

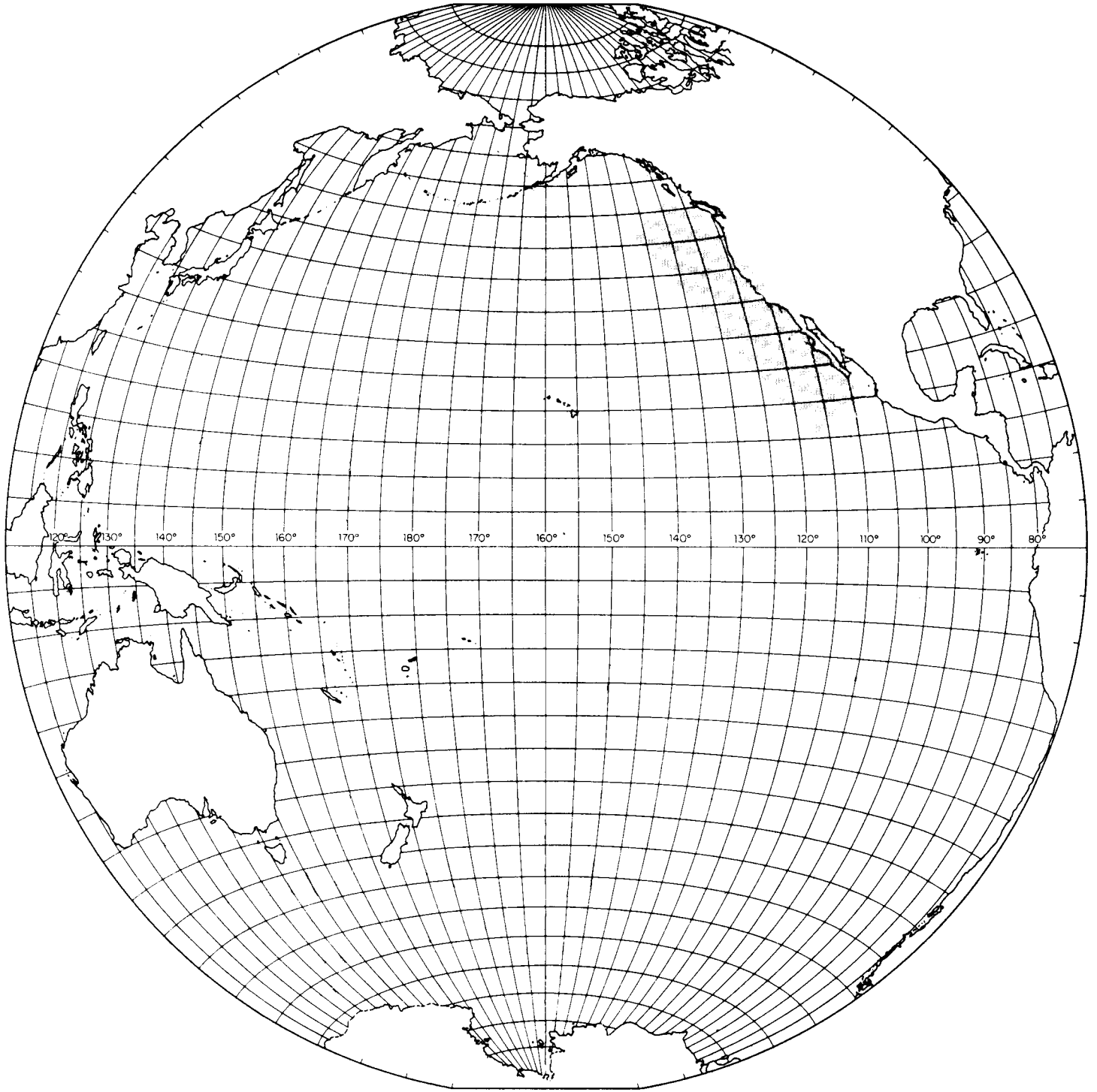
Atlas 9: Kramer, D. and E. H. Ahlstrom. Distributional atlas of fish larvae in the California Current region: northern anchovy, *Engraulis mordax* (Girard), 1951-1965. Published March 1968.

23 May 2007

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

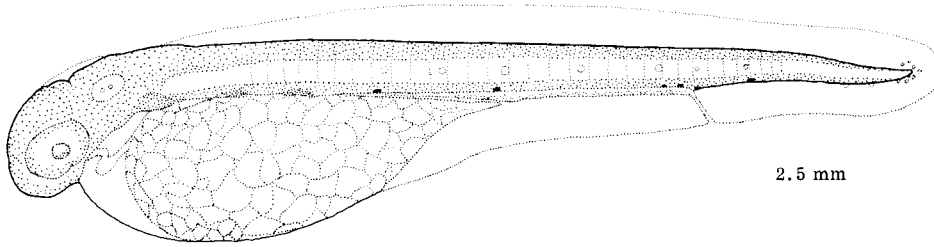
The report for each year usually is published about 7-9 months after the fall cruise, and includes notes about nomenclature changes, etc. The ultimate goal is to update the old ichthyoplankton identifications to current standards; the database is updated as re-identifications for each cruise are completed.

STATE OF CALIFORNIA  
MARINE RESEARCH COMMITTEE

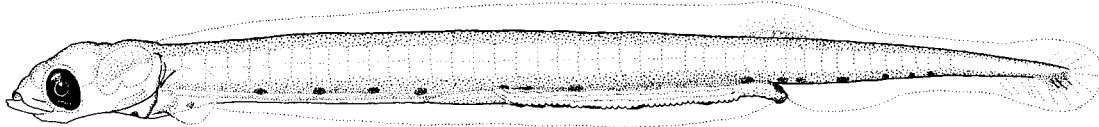


# CALIFORNIA COOPERATIVE OCEANIC FISHERIES INVESTIGATIONS

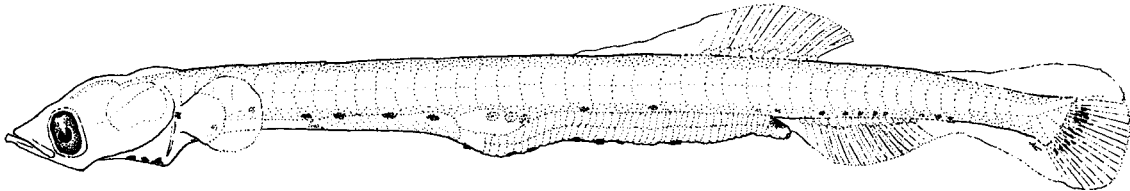
ATLAS No. 9



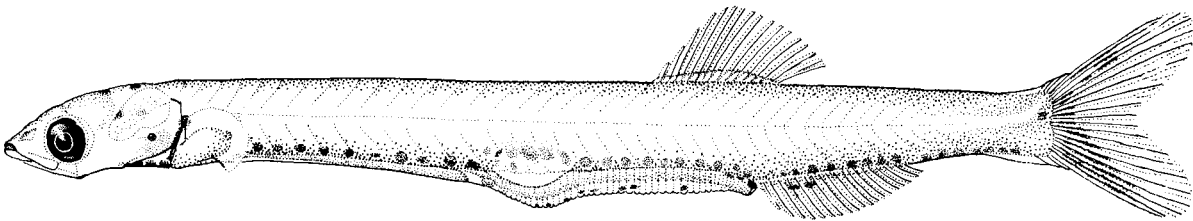
2.5 mm



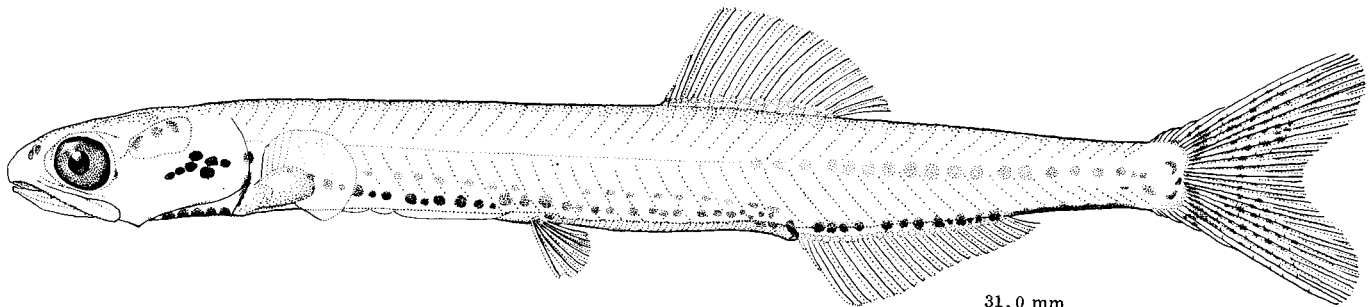
7.5 mm



11.5 mm



18.4 mm



31.0 mm

NORTHERN ANCHOVY

*Engraulis mordax*

CALIFORNIA  
COOPERATIVE  
OCEANIC  
FISHERIES  
INVESTIGATIONS

*Atlas No. 9*

STATE OF CALIFORNIA  
MARINE RESEARCH COMMITTEE

*Cooperating Agencies:*

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

March, 1968

THE CALCOFI ATLAS SERIES

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

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

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

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

CalCOFI Atlas Editorial Staff:

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

Atlases in this series, through March 1968, are:

- CalCOFI Atlas No. 1  
Anonymous. CalCOFI atlas of 10-meter temperatures and salinities 1949 through 1959.
- CalCOFI Atlas No. 2  
Fleminger, A. Distributional atlas of calanoid copepods in the California Current region, Part I.
- CalCOFI Atlas No. 3  
Alvariño, A. Distributional atlas of Chaetognatha in the California Current region.
- CalCOFI Atlas No. 4  
Wyllie, J. G. Geostrophic flow of the California Current at the surface and at 200 meters.
- CalCOFI Atlas No. 5  
Brinton, E. Distributional atlas of Euphausiacea (Crustacea) in the California Current region, Part I.
- CalCOFI Atlas No. 6  
McGowan, J. A. Distributional atlas of pelagic molluscs in the California Current region.
- CalCOFI Atlas No. 7  
Fleminger, A. Distributional atlas of calanoid copepods in the California Current region, Part II.
- CalCOFI Atlas No. 8  
Bernier, L. Distributional atlas of Thaliacea in the California Current region.
- CalCOFI Atlas No. 9  
Kramer, D., and E. H. Ahlstrom. Distributional atlas of fish larvae in the California Current region:  
Northern Anchovy, Engraulis mordax Girard, 1951 through 1965.

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

<sup>2</sup> For citation this issue in the series should be referred to as CalCOFI Atlas No. 9.

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David Kramer and Elbert H. Ahlstrom

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DISTRIBUTIONAL ATLAS OF FISH LARVAE IN THE  
CALIFORNIA CURRENT REGION: NORTHERN ANCHOVY,  
ENGRAULIS MORDAX GIRARD, 1951 THROUGH 1965

David Kramer<sup>1</sup> and Elbert H. Ahlstrom<sup>1</sup>

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Introduction to the Charts

This atlas depicts the abundance and distribution of the larvae of the northern anchovy, Engraulis mordax Girard, in the region of the California Current off California and Baja California. The charts include the data collected on all cruises (exclusive of special surveys and special stations) conducted by the California Cooperative Oceanic Fisheries Investigations during the years 1951 through 1965 (Ahlstrom, 1953, 1954; Ahlstrom and Kramer, 1955, 1956, 1957; Ahlstrom, 1958, MSS<sup>2</sup>). Surveys were conducted monthly during the decade 1951 through 1960 and quarterly during 1961 through 1965. Details of sampling methods were described by Ahlstrom (1948, 1953) and Fleminger (1964). Briefly, each sample was collected with the standard CalCOFI net constructed of silk mesh (bolting cloth), mouth diameter one meter and mesh size approximately 0.55 mm. Occasionally, a nylon net of the same mouth opening and mesh size was used. A flowmeter in the mouth of the net permitted calculation of the amount of water strained. Each tow was made by sinking the net at 50 meters per minute to a depth of about 140 meters (200 meters of wire out, depth permitting) and by retrieving it at 20 meters per minute while maintaining a wire angle of 45 degrees. The ship's speed during the tow was about 2 knots.

In the laboratory, samples were sorted for all fish eggs and larvae. In the case of a very large-sized sample examination was made of an aliquot obtained from the Folsom Plankton Sample Splitter (McEwen, Johnson and Folsom, 1954).

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

<sup>2</sup> Ahlstrom, MSS are preliminary data reports (1) for 1958 and 1959, and (2) for 1960 through 1964, prepared at the Fishery-Oceanography Center for limited distribution. The data for 1965 have not been released before.

The standardized values for fish eggs and larvae are not directly comparable with the standardized values used by authors of previous CalCOFI atlases, where the values were adjusted to volume of water strained. For most stations, the standardized values for anchovies are approximately 1.4 times as large.

Estimates of abundance of larvae and eggs were made comparable between samples by standardizing the values to a unit of ten square meters of sea surface. The standardization factor was derived for each station according to the volume of water strained and the average depth of each haul as follows:

$$S = \frac{10 D}{V} \text{ or } \frac{10 D}{R a p}, \quad (1)$$

where

- S = standardized haul factor,
- D = average depth of a haul in meters,
- V = number of cubic meters of water strained during a haul,
- R = number of revolutions registered by the current meter during a haul,
- a = cross-sectional area of the net mouth in square meters, and
- p = length of the column of water in meters needed to effect one revolution of the current meter at the average speed at which the haul was taken.

Note that

$$V = R a p . \quad (2)$$

The contour intervals of the present charts also differ from those used in previous CalCOFI atlases. Since anchovy larvae are seldom collected in numbers greater than 10,000, and since five contour intervals were desired, each interval was reduced to one-fifth of that used in CalCOFI Atlases 2, 3, 5, 6, 7 and 8.

The strata occupied by anchovy larvae are completely sampled by the standard haul from the surface to 140 meters of depth (Ahlstrom, 1959b). It is known, however, that larvae of various sizes are able to escape the net. Small ones may pass through the 0.55-mm mesh and large ones may swim away from the path of the net, especially during daylight. Therefore, two charts are presented for each cruise, one for the size group most adequately sampled (6.26-12.25 mm), and one for the total numbers caught.



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- Ahlstrom, E. H., 1948. A record of pilchard eggs and larvae collected during surveys made during 1939 to 1941. U. S. Fish and Wildl. Serv. Spec. Sci. Rpt., No. 54: 1-76.
- \_\_\_\_\_, 1953. Pilchard eggs and larvae and other fish larvae, Pacific coast, 1951. U. S. Fish and Wildl. Serv. Spec. Sci. Rpt., Fish. 102: 1-55.
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- \_\_\_\_\_, Manuscript. Size composition of larvae of the Pacific sardine and northern anchovy obtained on CalCOFI survey cruises, 1960-1964. Preliminary data report. U. S. Bureau of Commercial Fisheries California Current Resources Laboratory, La Jolla, California: 98 pp.
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## CalCOFI Basic Station Plan

1

Distribution of Northern Anchovy larvae 2-269. See table below for individual cruises

Months	<u>01</u>	<u>02</u>	<u>03</u>	<u>04</u>	<u>05</u>	<u>06</u>
Years						
19 <u>51</u>	2, 3	4, 5	6, 7	8, 9	10, 11	12, 13
<u>52</u>	26, 27	28, 29	30, 31**	32, 33	34, 35	36, 37
<u>53</u>	48, 49	50, 51	52, 53**	54, 55	56, 57	58, 59
<u>54</u>	72, 73	74, 75	76, 77	78, 79	80, 81	82, 83
<u>55</u>	92, 93	94, 95	96, 97	98, 99	100, 101	102, 103
<u>56</u>	114, 115	116, 117	118, 119	120, 121	122, 123	124, 125
<u>57</u>	138, 139	140, 141	142, 143	144, 145	146, 147	148, 149
<u>58</u>	162, 163	164, 165	166, 167	168, 169	170, 171	172, 173
<u>59</u>	186, 187	188, 189	190, 191	192, 193	194, 195	196, 197
<u>60</u>	210, 211	212, 213	214, 215	216, 217	218, 219	220, 221
<u>61</u>	230, 231			232, 233		
<u>62</u>	238, 239			240, 241		
<u>63</u>	246, 247			248, 249		
<u>64</u>	254, 255			256, 257		
19 <u>65</u>	262, 263			264, 265		

\* The first two figures in the CalCOFI cruise-numbering system represent the year of the cruise; the last two figures, the month.

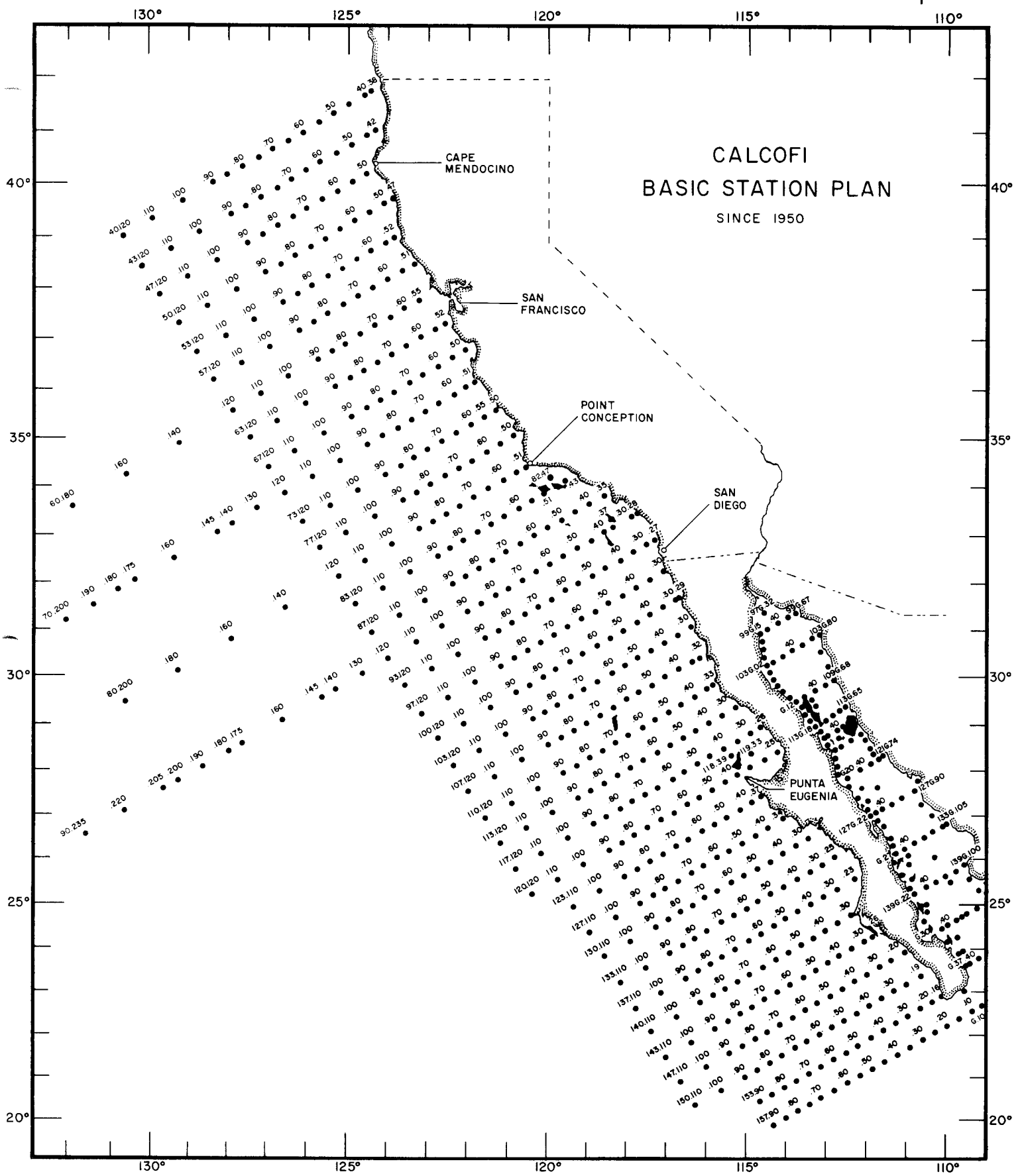
The table below is a cross reference to an earlier system of assigning cruise numbers. The earlier numbers are in parentheses.

5101 (21)	5105 (25)	5109 (29)	5201 (33)	5204 (36)	5208 (40)
5102 (22)	5106 (26)	5110 (30)	5202 (34)	5205 (37)	5209 (41)
5103 (23)	5107 (27)	5111 (31)	5203 (35)	5206 (38)	5210 (42)
5104 (24)	5108 (28)	5112 (32)	5203 (35)	5207 (39)	5211 (43)

OF CHARTS\*

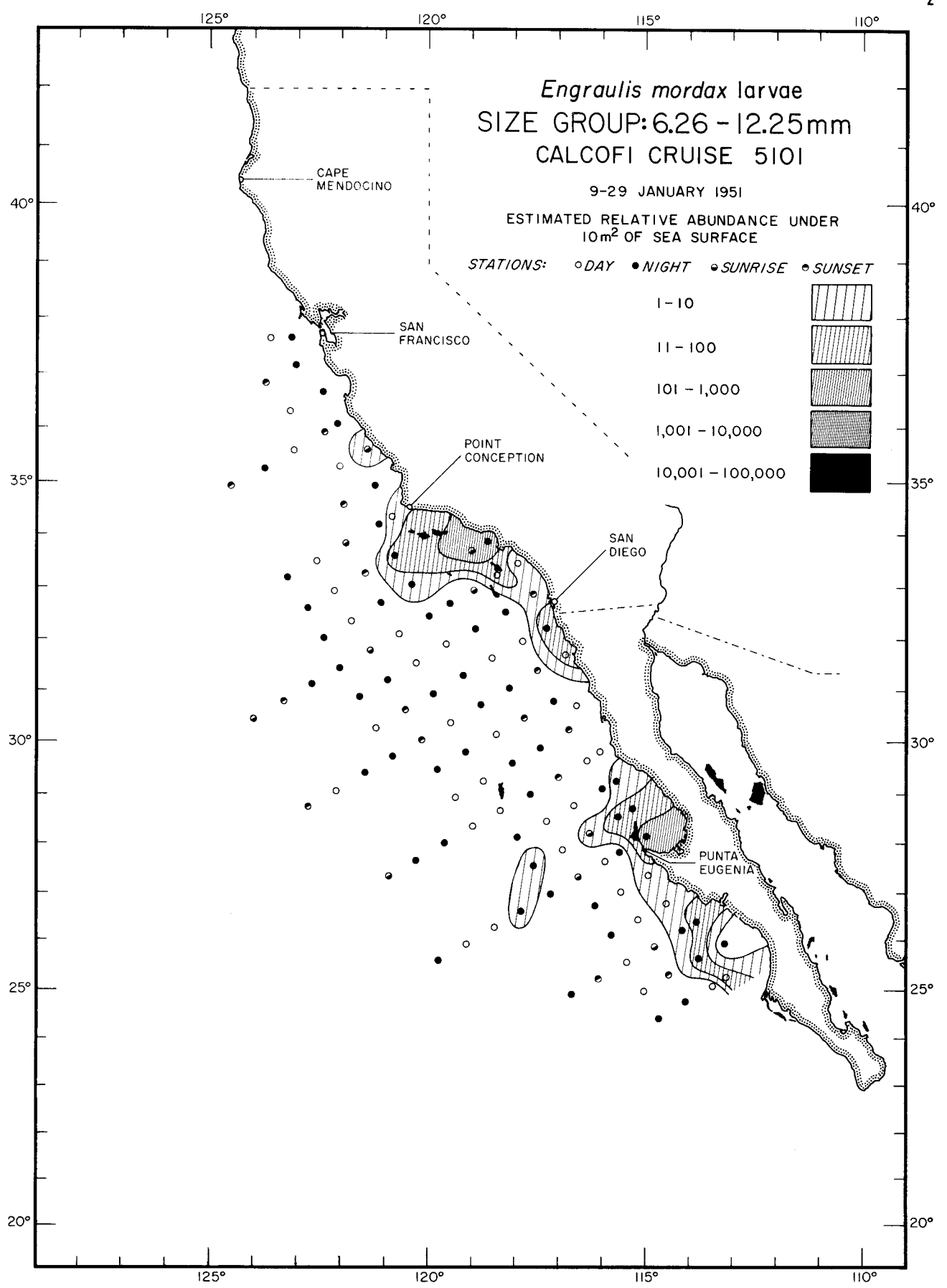
<u>07</u>	<u>08</u>	<u>09</u>	<u>10</u>	<u>11</u>	<u>12</u>	Years
14, 15	16, 17	18, 19	20, 21	22, 23	24, 25	<u>1951</u>
38, 39	40, 41	42, 43	44, 45	46, 47		<u>52</u>
60, 61	62, 63	64, 65	66, 67	68, 69	70, 71	<u>53</u>
84, 85	86, 87		88, 89		90, 91	<u>54</u>
104, 105		106, 107	108, 109	110, 111	112, 113	<u>55</u>
126, 127	128, 129	130, 131	132, 133	134, 135	136, 137	<u>56</u>
150, 151	152, 153	154, 155	156, 157	158, 159	160, 161	<u>57</u>
174, 175	176, 177	178, 179	180, 181	182, 183	184, 185	<u>58</u>
198, 199	200, 201	202, 203	204, 205	206, 207	208, 209	<u>59</u>
222, 223	224, 225	226, 227	228, 229			<u>60</u>
234, 235			236, 237			<u>61</u>
242, 243			244, 245			<u>62</u>
250, 251			252, 253			<u>63</u>
258, 259			260, 261			<u>64</u>
266, 267		268, 269				<u>1965</u>

\*\* In March 1952 and March 1953, surveys were conducted twice a month. The results of the repetitive cruises are shown separately on the same page.

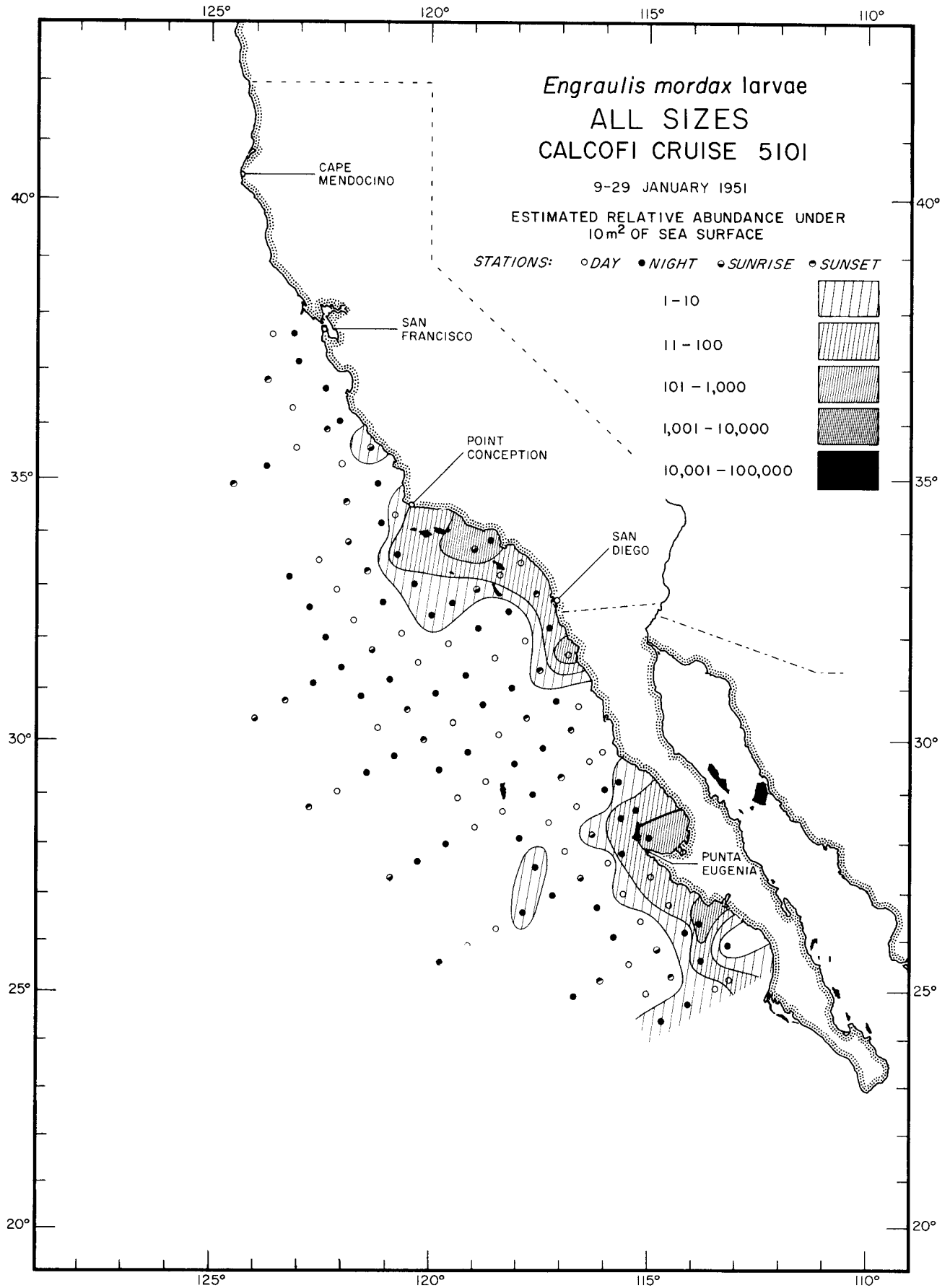


CALCOFI

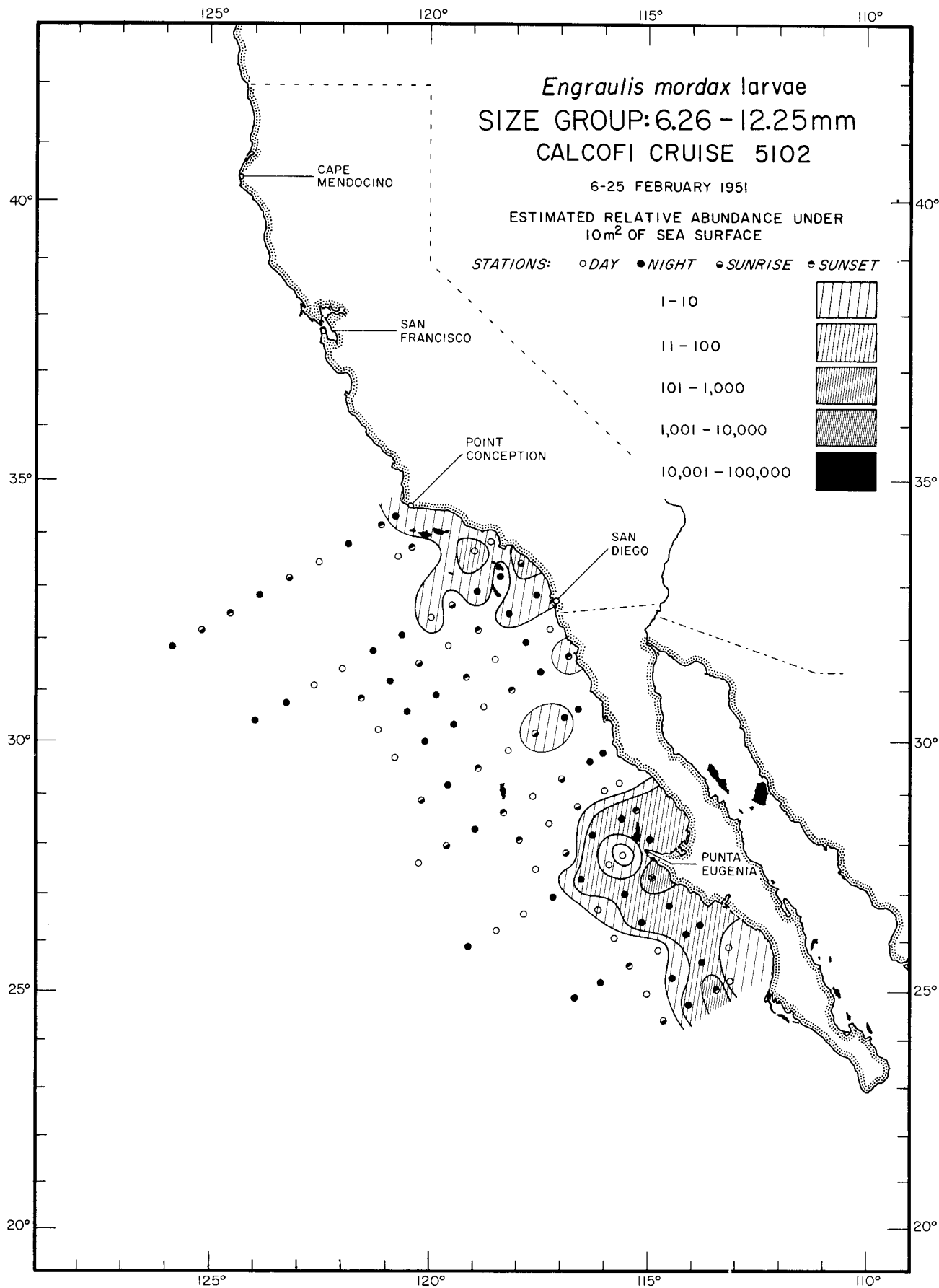
BASIC STATION PLAN  
SINCE 1950



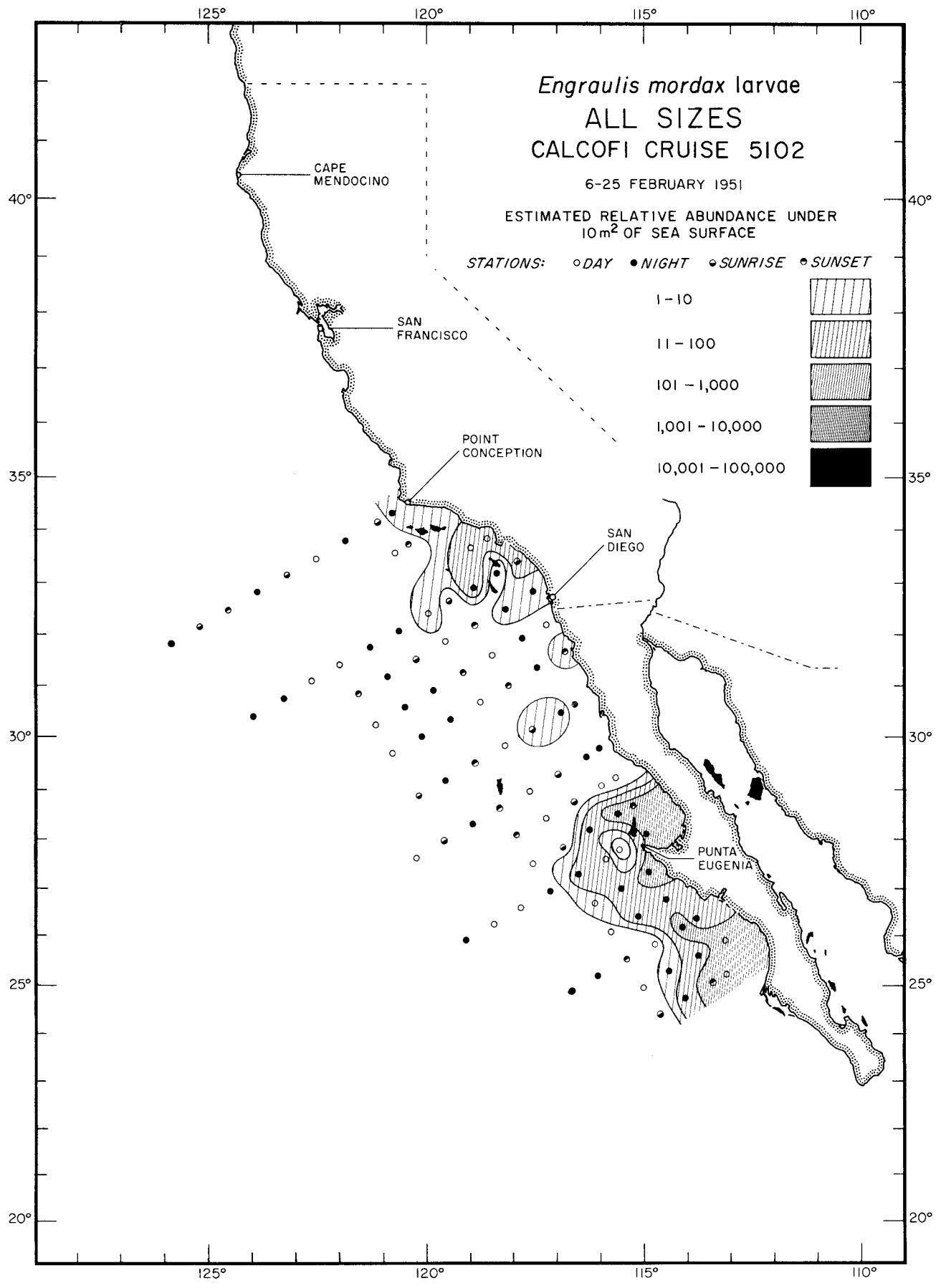
*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5101



*Engraulis mordax* larvae  
All Sizes  
5101

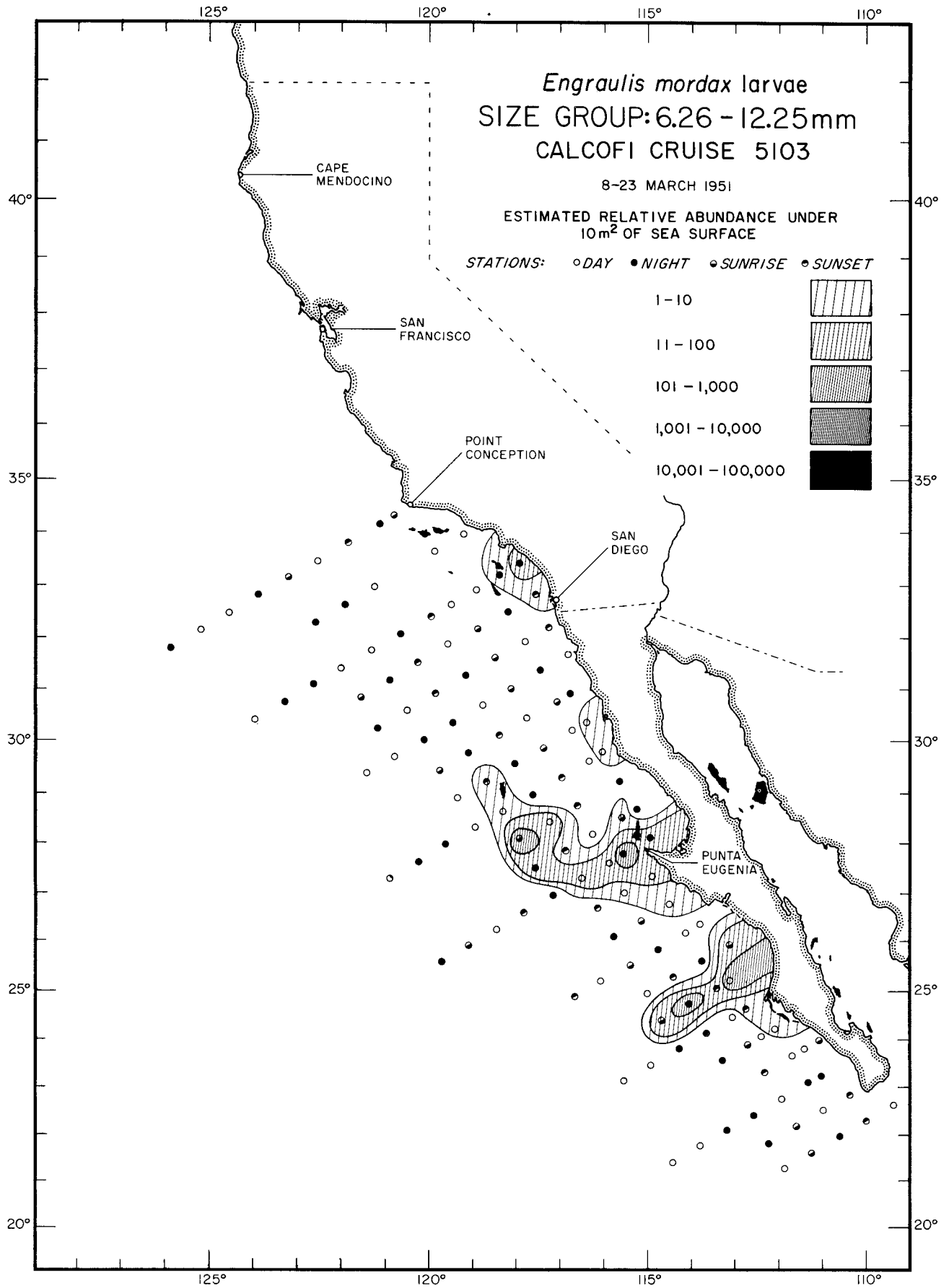


*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5102

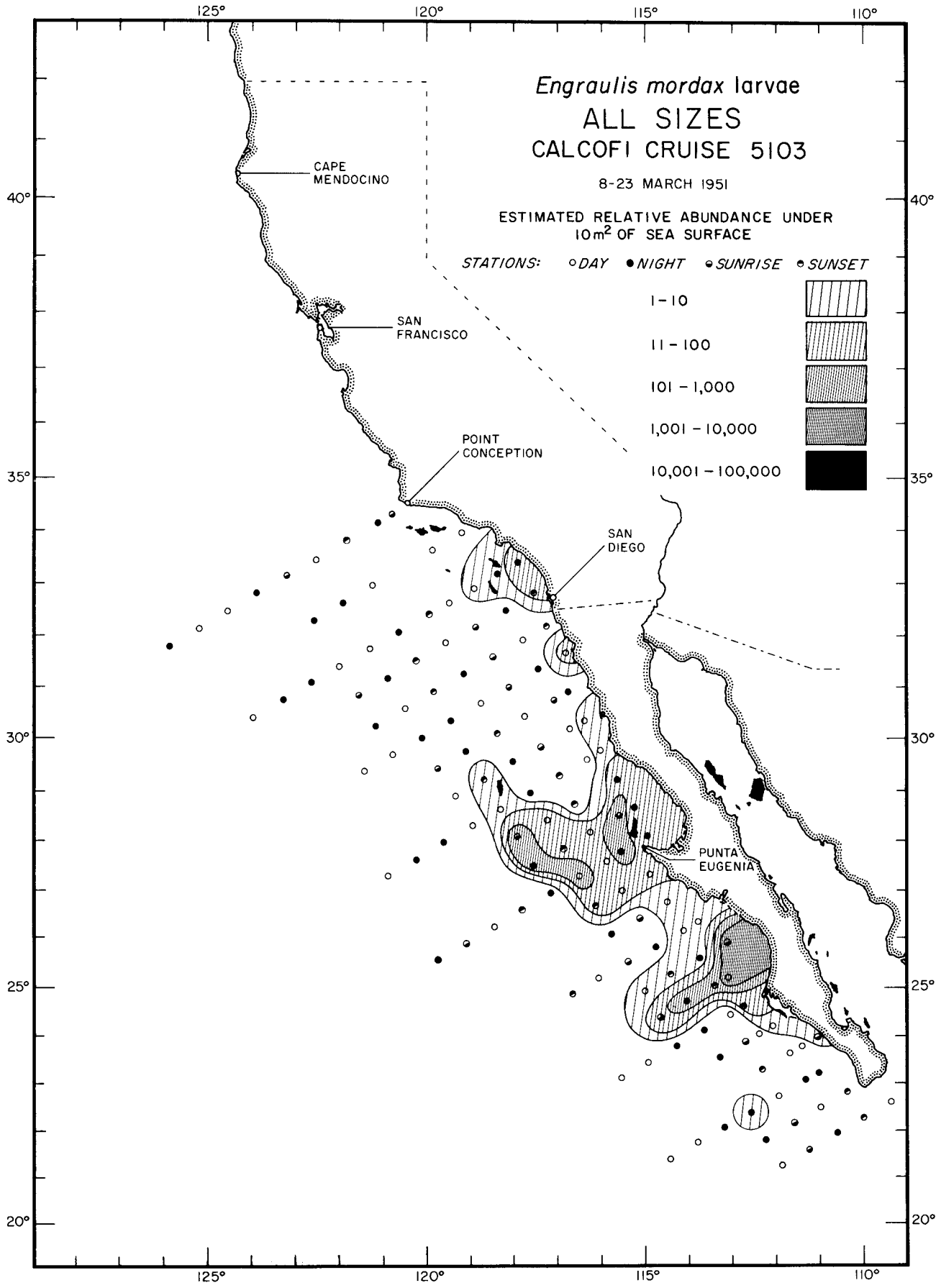


*Engraulis mordax* larvae  
All Sizes  
5102

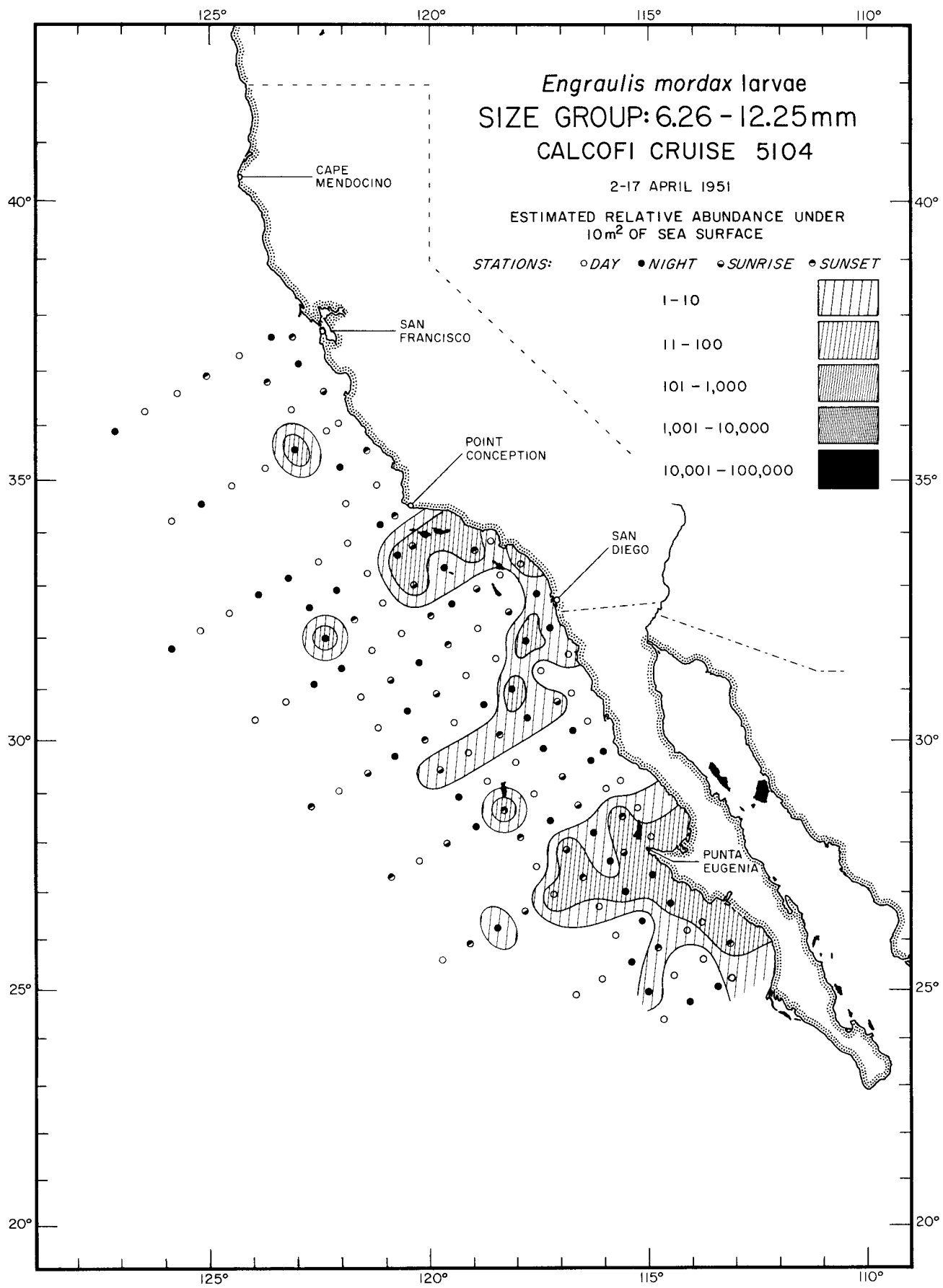




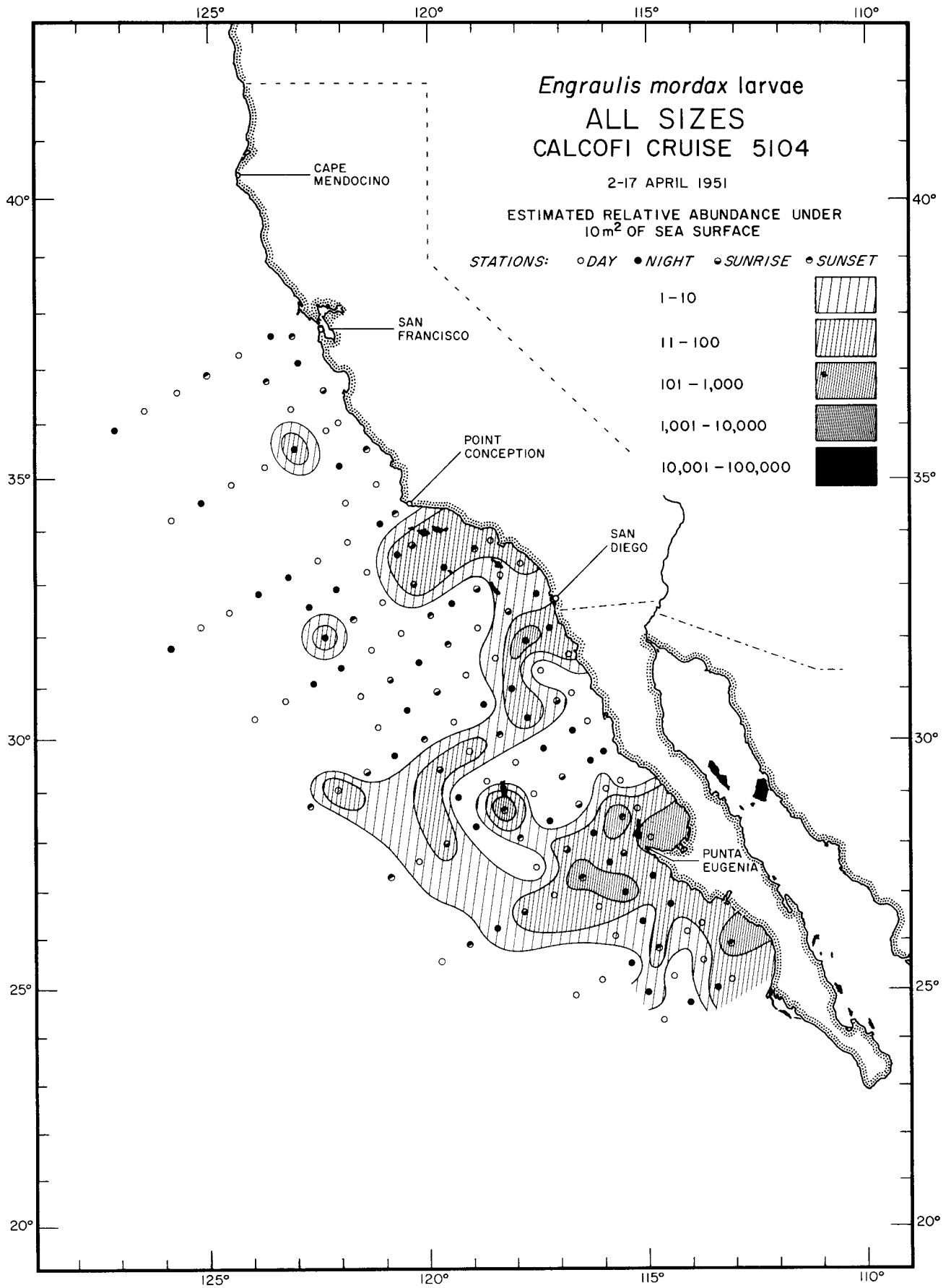
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Size Group: 6.26-12.25mm  
5103



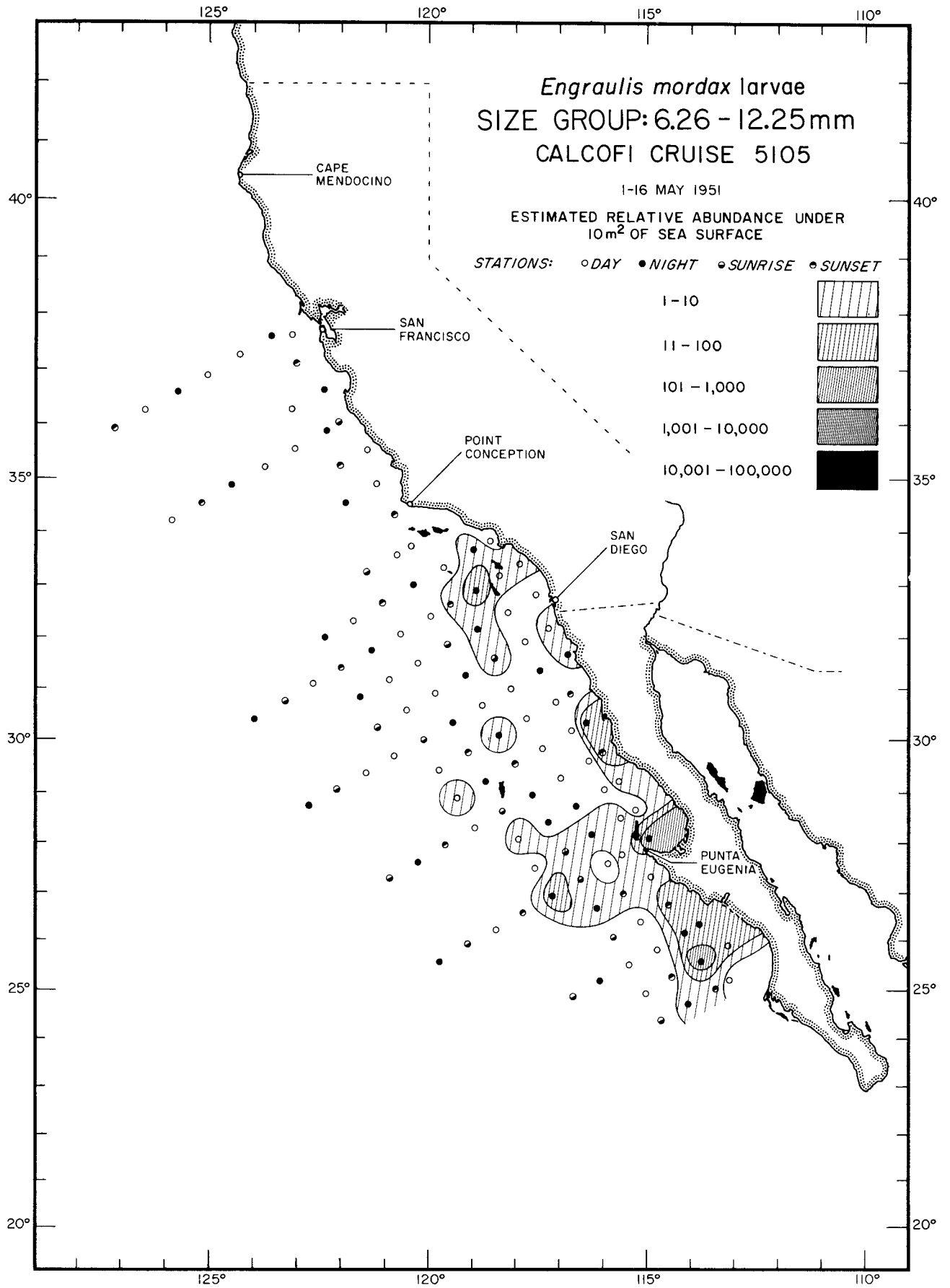
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All Sizes  
5103



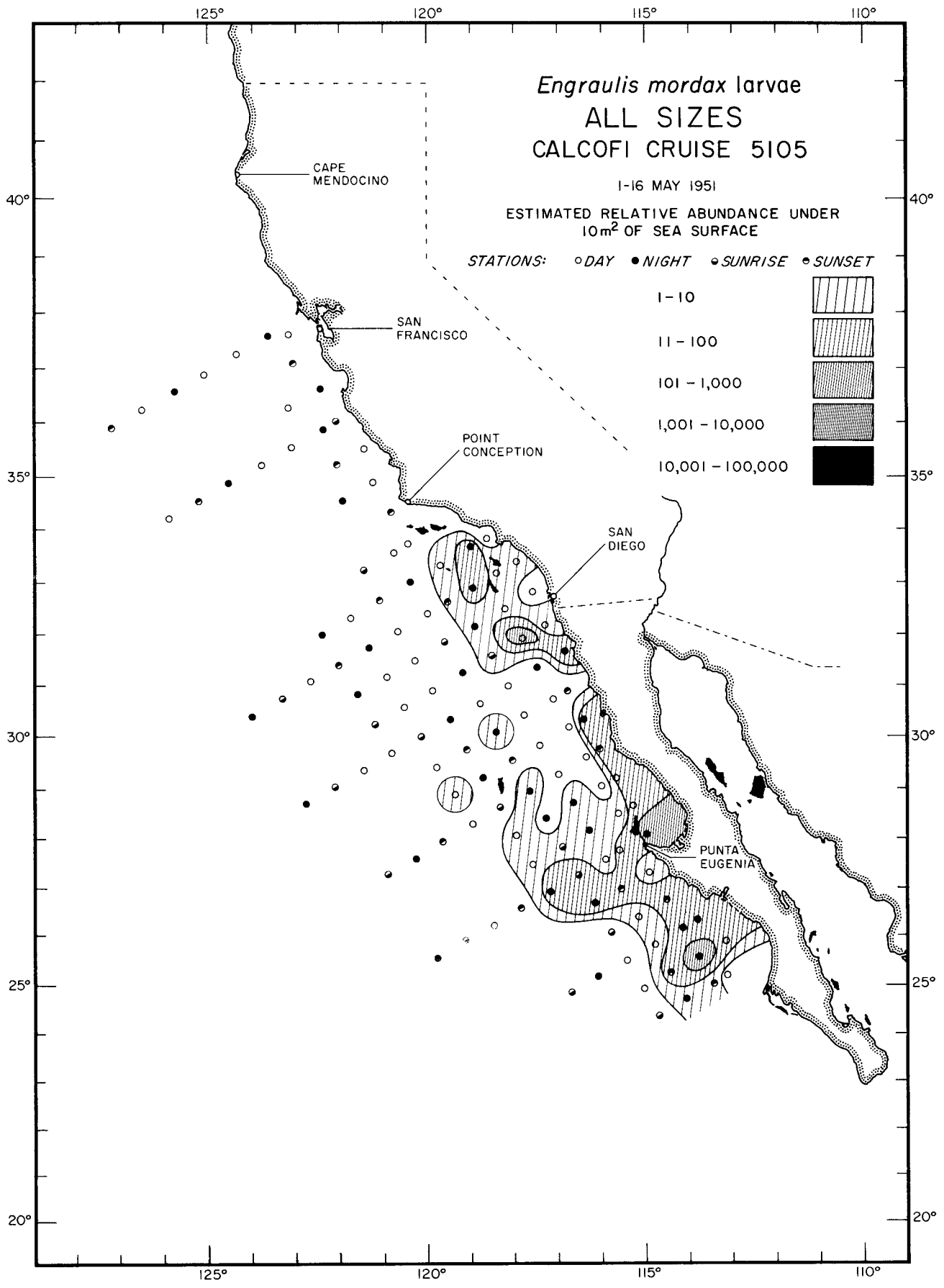
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5104



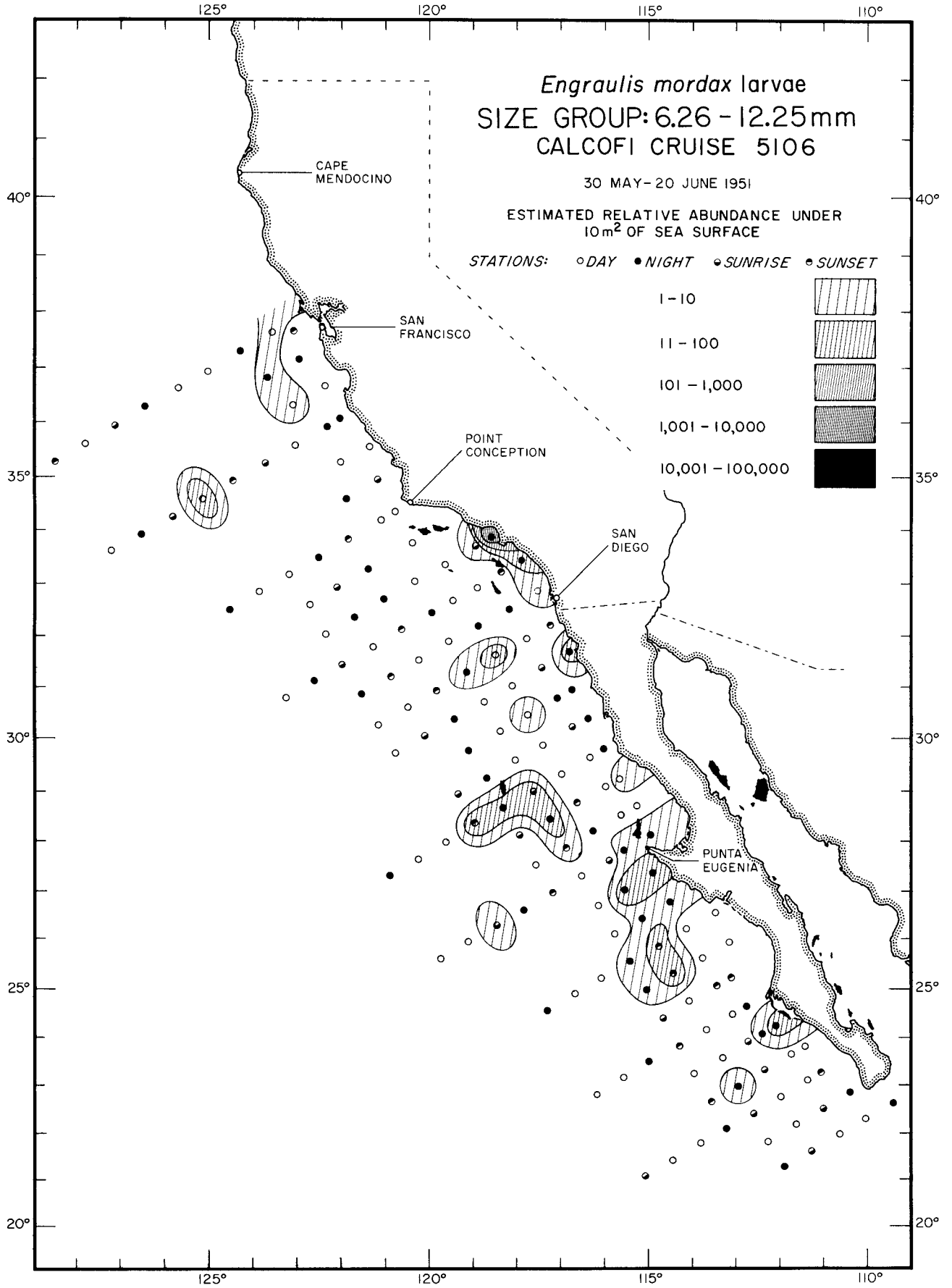
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All Sizes  
5104



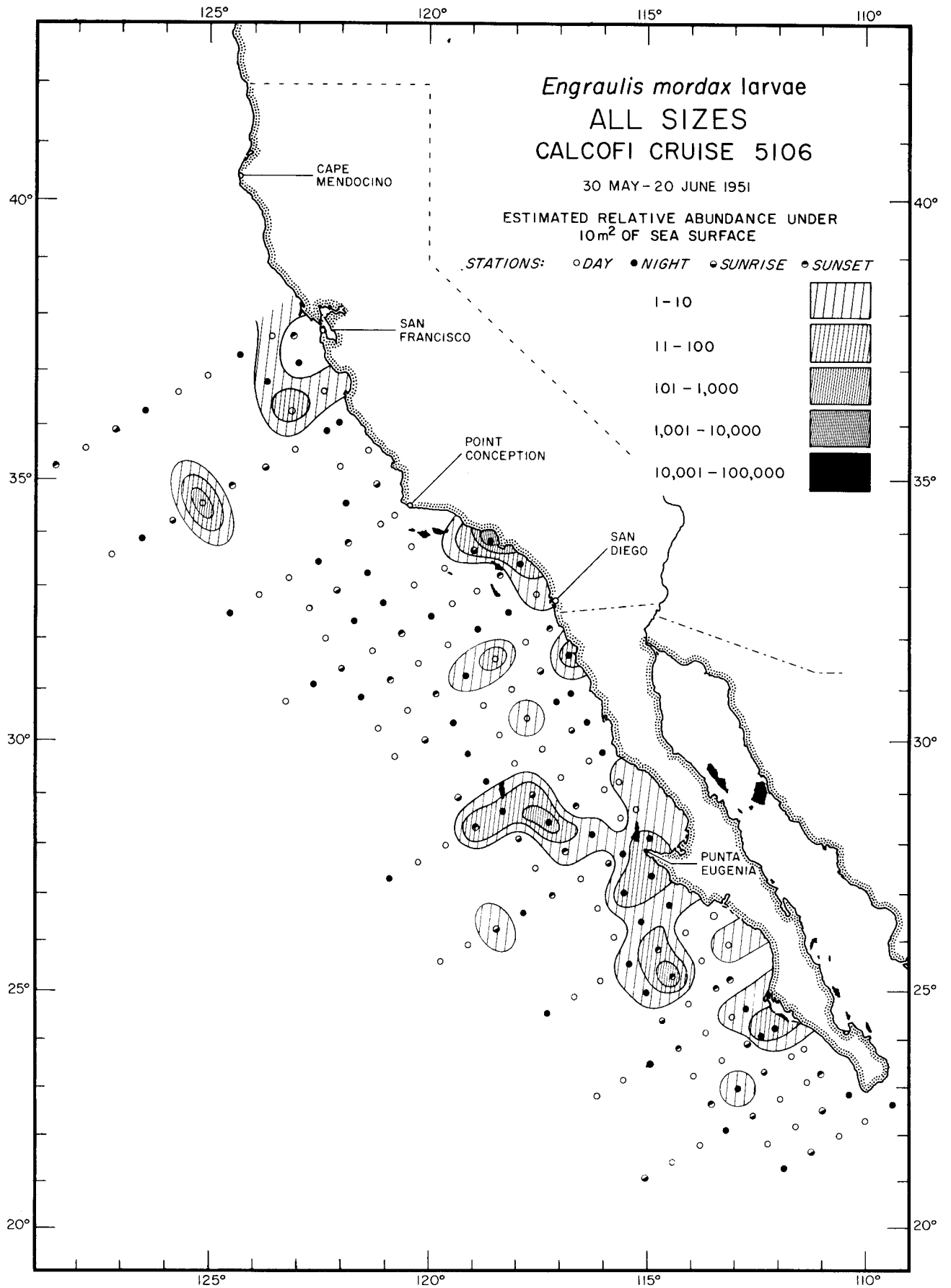
*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5105



*Engraulis mordax* larvae  
 All Sizes  
 5105



*Engraulis mordax* larvae  
 Size Group: 6.26-12.25mm  
 5106

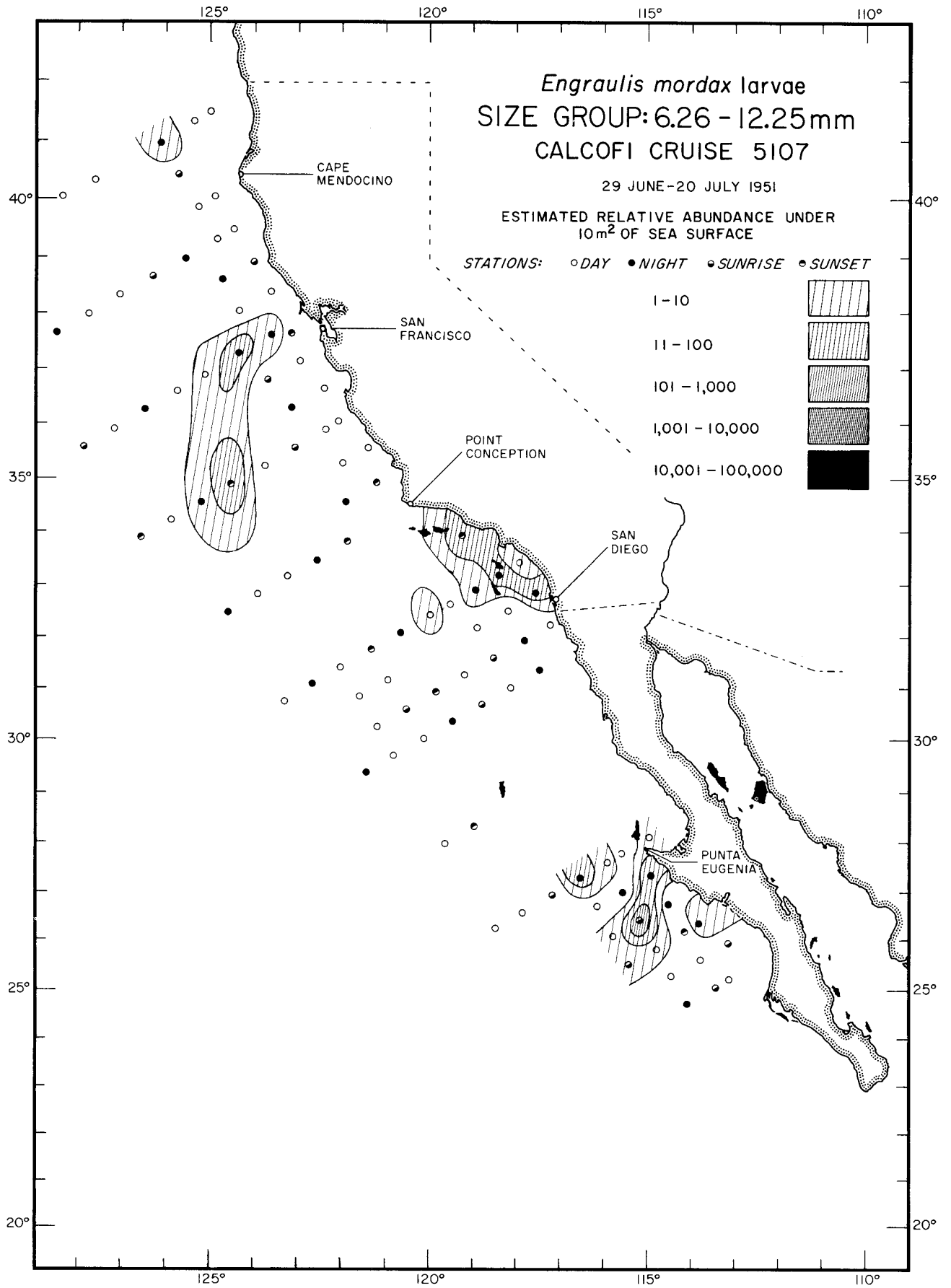


*Engraulis mordax* larvae

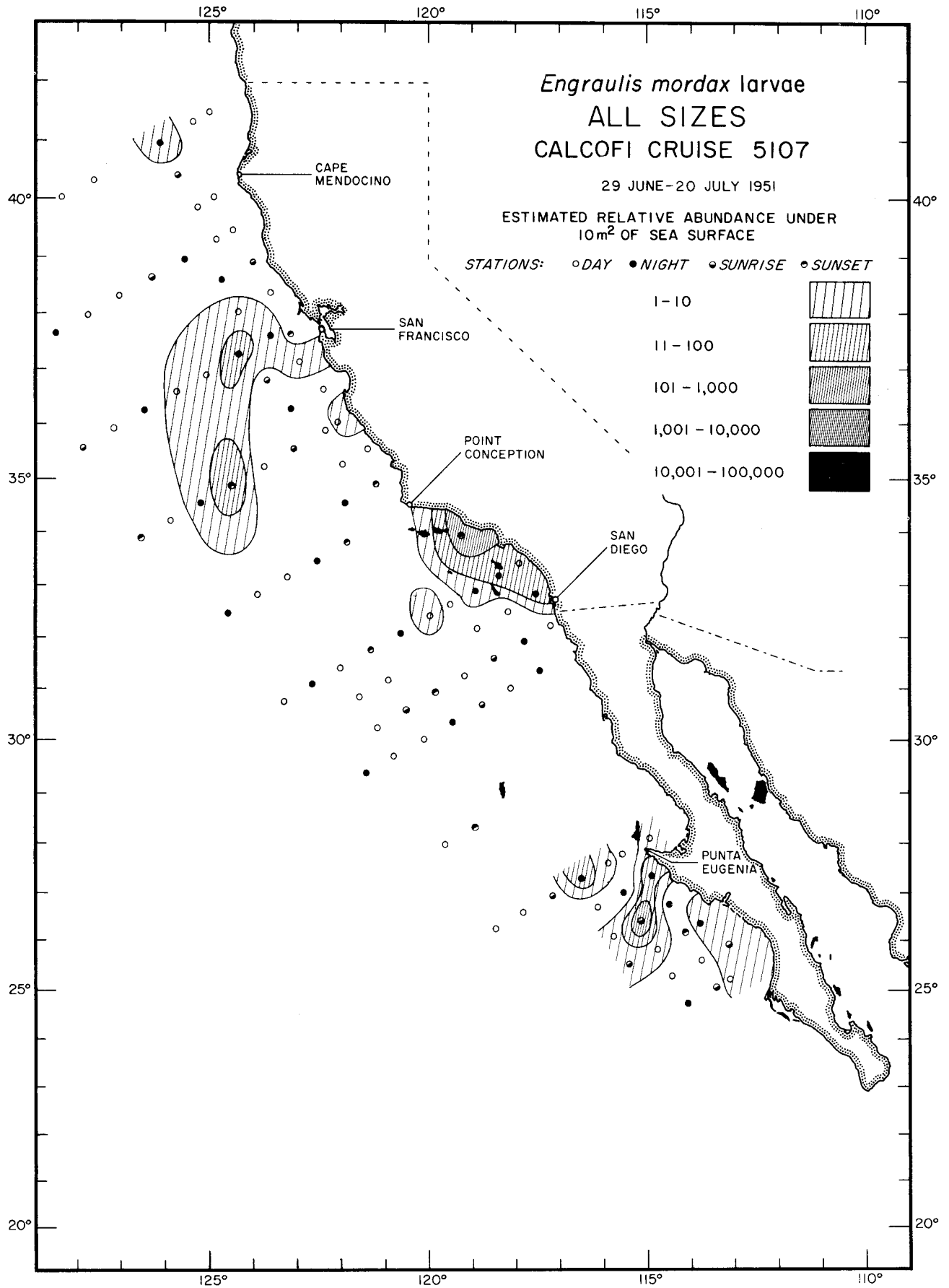
All Sizes

5106





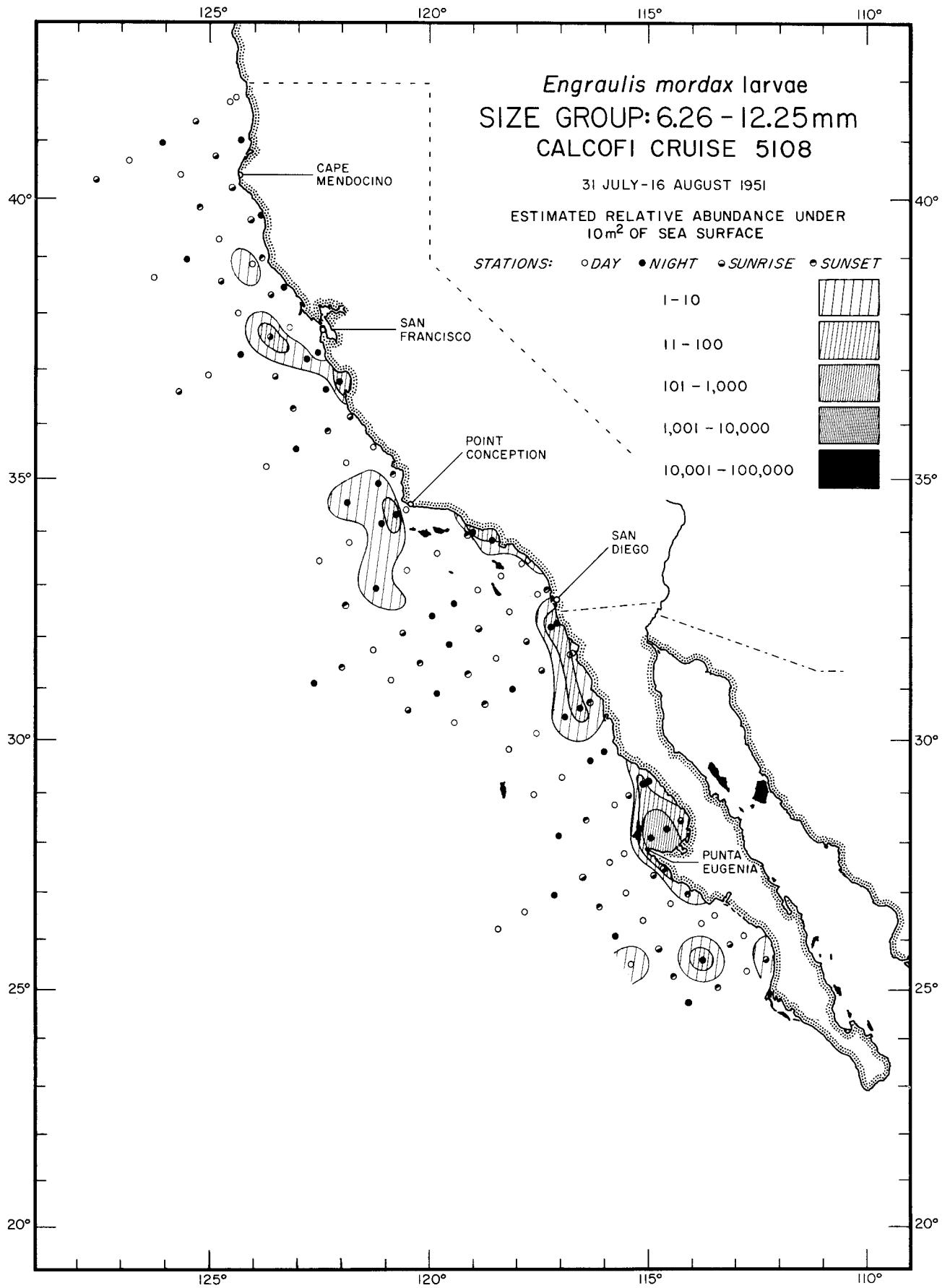
*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5107



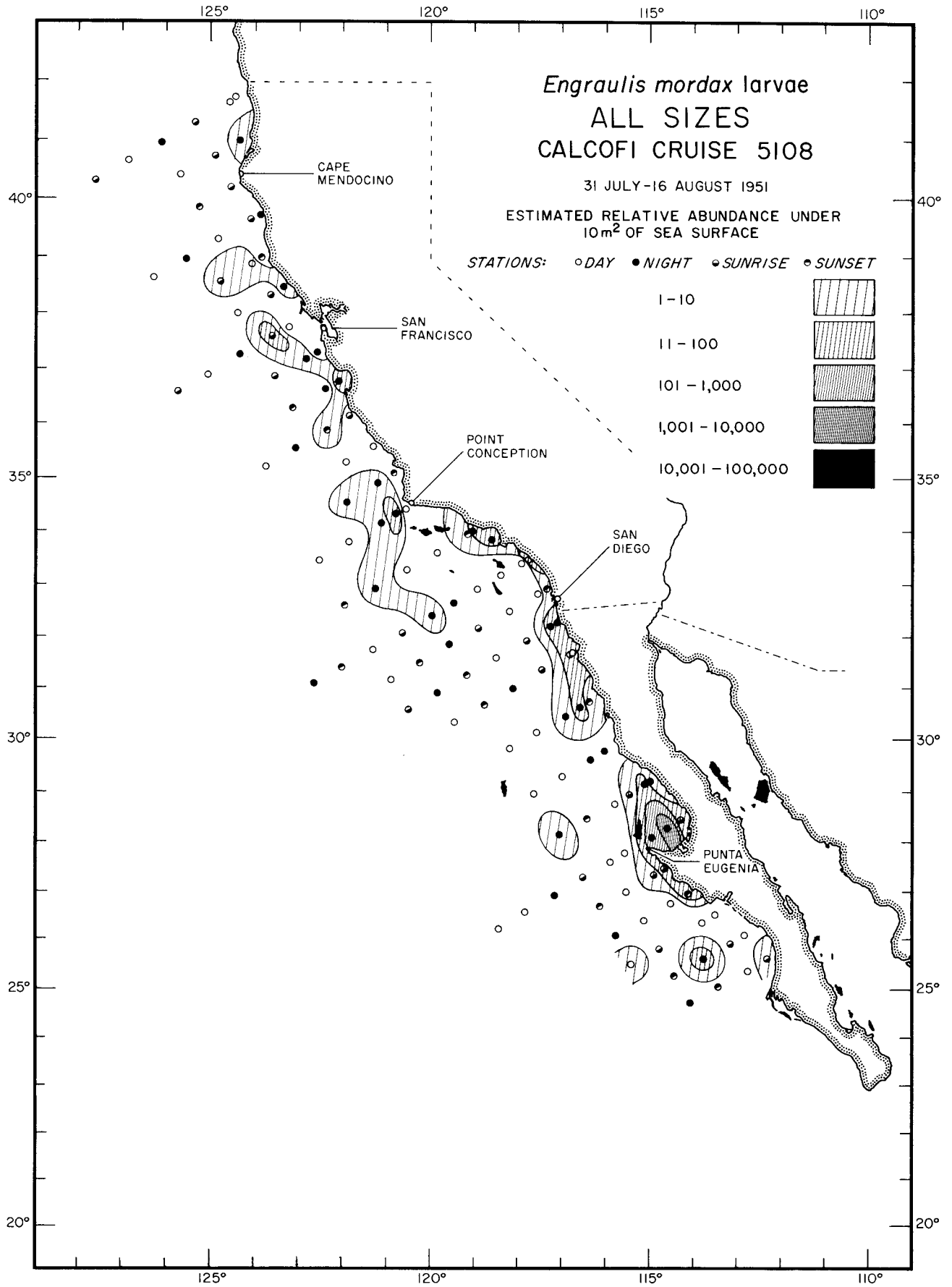
*Engraulis mordax* larvae

All Sizes

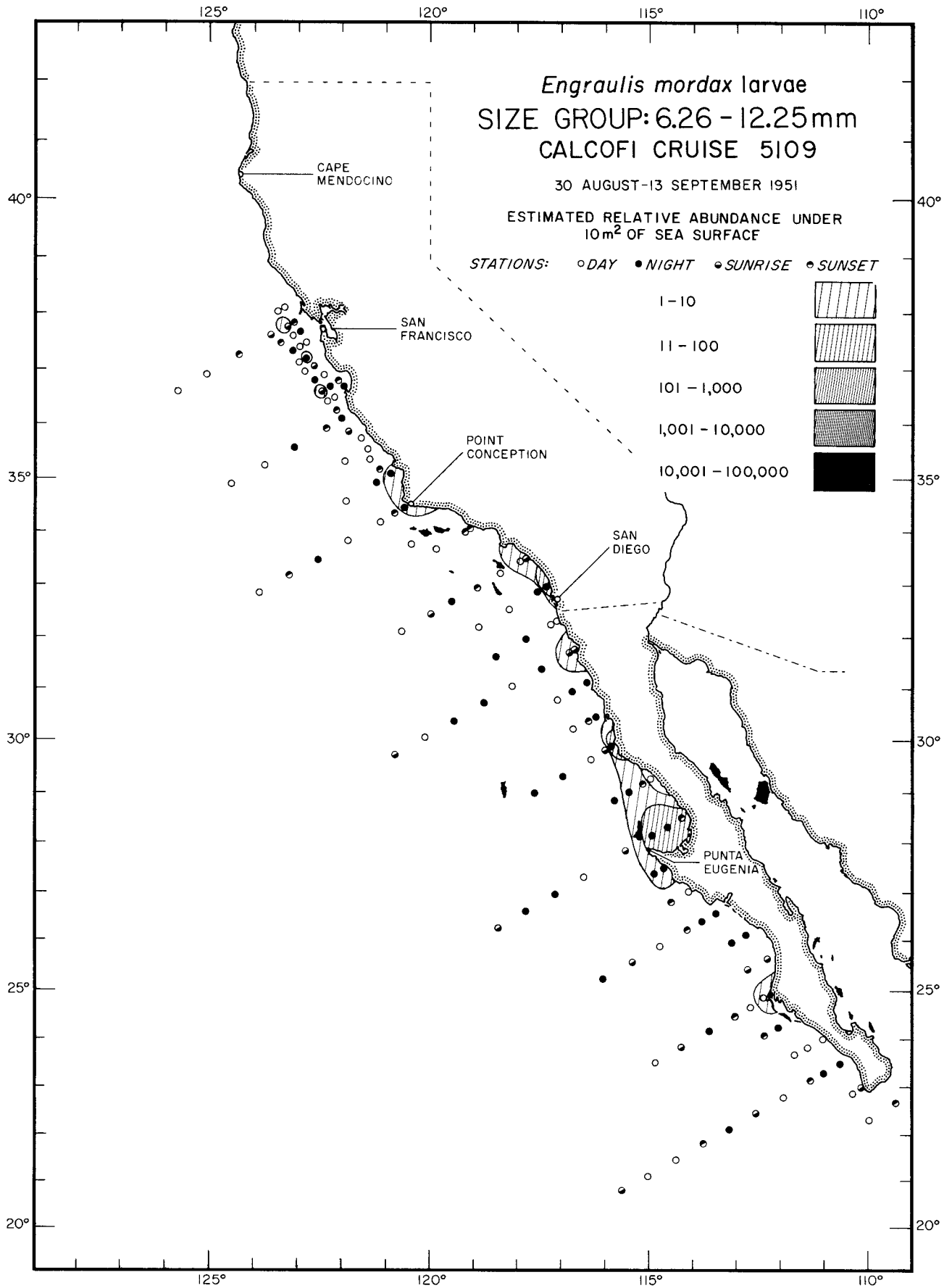
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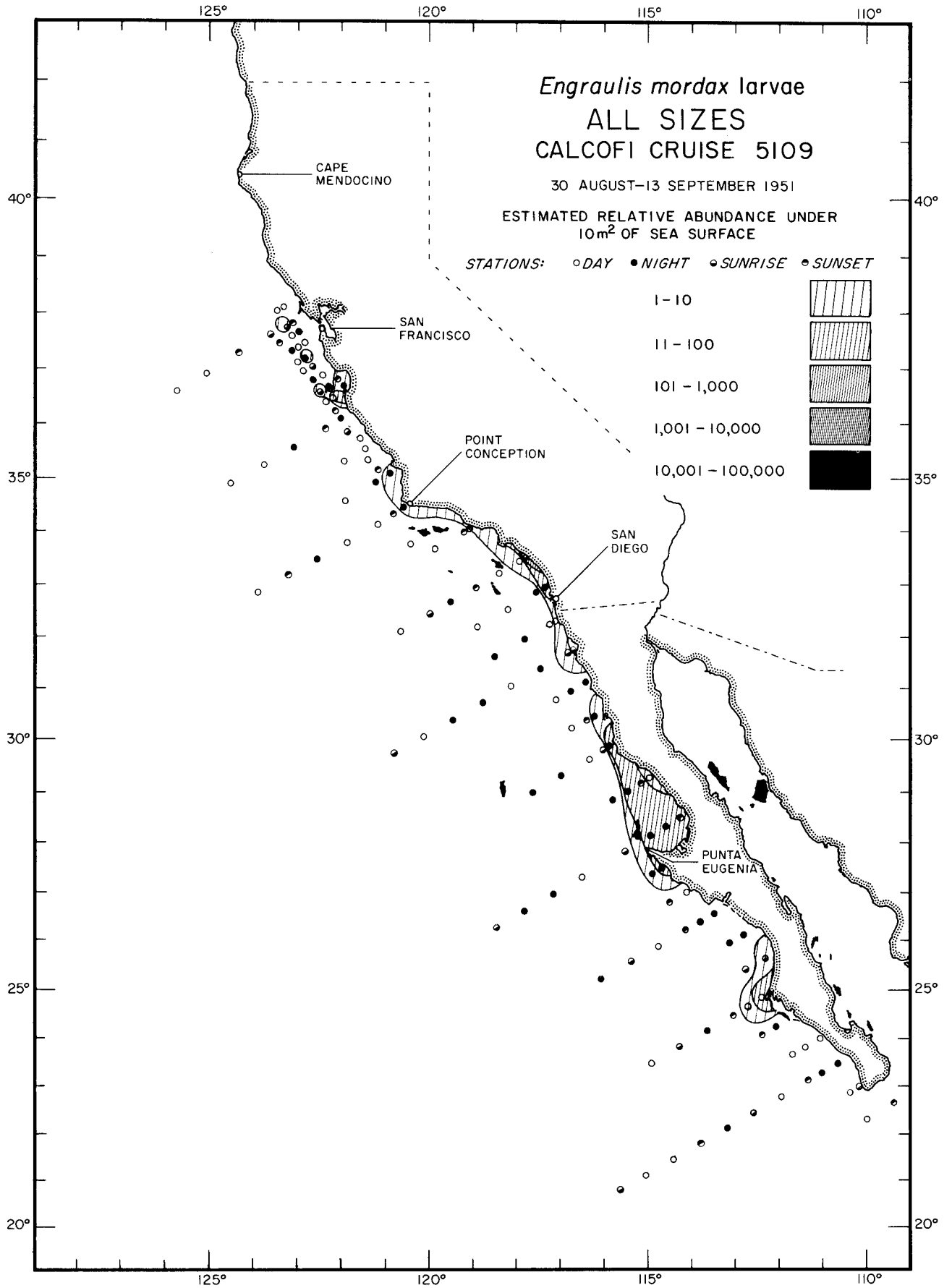
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 5108



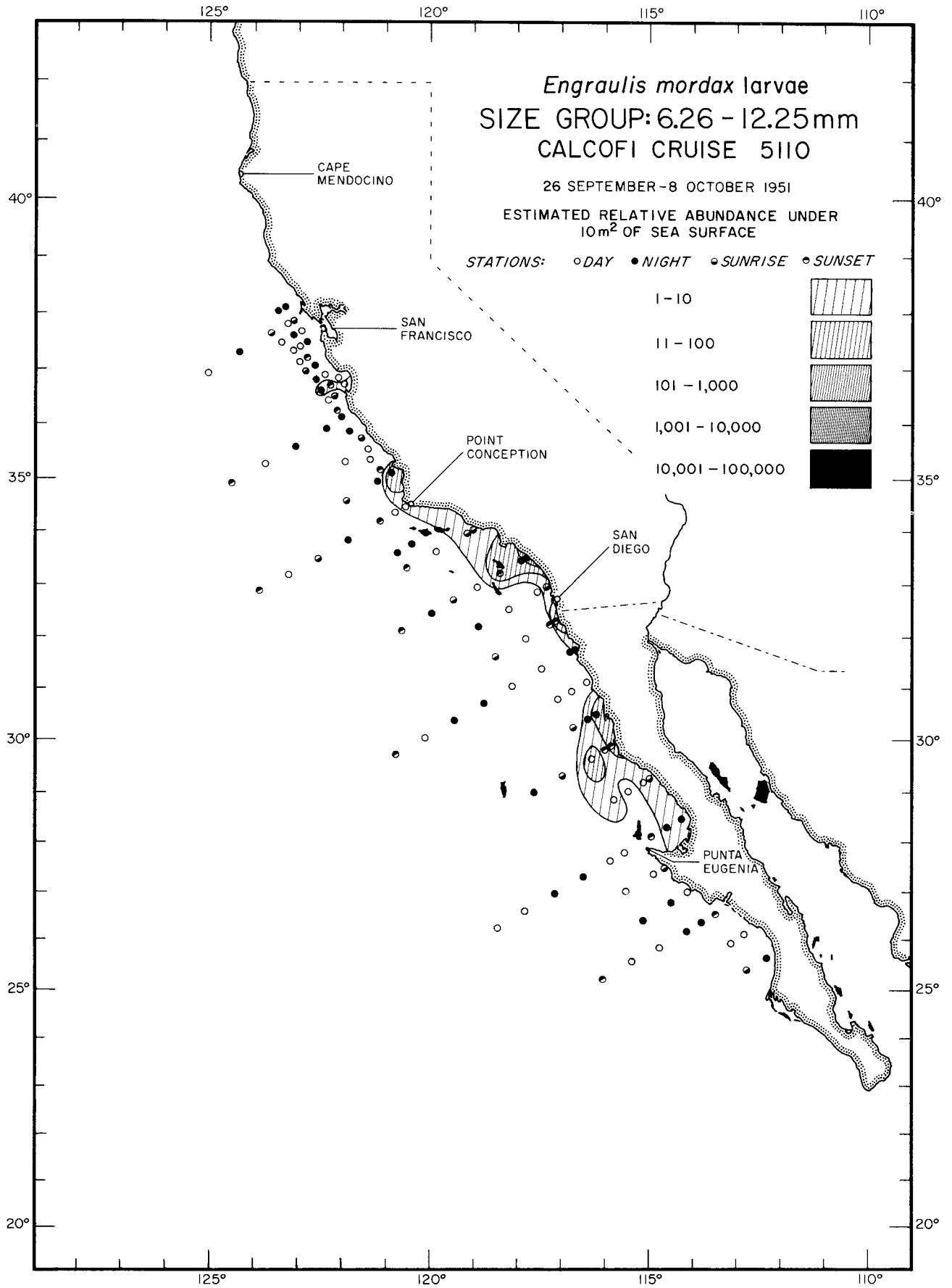
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All Sizes  
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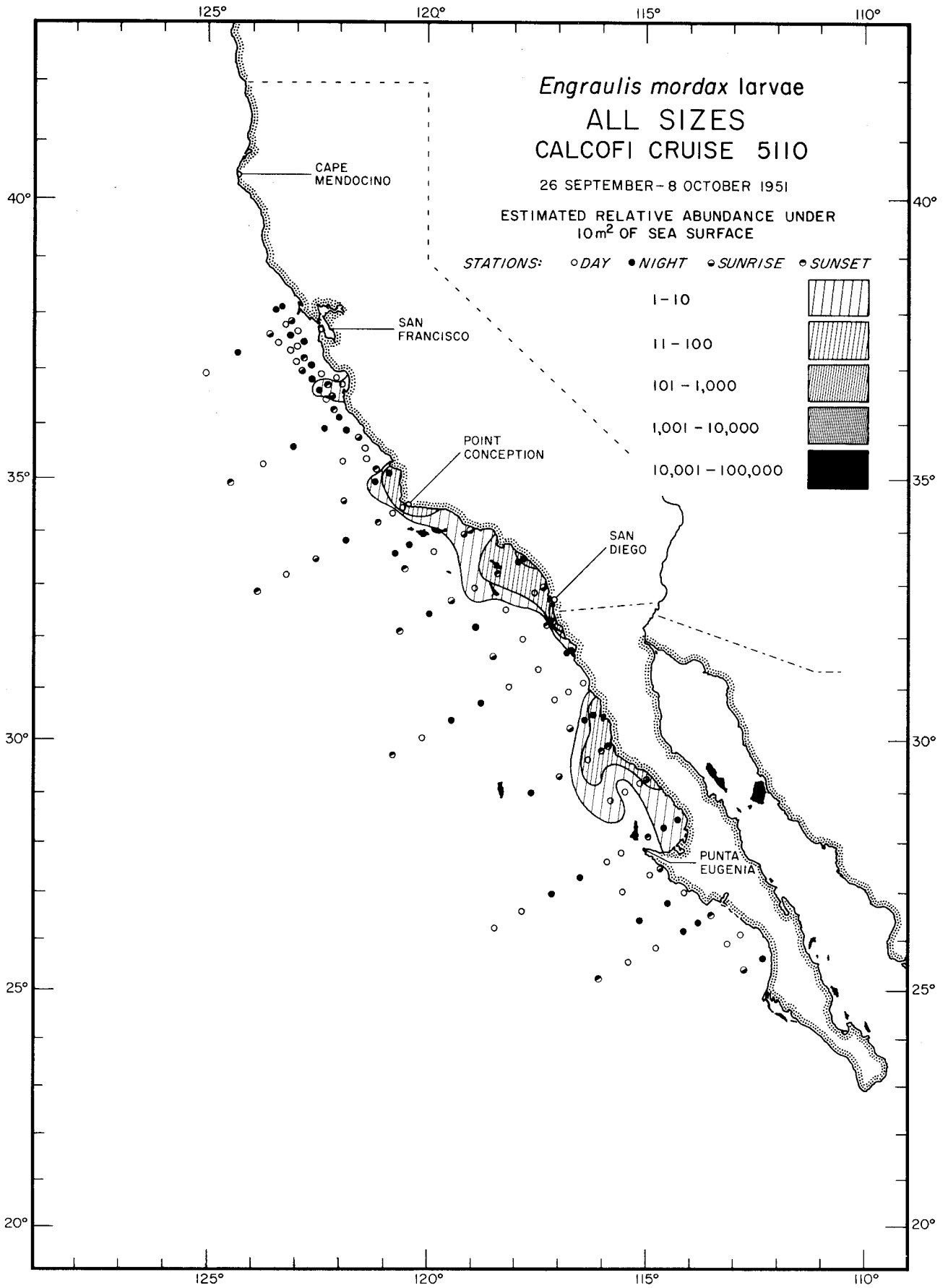
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Size Group: 6.26-12.25mm  
5109



*Engraulis mordax* larvae  
All Sizes  
5109



*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
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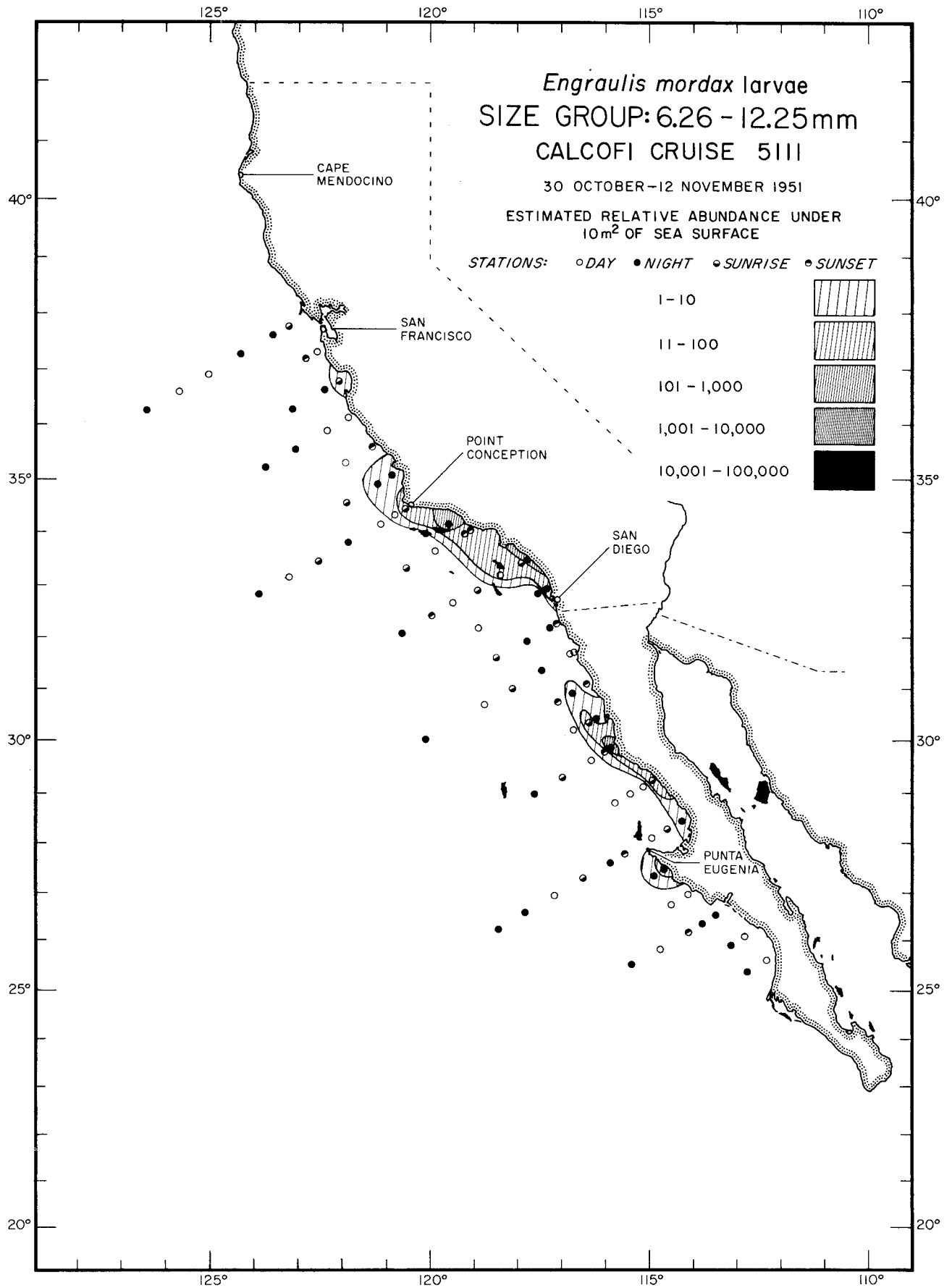


*Engraulis mordax* larvae

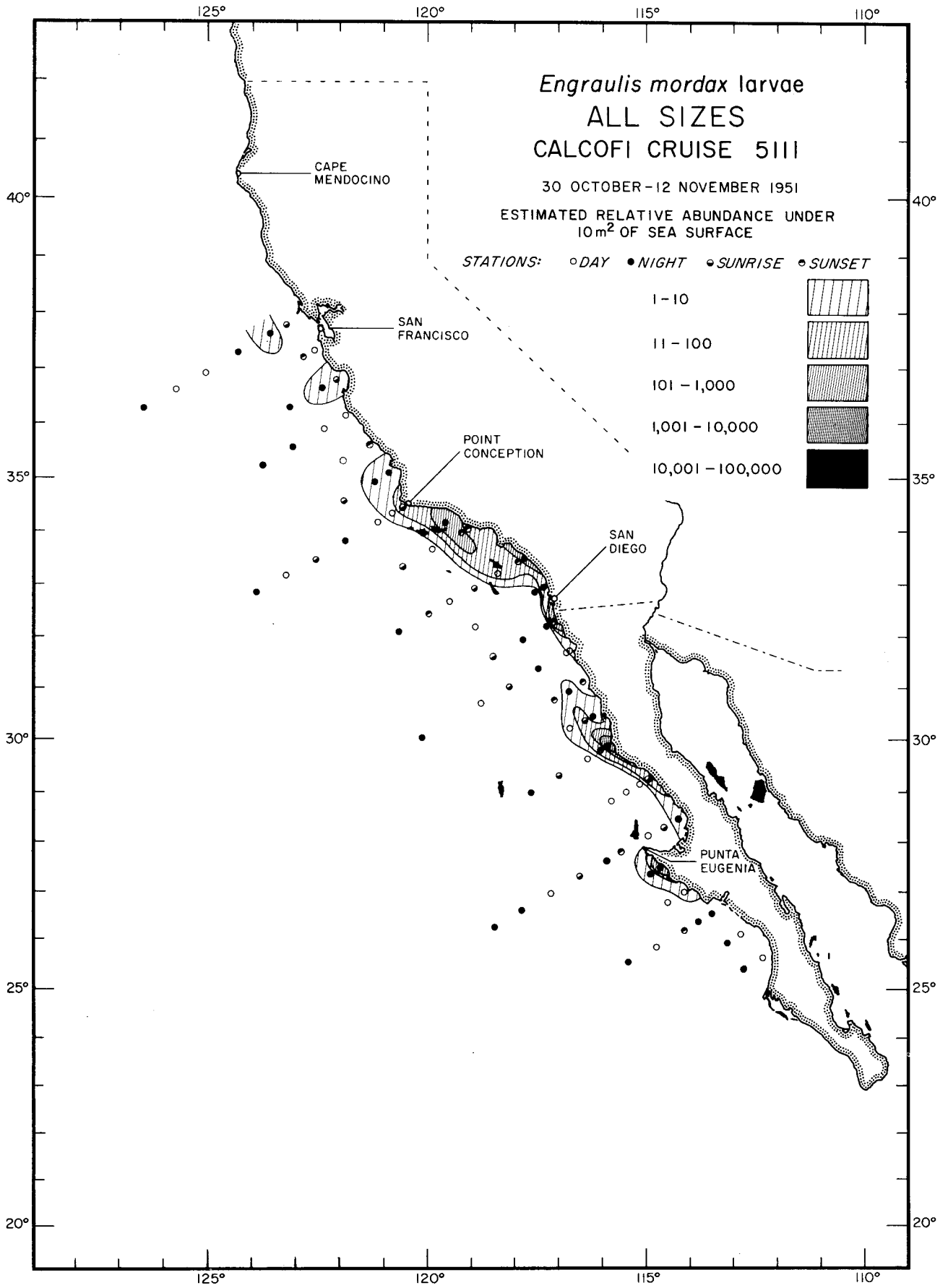
All Sizes

5110





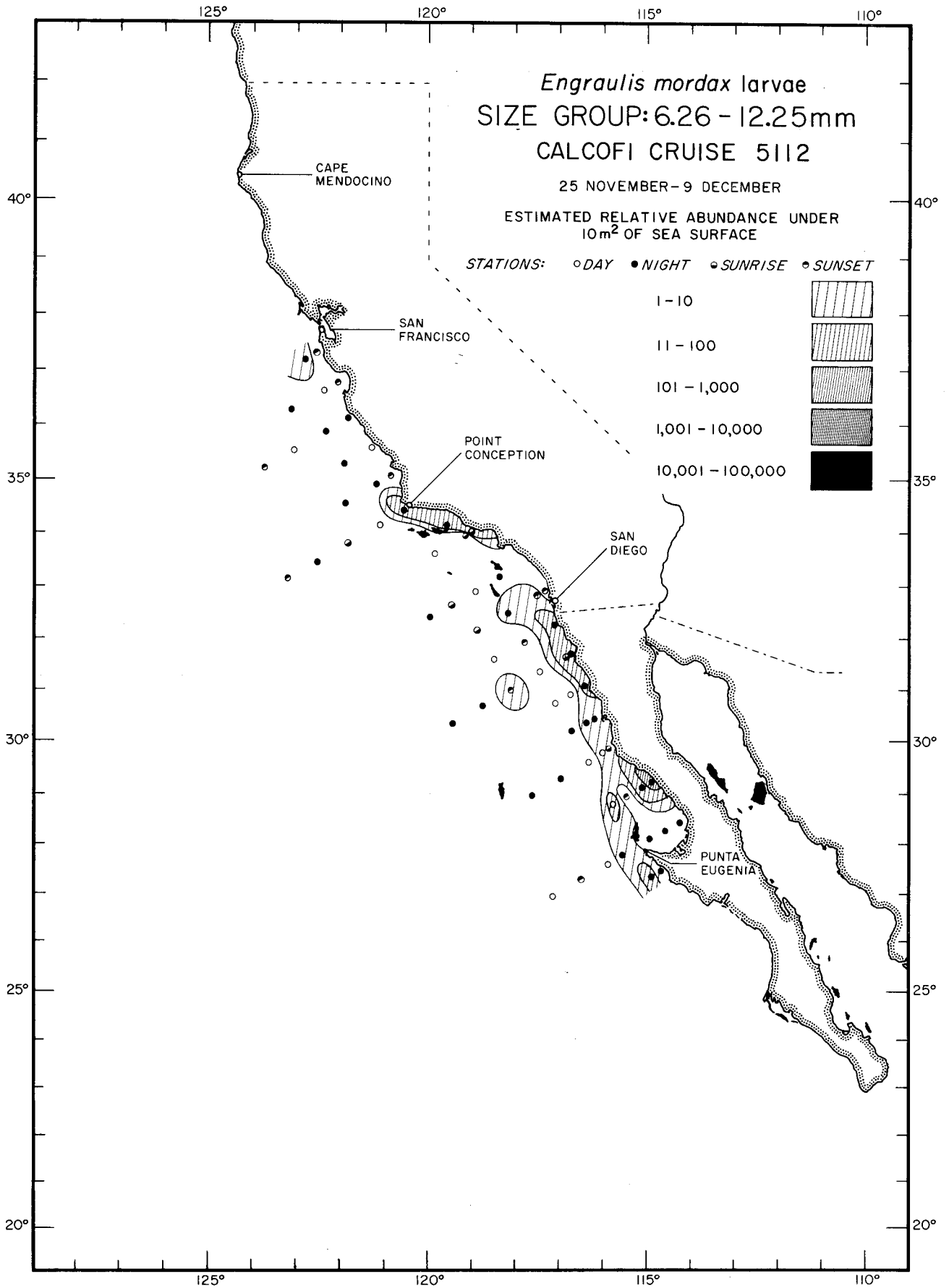
*Engraulis mordax* larvae  
 Size Group: 6.26-12.25mm  
 5111



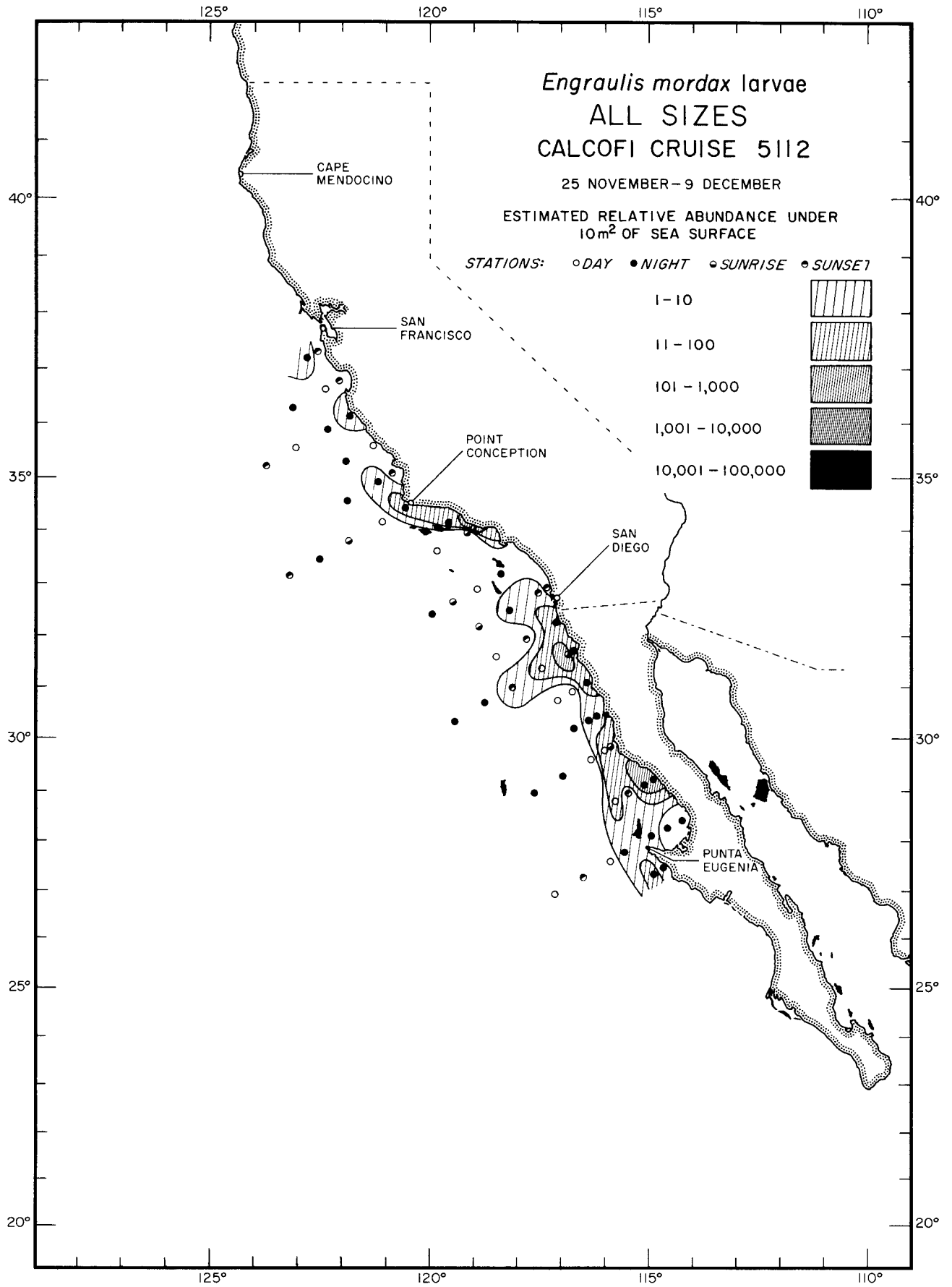
*Engraulis mordax* larvae

All Sizes

5111



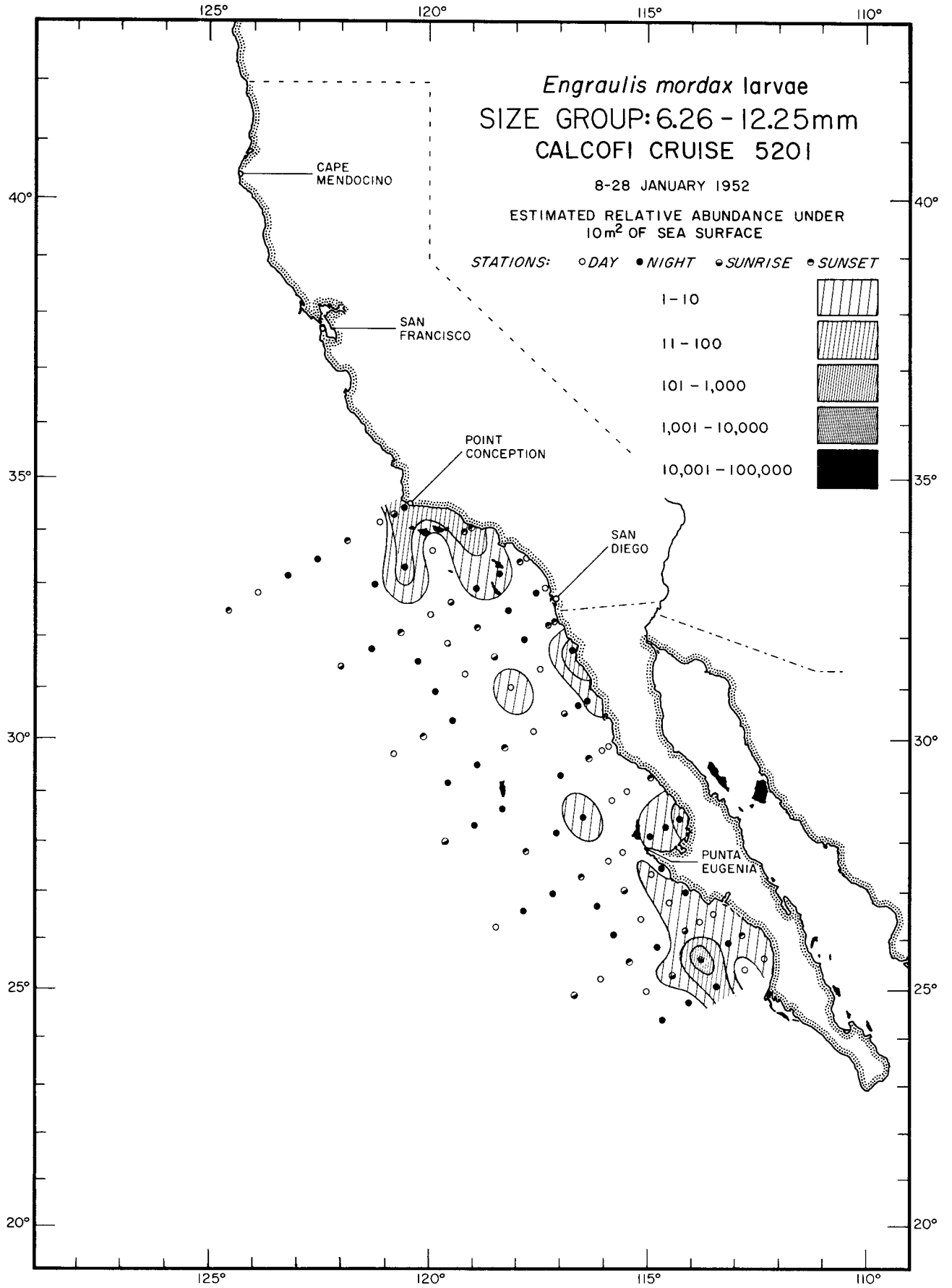
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Size Group: 6.26-12.25mm  
5112



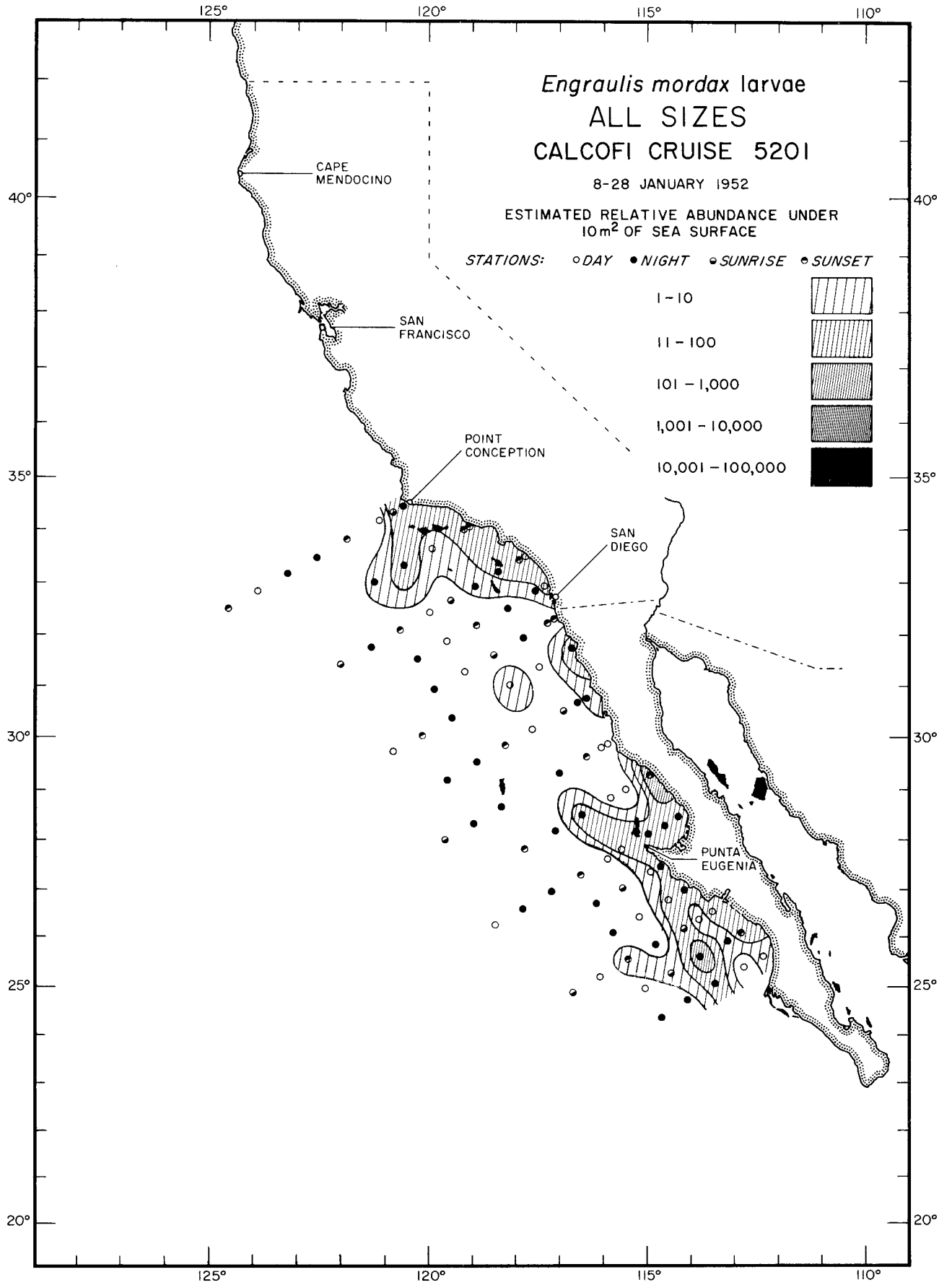
*Engraulis mordax* larvae

All Sizes

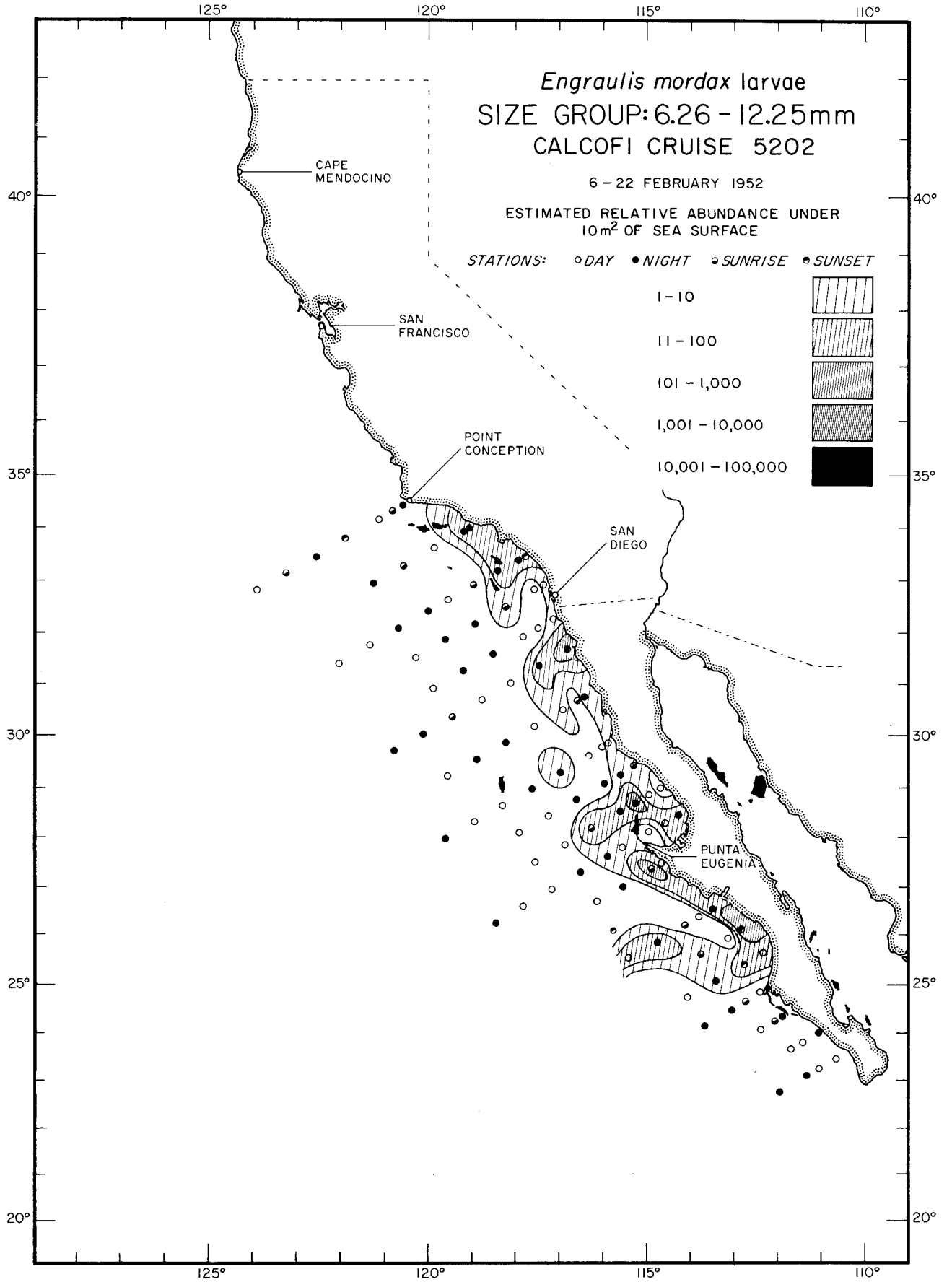
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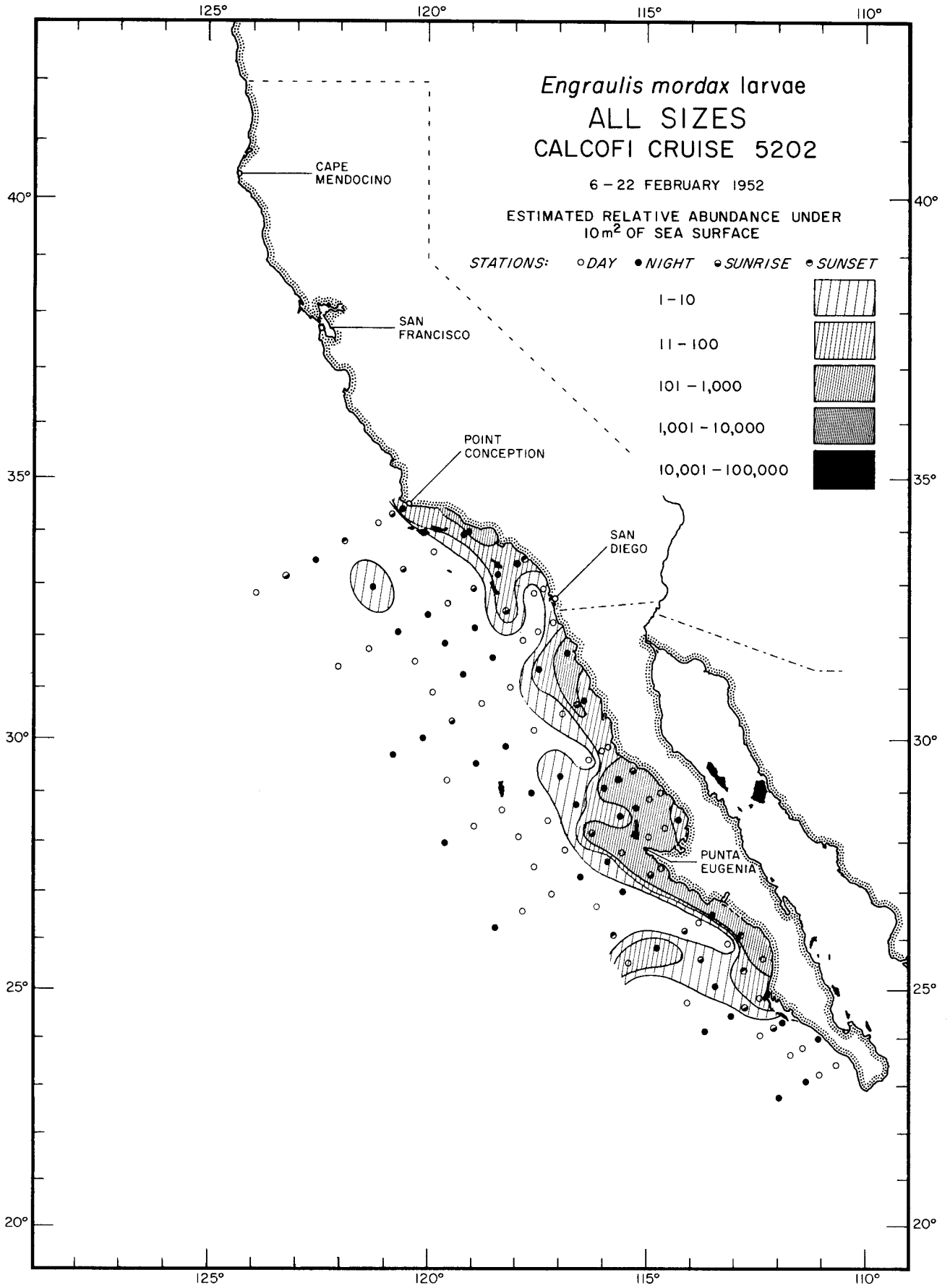
*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5201



*Engraulis mordax* larvae  
All Sizes  
5201



*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5202

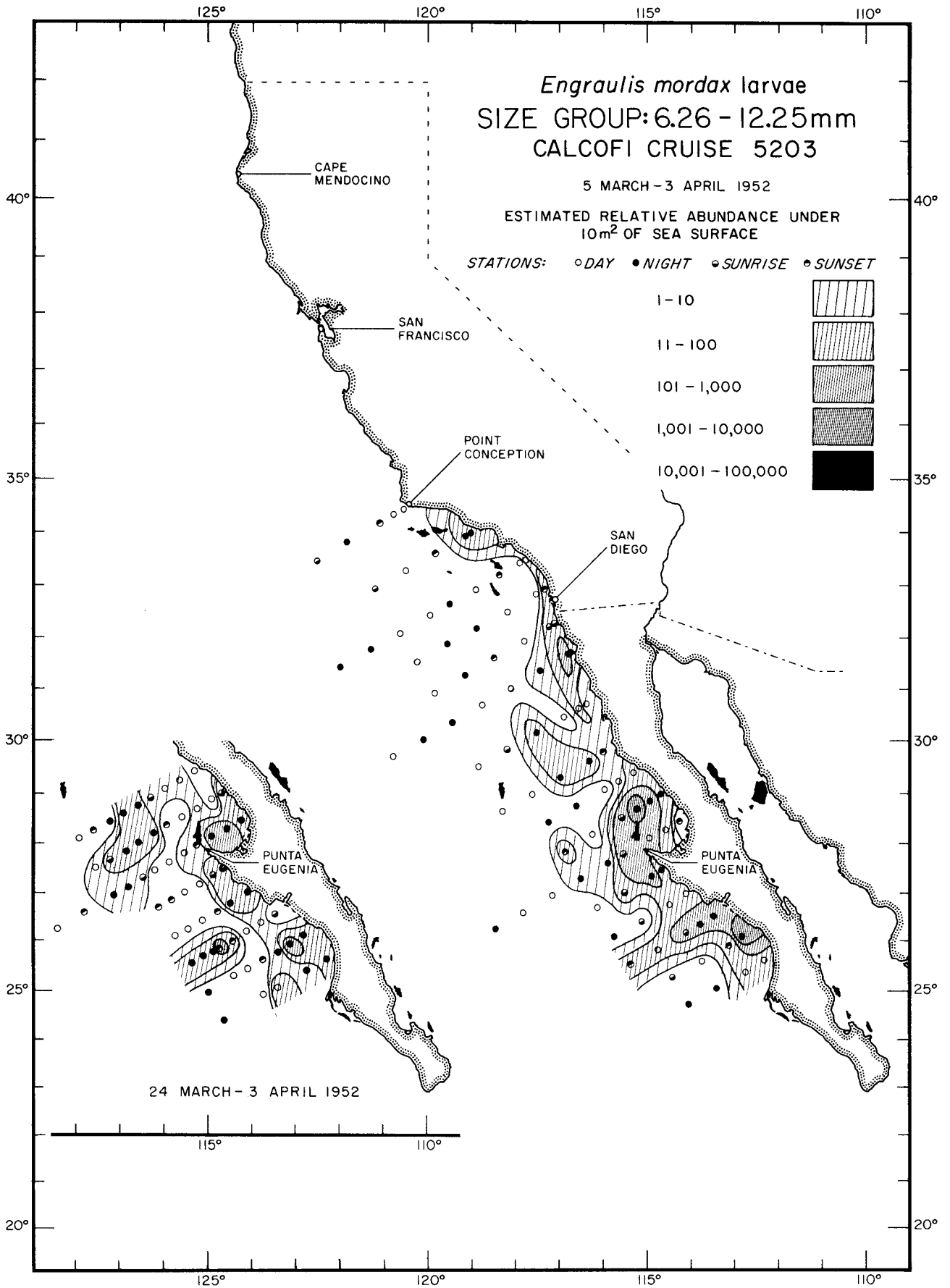


*Engraulis mordax* larvae

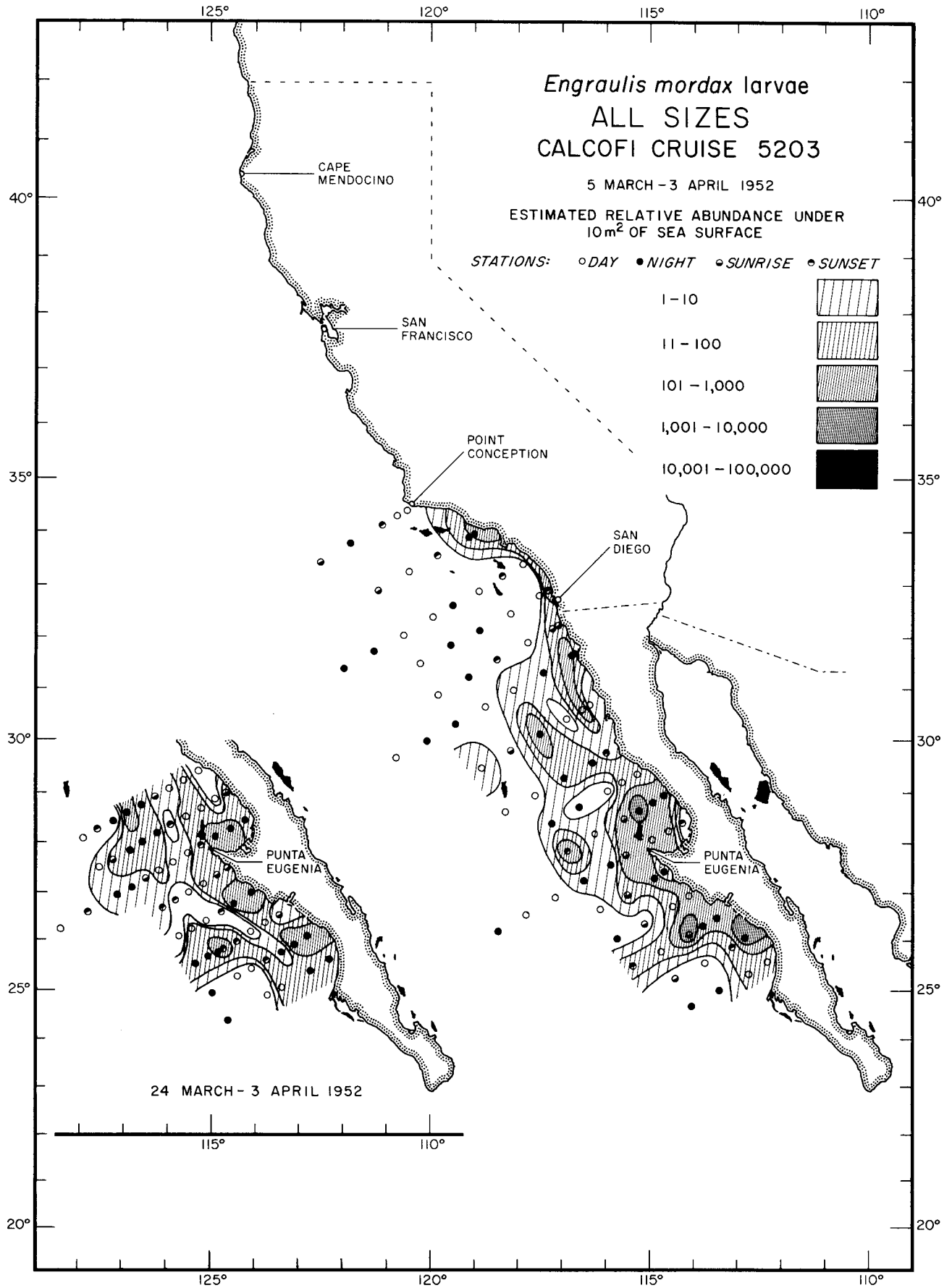
All Sizes

5202





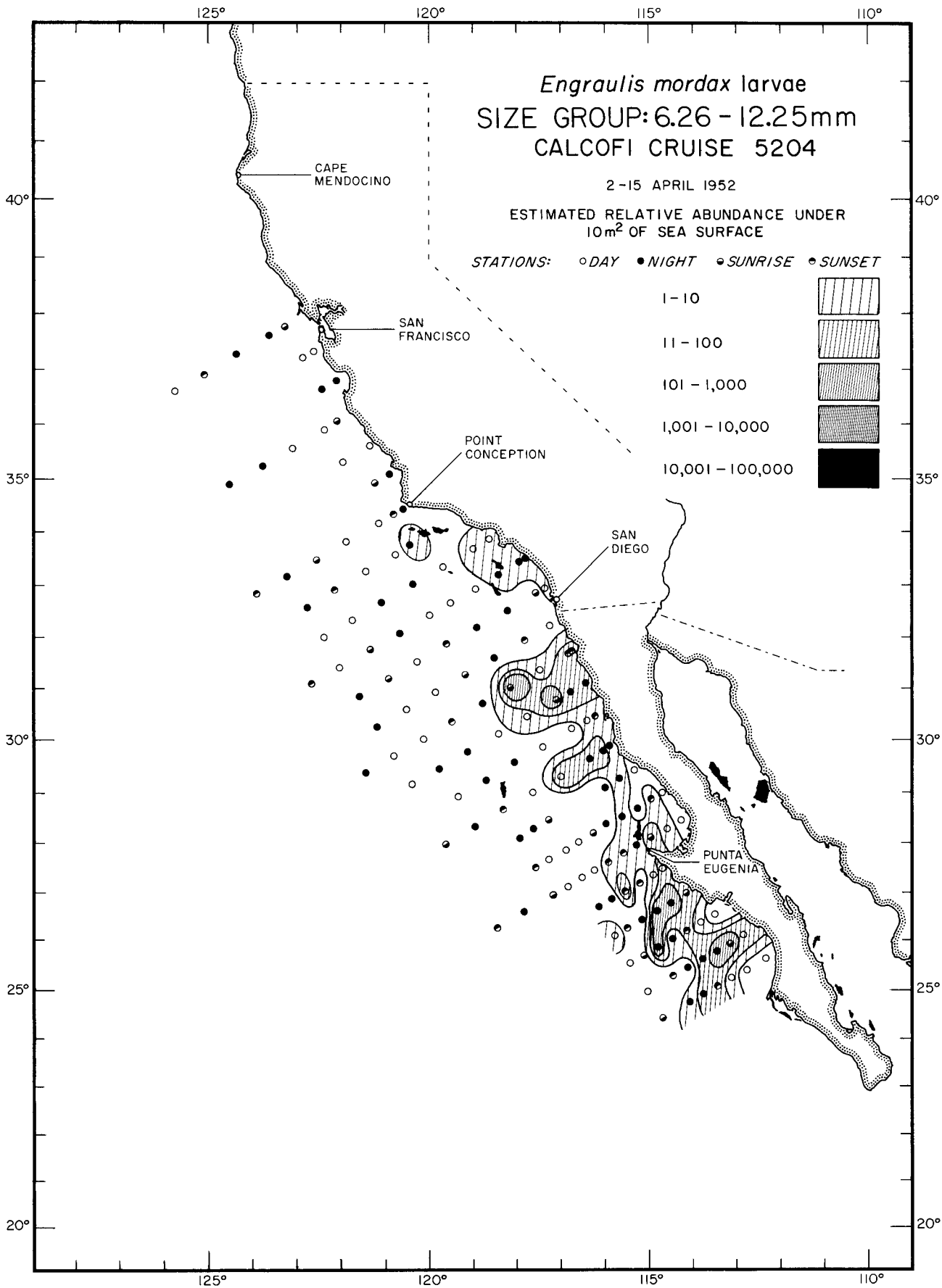
*Engraulis mordax* larvae  
 Size Group: 6.26-12.25mm  
 5203



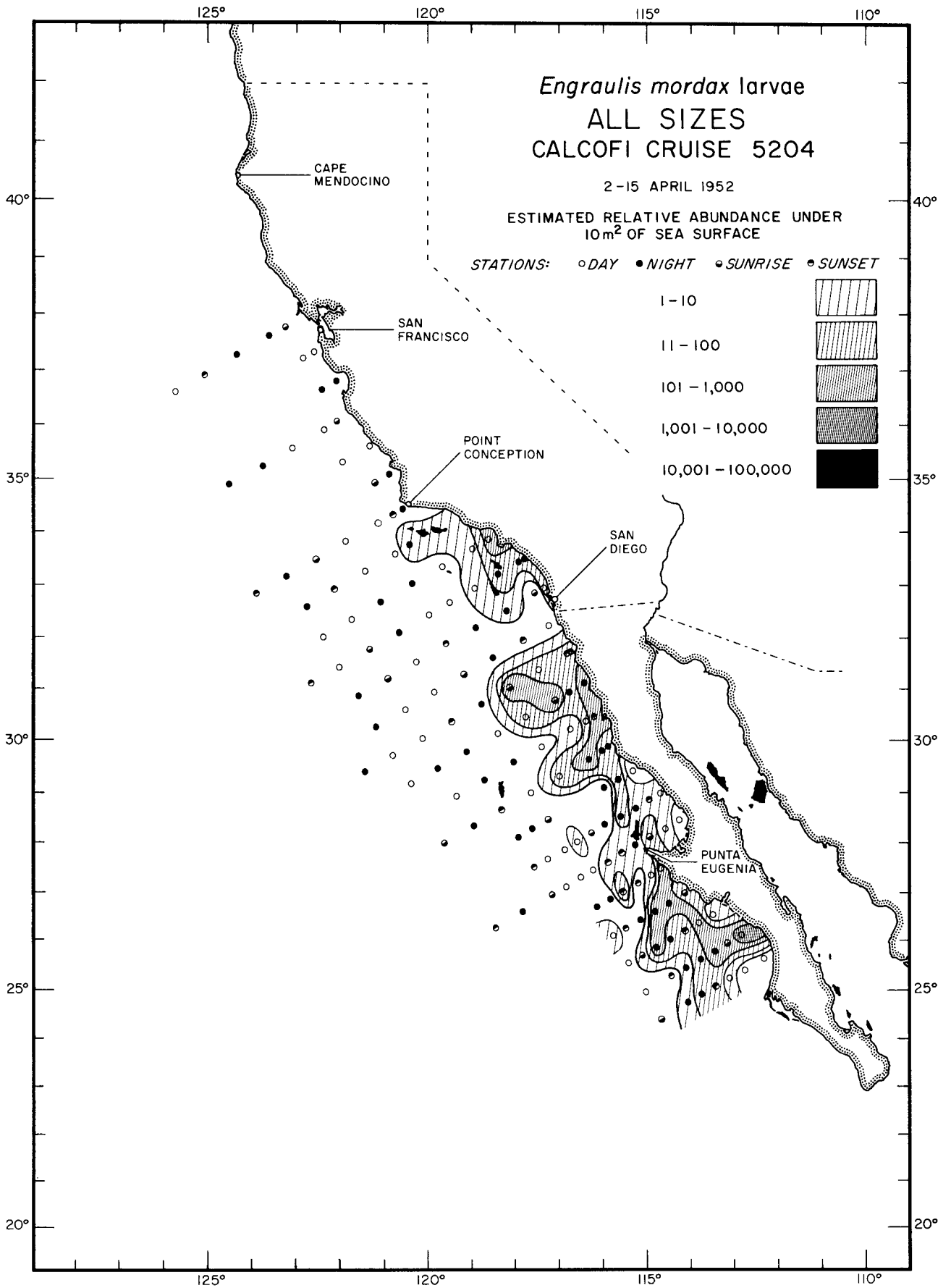
*Engraulis mordax* larvae

All Sizes

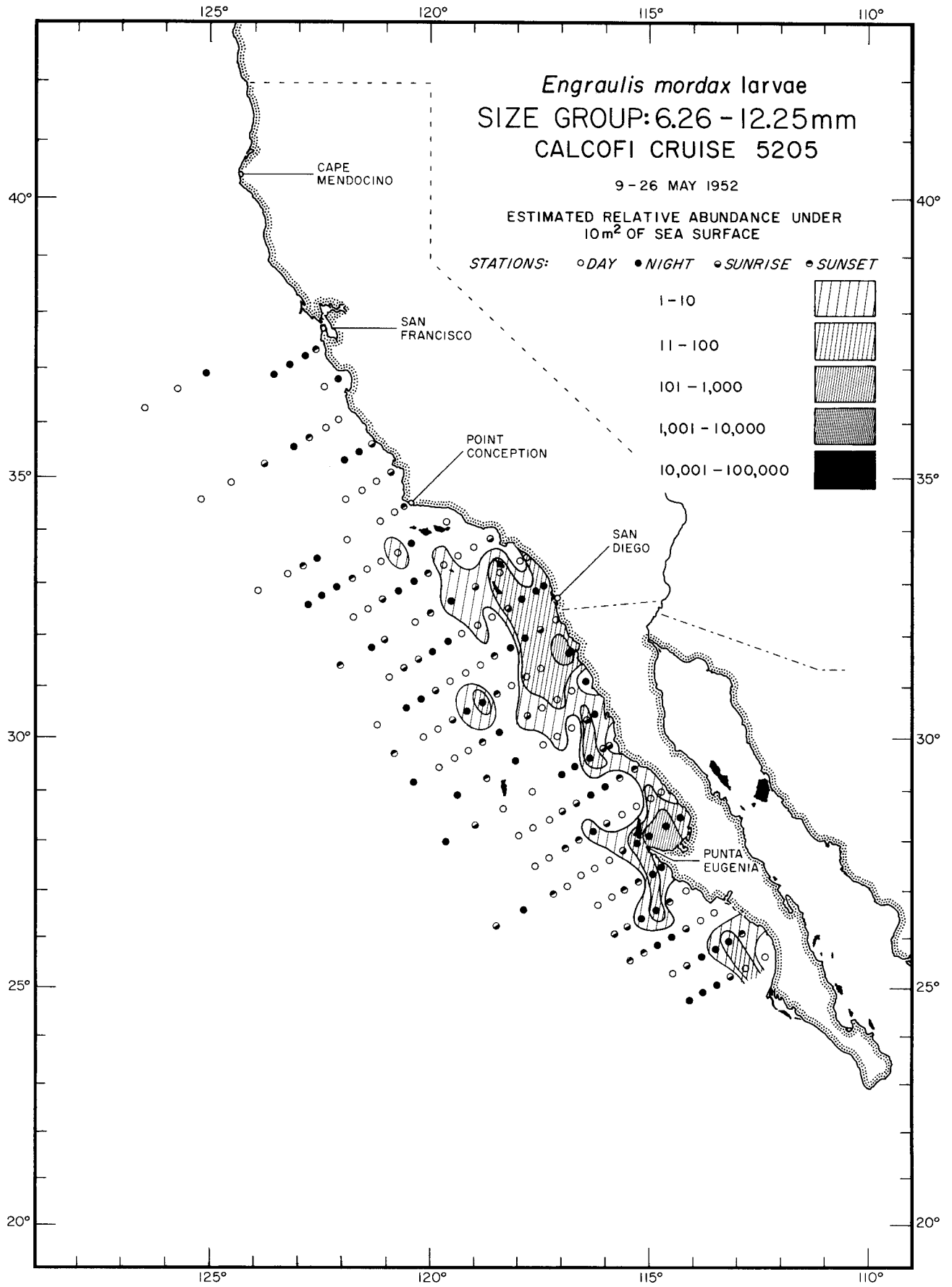
5203



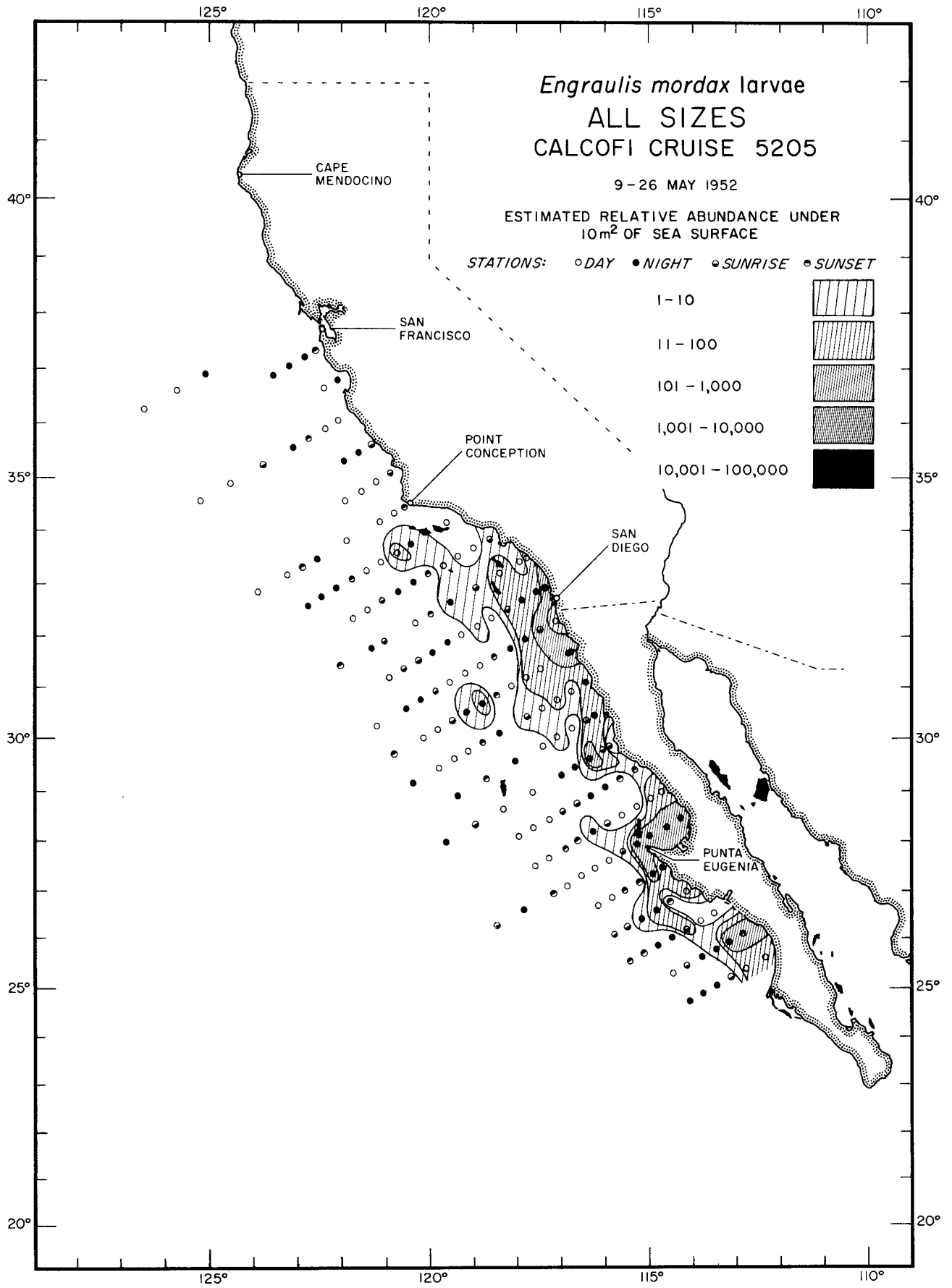
*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5204



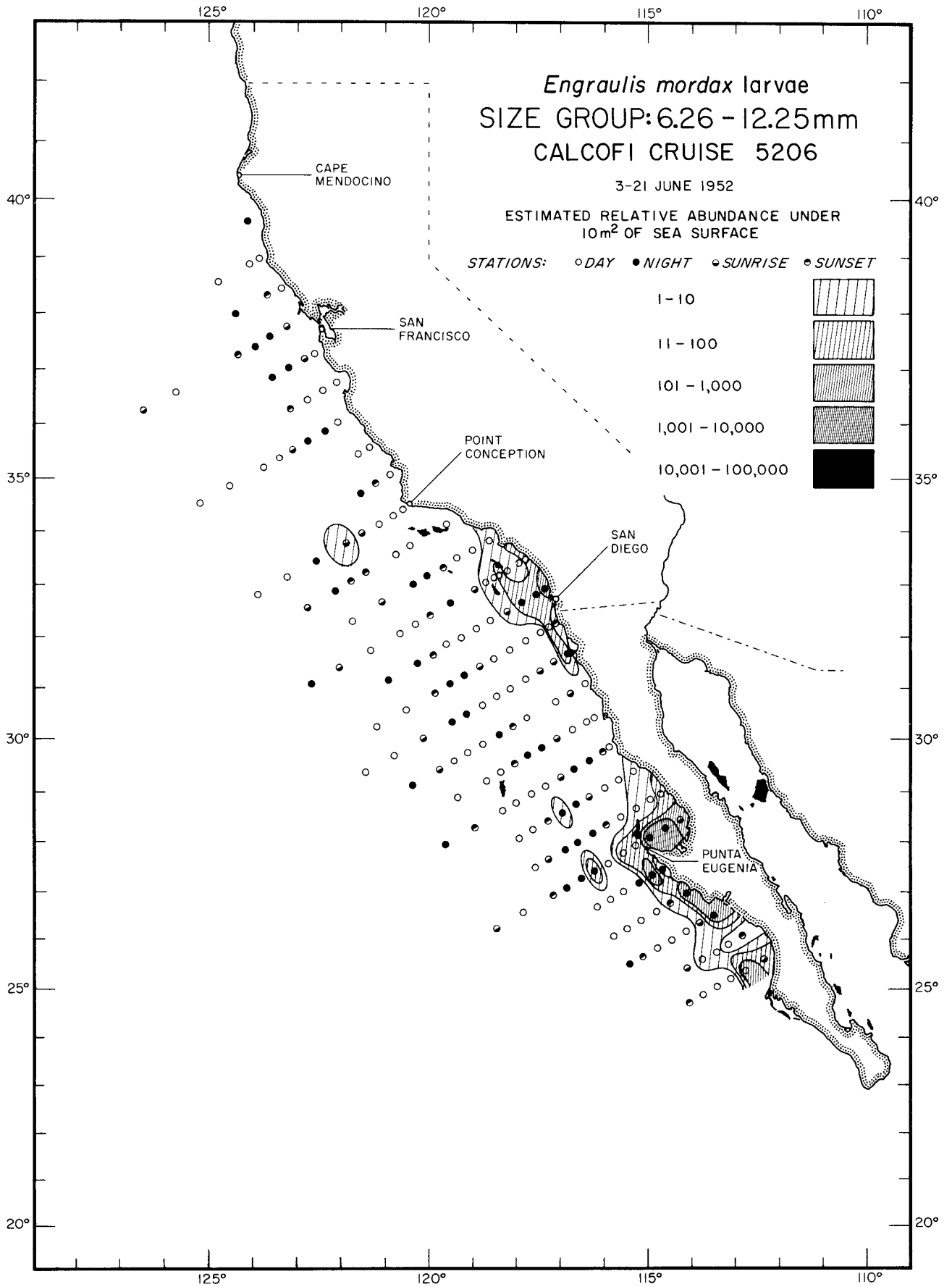
*Engraulis mordax* larvae  
All Sizes  
5204



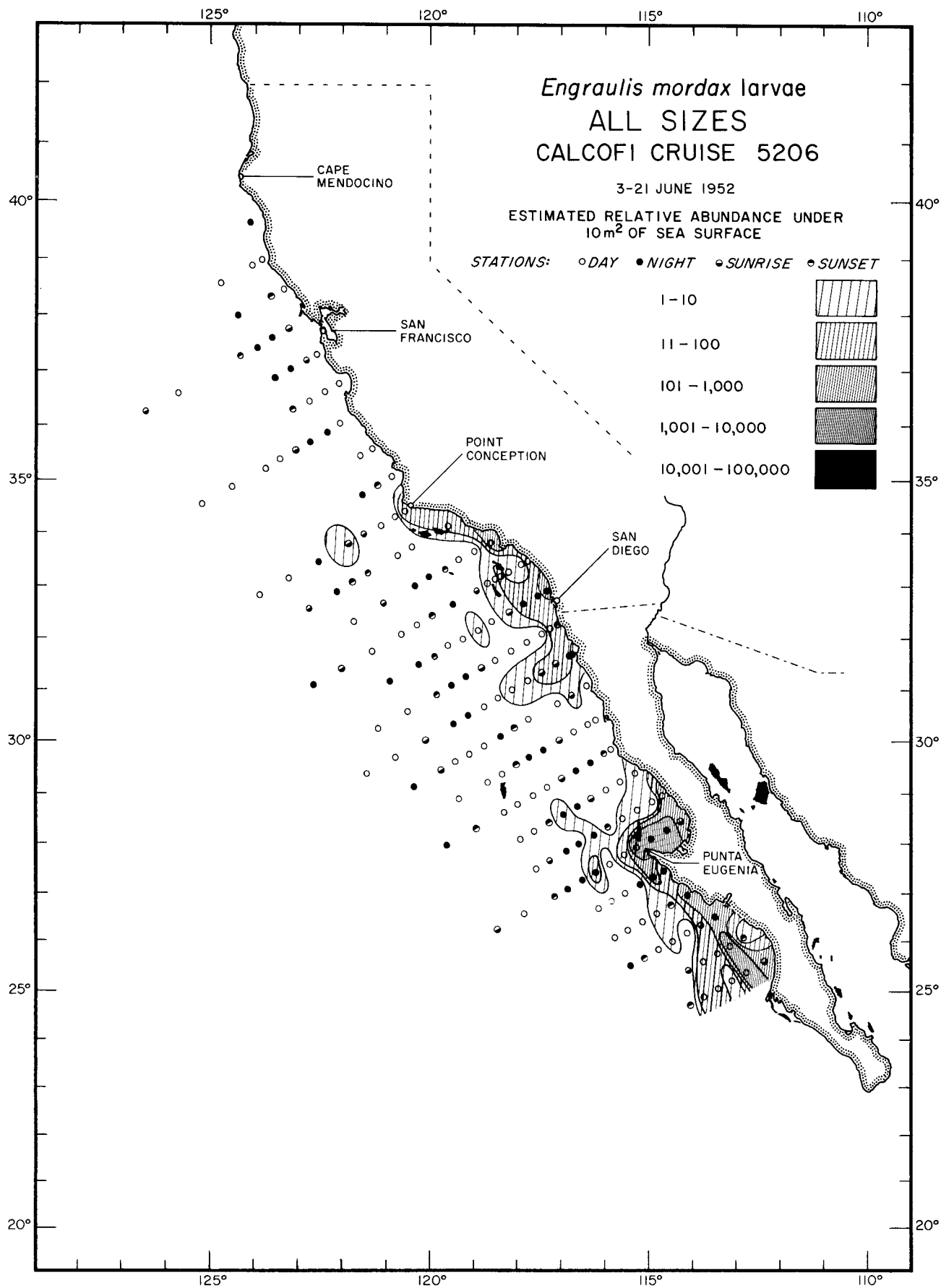
*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5205



*Engraulis mordax* larvae  
All Sizes  
5205



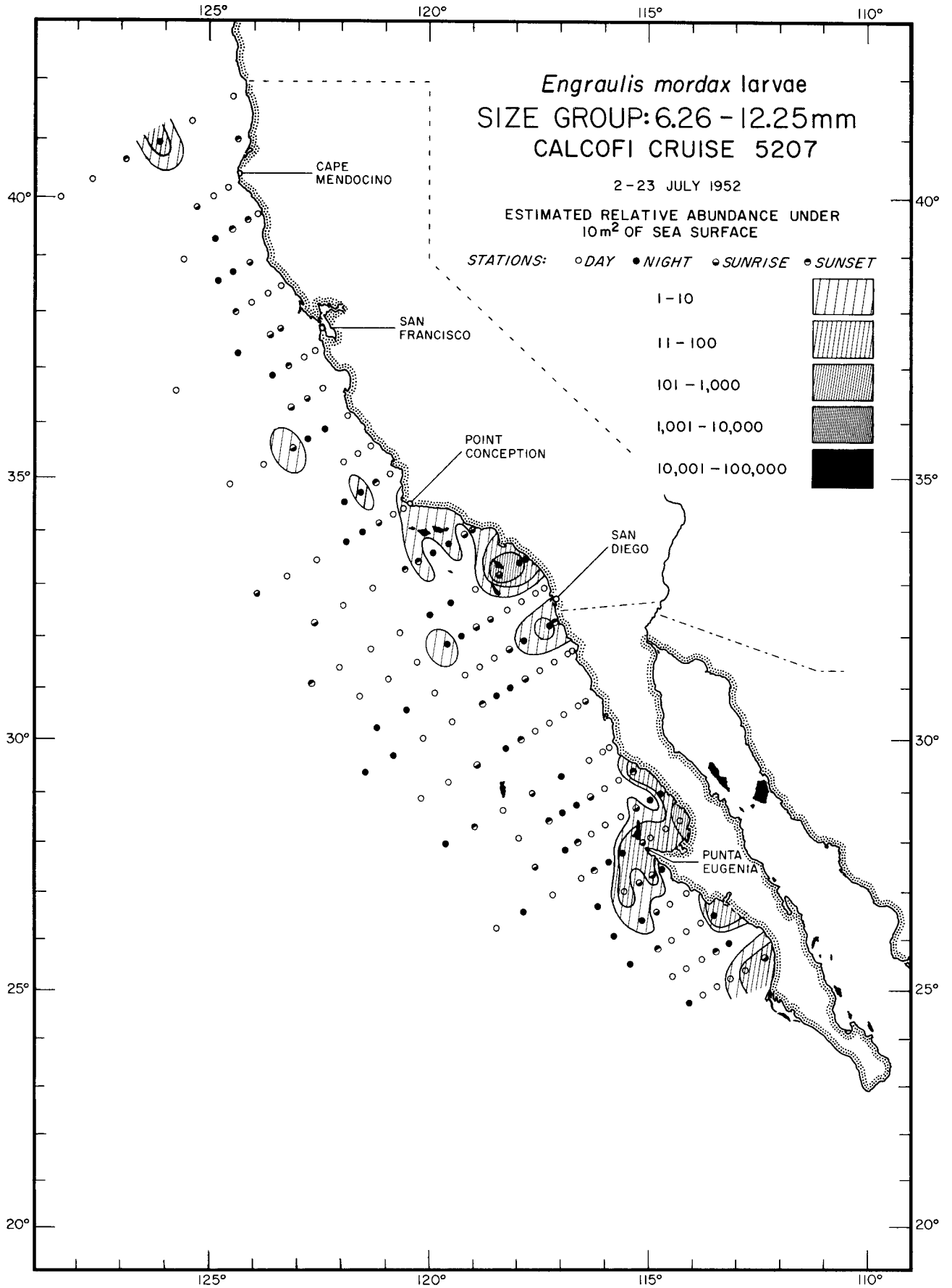
*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5206



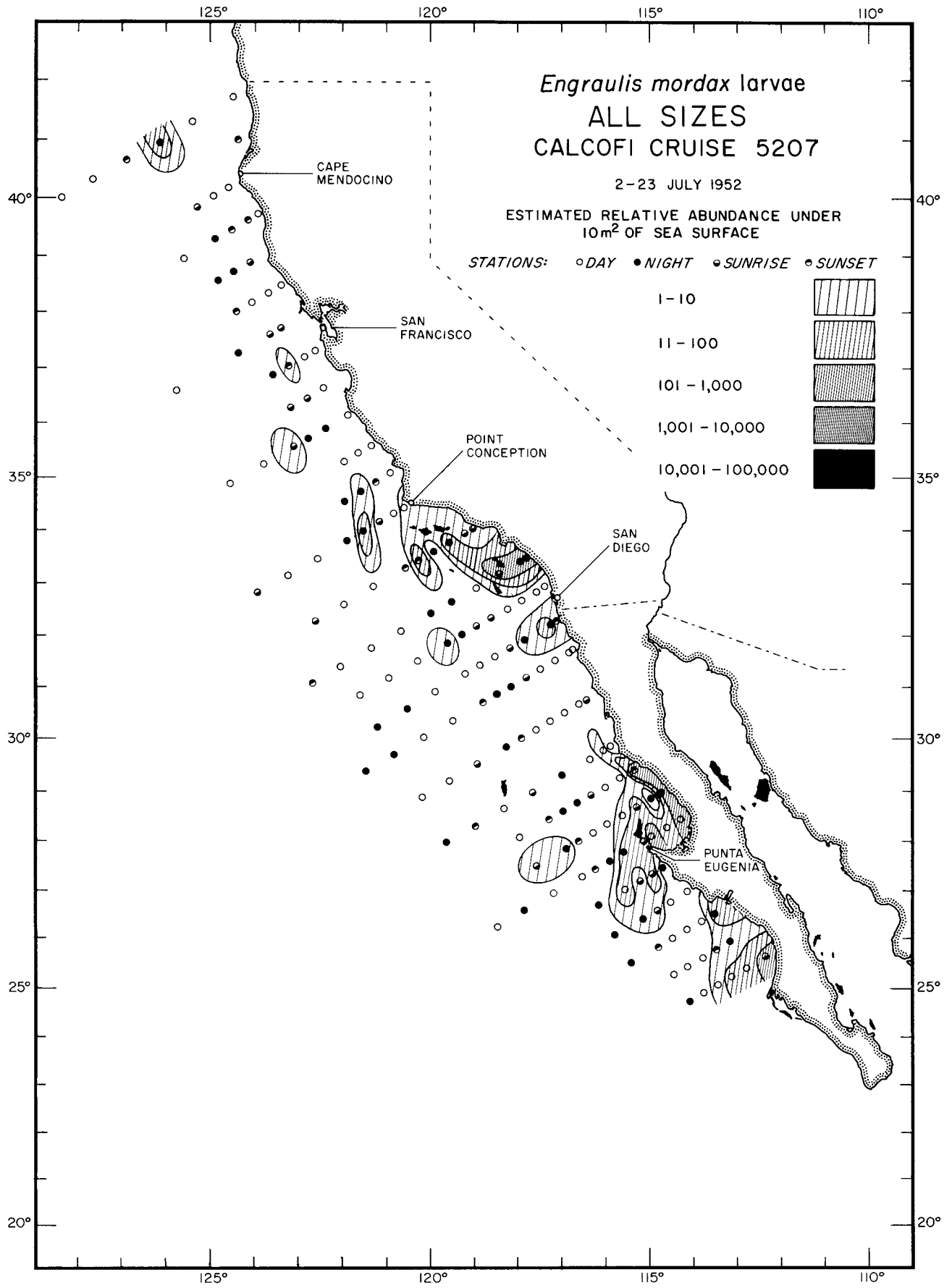
*Engraulis mordax* larvae

All Sizes  
5206



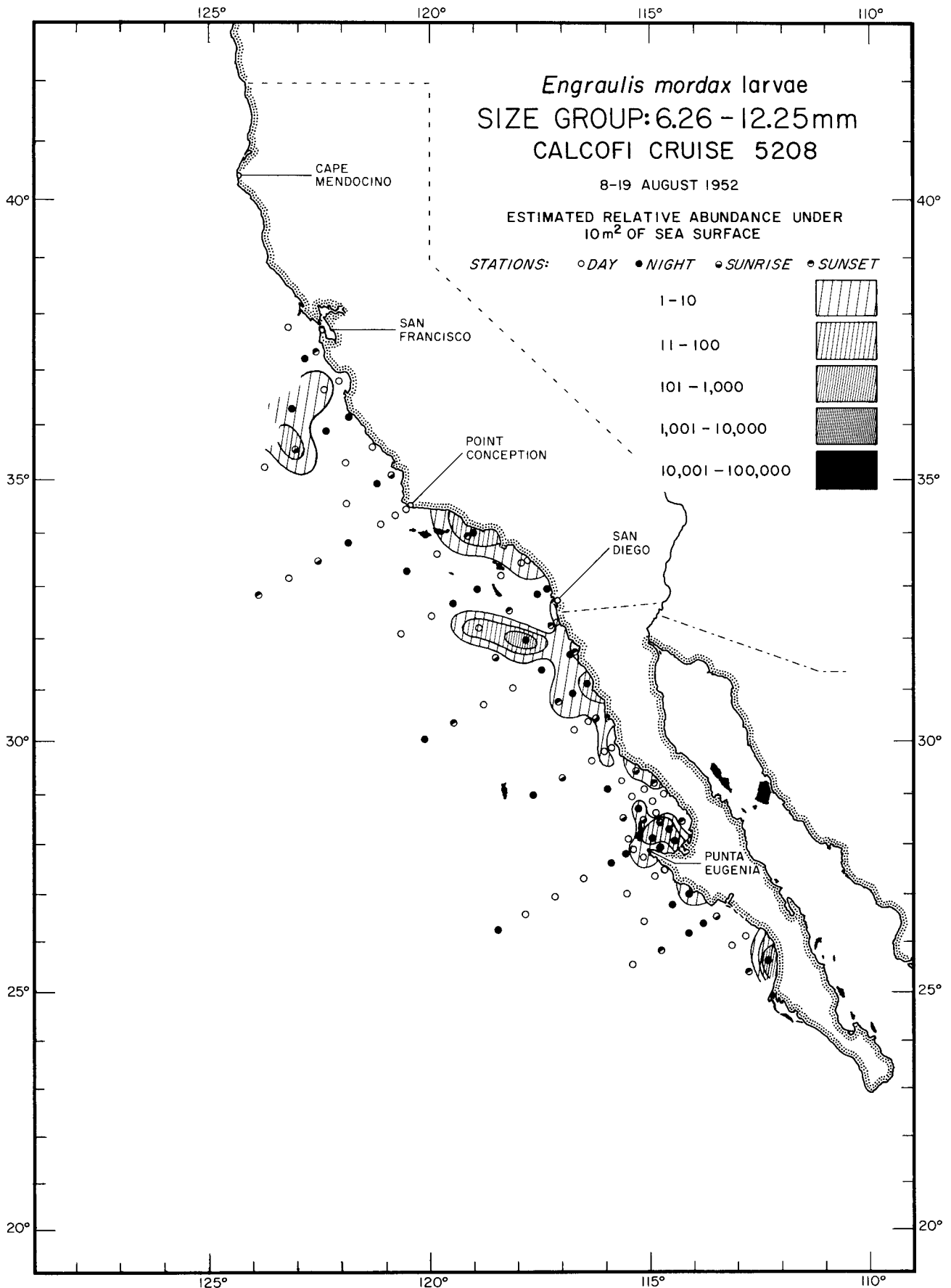


*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5207

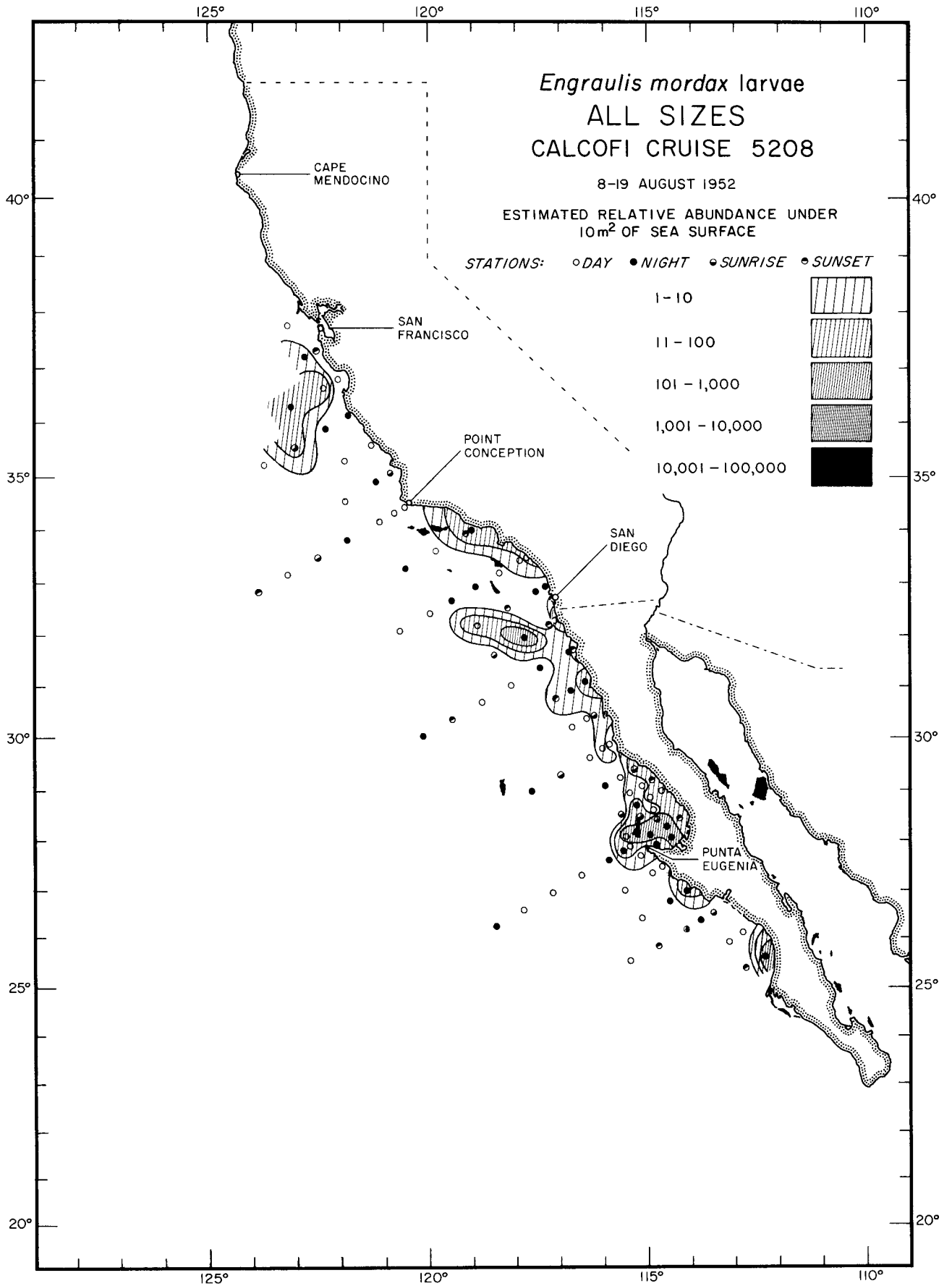


*Engraulis mordax* larvae

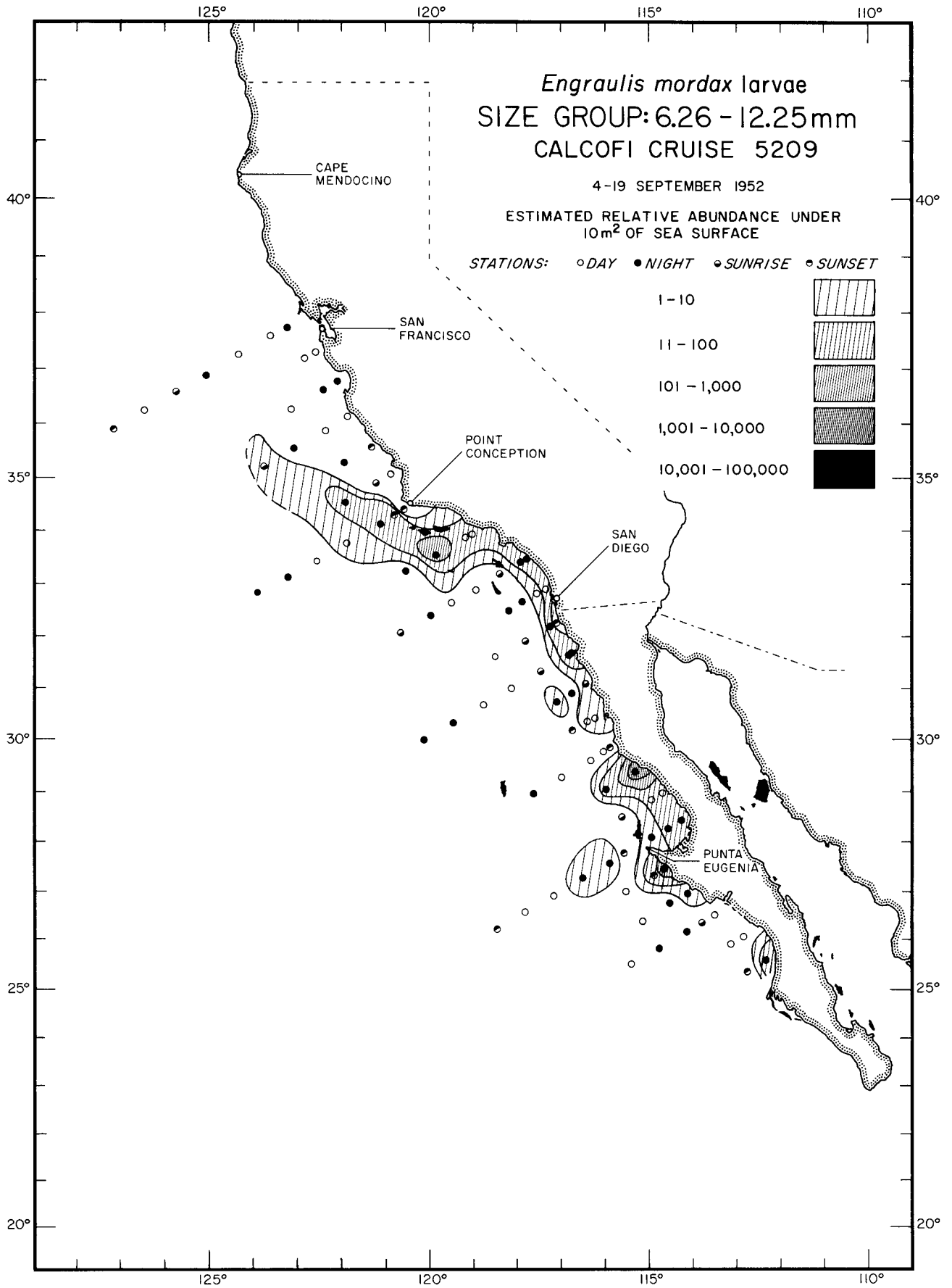
All Sizes  
5207



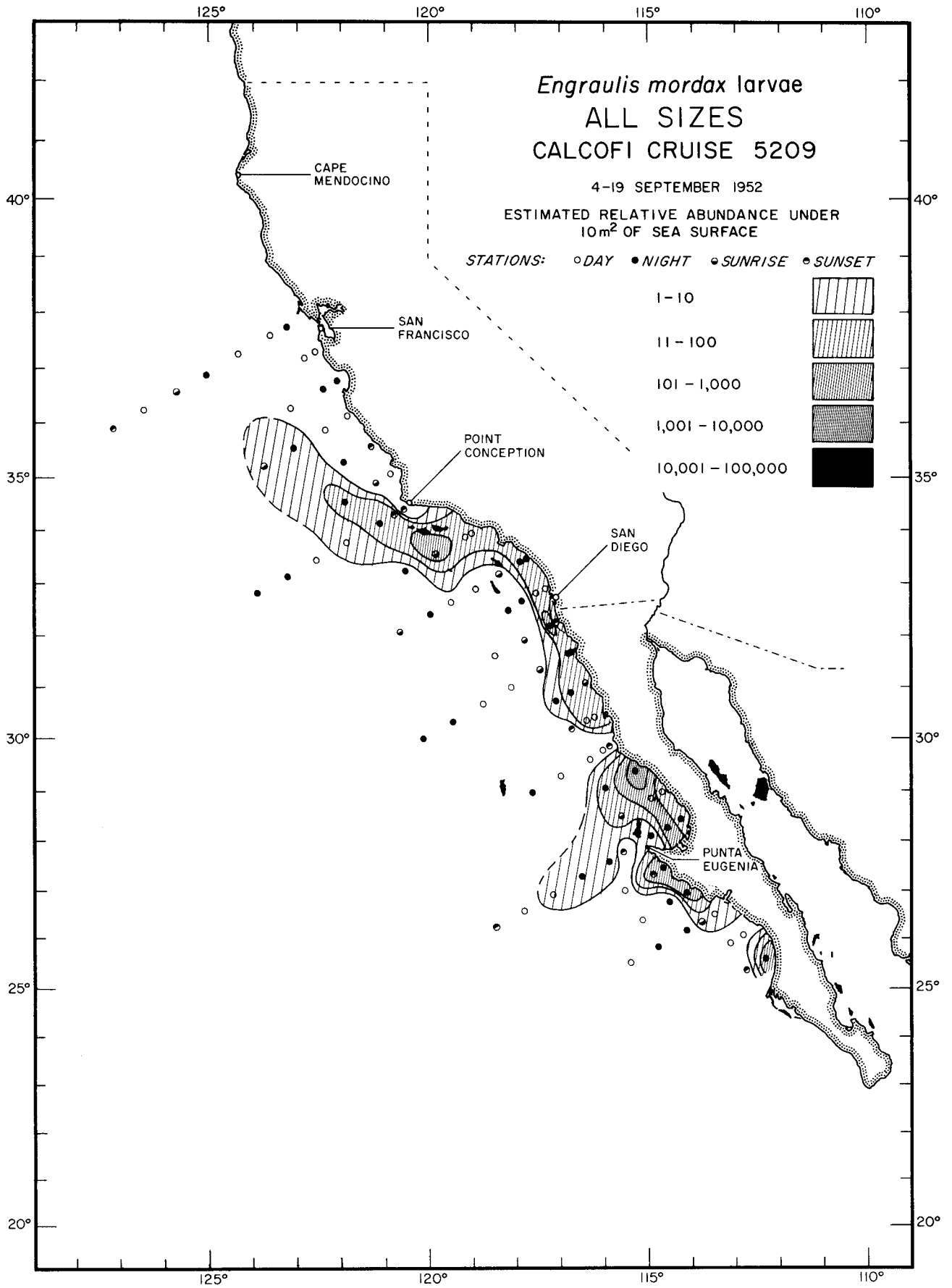
*Engraulis mordax* larvae  
 Size Group: 6.26-12.25mm  
 5208



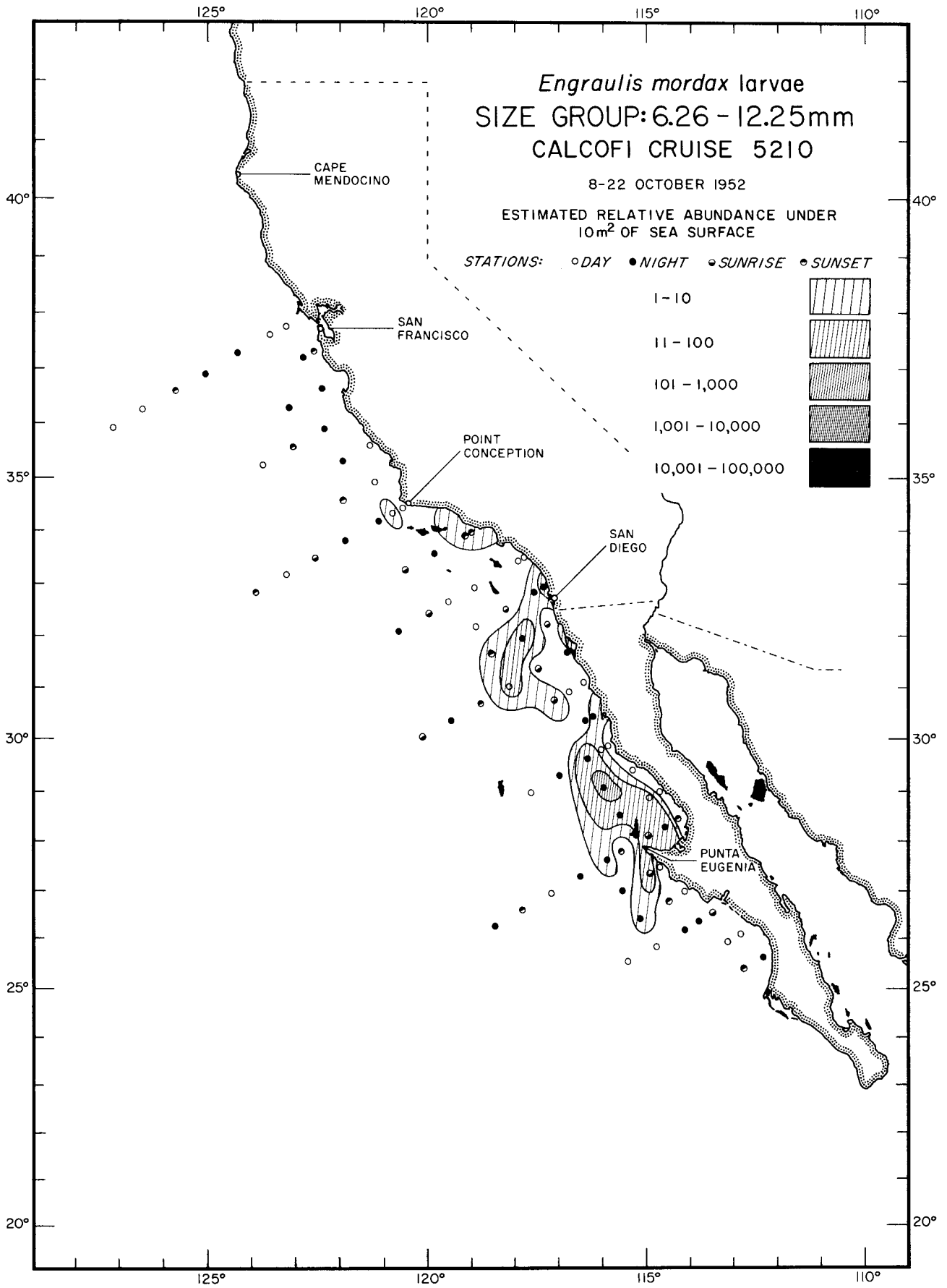
*Engraulis mordax* larvae  
All Sizes  
5208



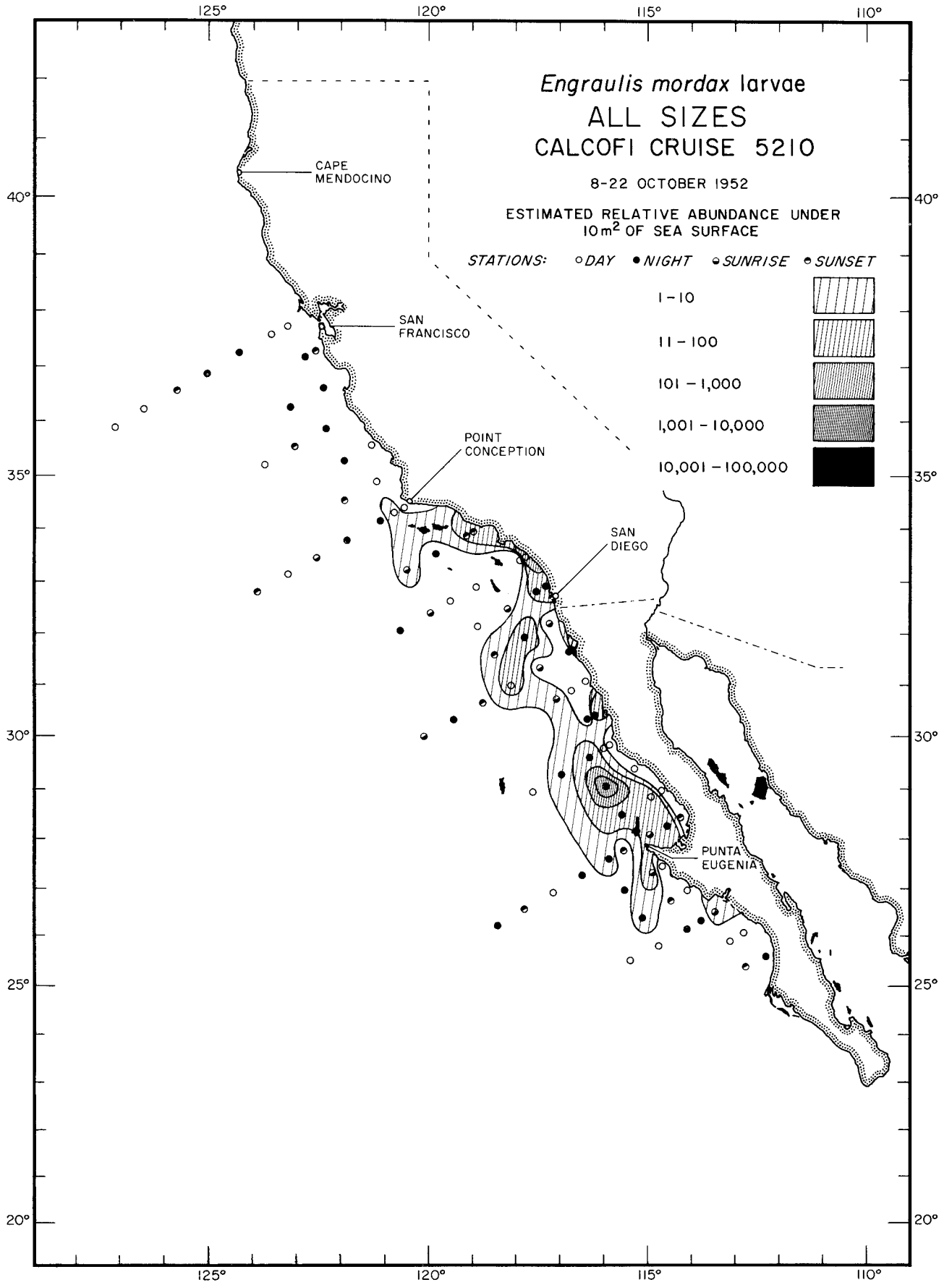
*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5209



*Engraulis mordax* larvae  
All Sizes  
5209



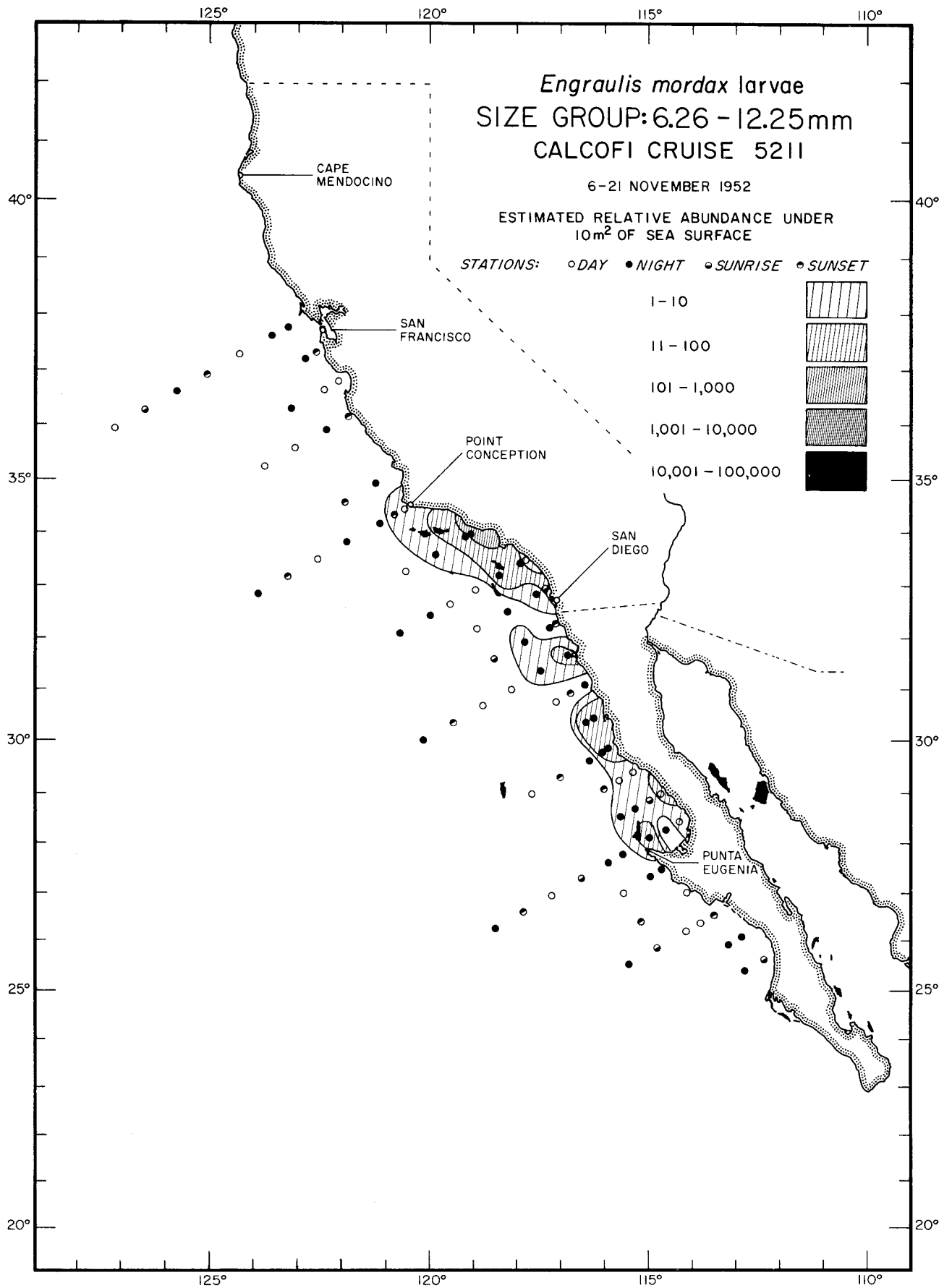
*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5210



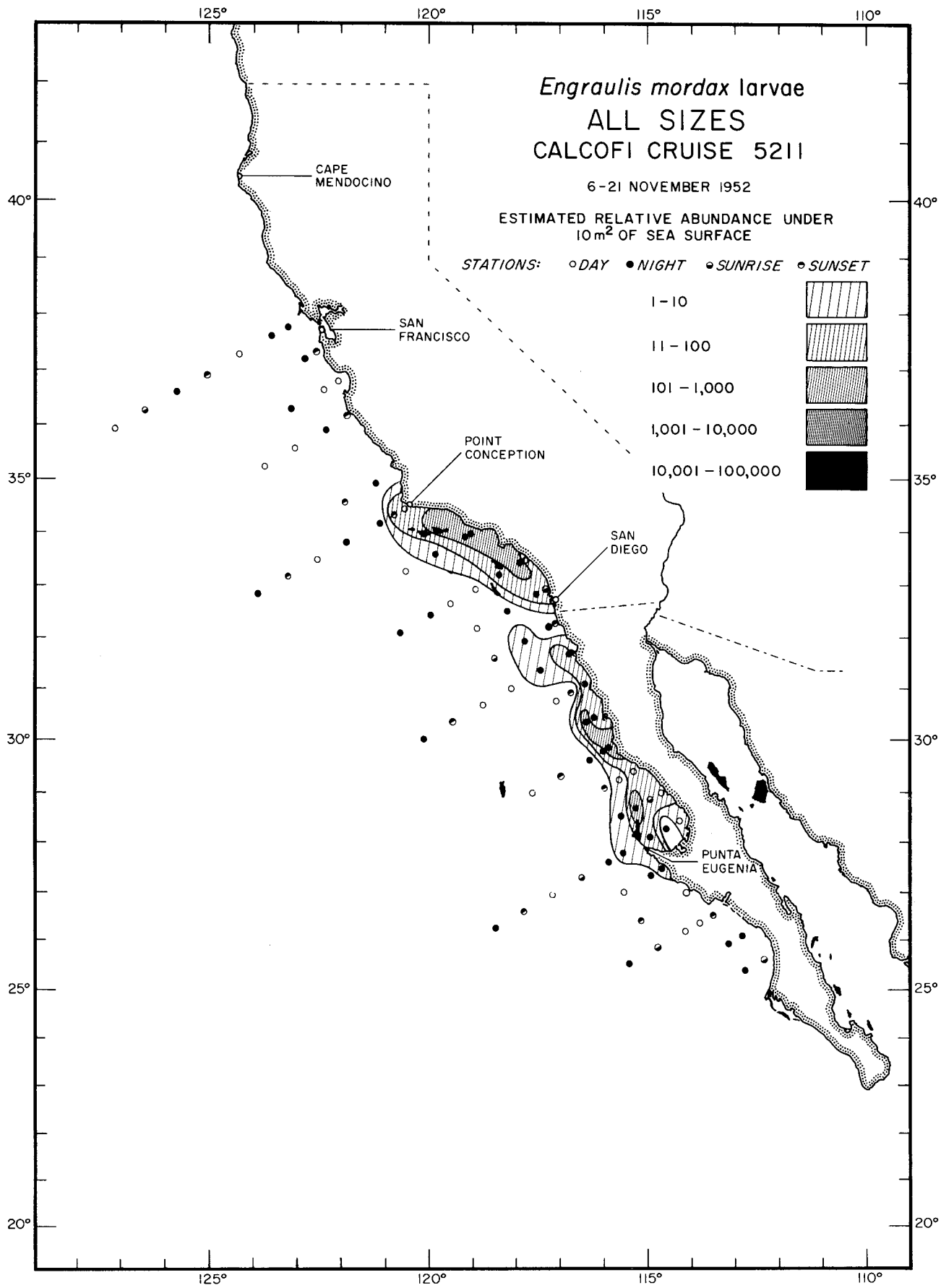
*Engraulis mordax* larvae

All Sizes  
5210



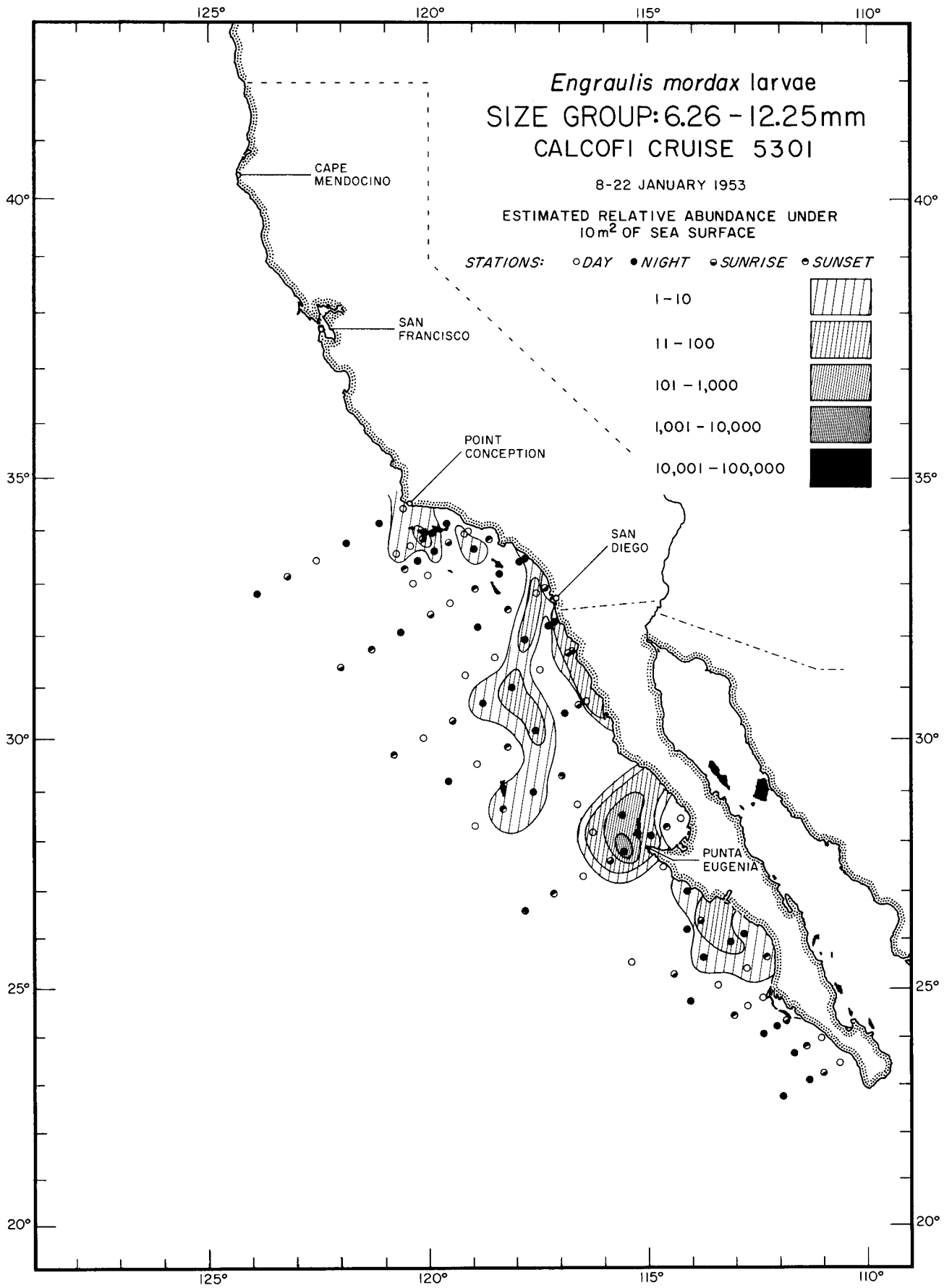


*Engraulis mordax* larvae  
 Size Group: 6.26-12.25mm  
 5211

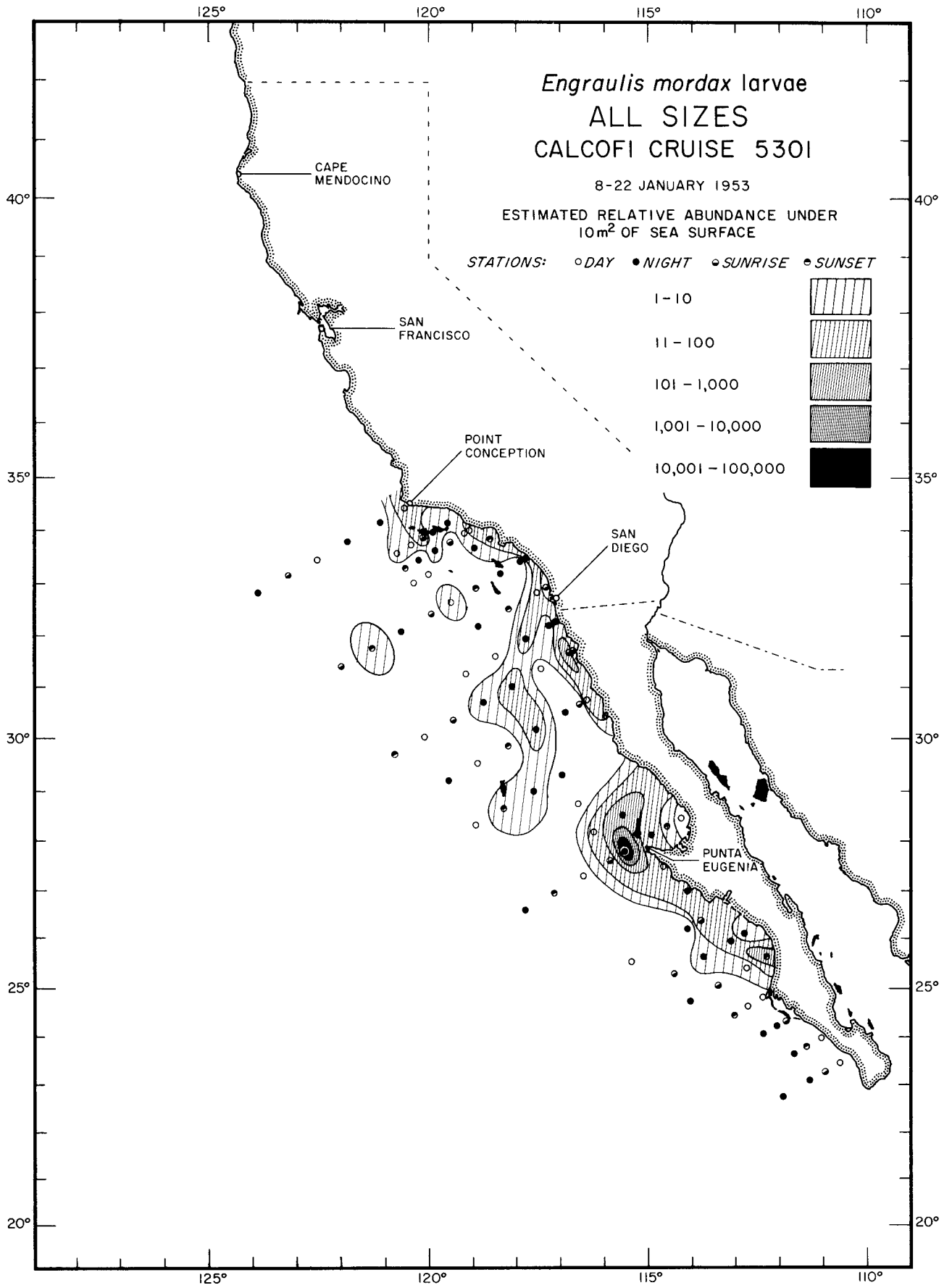


*Engraulis mordax* larvae

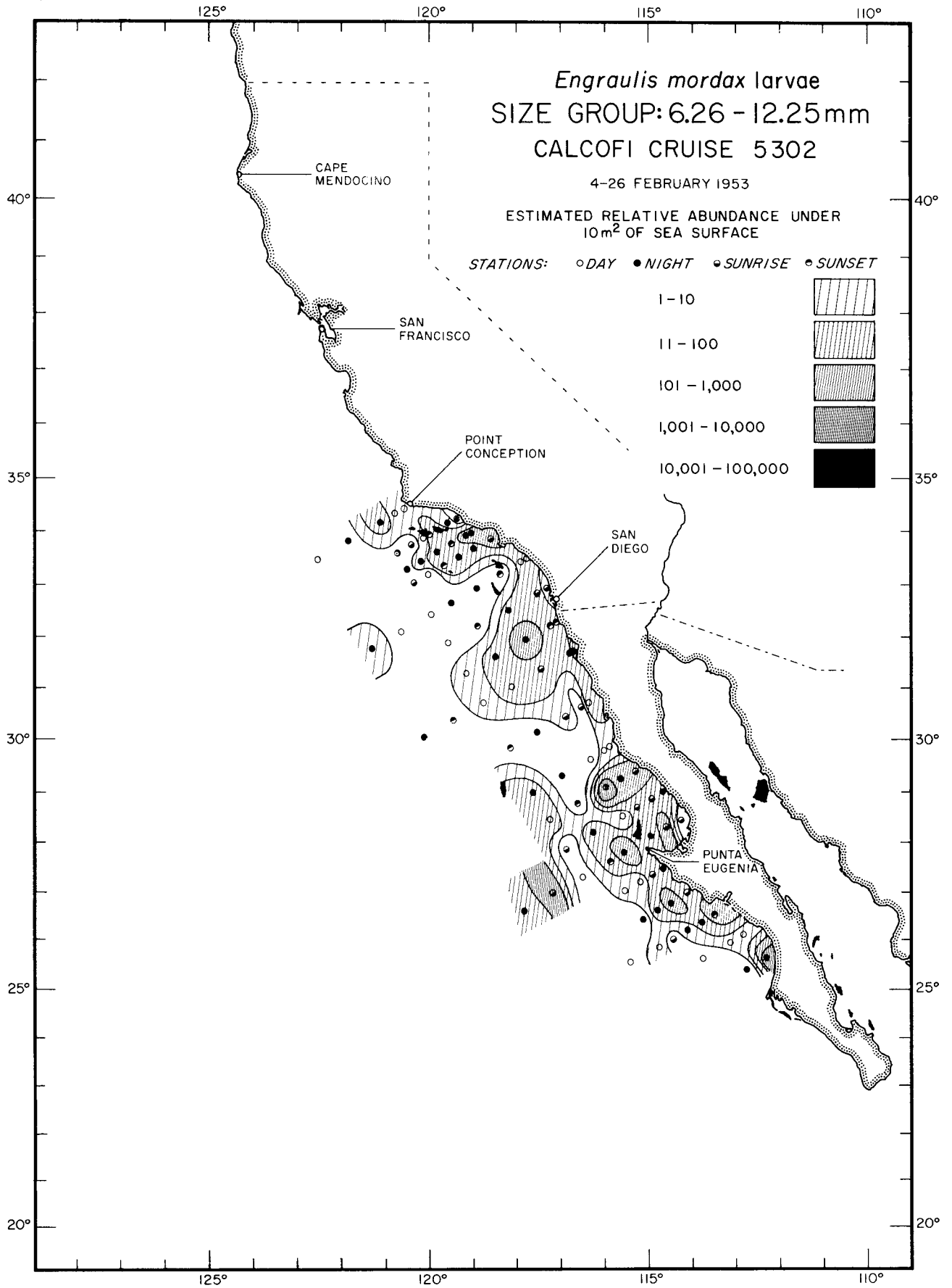
All Sizes  
5211



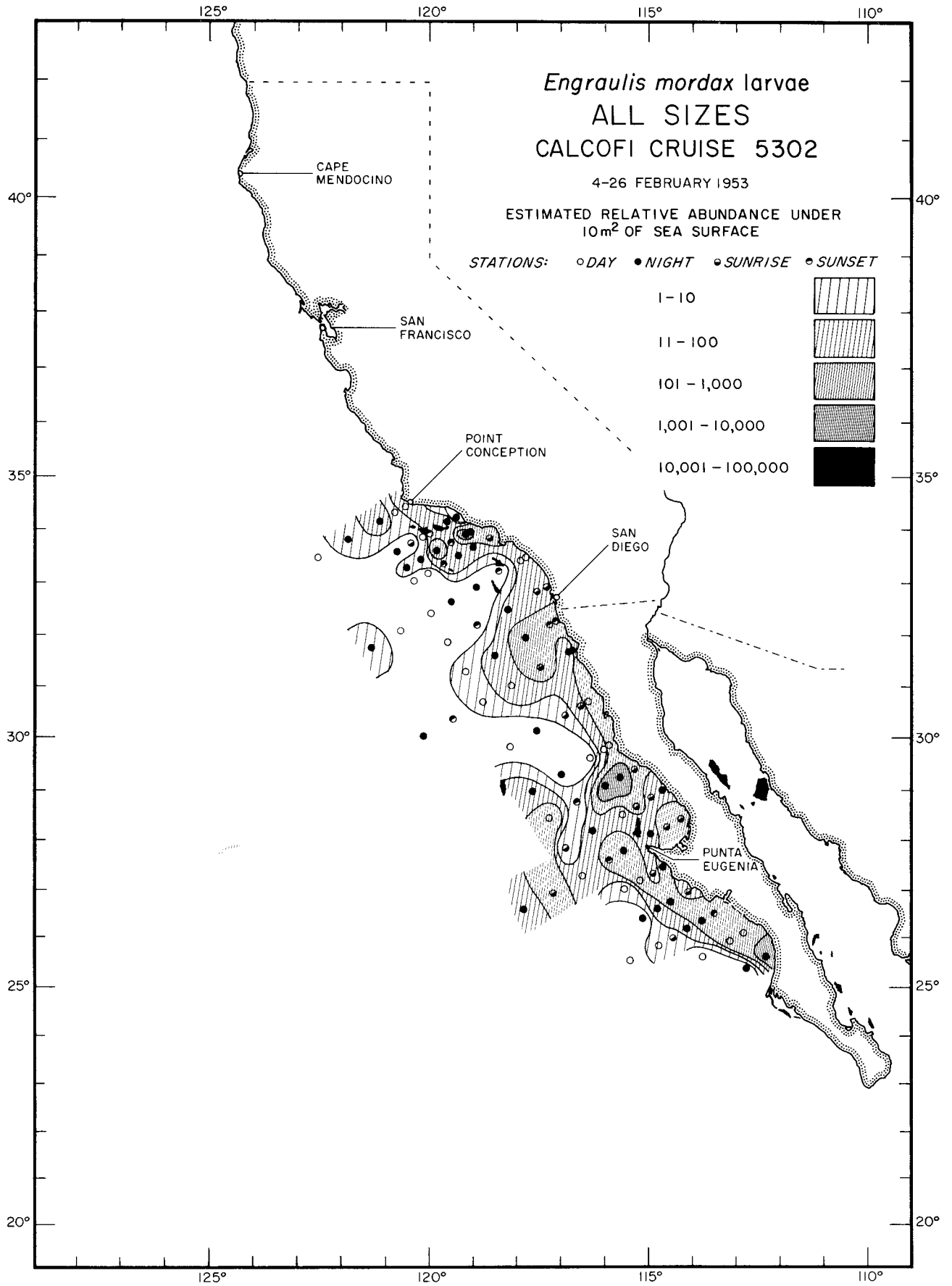
*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5301



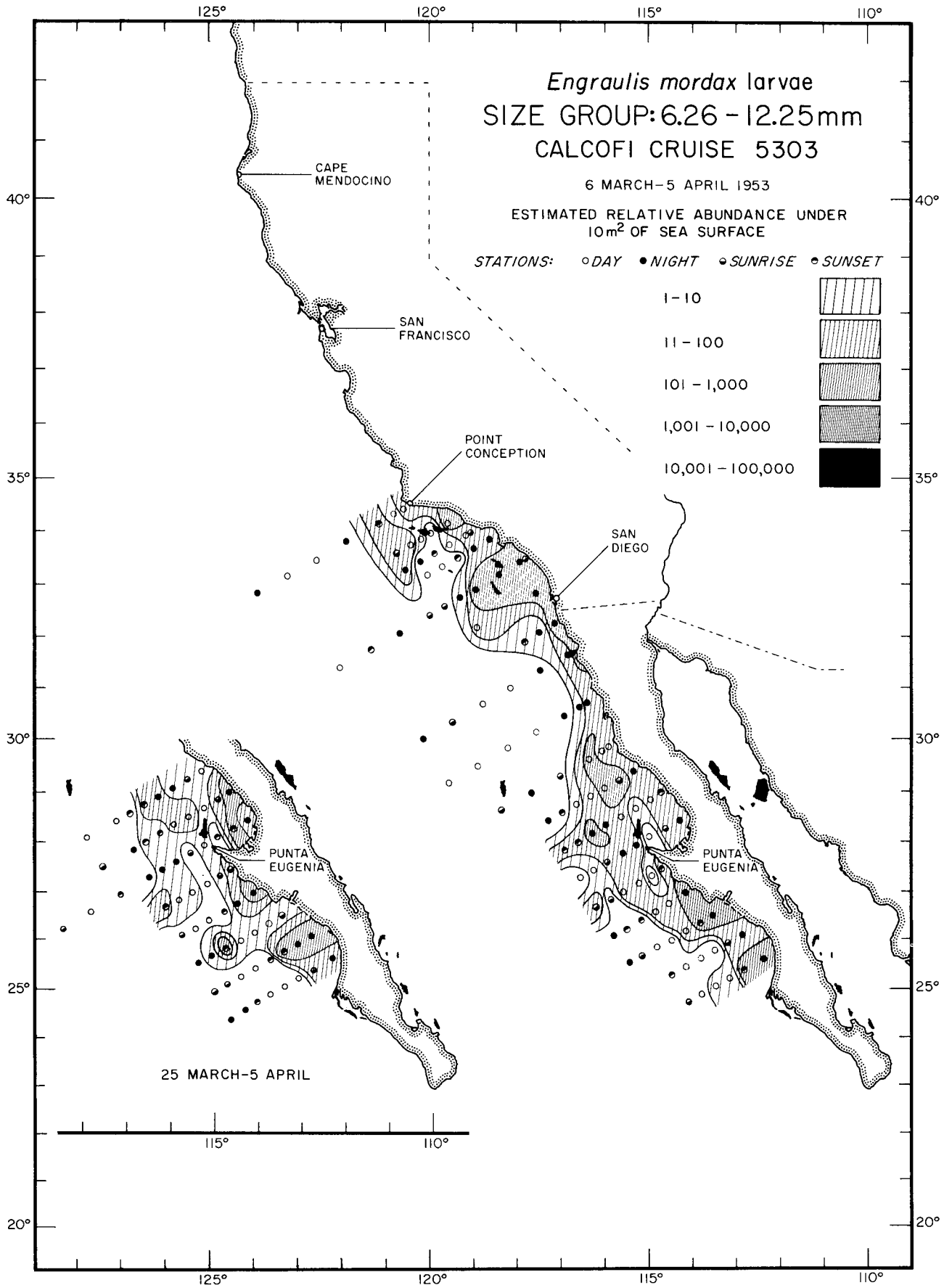
*Engraulis mordax* larvae  
All Sizes  
5301



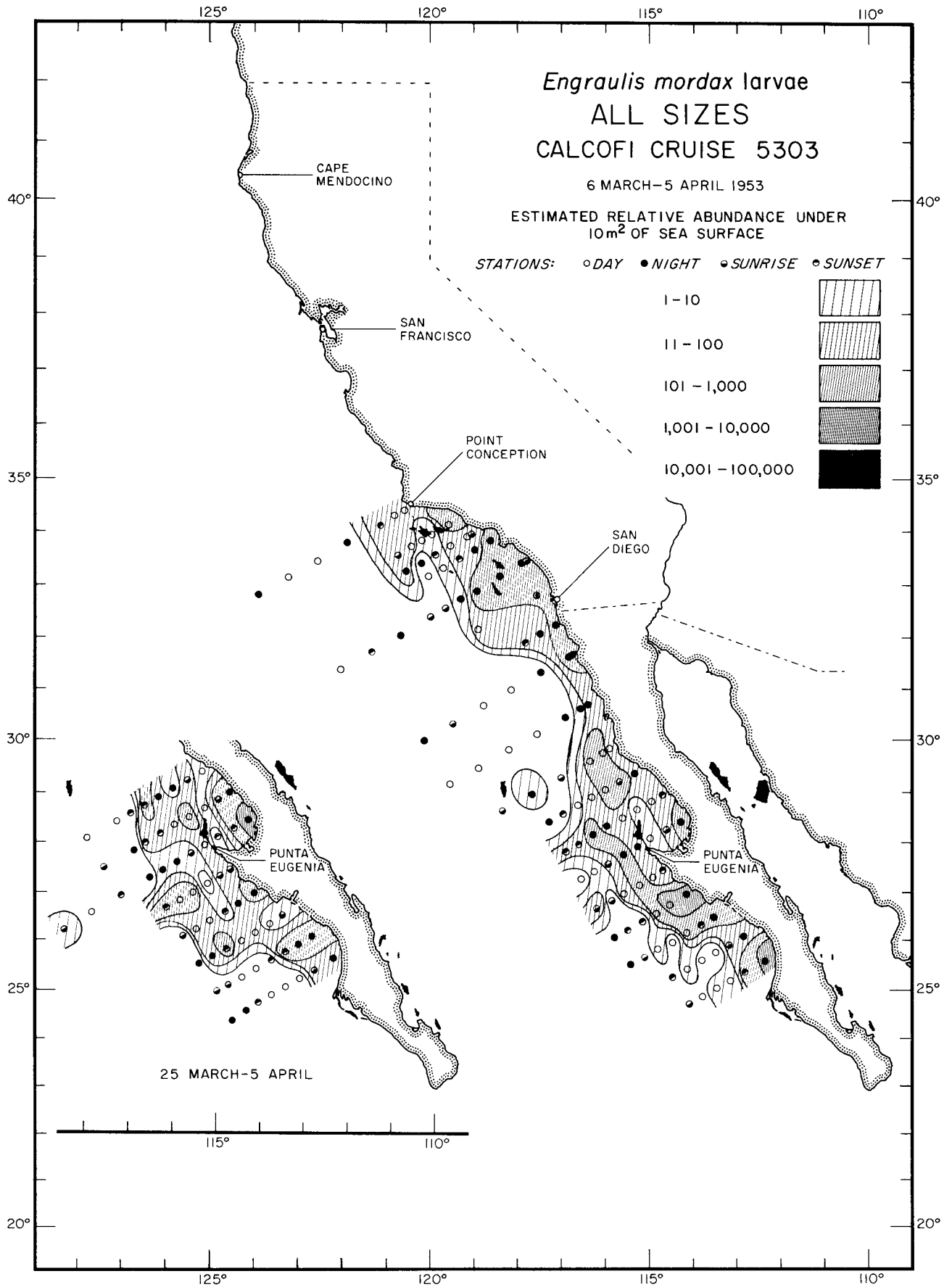
*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5302



*Engraulis mordax* larvae  
All Sizes  
5302



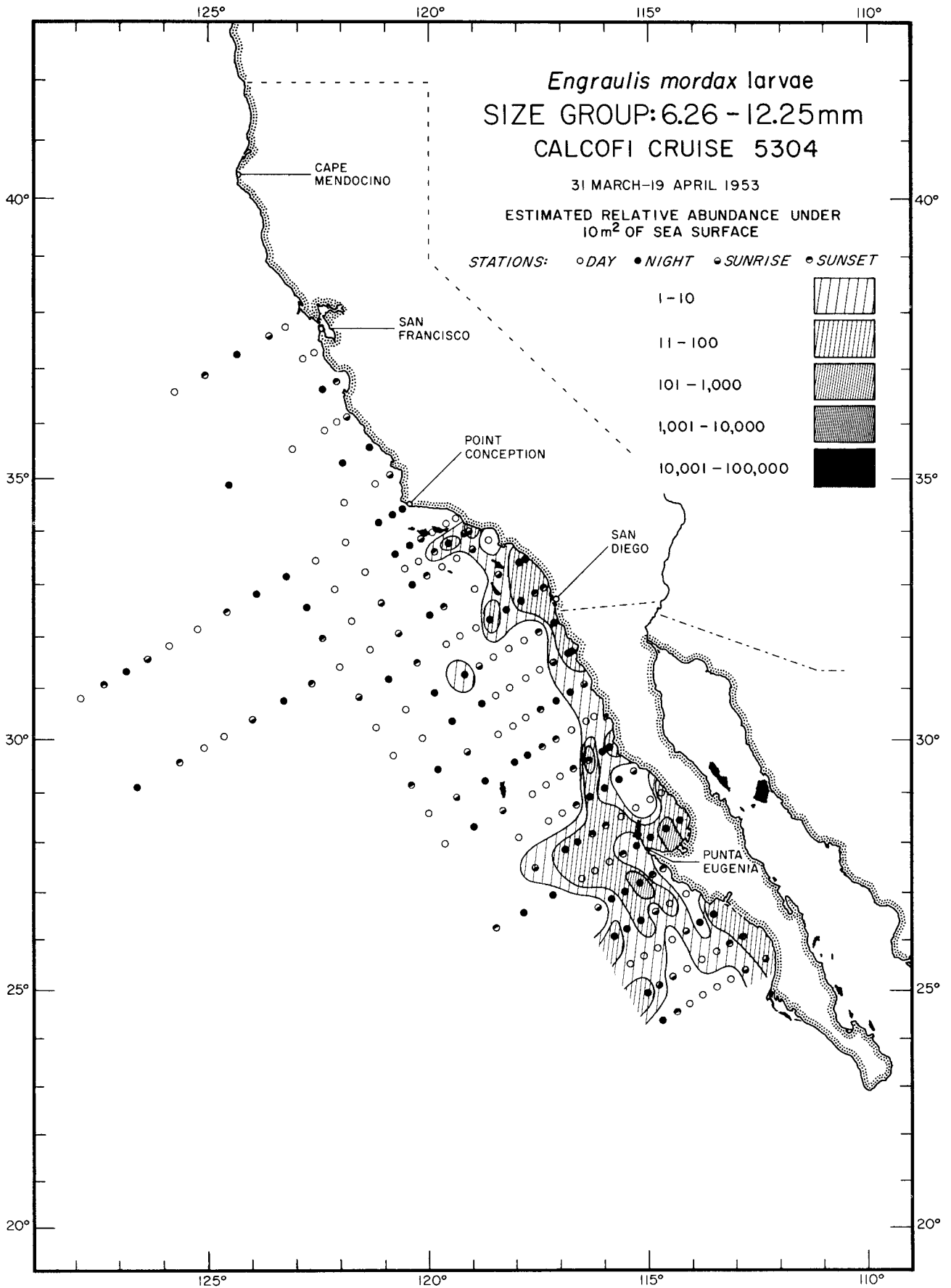
*Engraulis mordax* larvae  
 Size Group: 6.26-12.25mm  
 5303



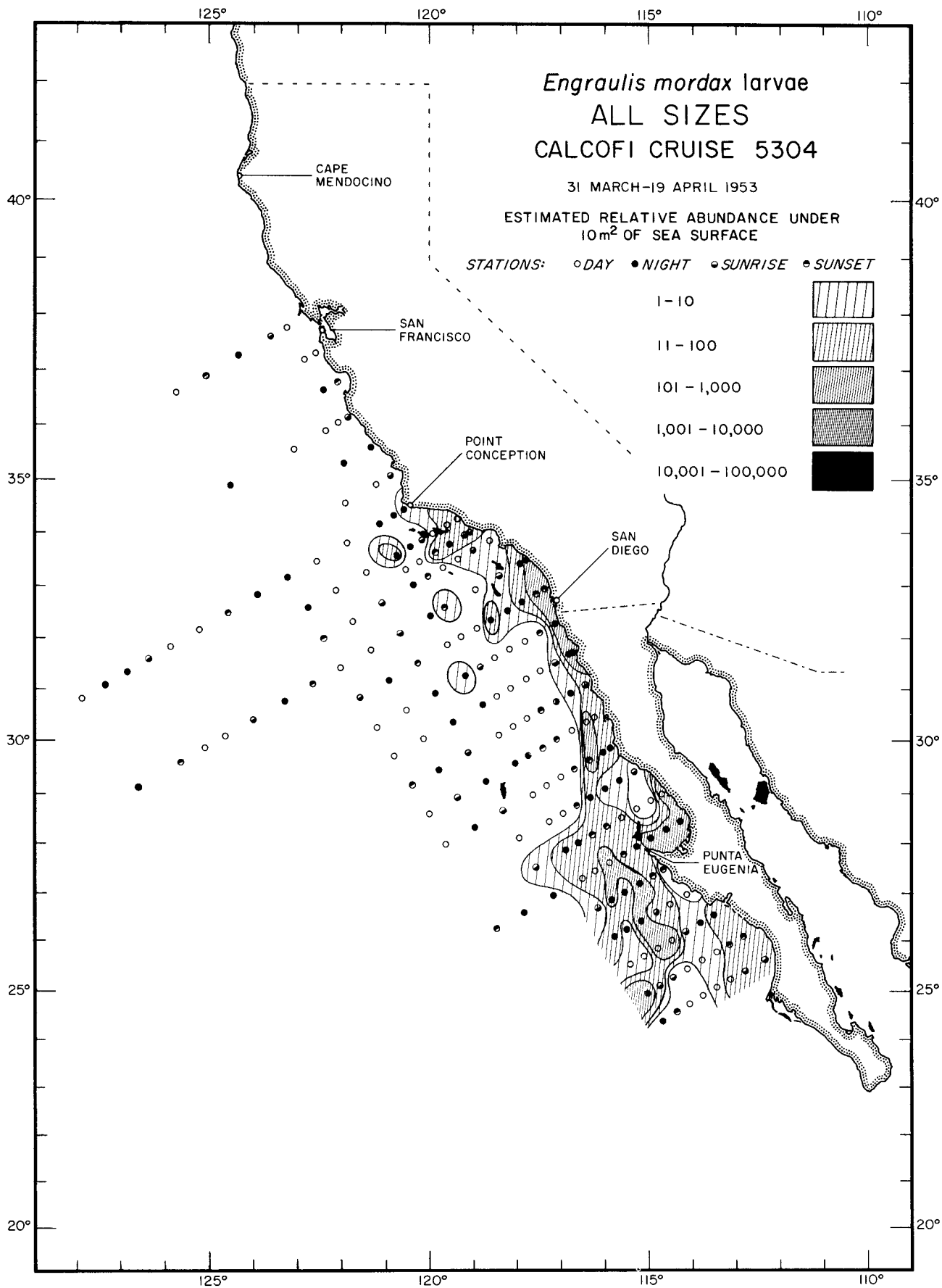
*Engraulis mordax* larvae

All Sizes  
5303

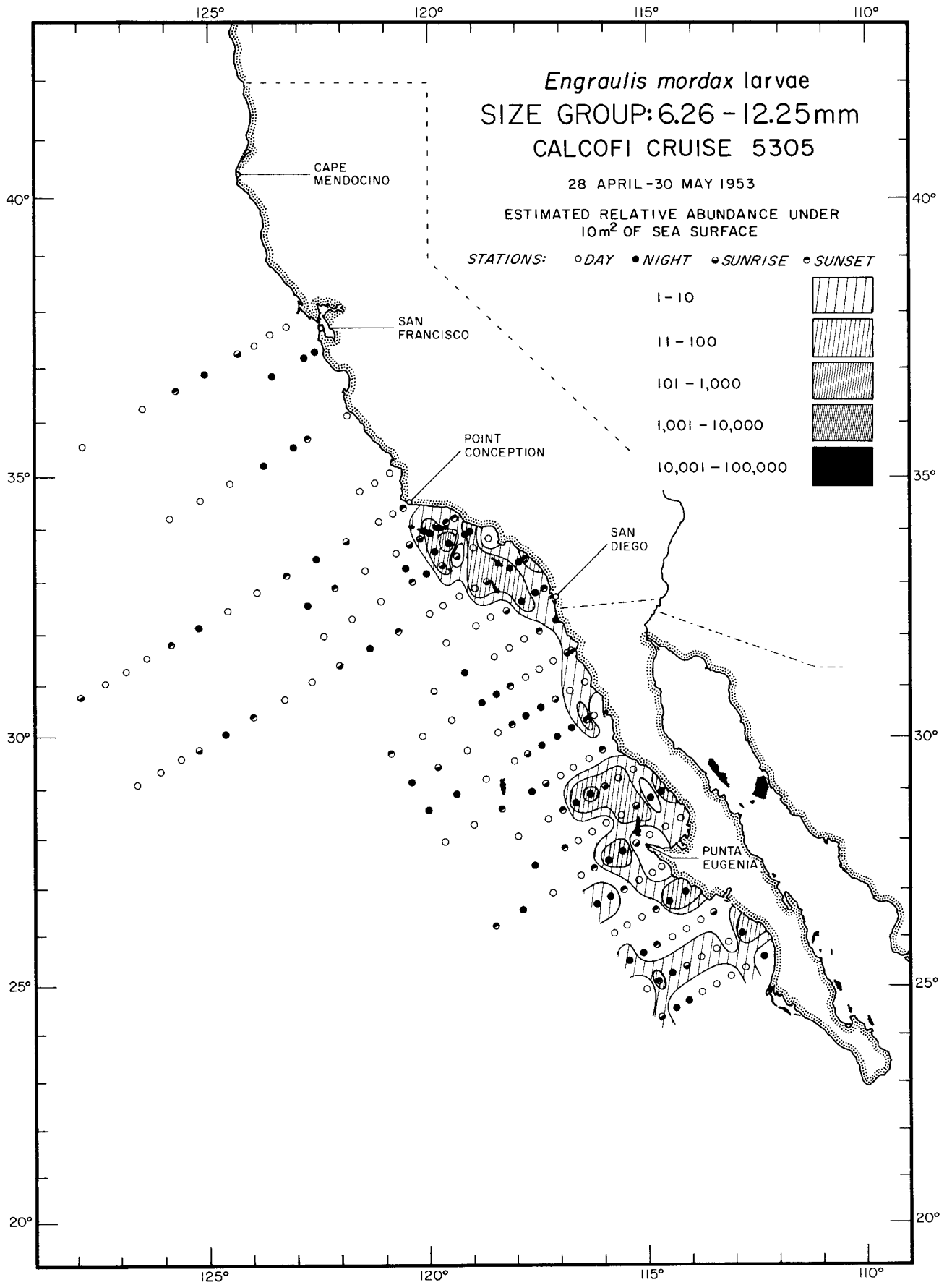




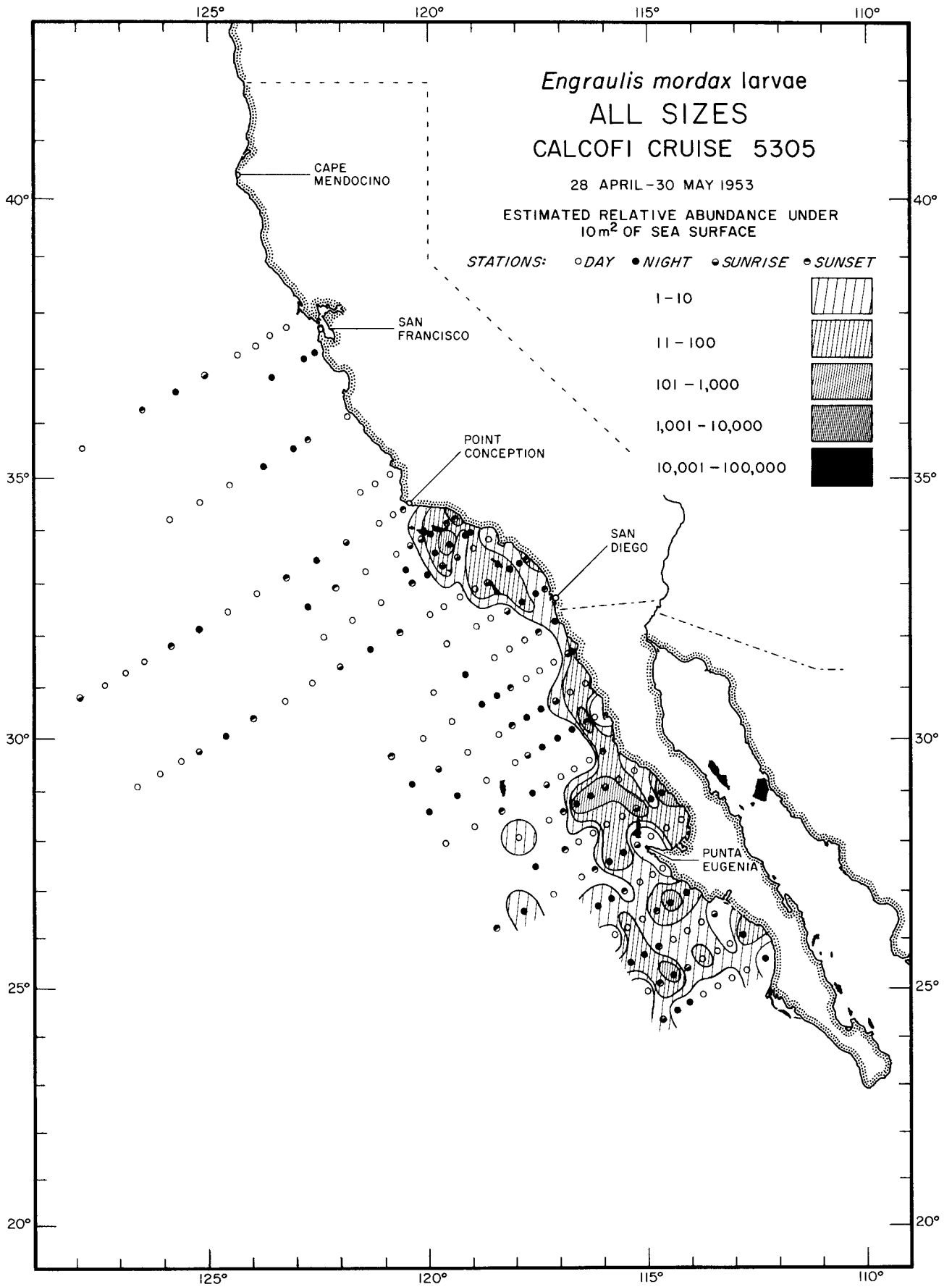
*Engraulis mordax* larvae  
 Size Group: 6.26-12.25mm  
 5304



*Engraulis mordax* larvae  
All Sizes  
5304

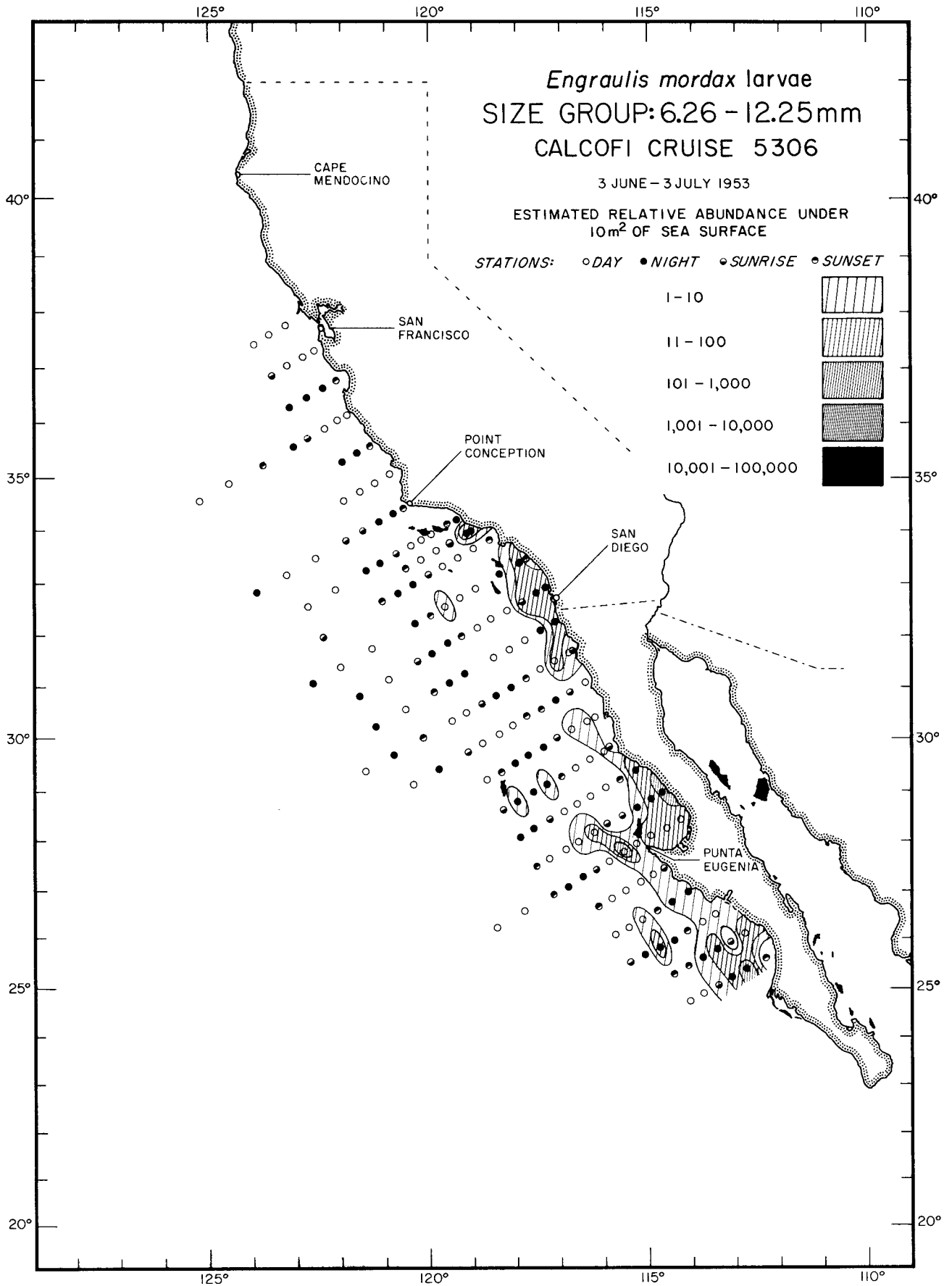


*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5305

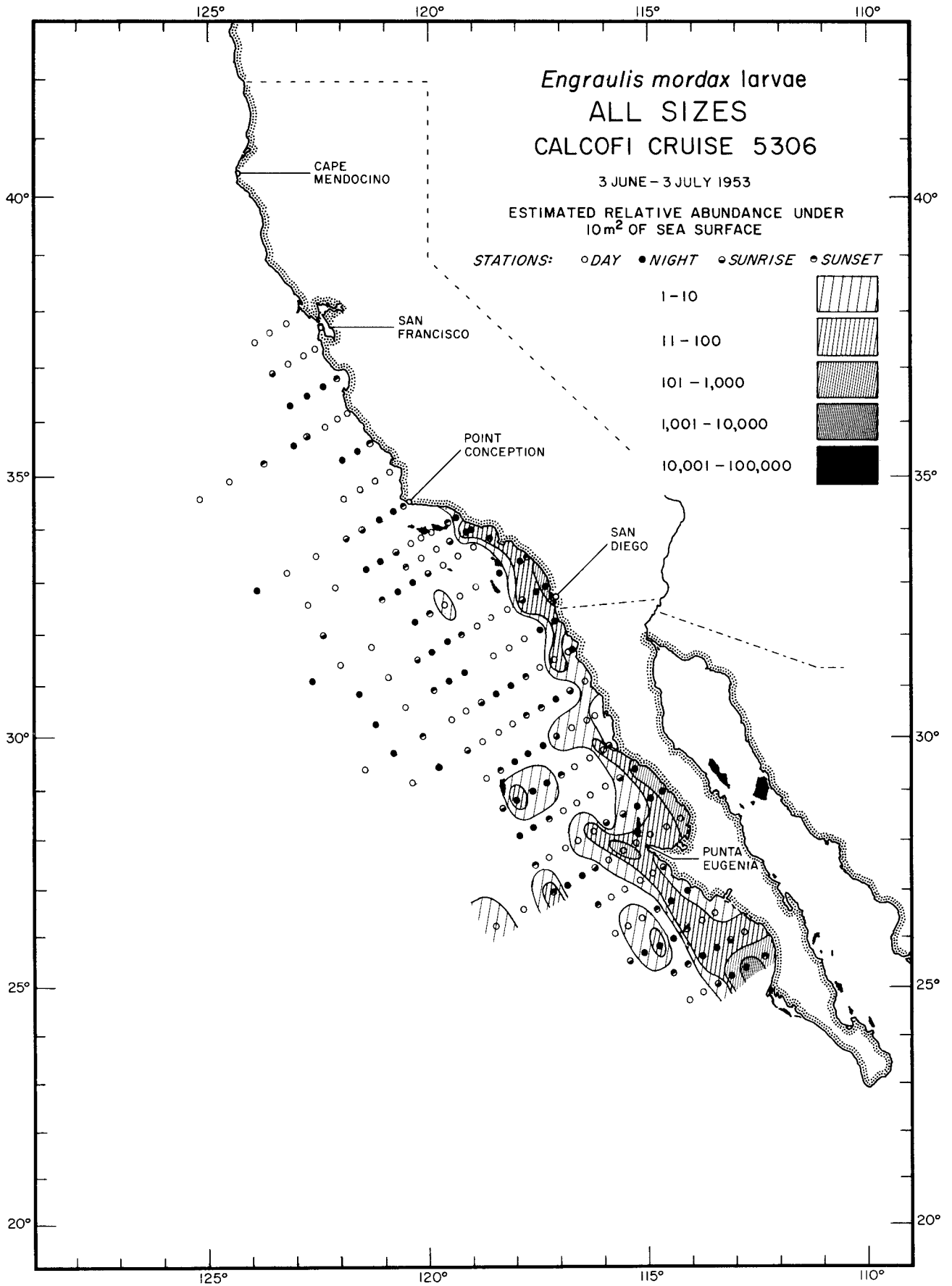


*Engraulis mordax* larvae

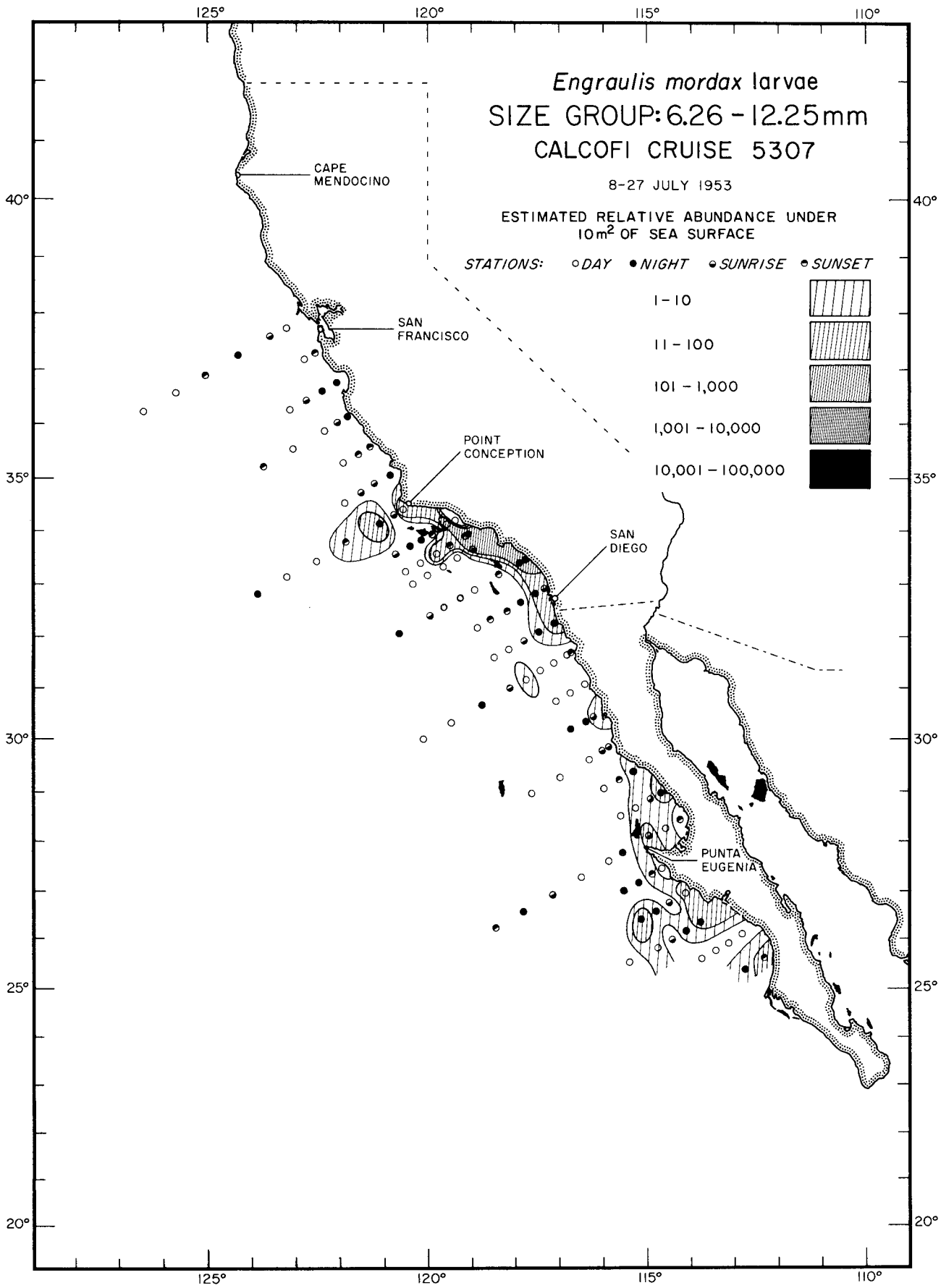
All Sizes  
5305



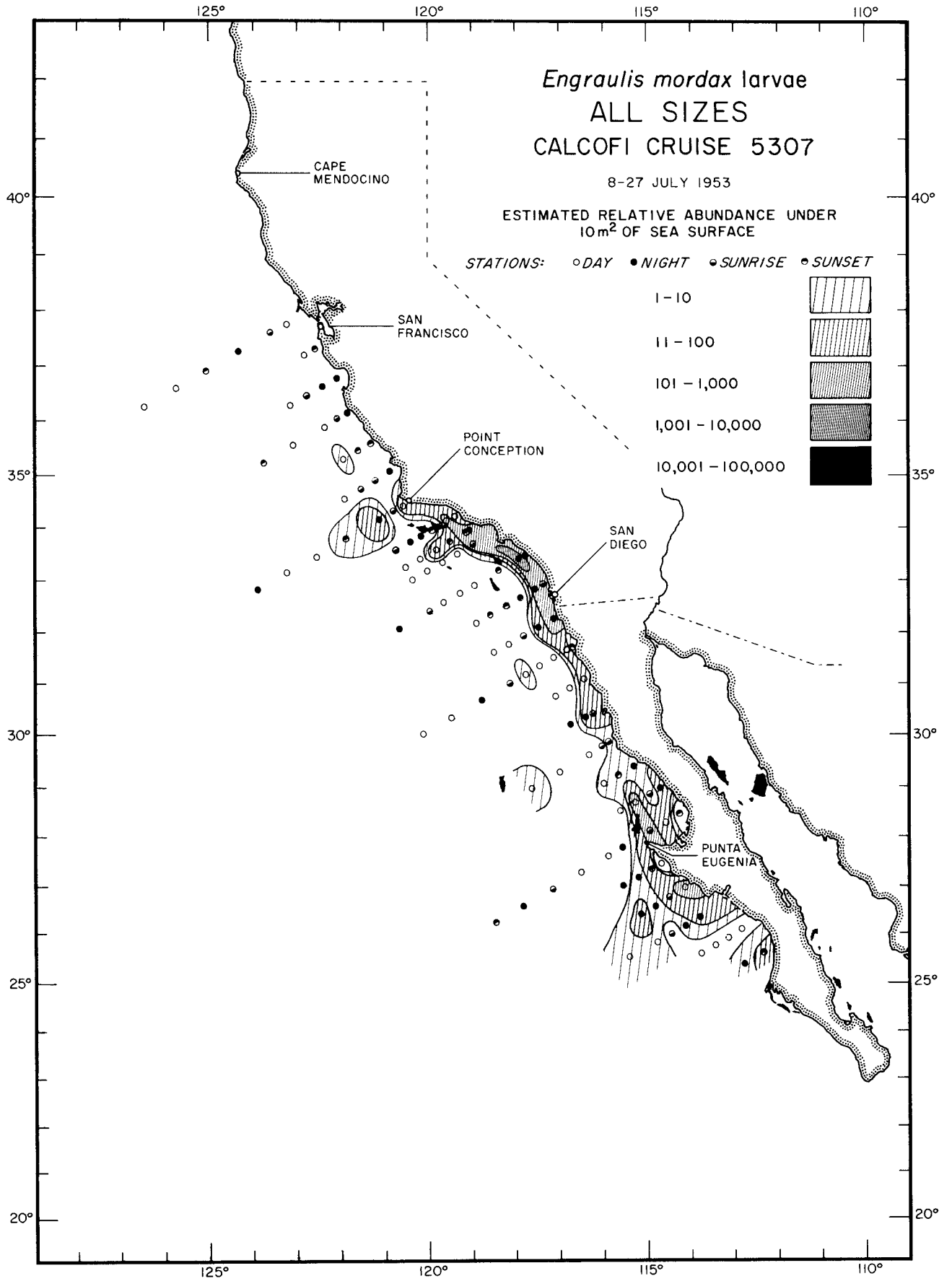
*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5306



*Engraulis mordax* larvae  
All Sizes  
5306



*Engraulis mordax* larvae  
 Size Group: 6.26-12.25mm  
 5307

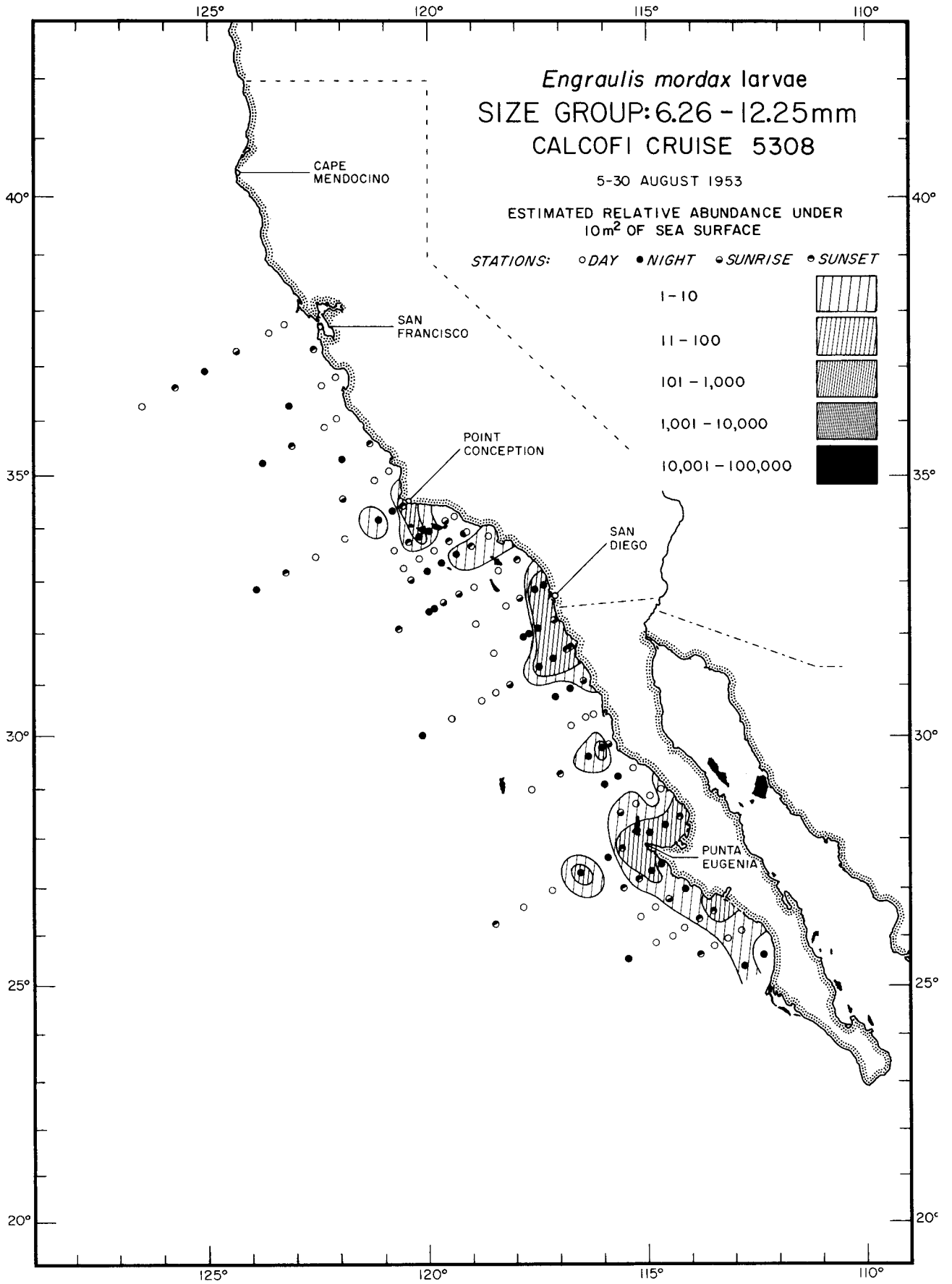


*Engraulis mordax* larvae

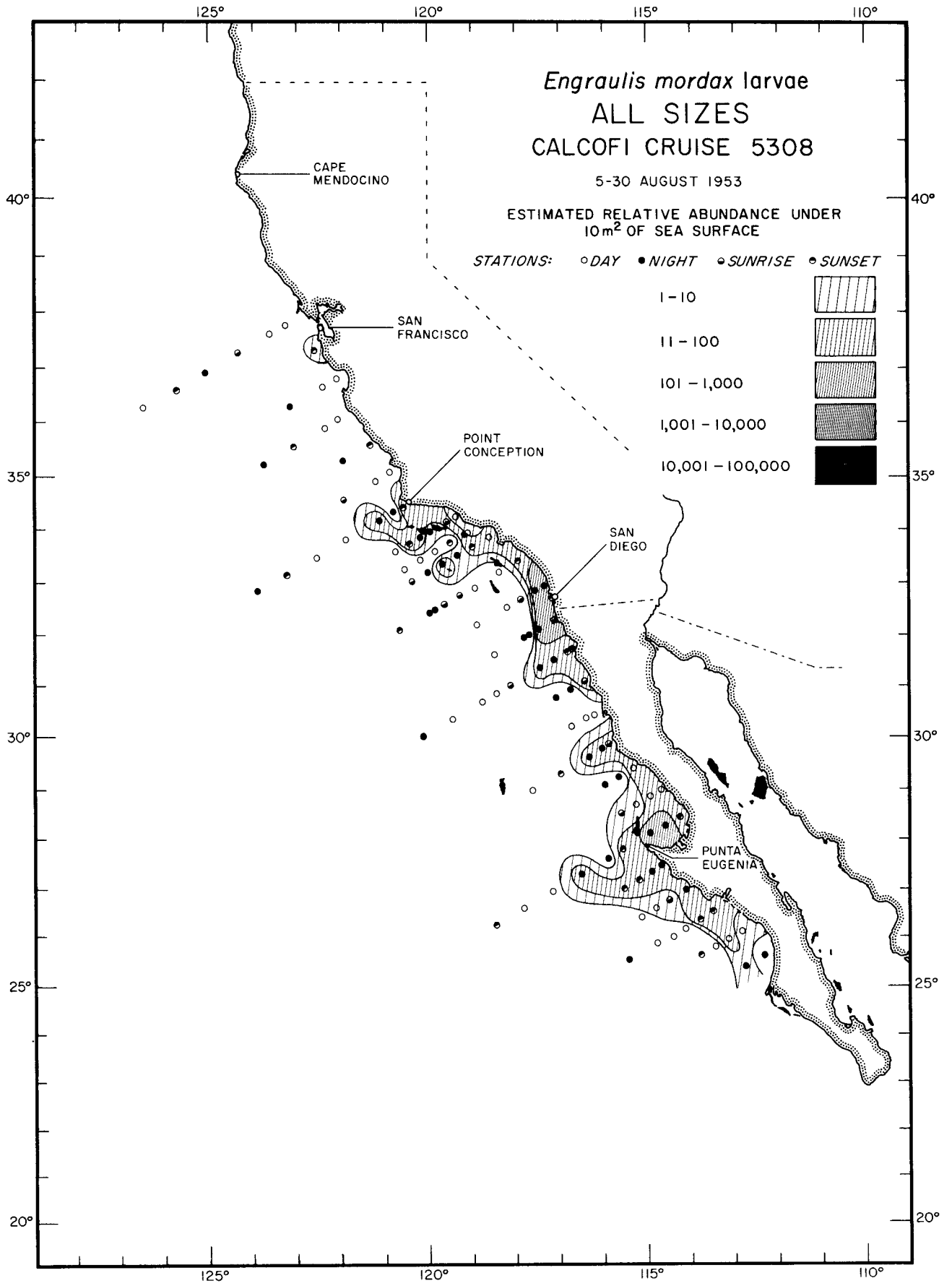
All Sizes

5307





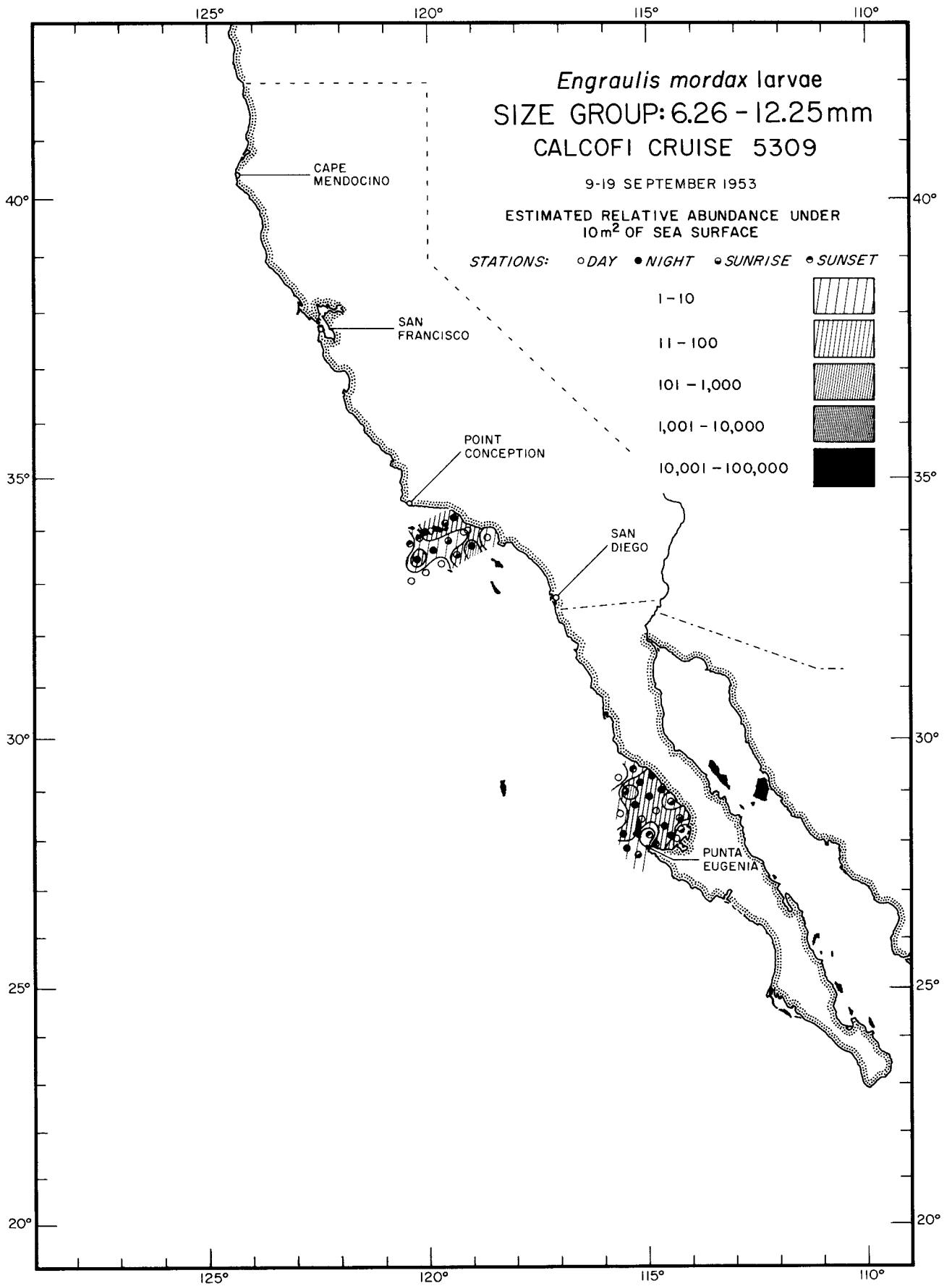
*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5308



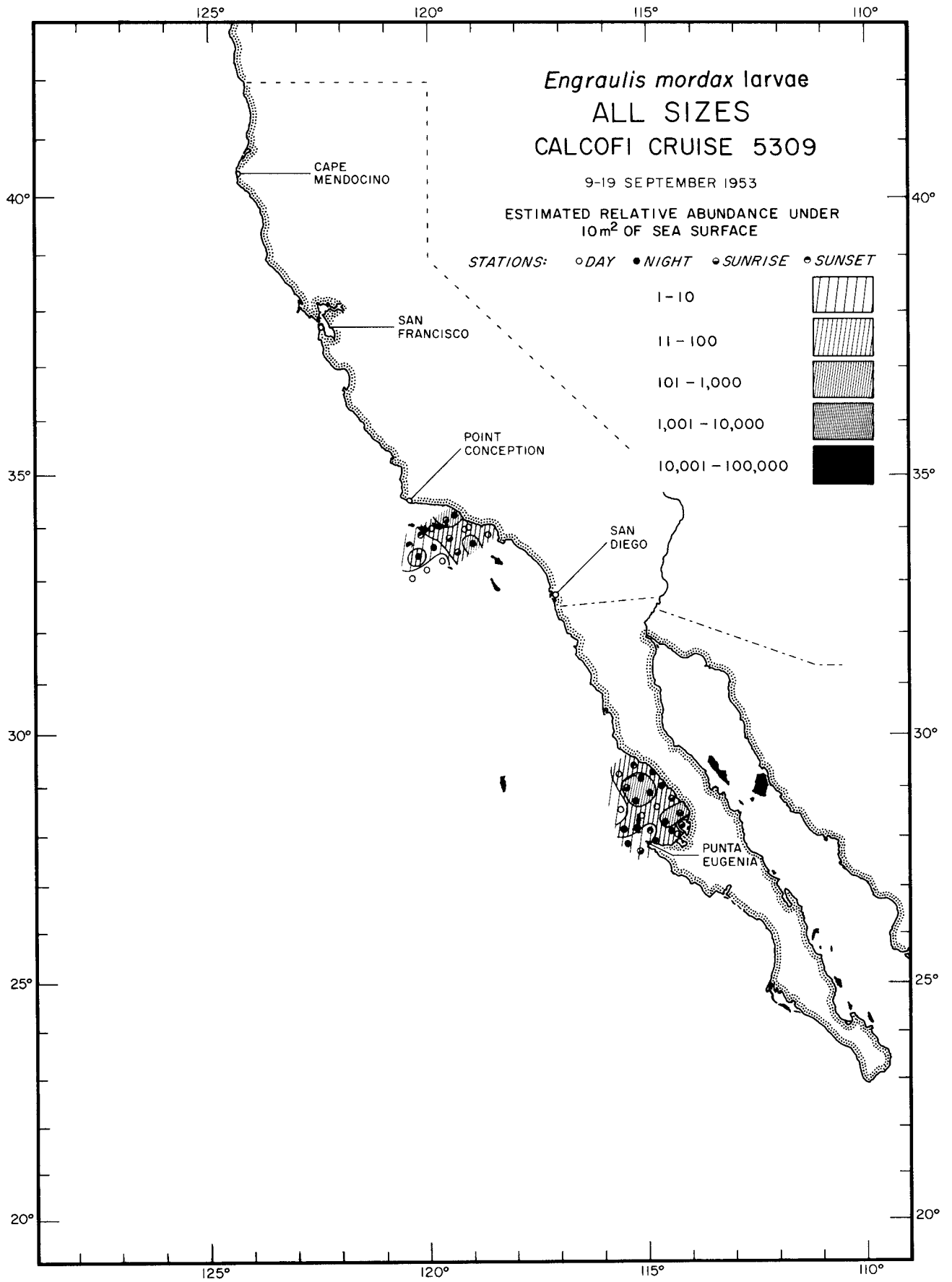
*Engraulis mordax* larvae

All Sizes

5308

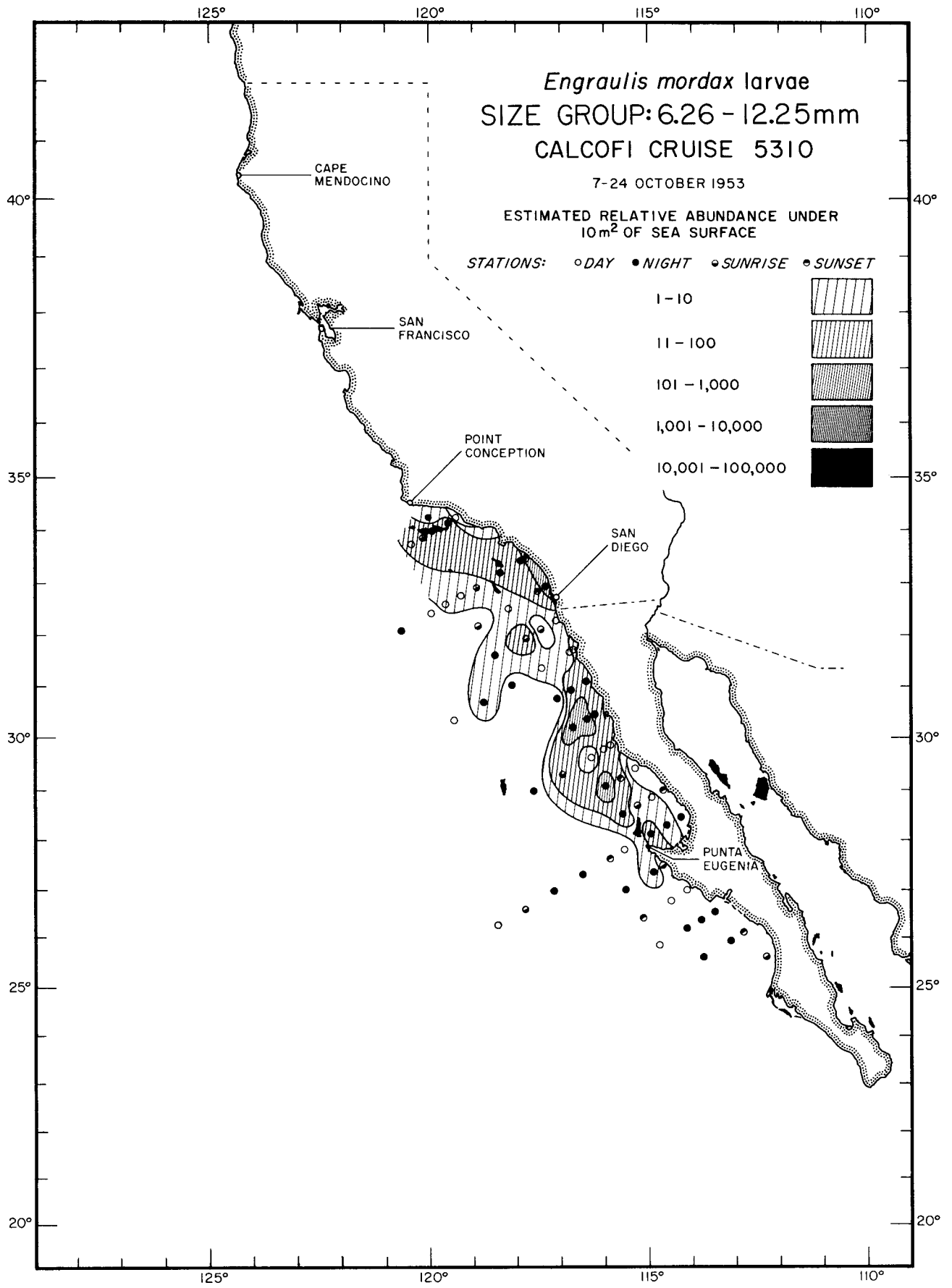


*Engraulis mordax* larvae  
 Size Group: 6.26-12.25mm  
 5309

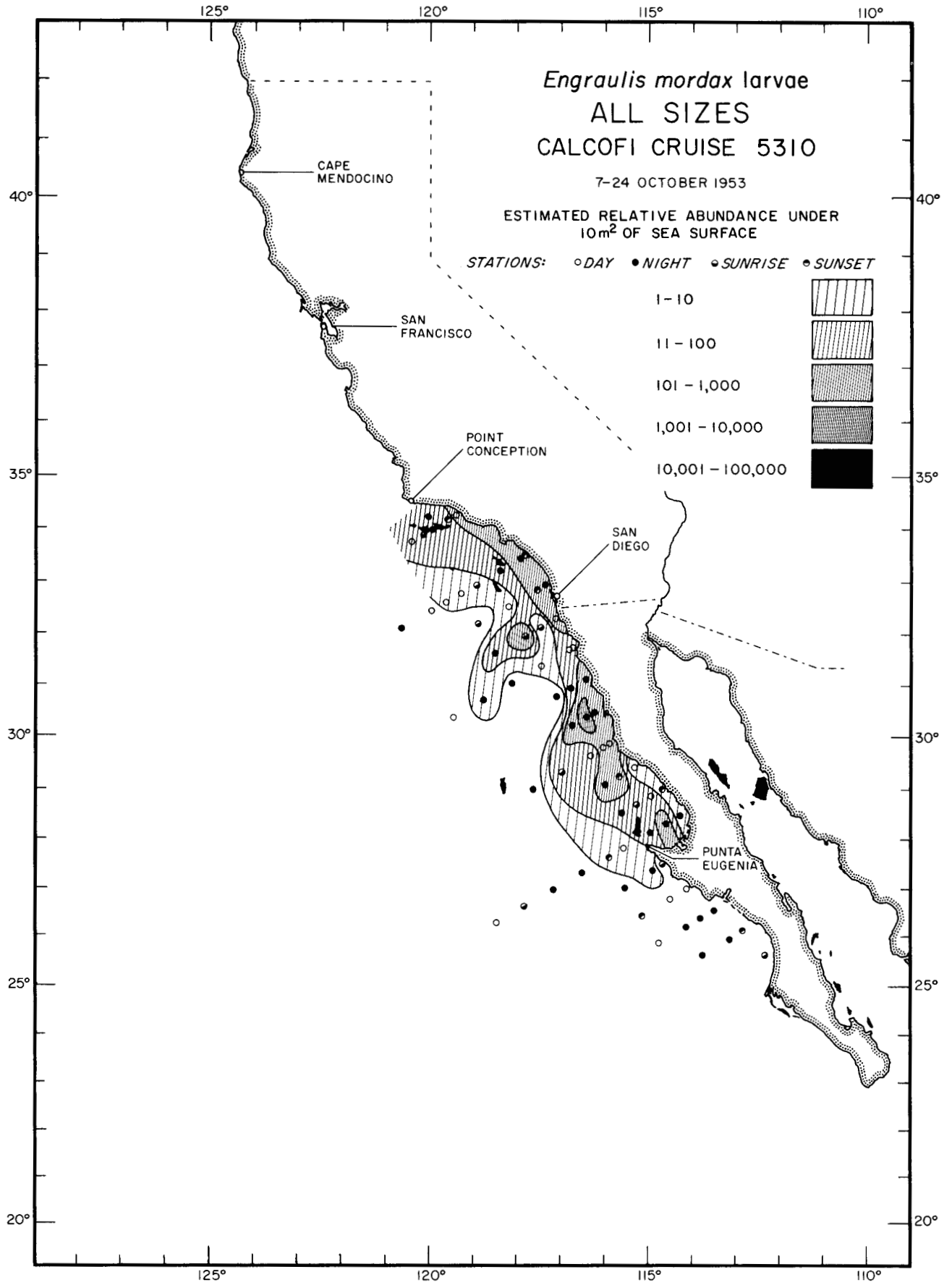


*Engraulis mordax* larvae

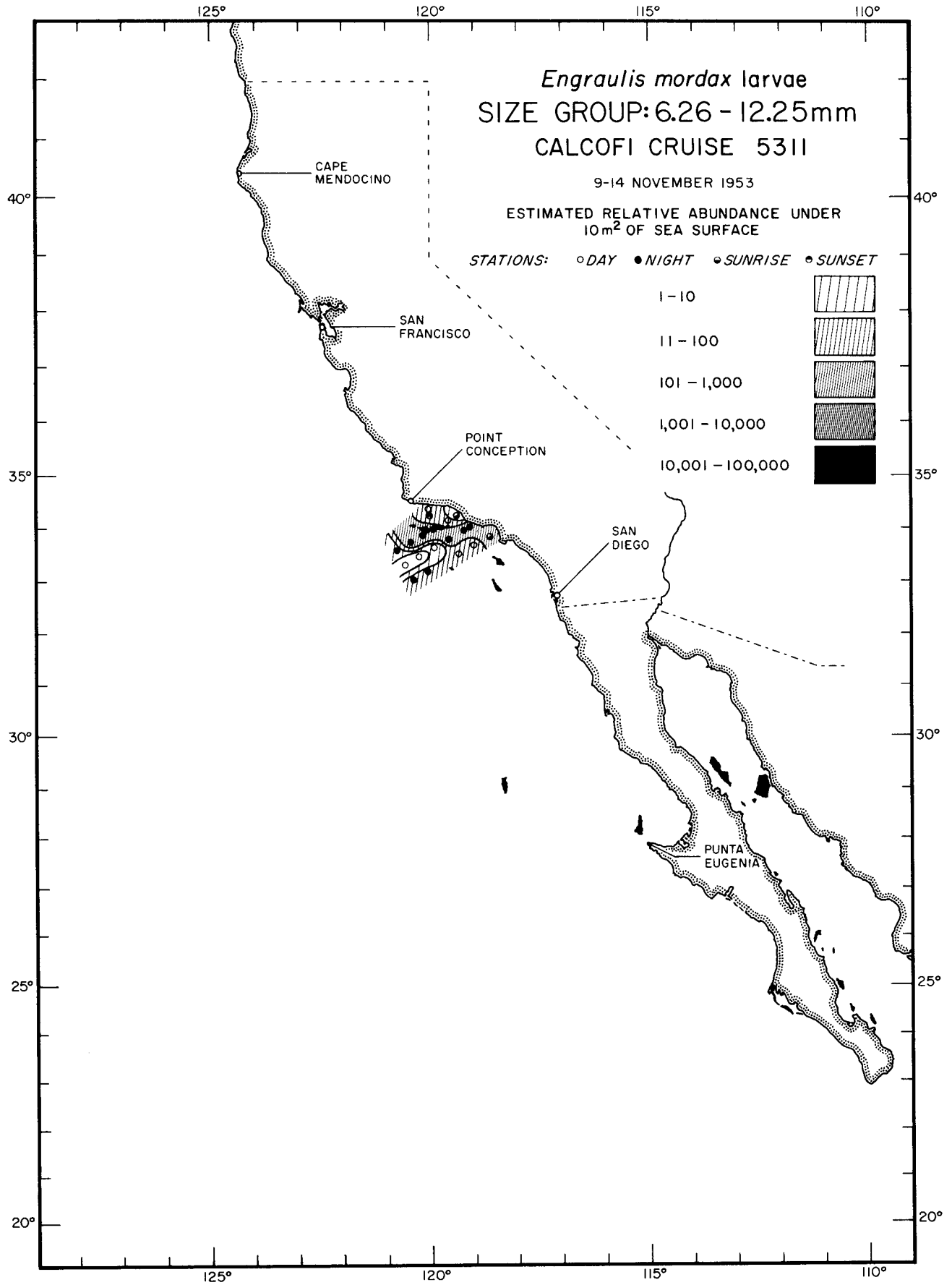
All Sizes  
5309



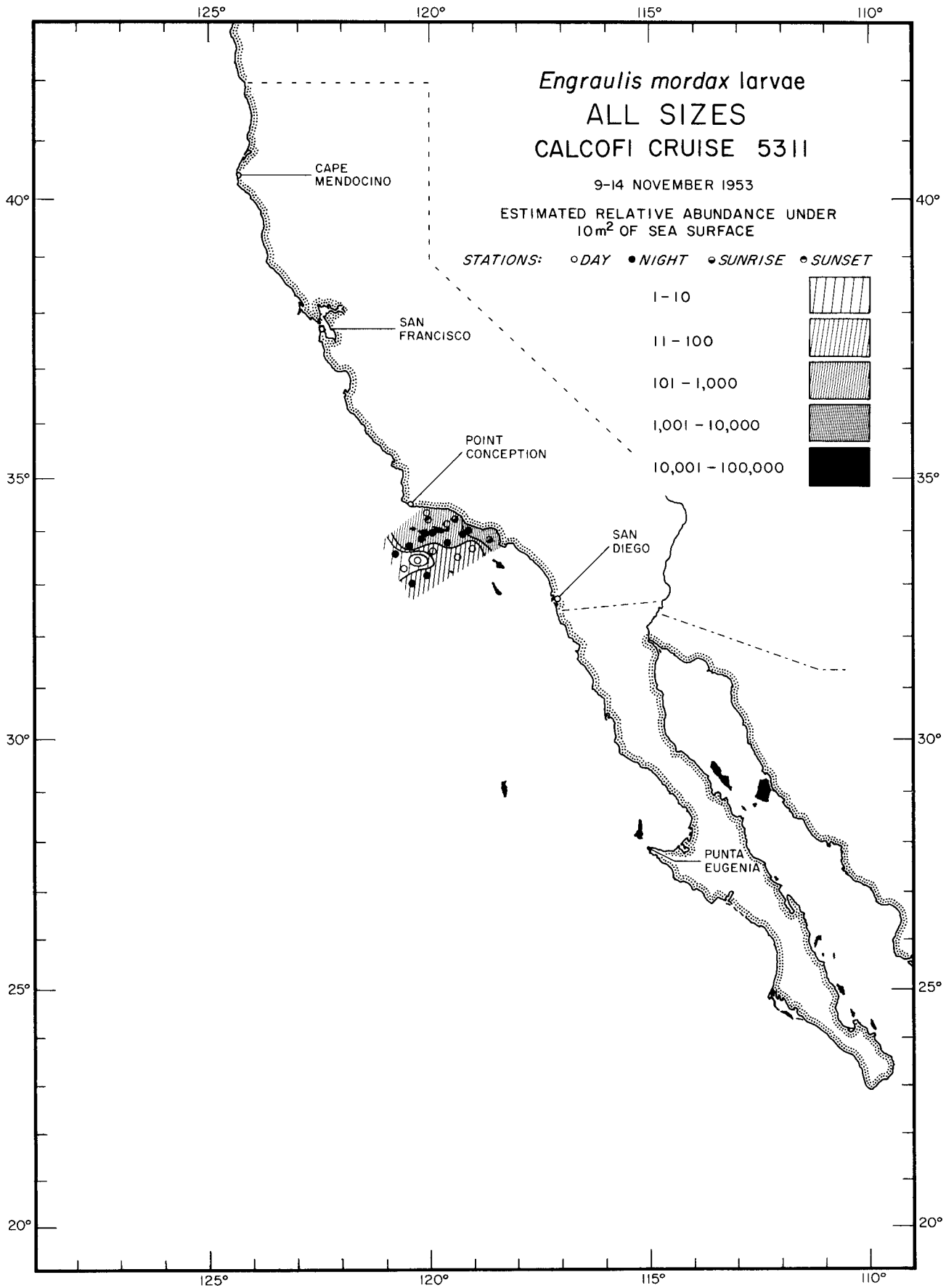
*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5310



*Engraulis mordax* larvae  
All Sizes  
5310

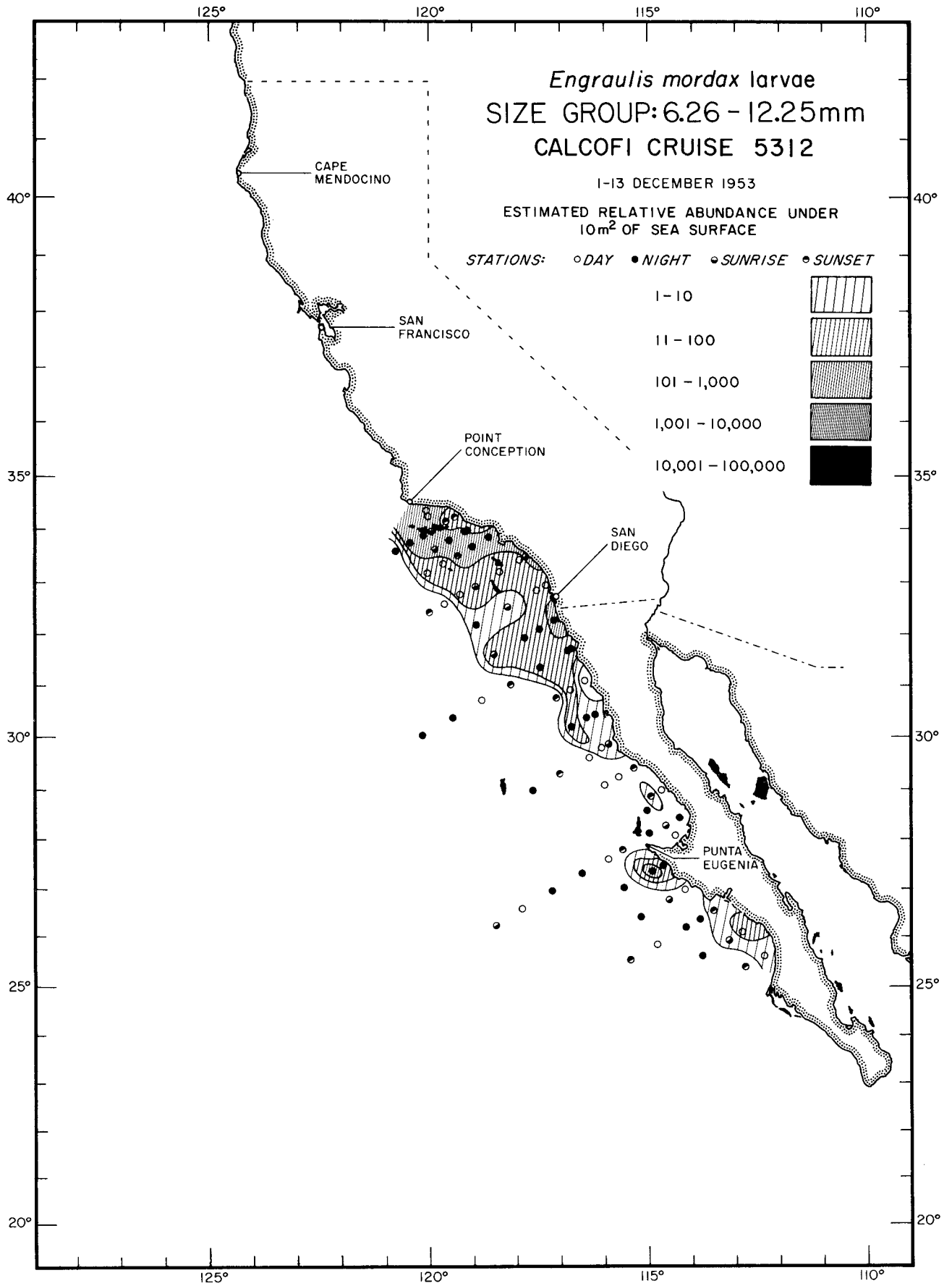


*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5311

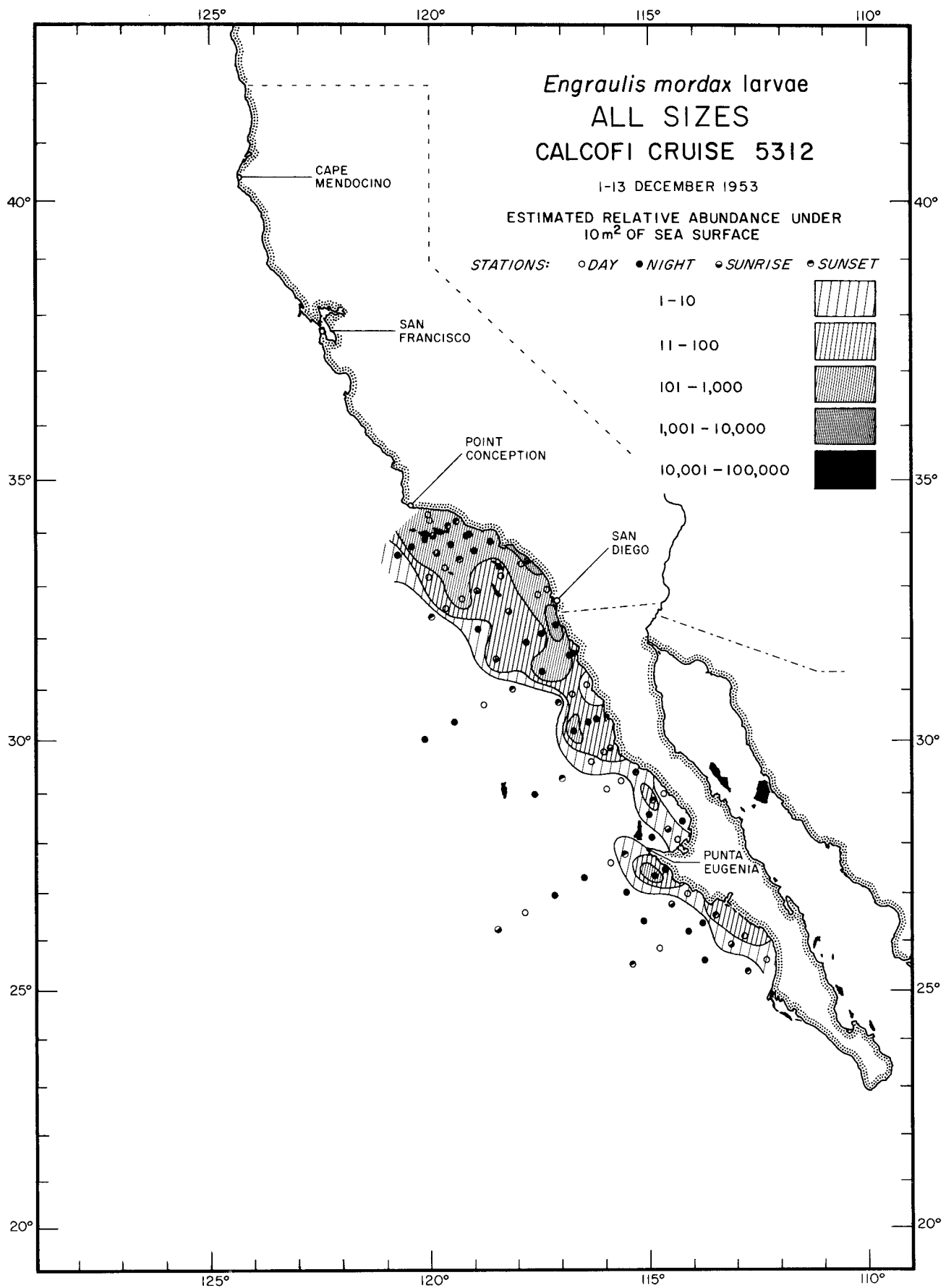


*Engraulis mordax* larvae  
All Sizes  
5311

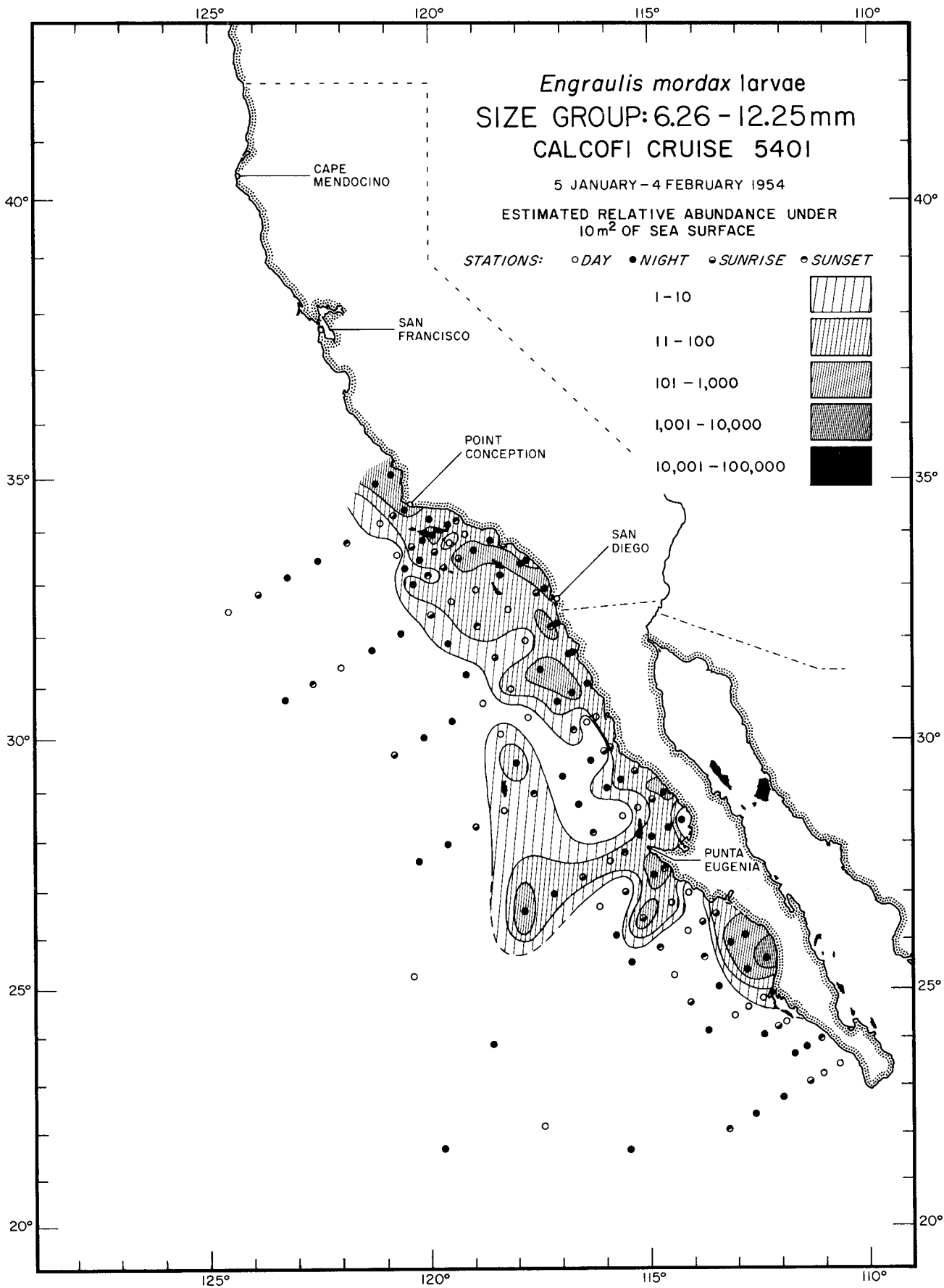




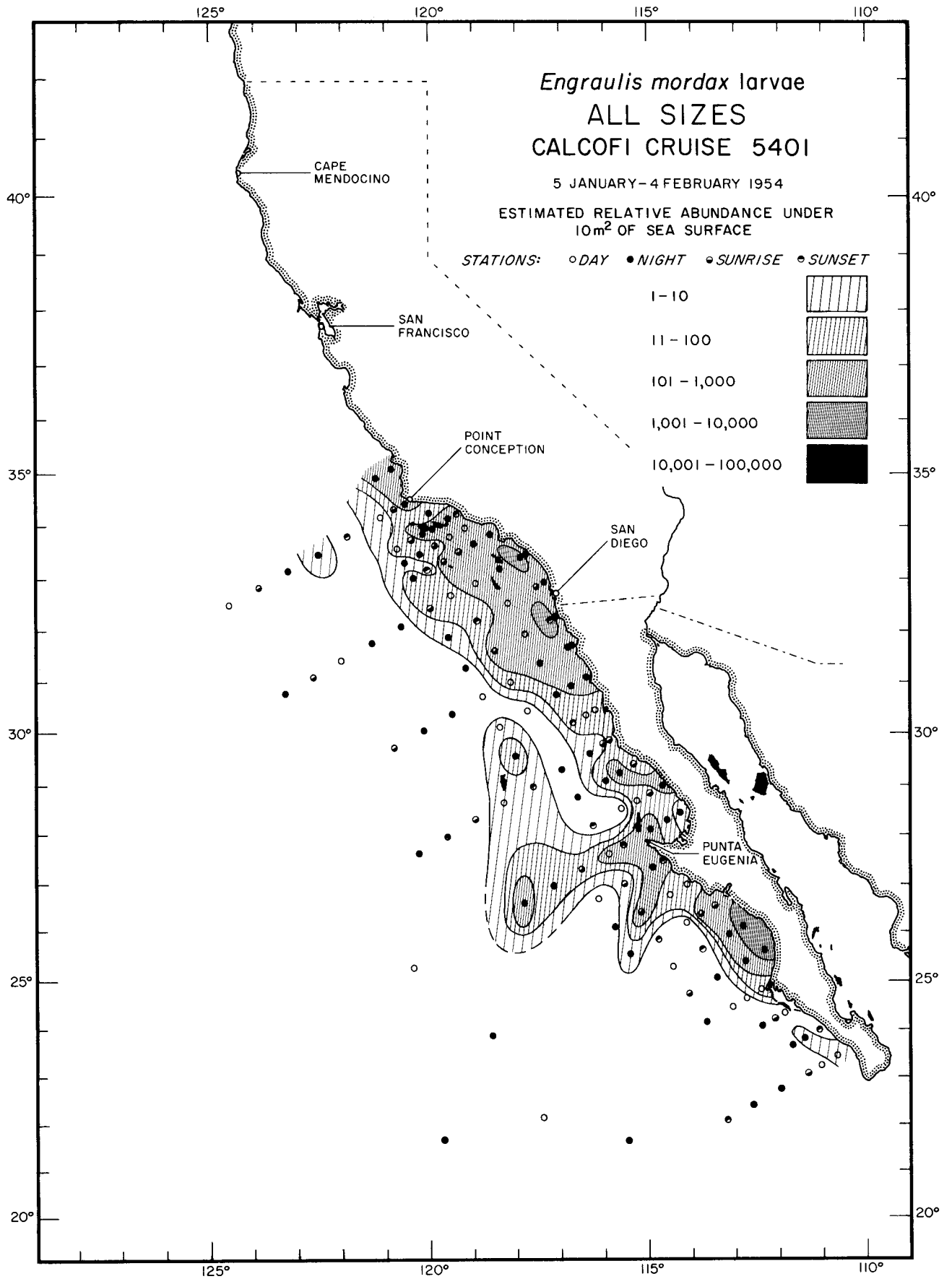
*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5312



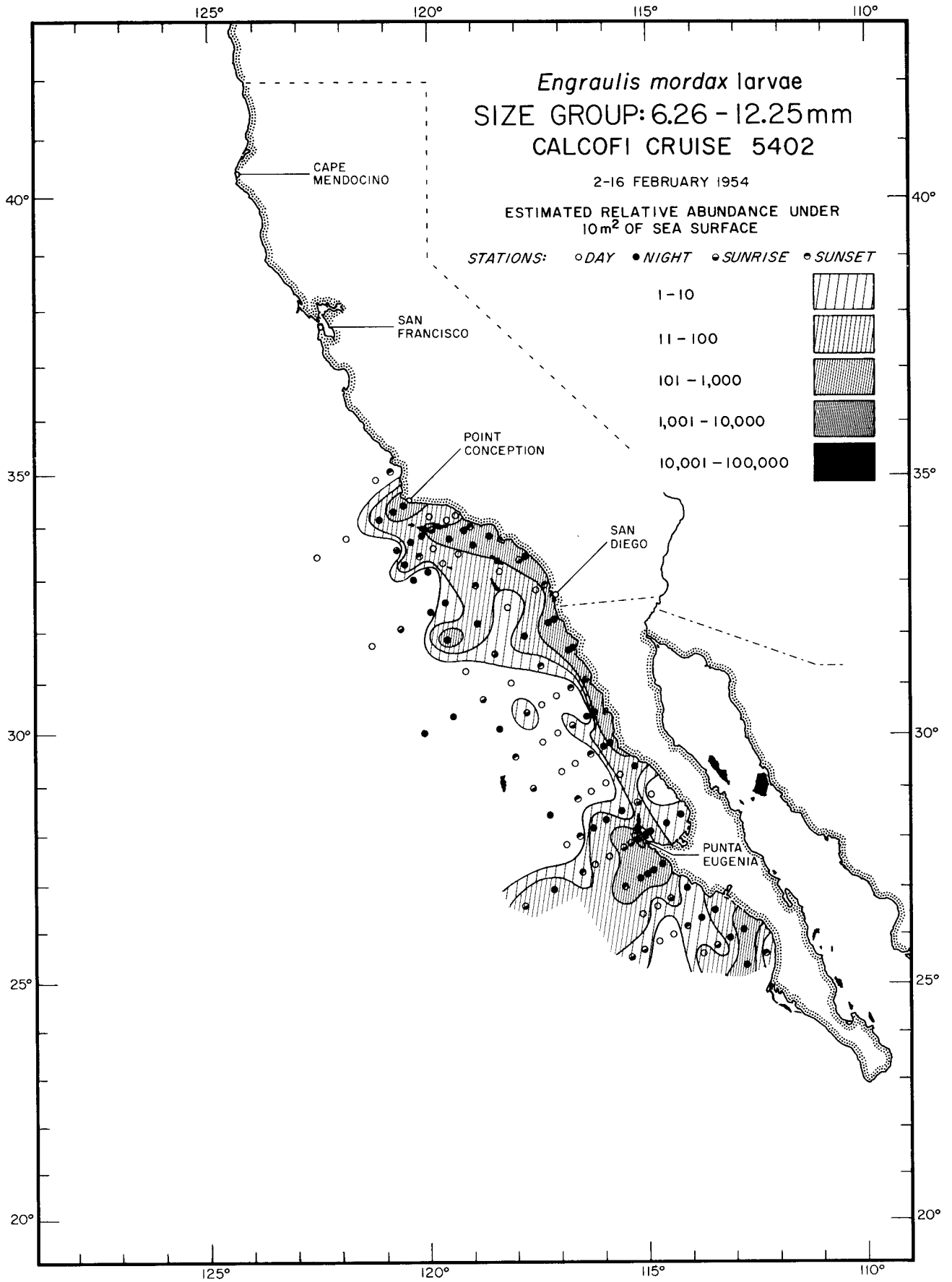
*Engraulis mordax* larvae  
All Sizes  
5312



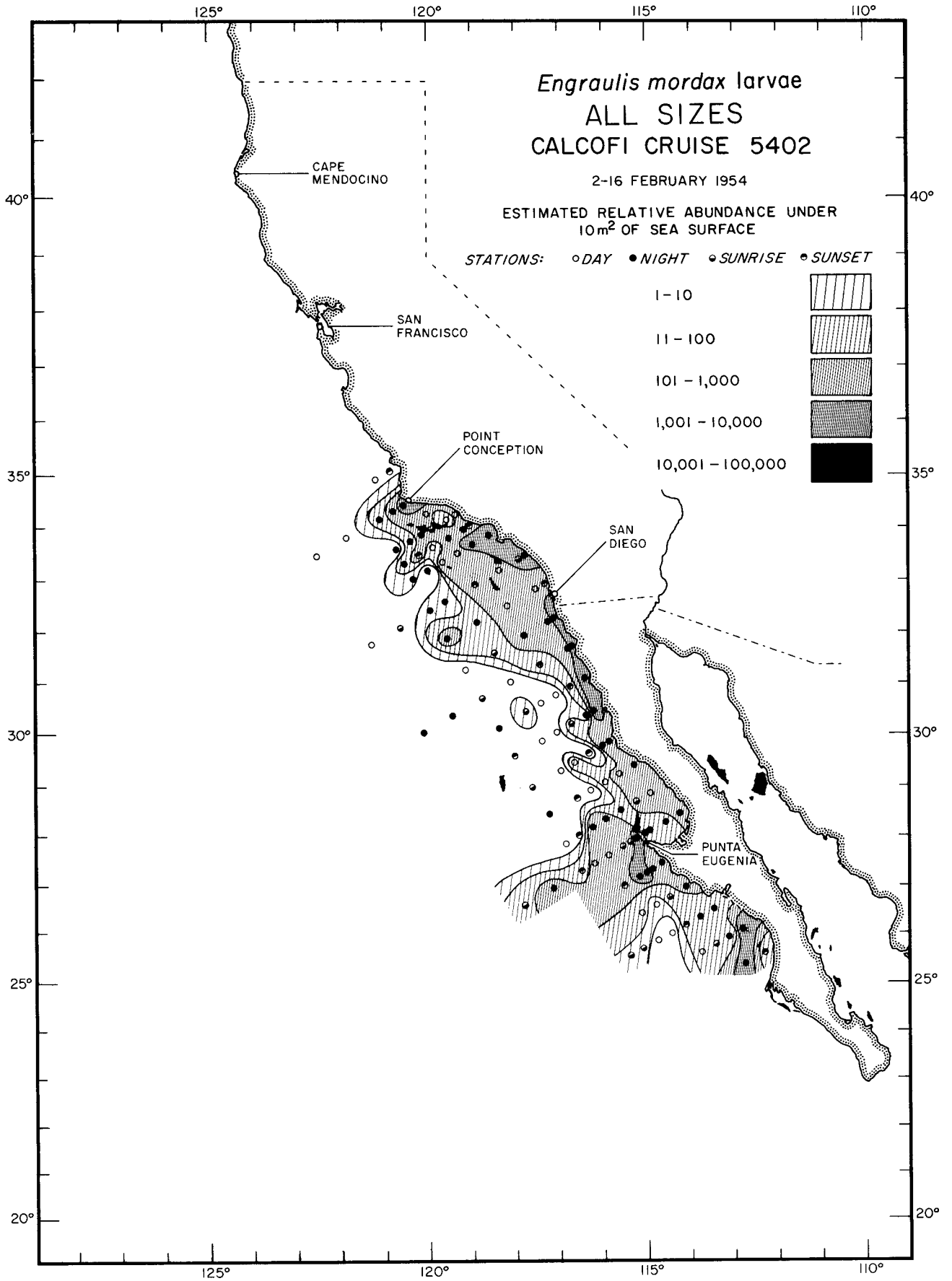
*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5401



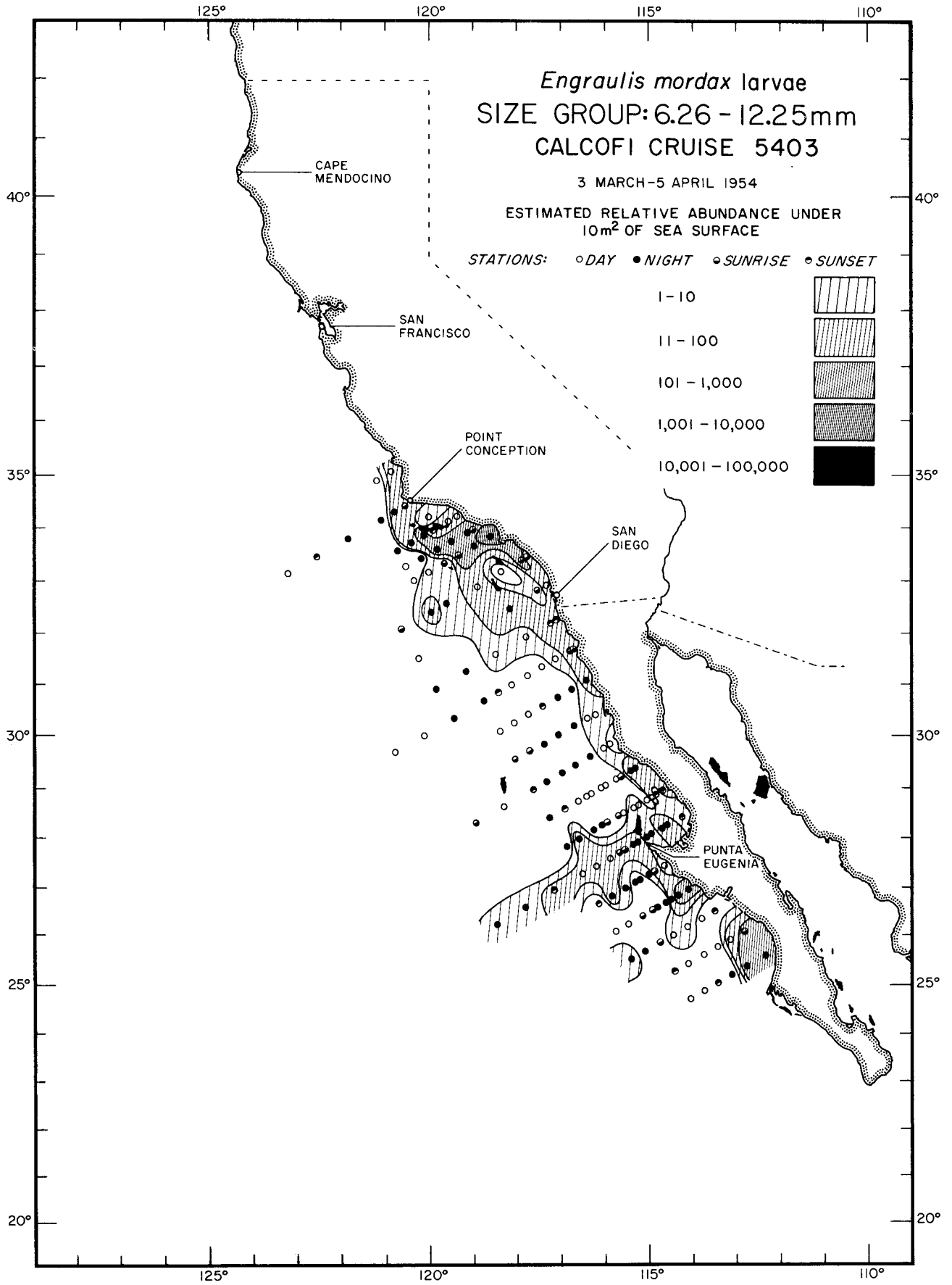
*Engraulis mordax* larvae  
All Sizes  
5401



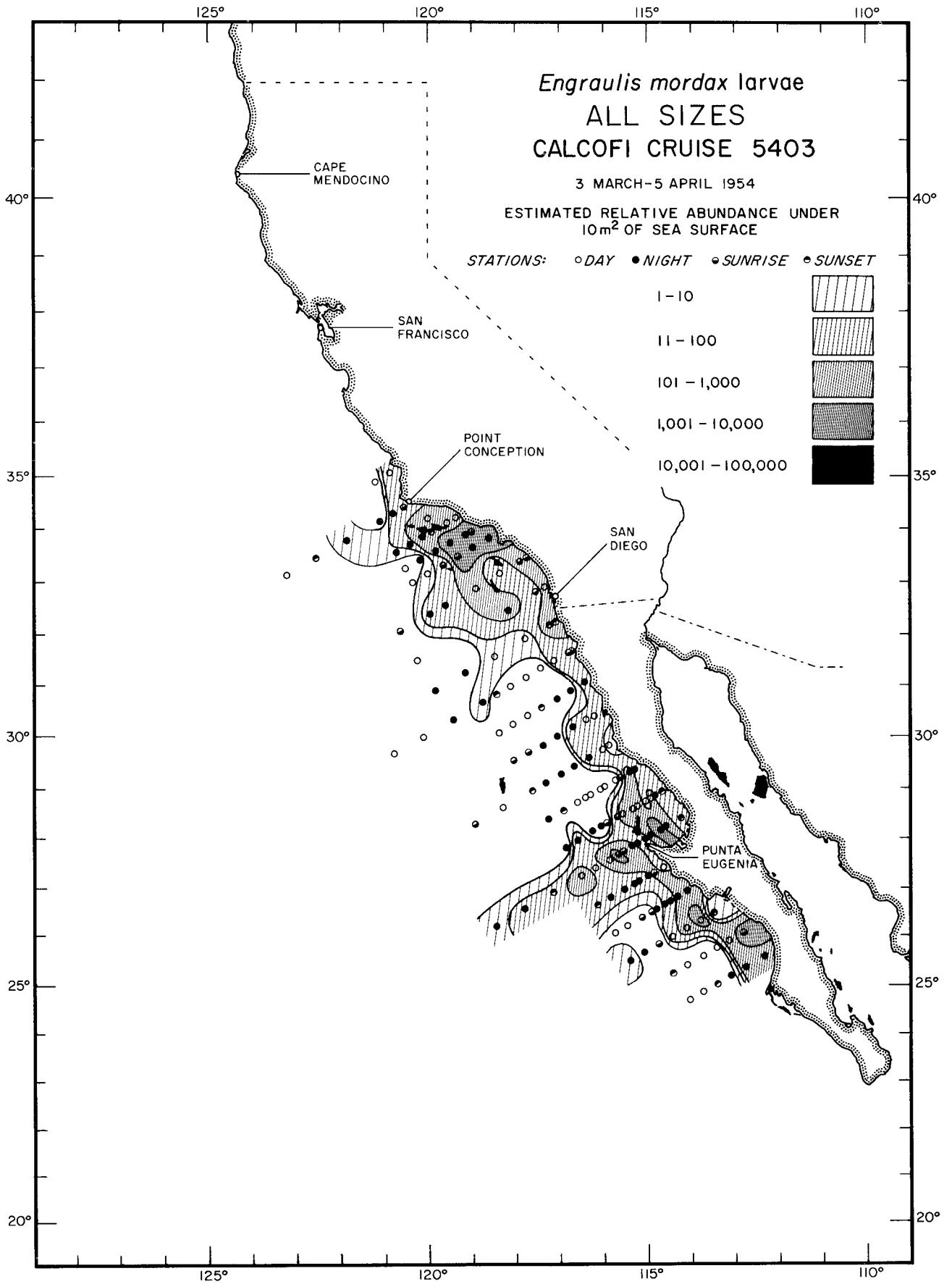
*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5402



*Engraulis mordax* larvae  
All Sizes  
5402

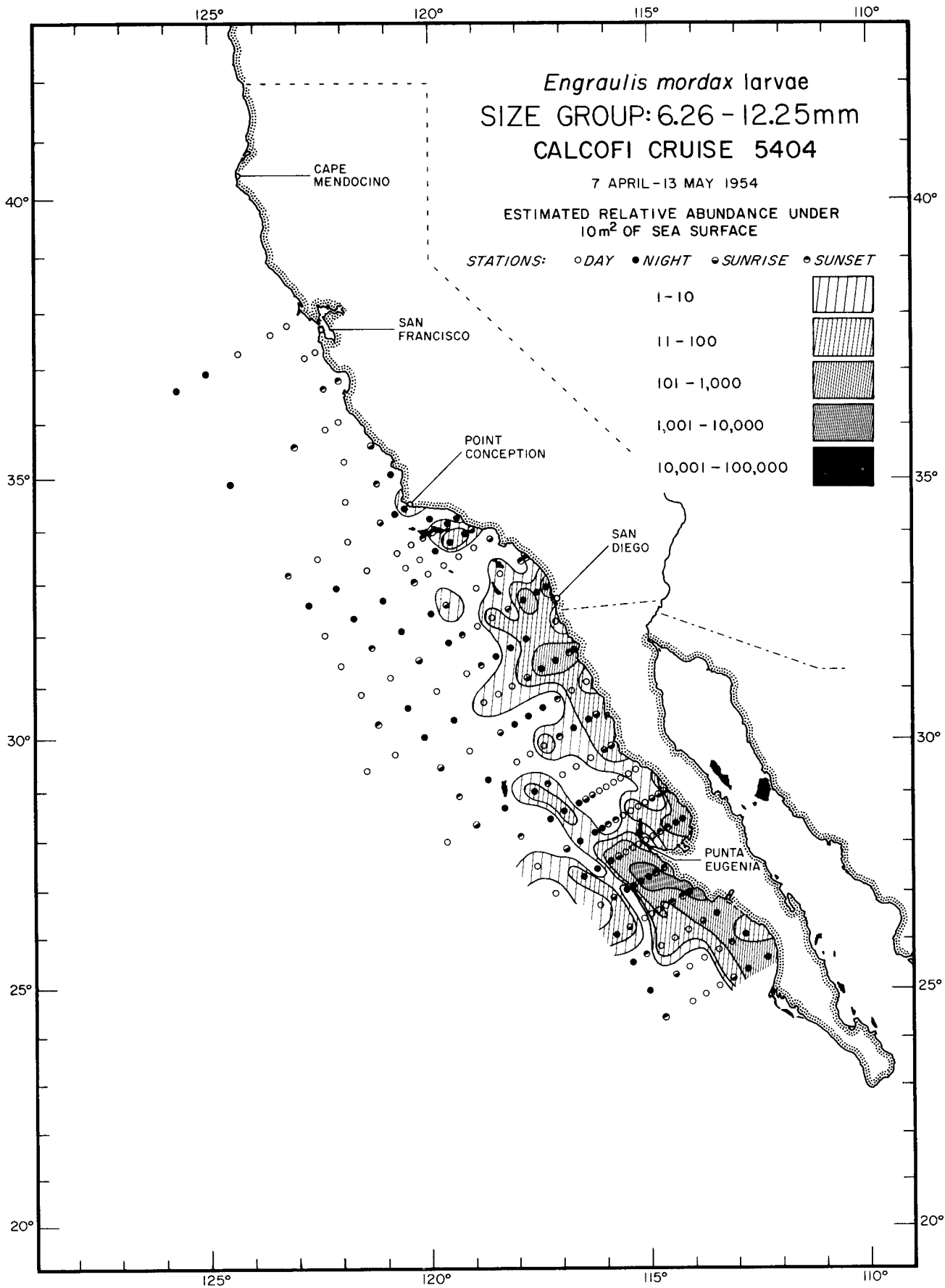


*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5403

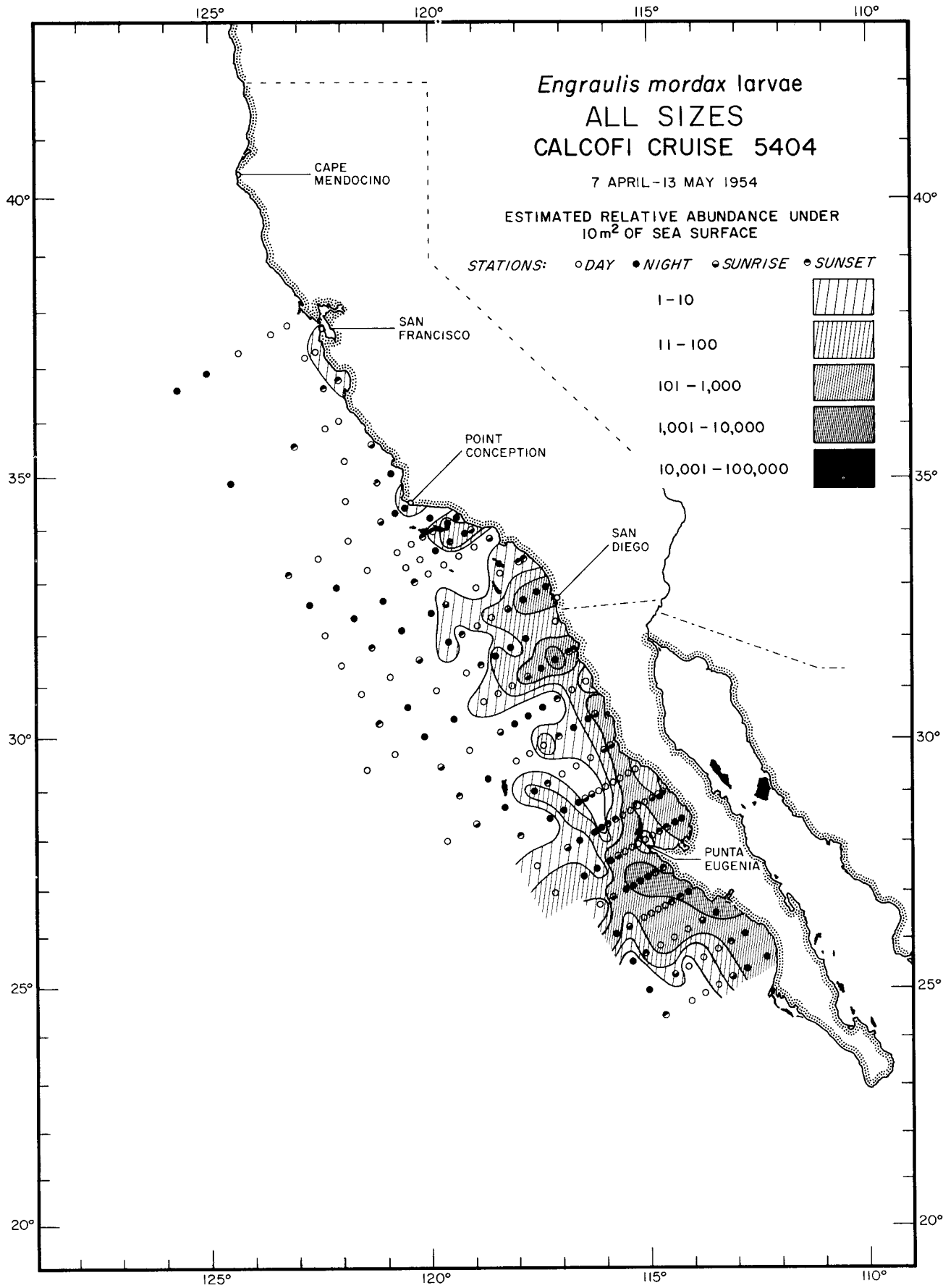


*Engraulis mordax* larvae  
All Sizes  
5403

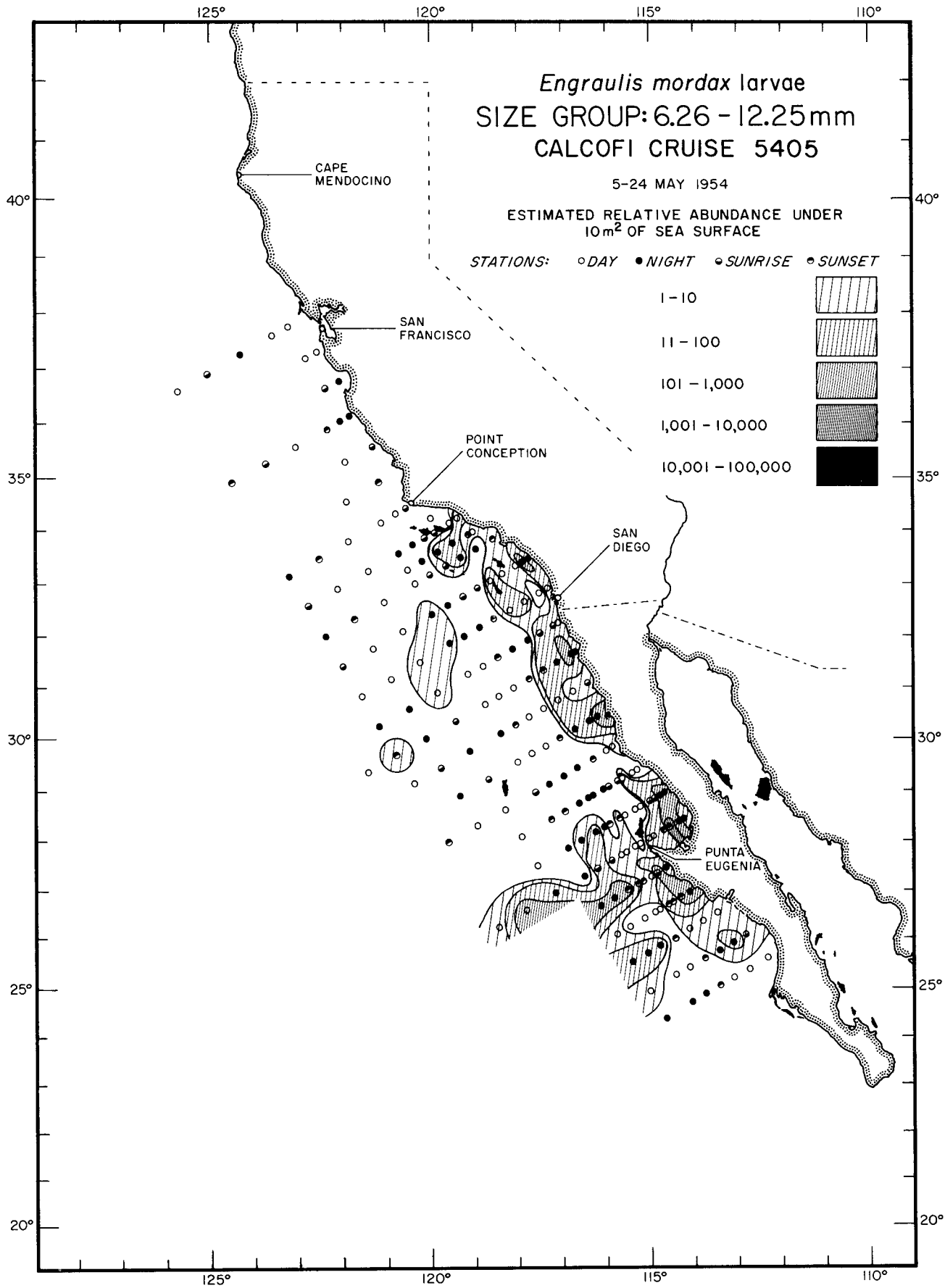




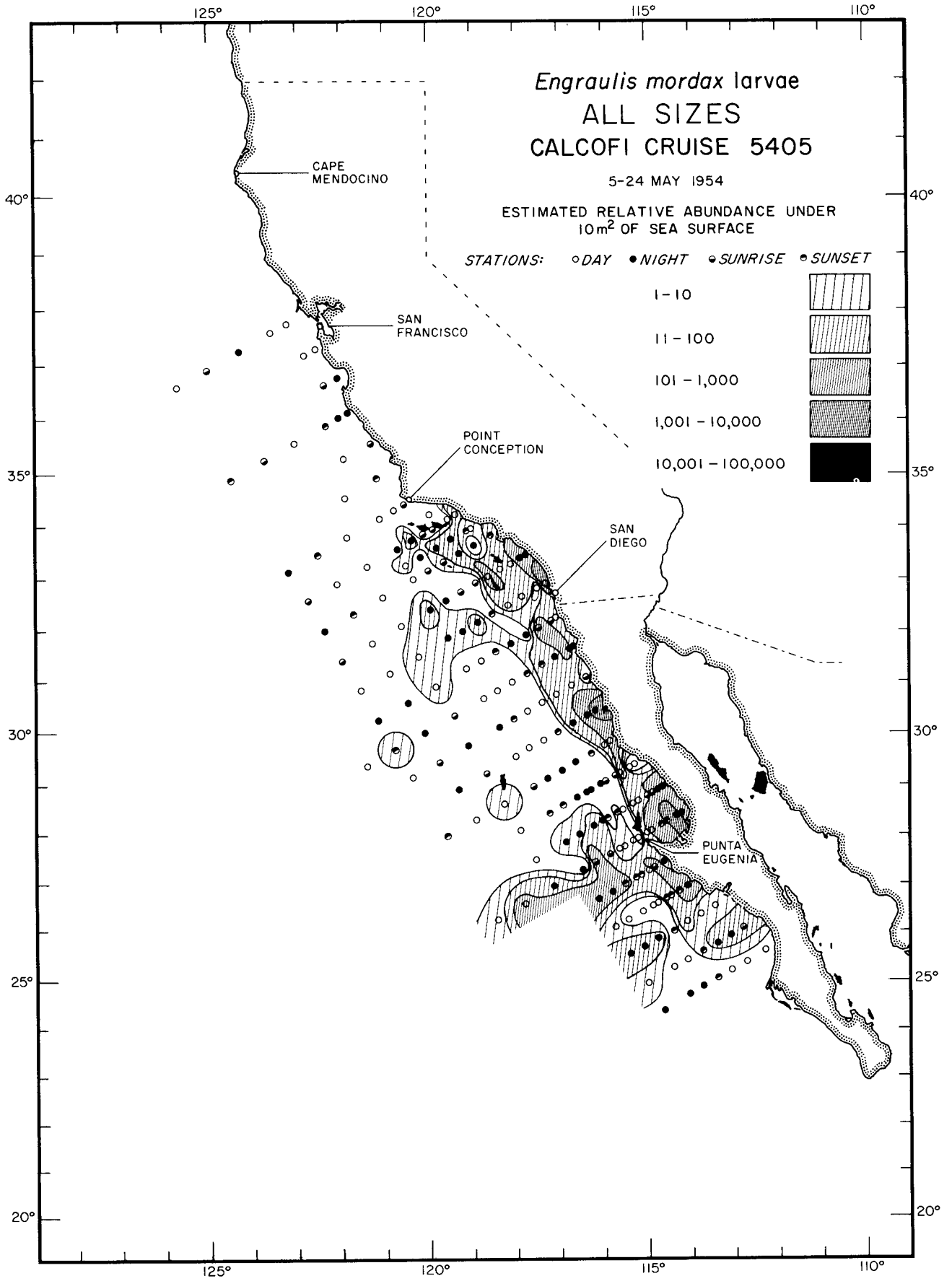
*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5404



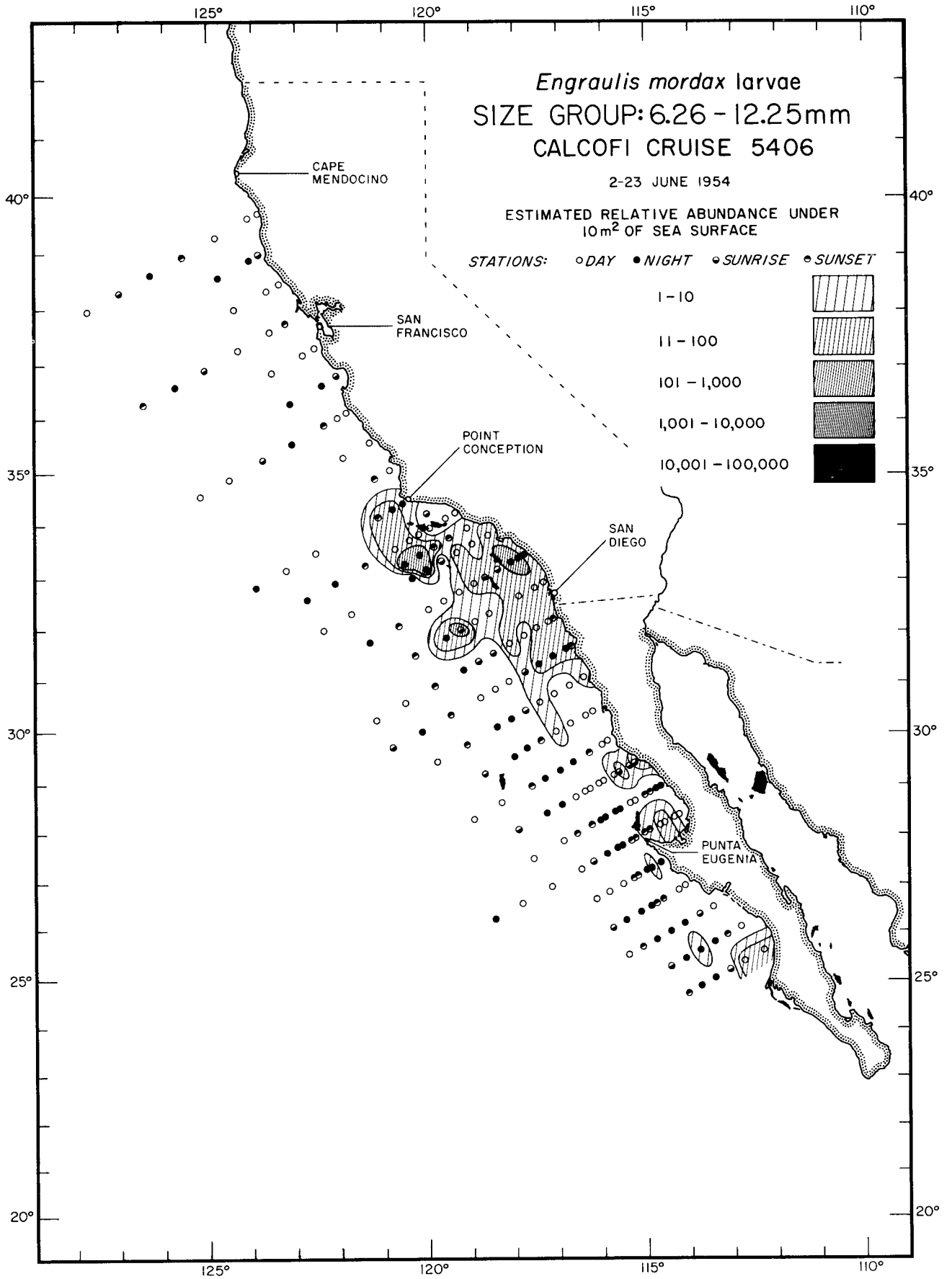
*Engraulis mordax* larvae  
All Sizes  
5404



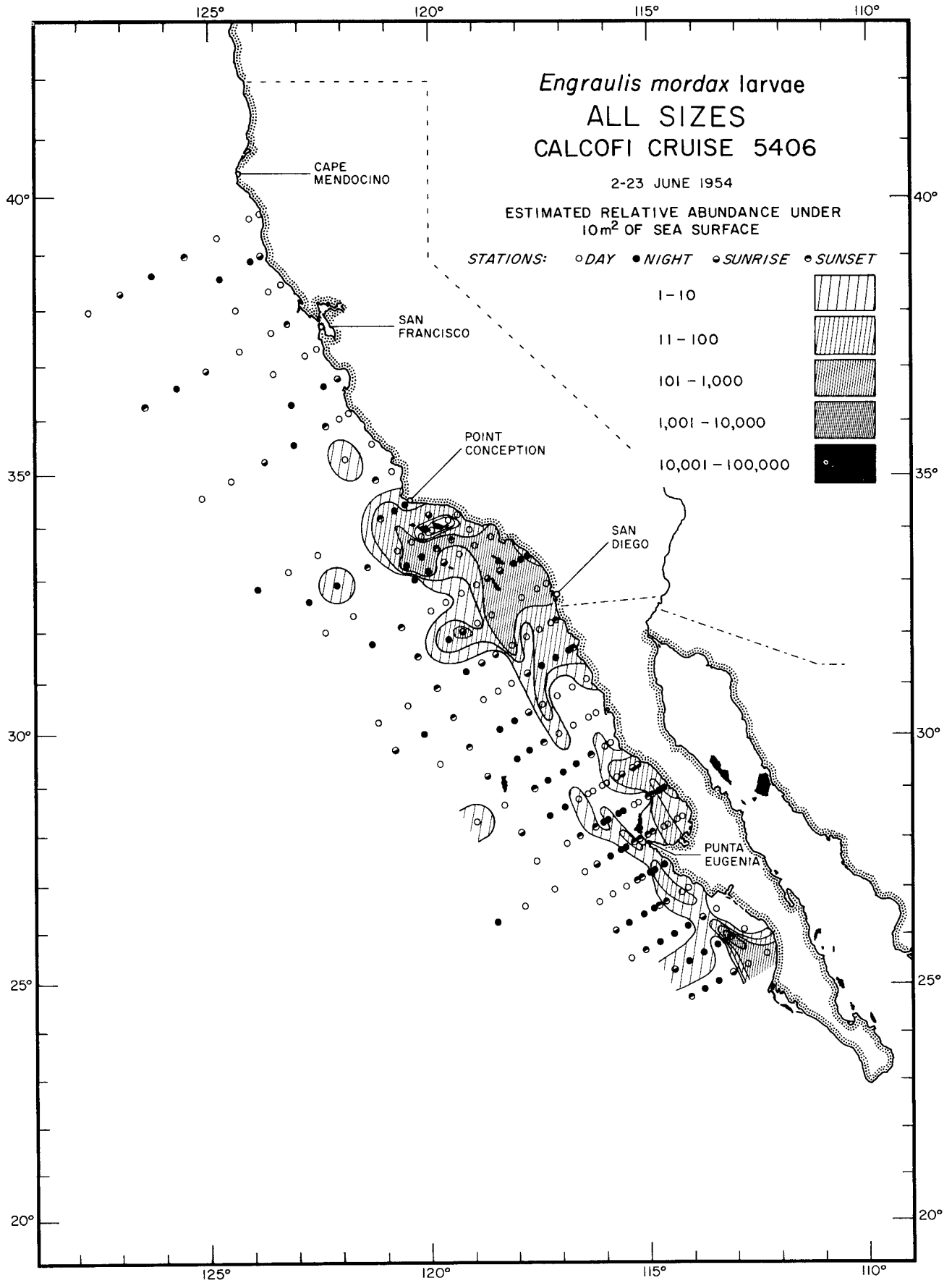
*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5405



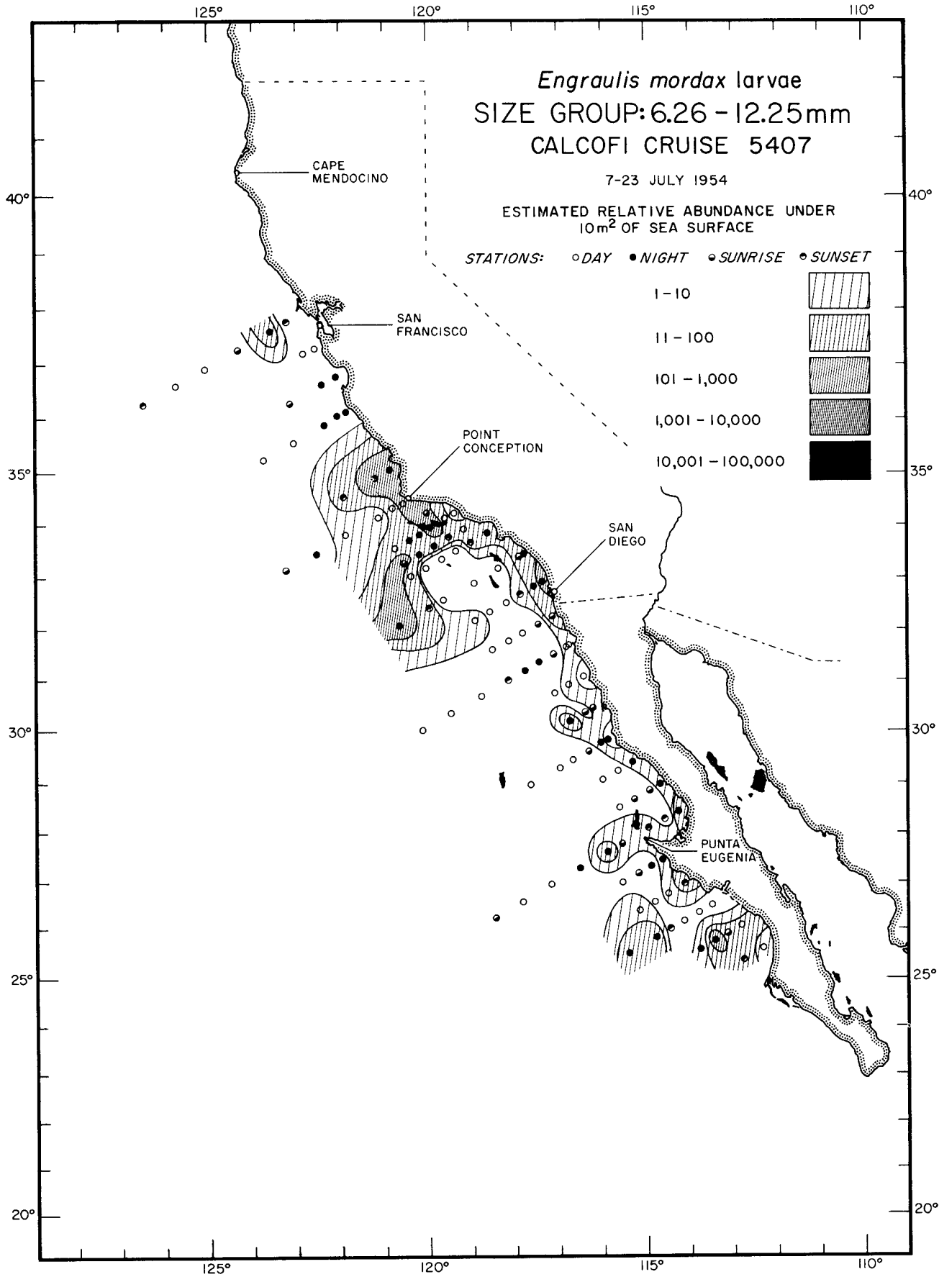
*Engraulis mordax* larvae  
All Sizes  
5405



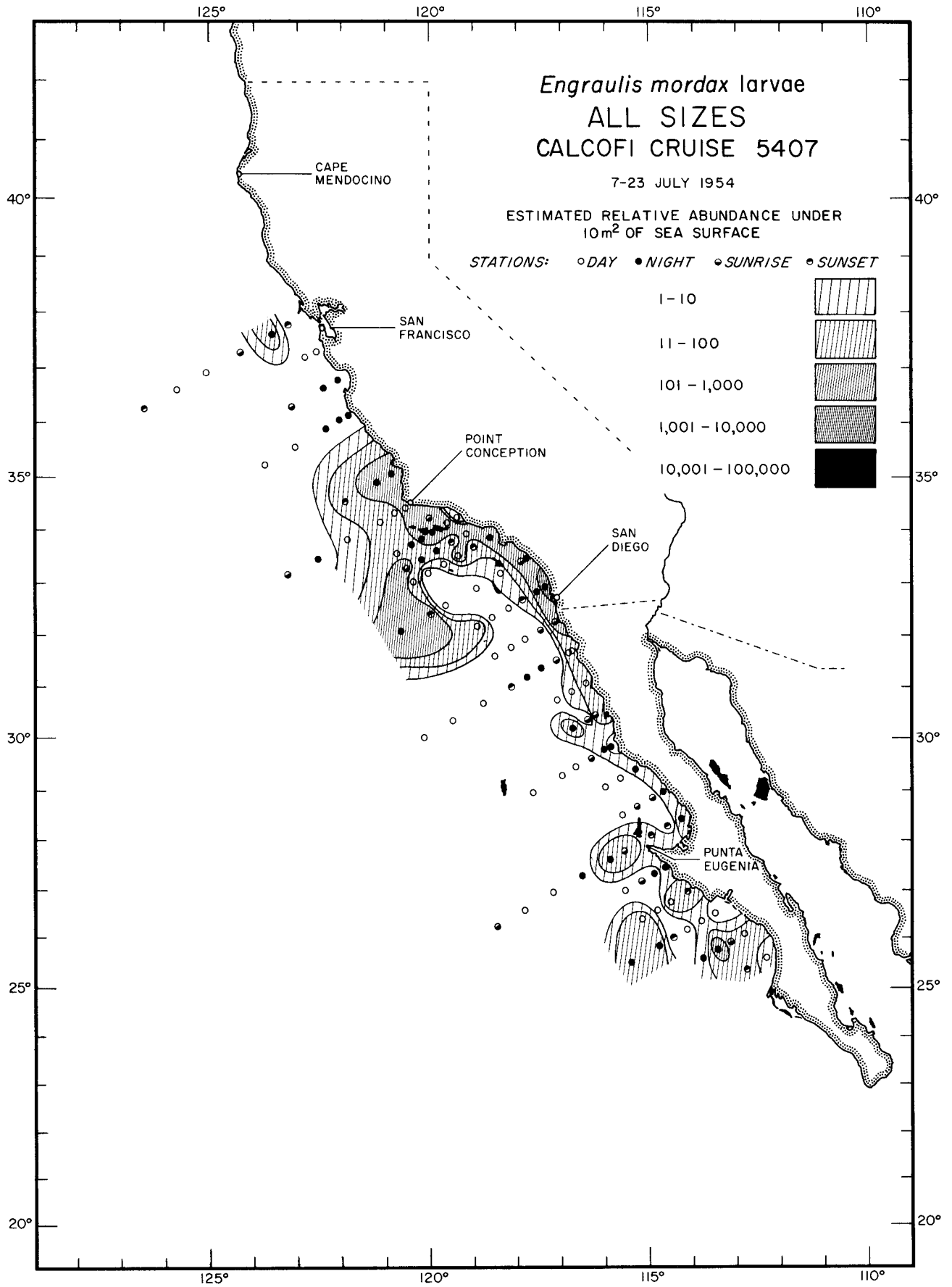
*Engraulis mordax* larvae  
 Size Group: 6.26-12.25mm  
 5406



*Engraulis mordax* larvae  
All Sizes  
5406

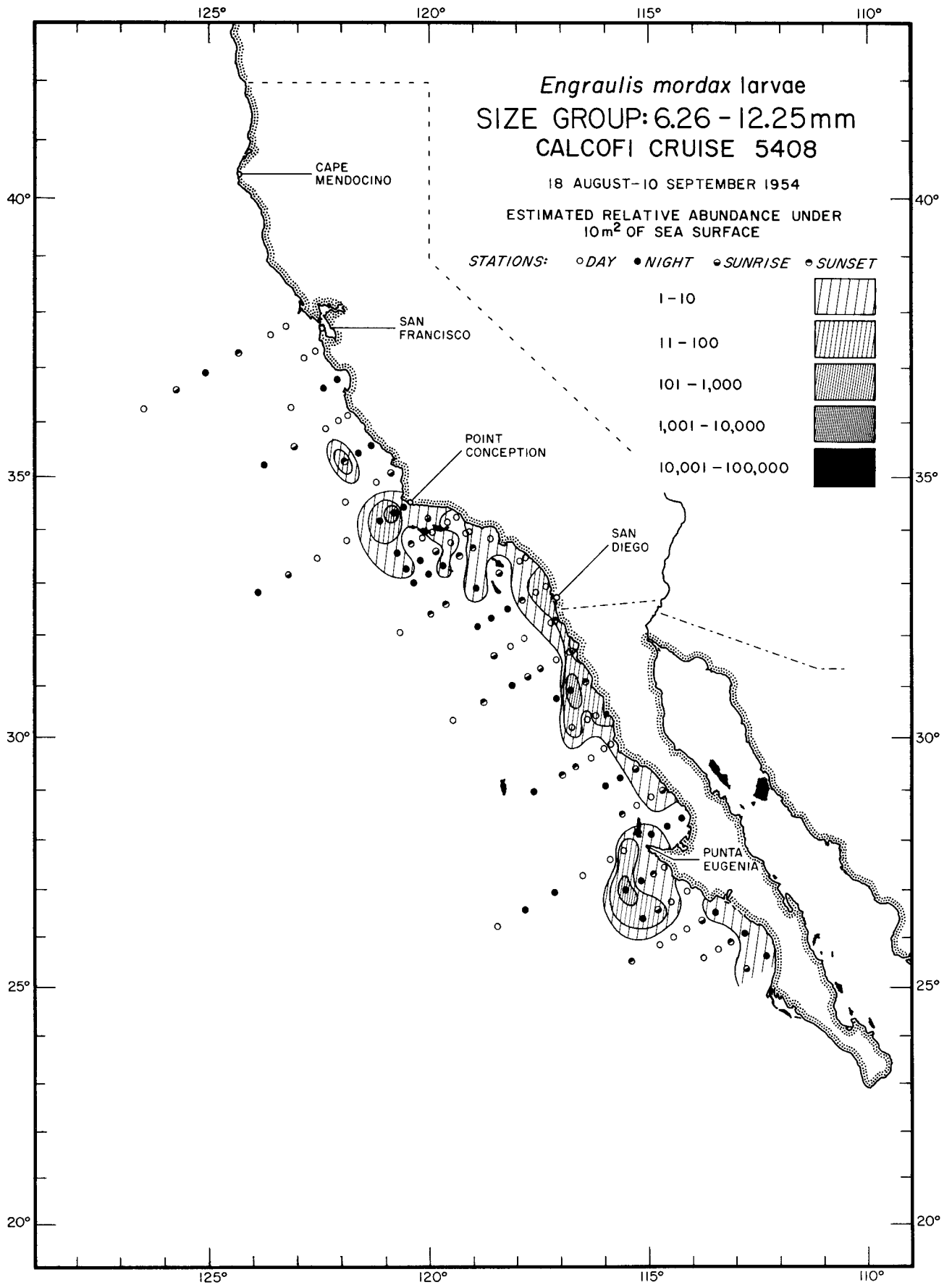


*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5407

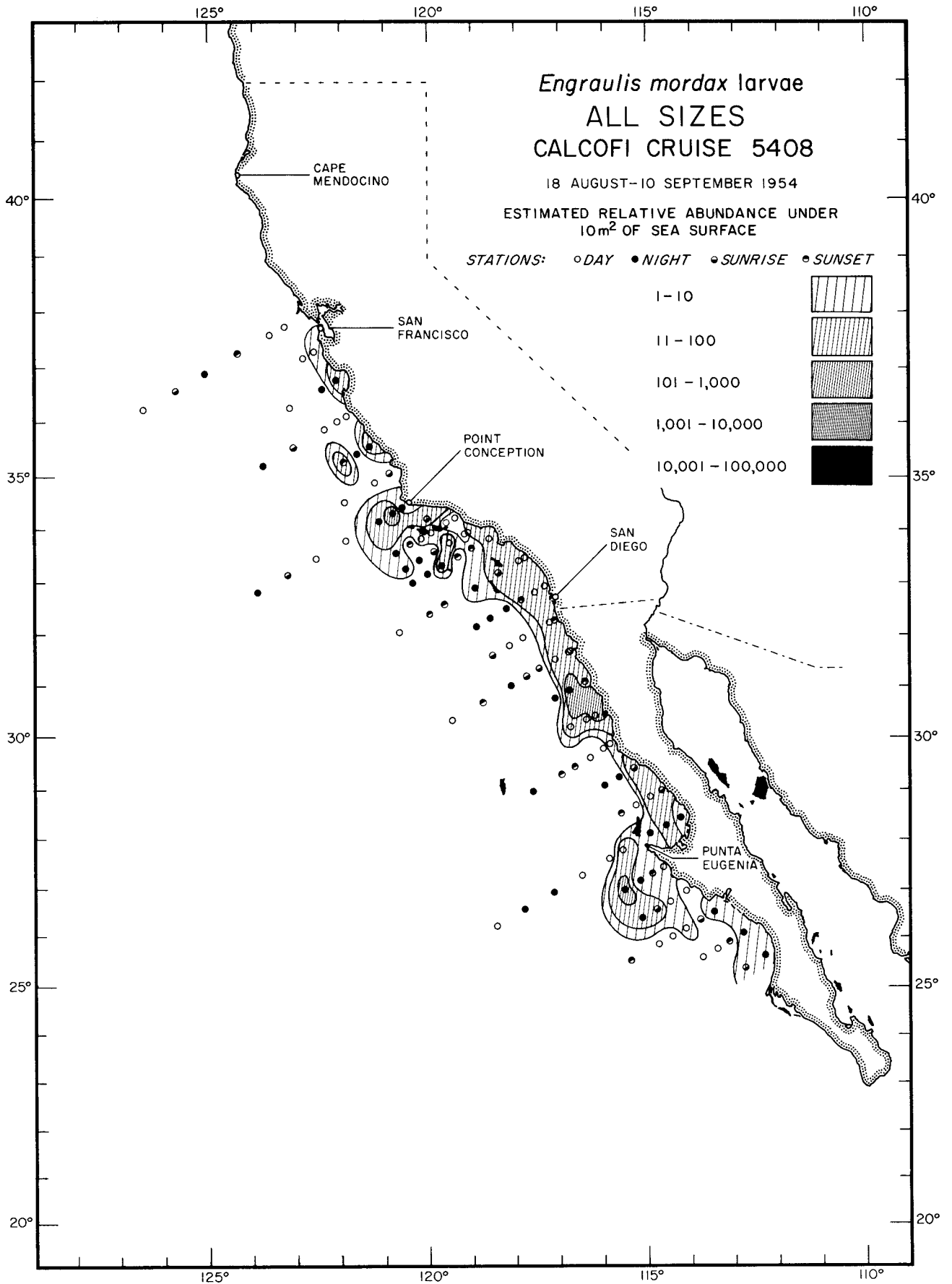


*Engraulis mordax* larvae  
All Sizes  
5407

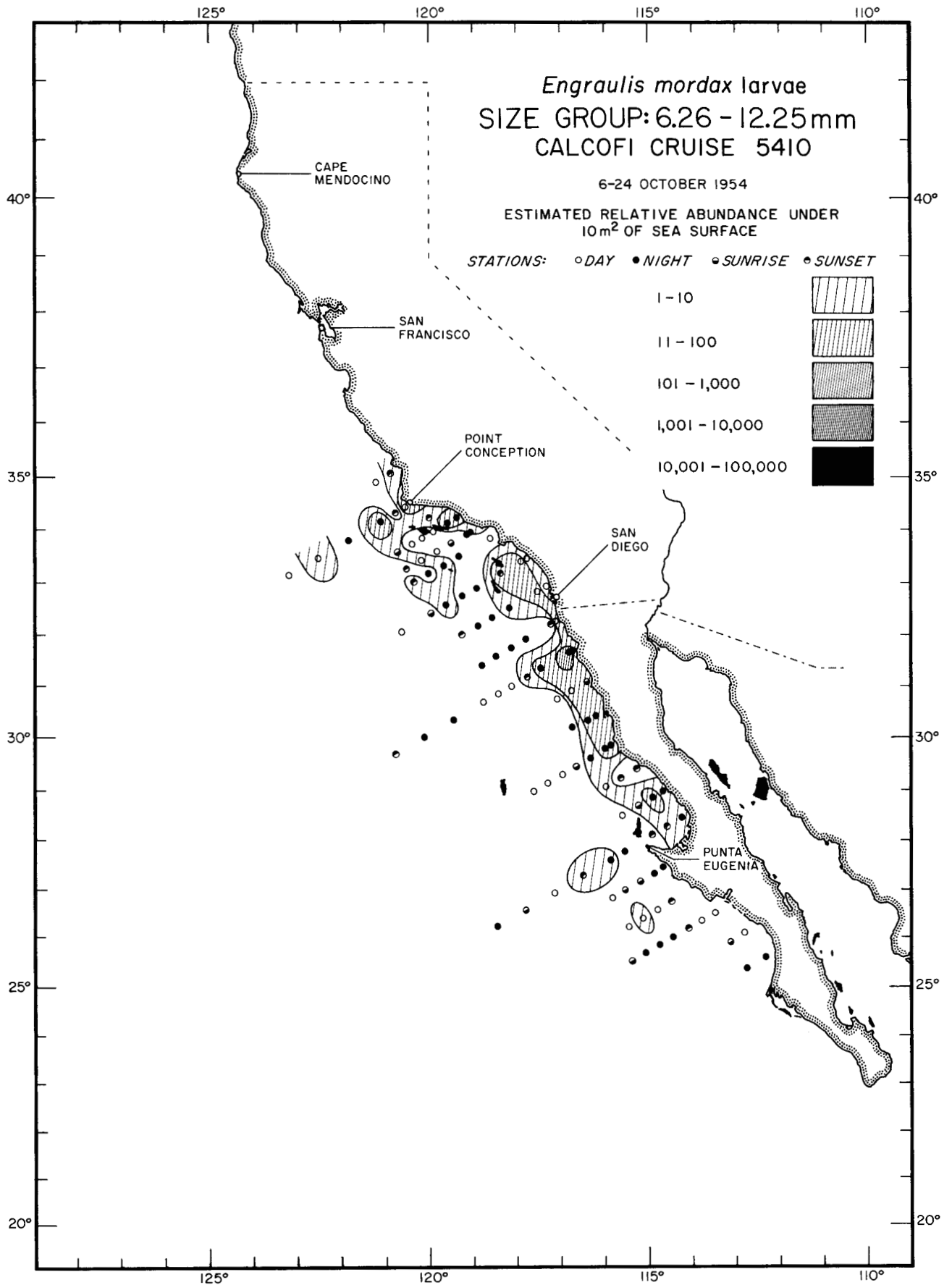




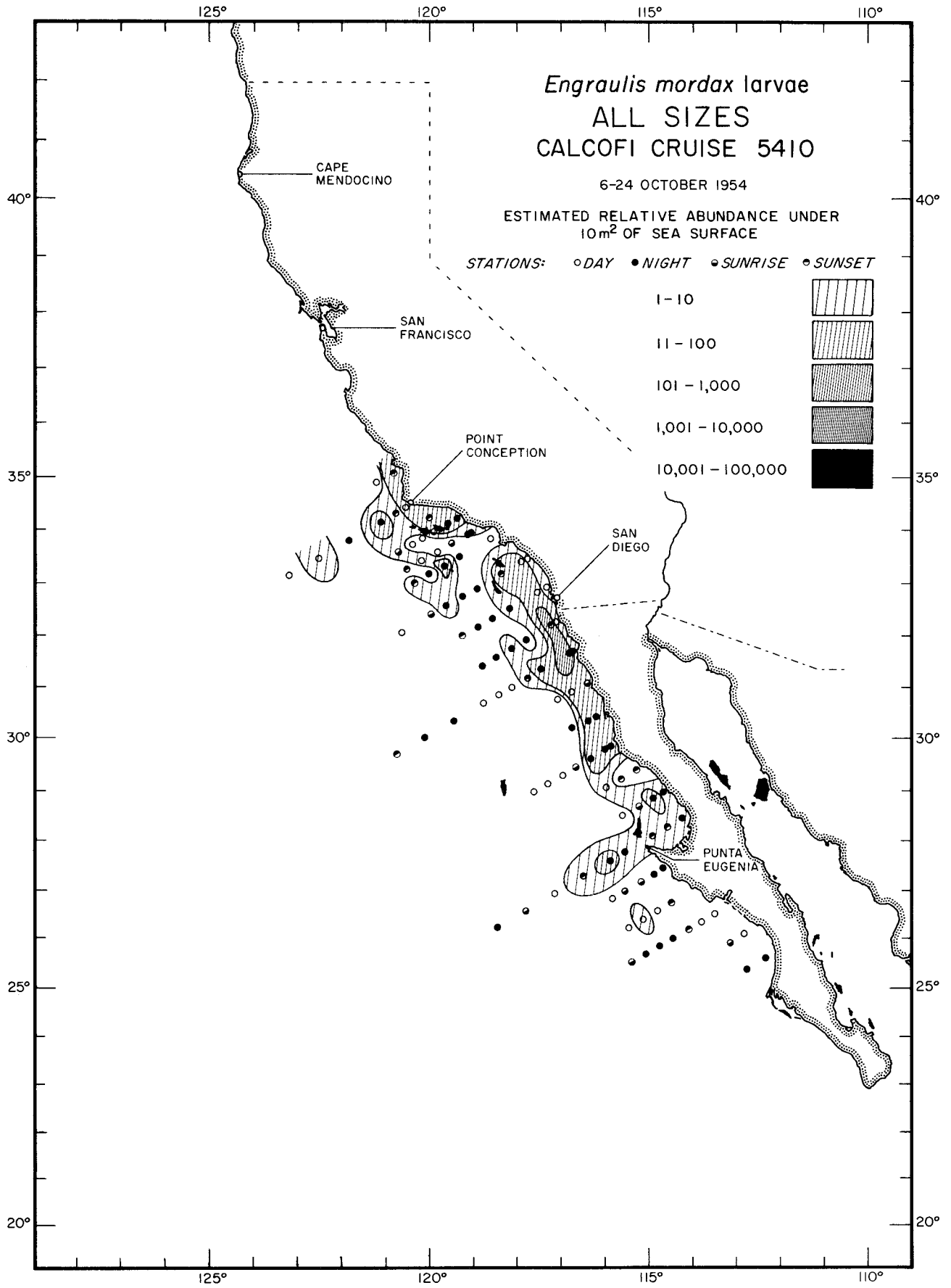
*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5408



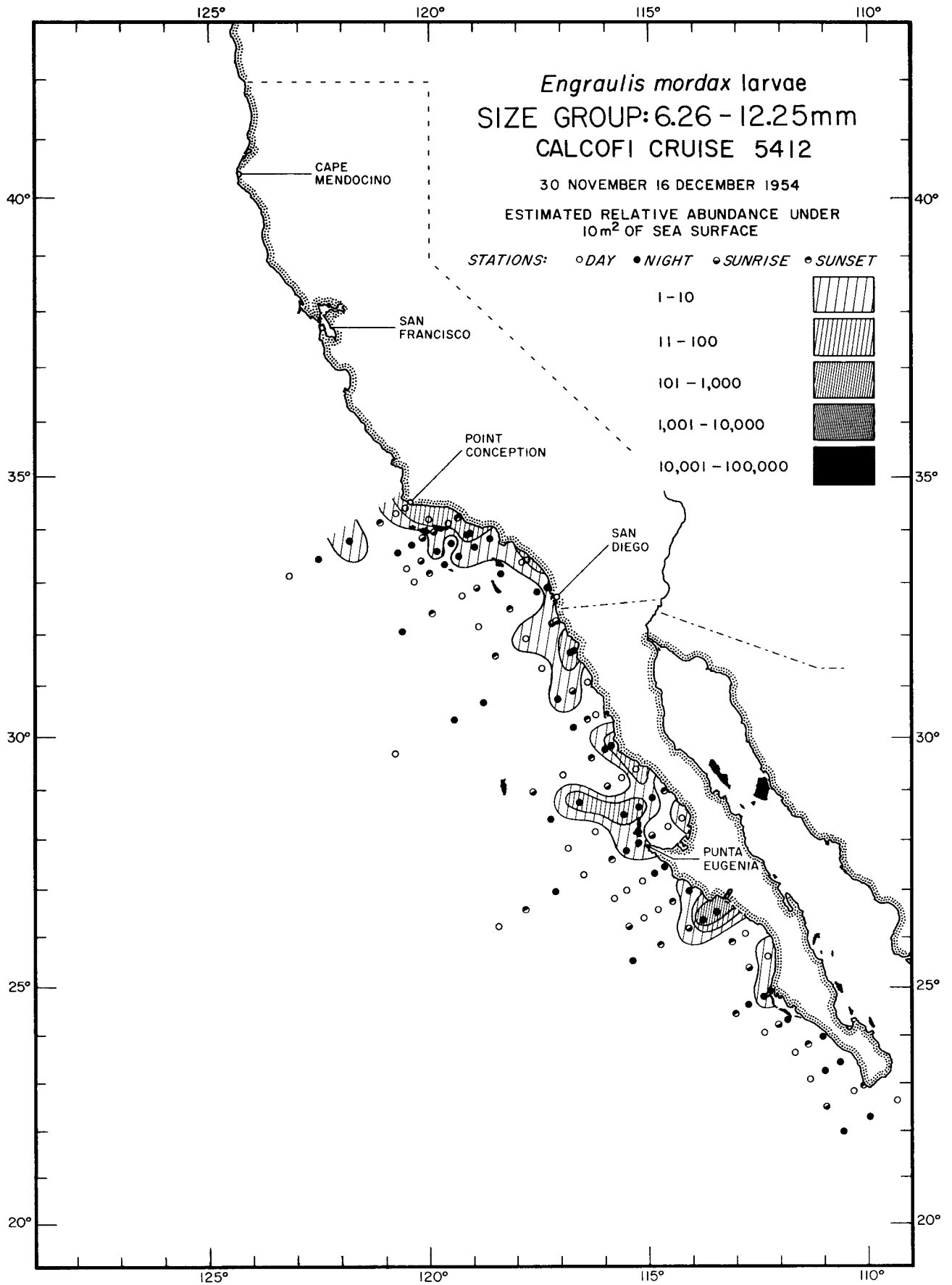
*Engraulis mordax* larvae  
All Sizes  
5408



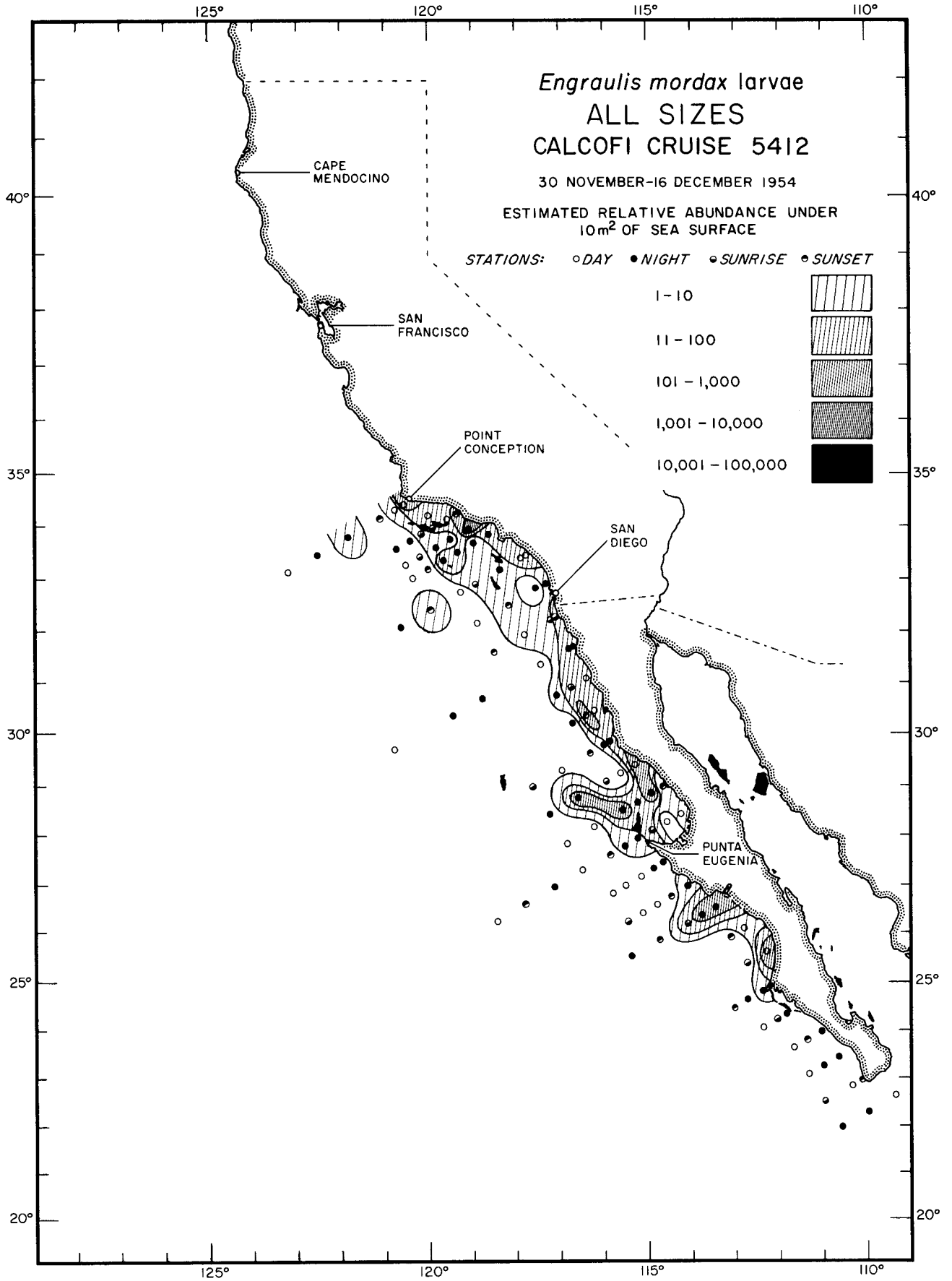
*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5410



*Engraulis mordax* larvae  
All Sizes  
5410



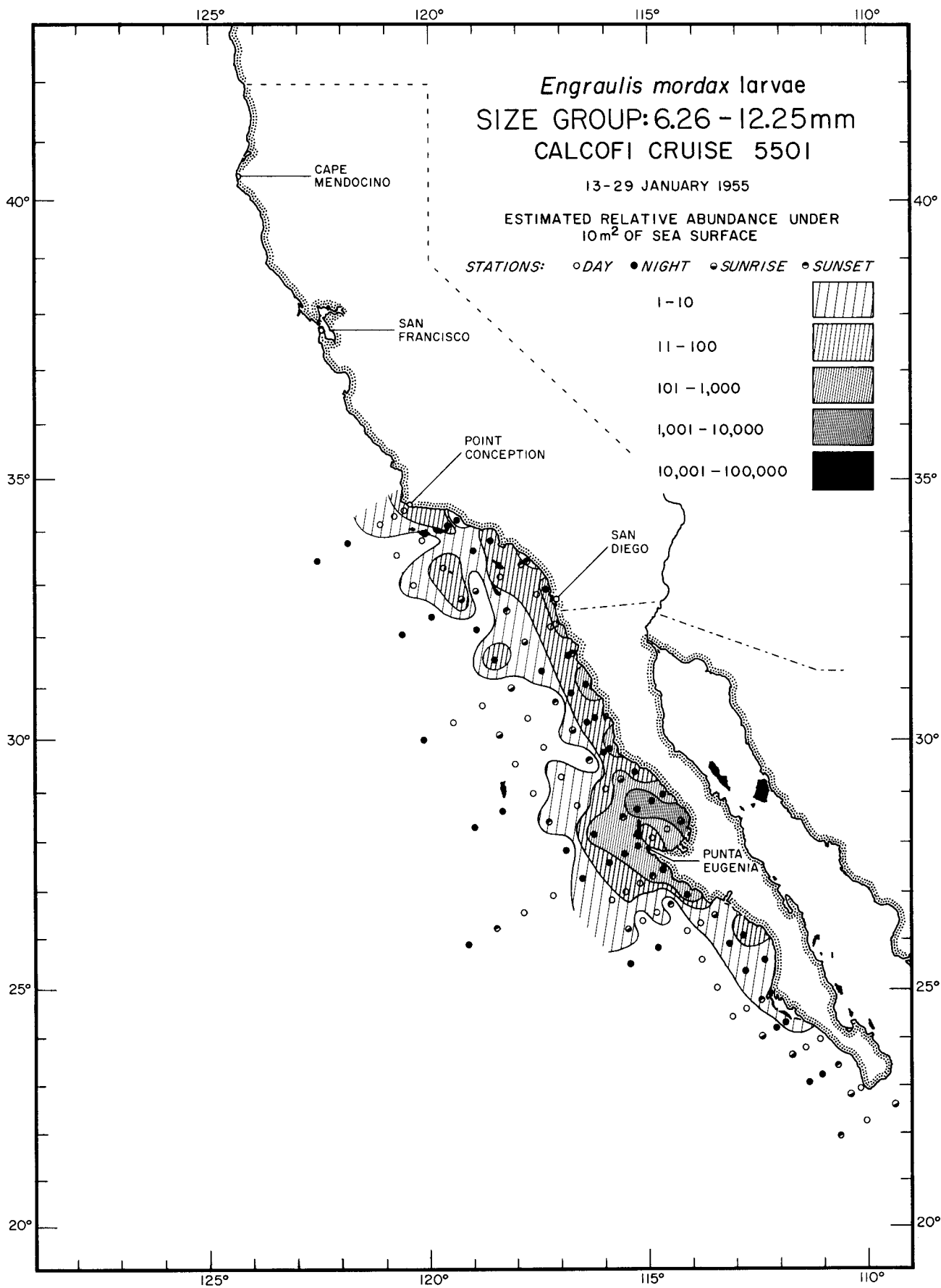
*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5412



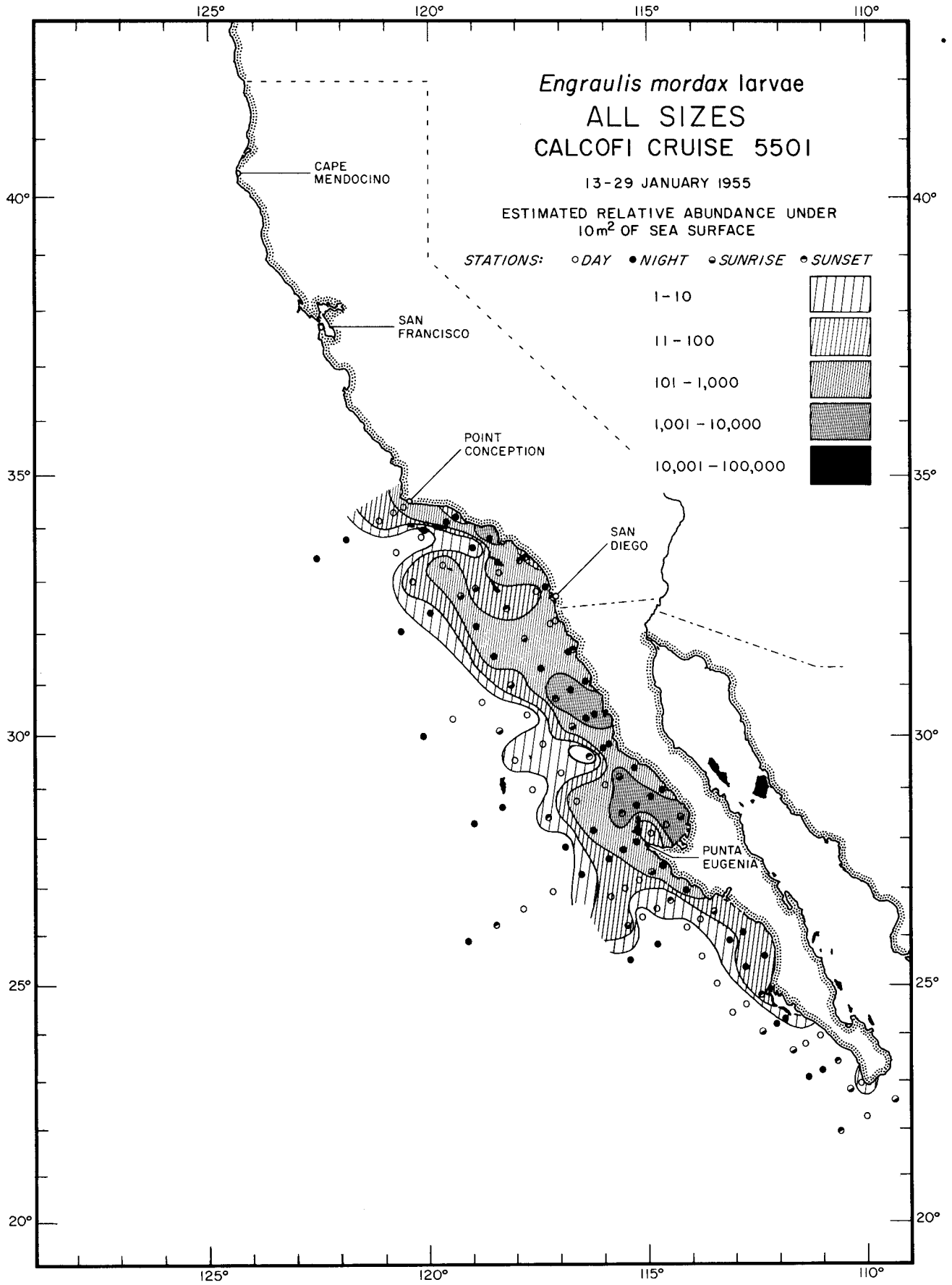
*Engraulis mordax* larvae

All Sizes

5412

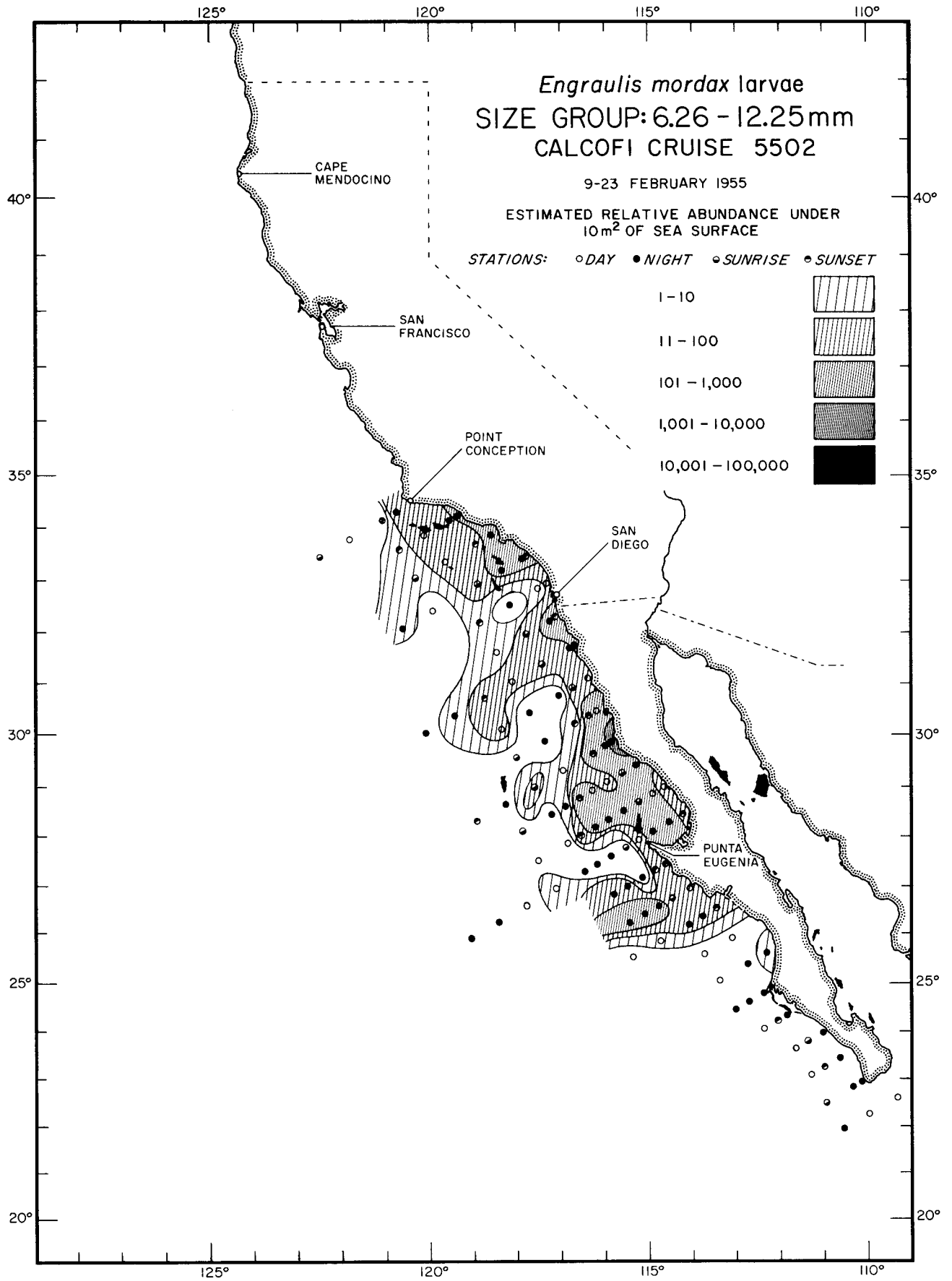


*Engraulis mordax* larvae  
 Size Group: 6.26-12.25mm  
 5501

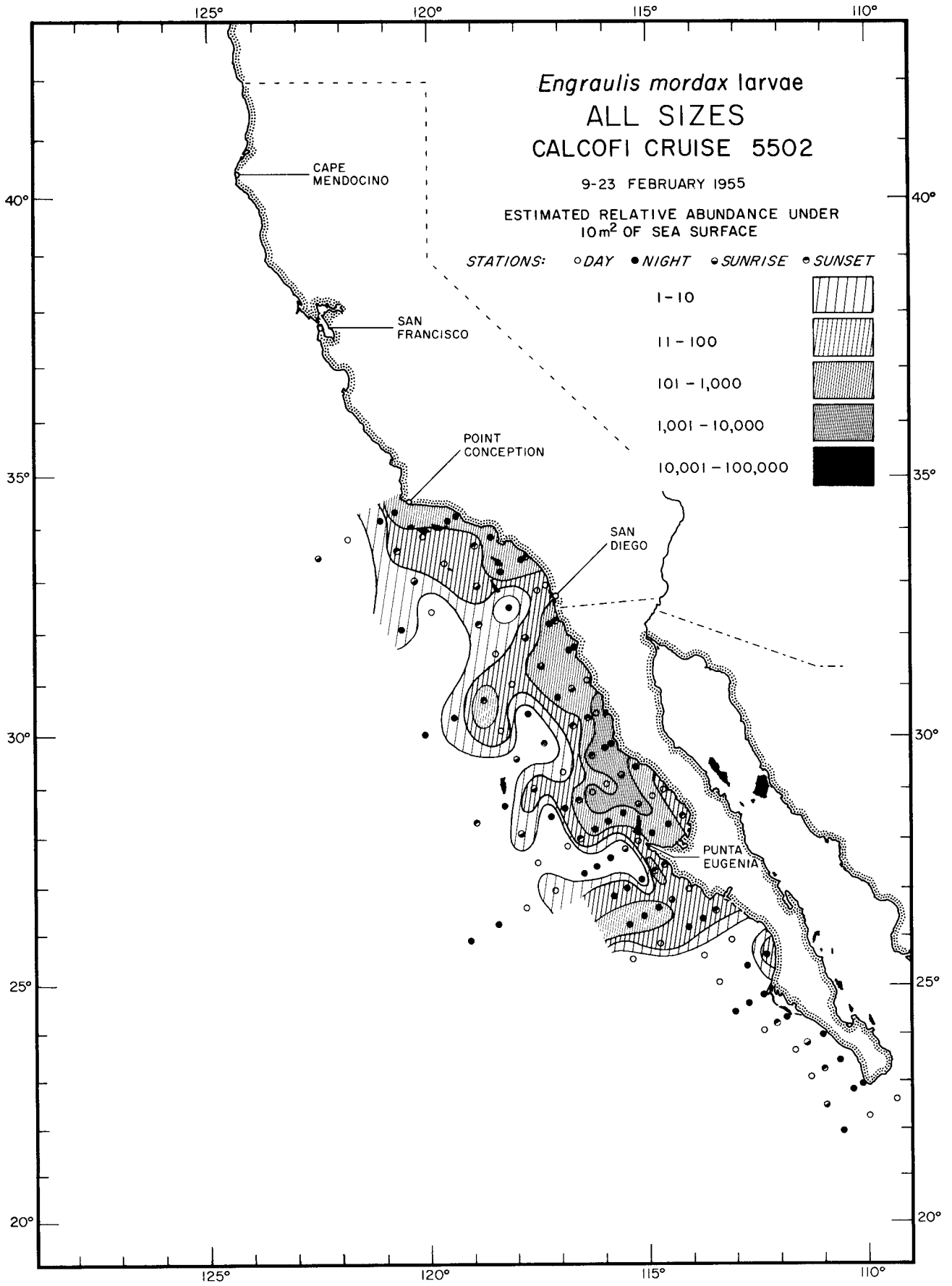


*Engraulis mordax* larvae  
All Sizes  
5501





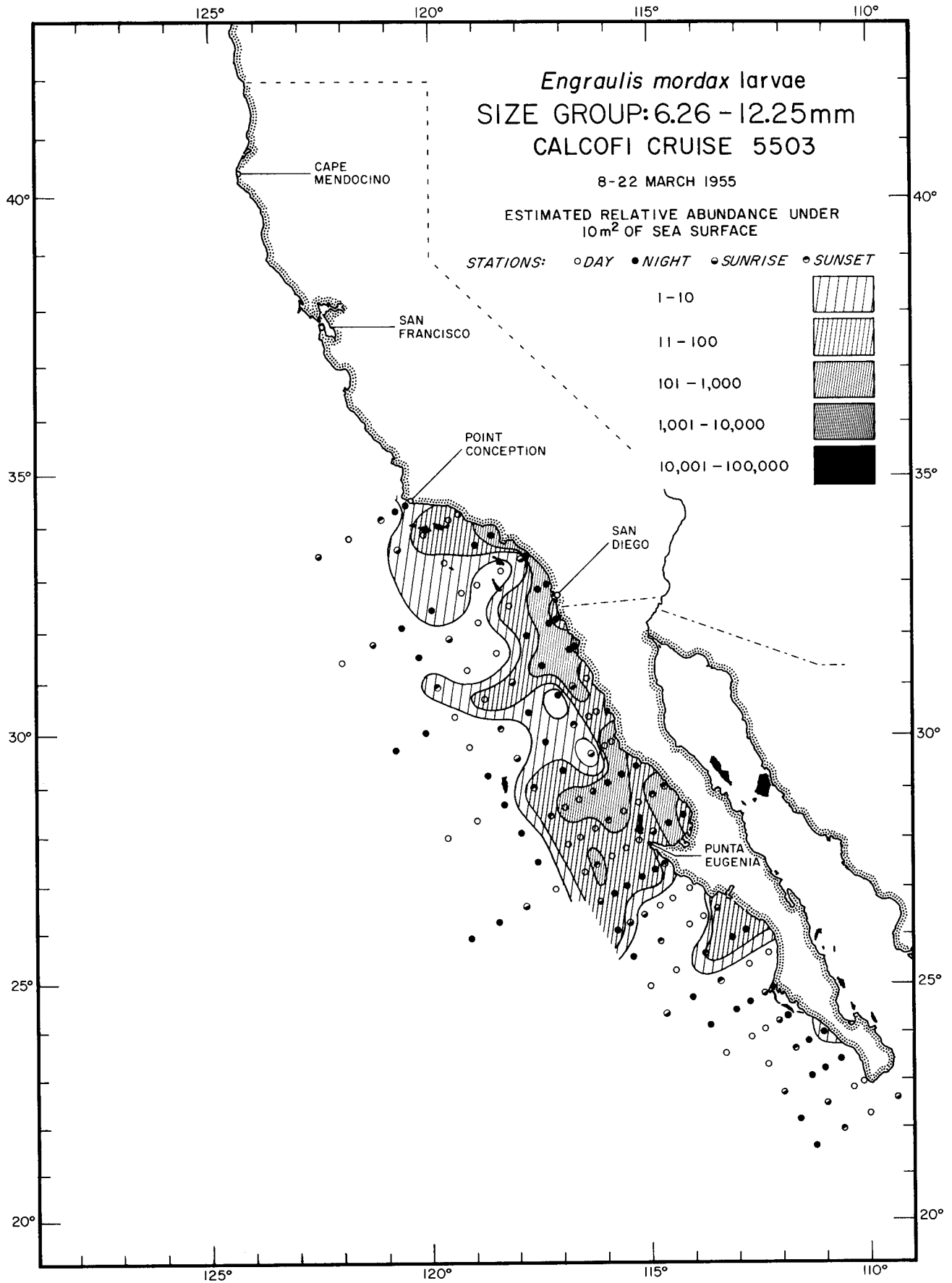
*Engraulis mordax* larvae  
 Size Group: 6.26-12.25mm  
 5502



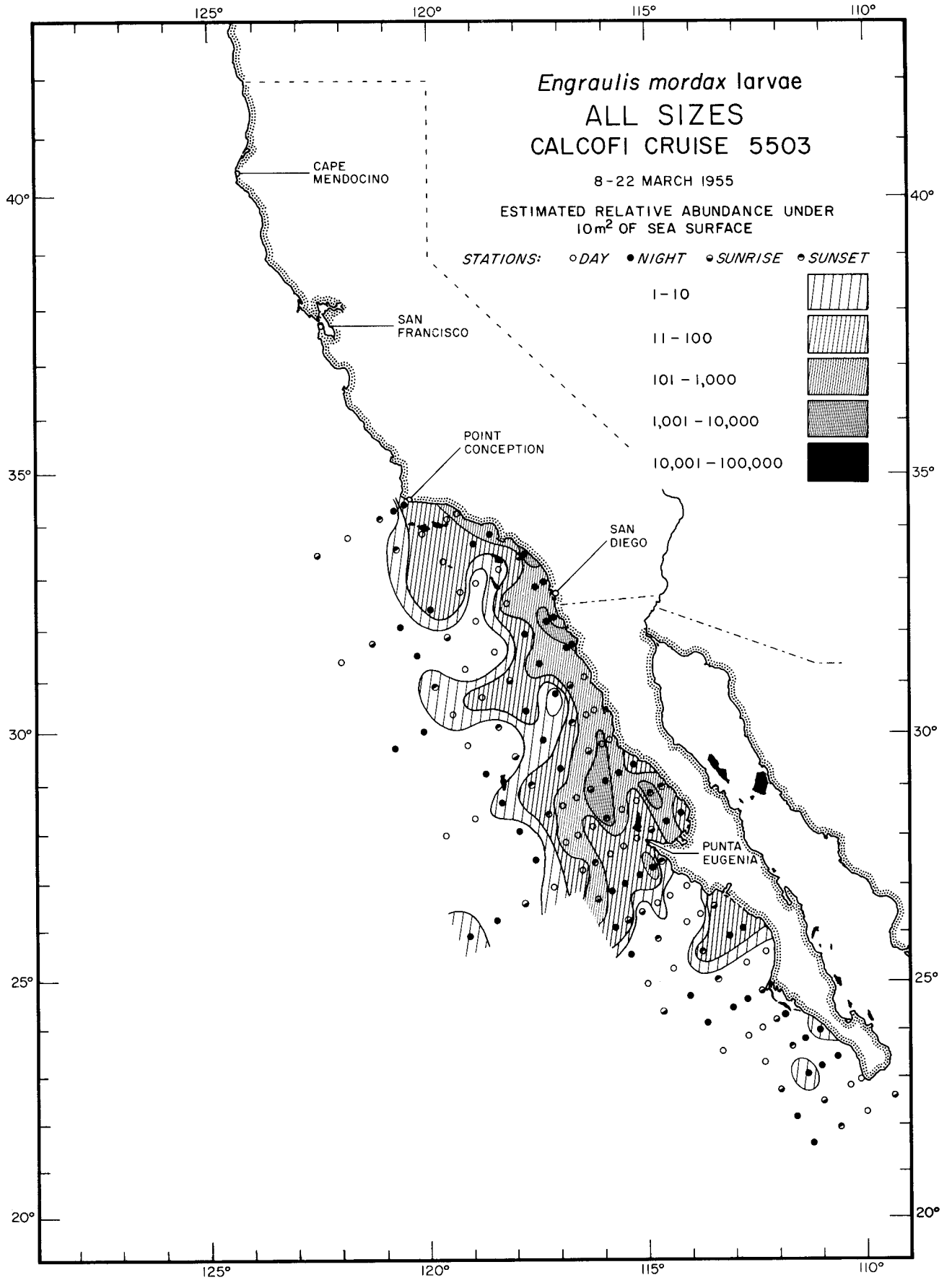
*Engraulis mordax* larvae

All Sizes

5502



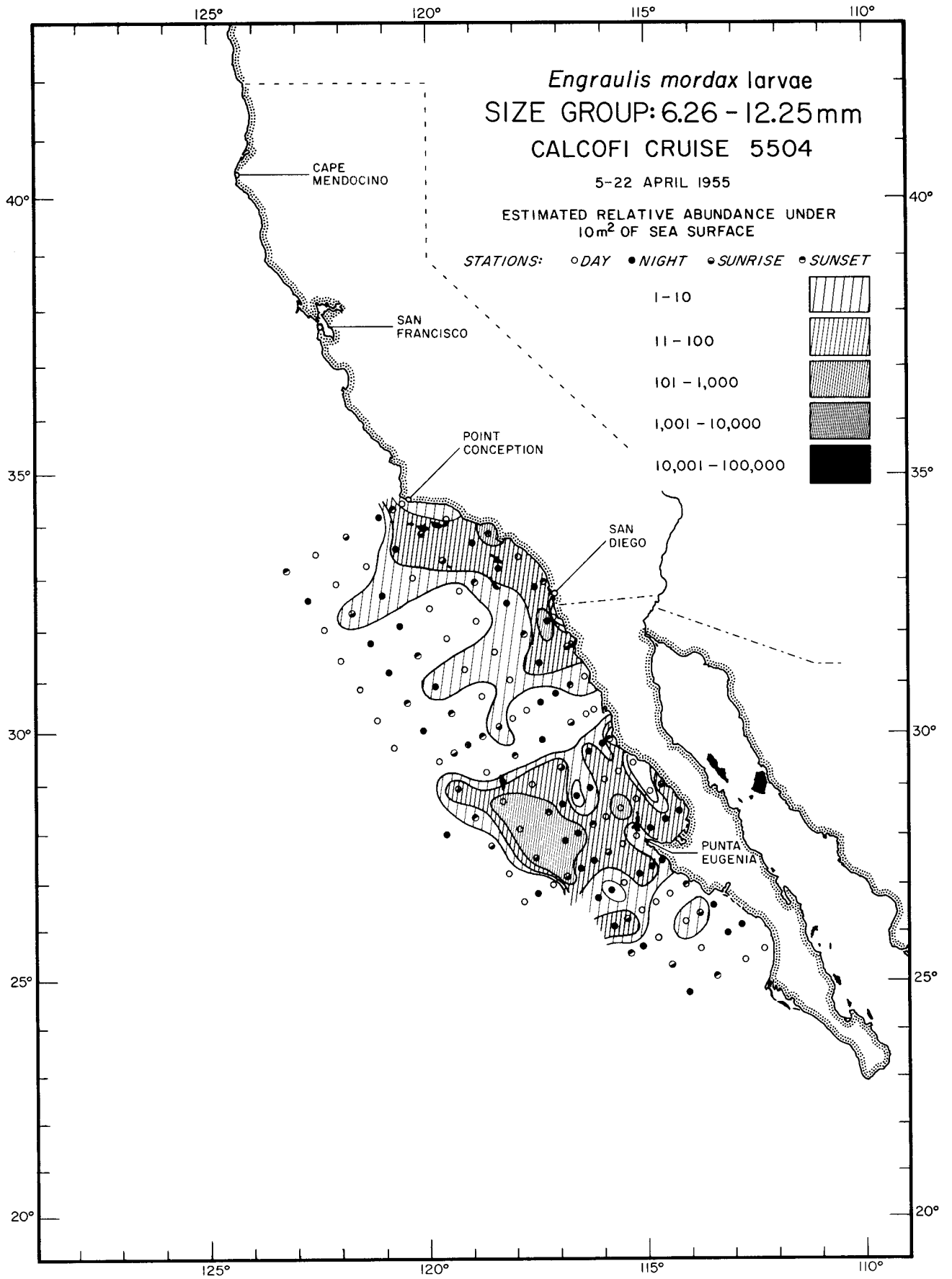
*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5503



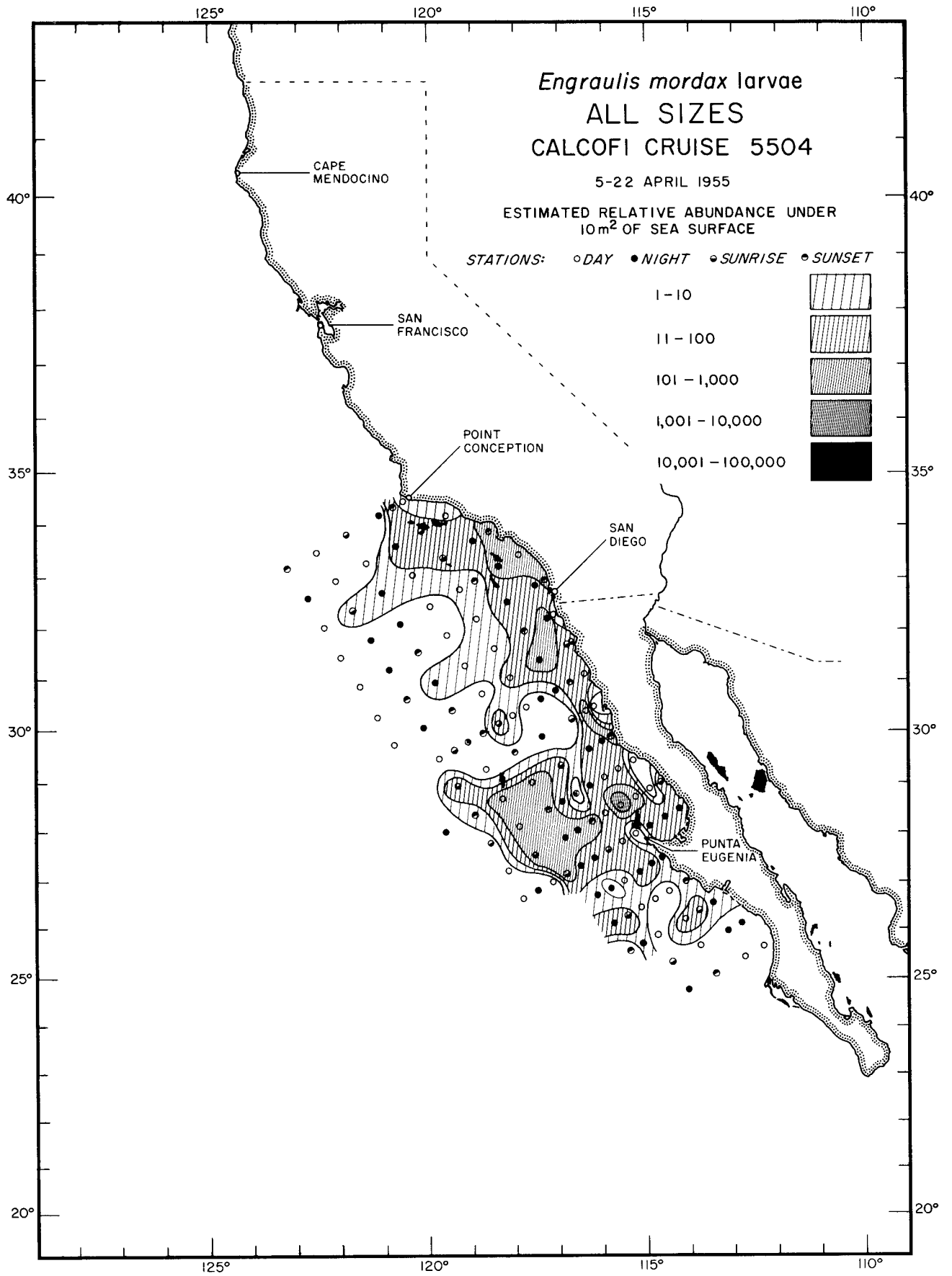
*Engraulis mordax* larvae

All Sizes

5503



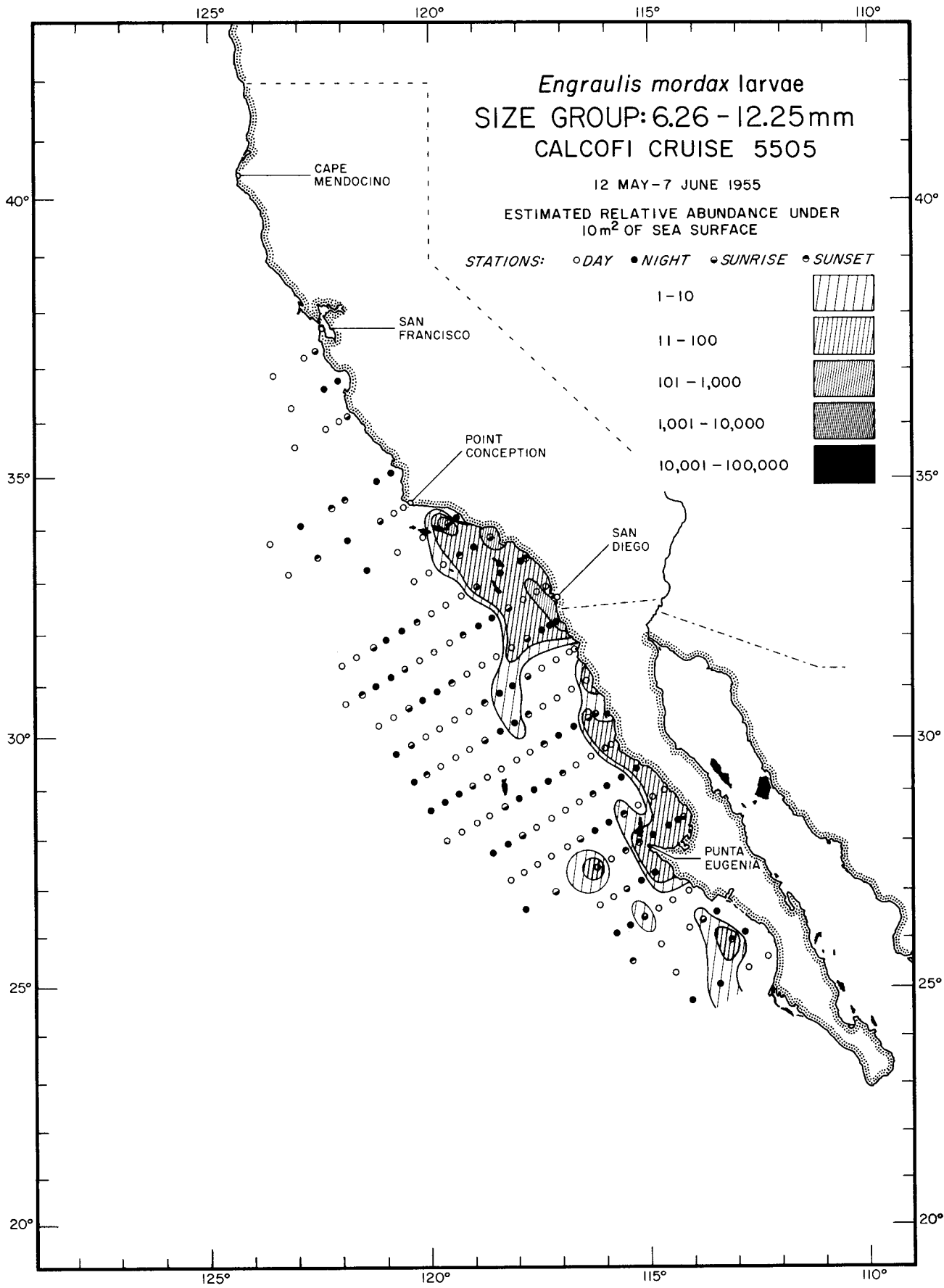
*Engraulis mordax* larvae  
 Size Group: 6.26-12.25mm  
 5504



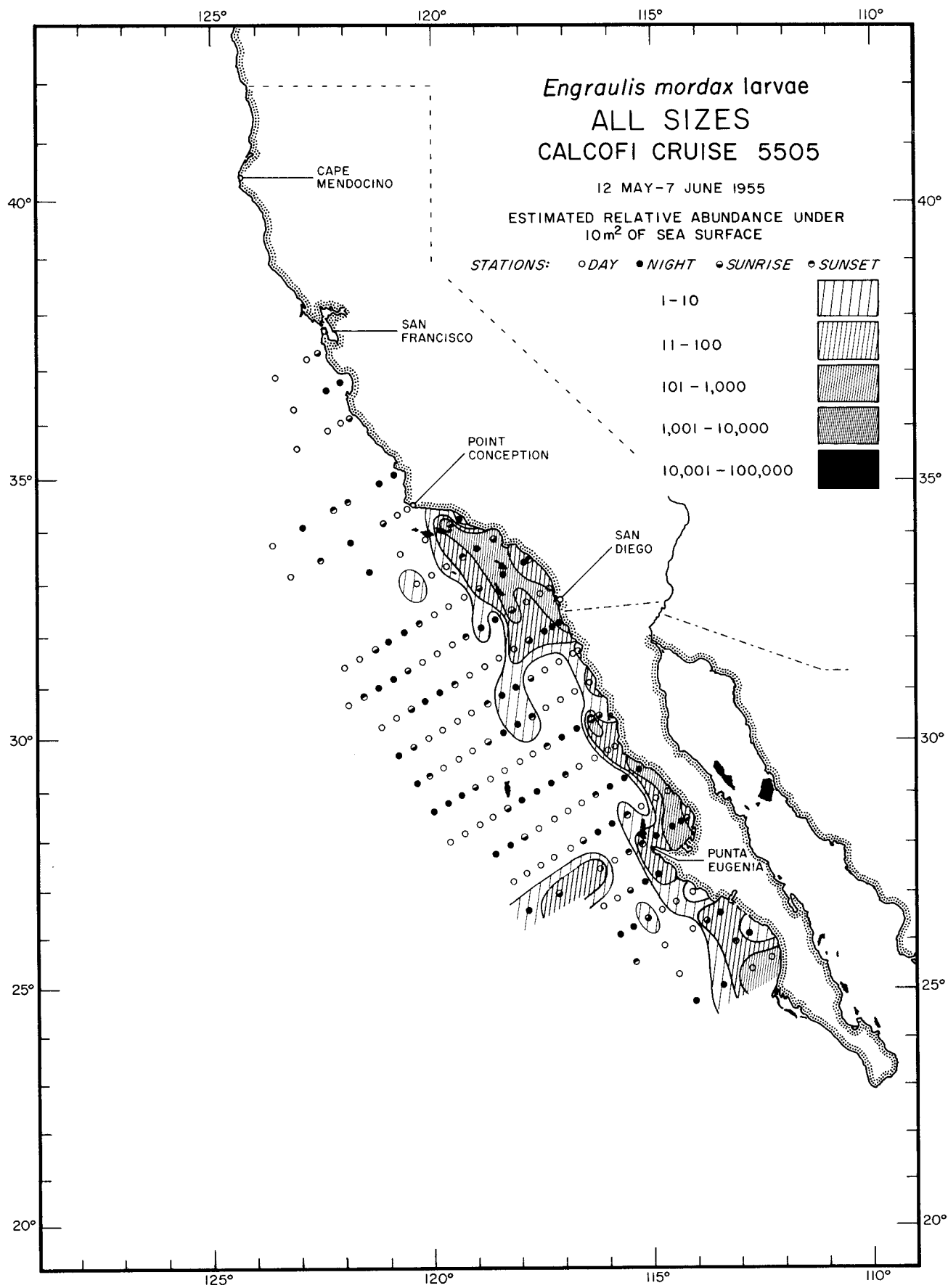
*Engraulis mordax* larvae

All Sizes

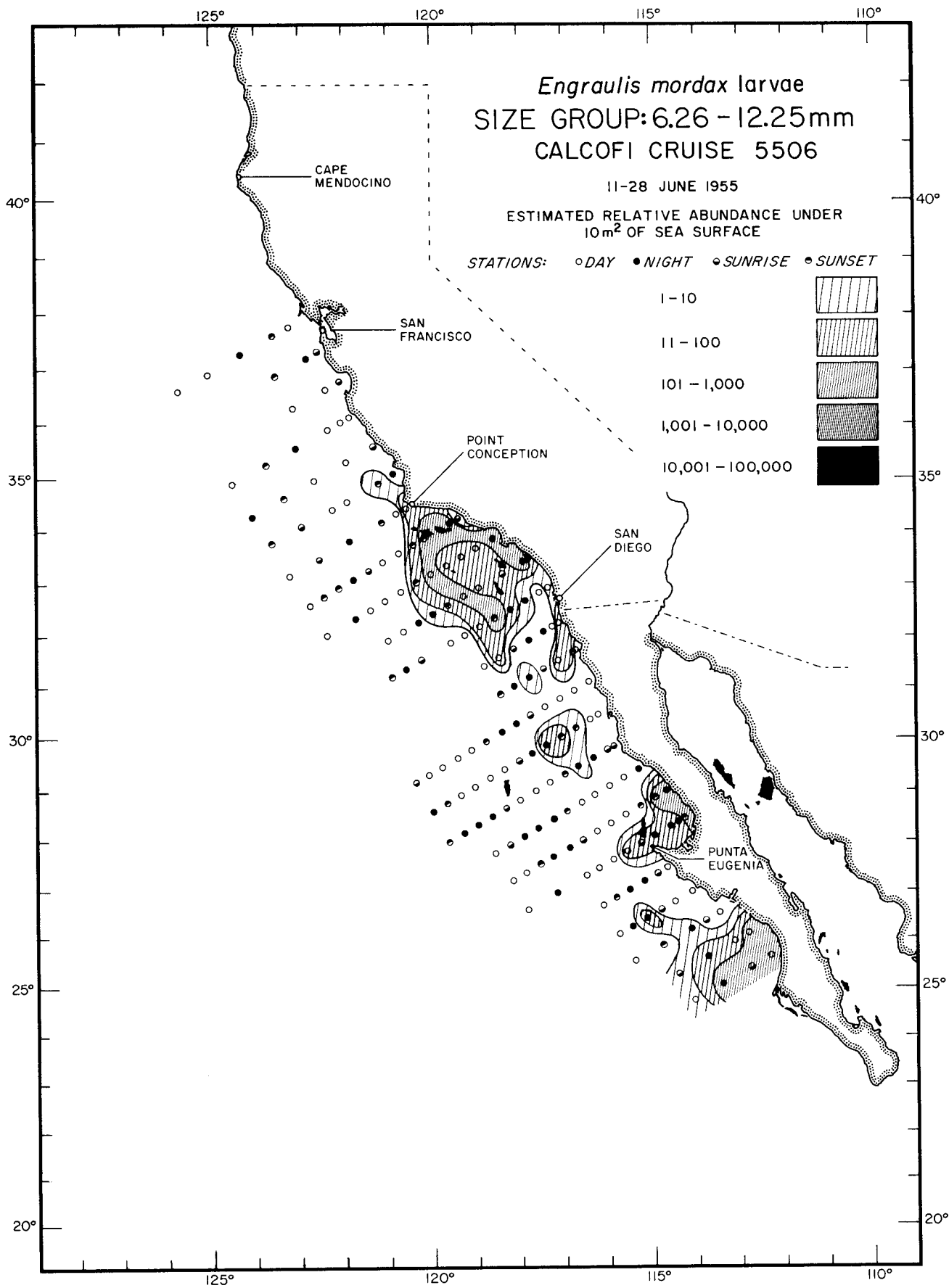
5504



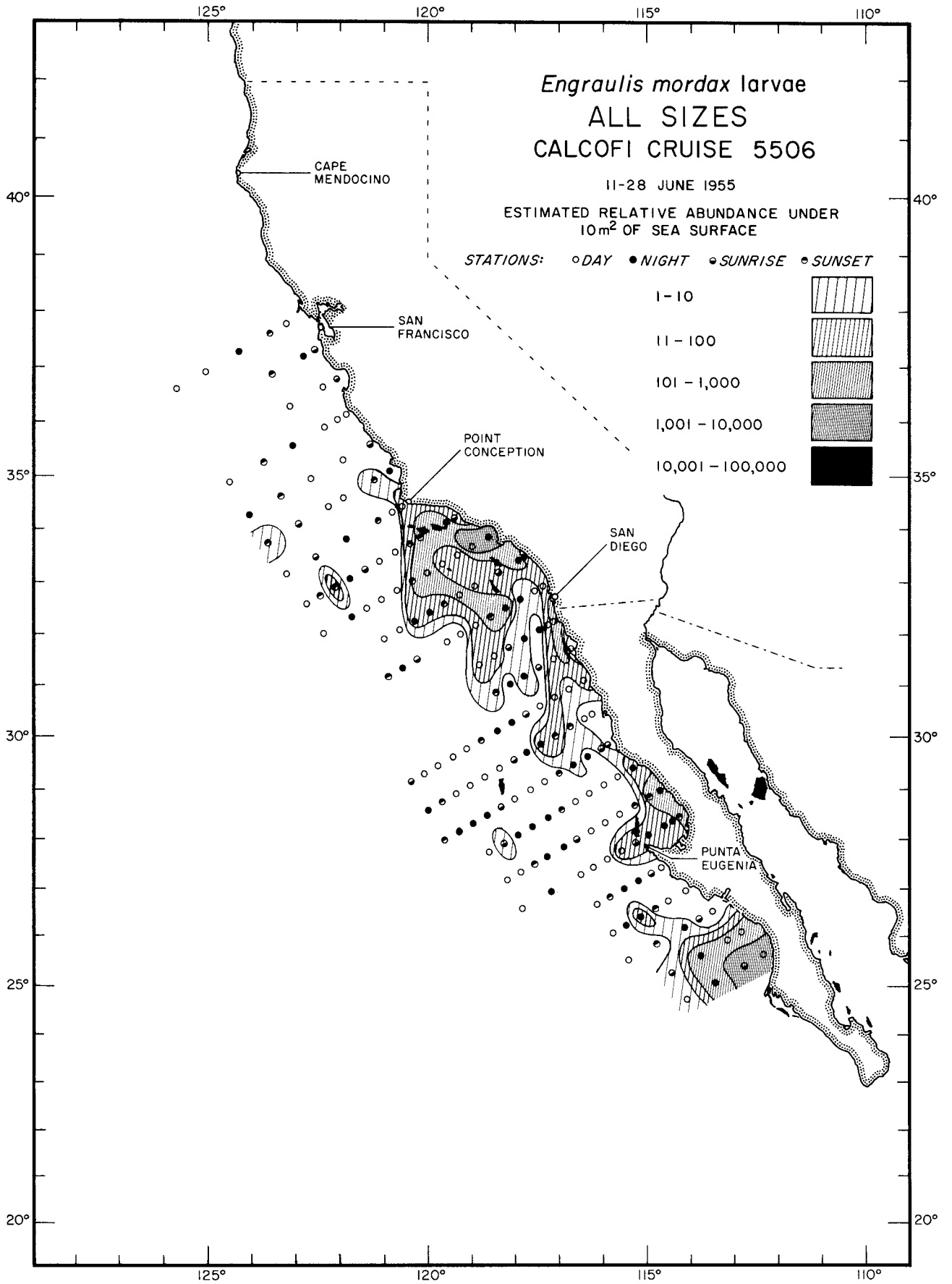
*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5505

*Engraulis mordax* larvaeAll Sizes  
5505

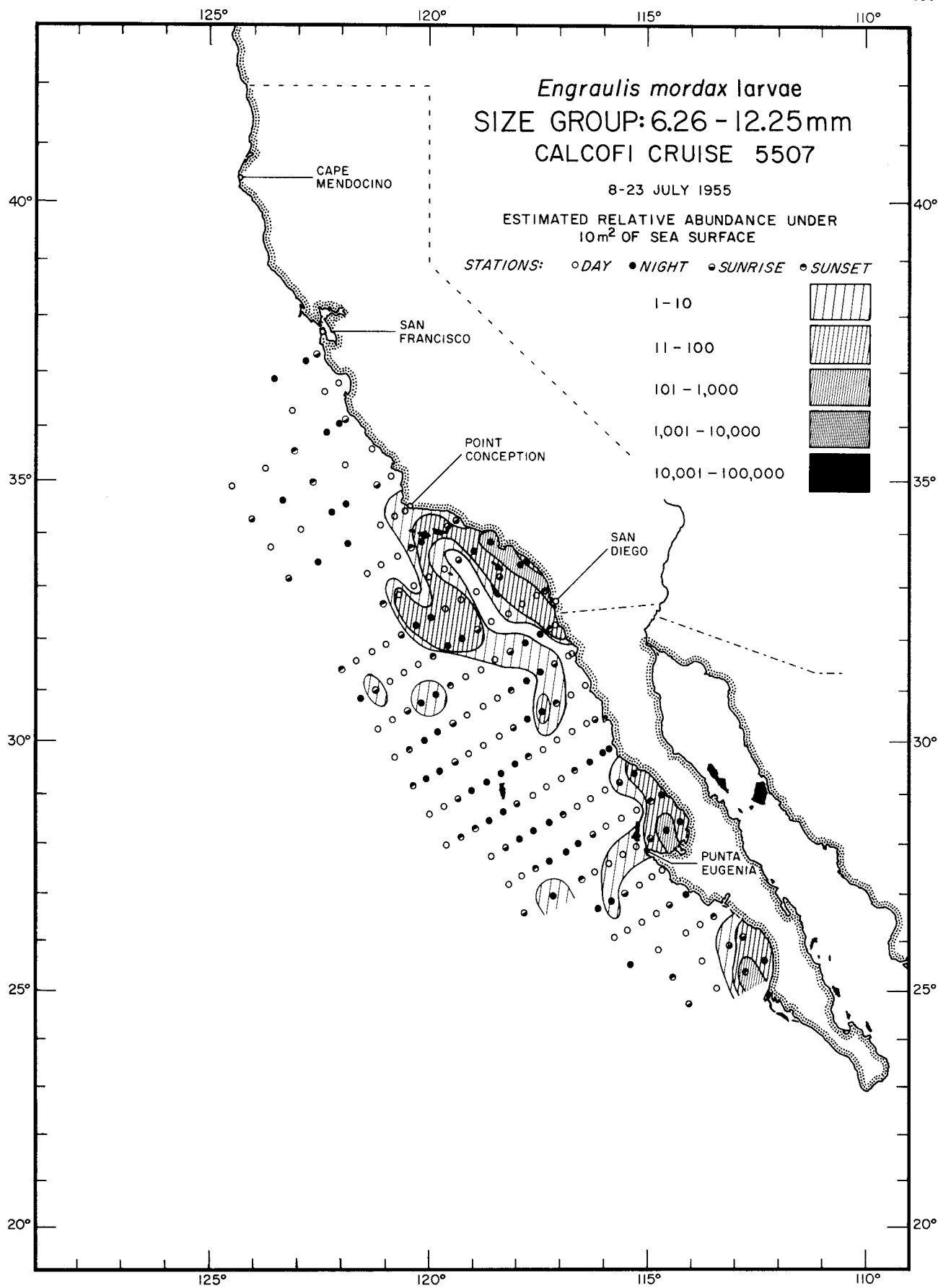




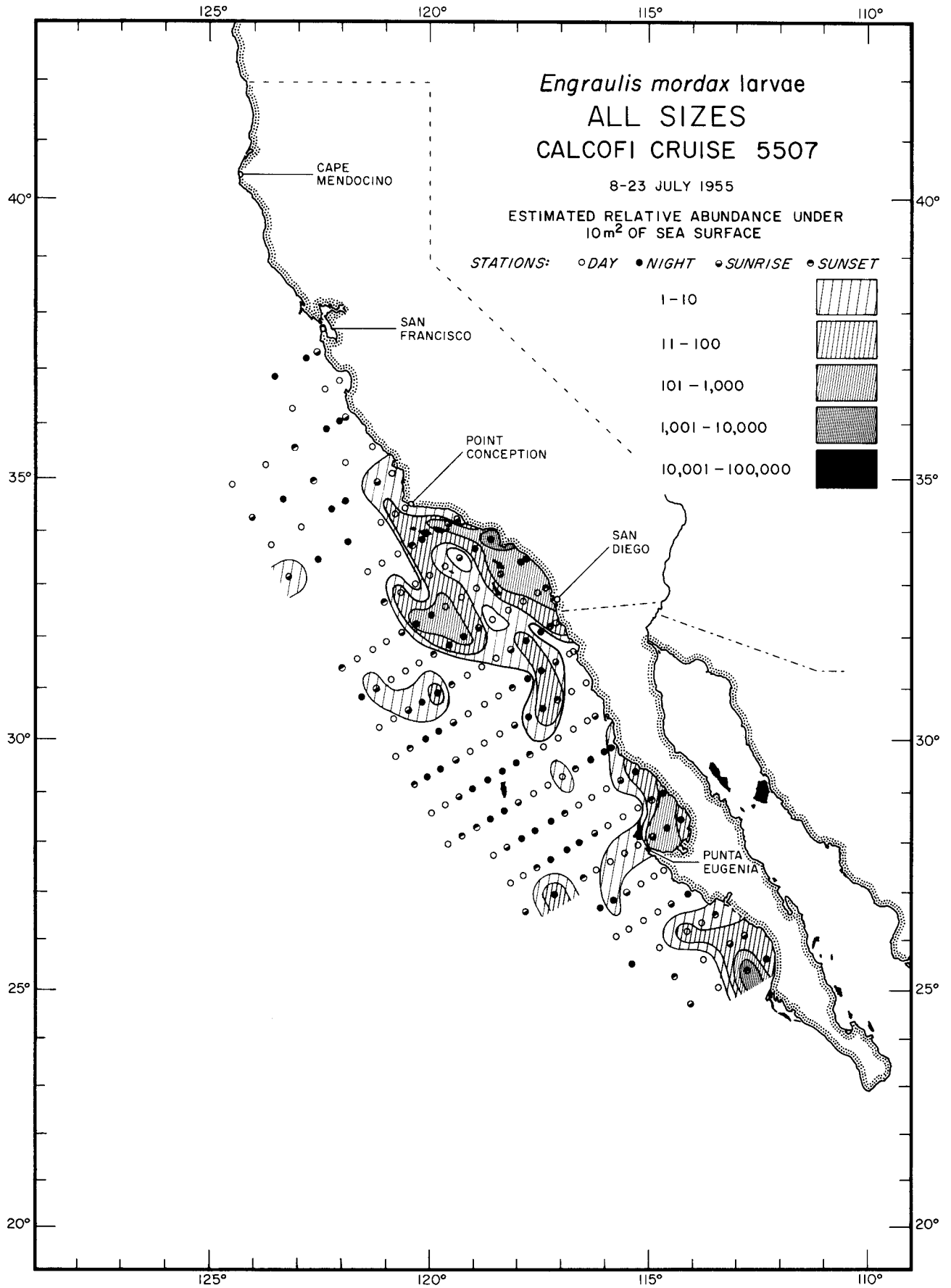
*Engraulis mordax* larvae  
 Size Group: 6.26-12.25mm  
 5506



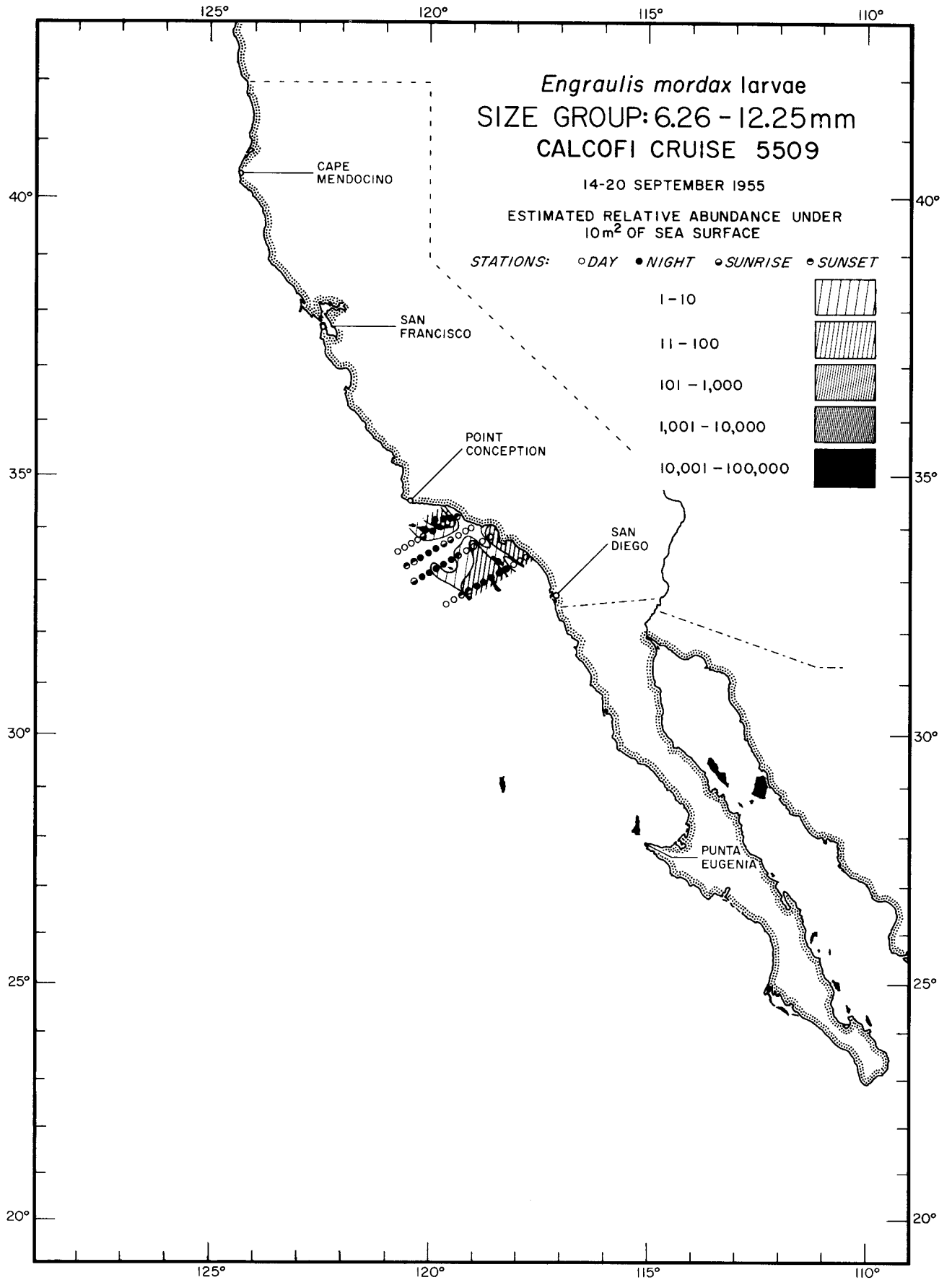
*Engraulis mordax* larvae  
All Sizes  
5506



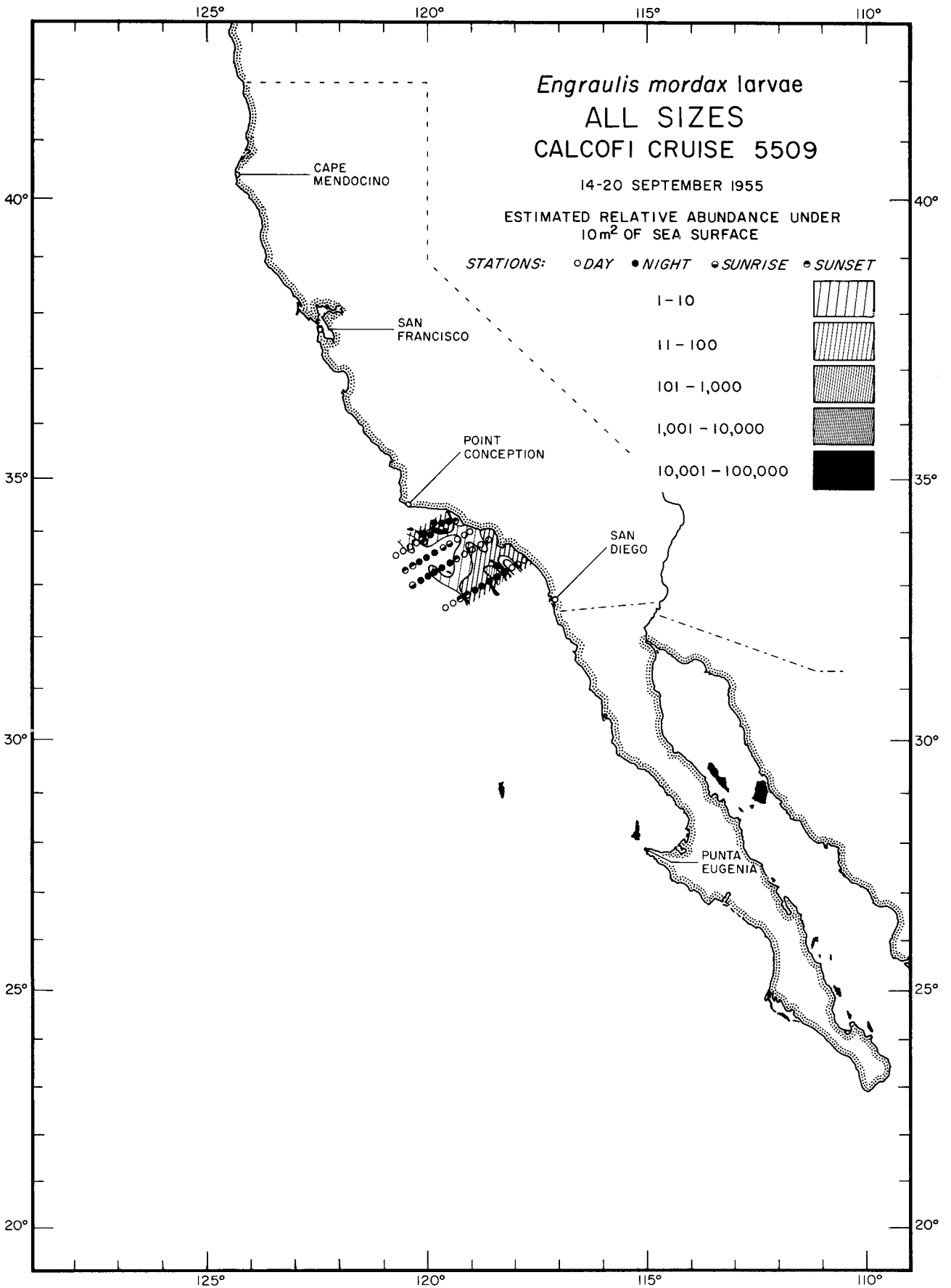
*Engraulis mordax* larvae  
 Size Group: 6.26-12.25mm  
 5507



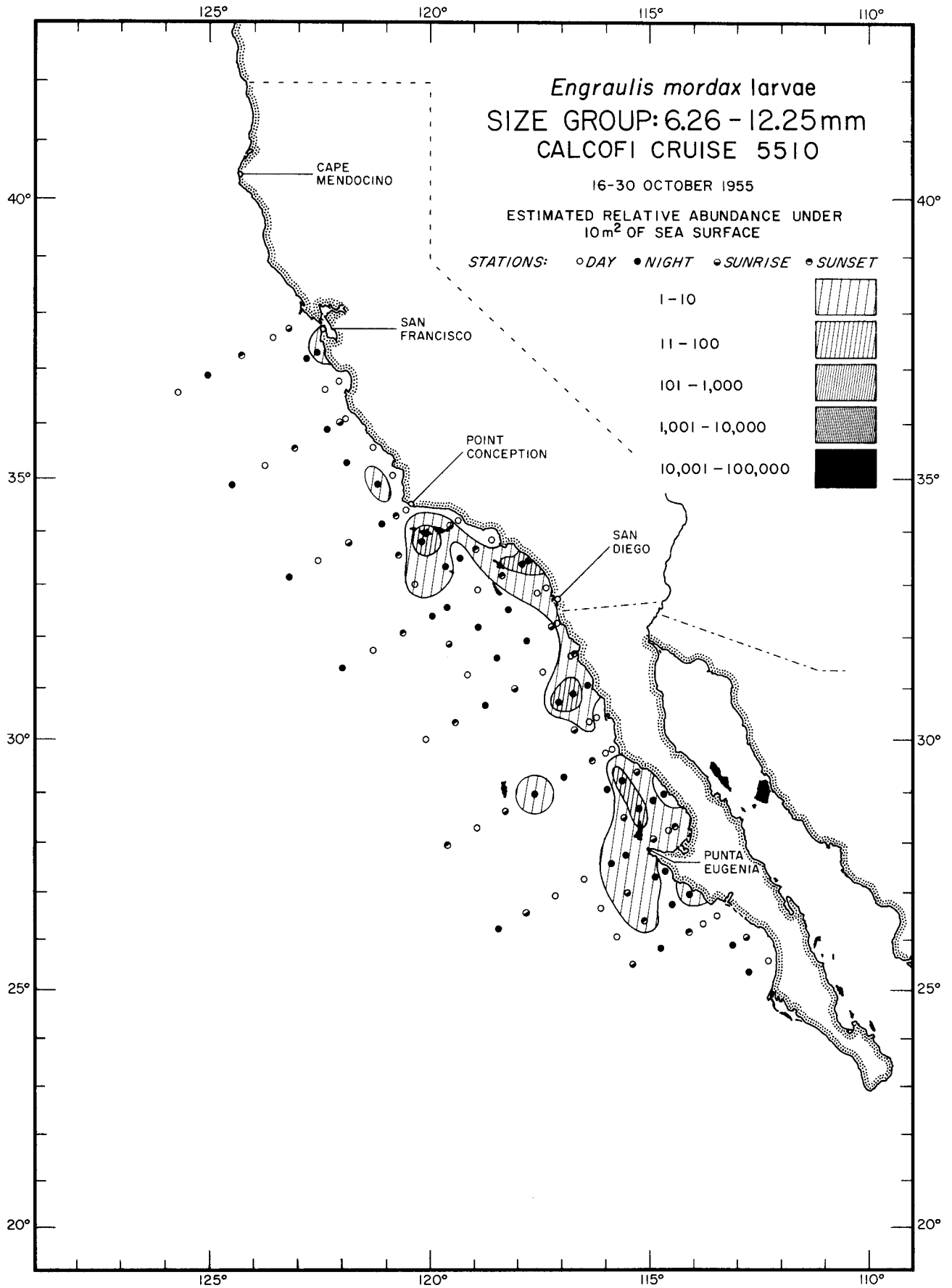
*Engraulis mordax* larvae  
All Sizes  
5507



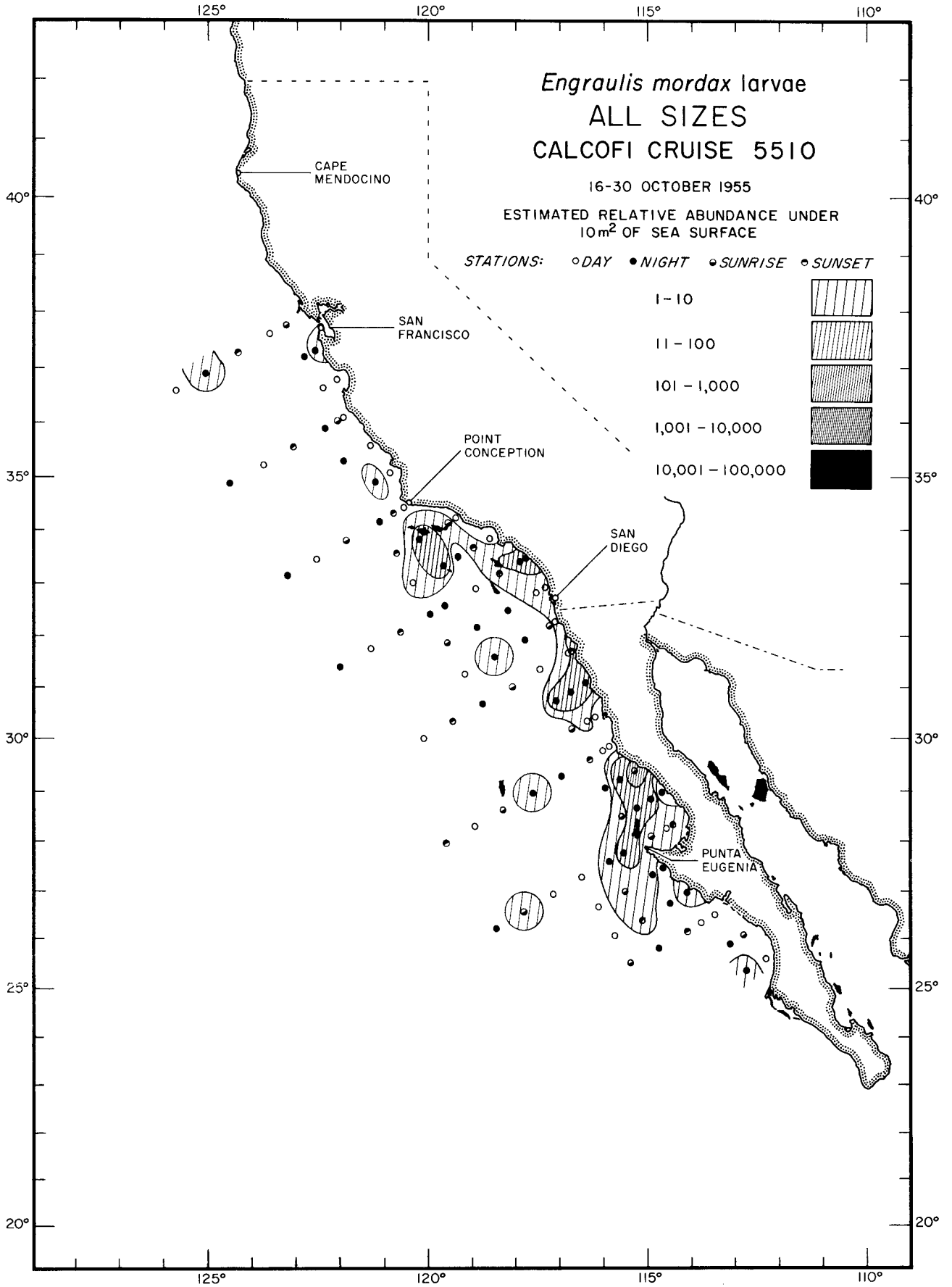
*Engraulis mordax* larvae  
 Size Group: 6.26-12.25mm  
 5509



*Engraulis mordax* larvae  
All Sizes  
5509



*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5510

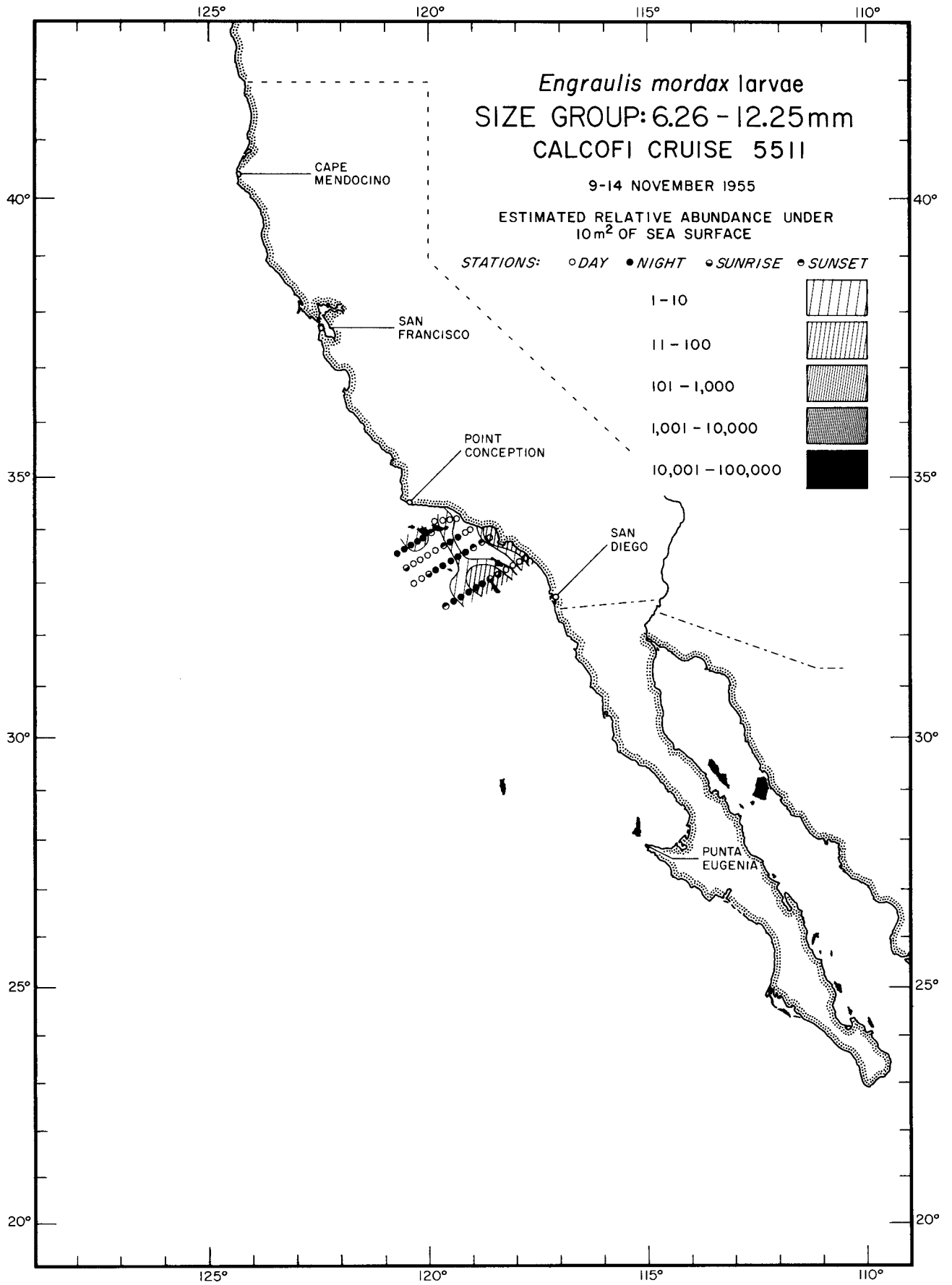


*Engraulis mordax* larvae

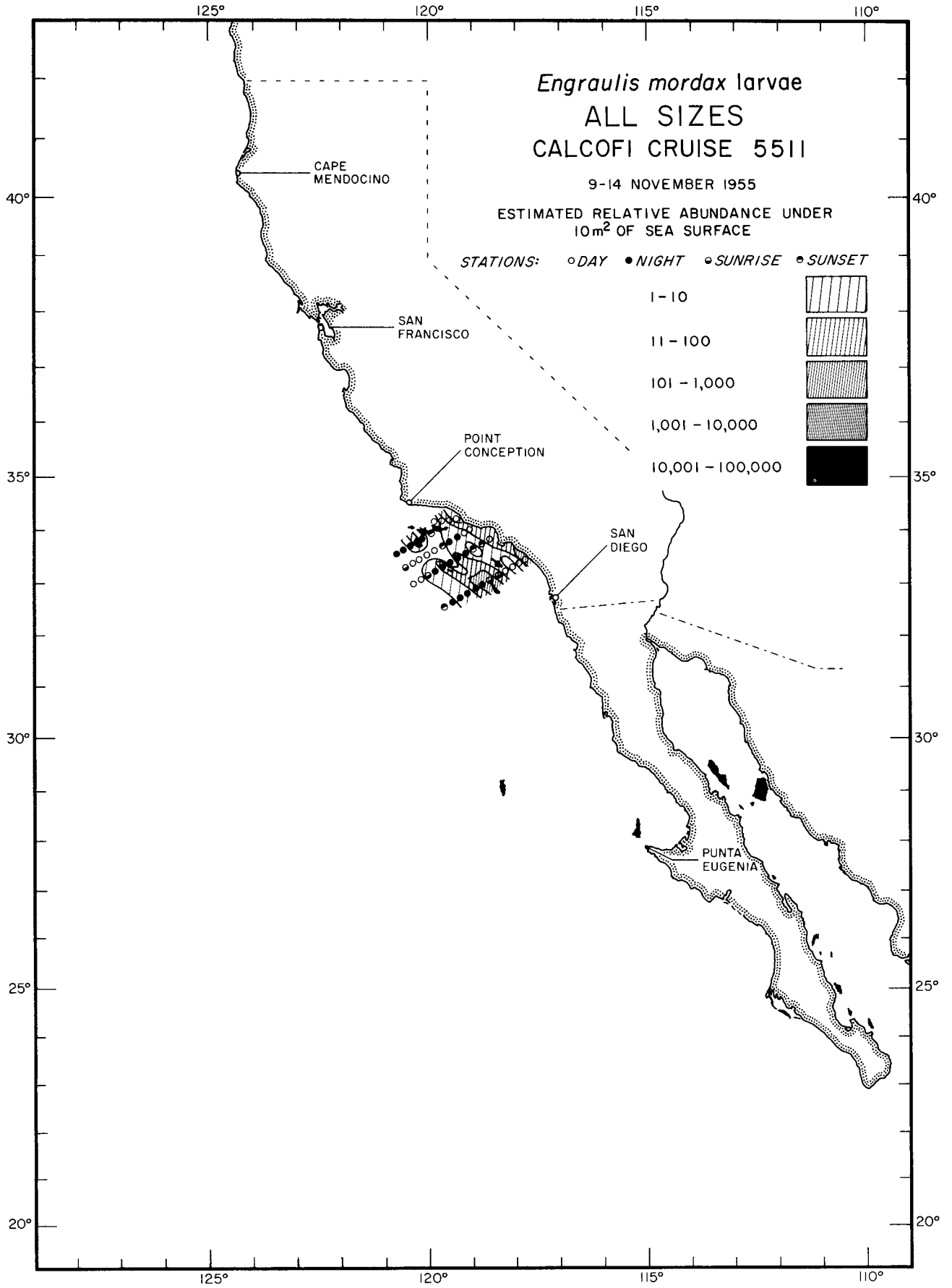
All Sizes

5510





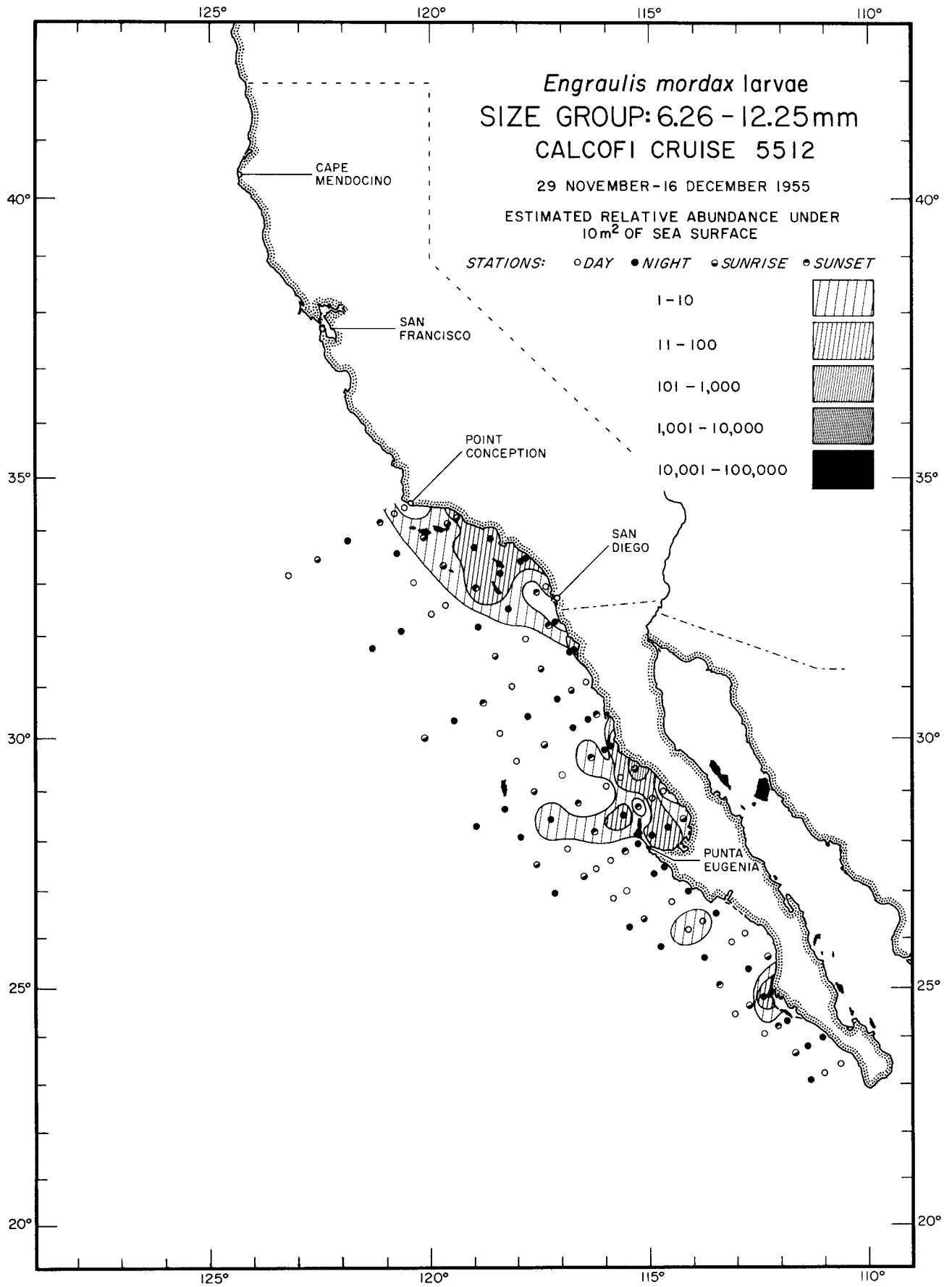
*Engraulis mordax* larvae  
 Size Group: 6.26-12.25mm  
 5511



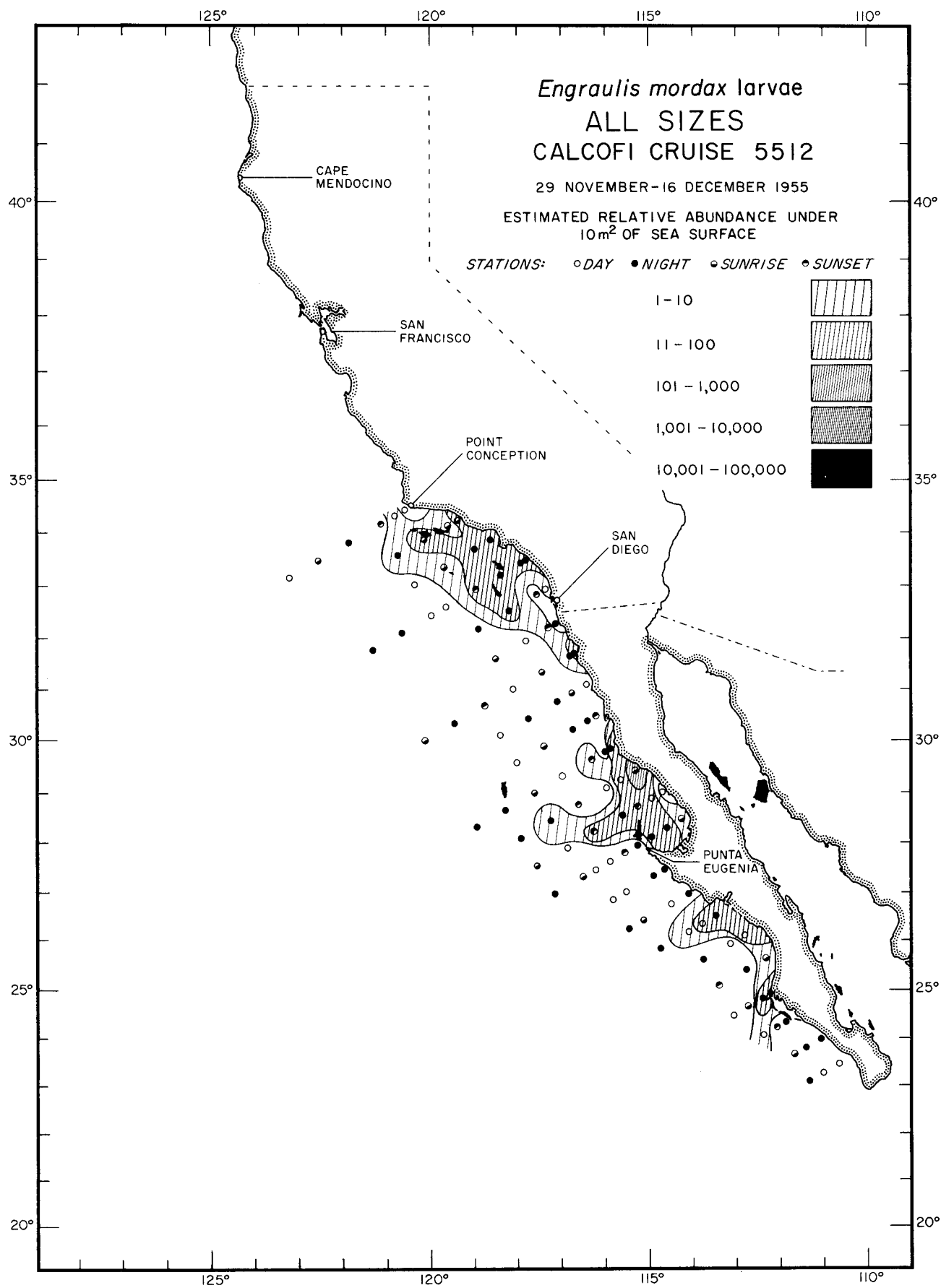
*Engraulis mordax* larvae

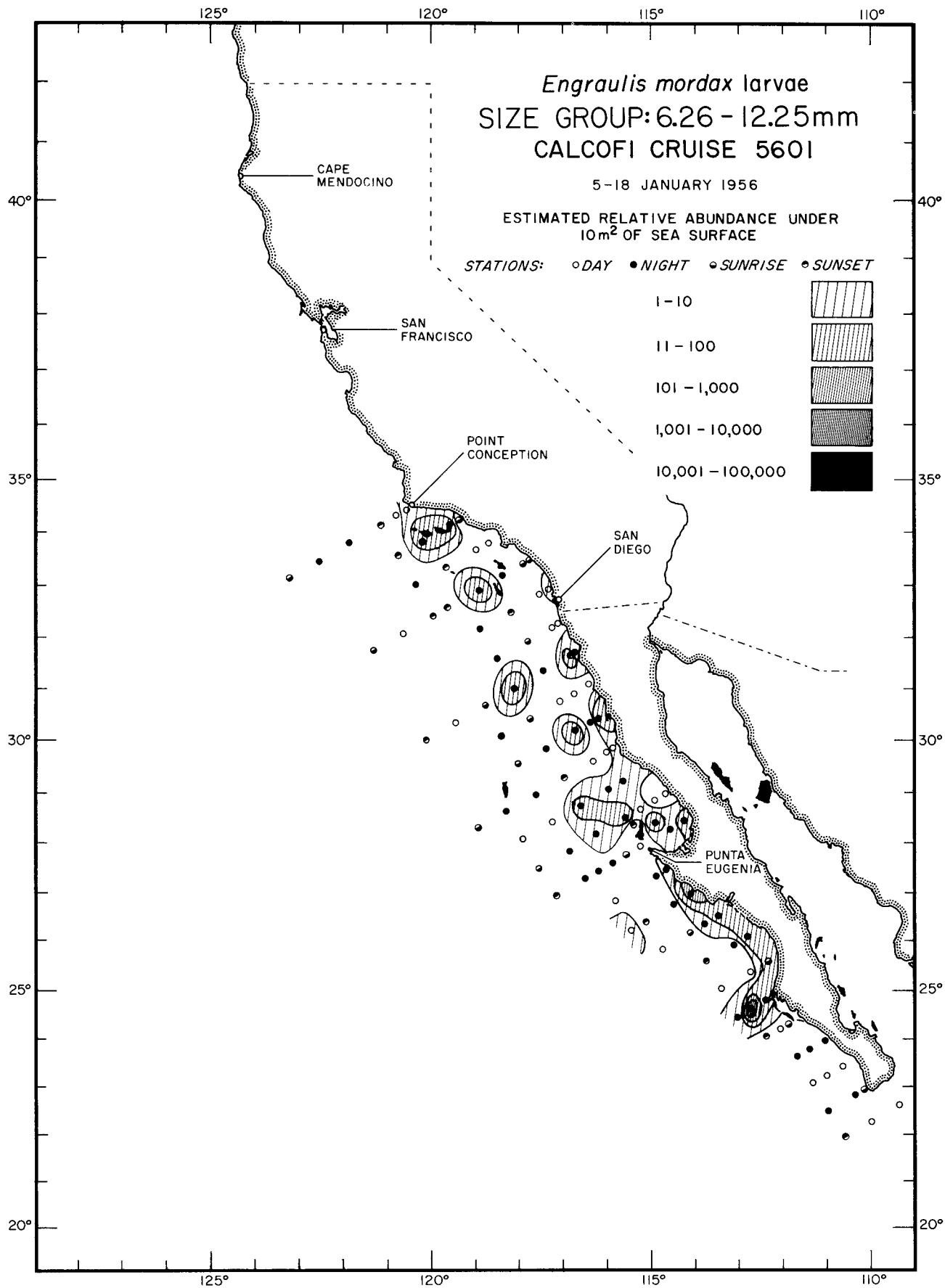
All Sizes

5511

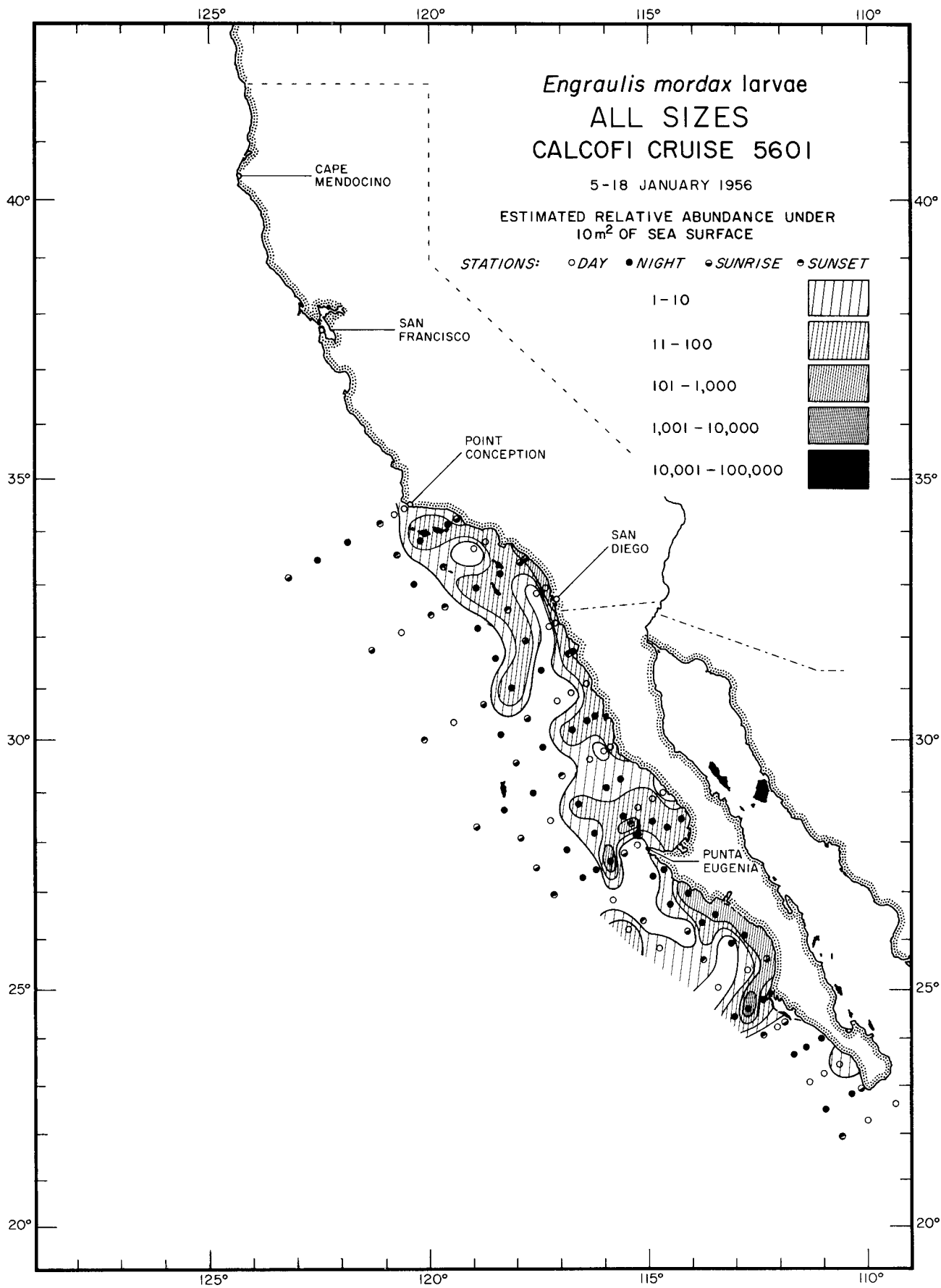


*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5512

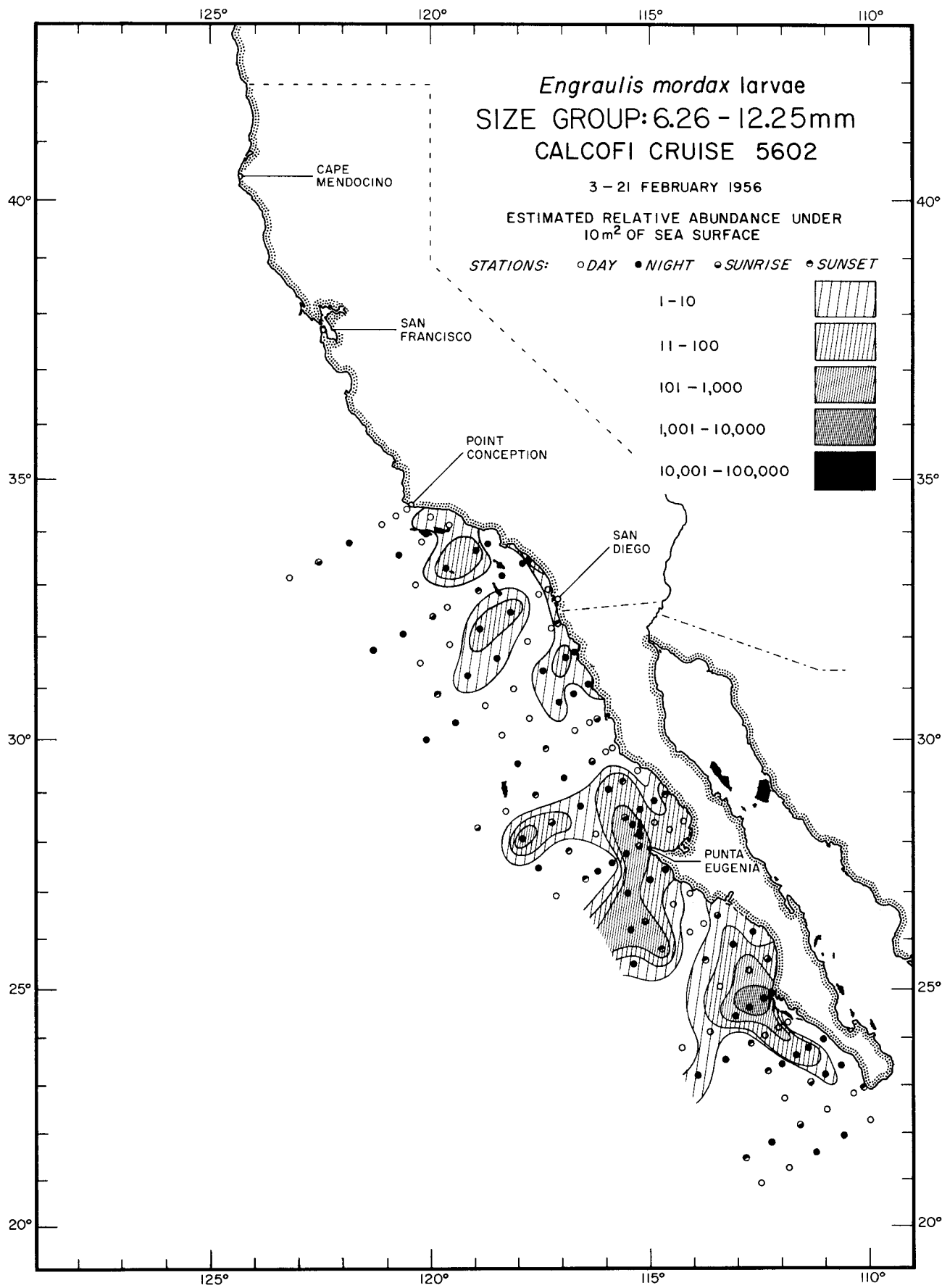
*Engraulis mordax* larvaeAll Sizes  
5512



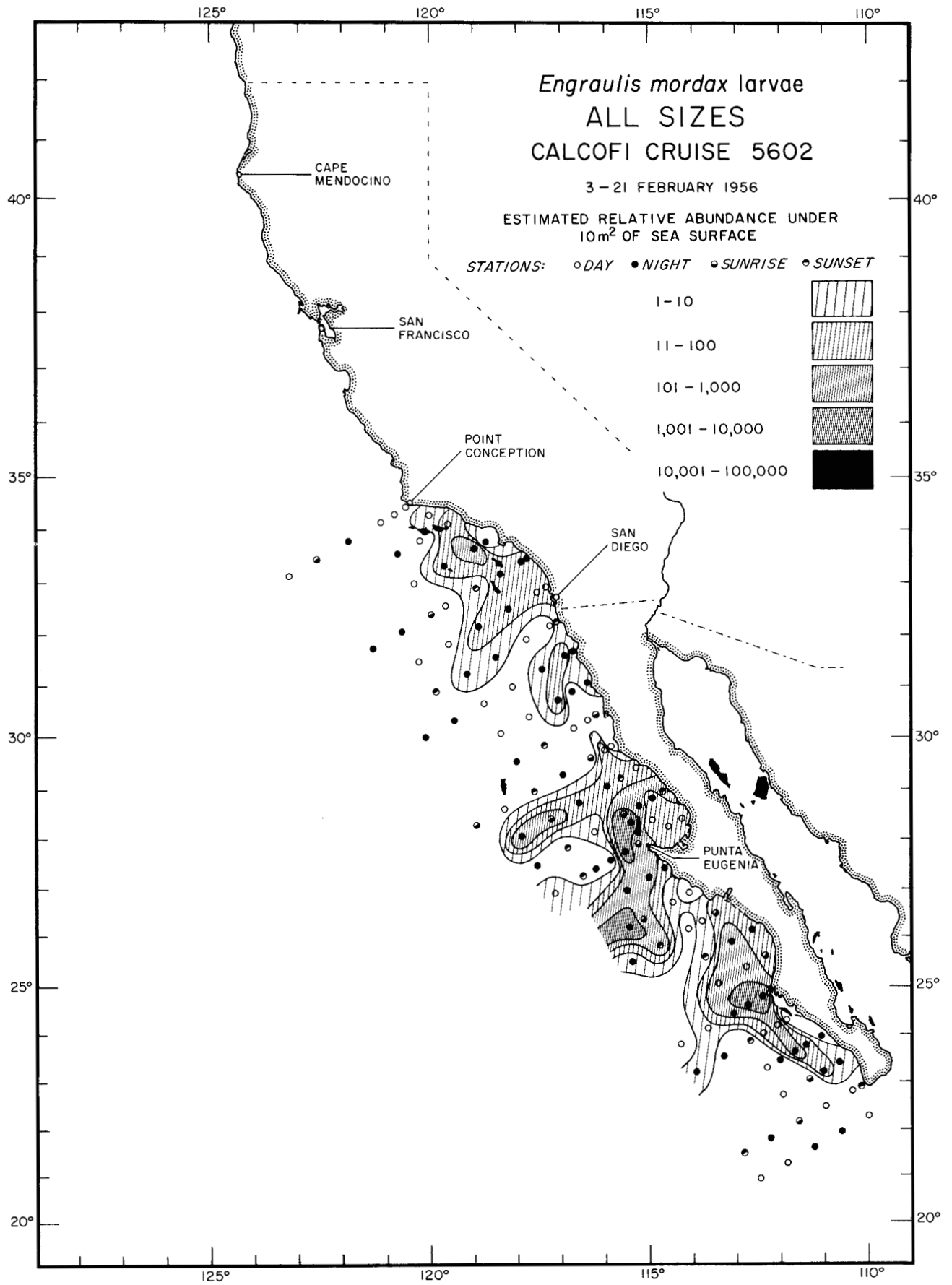
*Engraulis mordax* larvae  
 Size Group: 6.26-12.25mm  
 5601



*Engraulis mordax* larvae  
All Sizes  
5601



*Engraulis mordax* larvae  
 Size Group: 6.26-12.25mm  
 5602

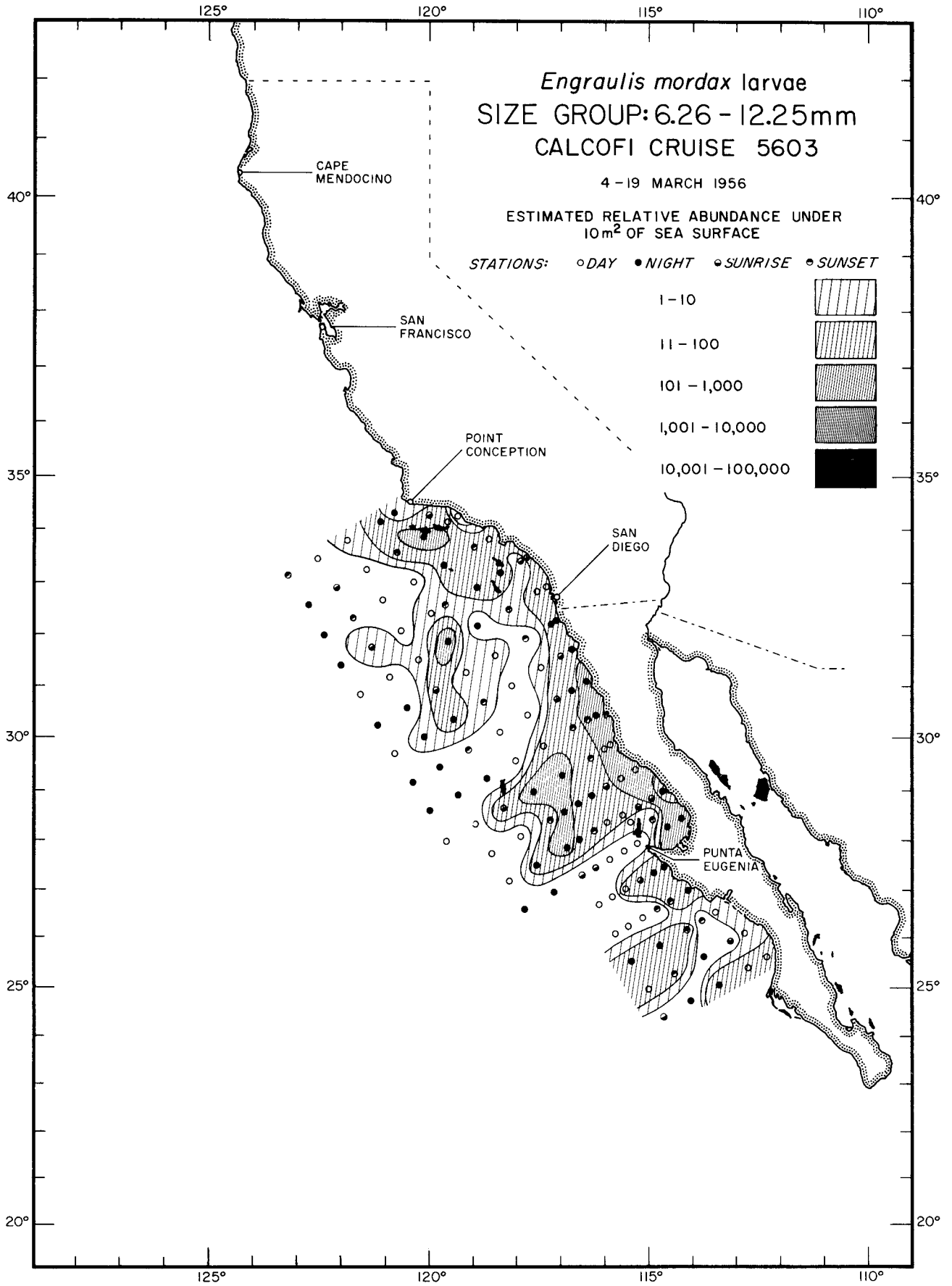


*Engraulis mordax* larvae

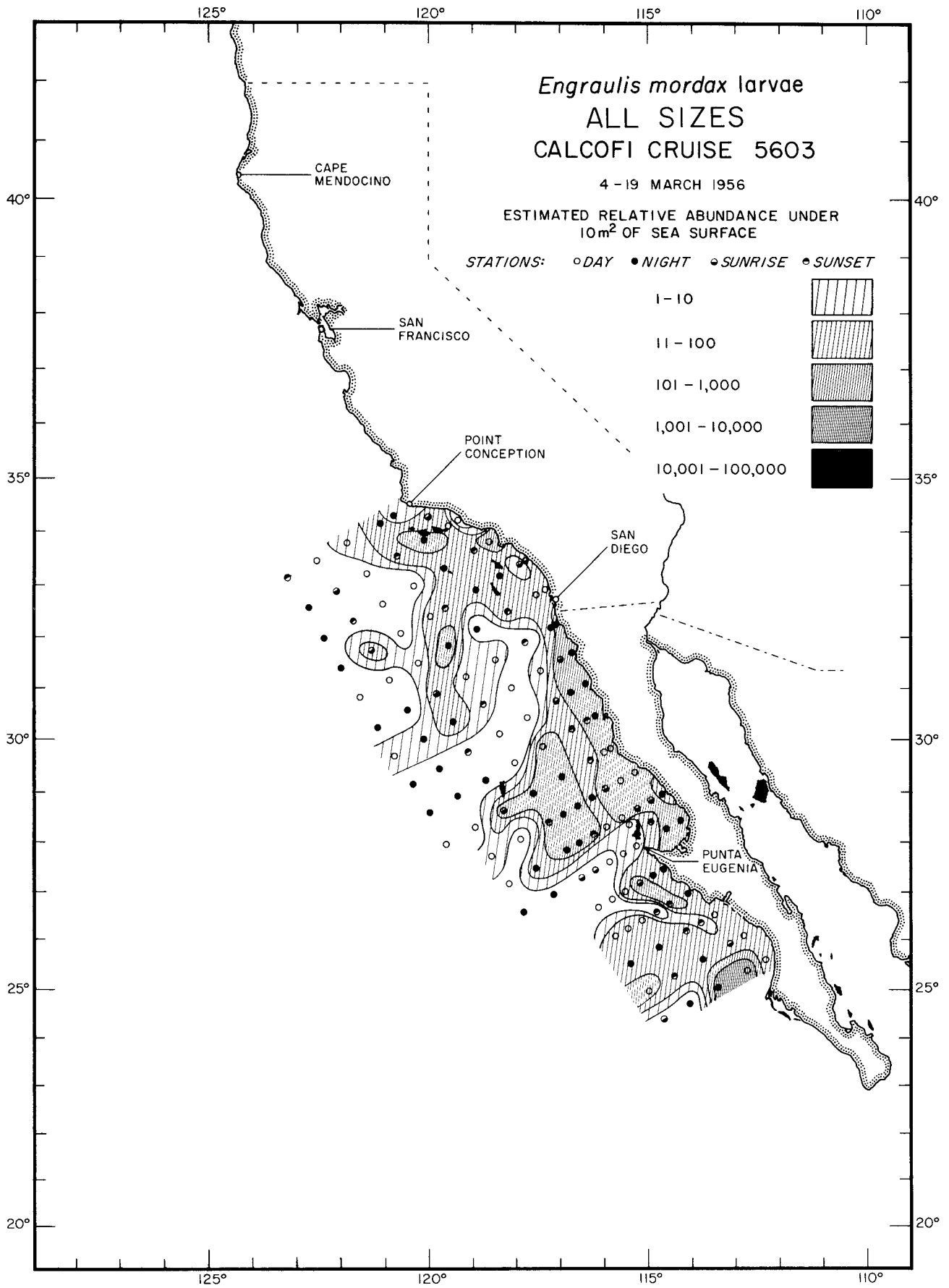
All Sizes

5602





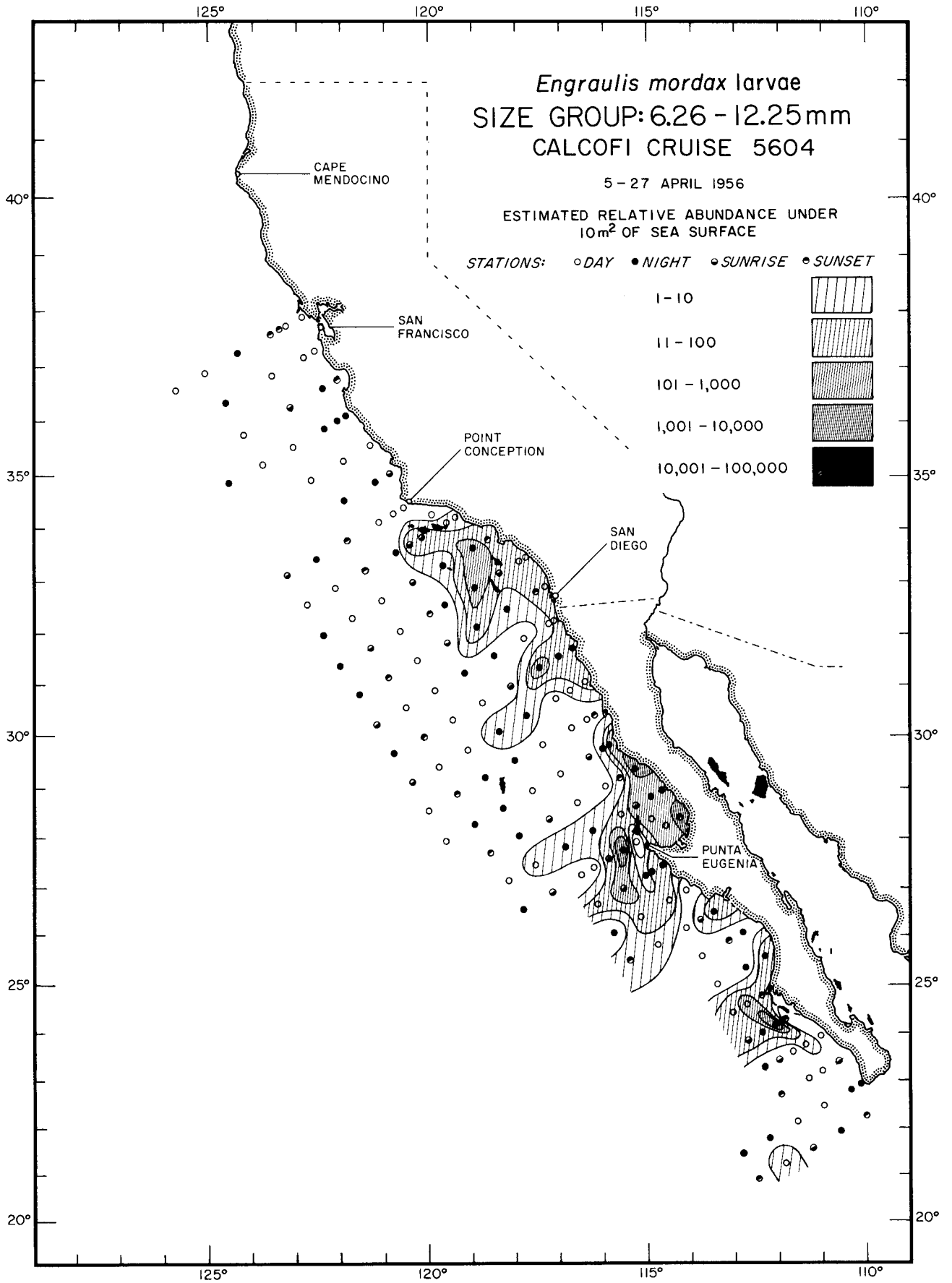
*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5603



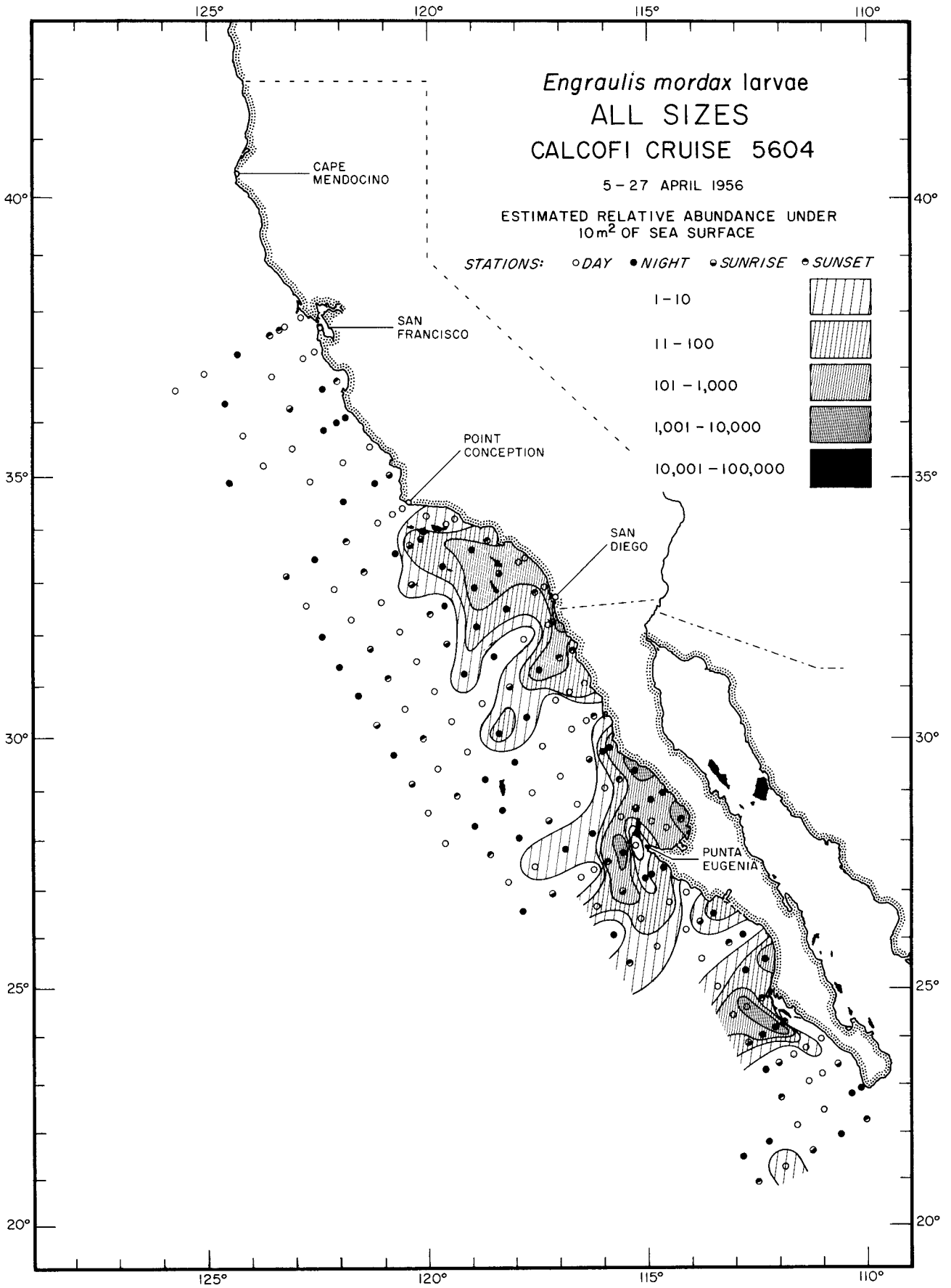
*Engraulis mordax* larvae

All Sizes

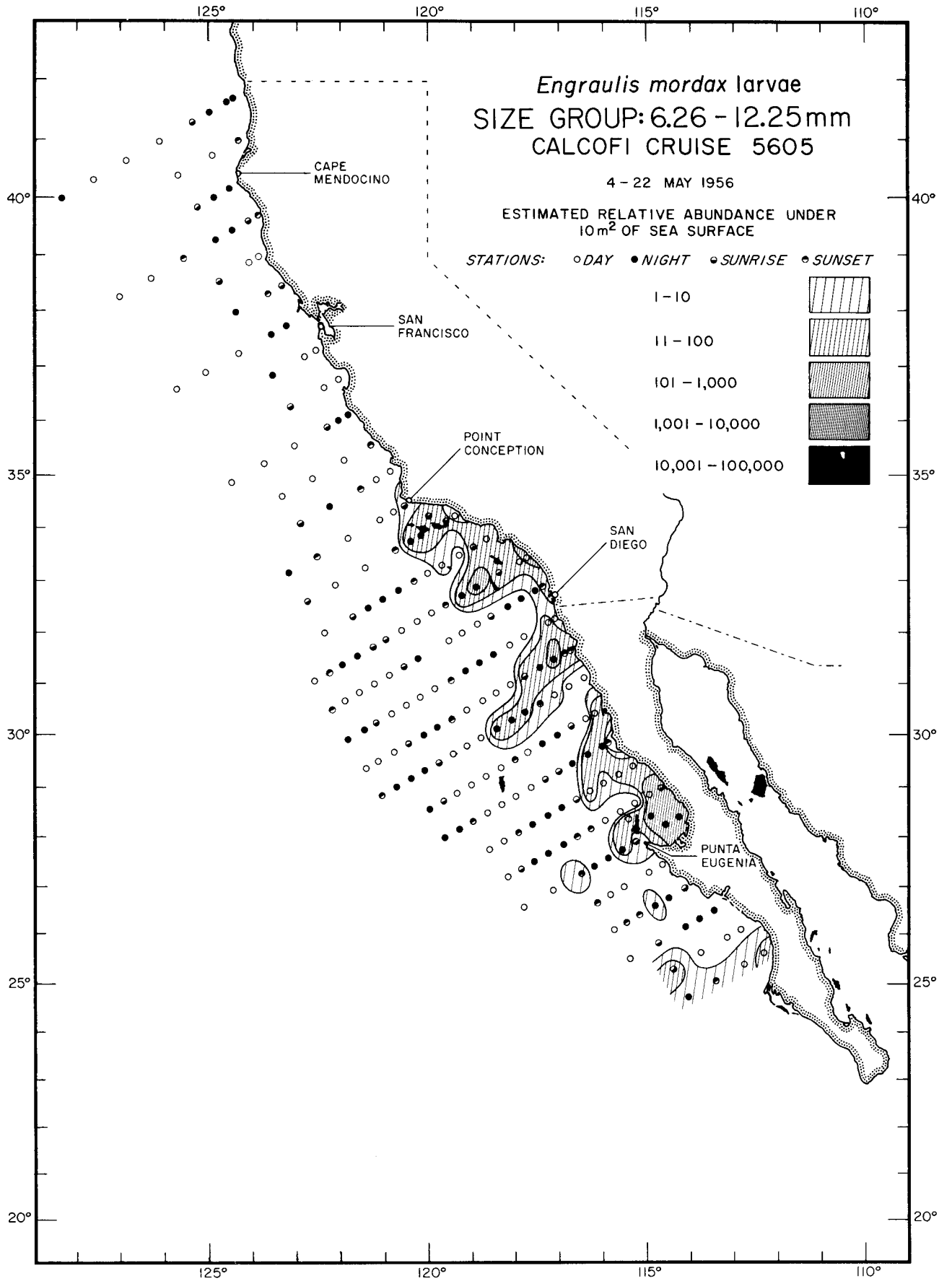
5603



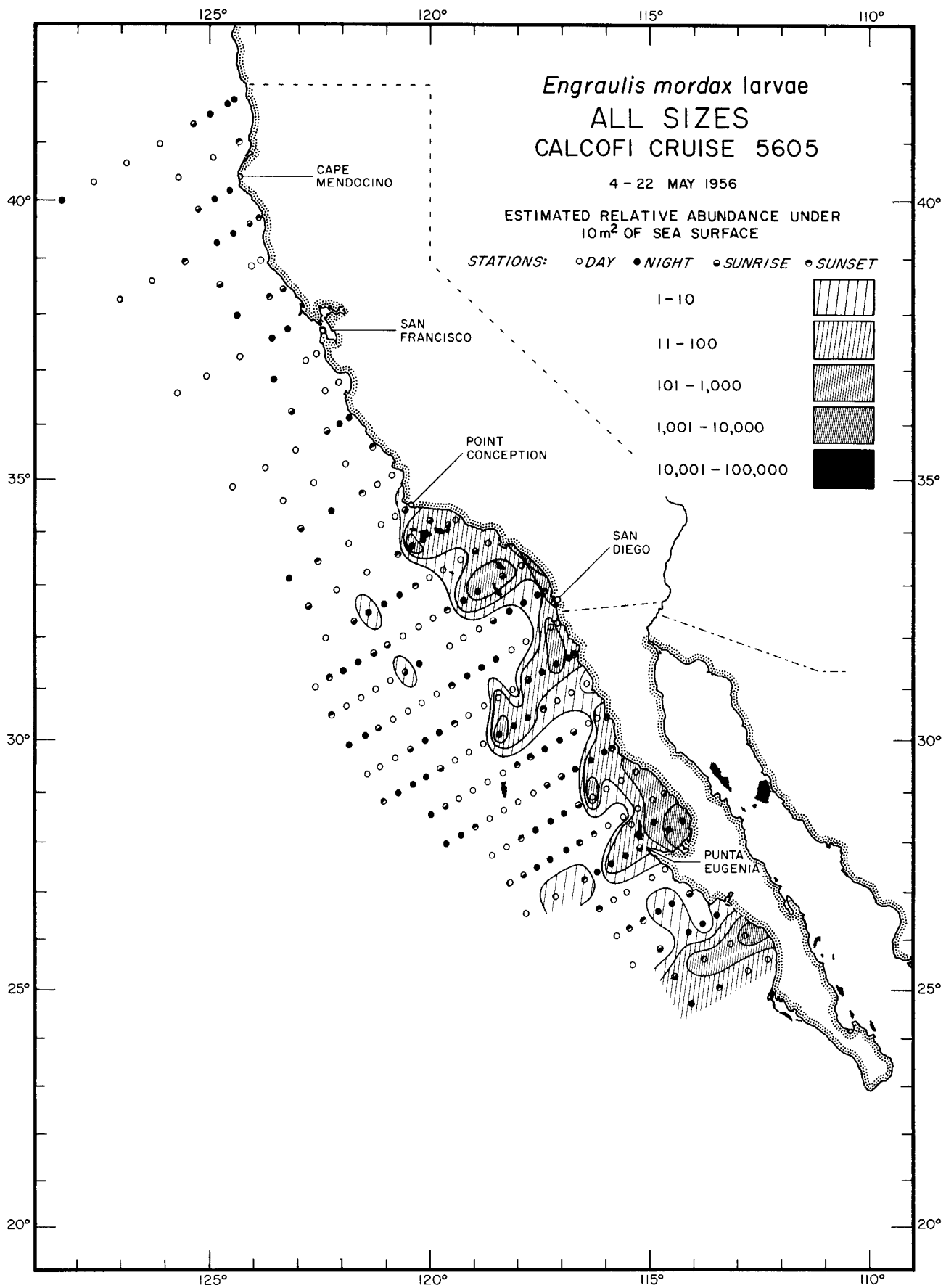
*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5604



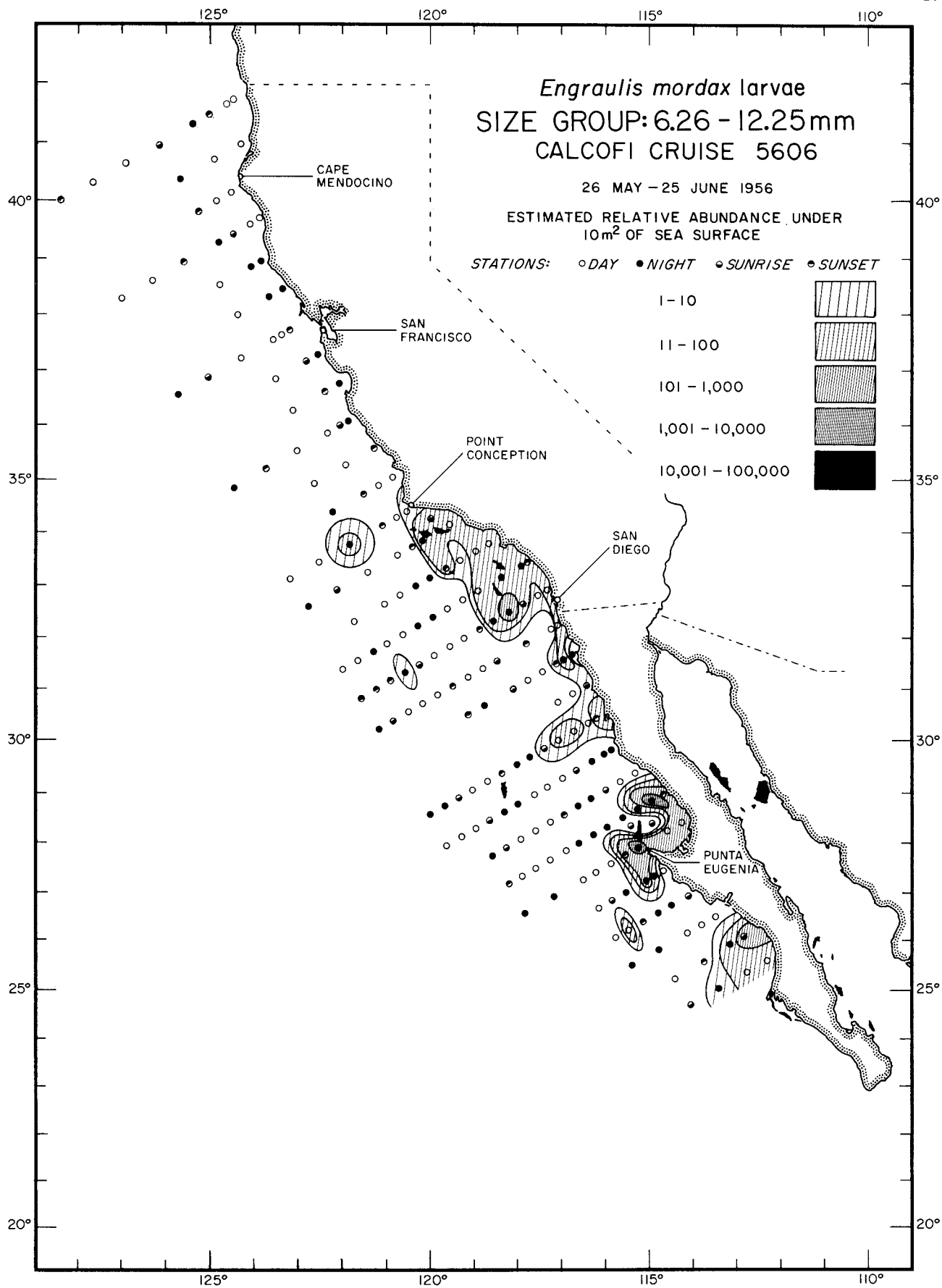
*Engraulis mordax* larvae  
All Sizes  
5604



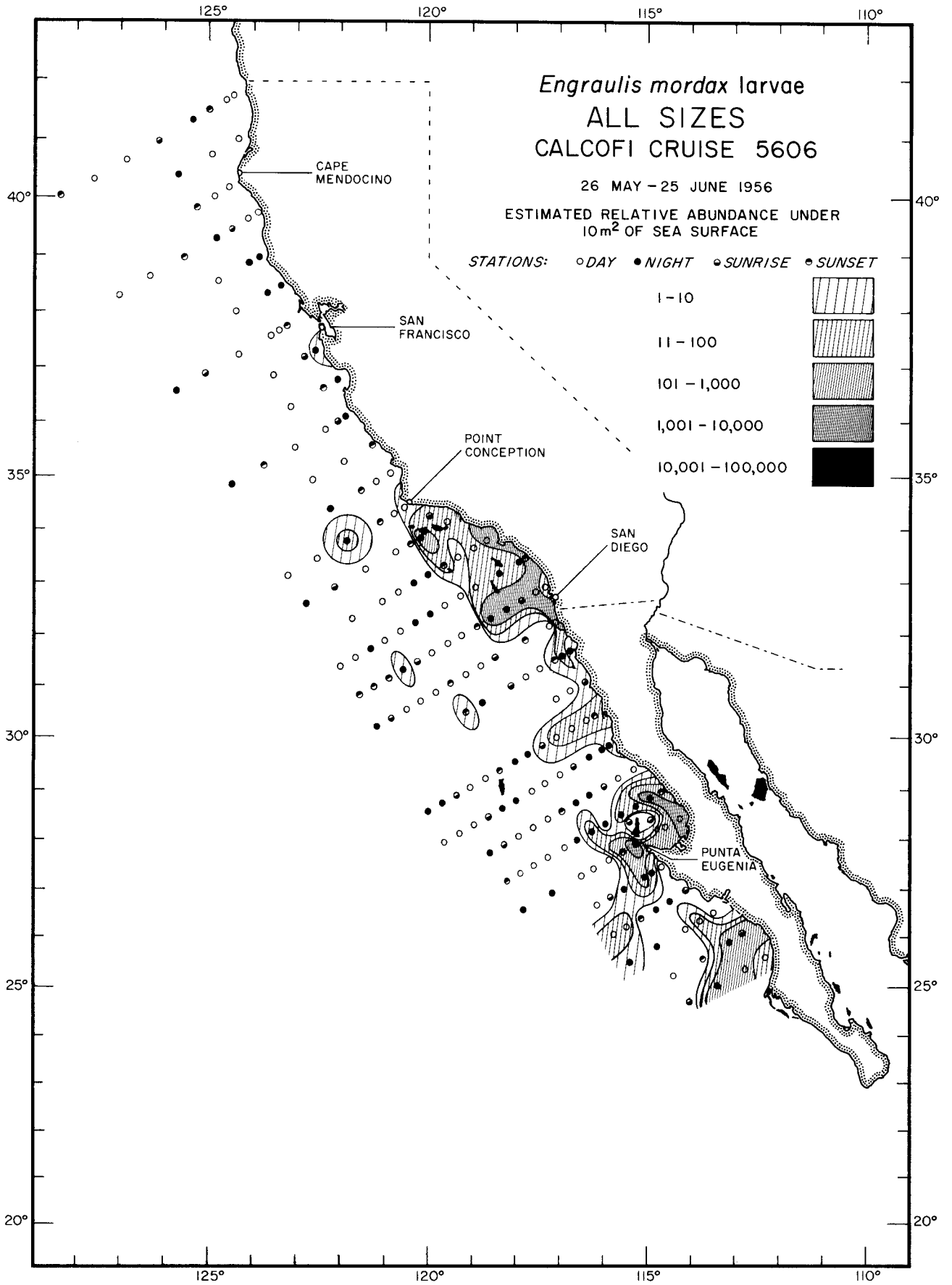
*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5605



*Engraulis mordax* larvae  
 All Sizes  
 5605



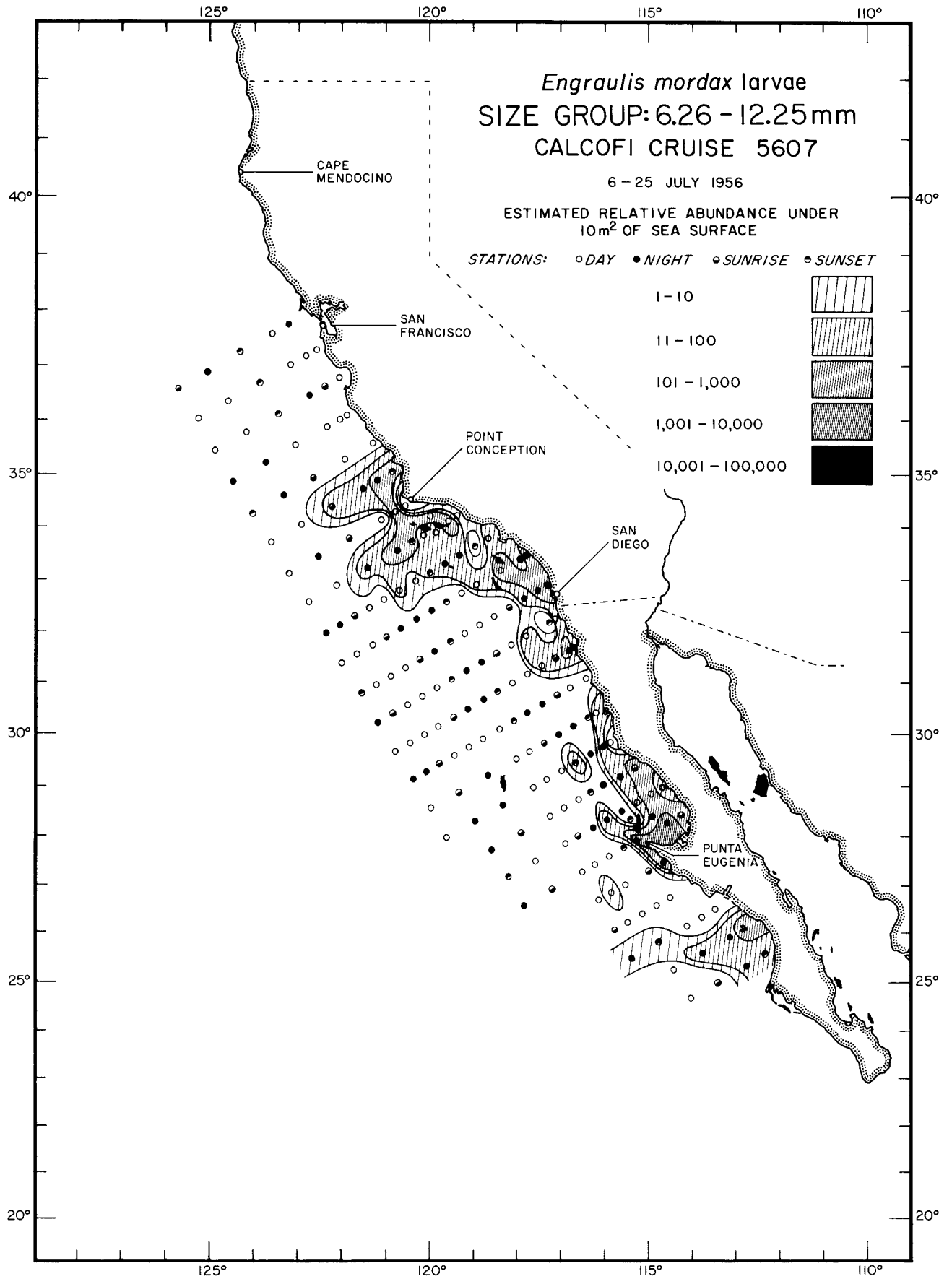
*Engraulis mordax* larvae  
 Size Group: 6.26-12.25mm  
 5606



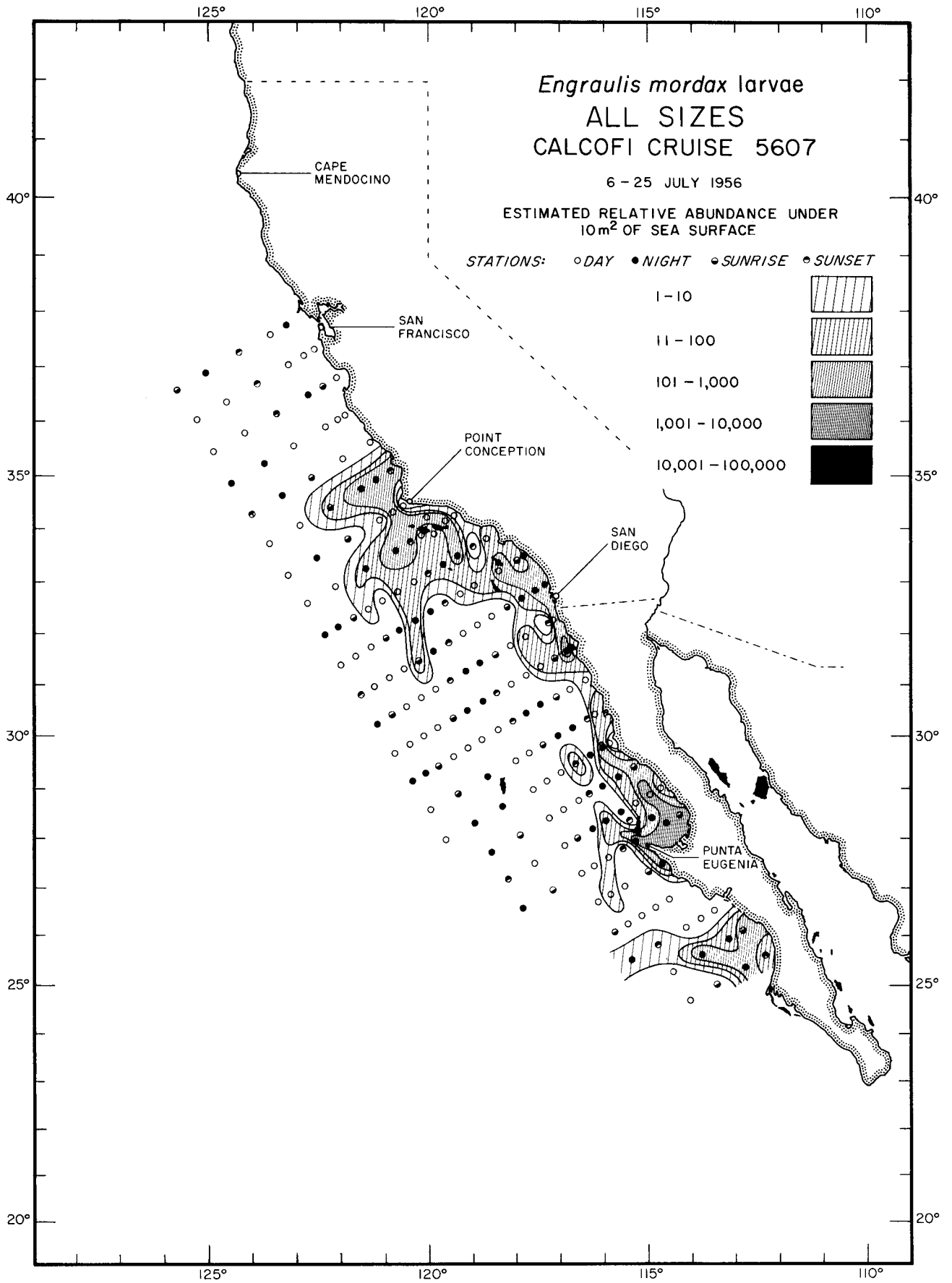
*Engraulis mordax* larvae

All Sizes  
5606

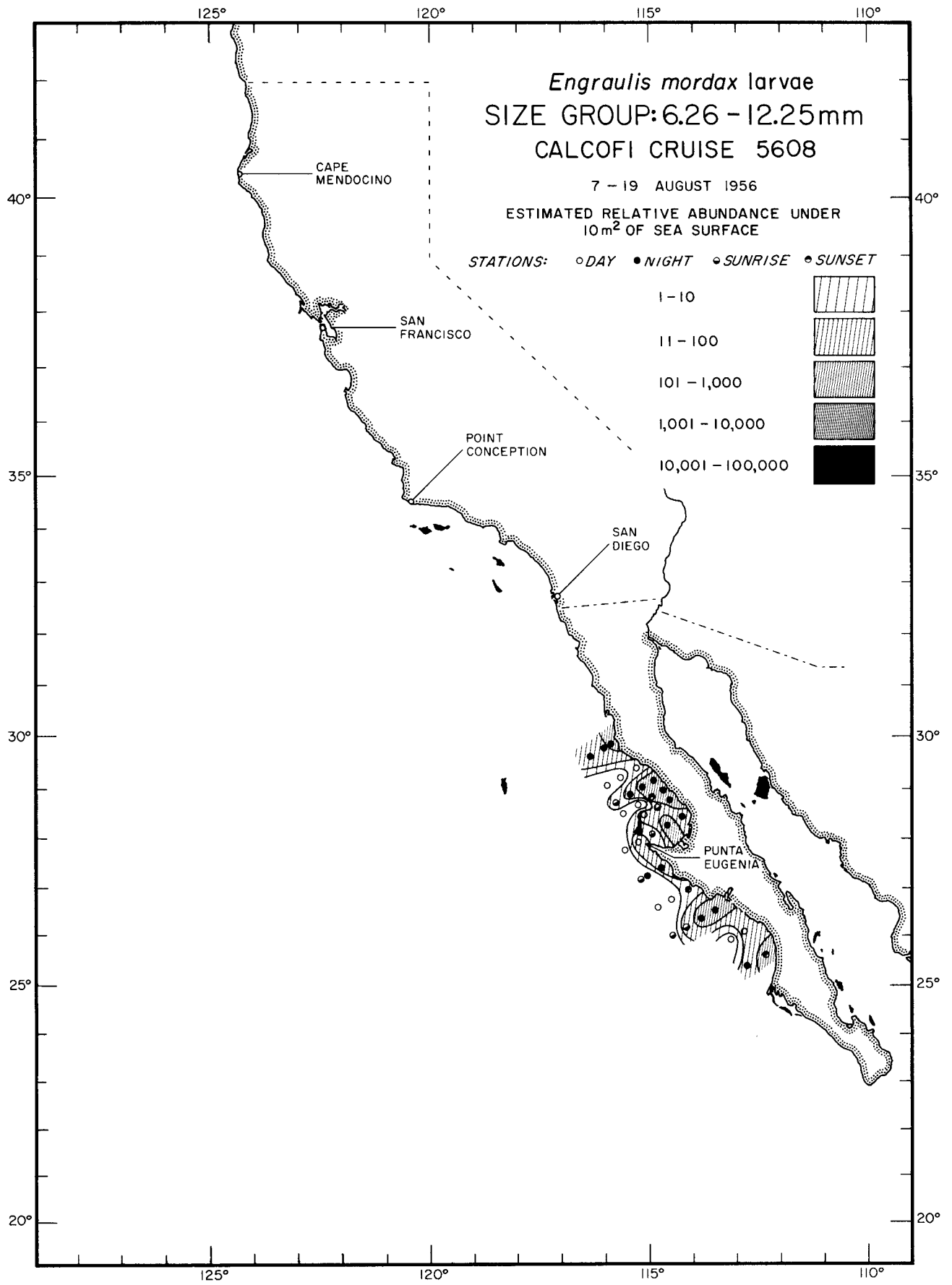




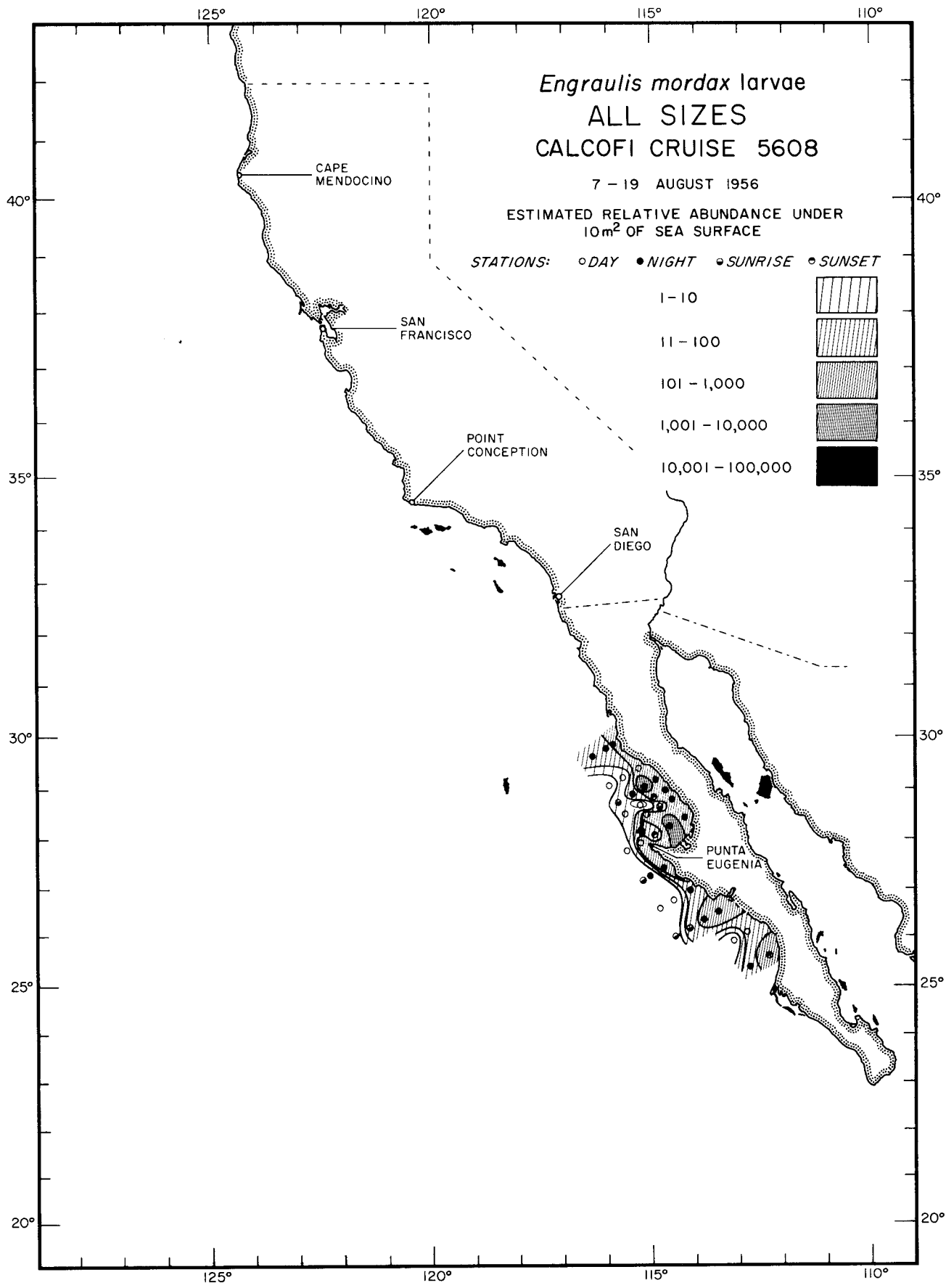
*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5607



*Engraulis mordax* larvae  
All Sizes  
5607

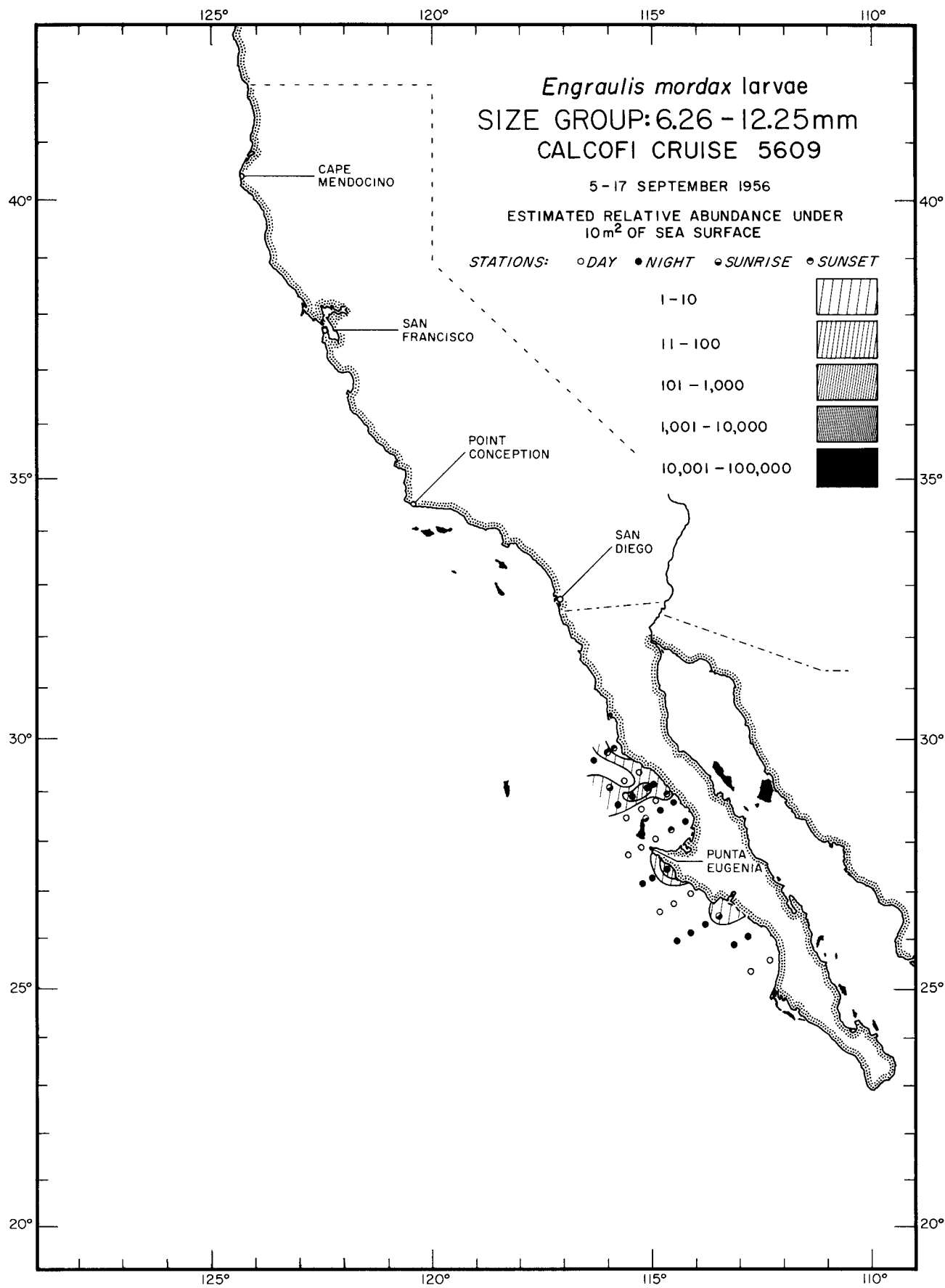


*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5608

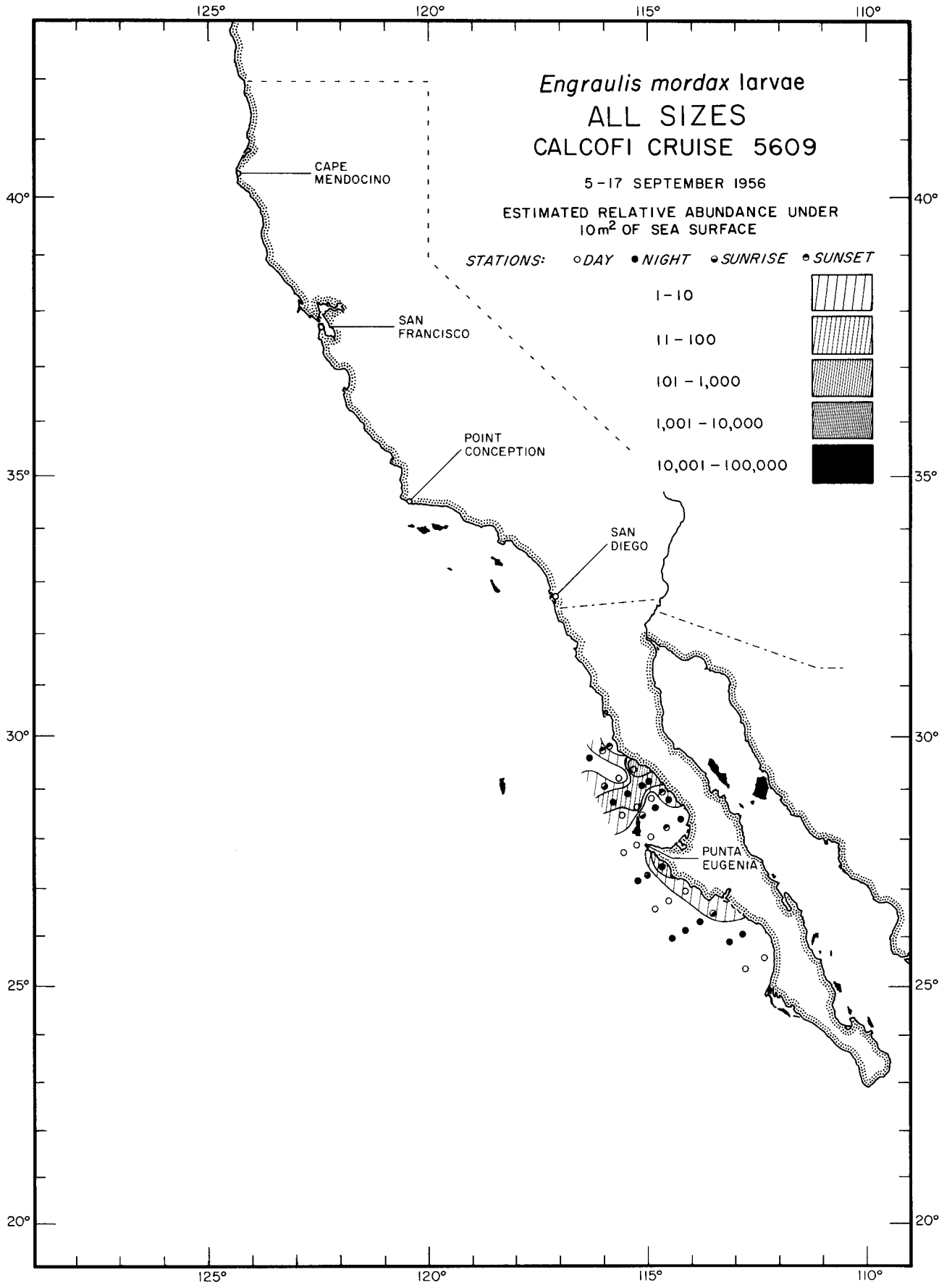


*Engraulis mordax* larvae

All Sizes  
5608



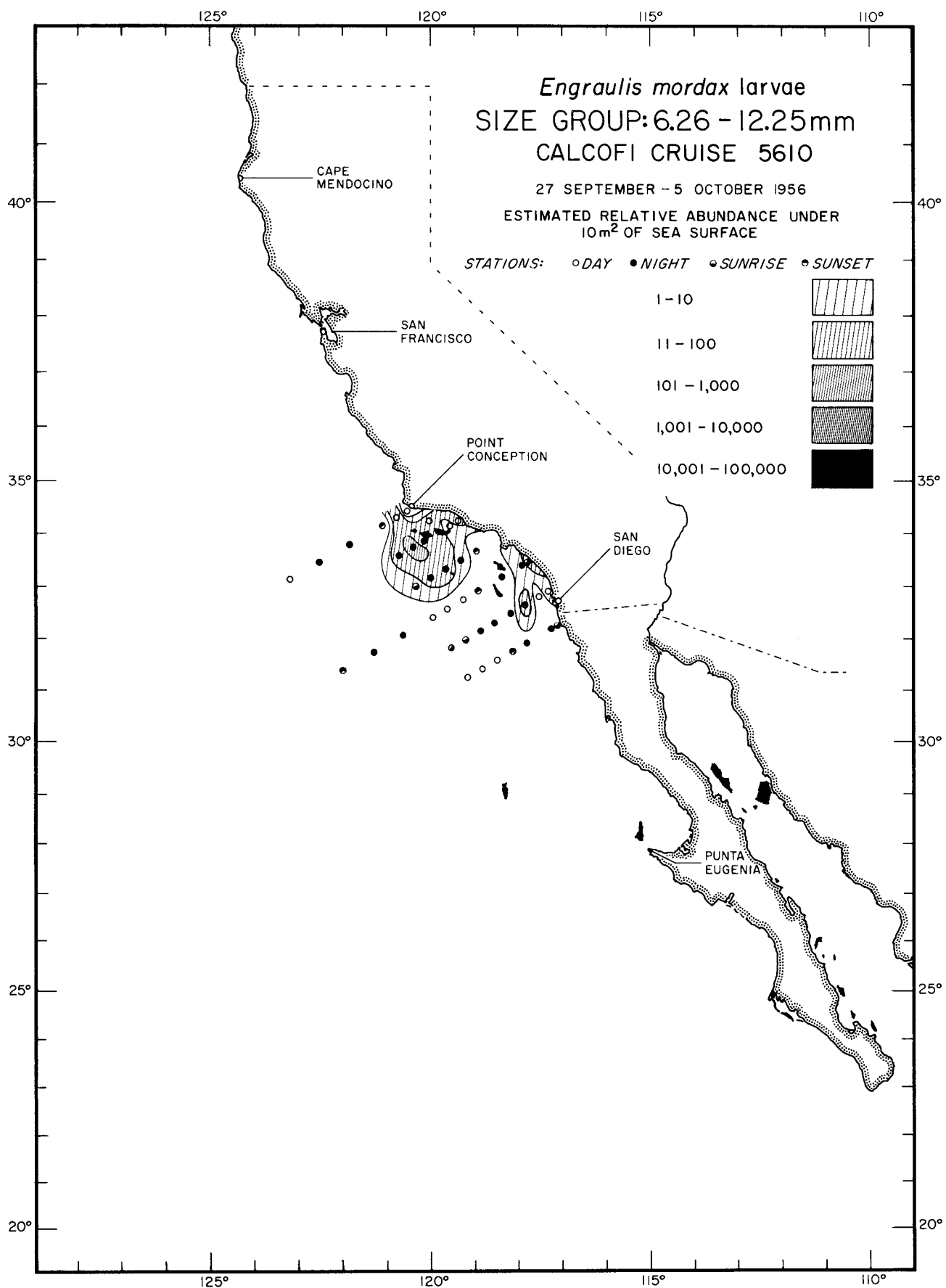
*Engraulis mordax* larvae  
 Size Group: 6.26-12.25mm  
 5609



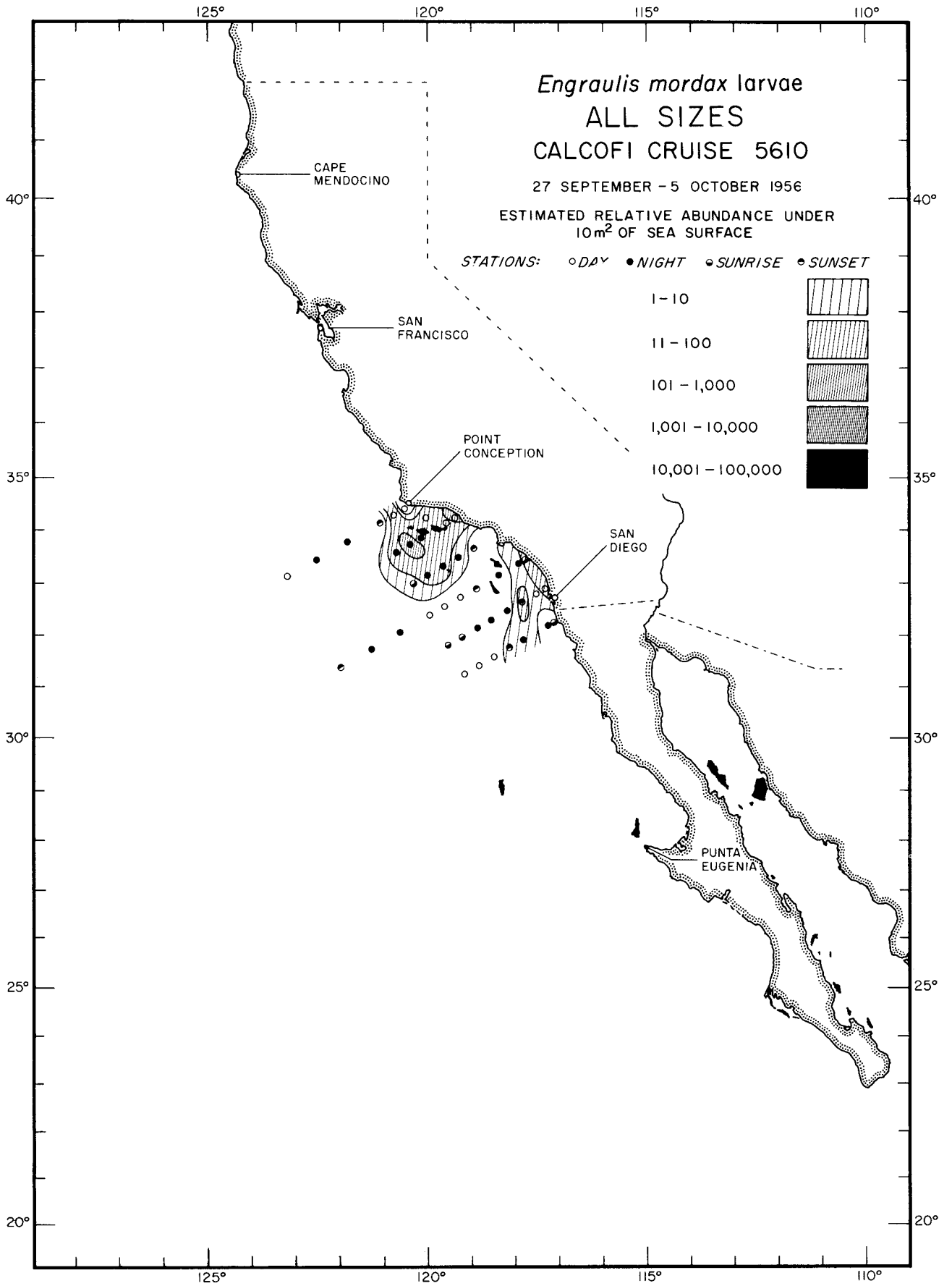
*Engraulis mordax* larvae

All Sizes

5609

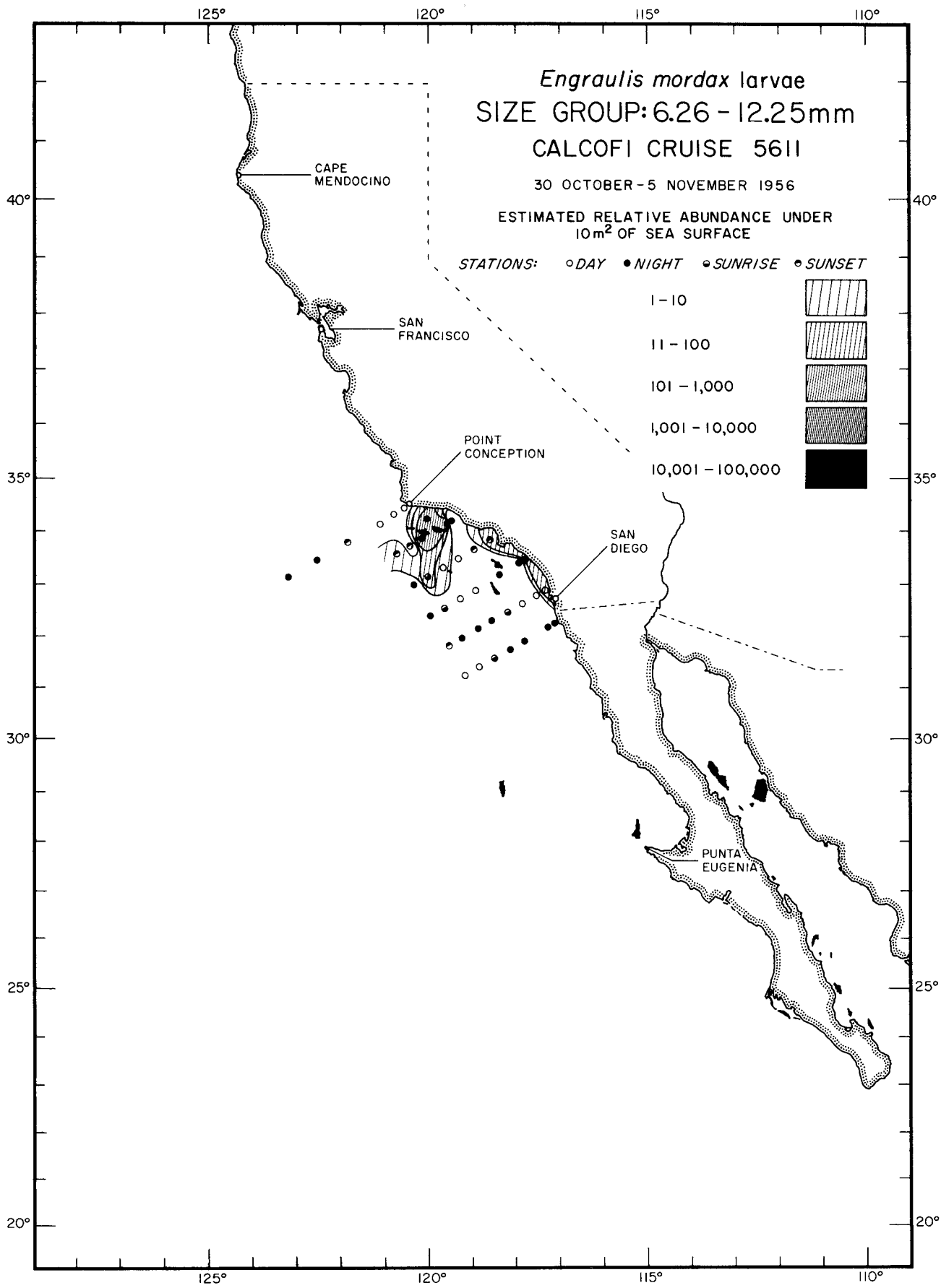


*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5610

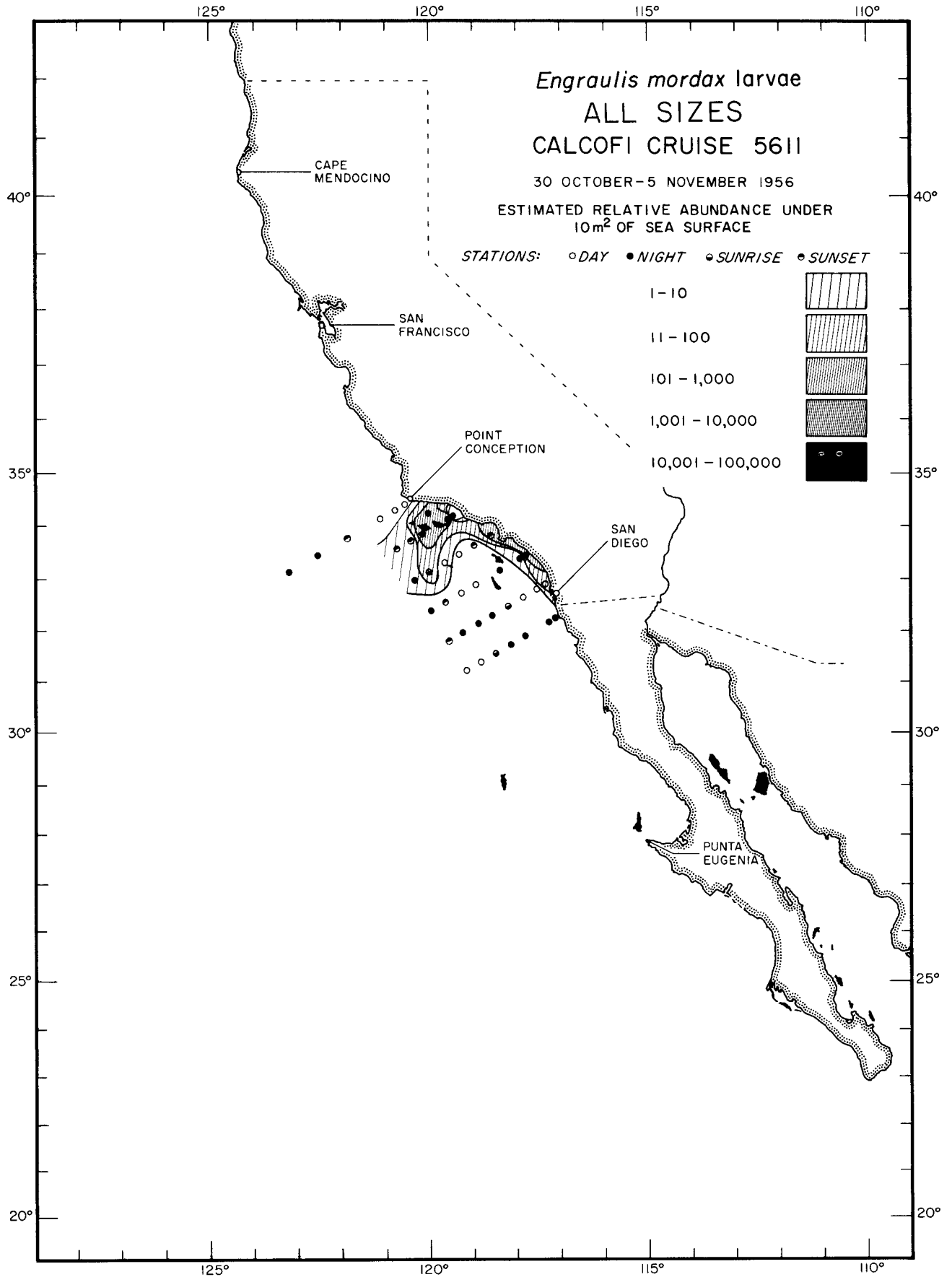


*Engraulis mordax* larvae  
All Sizes  
5610

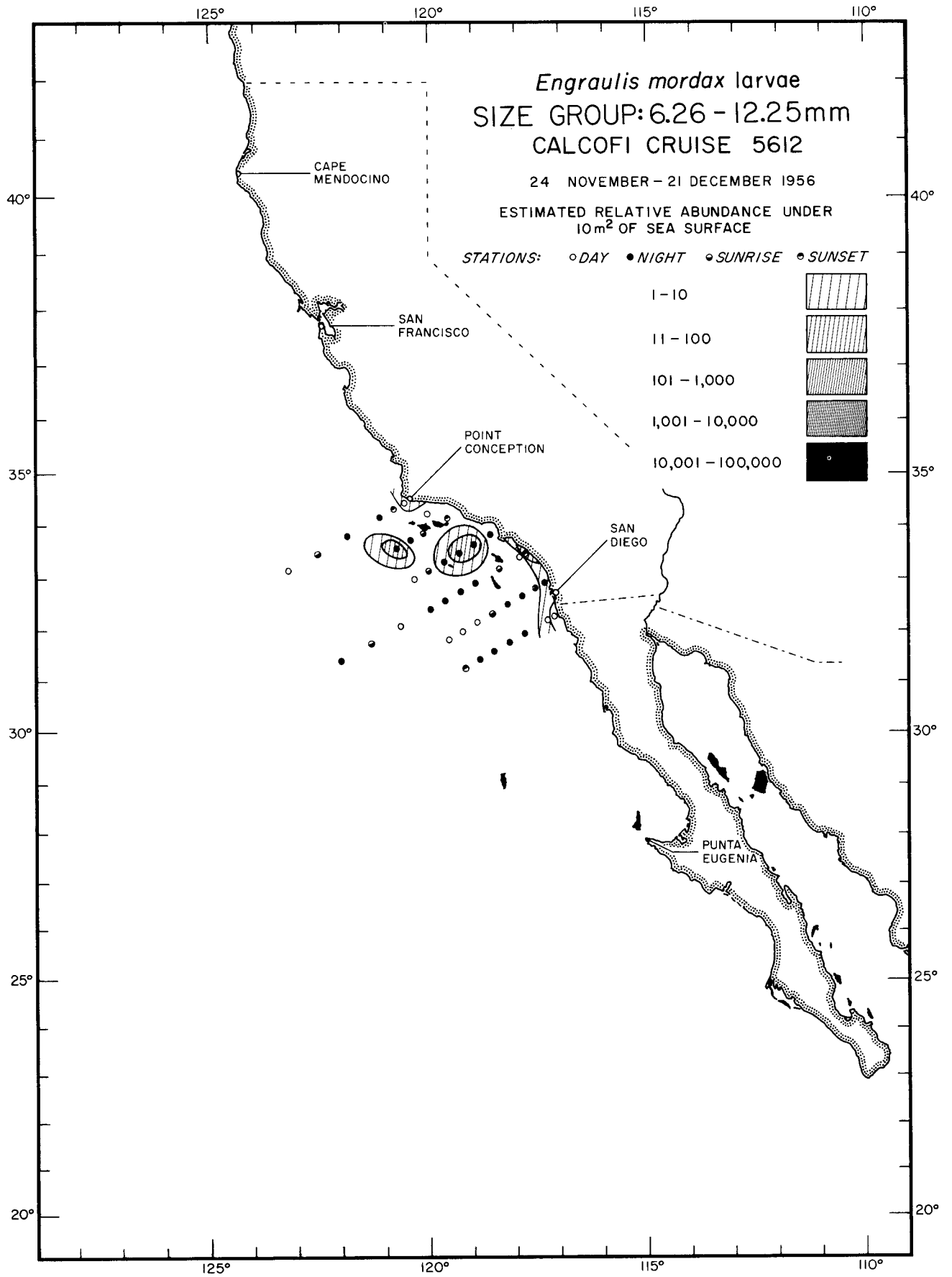




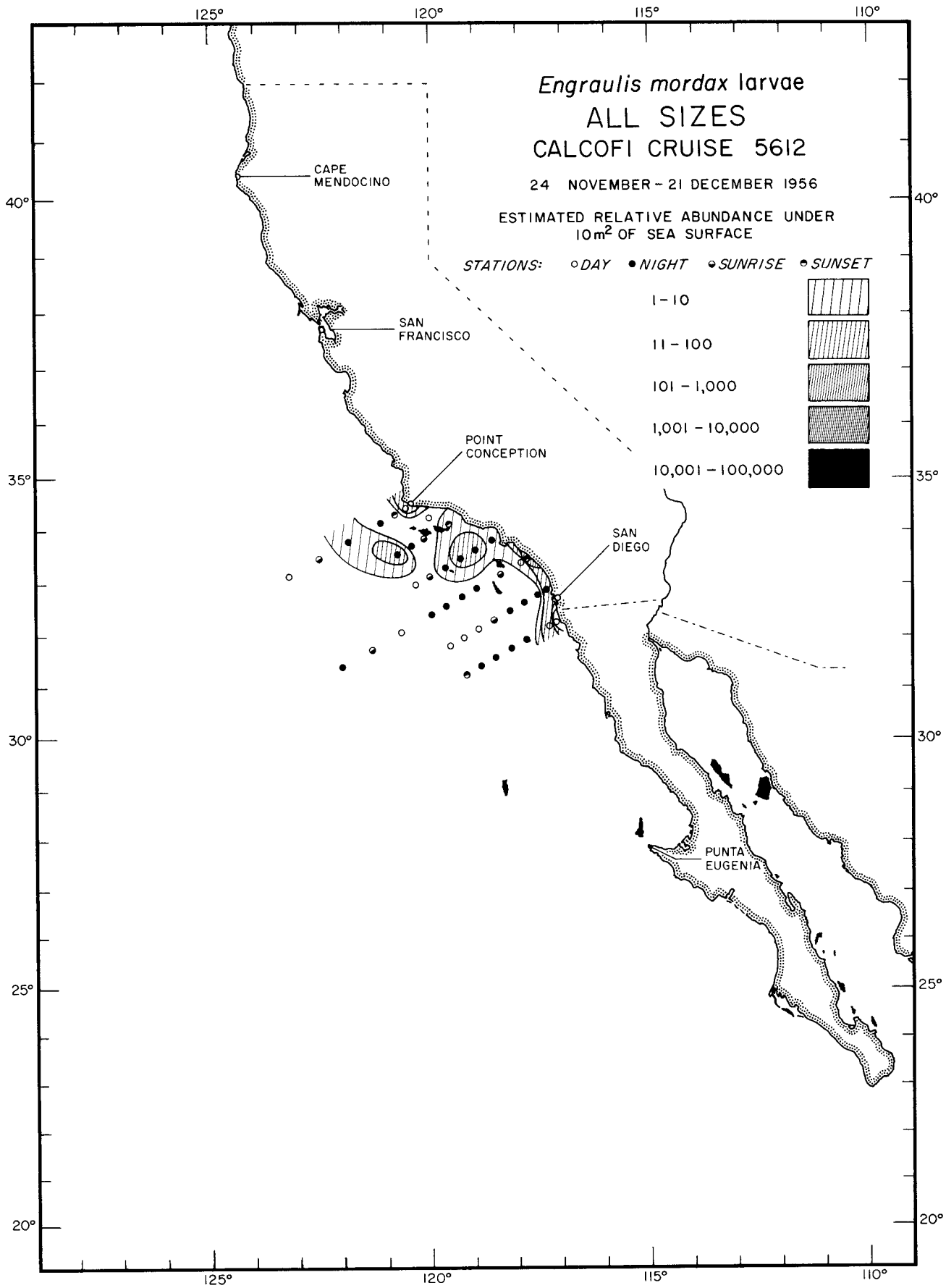
*Engraulis mordax* larvae  
 Size Group: 6.26-12.25mm  
 5611



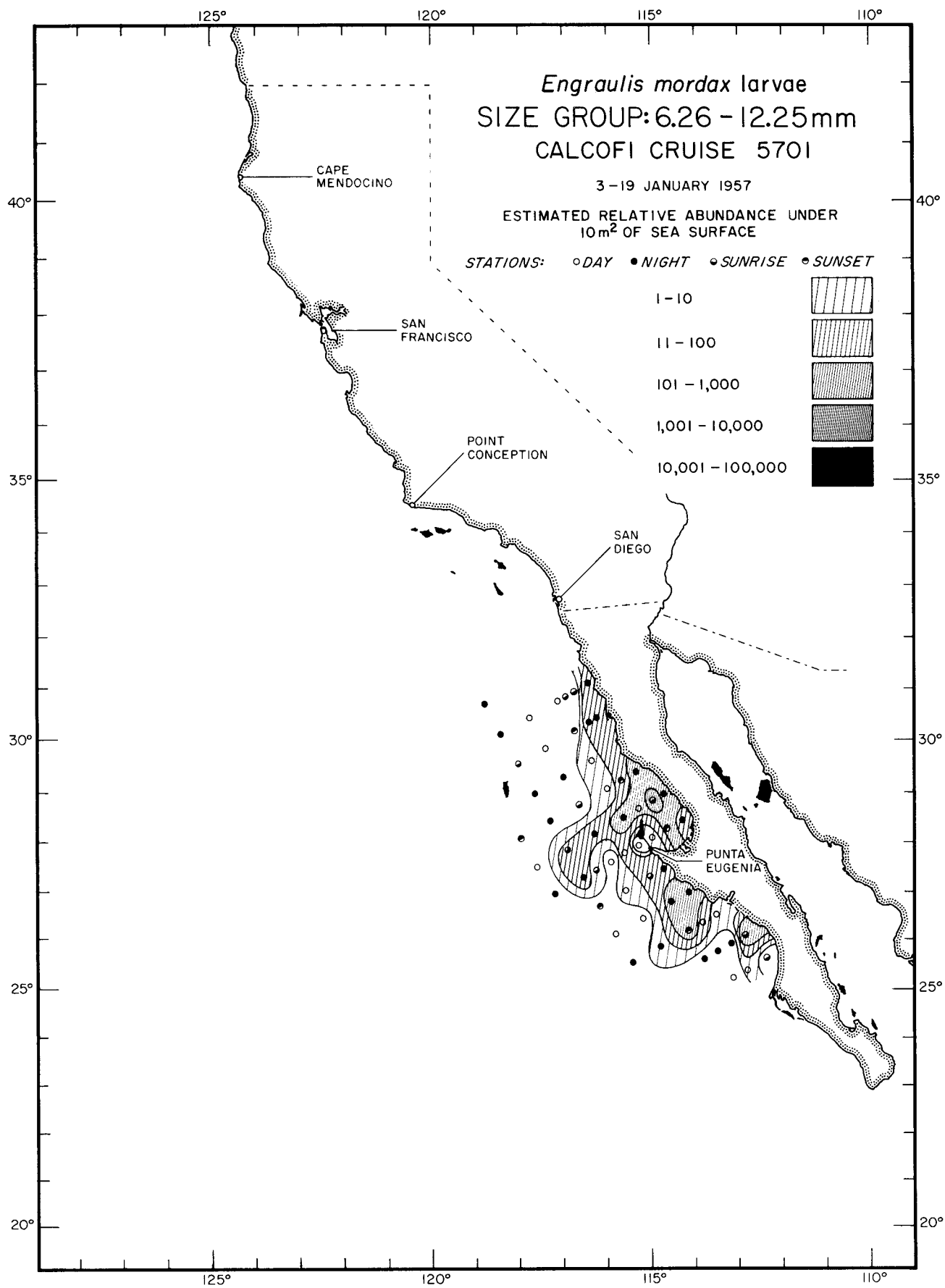
*Engraulis mordax* larvae  
All Sizes  
5611



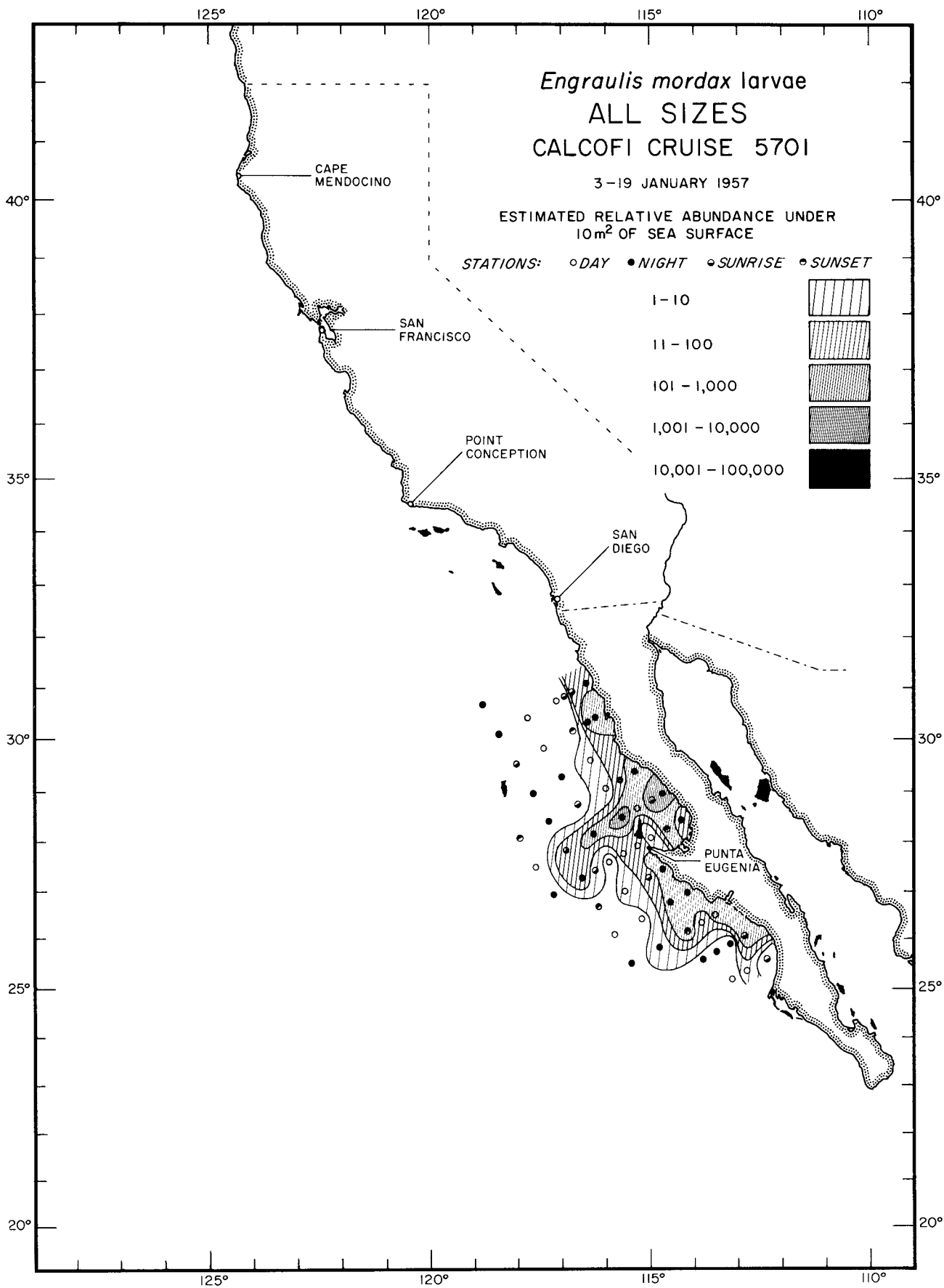
*Engraulis mordax* larvae  
 Size Group: 6.26-12.25mm  
 5612



*Engraulis mordax* larvae  
All Sizes  
5612

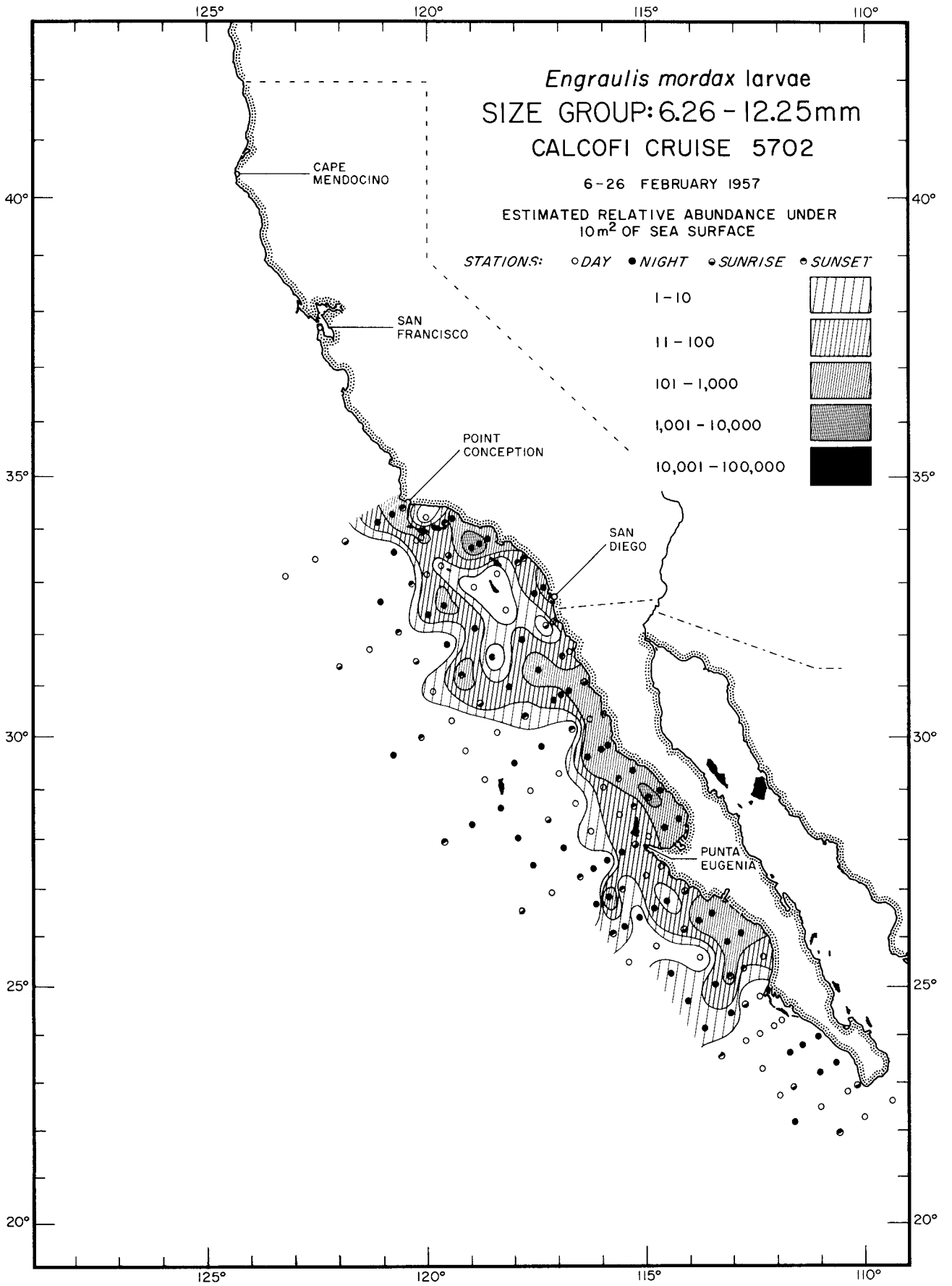


*Engraulis mordax* larvae  
 Size Group: 6.26-12.25mm  
 5701

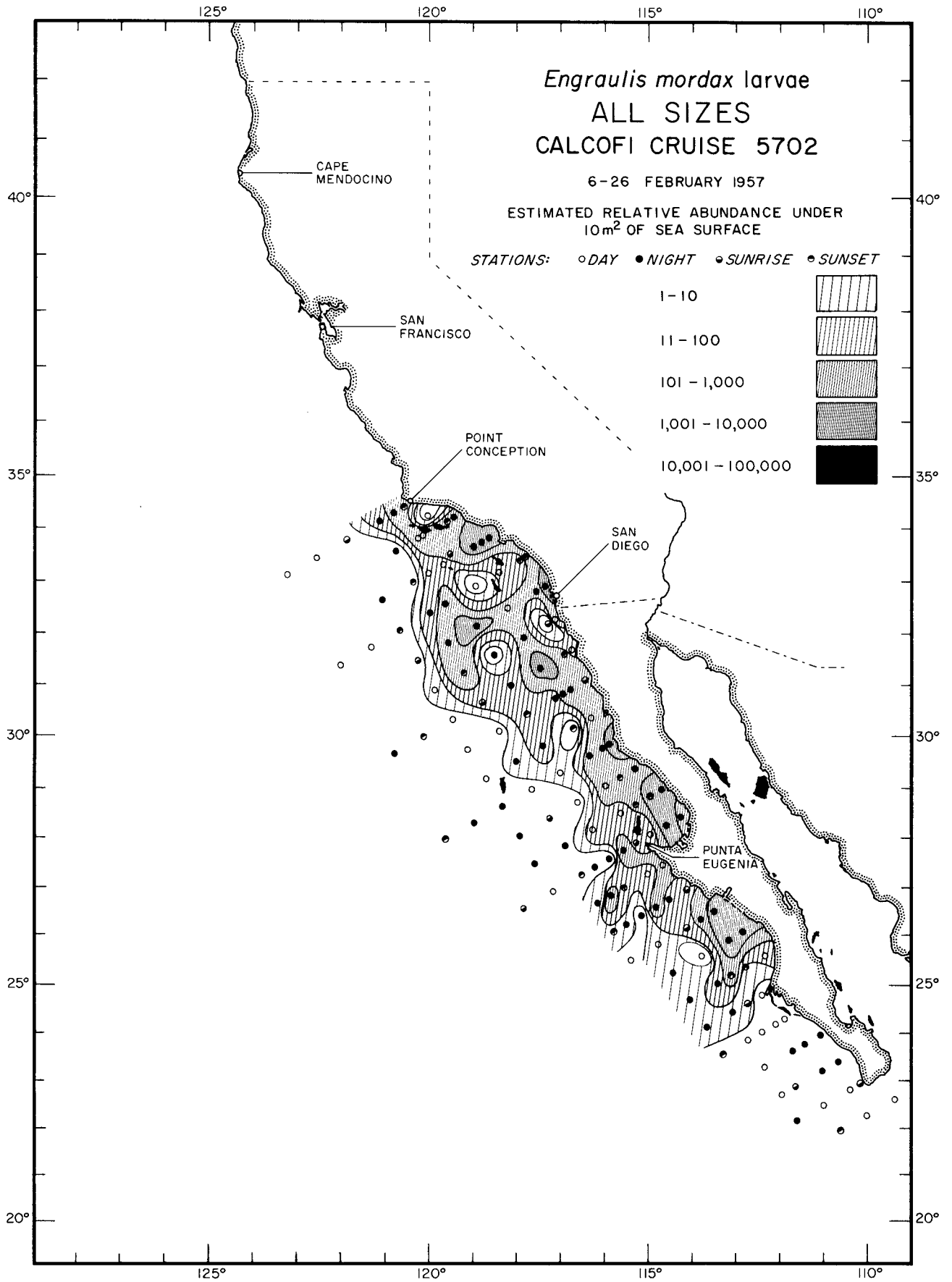


*Engraulis mordax* larvae

All Sizes  
5701

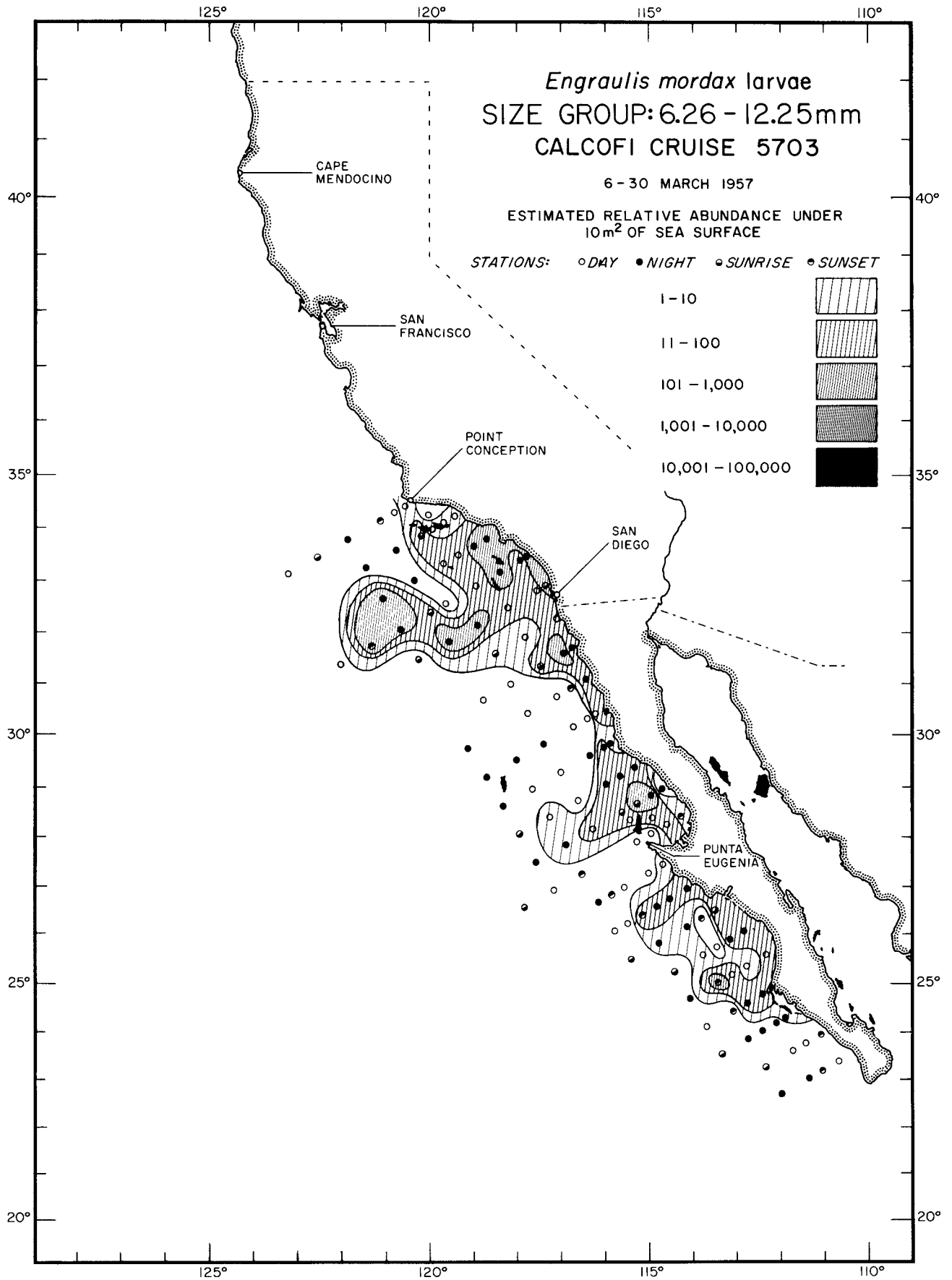


*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5702

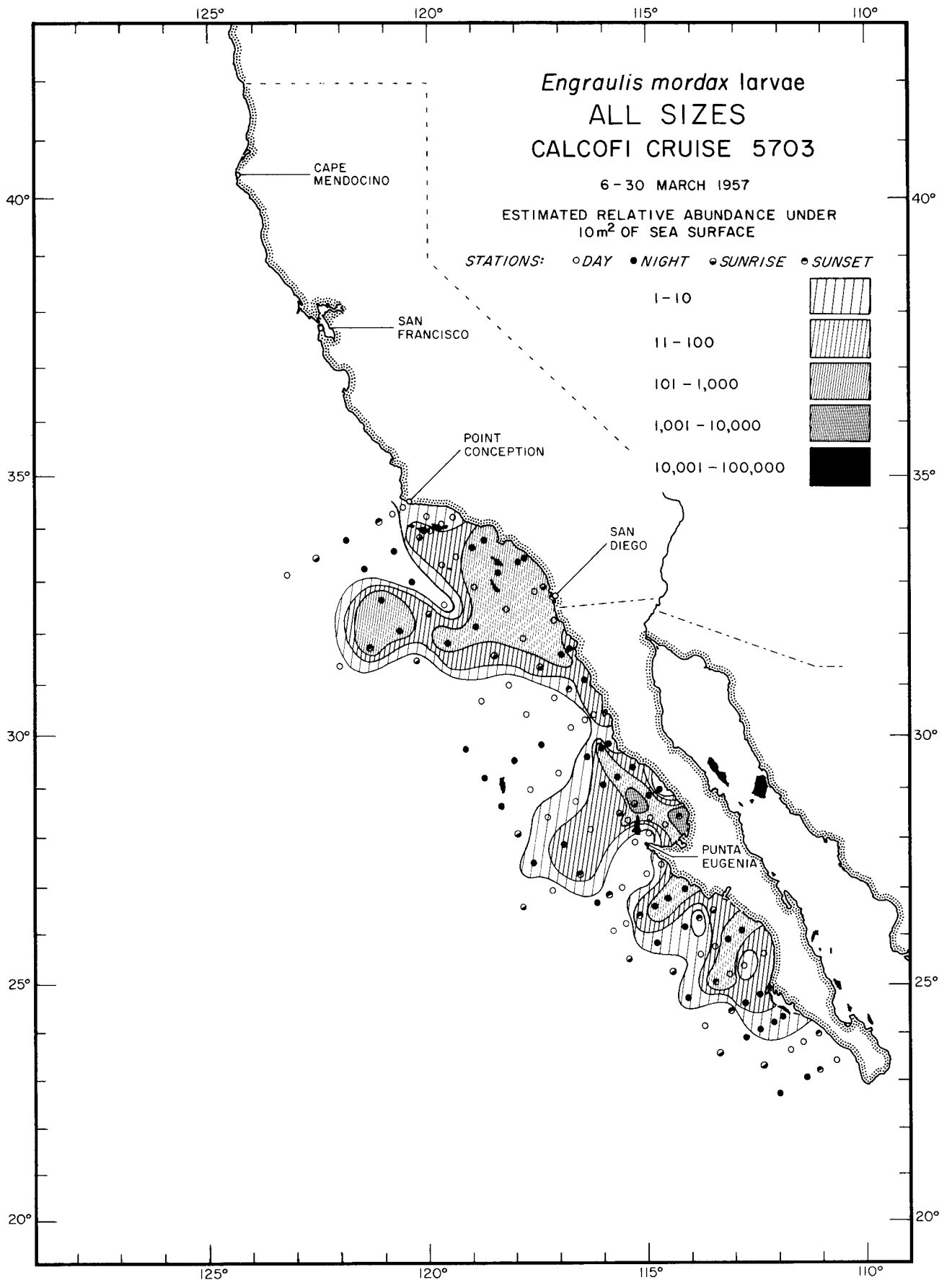


*Engraulis mordax* larvae  
 All Sizes  
 5702

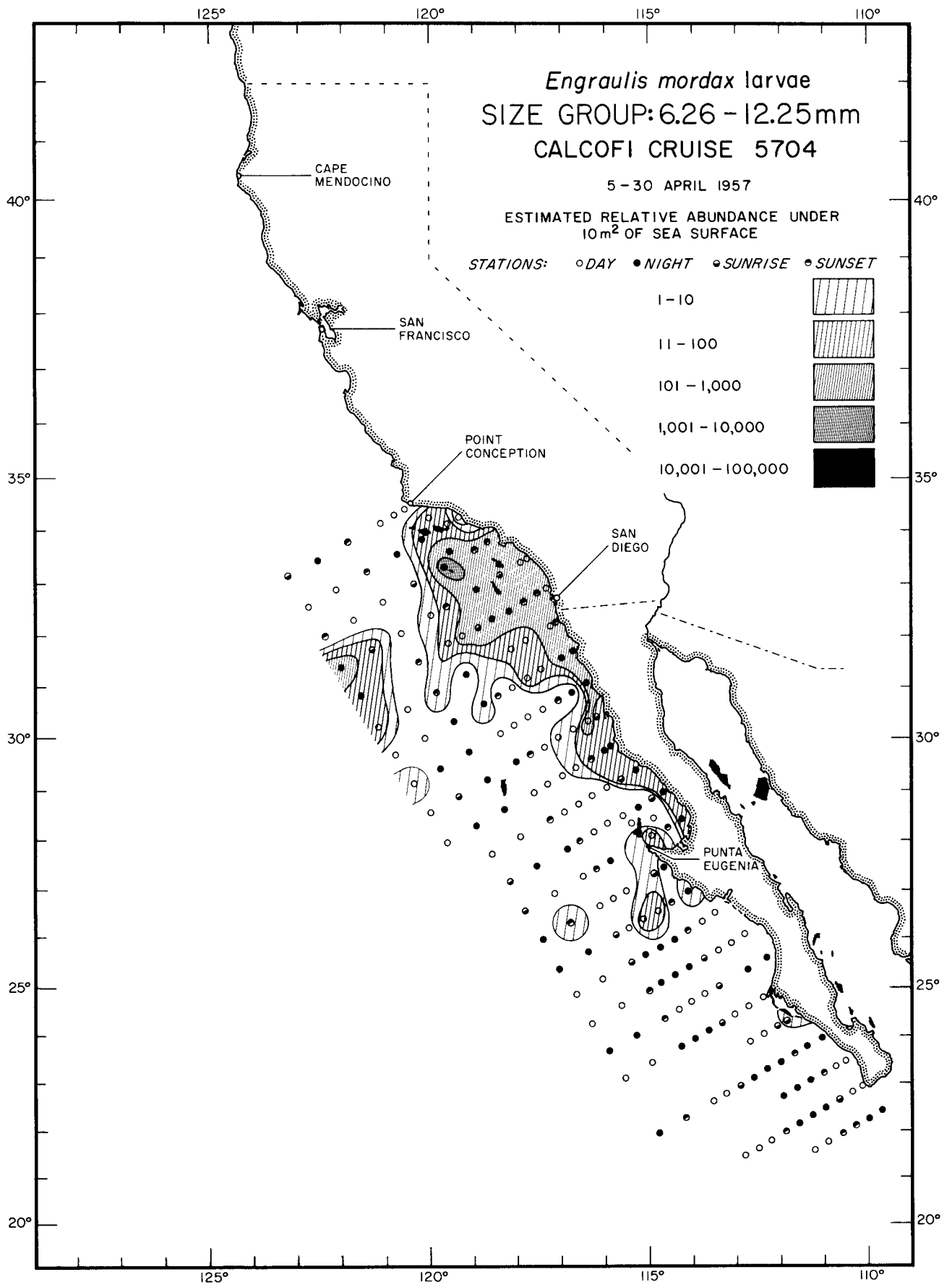




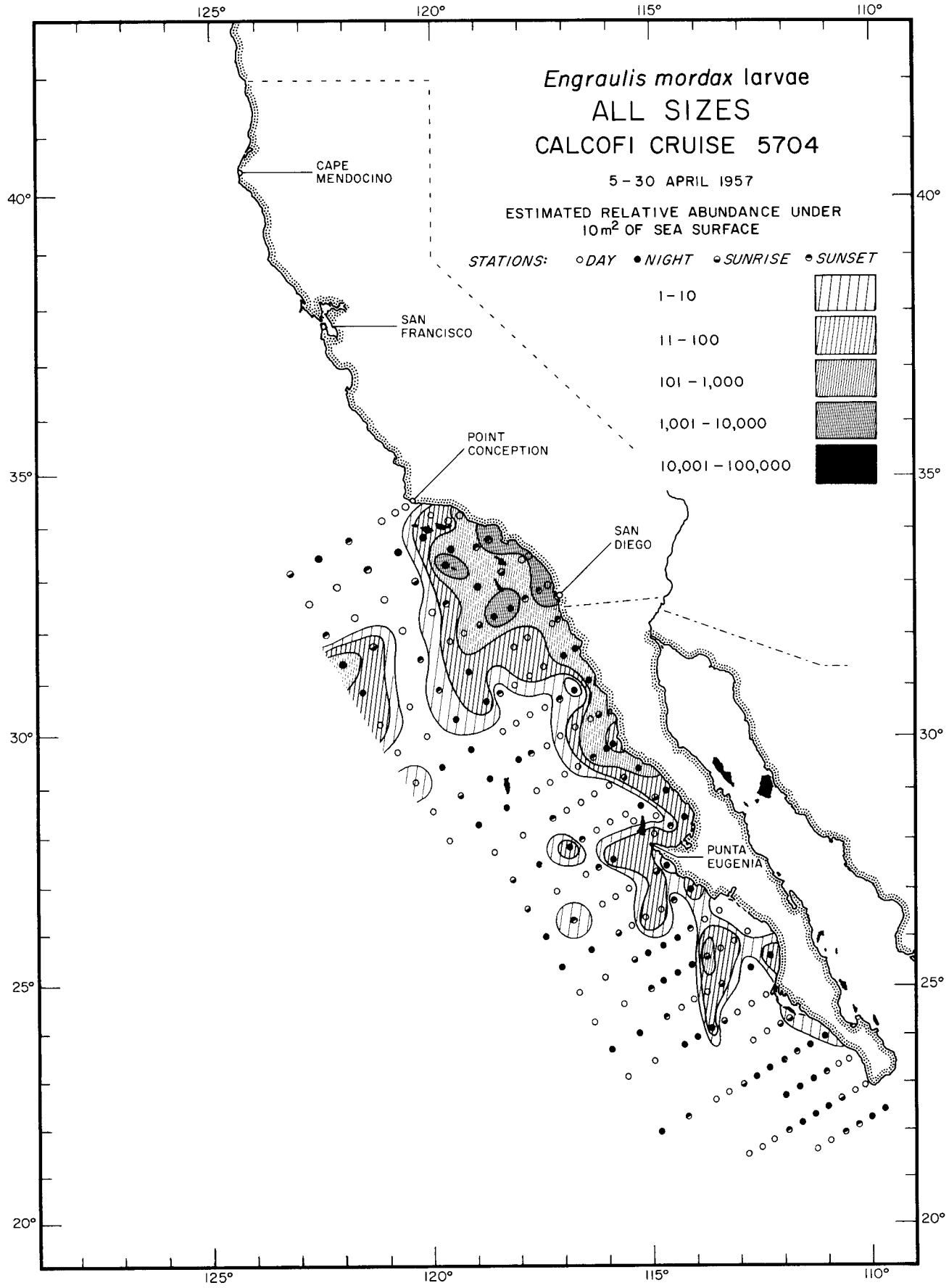
*Engraulis mordax* larvae  
 Size Group: 6.26-12.25mm  
 5703



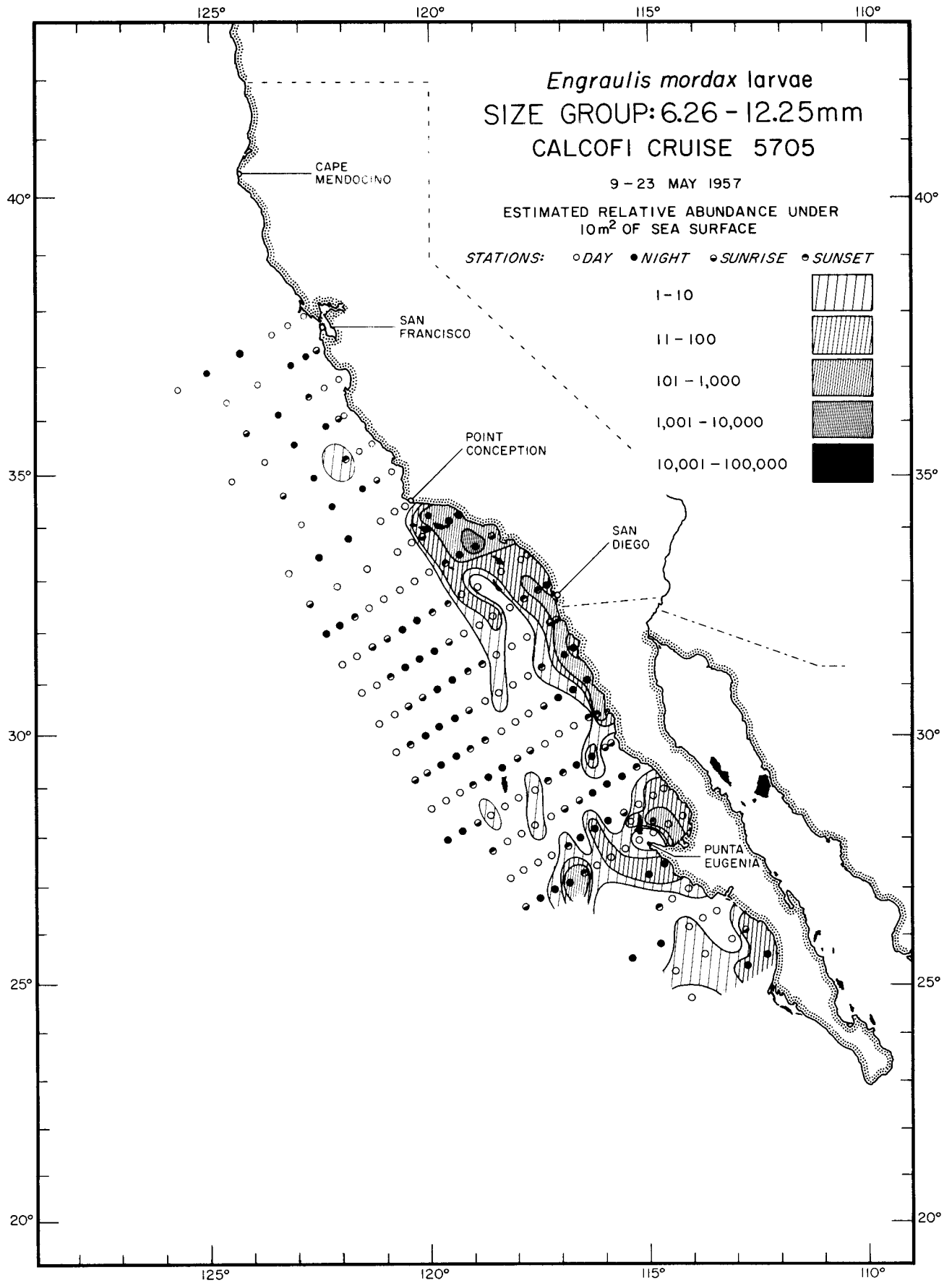
*Engraulis mordax* larvae  
All Sizes  
5703



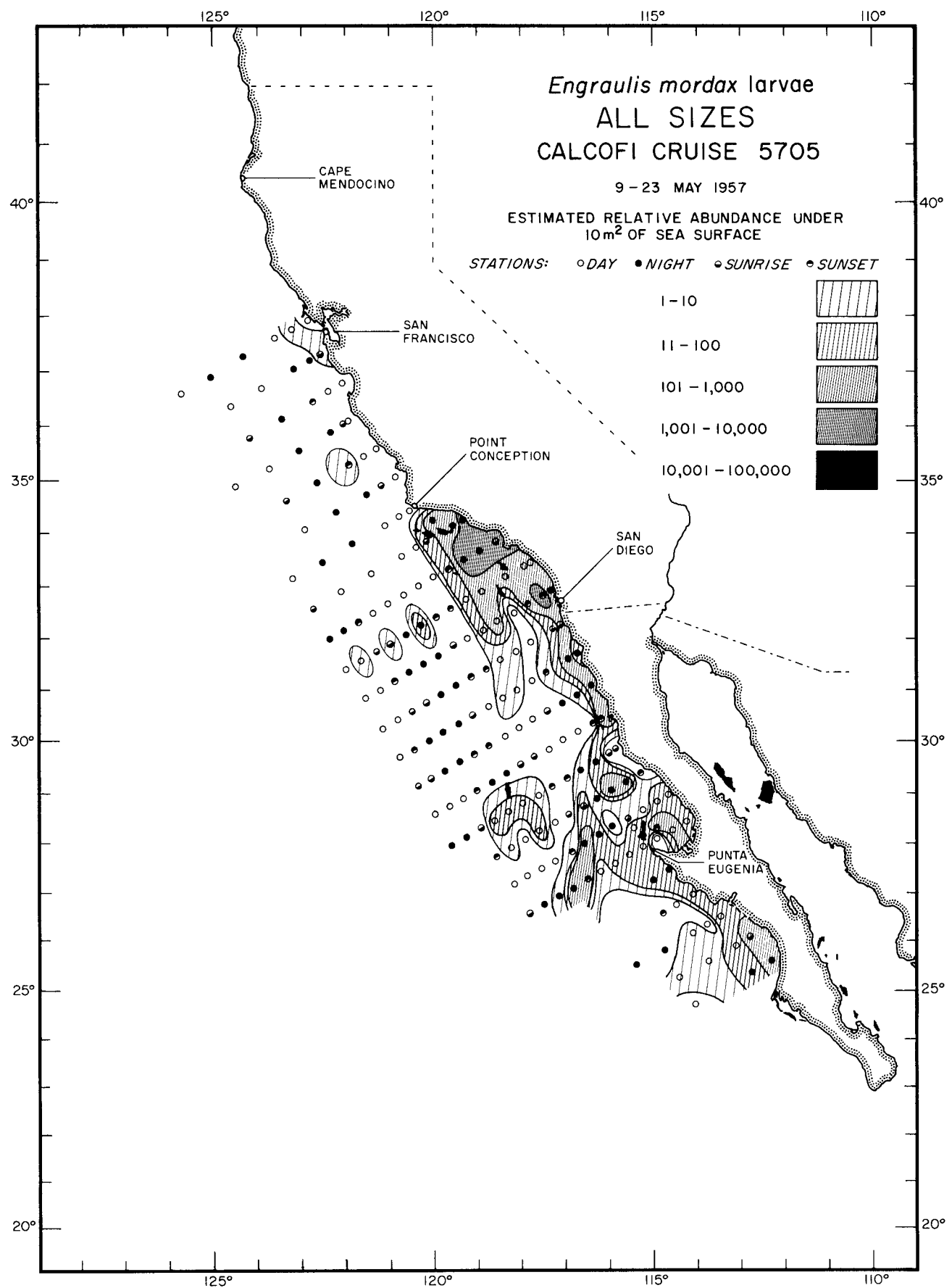
*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5704



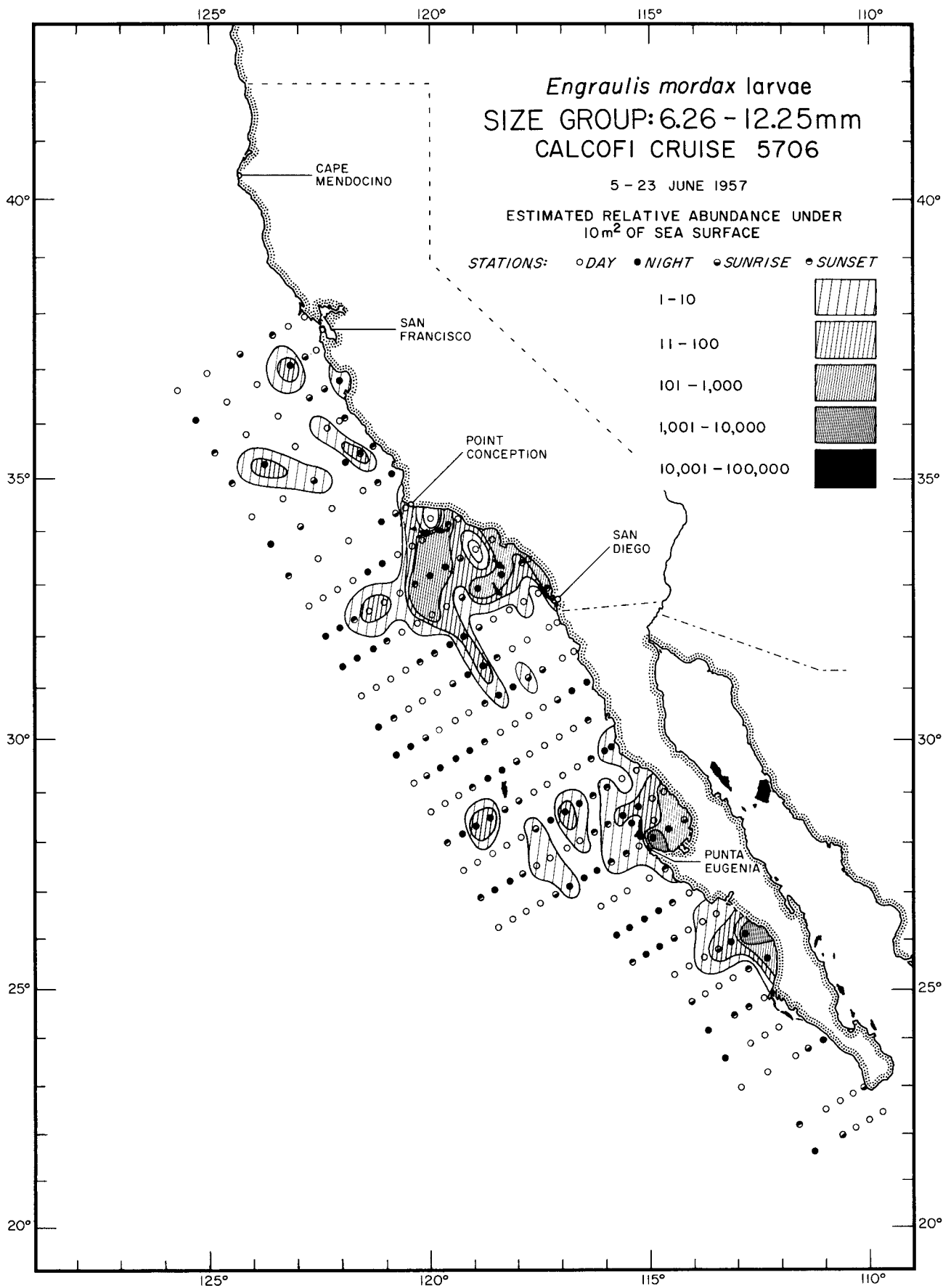
*Engraulis mordax* larvae  
All Sizes  
5704



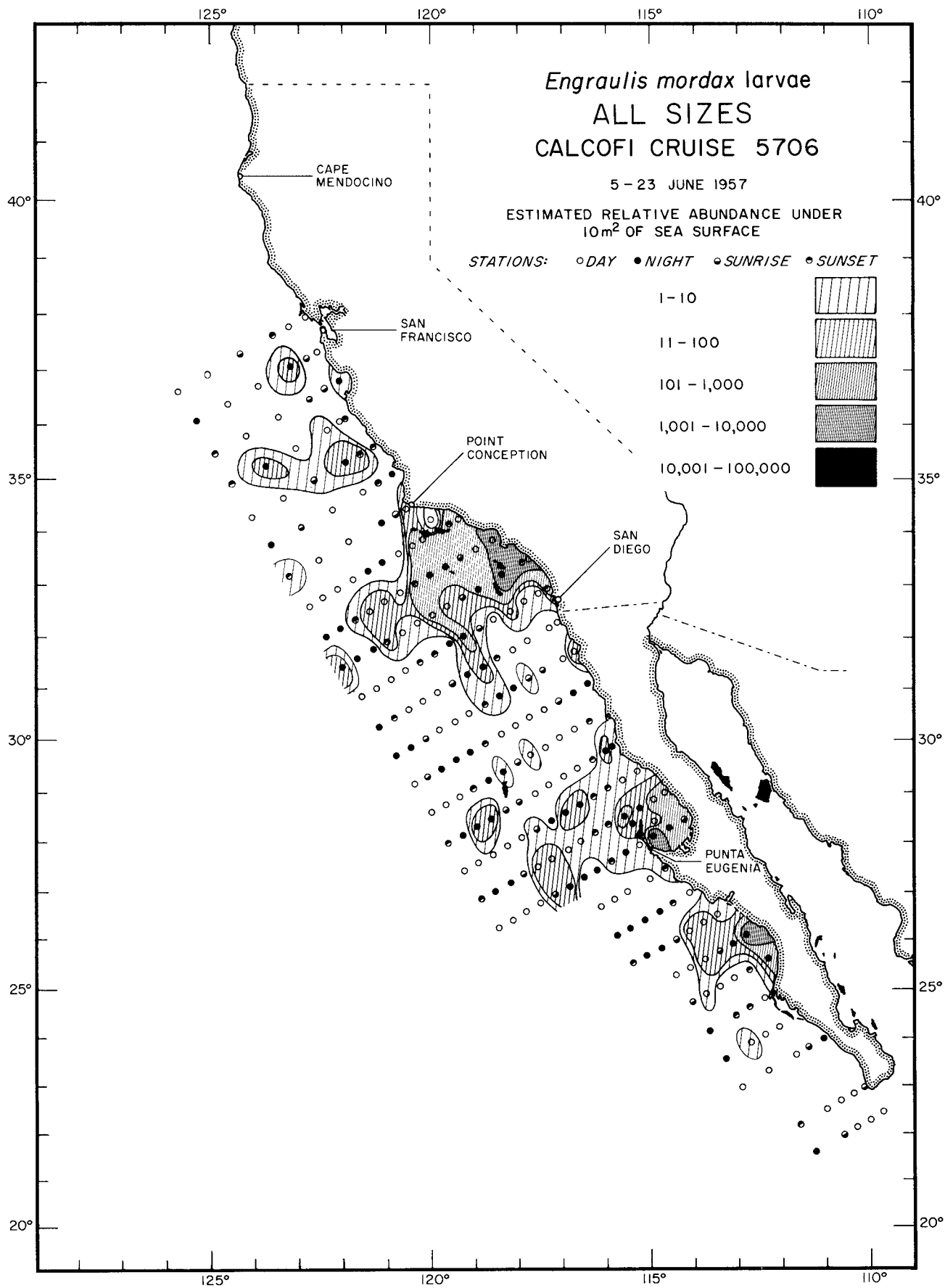
*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5705



*Engraulis mordax* larvae  
All Sizes  
5705



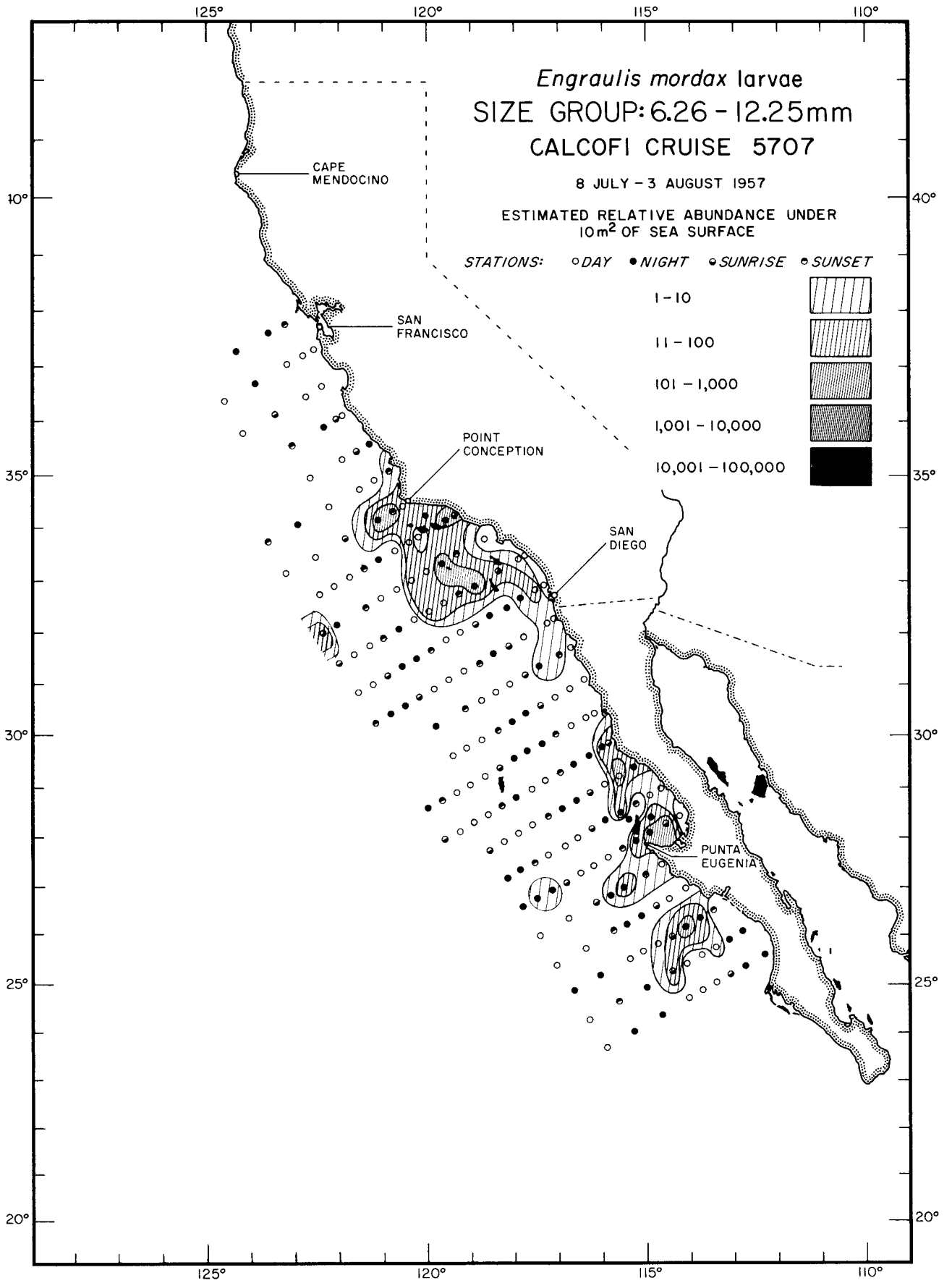
*Engraulis mordax* larvae  
 Size Group: 6.26-12.25mm  
 5706



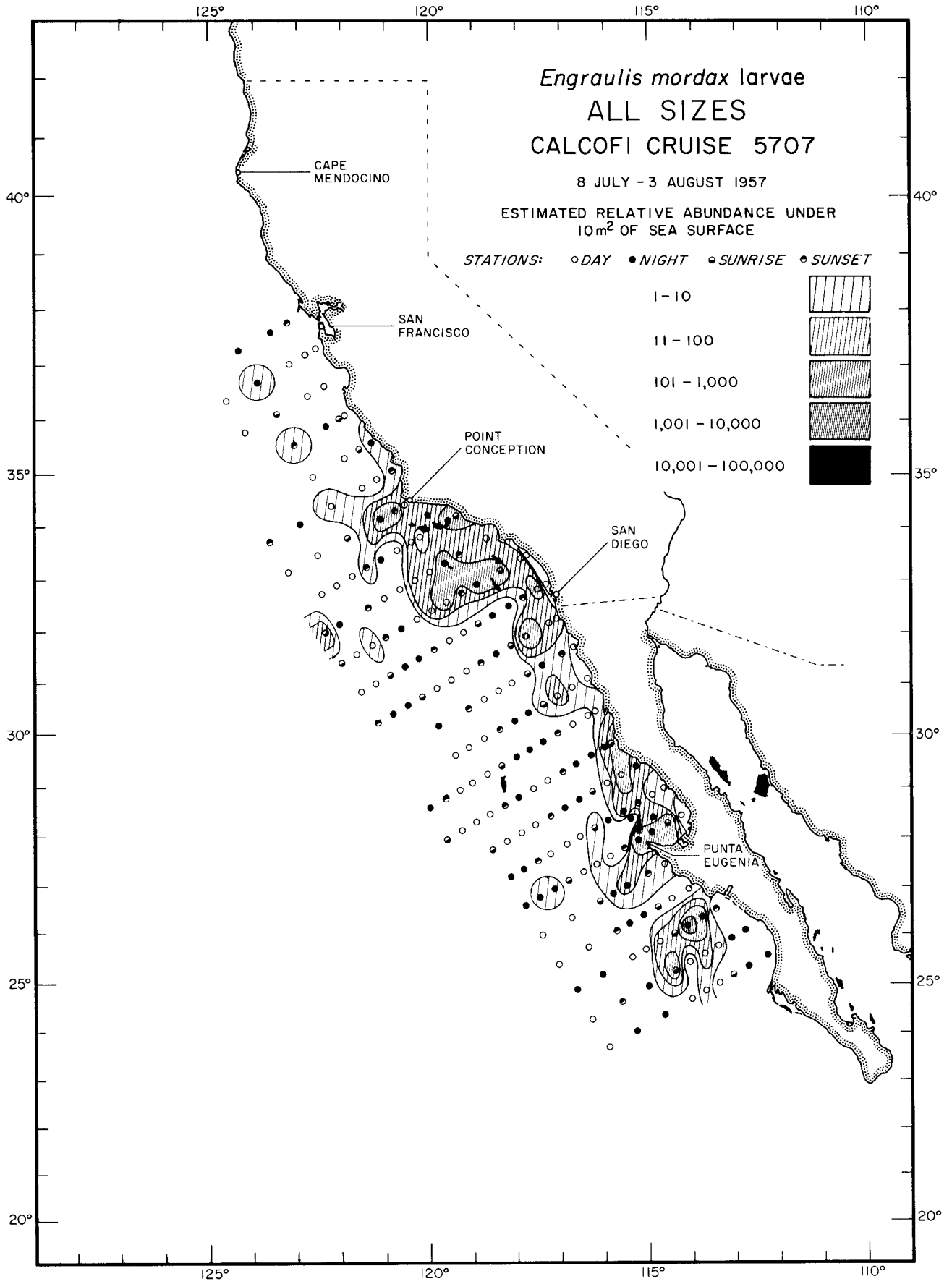
*Engraulis mordax* larvae

All Sizes  
5706





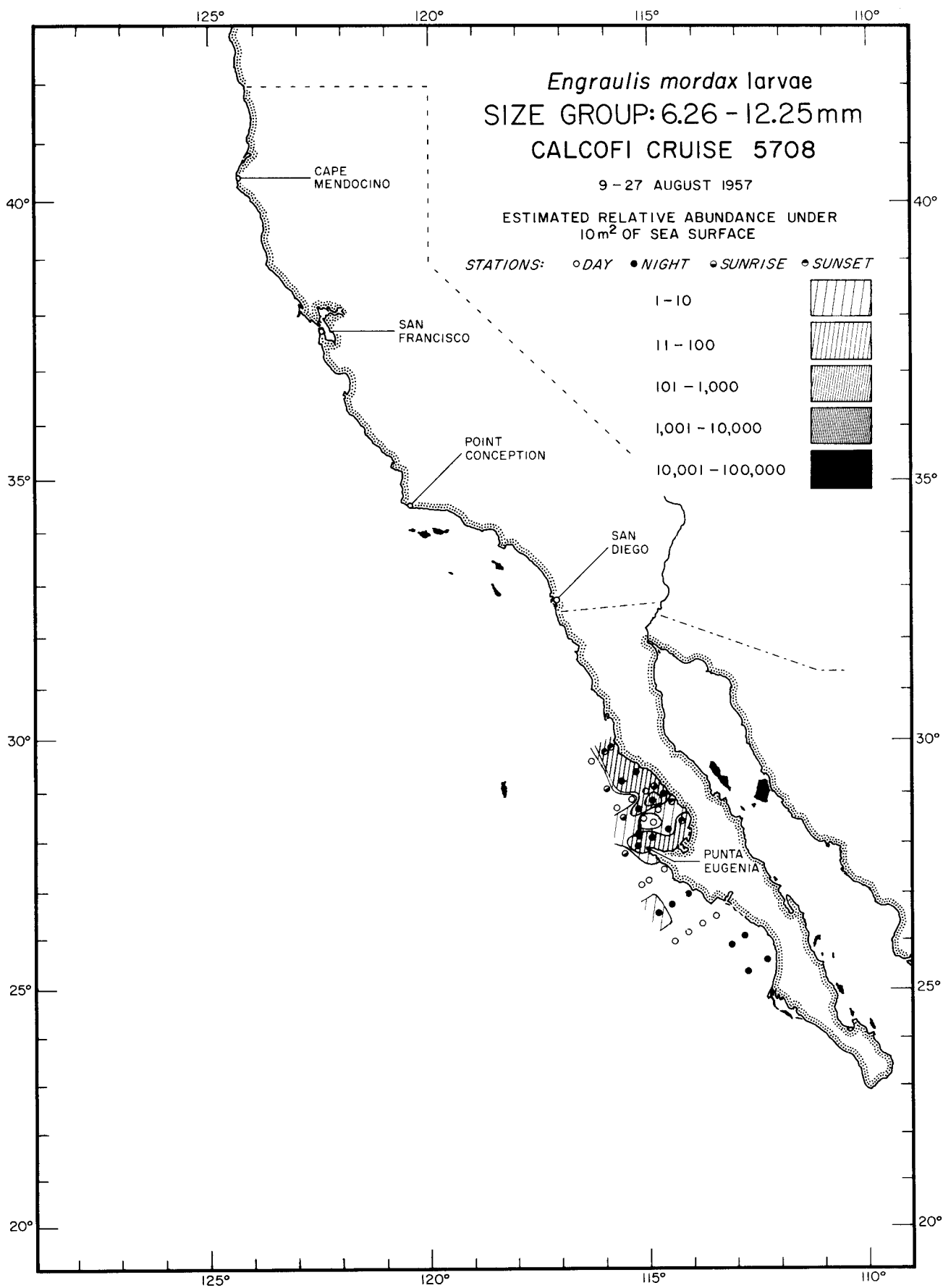
*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5707



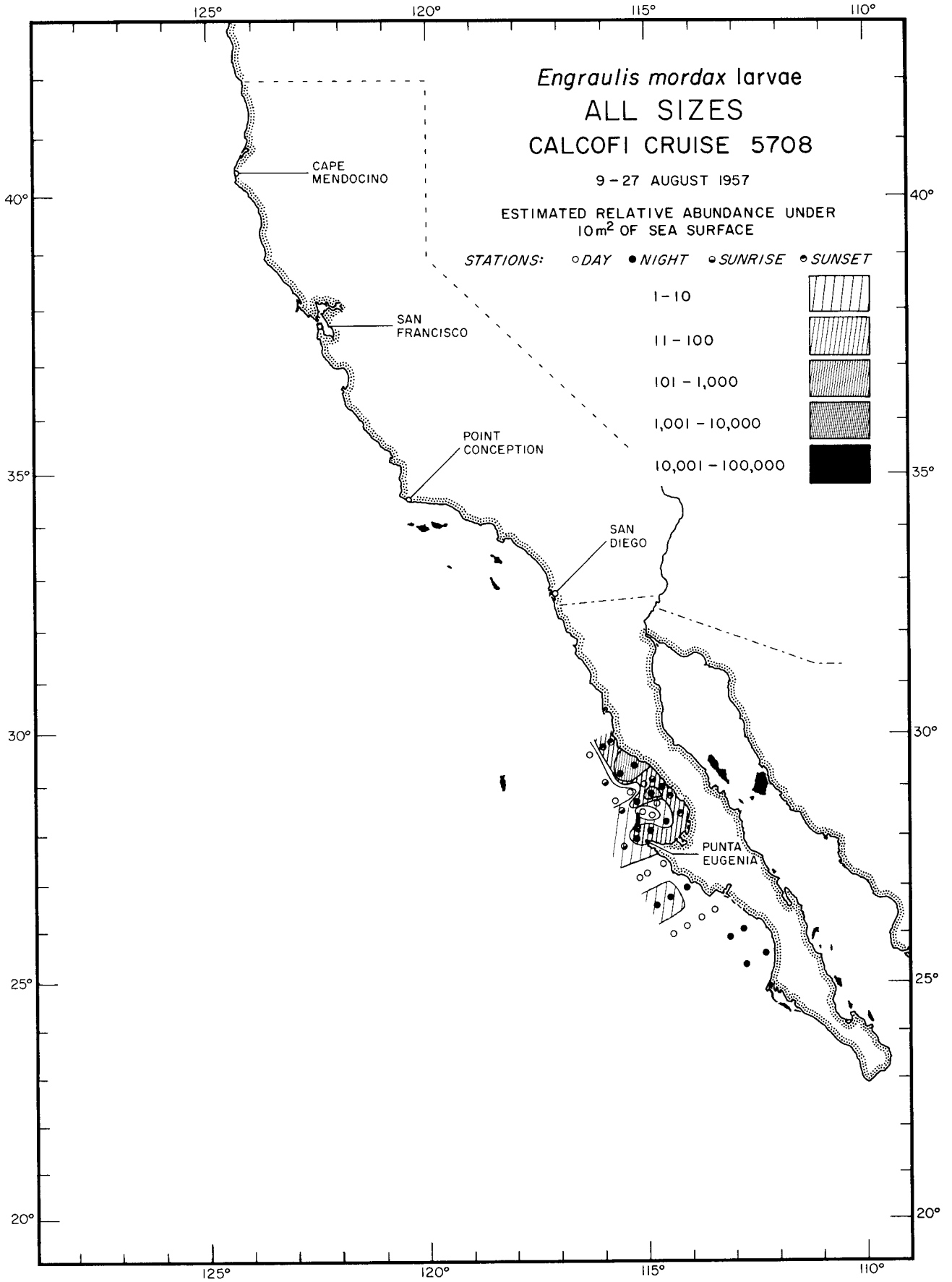
*Engraulis mordax* larvae

All Sizes

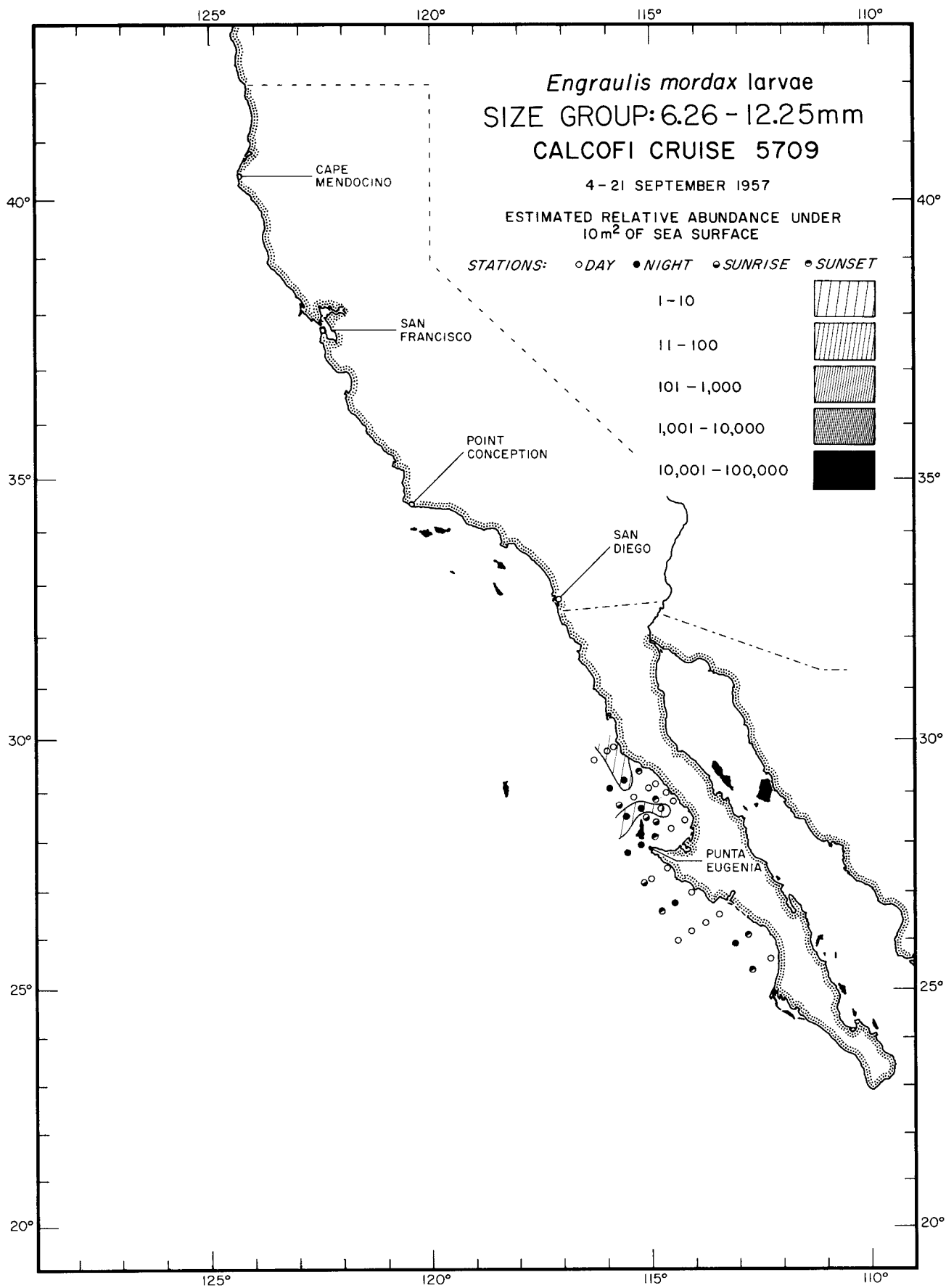
5707



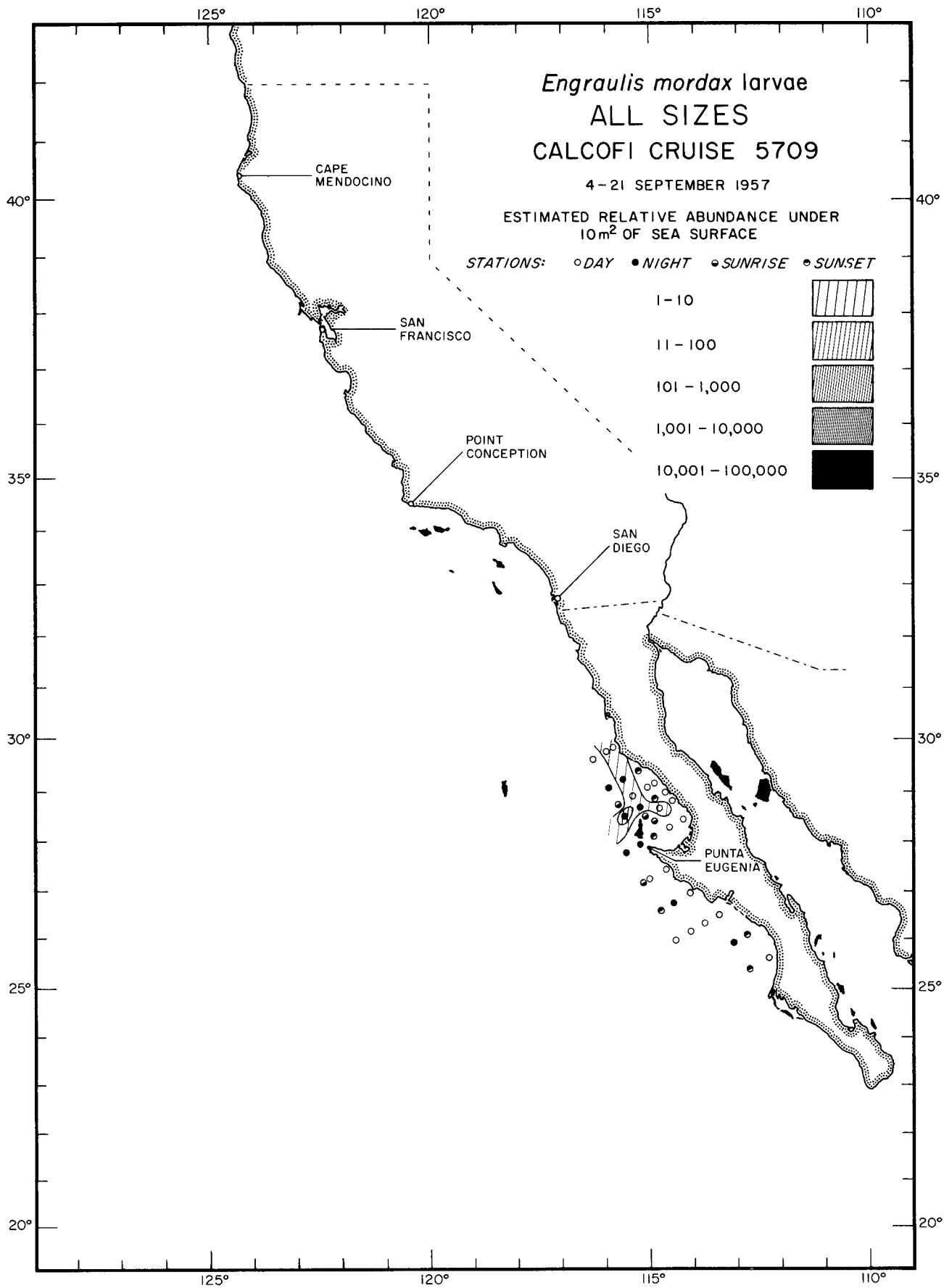
*Engraulis mordax* larvae  
 Size Group: 6.26-12.25mm  
 5708



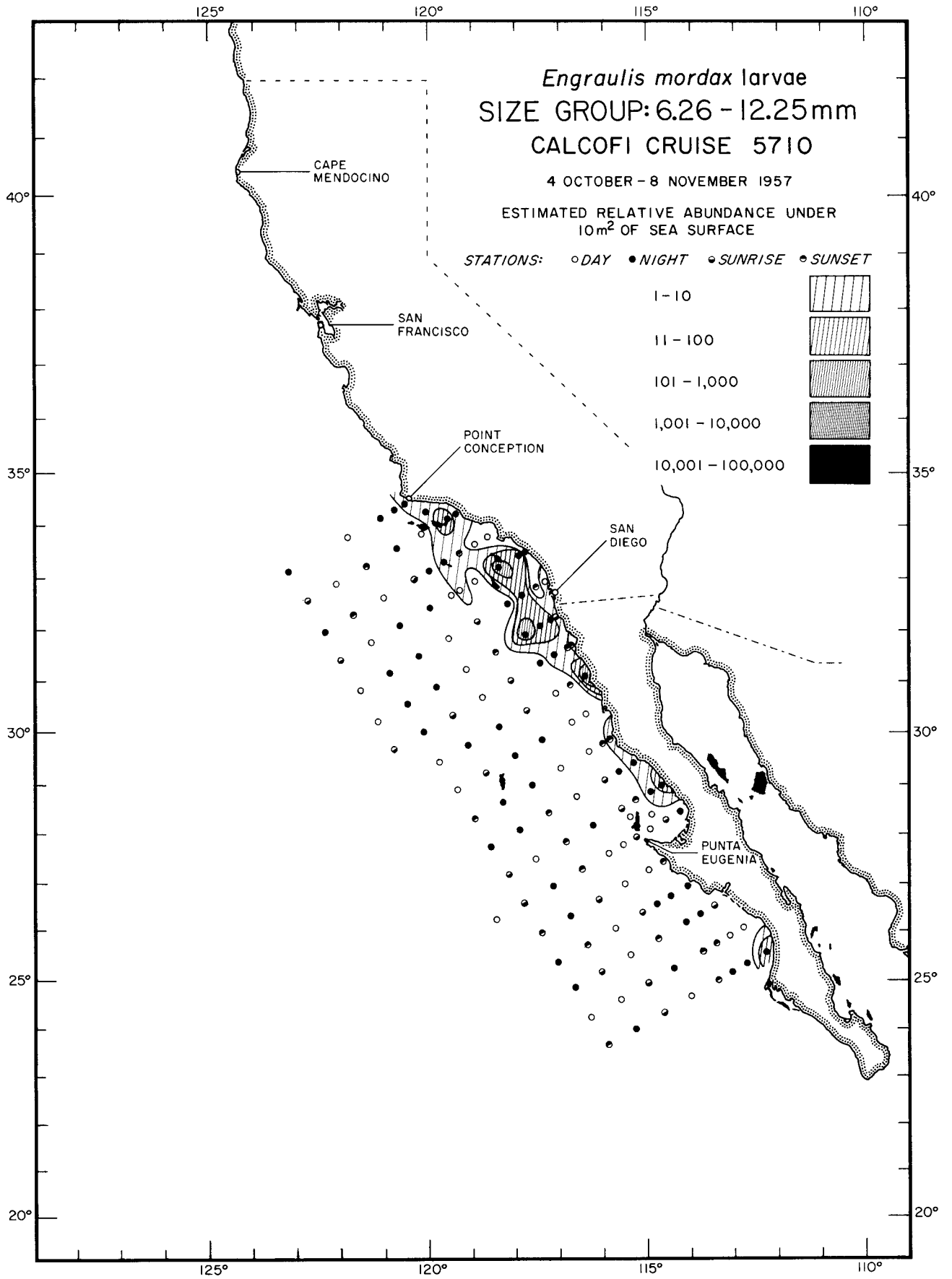
*Engraulis mordax* larvae  
All Sizes  
5708



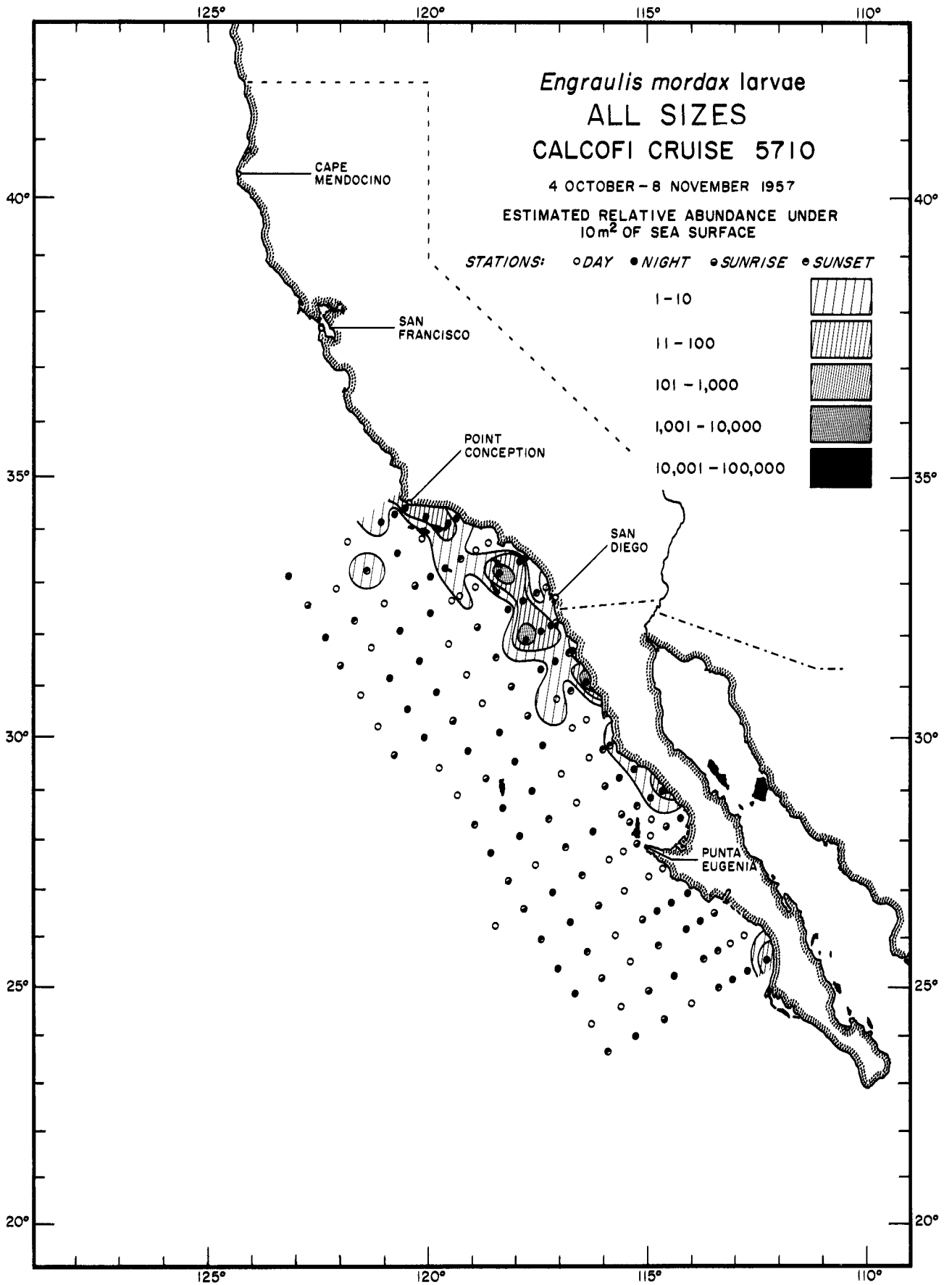
*Engraulis mordax* larvae  
 Size Group: 6.26-12.25mm  
 5709



*Engraulis mordax* larvae  
All Sizes  
5709

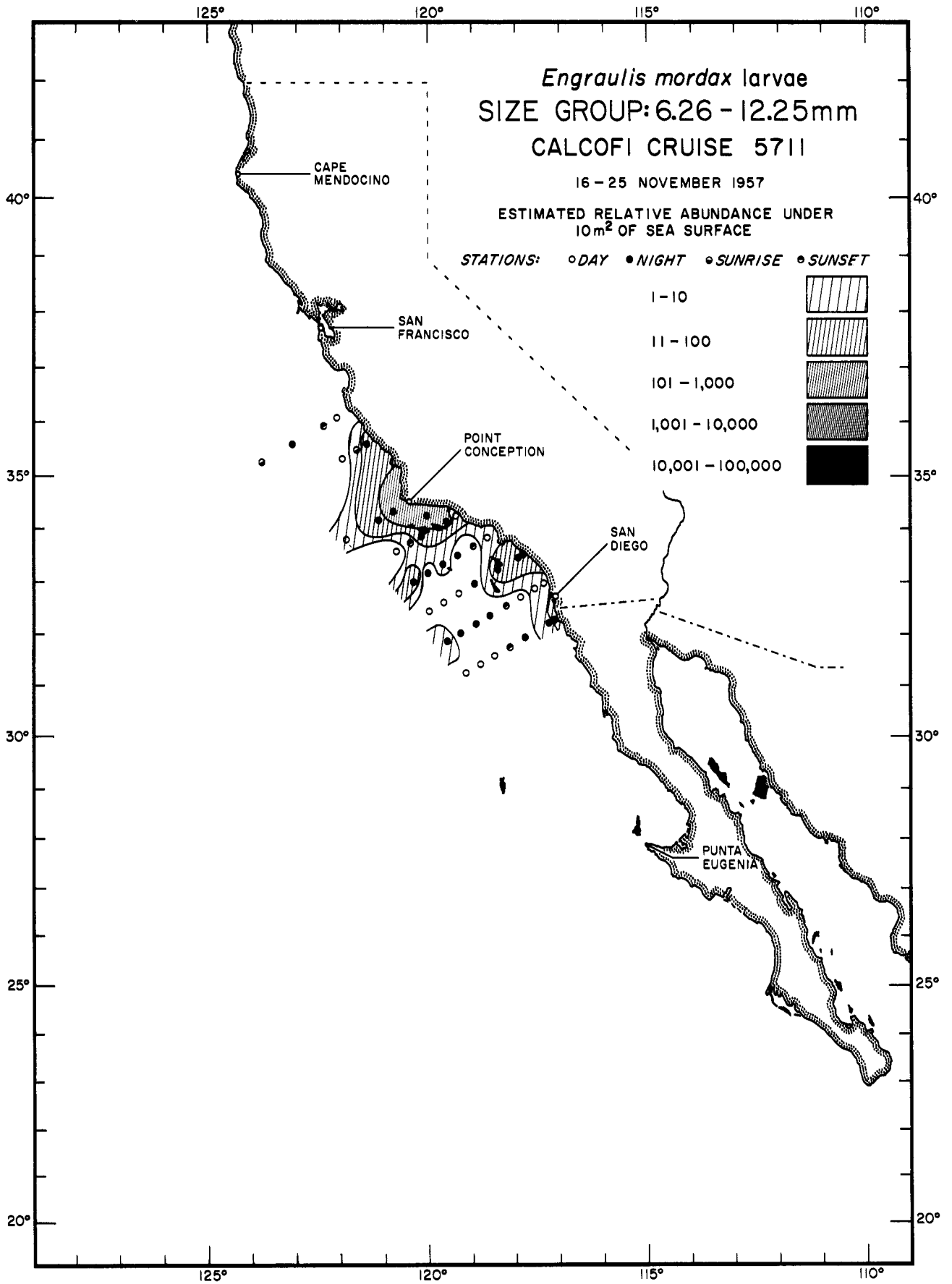


*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5710

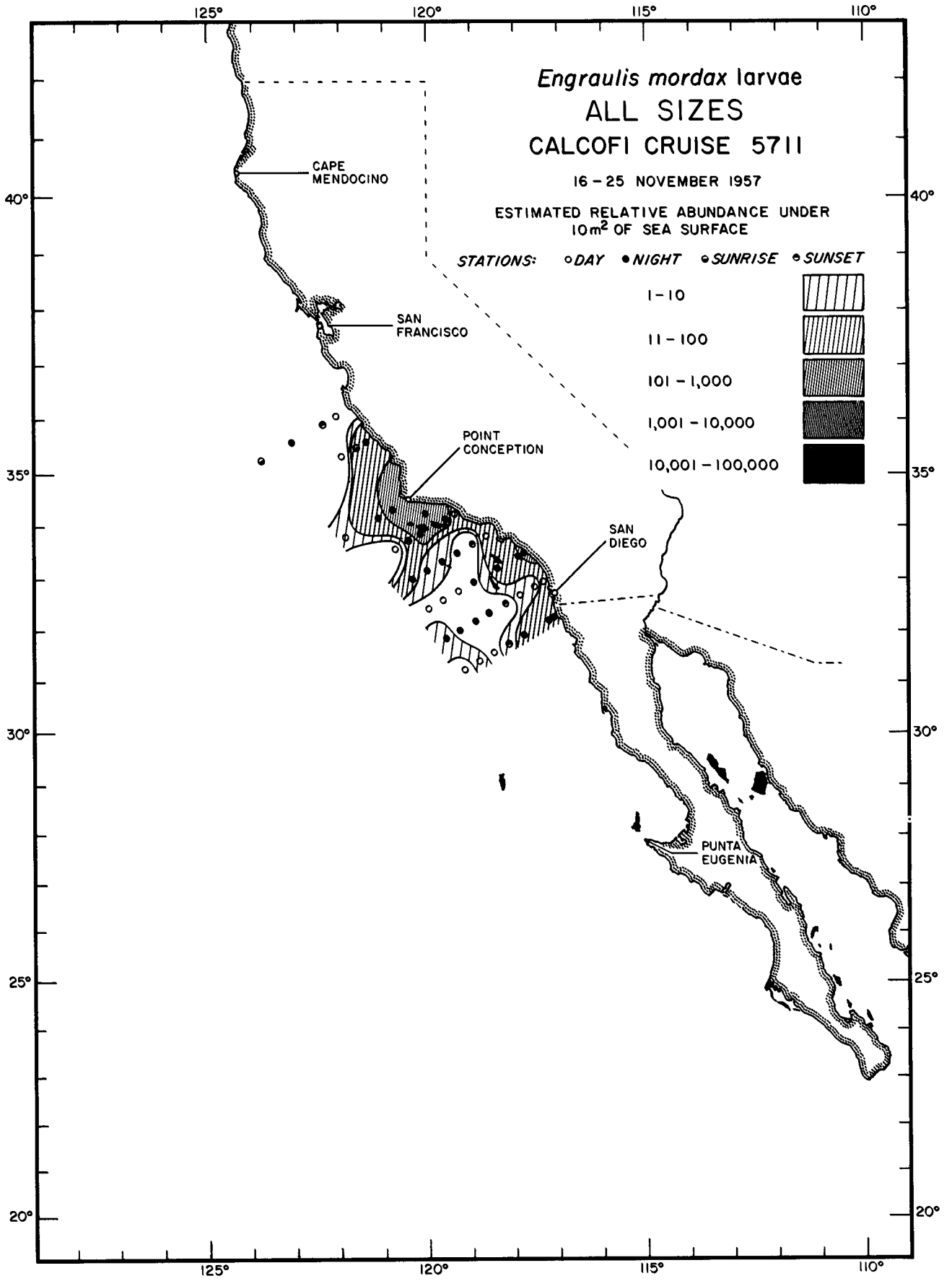


*Engraulis mordax* larvae  
All Sizes  
5710

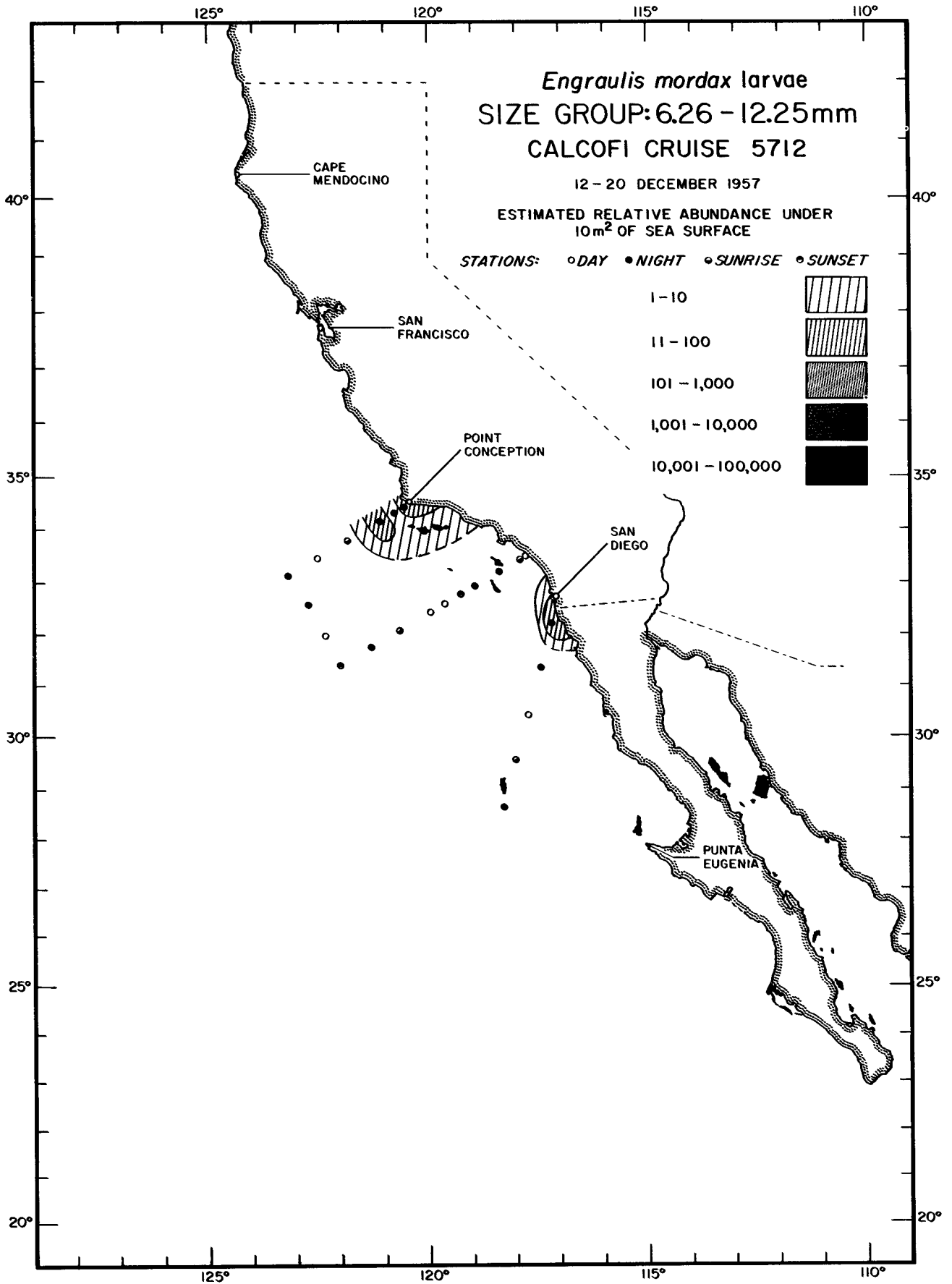




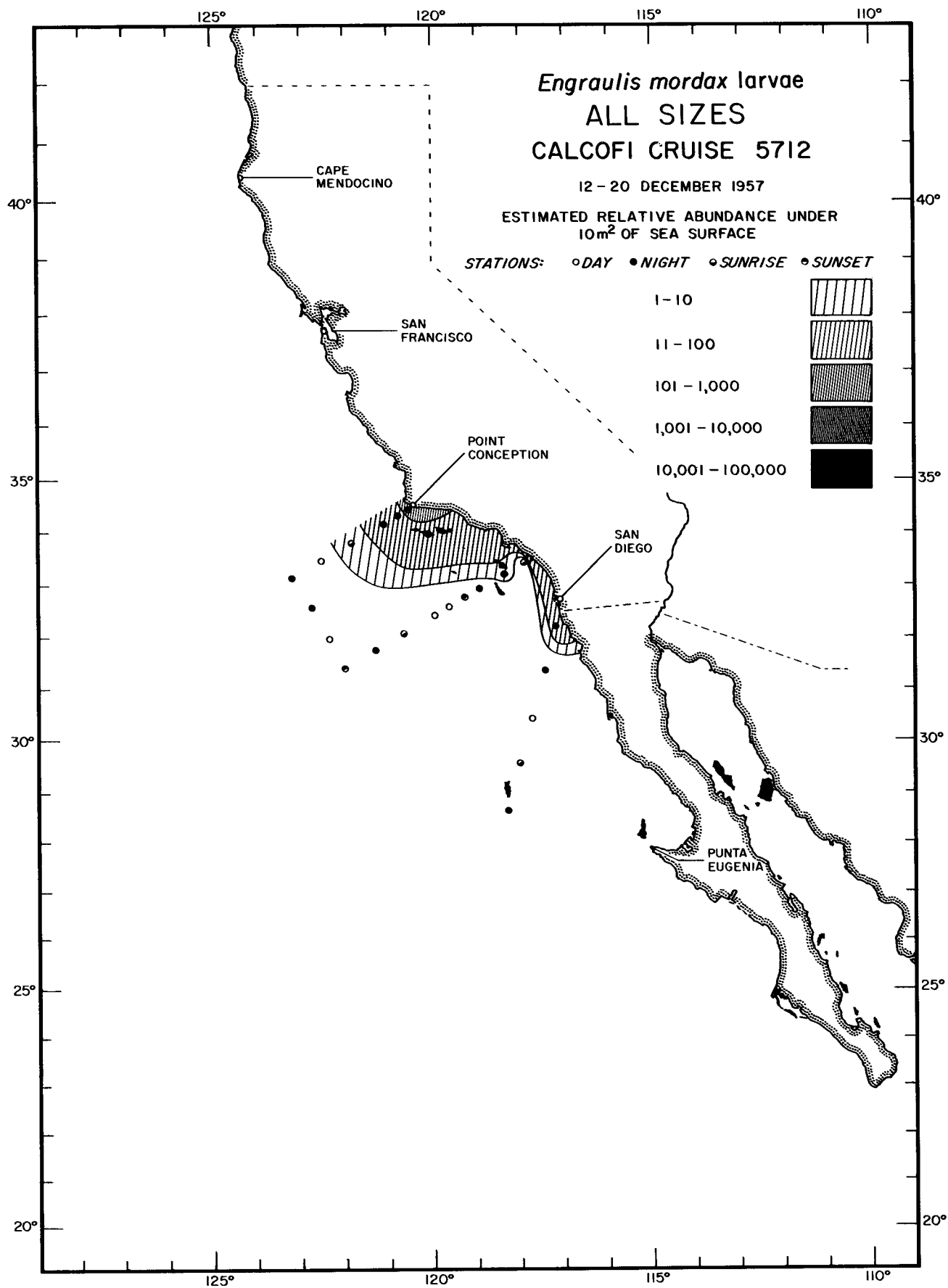
*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5711

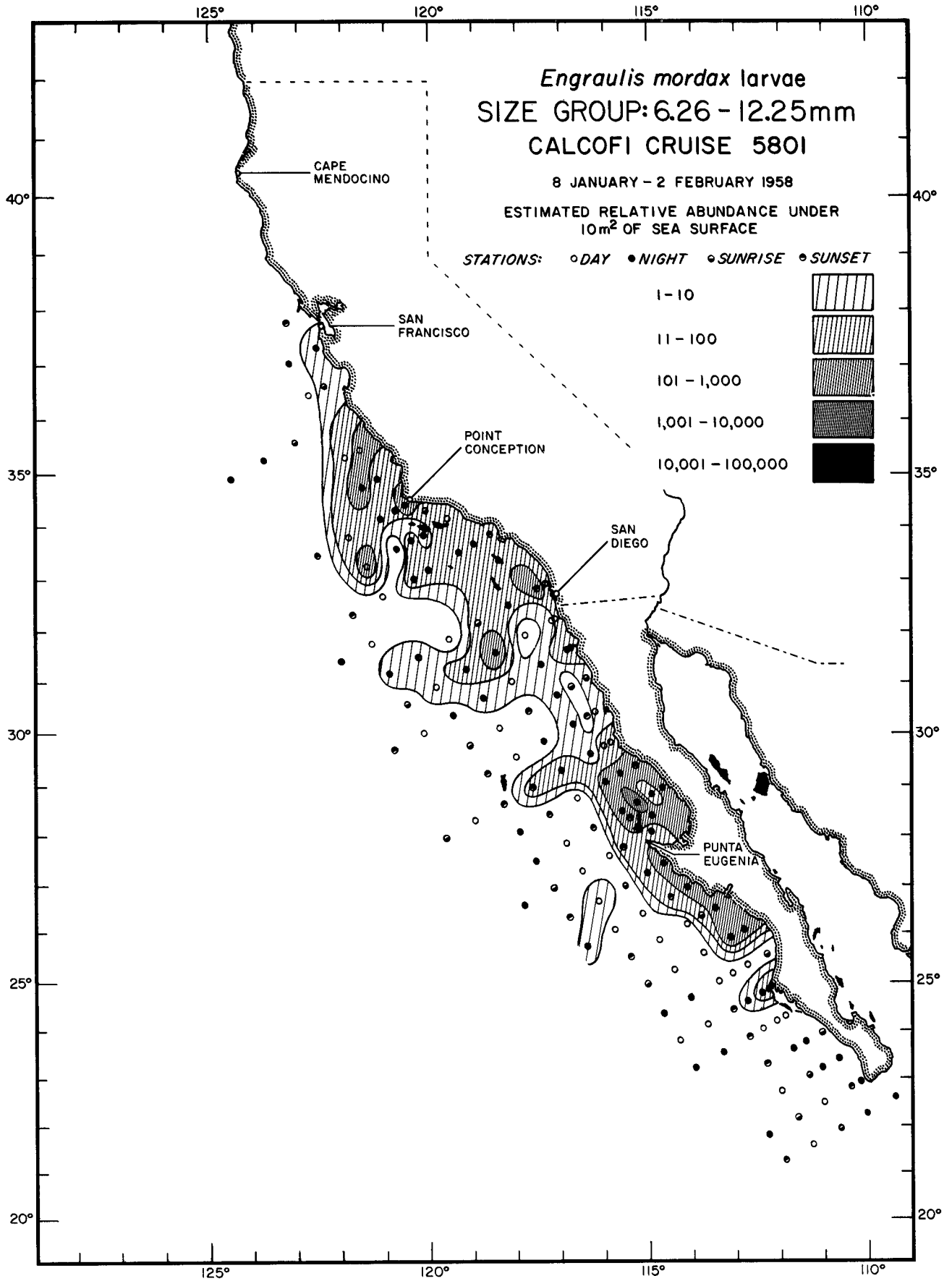


*Engraulis mordax* larvae  
All Sizes  
5711

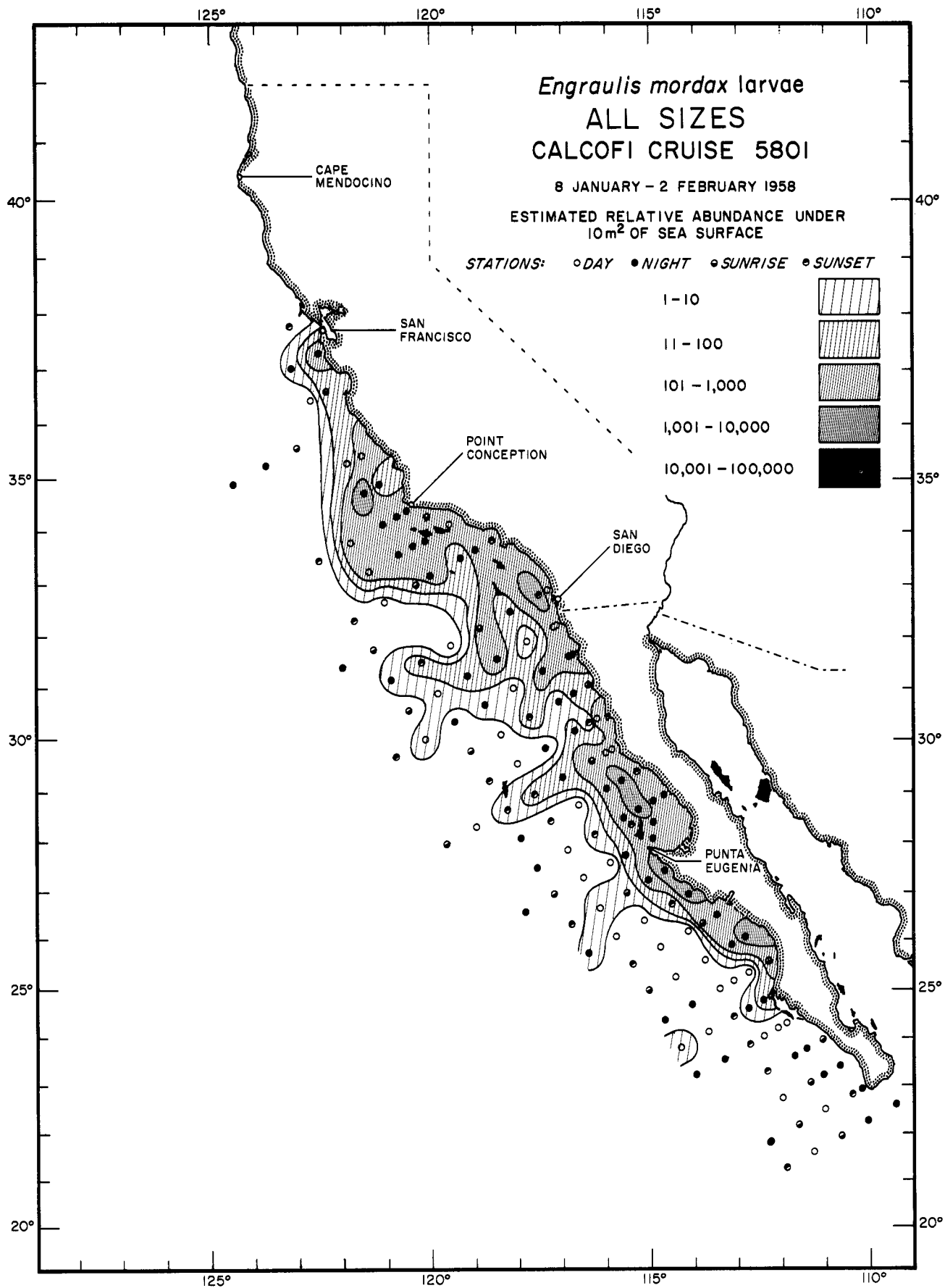


*Engraulis mordax* larvae  
 Size Group: 6.26-12.25mm  
 5712

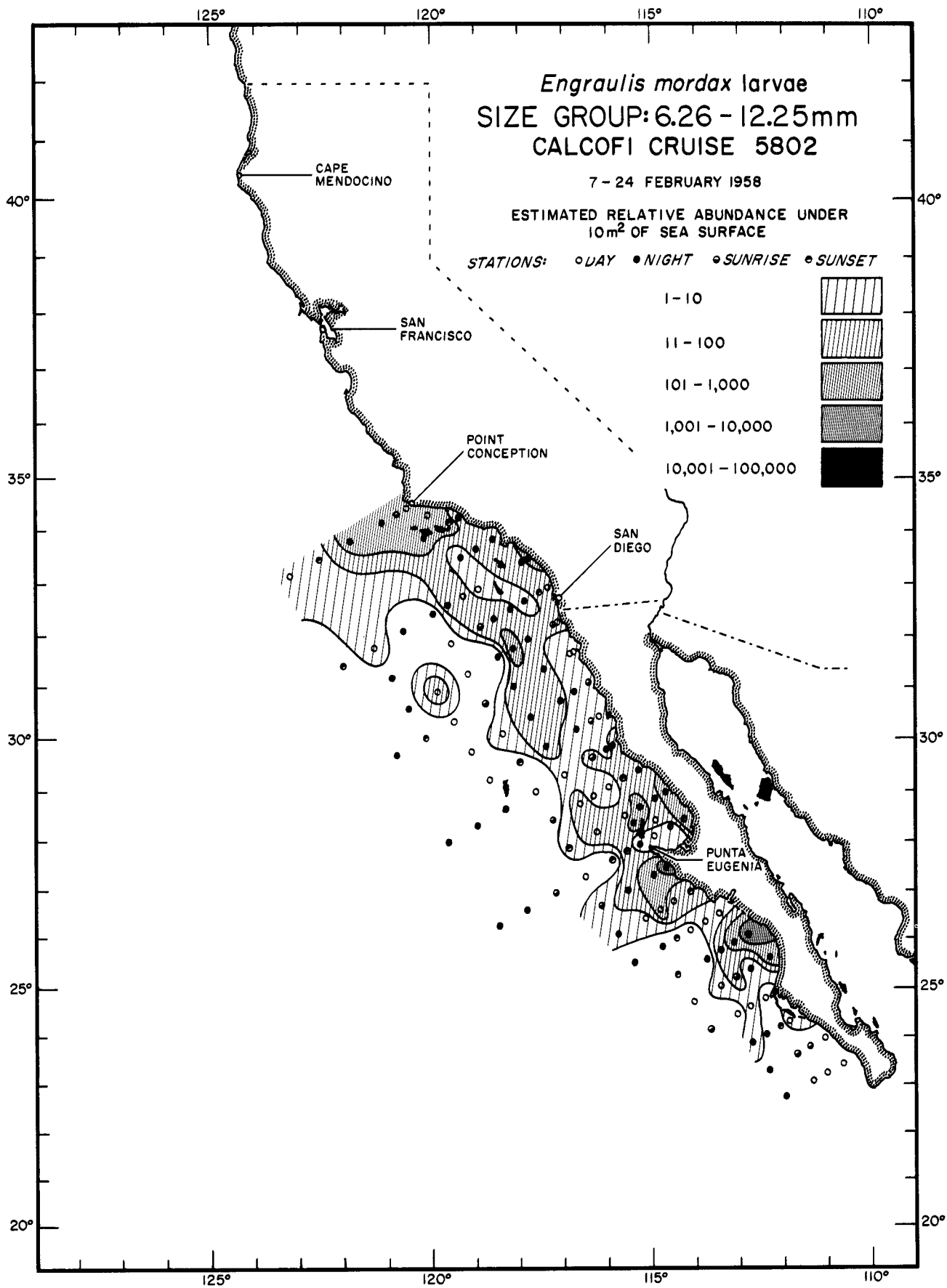
*Engraulis mordax* larvaeAll Sizes  
5712



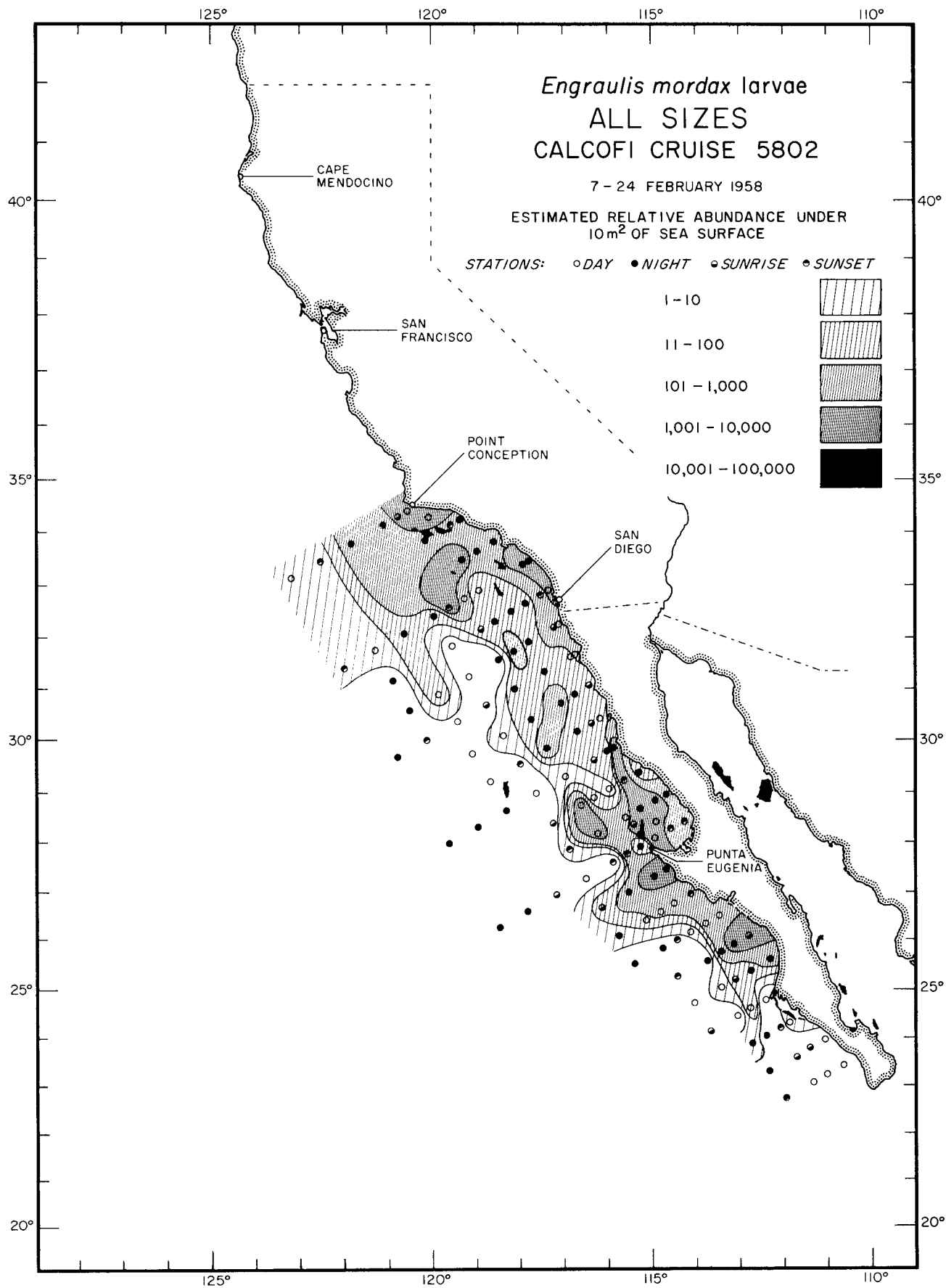
*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5801



*Engraulis mordax* larvae  
All Sizes  
5801

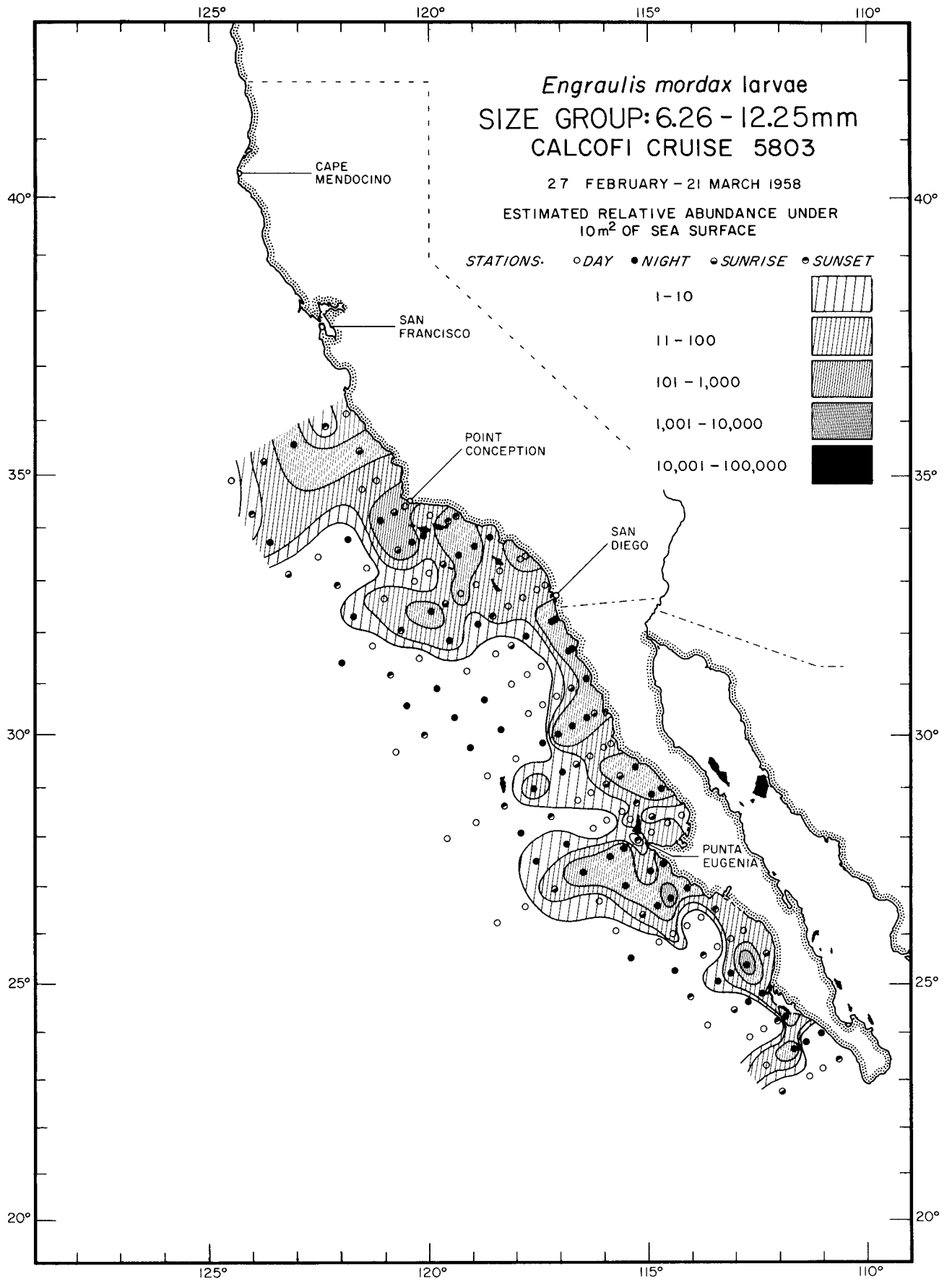


*Engraulis mordax* larvae  
 Size Group: 6.26-12.25mm  
 5802

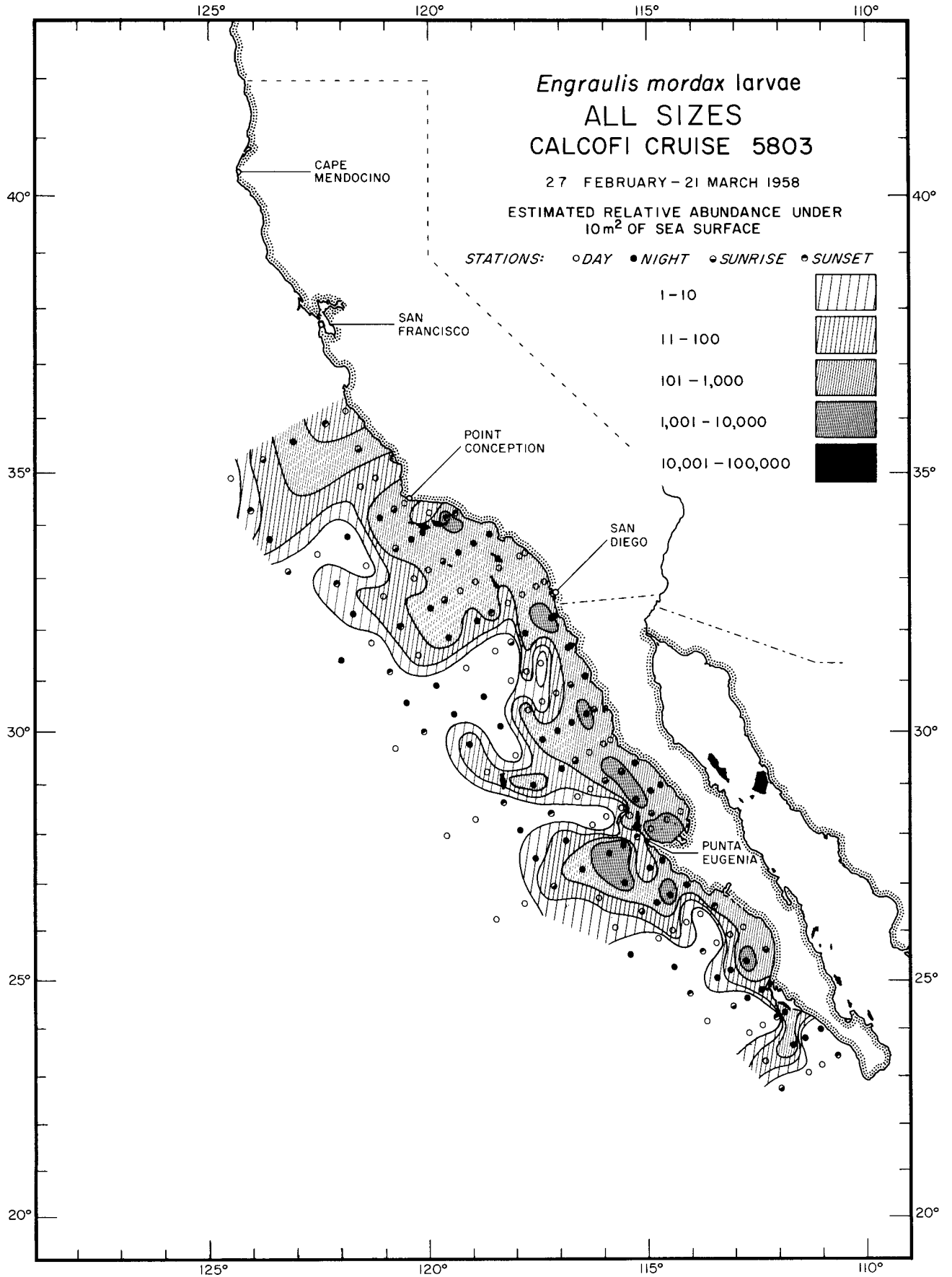


*Engraulis mordax* larvae  
All Sizes  
5802





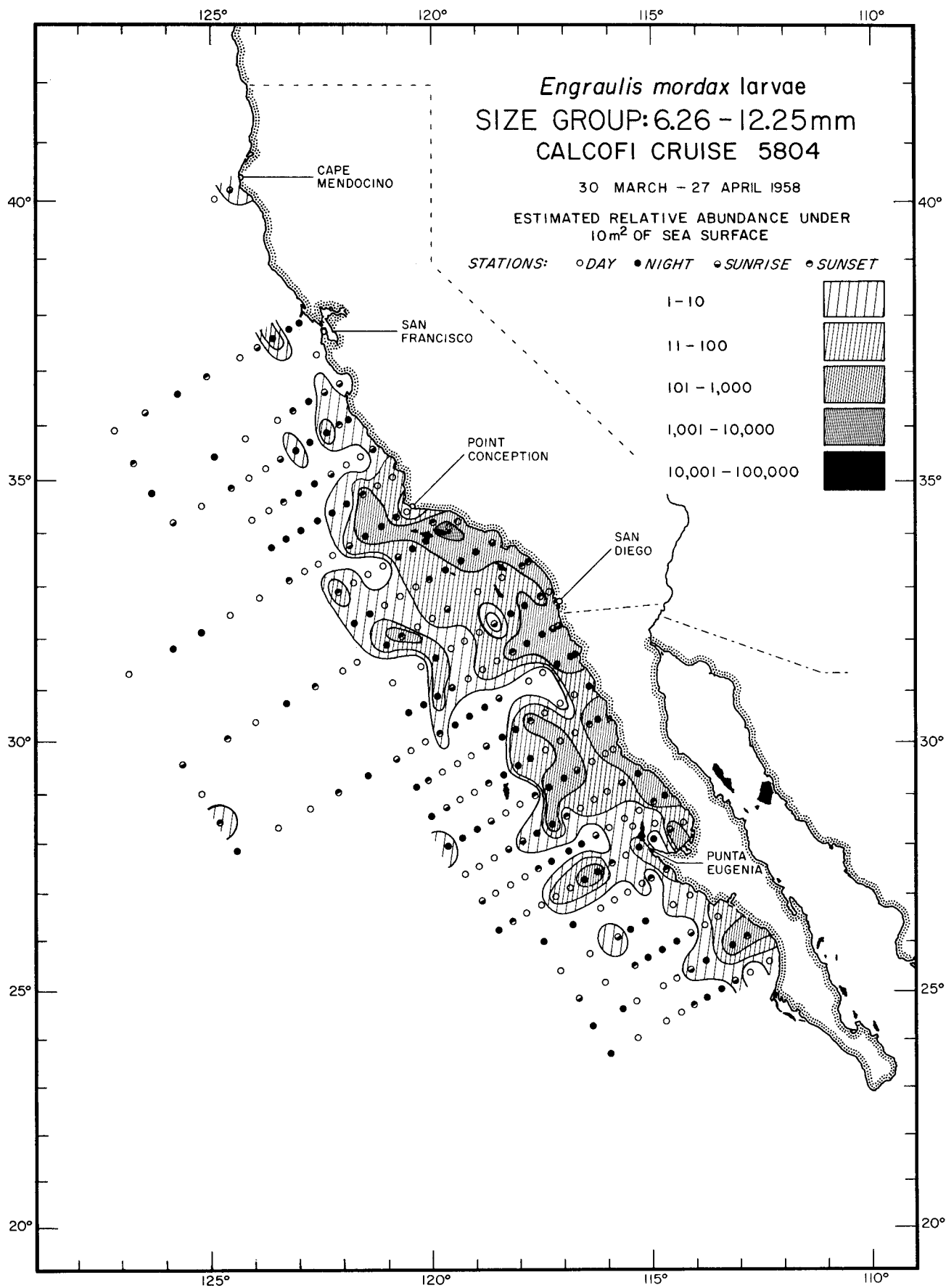
*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5803



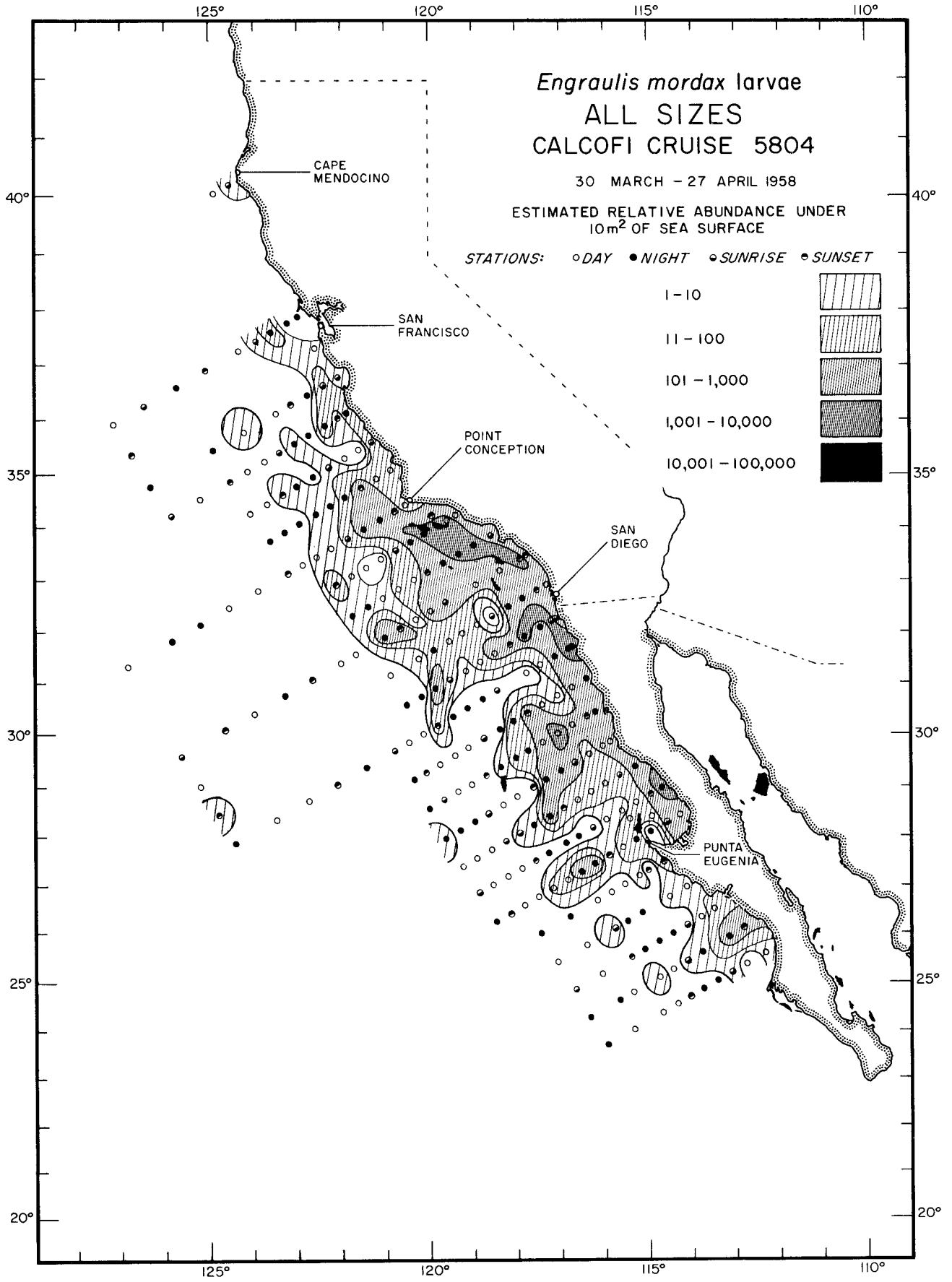
*Engraulis mordax* larvae

All Sizes

5803



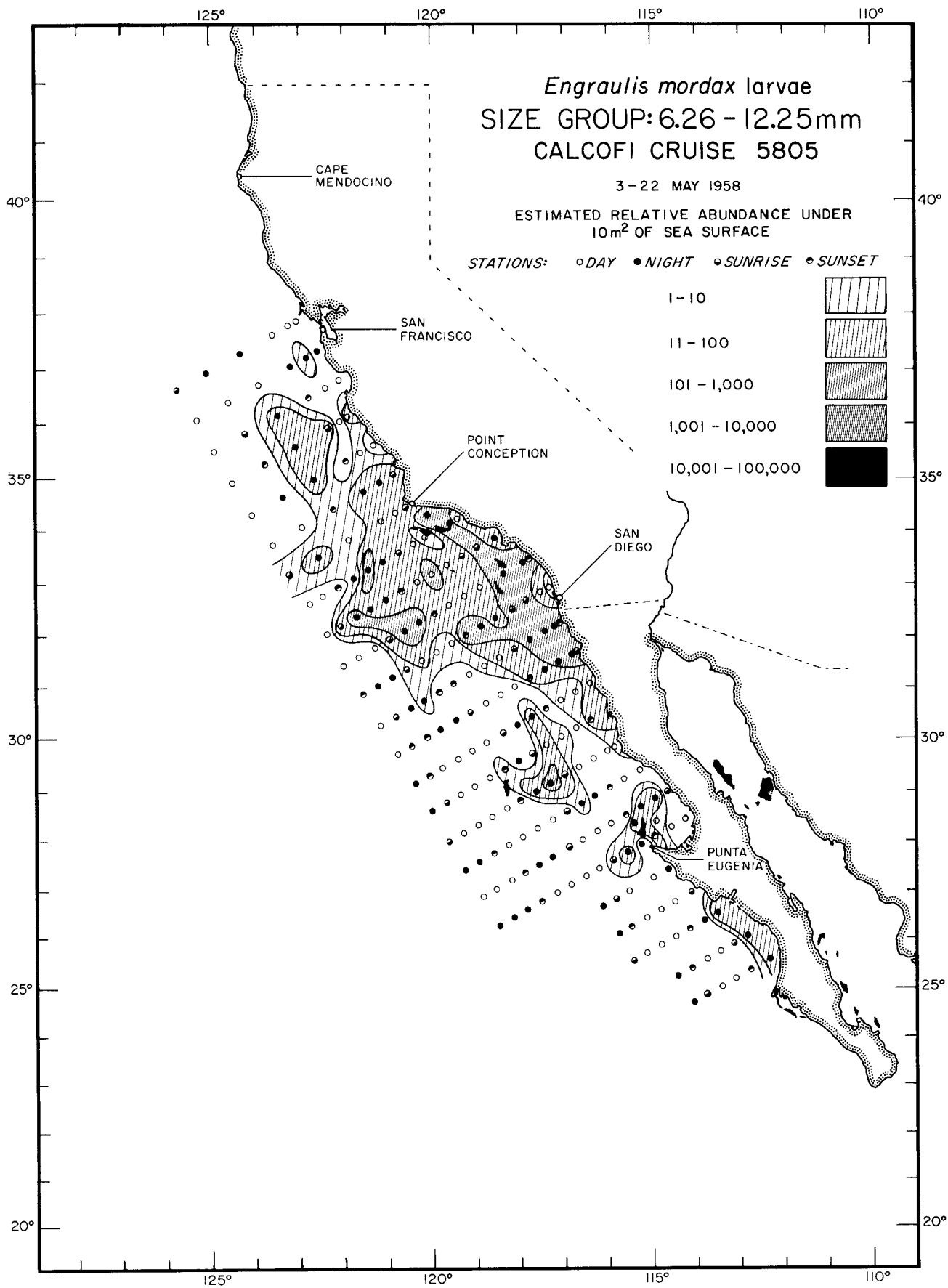
*Engraulis mordax* larvae  
 Size Group: 6.26-12.25mm  
 5804



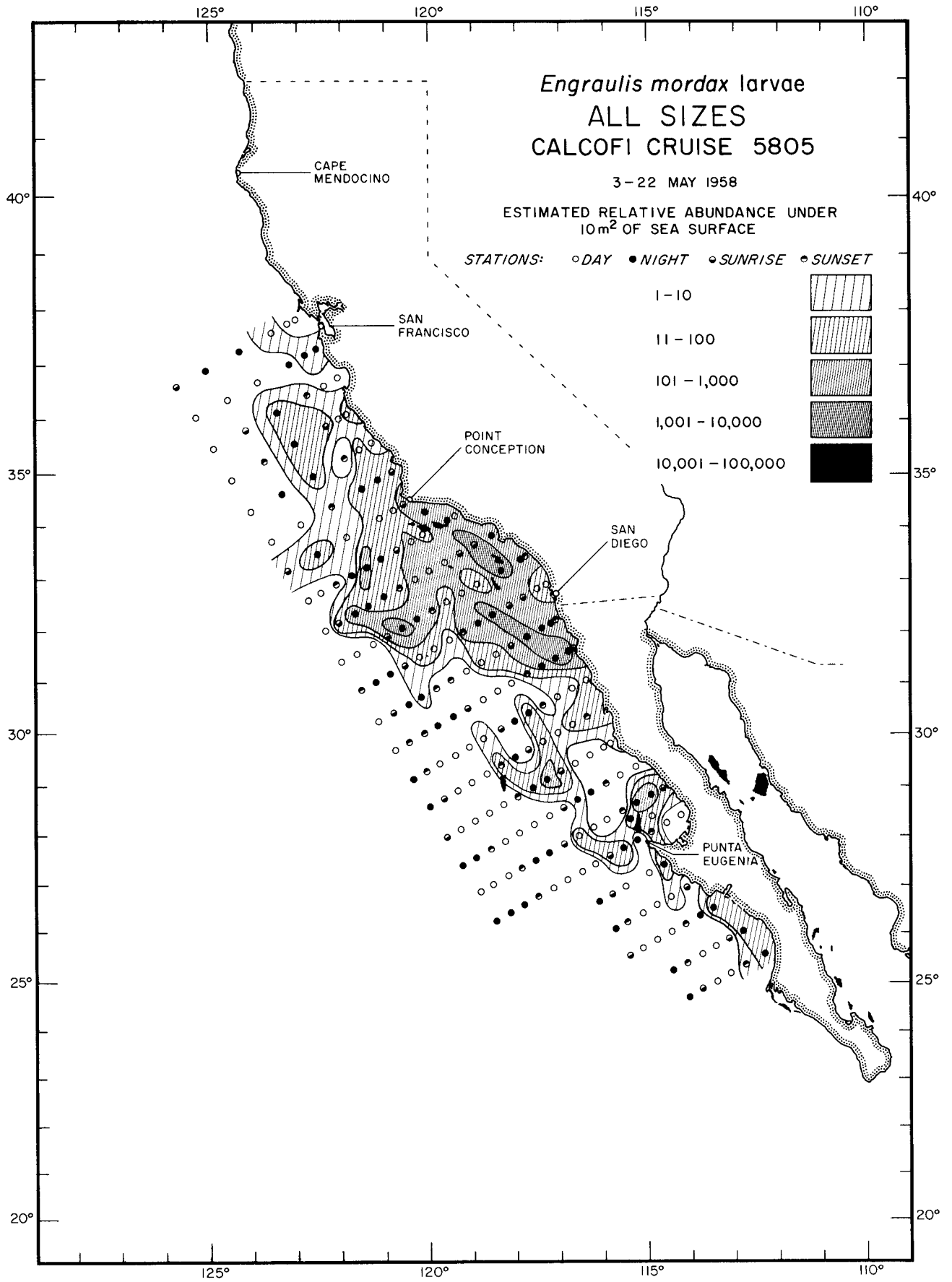
*Engraulis mordax* larvae

All Sizes

5804



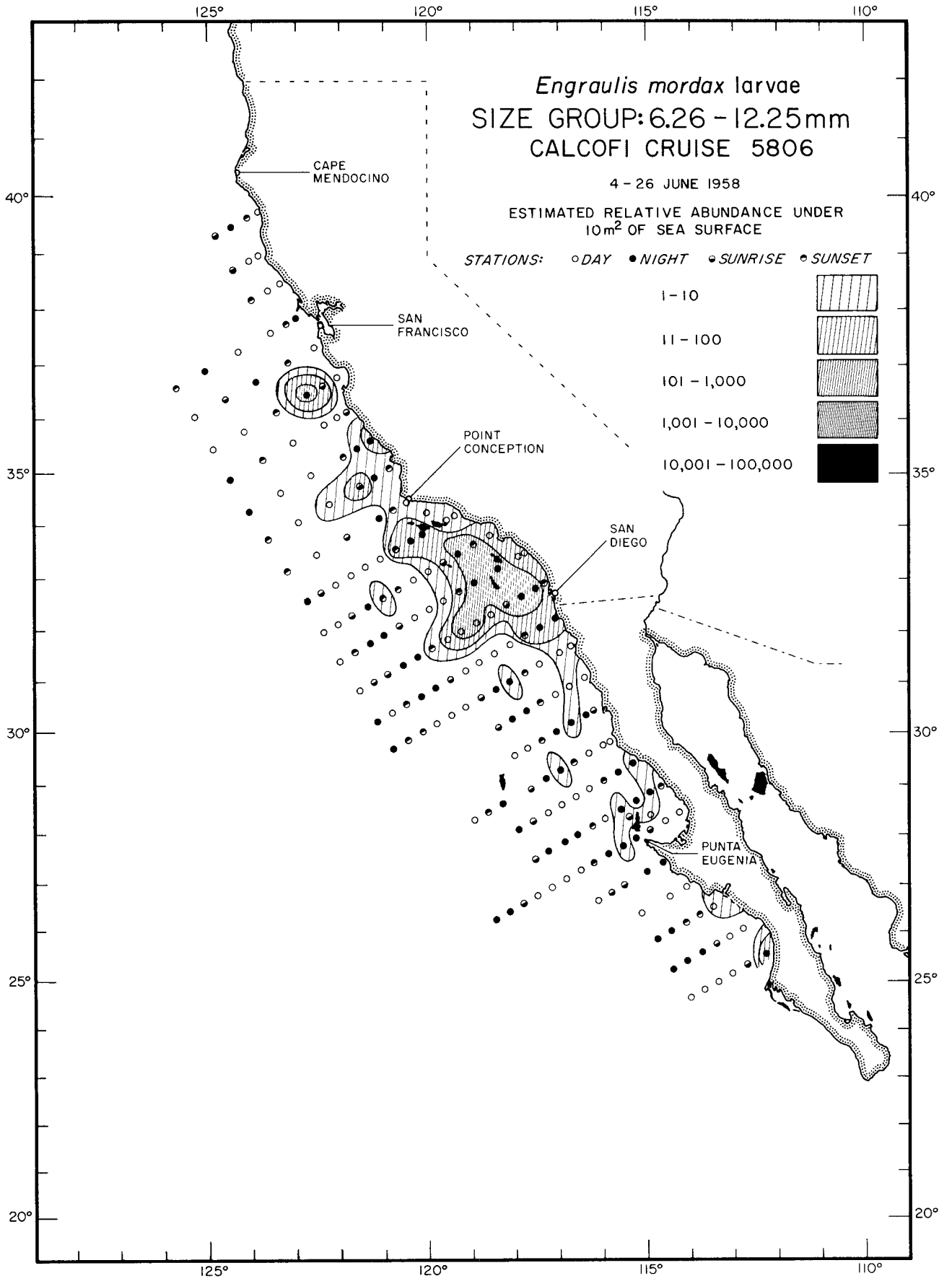
*Engraulis mordax* larvae  
 Size Group: 6.26-12.25mm  
 5805



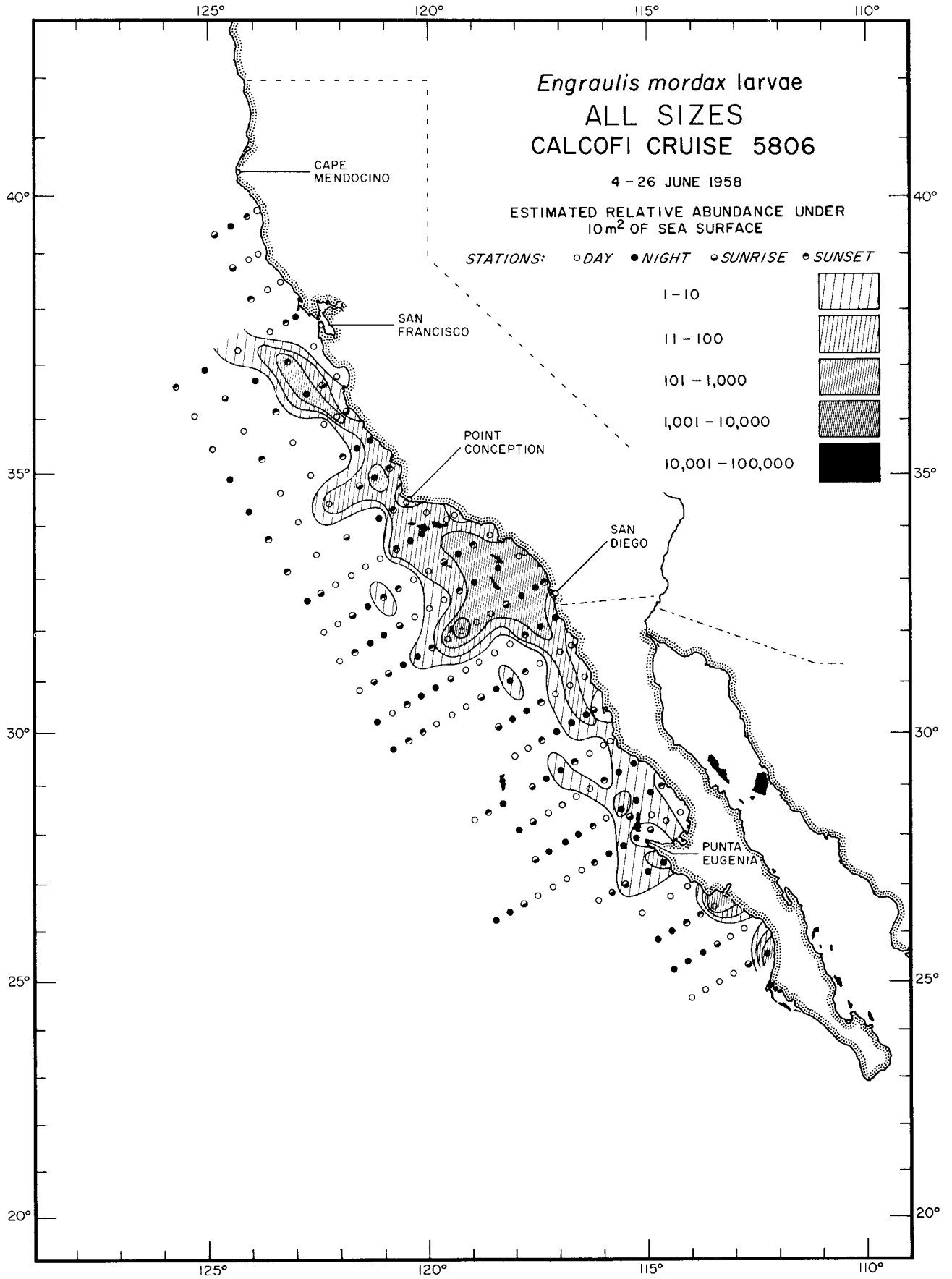
*Engraulis mordax* larvae

All Sizes

5805

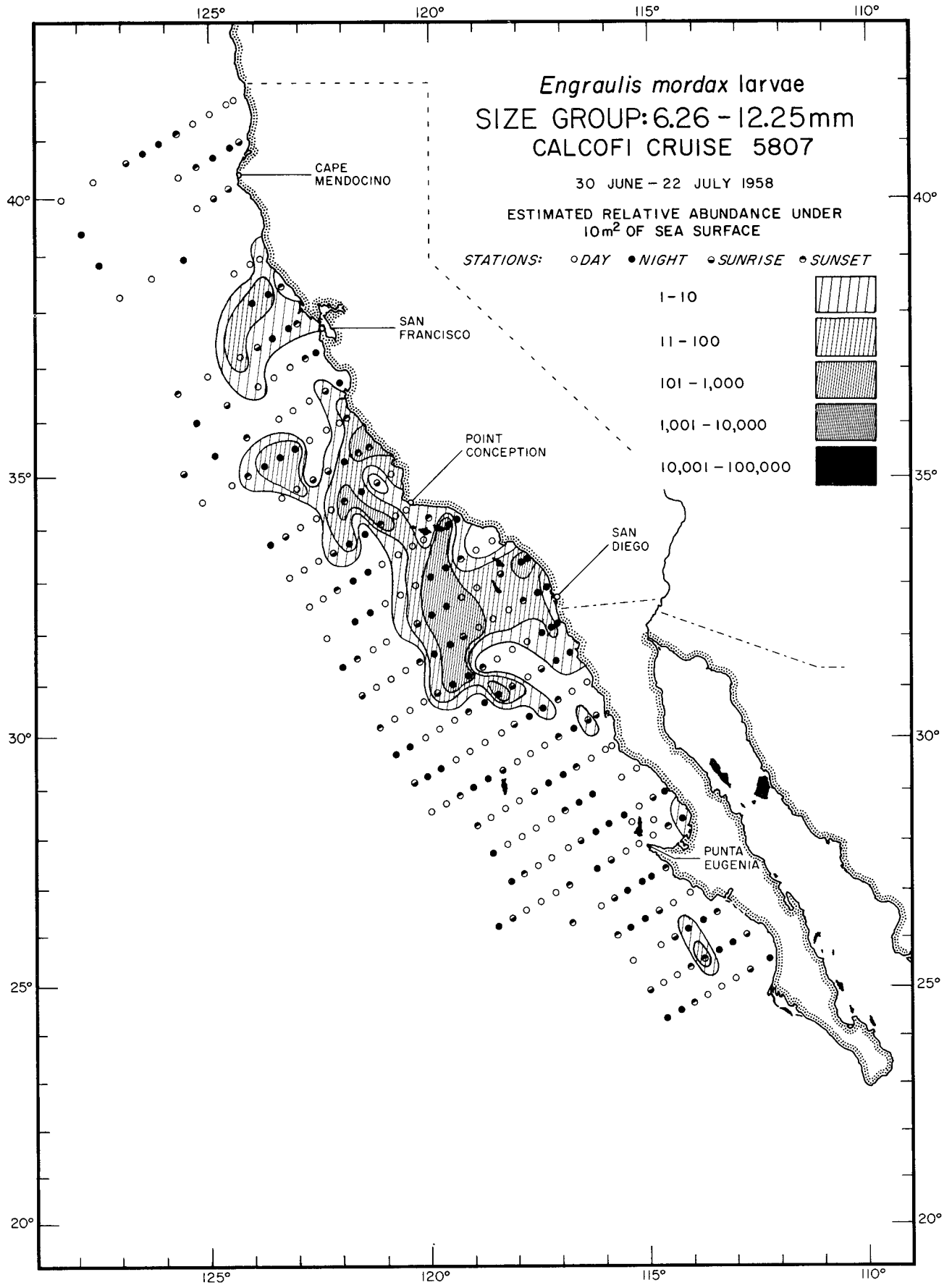


*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5806

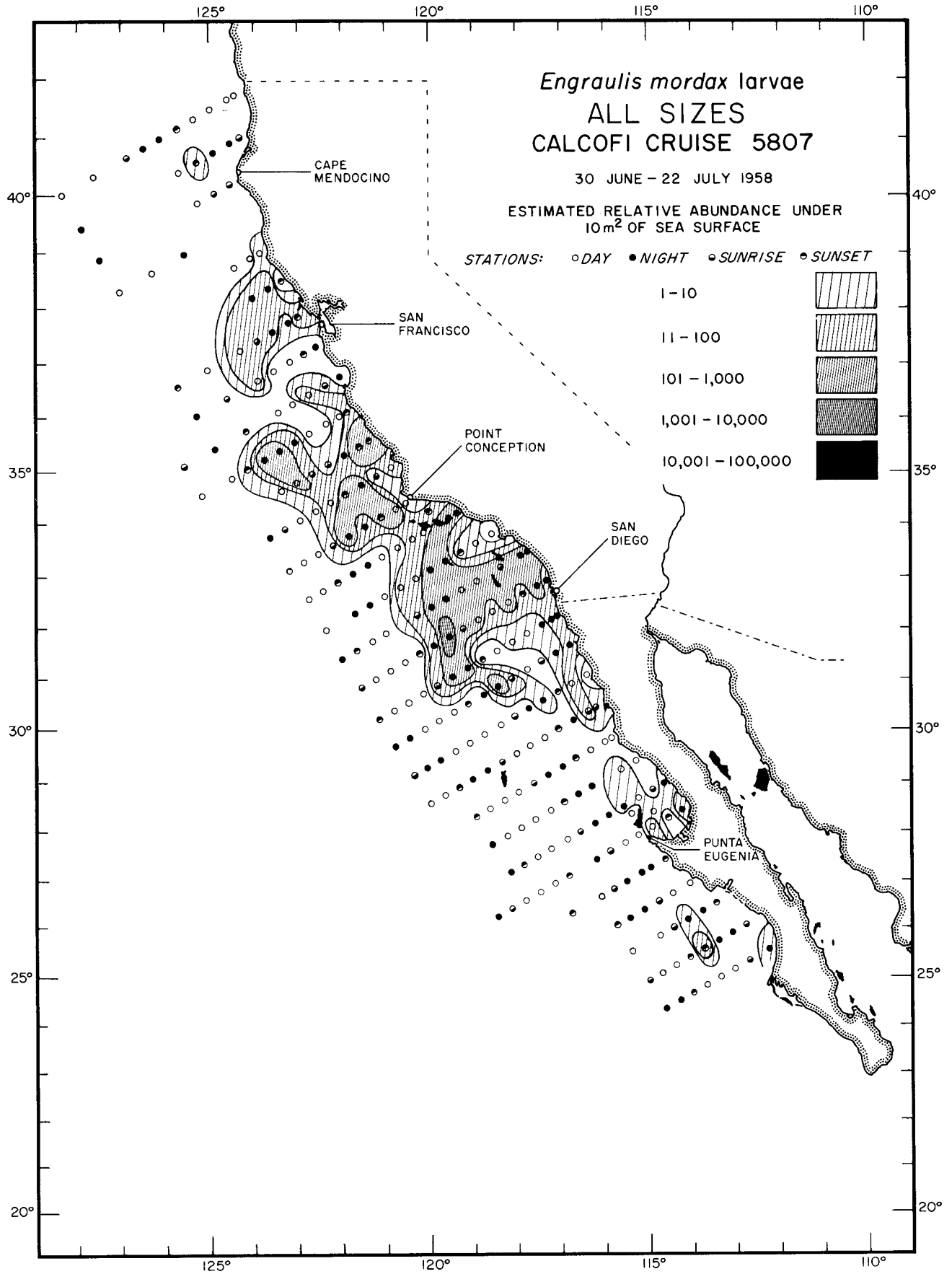


*Engraulis mordax* larvae  
All Sizes  
5806



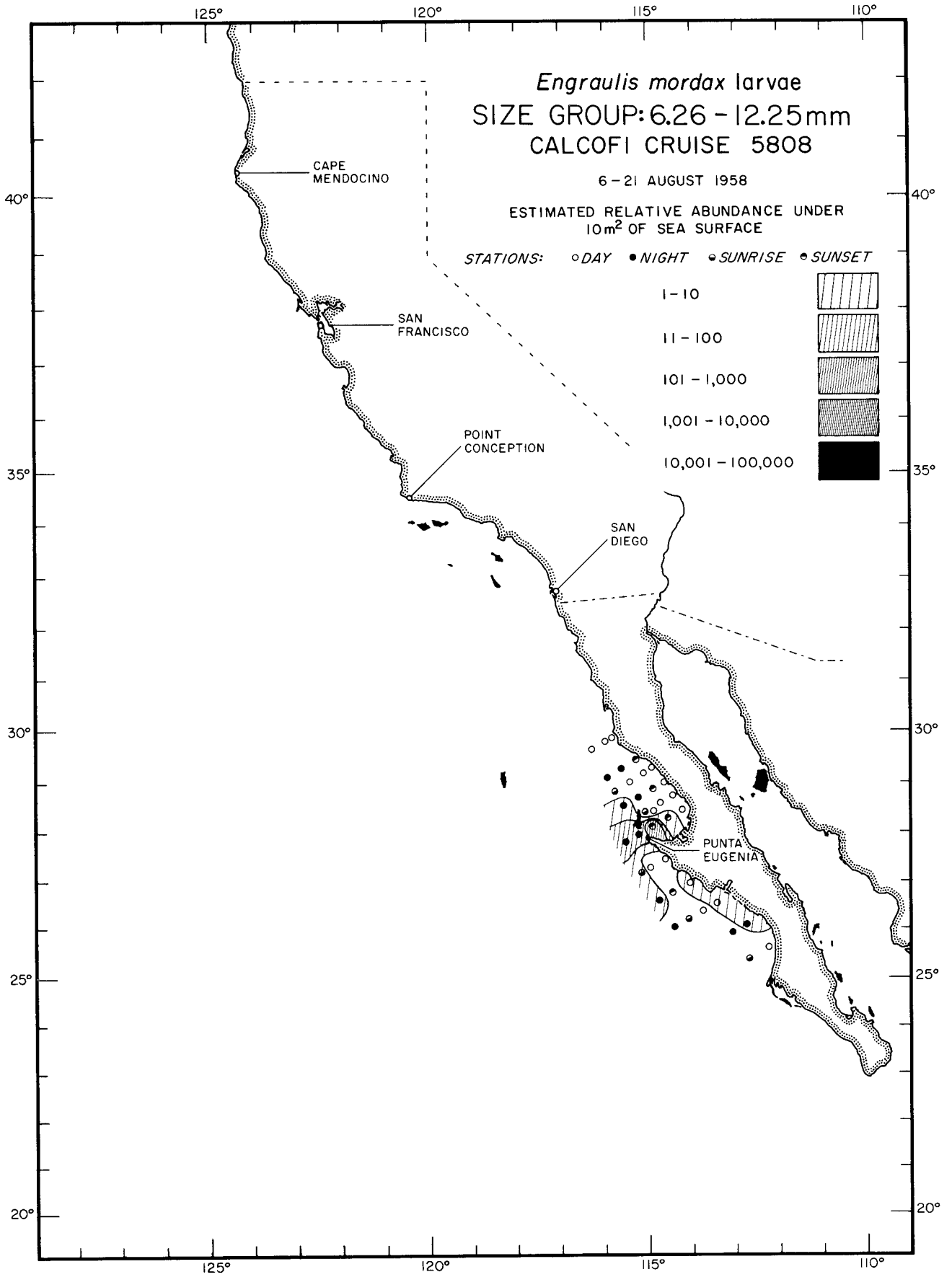


*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5807

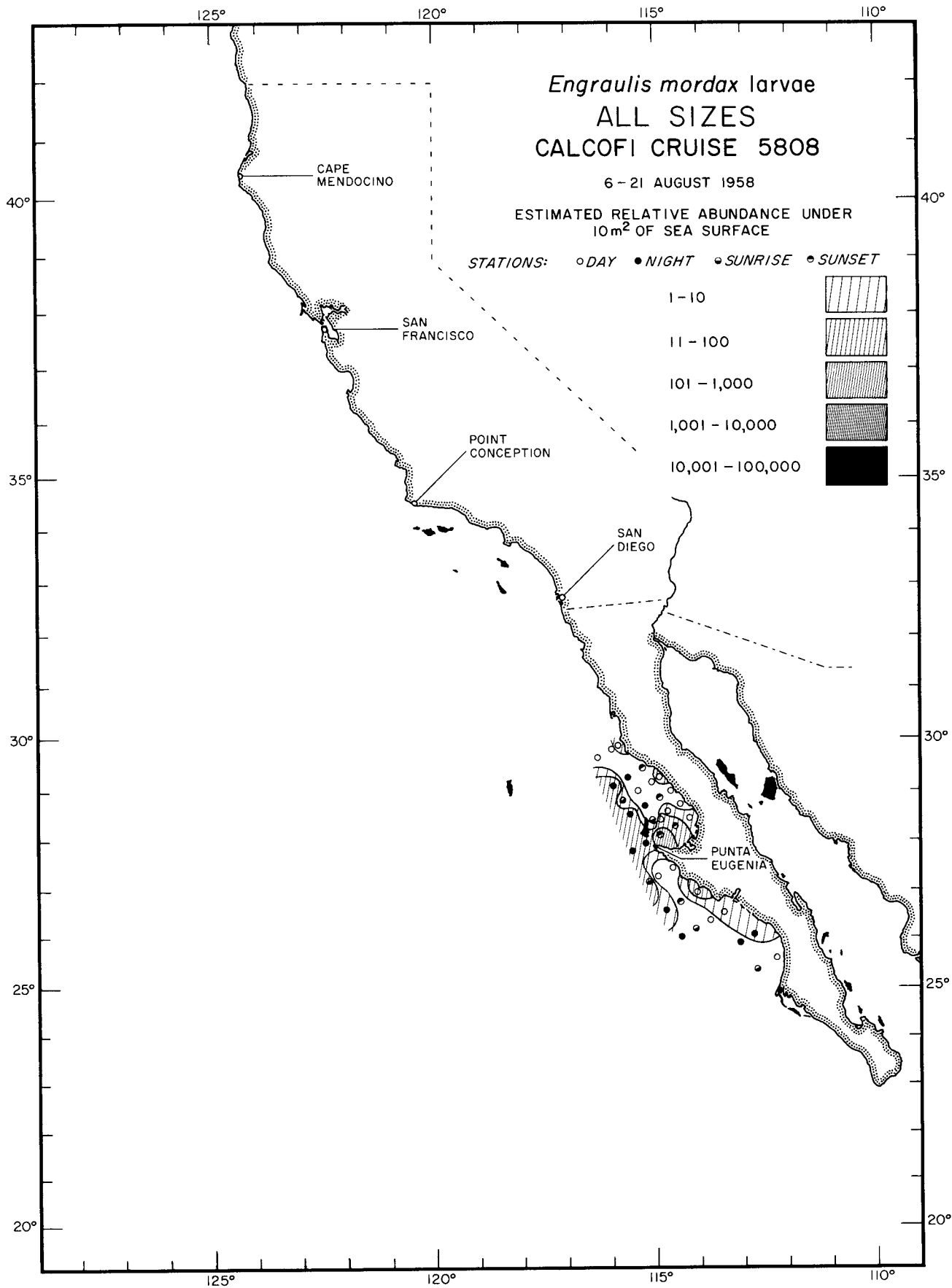


*Engraulis mordax* larvae

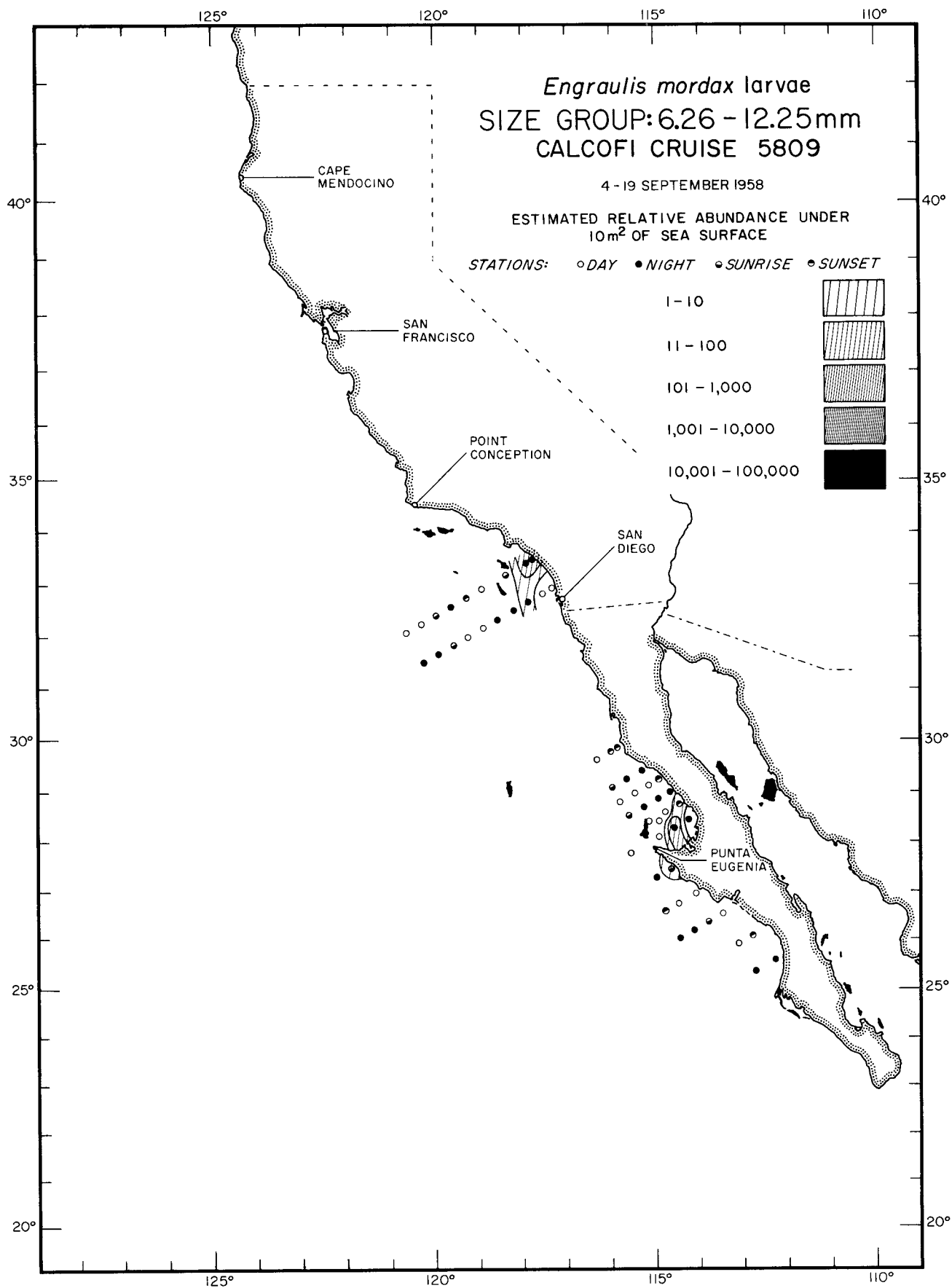
All Sizes  
5807



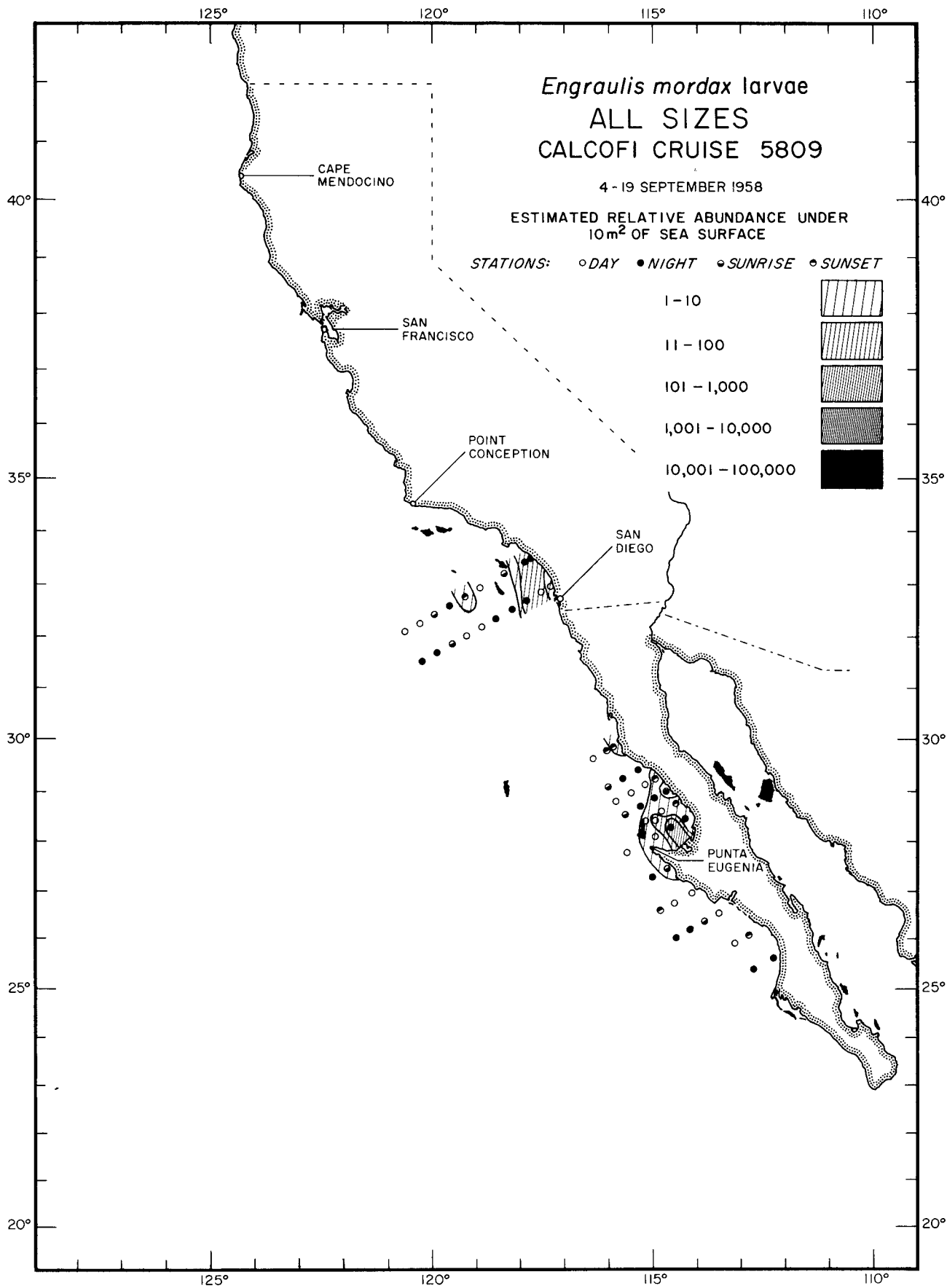
*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5808



*Engraulis mordax* larvae  
All Sizes  
5808



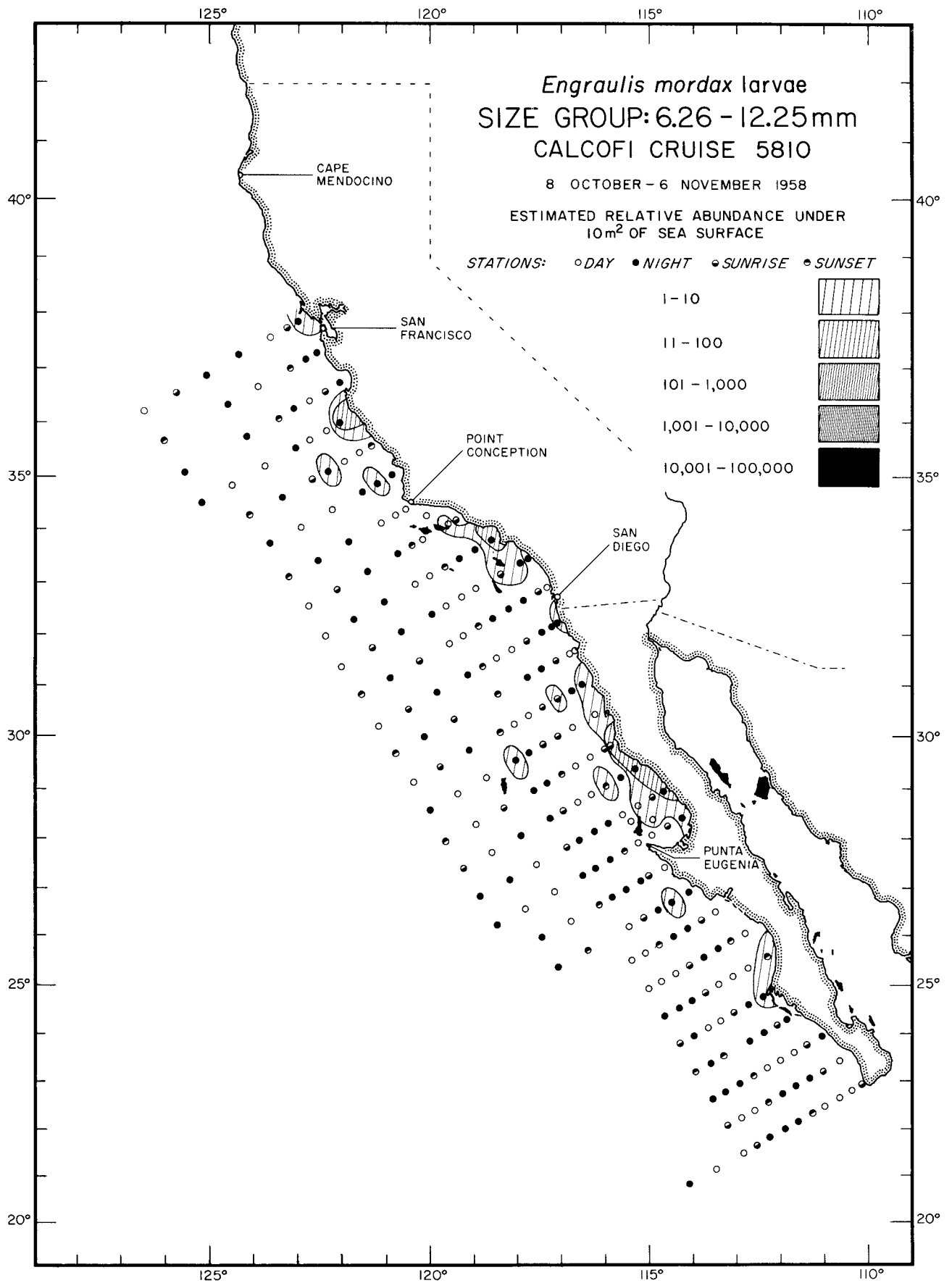
*Engraulis mordax* larvae  
 Size Group: 6.26-12.25mm  
 5809



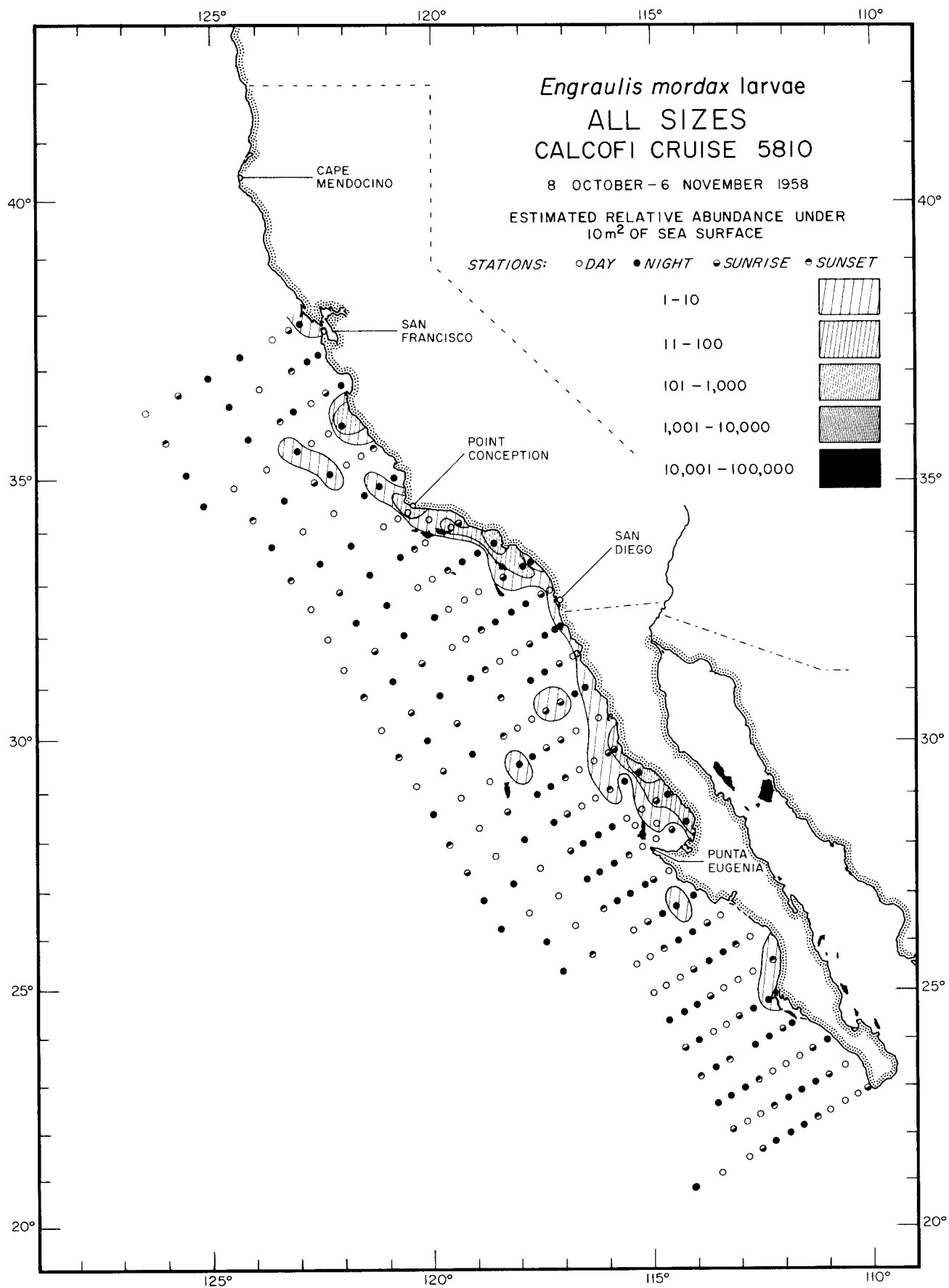
*Engraulis mordax* larvae

All Sizes

5809



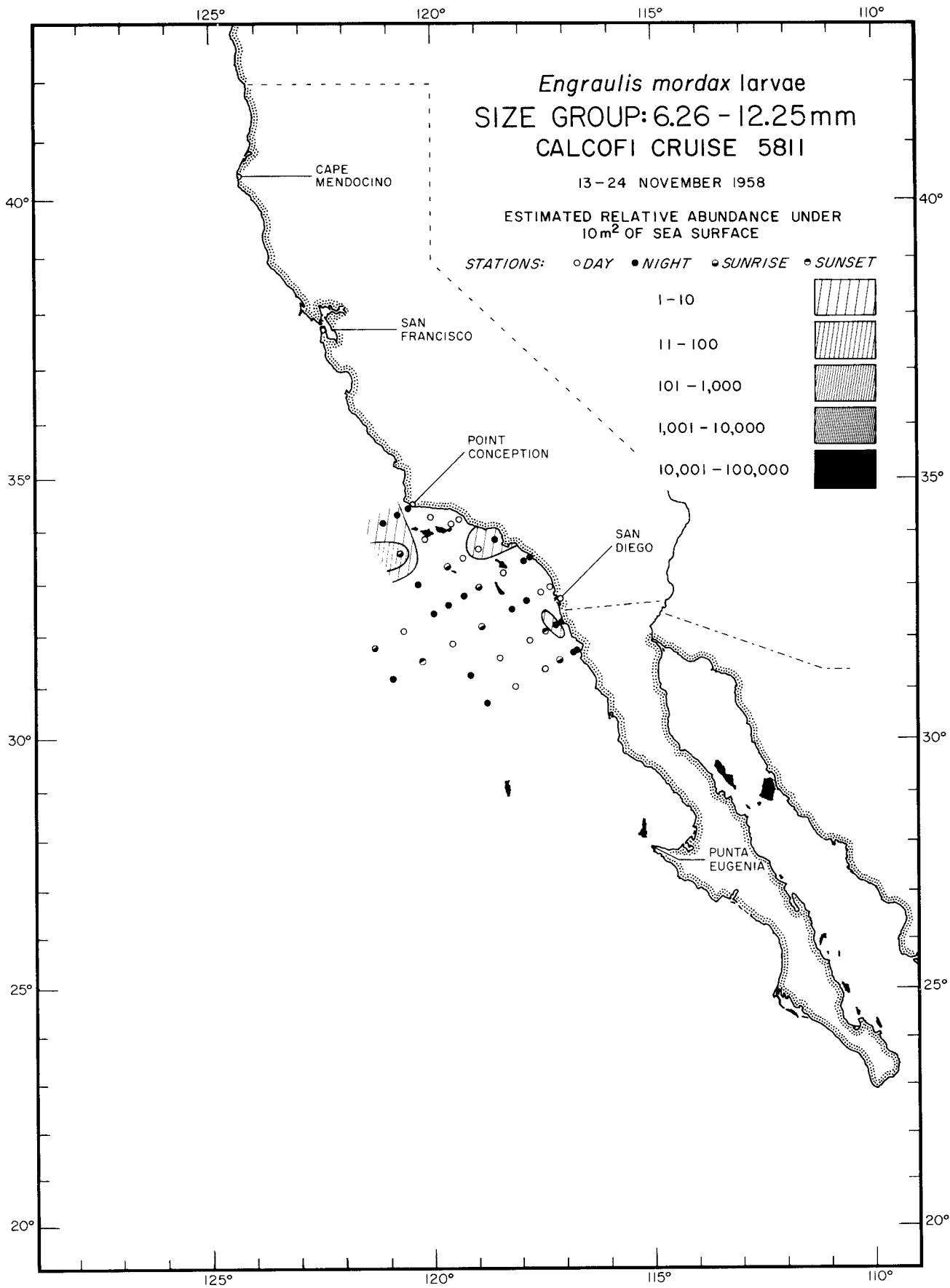
*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5810



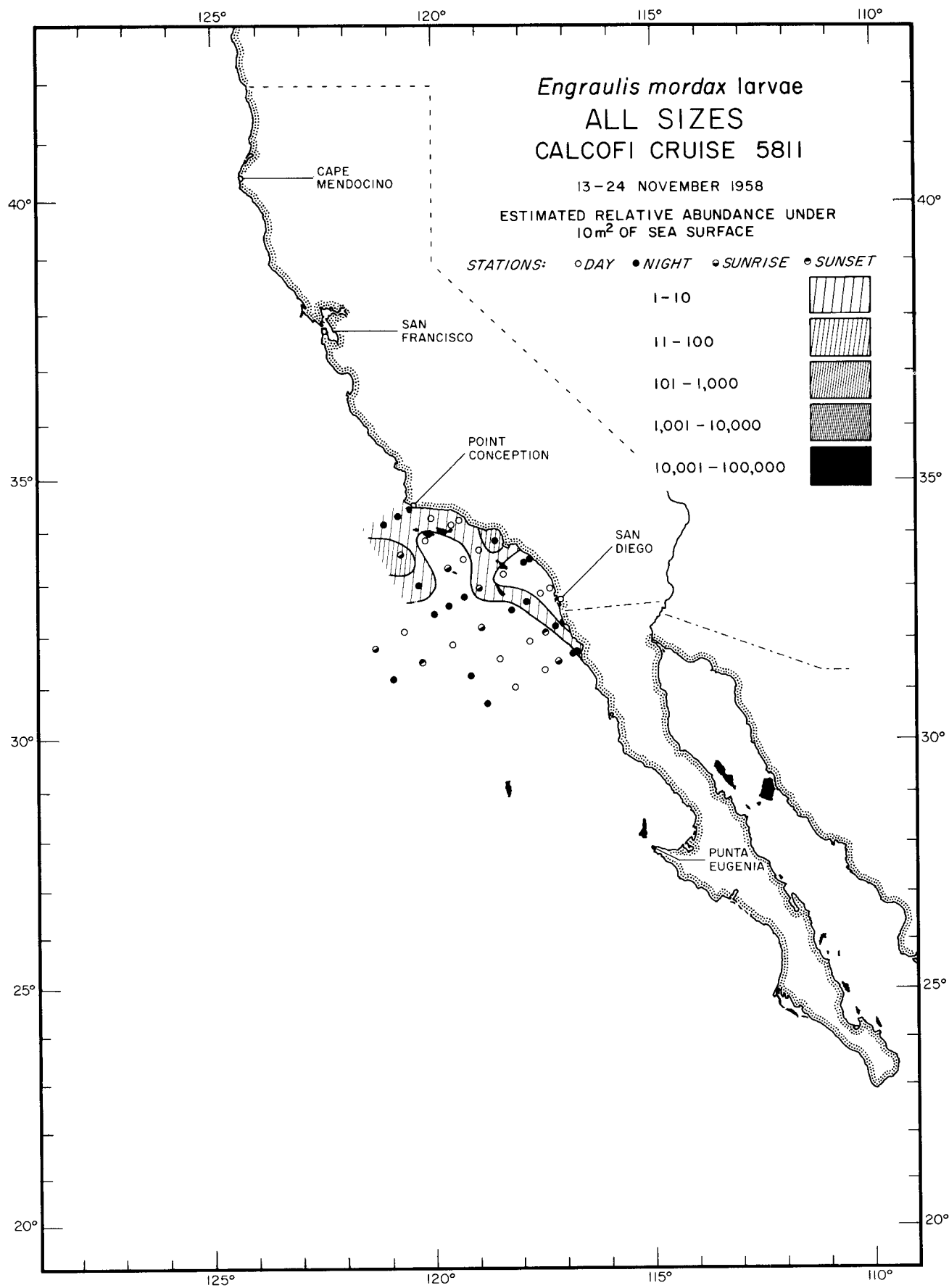
*Engraulis mordax* larvae

All Sizes  
5810



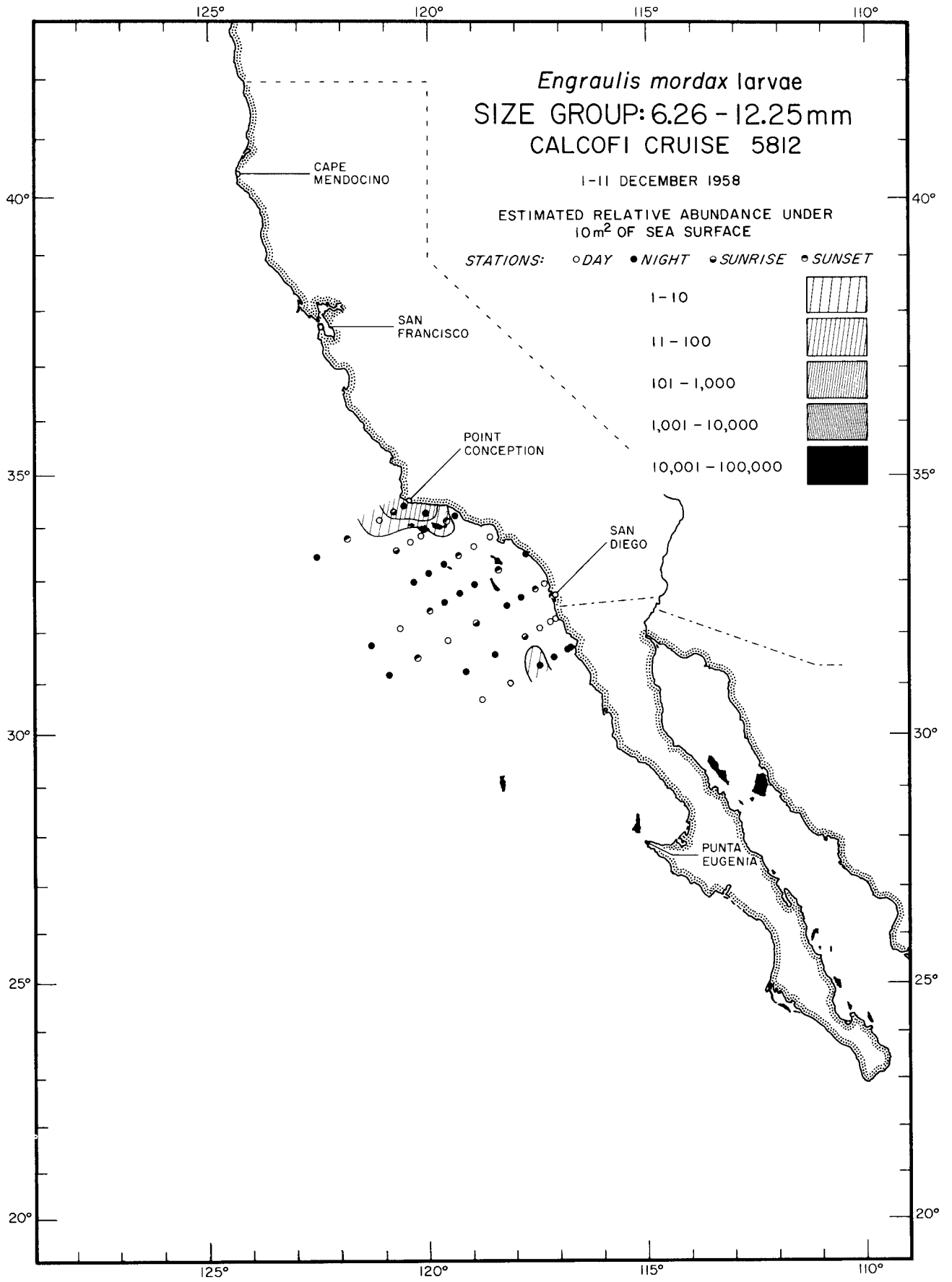


*Engraulis mordax* larvae  
 Size Group: 6.26-12.25mm  
 5811

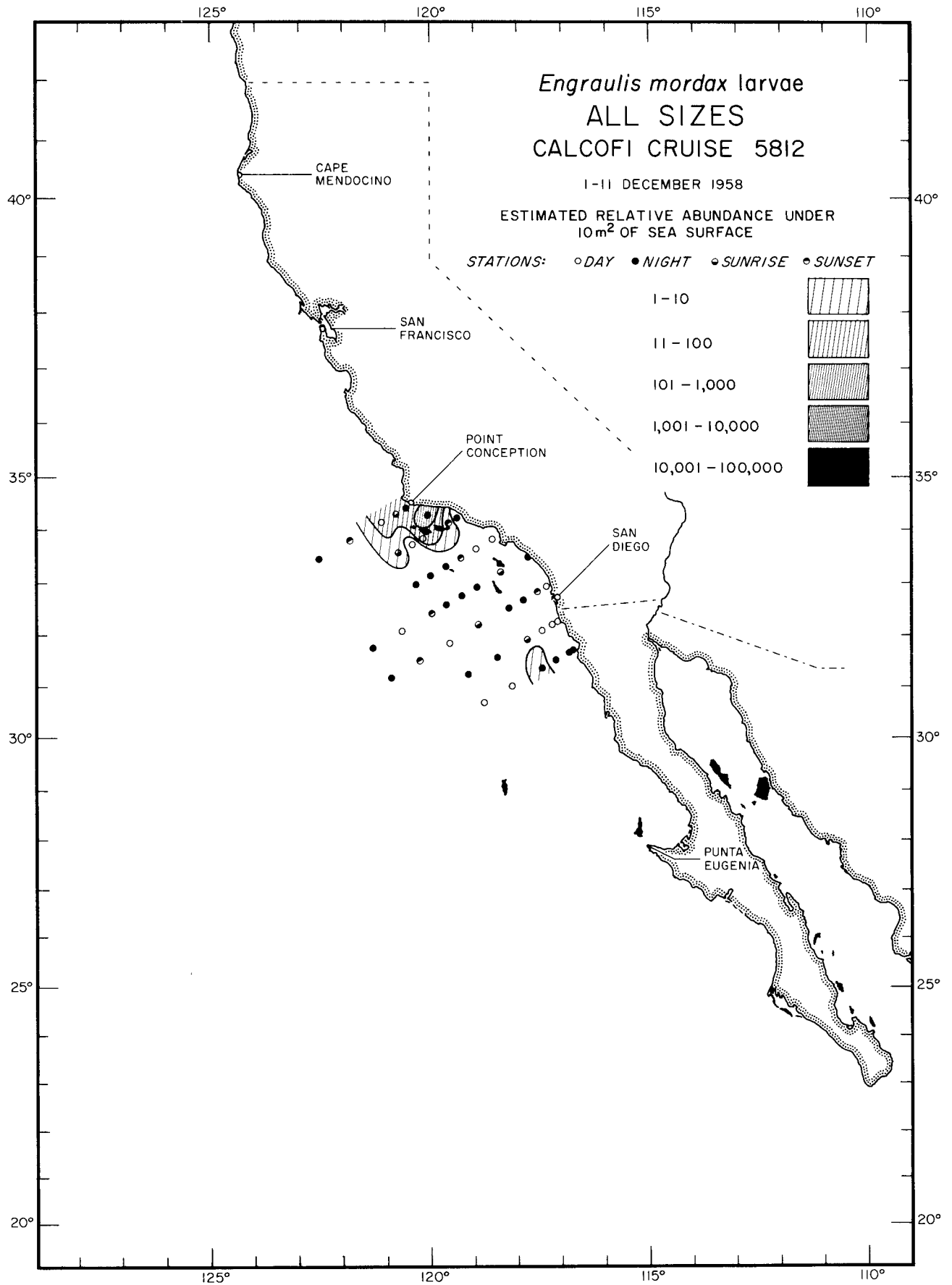
*Engraulis mordax* larvae

All Sizes

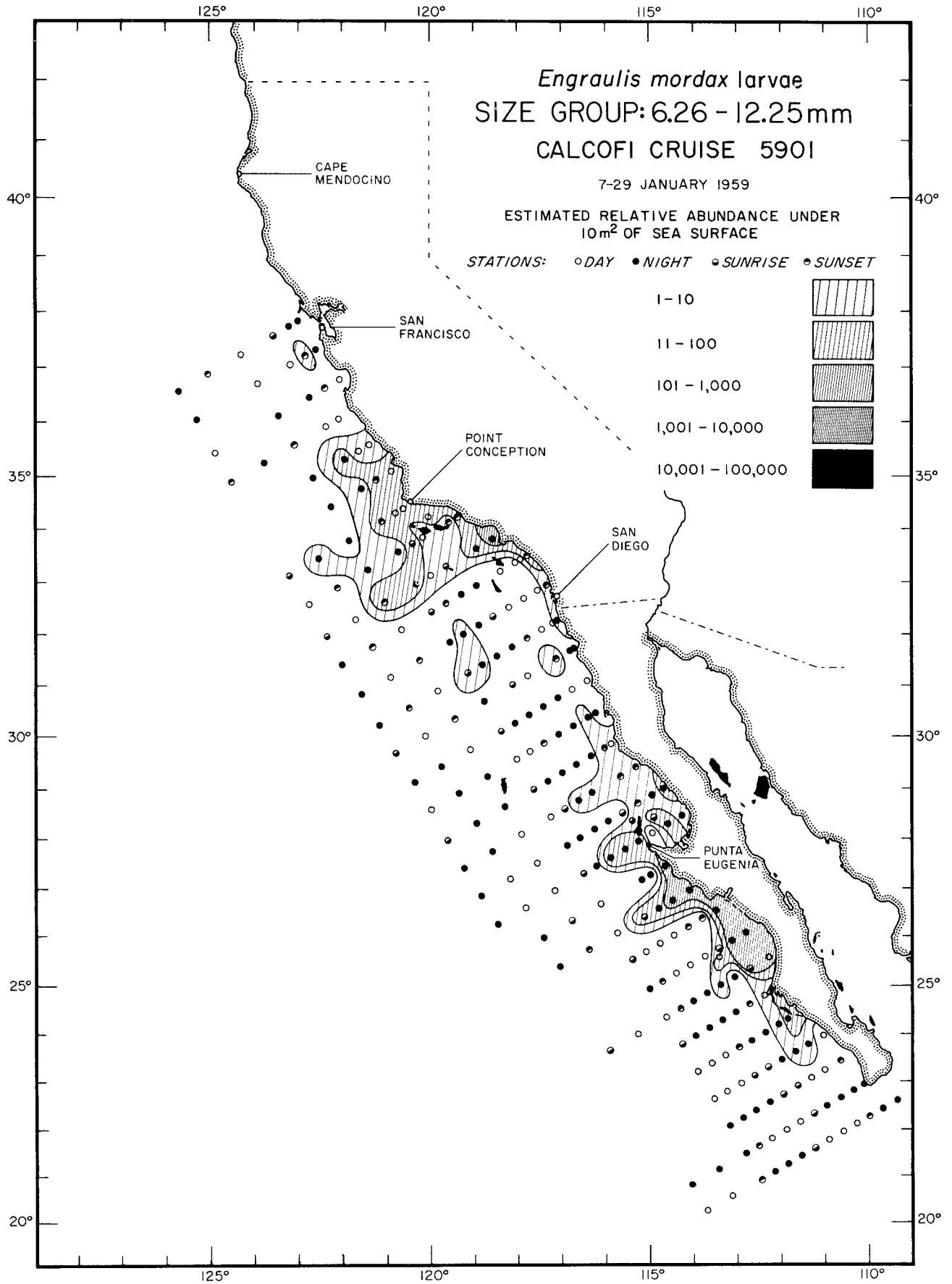
5811



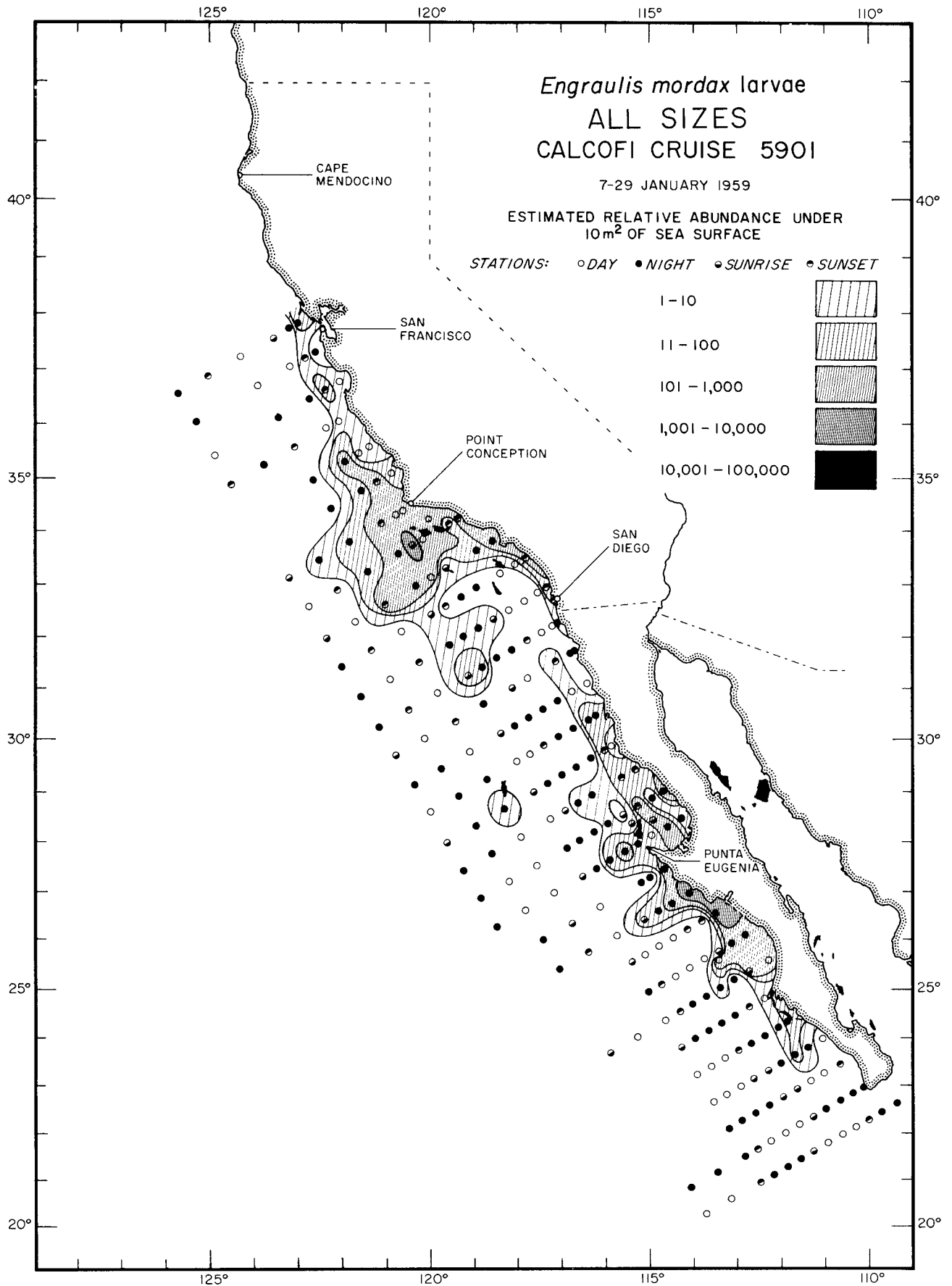
*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5812



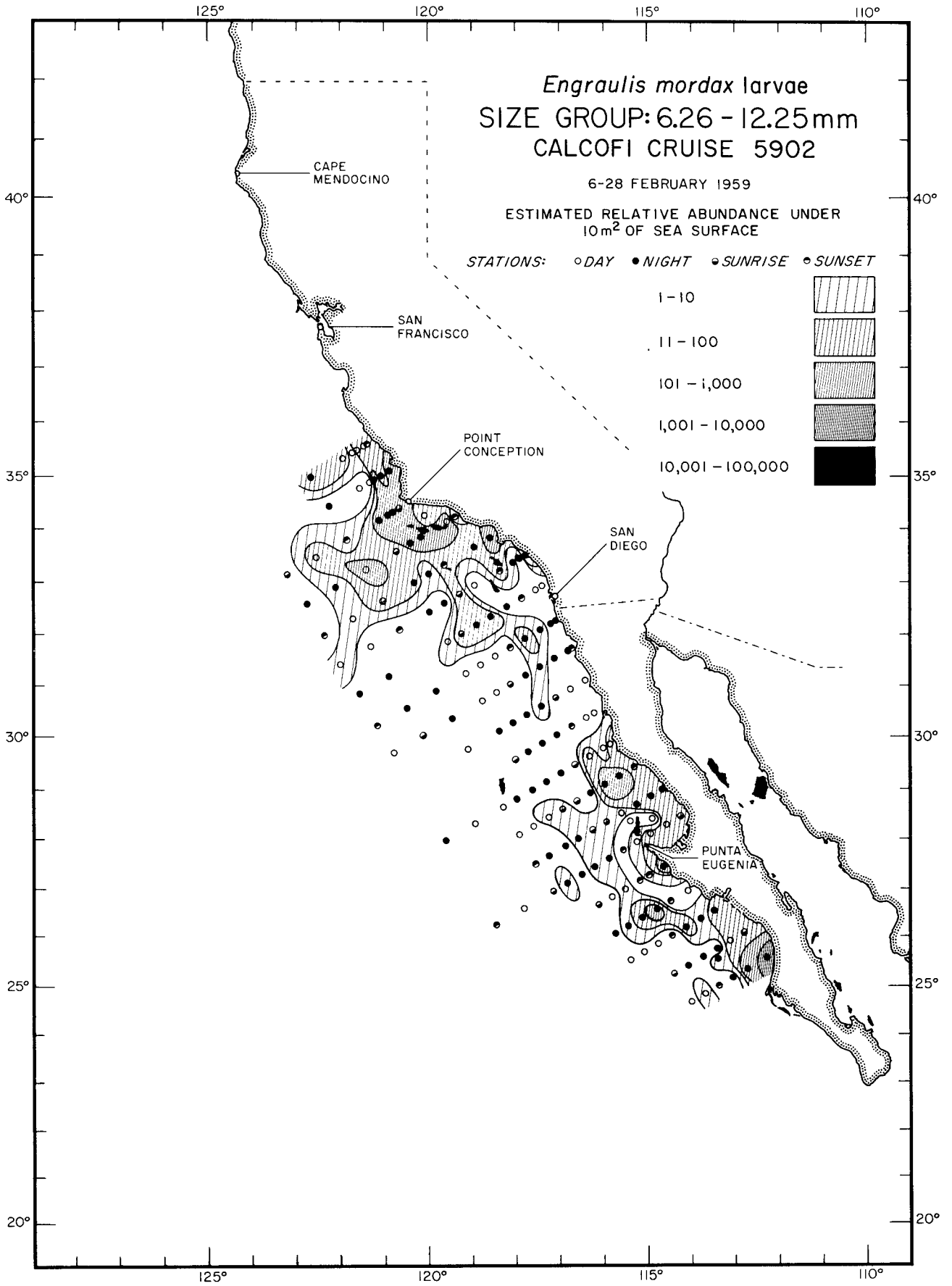
*Engraulis mordax* larvae  
All Sizes  
5812



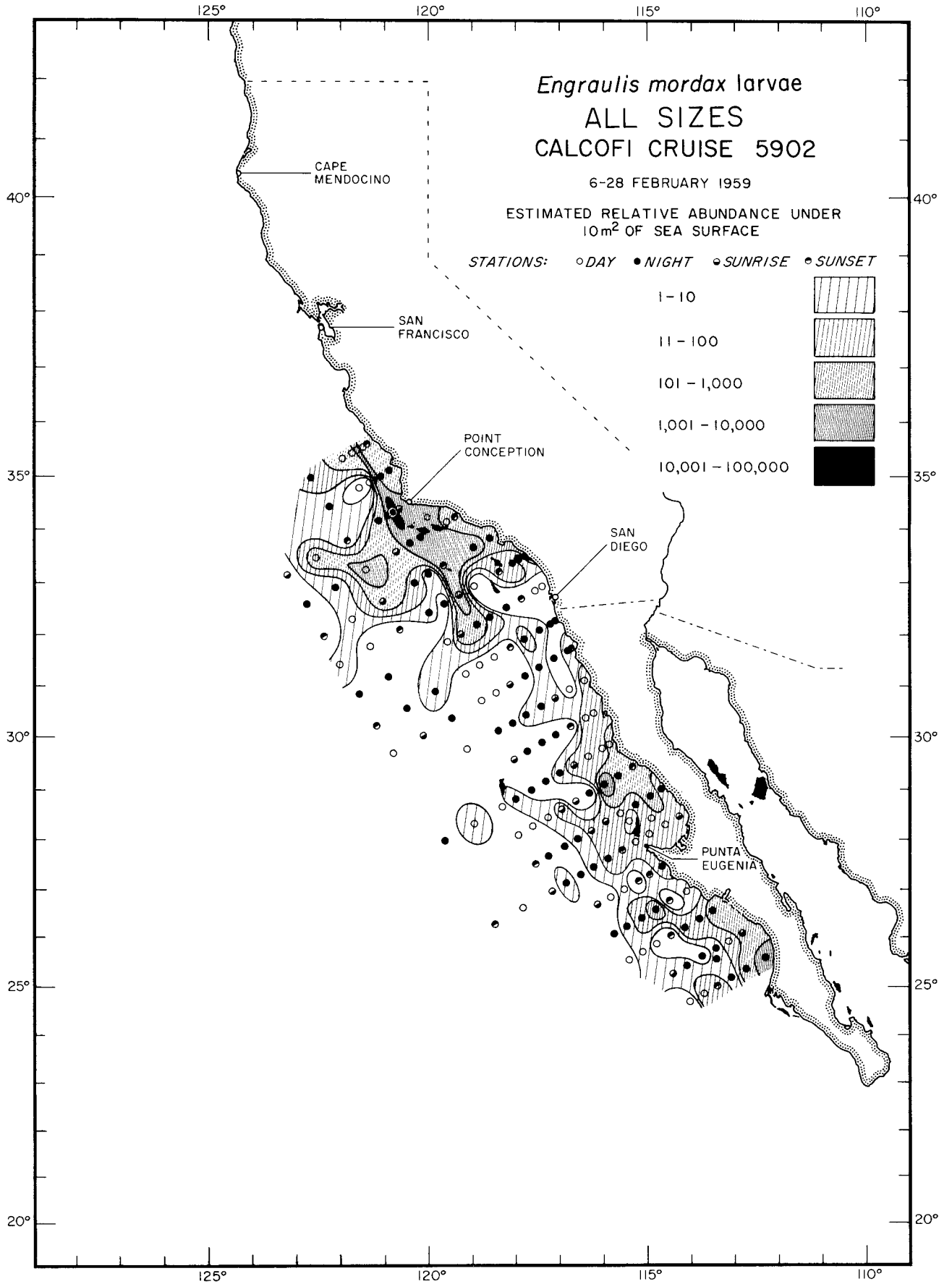
*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5901



*Engraulis mordax* larvae  
All Sizes  
5901

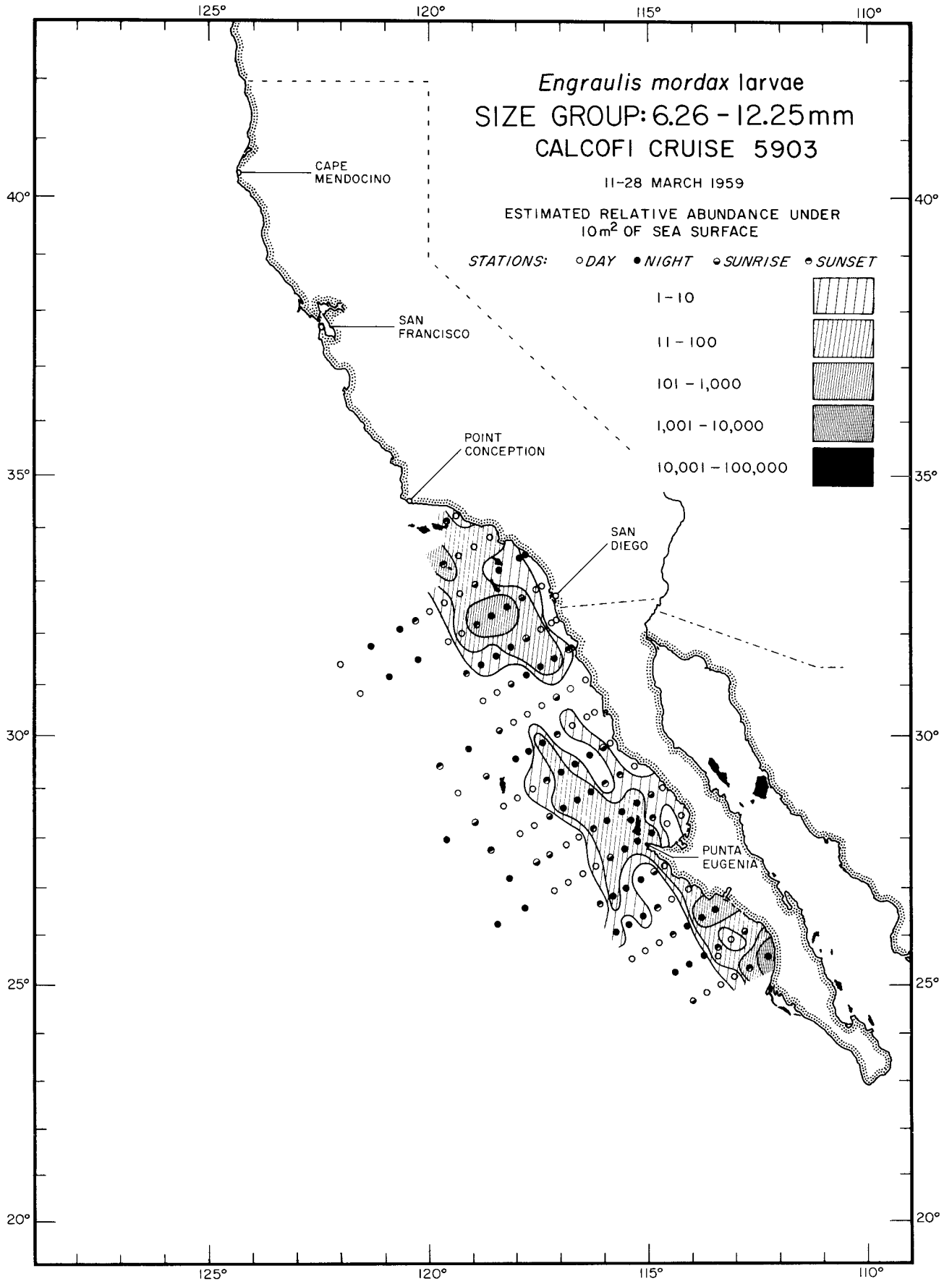


*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5902

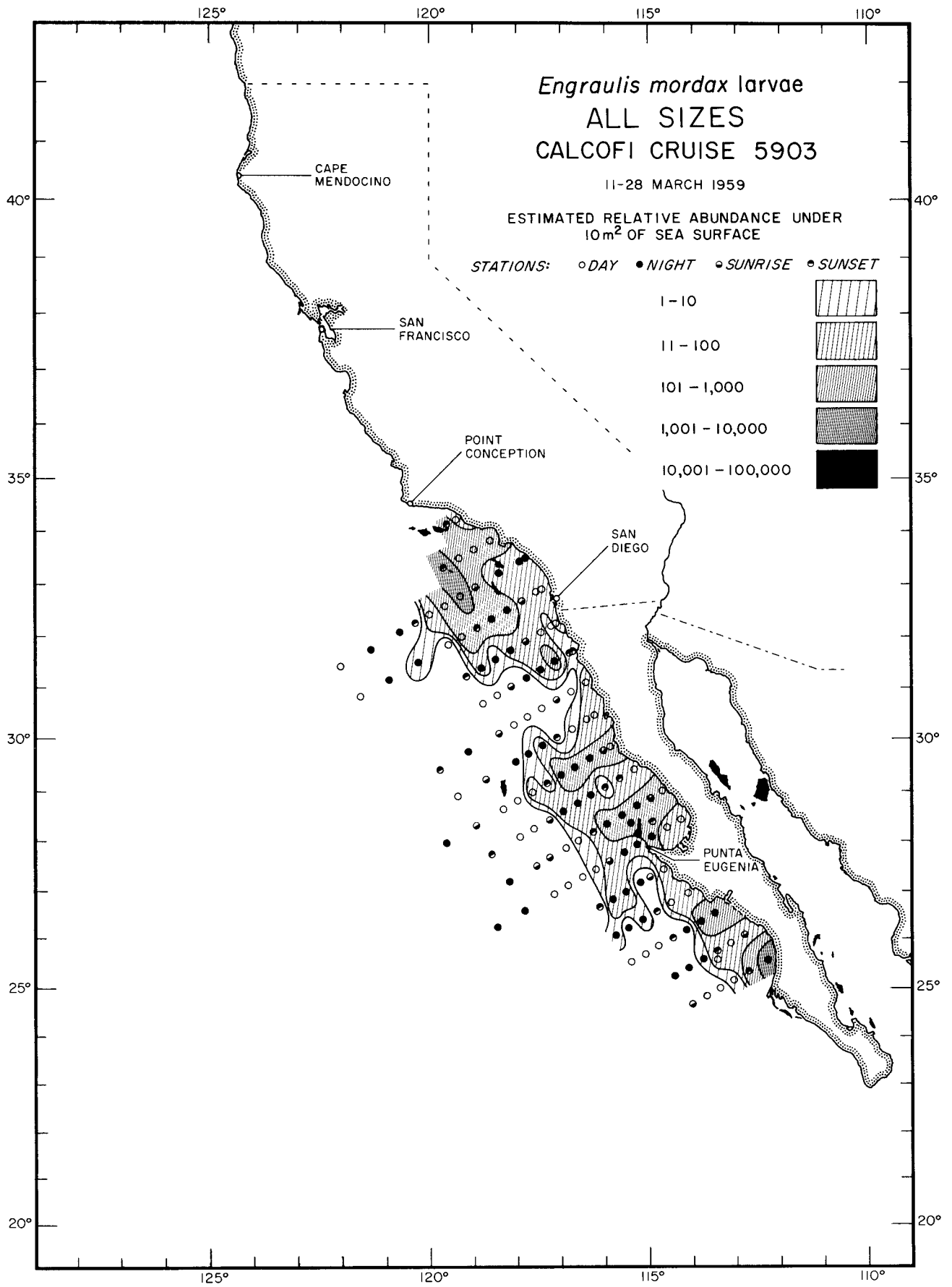


*Engraulis mordax* larvae  
All Sizes  
5902





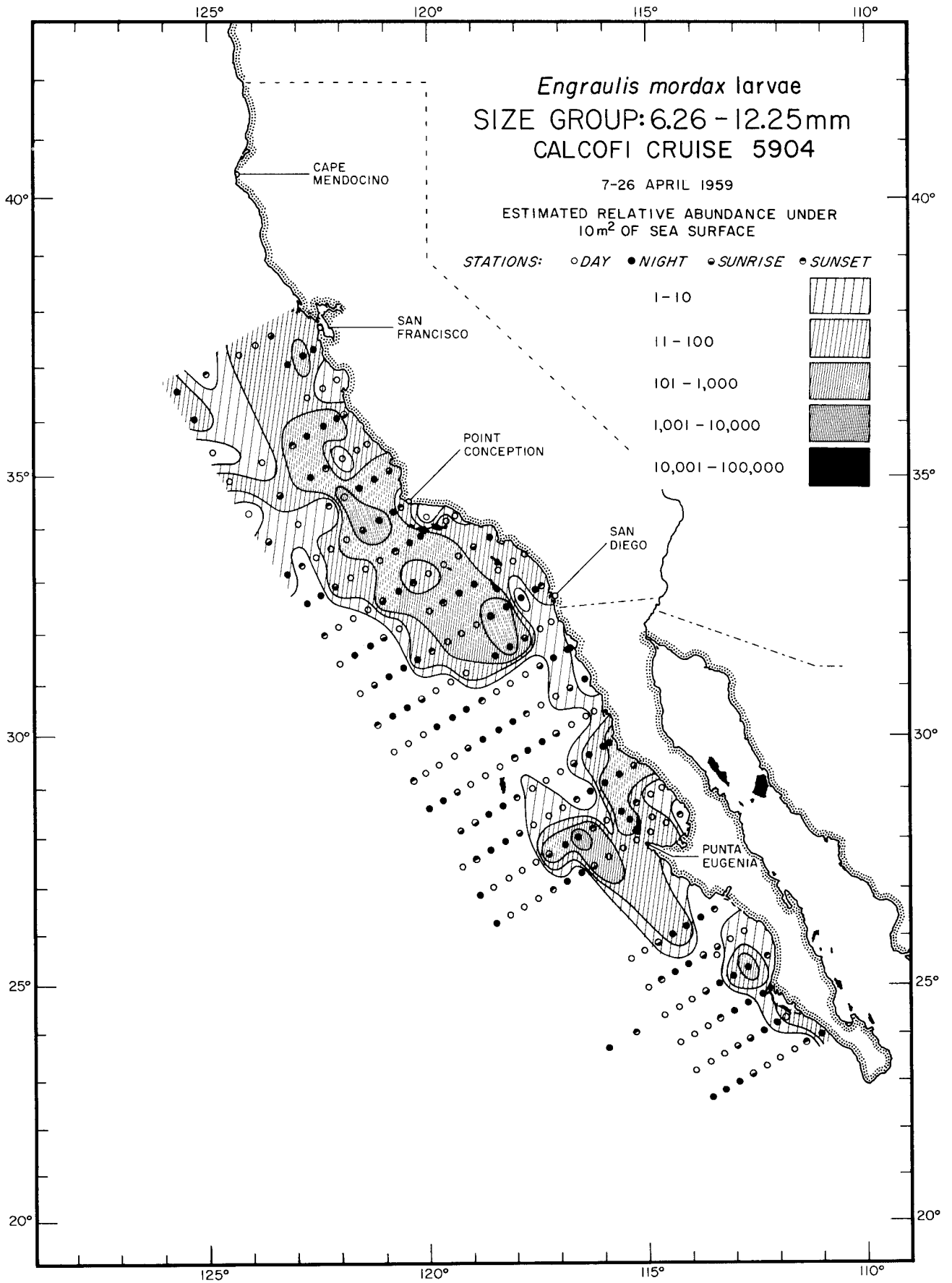
*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5903



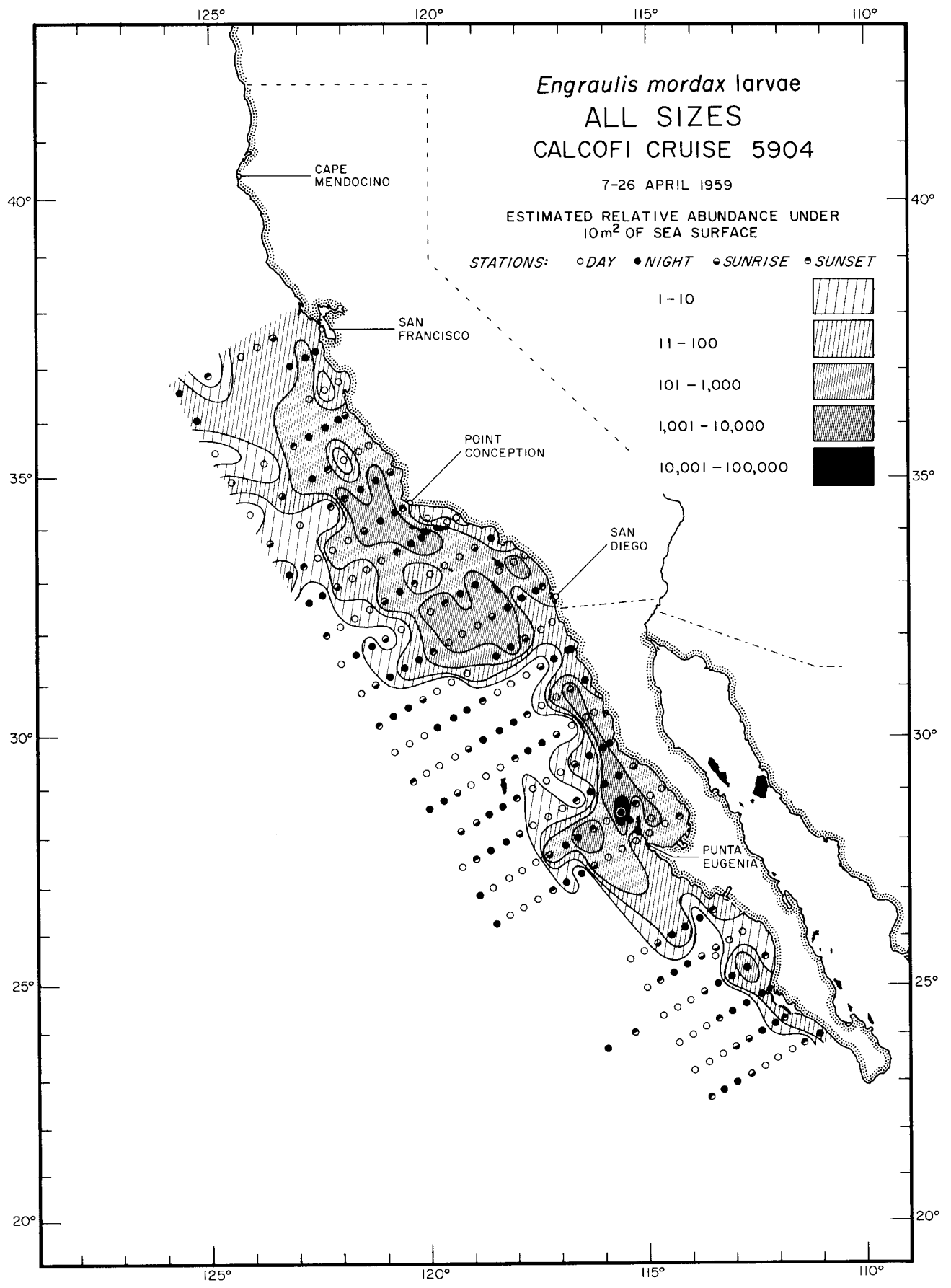
*Engraulis mordax* larvae

All Sizes

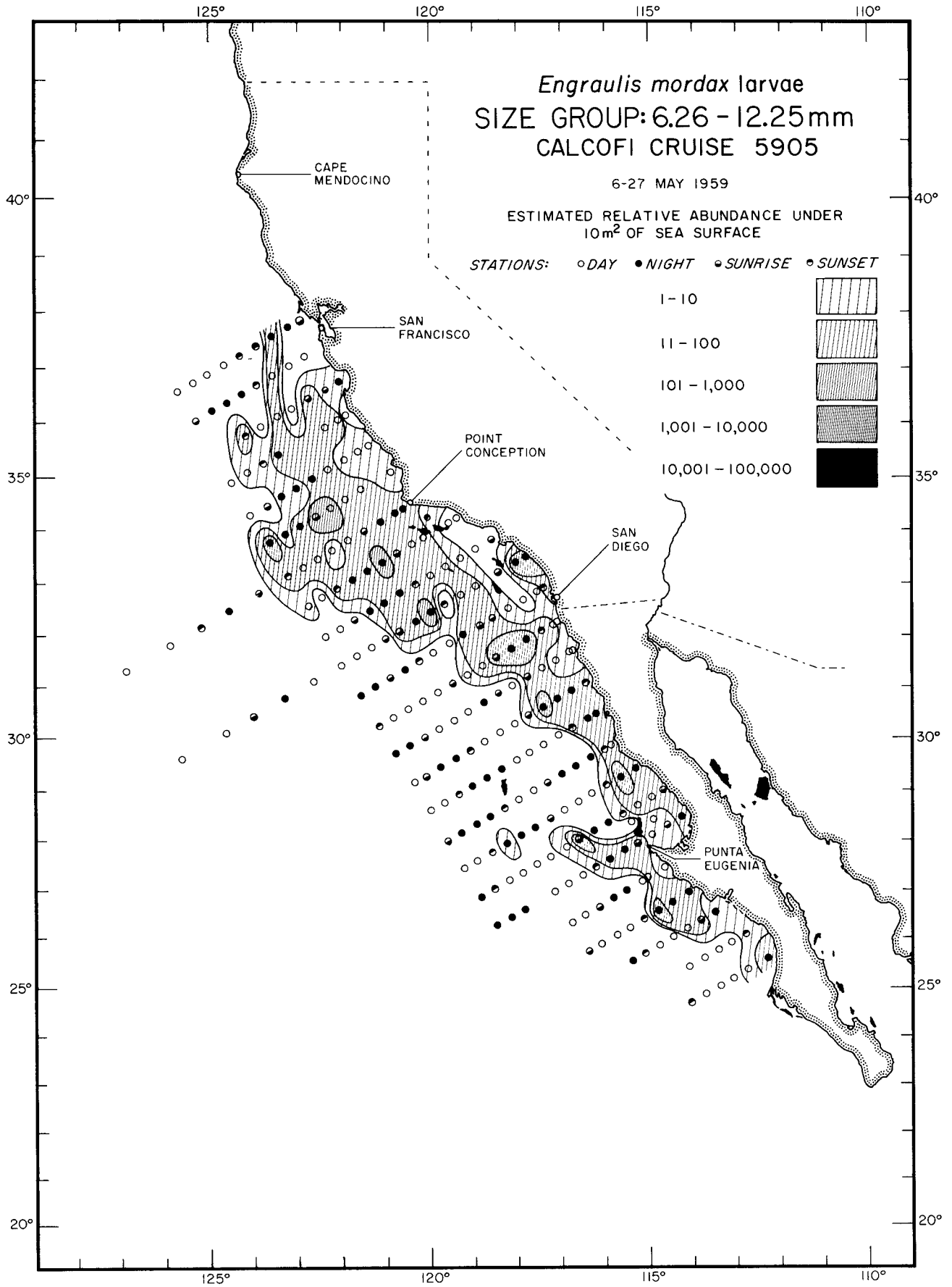
5903



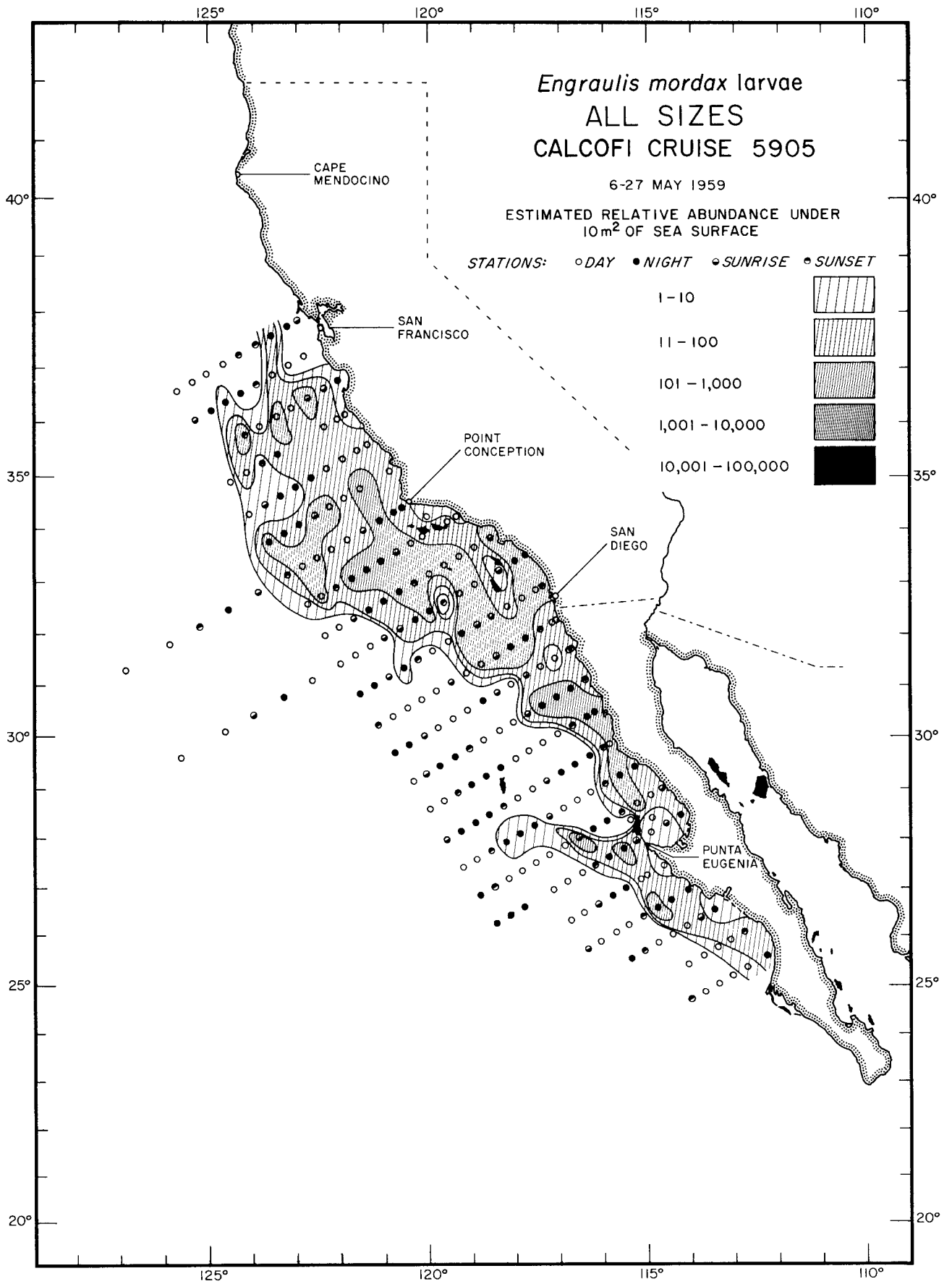
*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5904



*Engraulis mordax* larvae  
All Sizes  
5904

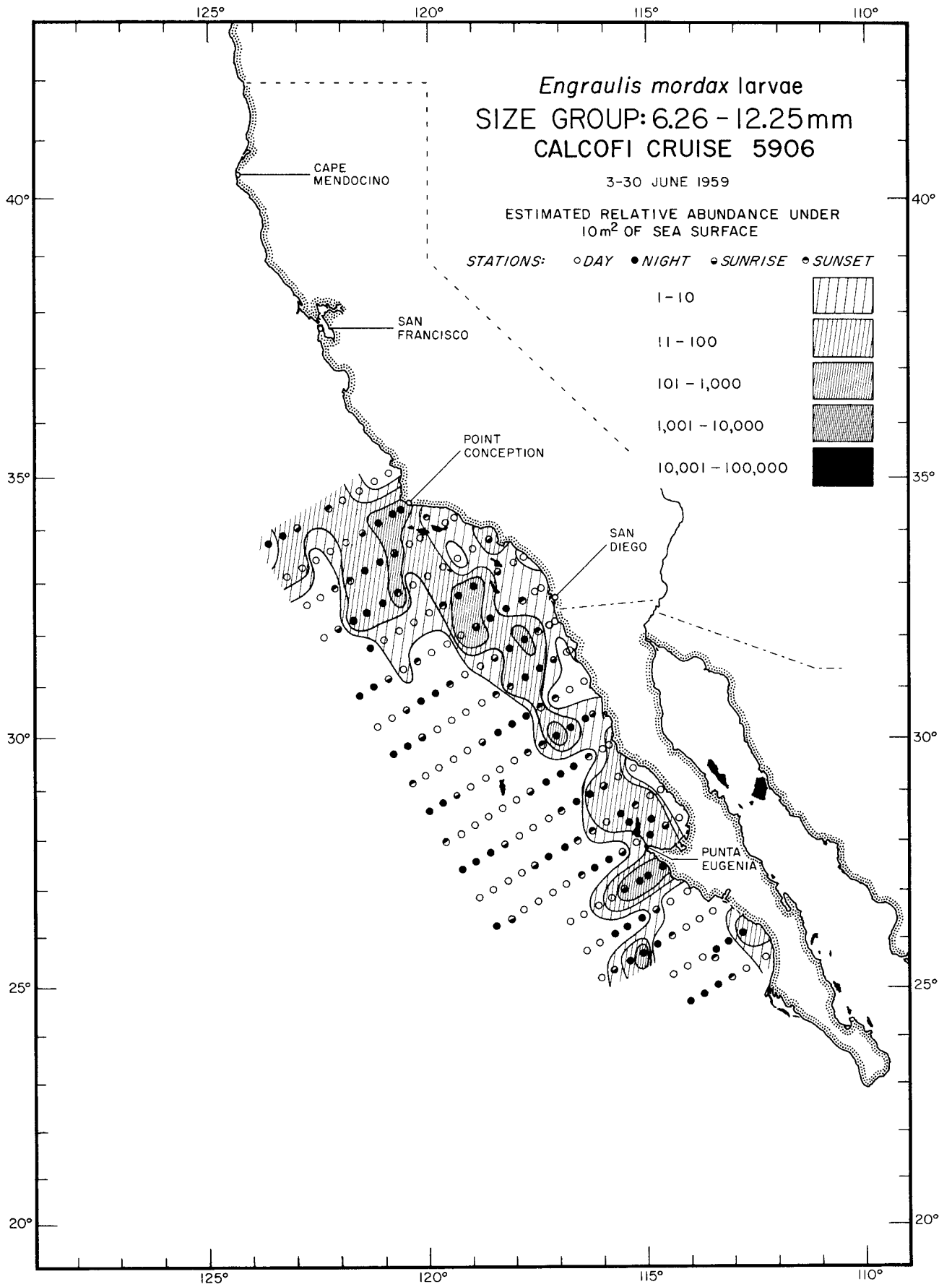


*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5905

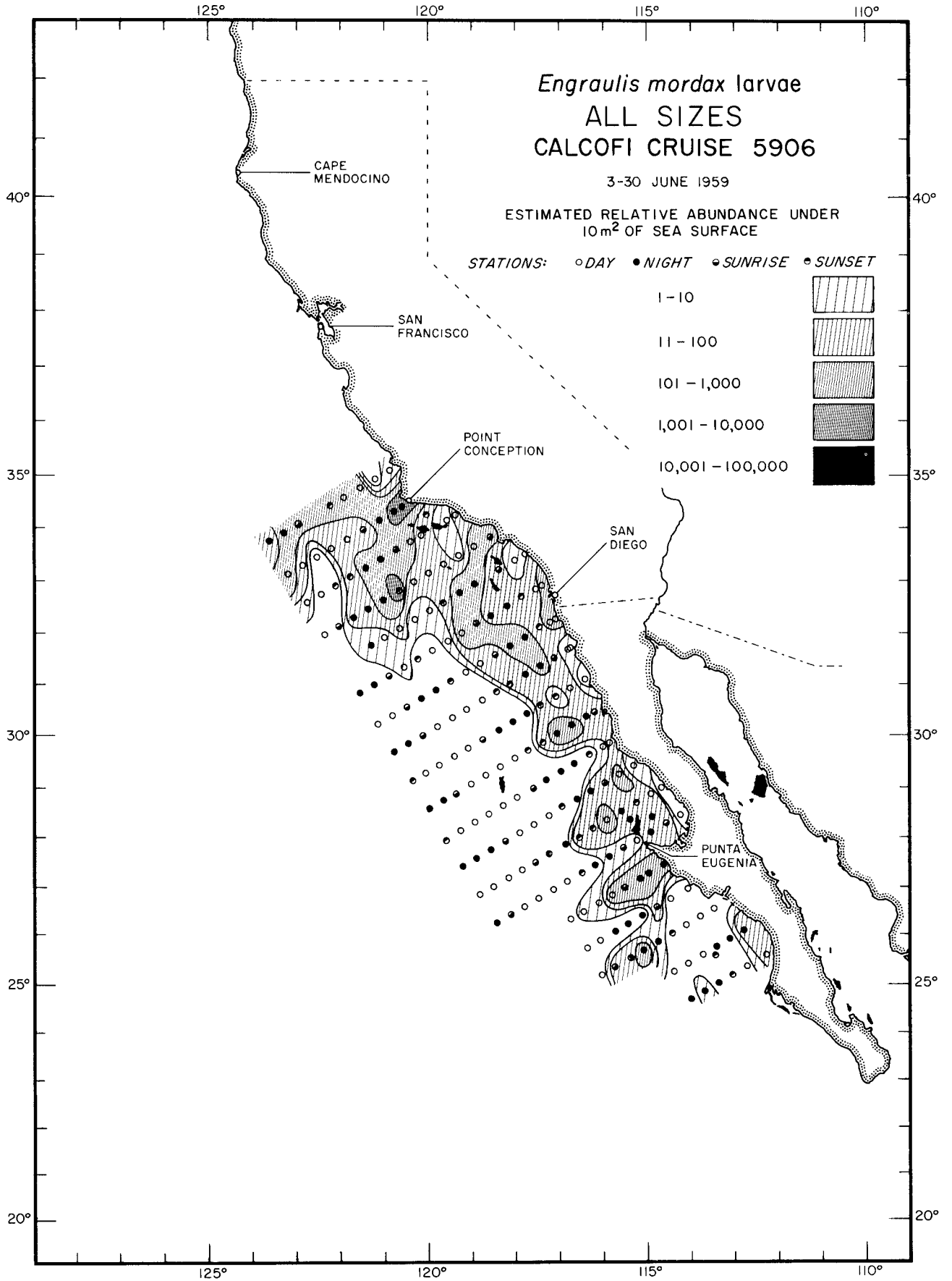


*Engraulis mordax* larvae

All Sizes  
5905



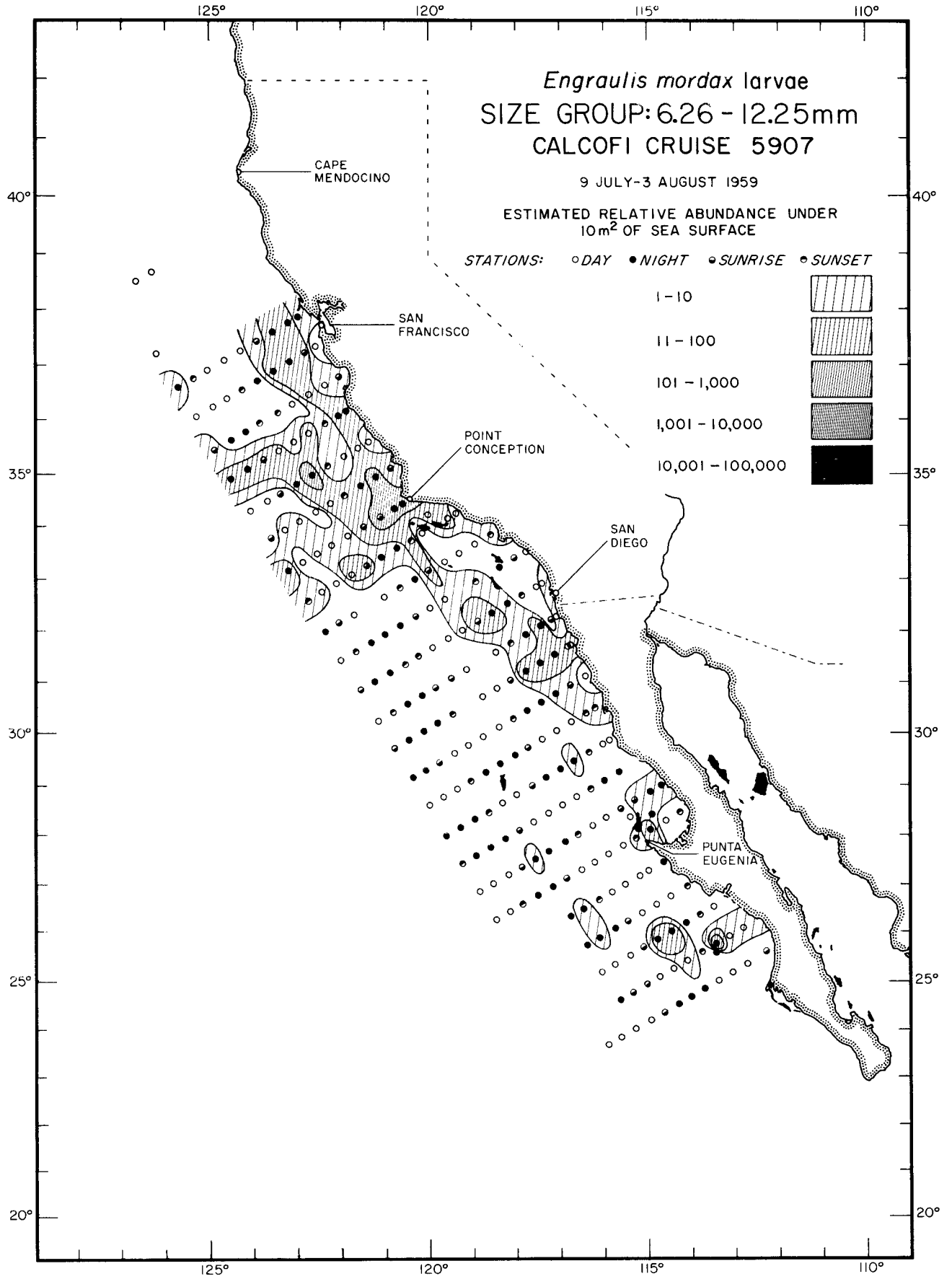
*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5906



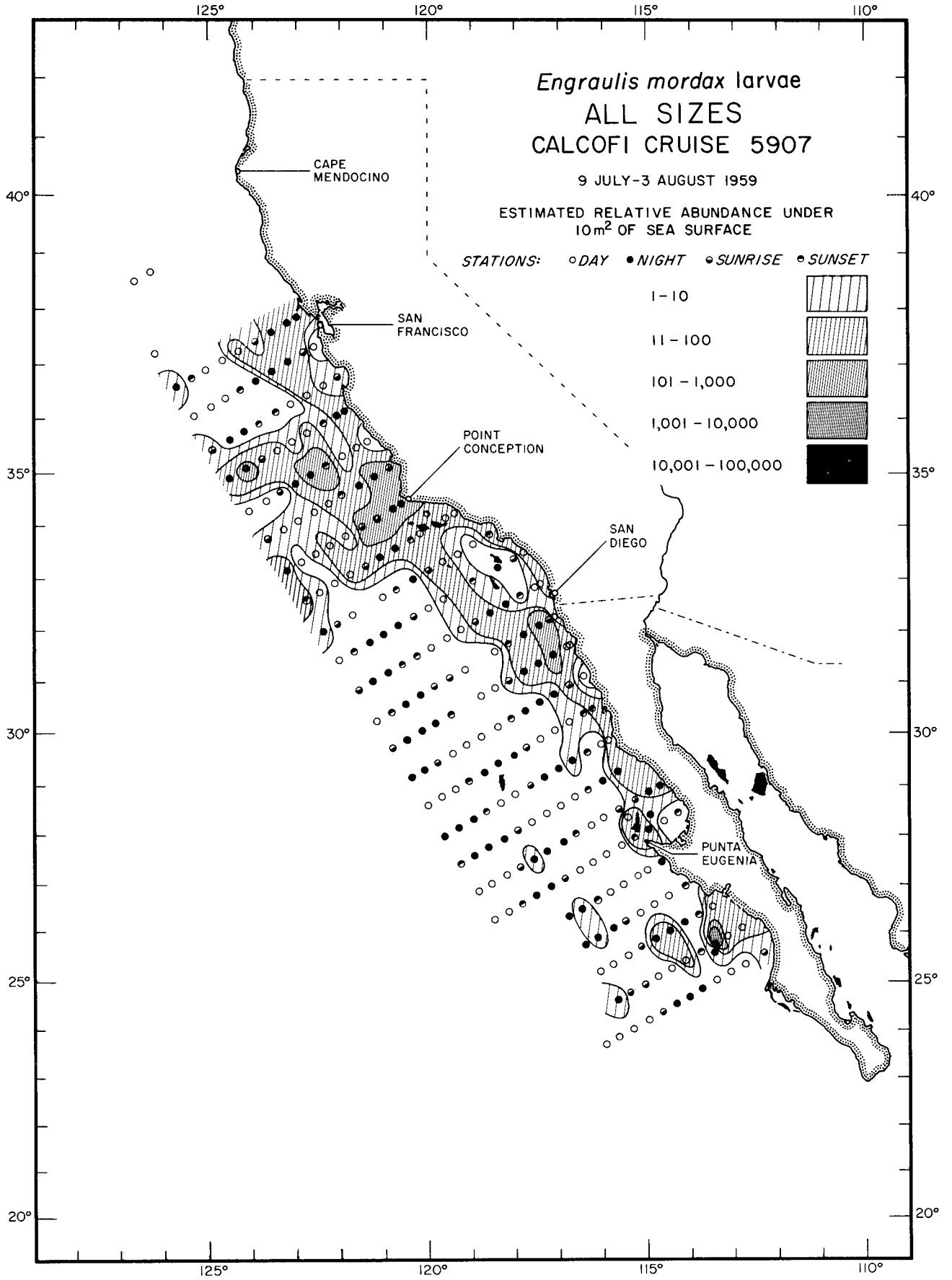
*Engraulis mordax* larvae

All Sizes  
5906



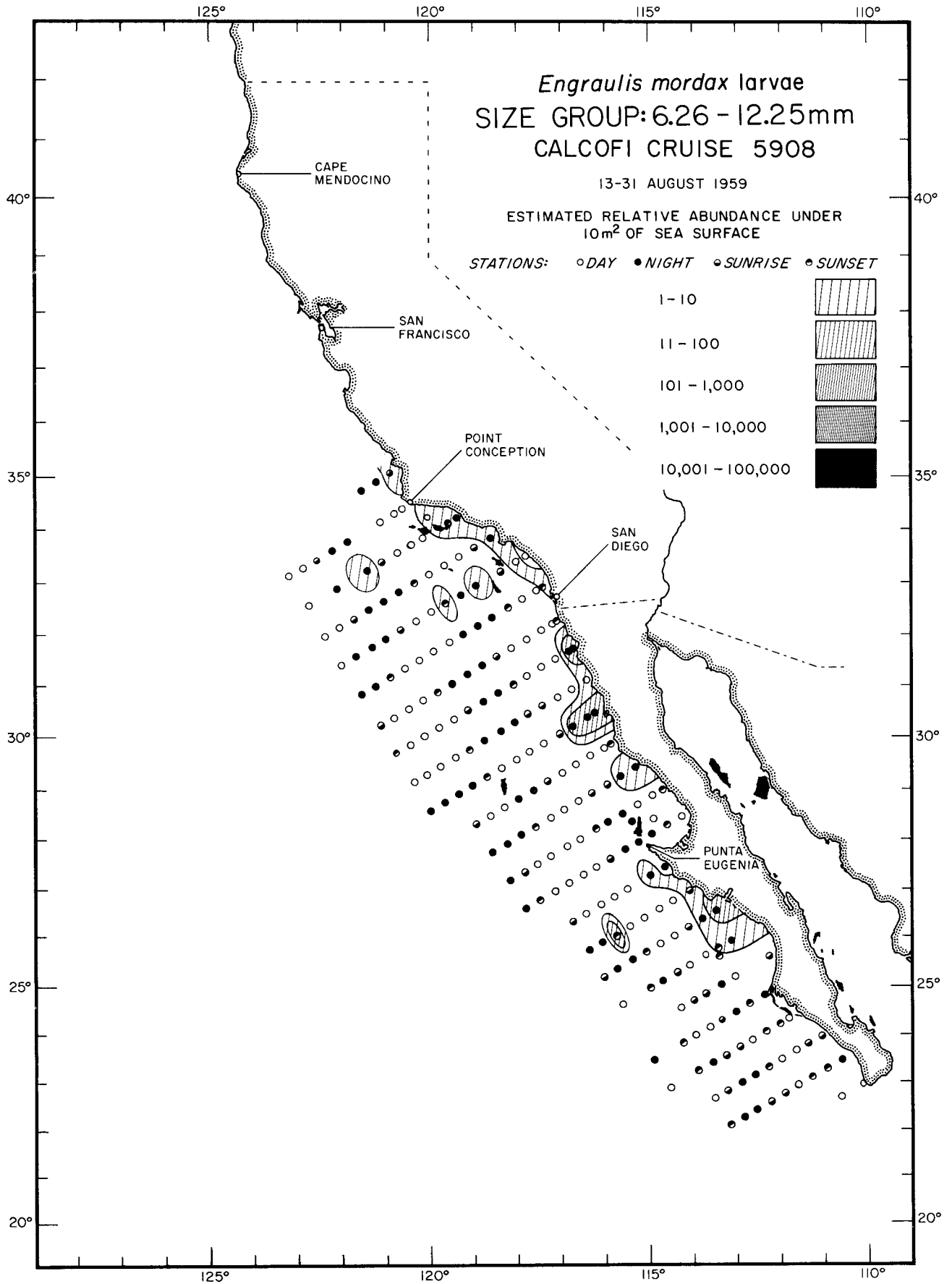


*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5907

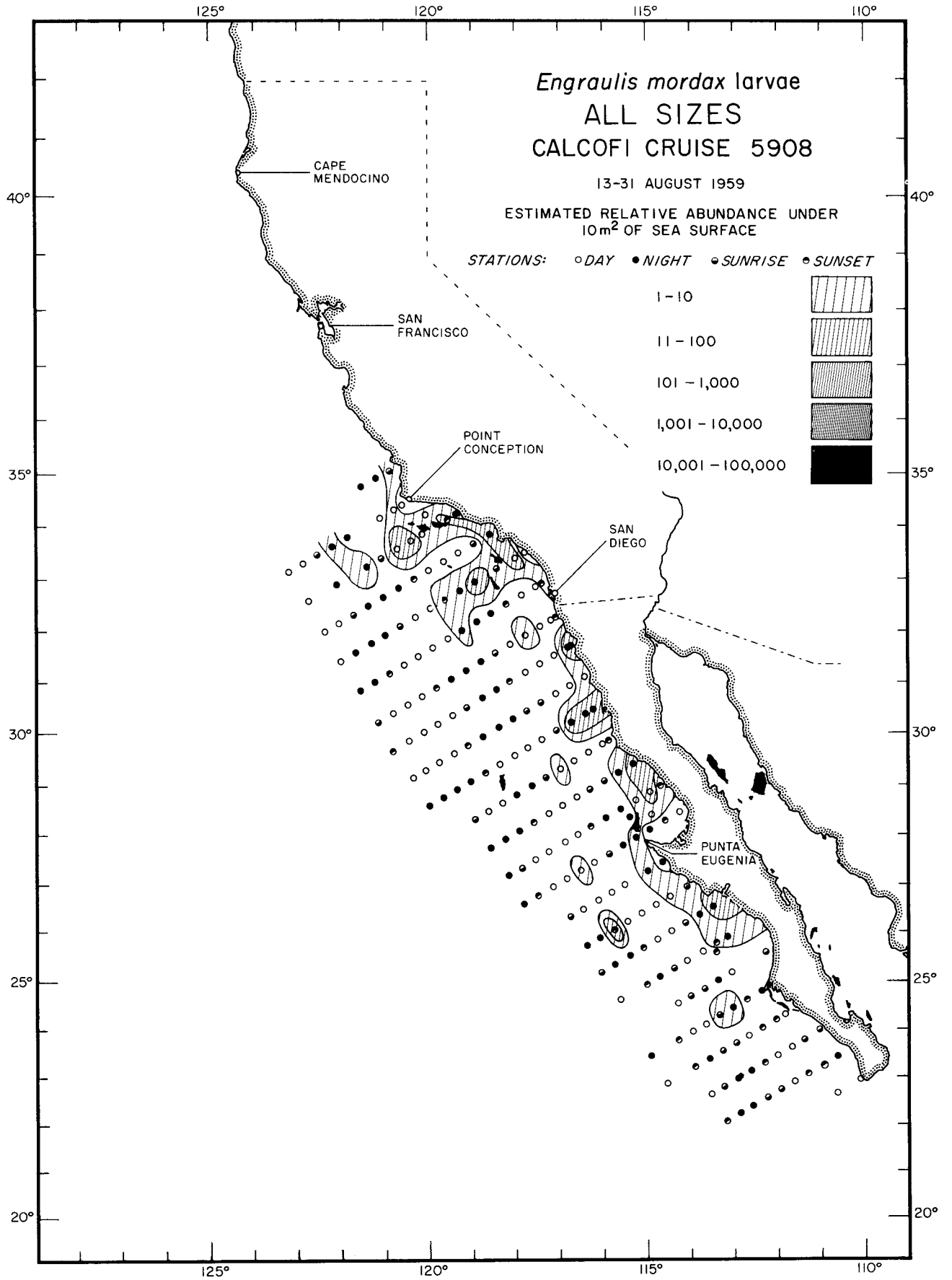


*Engraulis mordax* larvae

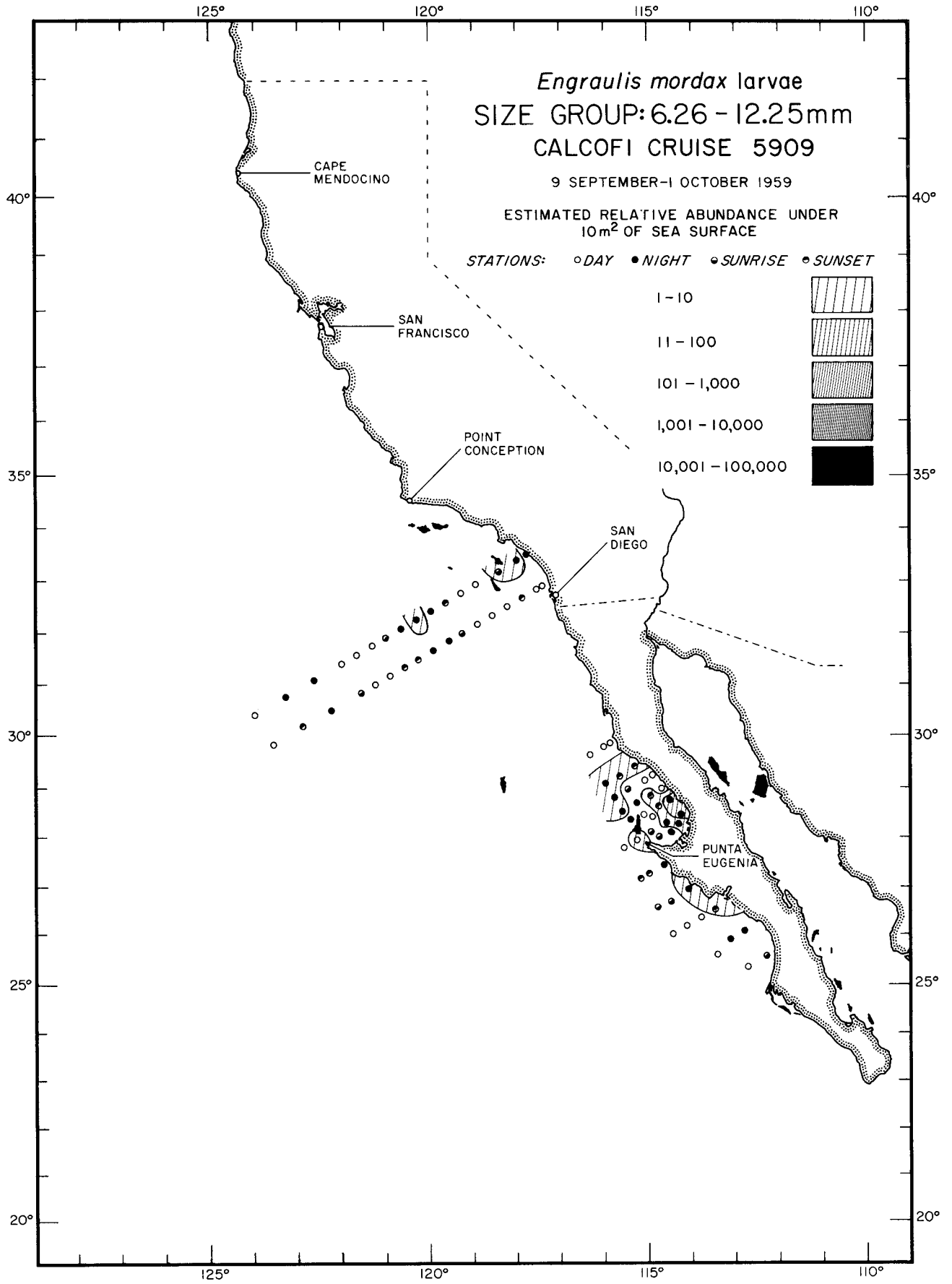
All Sizes  
5907



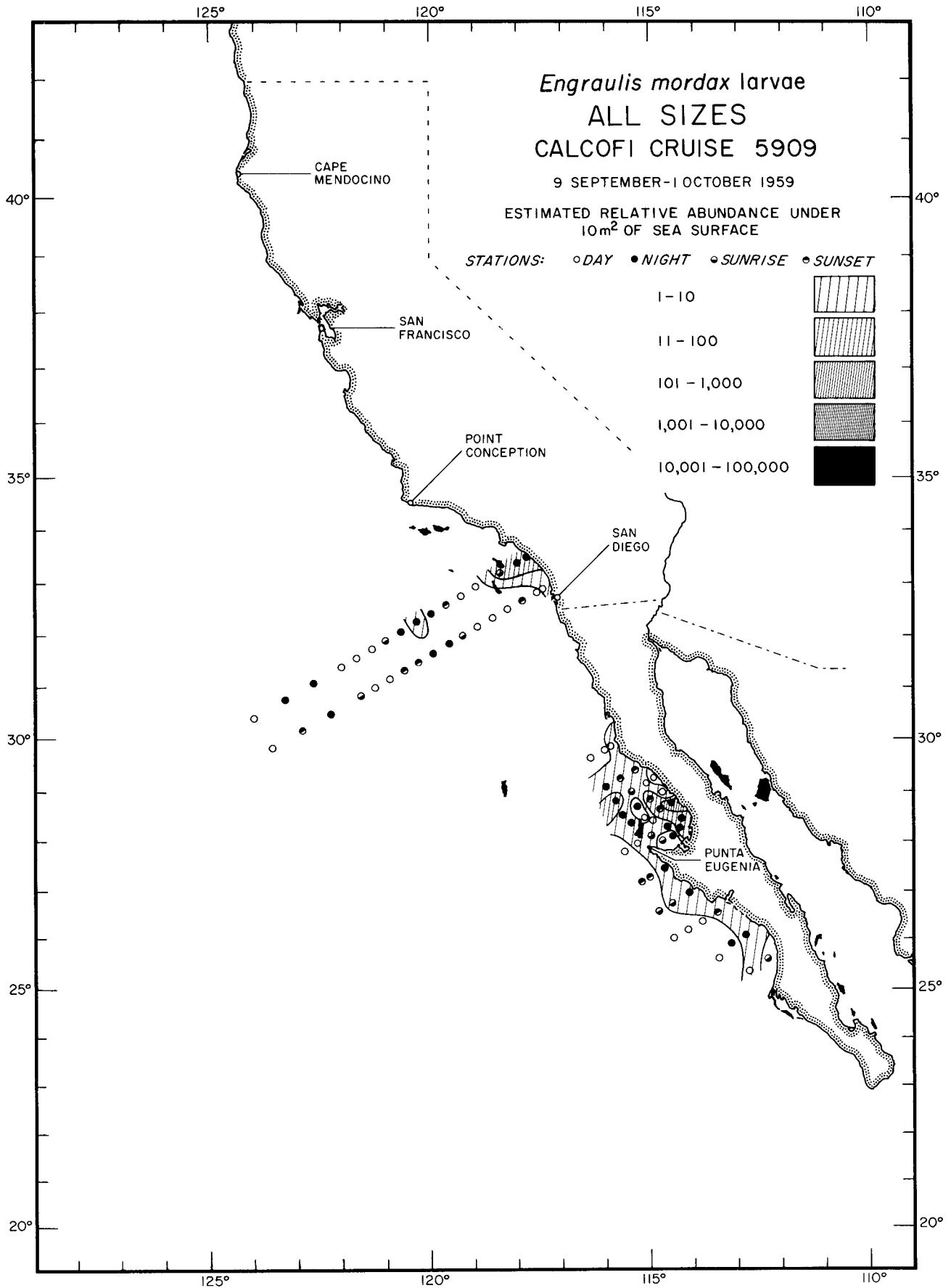
*Engraulis mordax* larvae  
 Size Group: 6.26-12.25mm  
 5908



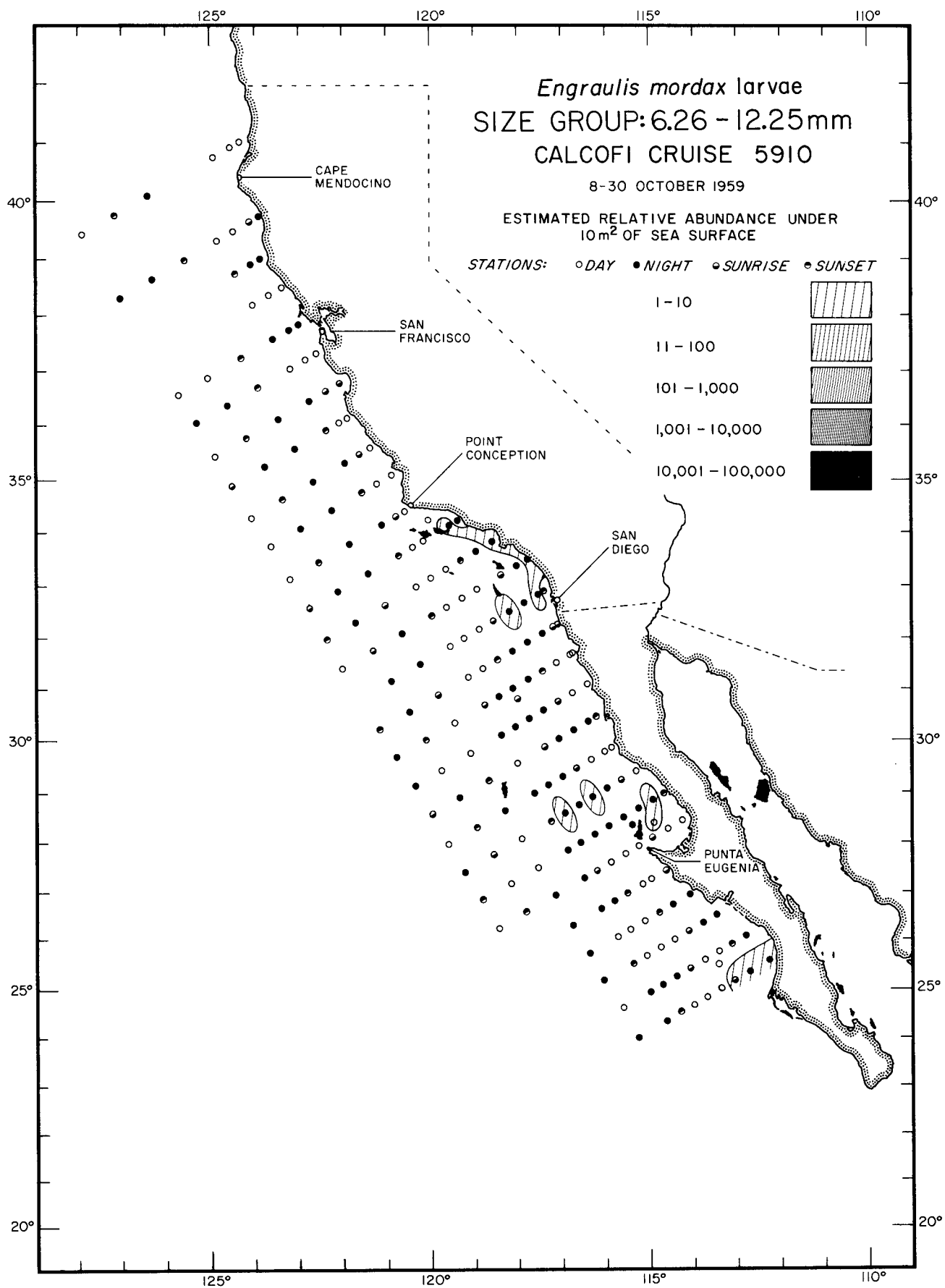
*Engraulis mordax* larvae  
All Sizes  
5908



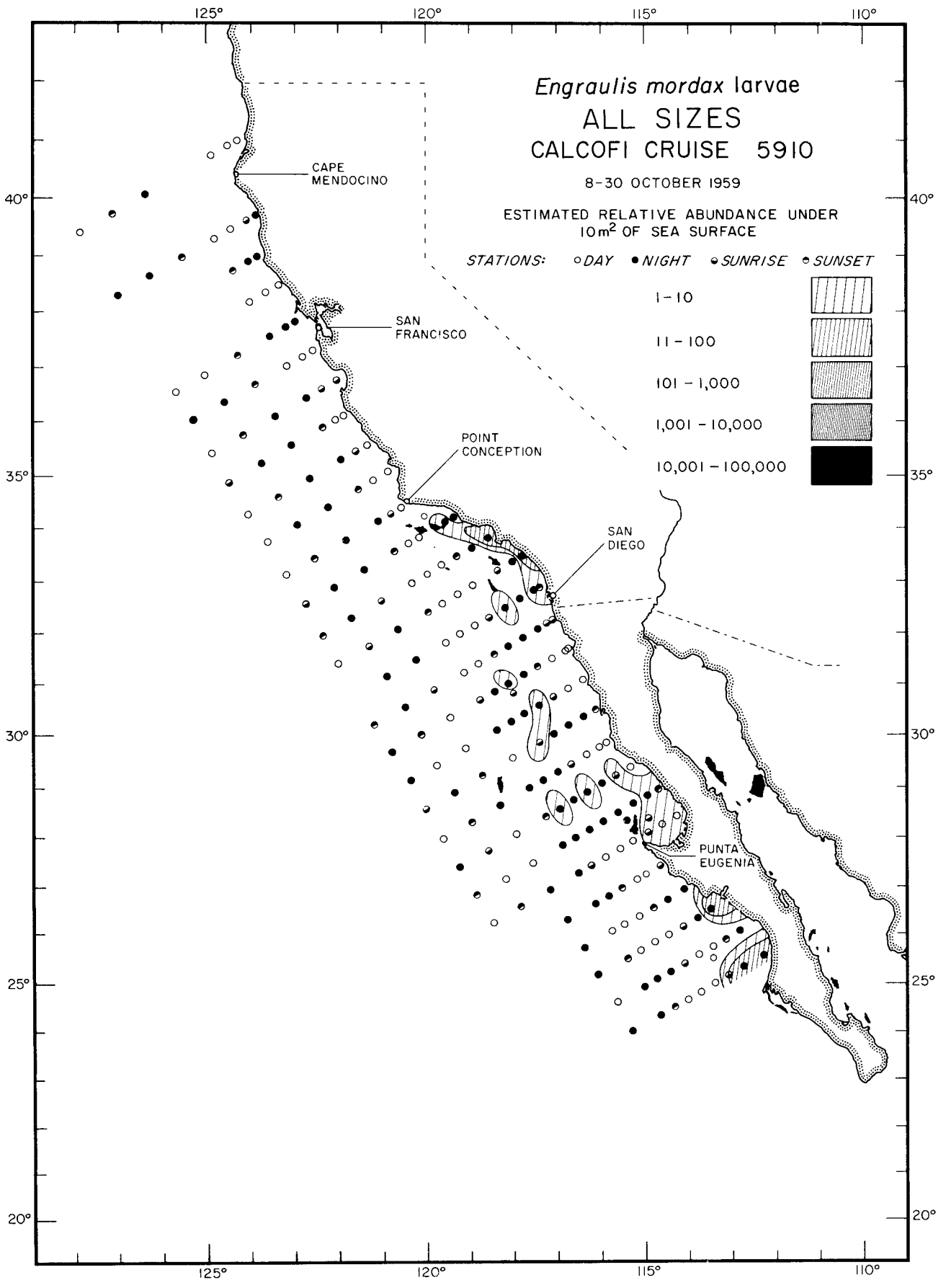
*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5909



*Engraulis mordax* larvae  
All Sizes  
5909

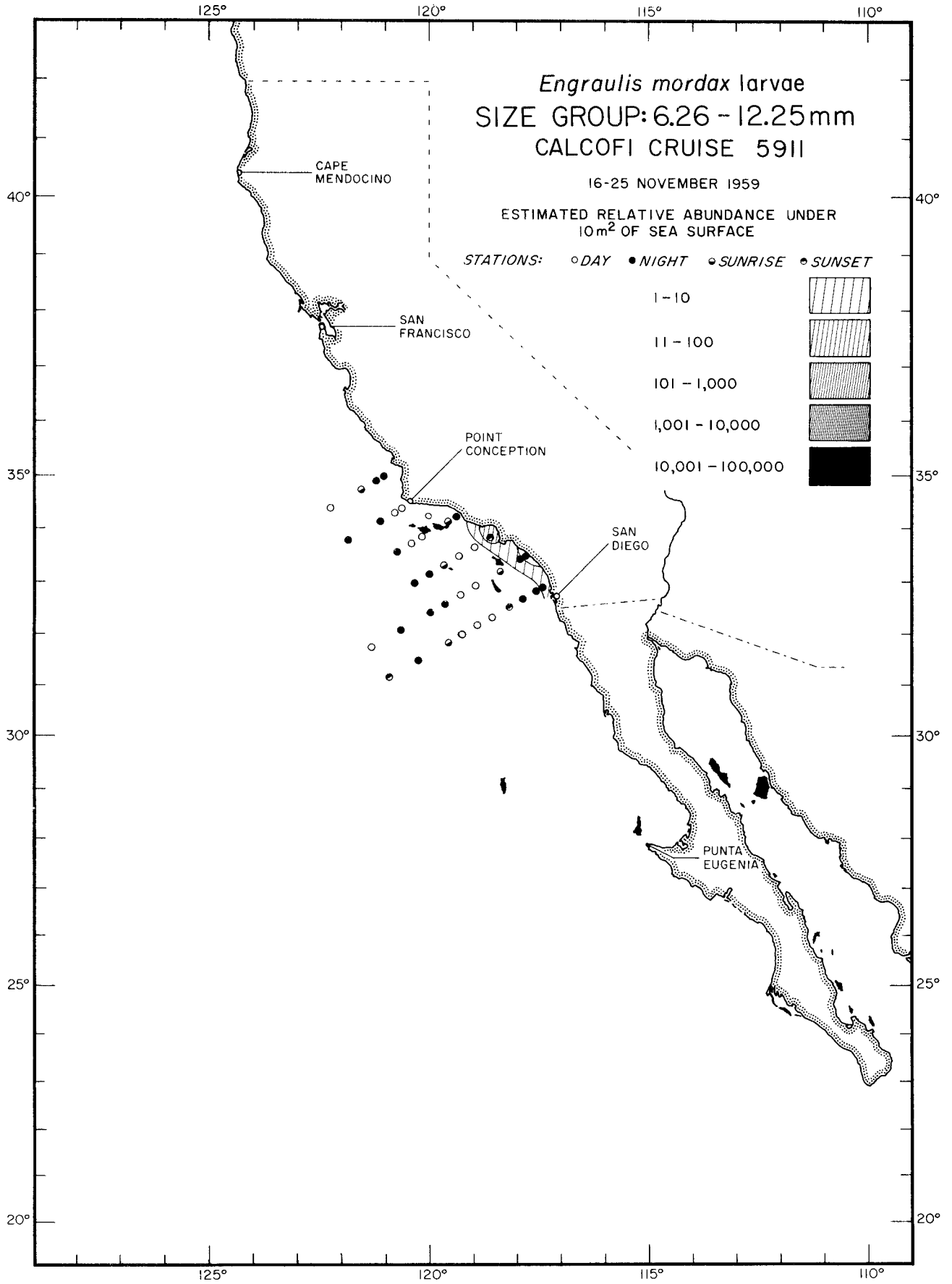


*Engraulis mordax* larvae  
 Size Group: 6.26-12.25mm  
 5910

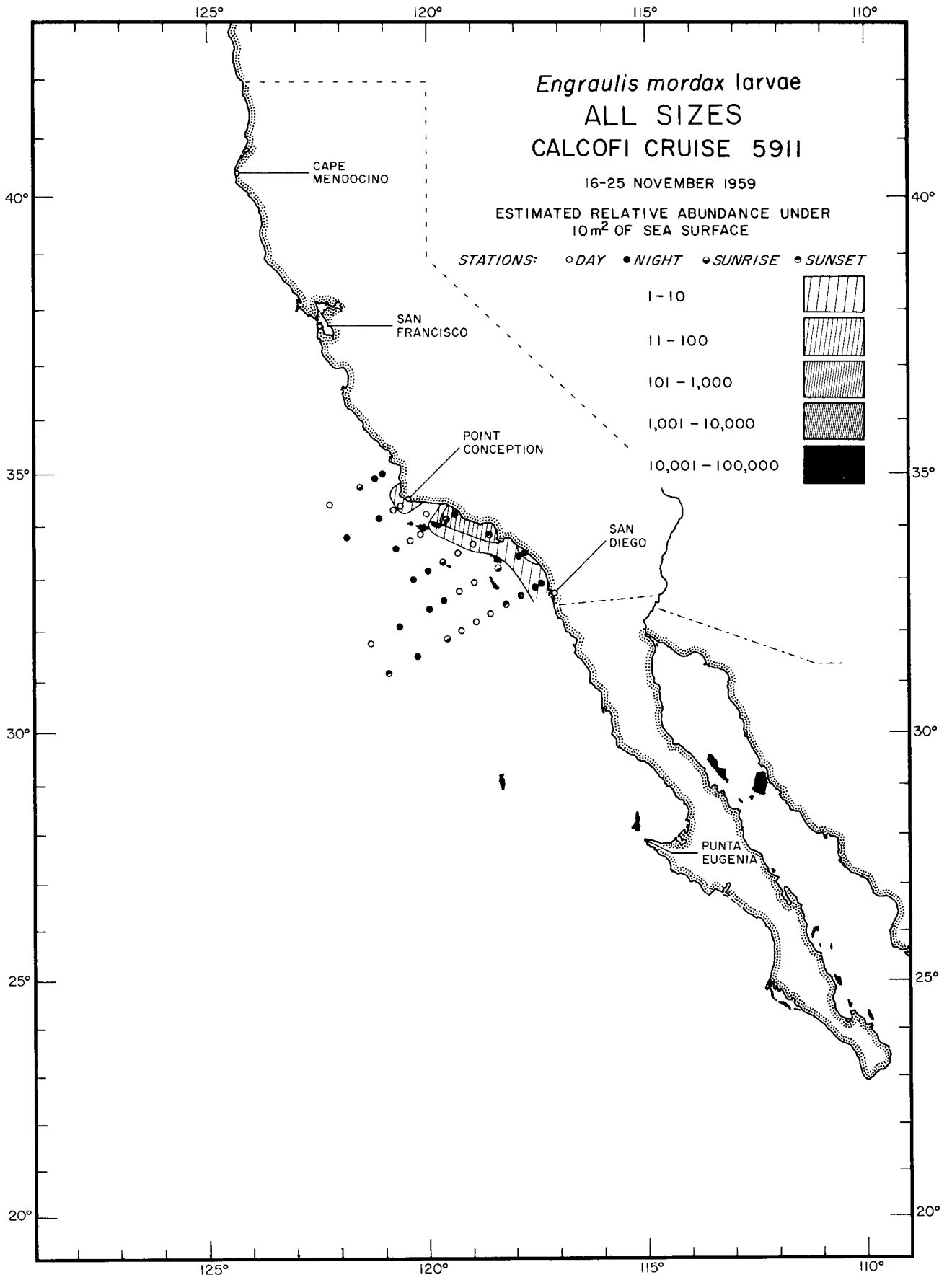


*Engraulis mordax* larvae  
All Sizes  
5910

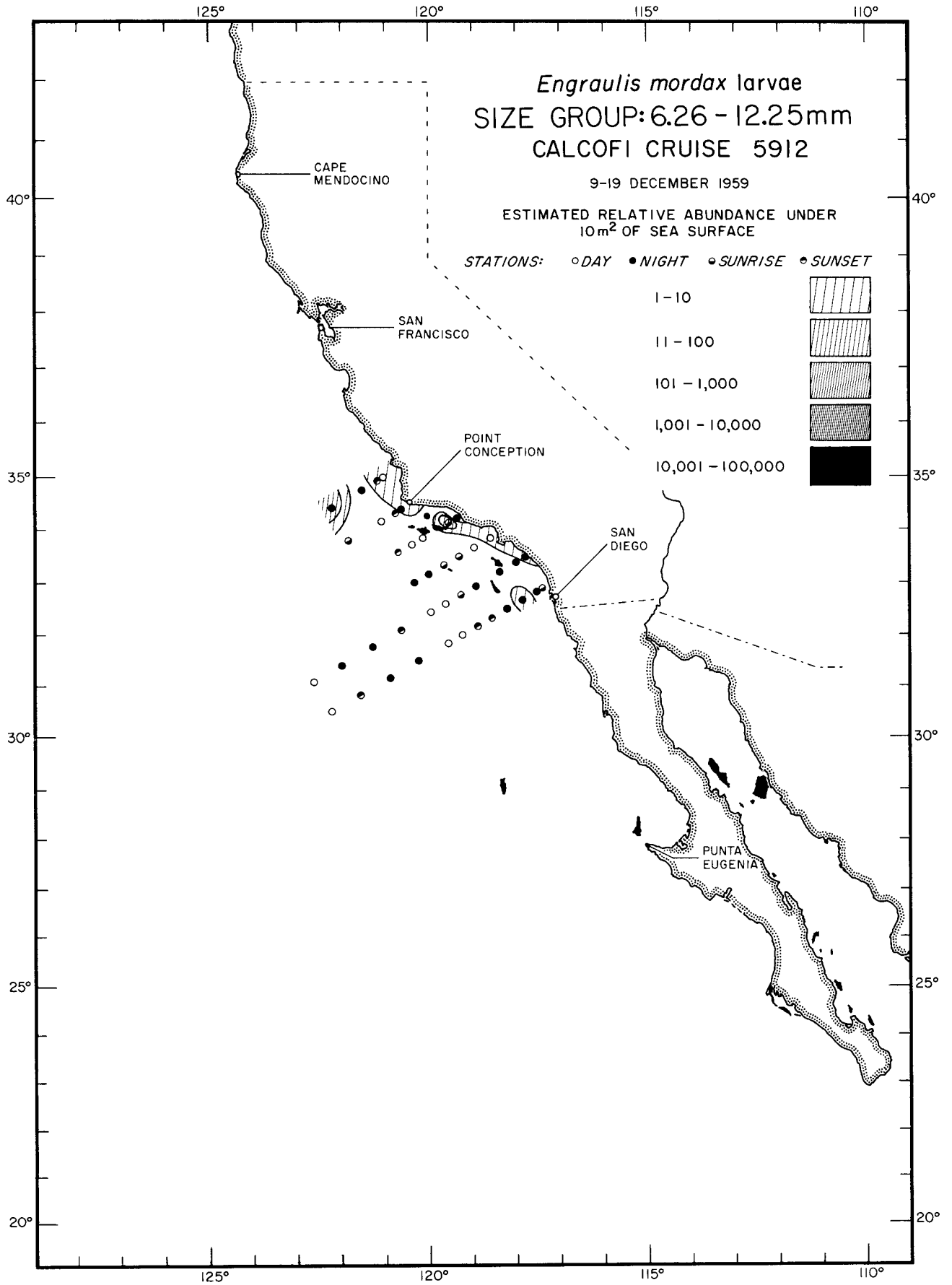




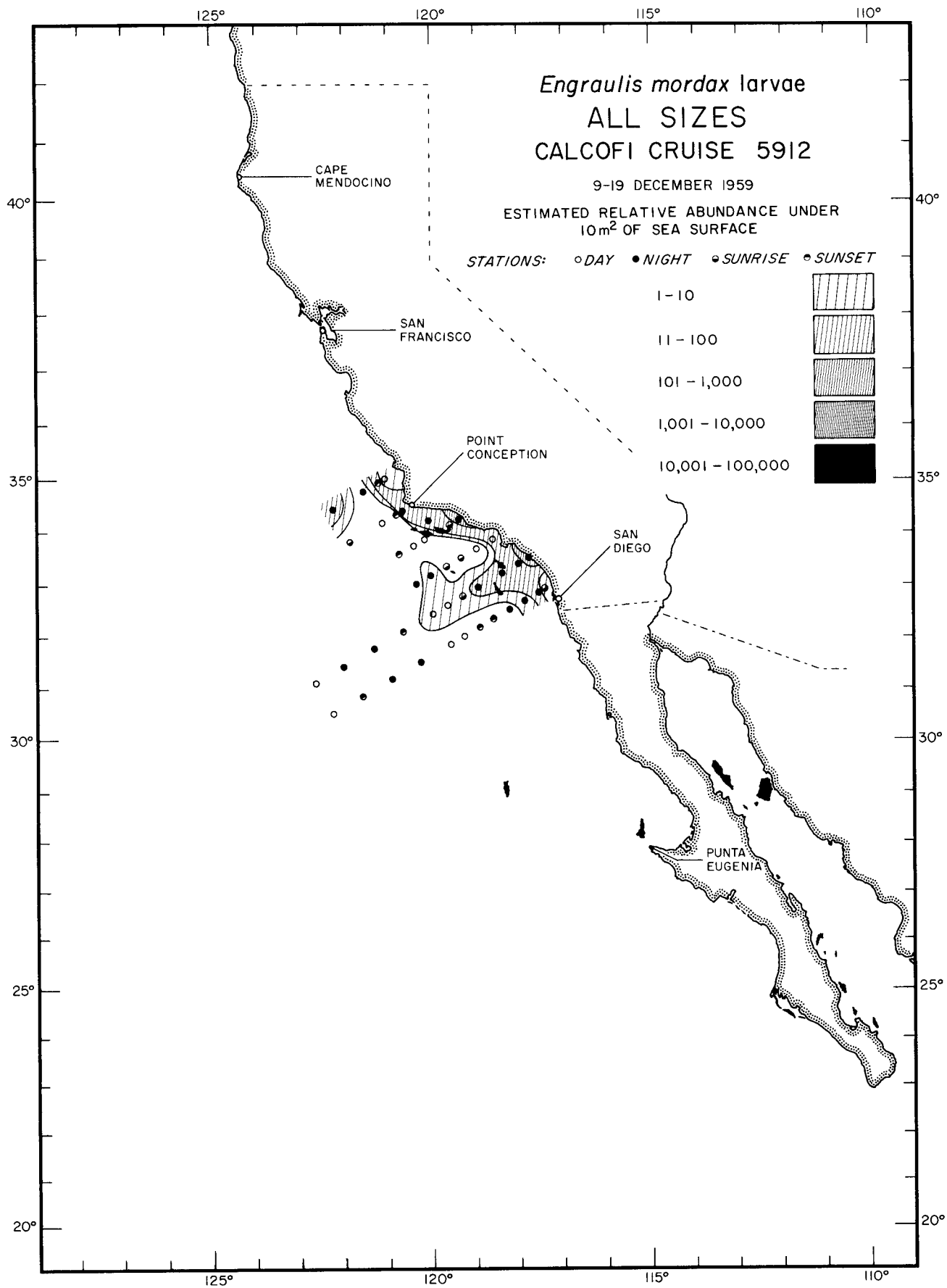
*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
5911

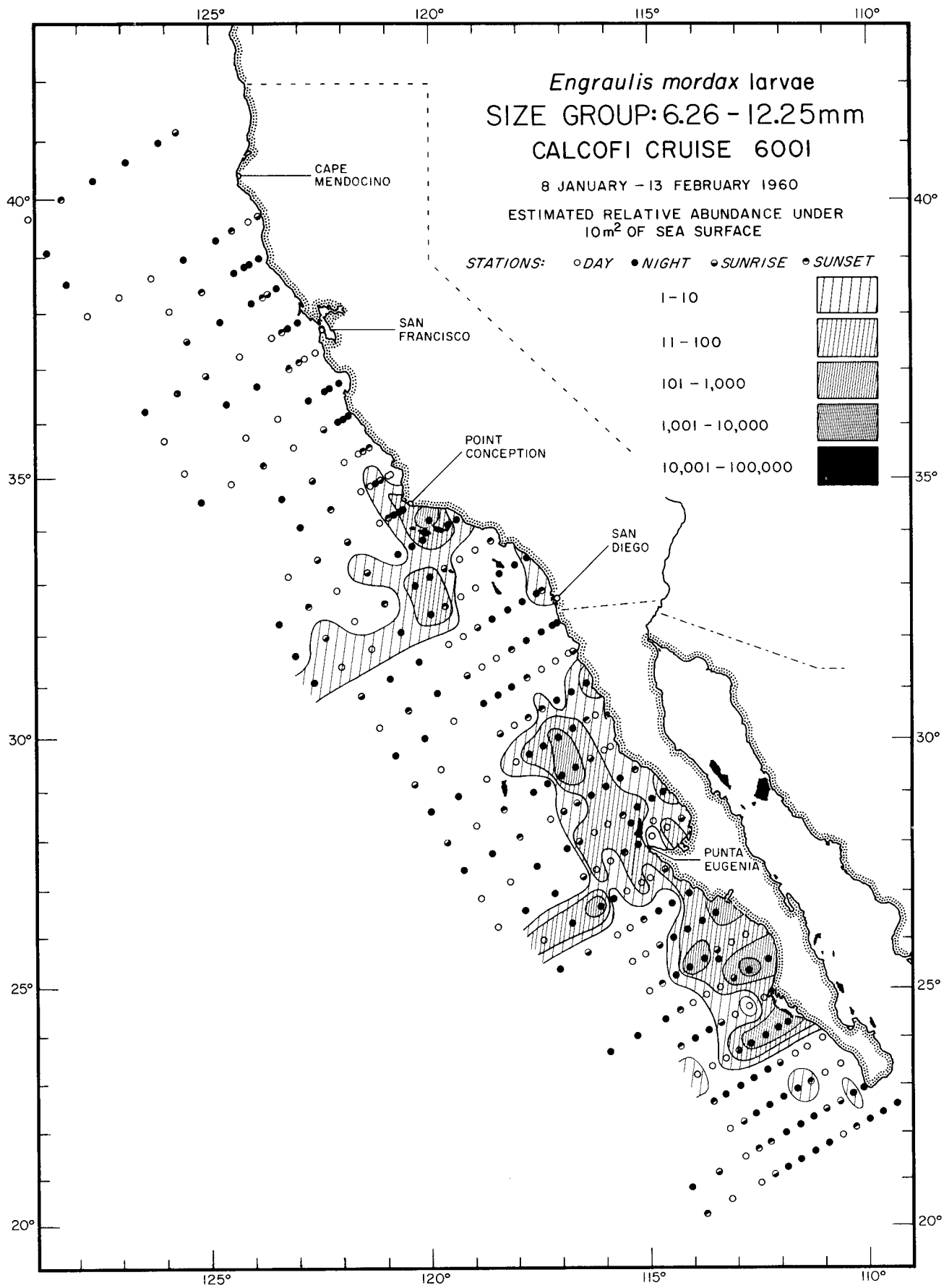


*Engraulis mordax* larvae  
All Sizes  
5911

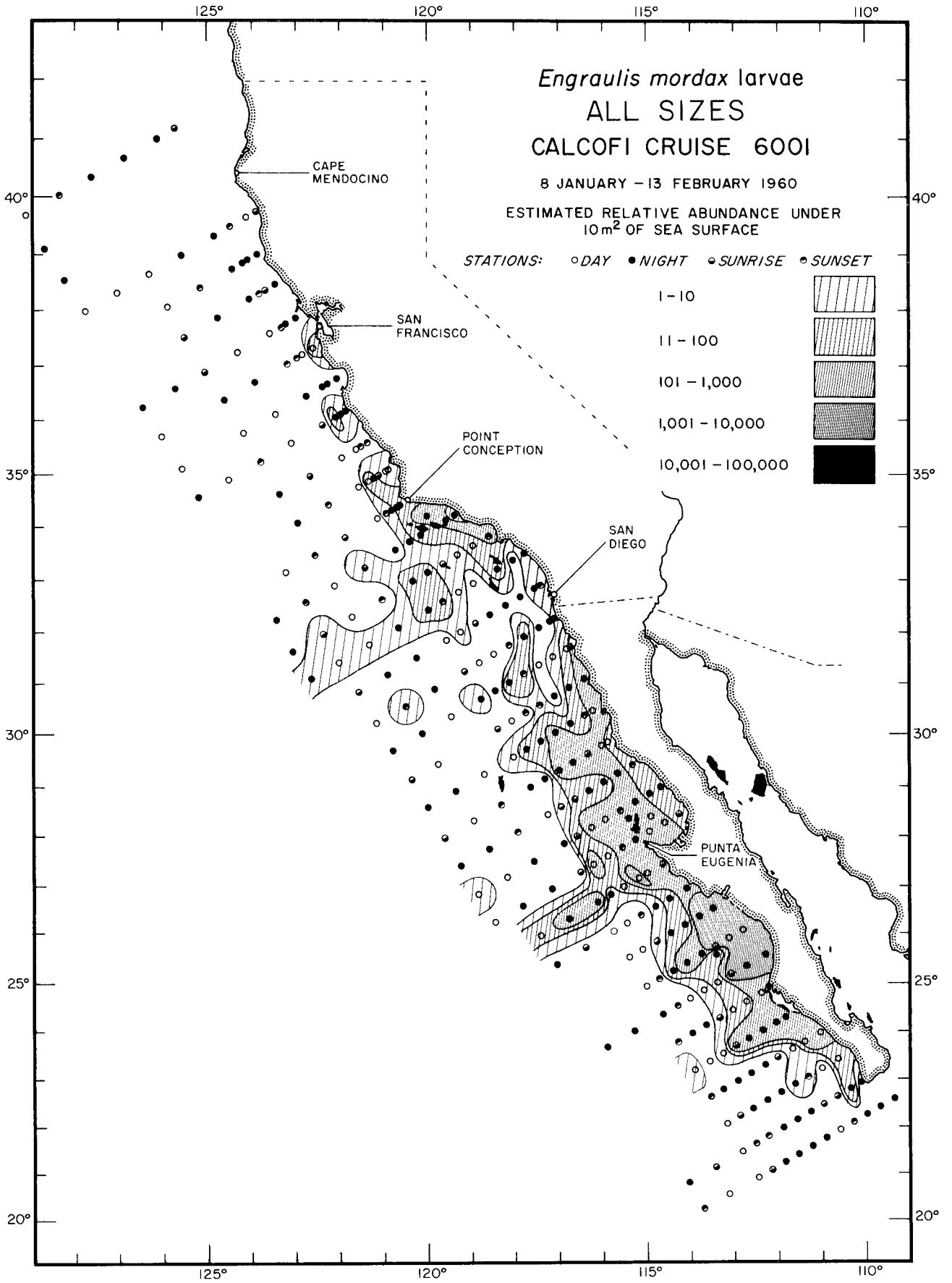


*Engraulis mordax* larvae  
 Size Group: 6.26-12.25mm  
 5912

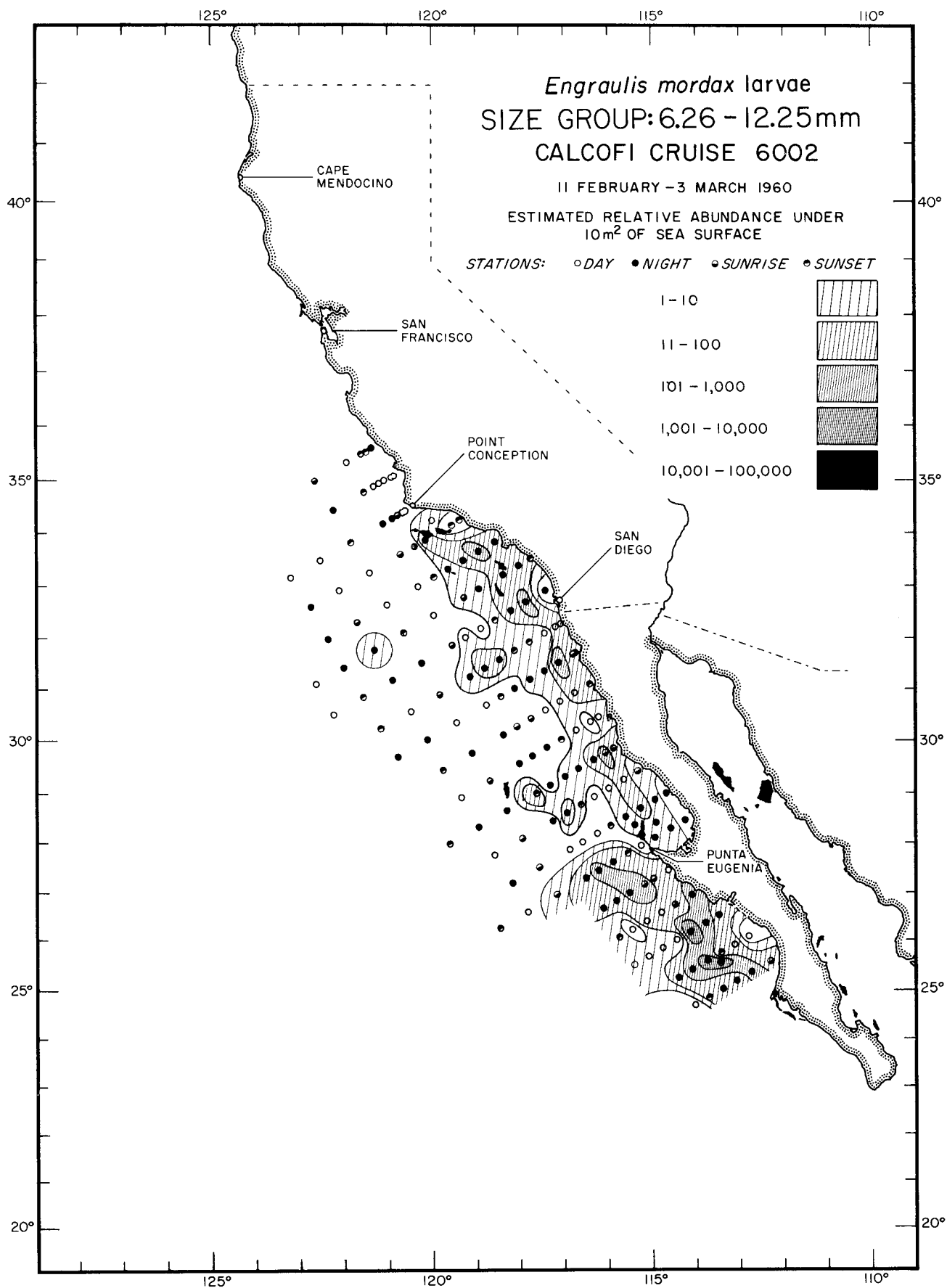
*Engraulis mordax* larvaeAll Sizes  
5912



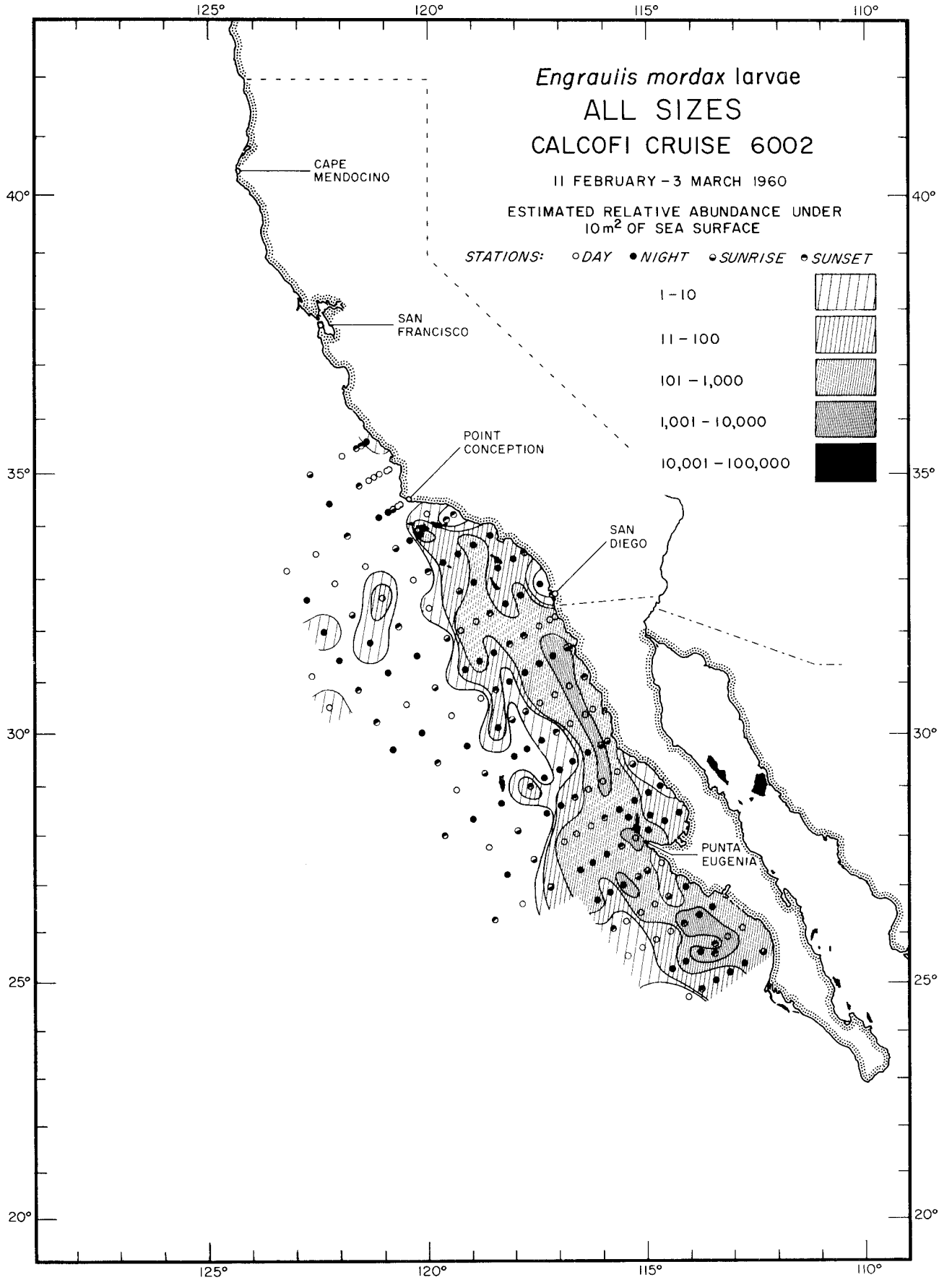
*Engraulis mordax* larvae  
 Size Group: 6.26-12.25mm  
 6001



*Engraulis mordax* larvae  
All Sizes  
6001



*Engraulis mordax* larvae  
 Size Group: 6.26-12.25mm  
 6002

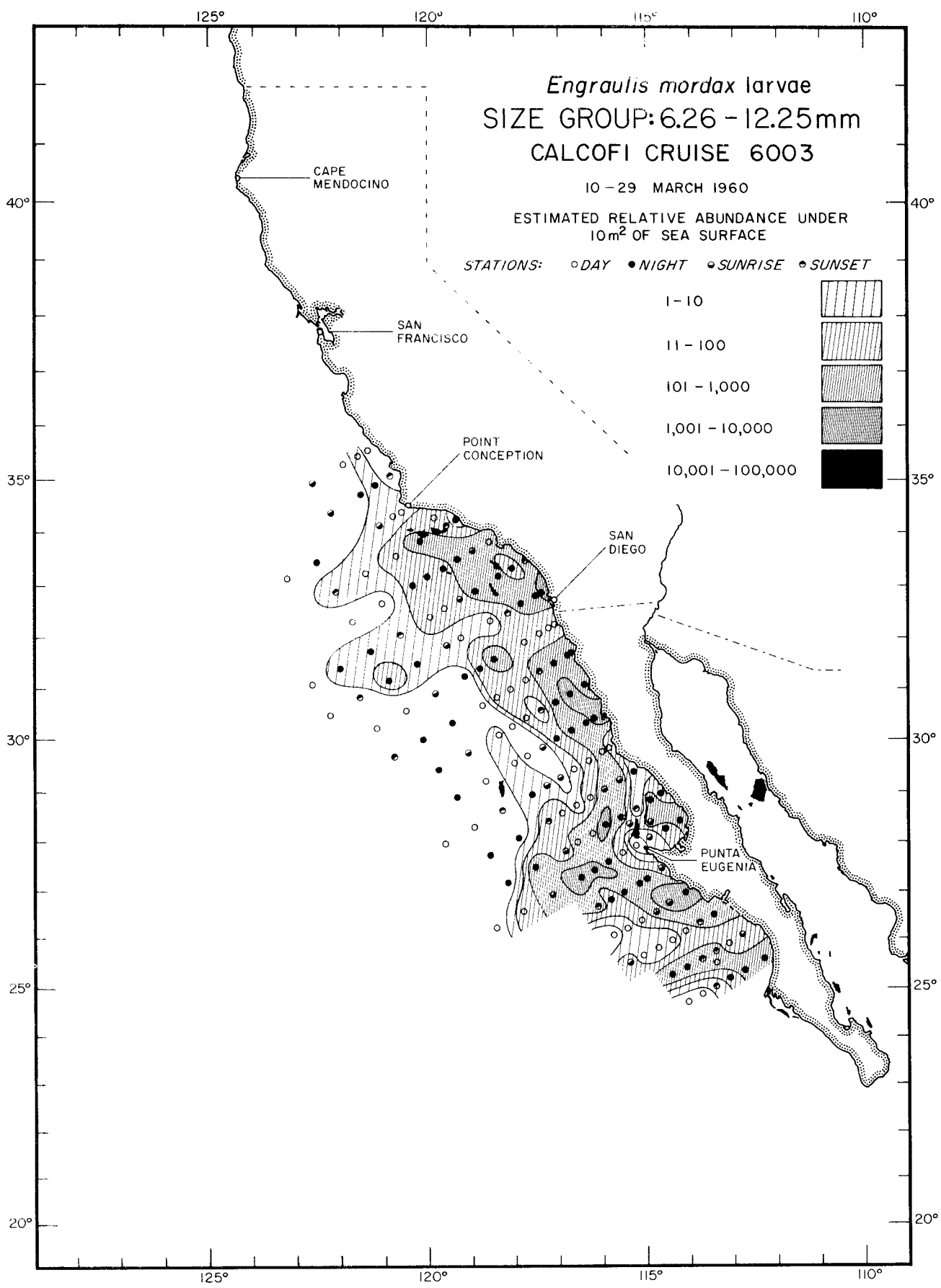


*Engraulis mordax* larvae

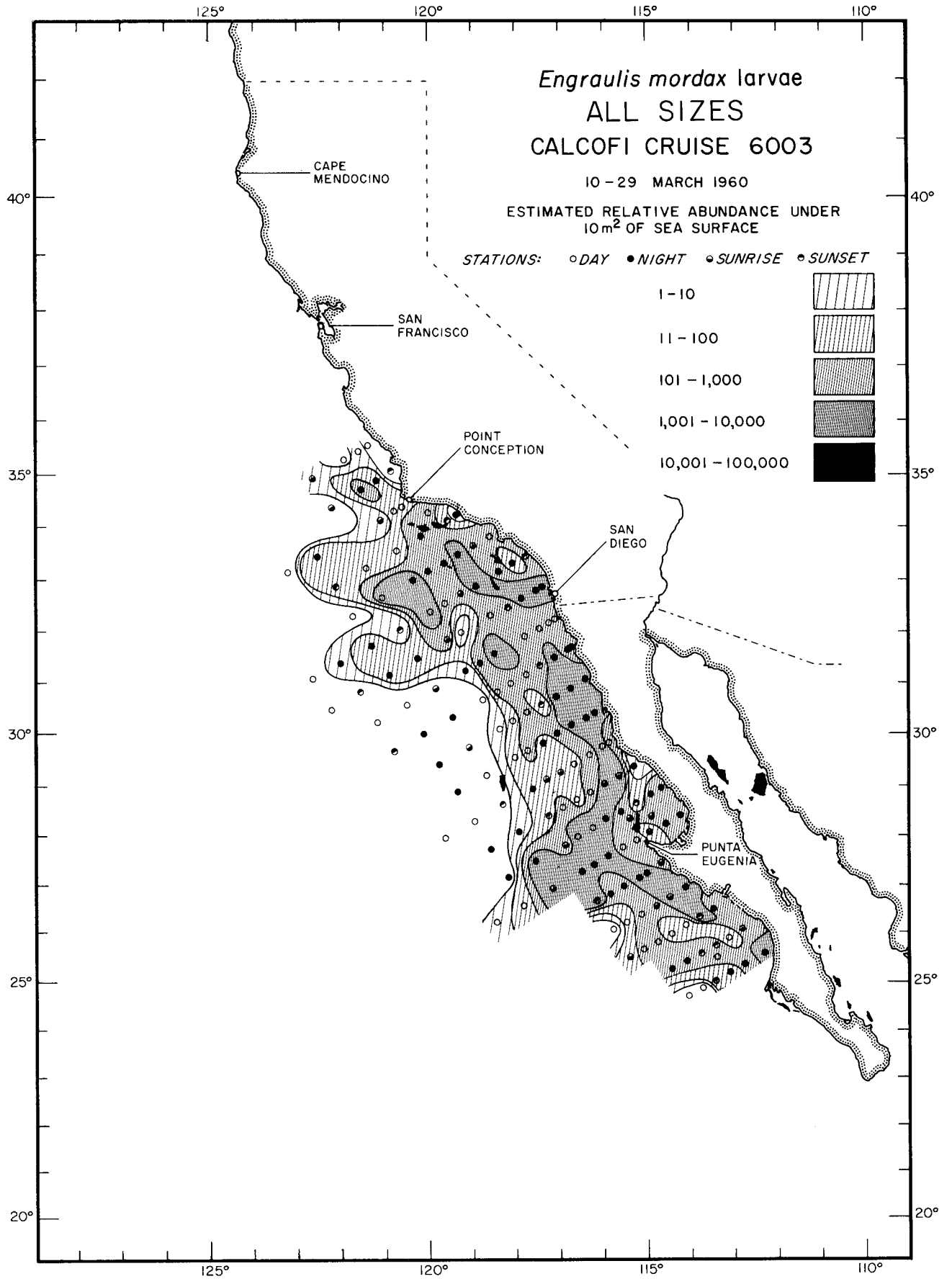
All Sizes

6002



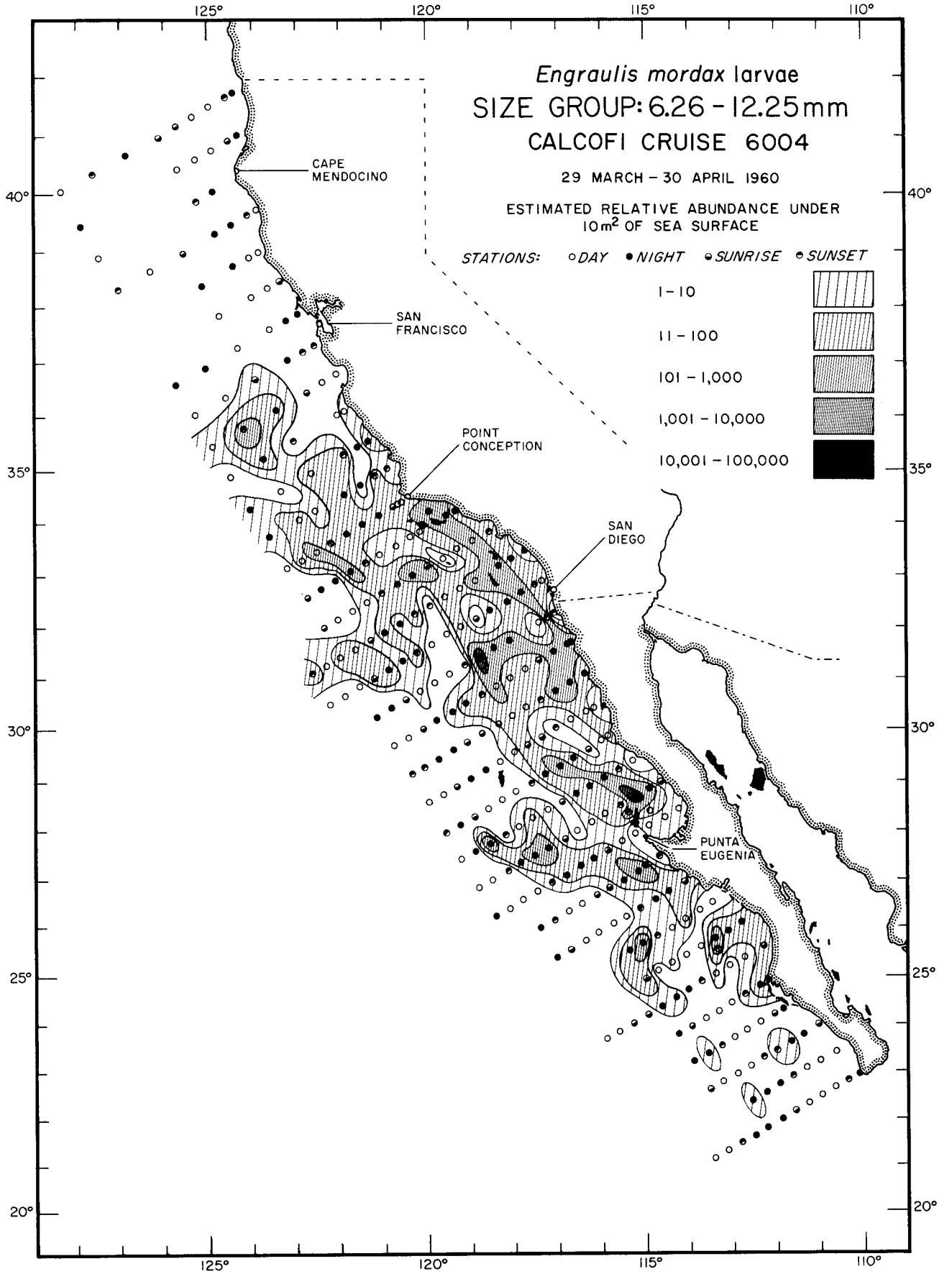


*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
6003

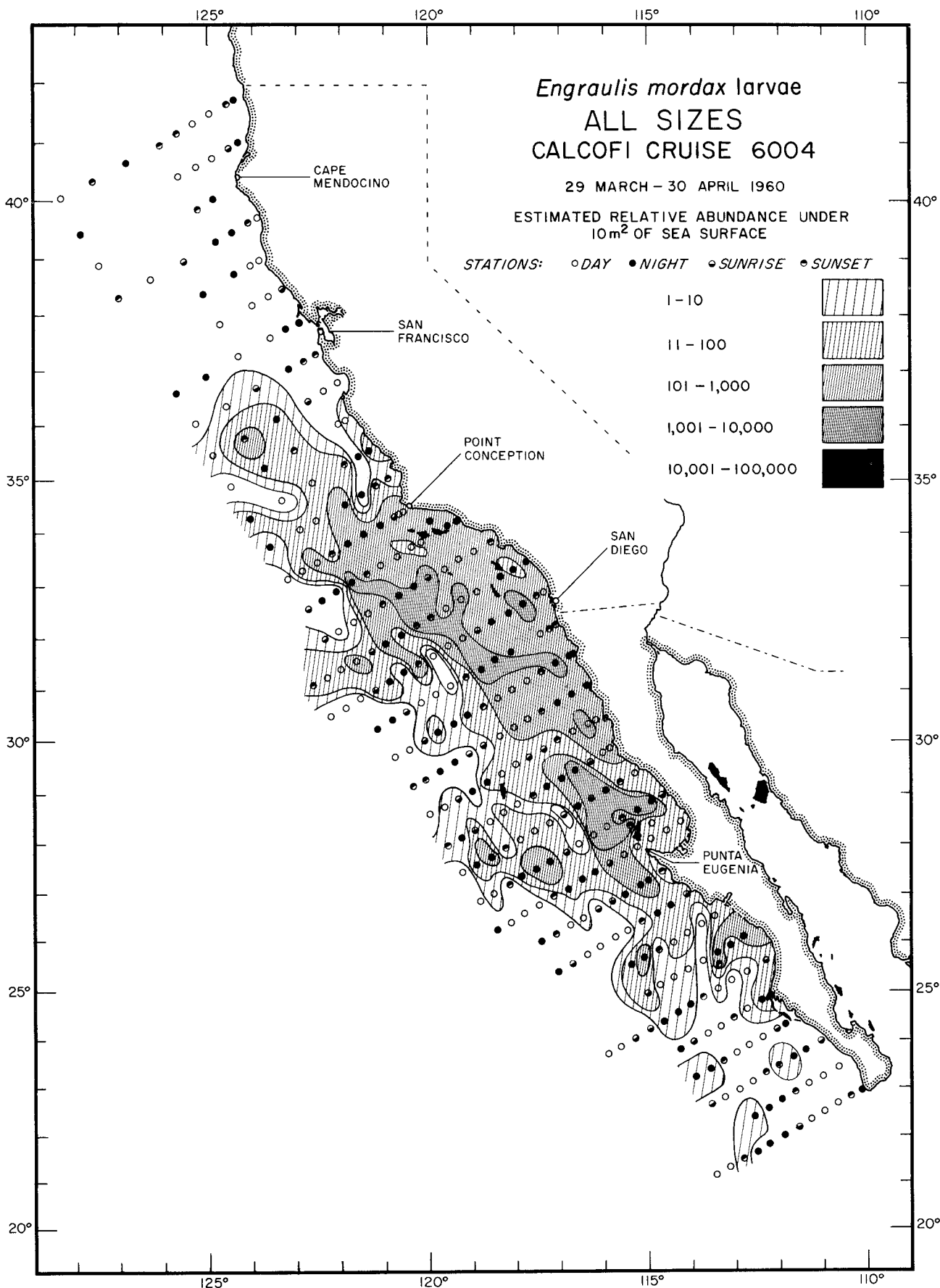


*Engraulis mordax* larvae

All Sizes  
6003

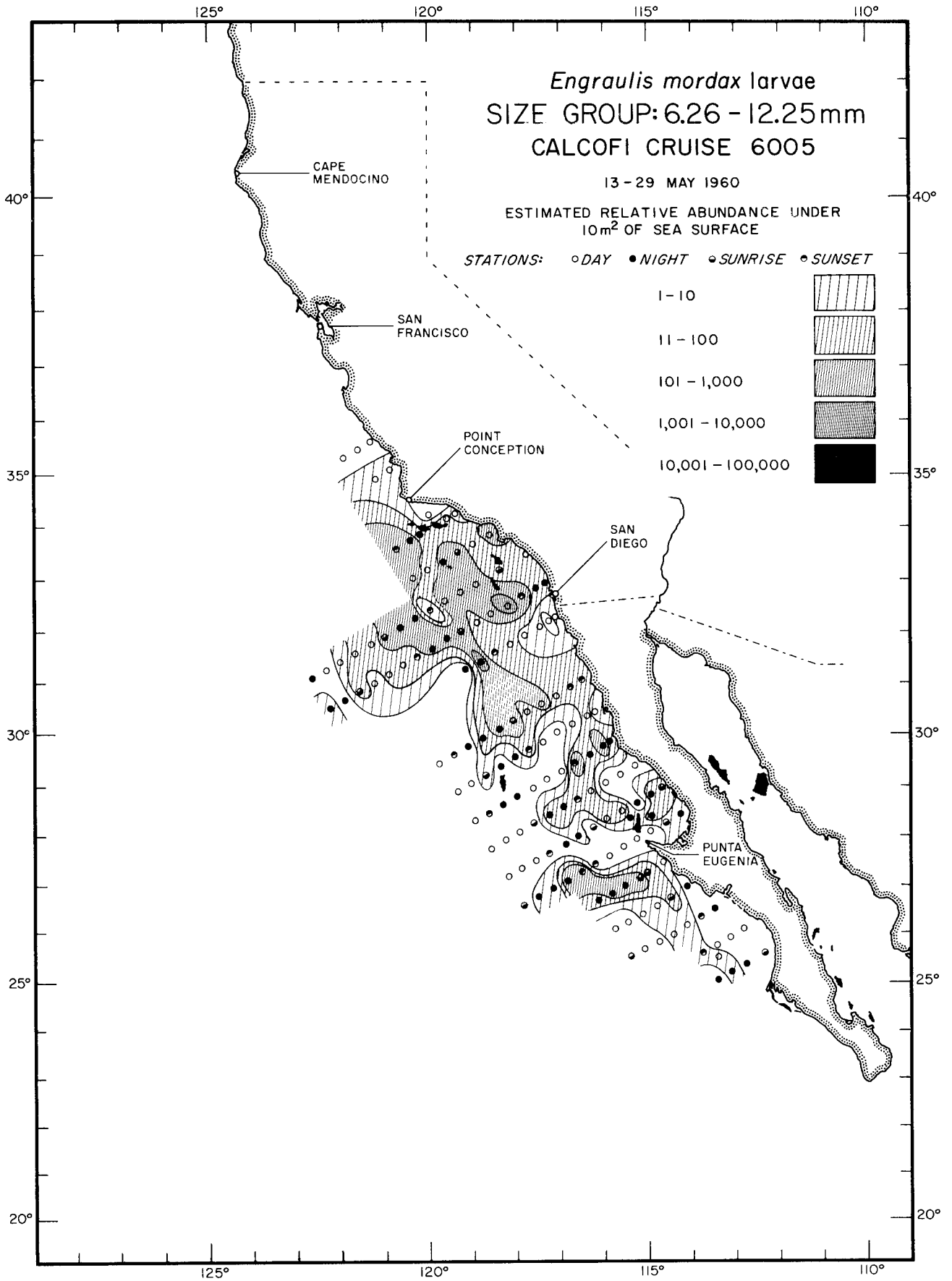


*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
6004

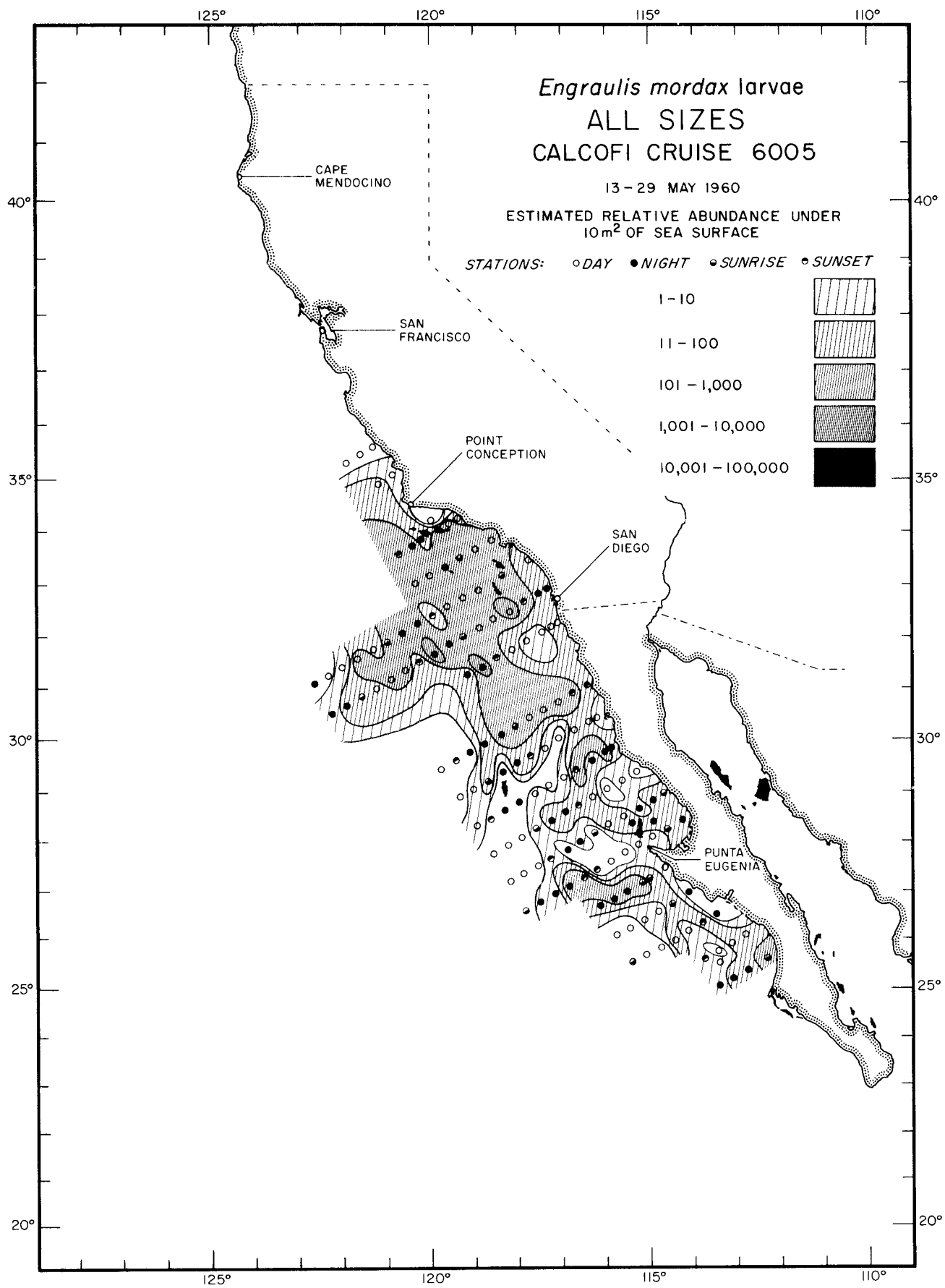


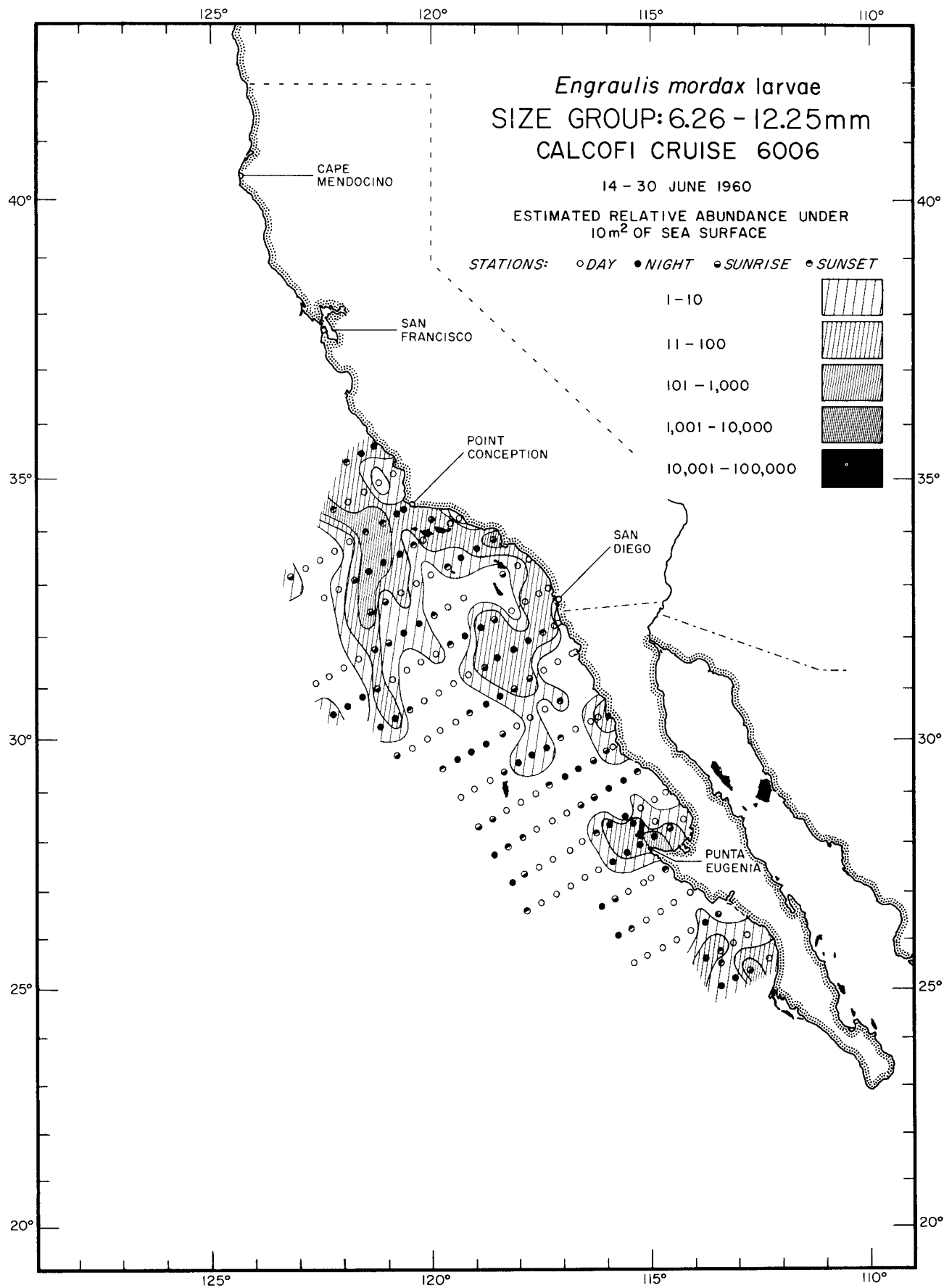
*Engraulis mordax* larvae

All Sizes  
6004

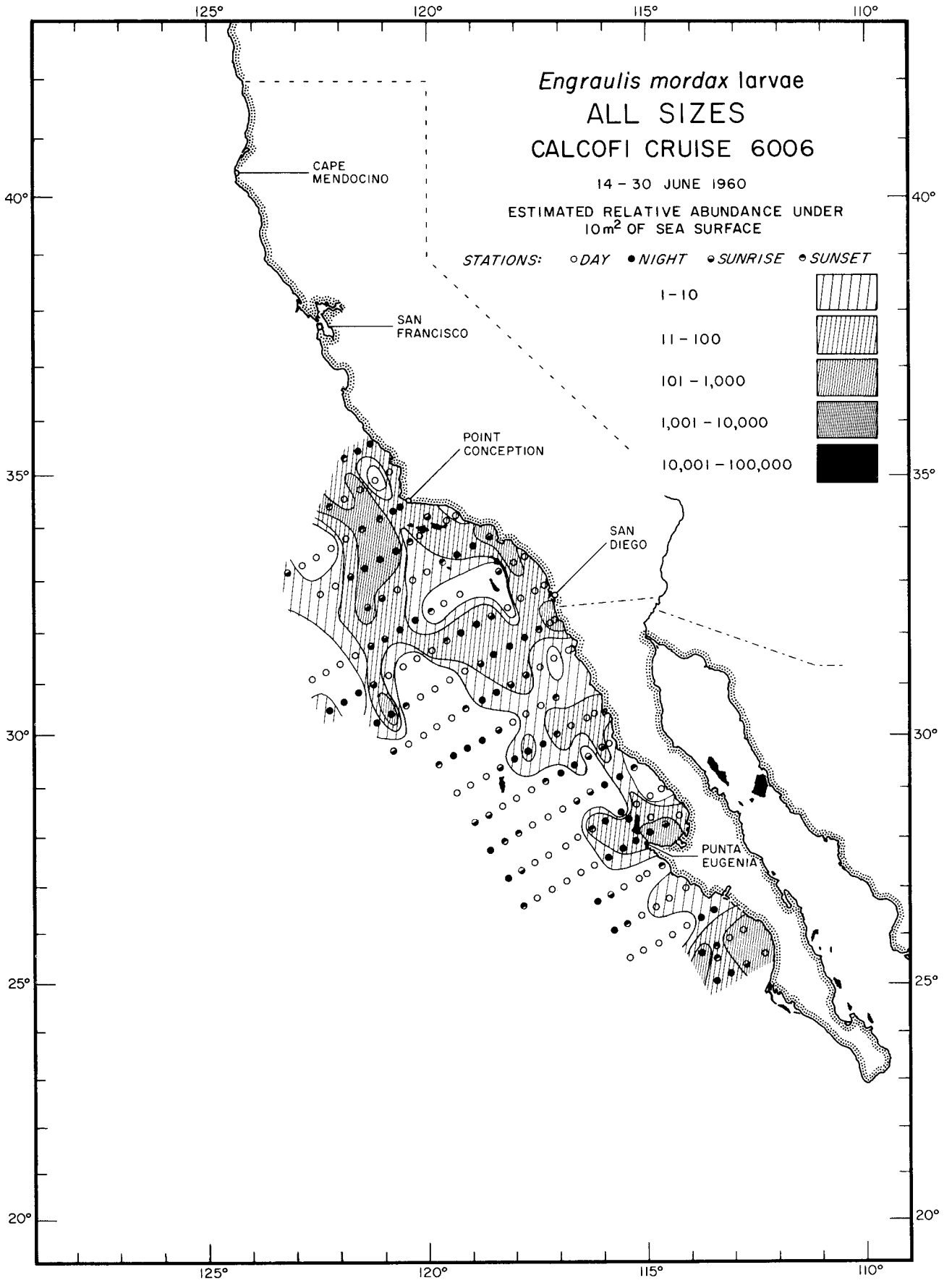


*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
6005

*Engraulis mordax* larvaeAll Sizes  
6005

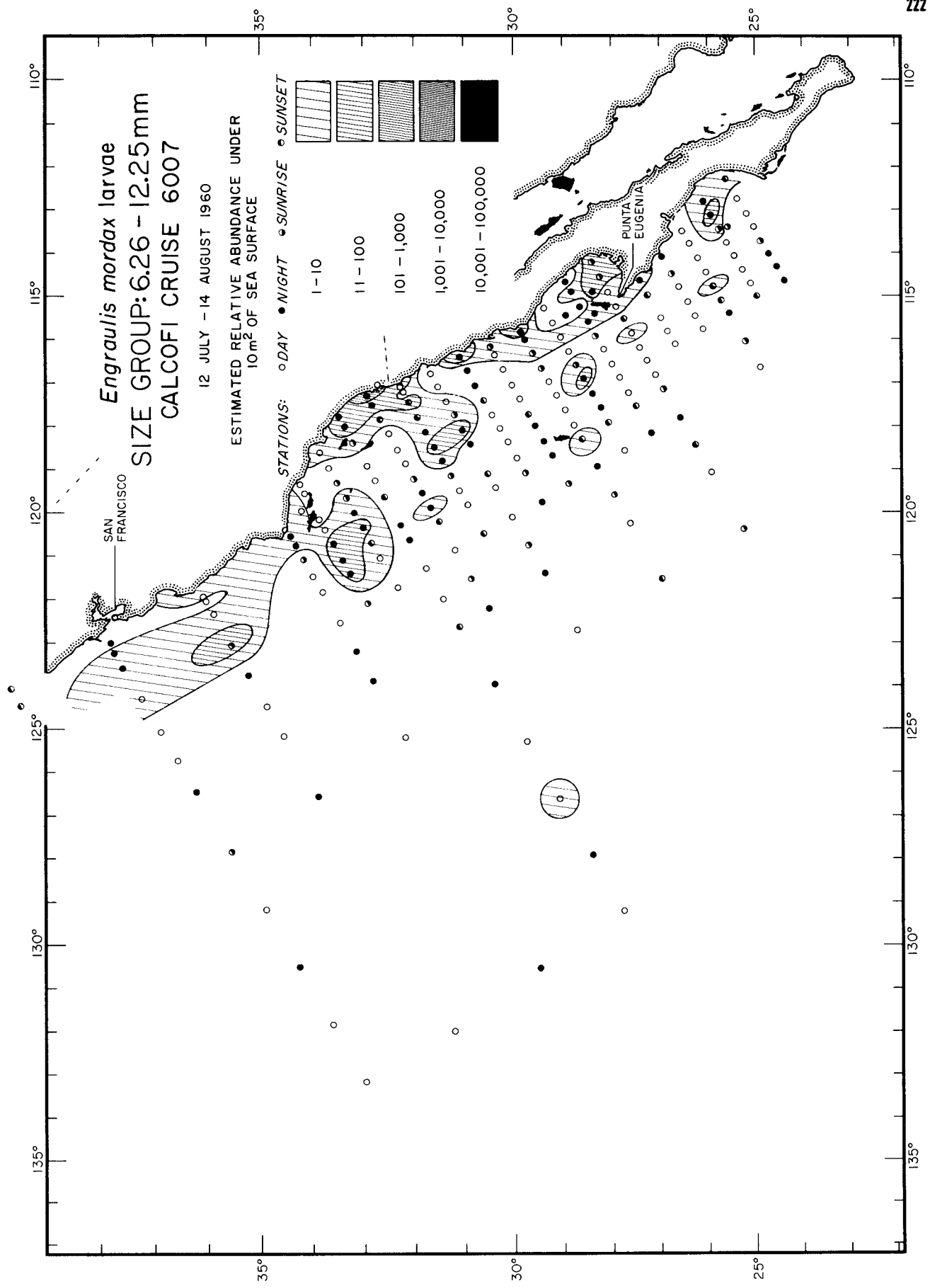


*Engraulis mordax* larvae  
 Size Group: 6.26-12.25mm  
 6006

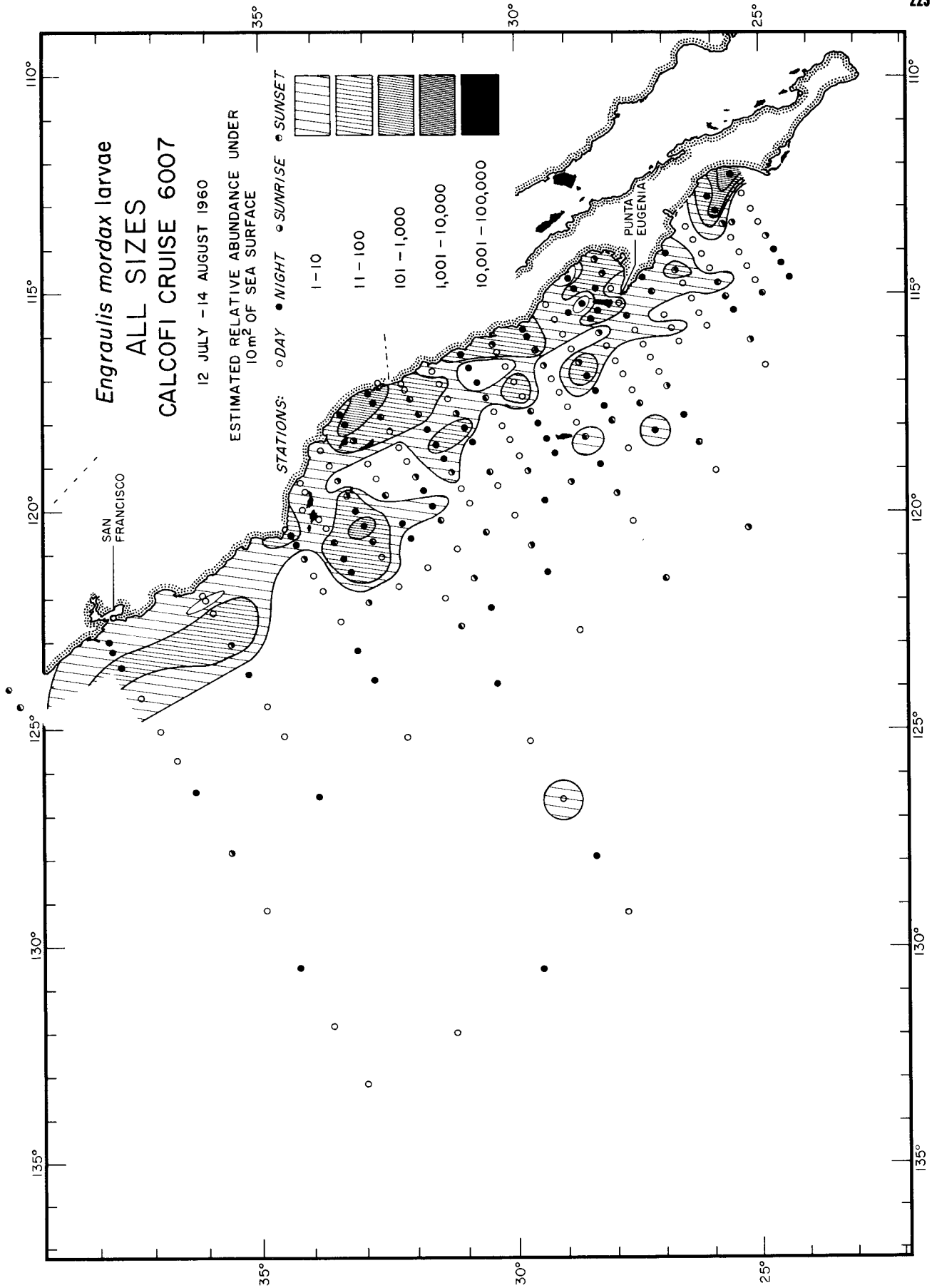


*Engraulis mordax* larvae  
All Sizes  
6006





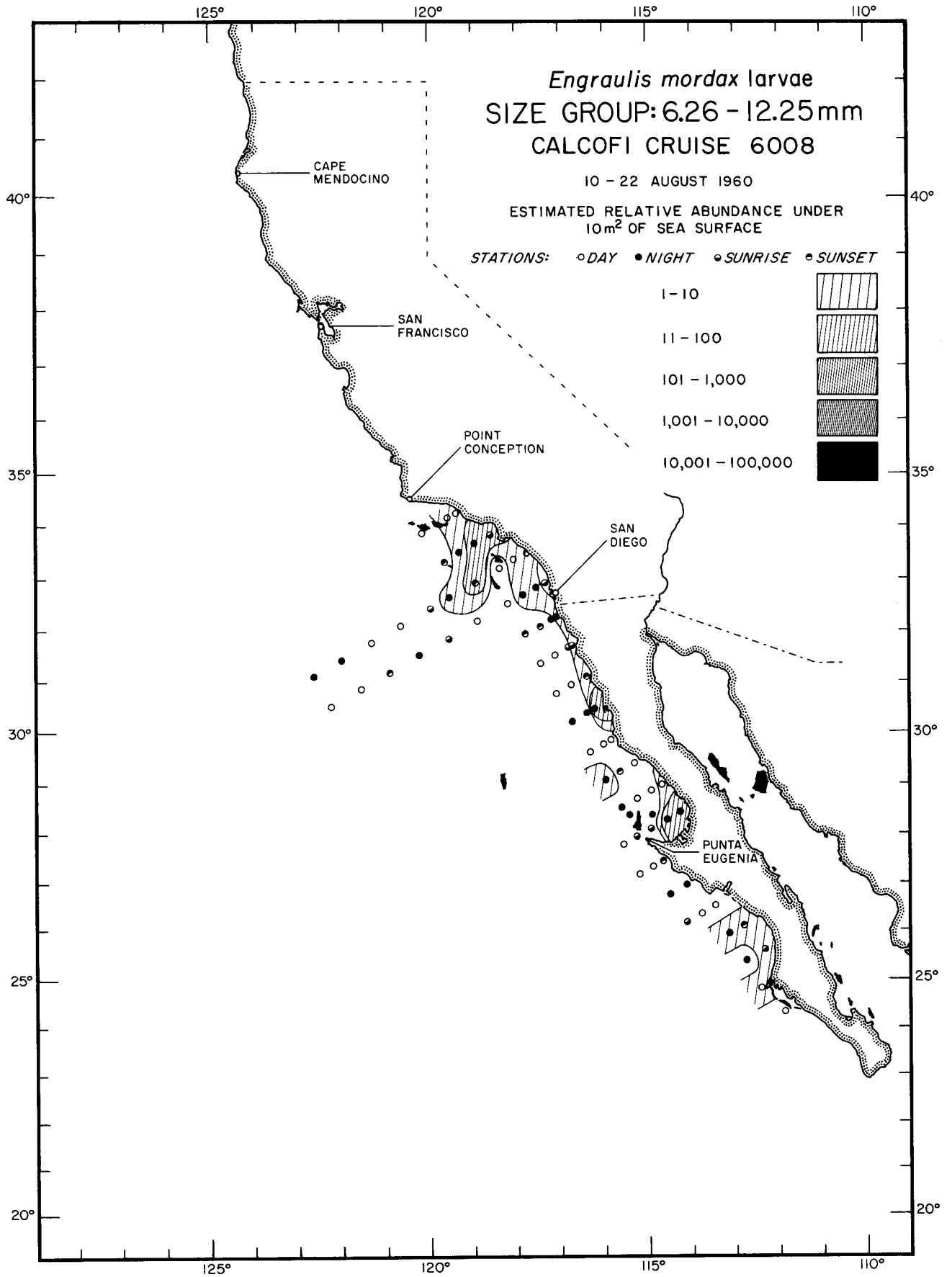
*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
6007



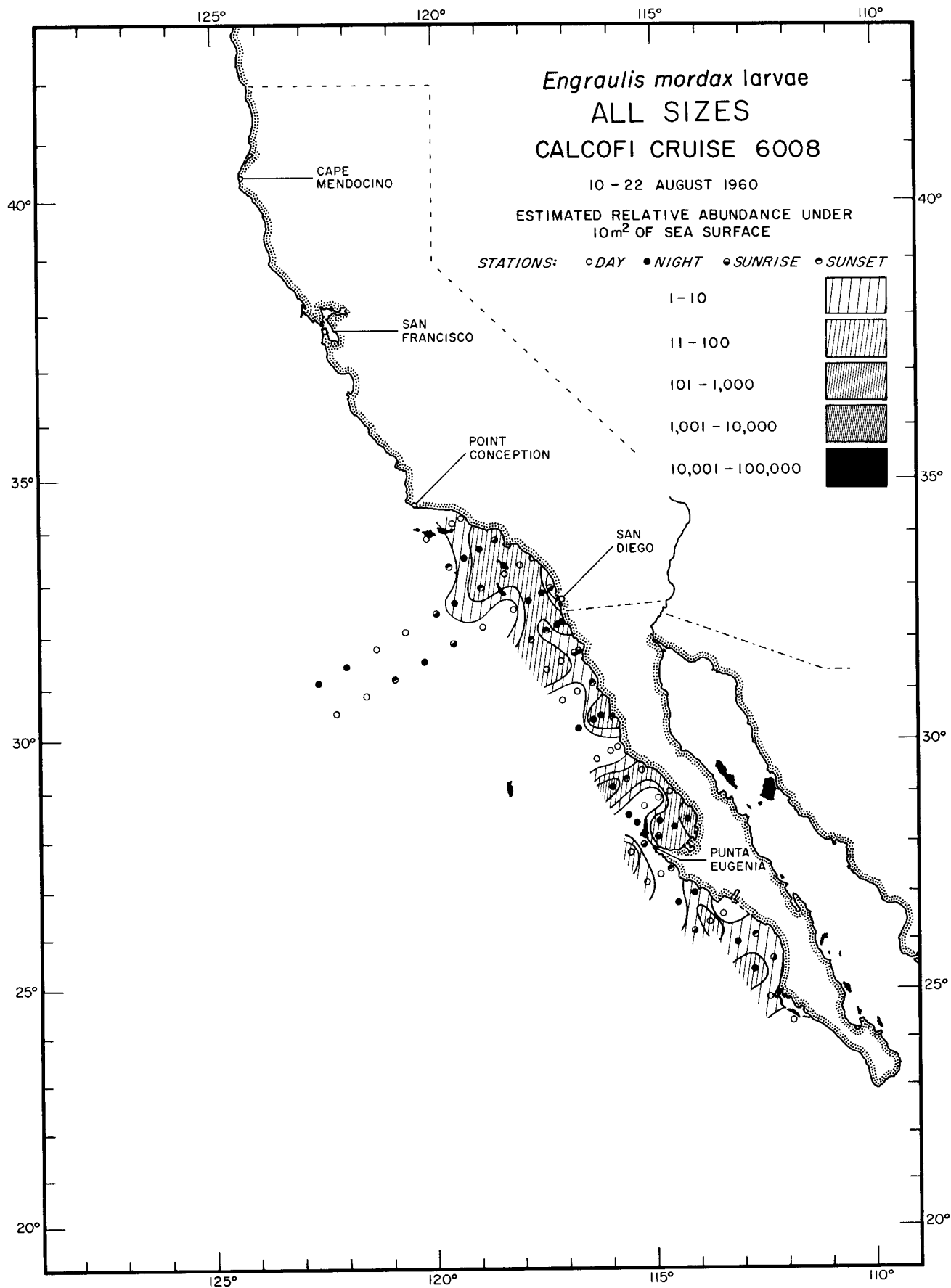
*Engraulis mordax* larvae

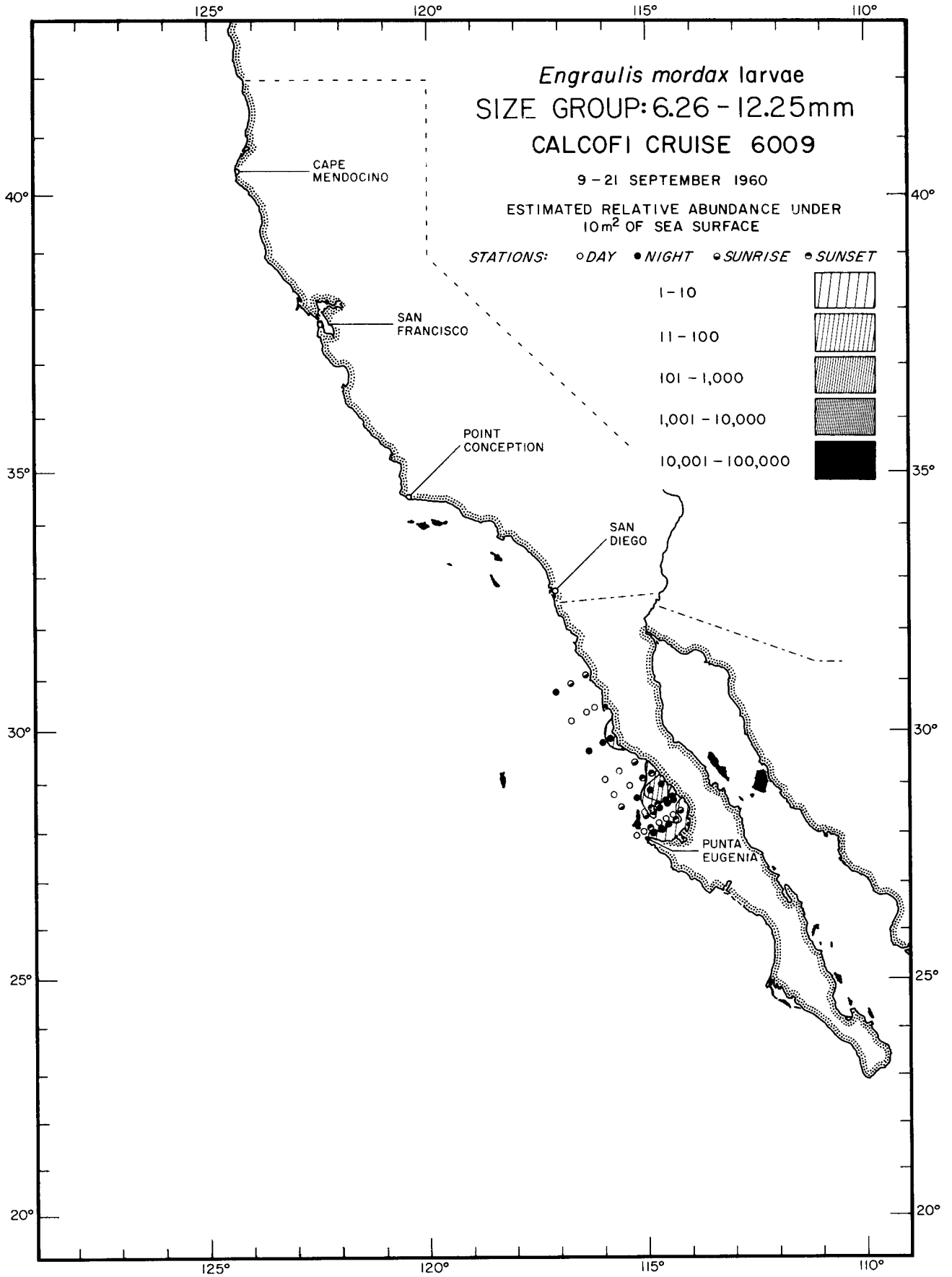
All Sizes

6007

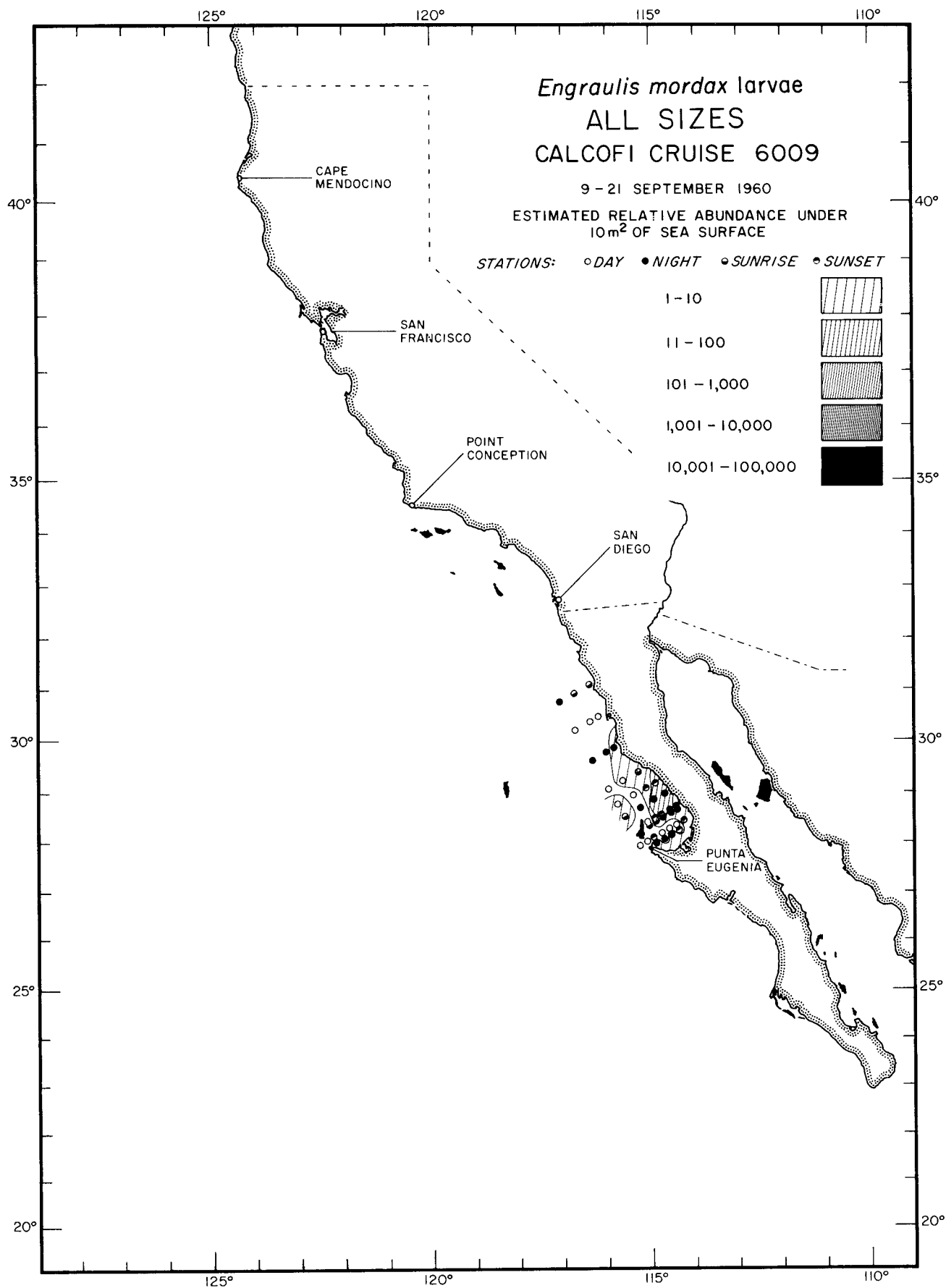


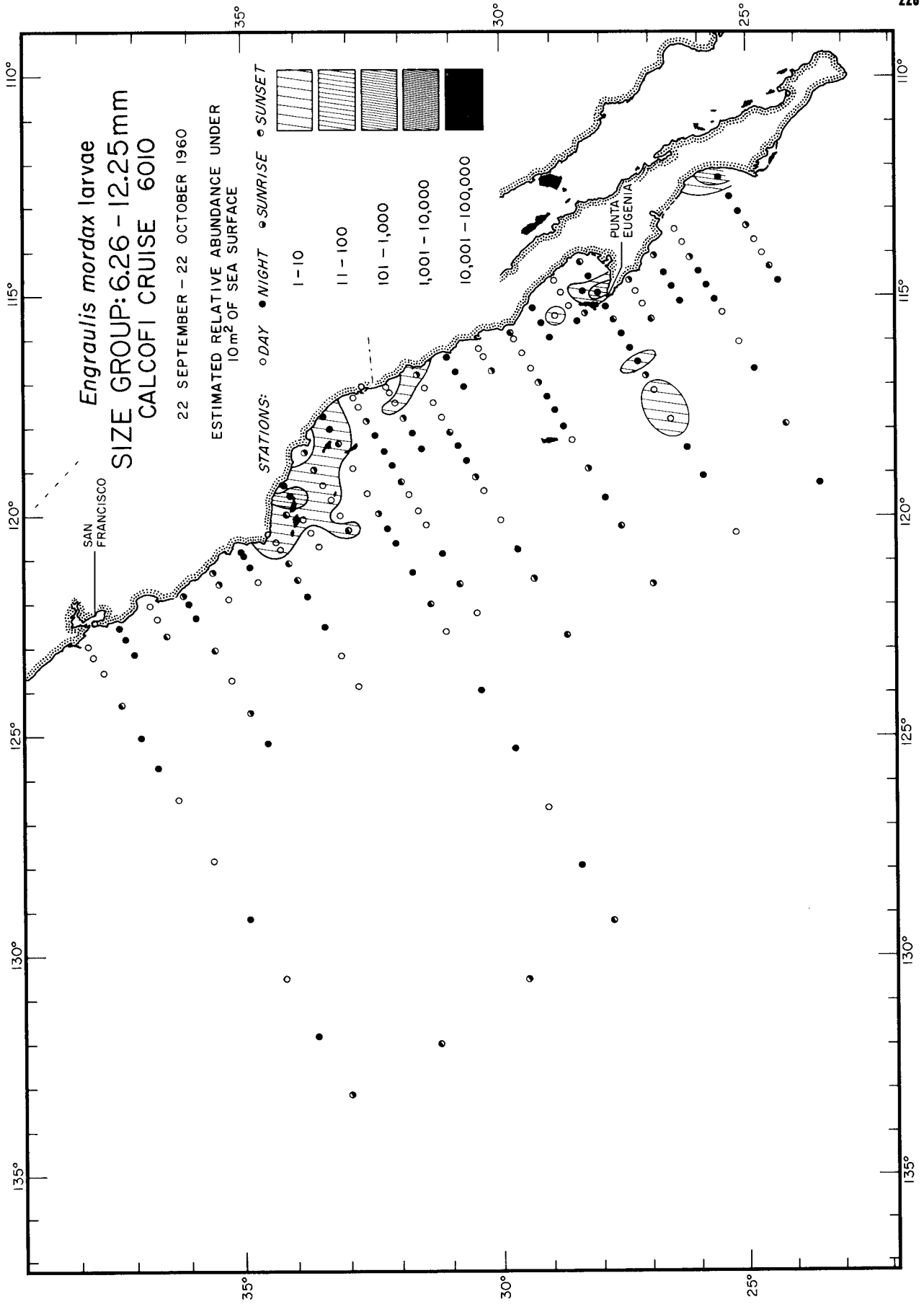
*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
6008

*Engraulis mordax* larvaeAll Sizes  
6008

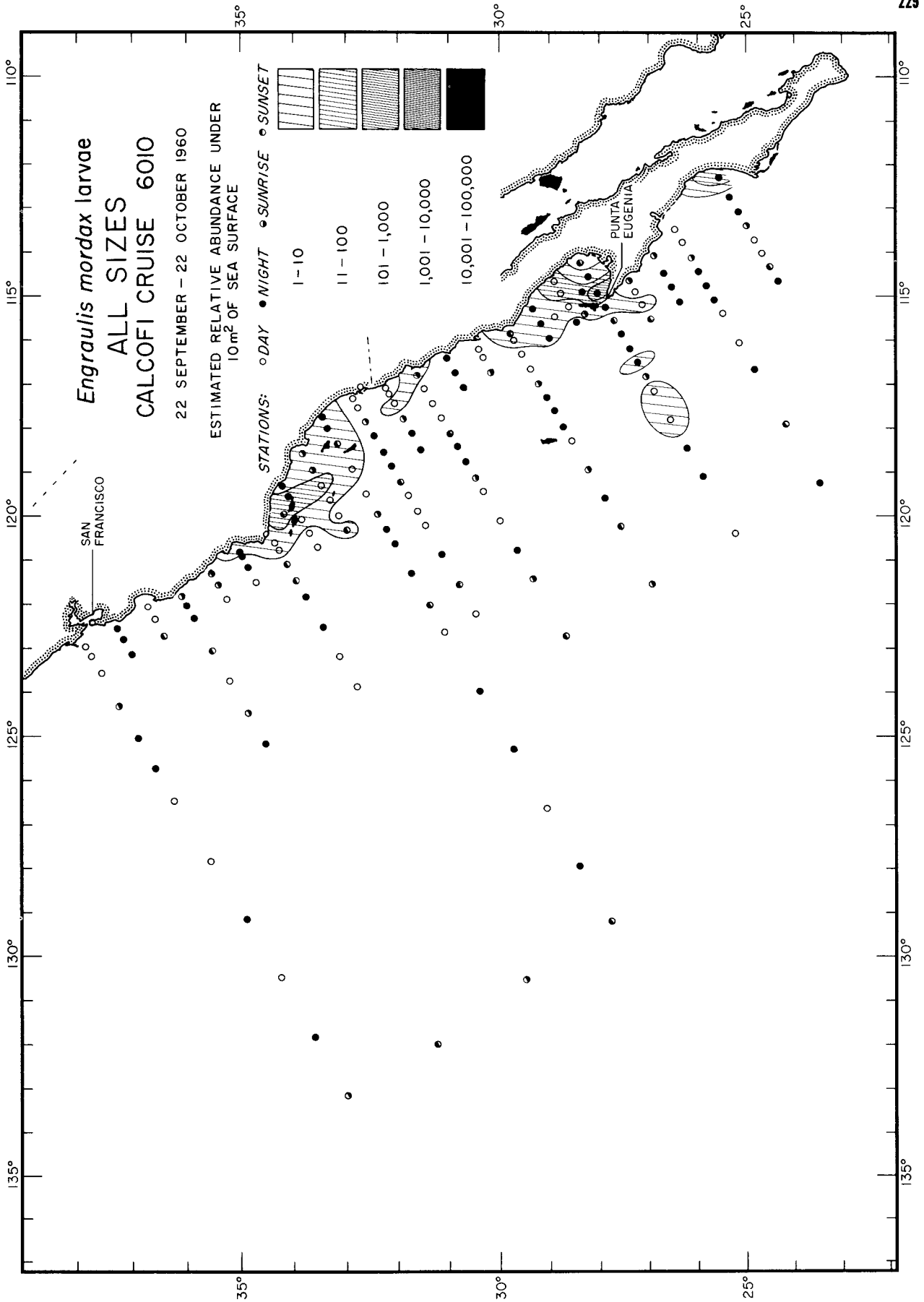


*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
6009

*Engraulis mordax* larvaeAll Sizes  
6009

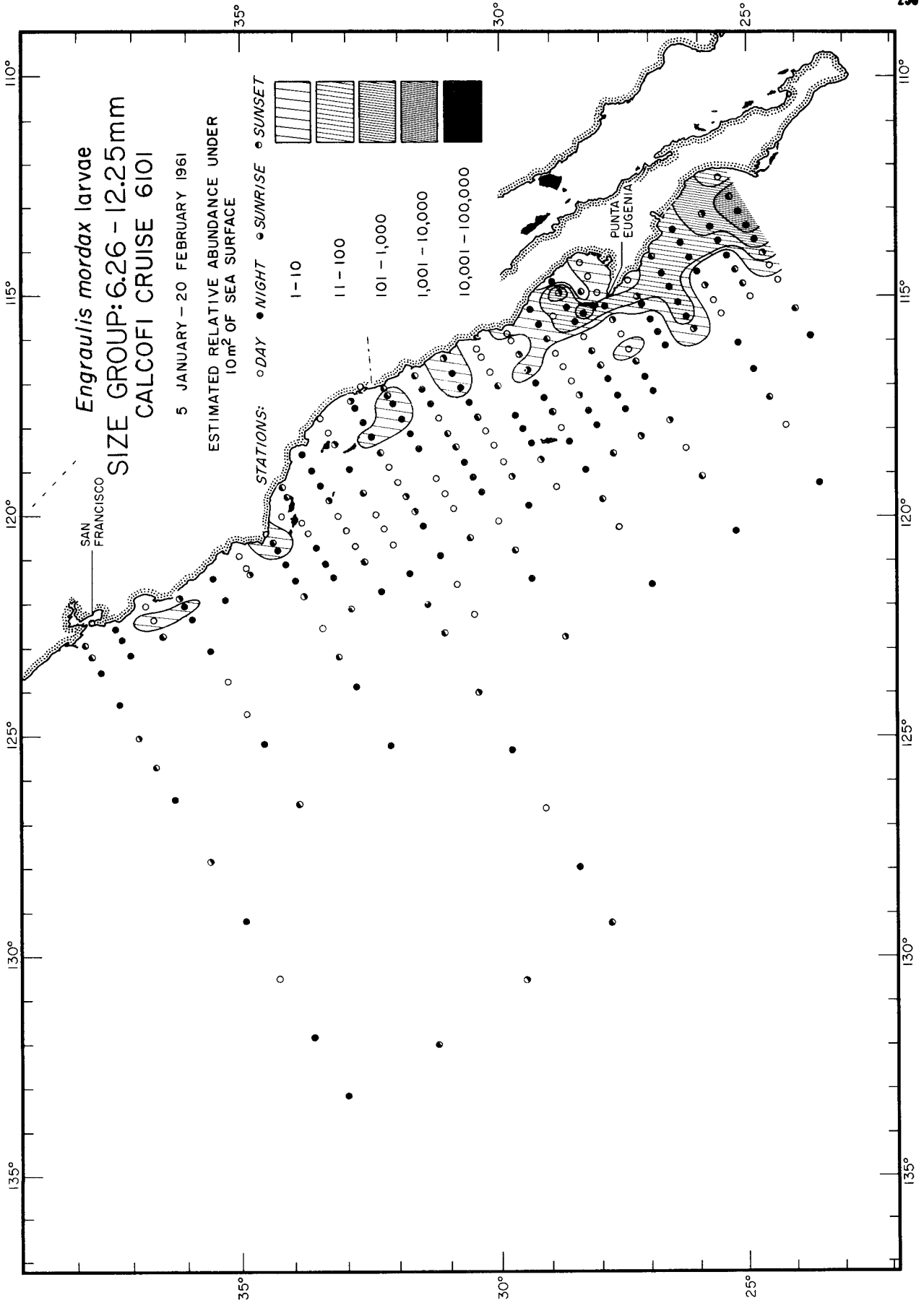


*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
6010

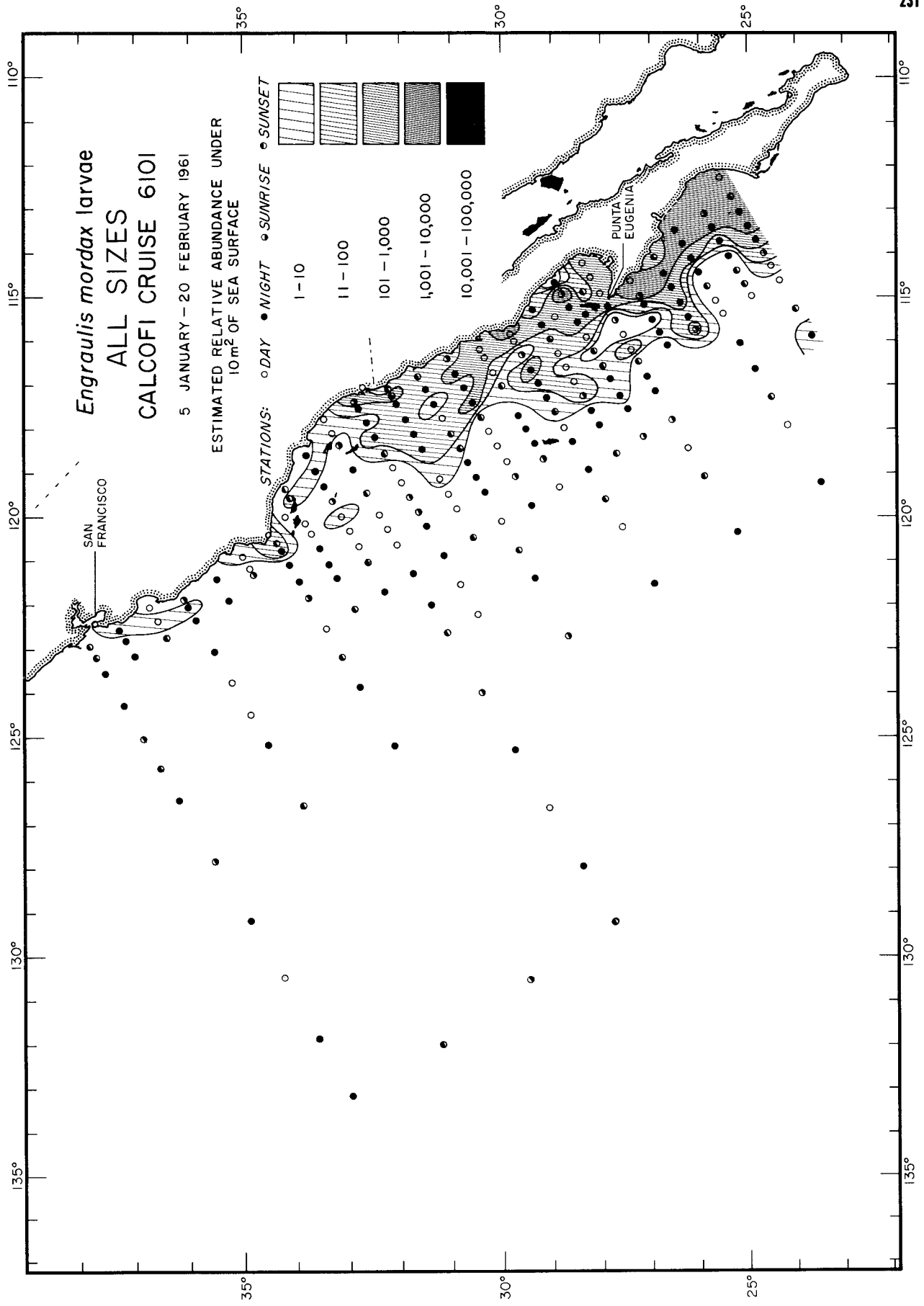


*Engraulis mordax* larvae  
All Sizes  
6010

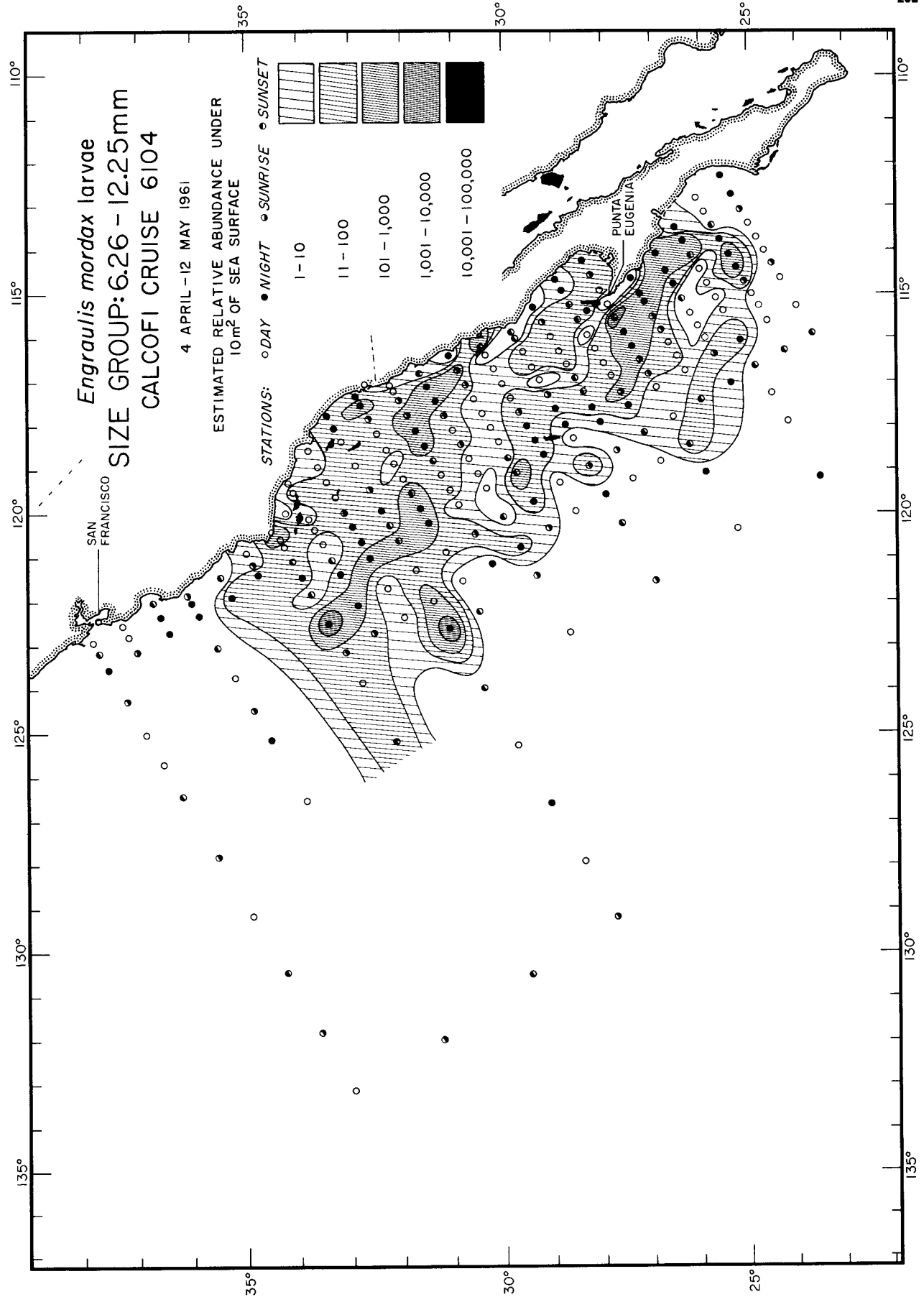




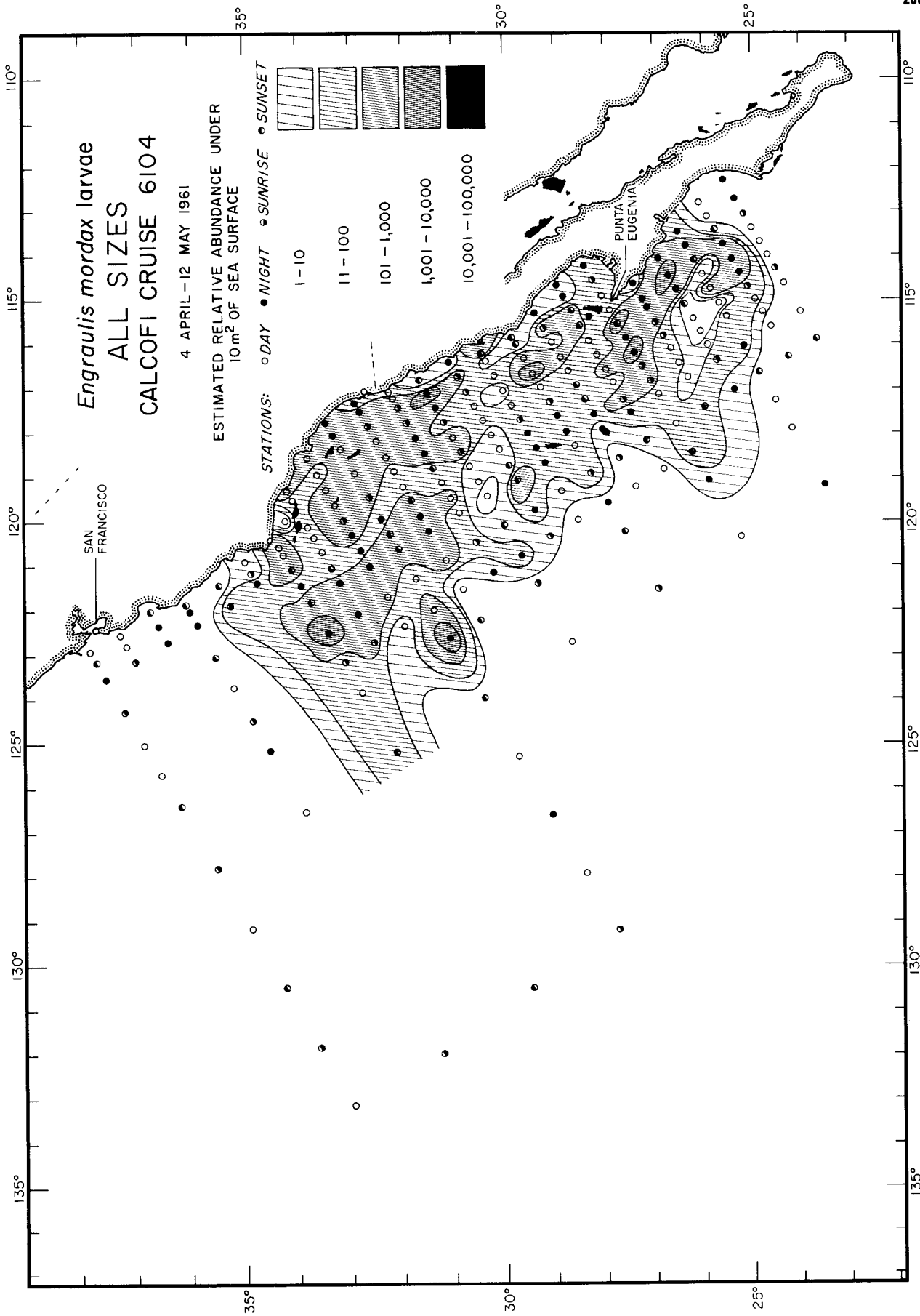
*Engraulis mordax* larvae  
 Size Group: 6.26-12.25mm  
 6101



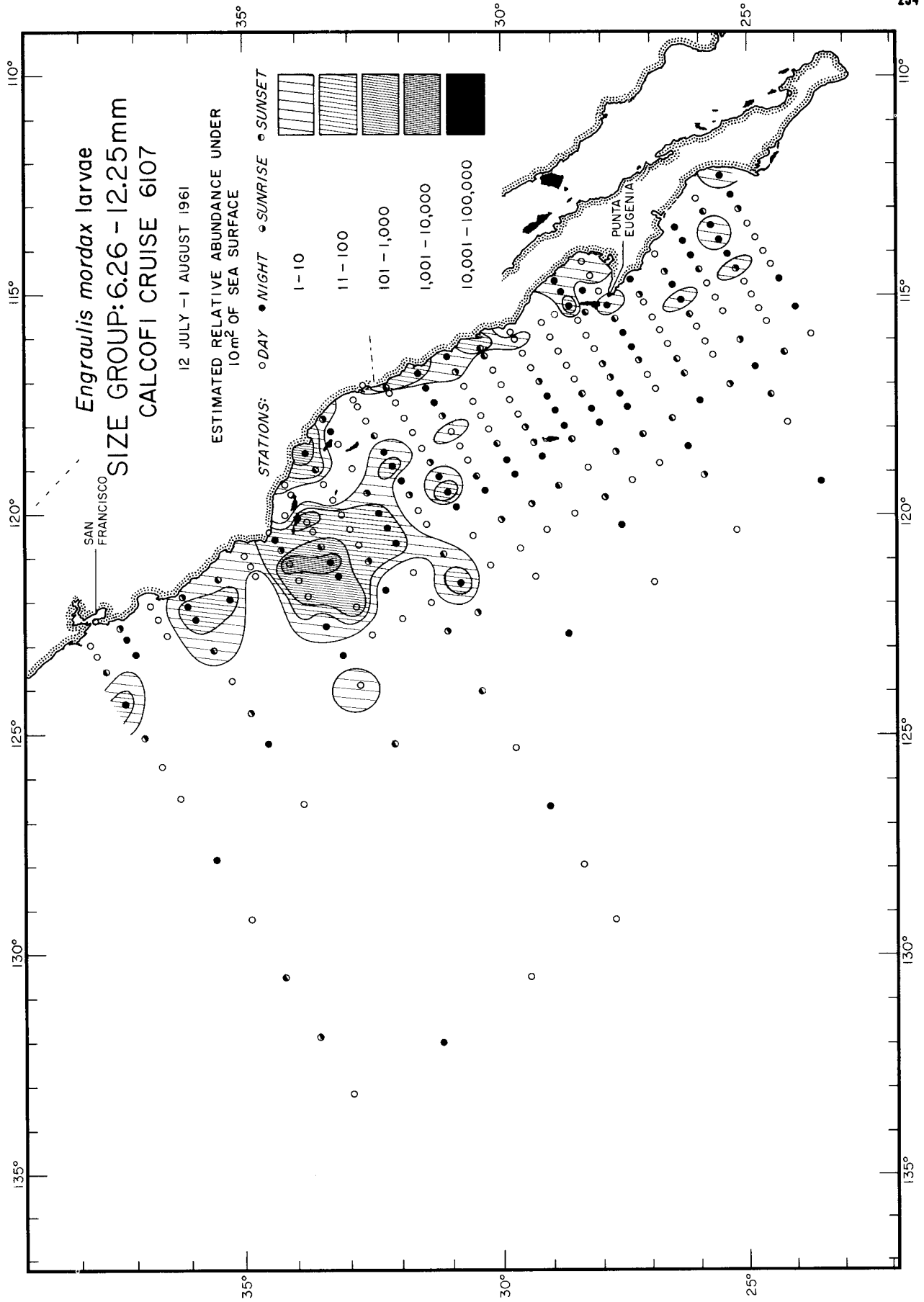
*Engraulis mordax* larvae  
All Sizes  
6101



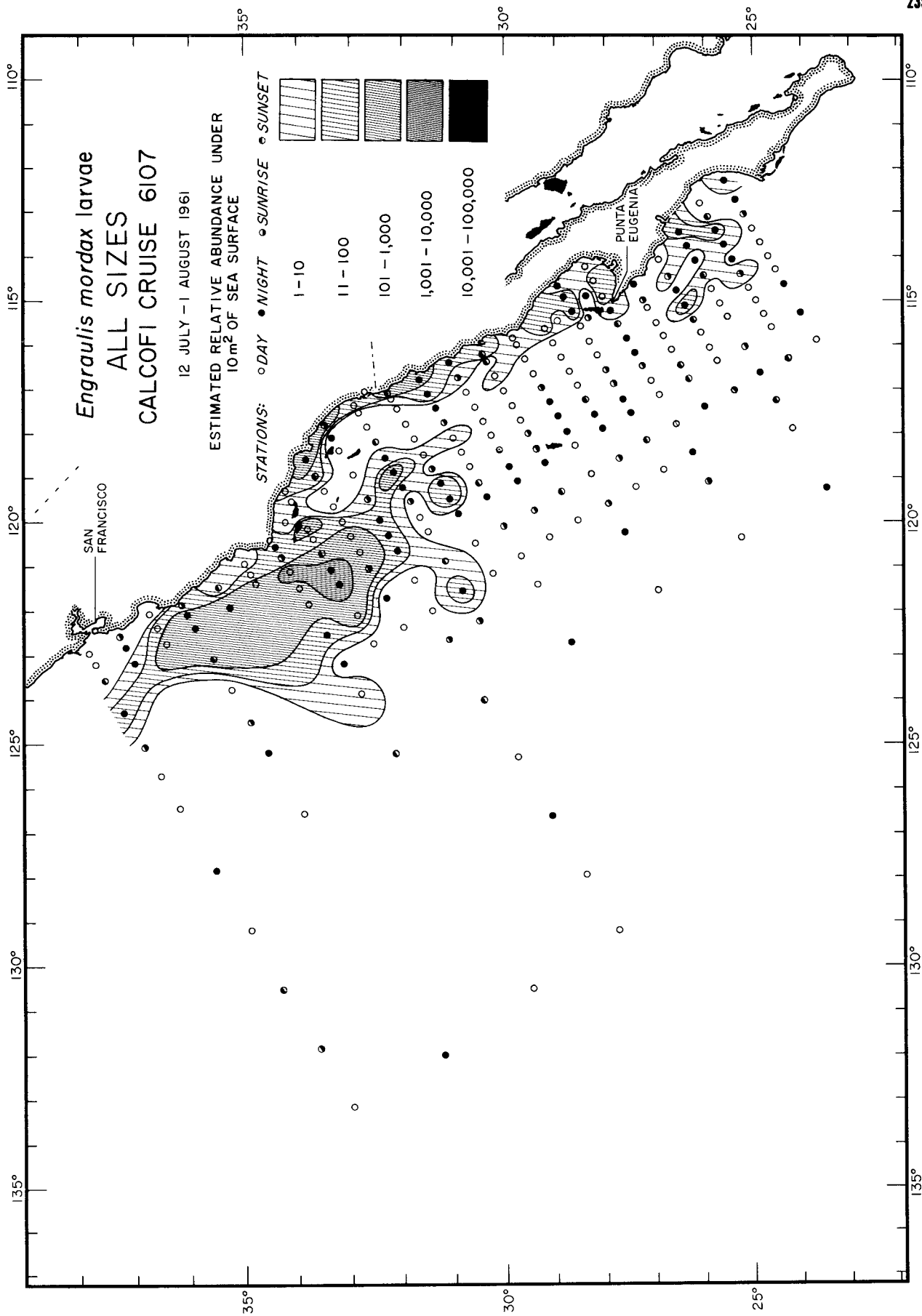
*Engraulis mordax* larvae  
 Size Group: 6.26-12.25mm  
 6104



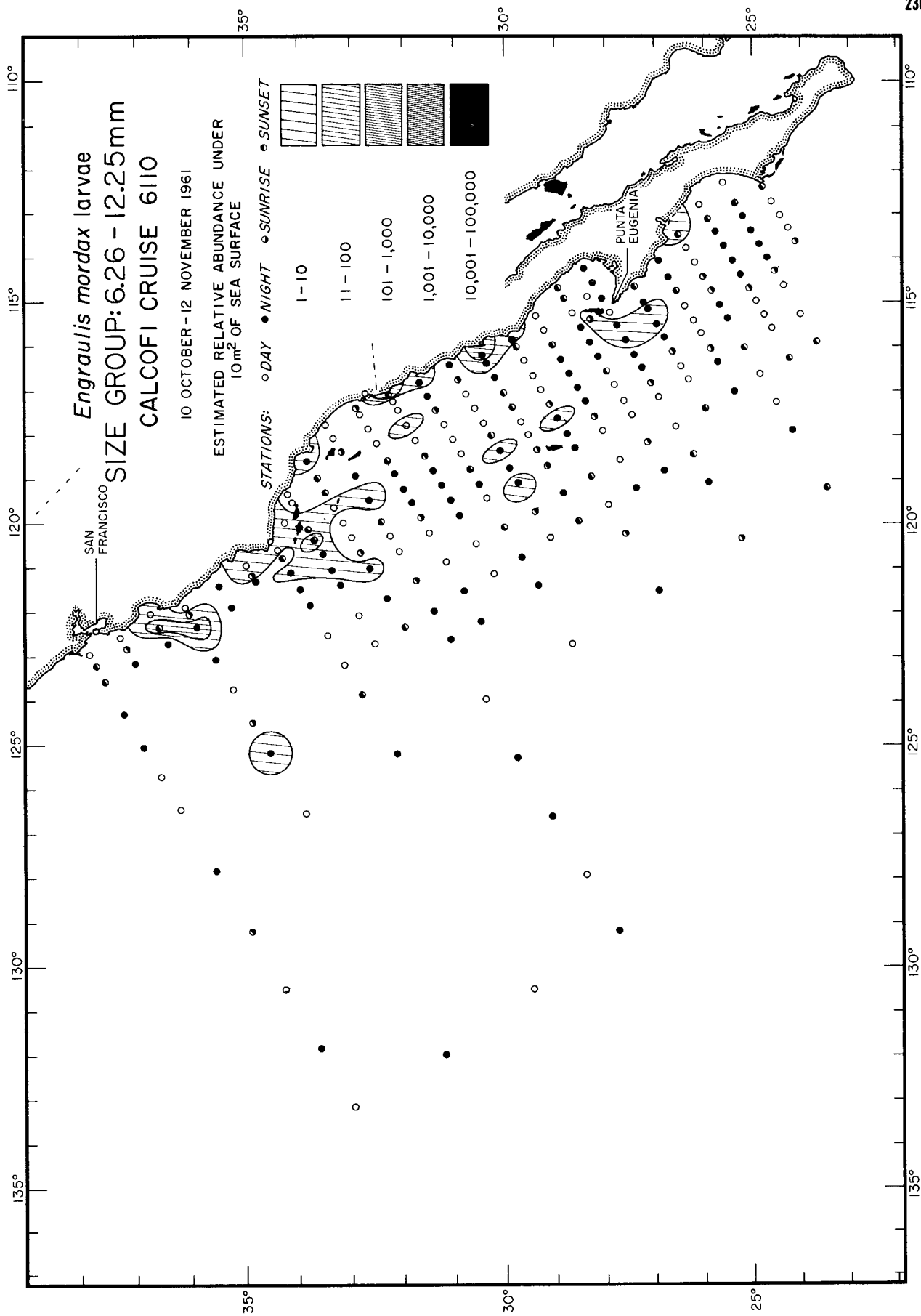
*Engraulis mordax* larvae  
All Sizes  
6104



*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
6107

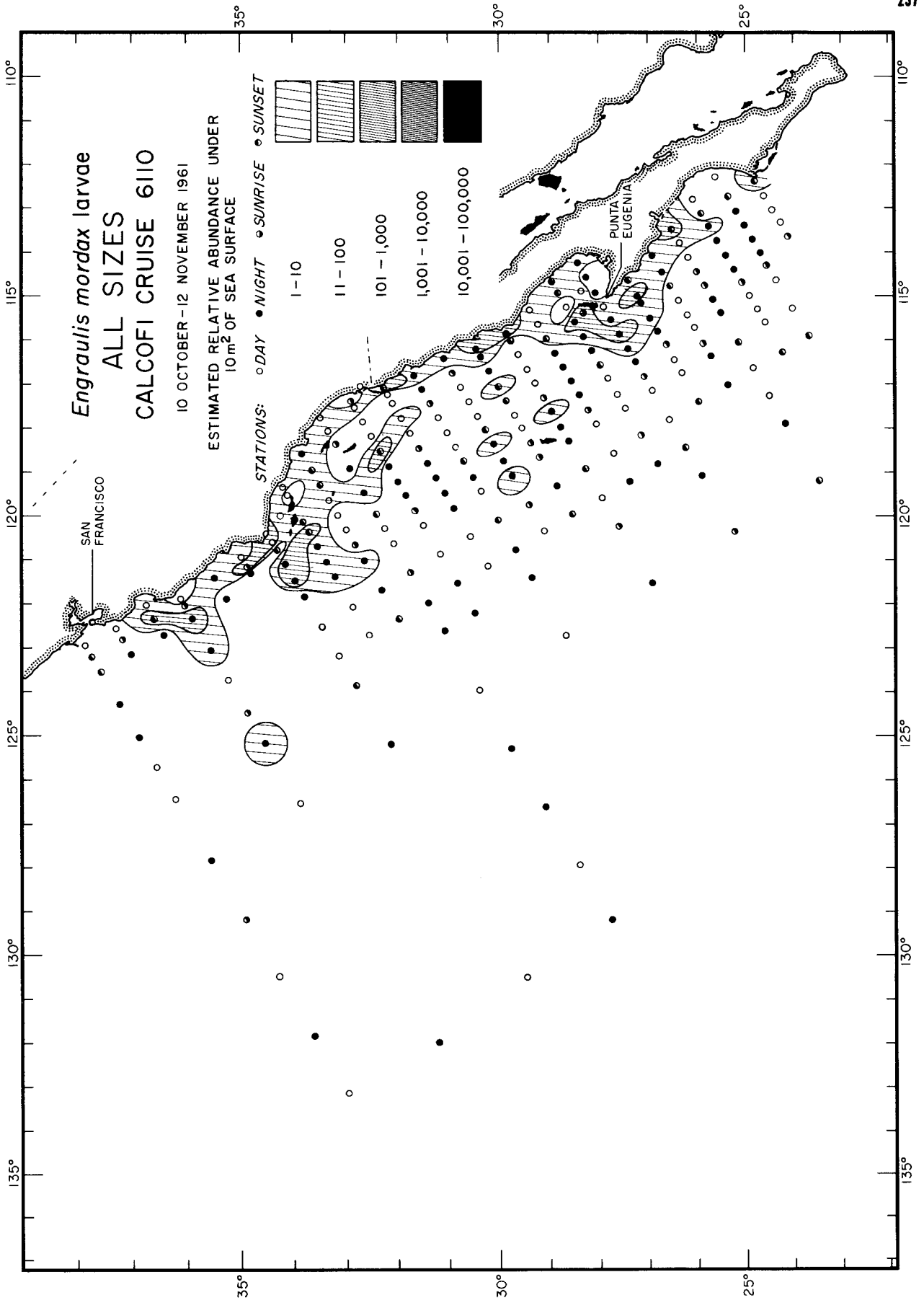


*Engraulis mordax* larvae  
All Sizes  
6107



*Engraulis mordax* larvae  
 Size Group: 6.26-12.25mm

6110

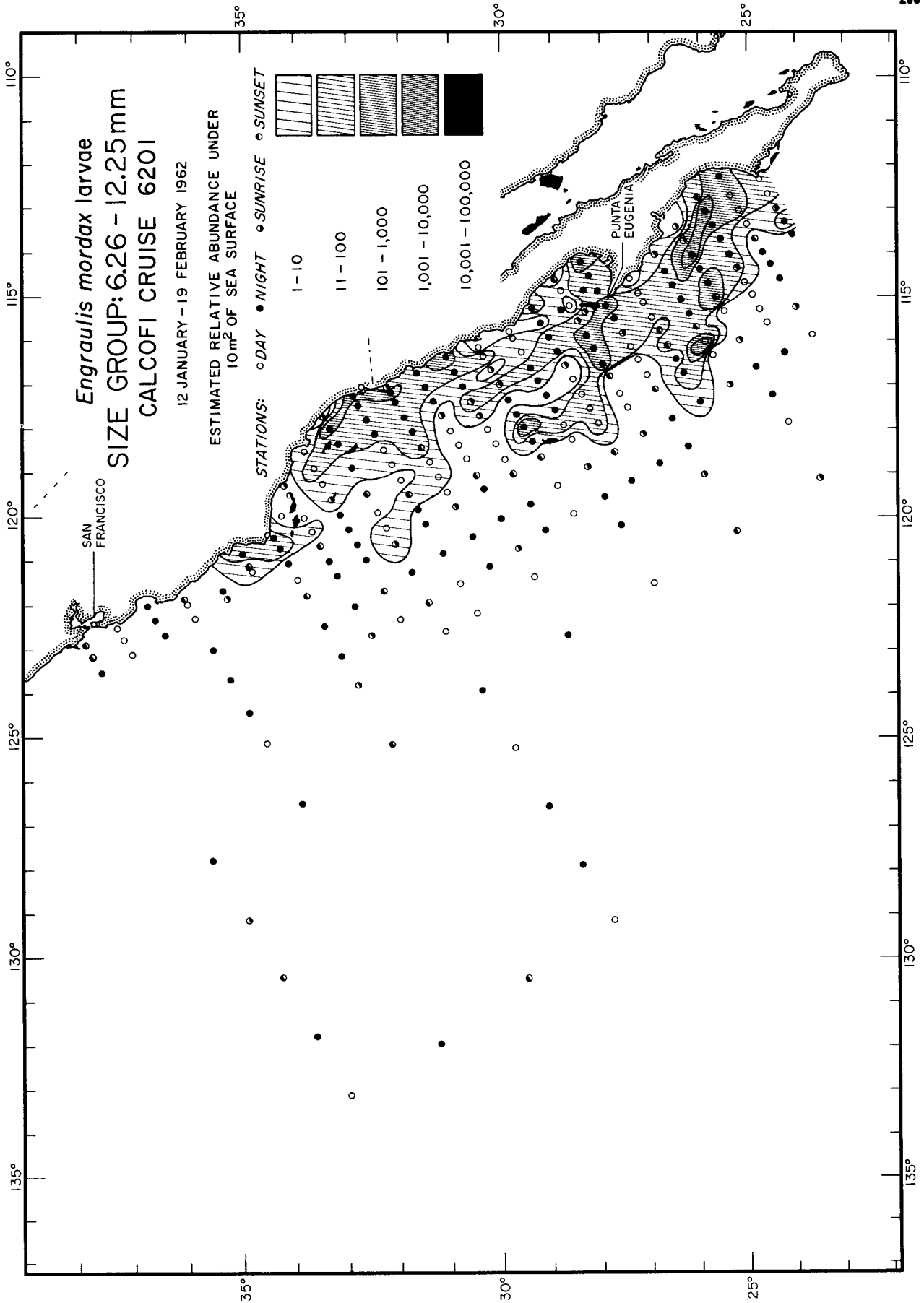


*Engraulis mordax* larvae

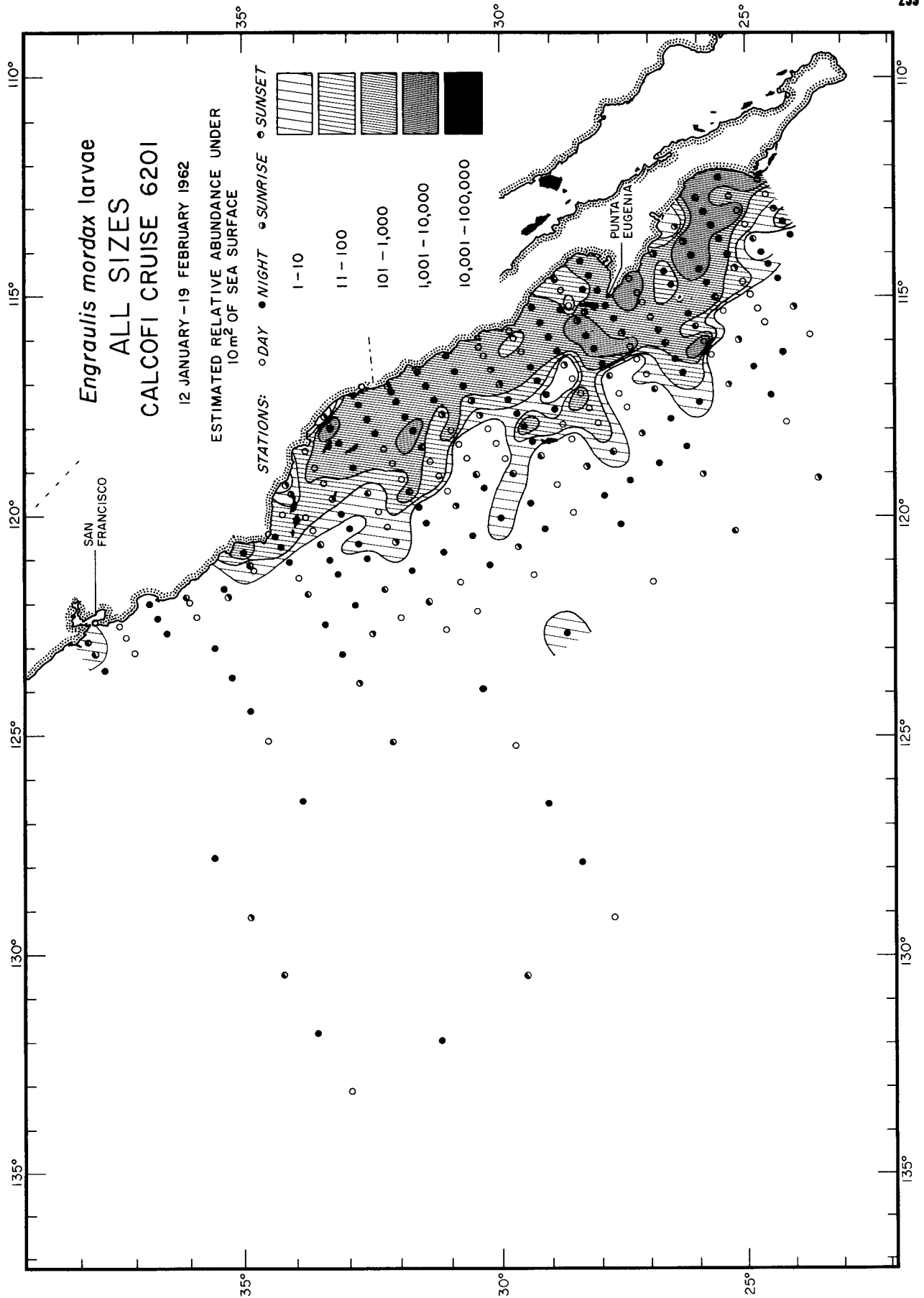
All Sizes

6110





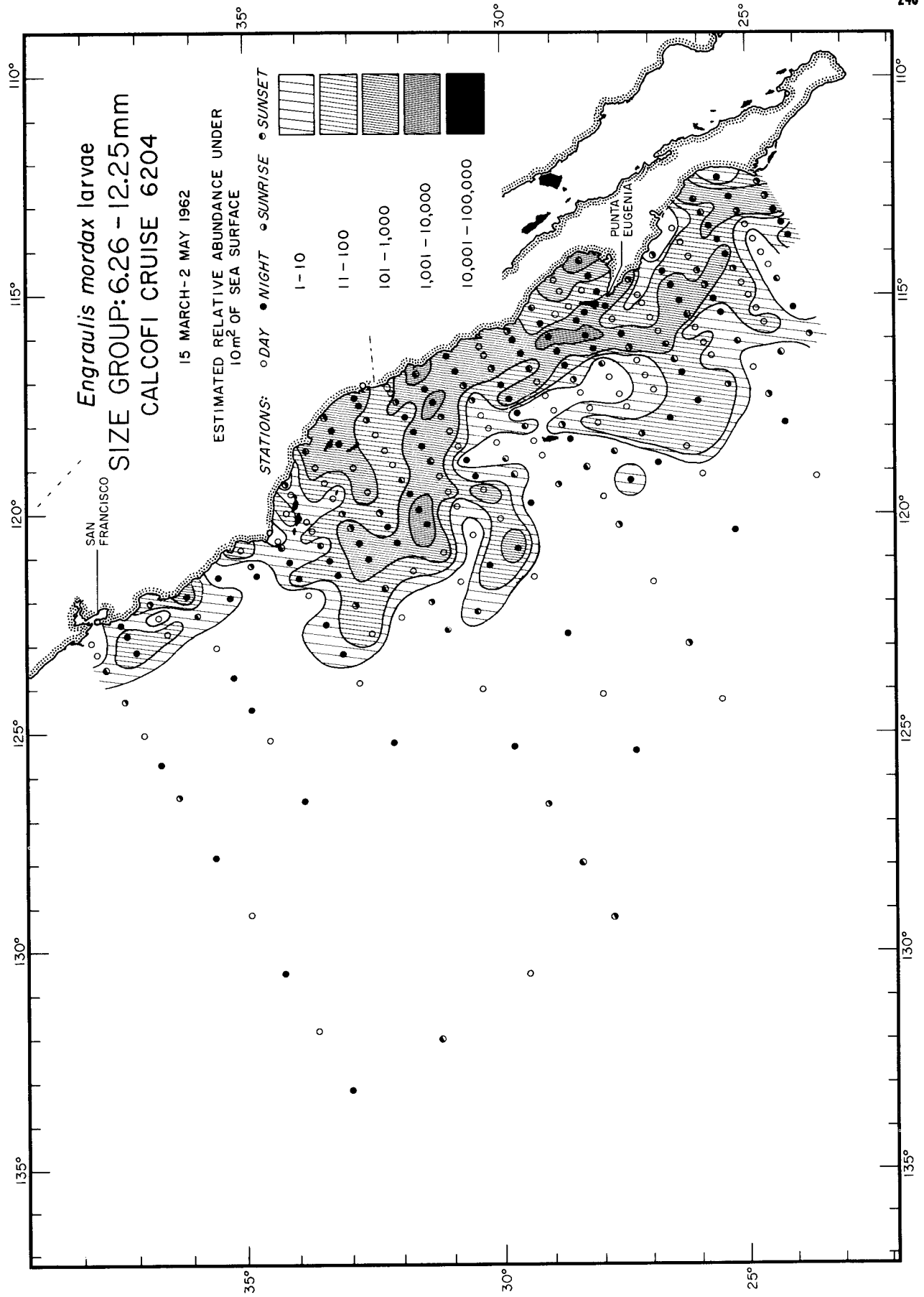
*Engraulis mordax* larvae  
 Size Group: 6.26-12.25mm  
 6201



*Engraulis mordax* larvae

All Sizes

6201



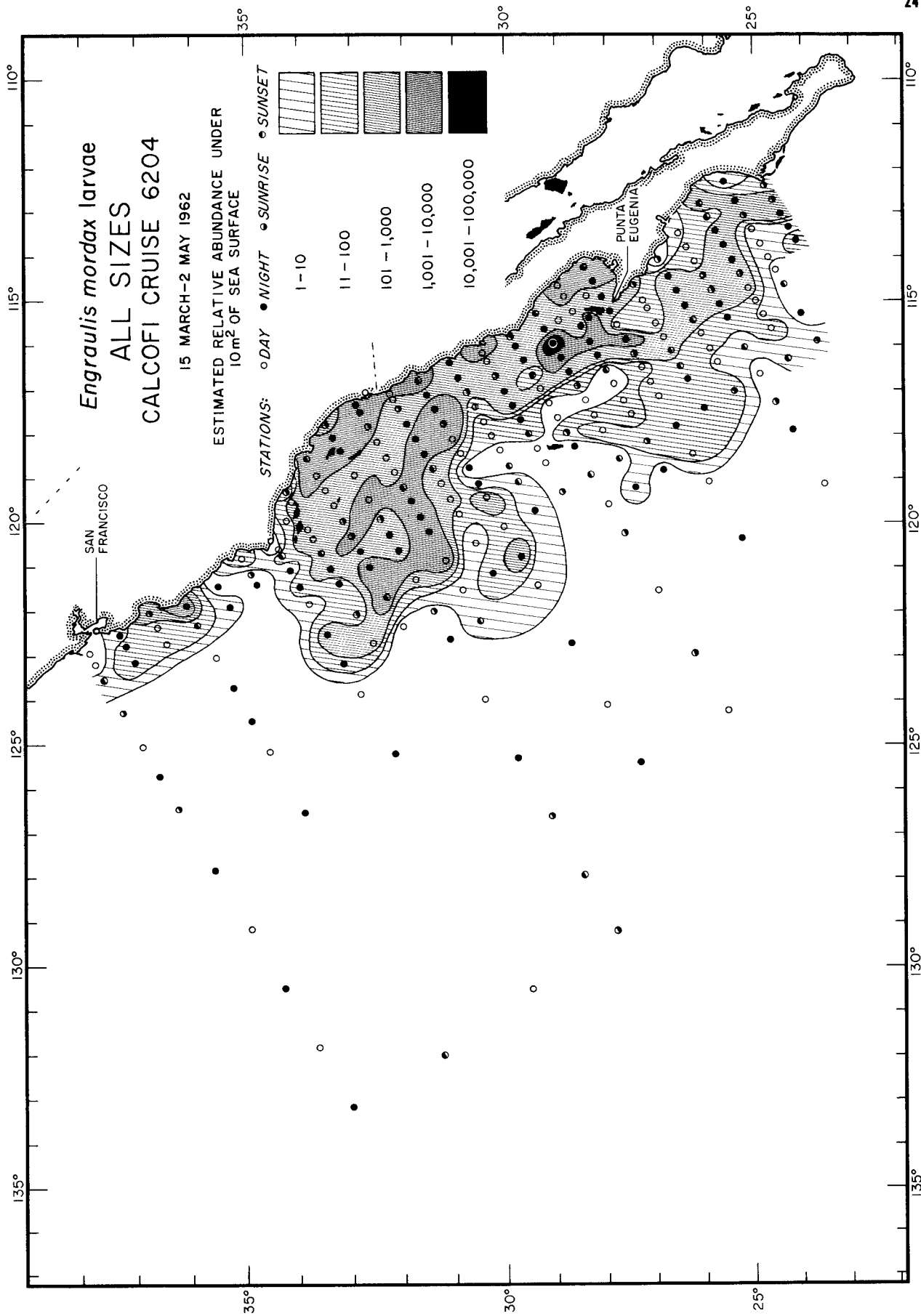
*Engraulis mordax* larvae  
SIZE GROUP: 6.26 - 12.25mm  
CALCOFI CRUISE 6204  
15 MARCH-2 MAY 1962

ESTIMATED RELATIVE ABUNDANCE UNDER  
10m<sup>2</sup> OF SEA SURFACE

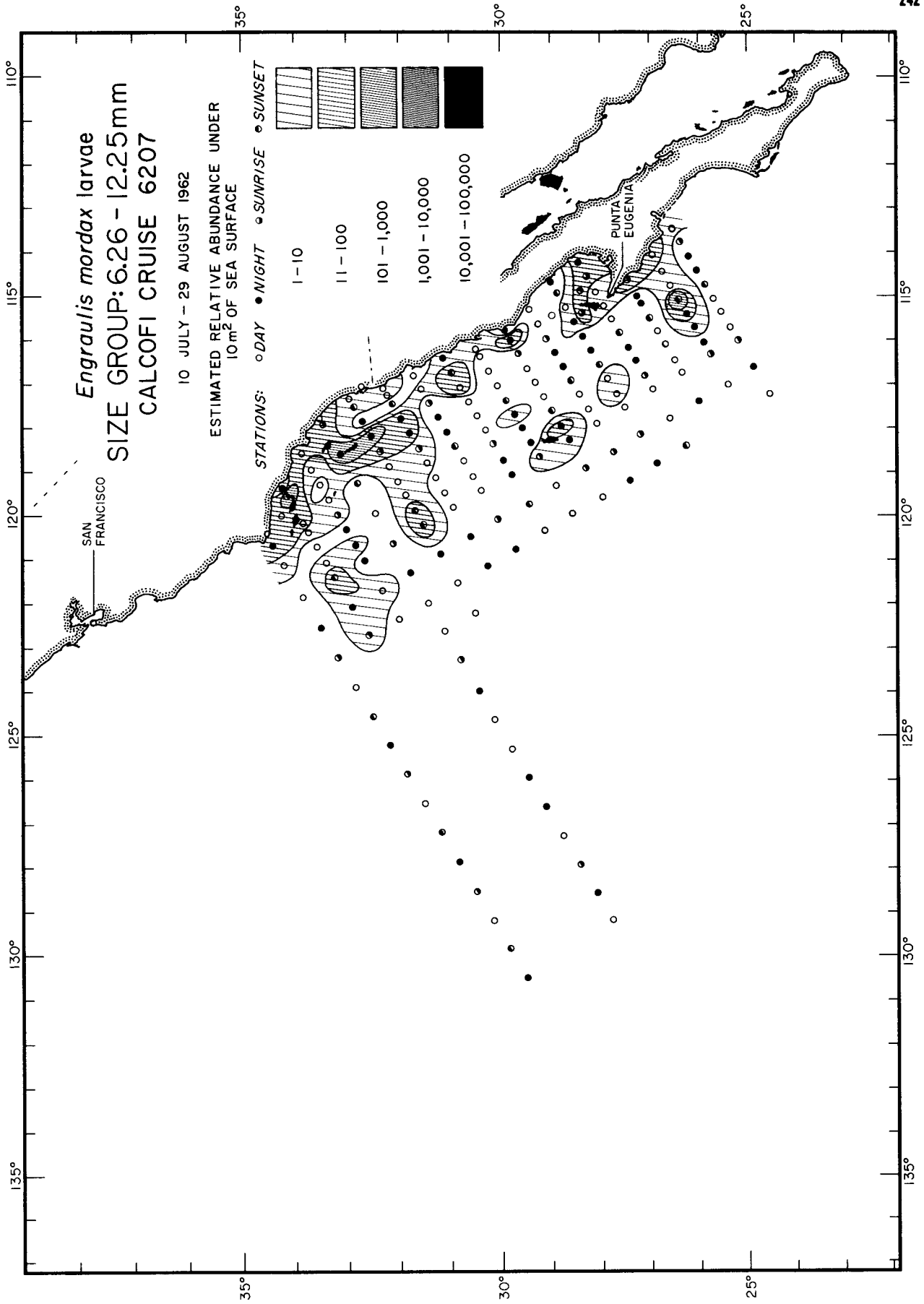
STATIONS: ○ DAY ● NIGHT ◐ SUNRISE ◑ SUNSET

1-10
11-100
101-1,000
1,001-10,000
10,001-100,000

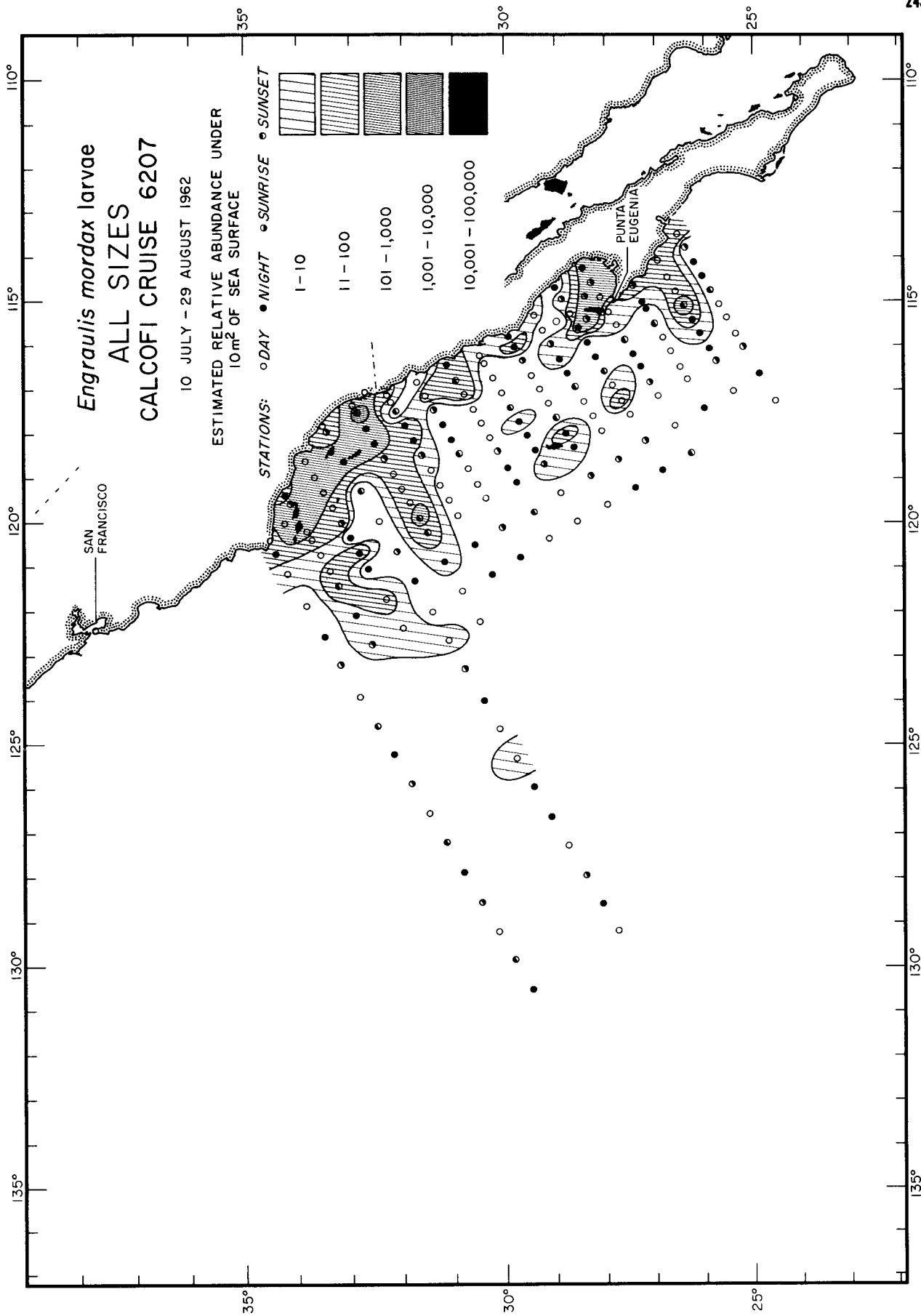
*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
6204



*Engraulis mordax* larvae  
All Sizes  
6204

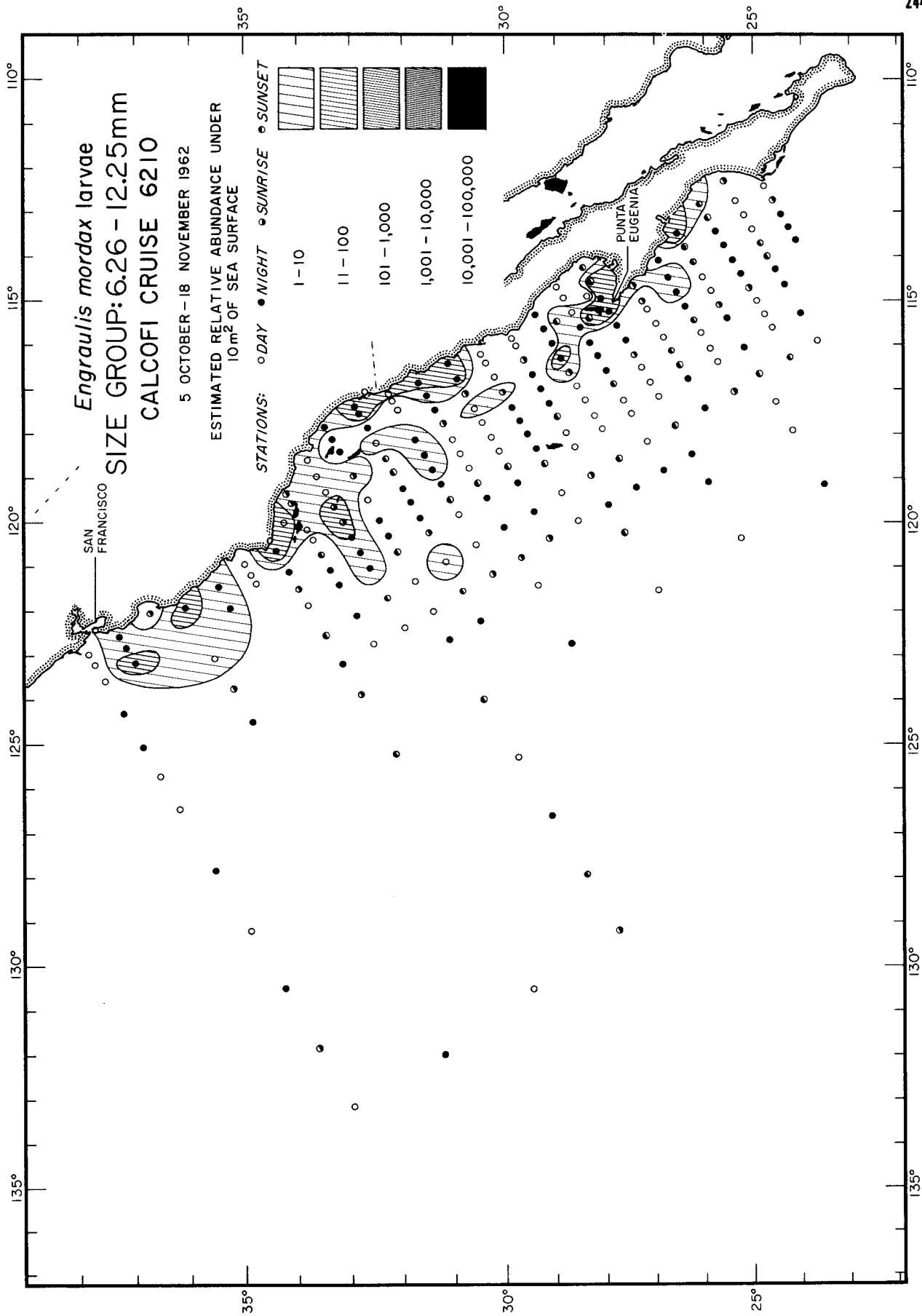


*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
6207

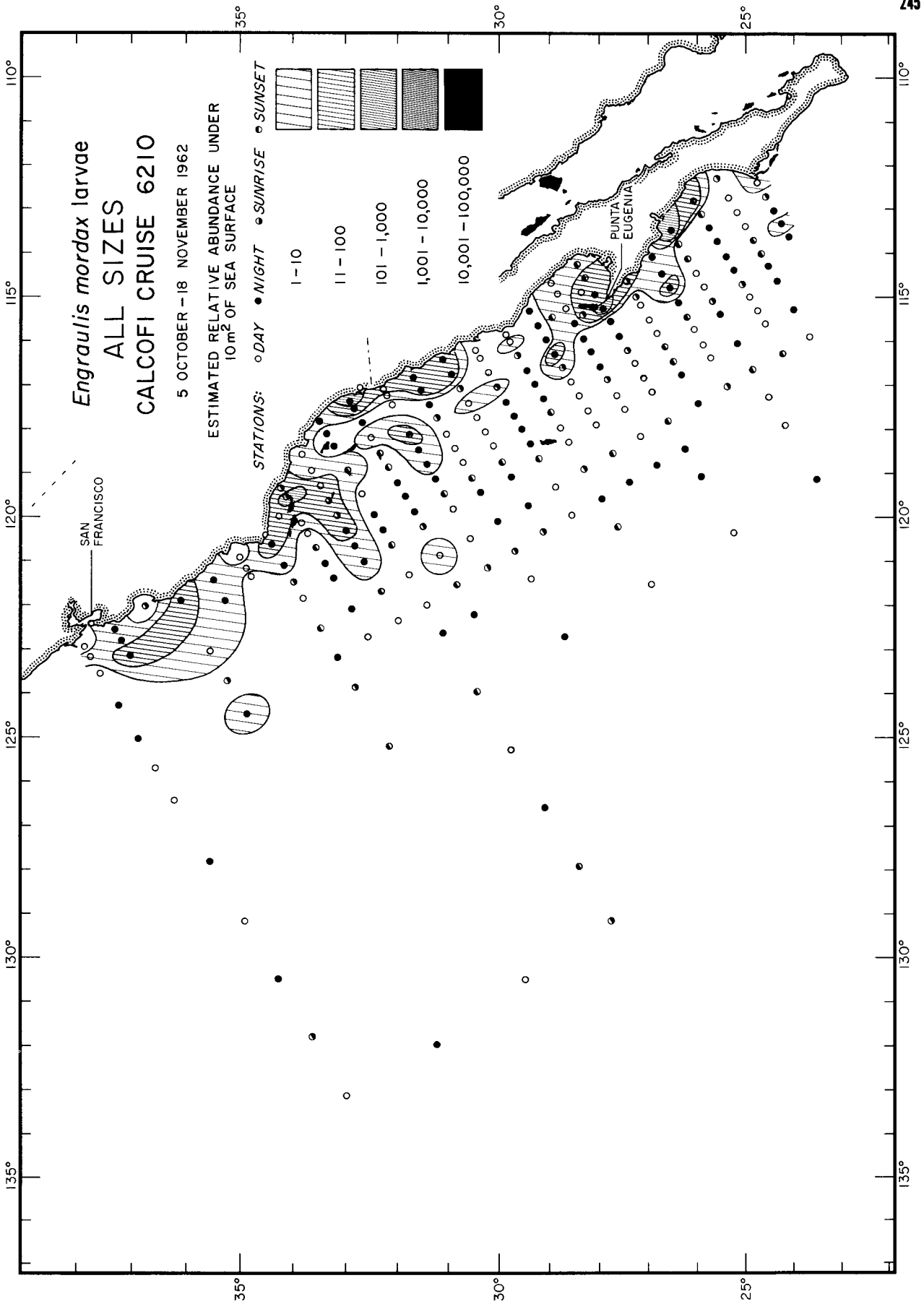


*Engraulis mordax* larvae

All Sizes  
6207

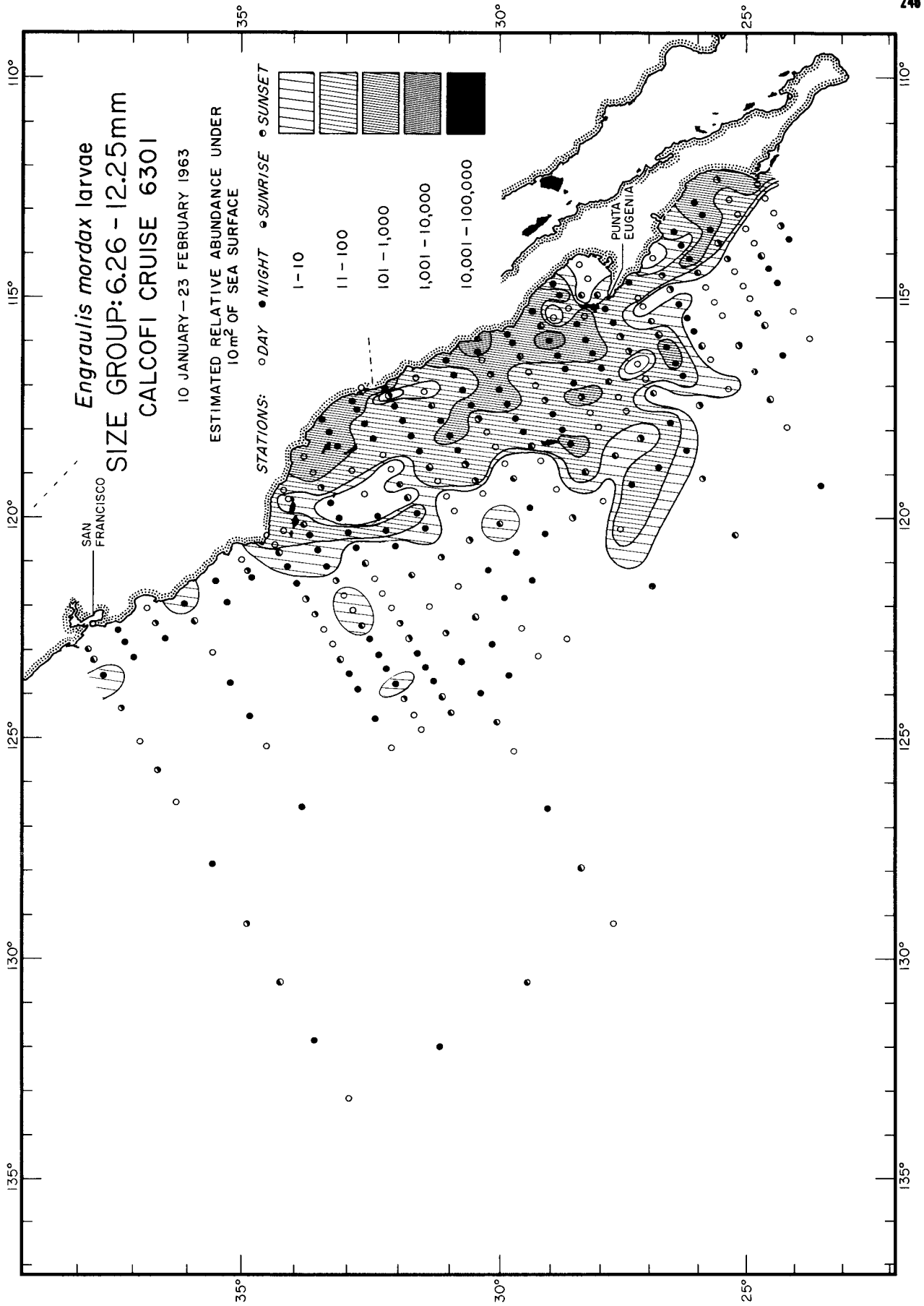


*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
6210

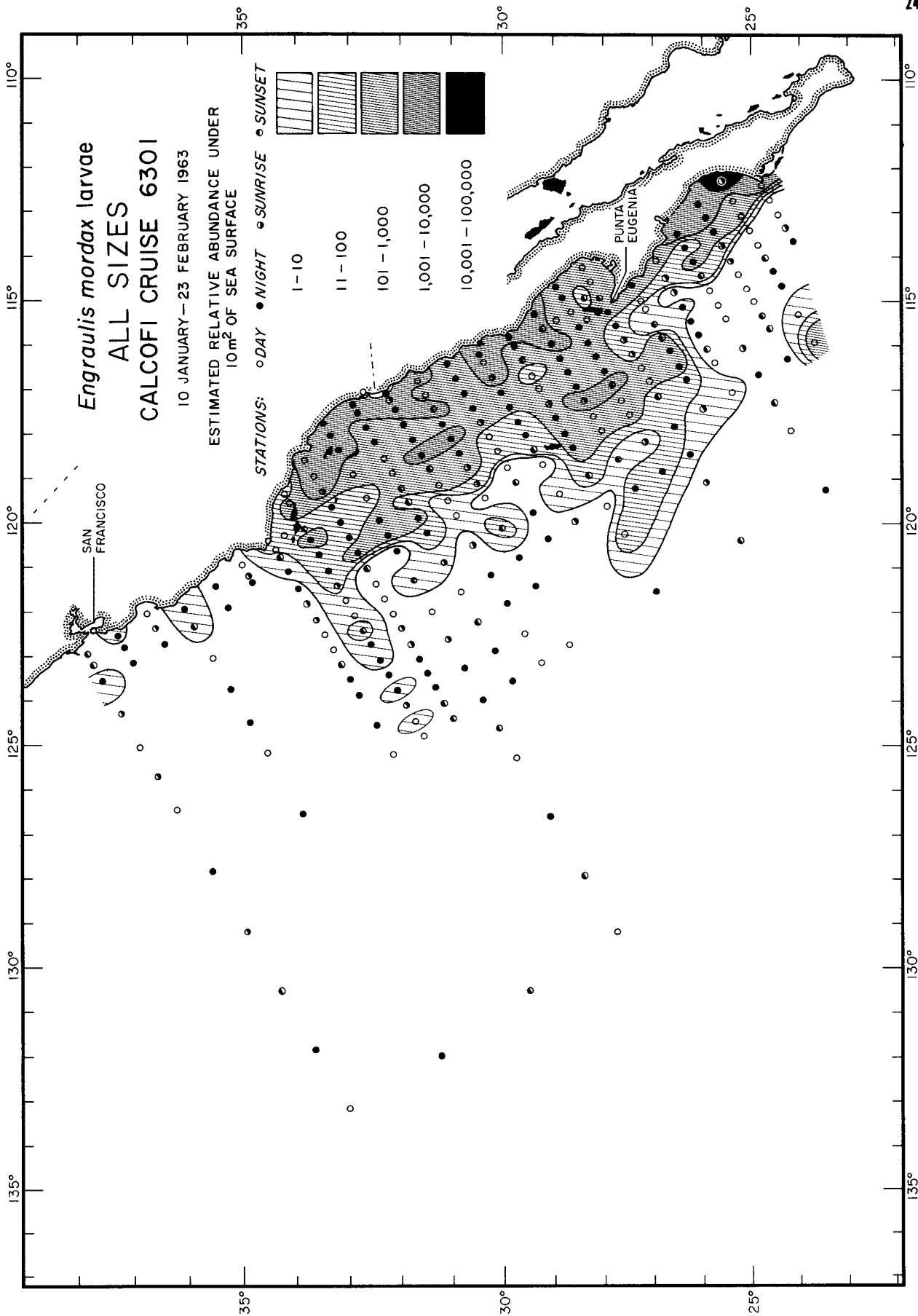


*Engraulis mordax* larvae  
All Sizes  
6210



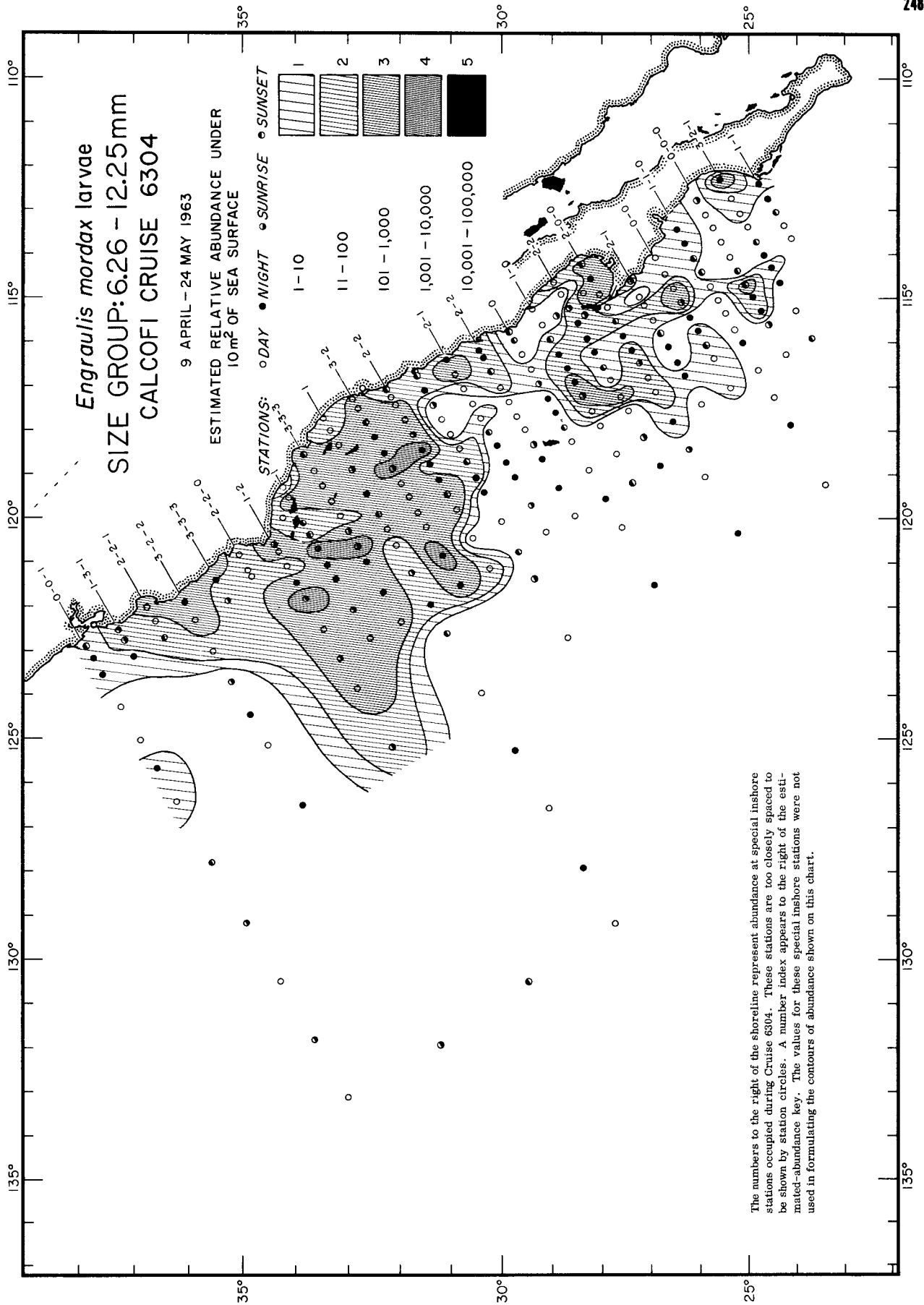


*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
6301

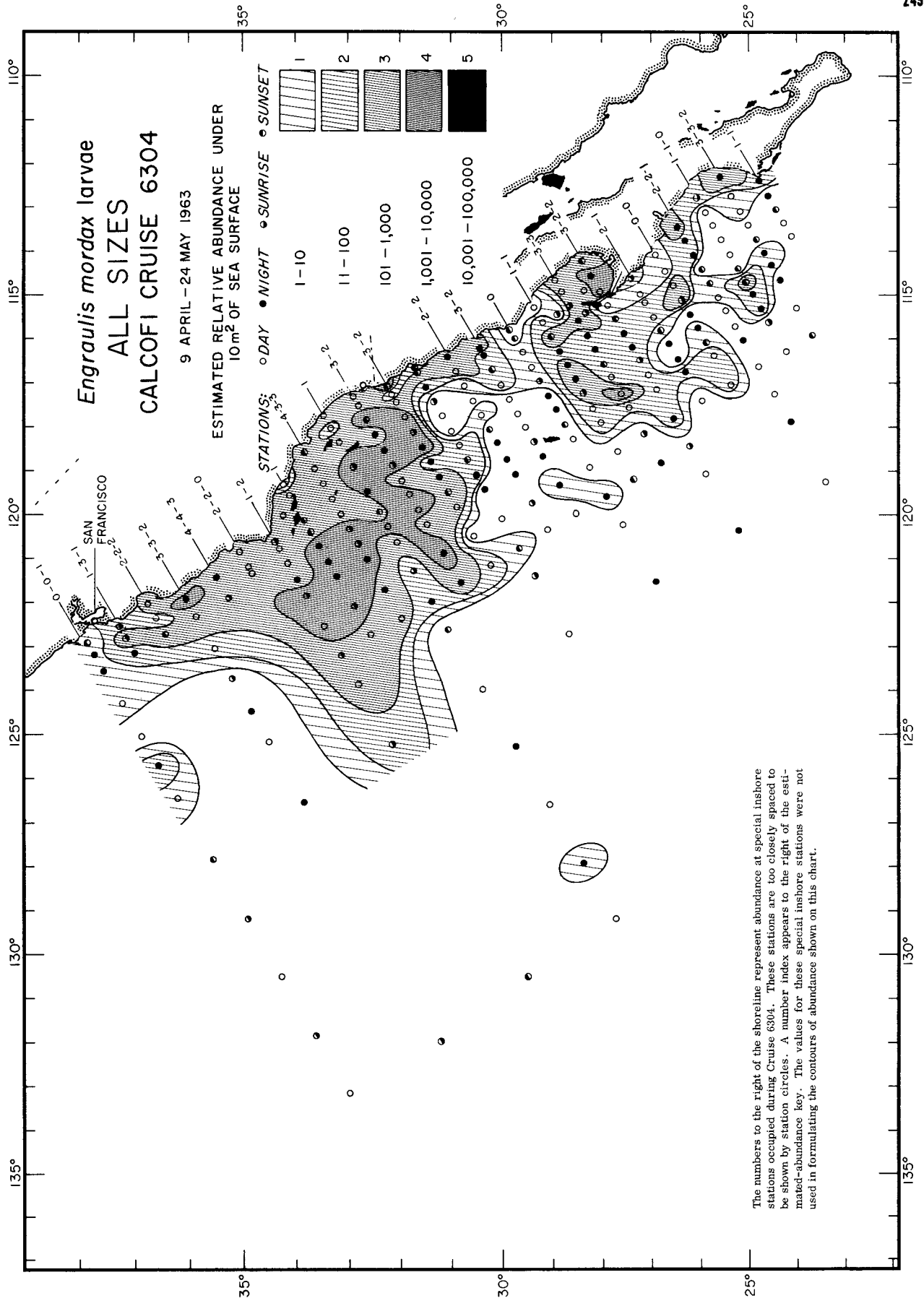


*Engraulis mordax* larvae

All Sizes  
6301



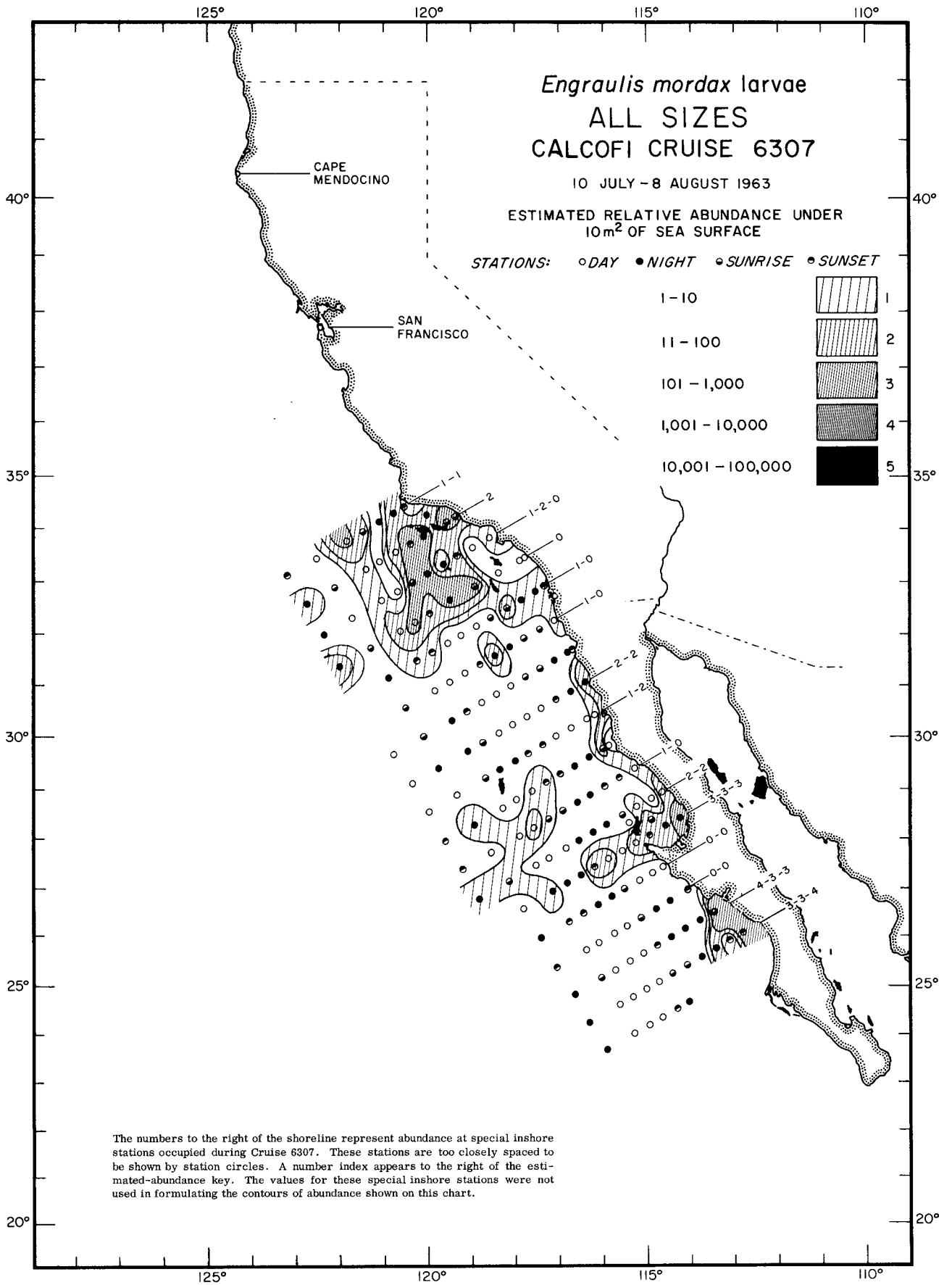
*Engraulis mordax* larvae  
 Size Group: 6.26-12.25mm  
 6304



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

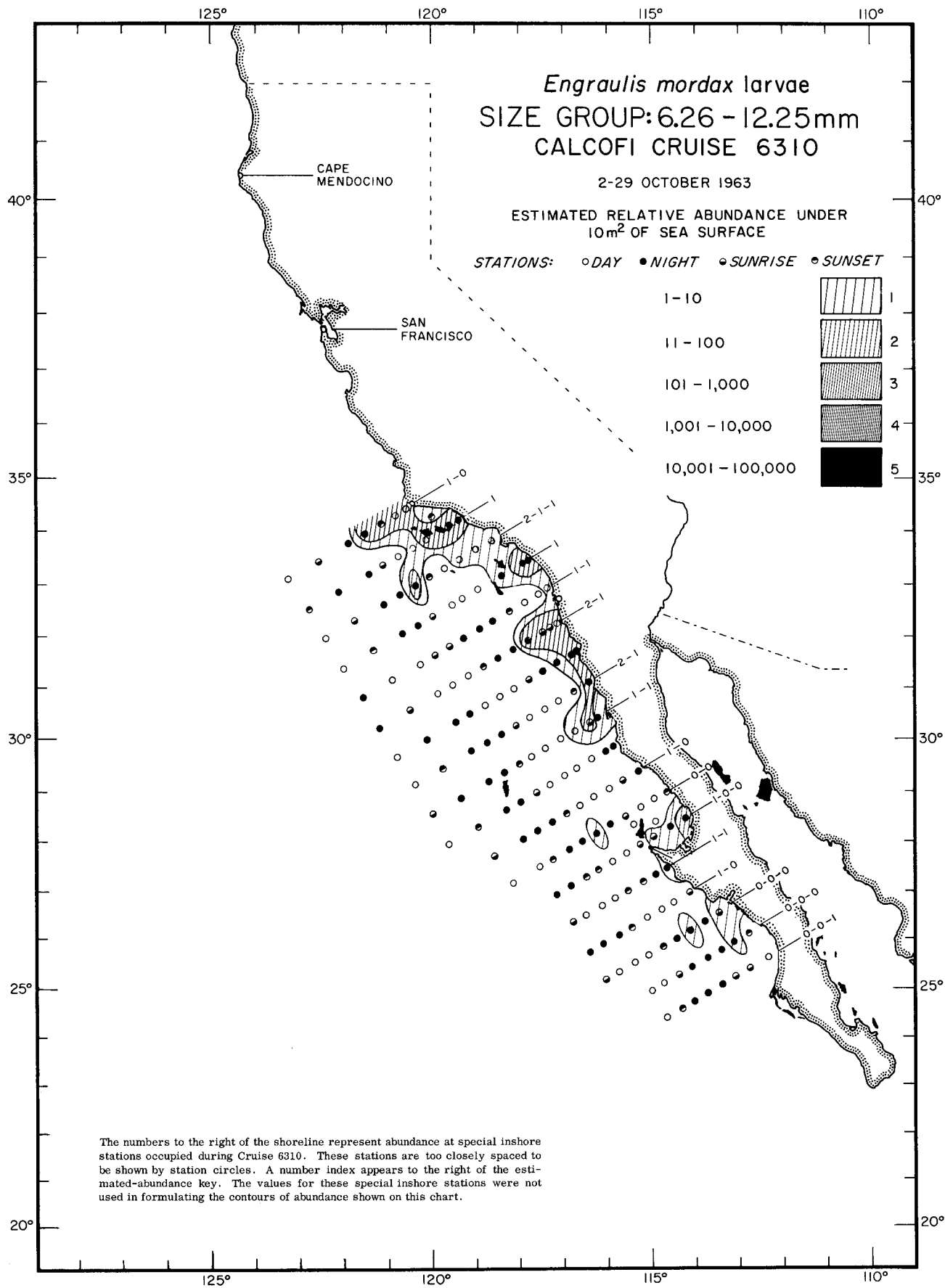
*Engraulis mordax* larvae  
 All Sizes  
 6304



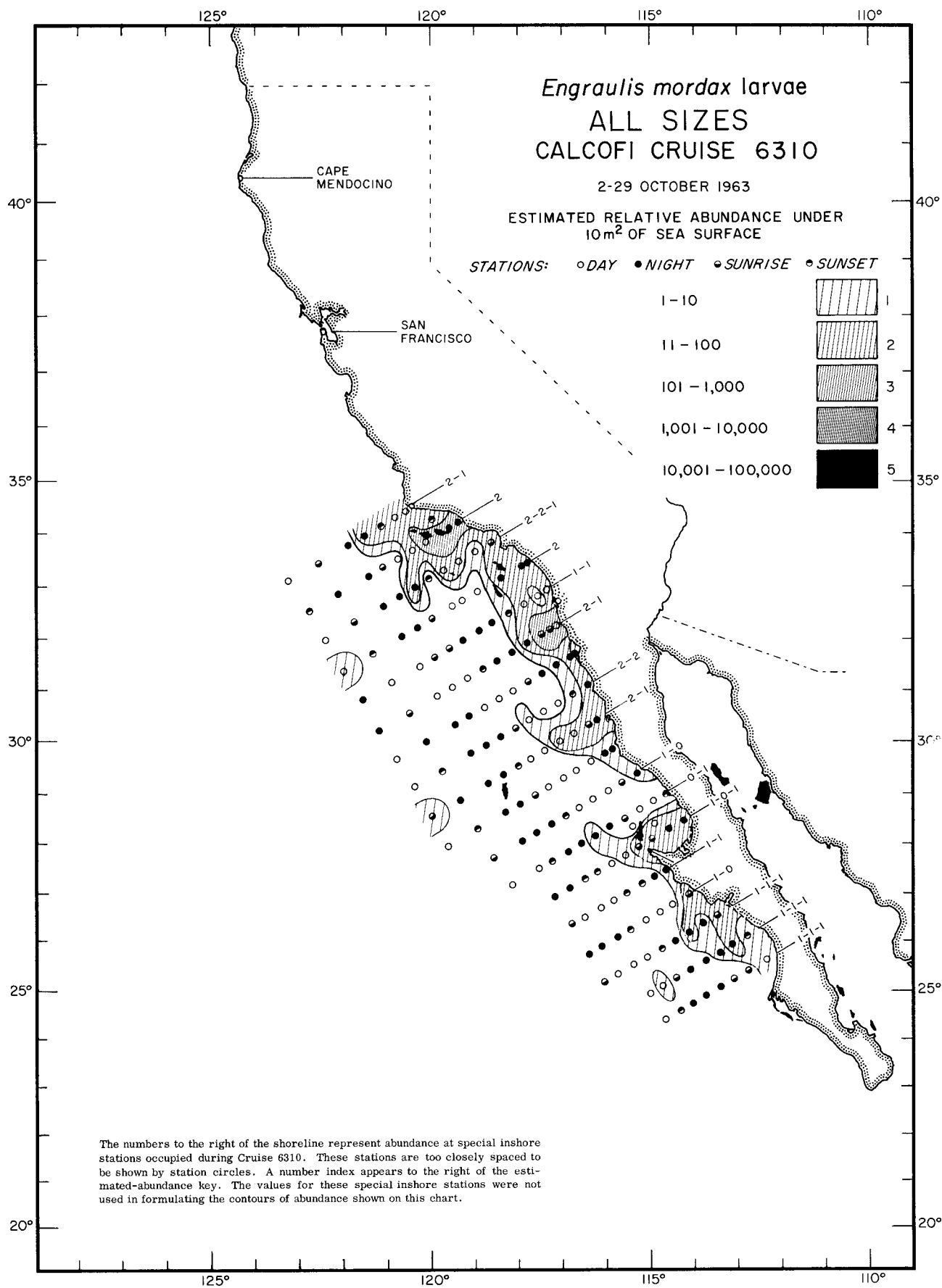


The numbers to the right of the shoreline represent abundance at special inshore stations occupied during Cruise 6307. These stations are too closely spaced to be shown by station circles. A number index appears to the right of the estimated-abundance key. The values for these special inshore stations were not used in formulating the contours of abundance shown on this chart.

*Engraulis mordax* larvae  
All Sizes  
6307

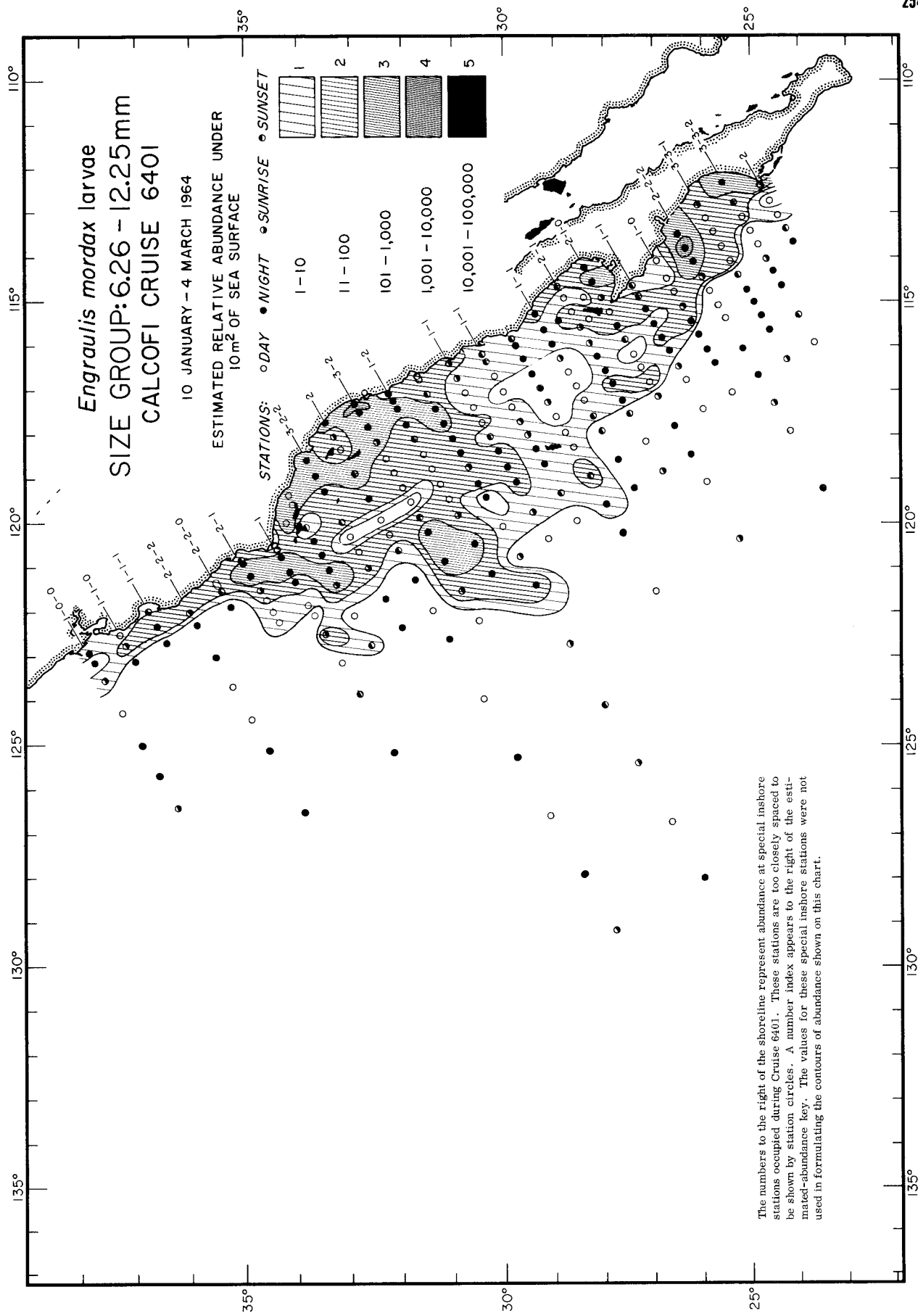


*Engraulis mordax* larvae  
 Size Group: 6.26-12.25mm  
 6310

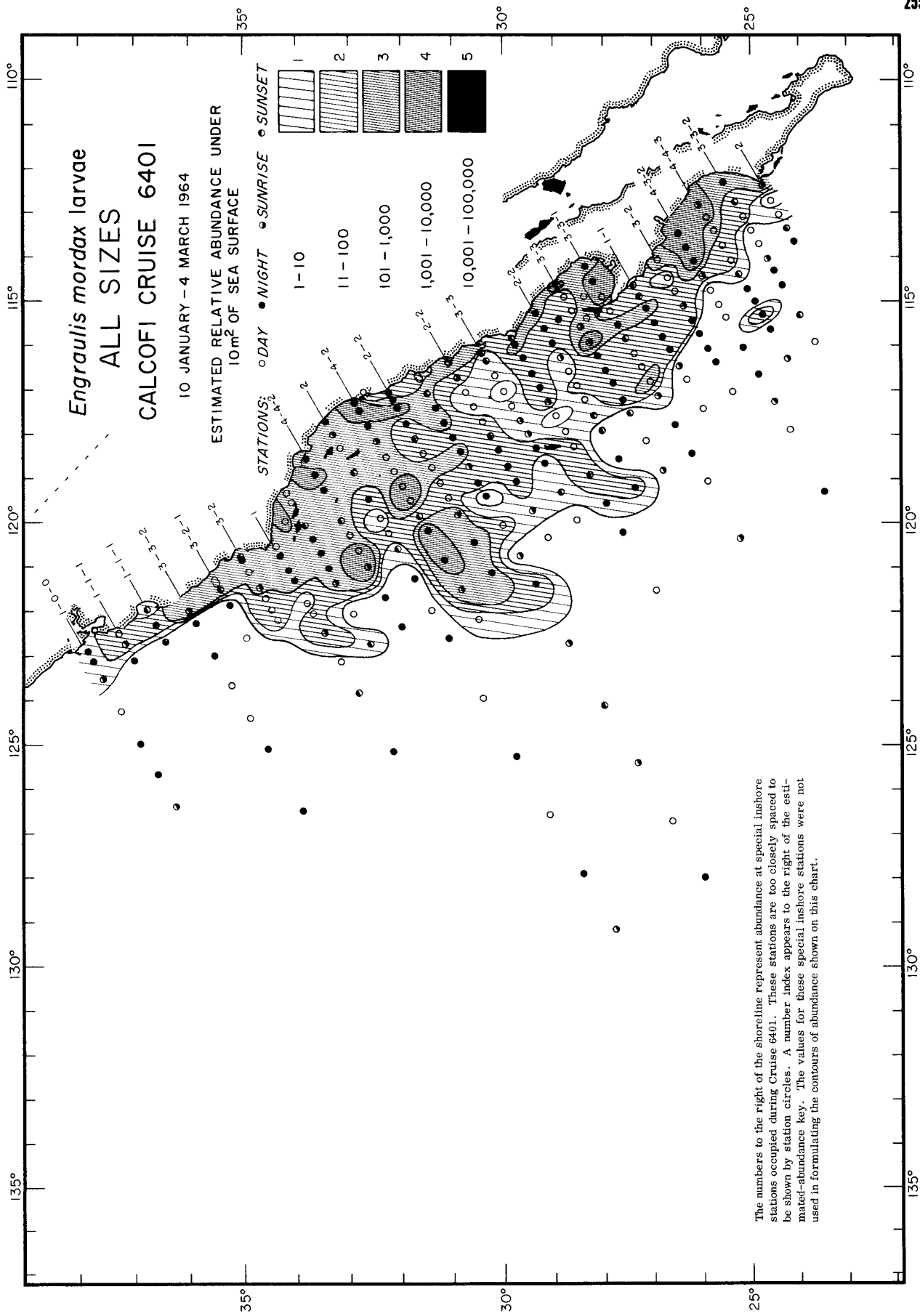


*Engraulis mordax* larvae  
All Sizes  
6310



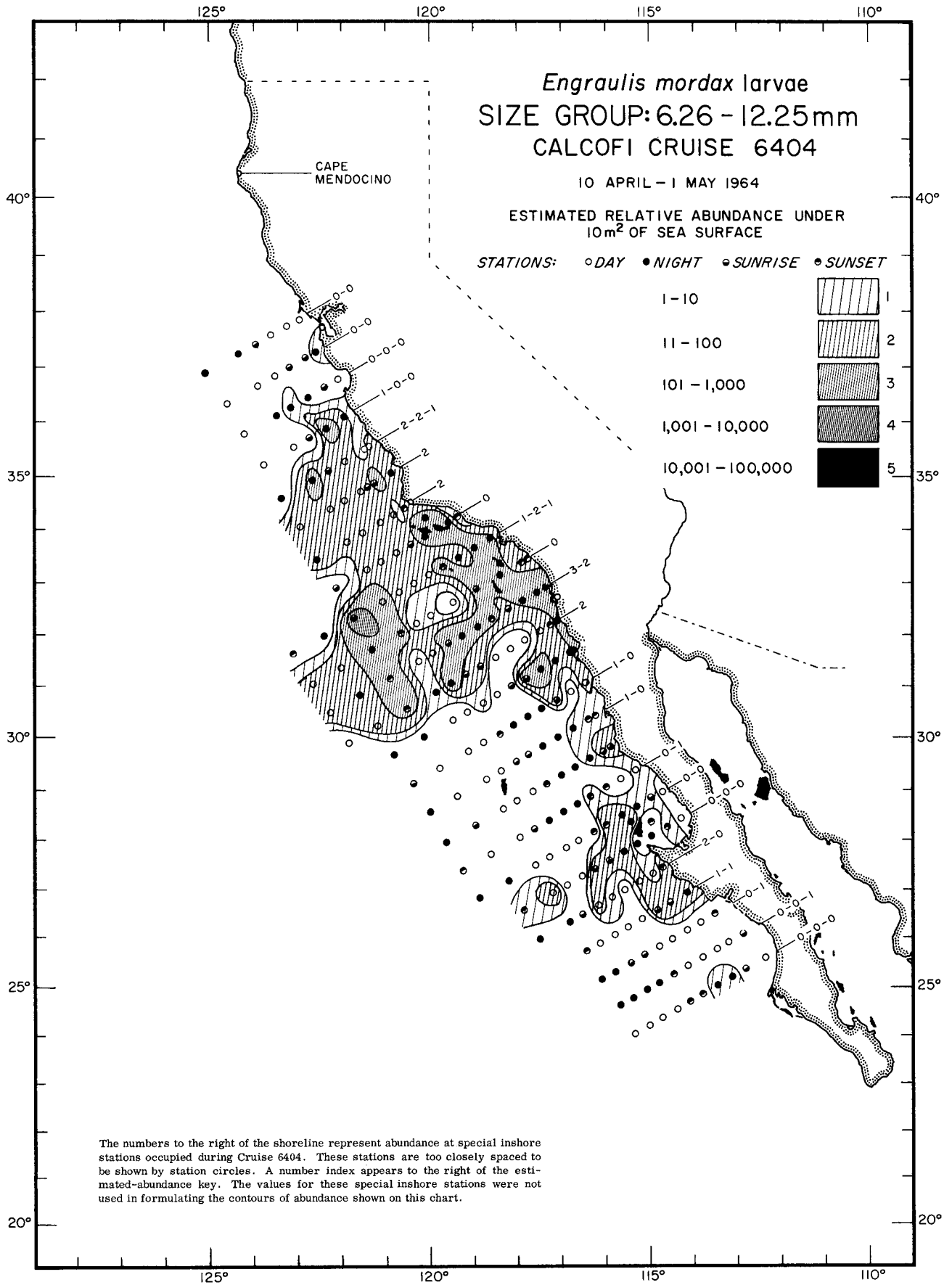


*Engraulis mordax* larvae  
Size Group: 6.26-12.25mm  
6401

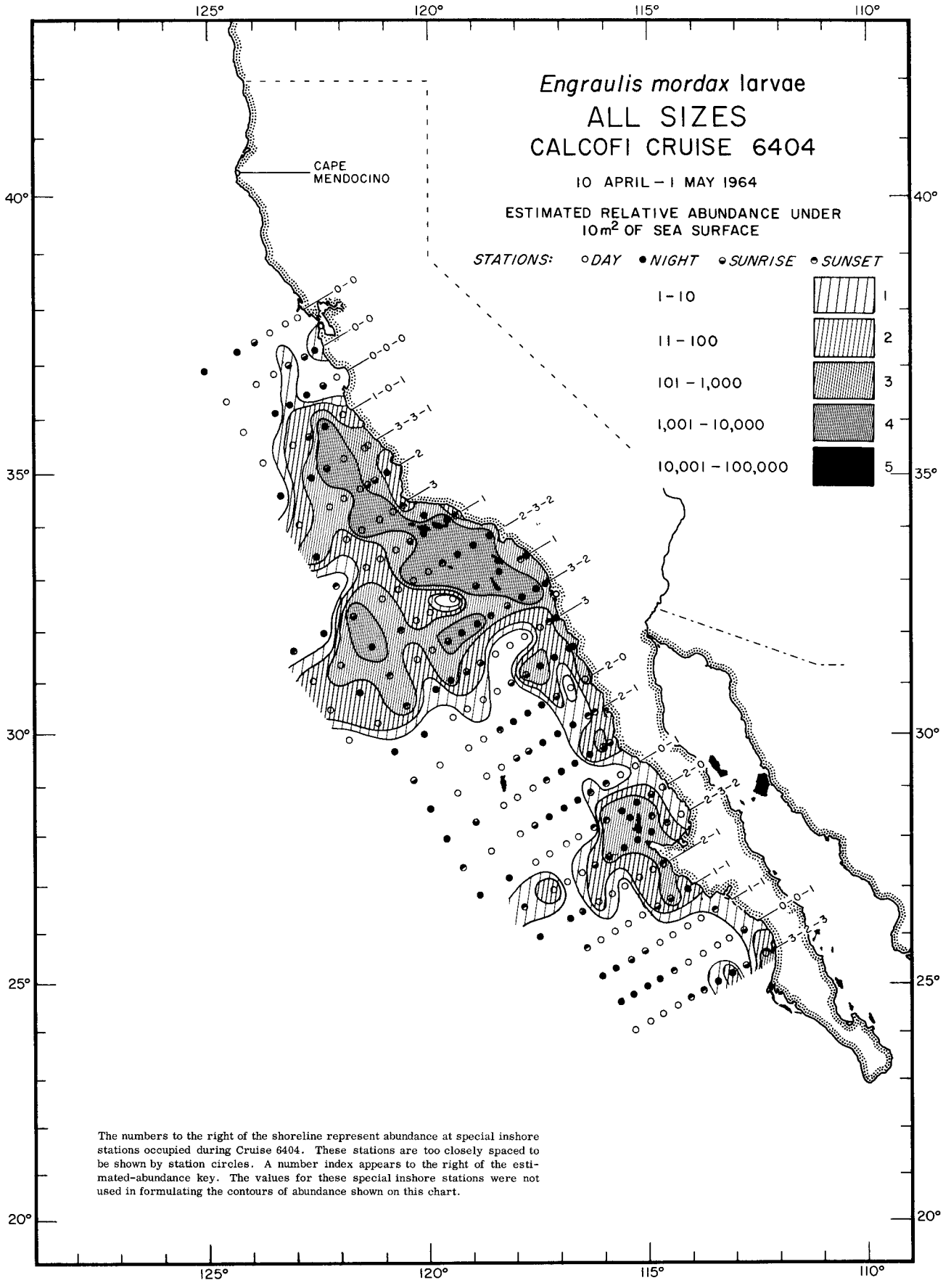


The numbers to the right of the shoreline represent abundance at special inshore stations occupied during Cruise 6401. These stations are too closely spaced to be shown by station circles. A number index appears to the right of the estimated-abundance key. The values for these special inshore stations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

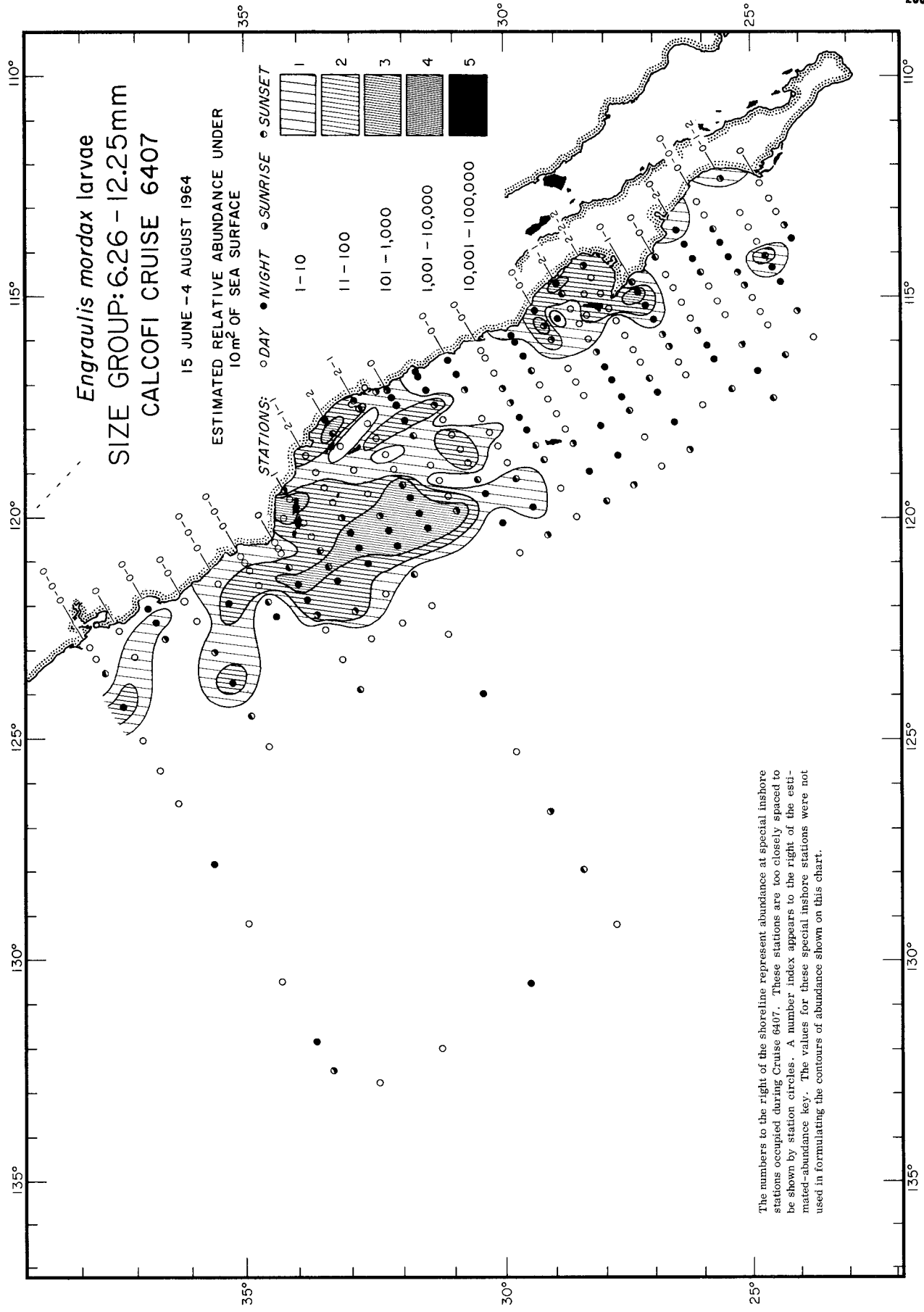
*Engraulis mordax* larvae  
 All Sizes  
 6401



*Engraulis mordax* larvae  
 Size Group: 6.26-12.25mm  
 6404



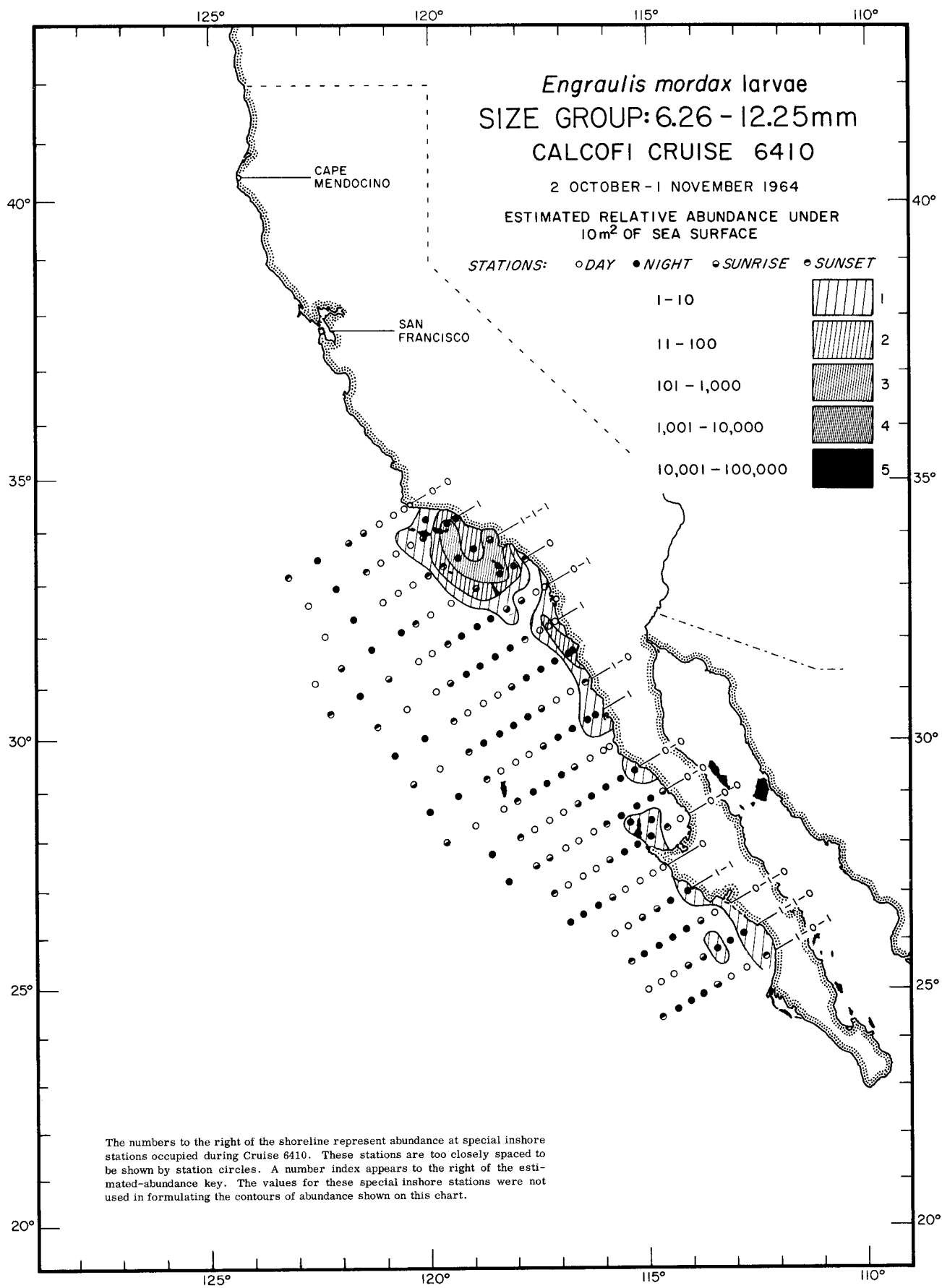
*Engraulis mordax* larvae  
All Sizes  
6404



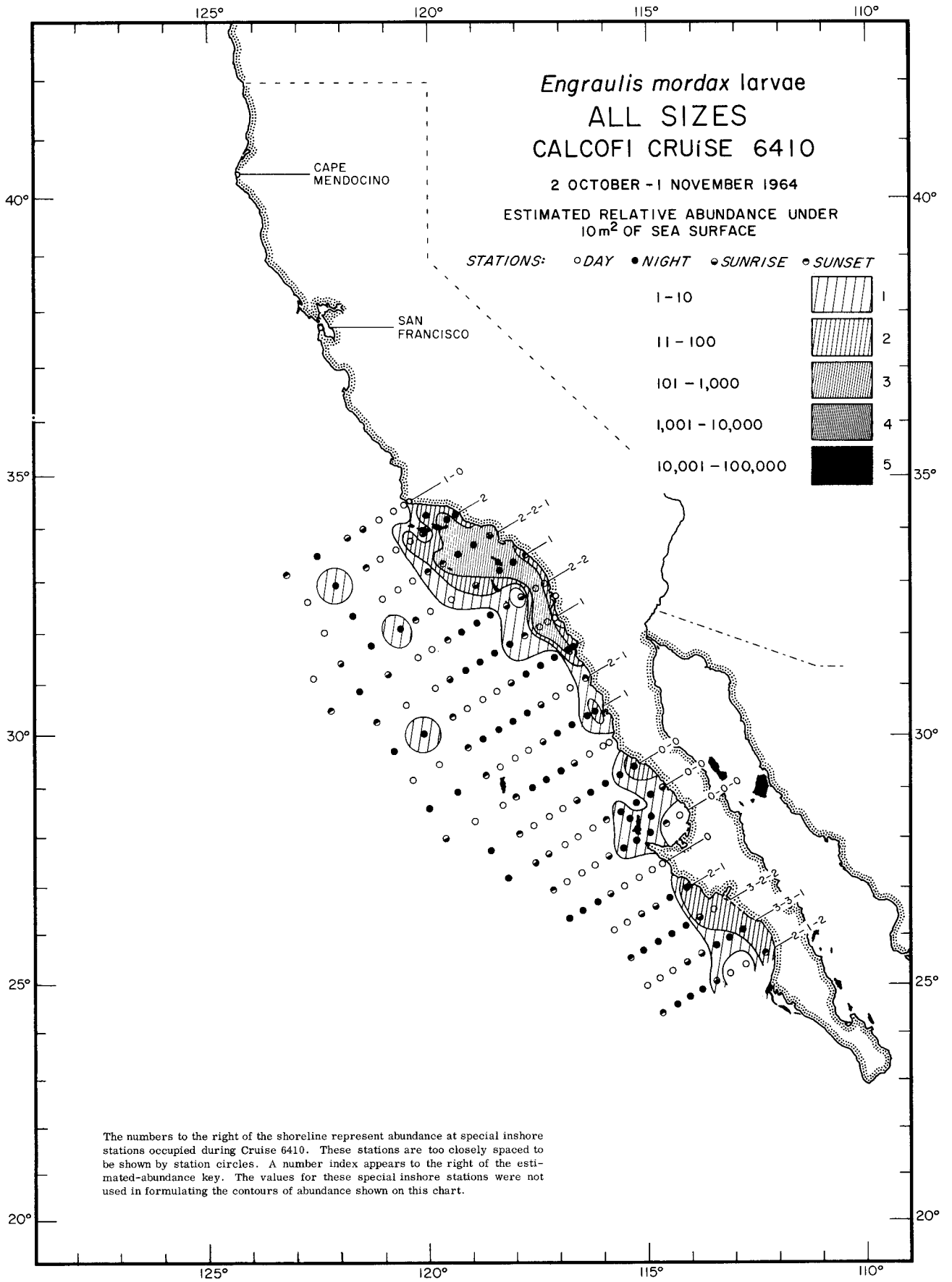
The numbers to the right of the shoreline represent abundance at special inshore stations occupied during Cruise 6407. These stations are too closely spaced to be shown by station circles. A number index appears to the right of the estimated-abundance key. The values for these special inshore stations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

*Engraulis mordax* larvae  
 Size Group: 6.26-12.25mm  
 6407





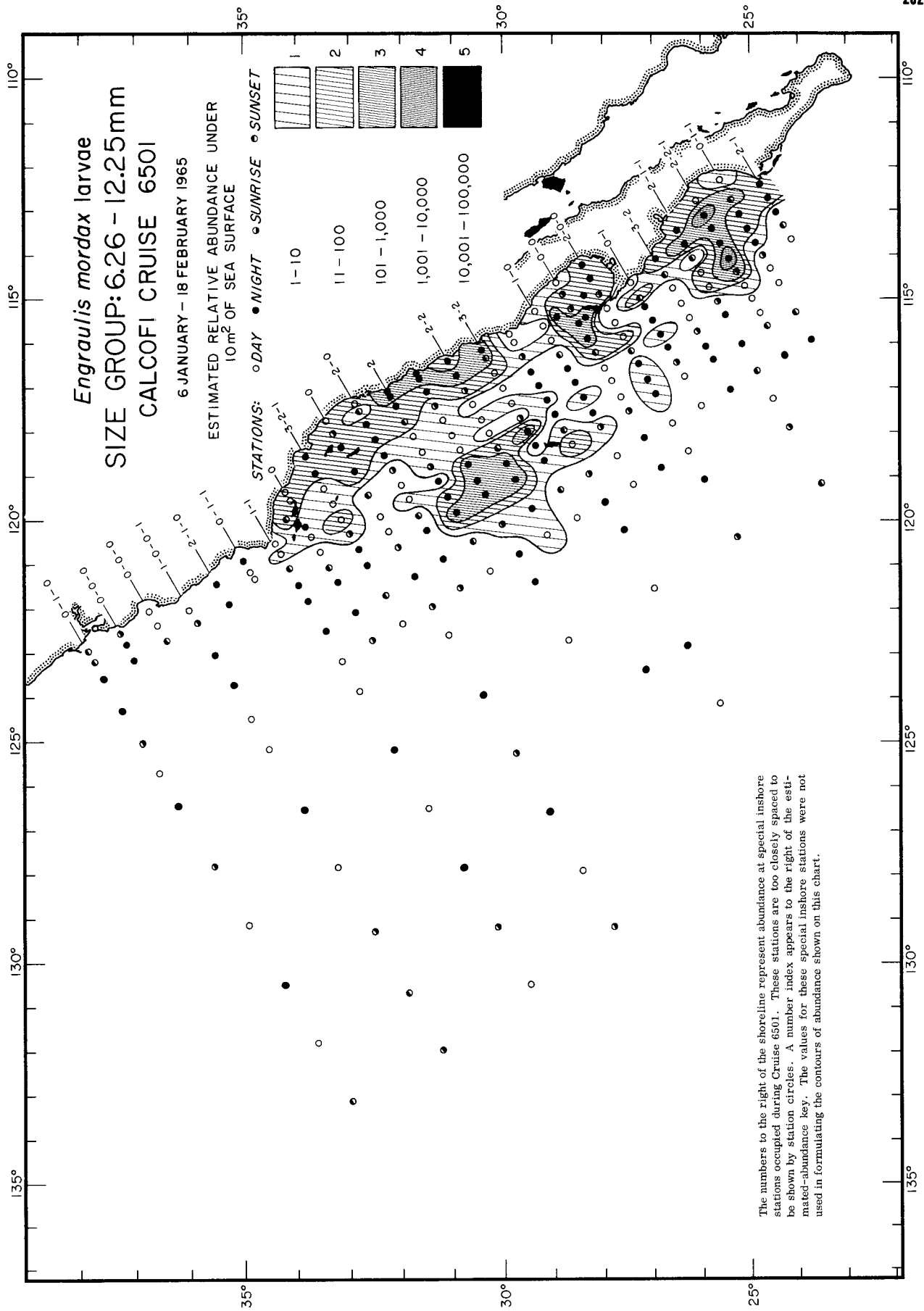
*Engraulis mordax* larvae  
 Size Group: 6.26-12.25mm  
 6410



*Engraulis mordax* larvae

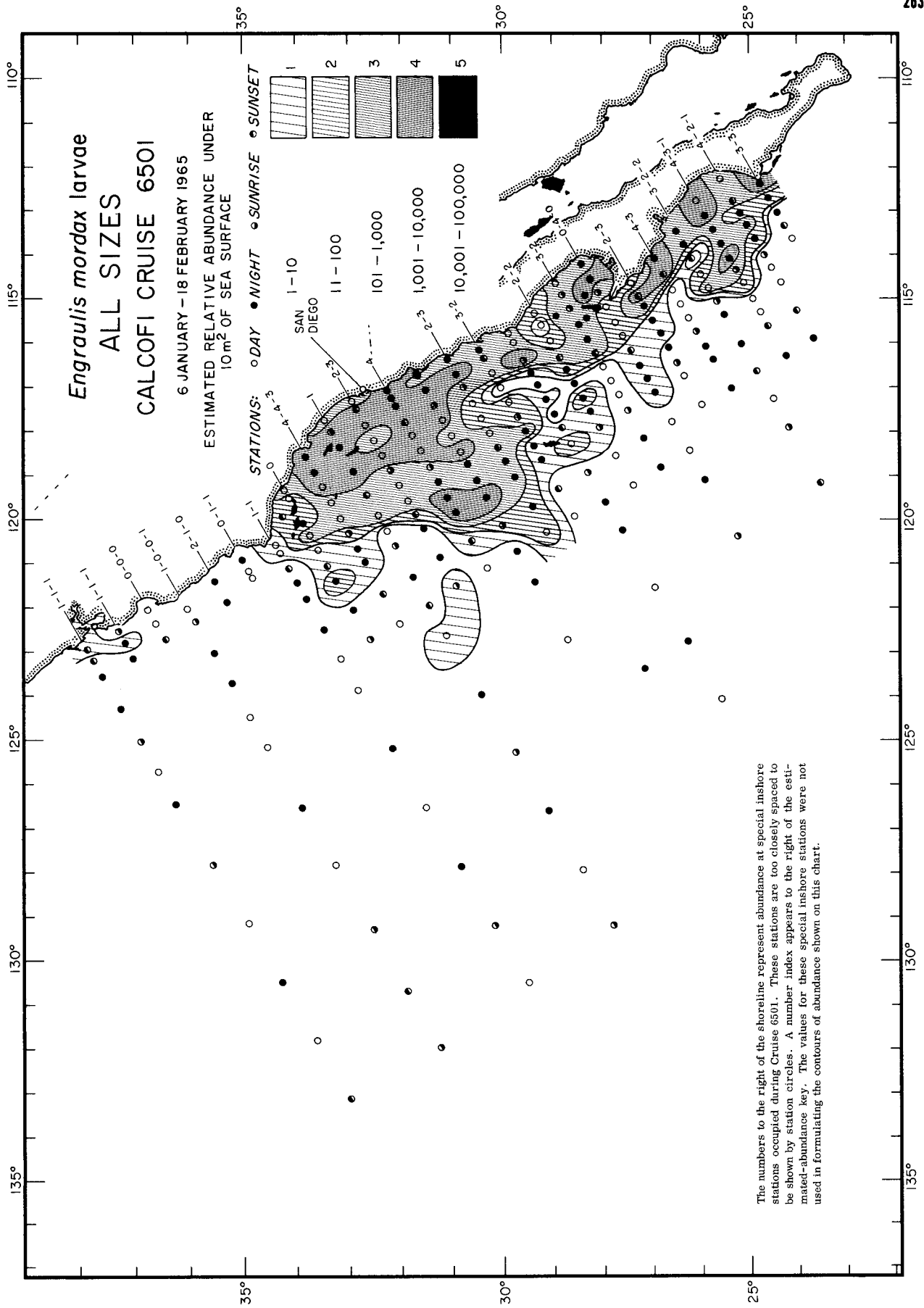
All Sizes  
6410





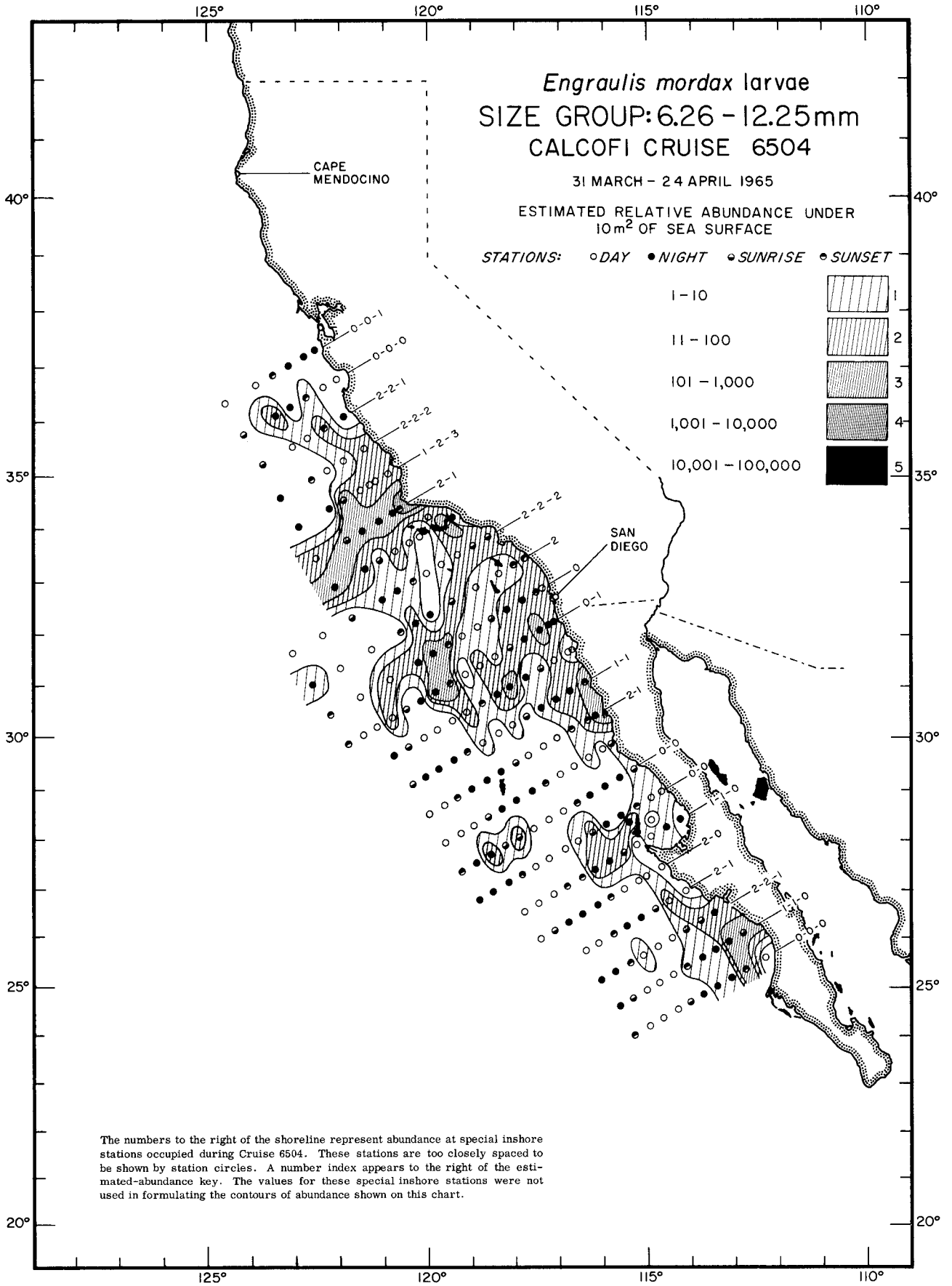
The numbers to the right of the shoreline represent abundance at special inshore stations occupied during Cruise 6501. These stations are too closely spaced to be shown by station circles. A number index appears to the right of the estimated-abundance key. The values for these special inshore stations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

*Engraulis mordax* larvae  
 Size Group: 6.26-12.25mm  
 6501

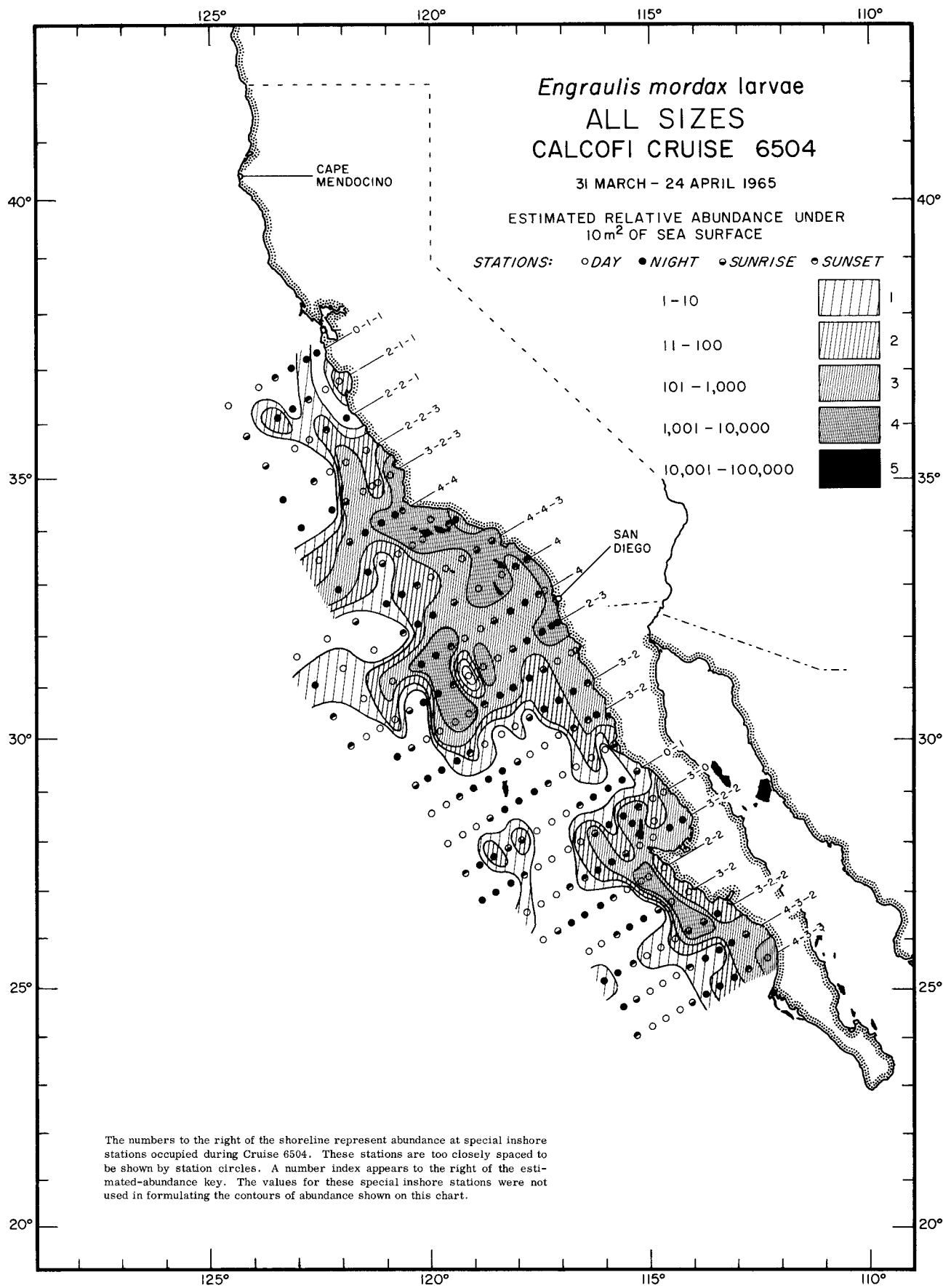


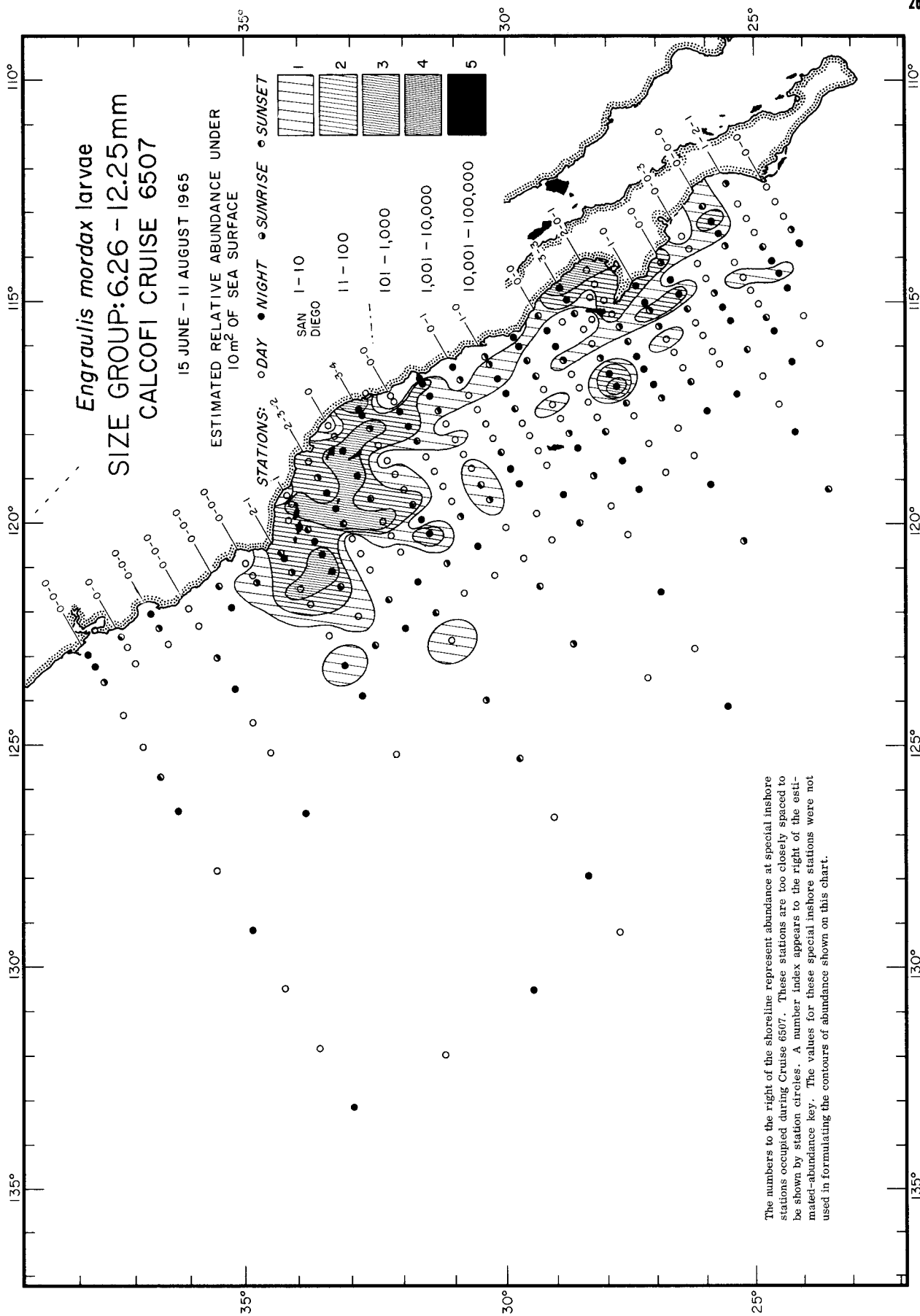
The numbers to the right of the shoreline represent abundance at special inshore stations occupied during Cruise 6501. These stations are too closely spaced to be shown by station circles. A number index appears to the right of the estimated-abundance key. The values for these special inshore stations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

*Engraulis mordax* larvae  
All Sizes  
6501



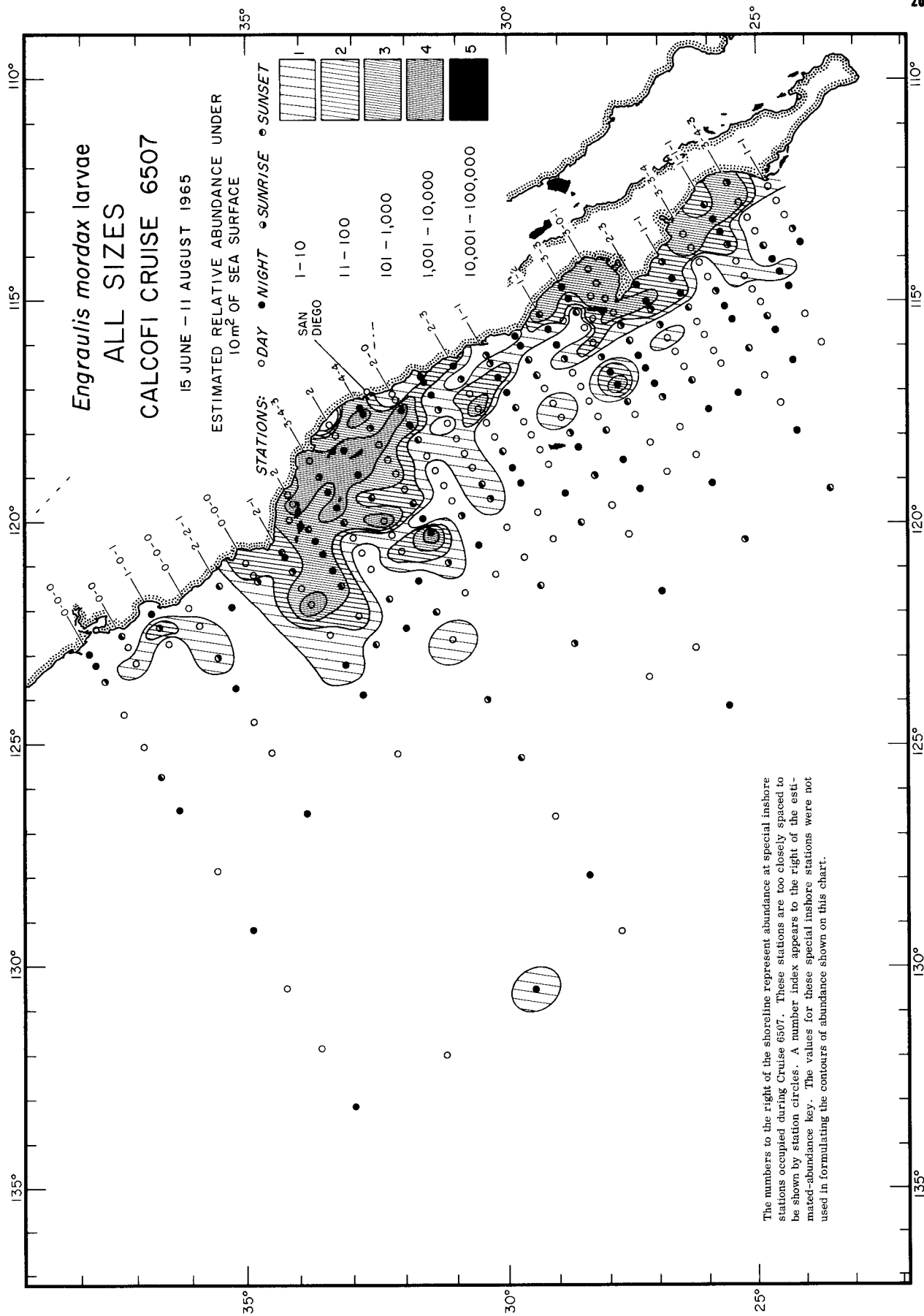
*Engraulis mordax* larvae  
 Size Group: 6.26-12.25mm  
 6504

*Engraulis mordax* larvaeAll Sizes  
6504

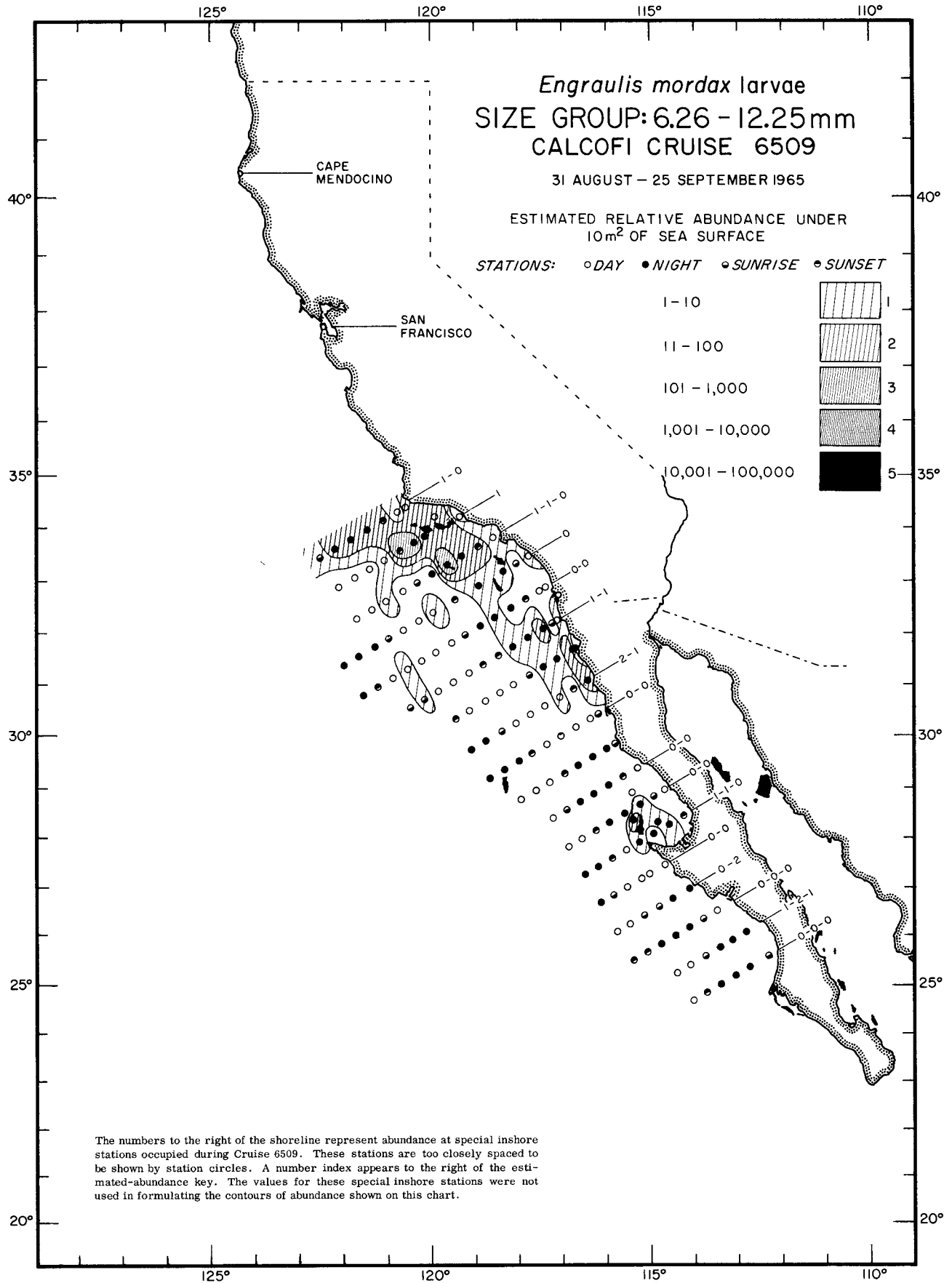


The numbers to the right of the shoreline represent abundance at special inshore stations occupied during Cruise 6507. These stations are too closely spaced to be shown by station circles. A number index appears to the right of the estimated-abundance key. The values for these special inshore stations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

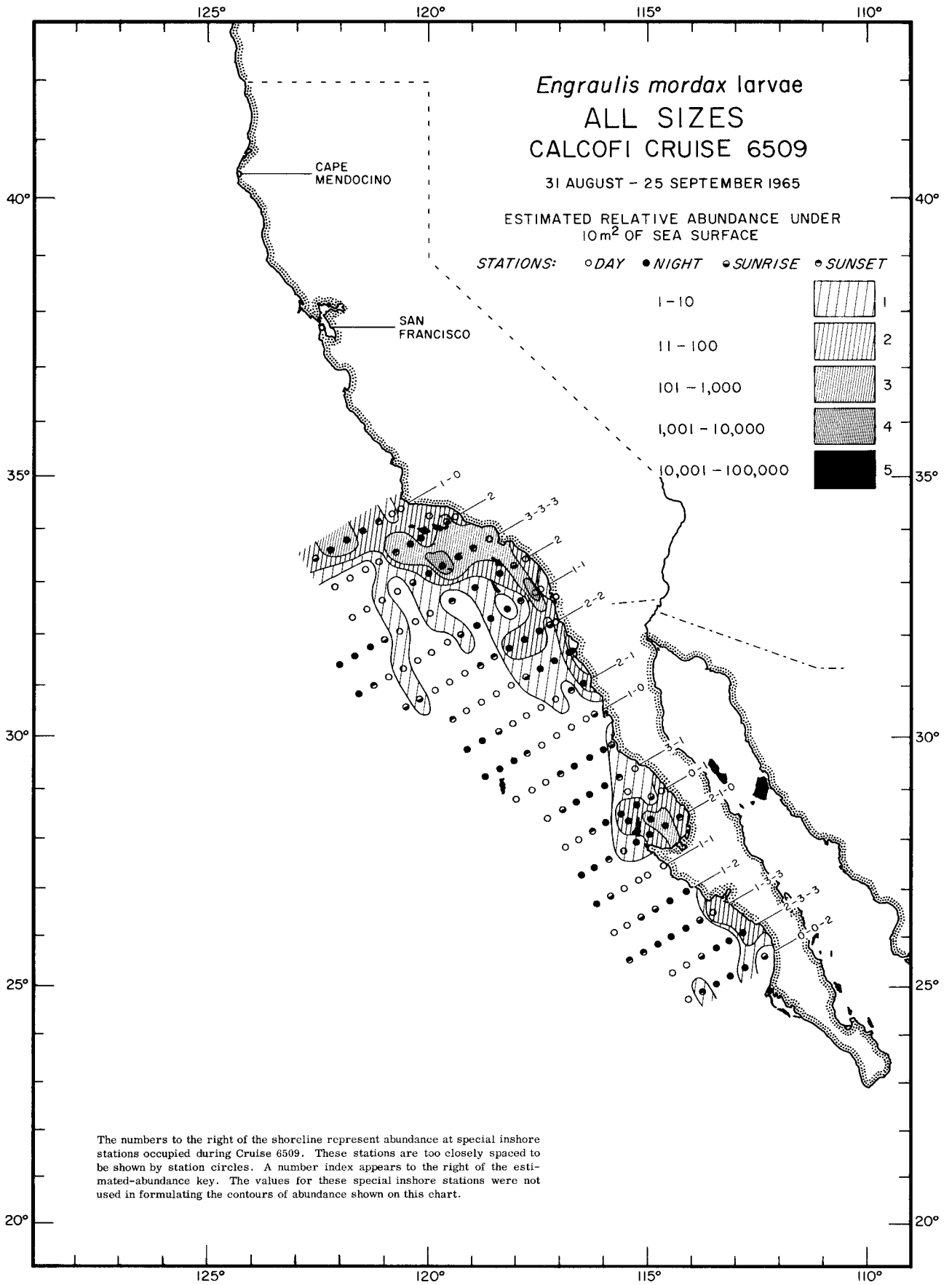
*Engraulis mordax* larvae  
 Size Group: 6.26-12.25mm  
 6507



*Engraulis mordax* larvae  
All Sizes  
6507

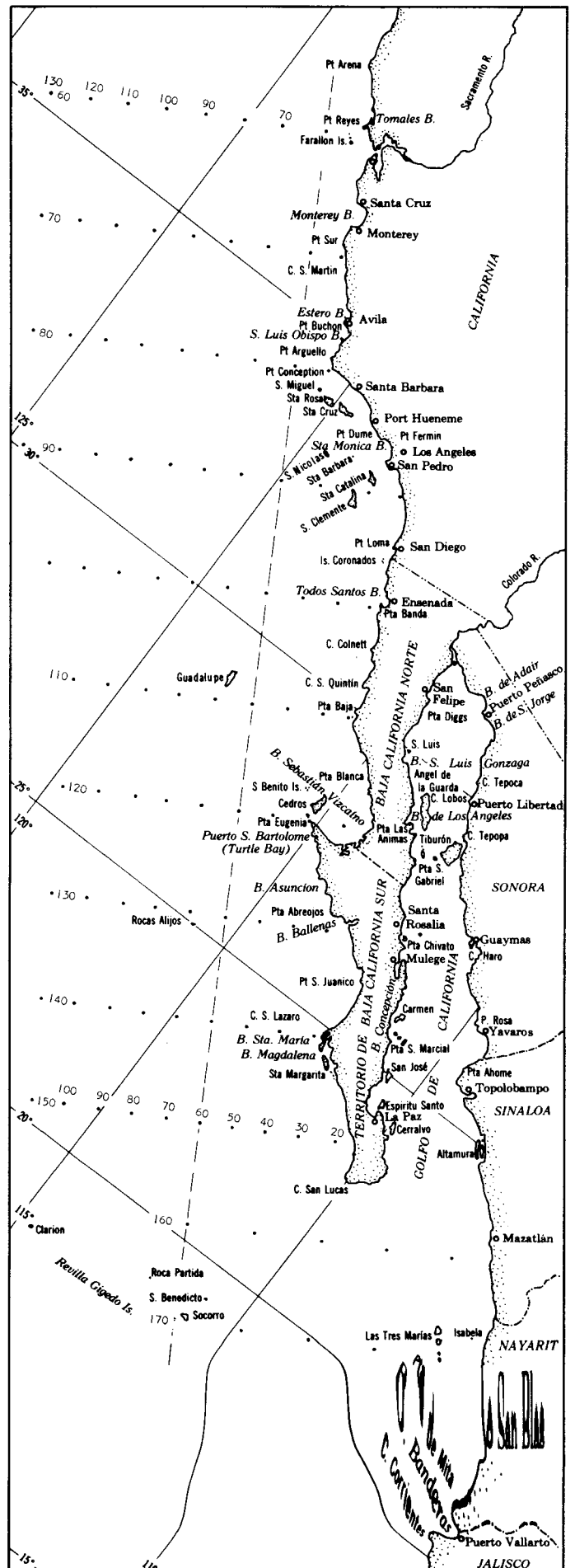
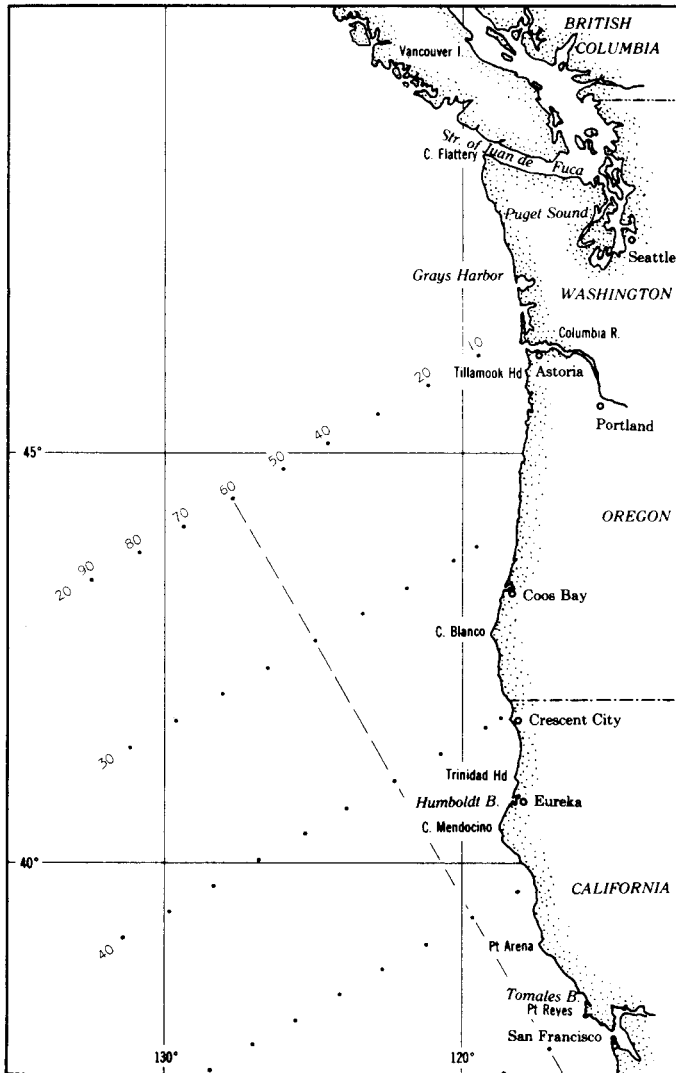


*Engraulis mordax* larvae  
 Size Group: 6.26-12.25 mm  
 6509



*Engraulis mordax* larvae  
All Sizes  
6509





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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