

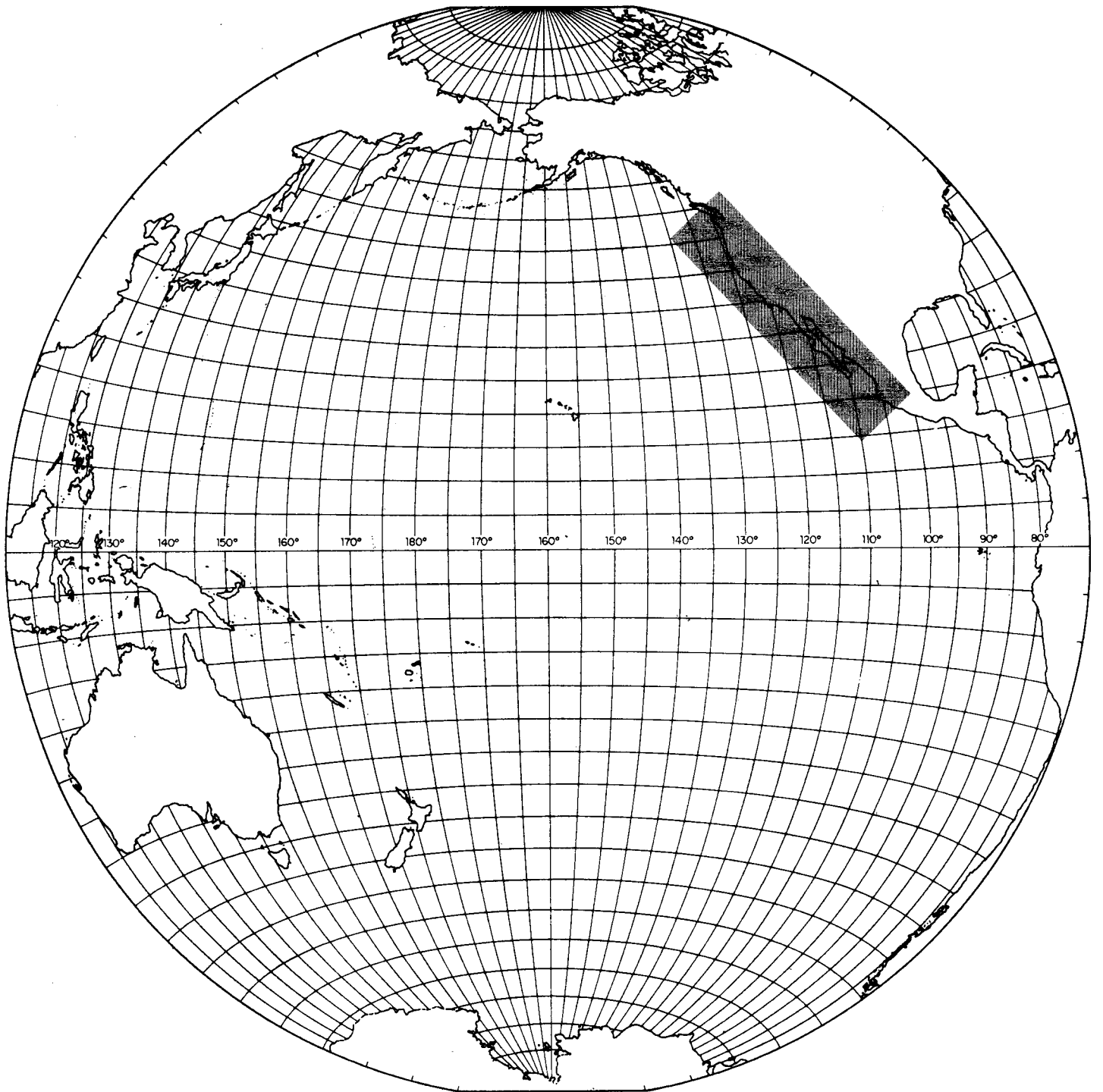
Atlas 17: Ahlstrom, E. H. Distributional atlas of fish larvae in the California Current region: six common mesopelagic species – *Vinciguerria lucetia*, *Triphoturus mexicanus*, *Stenobranchius leucopsarus*, *Leuroglossus stilbius*, *Bathylagus wesethi*, and *Bathylagus ochotensis*, 1955-1960. Published June 1972.

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.

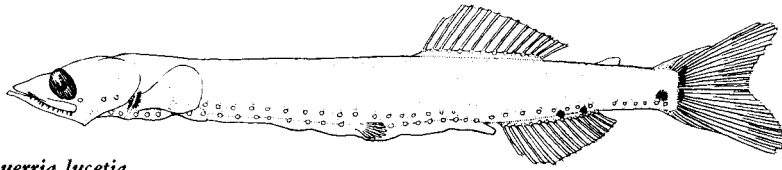
The report for each year usually is published about 7-9 months after the fall cruise, and includes notes about nomenclature changes, etc. The ultimate goal is to update the old ichthyoplankton identifications to current standards; the database is updated as re-identifications for each cruise are completed.

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MARINE RESEARCH COMMITTEE

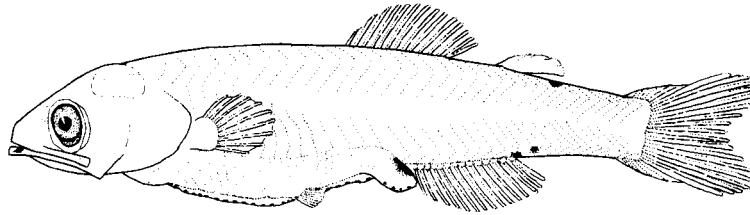


**CALIFORNIA COOPERATIVE OCEANIC
FISHERIES INVESTIGATIONS**

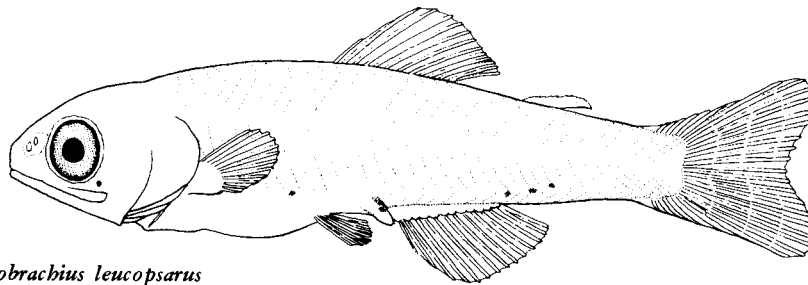
ATLAS No. 17



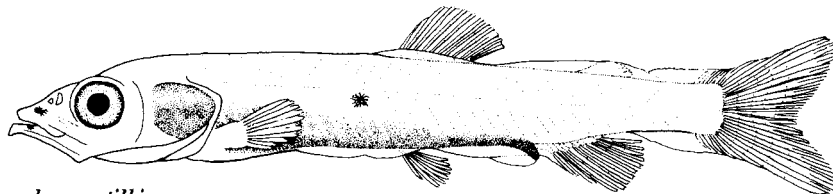
Vinciguerria lucetia



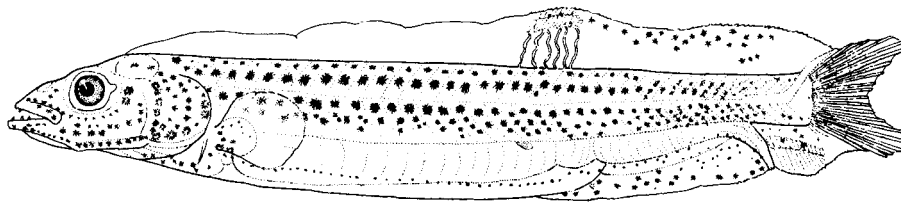
Triphoturus mexicanus



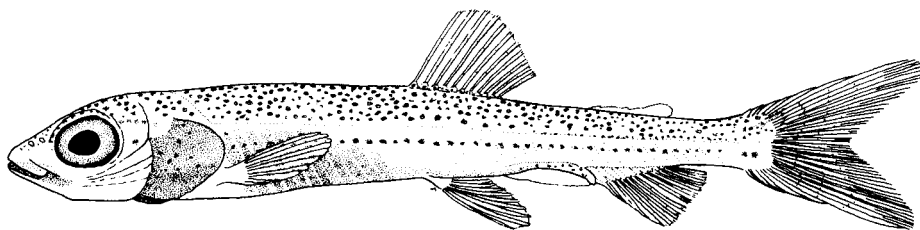
Stenobranchius leucopsarus



Leuroglossus stilbius



Bathylagus wesethi



Bathylagus ochotensis

CALIFORNIA
COOPERATIVE
OCEANIC
FISHERIES
INVESTIGATIONS

Atlas No. 17

STATE OF CALIFORNIA
MARINE RESEARCH COMMITTEE

Cooperating Agencies:

CALIFORNIA ACADEMY OF SCIENCES
CALIFORNIA DEPARTMENT OF FISH AND GAME
STANFORD UNIVERSITY, HOPKINS MARINE STATION

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, NATIONAL MARINE FISHERIES SERVICE
UNIVERSITY OF CALIFORNIA, SCRIPPS INSTITUTION OF OCEANOGRAPHY

June, 1972

THE CALCOFI ATLAS SERIES

This is the seventeenth 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
National Oceanic and Atmospheric Administration, National Marine Fisheries Service²
University of California, Scripps Institution of Oceanography

CalCOFI atlases³ 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 John G. Wyllie, Editors

CalCOFI atlases in this series, through June 1972, are:

- No. 1. Anonymous, 1963. CalCOFI atlas of 10-meter temperatures and salinities 1949 through 1959.
- No. 2. Fleminger, A., 1964. Distributional atlas of calanoid copepods in the California Current region, Part I.
- No. 3. Alvarino, A., 1965. Distributional atlas of Chaetognatha in the California Current region.
- No. 4. Wyllie, J. G., 1966. Geostrophic flow of the California Current at the surface and at 200 meters.
- No. 5. Brinton, E., 1967. Distributional atlas of Euphausiacea (Crustacea) in the California Current region, Part I.
- No. 6. McGowan, J. A., 1967. Distributional atlas of pelagic molluscs in the California Current region.
- No. 7. Fleminger, A., 1967. Distributional atlas of calanoid copepods in the California Current region, Part II.
- No. 8. Berner, L. D., 1967. Distributional atlas of Thaliacea in the California Current region.
- No. 9. 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.
- No. 10. Isaacs, J. D., A. Fleminger and J. K. Miller, 1969. Distributional atlas of zooplankton biomass in the California Current region: Spring and Fall 1955-1959.
- No. 11. Ahlstrom, E. H., 1969. Distributional atlas of fish larvae in the California Current region: jack mackerel, *Trachurus symmetricus*, and Pacific hake, *Merluccius productus*, 1951 through 1966.
- No. 12. Kramer, D., 1970. Distributional atlas of fish eggs and larvae in the California Current region: Pacific sardine, *Sardinops caerulea* (Girard), 1951 through 1966.
- No. 13. Smith, P. E., 1971. Distributional atlas of zooplankton volume in the California Current region, 1951 through 1966.
- No. 14. Isaacs, J. D., A. Fleminger and J. K. Miller, 1971. Distributional atlas of zooplankton biomass in the California Current region: Winter 1955-1959.
- No. 15. Wyllie, J. G., and R. J. Lynn, 1971. Distribution of temperature and salinity at 10 meters, 1960-1969 and mean temperature, salinity and oxygen at 150 meters, 1950-1968 in the California Current.
- No. 16. Crowe, F. J. and R. A. Schwartzlose, 1972. Release and recovery records of drift bottles in the California Current region, 1955 through 1971.
- No. 17. Ahlstrom, E. H., 1972. Distributional atlas of fish larvae in the California Current region: six common mesopelagic fishes—*Vinciguerria lucetia*, *Tripnoturus mexicanus*, *Stenobrachius leucopsarus*, *Leuroglossus stilbius*, *Bathylagus wesethi*; and *Bathylagus ochotensis*, 1955 through 1960.

¹Usually abbreviated CalCOFI, sometimes CALCOFI or CCOFI.

²Formerly called U. S. Fish and Wildlife Service, Bureau of Commercial Fisheries.

³For citation this issue in the series should be referred to as CalCOFI Atlas No. 17.



Hans T. Klein
1902 - 1972

The impressive role played by Hans T. Klein during two decades in support of physical oceanography at Scripps Institution of Oceanography was in fact paradoxically obscured by its effectiveness. The more successful his efforts, the more credit was gained by the physical oceanographers he so faithfully served. Klein's most memorable contribution was the development and management of procedures to produce uniformly high quality hydrographic data on a large scale. This in effect permitted the imaginative ideas of the research staff to be transformed into practical hydrographic programs.

He died suddenly on 7 September 1972 after appearing to be recovering from a heart ailment that incapacitated him earlier in the year.

Klein was born on 25 August 1902 in the small central European city of Hohenelbe, about 50 miles northeast of Prague. He studied in Prague and Vienna and throughout his life retained a strong sentimental attach-

ment to the pre-war image of these two great cities. Mere mention of either city during periods of administrative stress was usually sufficient for the tensions to be replaced by "gemütlichkeit." He emigrated to the United States in 1938 and came to La Jolla in 1941.

Klein was a man of dignity and loyalty, intensely proud of his association with Scripps Institution of Oceanography and strongly aware of his responsibilities to his colleagues and the community. His deep concern for the well-being of his co-workers was always in evidence; his sources of enjoyment included the rare ability to experience genuine pleasure from the happiness of others.

His association with Scripps Institution of Oceanography began in February 1947 when he joined Prof. Harald U. Sverdrup's laboratory to assist in a study on forecasting wave and surf conditions. Sverdrup was quick to recognize Klein's innovative talent for methodology and quality control in handling quantitative data. In the course of this proj-

ect he also began his close associations with Profs. John D. Isaacs and Robert S. Arthur. In subsequent years he added other distinguished La Jolla scientists and guests of the Institution to his list of friends and colleagues, including Elbert H. Ahlstrom, Maurice Blackburn, Albert Defant, Joseph L. Ried, Warren Wooster and Kozo Yoshida, to mention a few.

Klein entered the Marine Life Research Program near the end of 1948. He took charge of the Data Collection and Processing Group in 1958, the team of marine technicians responsible for obtaining and standardizing hydrographic field measurements. His search for accuracy and precision led to a refining of procedures for data collecting at sea and the development of a training program for marine technicians that has been admired and adopted by institutions in the U.S. and abroad. Former members of his training program may be found in various oceanographic laboratories, university laboratories, government agencies and the oceanographic industry. Visiting scientists and technical personnel from the Americas, Europe and Asia have come to Scripps Institution of Oceanography to study the training procedures that yield the admirable quality of oceanographic data for which Scripps Institution is so justly famous.

Klein developed the graphic method commonly referred to as Form 4.5 to simplify the processing of physical oceanographic data. Later he used the concept underlying this method as the basis for computerizing the processing procedures. The technique is significant both for processing and for analyzing hydrographic data and it has been adopted for use by a number of other institutions. Despite the rapidity of technological developments and the shifting emphasis in ocean science the system Klein established for data processing at Scripps Institution of Oceanography is still essentially as he developed it, its durability mute testimony of his skill in program development and administration.

Hand-in-hand with the processing of the data, he established standards of measurement which are as rigorous as his processing

system. He was a main force behind efforts that led to the improved quality of reversing thermometers manufactured in the United States. His method of calibrating reversing thermometers has been widely adopted.

The CalCOFI program greatly benefited from his counsel. For example, his persuasive arguments convinced the CalCOFI Committee to continue systematic monitoring of hydrographically distinctive stations within the CalCOFI survey region irrespective of subsequent program modifications. This decision made possible the existence of a unique time series of temperature, salinity and zooplankton collections representative of the various water masses contributing to the California Current region, a wealth of data that will serve present and future studies concerned with Earth's environmental record. He was among the first at Scripps to advocate preparation of visual summaries of temporal hydrographic data that led to the development of the CalCOFI Atlas series. Until illness precluded activity, he served the Atlas series from its inception officially as an editor but privately as its everwatchful sage.

Other facets of Hans Klein may be envisioned from his personal interests and activities outside of oceanography. He read avidly, especially in German literature, particular favorites being Goethe, Mann, Schiller and Heine. He wrote humorous poetry often to commemorate notable events affecting his associates and he particularly enjoyed presenting it to the recipient without warning. His pleasure in meter found another little-known outlet—enjoyment of percussion instruments which he attacked with enthusiasm.

One of Klein's special interests was in the organization, the physical arrangement and the historical development of cities, a reflection of his pleasure and concern for people and their activities in producing the human community.

His enjoyment of art was widespread, but his strong attachments to classical Gothic and the Bauhaus school is in keeping with the underlying qualities of his professional activities: accuracy, precision and order.

DISTRIBUTIONAL ATLAS OF FISH LARVAE IN THE
CALIFORNIA CURRENT REGION: SIX COMMON
MESOPELAGIC FISHES—*VINCIGUERRIA LUCETIA*,
TRIPHOTURUS MEXICANUS, *STENOBRACHIUS LEUCOPSARUS*,
LEUROGLOSSUS STILBIUS, *BATHYLAGUS WESETHI*,
AND *BATHYLAGUS OCHOTENSIS*, 1955 THROUGH 1960

Elbert H. Ahlstrom

CALCOFI ATLAS NO. 17

A. Fleminger and J. G. Wyllie, Editors
Data Collection and Processing Group
Marine Life Research Program
Scripps Institution of Oceanography
La Jolla, California

June, 1972

**DISTRIBUTIONAL ATLAS OF FISH LARVAE IN THE
CALIFORNIA CURRENT REGION:
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VINCIGUERRIA LUCETIA, TRIPHOTURUS MEXICANUS,
STENOBRACHIUS LEUCOPSARUS,
LEUROGLOSSUS STILBIUS, BATHYLAGUS WESETHI,
AND BATHYLAGUS OCHOTENSIS, 1955 THROUGH 1960**

Elbert H. Ahlstrom¹

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¹National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Center, La Jolla, California 92037.

Introduction

This atlas illustrates the distribution and relative abundance of larvae of six of the more abundant mesopelagic fishes found in California Current waters off California and Baja California during the years 1955 through 1960.

The group includes three members of the family Bathylagidae (*Leuroglossus stilbius*, *Bathylagus ochotensis*, *Bathylagus wesethi*), two species of Myctophidae (*Stenobranchius leucopsarus*, *Triphoturus mexicanus*), and one representative of the family Gonostomatidae (*Vinciguerria lucetia*).

Sixty-nine cruises are considered in this atlas, all monthly CalCOFI cruises between 1955 and 1960 except the unique wide ranging NORPAC expedition of August 1955; no monthly cruises were made in November and December of 1960.

Distribution charts were prepared for a species when it was obtained in five or more collections during a cruise. At least one distribution chart is included for 68 of the 69 CalCOFI cruises made during 1955 to 1960. The exception is Cruise 5611 (Table 1). Coverage was normally more extensive on cruises made in January through July, and October. Coverage was usually limited on cruises made during the remaining 4 months.

The larvae of the six species were obtained in plankton collections made with a standard CalCOFI net, 1-meter in diameter at the mouth. Details of the net and of its deployment during the haul are given in Fleminger (1964) and Ahlstrom (1966). Depth of water permitting, the net was lowered by paying out 200 meters of cable at the rate of 50 meters of wire per minute, and retrieved at a uniform rate of 20 meters per minute while maintaining a wire angle of 45 degrees. The usual depth reached

by the net was about 140 meters. The tow was taken at a vessel speed of 1½ to 2 knots. A flow meter in the mouth of the net permitted calculation of the volume of water strained during a haul.

As pointed out in previous distributional atlases for fish eggs and larvae, standardized values for fish eggs and larvae are not directly comparable with standardized values used by authors of some other CalCOFI atlases. Estimates of abundance of fish larvae were made comparable between samples by standardizing the counts to the number under 10 square meters of sea surface. Details for deriving standardization factors are given in Kramer and Ahlstrom (1968).

Information concerning the depth distribution of the larvae of the six species dealt with in this atlas is given in Ahlstrom (1959). Larvae of *Vinciguerria lucetia*, *Triphoturus mexicanus* and *Stenobranchius leucopsarus* occurred mostly in the upper mixed layer above the thermocline and were seldom taken below 100 meters depth. Larvae of the three bathylagid smelts occurred mostly below the thermocline, but were commonly taken between circa 70 to 125 meters, although a portion of the larvae occurred deeper than the level routinely sampled on standard CalCOFI hauls, i.e., below 140 meters depth. Hence, the standard haul values for three species are minimal estimates of their relative abundance.

TABLE 1. Number of distribution charts included in this atlas for monthly cruises made in 1955 through 1960. A distribution chart is included for each species having five or more collections of larvae on a particular cruise.

Month	Year						Total
	1955	1956	1957	1958	1959	1960	
01	5	5	1	6	6	5	28
02	6	5	5	6	5	6	33
03	6	6	6	6	6	6	36
04	6	6	6	6	6	6	36
05	6	6	6	6	6	6	36
06	6	6	6	6	5	6	35
07	6	6	5	6	6	5	34
08	NORPAC*	3	2	2	3	4	14
09	3	2	3	3	3	2	16
10	4	1	3	3	4	3	18
11	3	0	3	1	3	—	10
12	4	1	1	1	2	—	9
Total	55	47	47	52	55	49	305

* not included

Larvae of *Vinciguerria lucetia* (Figure 1; Distribution Charts 2-63)

V. lucetia is the only species among the six featured in this atlas, whose early life history stages have been described in detail (Ahlstrom and Counts, 1958). It is a tropical-subtropical species that is widely distributed in the eastern Pacific between California and Chile. It does not occur in the central water mass of either the North or South Pacific—being replaced

there by *V. nimbaria*. Its larvae are second in abundance in the eastern tropical Pacific to those of the myctophid, *Diogenichthys laternatus* (Ahlstrom, 1971a). Its abundance in the CalCOFI pattern is strongly influenced by water temperatures. It occurred in relatively low abundance during colder-than-average years, such as 1956, and in markedly higher numbers during warmer-than-average years, such as 1957 through 1959 (Table 2). Even so, it was taken

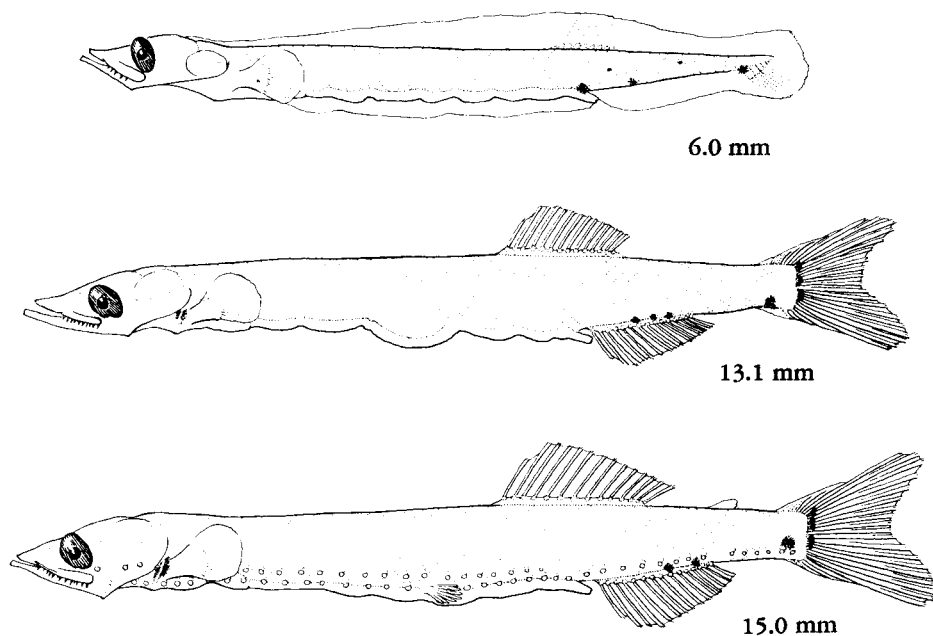


Figure 1. Larvae of *Vinciguerria lucetia*

on 67 of the 69 cruises included in this atlas, and in sufficient numbers for inclusion in distribution charts for 62 cruises. For pagination of

these charts, refer to Table 3; for information on the five cruises with one to four occurrences, refer to Table 4.

TABLE 2. Relative abundance of larvae of six mesopelagic fishes in the California Current region off California and Baja California during 1955-60. (Standard haul summations.)

	1955 ¹	1956	1957	1958	1959	1960	Source
Family Bathylagidae							
<i>Bathylagus ochotensis</i>	1,301	2,231	1,078	1,550	545	1,671	Ahlstrom, 1969
<i>Bathylagus wesethi</i>	3,245	2,146	6,347	7,033	2,386	1,207	Ibid
<i>Leuroglossus stilbius</i>	15,114	18,620	29,506	4,859	7,597	29,795	Ibid
Family Myctophidae							
<i>Stenobrachius leucopsarus</i>	7,453 ²	15,120	16,803	11,876	7,228	11,977	Moser & Ahlstrom, 1970
<i>Tripnoturus mexicanus</i>	13,160 ²	10,802	16,206	16,605	33,872	22,119	Ibid
Family Gonostomatidae							
<i>Vinciguerria lucetia</i>	12,658	9,832	55,114	57,424	117,959	35,041	Ahlstrom, 1969
Total — six categories	52,931	58,751	125,054	99,347	169,587	101,810	
Total — all fish larvae	378,898	408,140	493,549	456,018	470,456	504,980	Ahlstrom, 1969

¹Includes multiple occupancies of stations on Cruises 5509 and 5511 and excludes NORPAC.

²Totals for 1955 from Ahlstrom, 1969, for comparability, inasmuch as totals in Moser and Ahlstrom (1970) included NORPAC and excluded multiple occupancies on Cruises 5509 and 5511.

TABLE 3. Pagination of distribution charts for larvae of six mesopelagic fishes. Distribution charts limited to cruises with five or more occurrences of a species. Fewer occurrences (1 to 4) indicated by T (see Table 4 for data) and no occurrences by 0.

Cruise	<i>Vinciguernia lucetia</i>	<i>Tripboturus mexicanus</i>	<i>Stenobrachius leucopsarus</i>	<i>Leuroglossus stilbius</i>	<i>Bathylagus weselbi</i>	<i>Bathylagus ochotensis</i>	Cruise	<i>Vinciguernia lucetia</i>	<i>Tripboturus mexicanus</i>	<i>Stenobrachius leucopsarus</i>	<i>Leuroglossus stilbius</i>	<i>Bathylagus weselbi</i>	<i>Bathylagus ochotensis</i>
5501	2	64	125	175	T	269	5801	5	66	127	177	223	271
02	8	69	130	180	225	274	02	11	72	133	183	226	277
03	14	75	136	186	228	280	03	17	78	139	189	231	283
04	20	81	142	192	234	286	04	23	84	145	195	237	289
05	26	87	148	198	240	292	05	29	90	151	201	243	295
06	32	93	154	204	246	298	06	35	96	157	207	249	301
07	38	99	160	210	252	303	07	41	102	163	213	255	305
08	----- NORPAC -----						08	46	107	0	0	0	0
09	T	110	166	217	T	T	09	51	113	T	0	262	0
10	54	116	T	218	264	T	10	56	119	T	0	266	0
11	0	122	168	219	0	0	11	59	T	T	0	T	0
12	61	124	171	222	T	T	12	62	T	T	0	T	T
5601	3	65	126	176	T	270	5901	6	67	128	178	224	272
02	9	70	131	181	T	275	02	12	73	134	184	T	278
03	15	76	137	187	229	281	03	18	79	140	190	232	284
04	21	82	143	193	235	287	04	24	85	146	196	238	290
05	27	88	149	199	241	293	05	30	91	152	202	244	296
06	33	94	155	205	247	299	06	36	97	158	208	250	T
07	39	100	161	211	253	304	07	42	103	164	214	256	306
08	44	105	0	0	258	0	08	47	108	0	T	259	T
09	49	111	0	0	T	0	09	52	114	0	T	263	0
10	0	117	0	0	0	0	10	57	120	167	0	267	T
11	T	T	T	T	T	0	11	60	T	170	221	T	0
12	T	T	172	T	T	T	12	63	0	174	0	T	0
5701	4	T	T	T	T	0	6001	7	68	129	179	0	273
02	10	71	132	182	T	276	02	13	74	135	185	227	279
03	16	77	138	188	230	282	03	19	80	141	191	233	285
04	22	83	144	194	236	288	04	25	86	147	197	239	291
05	28	89	150	200	242	294	05	31	92	153	203	245	297
06	34	95	156	206	248	300	06	37	98	159	209	251	302
07	40	101	162	212	254	T	07	43	104	165	215	257	T
08	45	106	0	0	T	0	08	48	109	0	216	260	T
09	50	112	0	0	261	0	09	53	115	0	T	0	0
10	55	118	T	0	265	T	10	58	121	0	T	268	0
11	T	123	169	220	0	T							
12	T	T	173	T	T	0							

TABLE 4. Record of stations containing 1 to 4 positive samples of larvae on indicated cruises for each of the six mesopelagic fishes treated in this atlas. (These data are not presented in distribution chart form).

	Year	Cruise	Station	Number of larvae		Year	Cruise	Station	Number of larvae	
<i>Vinciguerria lucetia</i>	1955	5509A	83.55	3	<i>Leuroglossus stilbius</i> (cont.)	1960	6009	110.40	2	
			85.39	3				6010	63.60	3
	1956	5611	93.50	3				120.45	3	
			5612	97.45	3	<i>Bathylagus wesethi</i>	1955	5501	120.45	3
		97.55	3							120.100
	1957	5711	90.28	6			P5509B	85.55	5	
			5712	100.40	3			5512	113.35	2
				107.60	7		1956	5601	110.33	2
				110.70	114				110.50	3
	<i>Tripboturus mexicanus</i>	1956	5611	93.30	3				120.70	3
93.35				3				140.35	12	
				97.50	17		5602	120.25	5	
				90.37	3				123.50	3
1957		5701	113.40	3			5609	130.35	13	
			120.60	3				130.45	44	
				130.40	12			5611	80.90	6
				130.60	9			5612	80.80	3
1958		5712	90.80	36				80.90	3	
			5811	100.50	3	1957	5701	120.70	6	
			100.60	37				123.42	3	
			93.70	3				130.50	6	
			100.40	3			5702	110.60	5	
1959	5911	87.55	3				117.70	8		
		90.70	10				120.50	3		
			93.35	7				123.50	5	
			93.55	3			5708	110.40	9	
<i>Stenobrachius leucopsarus</i>	1955	5510	73.50	3				120.45	6	
	1956	5611	80.60	14			5712	90.90	10	
83.51			3		1958	5811	100.60	3		
			90.37	5			5812	93.80	3	
			97.30	5				97.35	3	
1957	5701	103.30	3			1959	5902	90.80	3	
		103.35	3				5911	87.55	48	
			103.40	6				93.50	3	
			107.40	3				93.100	6	
			83.70	5	<i>Bathylagus ochotensis</i>	1955	B5509A	87.52	8	
1958	5809	90.70	2				B5509A	87.60	3	
		93.27	1			B5509B	83.58	3		
			93.65	1			P5509A	85.60	2	
			87.70	3			5510	67.55	5	
			90.55	2			5512	80.70	5	
1959	5811	80.51	3				97.40	3		
		83.51	3			1956	5612	90.55	6	
			93.30	2		1957	5707	93.85	3	
			80.51	2				97.50	3	
			82.47	4				97.55	9	
<i>Leuroglossus stilbius</i>	1956	5611	80.51	3				100.50	3	
			82.47	6				5710	80.60	3
			83.60	3				5711	87.50	3
			82.47	12			1958	5812	83.60	3
			90.50	11			1959	5906	80.80	4
1957	5701	113.35	3					83.60	6	
		117.60	3					87.65	3	
			130.40	6				5908	83.80	2
			80.60	4				5910	43.50	3
			90.45	3				50.50	3	
1959	5908	83.80	2					53.60	3	
		90.55	3			1960	6007	60.100	1	
			110.70	3				80.90	2	
			90.110	3				6008	87.35	3

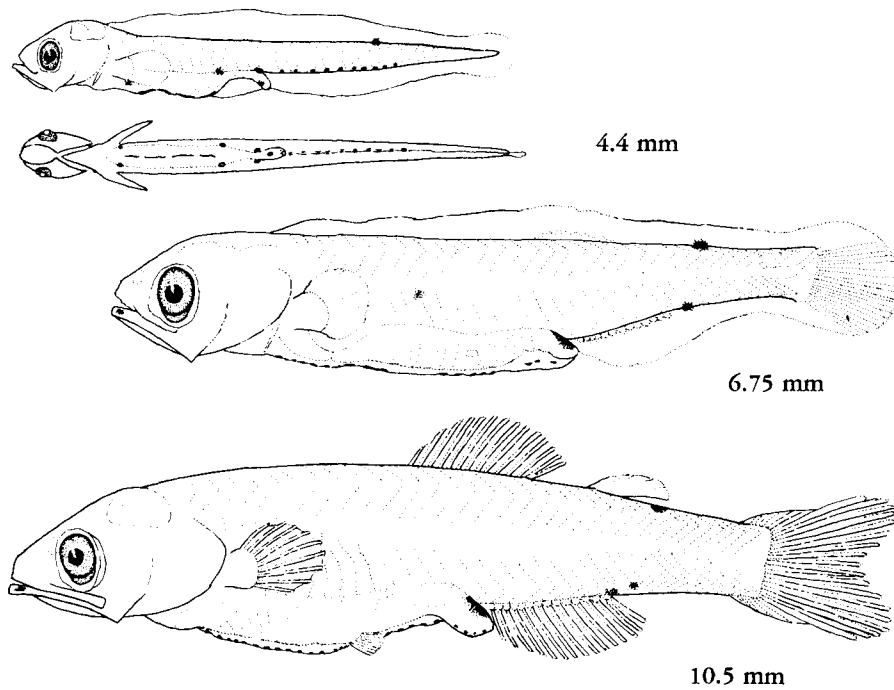


Figure 2. Larvae of *Triphoturus mexicanus*

Larvae of *Triphoturus mexicanus* (Figure 2; Distribution Charts 64-124)

Three sizes of larvae, 4.4 mm, 6.75 mm and 10.5 mm are illustrated in Ahlstrom (1965) as *Lampanyctus mexicanus*. Small-sized larvae have a series of ventral pigment spots on the tail that coalesce during development into one or two spots. Unusual pigment possessed by *T. mexicanus* larvae is a continuous ventral line of pigment spots under the intestine; larvae also develop a conspicuous dorsal pigment spot on the caudal peduncle behind

the adipose fin.

Larvae of *T. mexicanus* were obtained on all but one cruise between 1955 and 1960, but much more abundantly during the spring and summer cruises, with July usually the month of peak abundance. Distribution charts for *T. mexicanus* larvae are included for 61 cruises (see Table 3 for pagination); in addition larvae were taken at one to four stations on seven cruises (Table 4). This species is mainly distributed in the California Current region surveyed on CalCOFI cruises.

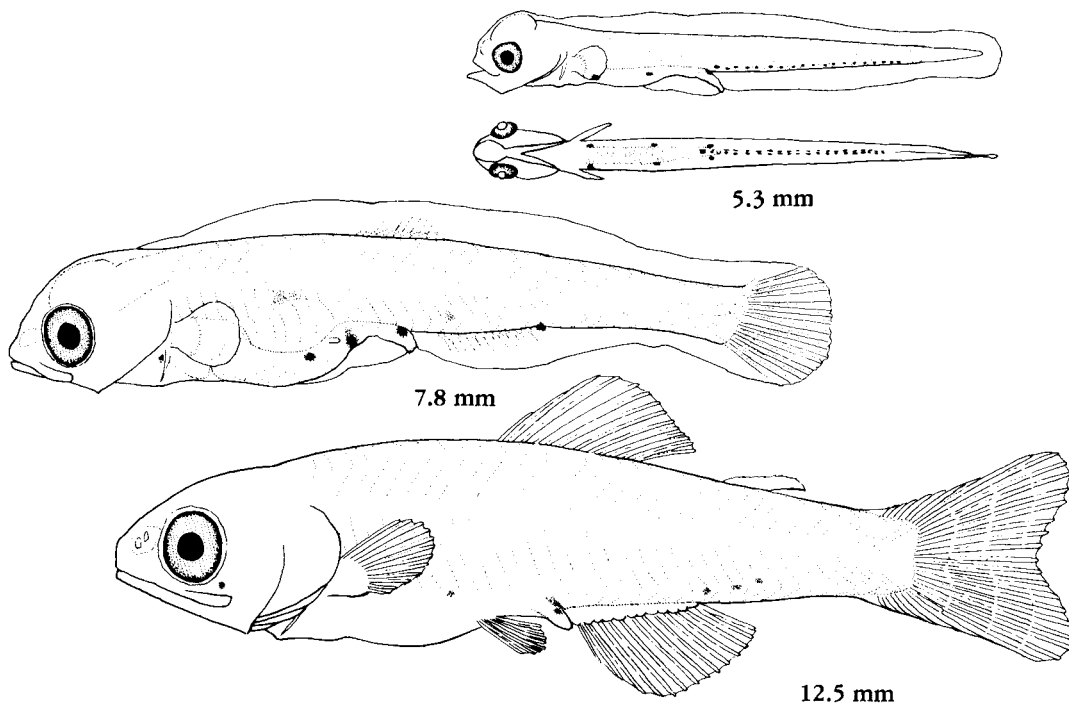


Figure 3. Larvae of *Stenobranchius leucopsarus*

Larvae of *Stenobranchius leucopsarus* (Figure 3; Distribution Charts 125-174)

Larvae of three sizes, 5.3 mm, 7.8 mm, and 12.5 mm, are illustrated in Ahlstrom (1965) as *Lampanyctus leucopsarus*. Small larvae have a large number of ventral pigment spots on the tail portion of the body (usually 19 to 21) which coalesce into one to three larger pigment spots in middle stage larvae.

This is one of the two most abundant kinds

of myctophid larvae in the California Current region. We sample the southern portion of its distribution on our CalCOFI cruises. It was taken most commonly from January to June and least frequently from August to October. The pagination of distribution charts for larvae of *S. leucopsarus* is given in Table 3. Distribution charts are included for 50 cruises. Some larvae (one to four collections per cruise) were taken on eight additional cruises (Table 4). No larvae were obtained on 11 cruises.

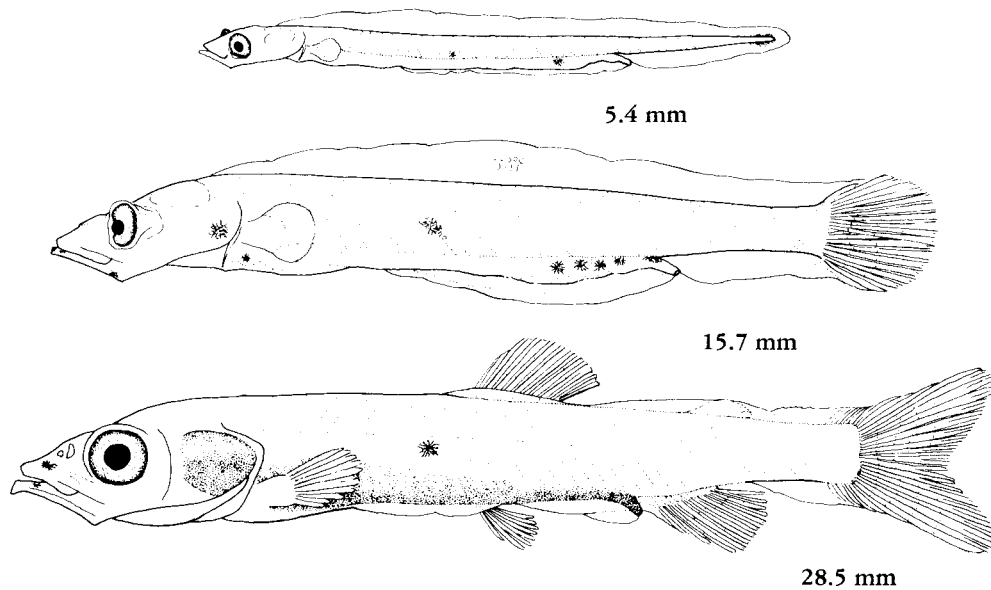


Figure 4. Larvae of *Leuroglossus stilbius*

Larvae of *Leuroglossus stilbius* (Figure 4; Distribution Charts 175-222)

Two sizes of larvae, 5.4 mm and 15.7 mm and one late metamorphic specimen, 28.5 mm are illustrated in Ahlstrom (1965). Eggs are illustrated and described in Ahlstrom (1971b). During the middle period of embryonic development in the egg, the multiple oil globules coalesce into two, situated at opposite pole positions with respect to the developing embryo, which occupies the equatorial plane. During the late period of embryonic development the oil globules move toward the embryo and fi-

nally coalesce under the embryo soon before hatching. Eggs of *L. stilbius* are among the most common in CalCOFI collections during winter and spring months.

Larvae were taken in largest numbers between January and May. The pagination for distribution charts for larvae of *L. stilbius* is given in Table 3. Distribution charts are included for 48 cruises. Some larvae (one to four collections per cruise) were taken on eight additional cruises (Table 4). No larvae were taken on 13 cruises.

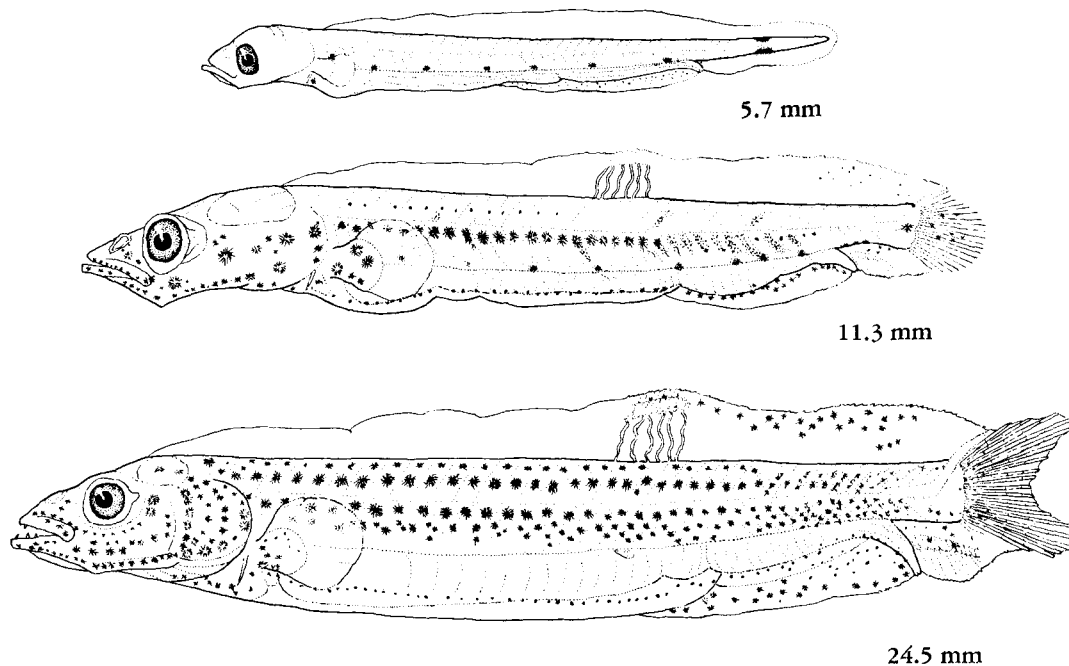


Figure 5. Larvae of *Bathylagus wesethi*

Larvae of *Bathylagus wesethi* (Figure 5; Distribution Charts 223-268)

Three sizes of larvae of this bathylagid smelt are illustrated in Ahlstrom (1965). Bathylagid larvae characteristically have wide finfolds and the dorsal fin forms at the outer margin of the finfold. Larvae of *B. wesethi* lack stalked eyes. Eggs of this species were described and illustrated in Ahlstrom (1971b). The multiple oil globules in these eggs perform complex movements in a sequential man-

ner during embryonic development.

The majority of larvae of *B. wesethi* were taken from April to July; usually few larvae were taken from September to March, although larvae were collected during all months of the year. The pagination of distribution charts for larvae of *B. wesethi* is given in Table 3. Distribution charts are included for 46 cruises. On 17 additional cruises one to four collections of *B. wesethi* larvae were obtained (Table 4). On only six cruises were larvae completely lacking.

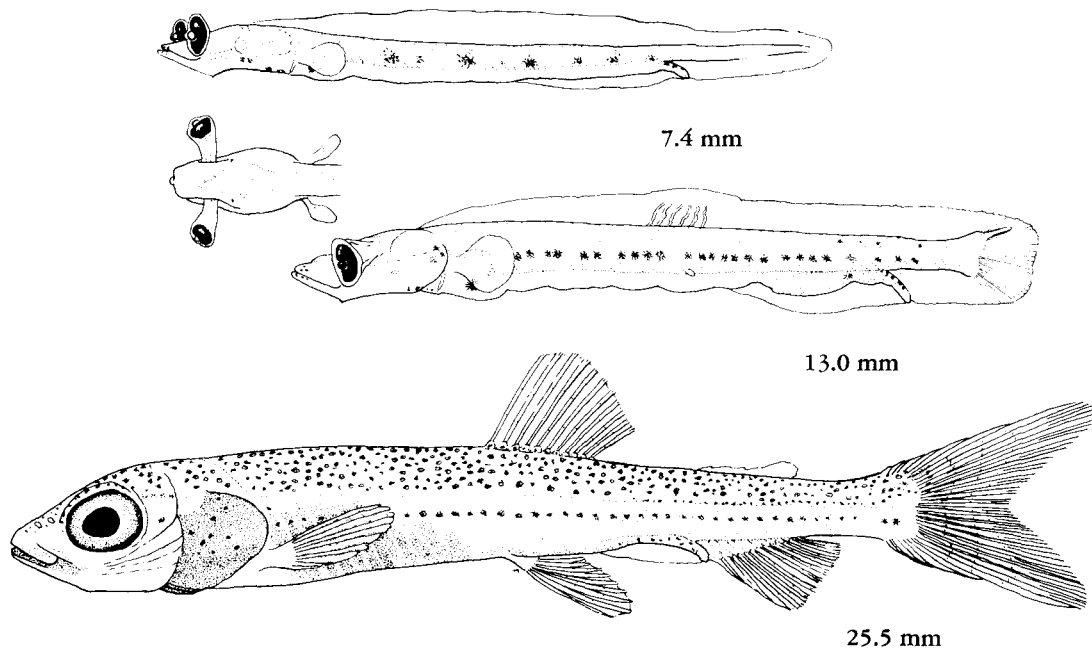


Figure 6. Larvae of *Bathylagus ochotensis*

Larvae of *Bathylagus ochotensis* (Figure 6; Distribution Charts 269-306)

Larvae of this bathylagid smelt have not been described in print, although they have been known and identified from CalCOFI collections since 1949. The southern portion of the distribution of larvae of this widely distributed subarctic transition species was sampled on CalCOFI cruises. As can be seen from the monthly distribution charts the larvae were taken mostly during winter and spring cruises.

Larvae of this species have their eyes on short stalks, a larval character shared with several other bathylagid smelts.

The pagination of distribution charts for larvae of *B. ochotensis* is given in Table 3. Distribution charts are included for 38 cruises, all falling between January and July. On 13 additional cruises, samples were obtained from one of four stations (Table 4). On 18 cruises no specimens of *B. ochotensis* were obtained.

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Vinciguerria lucetia

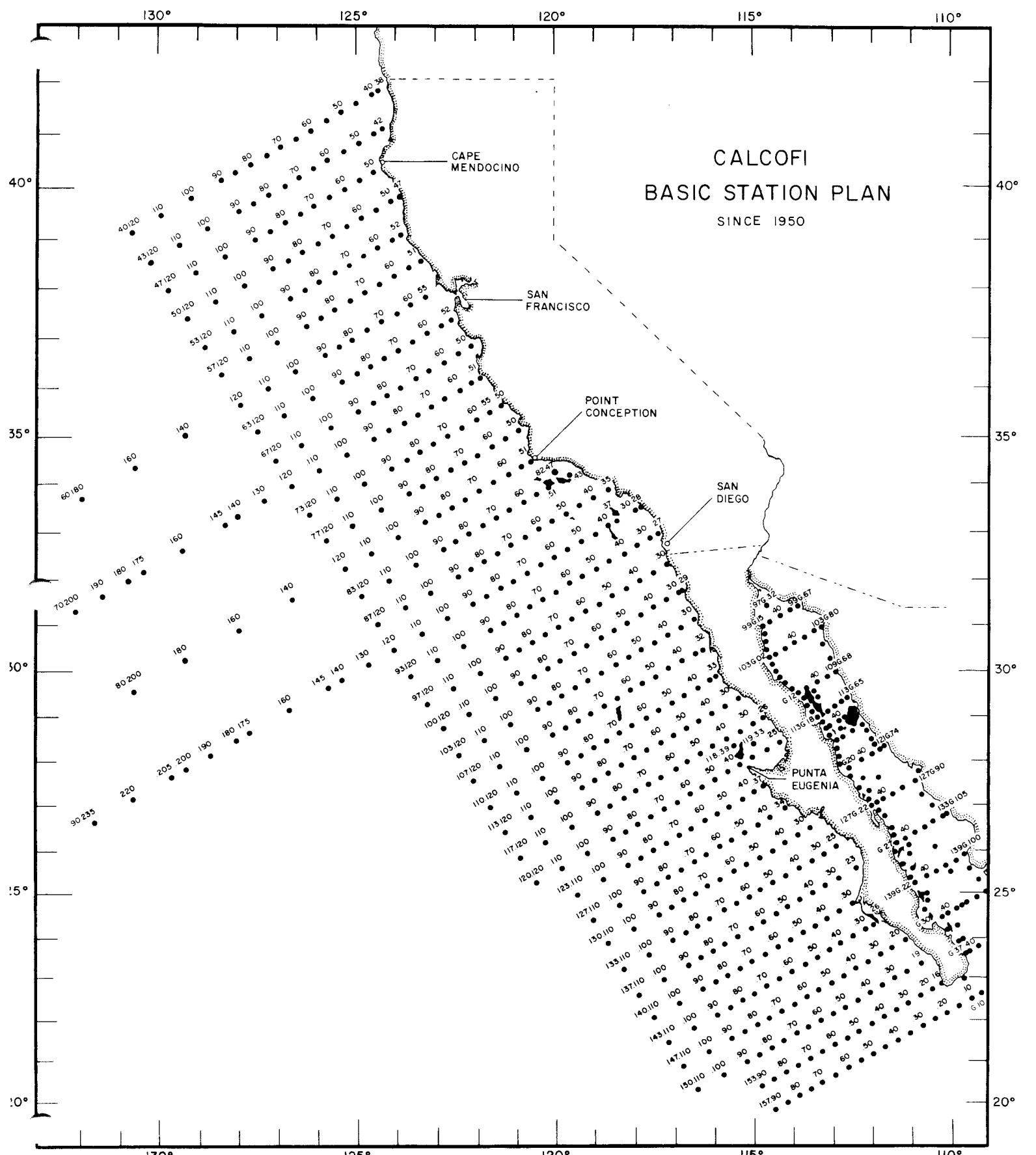
Triphoturus mexicanus

Stenobrachius leucopsarus

Leuroglossus stilbicus

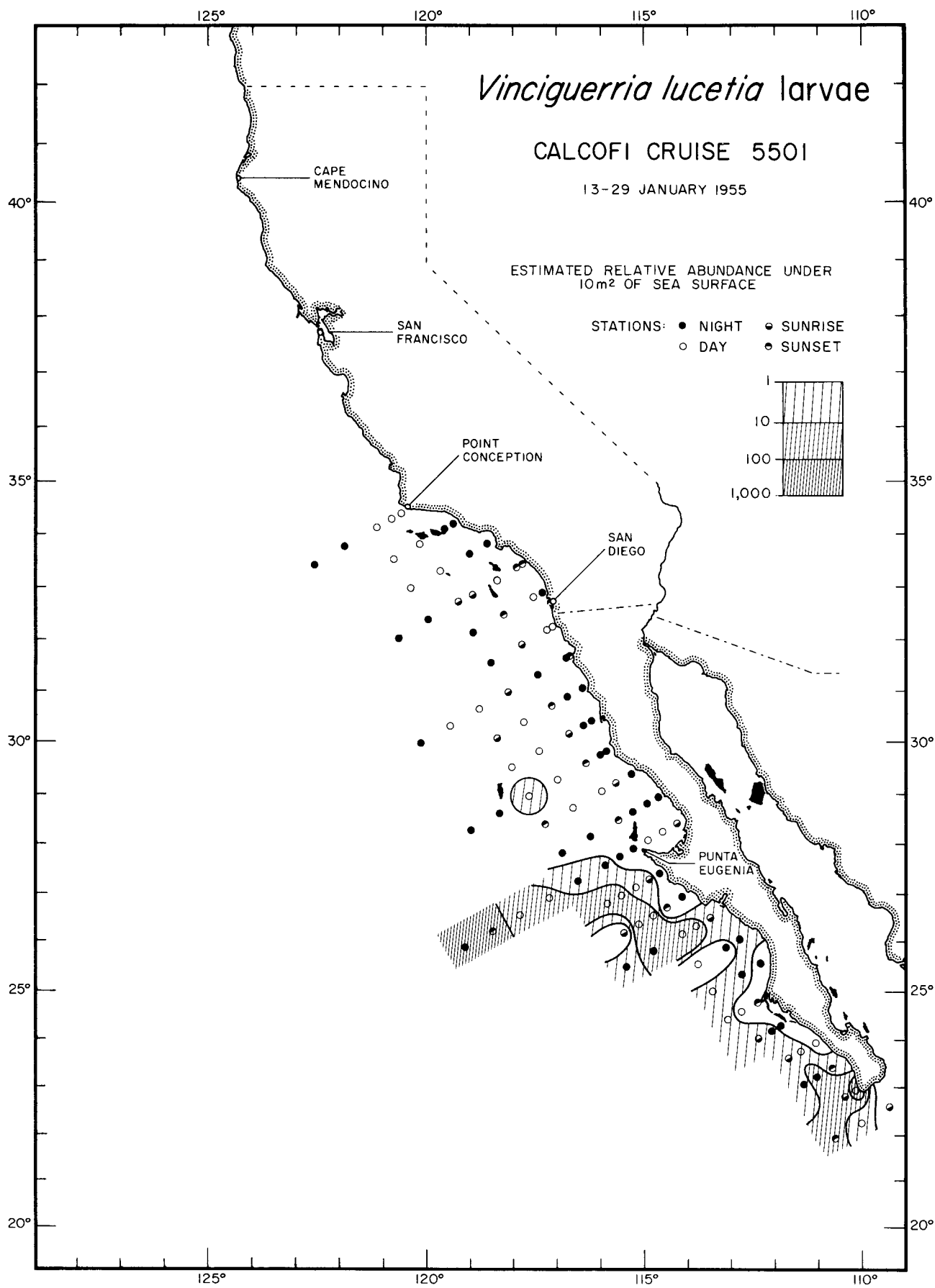
Bathylagus wesethi

Bathylagus ochotensis



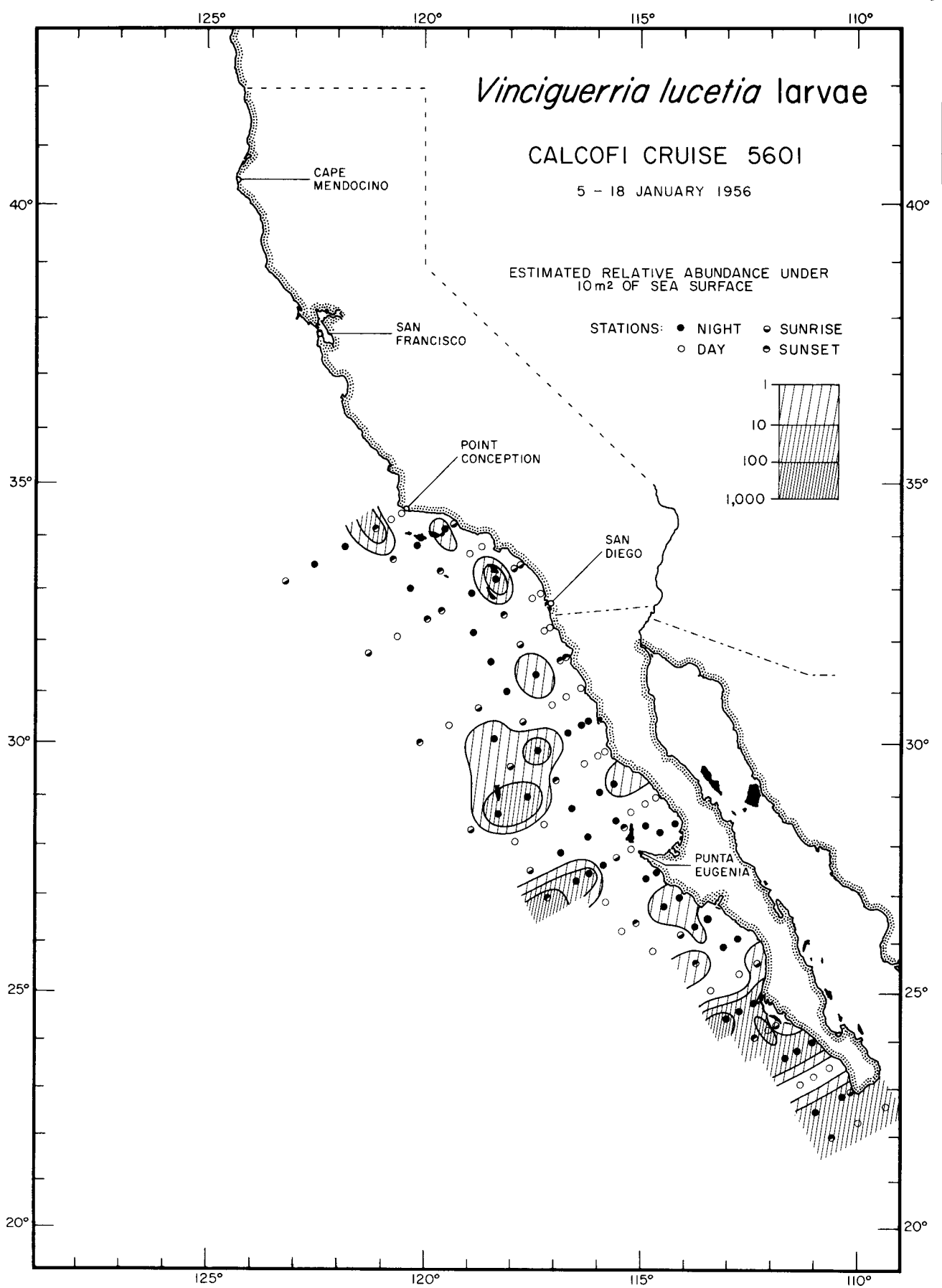
CALCOFI

BASIC STATION PLAN
SINCE 1950



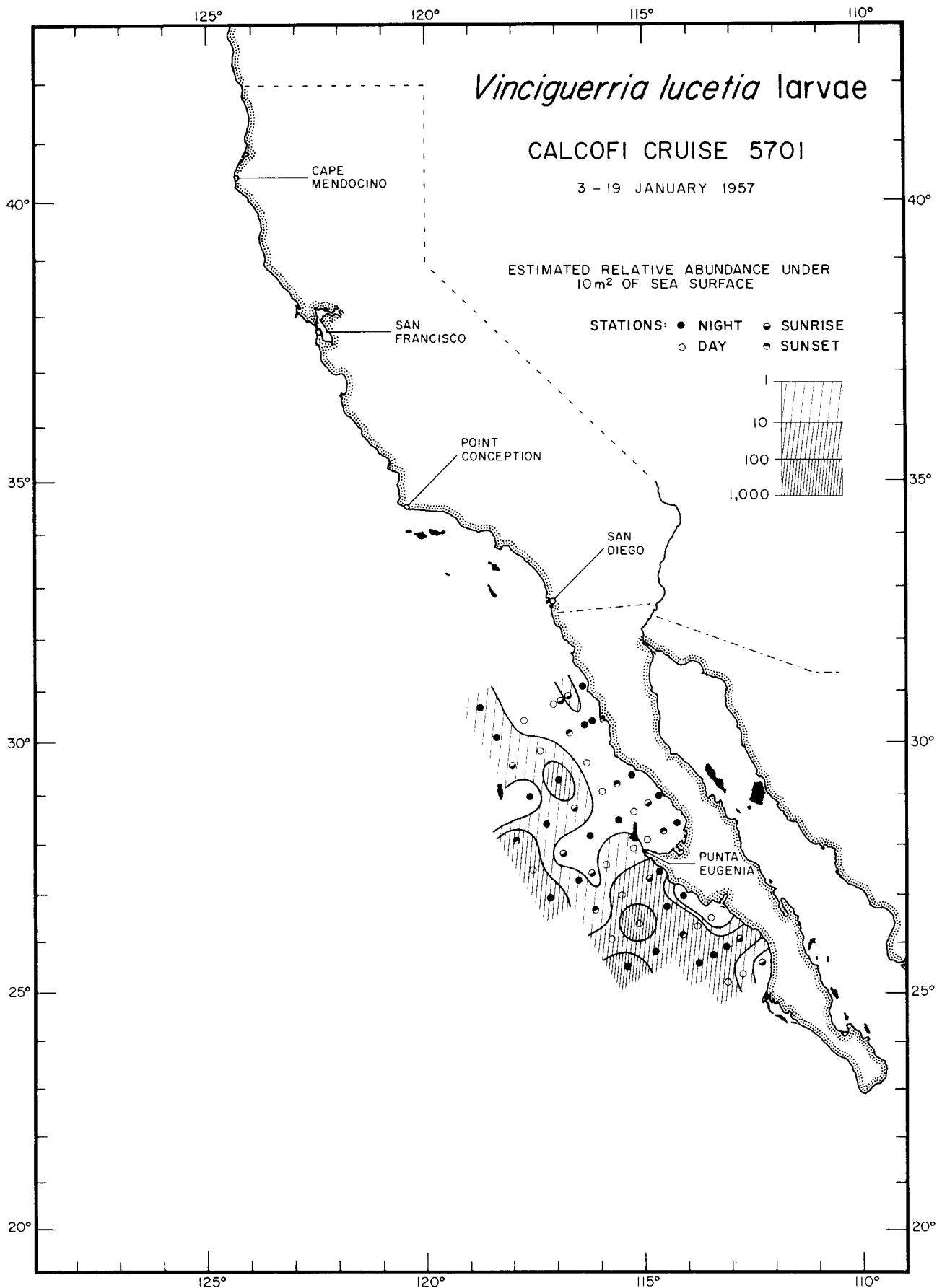
Vinciguerria lucetia larvae

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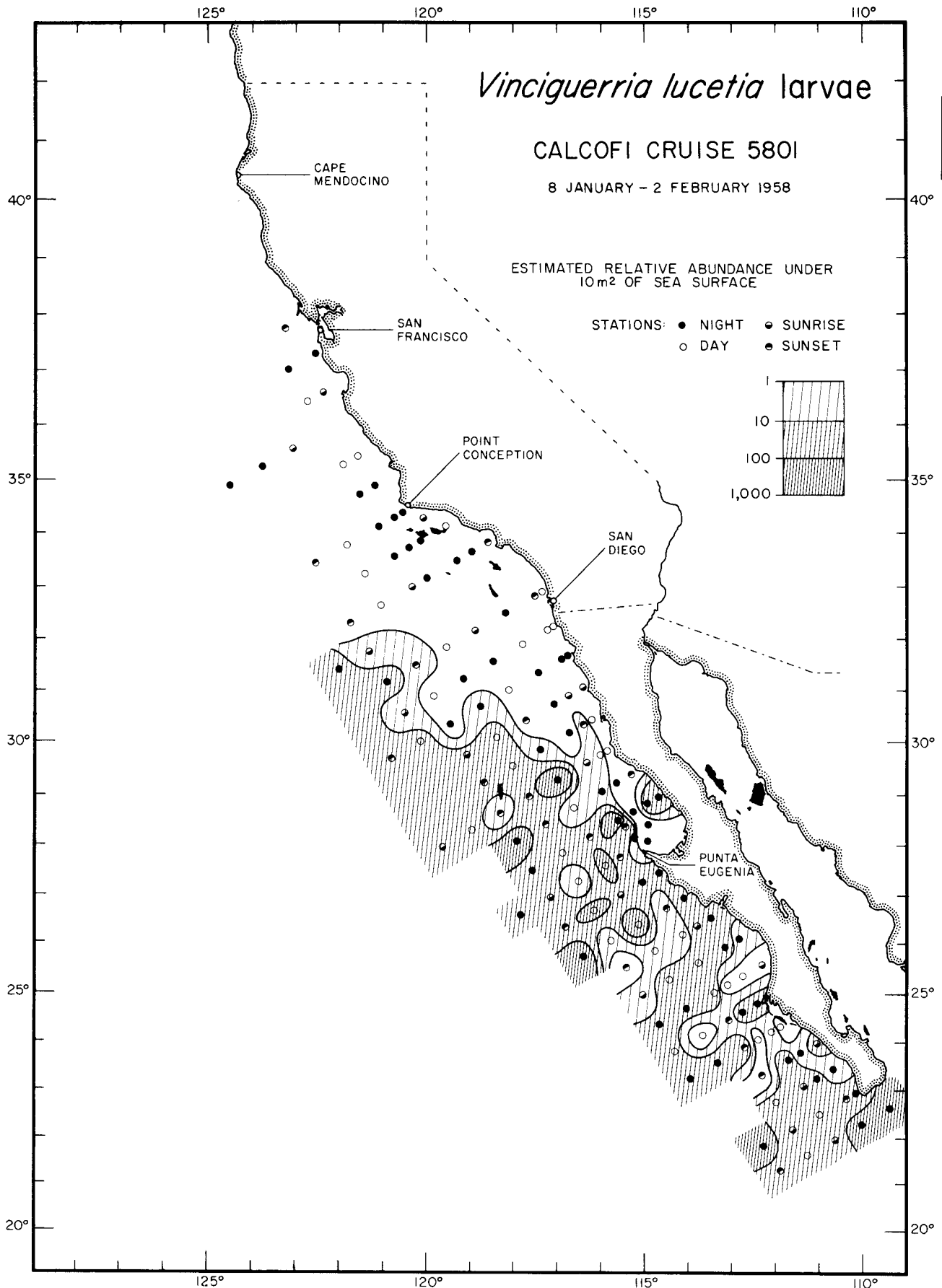
Vinciguerria lucetia larvae

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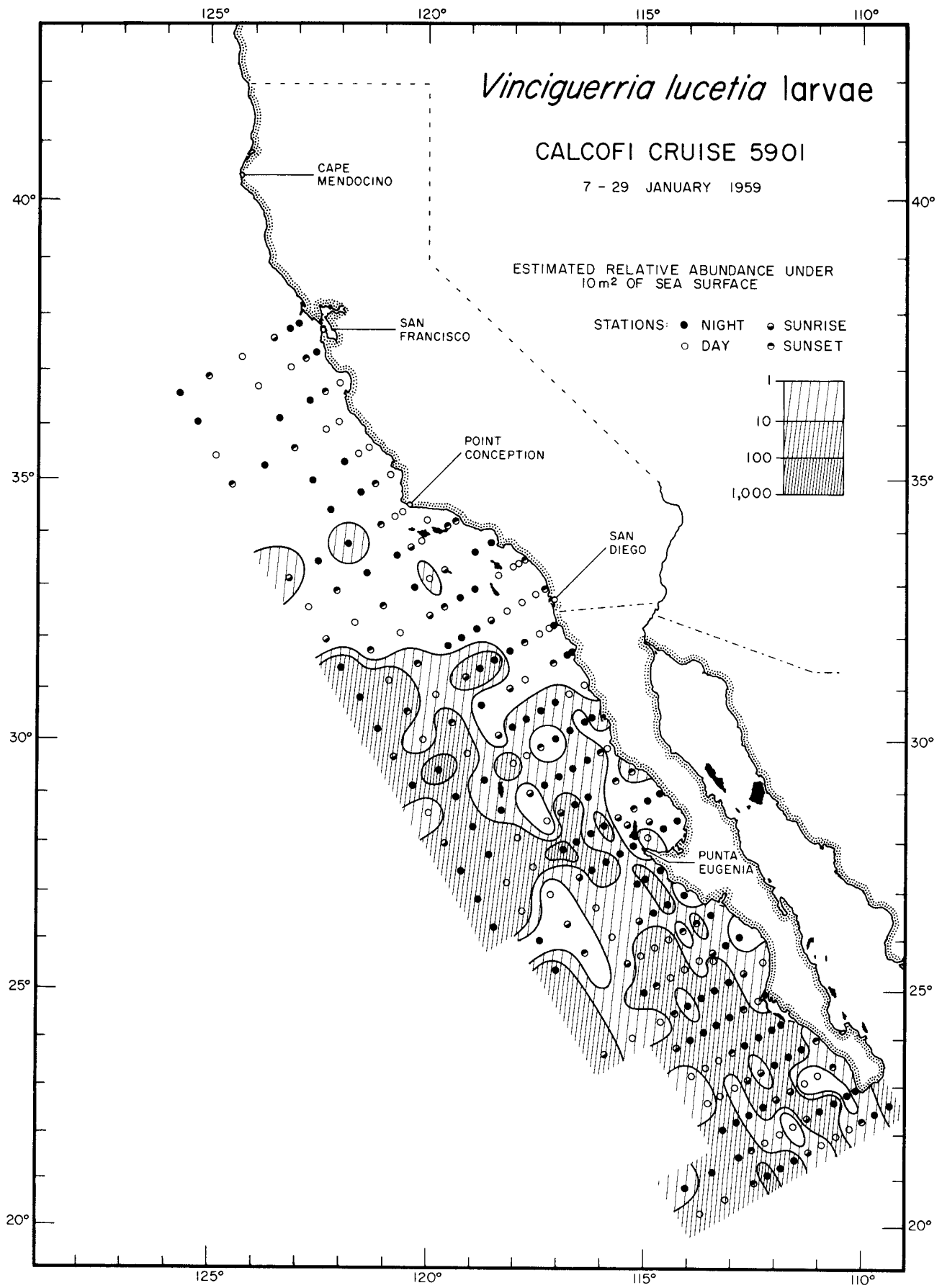


Vinciguerria lucetia larvae

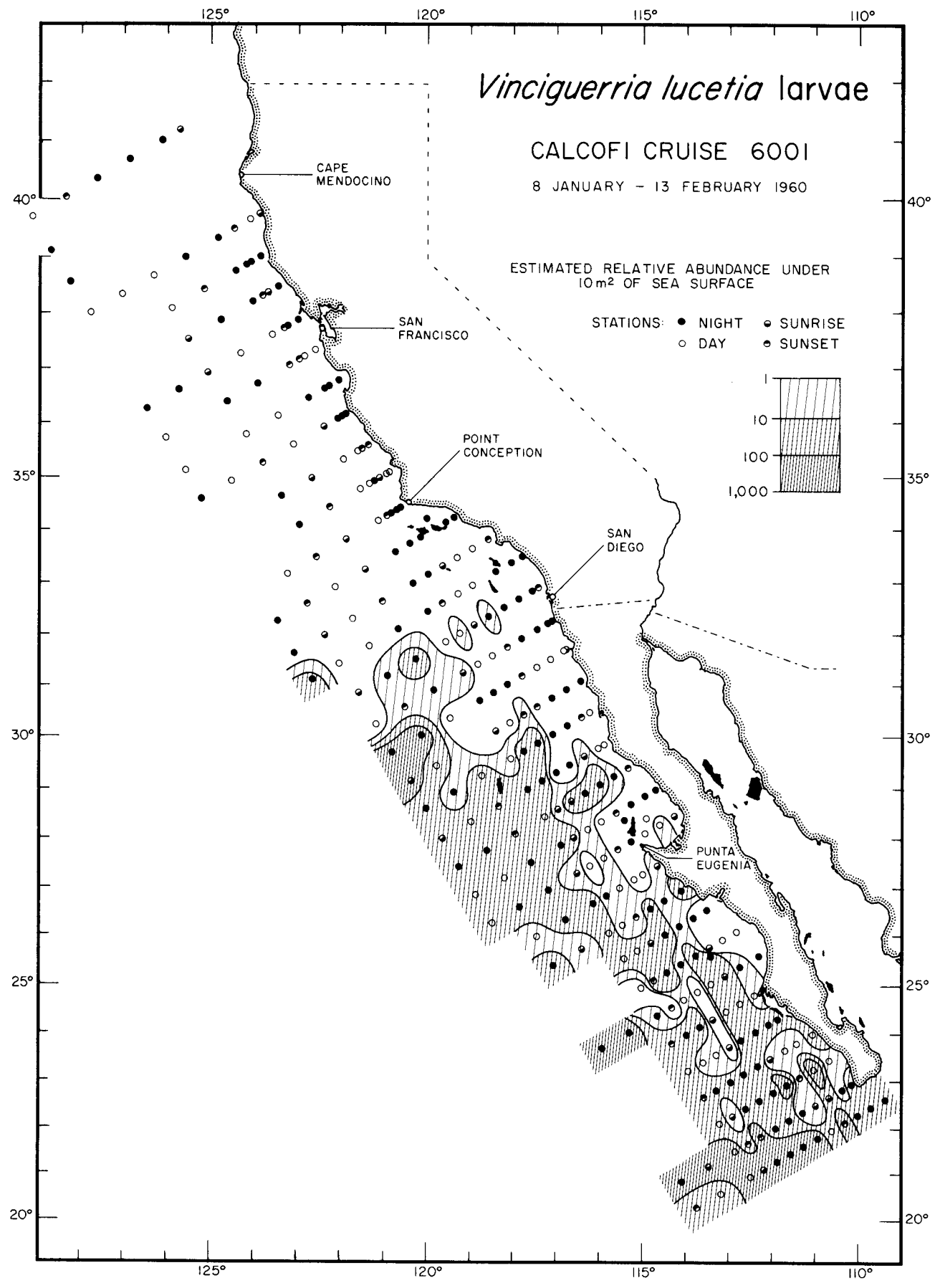
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Vinciguerria lucetia larvae

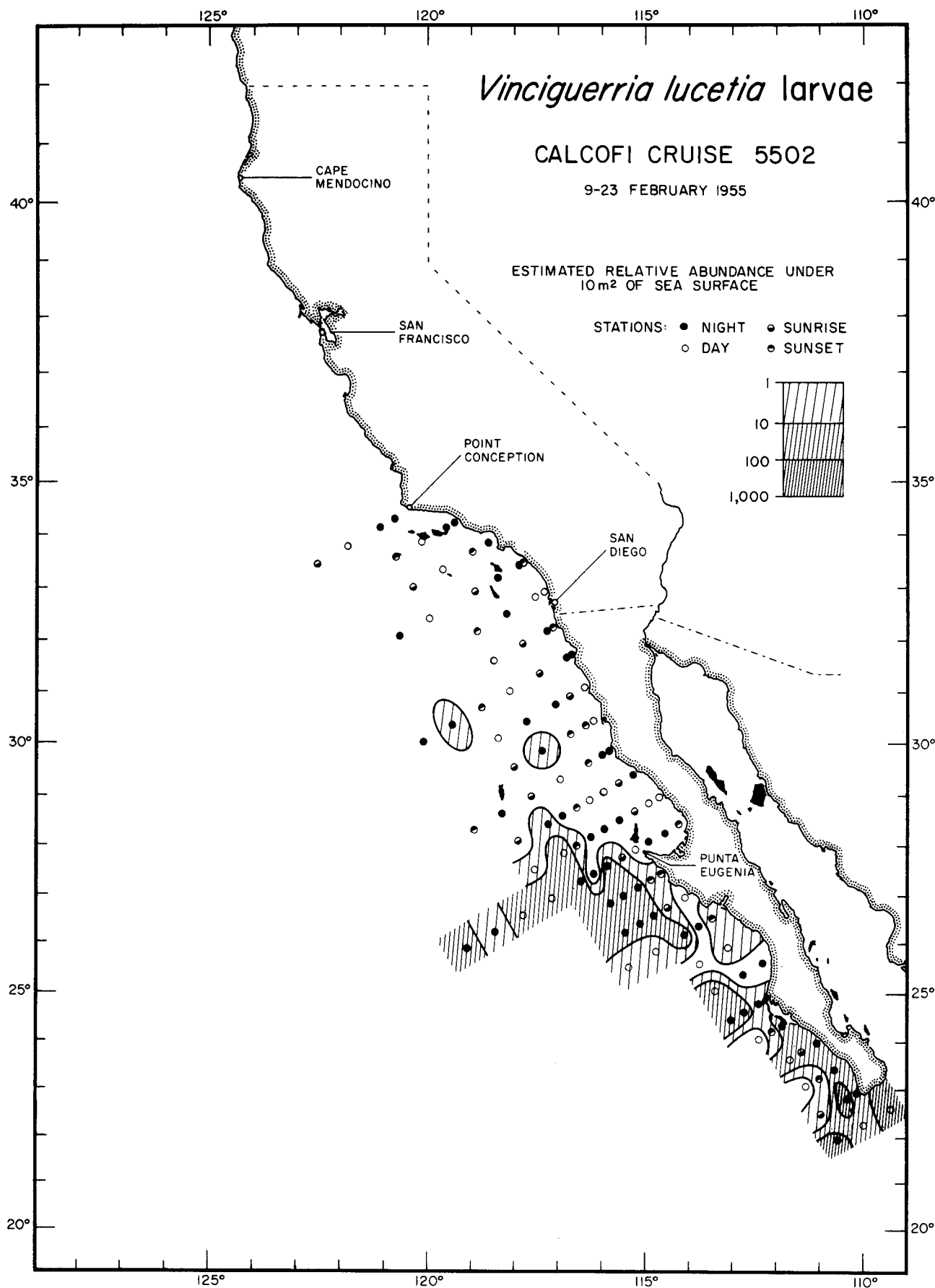


Vinciguerria lucetia larvae



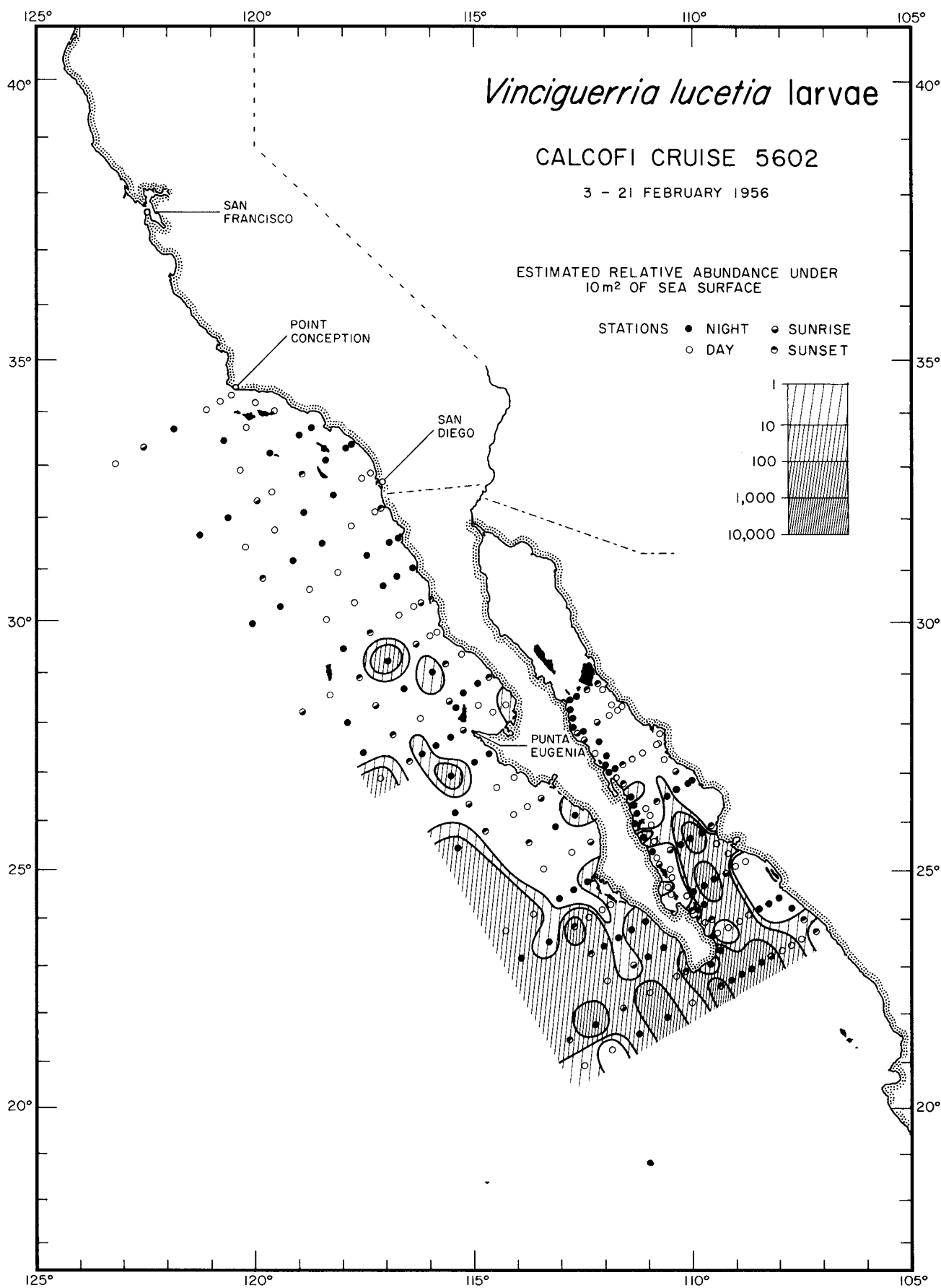
Vinciguerria lucetia larvae

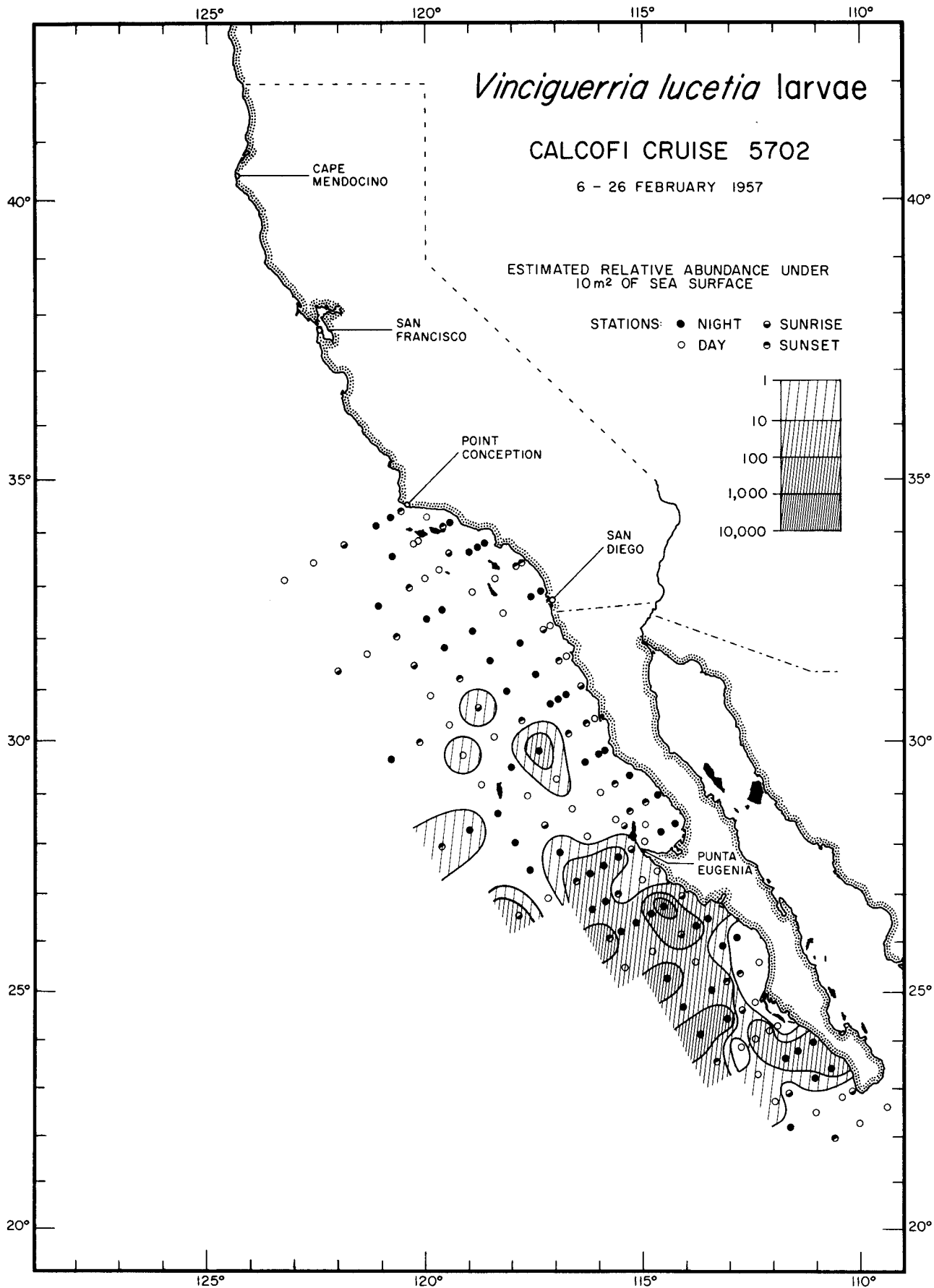
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Vinciguerria lucetia larvae

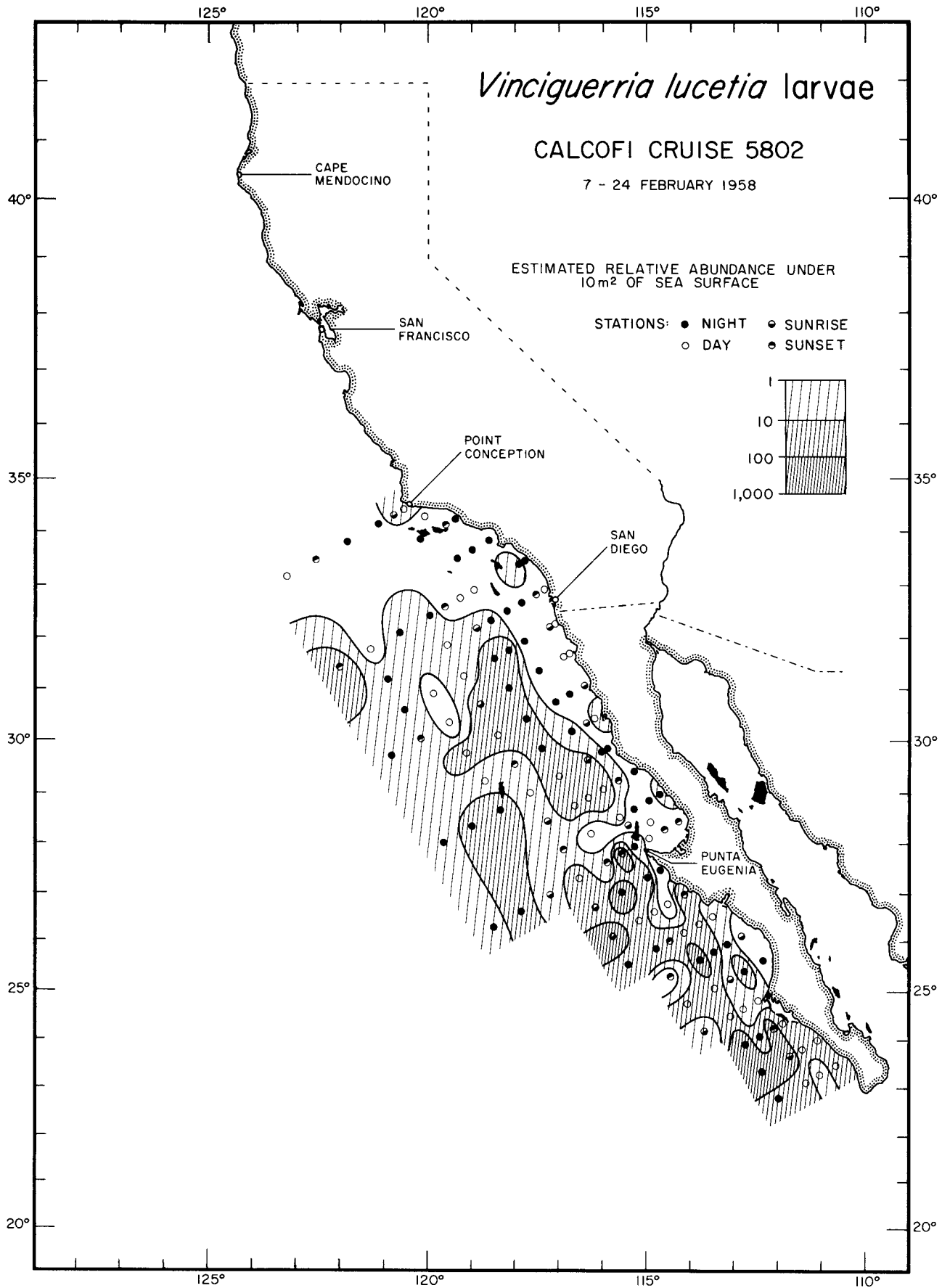
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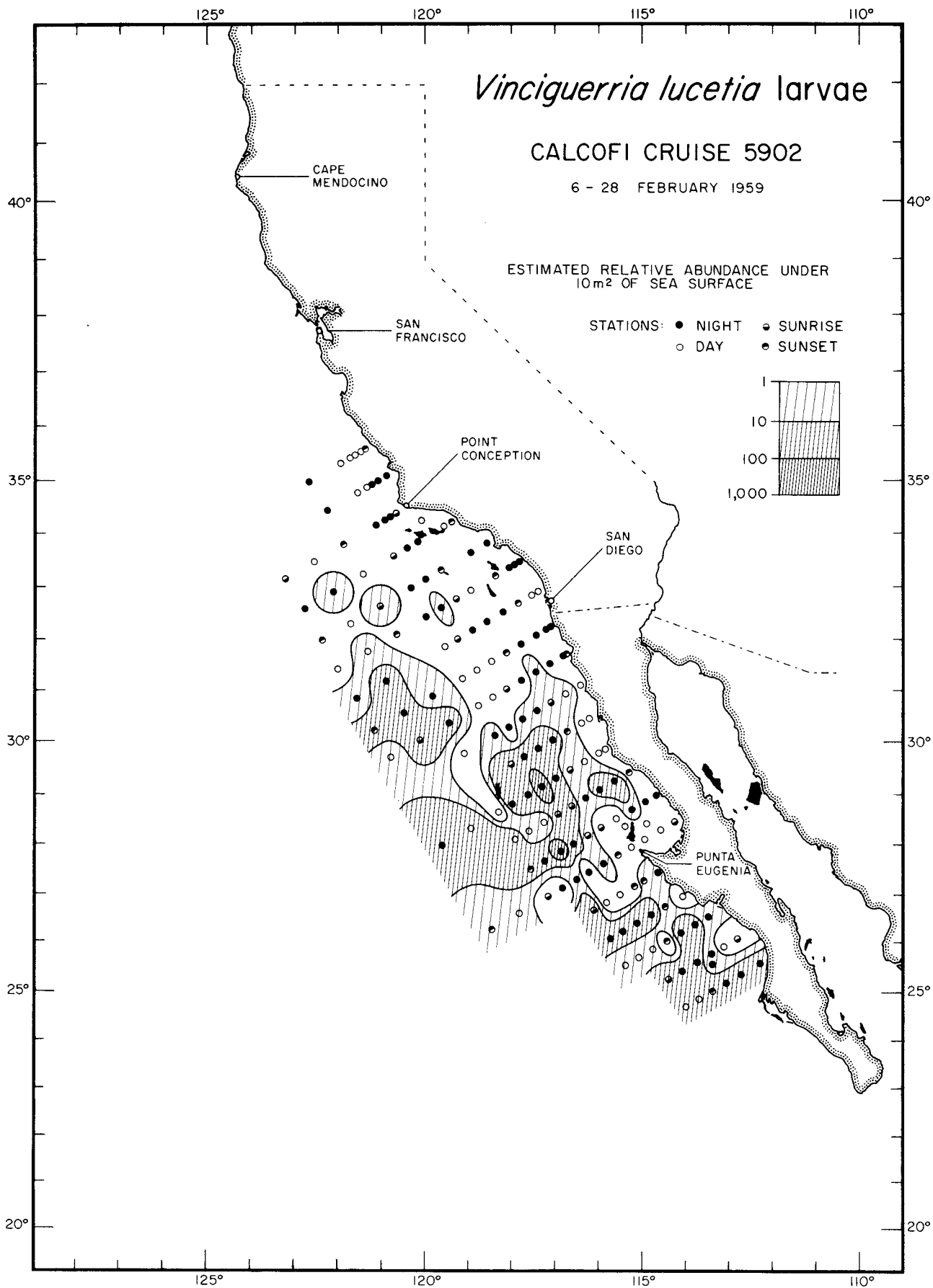
Vinciguerria lucetia larvae

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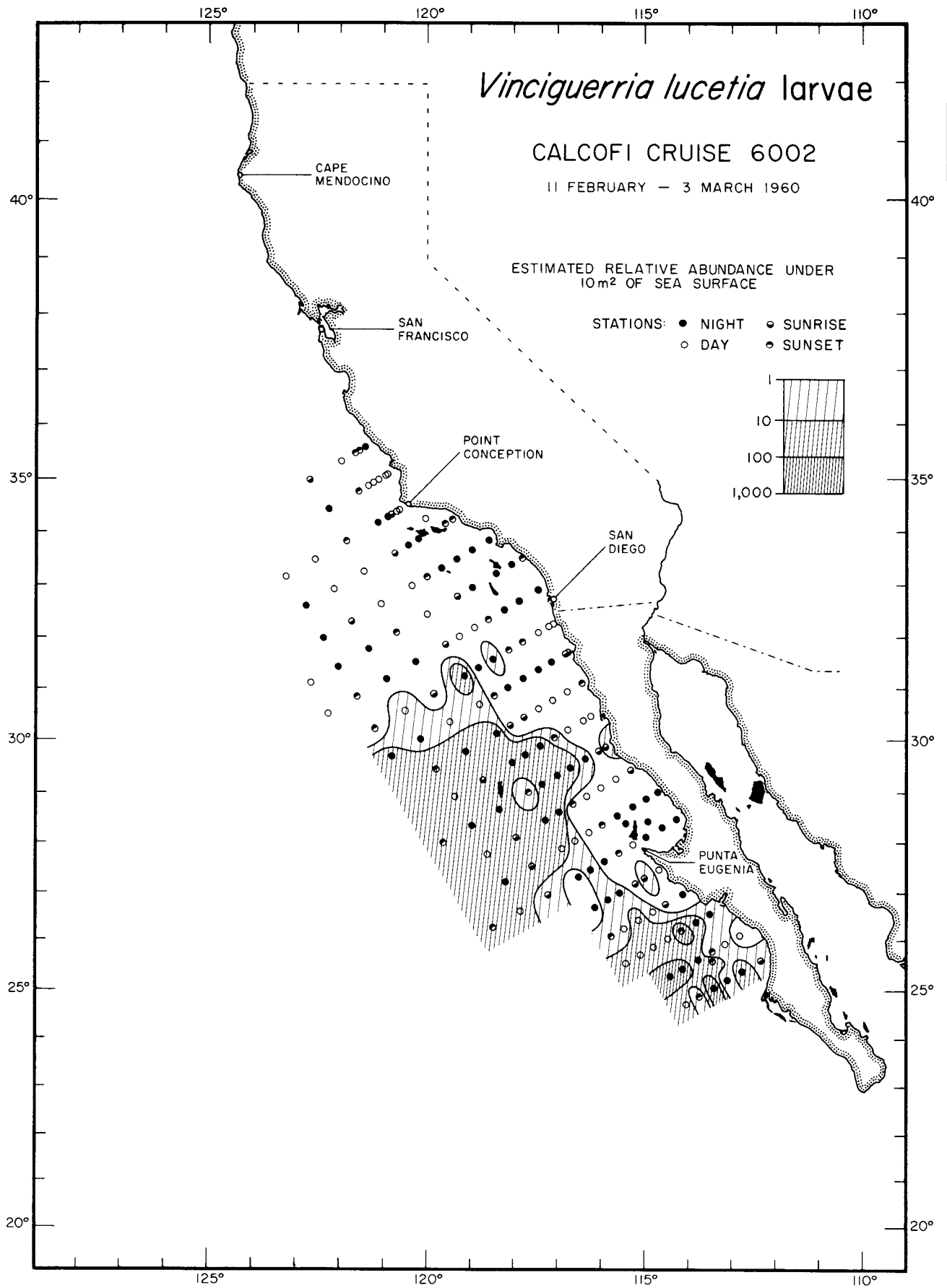
Vinciguerria lucetia larvae

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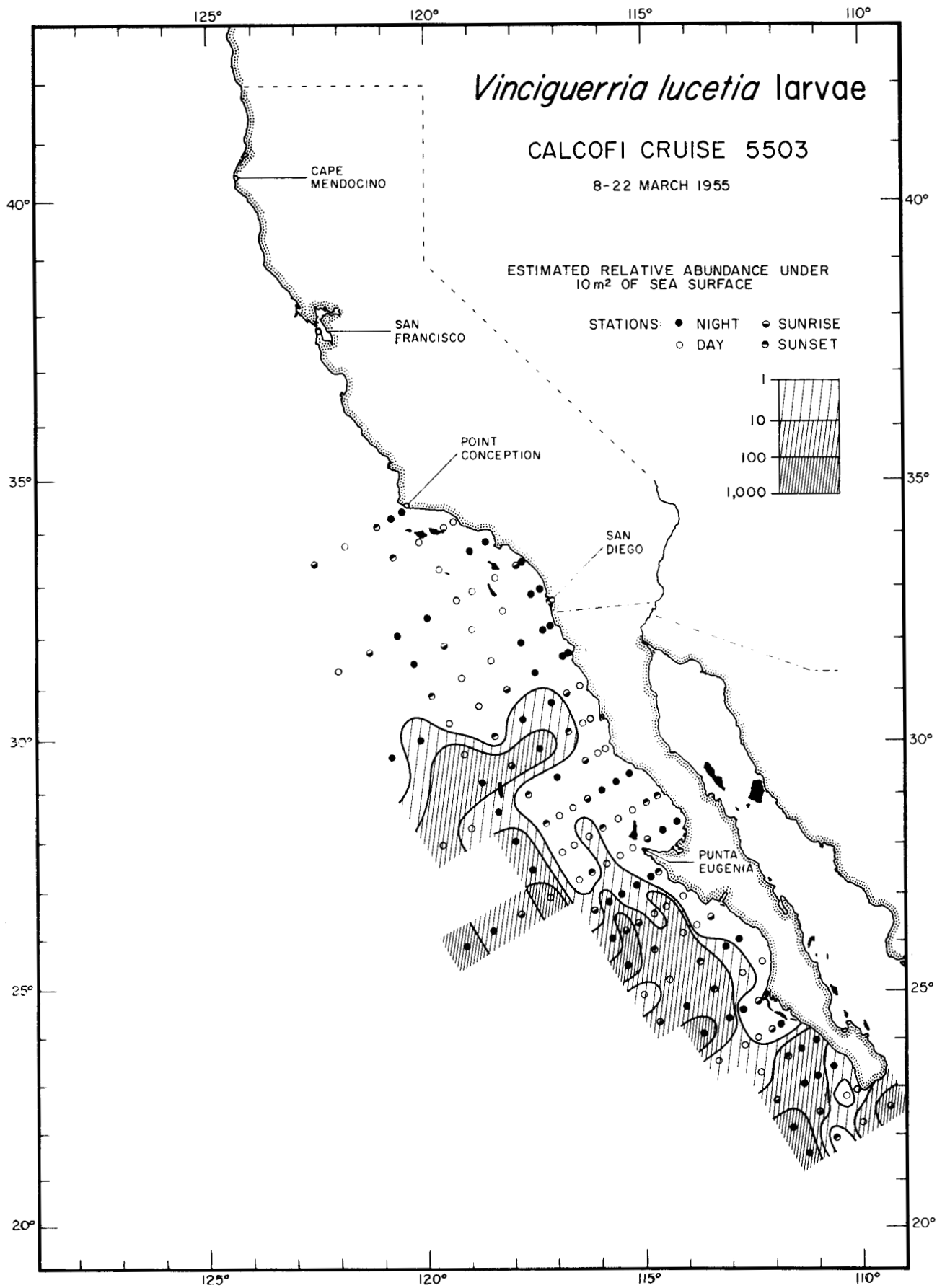
Vinciguerria lucetia larvae

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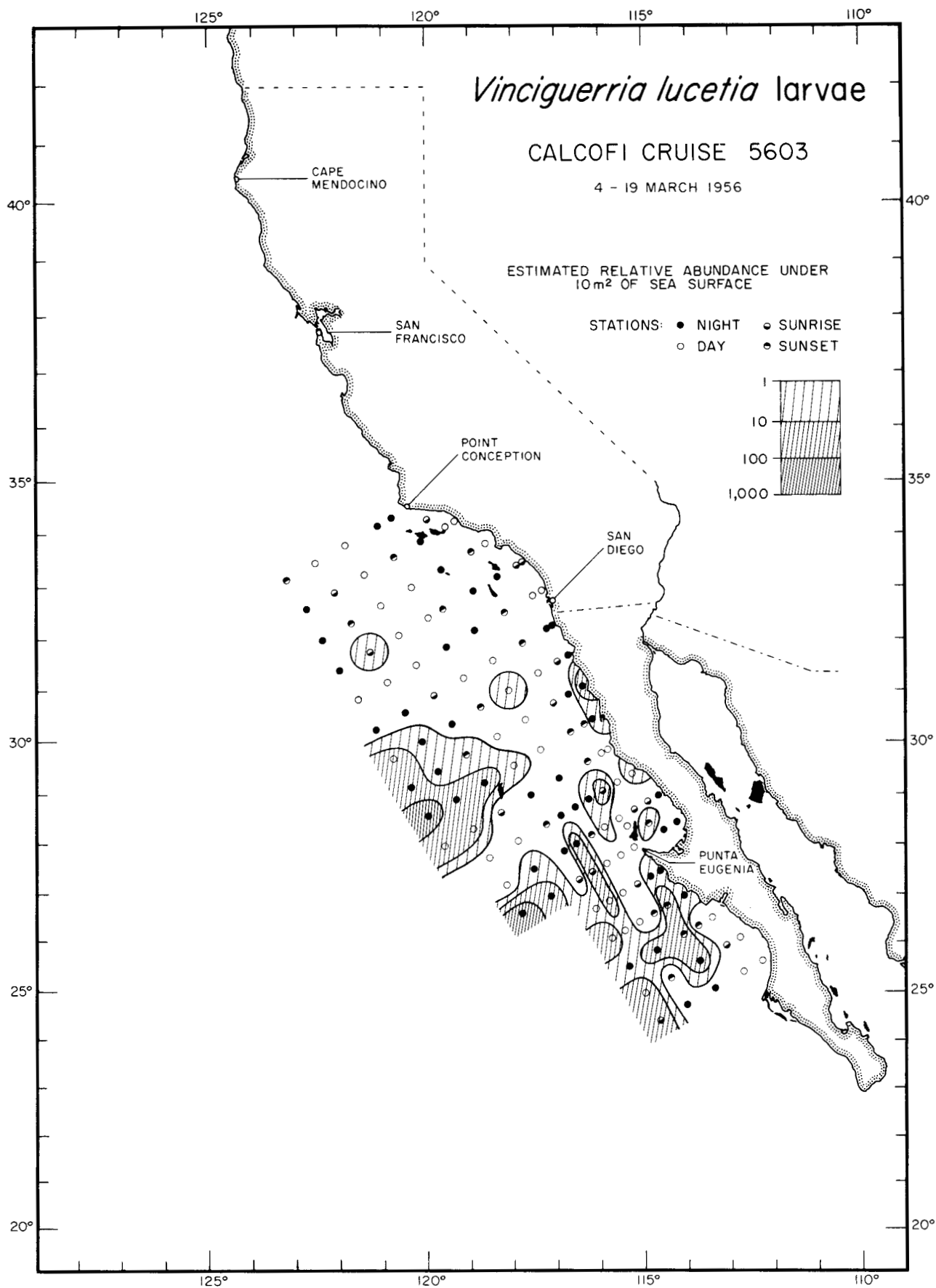
Vinciguerria lucetia larvae

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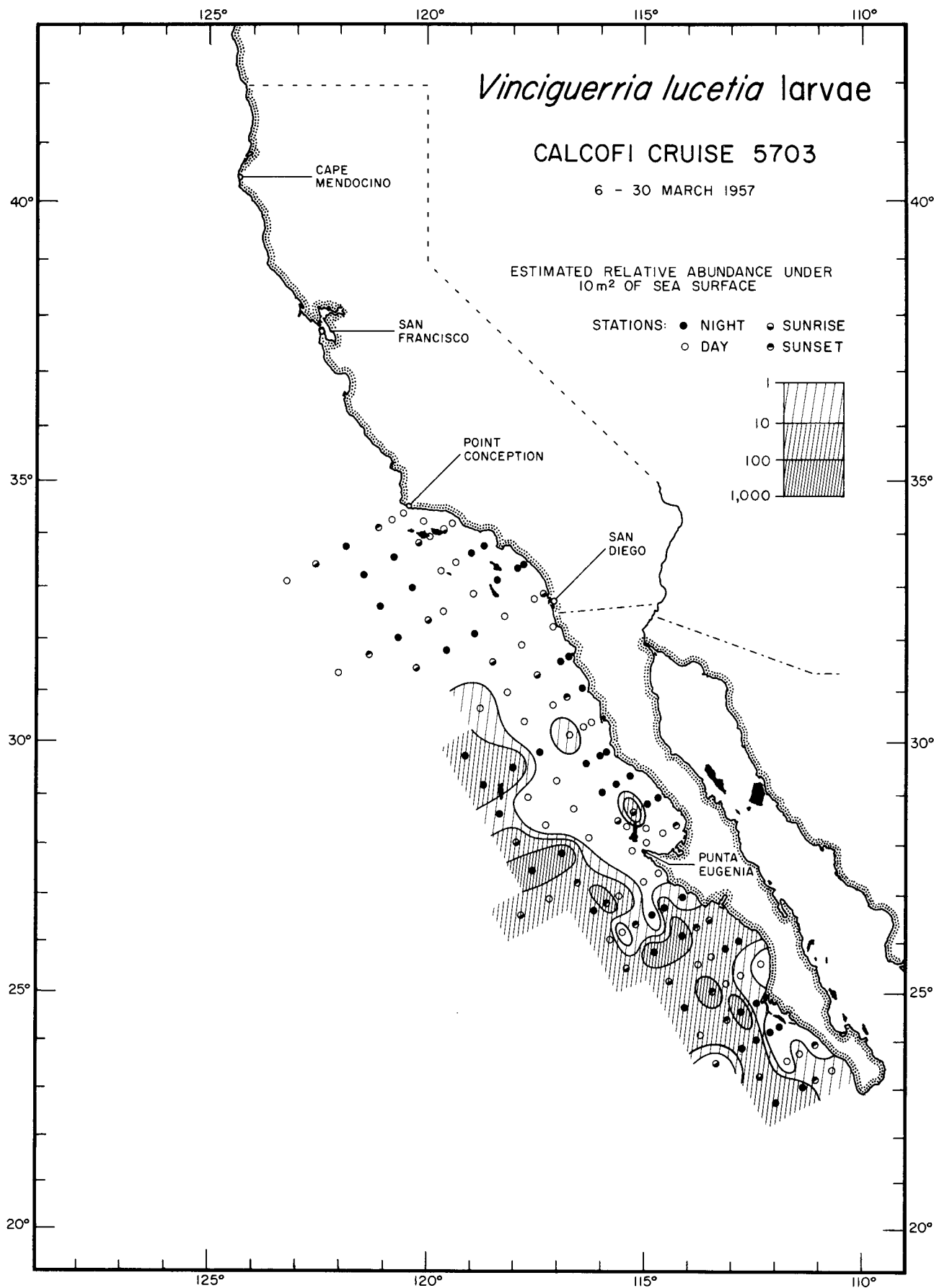


Vinciguerria lucetia larvae

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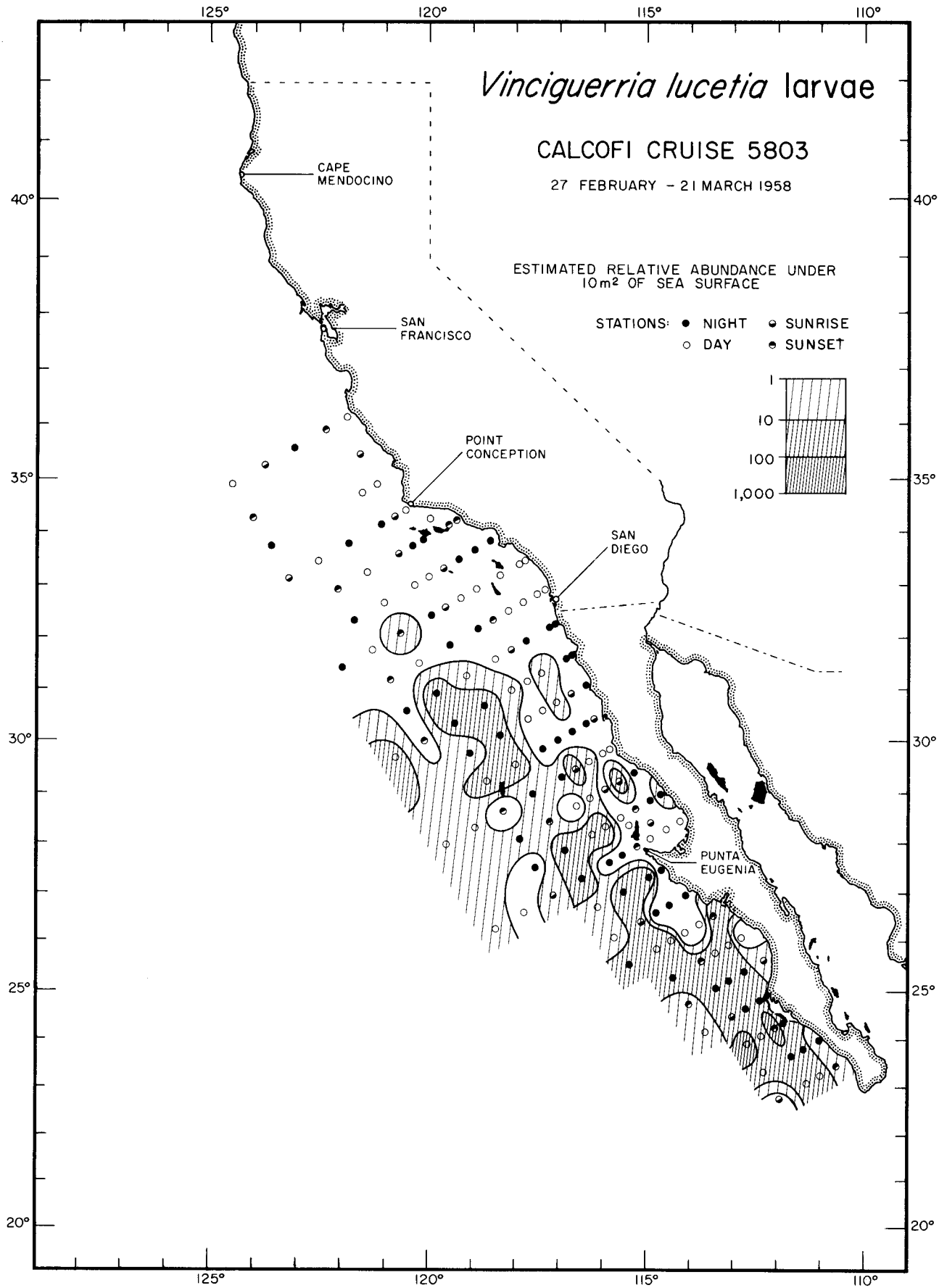
*Vinciguerria lucetia* larvae

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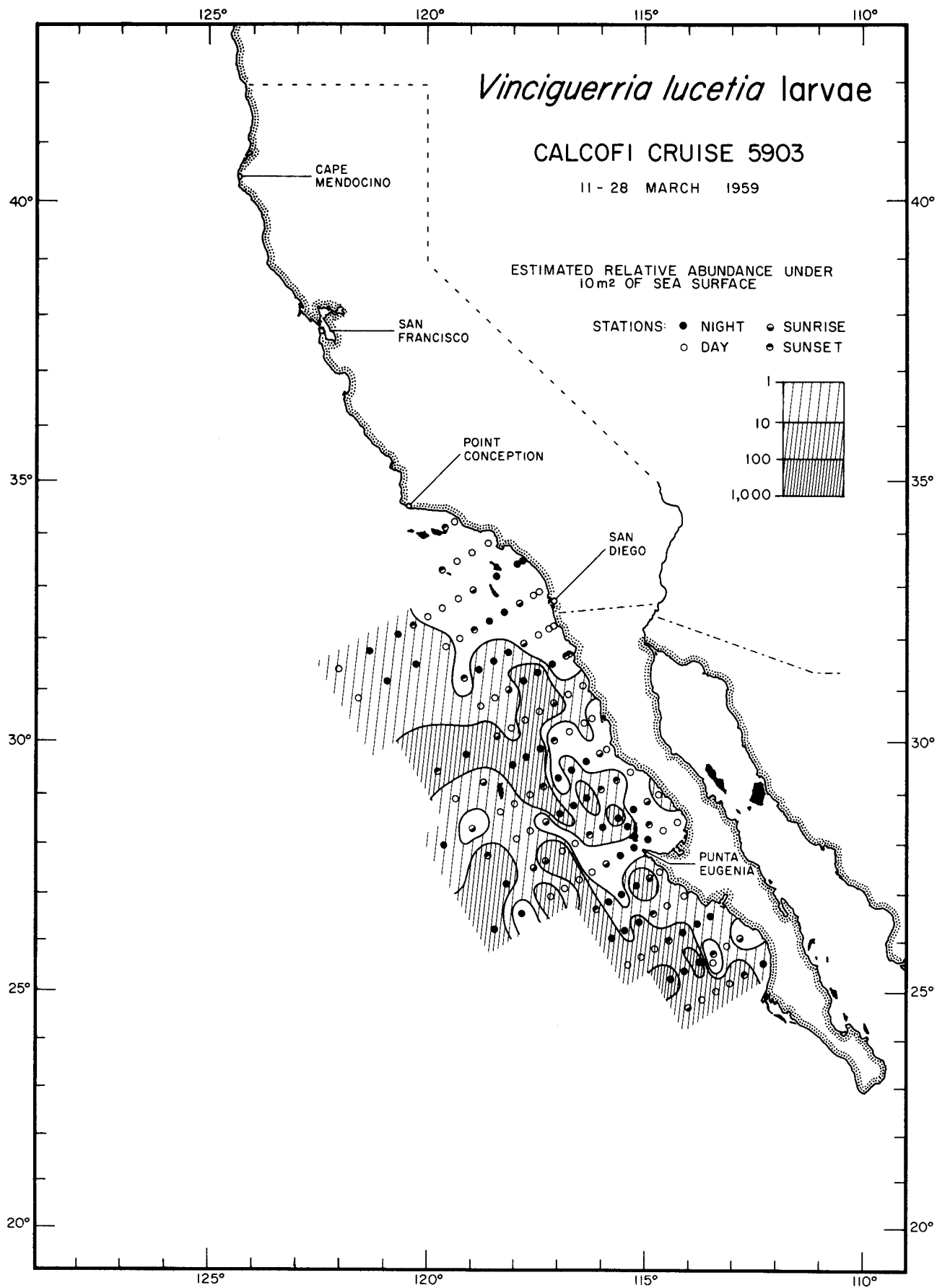
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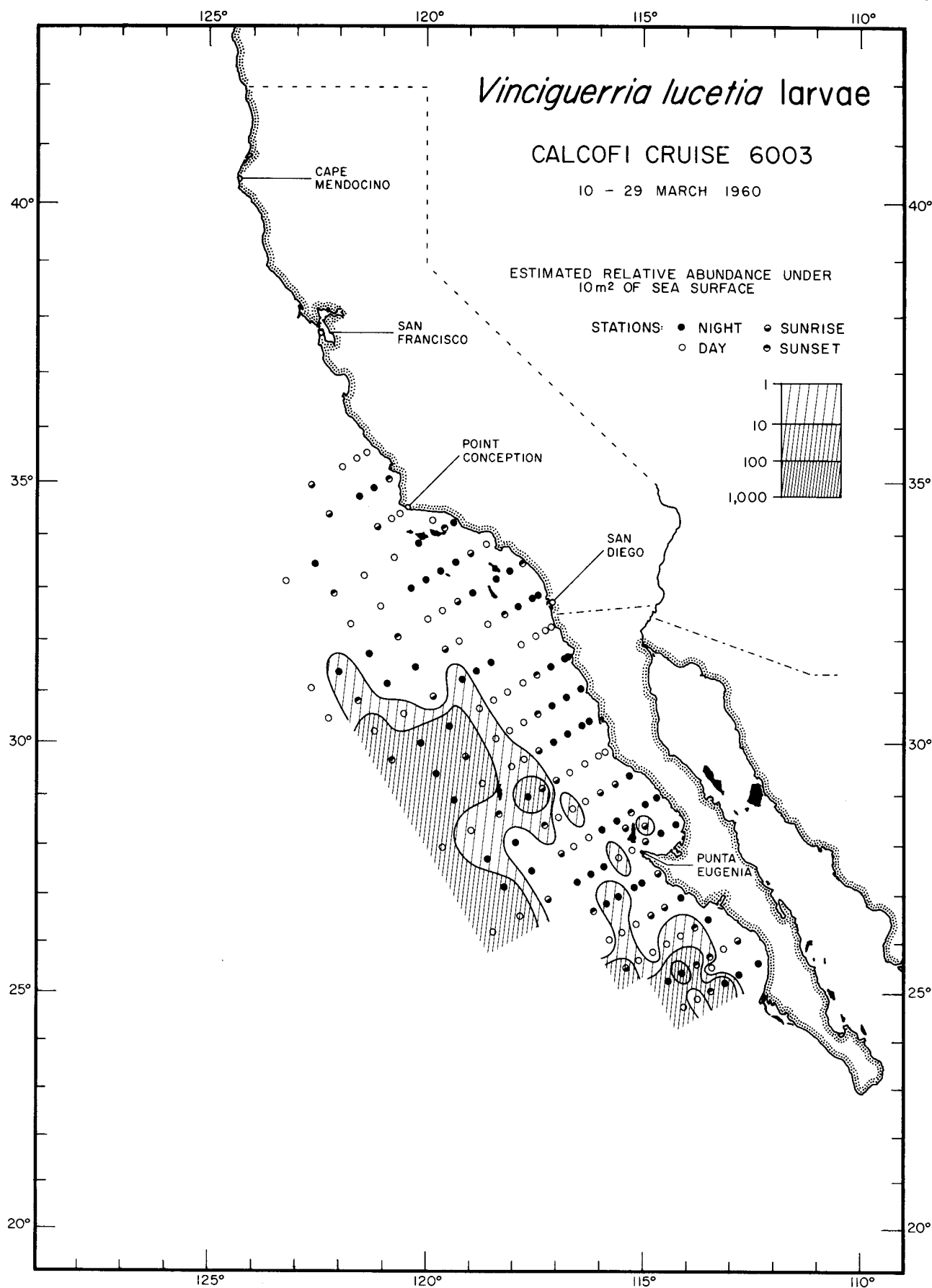
Vinciguerria lucetia larvae

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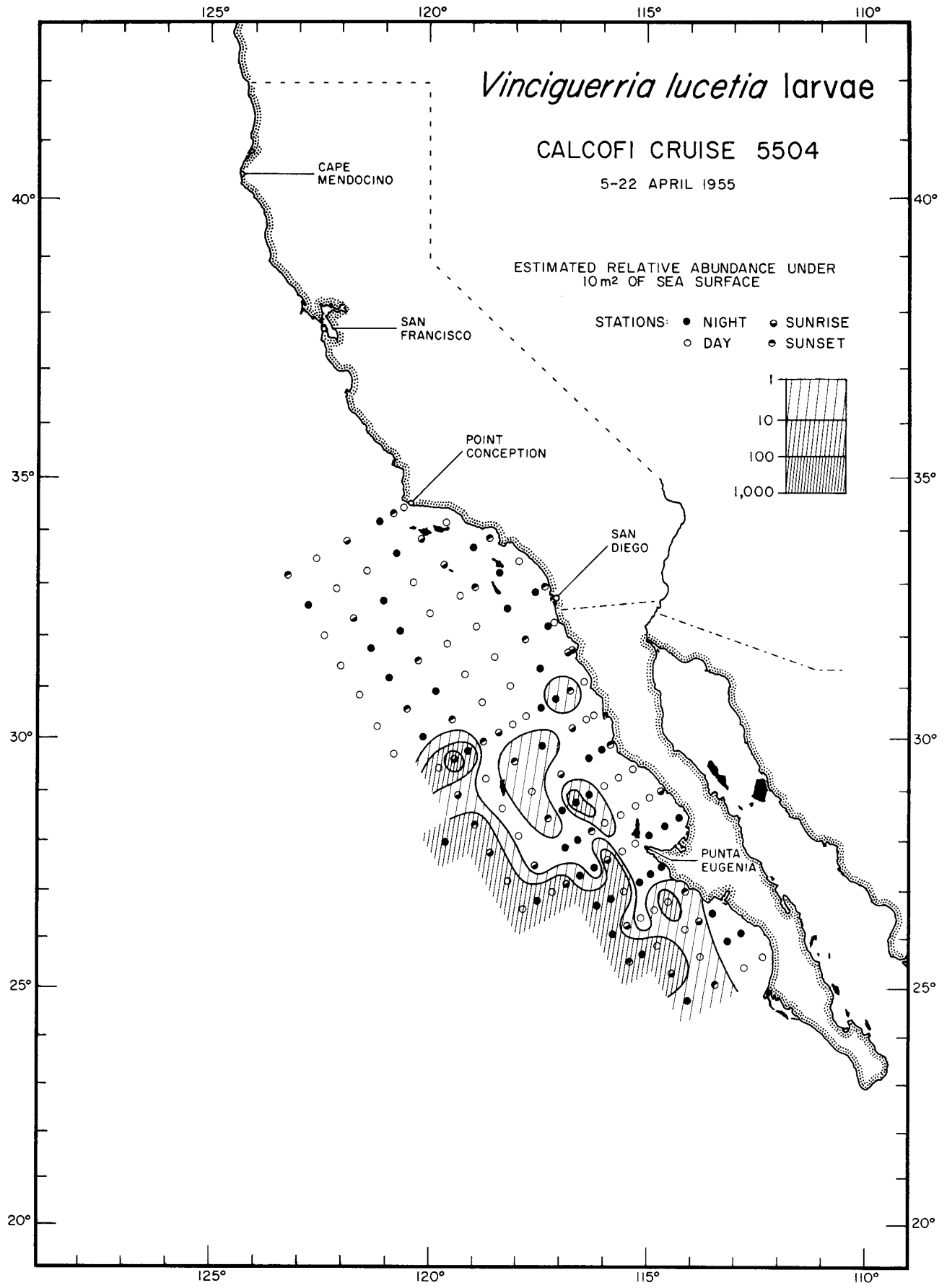
Vinciguerria lucetia larvae

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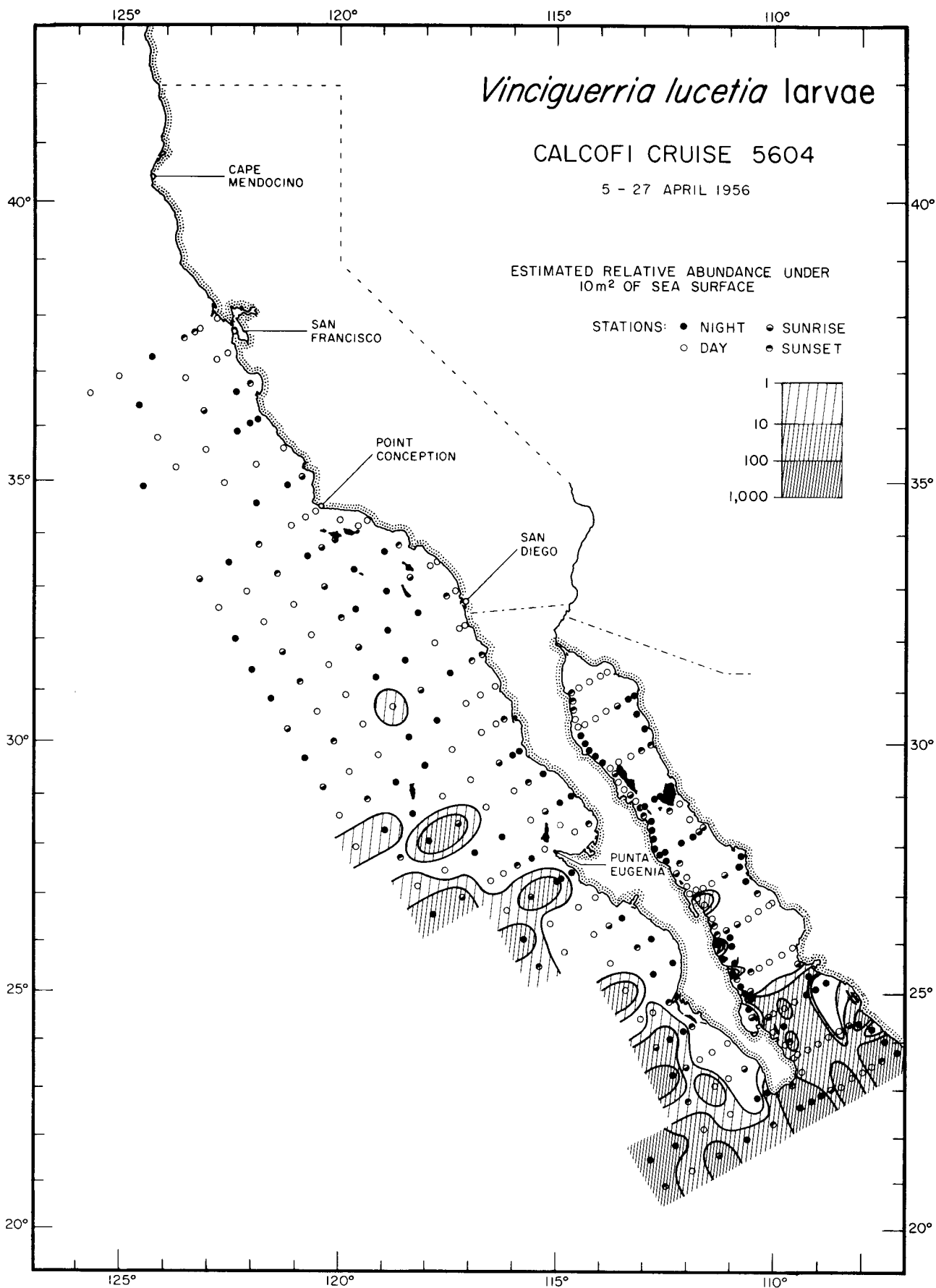
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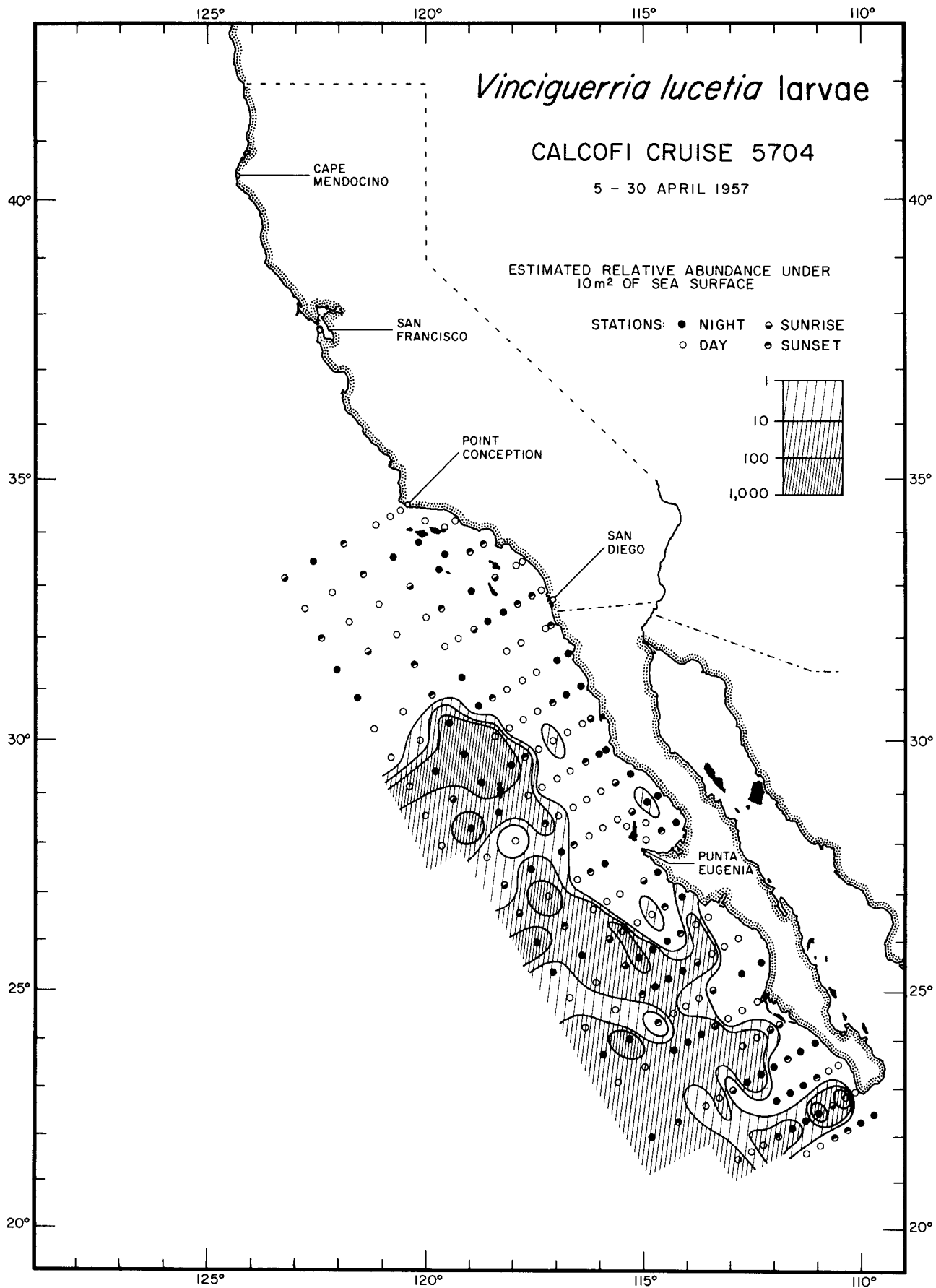
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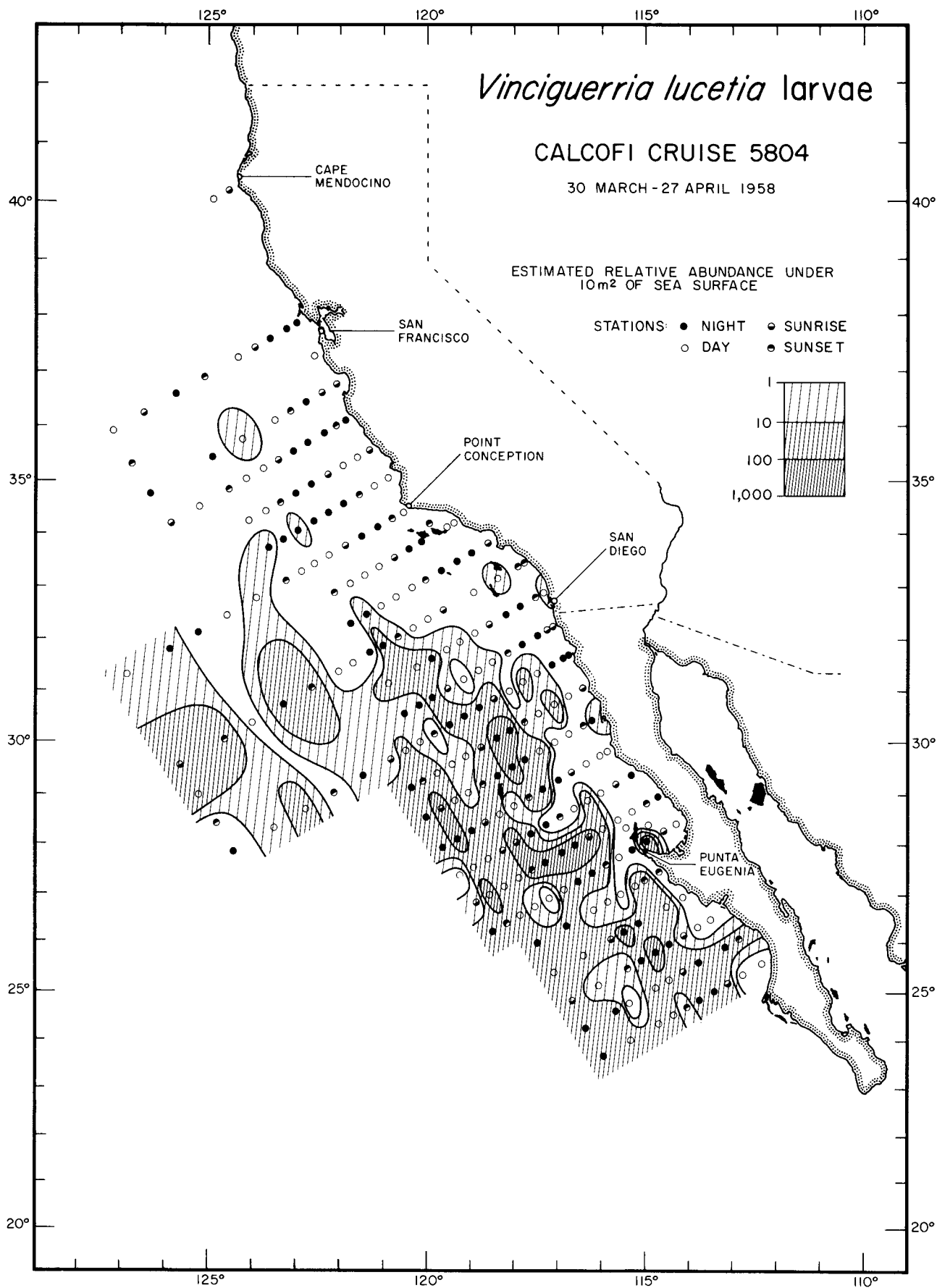
Vinciguerria lucetia larvae

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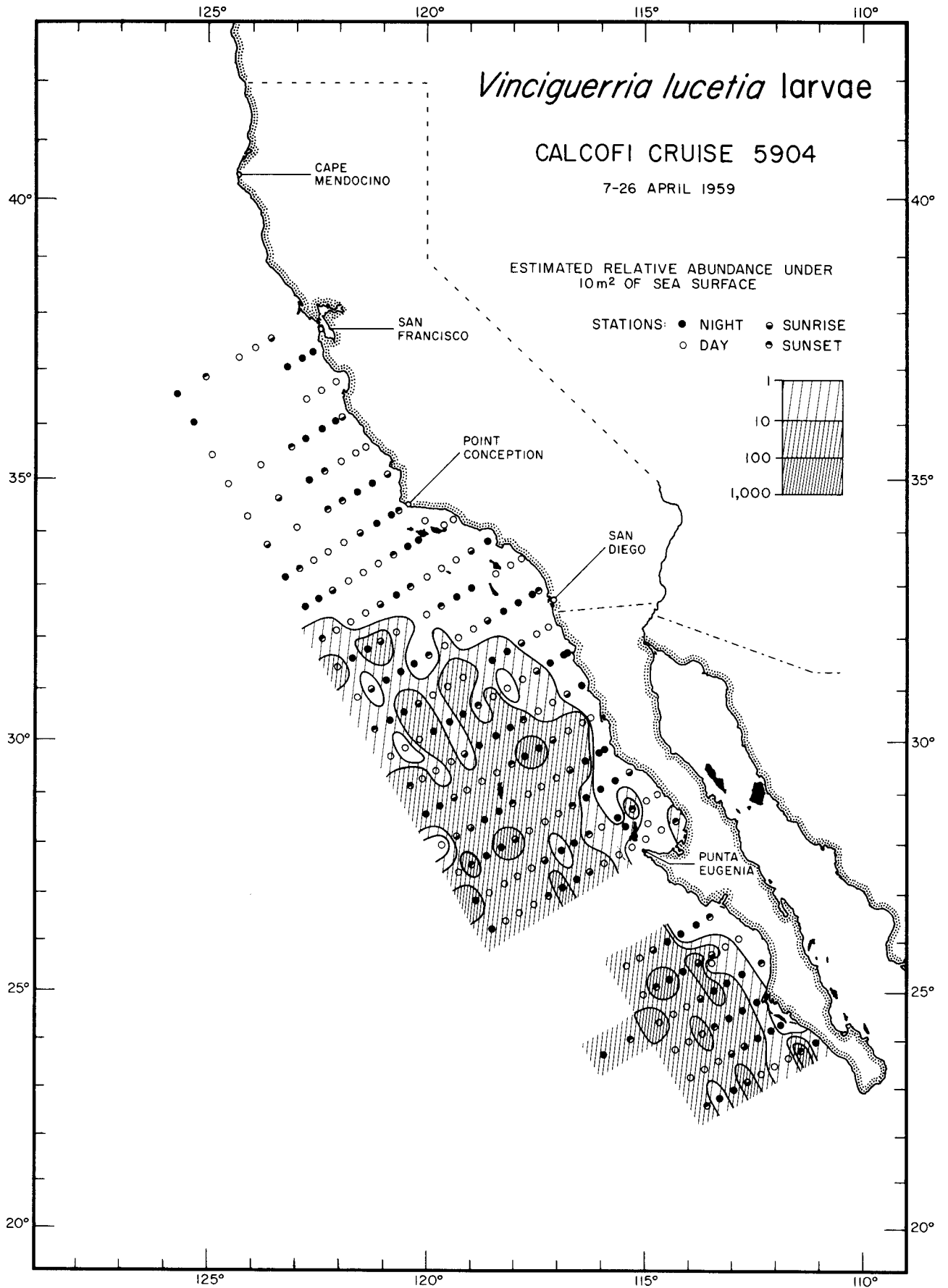
Vinciguerria lucetia larvae

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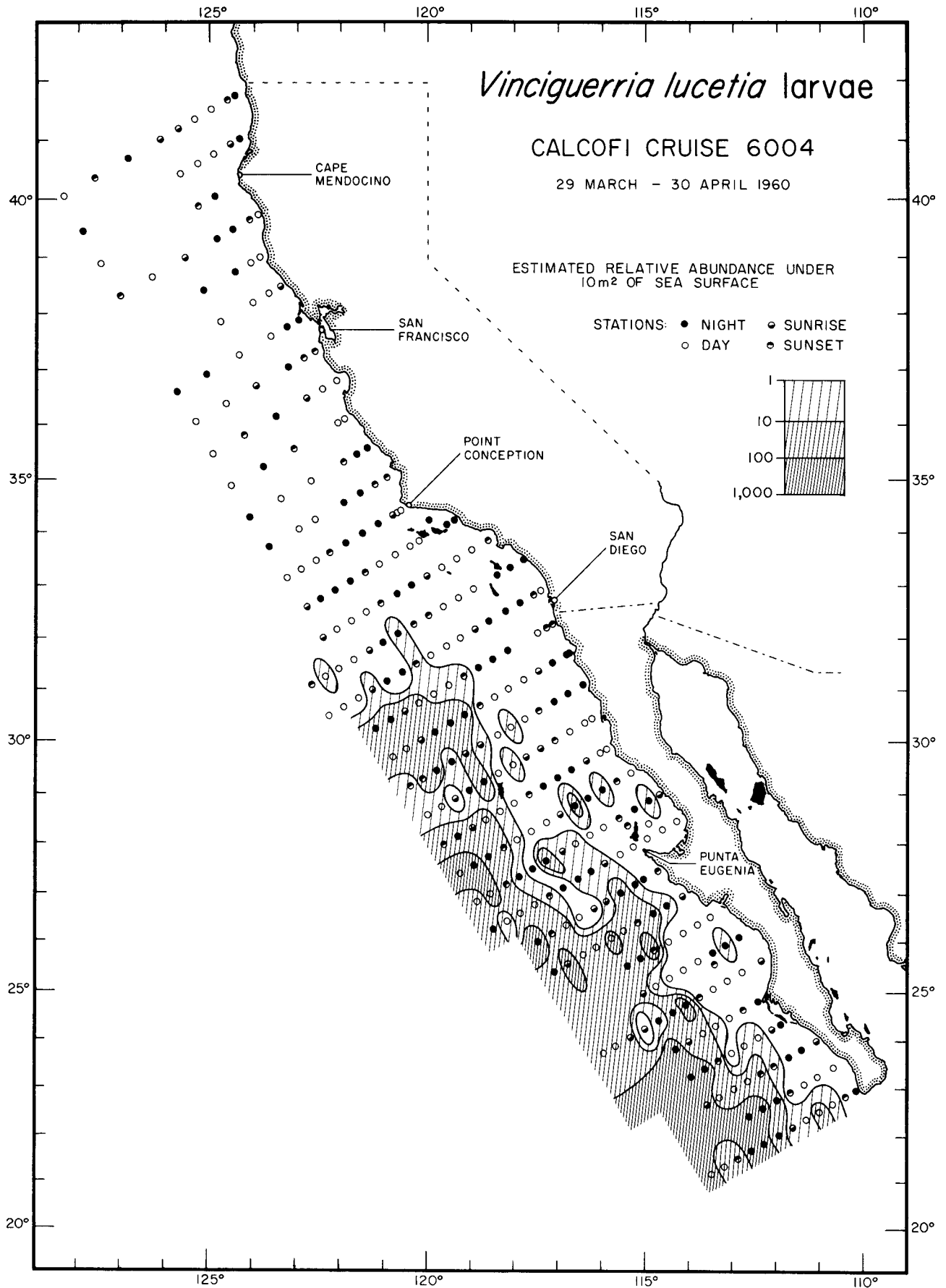
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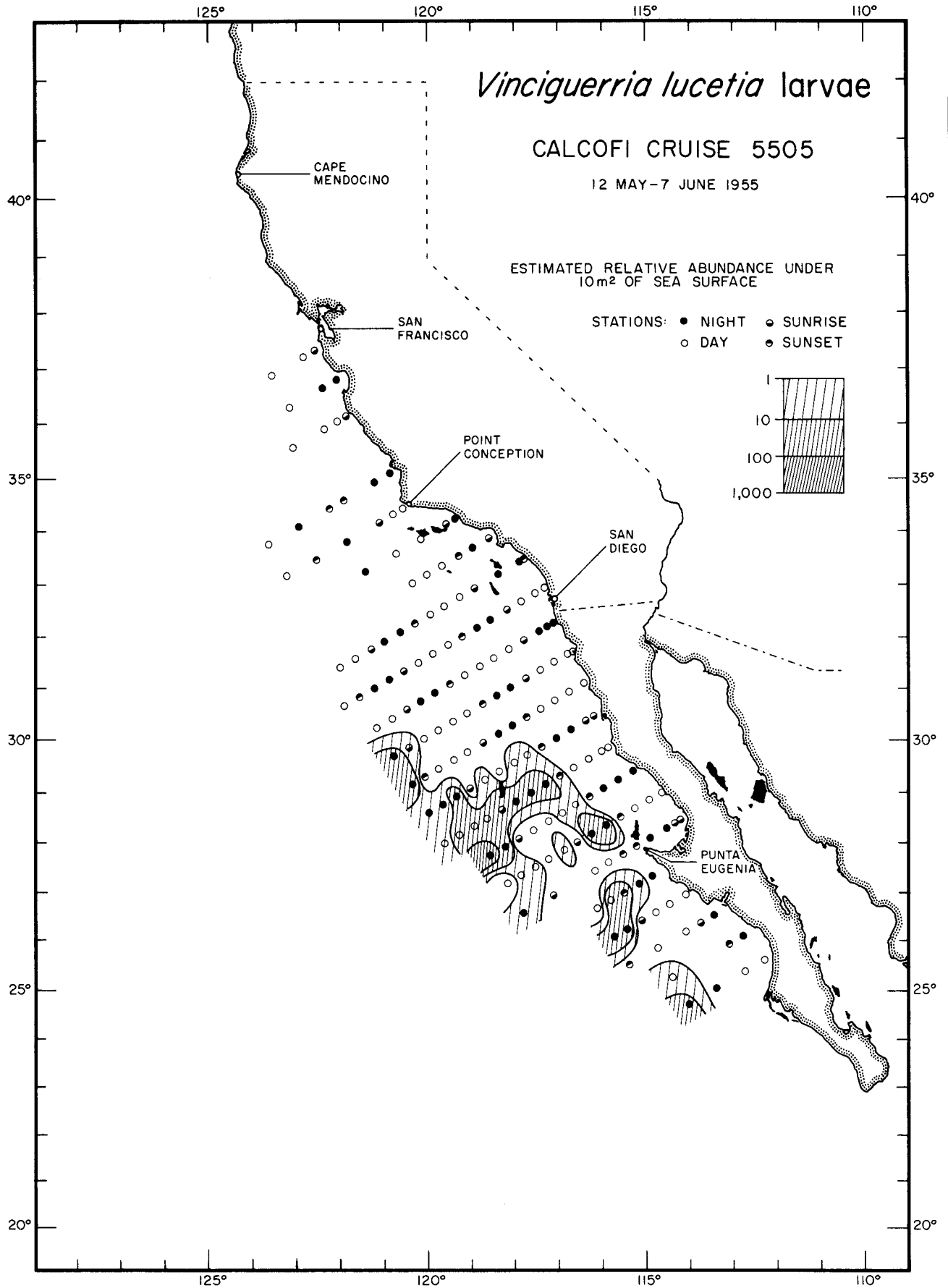
Vinciguerria lucetia larvae

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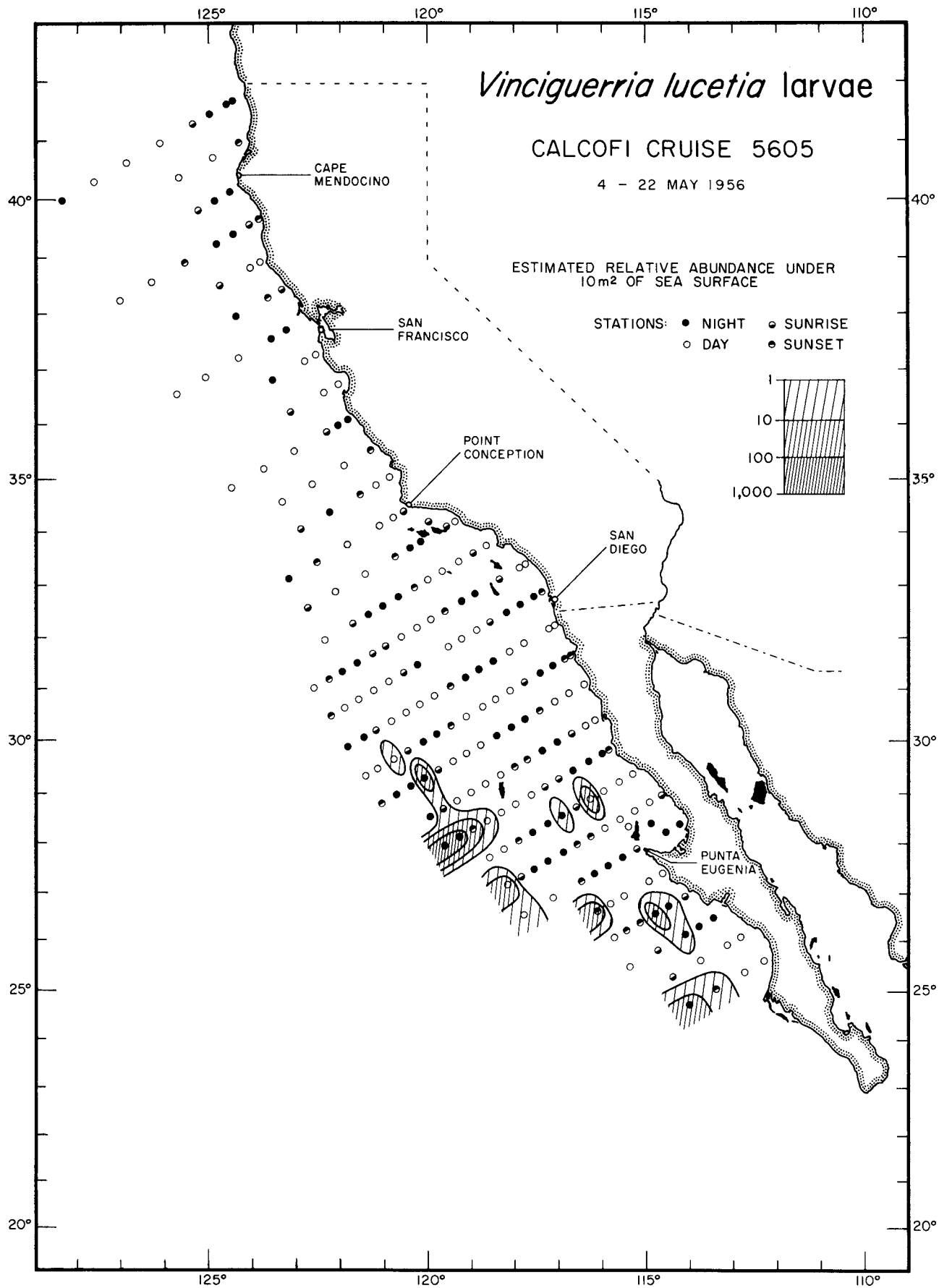
Vinciguerria lucetia larvae

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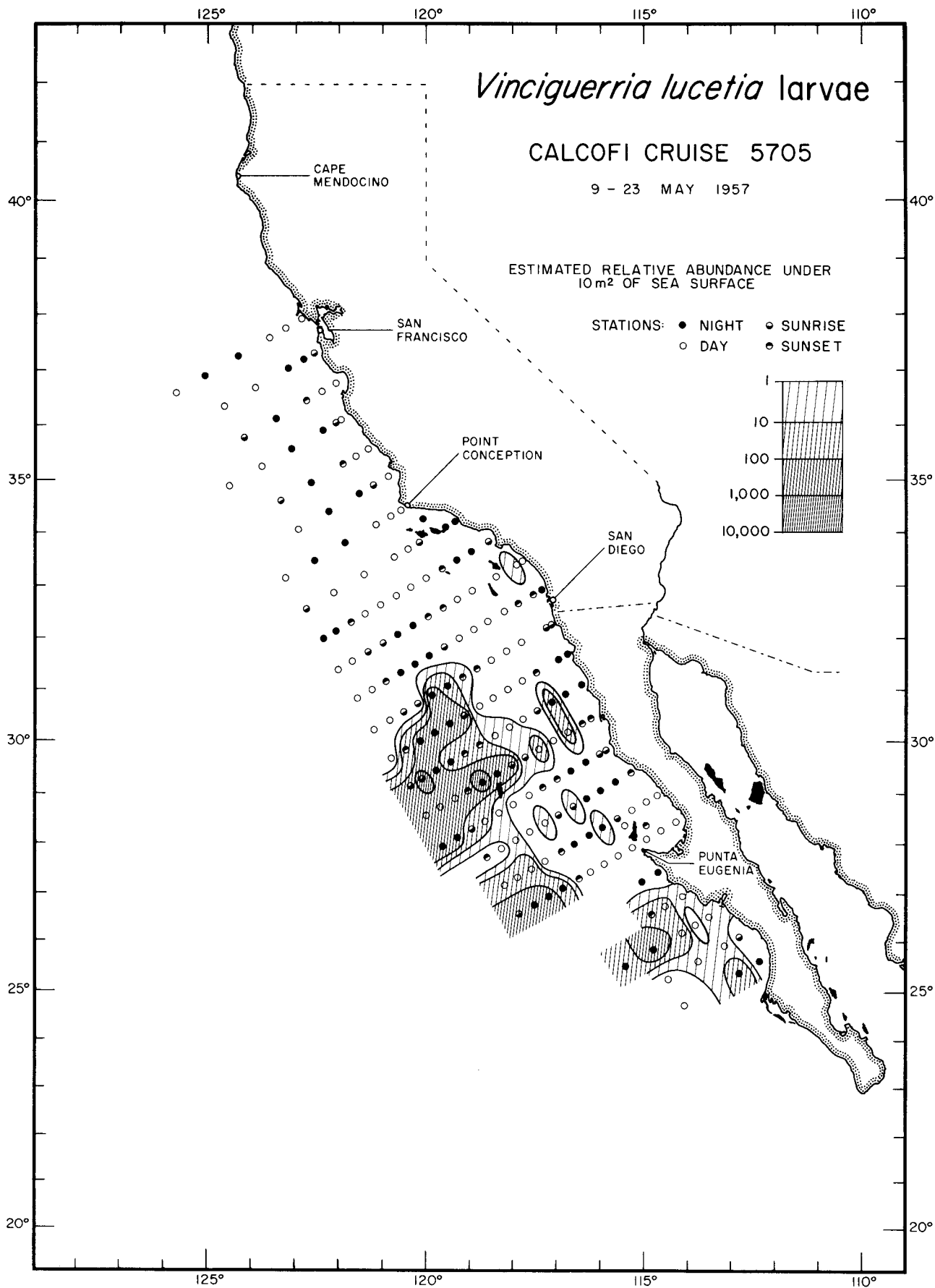
Vinciguerria lucetia larvae

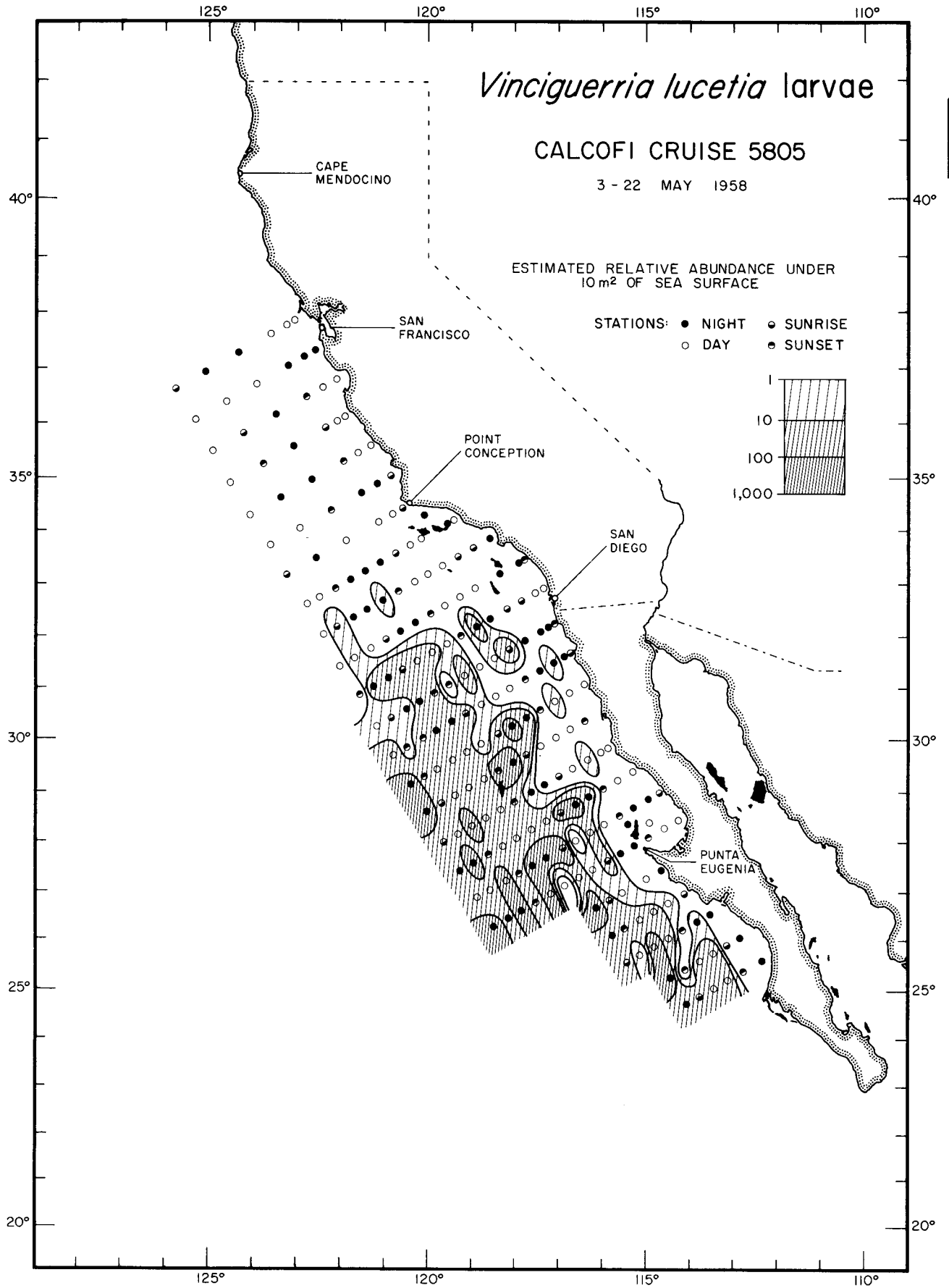
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Vinciguerria lucetia larvae

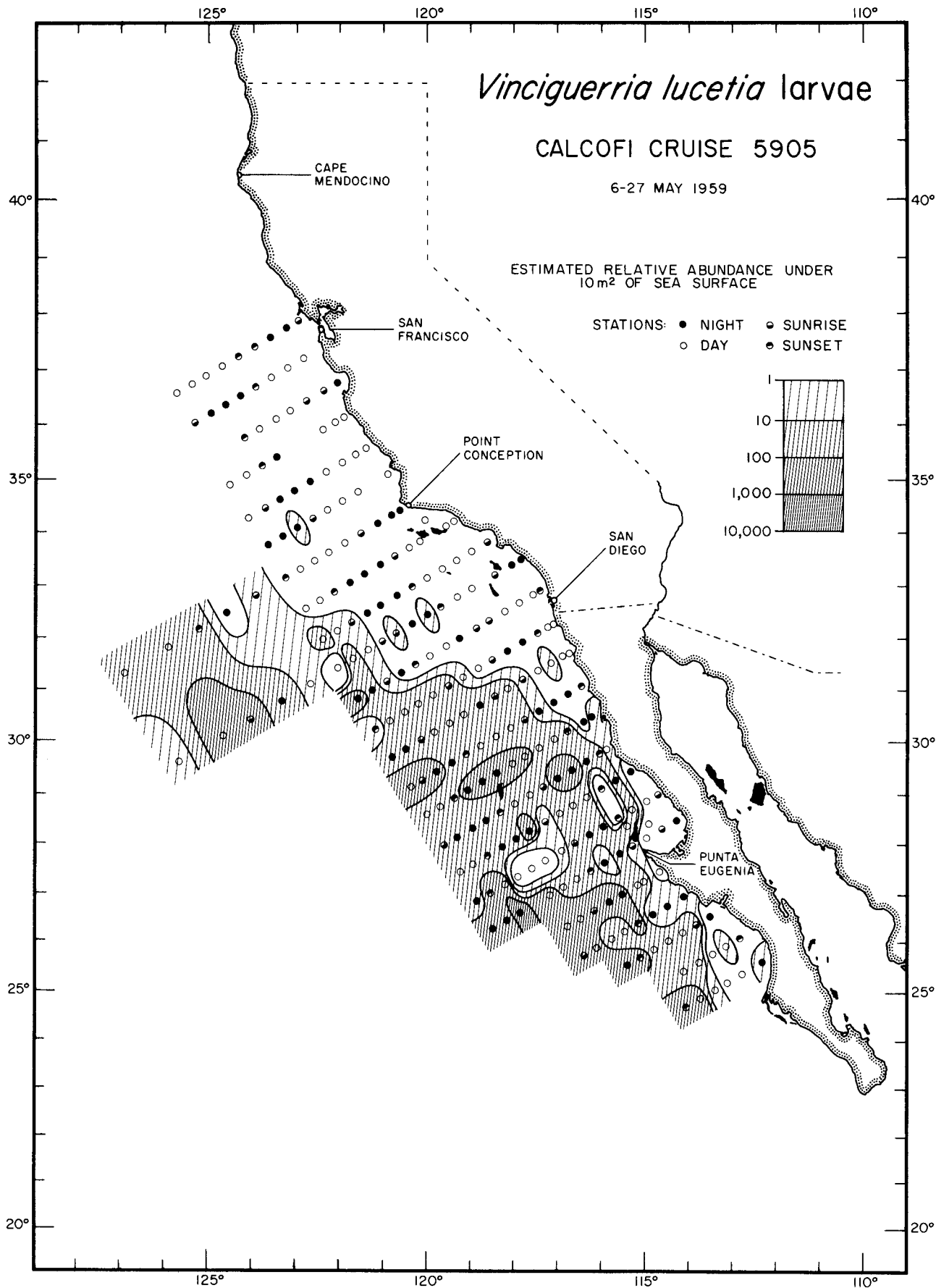
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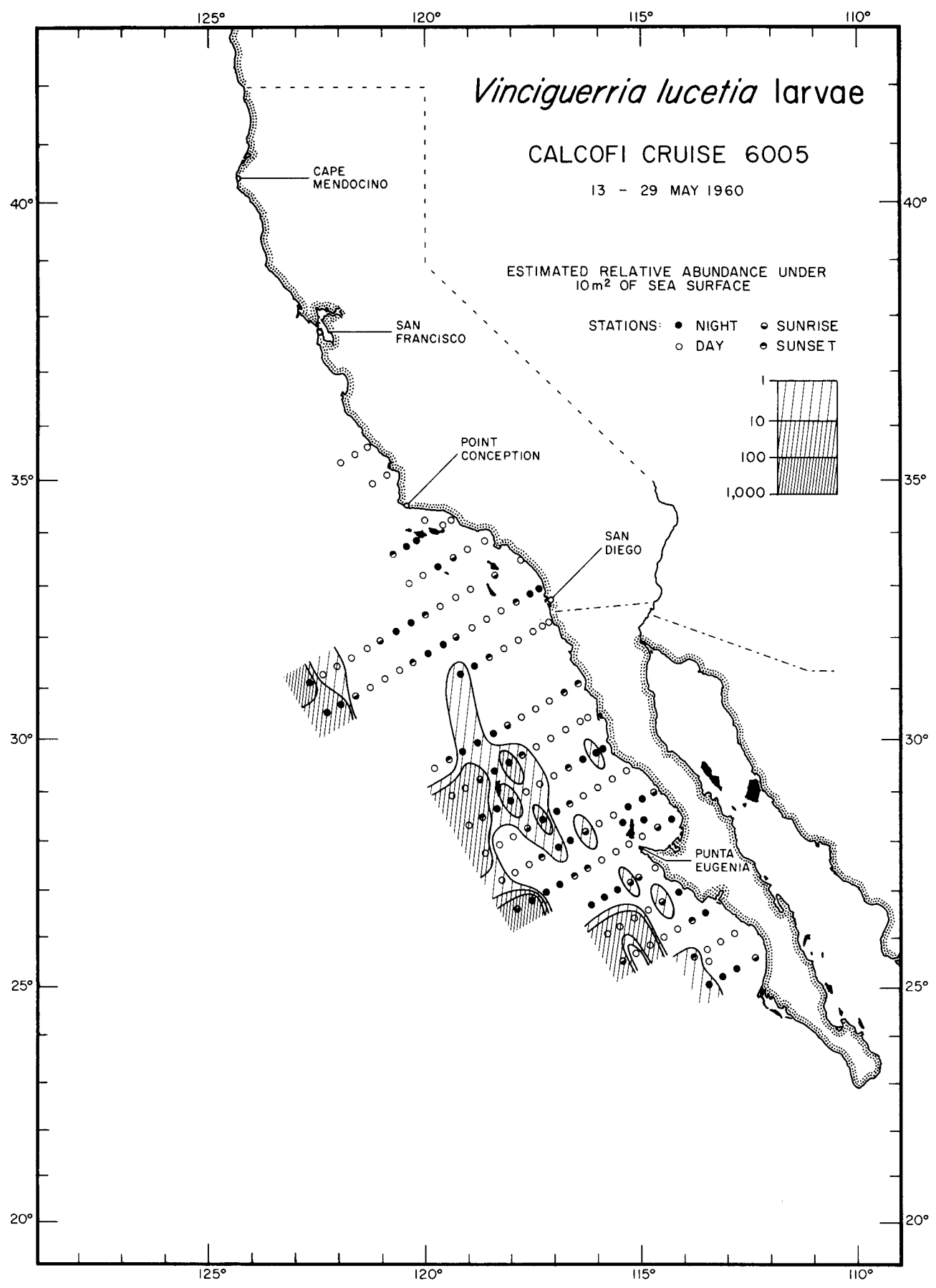
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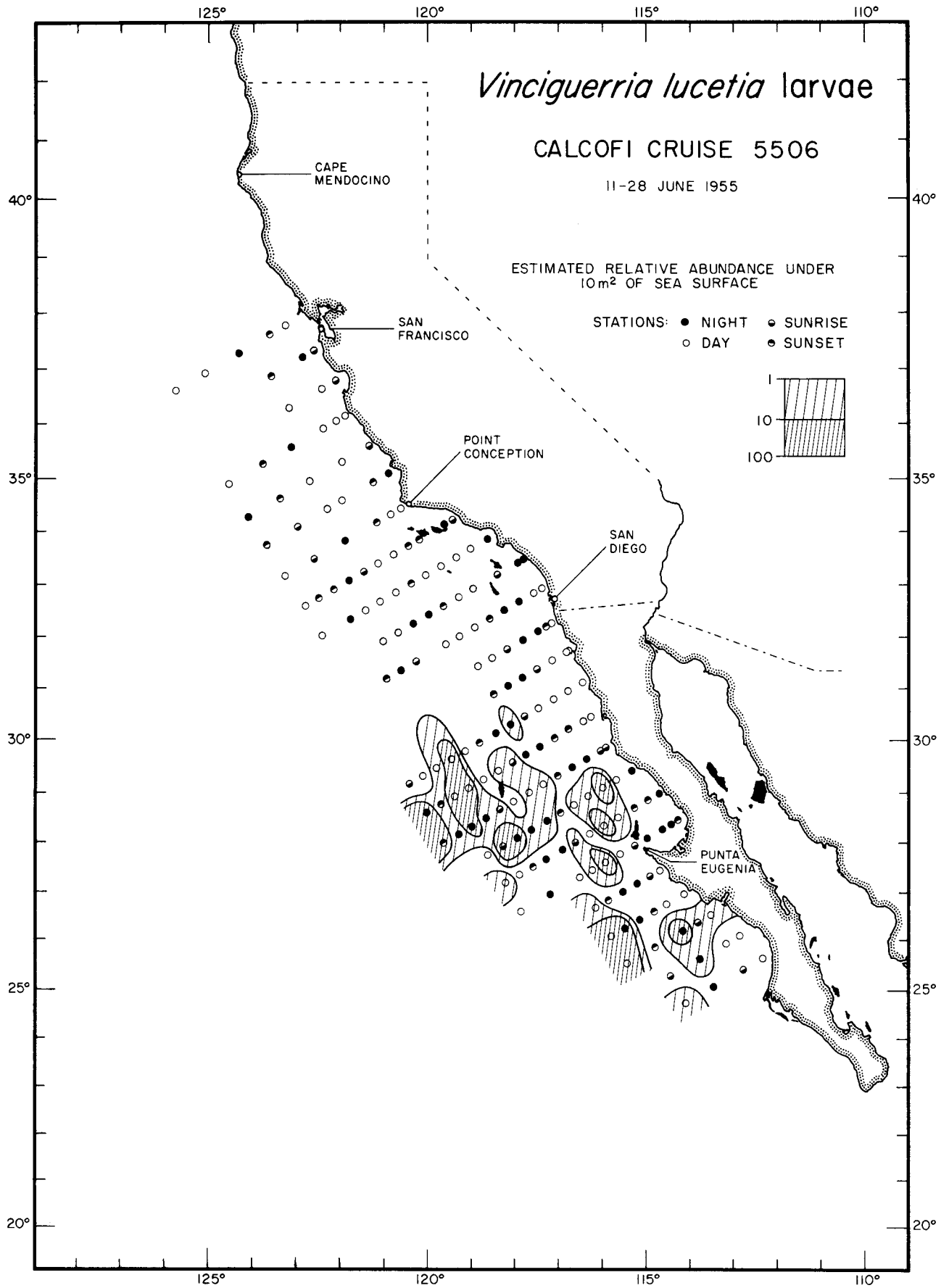
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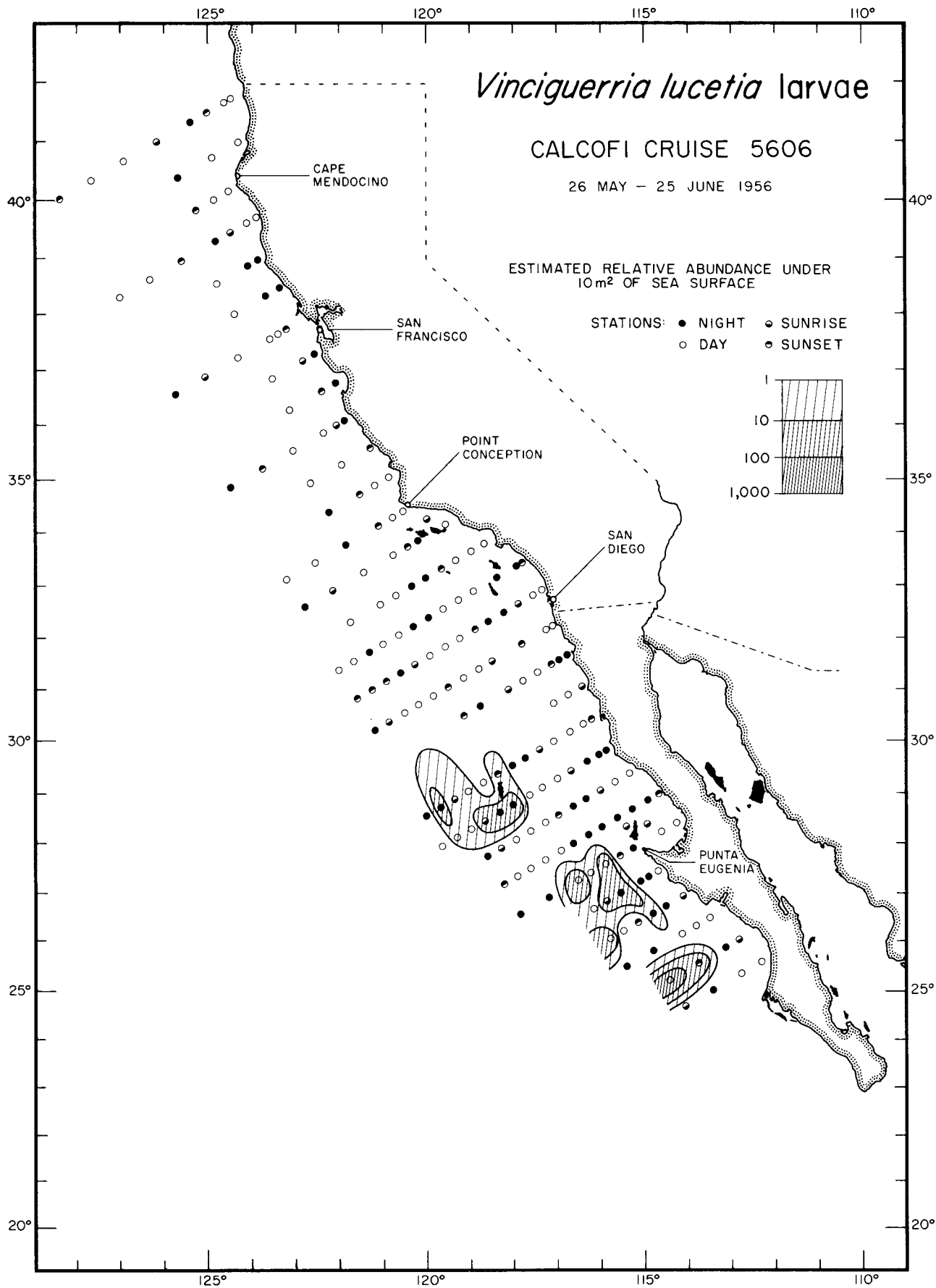
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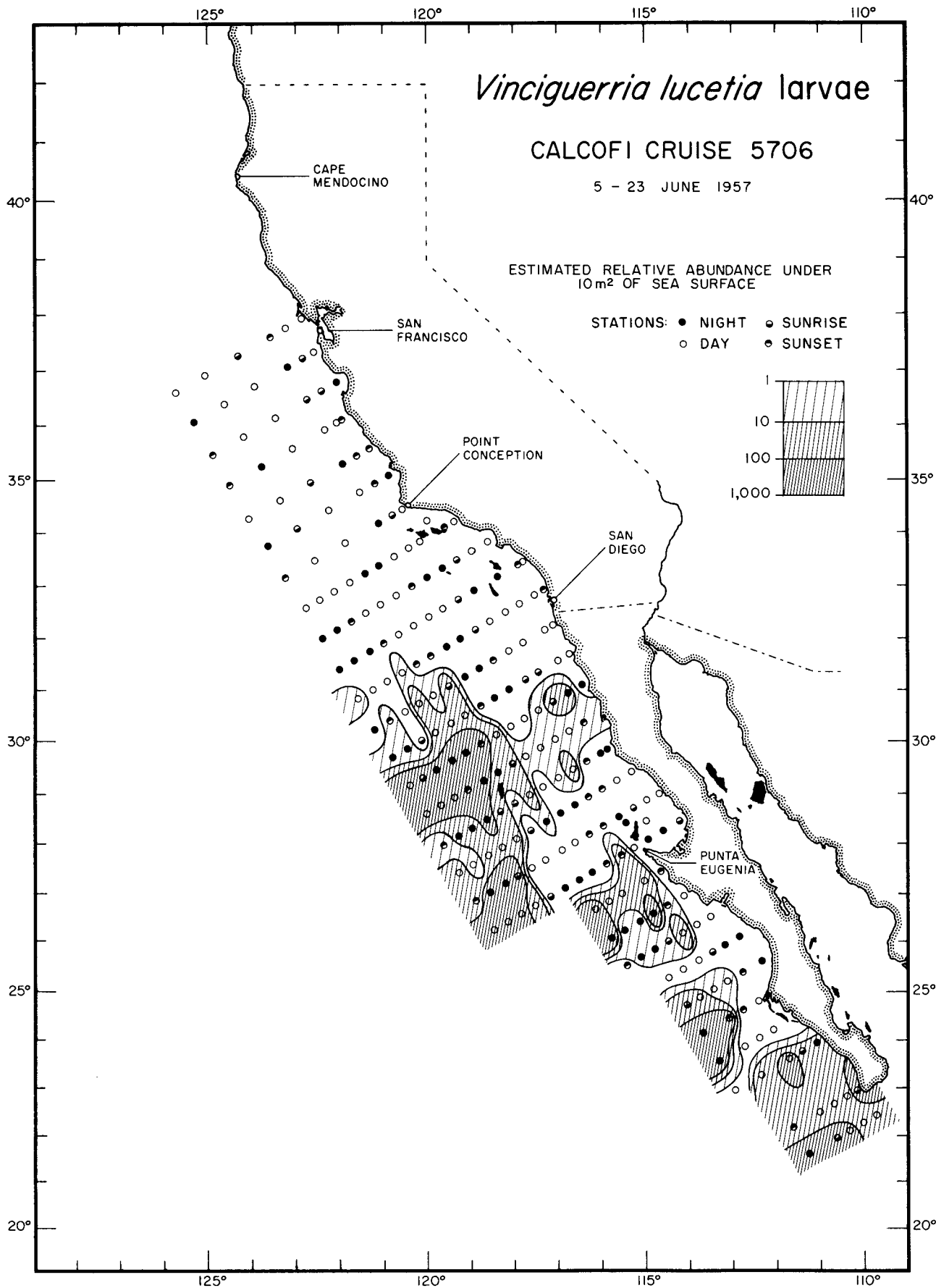
Vinciguerria lucetia larvae

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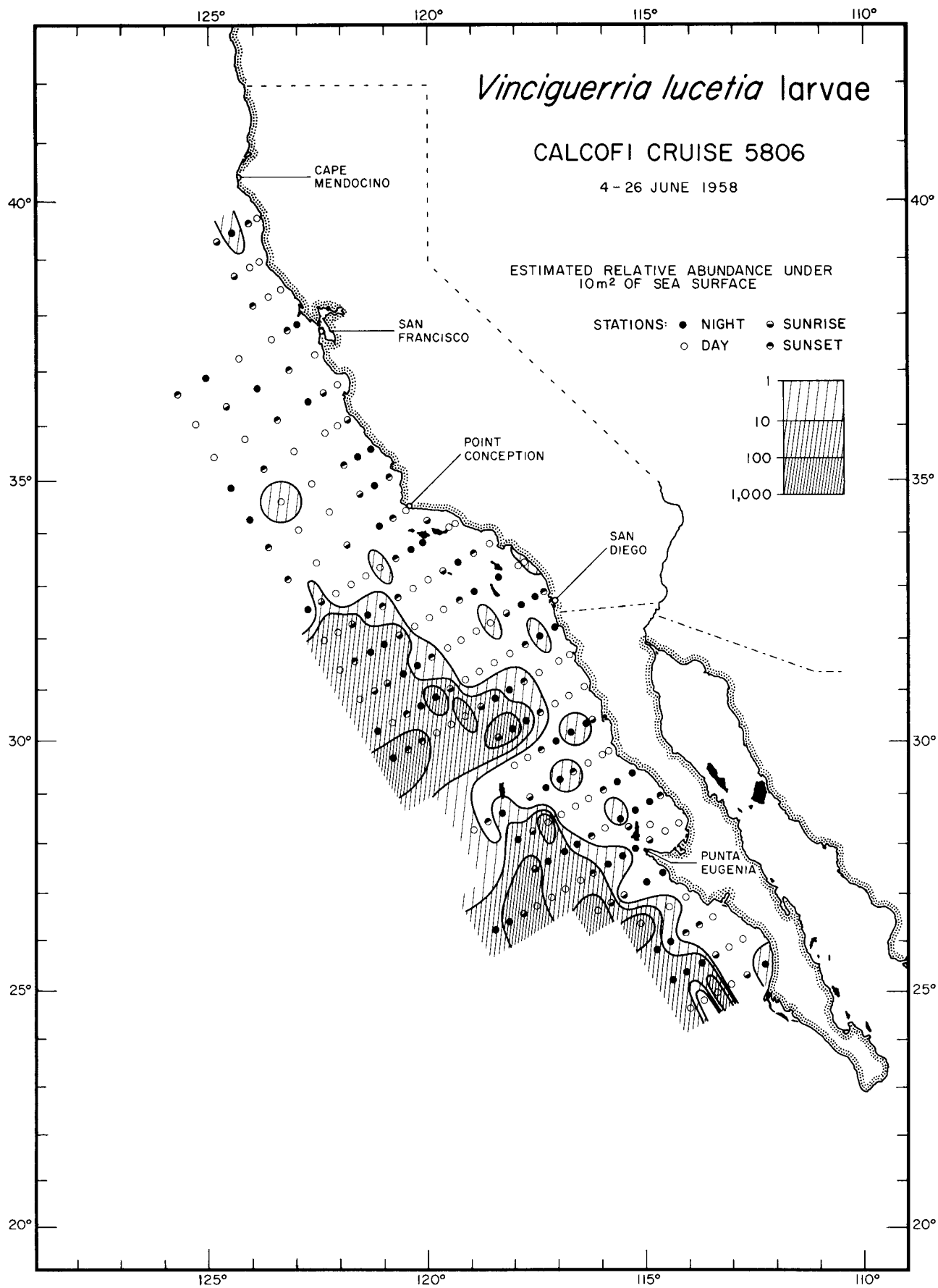
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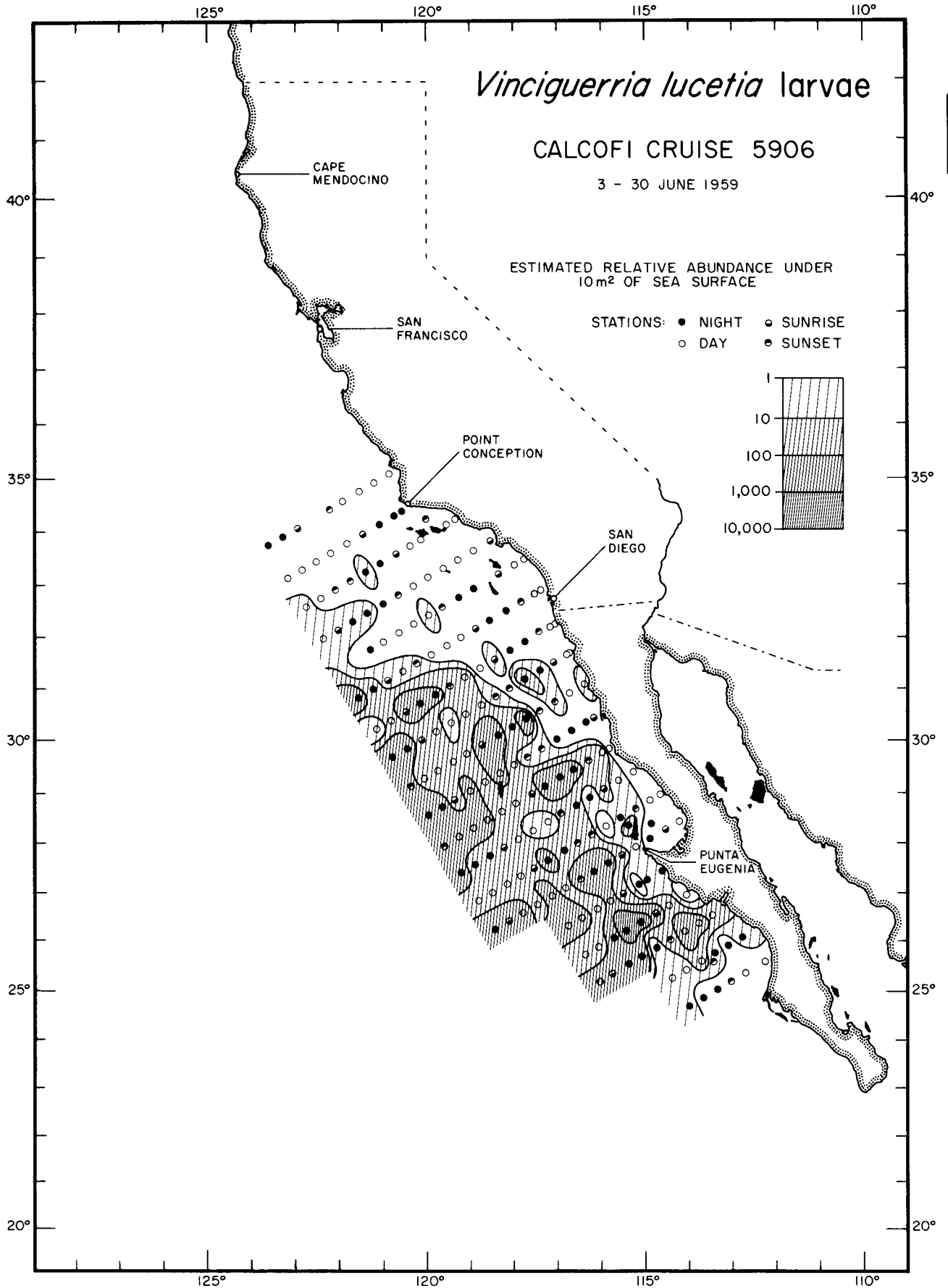
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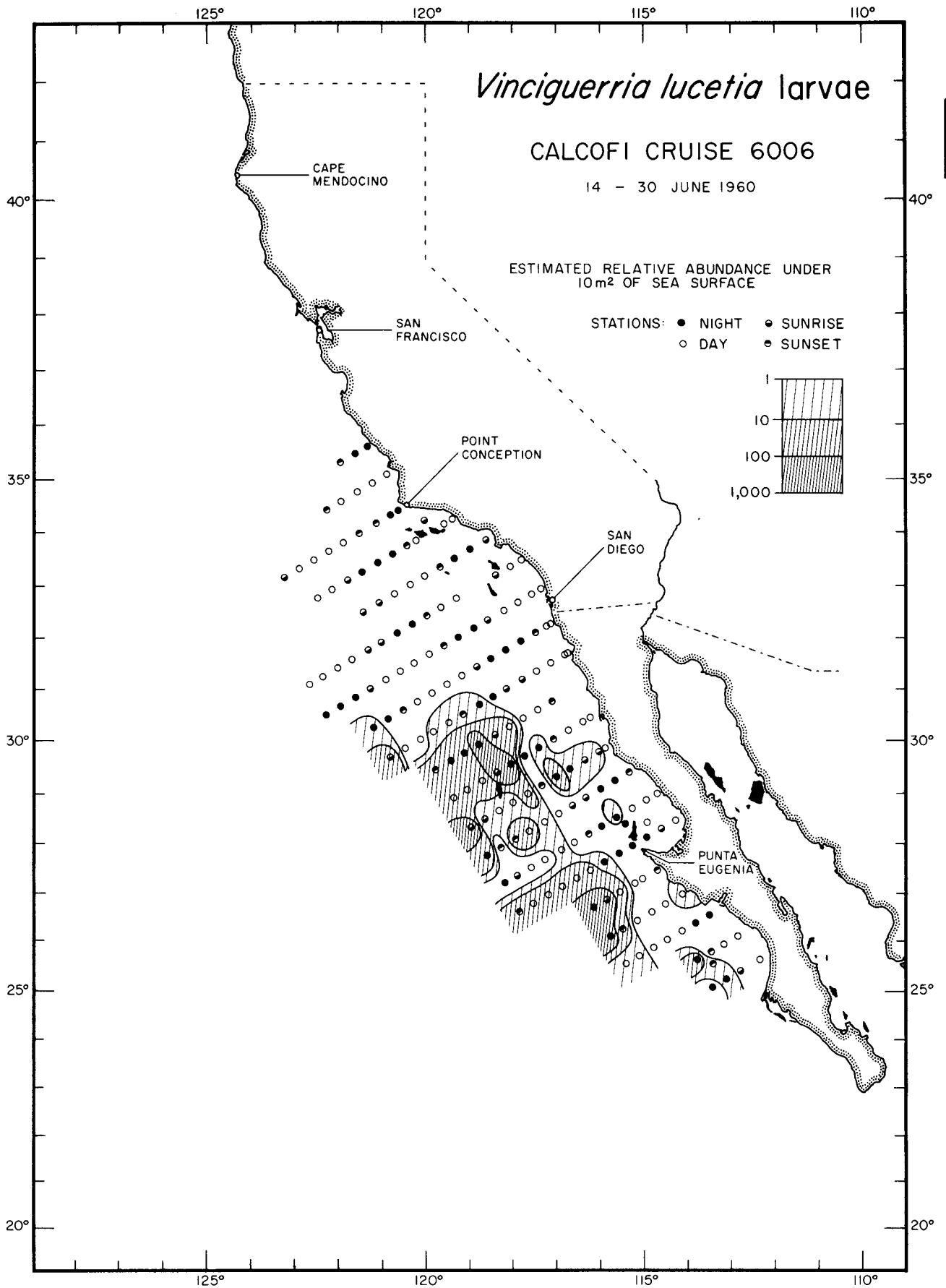
Vinciguerria lucetia larvae

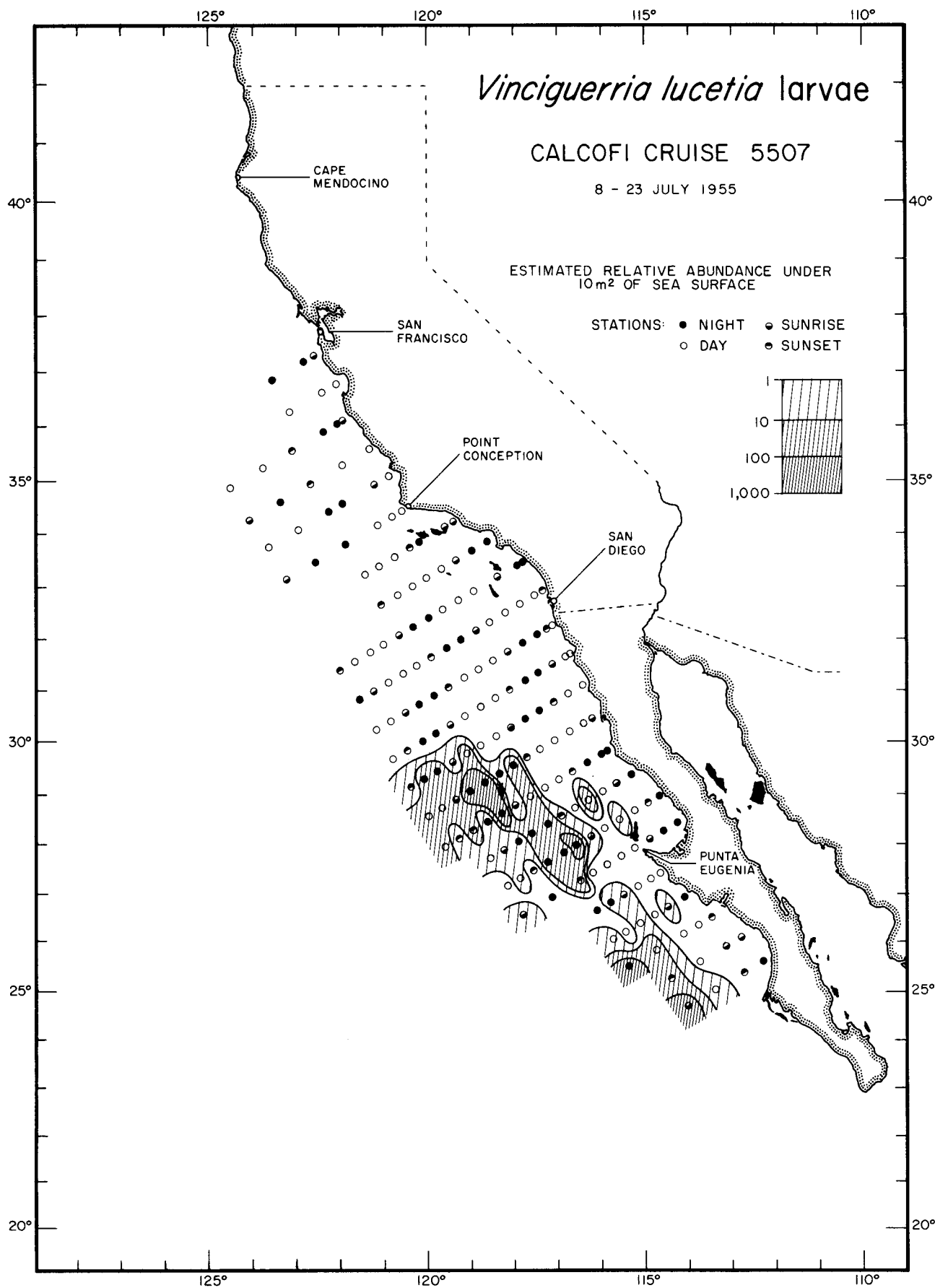
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Vinciguerria lucetia larvae

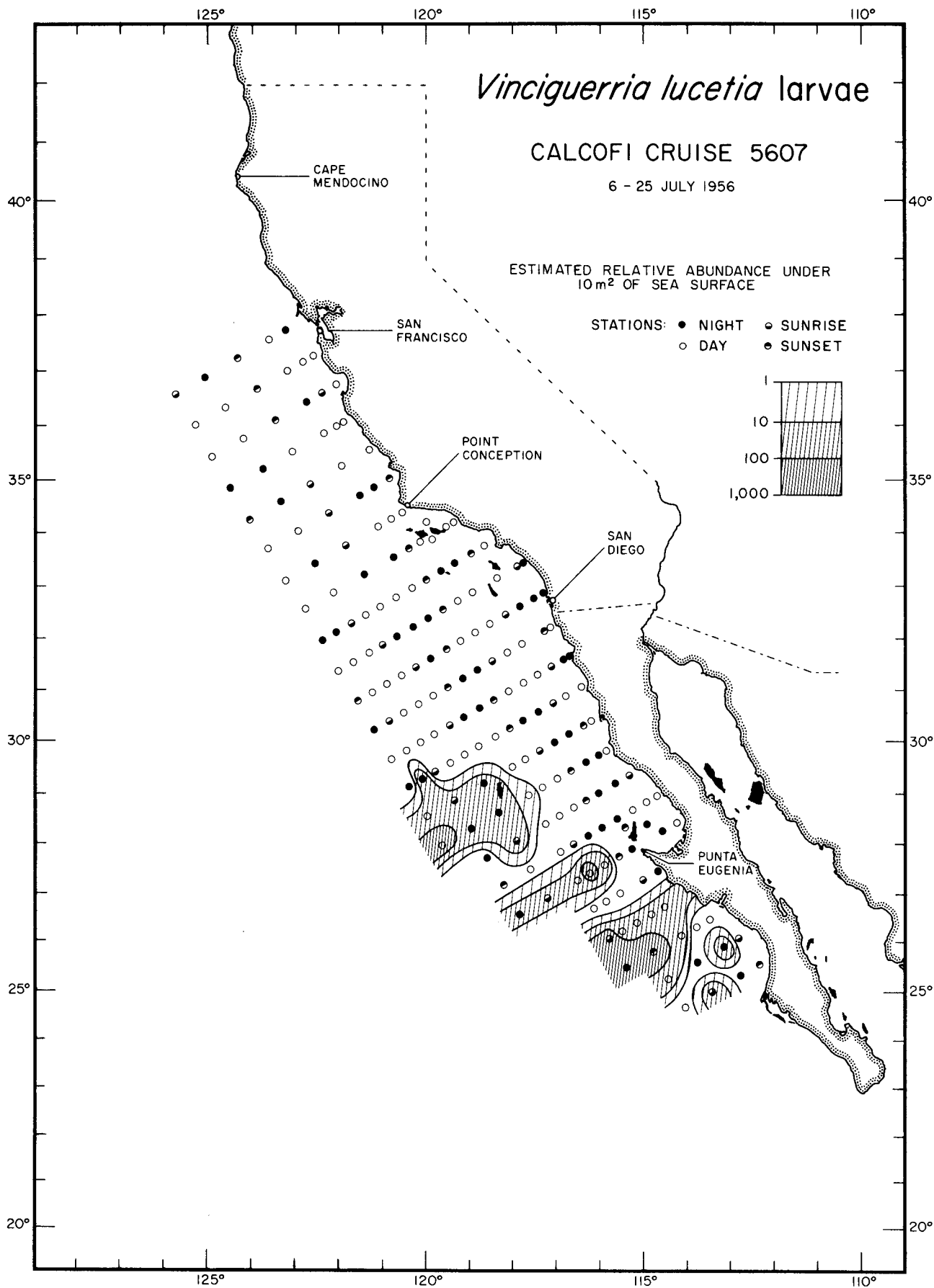
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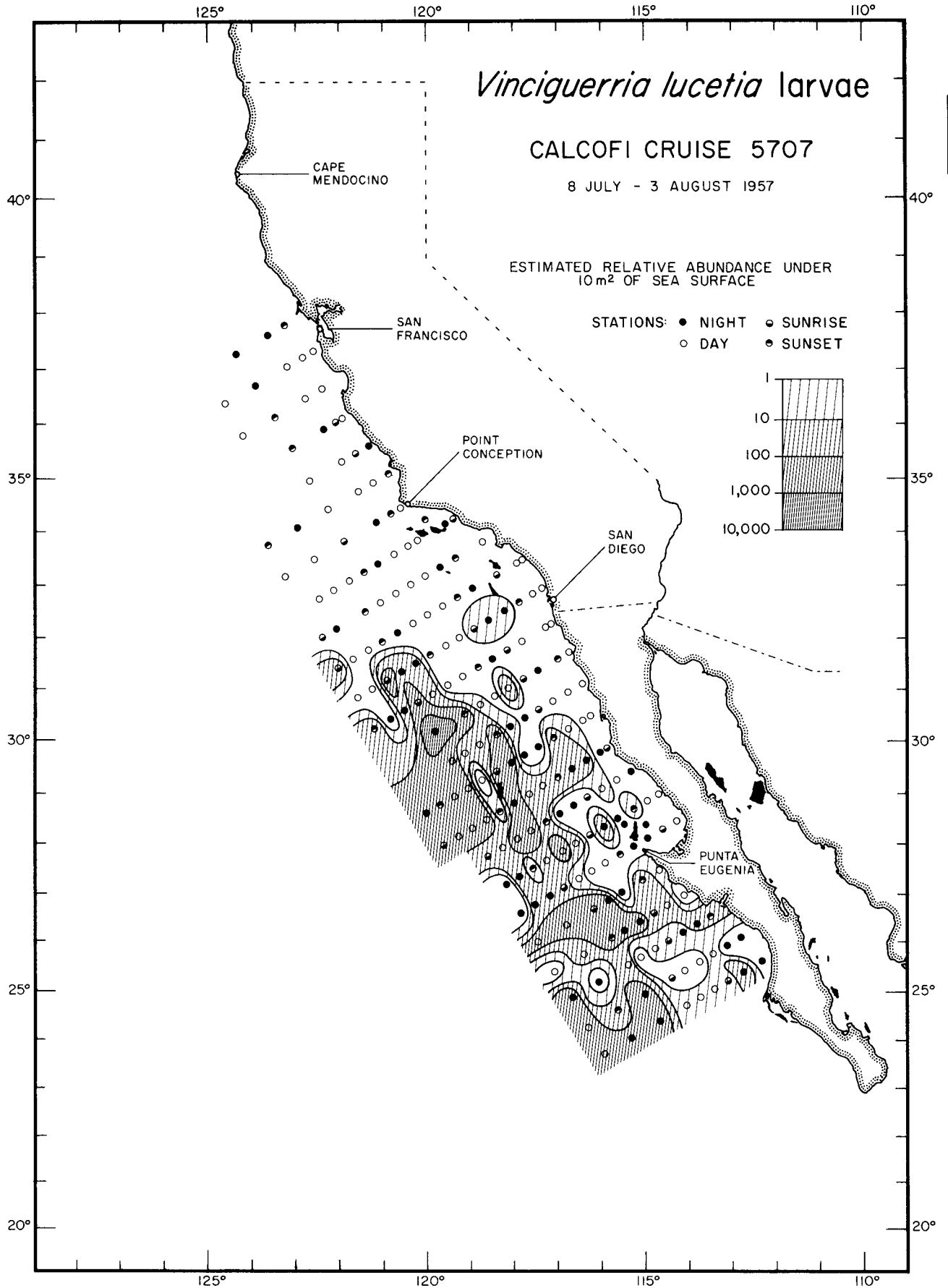


Vinciguerria lucetia larvae

5507

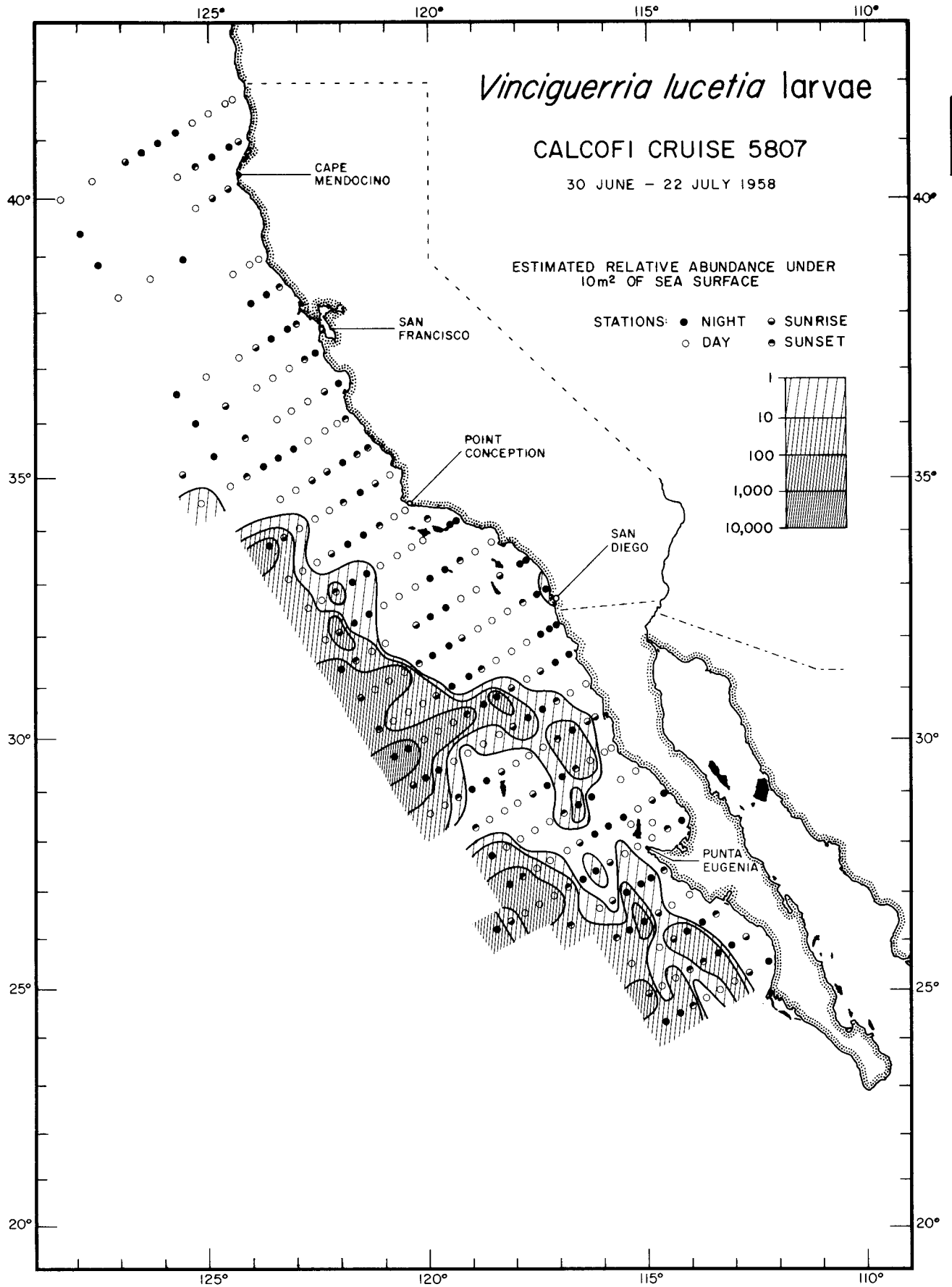


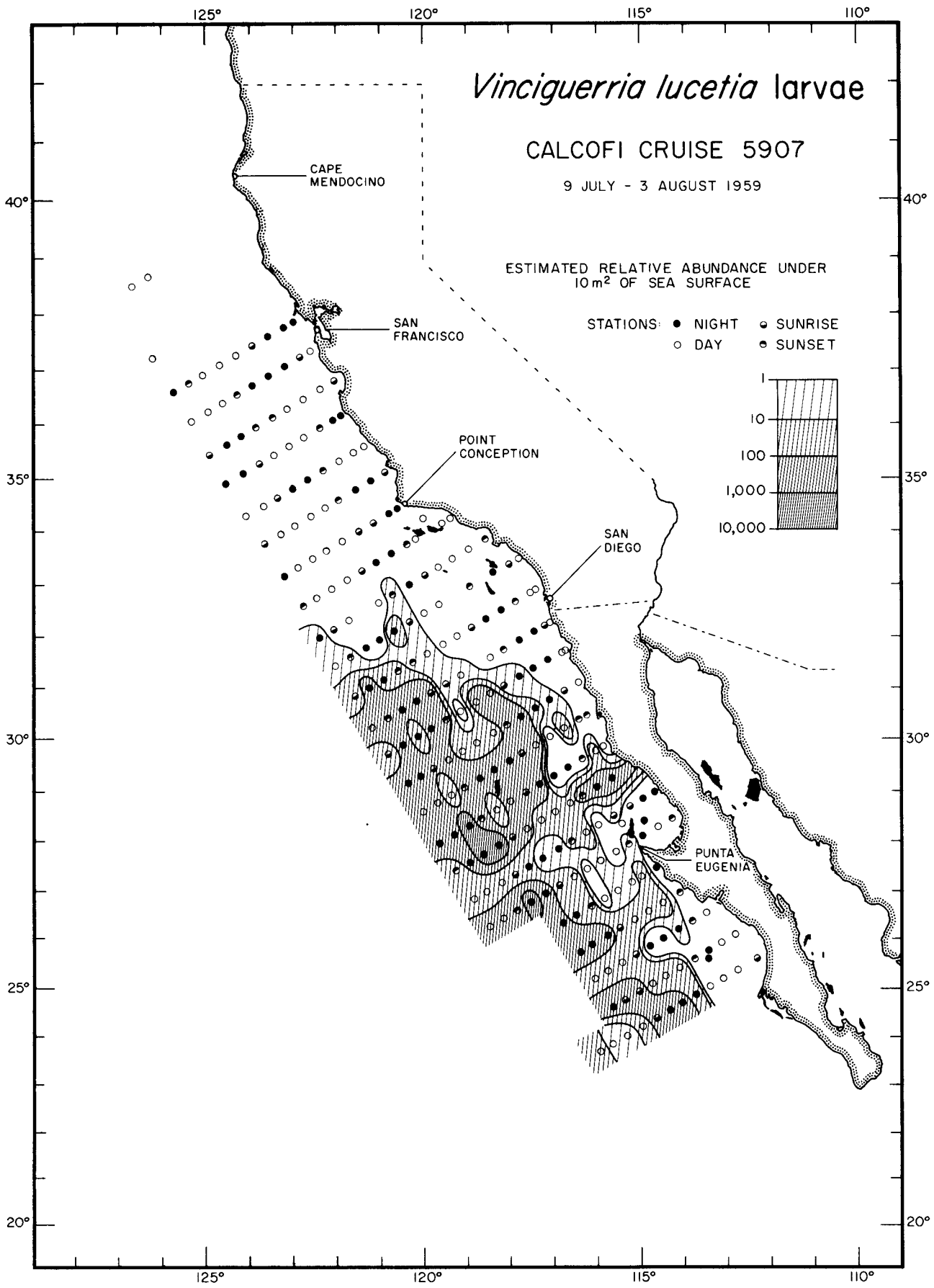
Vinciguerria lucetia larvae



Vinciguerria lucetia larvae

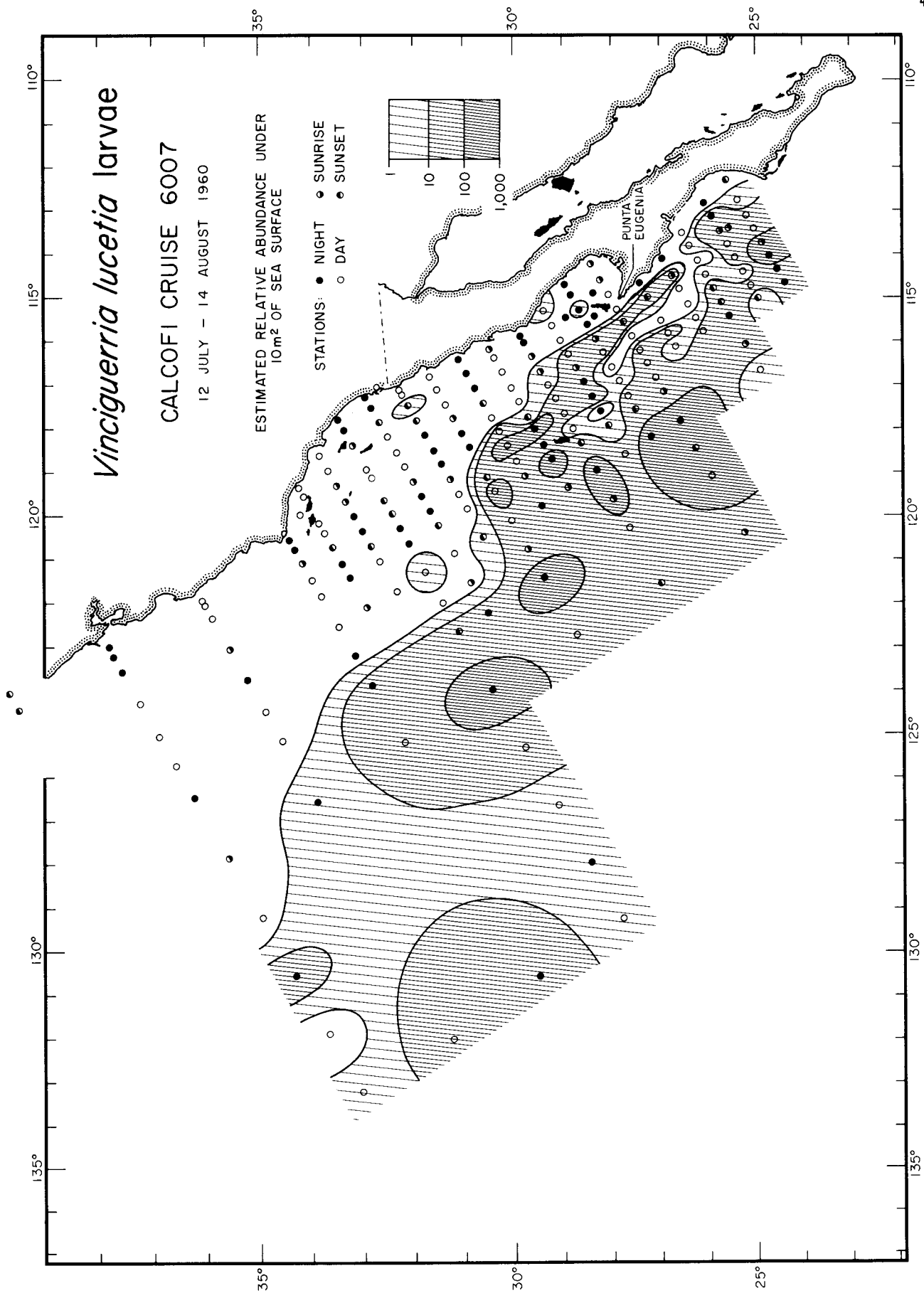
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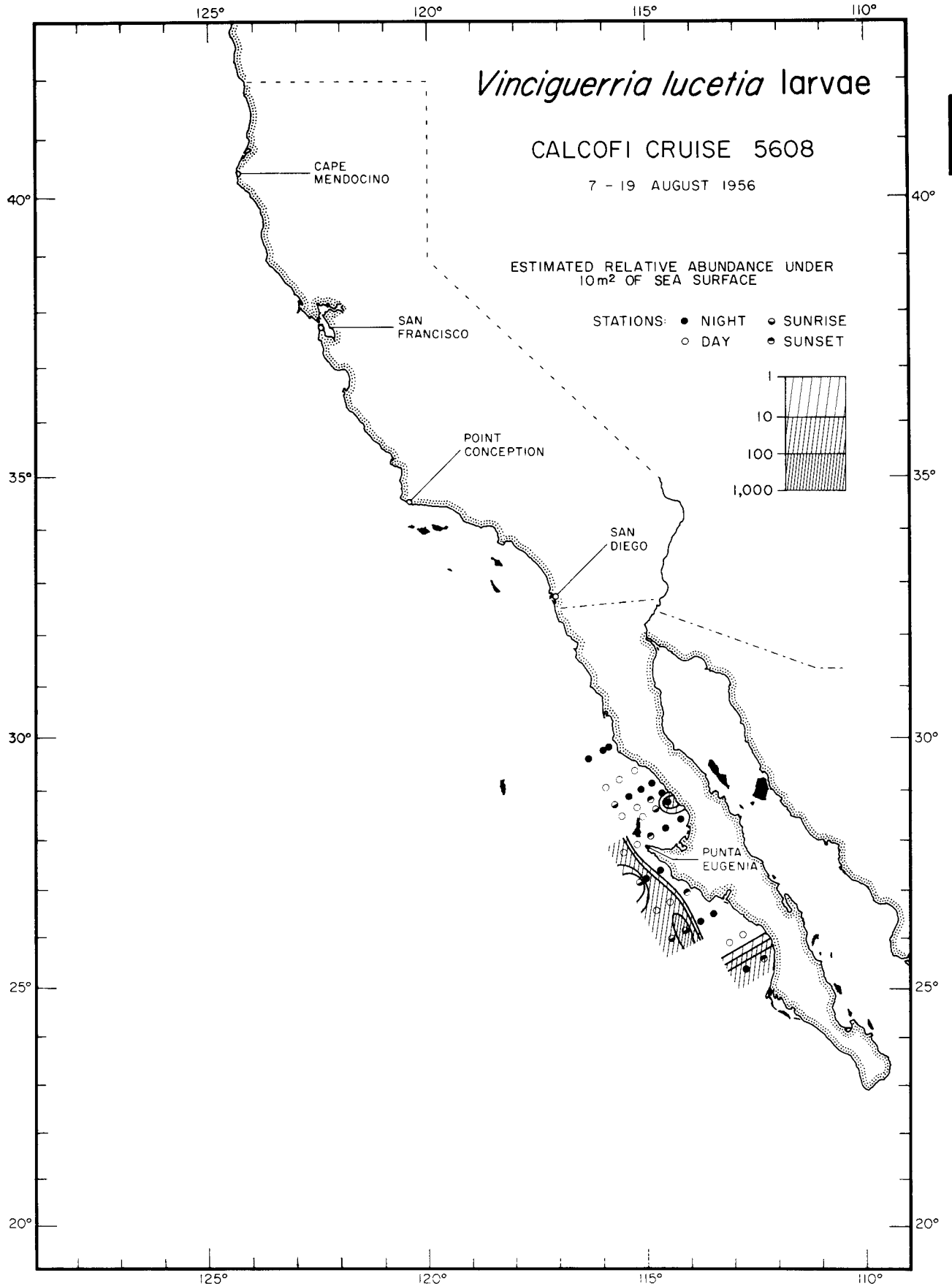
Vinciguerria lucetia larvae

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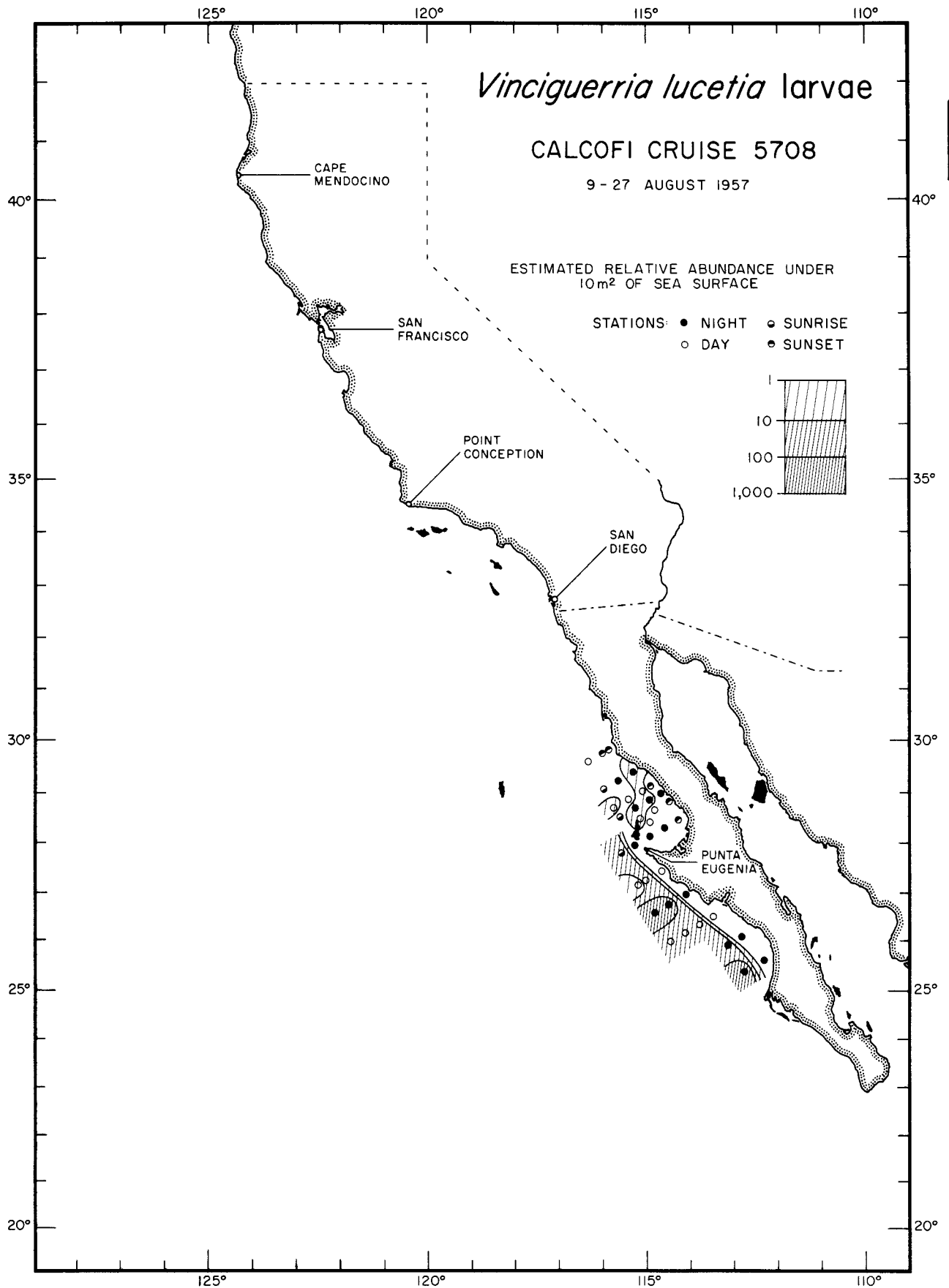
Vinciguerria lucetia larvae

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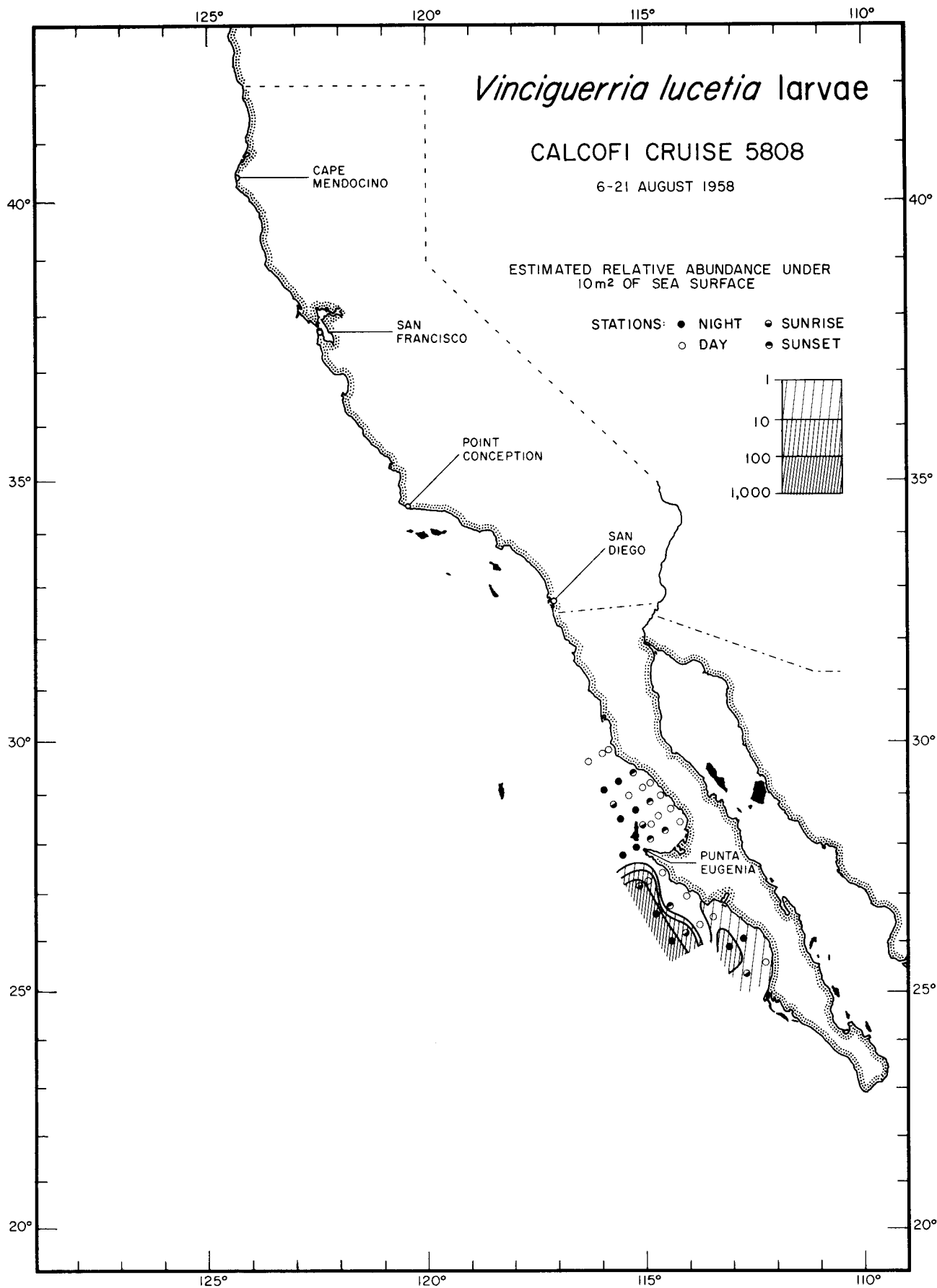
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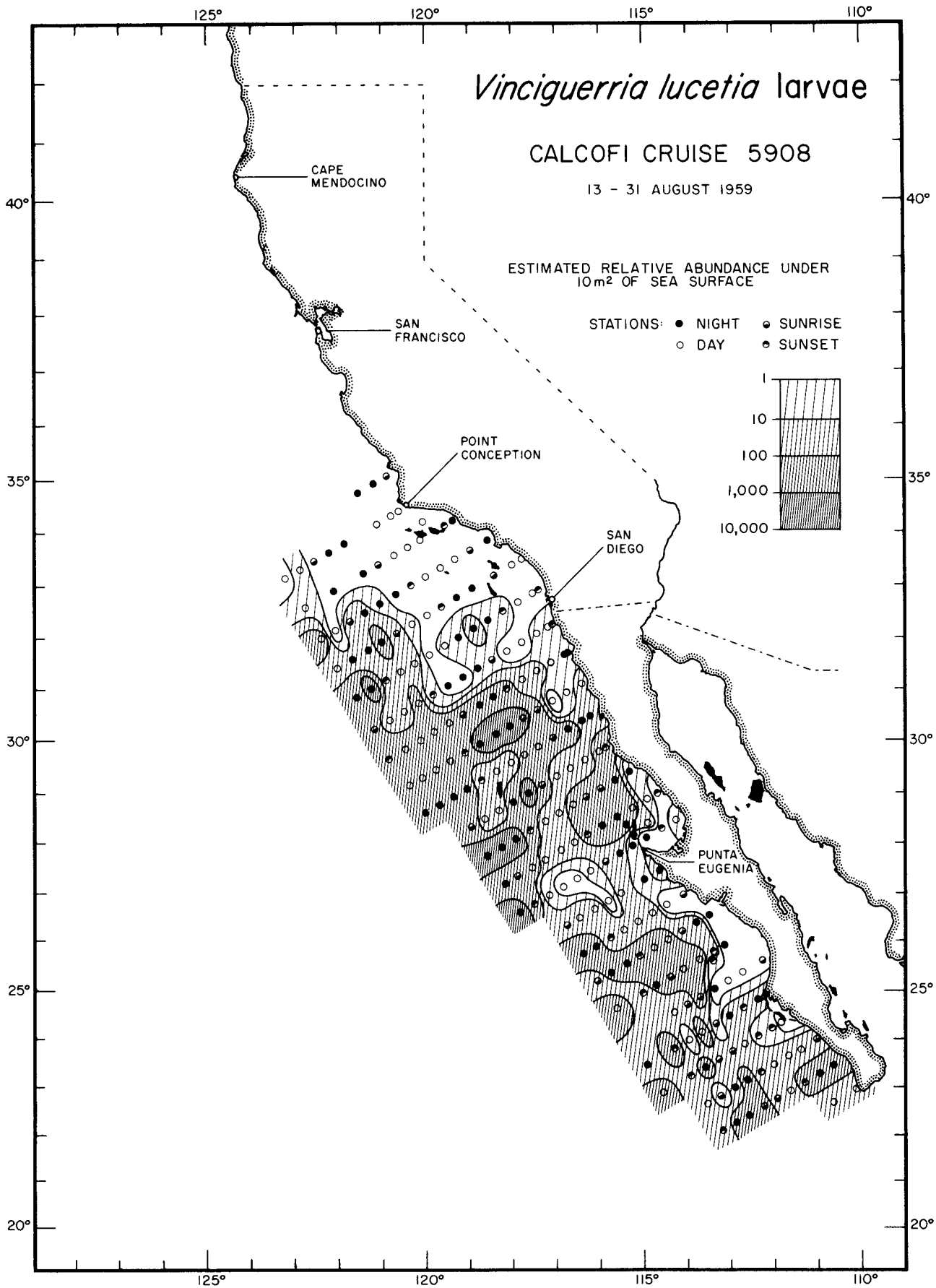
Vinciguerria lucetia larvae

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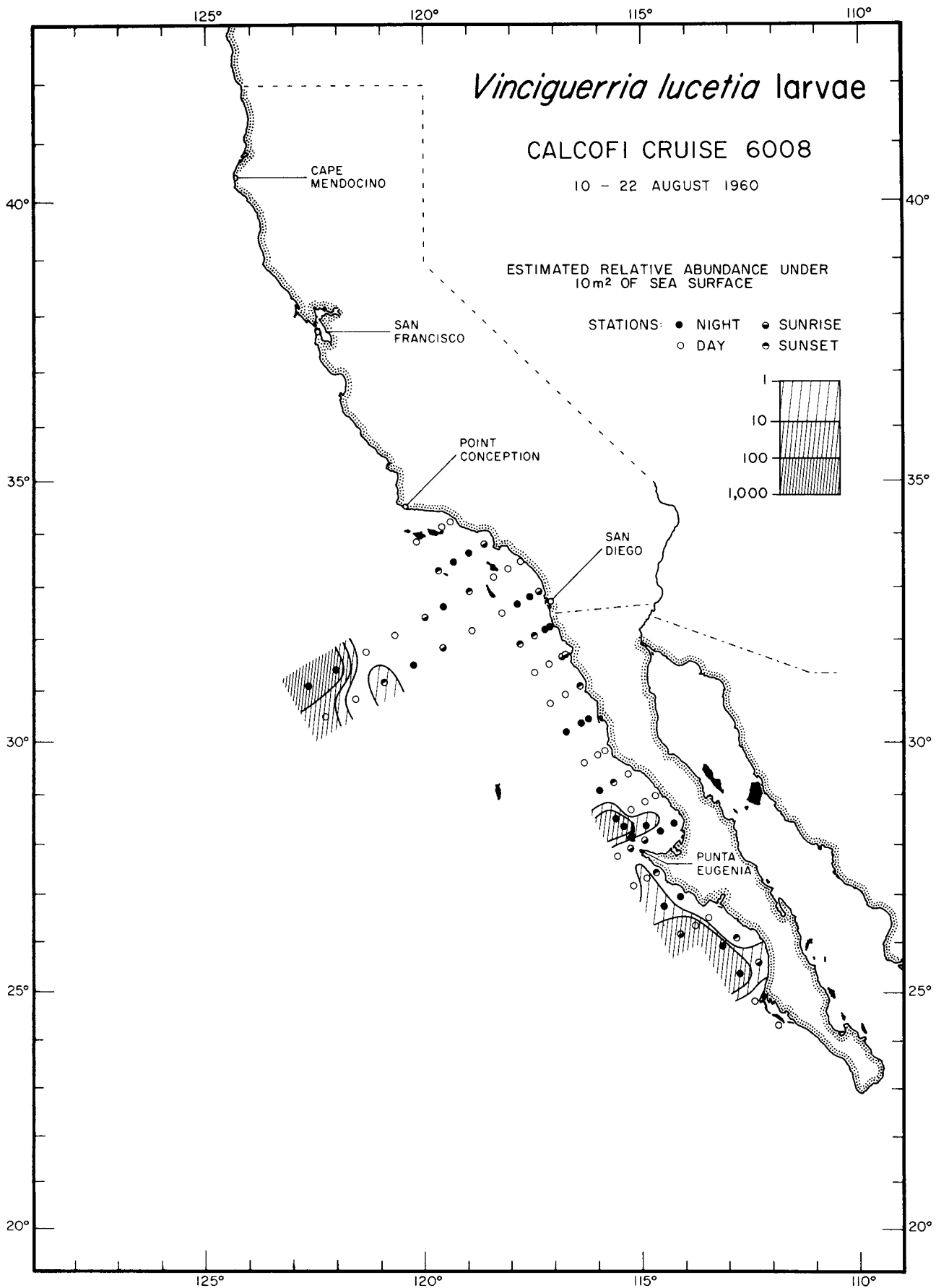
Vinciguerria lucetia larvae

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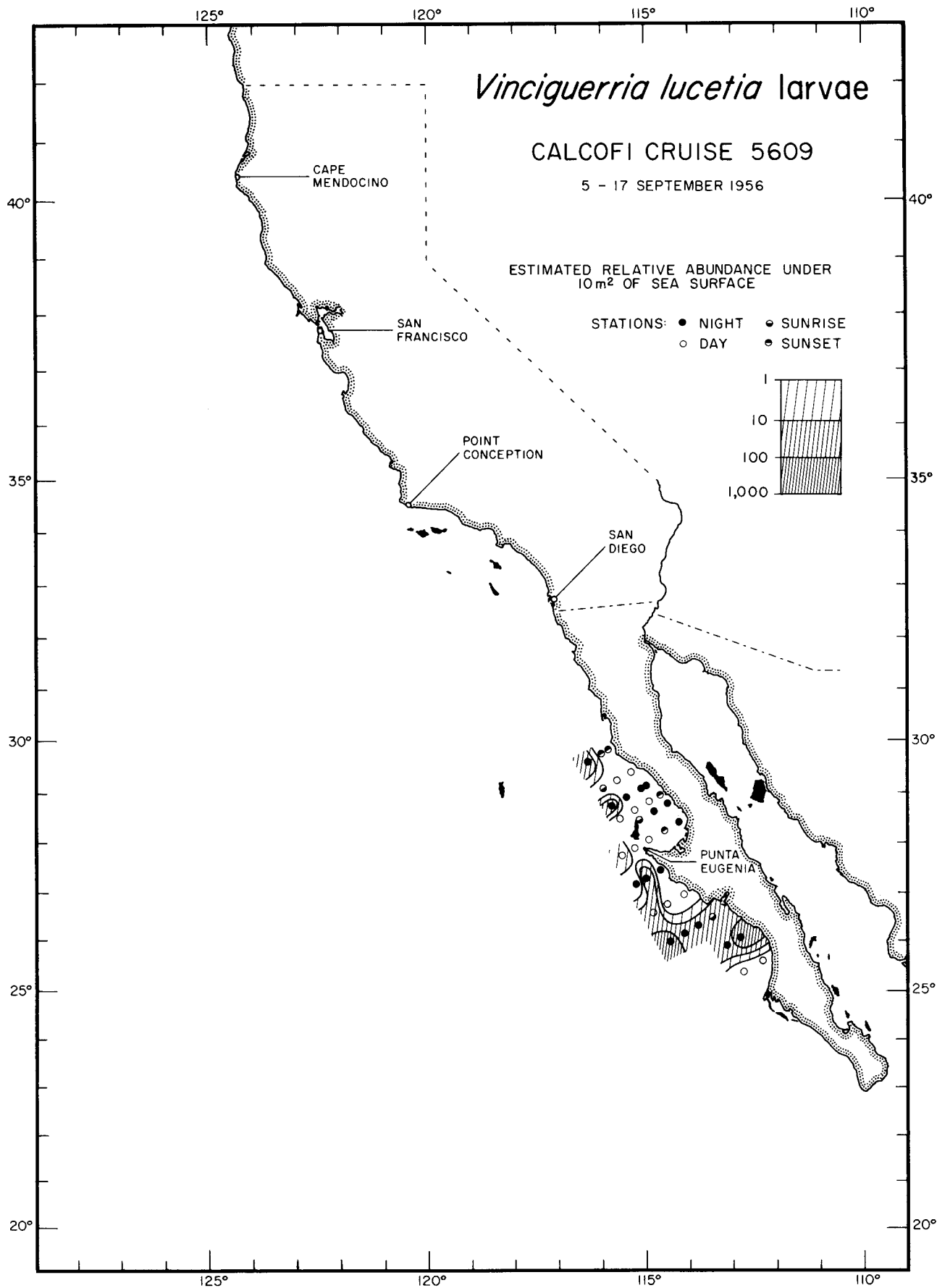
Vinciguerria lucetia larvae

5908



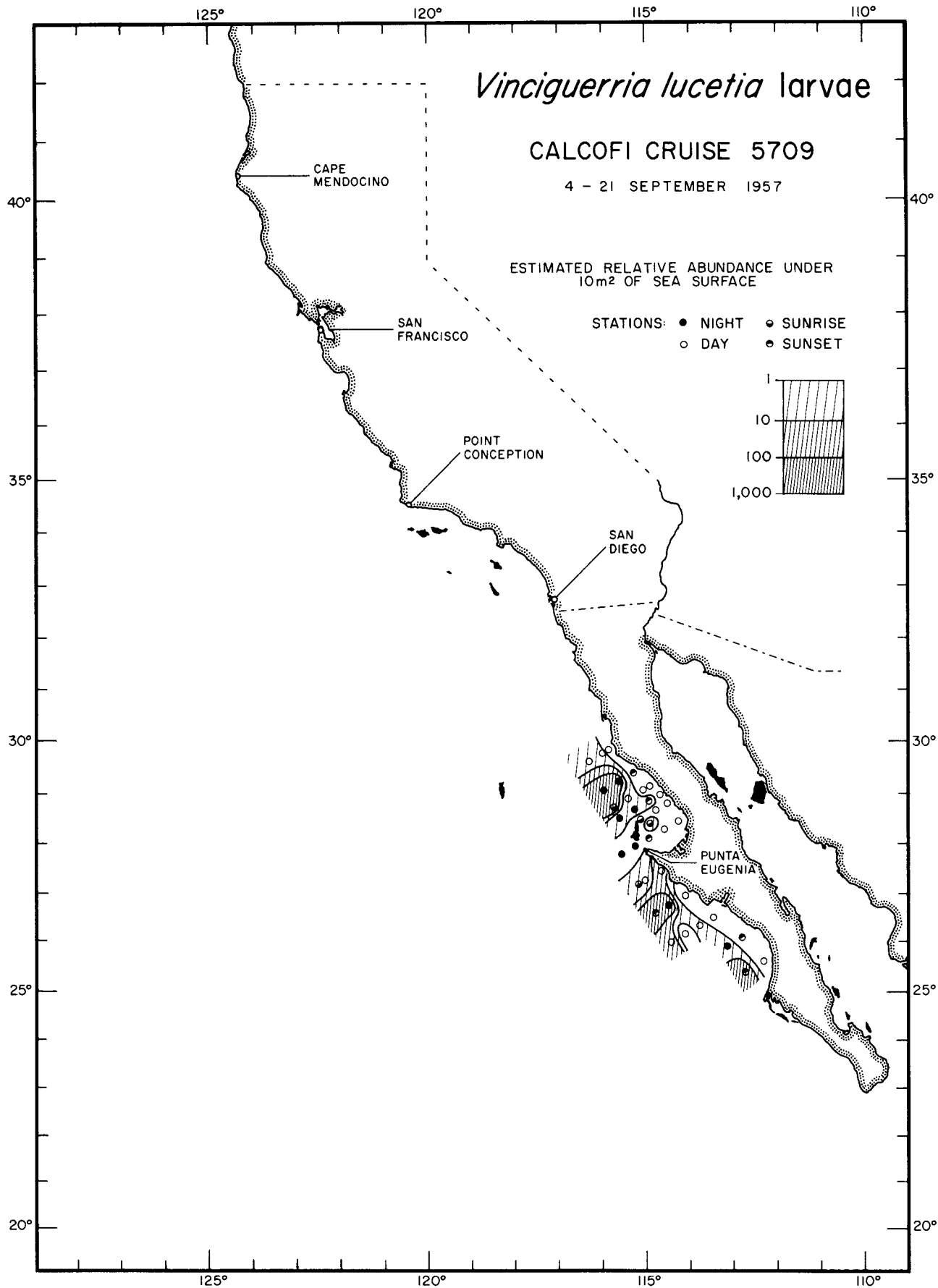
Vinciguerria lucetia larvae

6008



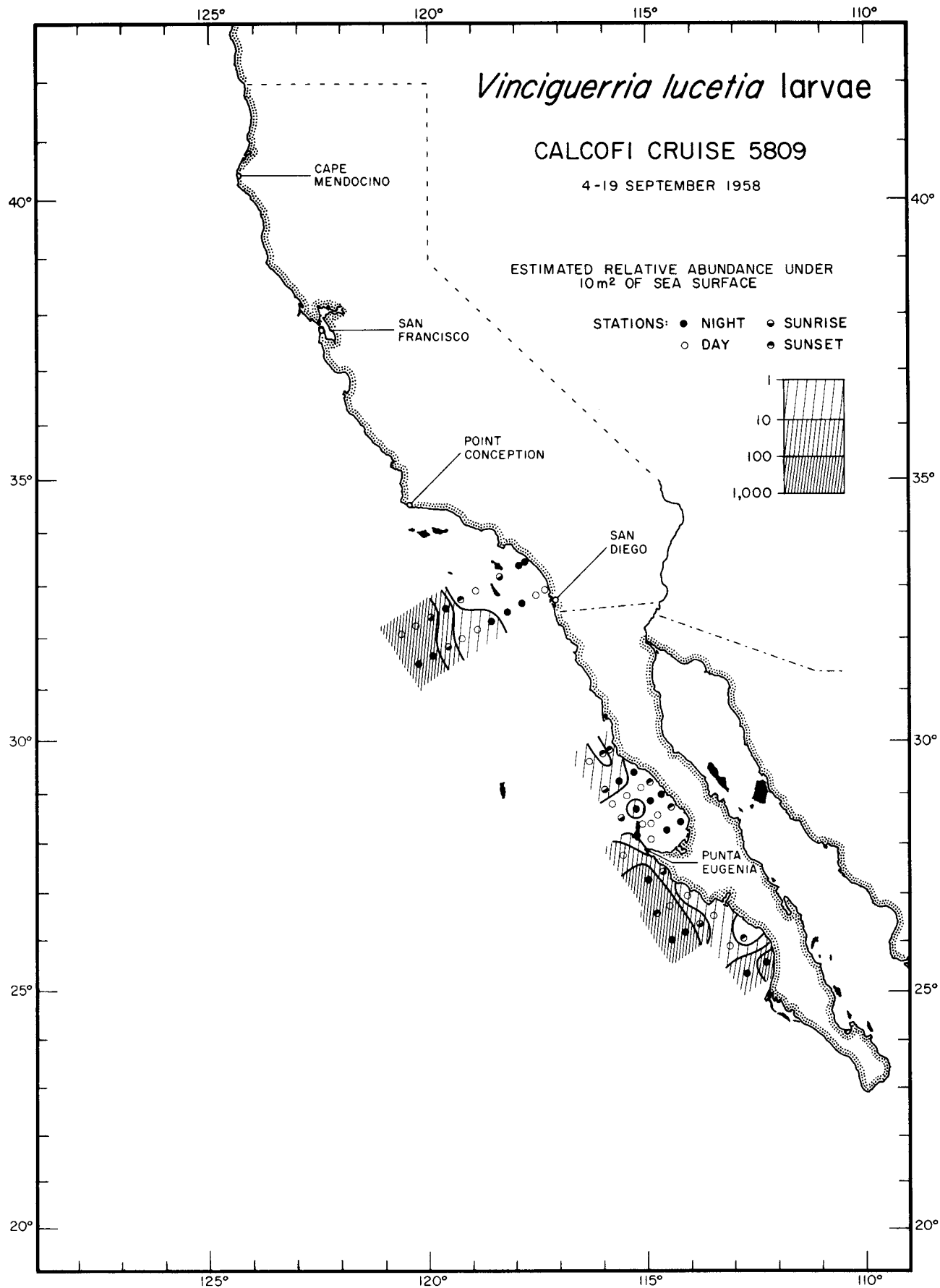
Vinciguerria lucetia larvae

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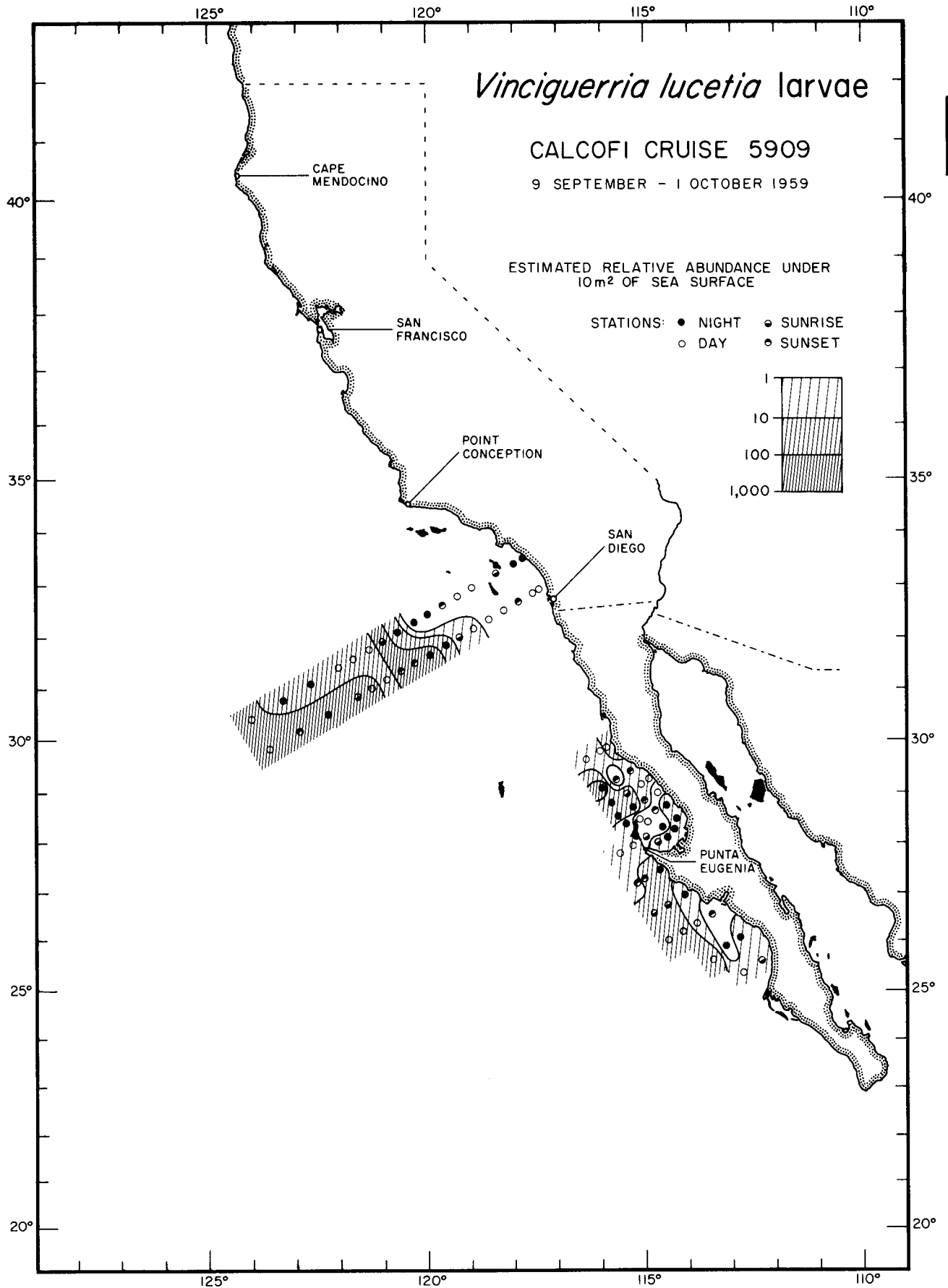
Vinciguerria lucetia larvae

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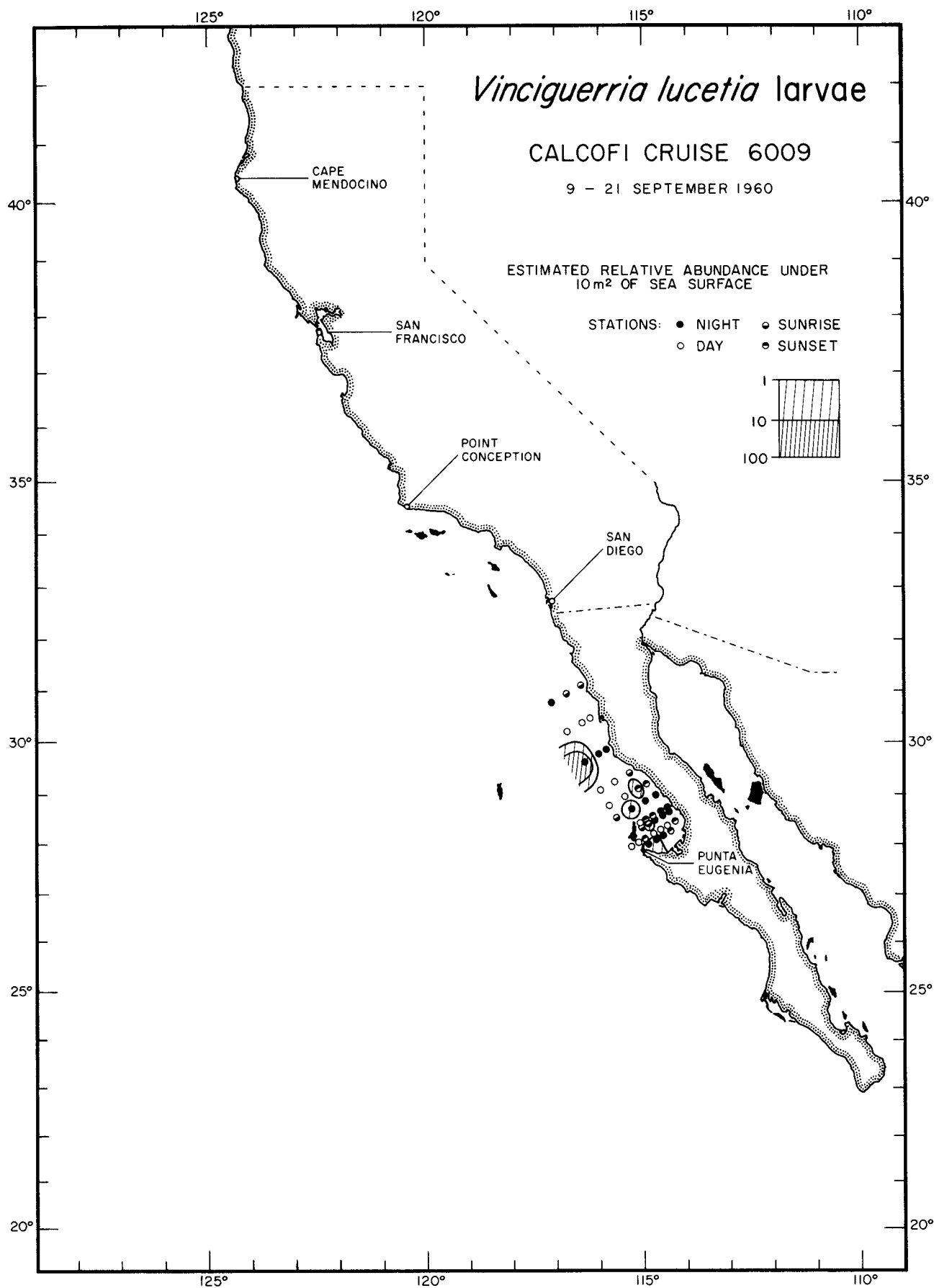
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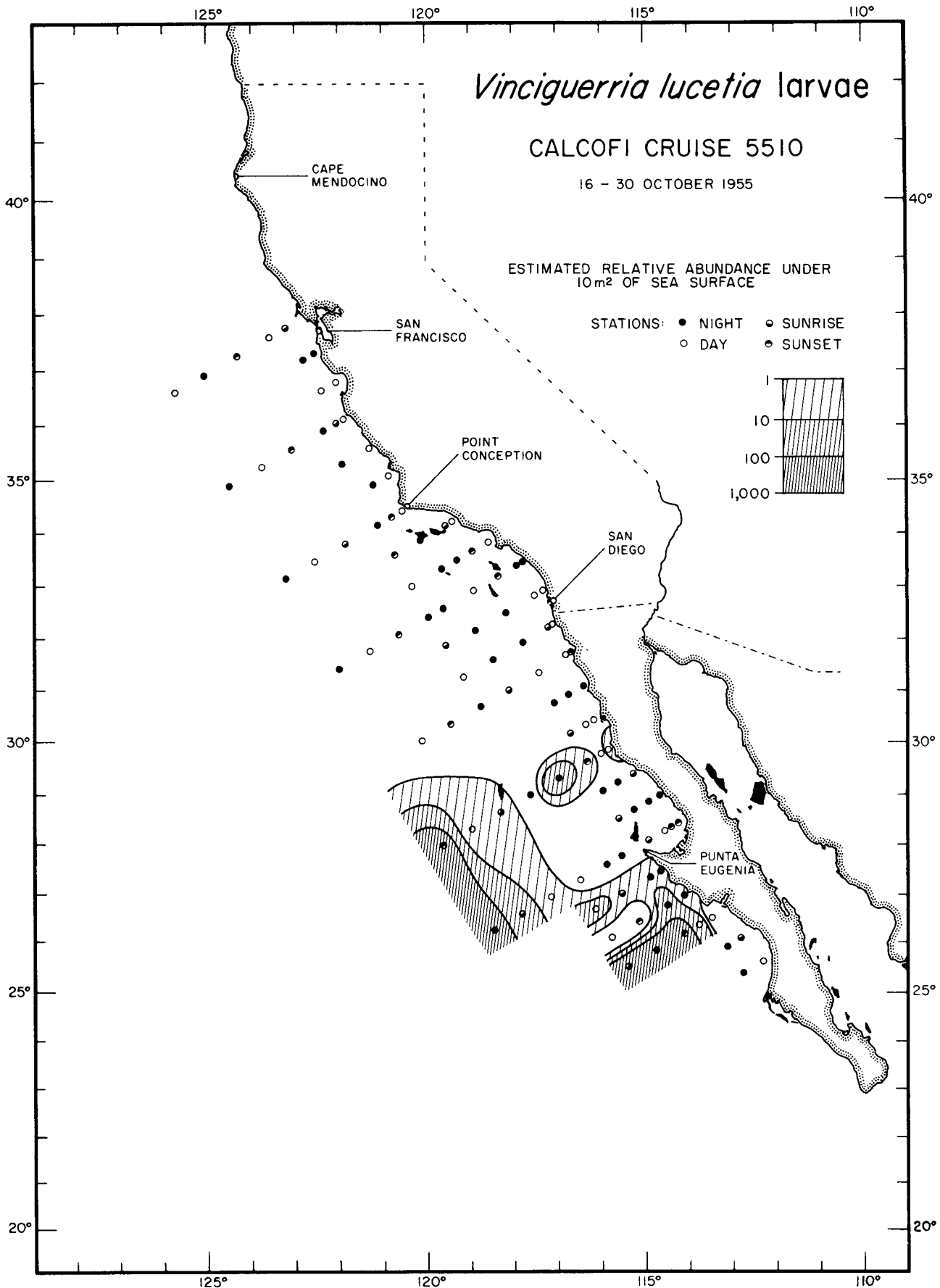
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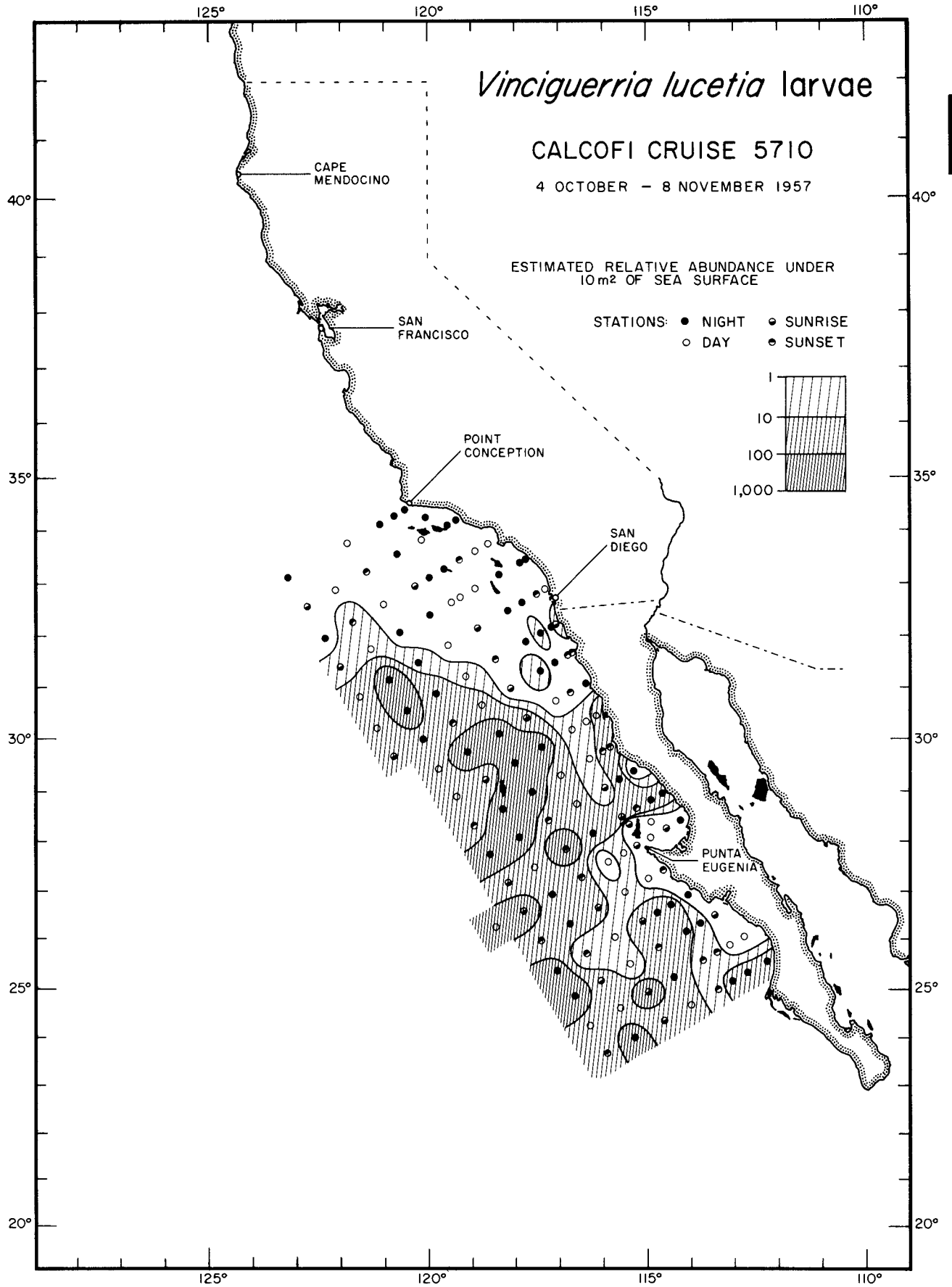
Vinciguerria lucetia larvae

6009



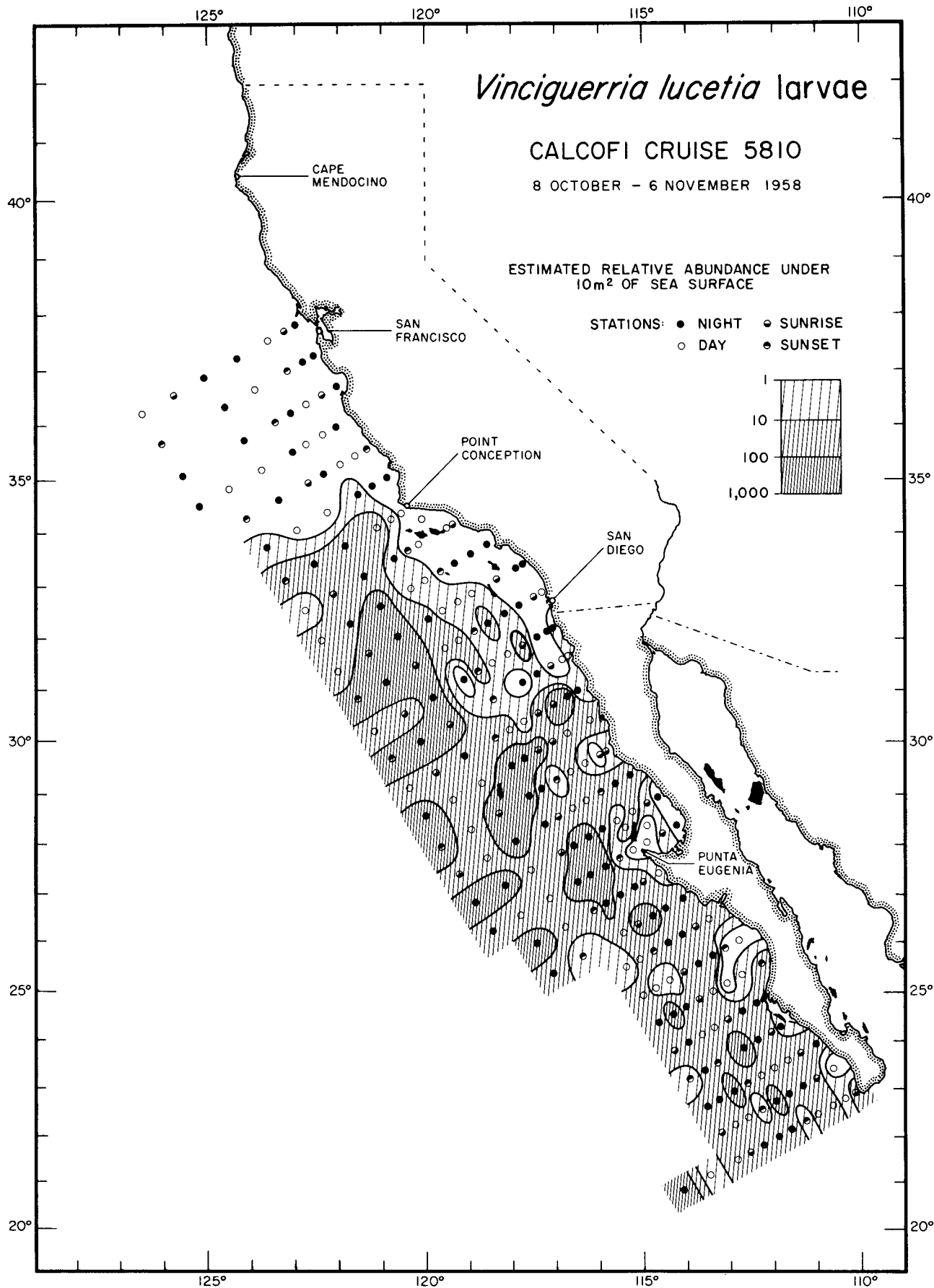
Vinciguerria lucetia larvae

5510



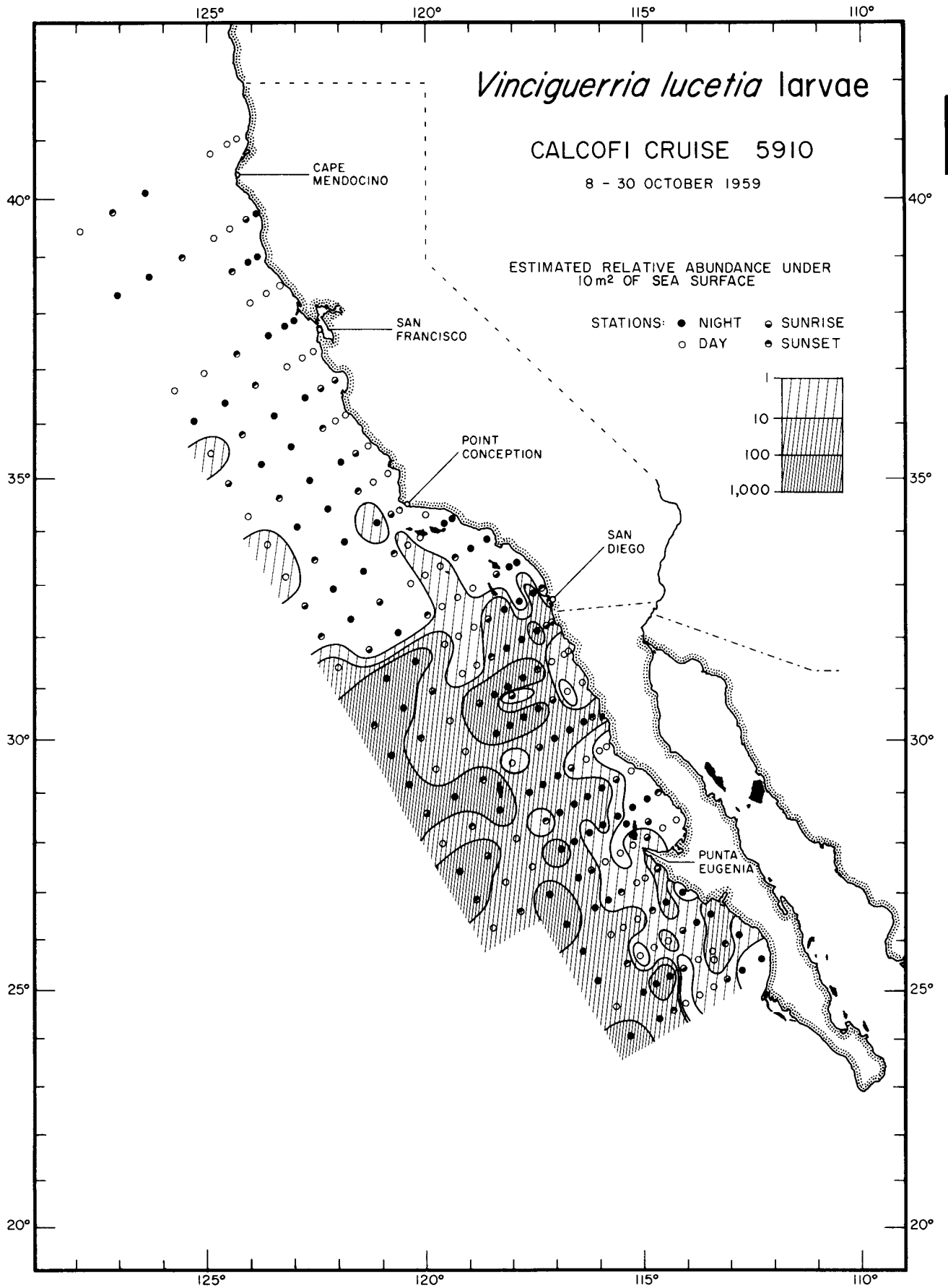
Vinciguerria lucetia larvae

5710



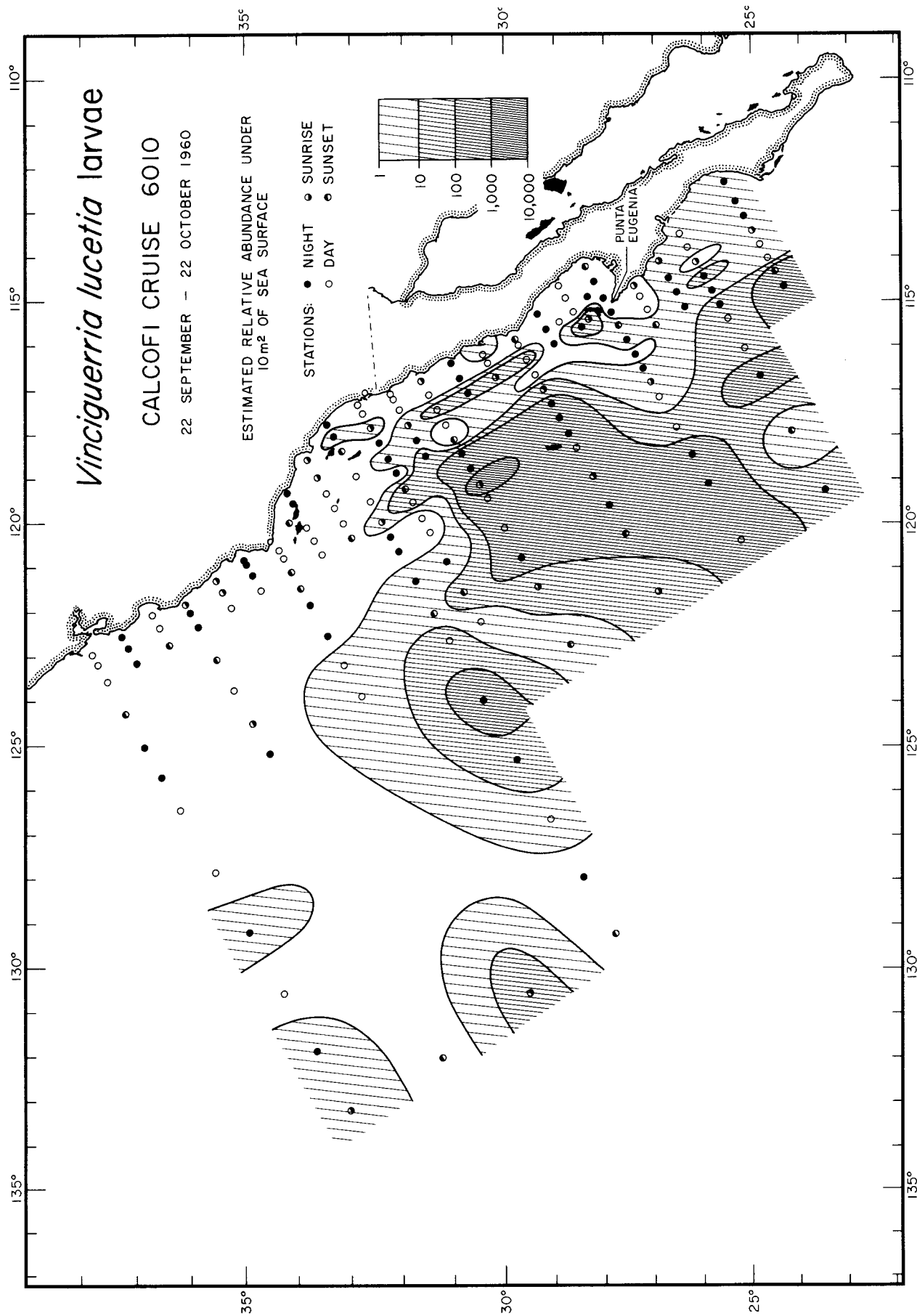
Vinciguerria lucetia larvae

5810



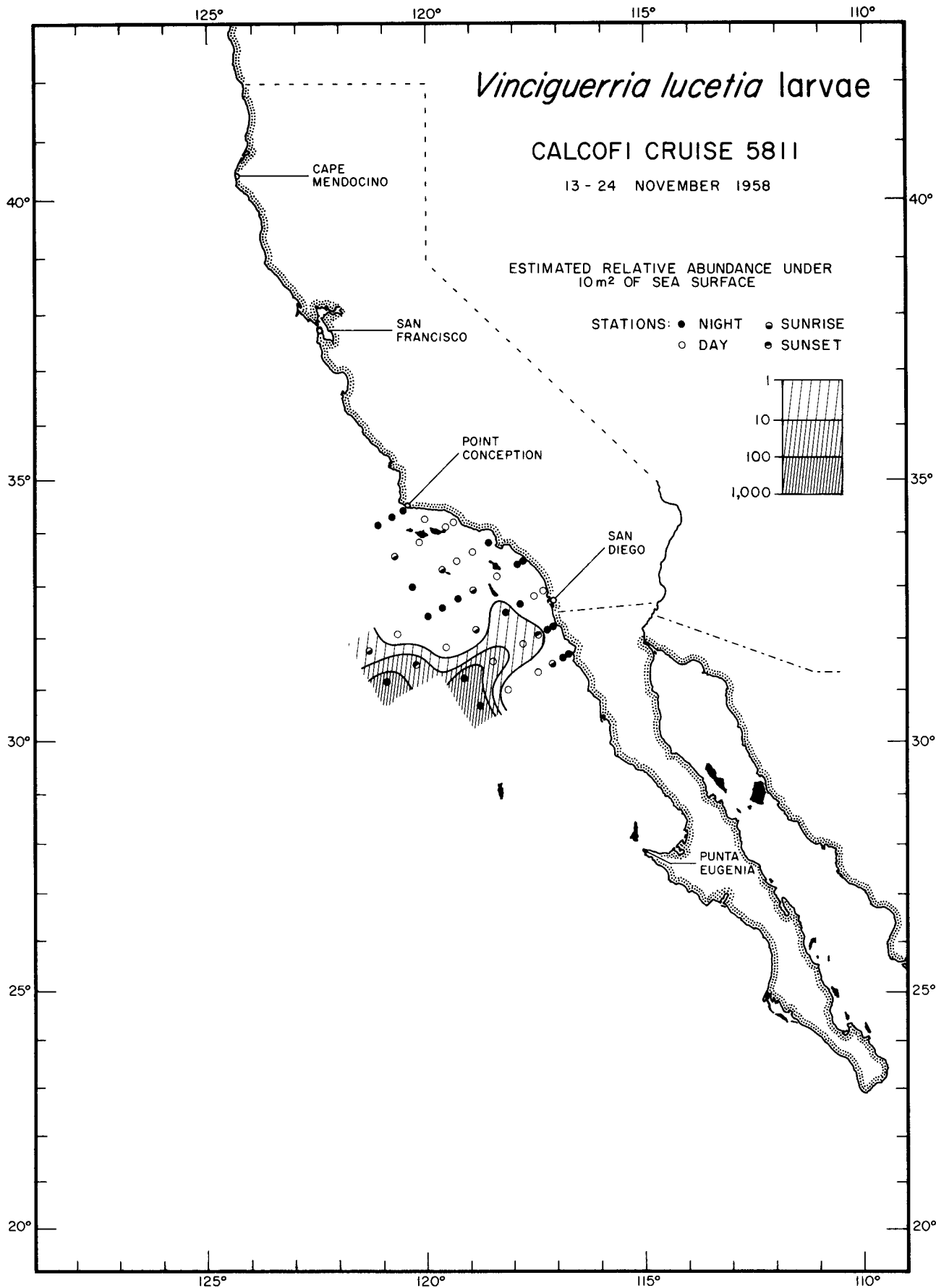
Vinciguerria lucetia larvae

5910



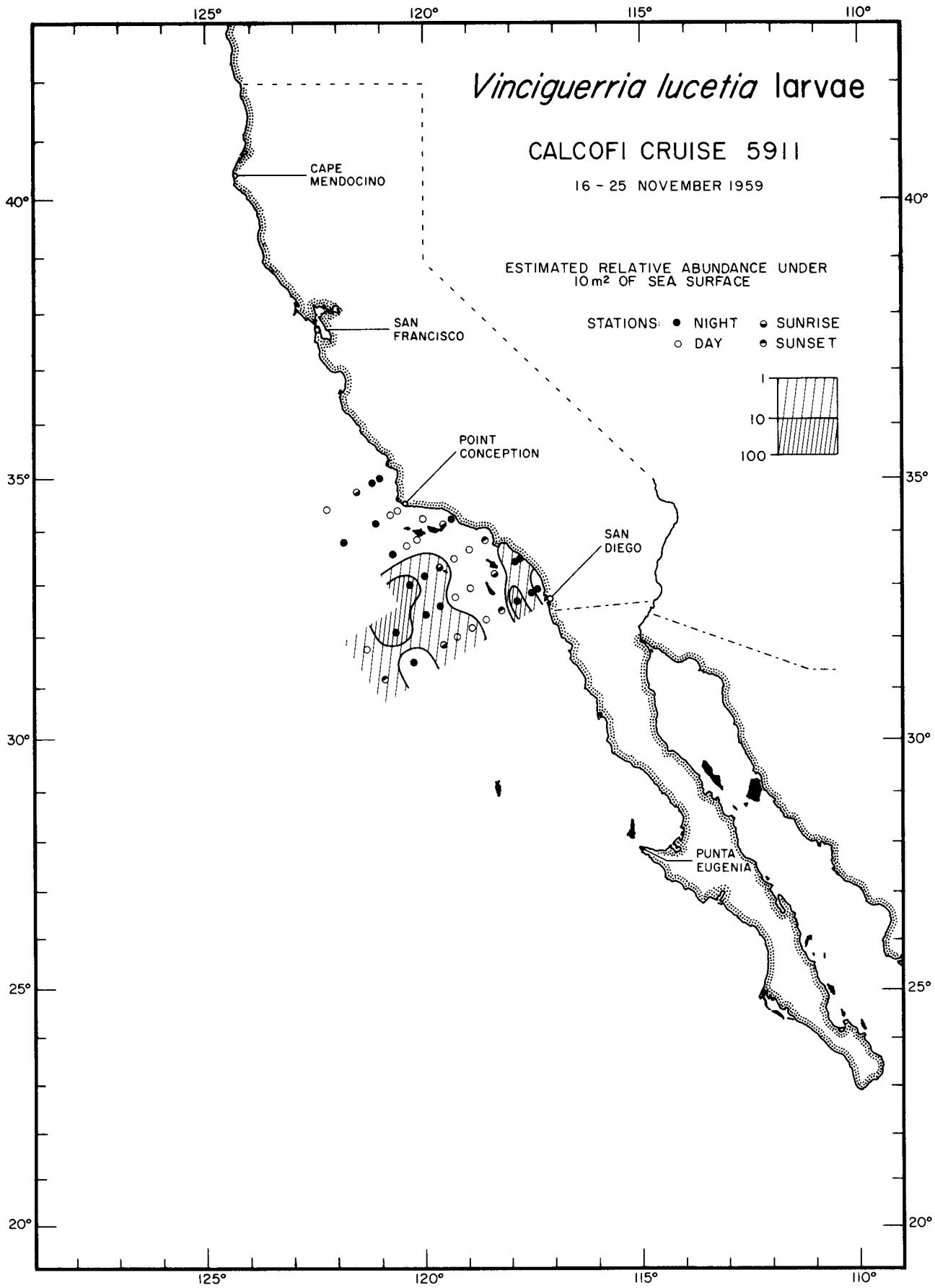
Vinciguerria lucetia larvae

6010

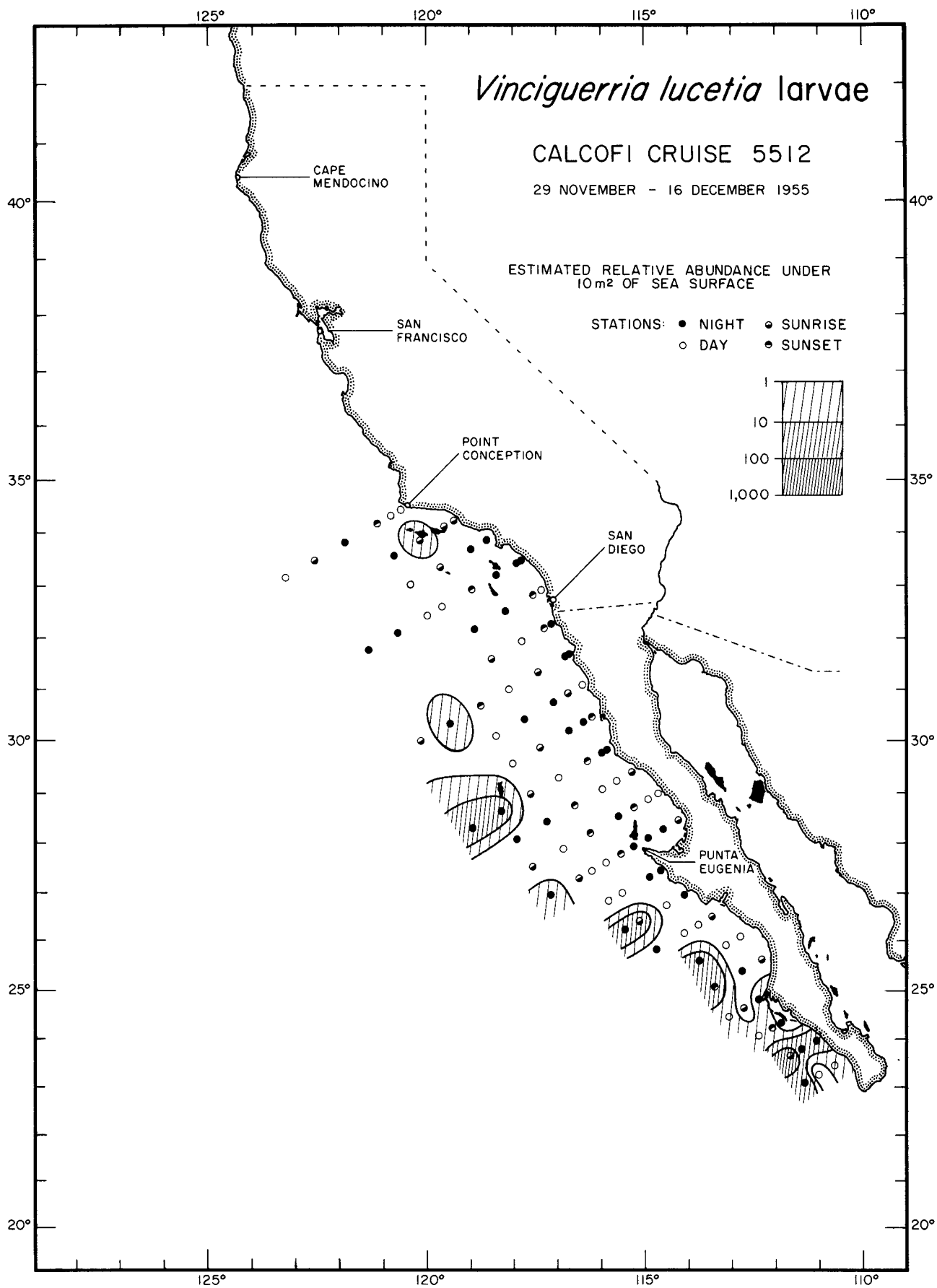


Vinciguerria lucetia larvae

5811

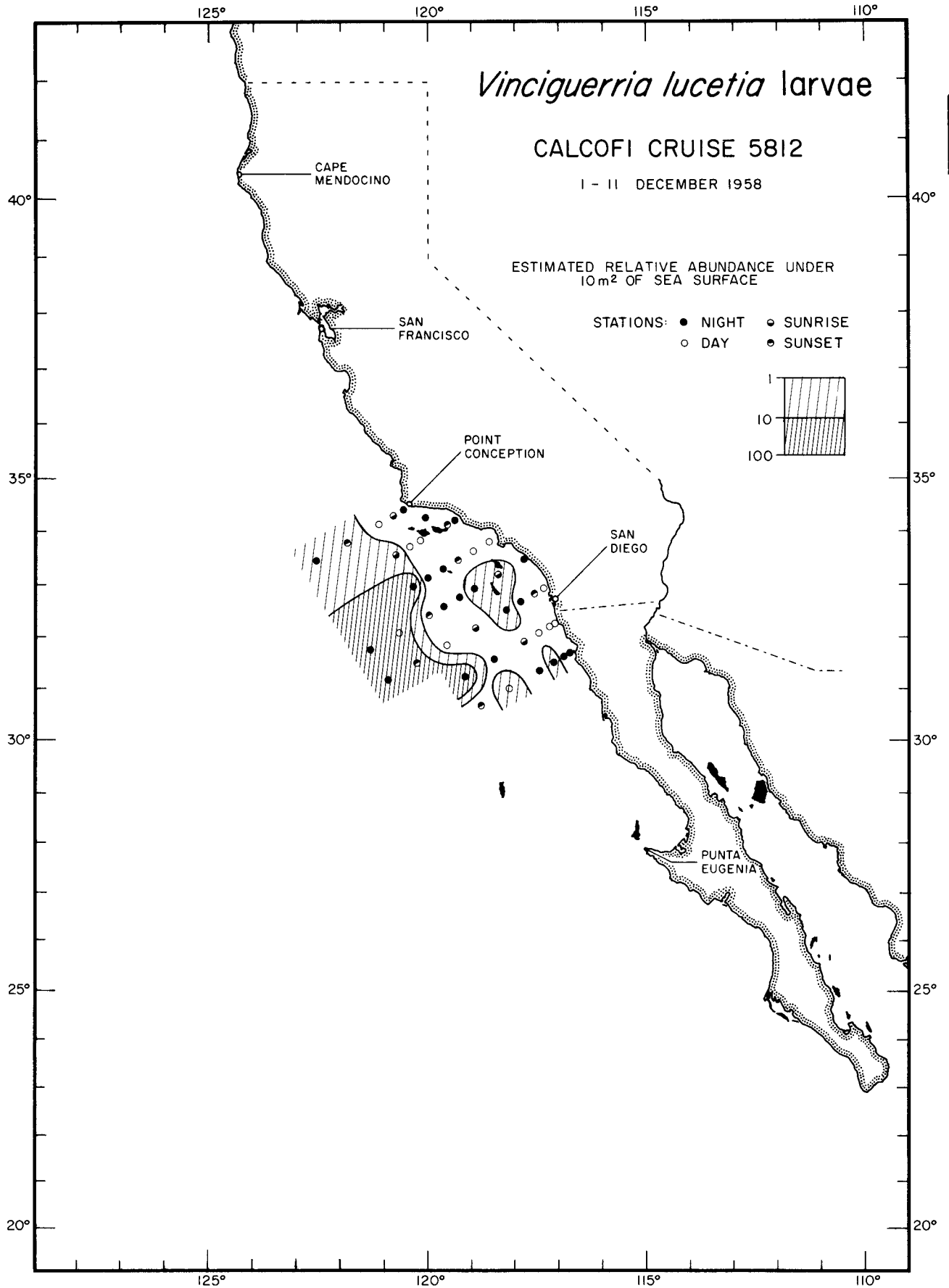


Vinciguerria lucetia larvae



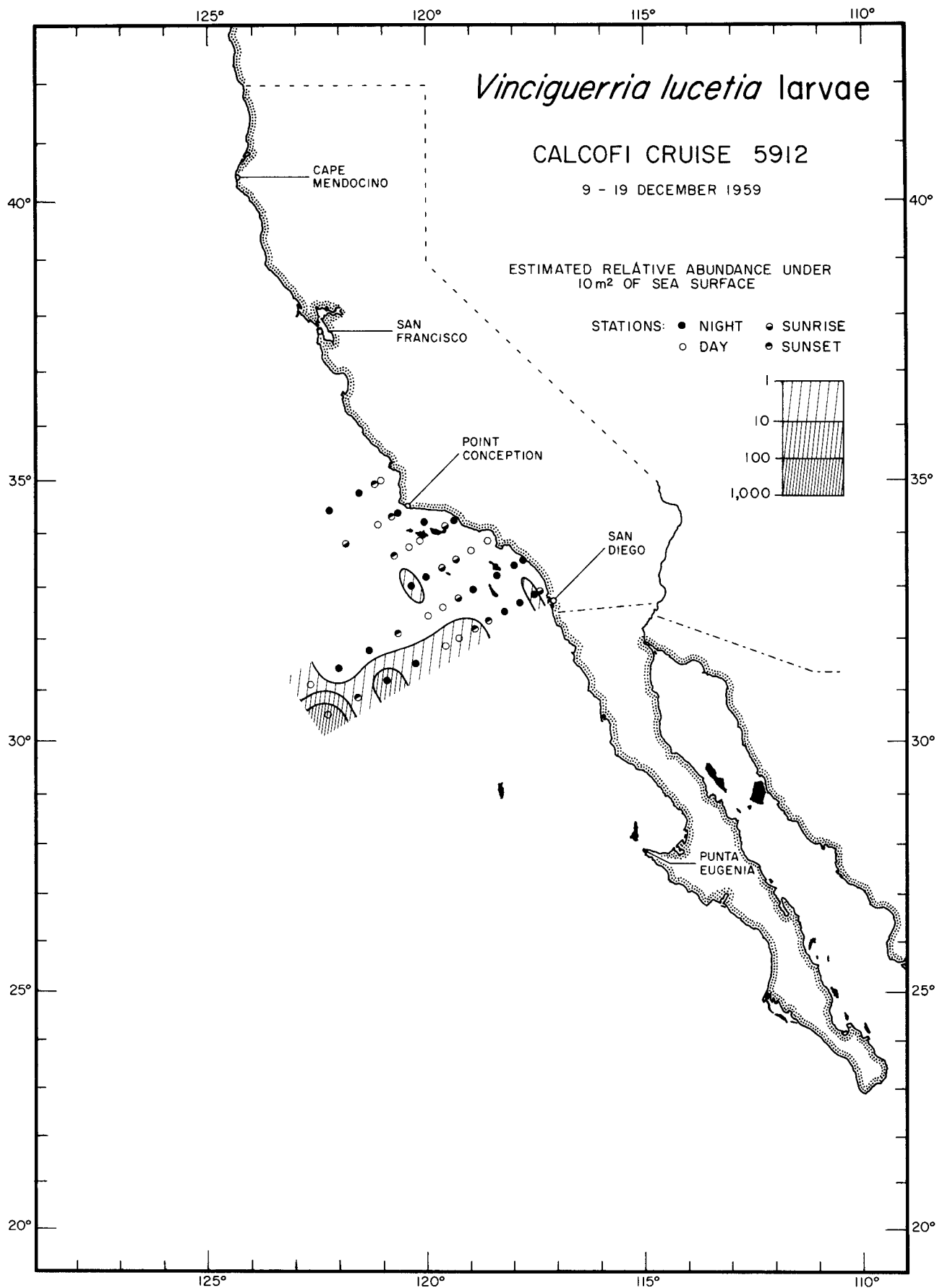
Vinciguerria lucetia larvae

5512



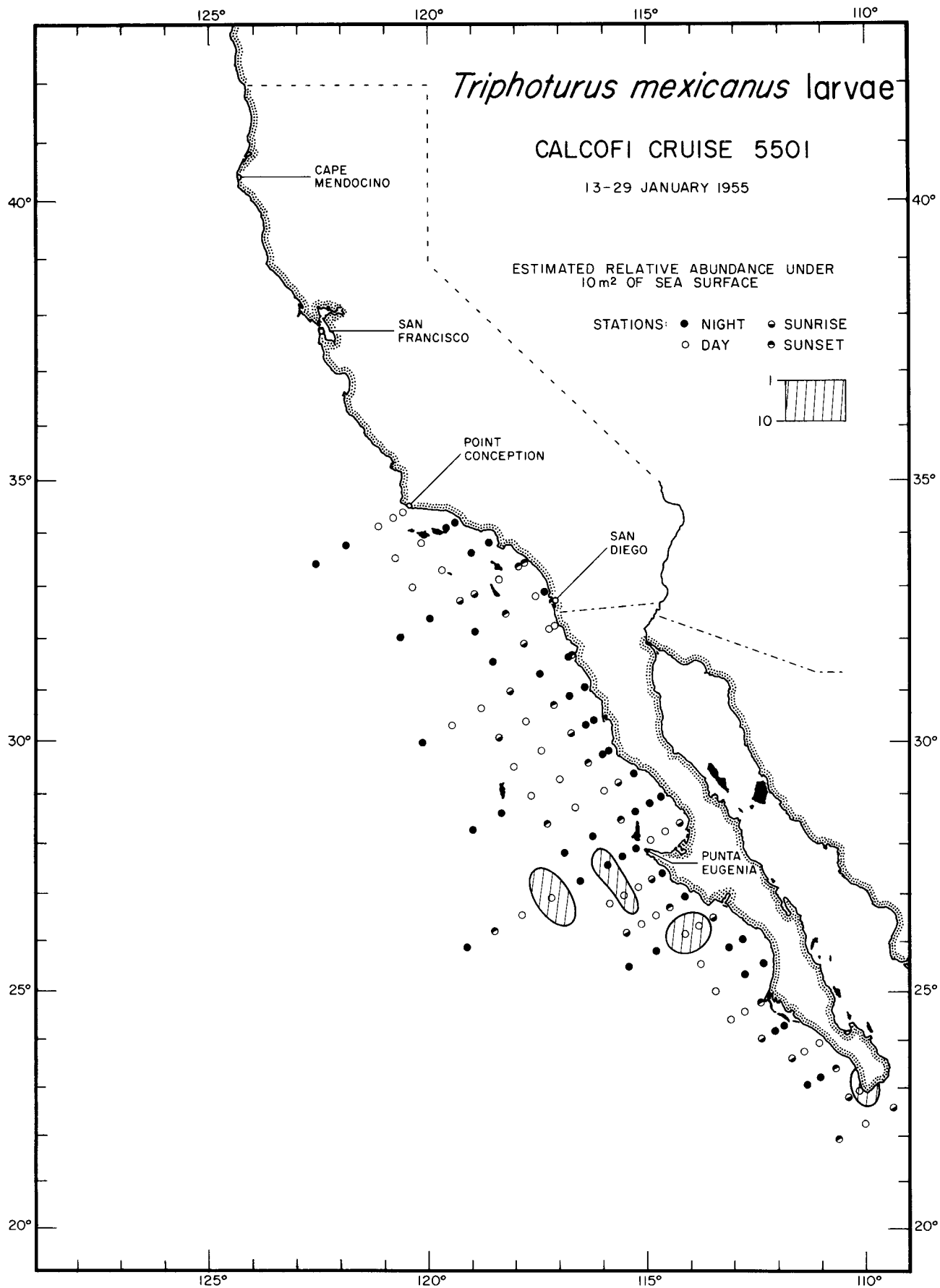
Vinciguerria lucetia larvae

5812



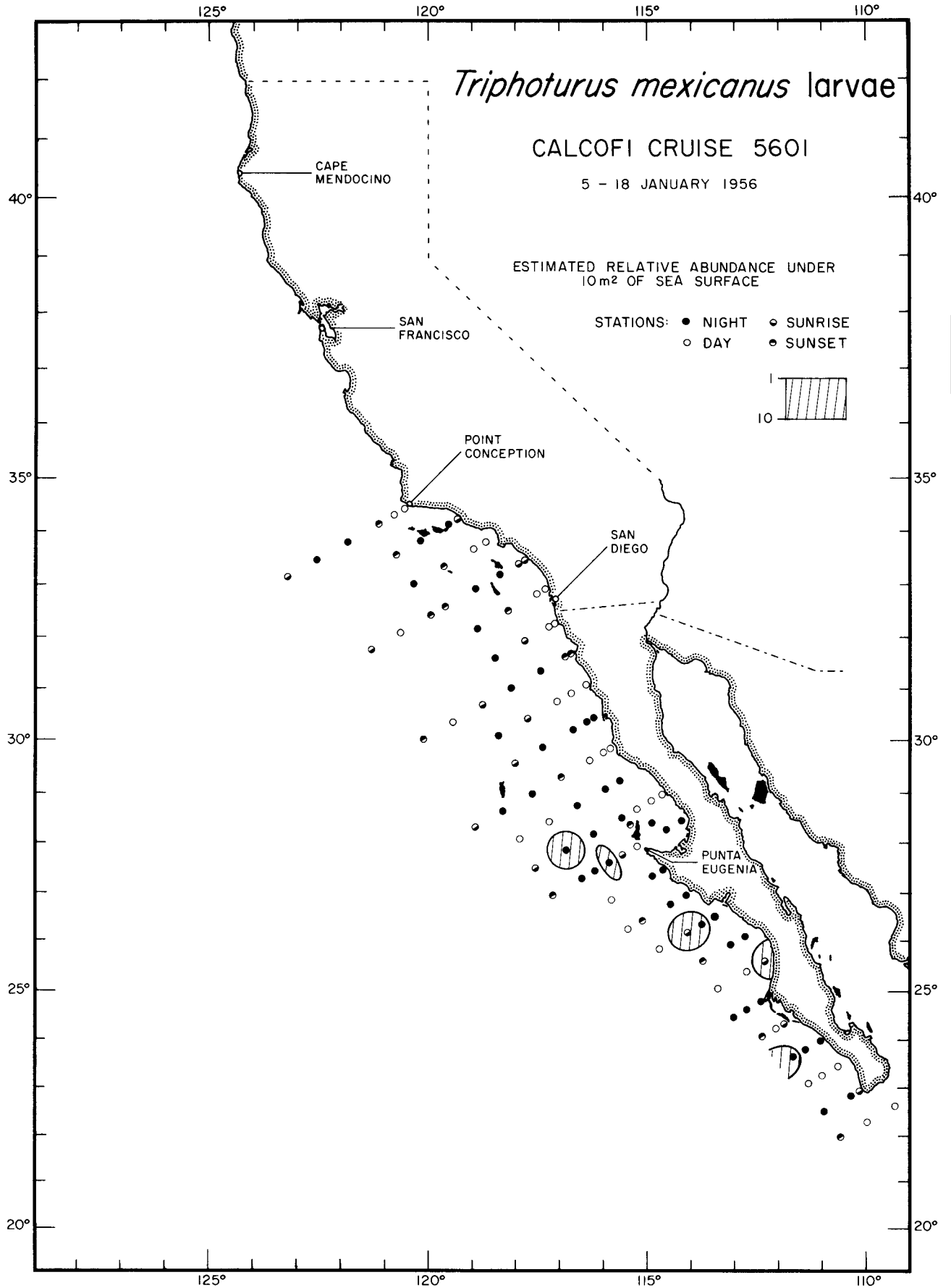
Vinciguerria lucetia larvae

5912



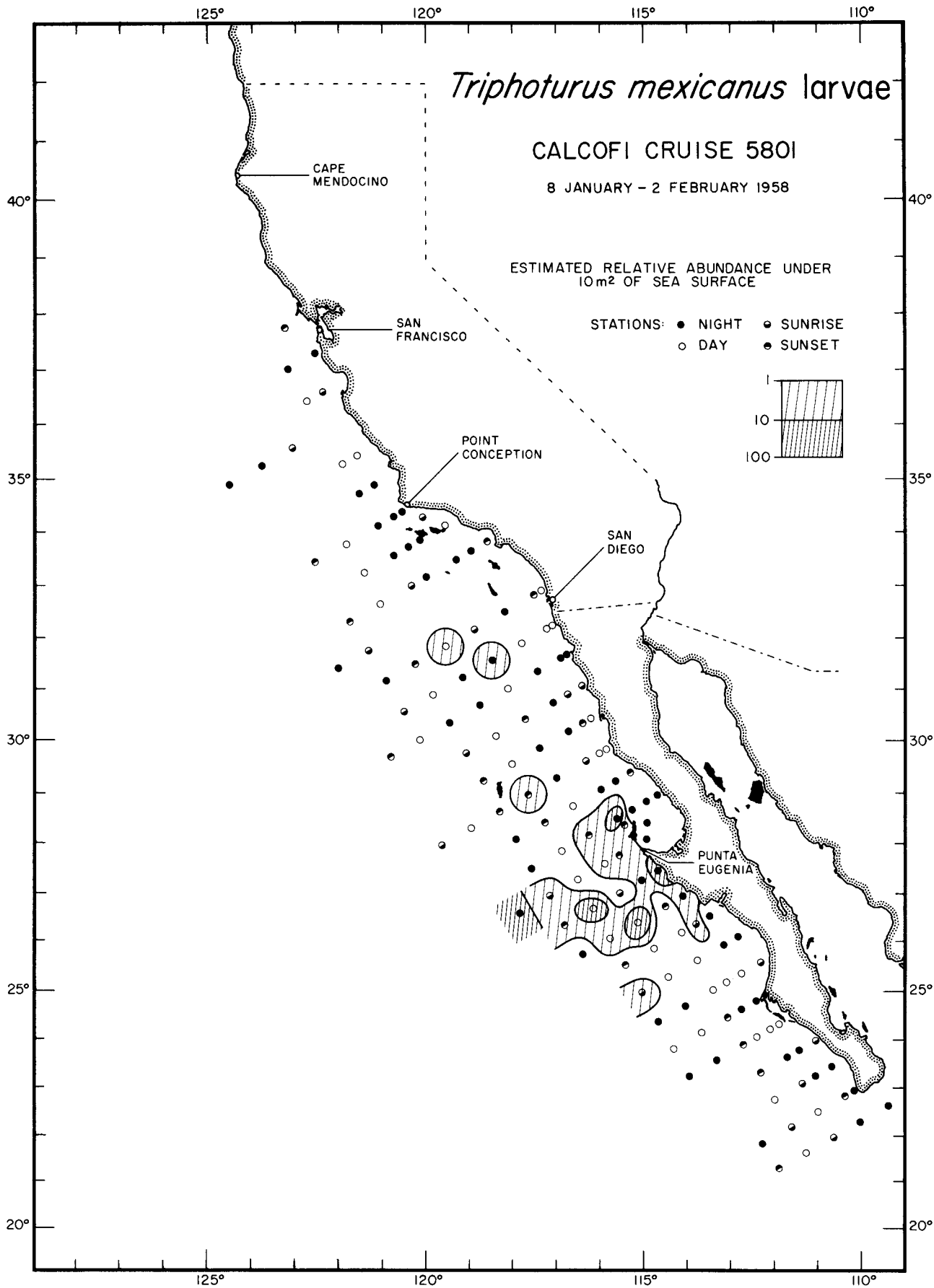
Triphoturus mexicanus larvae

5501



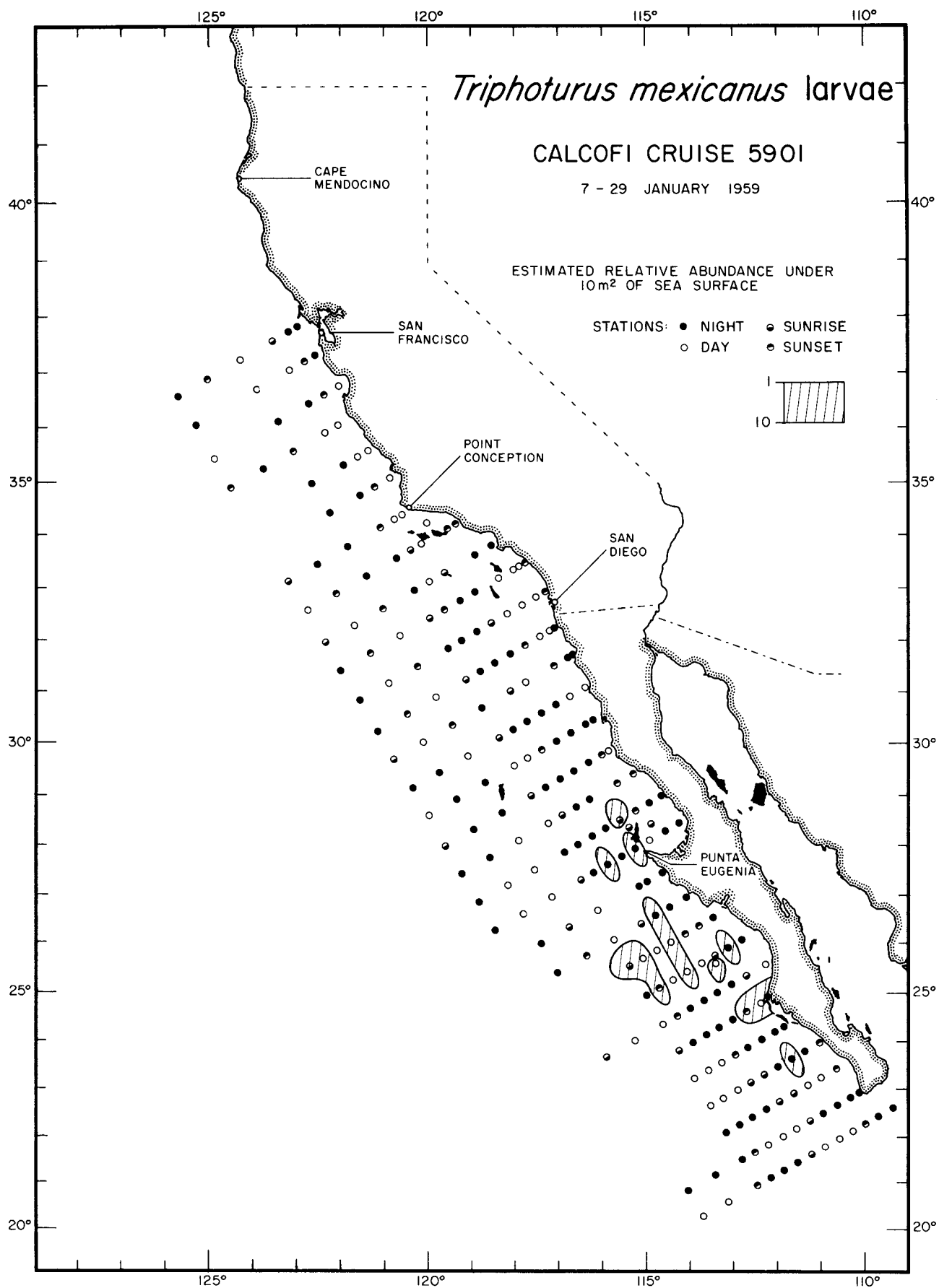
Triphoturus mexicanus larvae

5601



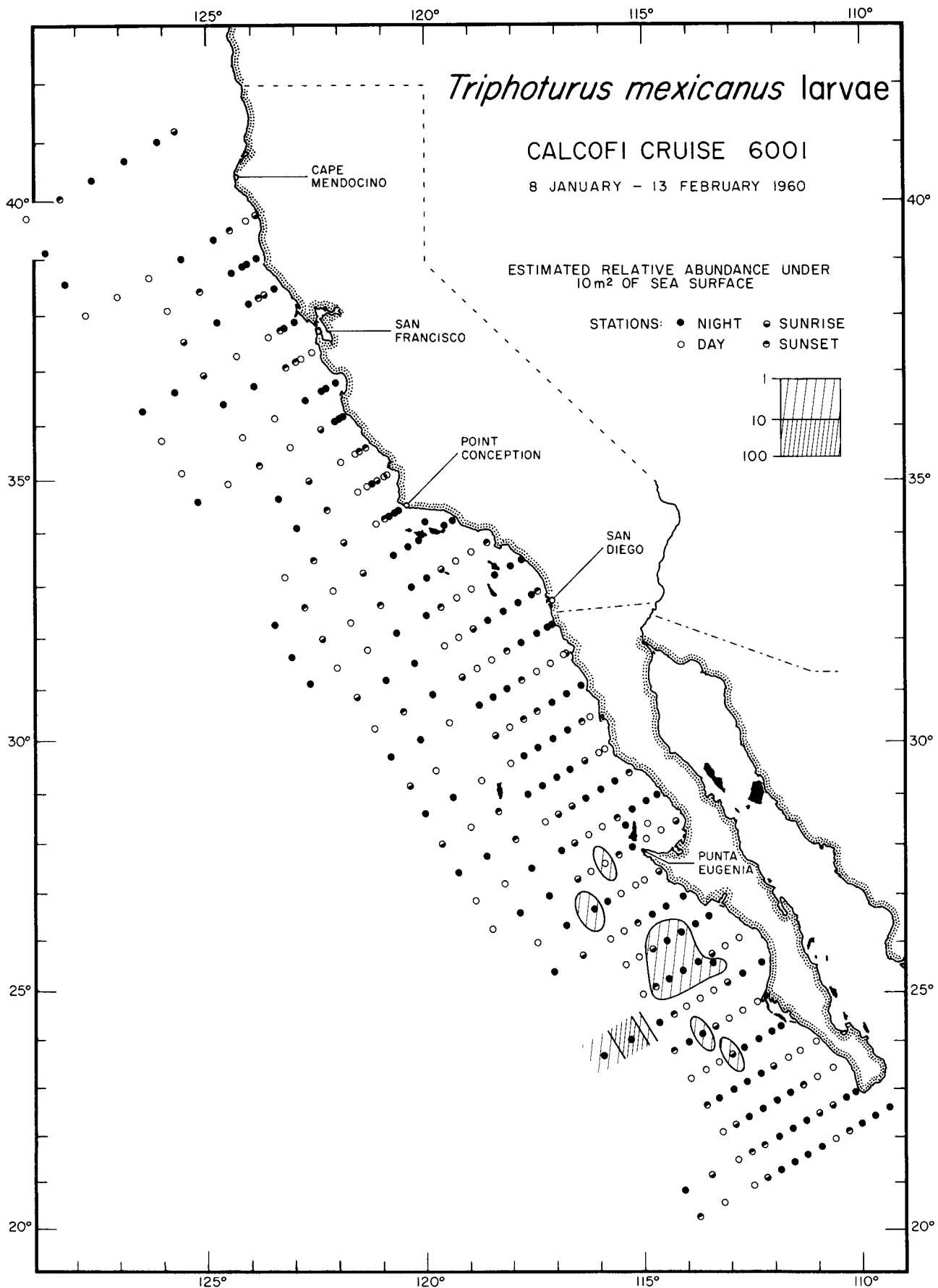
Triphoturus mexicanus larvae

5801



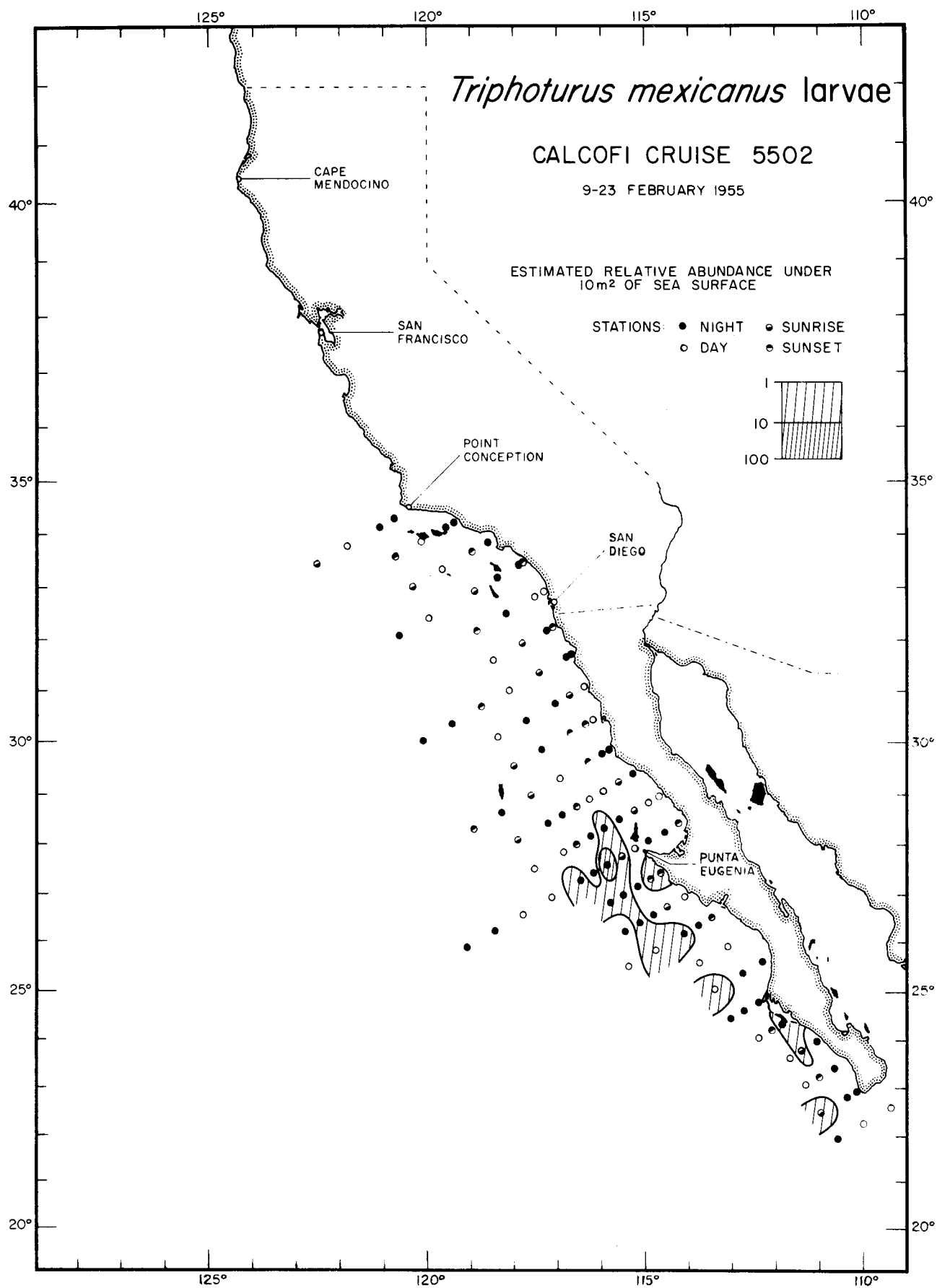
Triphoturus mexicanus larvae

5901



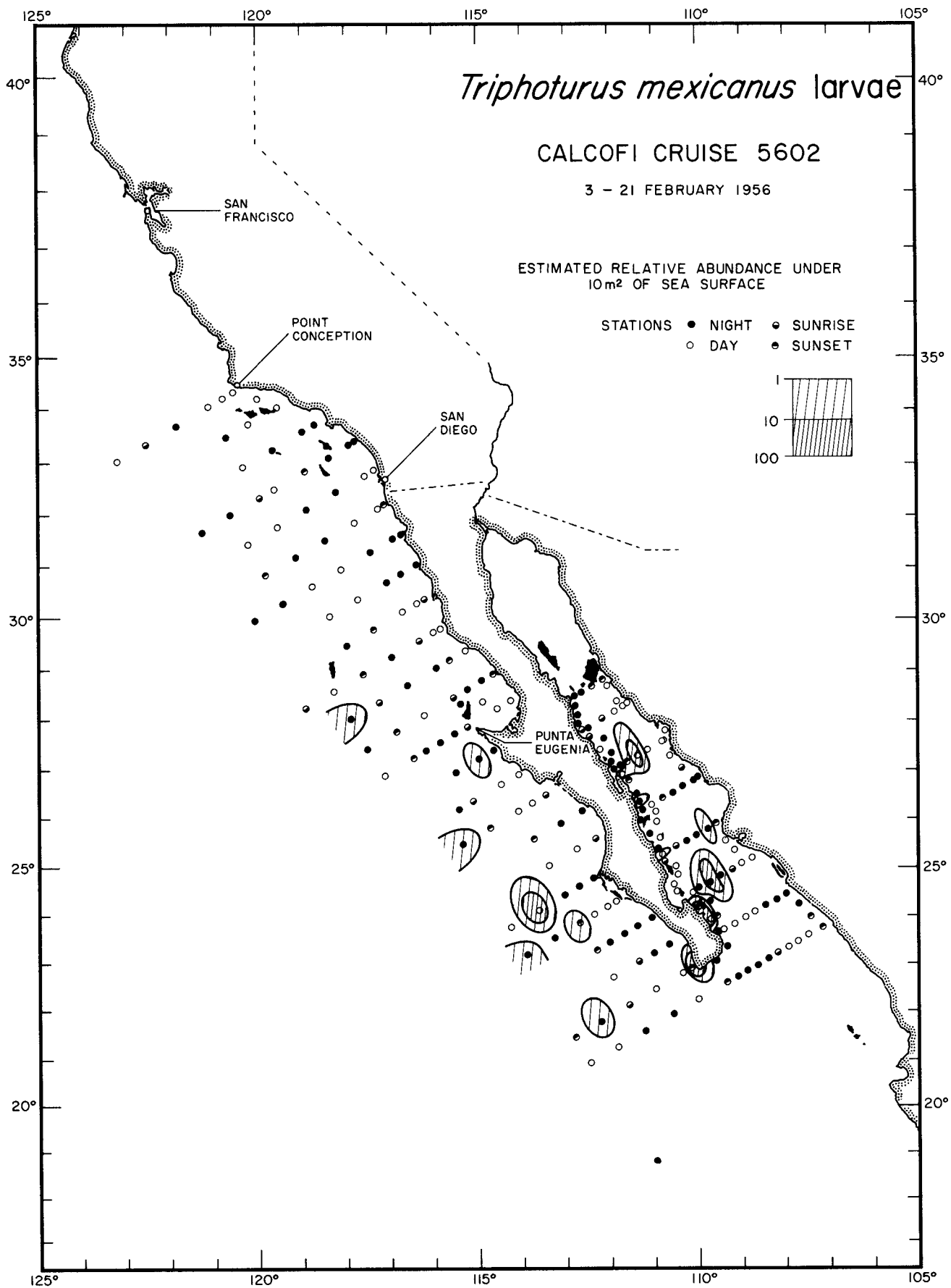
Triphoturus mexicanus larvae

6001



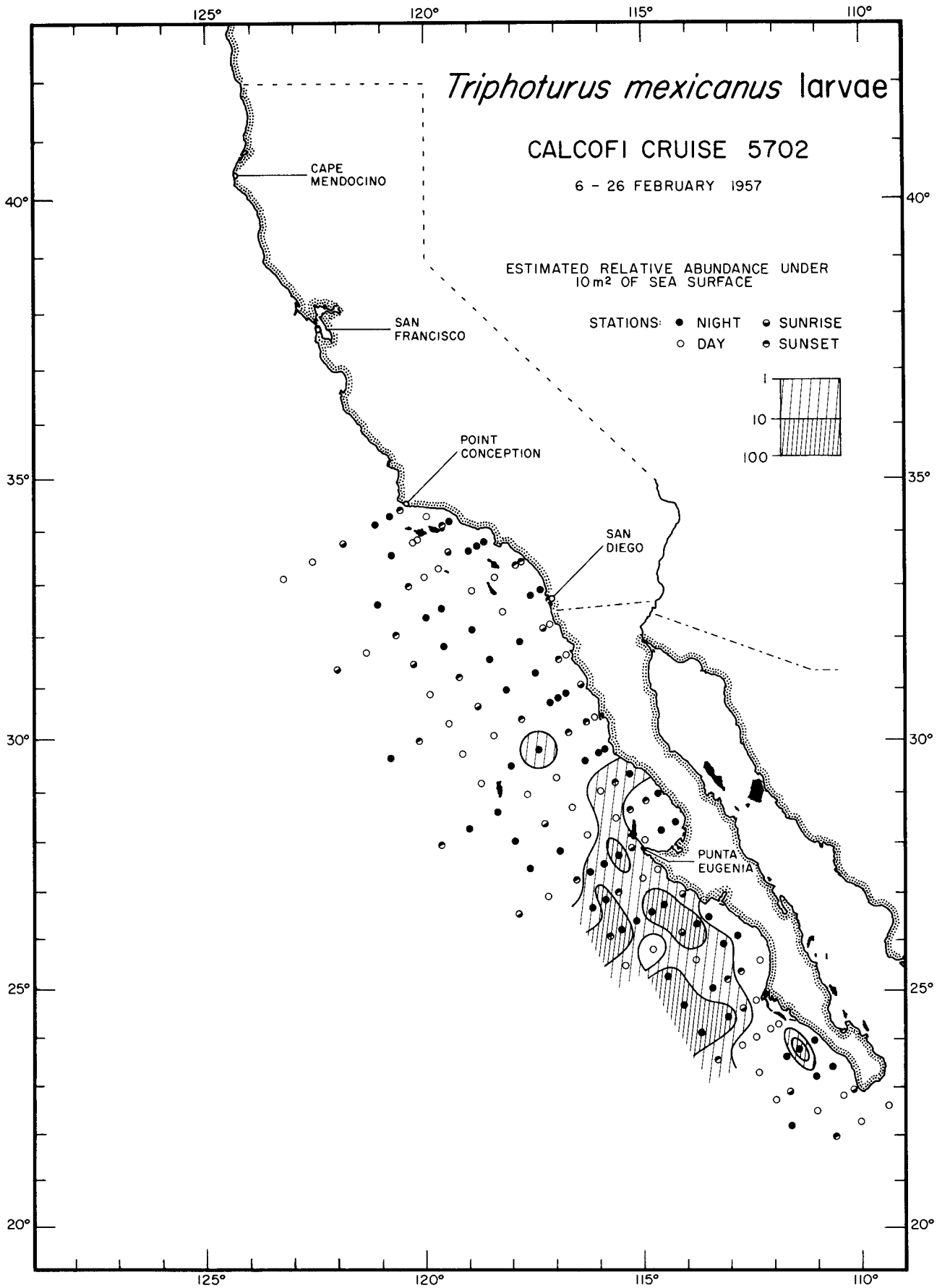
Triphoturus mexicanus larvae

5502

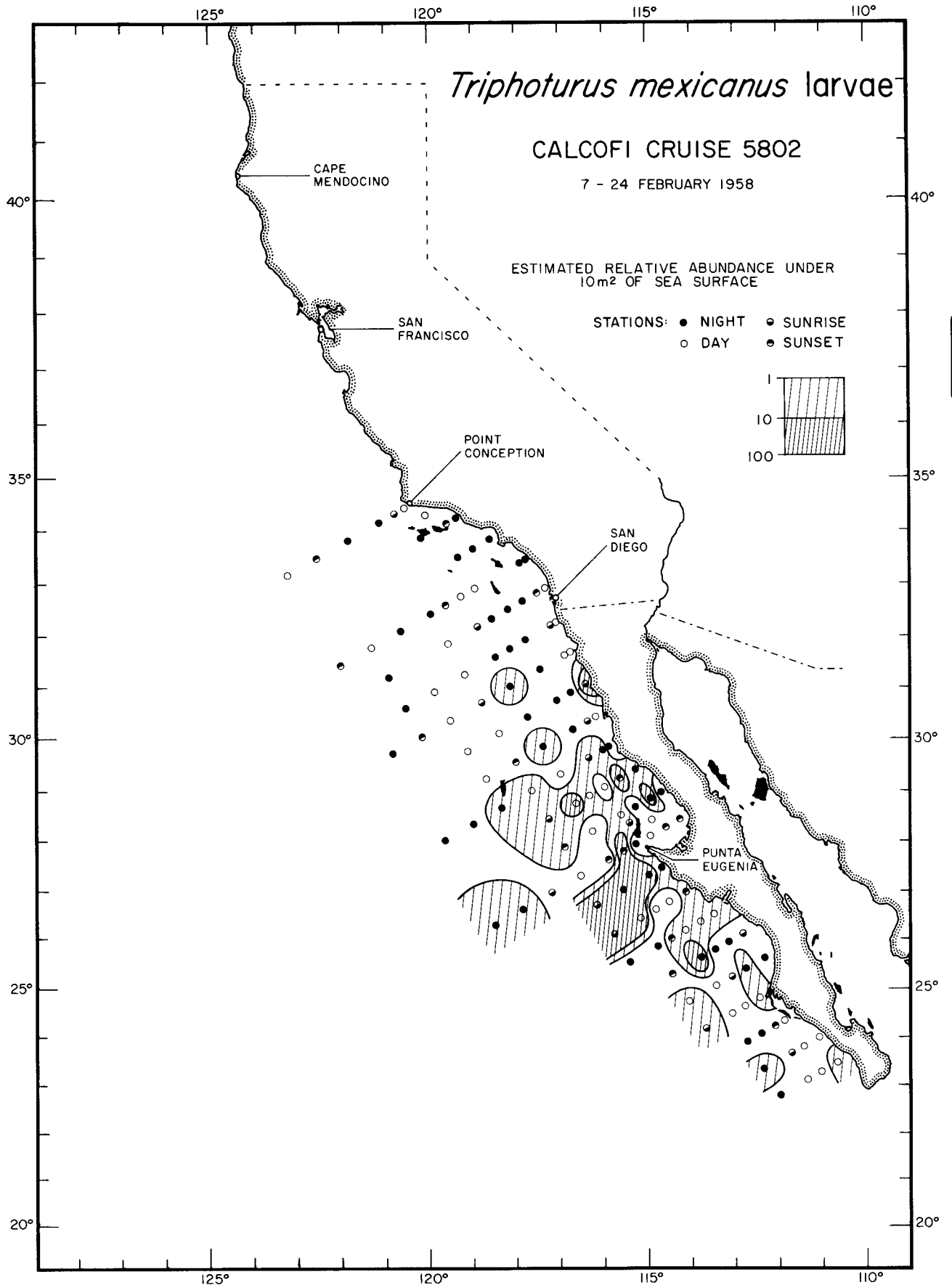


Triphoturus mexicanus larvae

5602

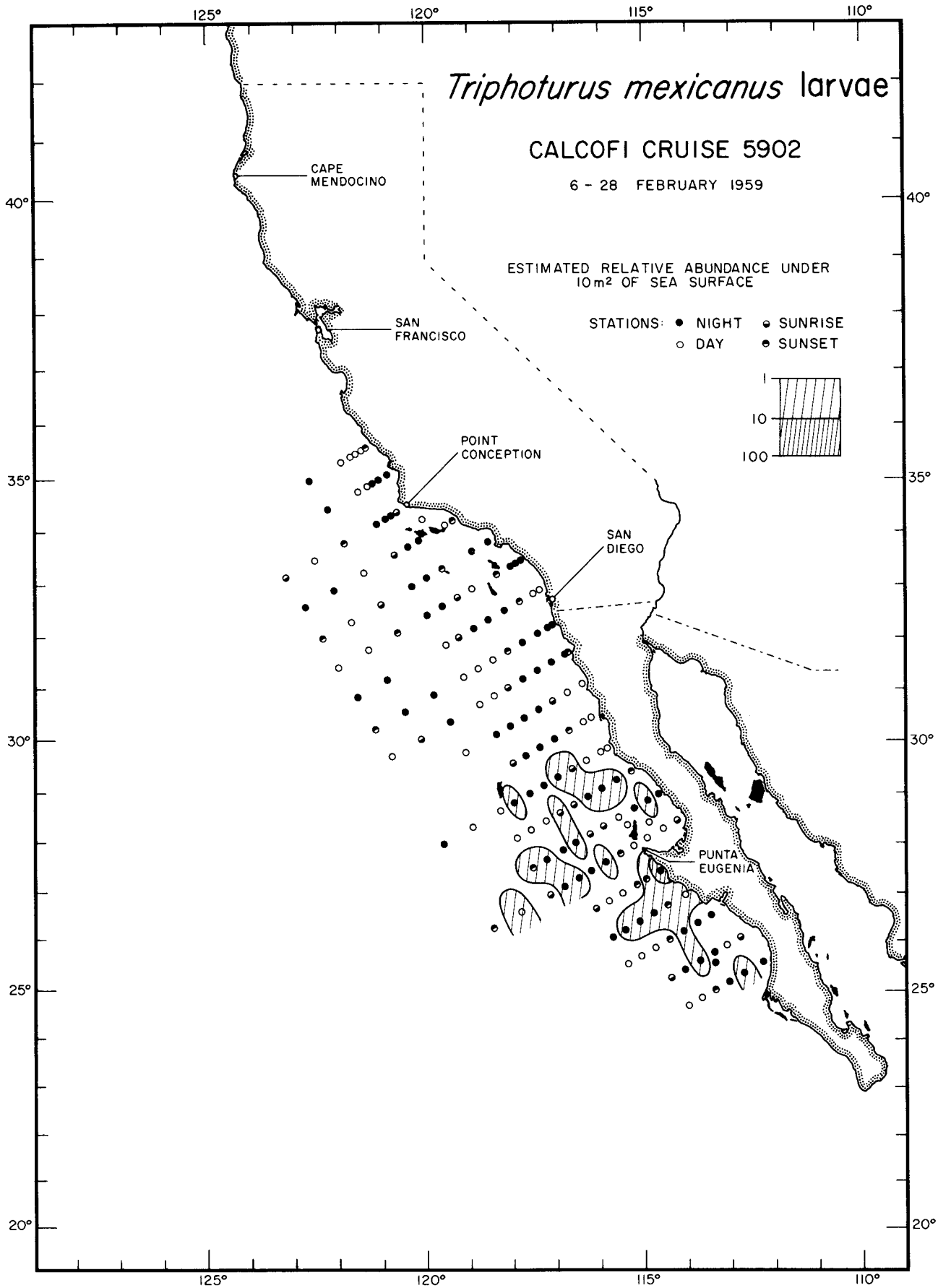


Triphoturus mexicanus larvae



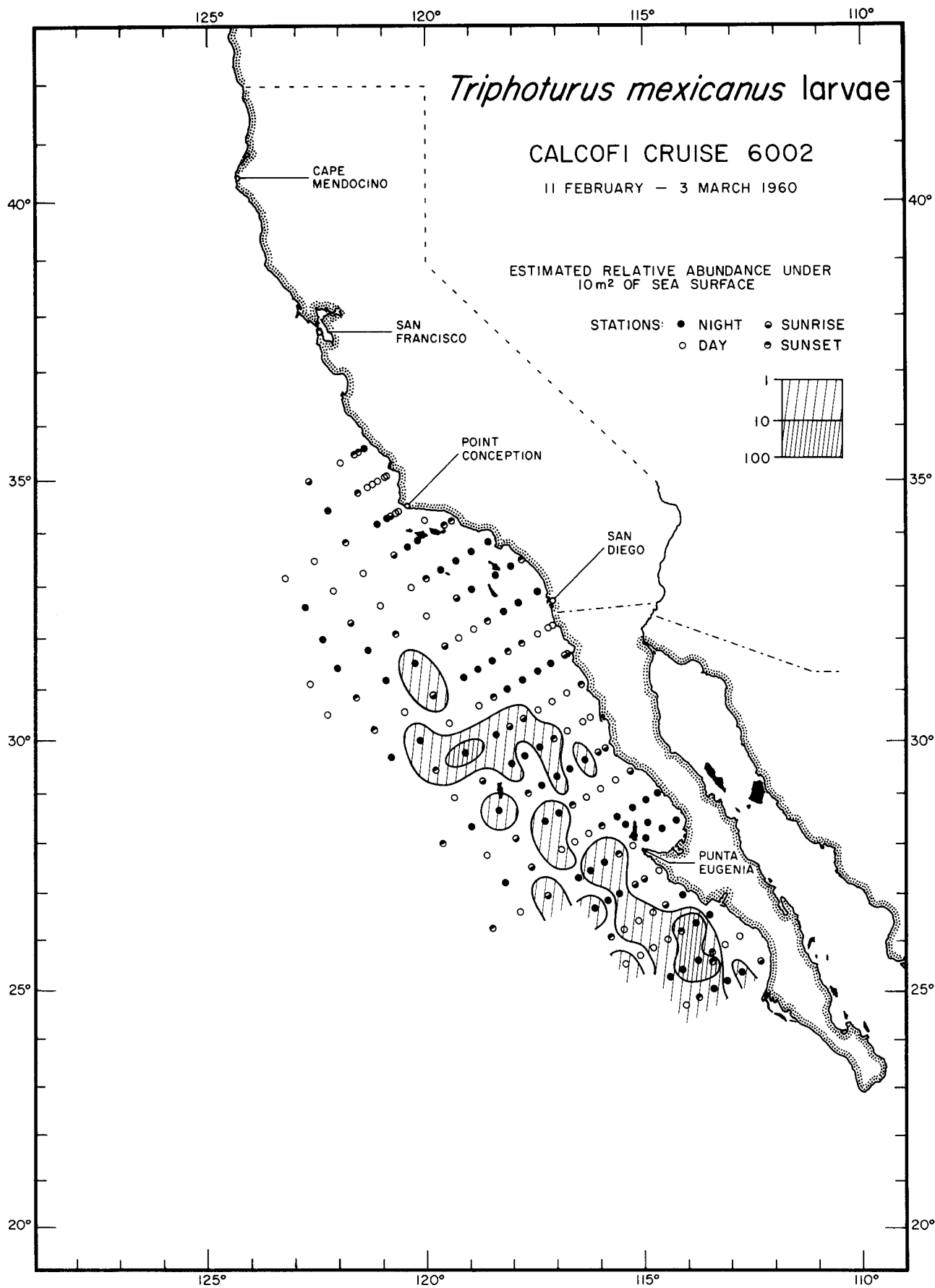
Triphoturus mexicanus larvae

5802



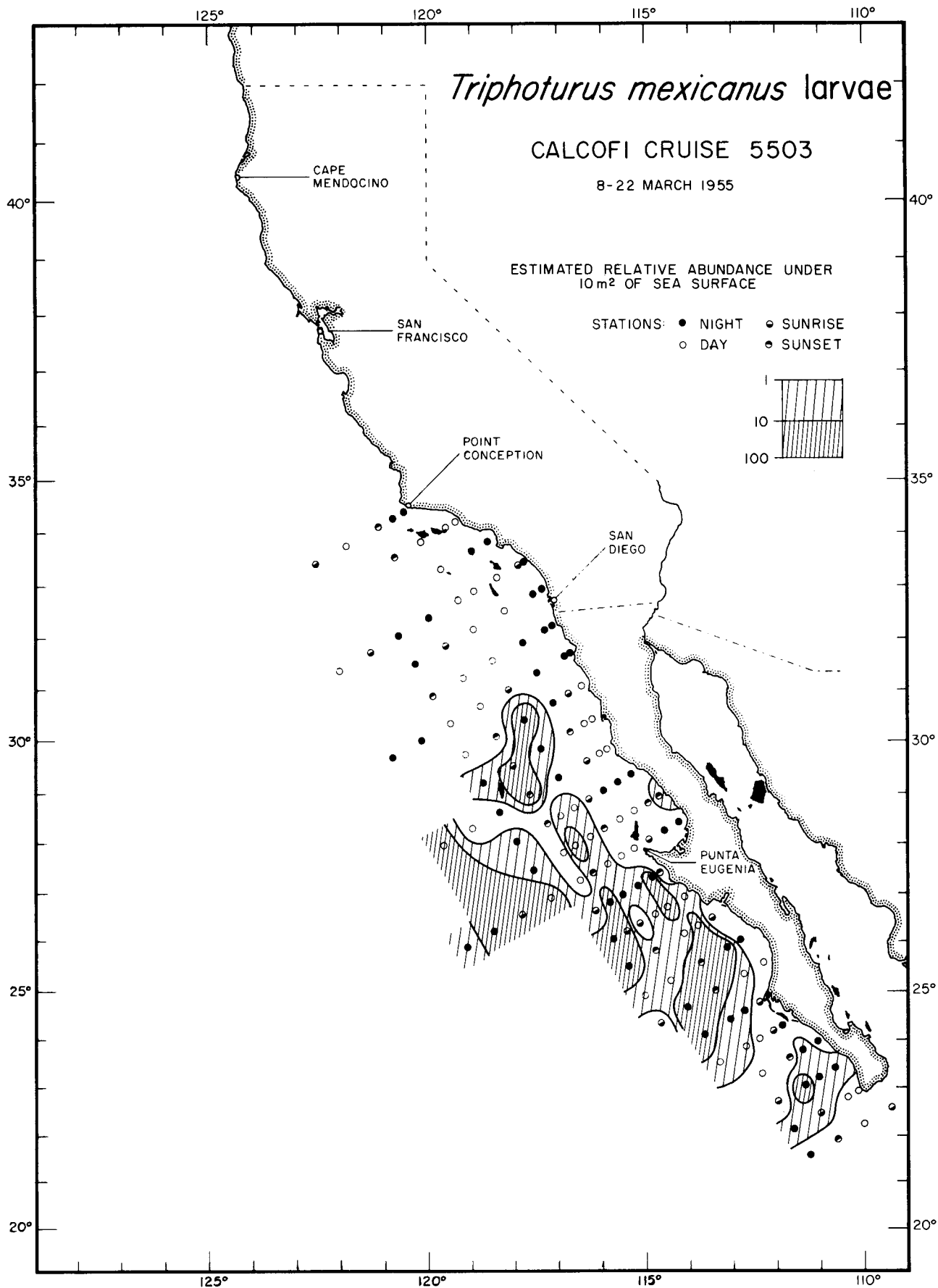
Triphoturus mexicanus larvae

5902



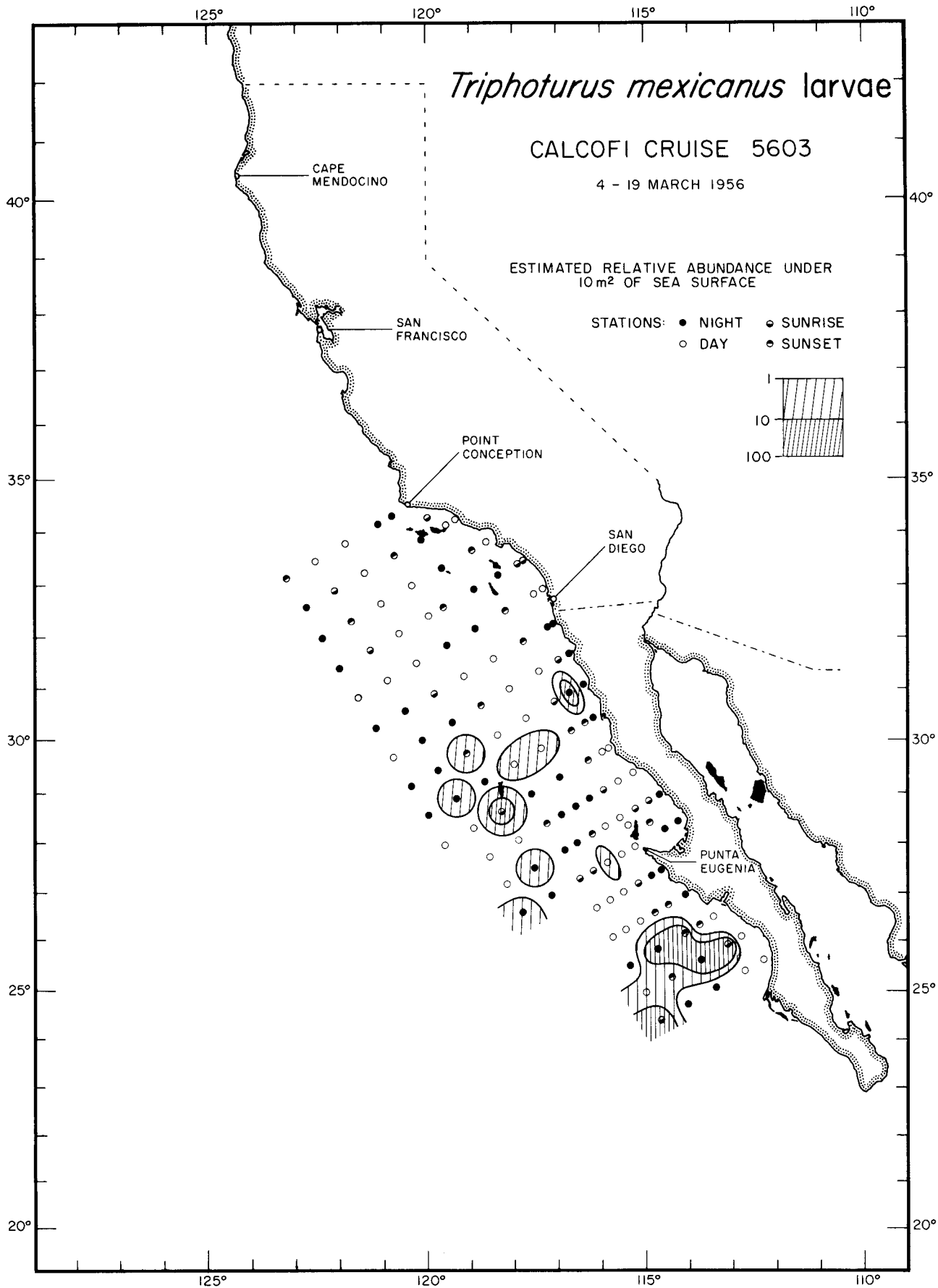
Triphoturus mexicanus larvae

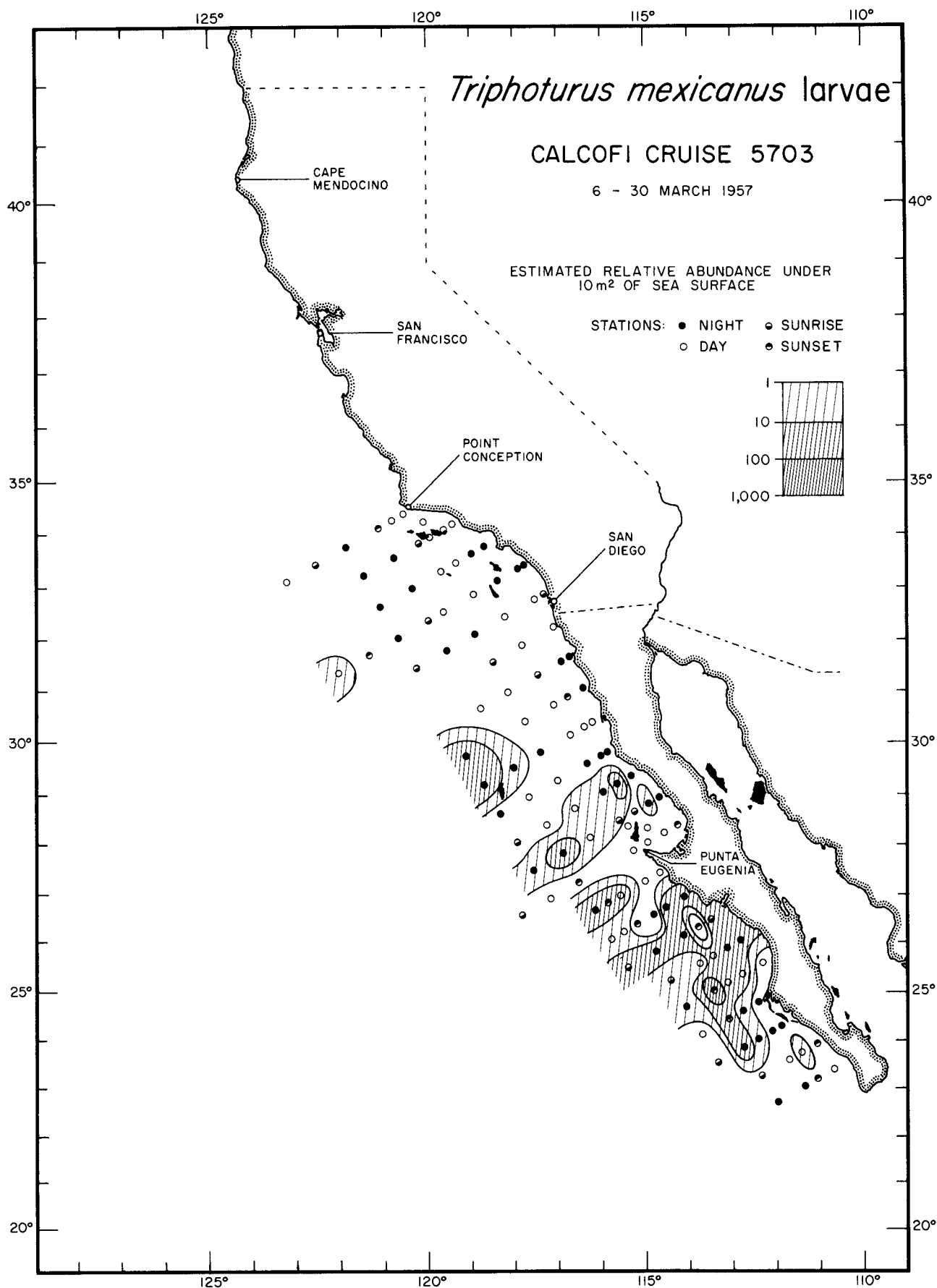
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Triphoturus mexicanus larvae

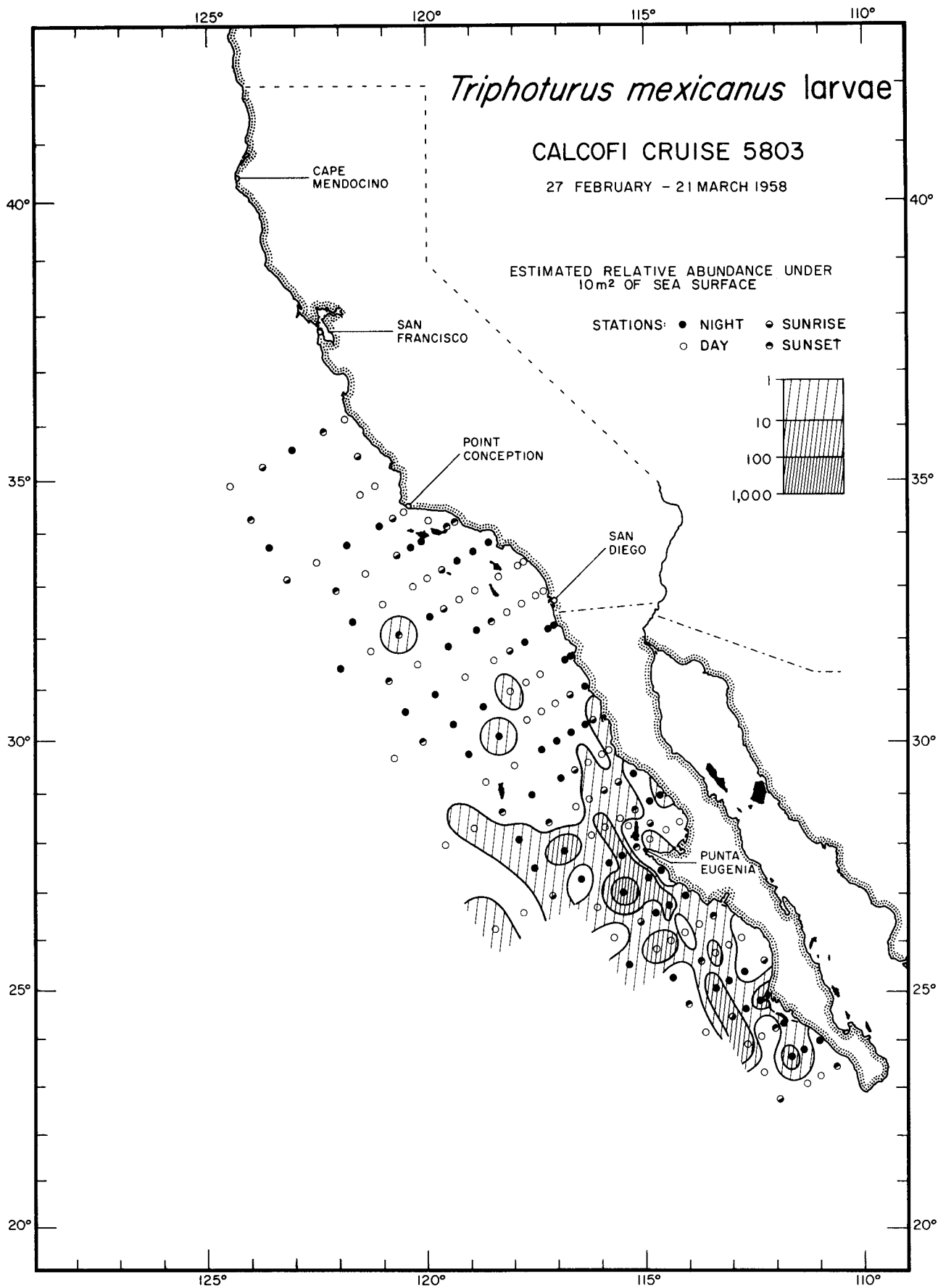
5503





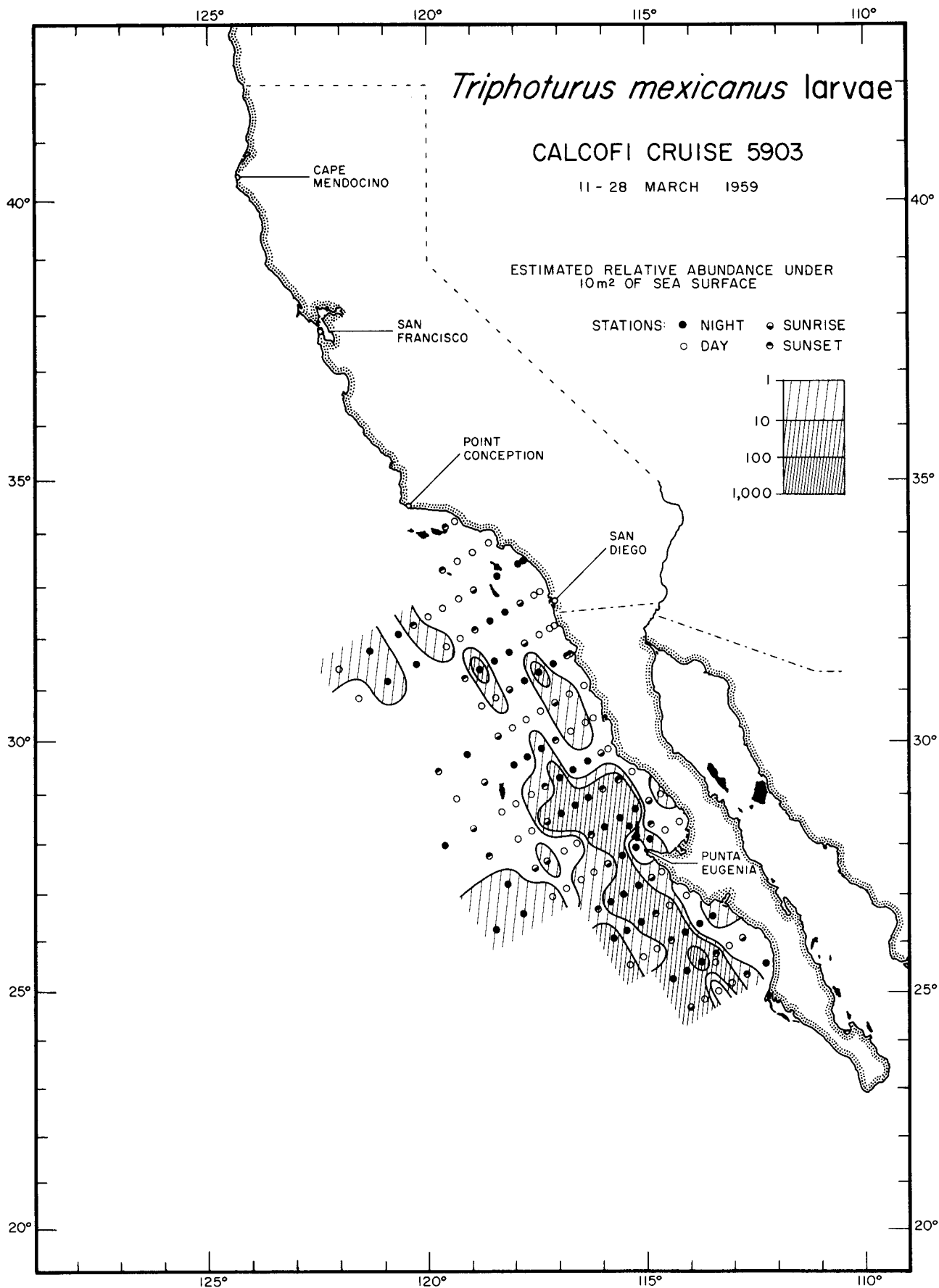
Triphoturus mexicanus larvae

5703



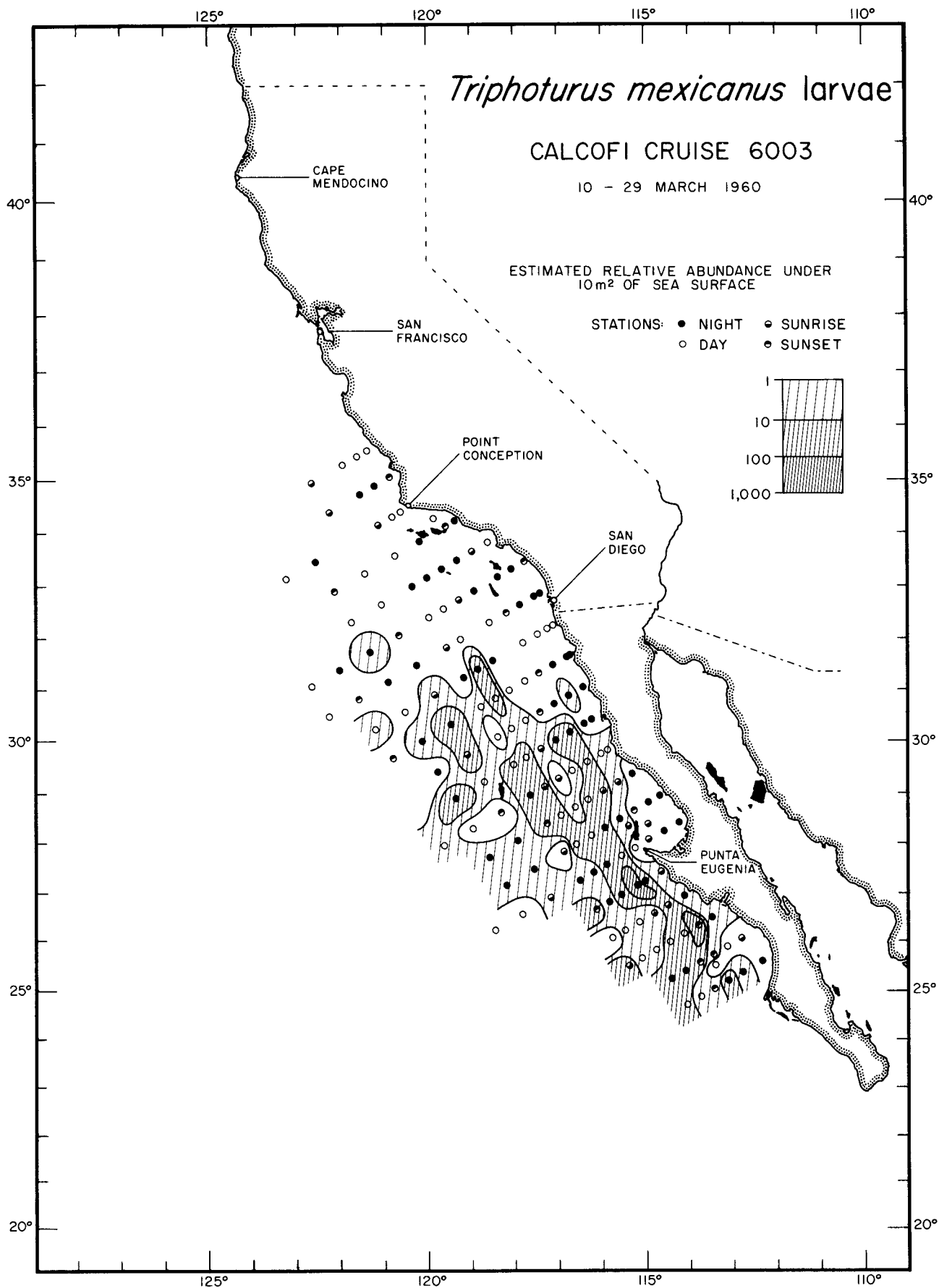
Triphoturus mexicanus larvae

5803



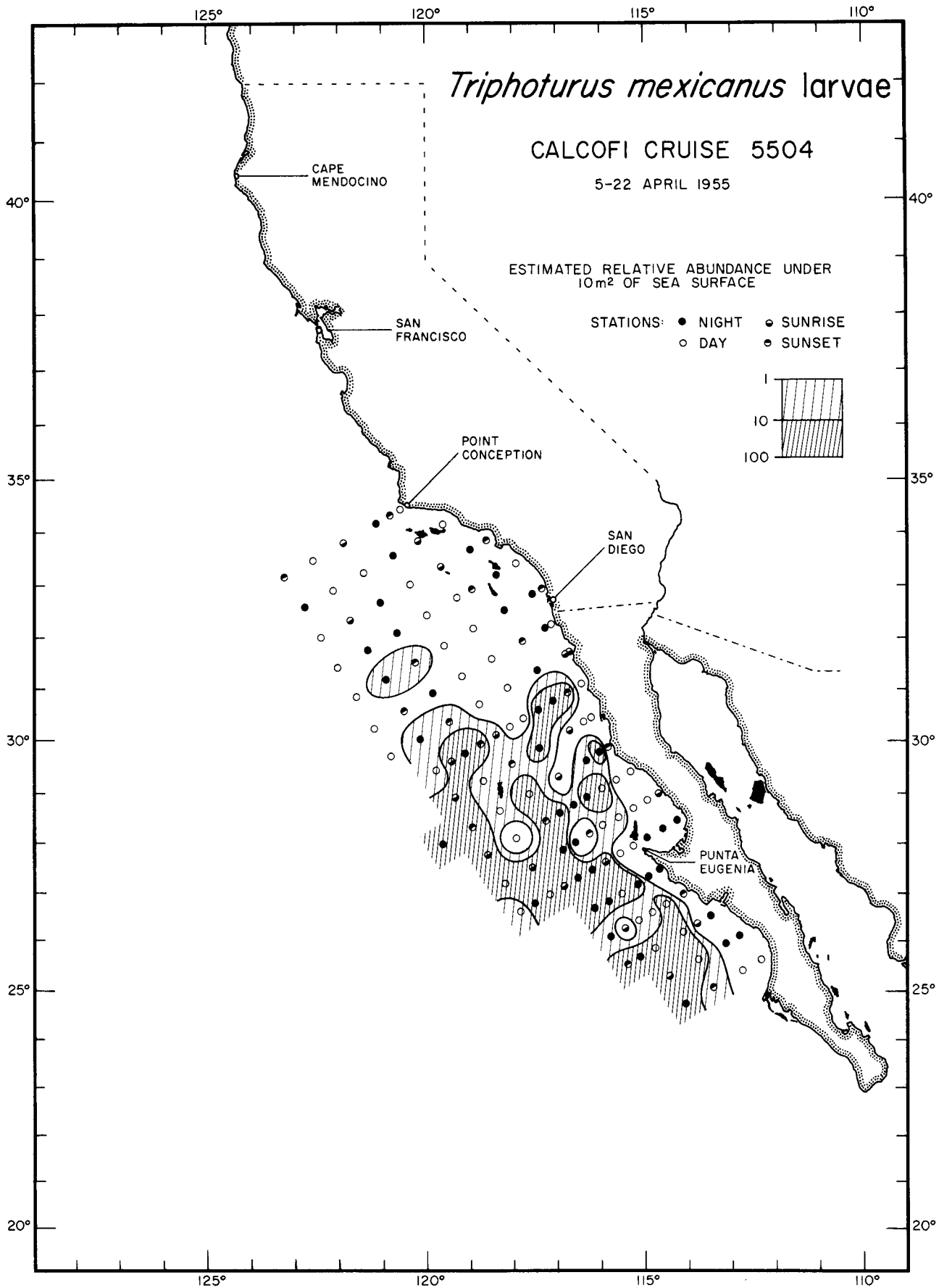
Triphoturus mexicanus larvae

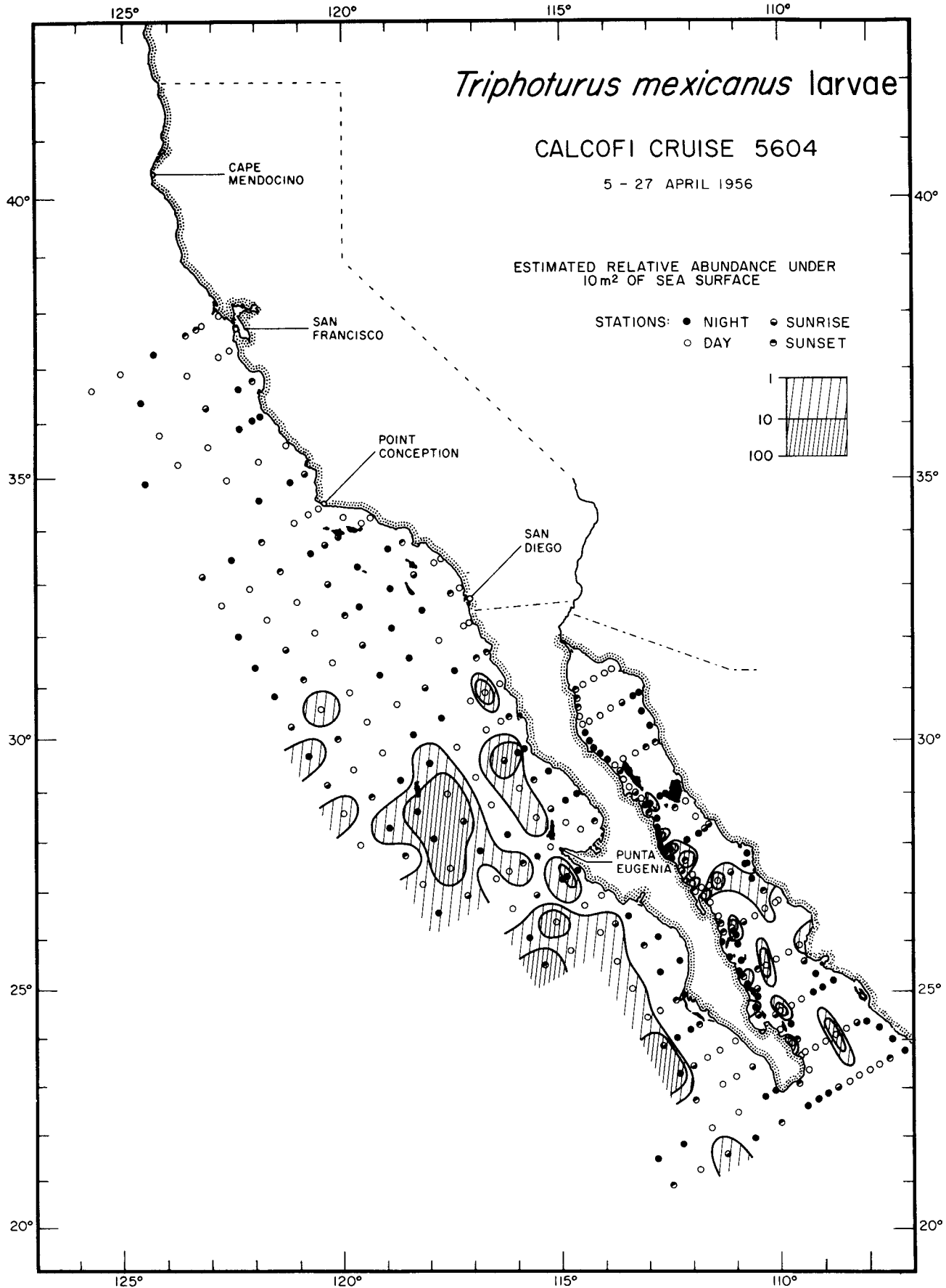
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Triphoturus mexicanus larvae

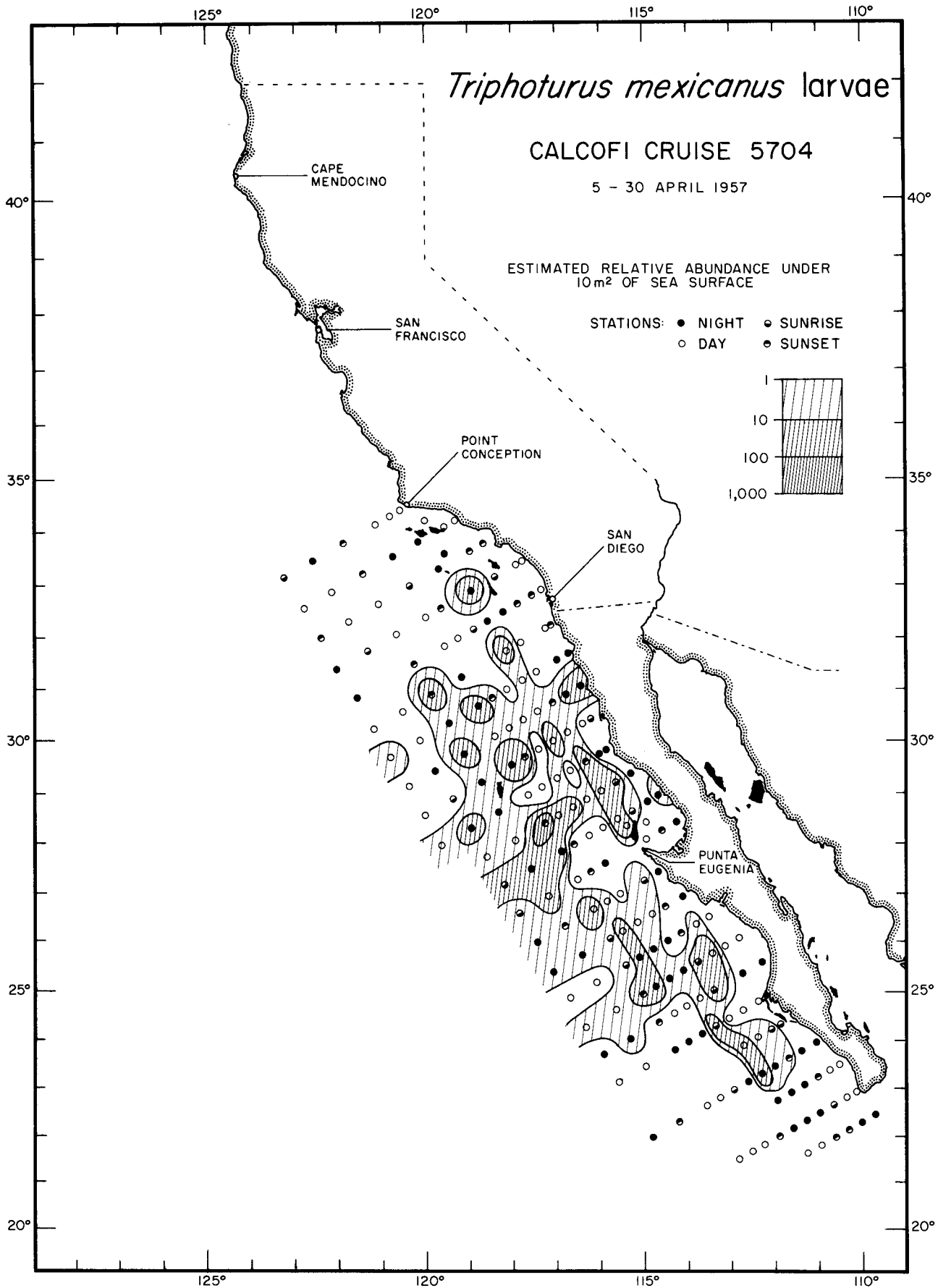
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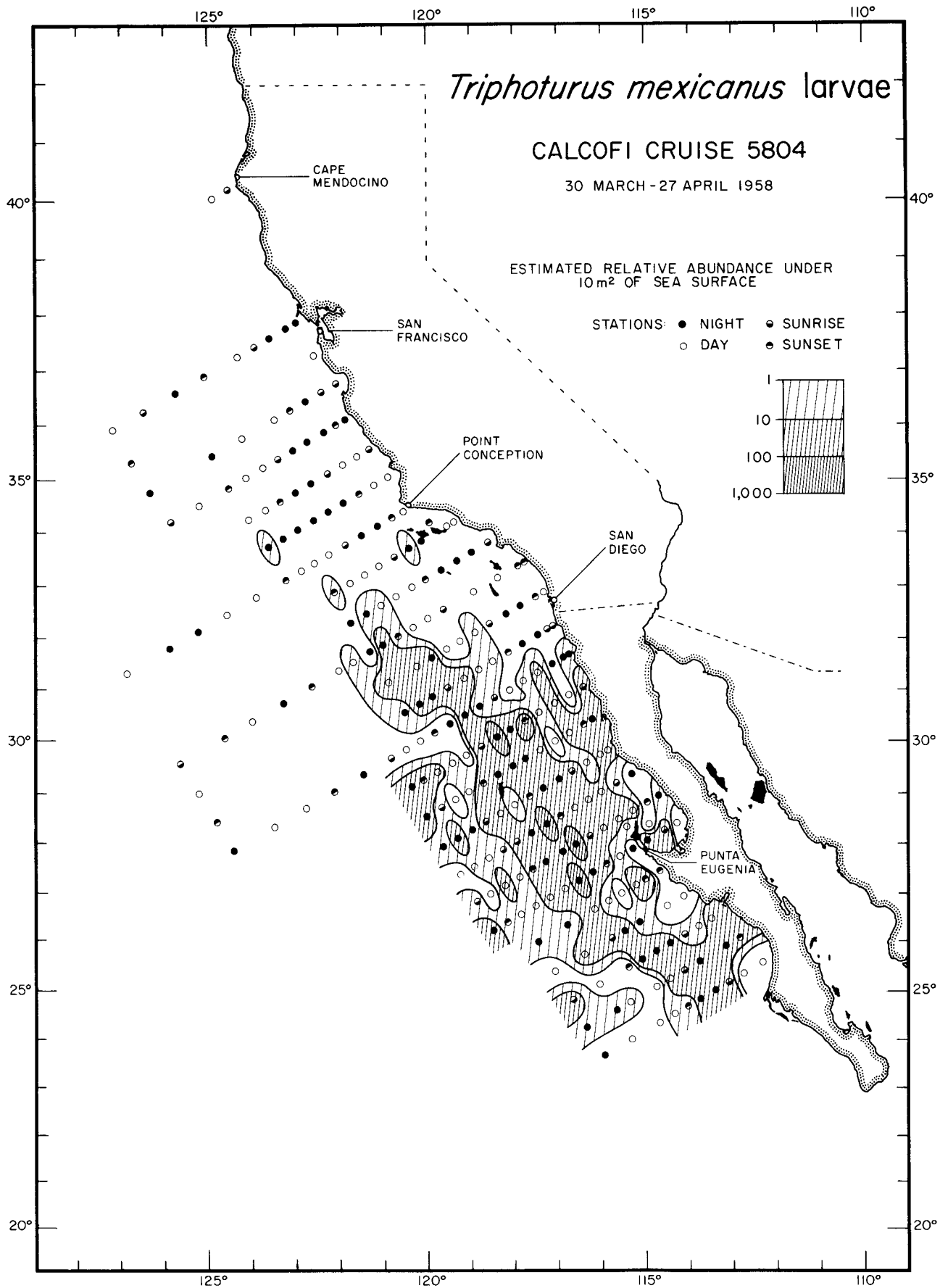
Triphoturus mexicanus larvae

5604

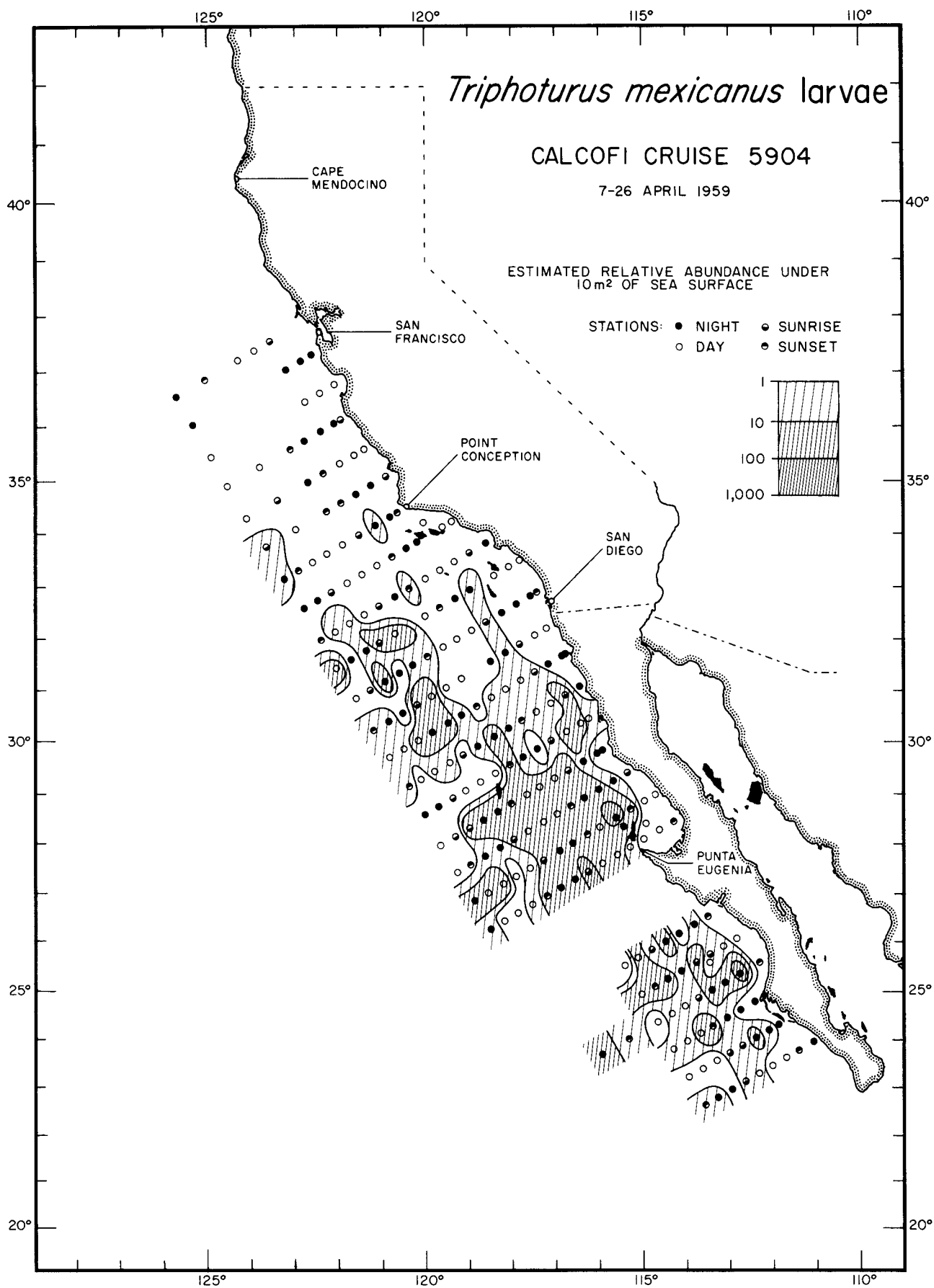


Triphoturus mexicanus larvae

5704

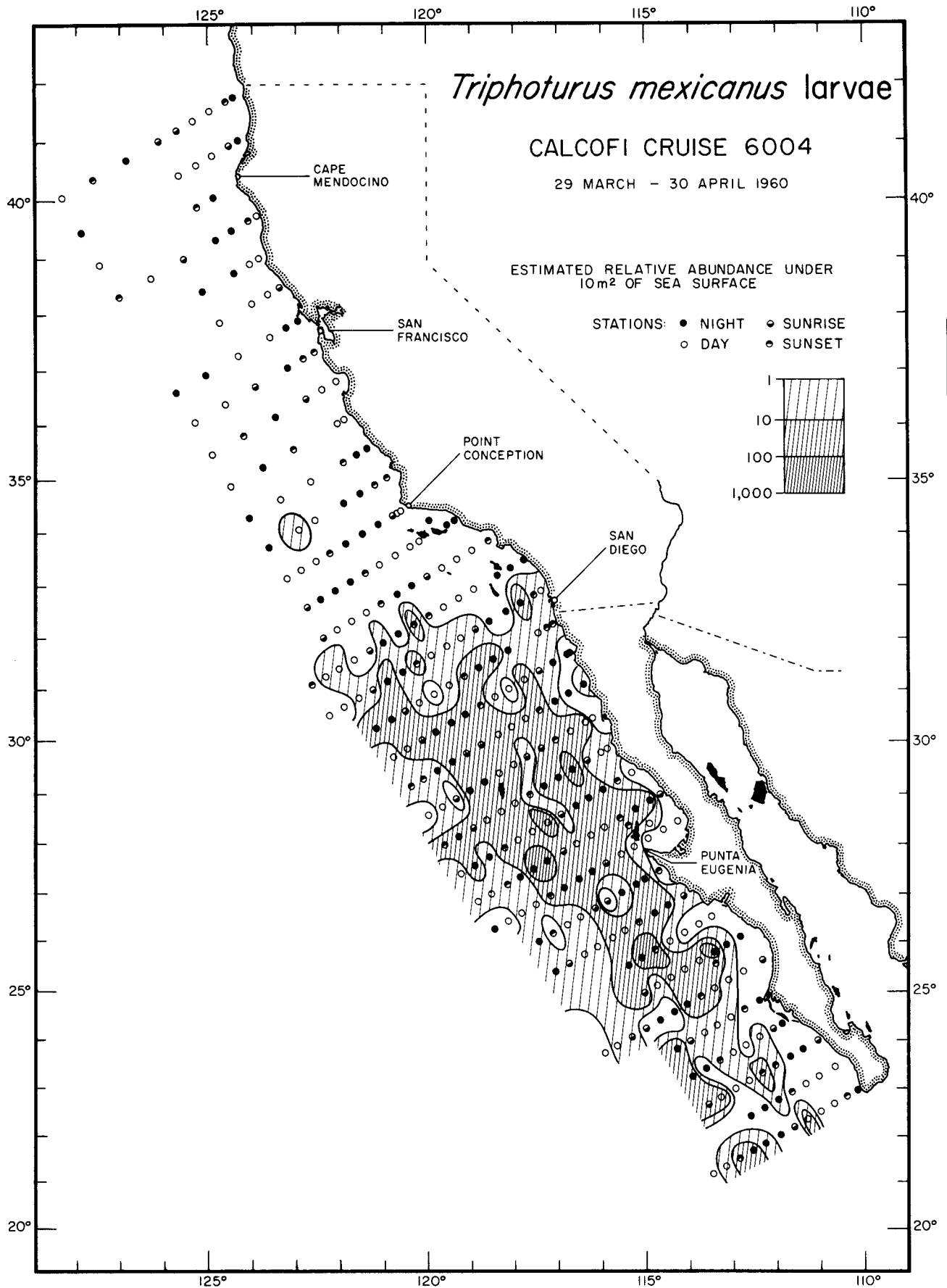


Triphoturus mexicanus larvae



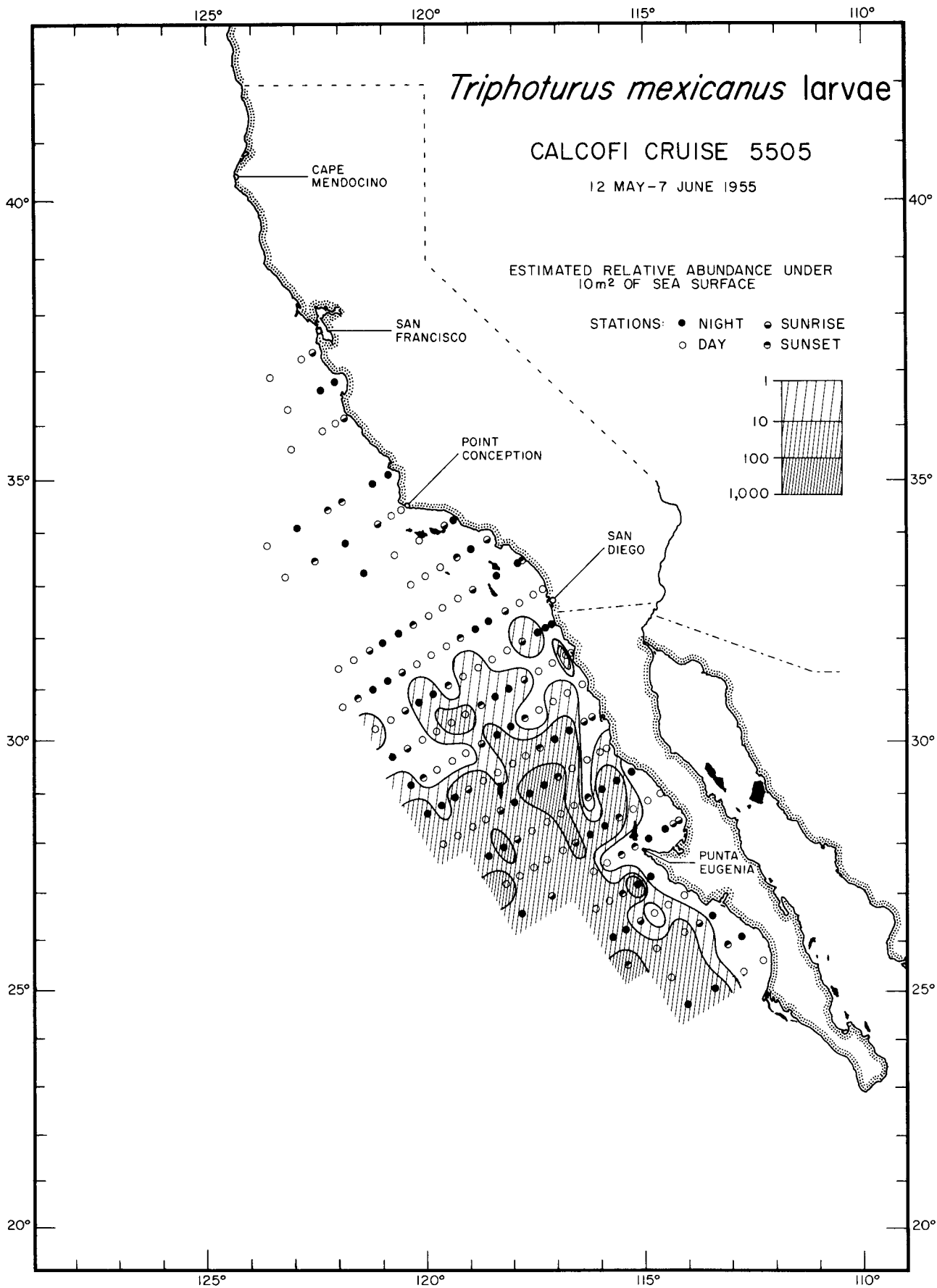
Triphoturus mexicanus larvae

5904

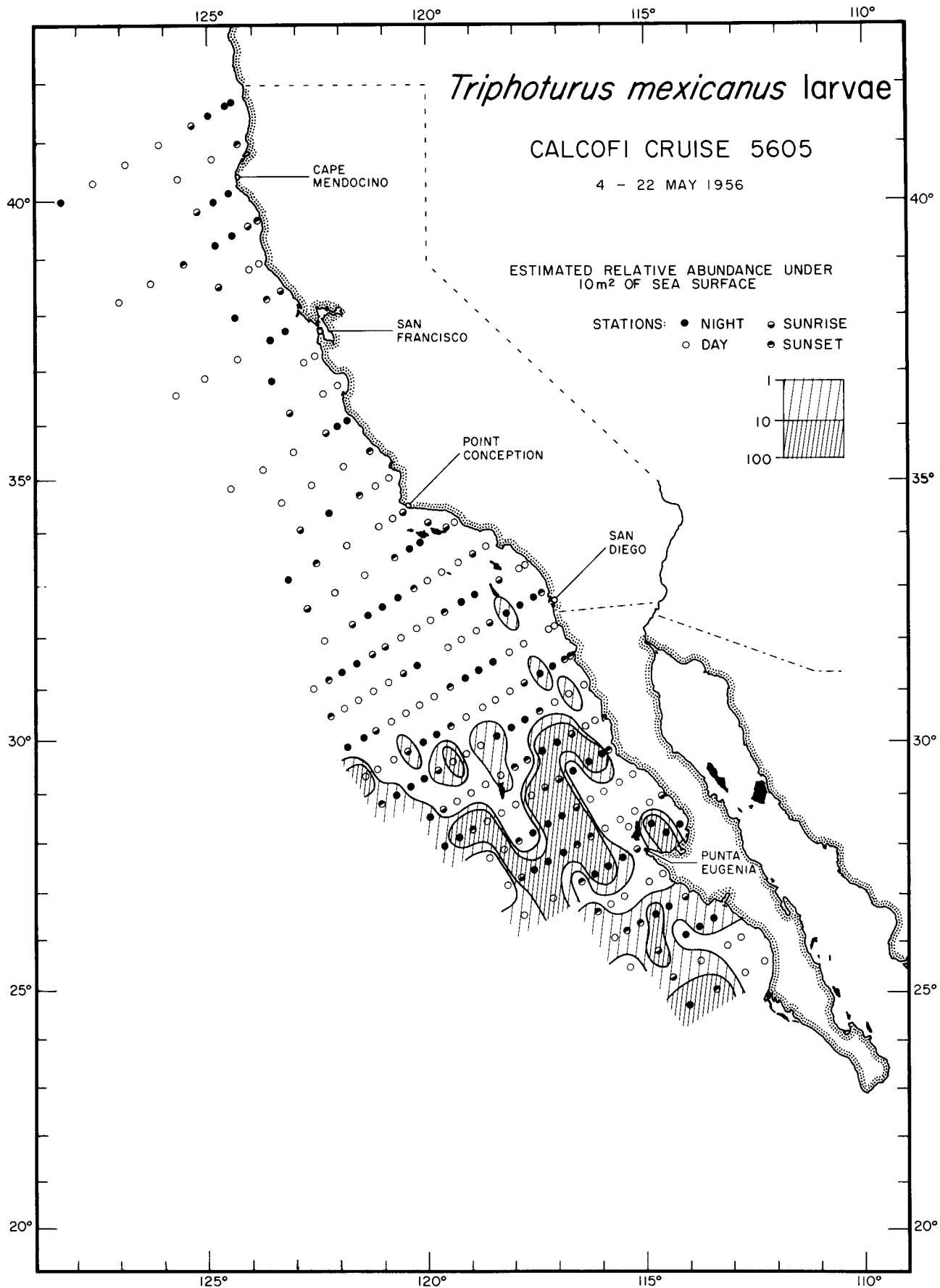


Triphoturus mexicanus larvae

6004

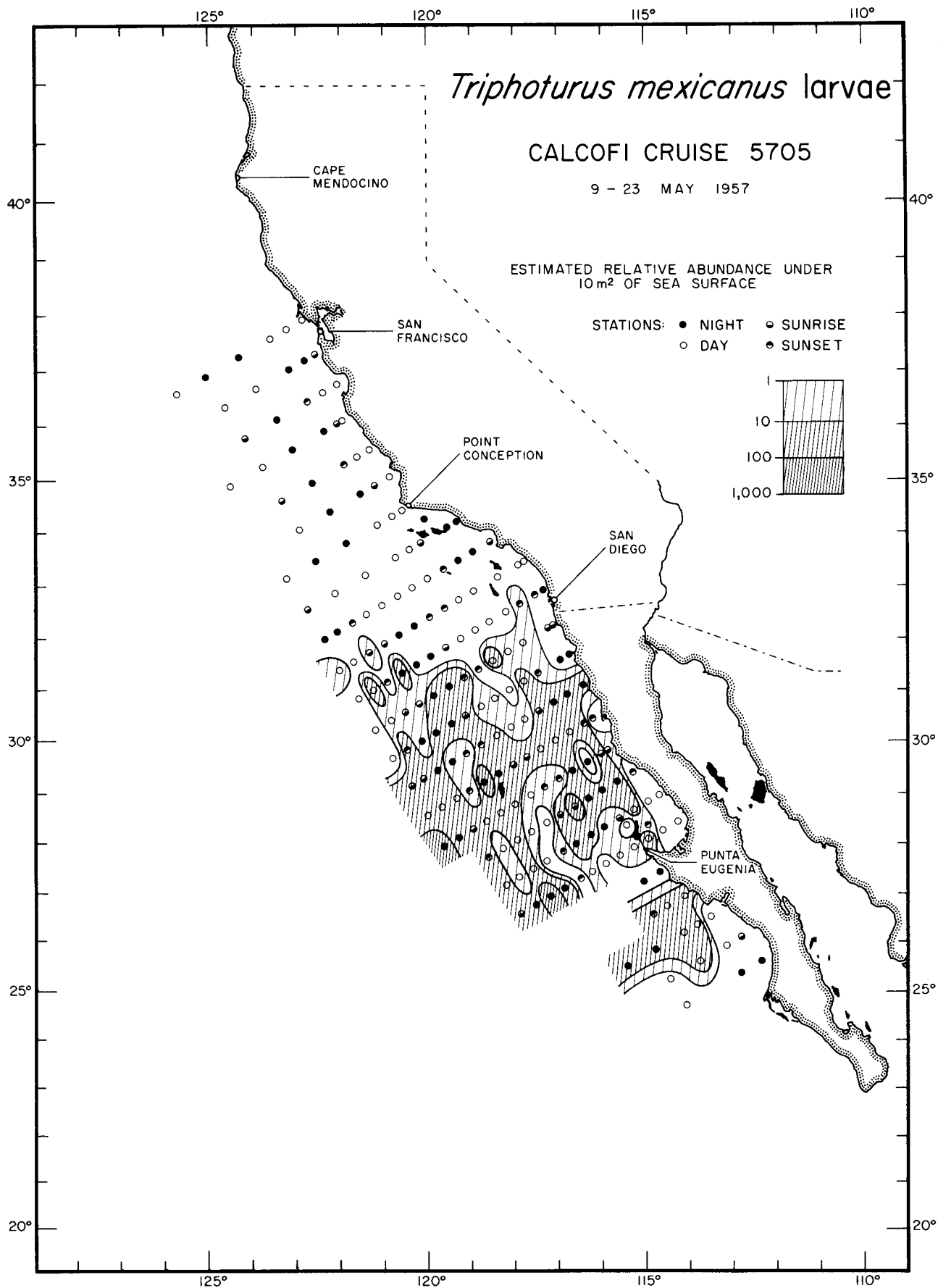


Triphoturus mexicanus larvae



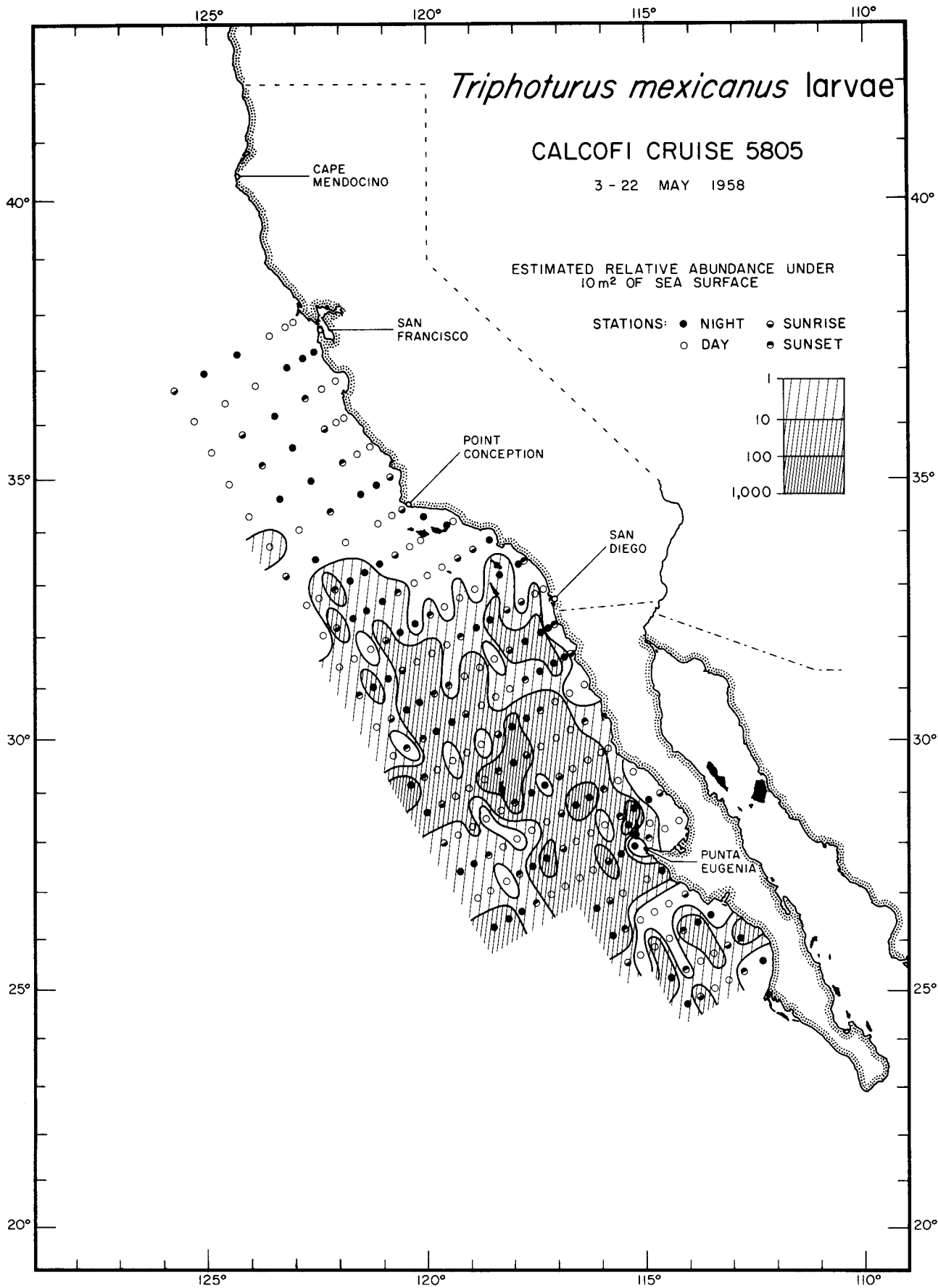
Triphoturus mexicanus larvae

5605



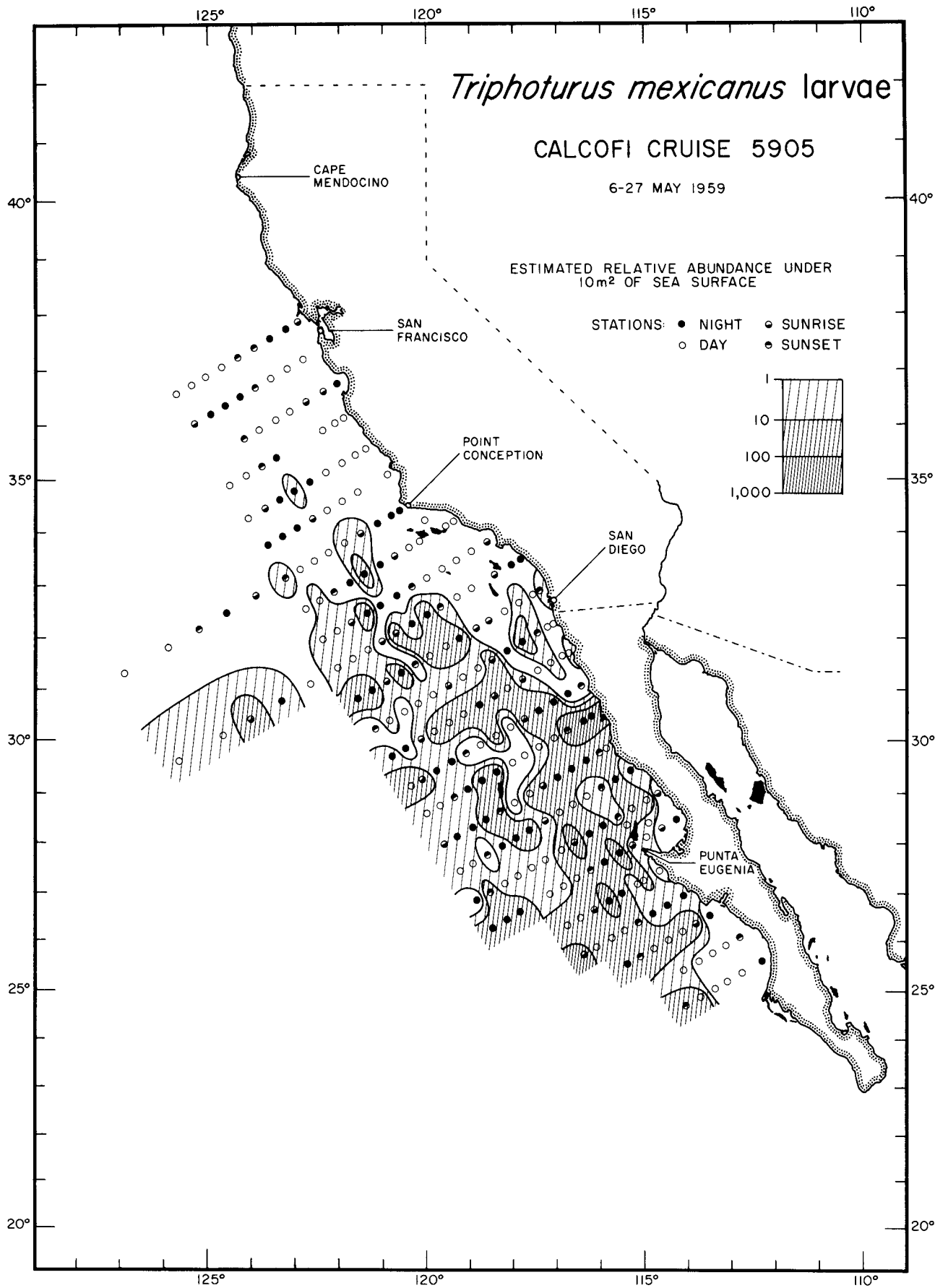
Triphoturus mexicanus larvae

5705

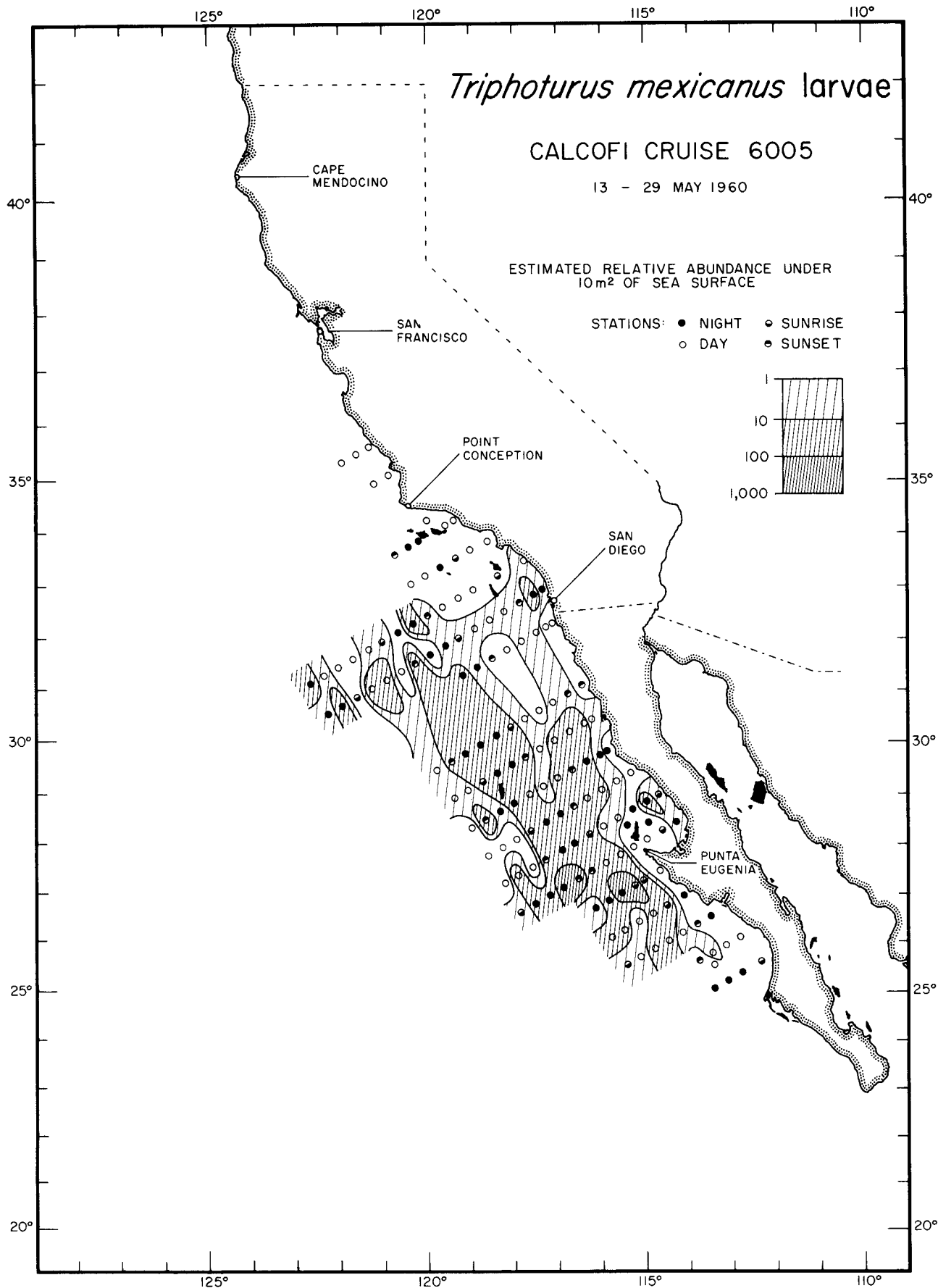


Triphoturus mexicanus larvae

5805

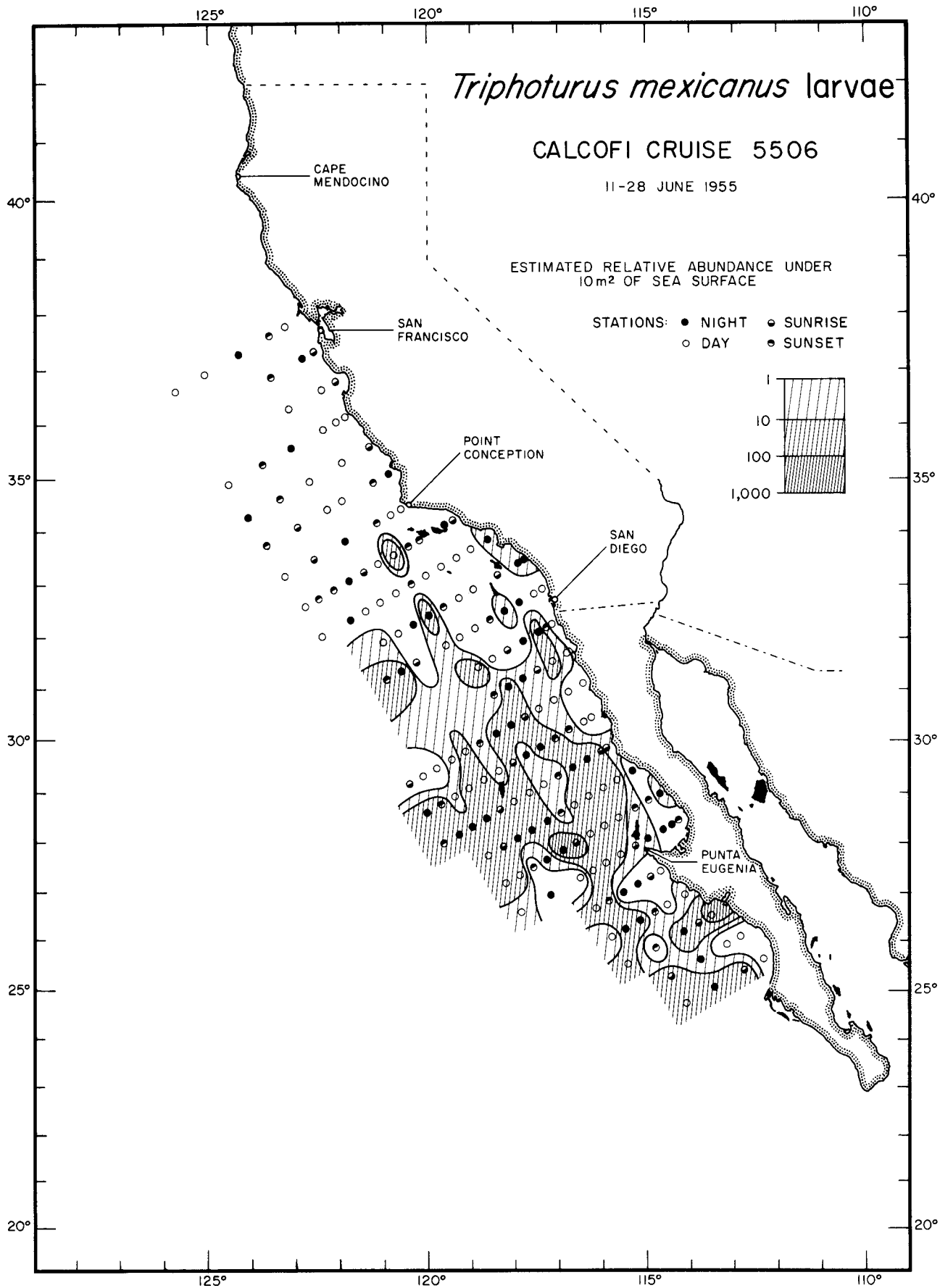


Triphoturus mexicanus larvae



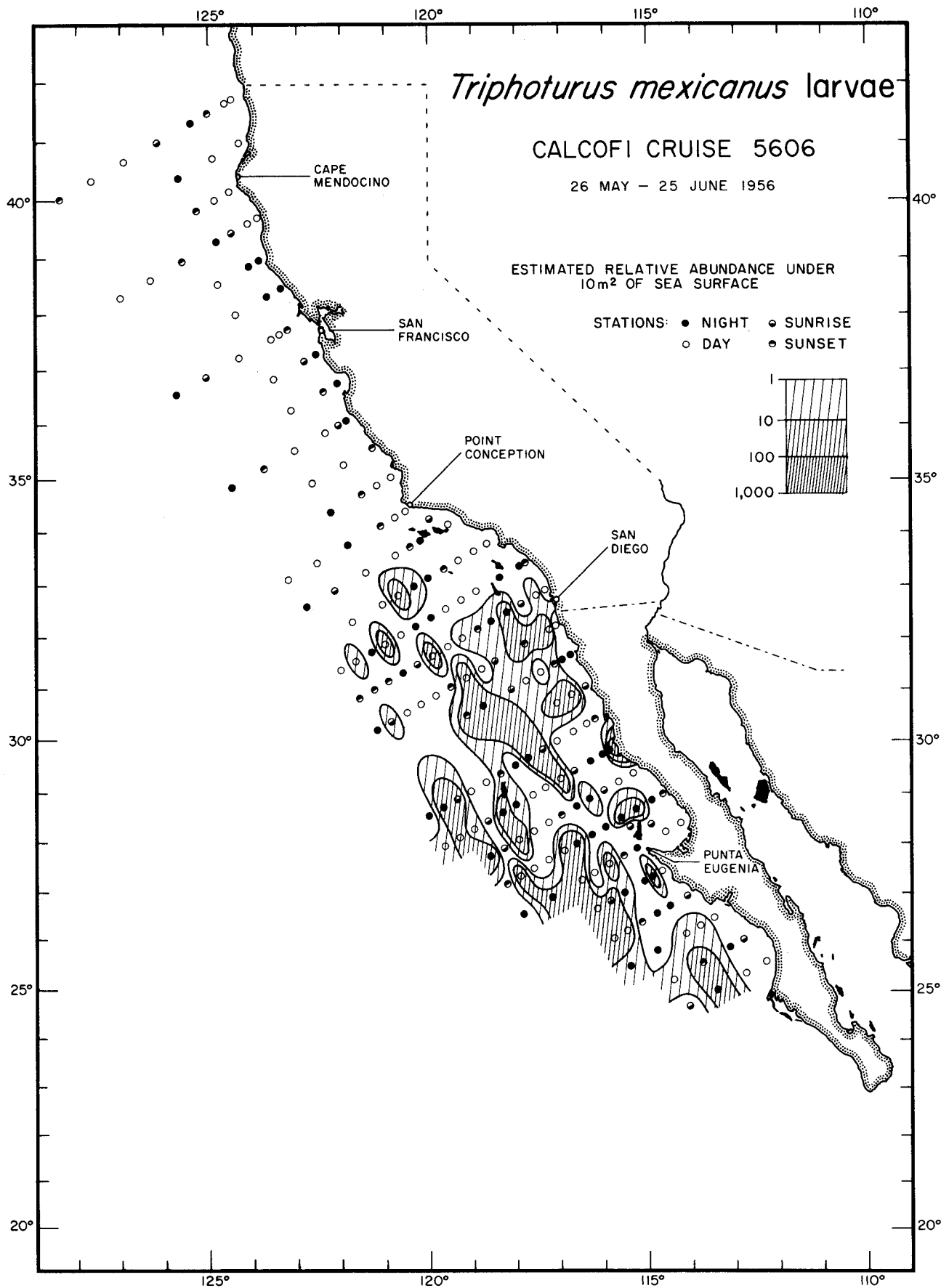
Triphoturus mexicanus larvae

6005



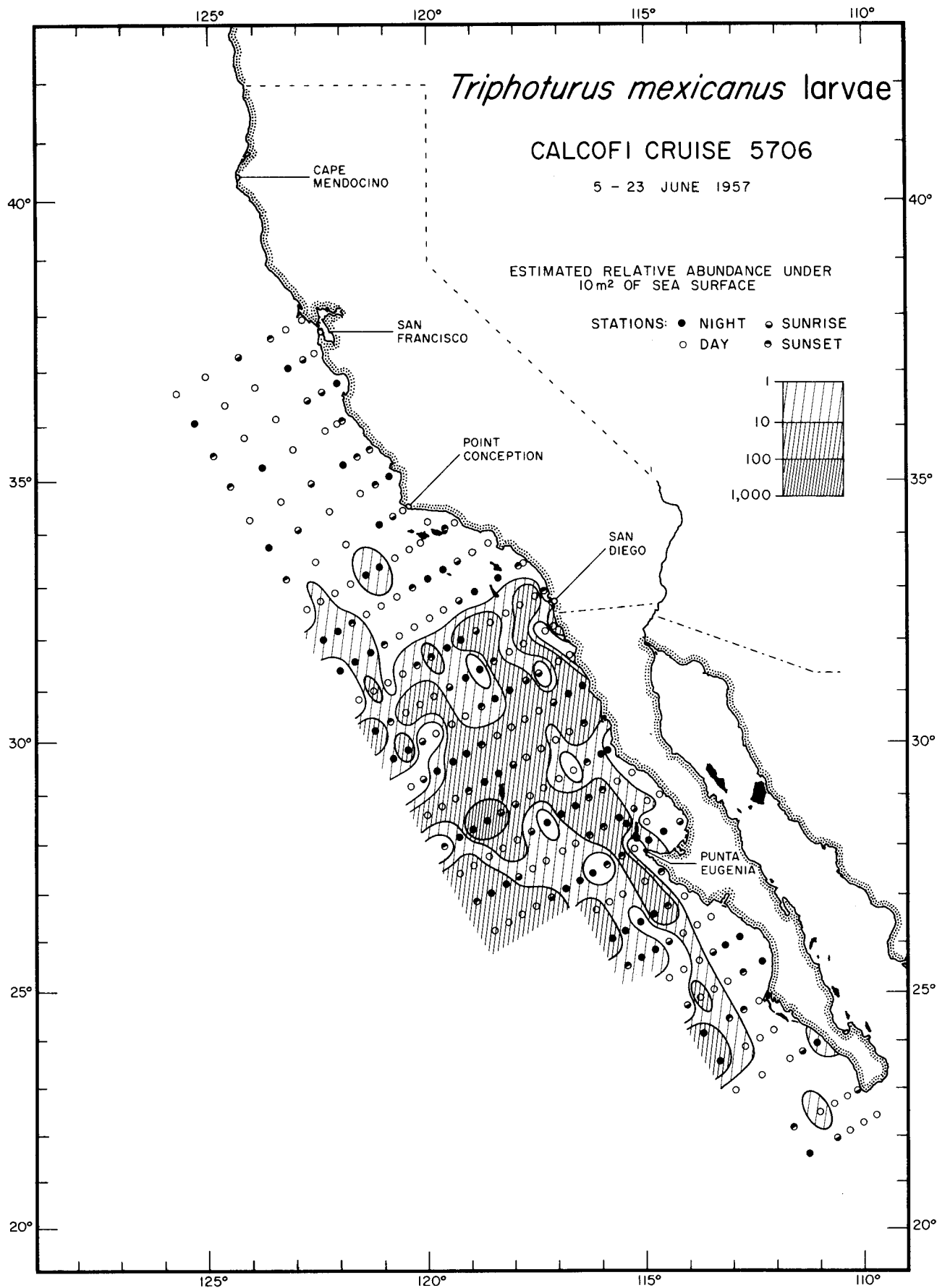
Triphoturus mexicanus larvae

5506



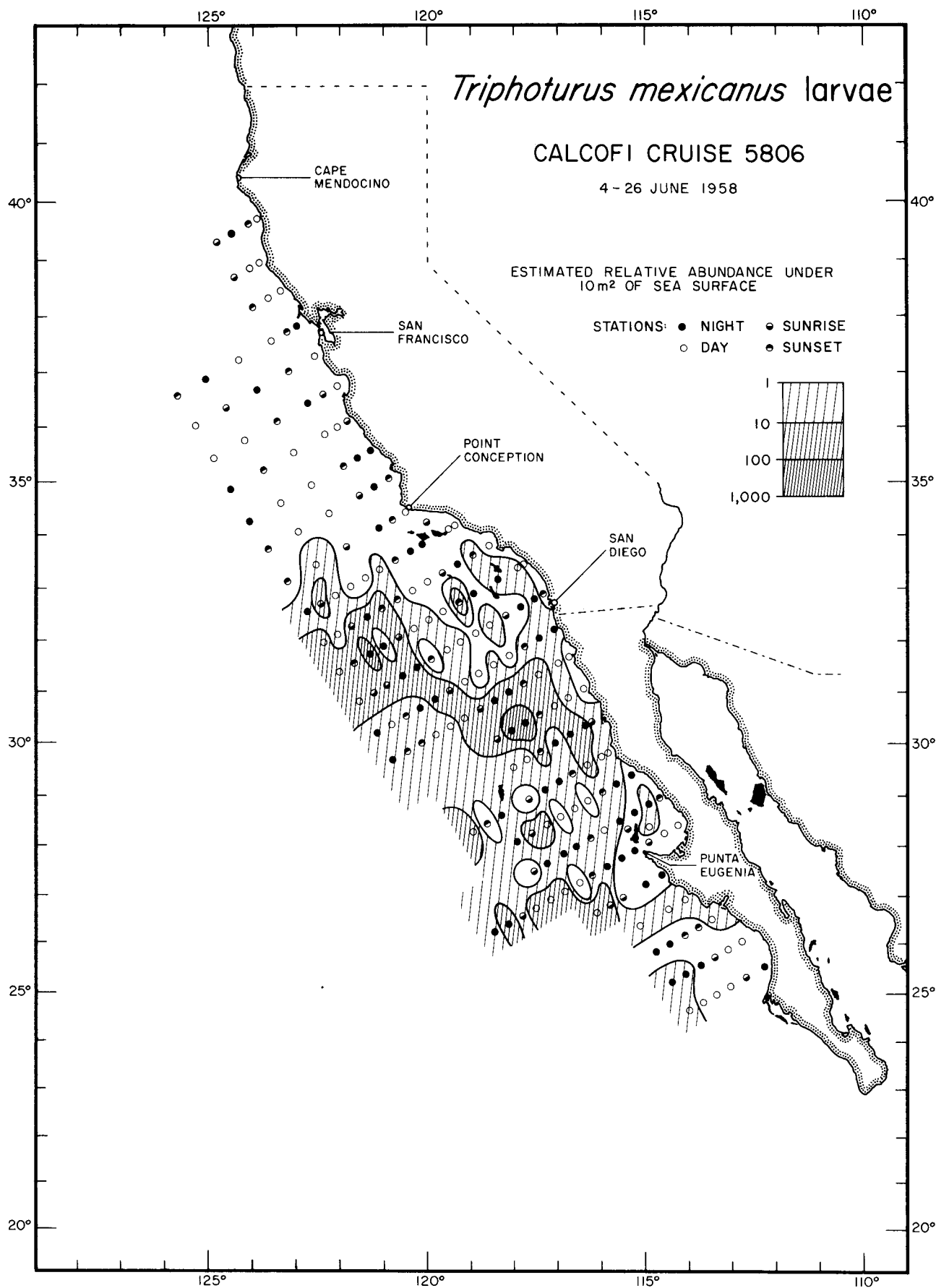
Triphoturus mexicanus larvae

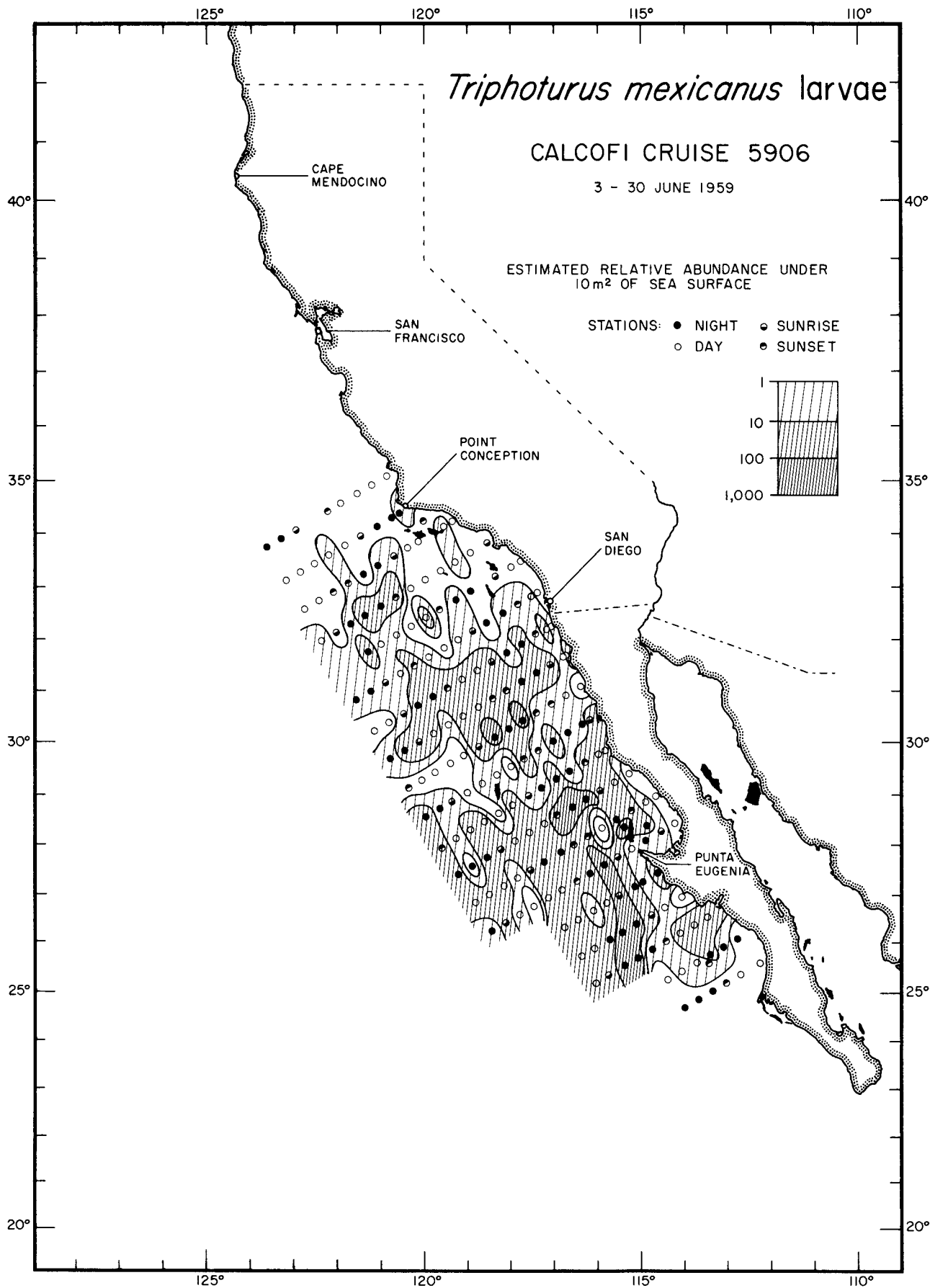
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Triphoturus mexicanus larvae

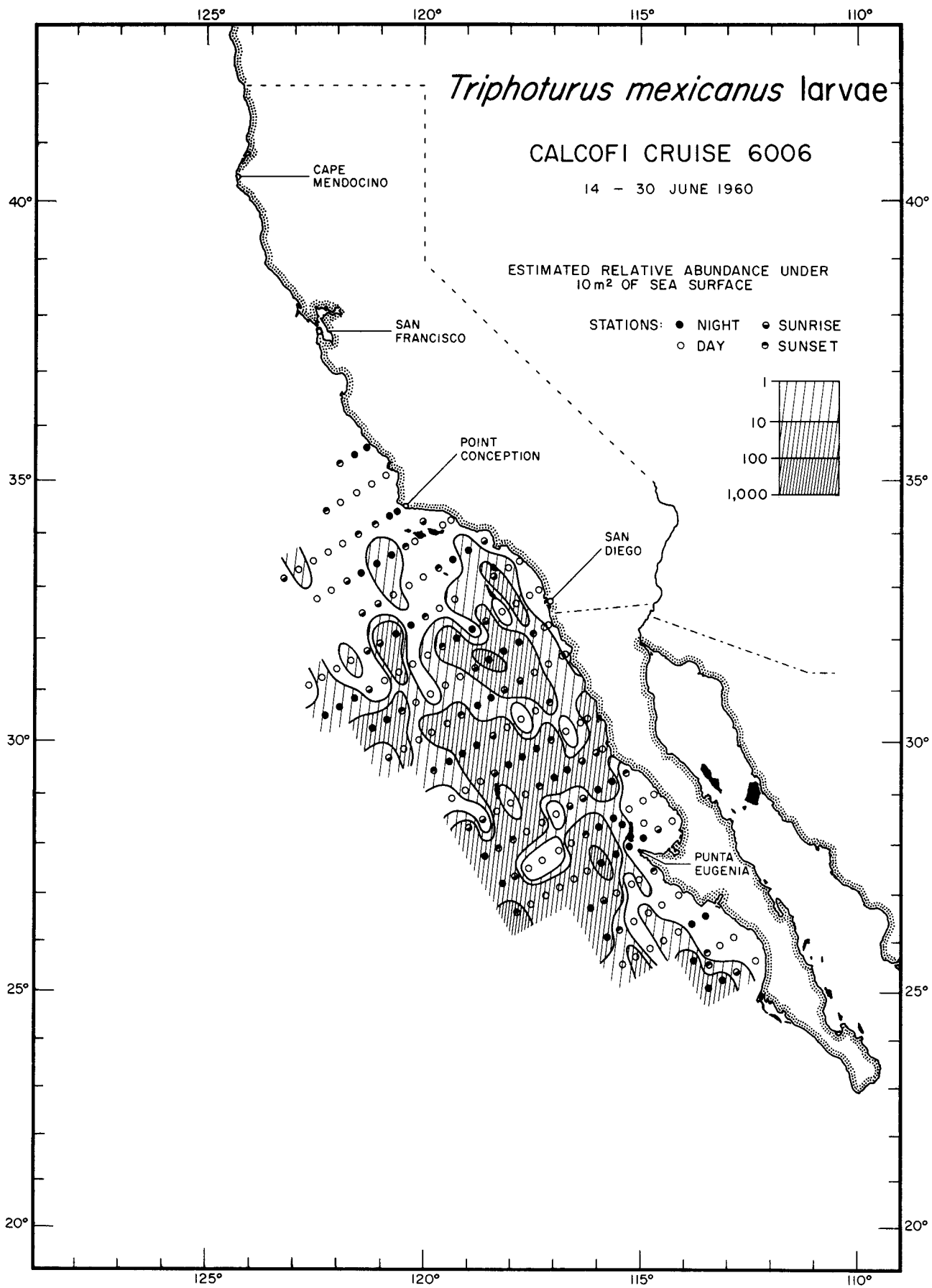
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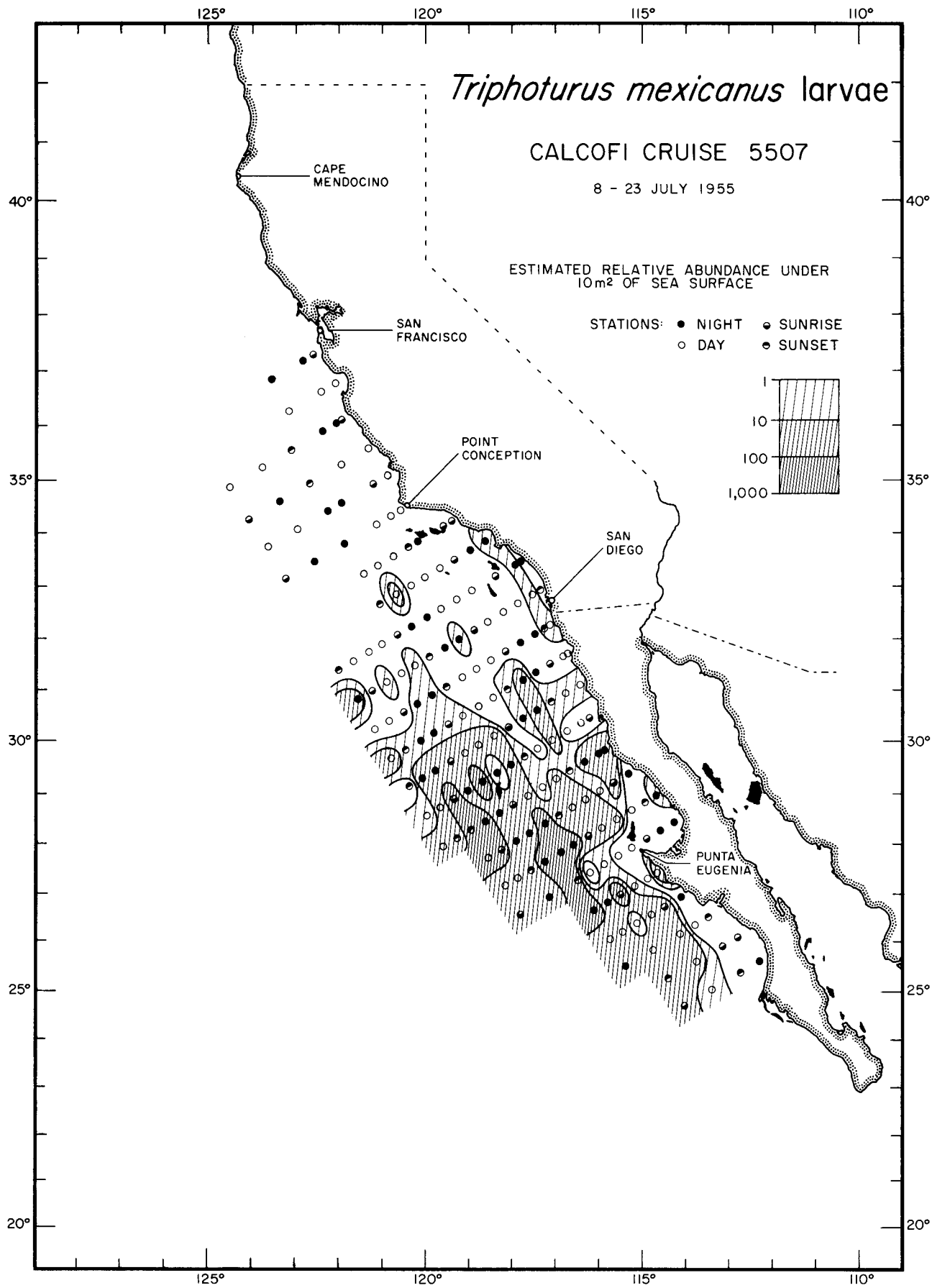
Triphoturus mexicanus larvae

5906



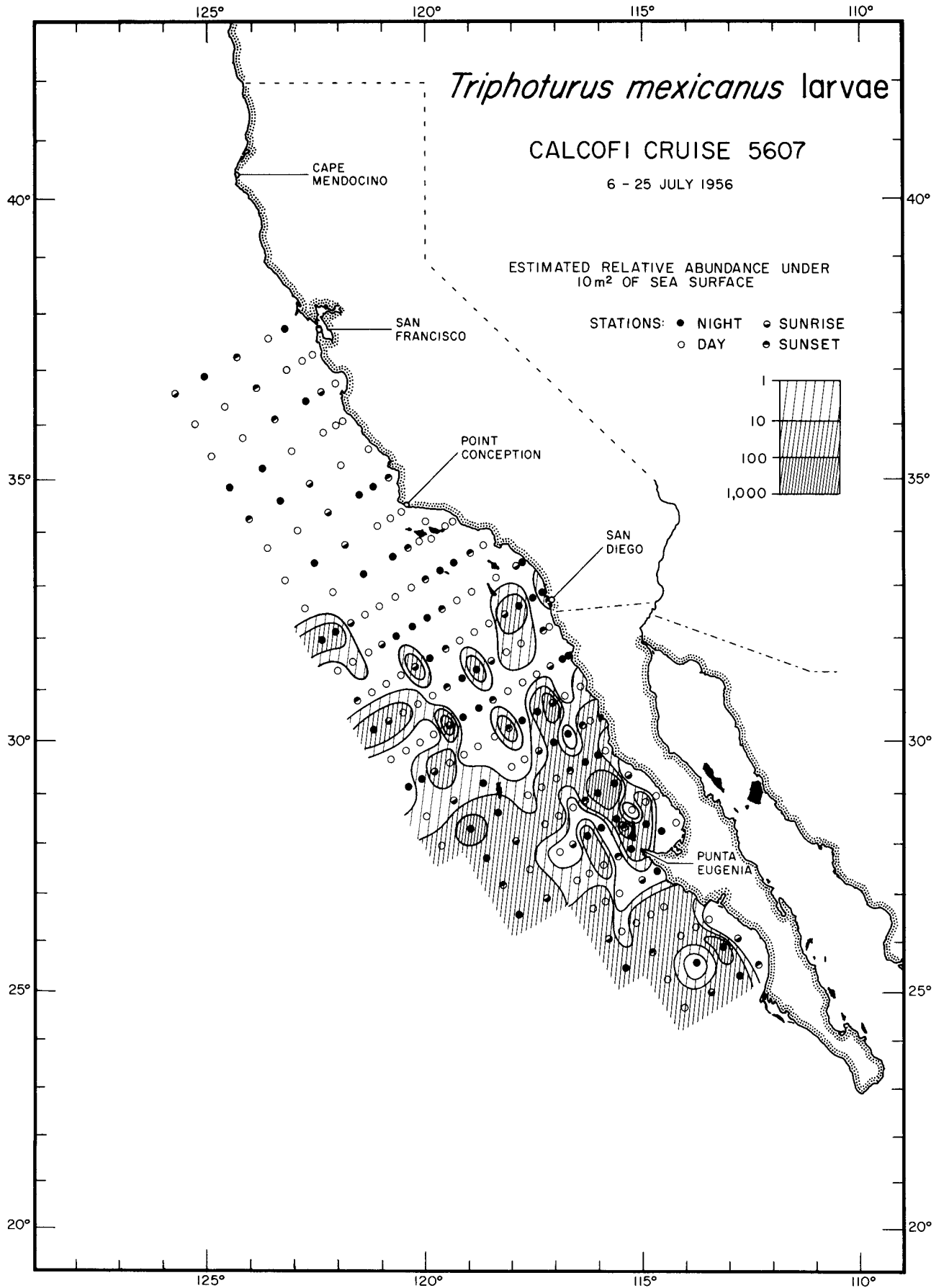
Triphoturus mexicanus larvae

6006



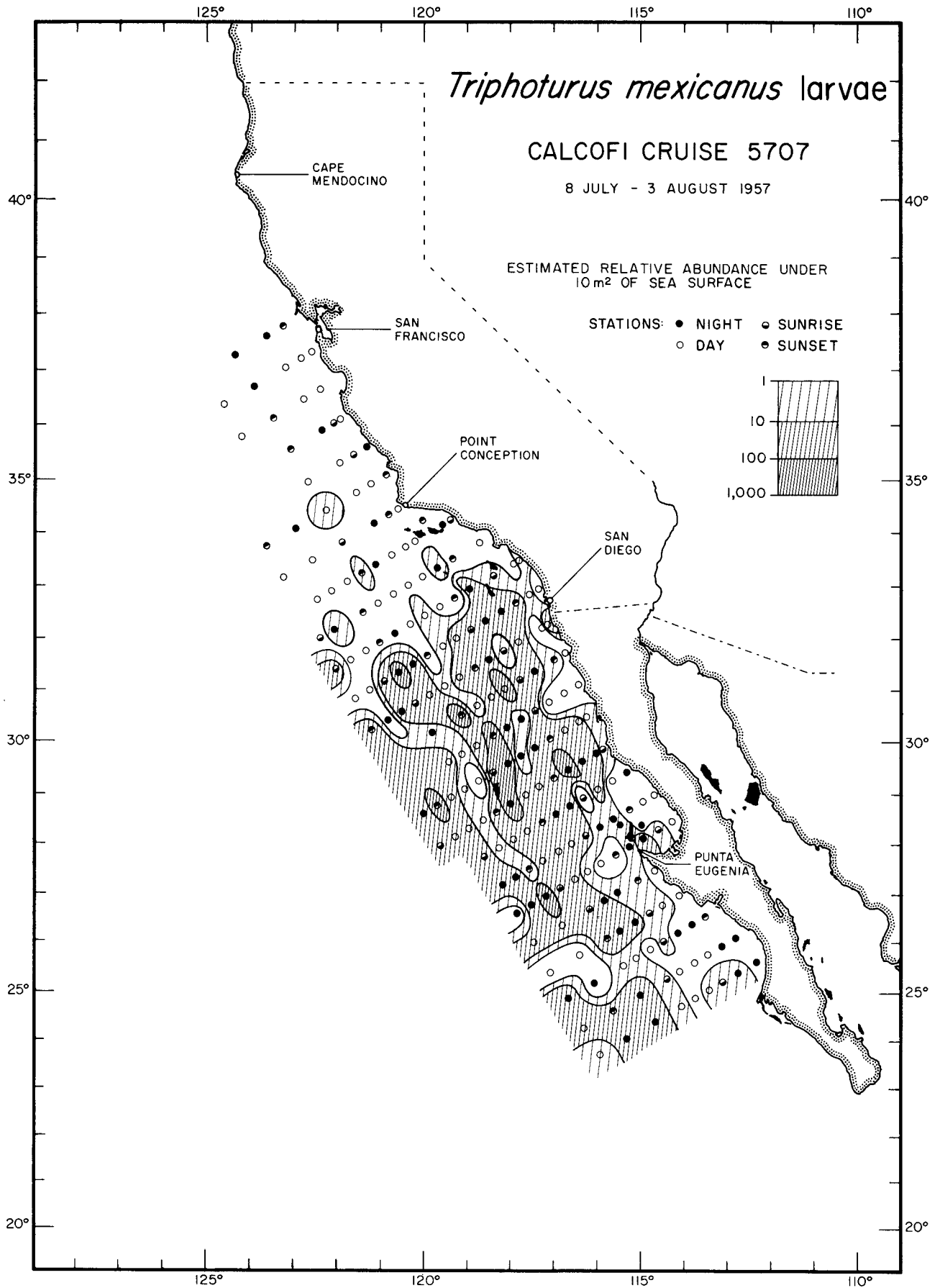
Triphoturus mexicanus larvae

5507

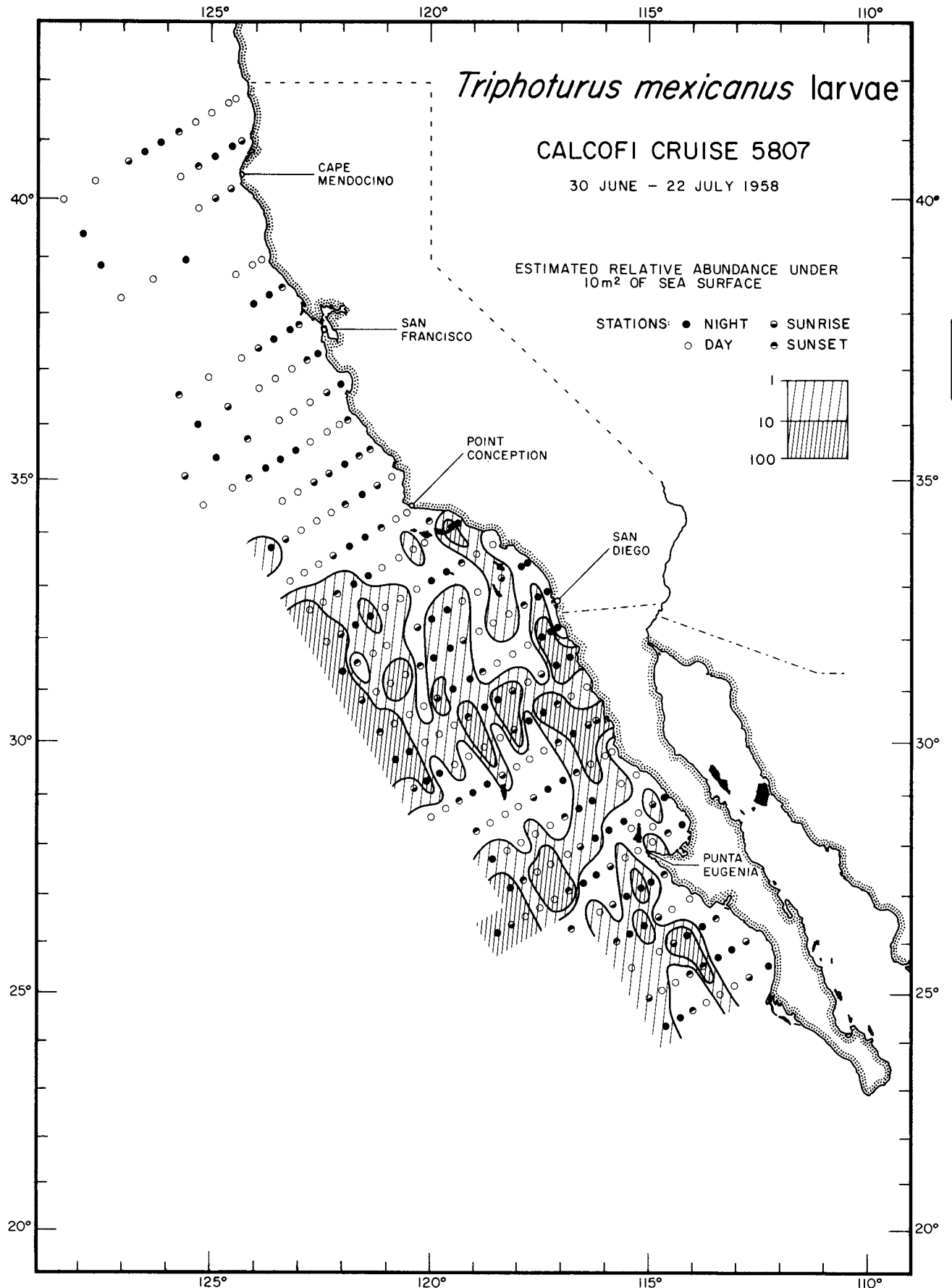


Triphoturus mexicanus larvae

5607

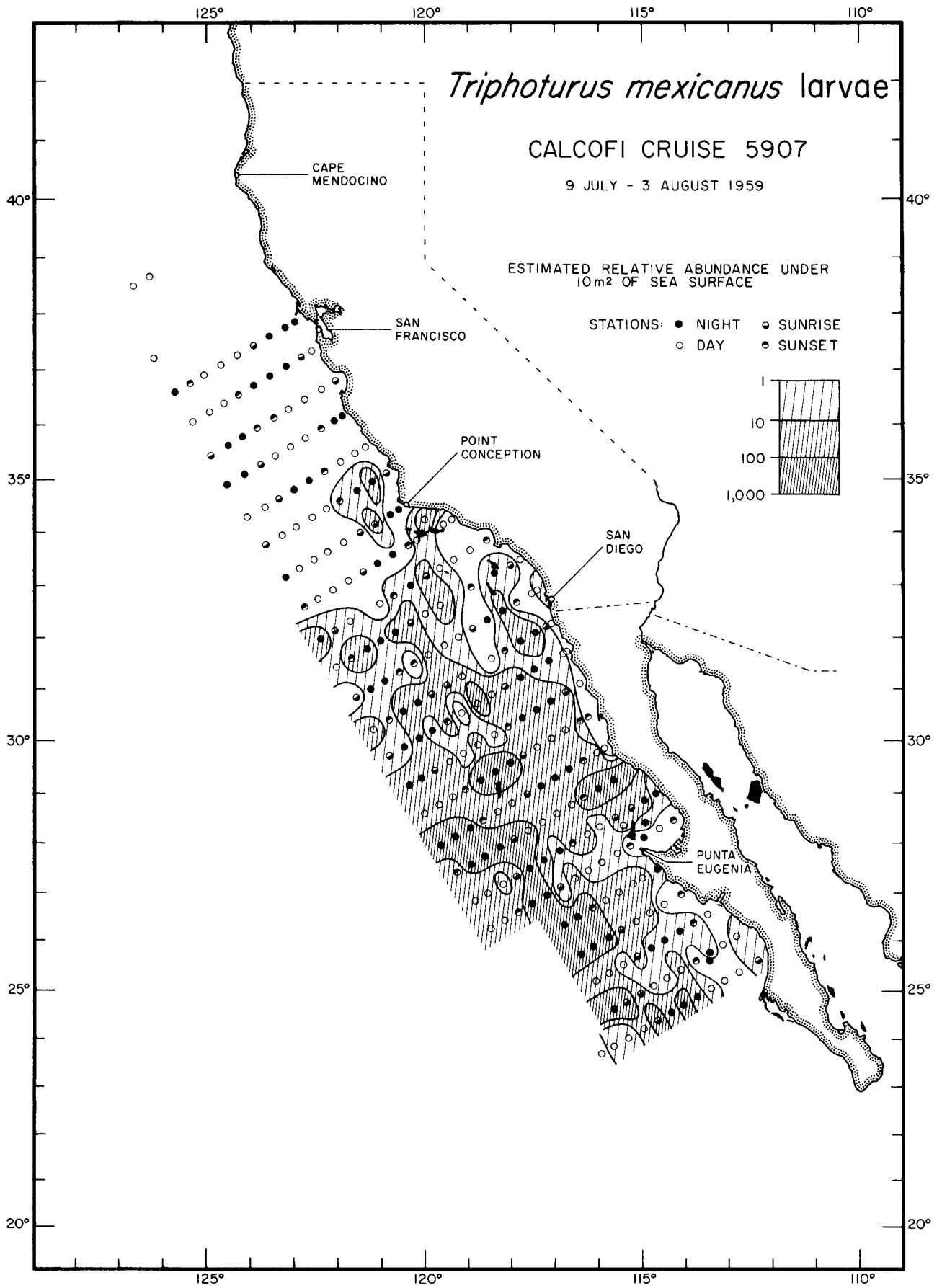


Triphoturus mexicanus larvae



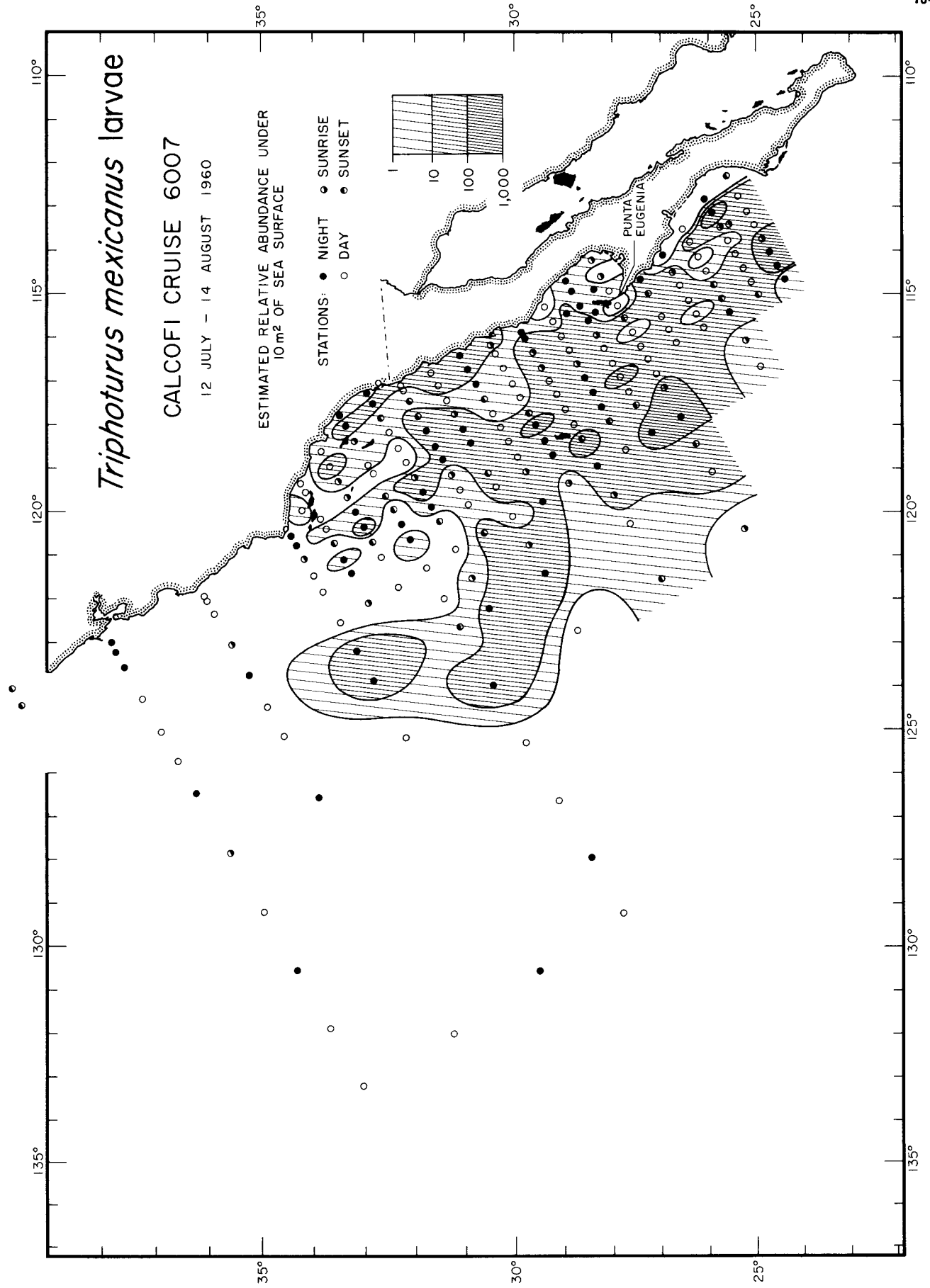
Triphoturus mexicanus larvae

5807



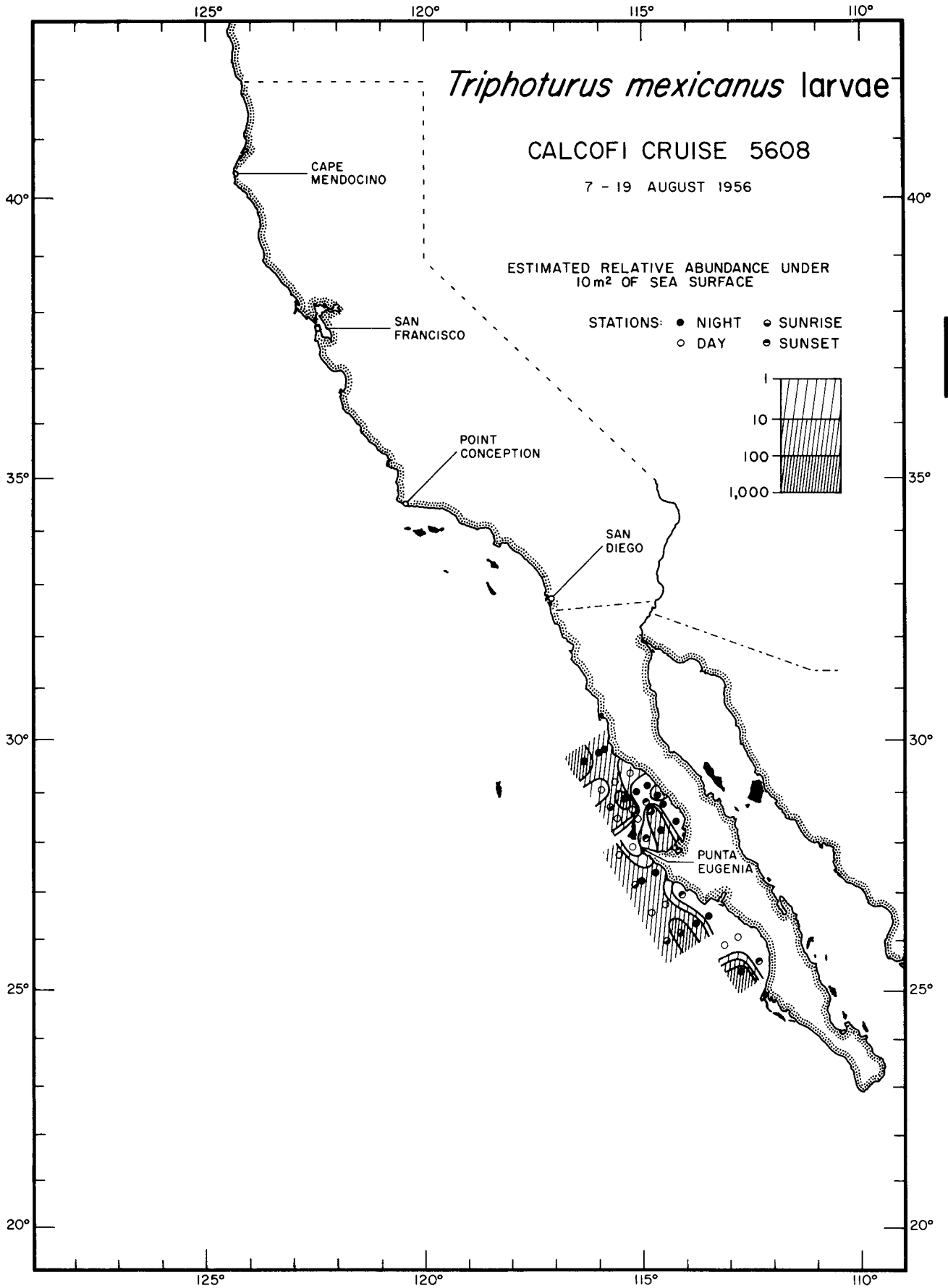
Triphoturus mexicanus larvae

5907



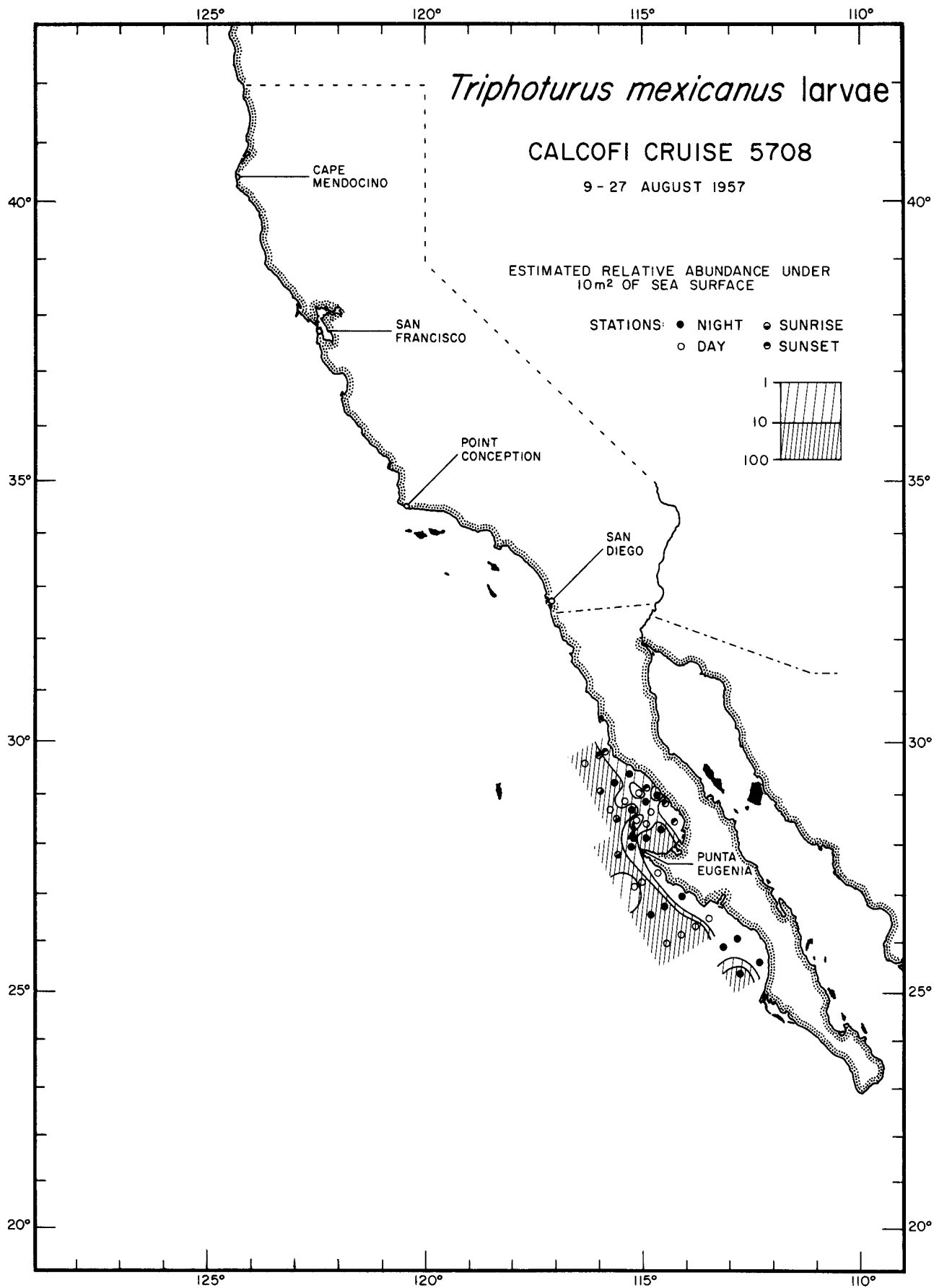
Triphoturus mexicanus larvae

6007



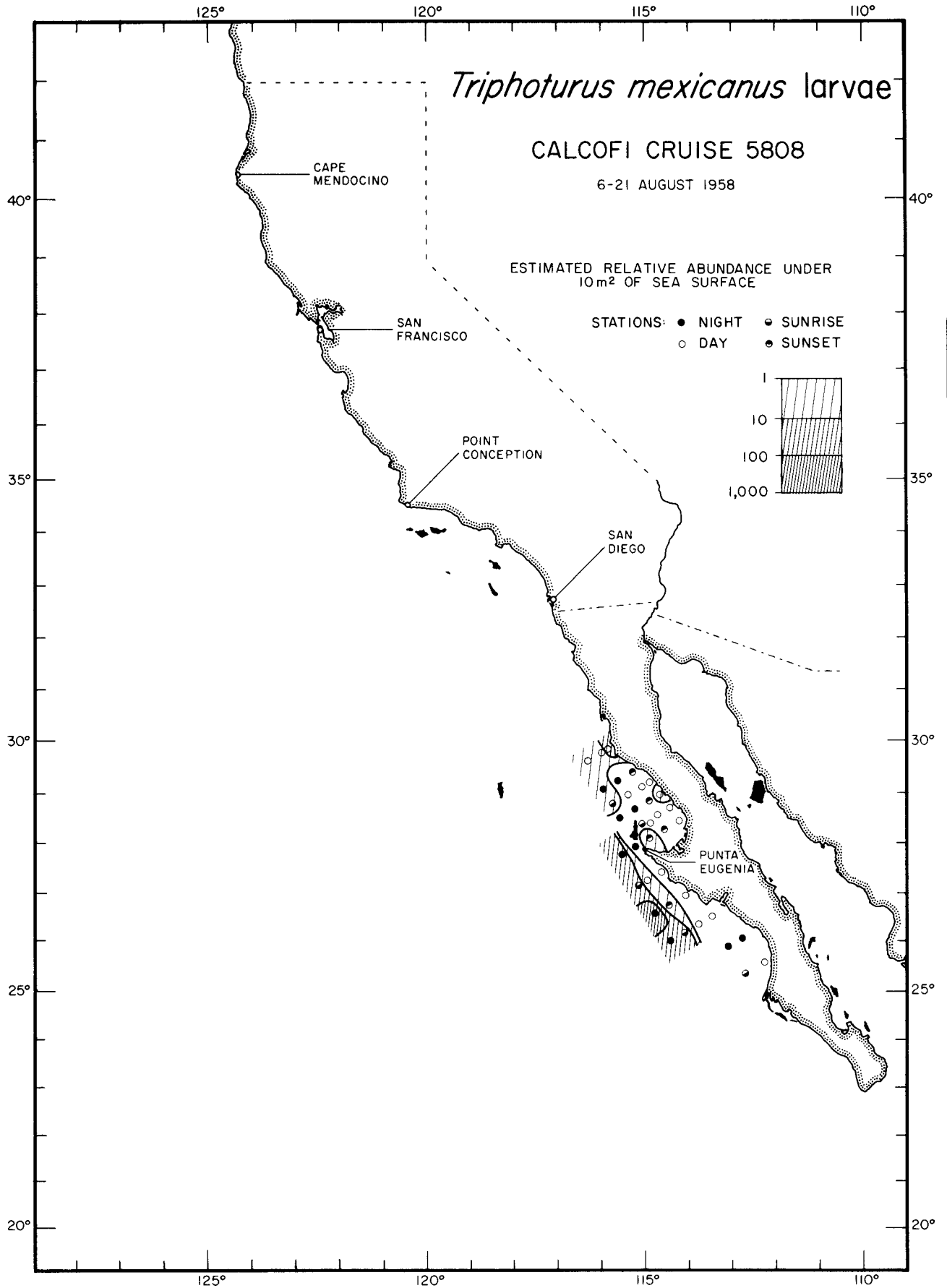
Triphoturus mexicanus larvae

5608



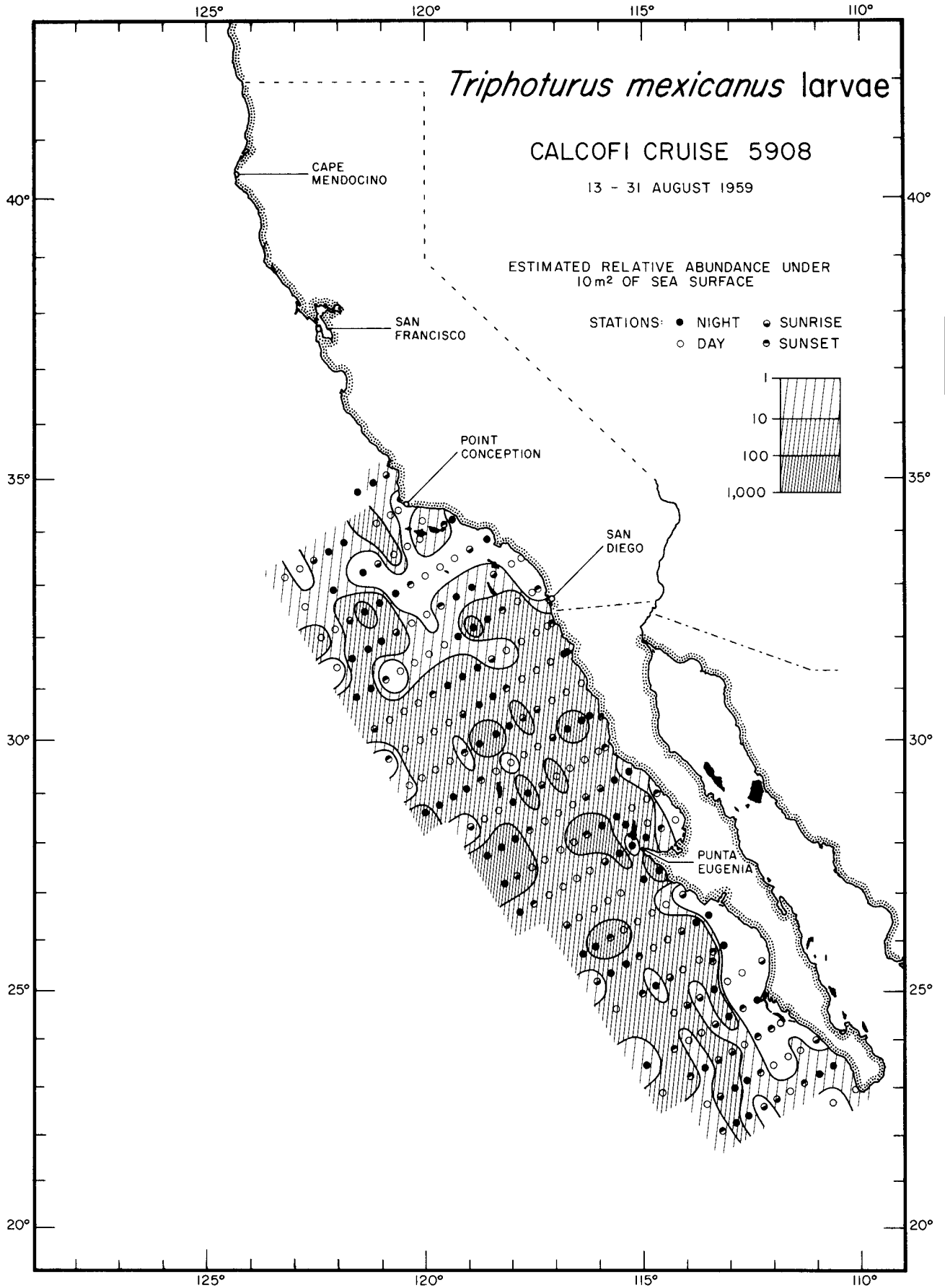
Triphoturus mexicanus larvae

5708



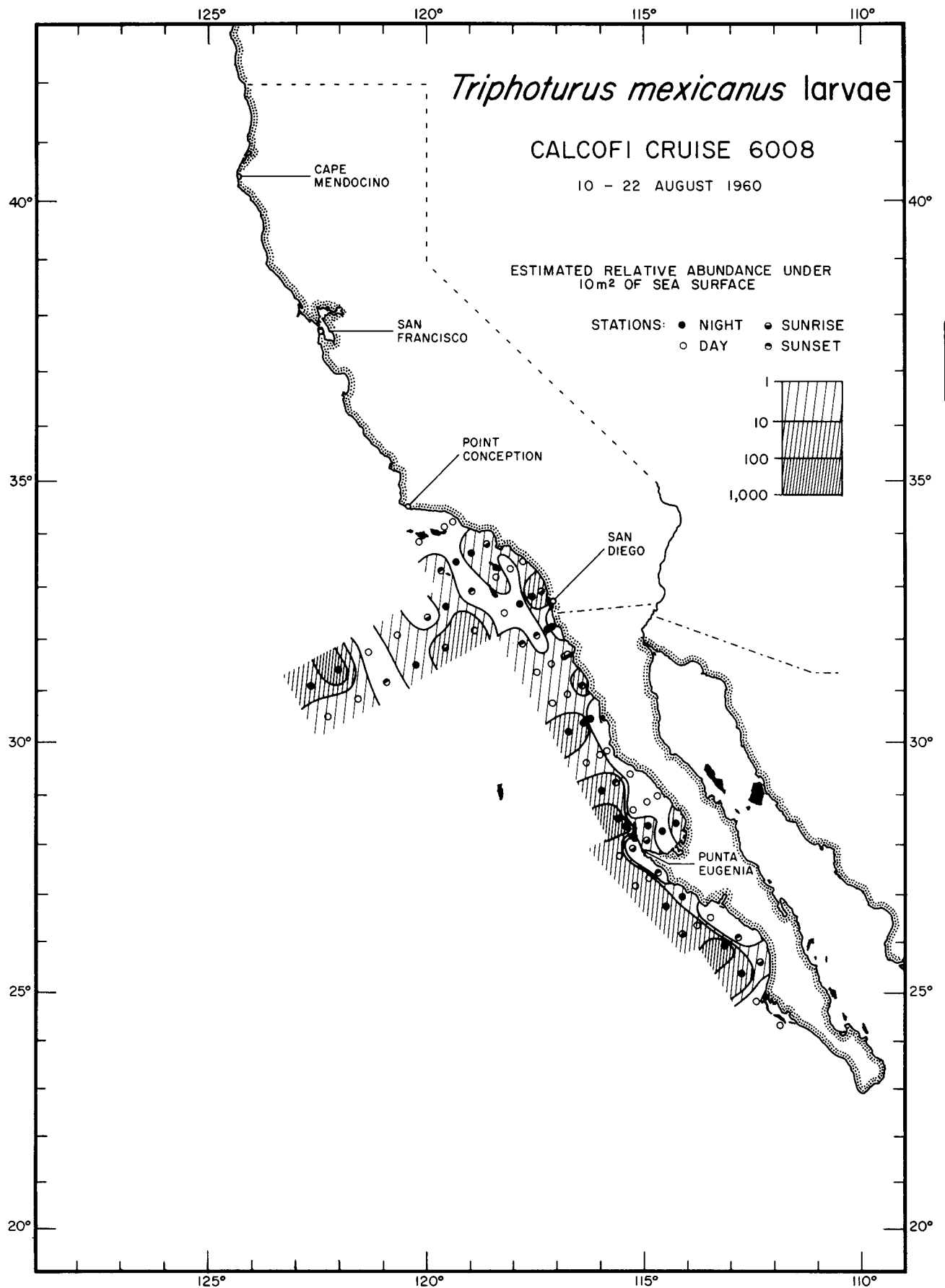
Triphoturus mexicanus larvae

5808



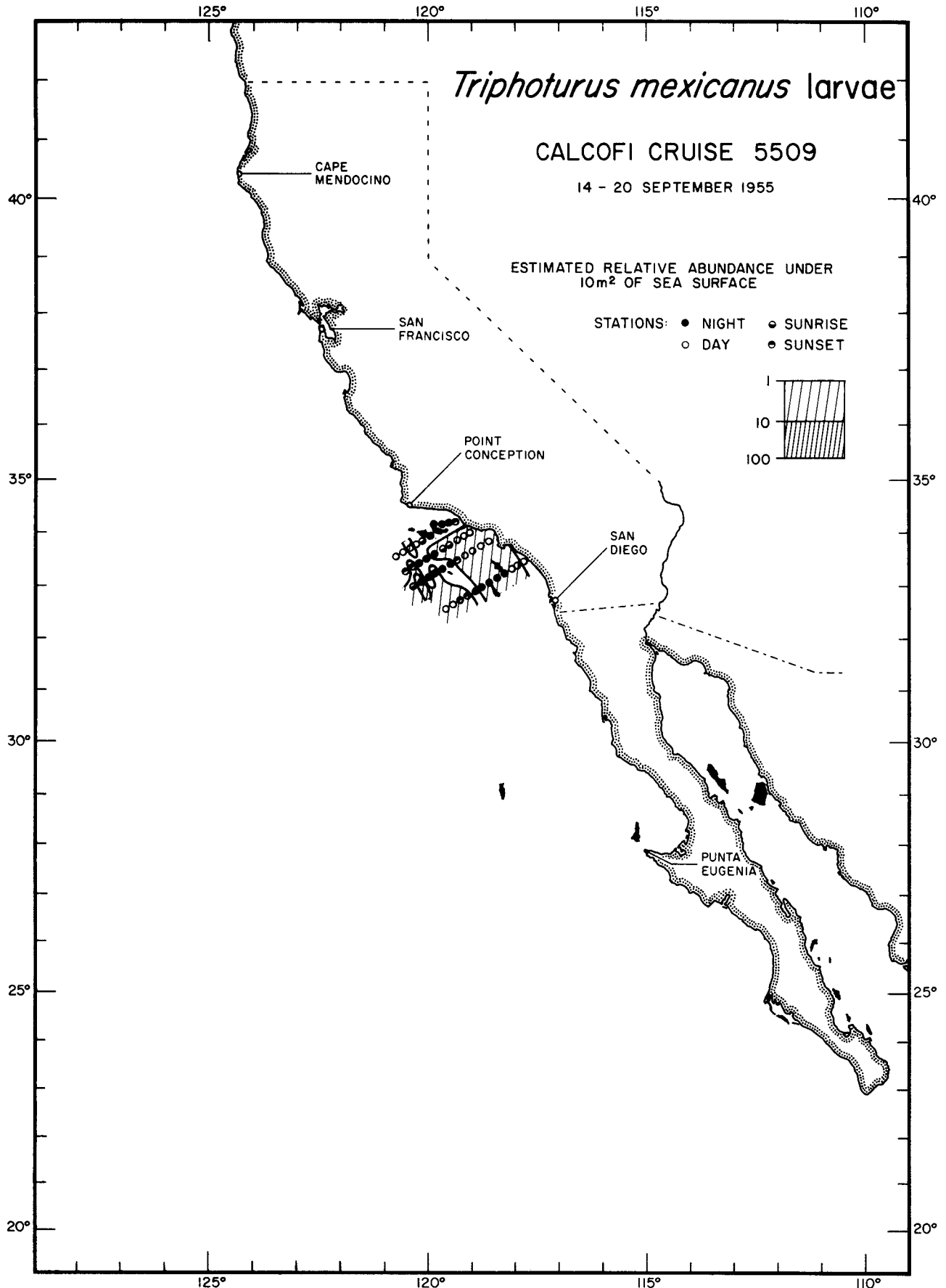
Triphoturus mexicanus larvae

5908

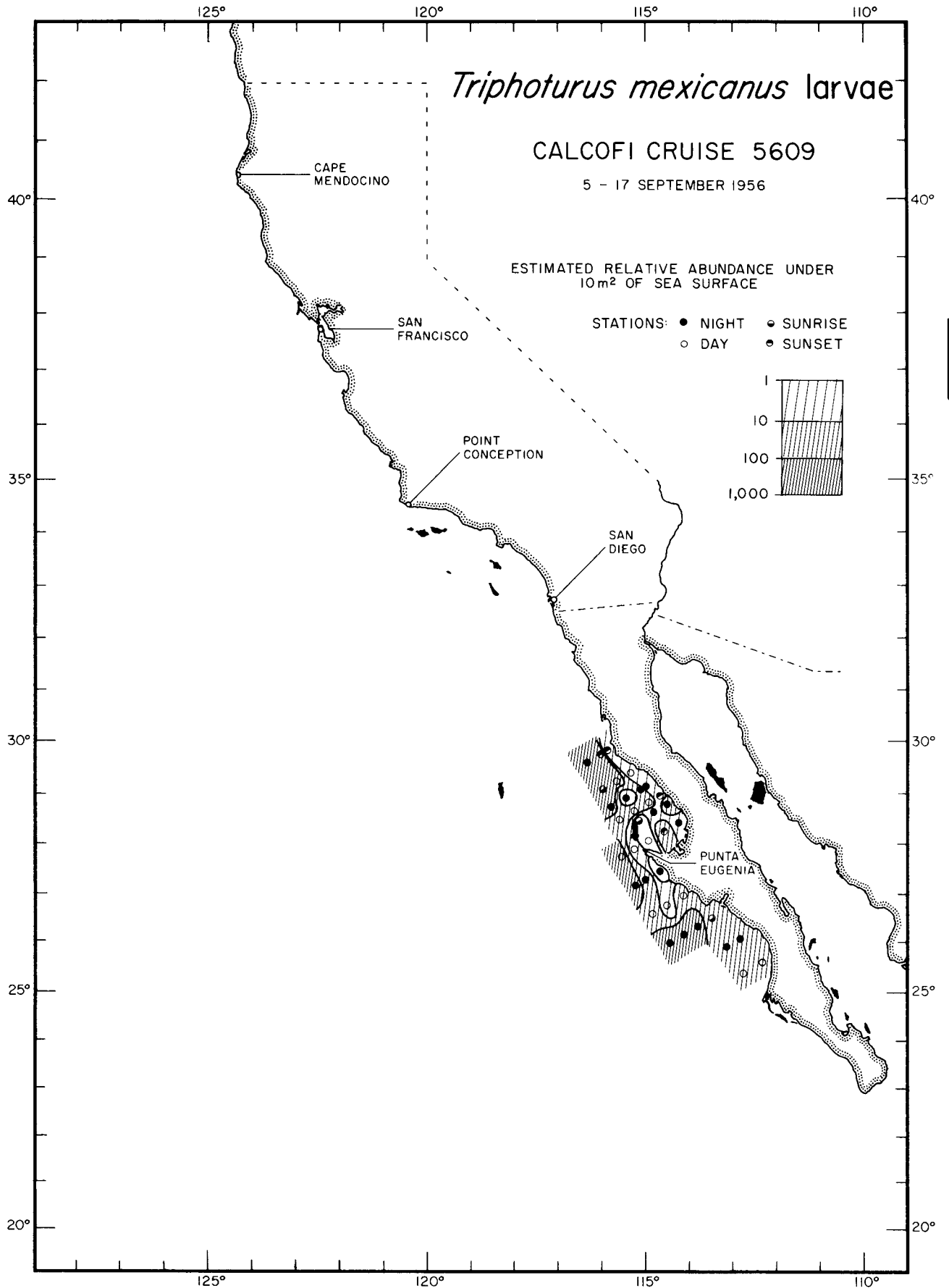


Triphoturus mexicanus larvae

6008

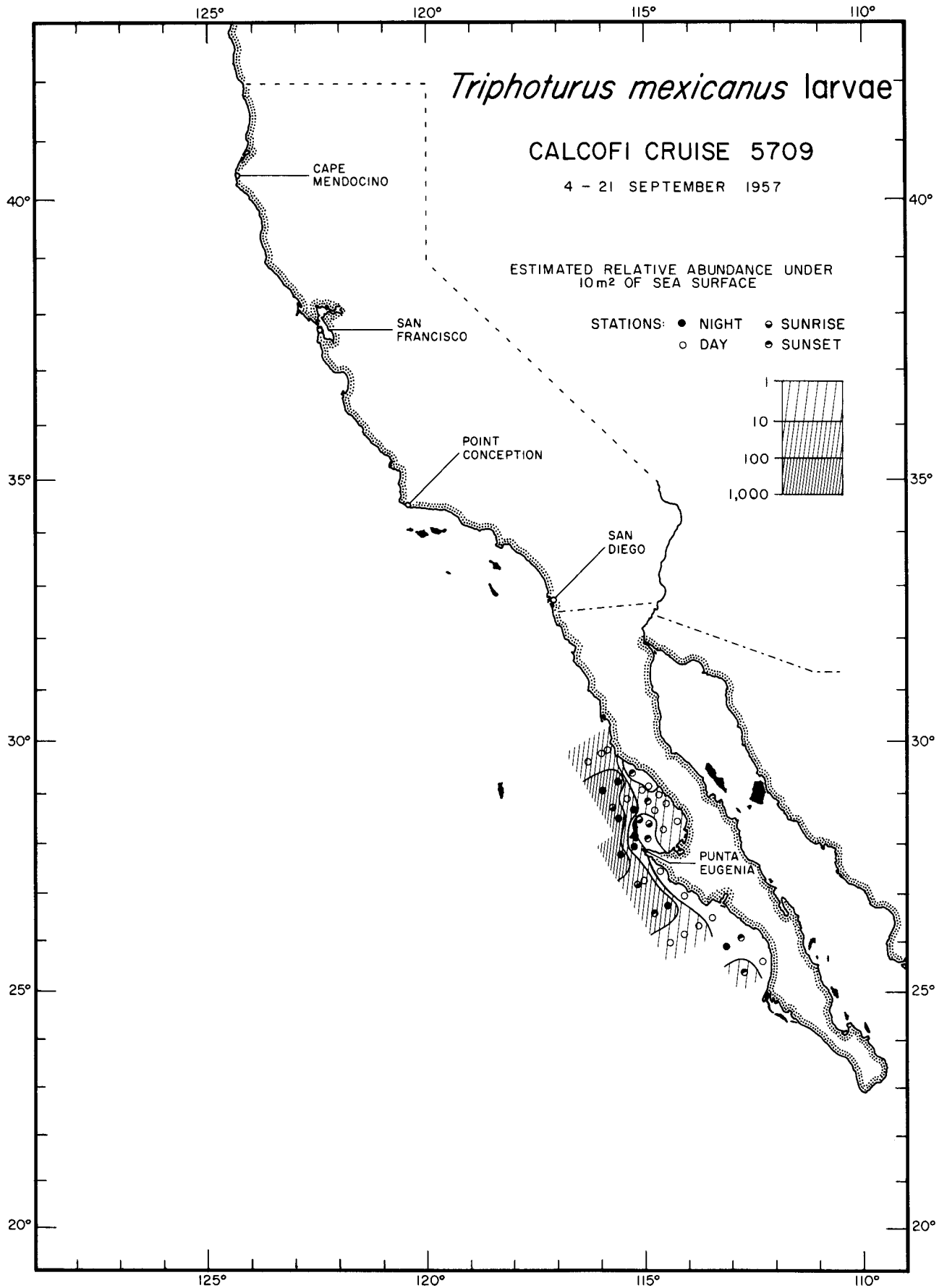


Triphoturus mexicanus larvae



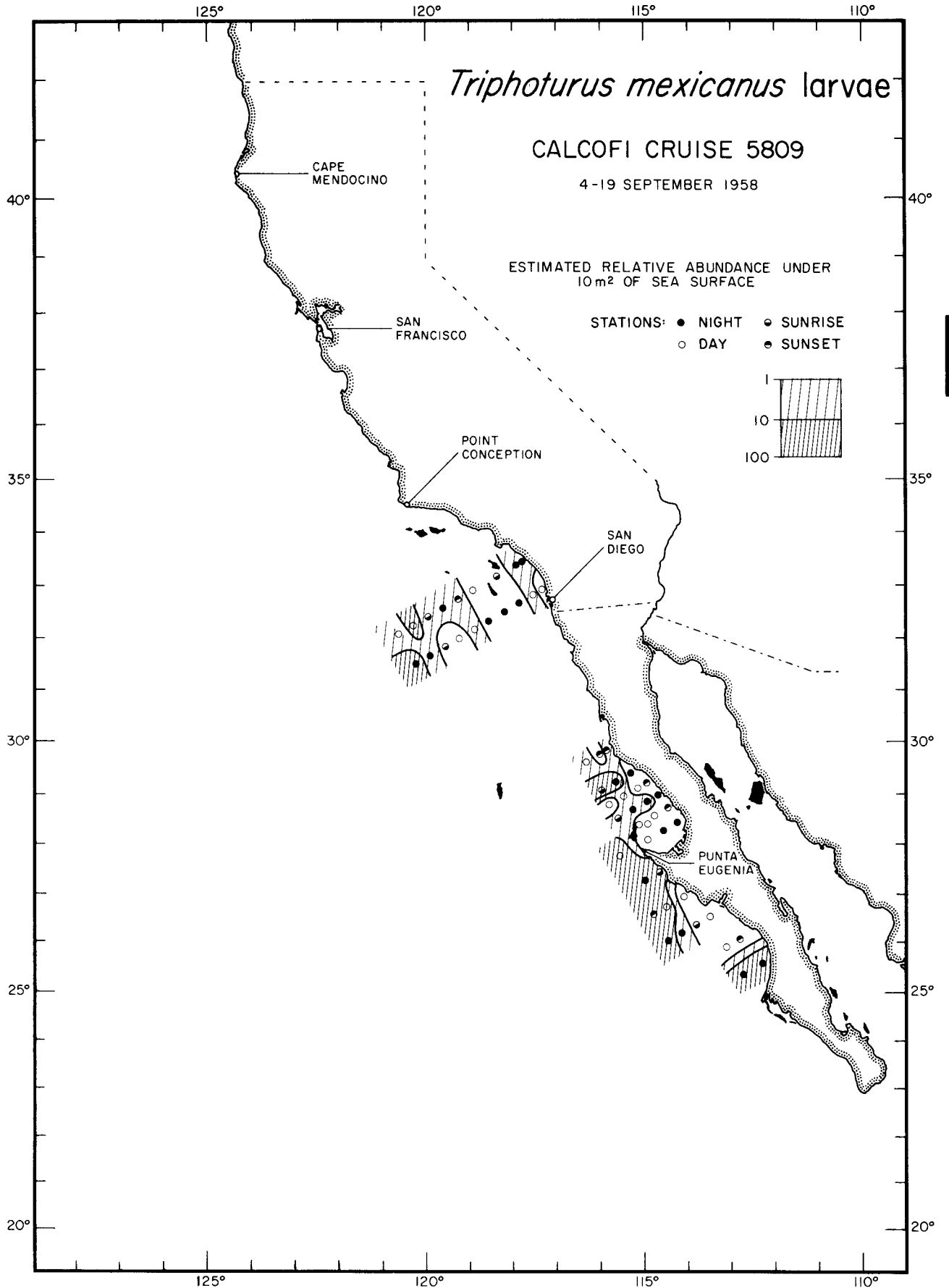
Triphoturus mexicanus larvae

5609



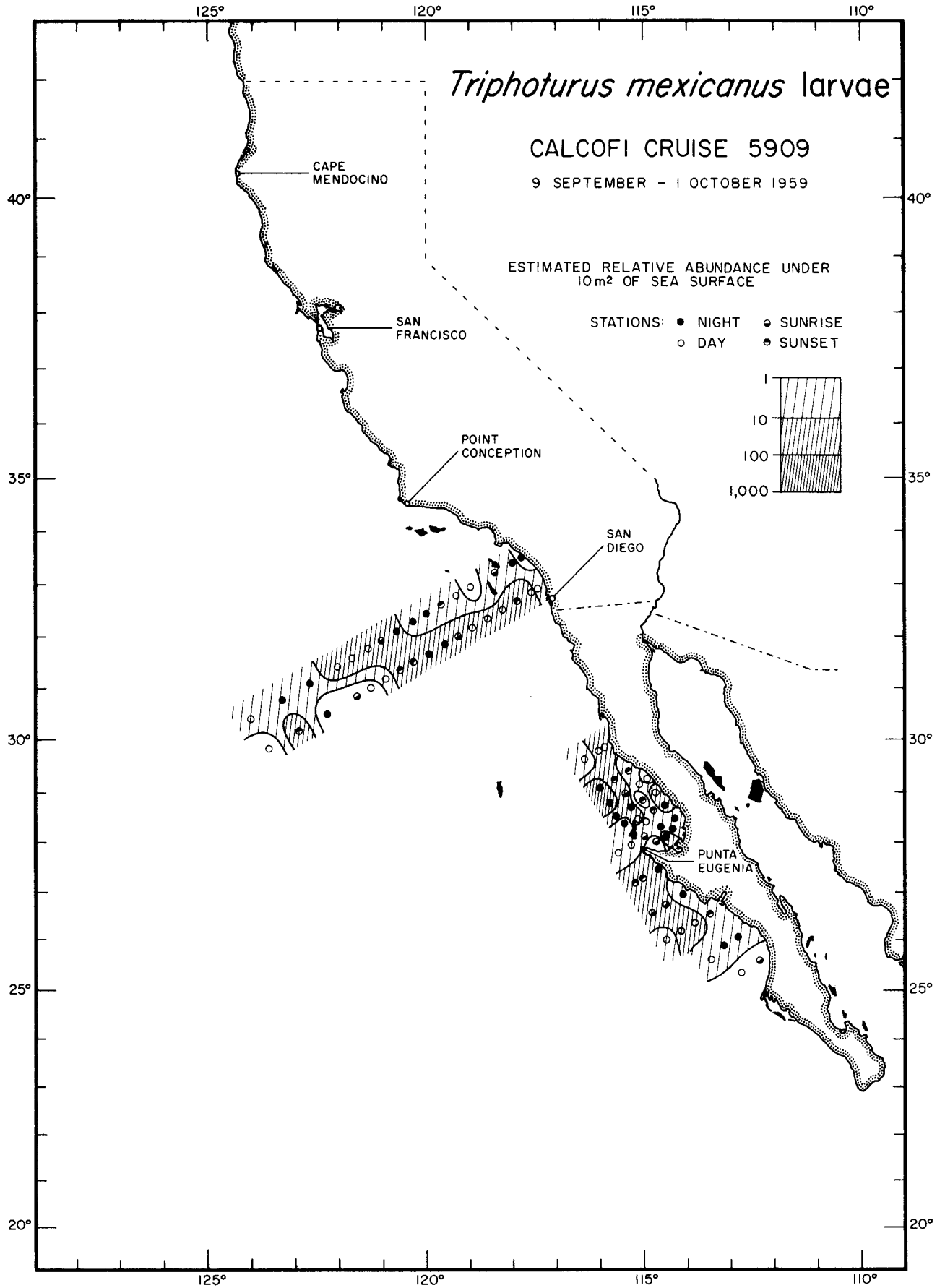
Triphoturus mexicanus larvae

5709



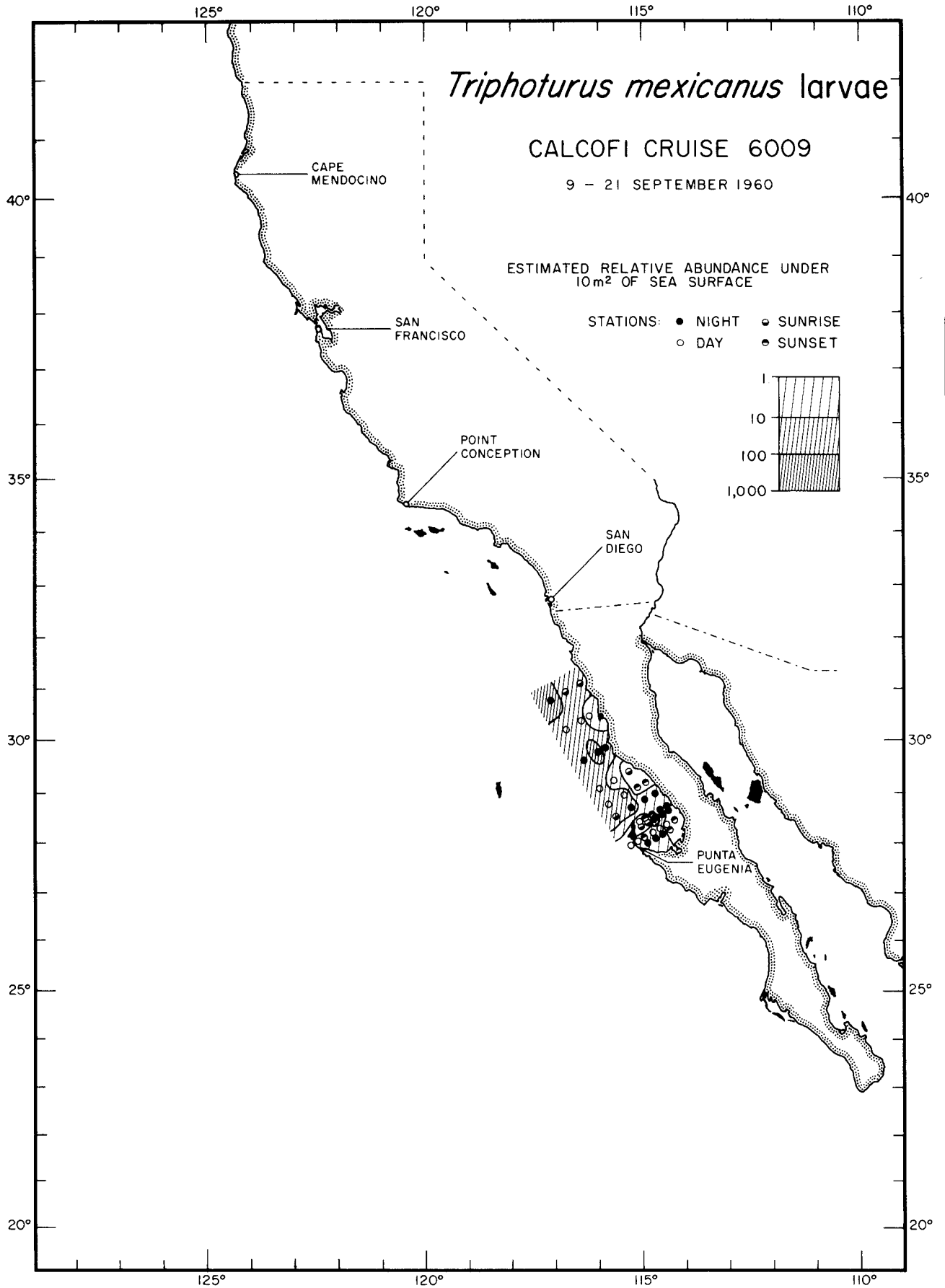
Triphoturus mexicanus larvae

5809



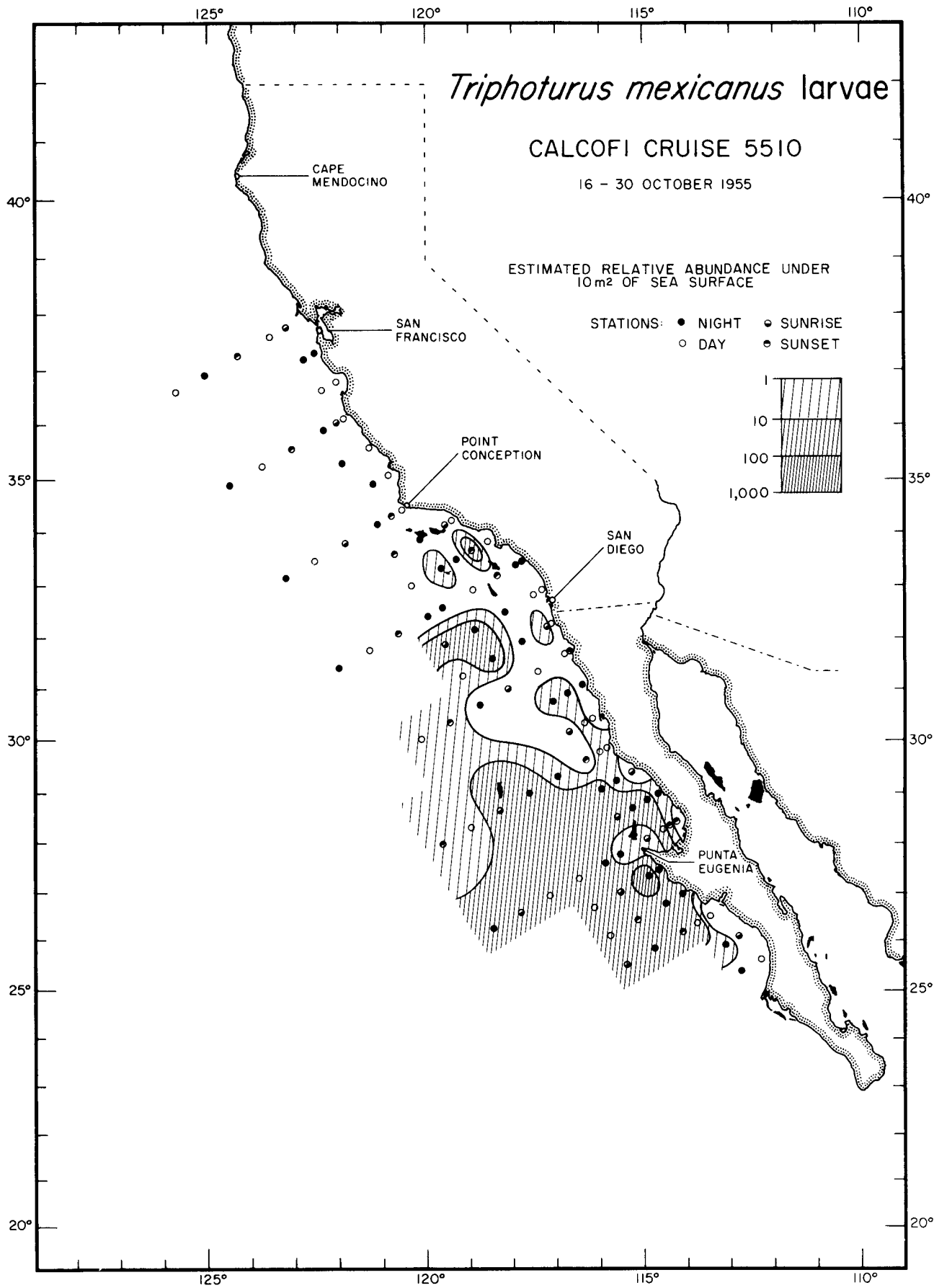
Triphoturus mexicanus larvae

5909



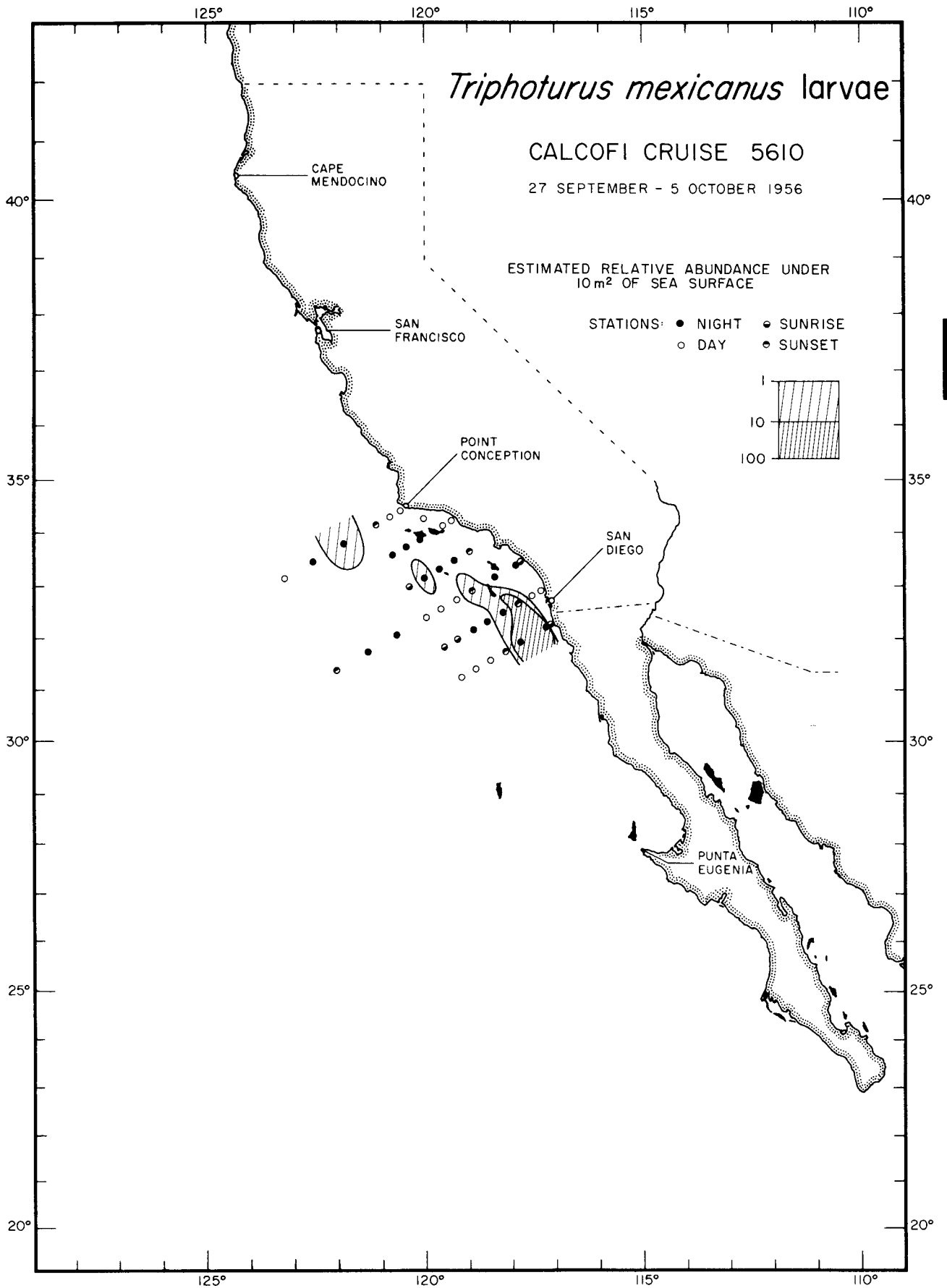
Triphoturus mexicanus larvae

6009



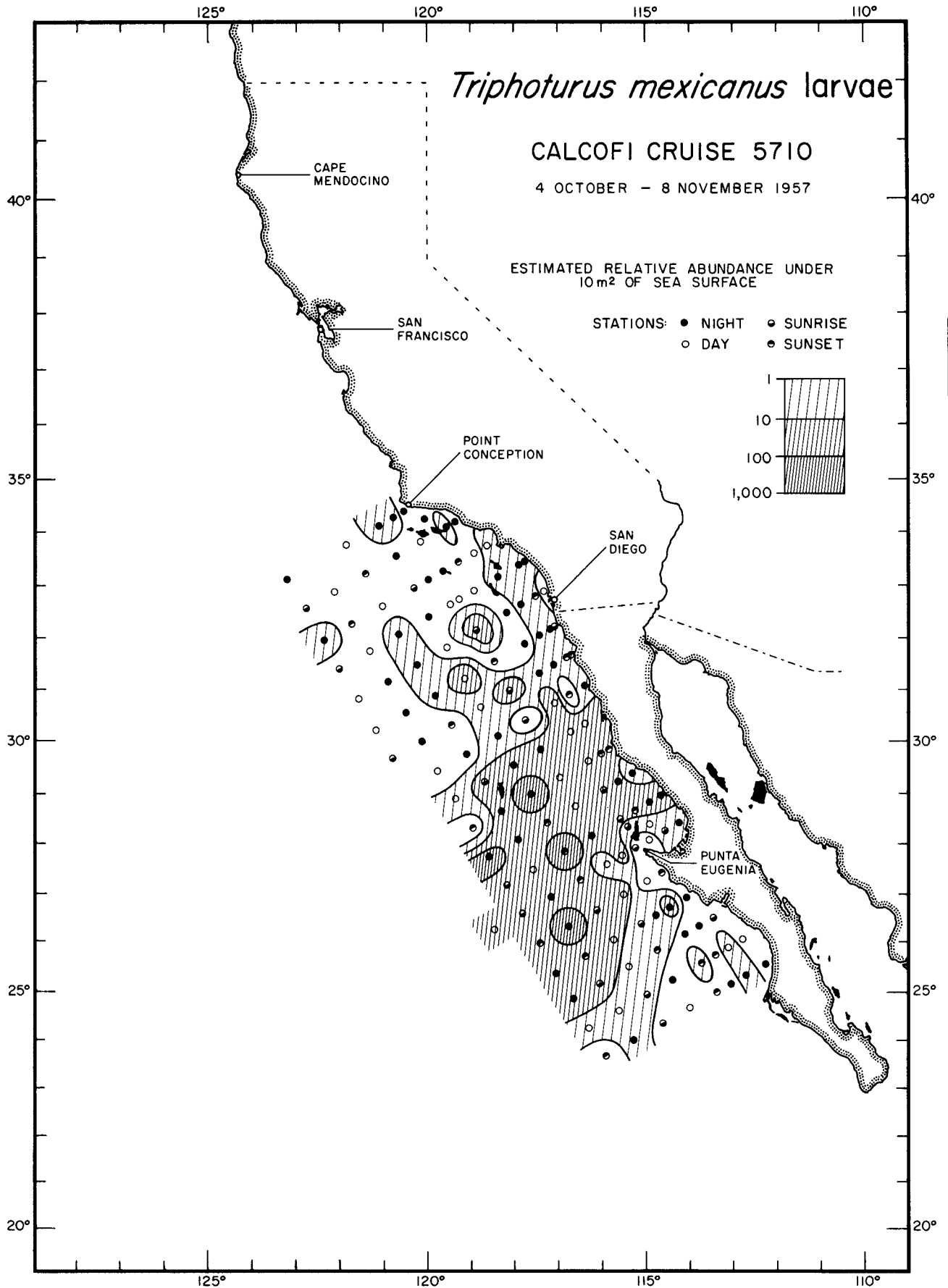
Triphoturus mexicanus larvae

5510



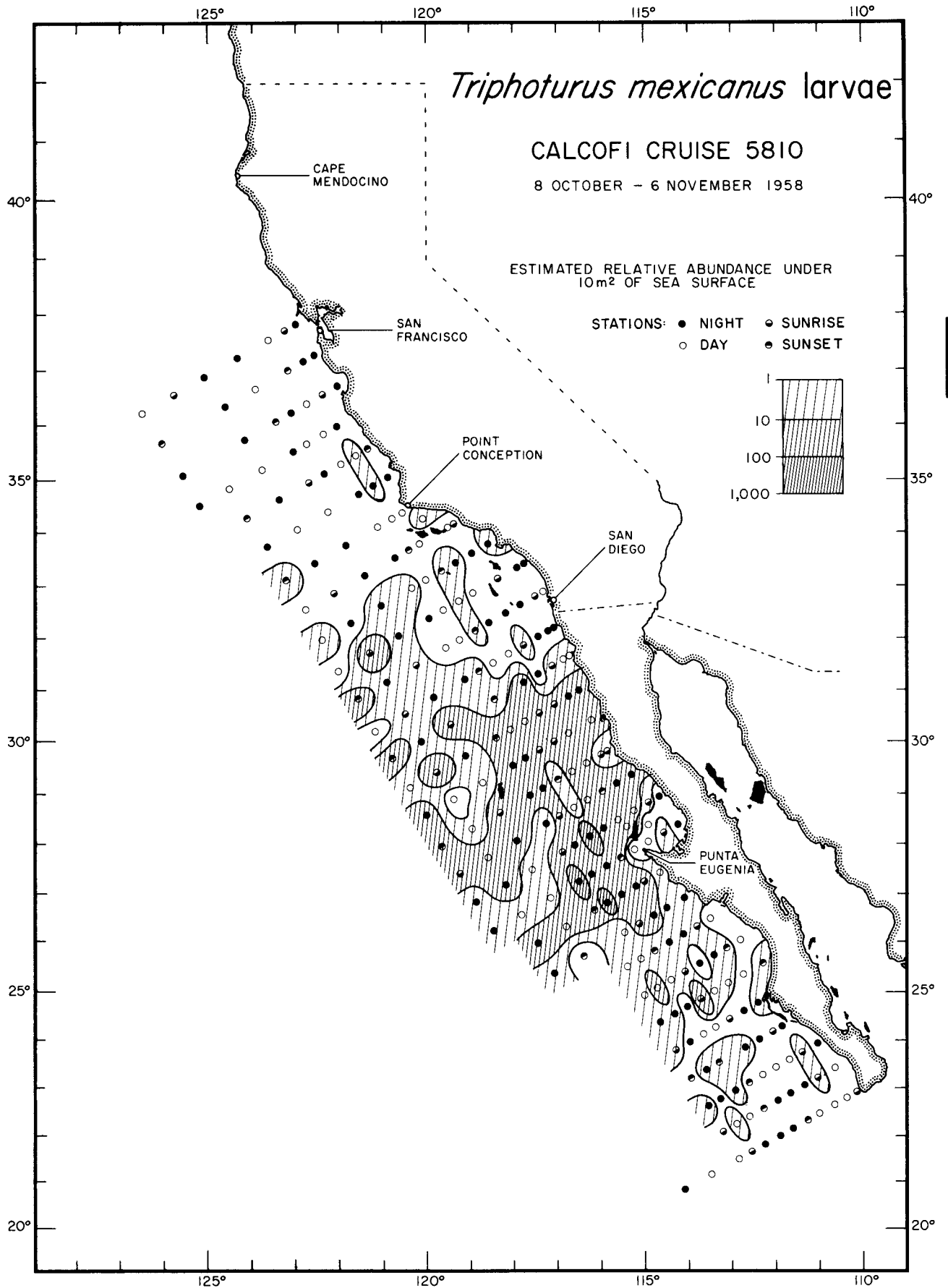
Triphoturus mexicanus larvae

5610



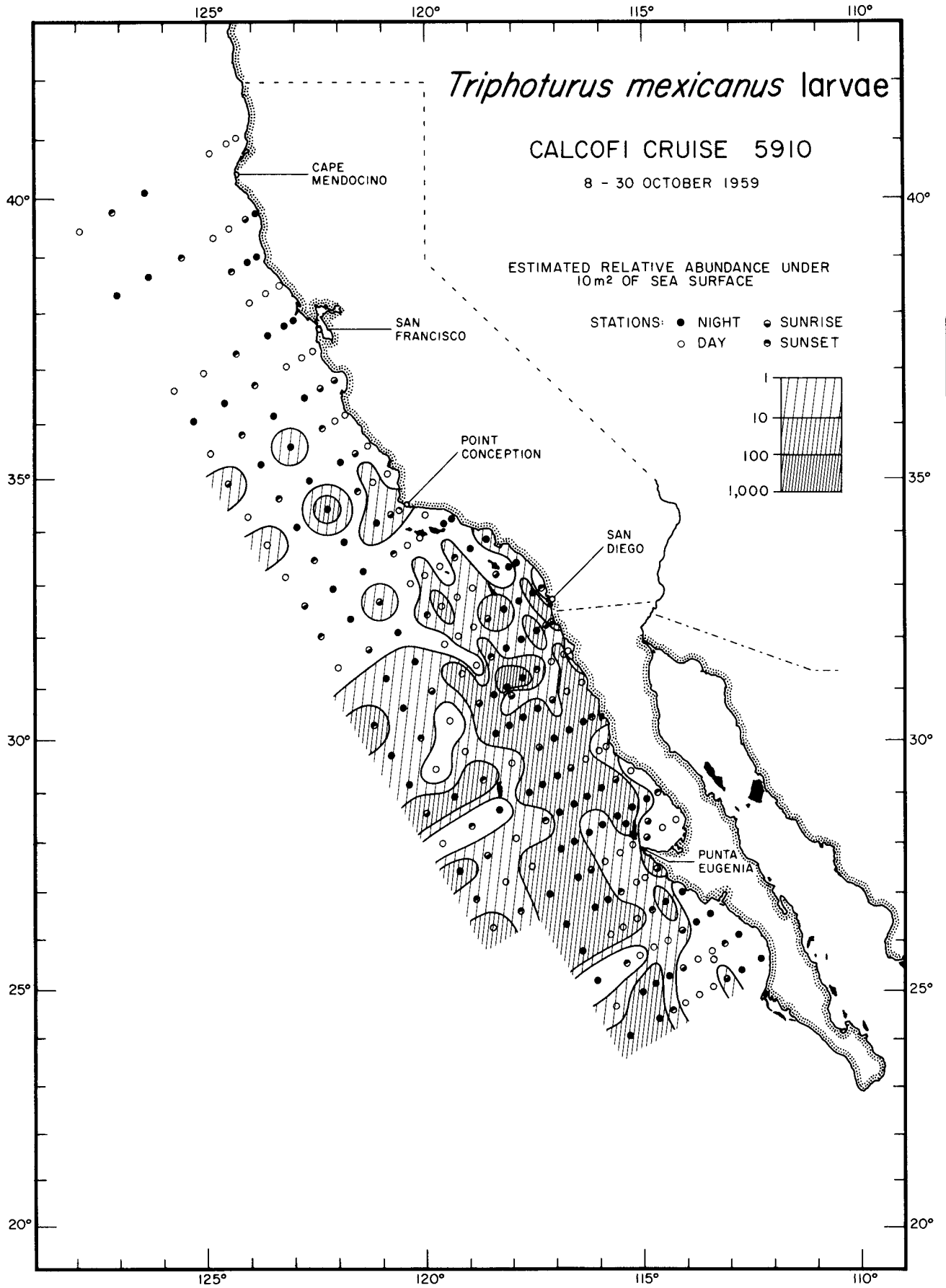
Triphoturus mexicanus larvae

5710



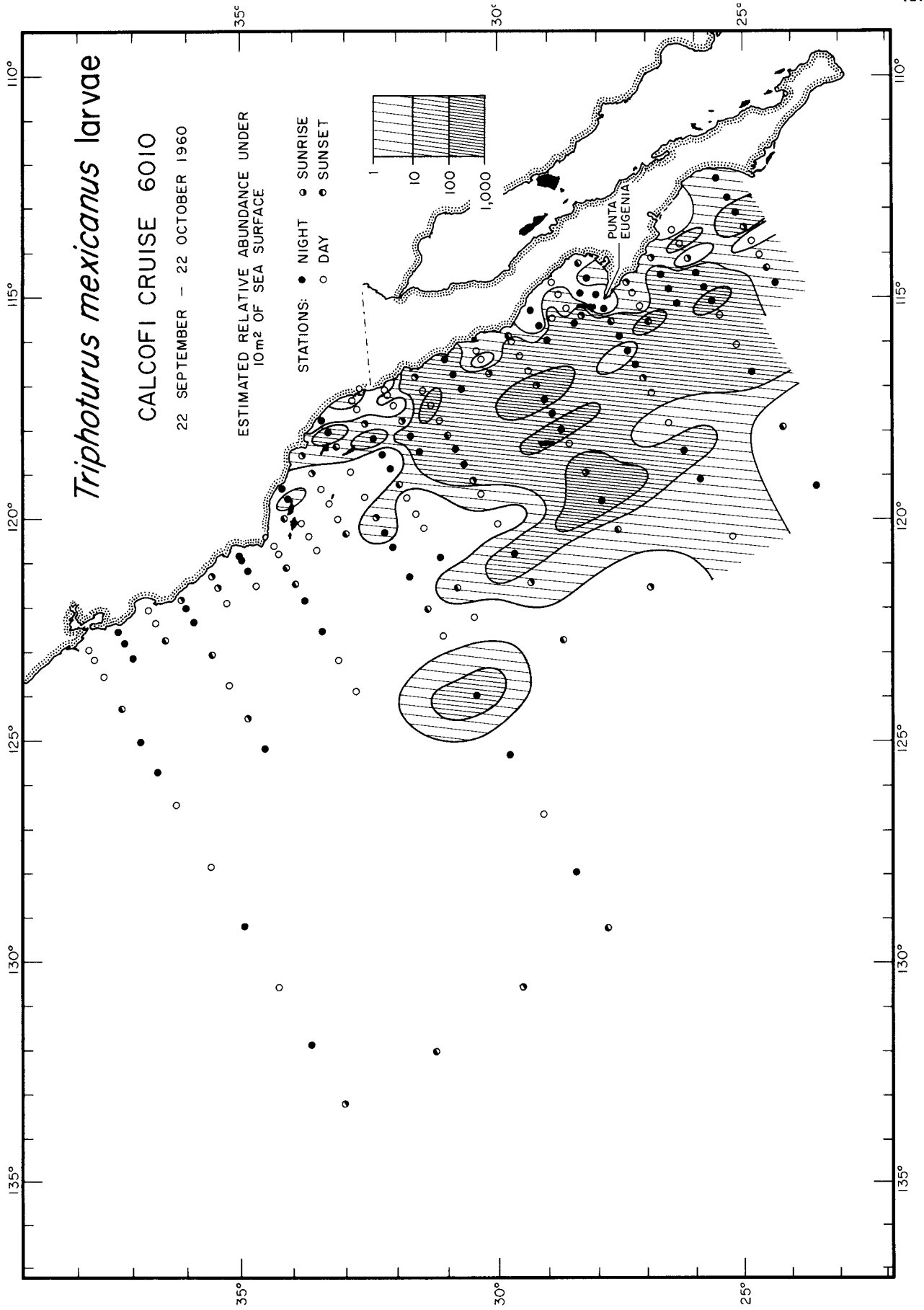
Triphoturus mexicanus larvae

5810



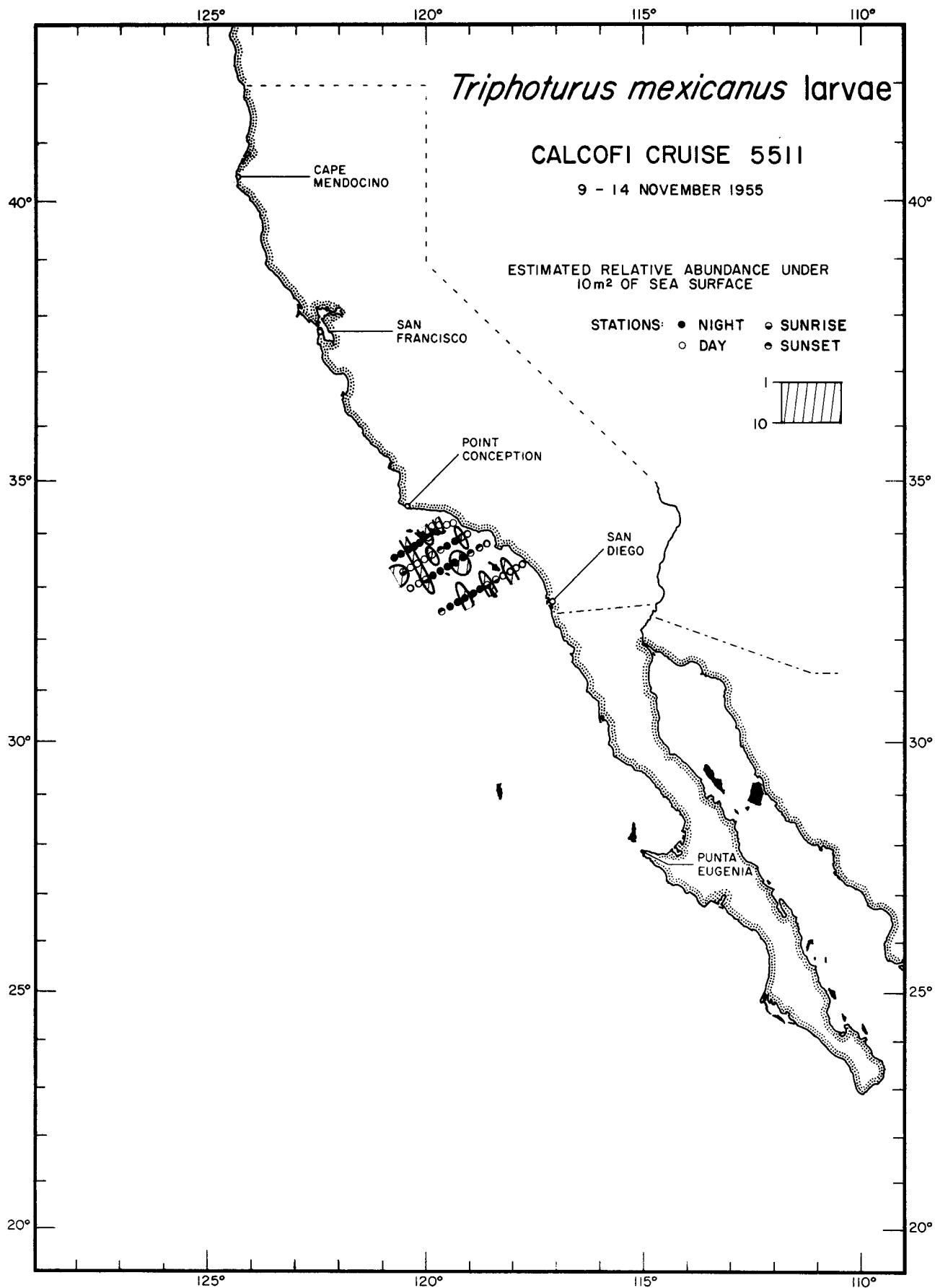
Triphoturus mexicanus larvae

5910



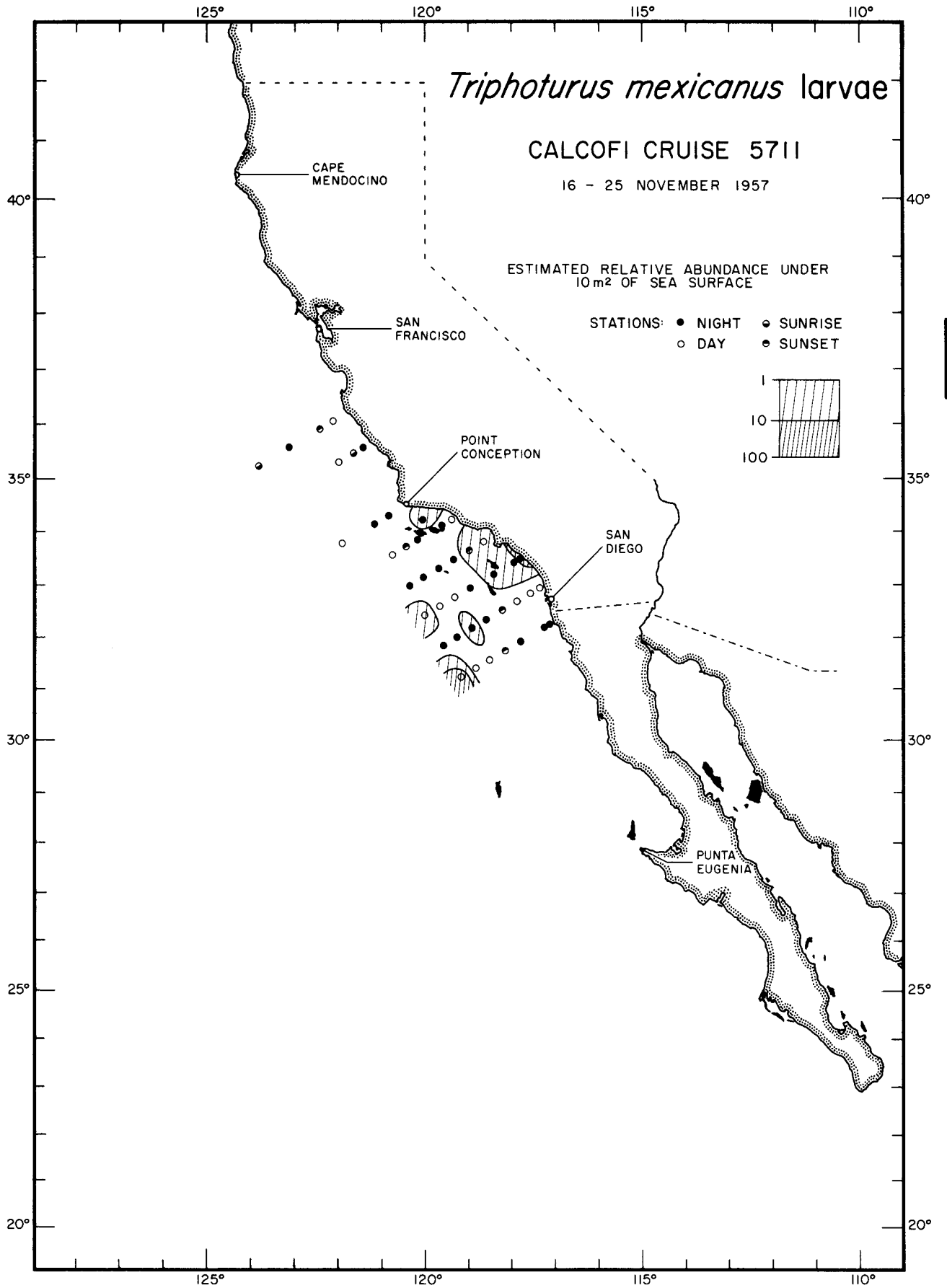
Triphoturus mexicanus larvae

6010



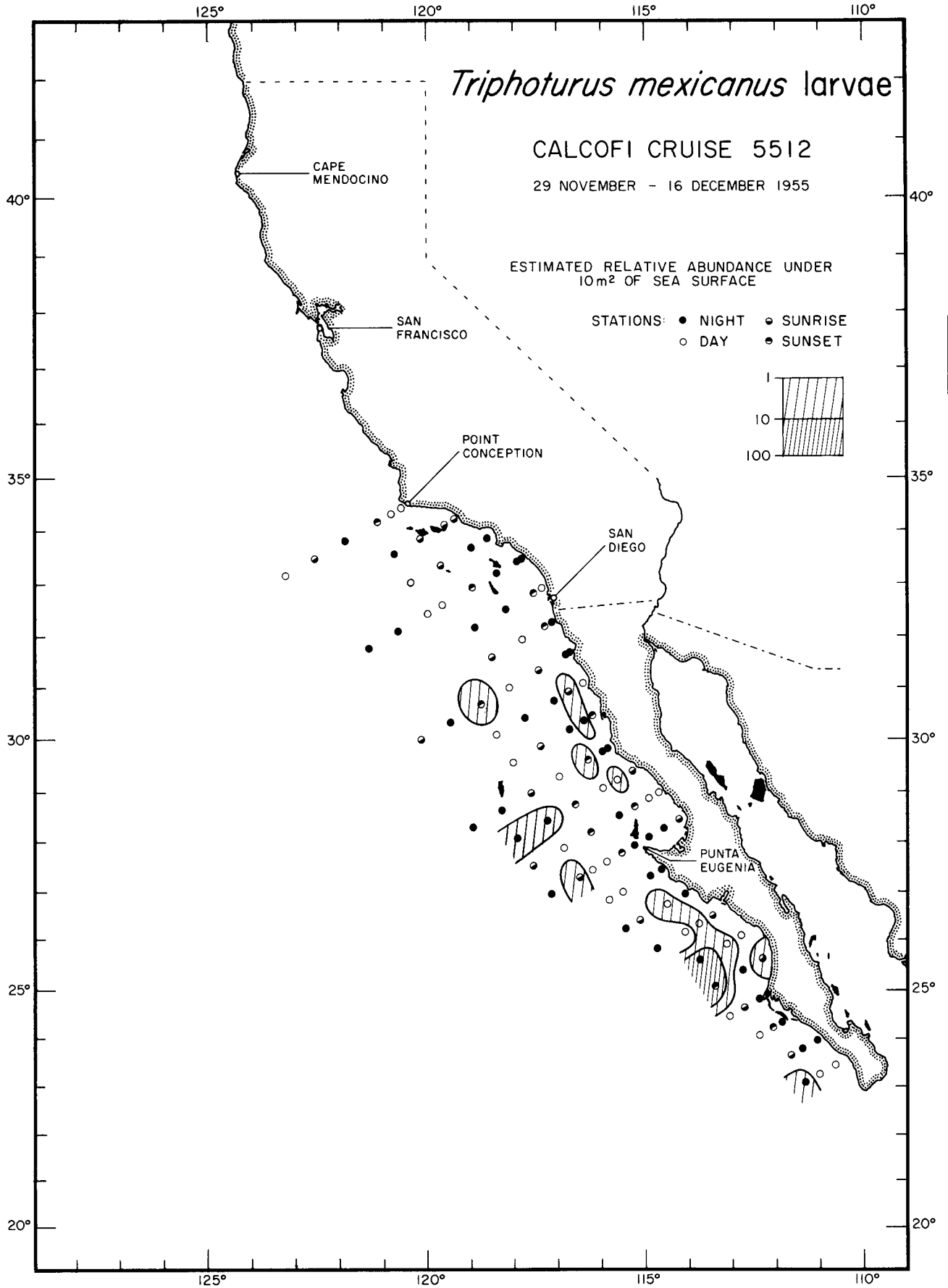
Triphoturus mexicanus larvae

5511



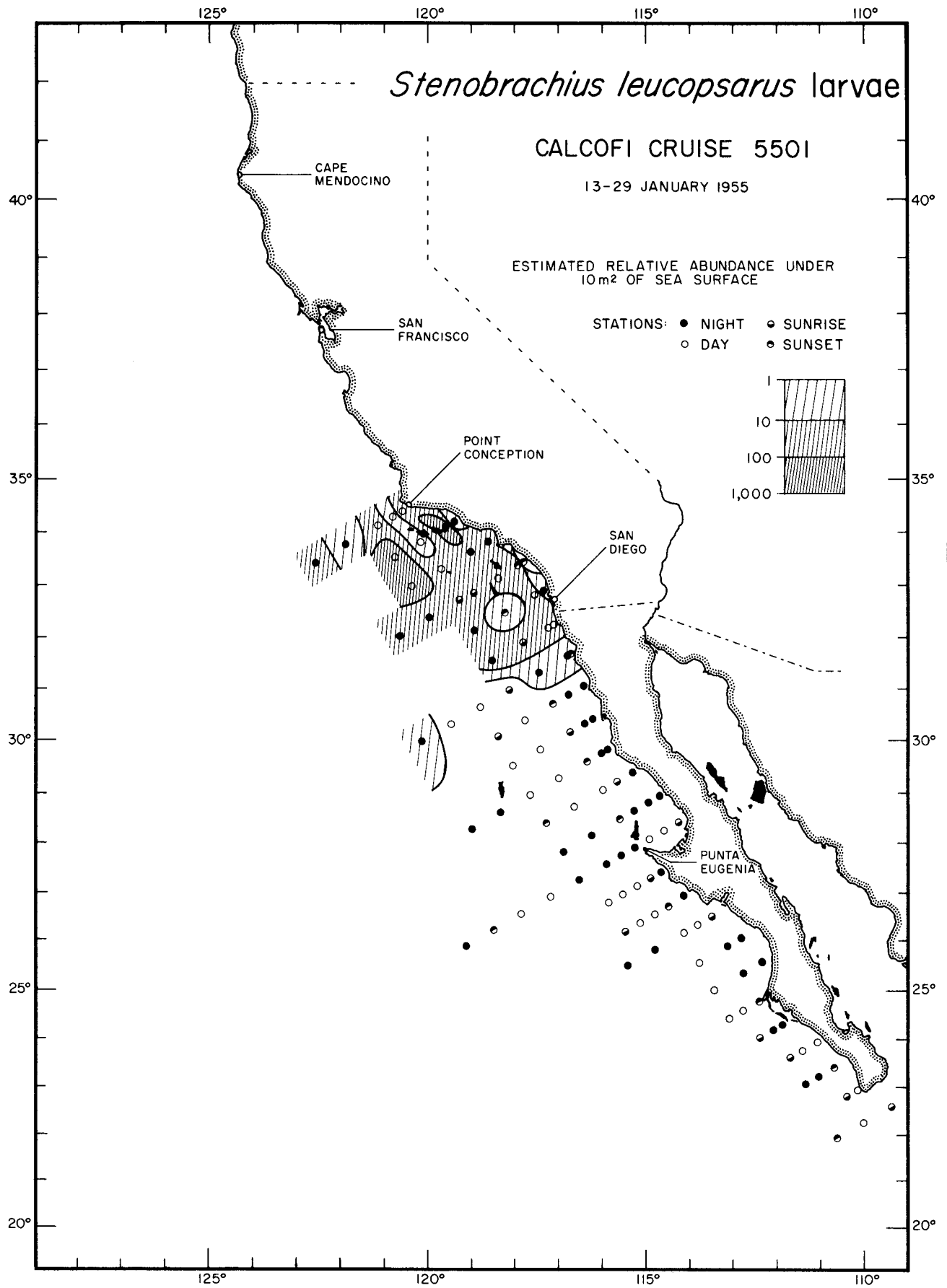
Triphoturus mexicanus larvae

5711



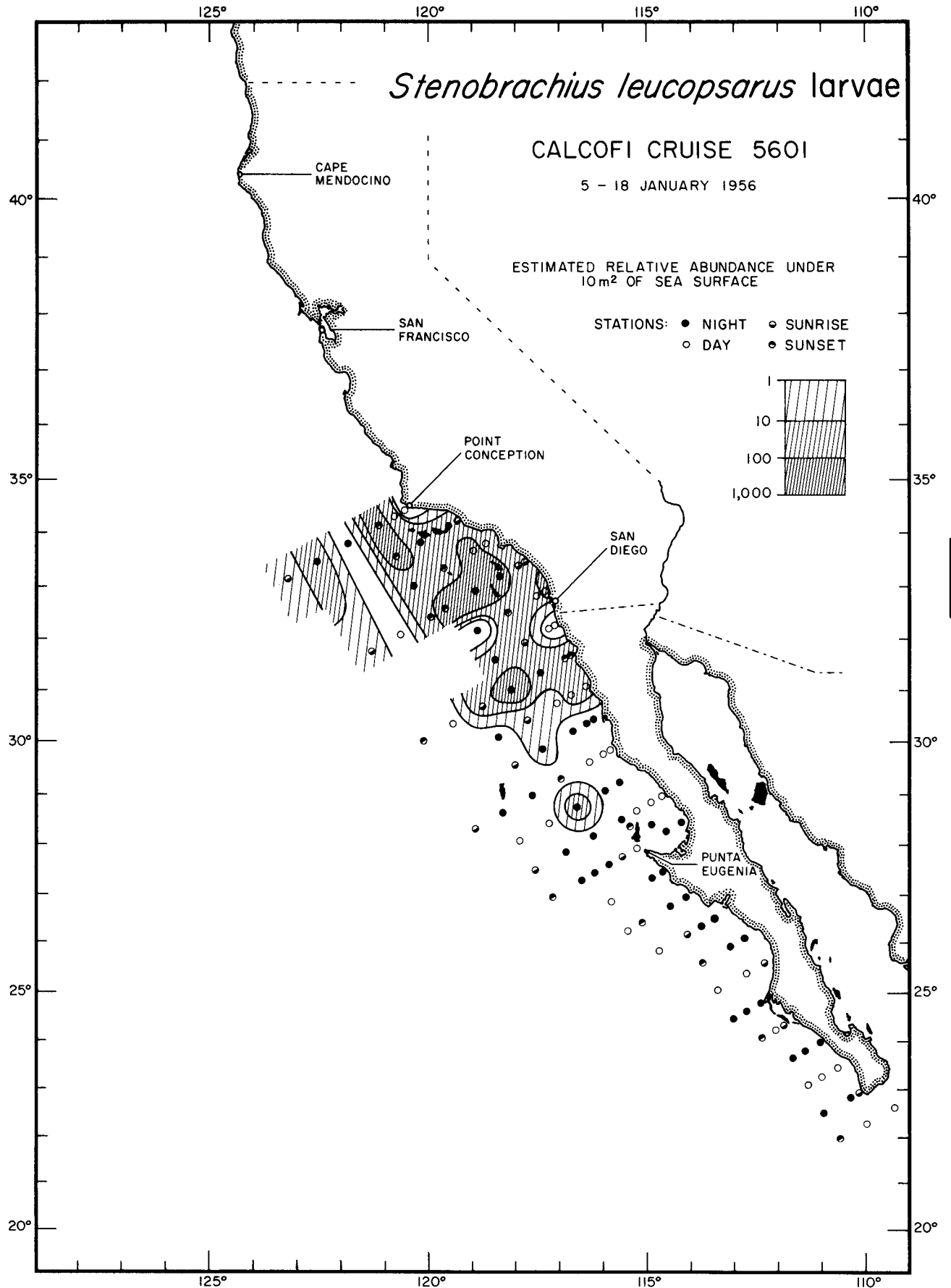
Triphoturus mexicanus larvae

5512



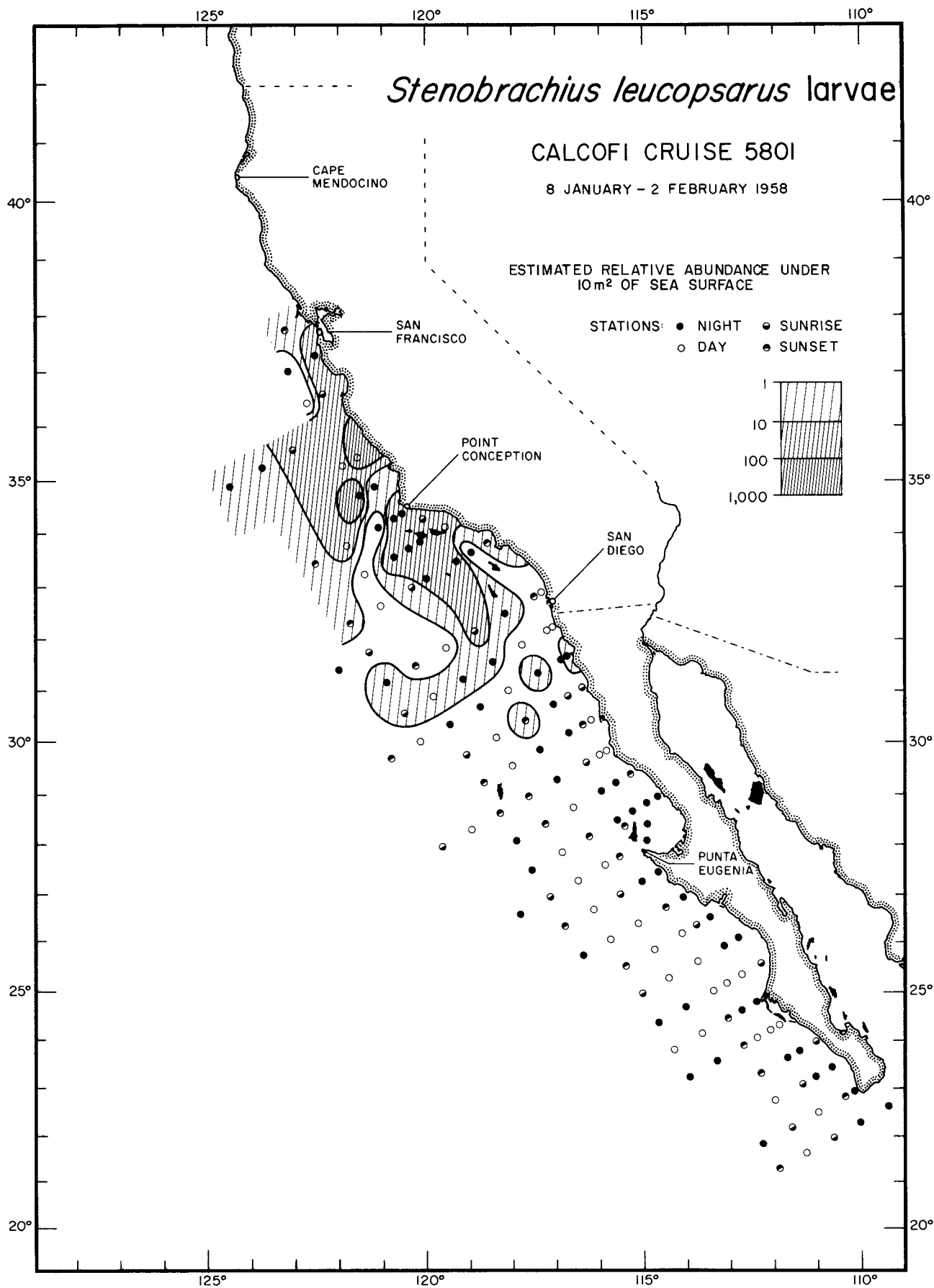
Stenobranchius leucopsarus larvae

5501



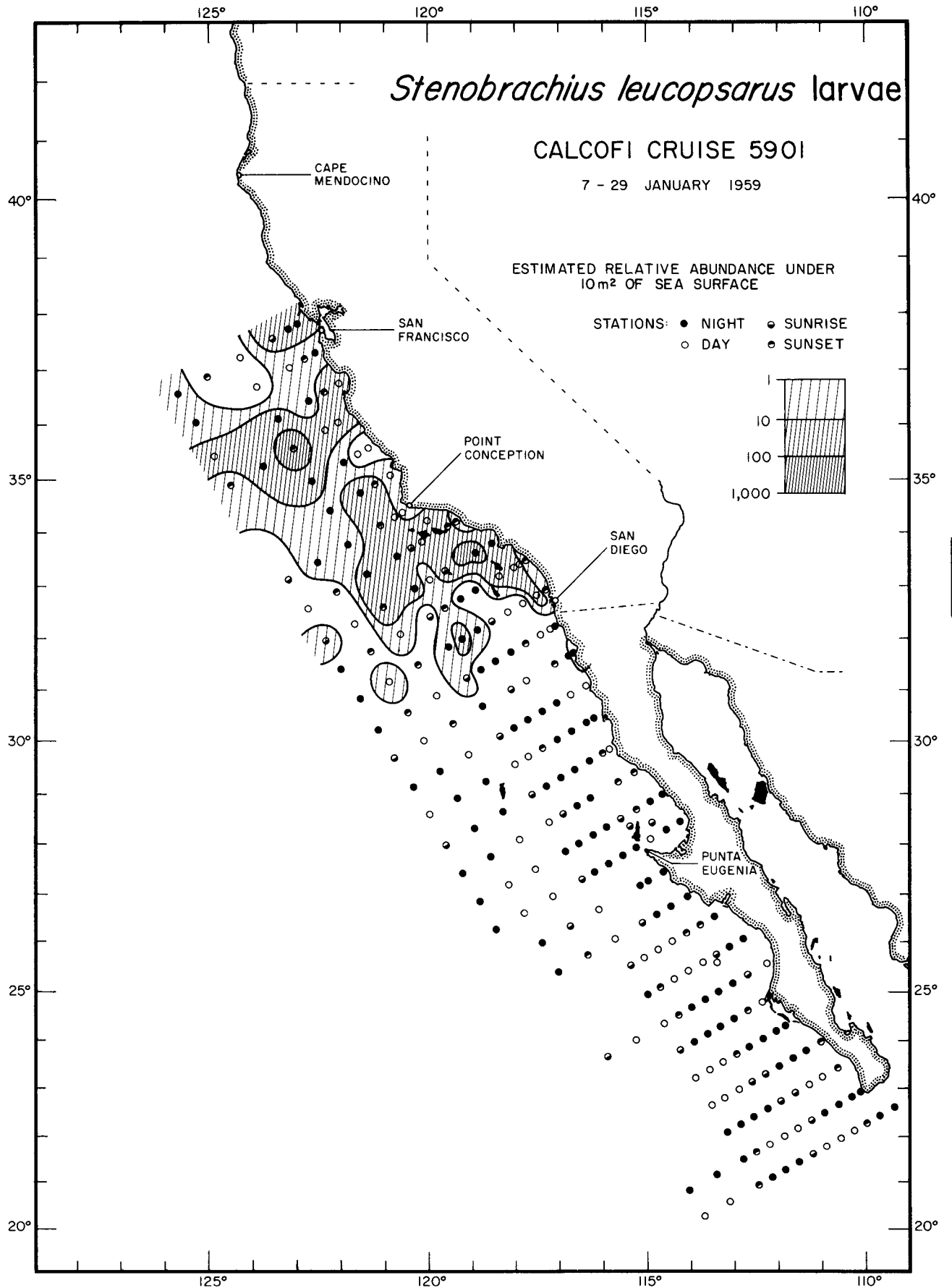
Stenobranchius leucopsarus larvae

5601



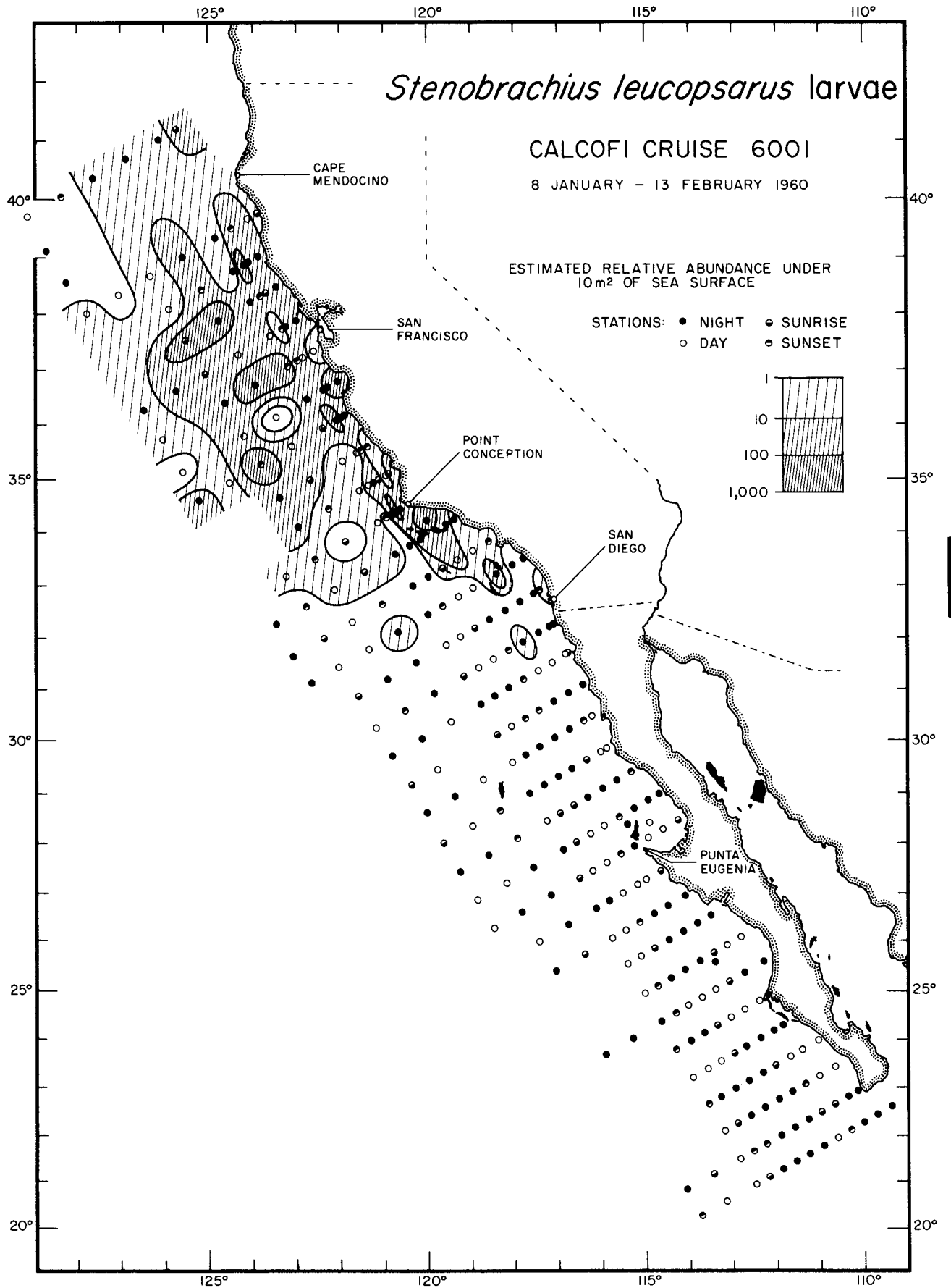
Stenobranchius leucopsarus larvae

5801



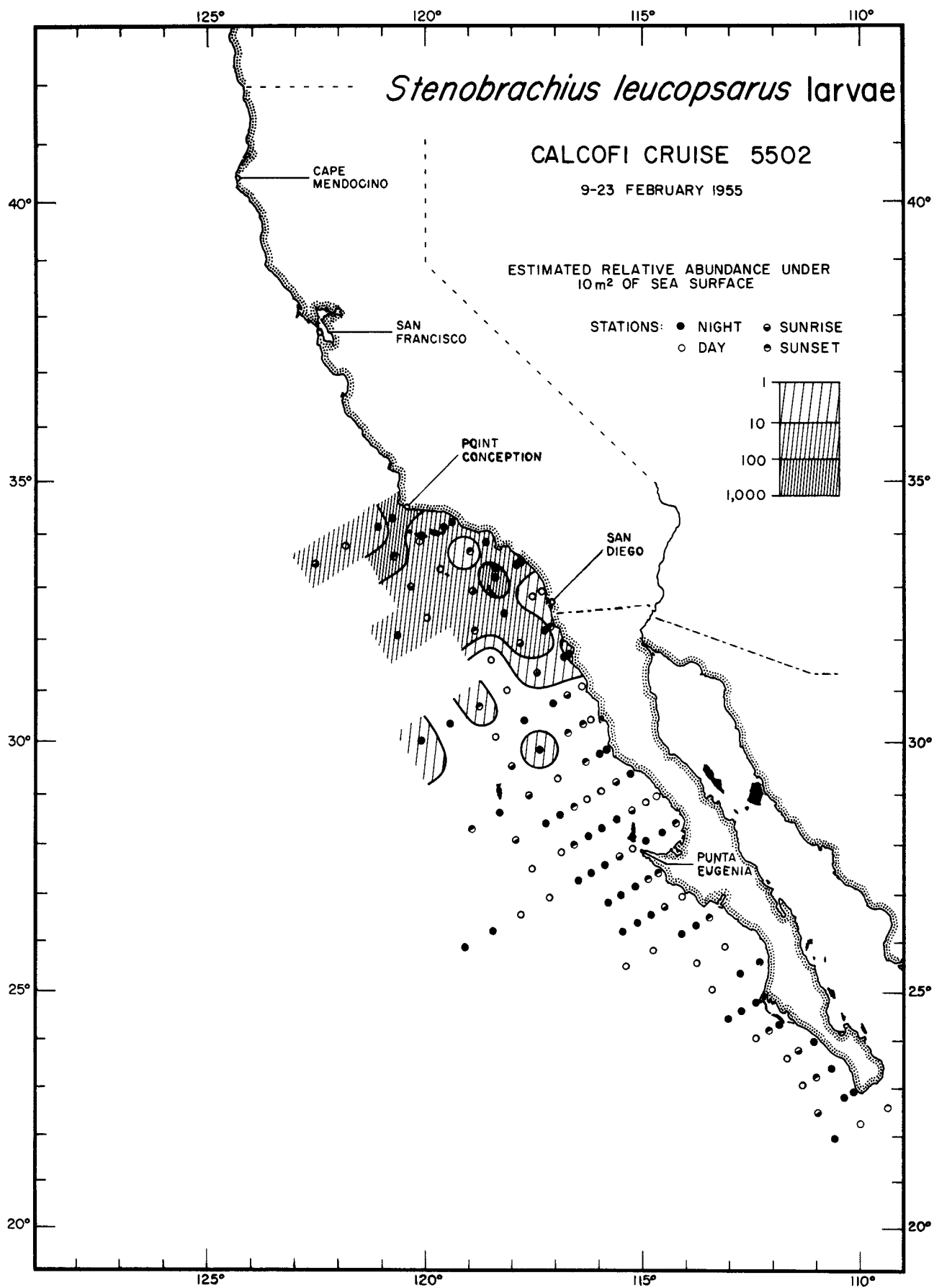
Stenobranchius leucopsarus larvae

5901



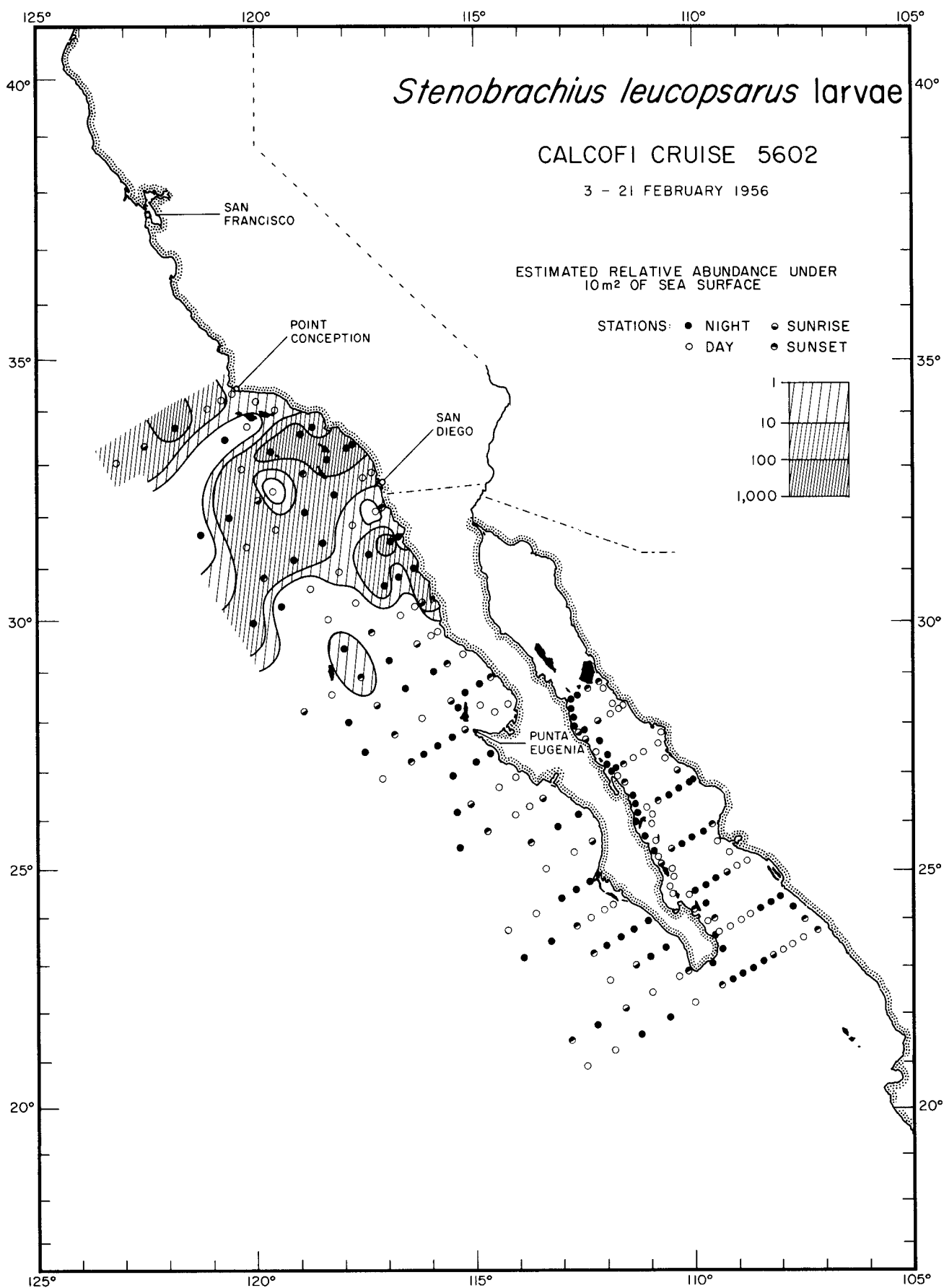
Stenobranchius leucopsarus larvae

6001



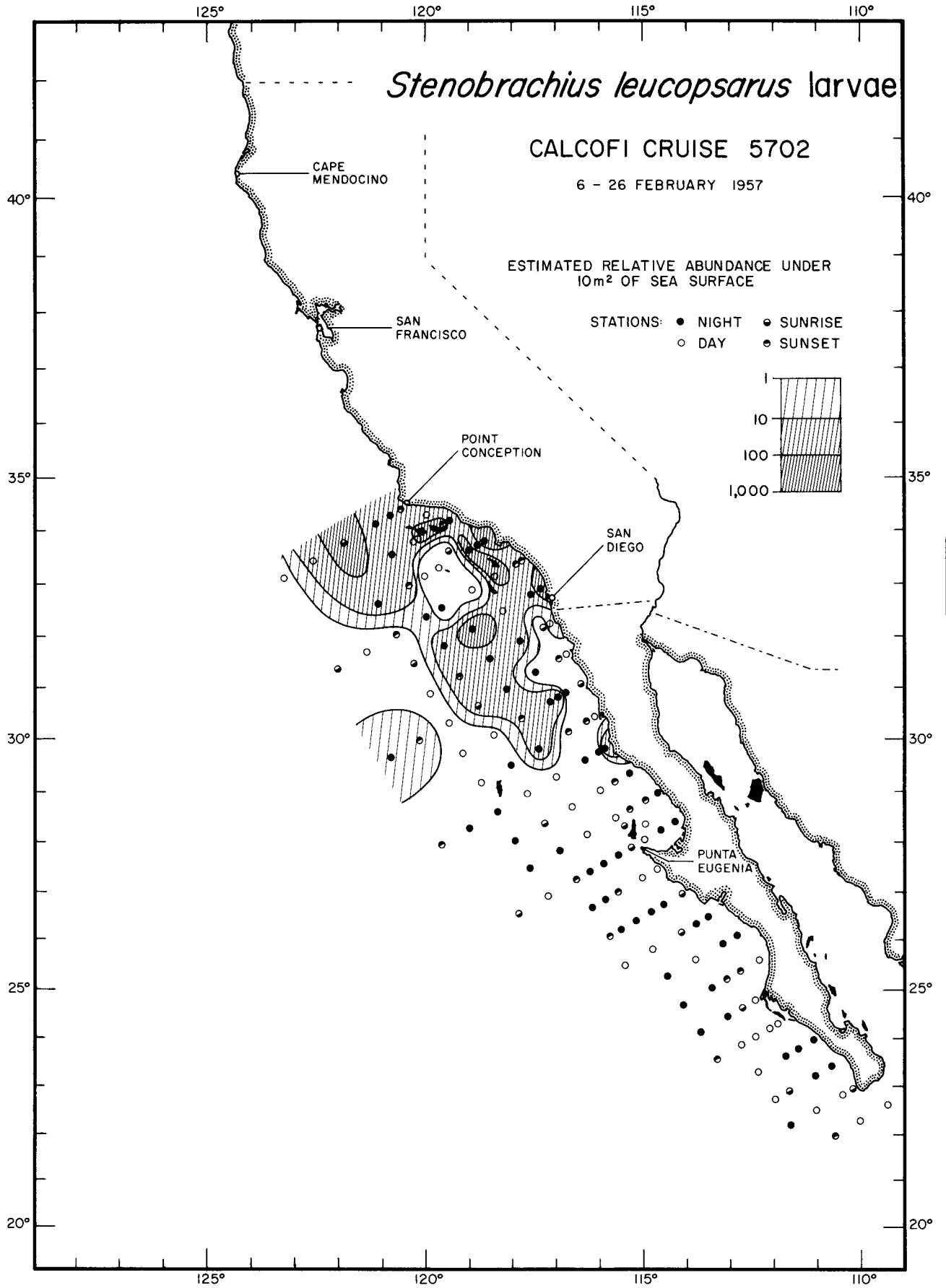
Stenobranchius leucopsarus larvae

5502



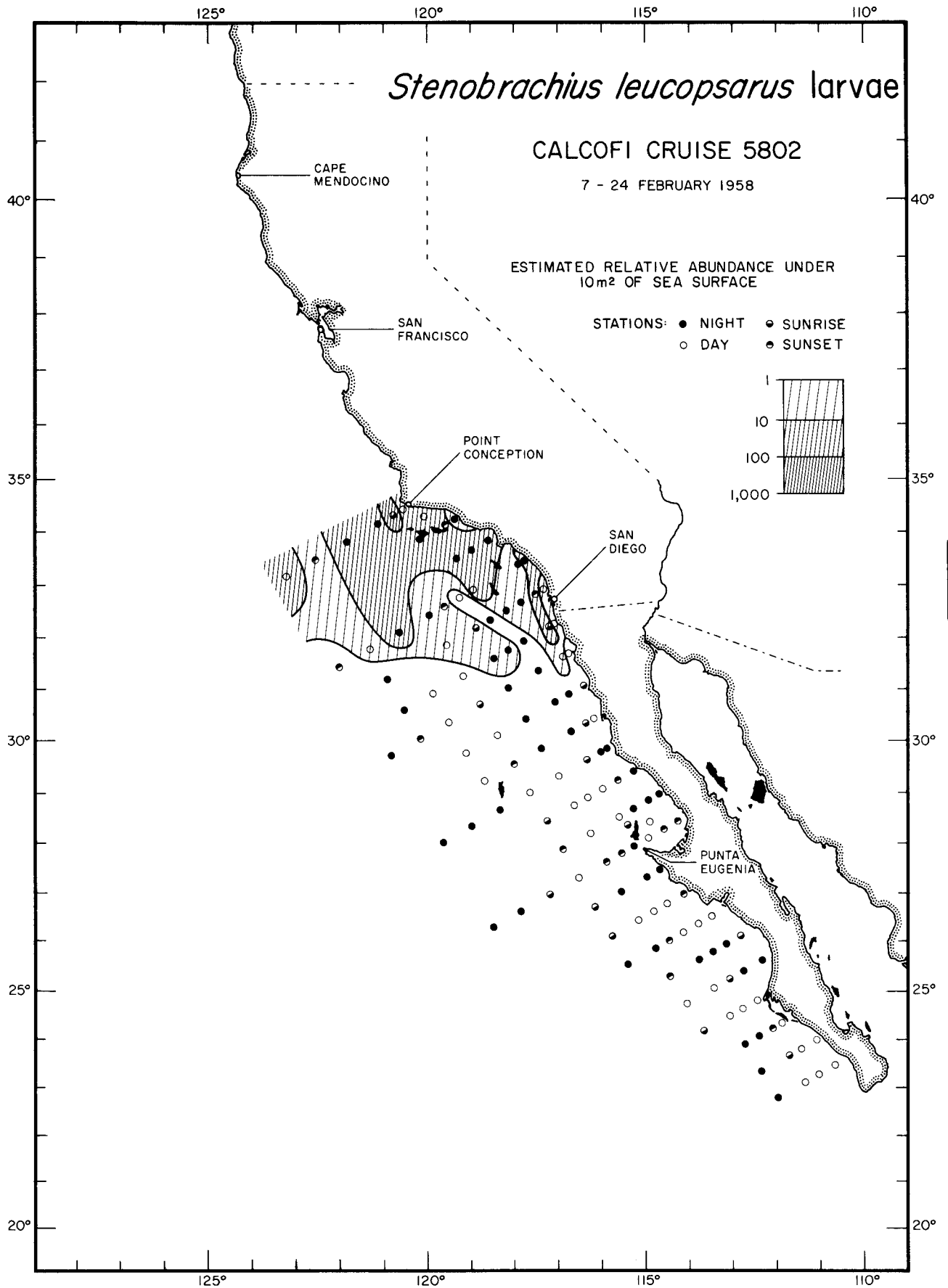
Stenobranchius leucopsarus larvae

5602



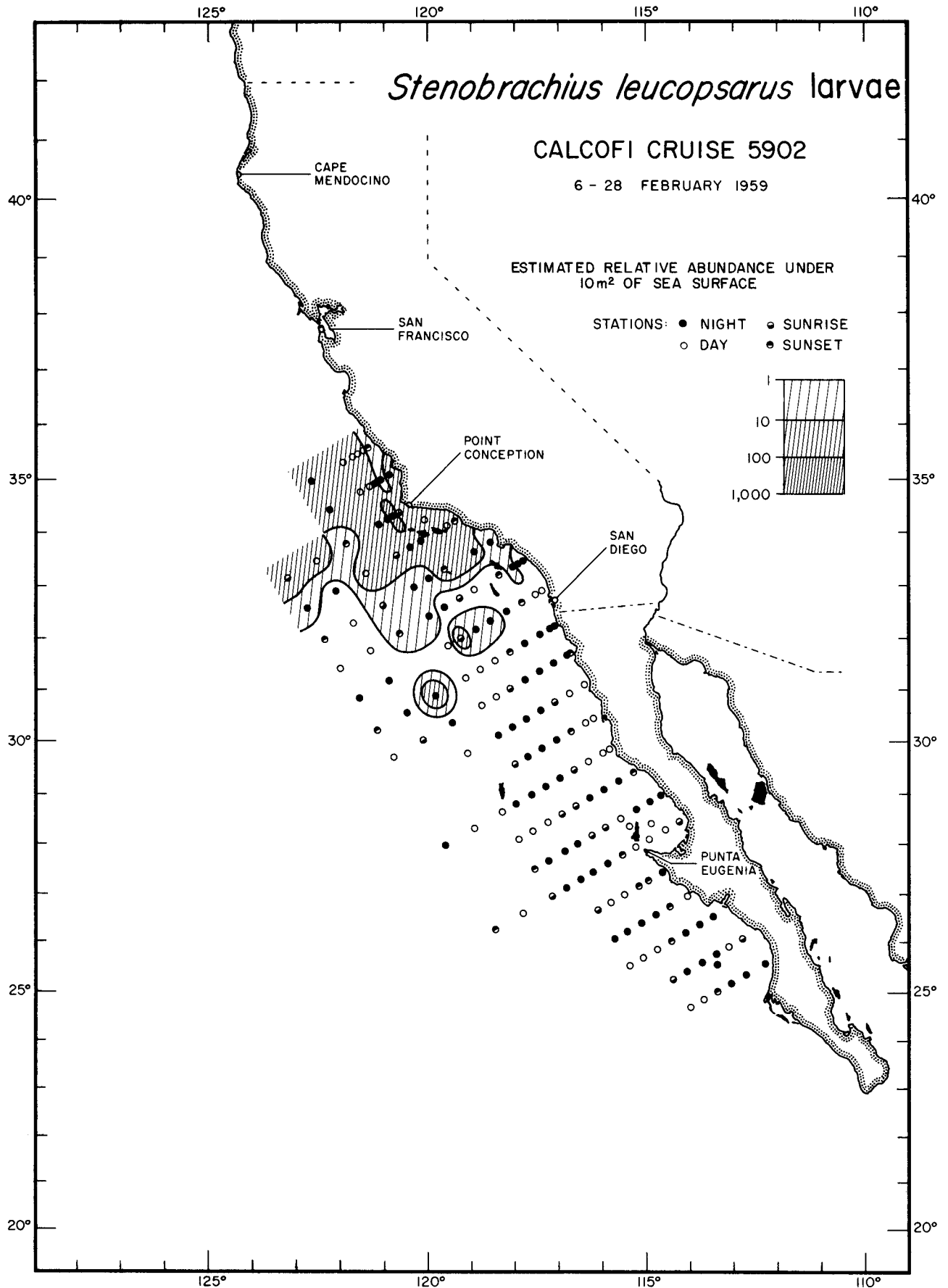
Stenobranchius leucopsarus larvae

5702



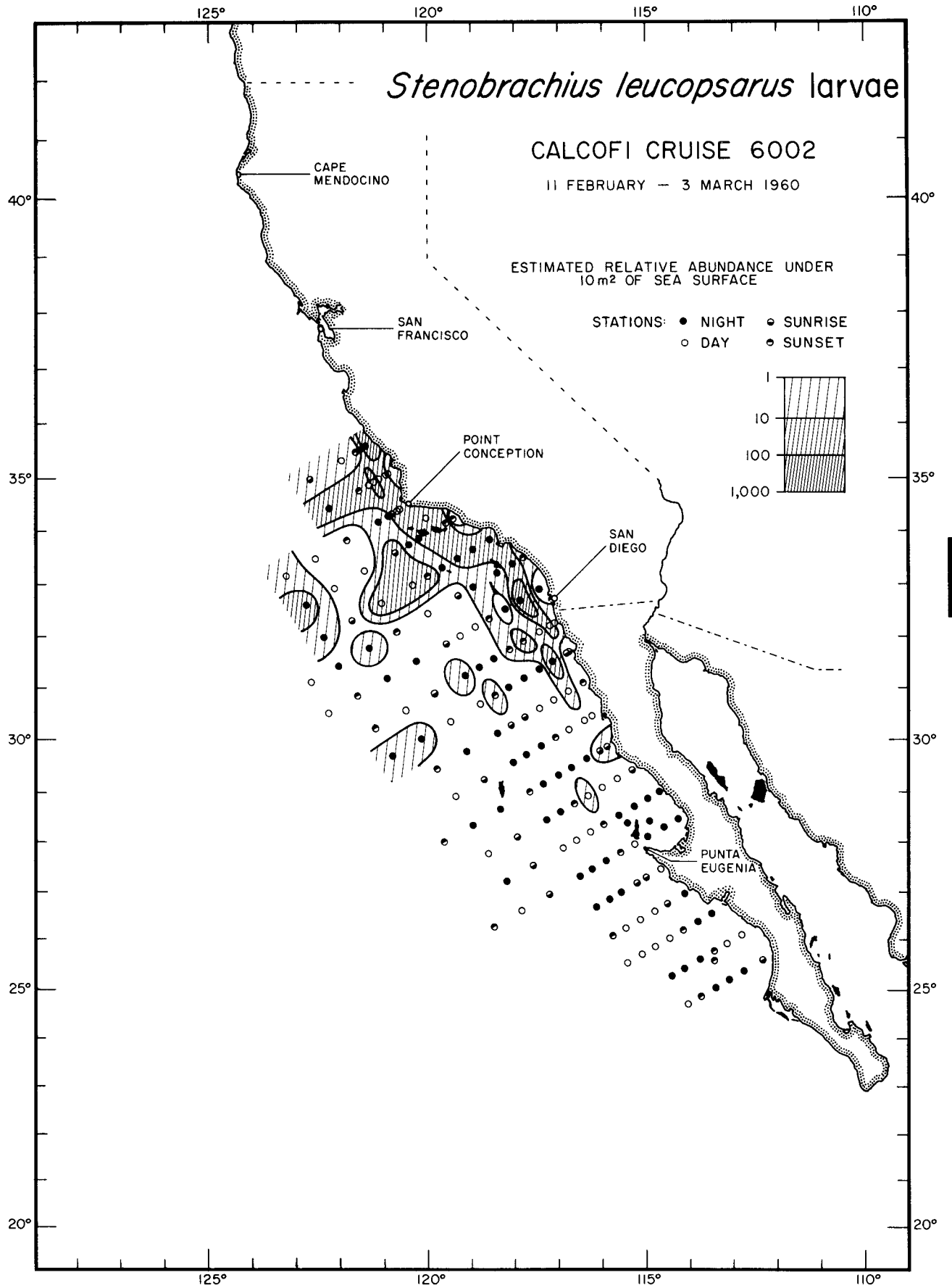
Stenobranchius leucopsarus larvae

5802



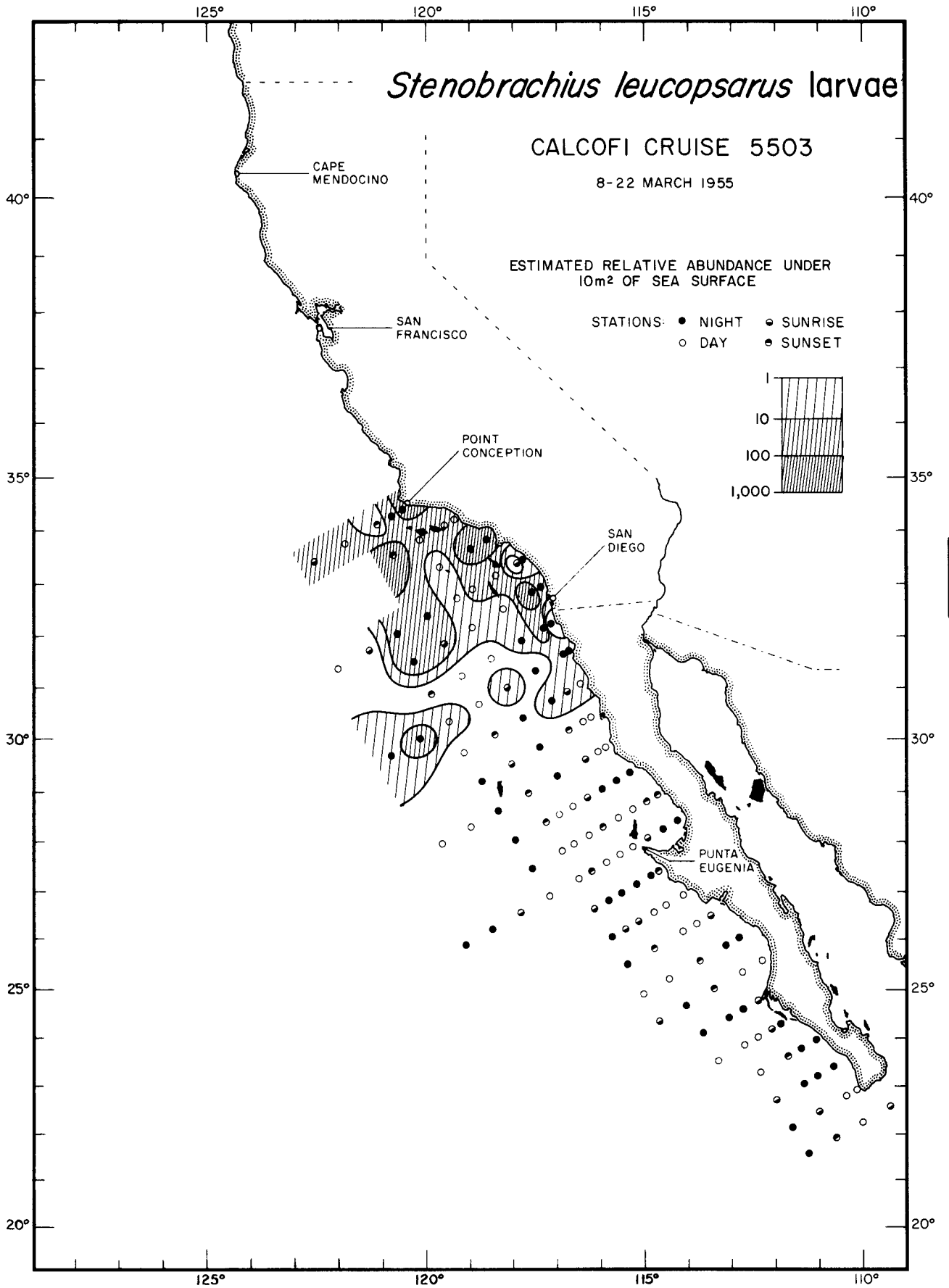
Stenobranchius leucopsarus larvae

5902



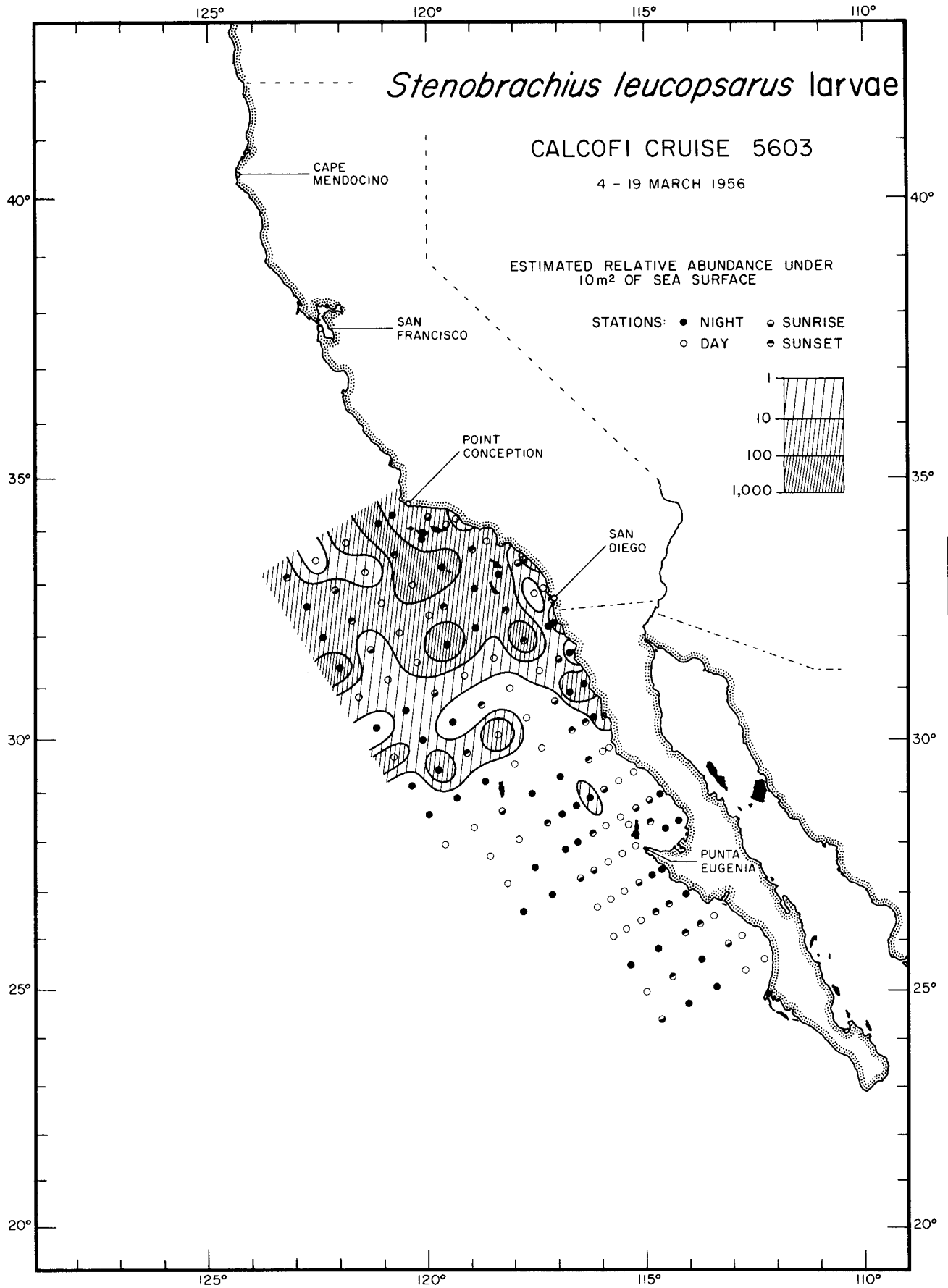
Stenobranchius leucopsarus larvae

6002



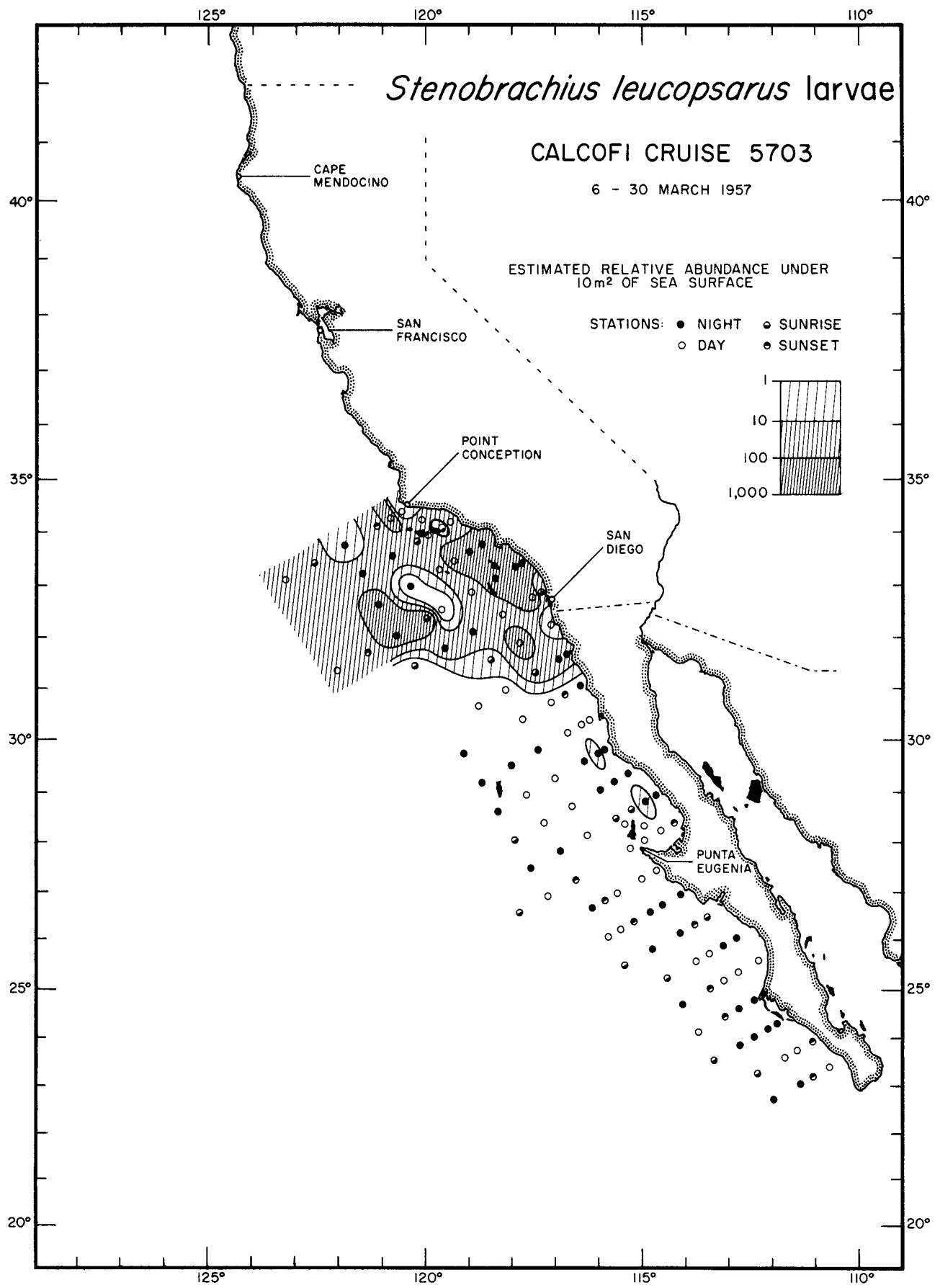
Stenobranchius leucopsarus larvae

5503



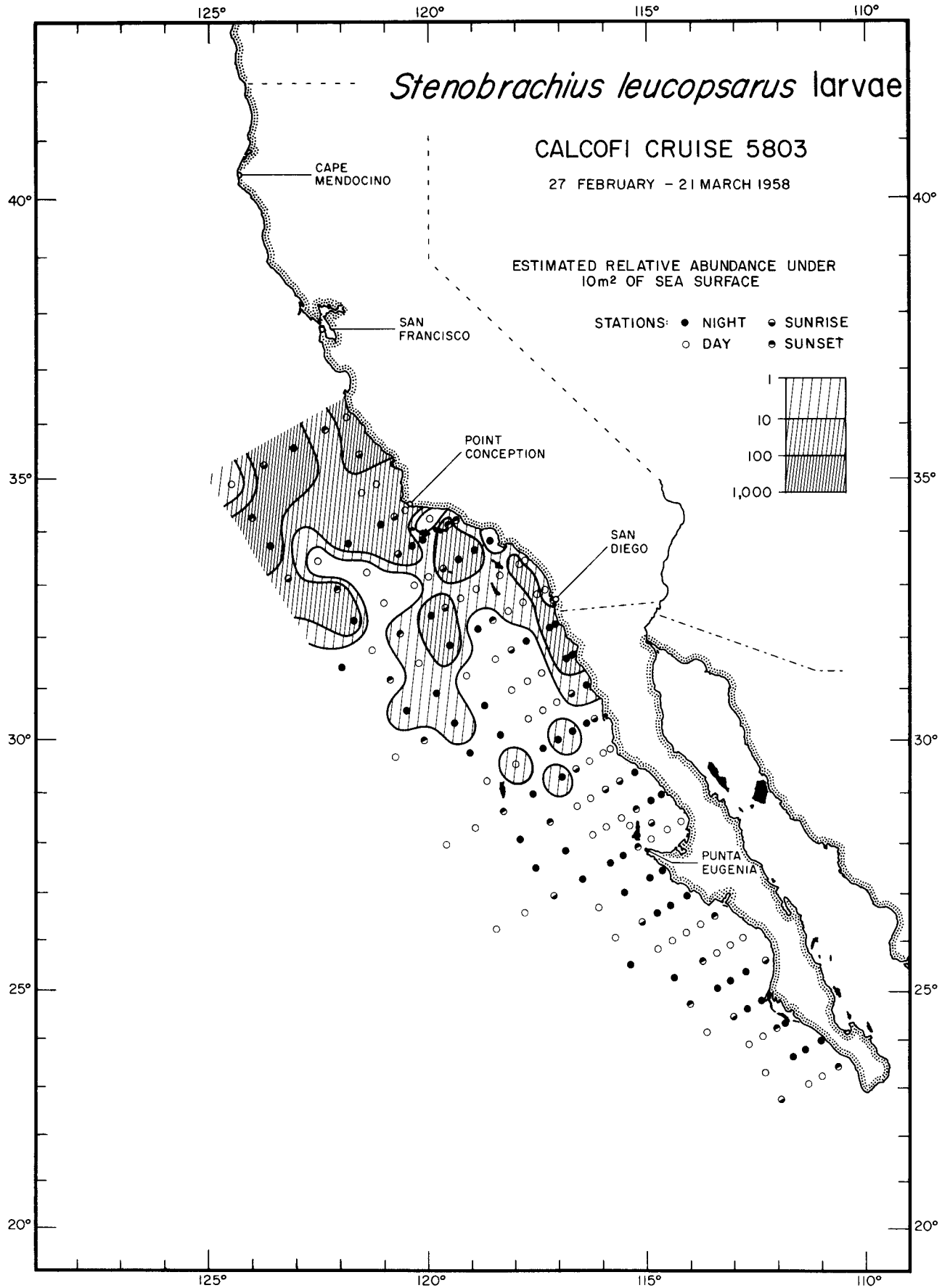
Stenobranchius leucopsarus larvae

5603



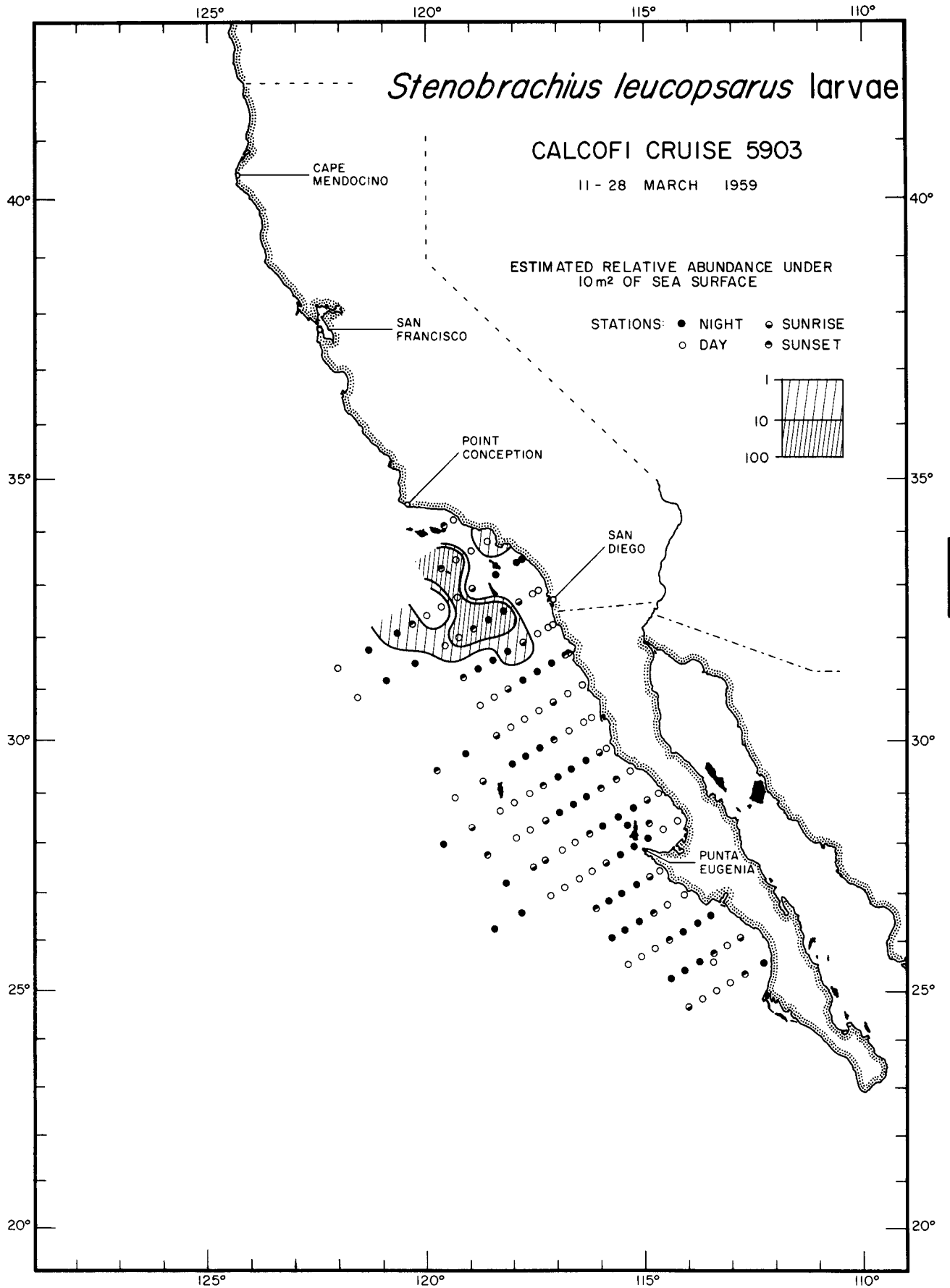
Stenobranchius leucopsarus larvae

5703



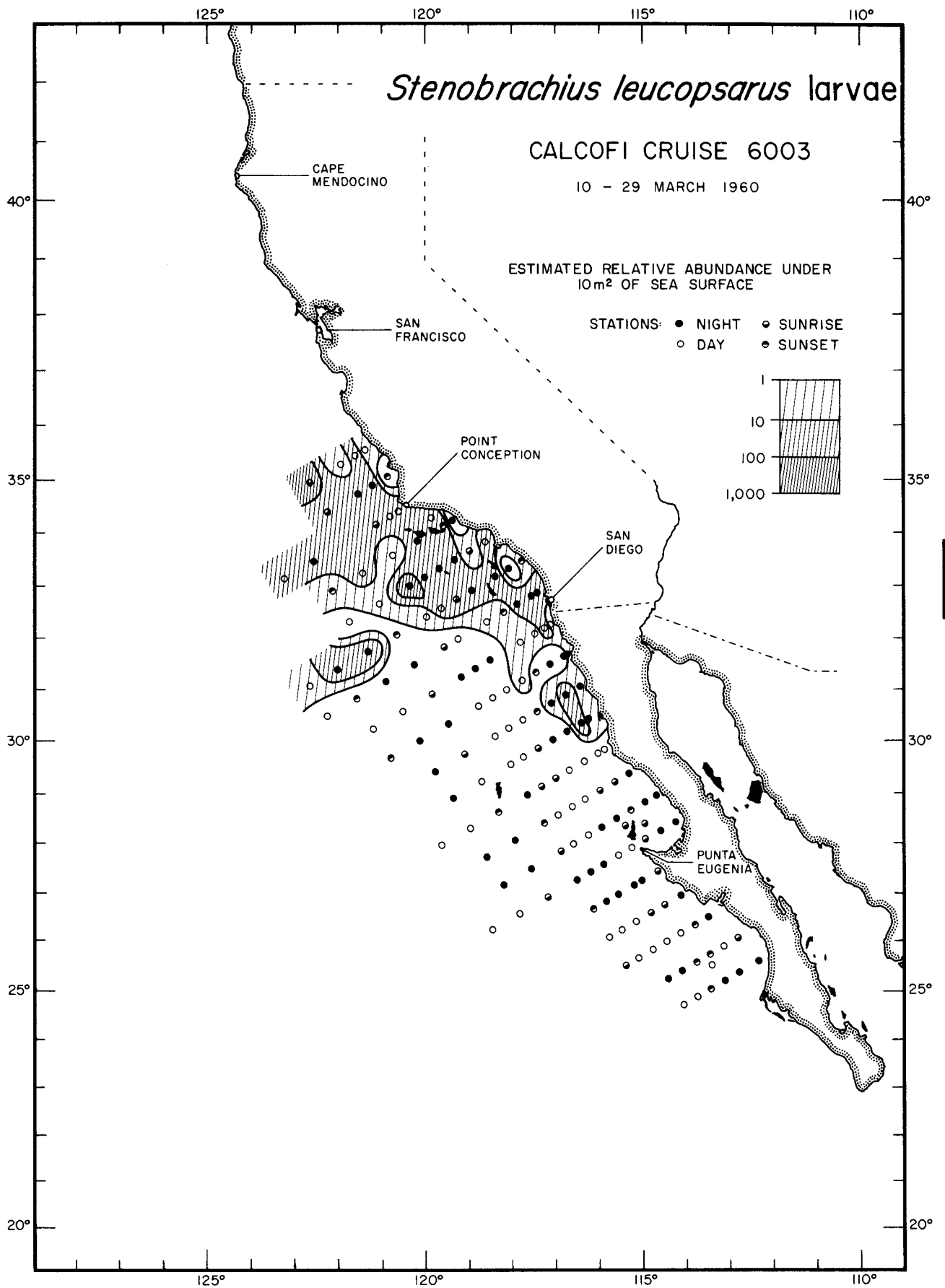
Stenobranchius leucopsarus larvae

5803



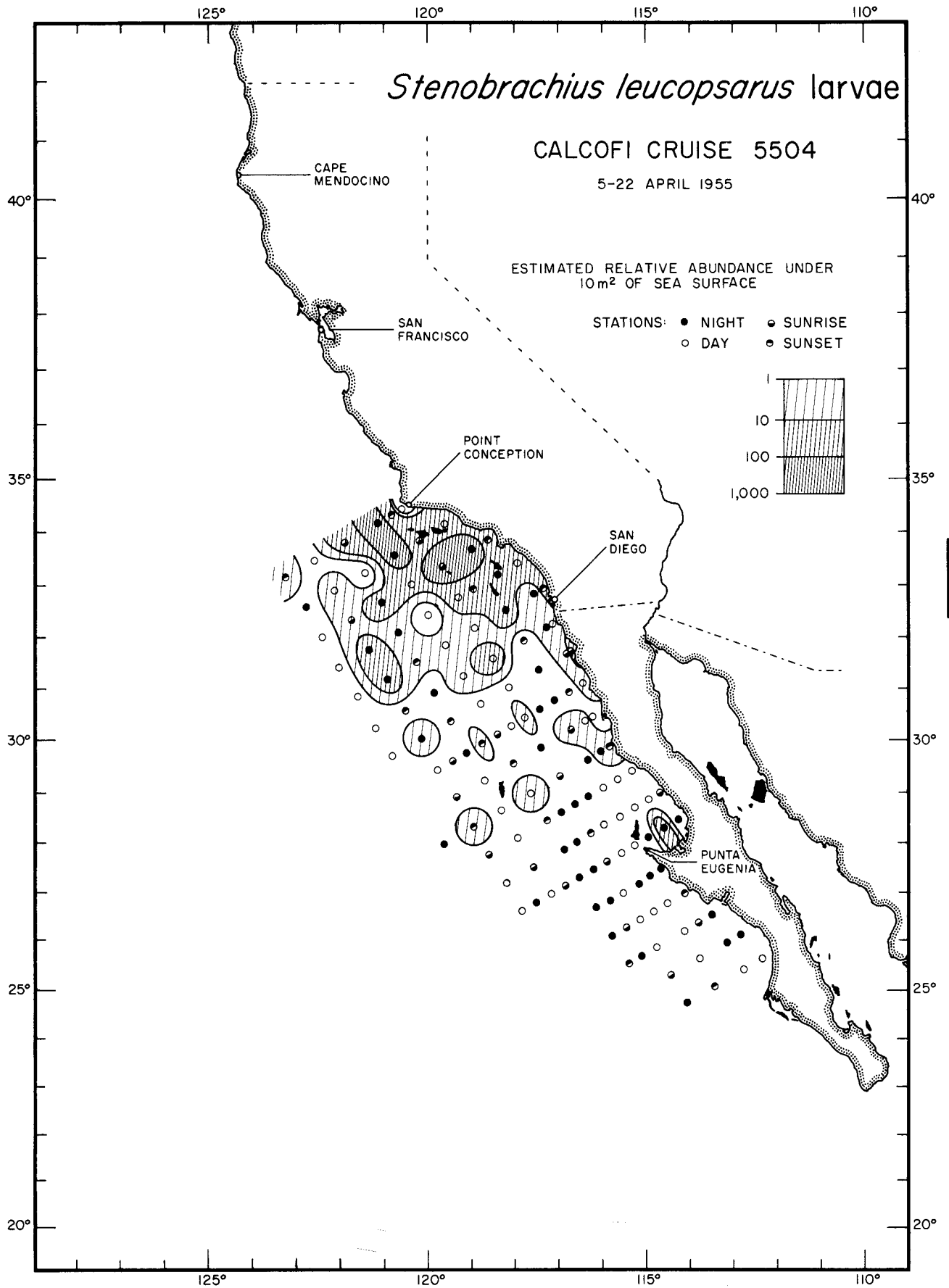
Stenobranchius leucopsarus larvae

5903



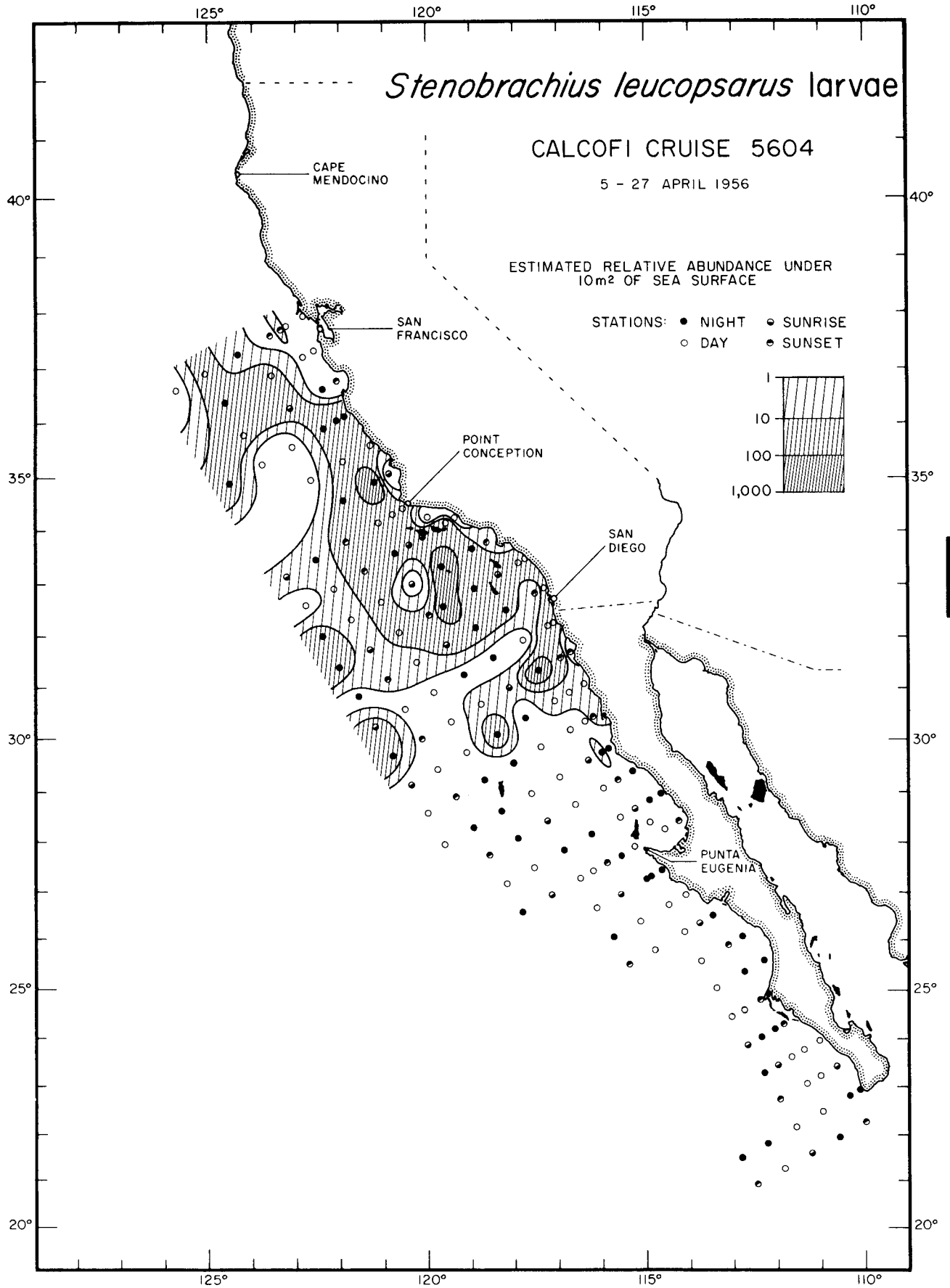
Stenobranchius leucopsarus larvae

6003



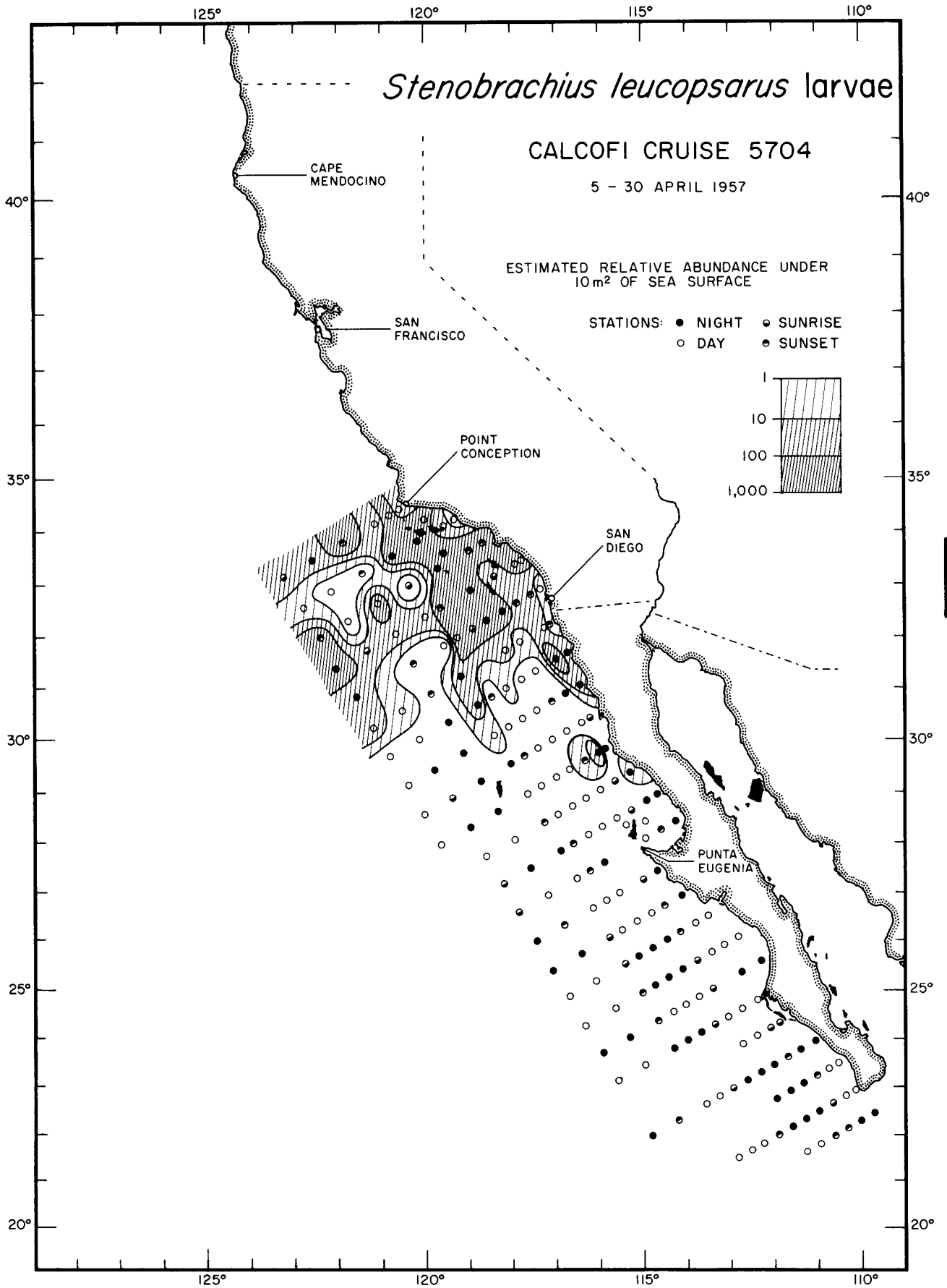
Stenobranchius leucopsarus larvae

5504



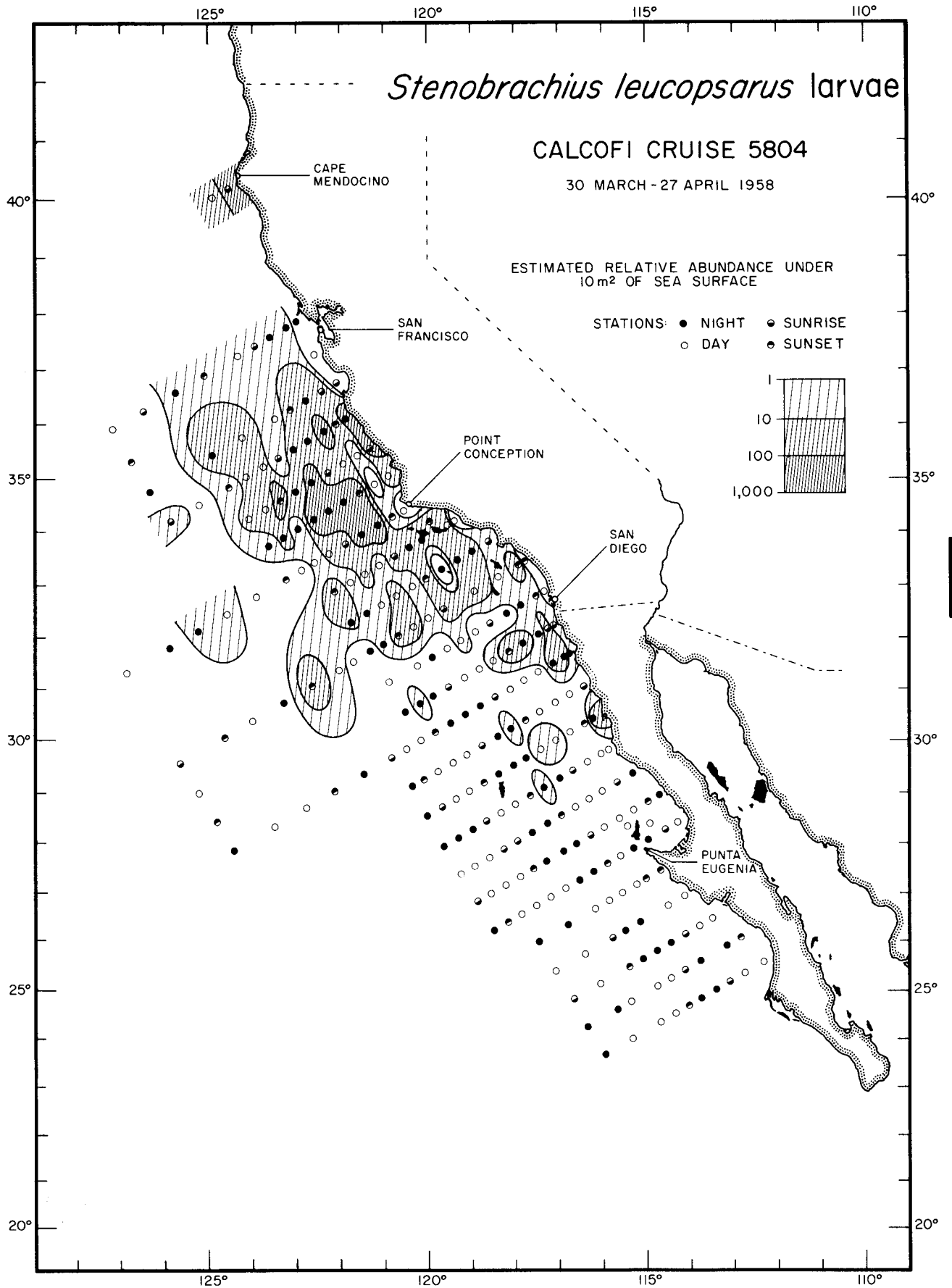
Stenobranchius leucopsarus larvae

5604



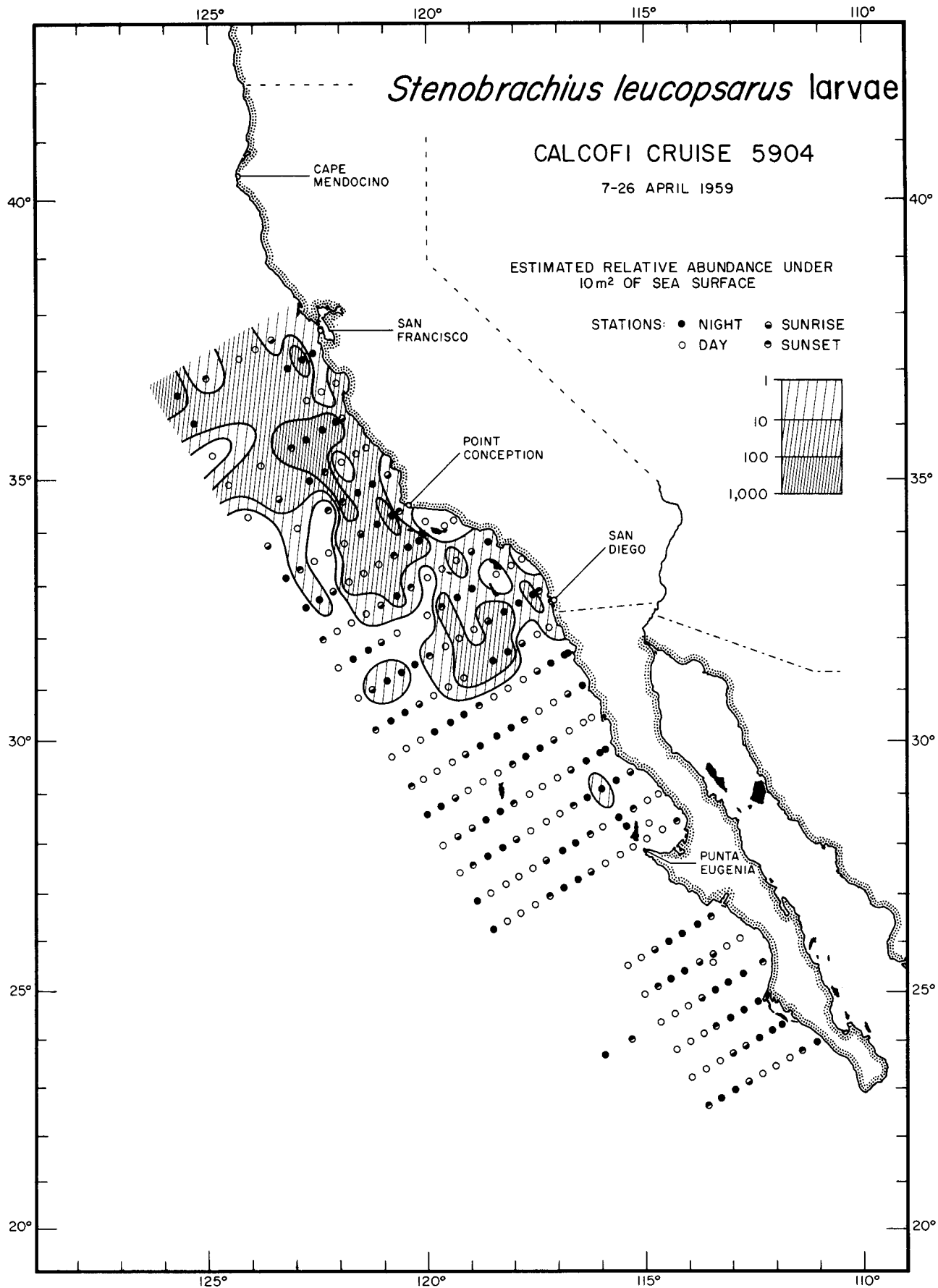
Stenobranchius leucopsarus larvae

5704



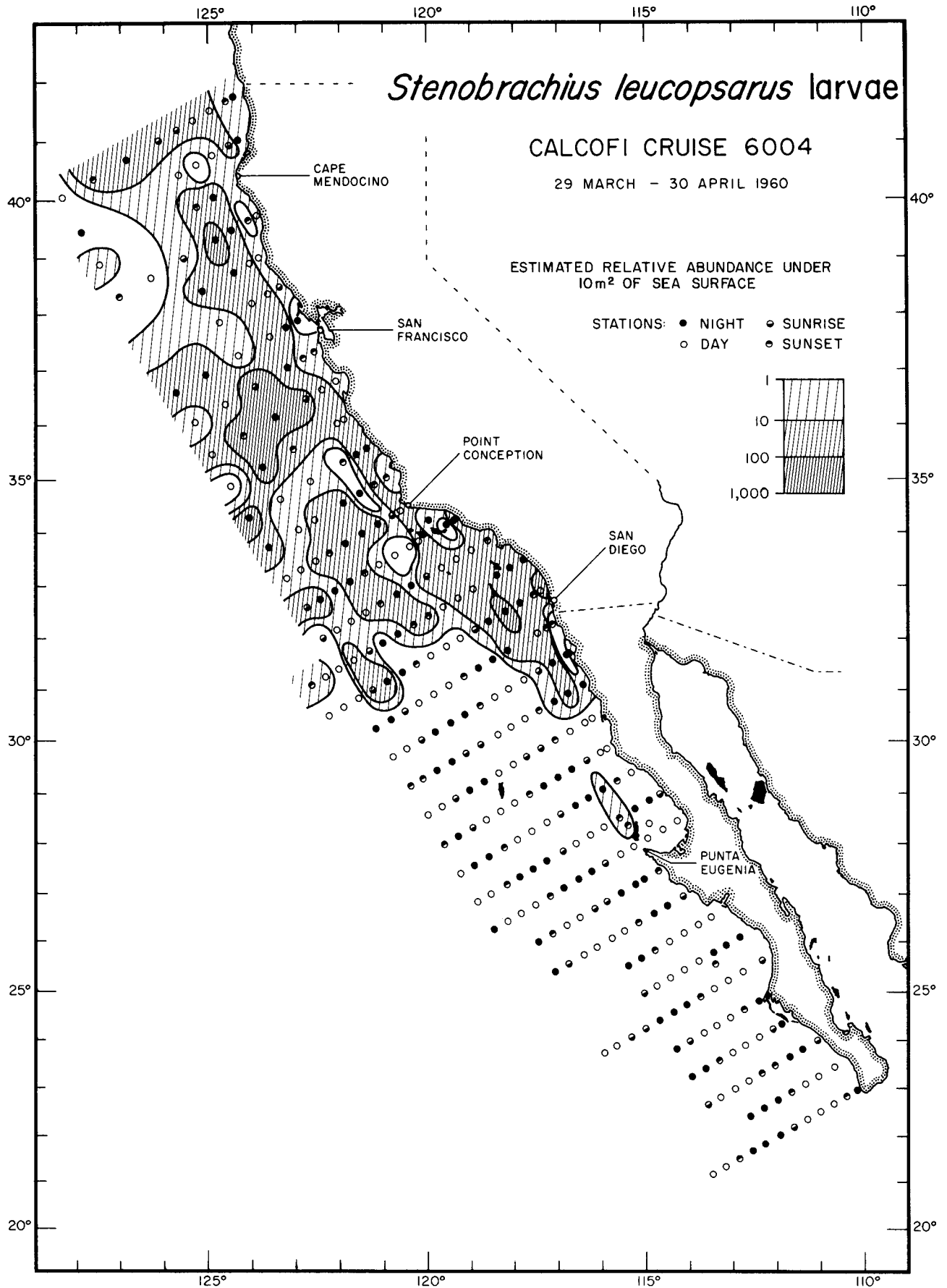
Stenobranchius leucopsarus larvae

5804

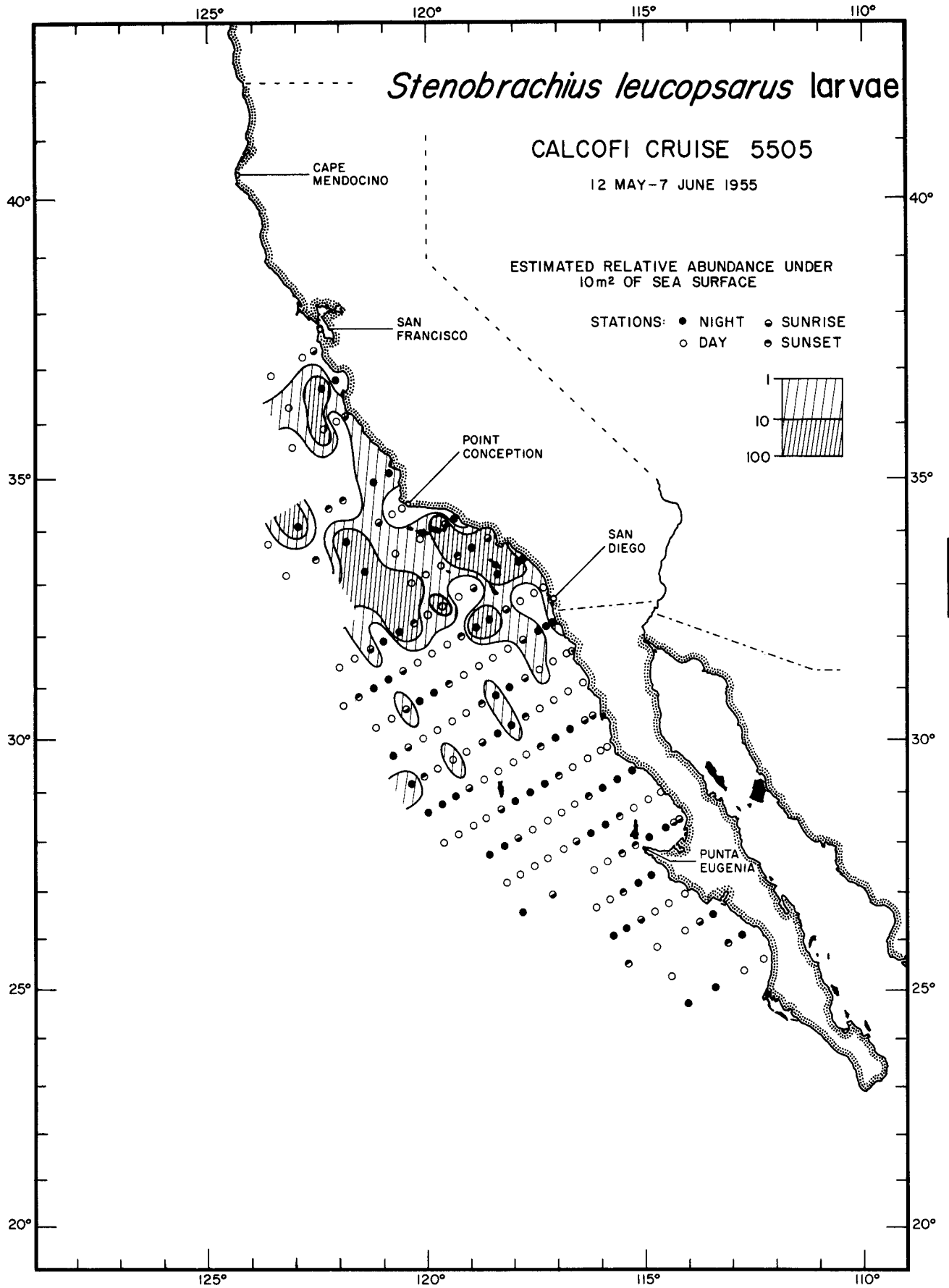


Stenobranchius leucopsarus larvae

5904



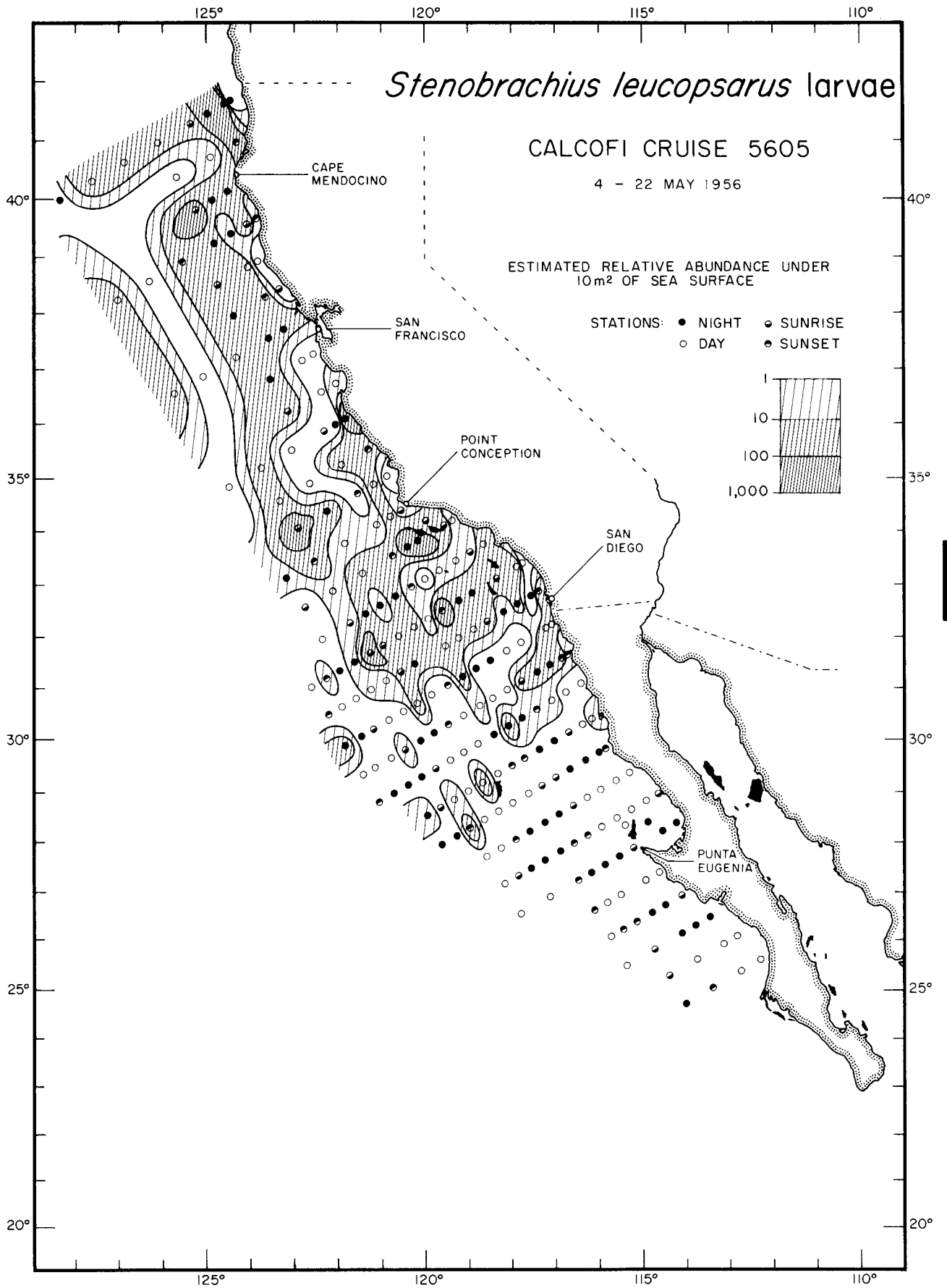
Stenobranchius leucopsarus larvae



Stenobranchius leucopsarus larvae

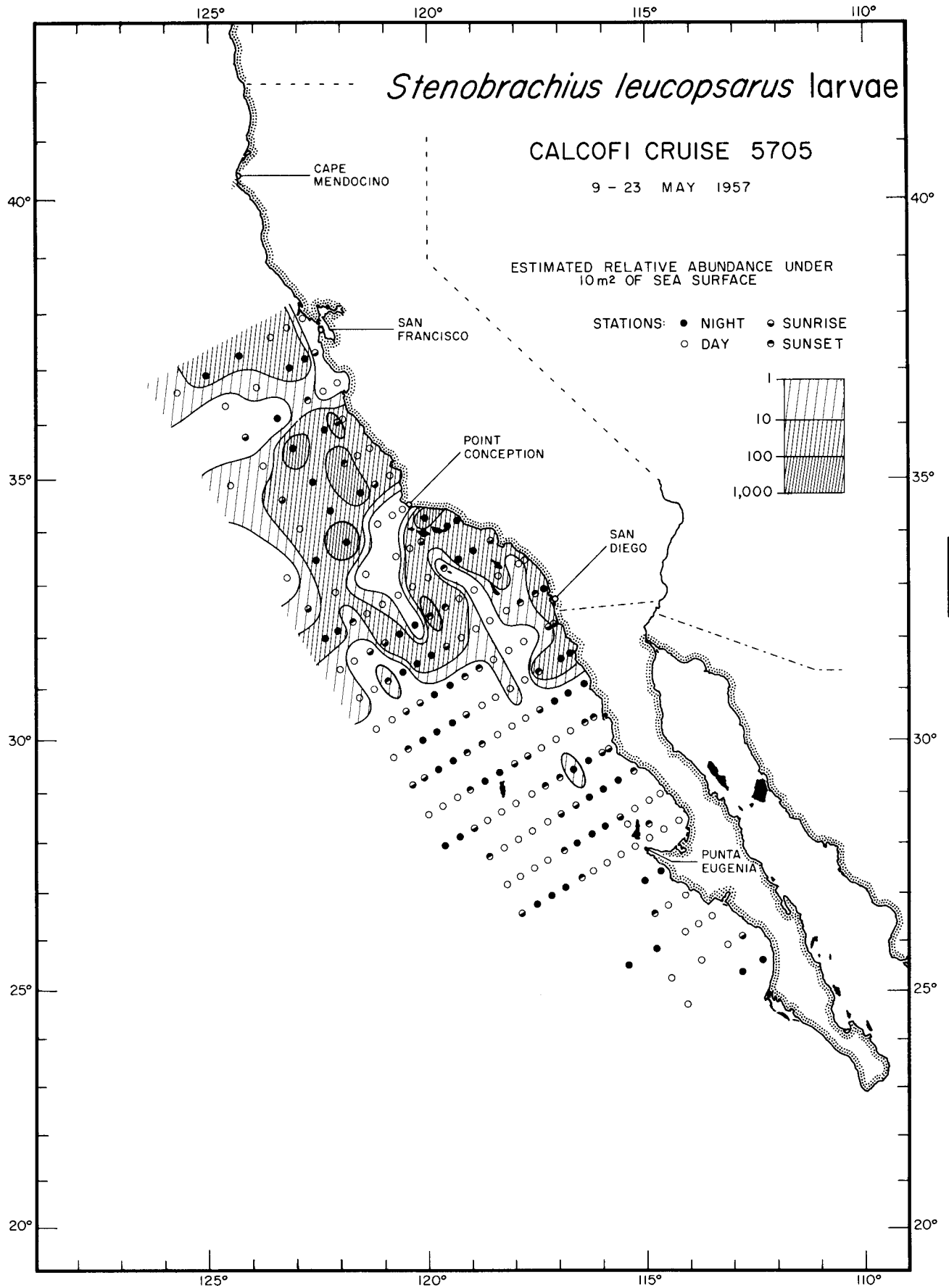
5505





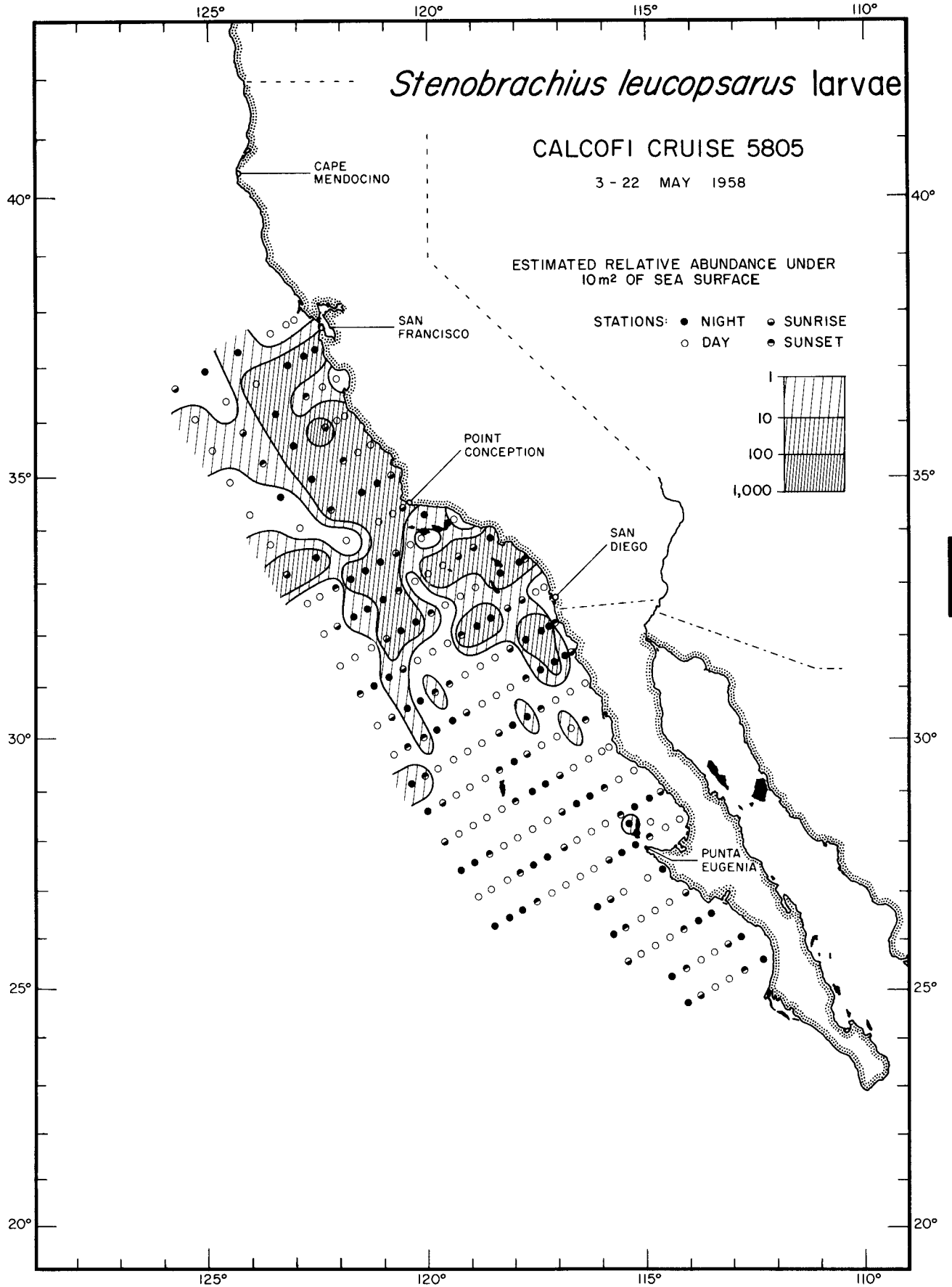
Stenobranchius leucopsarus larvae

5605



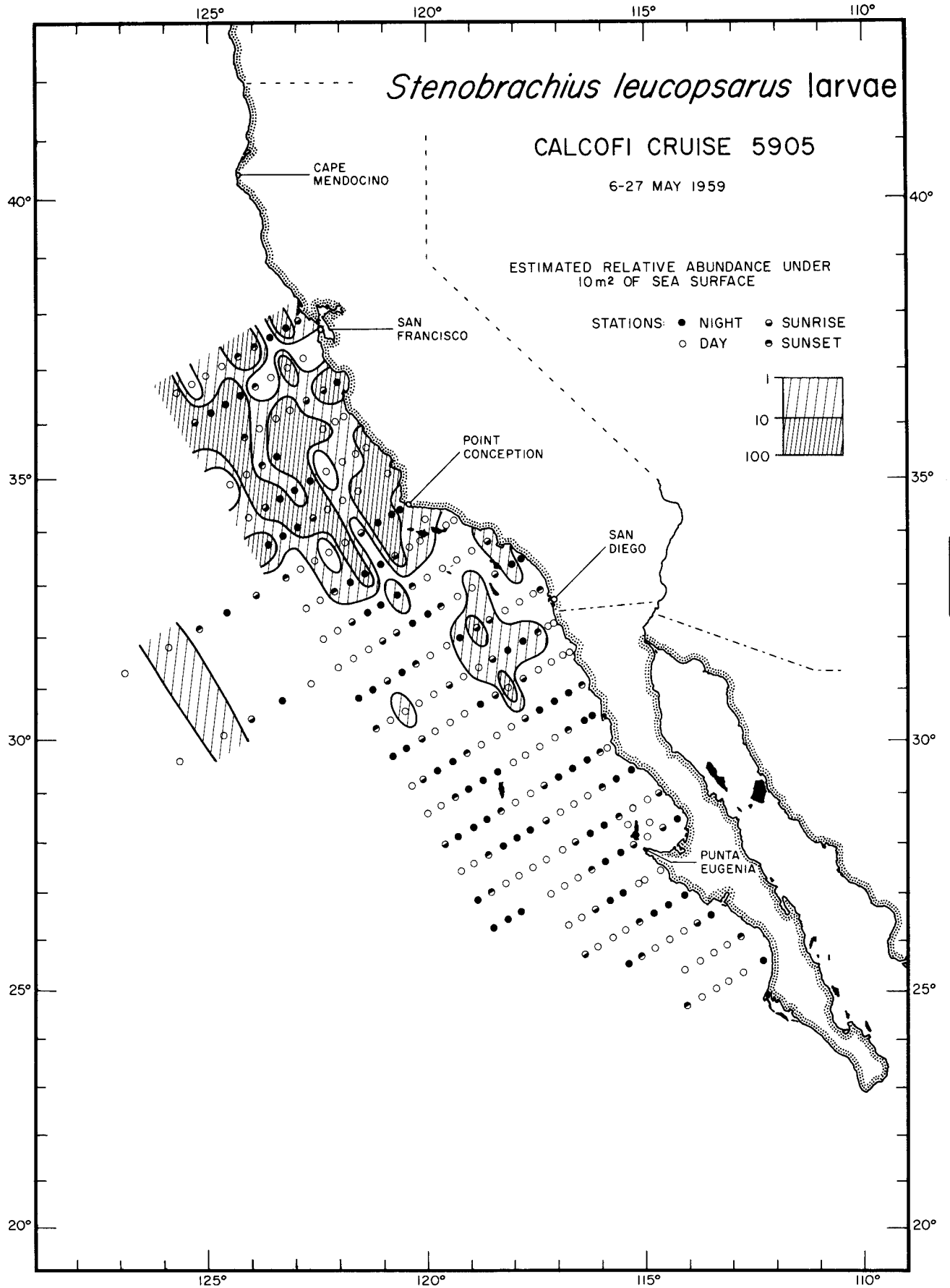
Stenobranchius leucopsarus larvae

5705



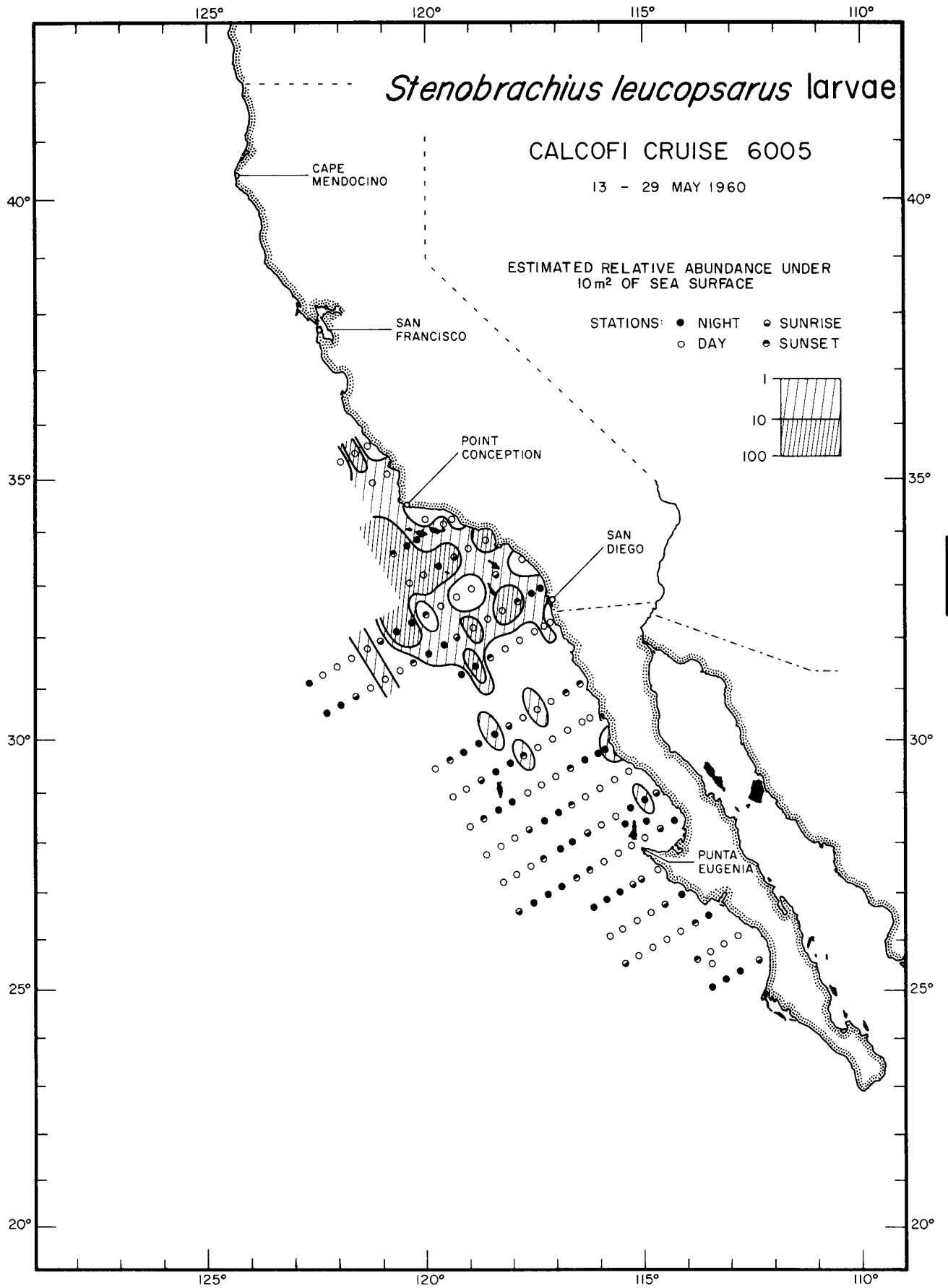
Stenobranchius leucopsarus larvae

5805



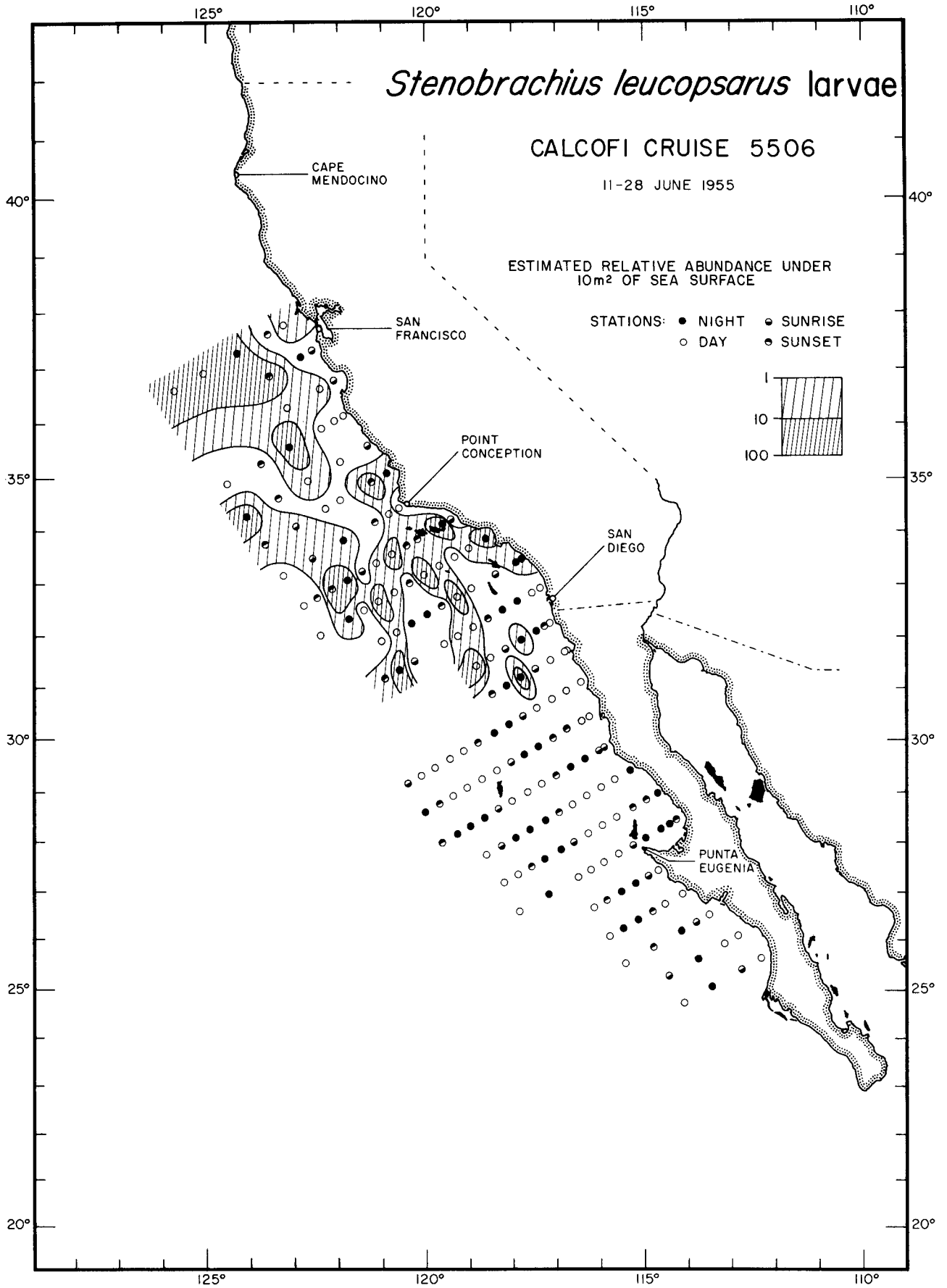
Stenobranchius leucopsarus larvae

5905

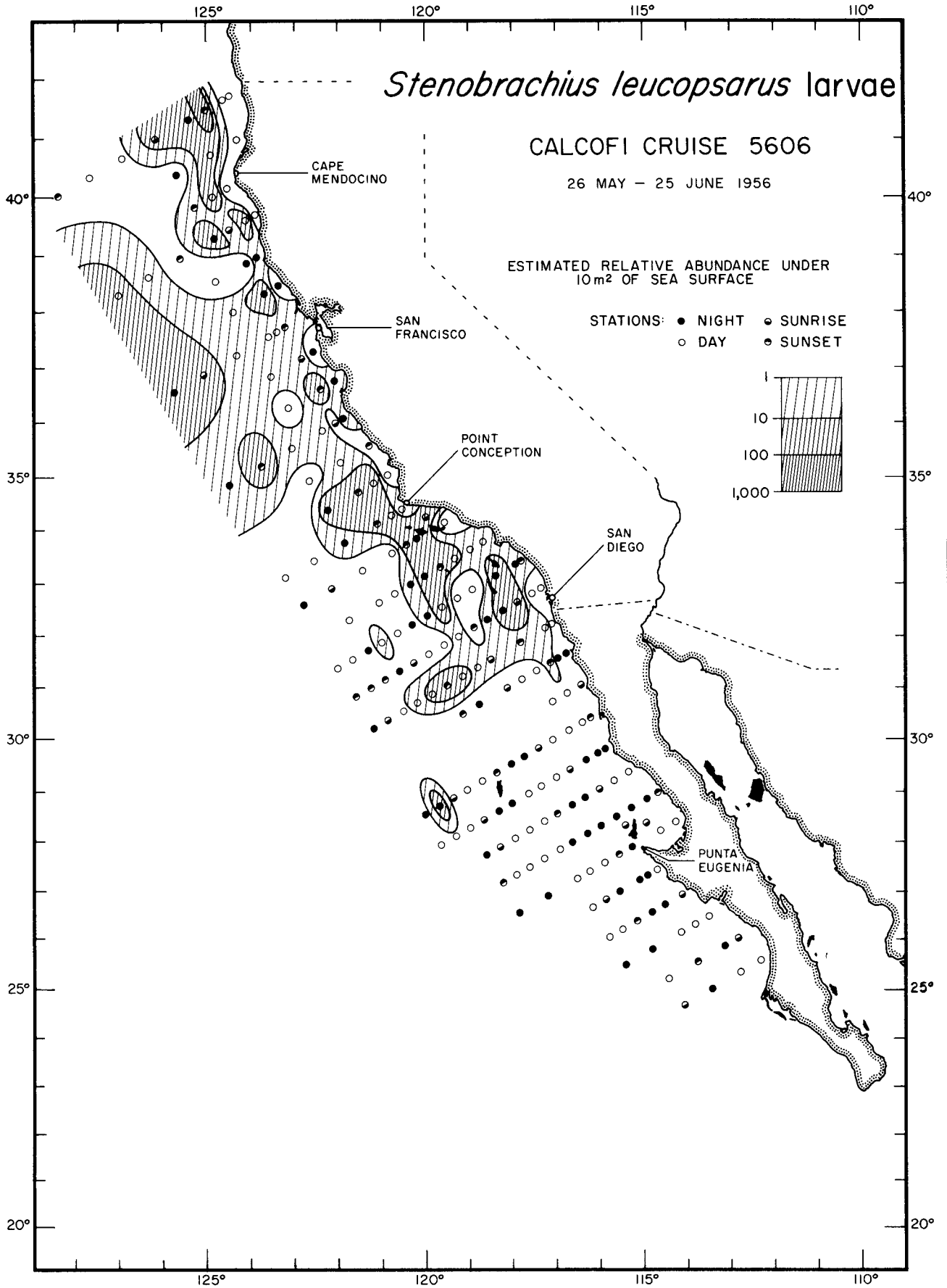


Stenobranchius leucopsarus larvae

6005

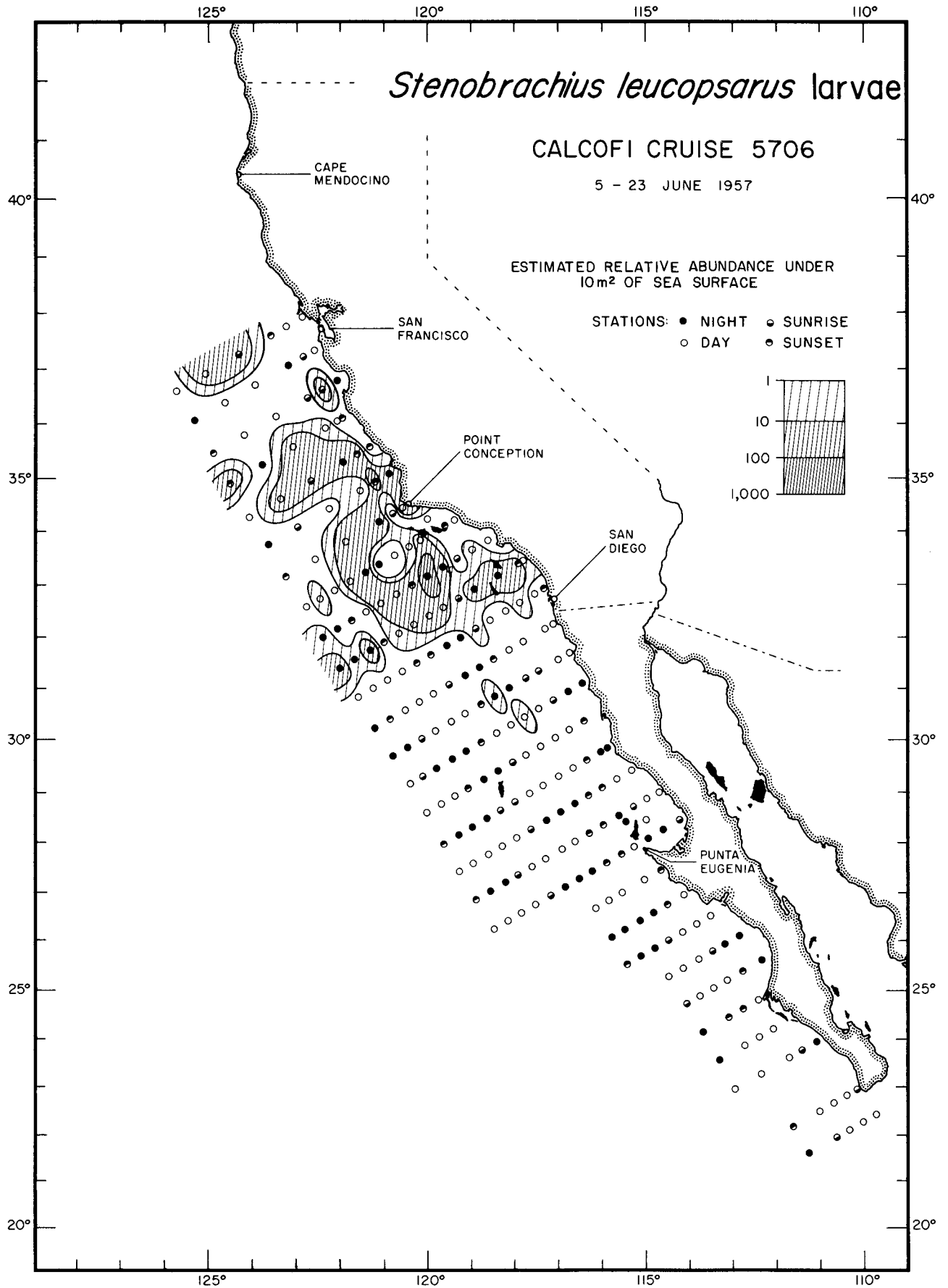


Stenobranchius leucopsarus larvae

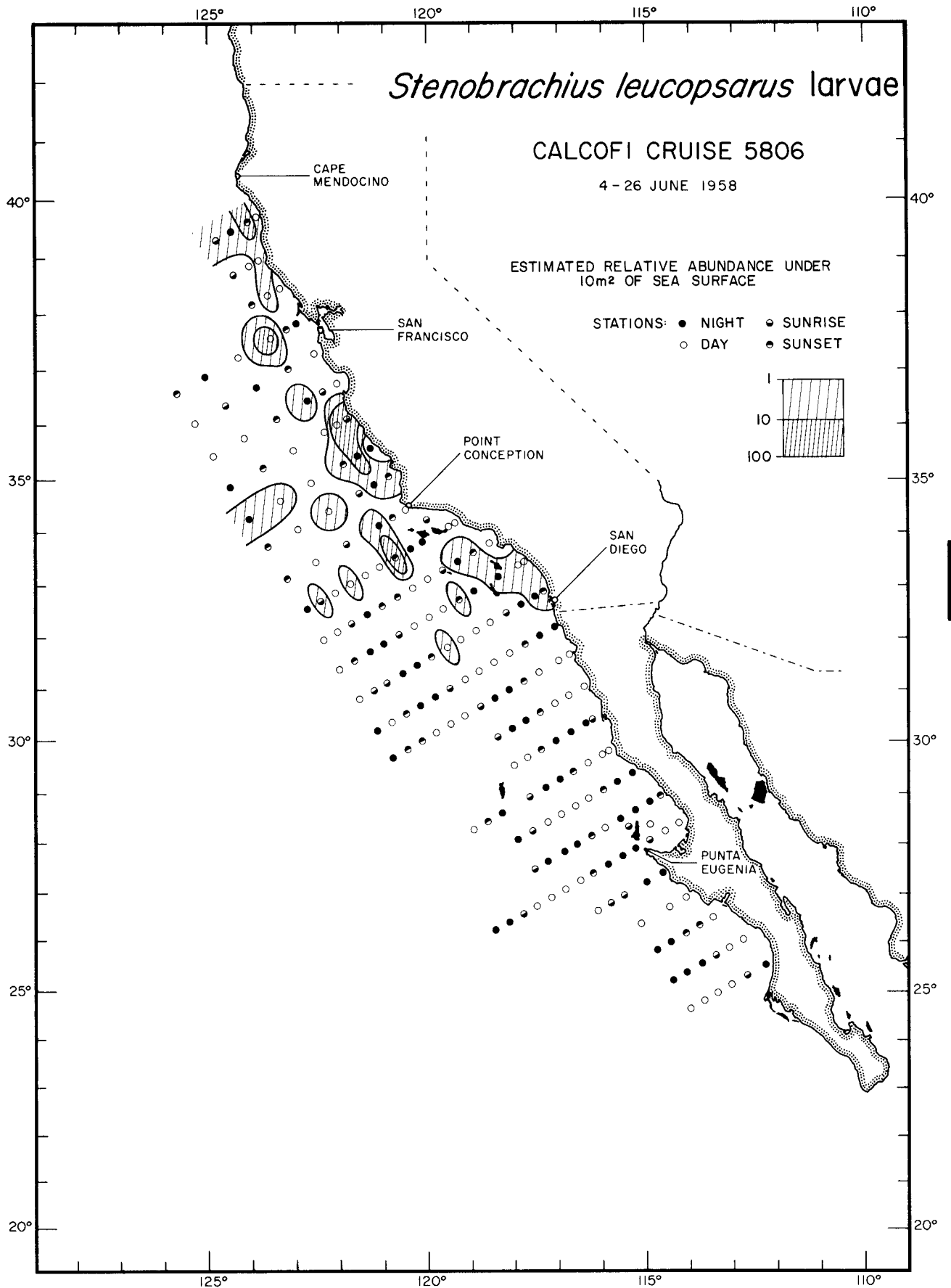


Stenobranchius leucopsarus larvae

5606

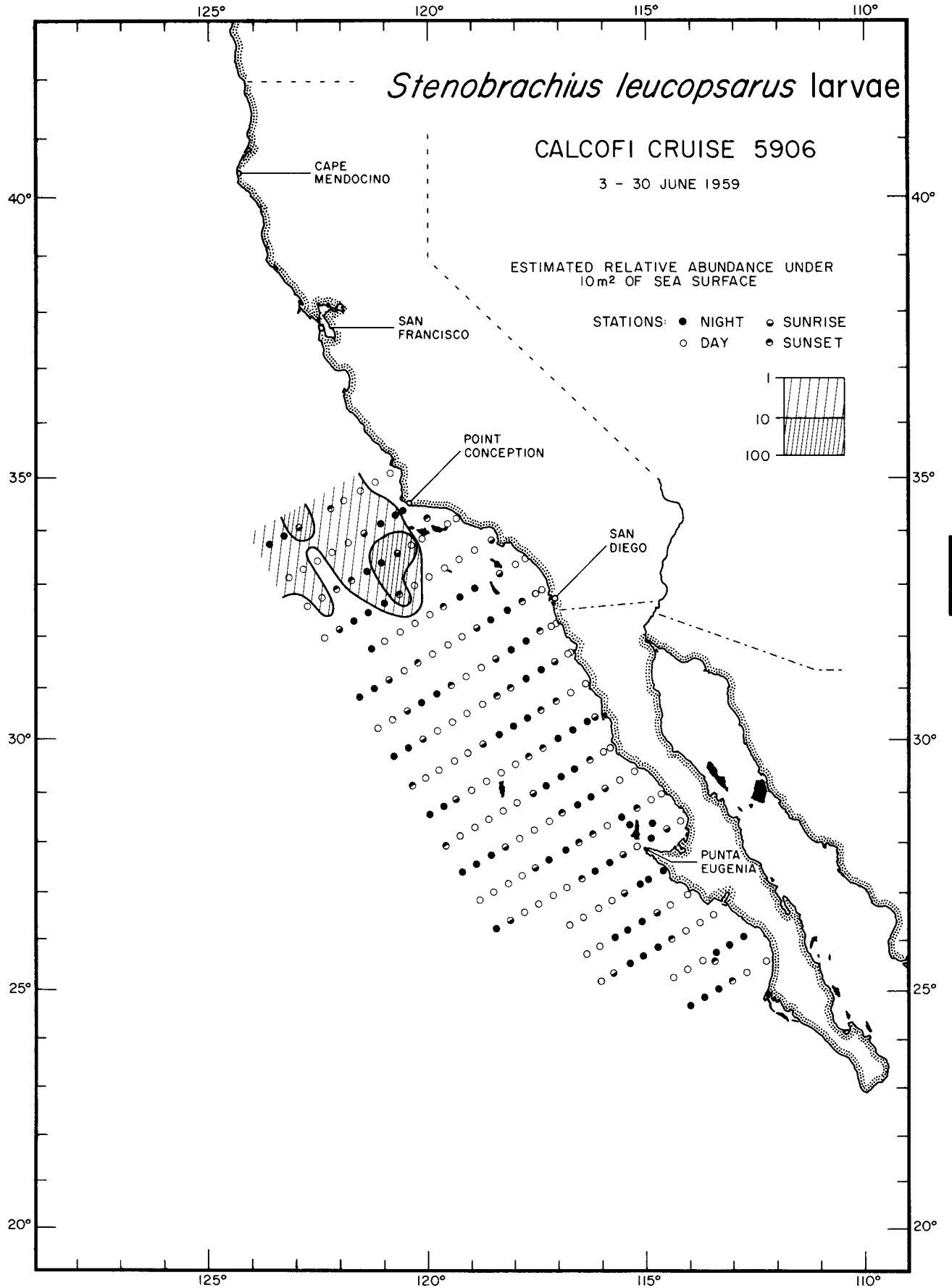


Stenobranchius leucopsarus larvae

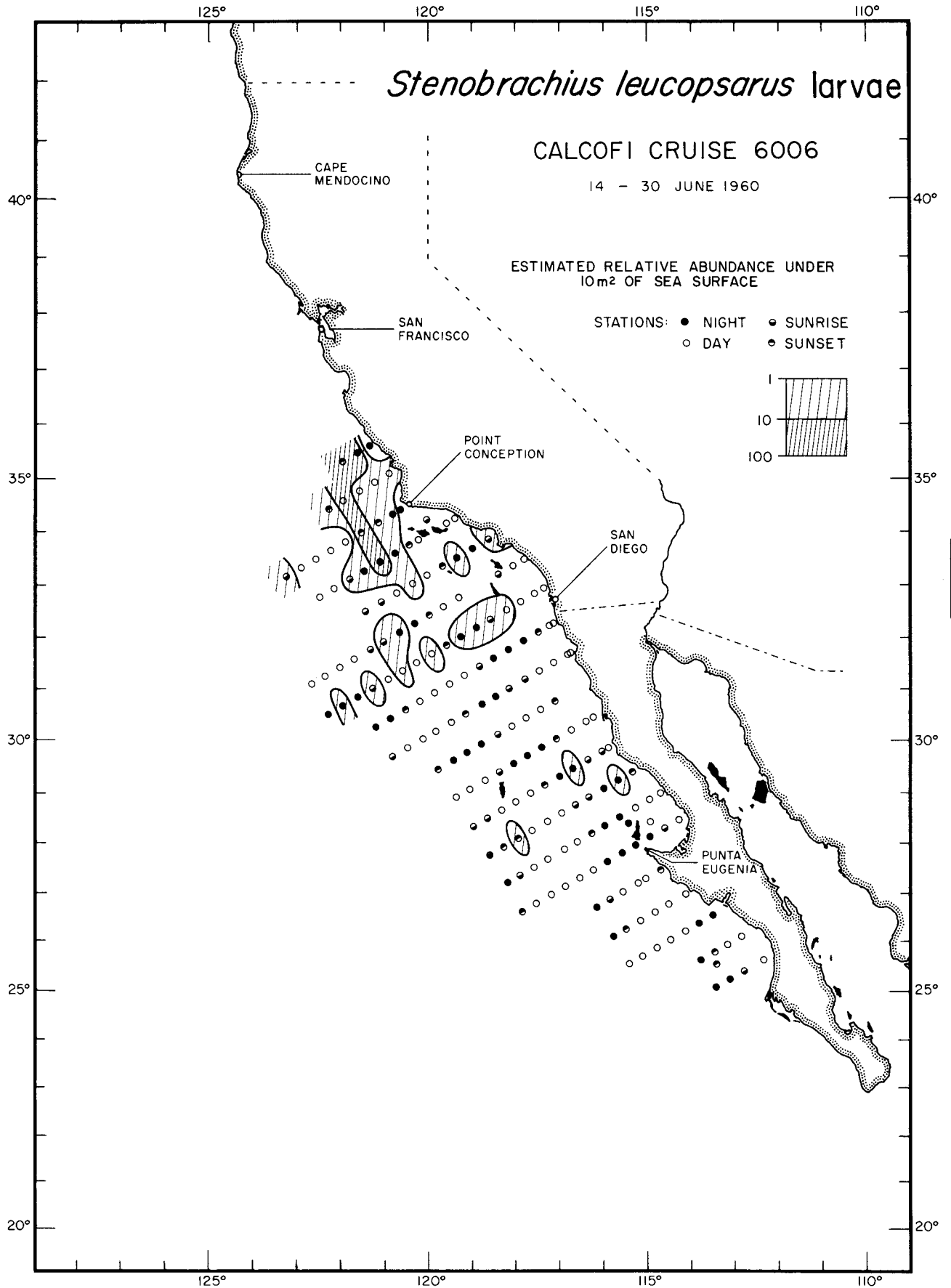


Stenobranchius leucopsarus larvae

5806

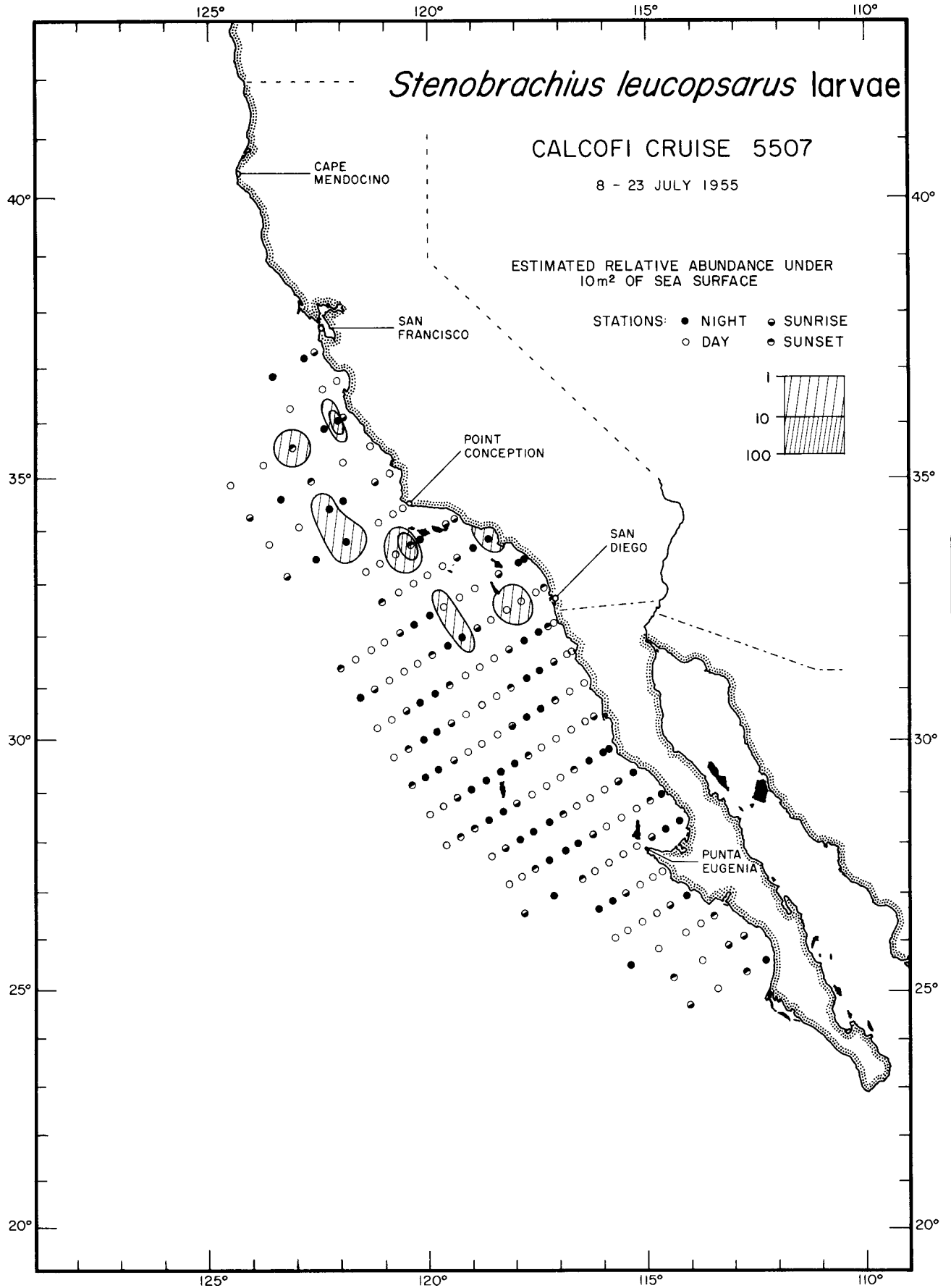


Stenobranchius leucopsarus larvae



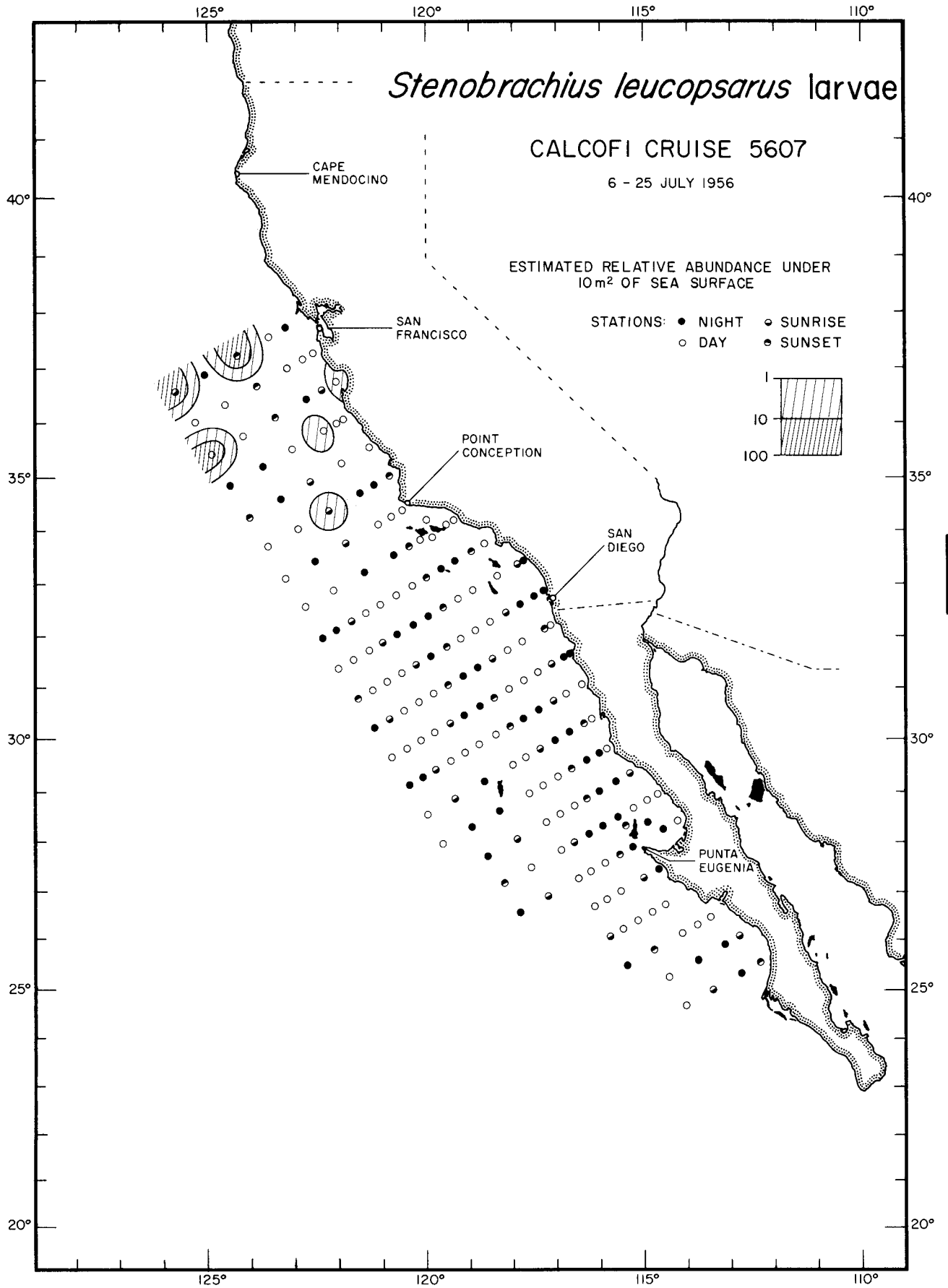
Stenobranchius leucopsarus larvae

6006



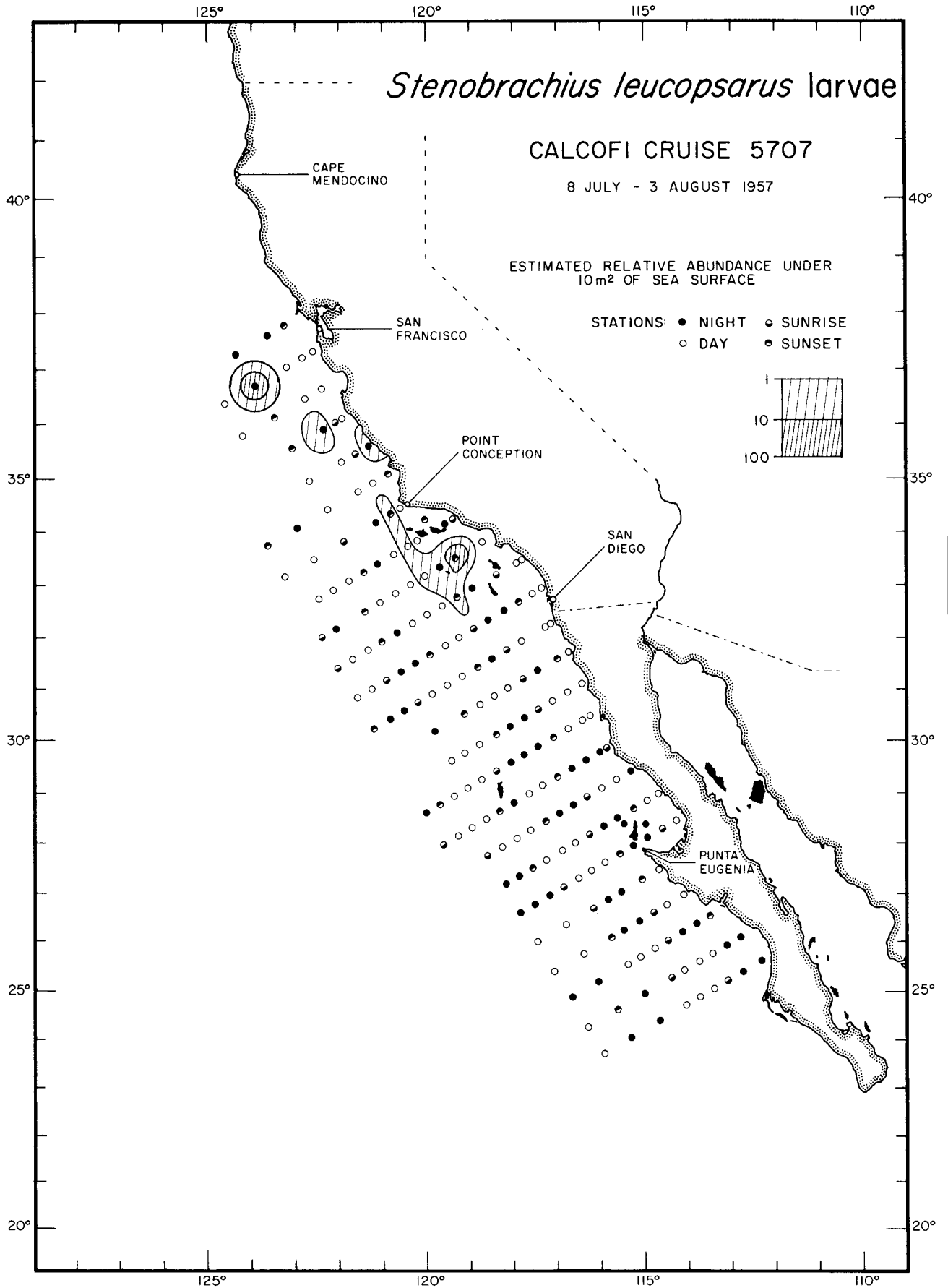
Stenobranchius leucopsarus larvae

5507



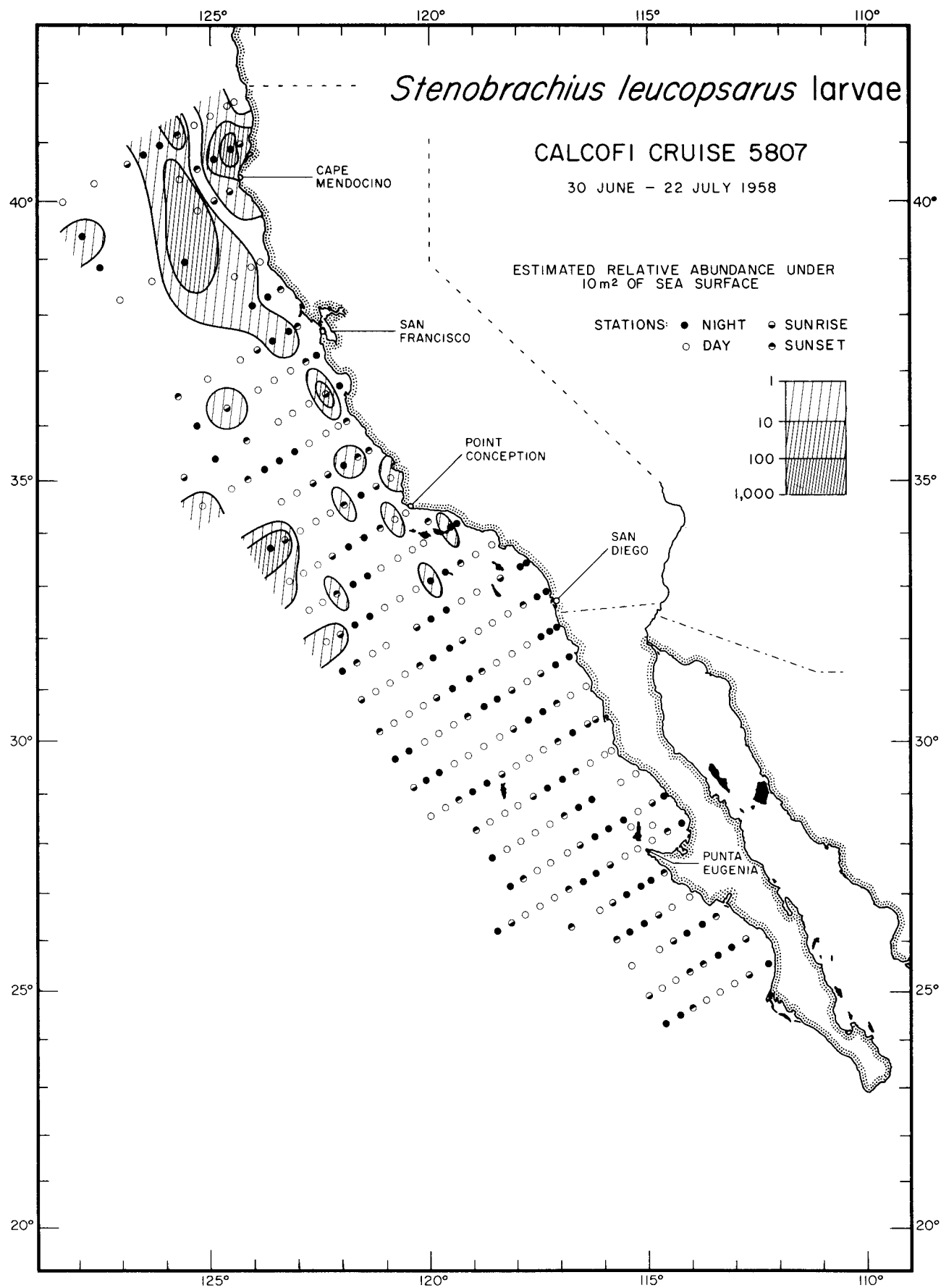
Stenobranchius leucopsarus larvae

5607



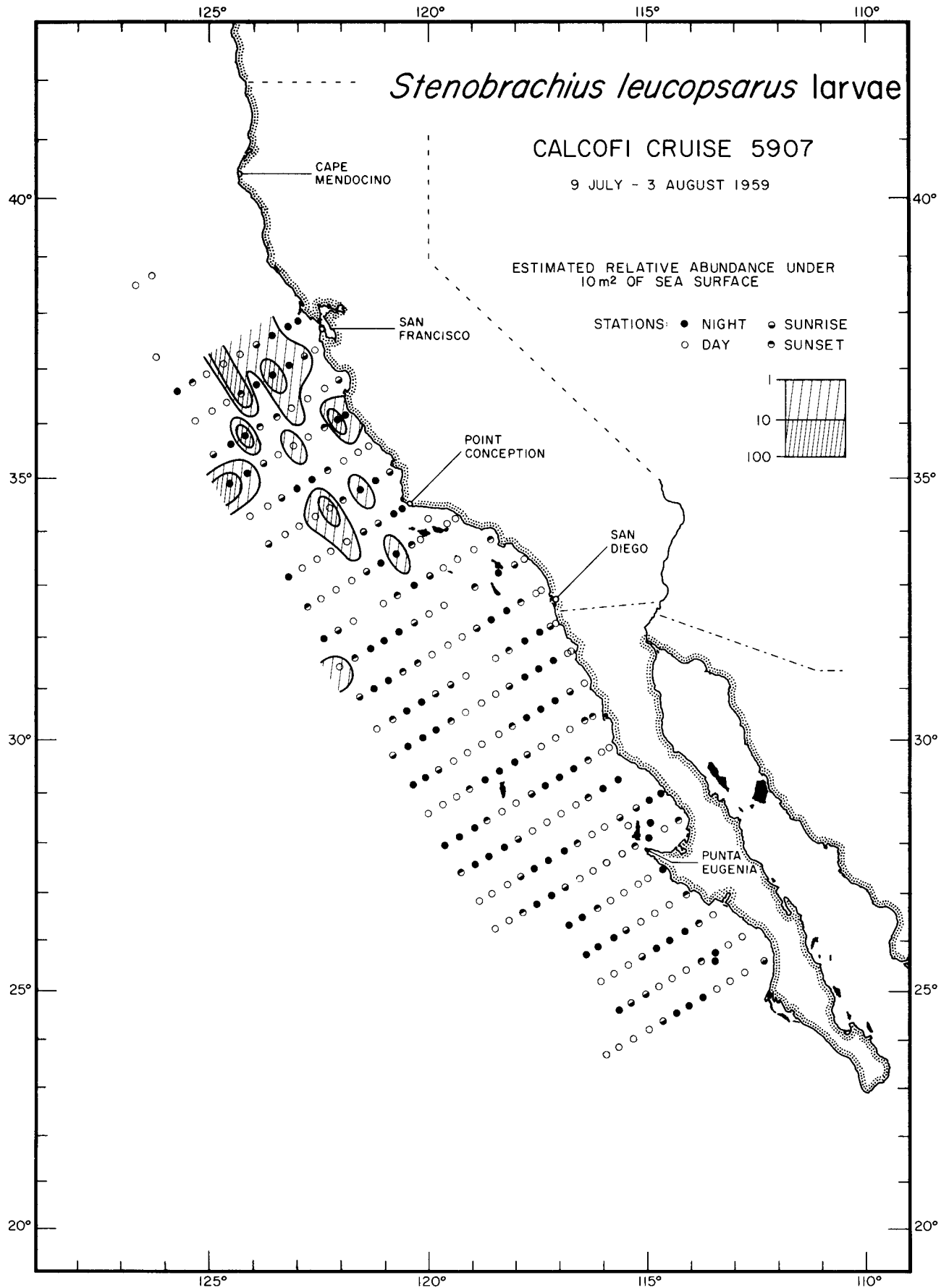
Stenobranchius leucopsarus larvae

5707



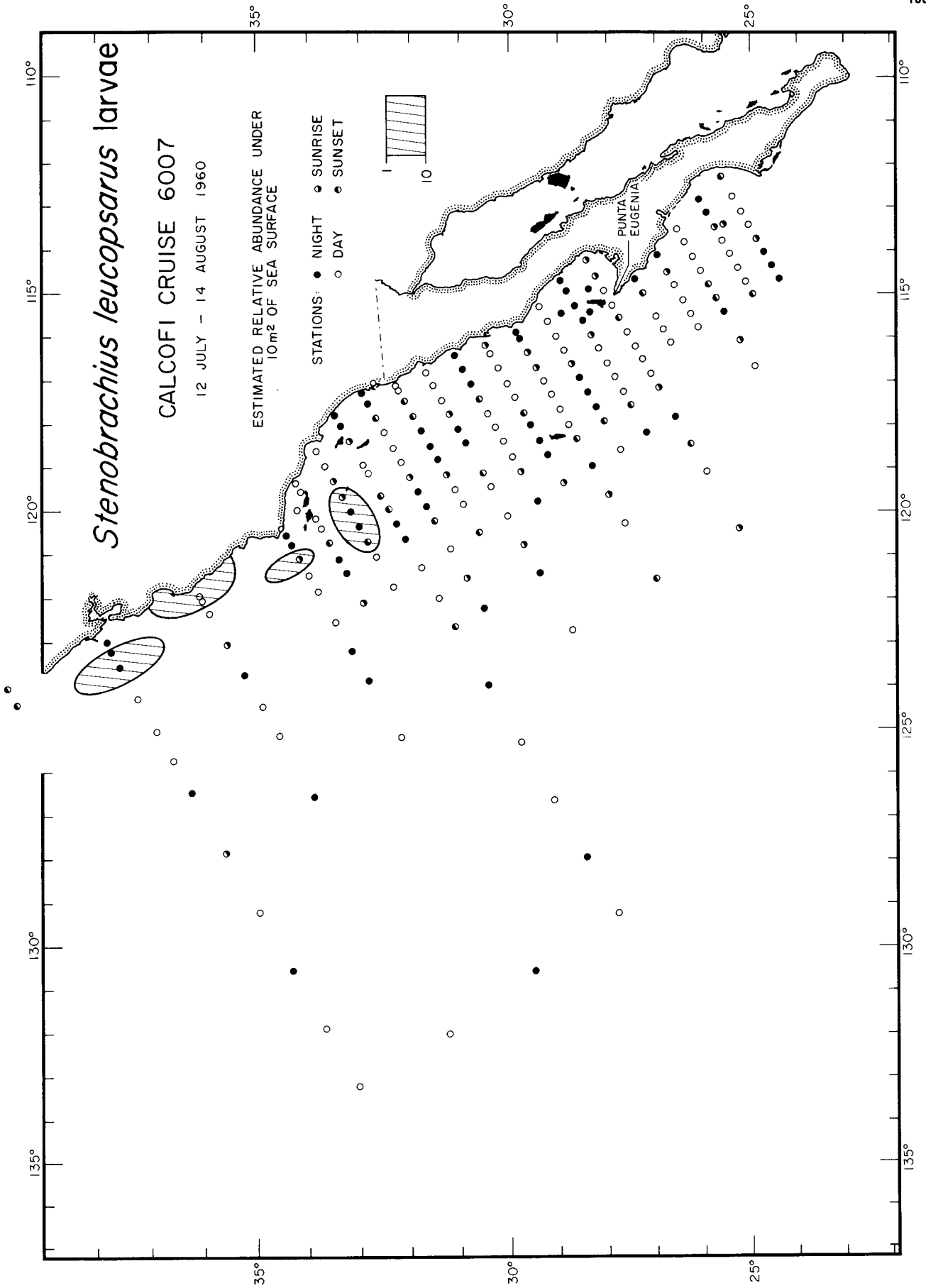
Stenobranchius leucopsarus larvae

5807



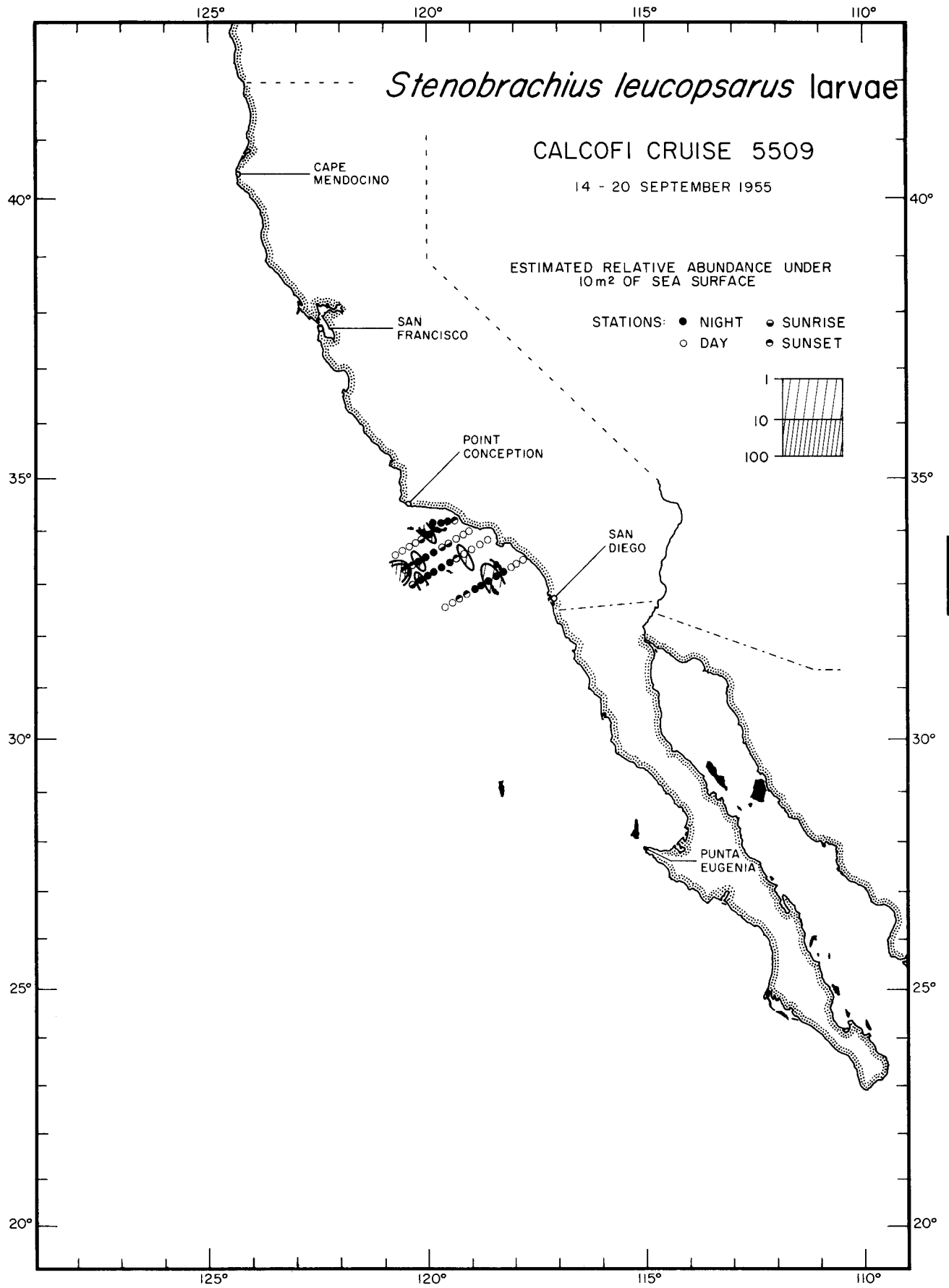
Stenobranchius leucopsarus larvae

5907

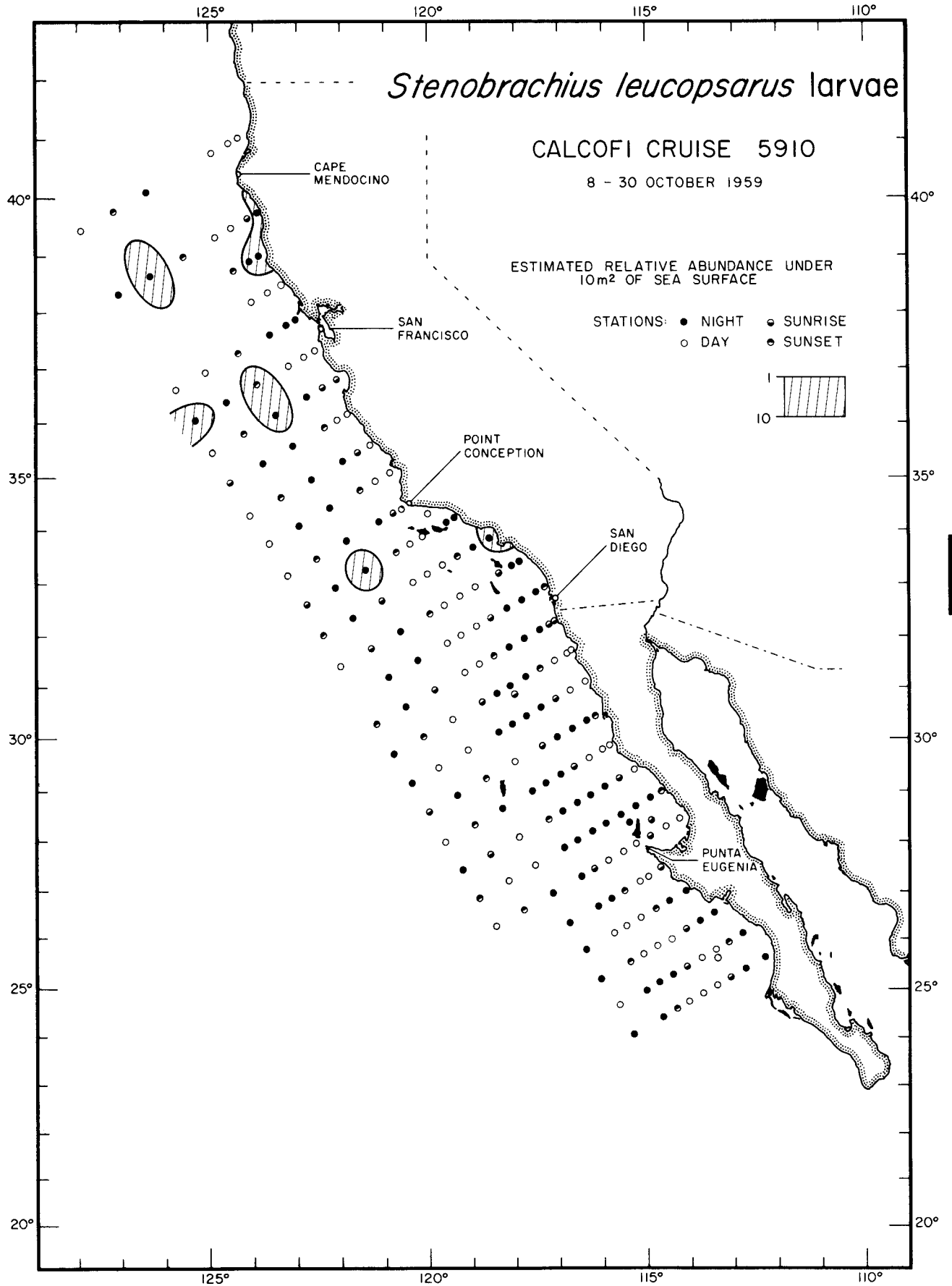


Stenobranchius leucopsarus larvae

6007

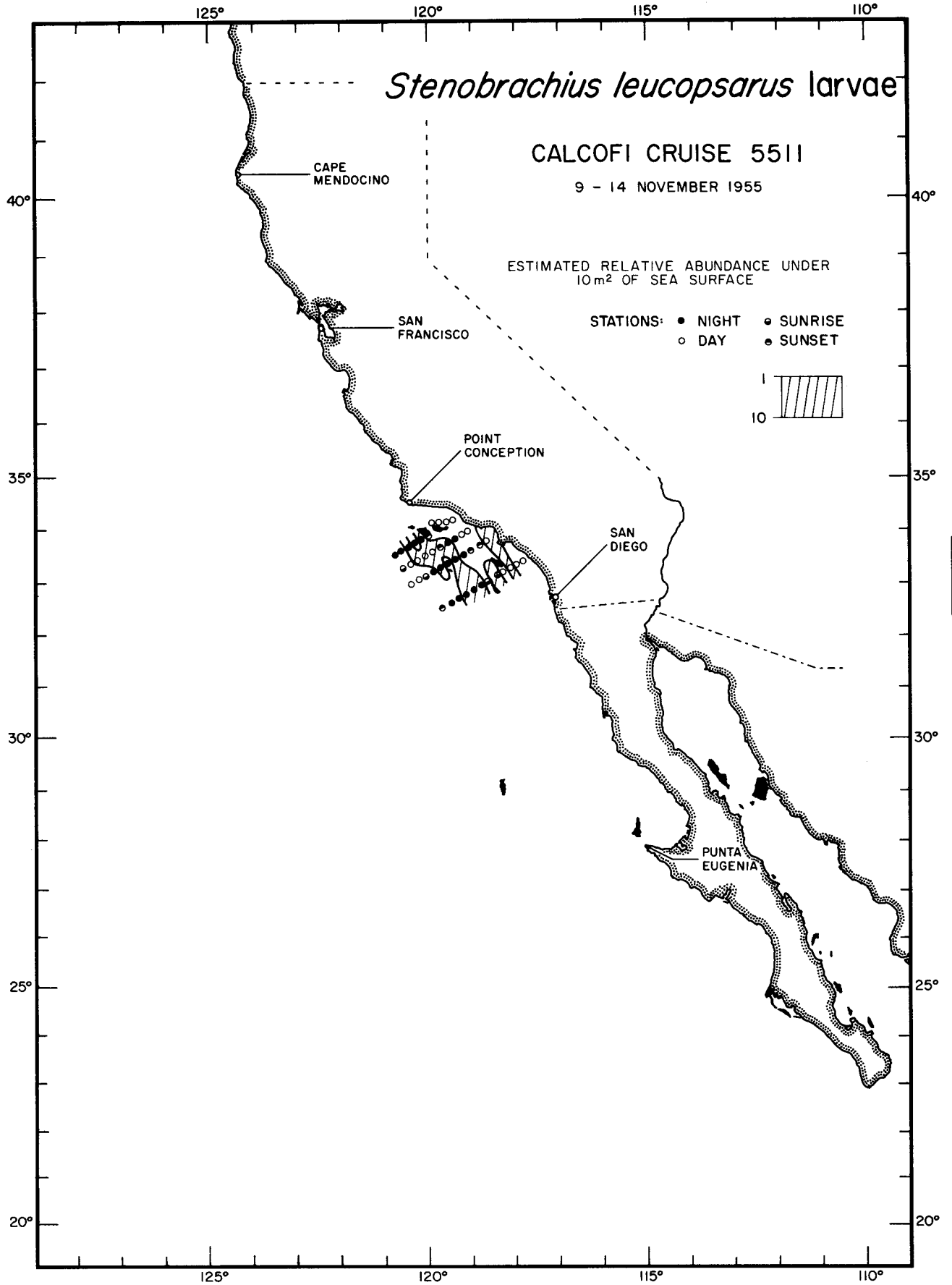


Stenobranchius leucopsarus larvae



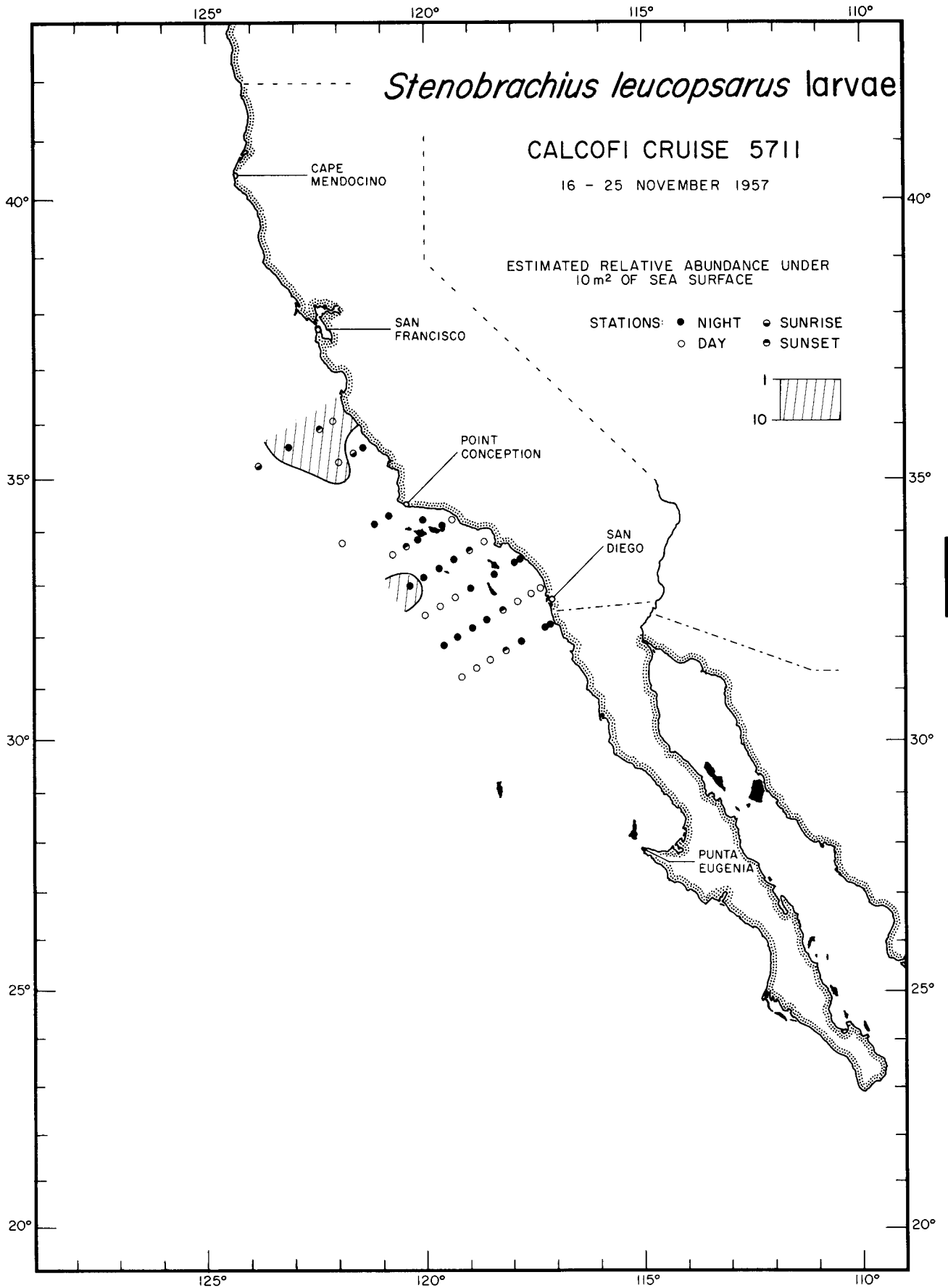
Stenobranchius leucopsarus larvae

5910



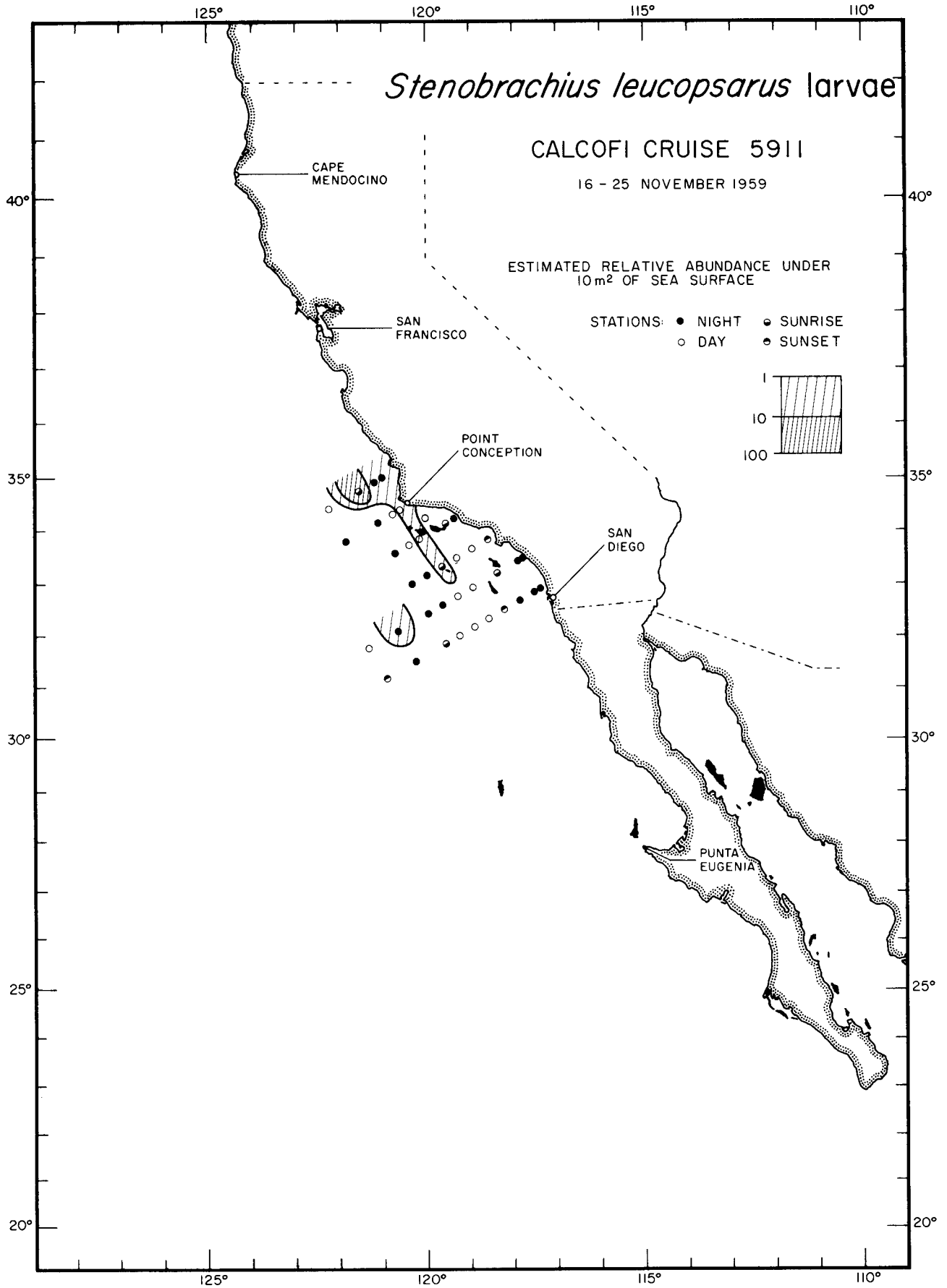
Stenobranchius leucopsarus larvae

5511

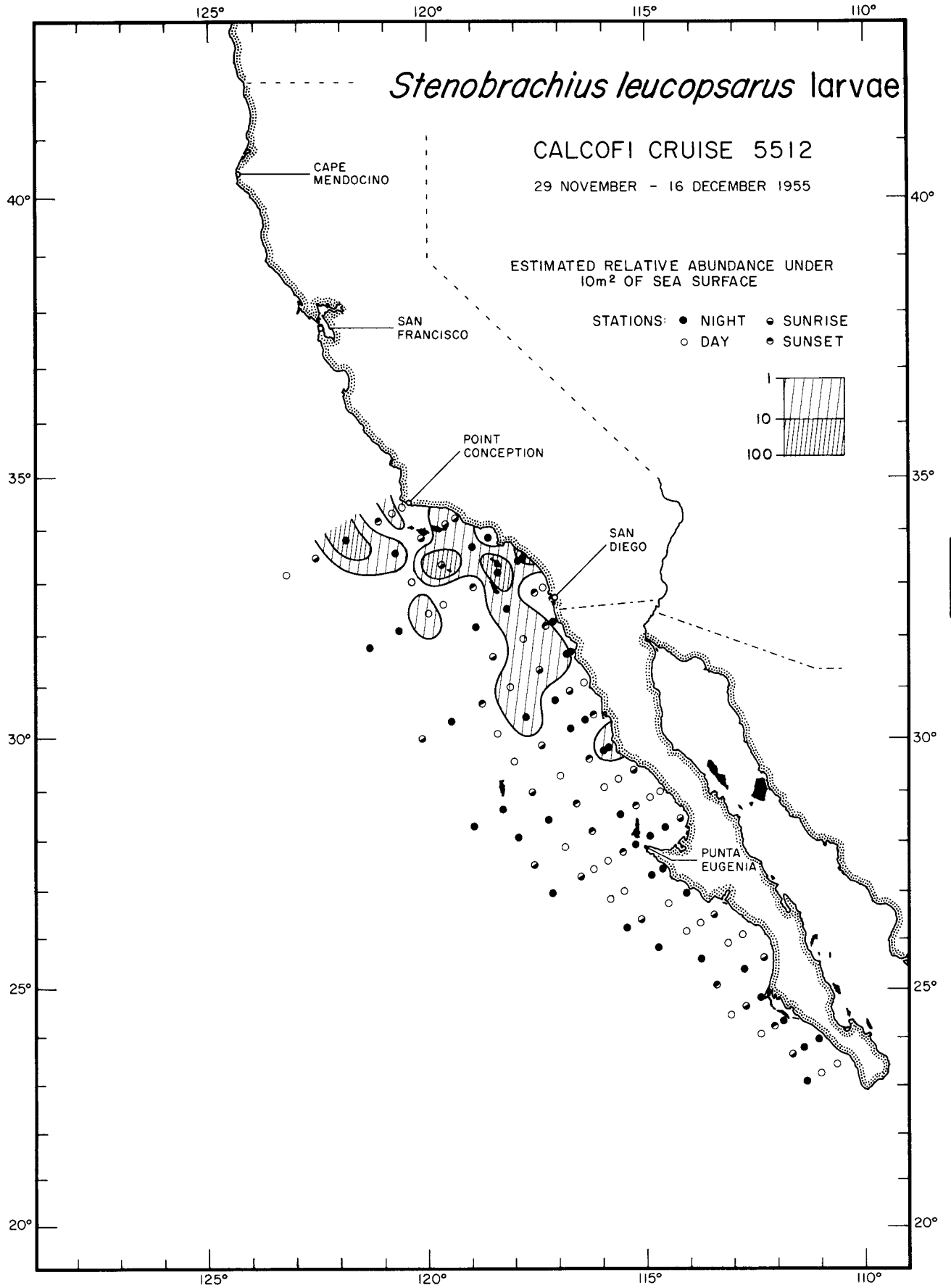


Stenobranchius leucopsarus larvae

5711

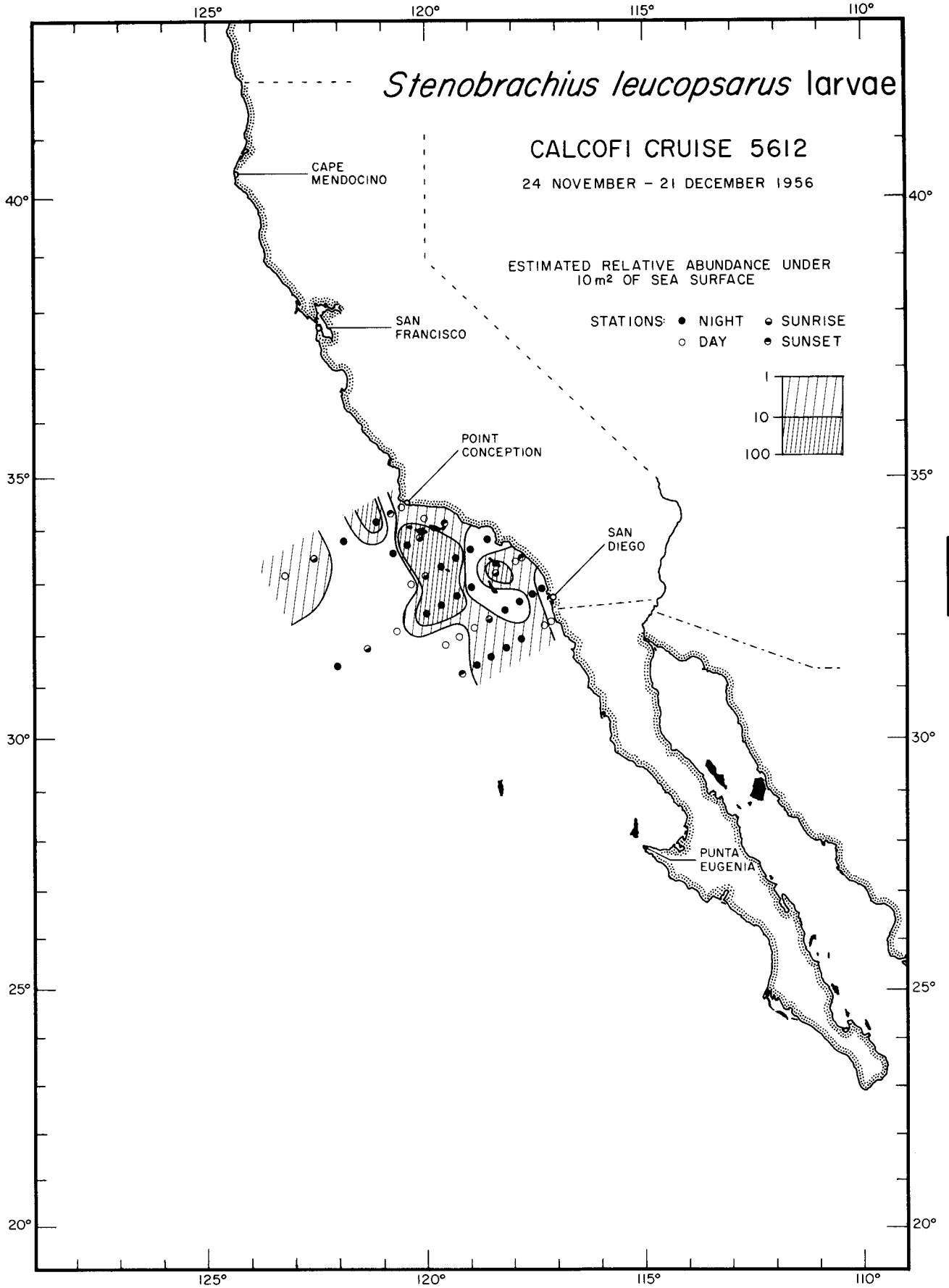


Stenobranchius leucopsarus larvae



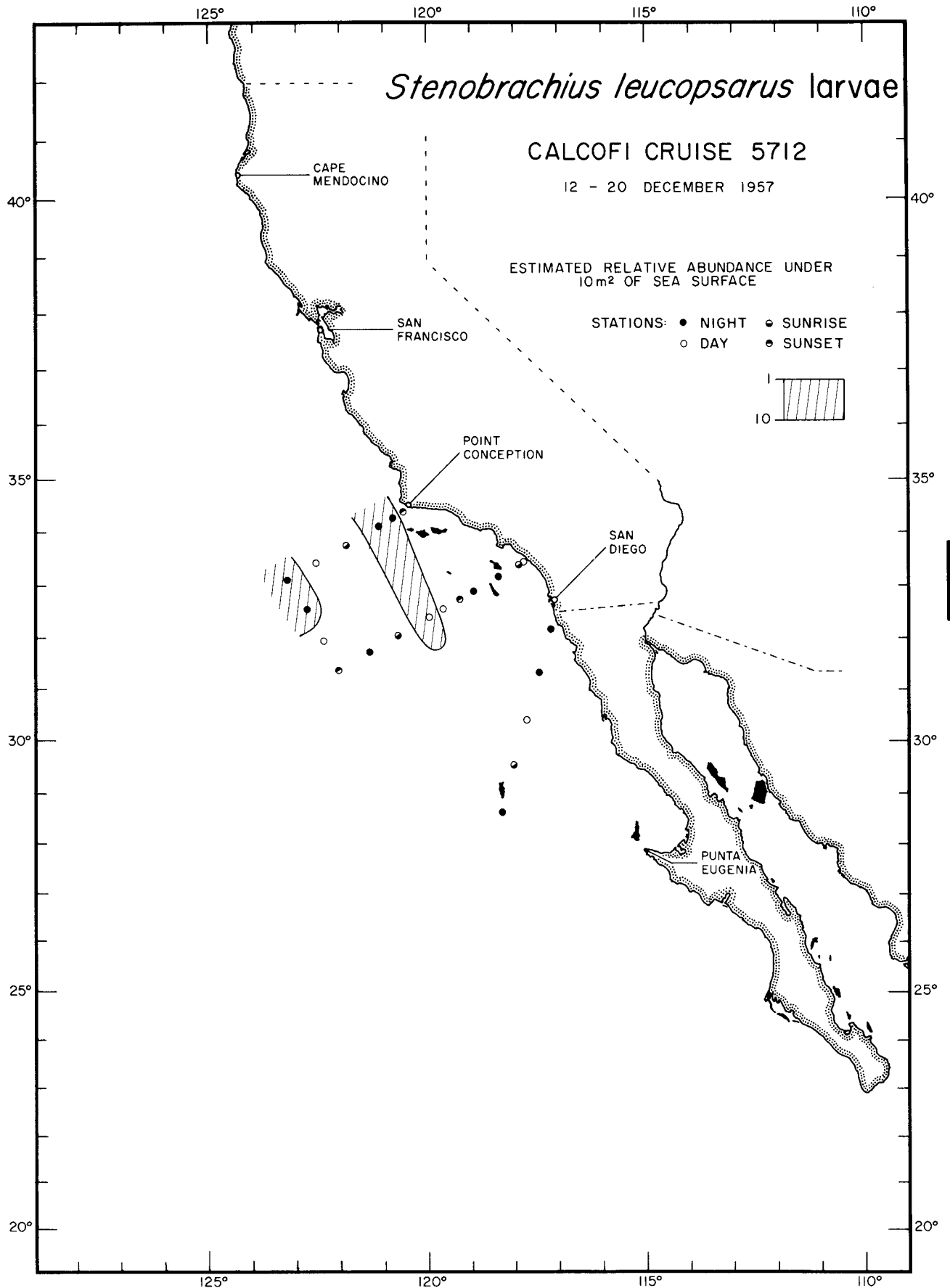
Stenobranchius leucopsarus larvae

5512



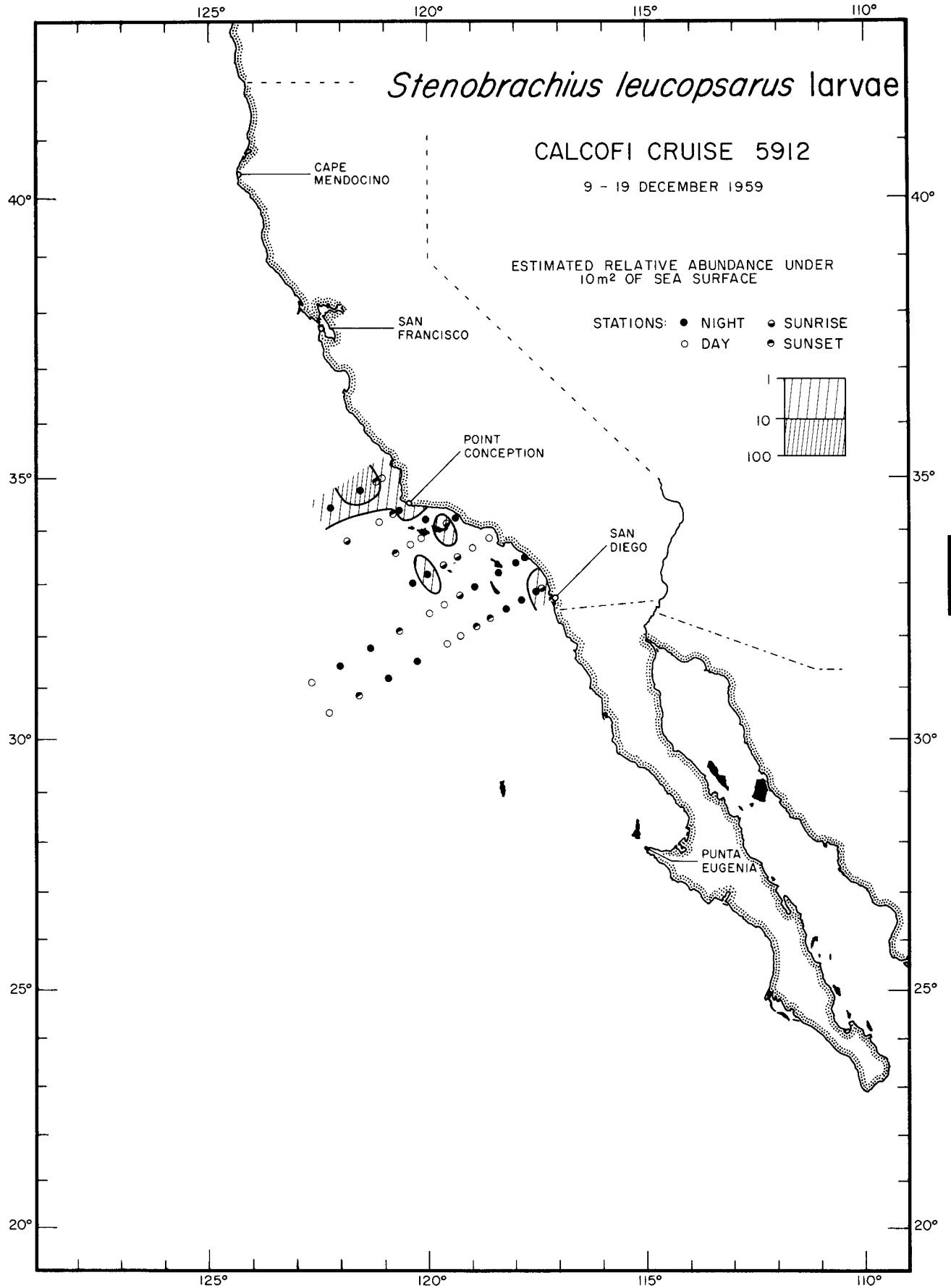
Stenobranchius leucopsarus larvae

5612

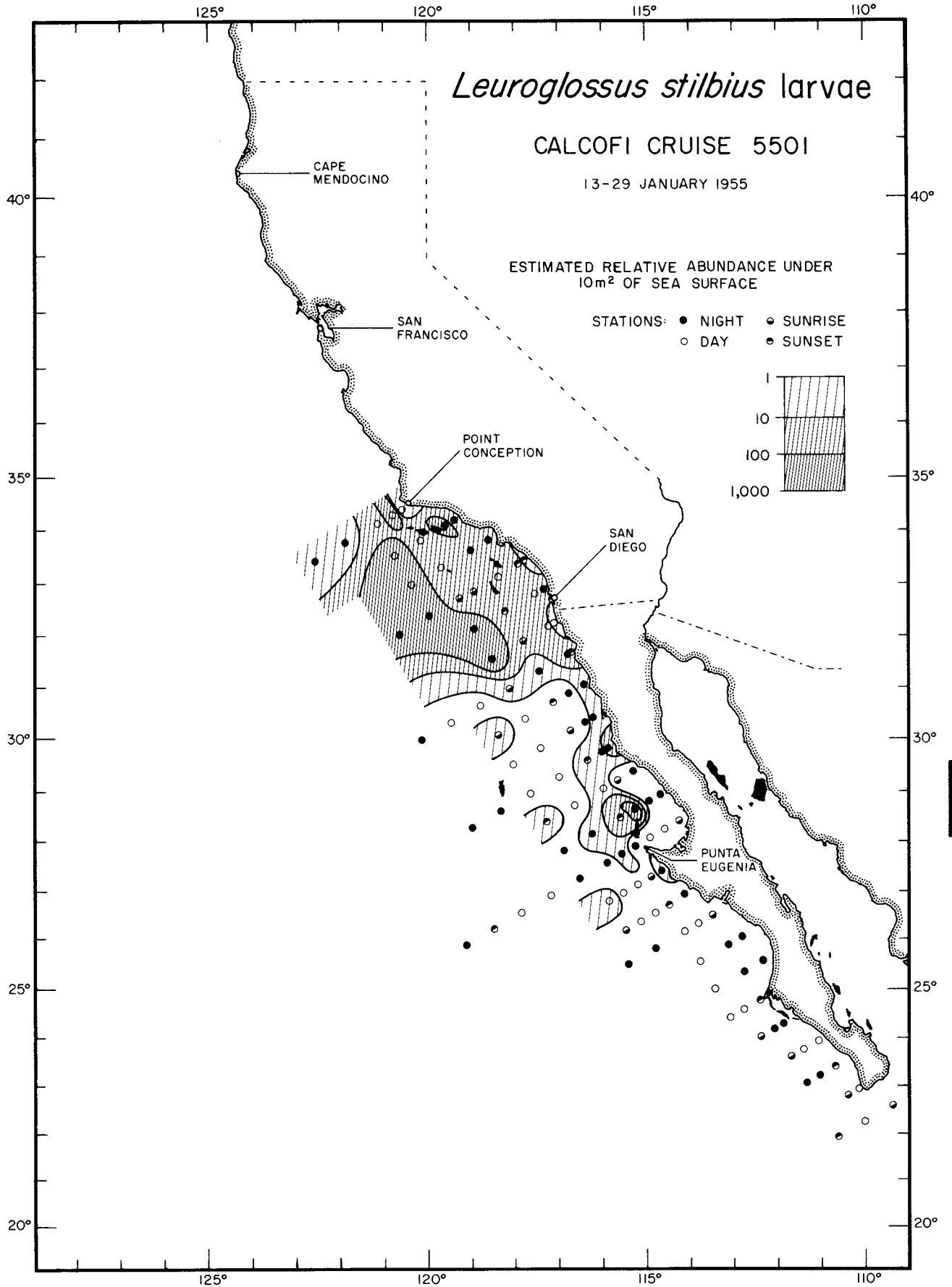


Stenobranchius leucopsarus larvae

5712

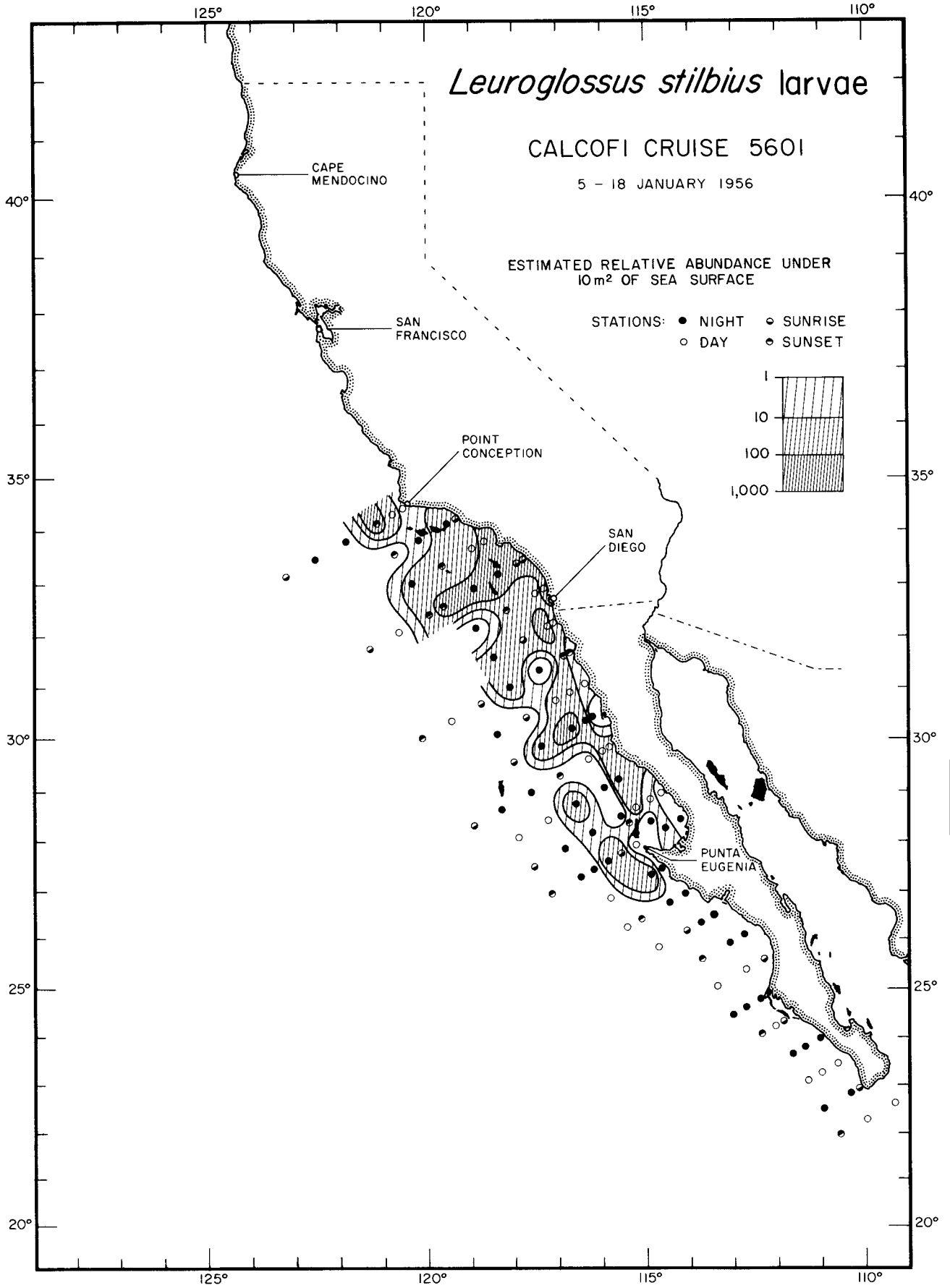


Stenobranchius leucopsarus larvae

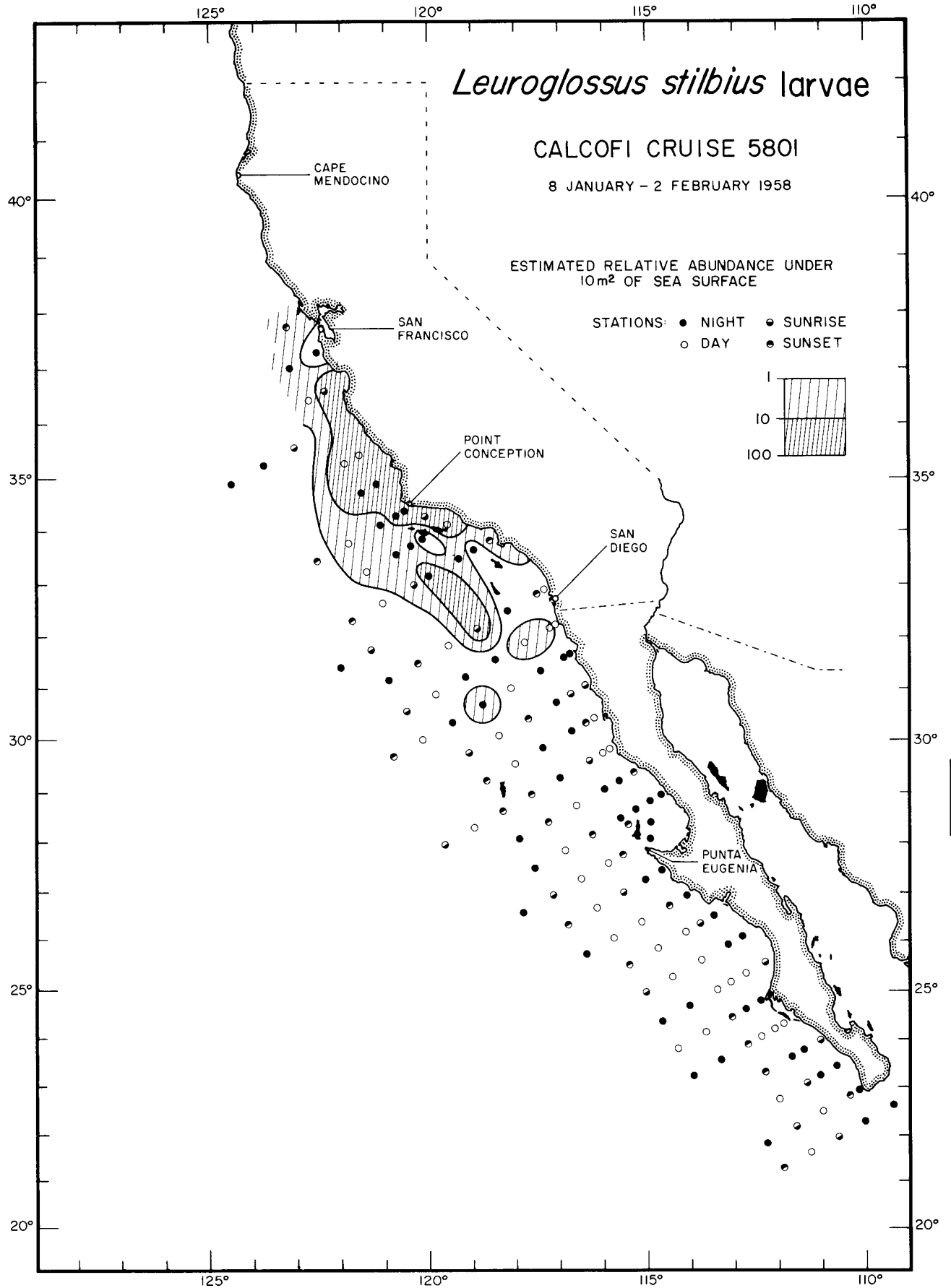


Leuroglossus stilbius larvae

5501

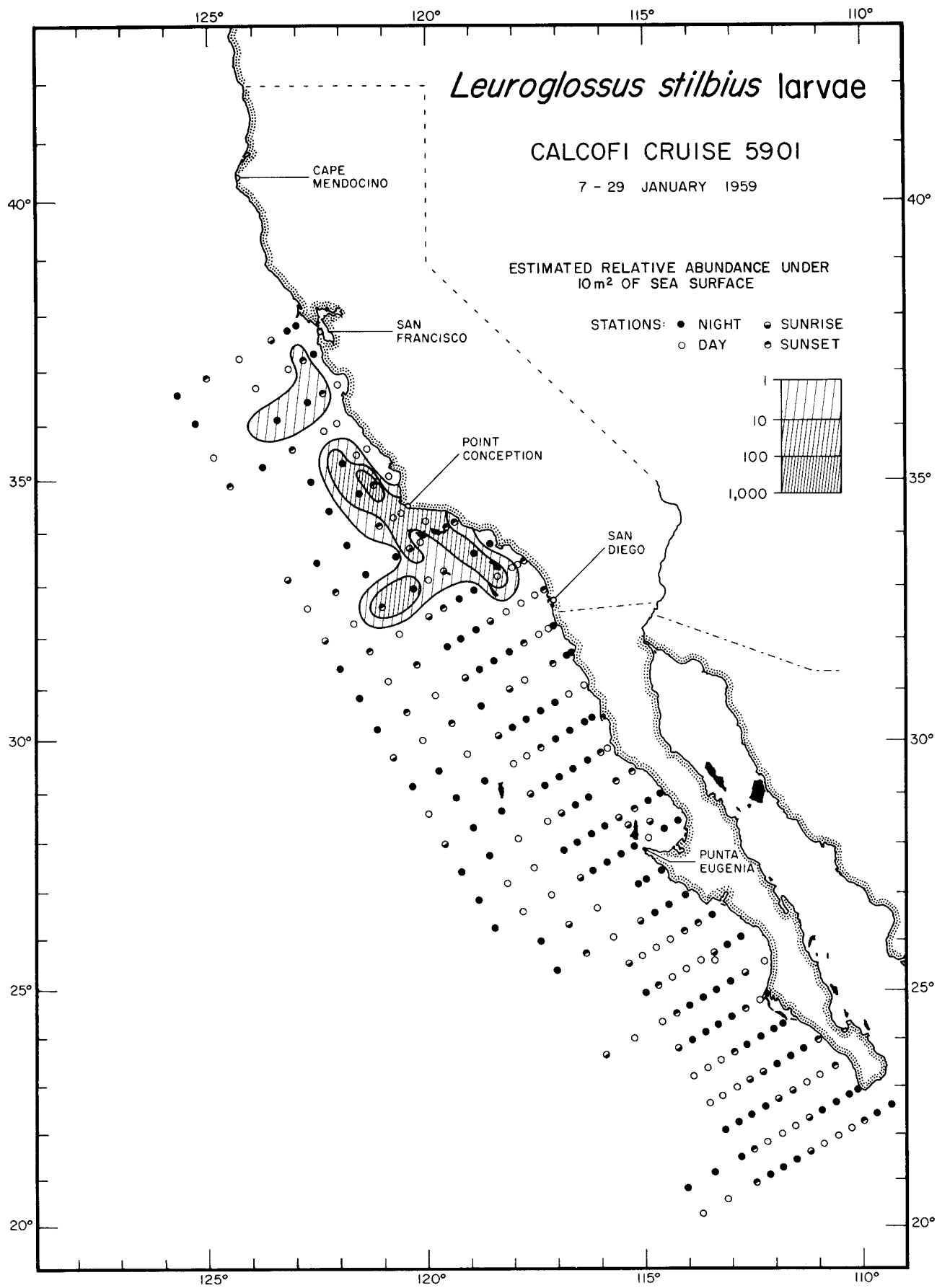


Leuroglossus stilbius larvae



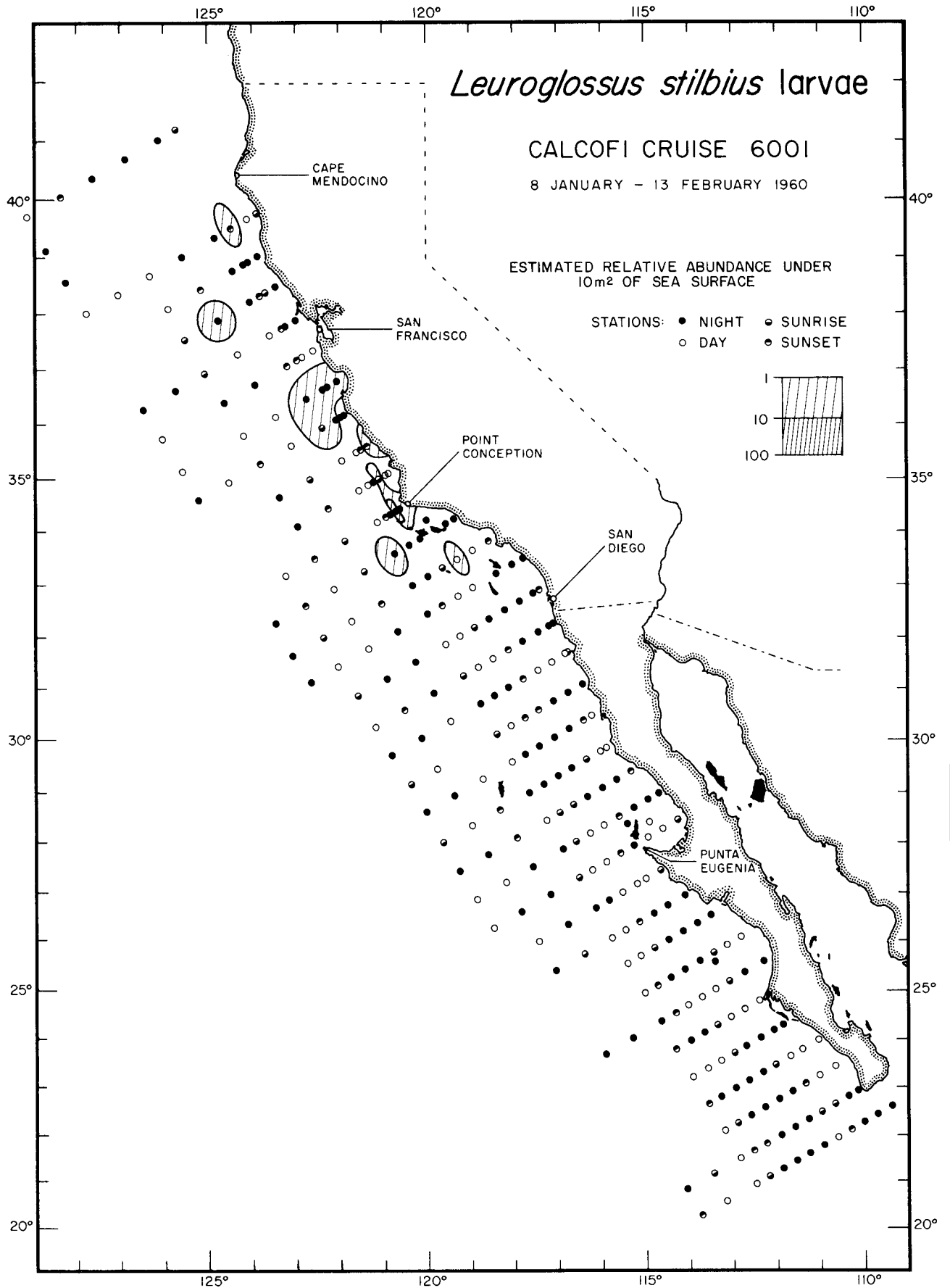
Leuroglossus stilbius larvae

5801



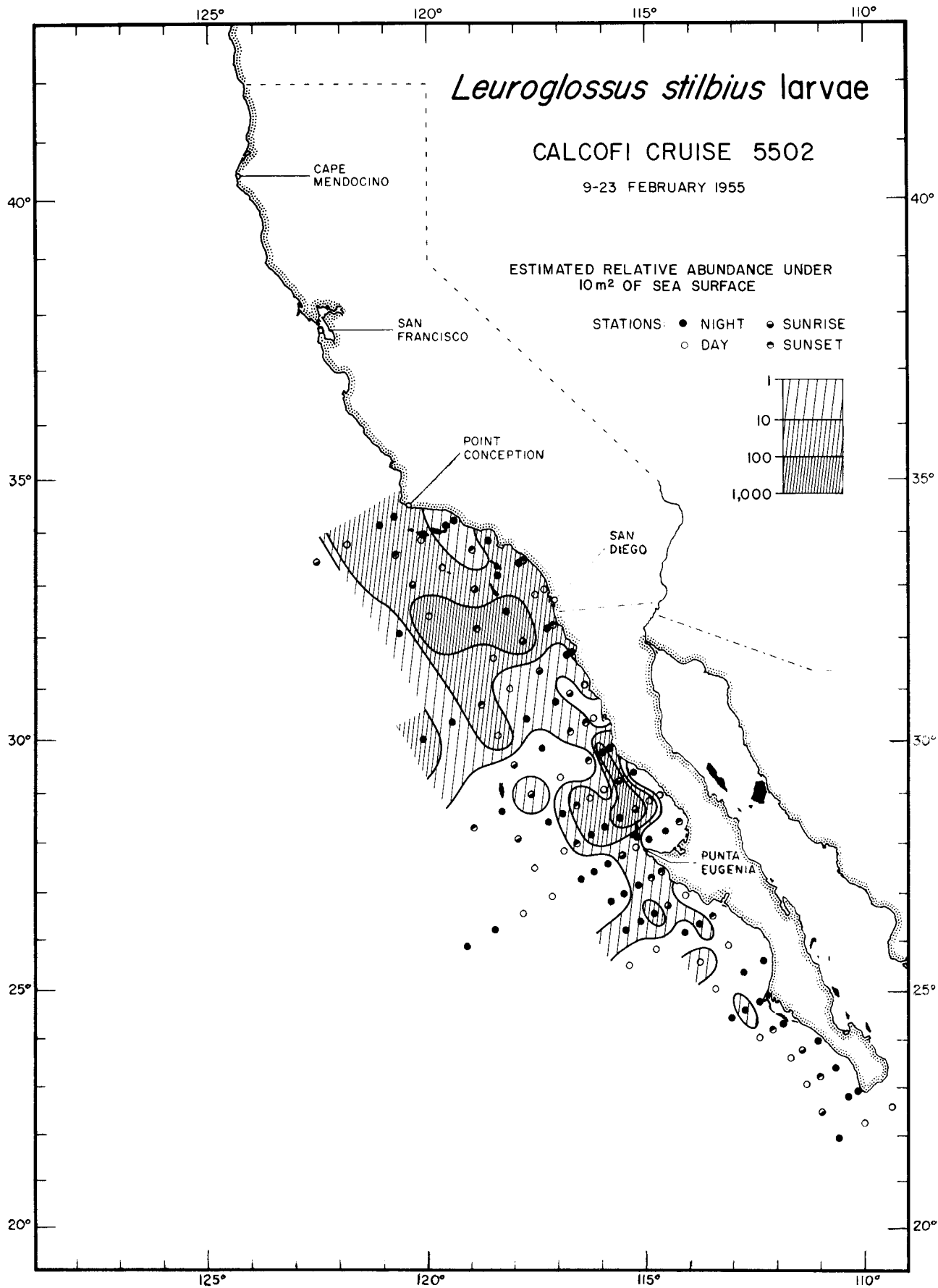
Leuroglossus stilbius larvae

5901



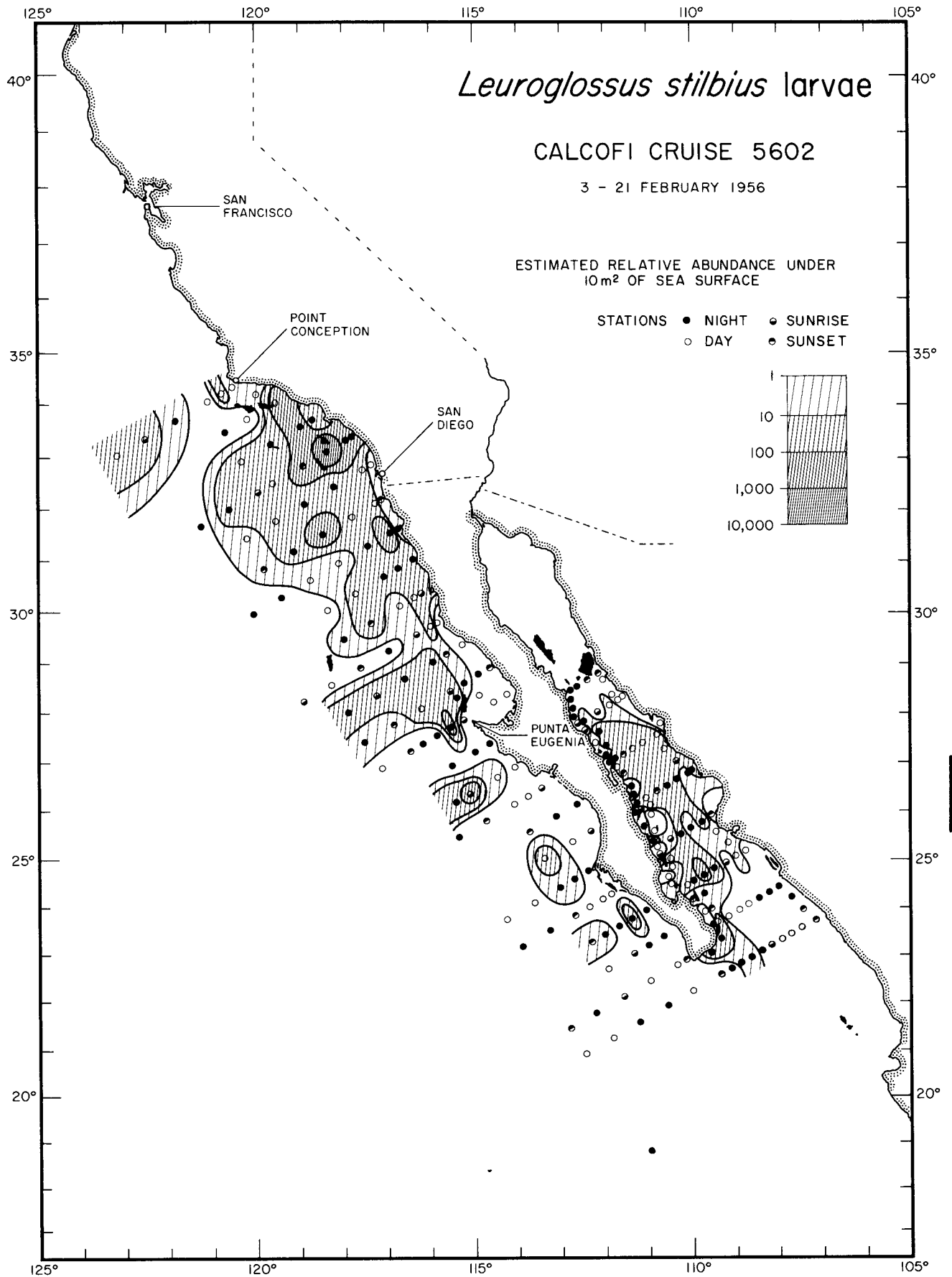
Leuroglossus stilbius larvae

6001



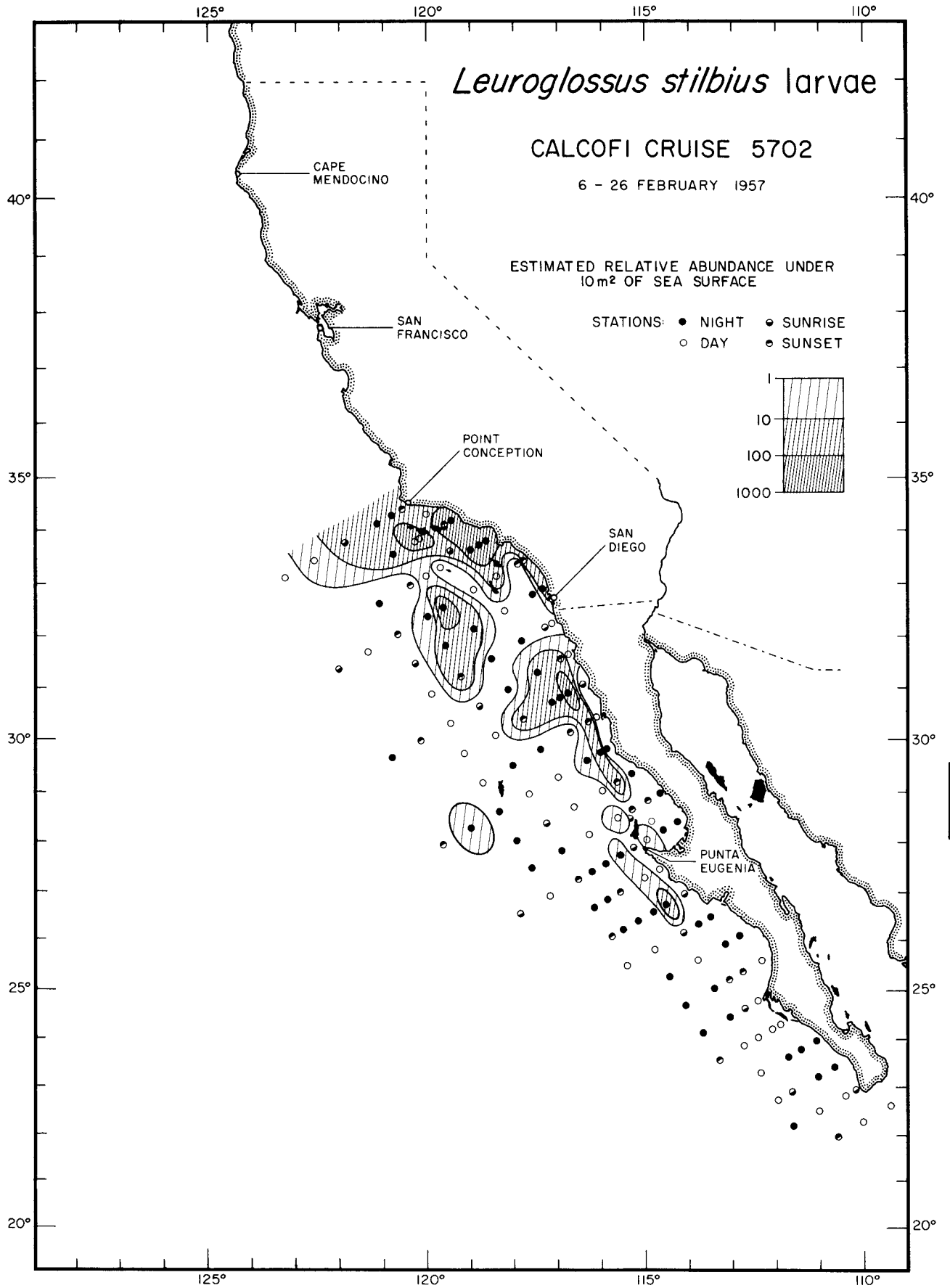
Leuroglossus stilbius larvae

5502



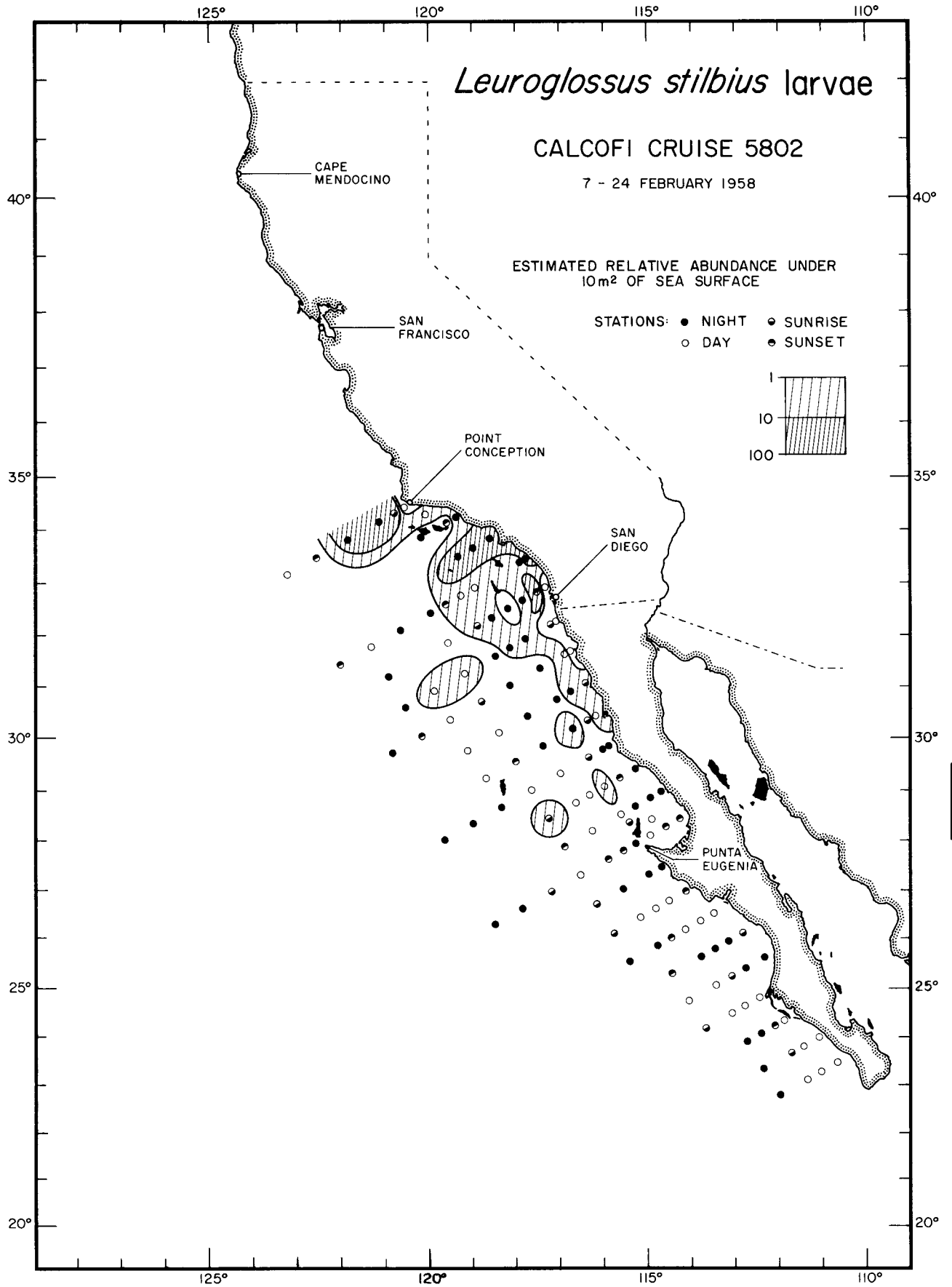
Leuroglossus stilbius larvae

5602



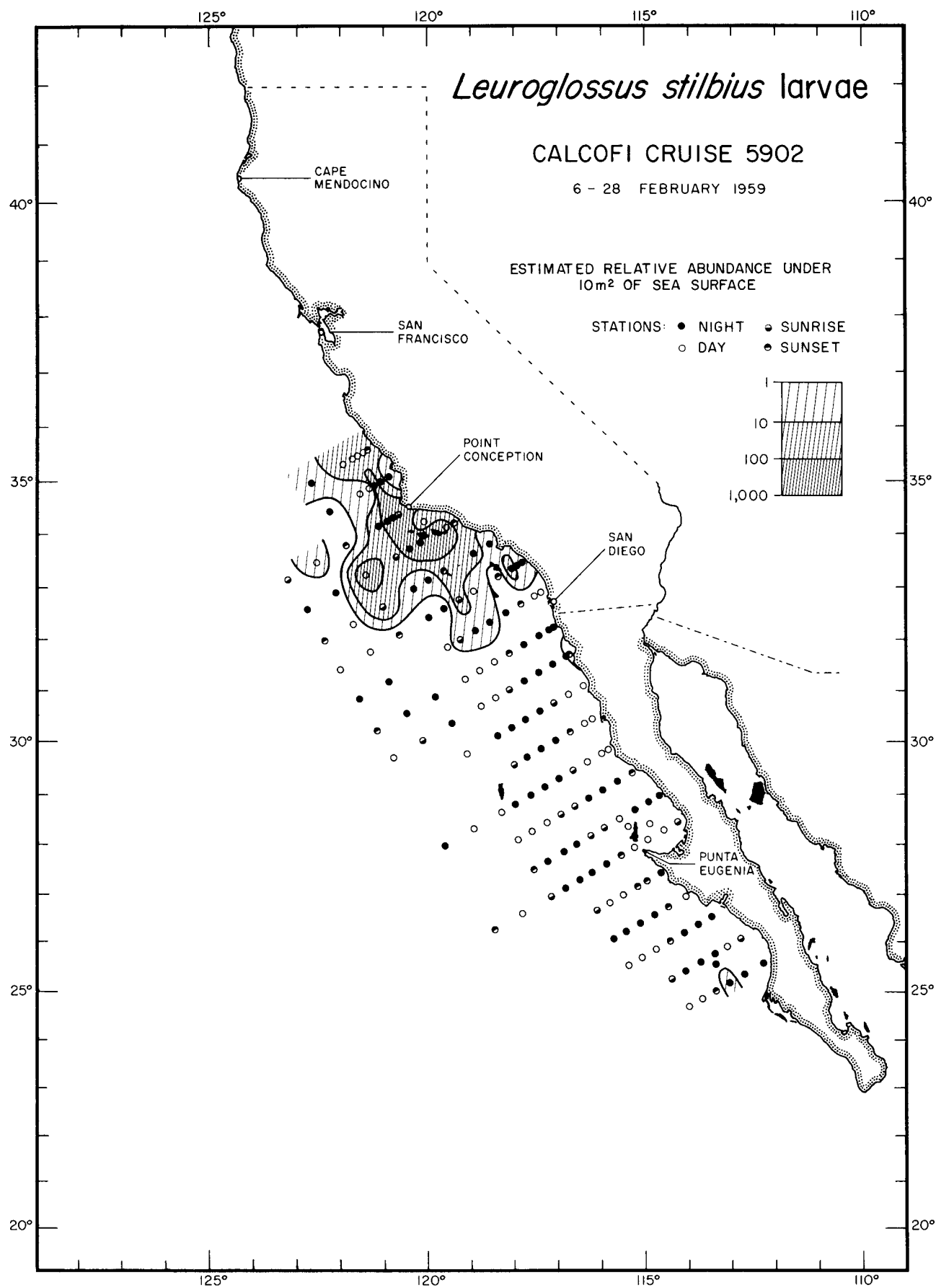
Leuroglossus stilbius larvae

5702



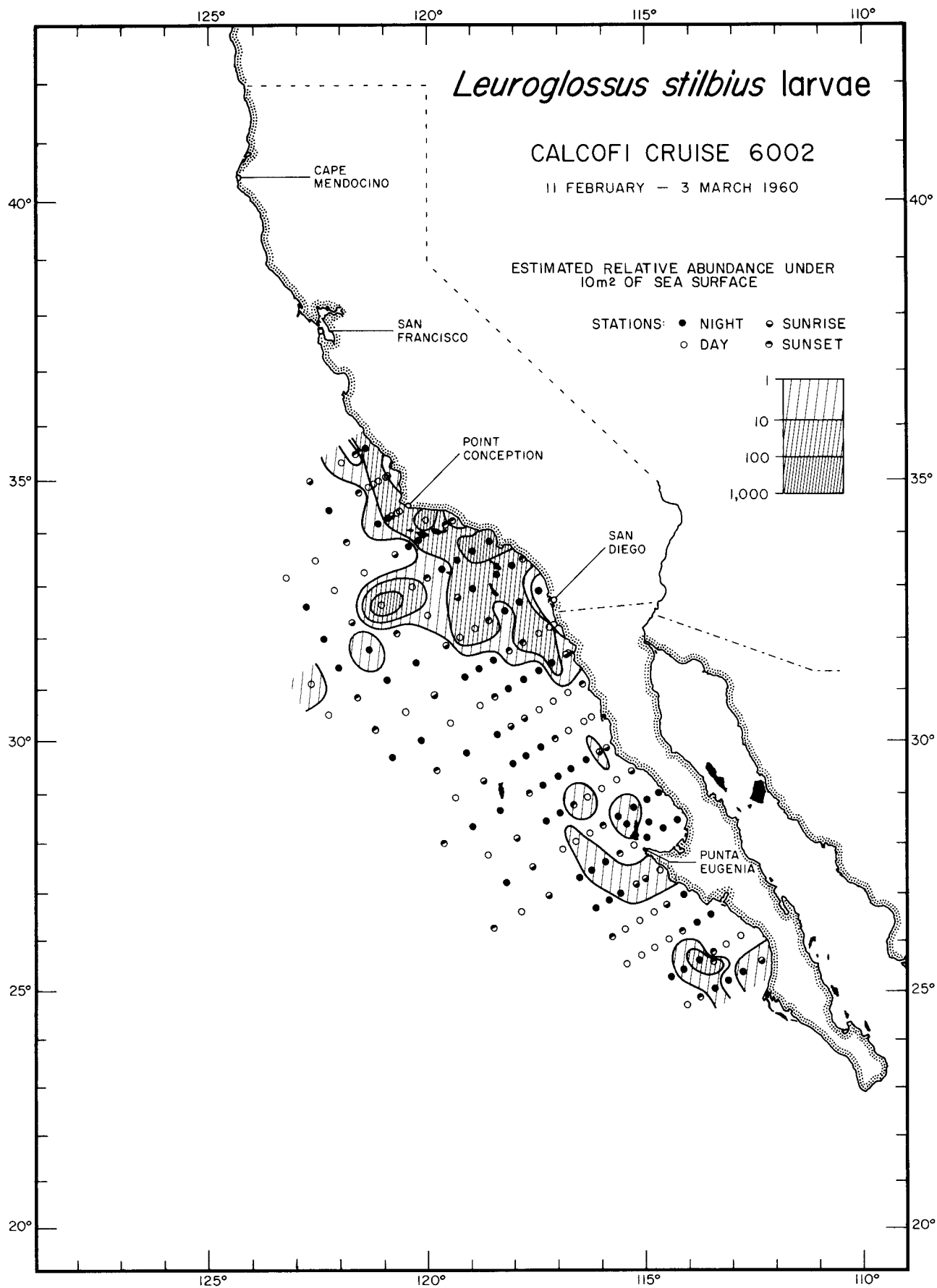
Leuroglossus stilbius larvae

5802



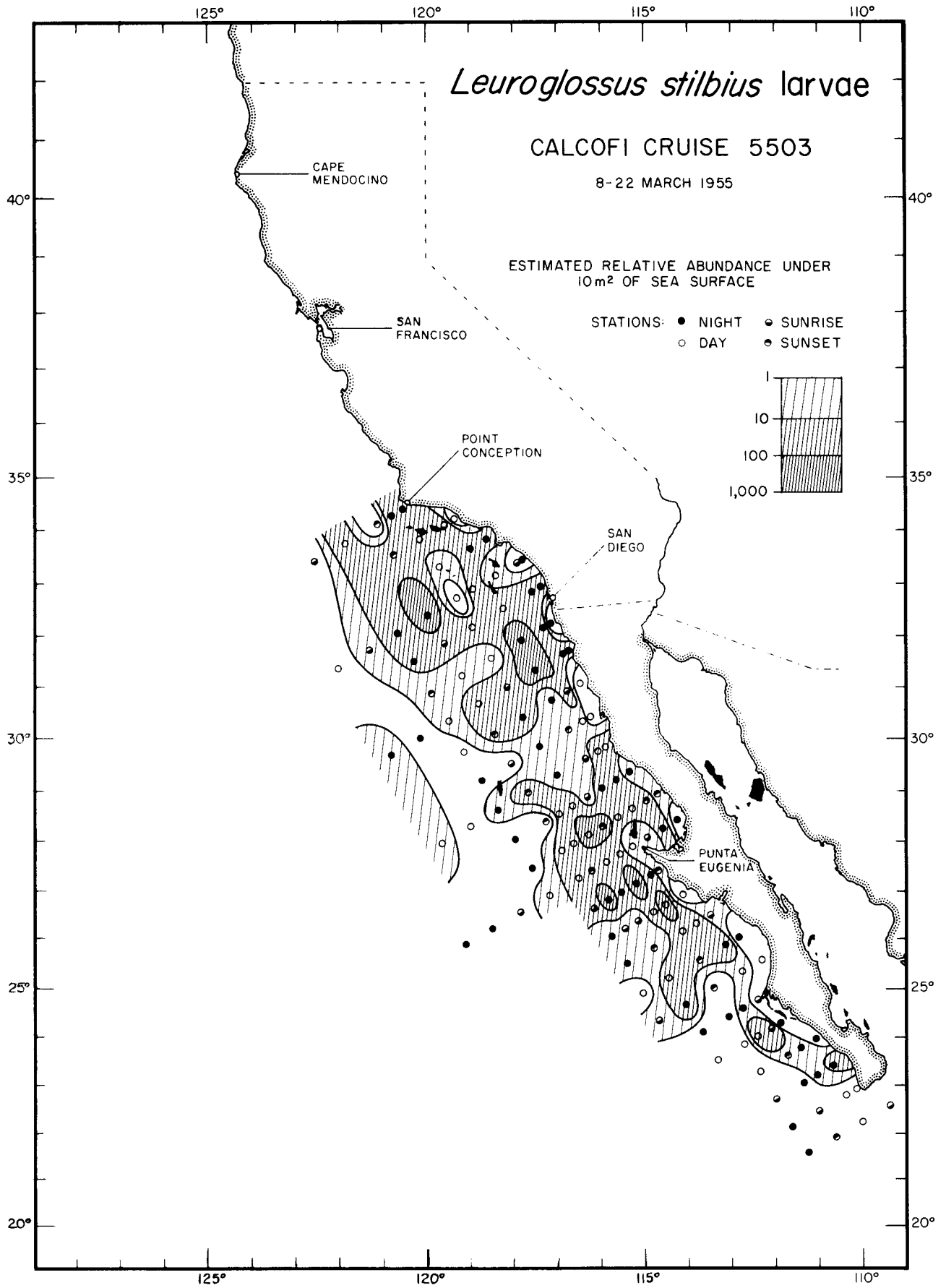
Leuroglossus stilbius larvae

5902



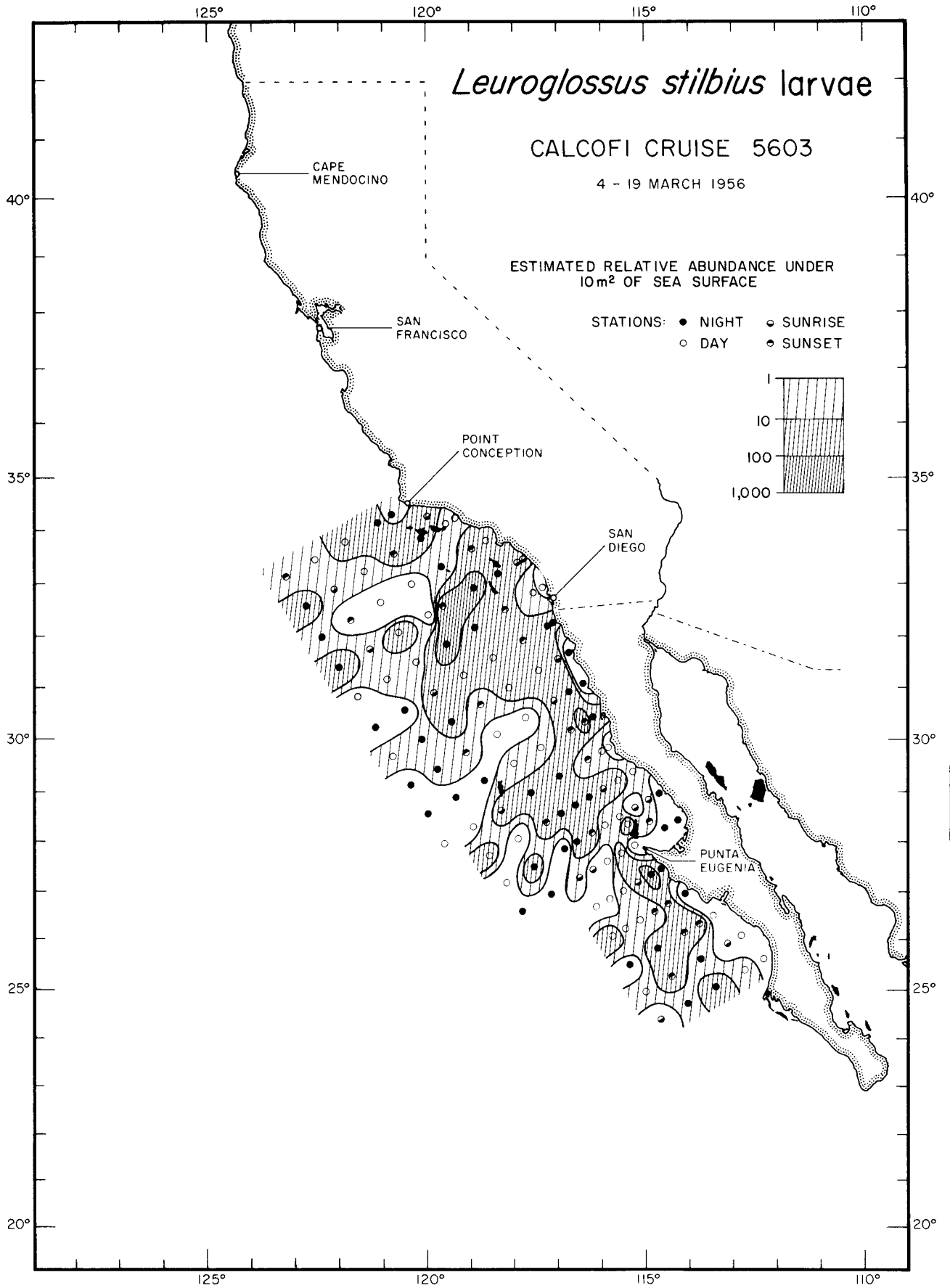
Leuroglossus stilbius larvae

6002



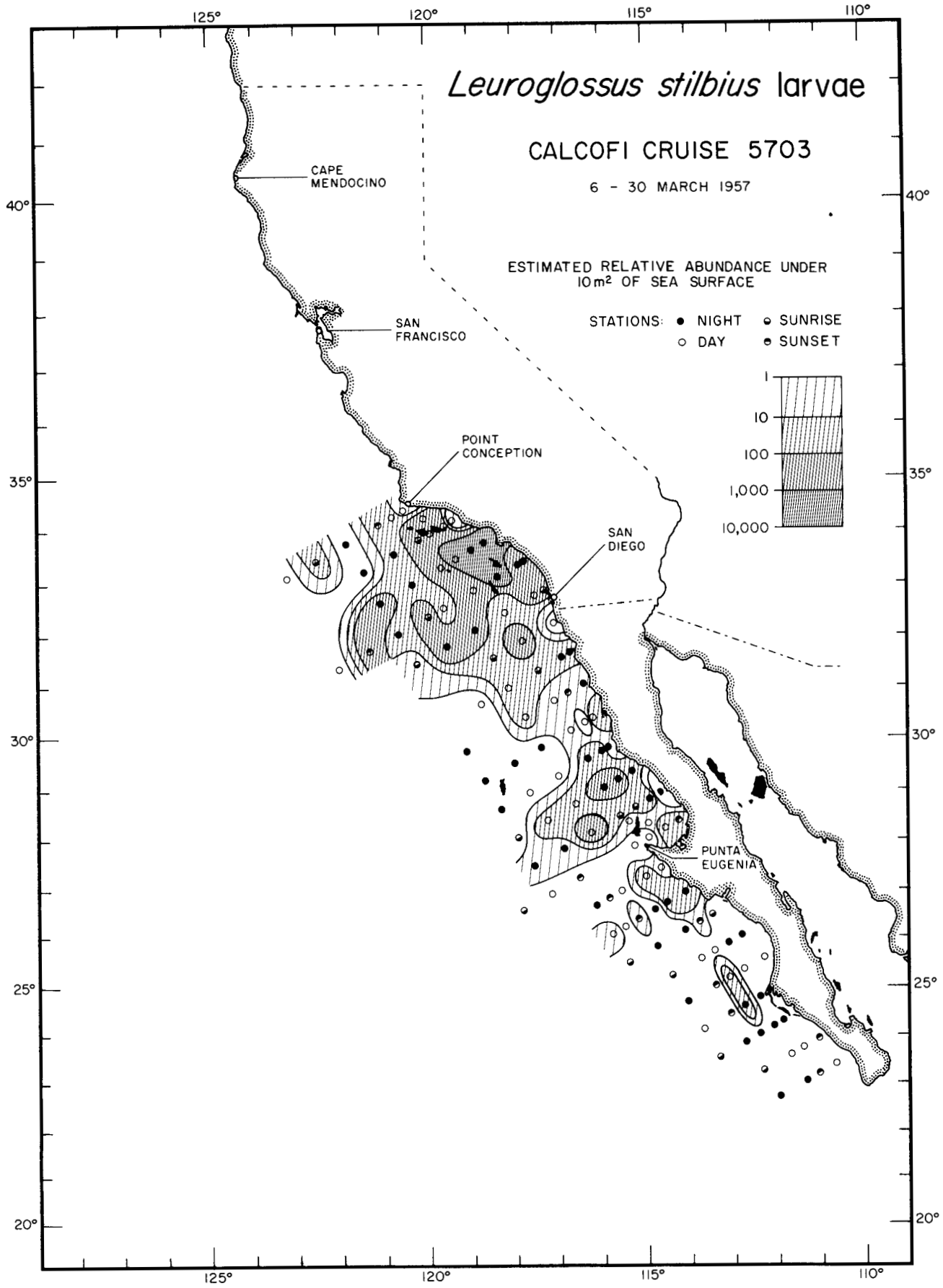
Leuroglossus stilbius larvae

5503

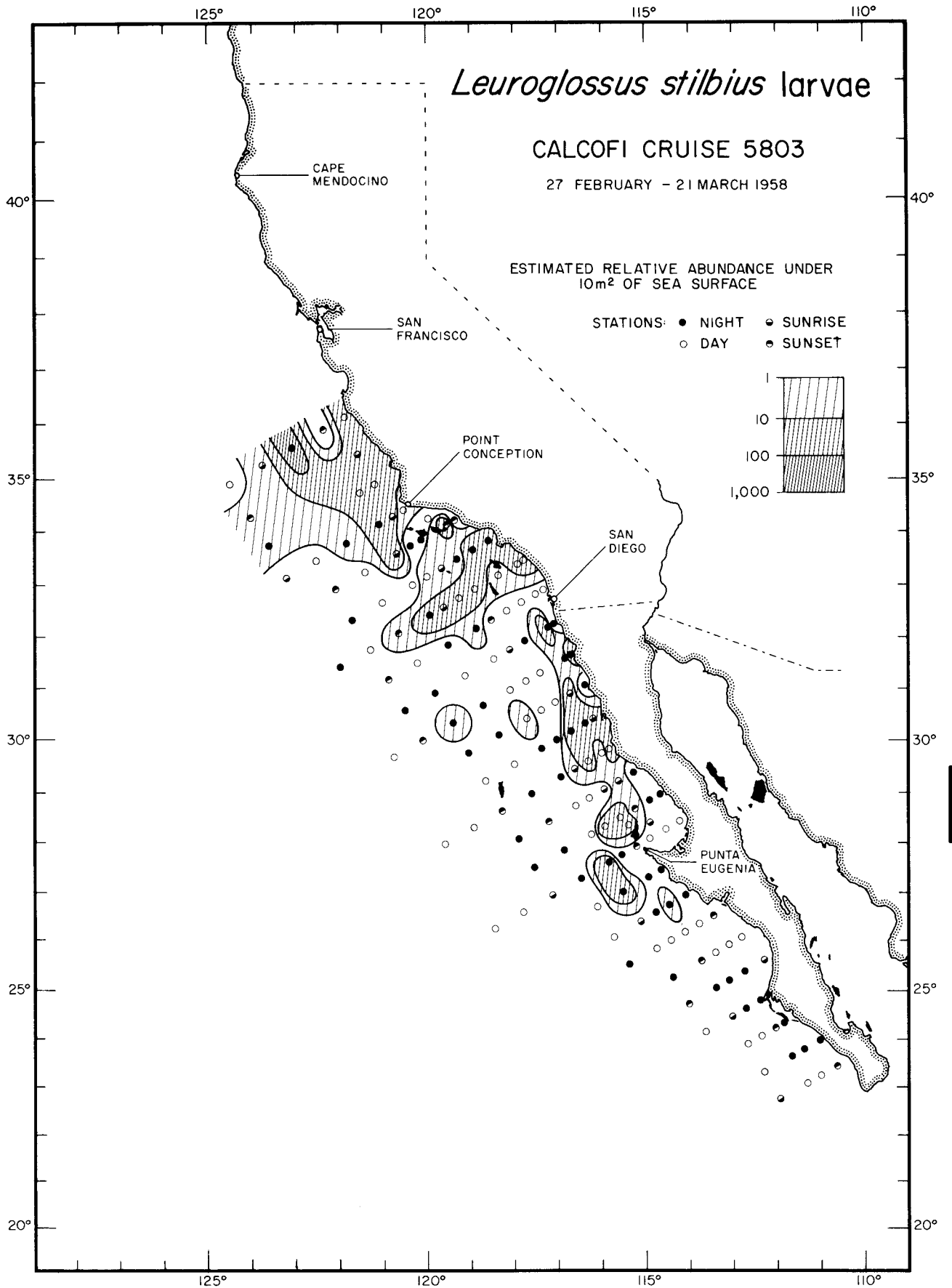


Leuroglossus stilbius larvae

5603

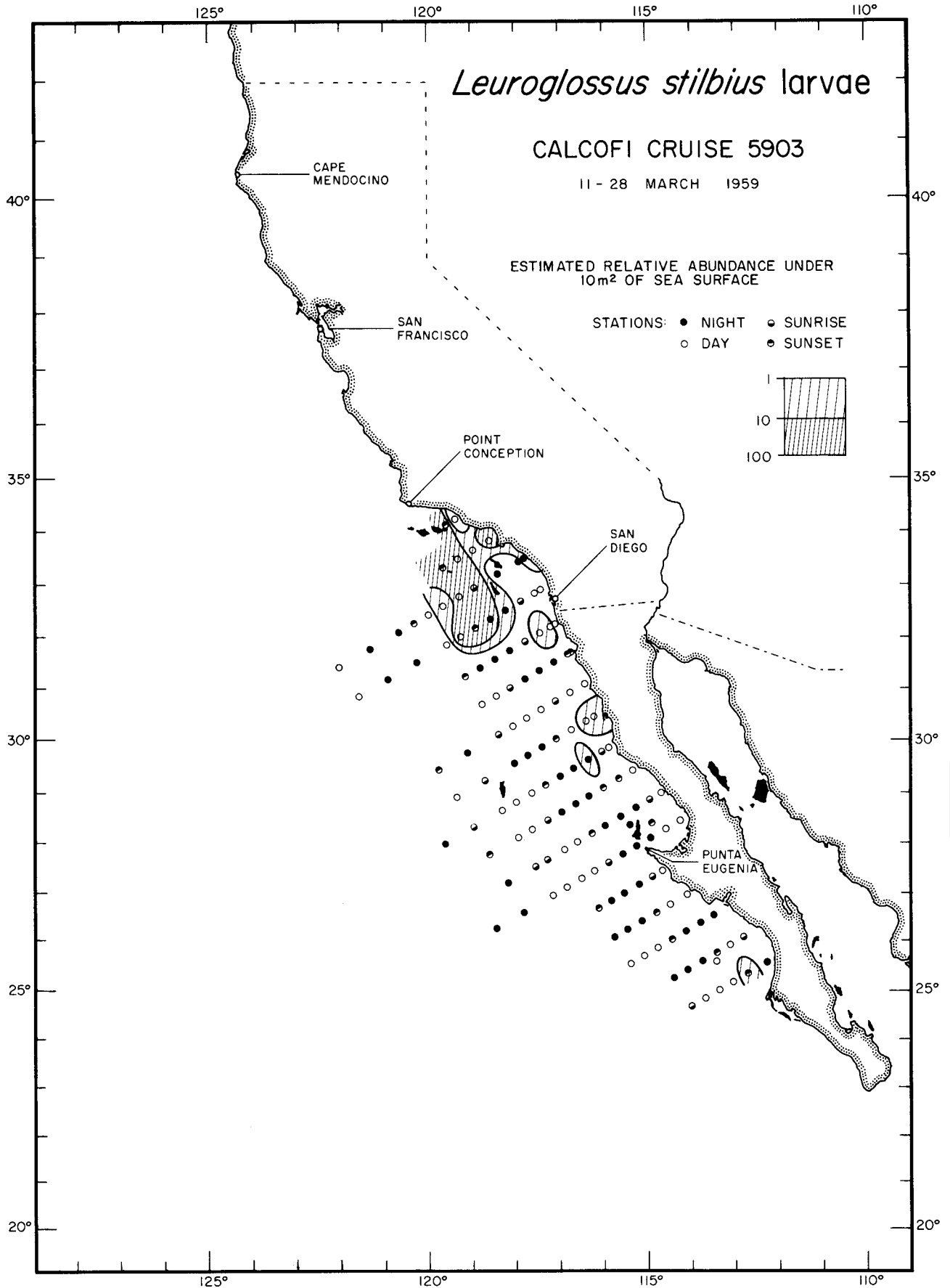


Leuroglossus stilbius larvae



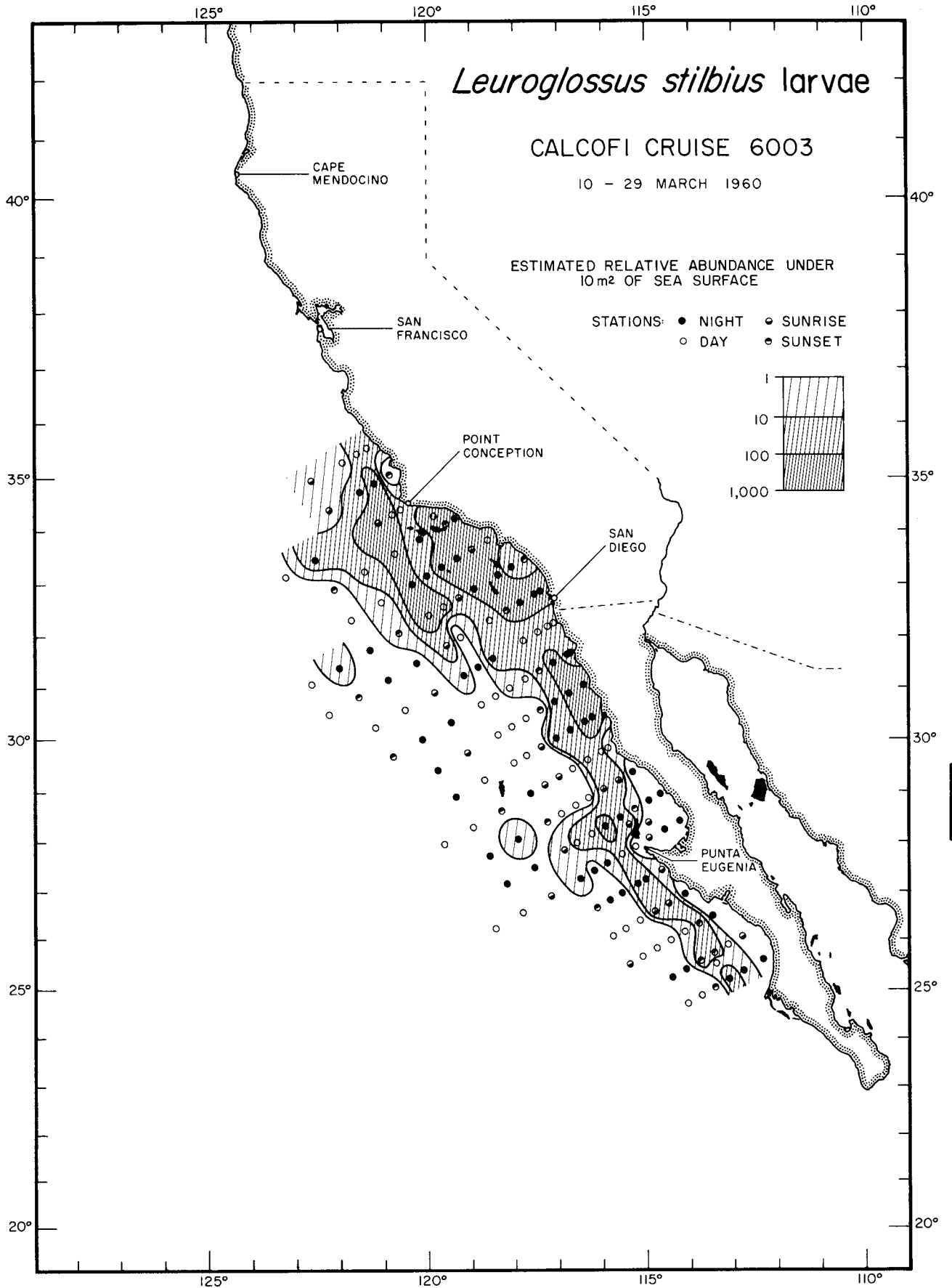
Leuroglossus stilbius larvae

5803



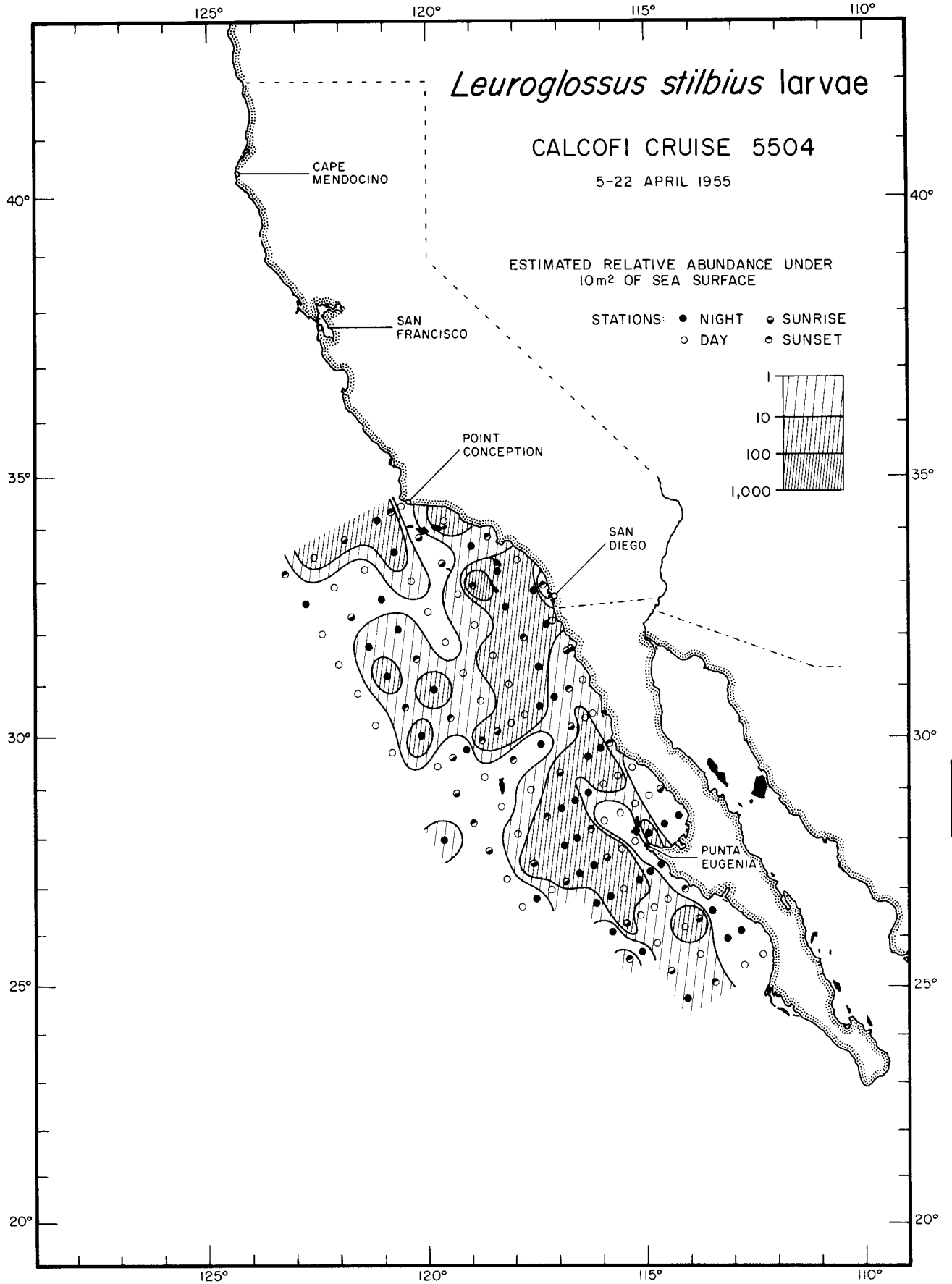
Leuroglossus stilbius larvae

5903



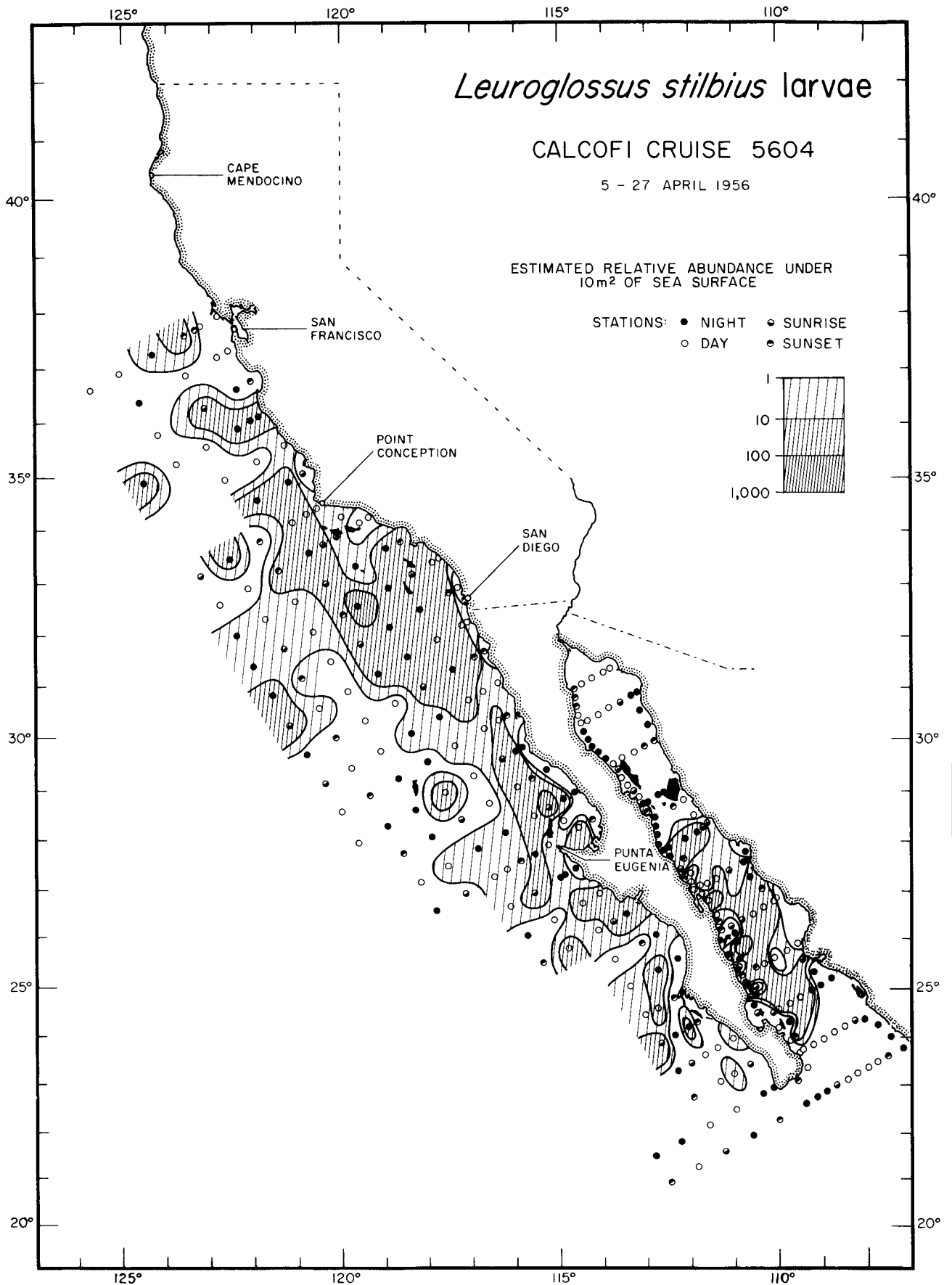
Leuroglossus stilbius larvae

6003



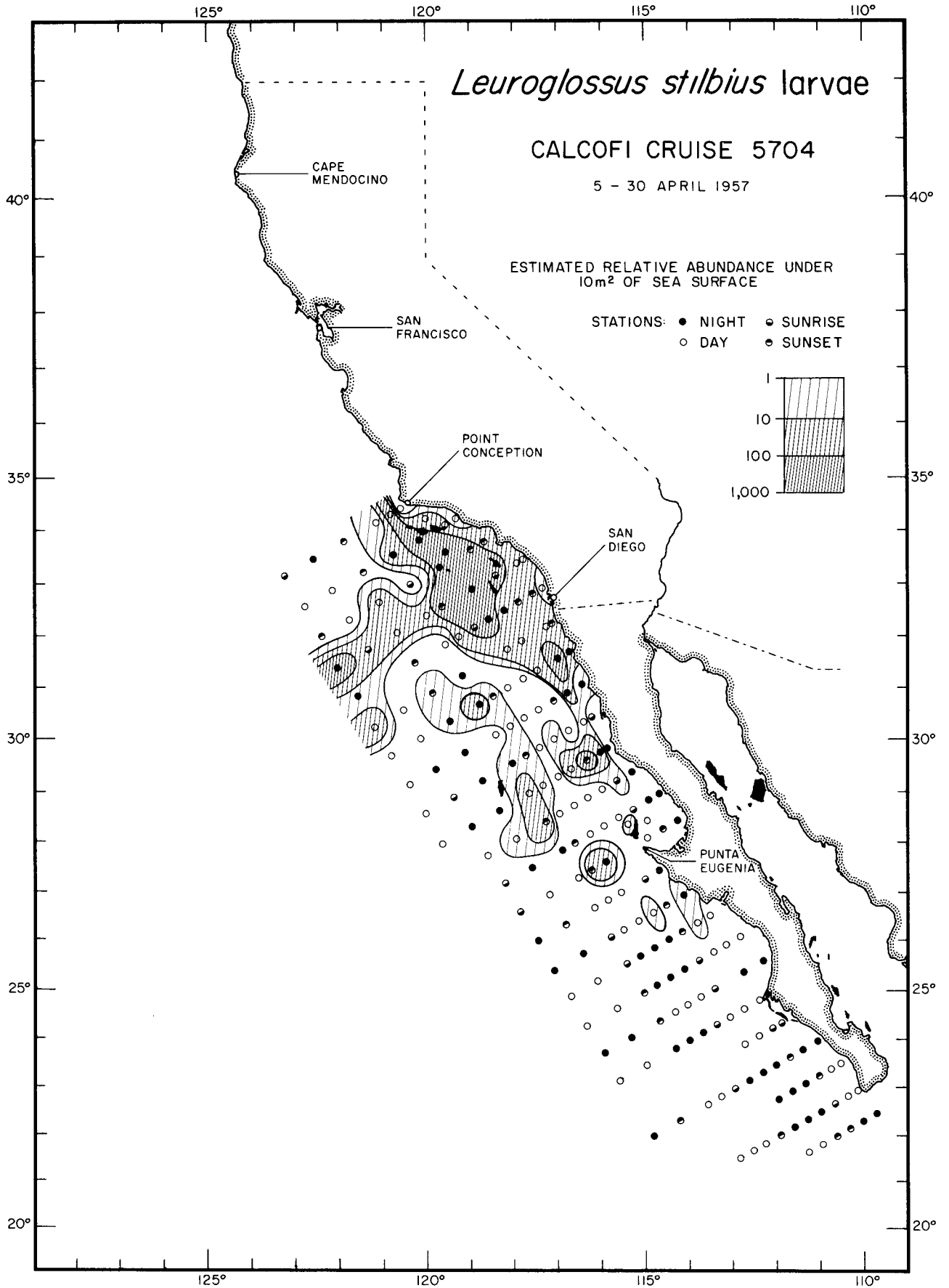
Leuroglossus stilbius larvae

5504



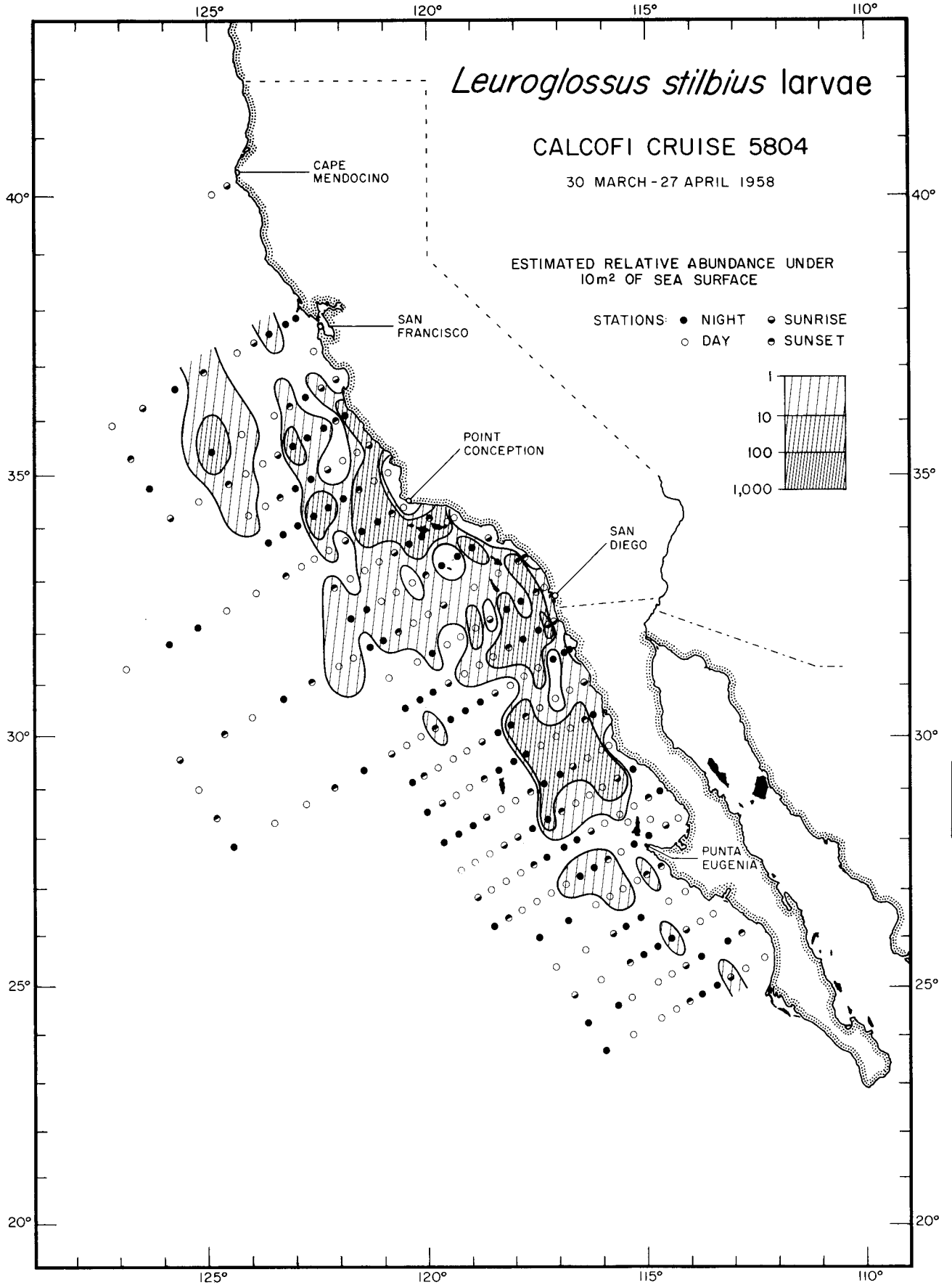
Leuroglossus stilbius larvae

5604



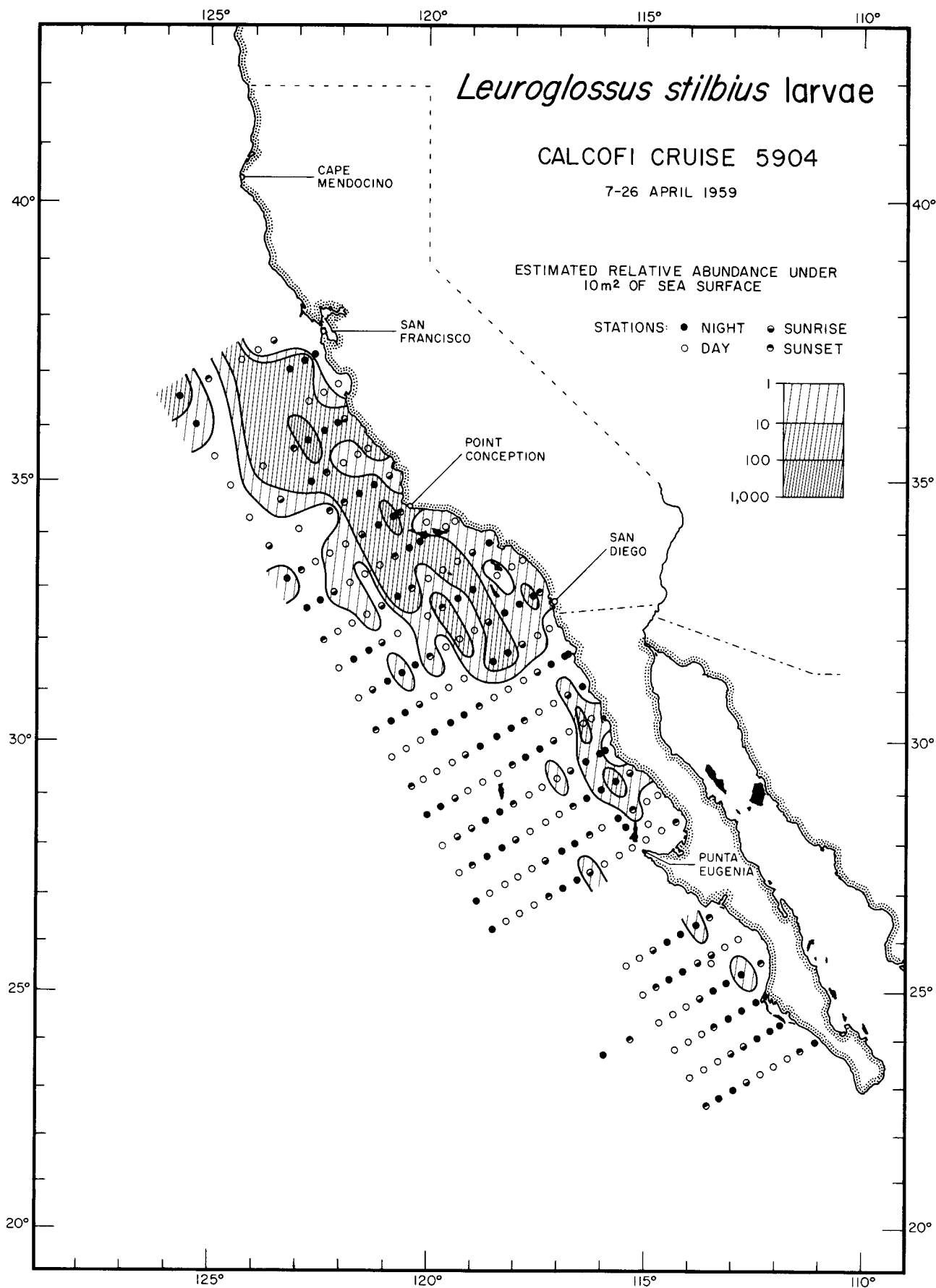
Leuroglossus stilbius larvae

5704



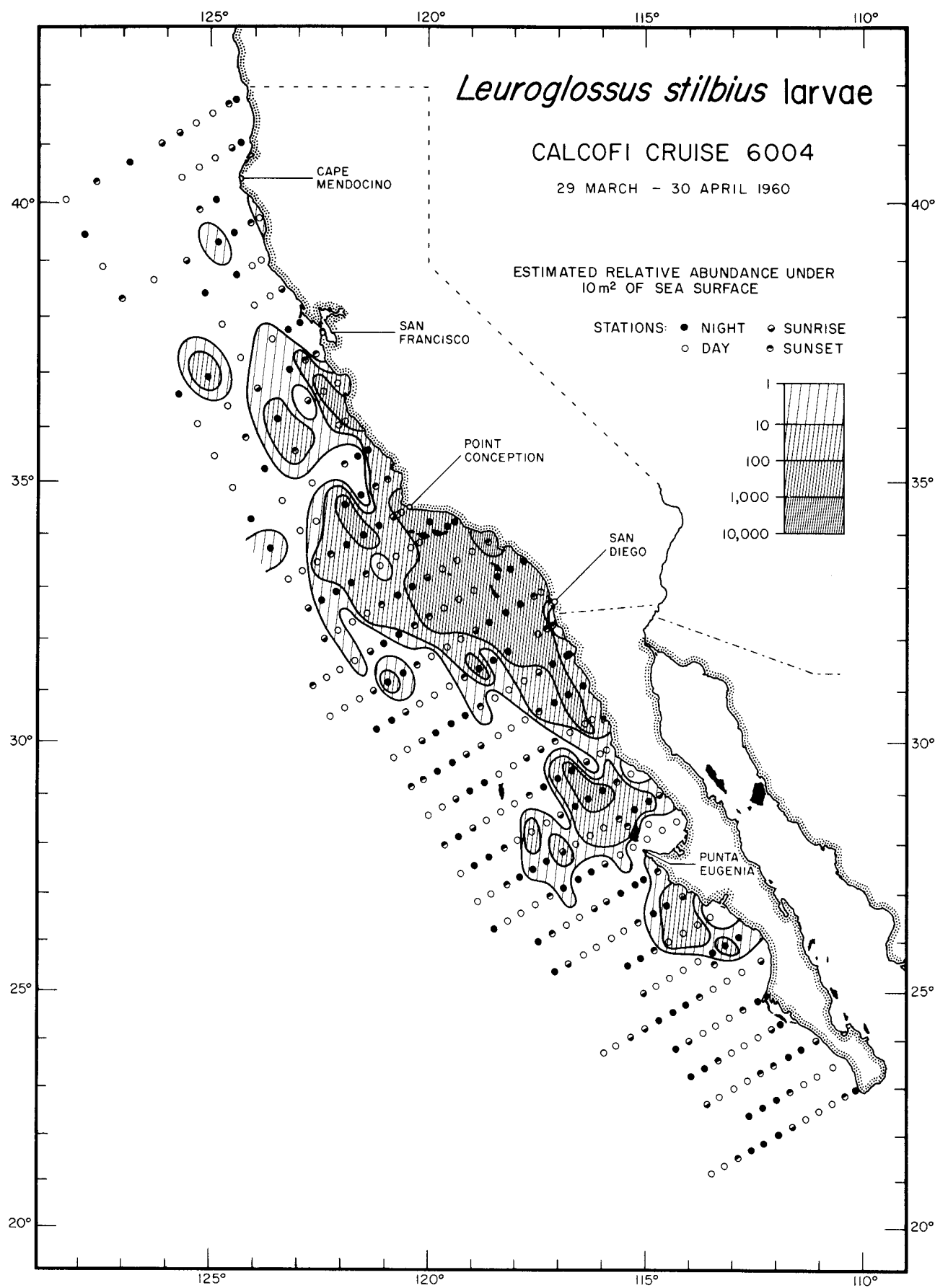
Leuroglossus stilbius larvae

5804



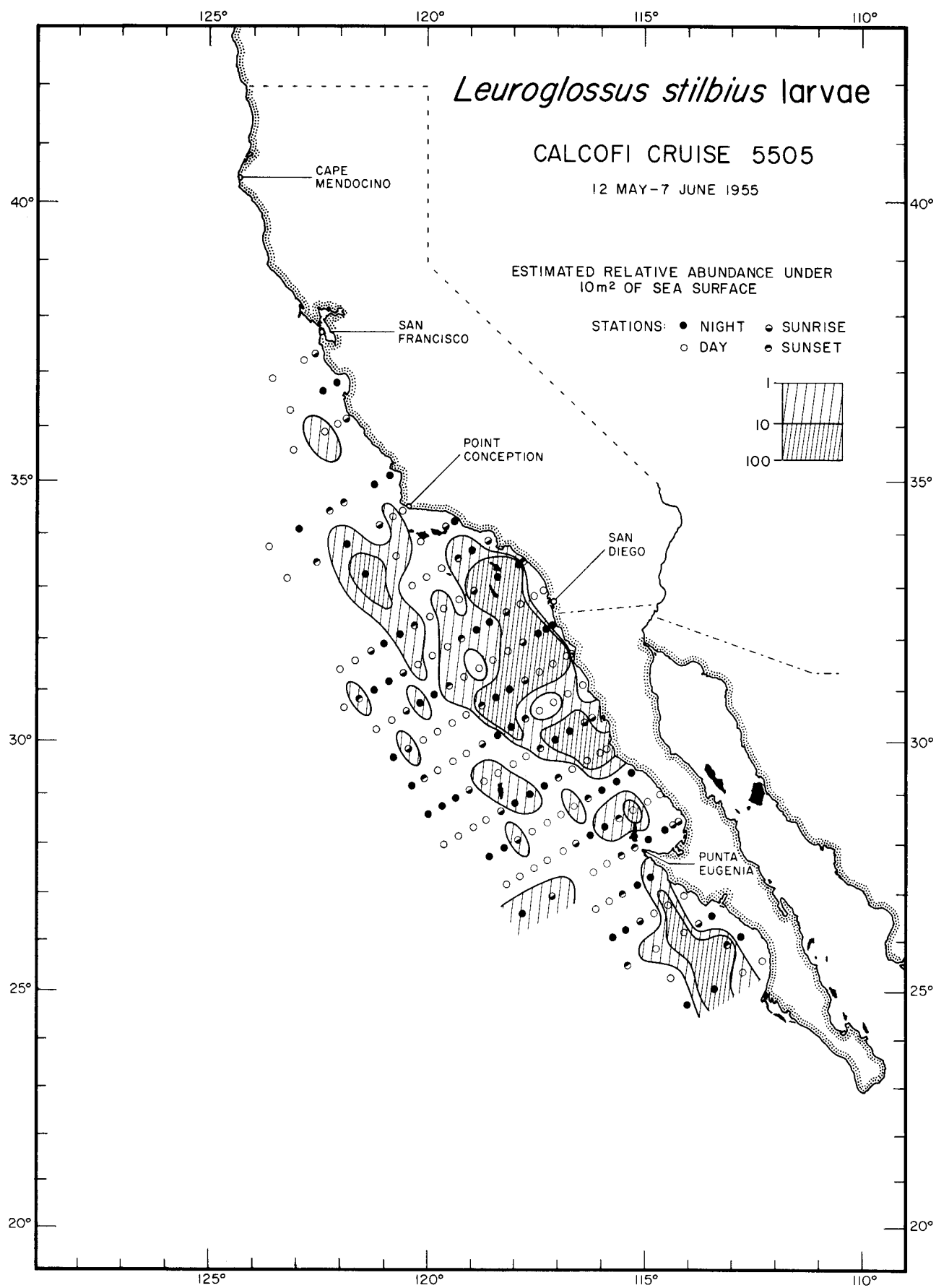
Leuroglossus stilbius larvae

5904



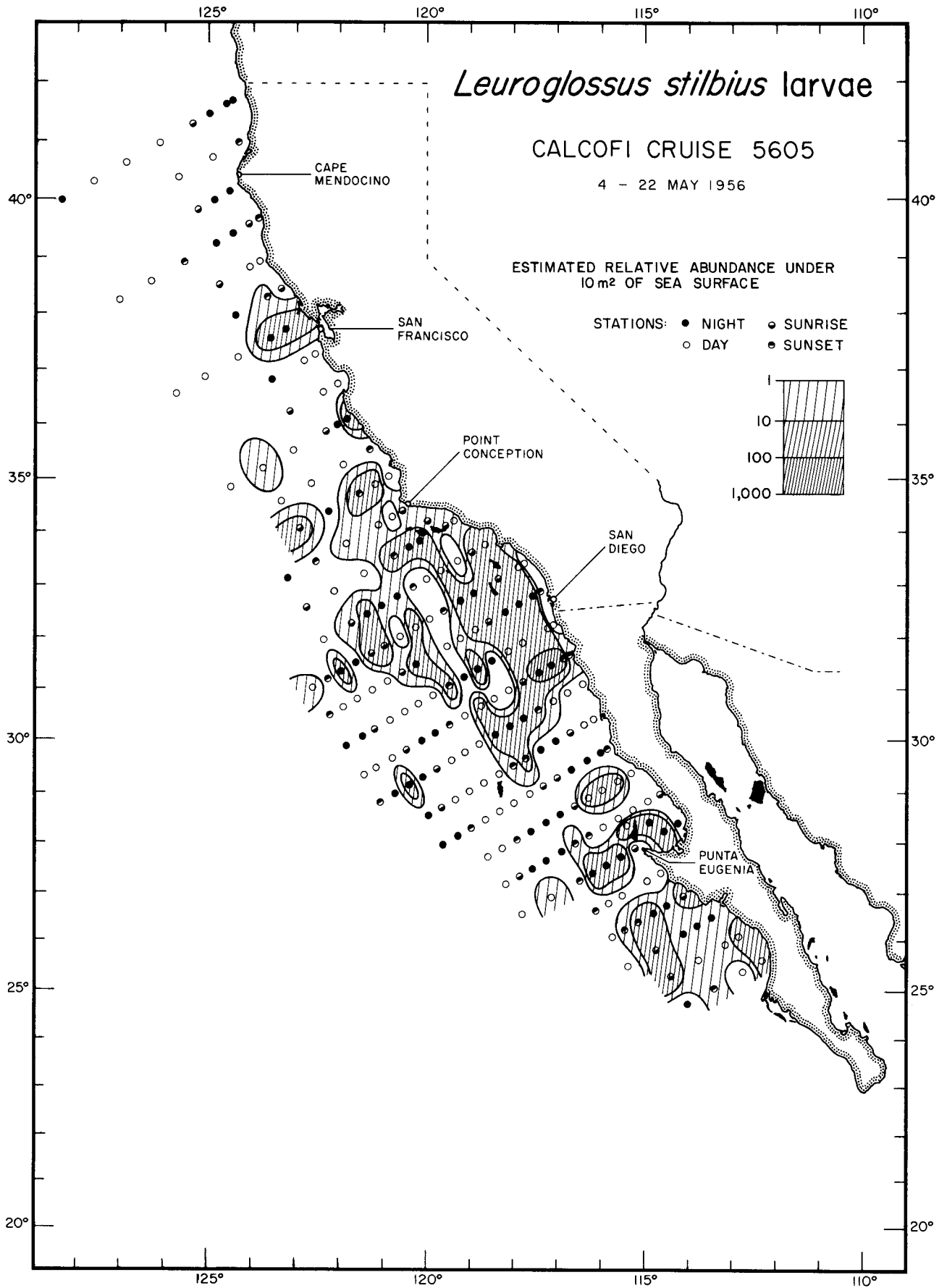
Leuroglossus stilbius larvae

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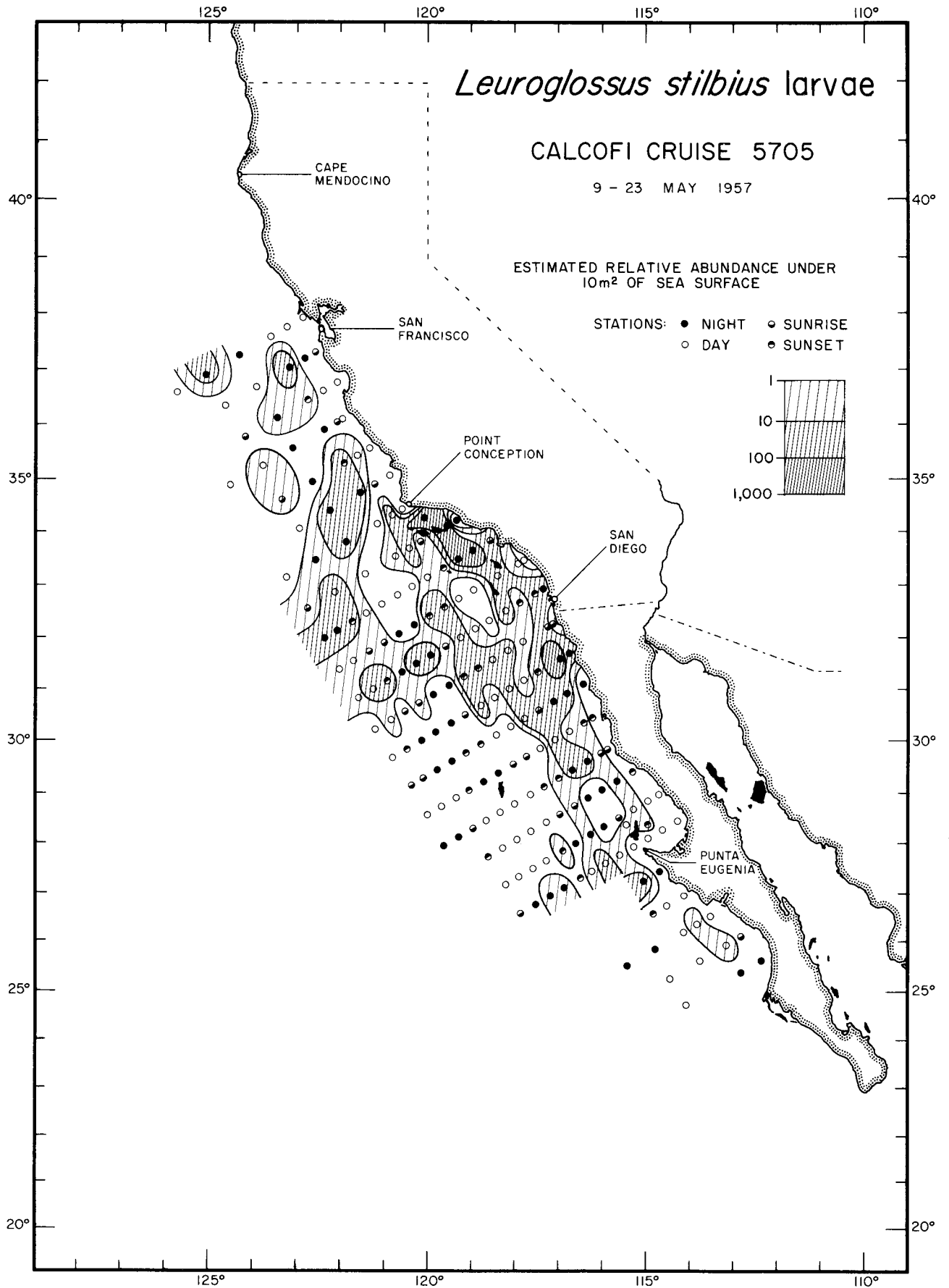
Leuroglossus stilbius larvae

5505



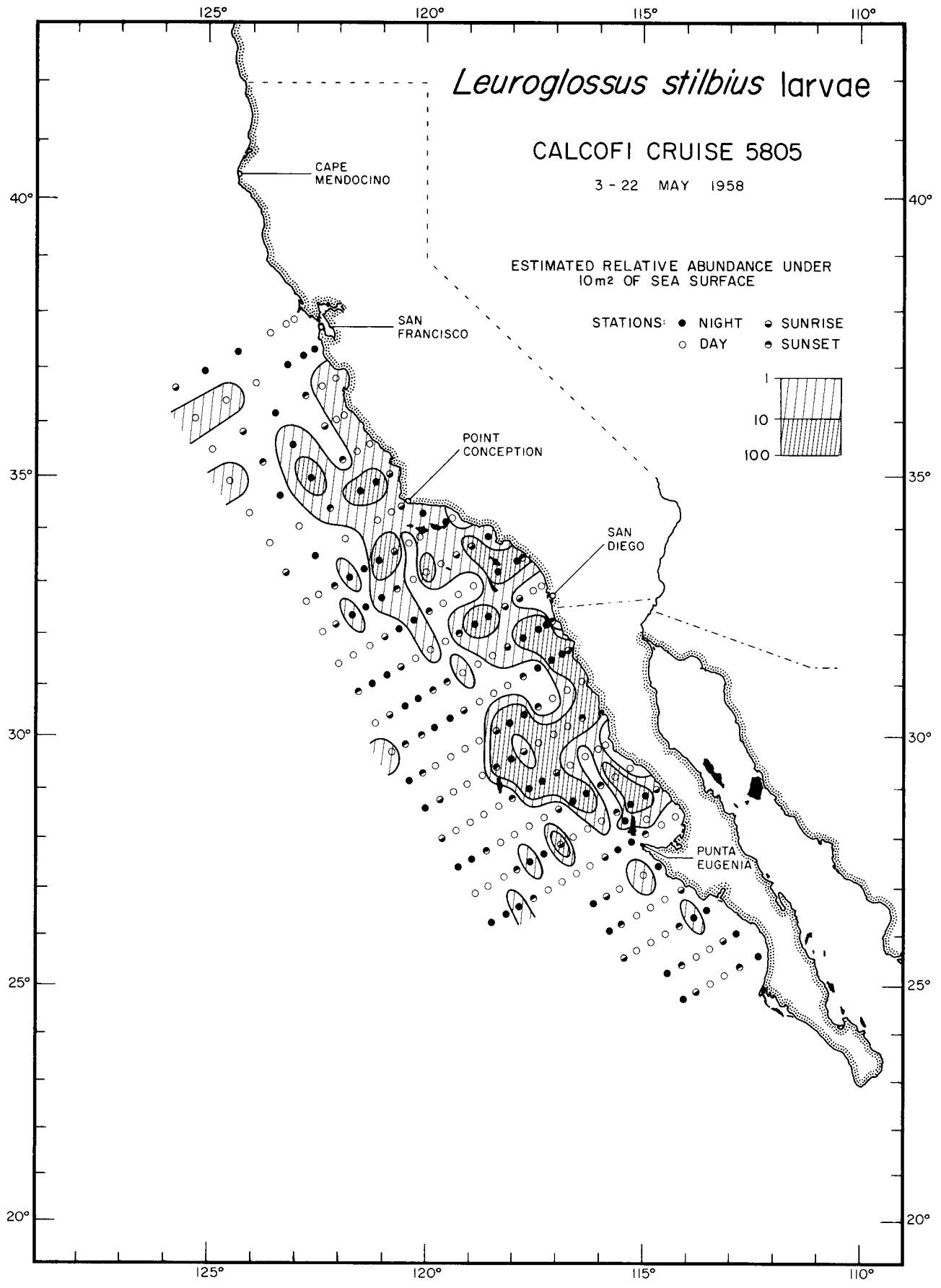
Leuroglossus stilbius larvae

5605



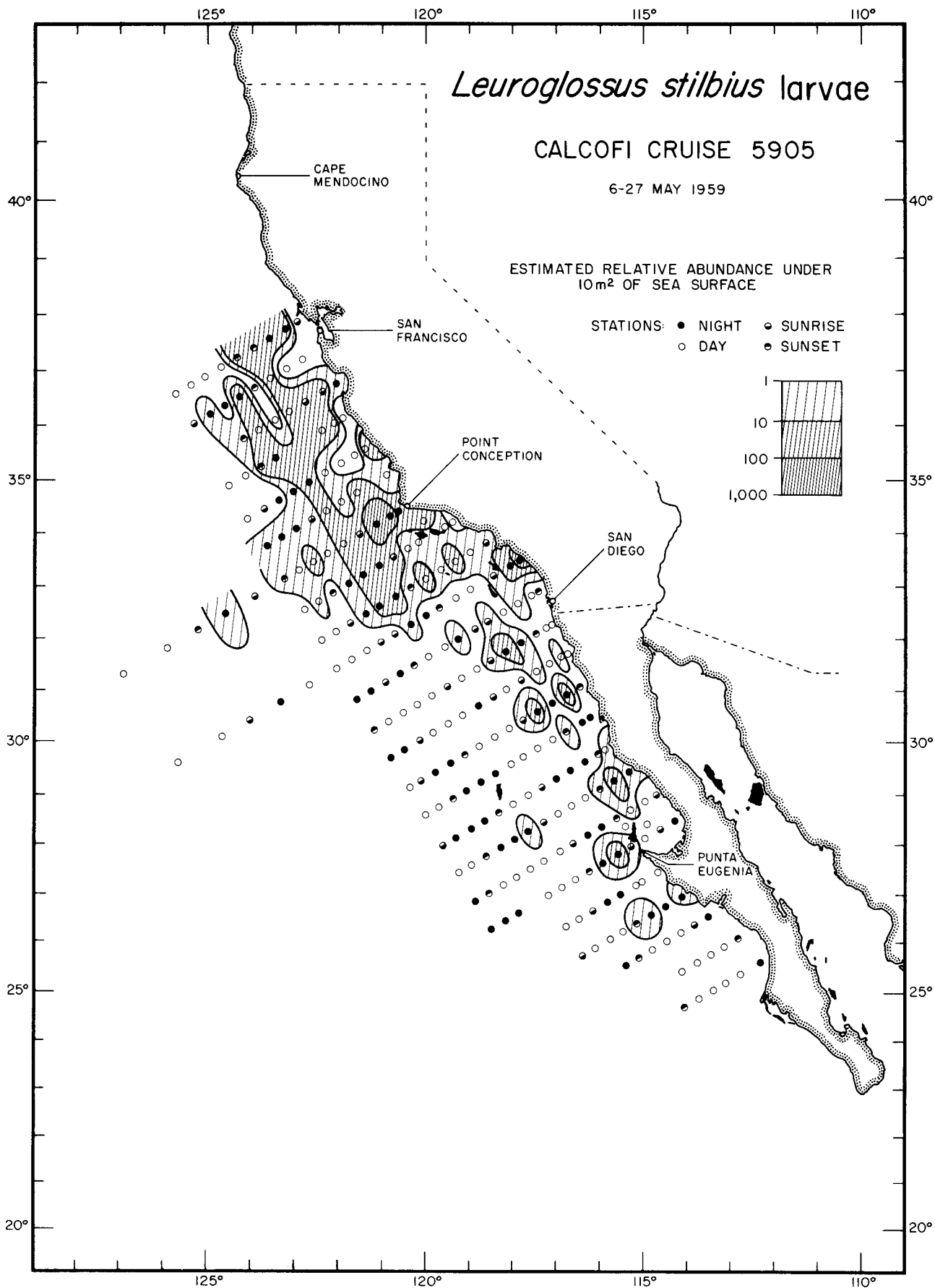
Leuroglossus stilbius larvae

5705



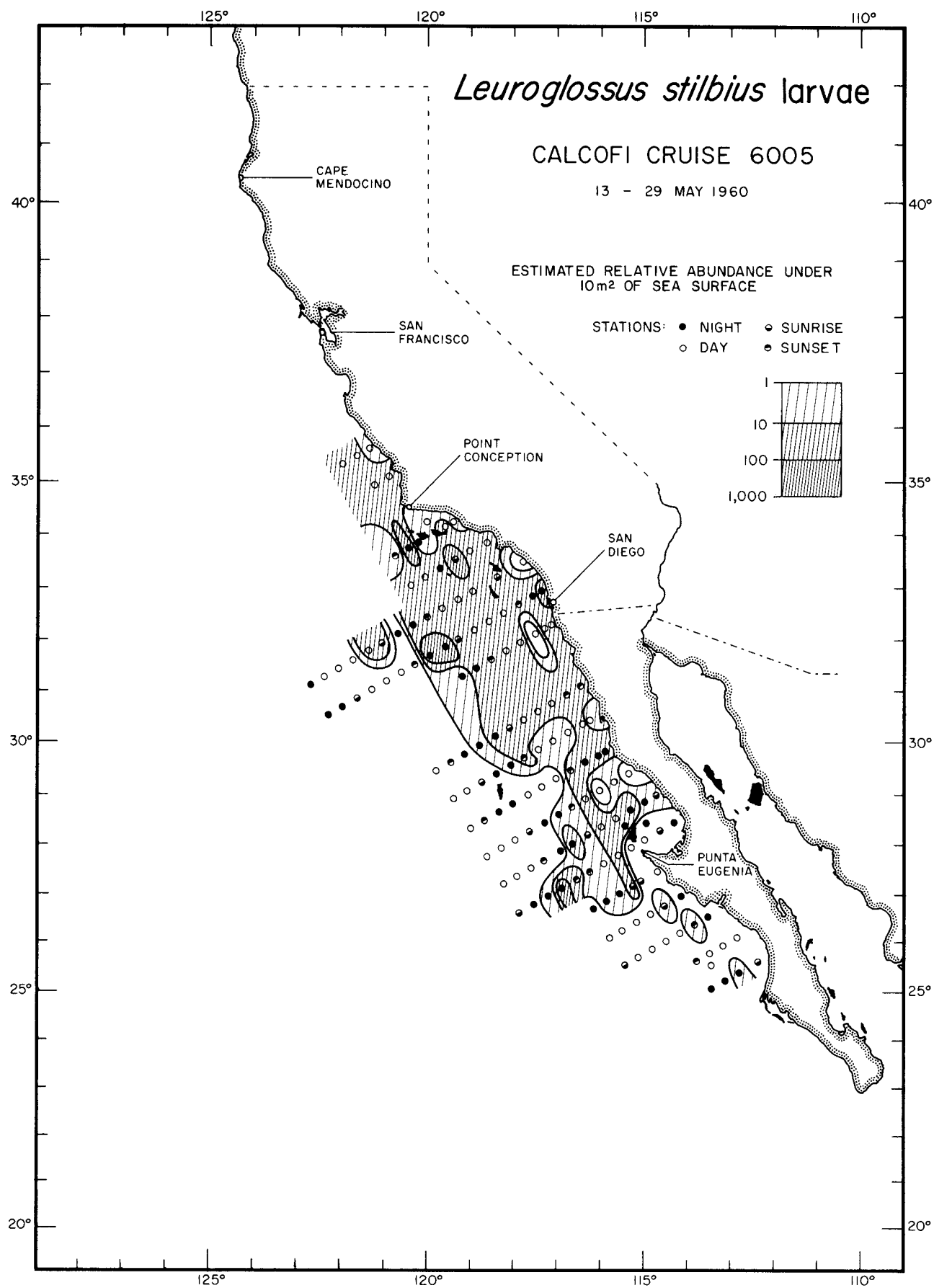
Leuroglossus stilbius larvae

5805



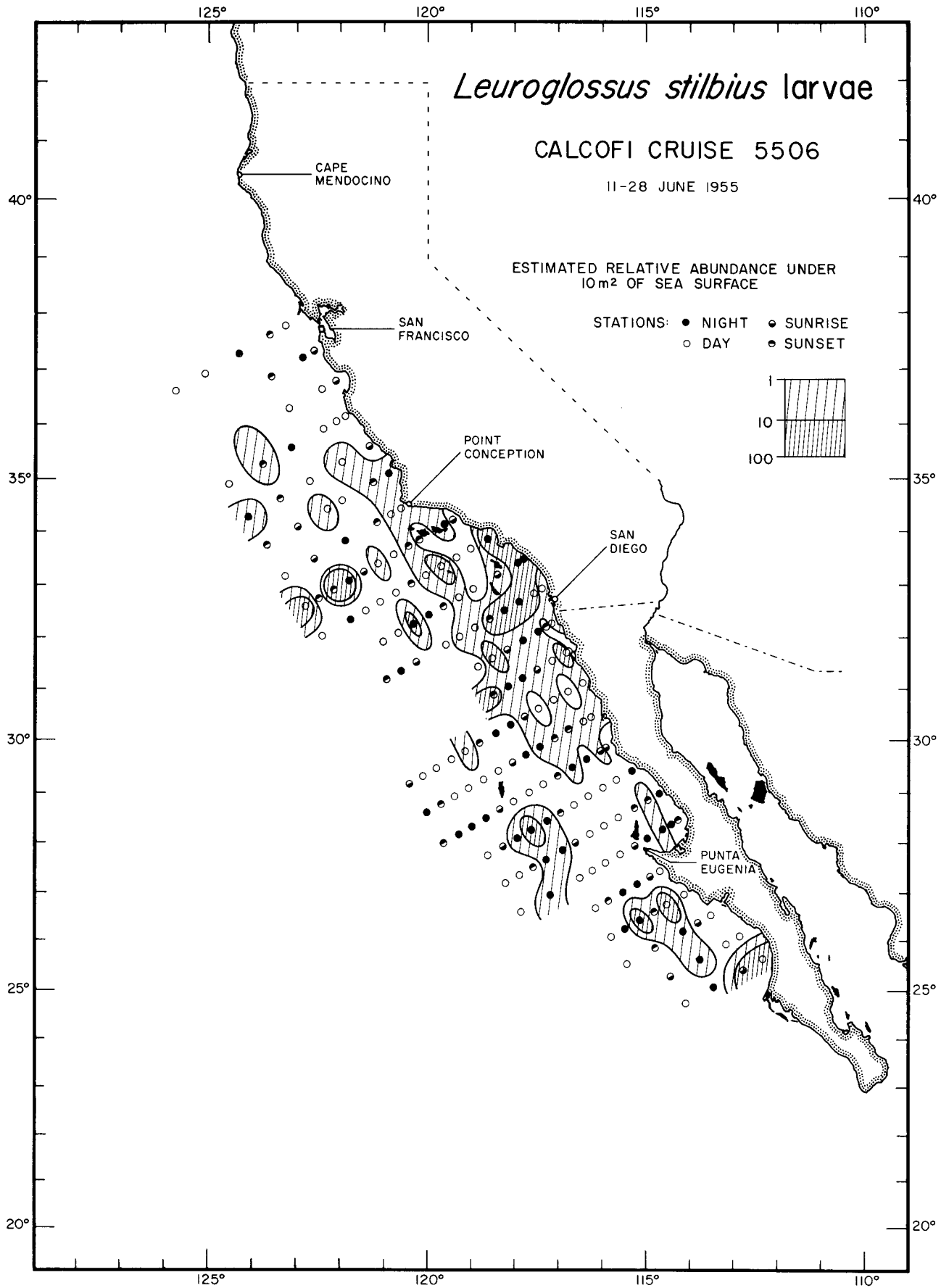
Leuroglossus stilbius larvae

5905



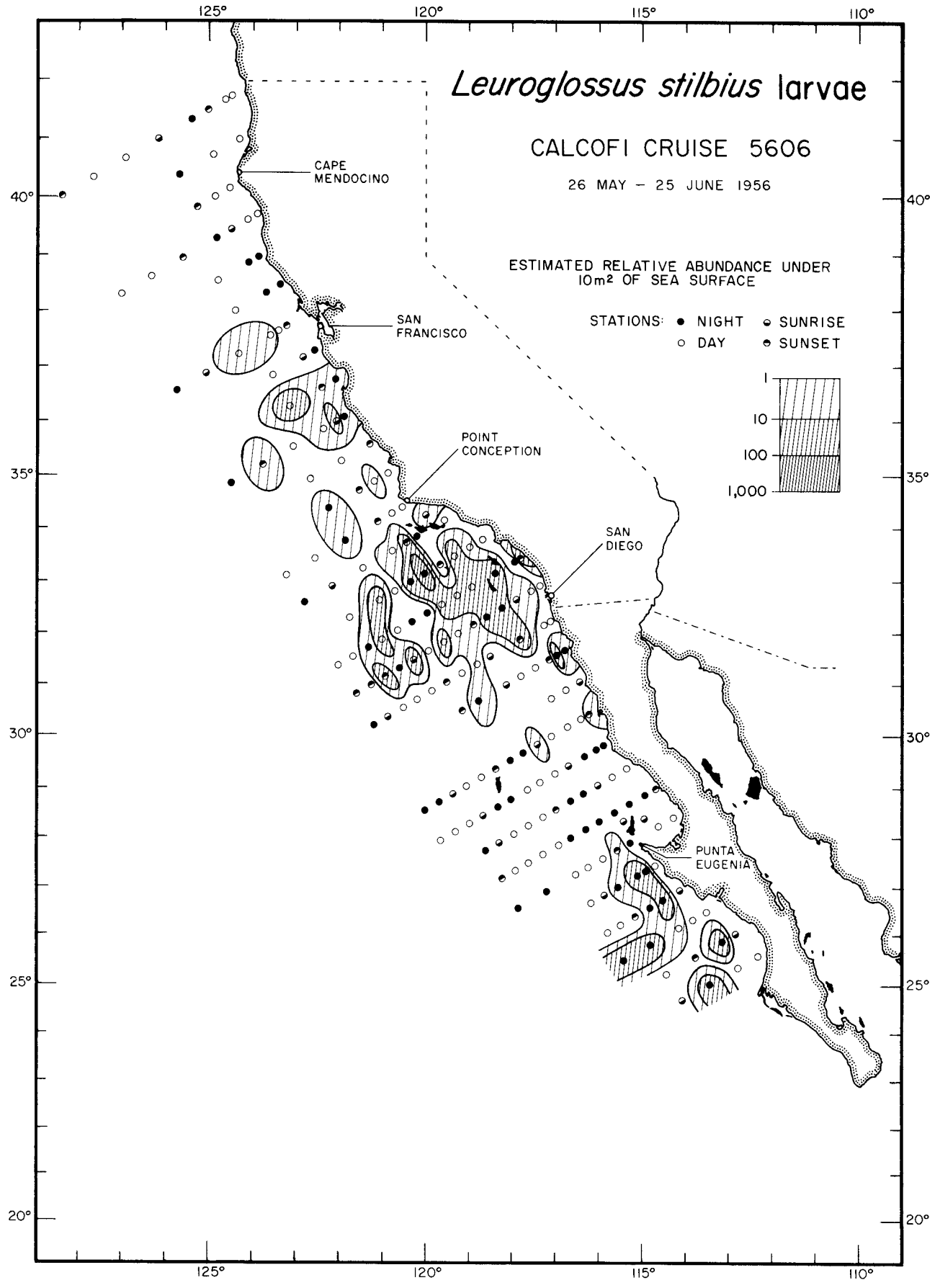
Leuroglossus stilbius larvae

6005

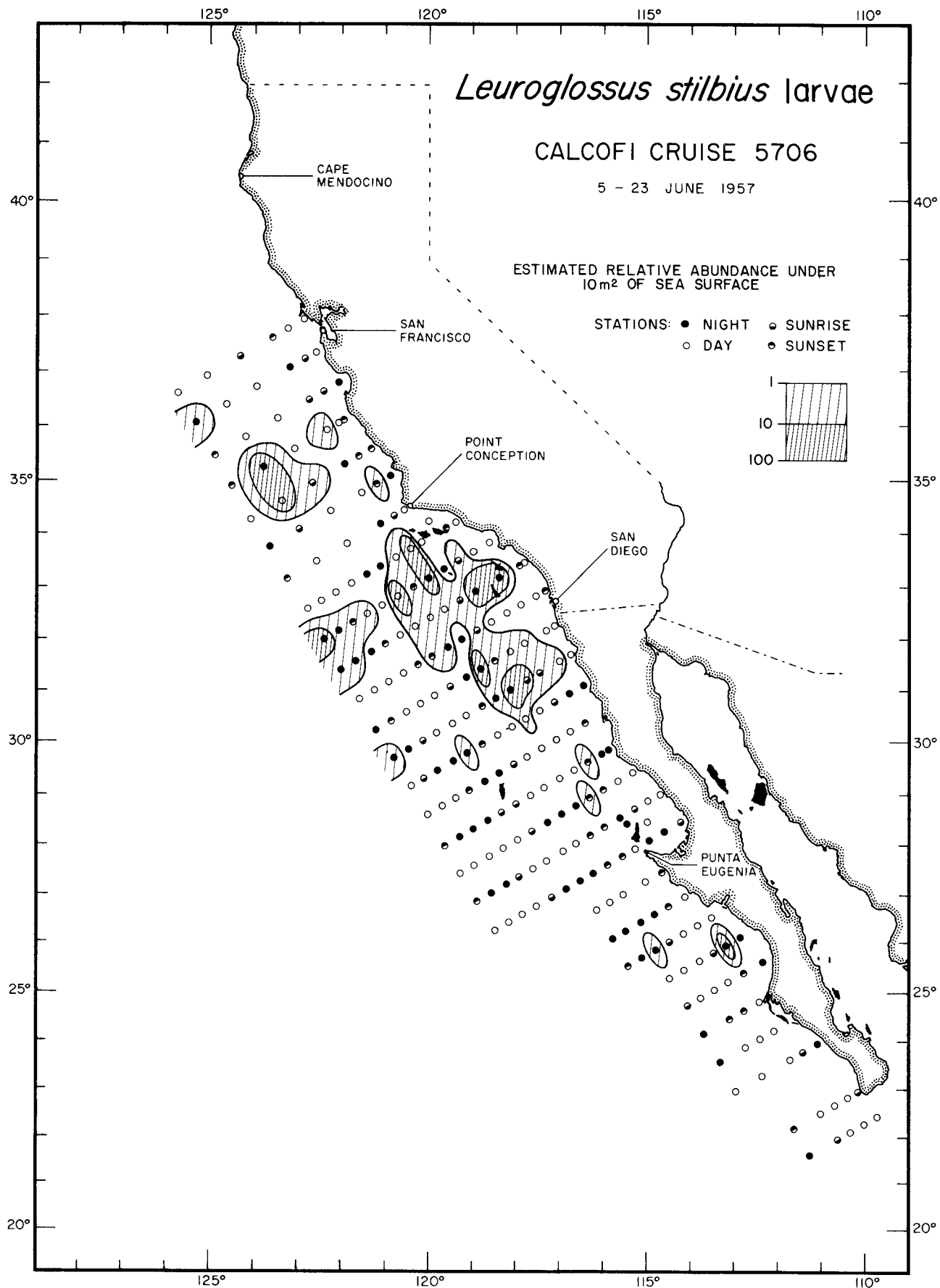


Leuroglossus stilbius larvae

5506

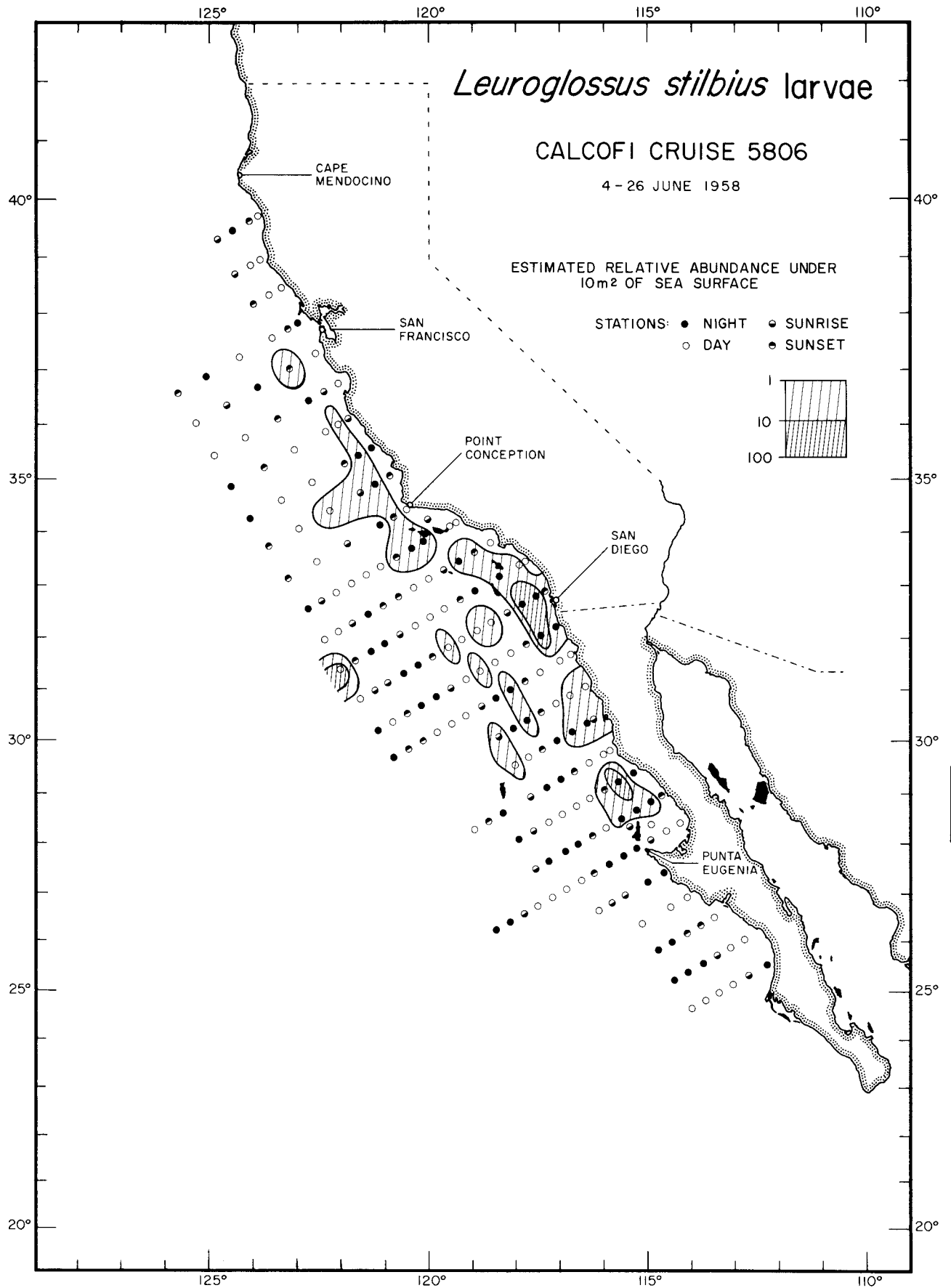


Leuroglossus stilbius larvae



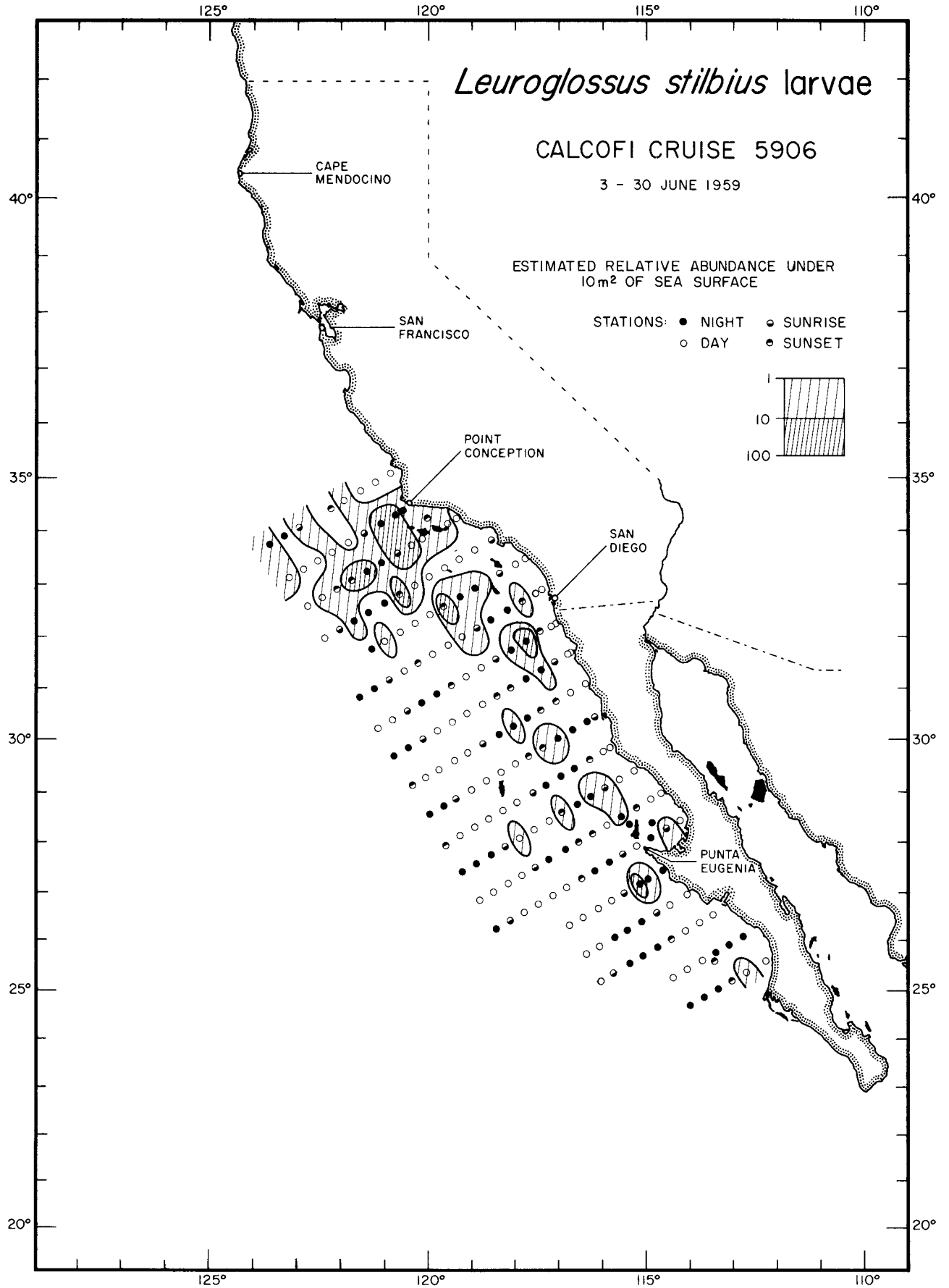
Leuroglossus stilbius larvae

5706



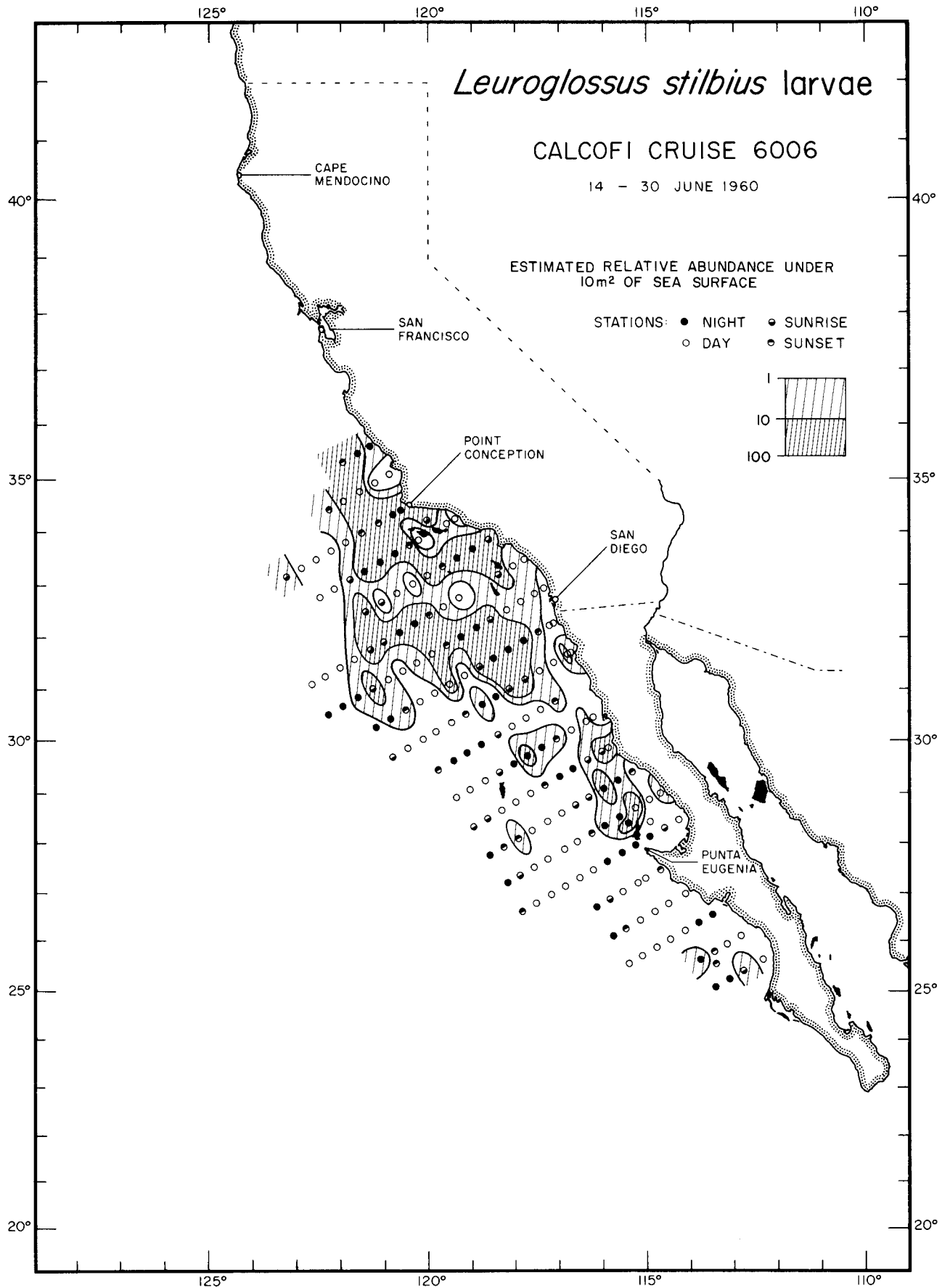
Leuroglossus stilbius larvae

5806



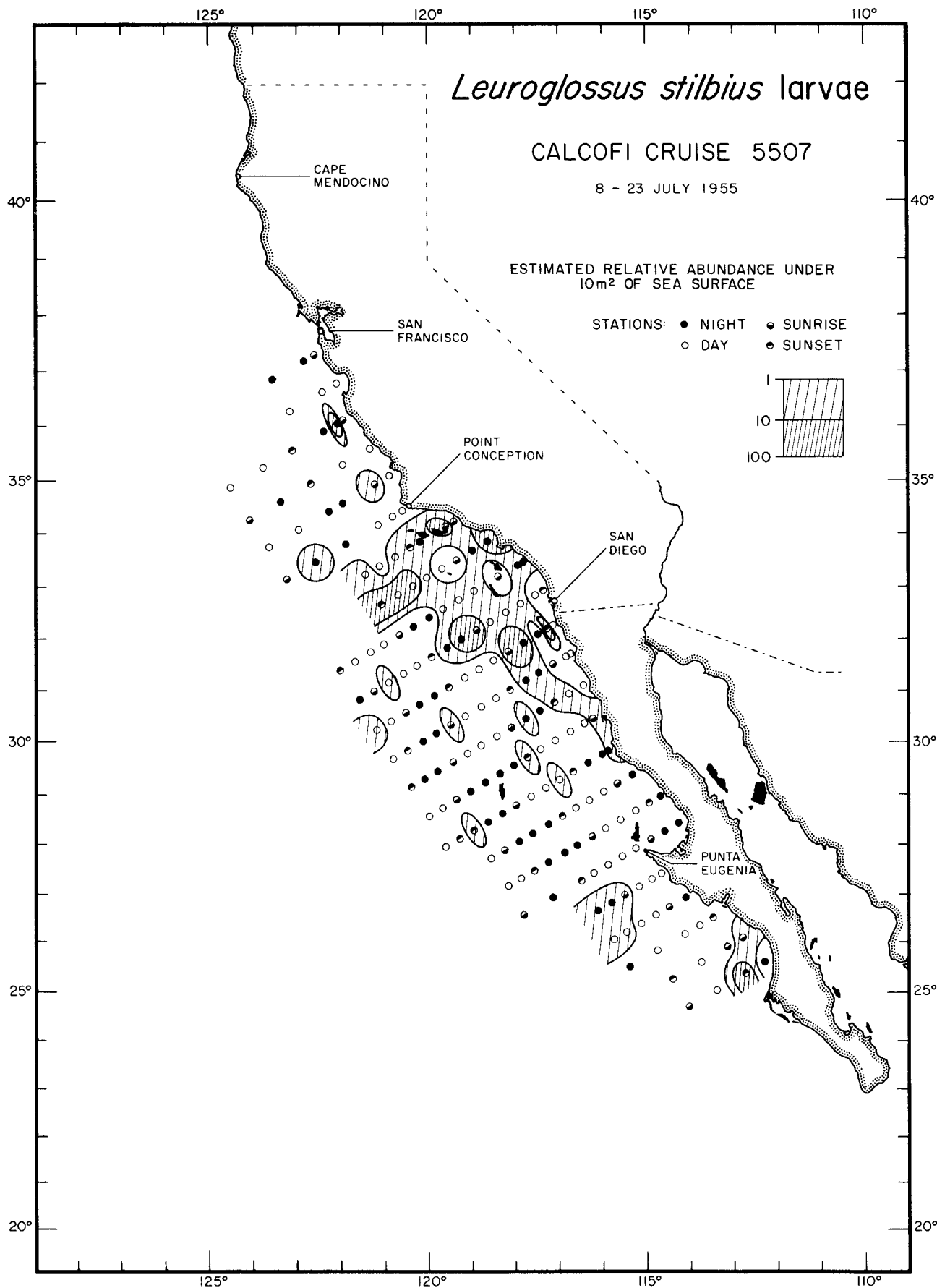
Leuroglossus stilbius larvae

5906



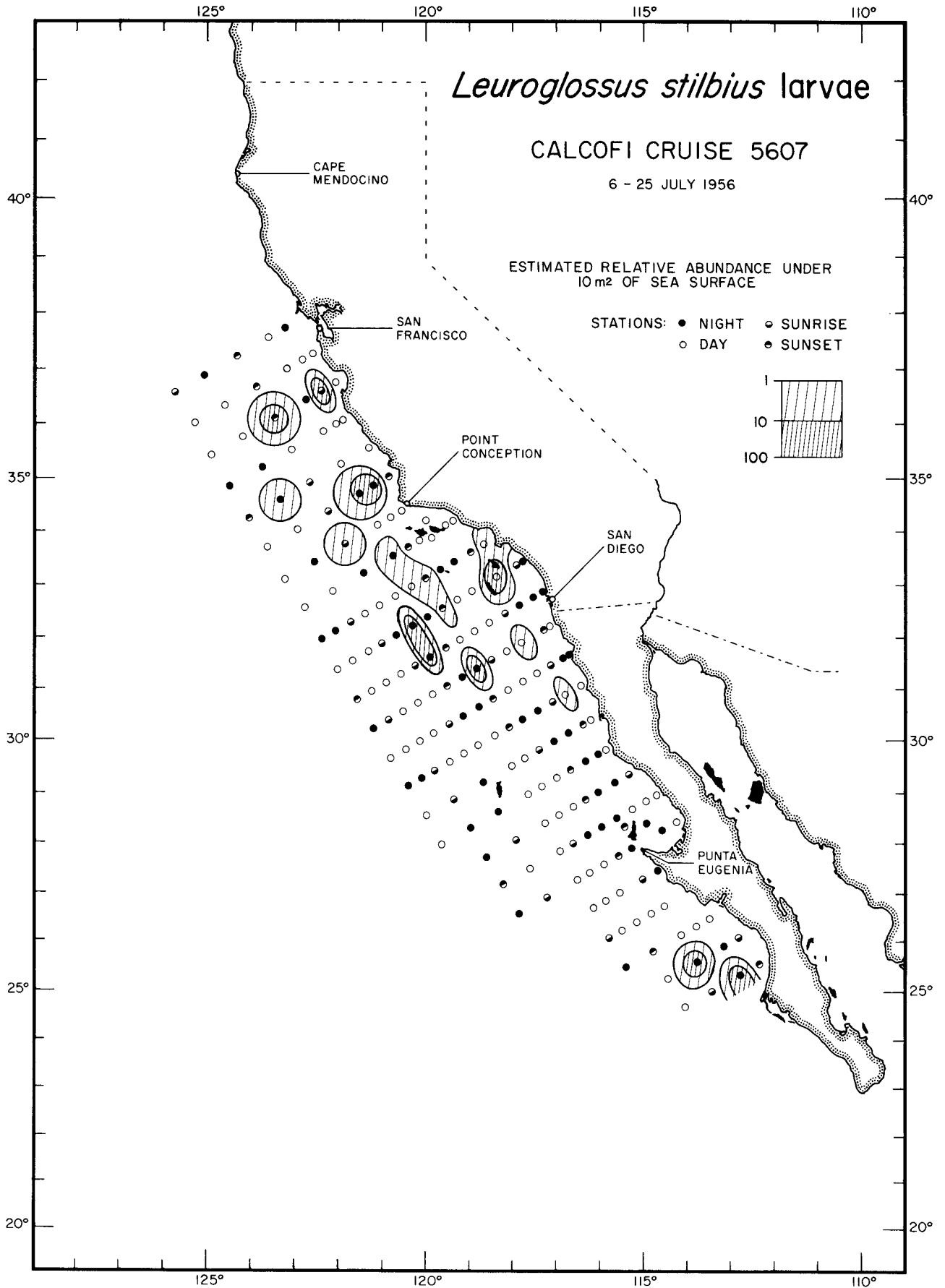
Leuroglossus stilbius larvae

6006

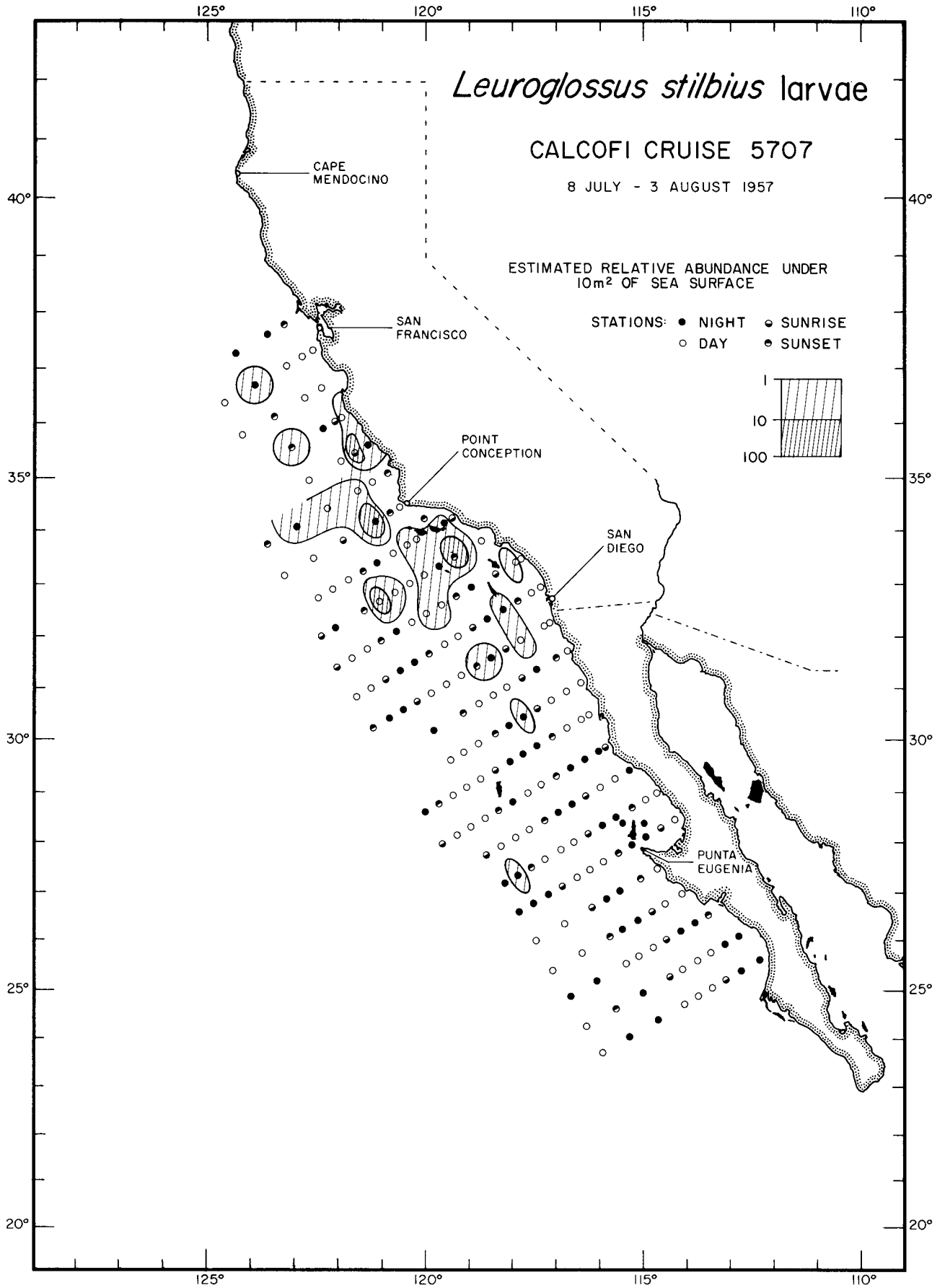


Leuroglossus stilbius larvae

5507

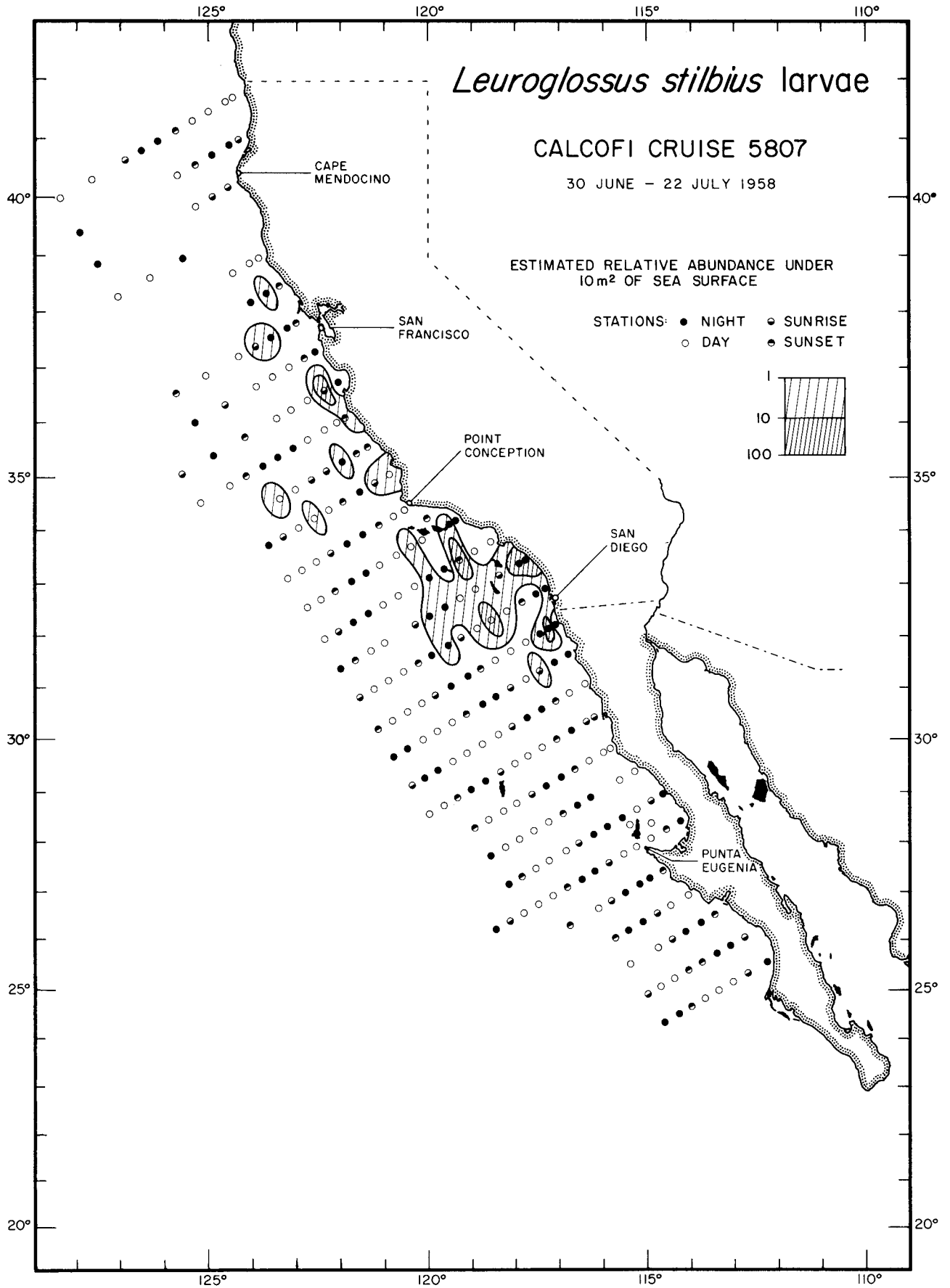


Leuroglossus stilbius larvae



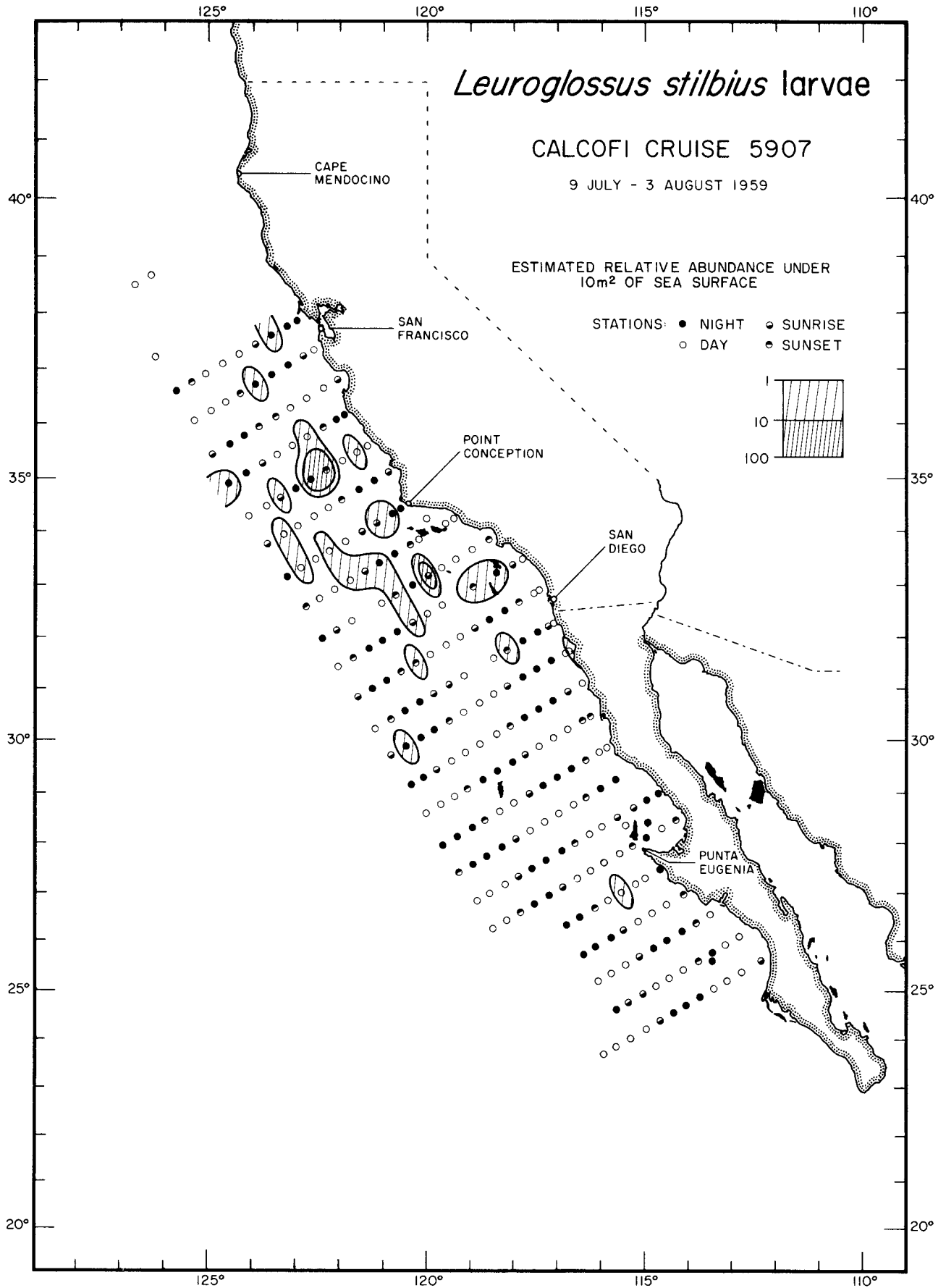
Leuroglossus stilbius larvae

5707

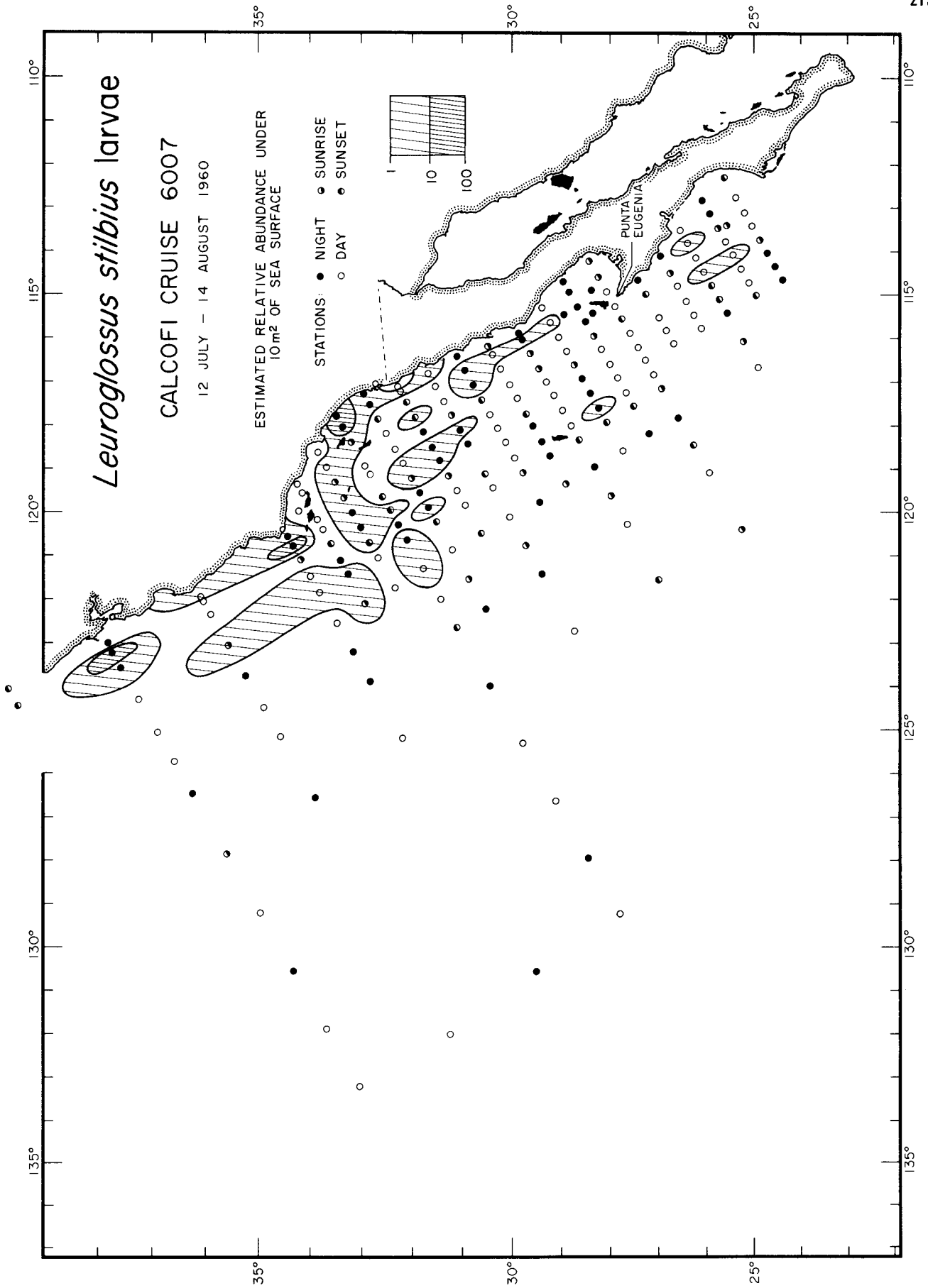


Leuroglossus stilbius larvae

5807

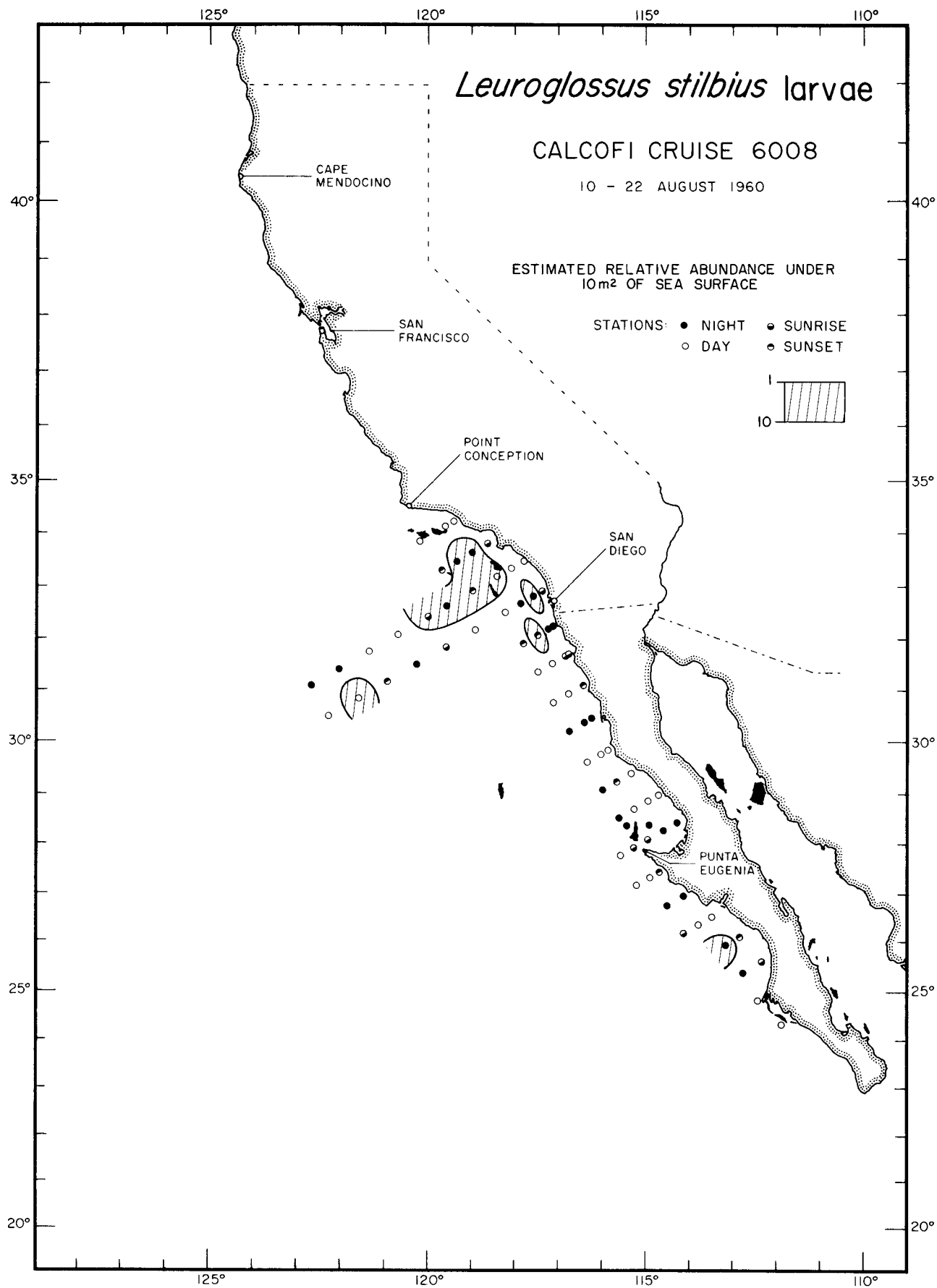


Leuroglossus stilbius larvae



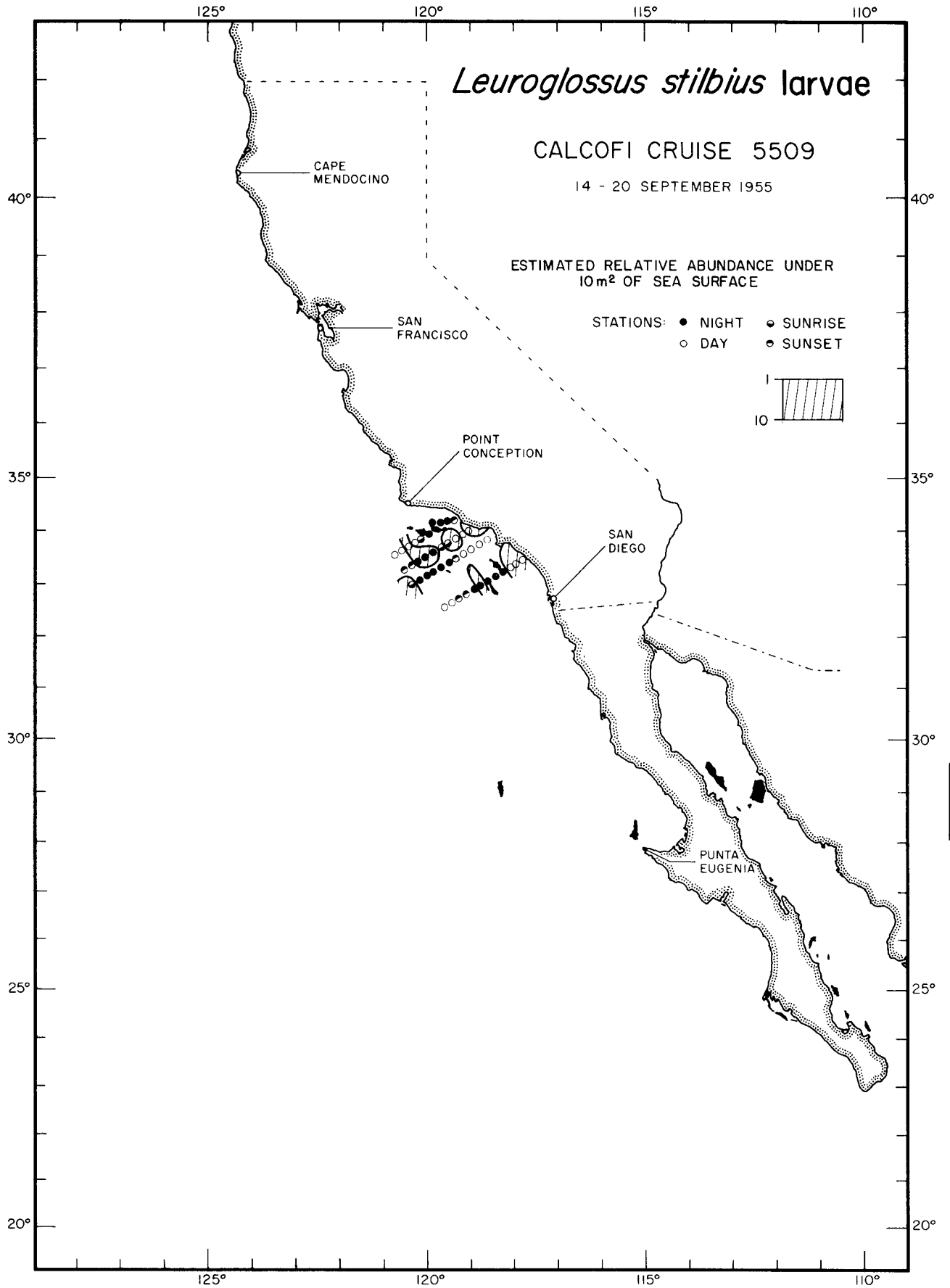
Leuroglossus stilbius larvae

6007



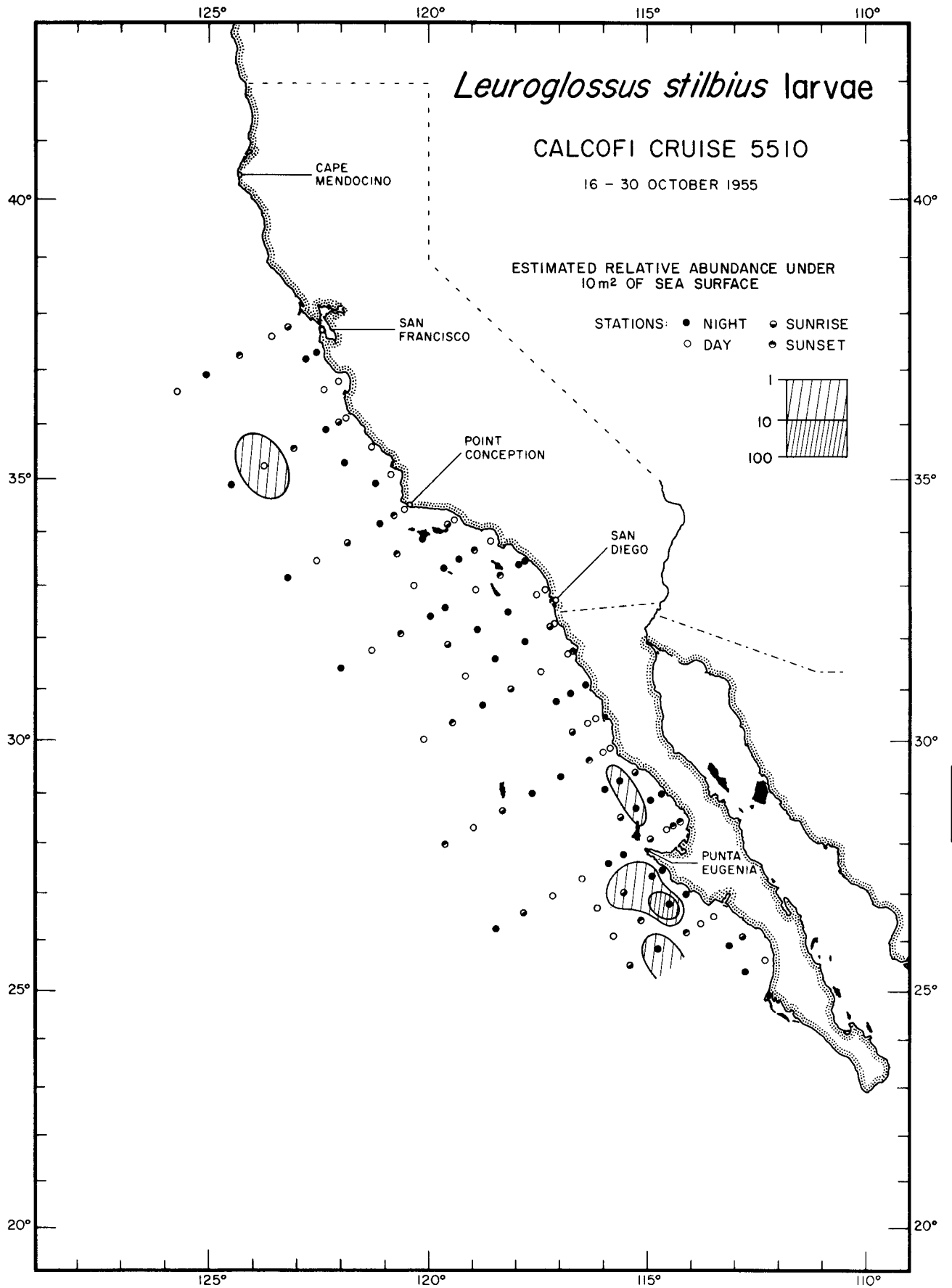
Leuroglossus stilbius larvae

6008



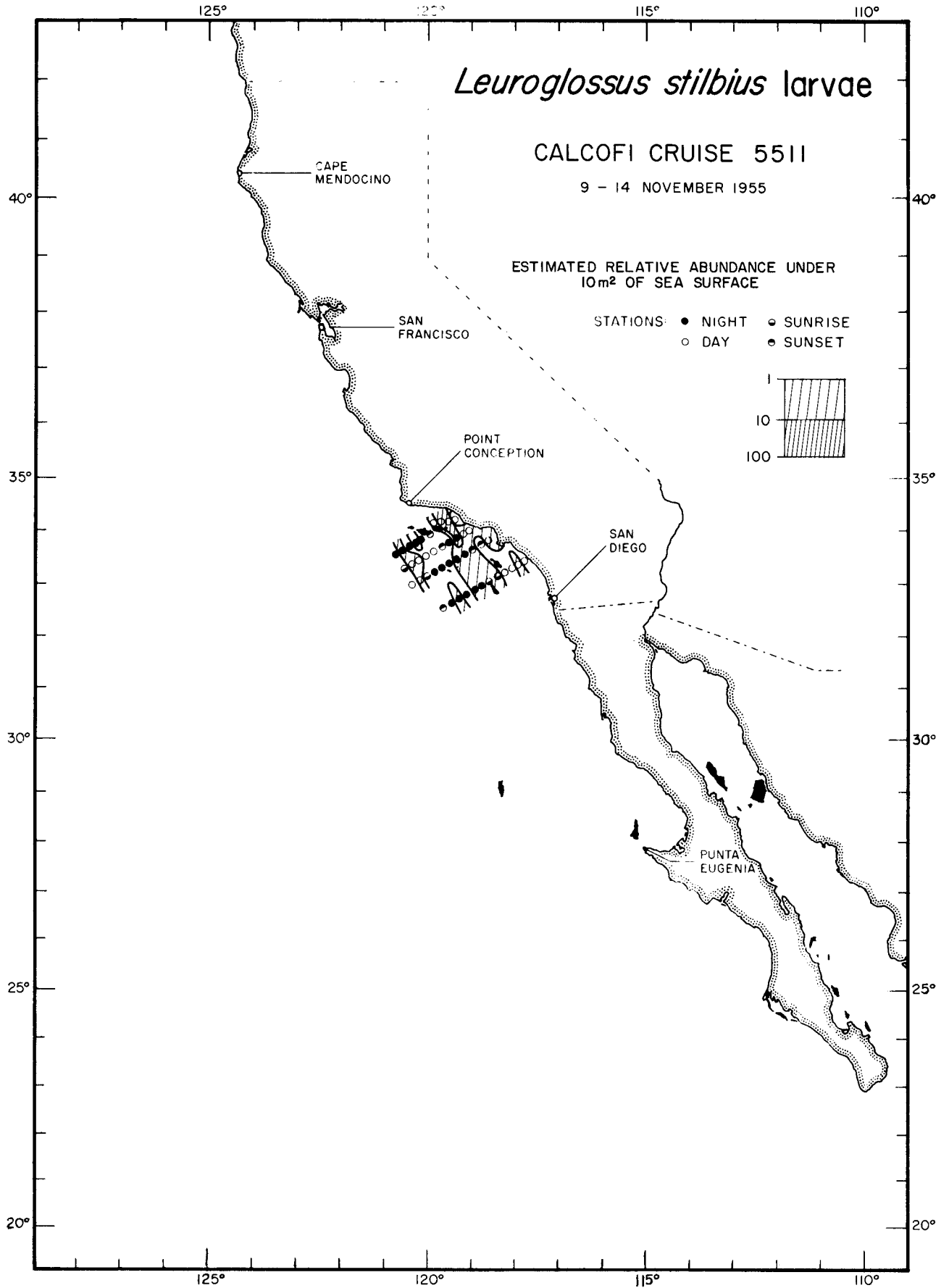
Leuroglossus stilbius larvae

5509



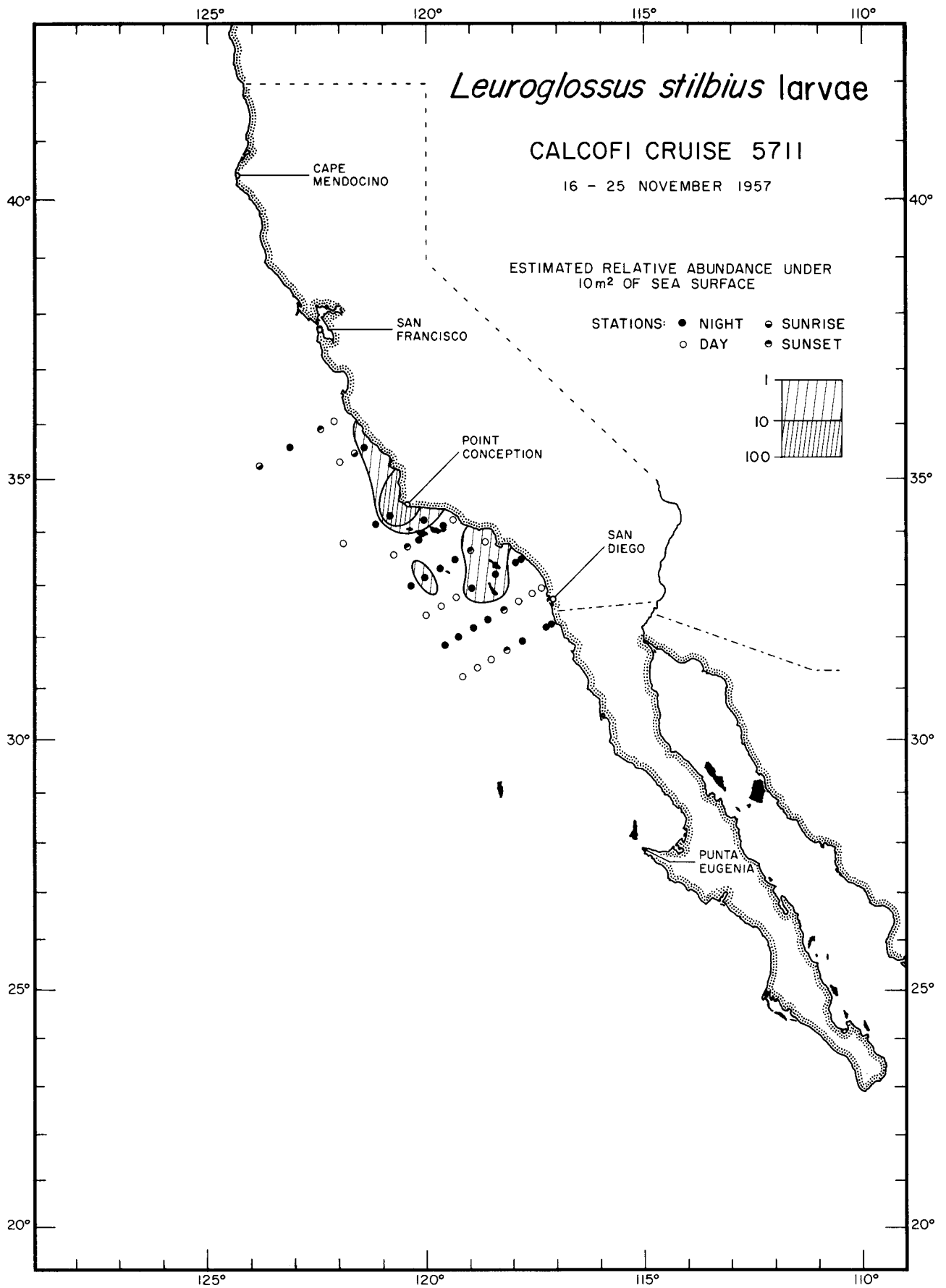
Leuroglossus stilbius larvae

5510



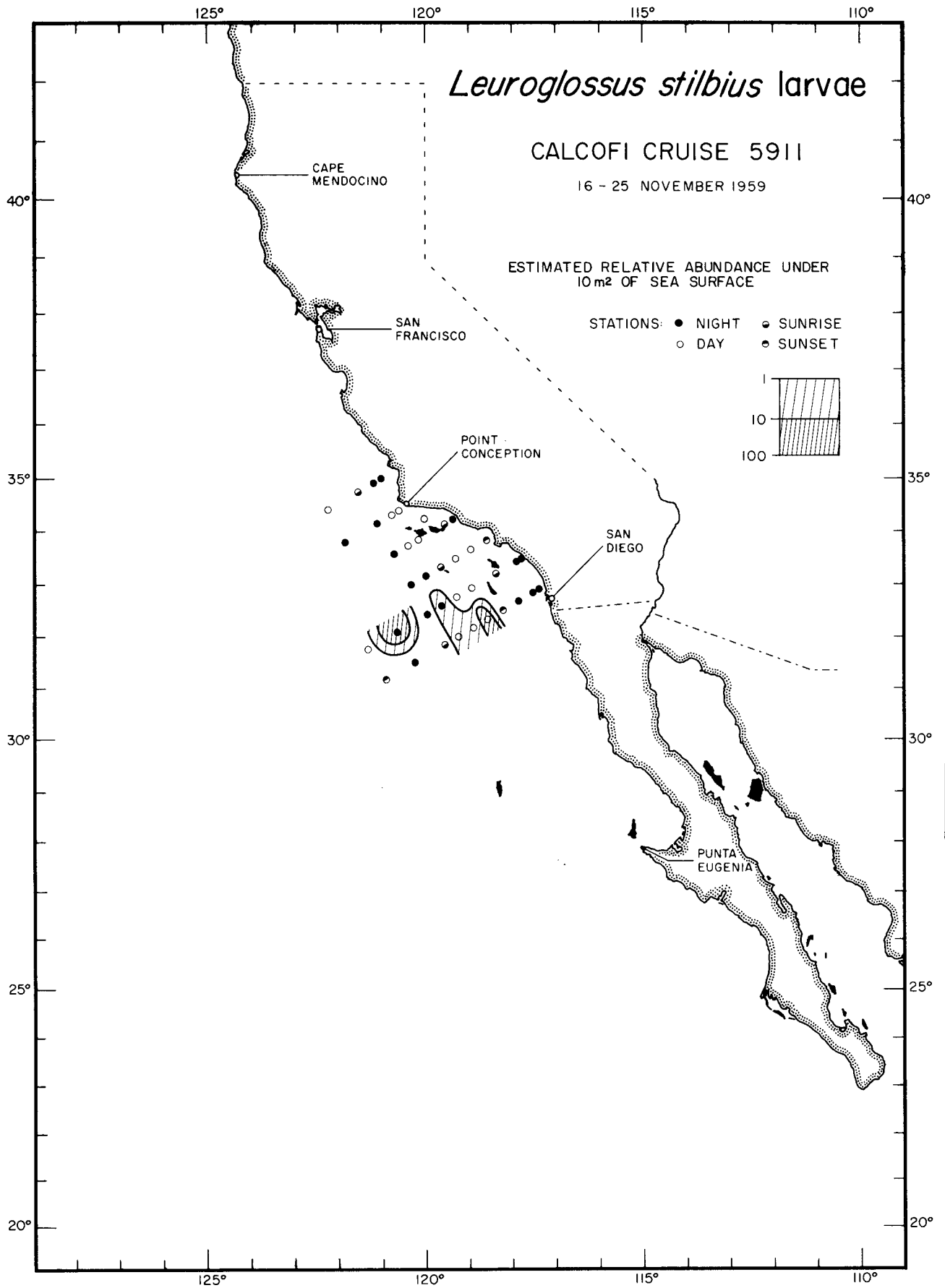
Leuroglossus stilbius larvae

5511

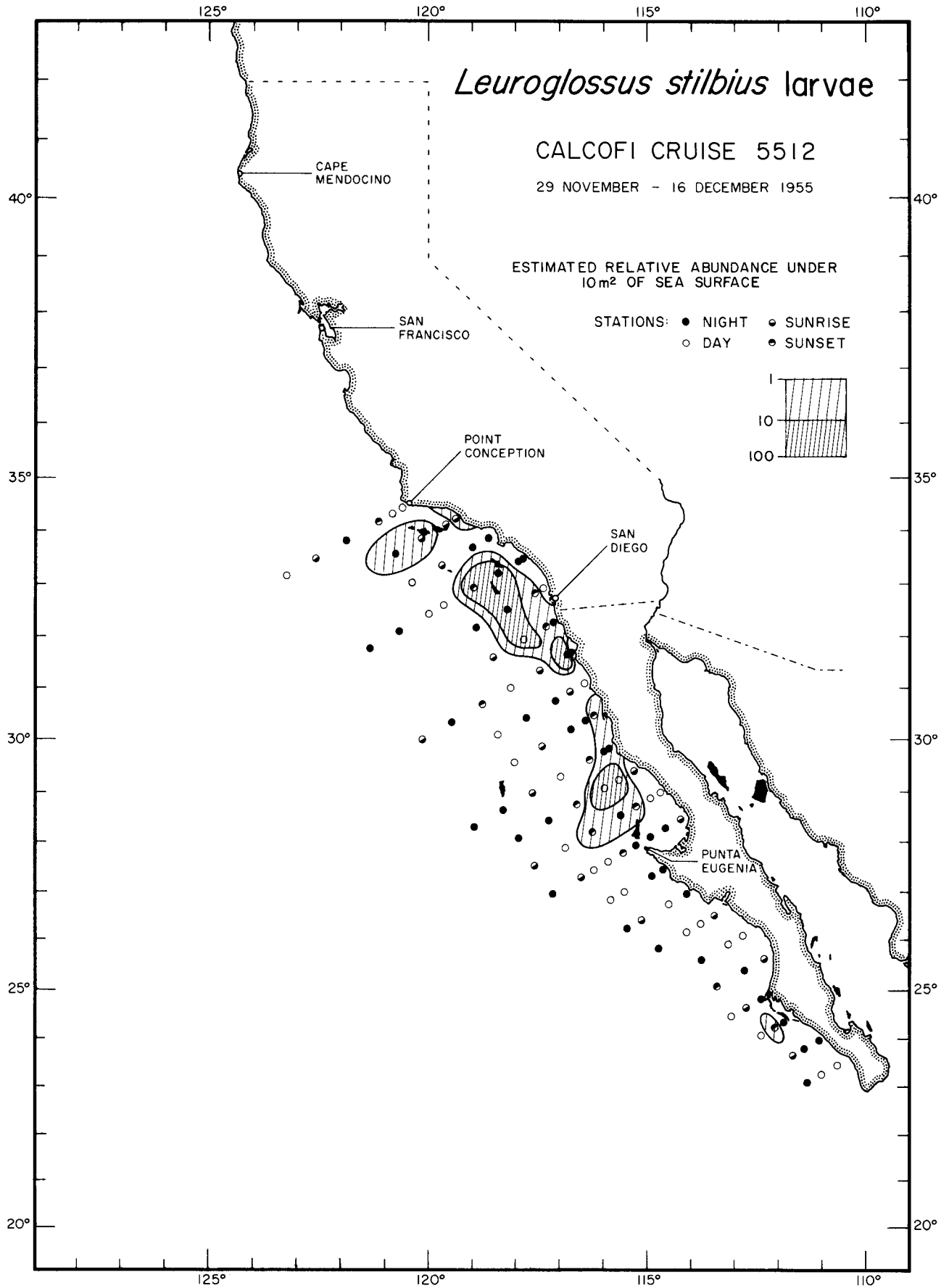


Leuroglossus stilbius larvae

5711

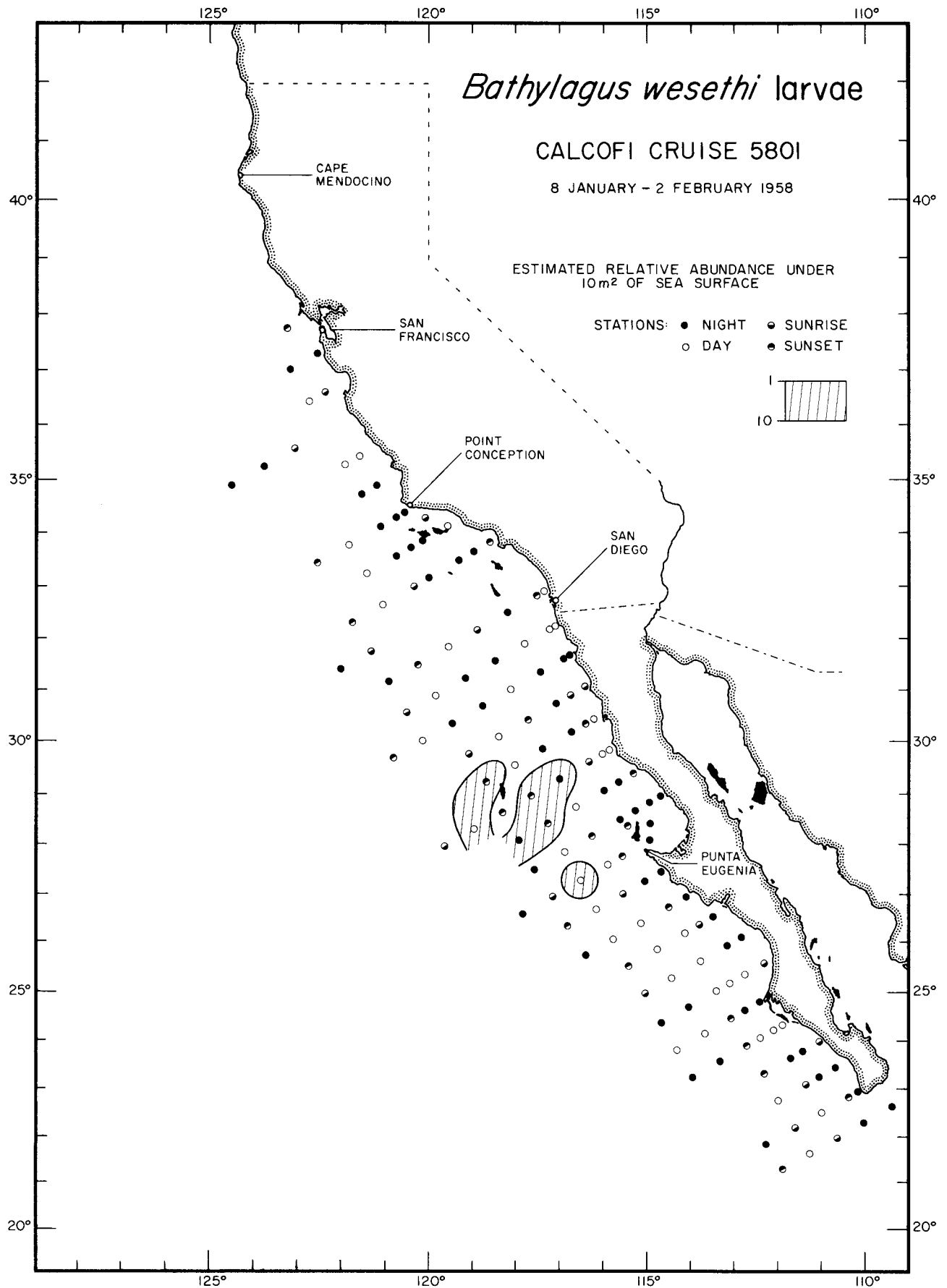


Leuroglossus stilbius larvae



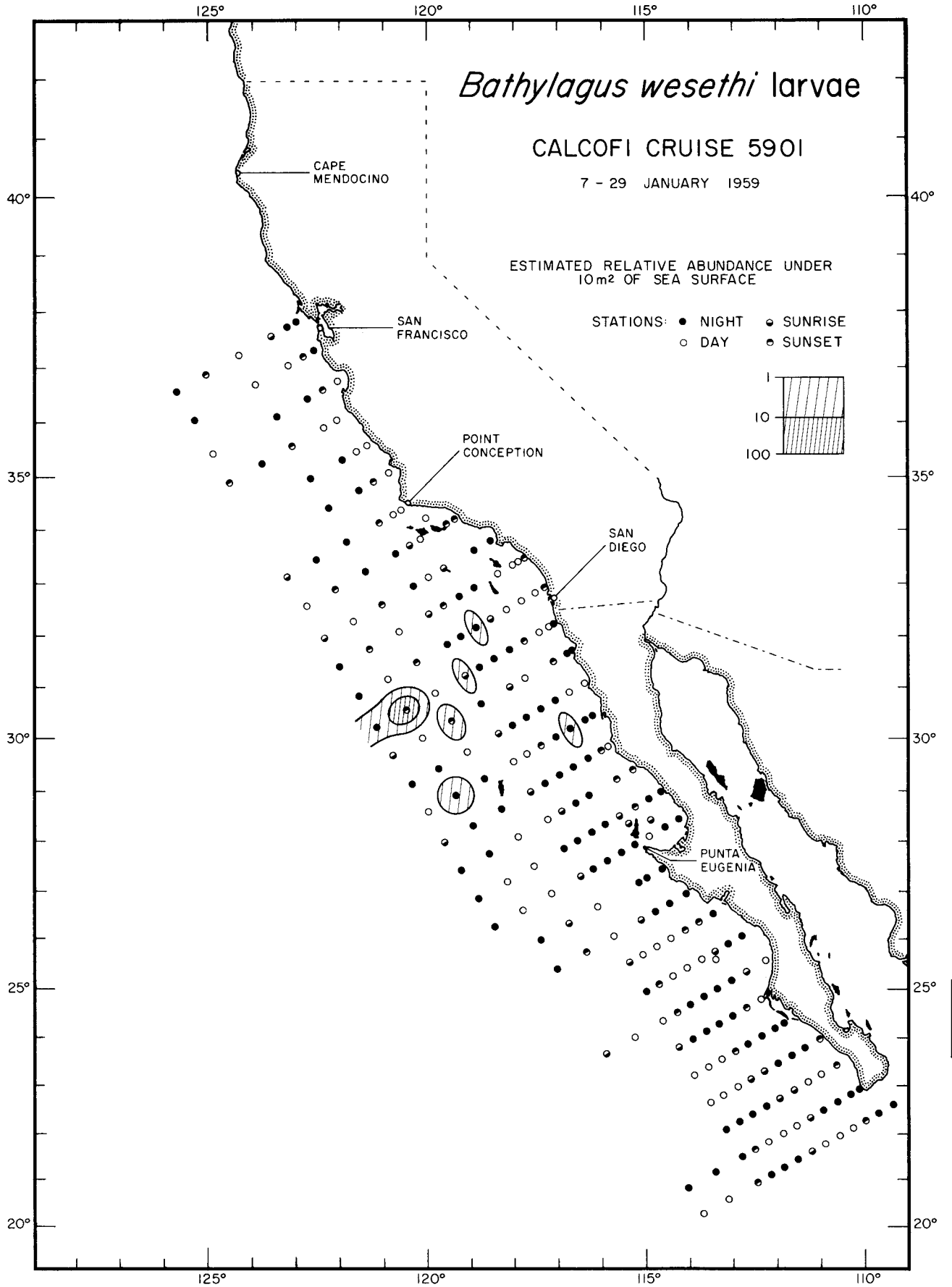
Leuroglossus stilbius larvae

5512



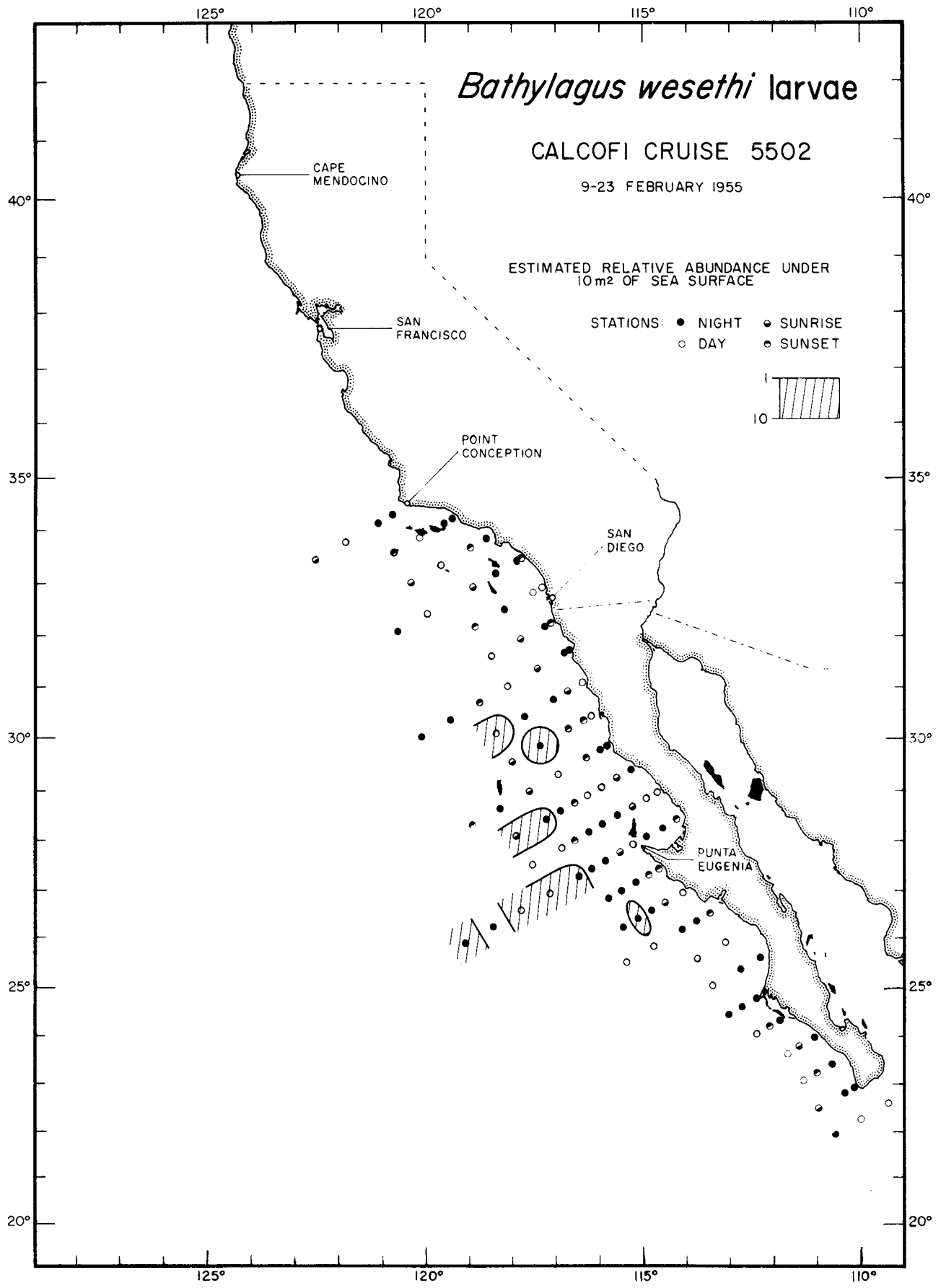
Bathylagus wesethi larvae

5801



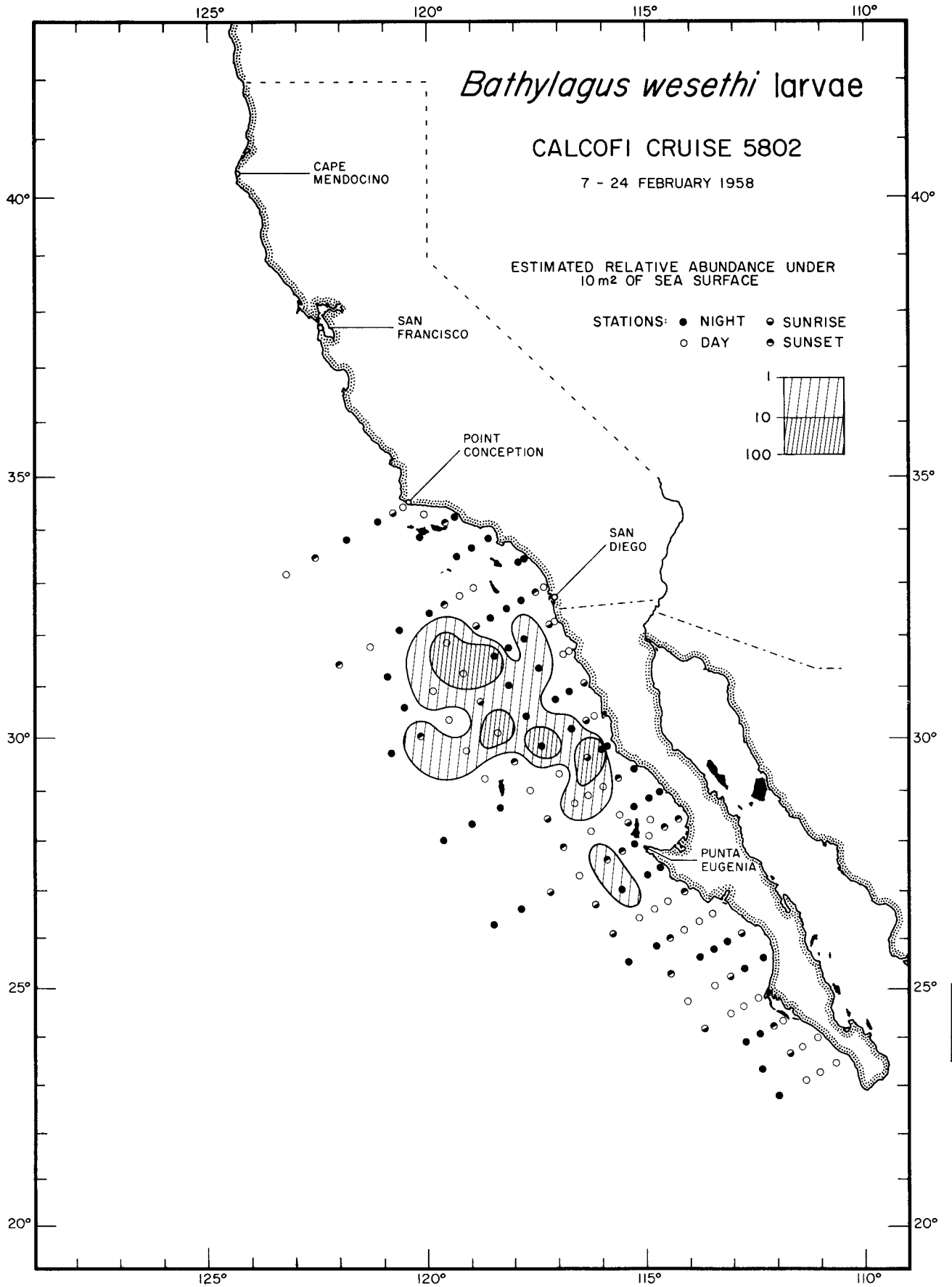
Bathylagus wesethi larvae

5901



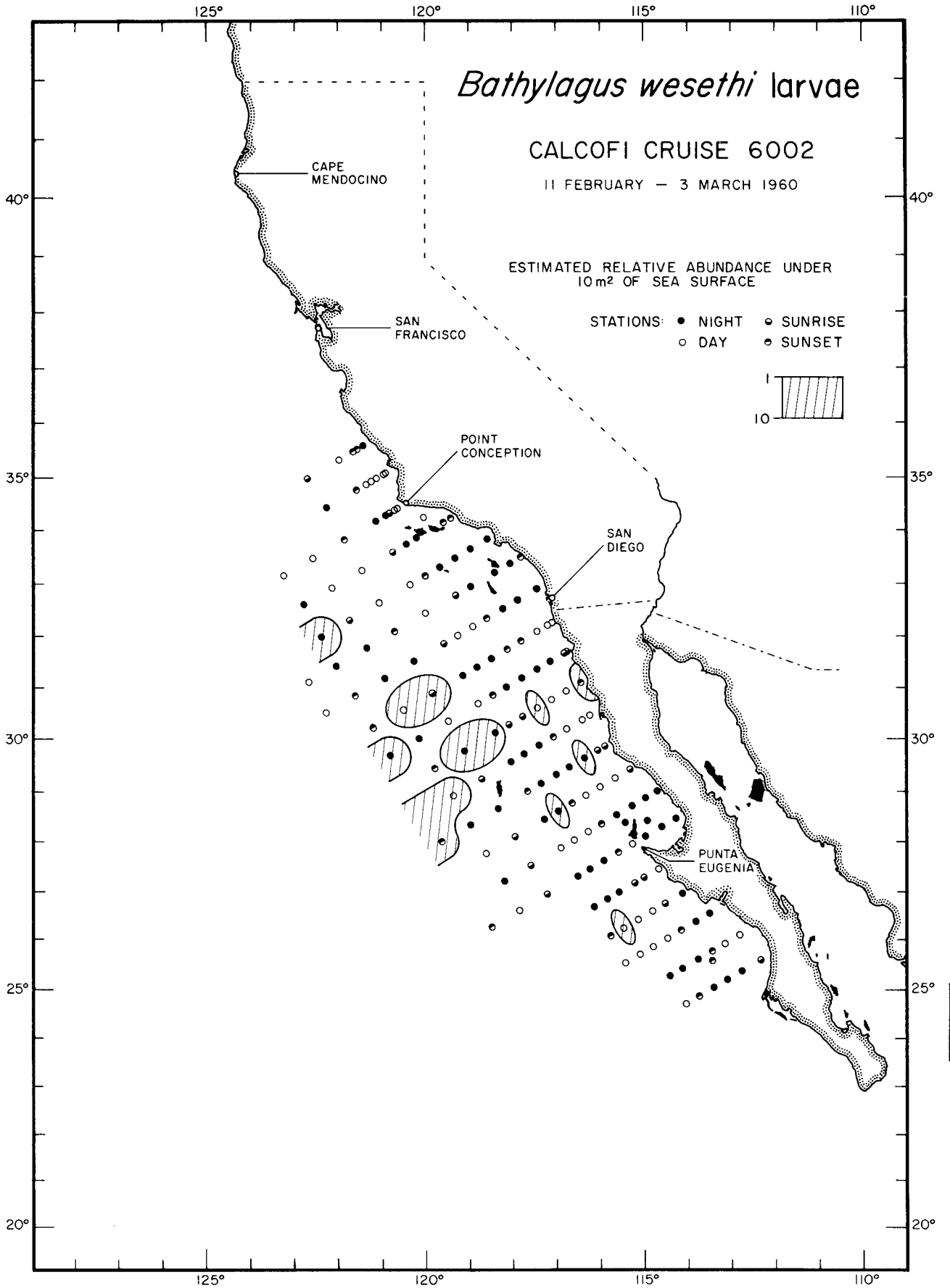
Bathylagus wesethi larvae

5502



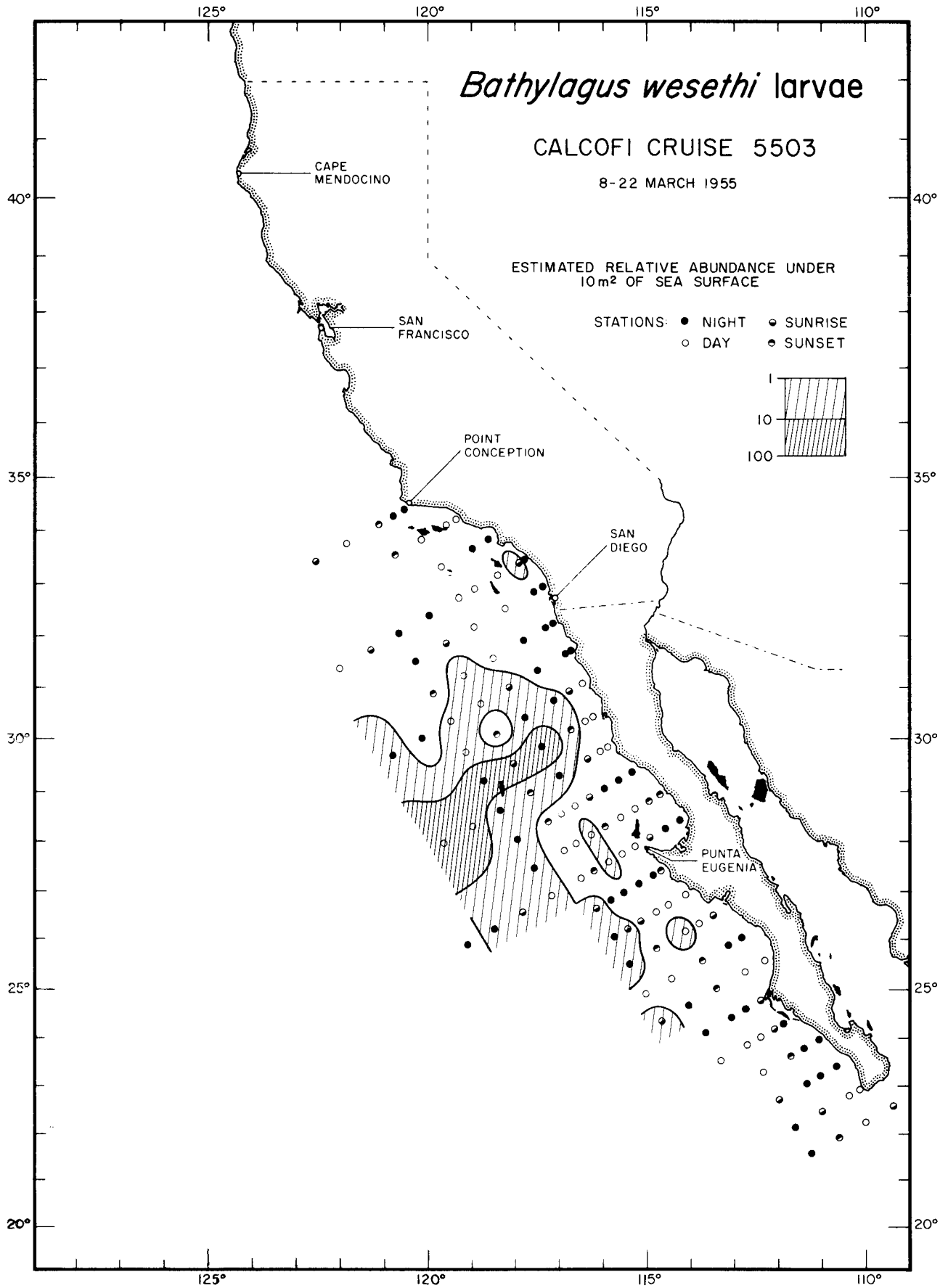
Bathylagus wesethi larvae

5802



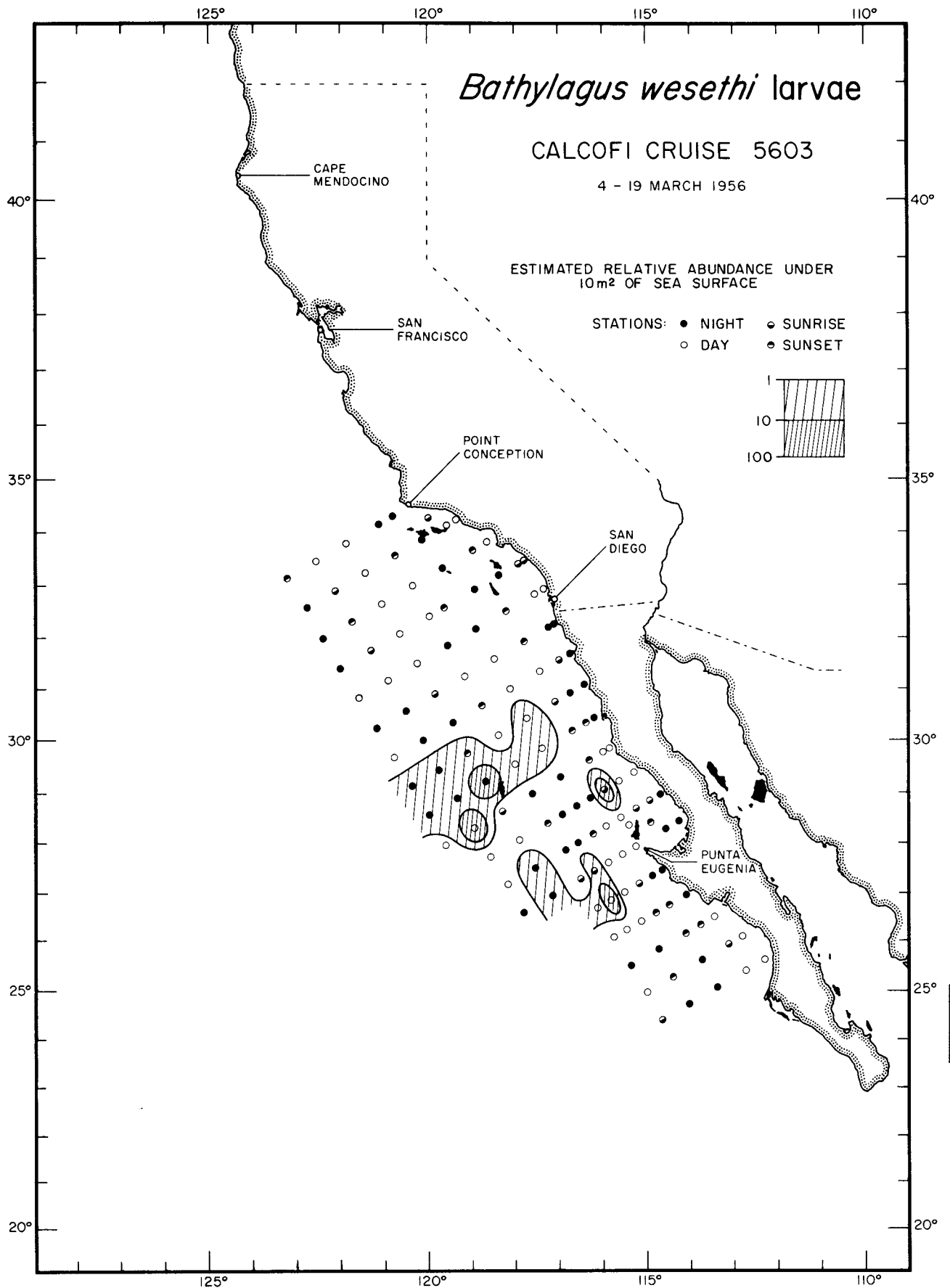
Bathylagus wesethi larvae

6002



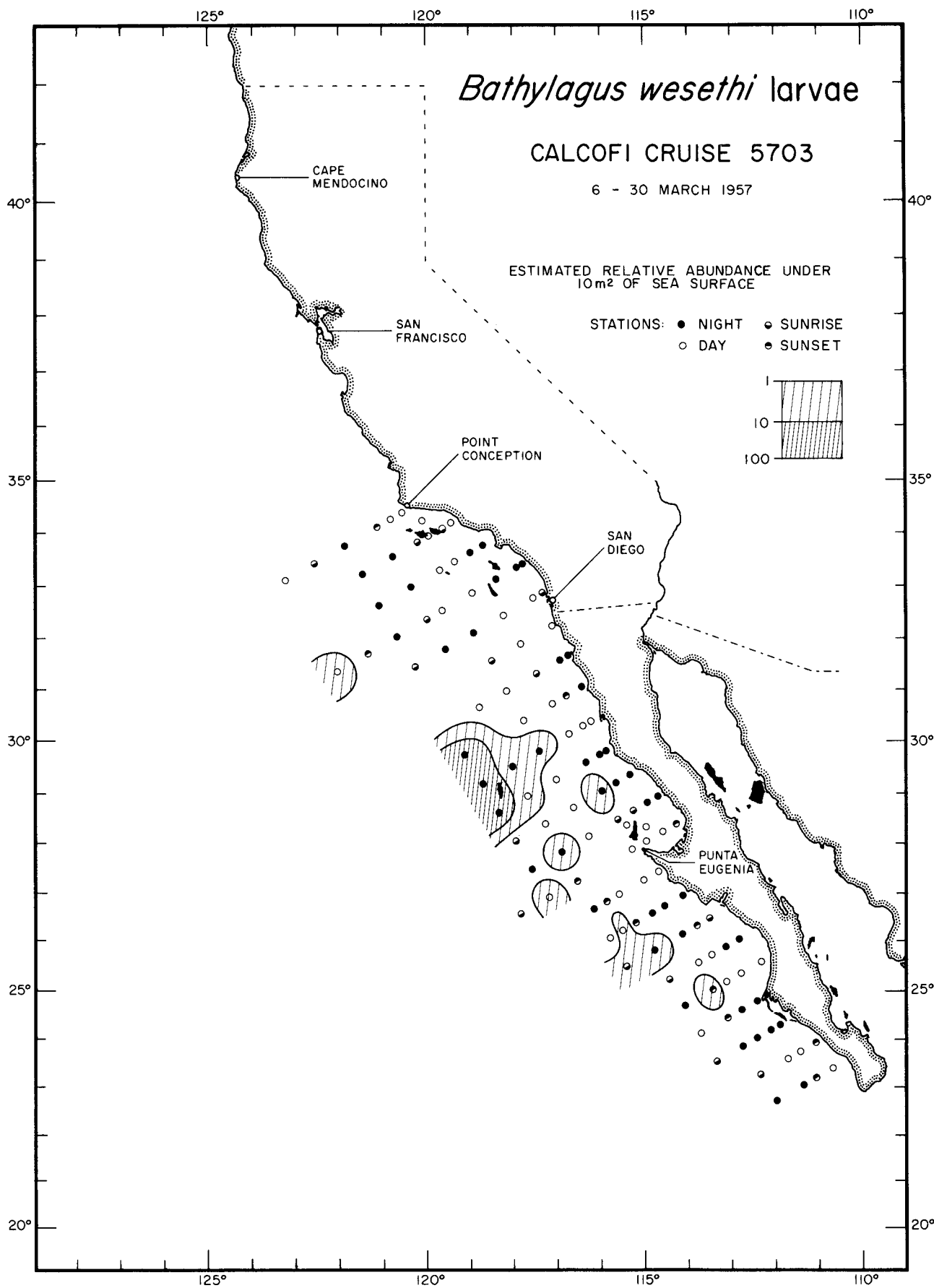
Bathylagus wesethi larvae

5503



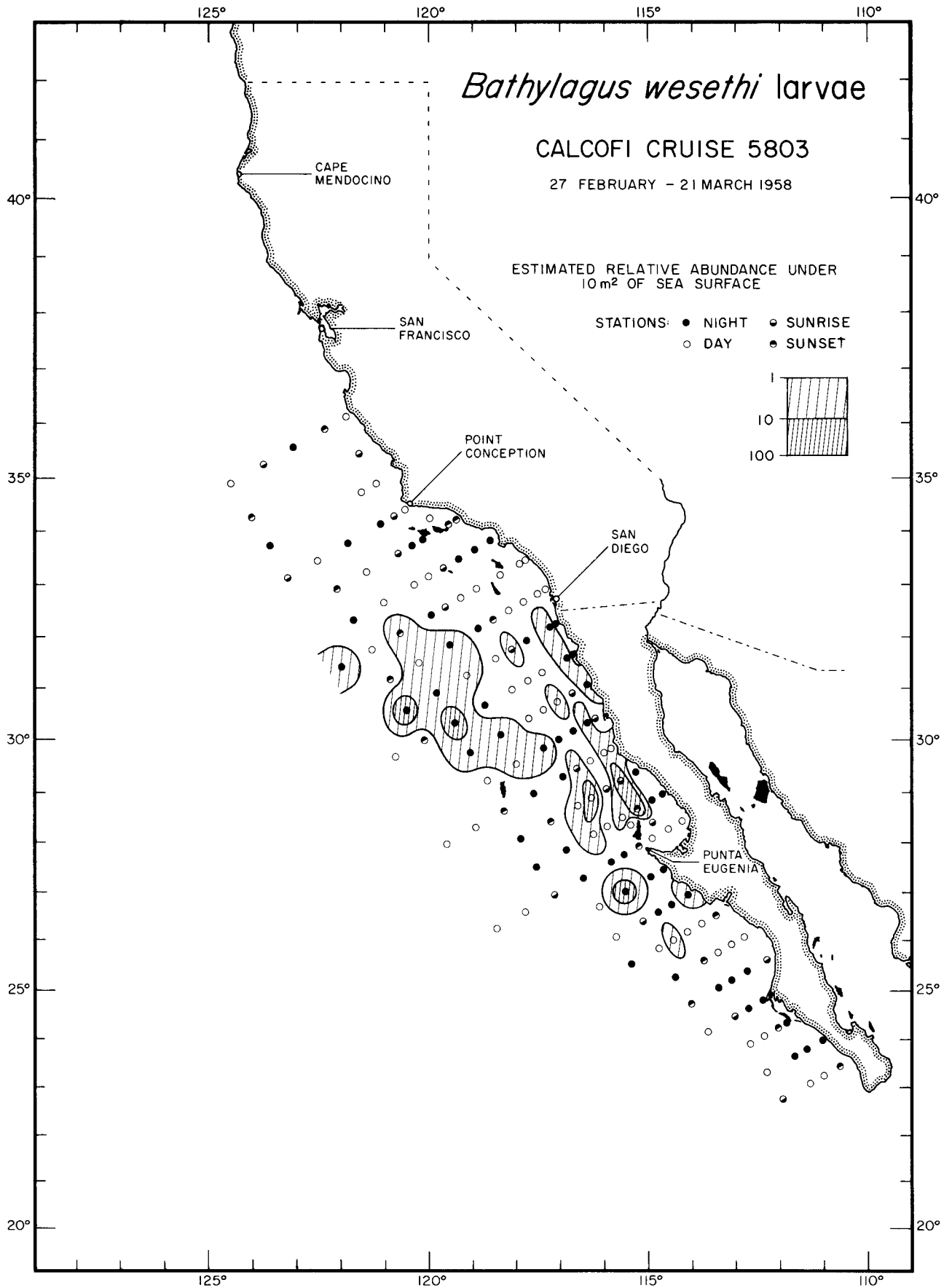
Bathylagus wesethi larvae

5603



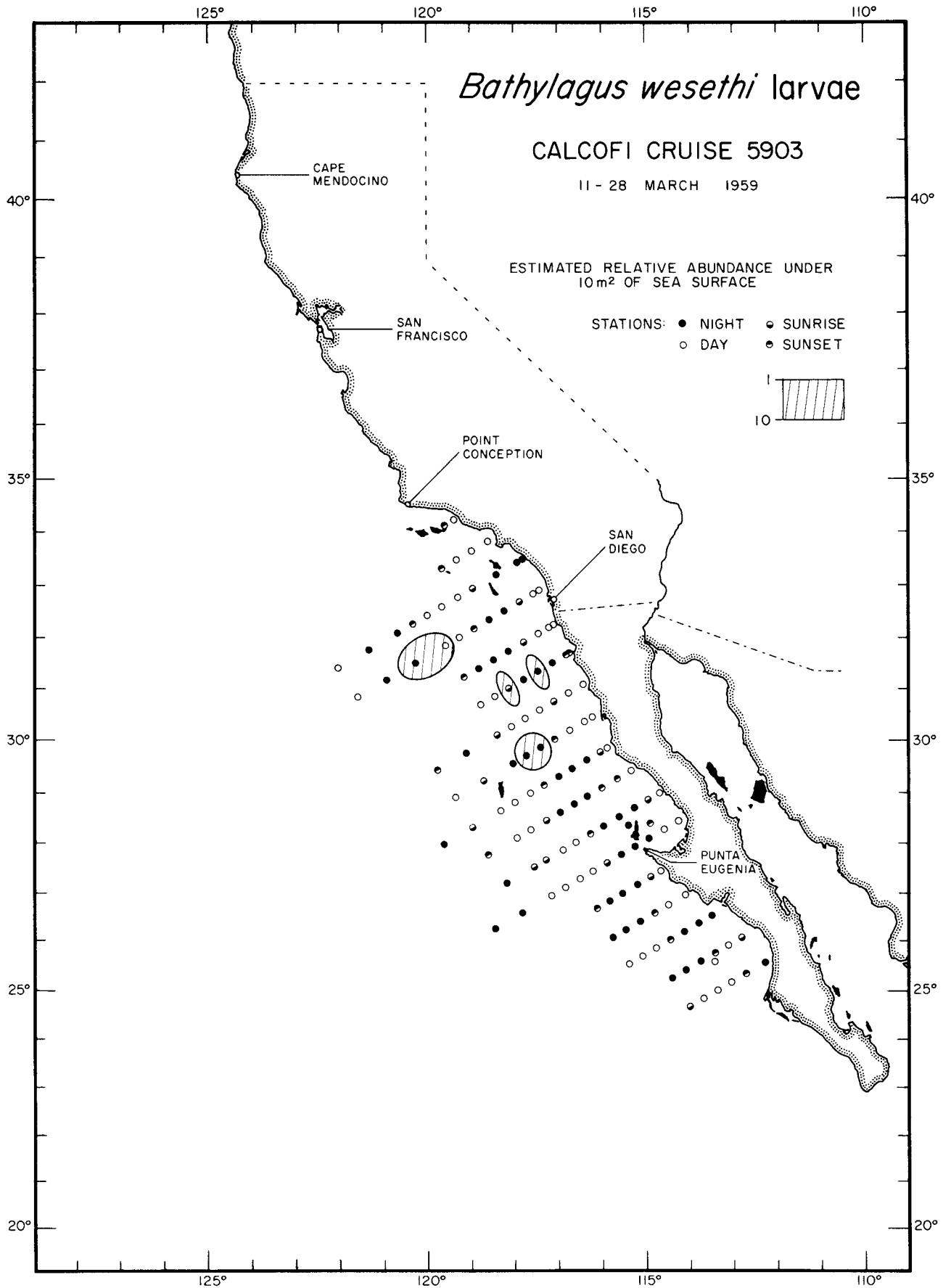
Bathylagus wesethi larvae

5703



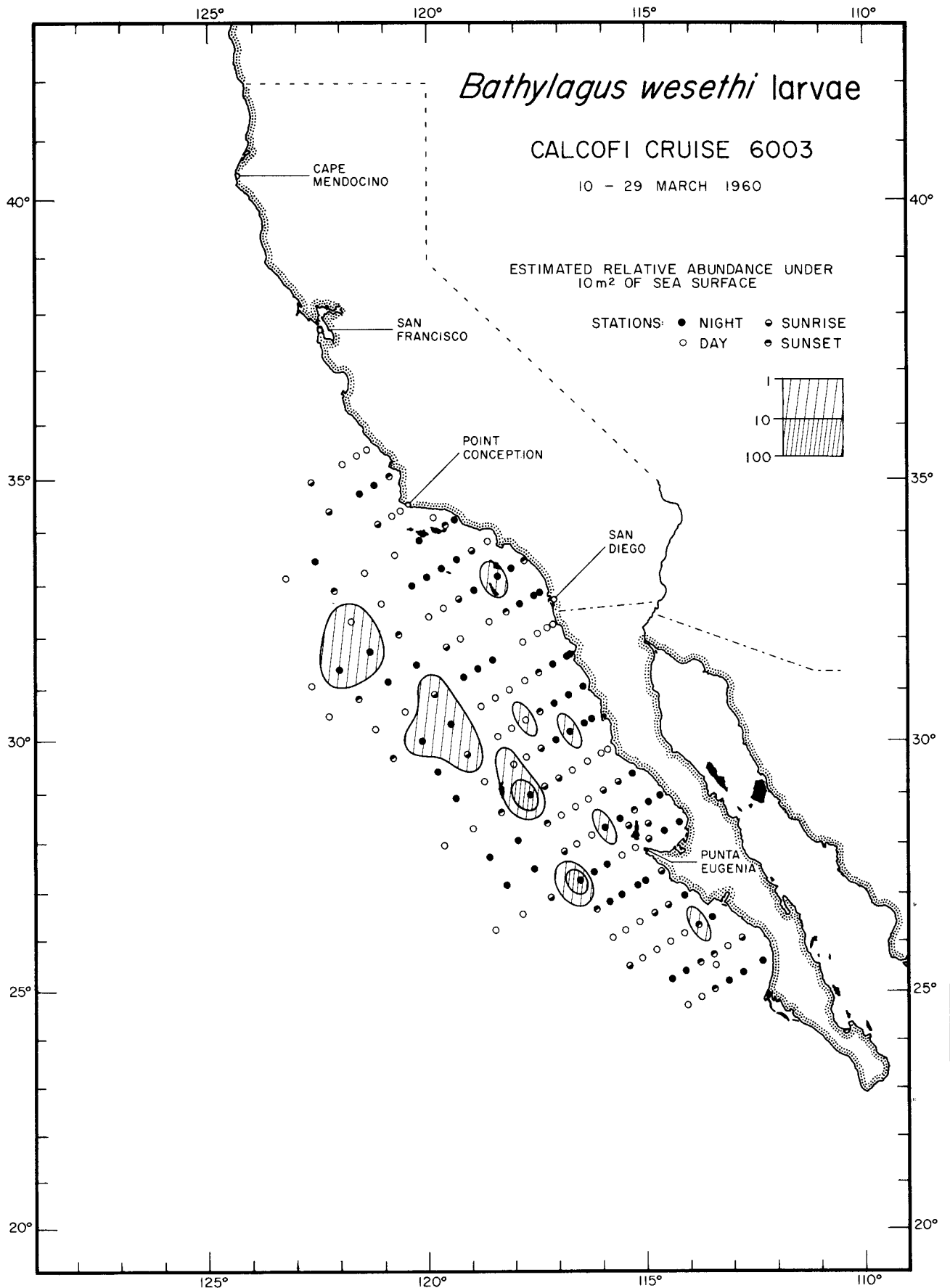
Bathylagus wesethi larvae

5803



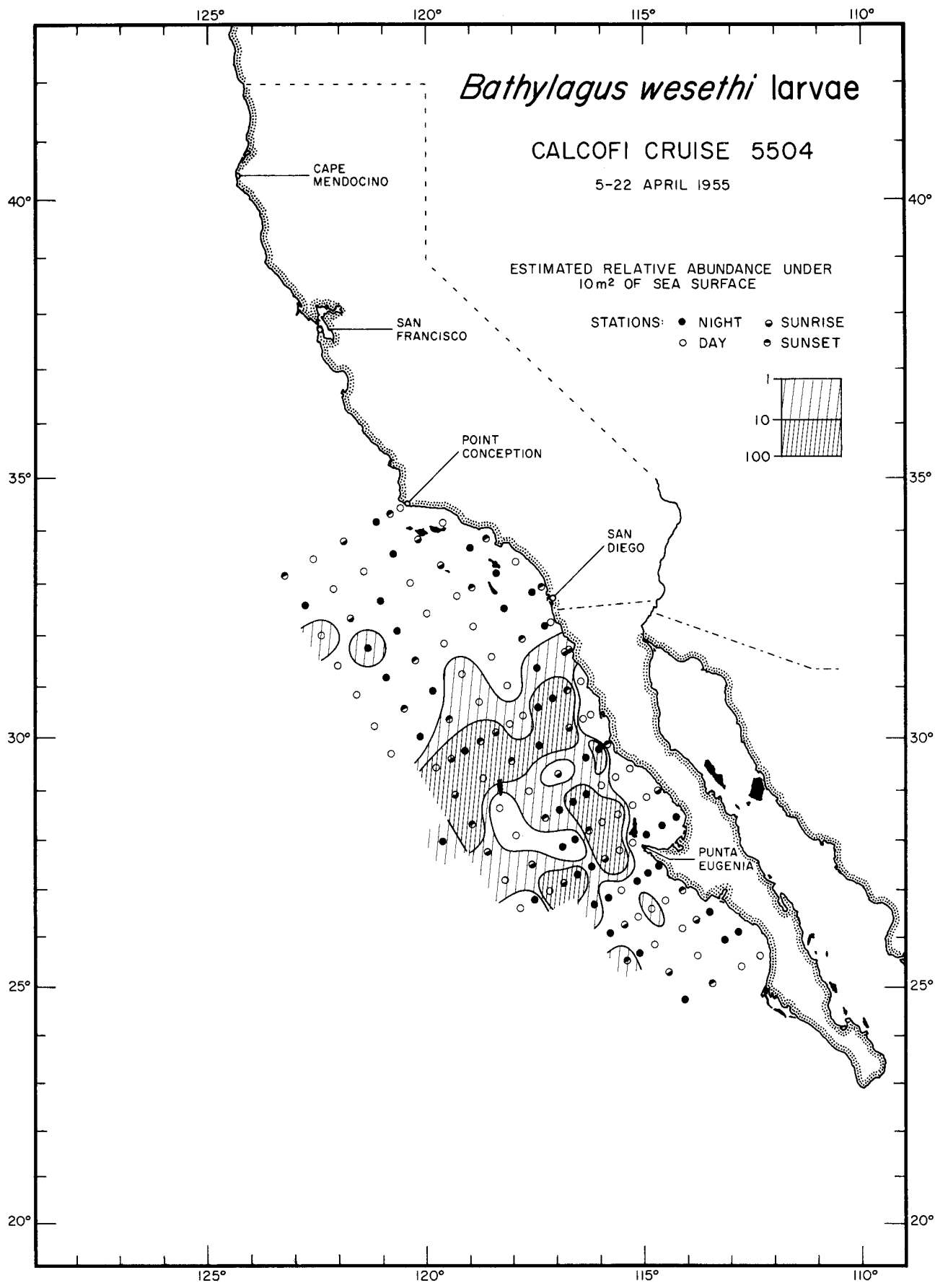
Bathylagus wesethi larvae

5903

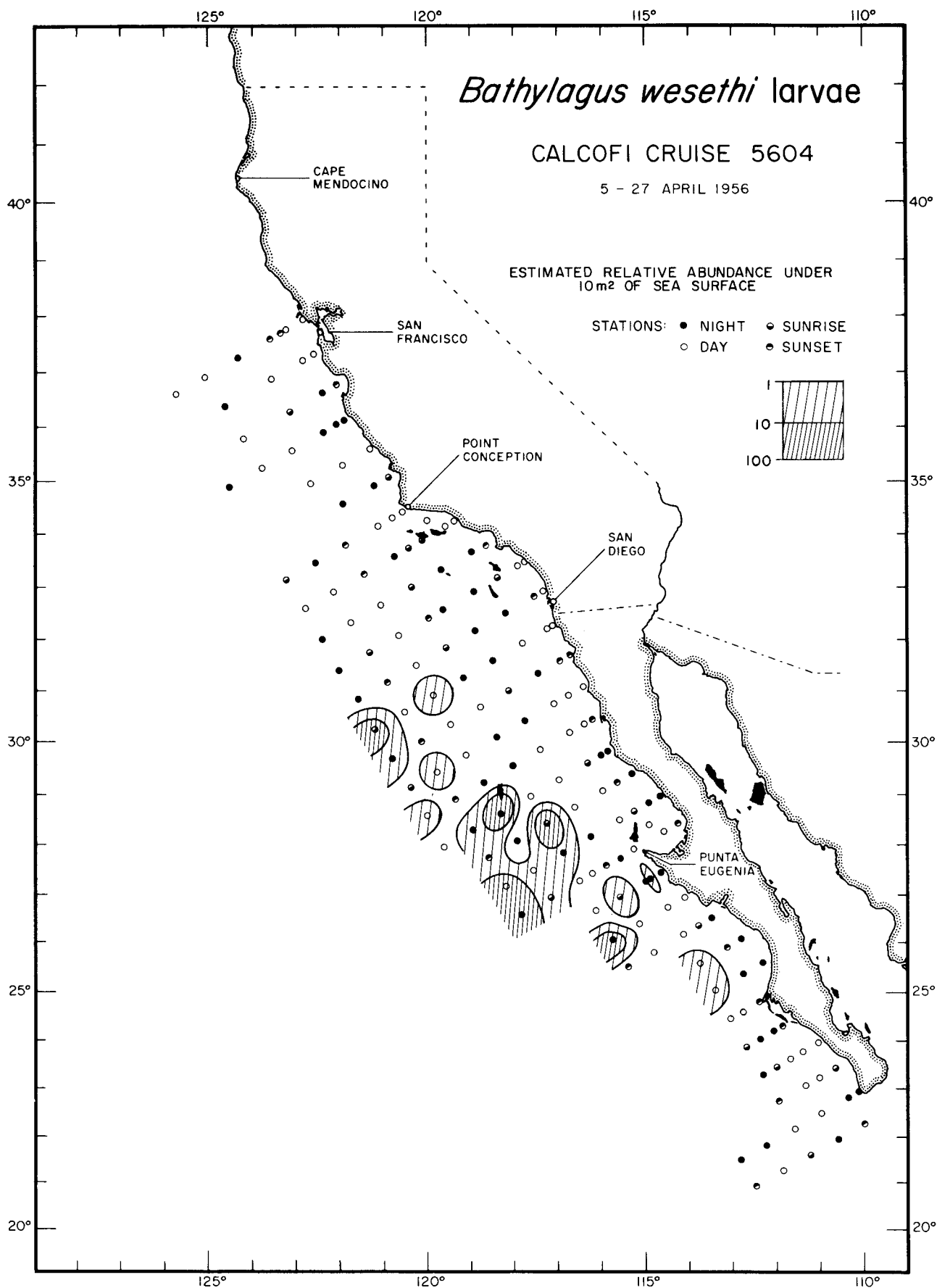


Bathylagus wesethi larvae

6003

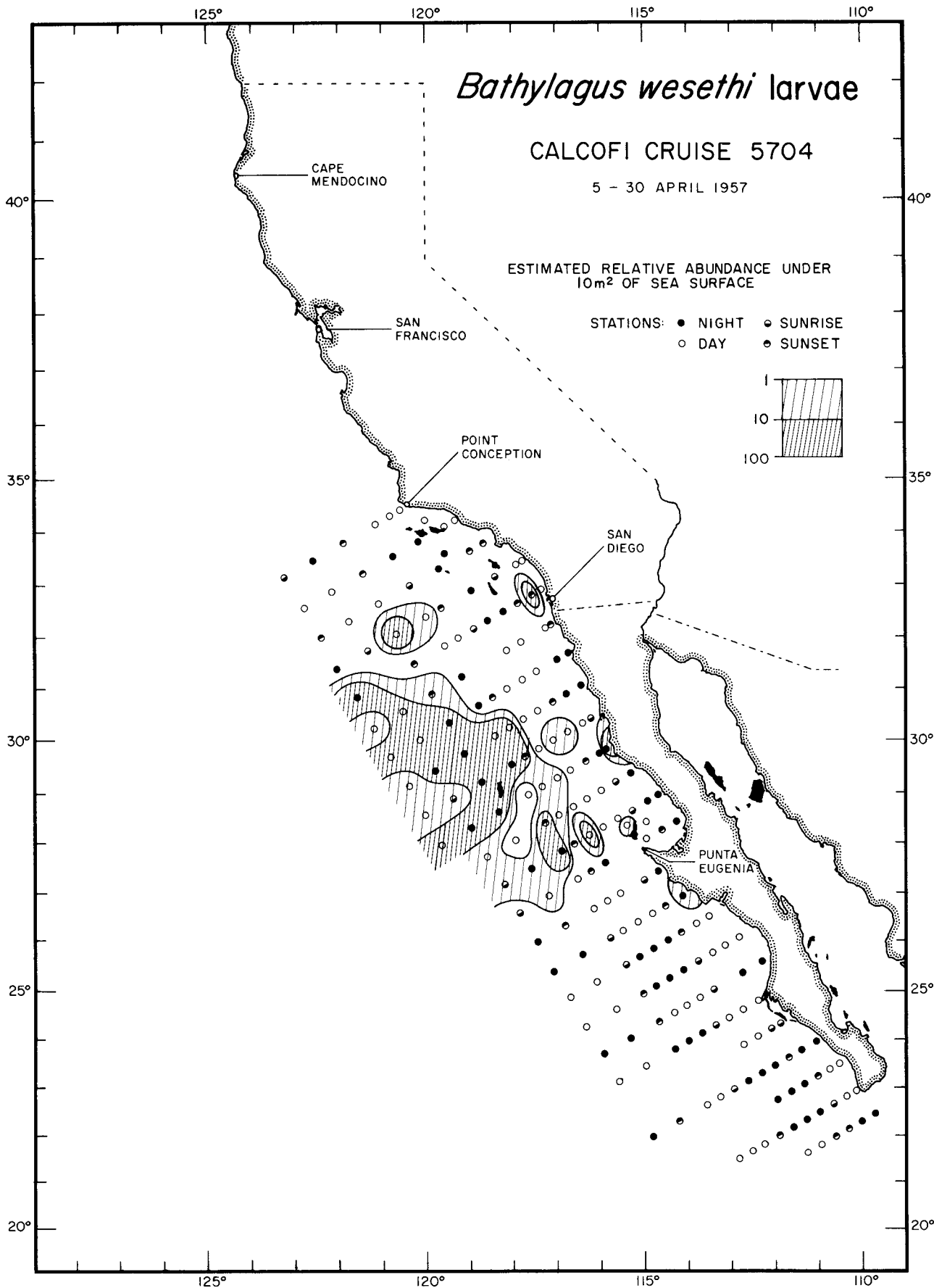


Bathylagus wesethi larvae

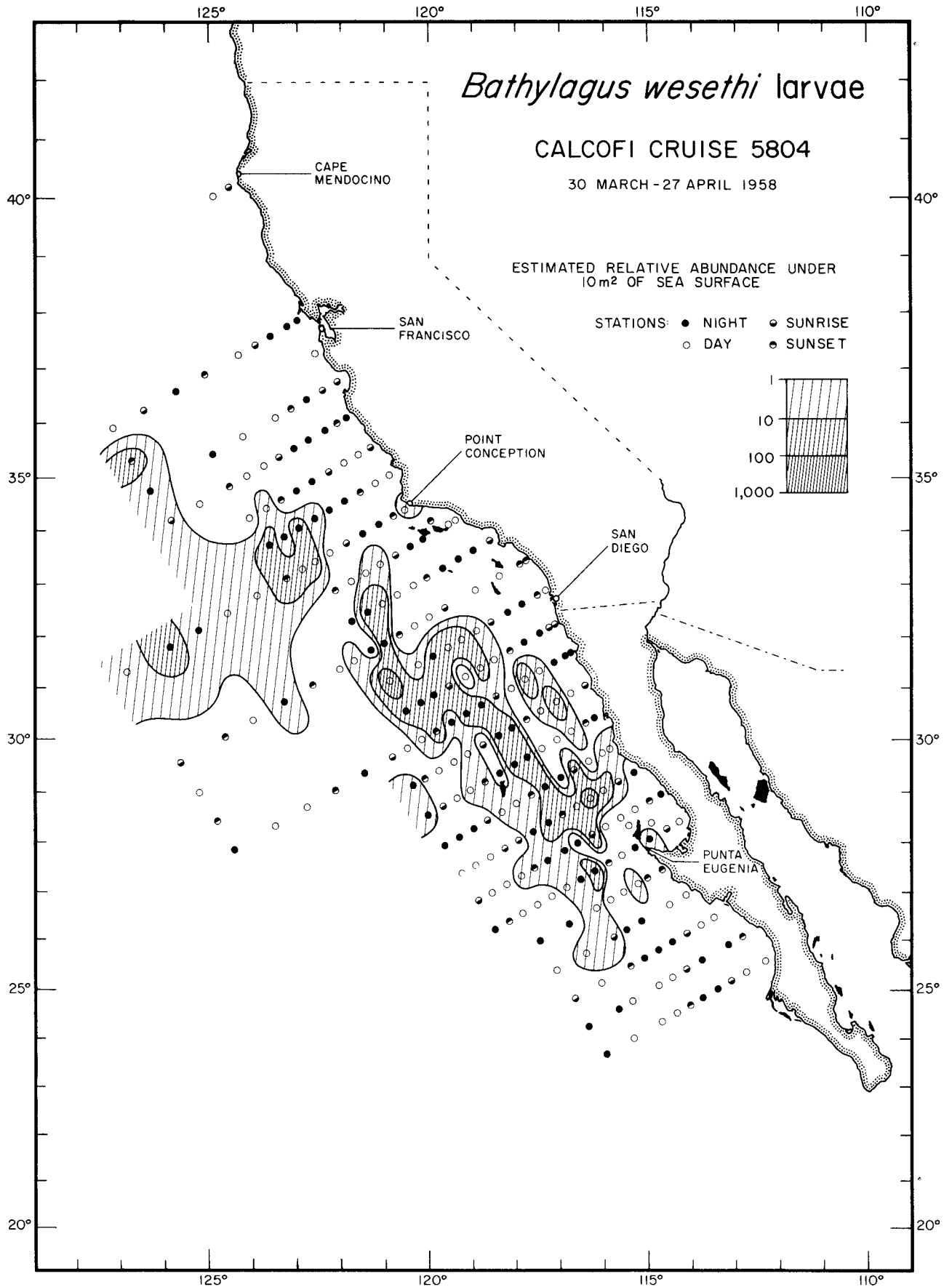


Bathylagus wesethi larvae

5604

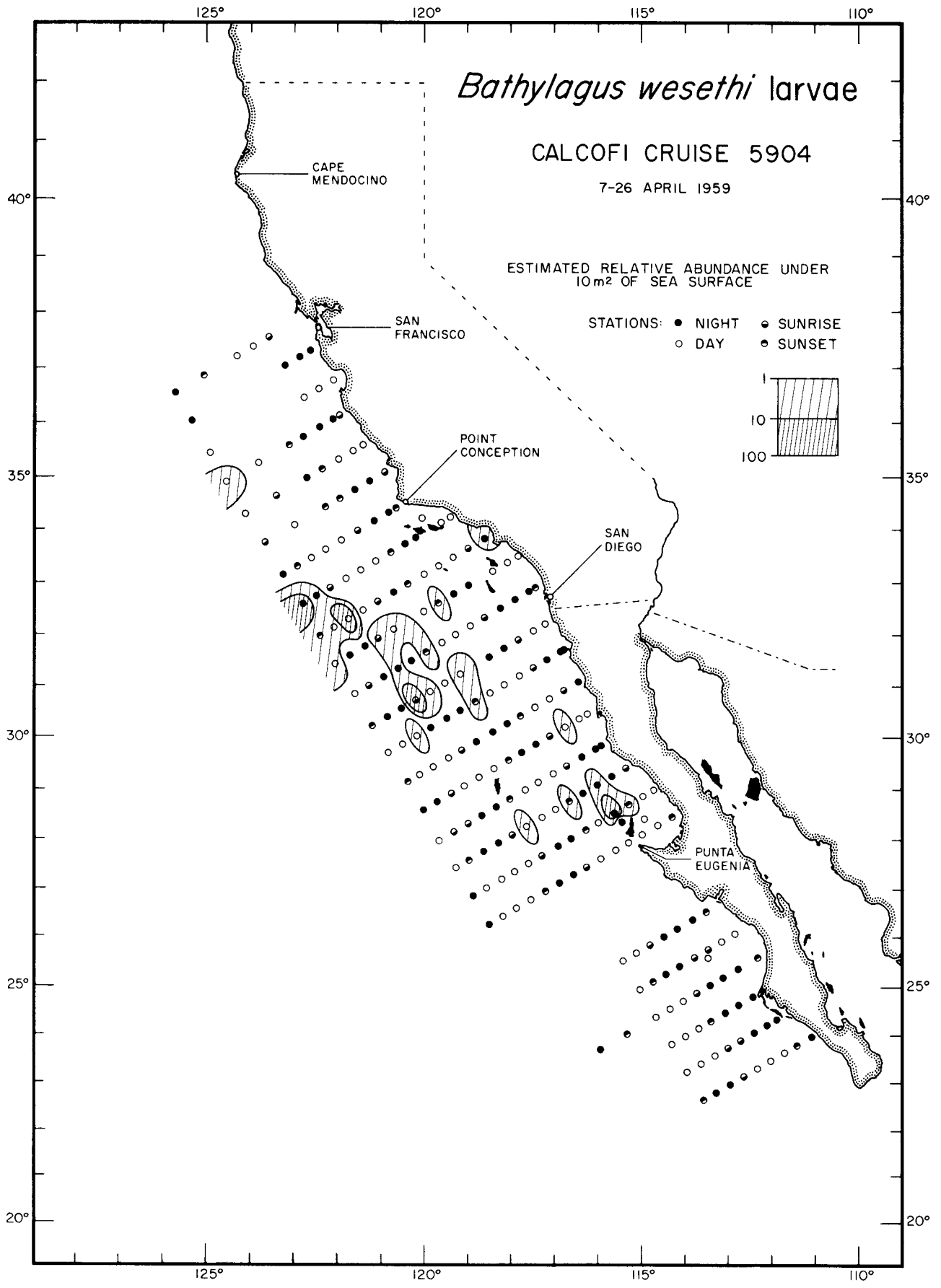


Bathylagus wesethi larvae



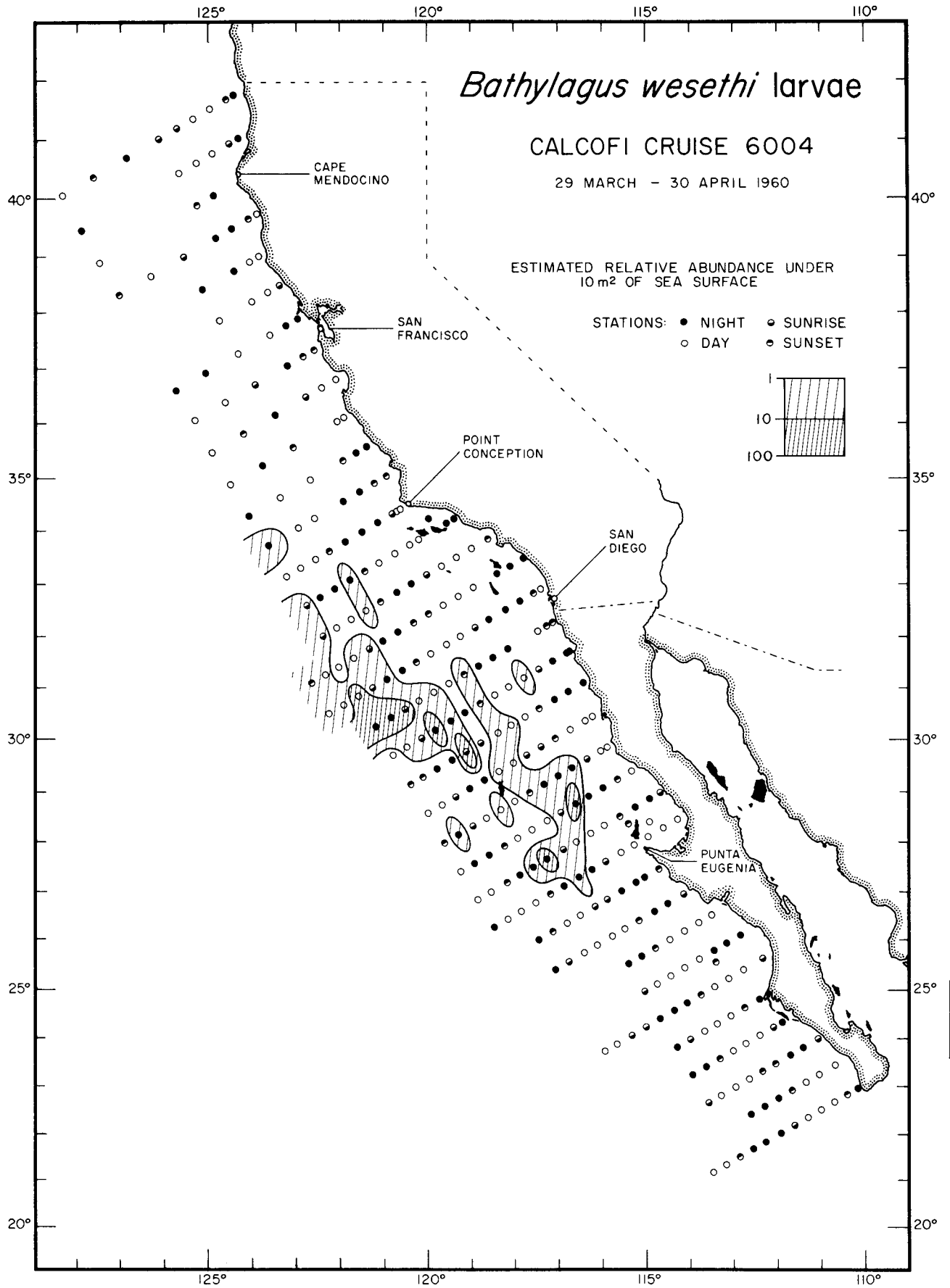
Bathylagus wesethi larvae

5804



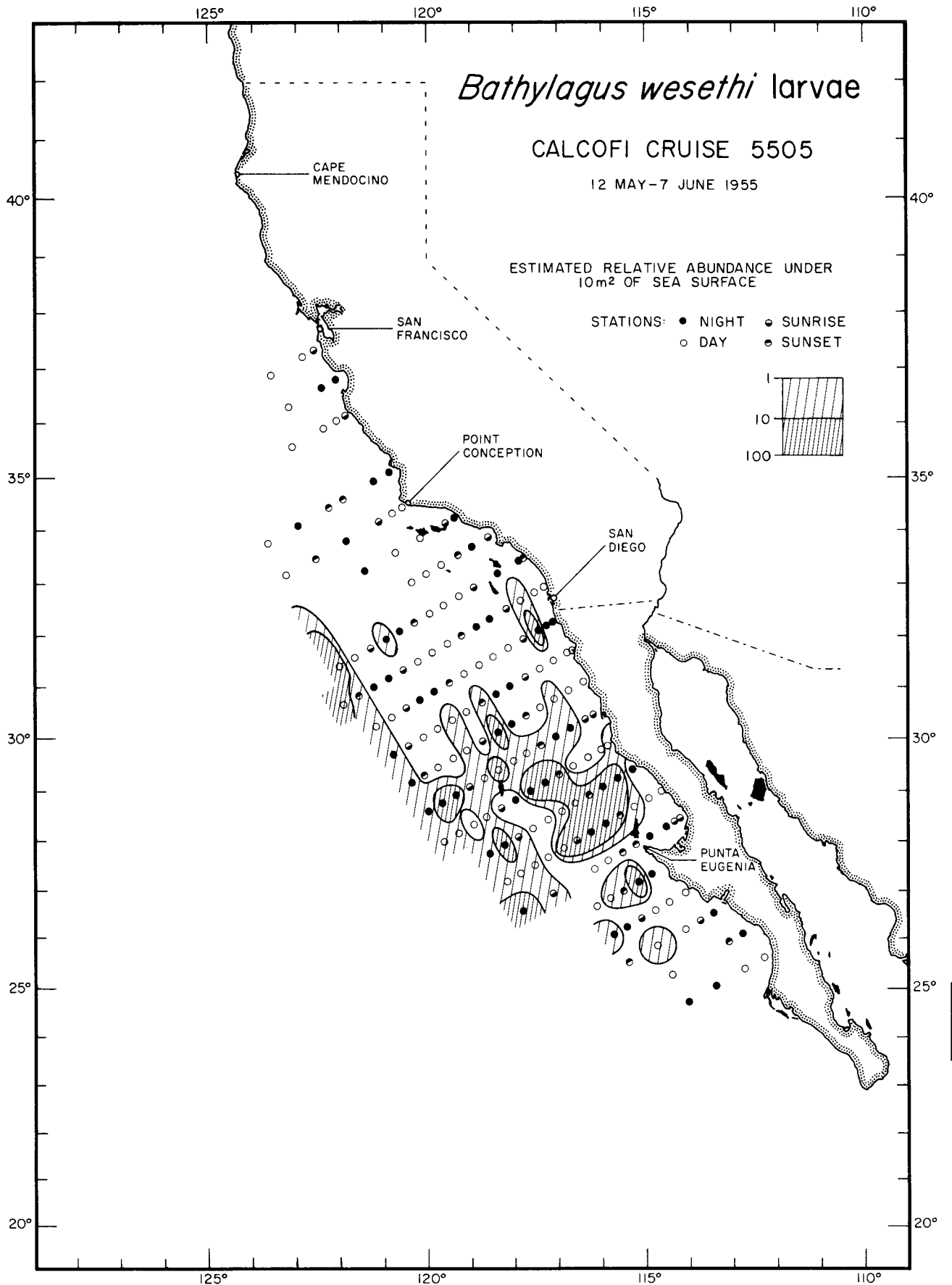
Bathylagus wesethi larvae

5904



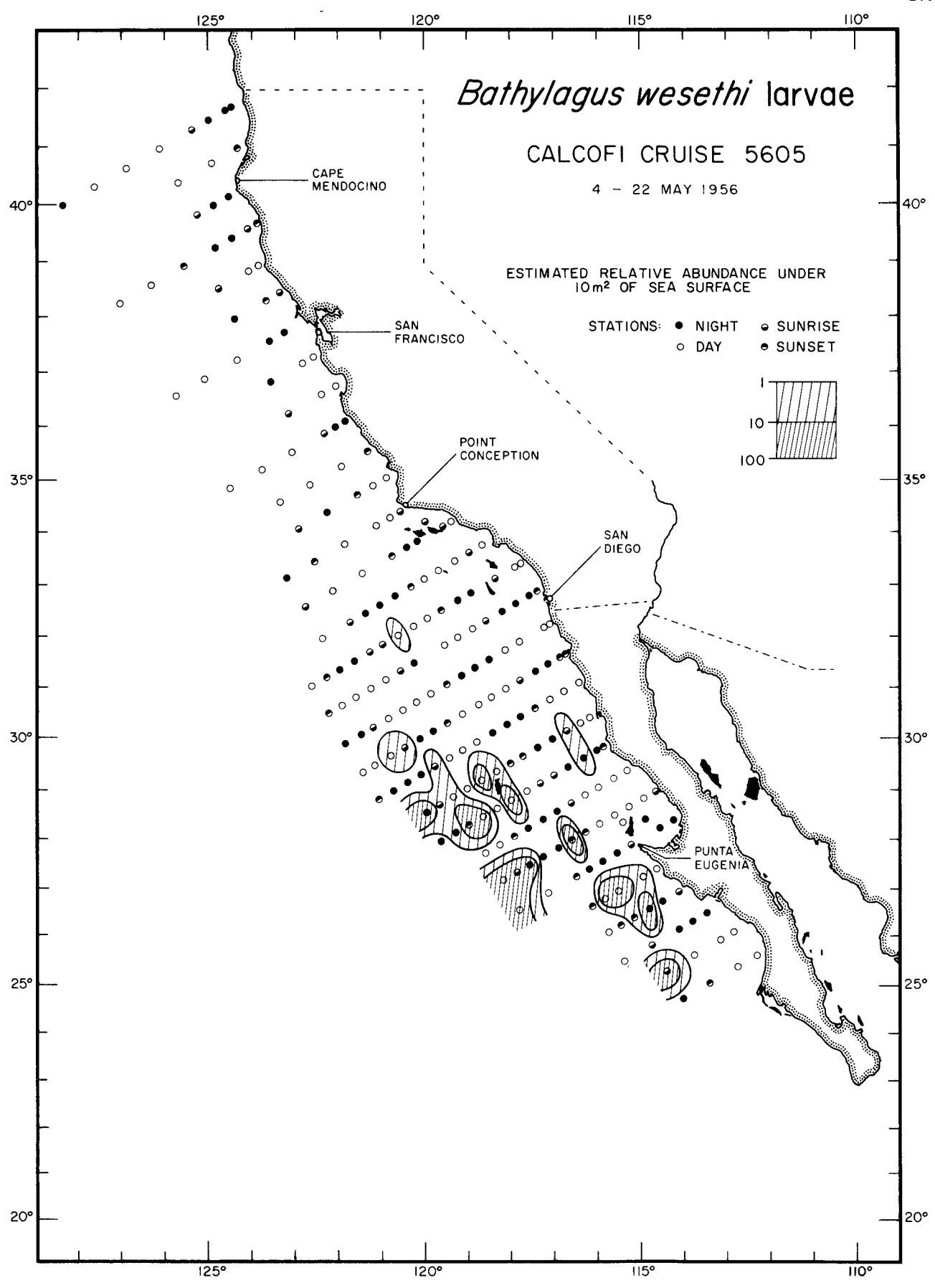
Bathylagus wesethi larvae

6004



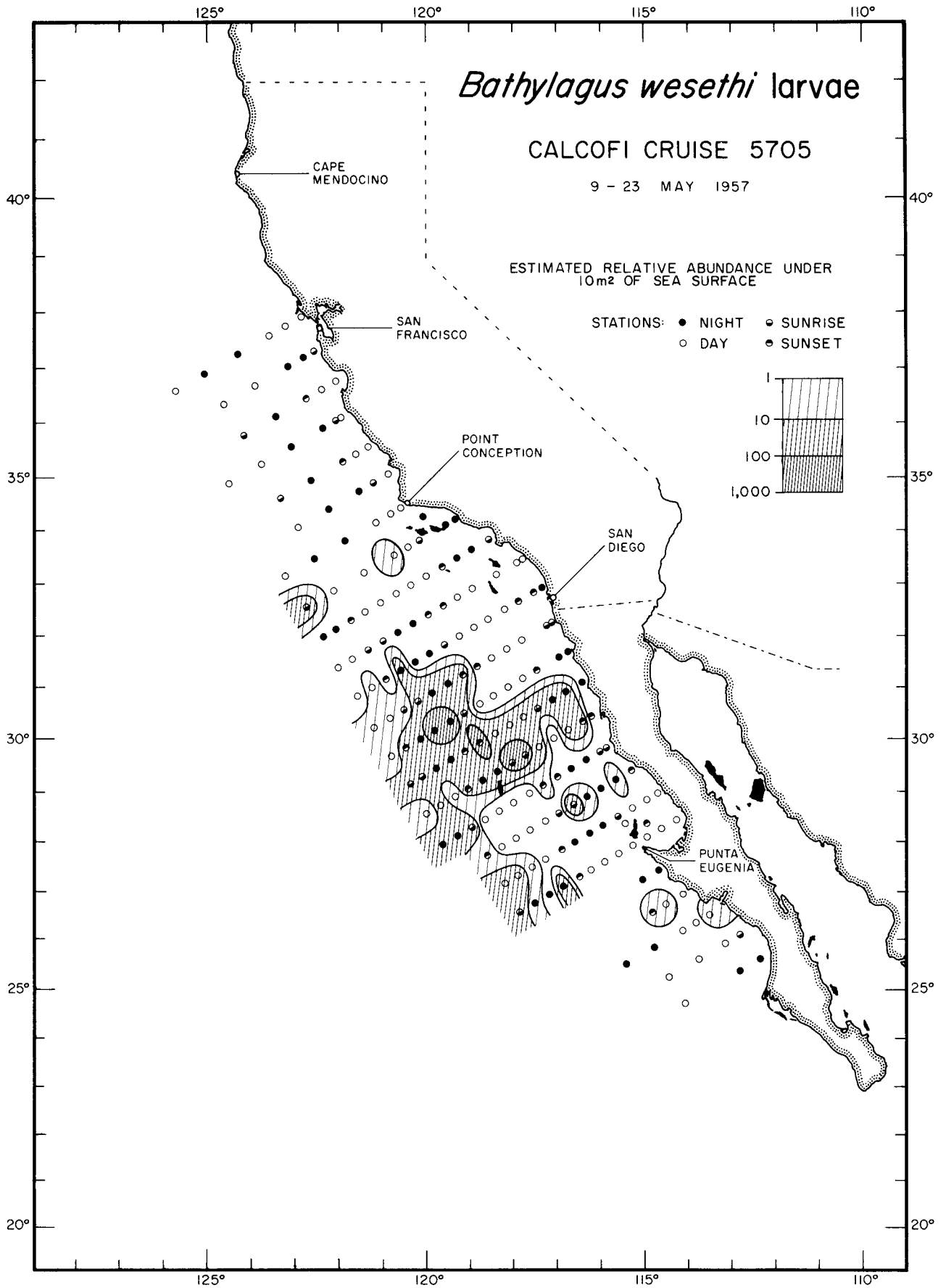
Bathylagus wesethi larvae

5505



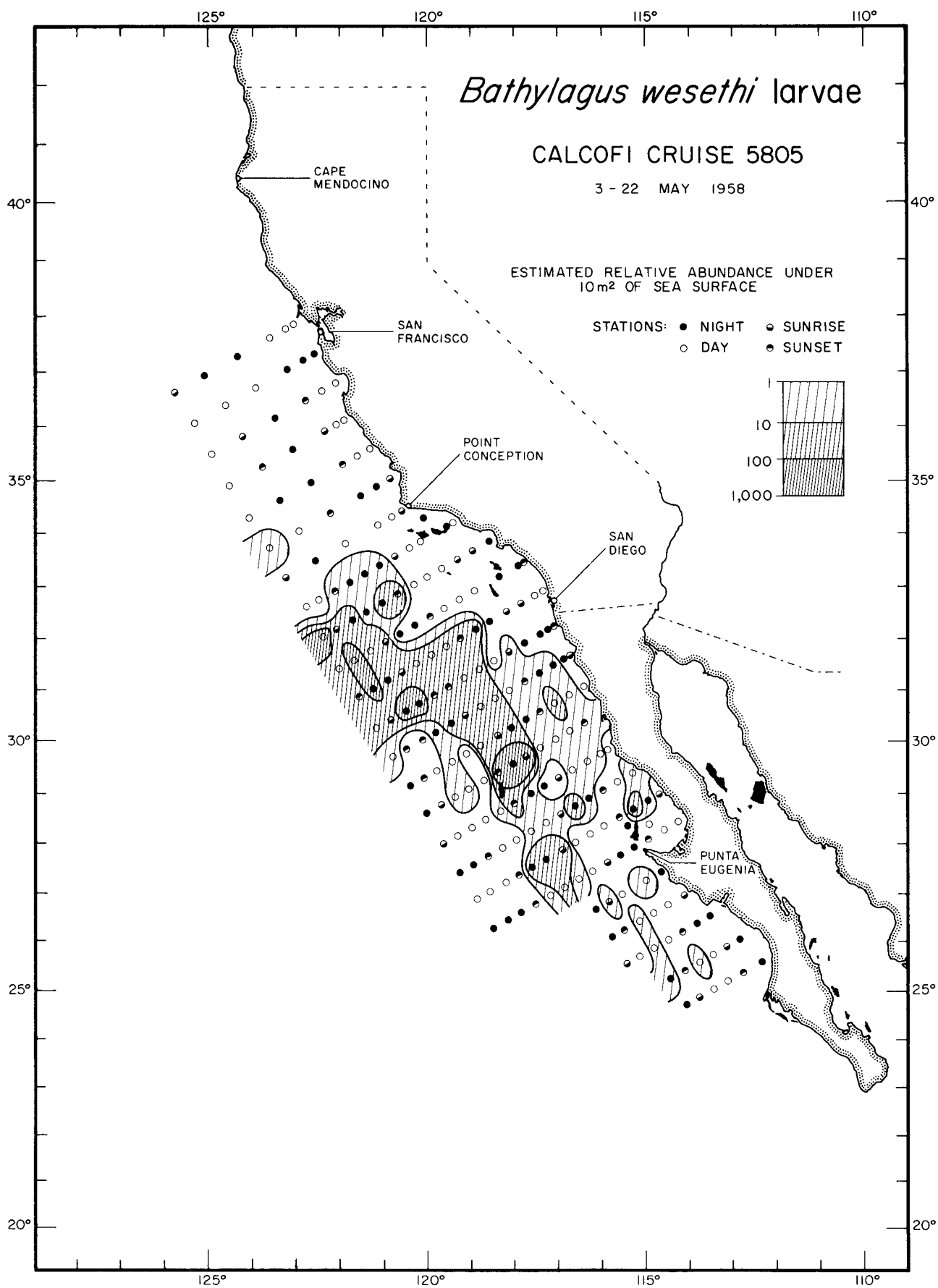
Bathylagus wesethi larvae

5605



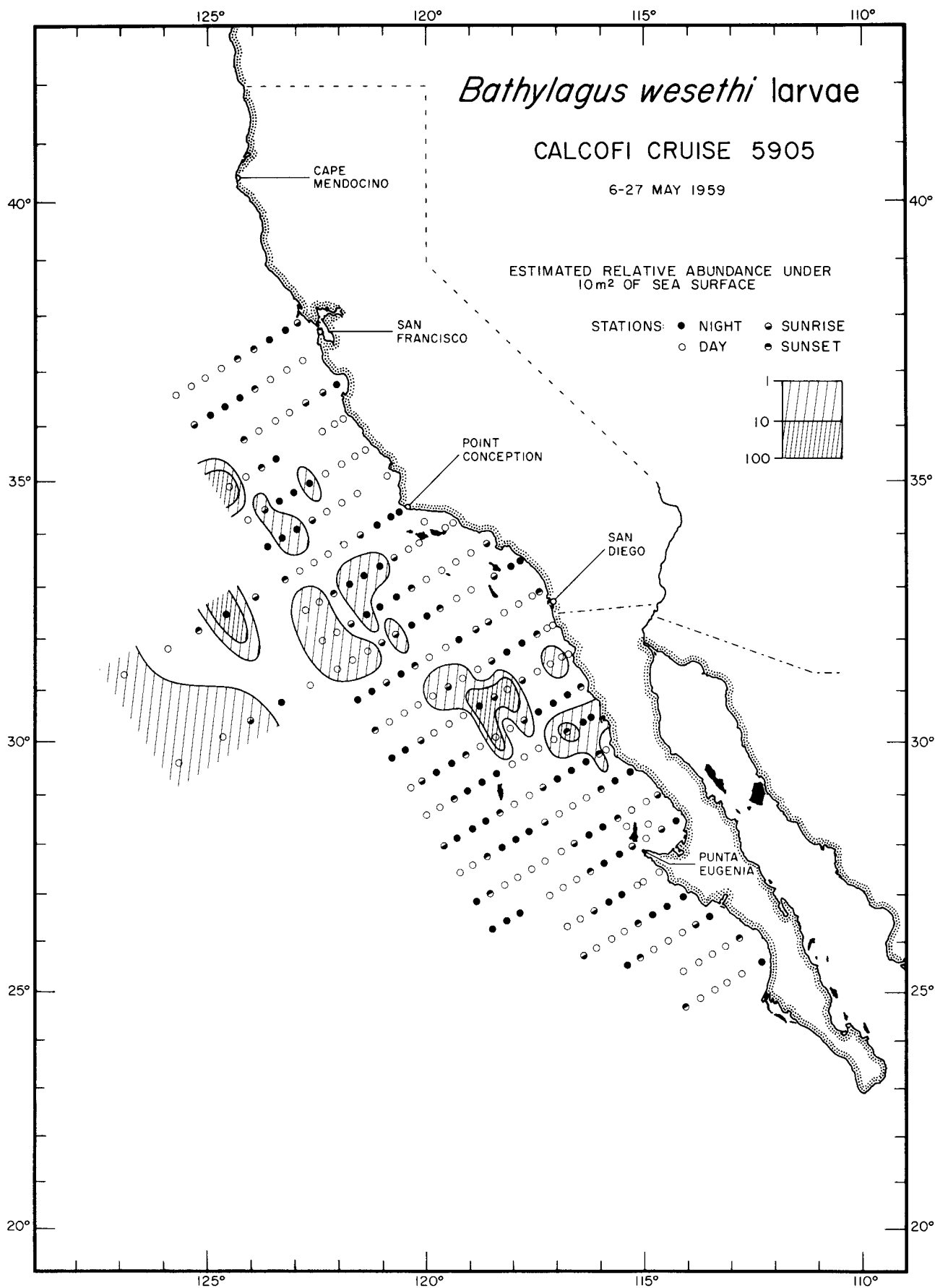
Bathylagus wesethi larvae

5705



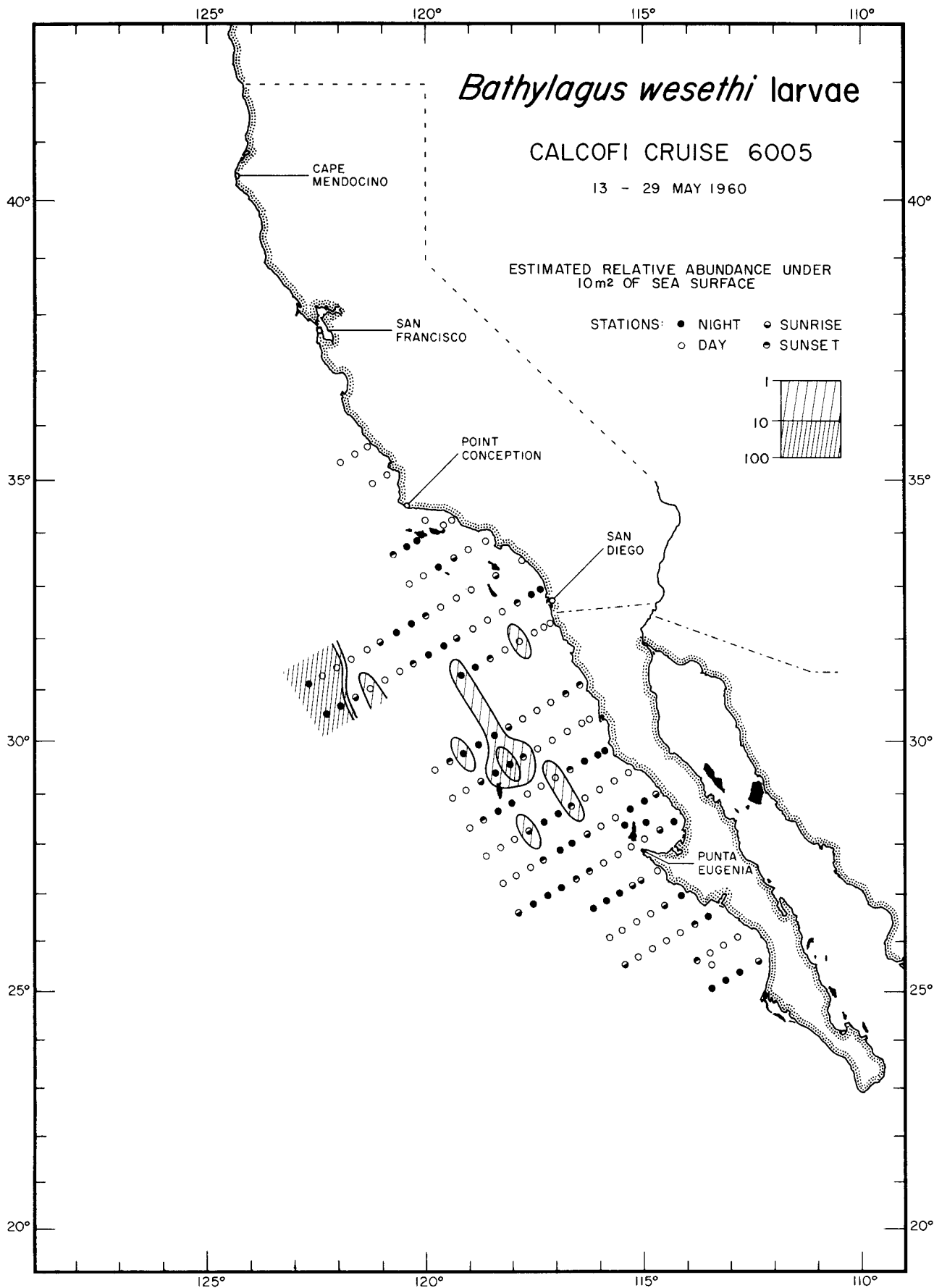
Bathylagus wesethi larvae

5805



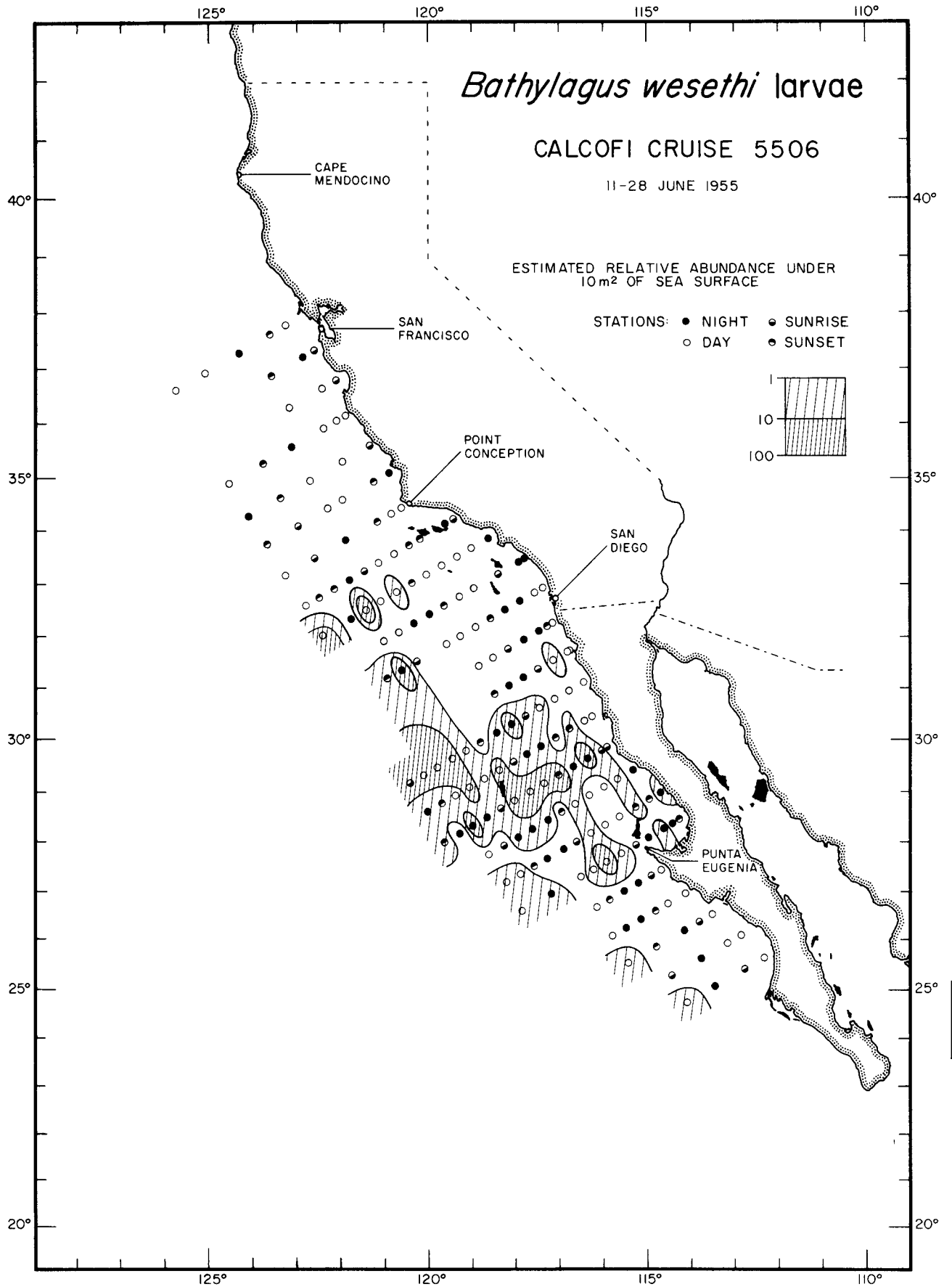
Bathylagus wesethi larvae

5905



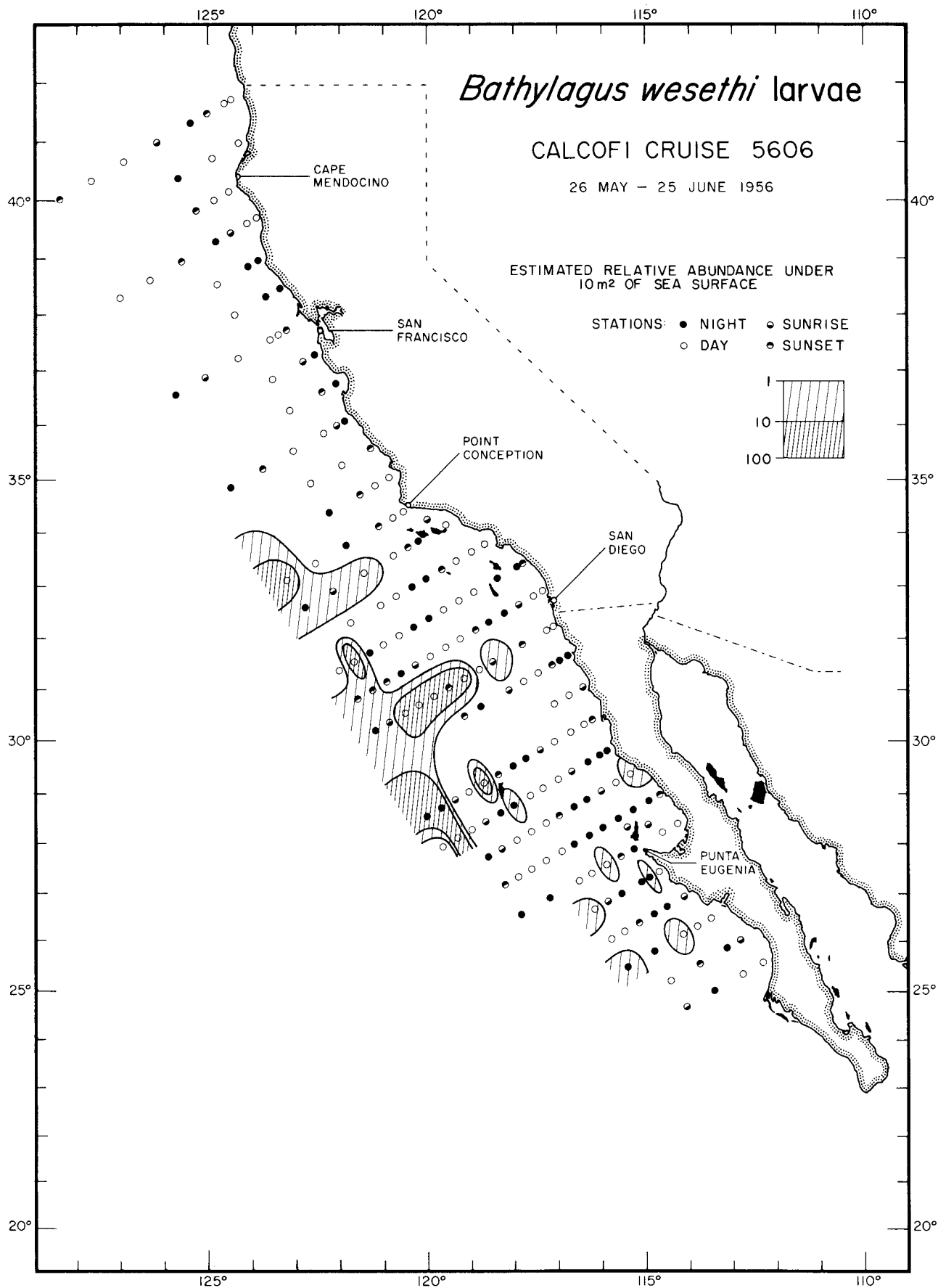
Bathylagus wesethi larvae

6005

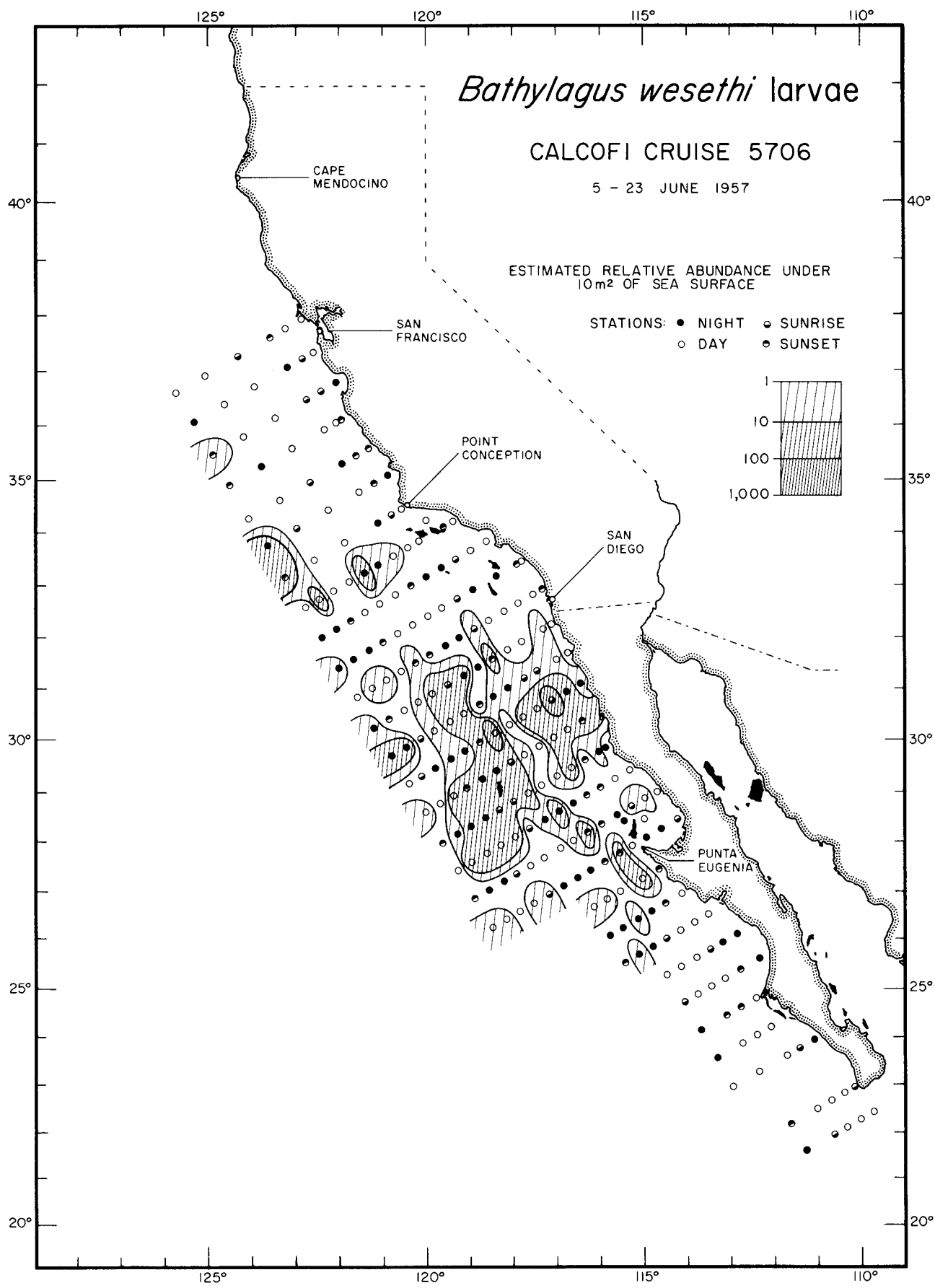


Bathylagus wesethi larvae

5506

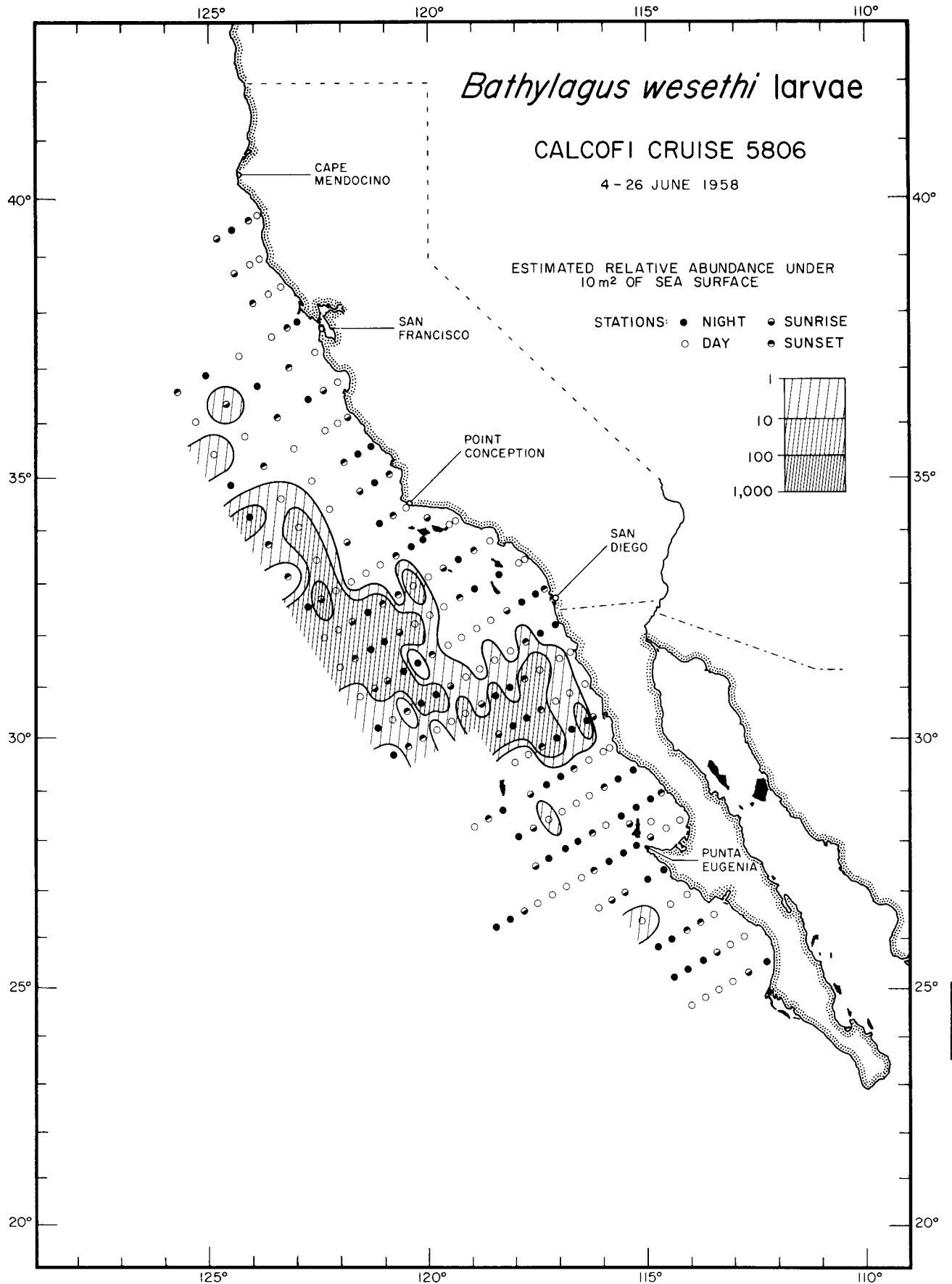


Bathylagus wesethi larvae



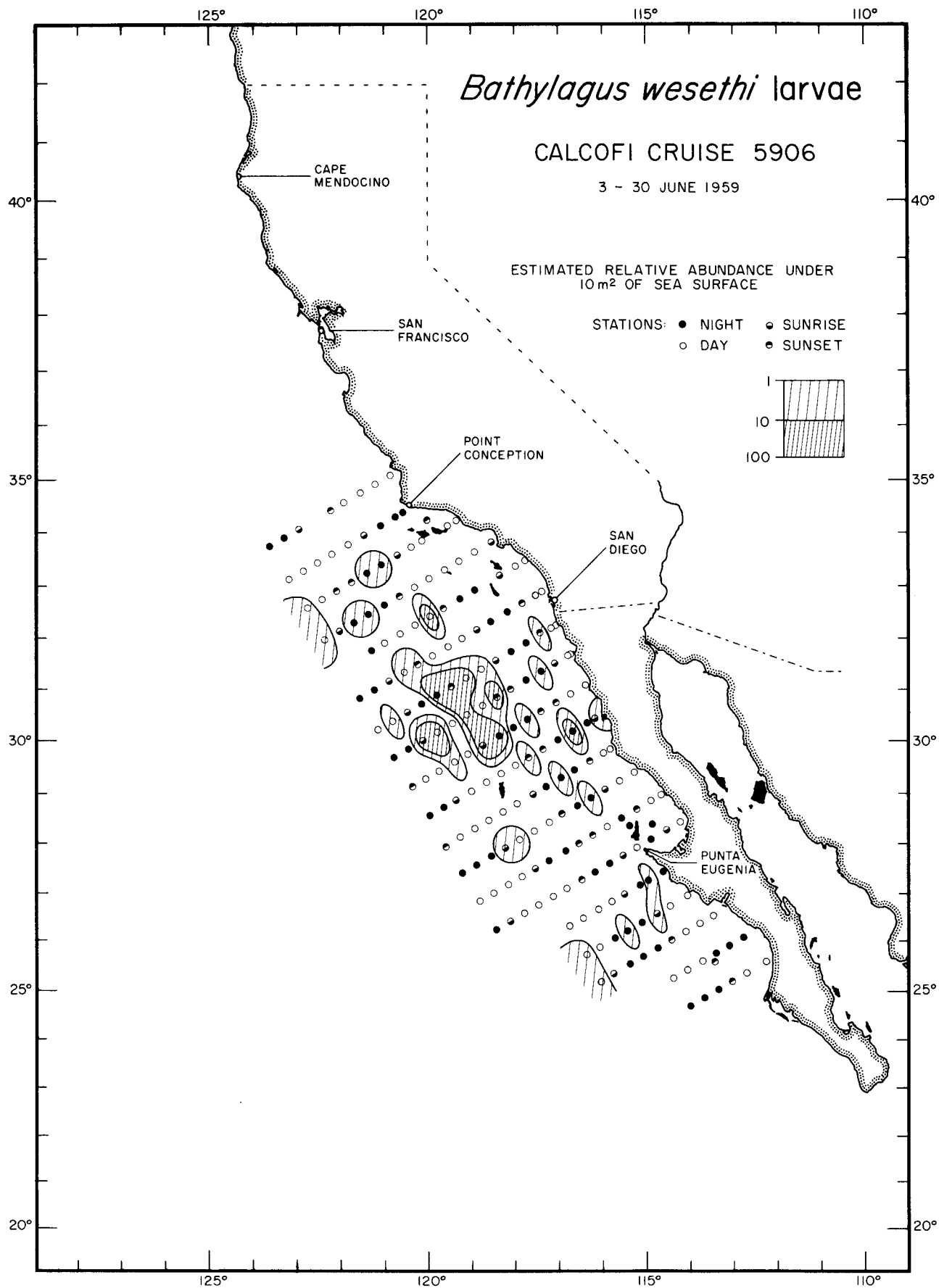
Bathylagus wesethi larvae

5706



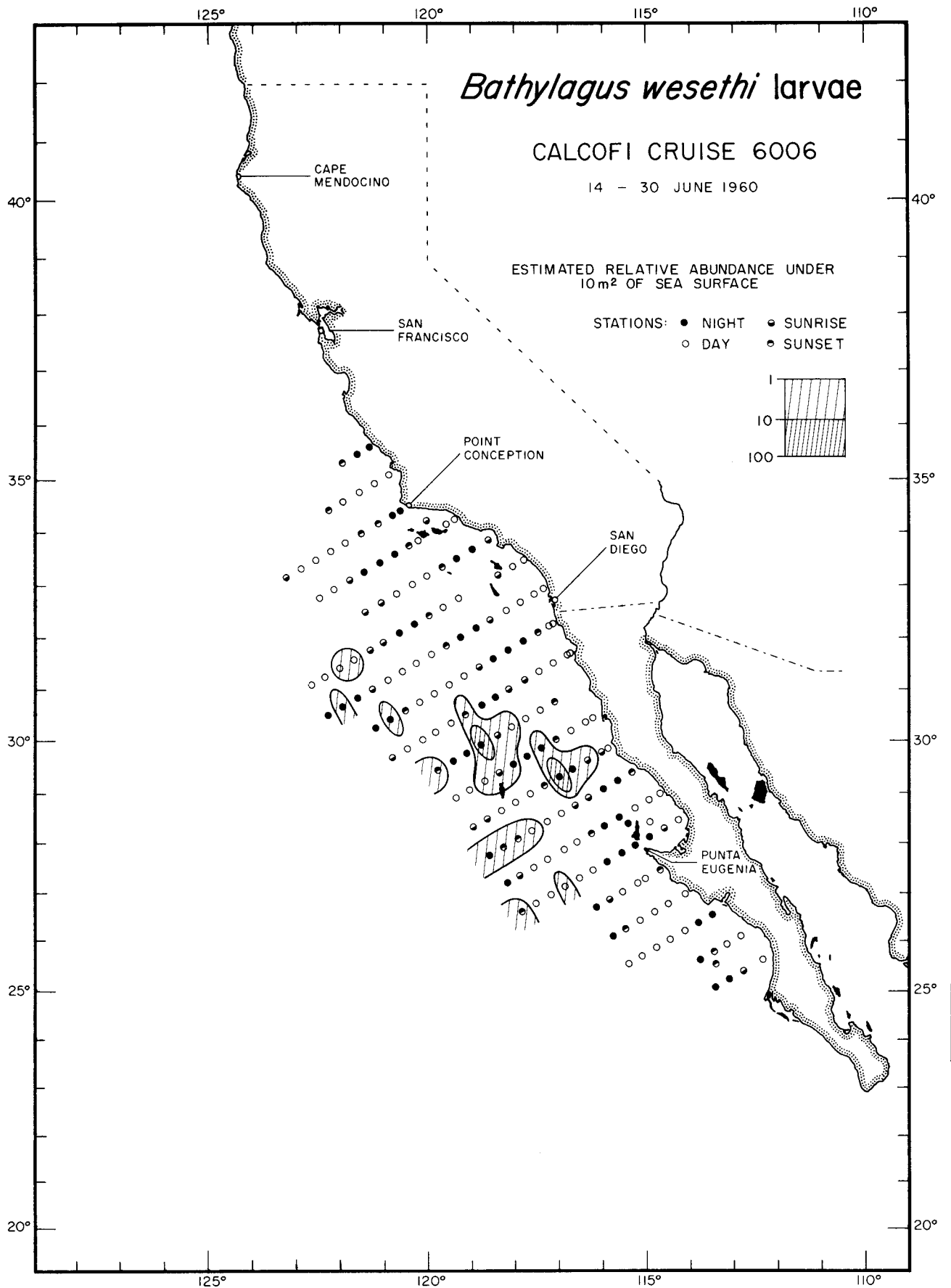
Bathylagus wesethi larvae

5806



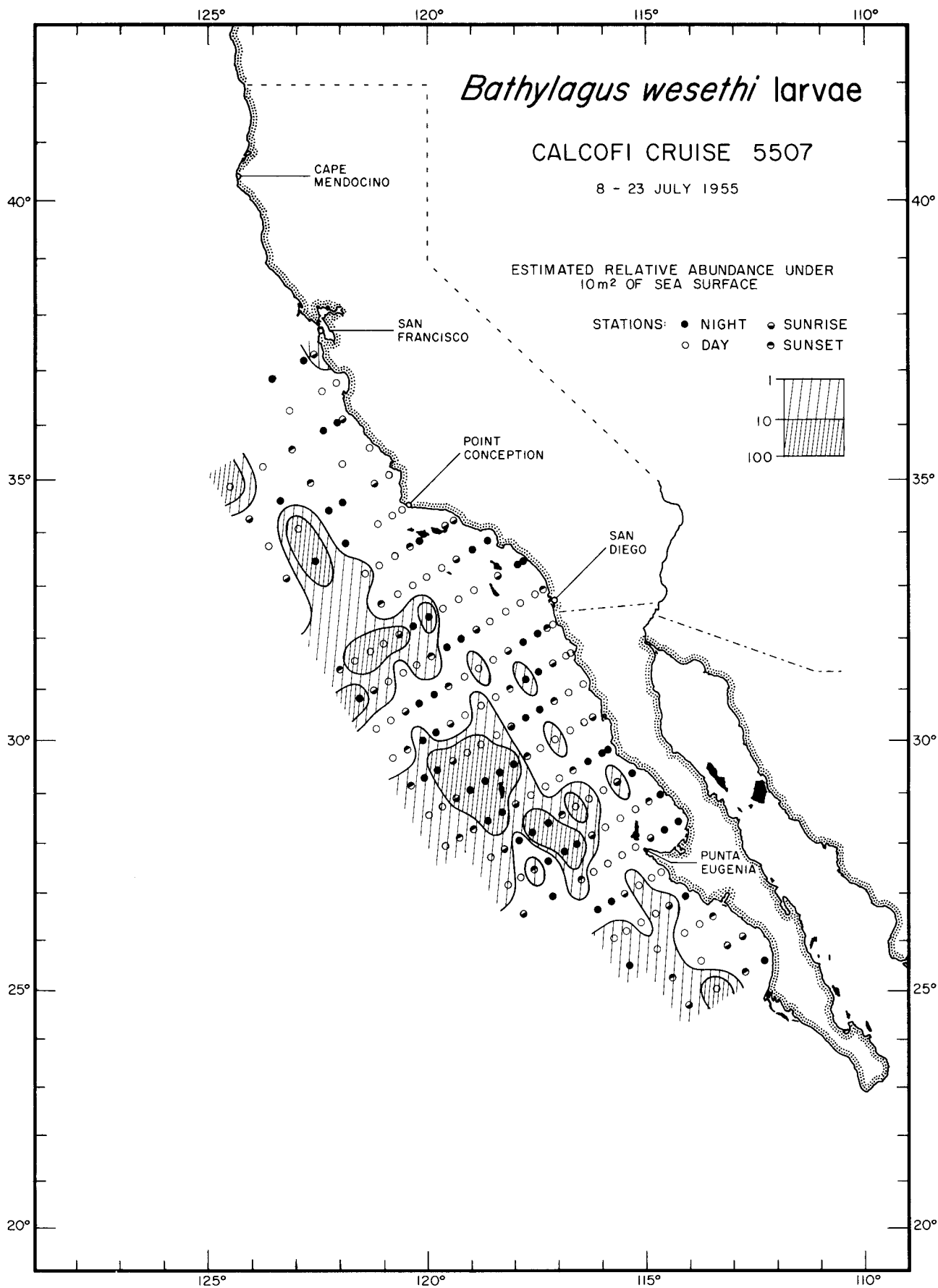
Bathylagus wesethi larvae

5906



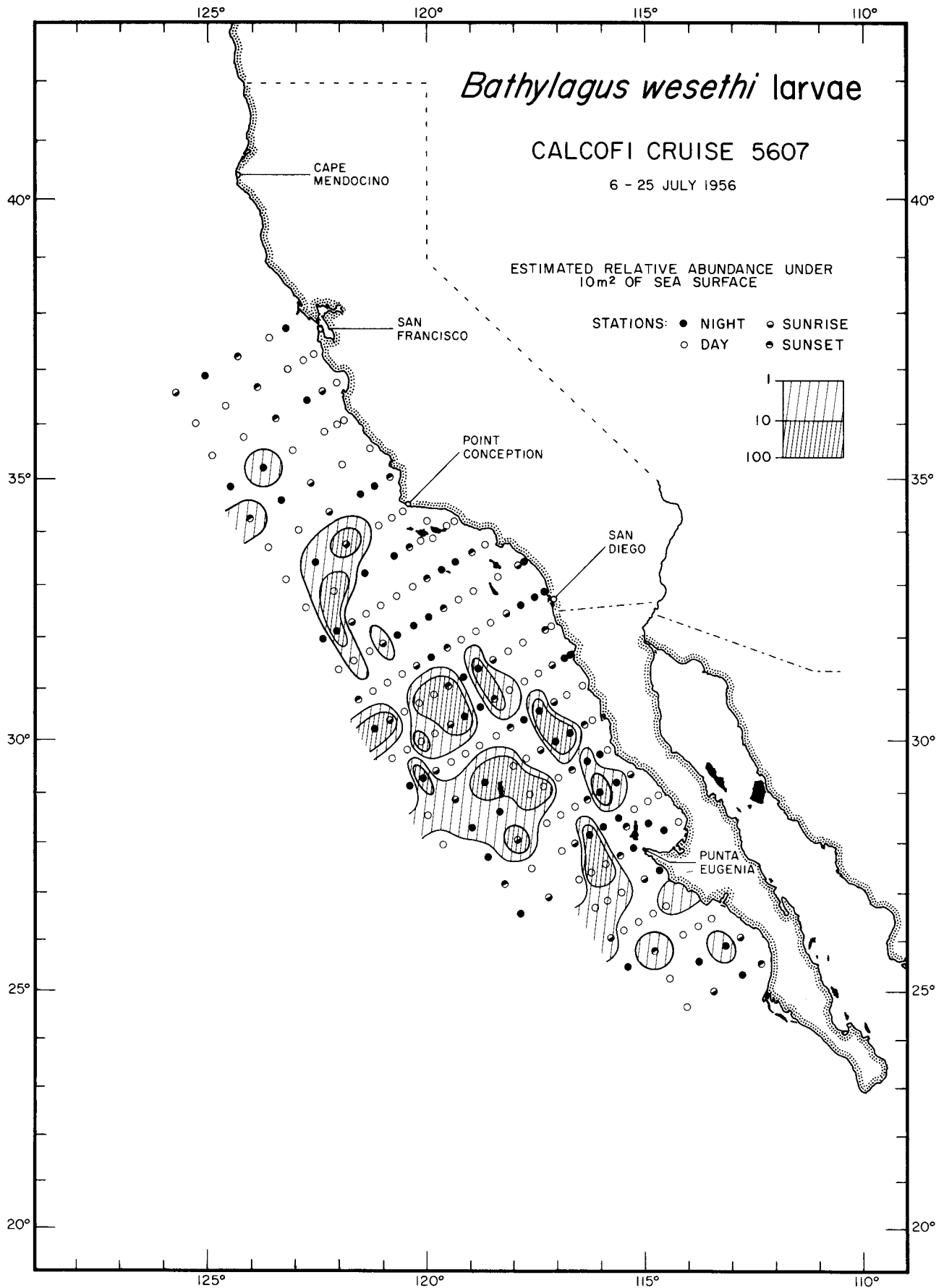
Bathylagus wesethi larvae

6006

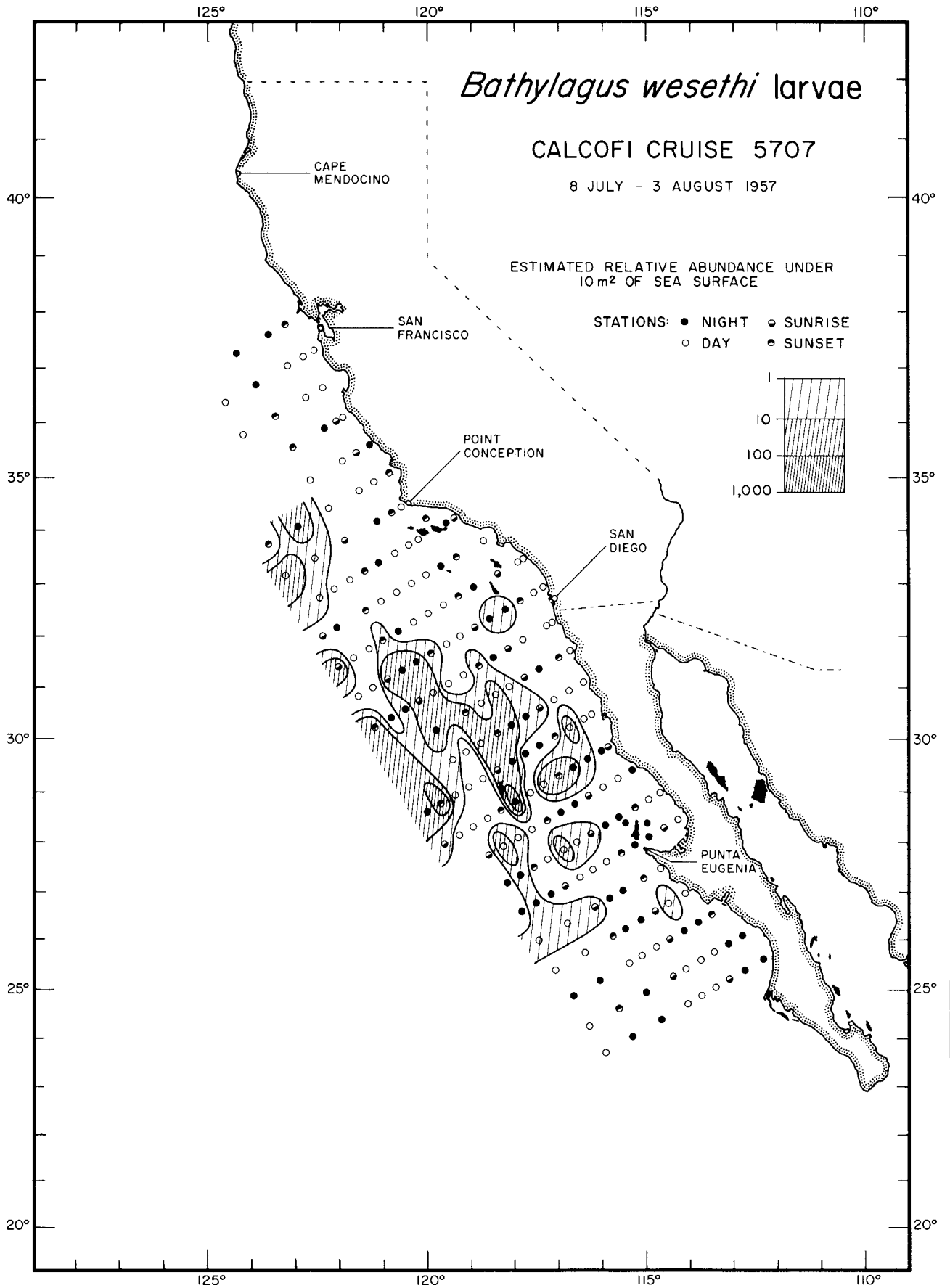


Bathylagus wesethi larvae

5507

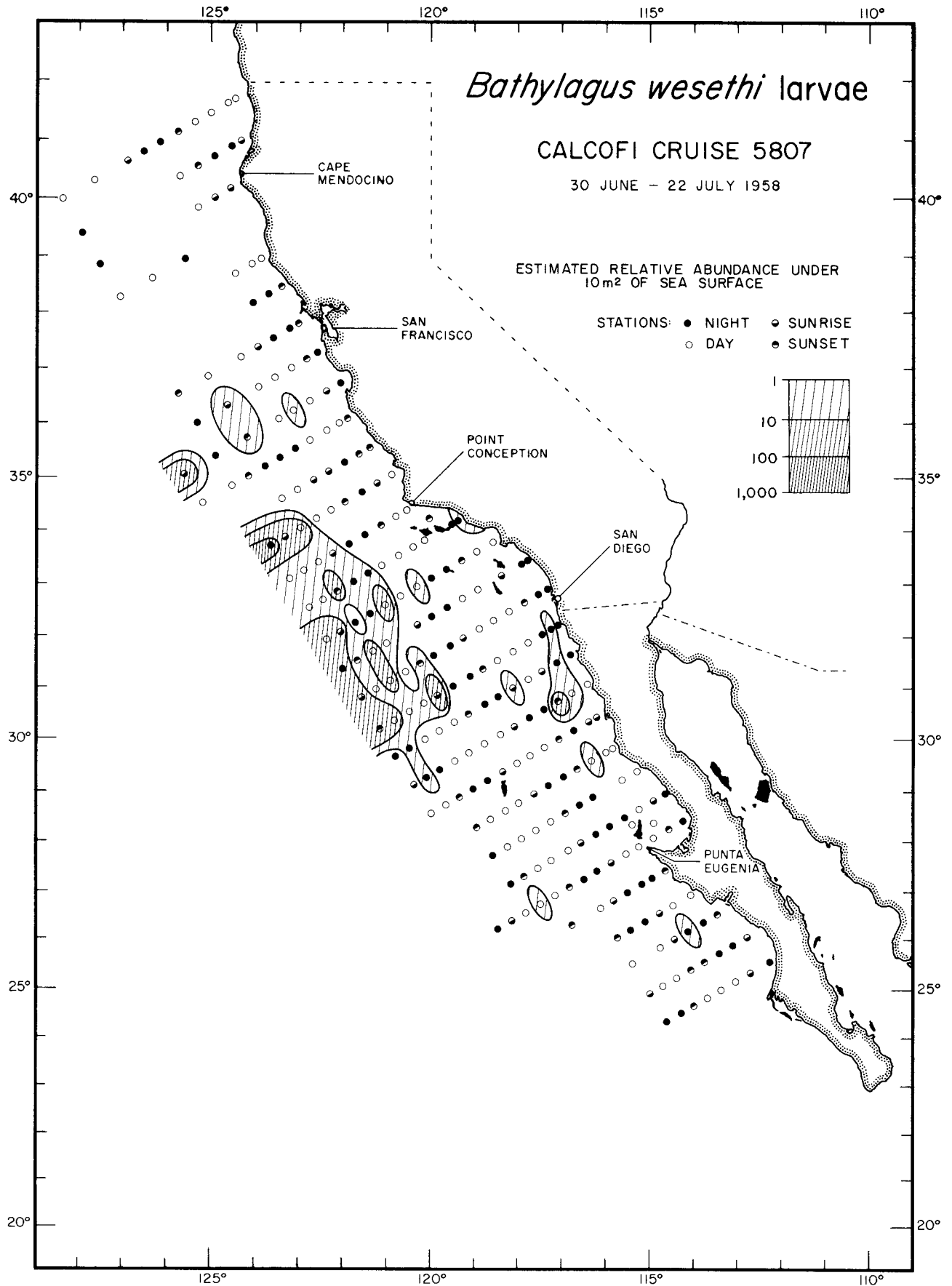


Bathylagus wesethi larvae



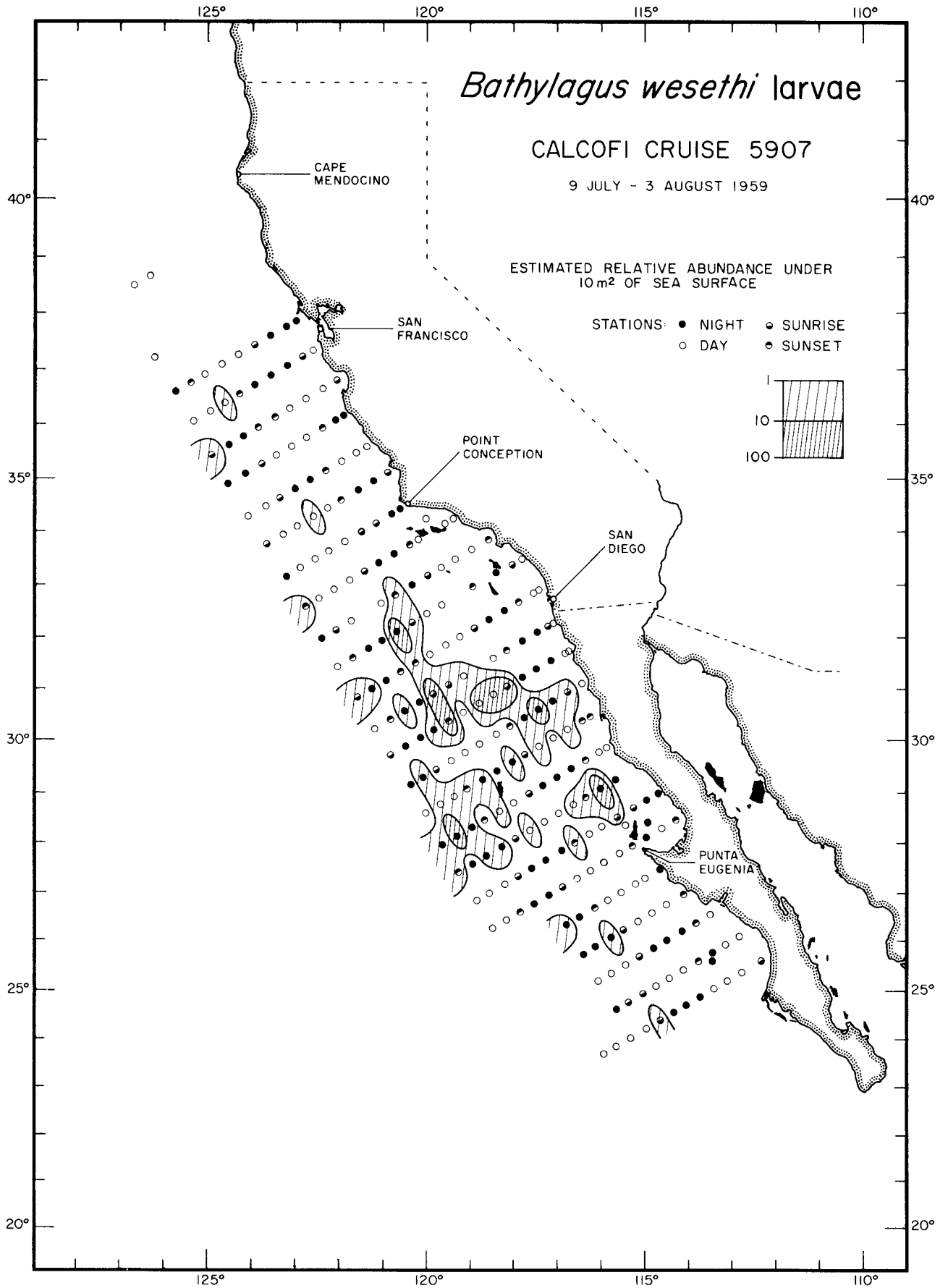
Bathylagus wesethi larvae

5707



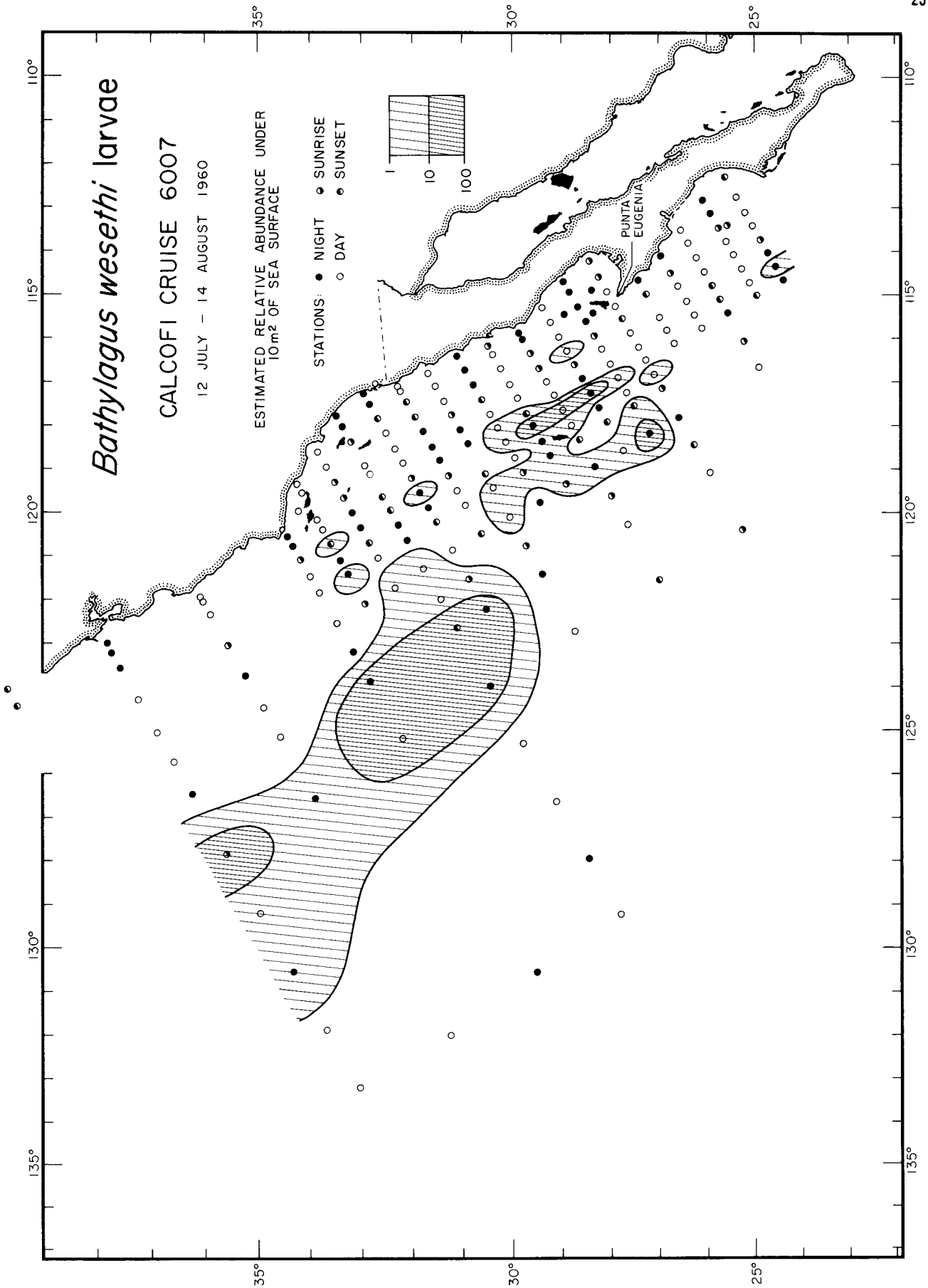
Bathylagus wesethi larvae

5807

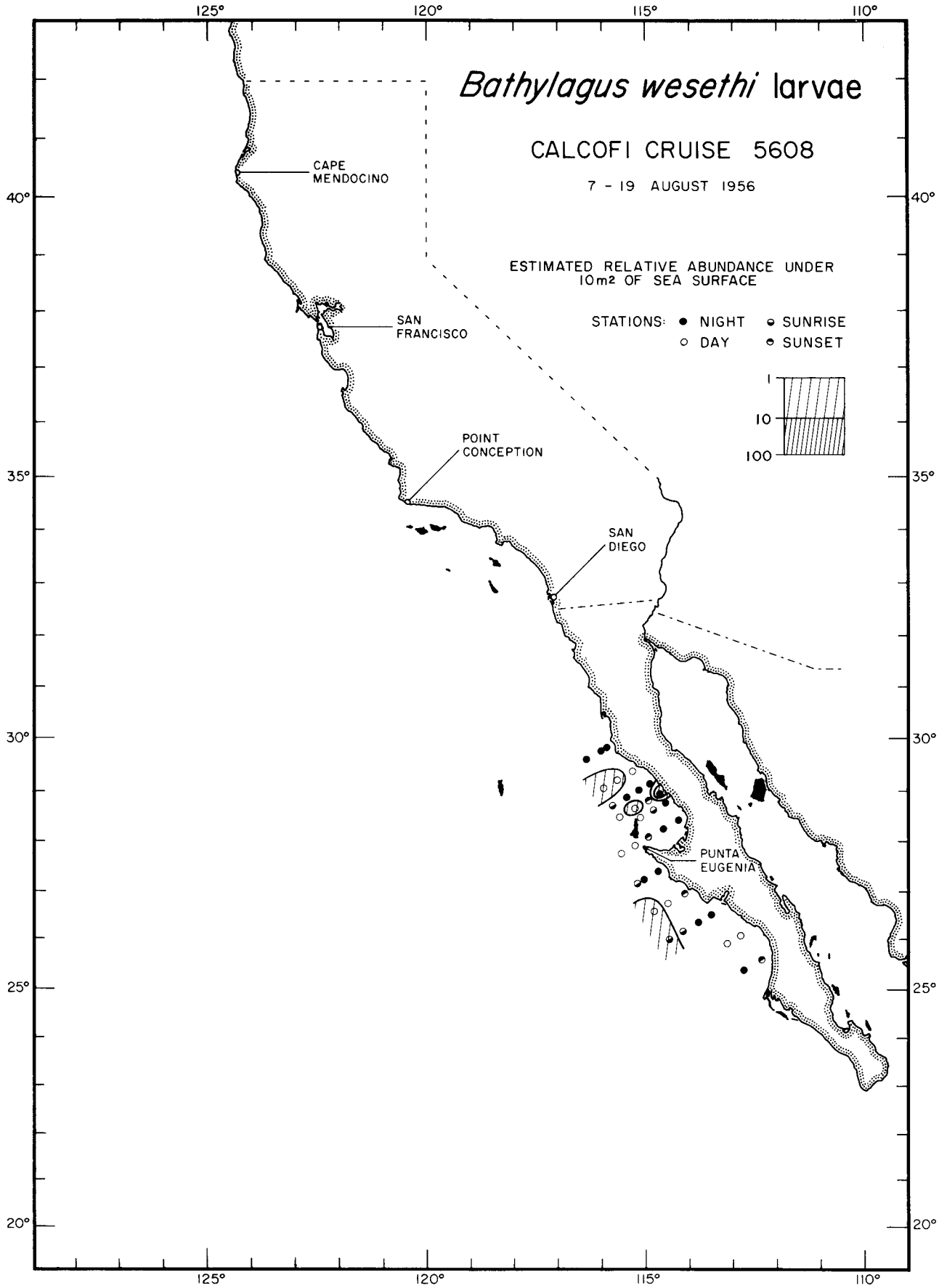


Bathylagus wesethi larvae

5907

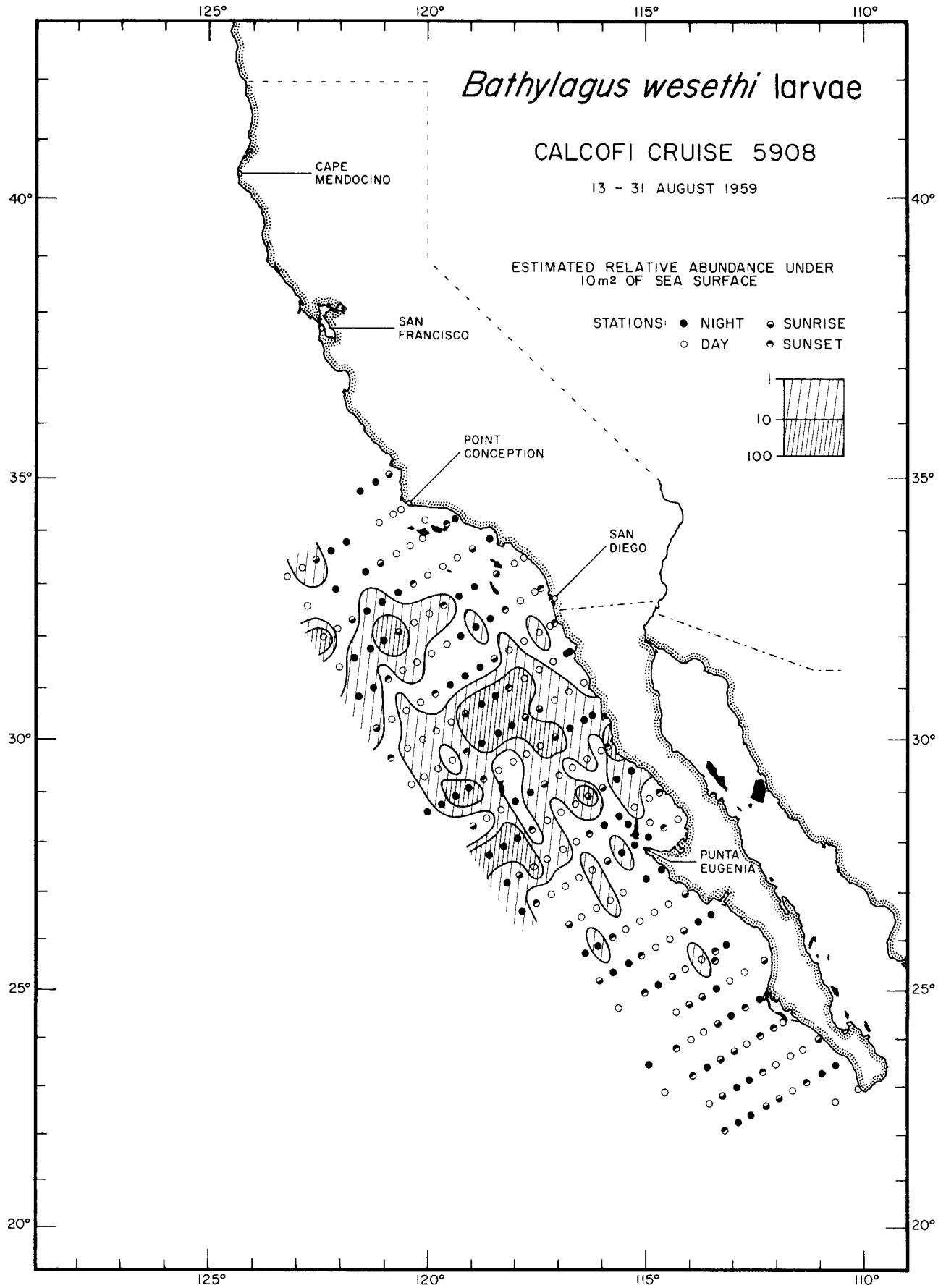


Bathylagus wesethi larvae



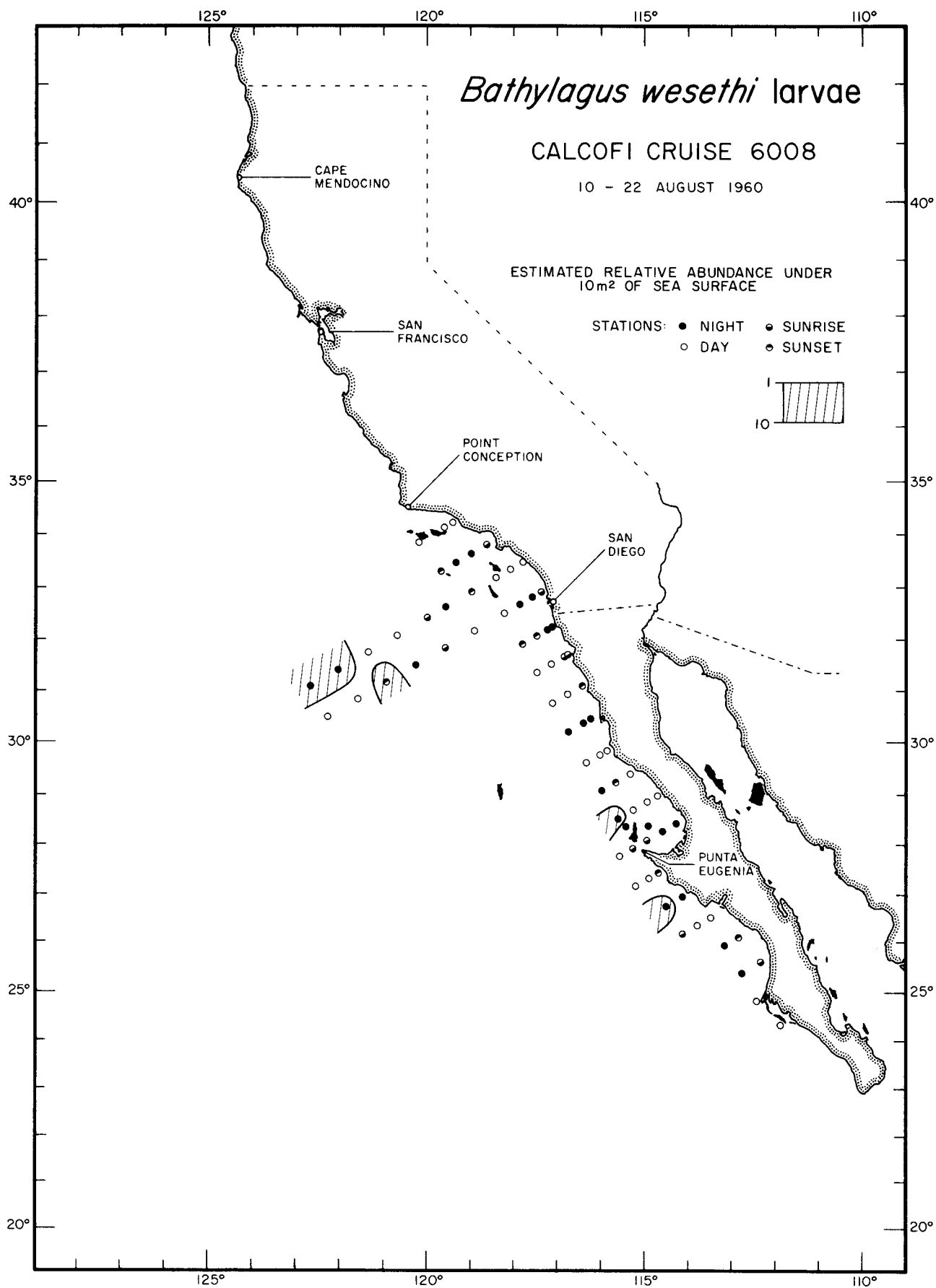
Bathylagus wesethi larvae

5608



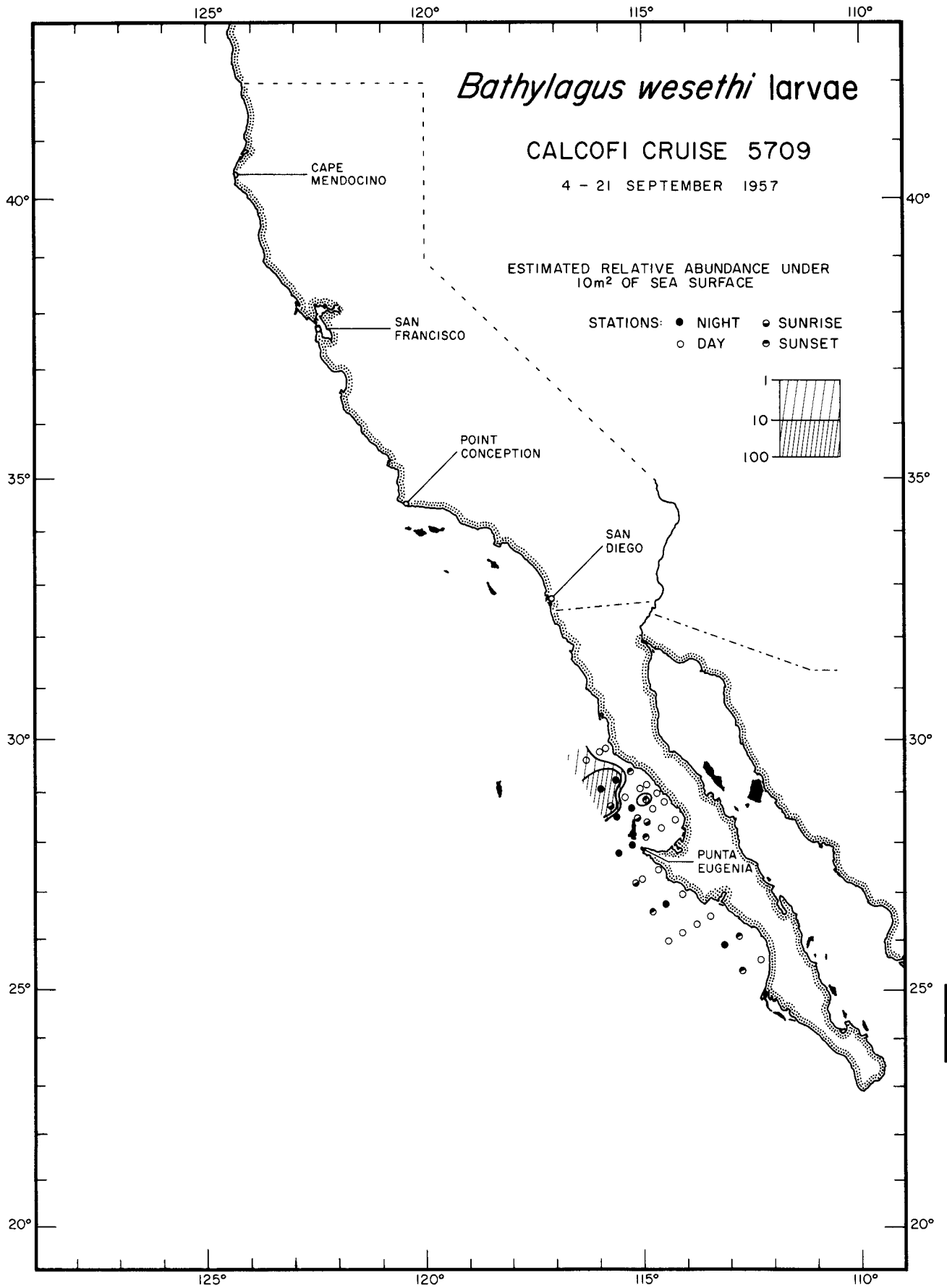
Bathylagus wesethi larvae

5908



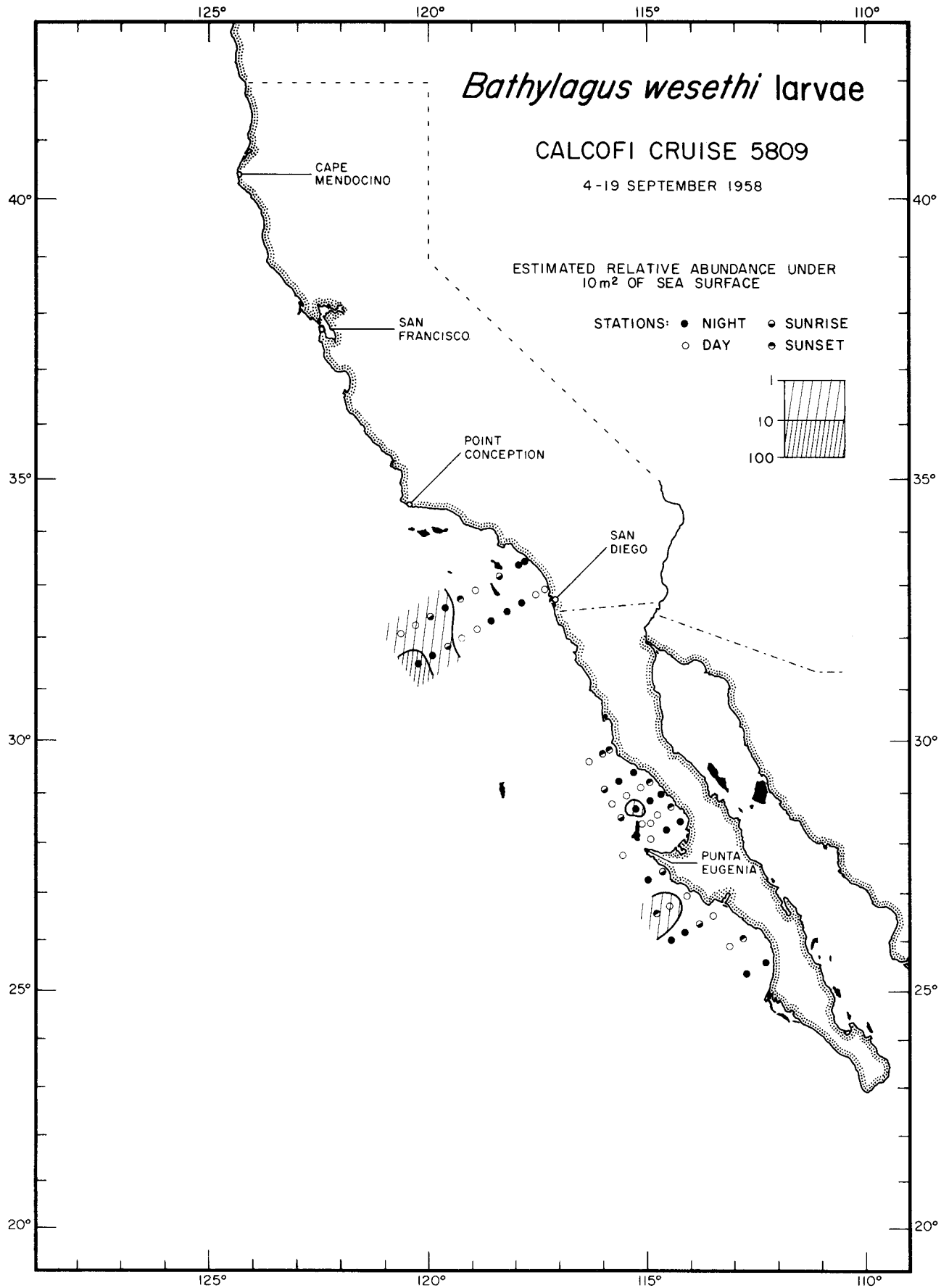
Bathylagus wesethi larvae

6008



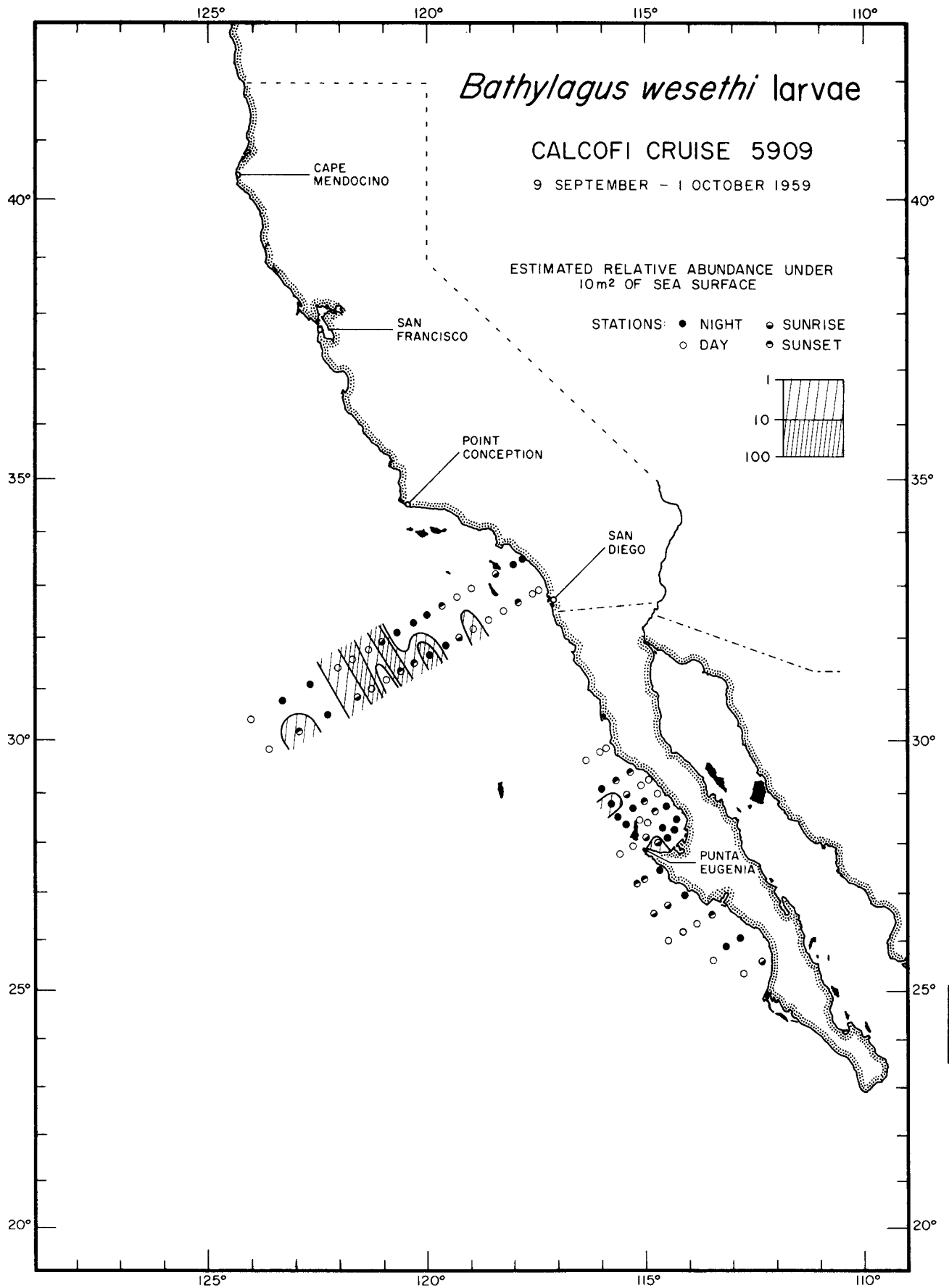
Bathylagus wesethi larvae

5709



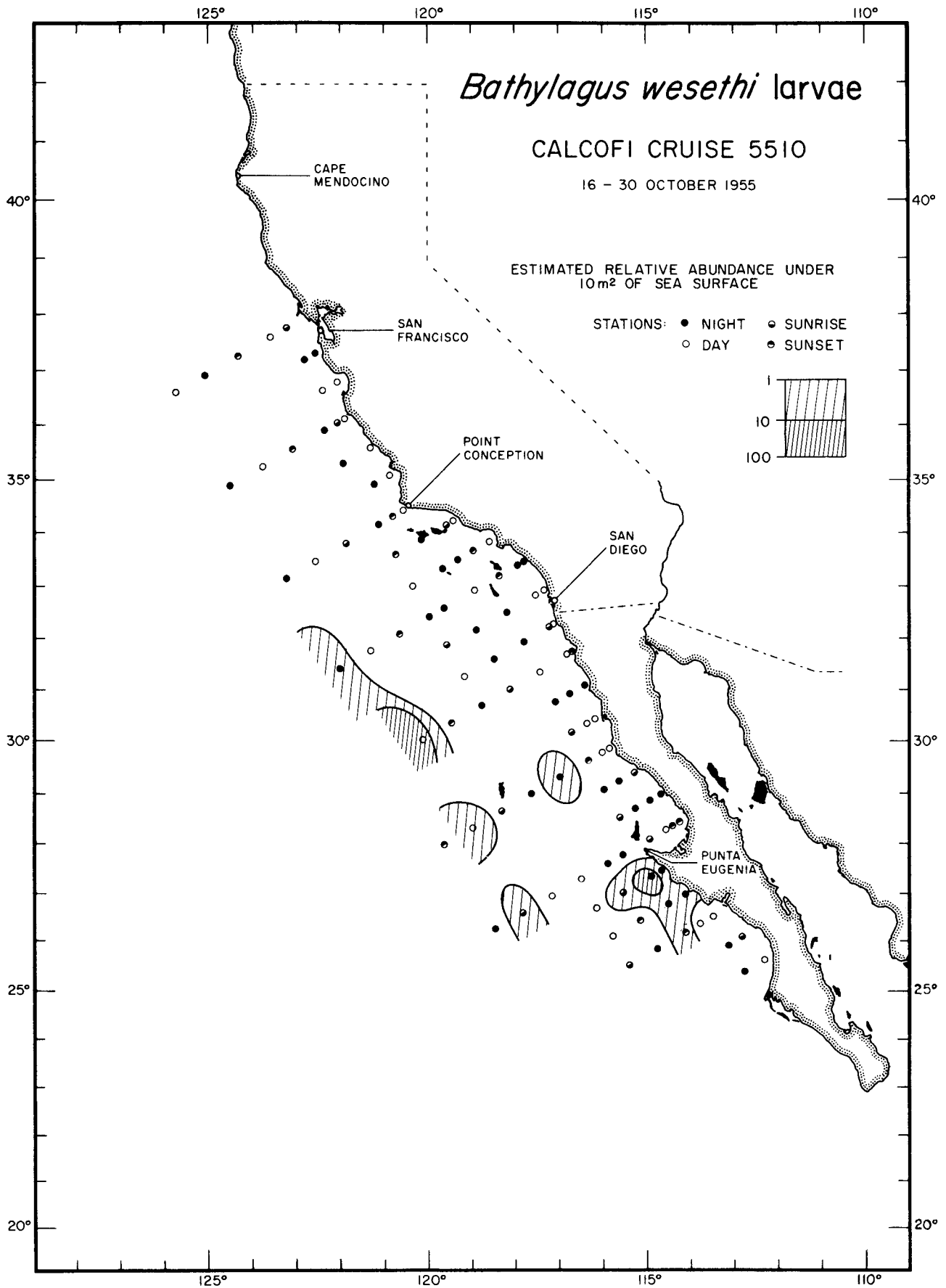
Bathylagus wesethi larvae

5809



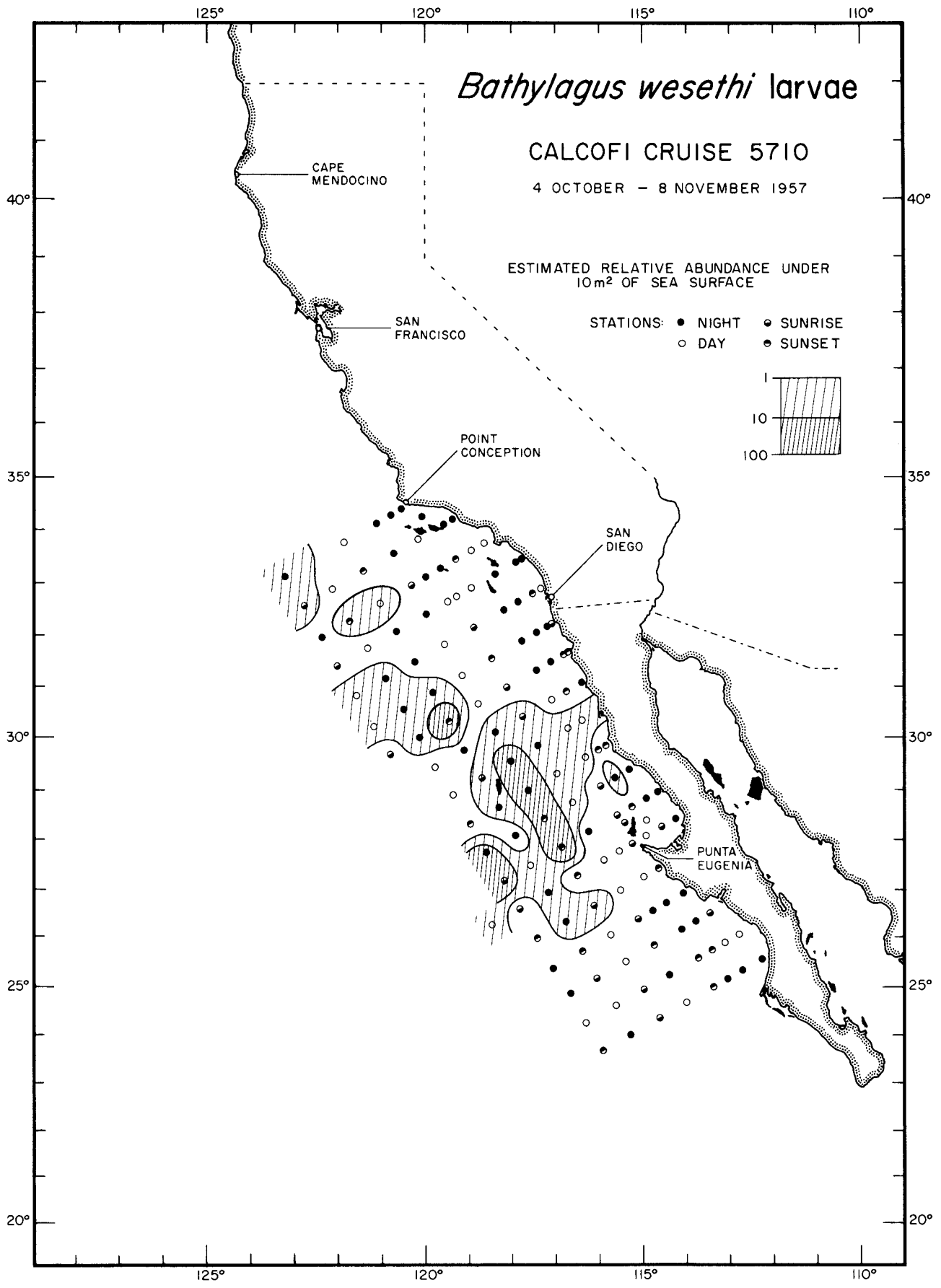
Bathylagus wesethi larvae

5909



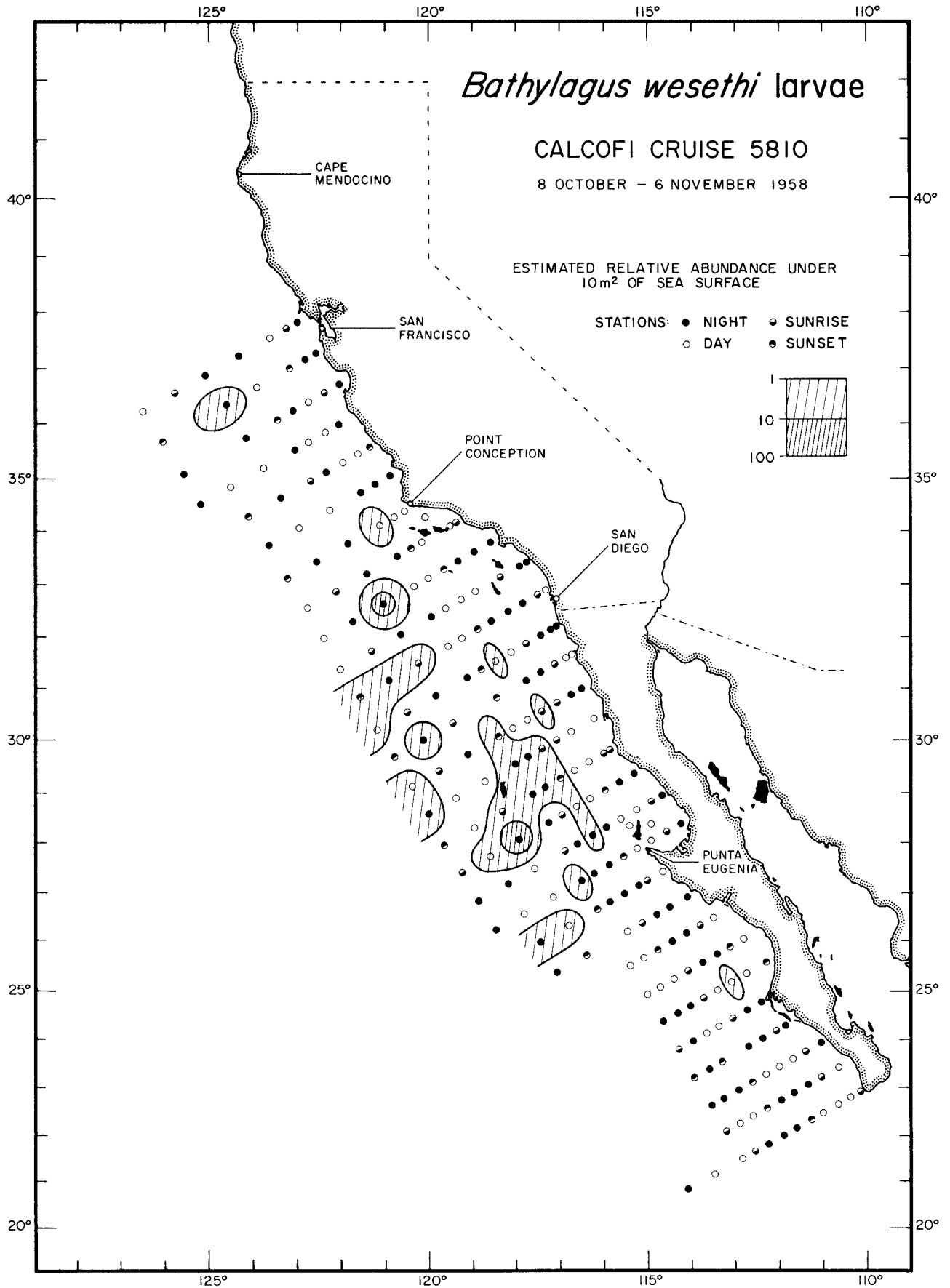
Bathylagus wesethi larvae

5510



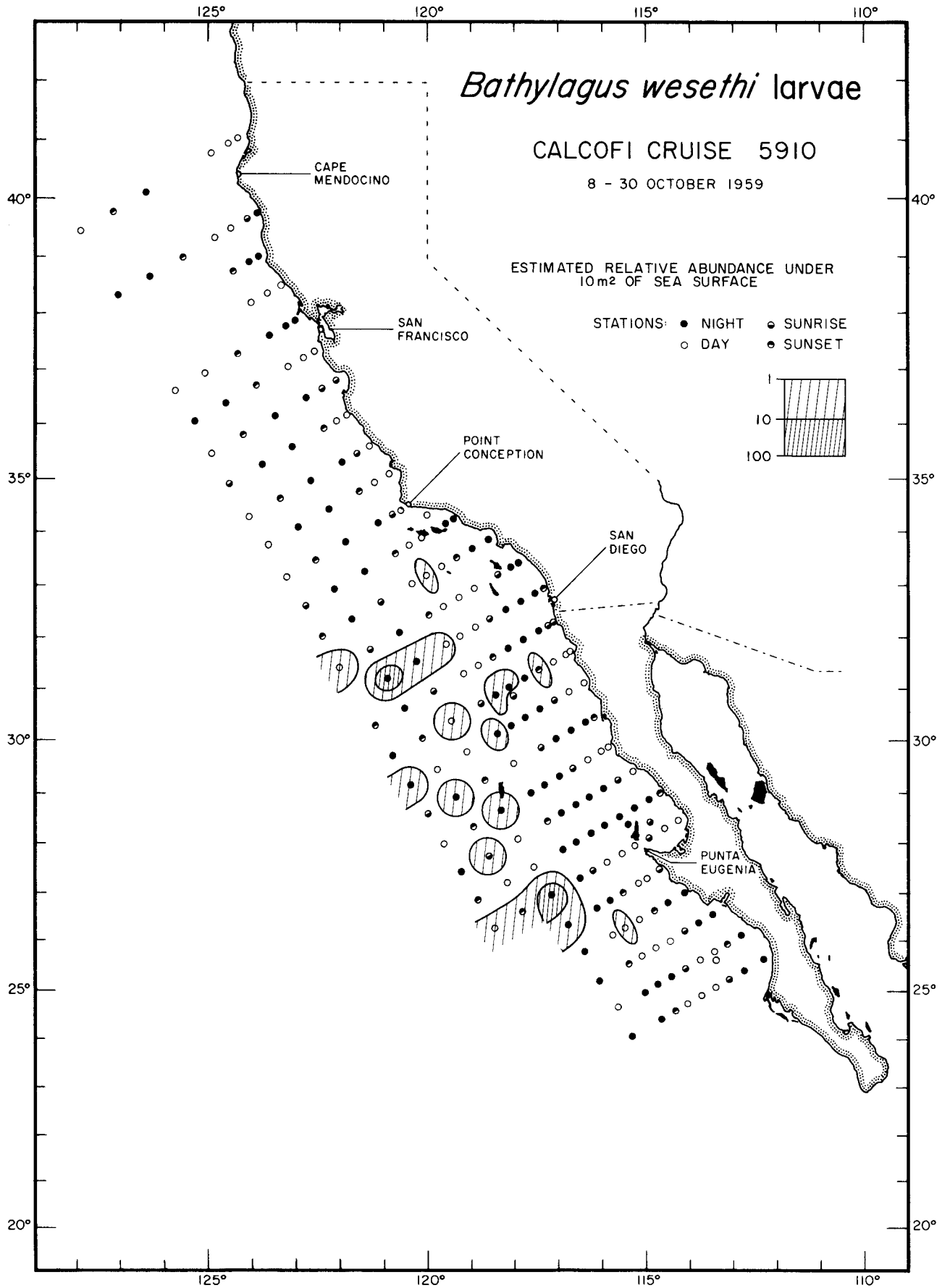
Bathylagus wesethi larvae

5710



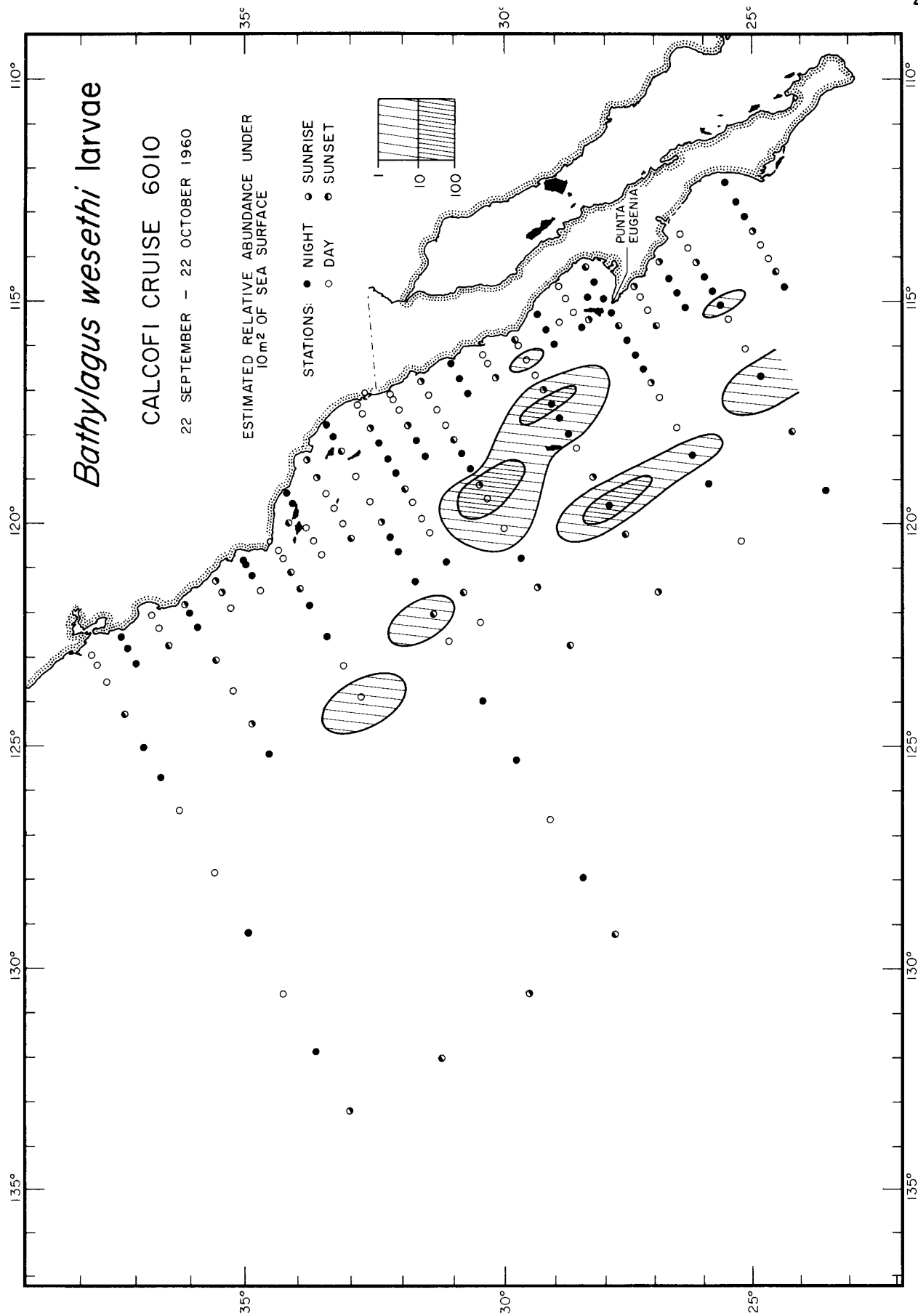
Bathylagus wesethi larvae

5810



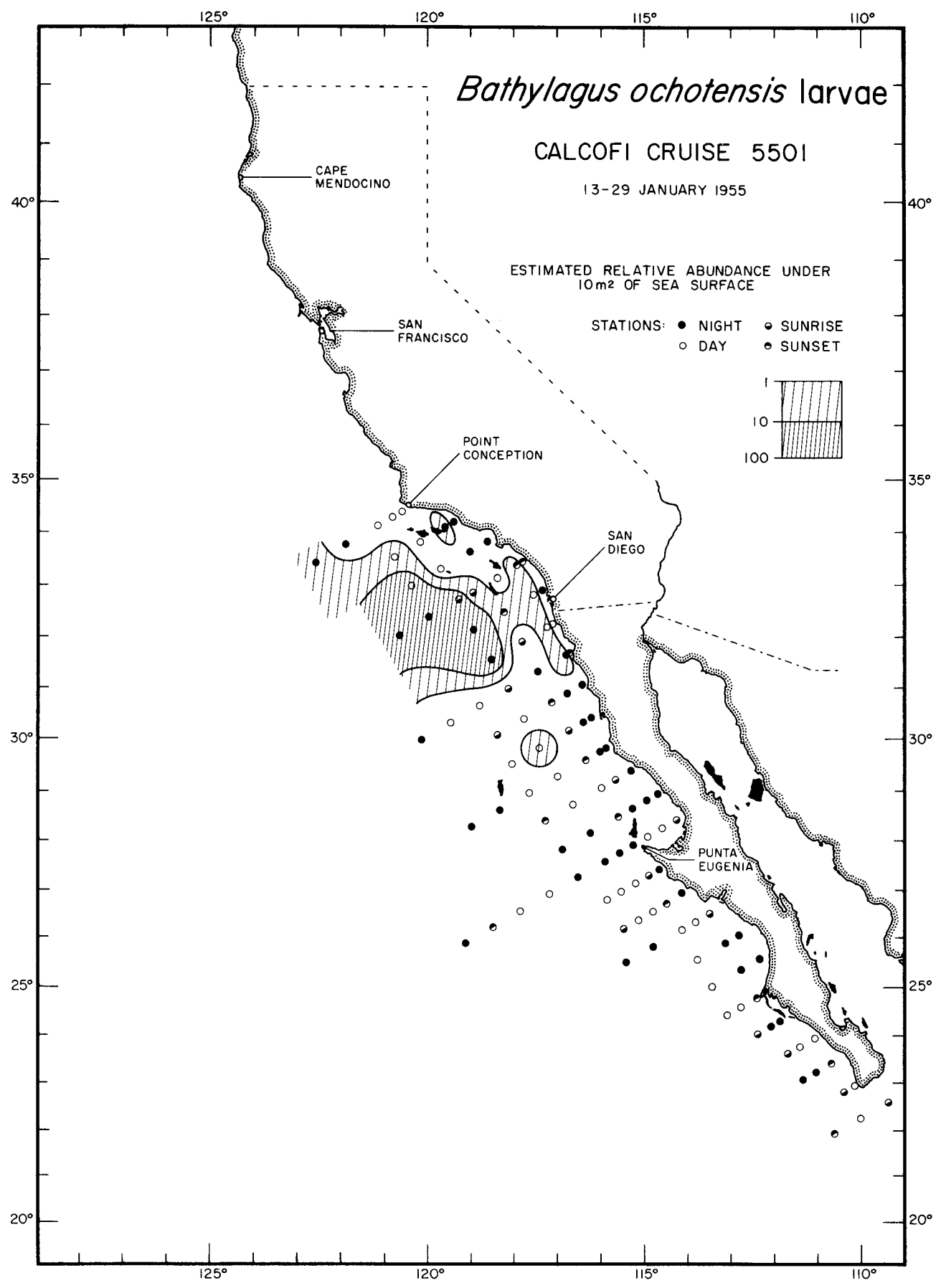
Bathylagus wesethi larvae

5910



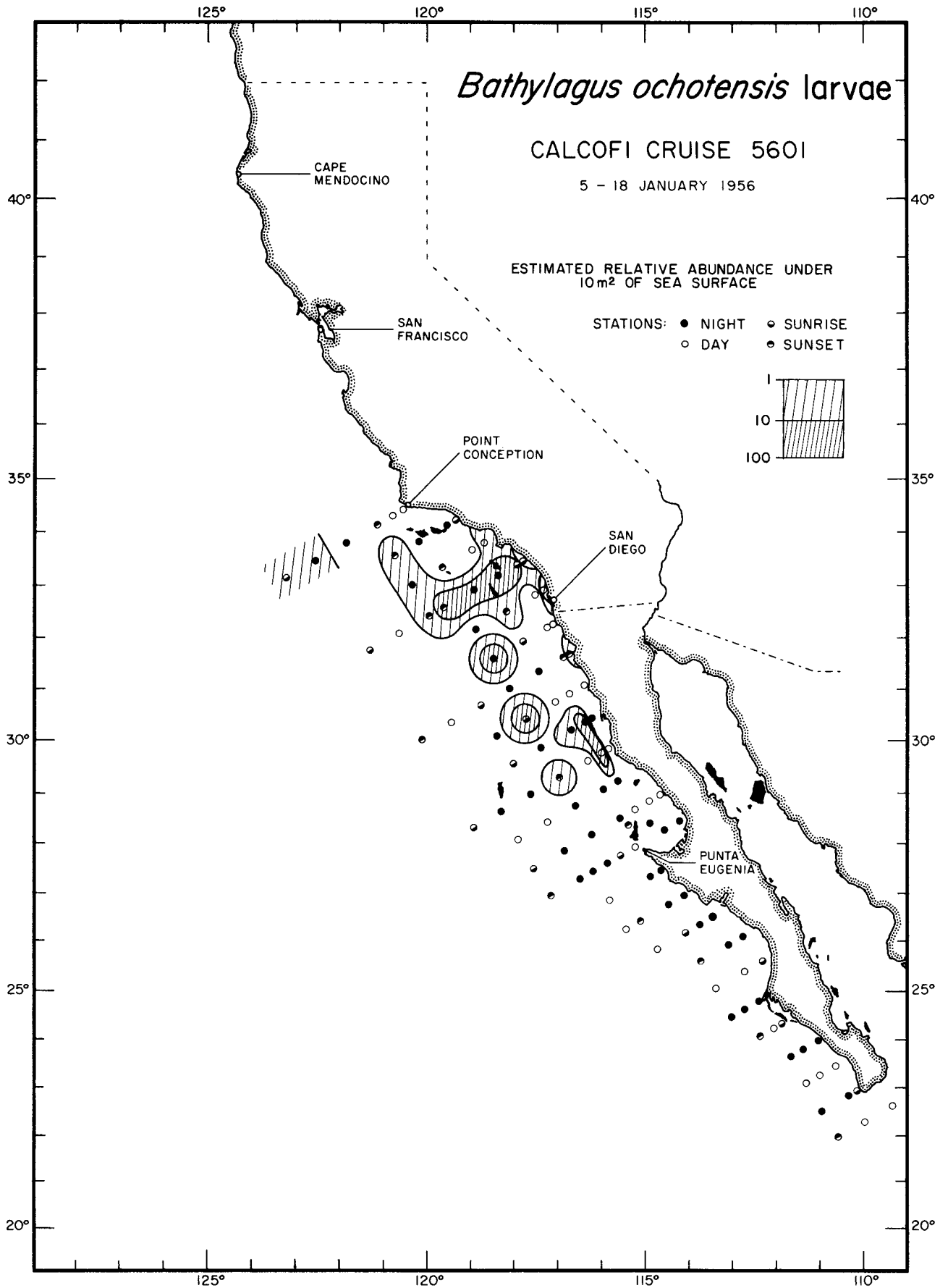
Bathylagus wesethi larvae

6010



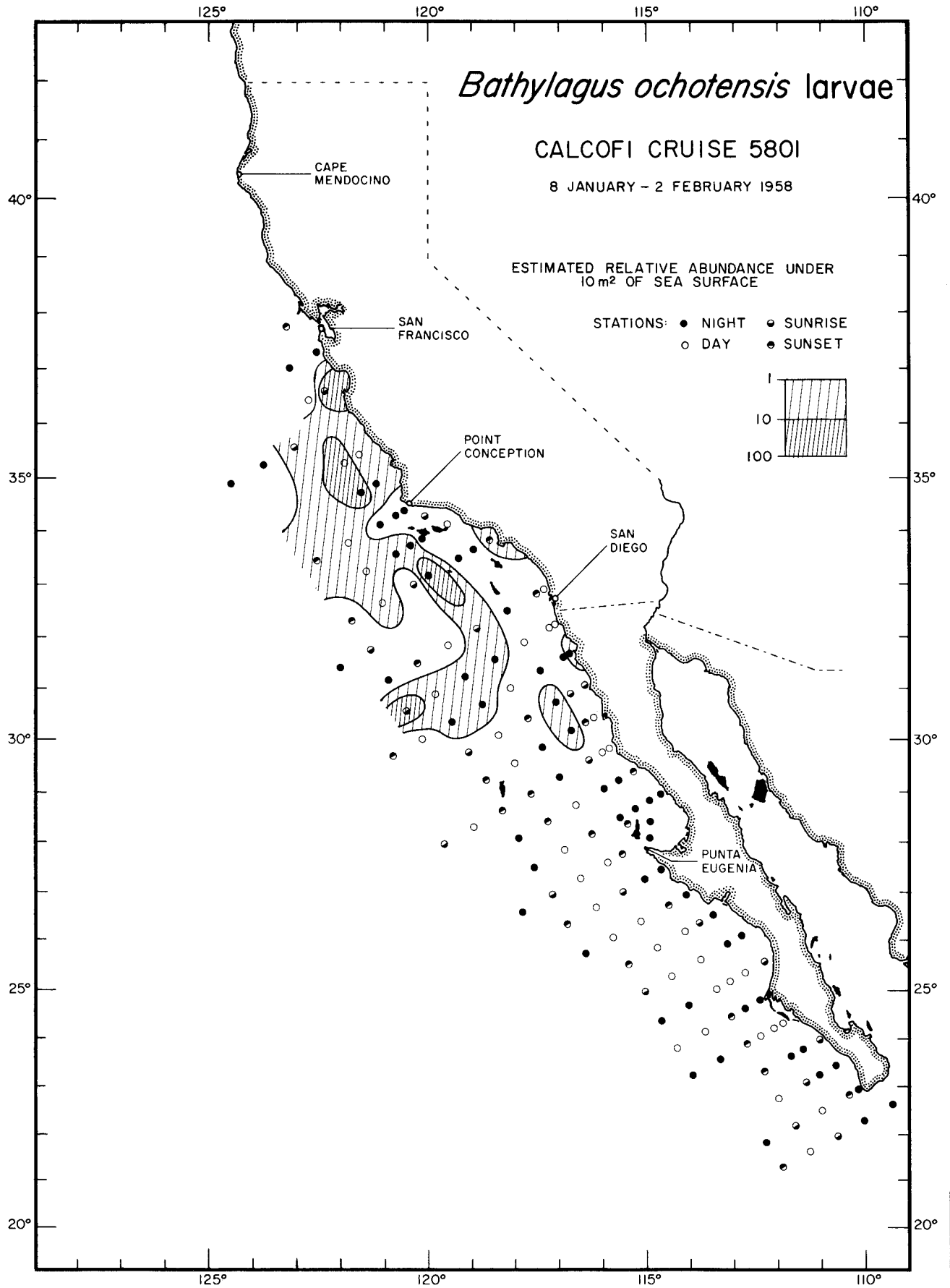
Bathylagus ochotensis larvae

5501



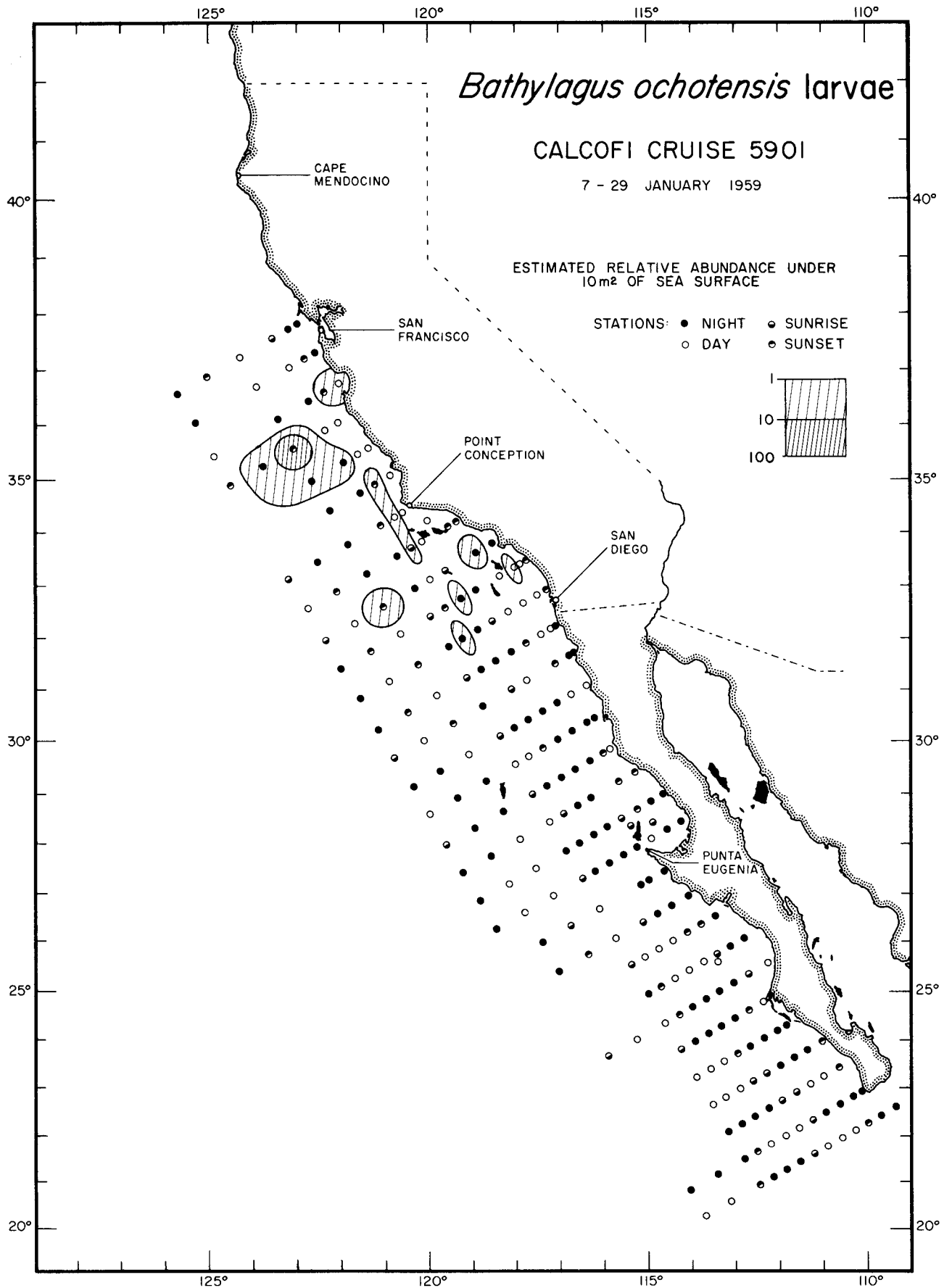
Bathylagus ochotensis larvae

5601



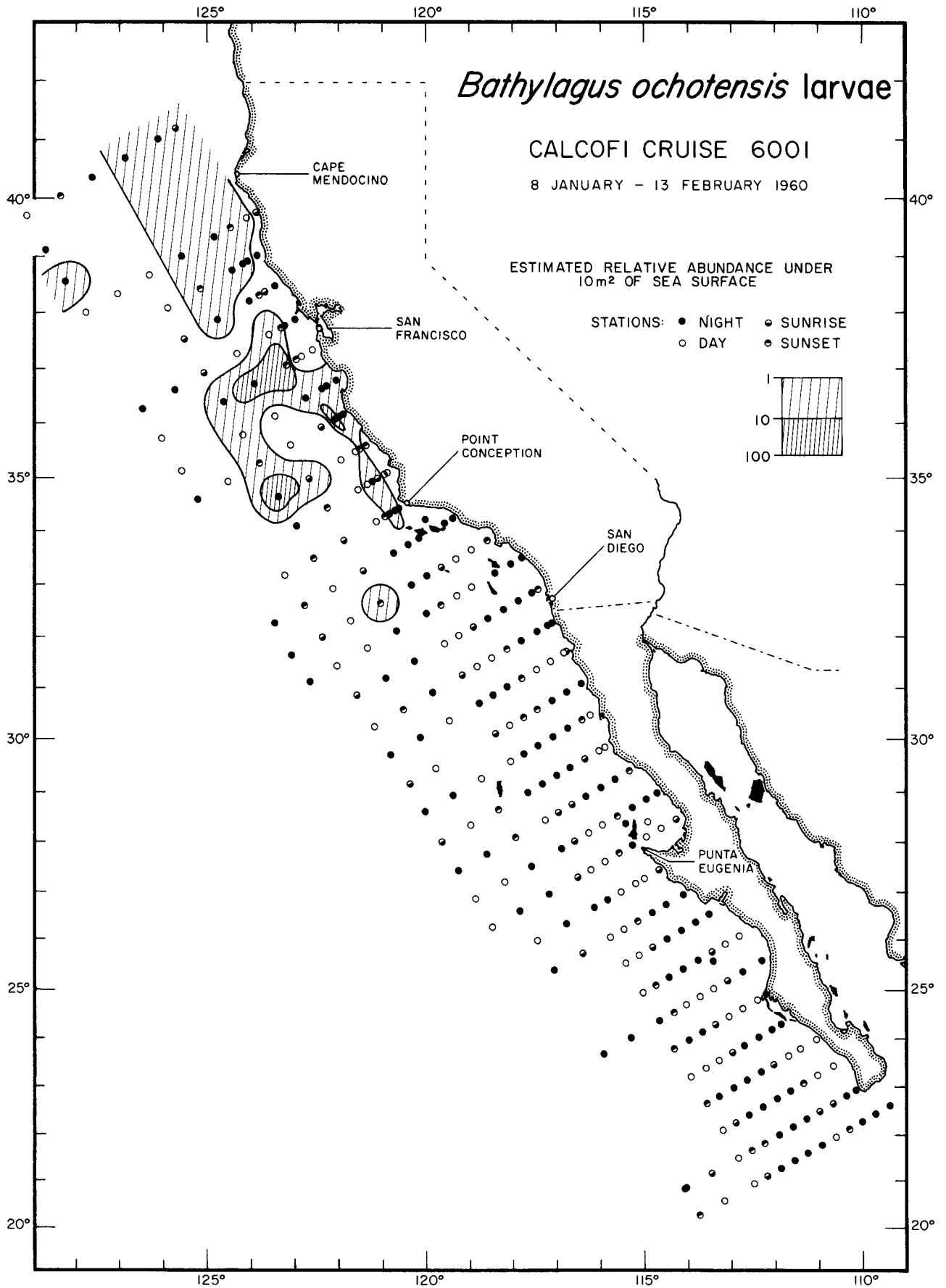
Bathylagus ochotensis larvae

5801



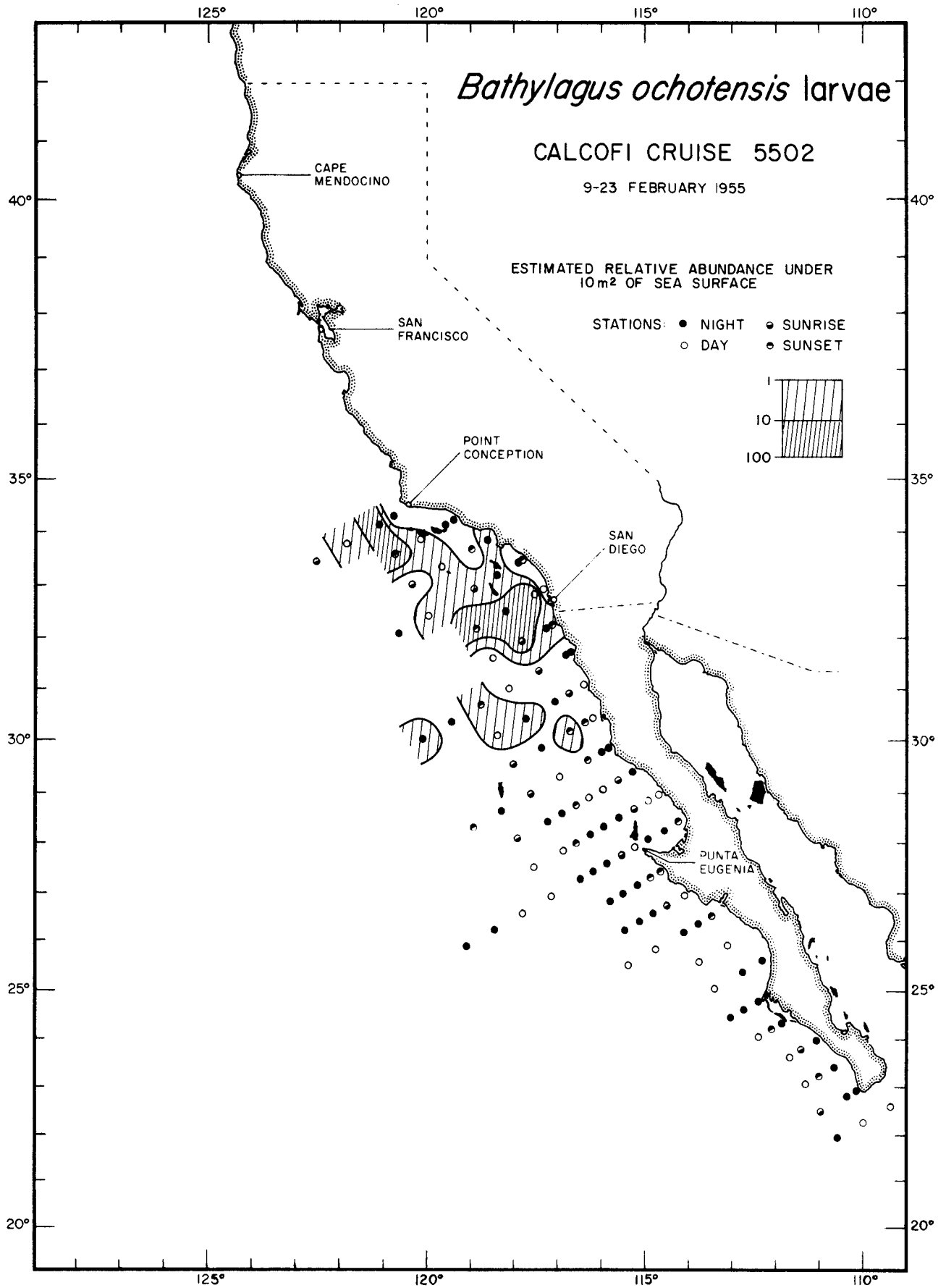
Bathylagus ochotensis larvae

5901



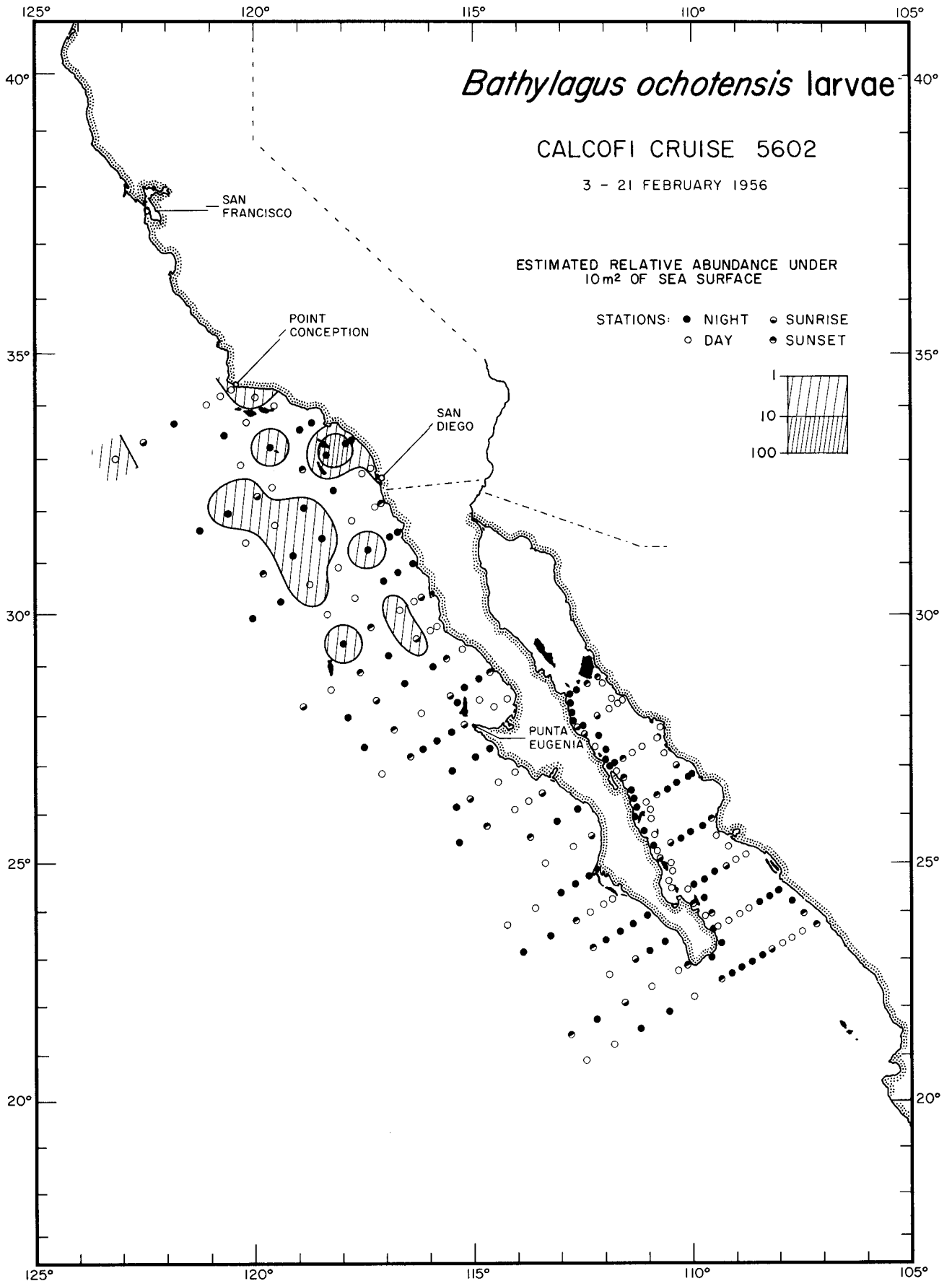
Bathylagus ochotensis larvae

6001



Bathylagus ochotensis larvae

5502



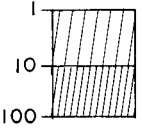
Bathylagus ochotensis larvae

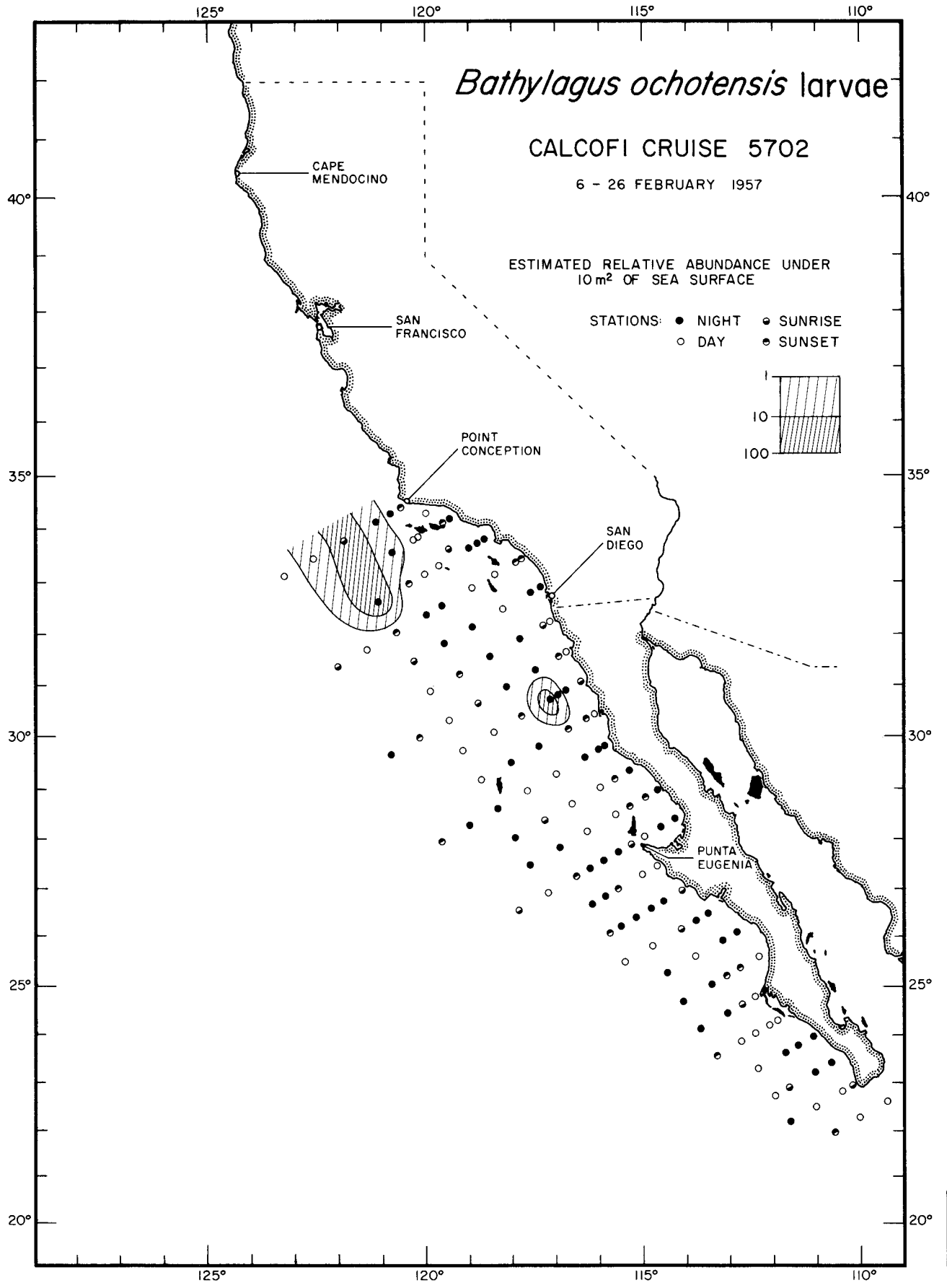
CALCOFI CRUISE 5602

3 - 21 FEBRUARY 1956

ESTIMATED RELATIVE ABUNDANCE UNDER 10m² OF SEA SURFACE

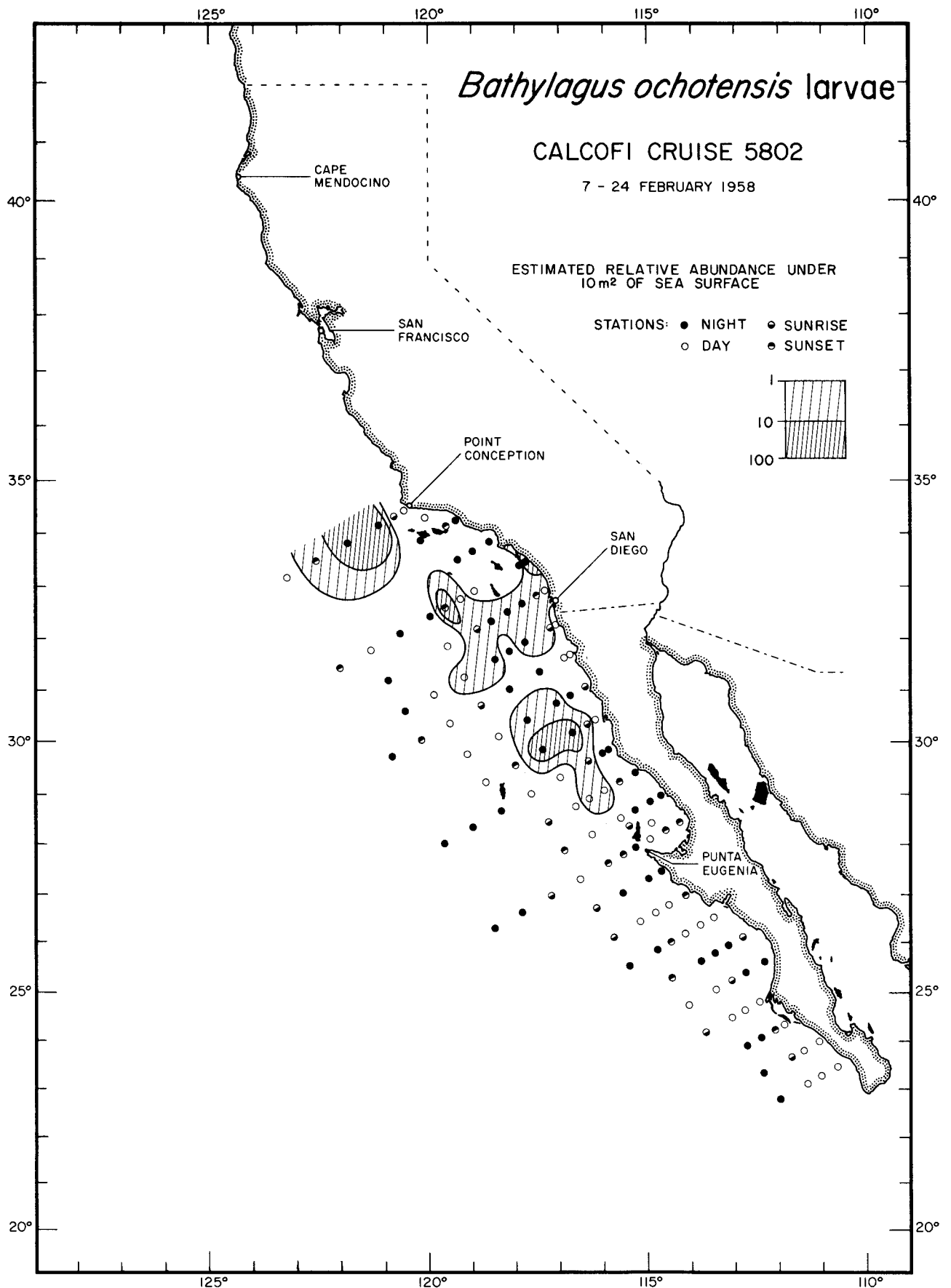
STATIONS: ● NIGHT ○ SUNRISE
○ DAY ● SUNSET





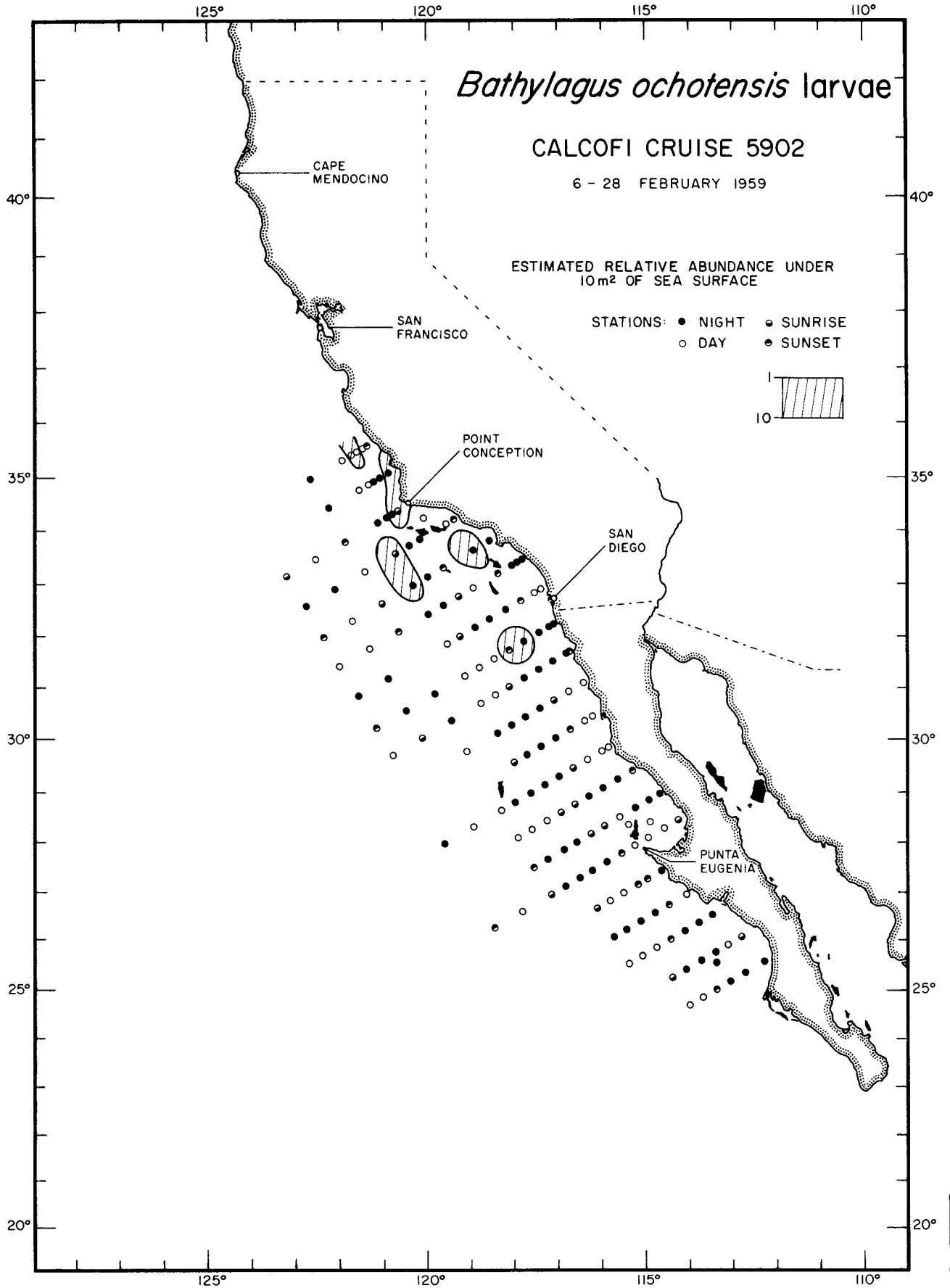
Bathylagus ochotensis larvae

5702

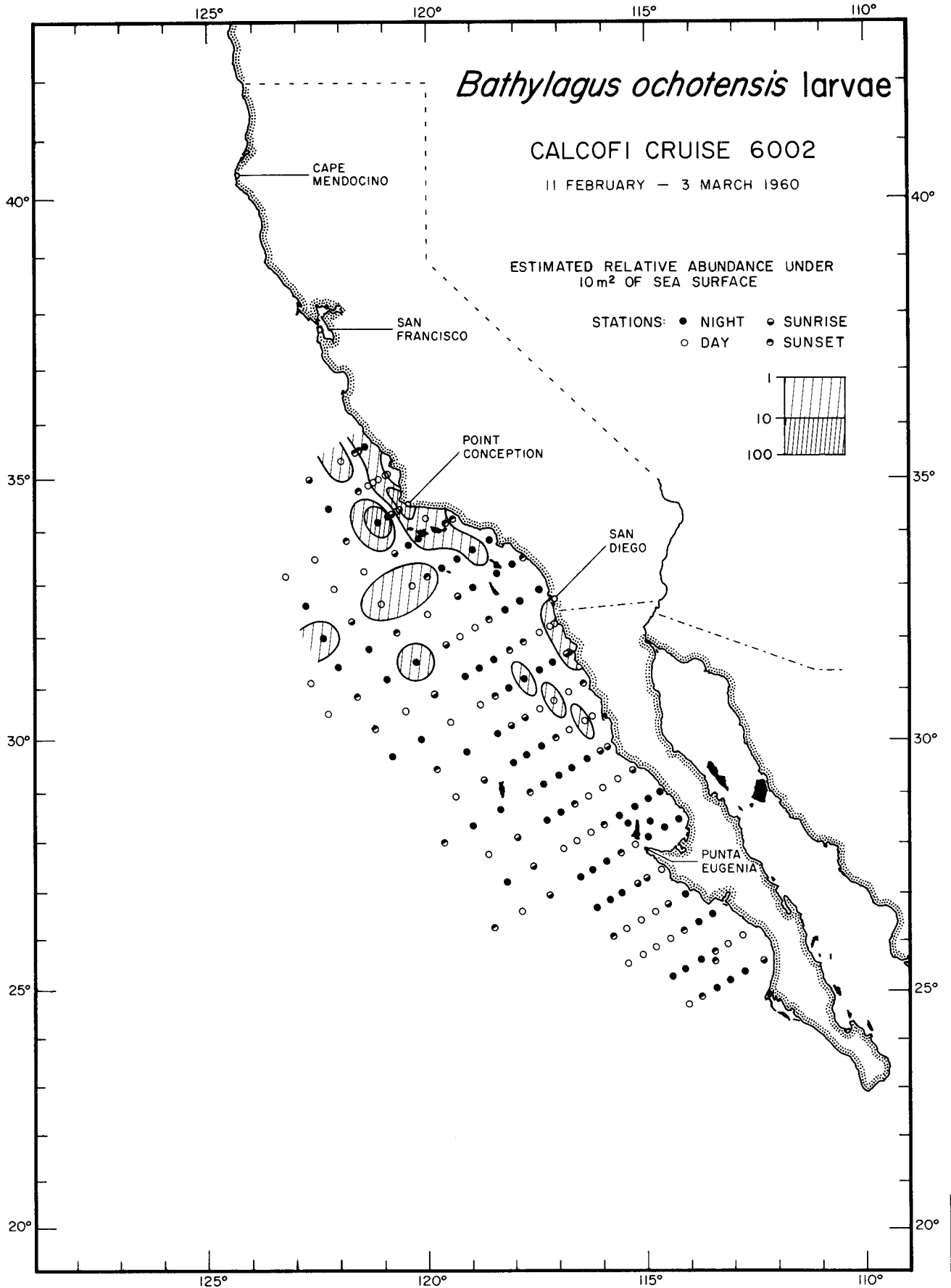


Bathylagus ochotensis larvae

5802

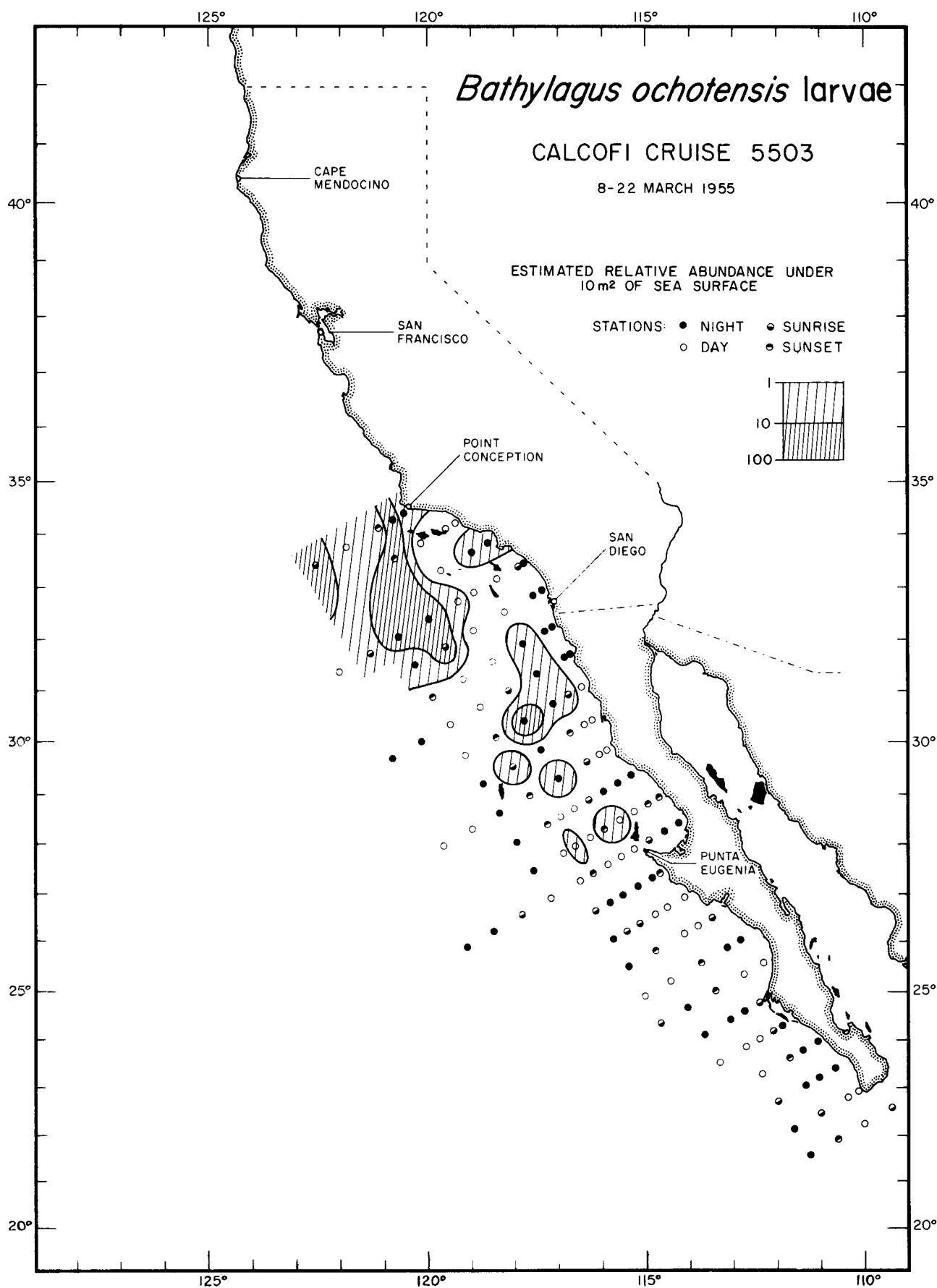


Bathylagus ochotensis larvae



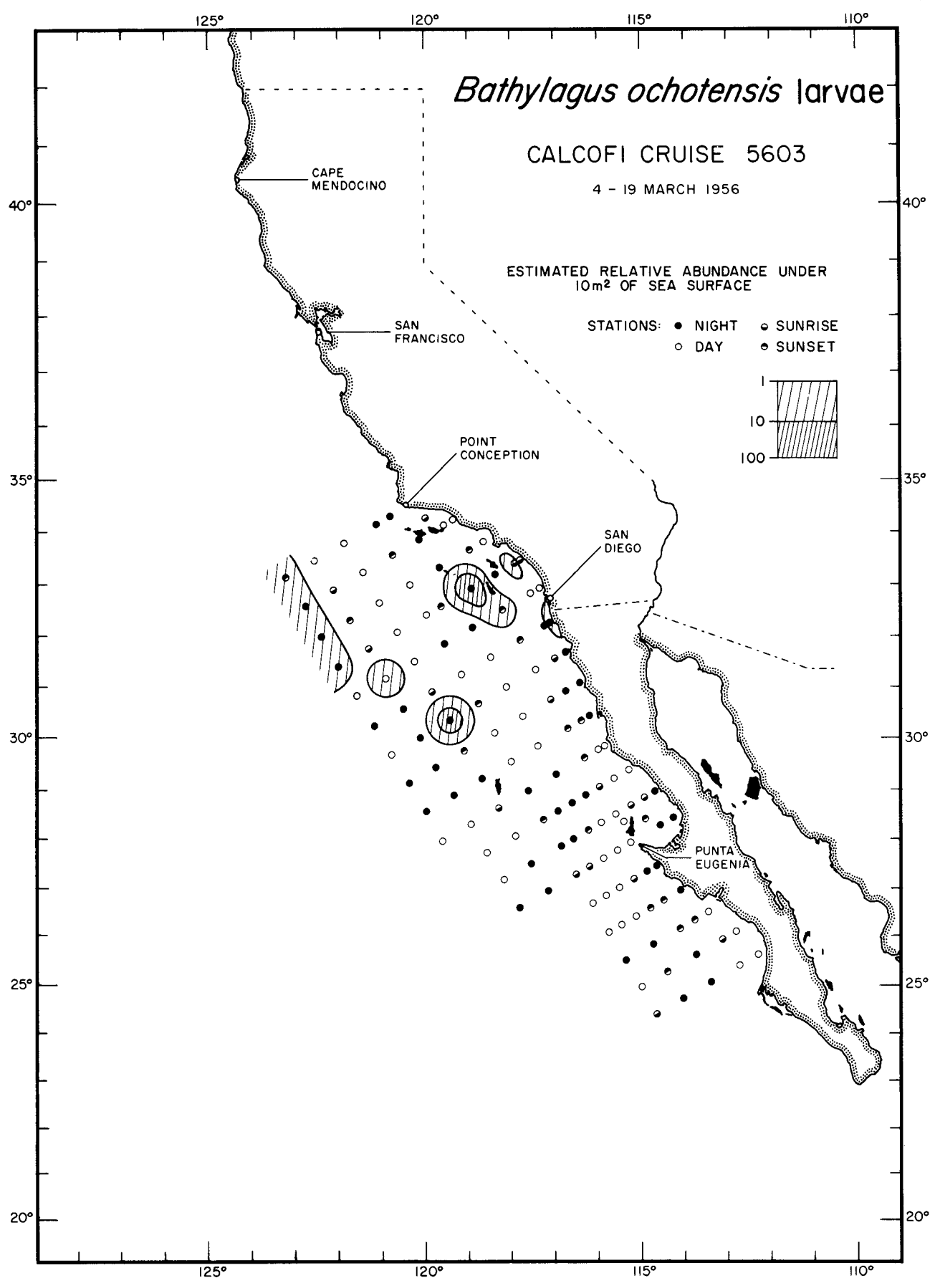
Bathylagus ochotensis larvae

6002

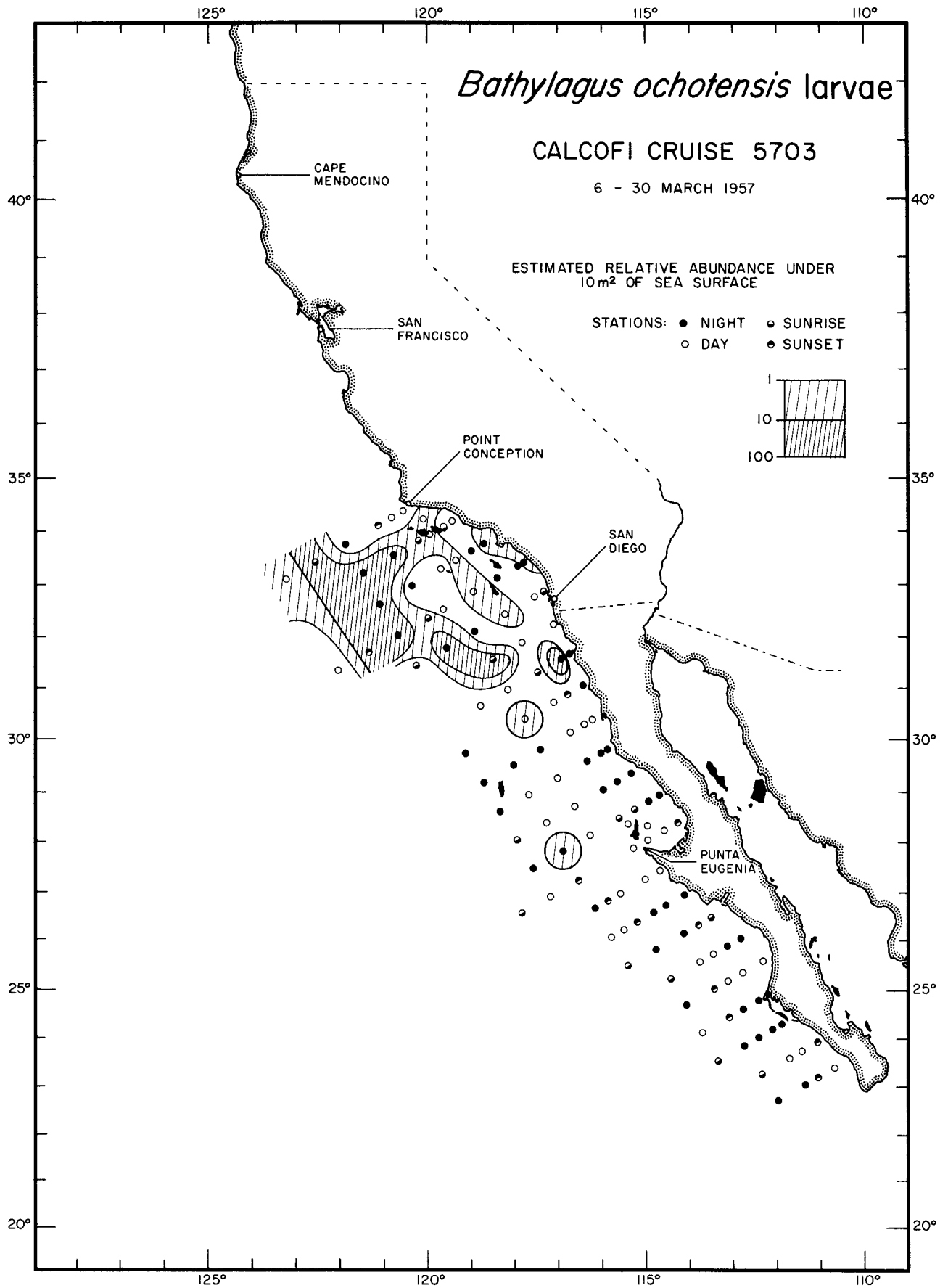


Bathylagus ochotensis larvae

5503

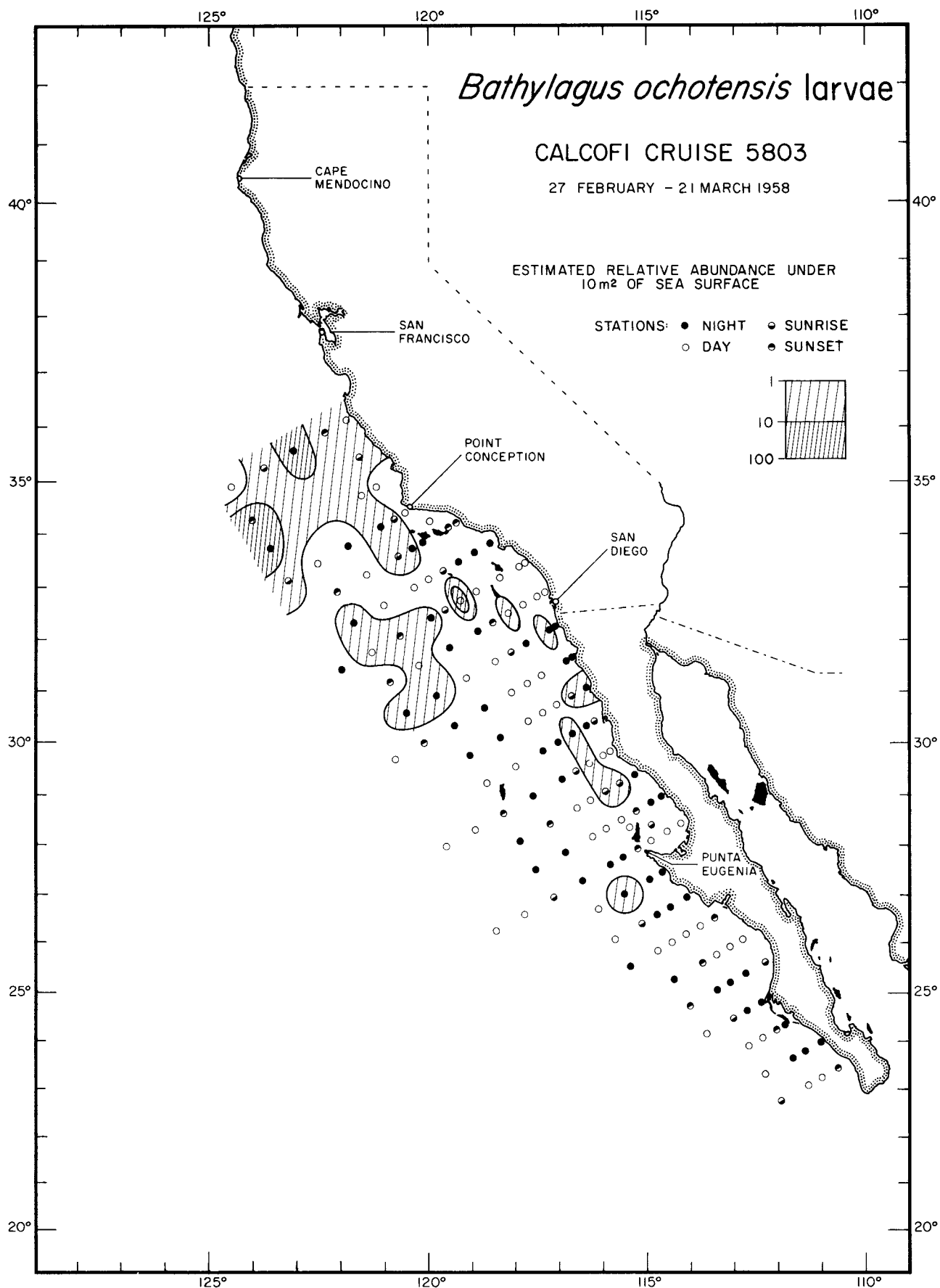


Bathylagus ochotensis larvae



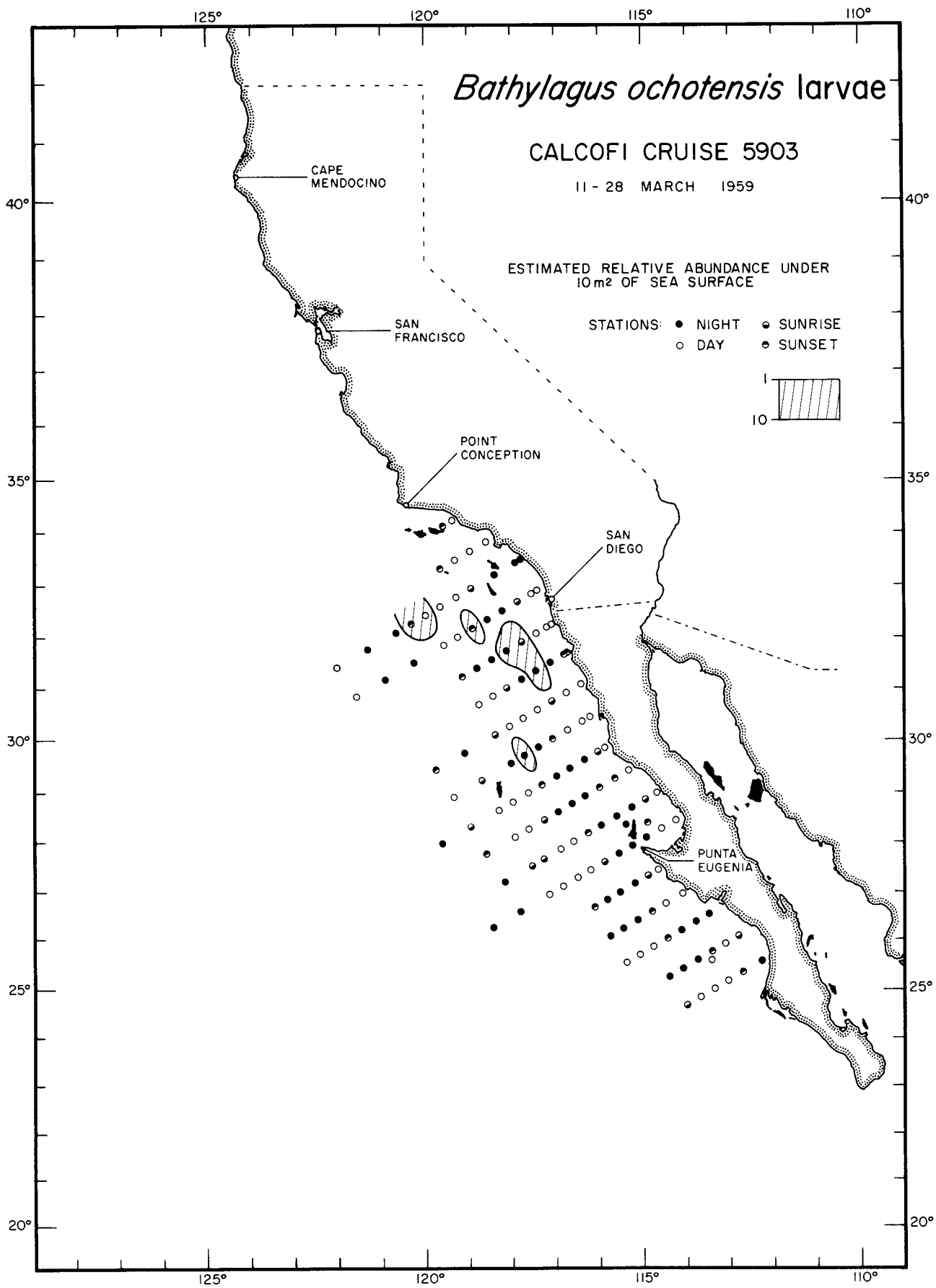
Bathylagus ochotensis larvae

5703



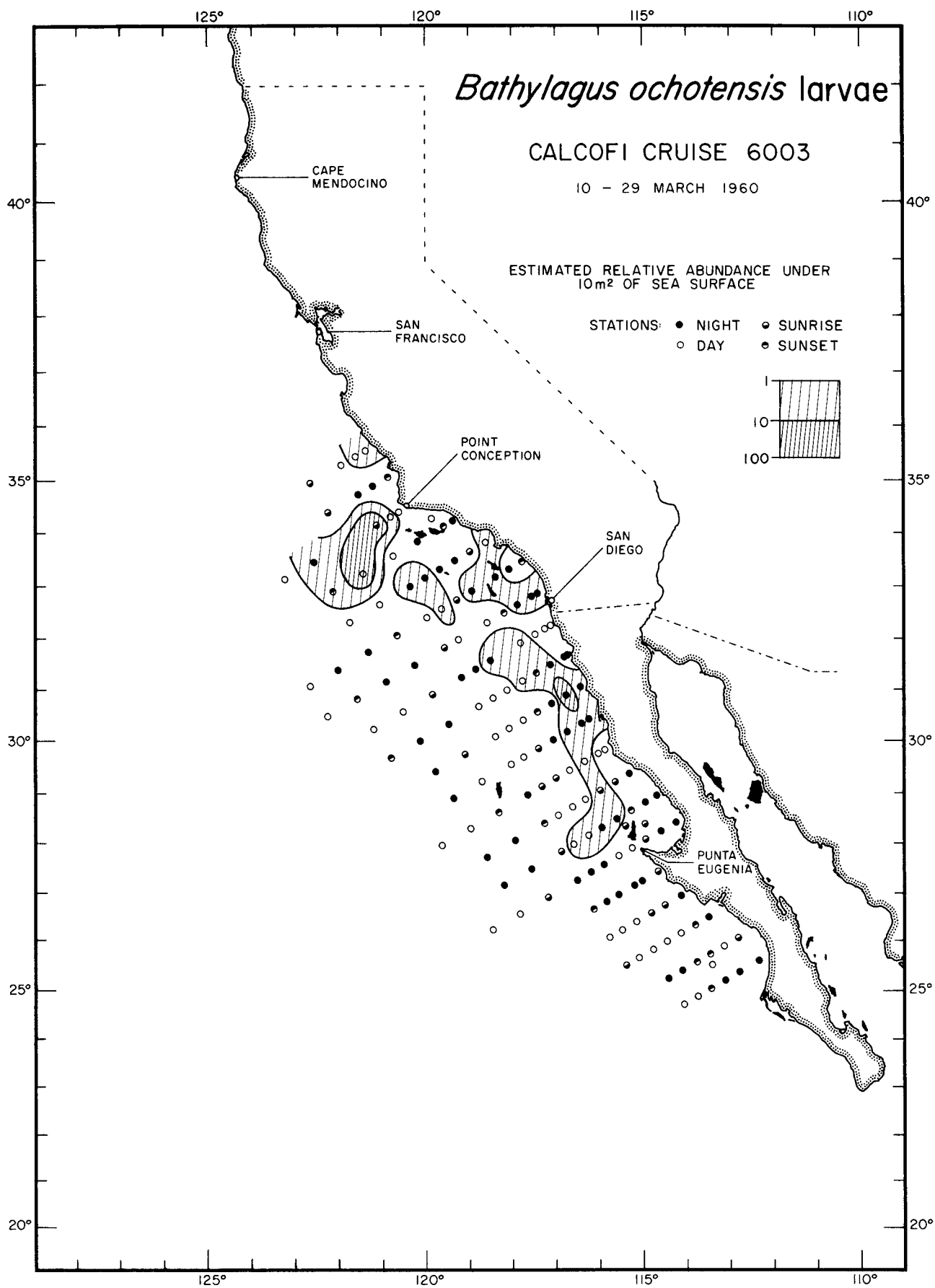
Bathylagus ochotensis larvae

5803



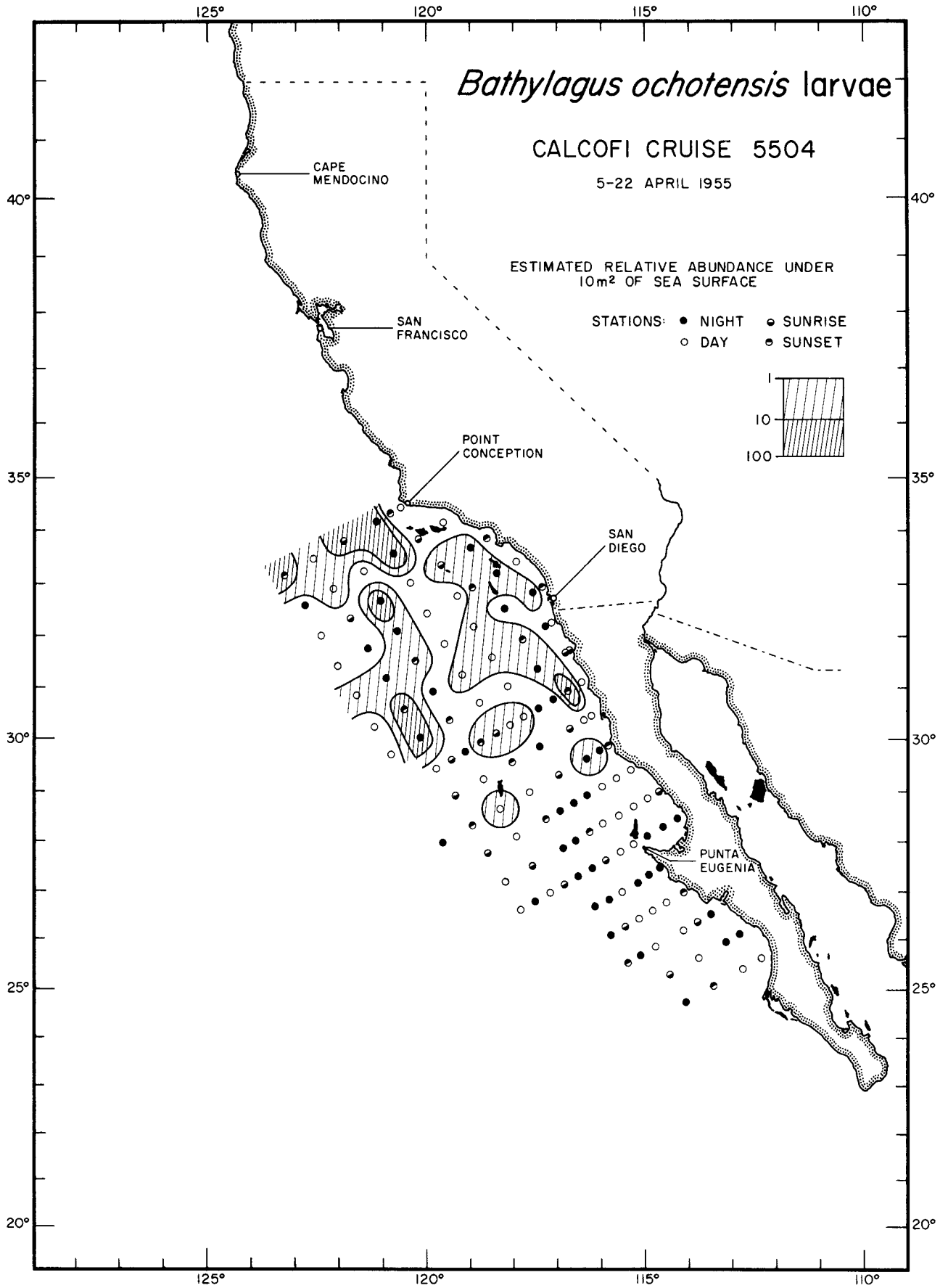
Bathylagus ochotensis larvae

5903



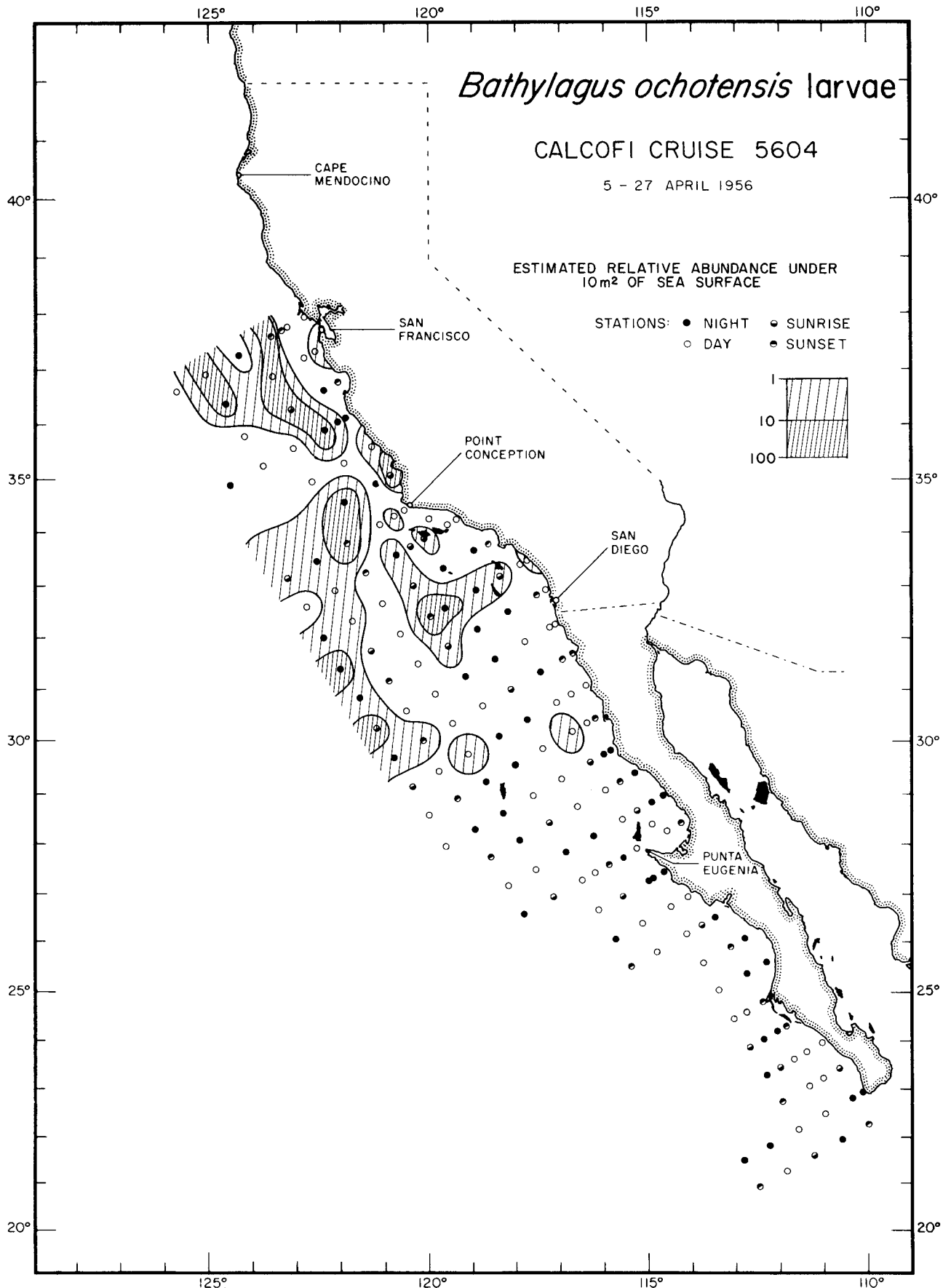
Bathylagus ochotensis larvae

6003



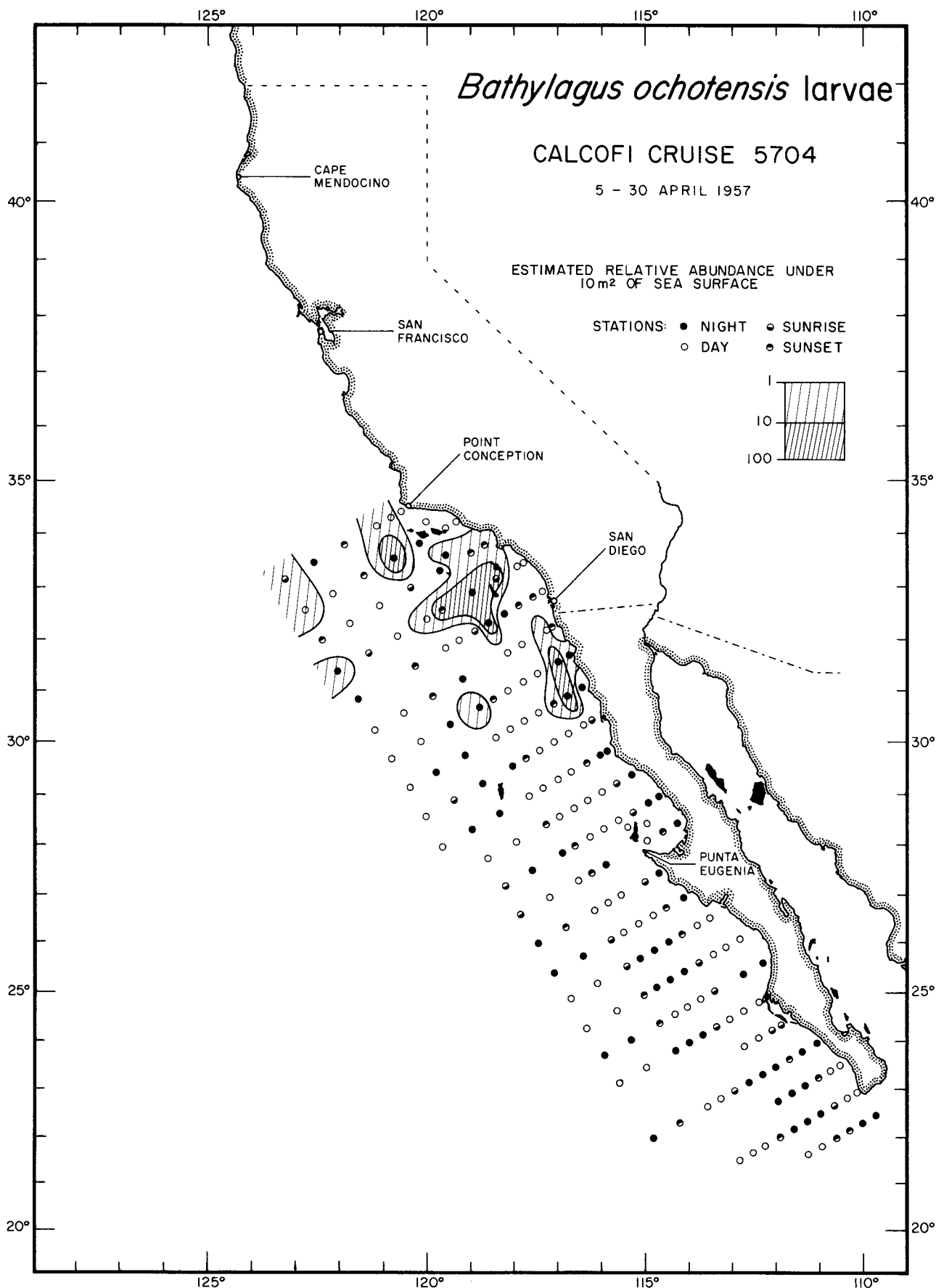
Bathylagus ochotensis larvae

5504



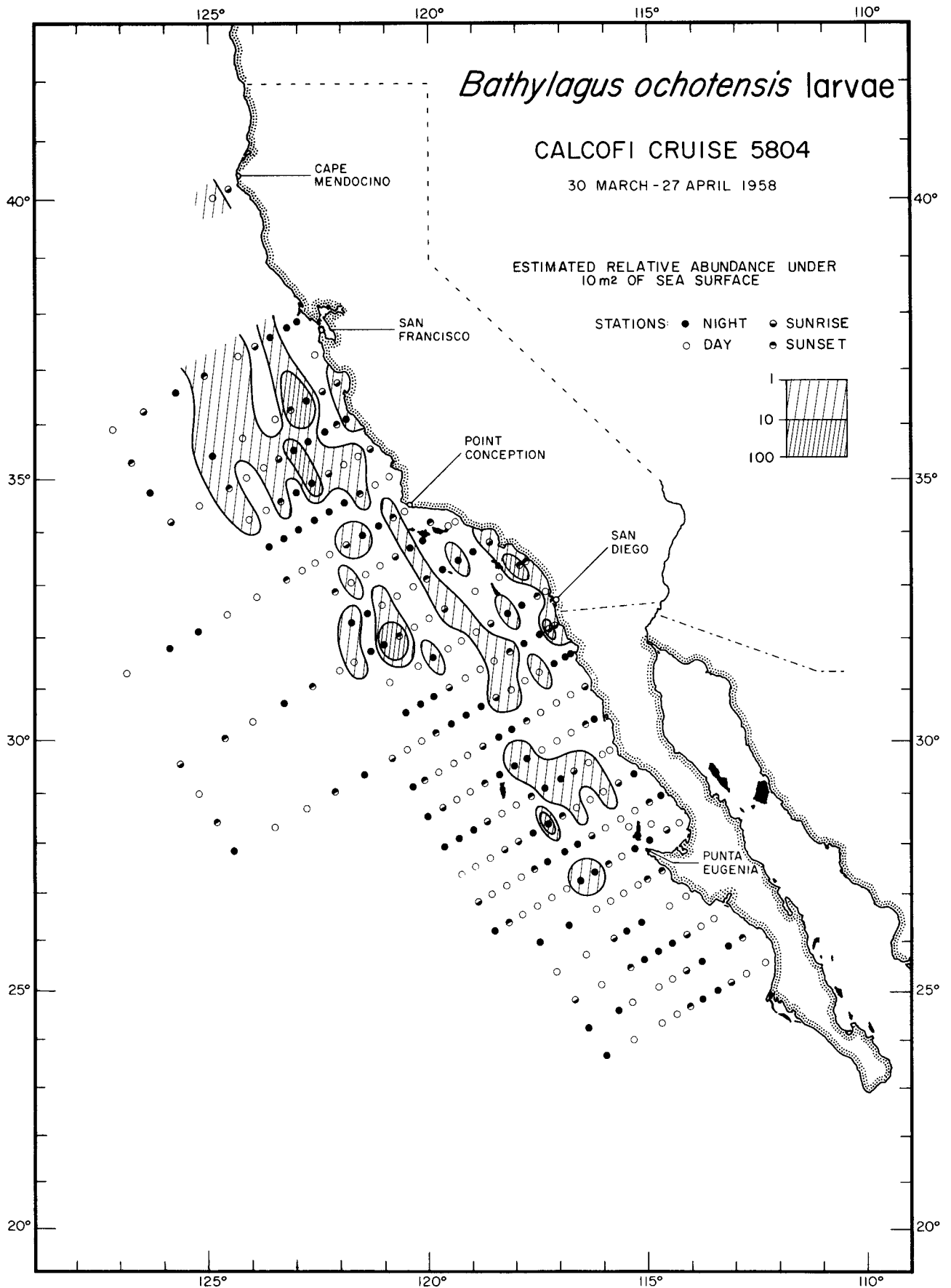
Bathylagus ochotensis larvae

5604



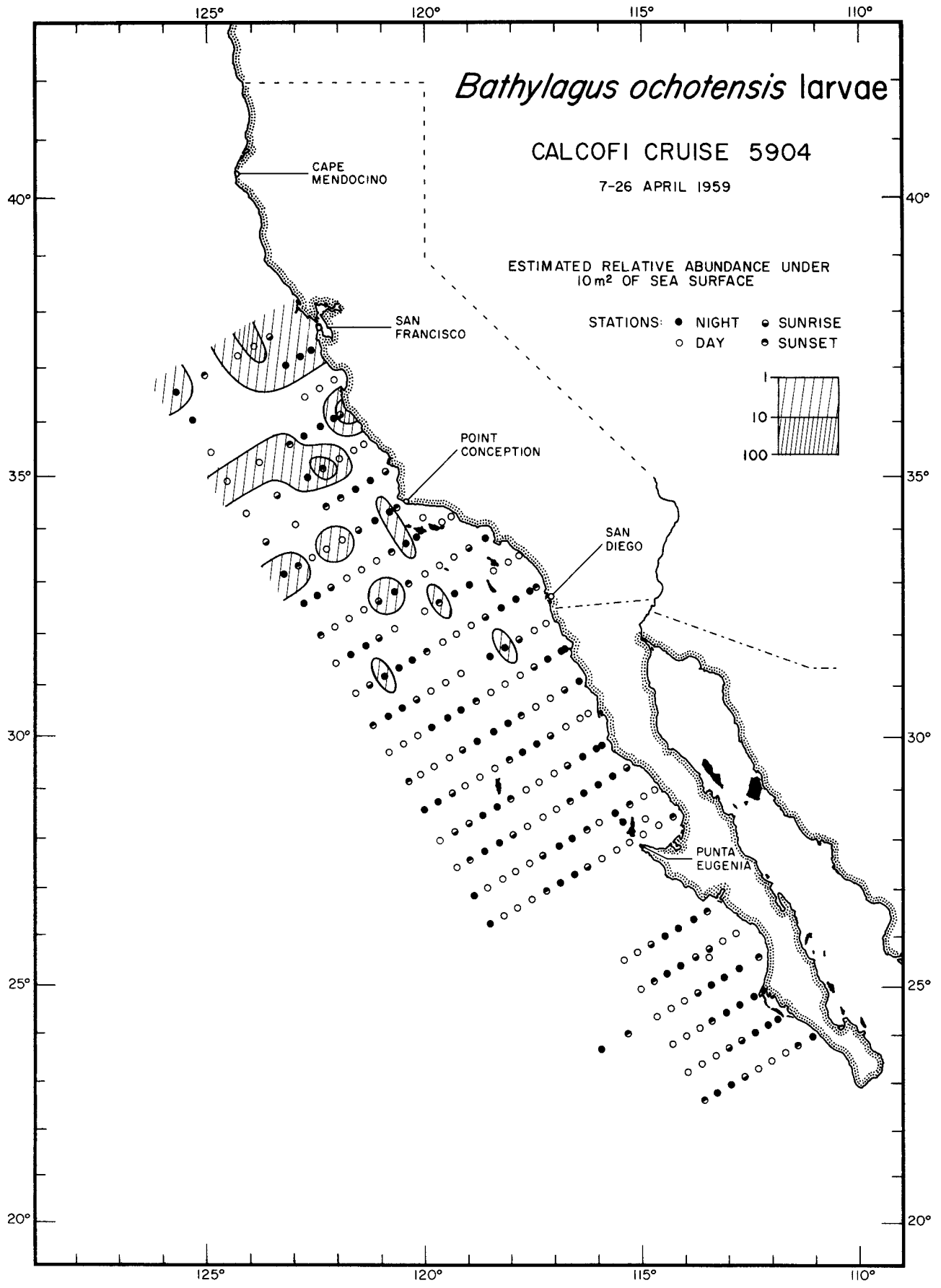
Bathylagus ochotensis larvae

5704



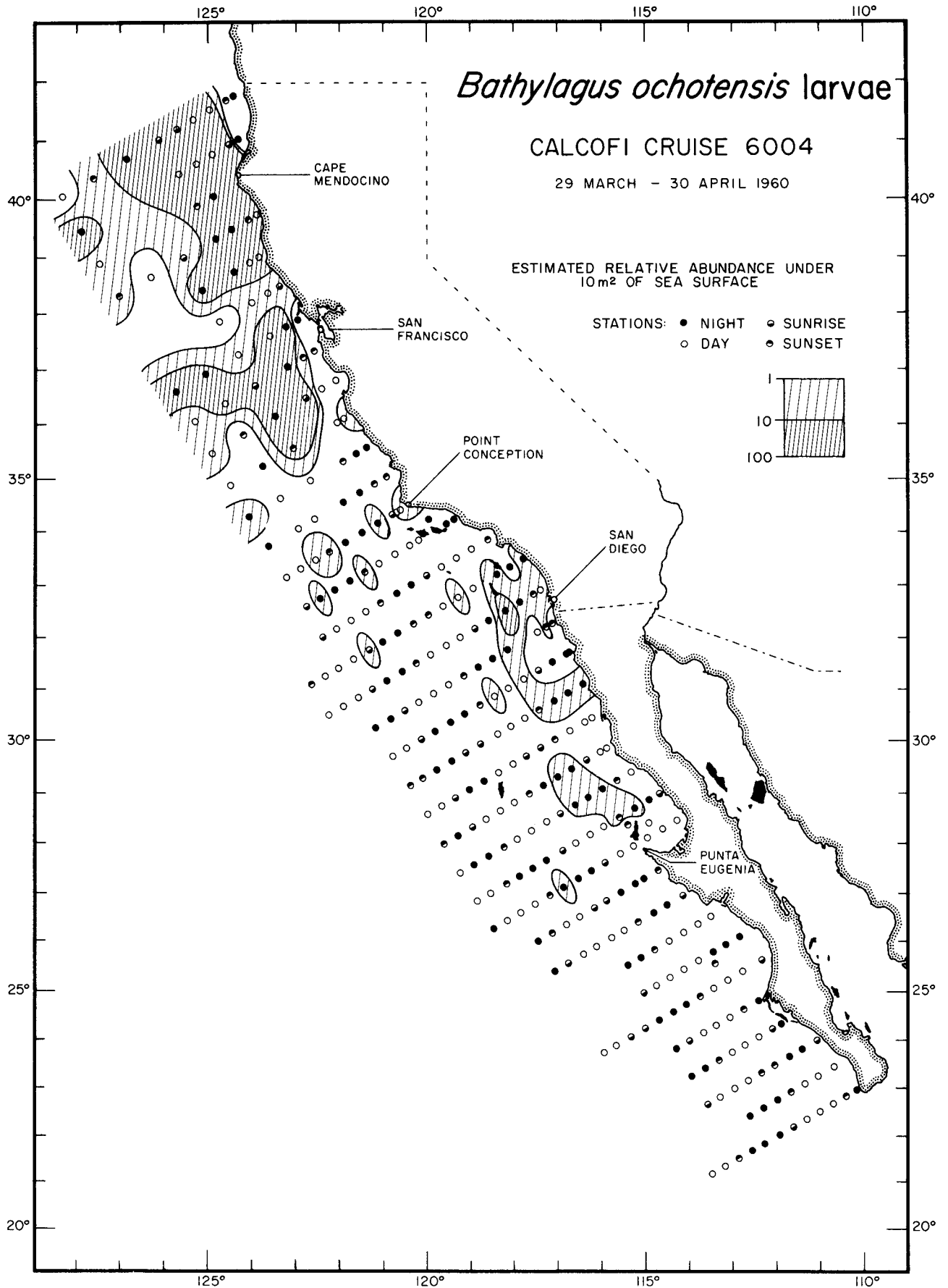
Bathylagus ochotensis larvae

5804



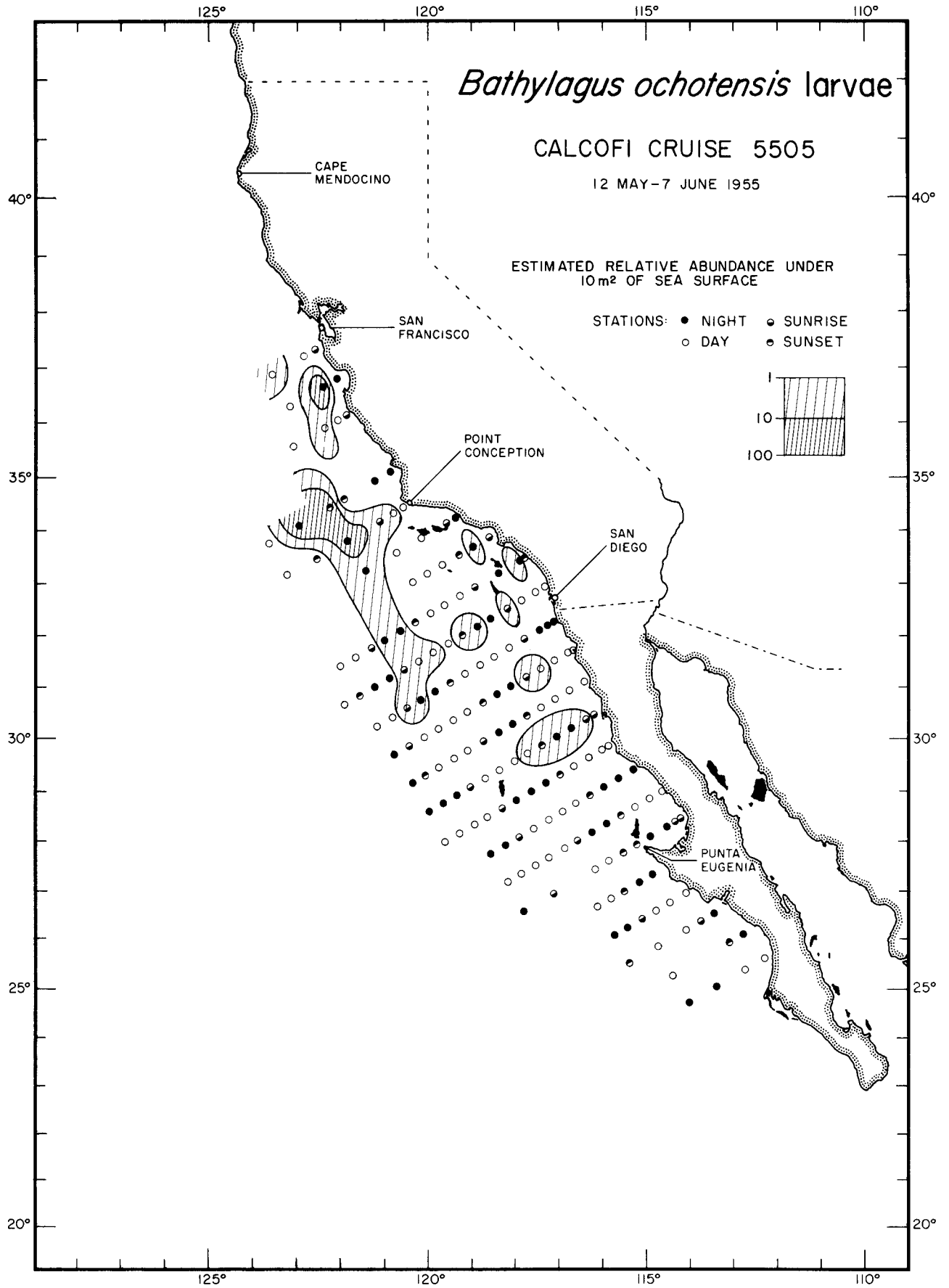
Bathylagus ochotensis larvae

5904



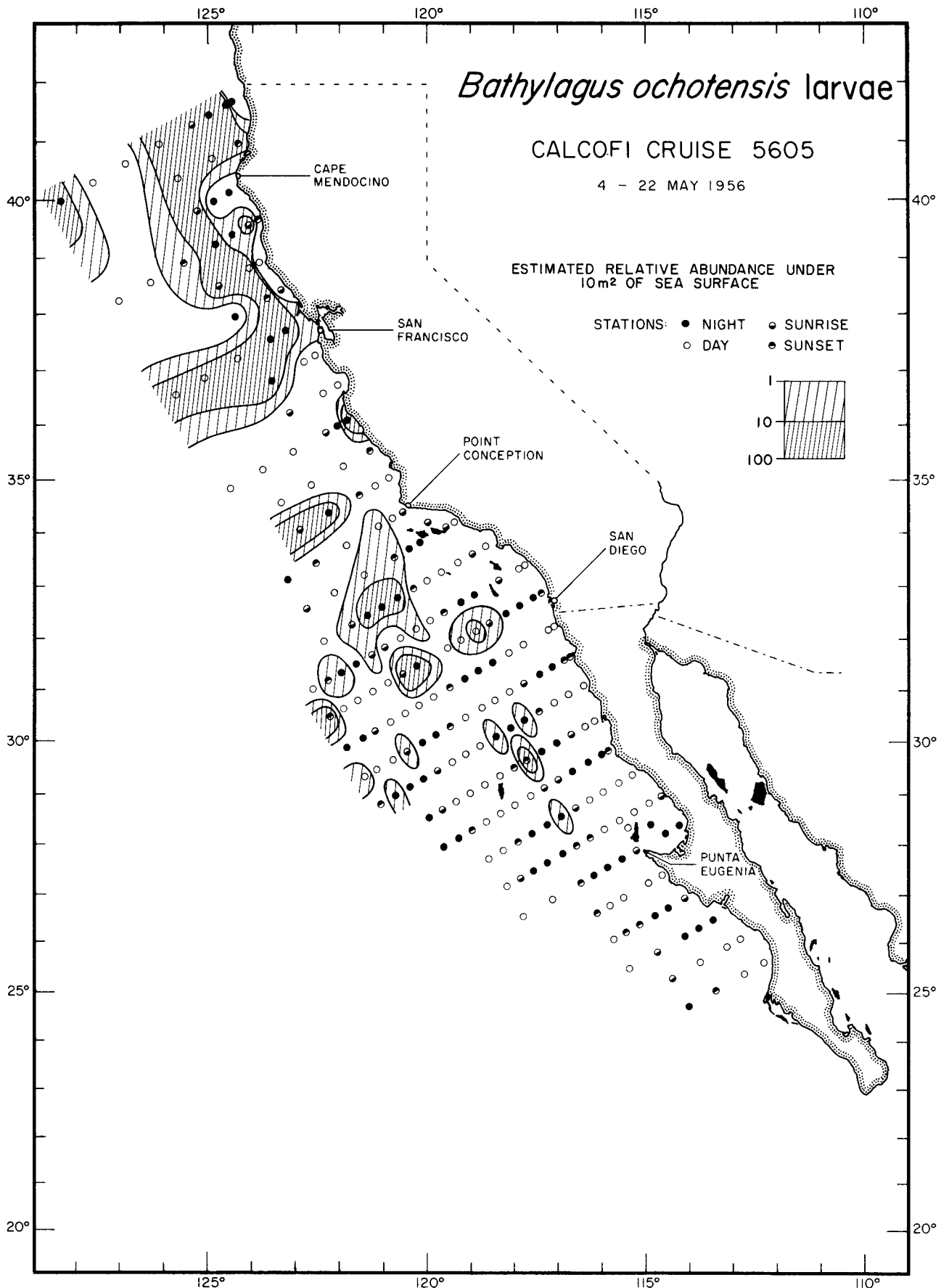
Bathylagus ochotensis larvae

6004



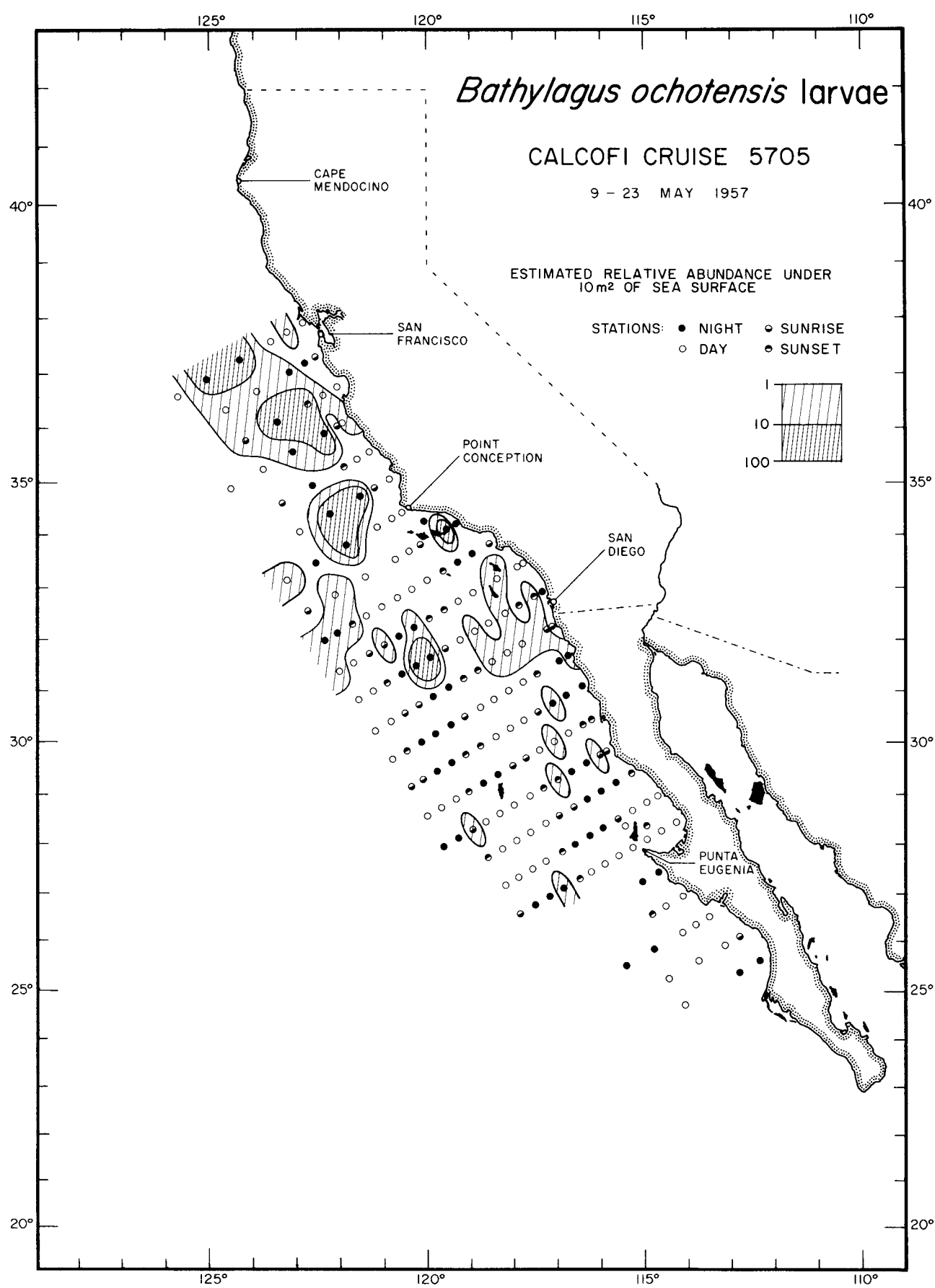
Bathylagus ochotensis larvae

5505



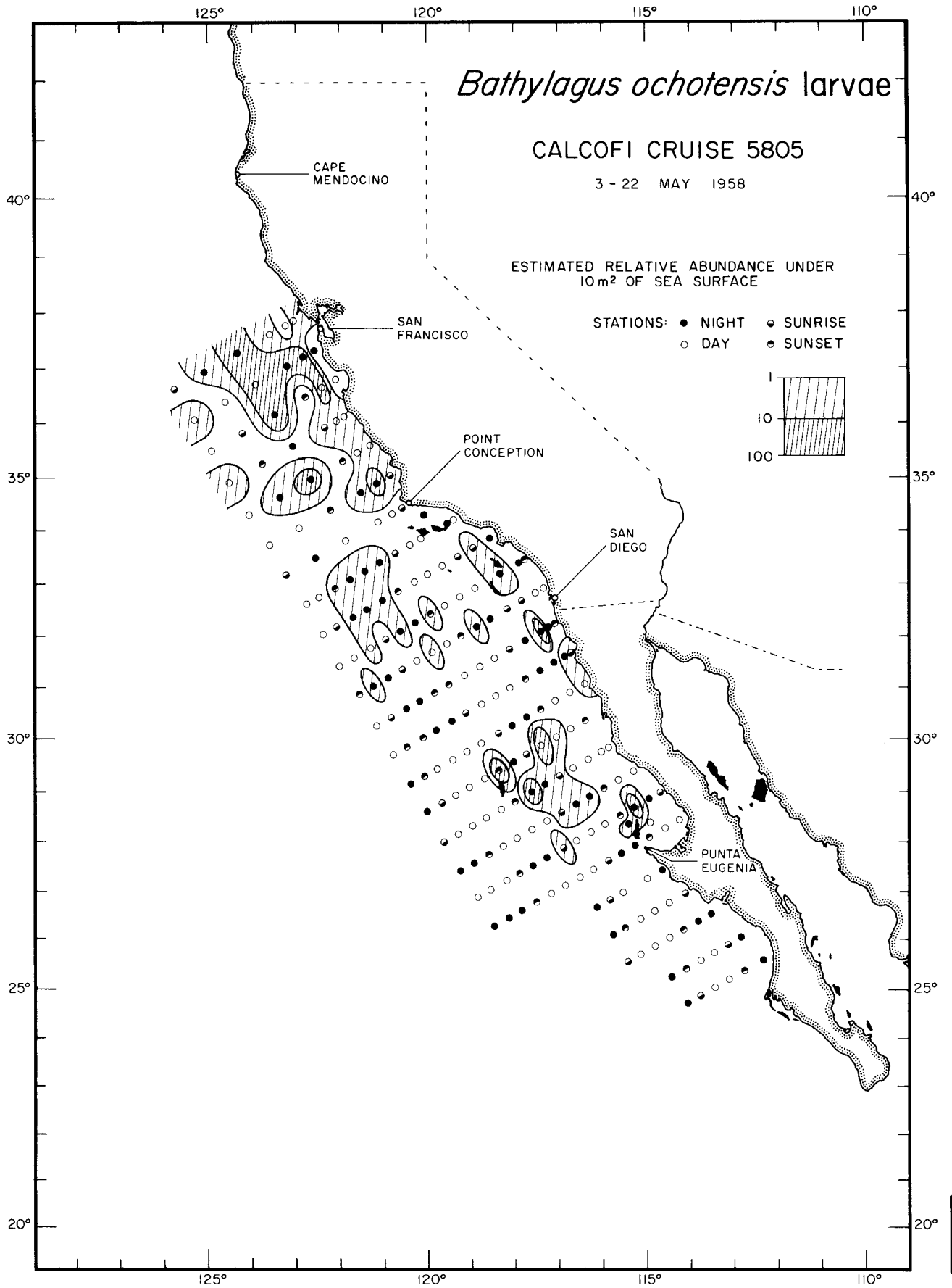
Bathylagus ochotensis larvae

5605



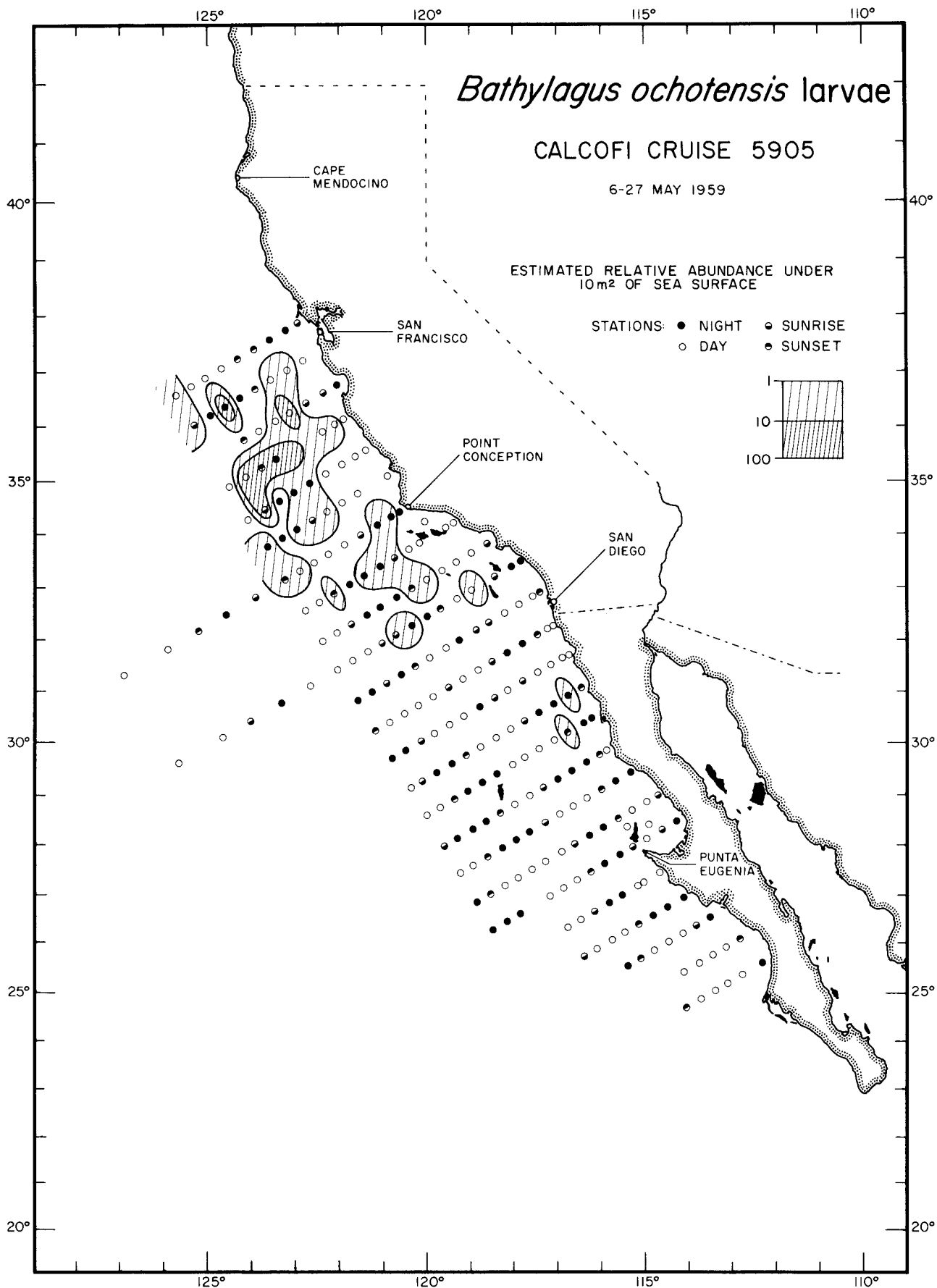
Bathylagus ochotensis larvae

5705



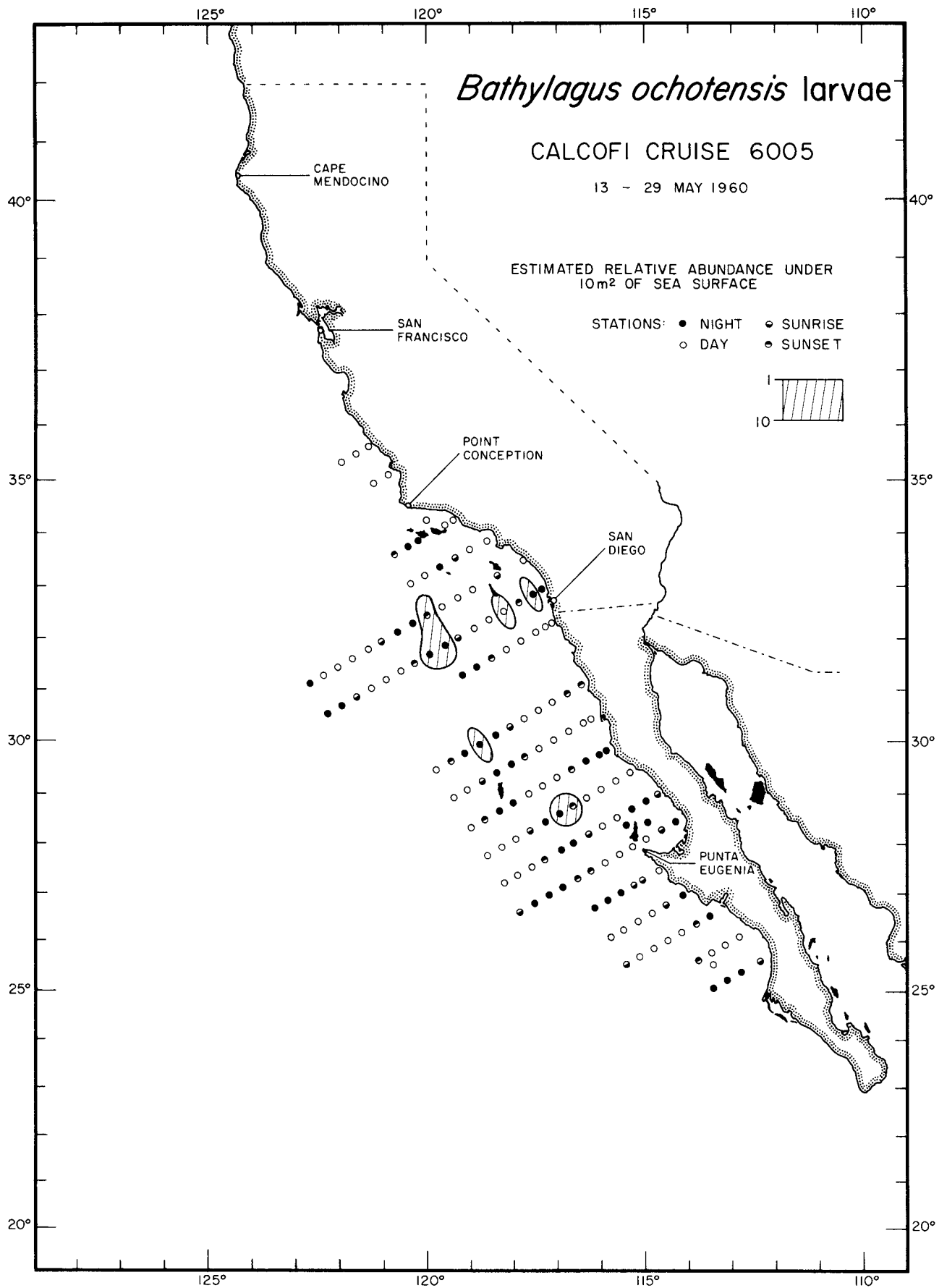
Bathylagus ochotensis larvae

5805



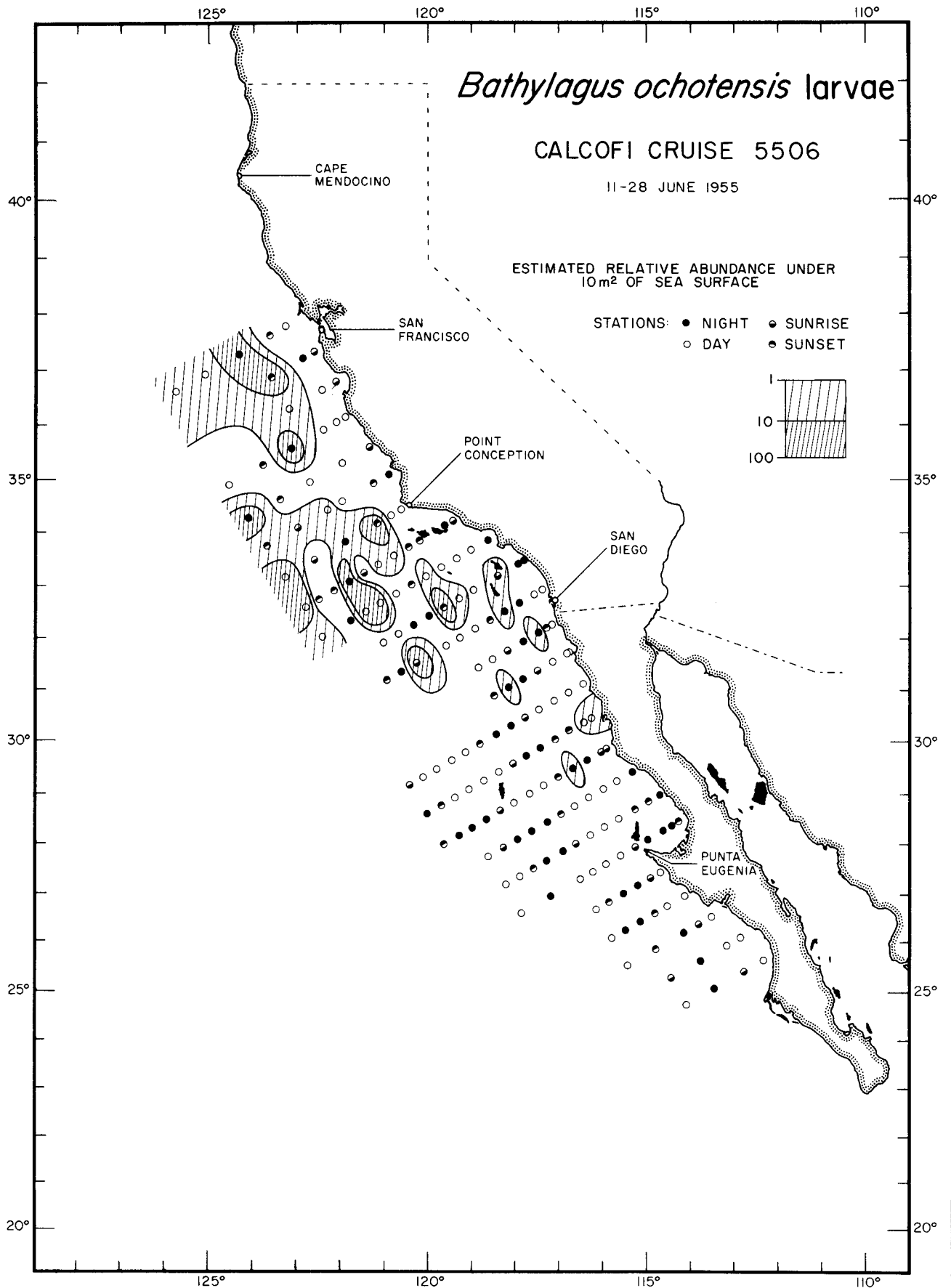
Bathylagus ochotensis larvae

5905



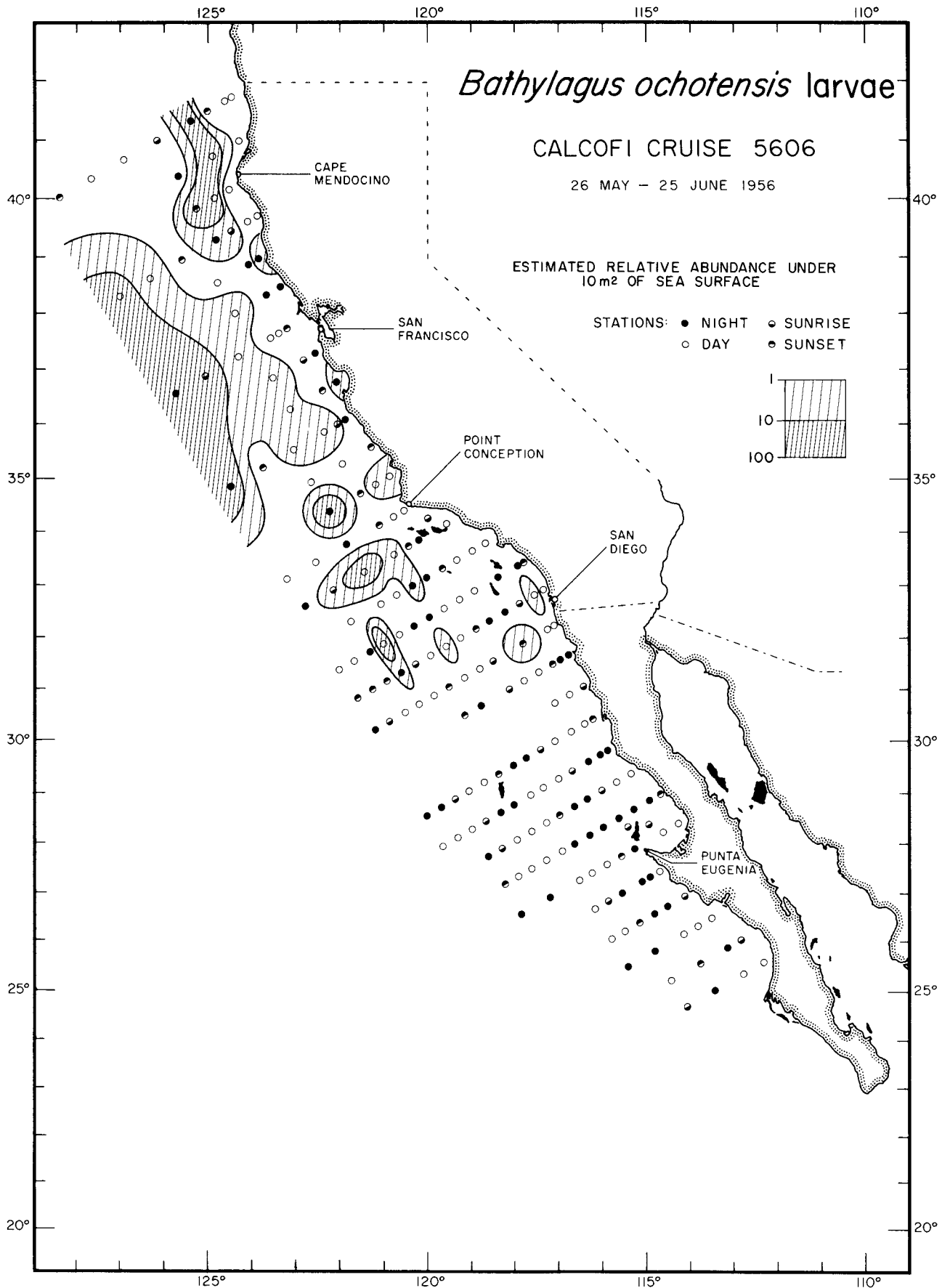
Bathylagus ochotensis larvae

6005

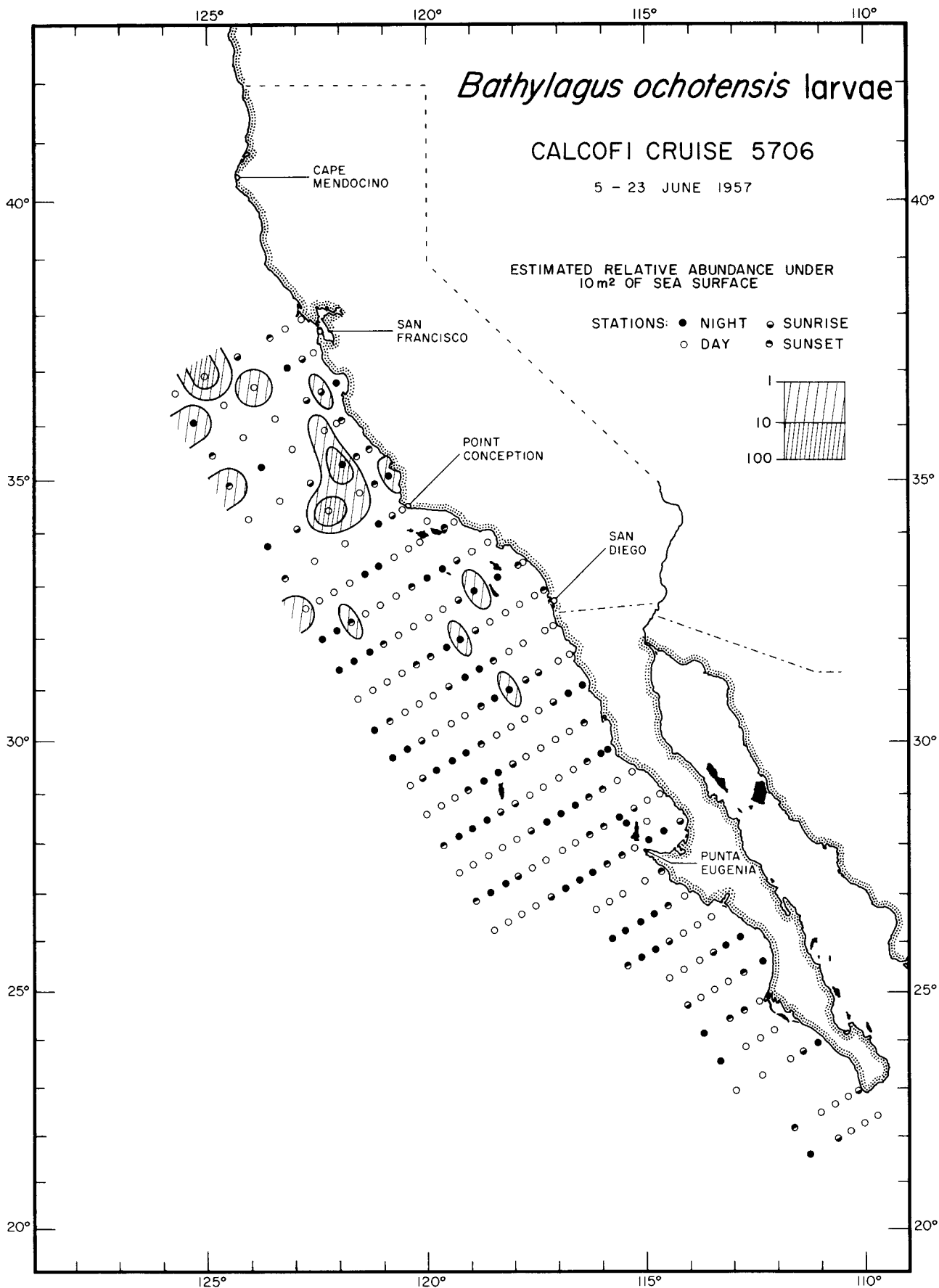


Bathylagus ochotensis larvae

5506

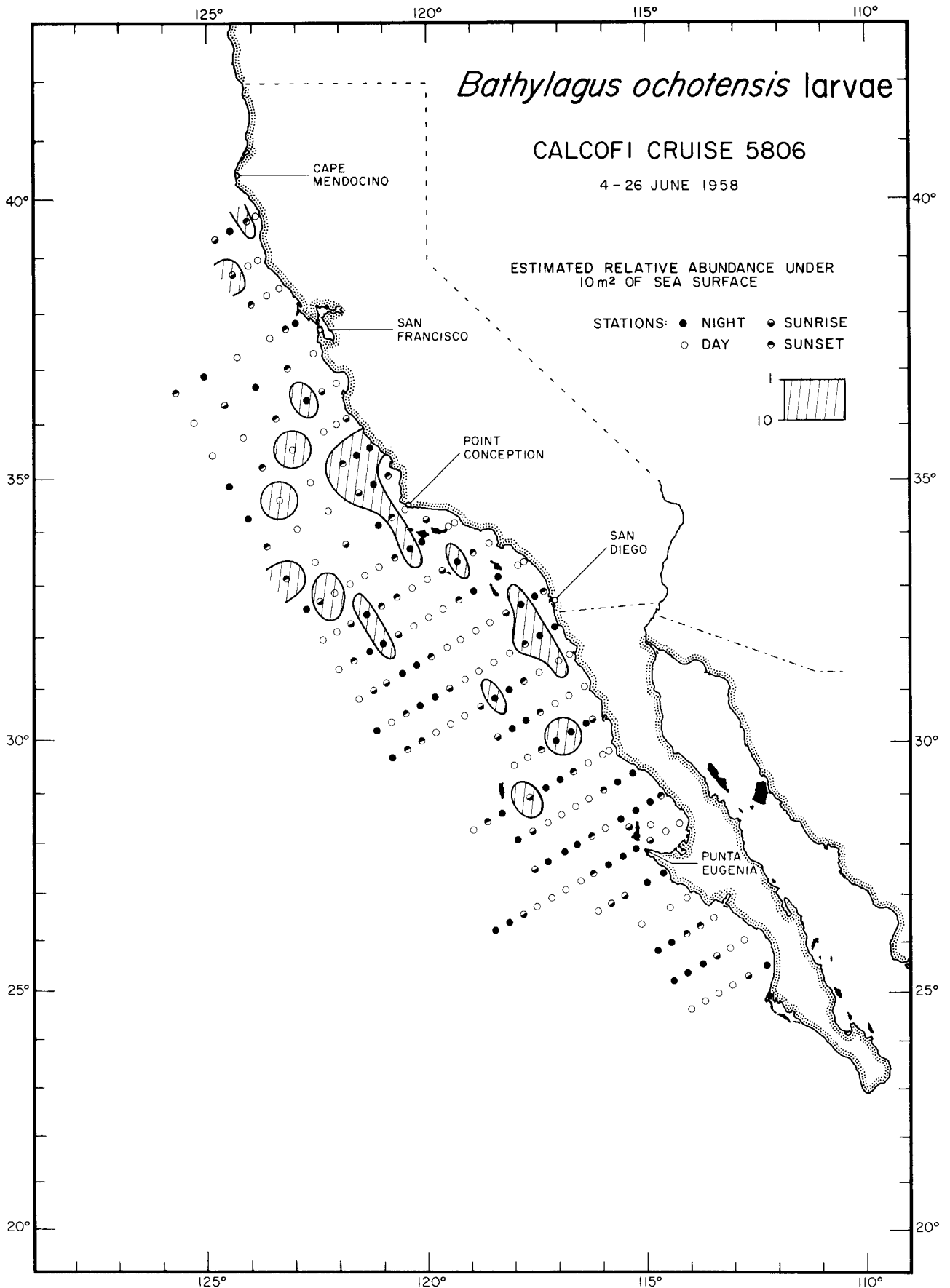


Bathylagus ochotensis larvae



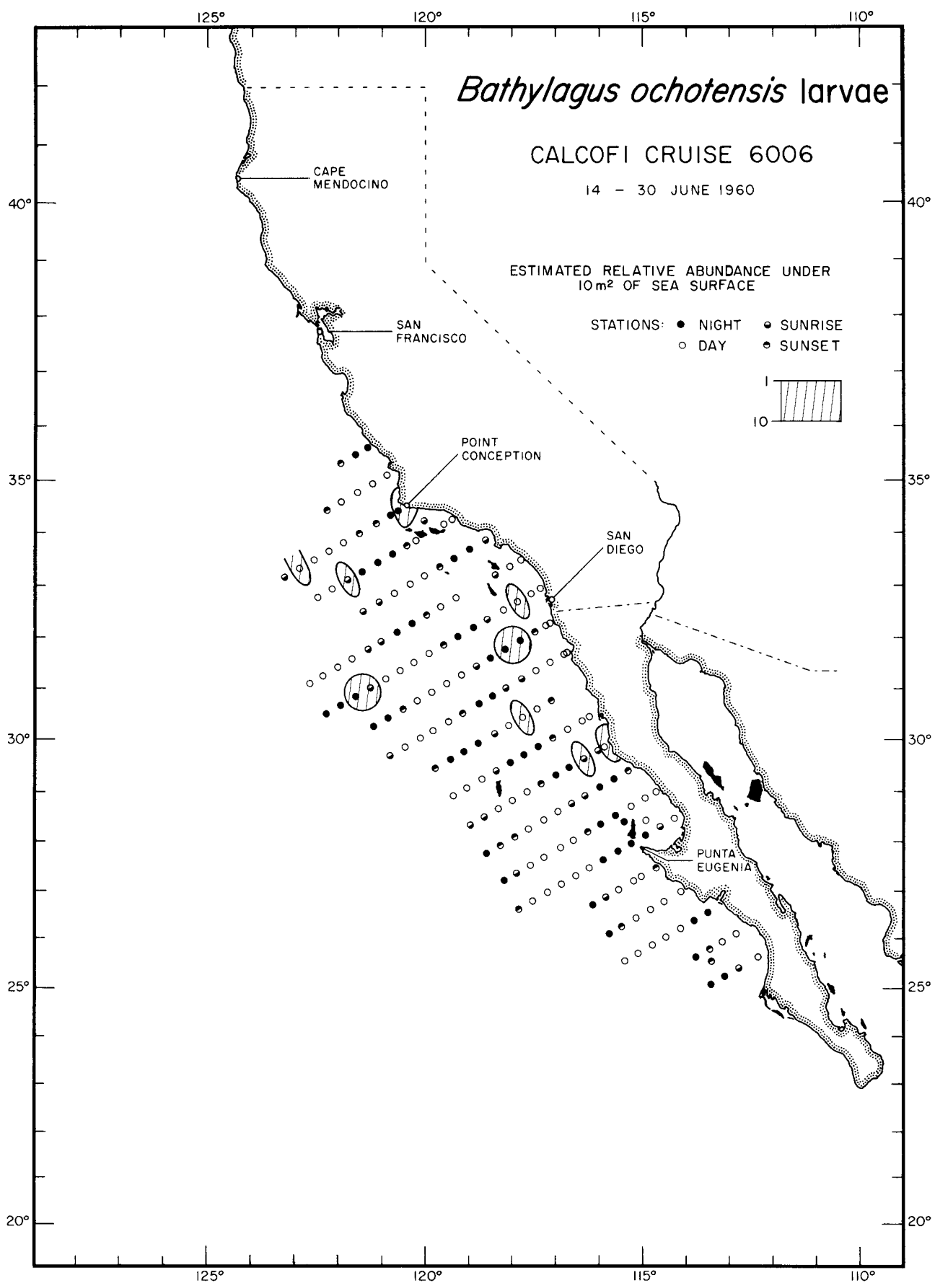
Bathylagus ochotensis larvae

5706



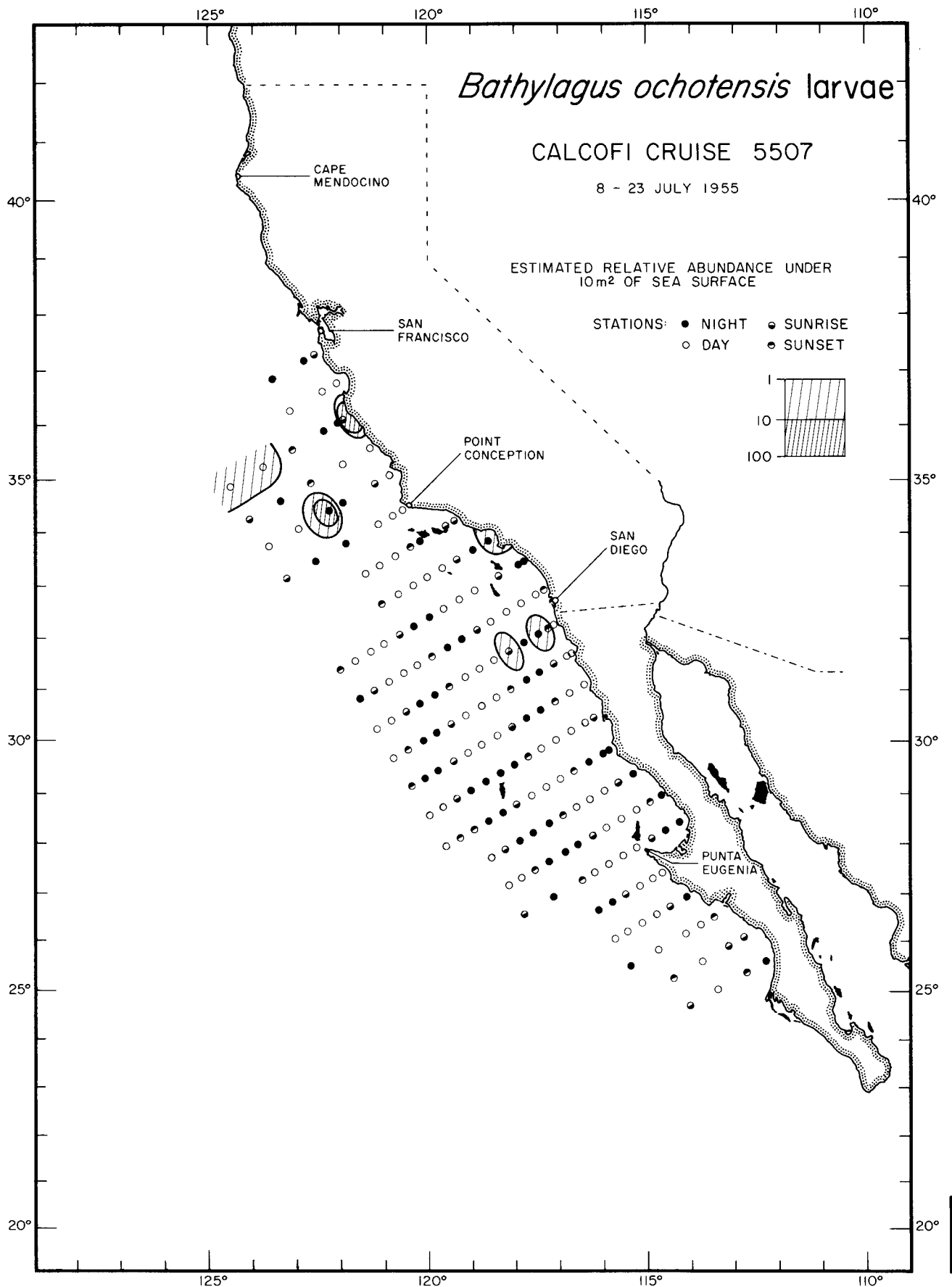
Bathylagus ochotensis larvae

5806



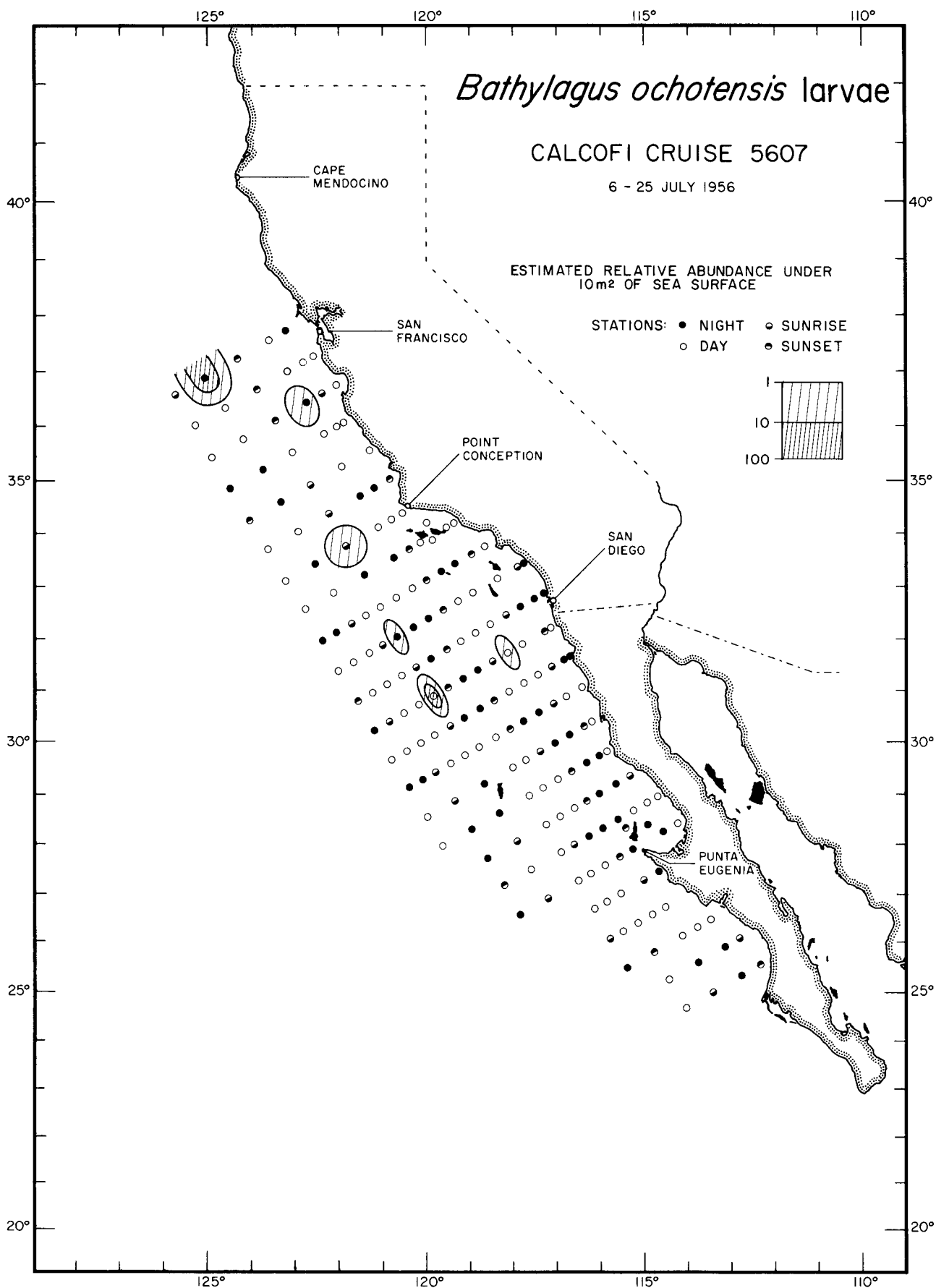
Bathylagus ochotensis larvae

6006



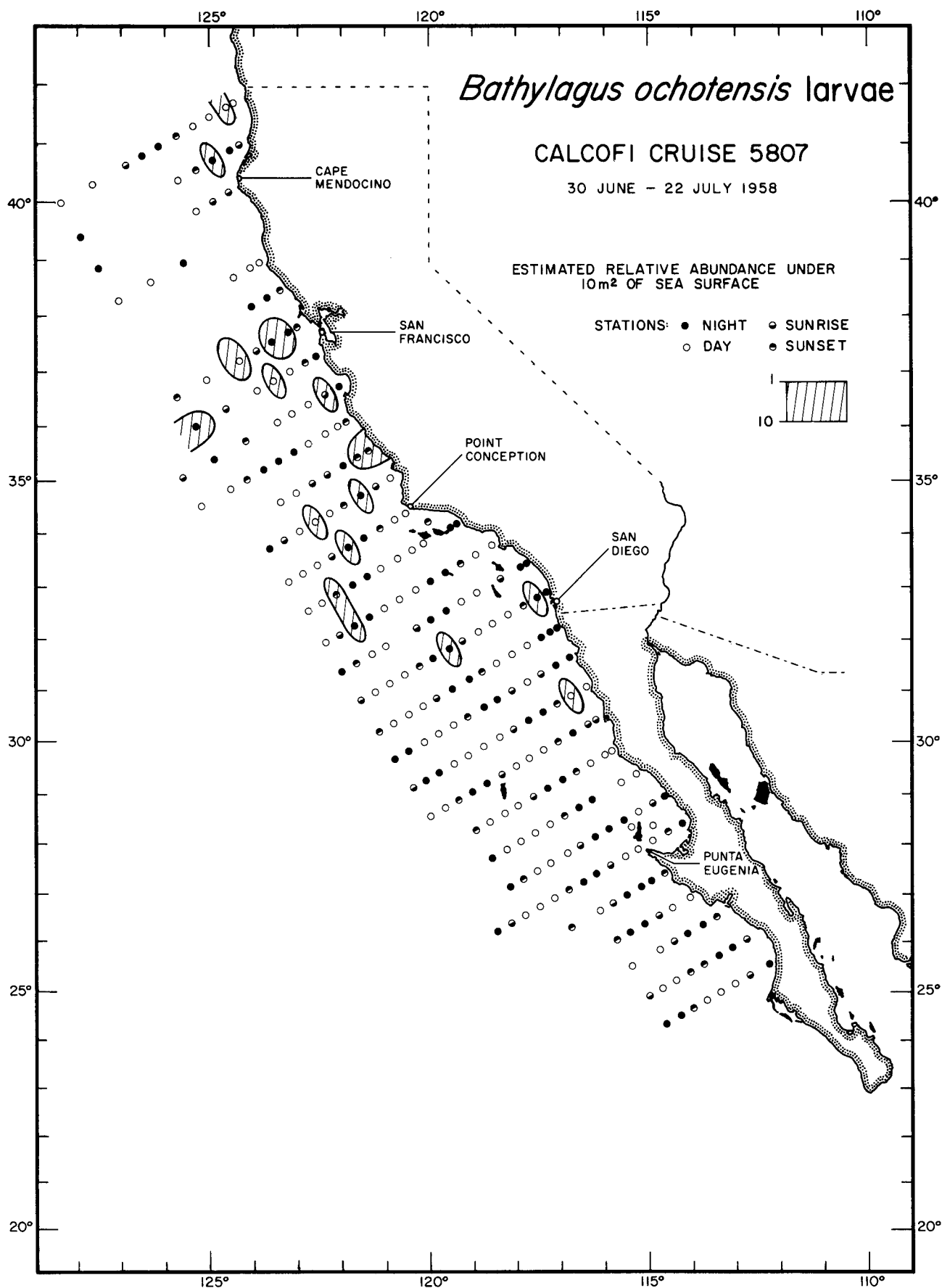
Bathylagus ochotensis larvae

5507



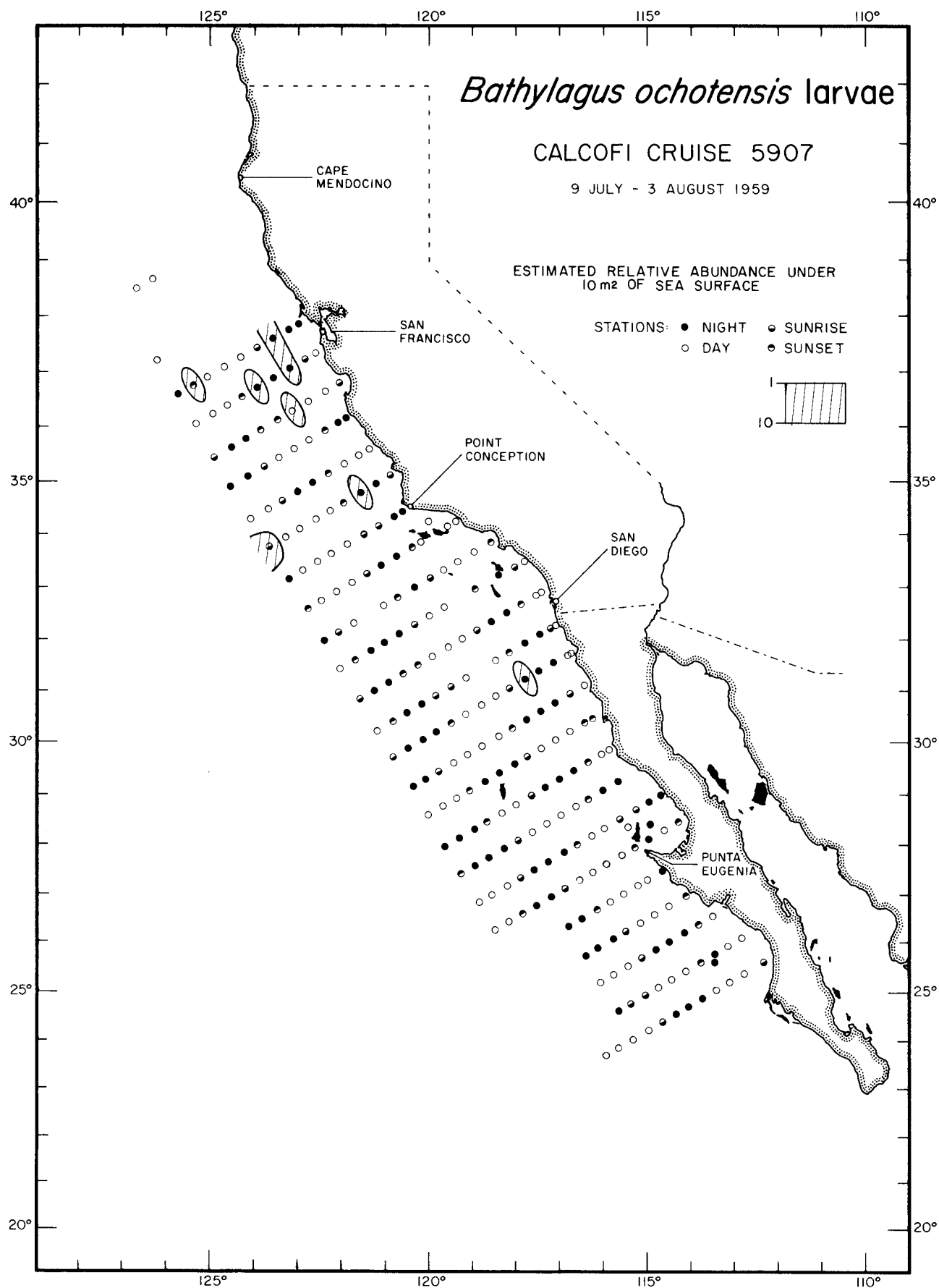
Bathylagus ochotensis larvae

5607



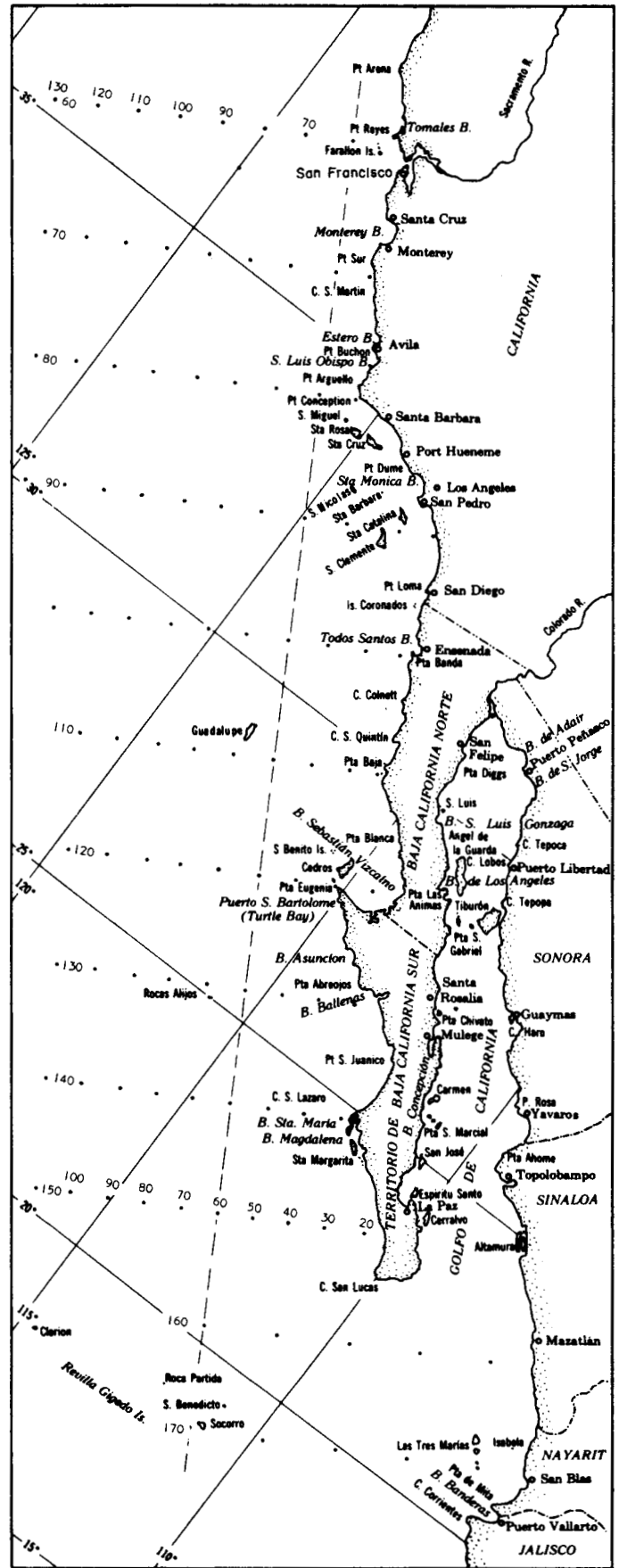
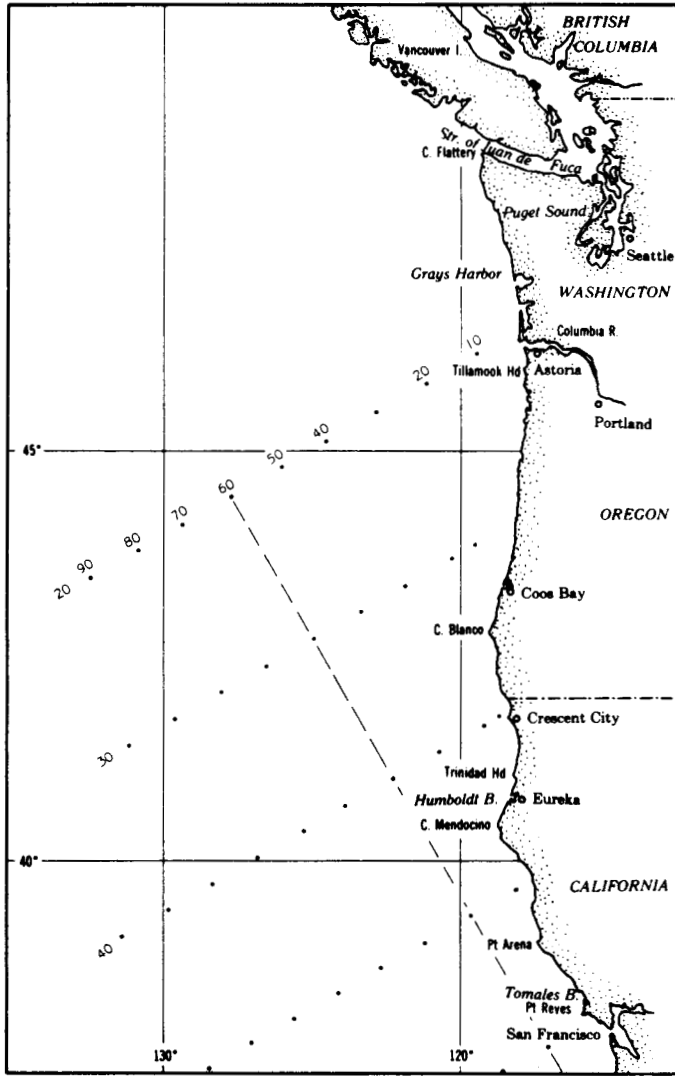
Bathylagus ochotensis larvae

5807



Bathylagus ochotensis larvae

5907



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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1955 through 1960

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