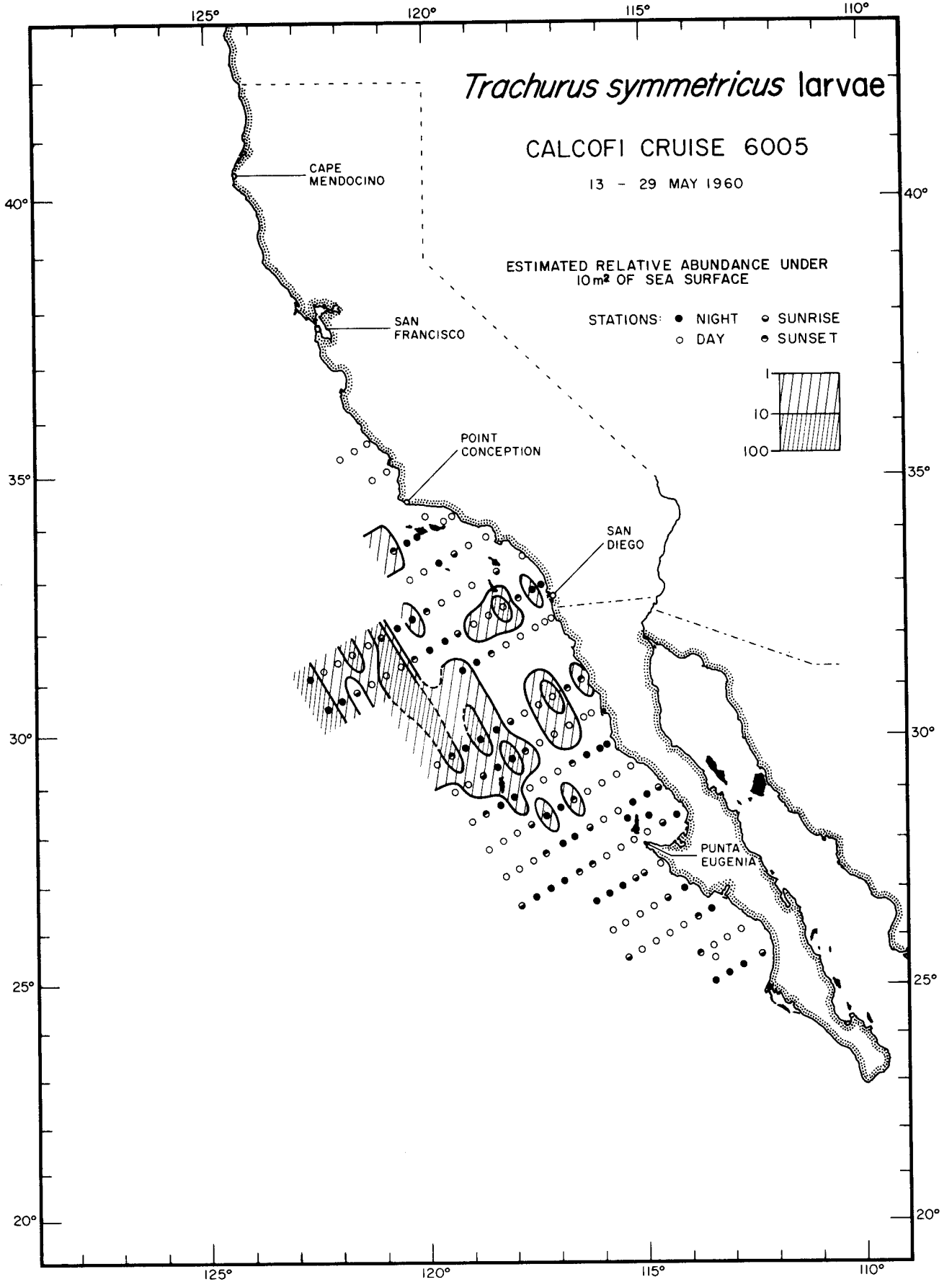
Trachurus symmetricus larvae

5805



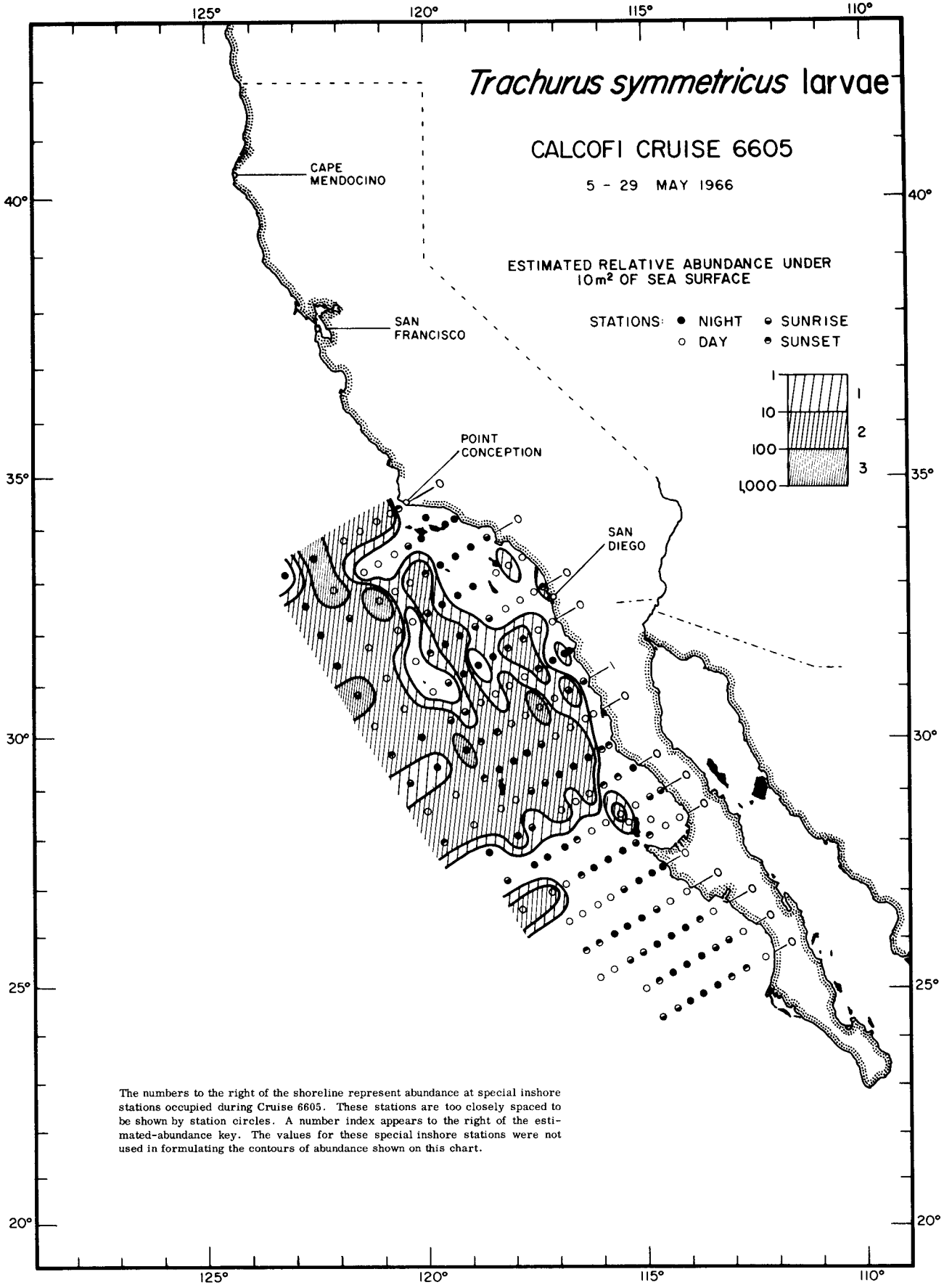
Trachurus symmetricus larvae

5905



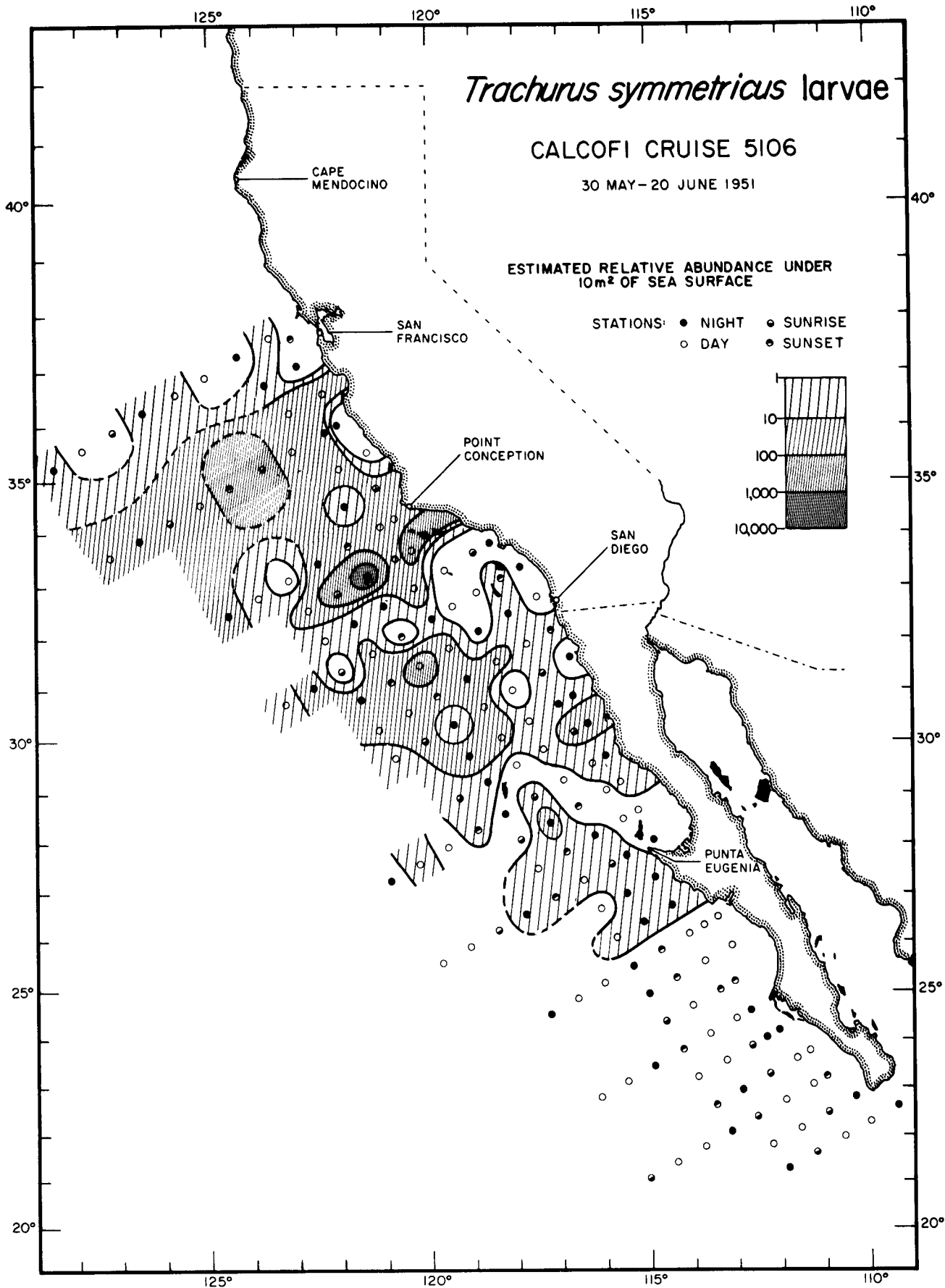
Trachurus symmetricus larvae

6005



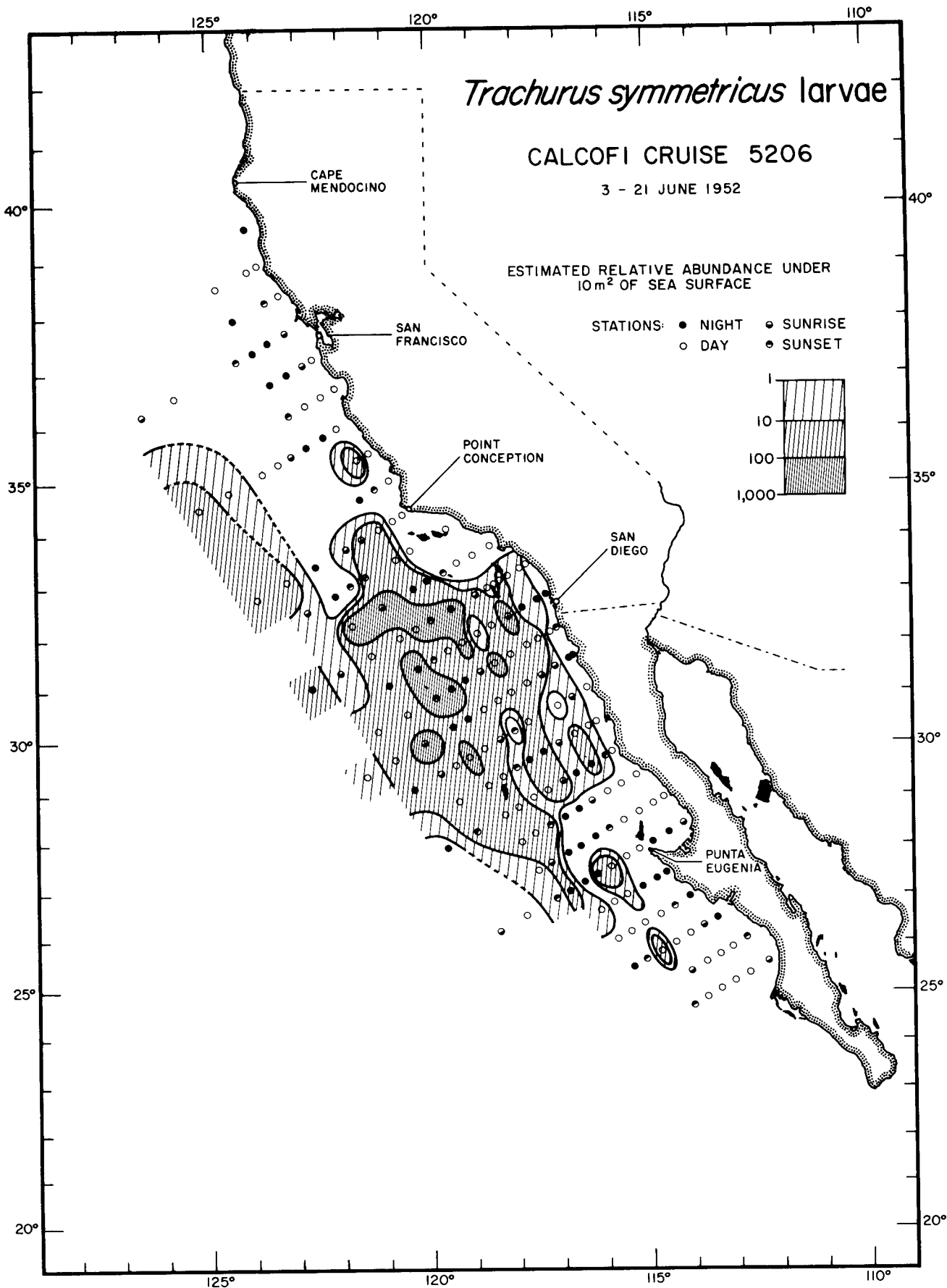
Trachurus symmetricus larvae

6605



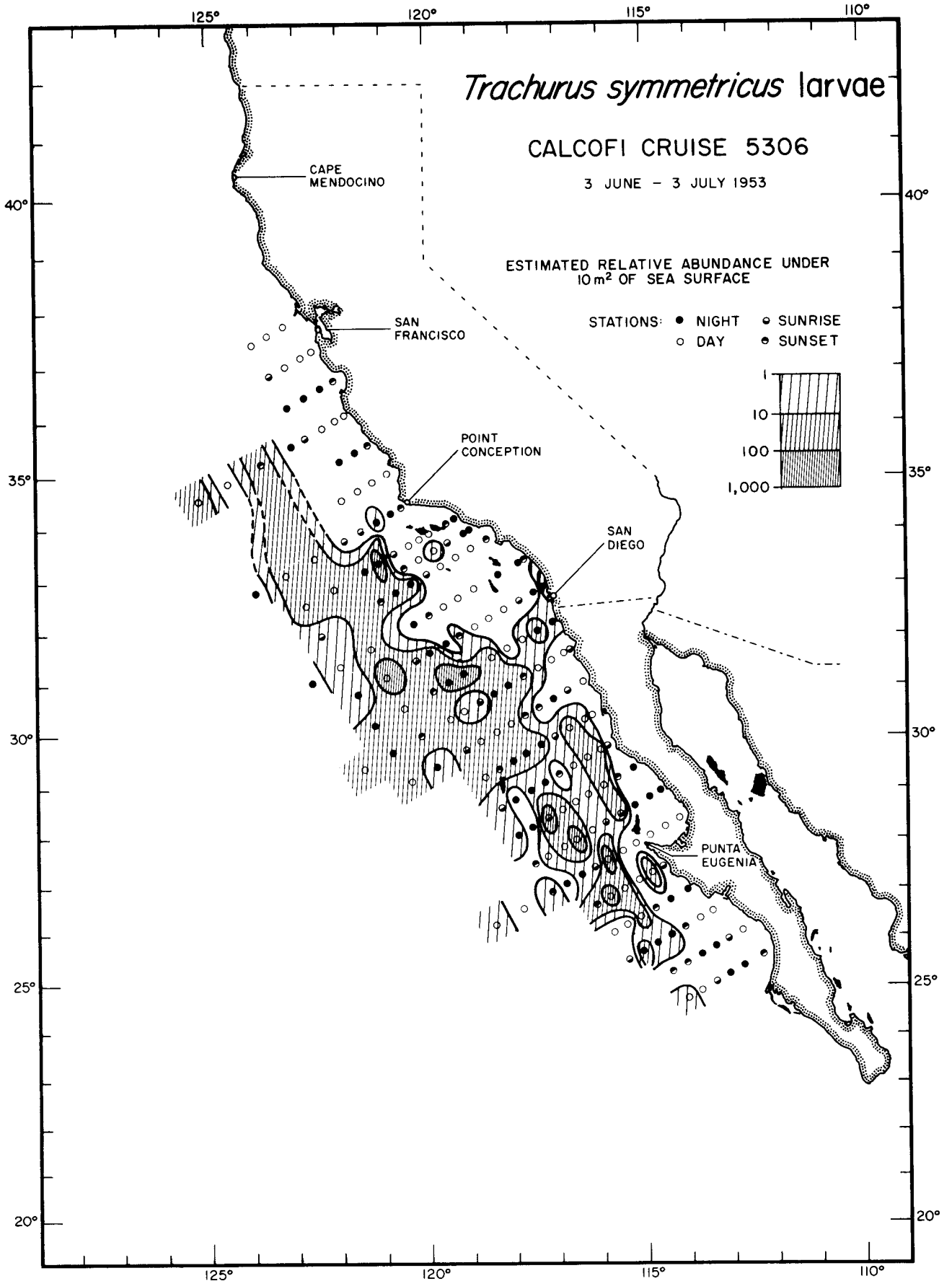
Trachurus symmetricus larvae

5106



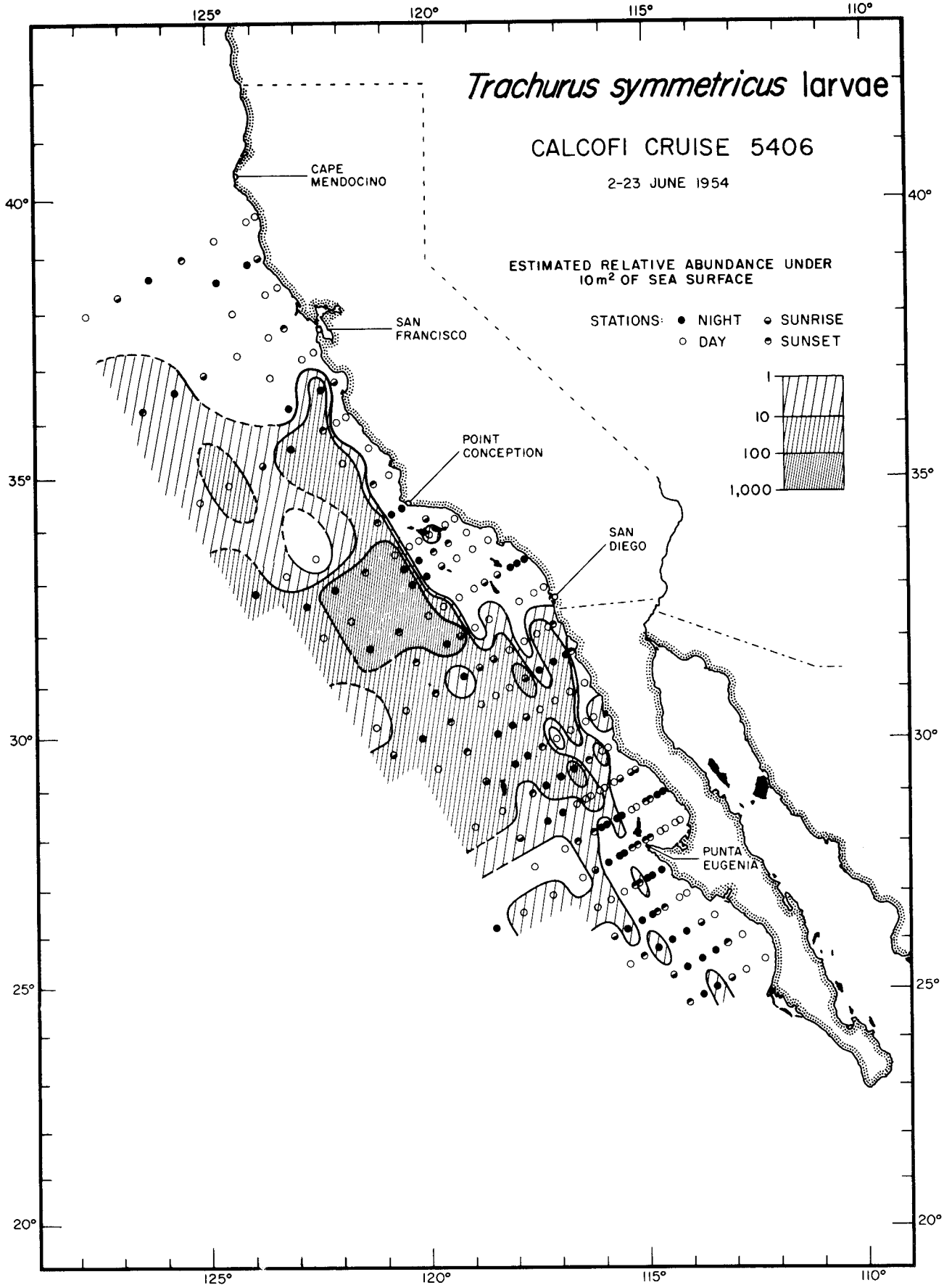
Trachurus symmetricus larvae

5206



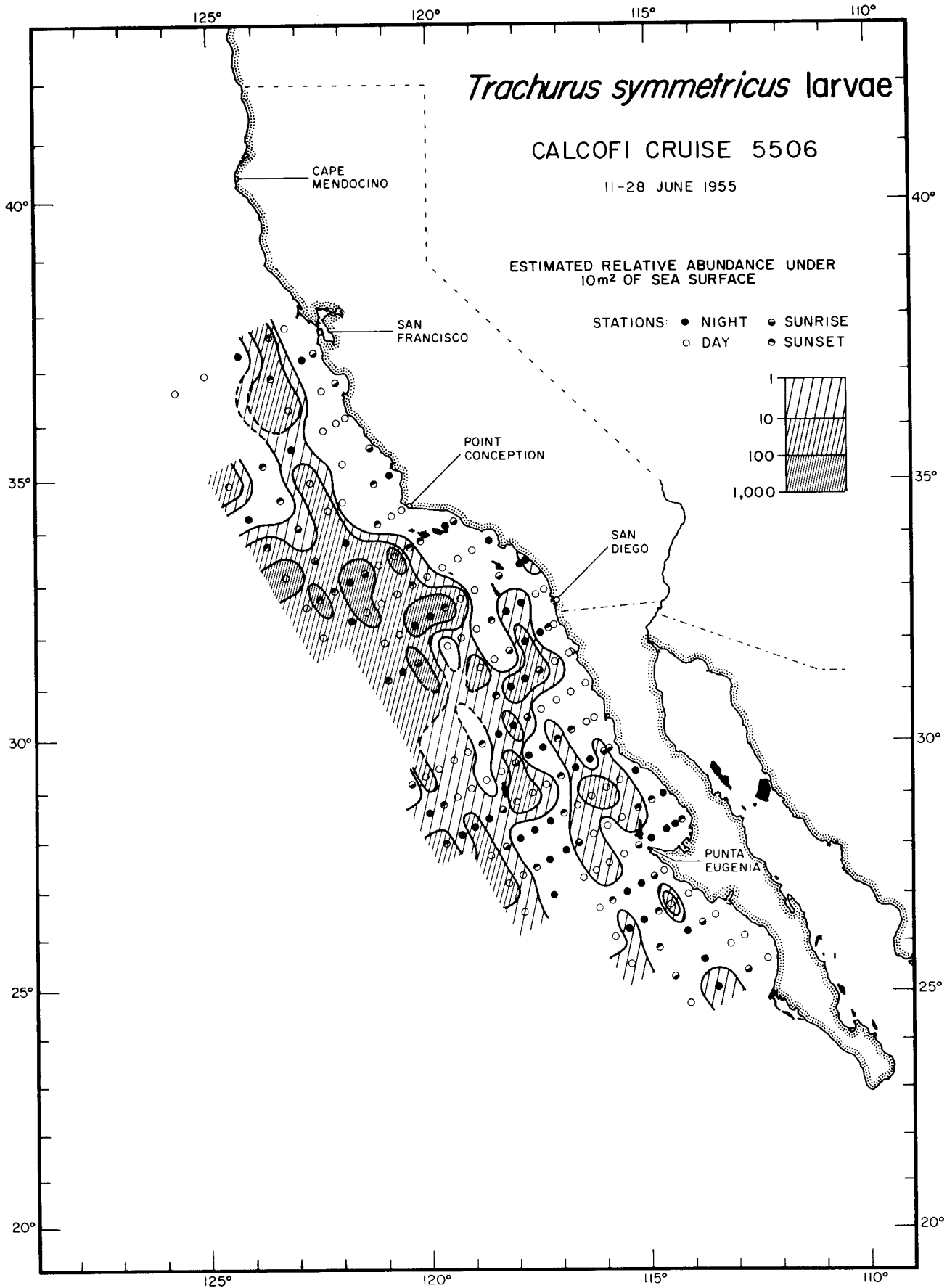
Trachurus symmetricus larvae

5306



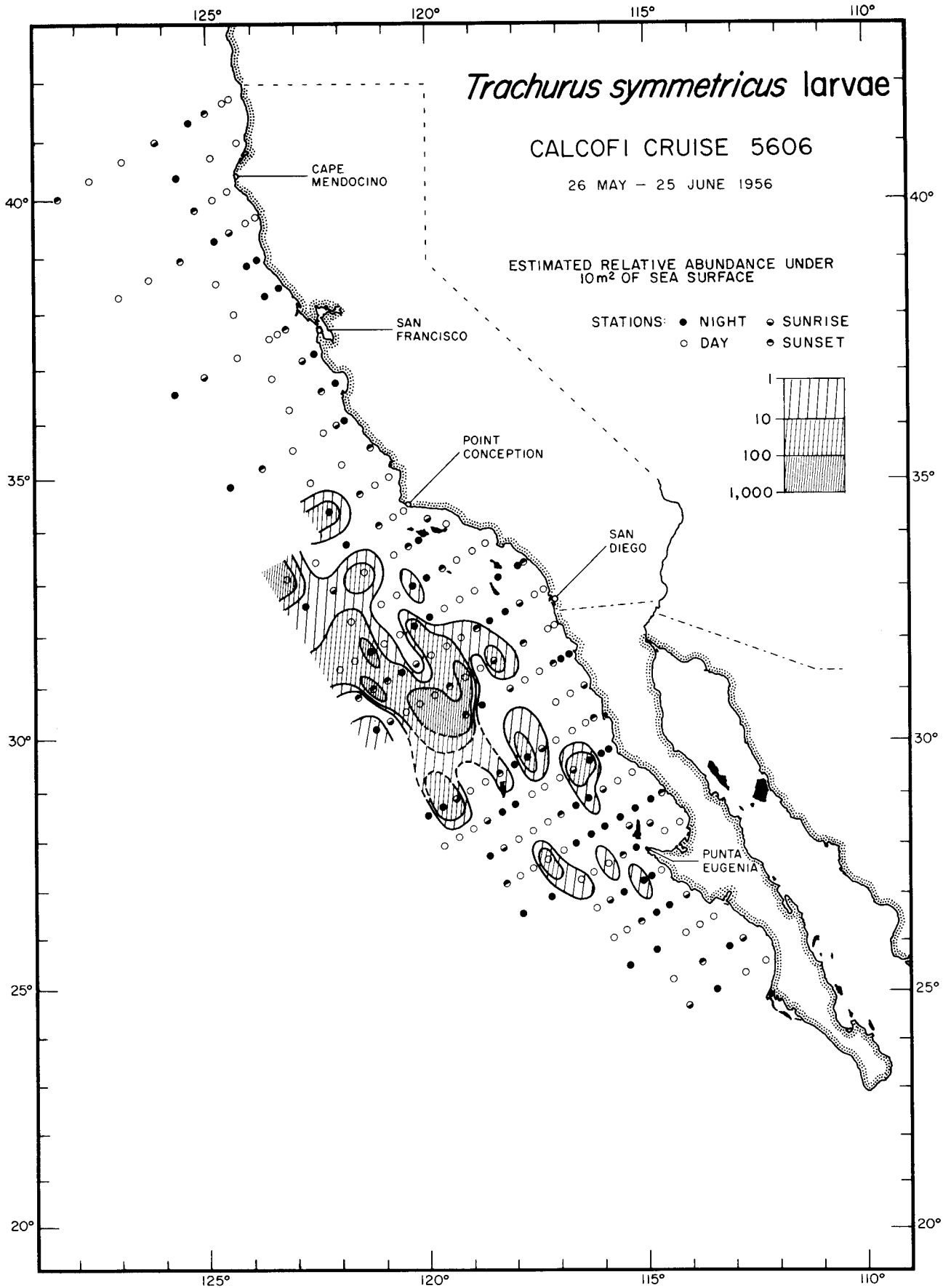
Trachurus symmetricus larvae

5406



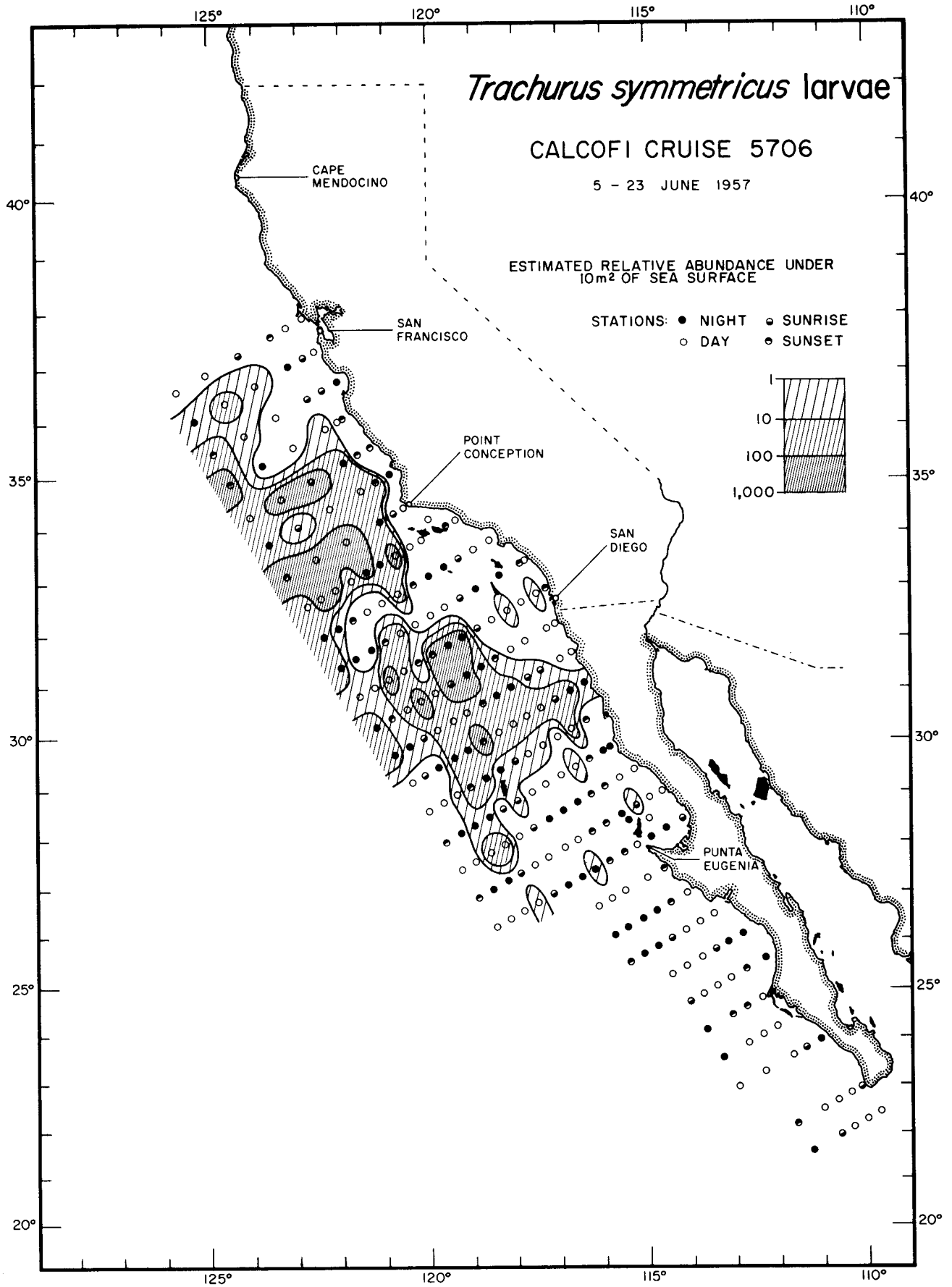
Trachurus symmetricus larvae

5506



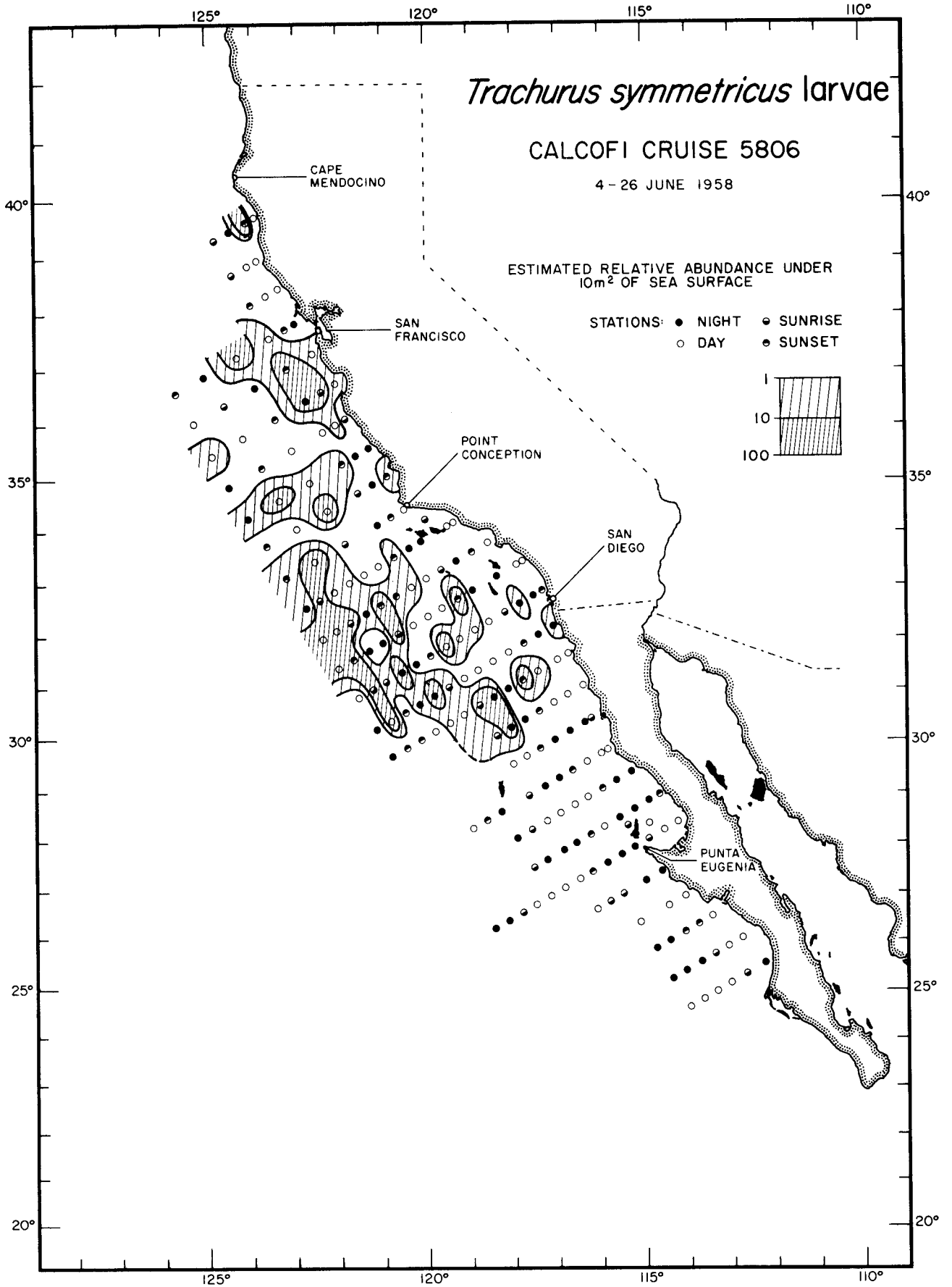
Trachurus symmetricus larvae

5606



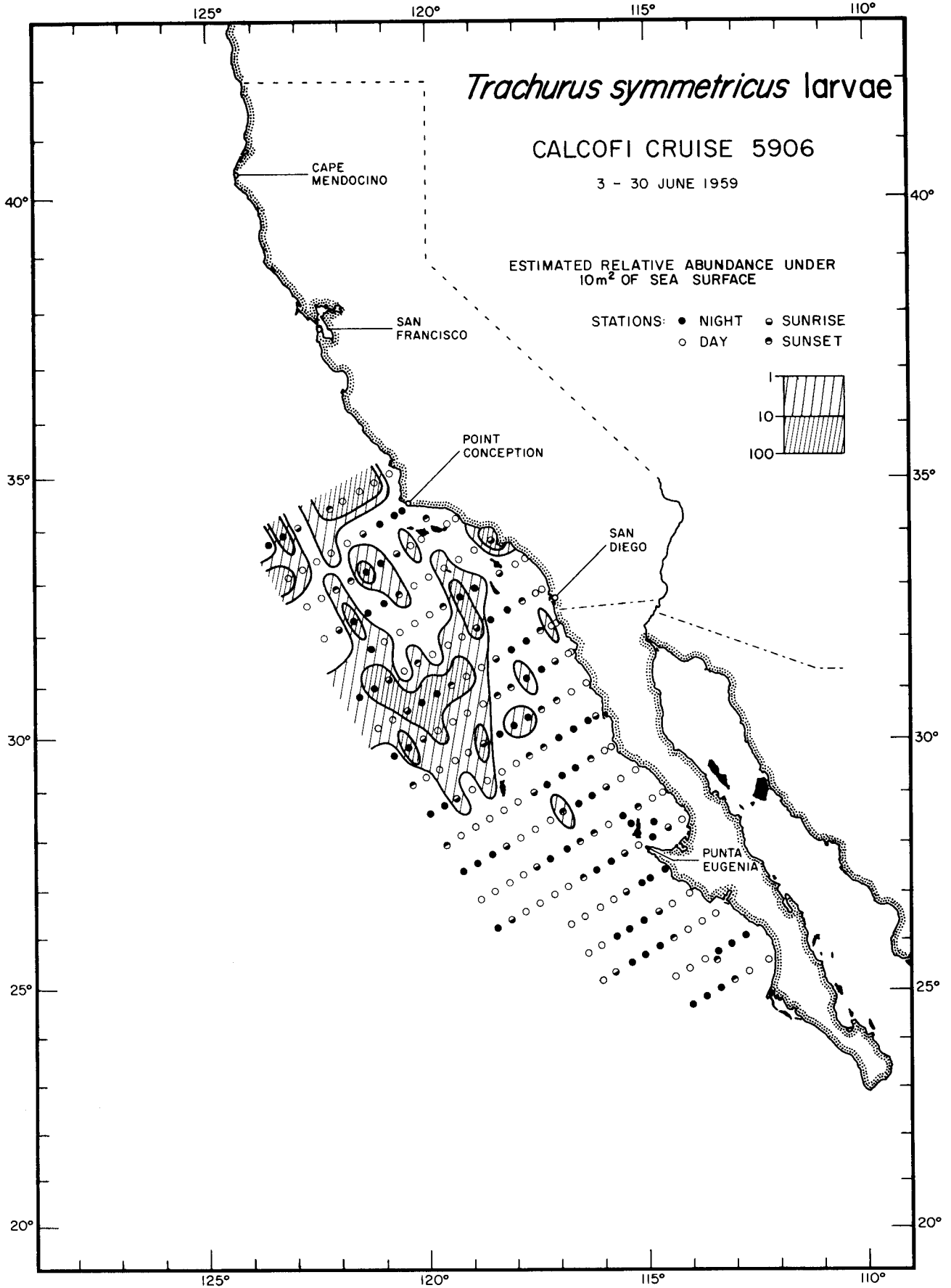
Trachurus symmetricus larvae

5706



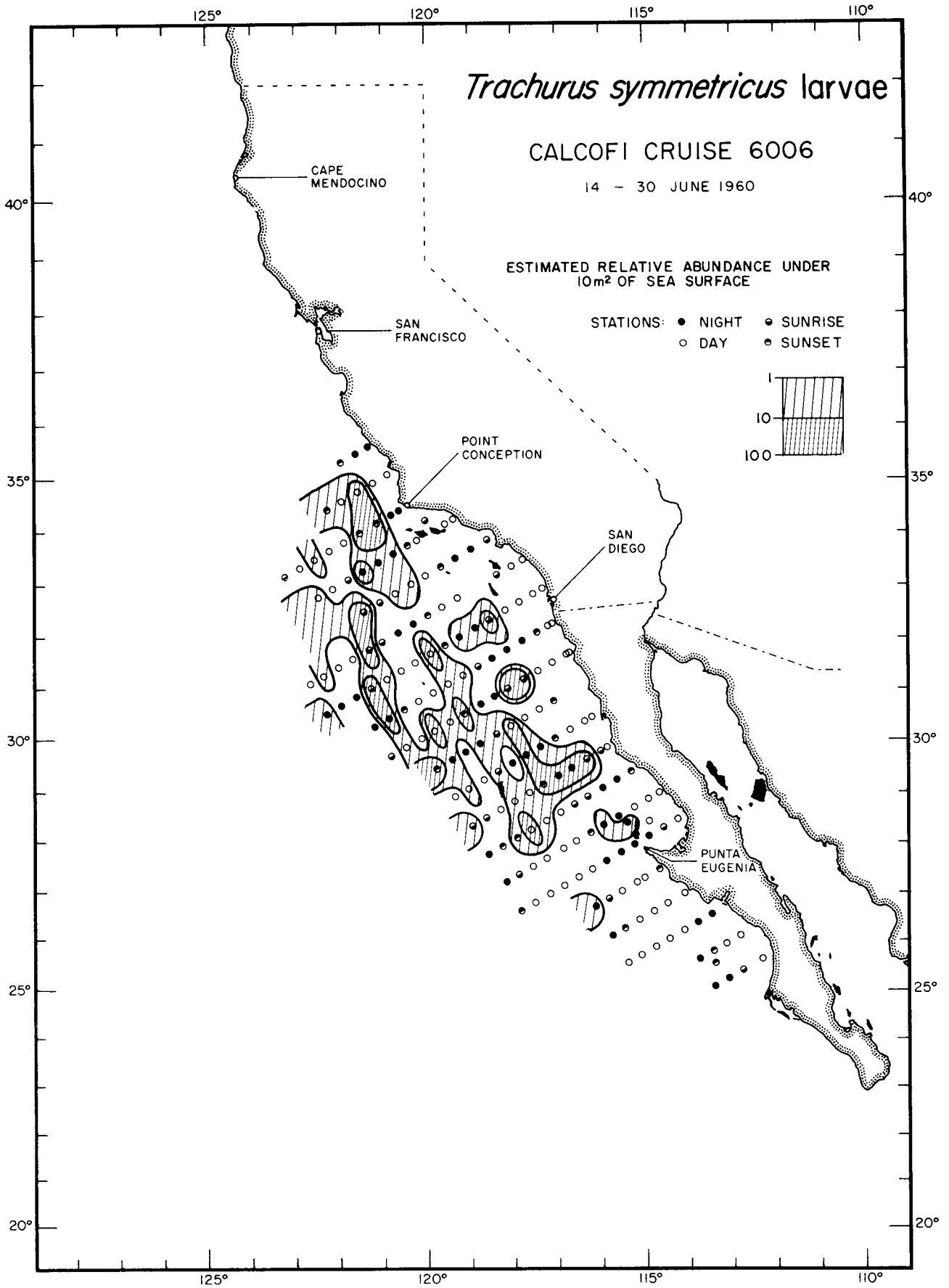
Trachurus symmetricus larvae

5806



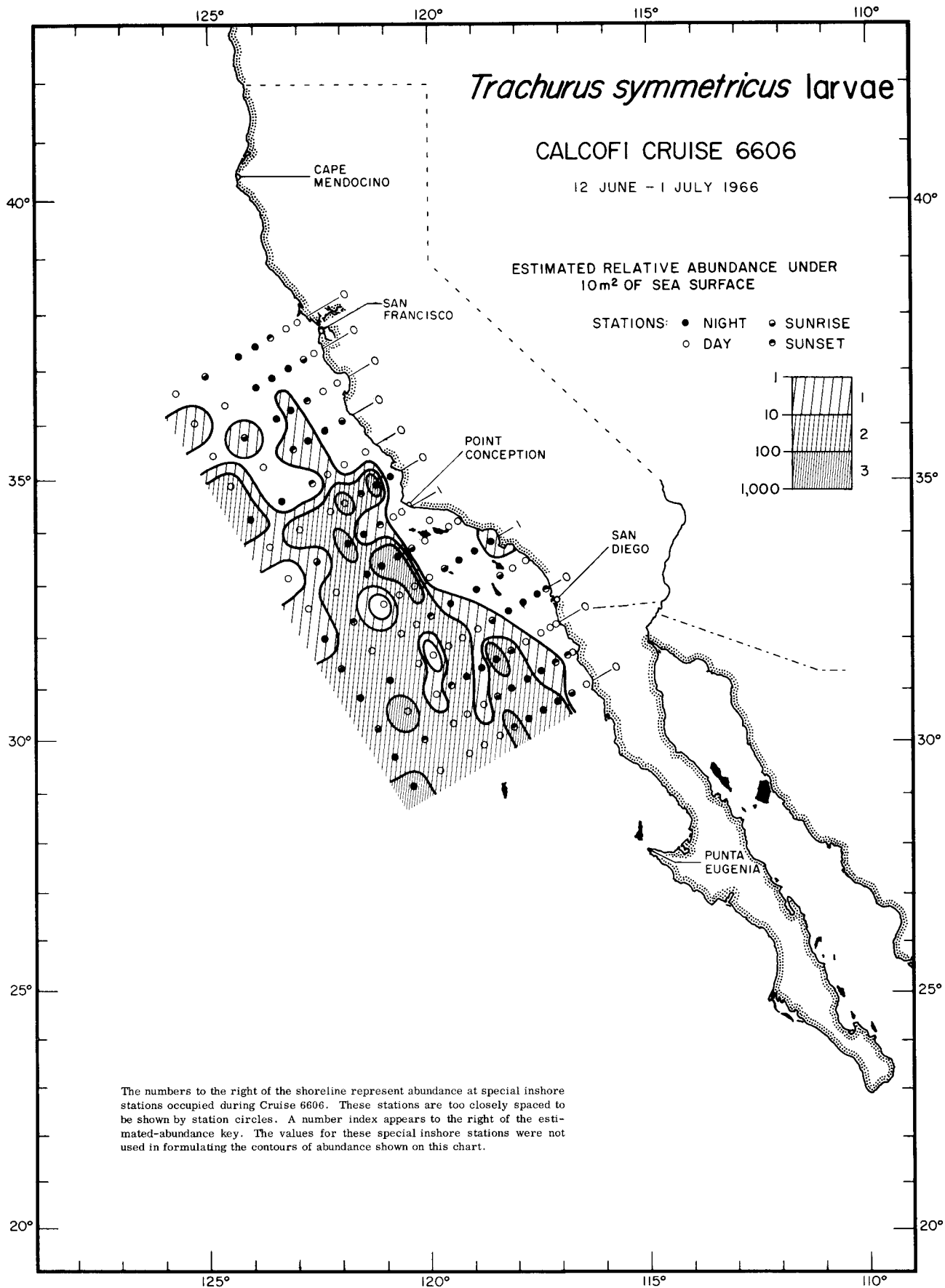
Trachurus symmetricus larvae

5906



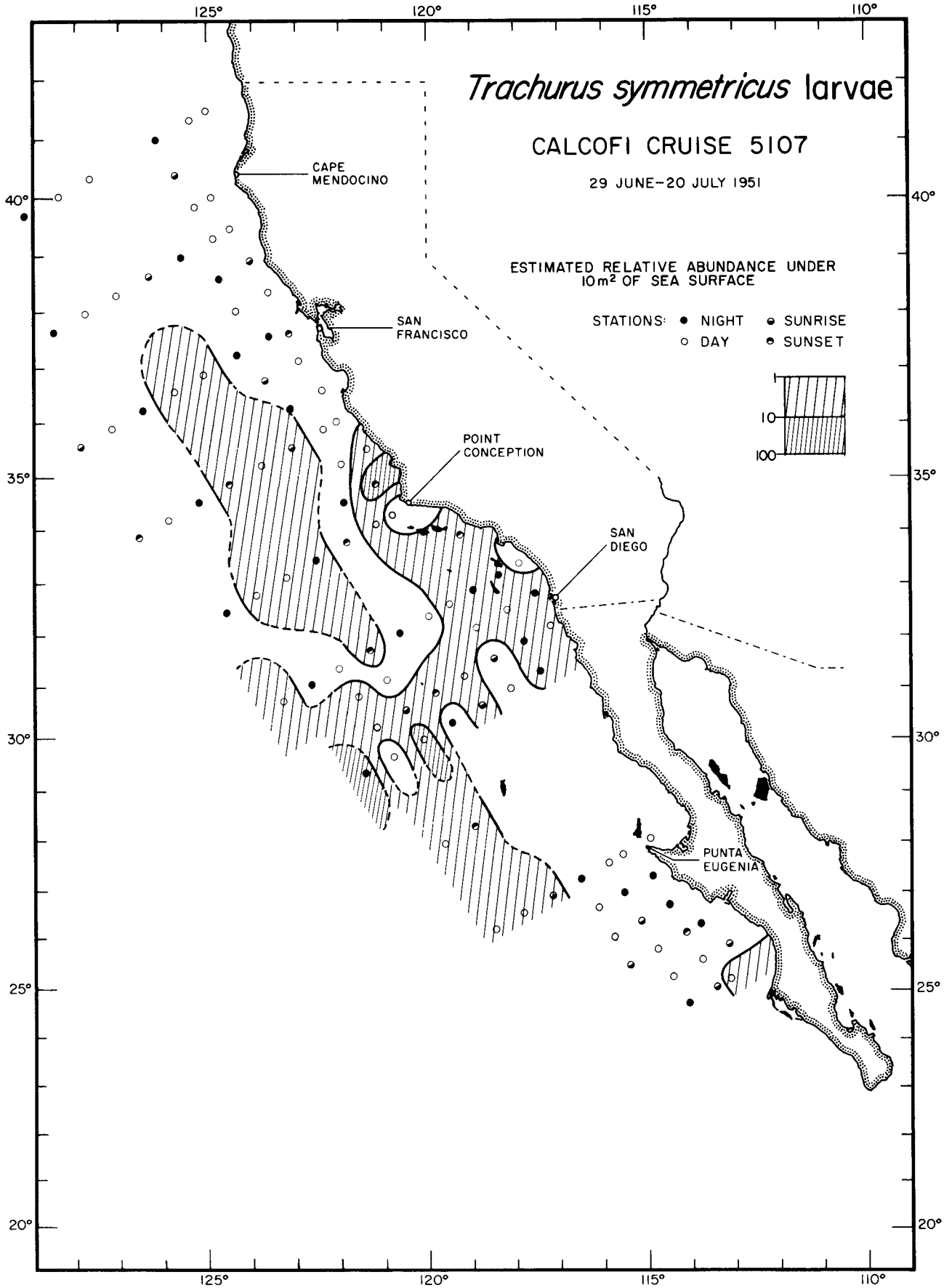
Trachurus symmetricus larvae

6006



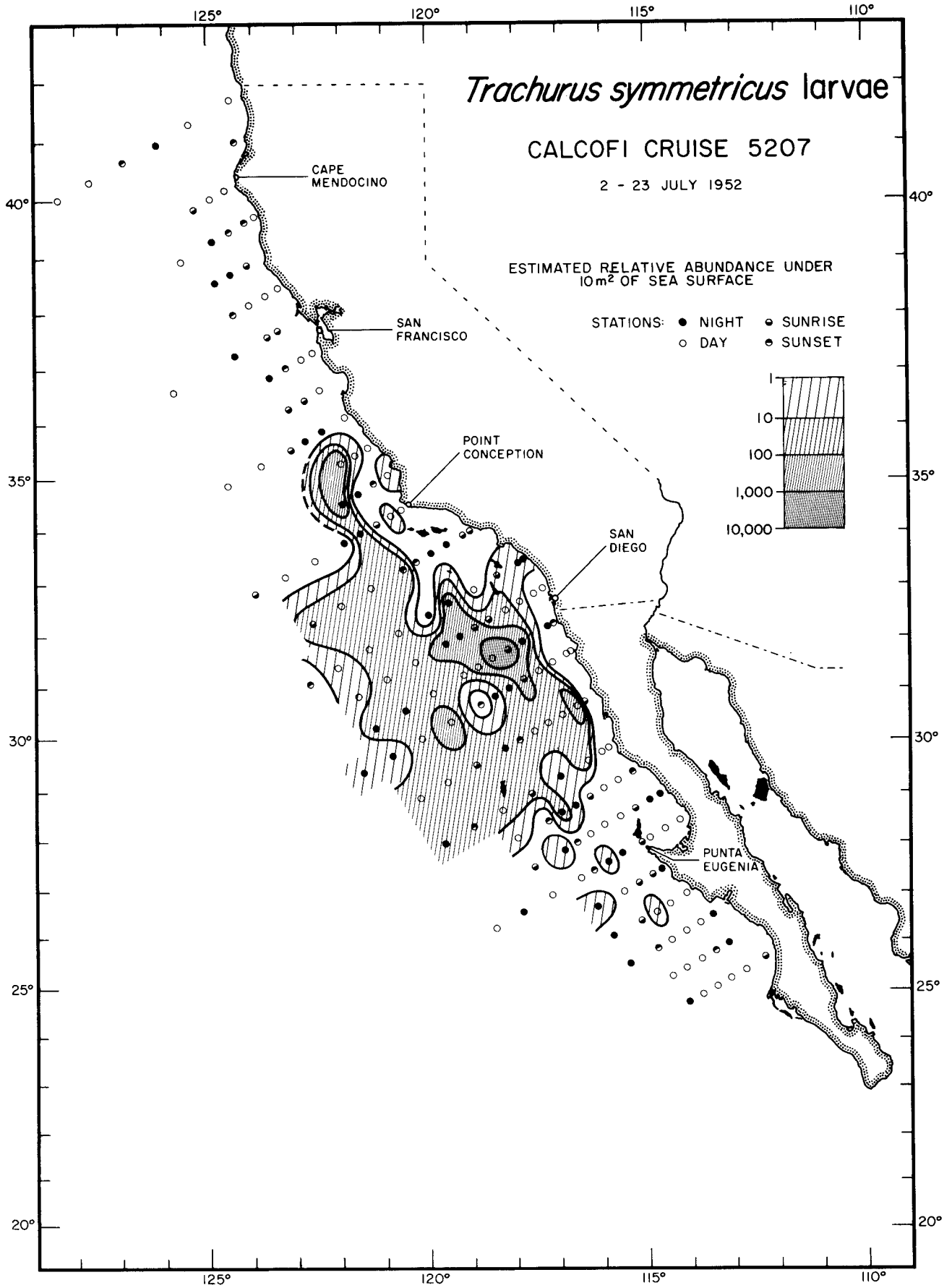
Trachurus symmetricus larvae

6606



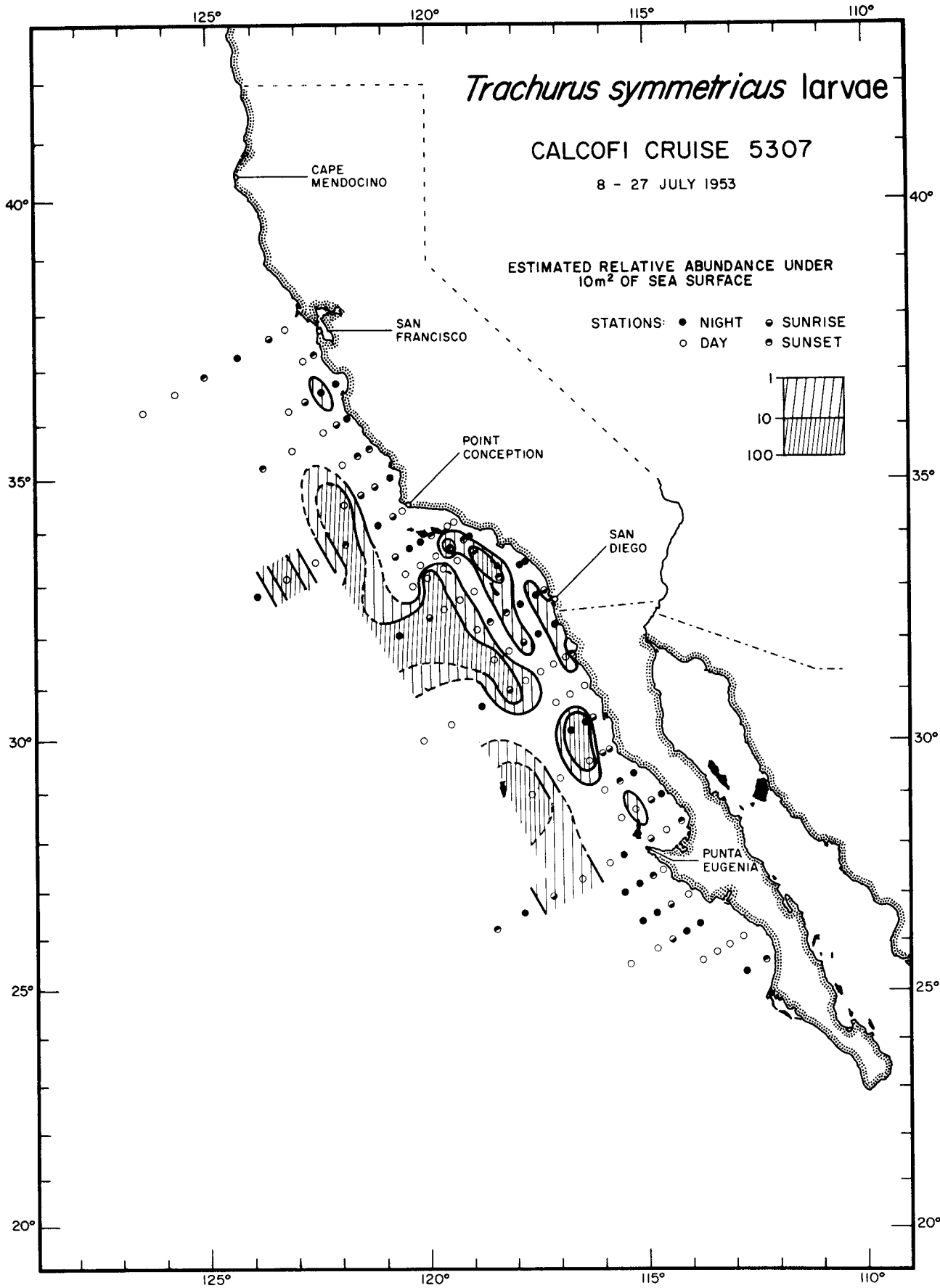
Trachurus symmetricus larvae

5107



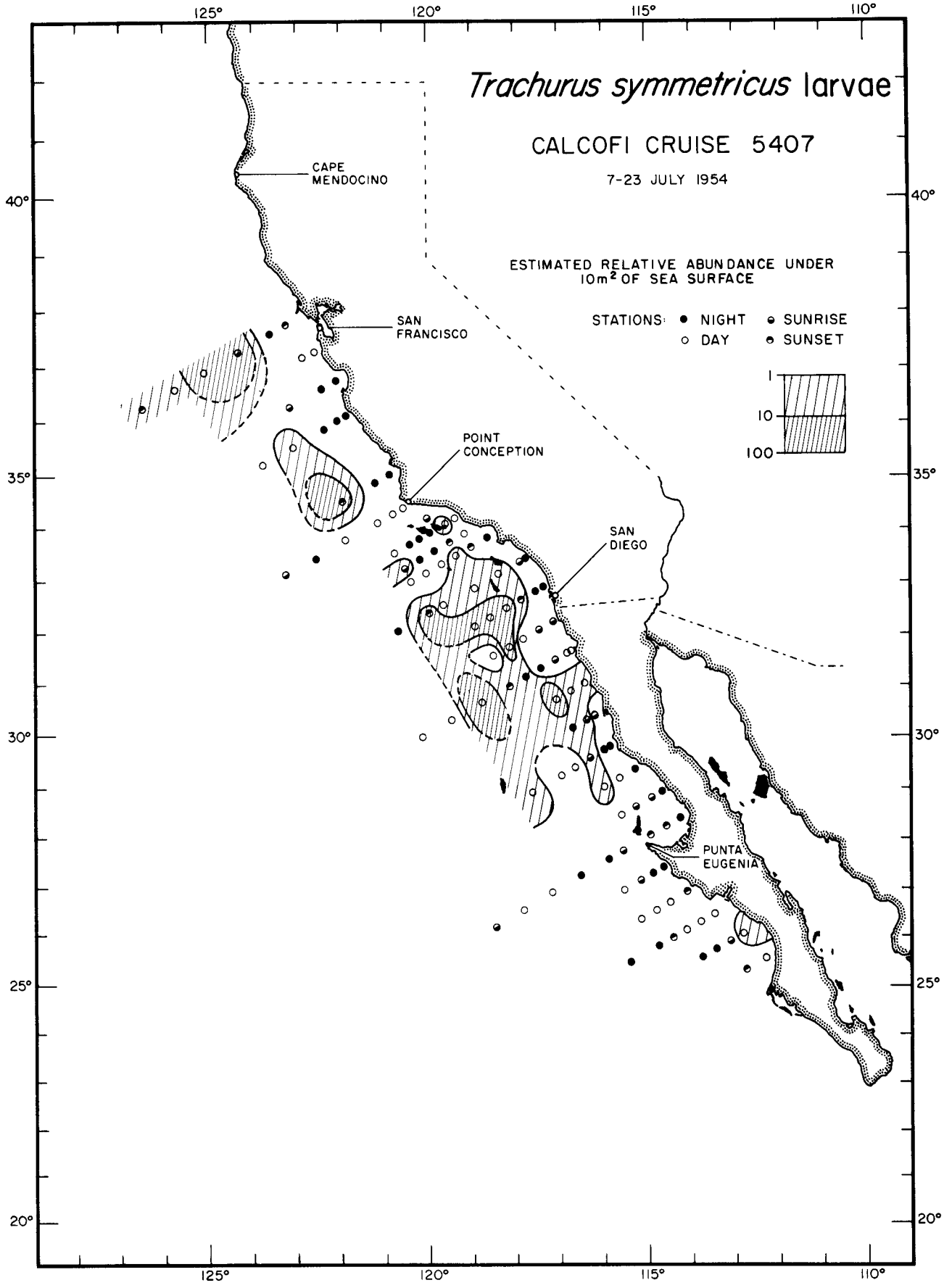
Trachurus symmetricus larvae

5207



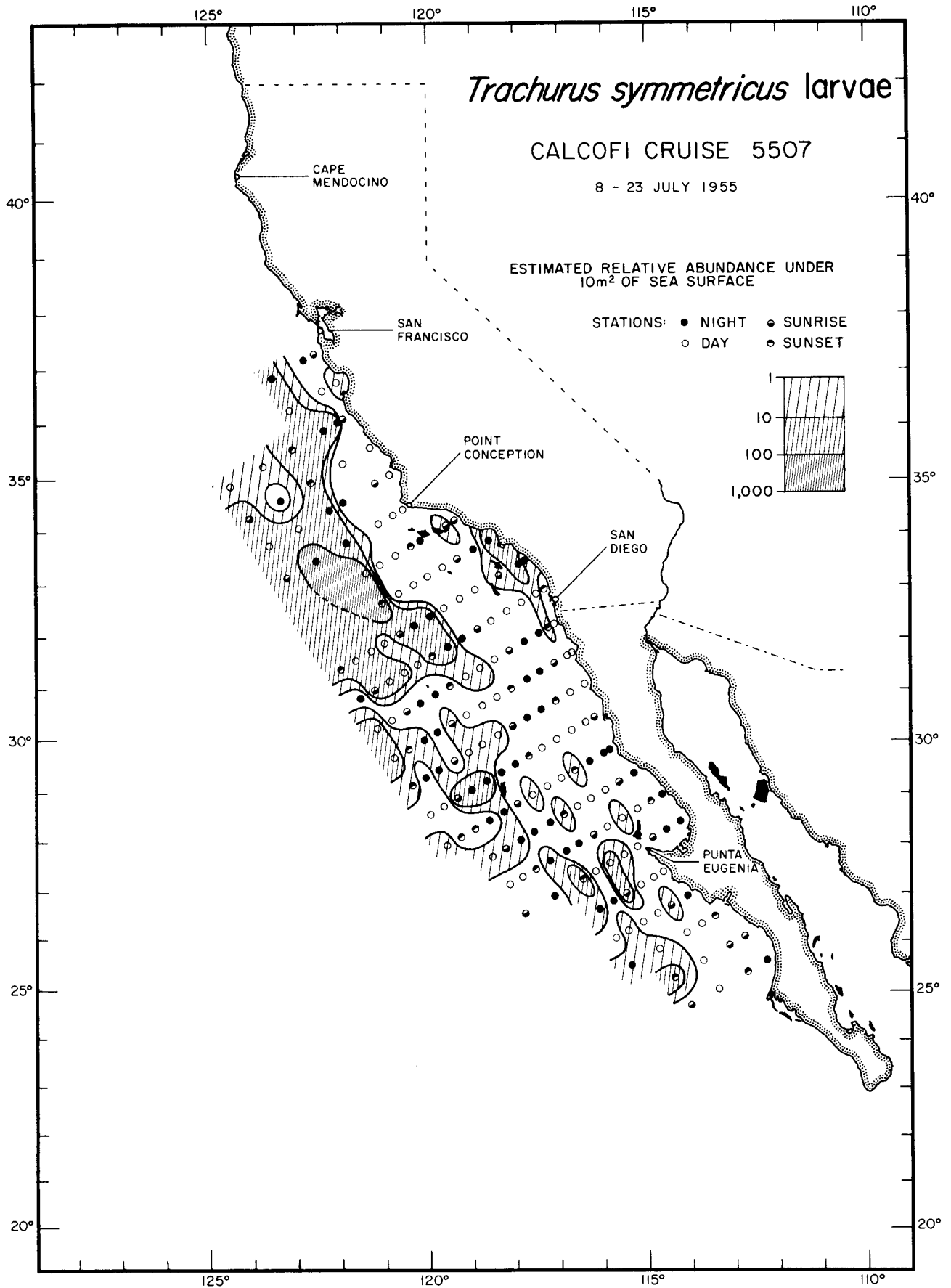
Trachurus symmetricus larvae

5307



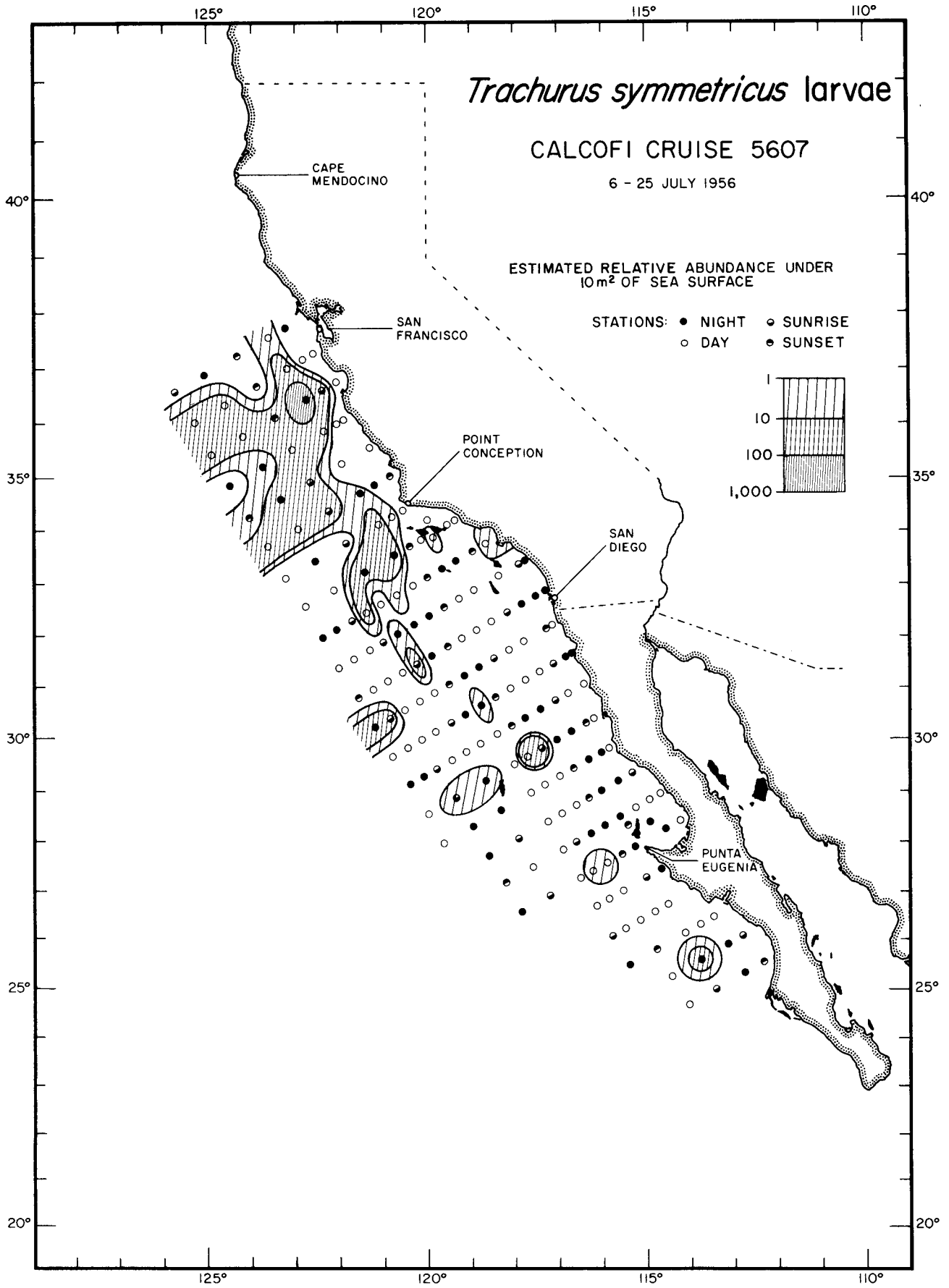
Trachurus symmetricus larvae

5407



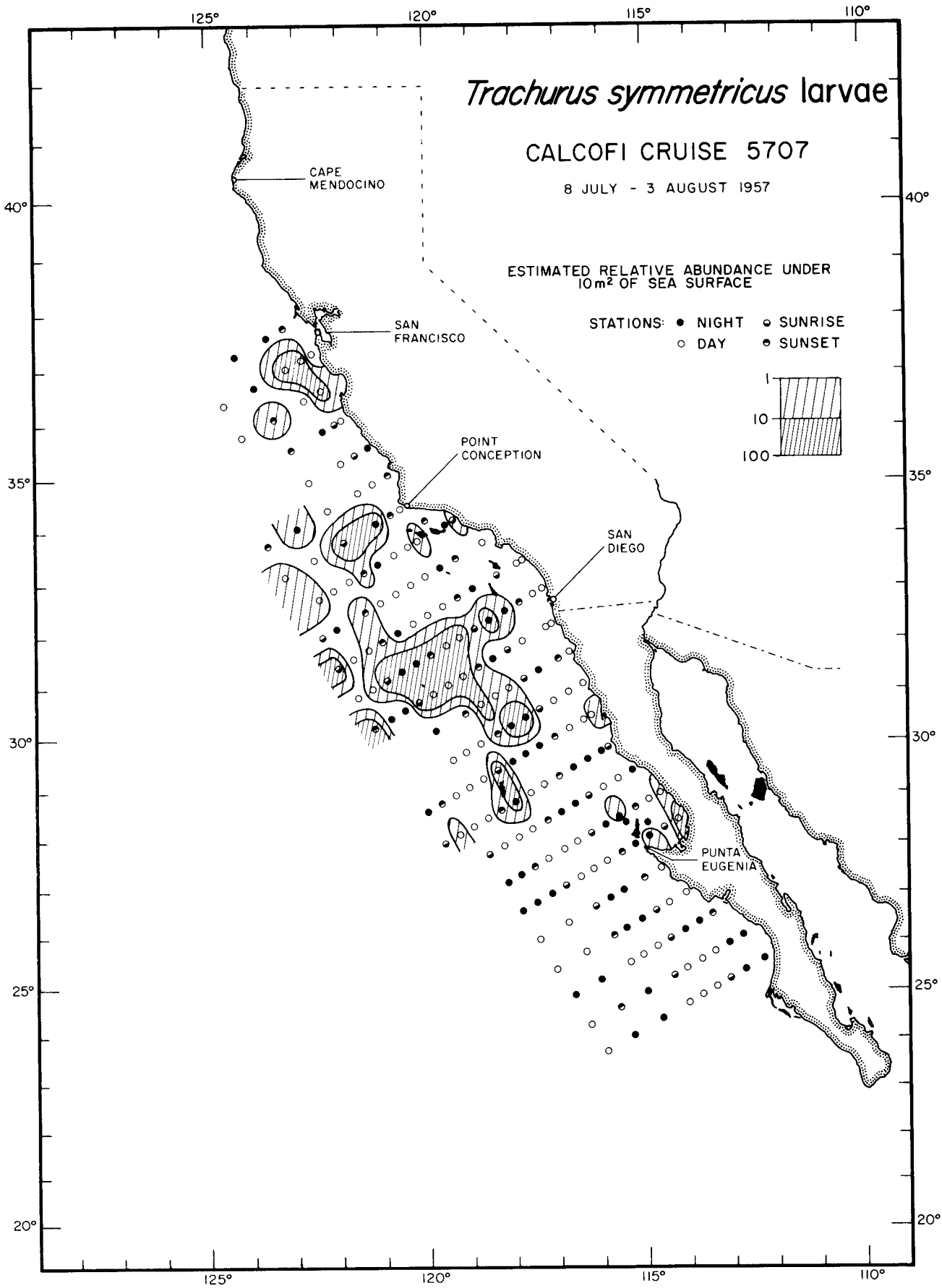
Trachurus symmetricus larvae

5507



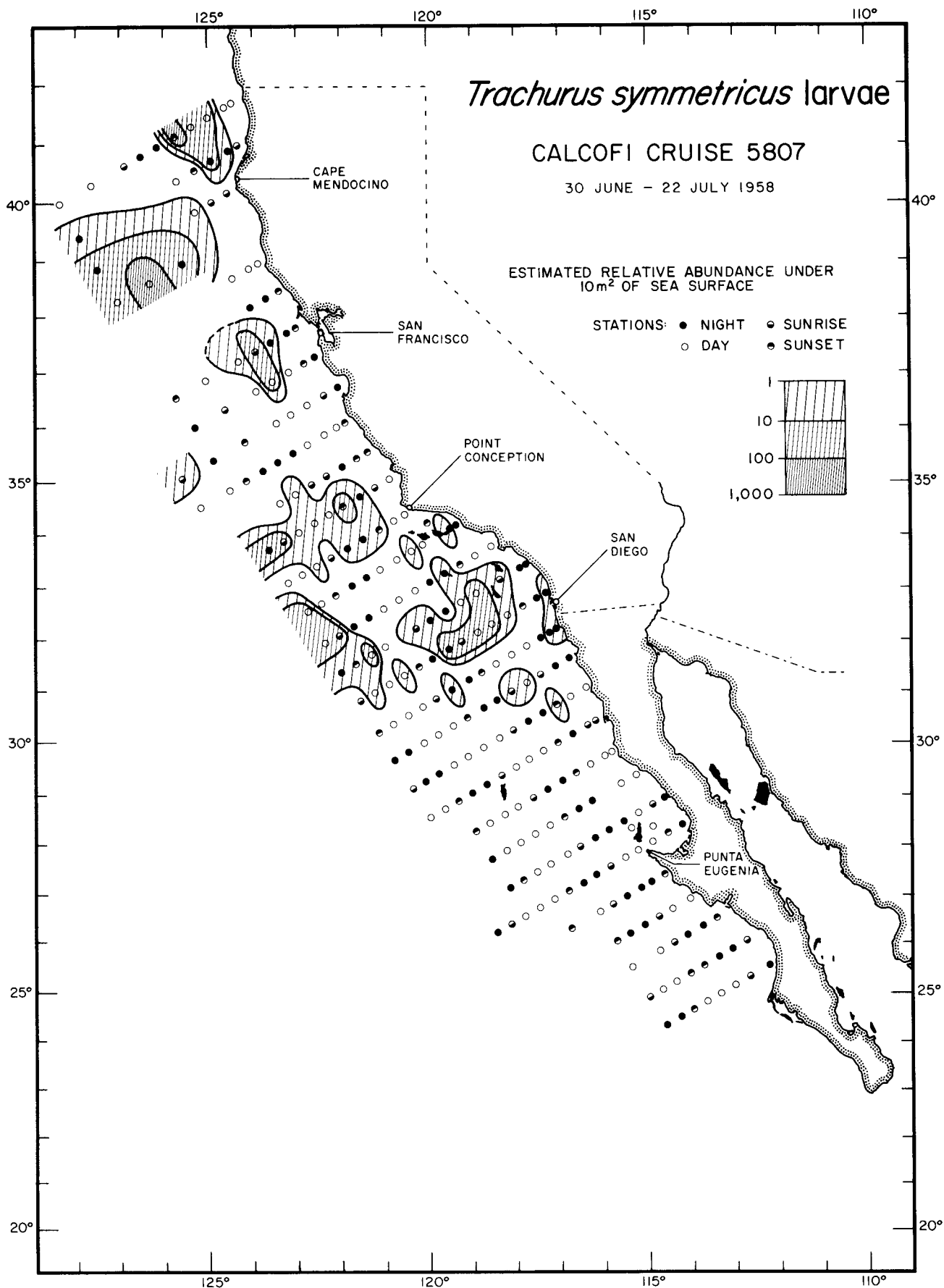
Trachurus symmetricus larvae

5607



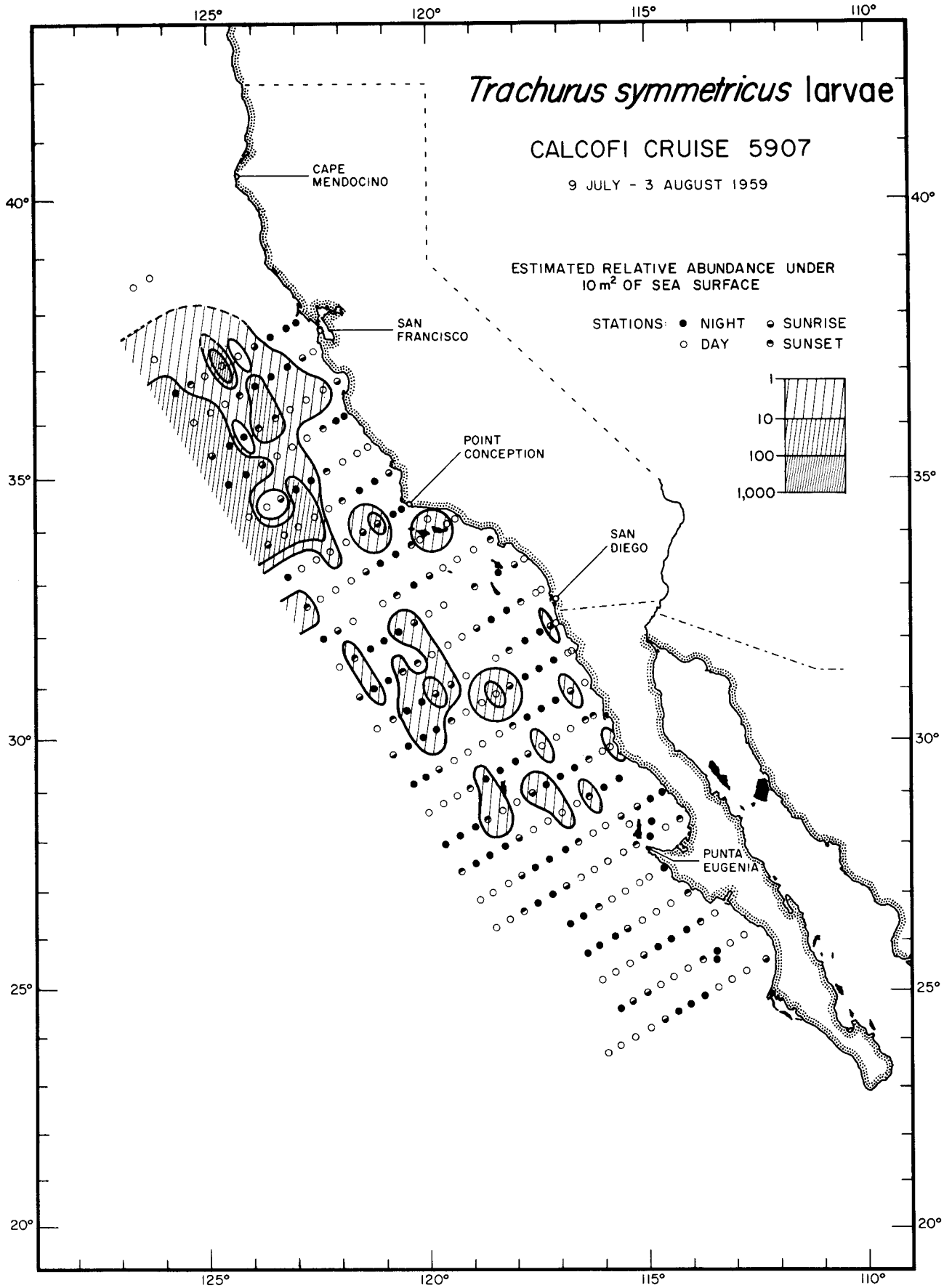
Trachurus symmetricus larvae

5707



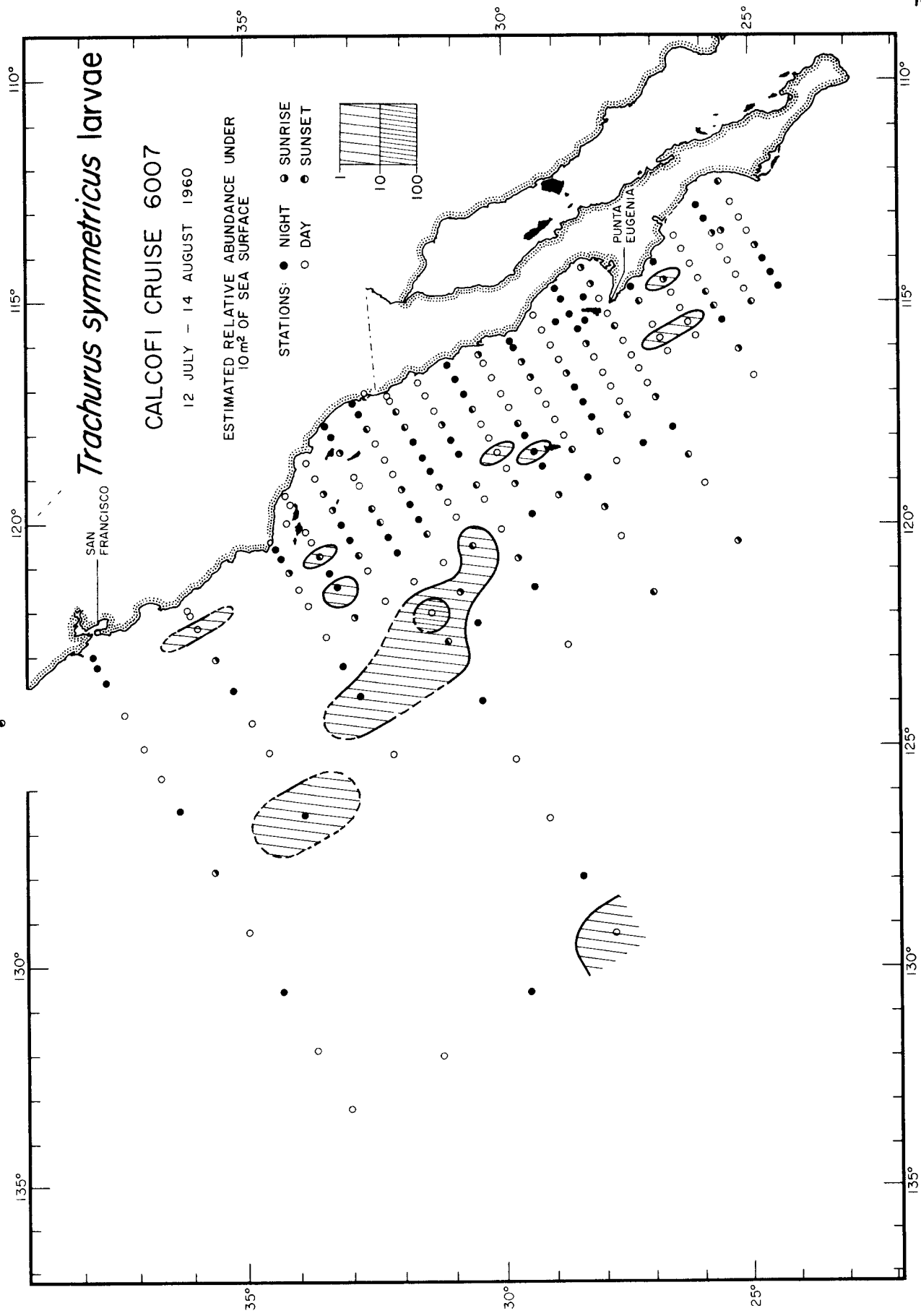
Trachurus symmetricus larvae

5807

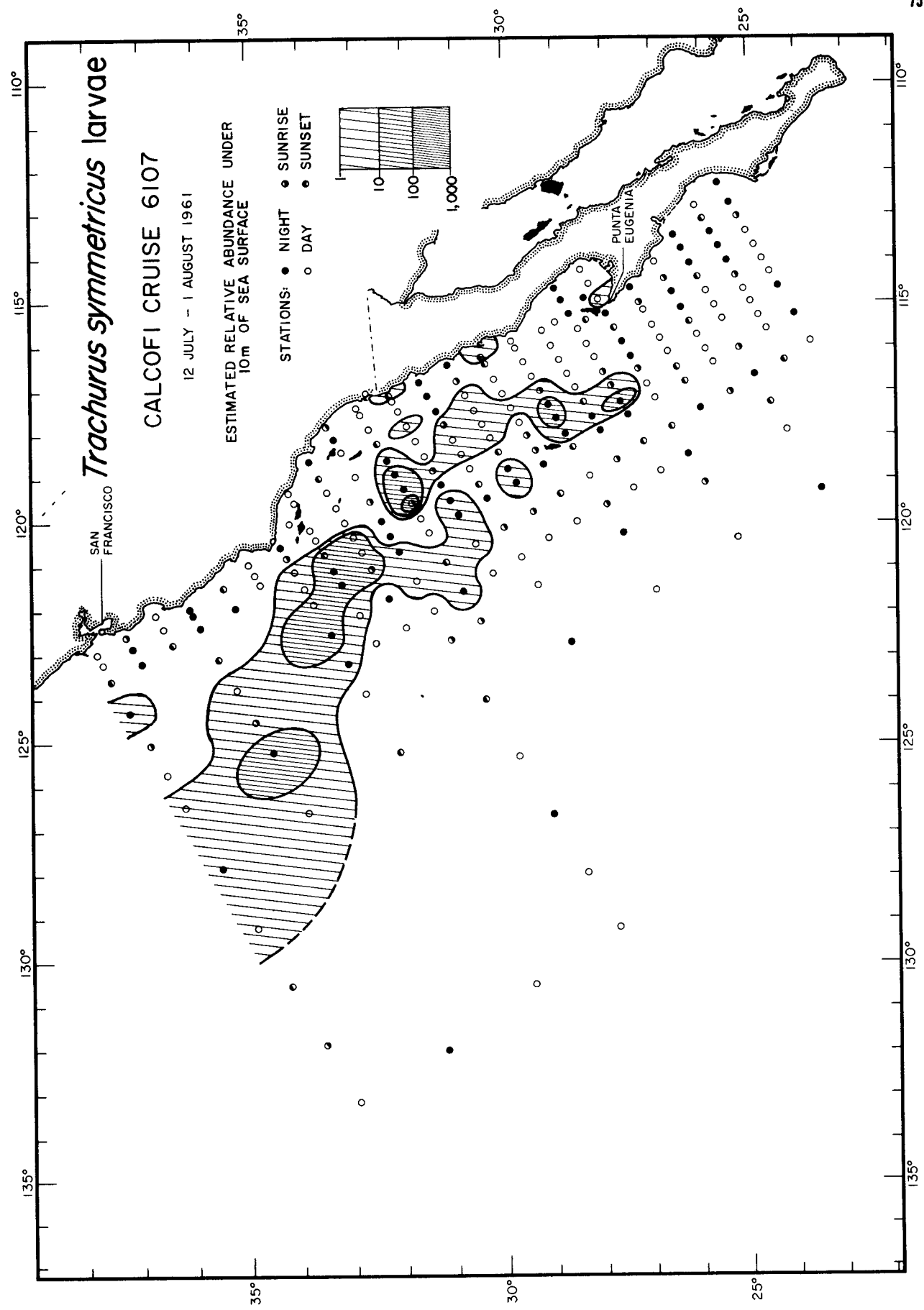


Trachurus symmetricus larvae

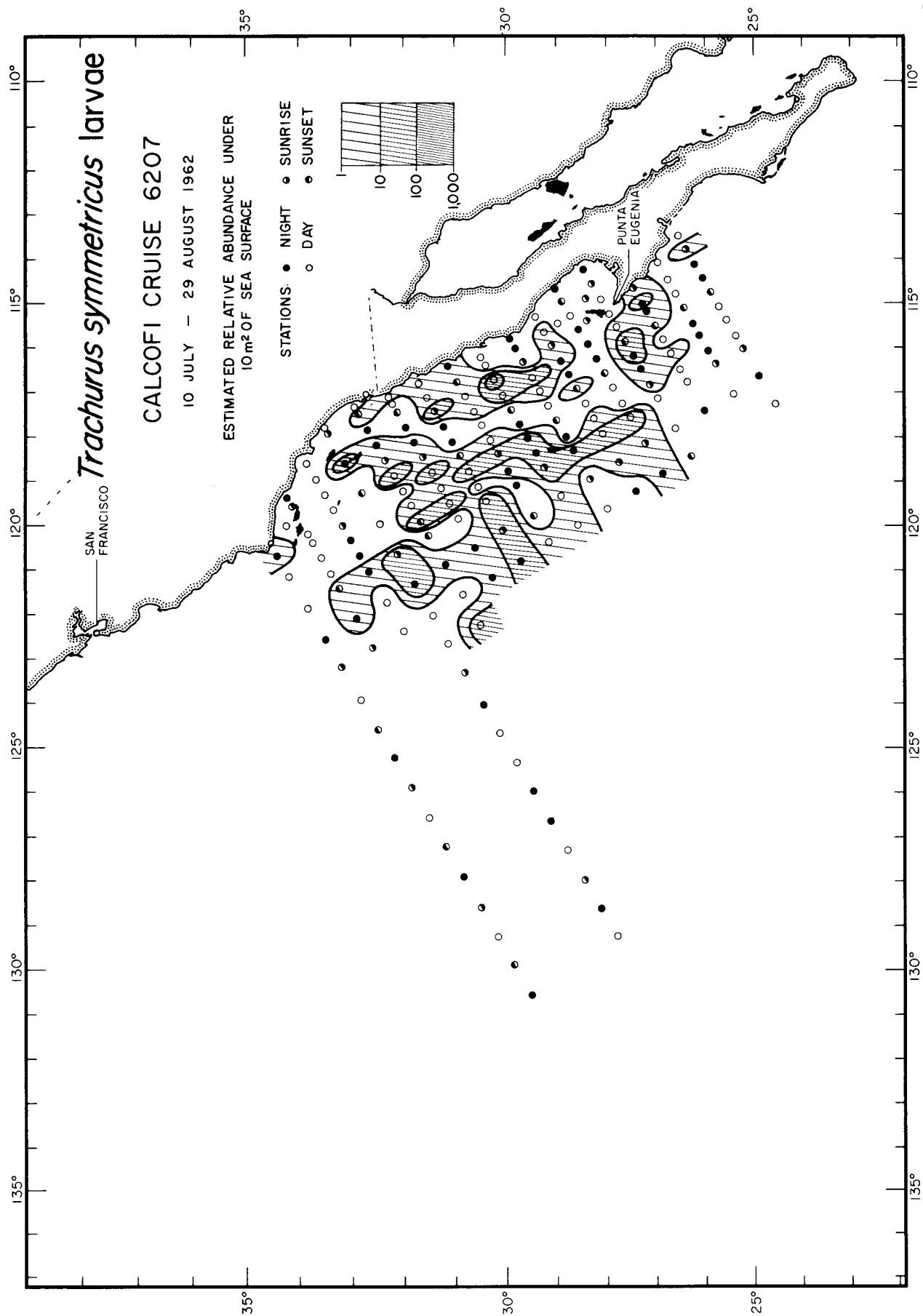
5907



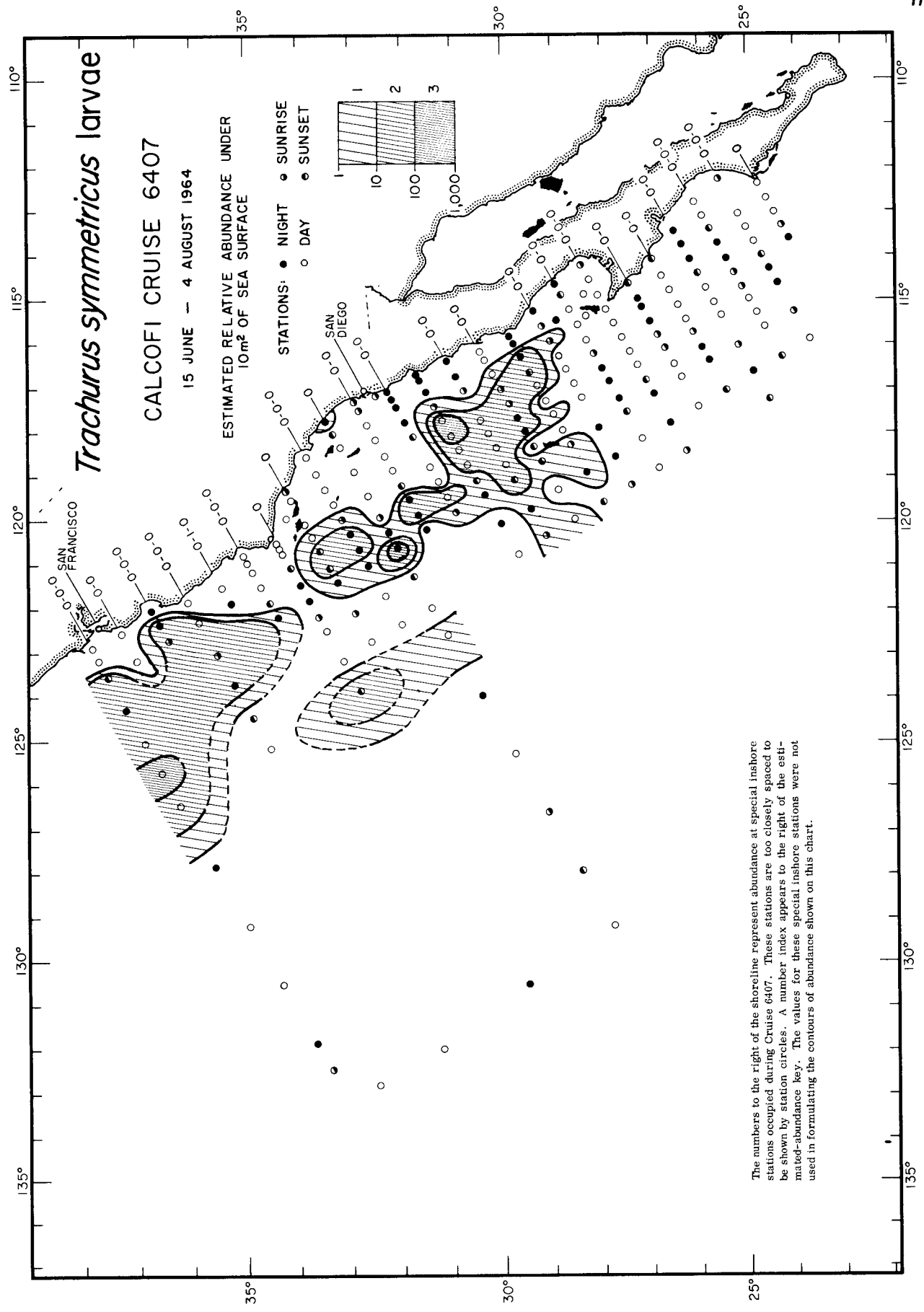
Trachurus symmetricus larvae



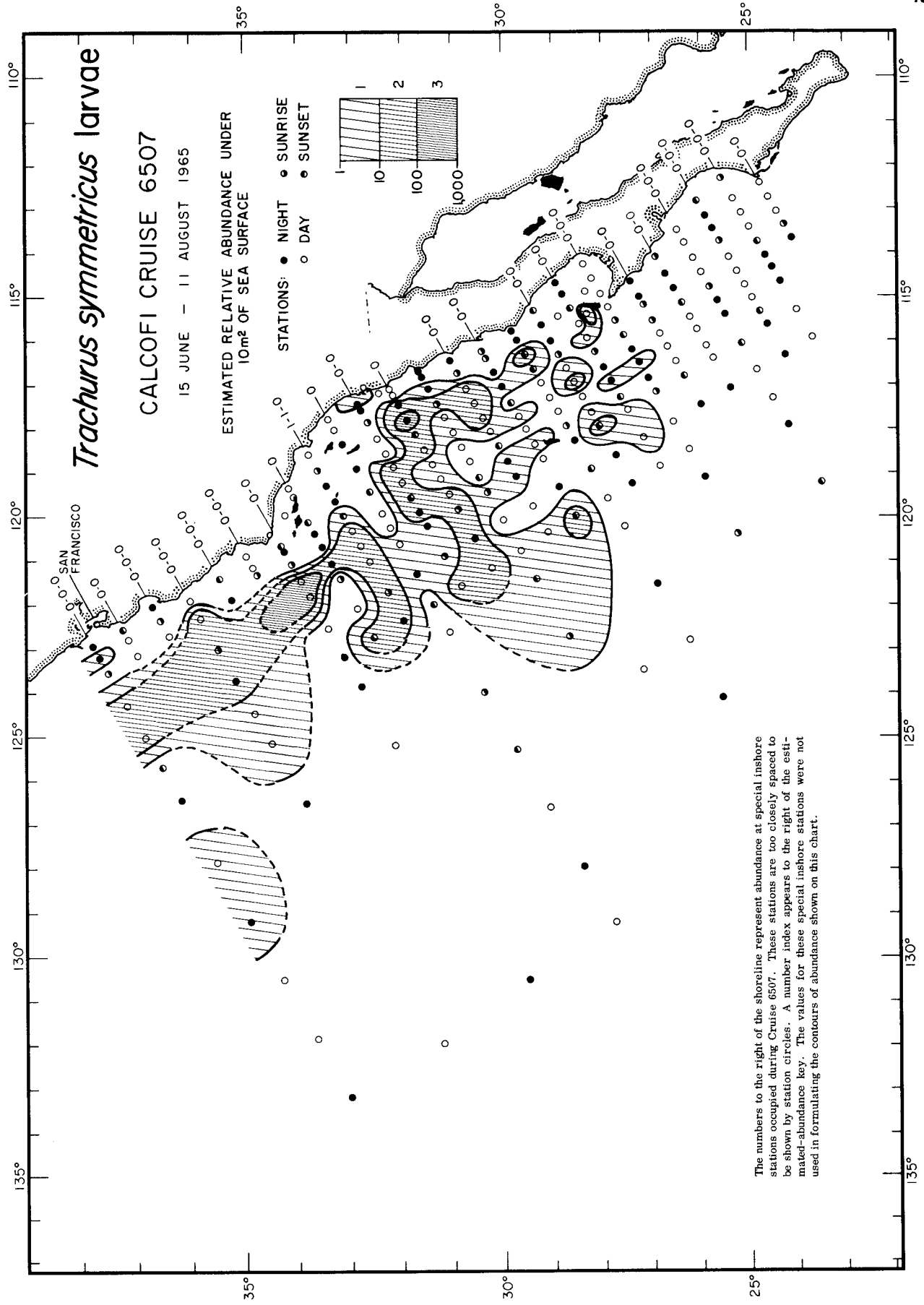
Trachurus symmetricus larvae

*Trachurus symmetricus* larvae

6207

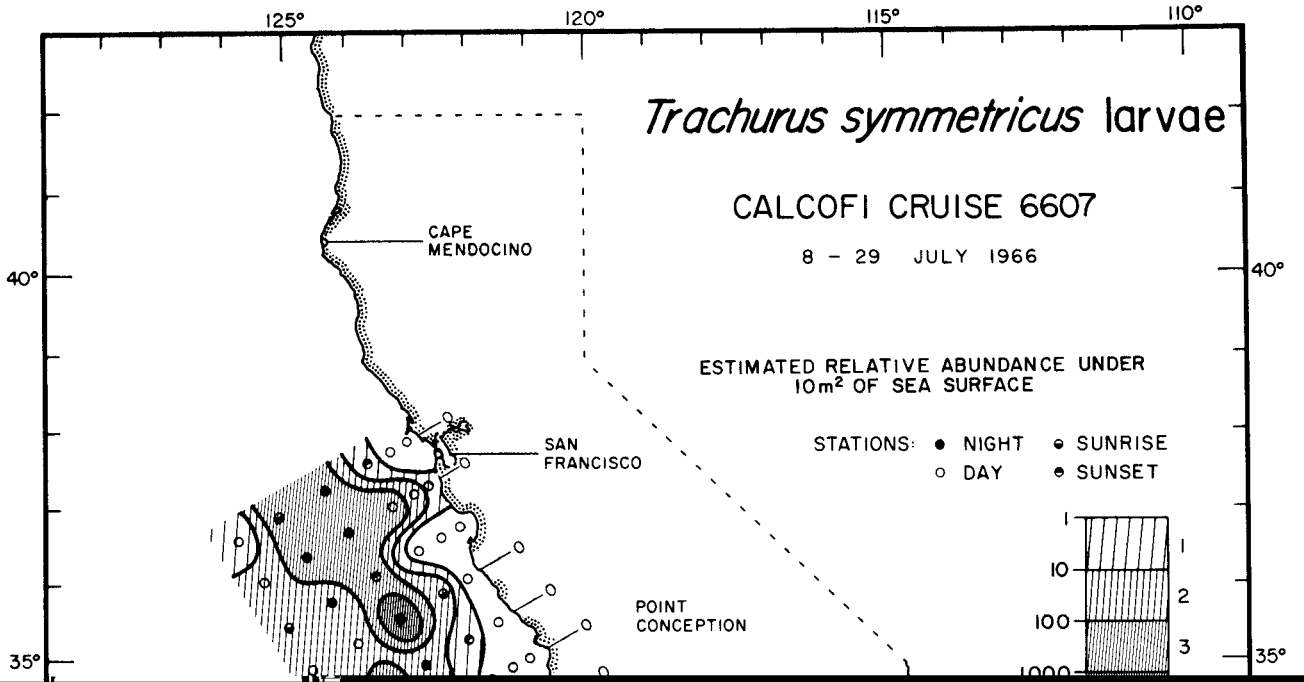


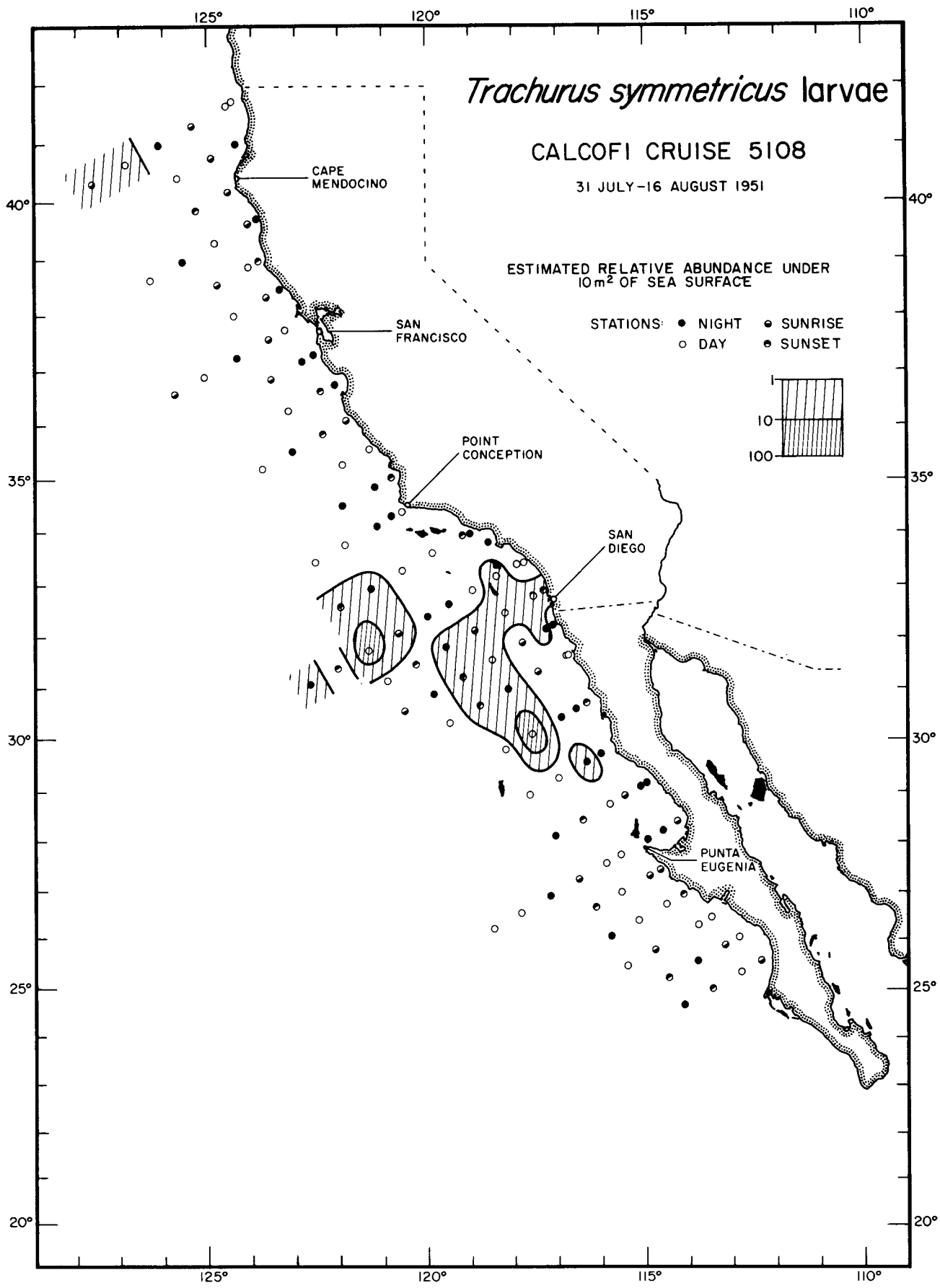
The numbers to the right of the shoreline represent abundance at special inshore stations occupied during Cruise 6407. These stations are too closely spaced to be shown by station circles. A number index appears to the right of the estimated-abundance key. The values for these special inshore stations 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 occupied during Cruise 6507. These stations are too closely spaced to be shown by station circles. A number index appears to the right of the estimated-abundance key. The values for these special inshore stations were not used in formulating the contours of abundance shown on this chart.

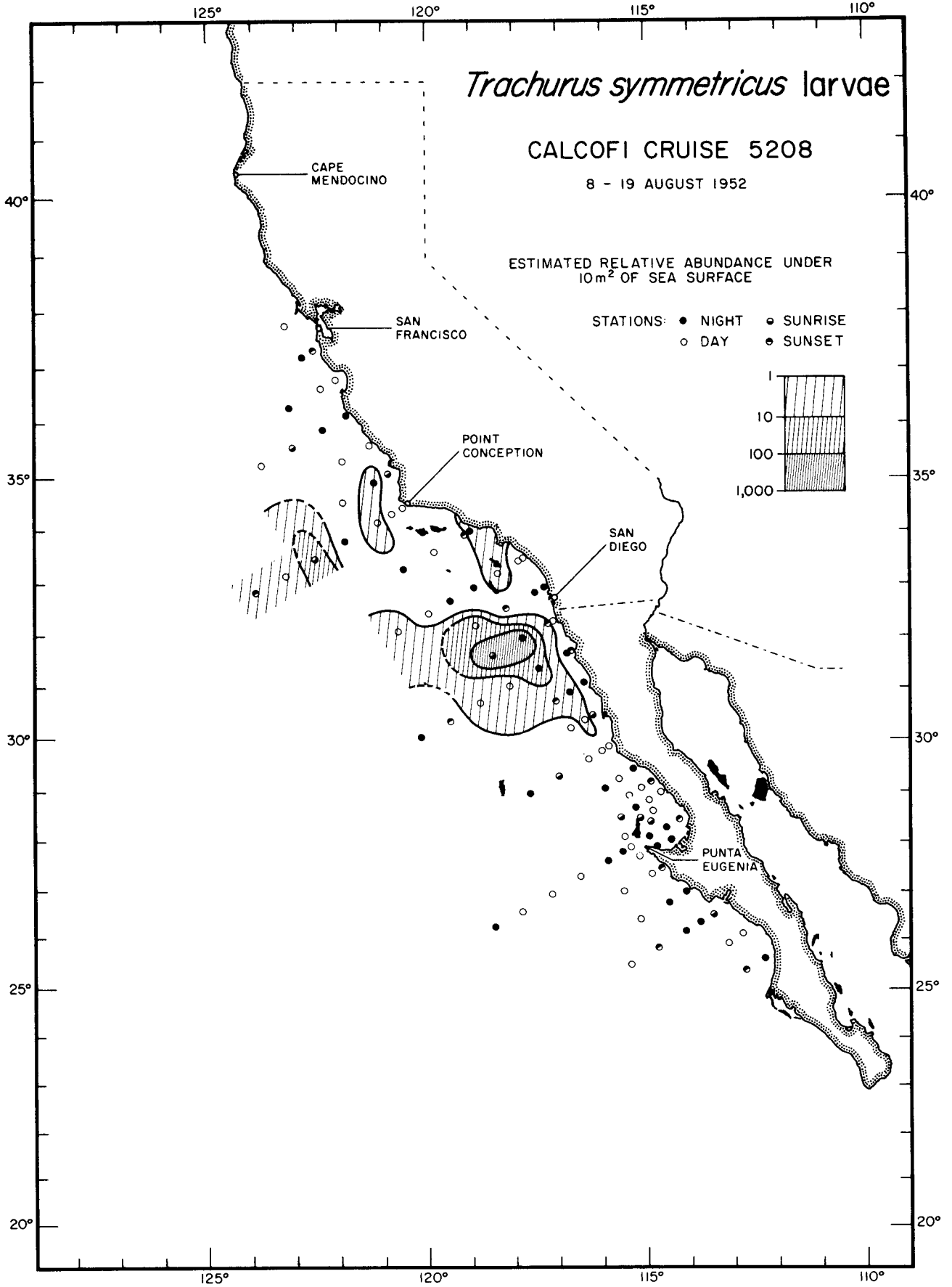
Trachurus symmetricus larvae





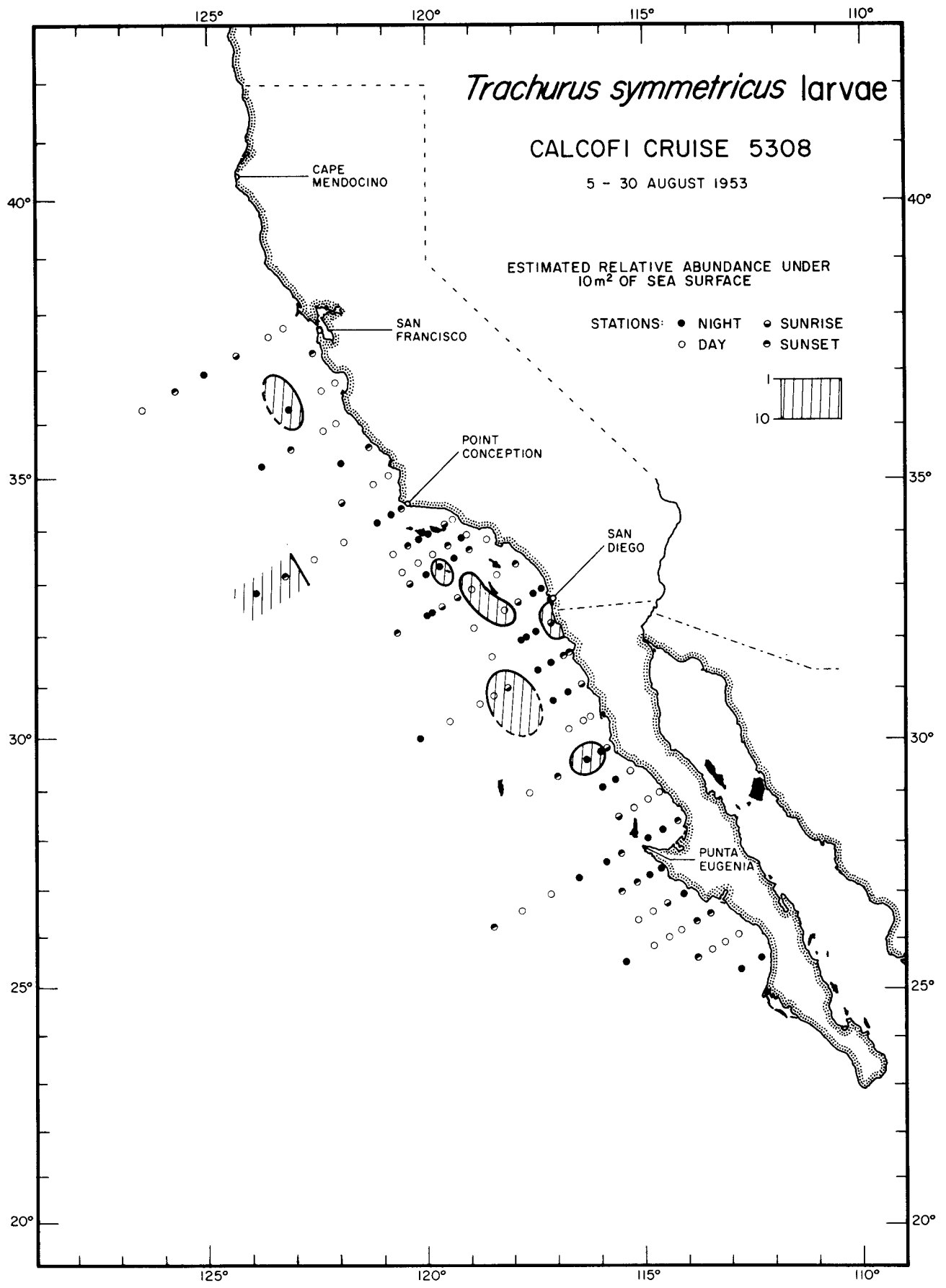
Trachurus symmetricus larvae

5108



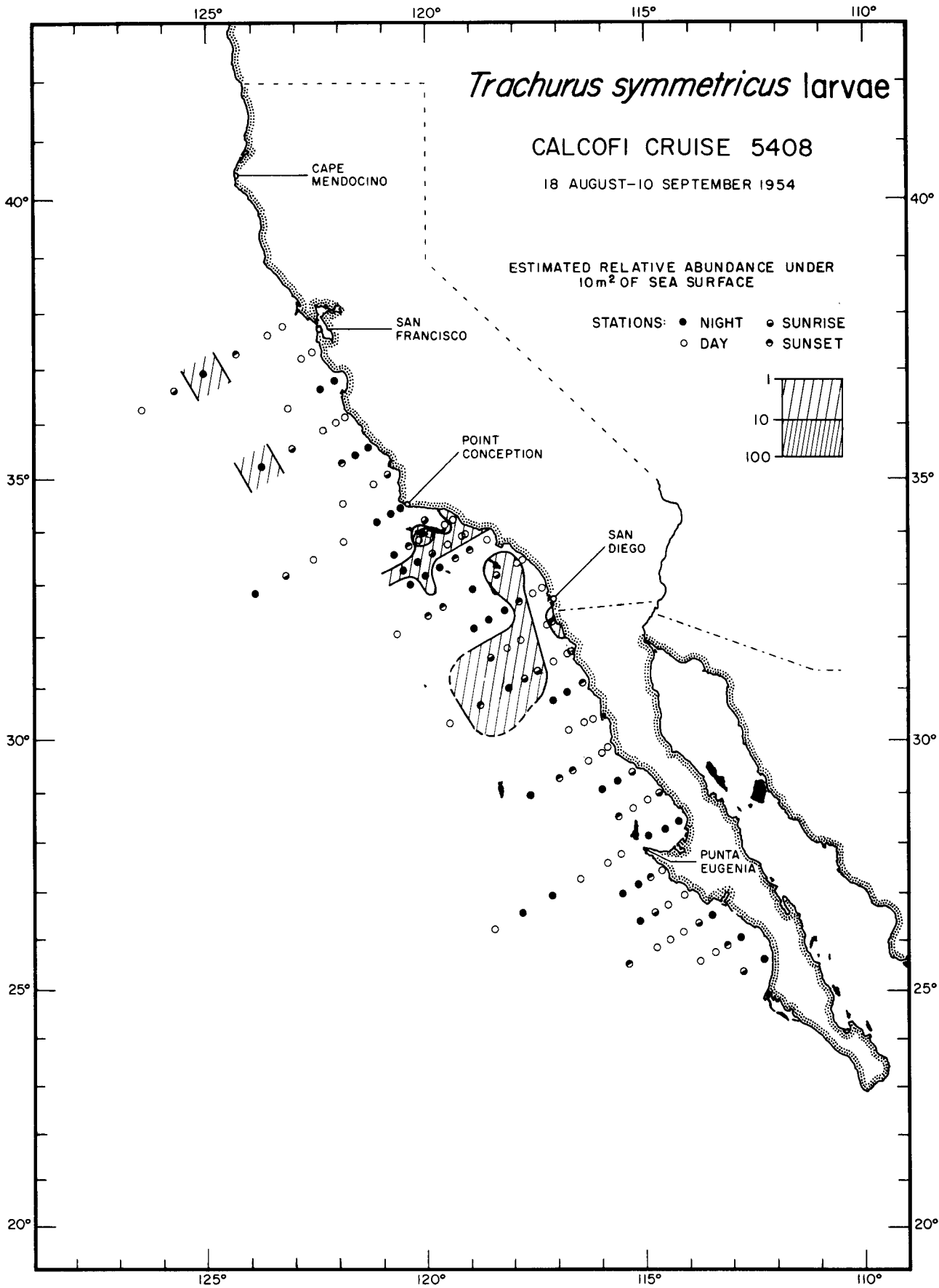
Trachurus symmetricus larvae

5208



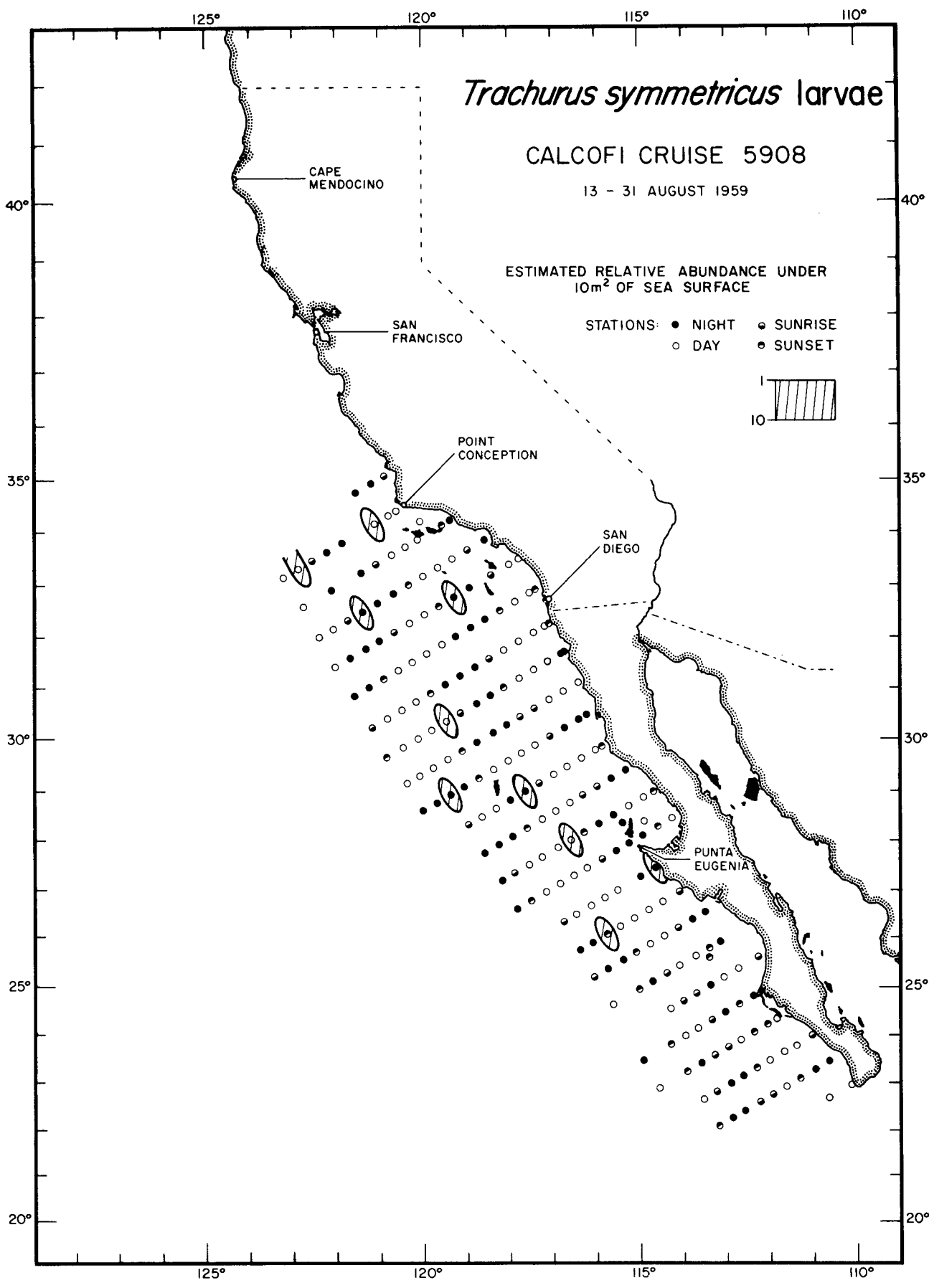
Trachurus symmetricus larvae

5308



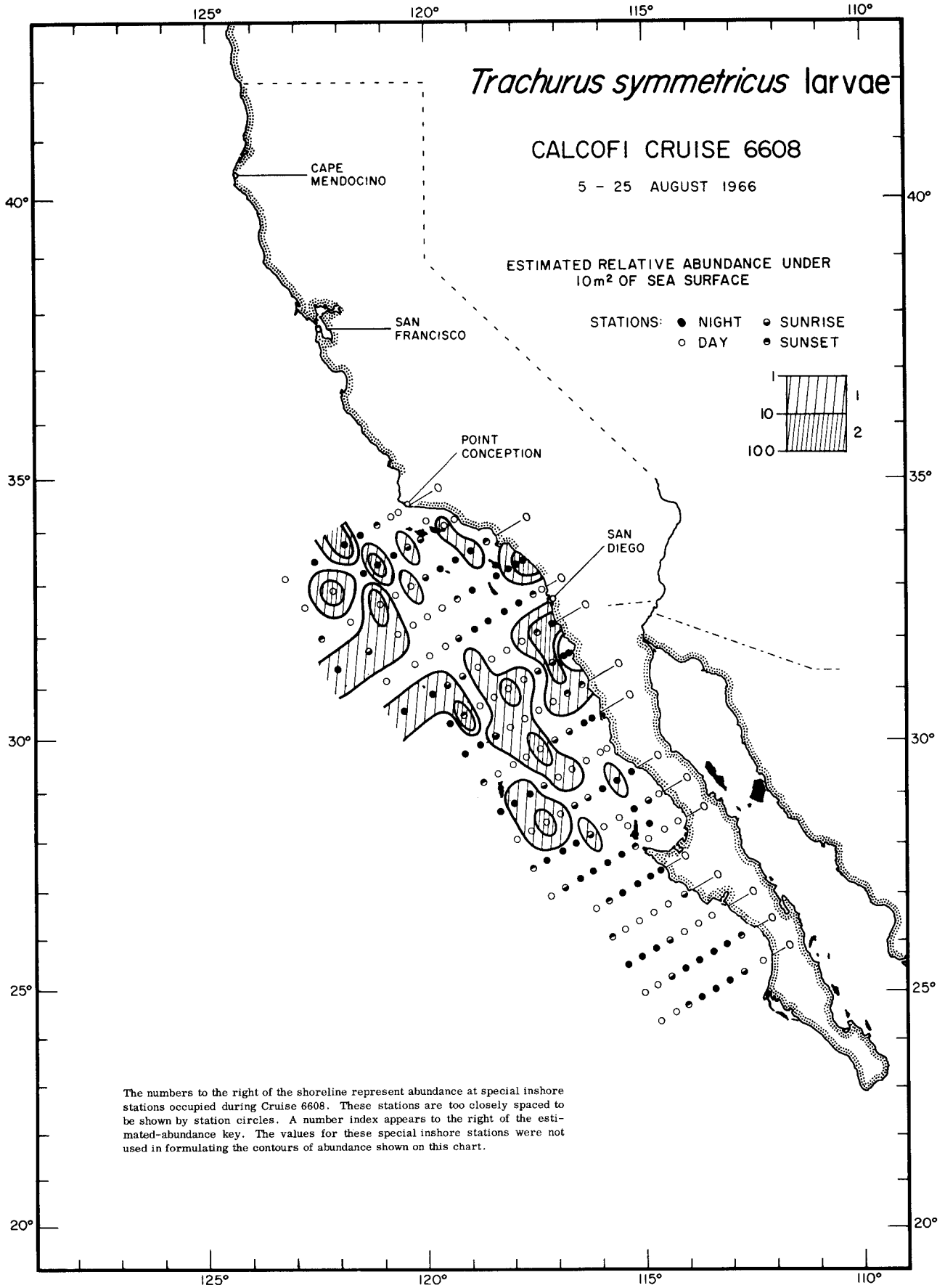
Trachurus symmetricus larvae

5408



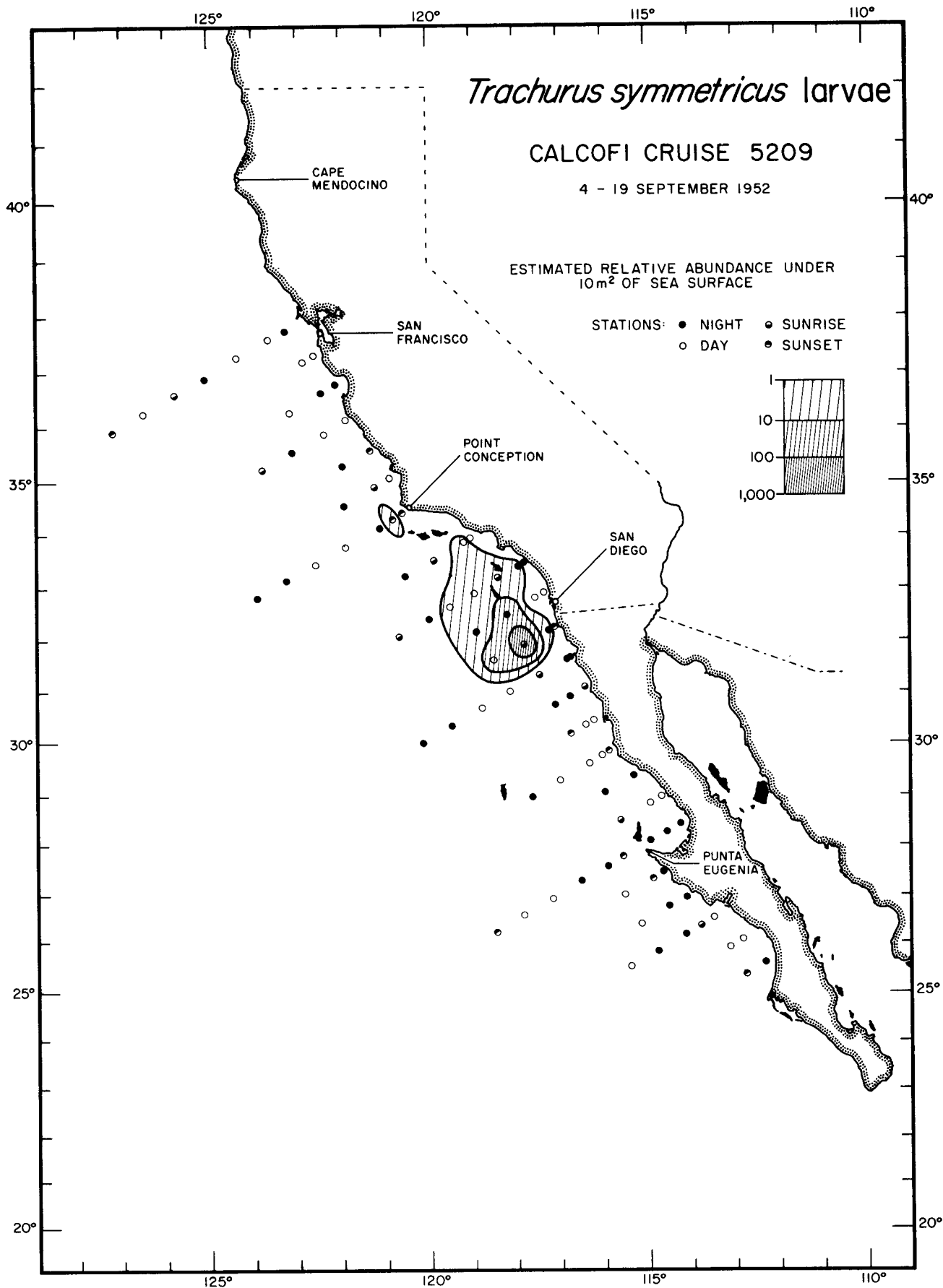
Trachurus symmetricus larvae

5908



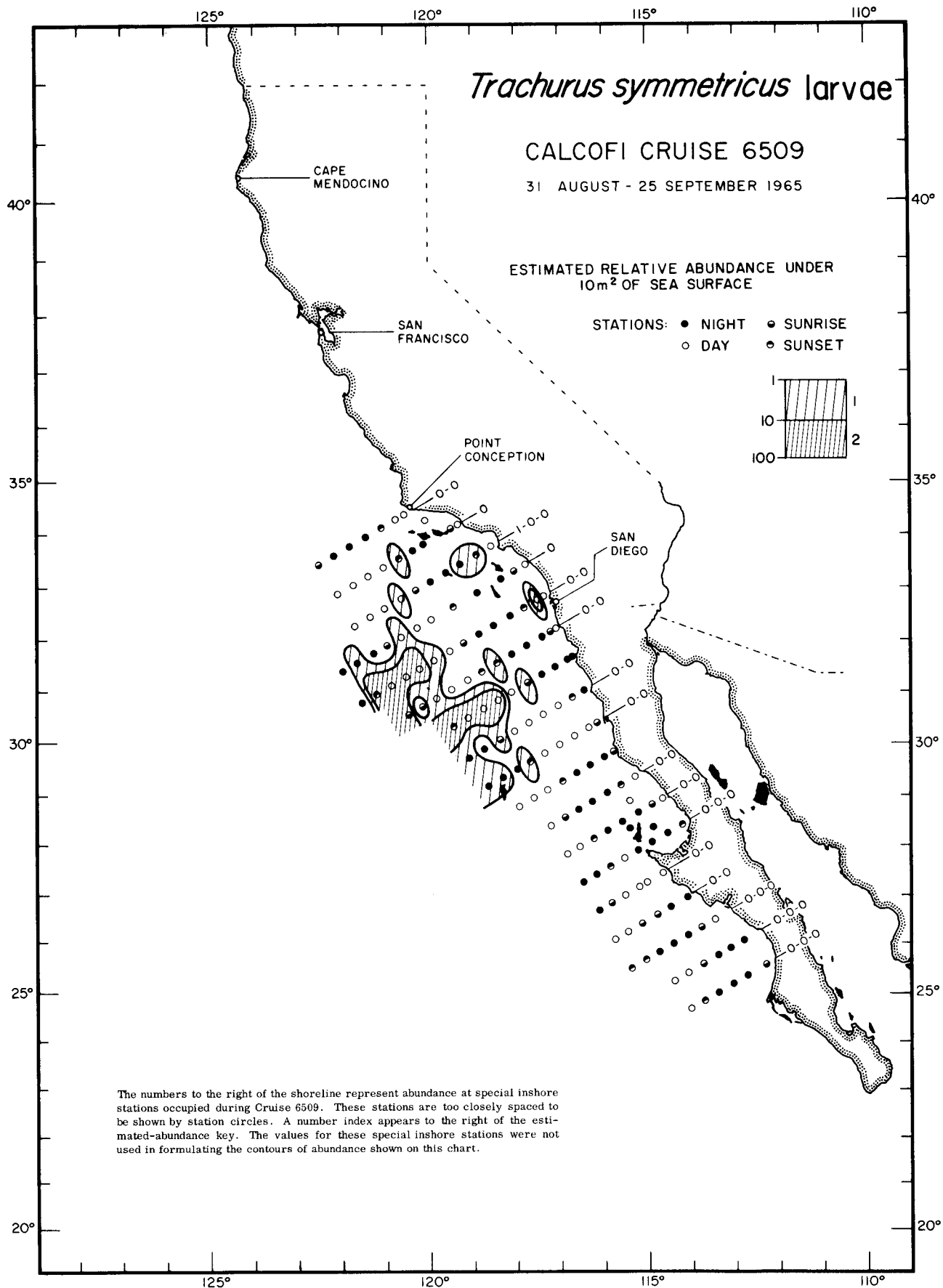
Trachurus symmetricus larvae

6608



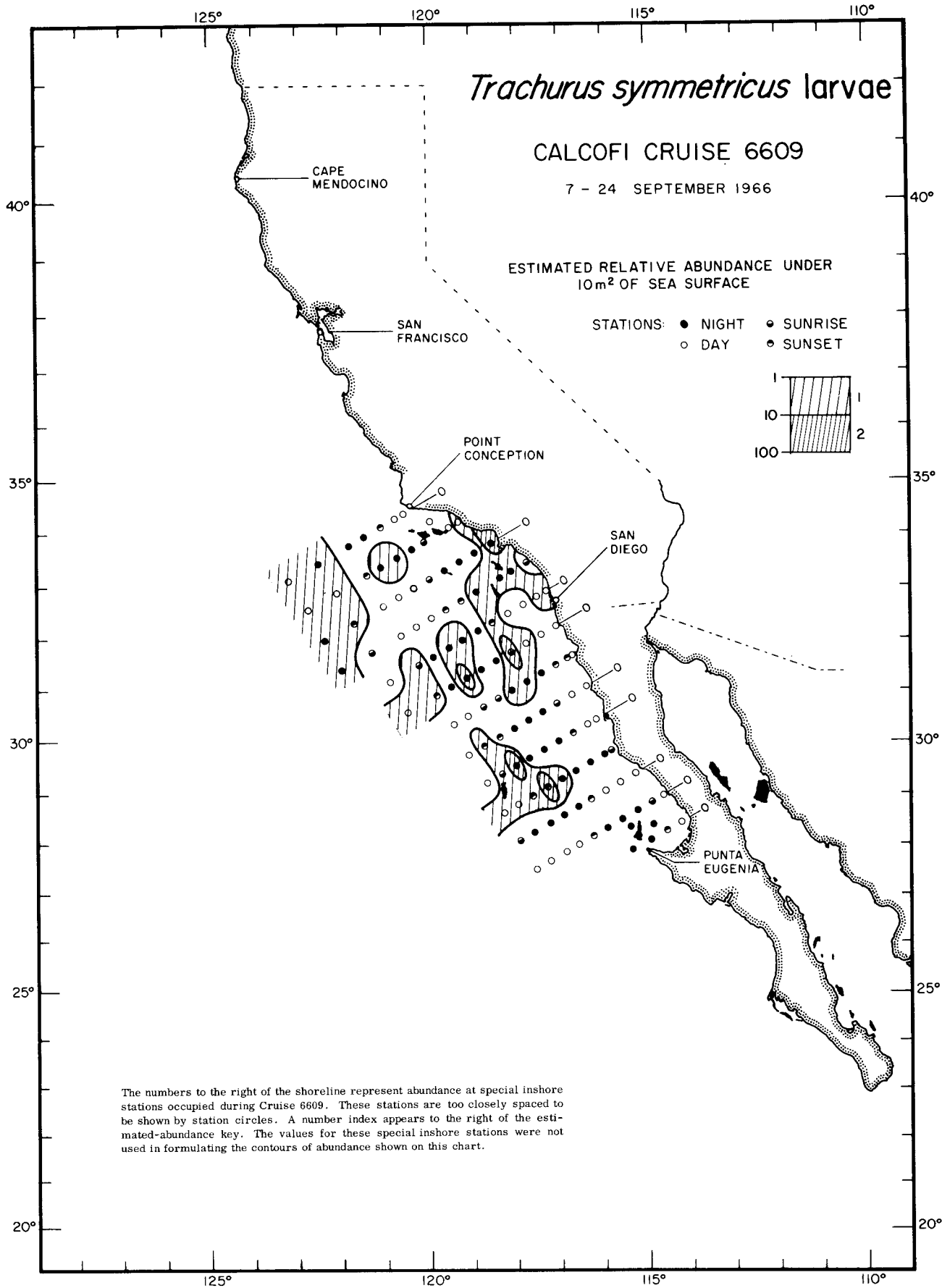
Trachurus symmetricus larvae

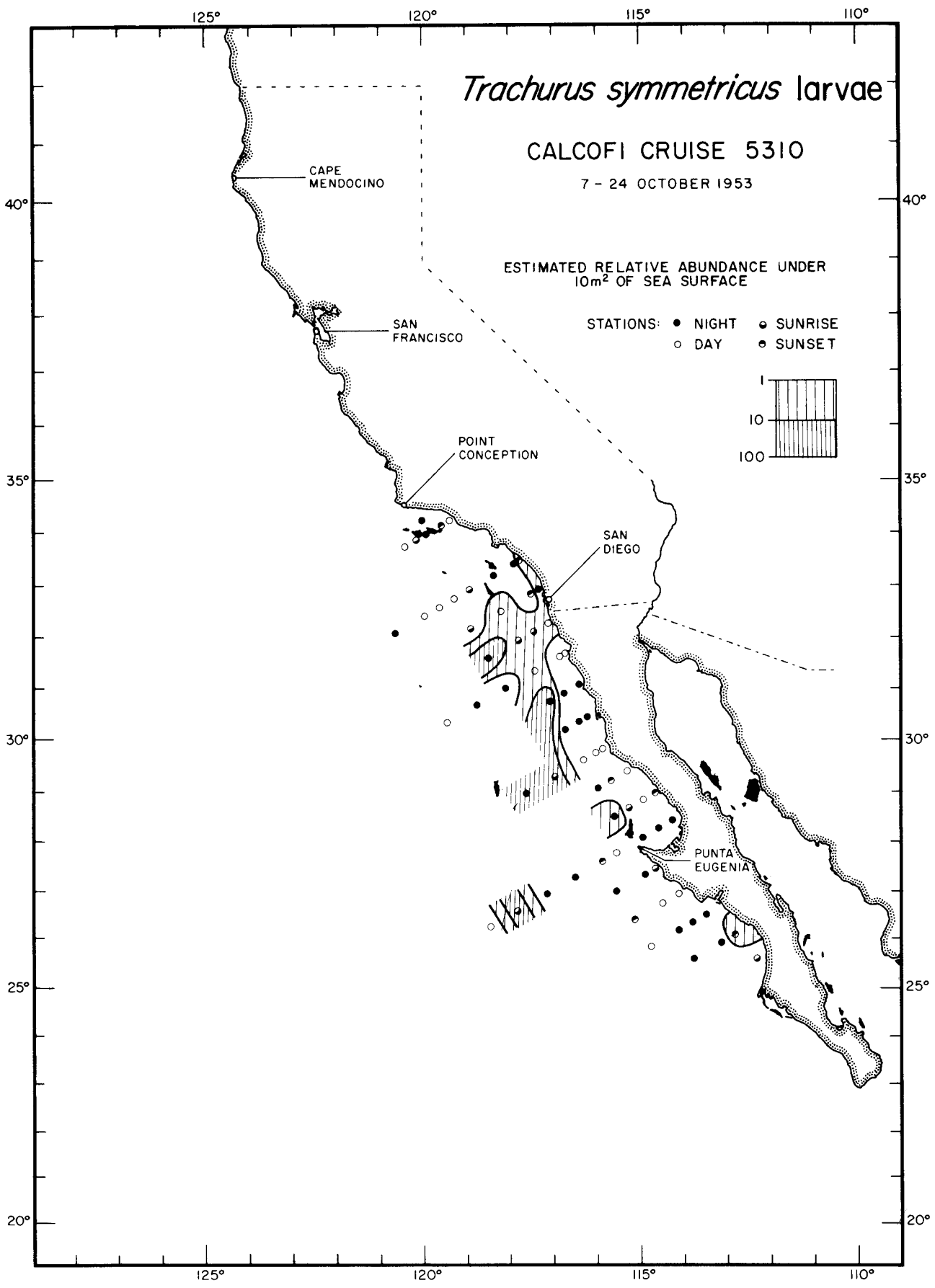
5209



Trachurus symmetricus larvae

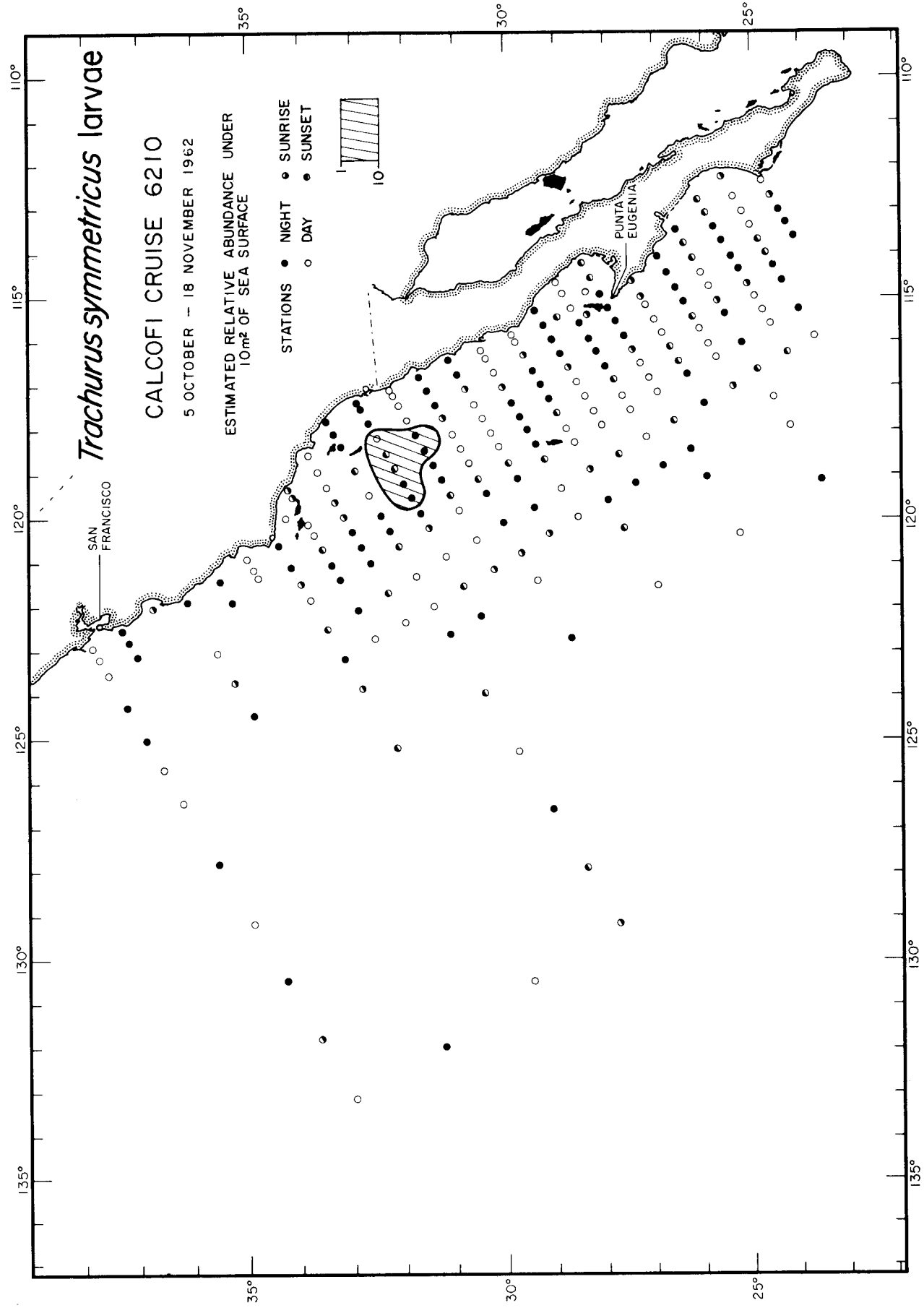
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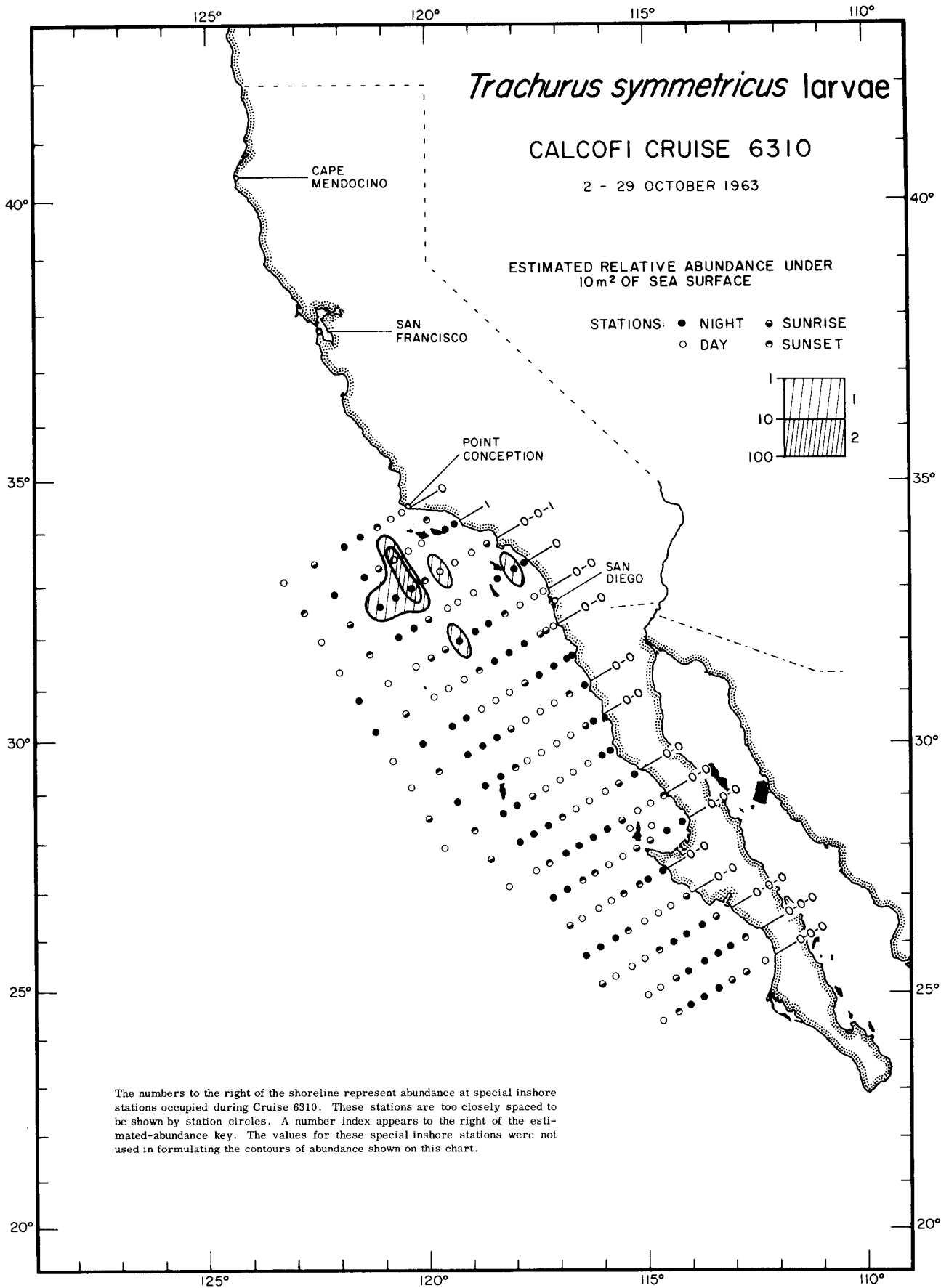


Trachurus symmetricus larvae

5310

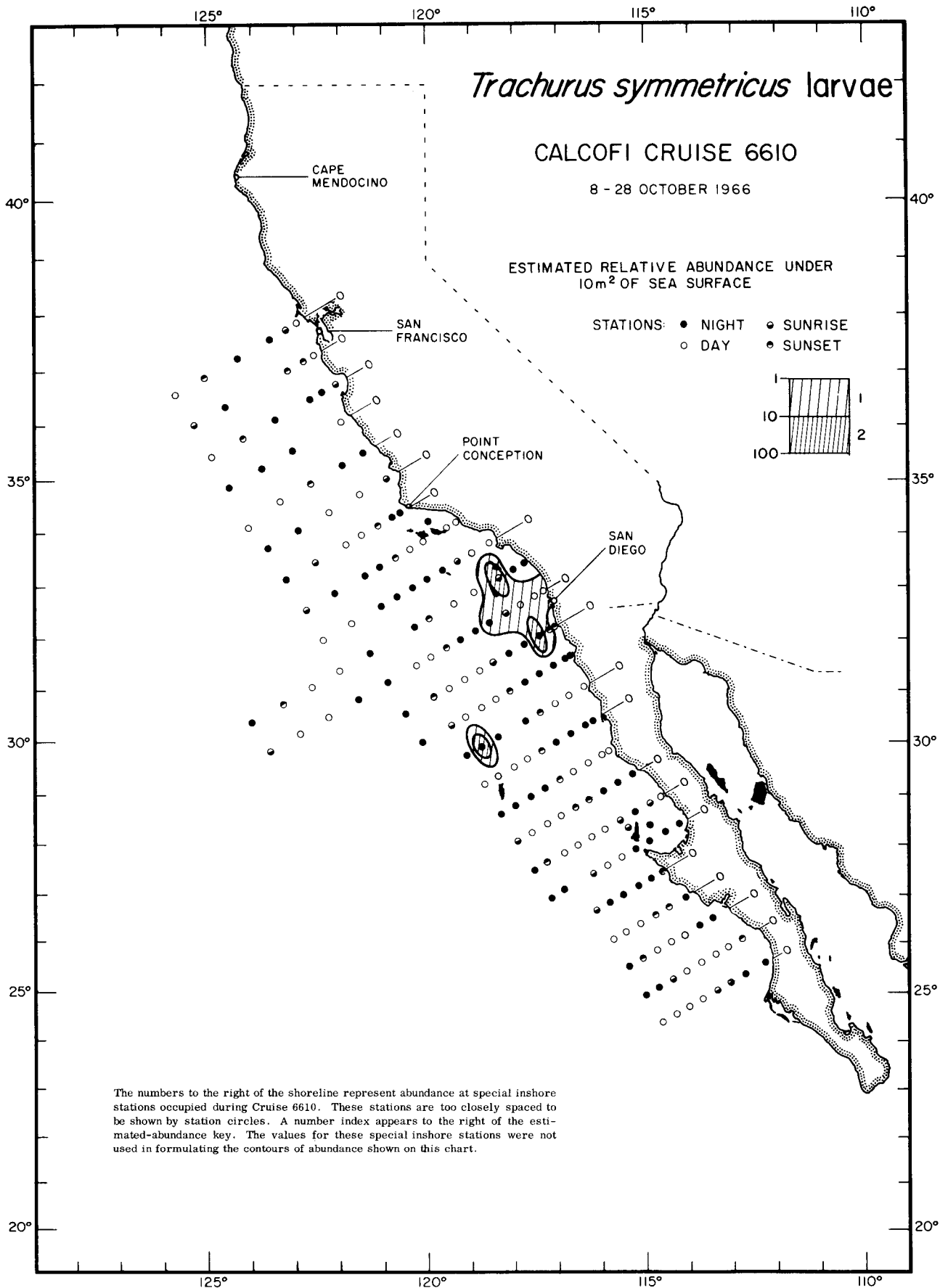


Trachurus symmetricus larvae



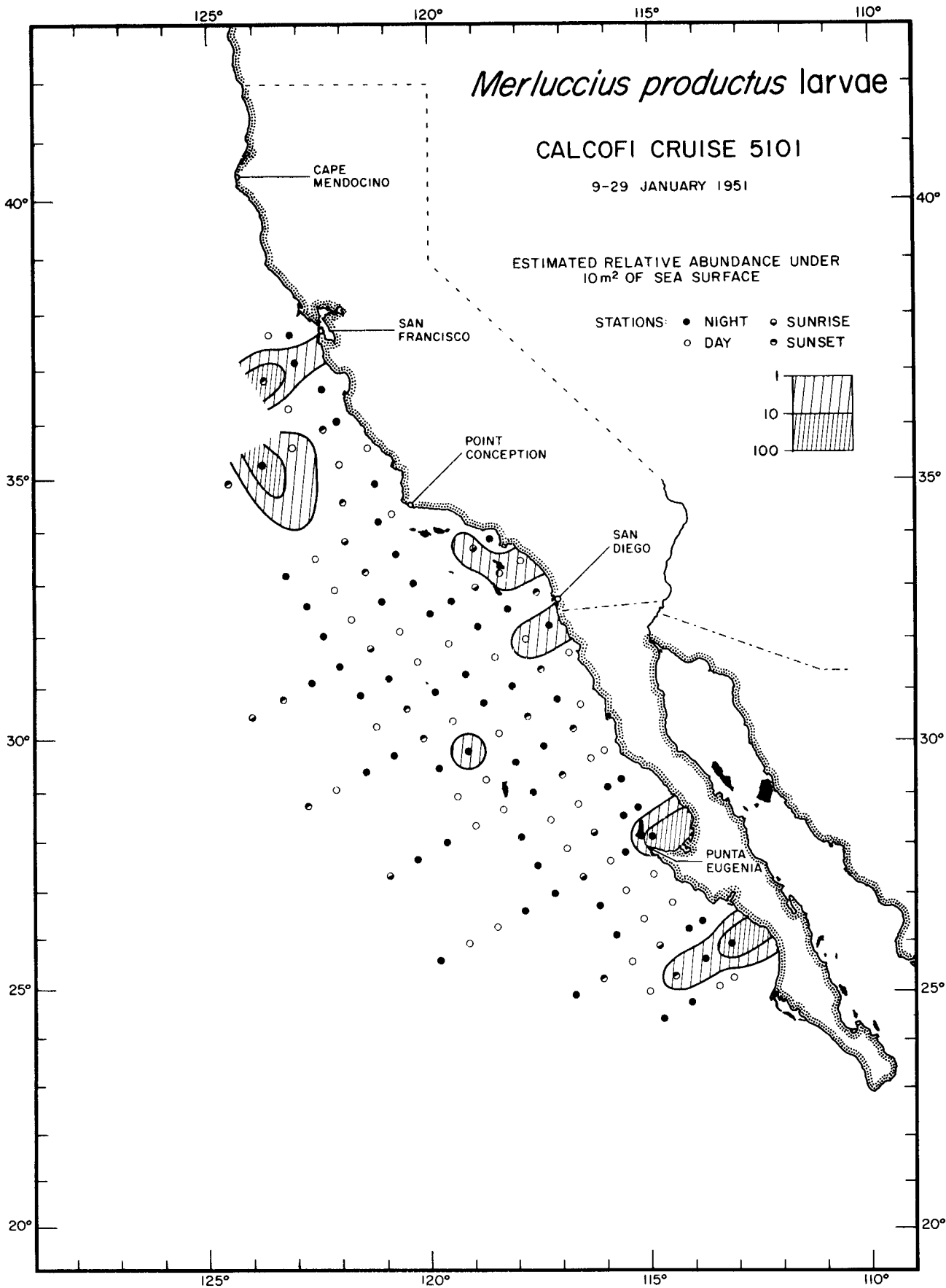
Trachurus symmetricus larvae

6310



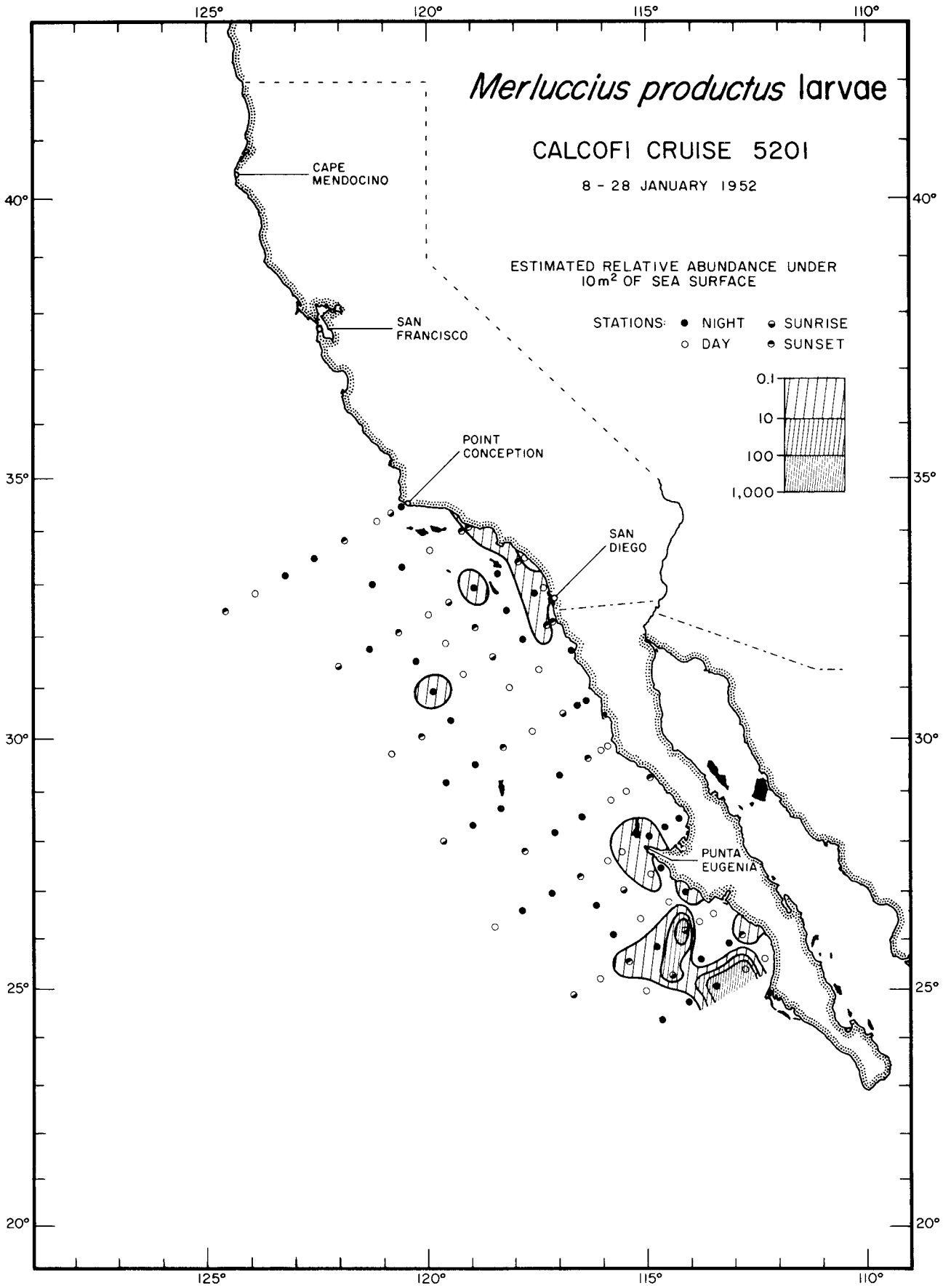
Trachurus symmetricus larvae

6610



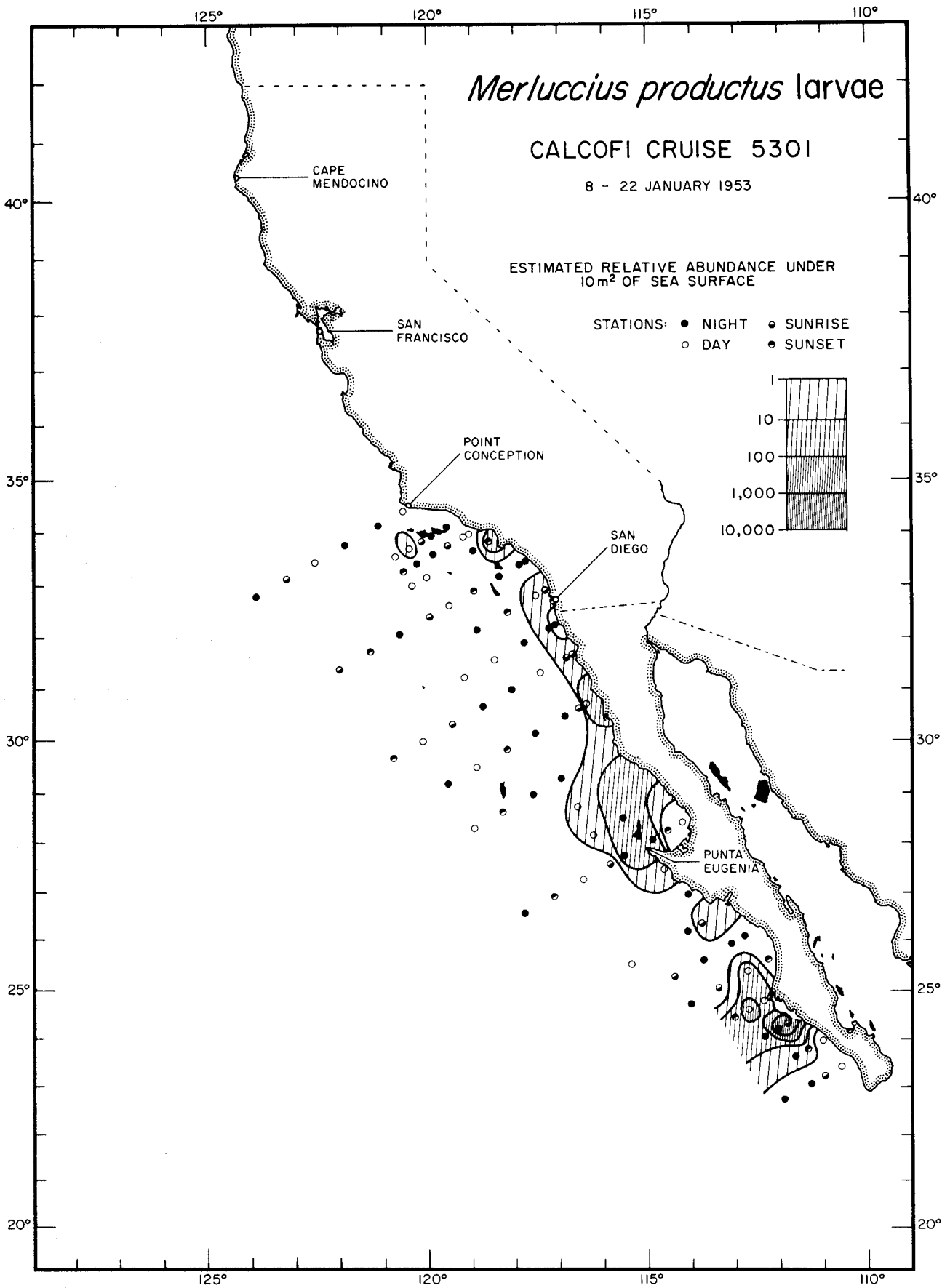
Merluccius productus larvae

5101



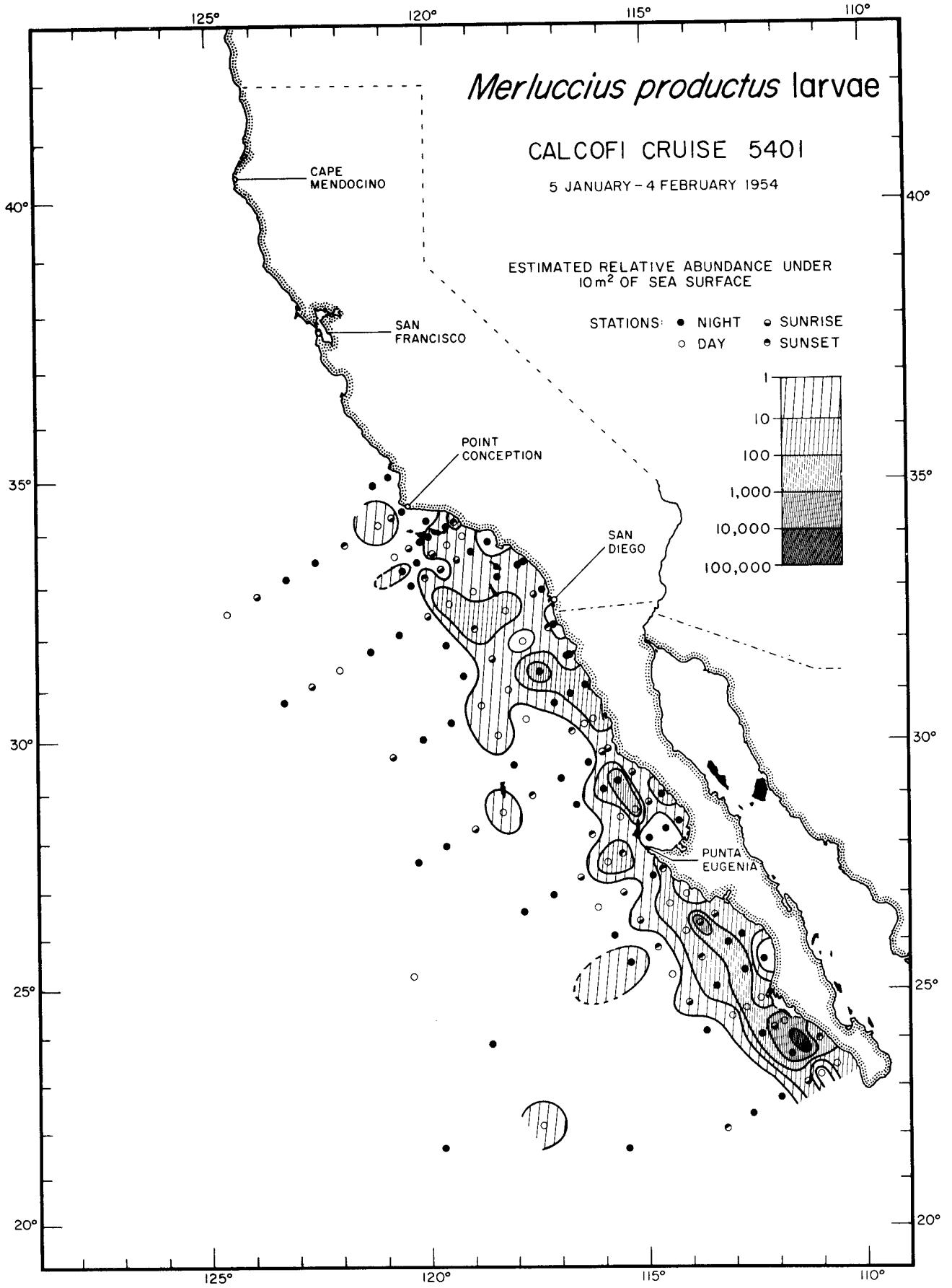
Merluccius productus larvae

5201



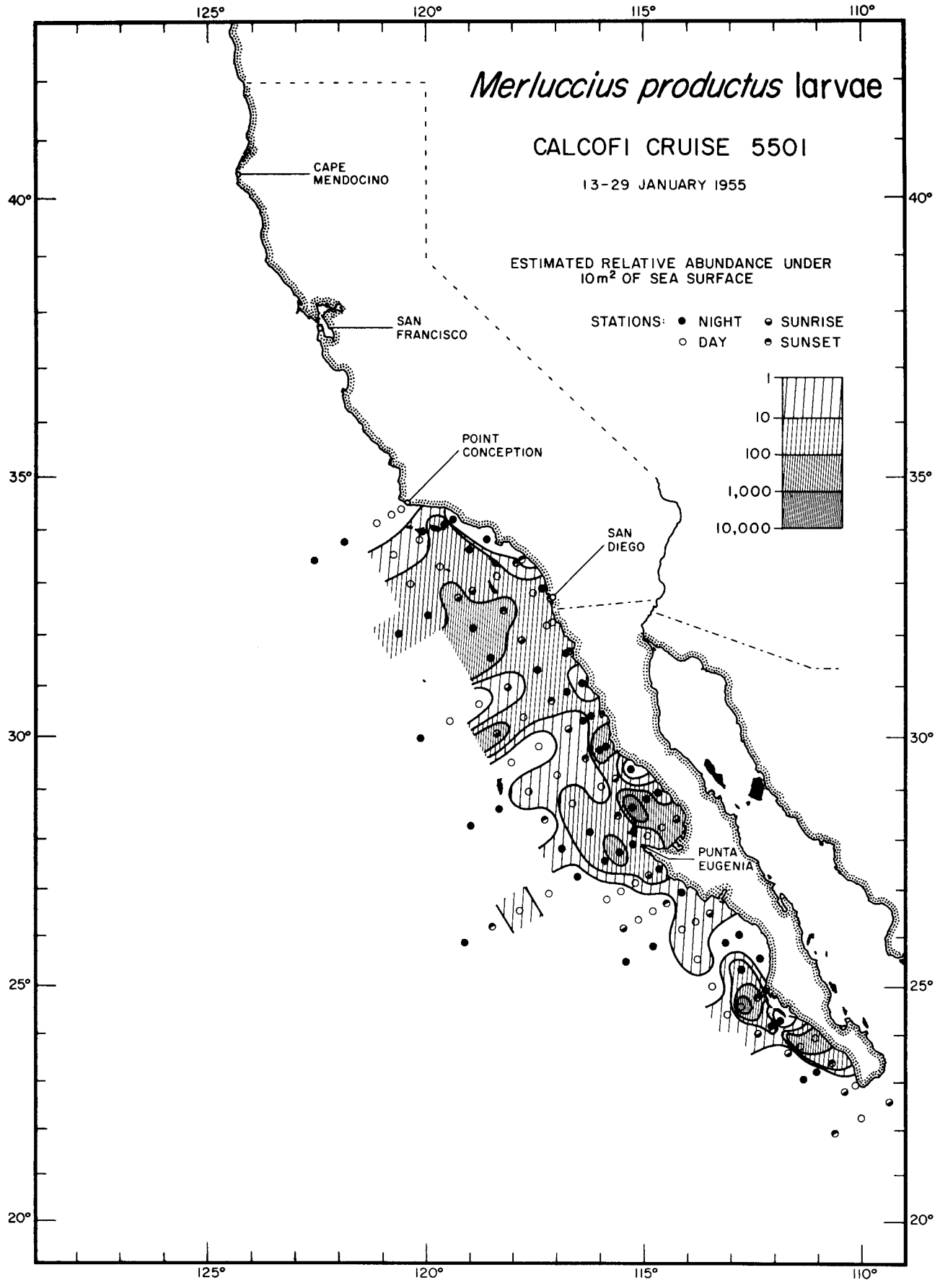
Merluccius productus larvae

5301



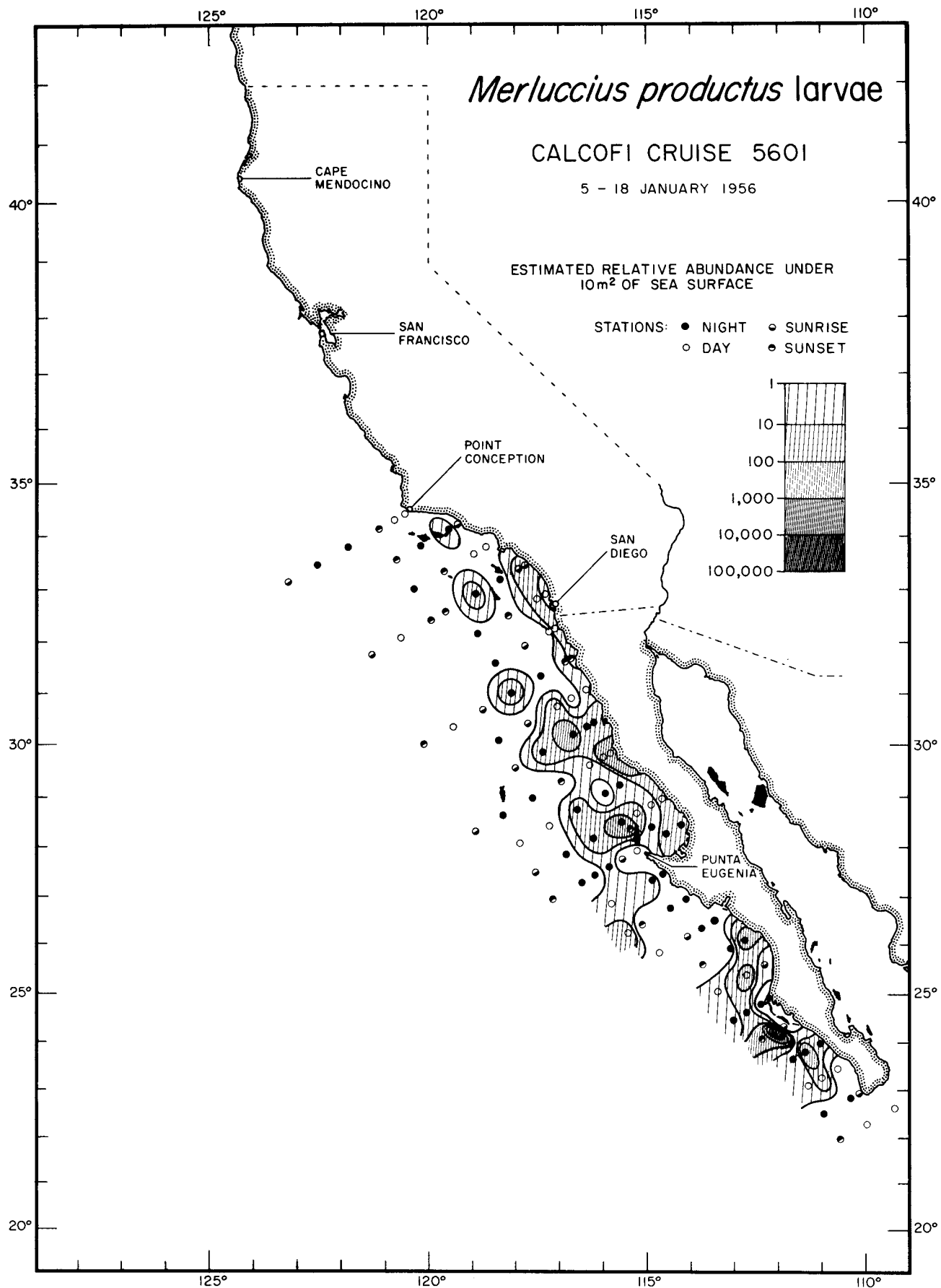
Merluccius productus larvae

5401



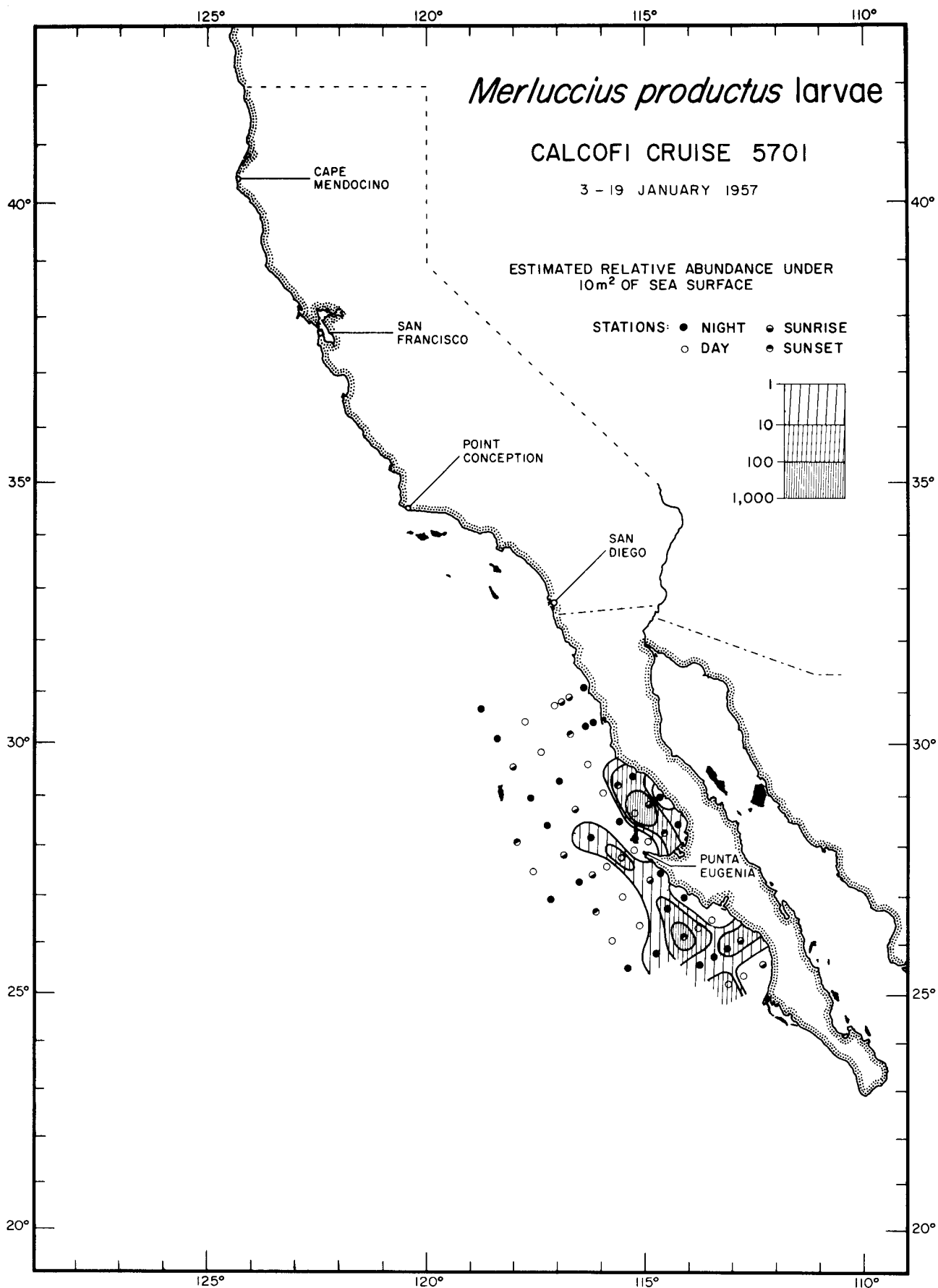
Merluccius productus larvae

5501



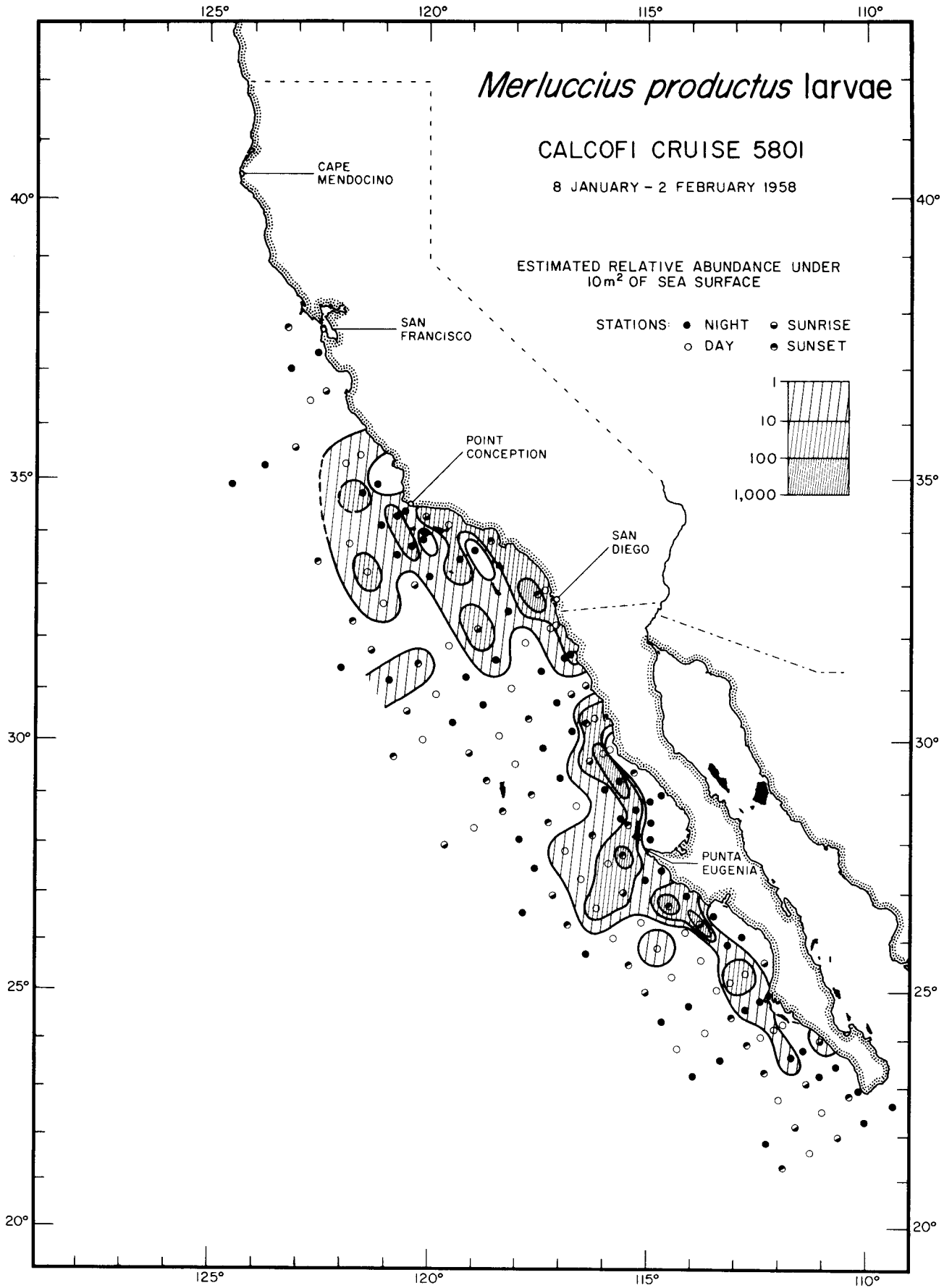
Merluccius productus larvae

5601



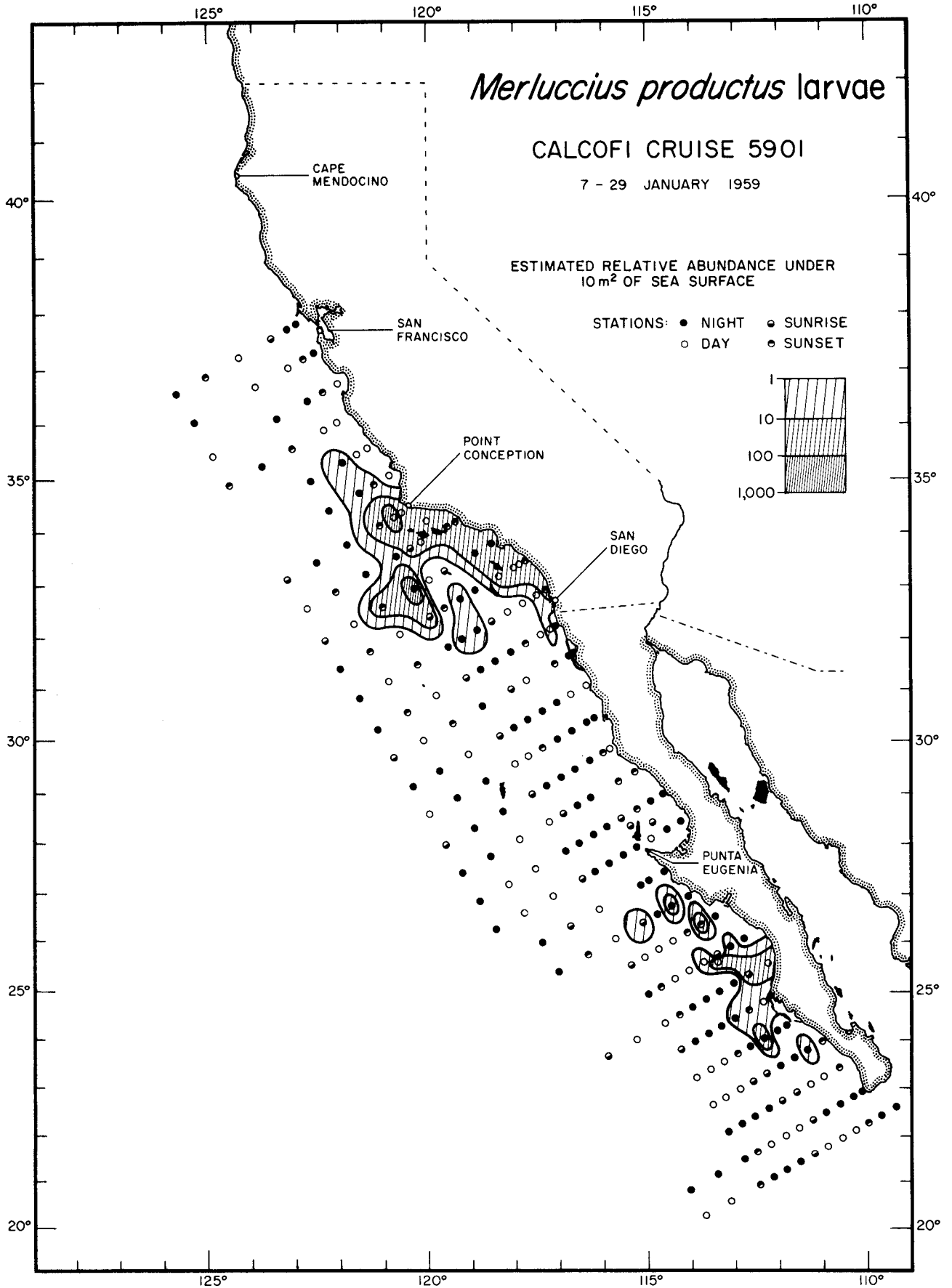
Merluccius productus larvae

5701



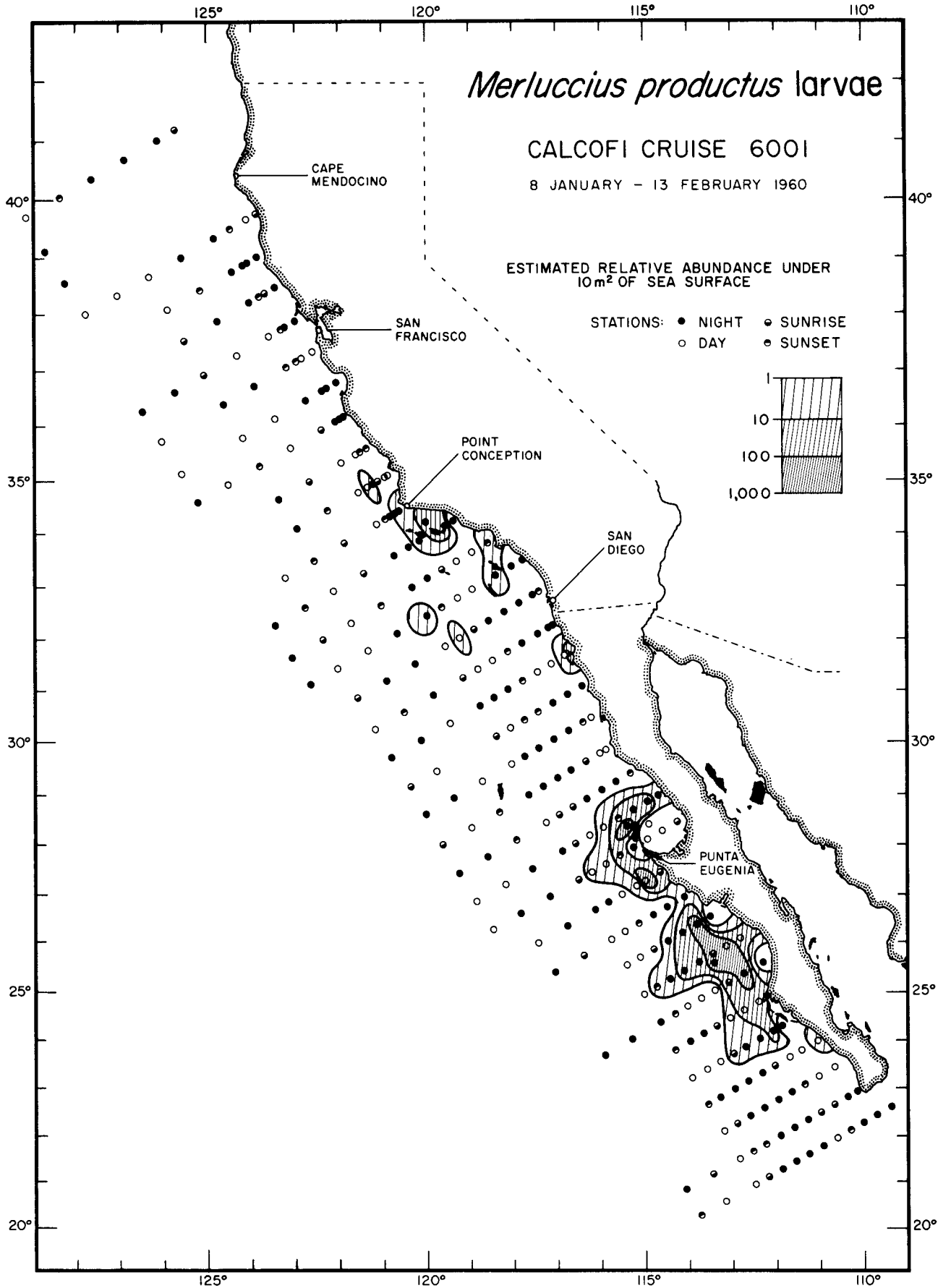
Merluccius productus larvae

5801



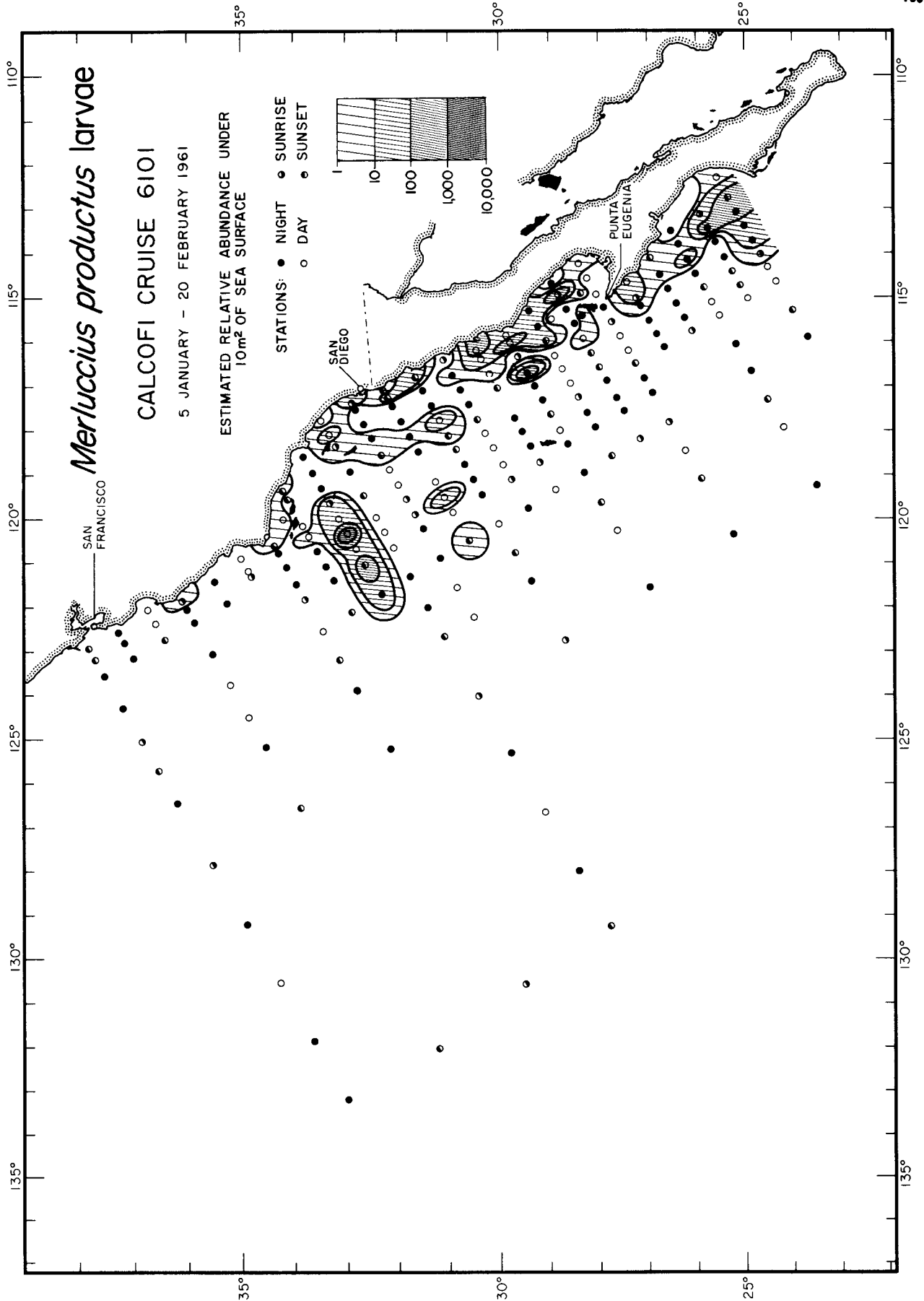
Merluccius productus larvae

5901



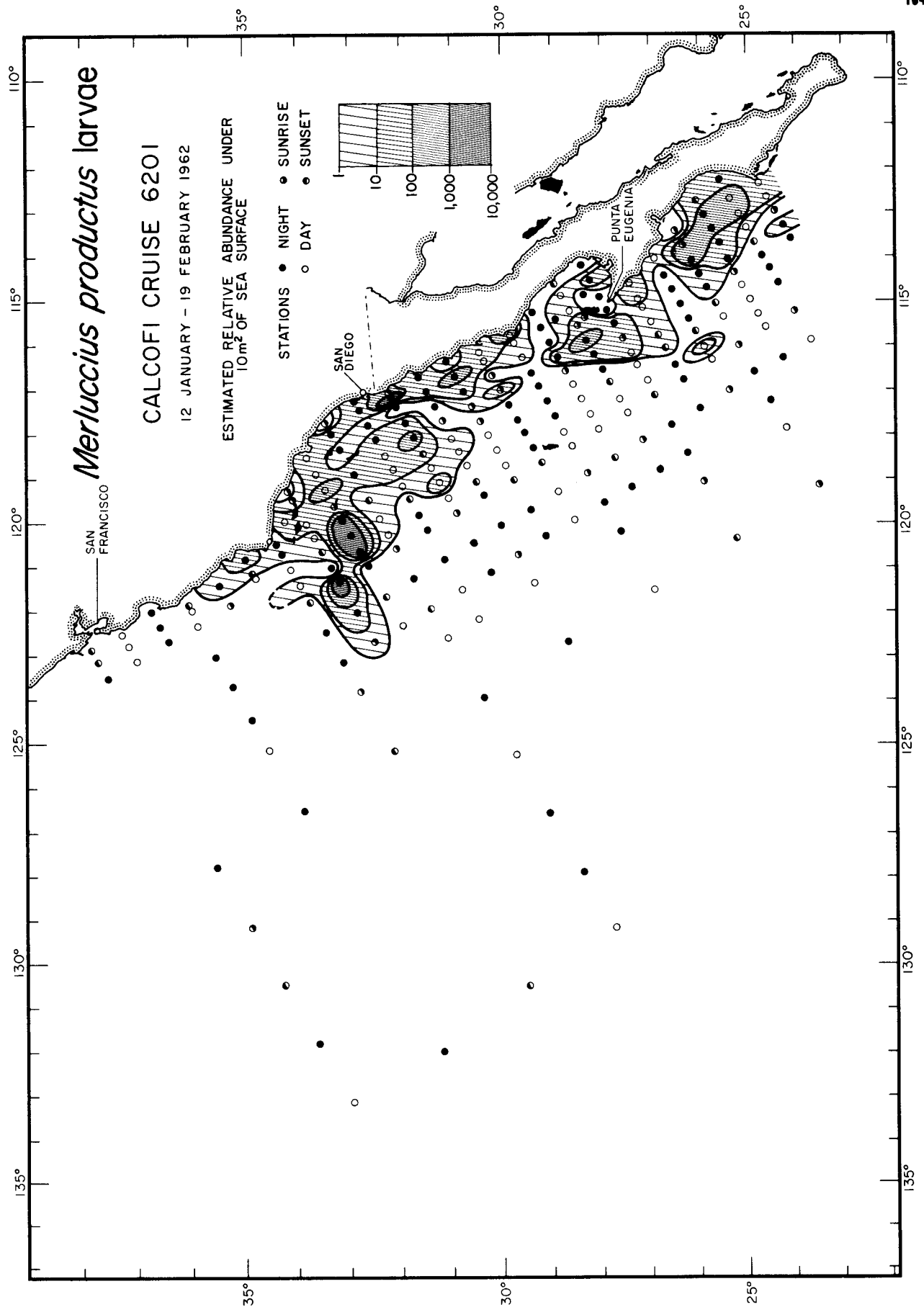
Merluccius productus larvae

6001



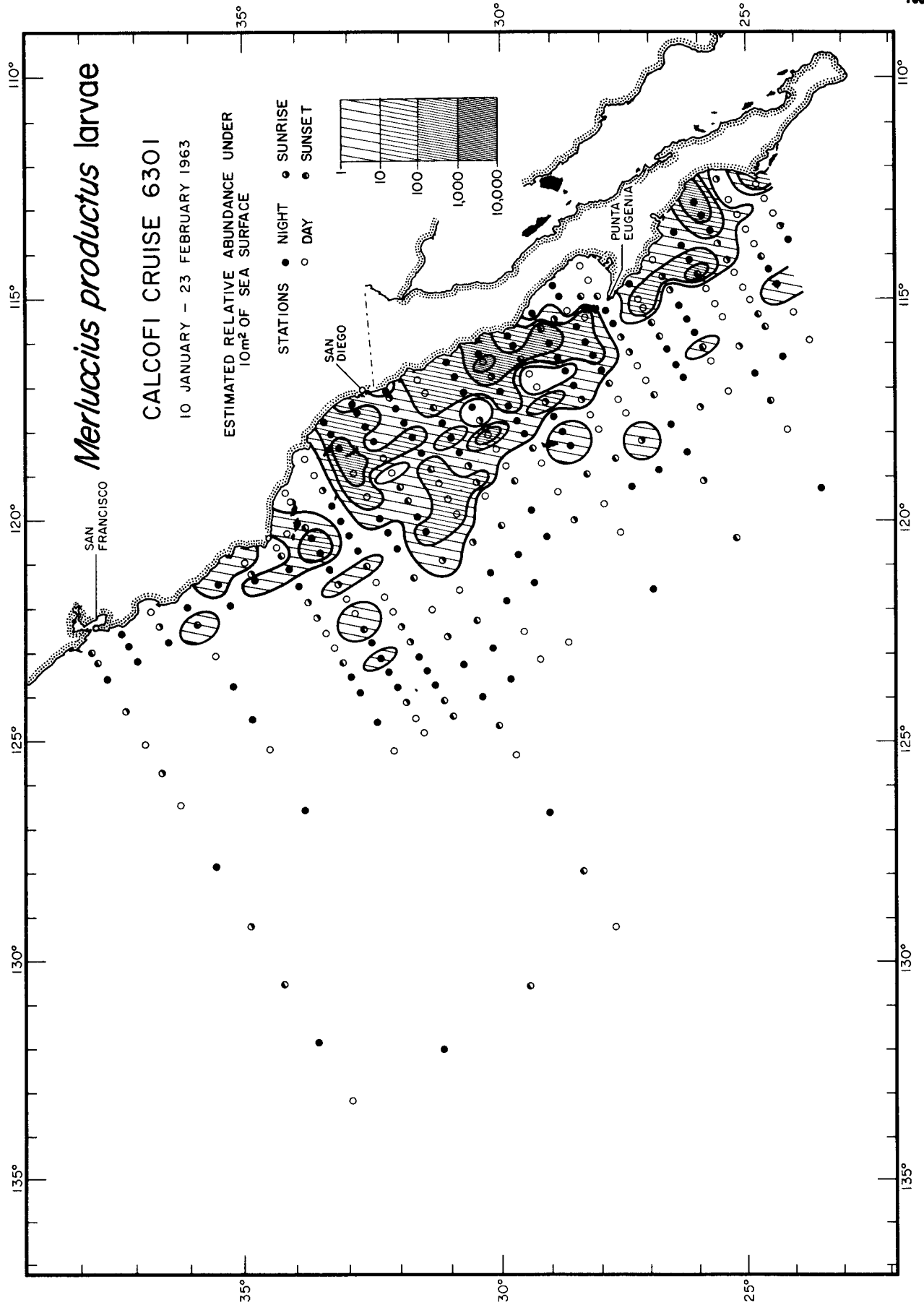
Merluccius productus larvae

6101



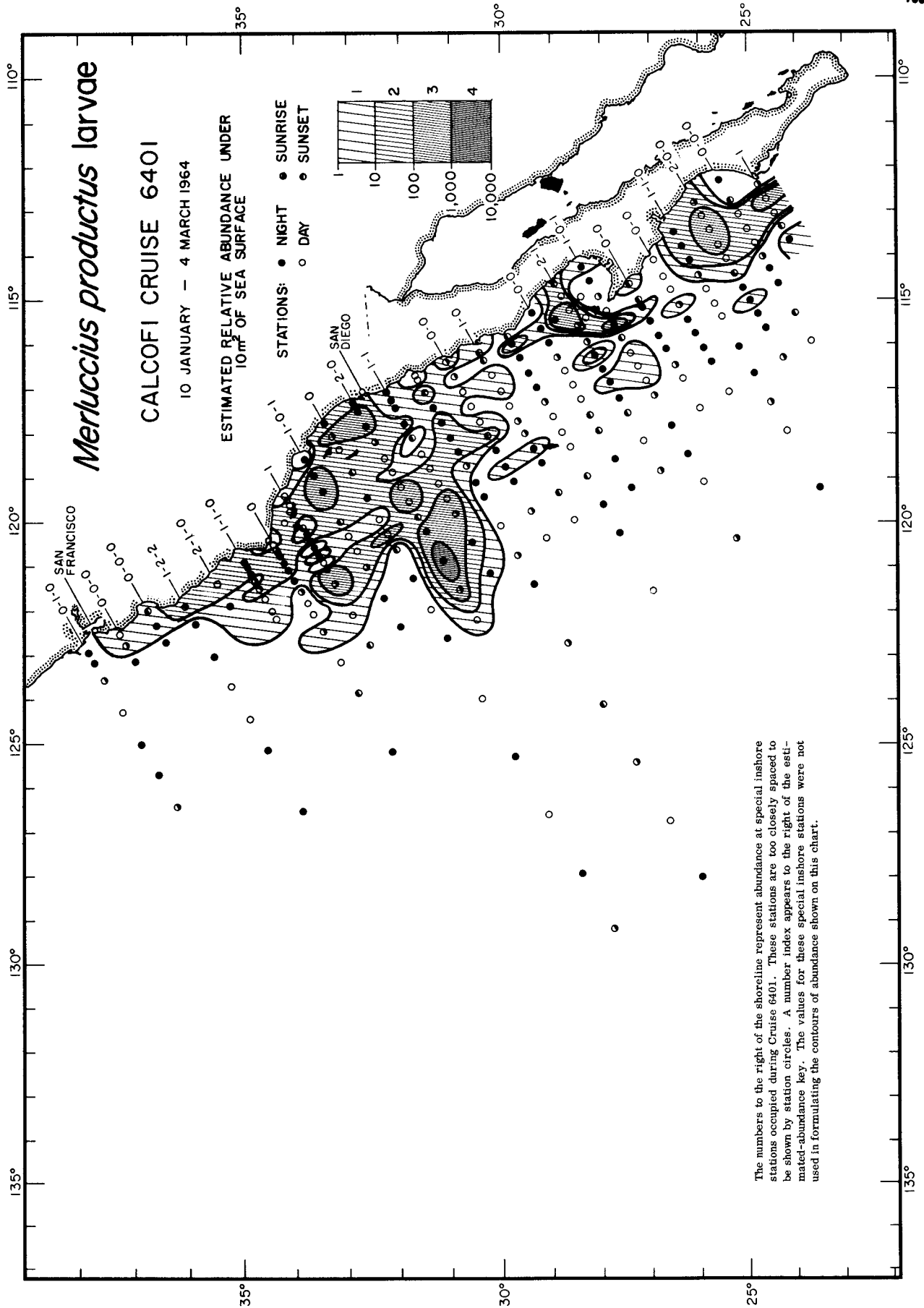
Merluccius productus larvae

6201

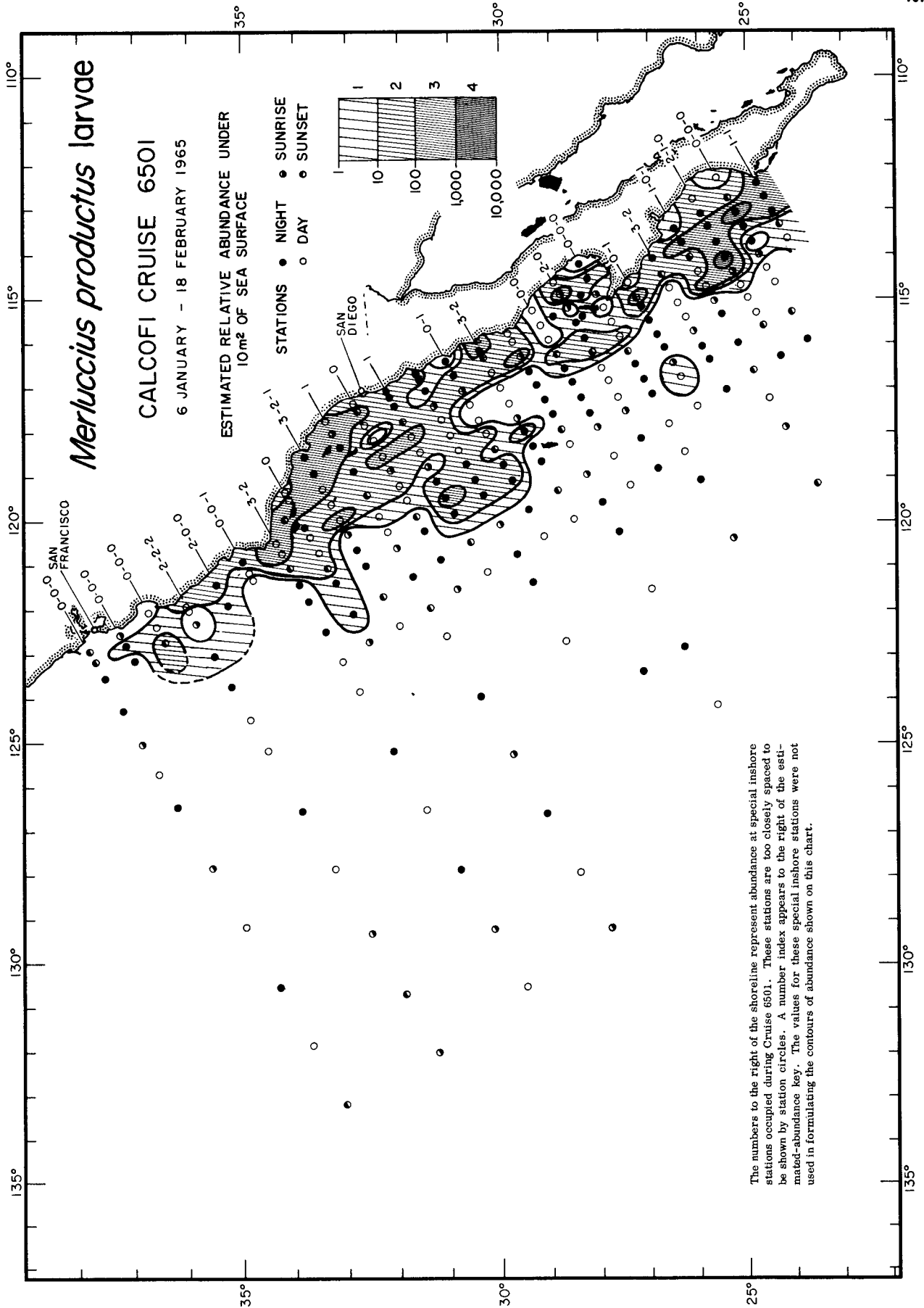


Merluccius productus larvae

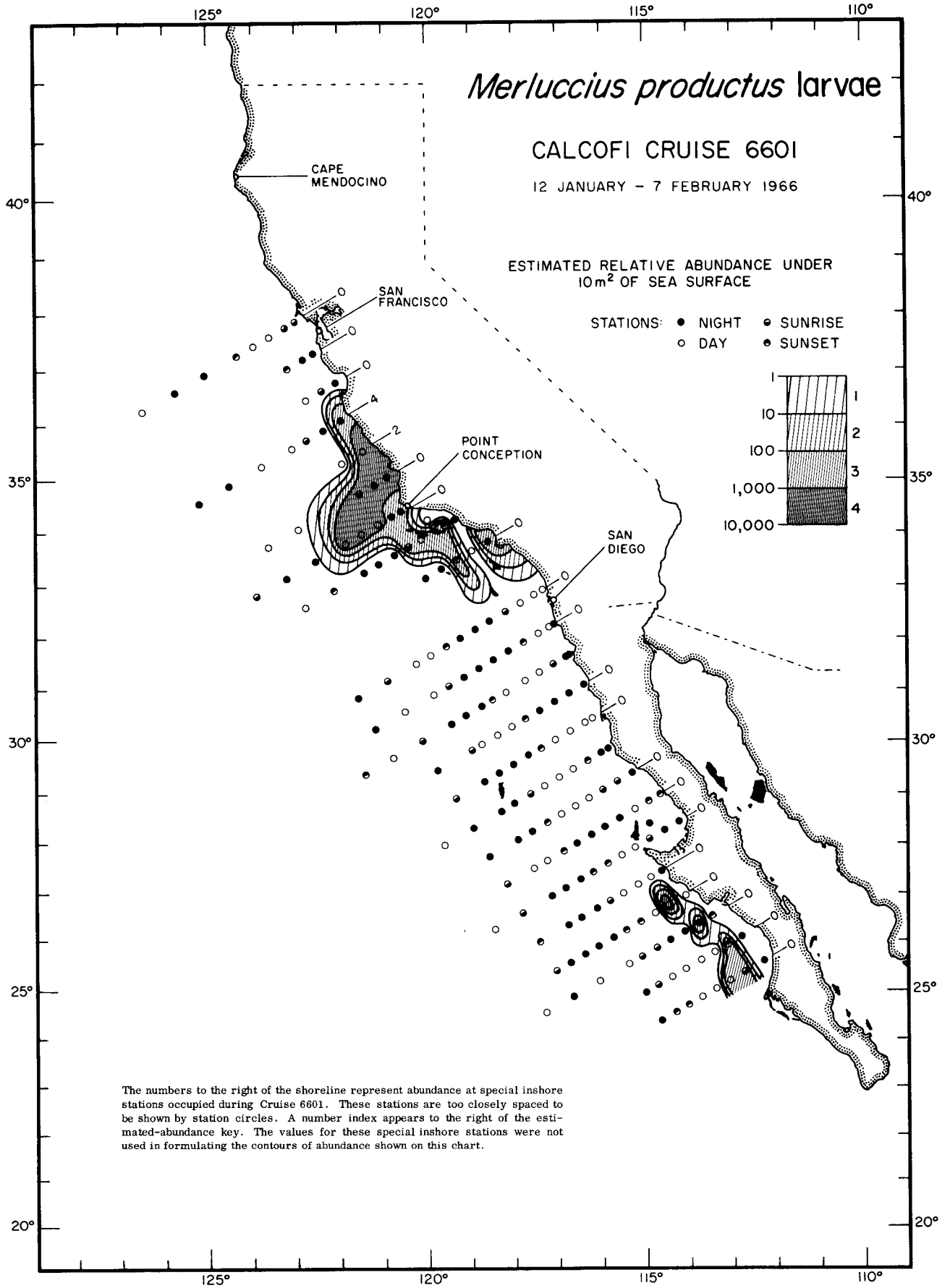
6301



The numbers to the right of the shoreline represent abundance at special inshore stations occupied during Cruise 6401. These stations are too closely spaced to be shown by station circles. A number index appears to the right of the estimated-abundance key. The values for these special inshore stations were not used in formulating the contours shown on this chart.

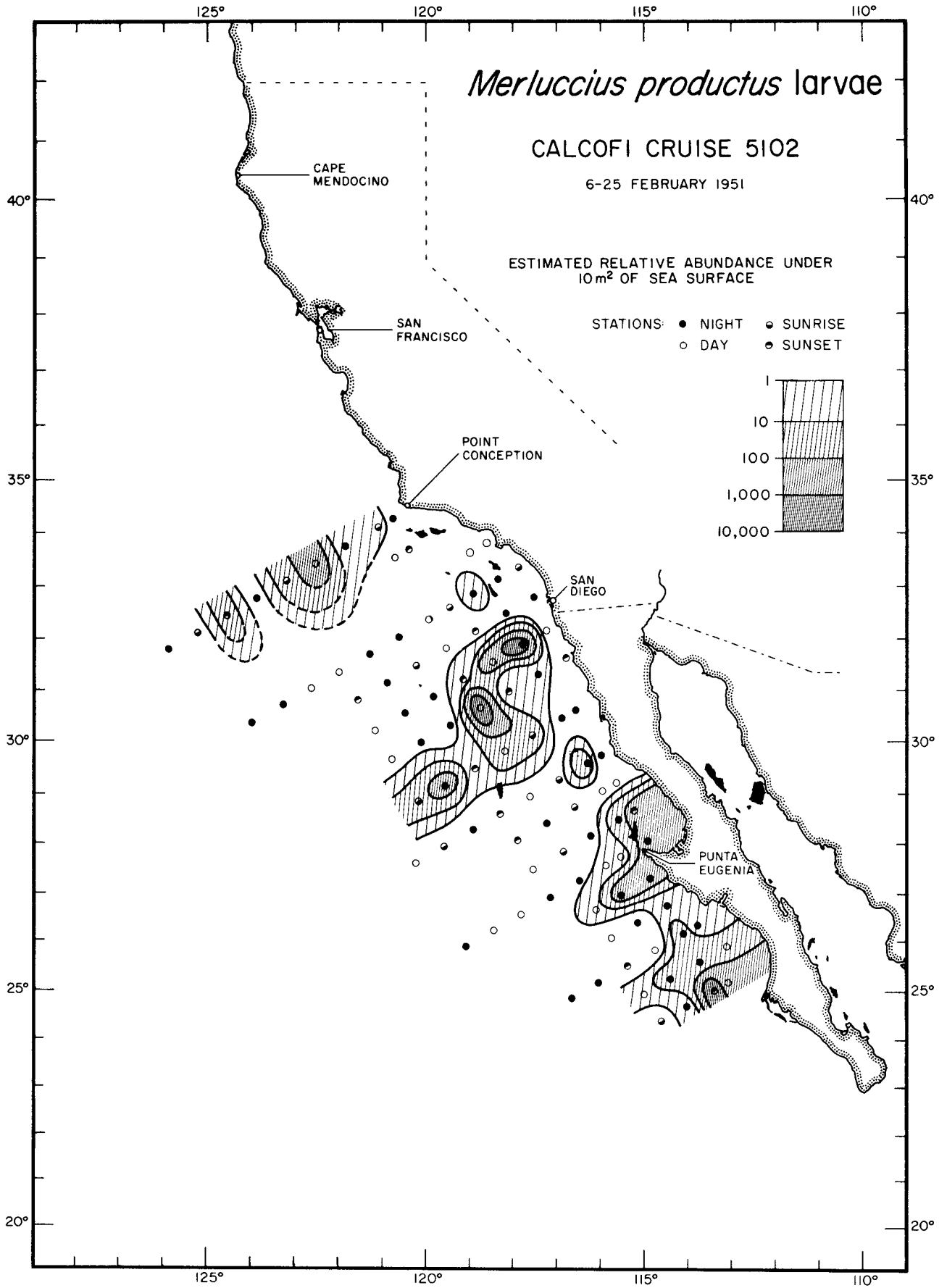


The numbers to the right of the shoreline represent abundance at special inshore stations occupied during Cruise 6501. These stations are too closely spaced to be shown by station circles. A number index appears to the right of the estimated-abundance key. The values for these special inshore stations were not used in formulating the contours of abundance shown on this chart.



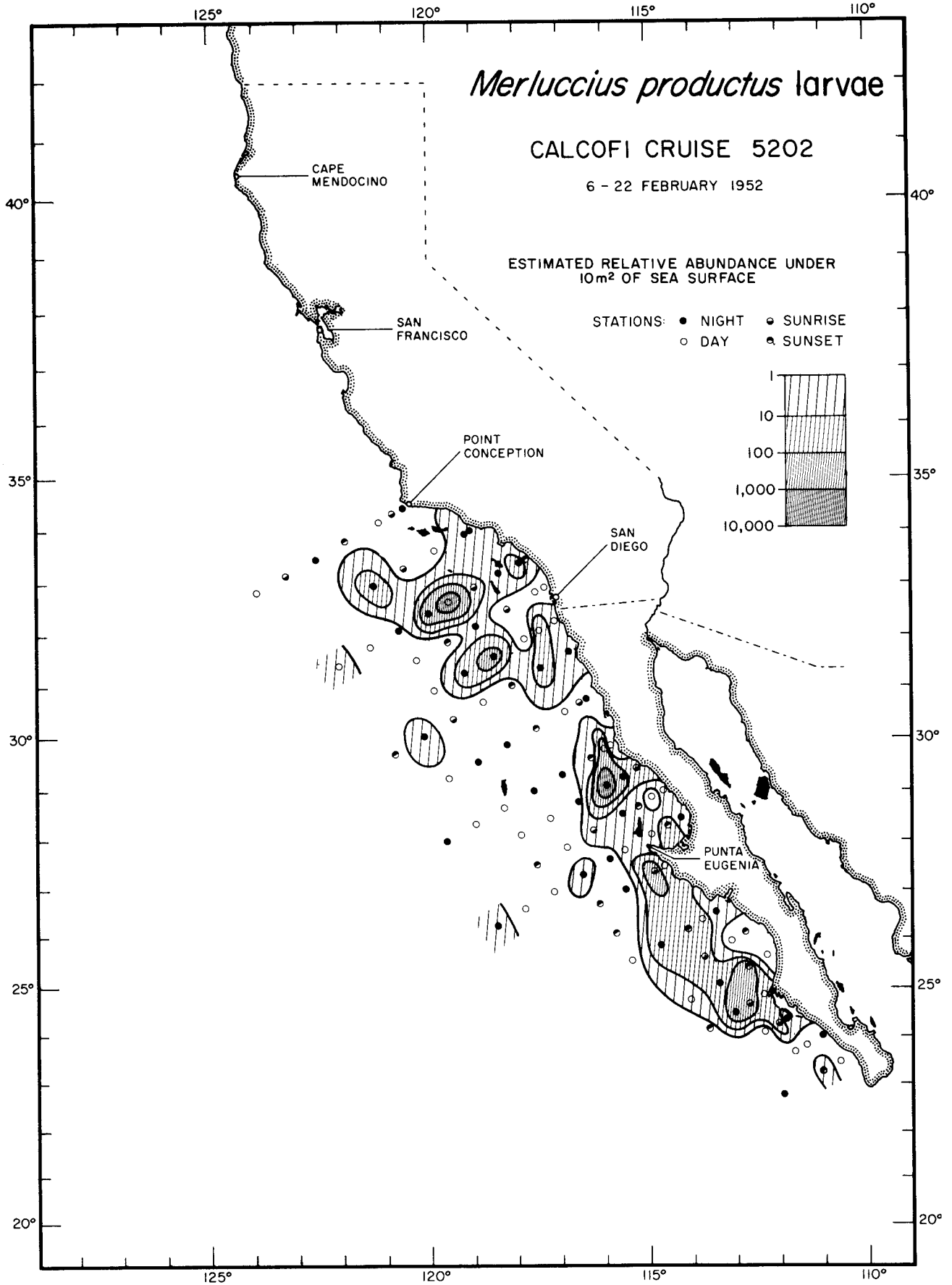
Merluccius productus larvae

6601



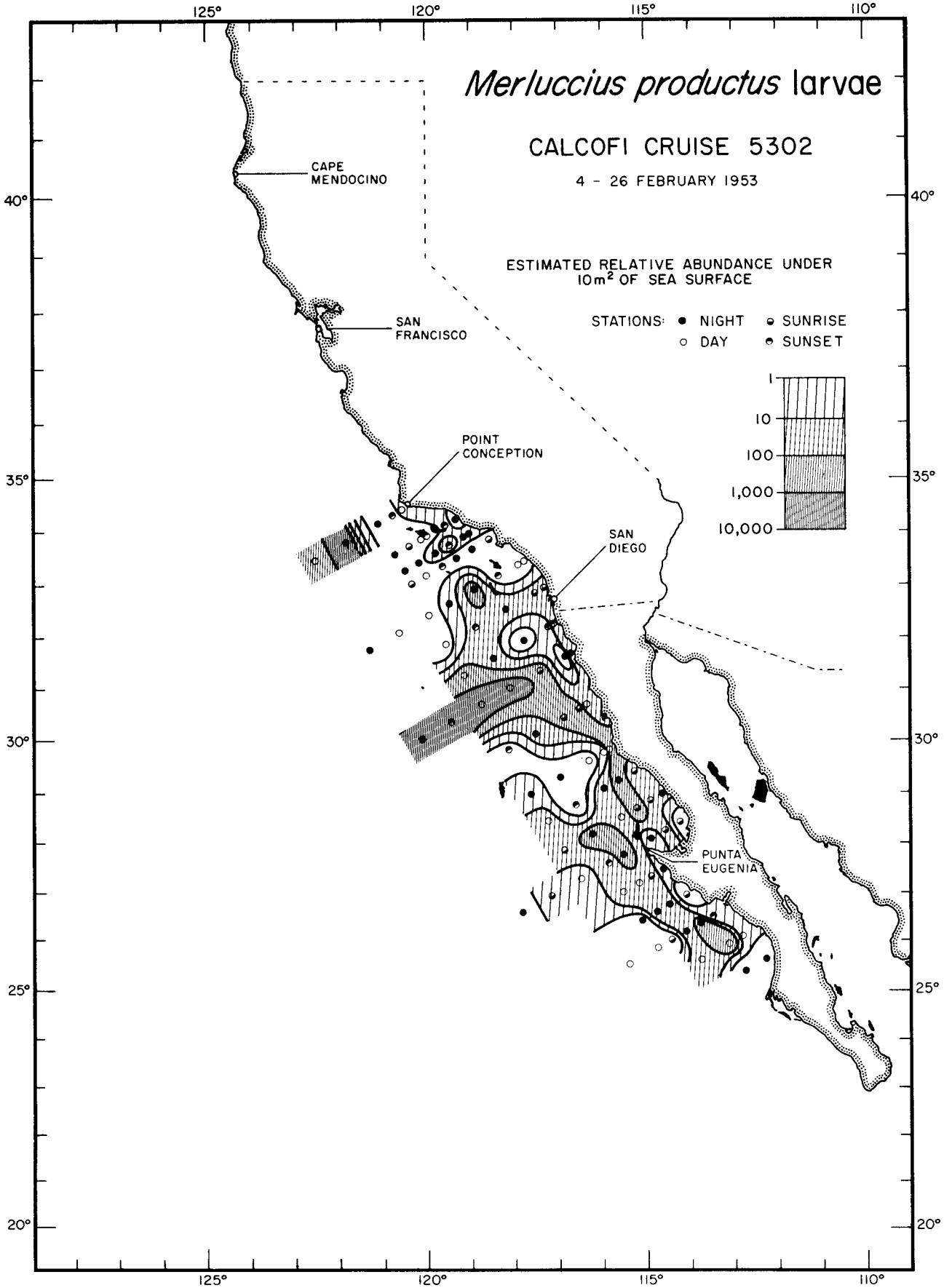
Merluccius productus larvae

5102



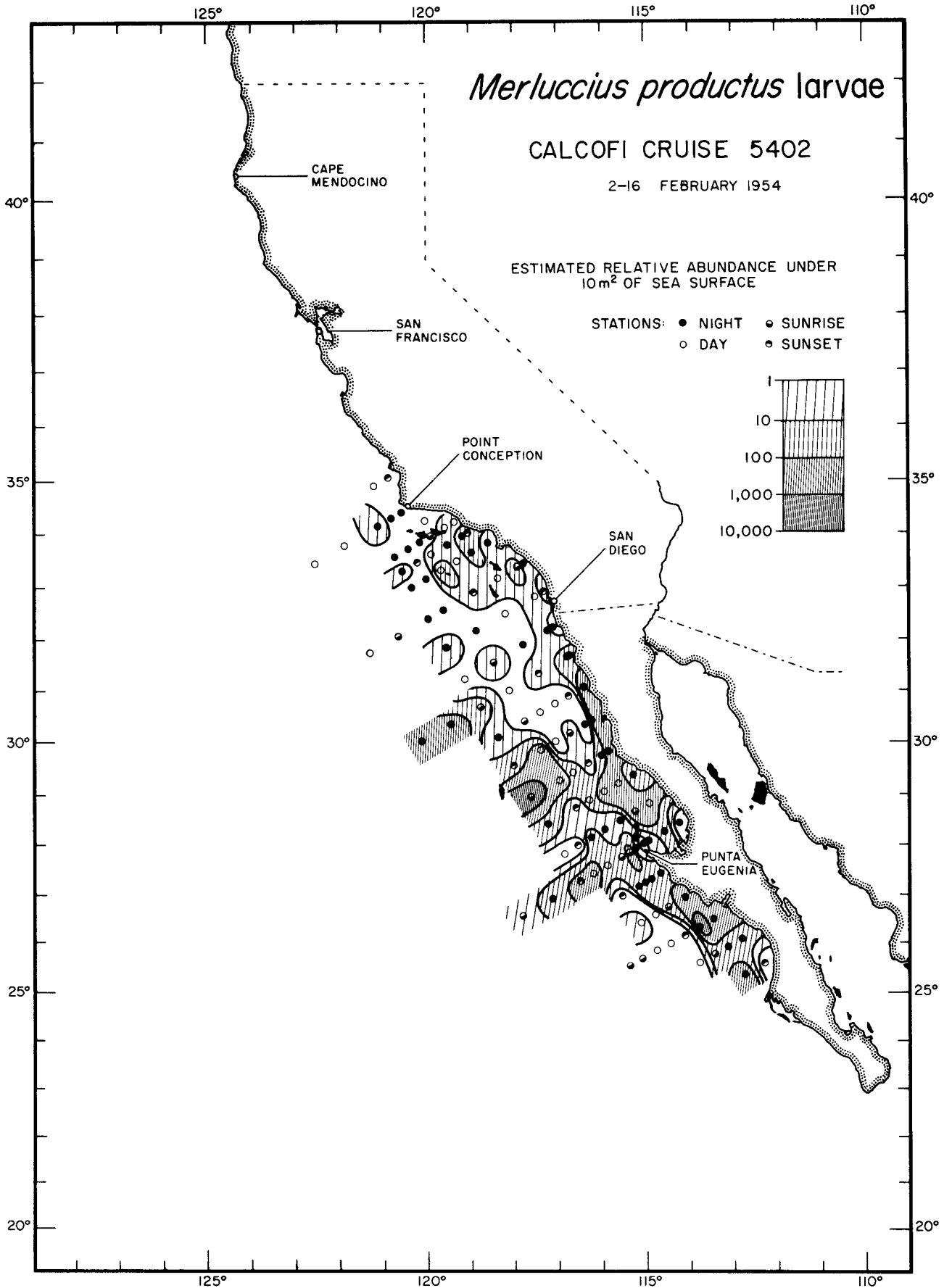
Merluccius productus larvae

5202



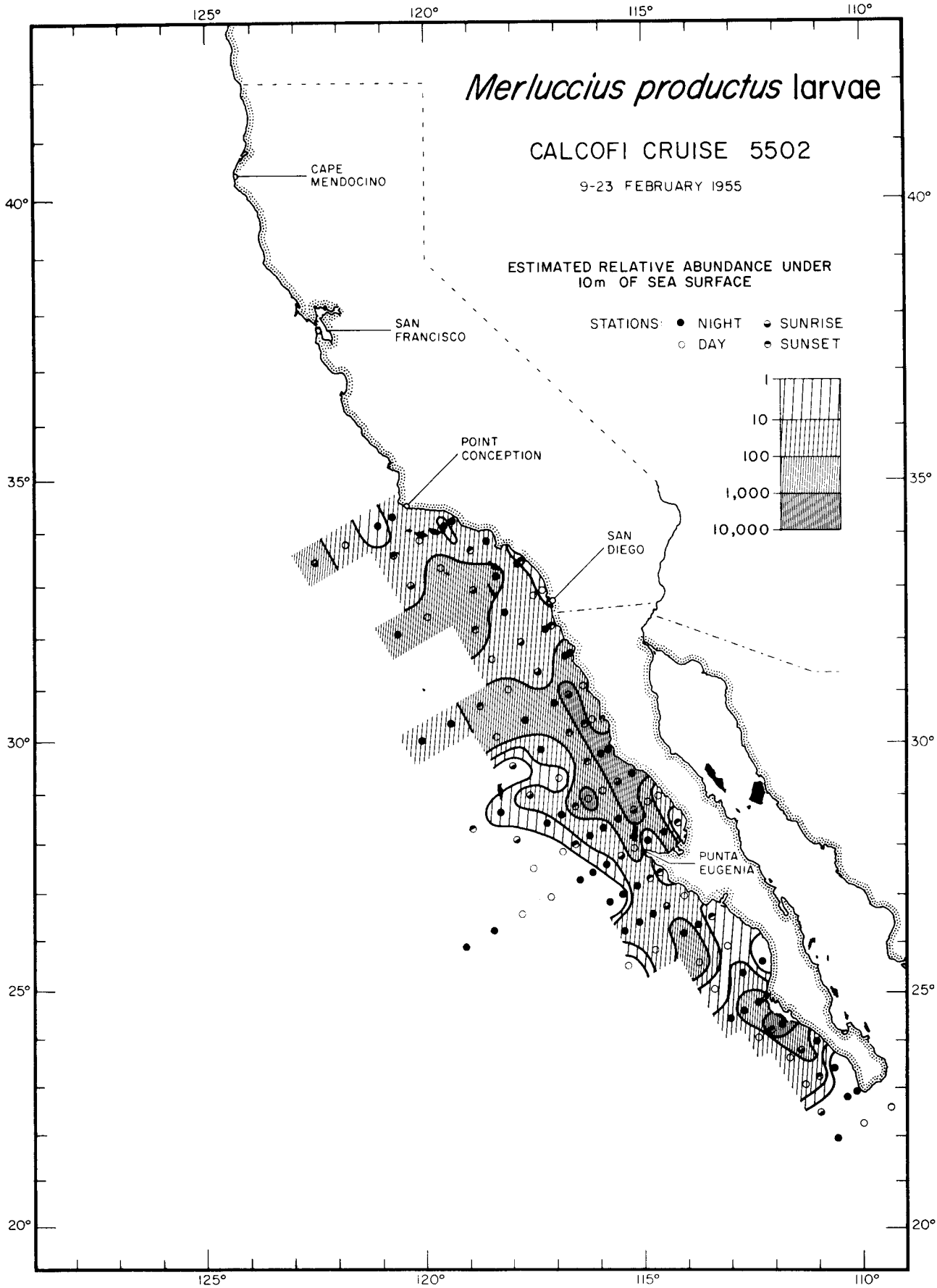
Merluccius productus larvae

5302



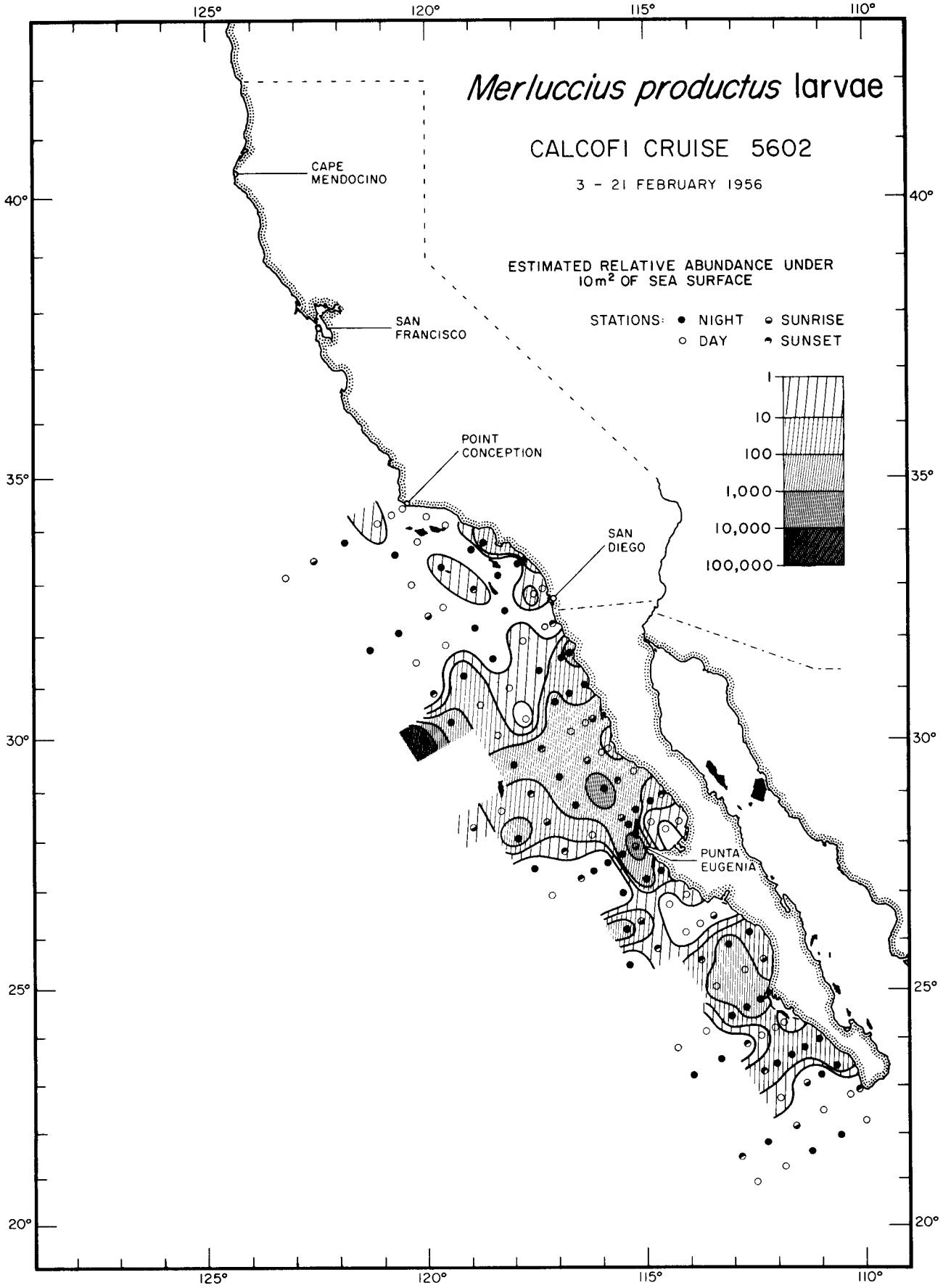
Merluccius productus larvae

5402



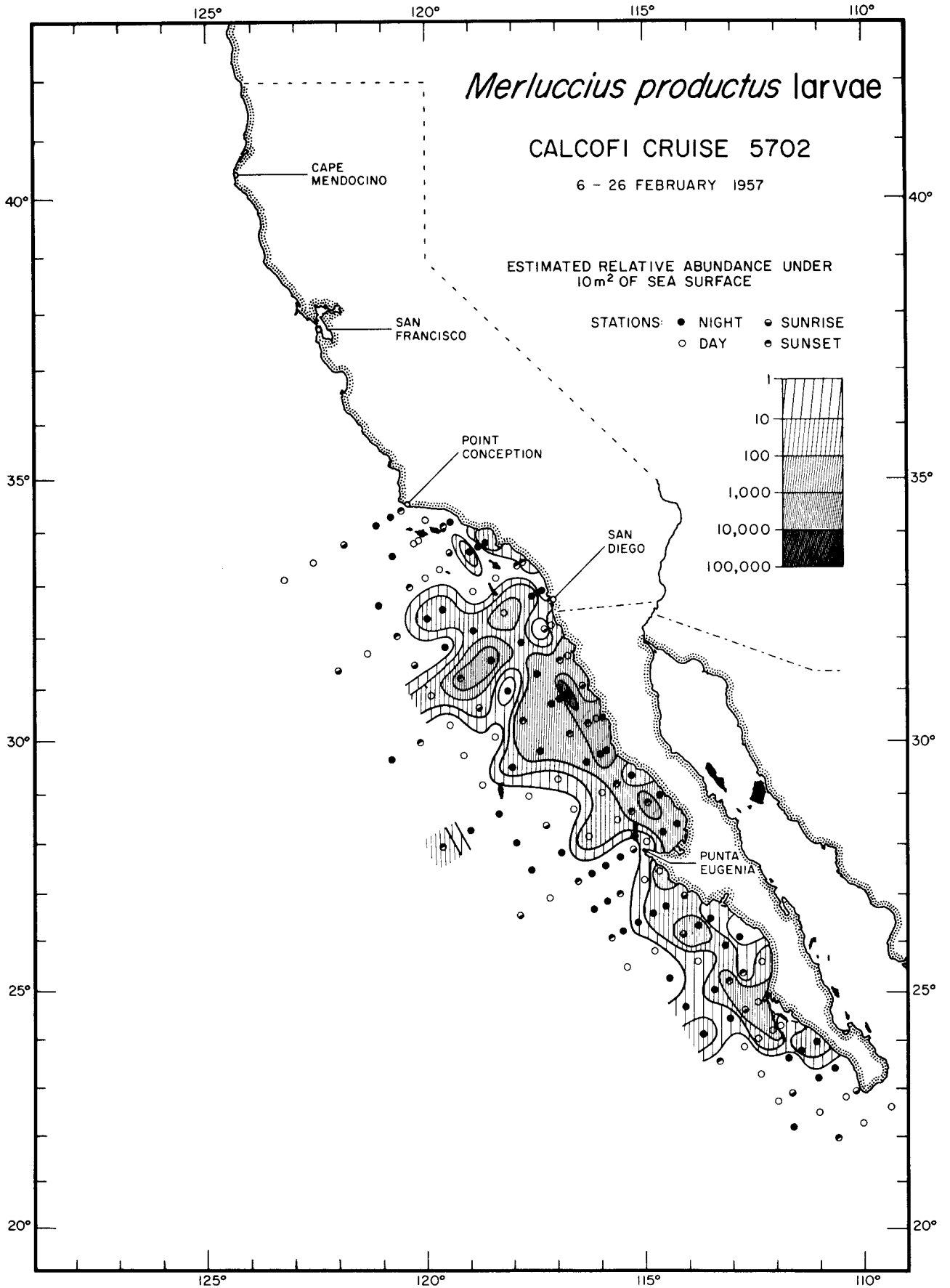
Merluccius productus larvae

5502



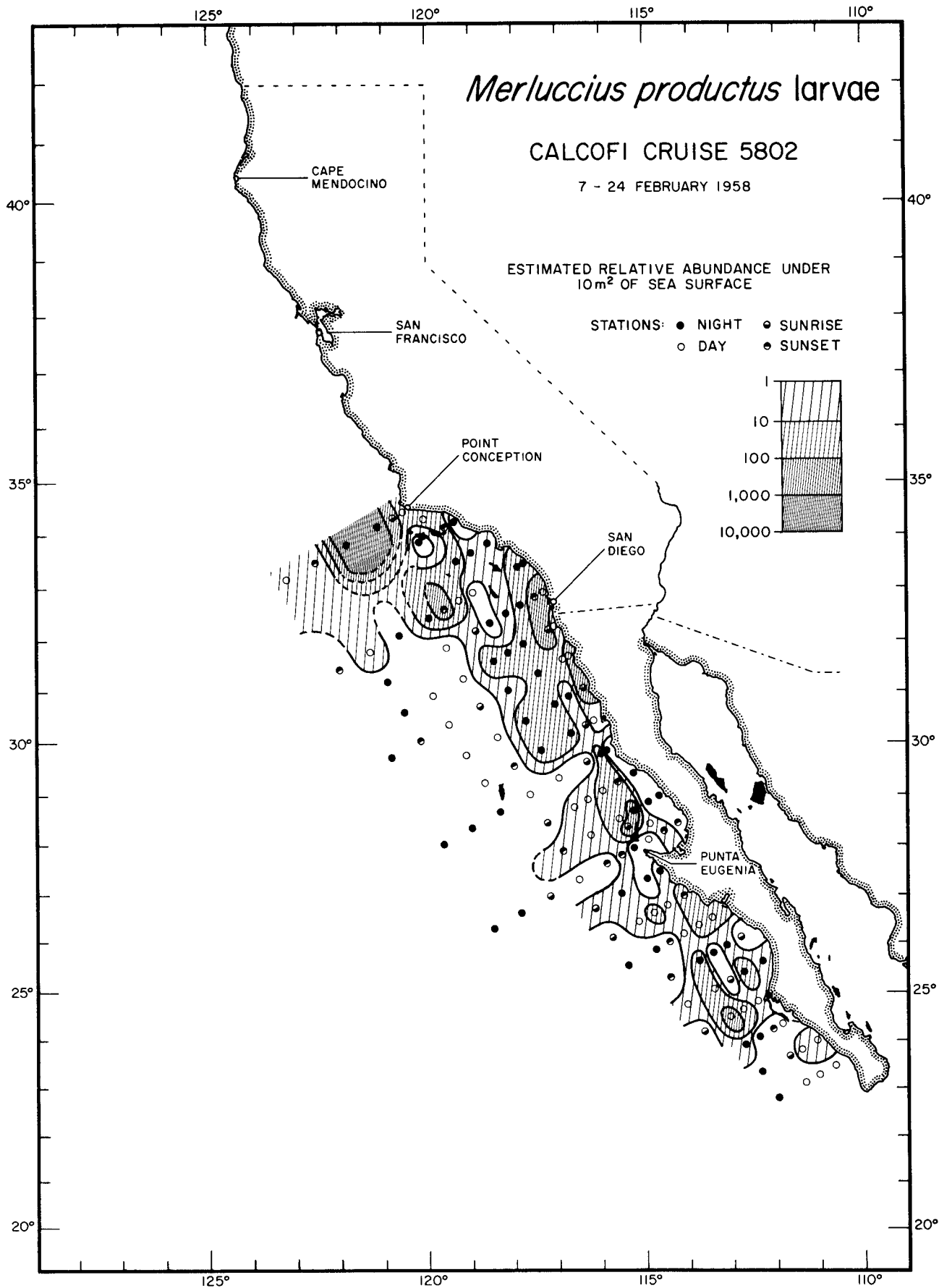
Merluccius productus larvae

5602



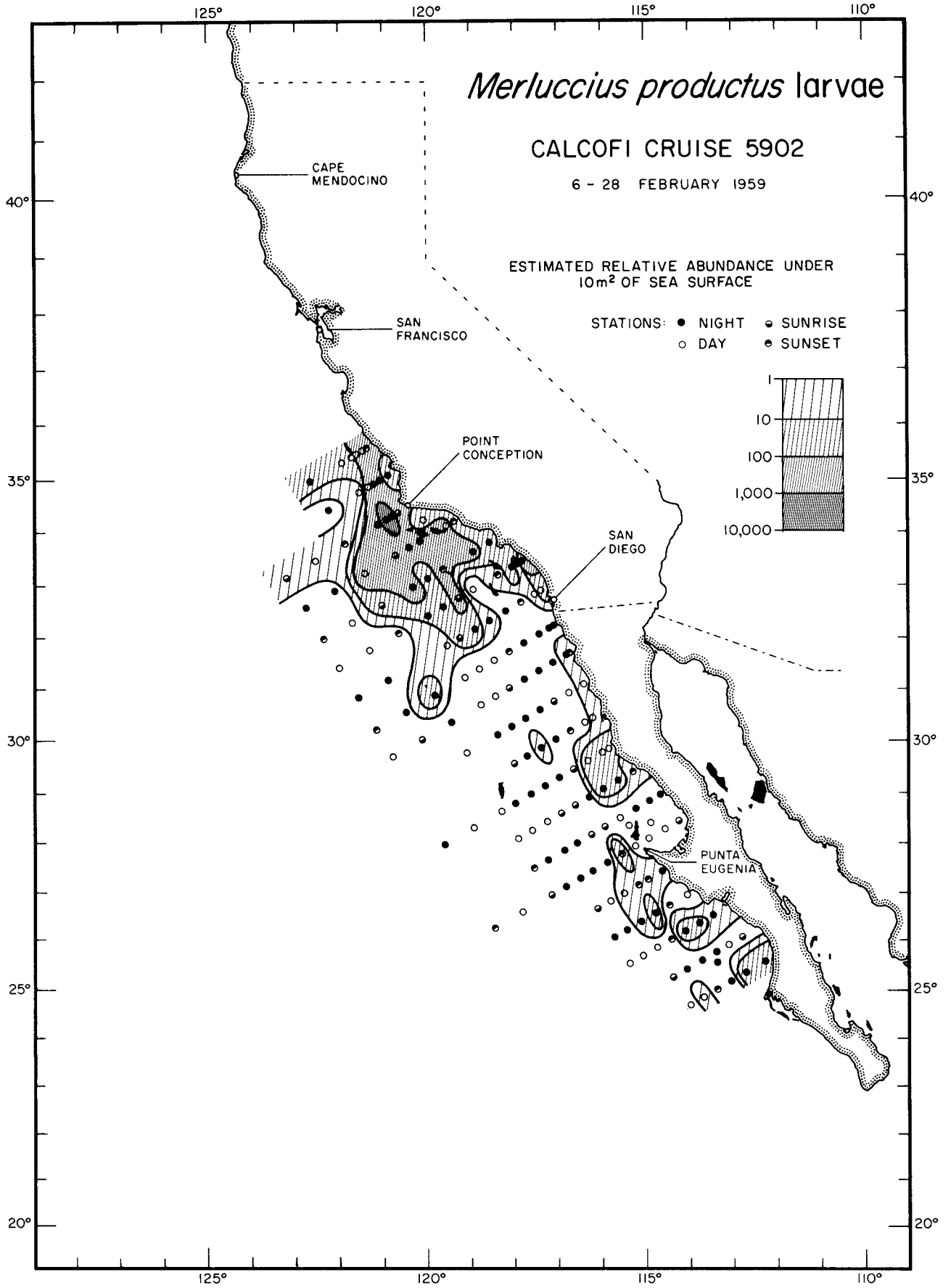
Merluccius productus larvae

5702



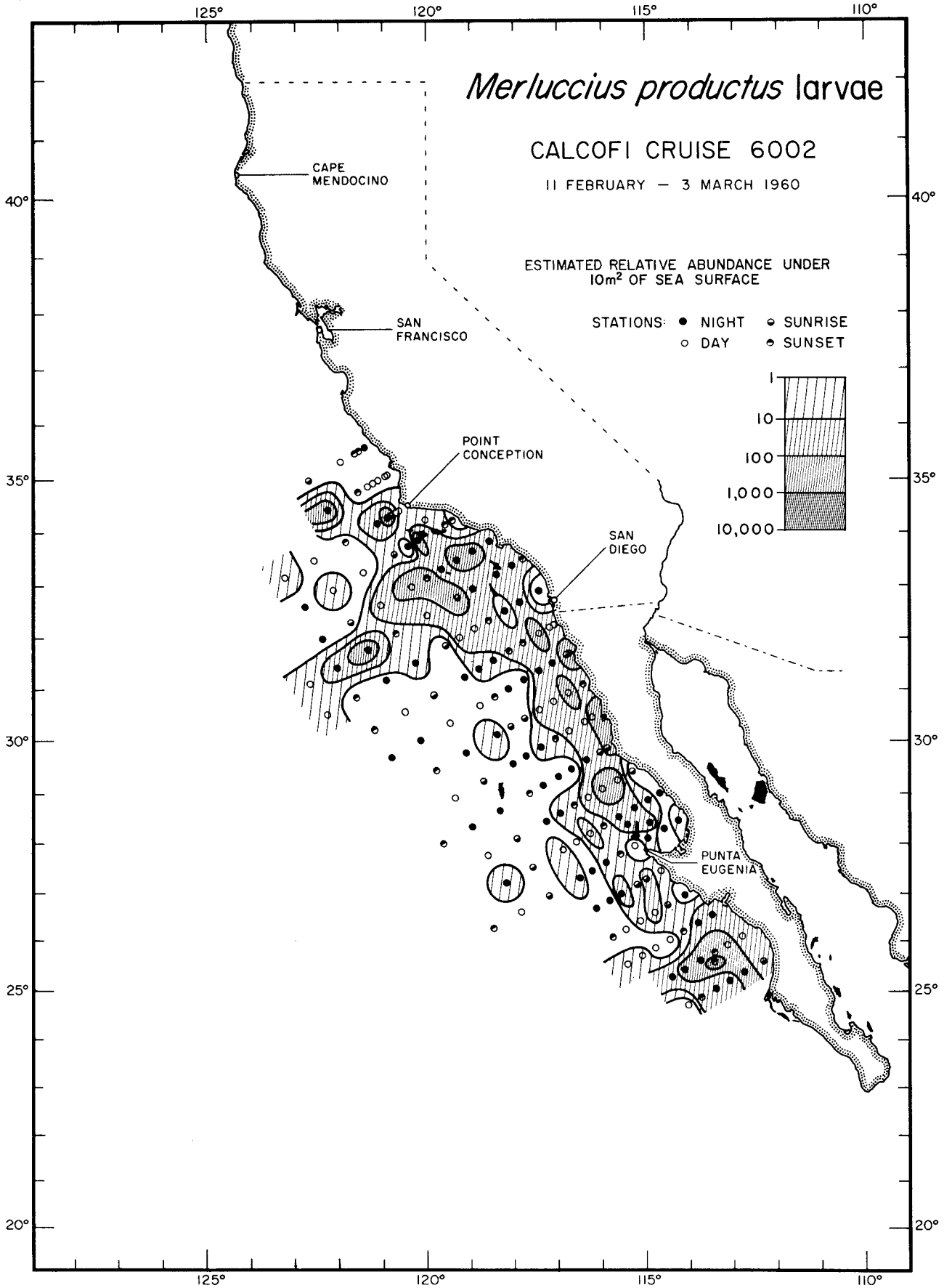
Merluccius productus larvae

5802



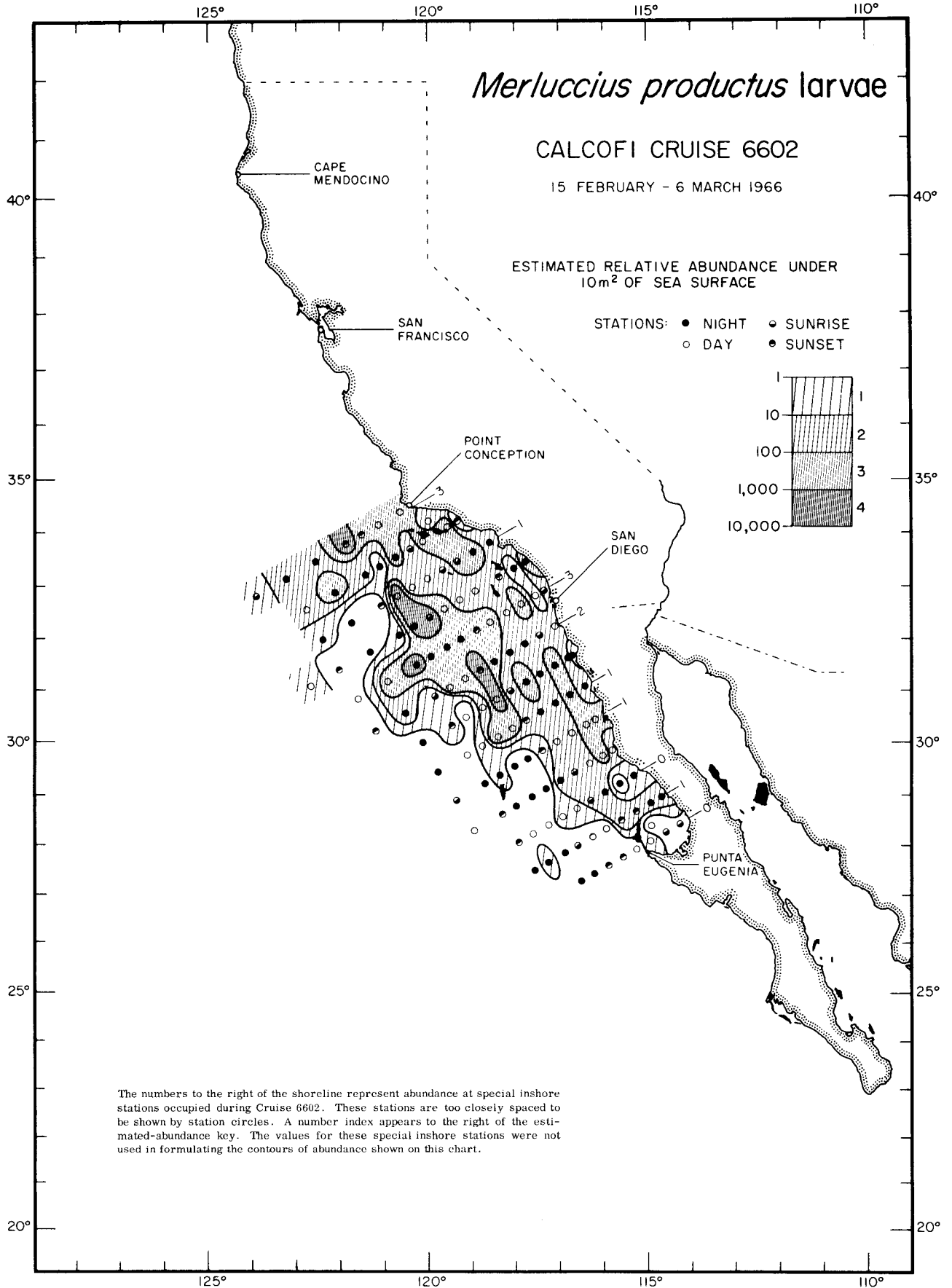
Merluccius productus larvae

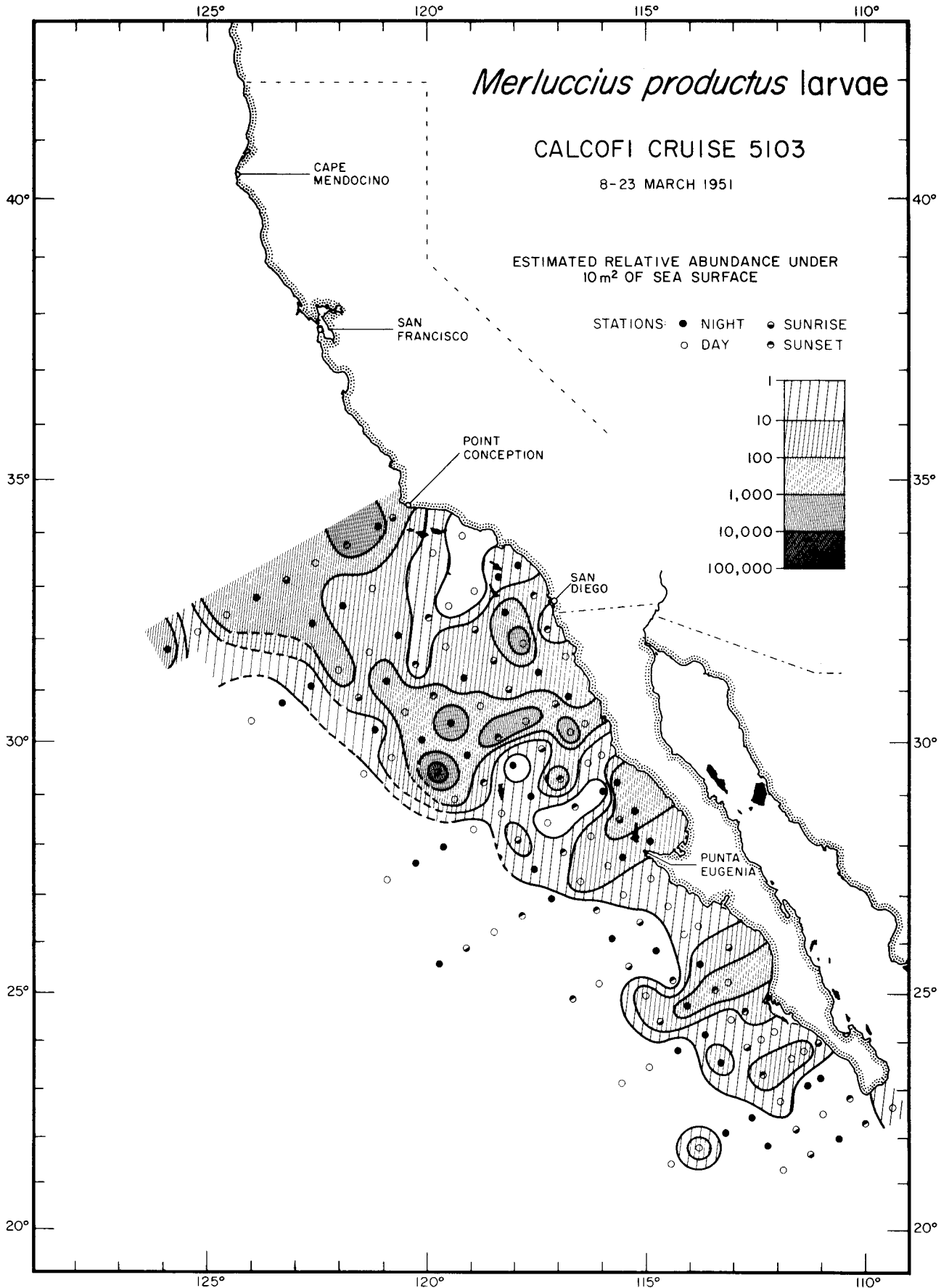
5902



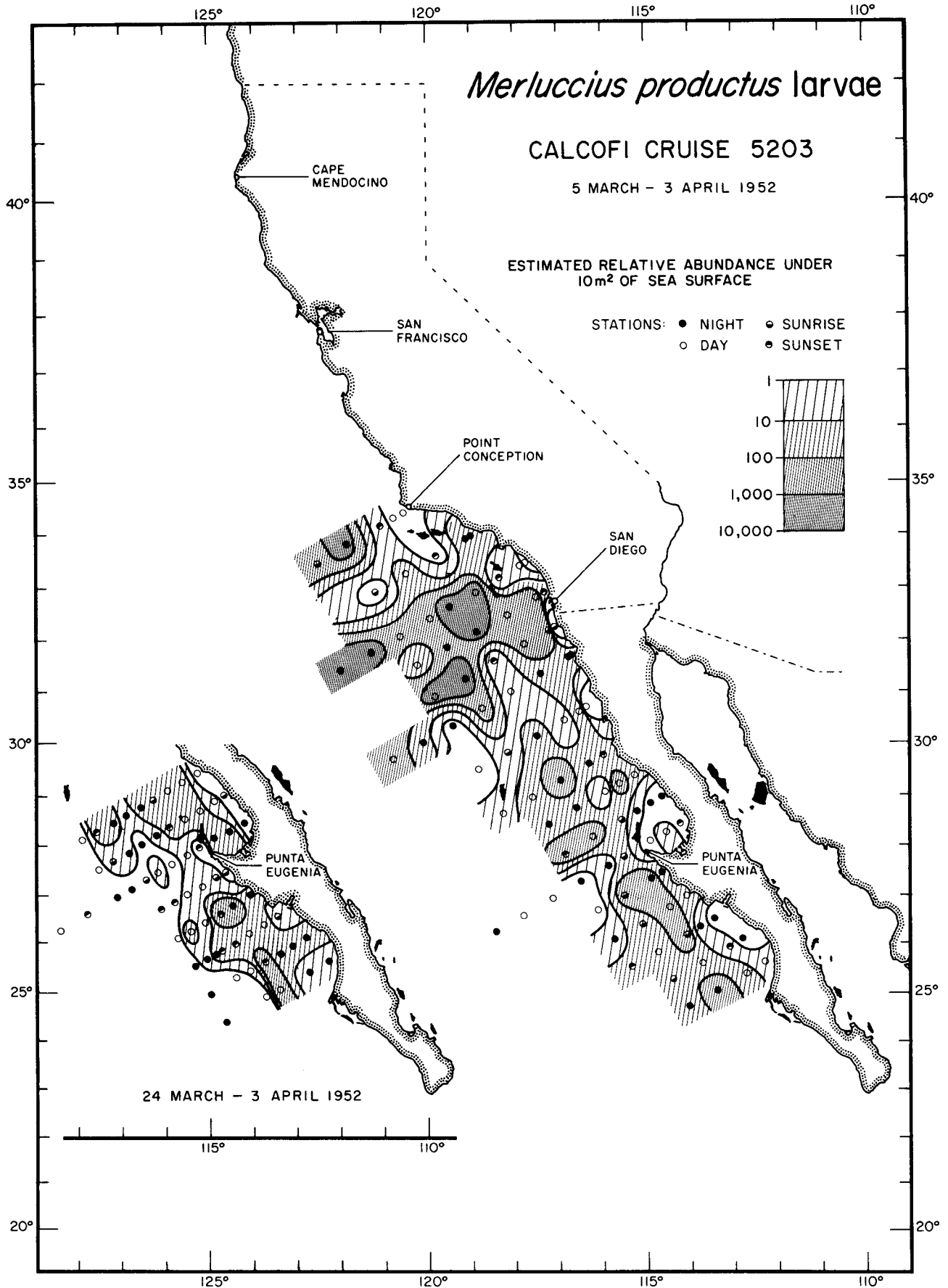
Merluccius productus larvae

6002



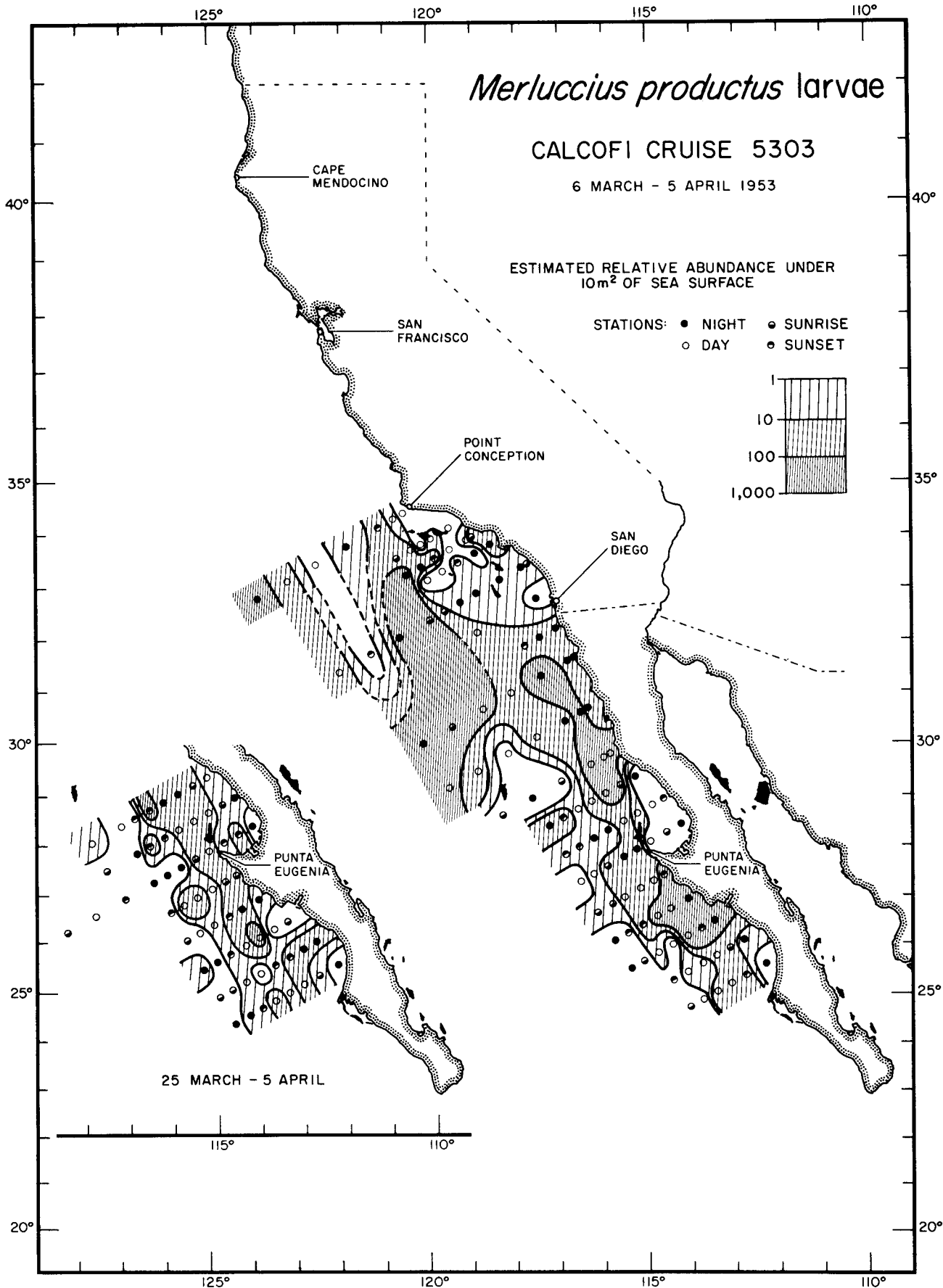


Merluccius productus larvae



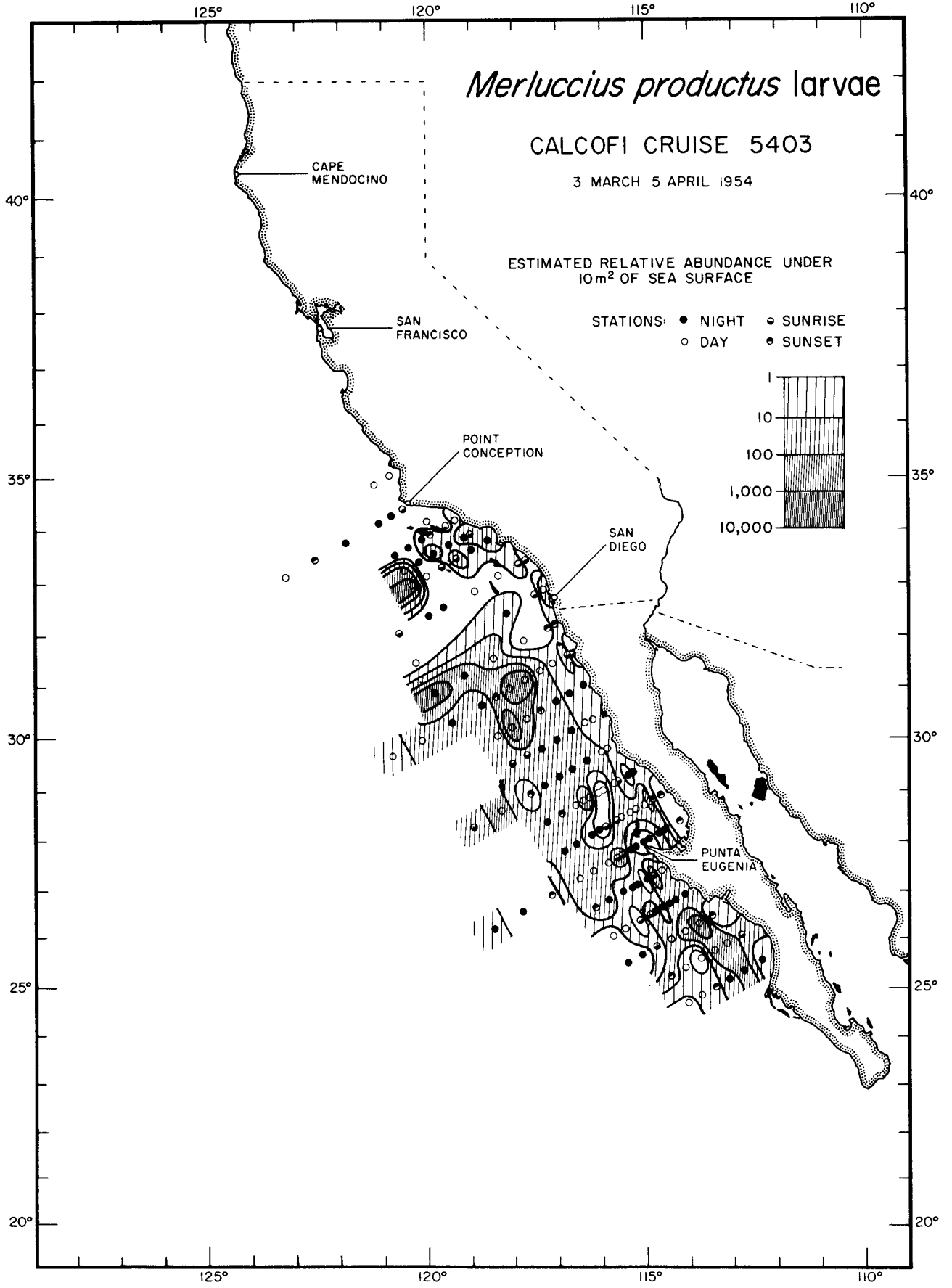
Merluccius productus larvae

5203



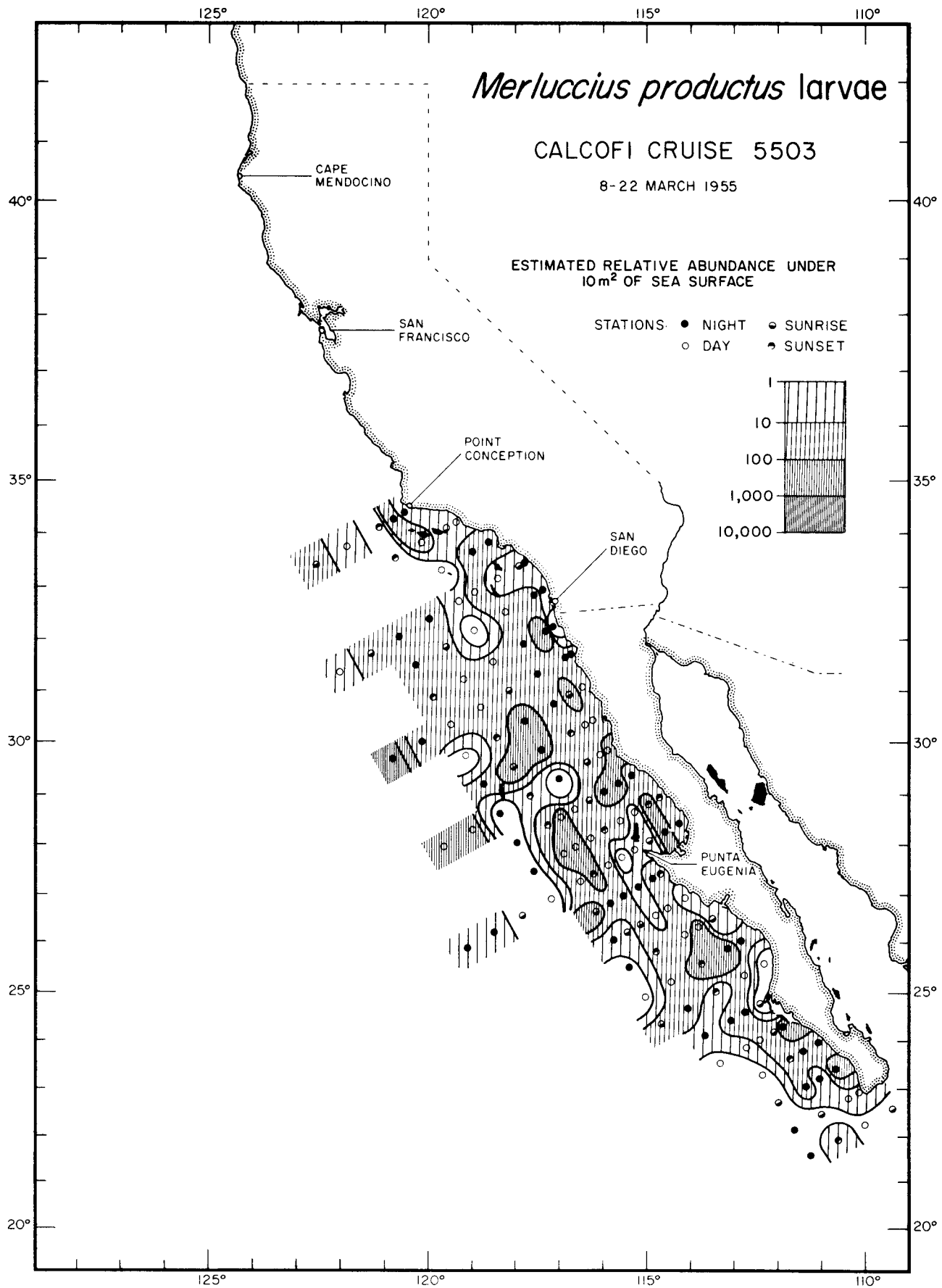
Merluccius productus larvae

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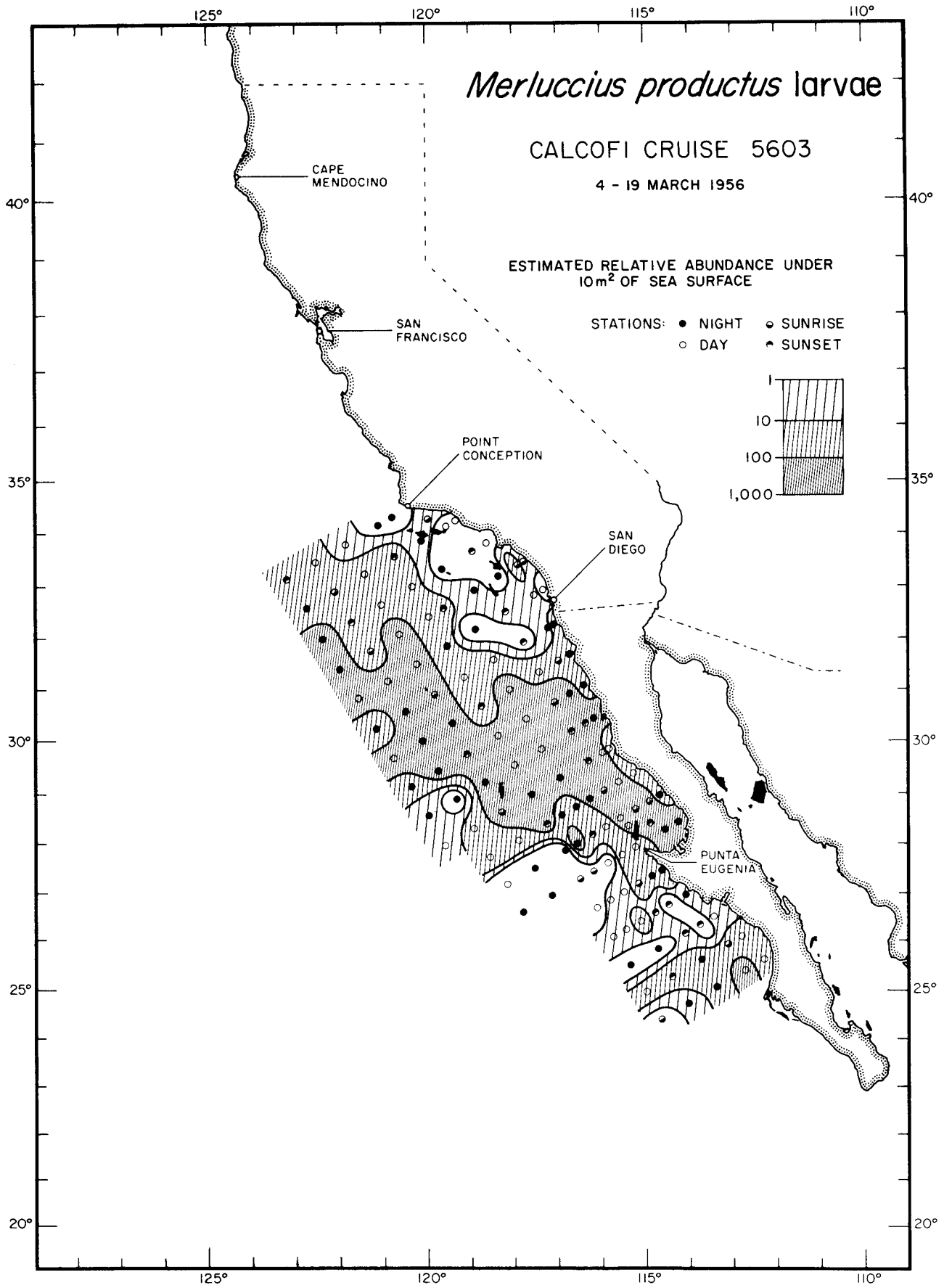
Merluccius productus larvae

5403



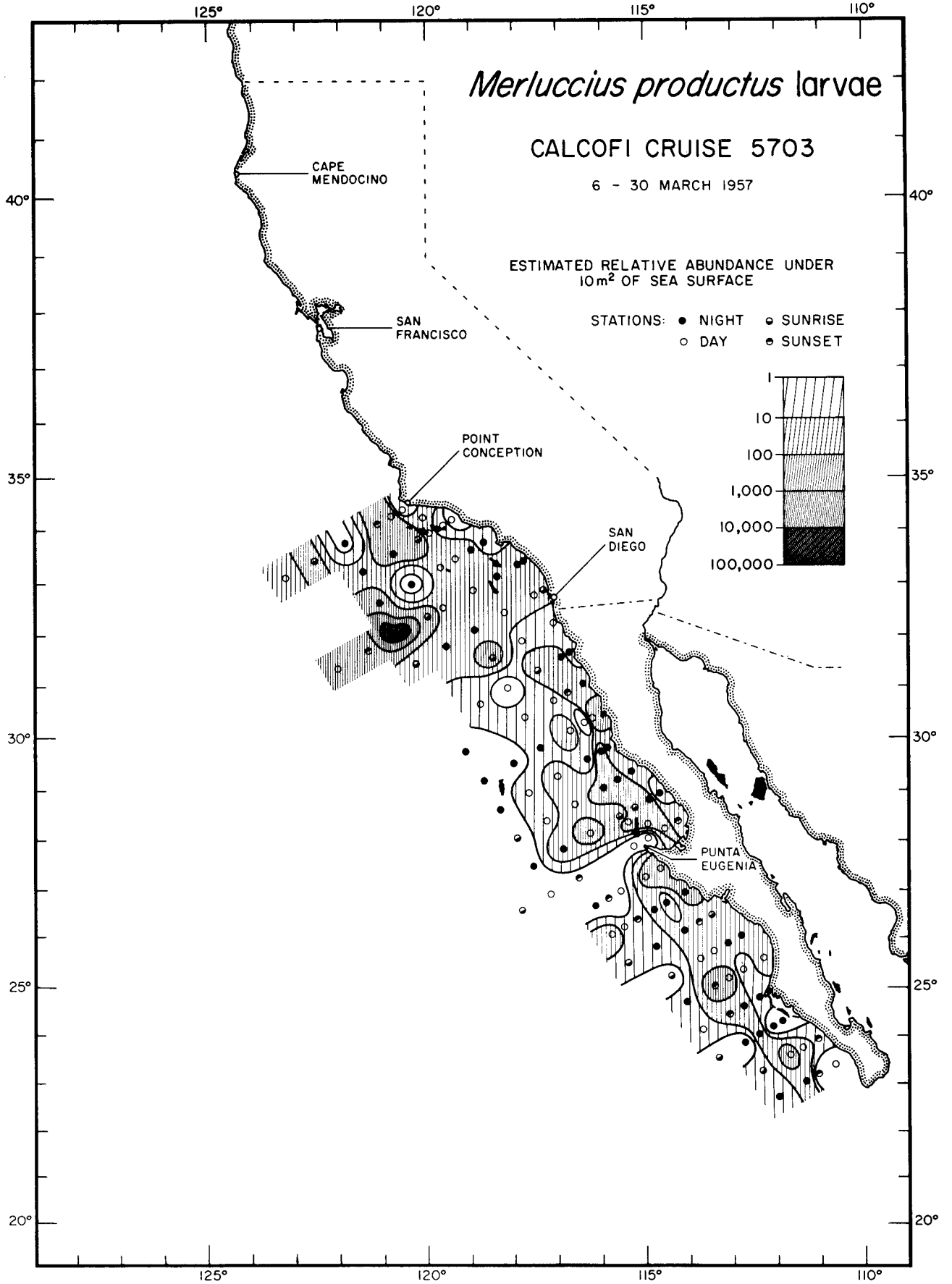
Merluccius productus larvae

5503



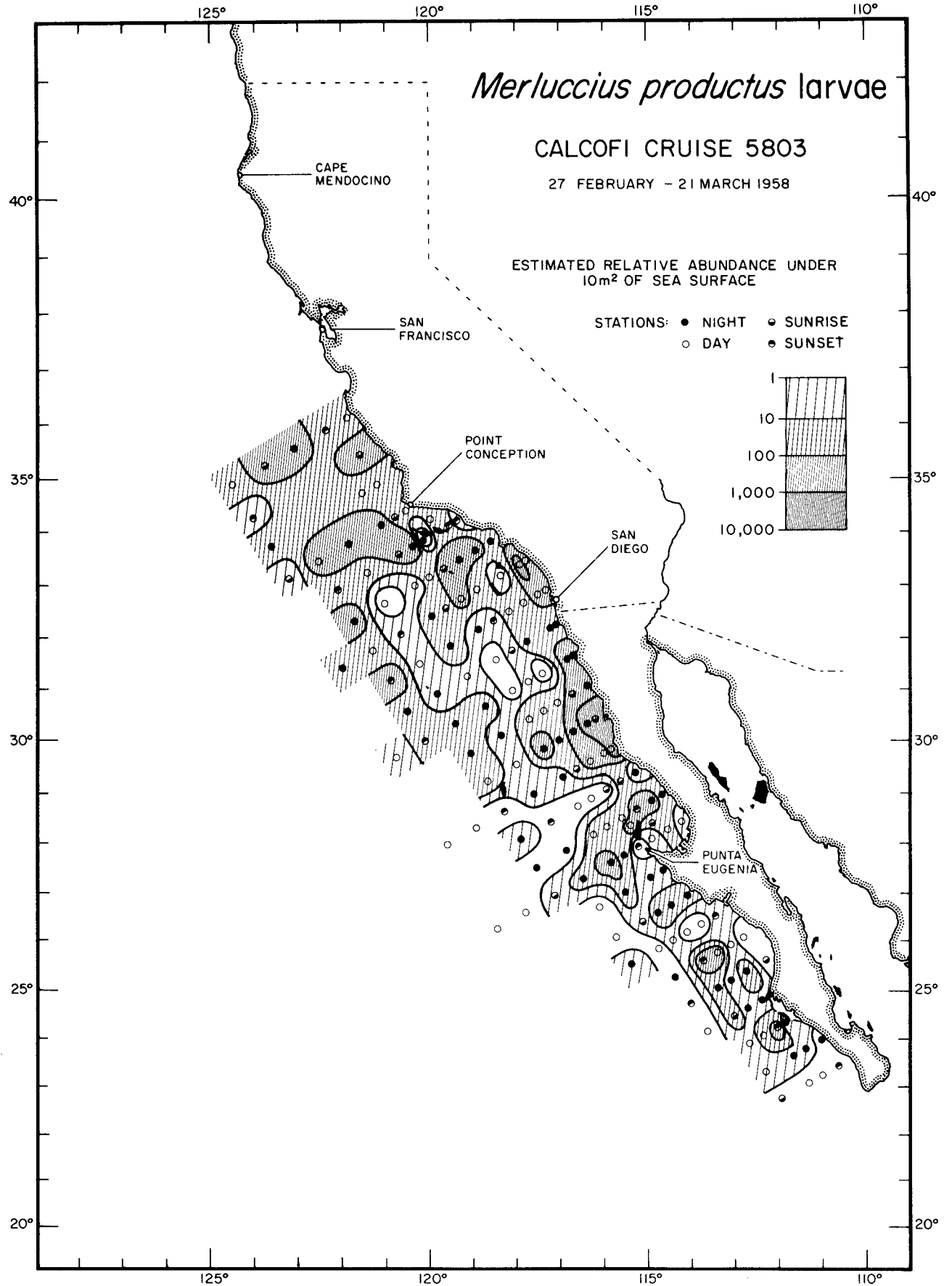
Merluccius productus larvae

5603



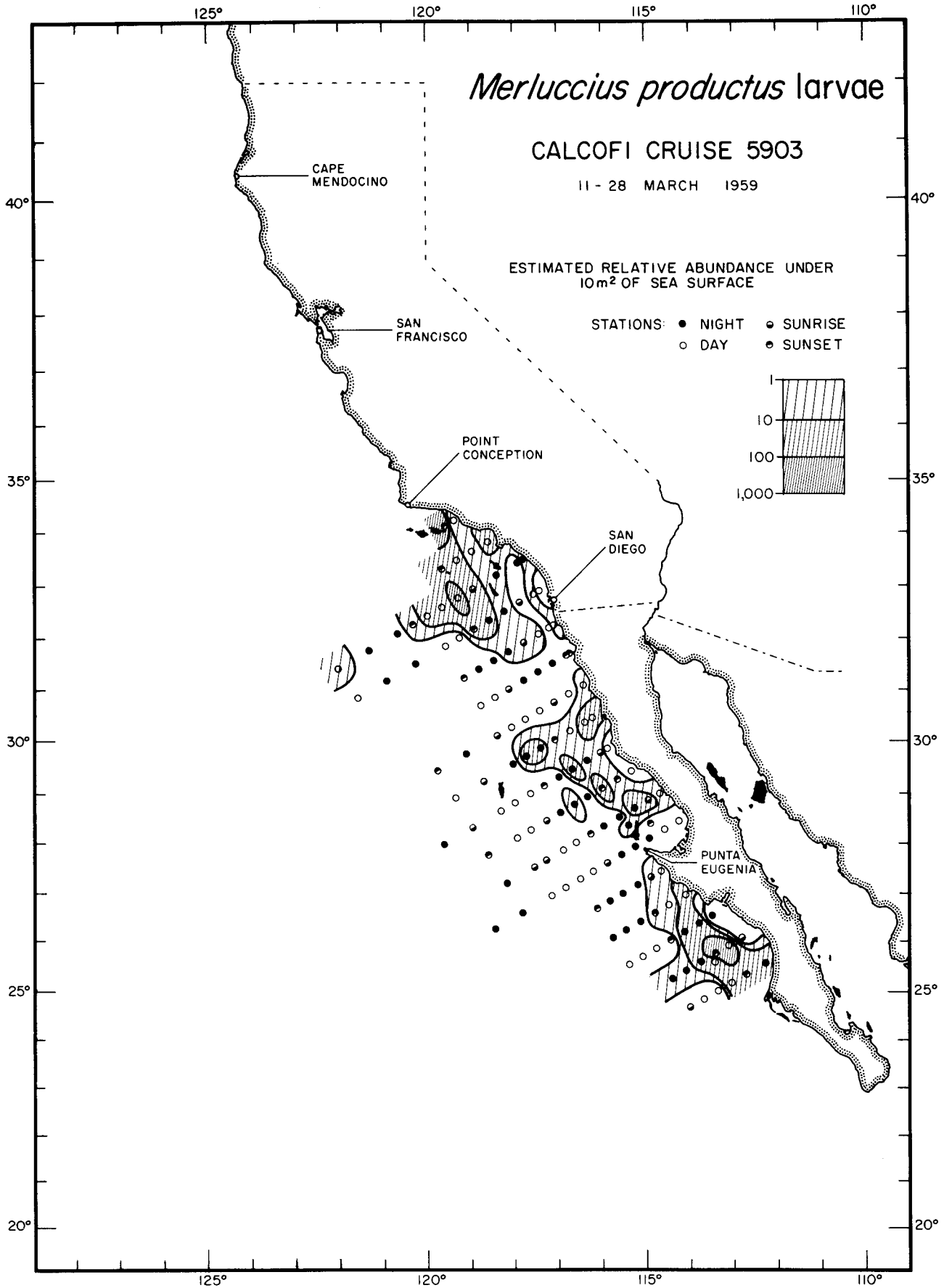
Merluccius productus larvae

5703



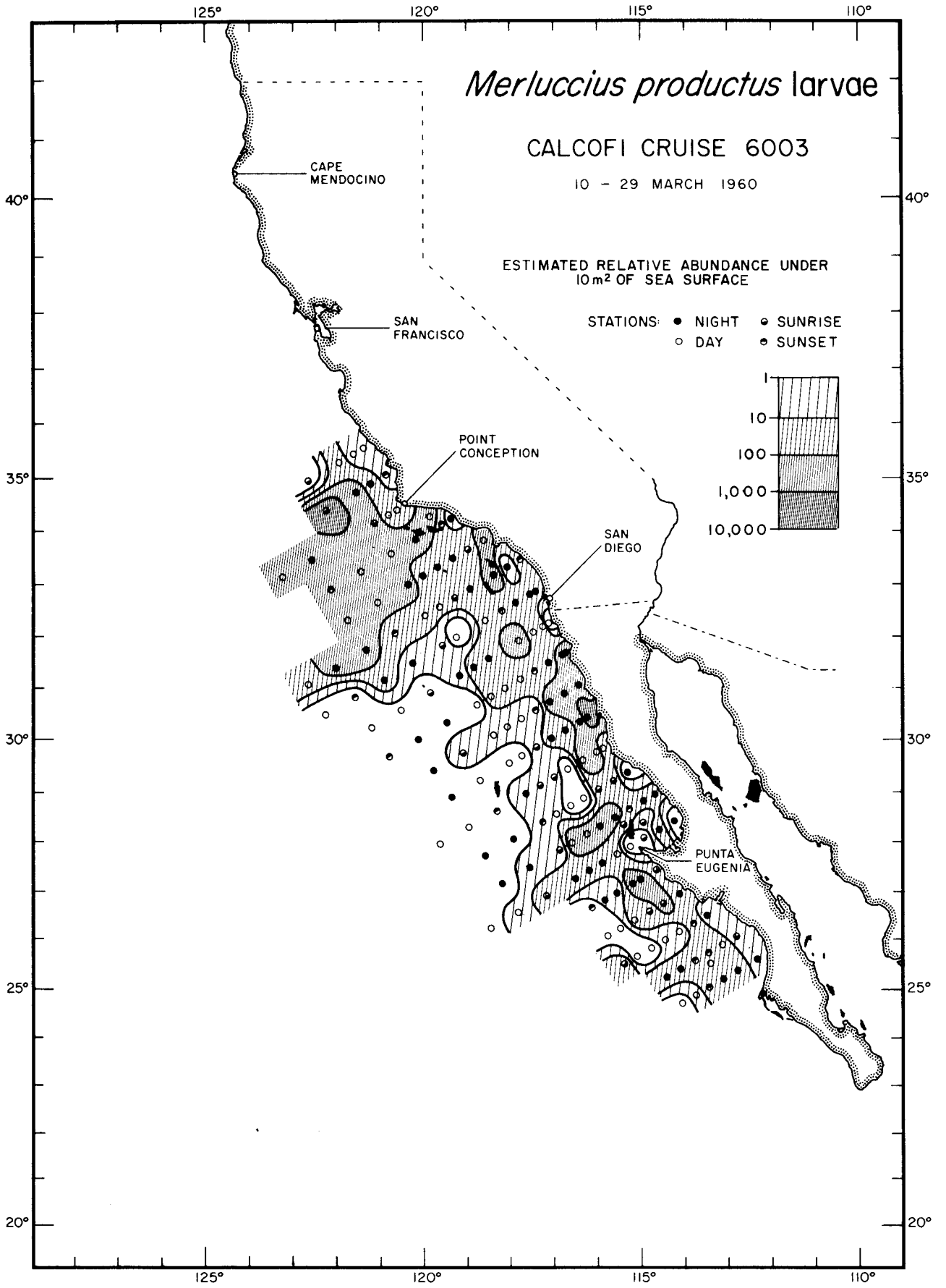
Merluccius productus larvae

5803



Merluccius productus larvae

5903



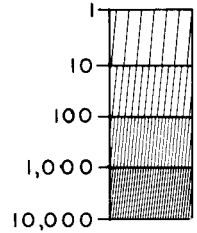
Merluccius productus larvae

CALCOFI CRUISE 6003

10 - 29 MARCH 1960

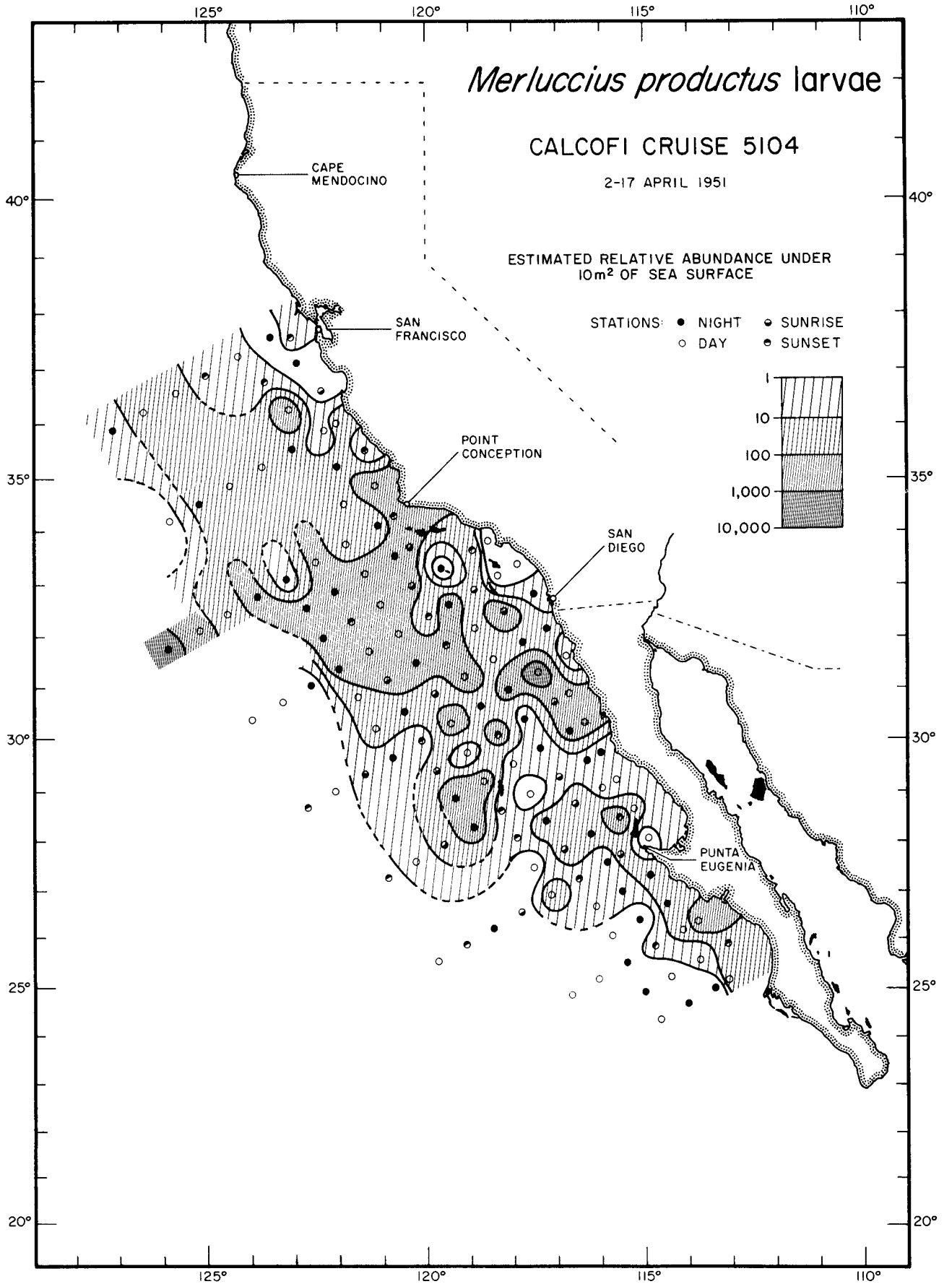
ESTIMATED RELATIVE ABUNDANCE UNDER 10m² OF SEA SURFACE

STATIONS: ● NIGHT ○ DAY ◐ SUNRISE ◑ SUNSET



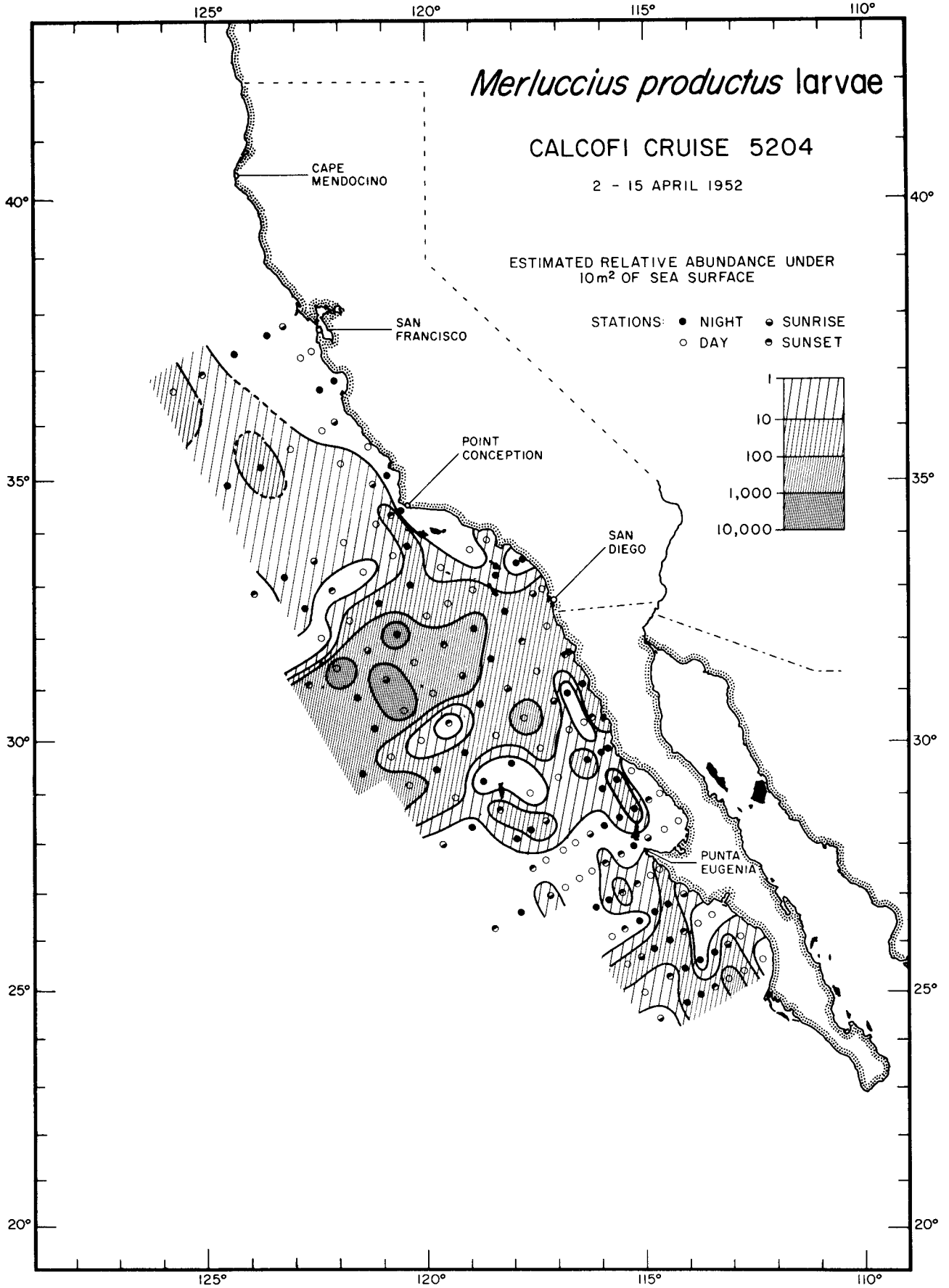
Merluccius productus larvae

6003



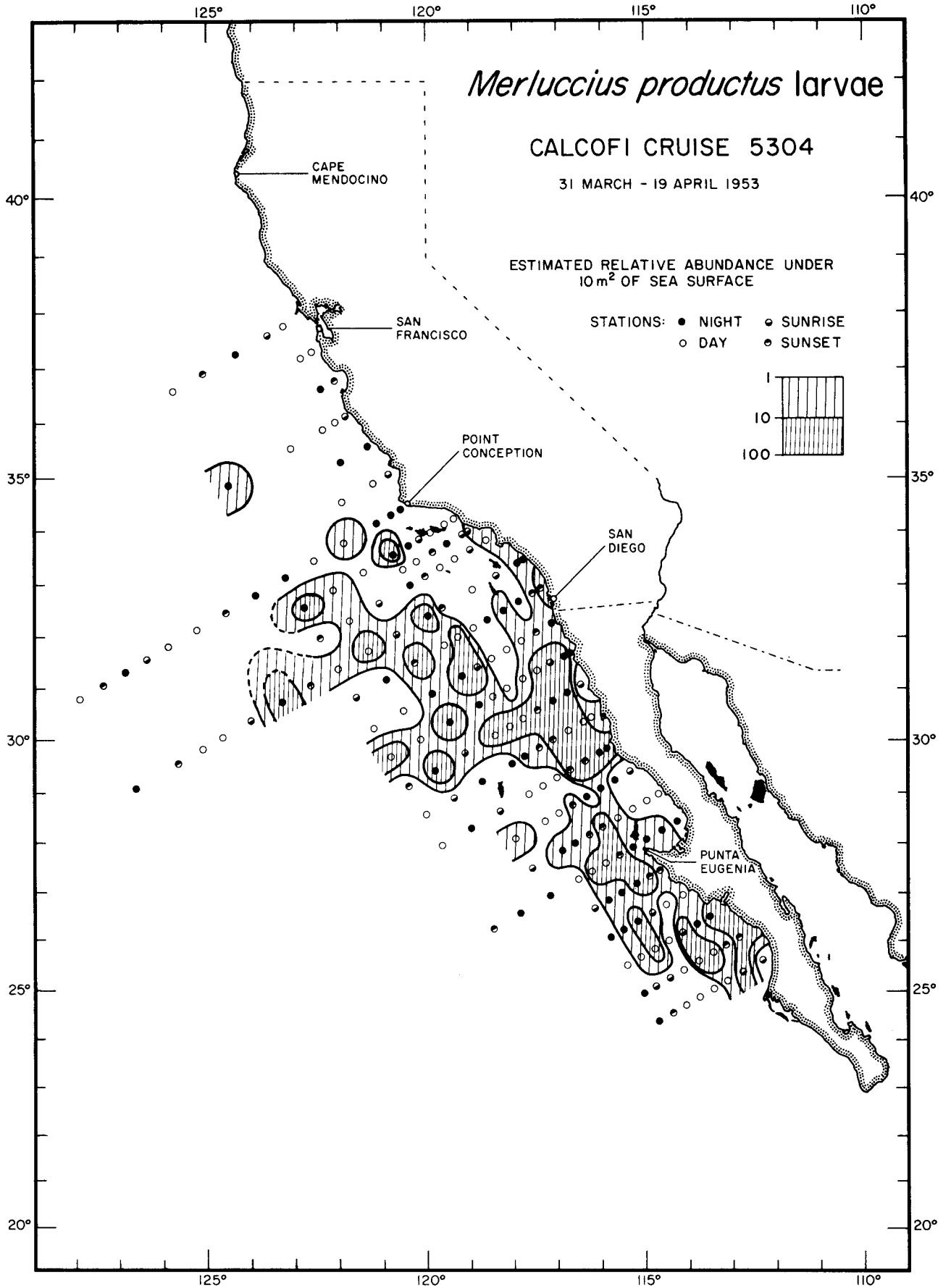
Merluccius productus larvae

5104



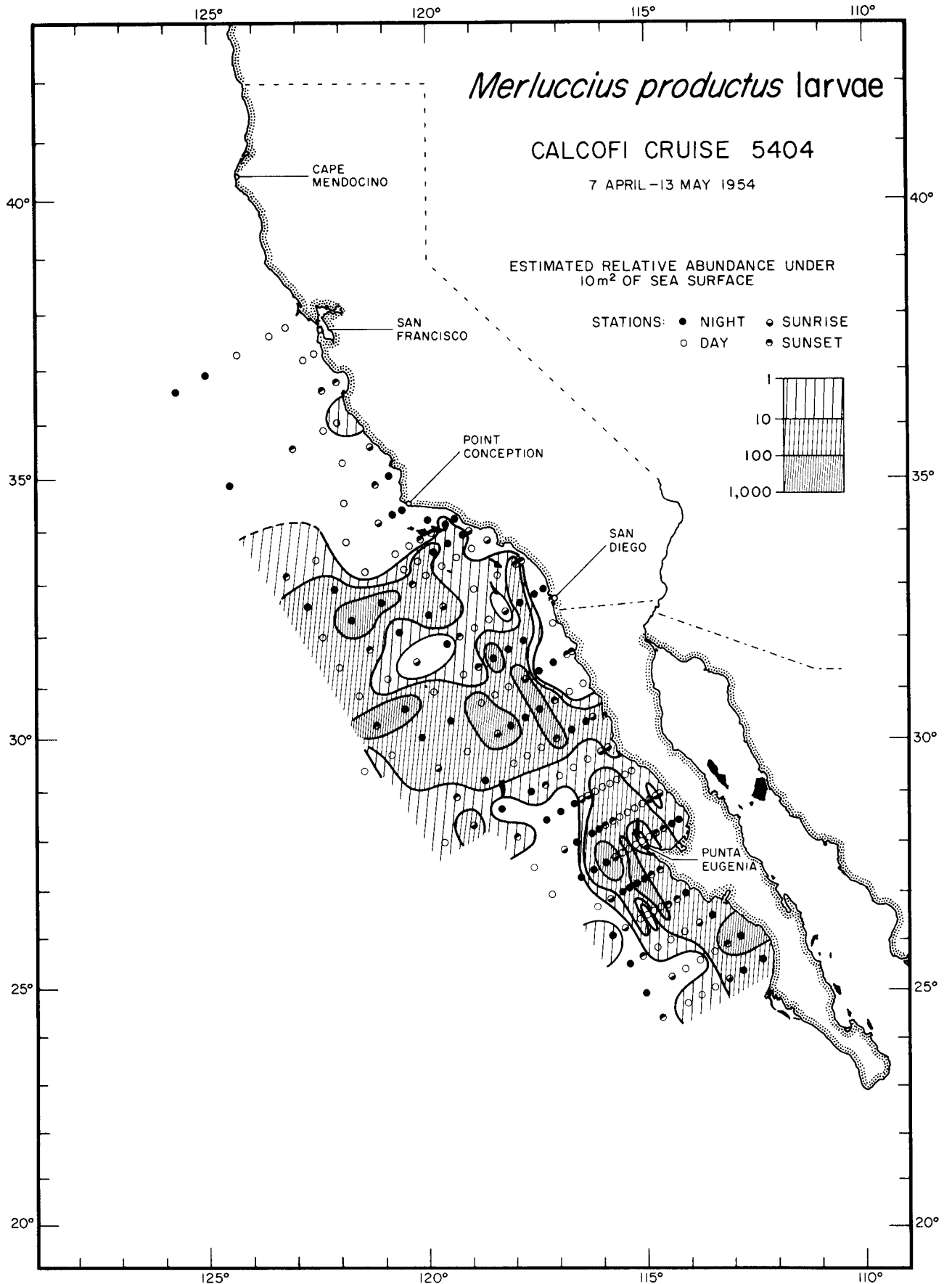
Merluccius productus larvae

5204



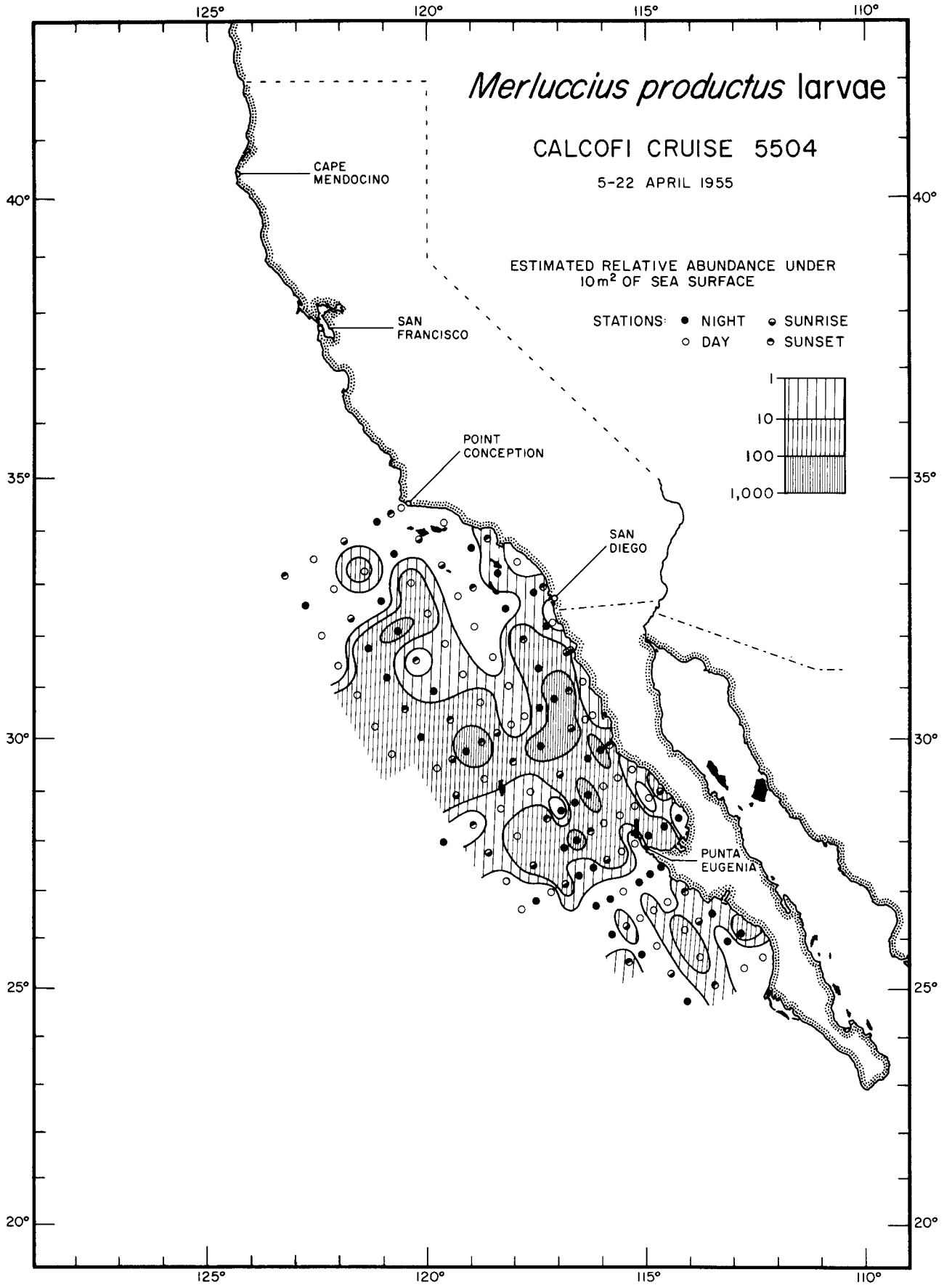
Merluccius productus larvae

5304



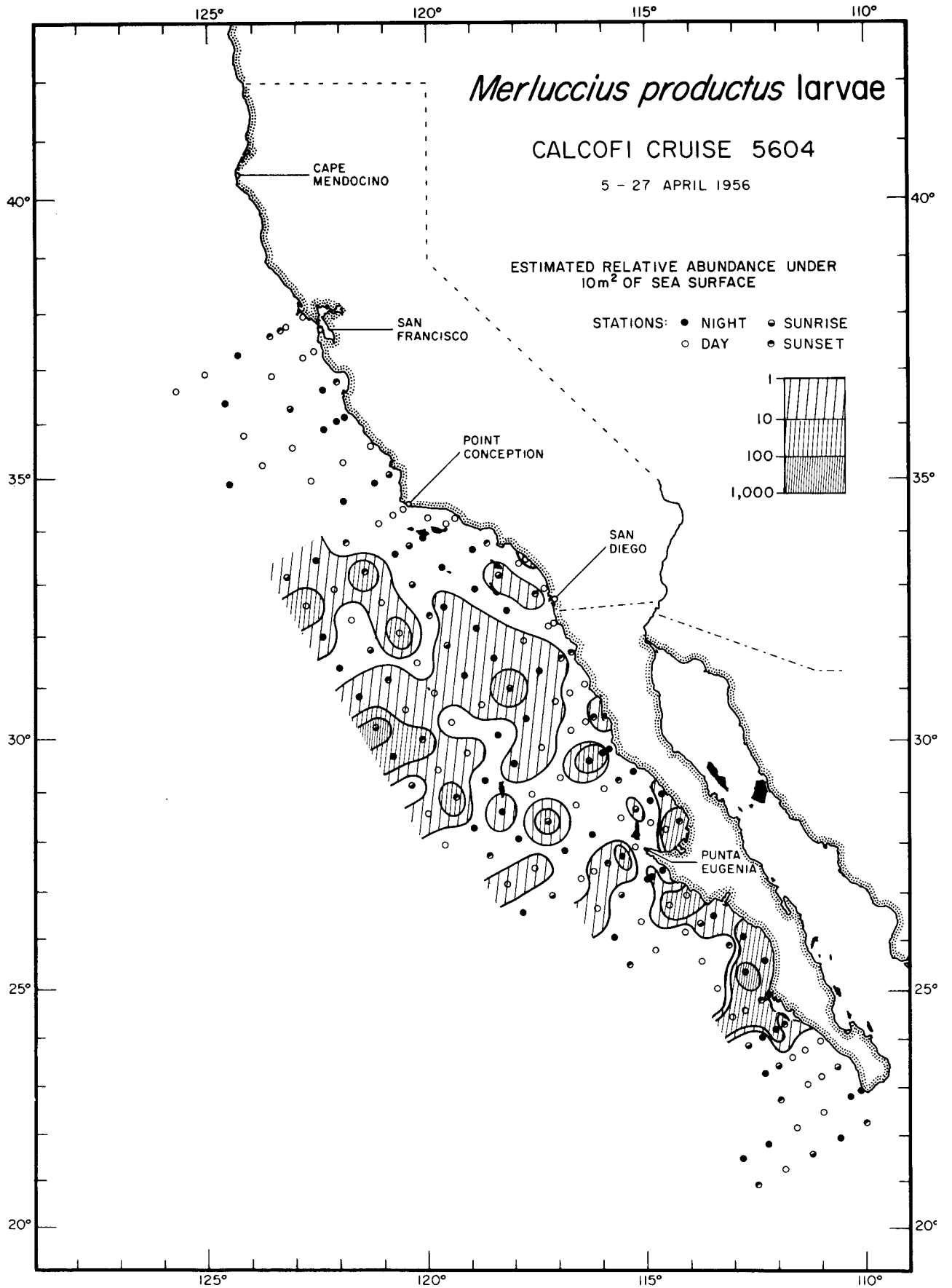
Merluccius productus larvae

5404



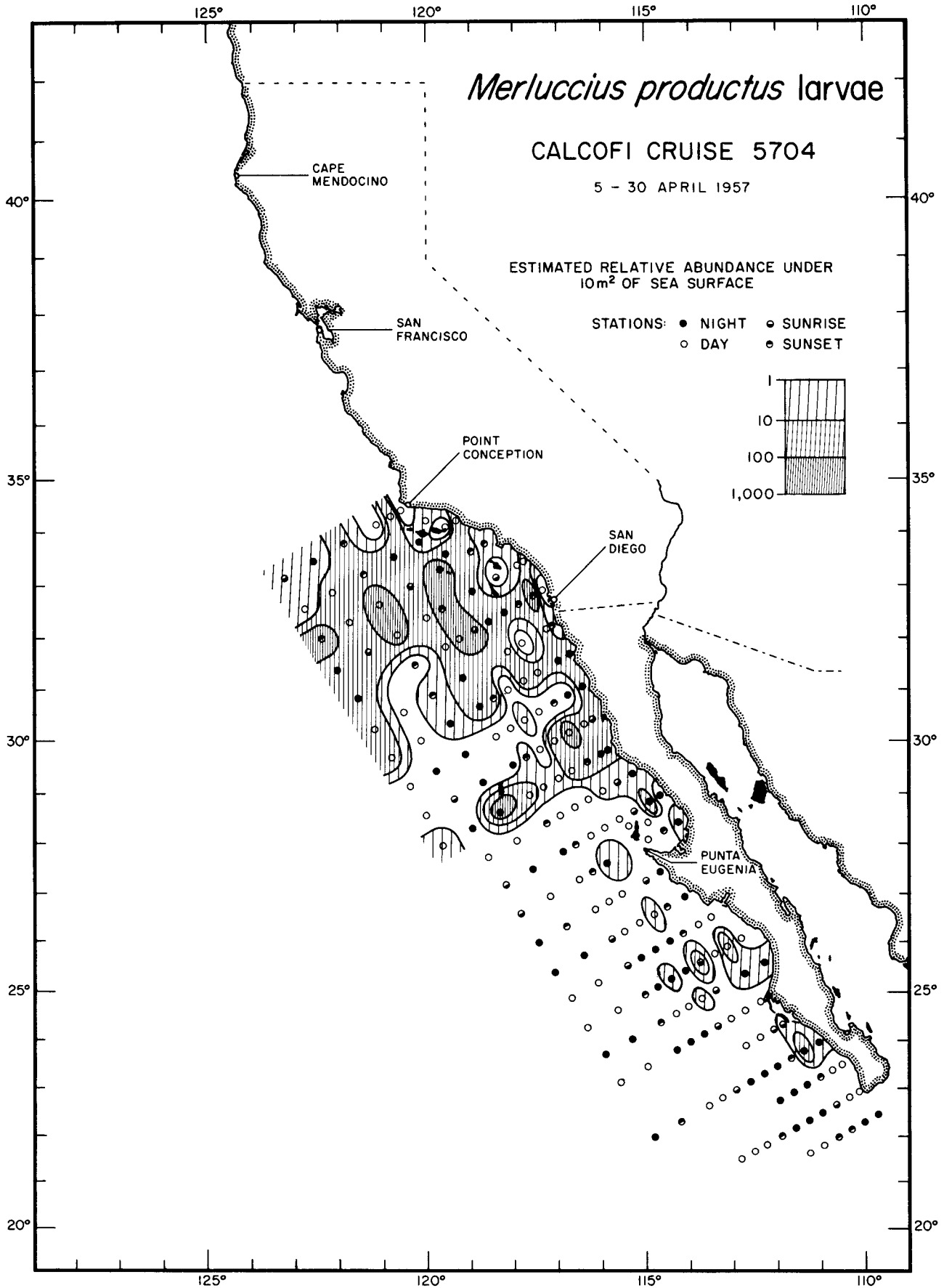
Merluccius productus larvae

5504



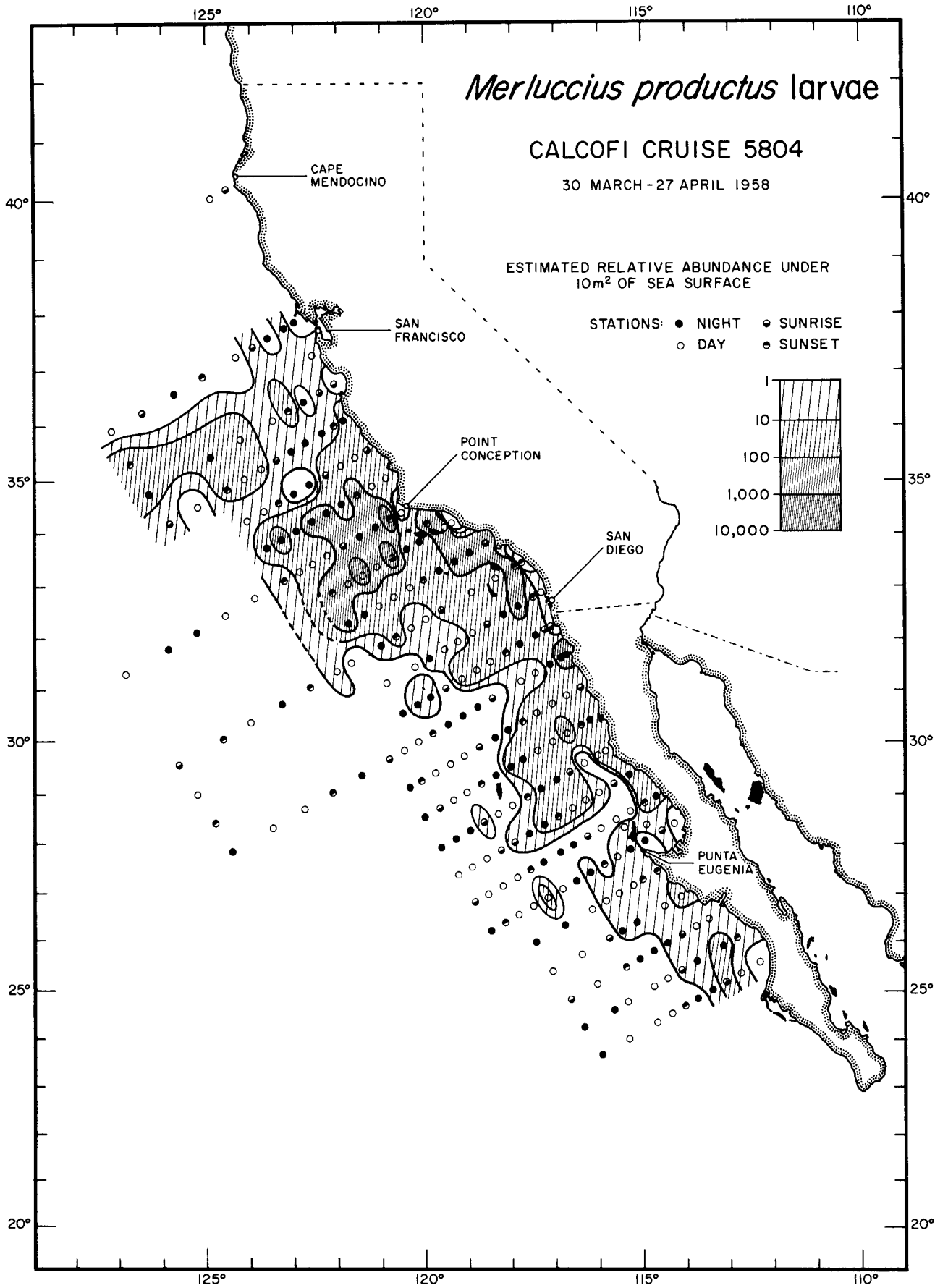
Merluccius productus larvae

5604



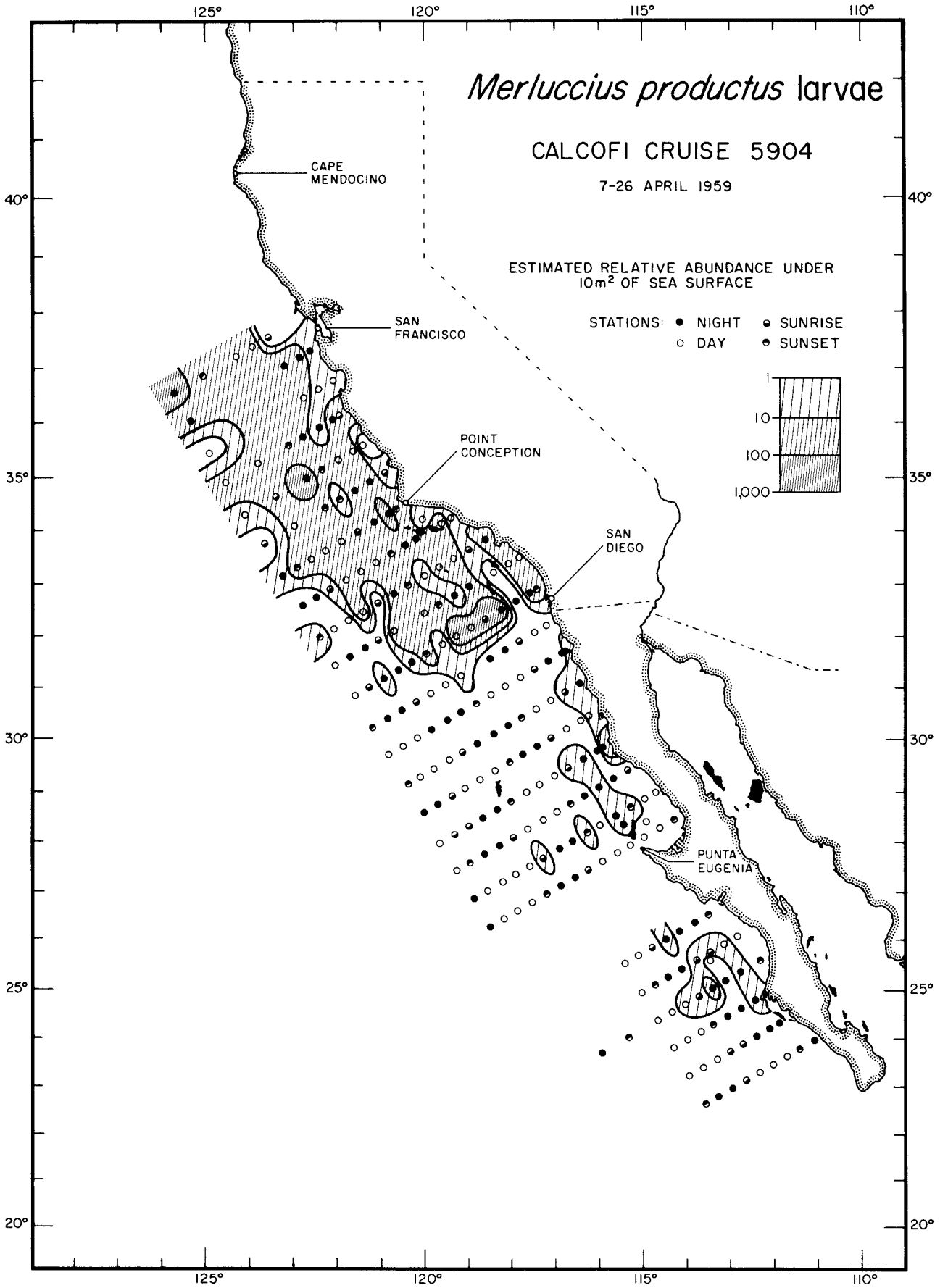
Merluccius productus larvae

5704



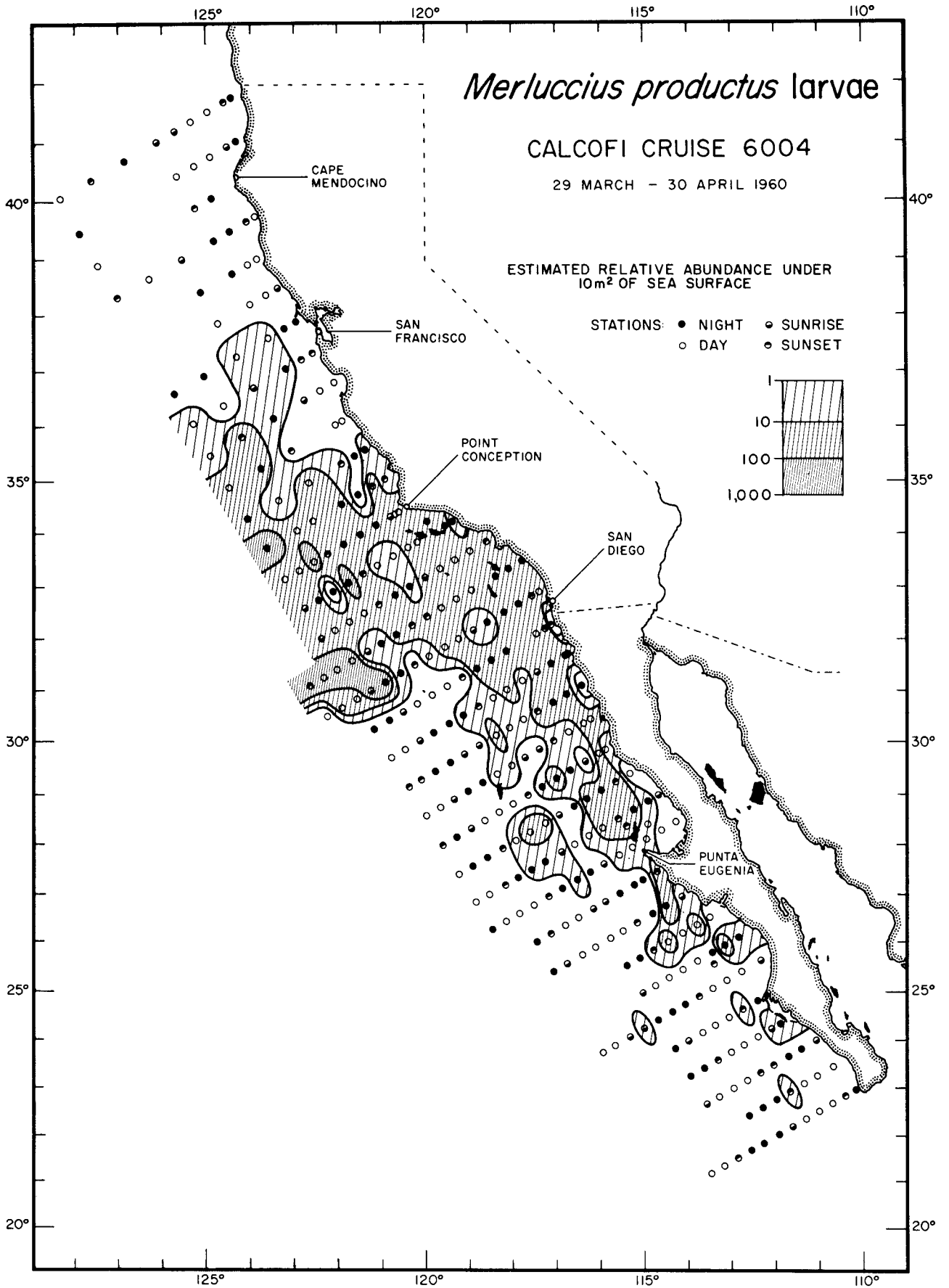
Merluccius productus larvae

5804



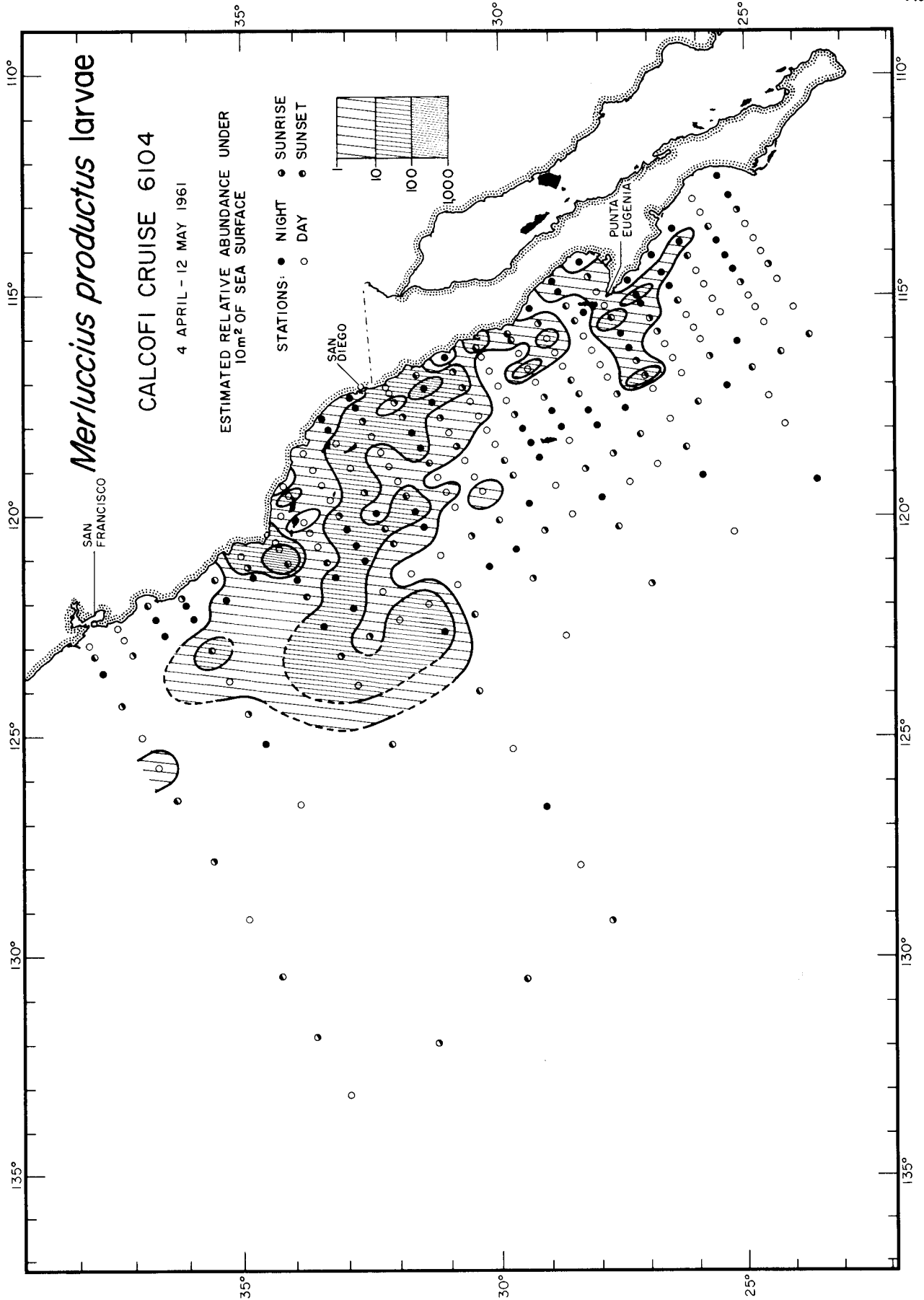
Merluccius productus larvae

5904



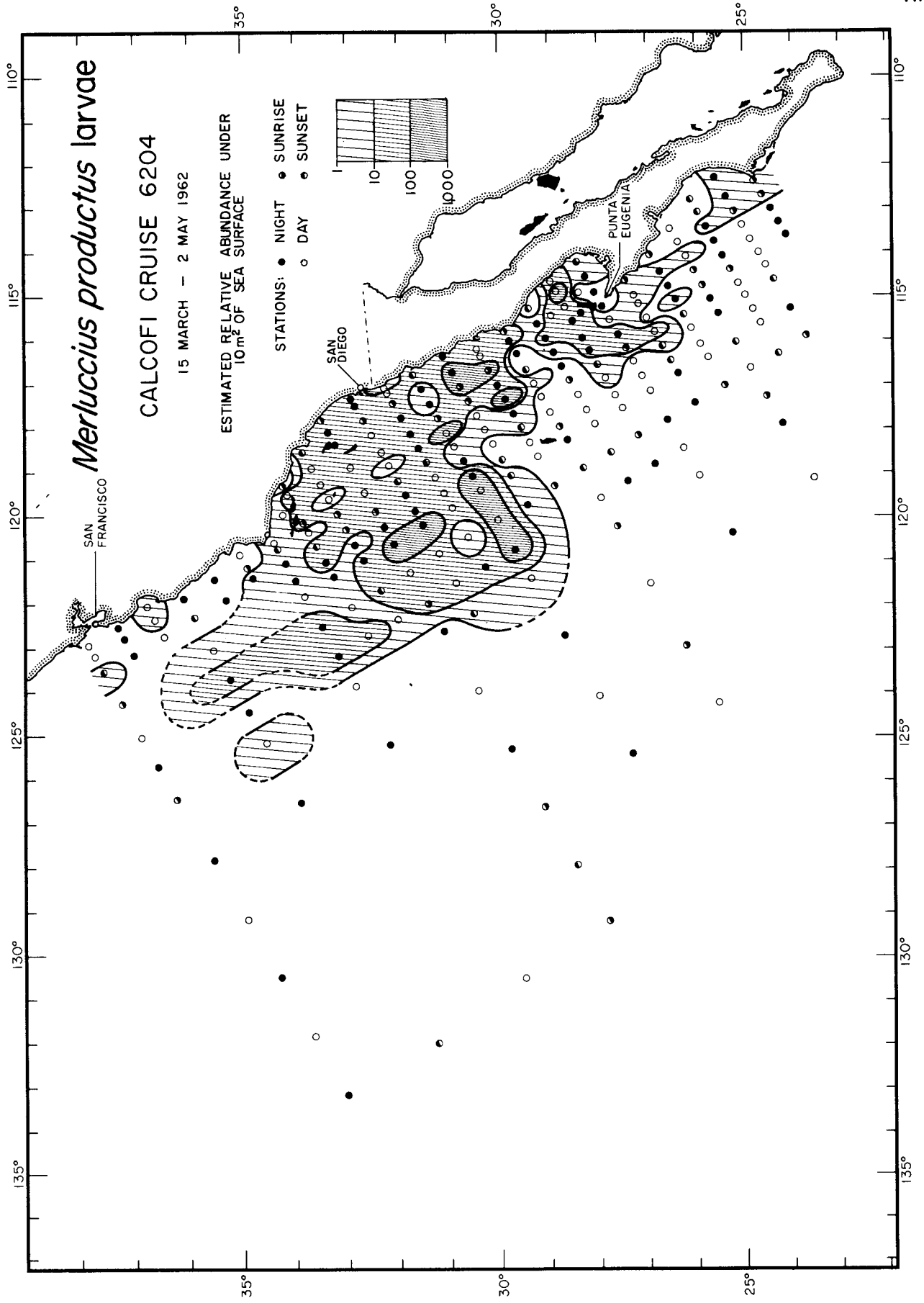
Merluccius productus larvae

6004

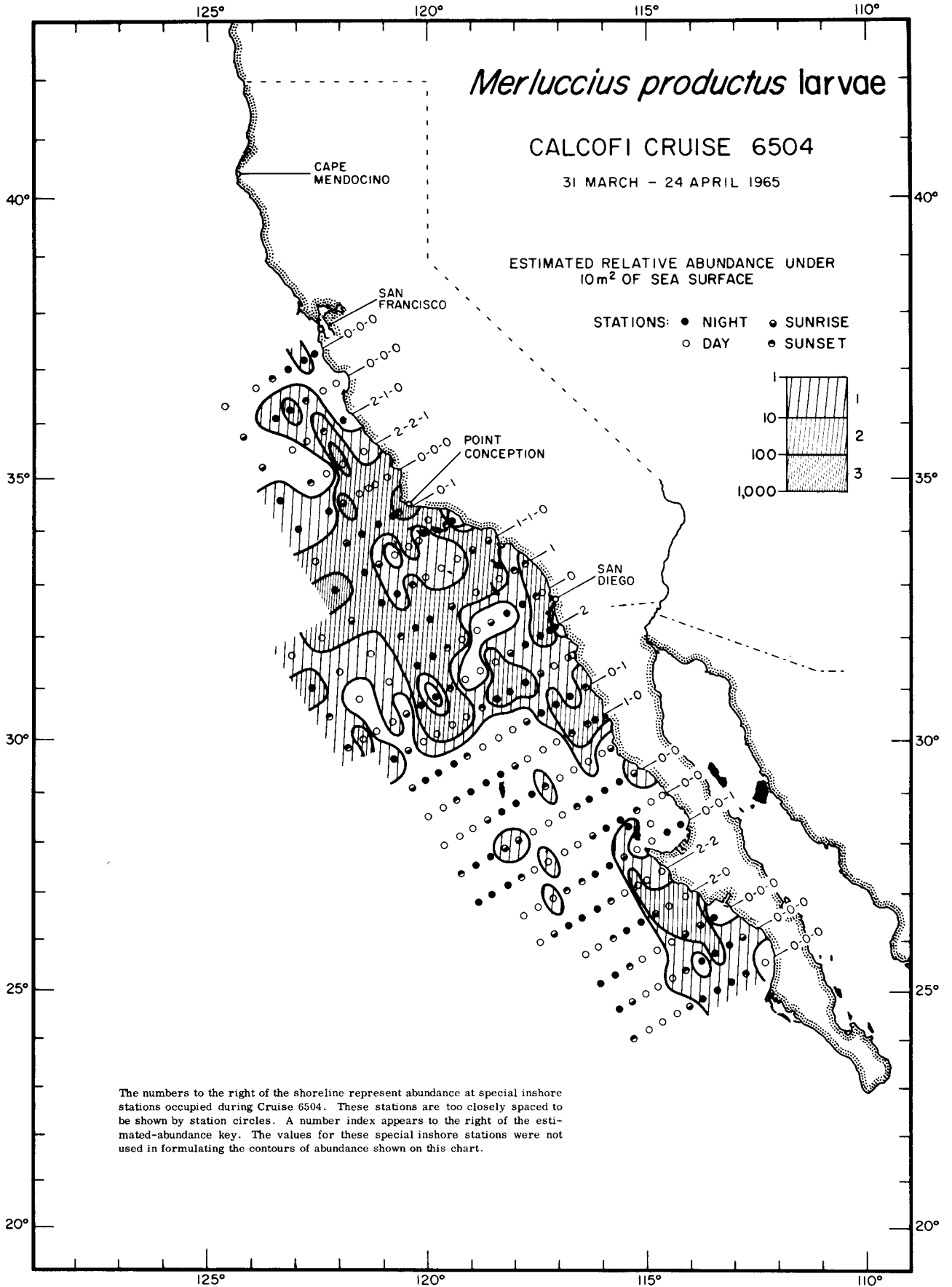


Merluccius productus larvae

6104

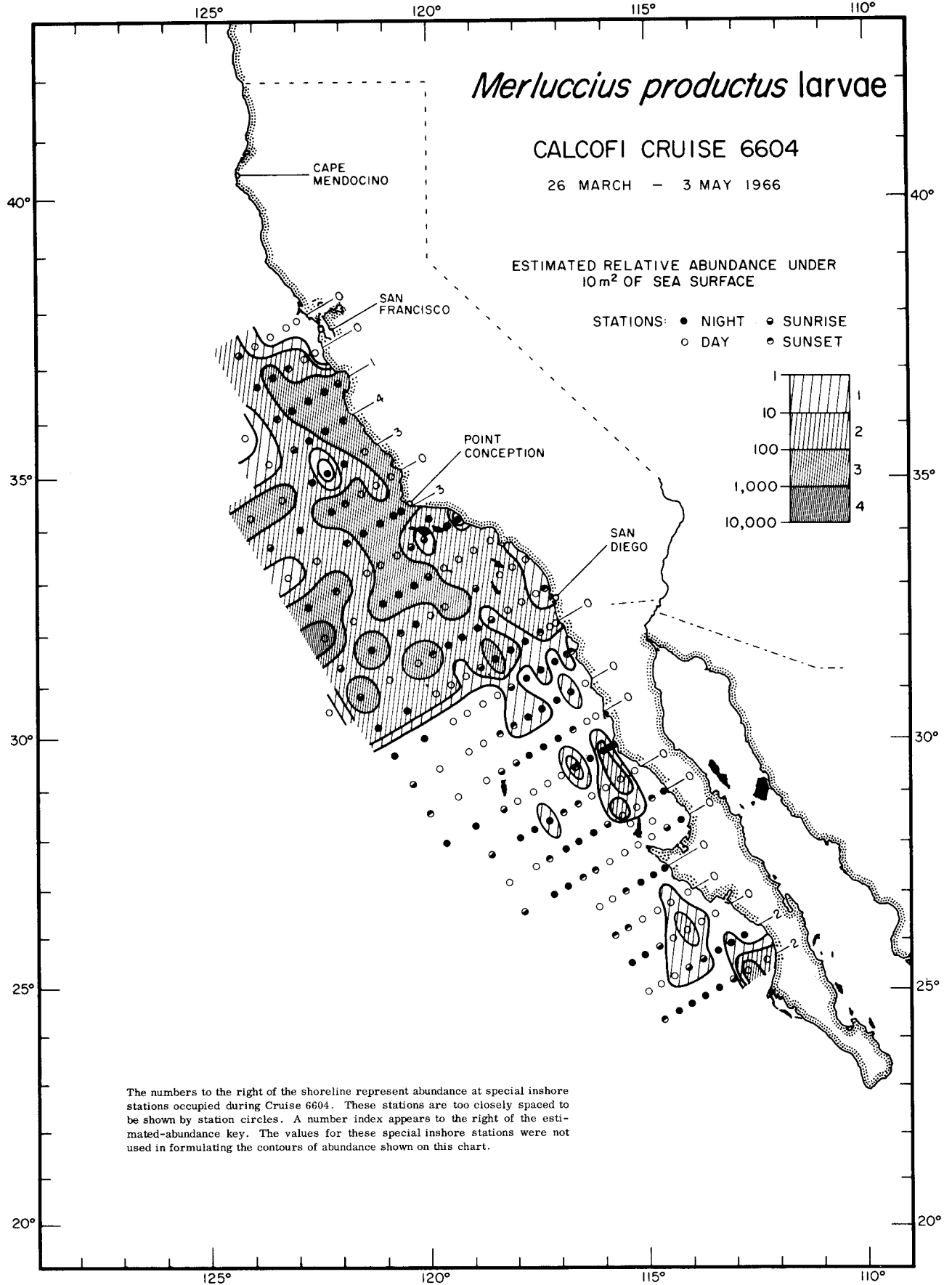


Merluccius productus larvae



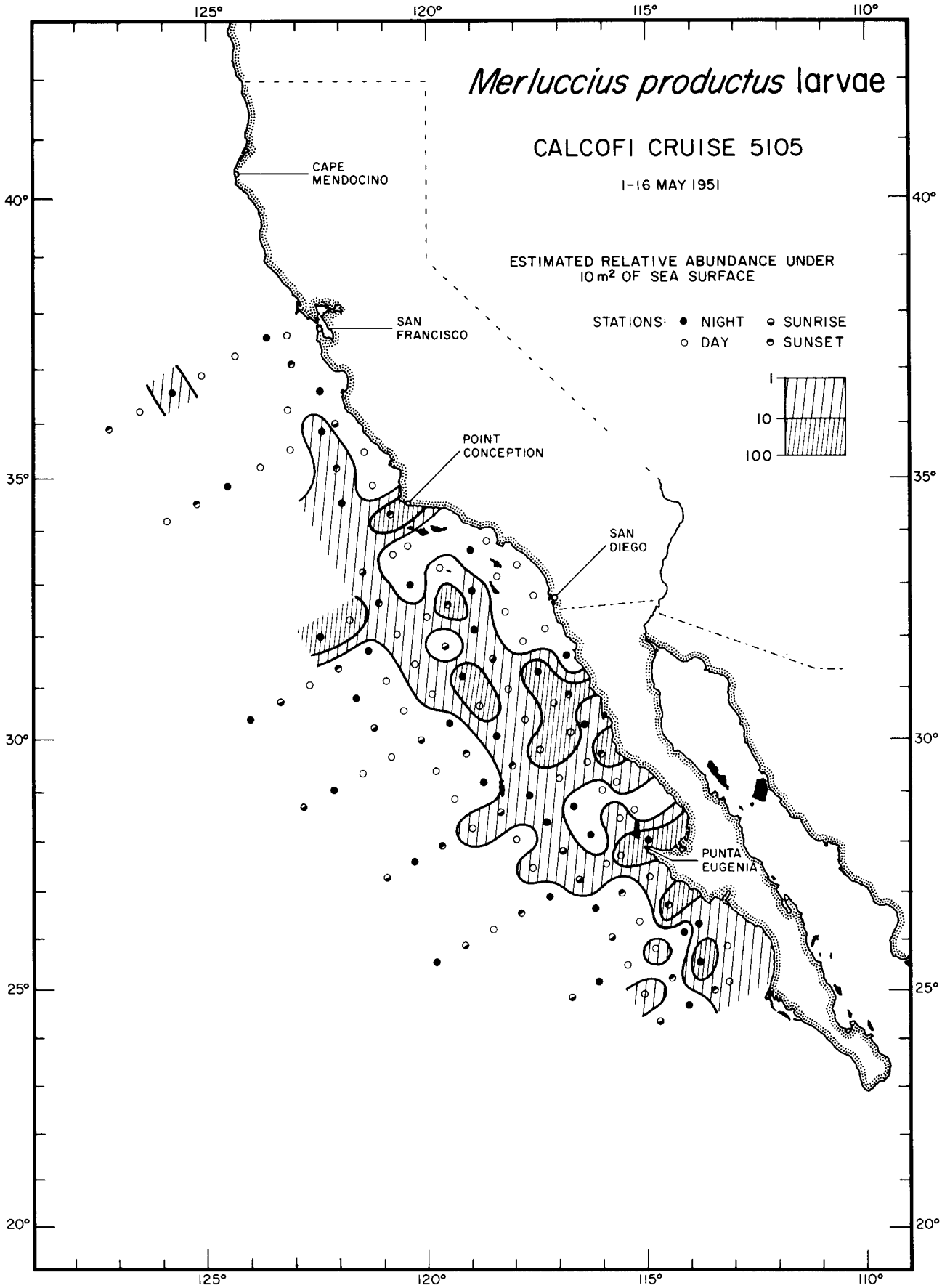
Merluccius productus larvae

6504



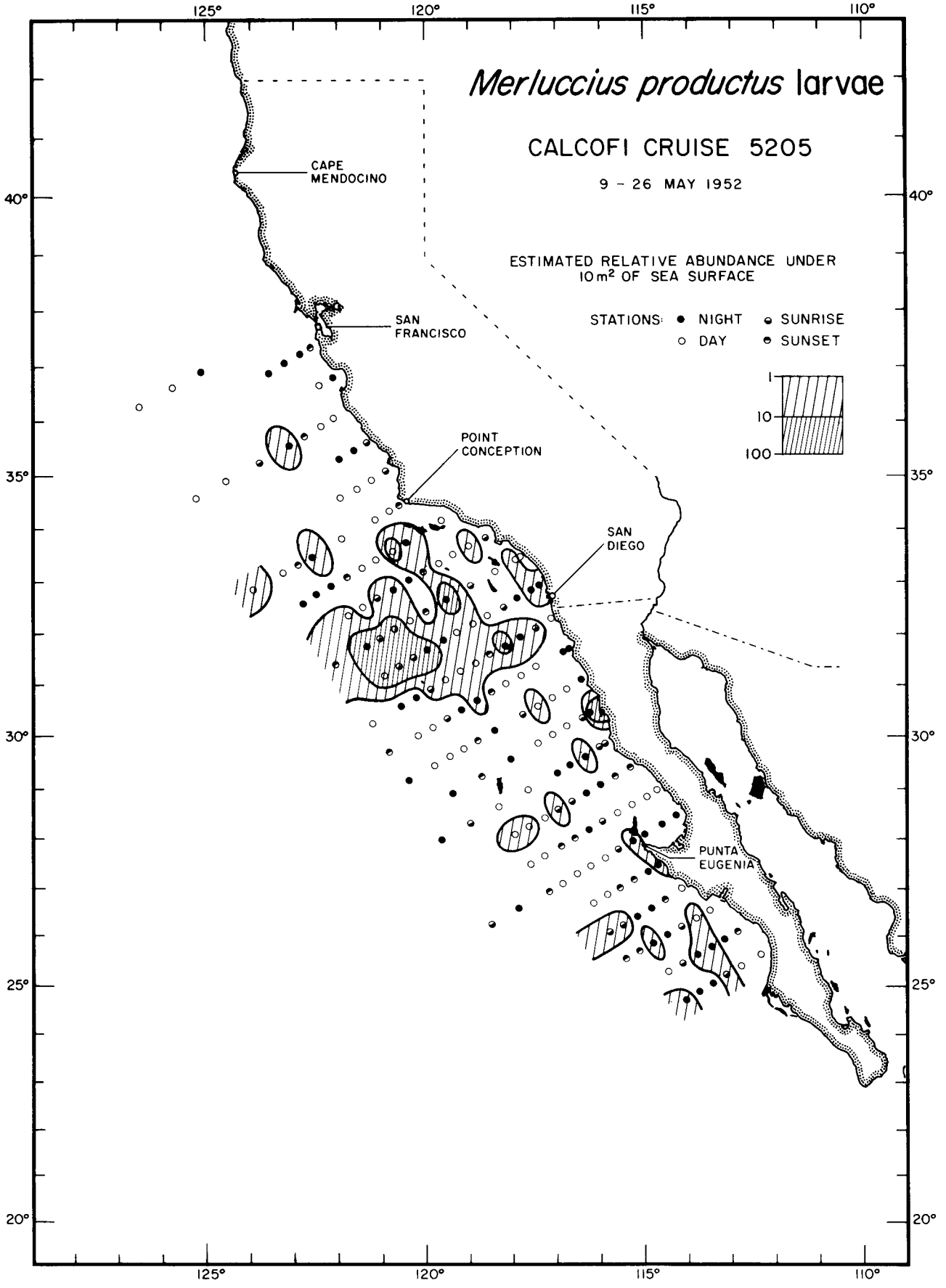
Merluccius productus larvae

6604



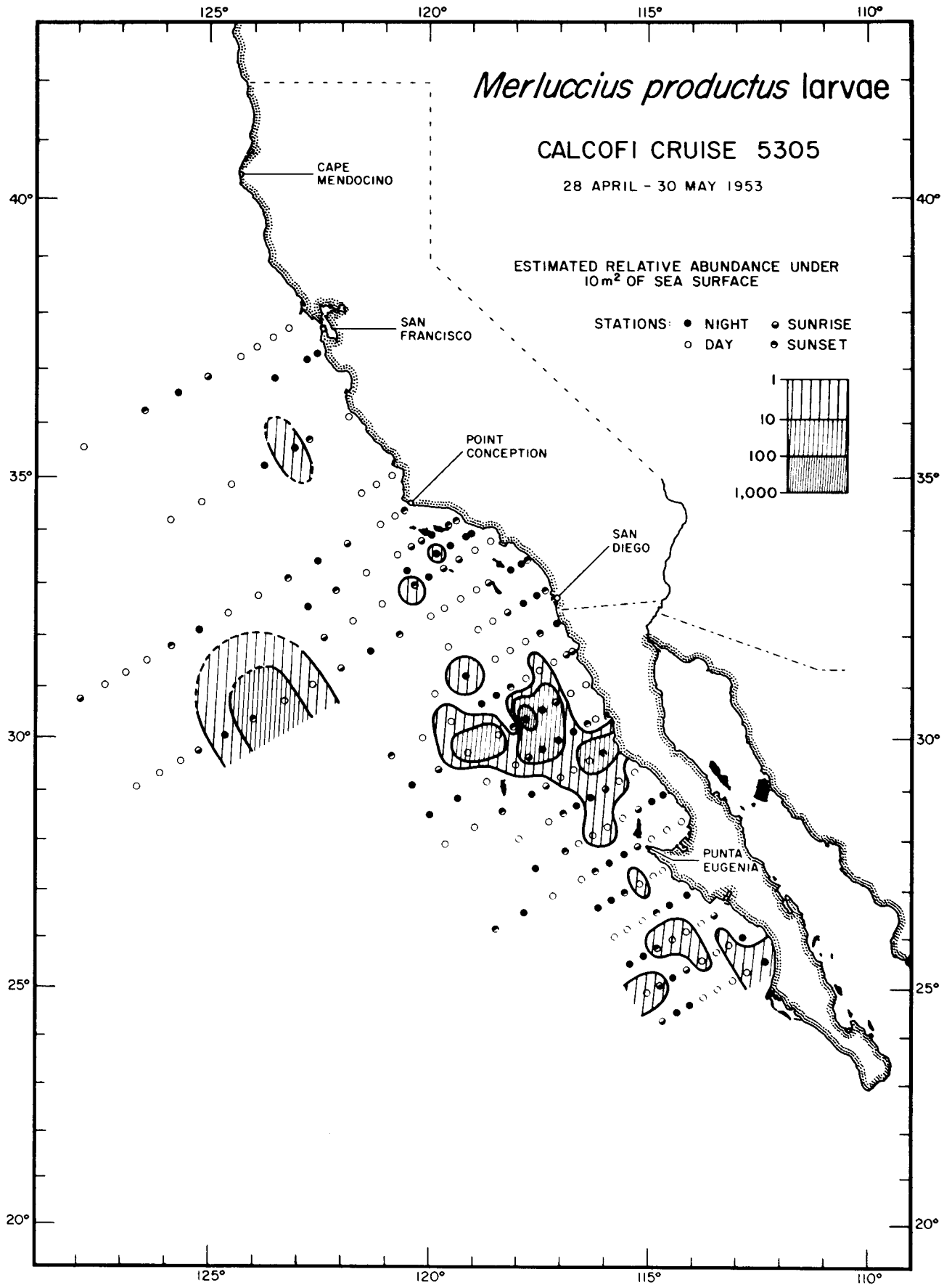
Merluccius productus larvae

5105



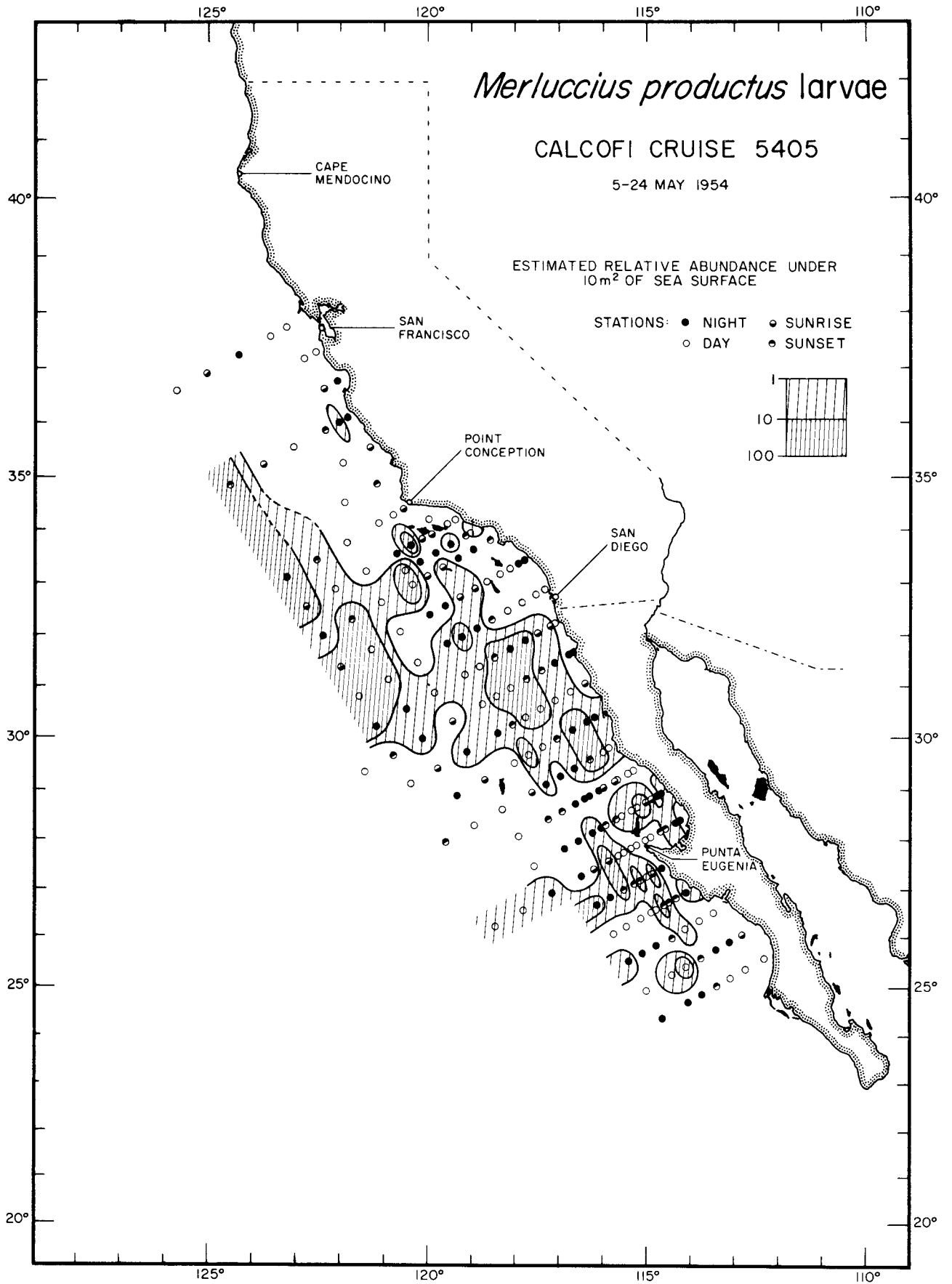
Merluccius productus larvae

5205



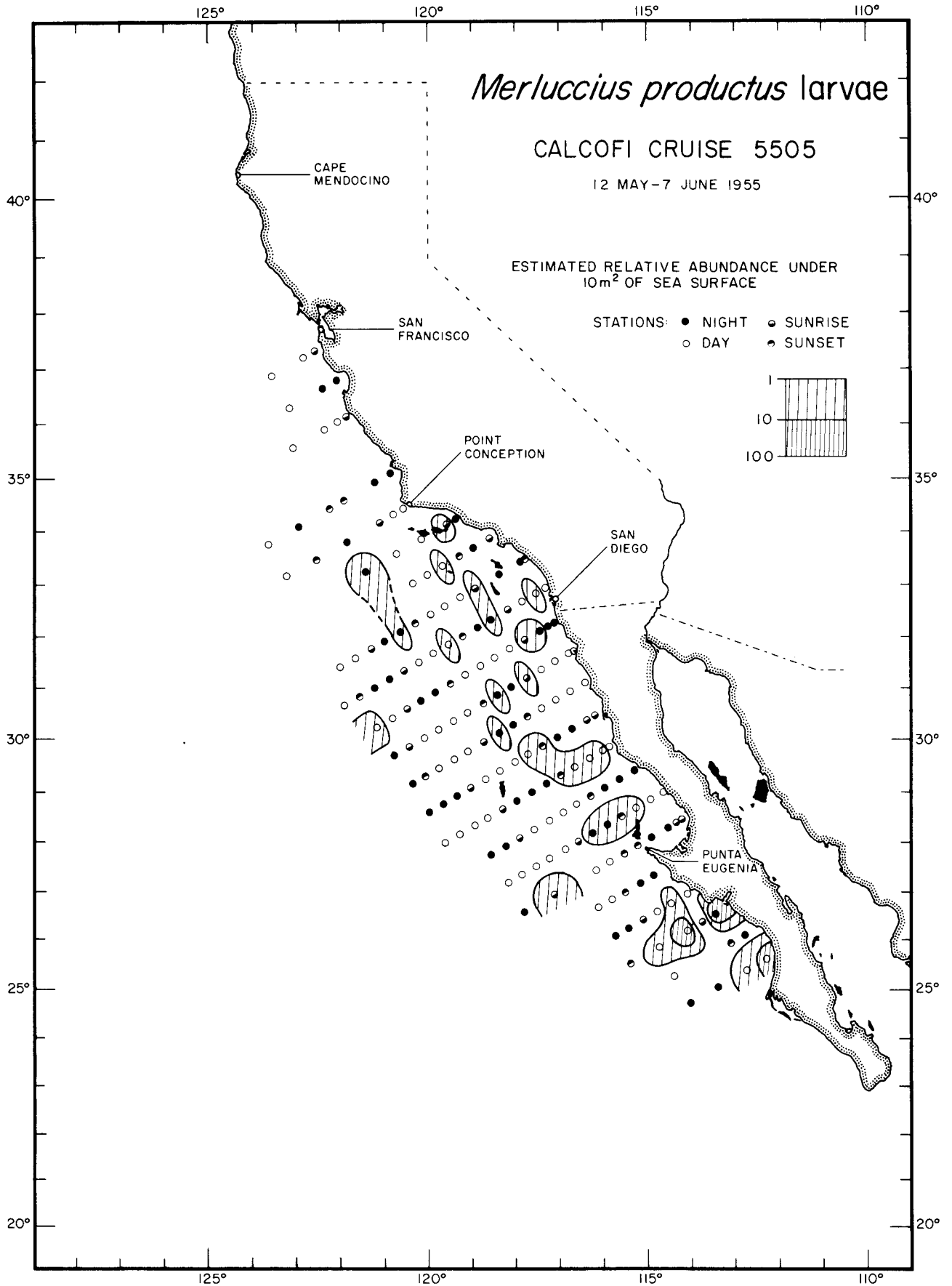
Merluccius productus larvae

5305



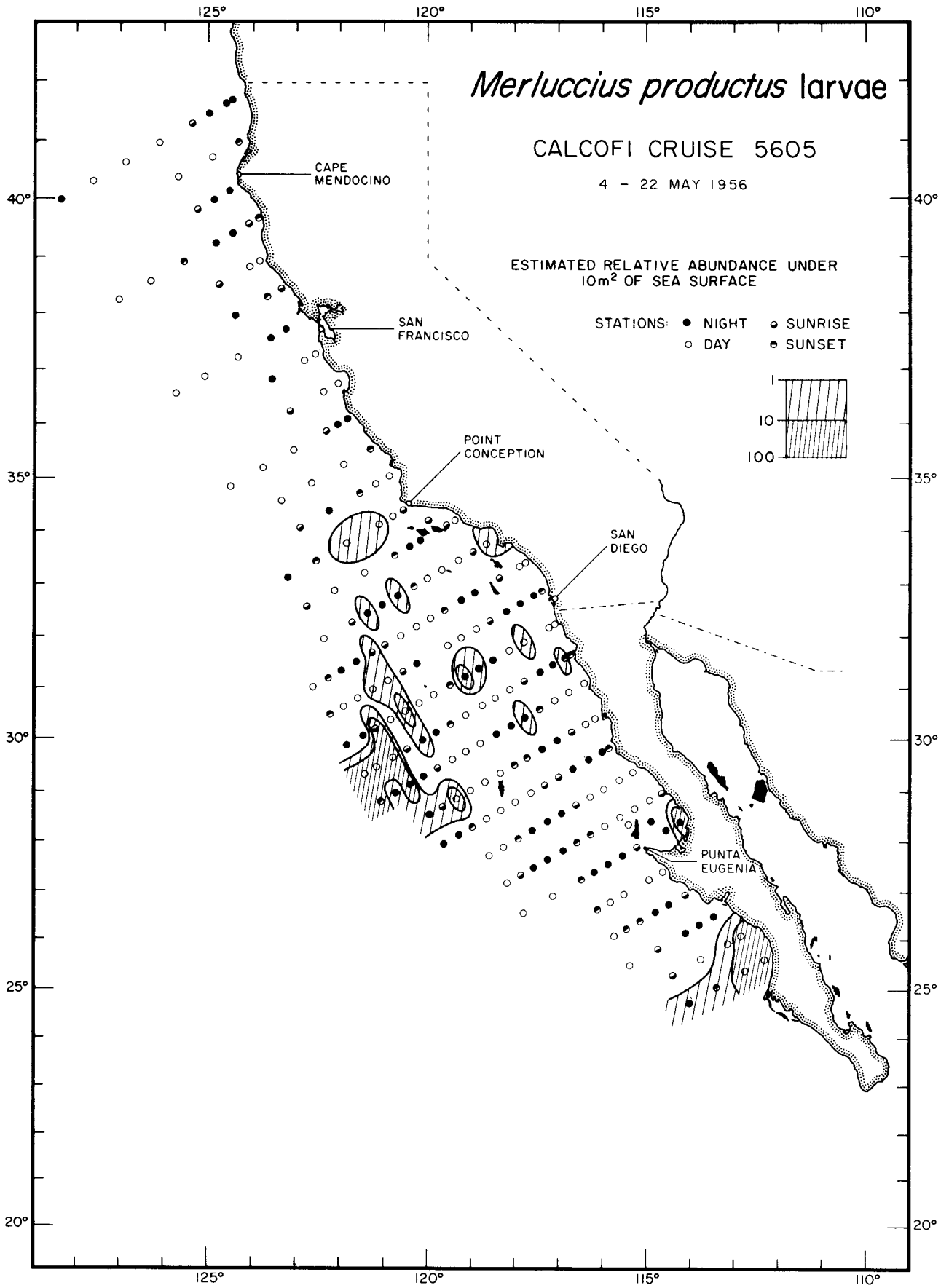
Merluccius productus larvae

5405



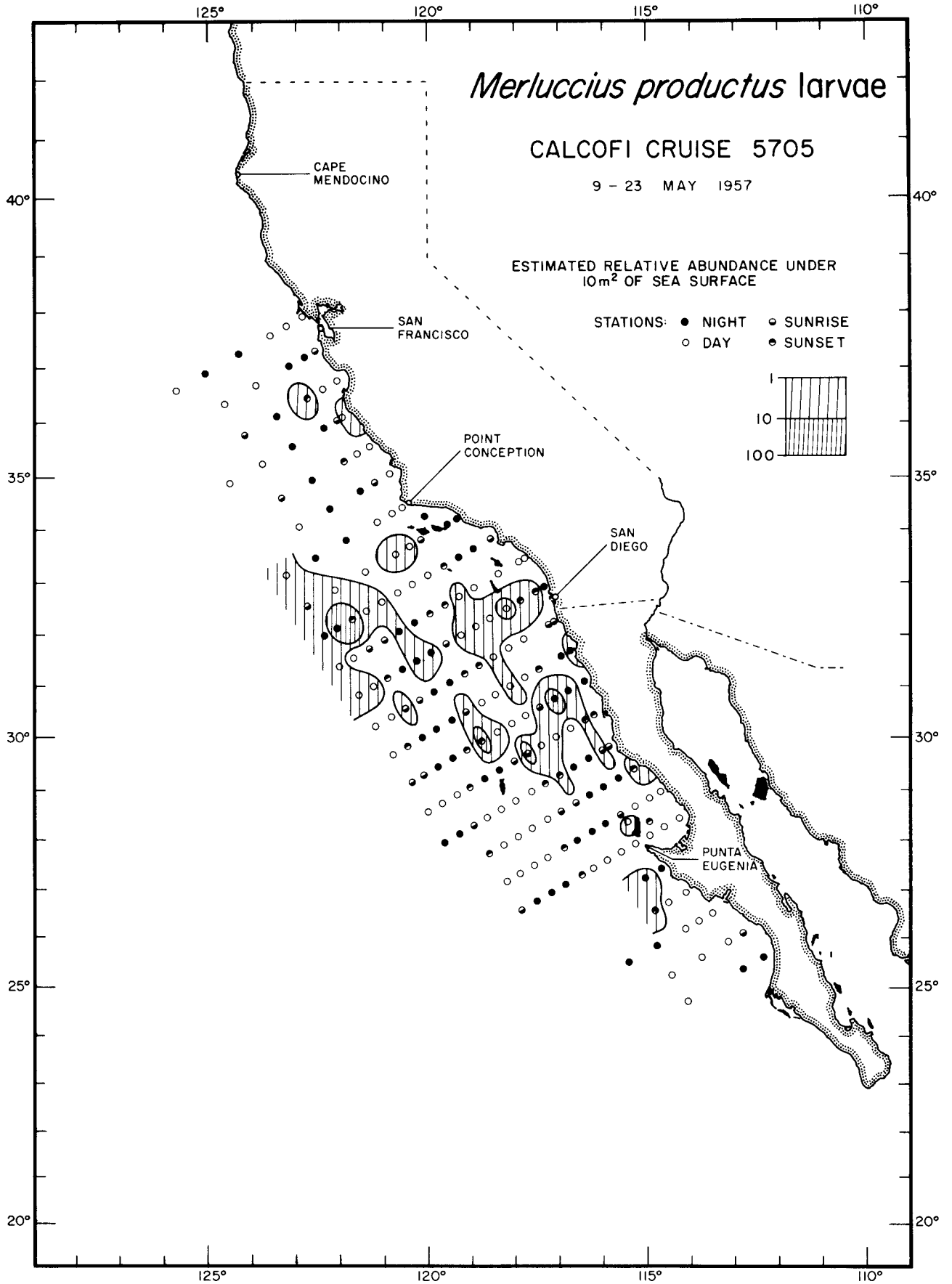
Merluccius productus larvae

5505



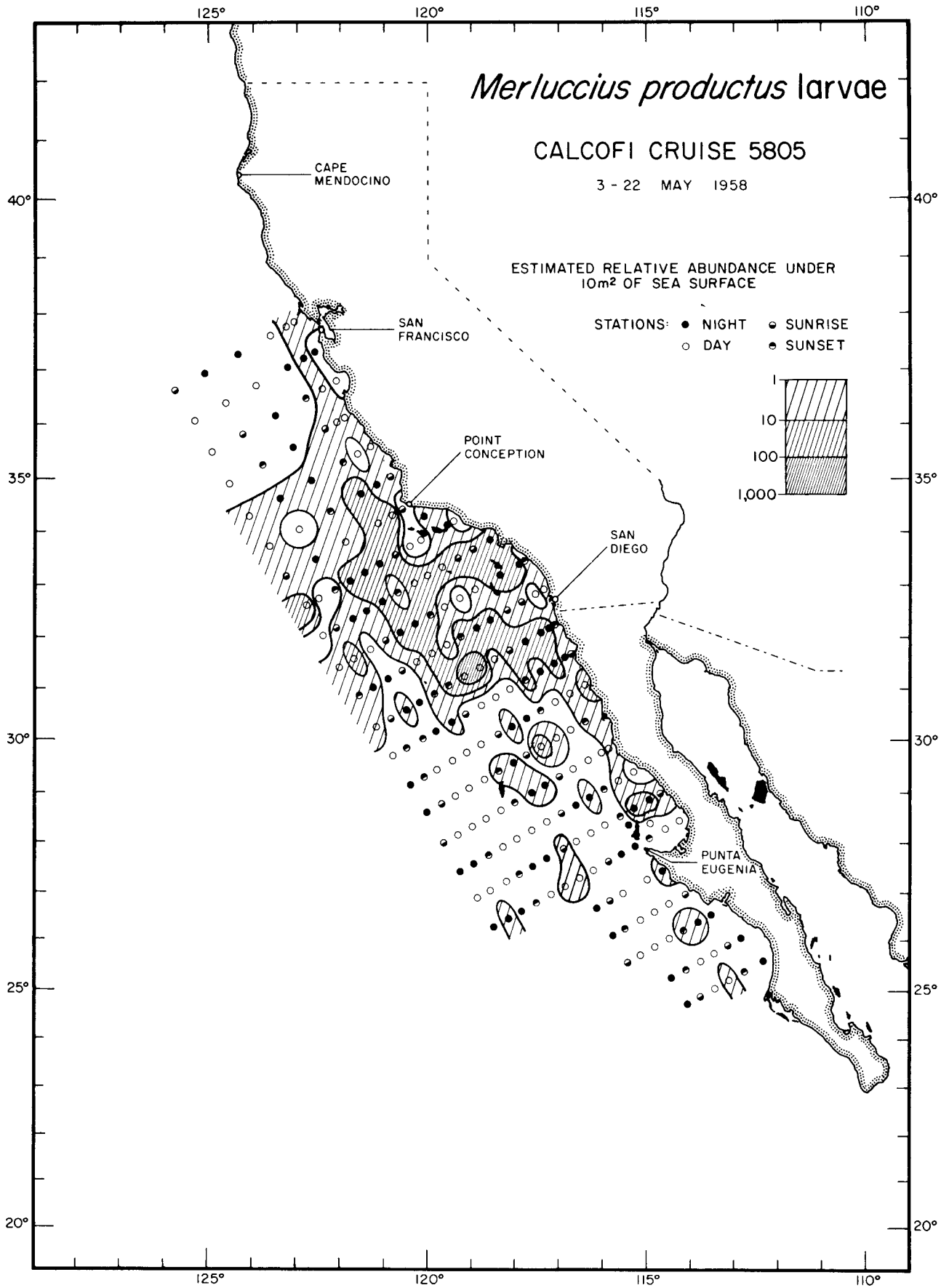
Merluccius productus larvae

5605



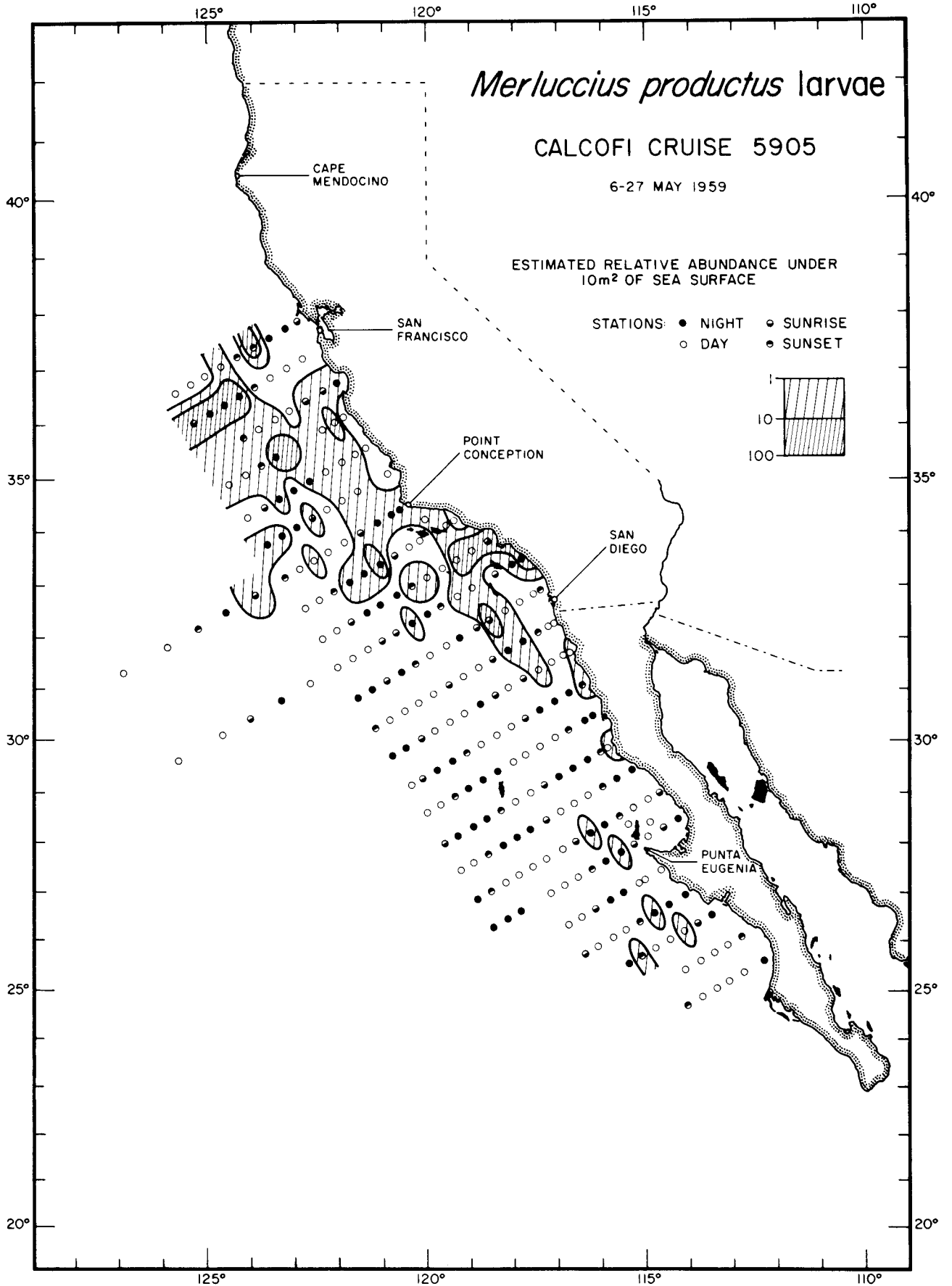
Merluccius productus larvae

5705



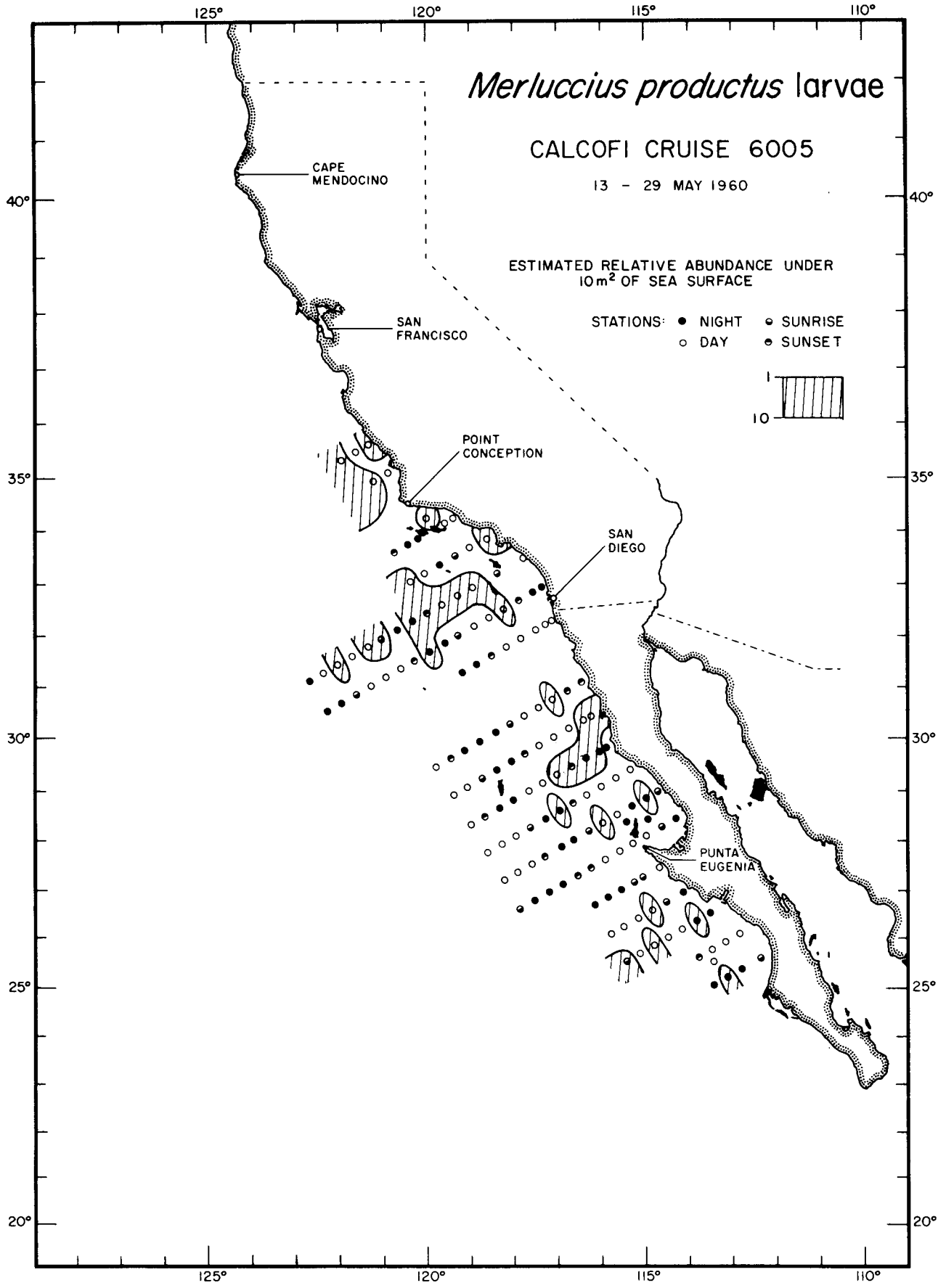
Merluccius productus larvae

5805



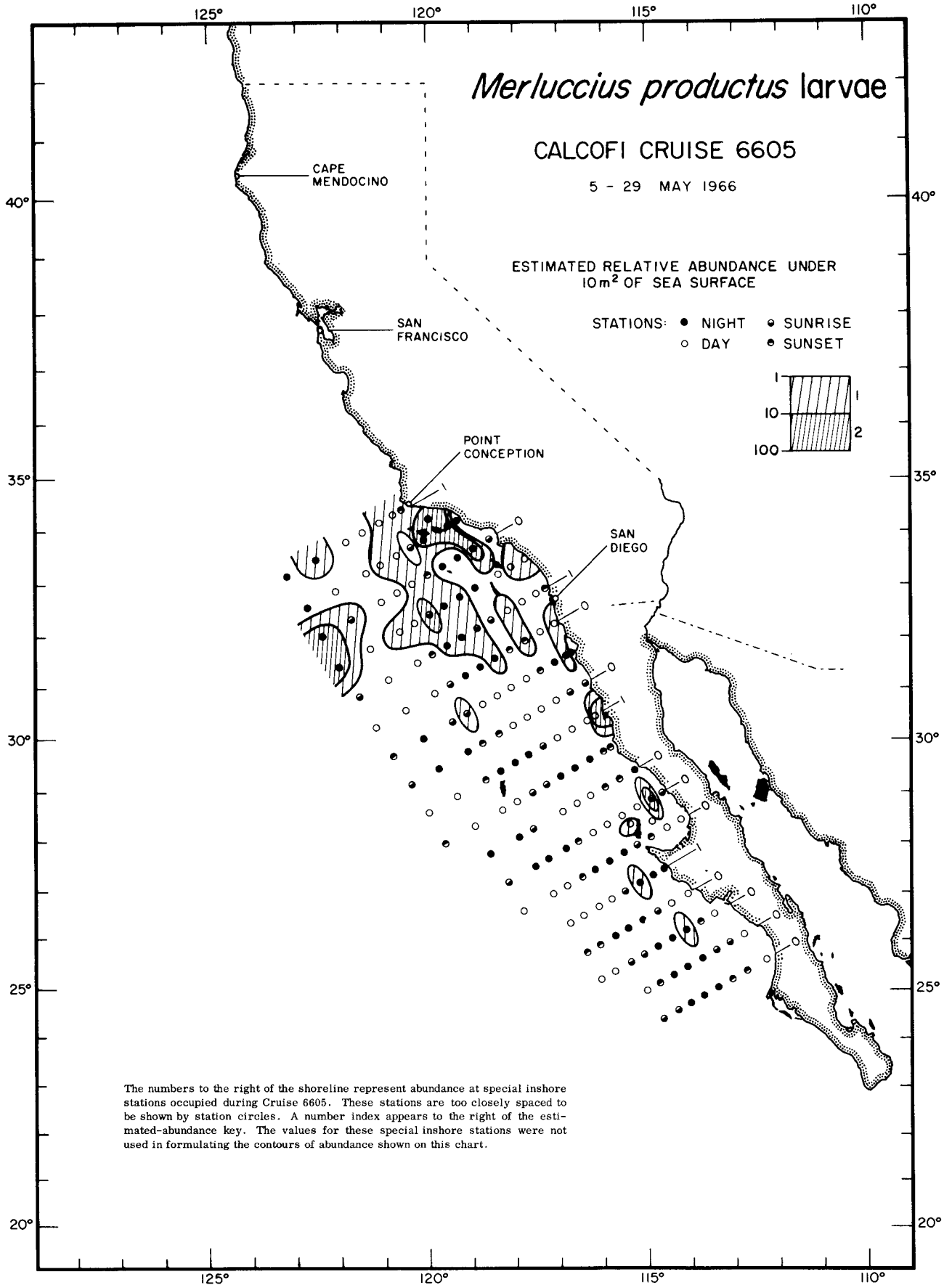
Merluccius productus larvae

5905



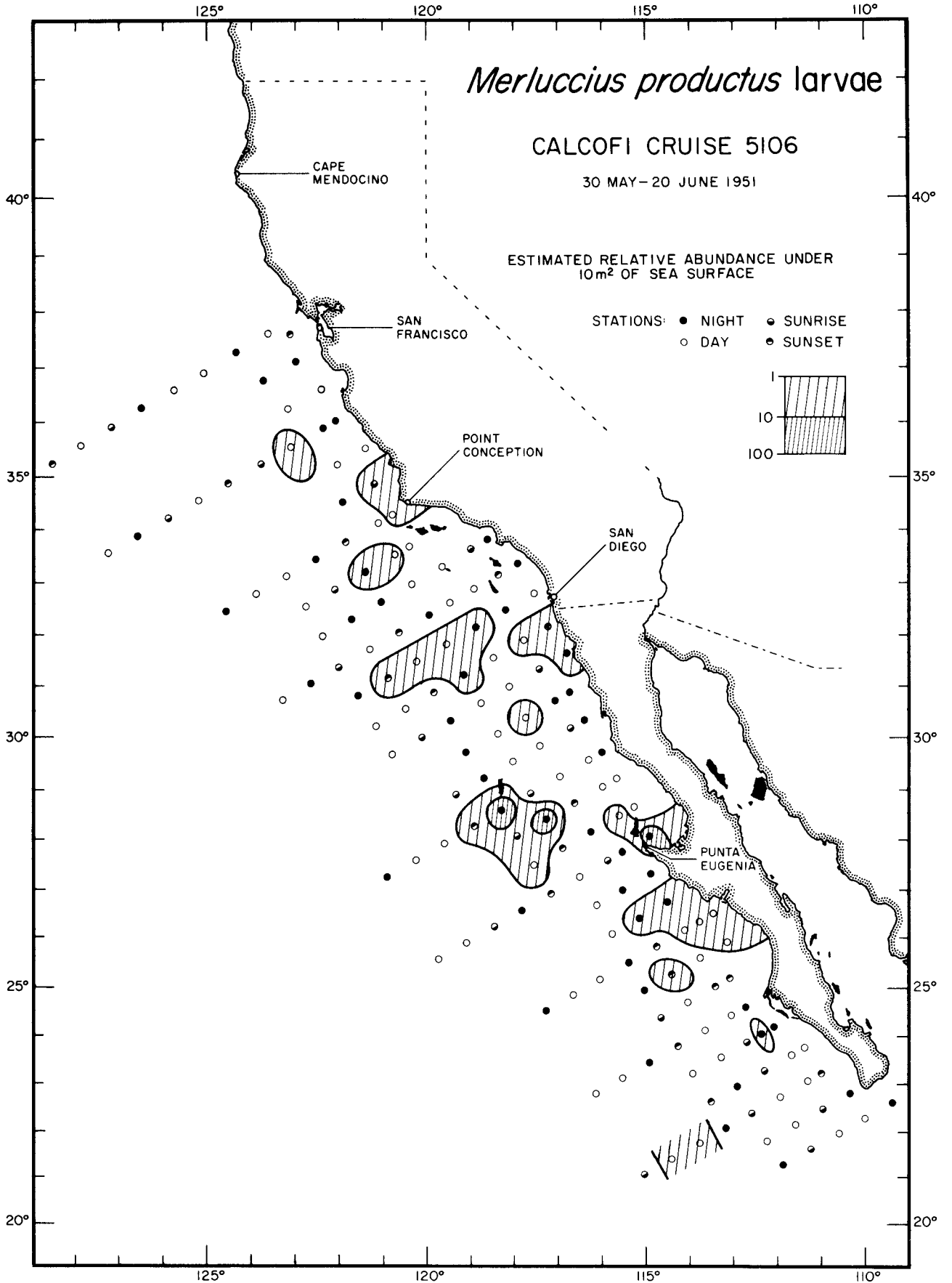
Merluccius productus larvae

6005



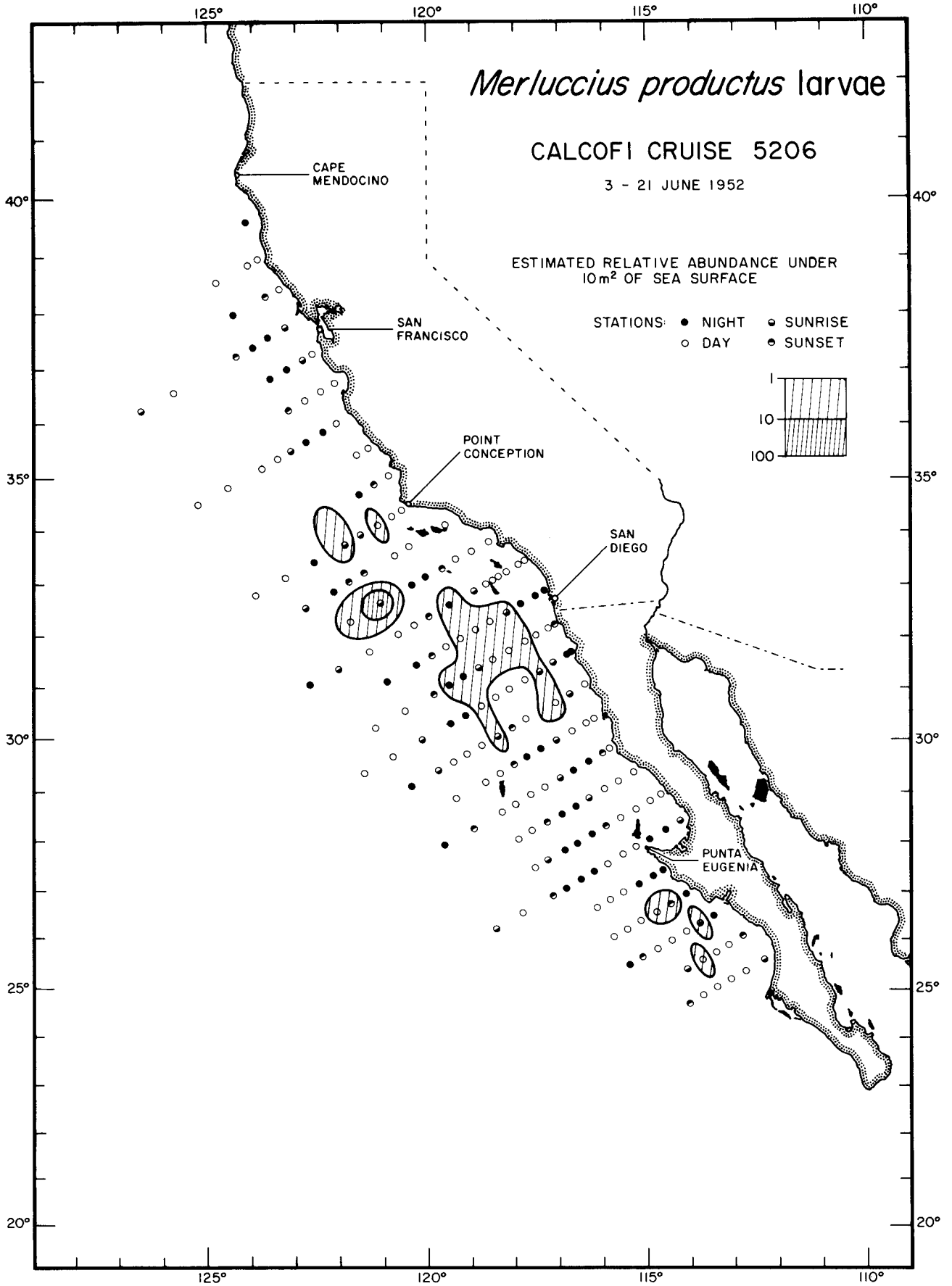
Merluccius productus larvae

6605



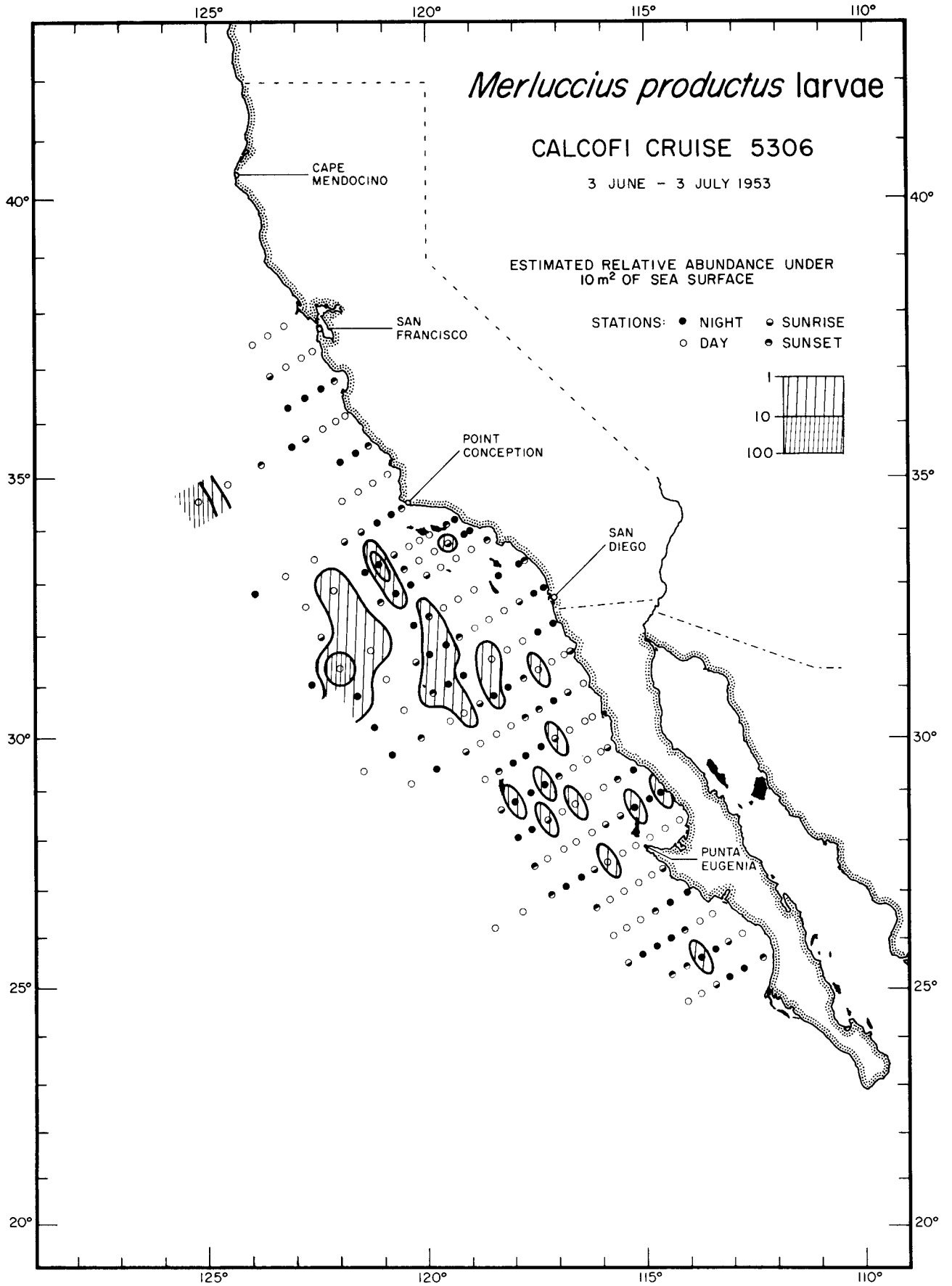
Merluccius productus larvae

5106



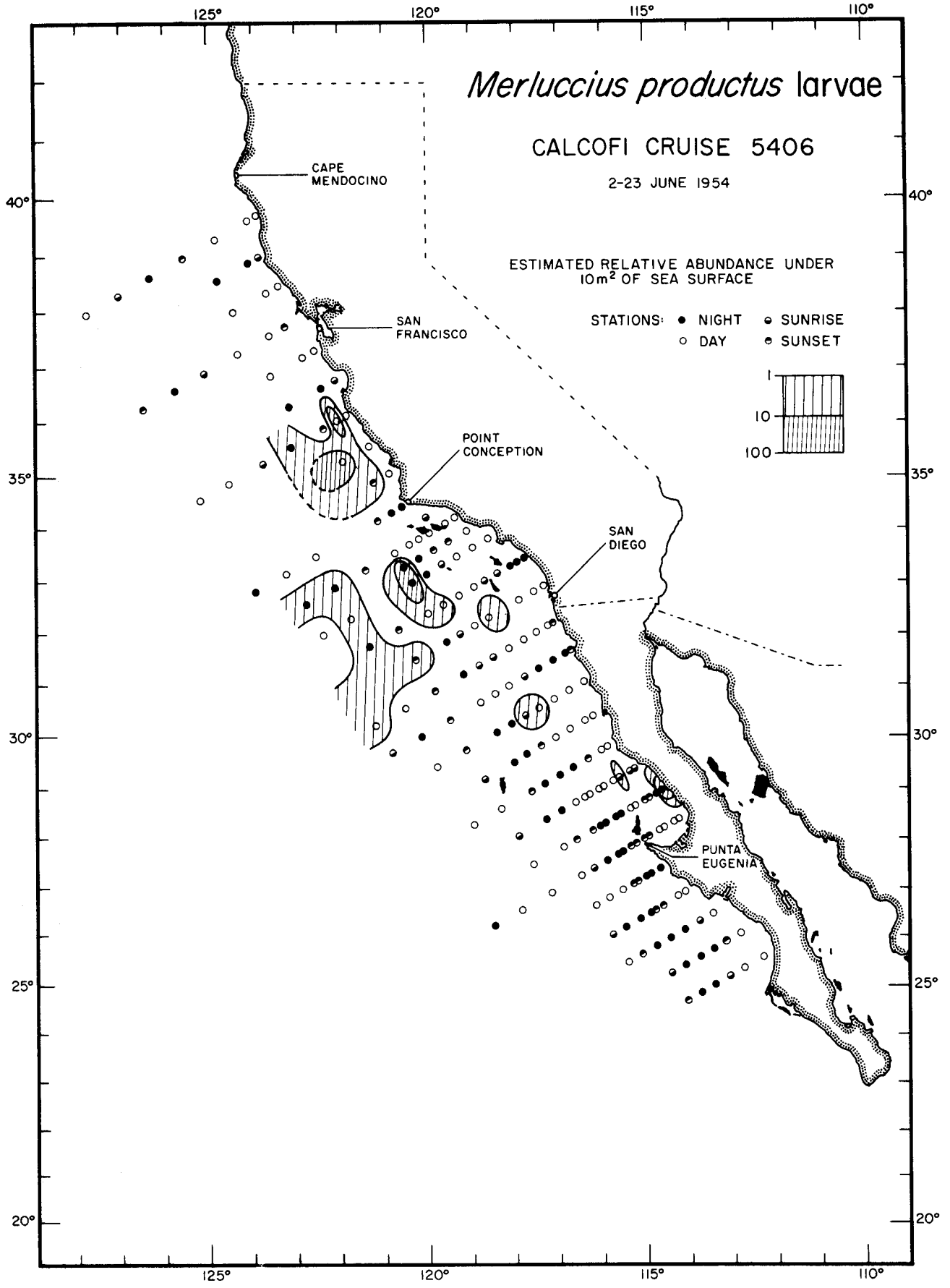
Merluccius productus larvae

5206



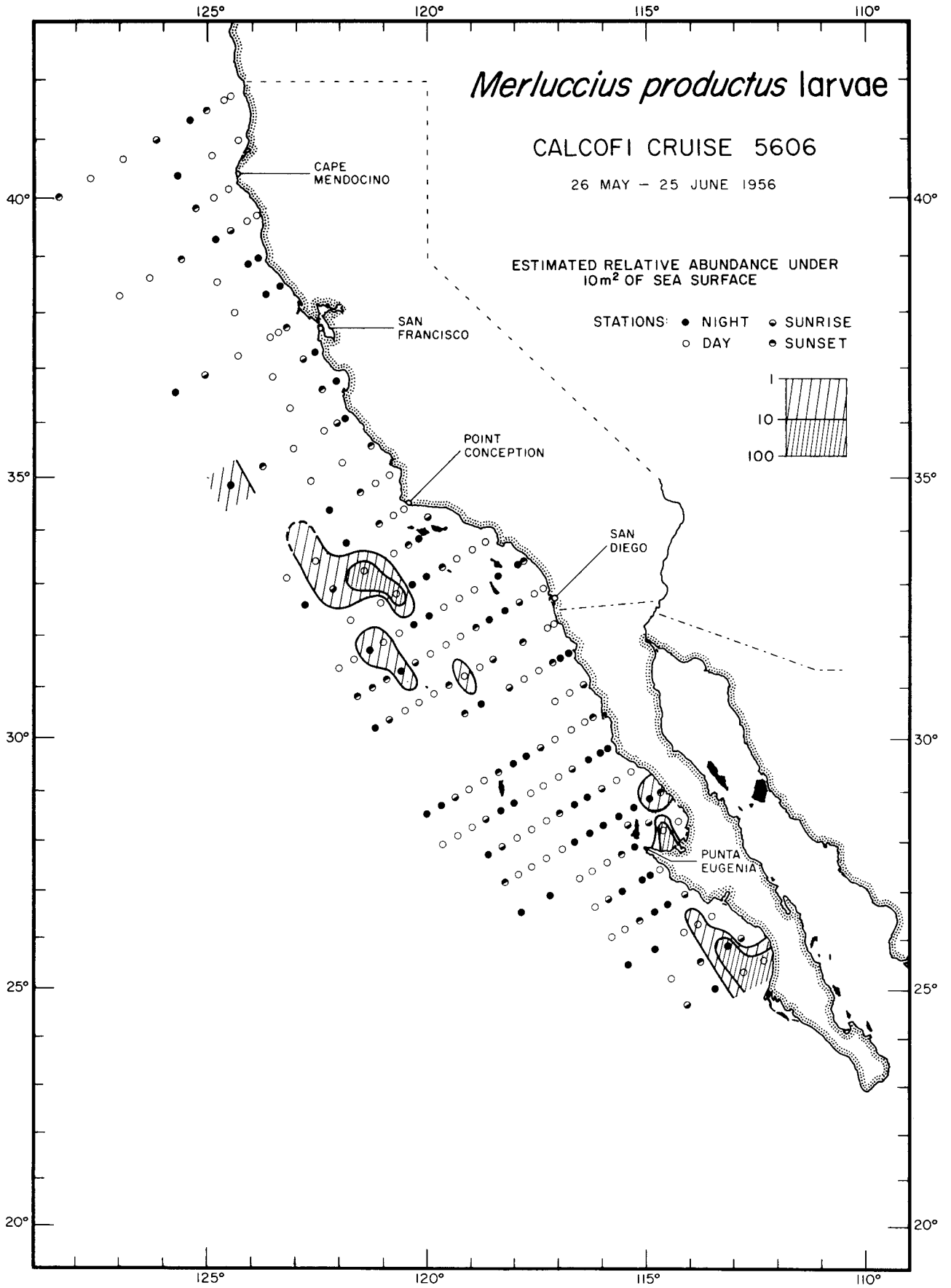
Merluccius productus larvae

5306



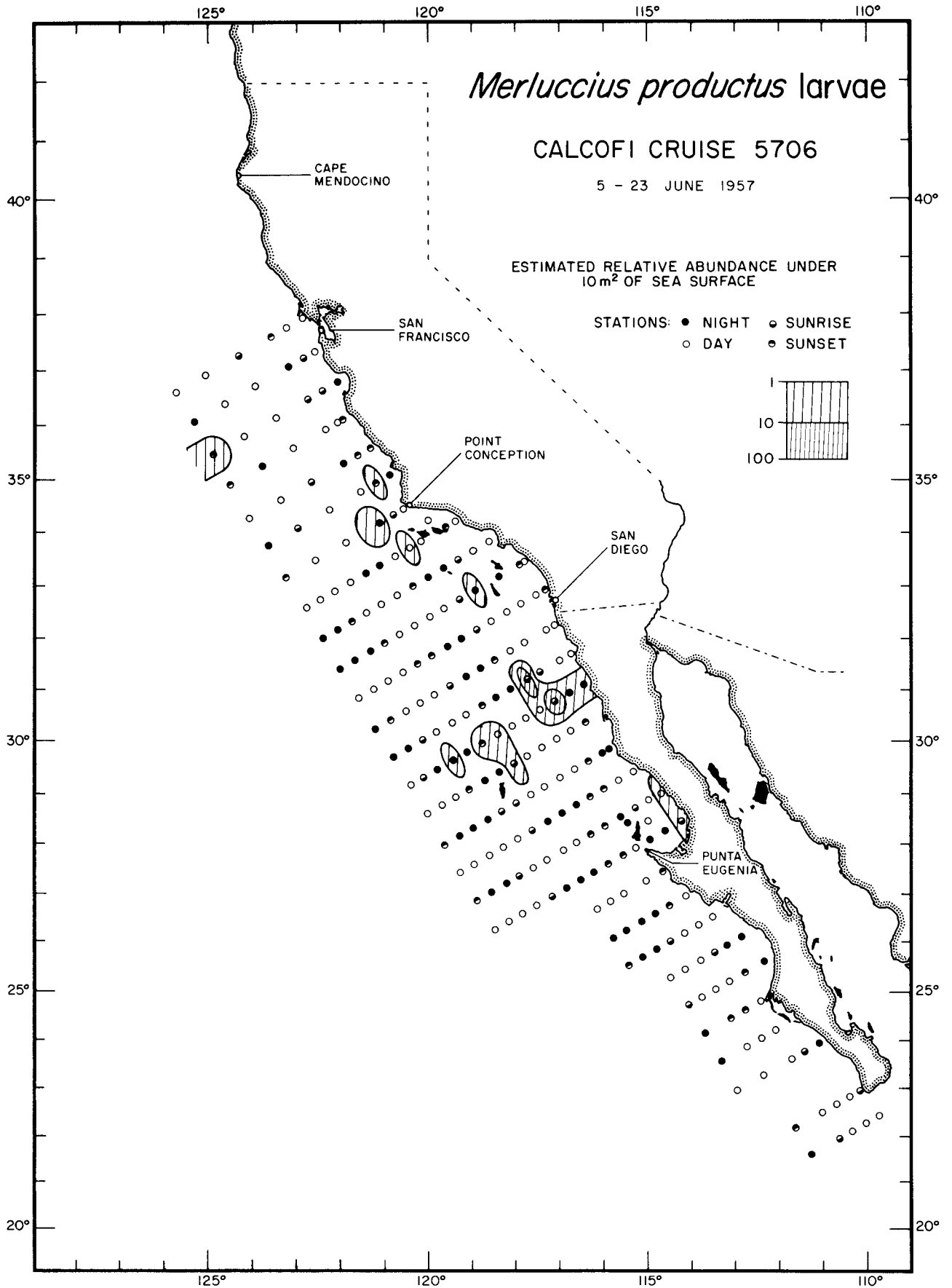
Merluccius productus larvae

5406



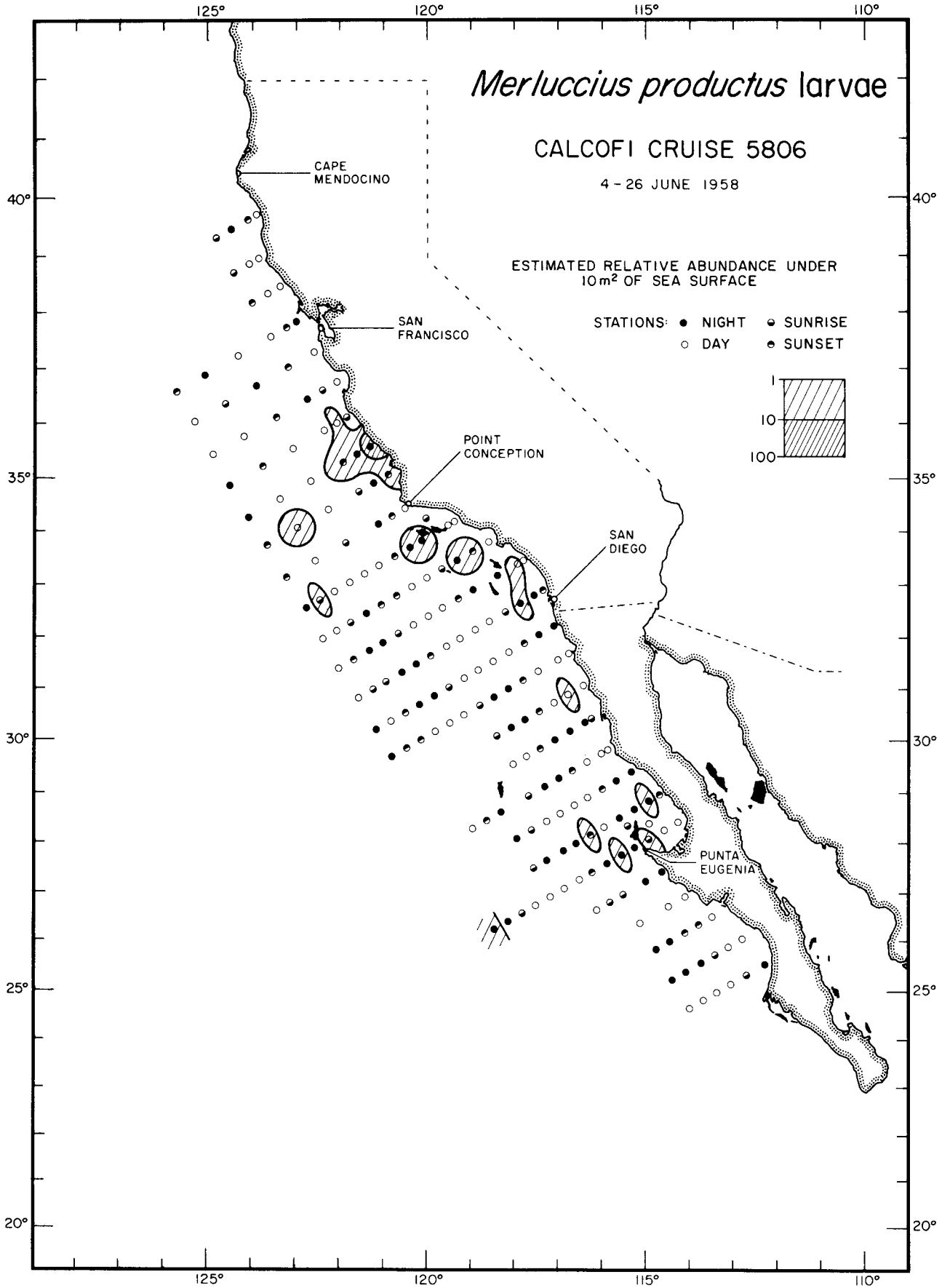
Merluccius productus larvae

5606



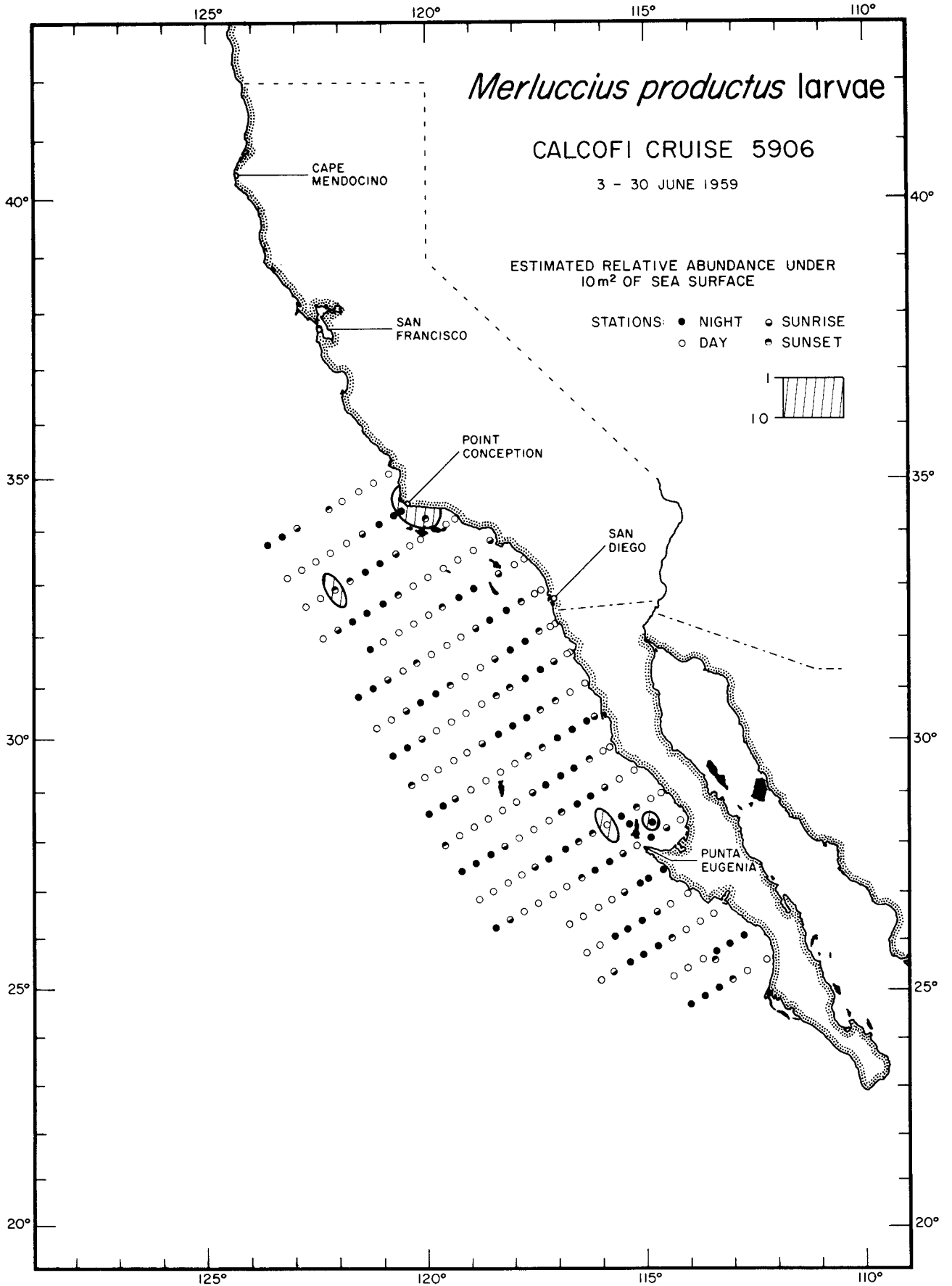
Merluccius productus larvae

5706



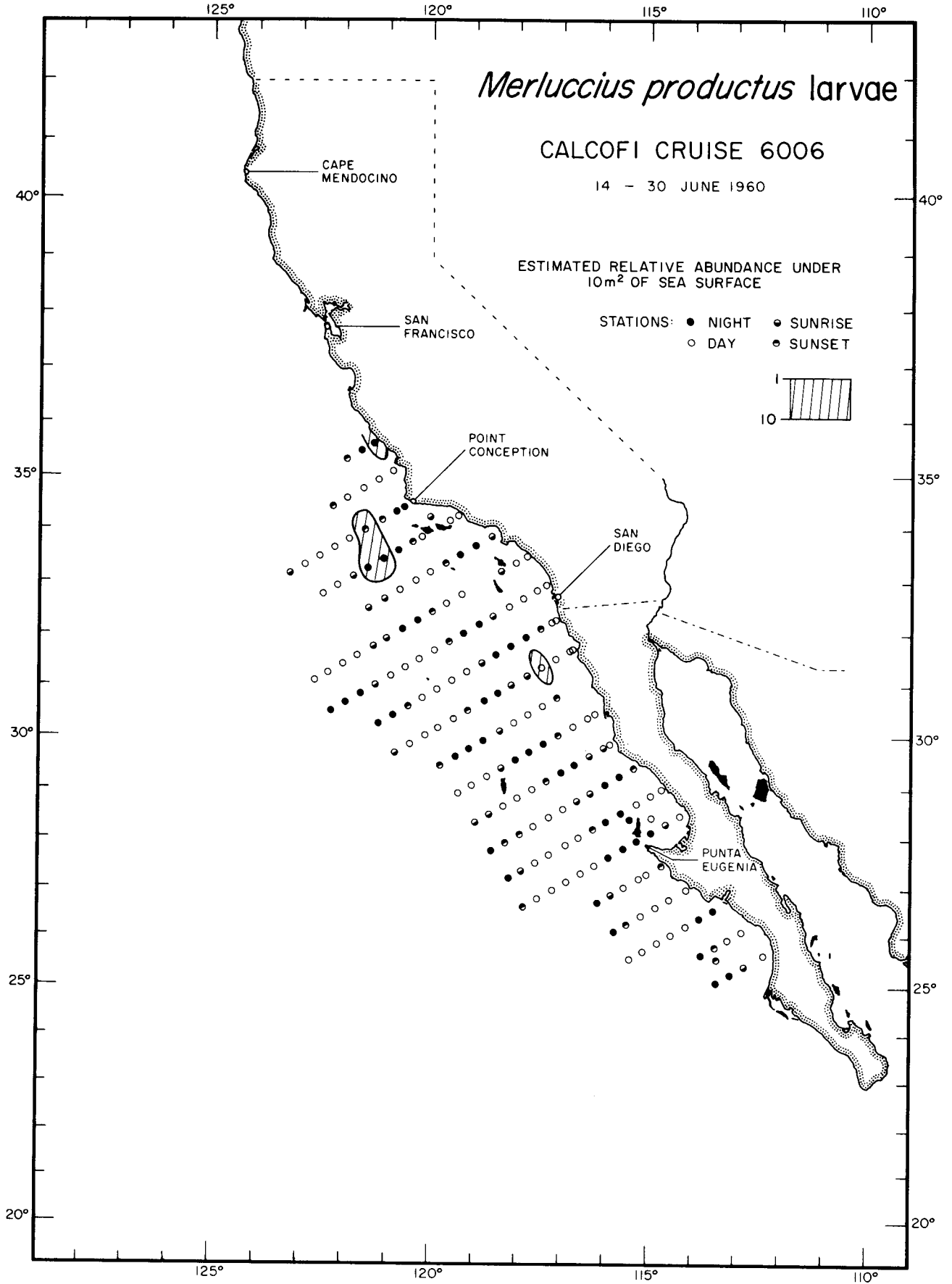
Merluccius productus larvae

5806



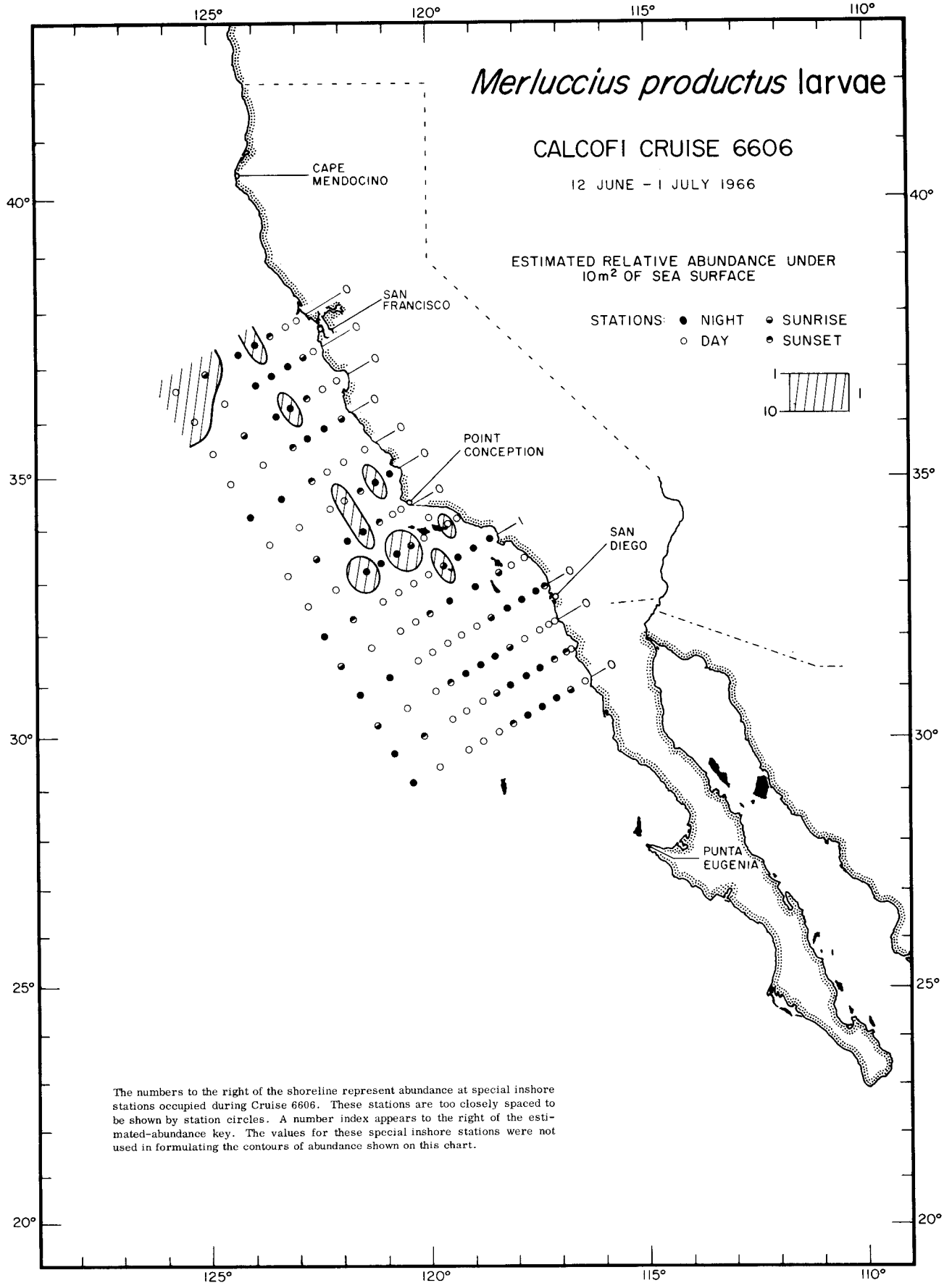
Merluccius productus larvae

5906



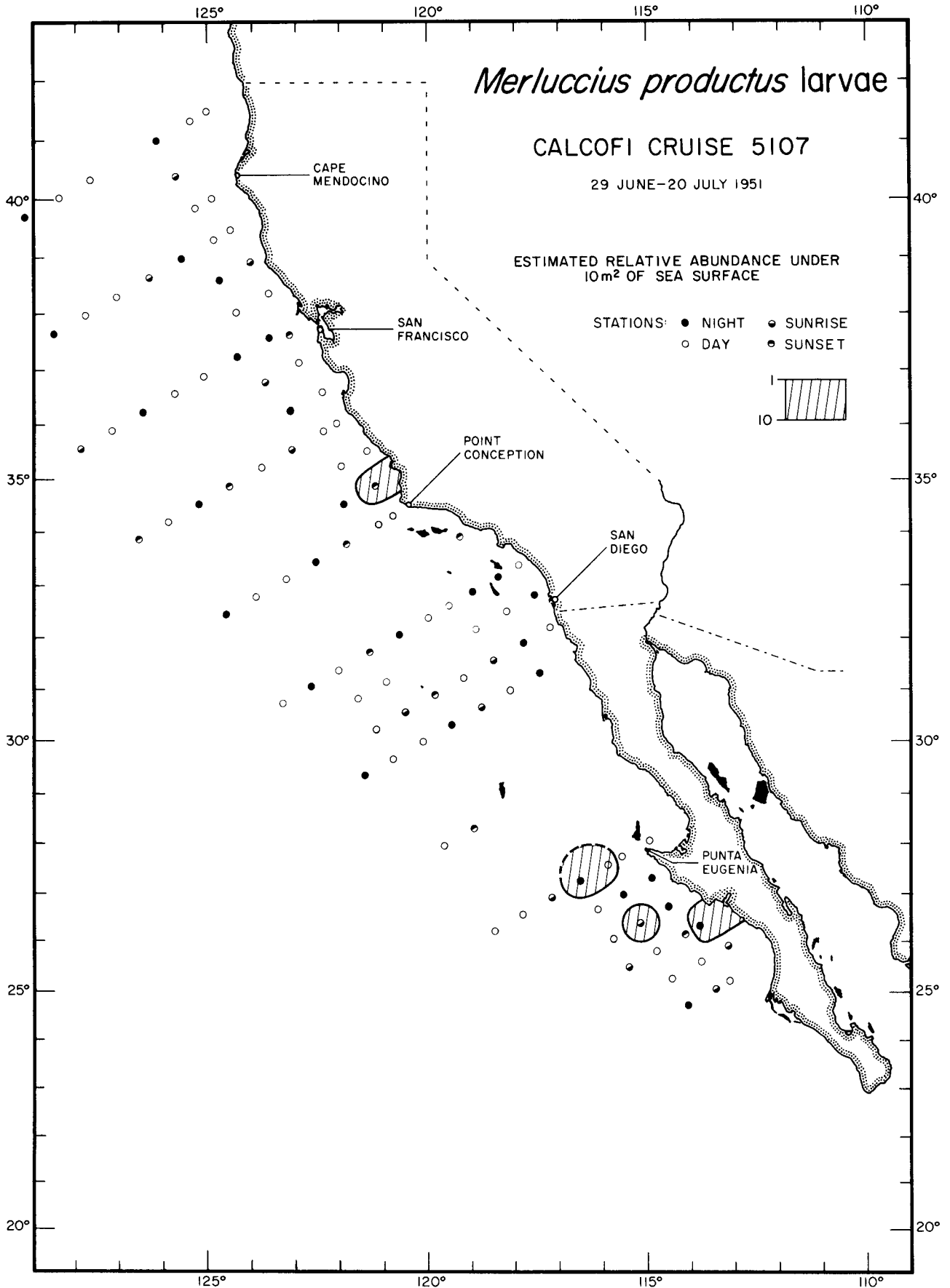
Merluccius productus larvae

6006



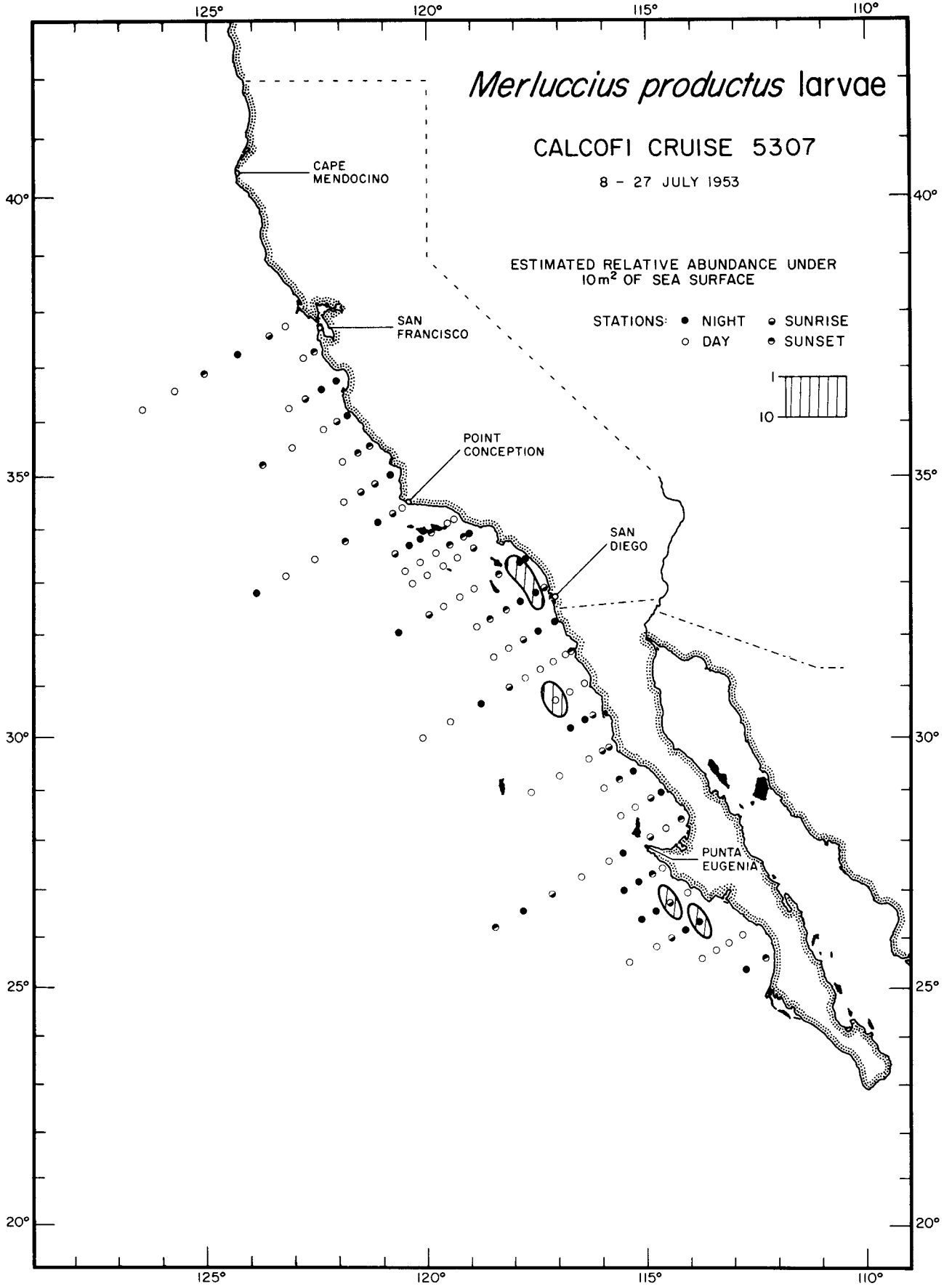
Merluccius productus larvae

6606



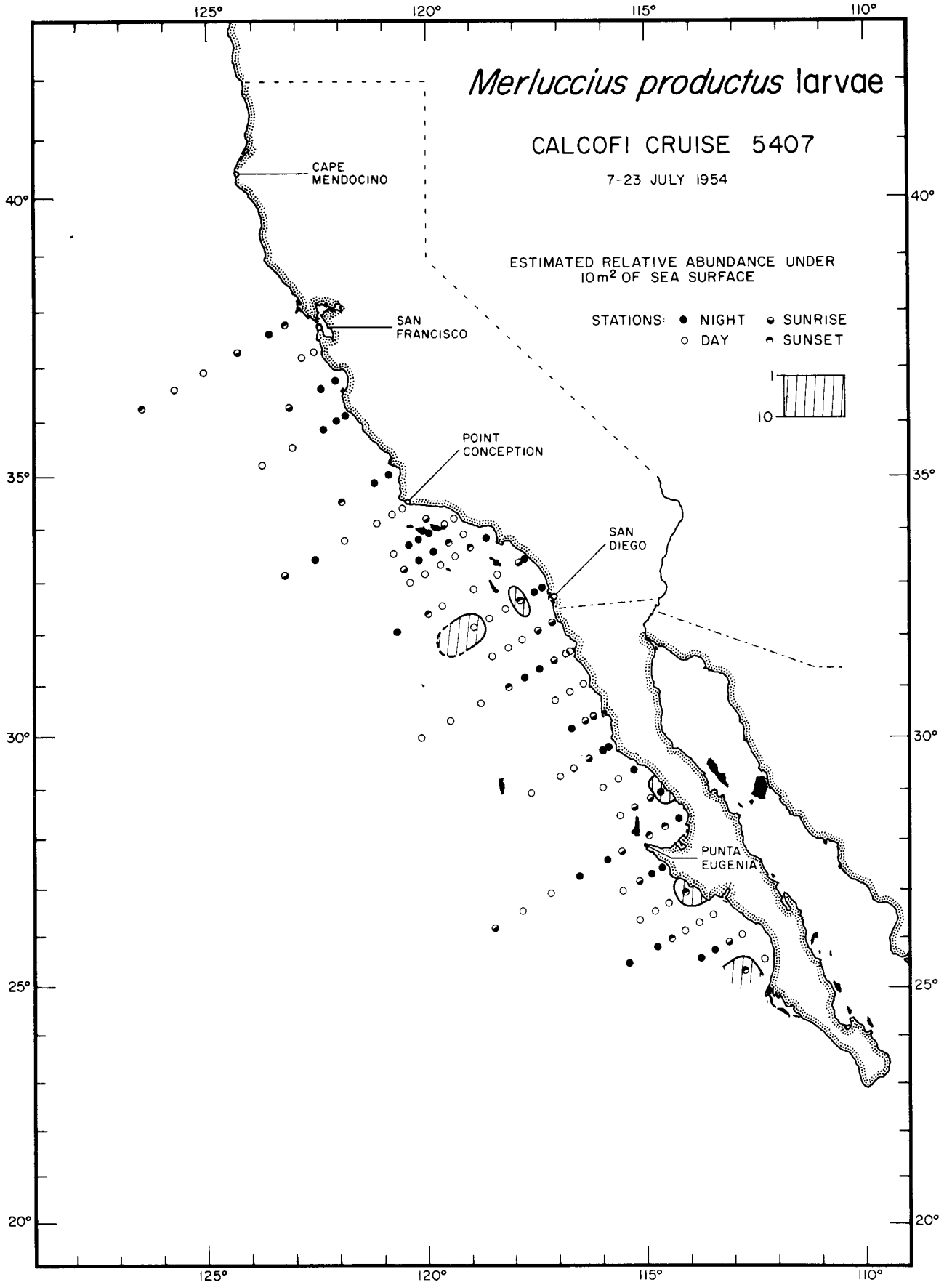
Merluccius productus larvae

5107



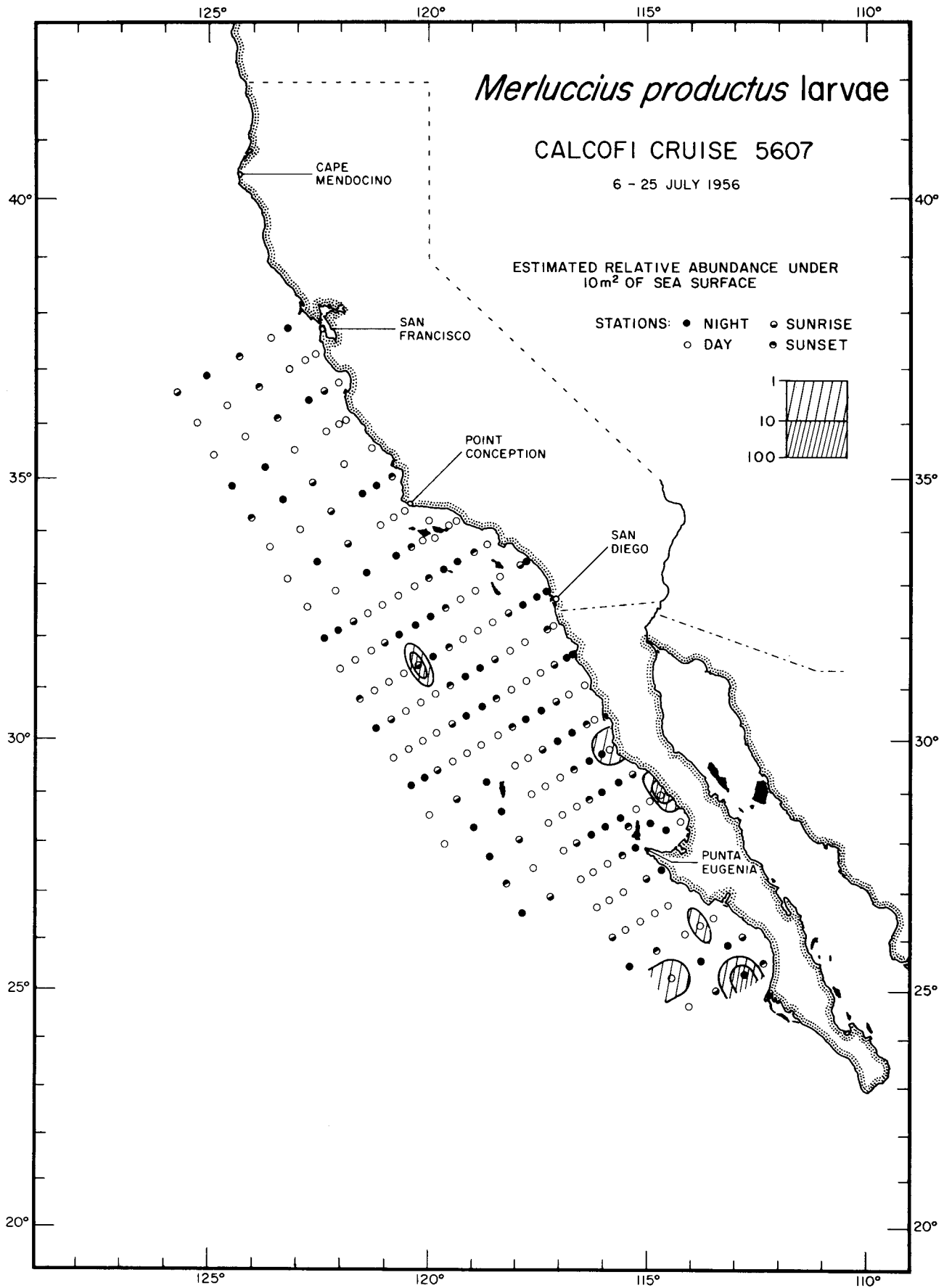
Merluccius productus larvae

5307



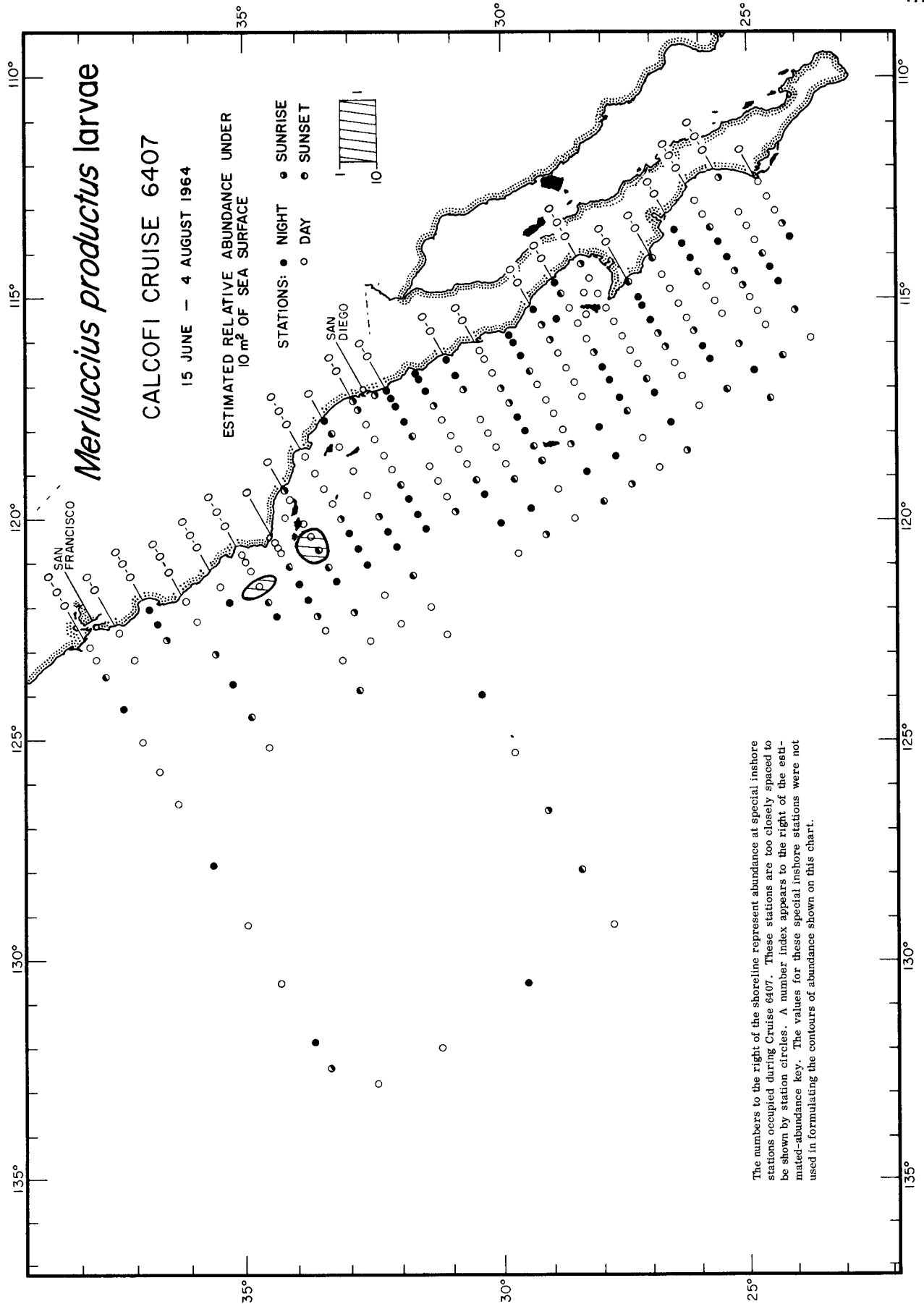
Merluccius productus larvae

5407

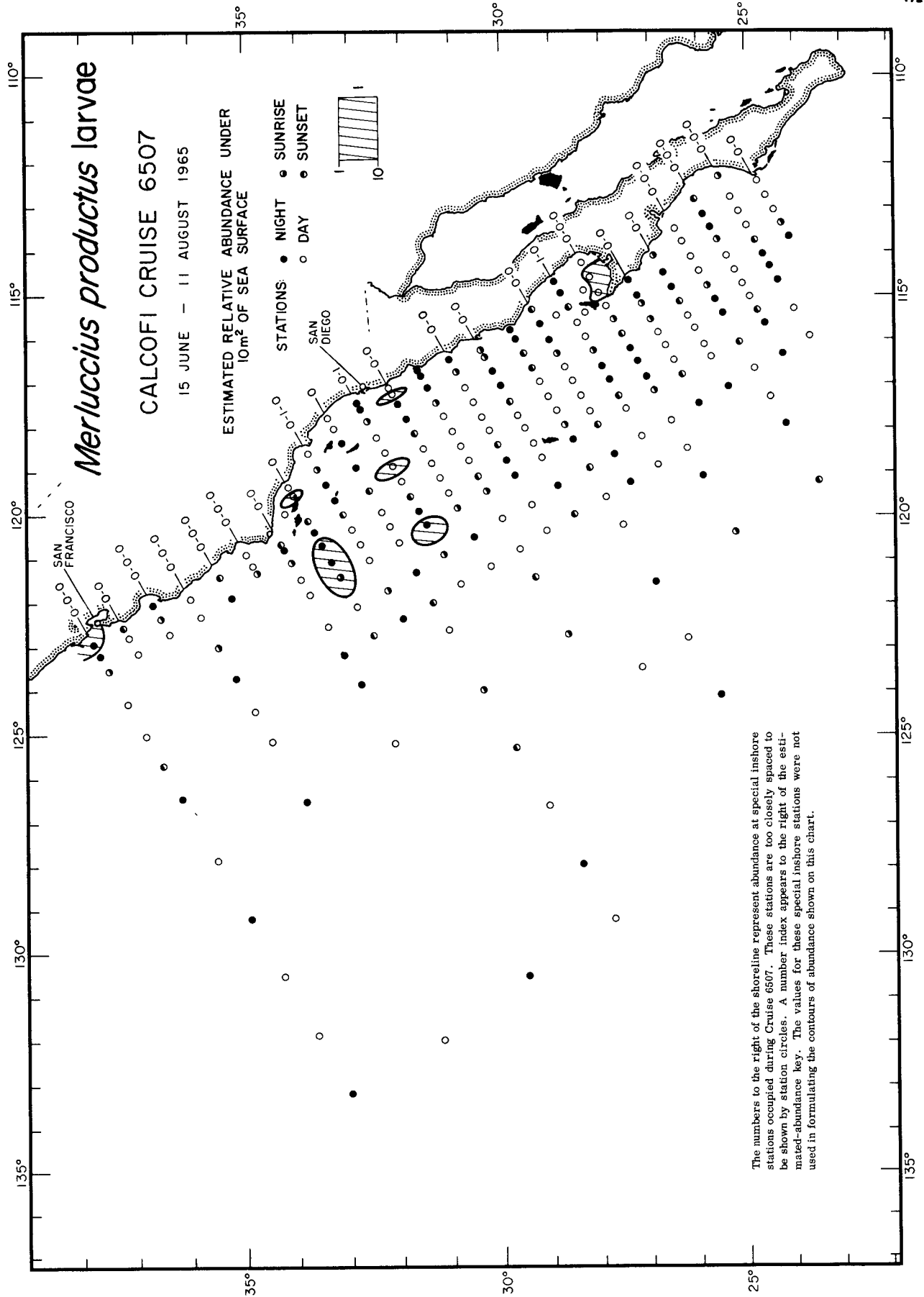


Merluccius productus larvae

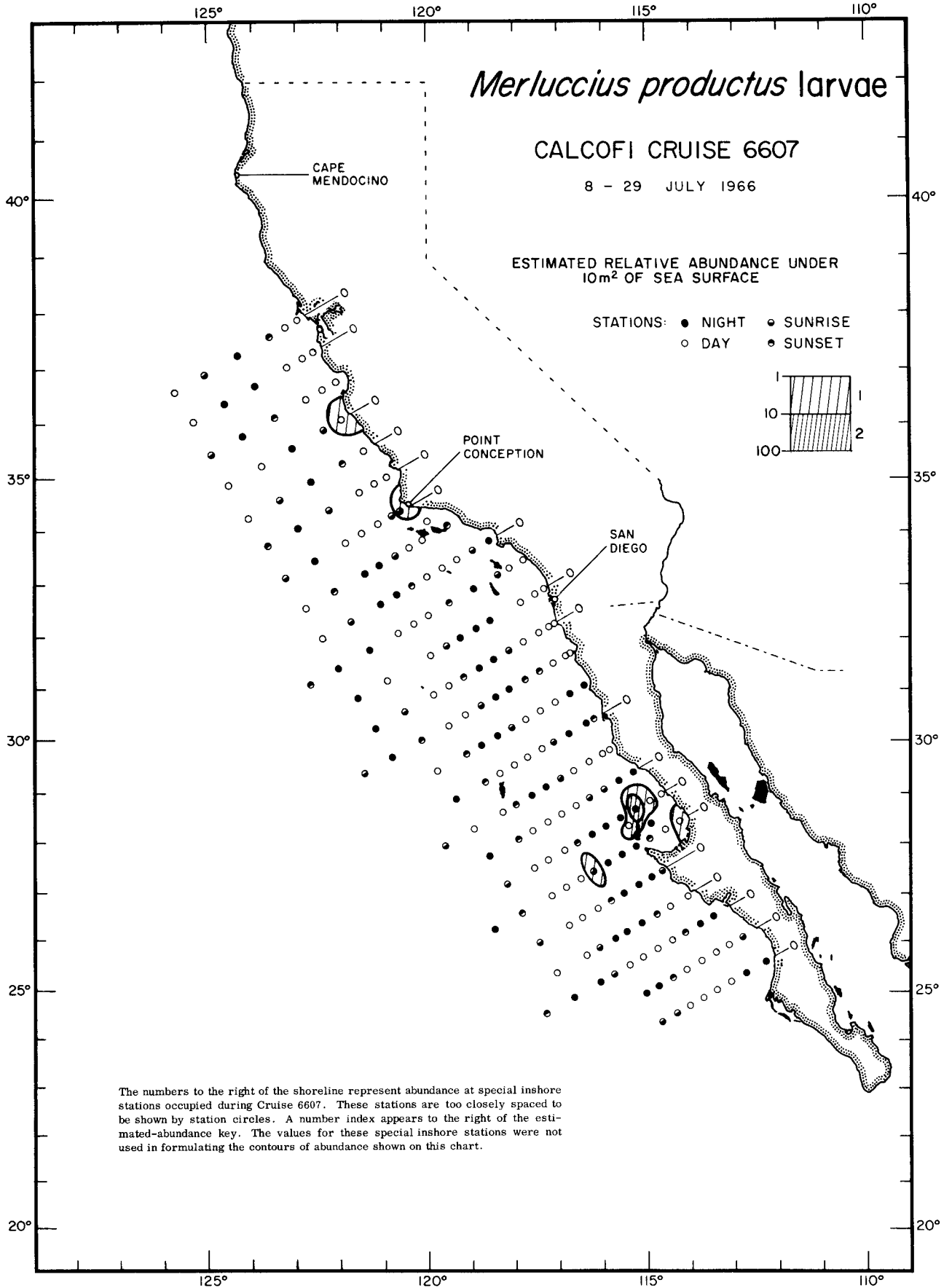
5607

*Merluccius productus* larvae

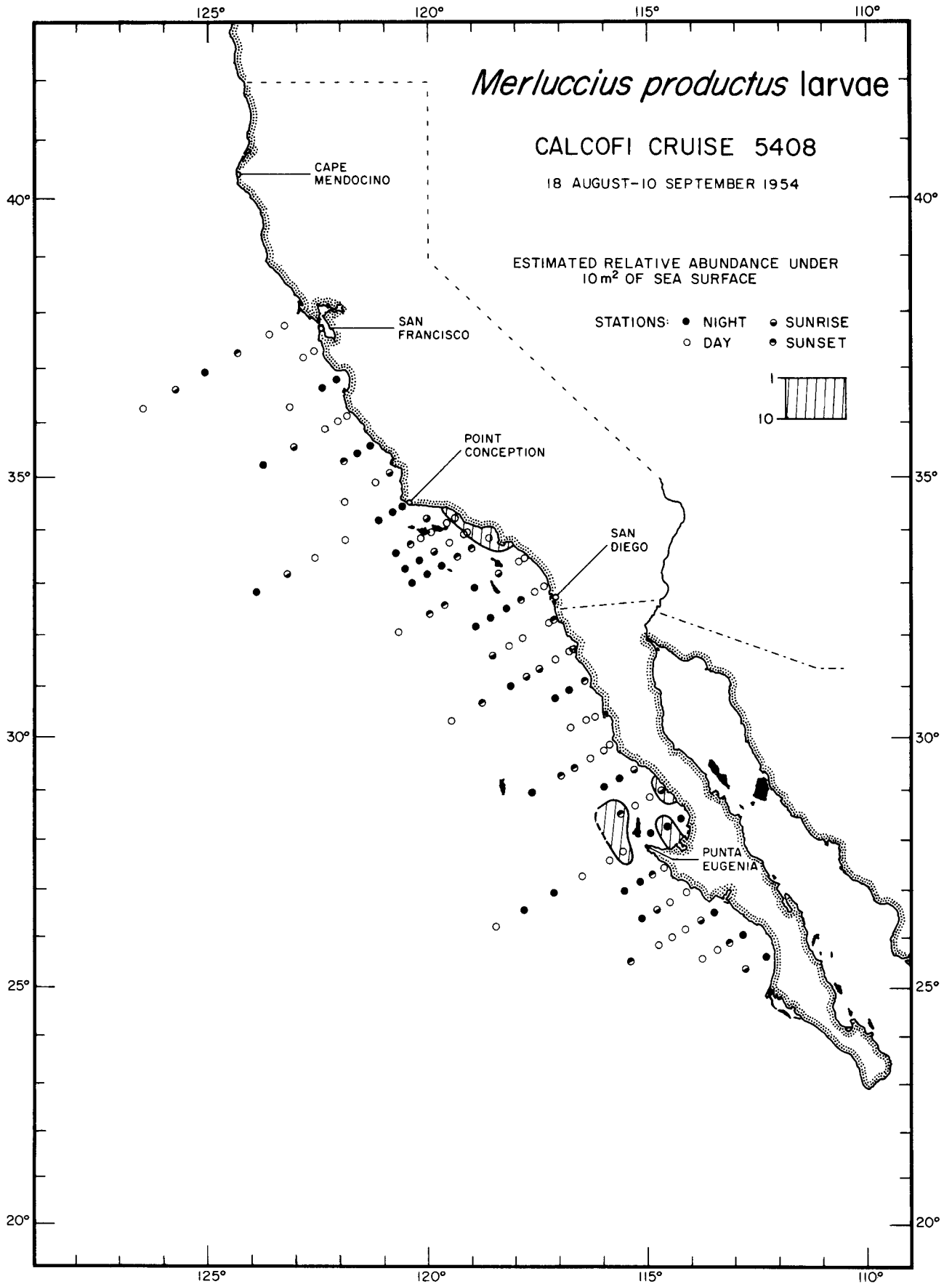
6407



The numbers to the right of the shoreline represent abundance at special inshore stations occupied during Cruise 6507. These stations are too closely spaced to be shown by station circles. A number index appears to the right of the estimated-abundance key. The values for these special inshore stations were not used in formulating the contours shown on this chart.

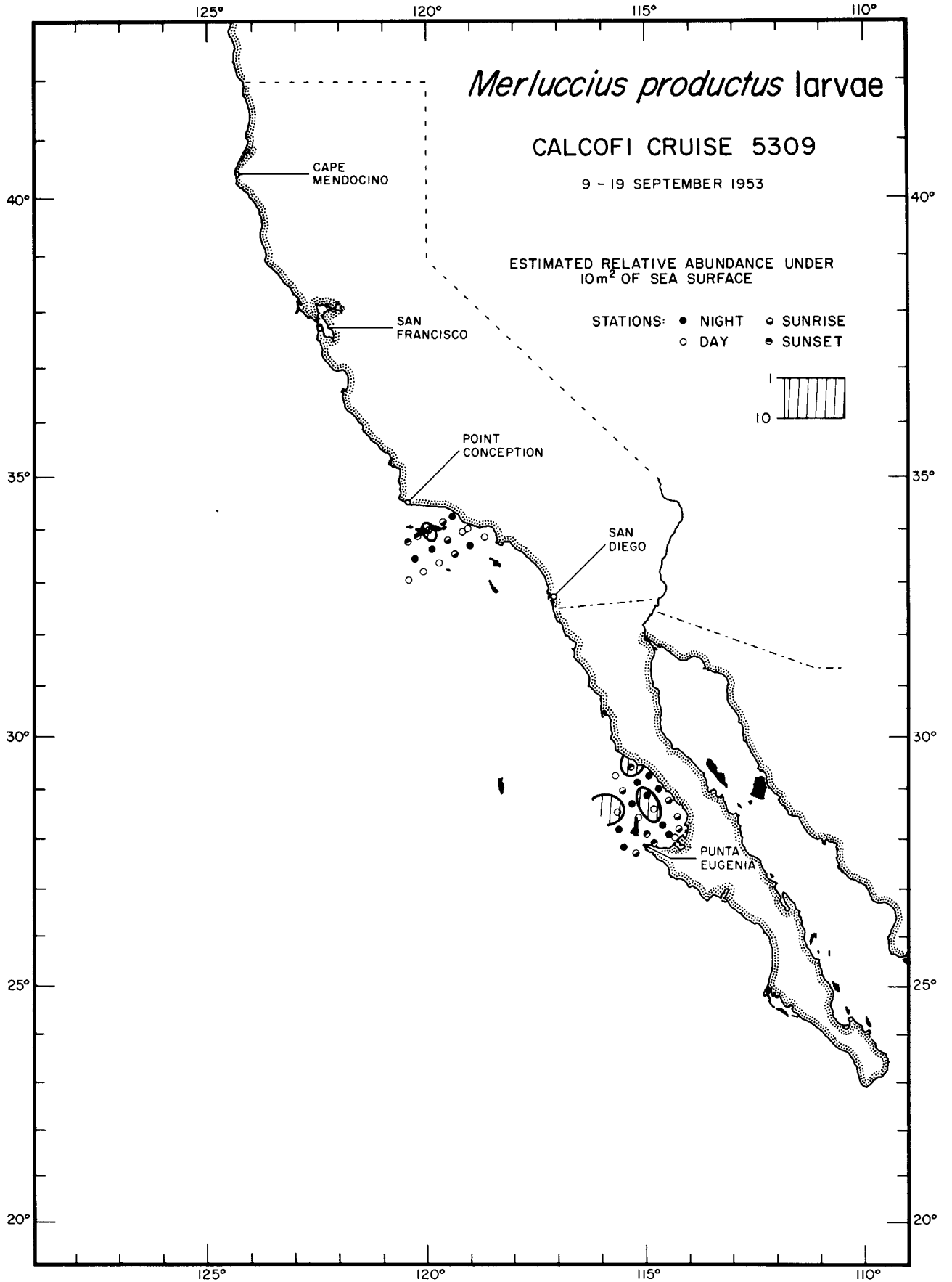


The numbers to the right of the shoreline represent abundance at special inshore stations occupied during Cruise 6607. These stations are too closely spaced to be shown by station circles. A number index appears to the right of the estimated-abundance key. The values for these special inshore stations were not used in formulating the contours of abundance shown on this chart.



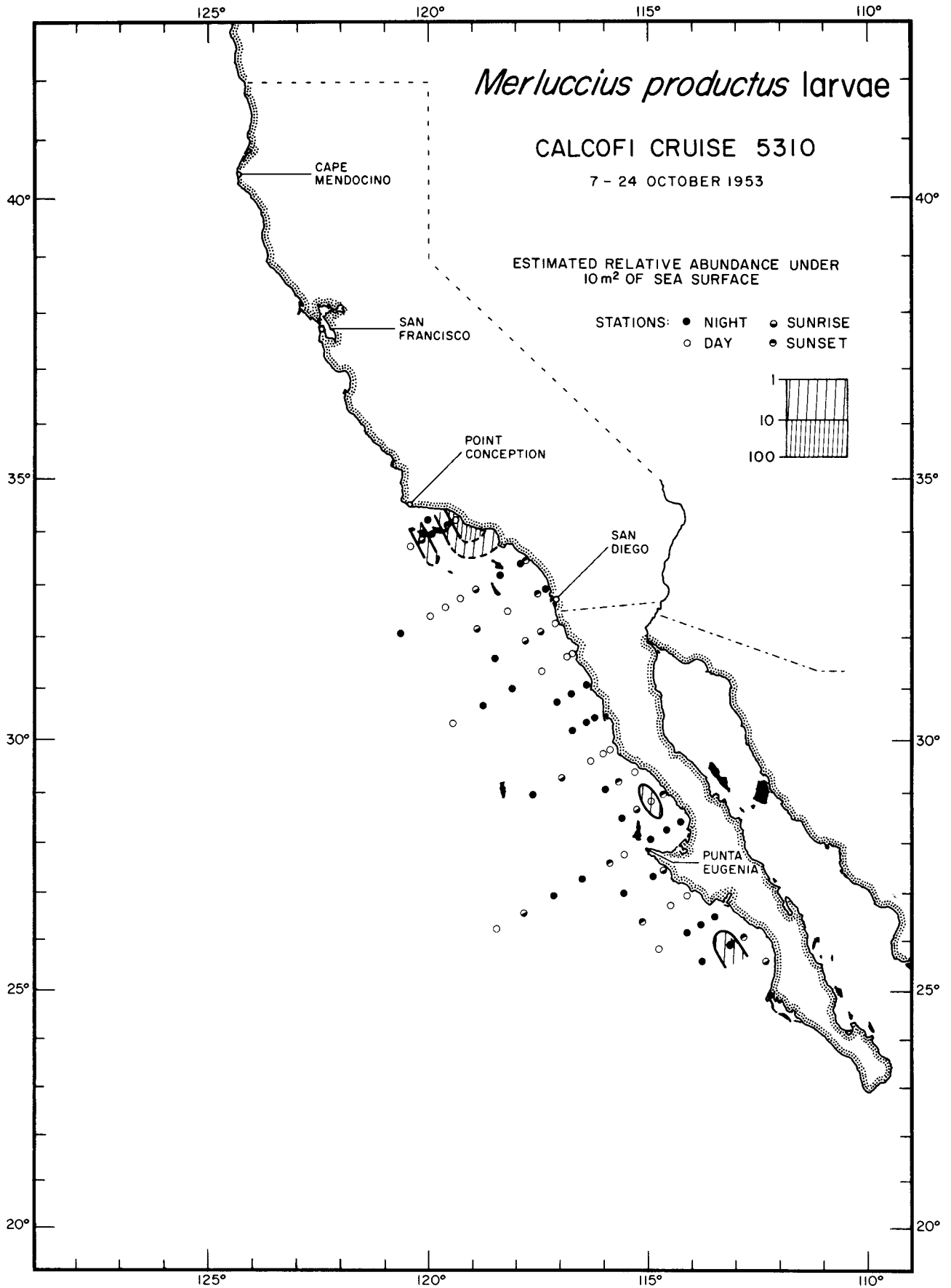
Merluccius productus larvae

5408



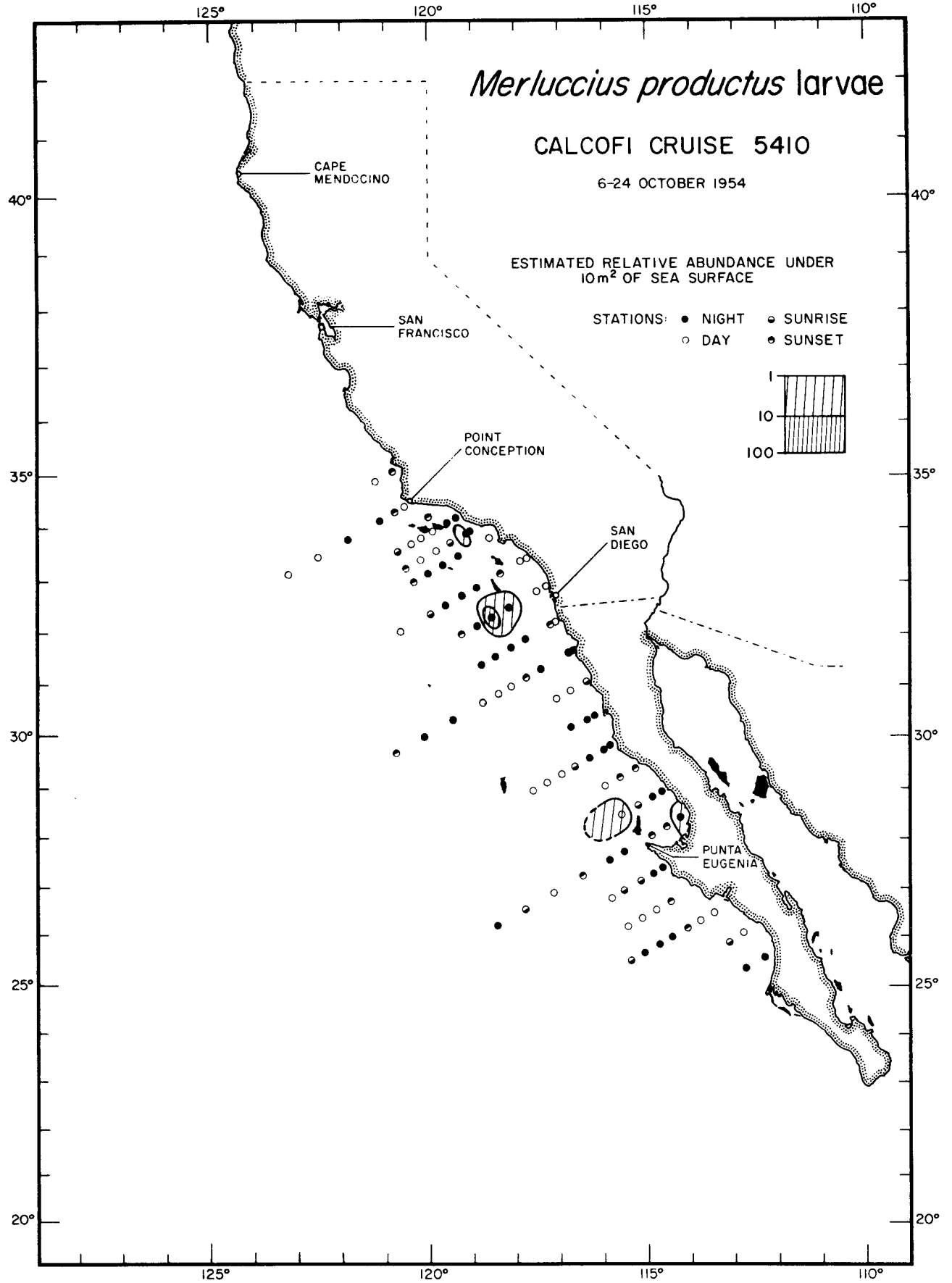
Merluccius productus larvae

5309



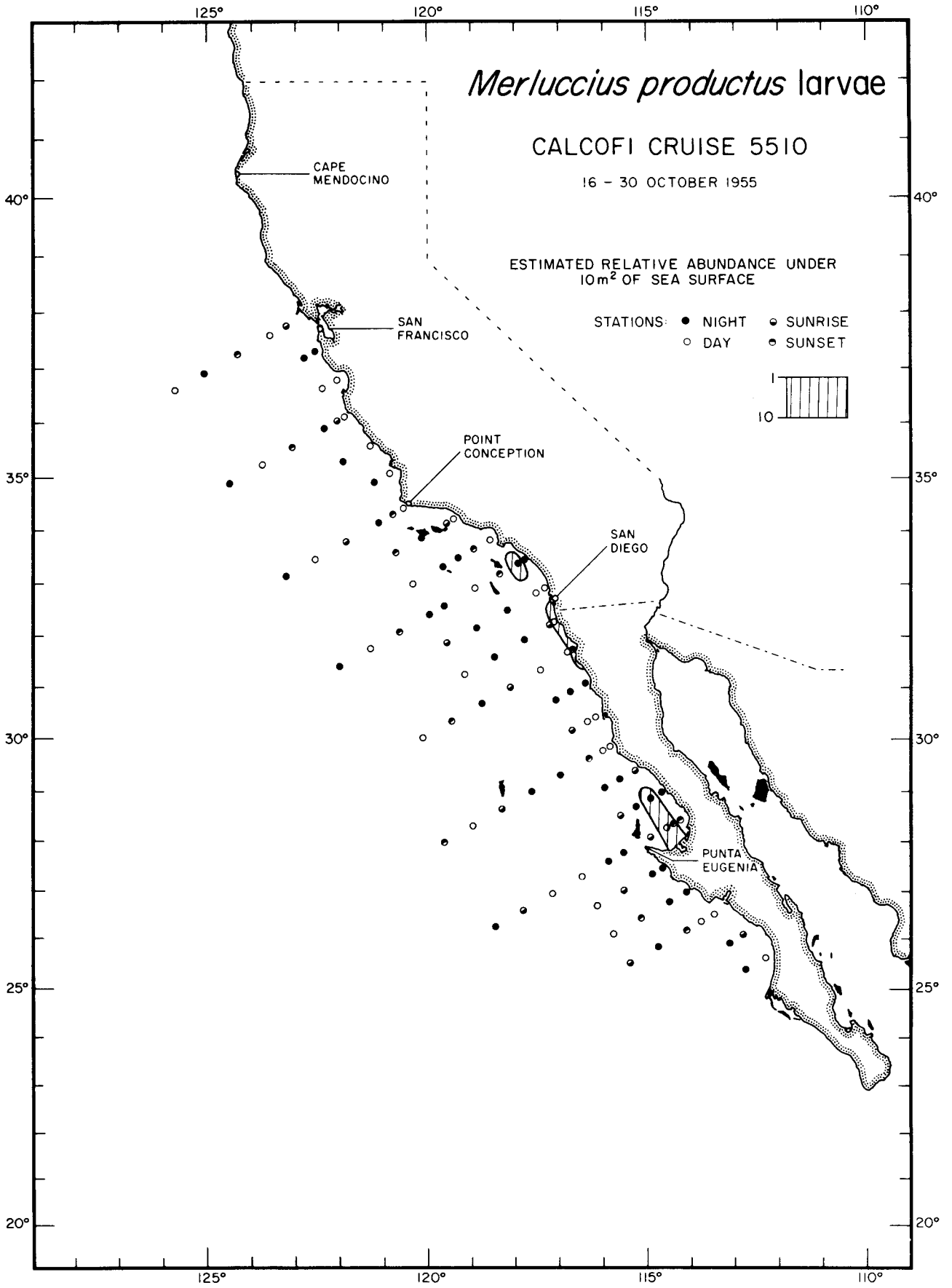
Merluccius productus larvae

5310



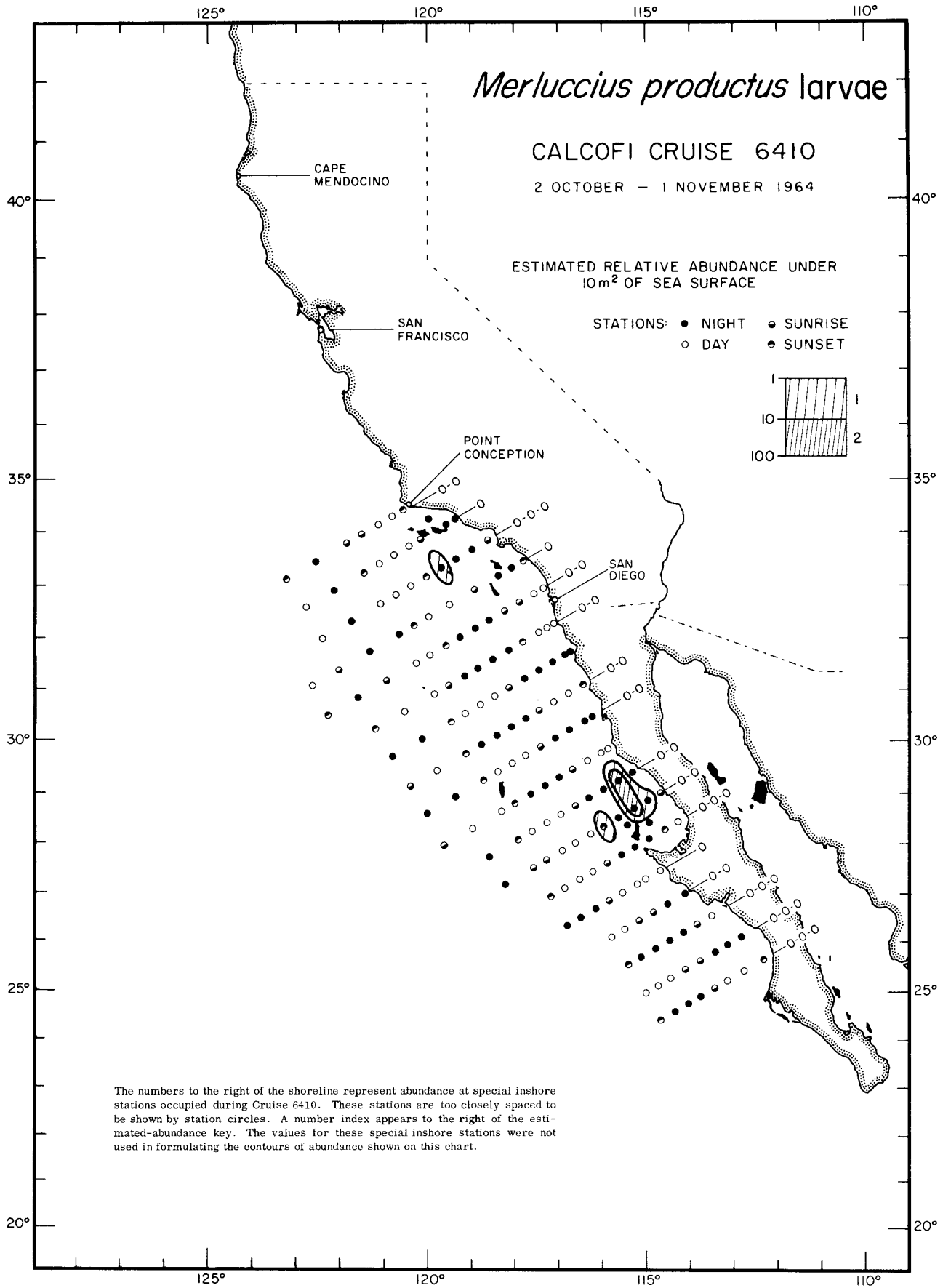
Merluccius productus larvae

5410



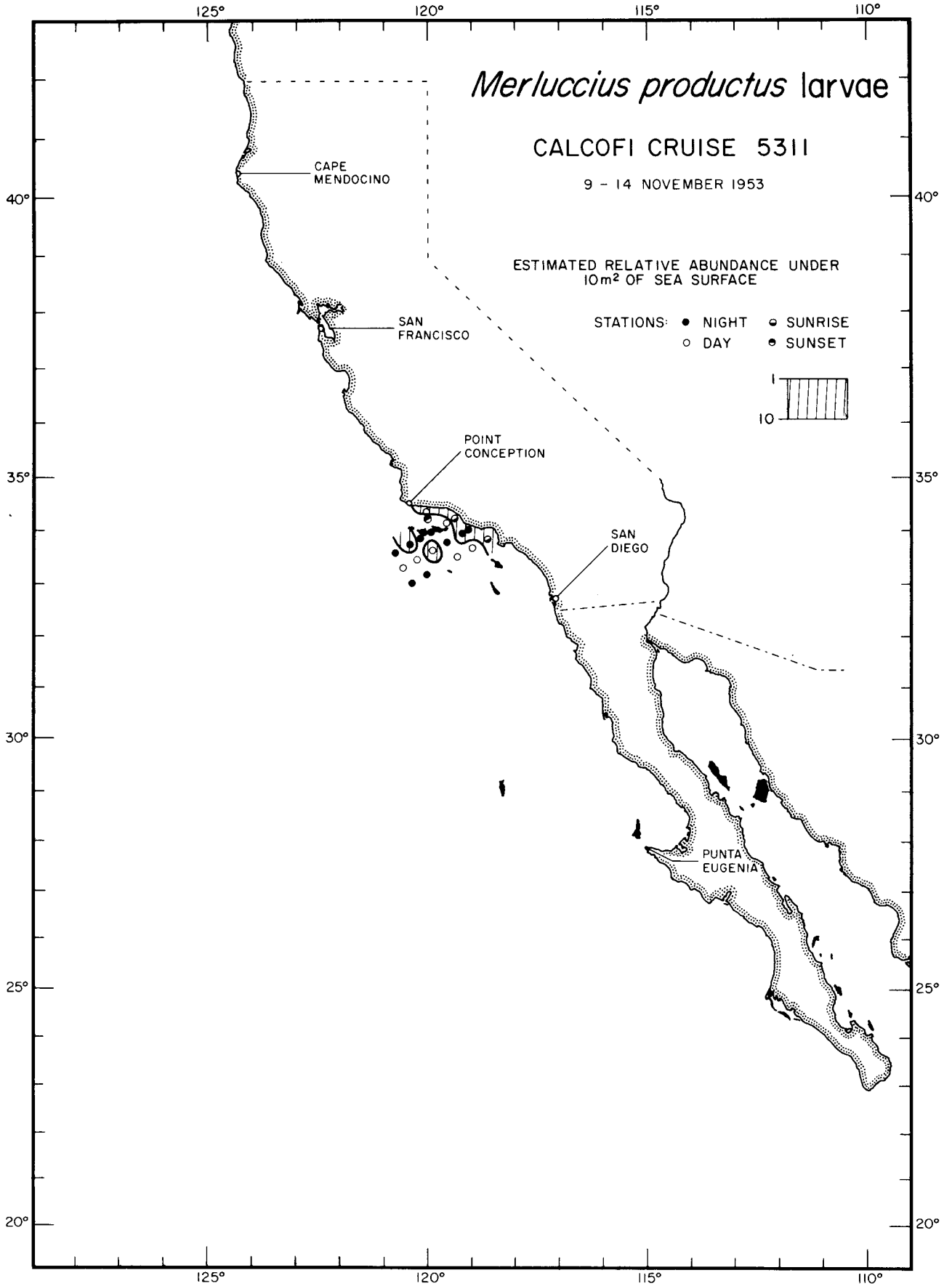
Merluccius productus larvae

5510



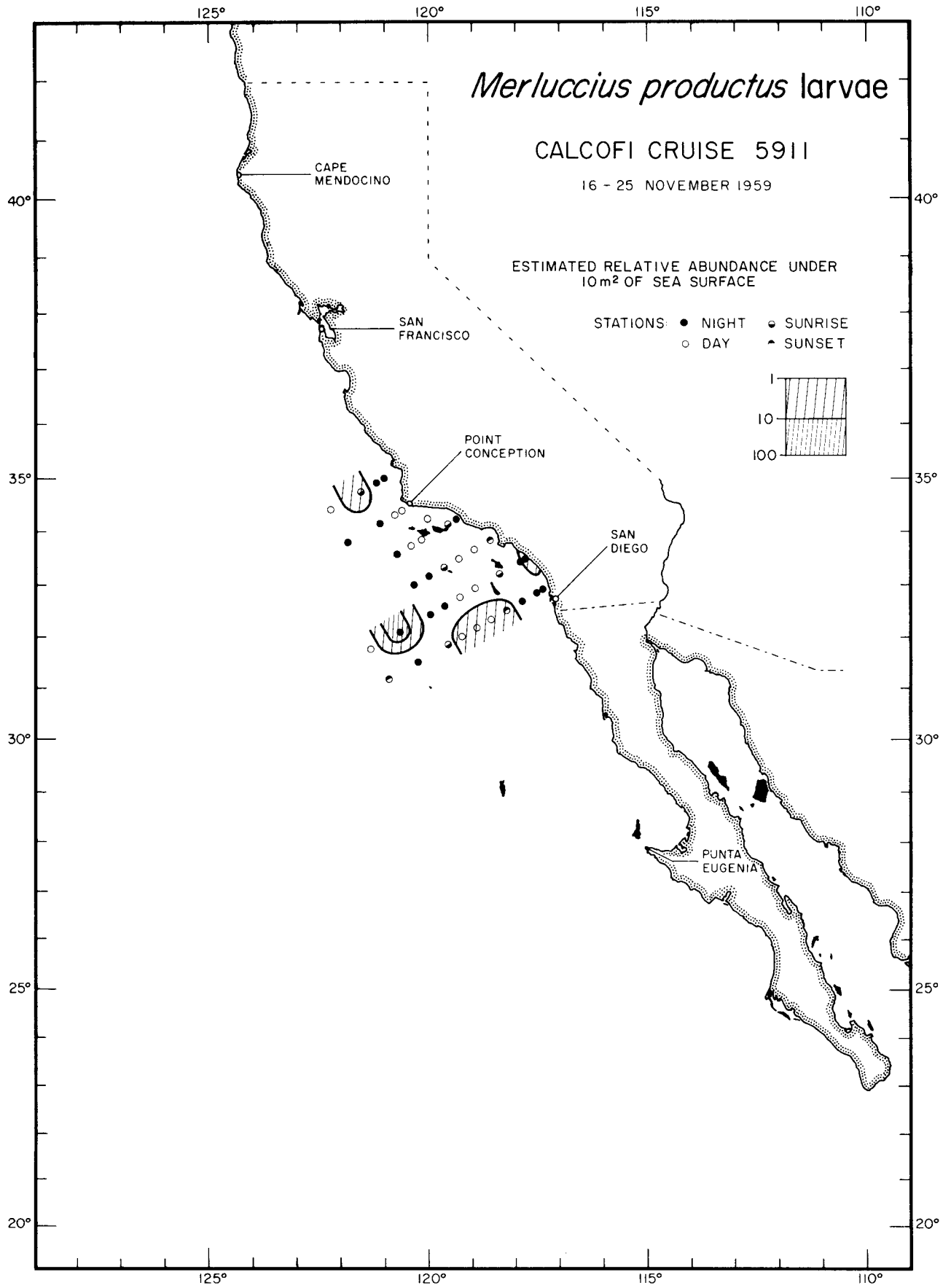
Merluccius productus larvae

6410



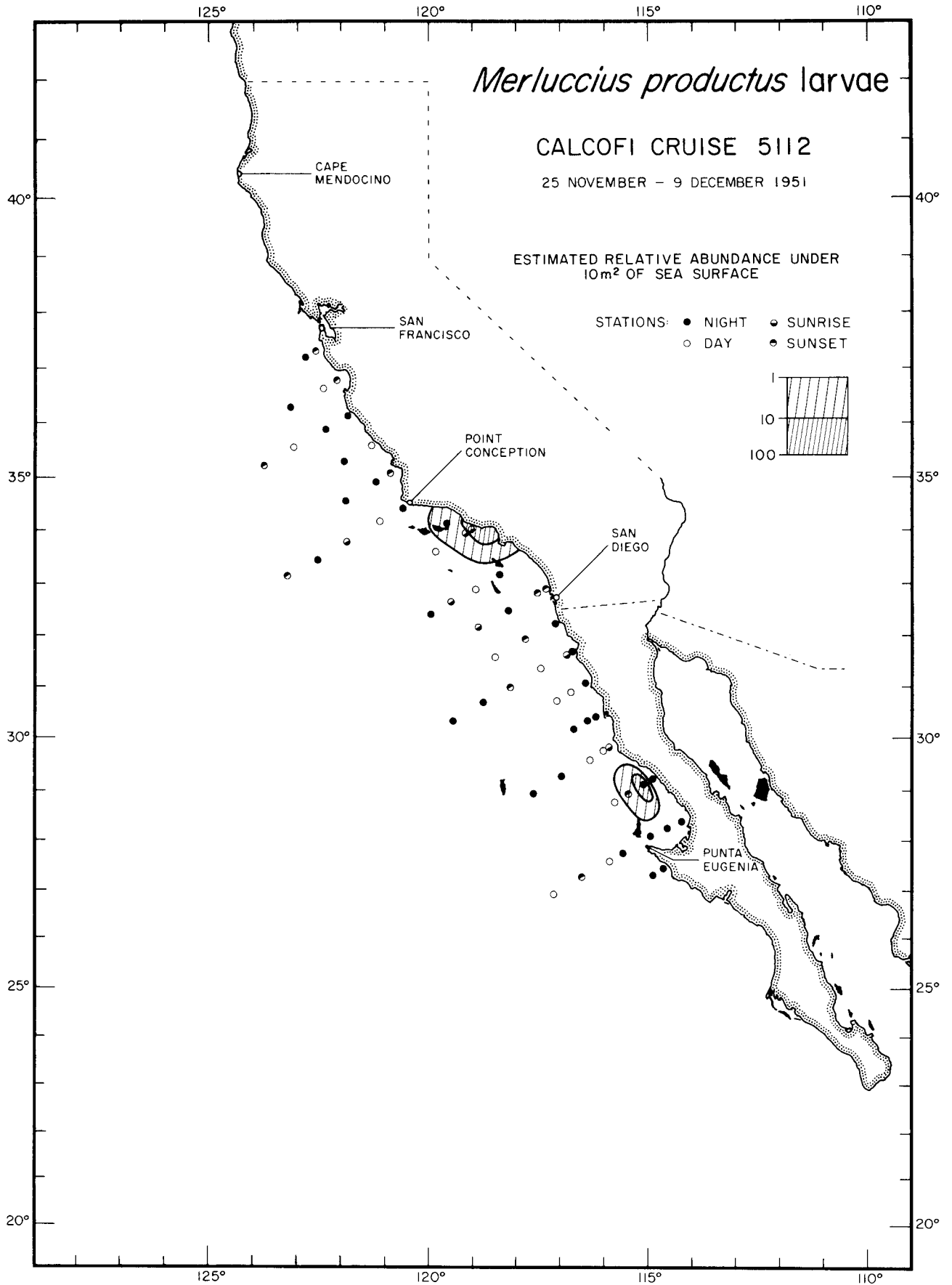
Merluccius productus larvae

5311



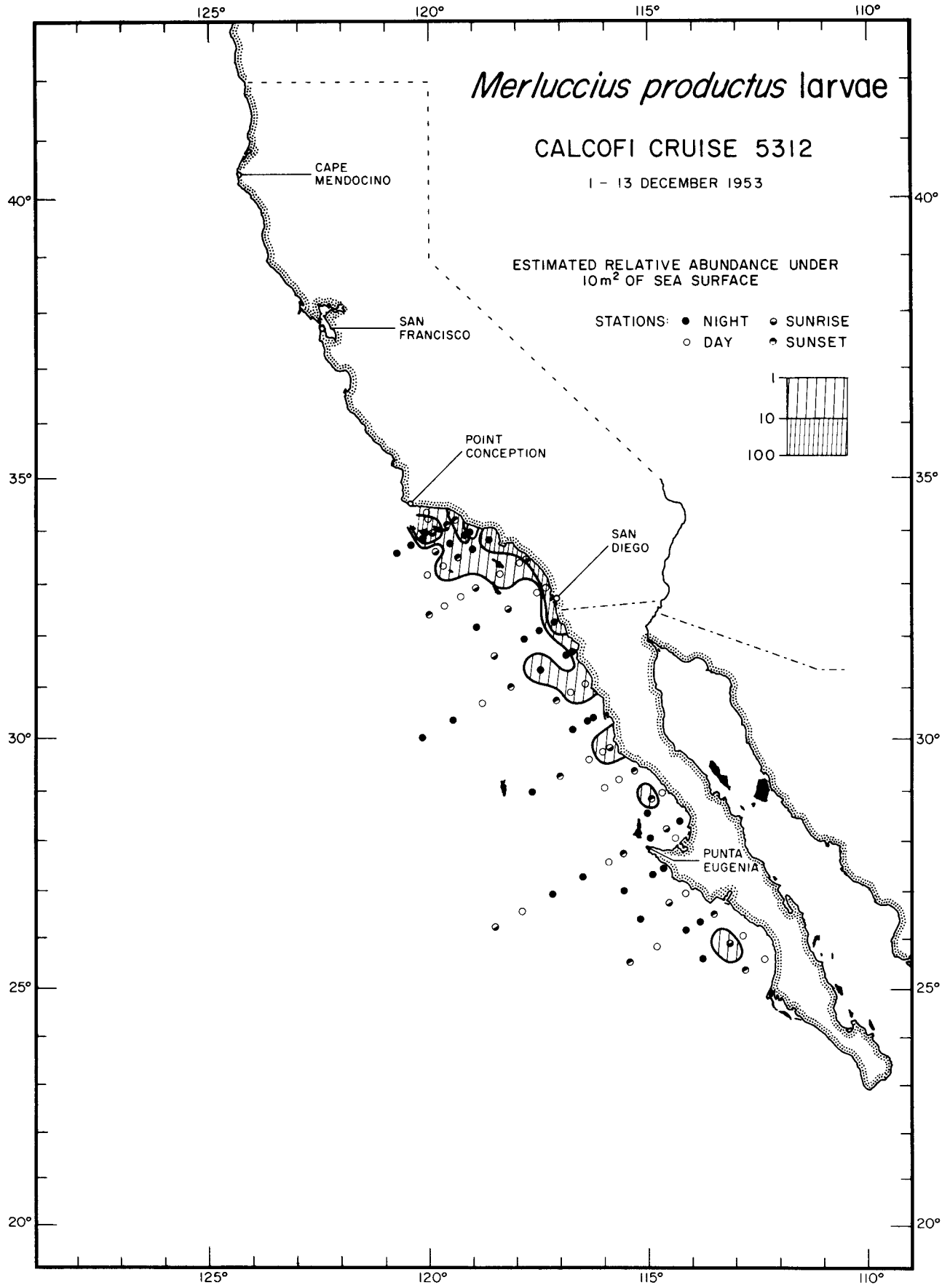
Merluccius productus larvae

5911



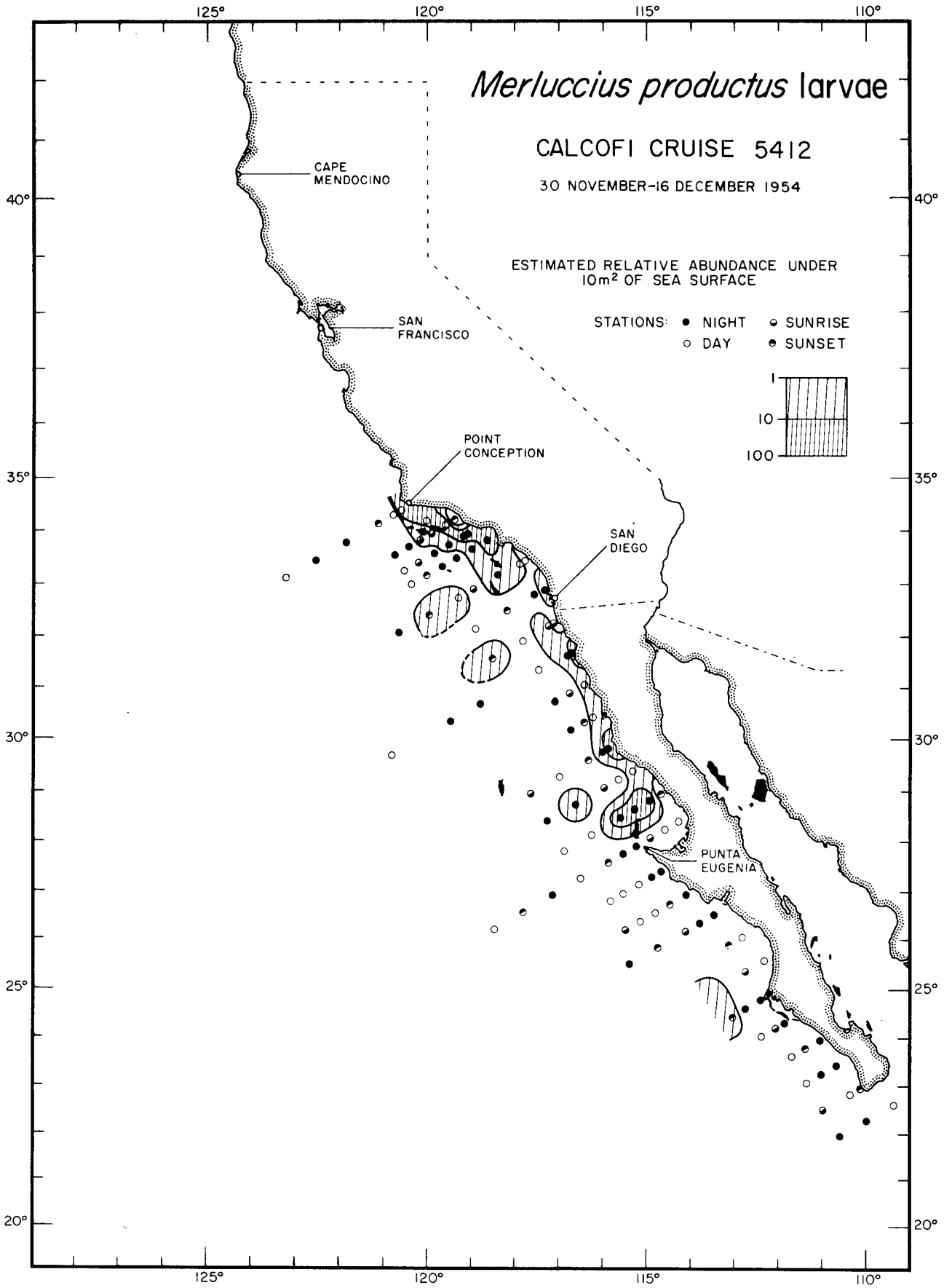
Merluccius productus larvae

5112



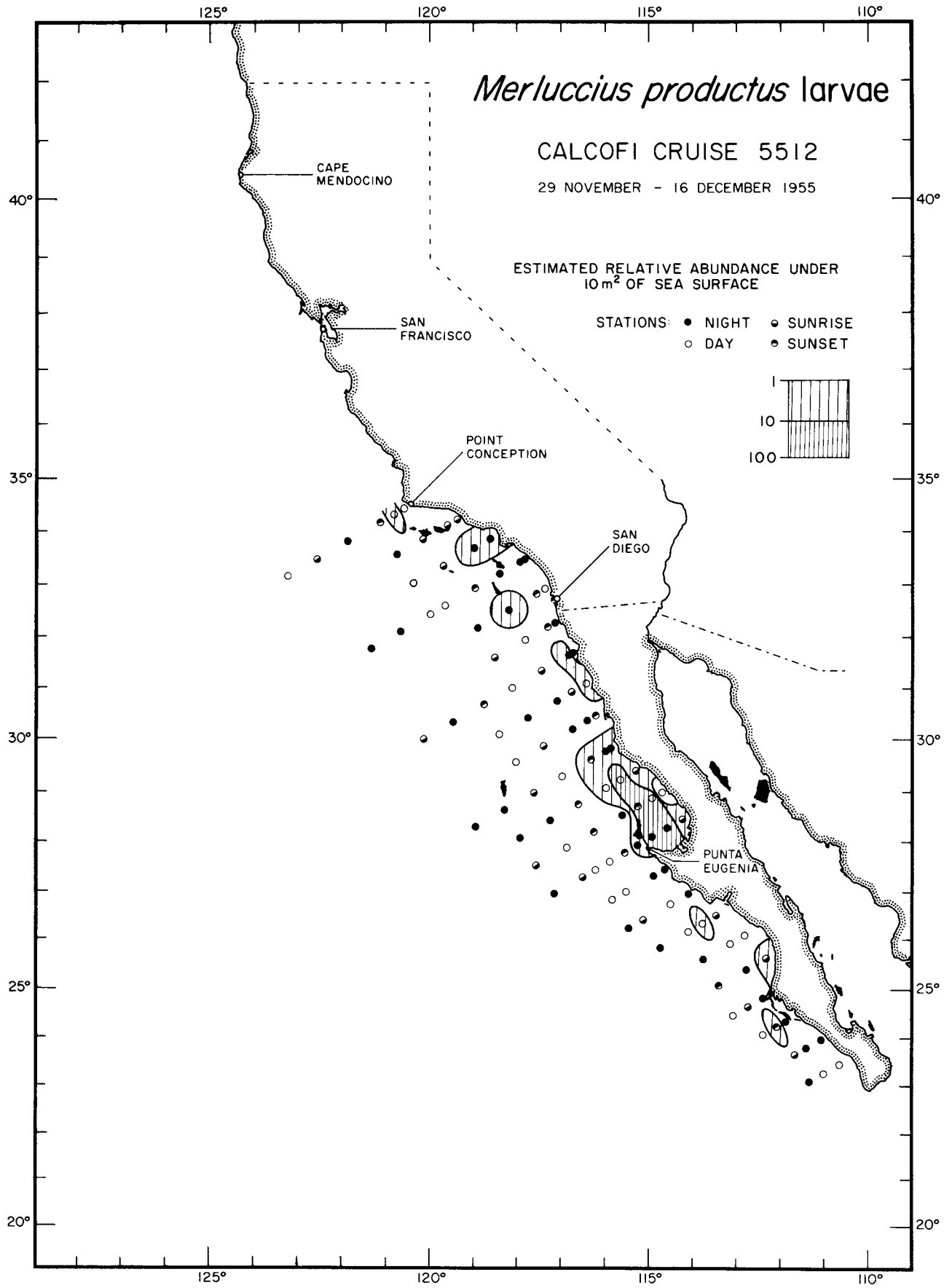
Merluccius productus larvae

5312



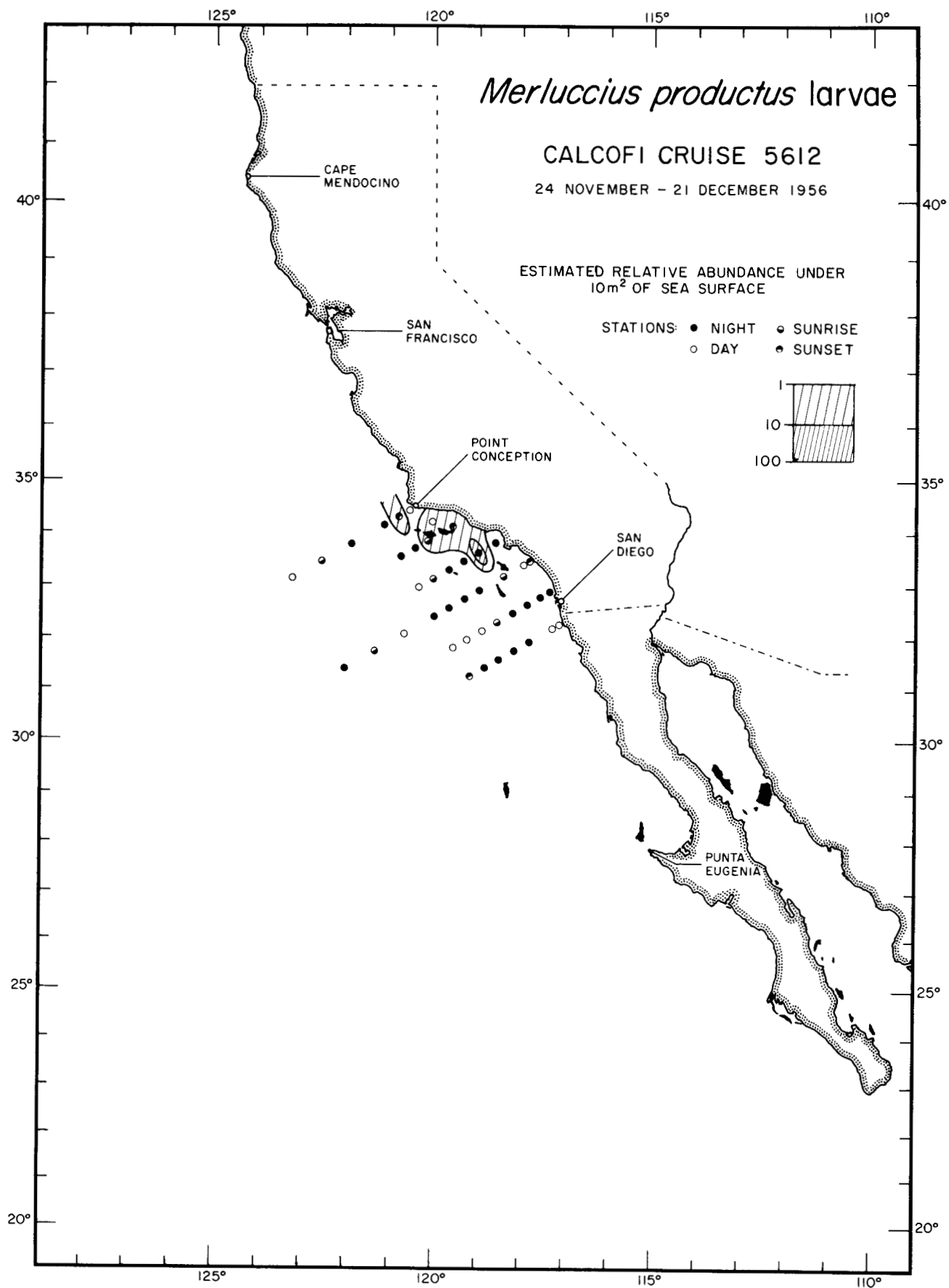
Merluccius productus larvae

5412



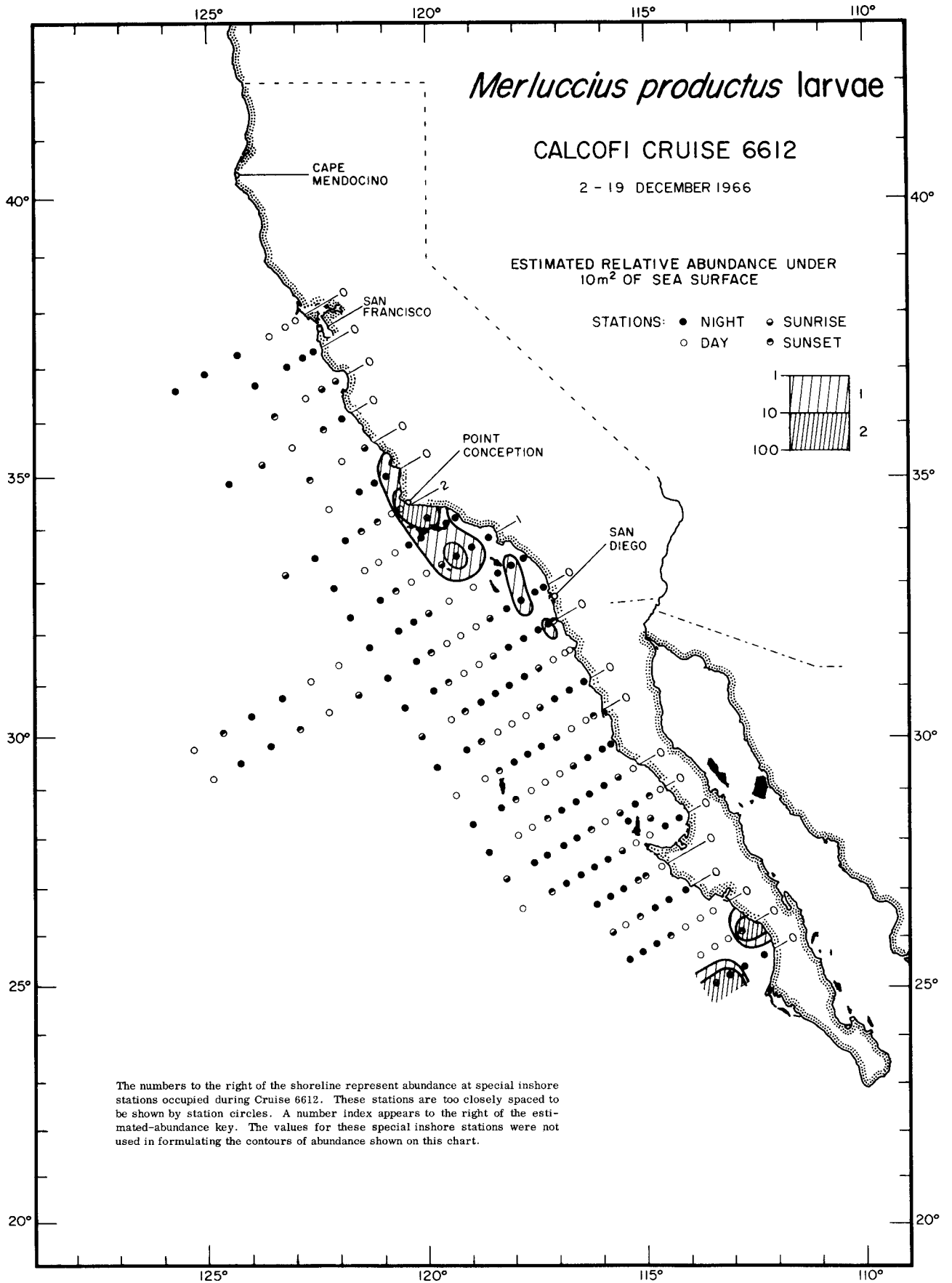
Merluccius productus larvae

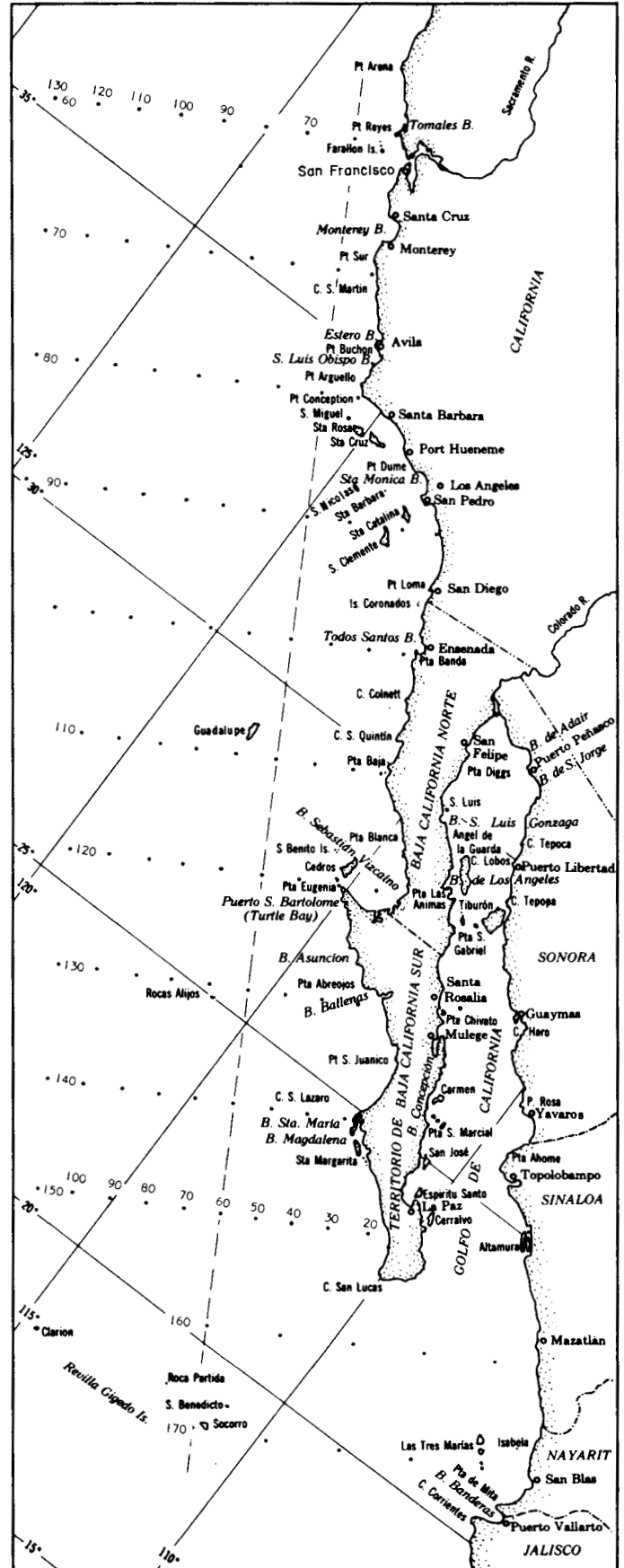
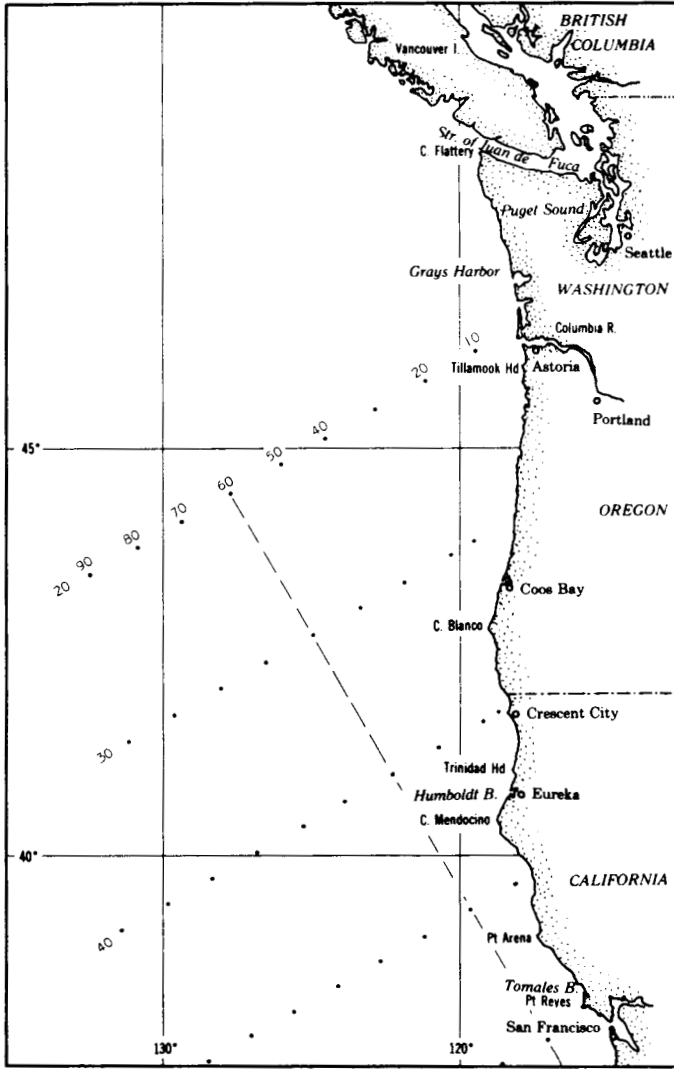
5512



Merluccius productus larvae

5612





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.

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