



Atlas 5: Brinton, E. Distributional atlas of Euphausiacea (Crustacea) in the California Current region, Part I. Published February 1967.

16 May 2007

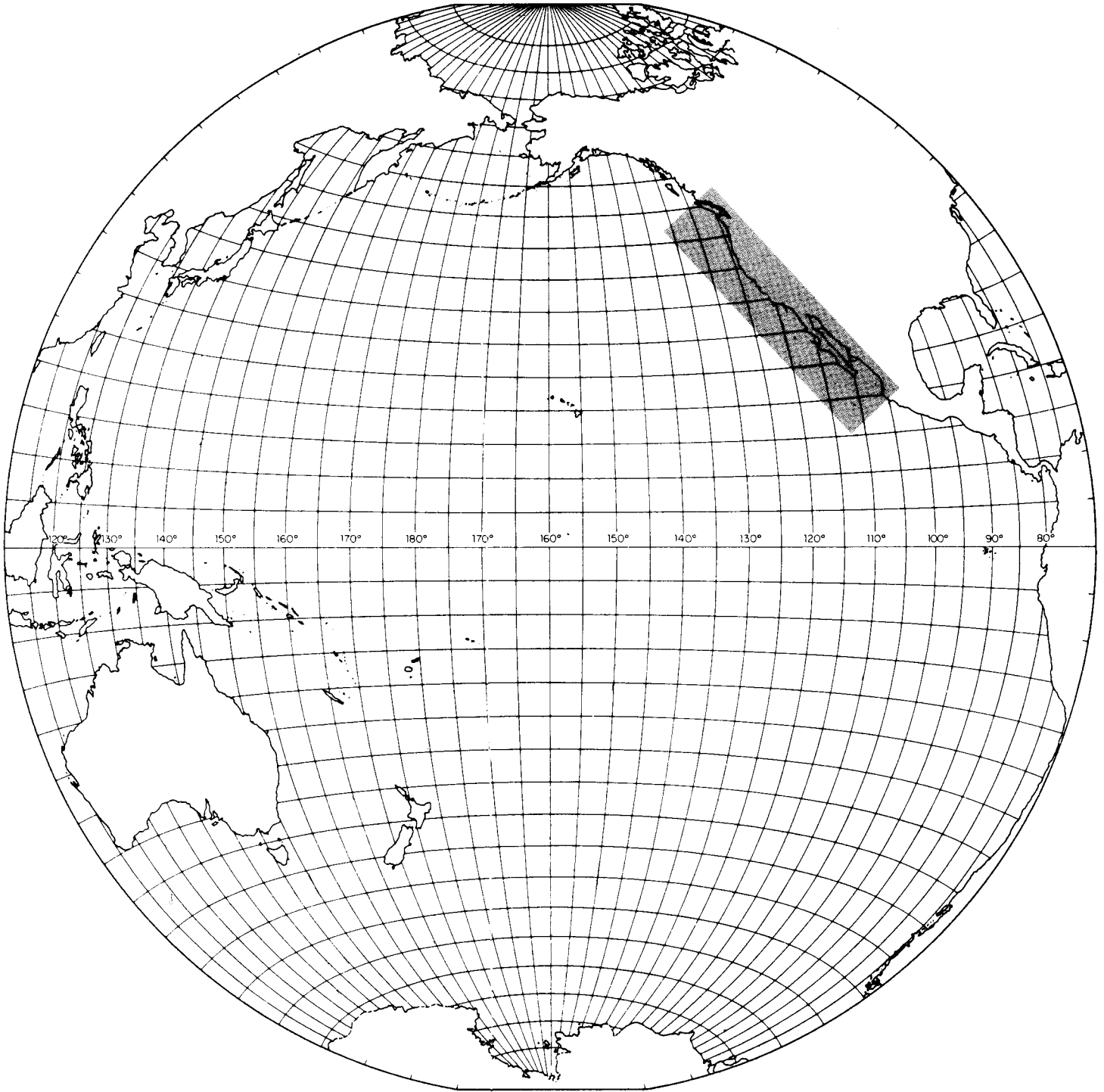
The taxonomic nomenclature in the atlas is exactly as published, even though the euphausiids have undergone taxonomic revision. Below are several references that may be useful in updating the species names:

Brinton, E., M. D. Ohman, A. W. Townsend, M. D. Knight, and A. L. Bridgeman. 2000. Euphausiids of the world ocean. Series: World Biodiversity Database CD-Rom Series Window version 1.0. Expert Center for Taxonomic Identification, Amsterdam, Netherlands, Springer Verlag, New York.

Brinton, E. 1975. Euphausiids of Southeast Asian waters. *Naga Reports* 4(5): 1-287.

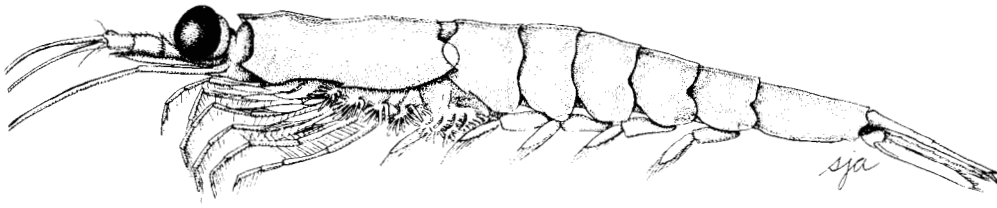
Baker, A. de C., B. P. Boden and E. Brinton. 1990. *A Practical Guide to the Euphausiids of the World*. Natural History Museum Publications. London, 96 pp.

STATE OF CALIFORNIA
MARINE RESEARCH COMMITTEE

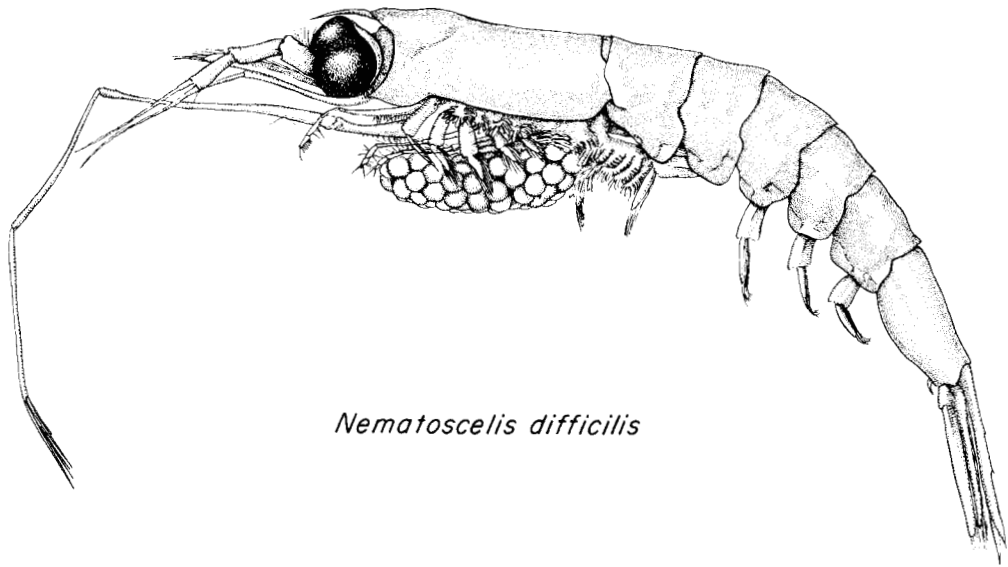


CALIFORNIA COOPERATIVE OCEANIC FISHERIES INVESTIGATIONS

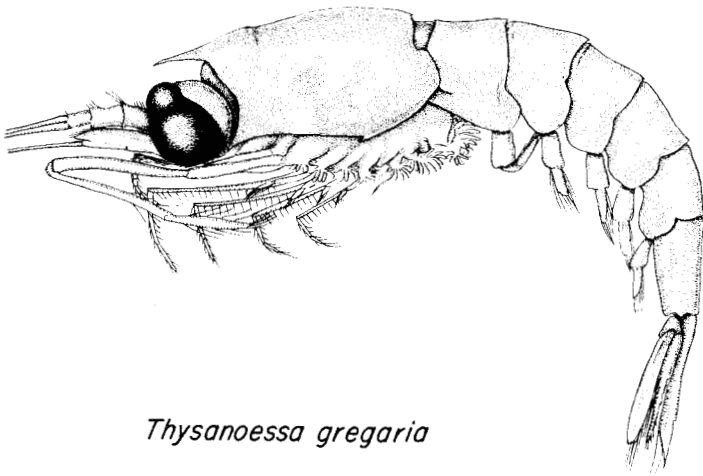
ATLAS No. 5



Euphausia pacifica



Nematoscelis difficilis



Thysanoessa gregaria

4mm

CALIFORNIA
COOPERATIVE
OCEANIC
FISHERIES
INVESTIGATIONS

Atlas No. 5

STATE OF CALIFORNIA
MARINE RESEARCH COMMITTEE

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UNIVERSITY OF CALIFORNIA, SCRIPPS INSTITUTION OF OCEANOGRAPHY

February 1967

THE CALCOFI ATLAS SERIES

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

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

CalCOFI atlases² are issued as individual units as they become available. They provide processed physical, chemical and biological measurements of the California Current region. Each number may contain one or more contributions. A general description of the CalCOFI program with its objectives appears in the preface of Atlas No. 2.

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

CalCOFI Atlas Editorial Staff:

Abraham Fleminger and Hans T. Klein, Editors
John G. Wyllie, Principal analyst, physical-chemical oceanographic data

Atlases in this series 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 1.
- 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 1.

¹ Usually abbreviated CalCOFI, sometimes CALCOFI or CCOFI.

² For citation this issue in the series should be referred to as CalCOFI Atlas No. 5.

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Edward Brinton

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in the California Current region, Part I

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DISTRIBUTIONAL ATLAS OF EUPHAUSIACEA (CRUSTACEA)

IN THE CALIFORNIA CURRENT REGION, PART I¹

Edward Brinton²

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Introduction

The charts in this atlas show the abundance and distribution of 28 species of Euphausiacea in the region of the California Current. The data were obtained from the following ten cruises: 1954, summer (Cruise 5408); 1955, spring (5504); 1957, winter (5702), fall (5710 and 5711); 1958, spring (5804), summer (5807), and fall (5810); 1962, spring (6204); and 1963, spring (6304).

Clear north-south faunistic or oceanographic boundaries are not found along the axis of flow of the California Current. It is therefore recognized as a transitional zone that is penetrated by species having population centers in (1) the subarctic north (e.g., Euphausia pacifica, Thysanoessa spinifera), (2) central waters to the west (e.g., Euphausia hemigibba, Nematoscelis atlantica), and (3) equatorial waters to the south (e.g., Euphausia distinguenda, E. tenera).

Such species as the above have principal affinities with waters marginal to the main body of the California Current. Superimposed upon the mosaic of their intrusions are the ranges of other species which occupy nearly the full length and breadth of the Current, but do not live in subarctic, central or equatorial waters. These include Nematoscelis difficilis, Thysanoessa gregaria and, probably, Euphausia gibboides. Nyctiphanes simplex is a coastal element of the assemblage. Pacific

¹ This research was carried out under the Scripps Institution's Marine Life Research Program with partial support from the National Science Foundation, Grant GB-2861.

² Scripps Institution of Oceanography, University of California, San Diego, La Jolla, California.

faunistics of the Euphausiacea are considered by Brinton (1962a), and discussion of zoogeographical changes in the California Current that took place in the "warm years", 1957-59, is contained in Brinton (1960).

Methods of Collection and Analysis

Details of the net and of the sampling procedure are given in the preface to CalCOFI Atlas No. 2. In brief, the standard CalCOFI plankton tow is made along an oblique path, 0m-140m-0m. For most of the California Current, this tow extends well into the discontinuity layer. The speed of the tow is about two knots. The mouth diameter of the net is one meter, and the mesh-width of the straining material (bolt-ing silk) is 0.6mm. A flow meter is mounted in the mouth of the net, and abundance of organisms is standardized on the basis of 1000 m³ of water strained. The standard tow commonly strains an estimated 400 m³ of water.

Laboratory treatment of the plankton consisted of (1) taking an aliquot of the sample, (2) counting all euphausiids in the aliquot and classifying them according to species as well as developmental stage, and (3) scanning the remainder of the sample under the microscope for species that appeared not to have been representatively subsampled in the aliquot, or that were entirely lacking in it. In counting, the aliquot was usually sufficient for dominant species, but the entire sample was used for rarer species.

One-tenth of the sample was usually counted when the total number of euphausiids was expected to exceed about 700 to 1000. When less abundant, an aliquot of one-fourth or one-fifth was taken. The aliquot was obtained as follows: the plankton and fluid were mixed thoroughly, the mixture was poured into a graduated cylinder, and then all but the desired aliquot was poured out. This method has been shown to yield effectively random aliquots (Brinton, 1962b).

The importance of scanning the entire sample for rare species was indicated by the fact that, in random aliquots, a species with a mean density of one specimen per aliquot was not present in about 37% of all aliquots, and a species with a mean density of 0.5 specimen per aliquot was absent in about 61% of all aliquots.

Limitations of the Sampling Method

It is recognized that euphausiids are active swimmers and that many engage in extensive diurnal vertical migrations. Inasmuch as CalCOFI stations are normally occupied without regard to the time of day, the charts of the distribution of euphausiids are therefore based on a mixture of daytime and nighttime samples. The effect of combining such data for presentation on charts has already been discussed (Brinton, 1962b).

More recently it has been shown (Brinton, in MS.) that Euphausia (juveniles and adults), Nematoscelis (adults), and Thysanopoda aequalis (juveniles and adults) undergo extensive diurnal vertical migrations in the CalCOFI region. On the other hand, Stylocheiron, Nematobranchion, and Thysanoessa gregaria apparently do not migrate vertically, but nevertheless show varying degrees of ability to escape the net during daylight. Thus, the juveniles and adults of most species either sink beneath the 0-140 m stratum during the day, or, if remaining in the upper layers, are able to avoid the net. Their measured daytime densities are therefore, at best, minimum estimates.

The daytime effect on estimates of abundance was greatest with E. pacifica, E. mutica and E. recurva. These species were also the ones most frequently underestimated: about 50% of the time. Those of Thysanoessa, Nematoscelis, Stylocheiron and Thysanopoda were least underestimated. In cases where vertical migration by furcilia was suspected, the daytime occurrences were still within the 0-140 m layer.

Brinton (in MS.) considers that daytime data may reasonably be included in mapping the abundance in the 0-140 m layer of Nyctiphanes, Thysanoessa, Nematoscelis, Stylocheiron, and Thysanopoda, providing that density contours are based on broad intervals, preferably logarithmic. Diurnal disparities in the observed 0-140 m abundance of Euphausia species were found to be so marked that day and night data should be considered separately, except for areas where larvae comprise the bulk of the population.

The recent findings of Brinton (in MS.) have not been taken into consideration in charting the distributions for this atlas. Day and night data are compiled together. Caution must therefore be exercised in the interpretation of distributions in areas in which daytime stations predominate.

Presentation of the Data

All samples available were examined for each cruise. Most of the charts show, for each station, the composite abundance of all the developmental stages sampled. These include furcilia, juveniles and adults. Naupliar and calyptopis stages are able to pass through the meshes of the standard CalCOFI plankton net, and are therefore only incidentally sampled.

For five of the numerically important species, charts of the distribution of larvae are included; "larva," here, means furcilia, but also includes those calyptopis stages that were sometimes found.

REFERENCES

- Brinton, E., 1960. Changes in the distribution of euphausiid crustaceans in the region of the California Current. *CalCOFI Repts.*, No. 7: 137-146
- _____, 1962a. The distribution of Pacific euphausiids. *Bull. Scripps Inst. Oceanogr., Univ. Calif.*, 8(2): 51-270
- _____, 1962b. Variable factors affecting the apparent range and estimated concentration of euphausiids in the North Pacific. *Pacific Science*, 16(4): 374-408
- _____, (manuscript). Vertical migration and avoidance-capability of euphausiids in the California Current.

List of Charts

CalCOFI Basic Station Plan 1

Euphausia

diomediae	2 - 3
distinguenda	4 - 8
eximia (<u>larvae</u>)	9 - 17
eximia (<u>total</u>)	18 - 27
gibboides (<u>larvae</u>)	28 - 37
gibboides (<u>total</u>)	38 - 47
hemigibba	48 - 57
lamelligera	58 - 60
mutica	61 - 69
pacifica (<u>larvae</u>)	70 - 79
pacifica (<u>total</u>)	80 - 89
recurva	90 - 99
tenera	100 - 106

Nematobranchion

flexipes	107 - 115
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Nematoscelis

atlantica	116 - 123
difficilis (<u>larvae</u>)	124 - 133
difficilis (<u>total</u>)	134 - 143
gracilis	144 - 152
tenella	153 - 161

Nyctiphanes

simplex (<u>larvae</u>)	162 - 171
simplex (<u>total</u>)	172 - 181

Stylocheiron

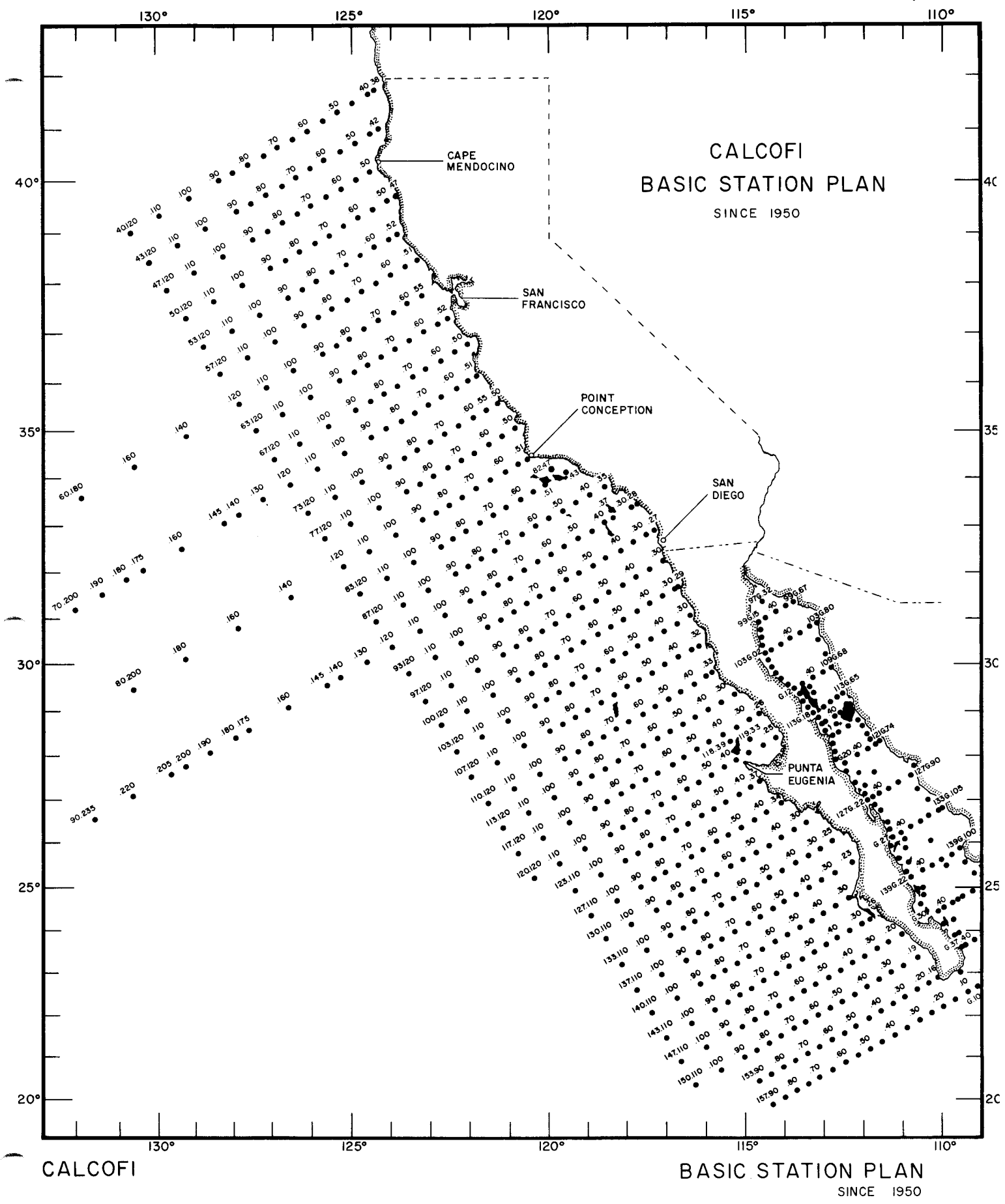
abbreviatum	182 - 189
affine	190 - 199
carinatum	200 - 206
longicorne	207 - 216
maximum	217 - 226
suhmii	227 - 235

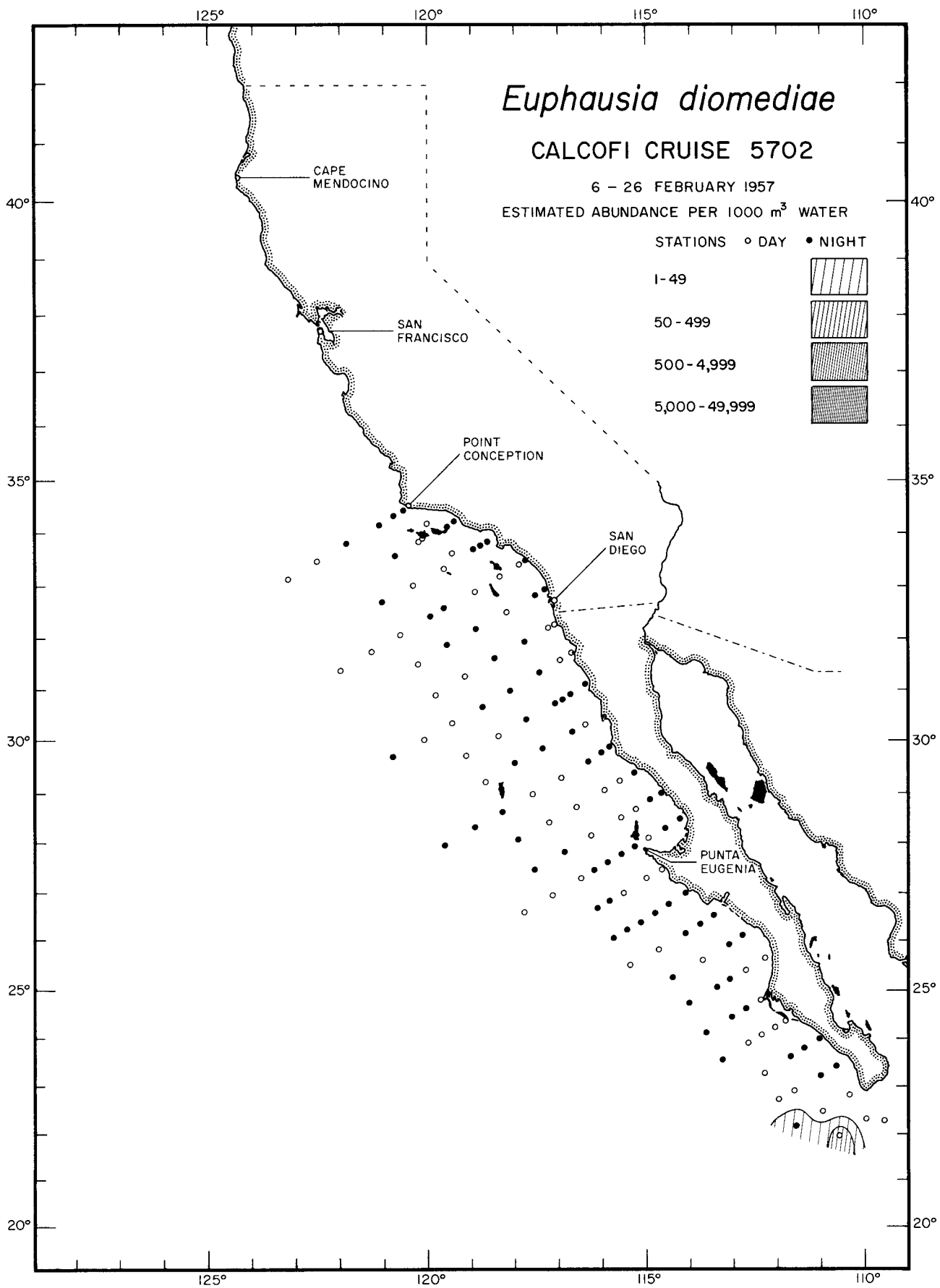
Thysanoessa

gregaria	236 - 245
spinifera	246 - 255

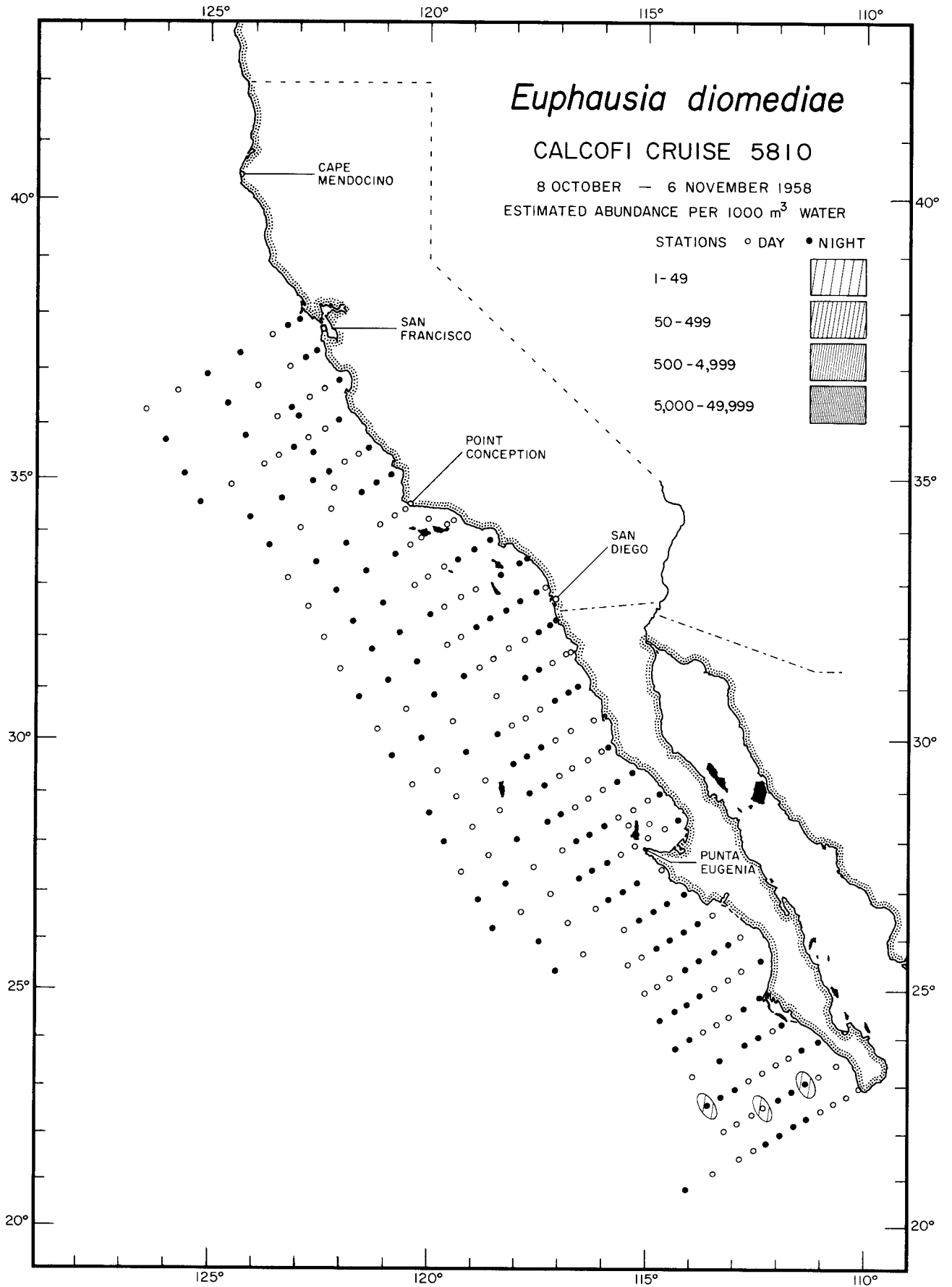
Thysanopoda

aequalis	256 - 264
monacantha	265 - 267
obtusifrons	268 - 273
pectinata	274 - 275

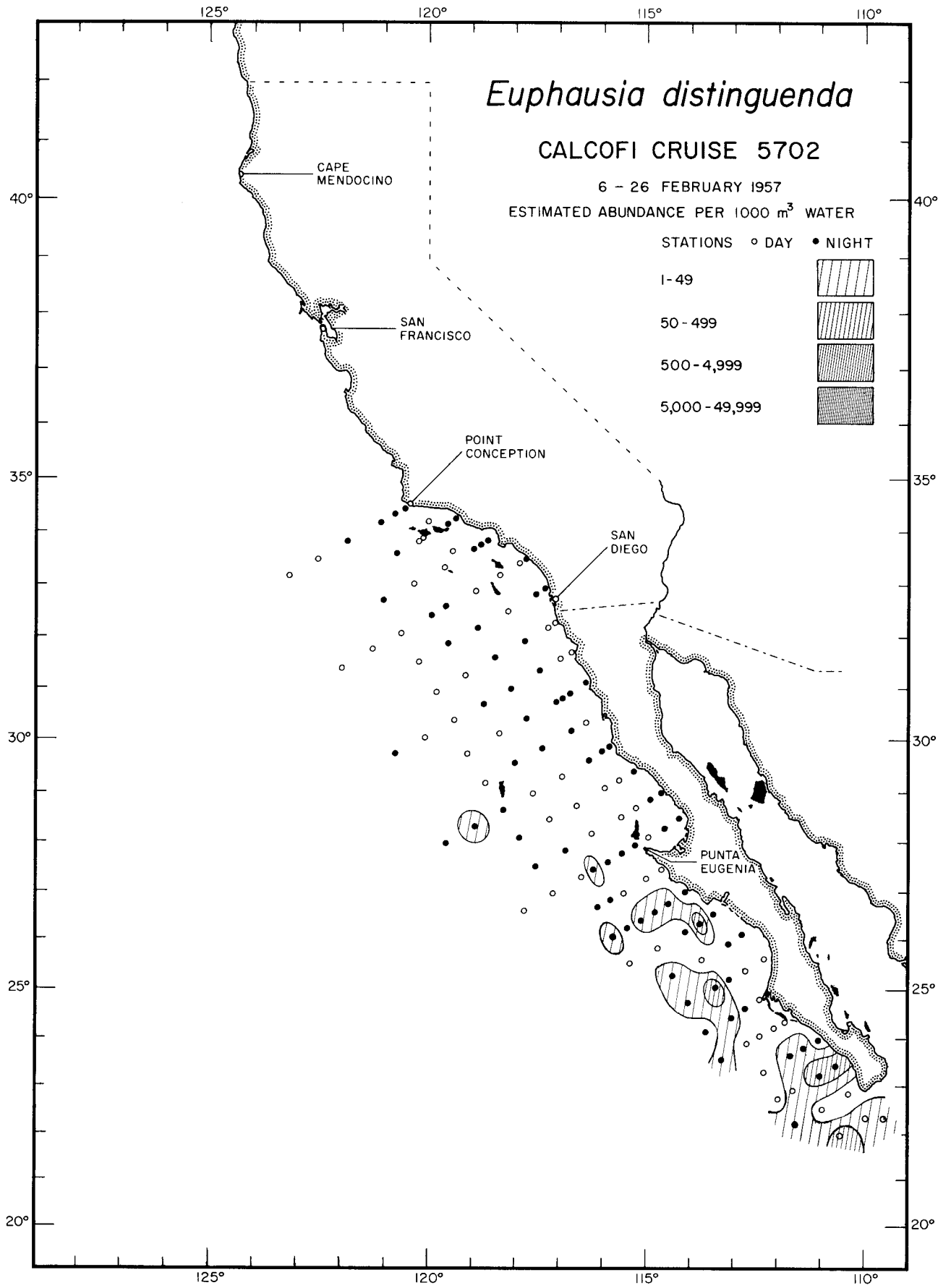




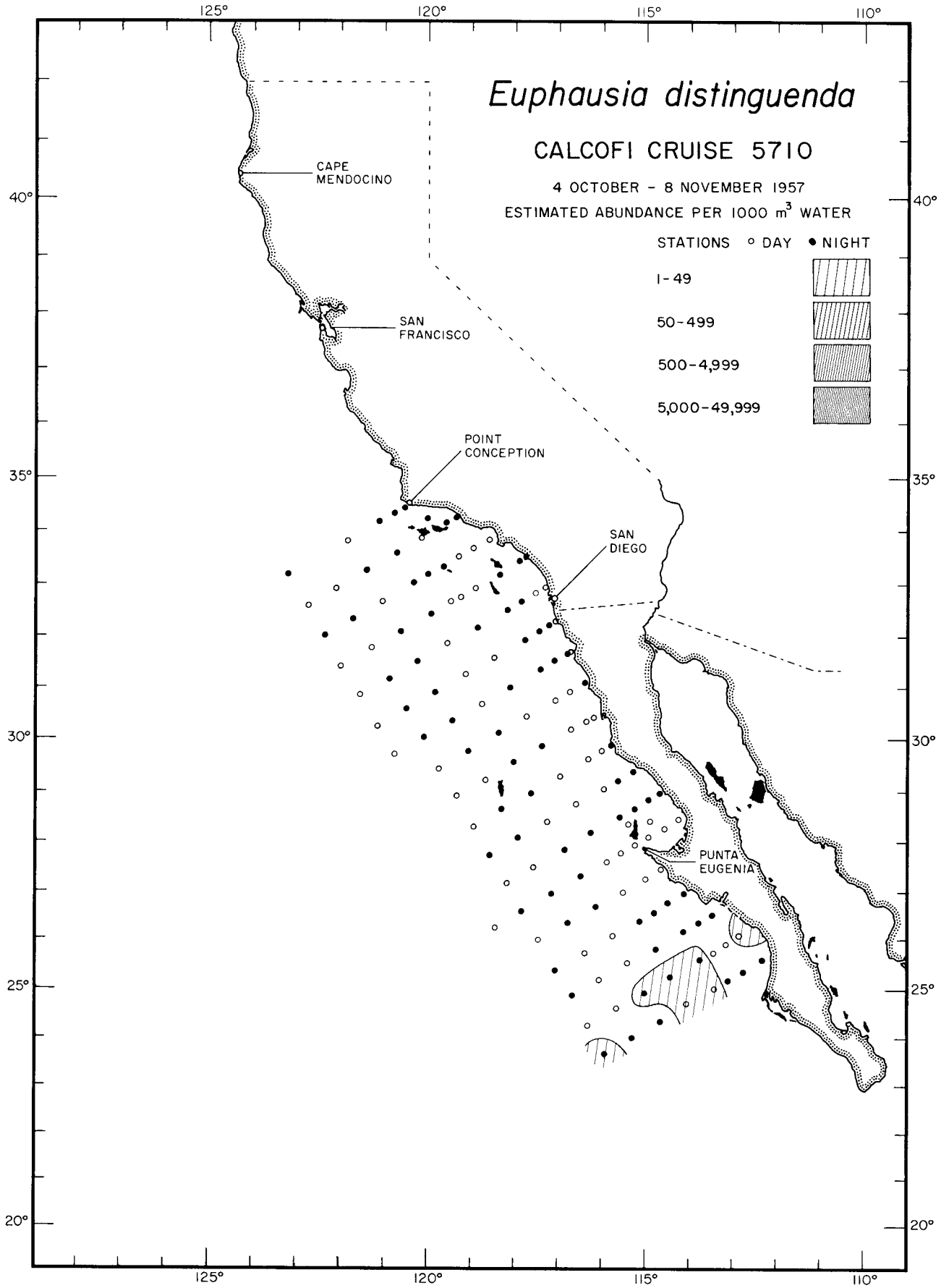
Euphausiacea
Euphausia diomediae
5702



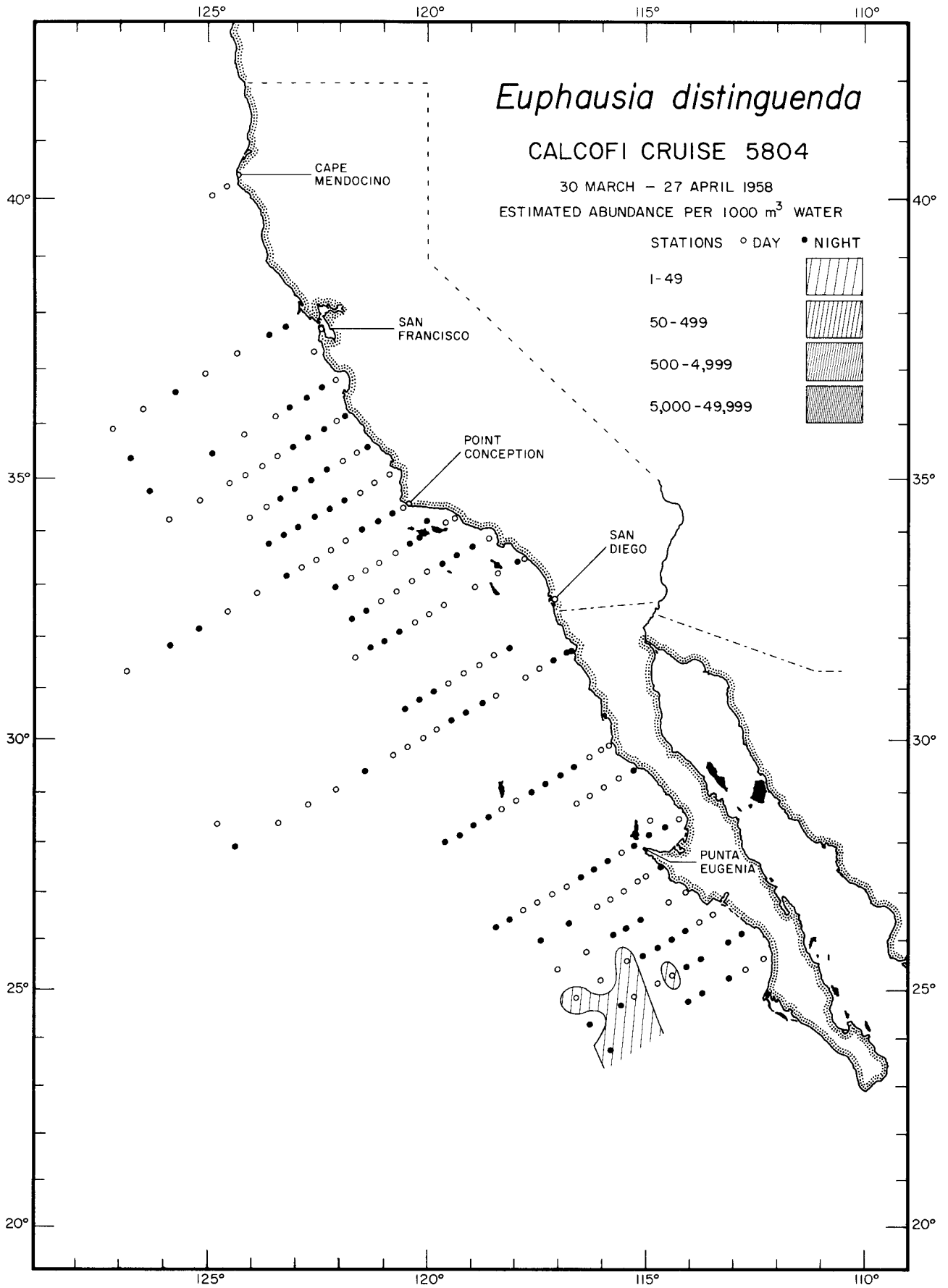
Euphausiacea
Euphausia diomediae
5810



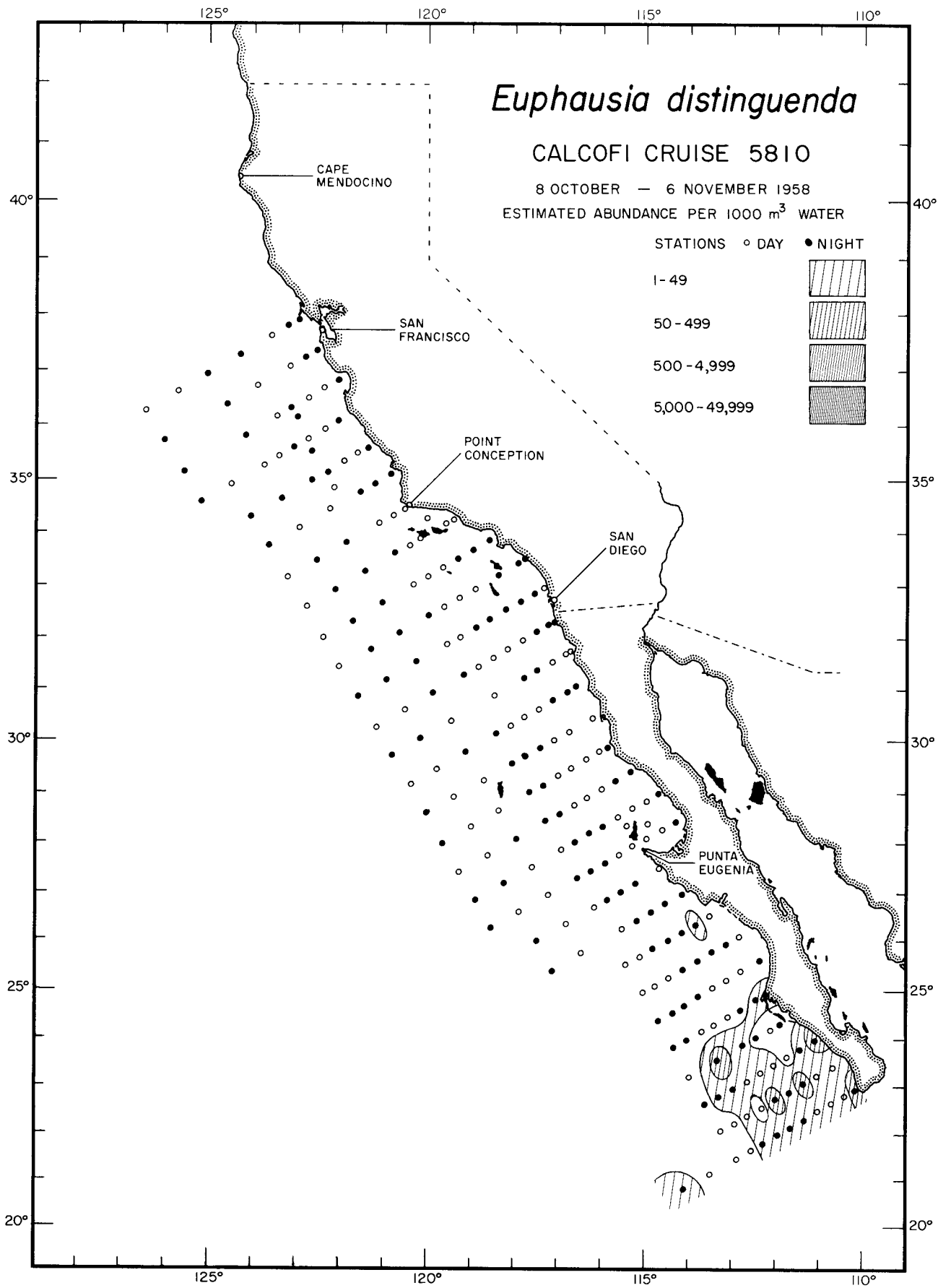
Euphausiacea
Euphausia distinguenda
5702



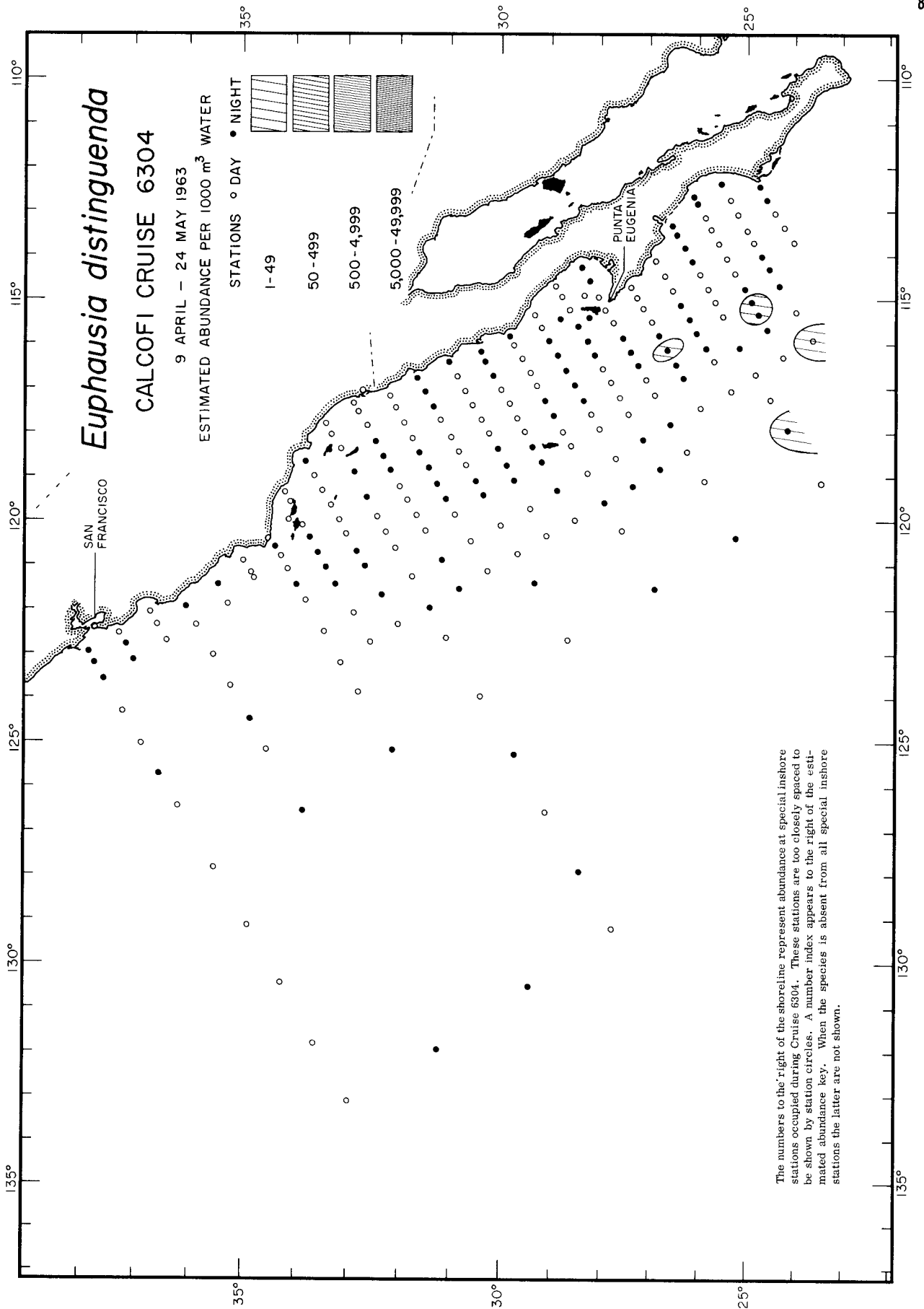
Euphausiacea
Euphausia distinguenda
 5710



Euphausiacea
Euphausia distinguenda
 5804

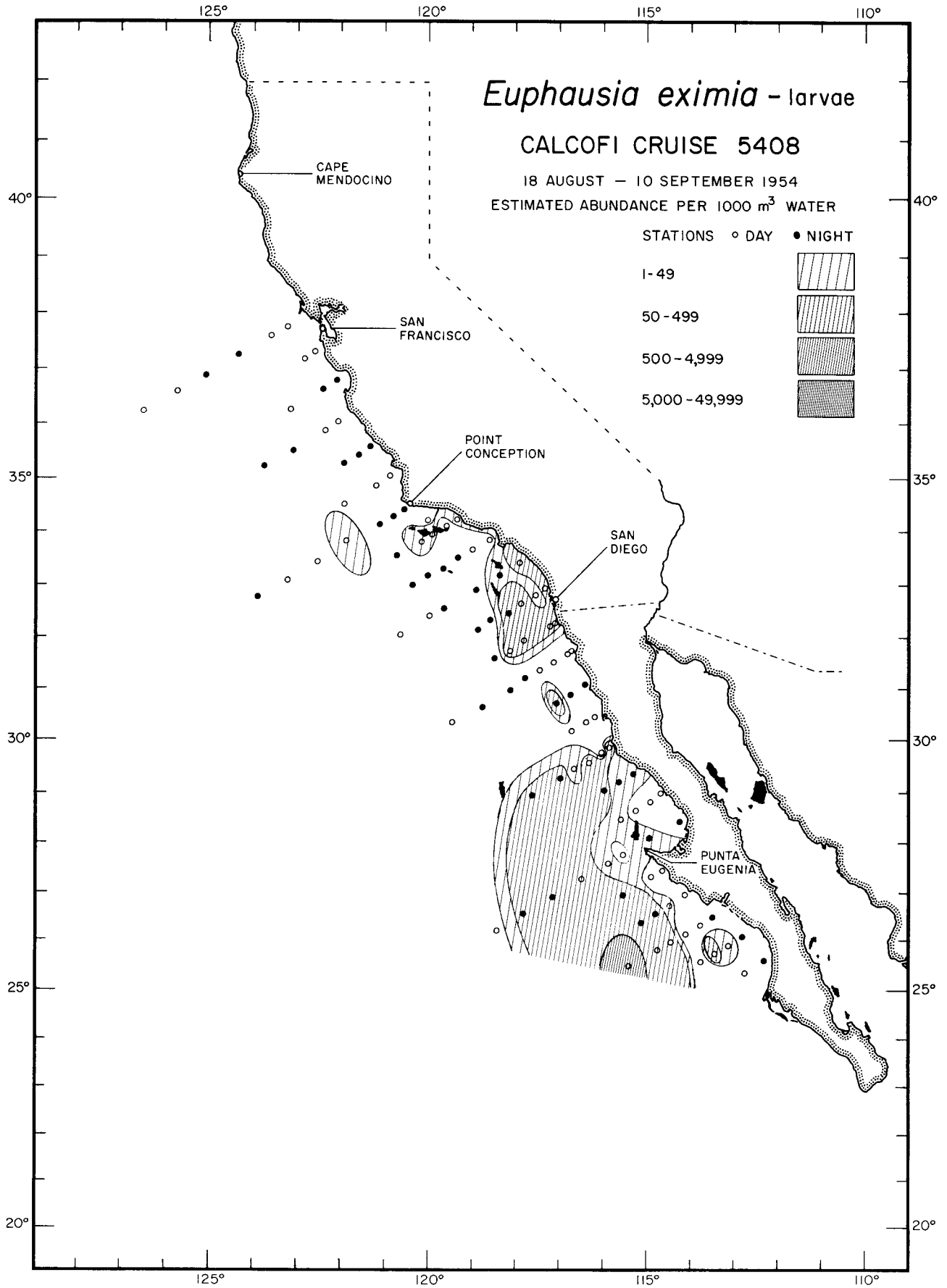


Euphausiacea
Euphausia distinguenda
 5810

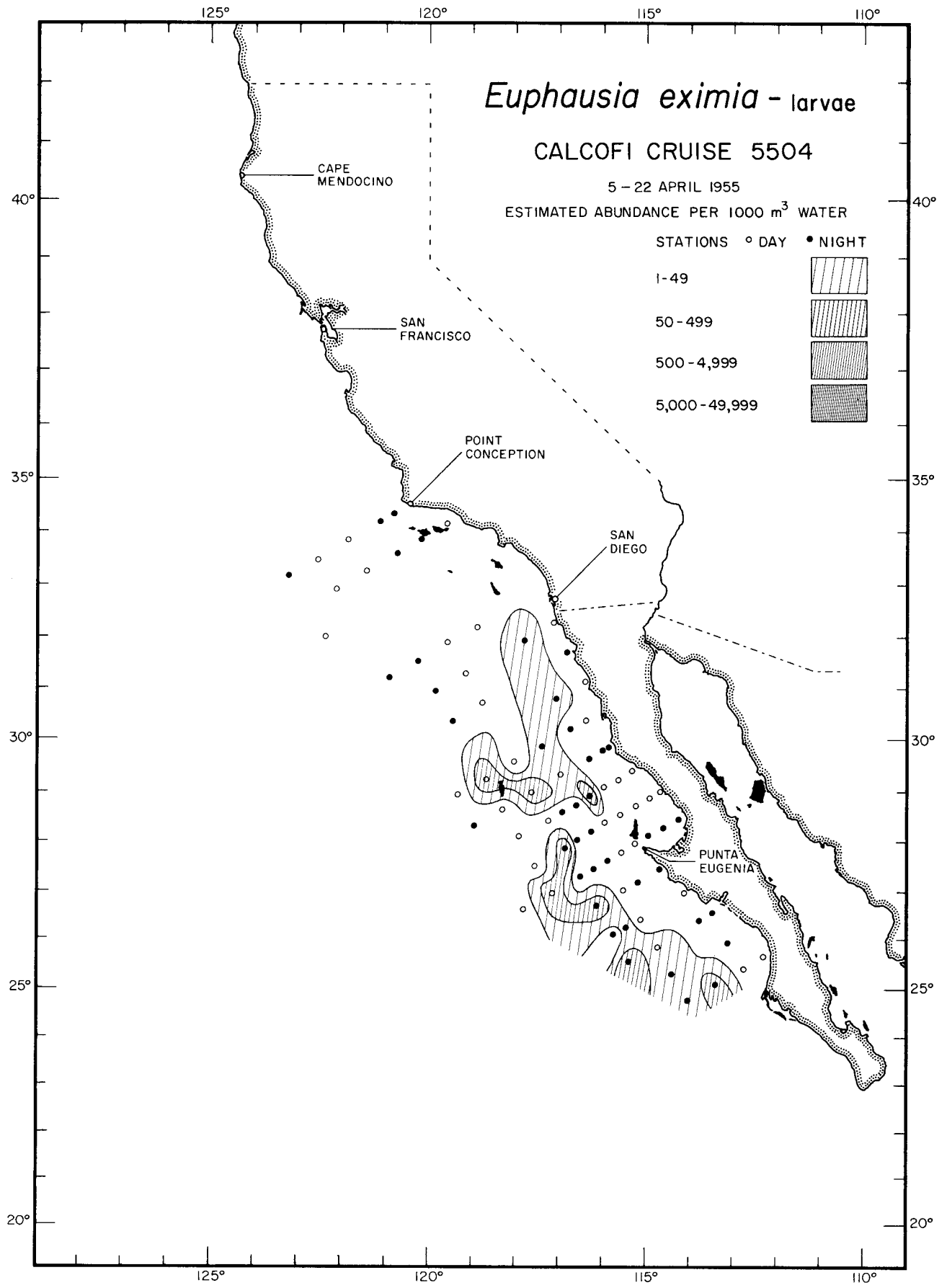


The numbers to the right of the shoreline represent abundance at special inshore stations occupied during Cruise 6304. These stations are too closely spaced to be shown by station circles. A number index appears to the right of the estimated abundance key. When the species is absent from all special inshore stations the latter are not shown.

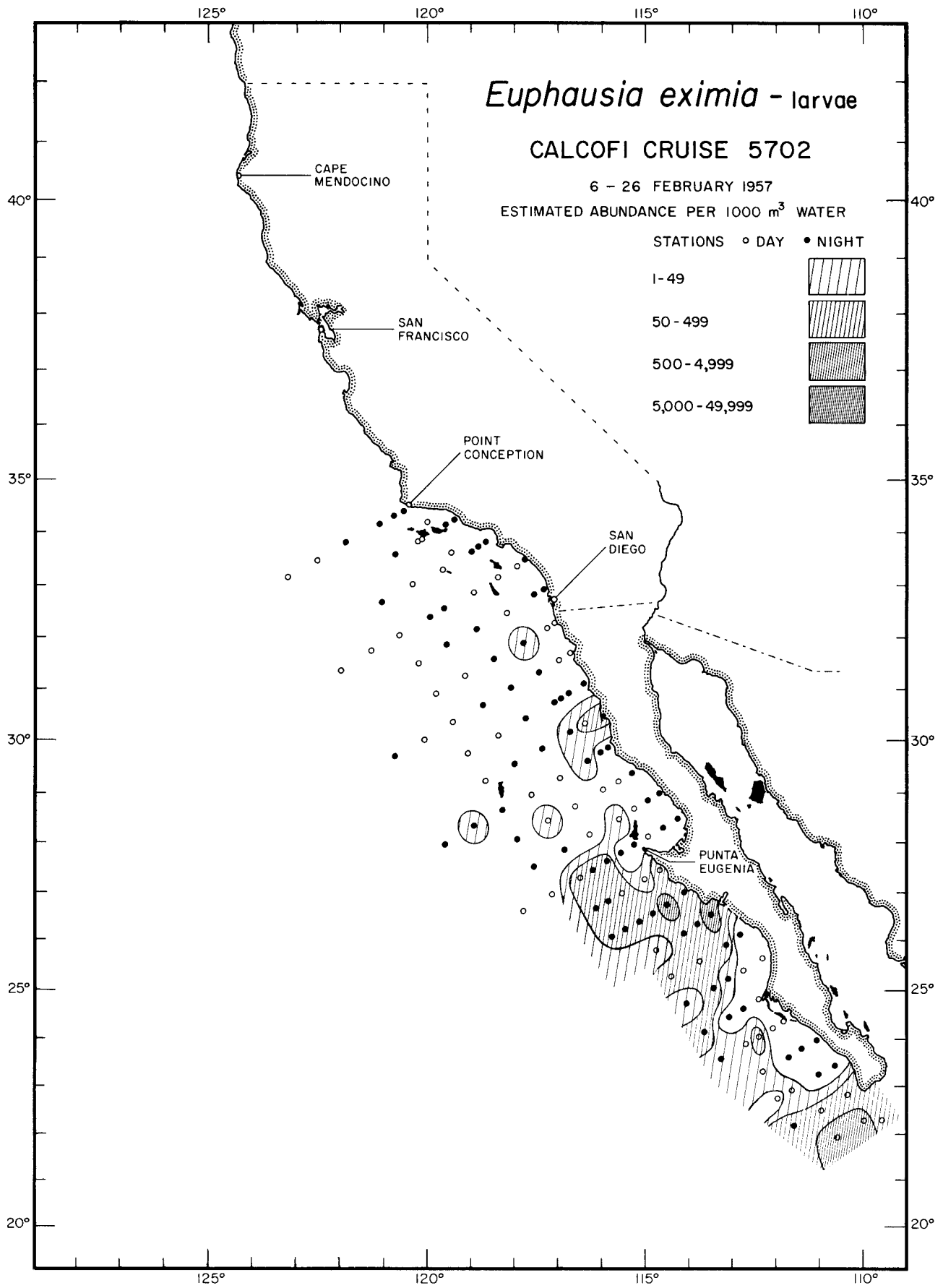
Euphausiacea
Euphausia distinguenda
 6304



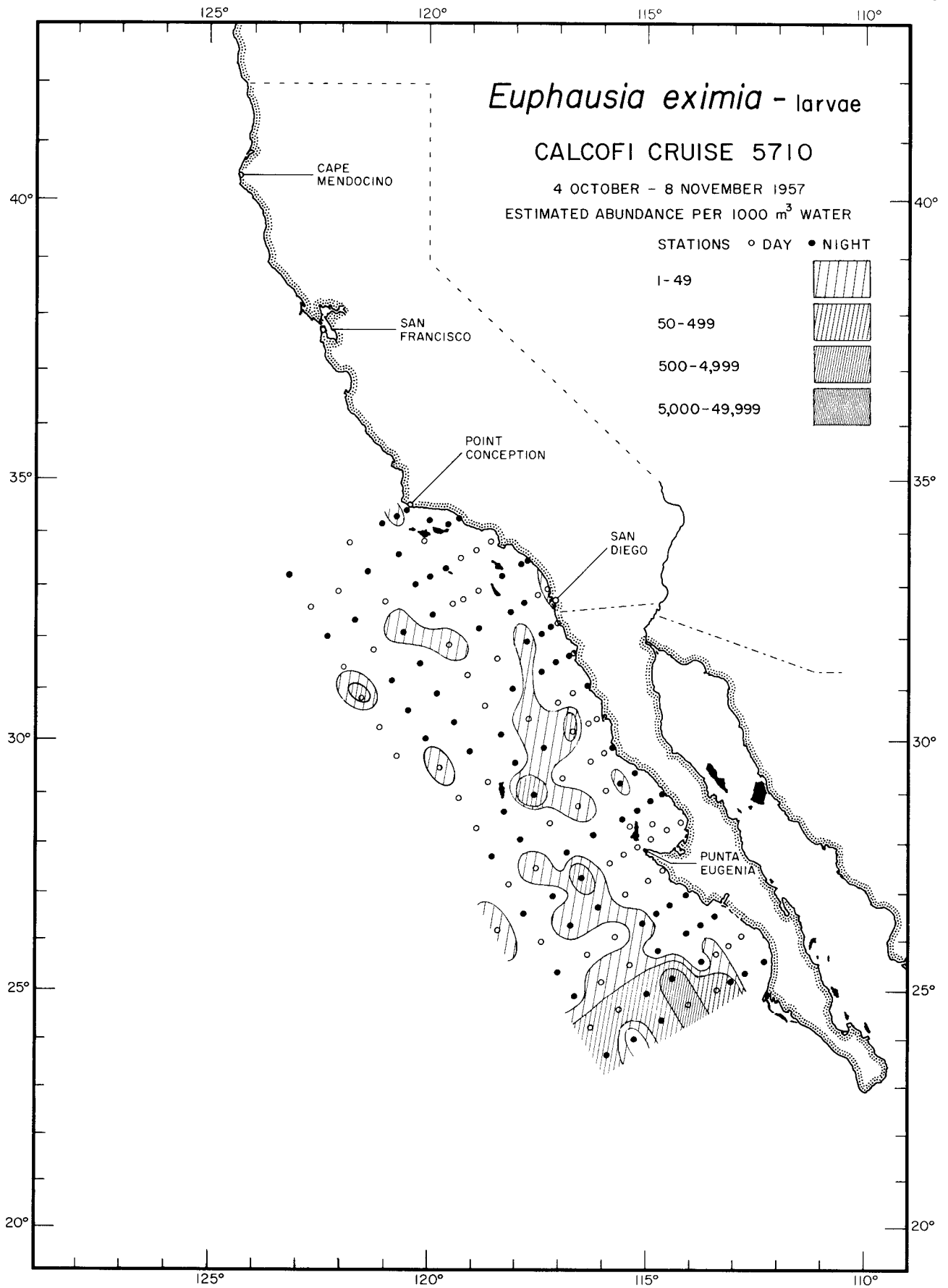
Euphausiacea
Euphausia eximia - larvae
 5408



Euphausiacea
Euphausia eximia - larvae
5504



Euphausiacea
Euphausia eximia - larvae
5702



Euphausia eximia - larvae

CALCOFI CRUISE 5710

4 OCTOBER - 8 NOVEMBER 1957

ESTIMATED ABUNDANCE PER 1000 m³ WATER

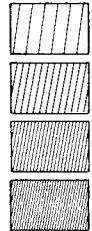
STATIONS ○ DAY ● NIGHT

1-49

50-499

500-4,999

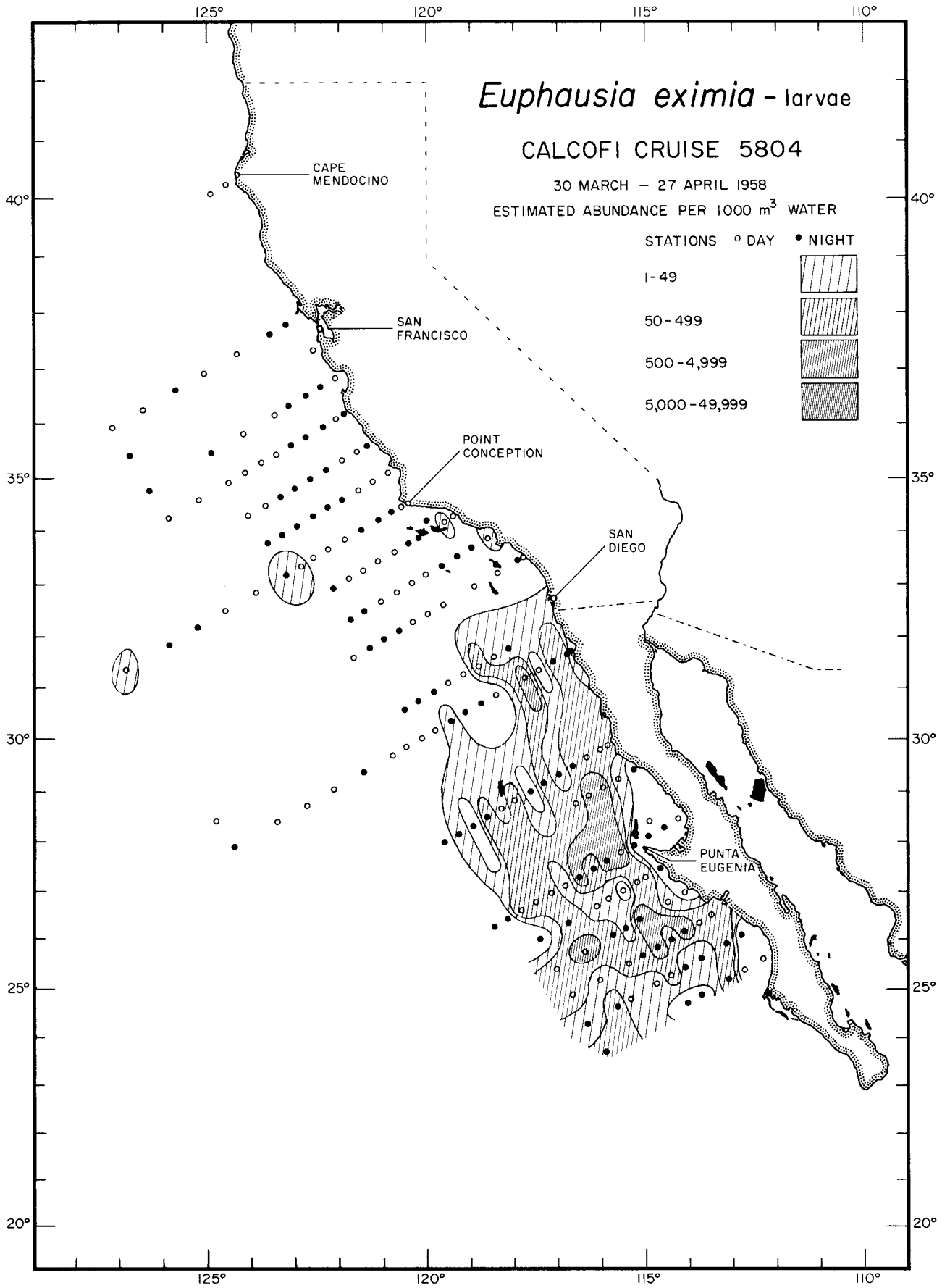
5,000-49,999



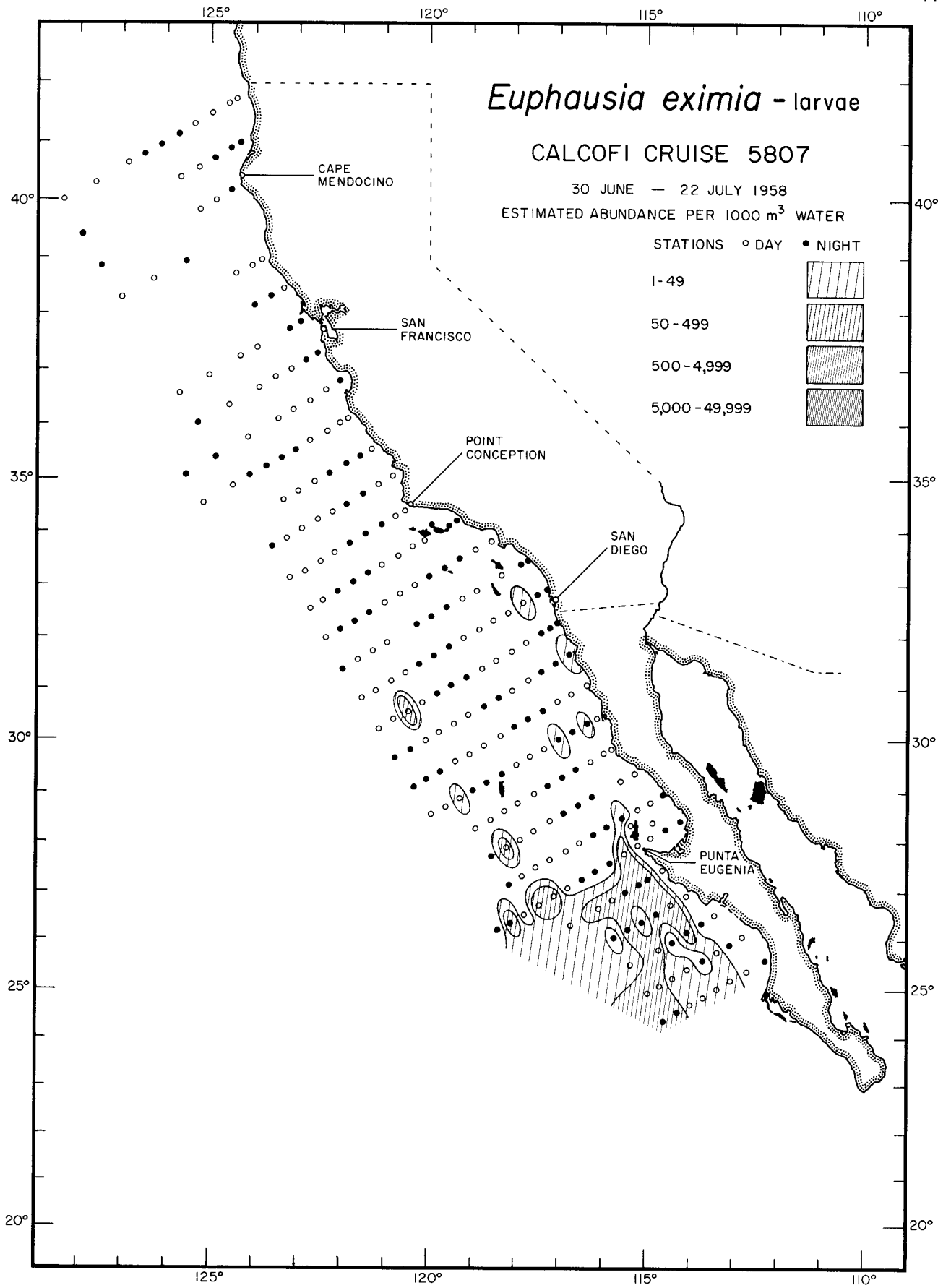
Euphausiacea

Euphausia eximia - larvae

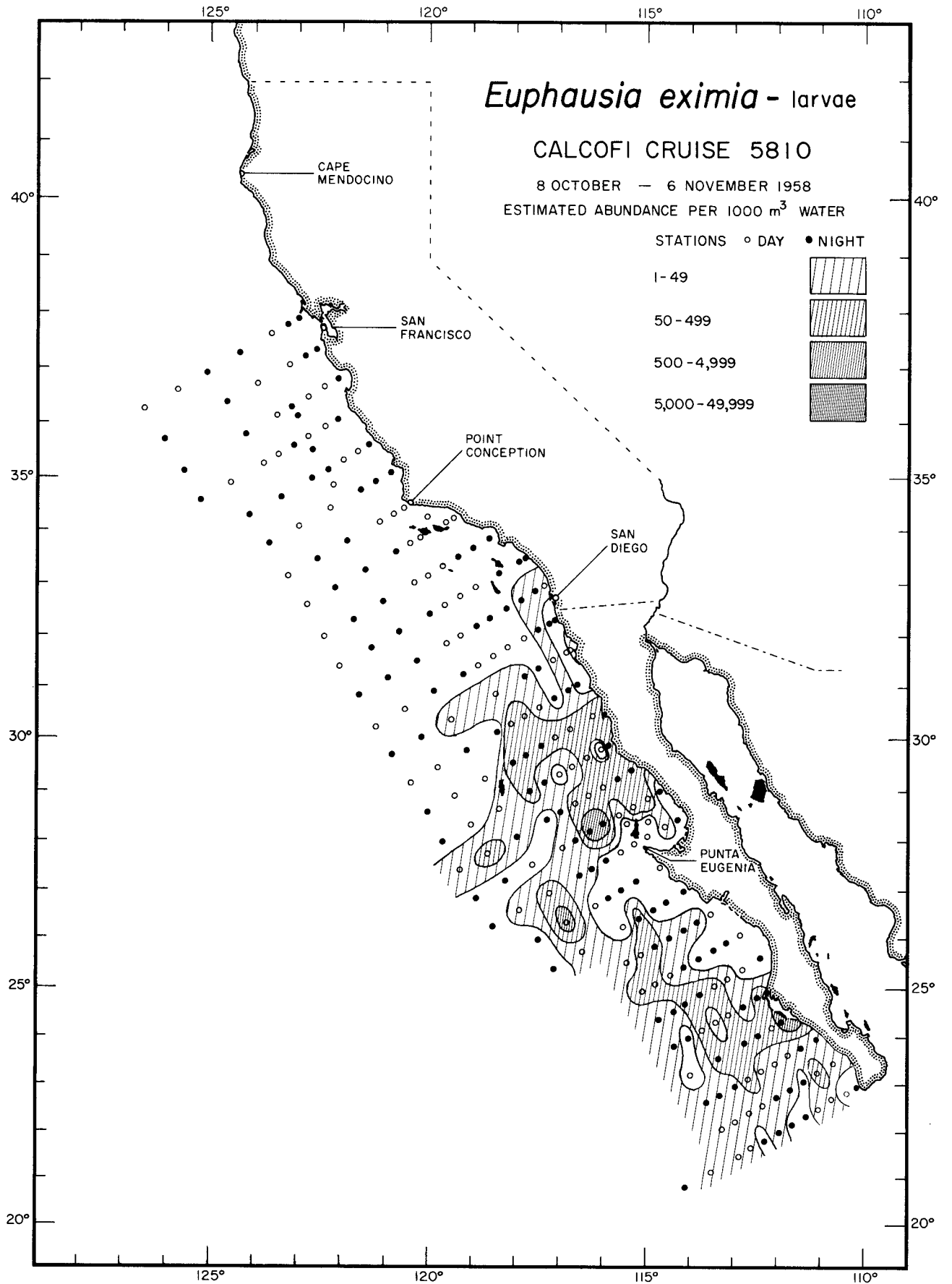
5710



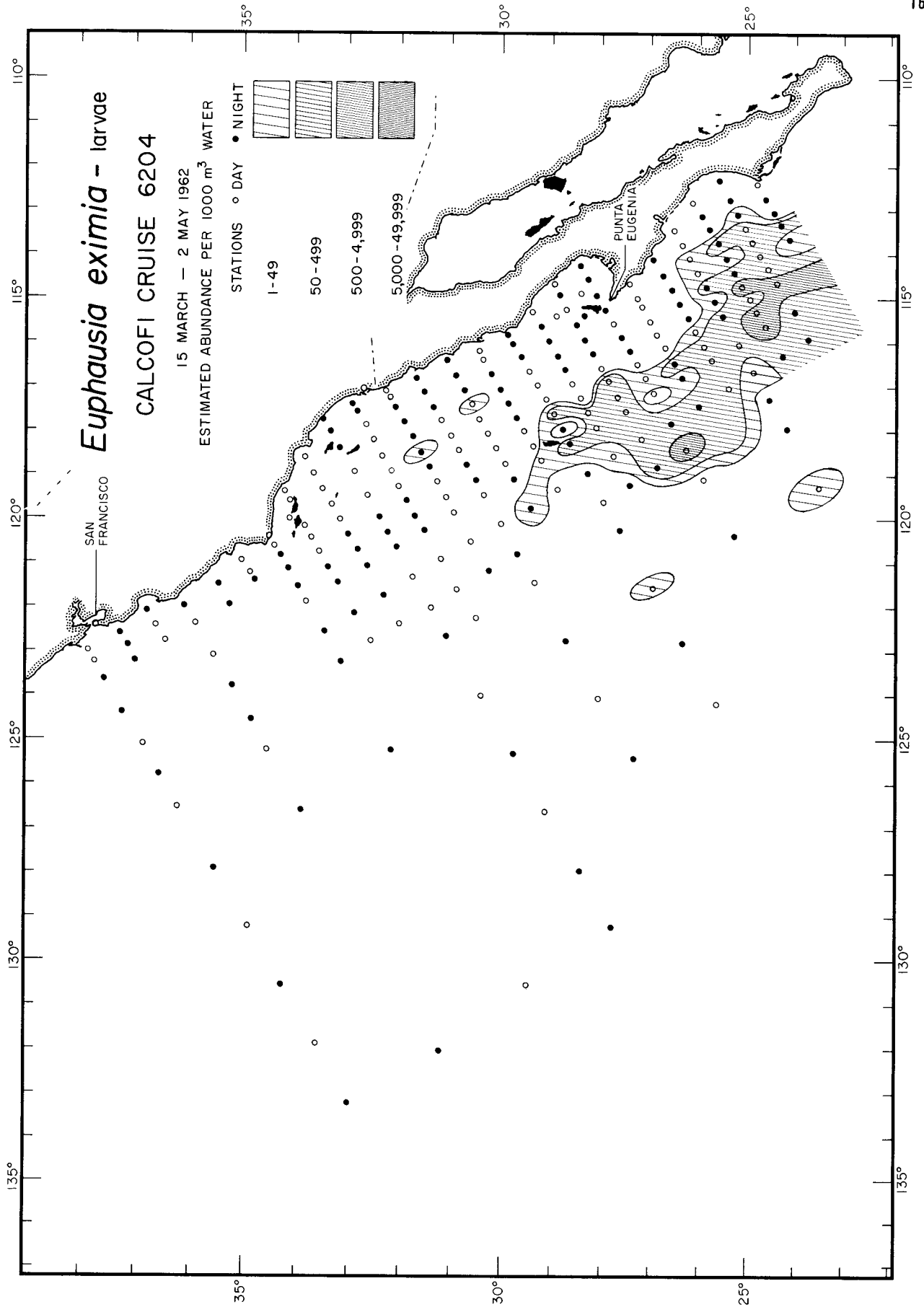
Euphausiacea
Euphausia eximia - larvae
5804



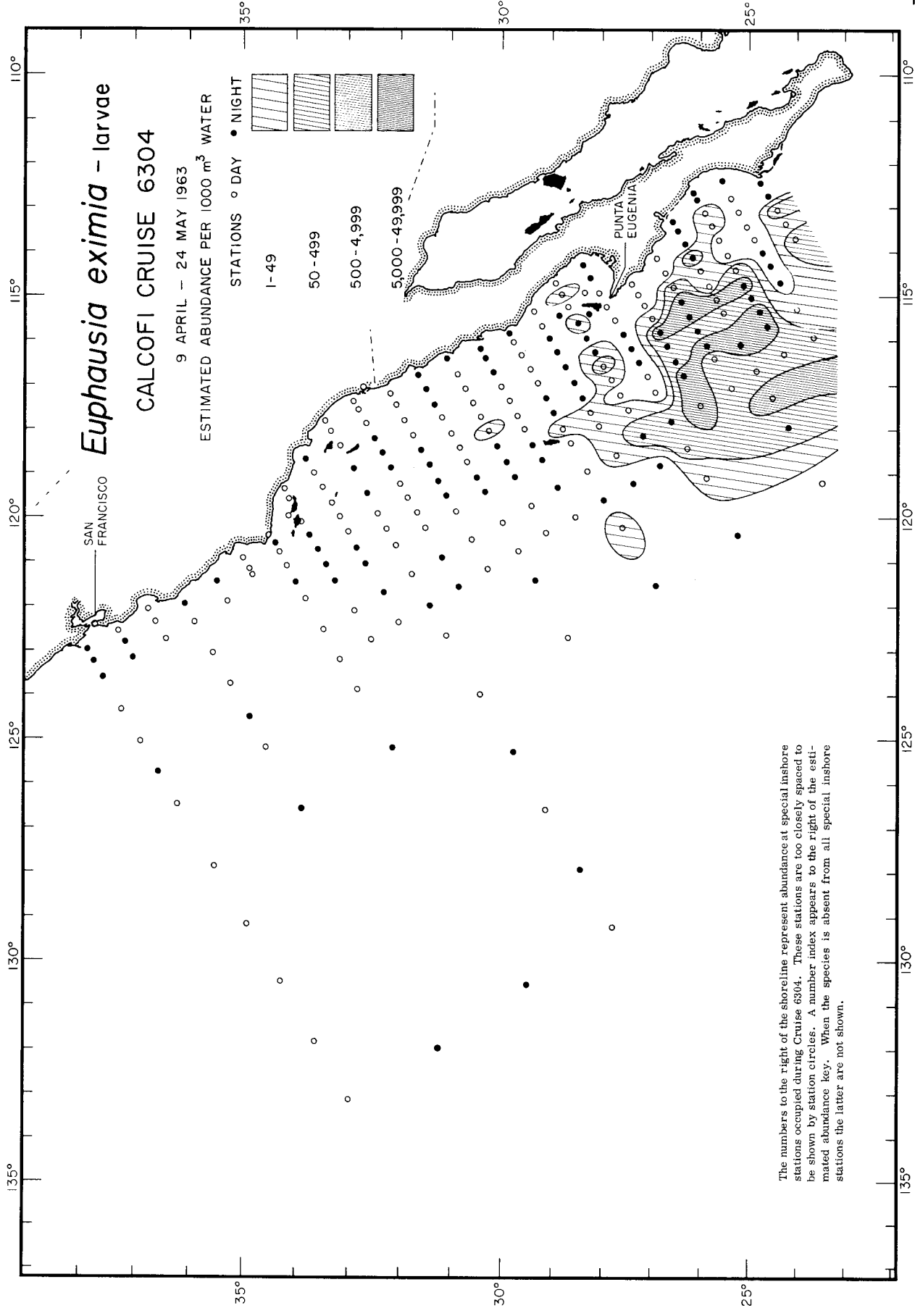
Euphausiacea
Euphausia eximia - larvae
 5807



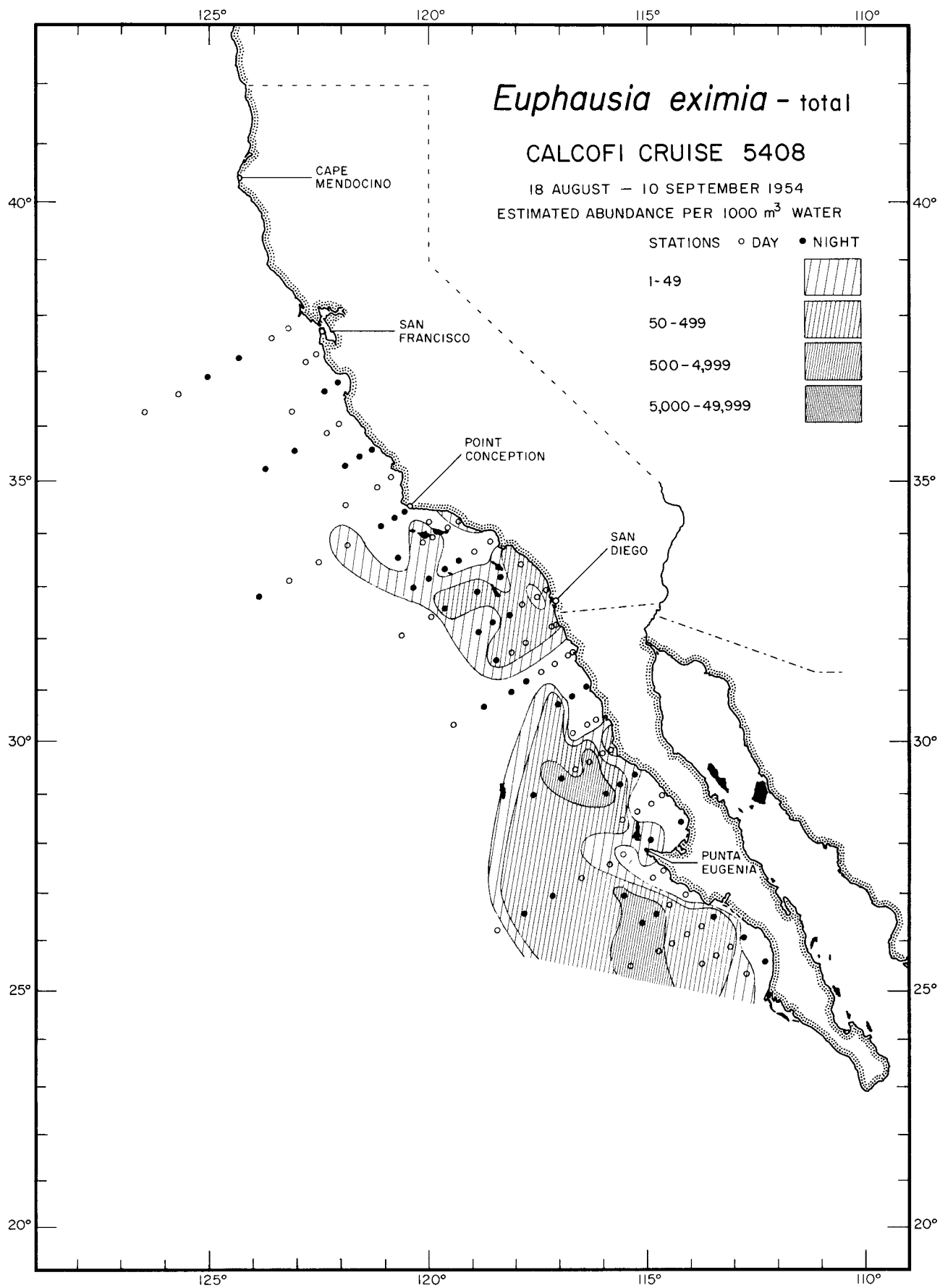
Euphausiacea
Euphausia eximia - larvae
5810



Euphausiacea
Euphausia eximia - larvae
6204

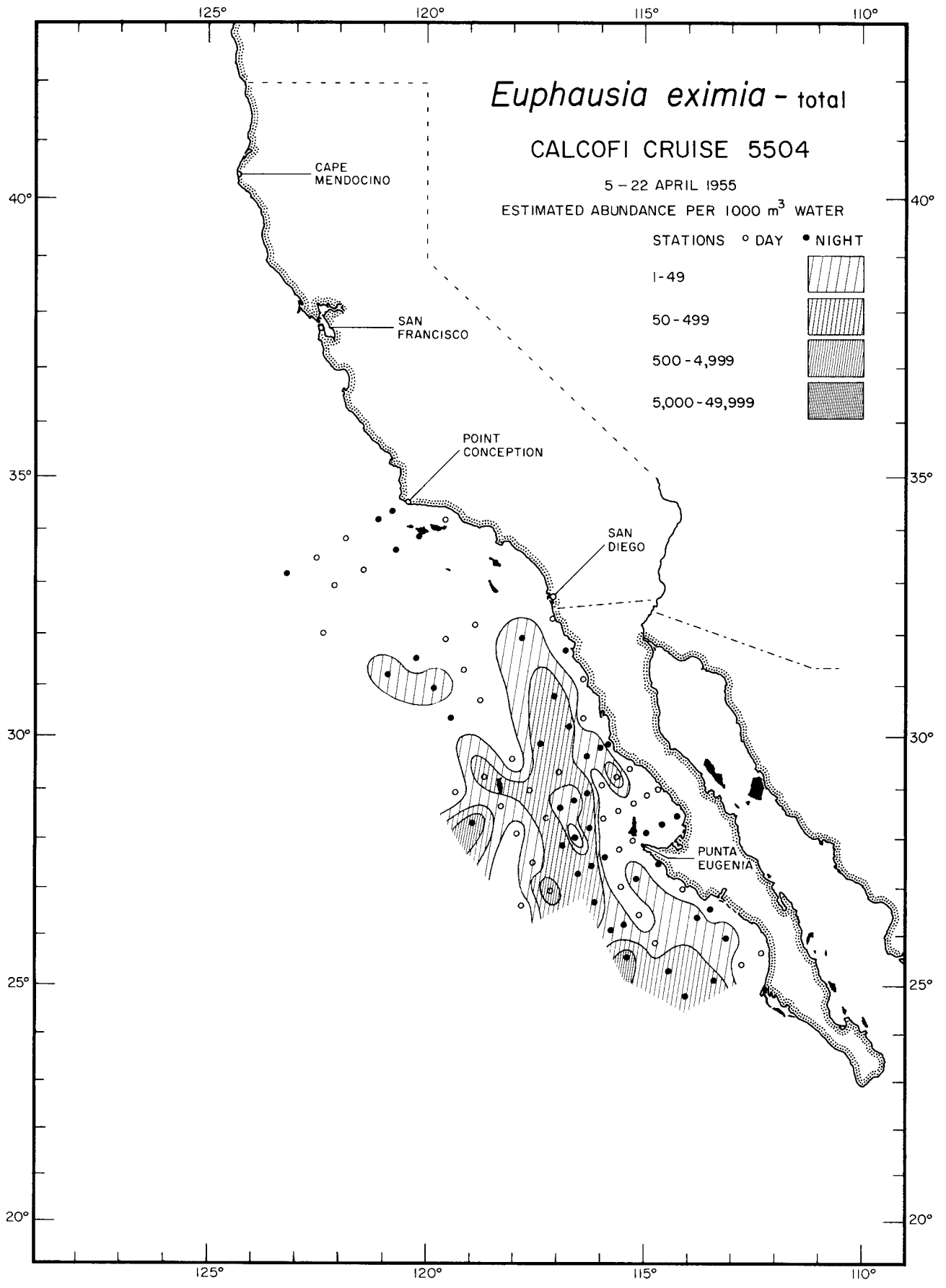


The numbers to the right of the shoreline represent abundance at special inshore stations occupied during Cruise 6304. These stations are too closely spaced to be shown by station circles. A number index appears to the right of the estimated abundance key. When the species is absent from all special inshore stations the latter are not shown.

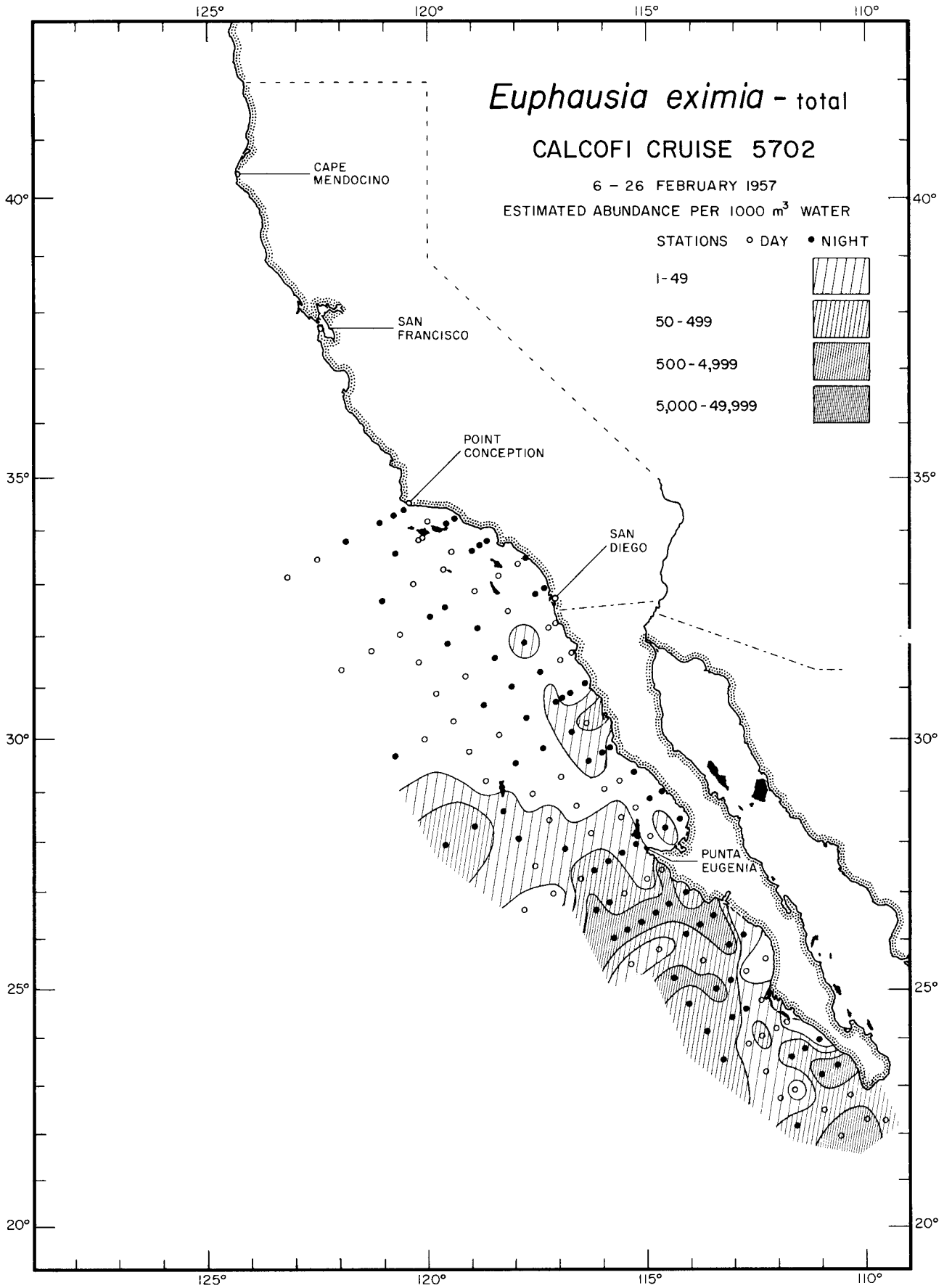


Euphausiacea

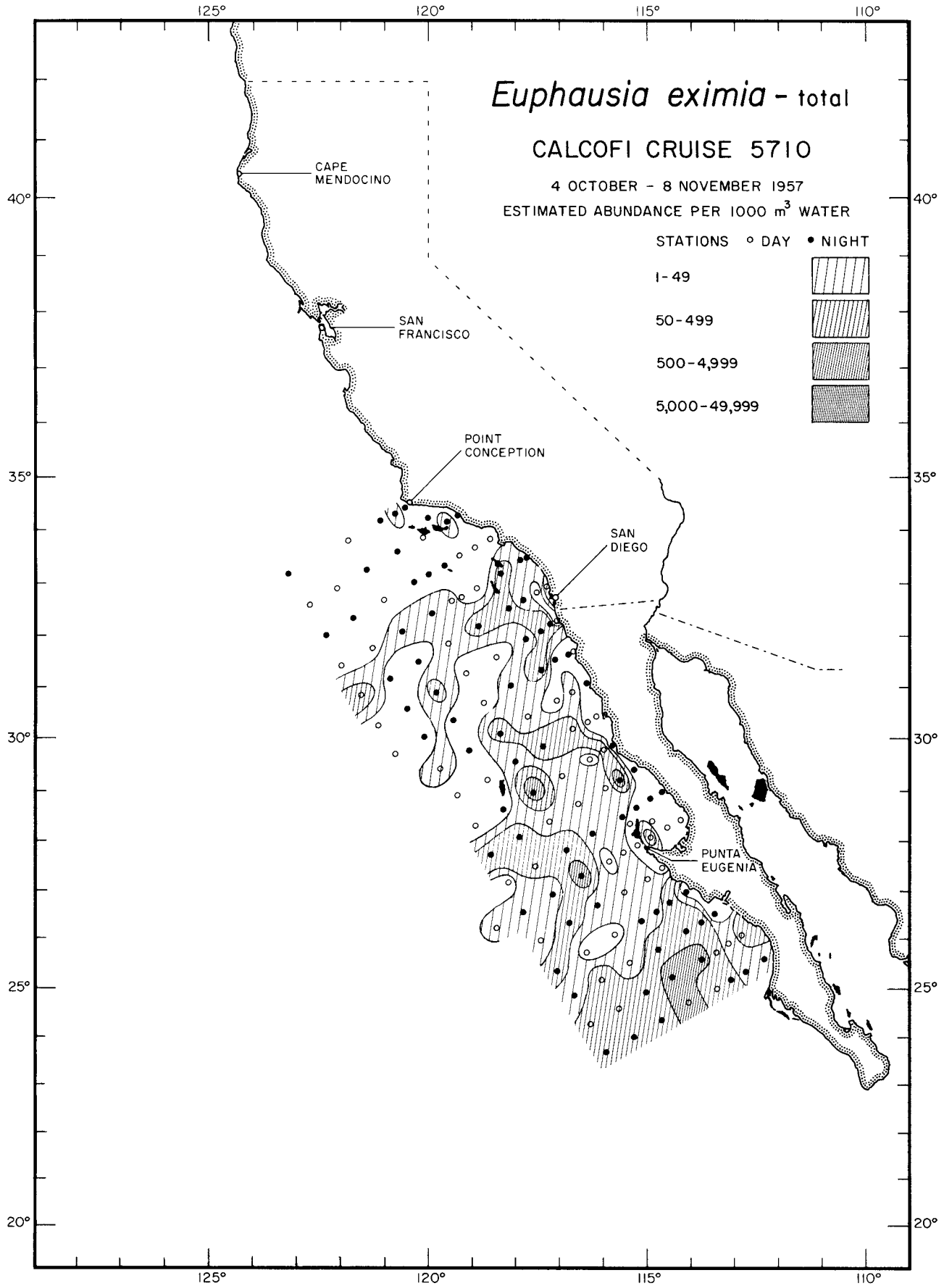
Euphausia eximia - total
5408



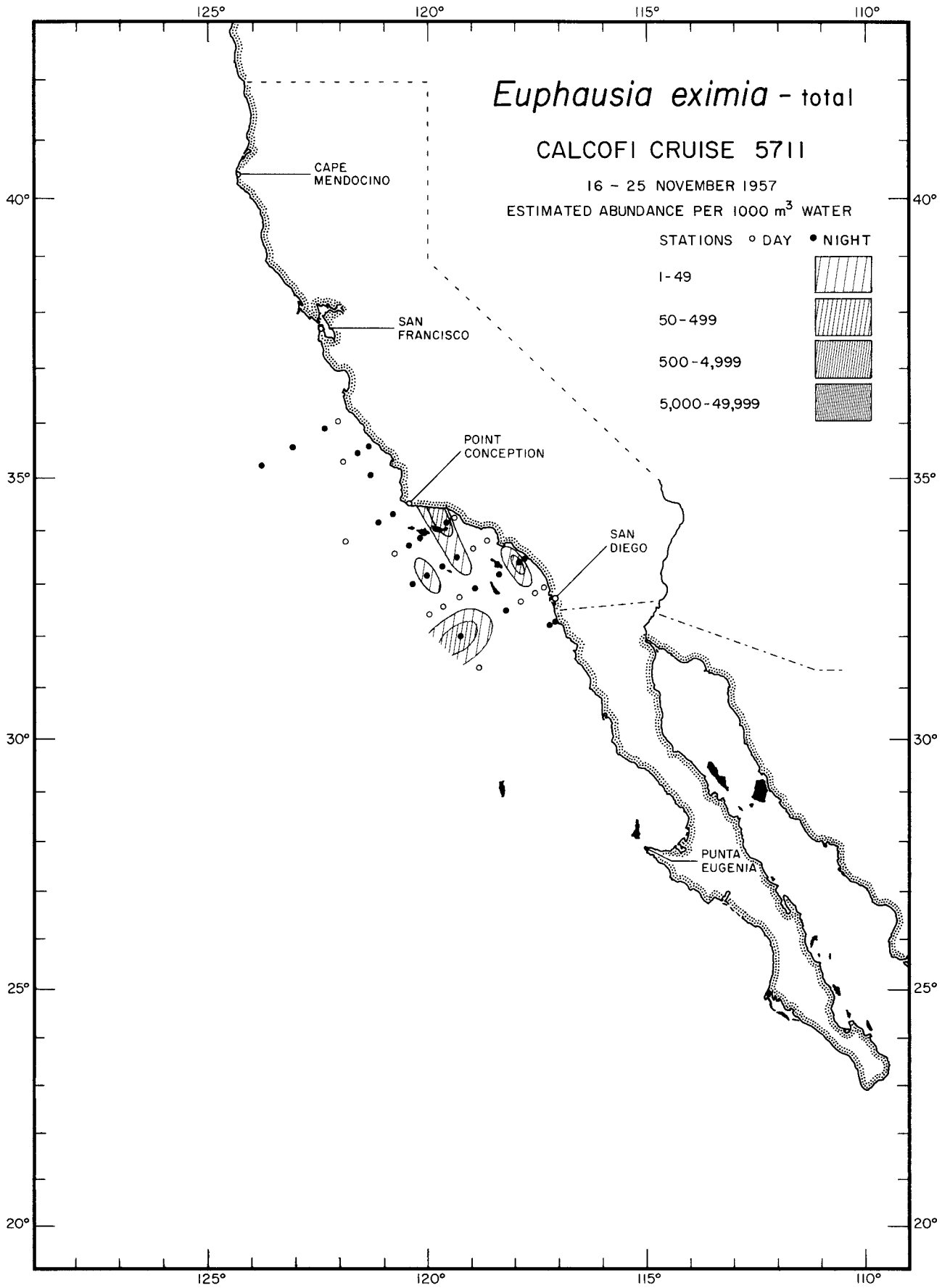
Euphausiacea
Euphausia eximia - total
5504



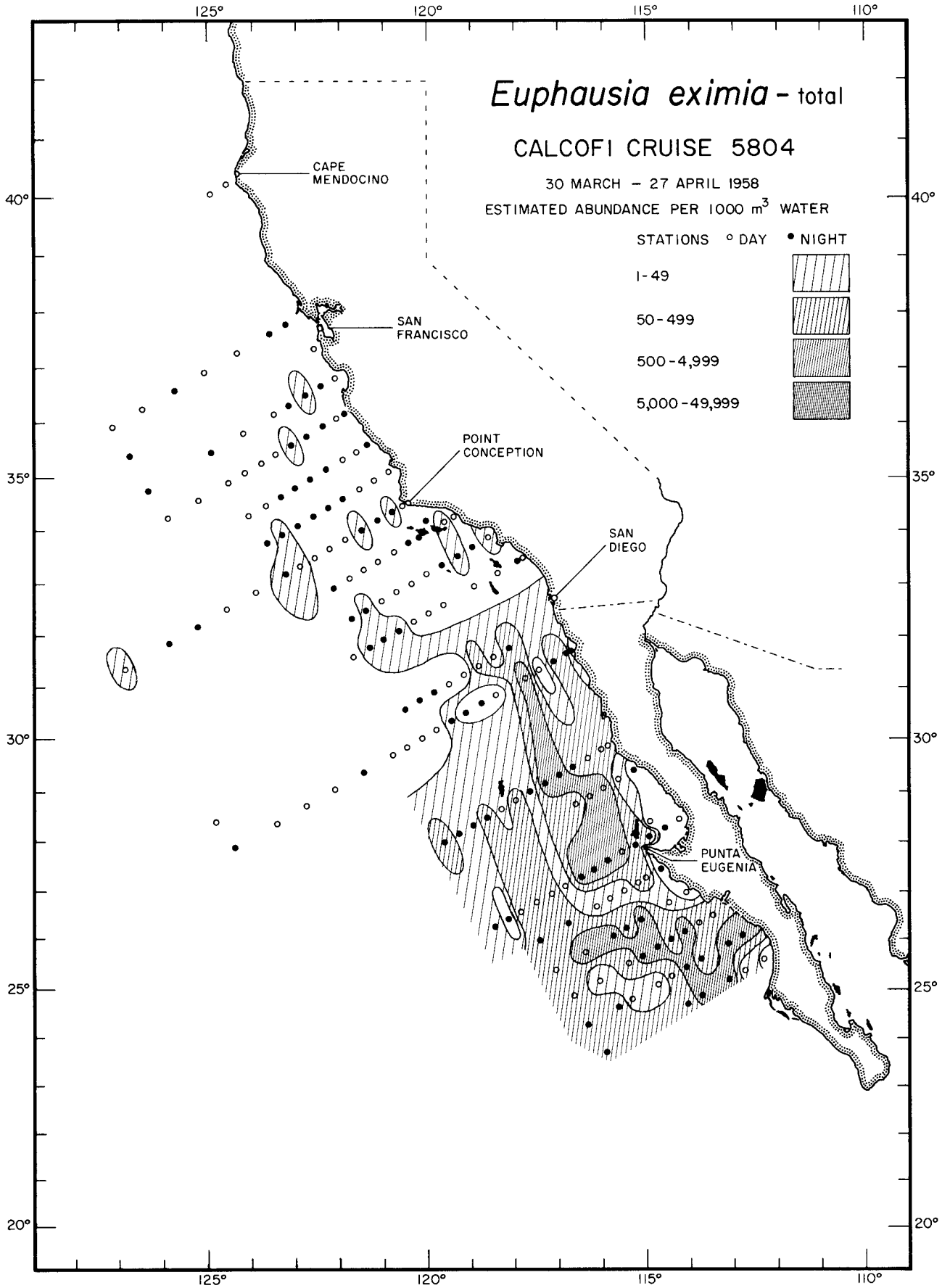
Euphausiacea
Euphausia eximia - total
5702



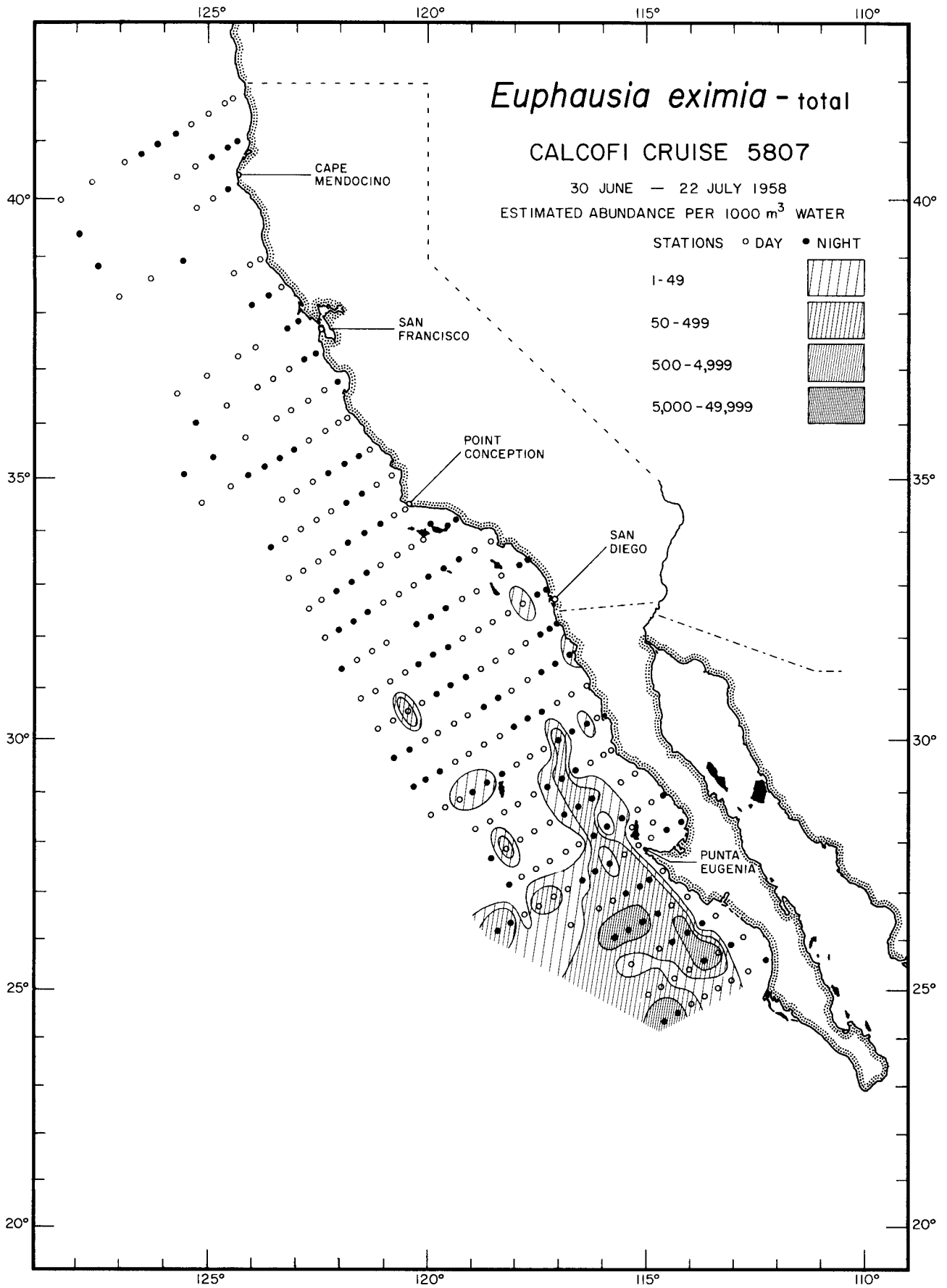
Euphausiacea
Euphausia eximia - total
 5710



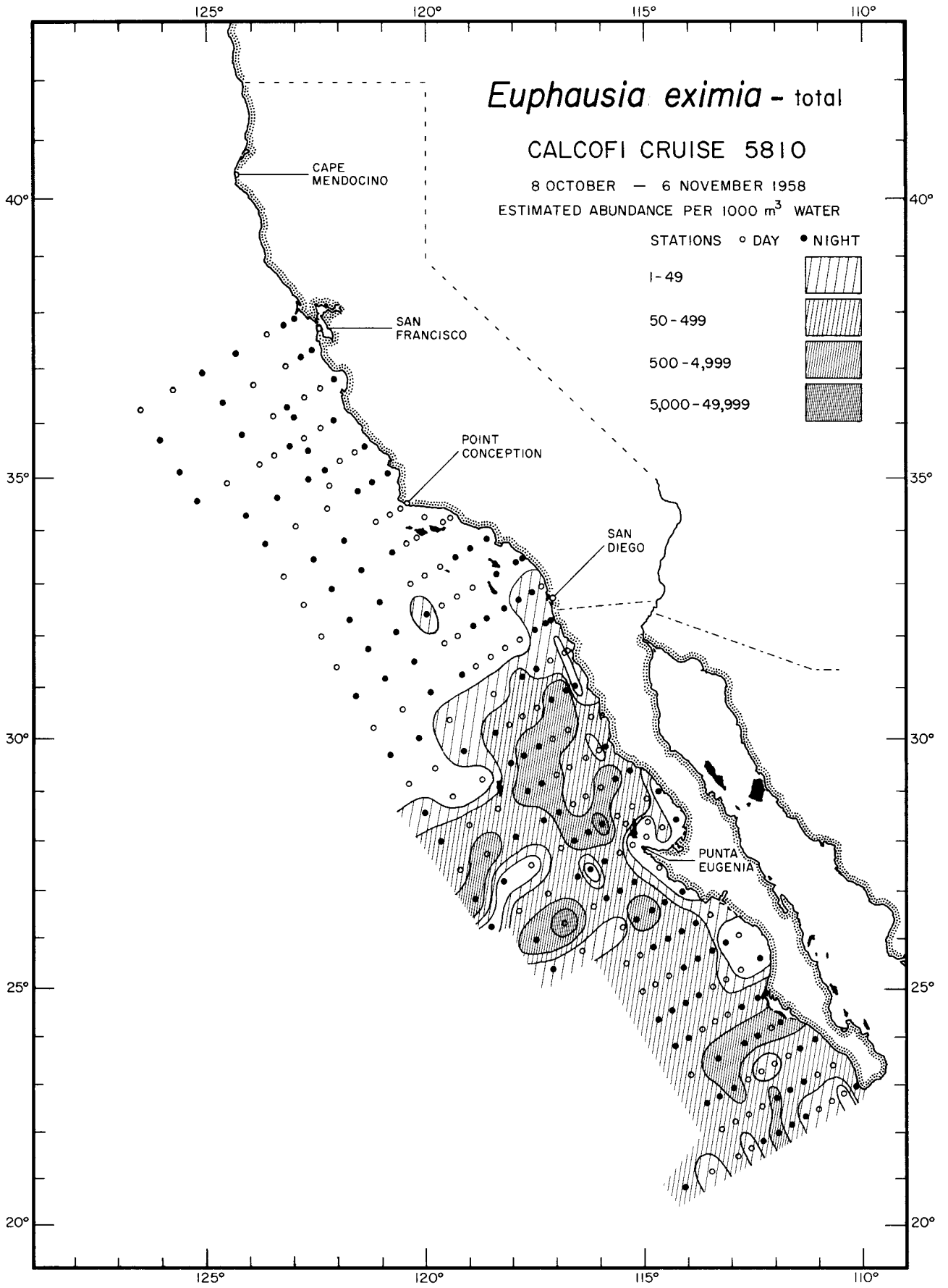
Euphausiacea
Euphausia eximia - total
5711



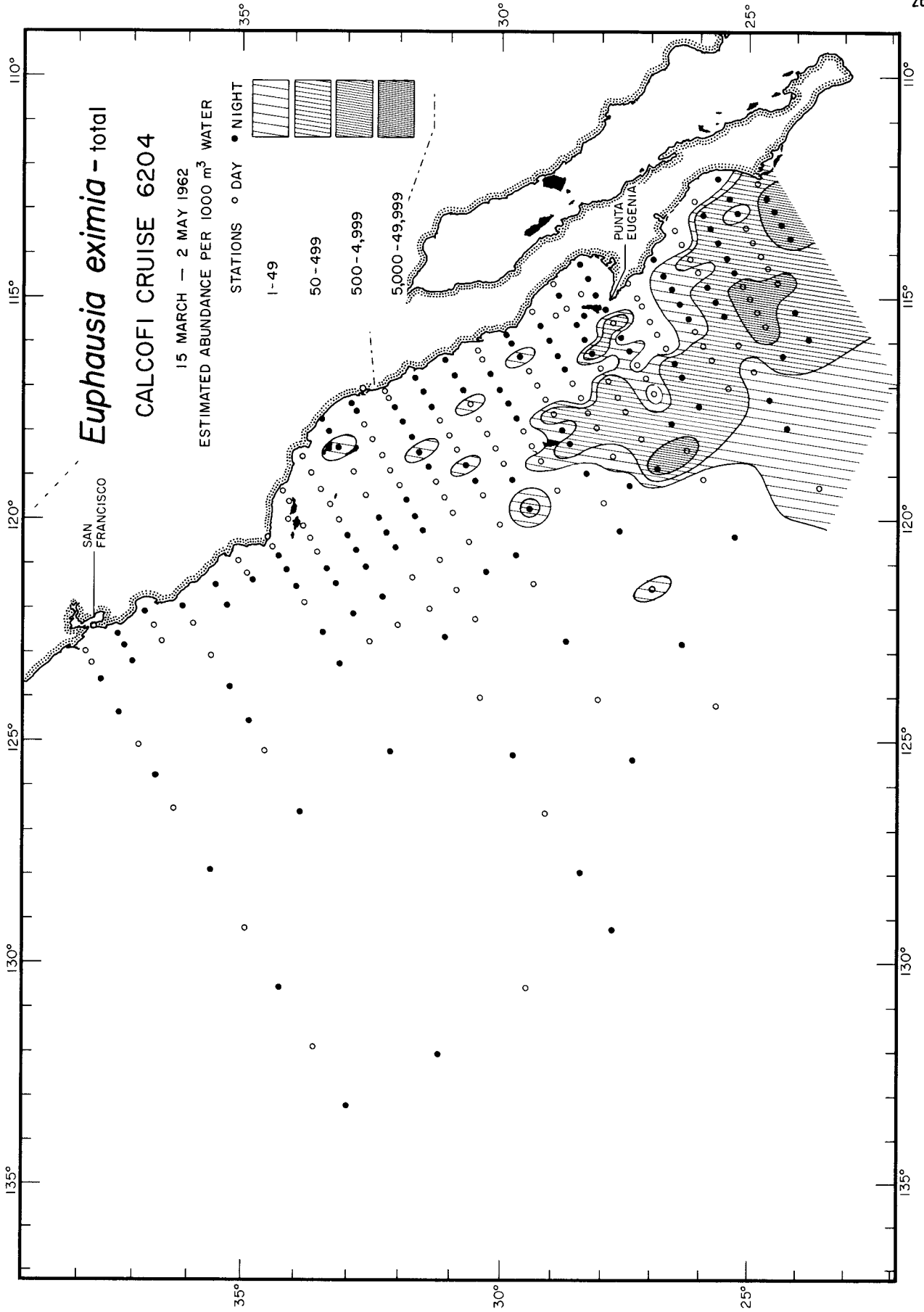
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Euphausia eximia - total
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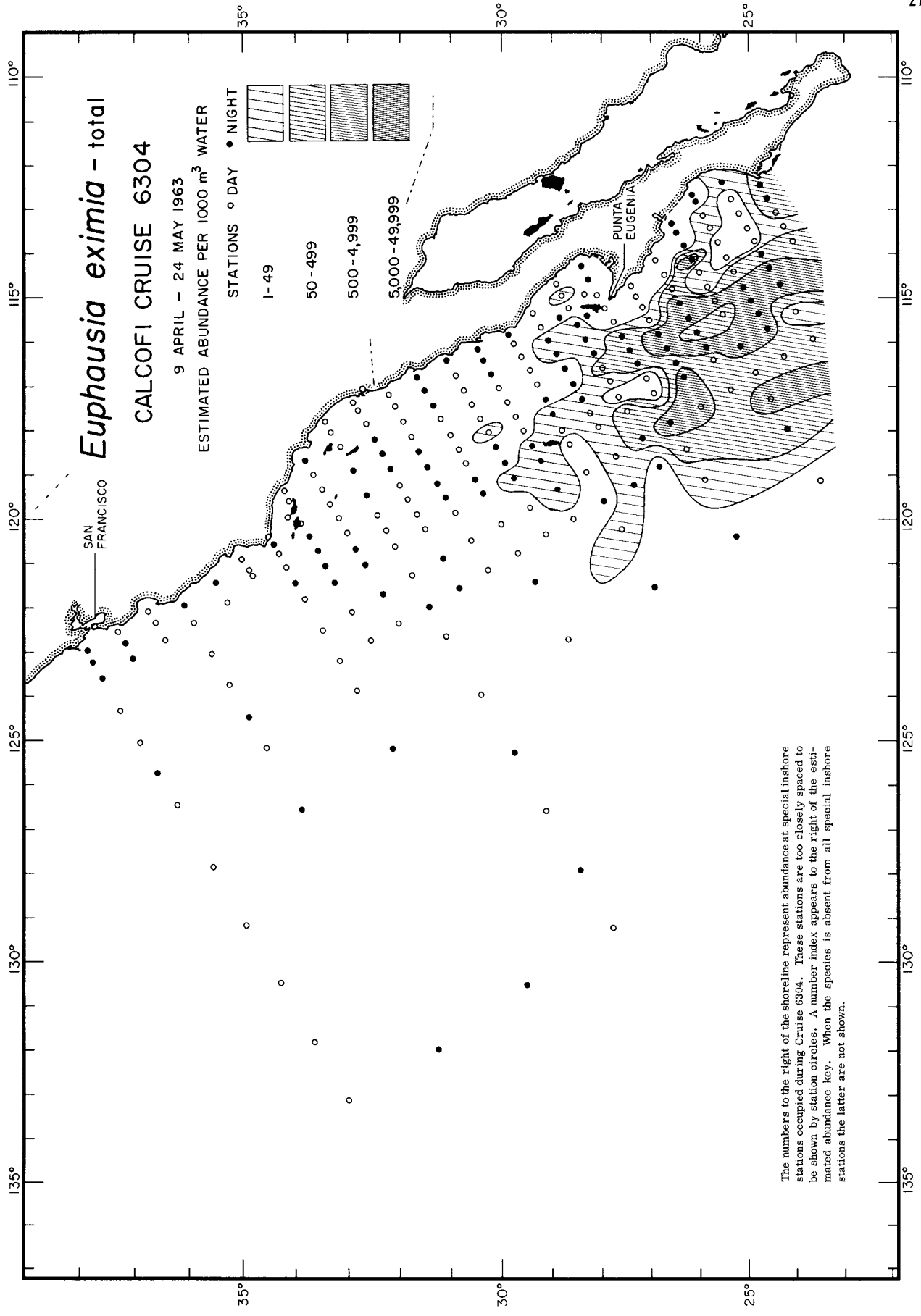
Euphausiacea
Euphausia eximia - total
 5807



Euphausiacea
Euphausia eximia - total
 5810

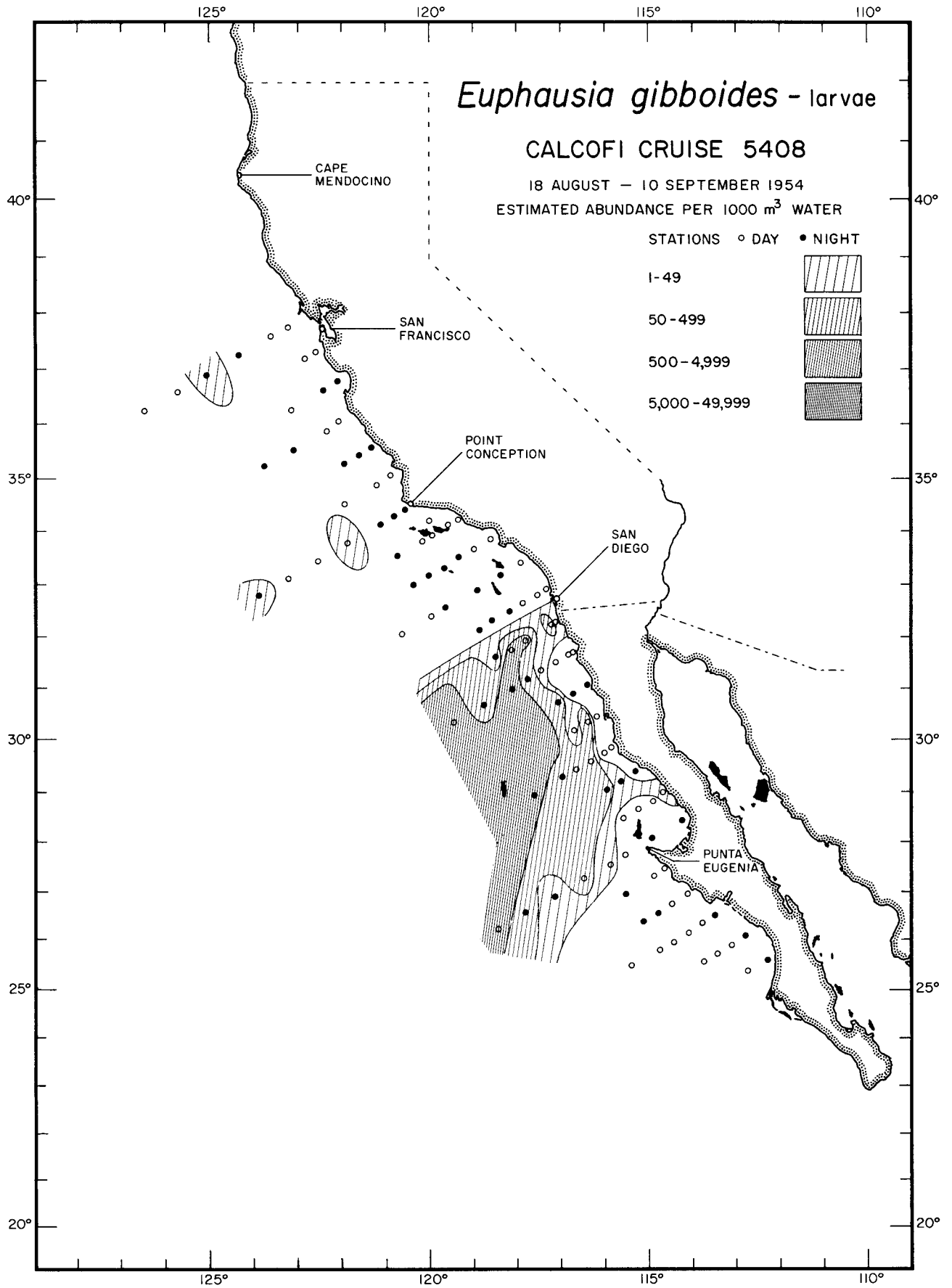


Euphausiacea
Euphausia eximia - total
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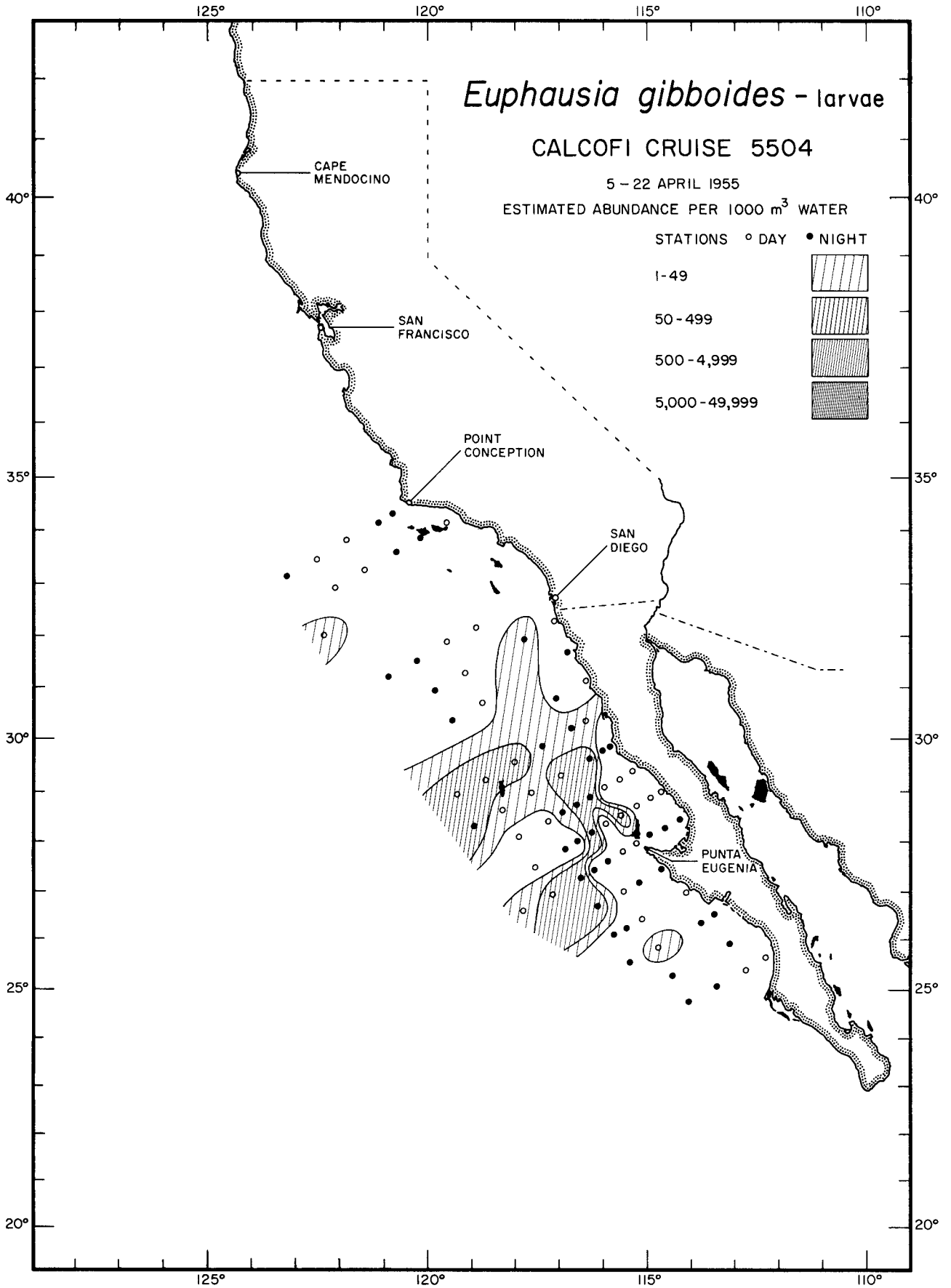


The numbers to the right of the shoreline represent abundance at special inshore stations occupied during Cruise 6304. These stations are too closely spaced to be shown by station circles. A number index appears to the right of the estimated abundance key. When the species is absent from all special inshore stations the latter are not shown.

Euphausiacea
Euphausia eximia - total
6304



Euphausiacea
Euphausia gibboides - larvae
5408



Euphausia gibboides - larvae

CALCOFI CRUISE 5504

5 - 22 APRIL 1955

ESTIMATED ABUNDANCE PER 1000 m³ WATER

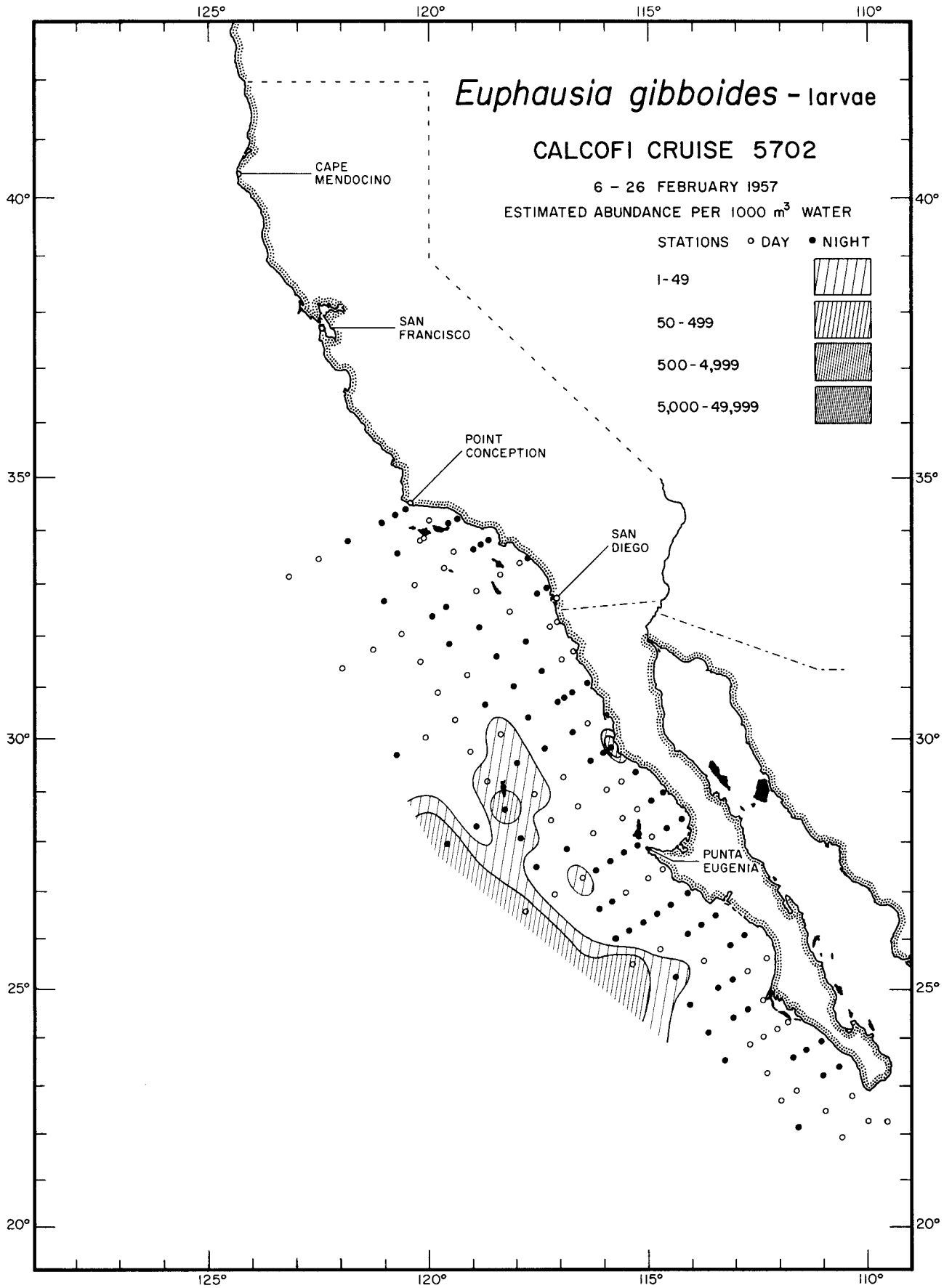
STATIONS ○ DAY ● NIGHT

1-49	
50-499	
500-4,999	
5,000-49,999	

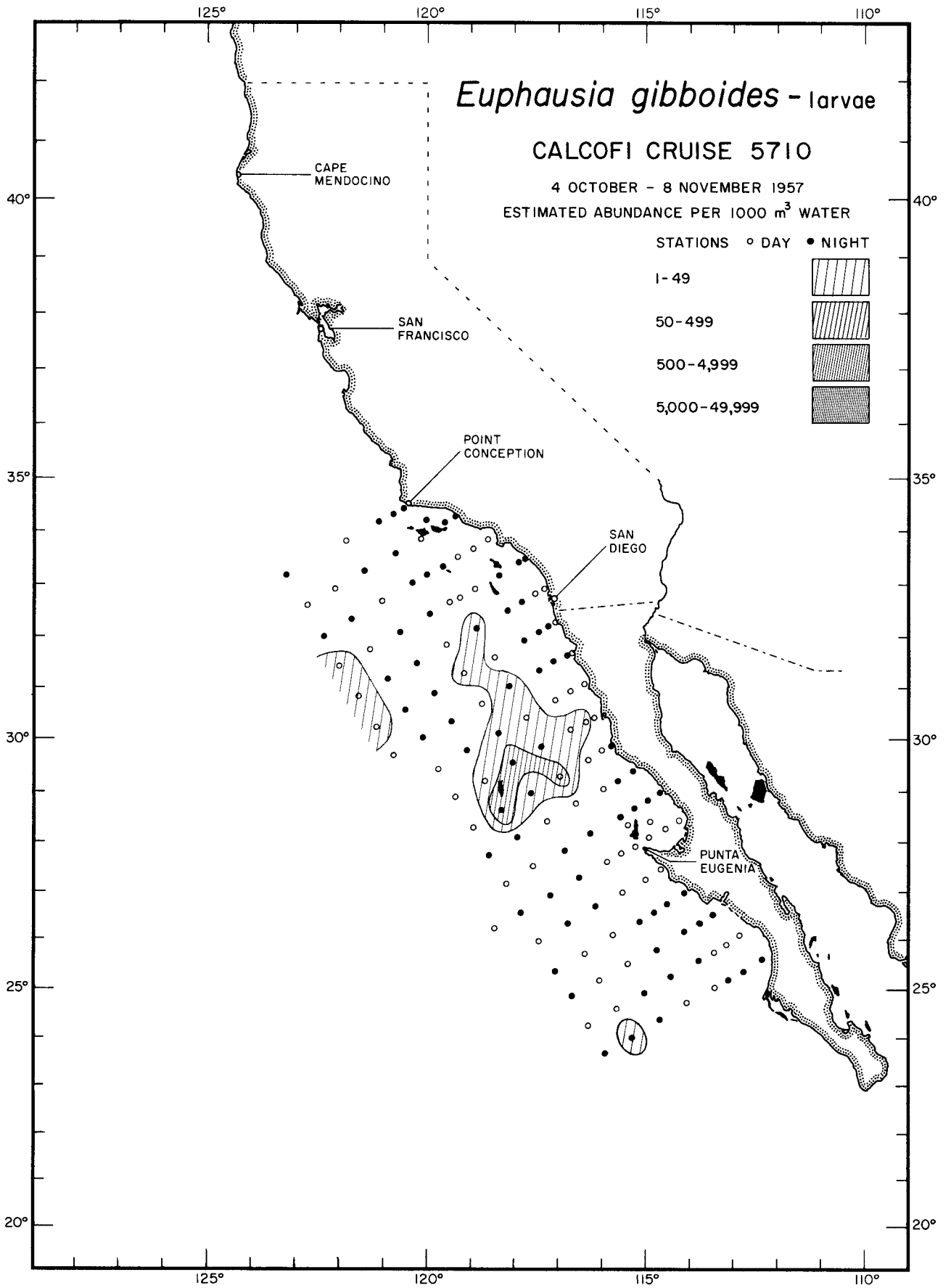
Euphausiacea

Euphausia gibboides - larvae

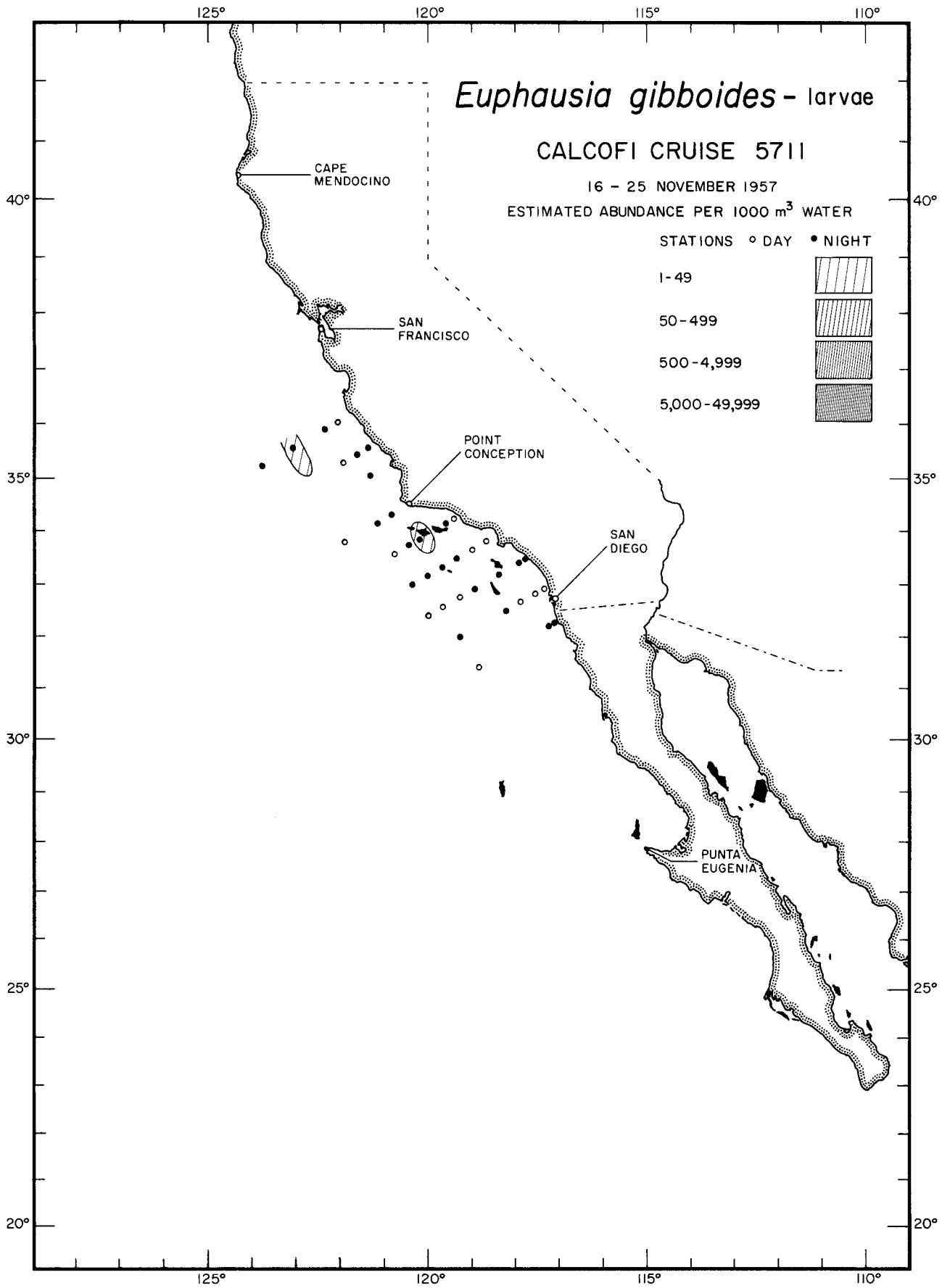
5504



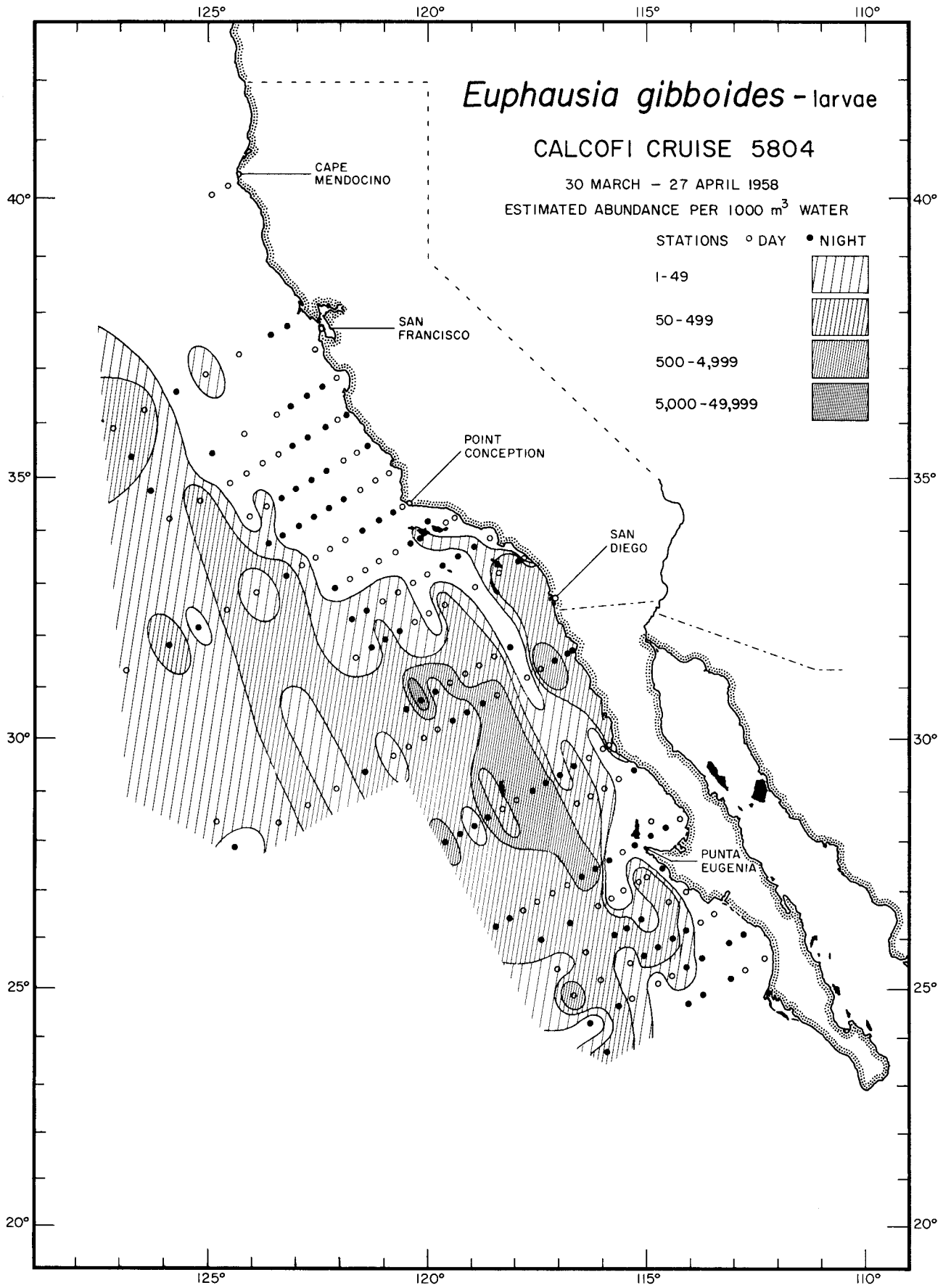
Euphausiacea
Euphausia gibboides - larvae
 5702



Euphausiacea
Euphausia gibboides - larvae
5710

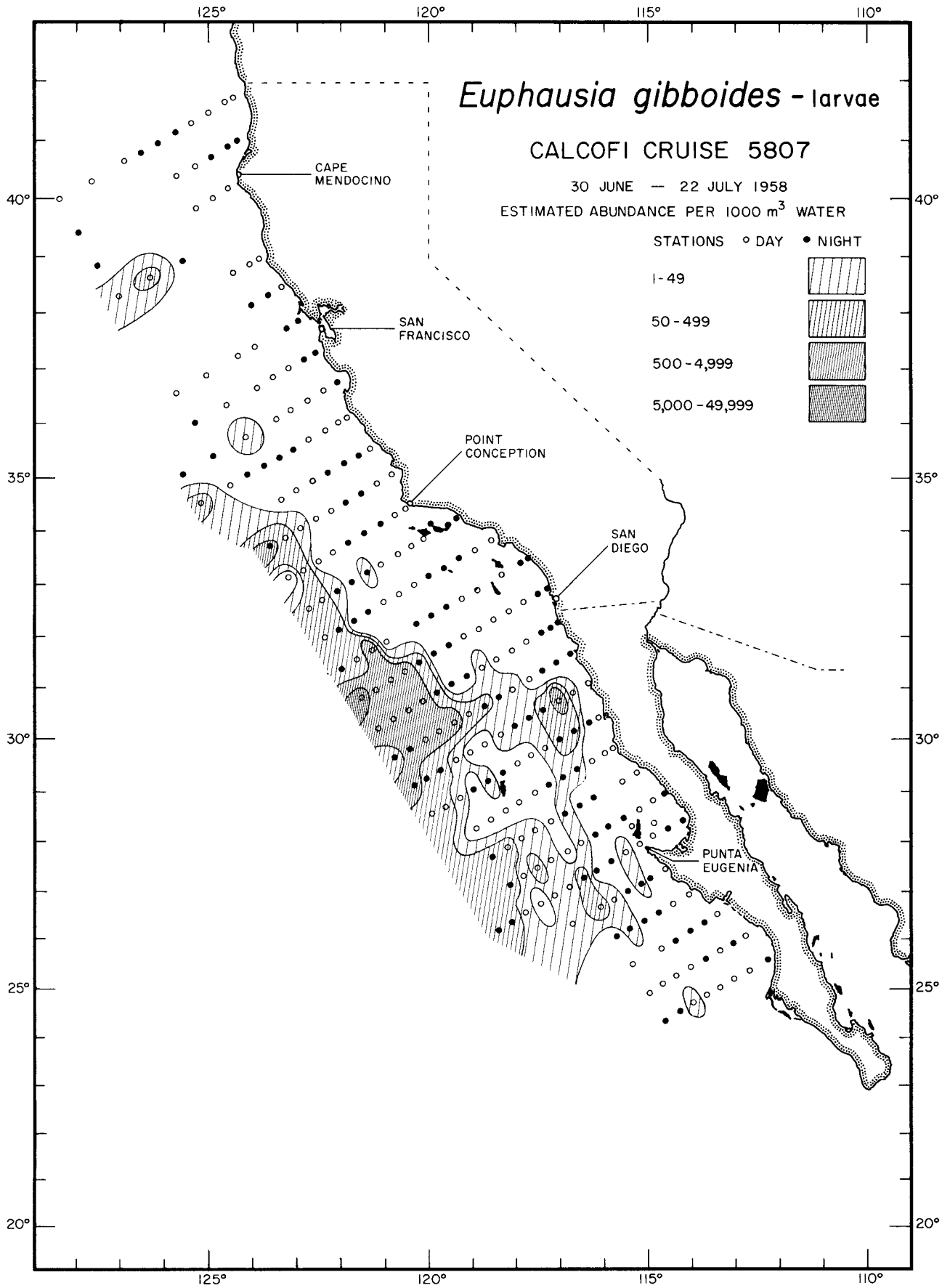


Euphausiacea
Euphausia gibboides - larvae
5711

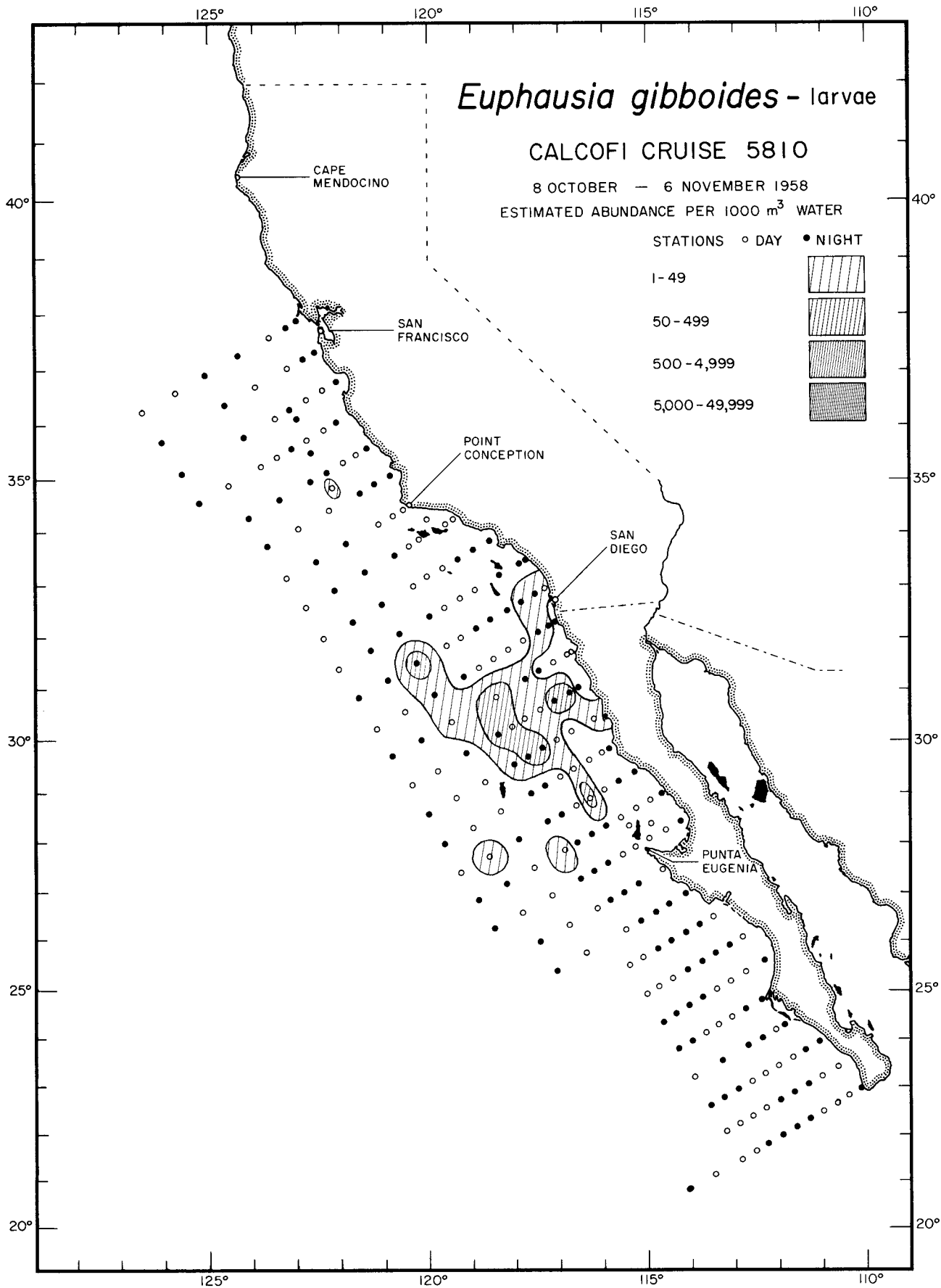


Euphausiacea
Euphausia gibboides - larvae

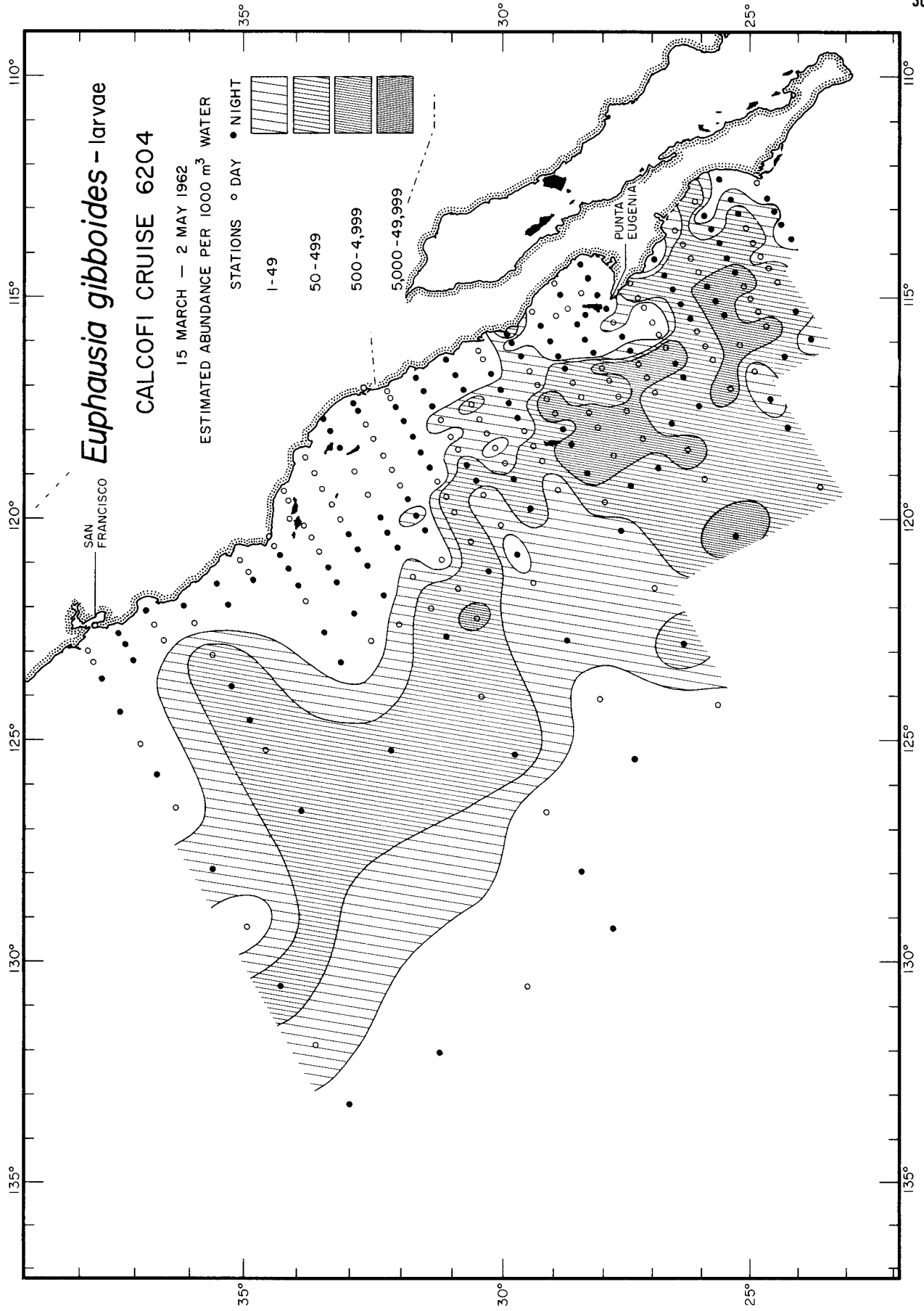
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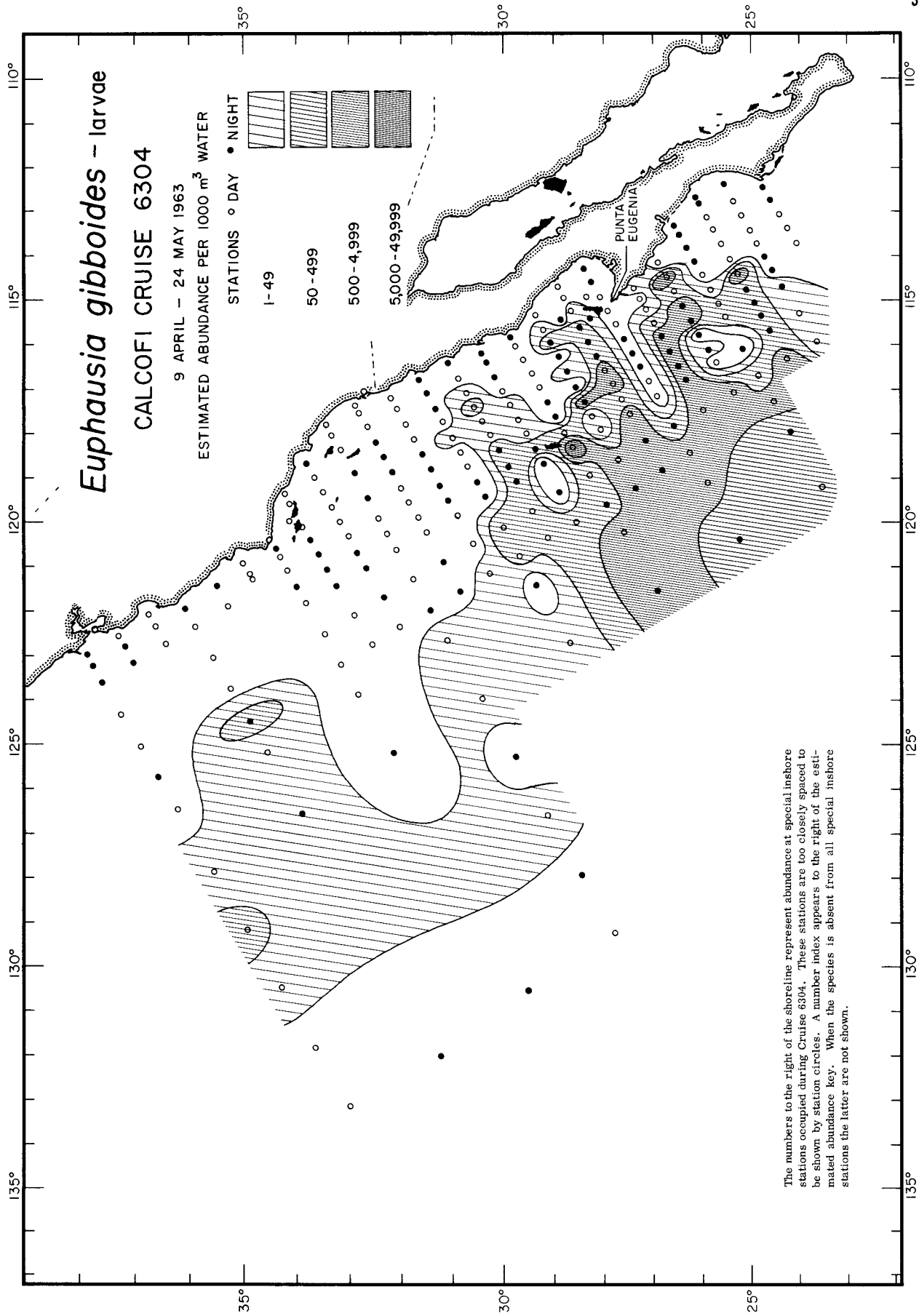
Euphausiacea
Euphausia gibboides - larvae
 5807



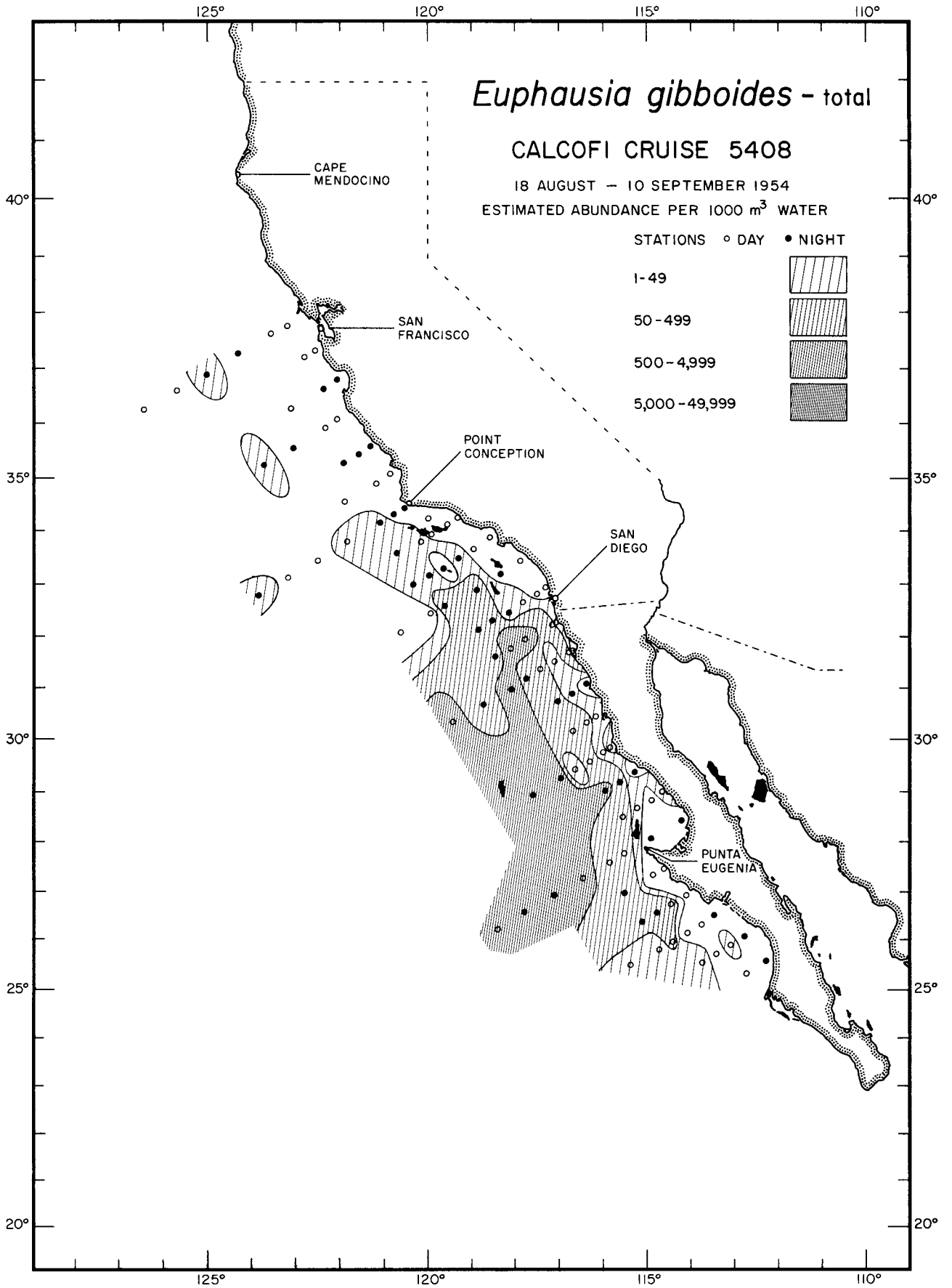
Euphausiacea
Euphausia gibboides - larvae
5810



Euphausiacea
Euphausia gibboides - larvae
6204



The numbers to the right of the shoreline represent abundance at special inshore stations occupied during Cruise 6304. These stations are too closely spaced to be shown by station circles. A number index appears to the right of the estimated abundance key. When the species is absent from all special inshore stations the latter are not shown.



Euphausia gibboides - total

CALCOFI CRUISE 5408

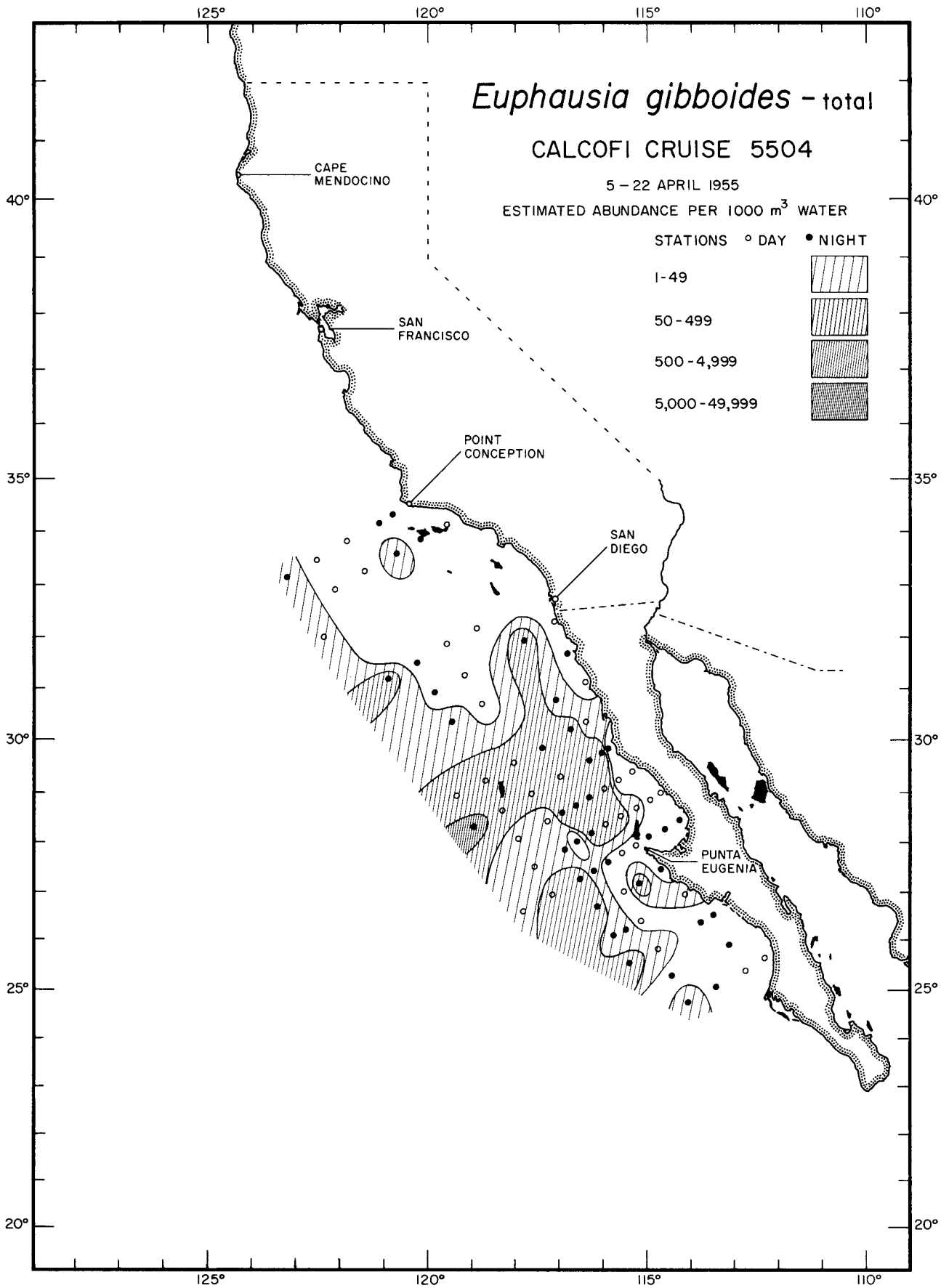
18 AUGUST - 10 SEPTEMBER 1954
ESTIMATED ABUNDANCE PER 1000 m³ WATER

STATIONS	DAY	NIGHT
1-49	○	●
50-499	▨	▩
500-4,999	▧	▦
5,000-49,999	▣	▢

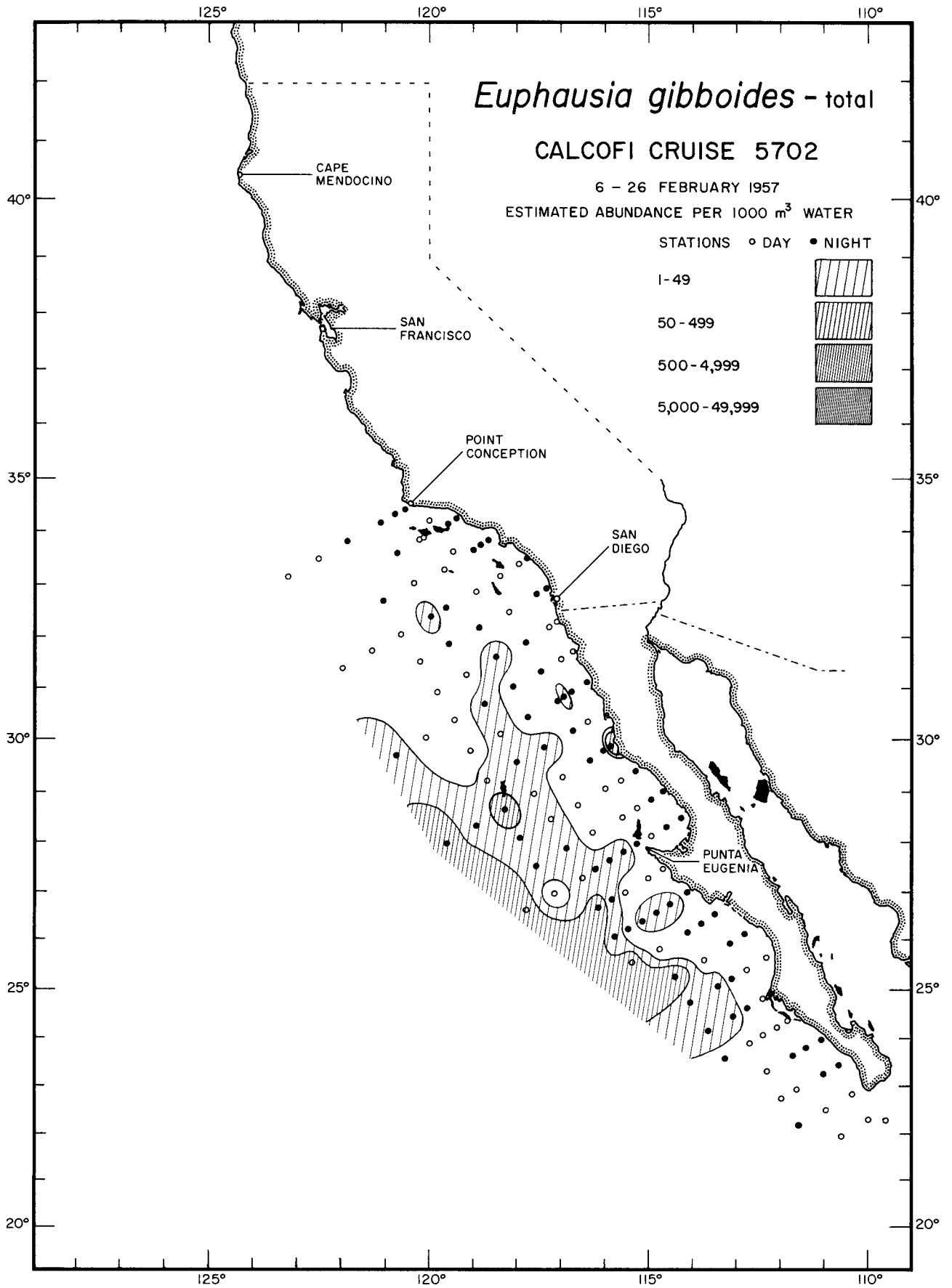
Euphausiacea

Euphausia gibboides - total

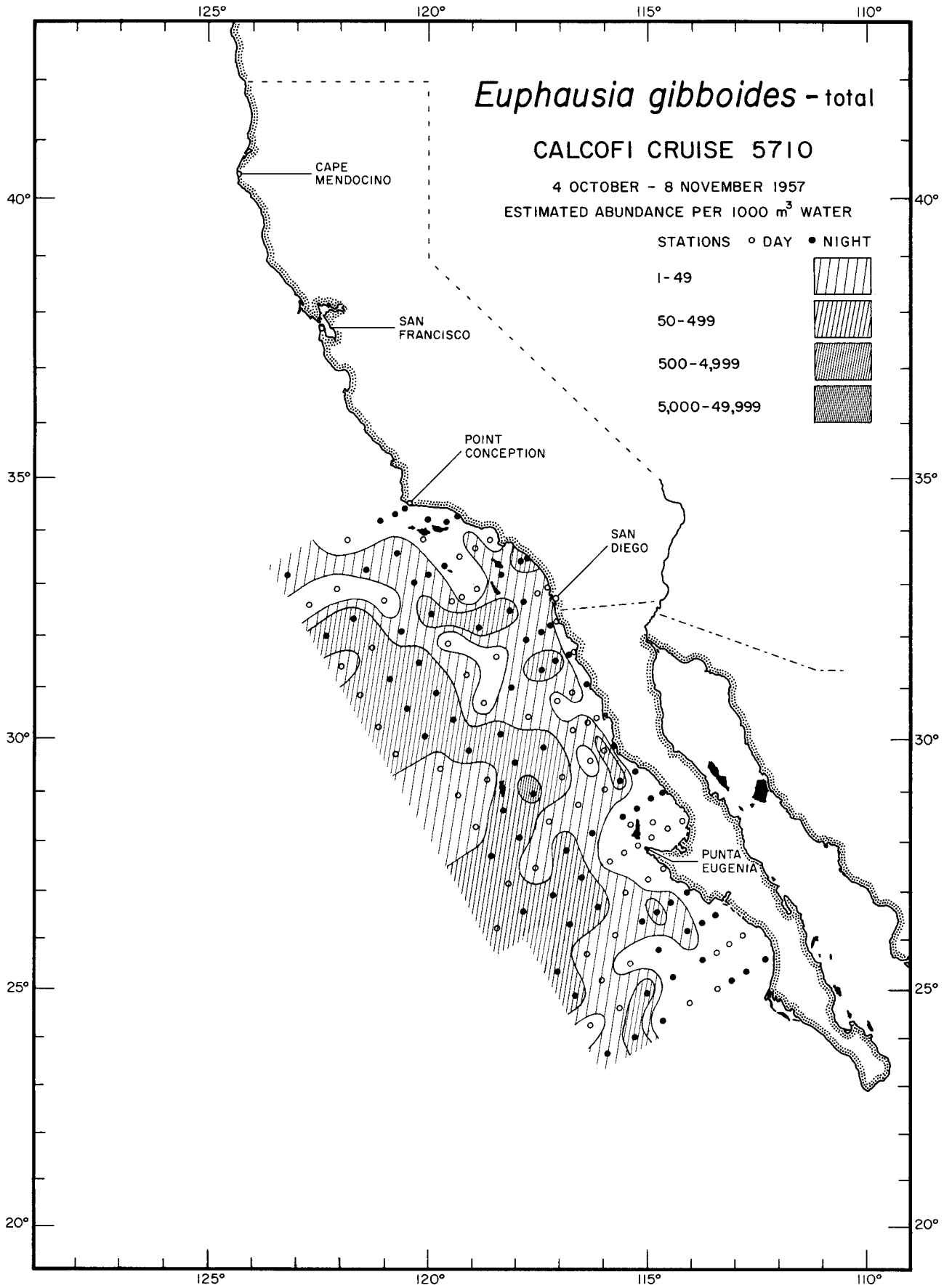
5408



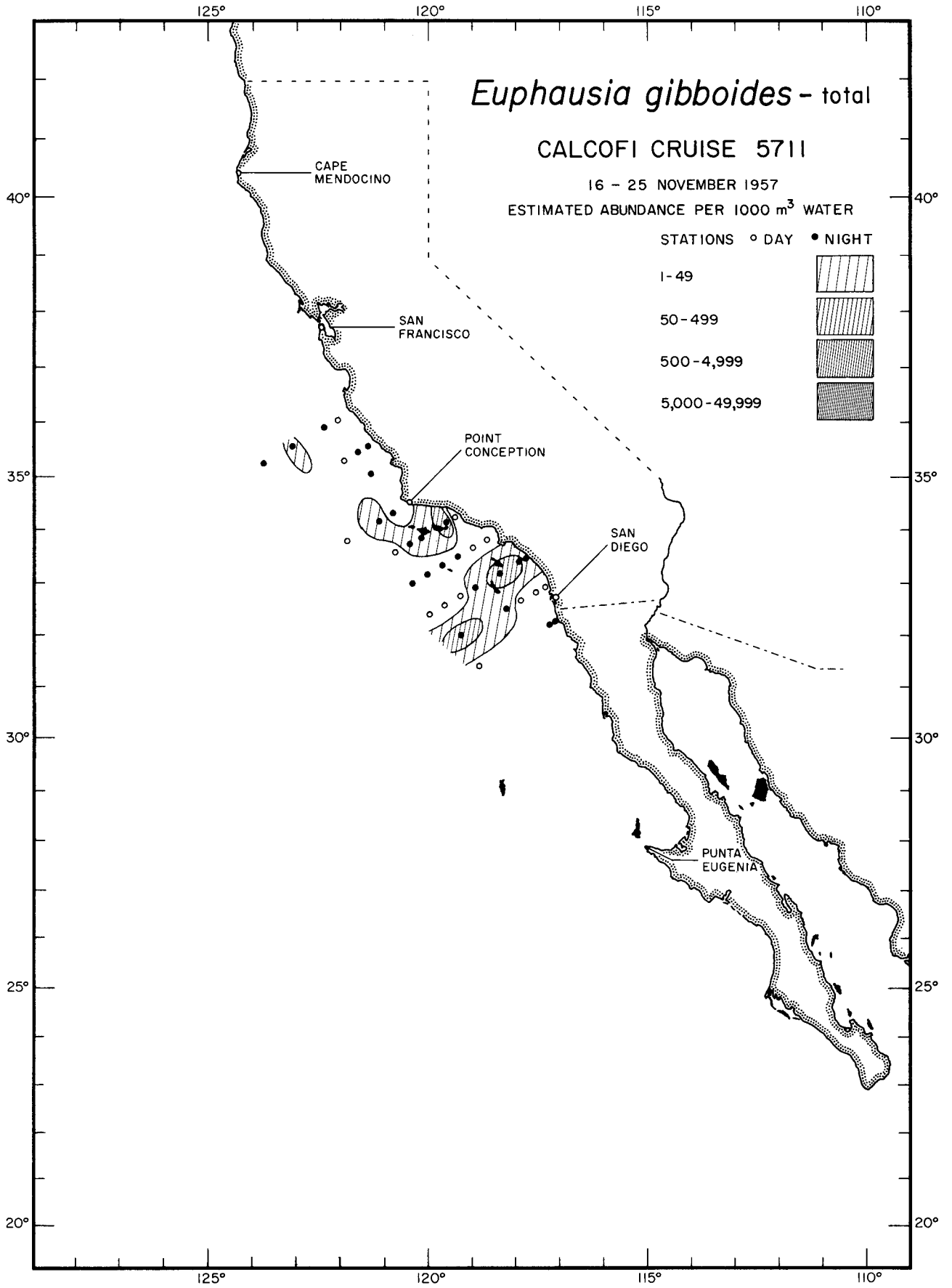
Euphausiacea
Euphausia gibboides - total
 5504



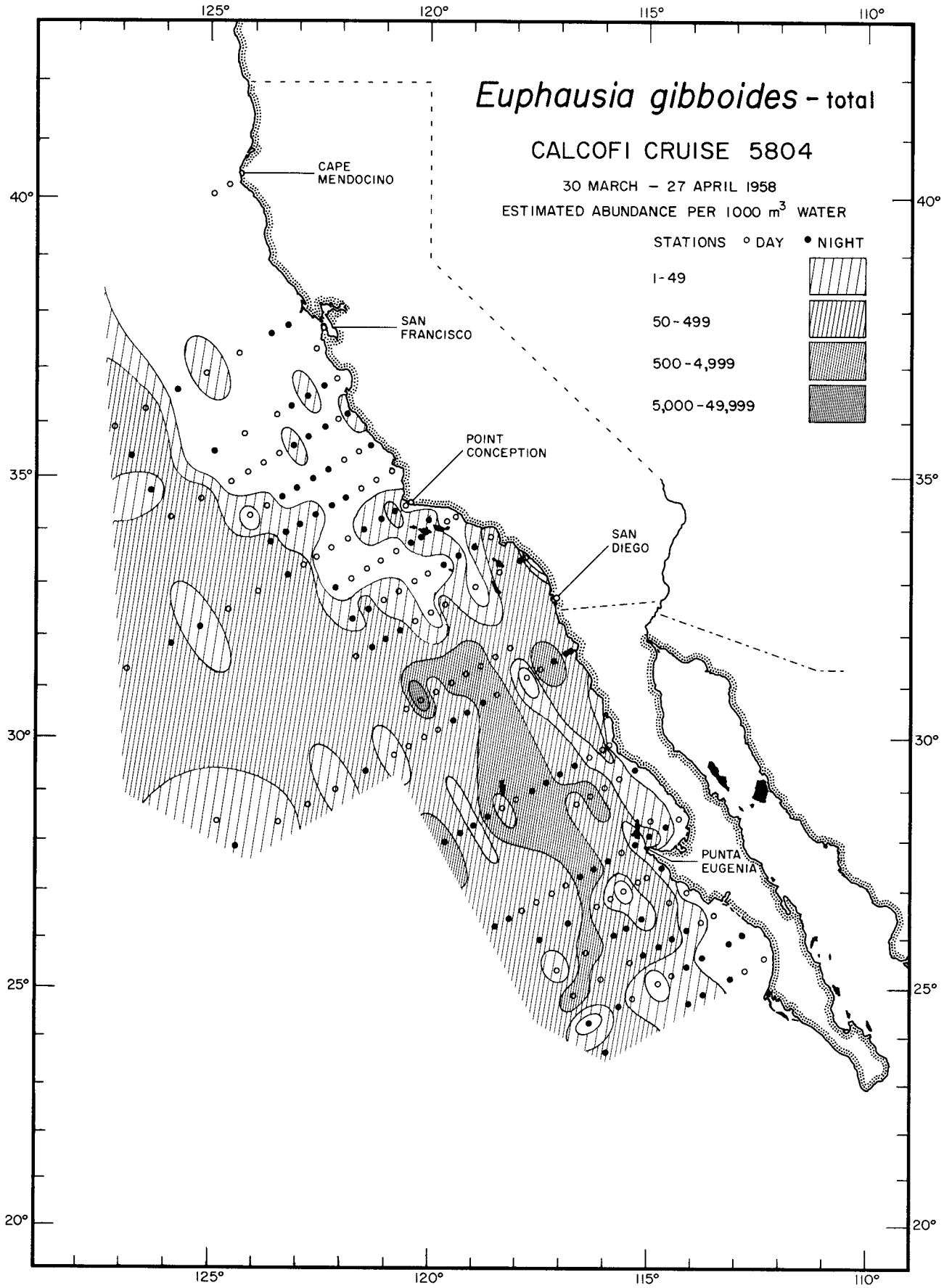
Euphausiacea
Euphausia gibboides - total
 5702



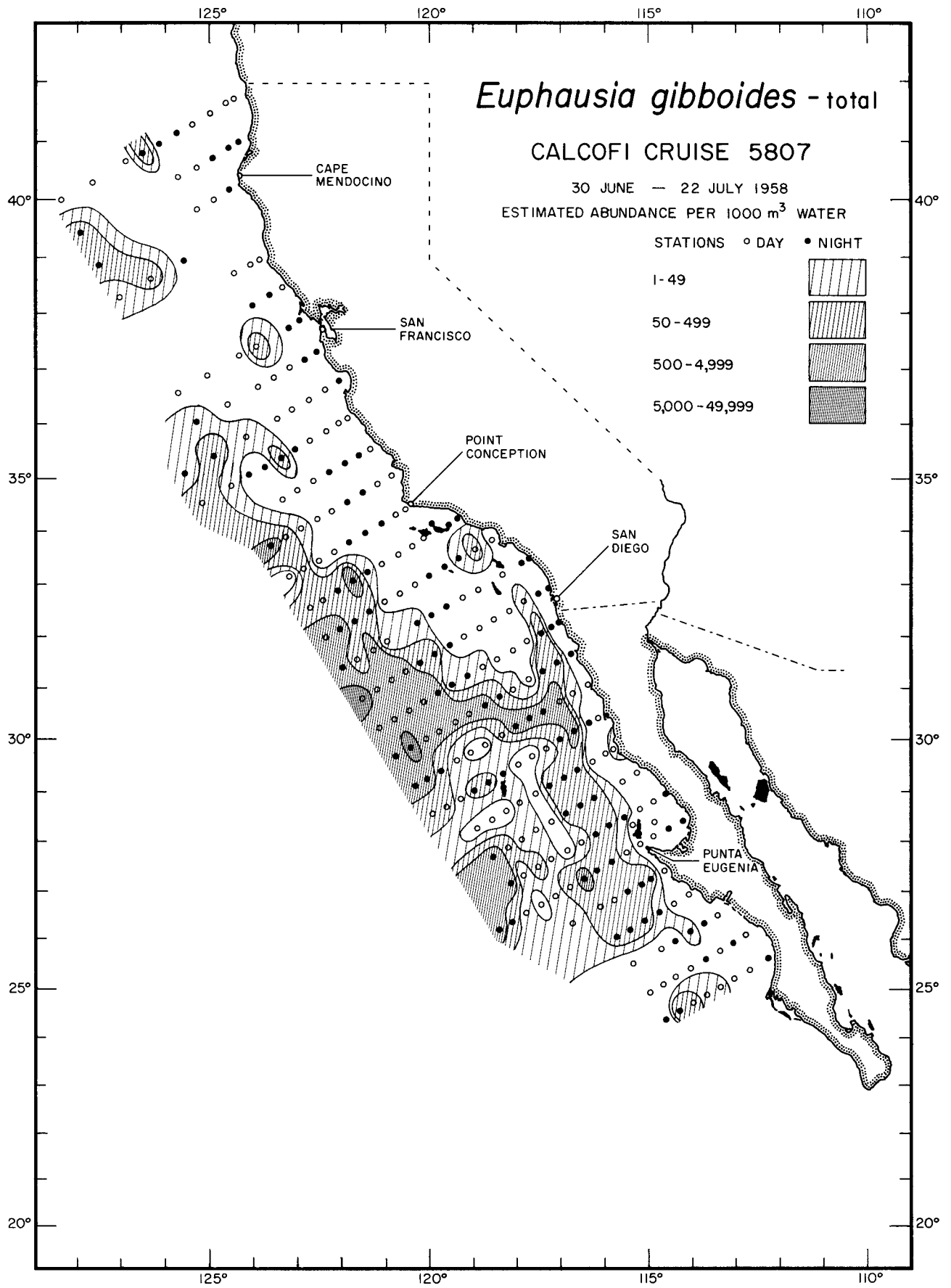
Euphausiacea
Euphausia gibboides - total
5710



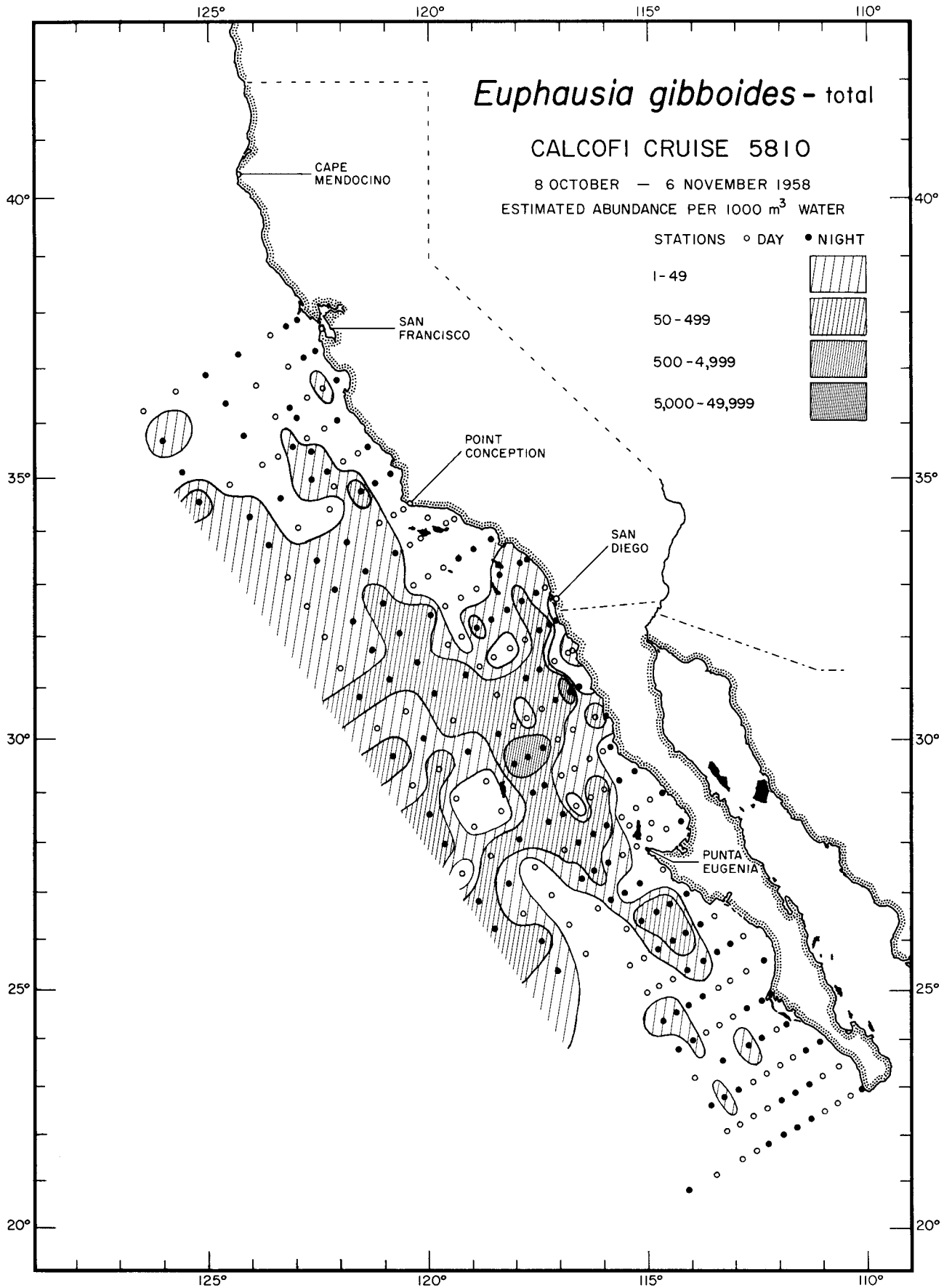
Euphausiacea
Euphausia gibboides - total
 5711



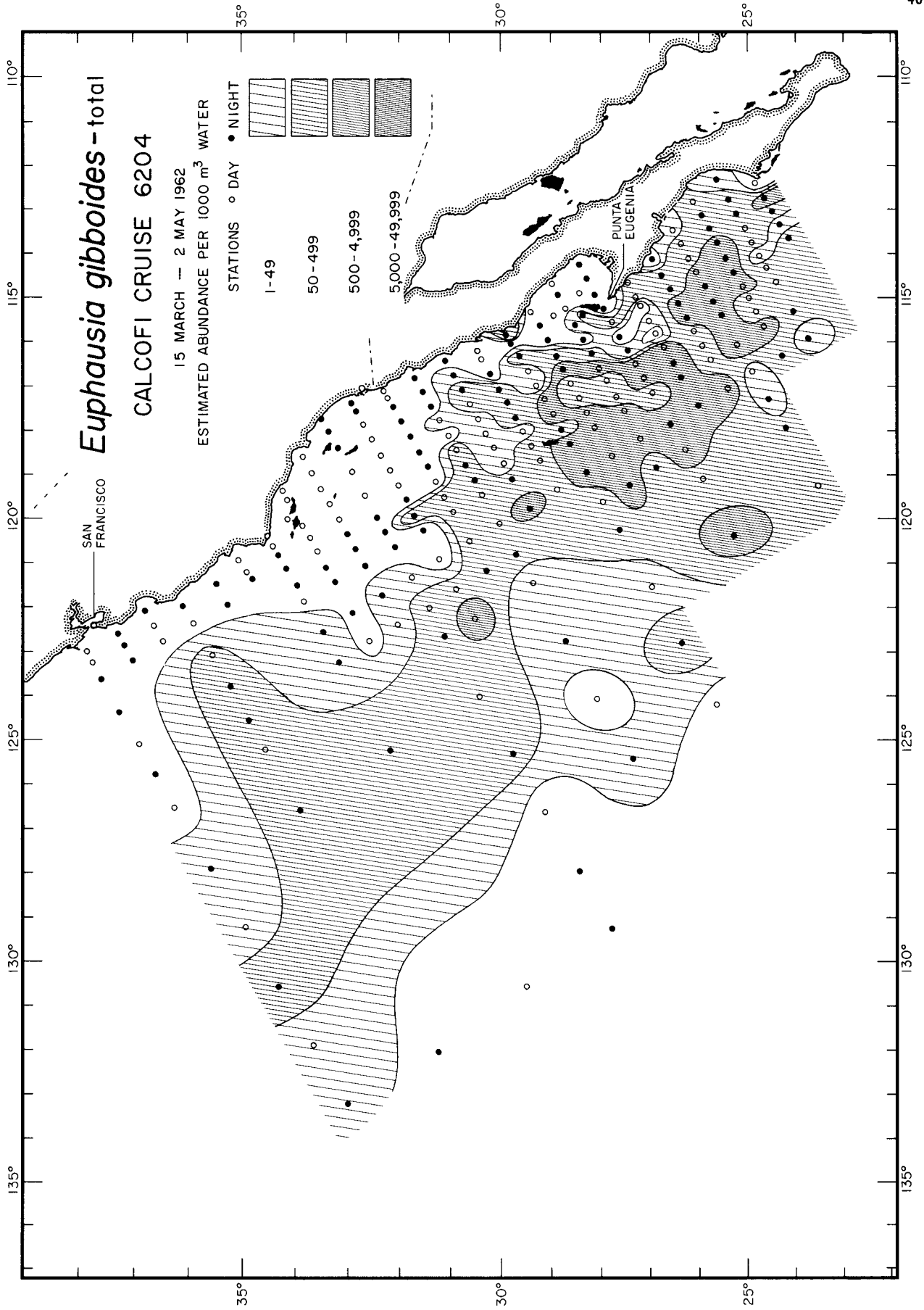
Euphausiacea
Euphausia gibboides - total
5804



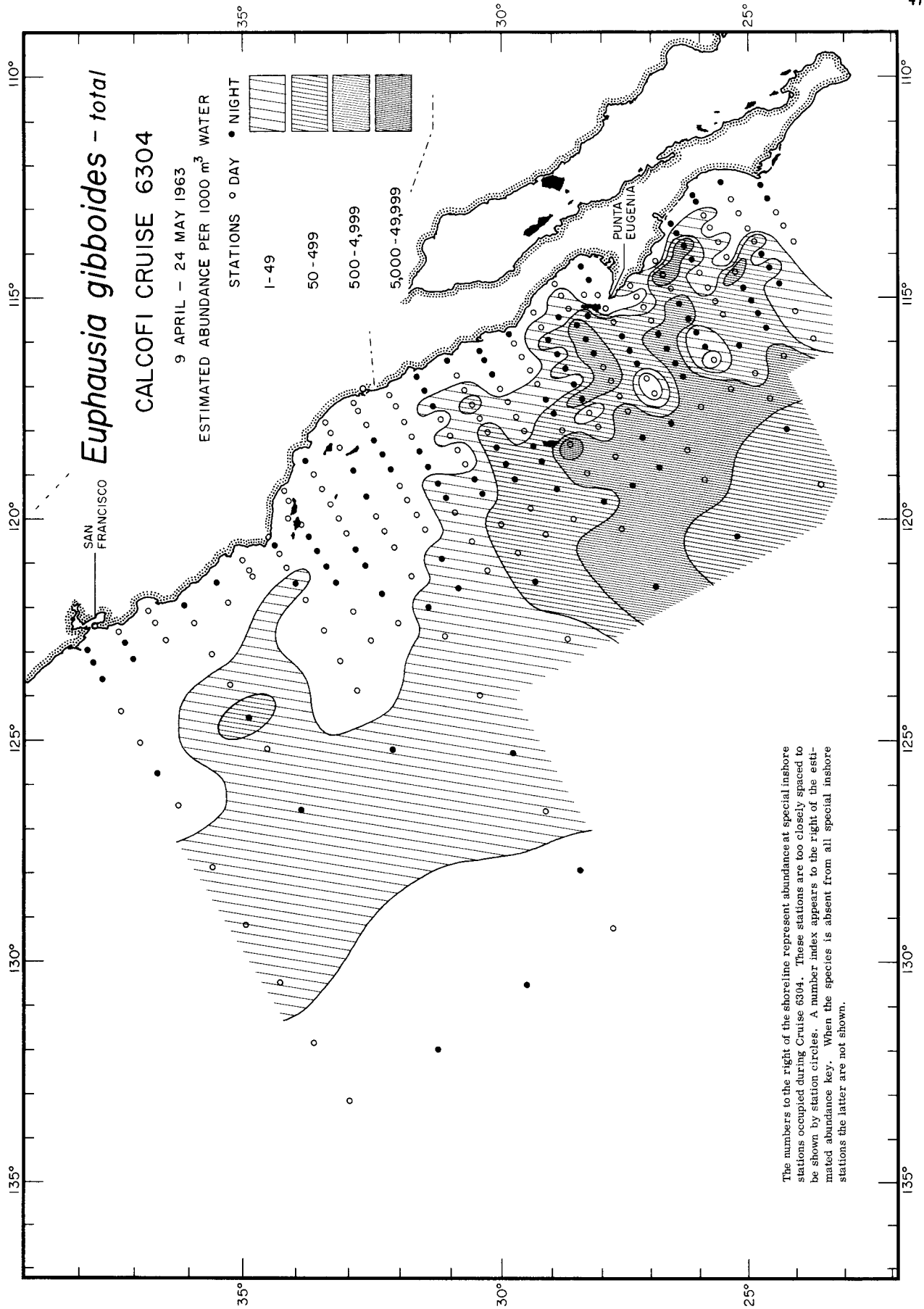
Euphausiacea
Euphausia gibboides - total
5807



Euphausiacea
Euphausia gibboides - total
 5810

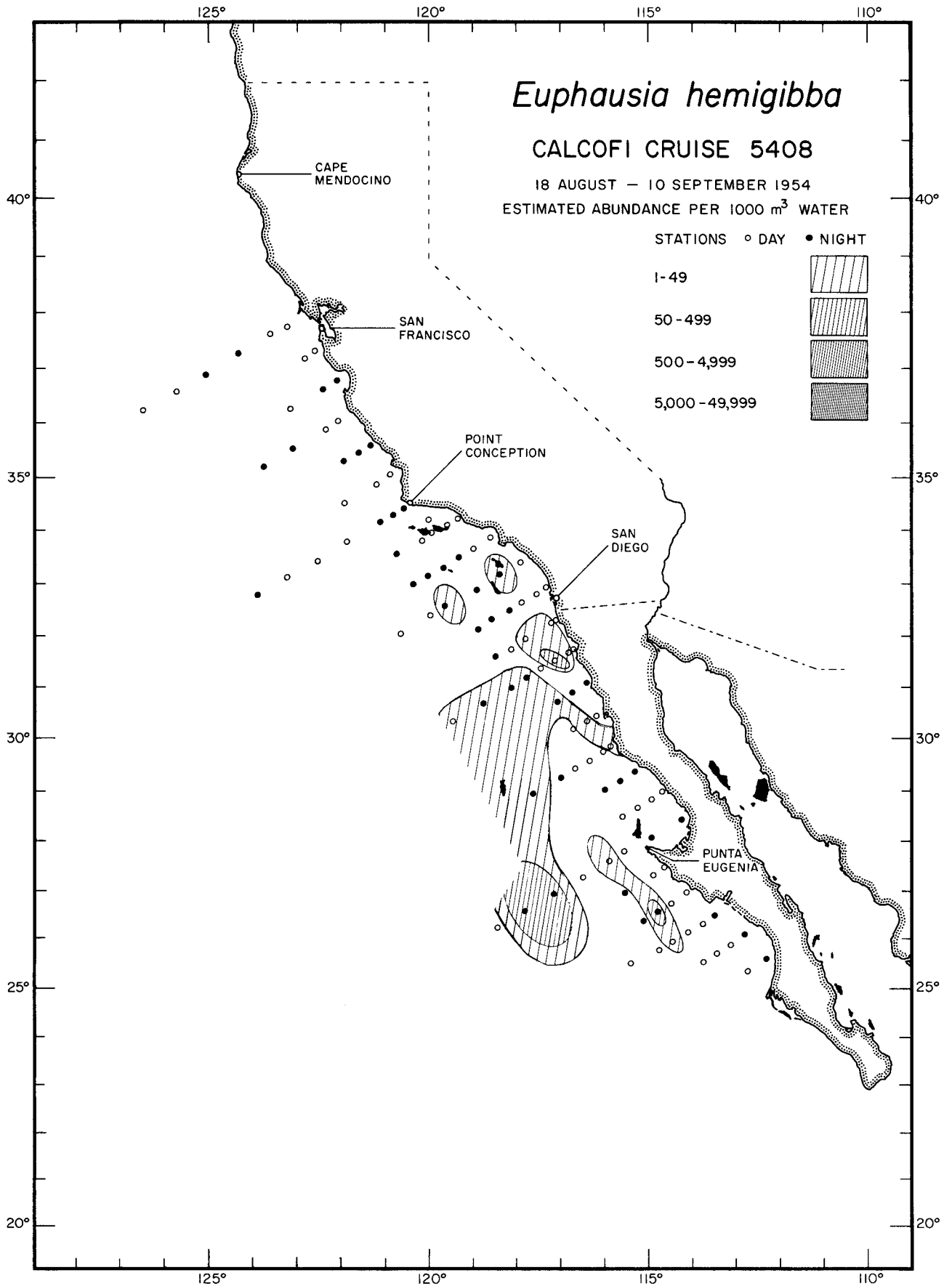


Euphausiacea
Euphausia gibboides - total
6204

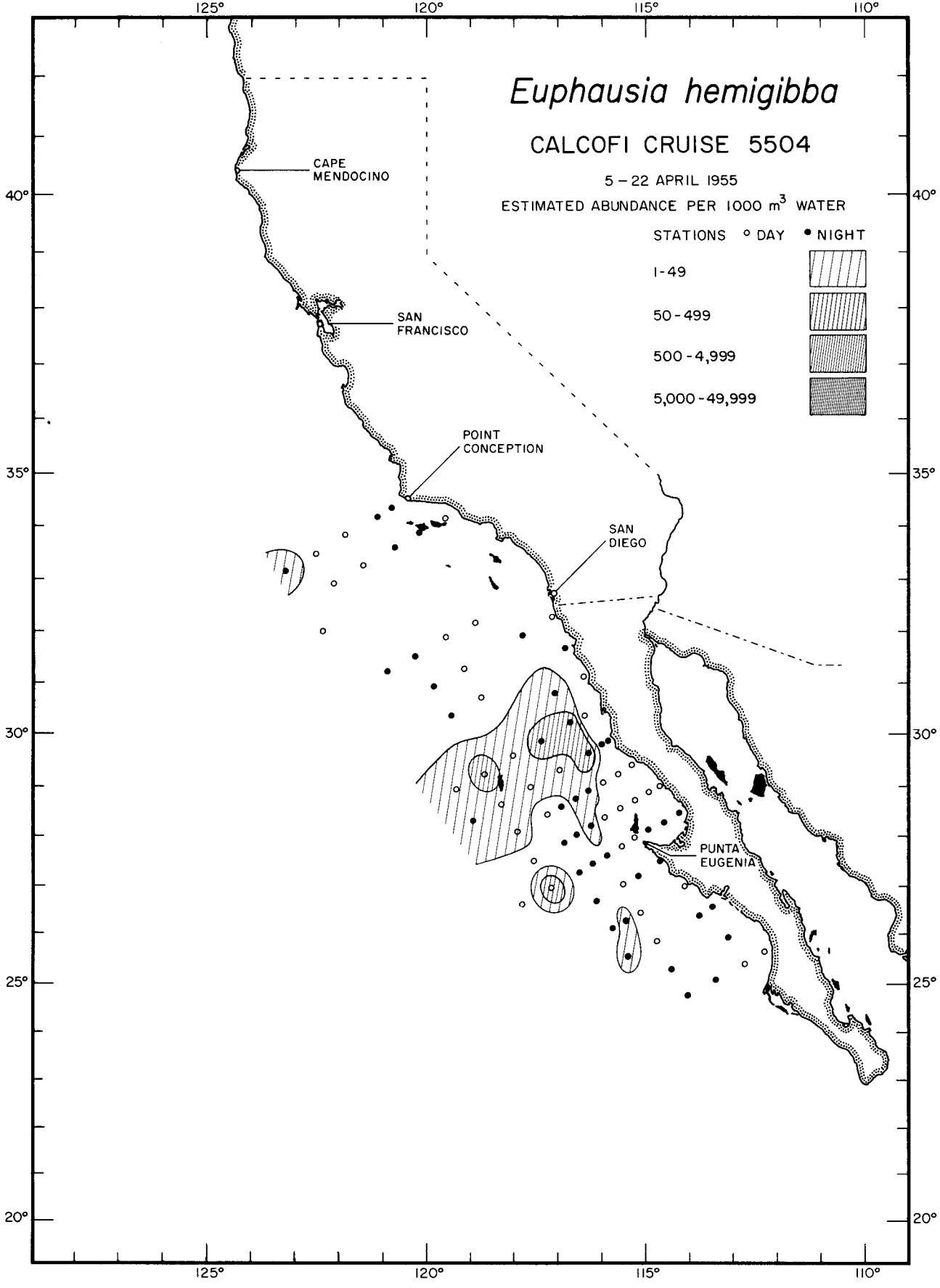


The numbers to the right of the shoreline represent abundance at special inshore stations occupied during Cruise 6304. These stations are too closely spaced to be shown by station circles. A number index appears to the right of the estimated abundance key. When the species is absent from all special inshore stations the latter are not shown.

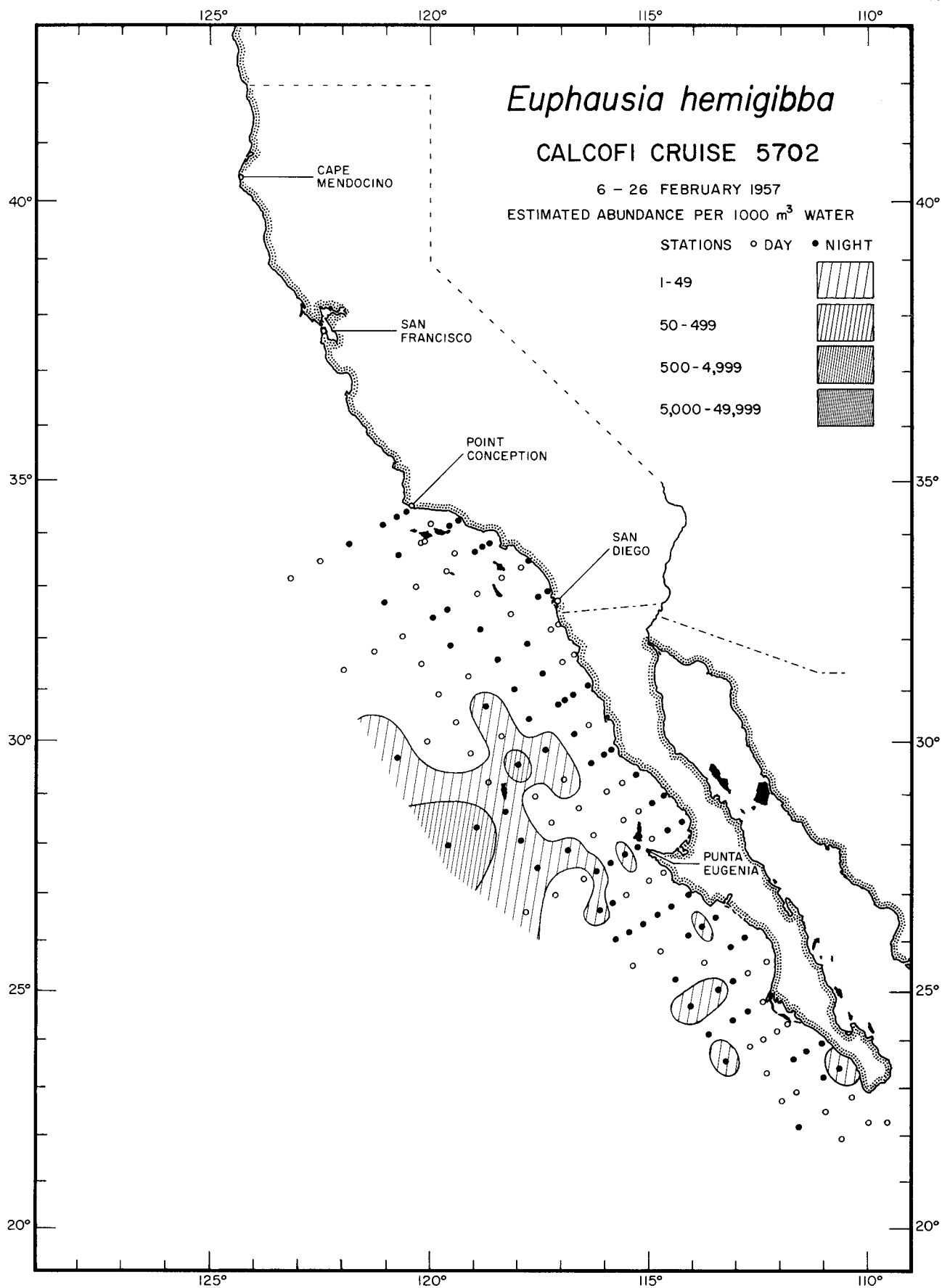
Euphausiacea
Euphausia gibboides - total
6304



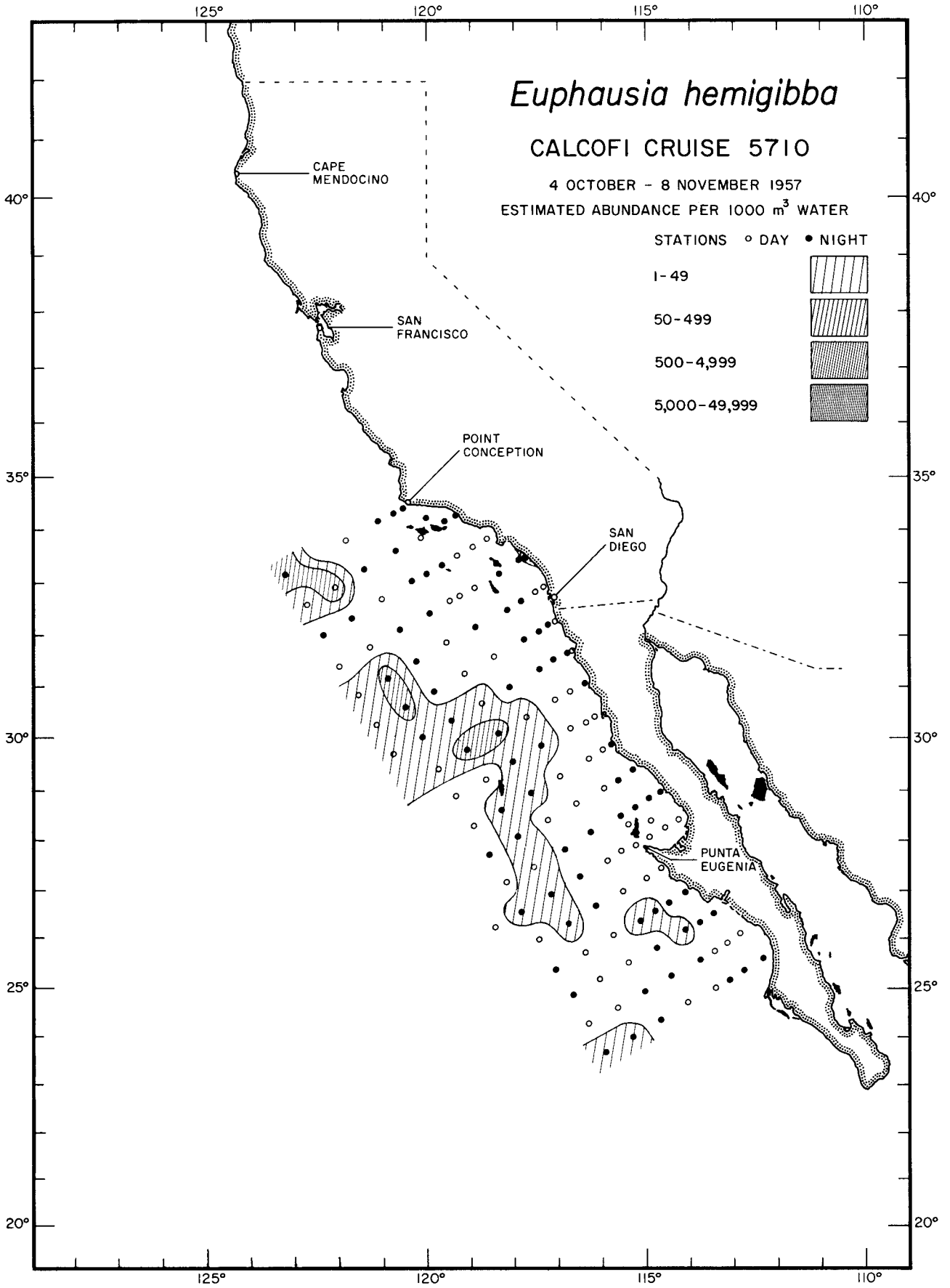
Euphausiacea
Euphausia hemigibba
5408



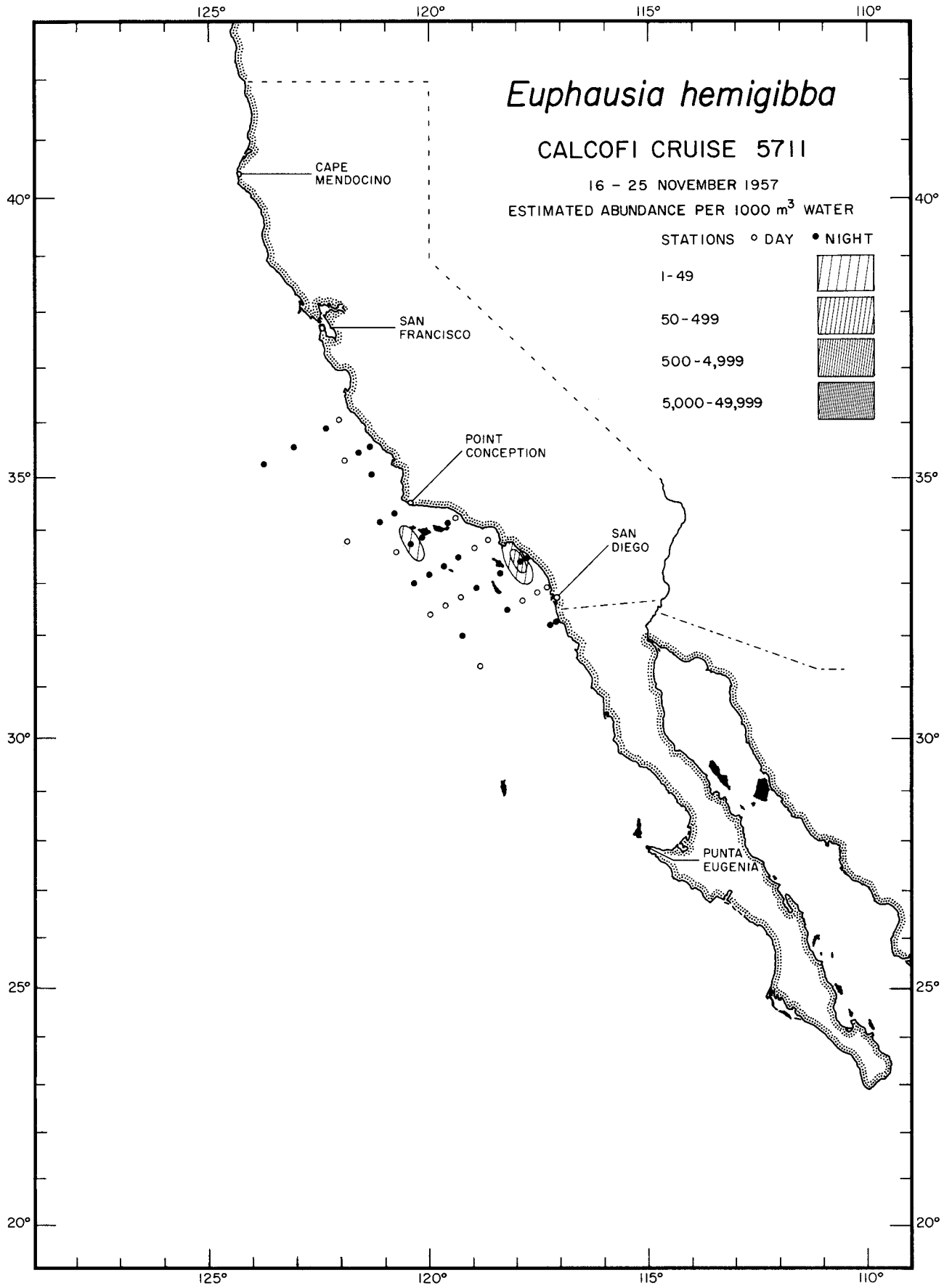
Euphausiacea
Euphausia hemigibba
 5504



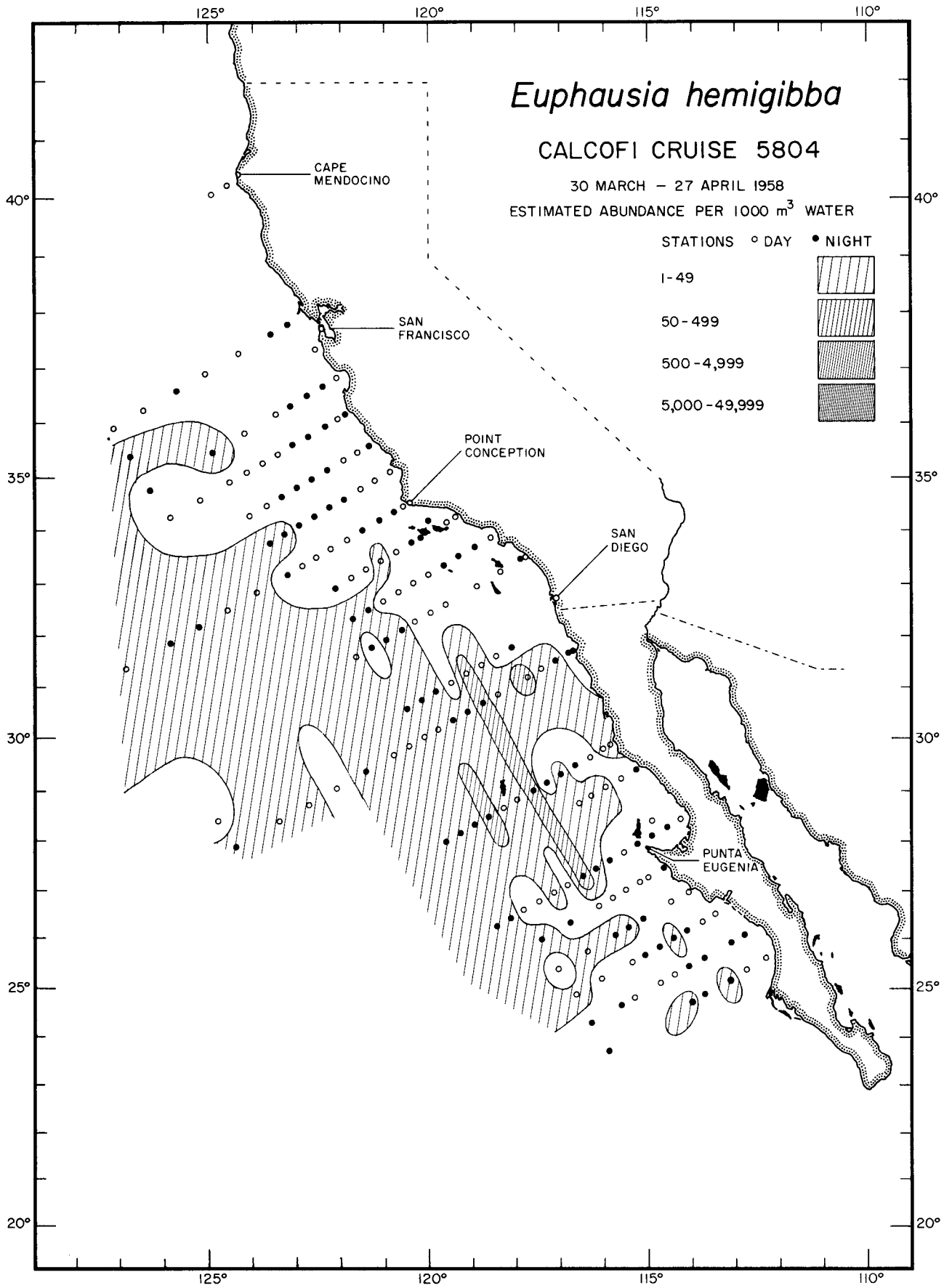
Euphausiacea
Euphausia hemigibba
5702



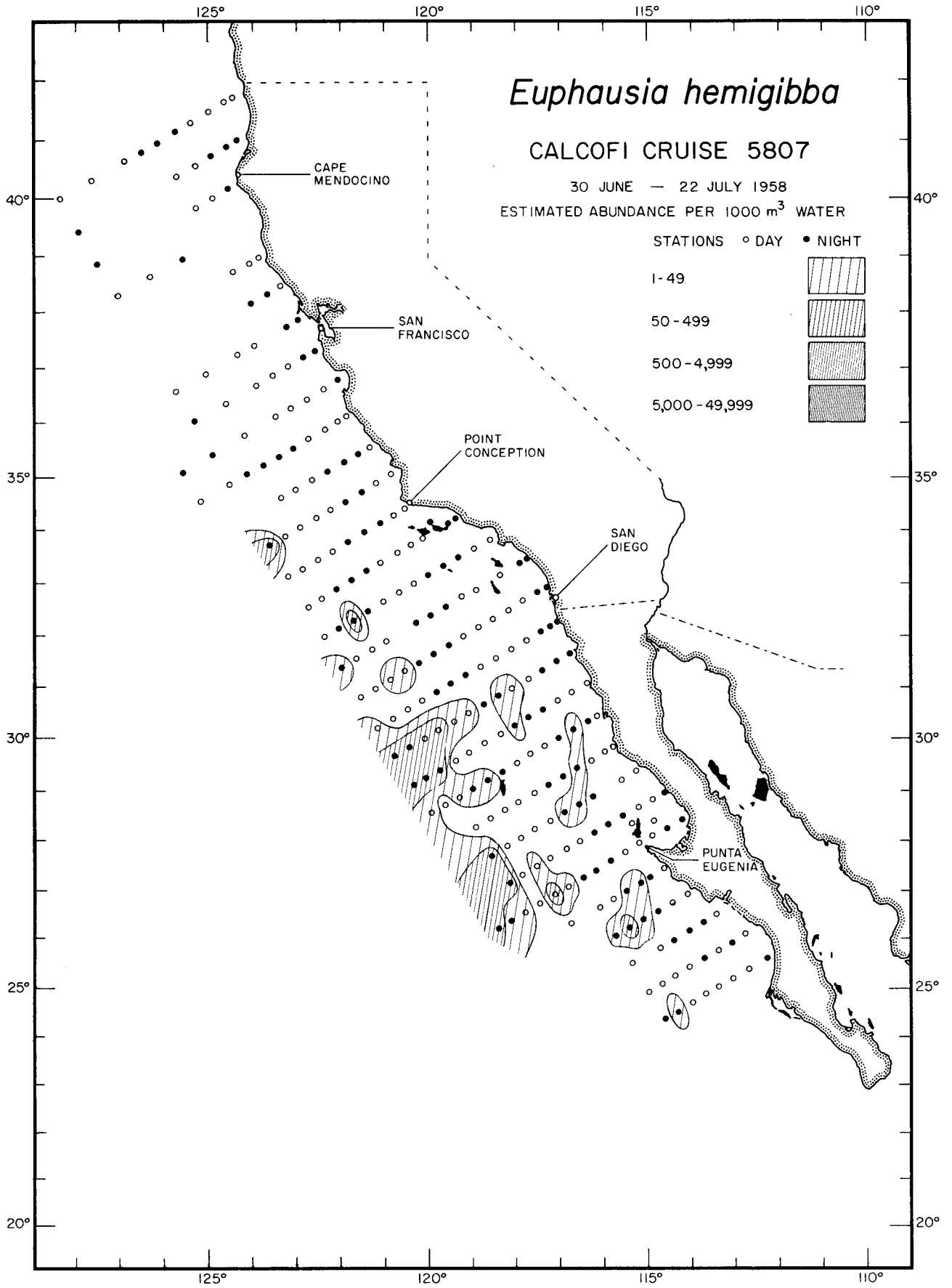
Euphausiacea
Euphausia hemigibba
 5710



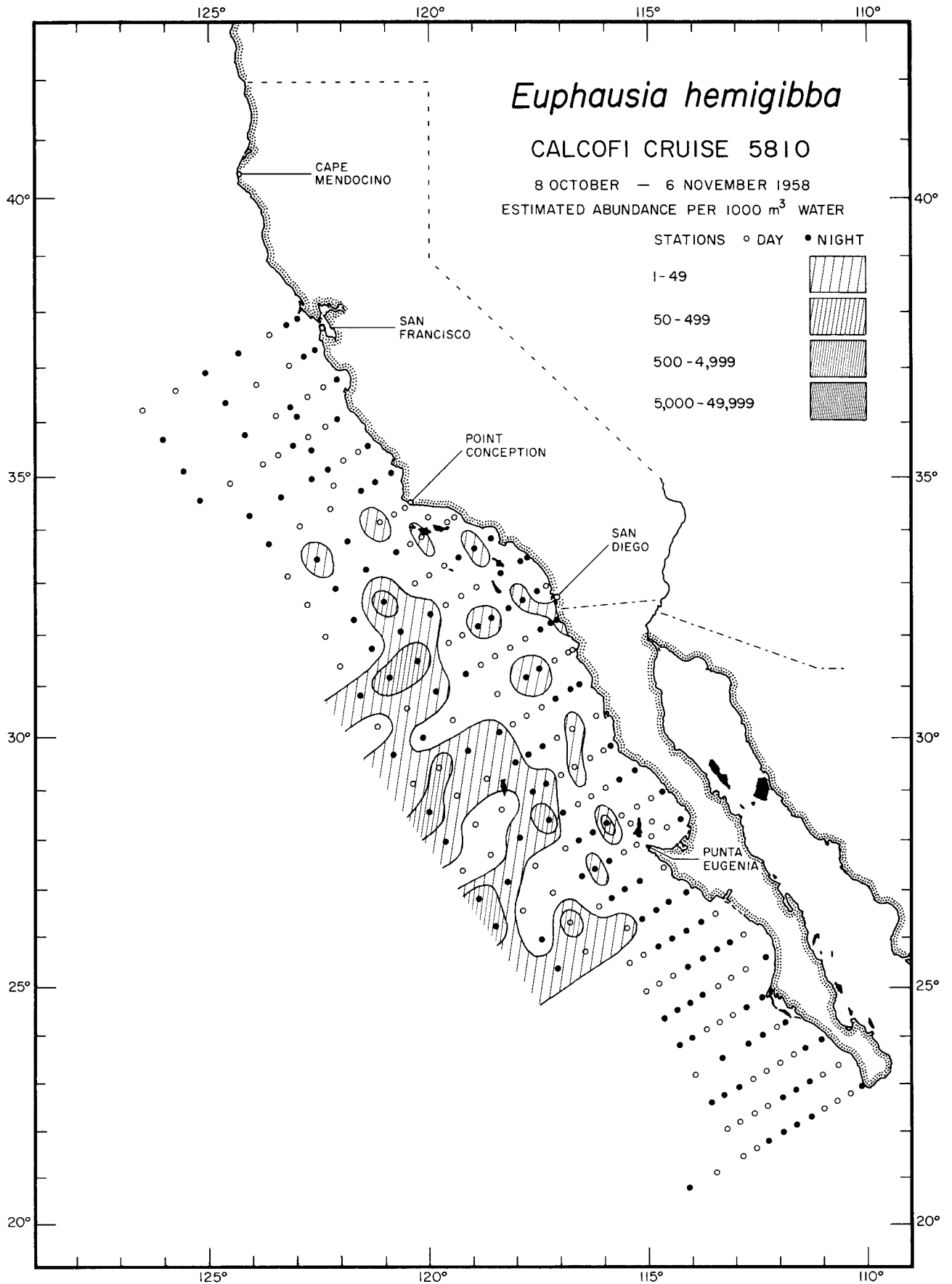
Euphausiacea
Euphausia hemigibba
5711



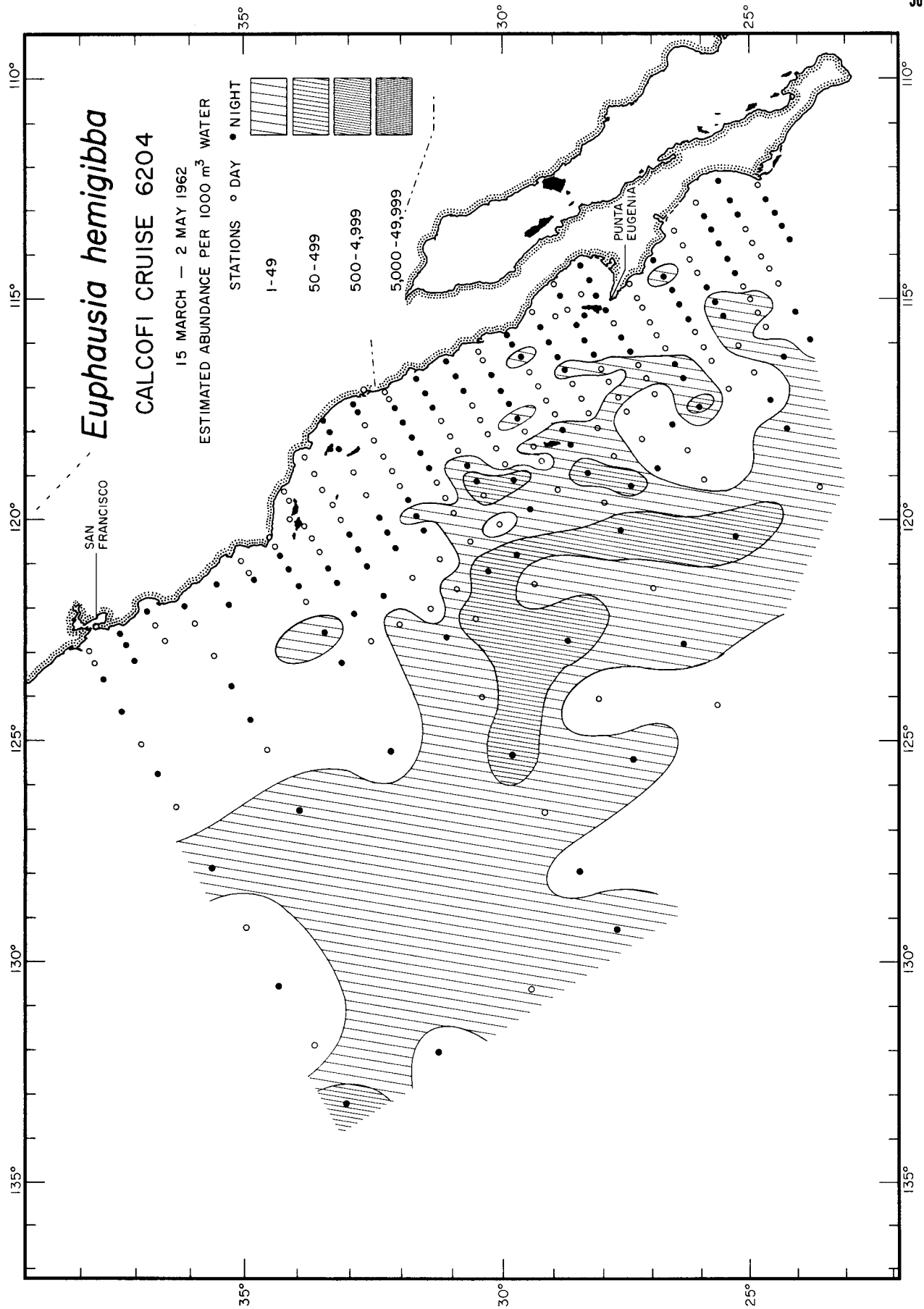
Euphausiacea
Euphausia hemigibba
 5804



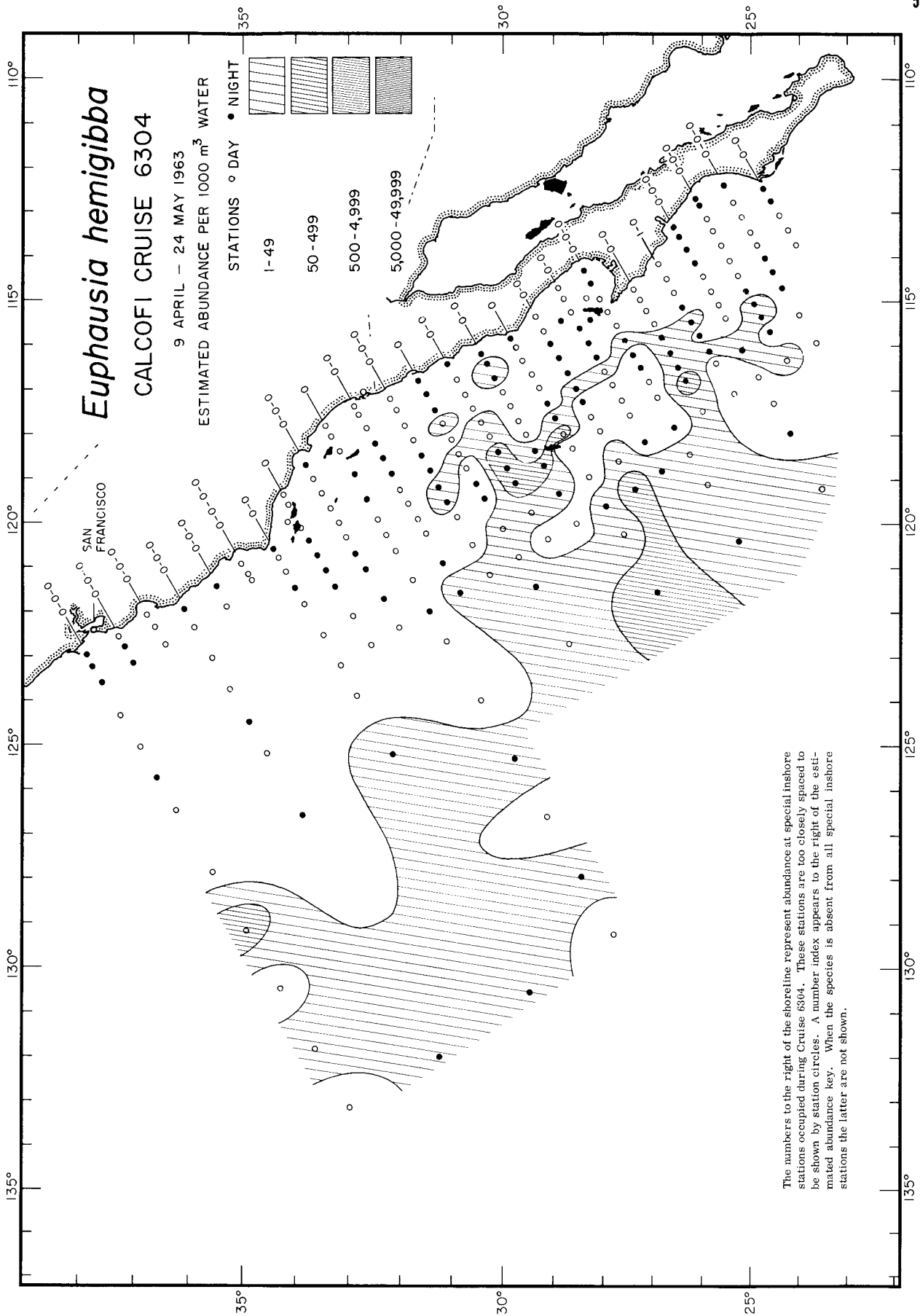
Euphausiacea
Euphausia hemigibba
5807



Euphausiacea
Euphausia hemigibba
5810

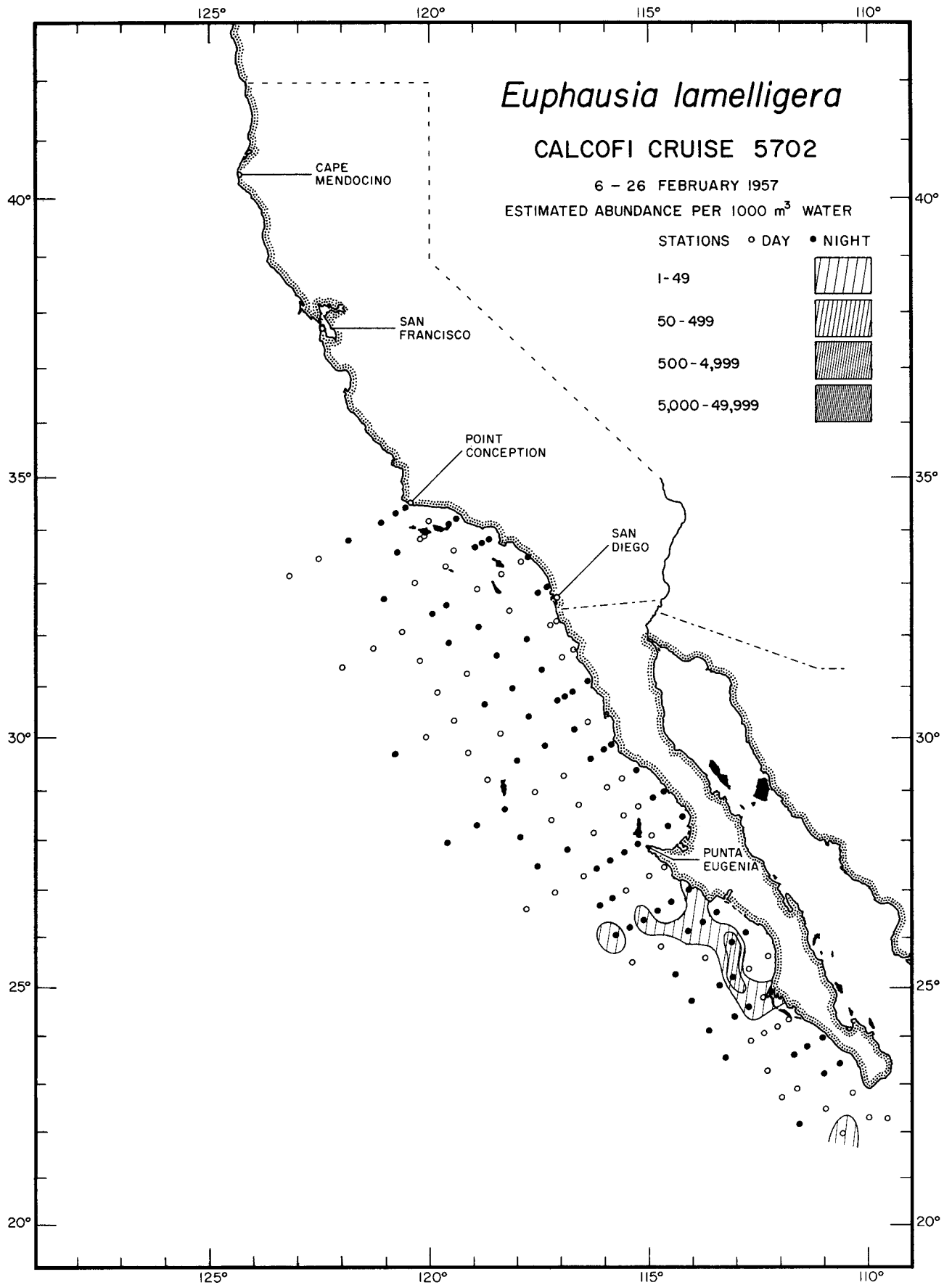


Euphausiacea
Euphausia hemigibba
 6204

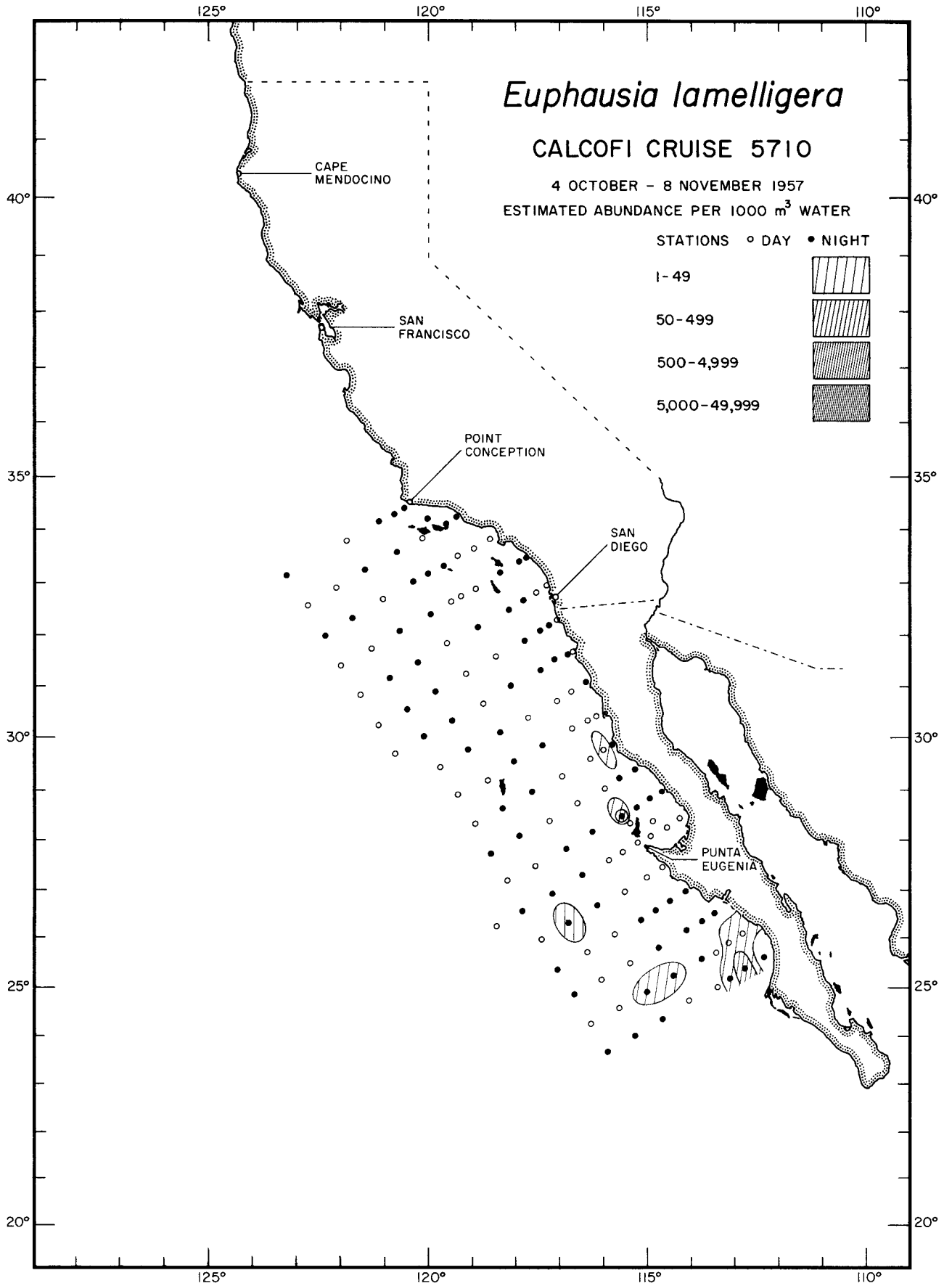


The numbers to the right of the shoreline represent abundance at special inshore stations occupied during Cruise 6304. These stations are too closely spaced to be shown by station circles. A number index appears to the right of the estimated abundance key. When the species is absent from all special inshore stations the latter are not shown.

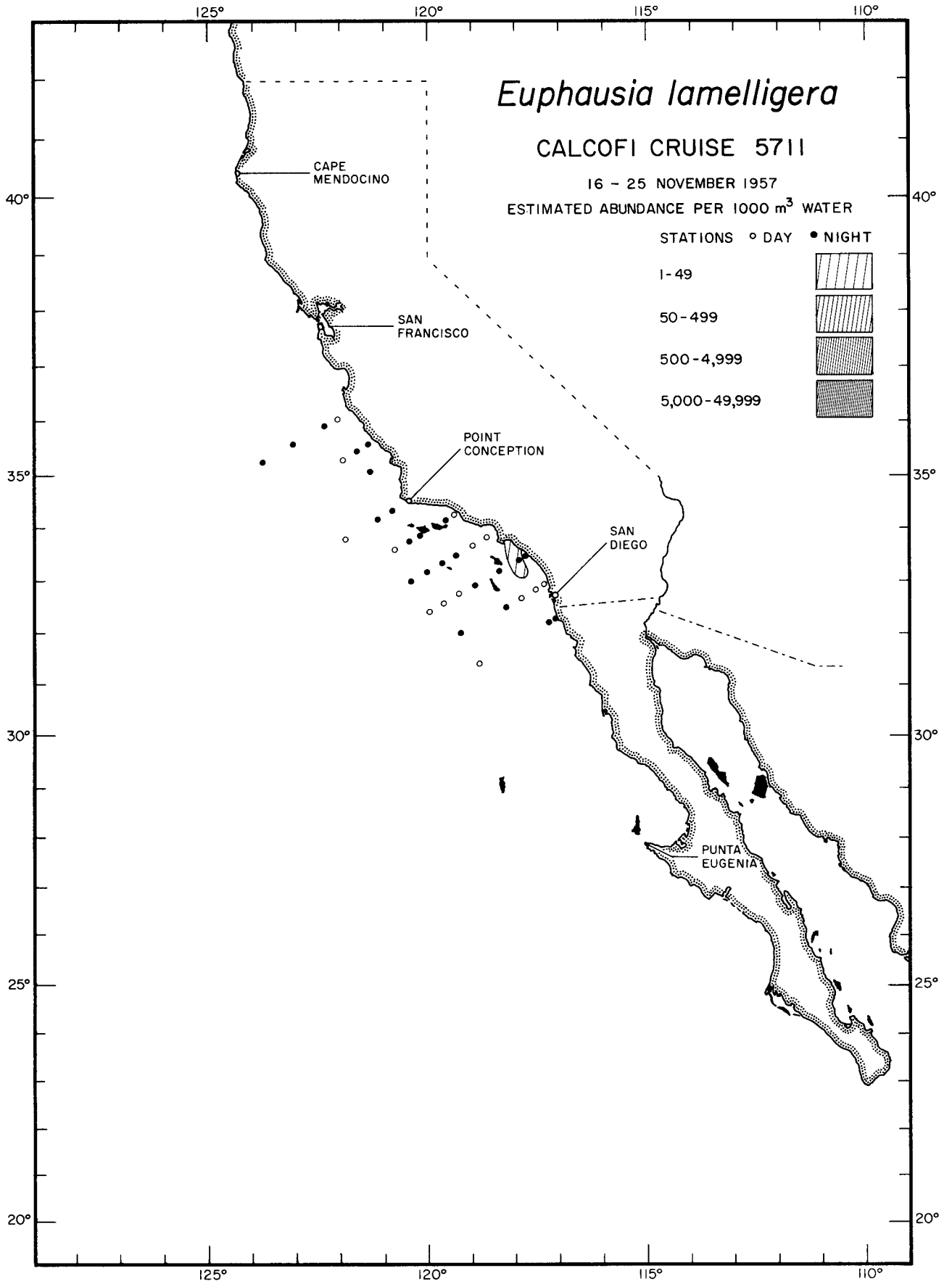
Euphausiacea
Euphausia hemigibba
 6304



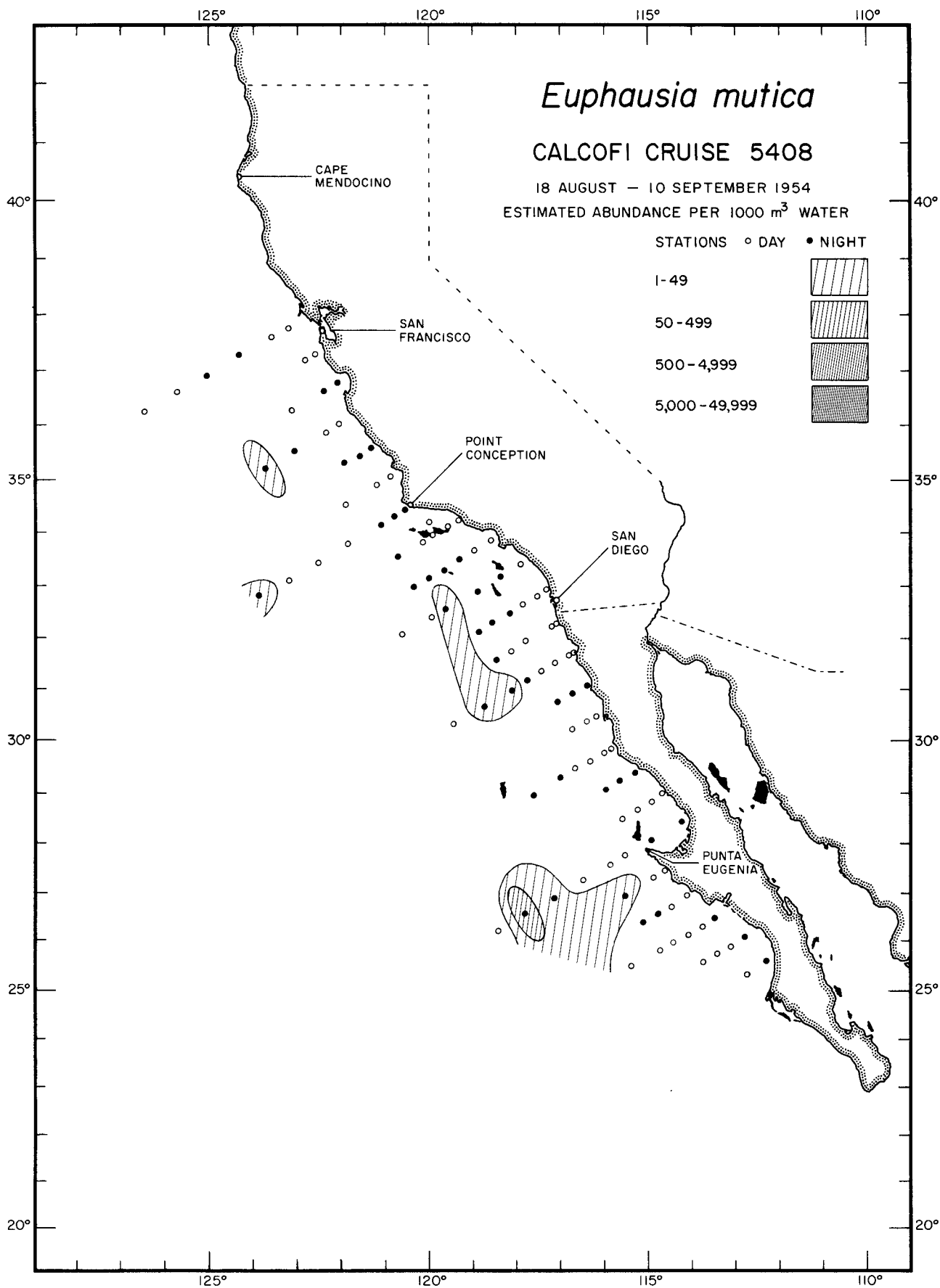
Euphausiacea
Euphausia lamelligera
5702



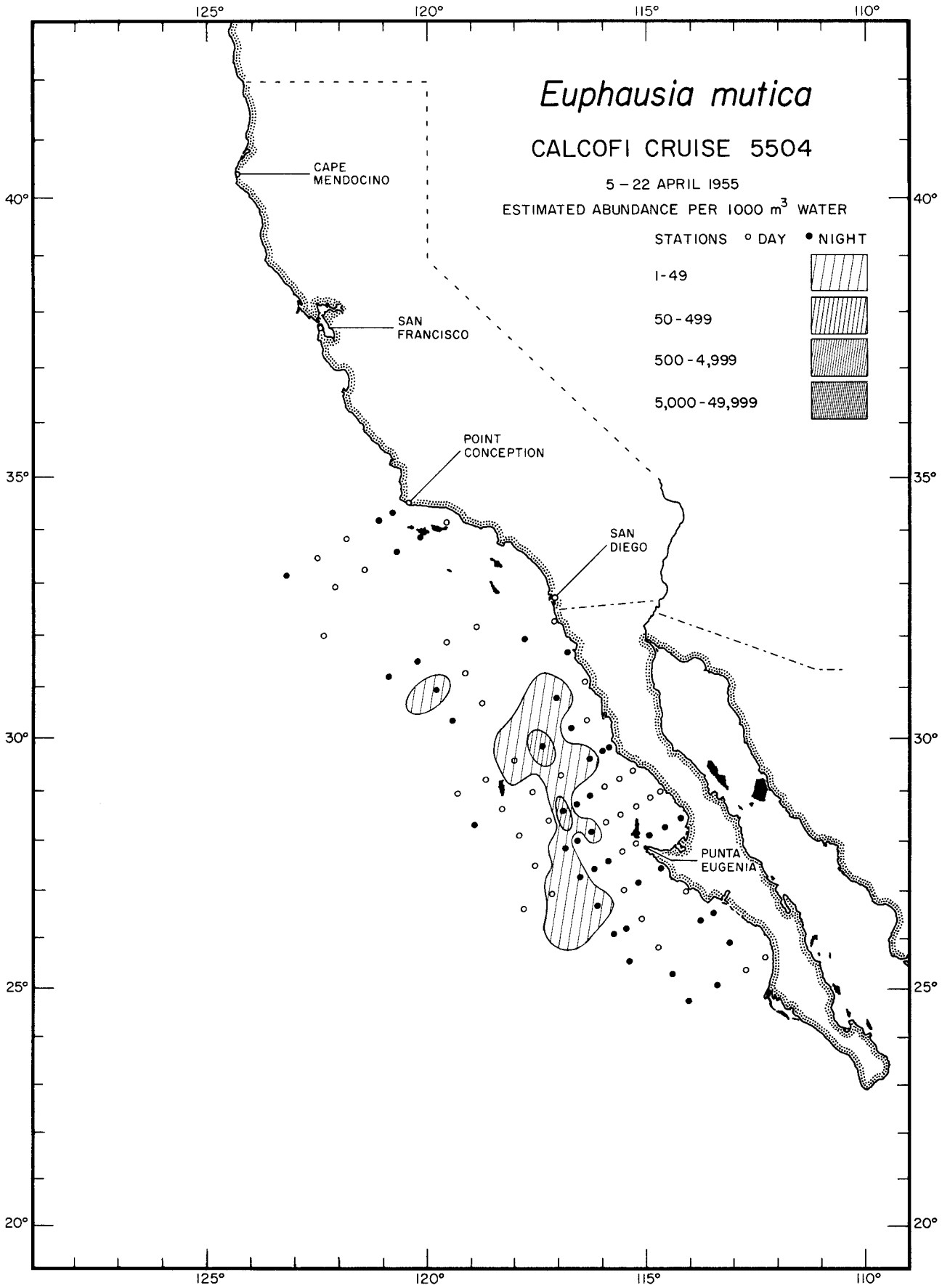
Euphausiacea
Euphausia lamelligera
5710



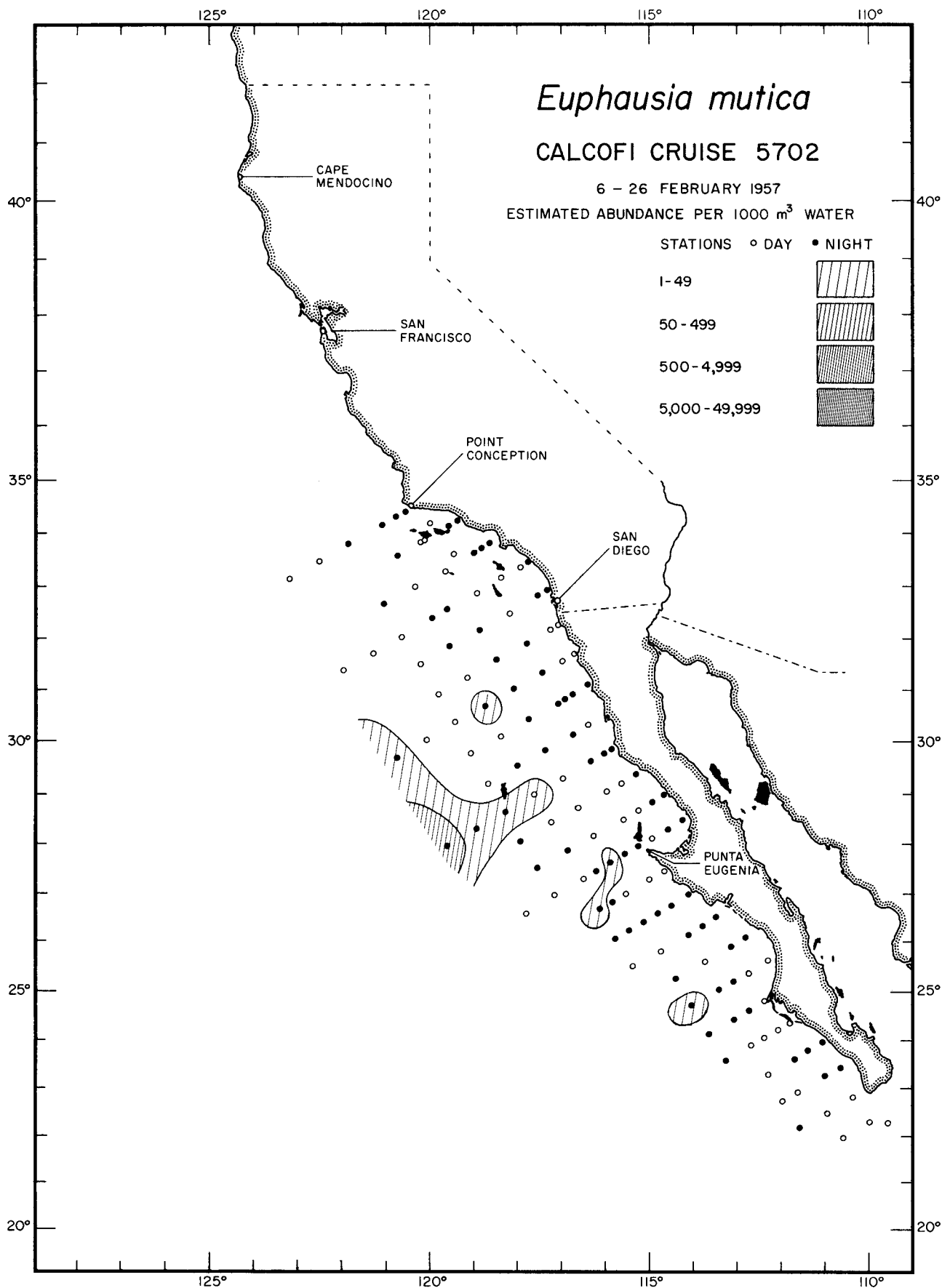
Euphausiacea
Euphausia lamelligera
5711



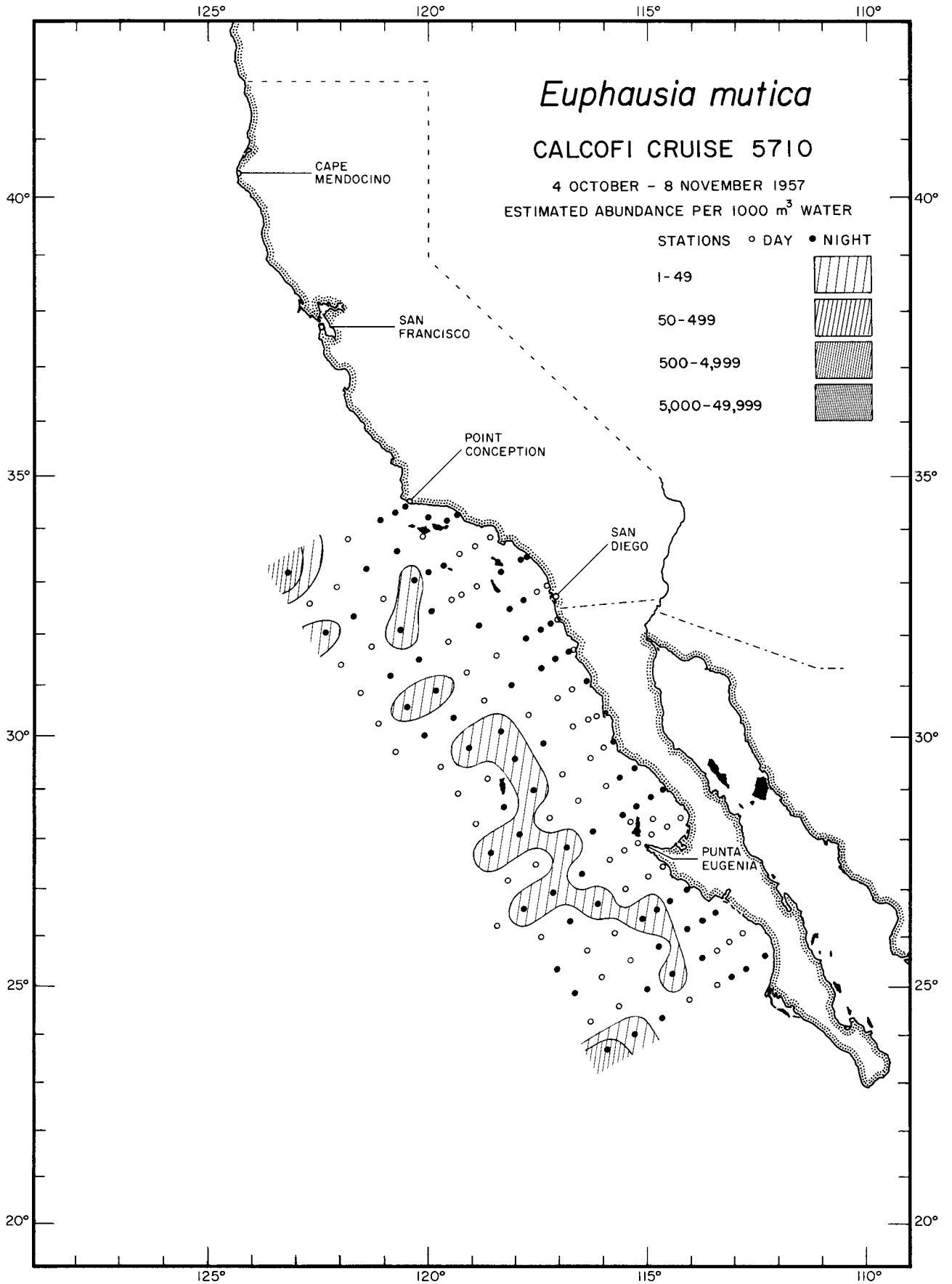
Euphausiacea
Euphausia mutica
5408



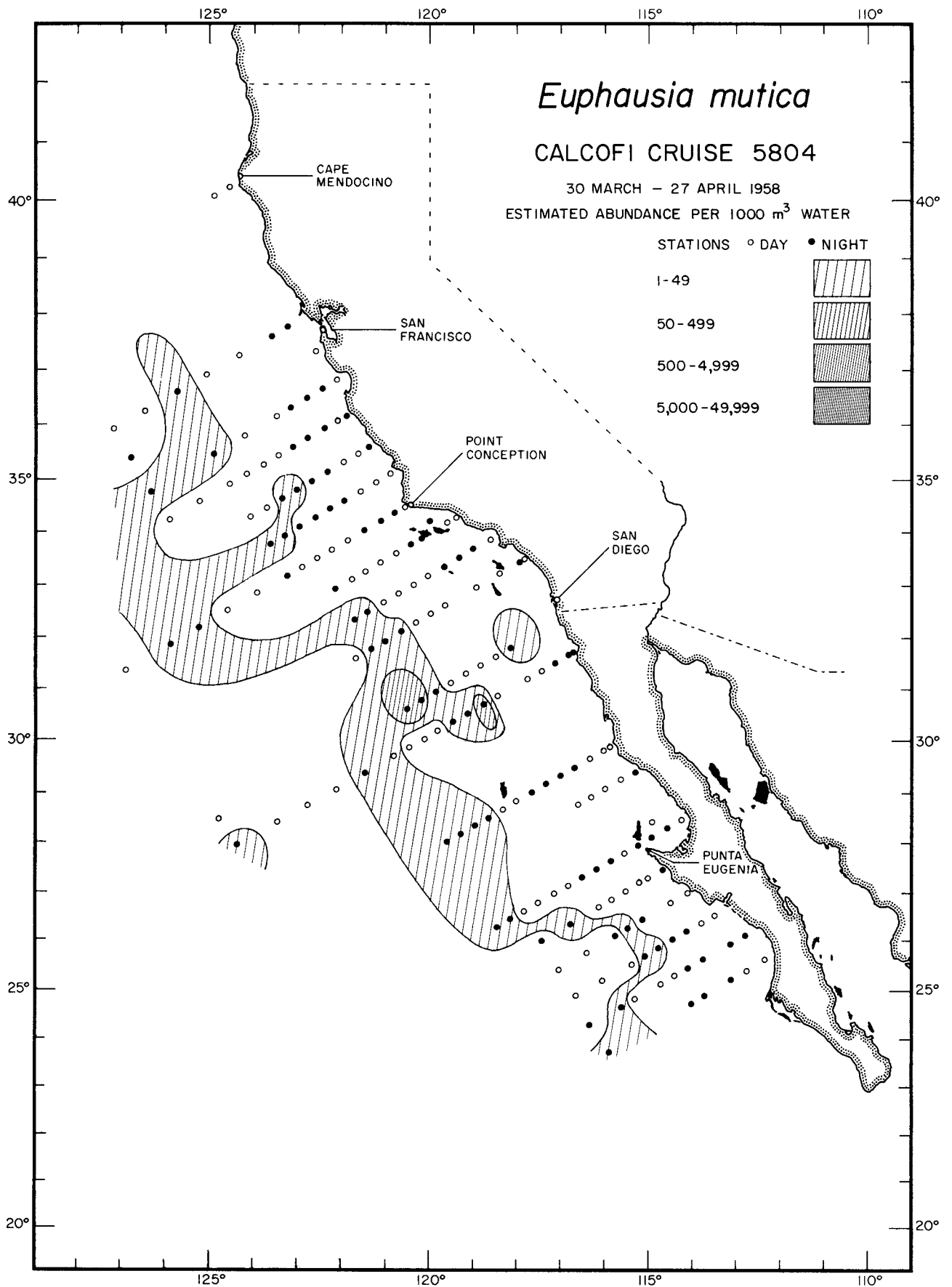
Euphausiacea
Euphausia mutica
5504



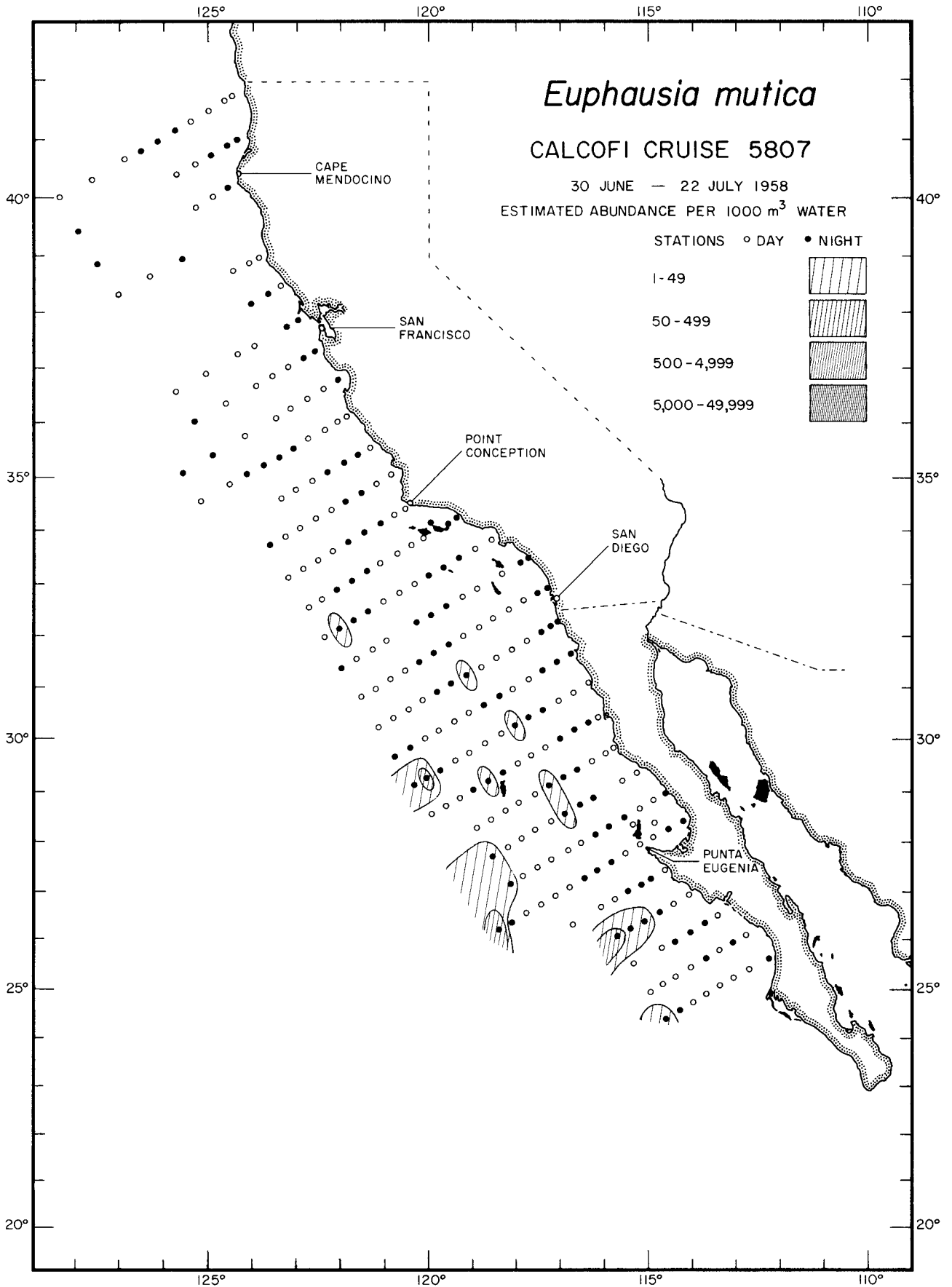
Euphausiacea
Euphausia mutica
5702



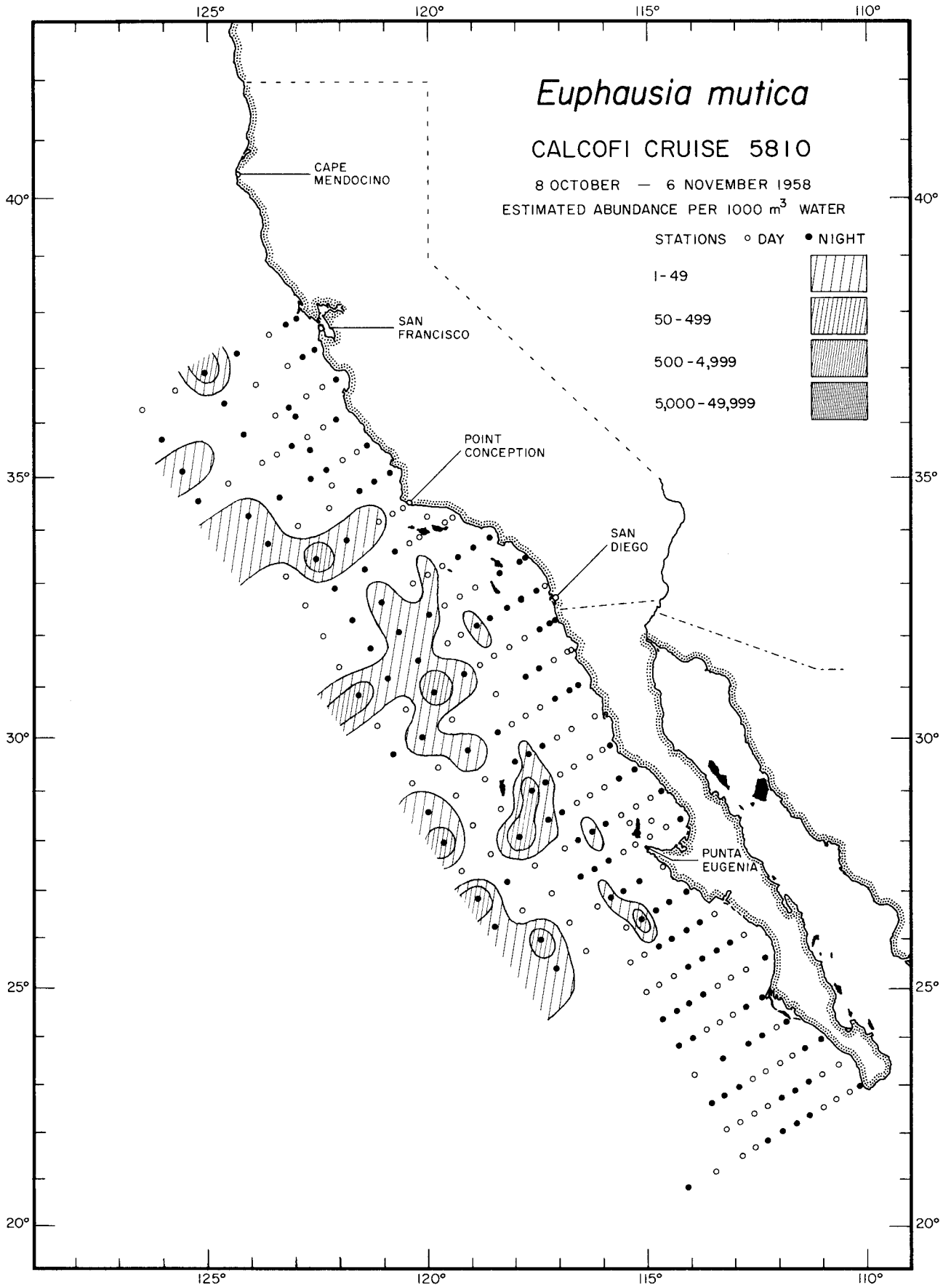
Euphausiacea
Euphausia mutica
5710



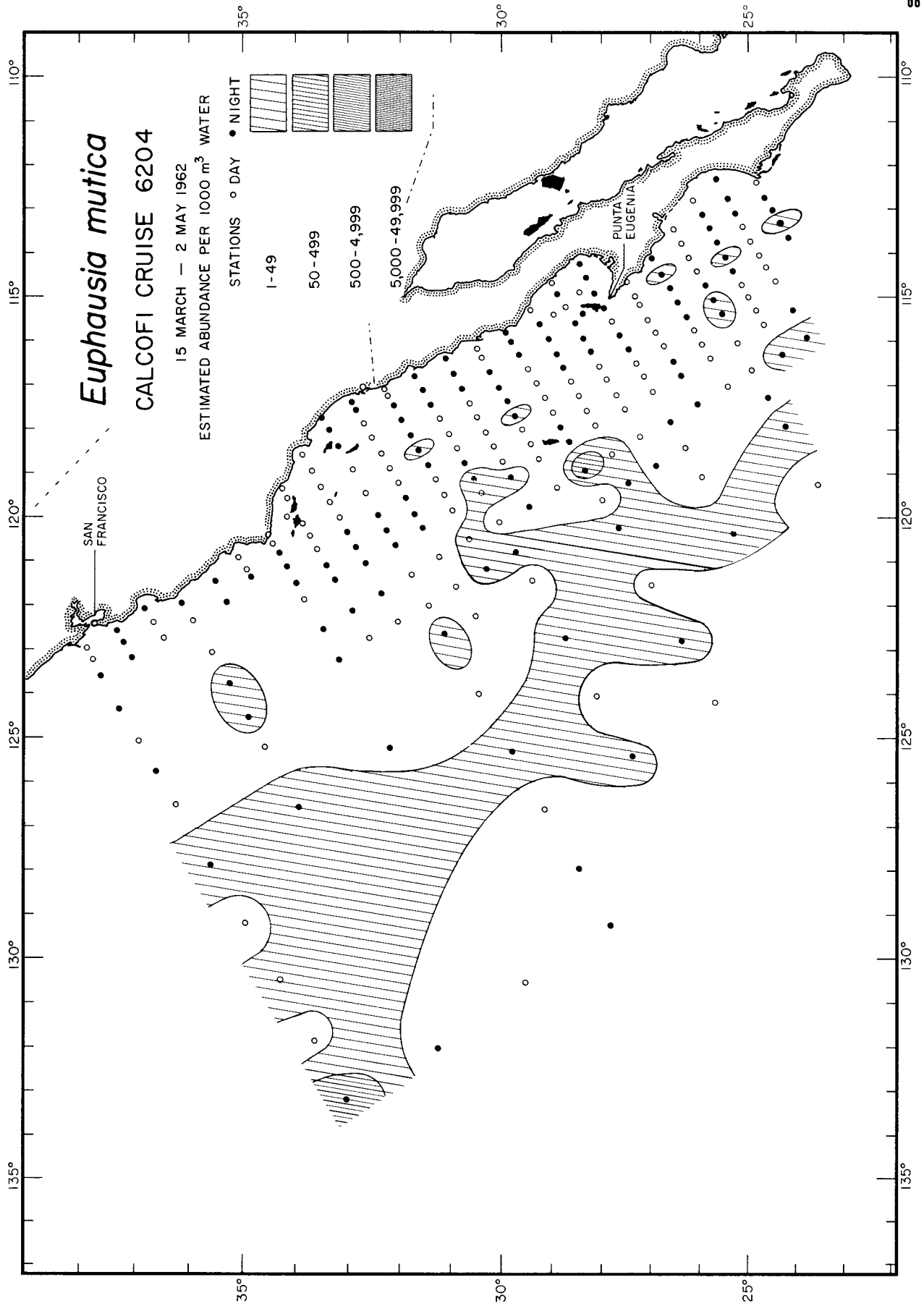
Euphausiacea
Euphausia mutica
5804



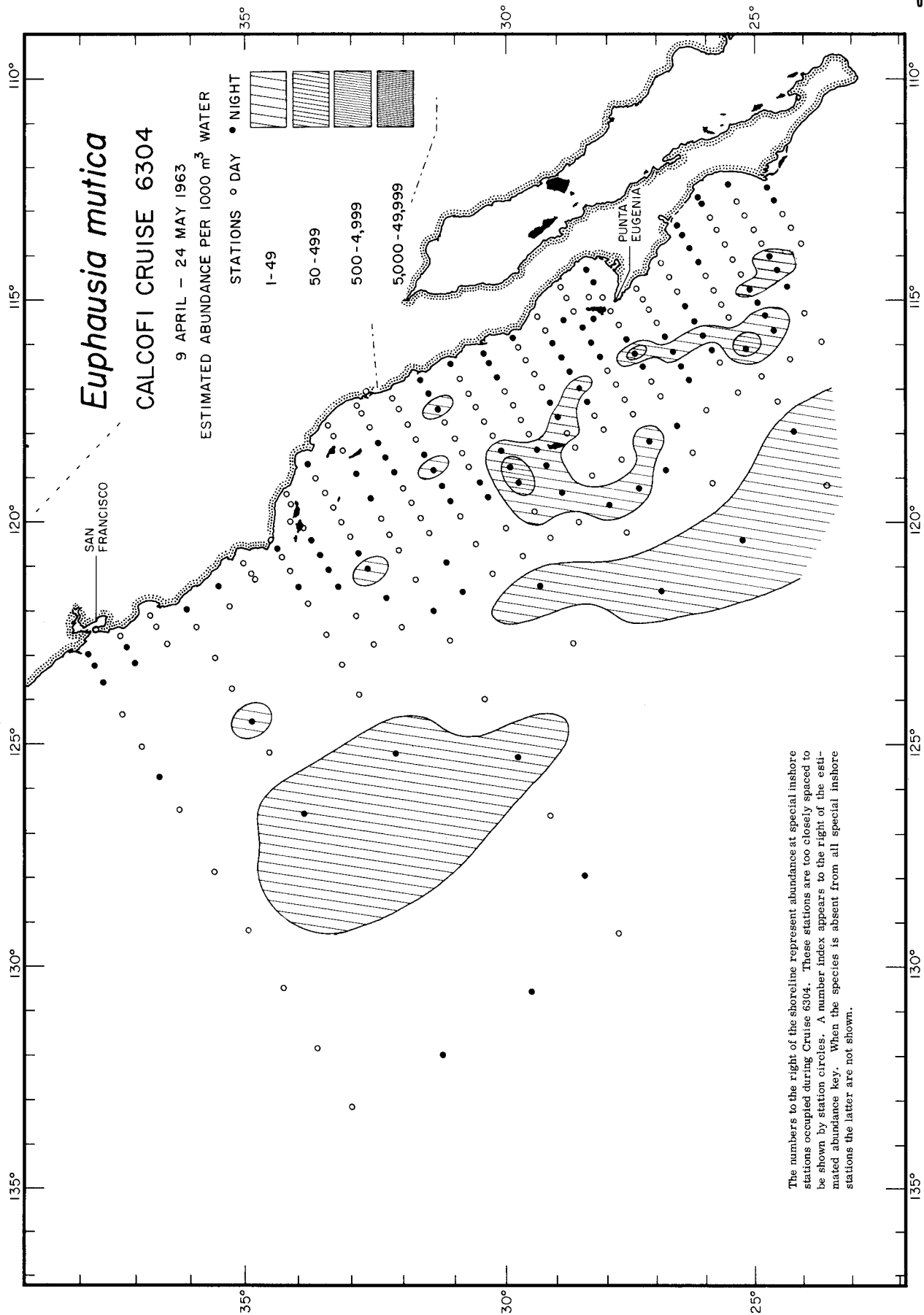
Euphausiacea
Euphausia mutica
 5807



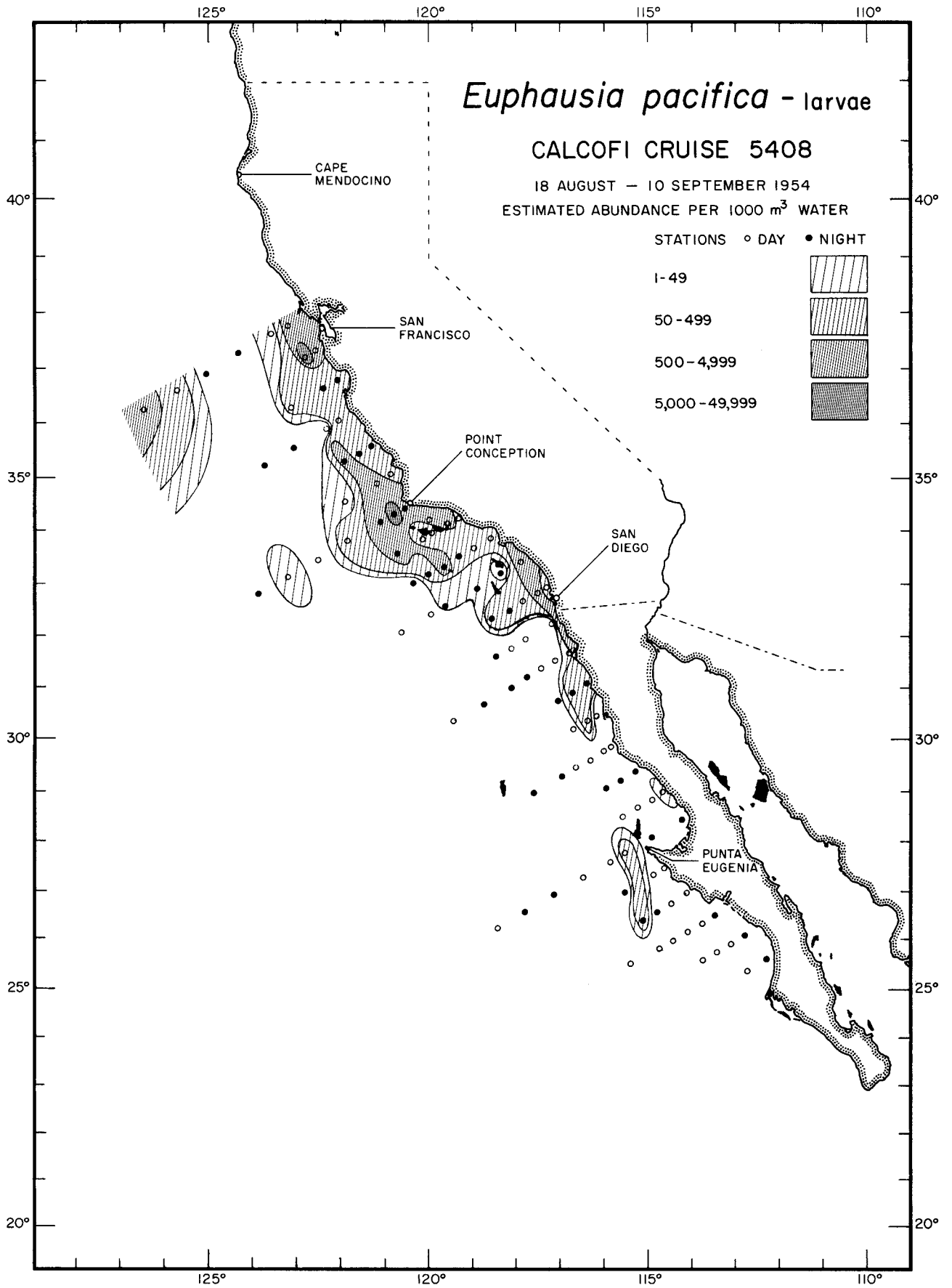
Euphausiacea
Euphausia mutica
5810



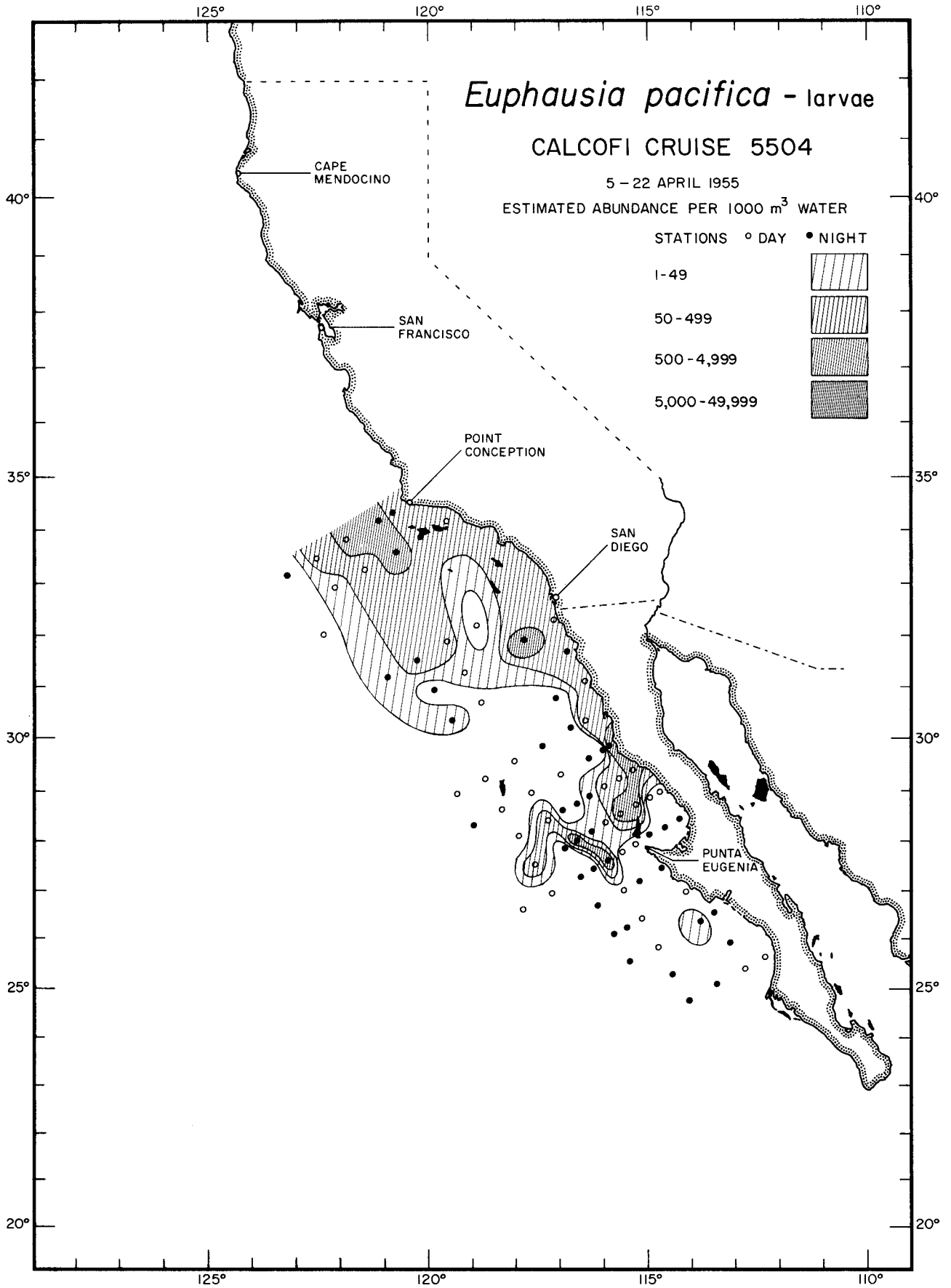
Euphausiacea
Euphausia mutica
6204



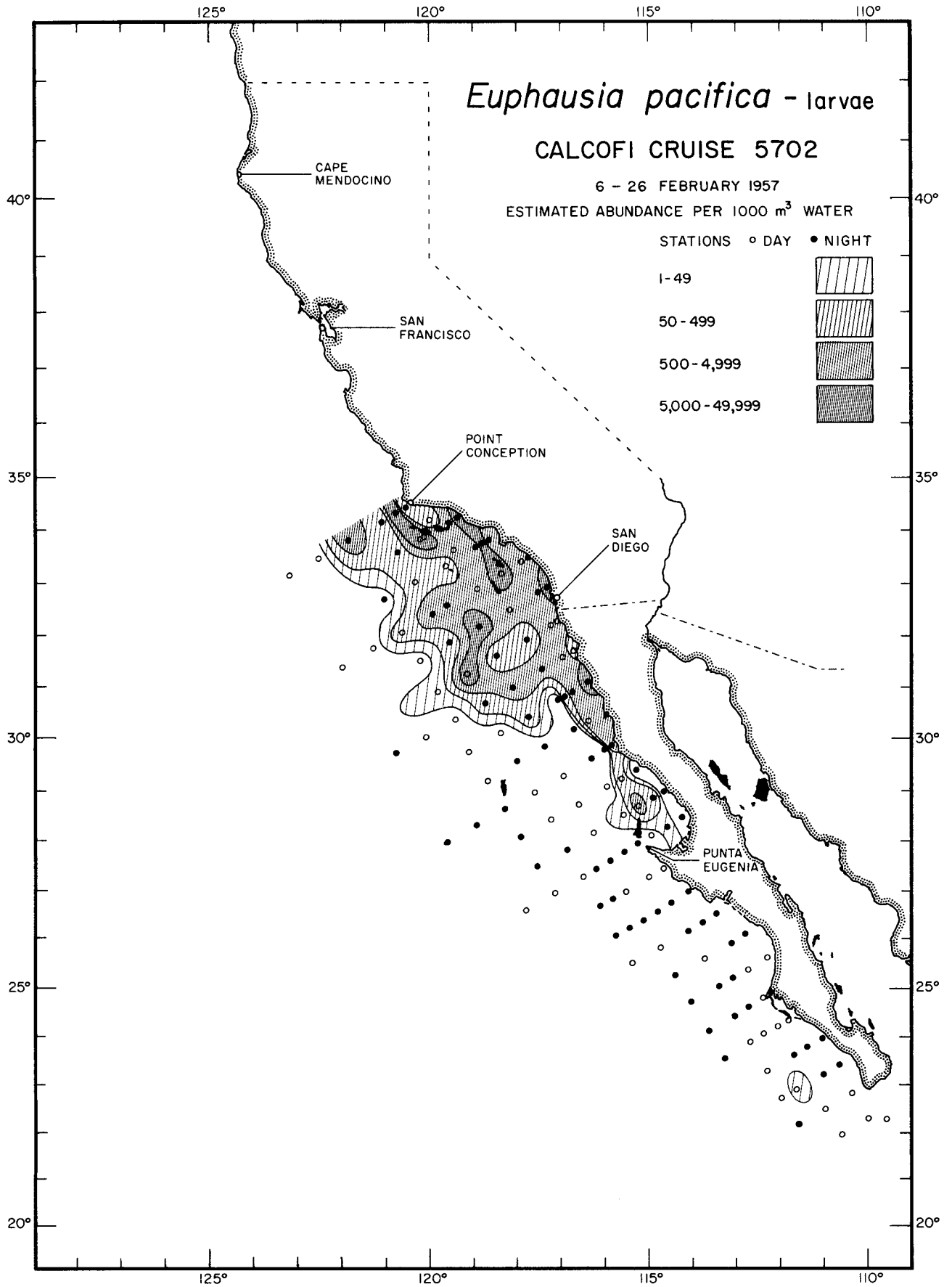
The numbers to the right of the shoreline represent abundance at special inshore stations occupied during Cruise 6304. These stations are too closely spaced to be shown by station circles. A number index appears to the right of the estimated abundance key. When the species is absent from all special inshore stations the latter are not shown.



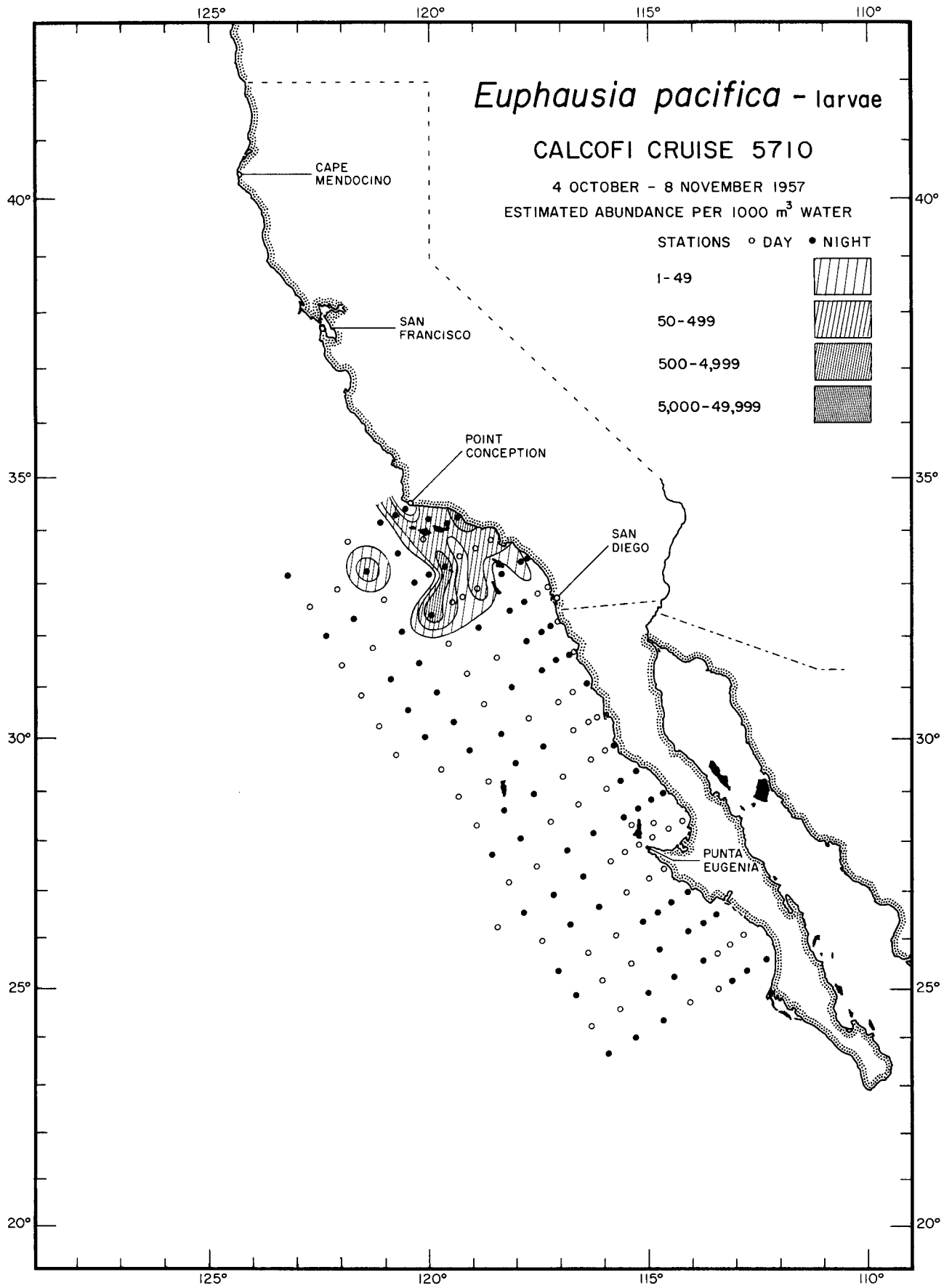
Euphausiacea
Euphausia pacifica - larvae
5408



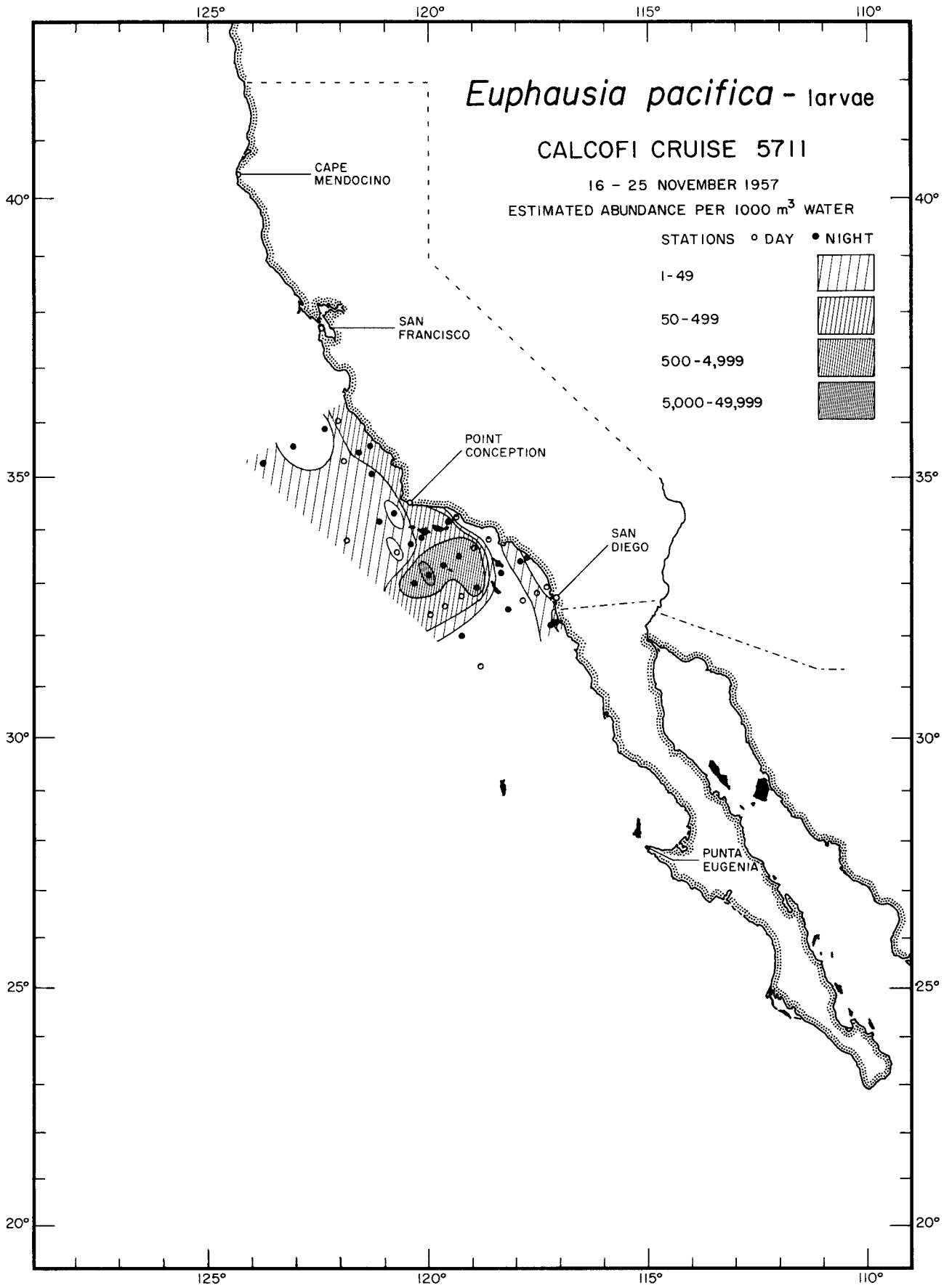
Euphausiacea
Euphausia pacifica - larvae
5504



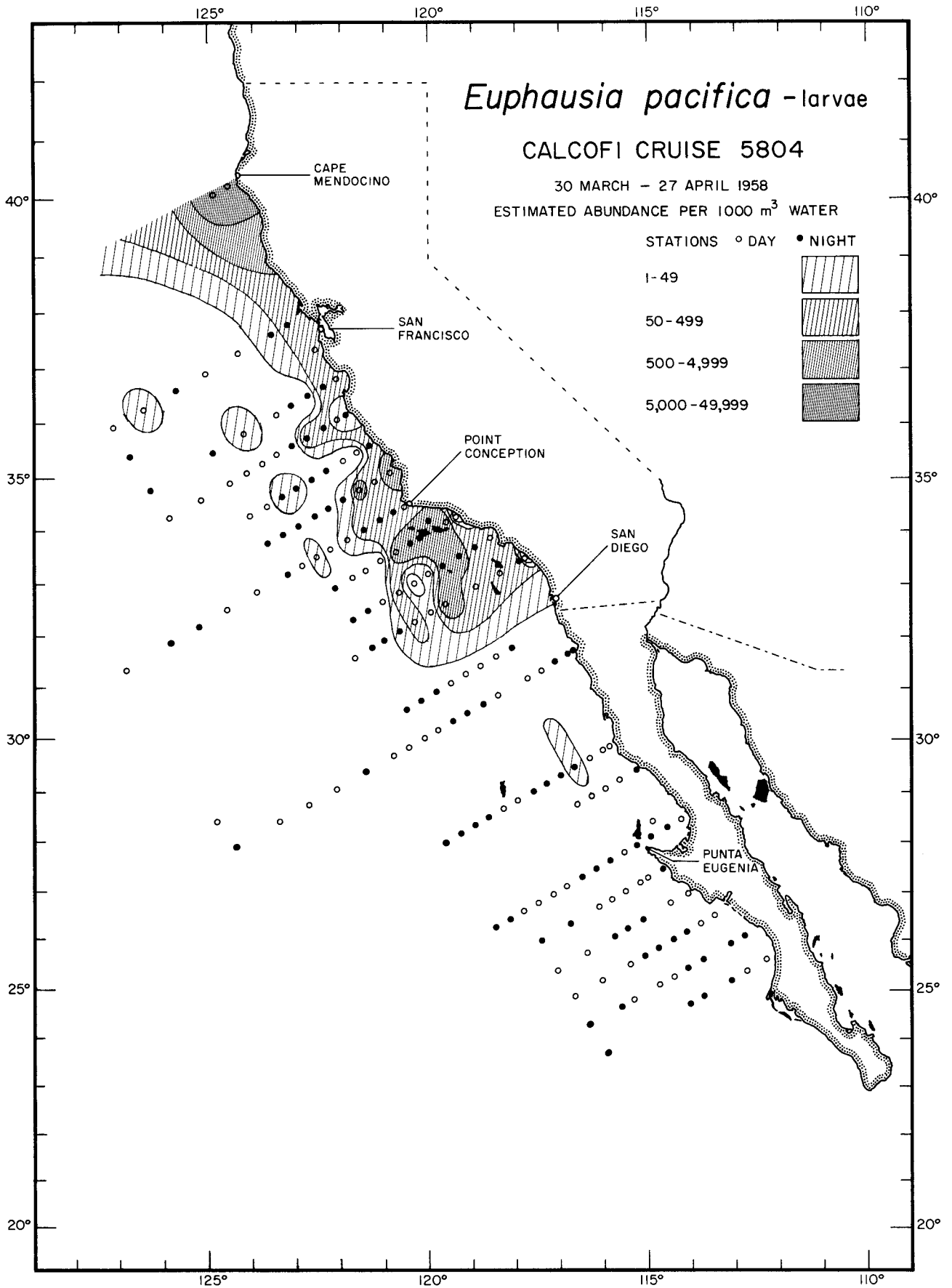
Euphausiacea
Euphausia pacifica - larvae
5702



Euphausiacea
Euphausia pacifica - larvae
5710

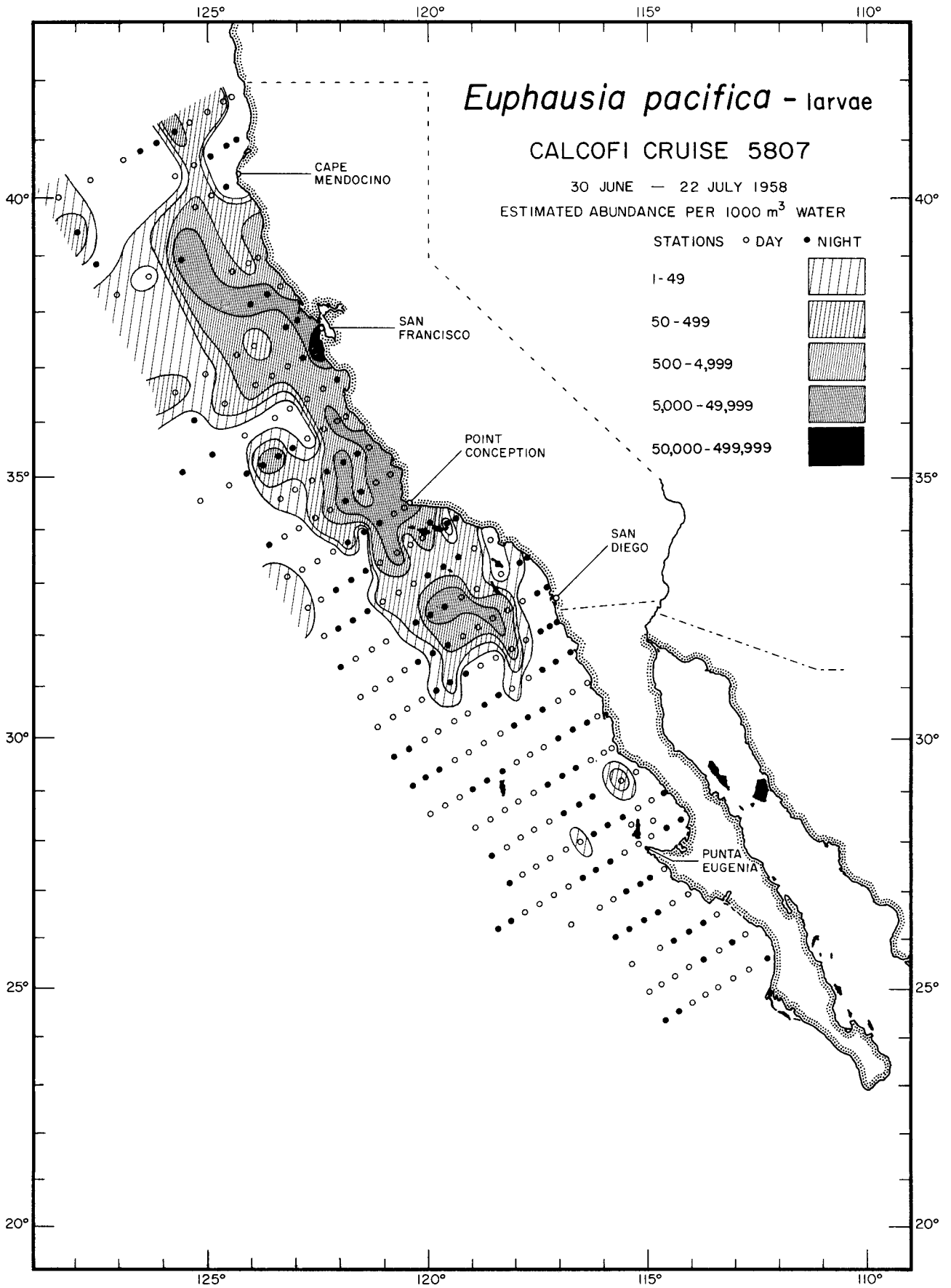


Euphausiacea
Euphausia pacifica - larvae
5711

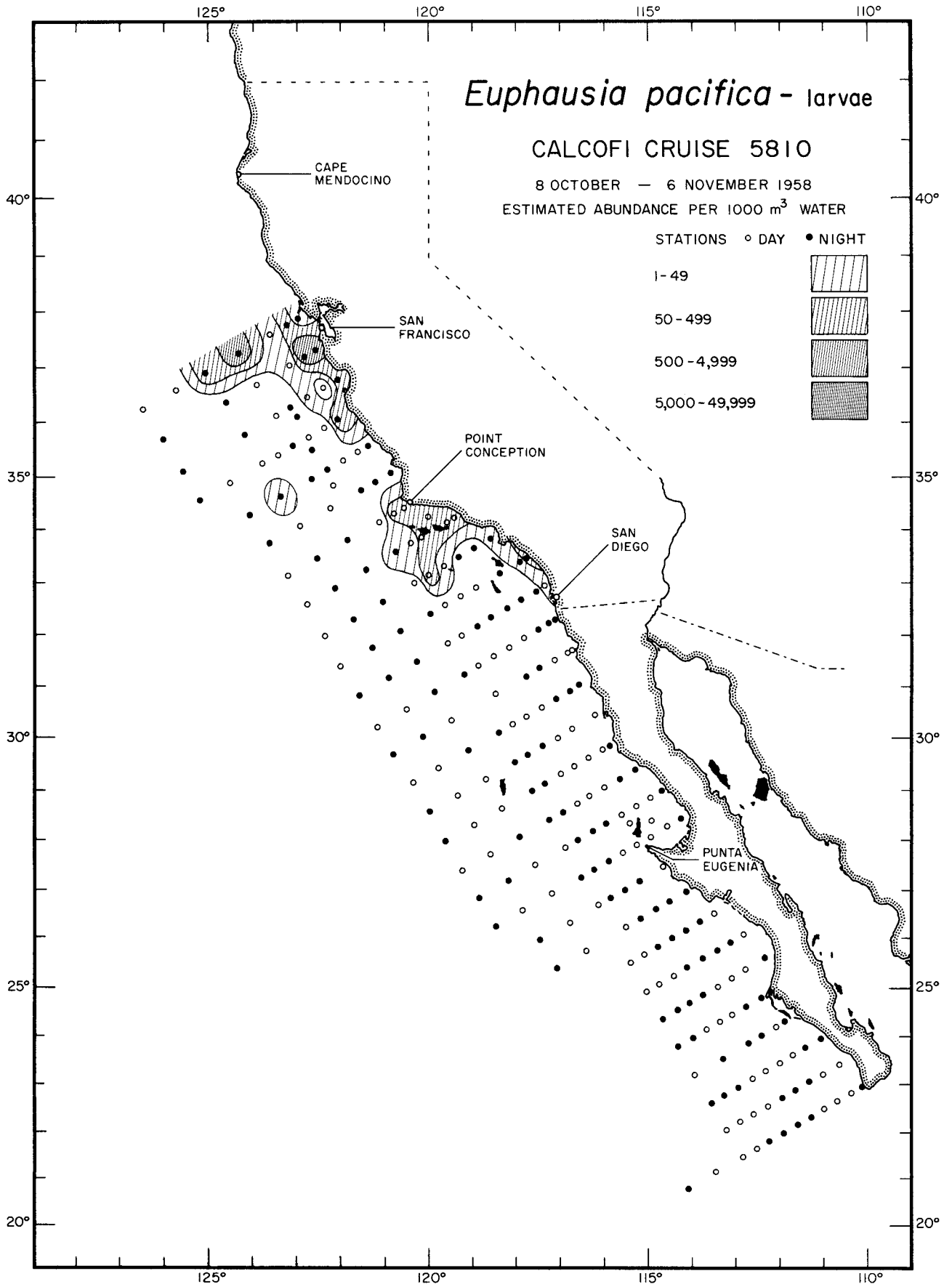


Euphausiacea
Euphausia pacifica - larvae

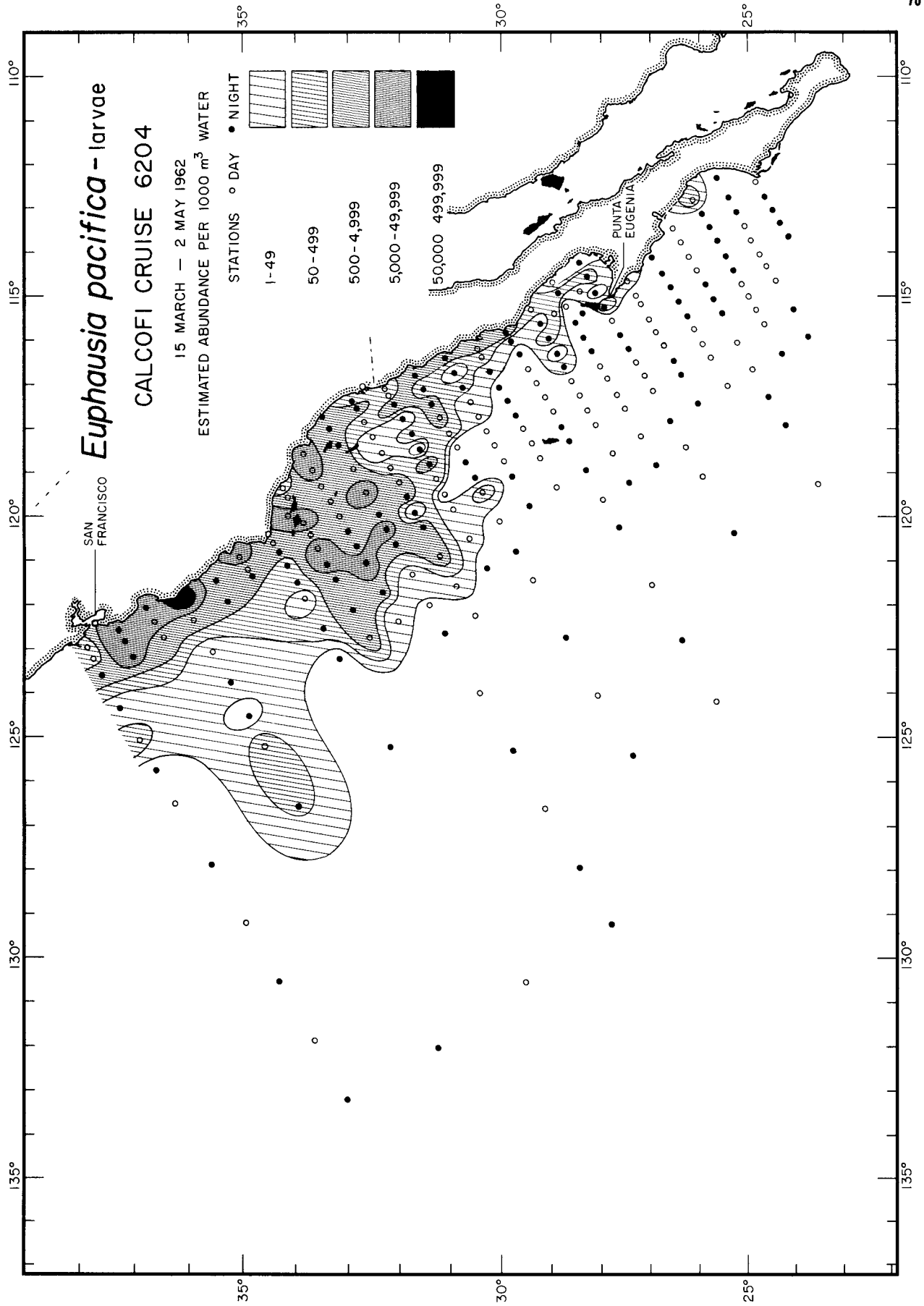
5804



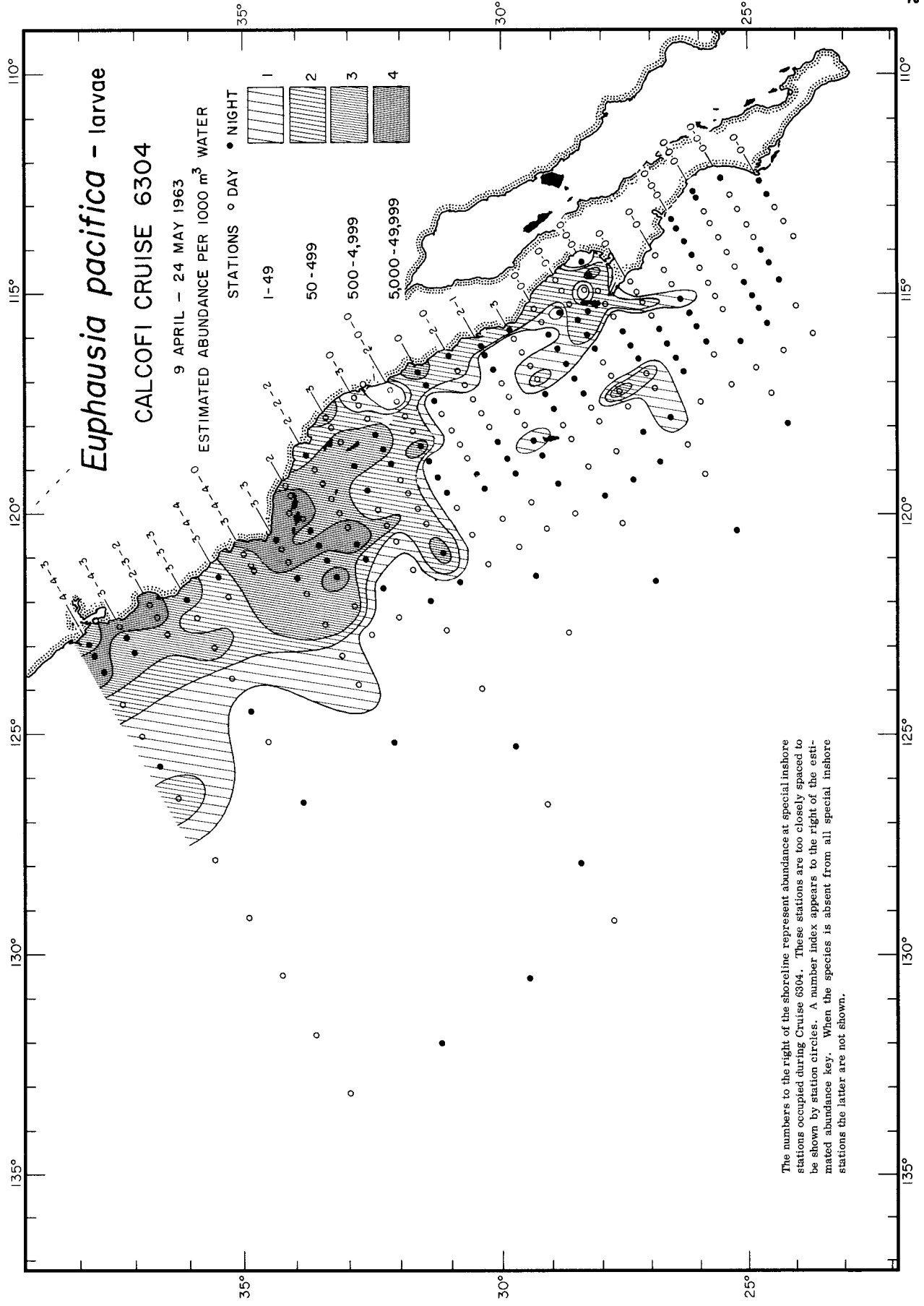
Euphausiacea
Euphausia pacifica - larvae
 5807



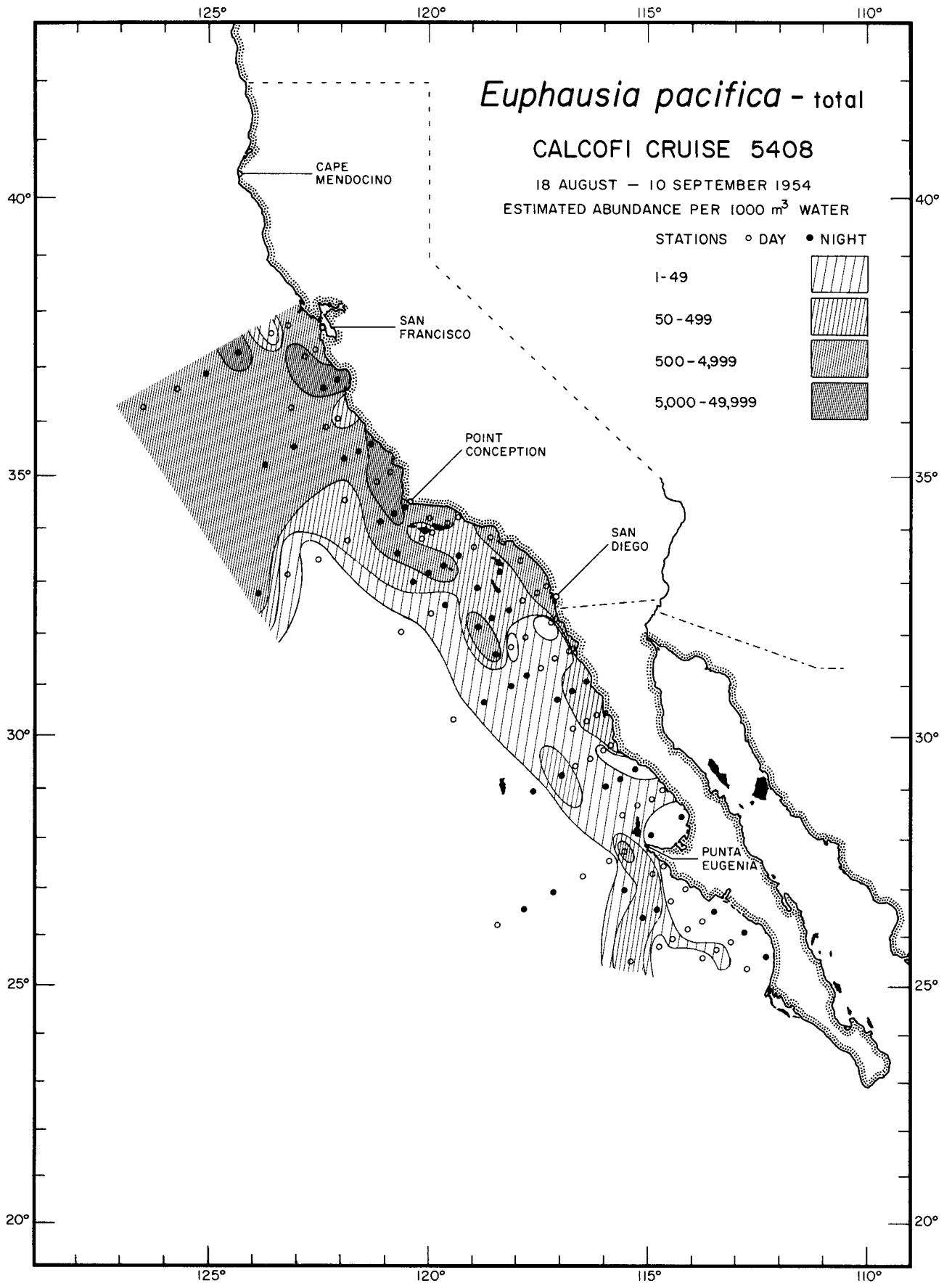
Euphausiacea
Euphausia pacifica - larvae
 5810



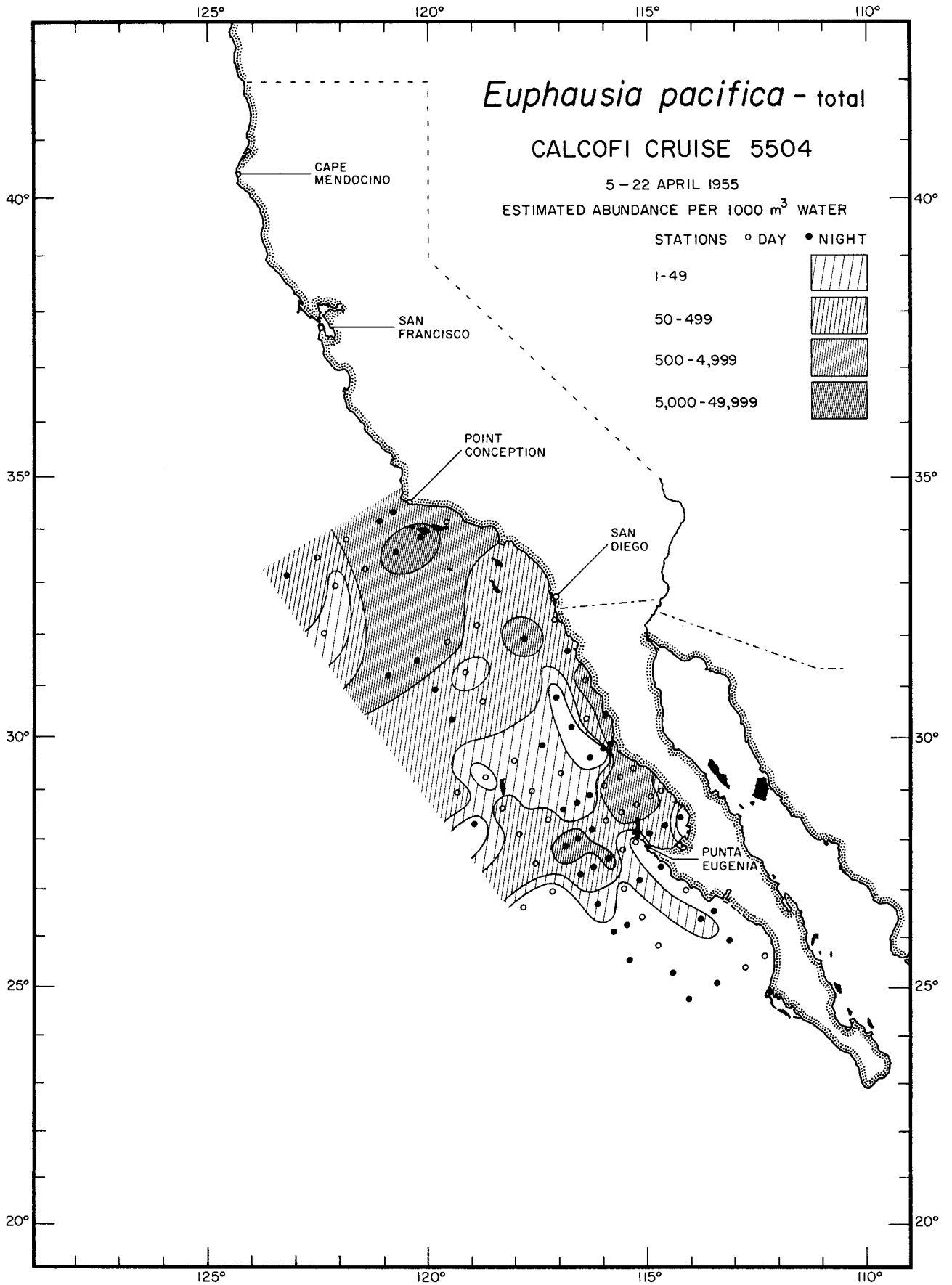
Euphausiacea
Euphausia pacifica - larvae
6204



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Euphausiacea
Euphausia pacifica - total
5408



Euphausia pacifica - total

CALCOFI CRUISE 5504

5 - 22 APRIL 1955

ESTIMATED ABUNDANCE PER 1000 m³ WATER

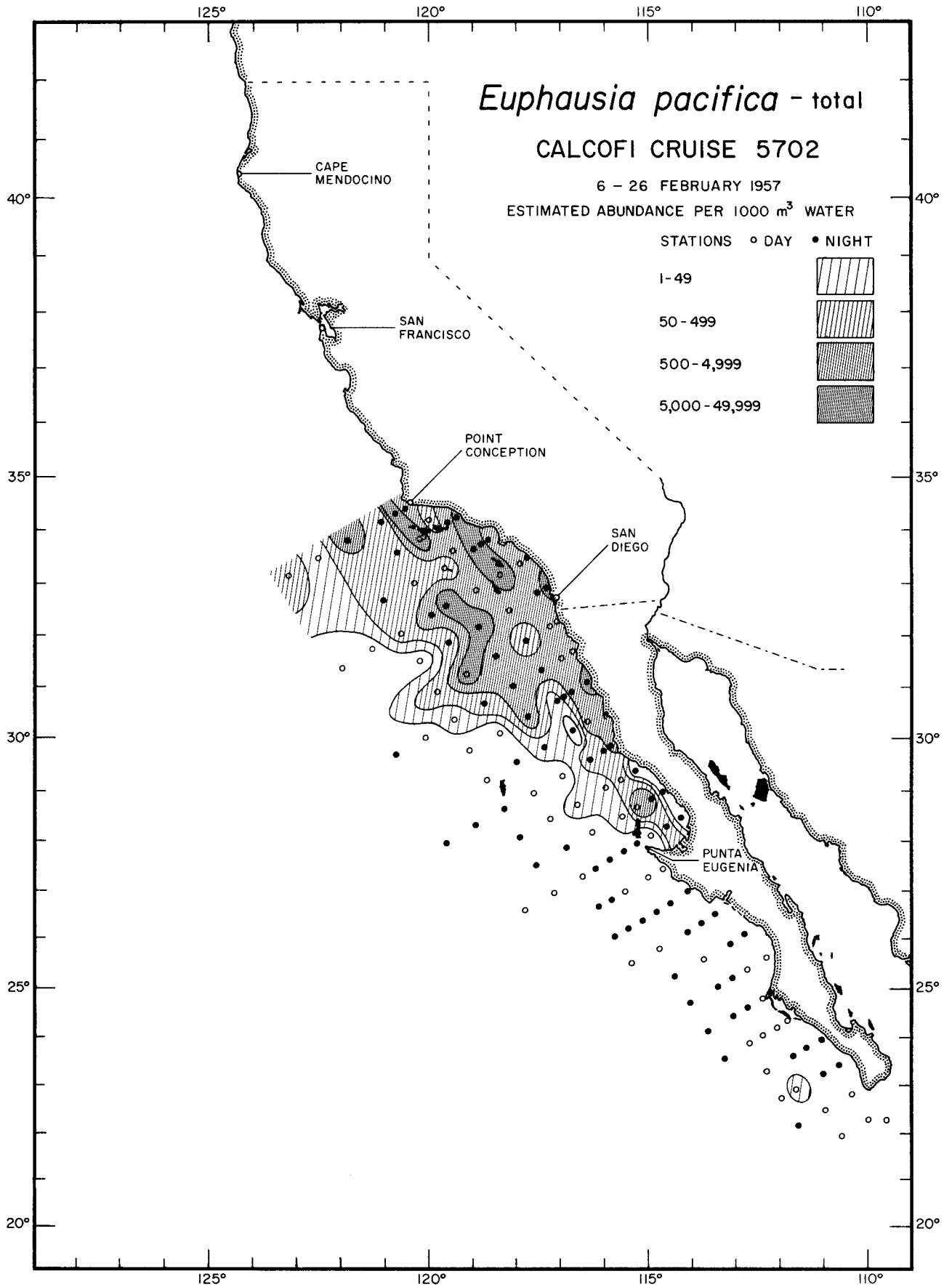
STATIONS ○ DAY ● NIGHT

1-49	
50-499	
500-4,999	
5,000-49,999	

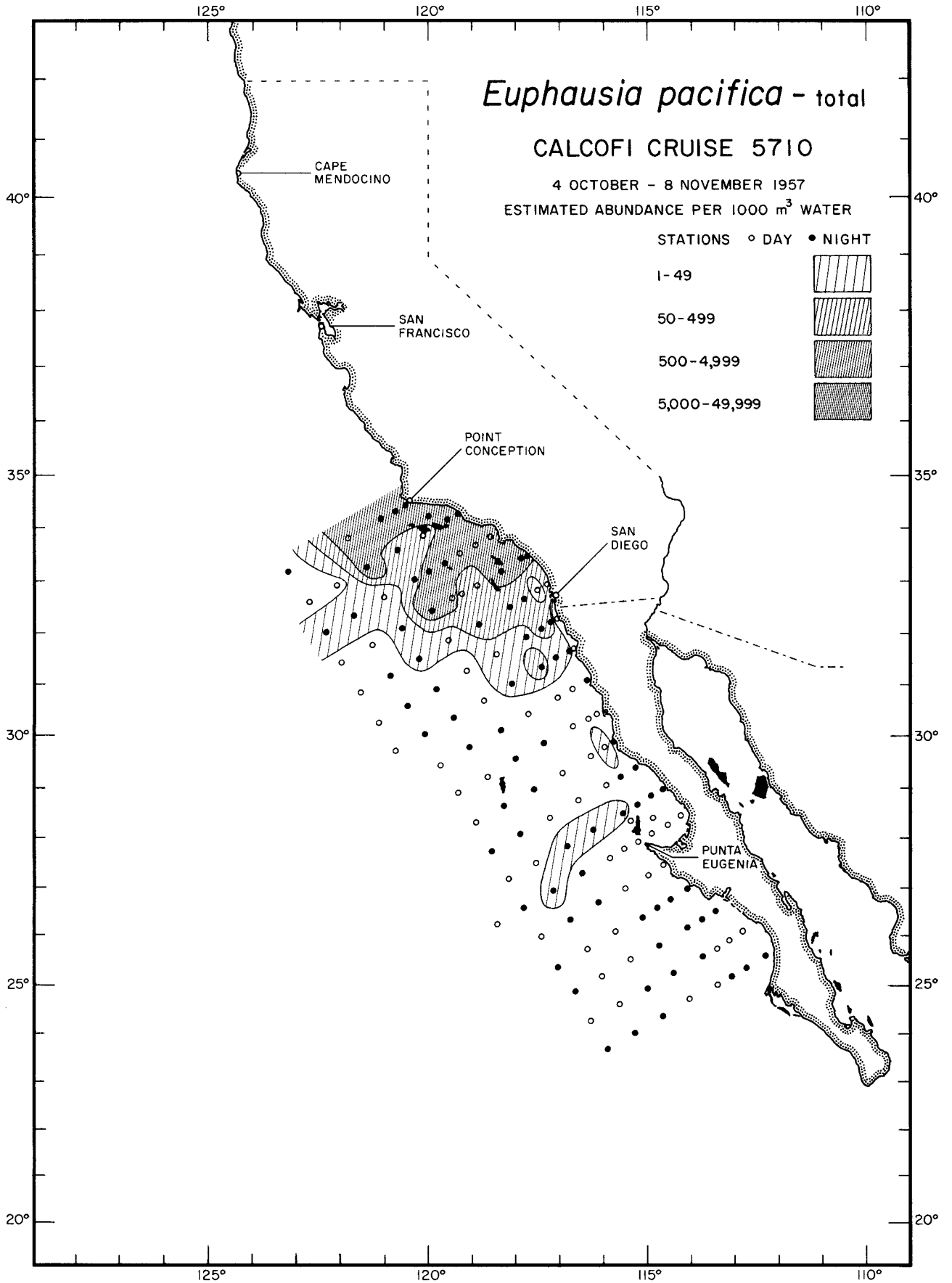
Euphausiacea

Euphausia pacifica - total

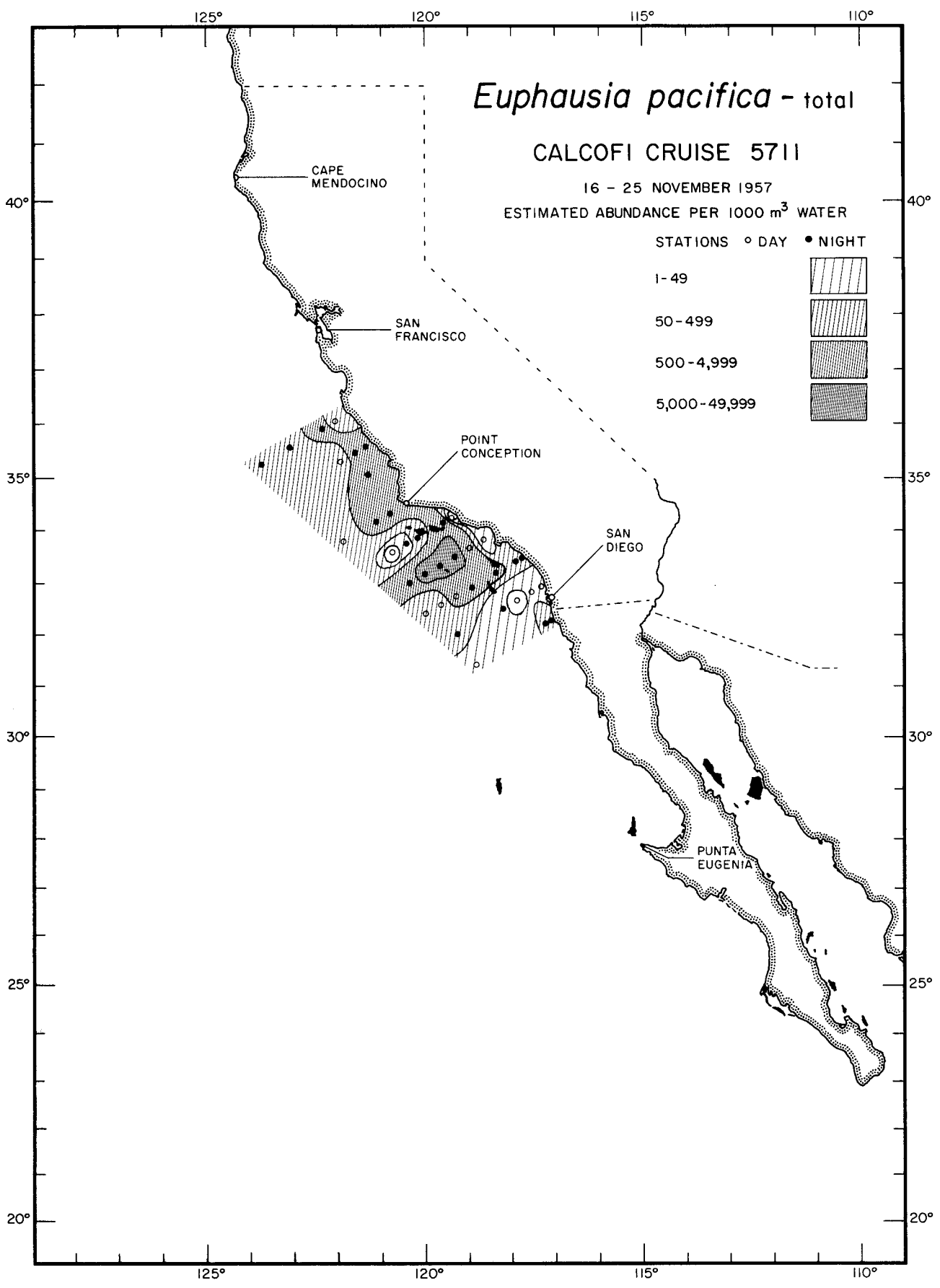
5504



Euphausiacea
Euphausia pacifica - total
5702



Euphausiacea
Euphausia pacifica - total
5710



Euphausia pacifica - total

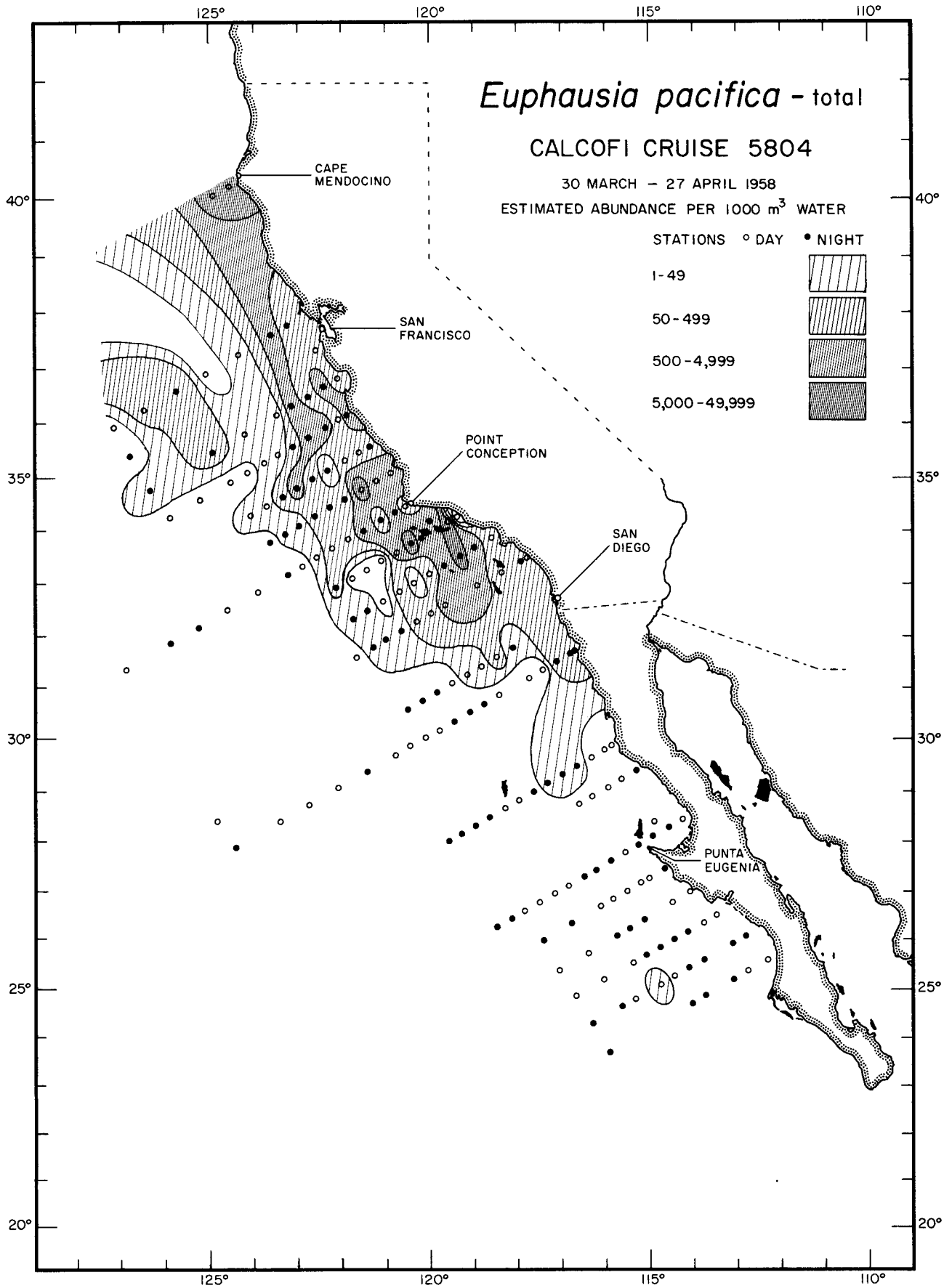
CALCOFI CRUISE 5711

16 - 25 NOVEMBER 1957

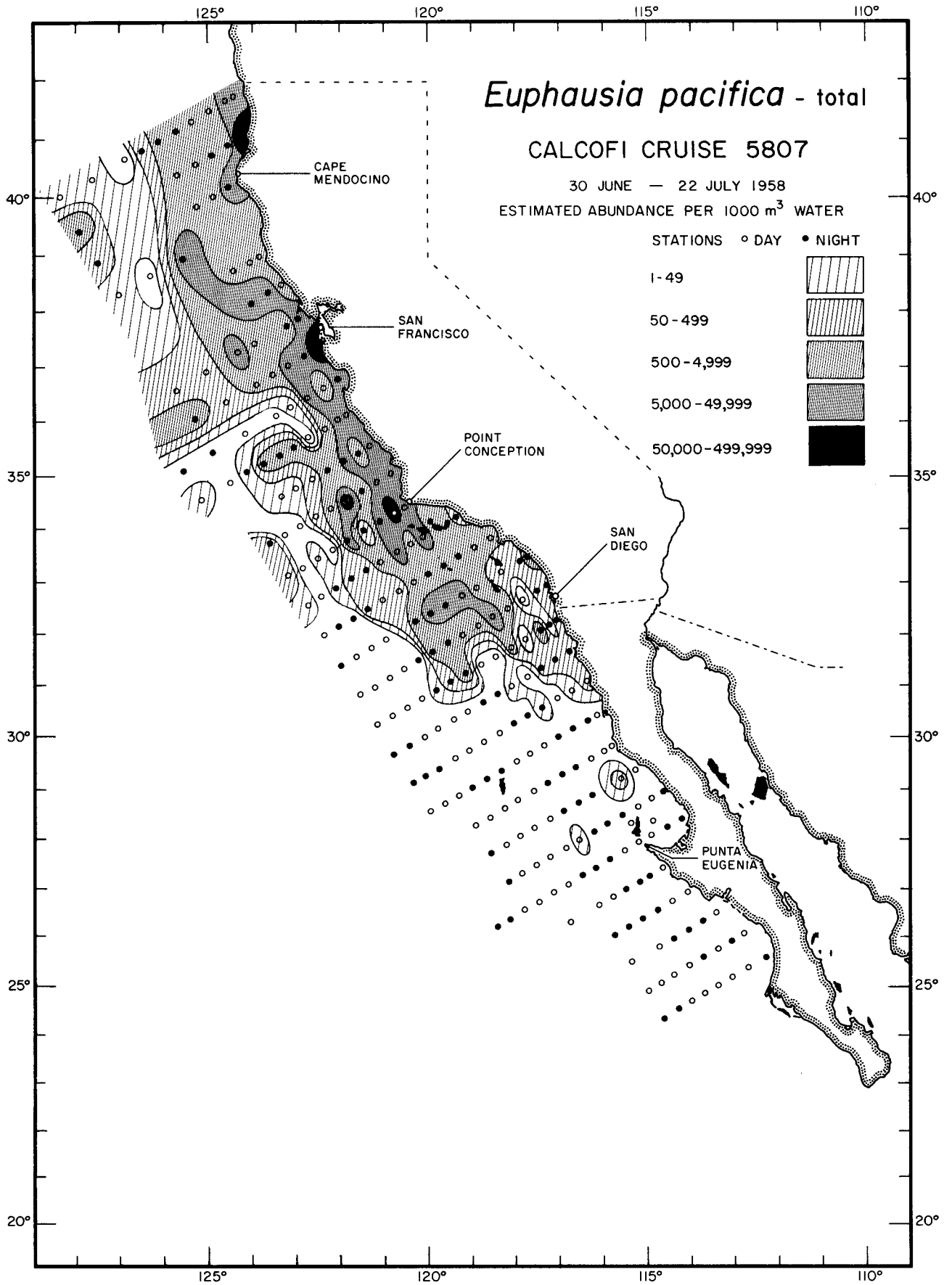
ESTIMATED ABUNDANCE PER 1000 m³ WATER

STATIONS	○ DAY	● NIGHT
1-49		
50-499		
500-4,999		
5,000-49,999		

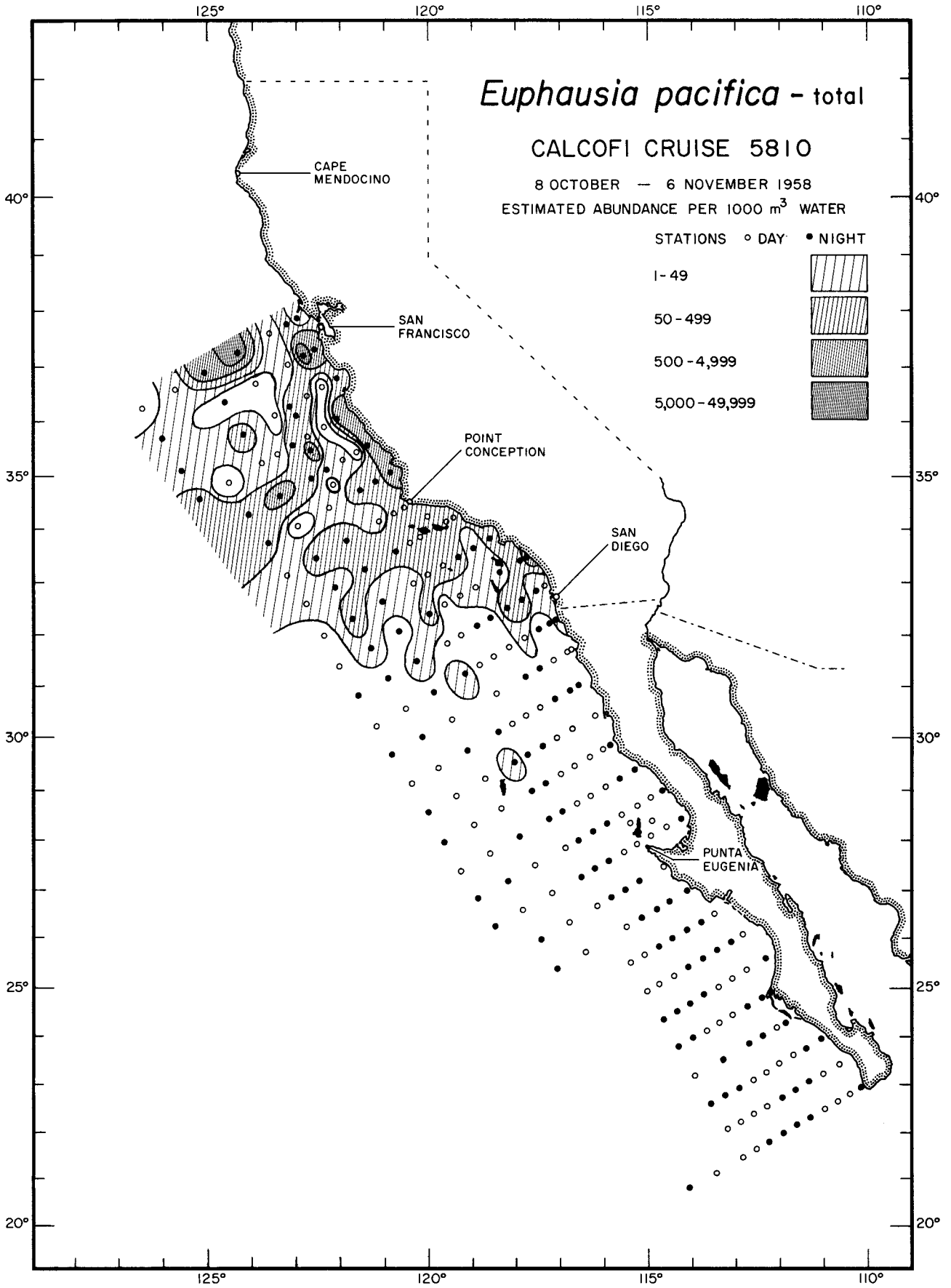
Euphausiacea
Euphausia pacifica - total
5711



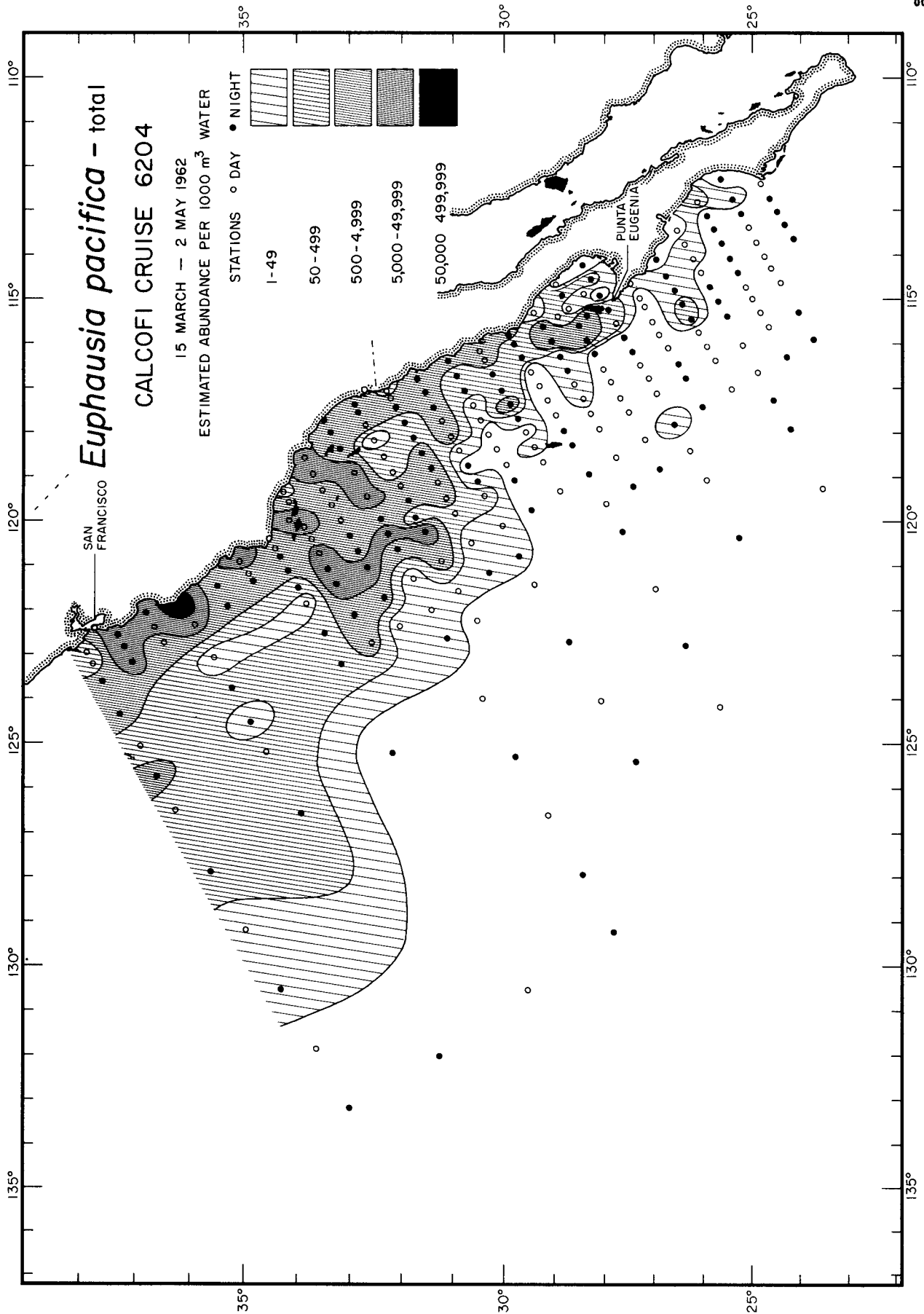
Euphausiacea
Euphausia pacifica - total
5804



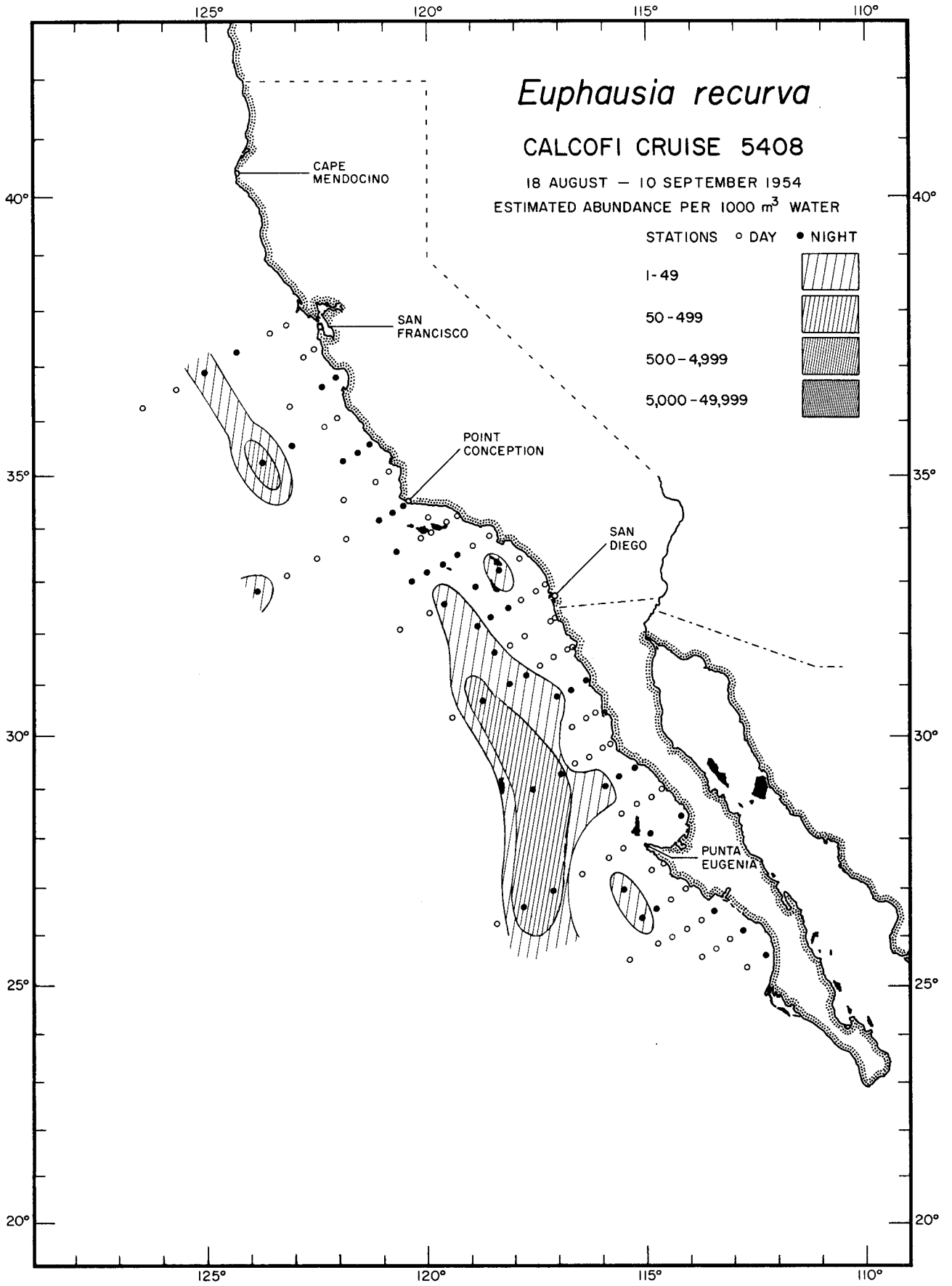
Euphausiacea
Euphausia pacifica - total
5807



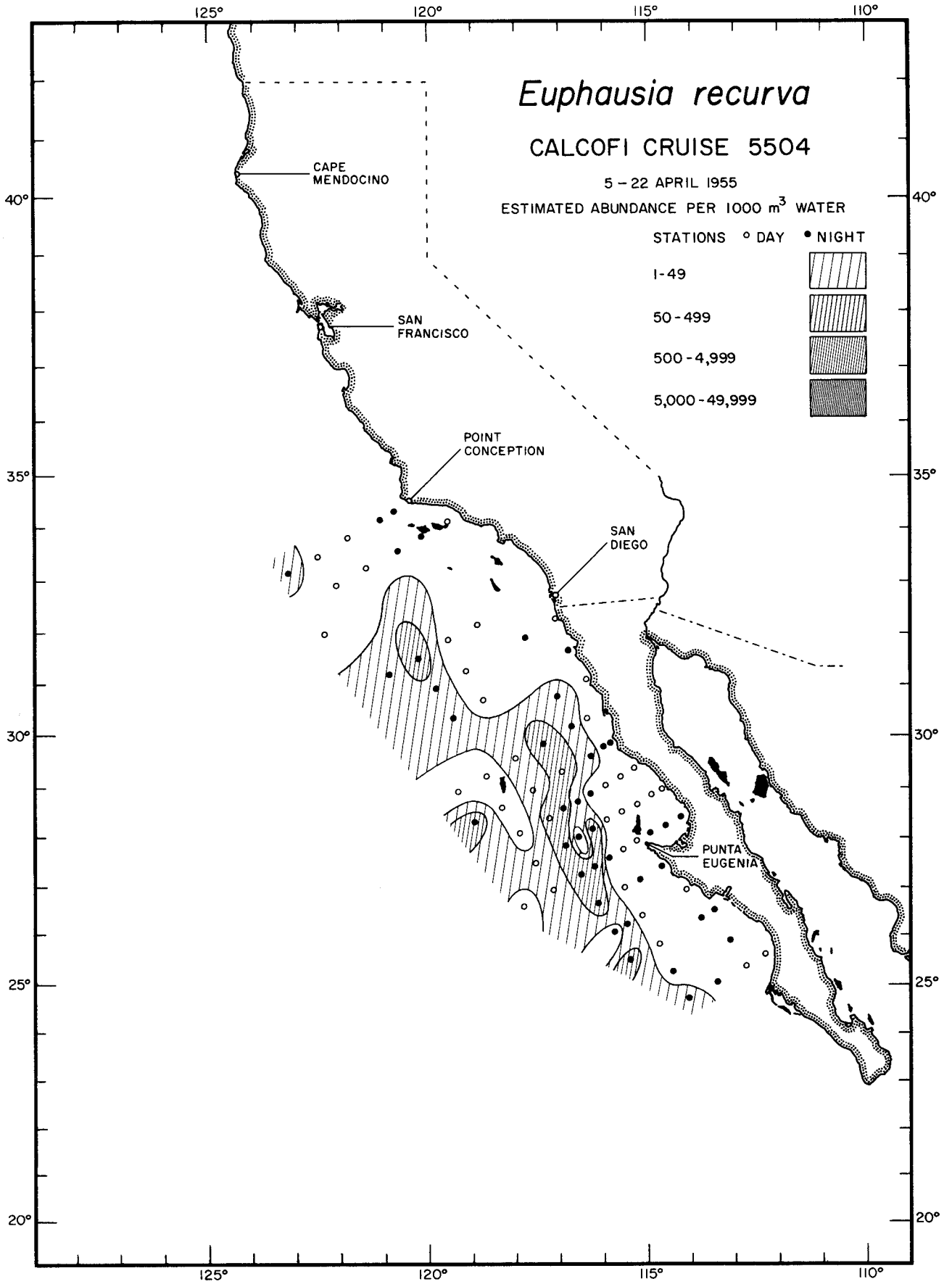
Euphausiacea
Euphausia pacifica - total
 5810



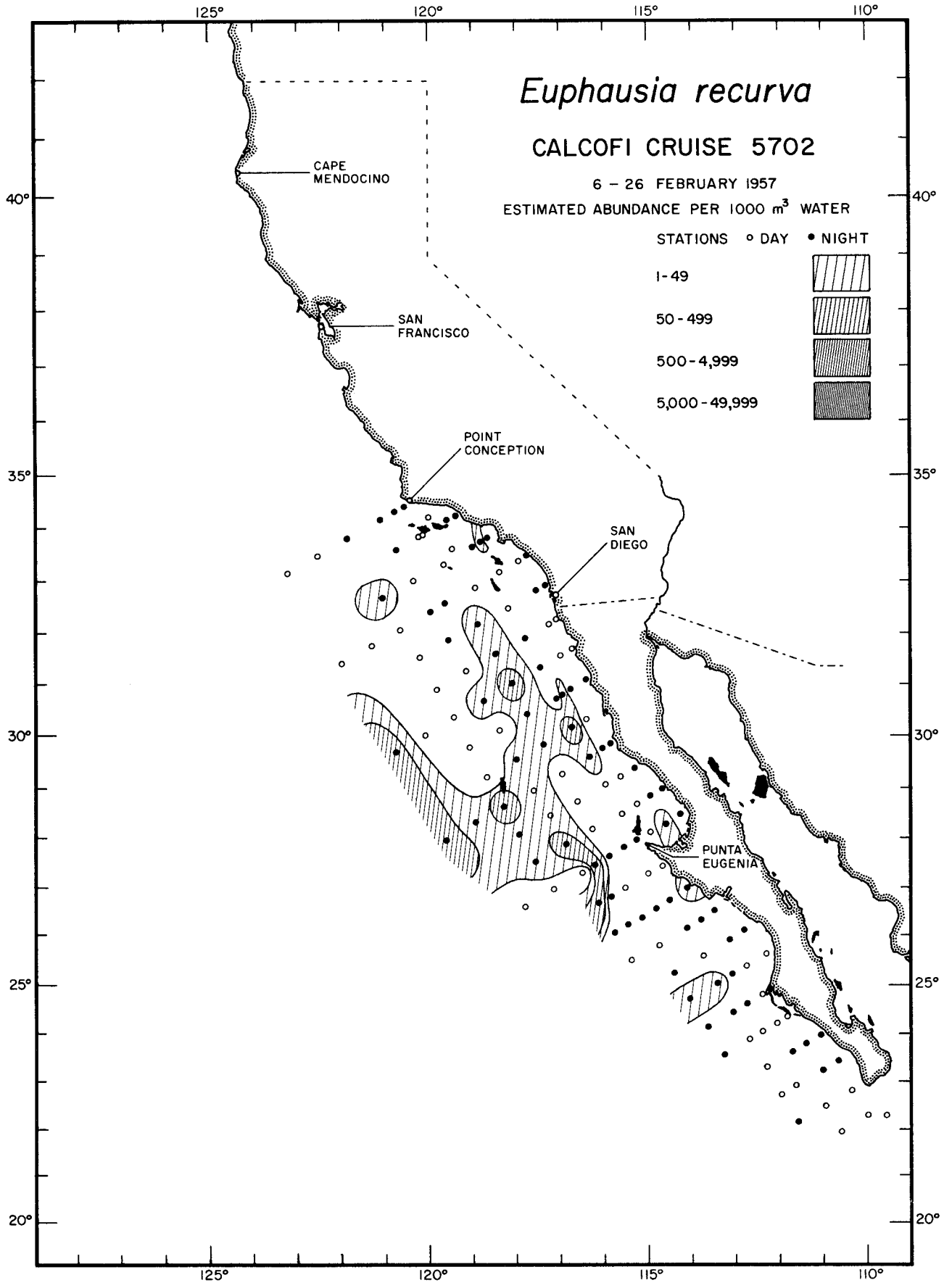
Euphausiacea
Euphausia pacifica - total
6204



Euphausiacea
Euphausia recurva
 5408



Euphausiacea
Euphausia recurva
5504

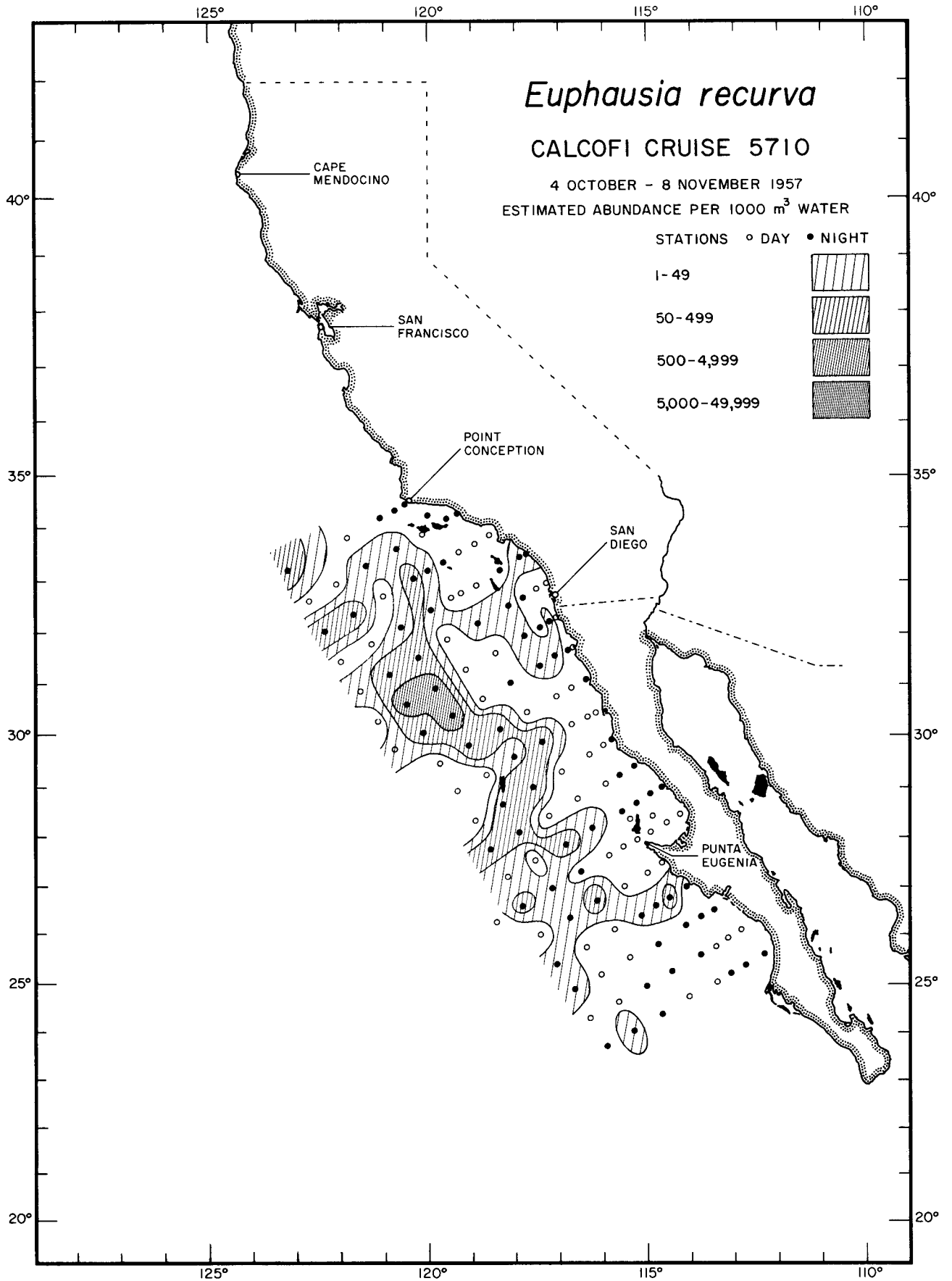


Euphausia recurva
 CALCOFI CRUISE 5702

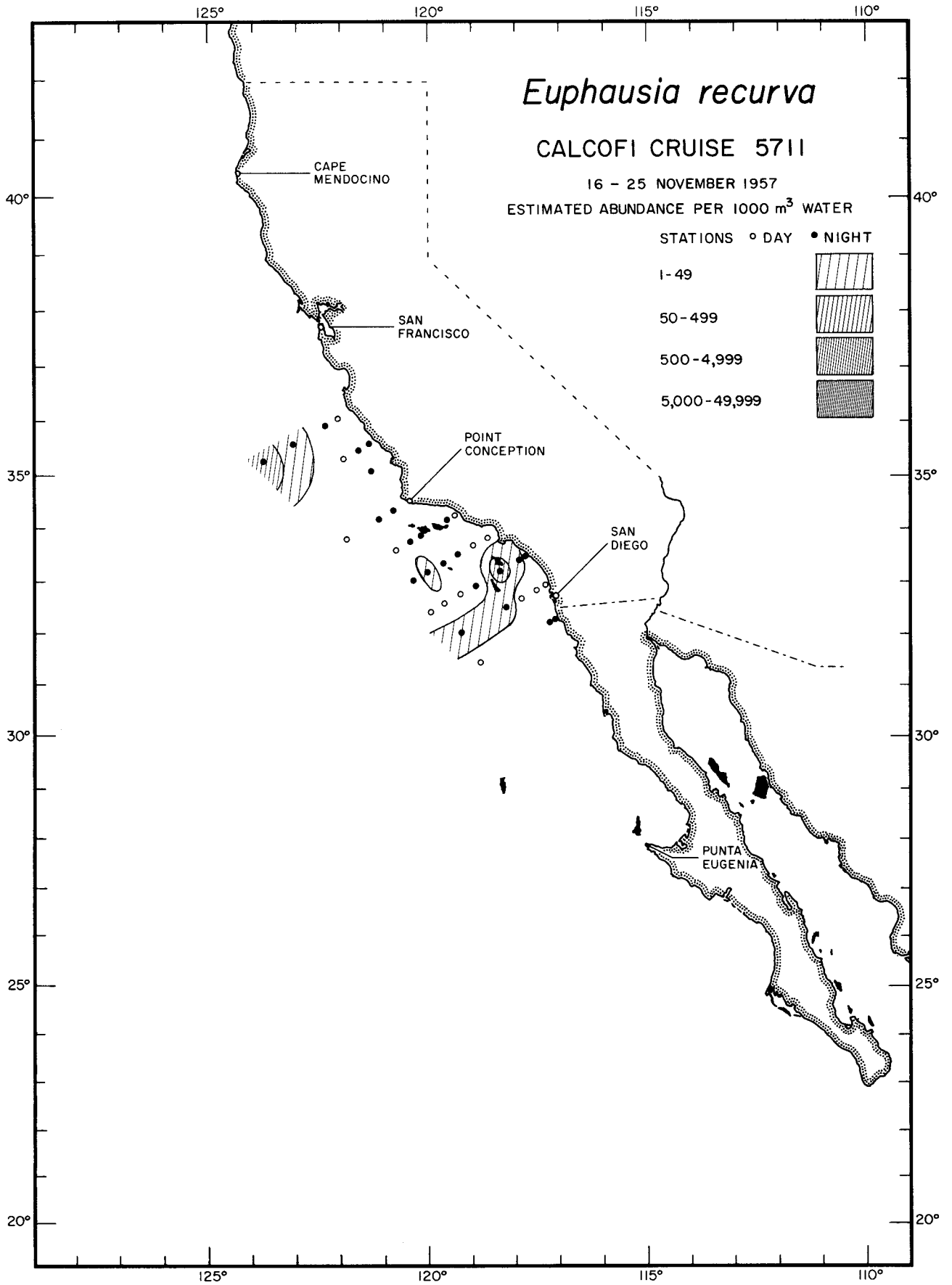
6 - 26 FEBRUARY 1957
 ESTIMATED ABUNDANCE PER 1000 m³ WATER

STATIONS	○ DAY	● NIGHT
1-49		
50-499		
500-4,999		
5,000-49,999		

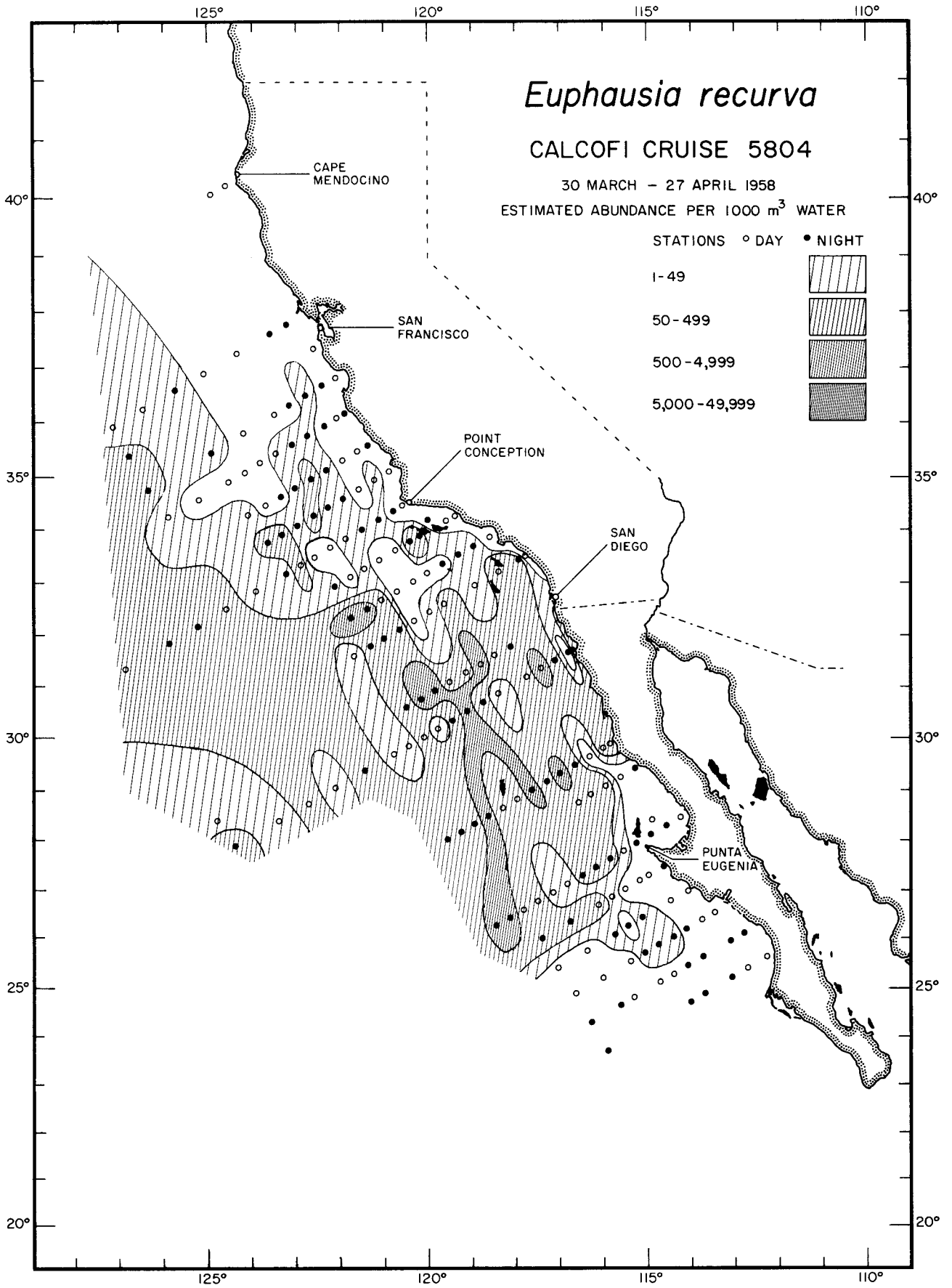
Euphausiacea
Euphausia recurva
 5702



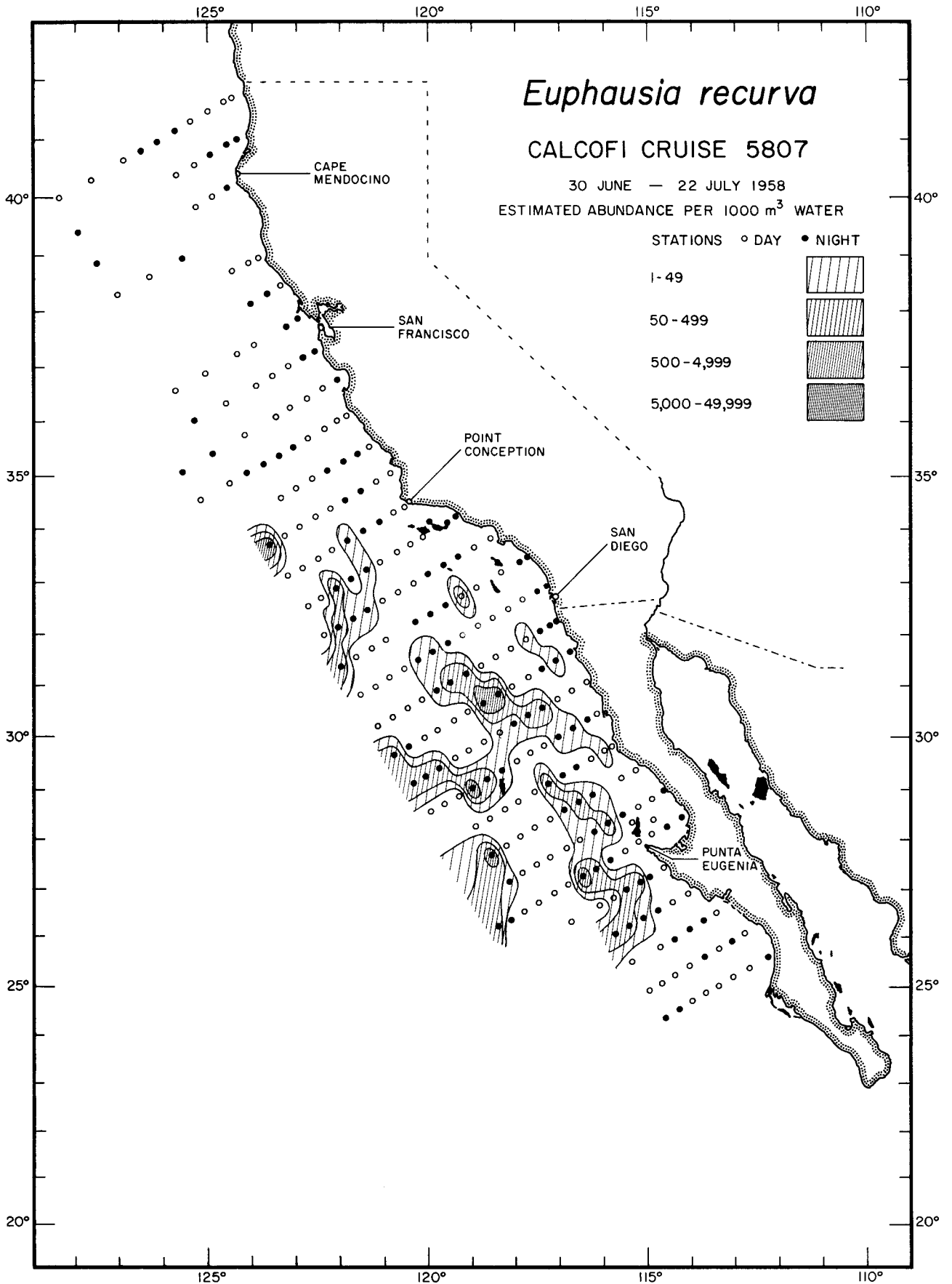
Euphausiacea
Euphausia recurva
5710



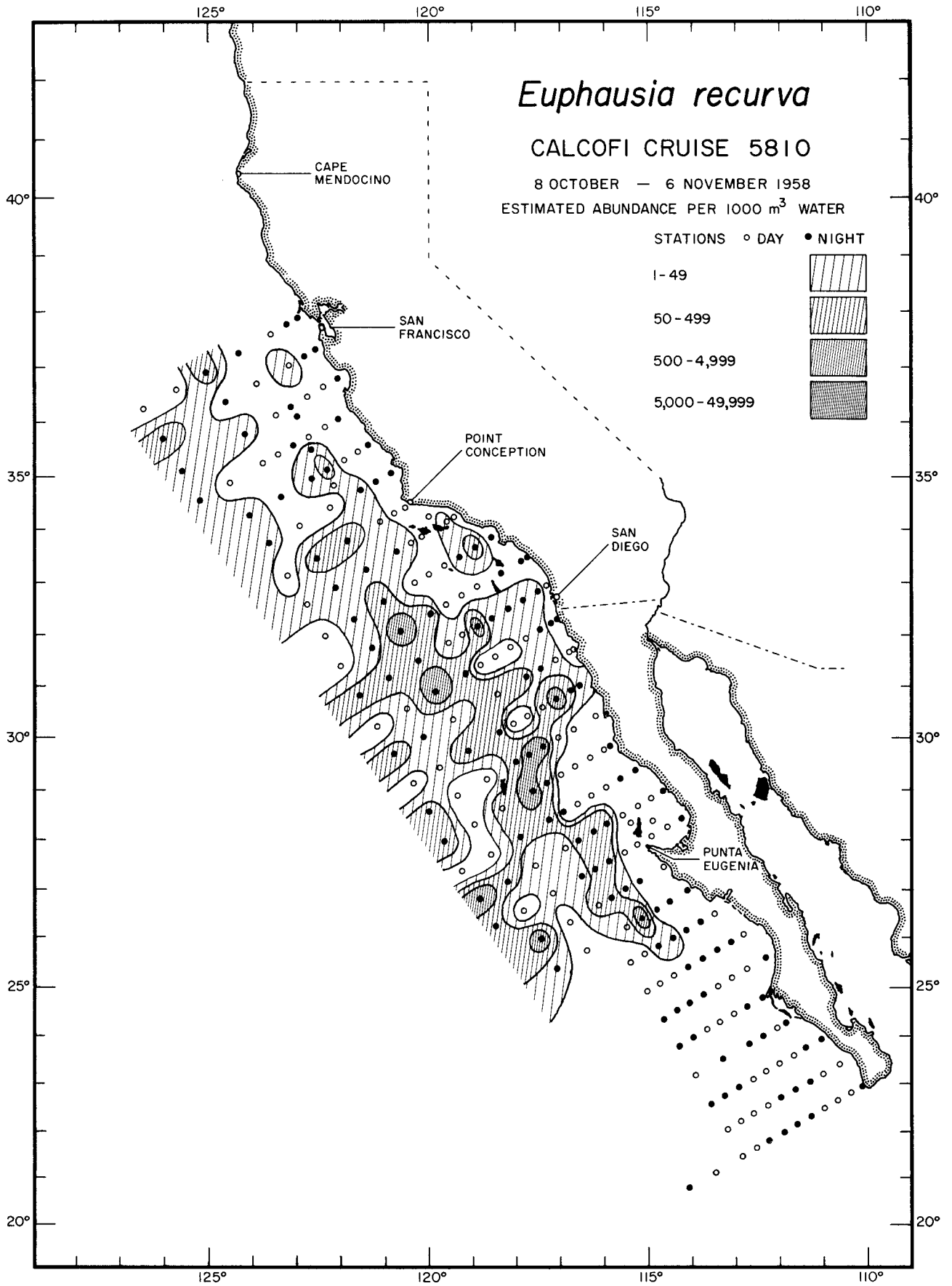
Euphausiacea
Euphausia recurva
5711



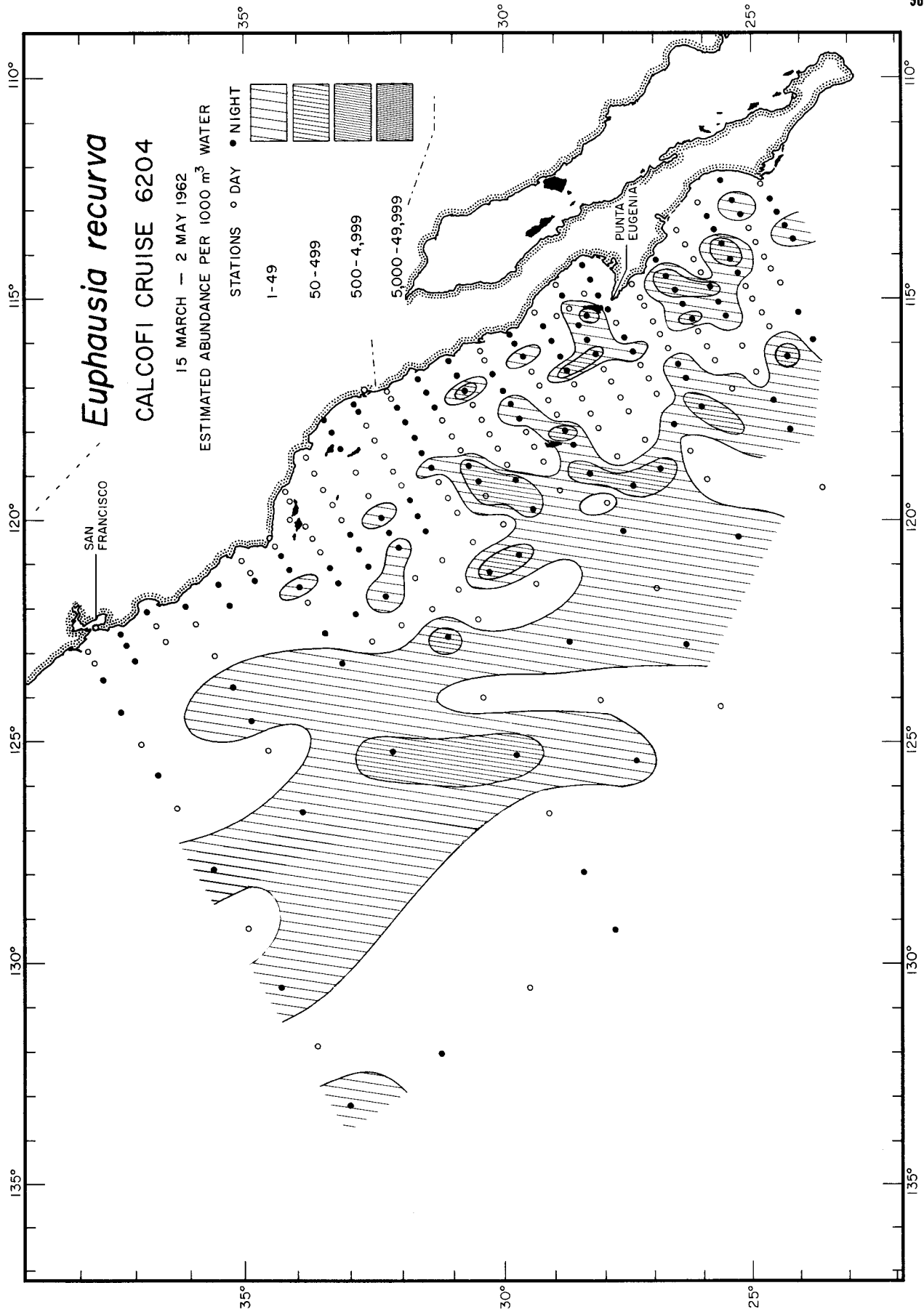
Euphausiacea
Euphausia recurva
5804



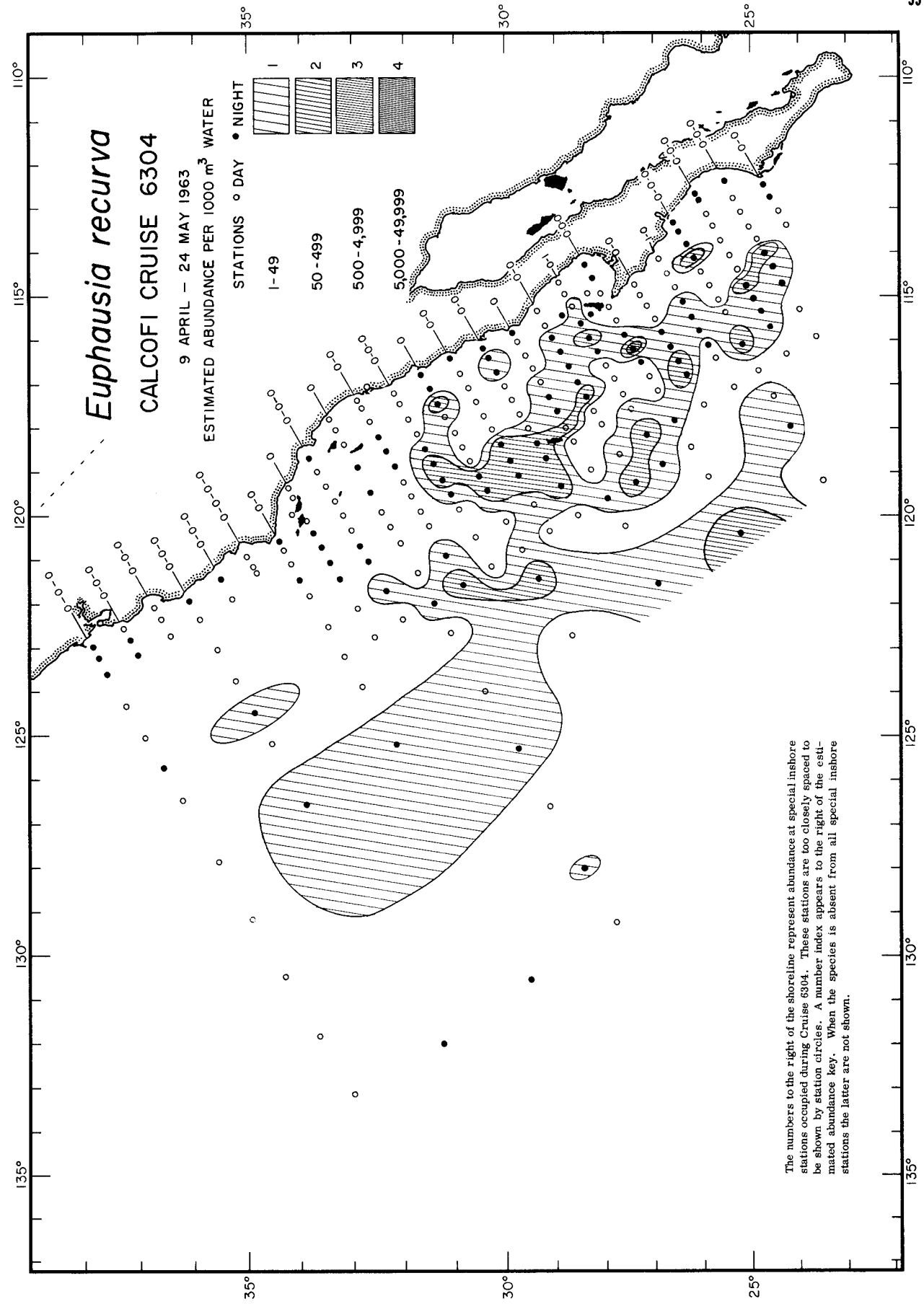
Euphausiacea
Euphausia recurva
5807



Euphausiacea
Euphausia recurva
5810

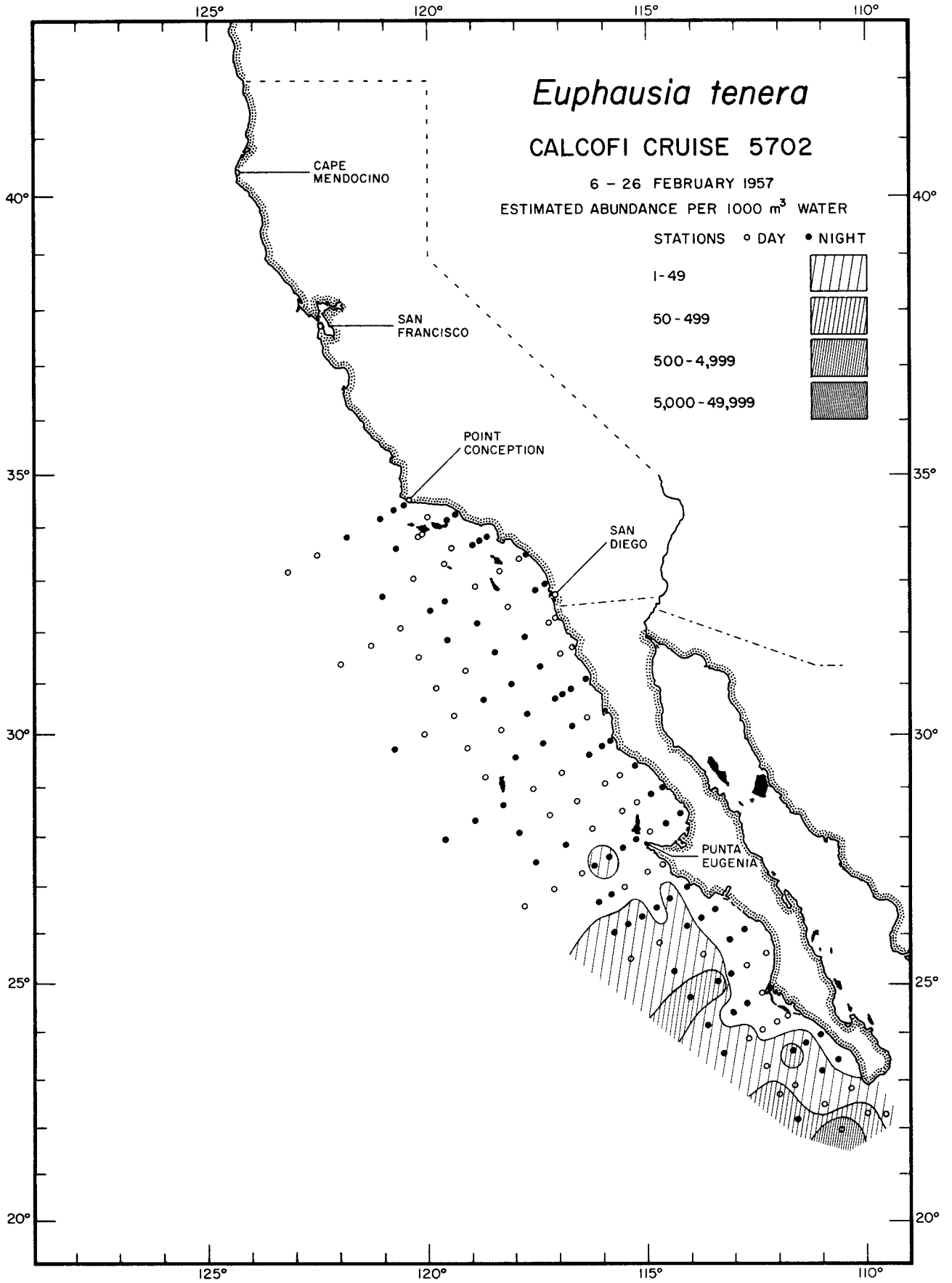


Euphausiacea
Euphausia recurva
6204

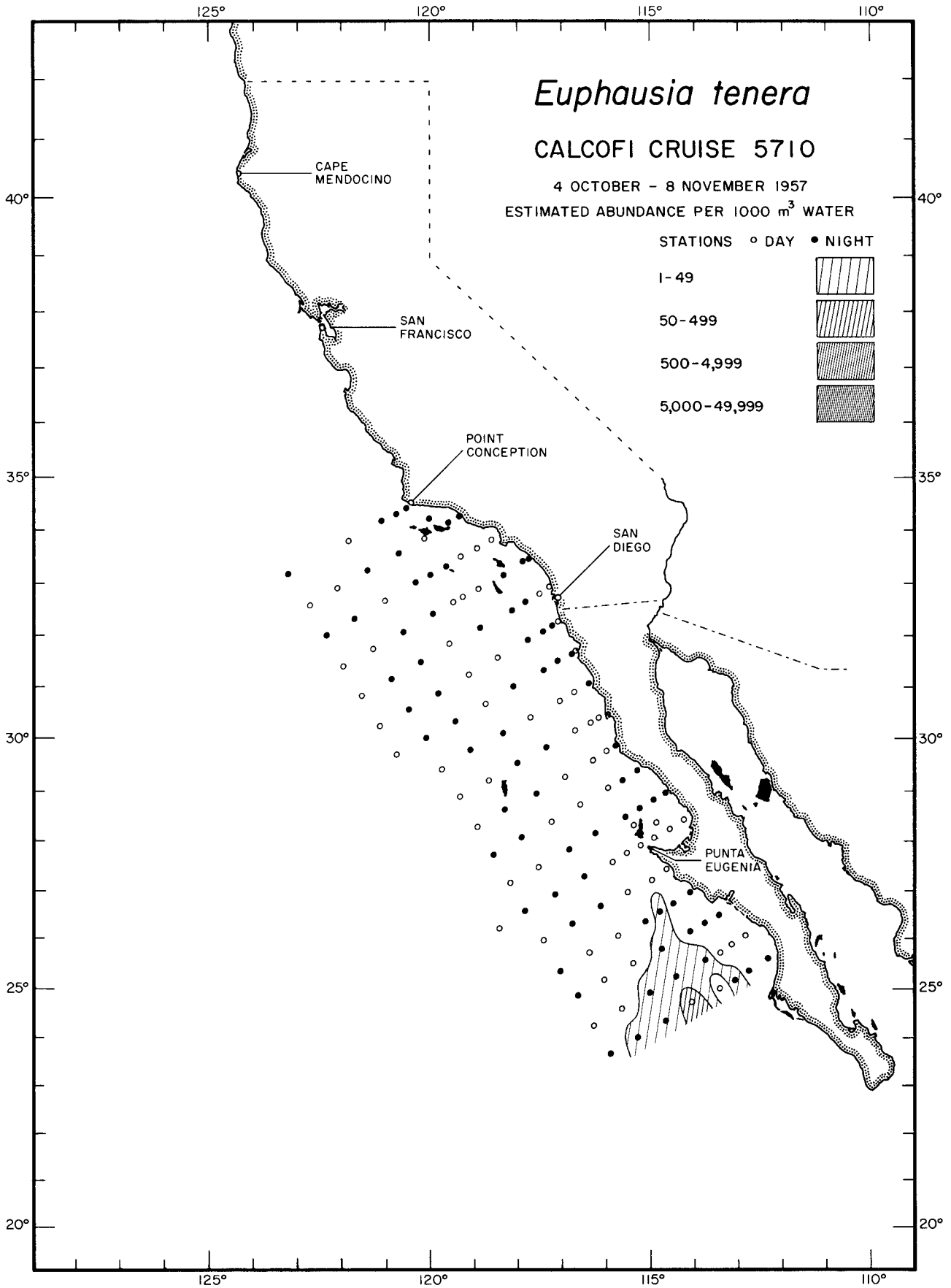


The numbers to the right of the shoreline represent abundance at special inshore stations occupied during Cruise 6304. These stations are too closely spaced to be shown by station circles. A number index appears to the right of the estimated abundance key. When the species is absent from all special inshore stations the latter are not shown.

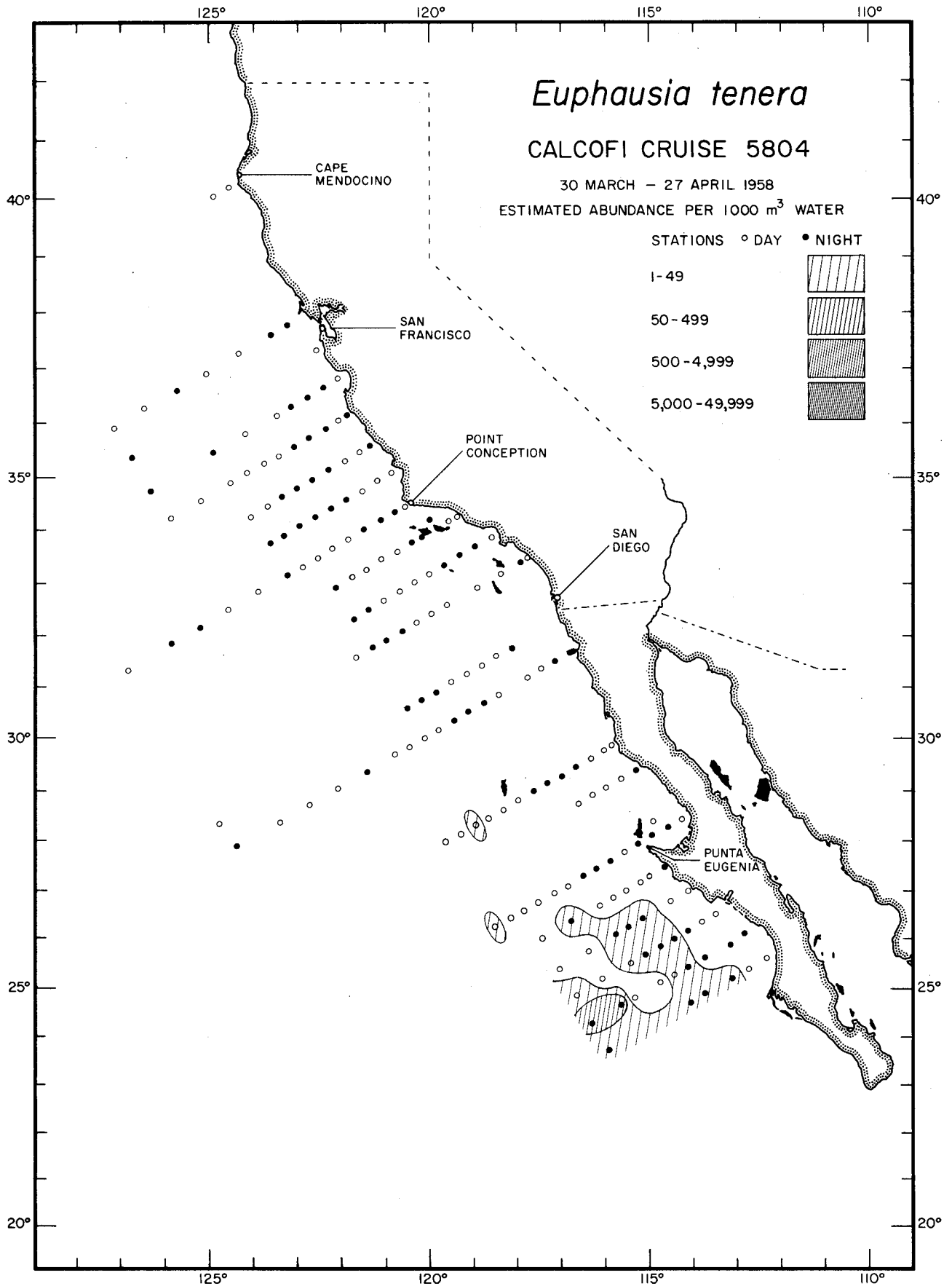
Euphausiacea
Euphausia recurva
6304



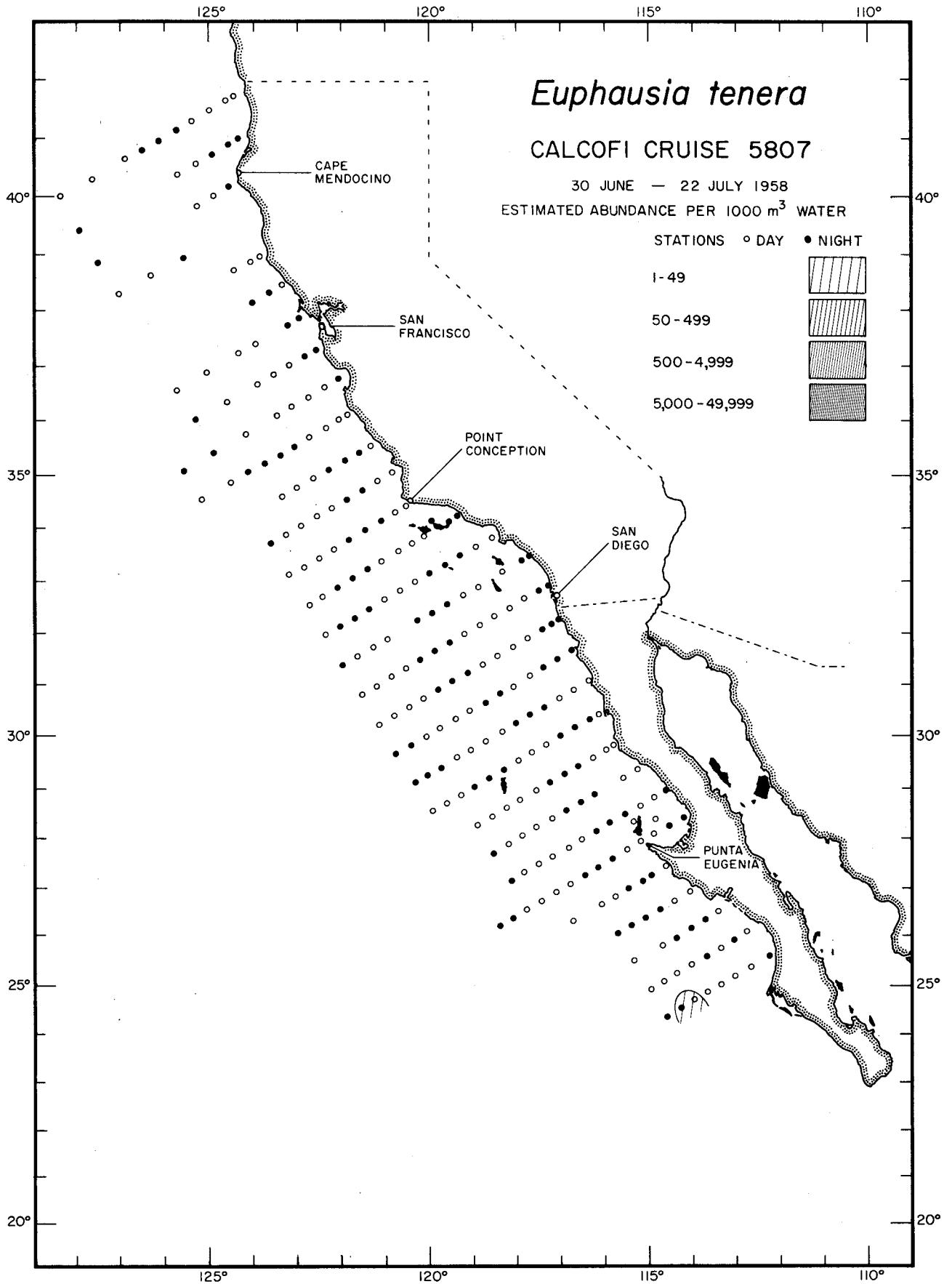
Euphausiacea
Euphausia tenera
5702



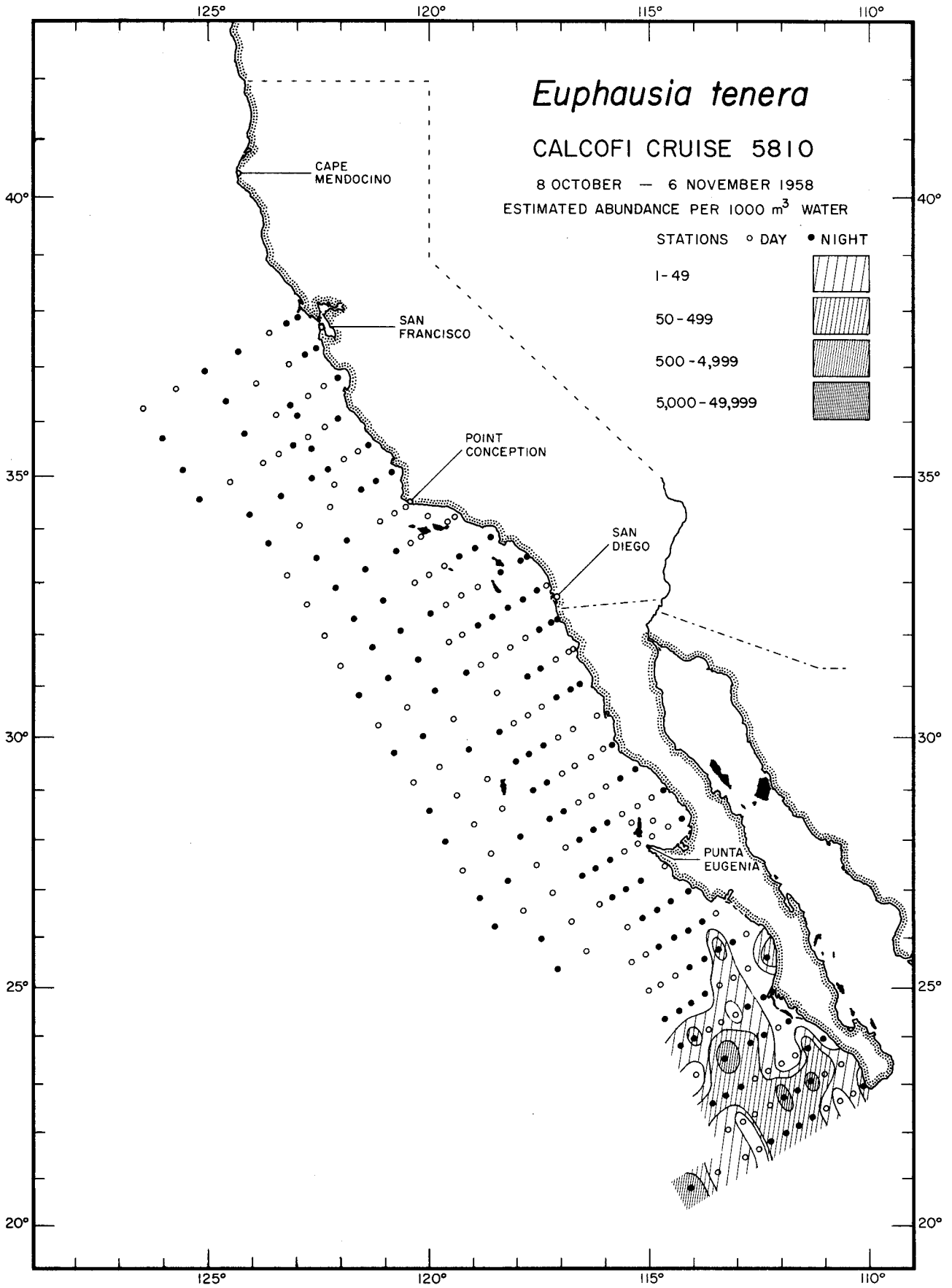
Euphausiacea
Euphausia tenera
5710



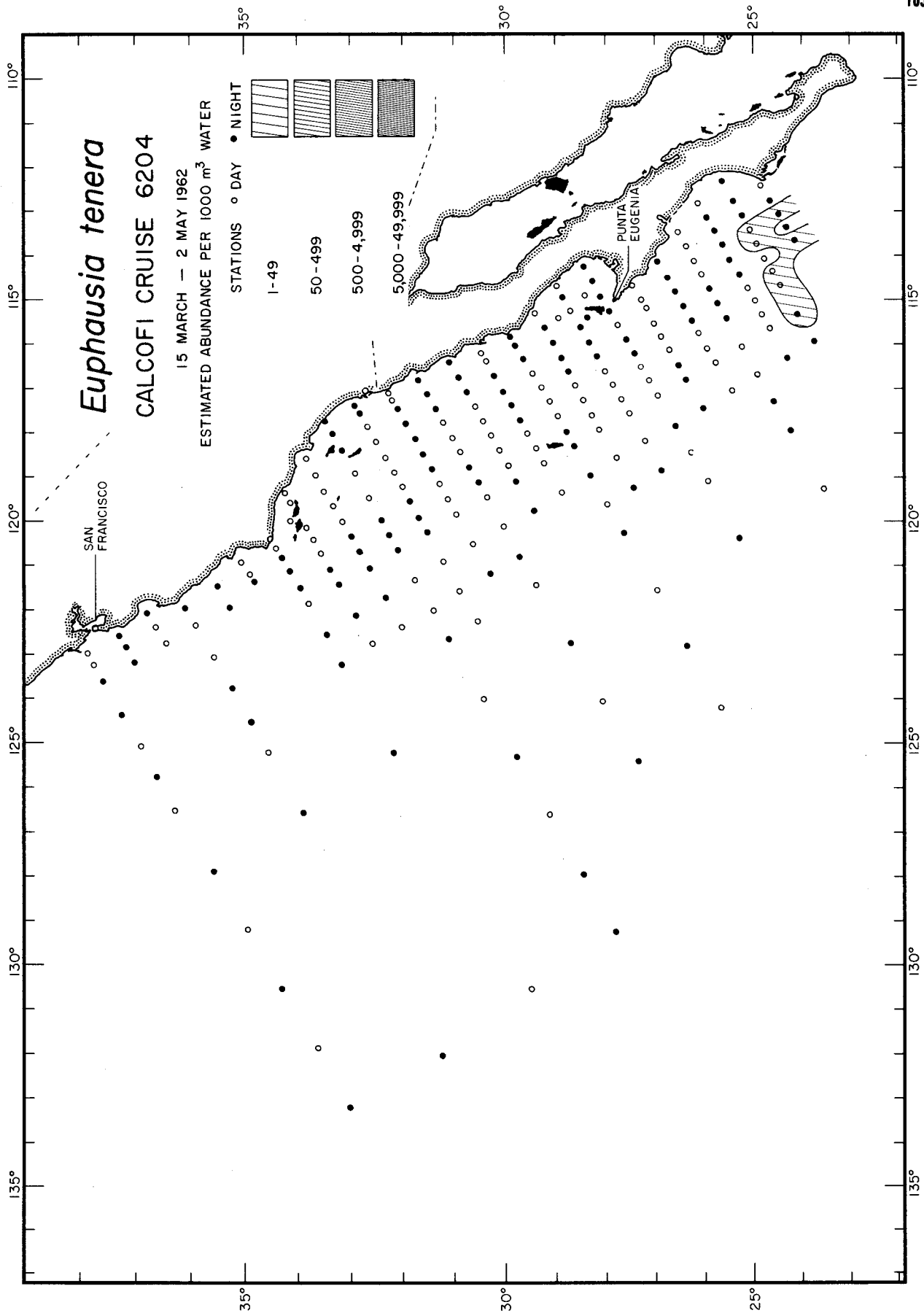
Euphausiacea
Euphausia tenera
5804



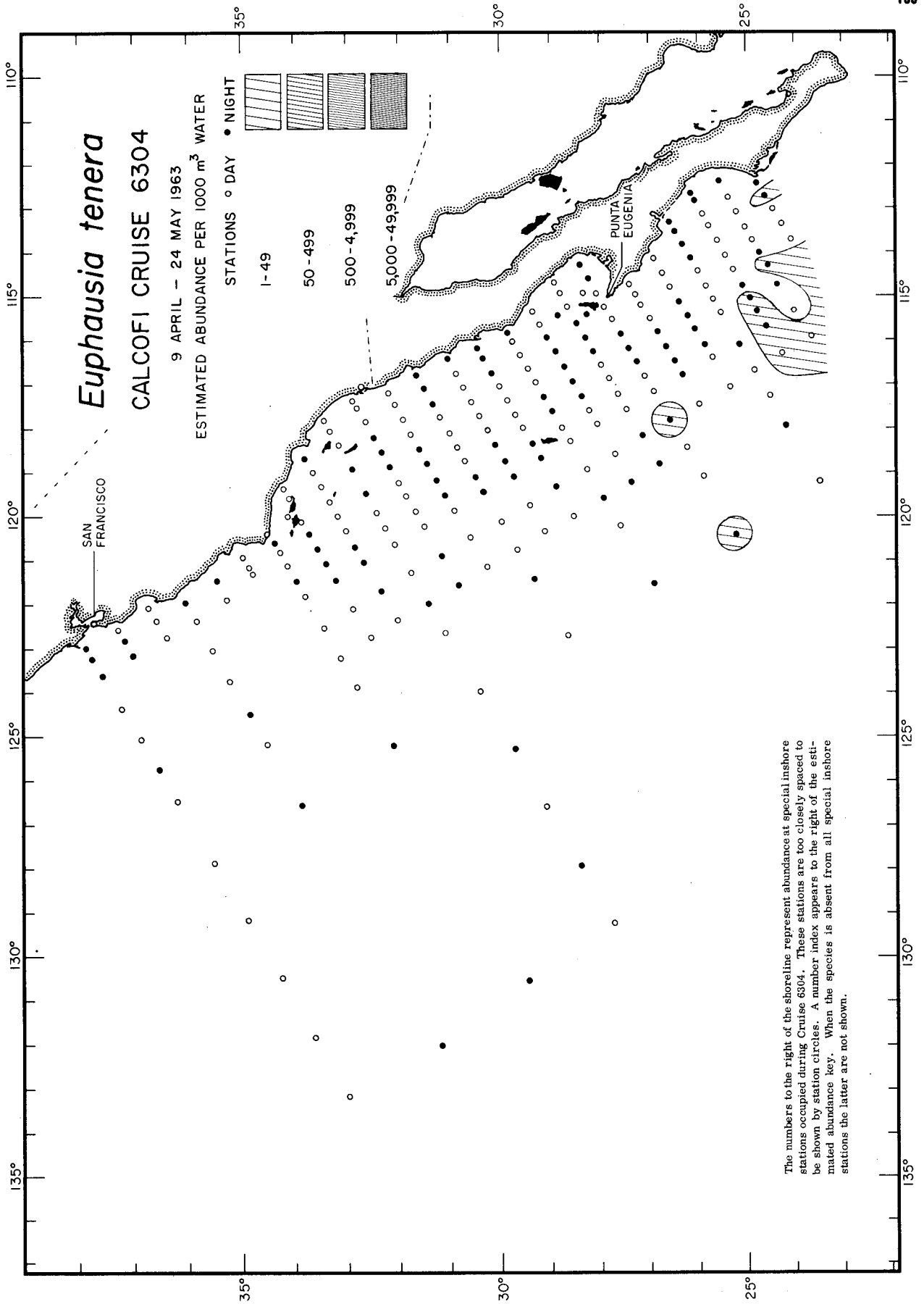
Euphausiacea
Euphausia tenera
5807



Euphausiacea
Euphausia tenera
5810

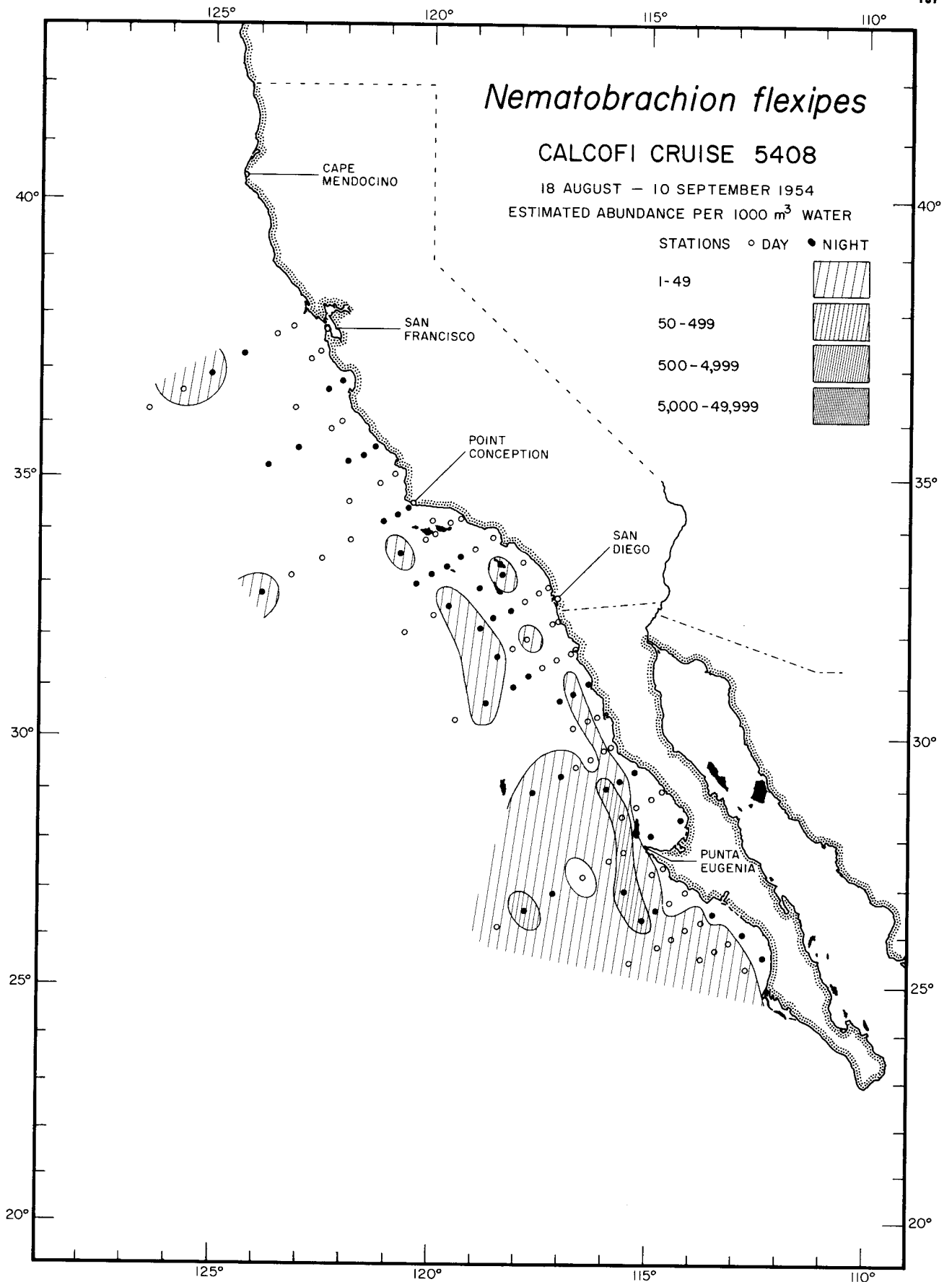


Euphausiacea
Euphausia tenera
6204

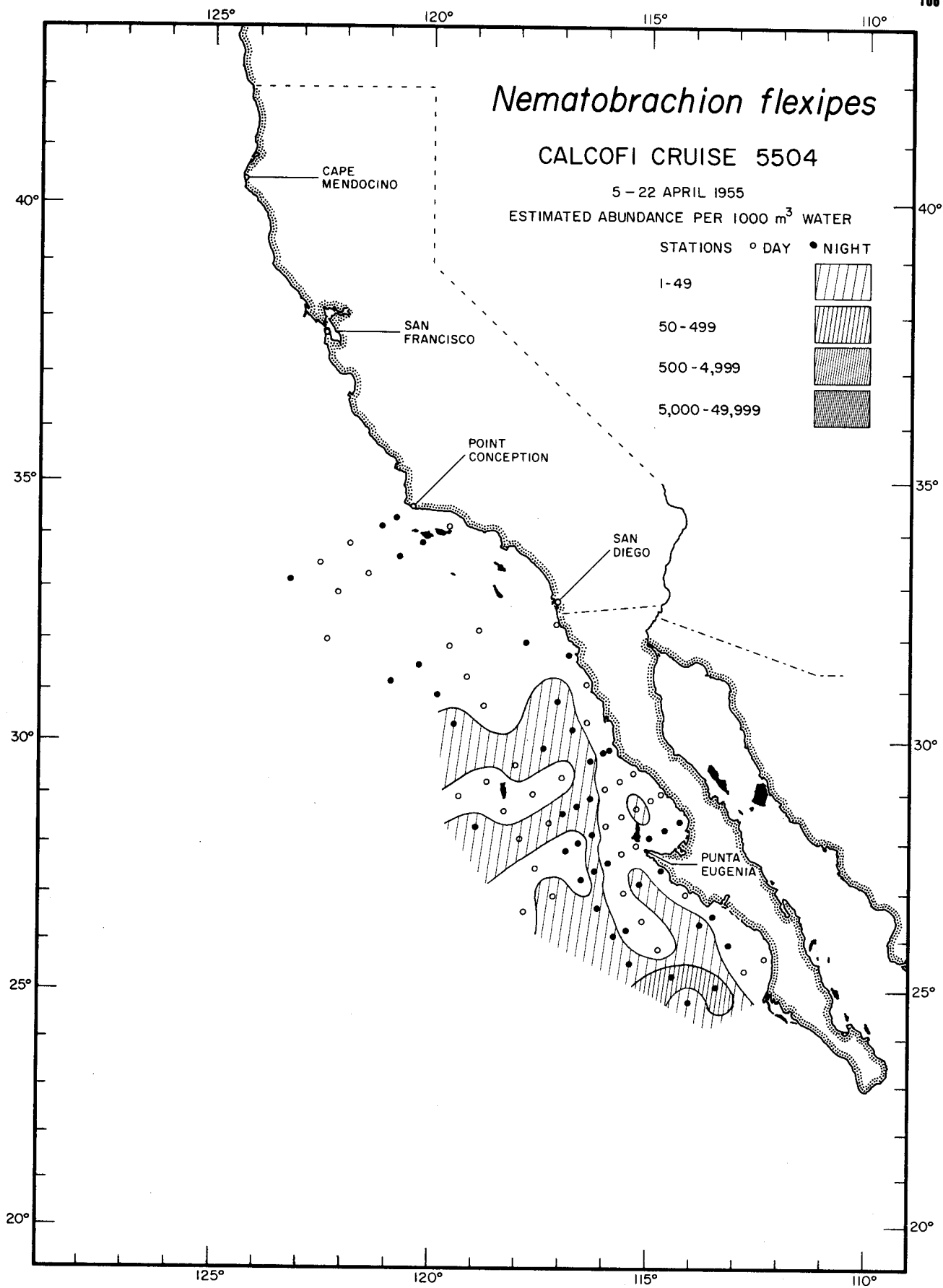


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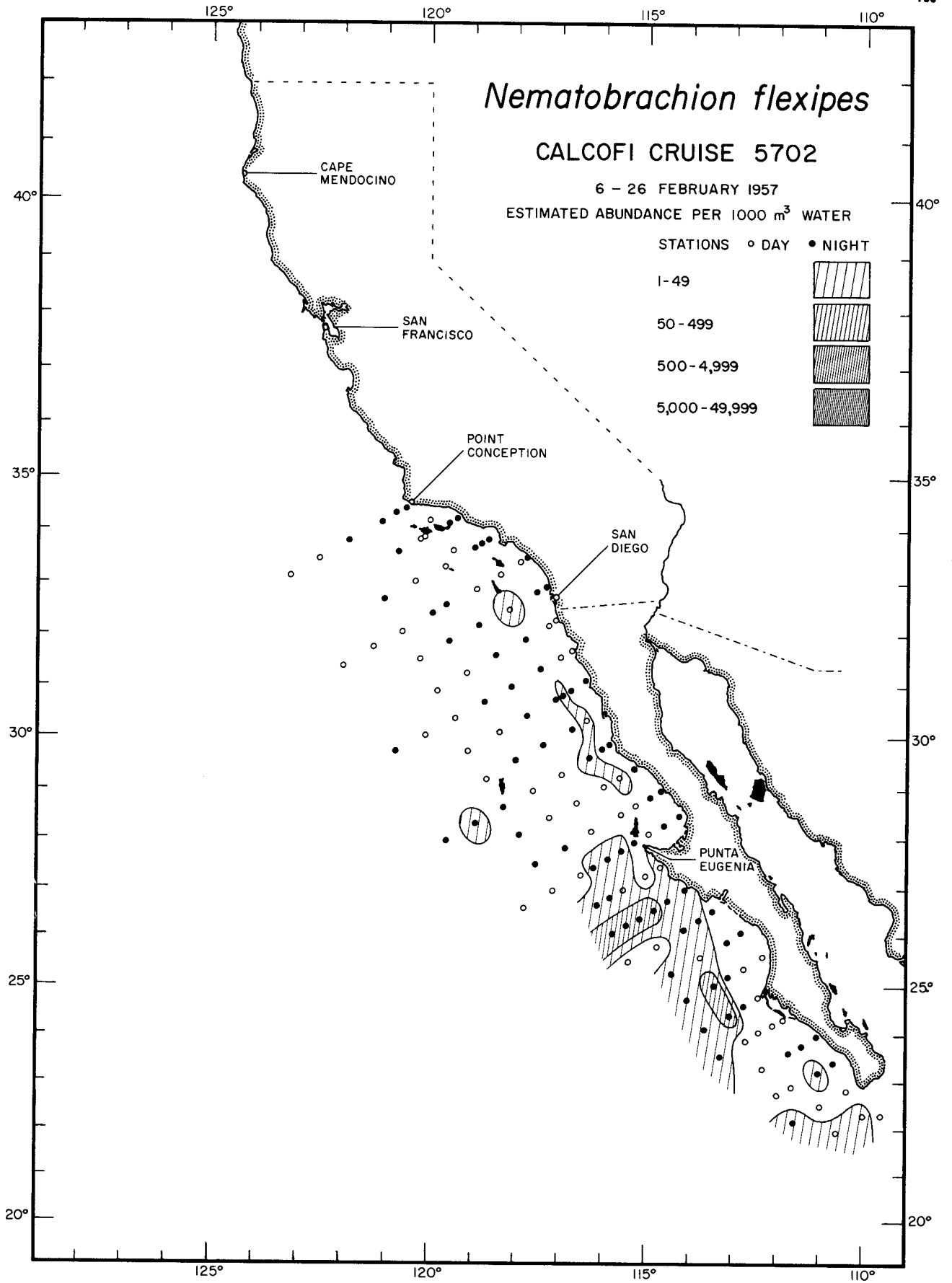
Euphausiacea
Euphausia tenera
6304



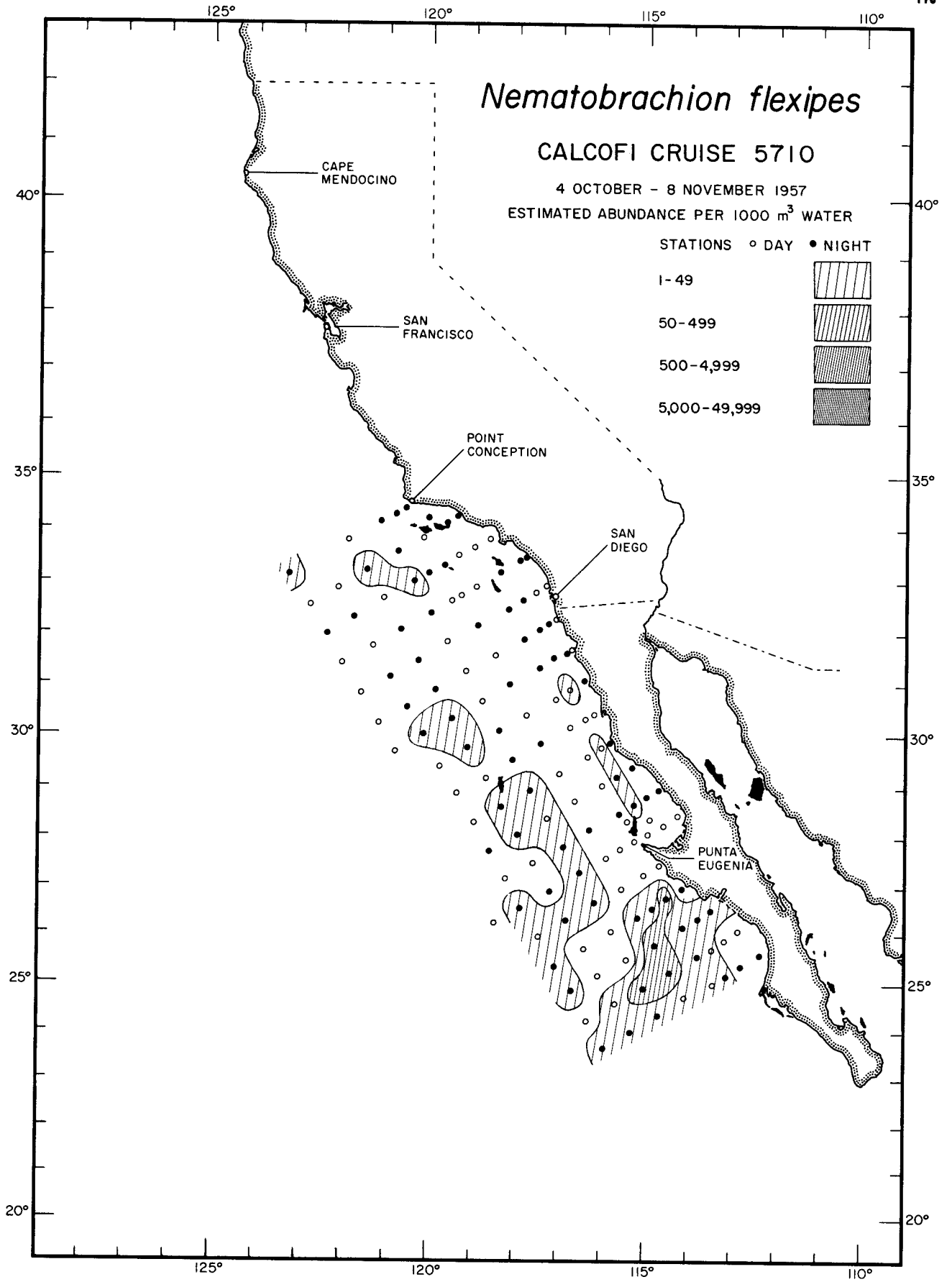
Euphausiacea
Nematobranchion flexipes
5408



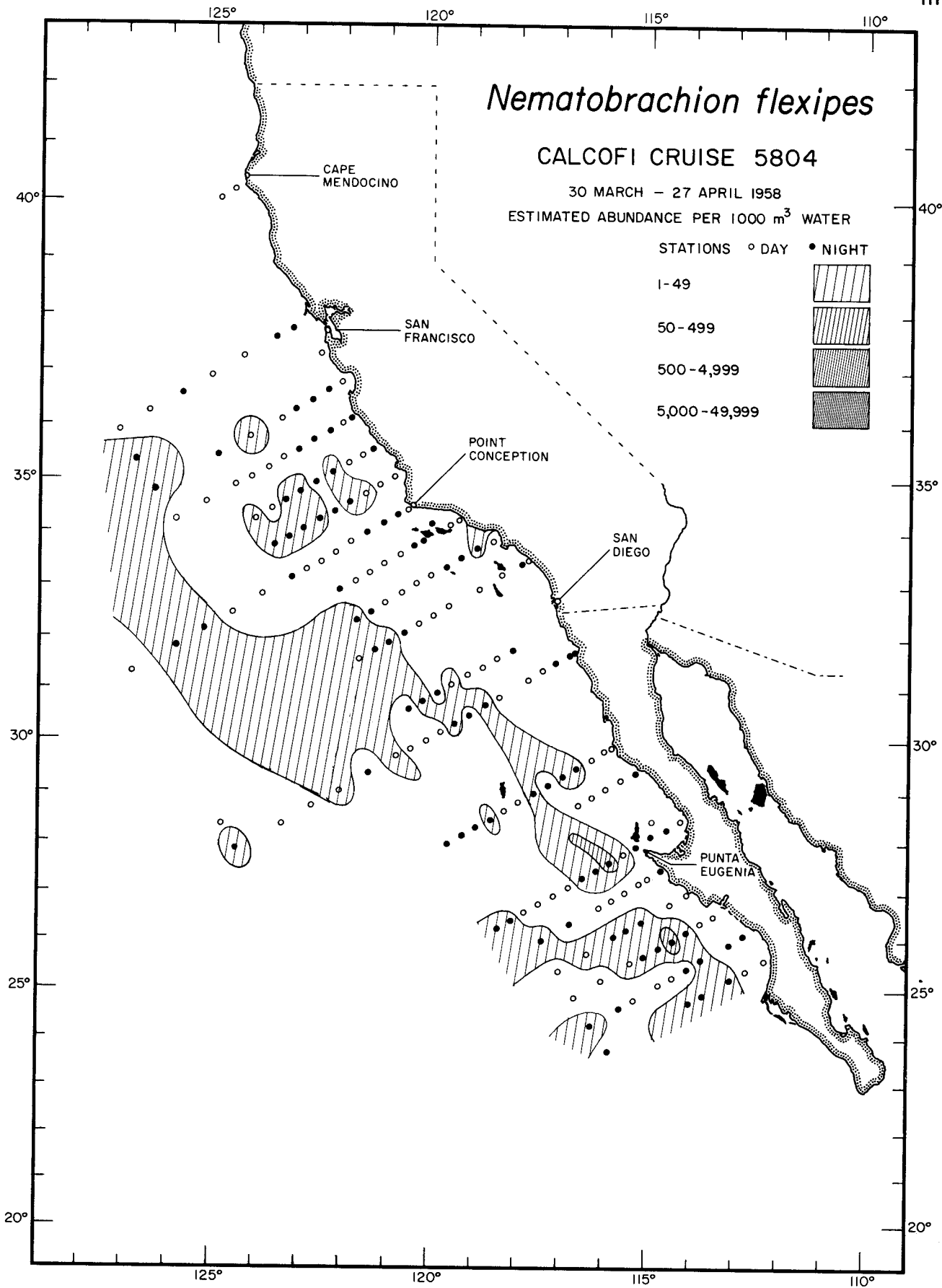
Euphausiacea
Nematobranchion flexipes
5504



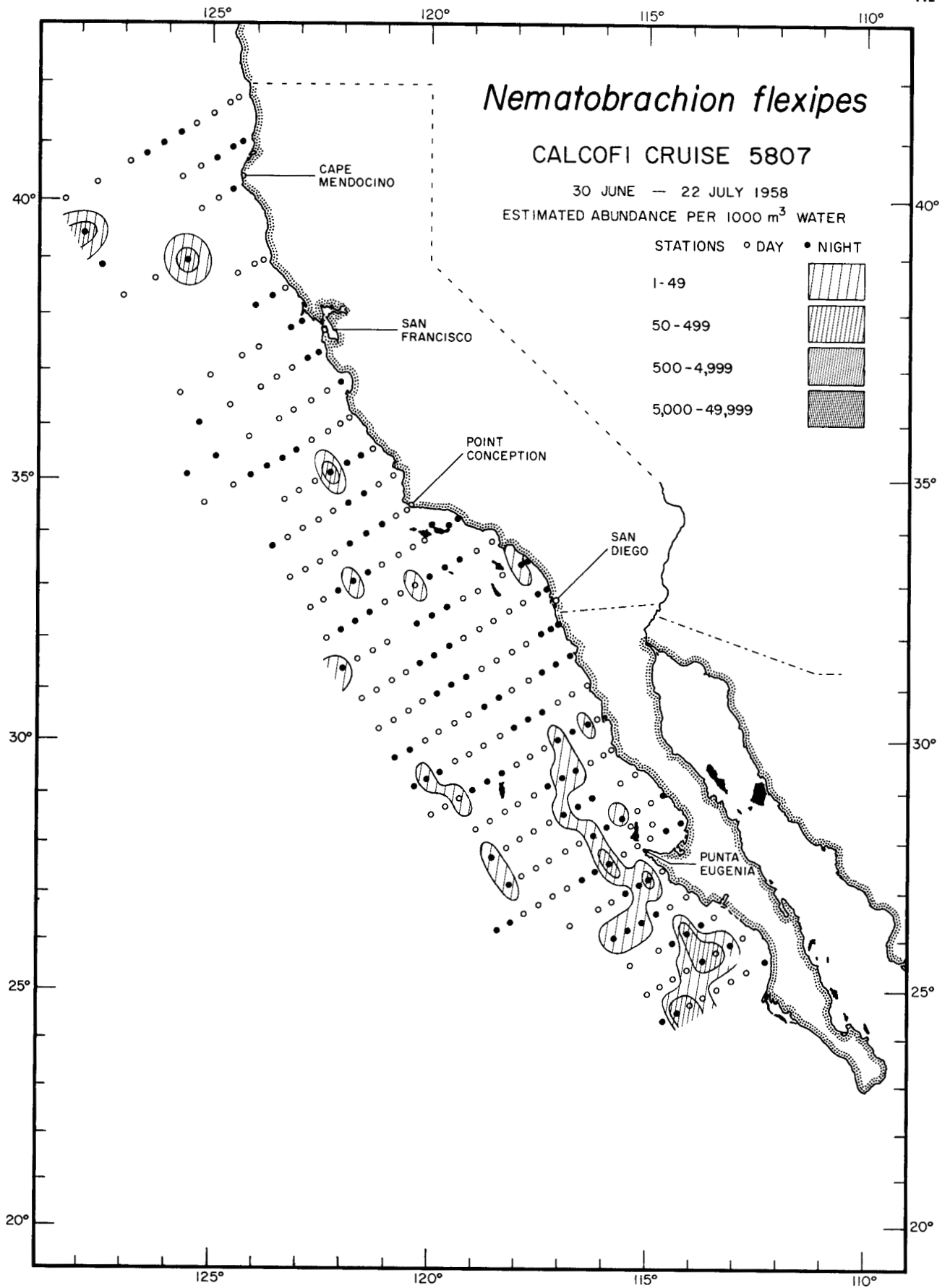
Euphausiacea
Nematobrachion flexipes
5702



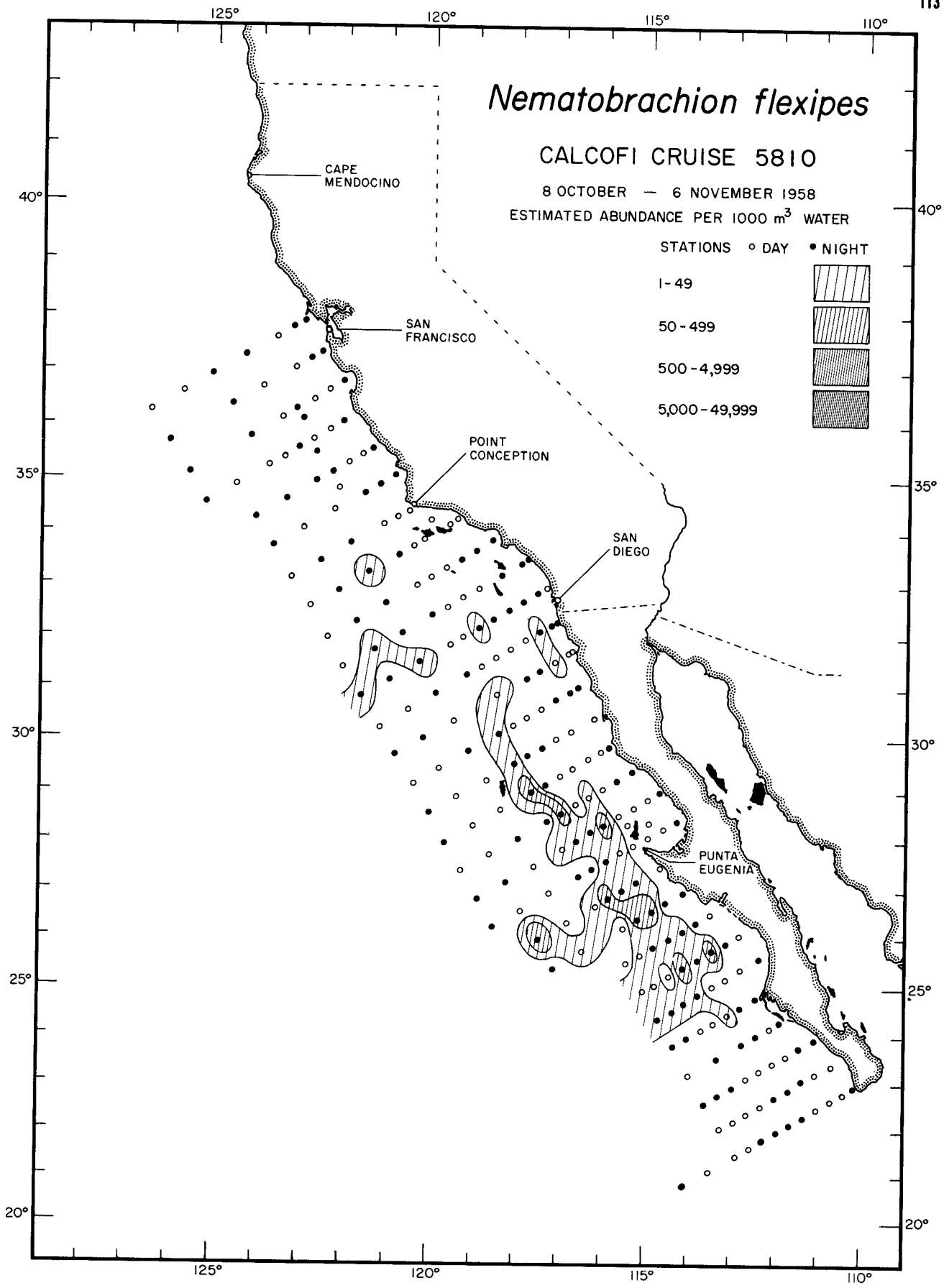
Euphausiacea
Nematobranchion flexipes
 5710



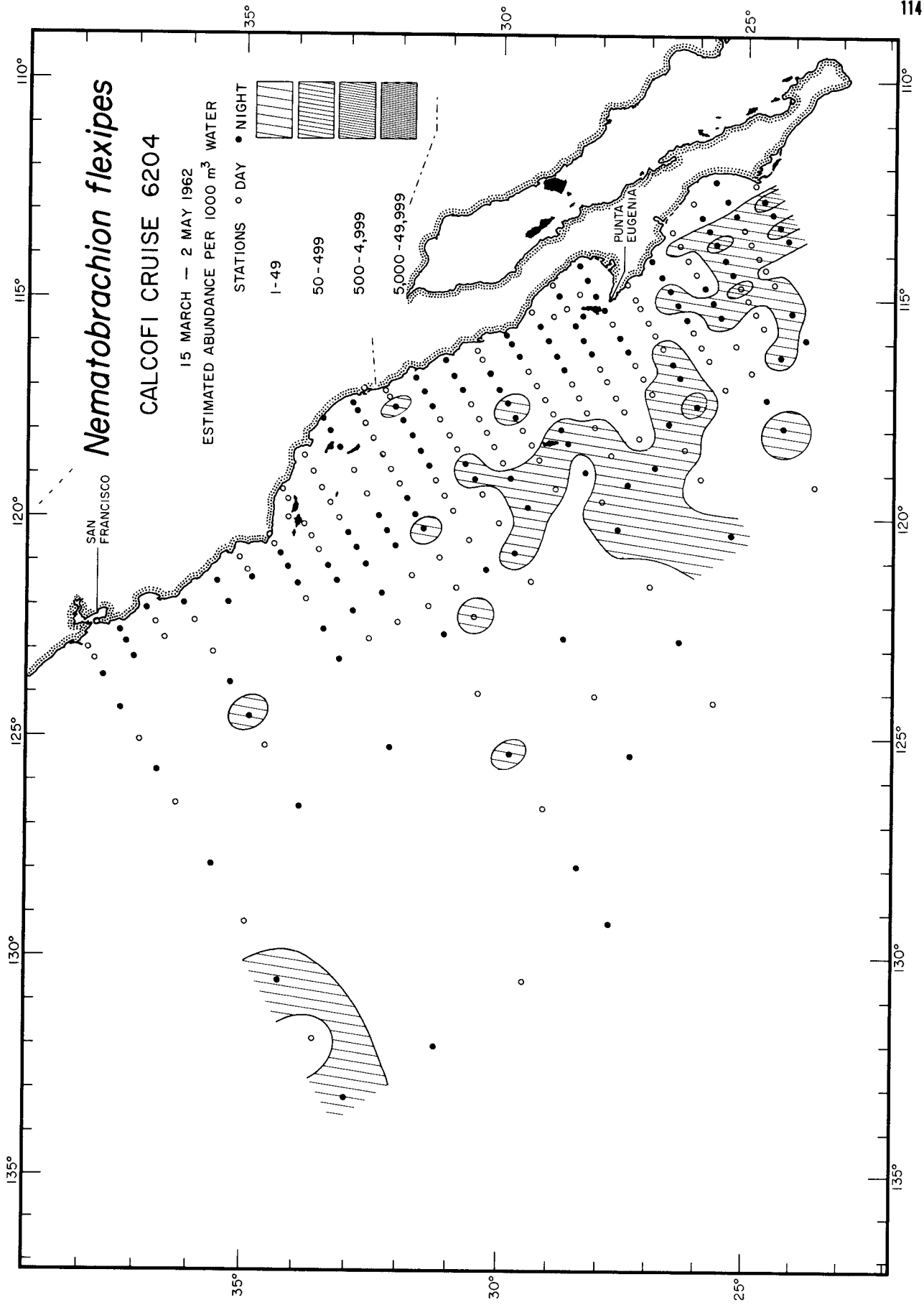
Euphausiacea
Nematobranchion flexipes
5804



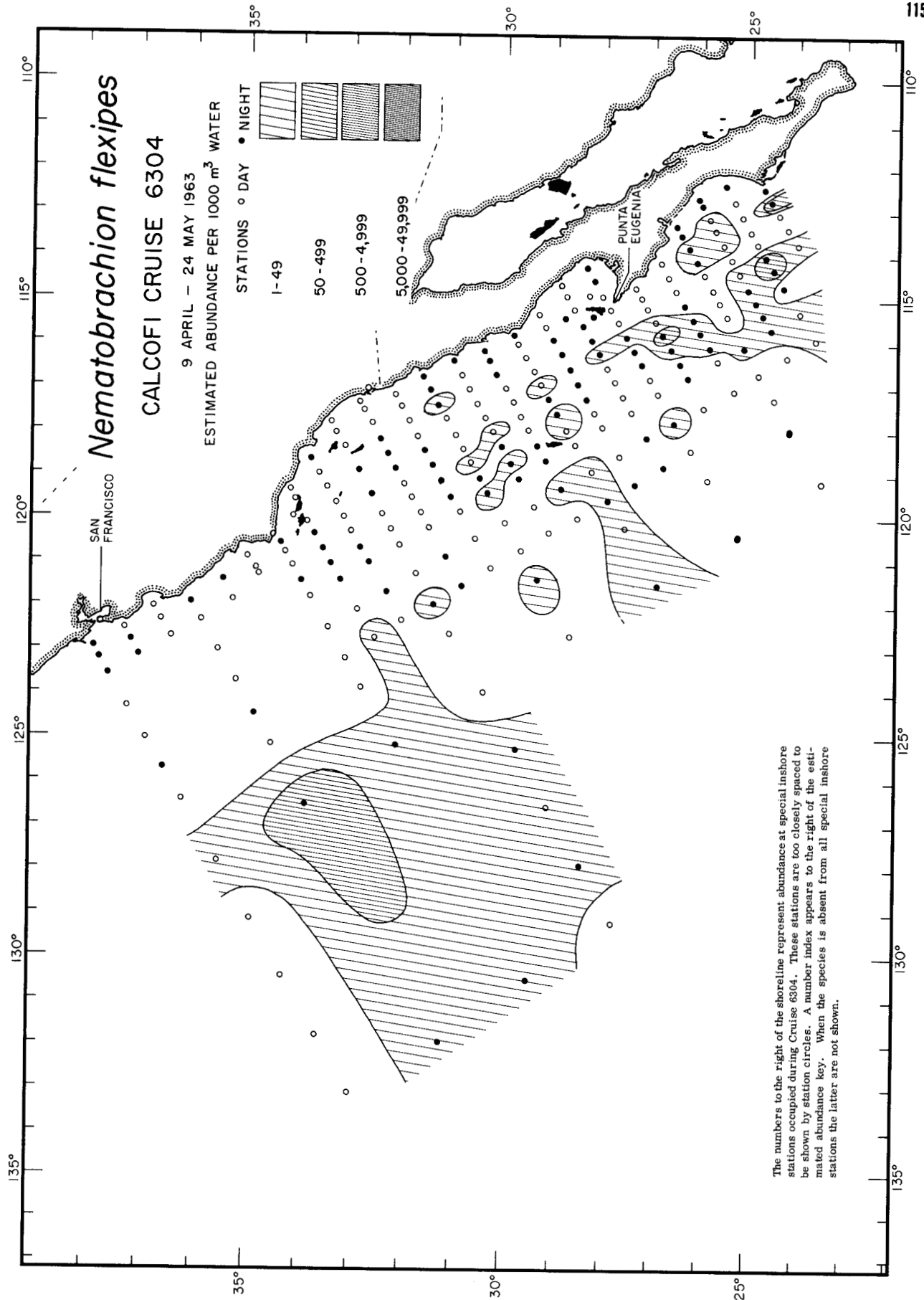
Euphausiacea
Nematobranchion flexipes
5807



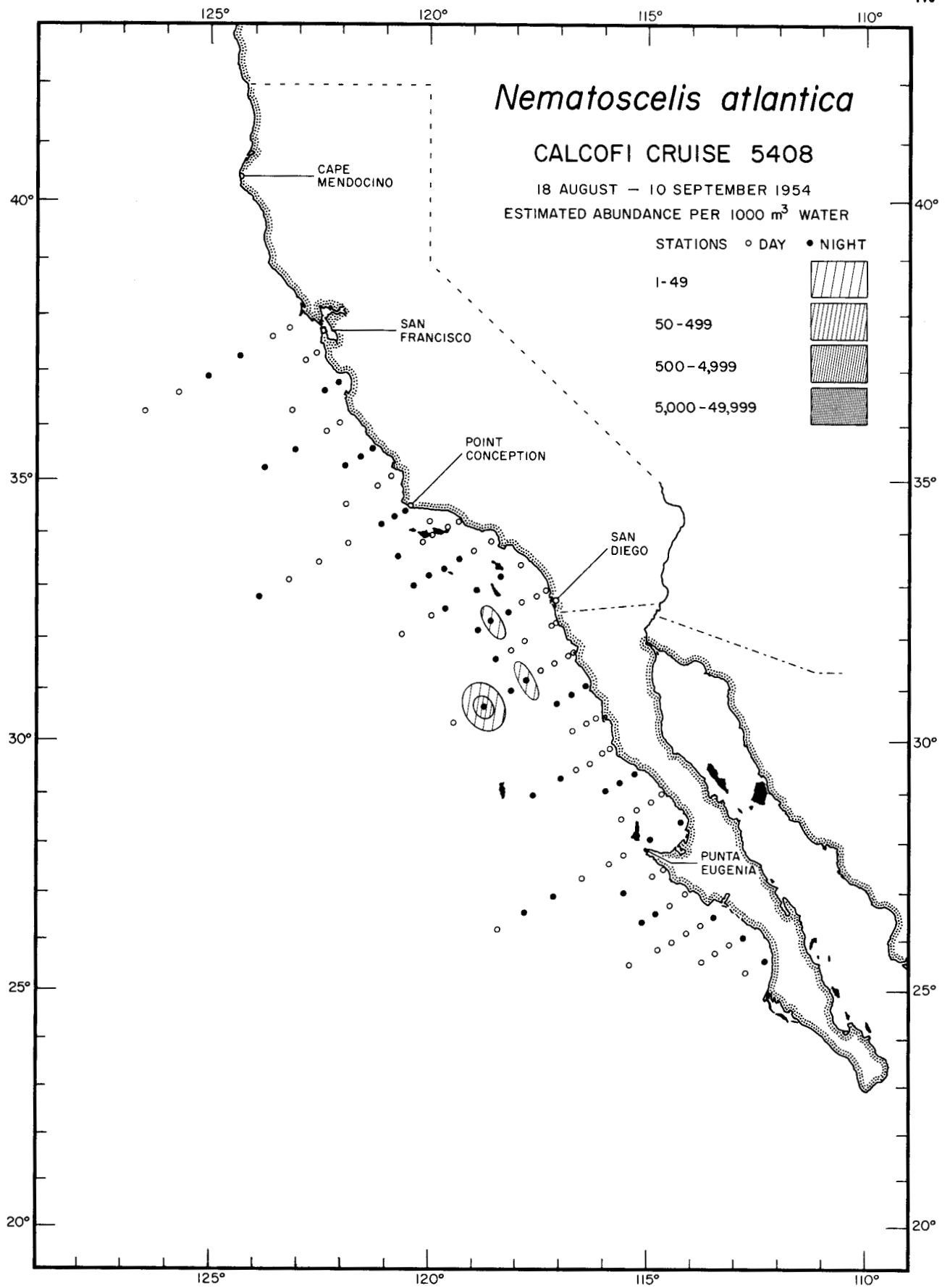
Euphausiacea
Nematobranchion flexipes
 5810



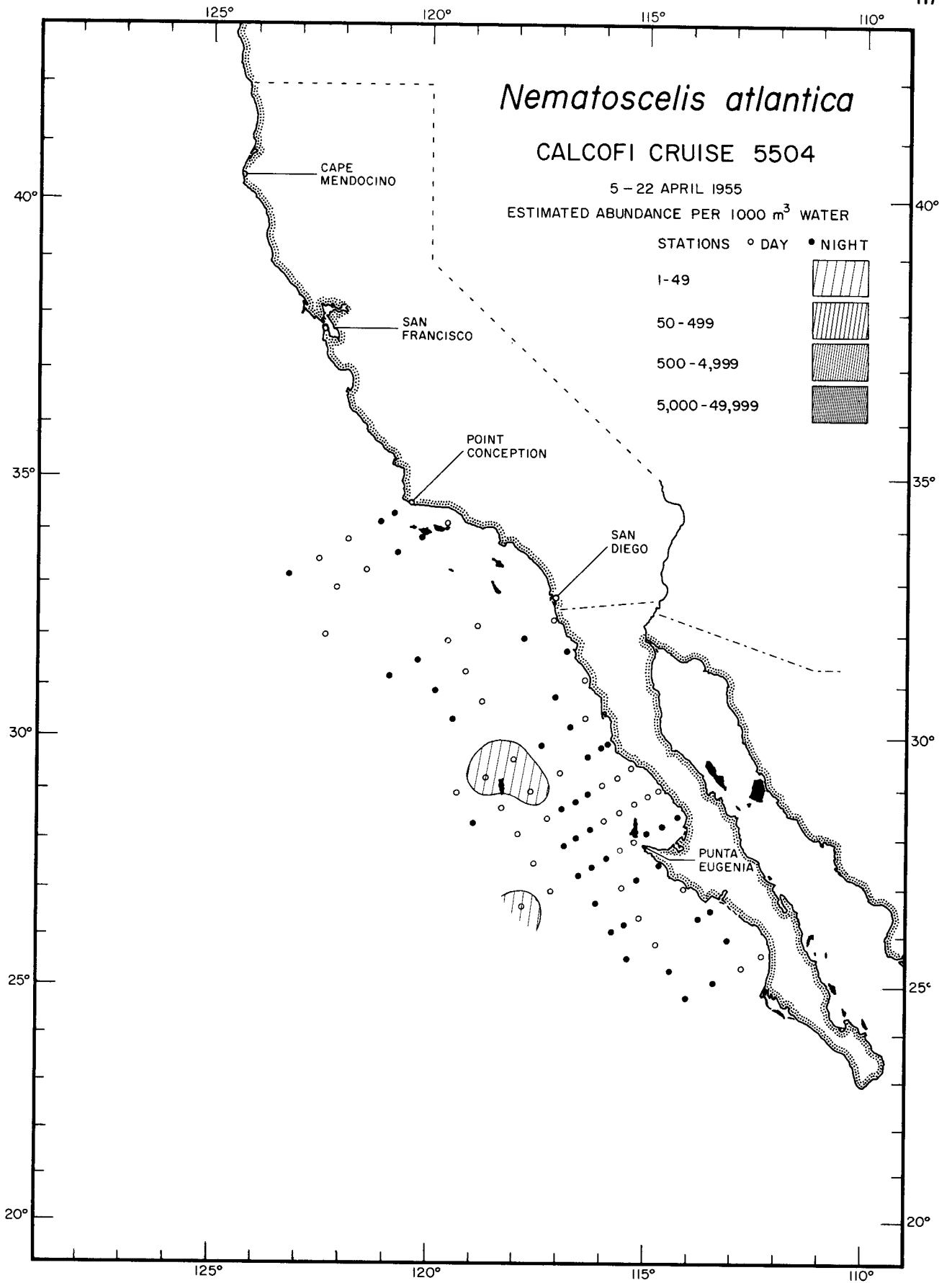
Euphausiacea
Nematobranchion flexipes
6204



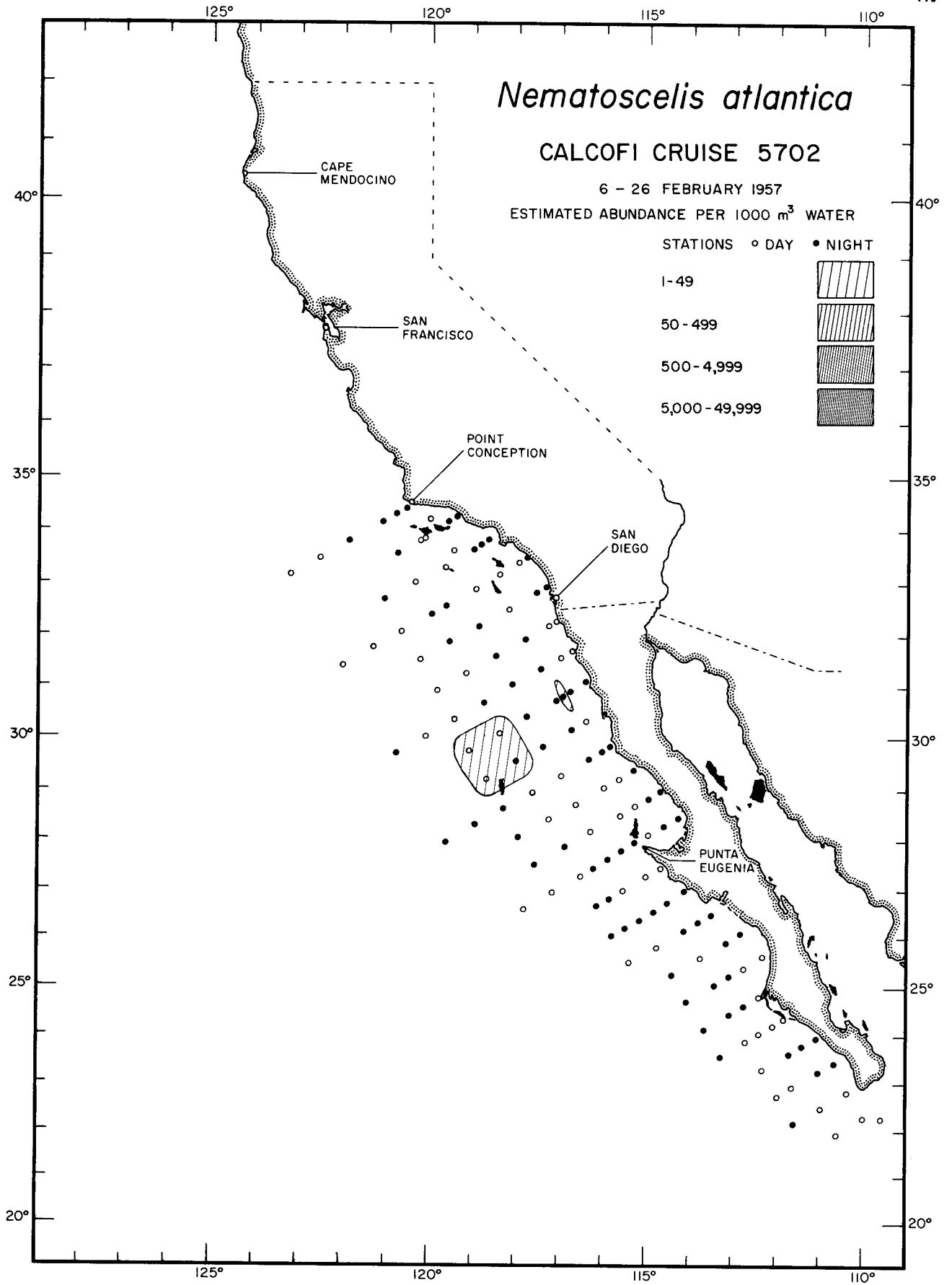
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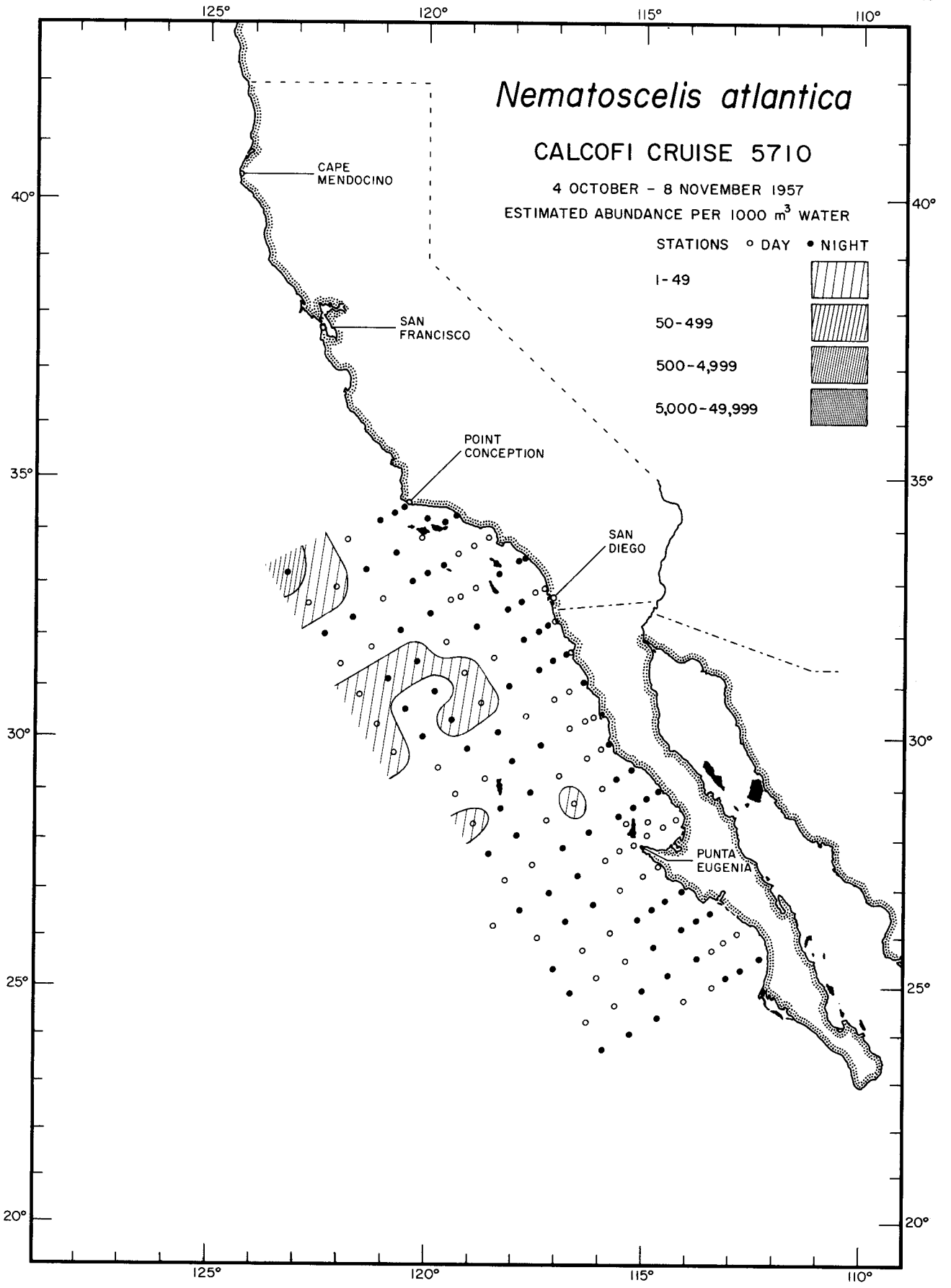
Euphausiacea
Nematoscelis atlantica
 5408



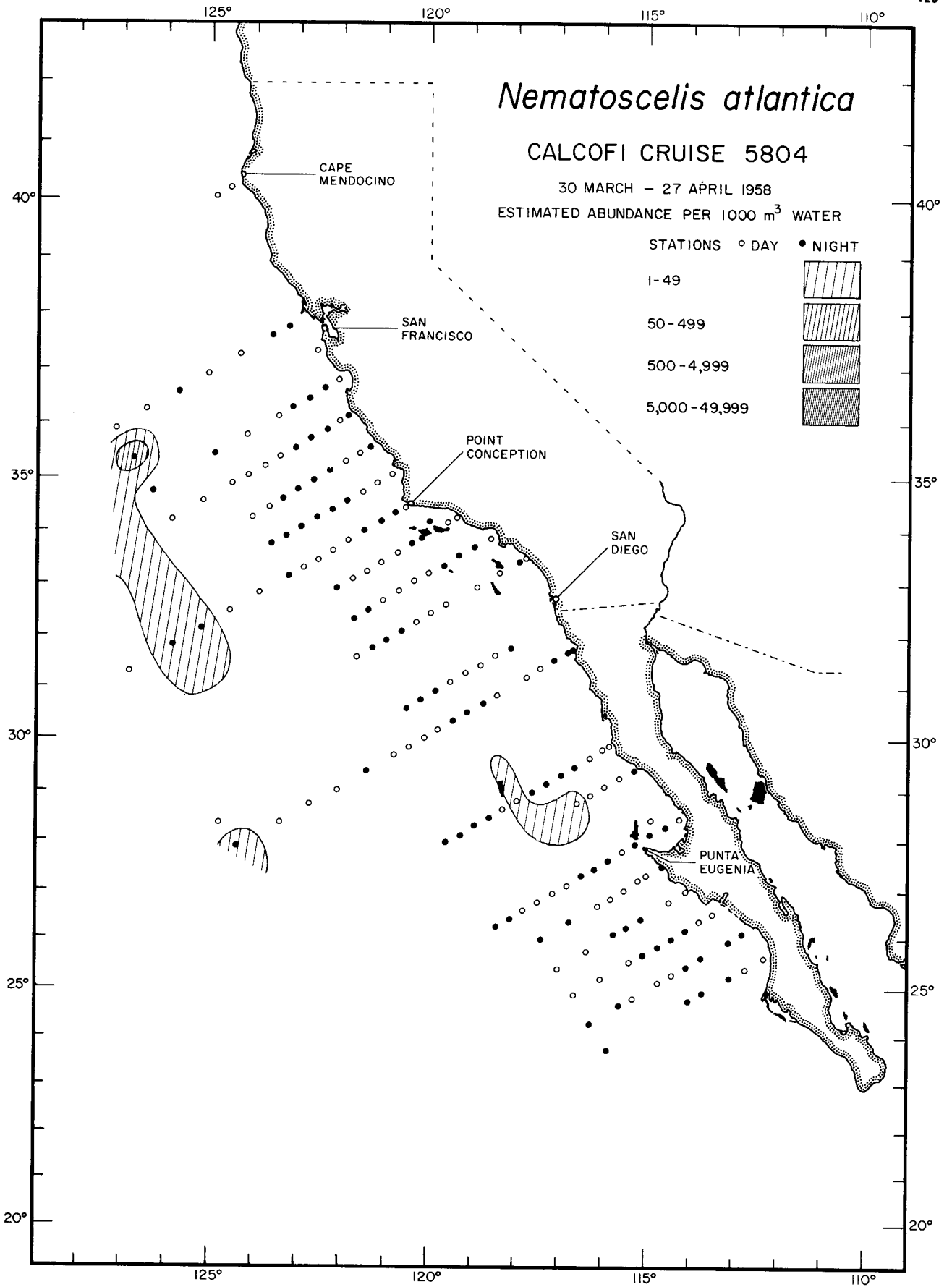
Euphausiacea
Nematoscelis atlantica
 5504



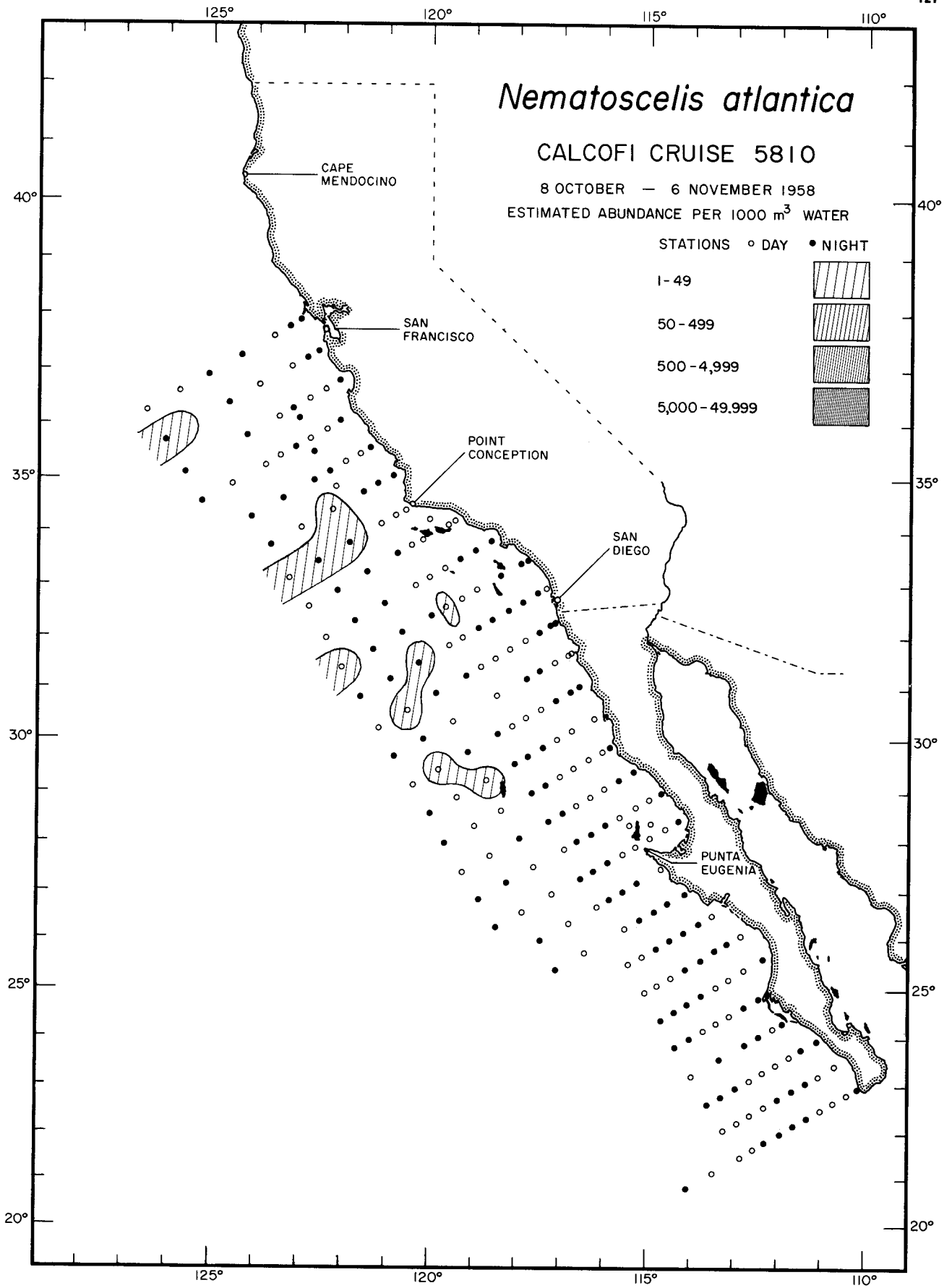
Euphausiacea
Nematoscelis atlantica
5702



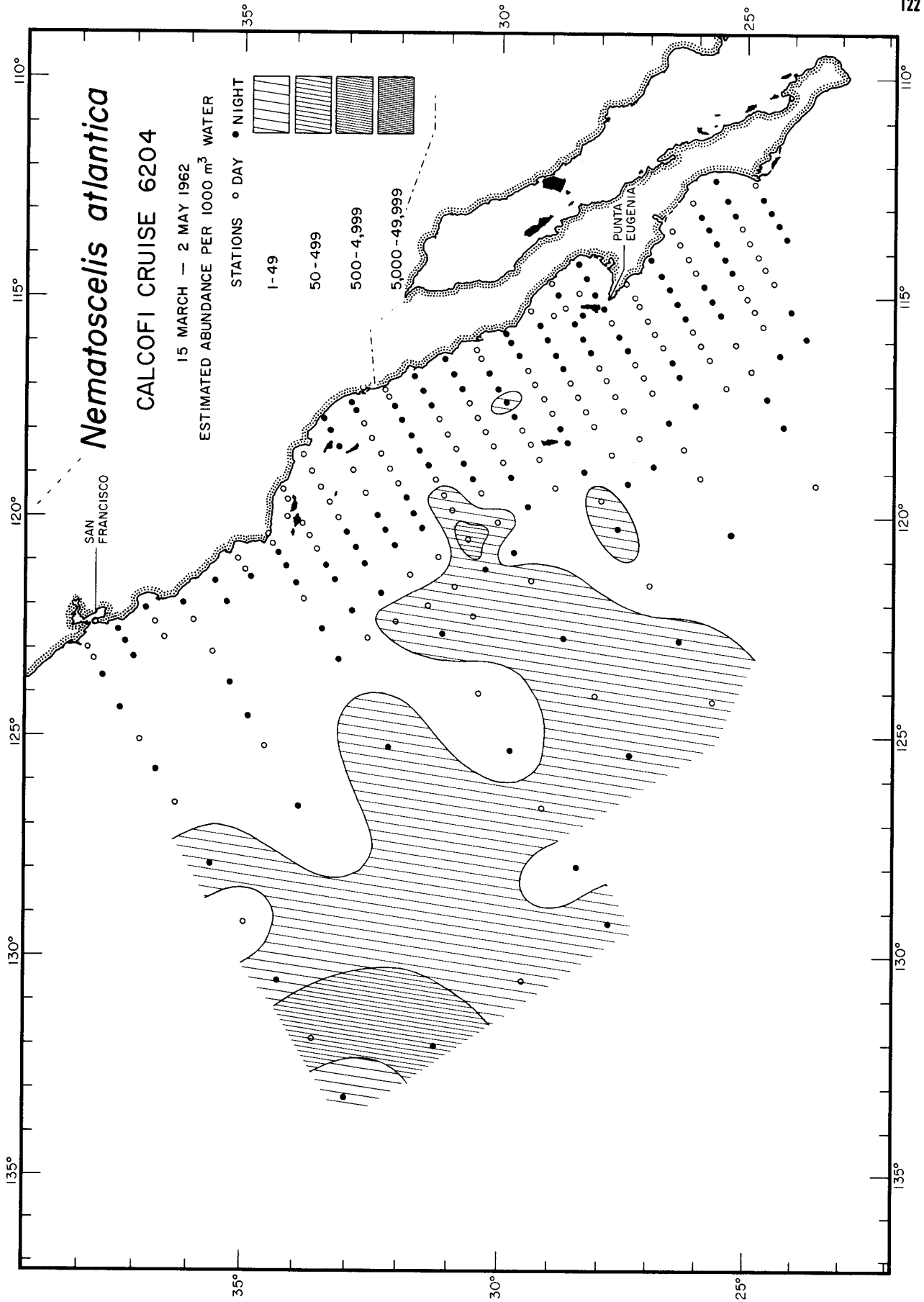
Euphausiacea
Nematoscelis atlantica
5710



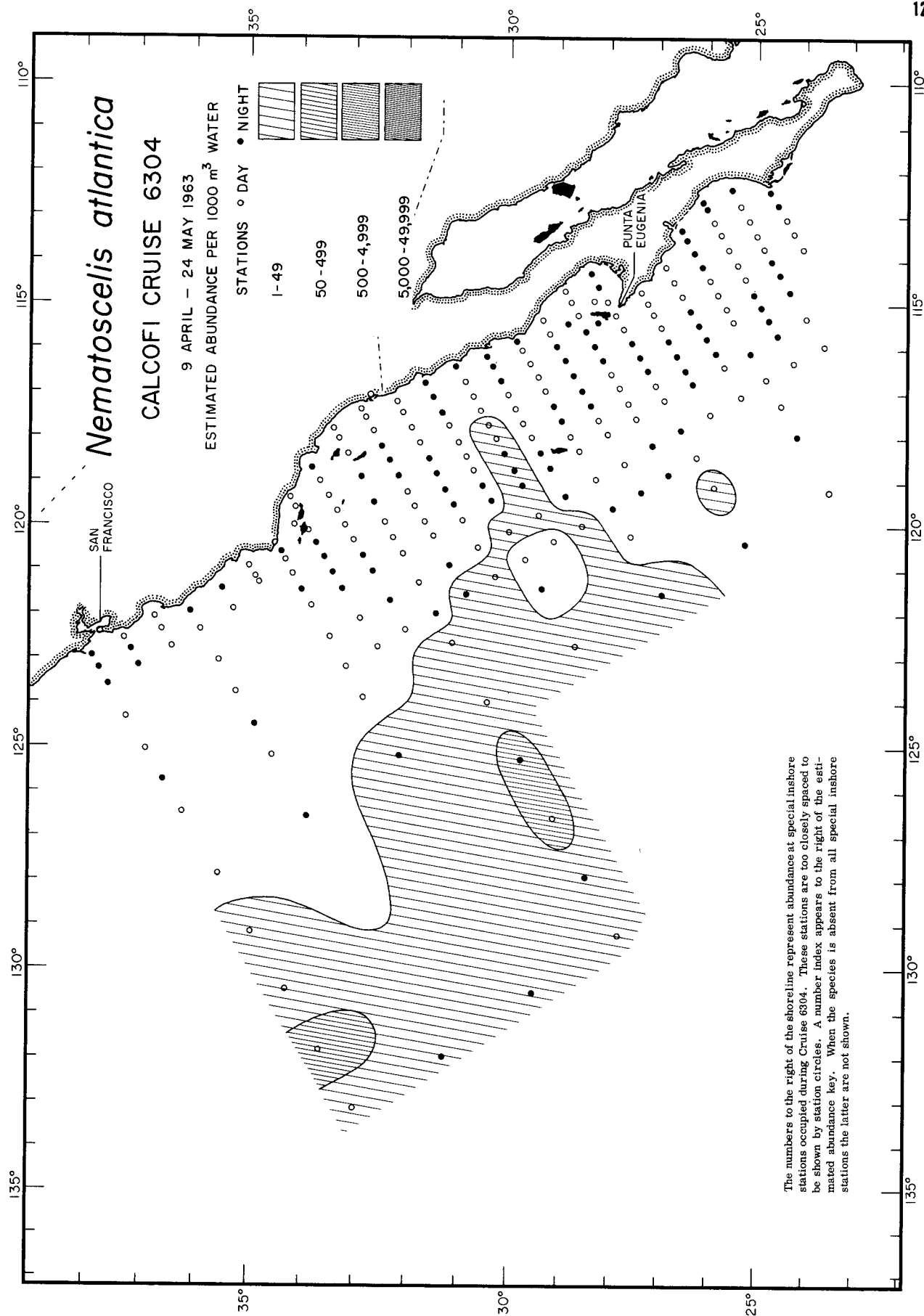
Euphausiacea
Nematoscelis atlantica
 5804



Euphausiacea
Nematoscelis atlantica
5810

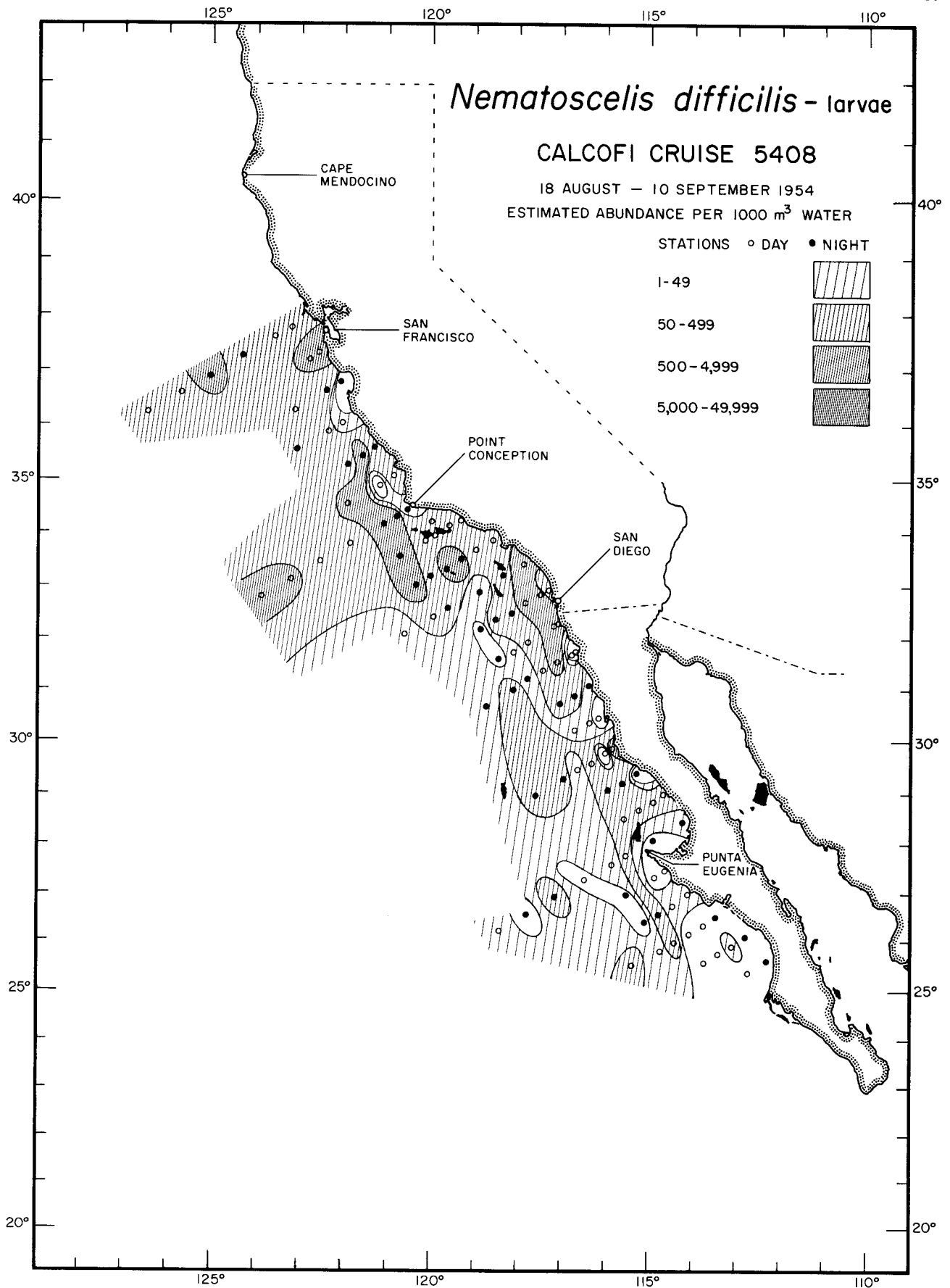


Euphausiacea
Nematoscelis atlantica
6204

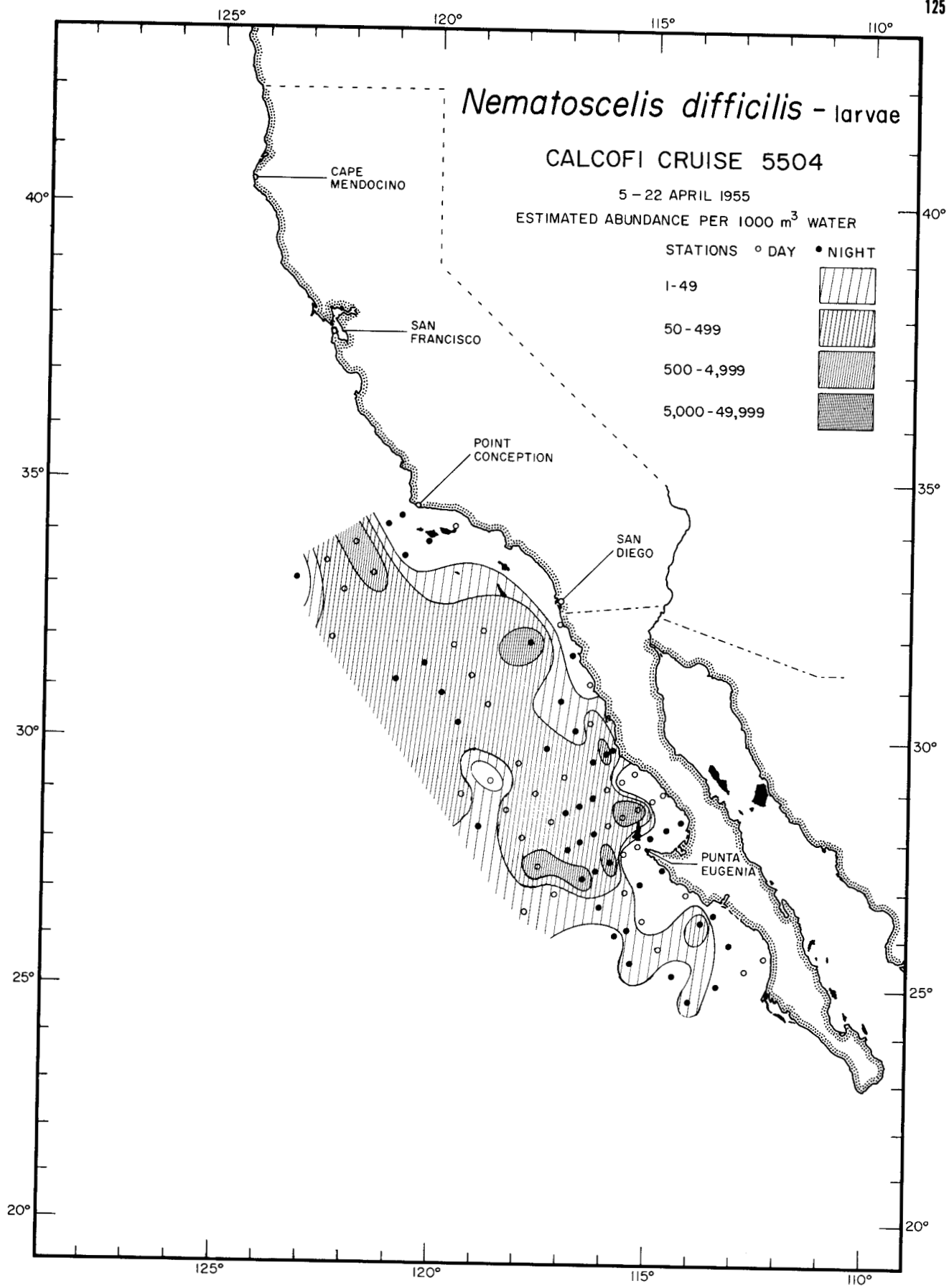


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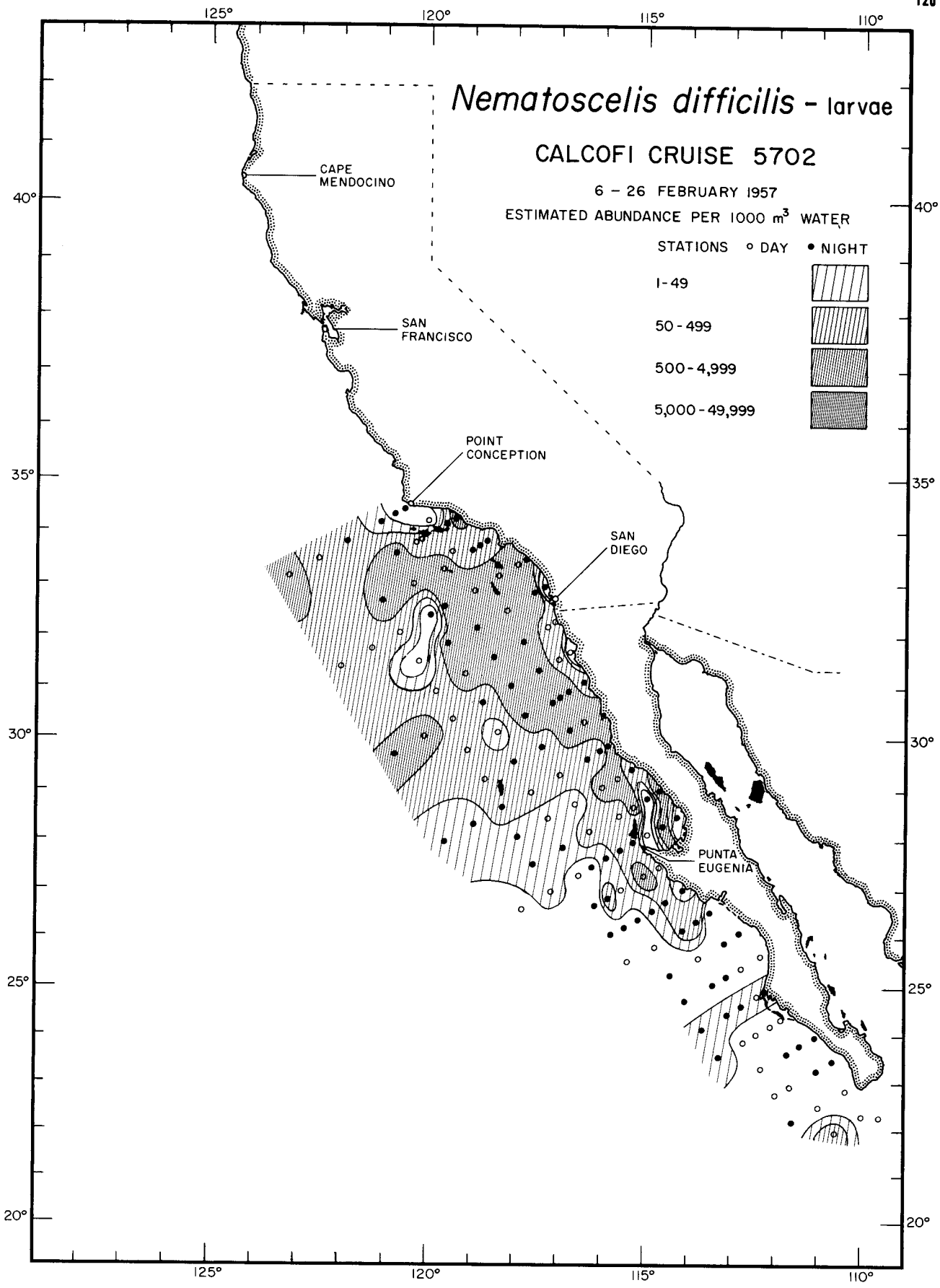
Euphausiacea
Nematoscelis atlantica
6304



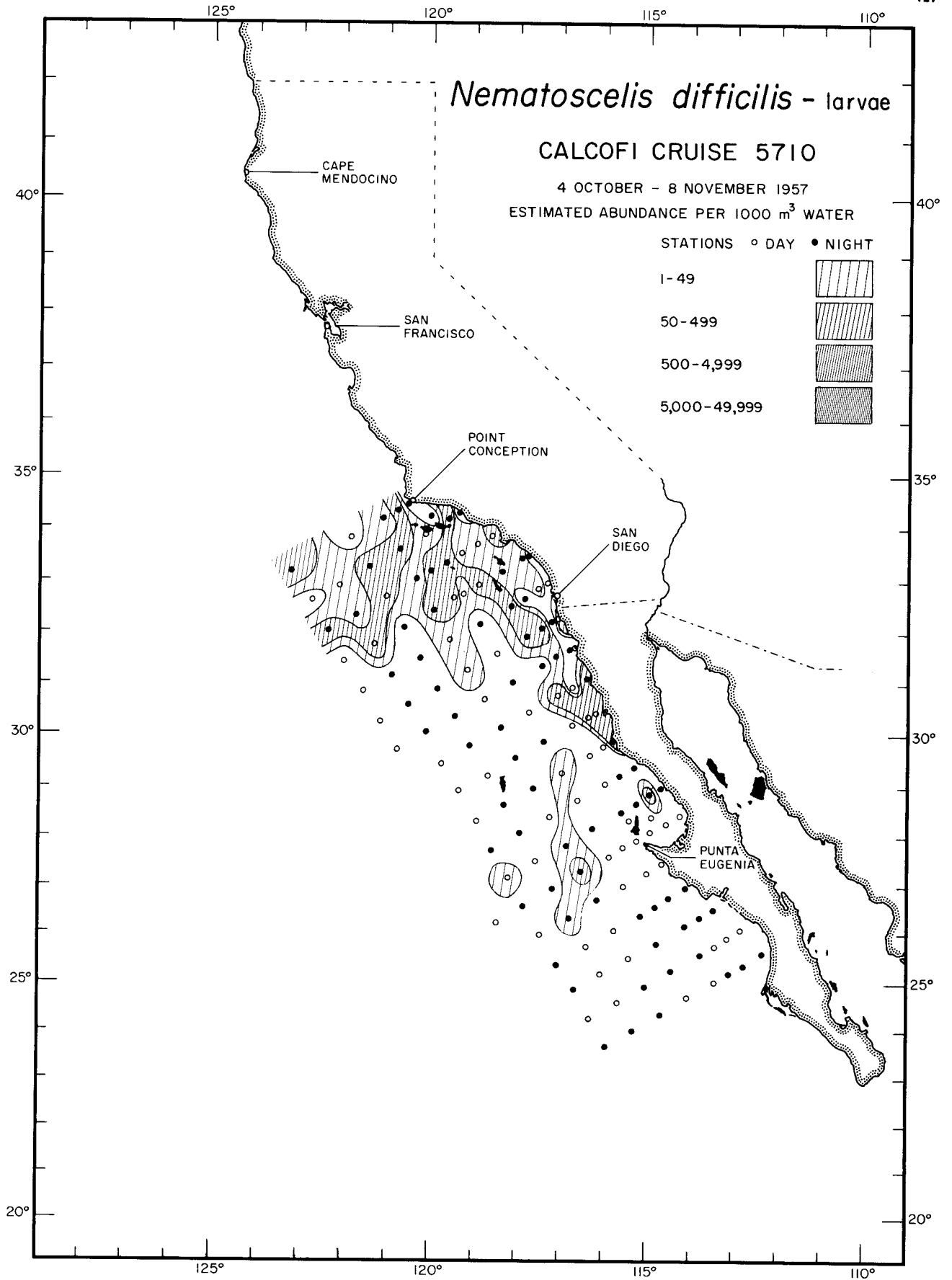
Euphausiacea
Nematoscelis difficilis - larvae
5408



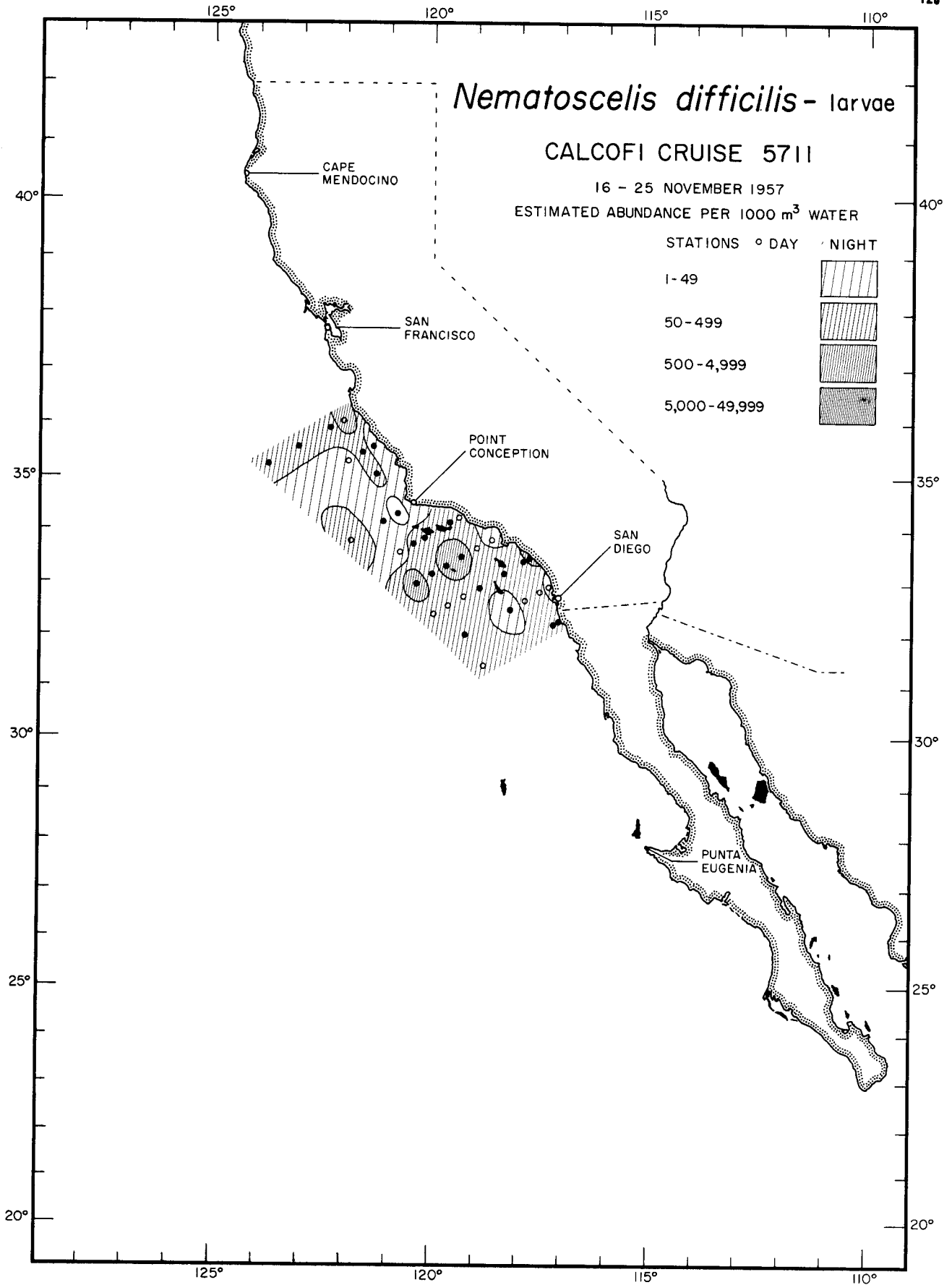
Euphausiacea
Nematoscelis difficilis - larvae
 5504



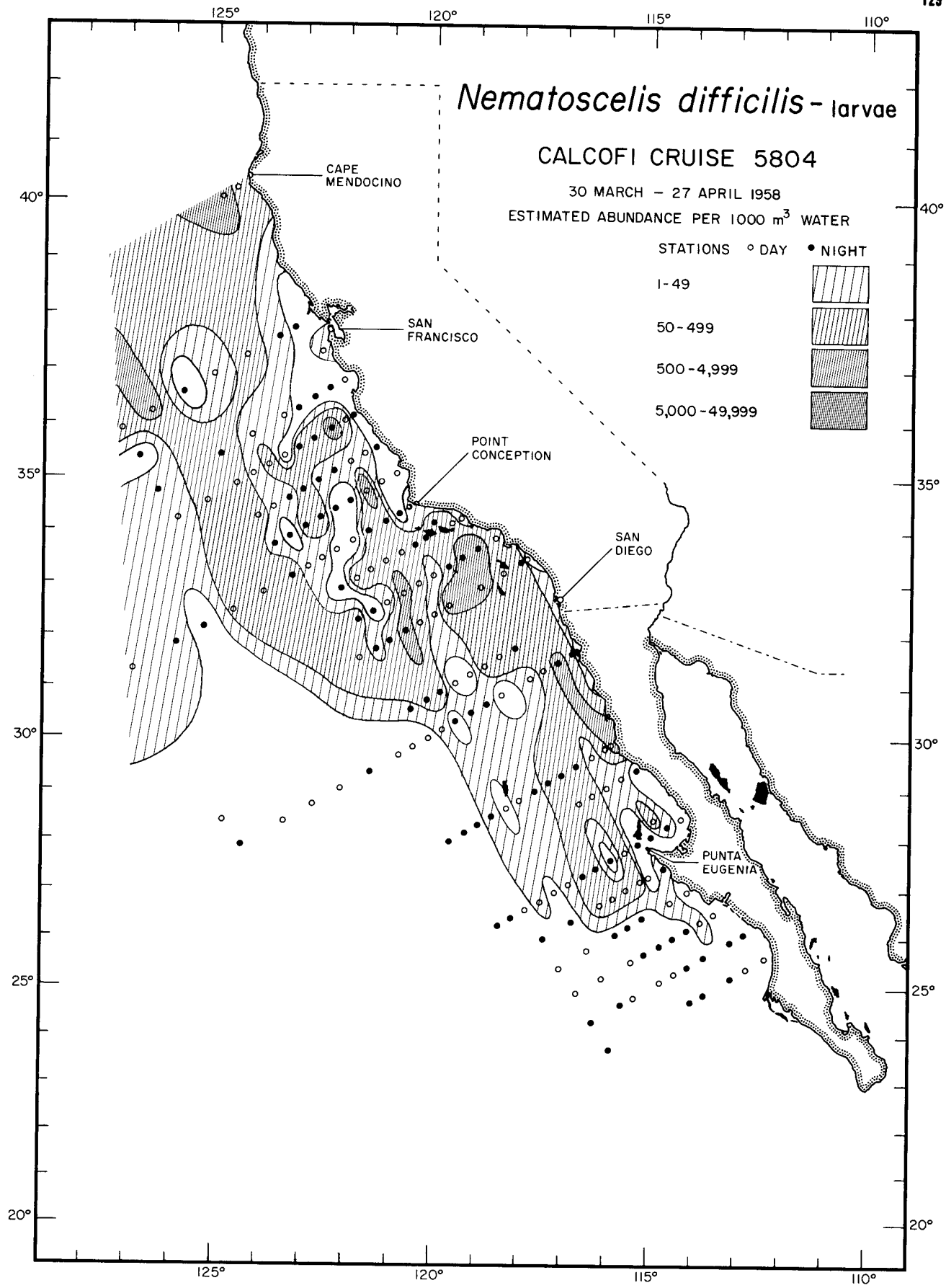
Euphausiacea
Nematoscelis difficilis - larvae
5702



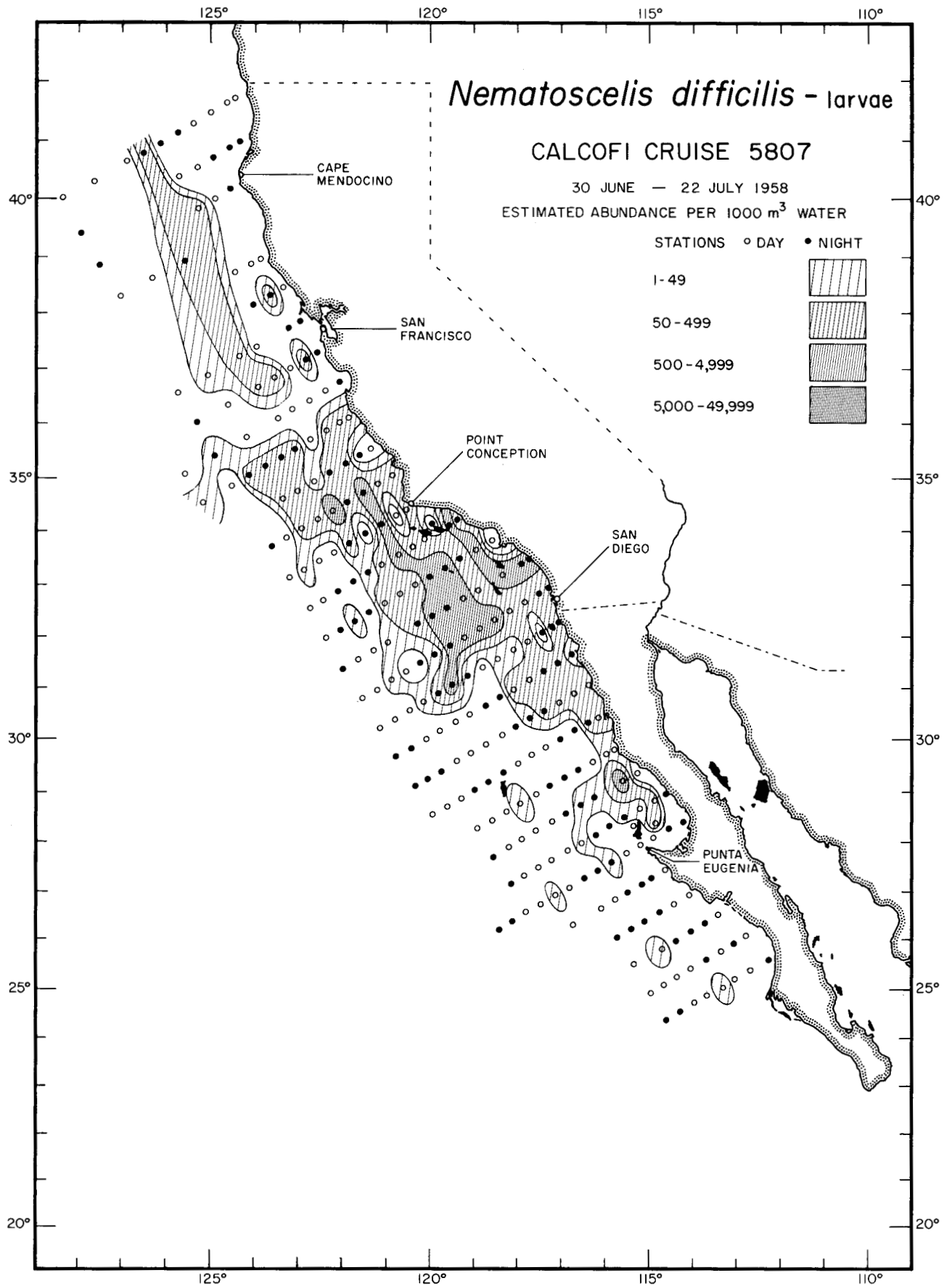
Euphausiacea
Nematoscelis difficilis - larvae
5710



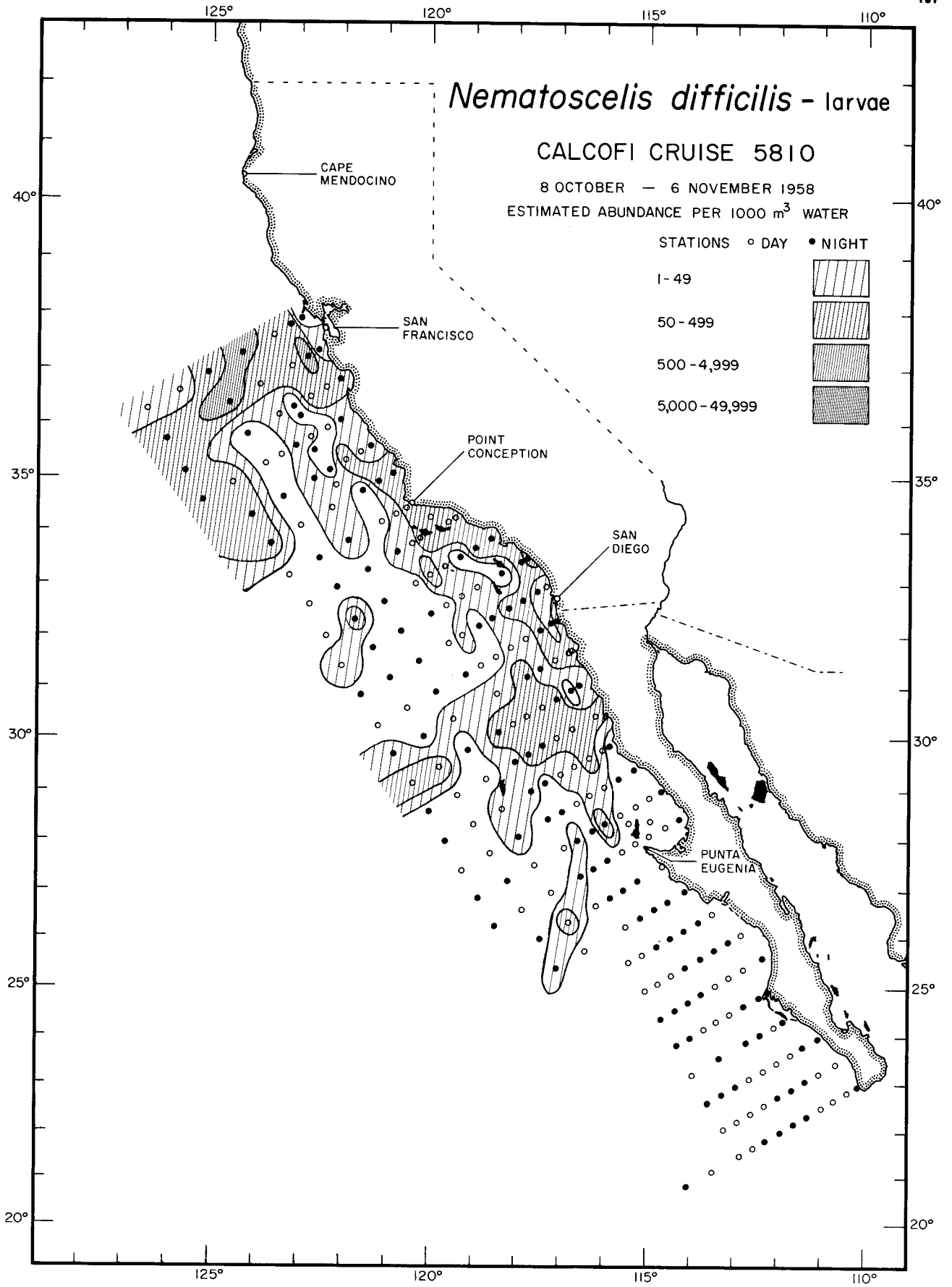
Euphausiacea
Nematoscelis difficilis - larvae
 5711



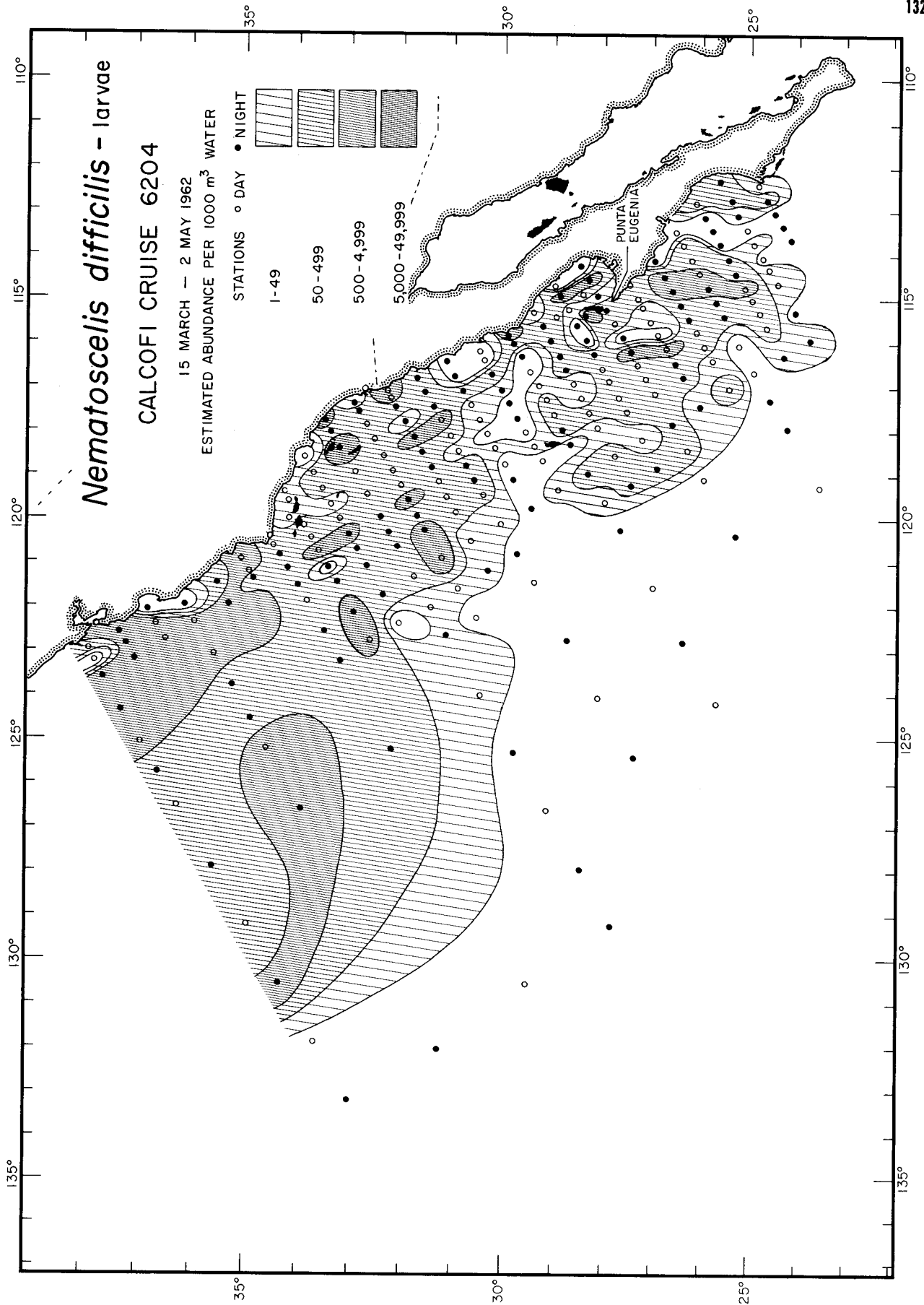
Euphausiacea
Nematoscelis difficilis - larvae
 5804

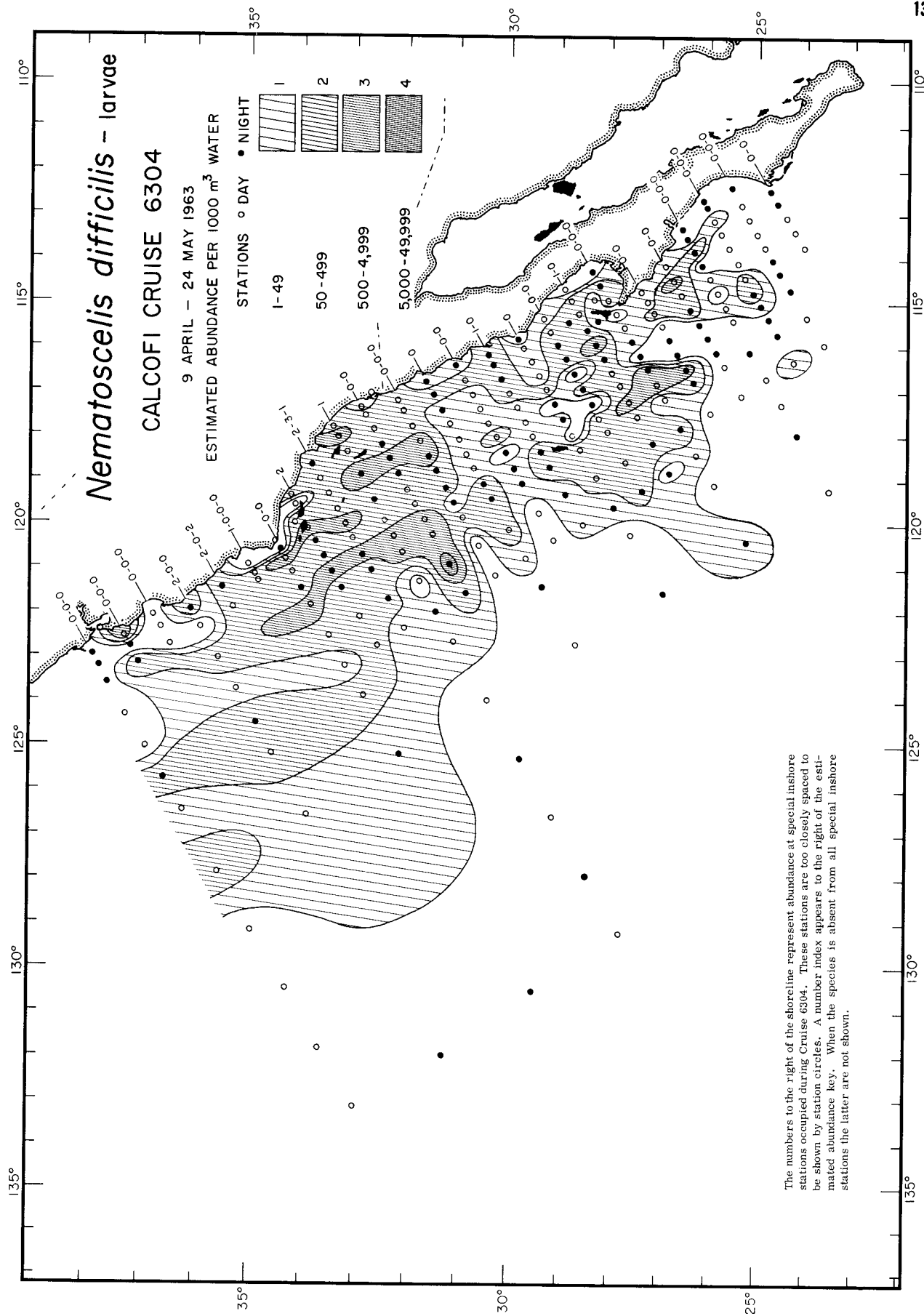


Euphausiacea
Nematoscelis difficilis - larvae
5807

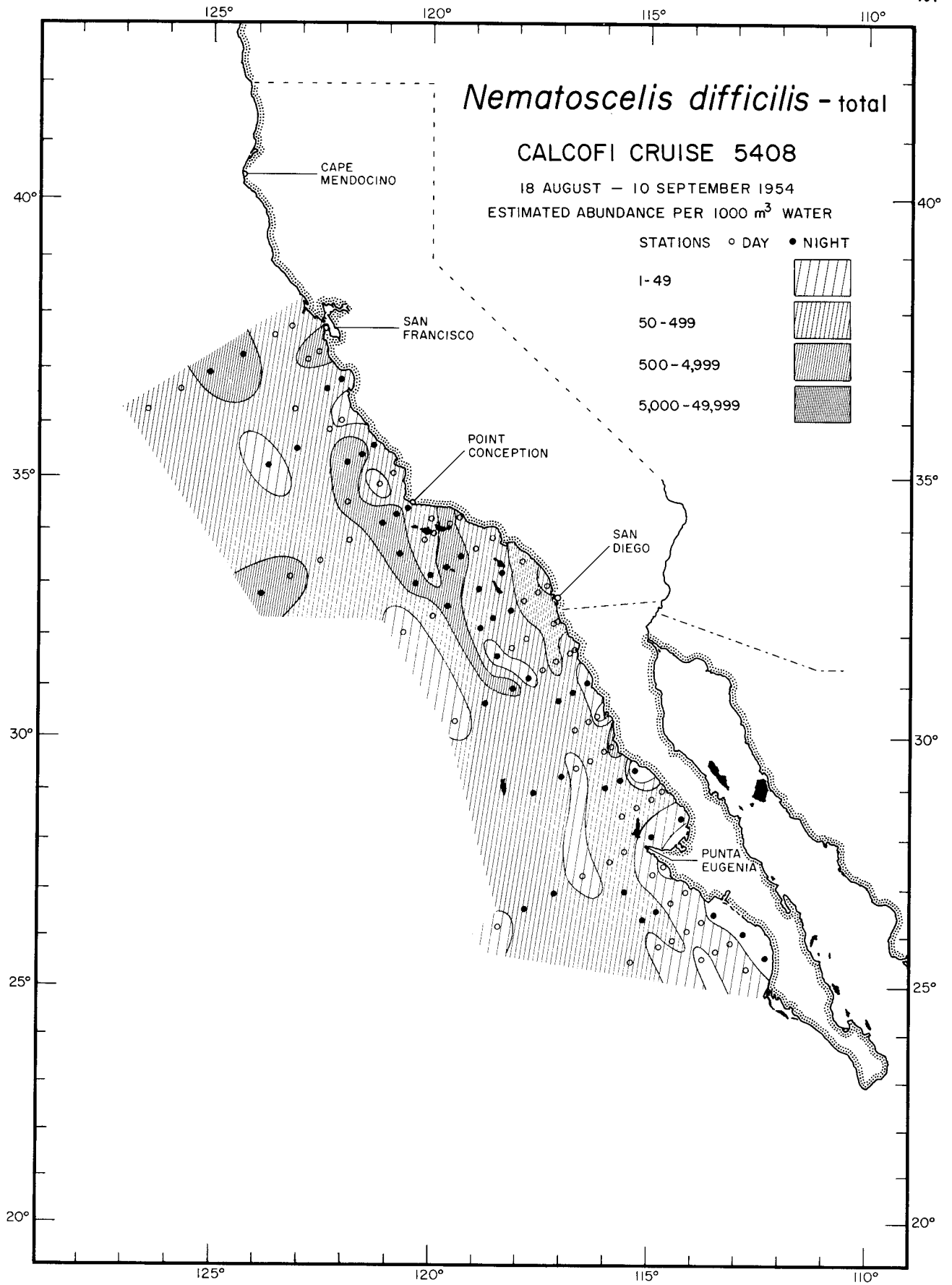


Euphausiacea
Nematoscelis difficilis - larvae
5810

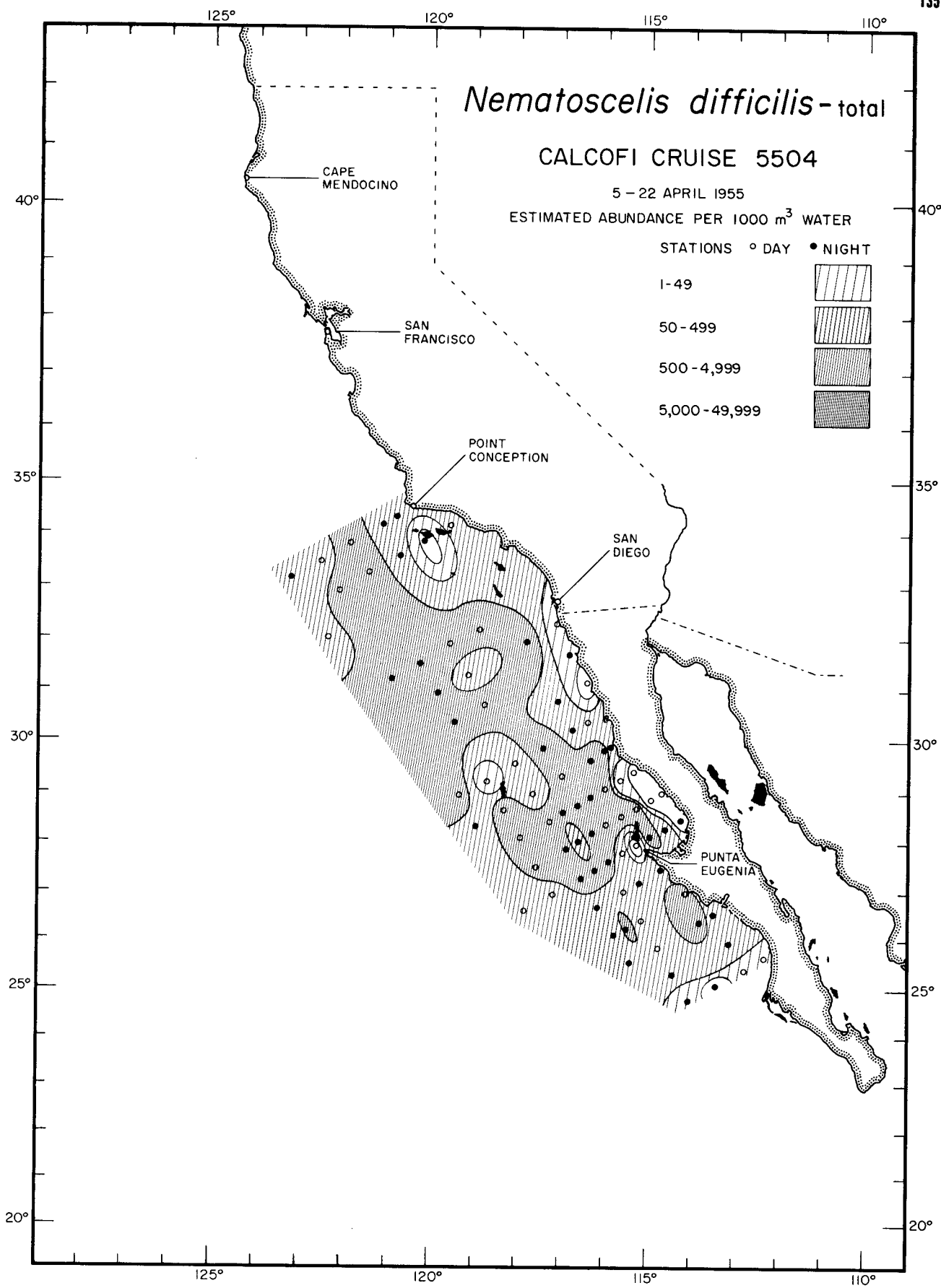




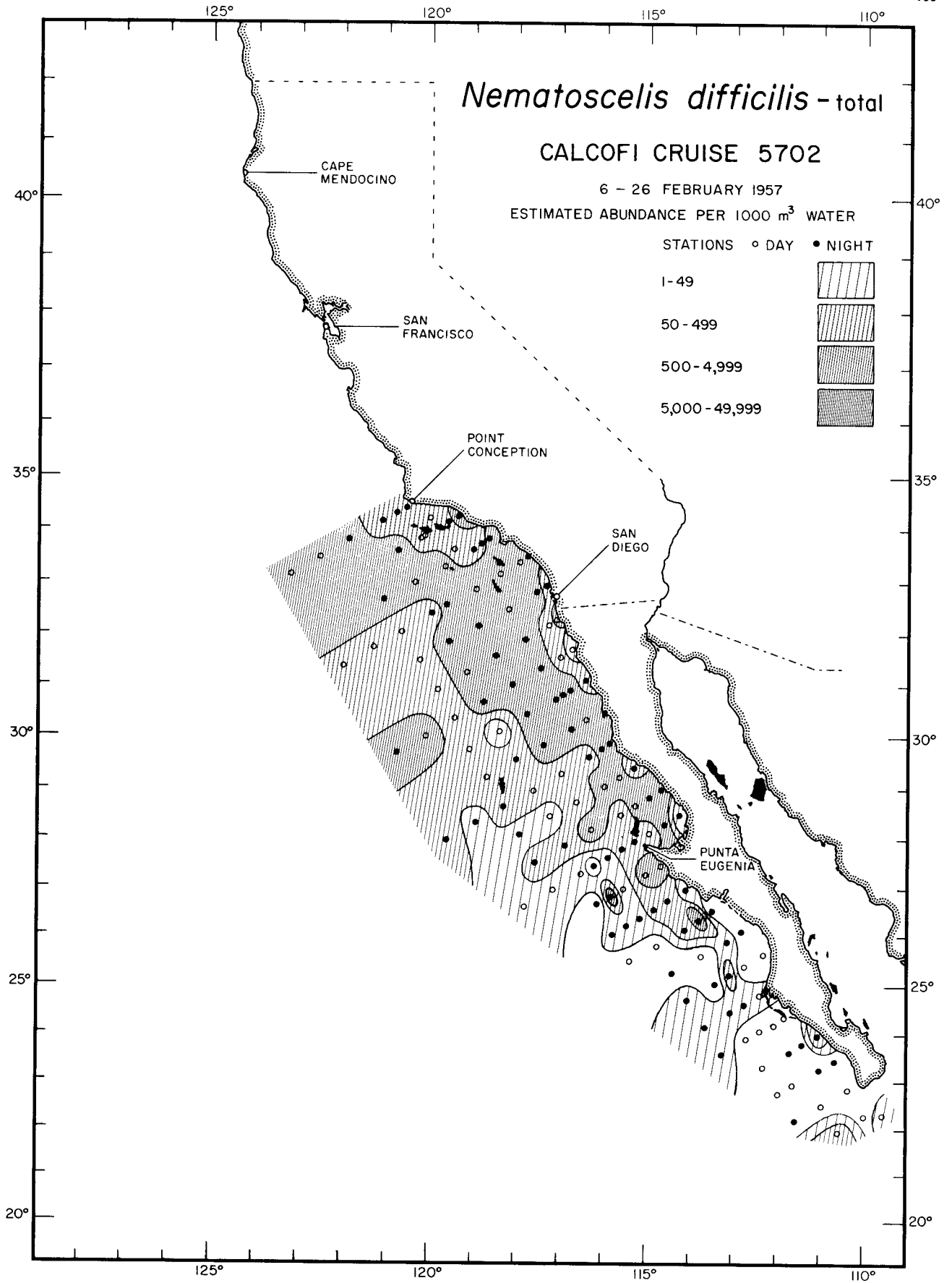
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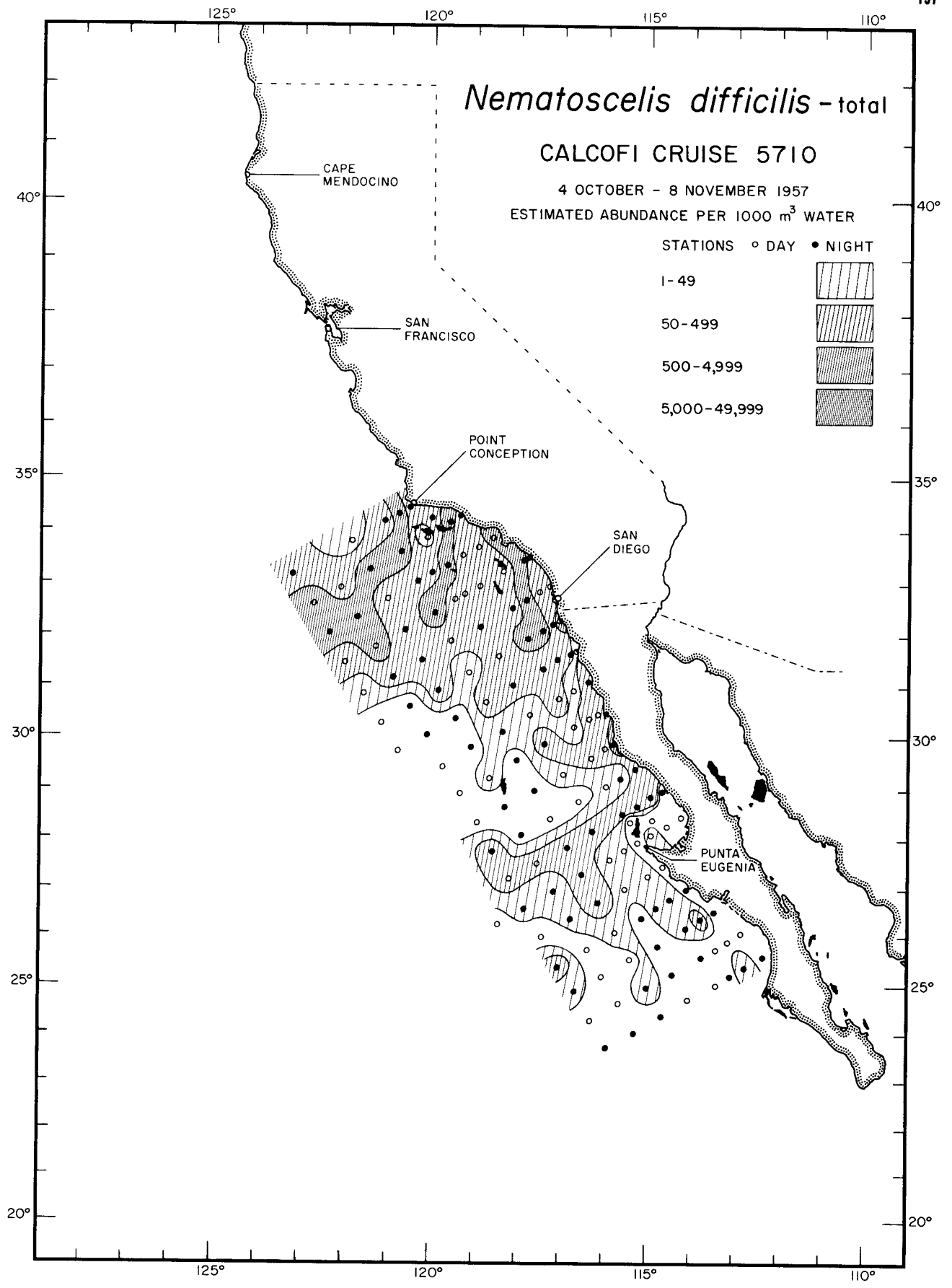
Euphausiacea
Nematoscelis difficilis - total
5408



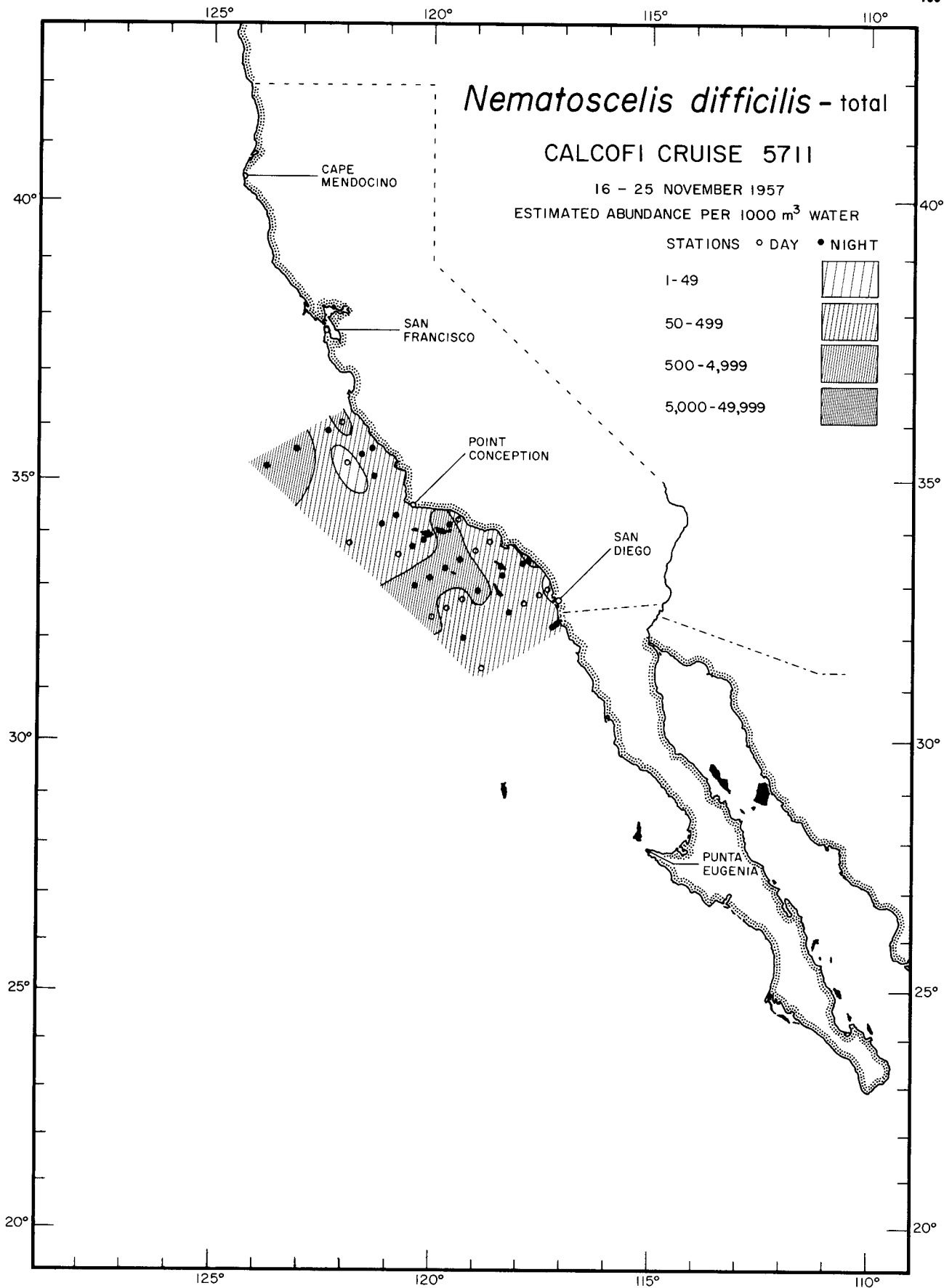
Euphausiacea
Nematoscelis difficilis - total
 5504



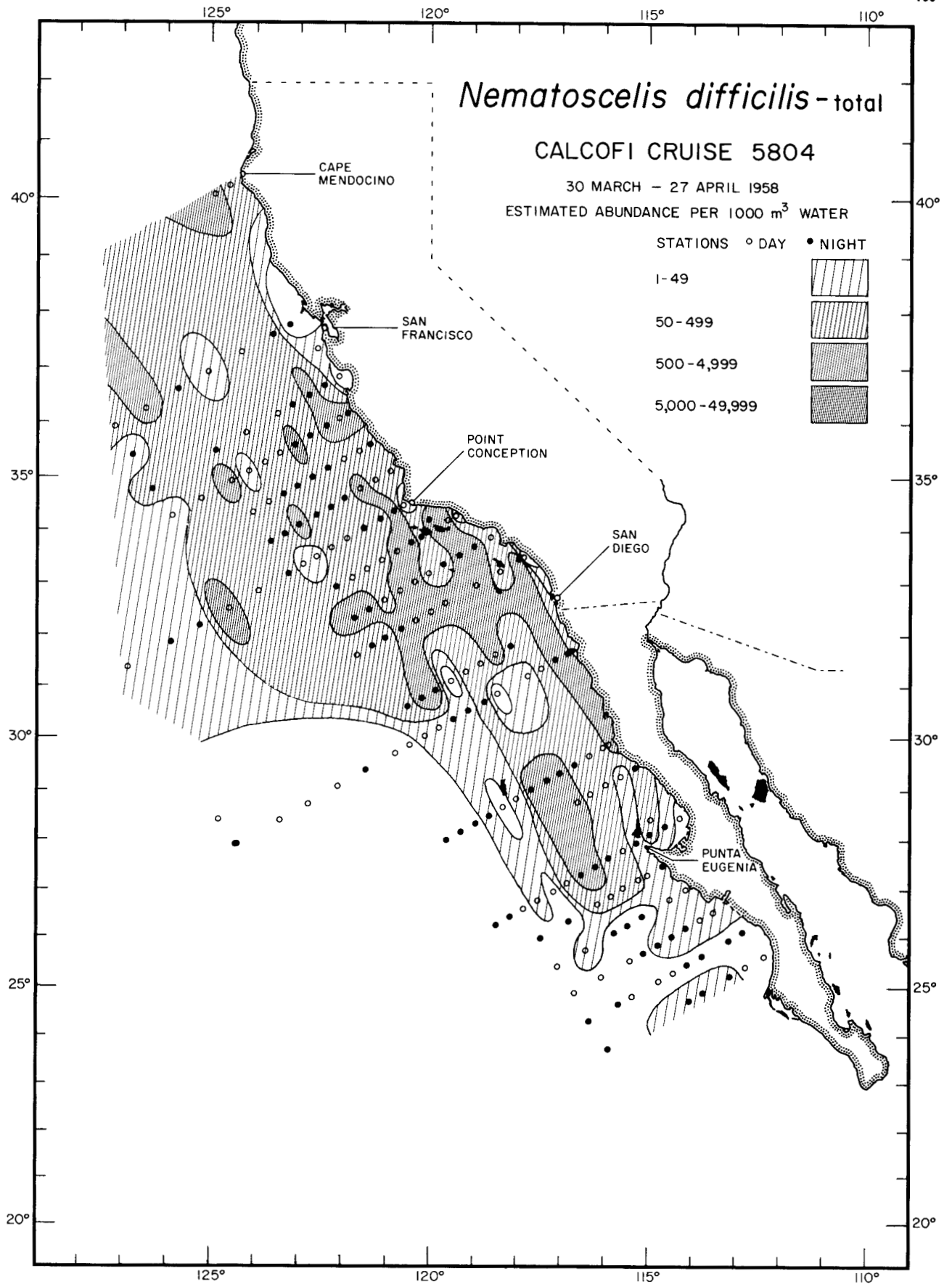
Euphausiacea
Nematoscelis difficilis - total
5702



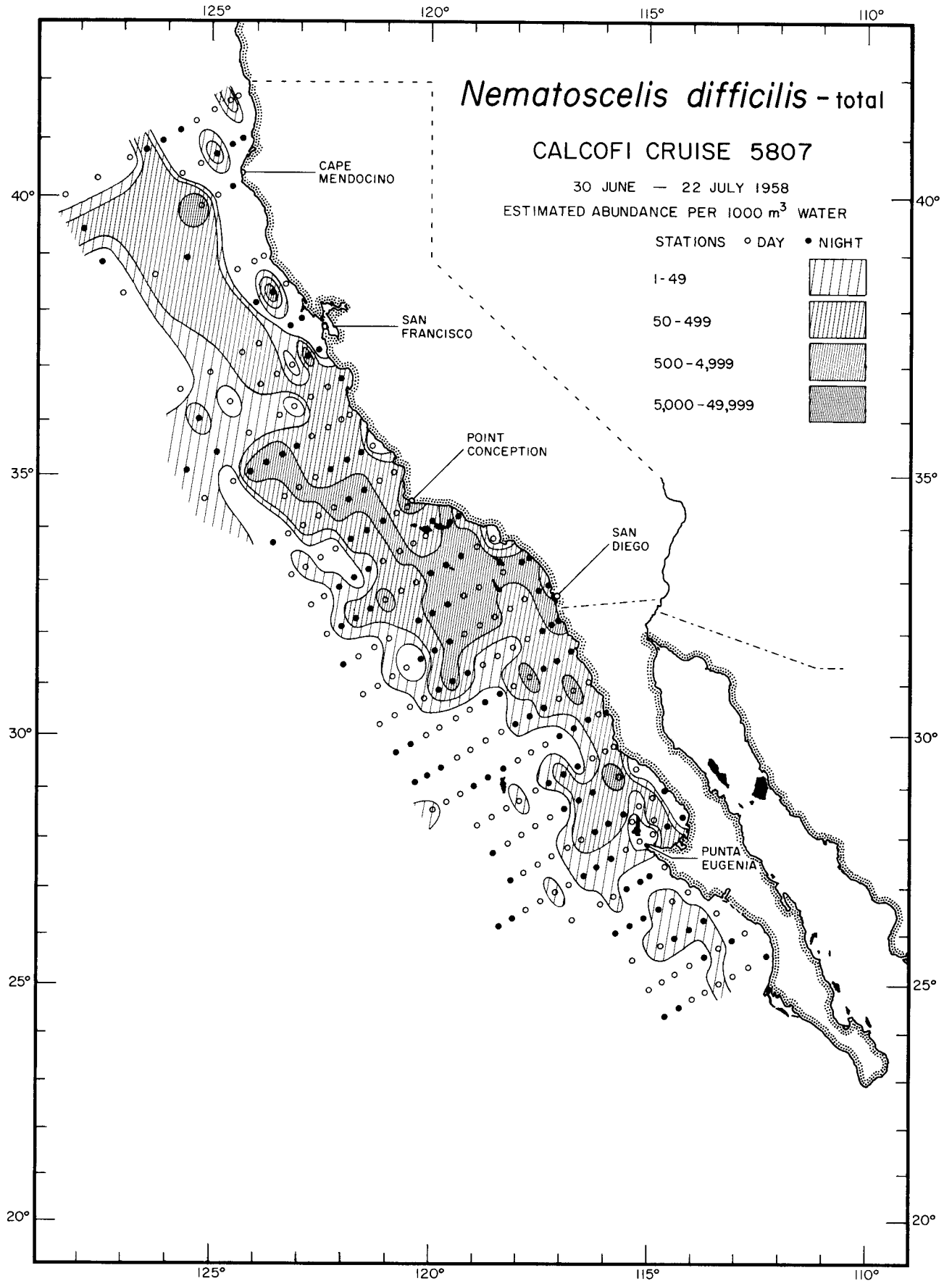
Euphausiacea
Nematoscelis difficilis - total
5710



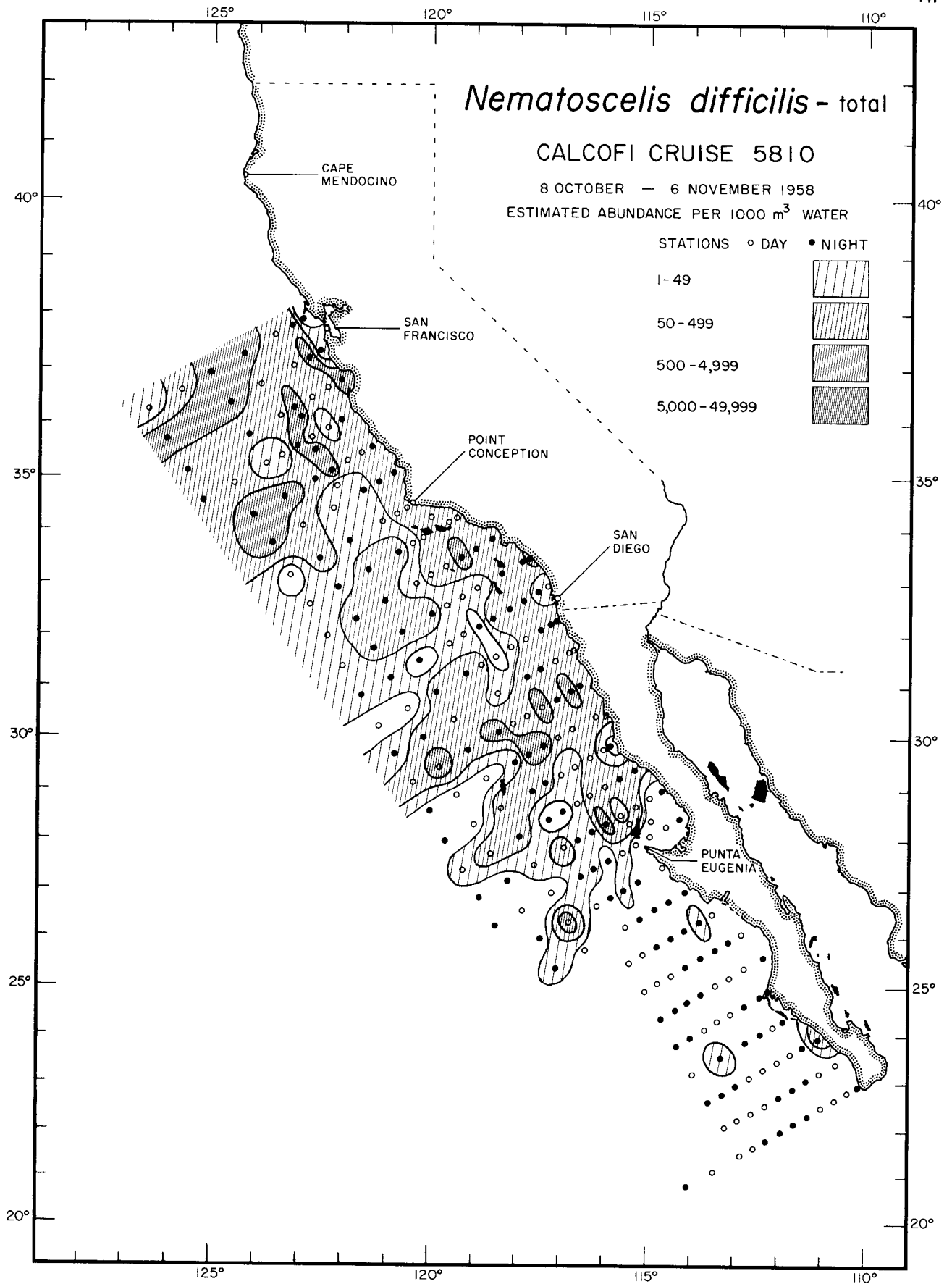
Euphausiacea
Nematoscelis difficilis - total
5711



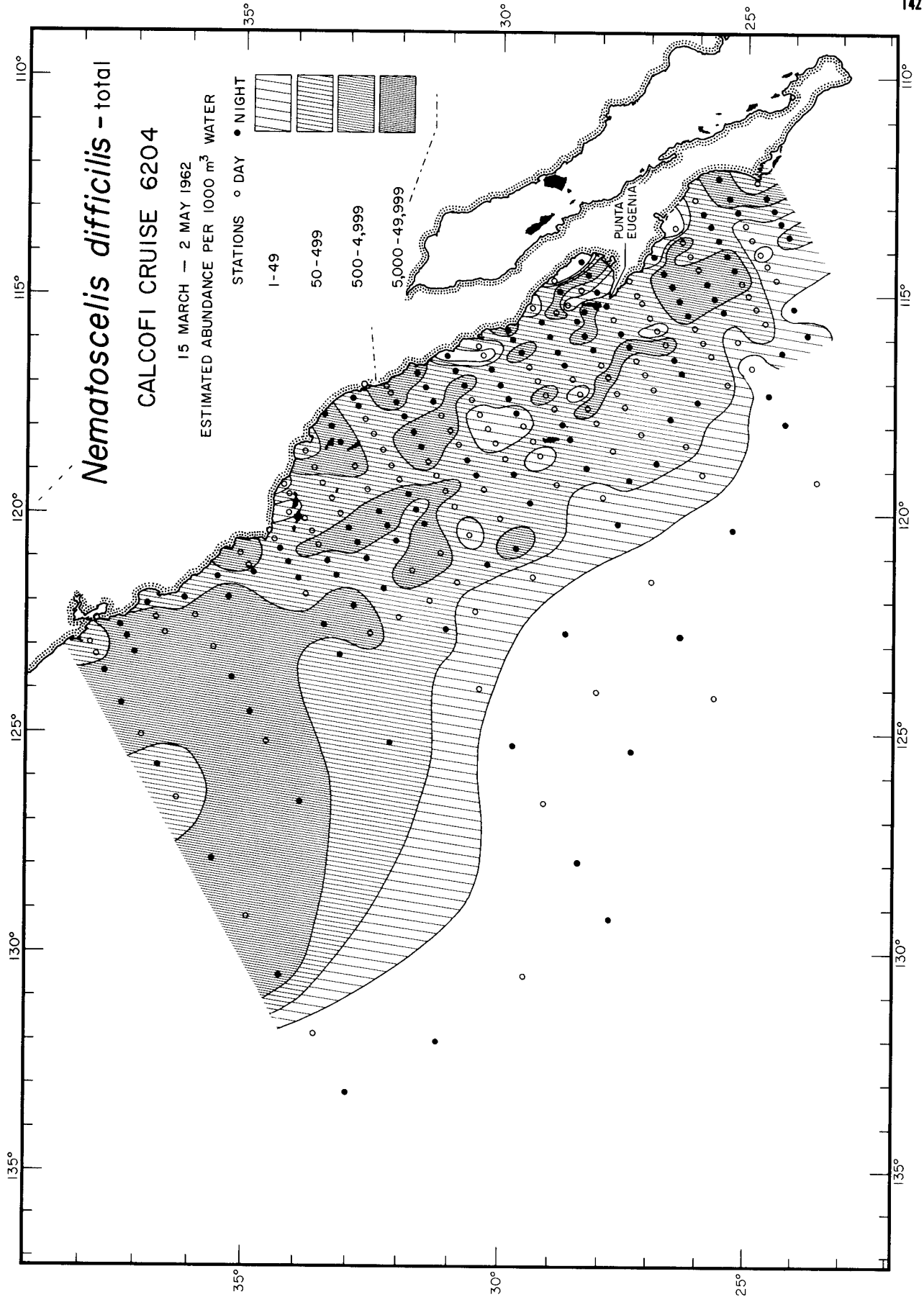
Euphausiacea
Nematoscelis difficilis - total
 5804



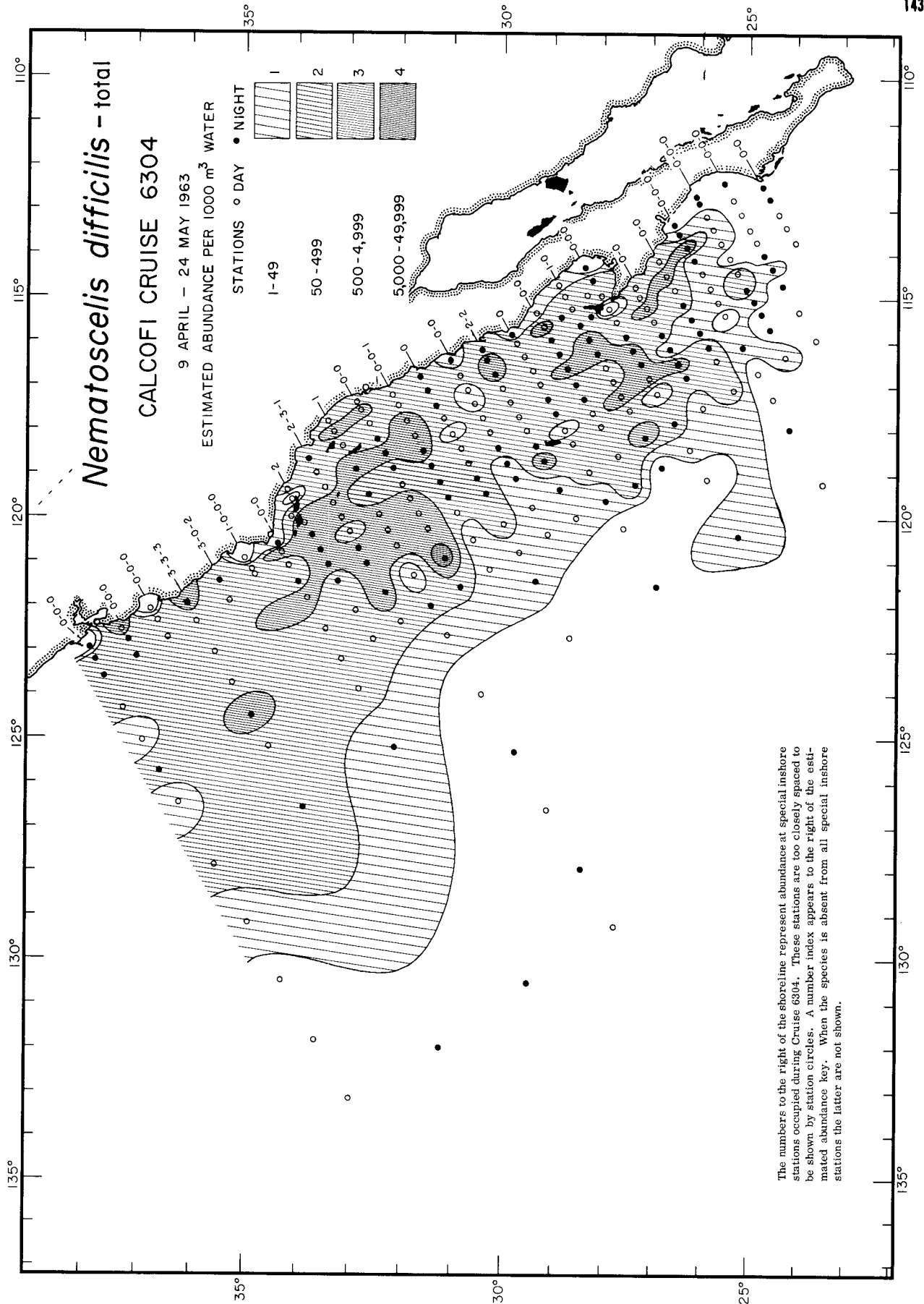
Euphausiacea
Nematoscelis difficilis - total
5807



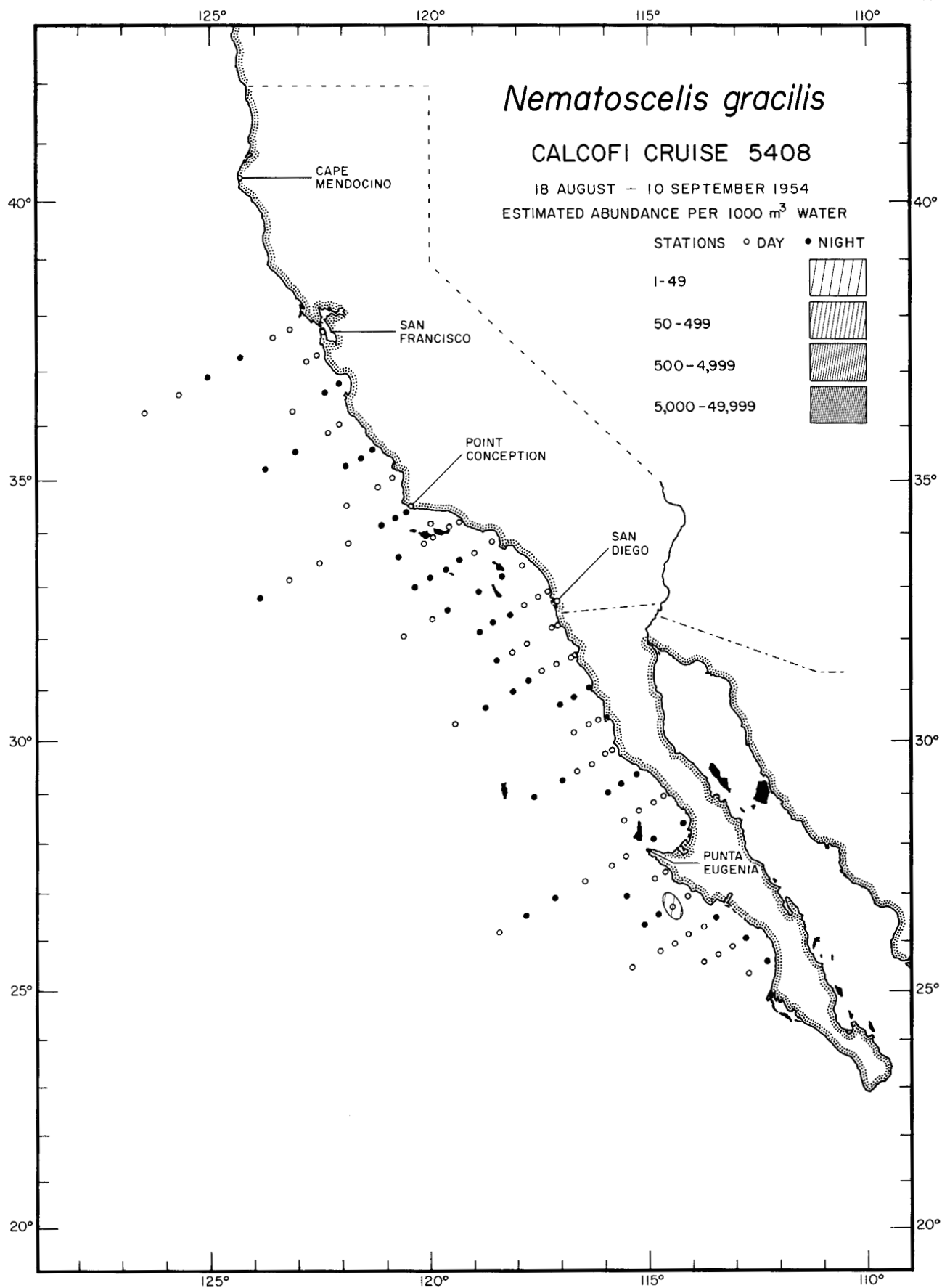
Euphausiacea
Nematoscelis difficilis - total
 5810



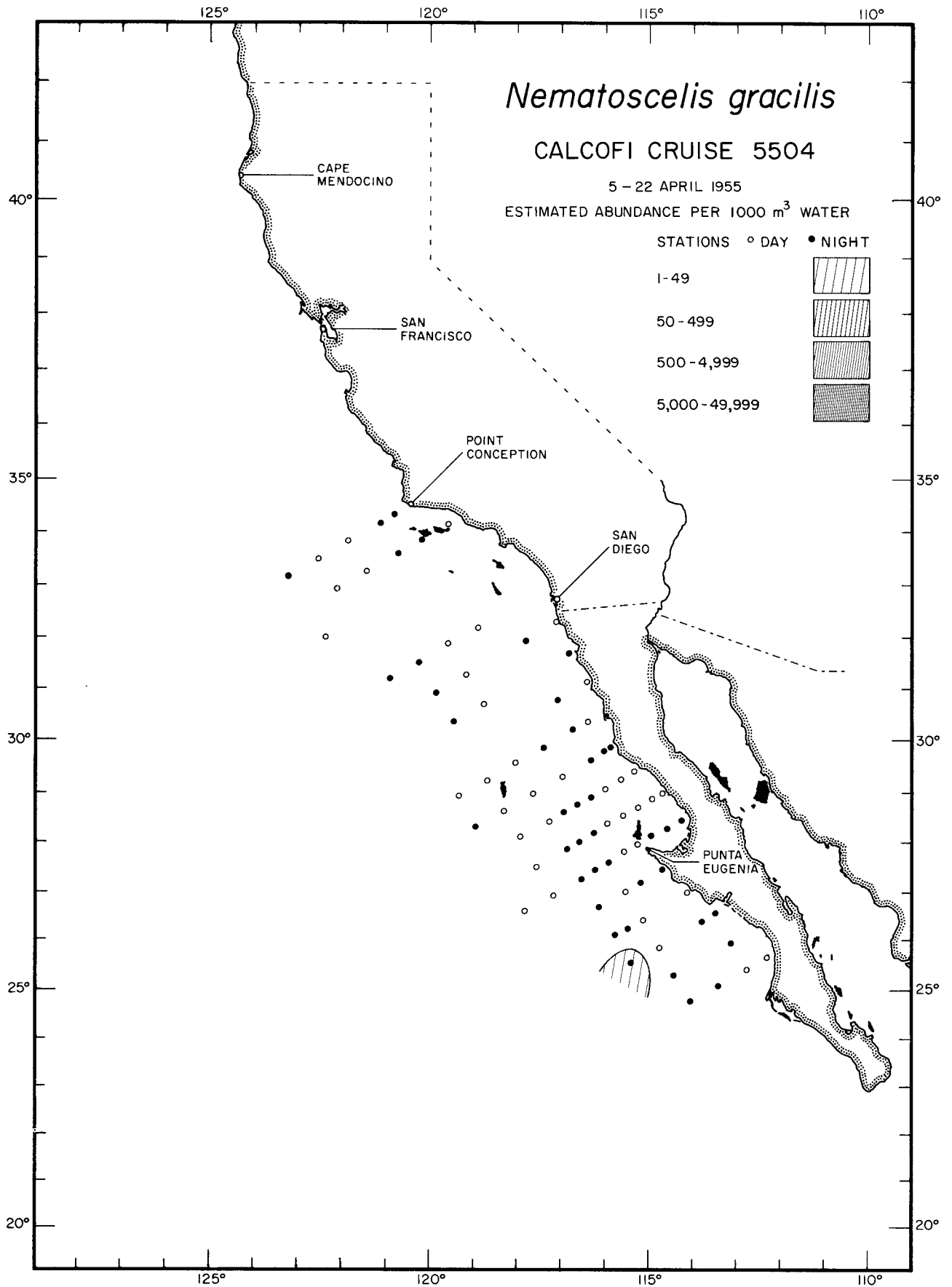
Euphausiacea
Nematoscelis difficilis - total
6204



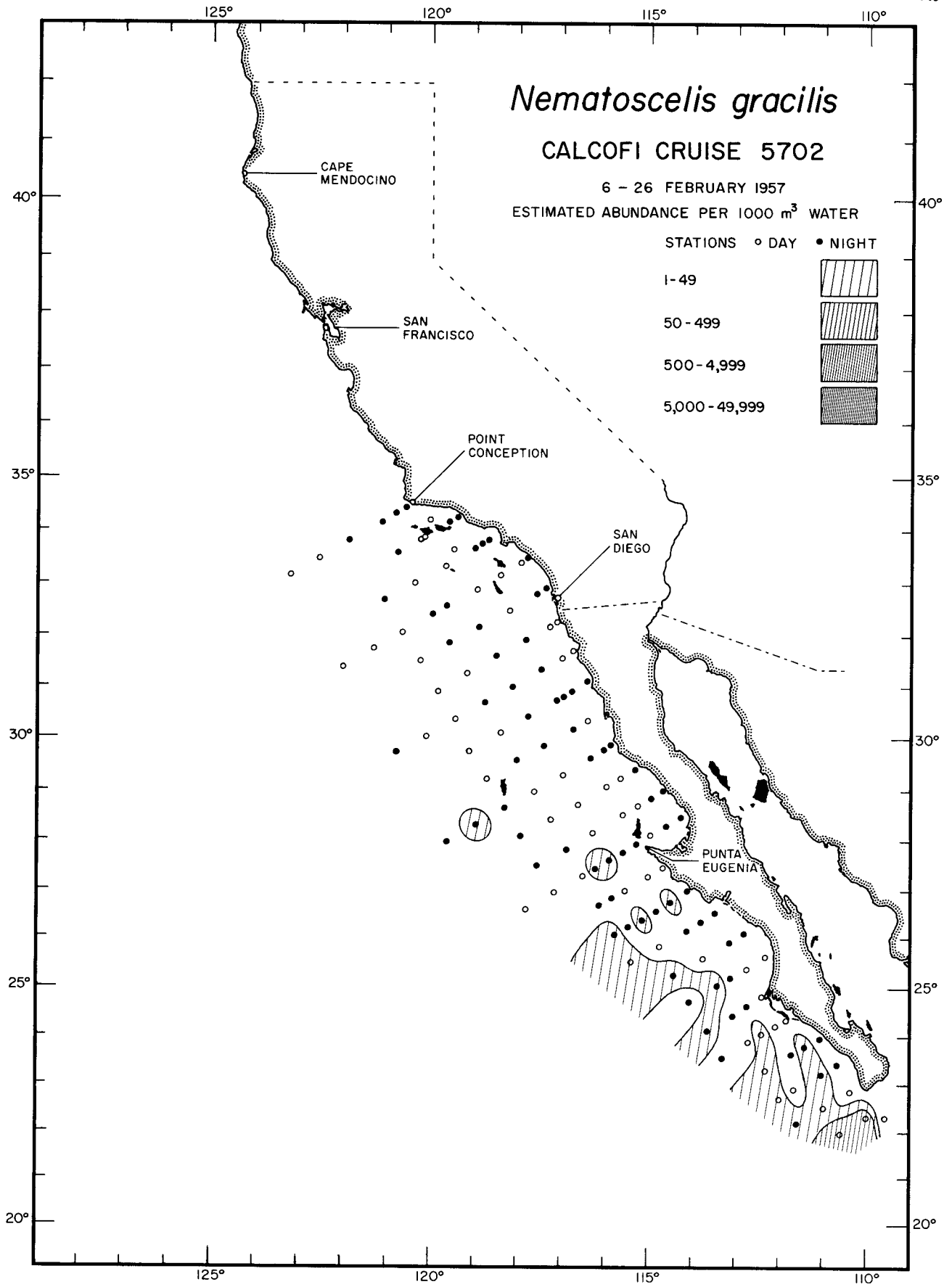
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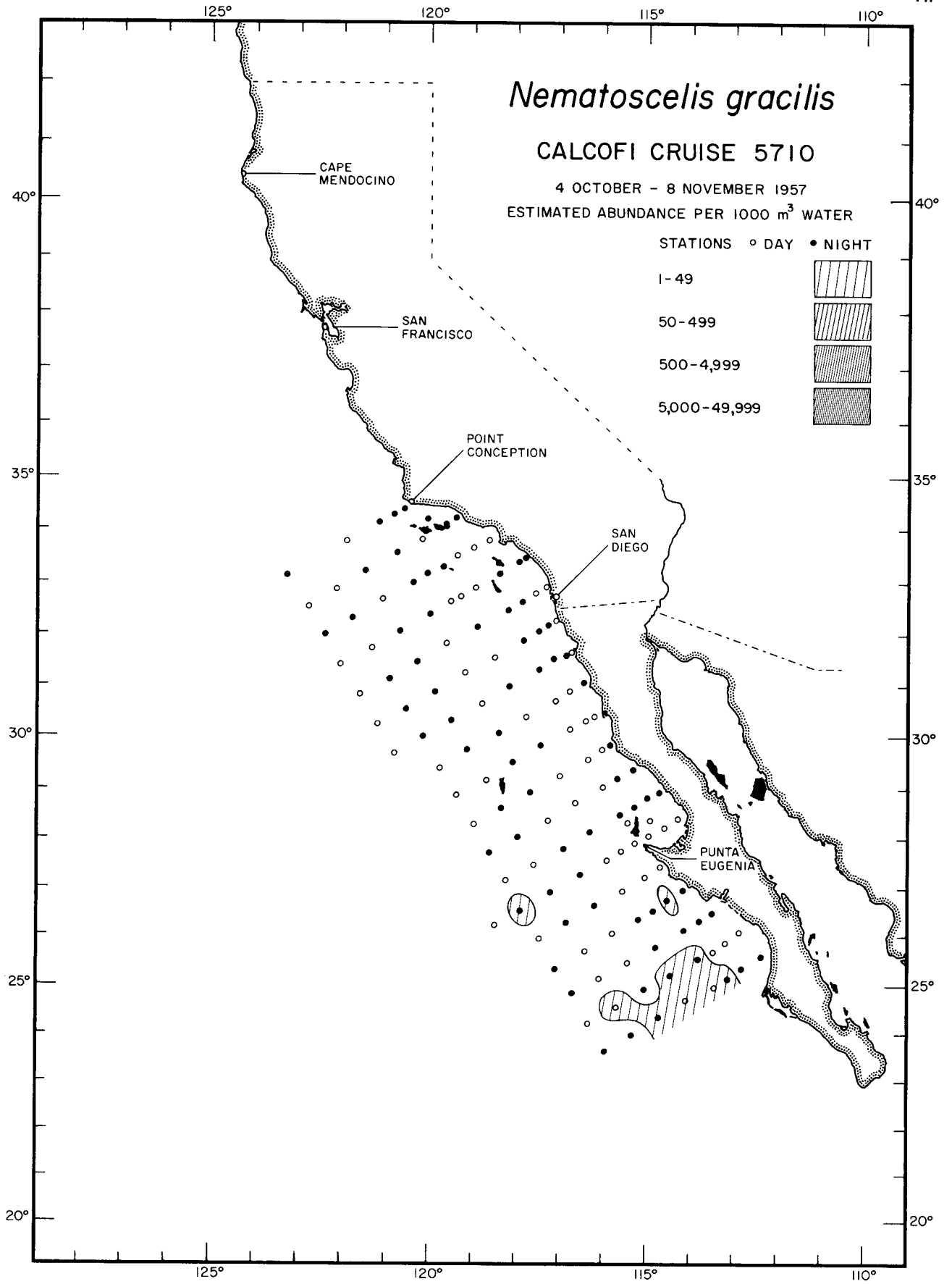
Euphausiacea
Nematoscelis gracilis
5408



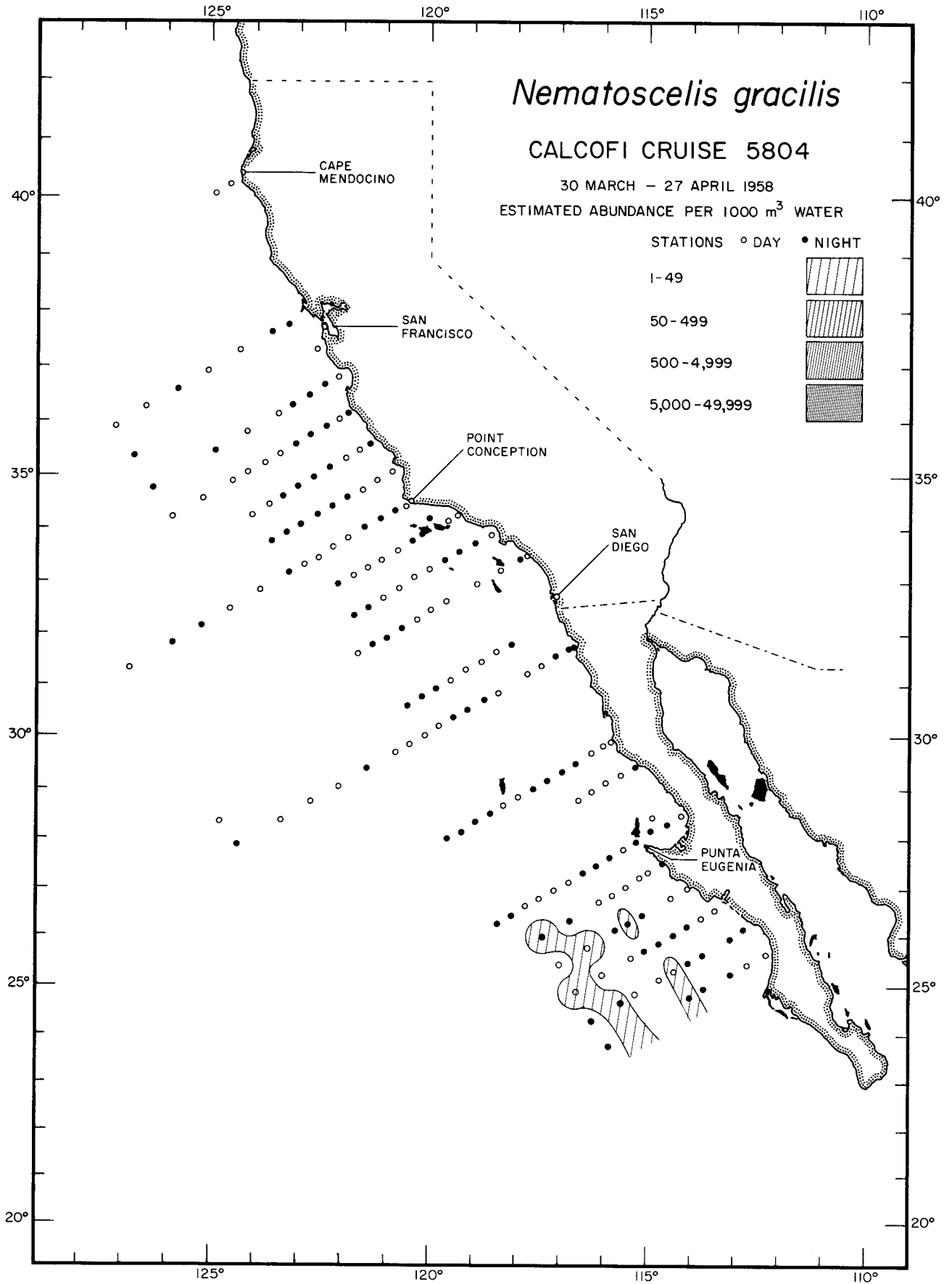
Euphausiacea
Nematoscelis gracilis
5504



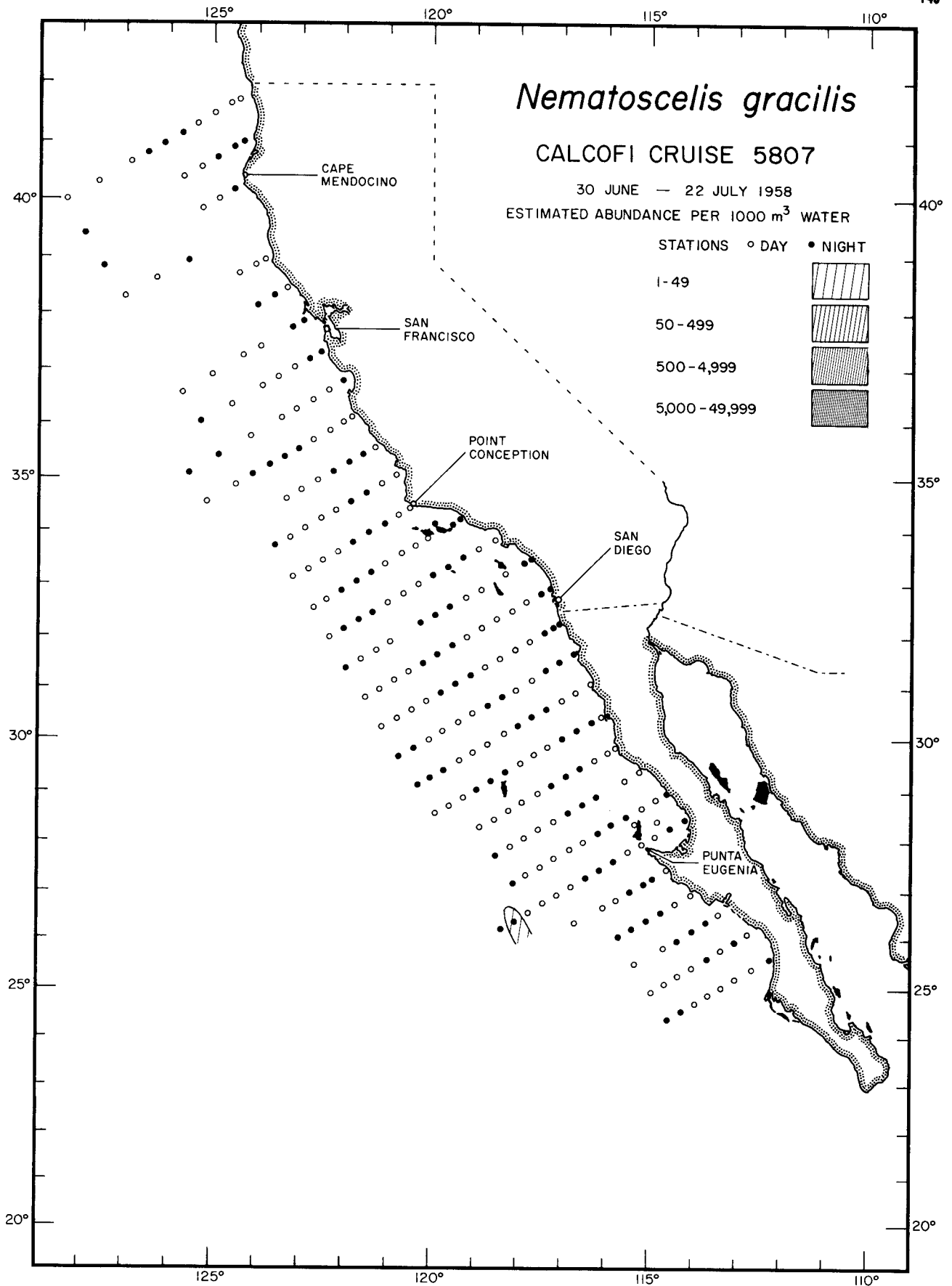
Euphausiacea
Nematoscelis gracilis
5702



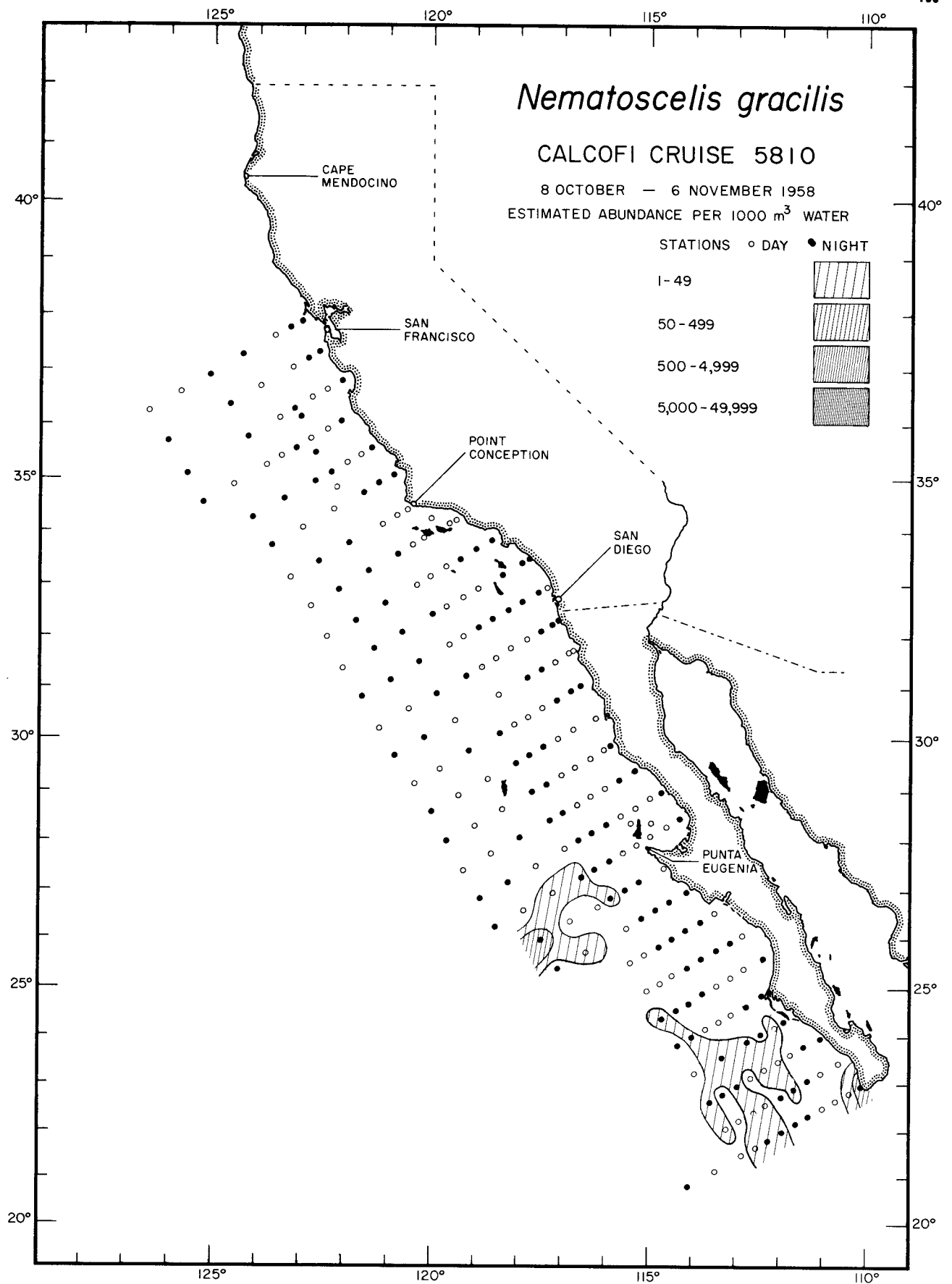
Euphausiacea
Nematoscelis gracilis
5710



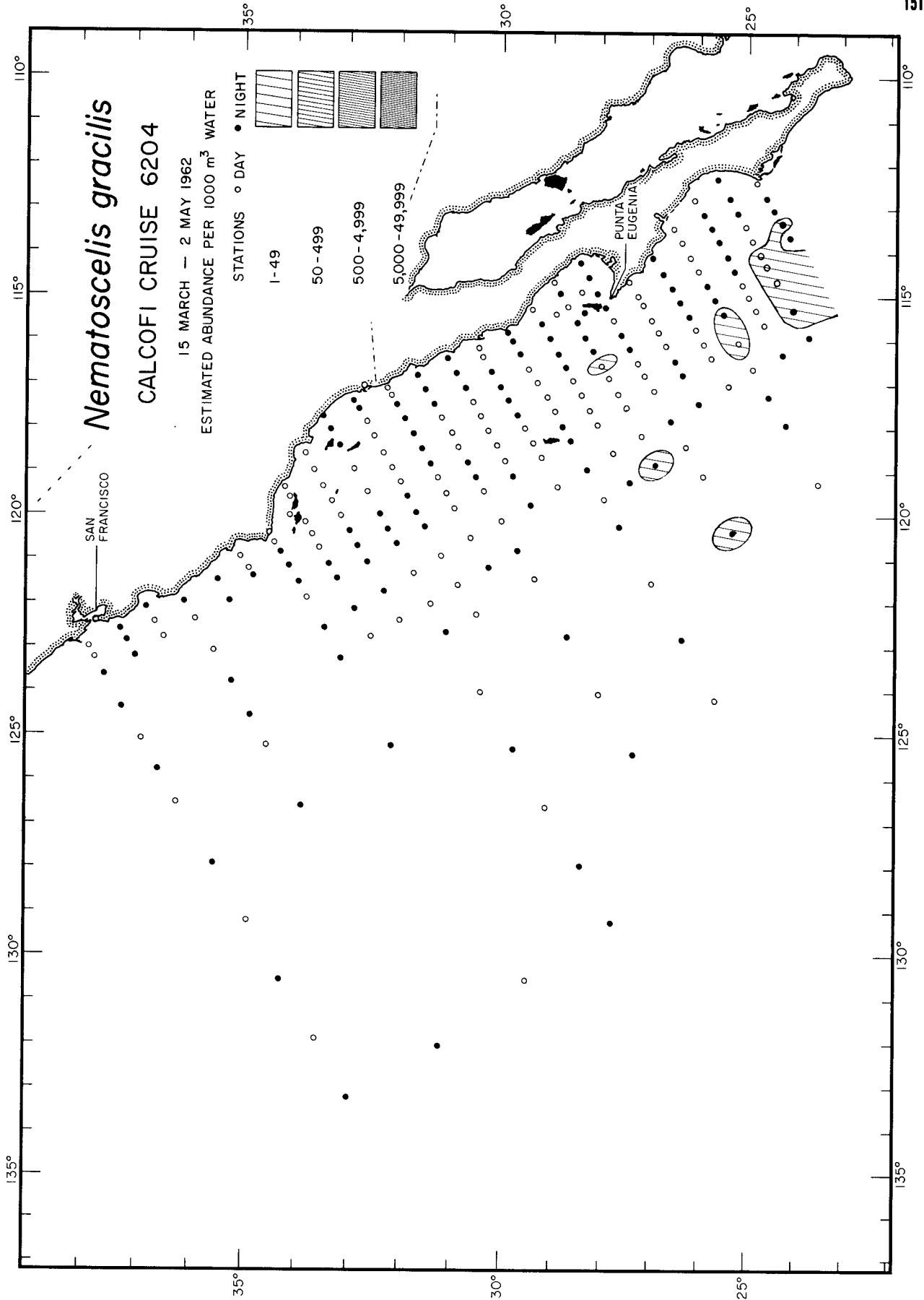
Euphausiacea
Nematoscelis gracilis
5804



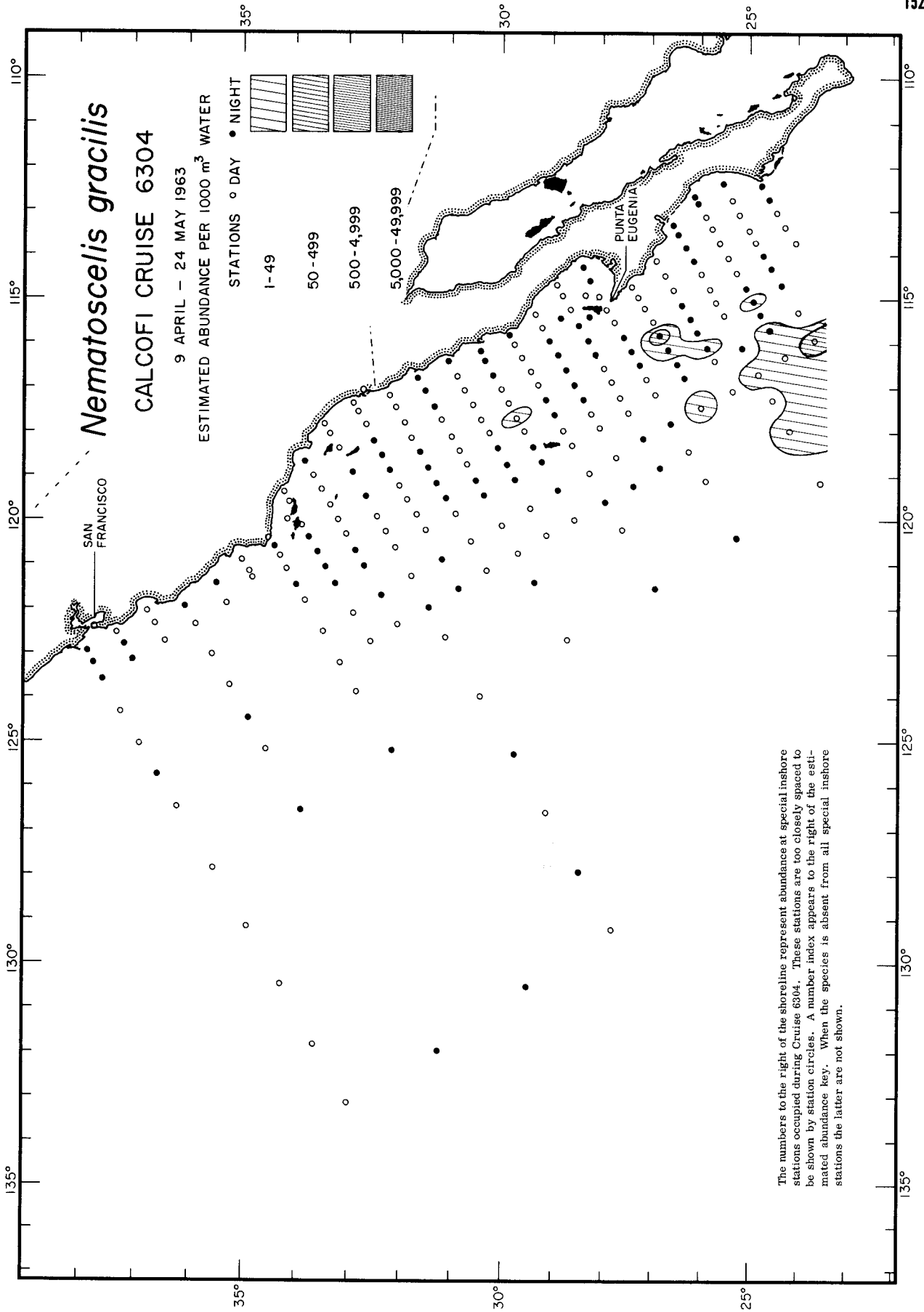
Euphausiacea
Nematoscelis gracilis
5807



Euphausiacea
Nematoscelis gracilis
5810

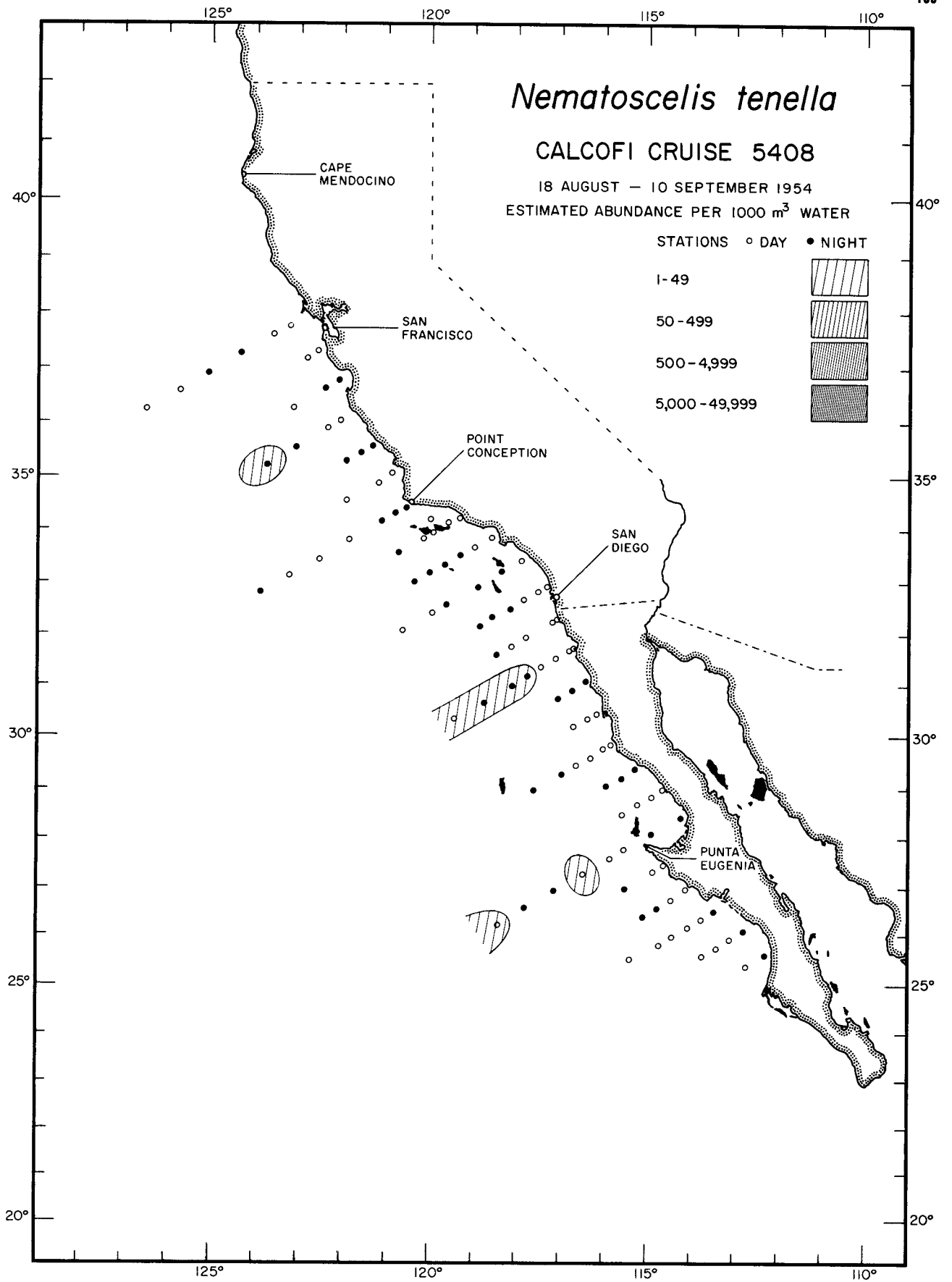


Euphausiacea
Nematoscelis gracilis
6204

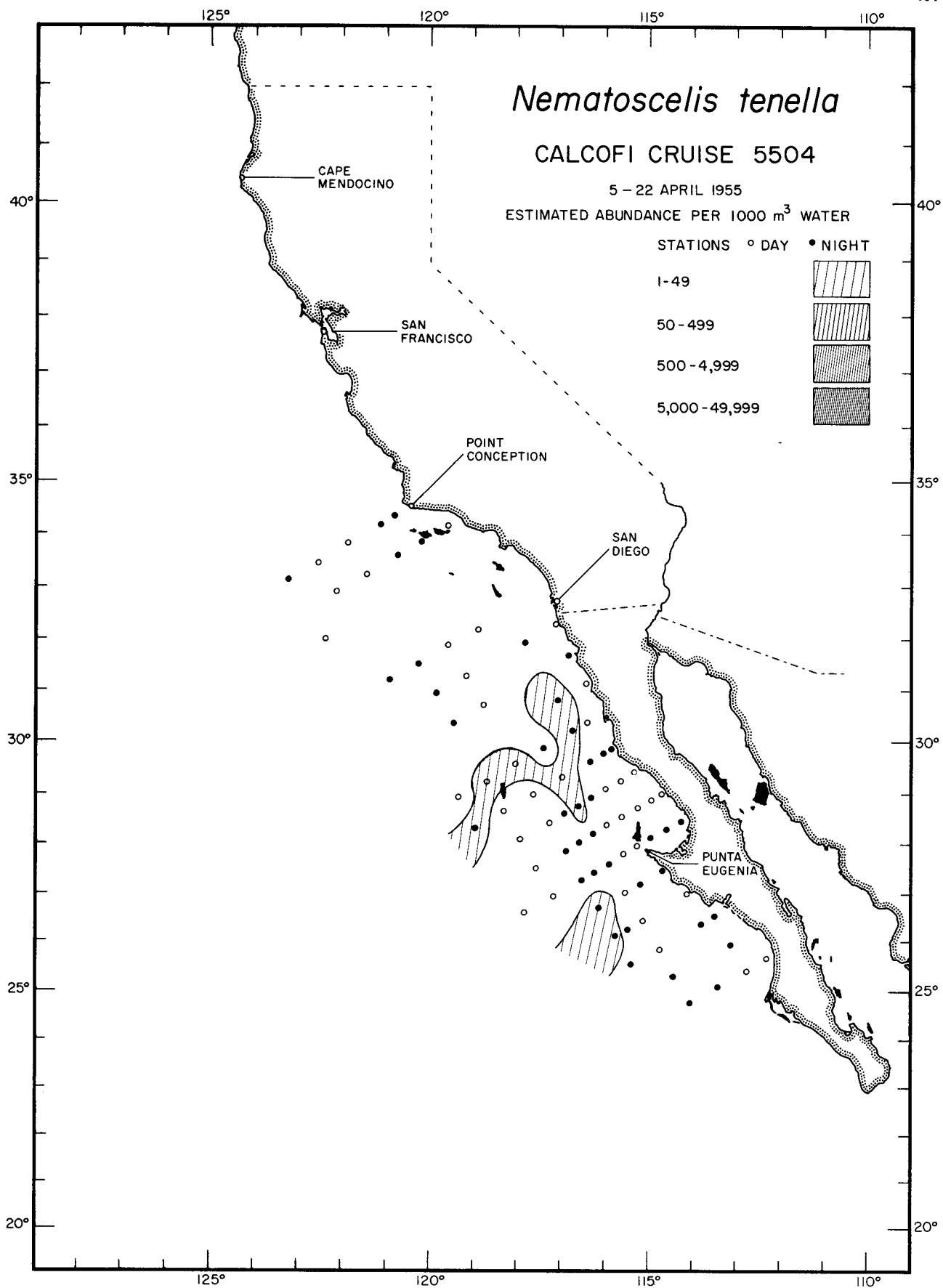


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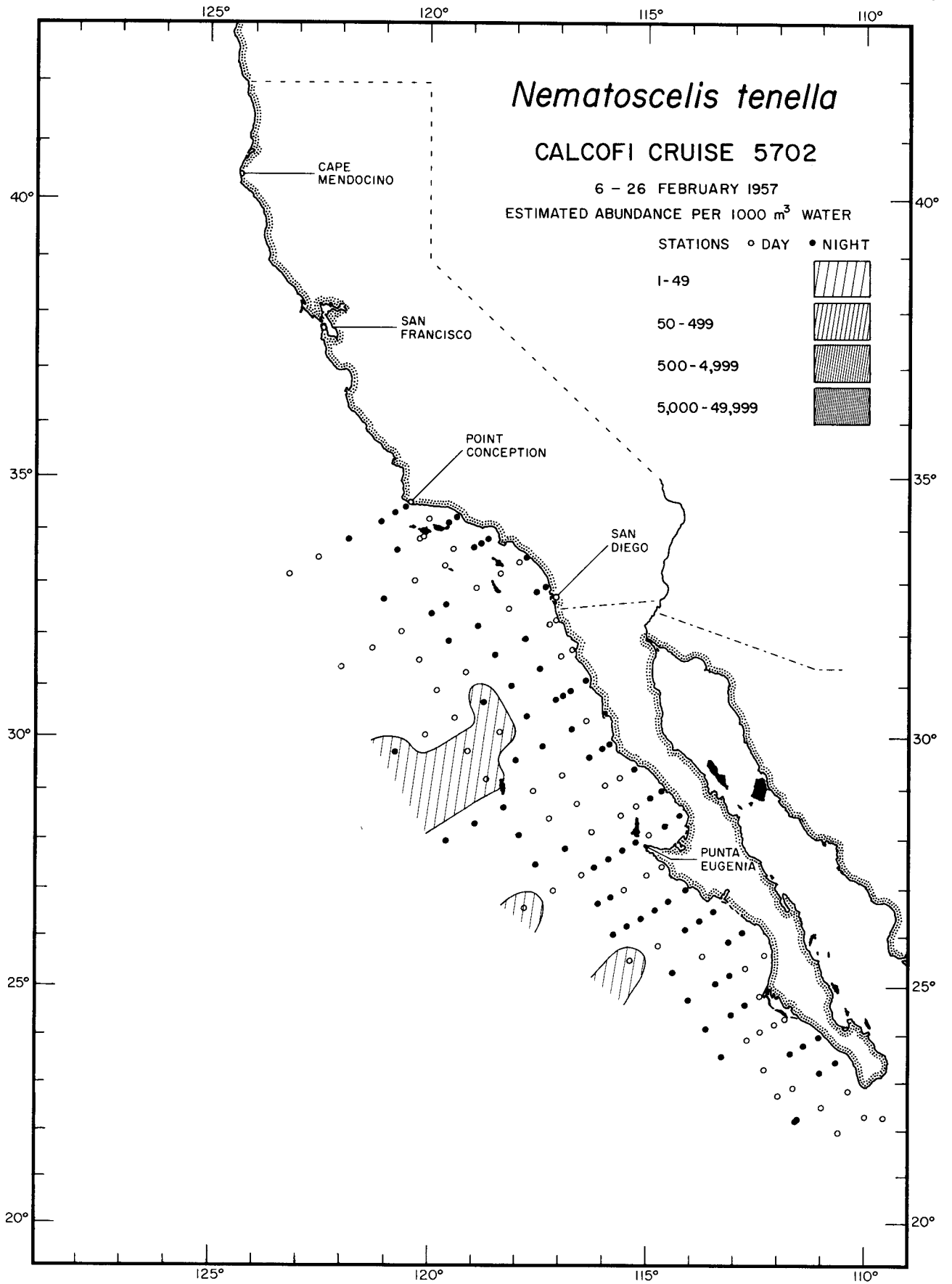
Euphausiacea
Nematoscelis gracilis
 6304



Euphausiacea
Nematoscelis tenella
5408



Euphausiacea
Nematoscelis tenella
5504



Nematoscelis tenella

CALCOFI CRUISE 5702

6 - 26 FEBRUARY 1957

ESTIMATED ABUNDANCE PER 1000 m³ WATER

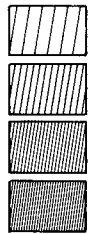
STATIONS ○ DAY ● NIGHT

1-49

50-499

500-4,999

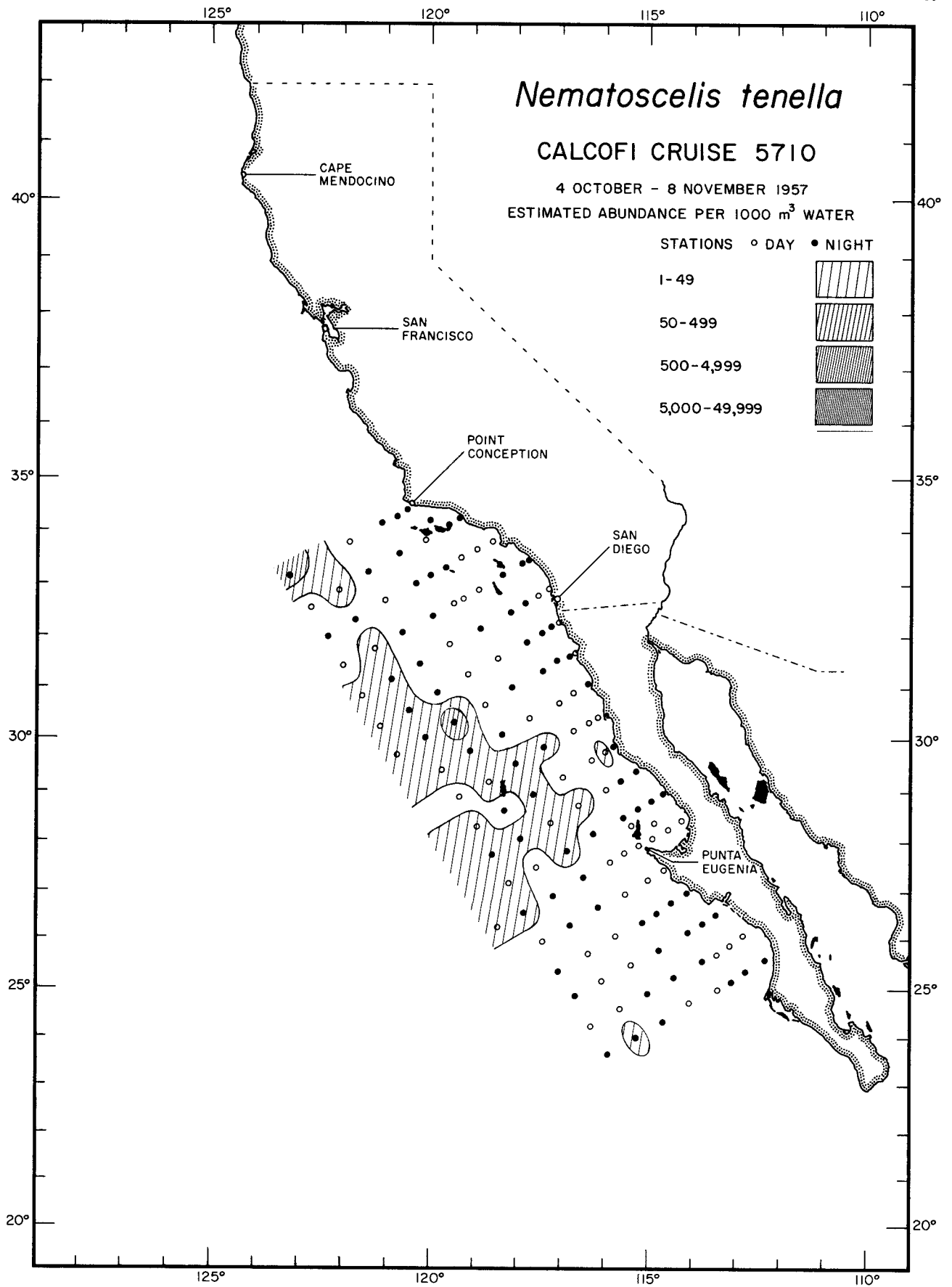
5,000-49,999



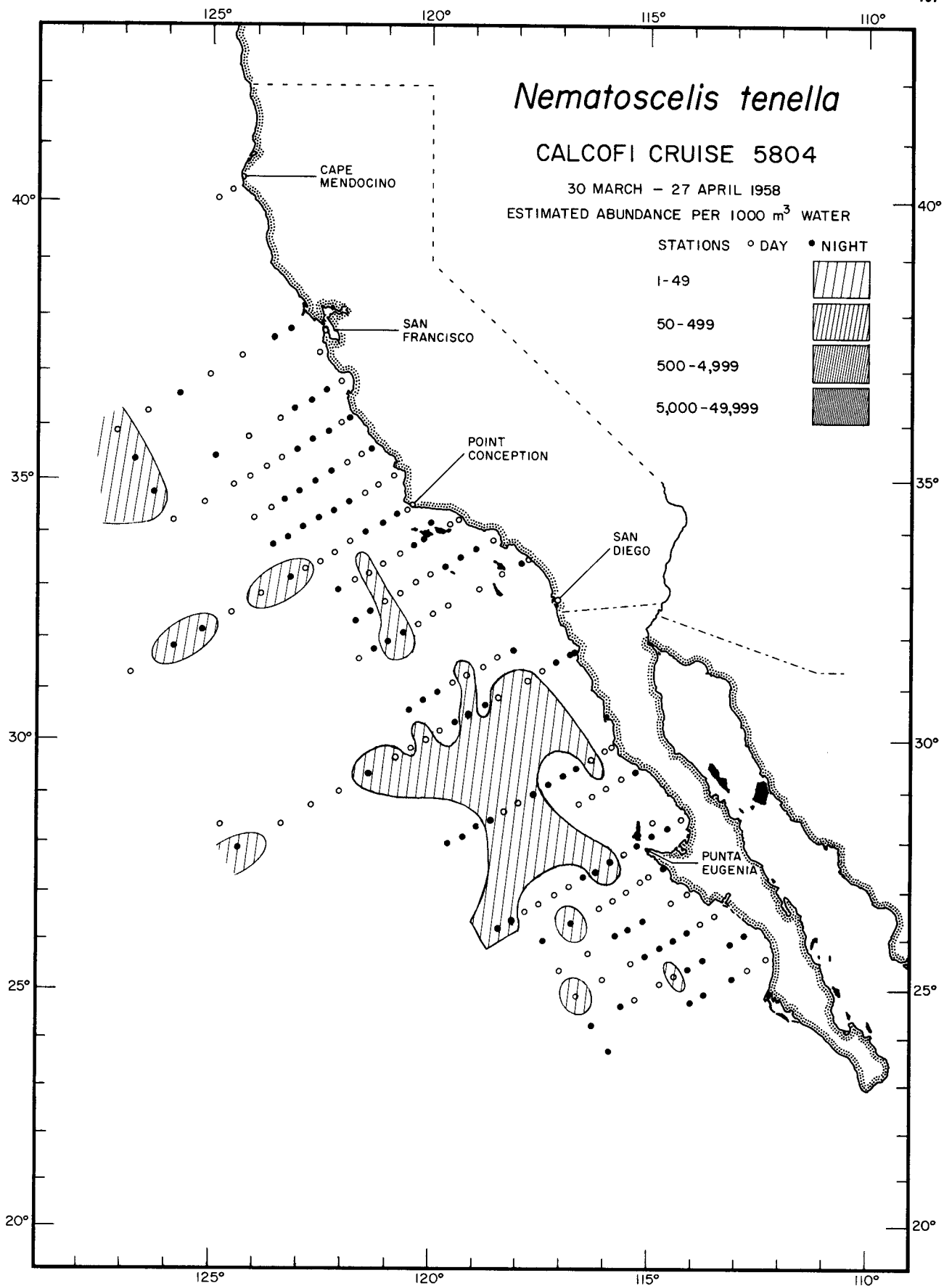
Euphausiacea

Nematoscelis tenella

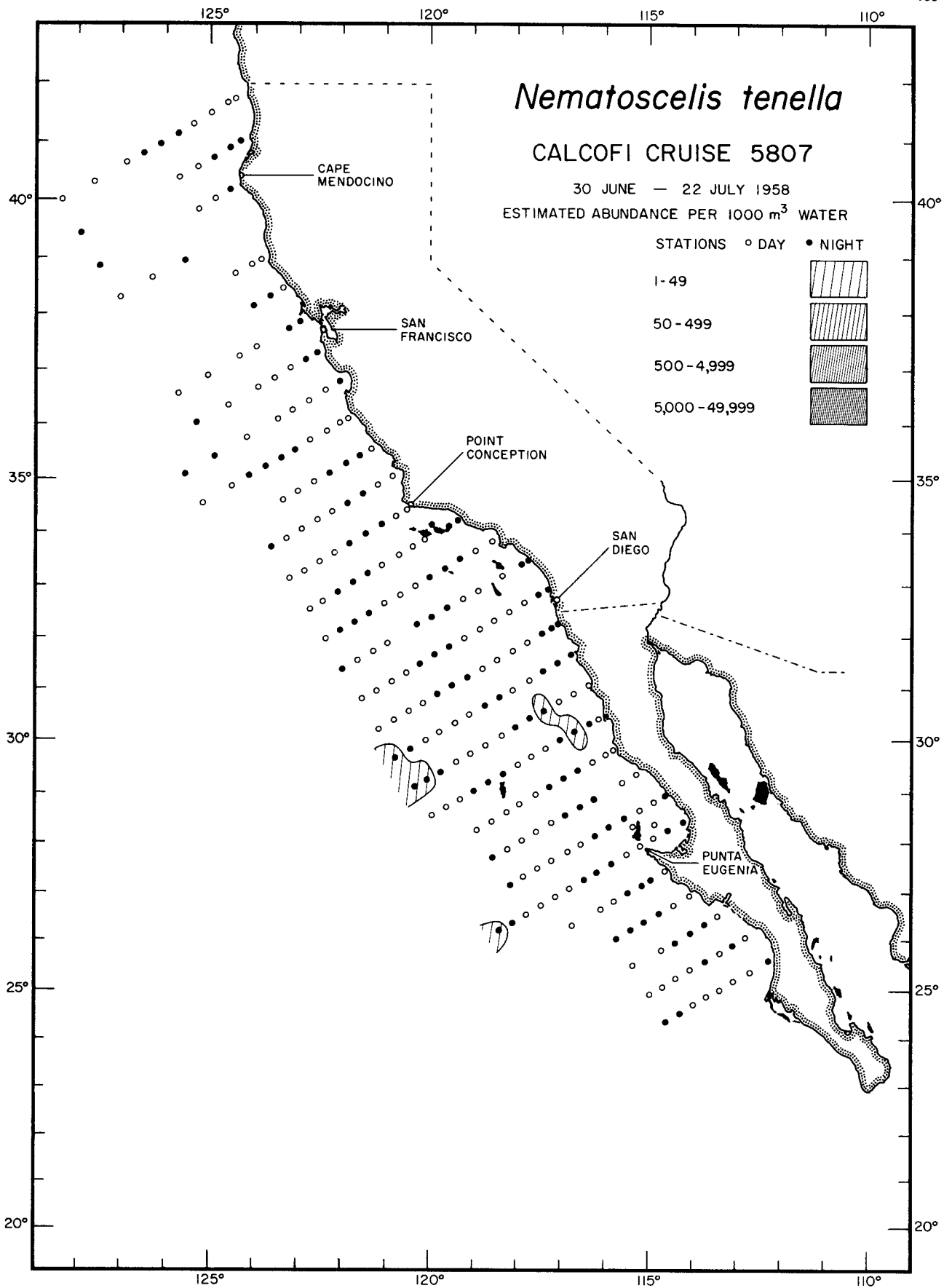
5702



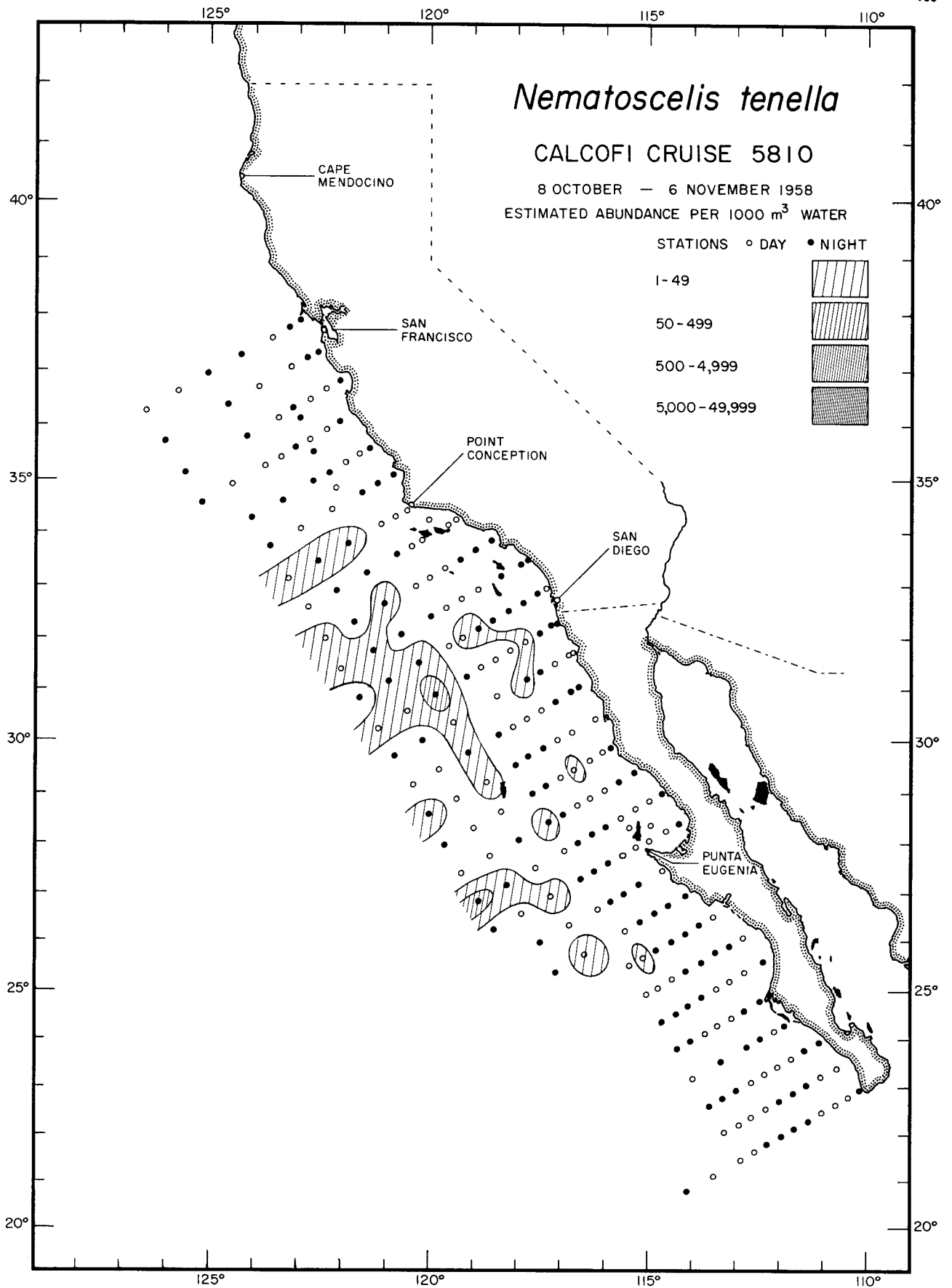
Euphausiacea
Nematoscelis tenella
5710



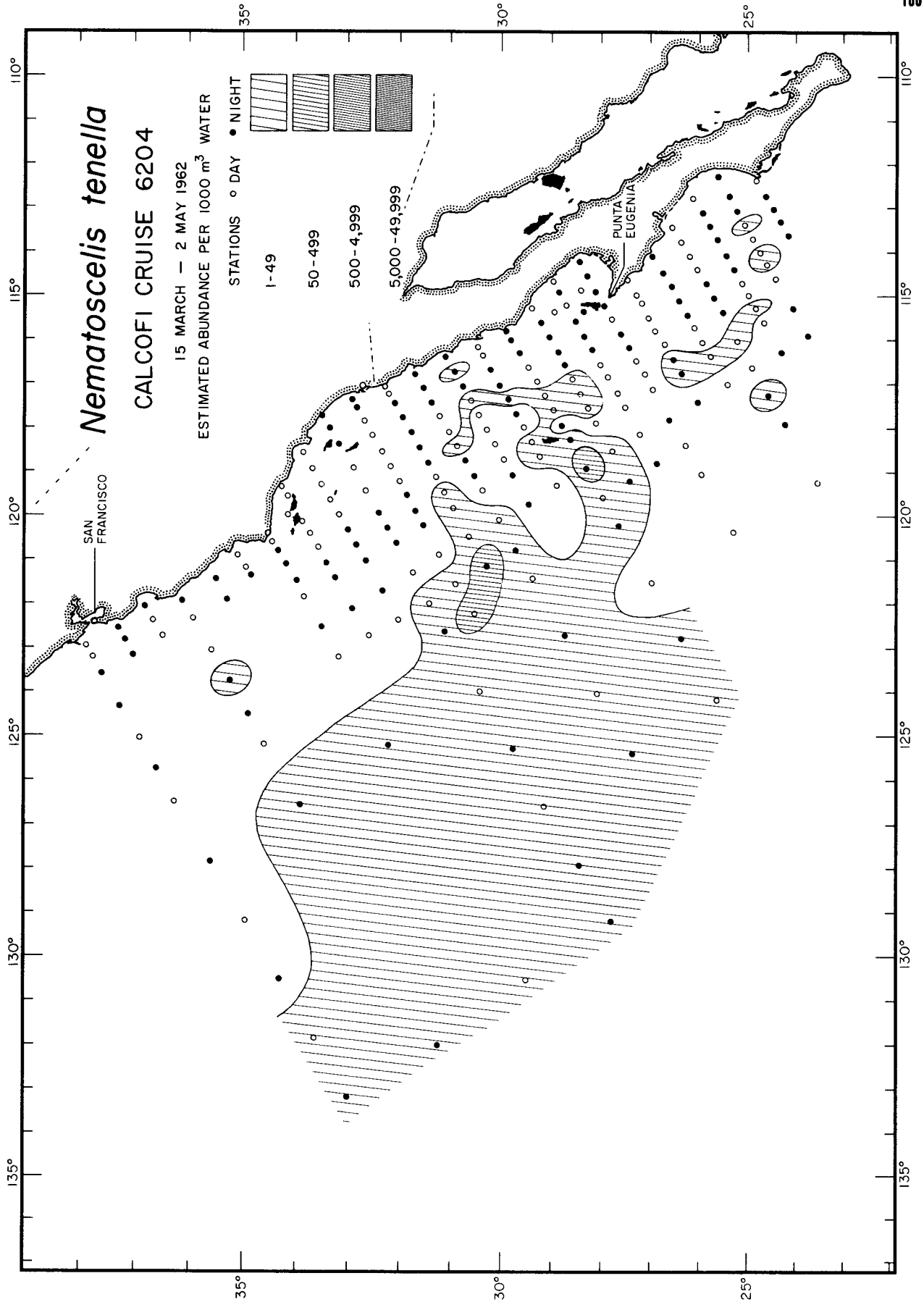
Euphausiacea
Nematoscelis tenella
 5804



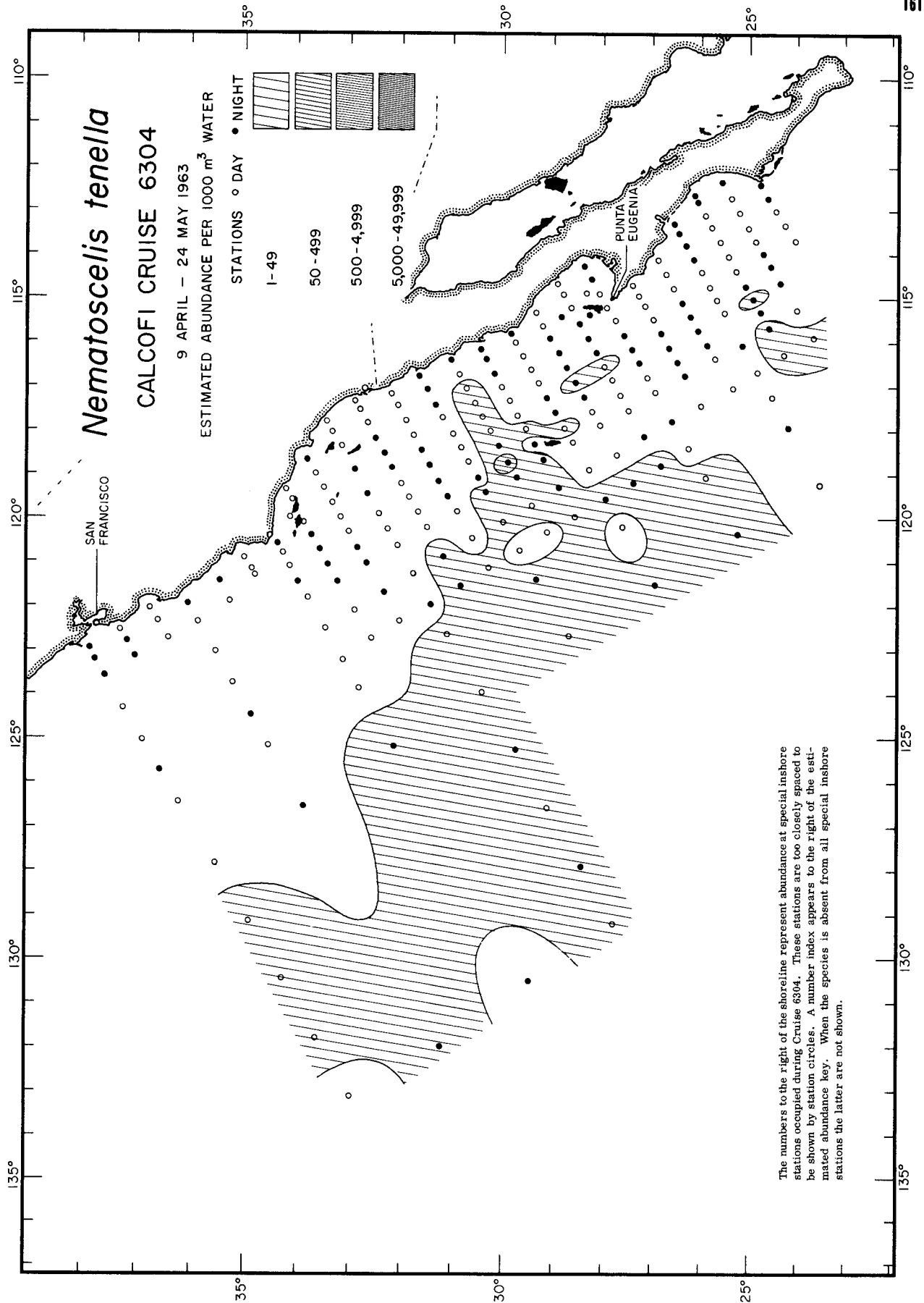
Euphausiacea
Nematoscelis tenella
 5807



Euphausiacea
Nematoscelis tenella
5810

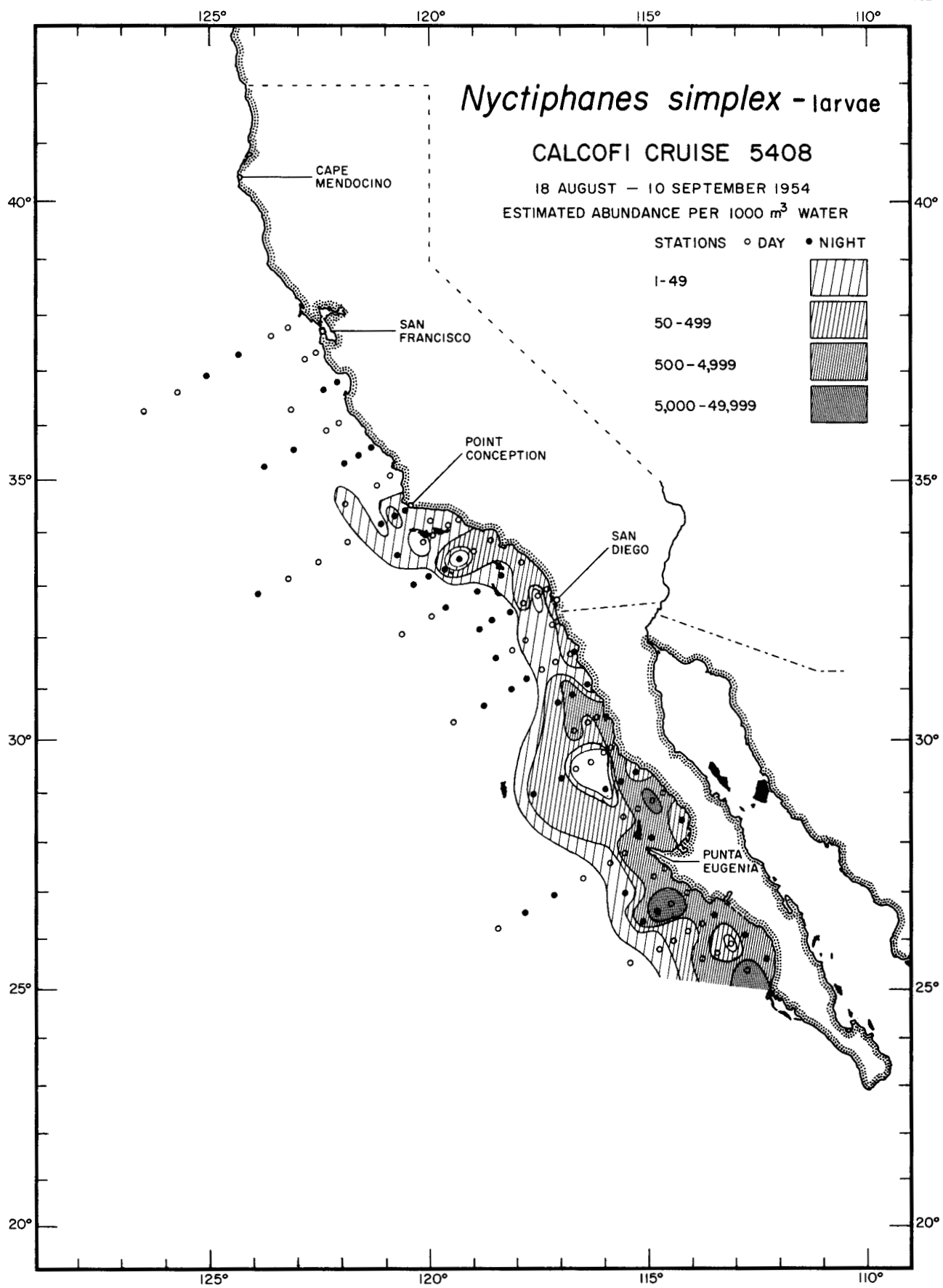


Euphausiacea
Nematoscelis tenella
6204

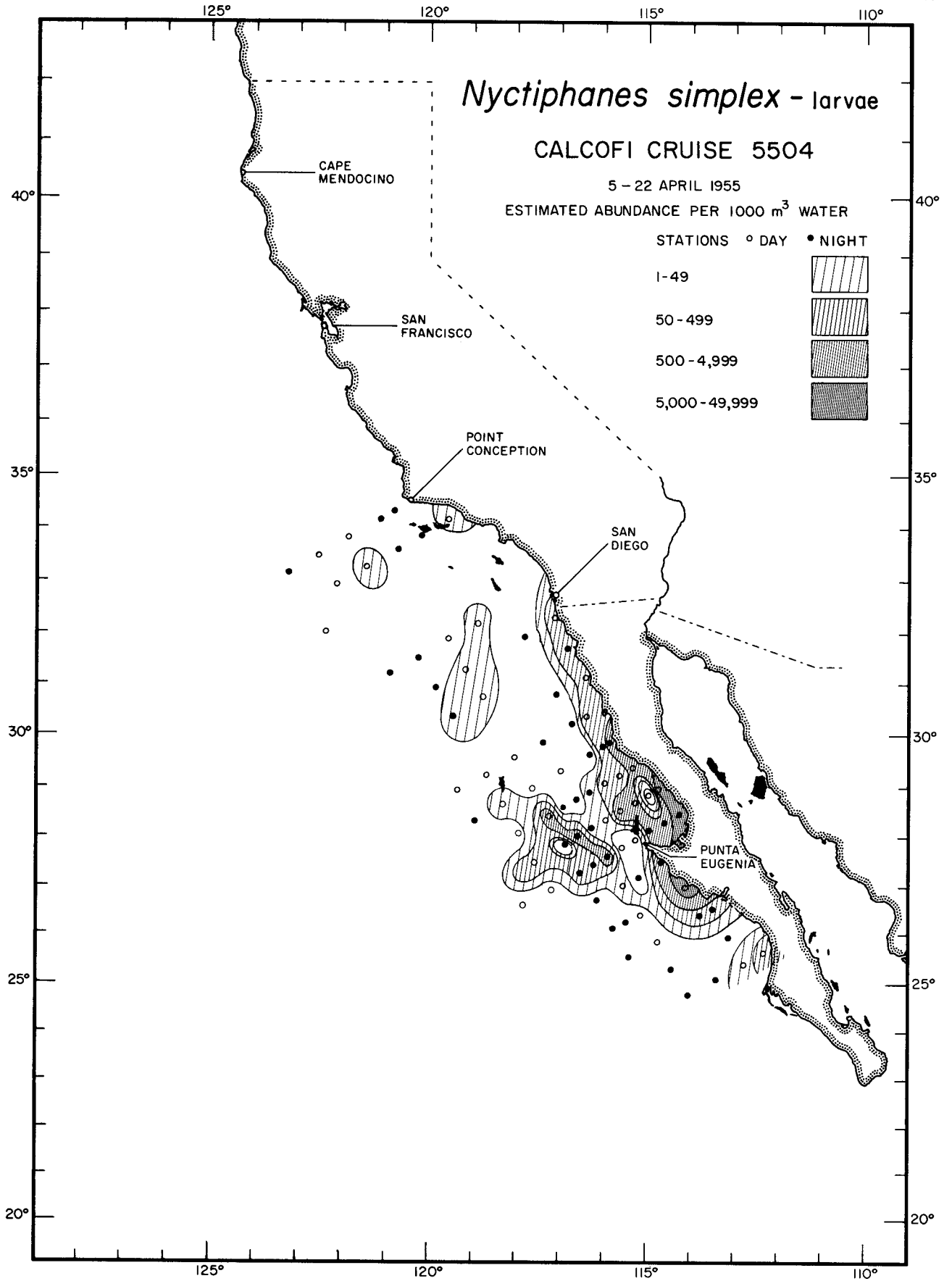


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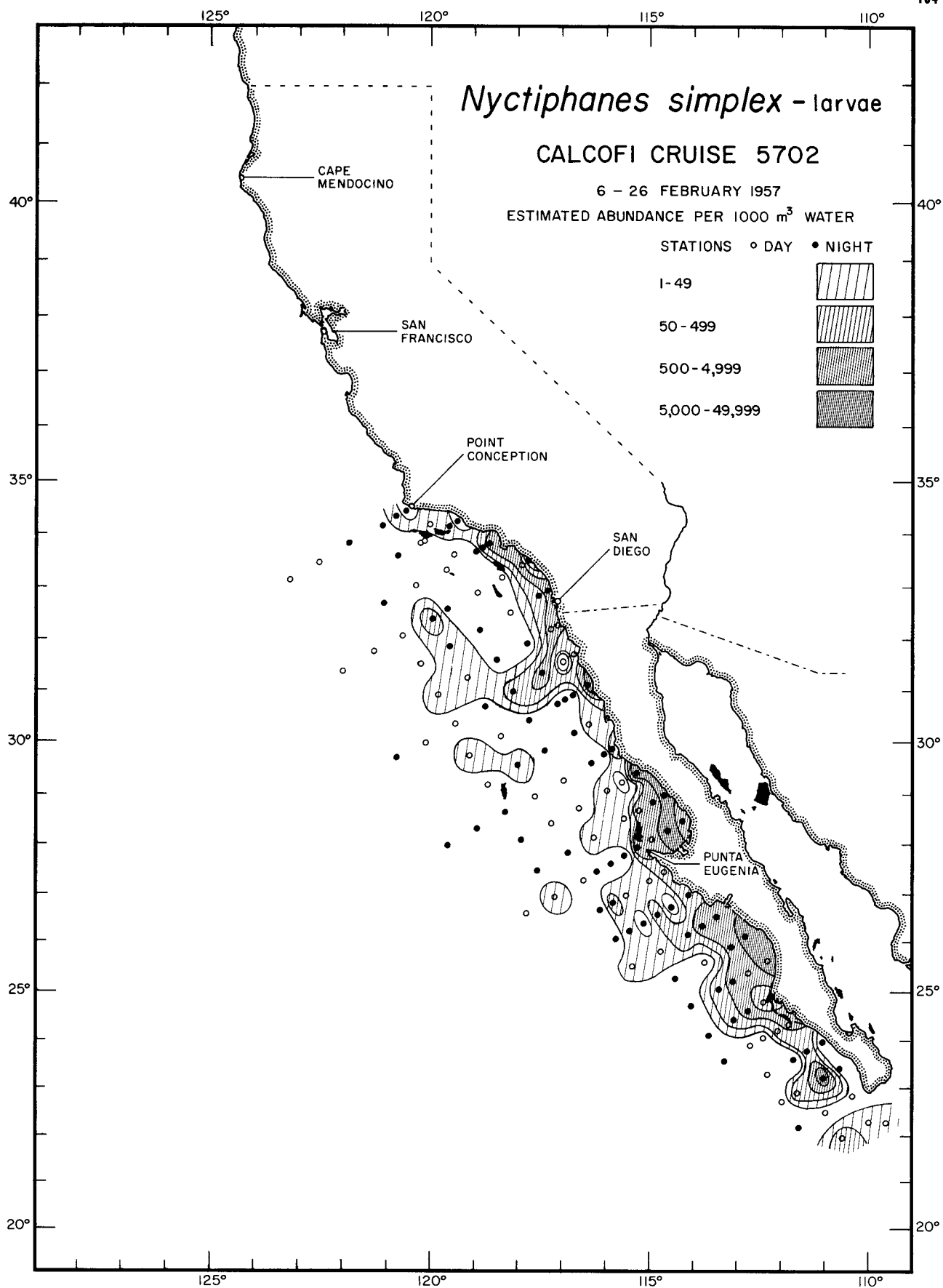
Euphausiacea
Nematoscelis tenella
6304



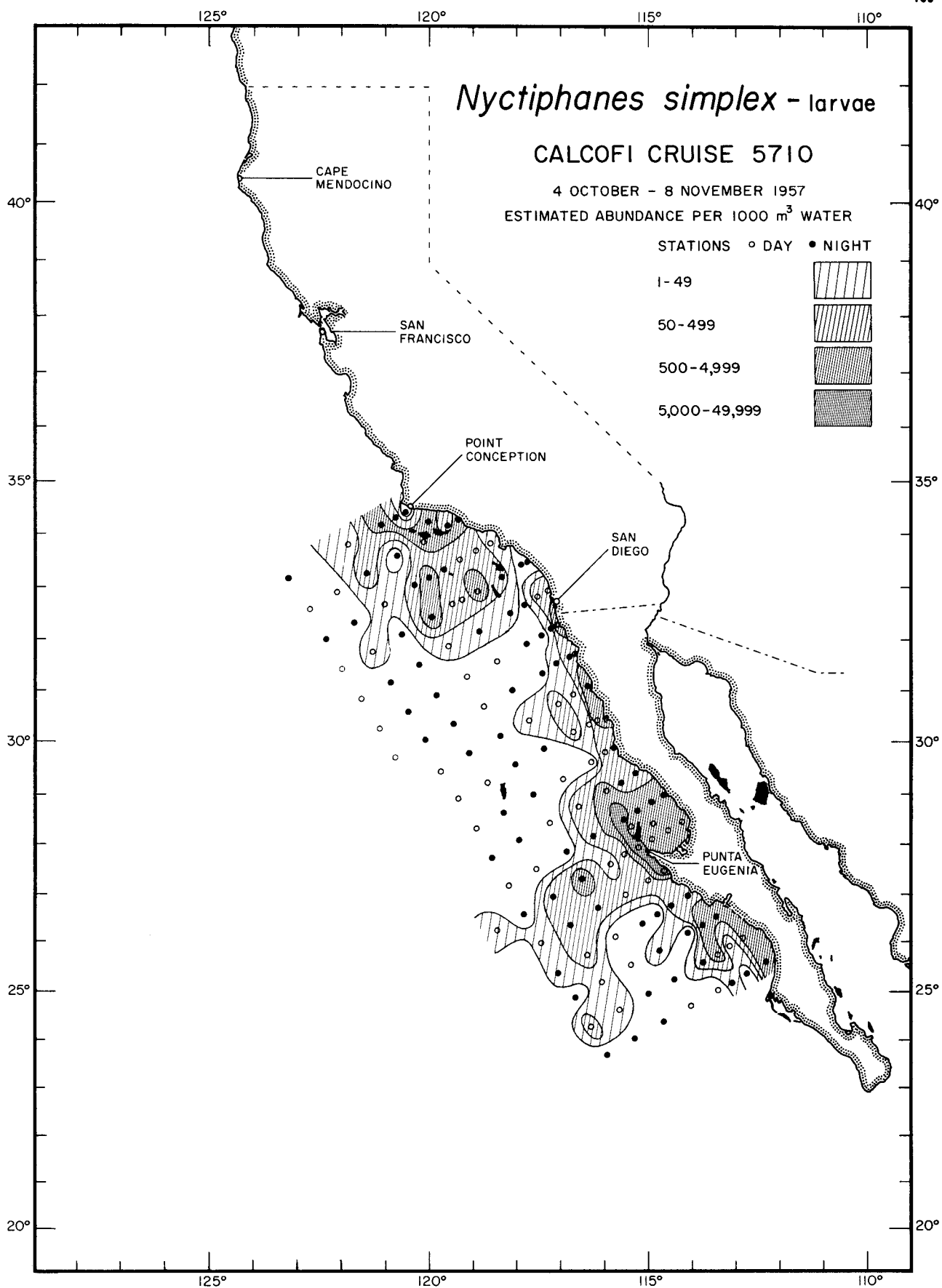
Euphausiacea
Nyctiphanes simplex-larvae
5408



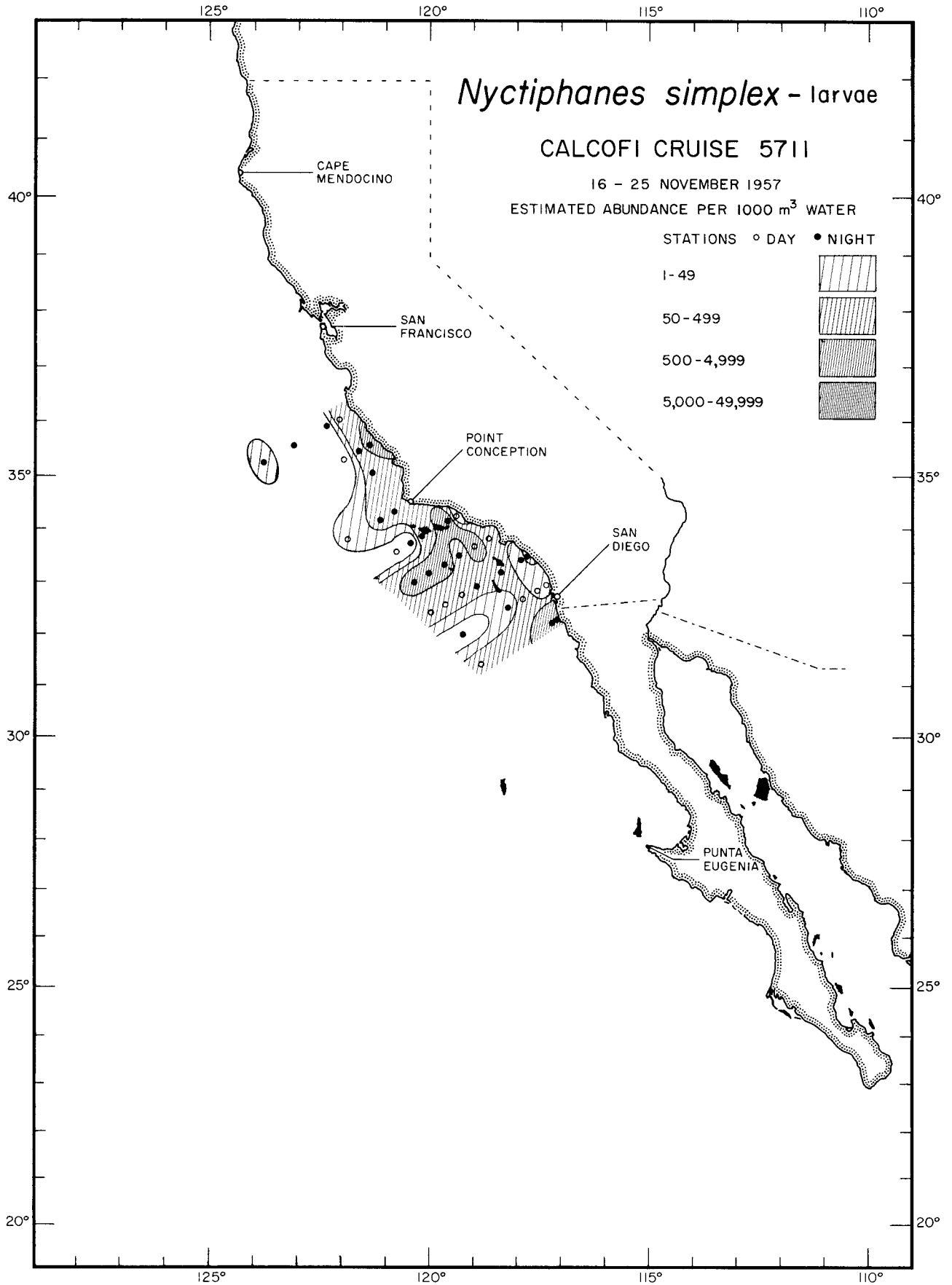
Euphausiacea
Nyctiphanes simplex - larvae
 5504



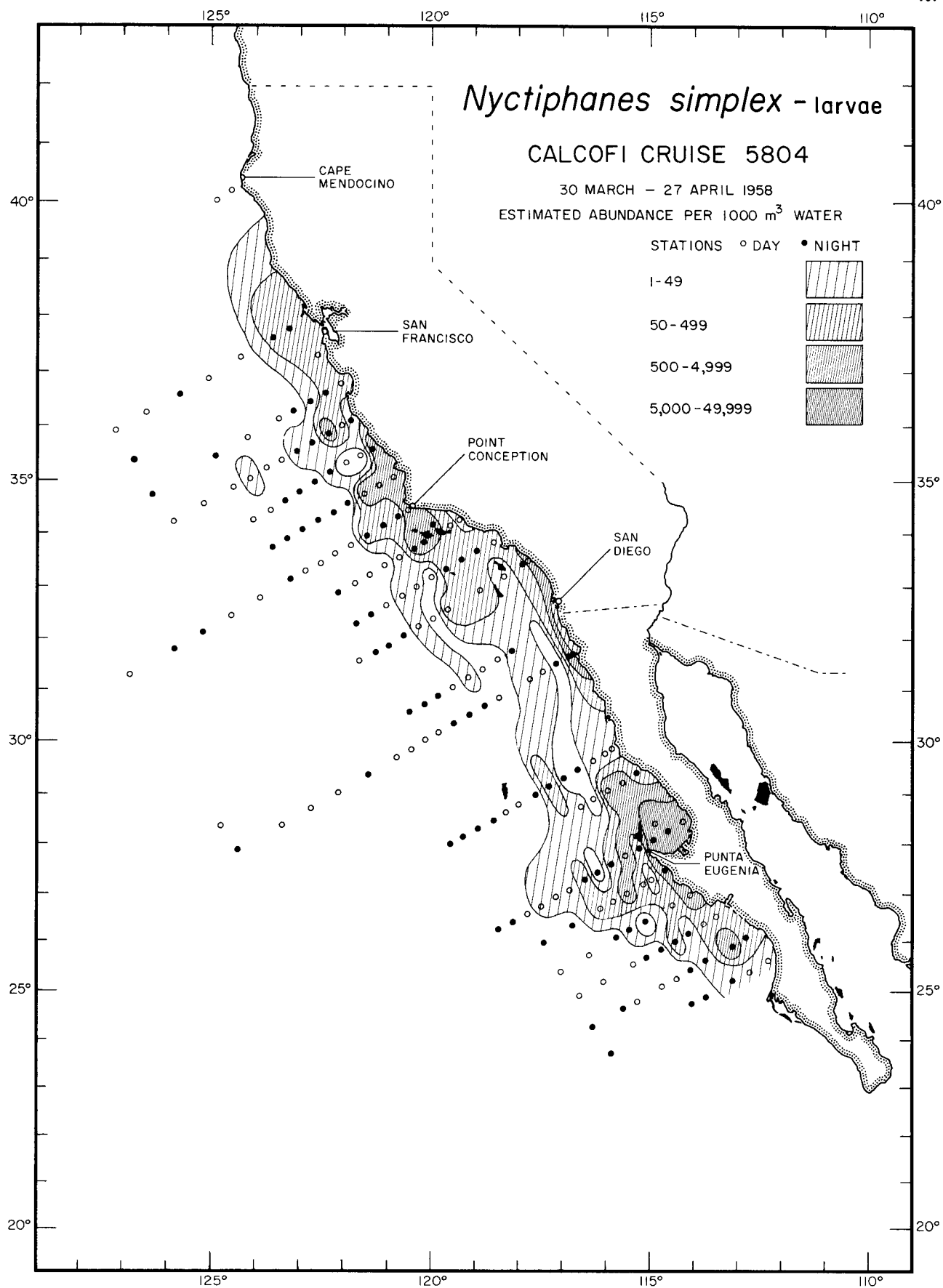
Euphausiacea
Nyctiphanes simplex - larvae
5702



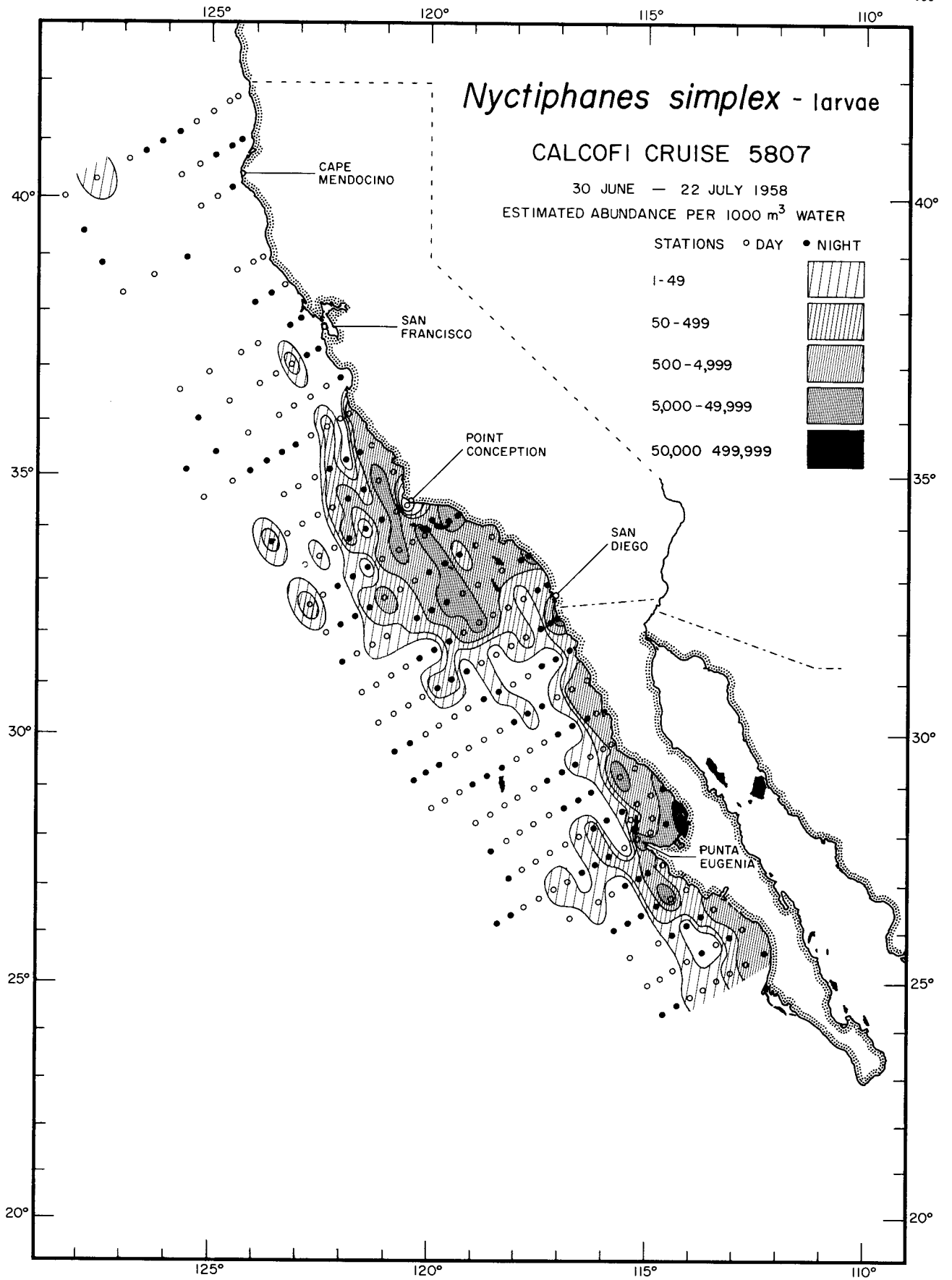
Euphausiacea
Nyctiphanes simplex - larvae
5710



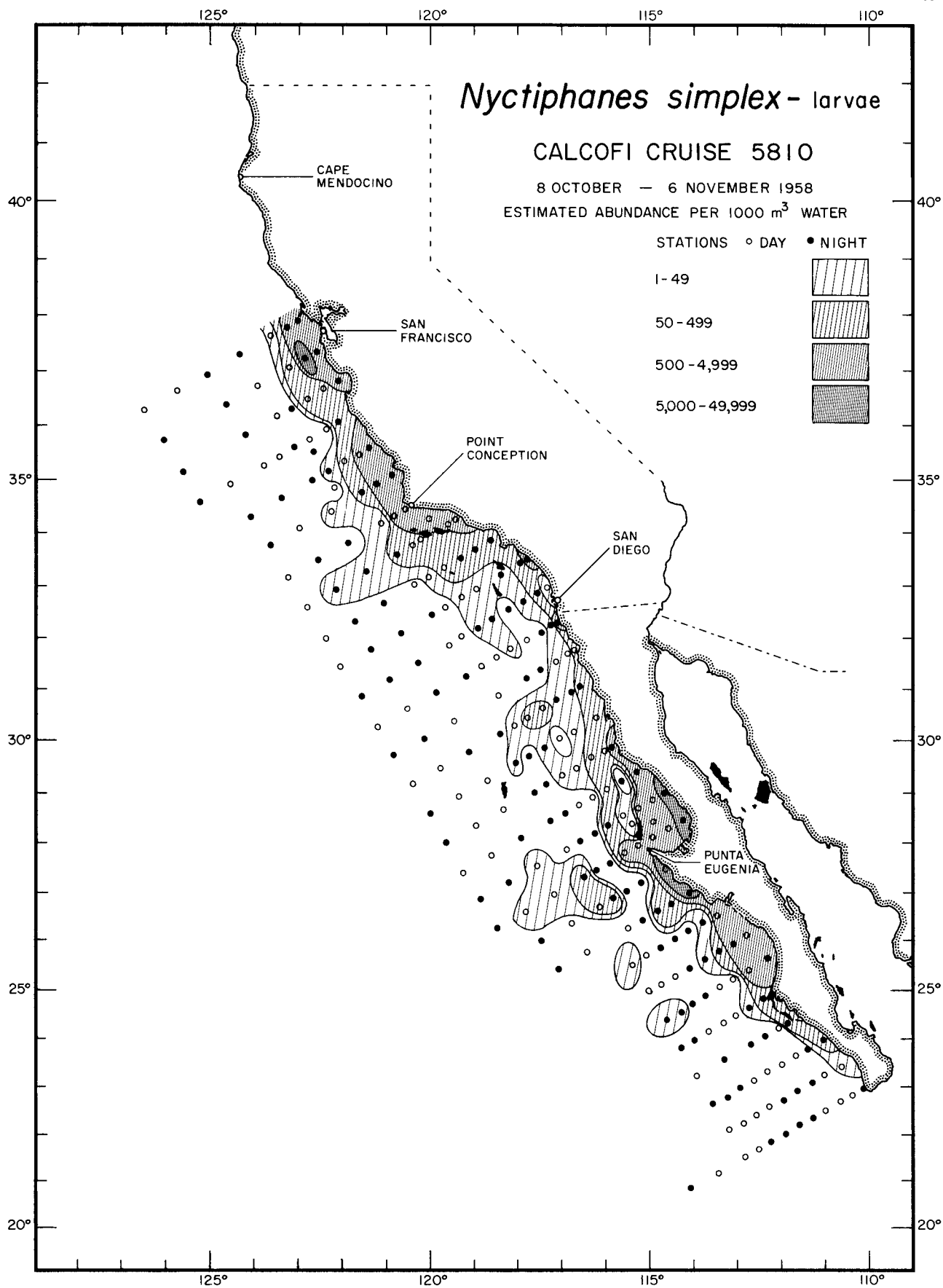
Euphausiacea
Nyctiphanes simplex - larvae
 5711



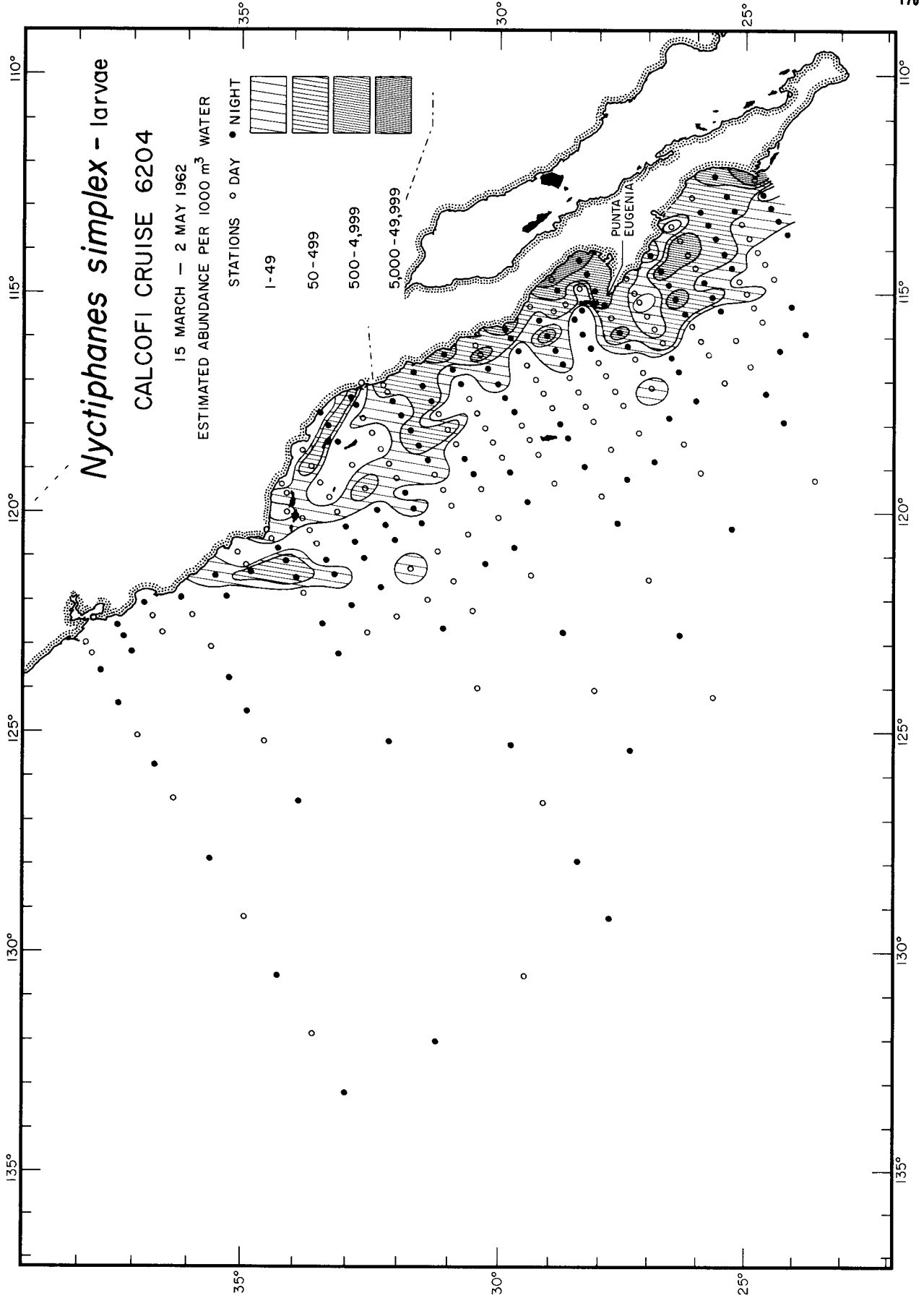
Euphausiacea
Nyctiphanes simplex - larvae
5804



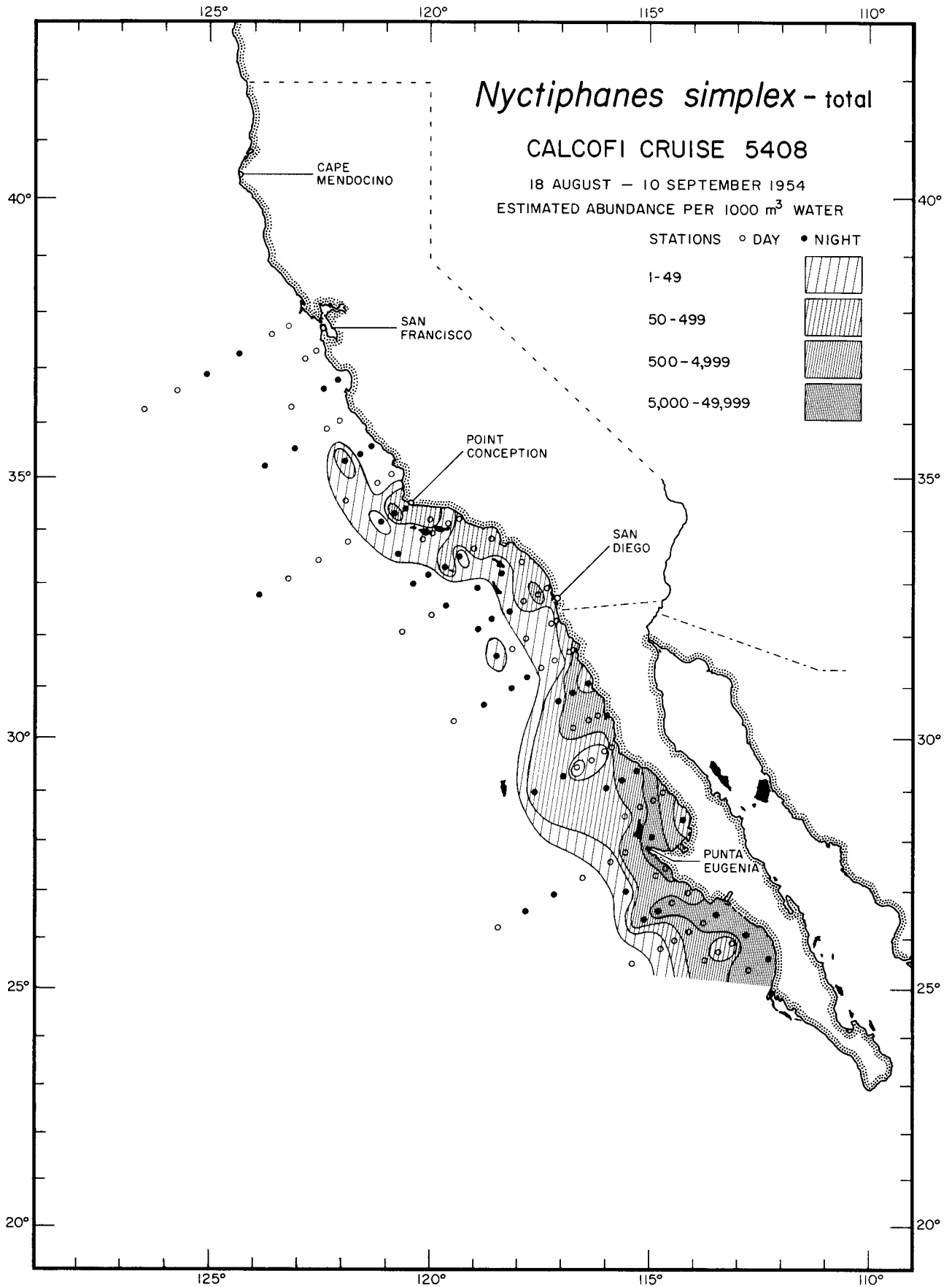
Euphausiacea
Nyctiphanes simplex - larvae
5807



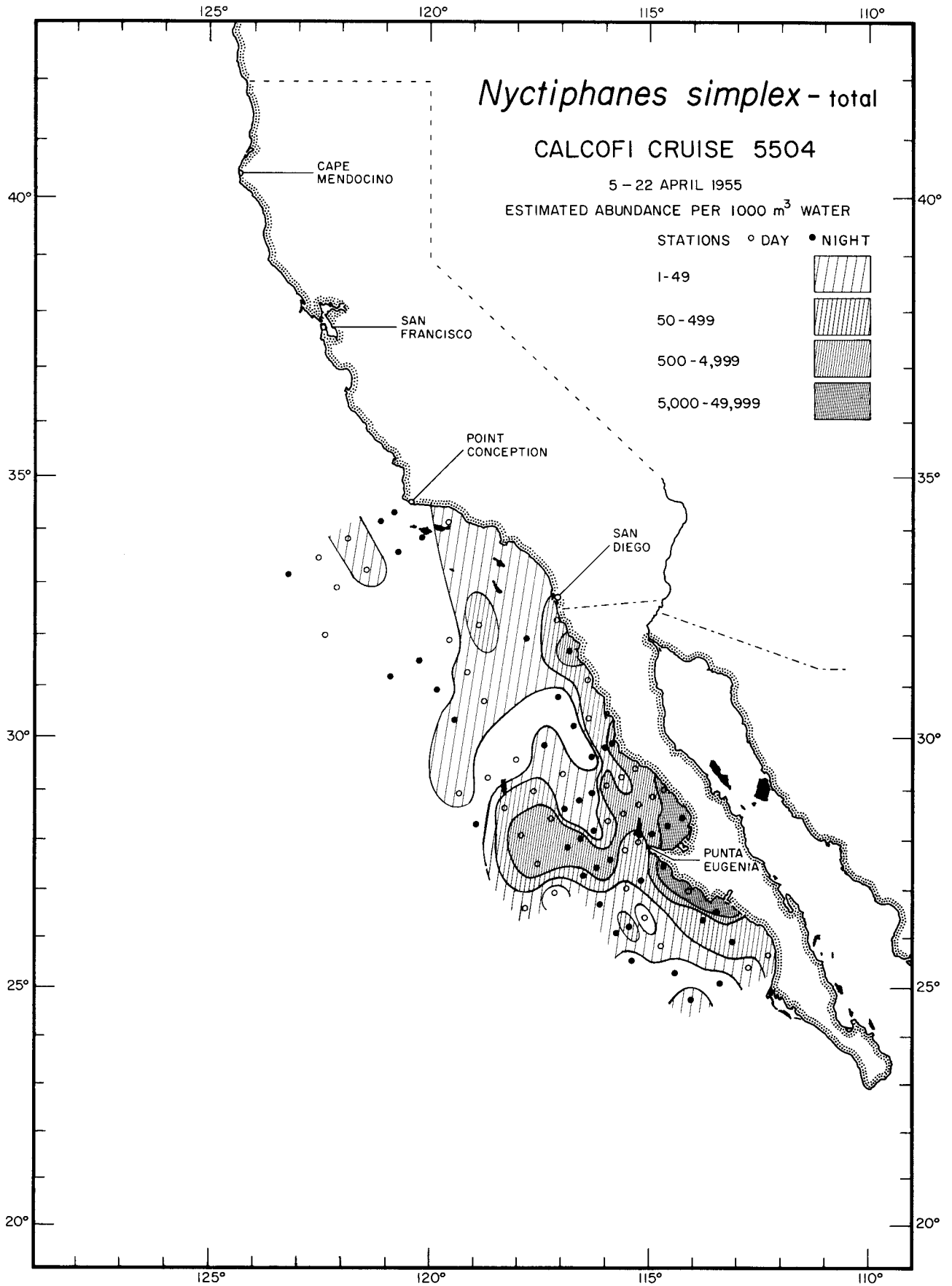
Euphausiacea
Nyctiphanes simplex - larvae
5810



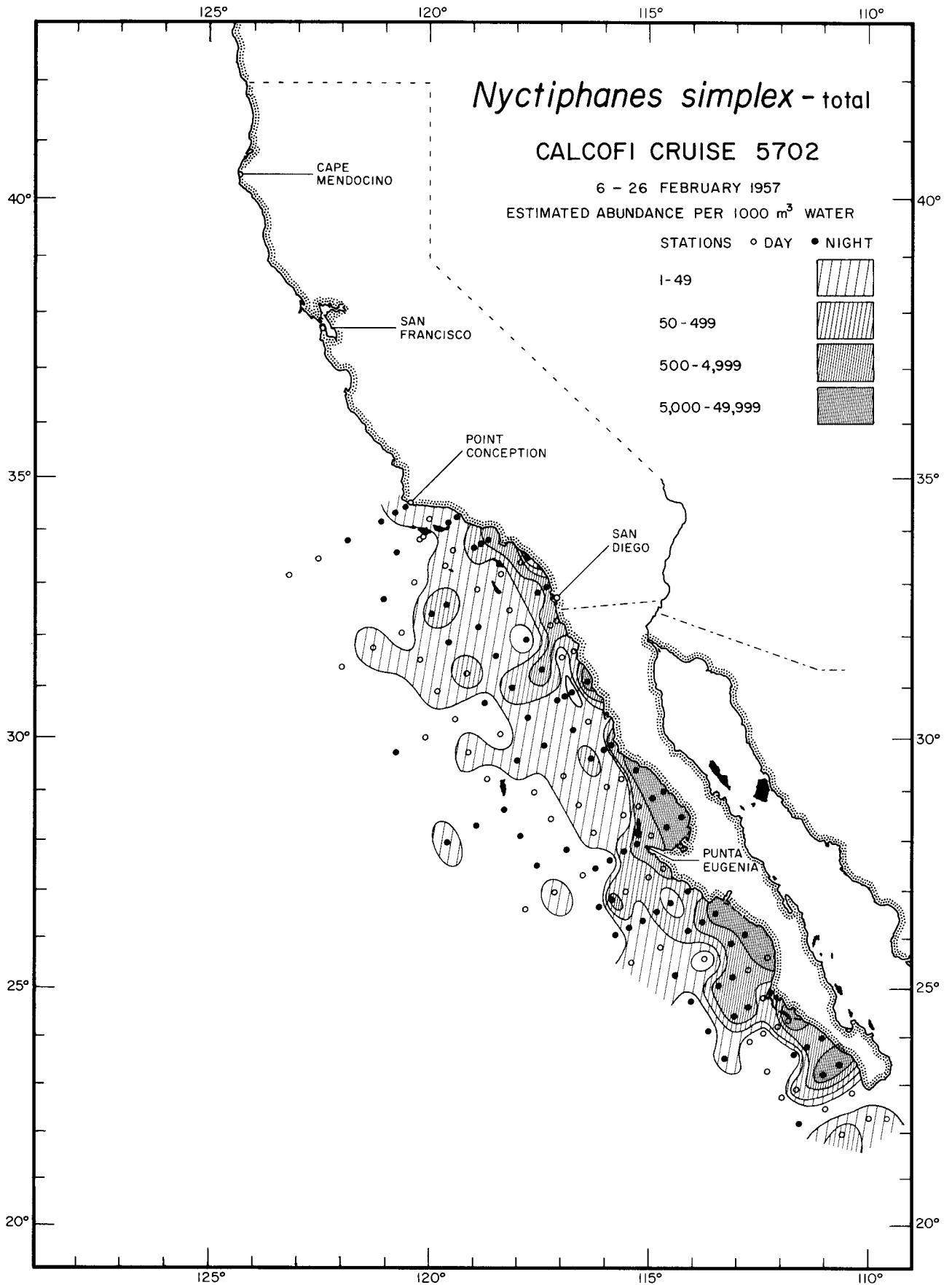
Euphausiacea
Nyctiphanes simplex - larvae
6204



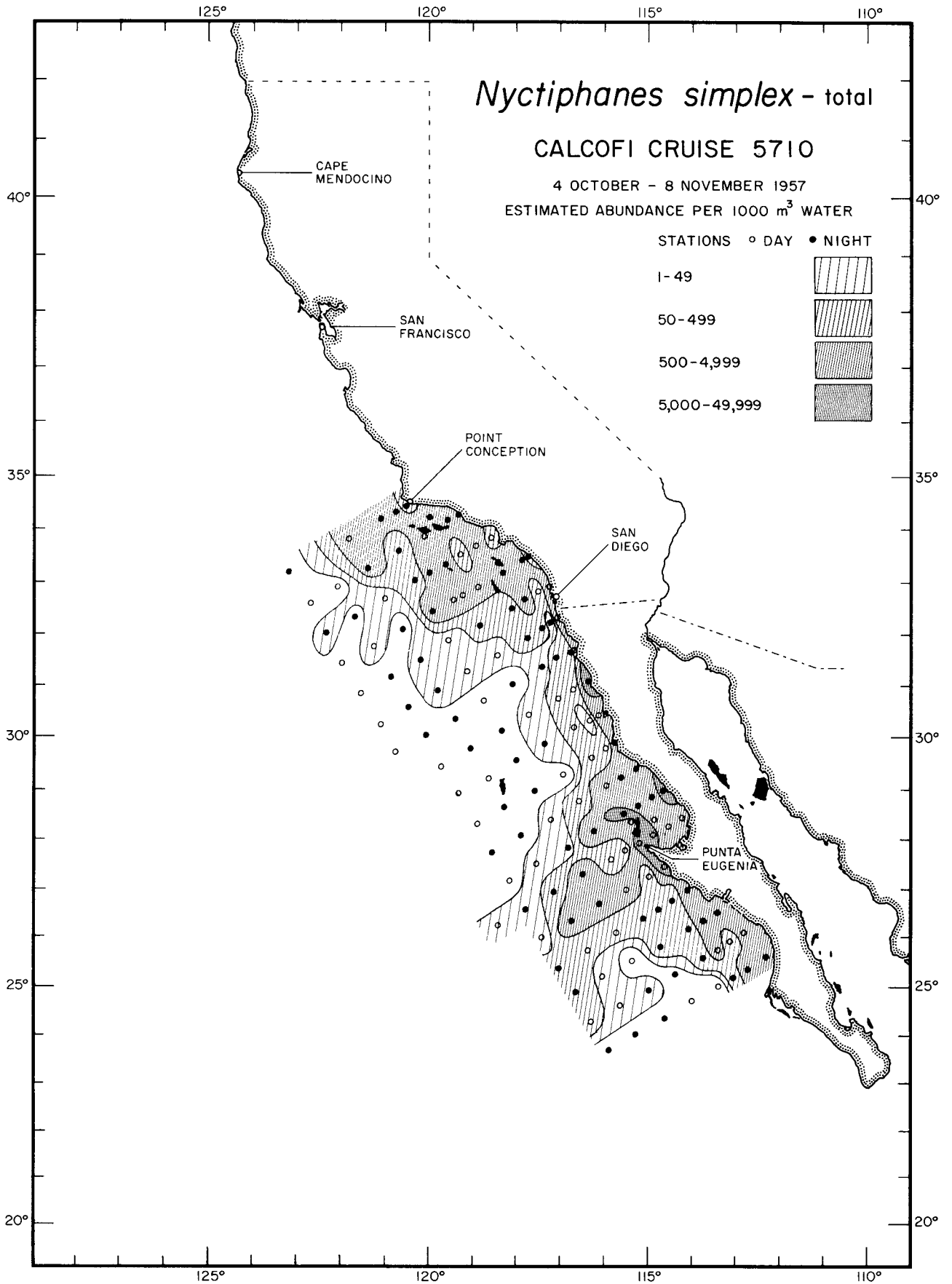
Euphausiacea
Nyctiphanes simplex - total
5408



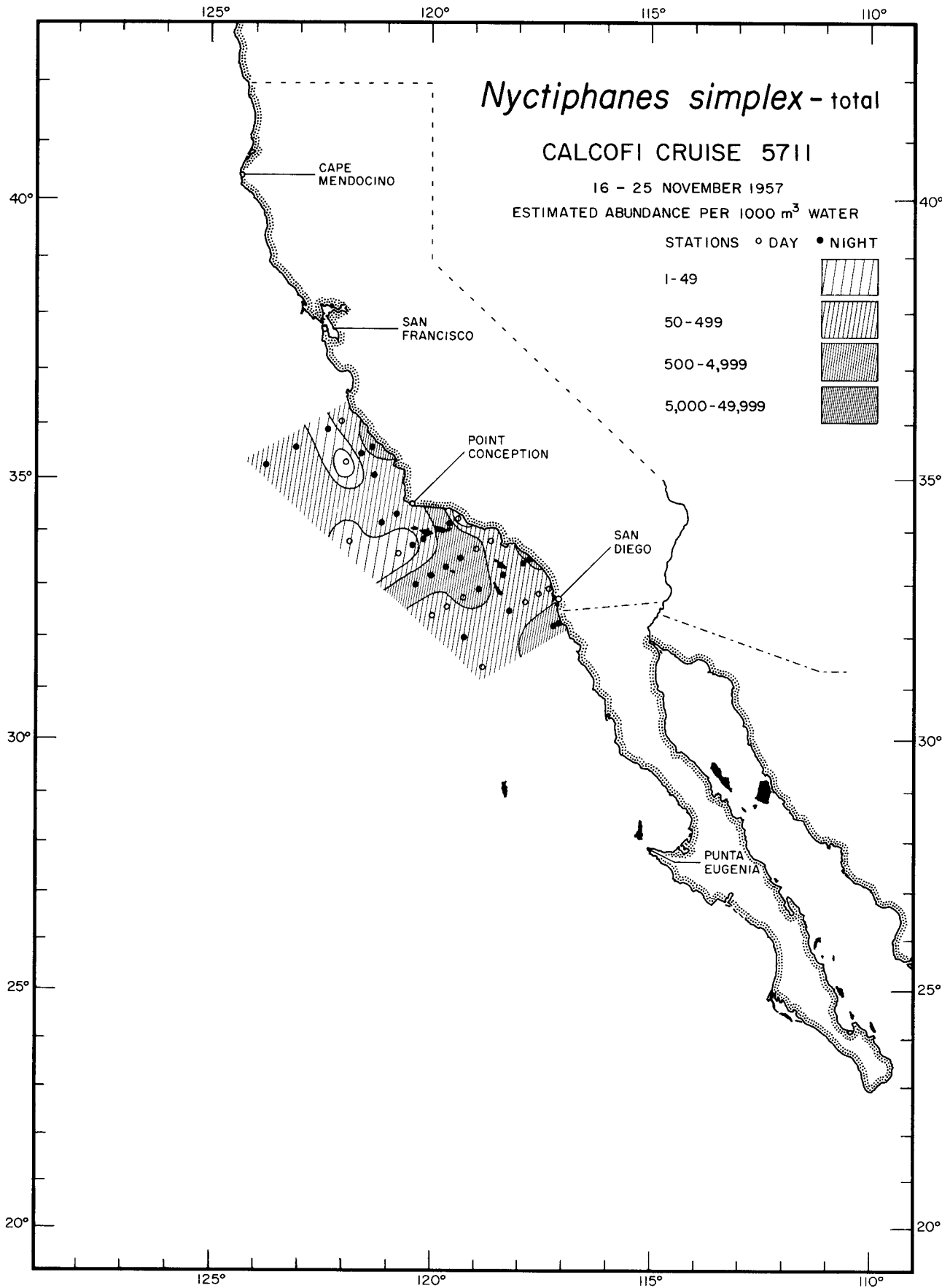
Euphausiacea
Nyctiphanes simplex - total
5504



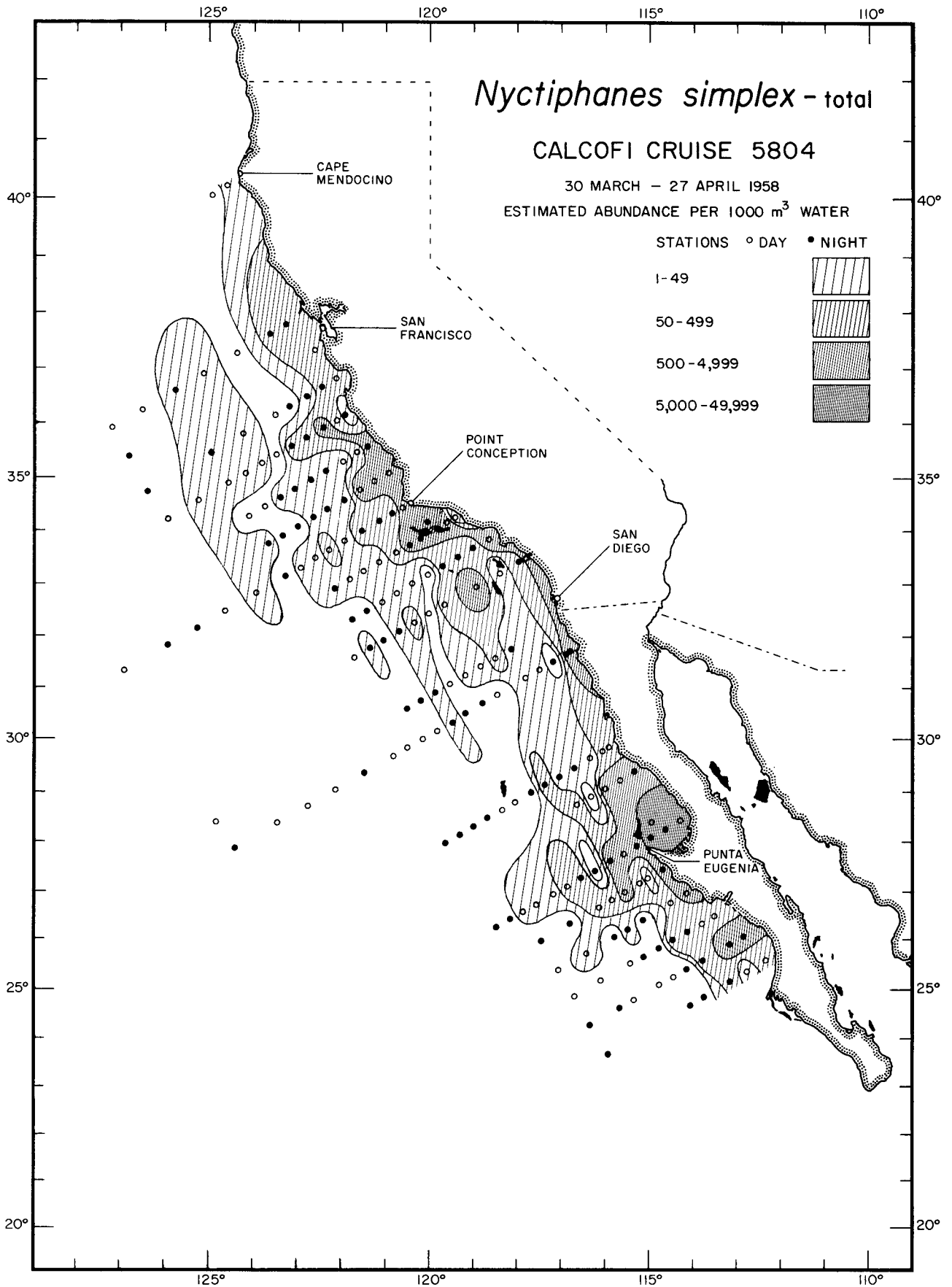
Euphausiacea
Nyctiphanes simplex - total
 5702



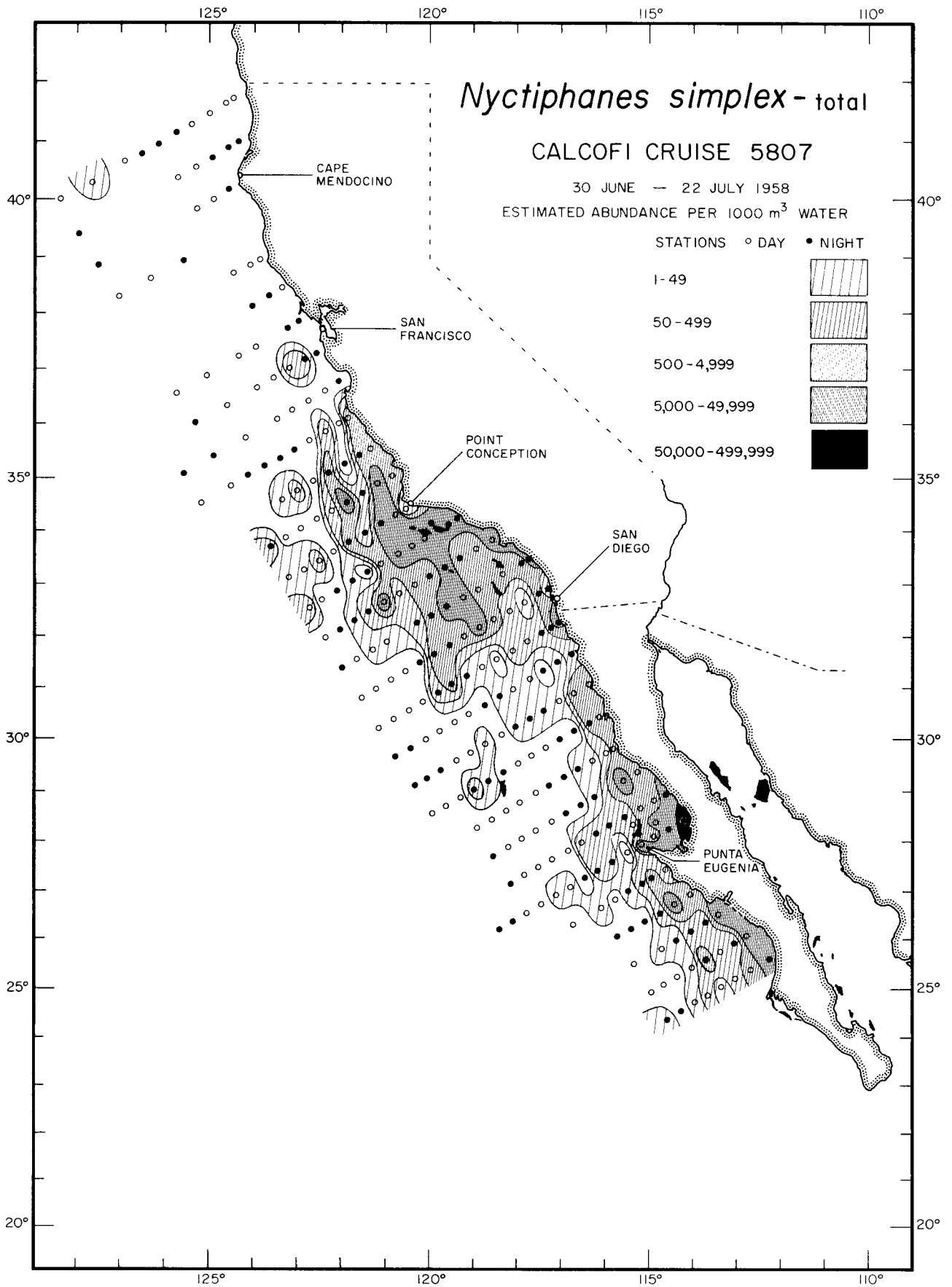
Euphausiacea
Nyctiphanes simplex - total
5710



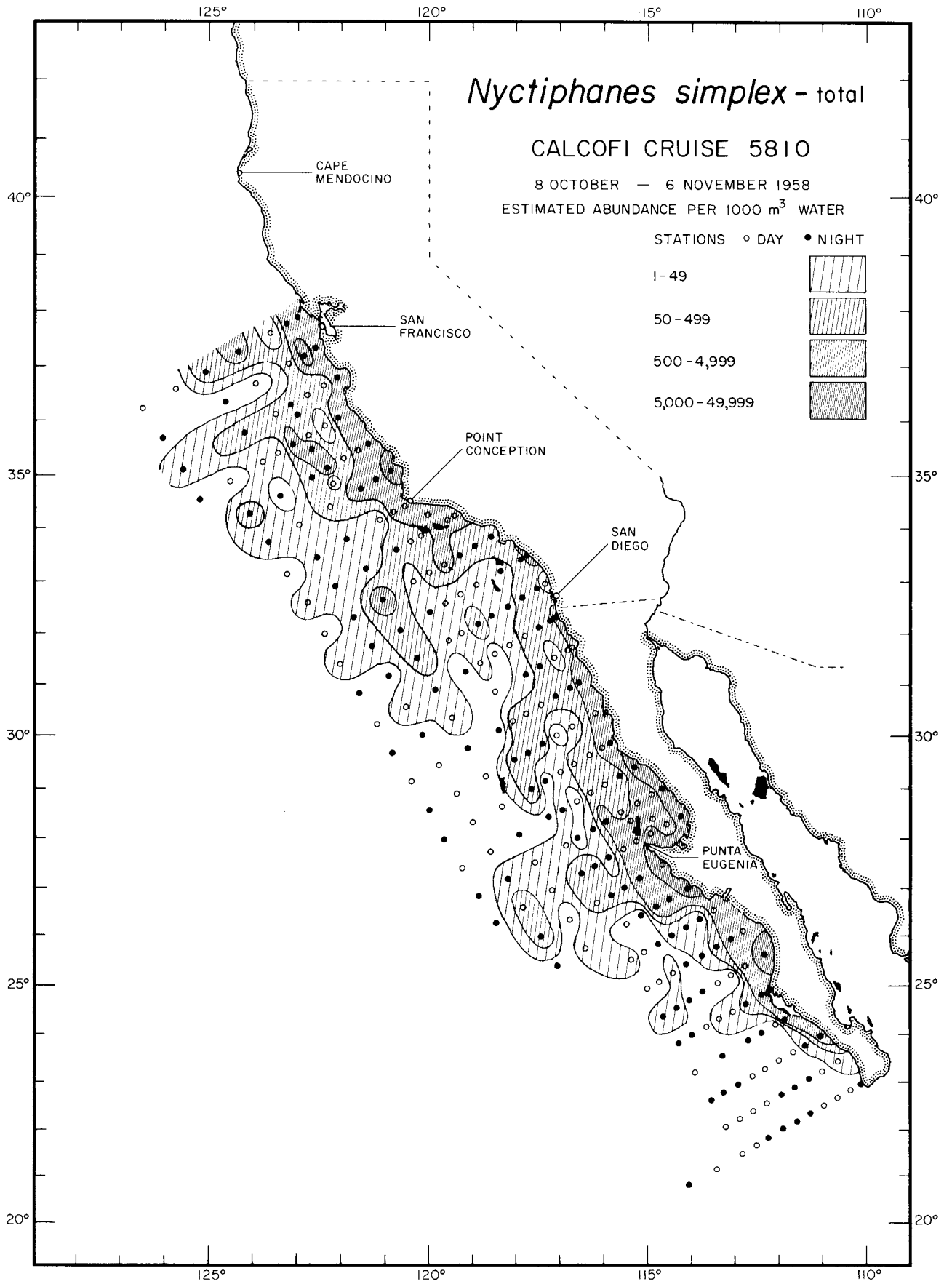
Euphausiacea
Nyctiphanes simplex - total
5711



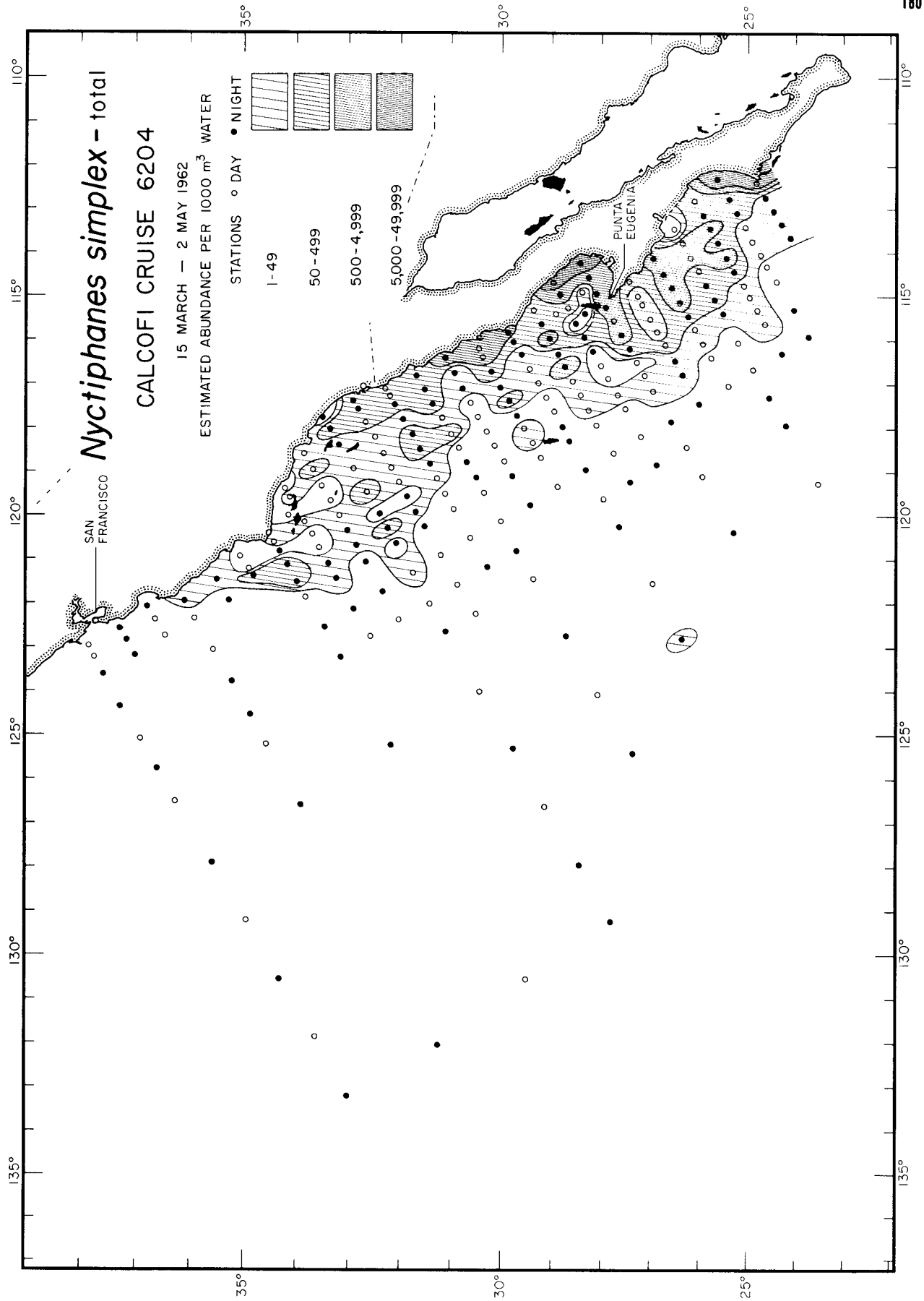
Euphausiacea
Nyctiphanes simplex - total
5804



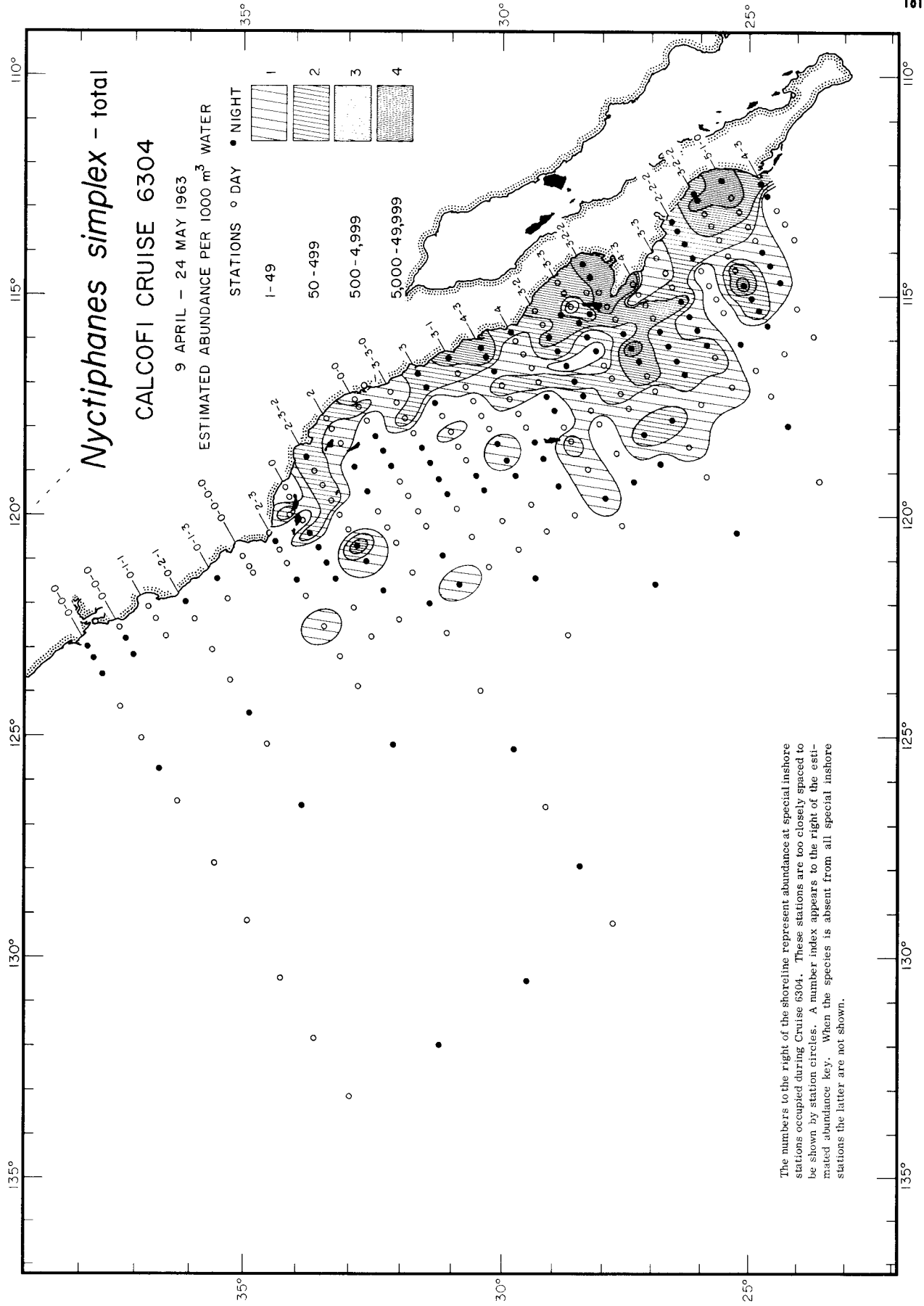
Euphausiacea
Nyctiphanes simplex - total
5807



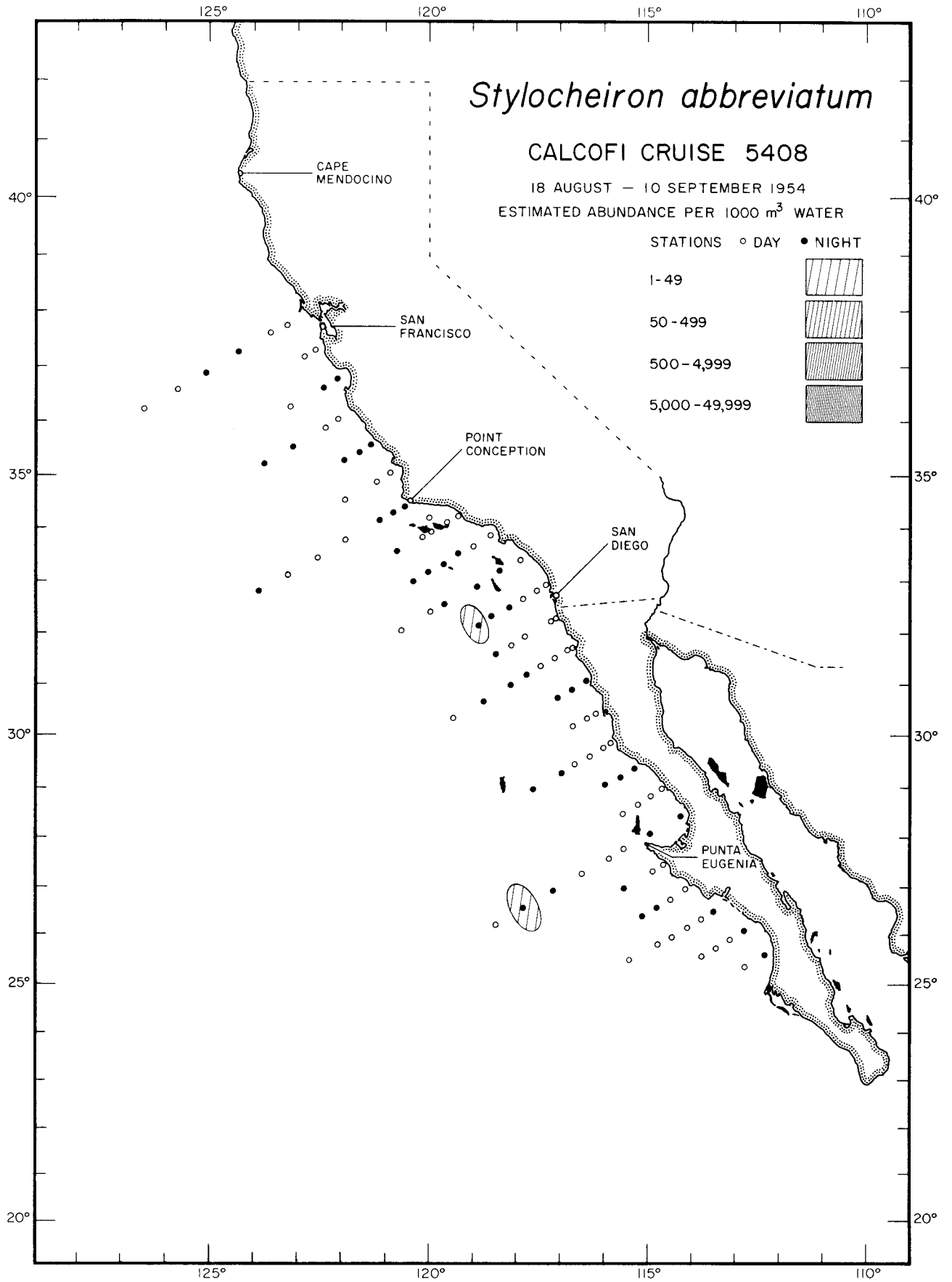
Euphausiacea
Nyctiphanes simplex - total
 5810



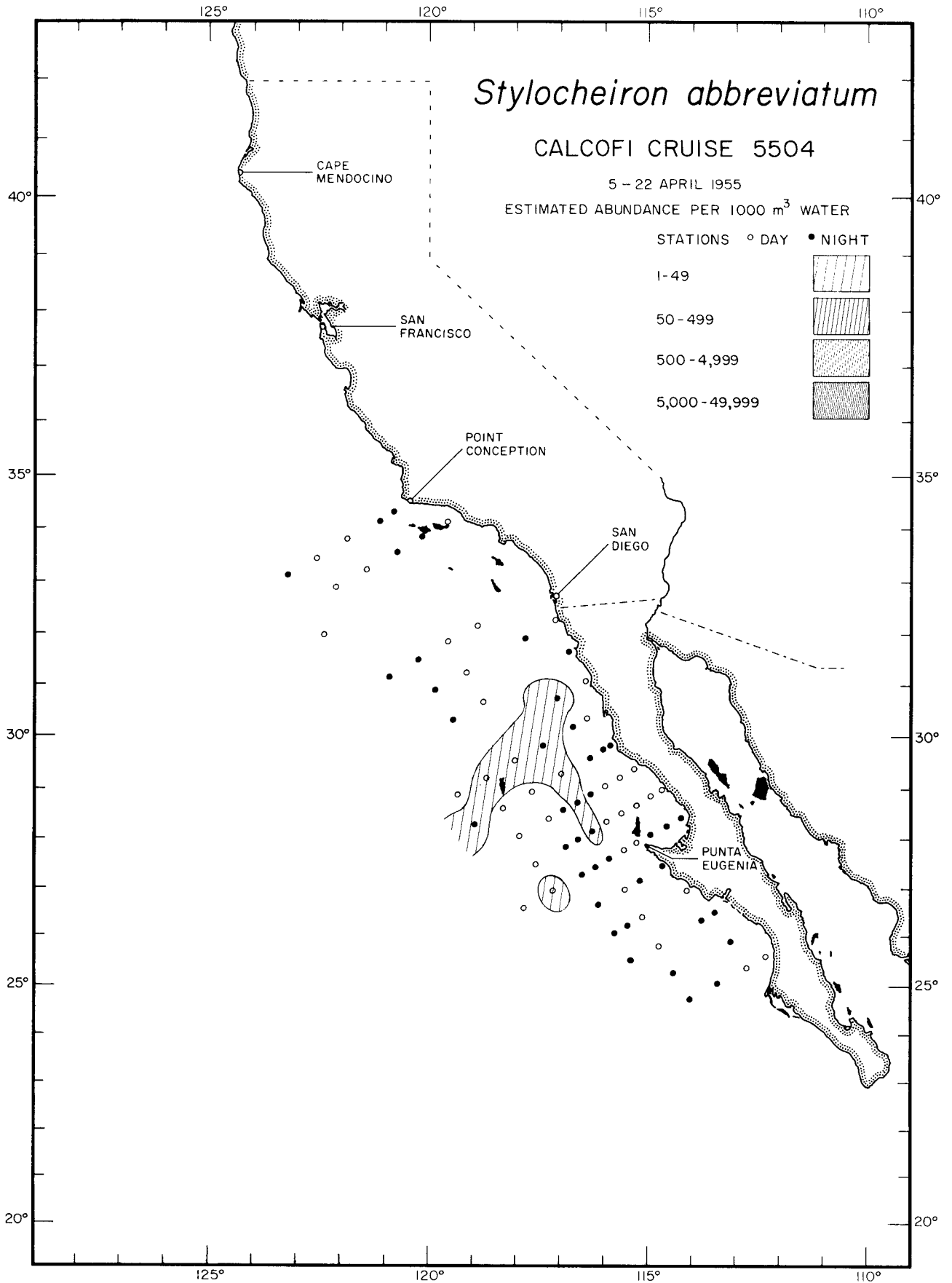
Euphausiacea
Nyctiphanes simplex - total
6204



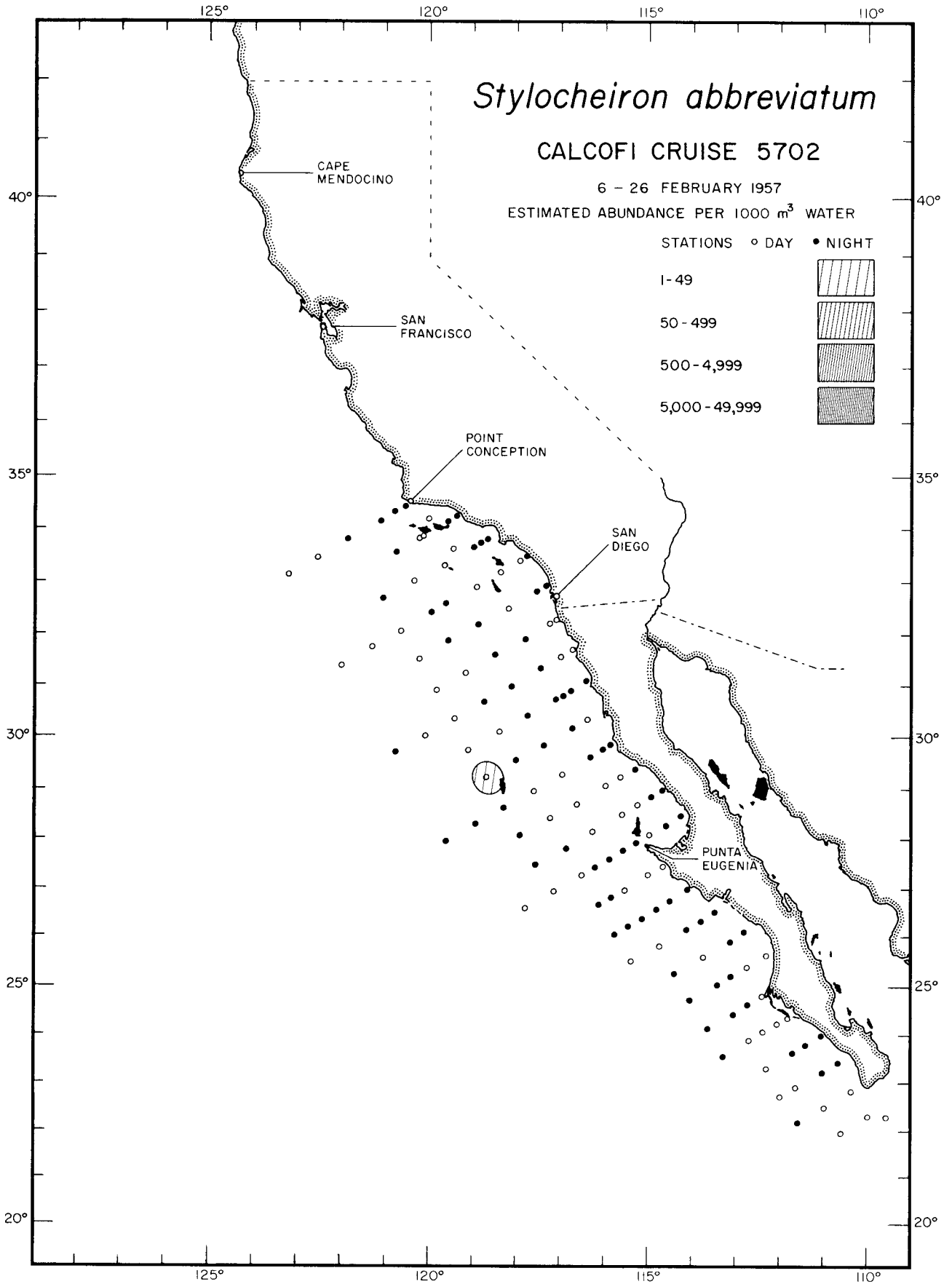
Euphausiacea
Nyctiphanes simplex - total
 6304



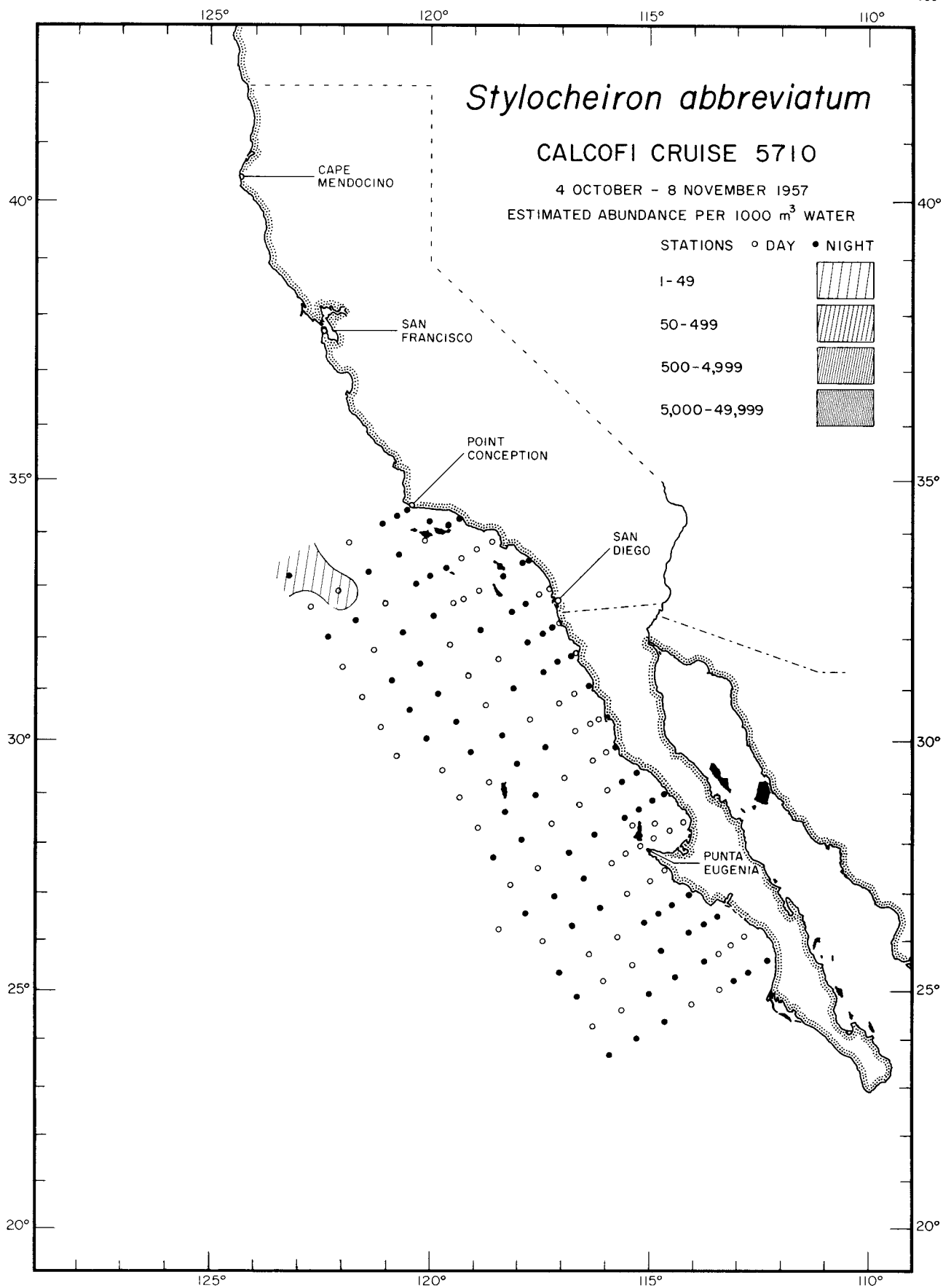
Euphausiacea
Stylocheiron abbreviatum
5408



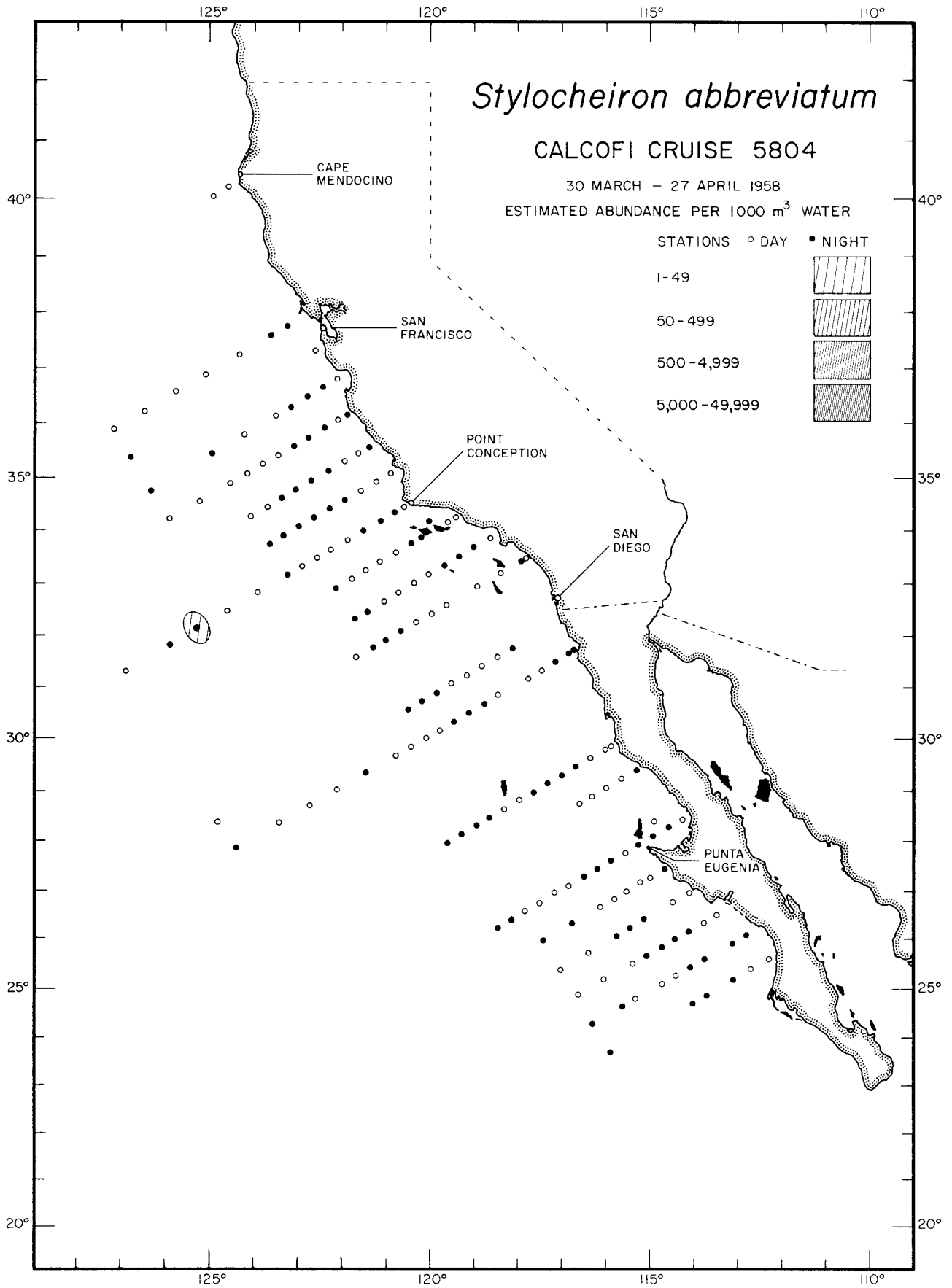
Euphausiacea
Stylocheiron abbreviatum
 5504



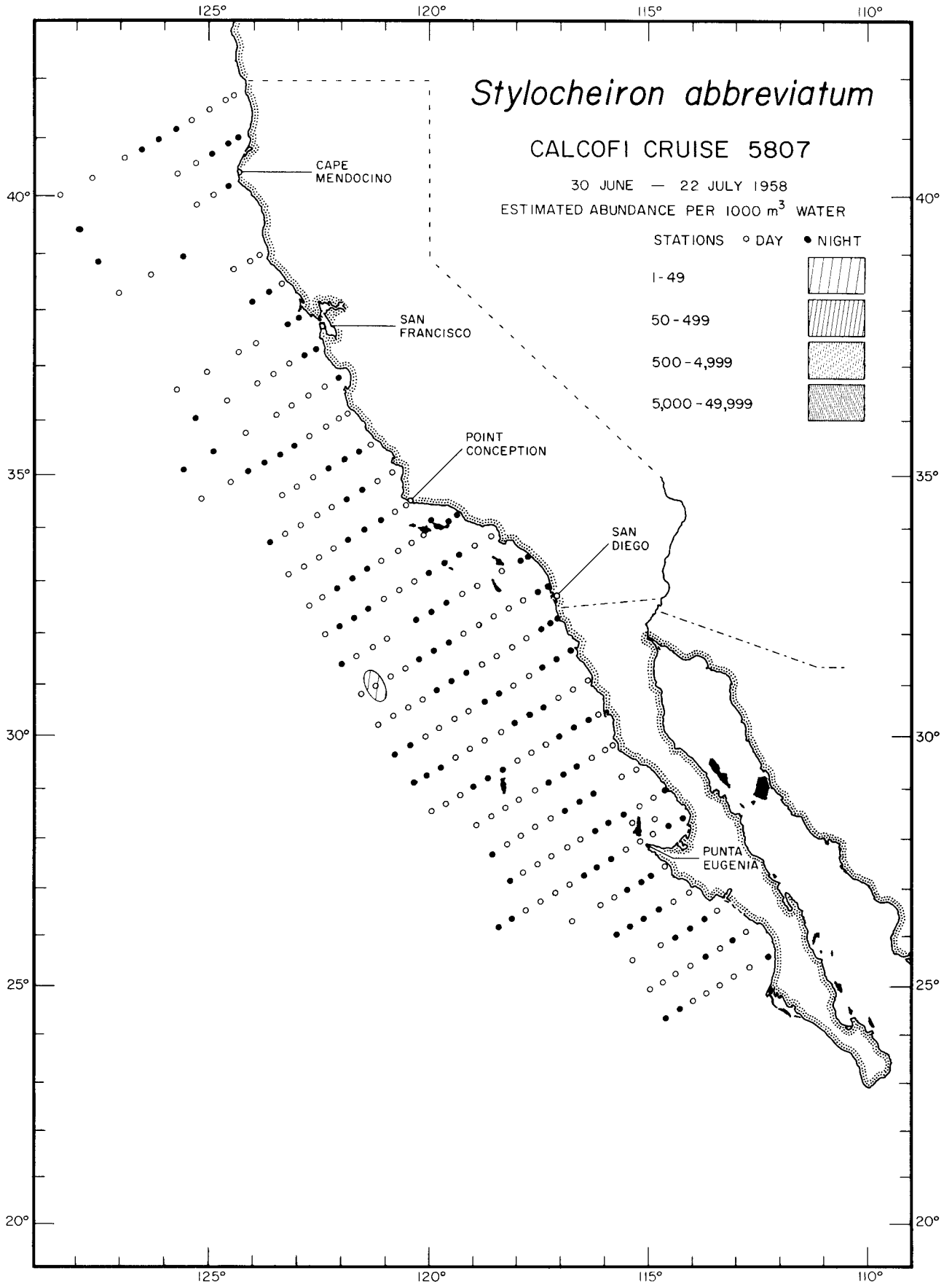
Euphausiacea
Stylocheiron abbreviatum
5702



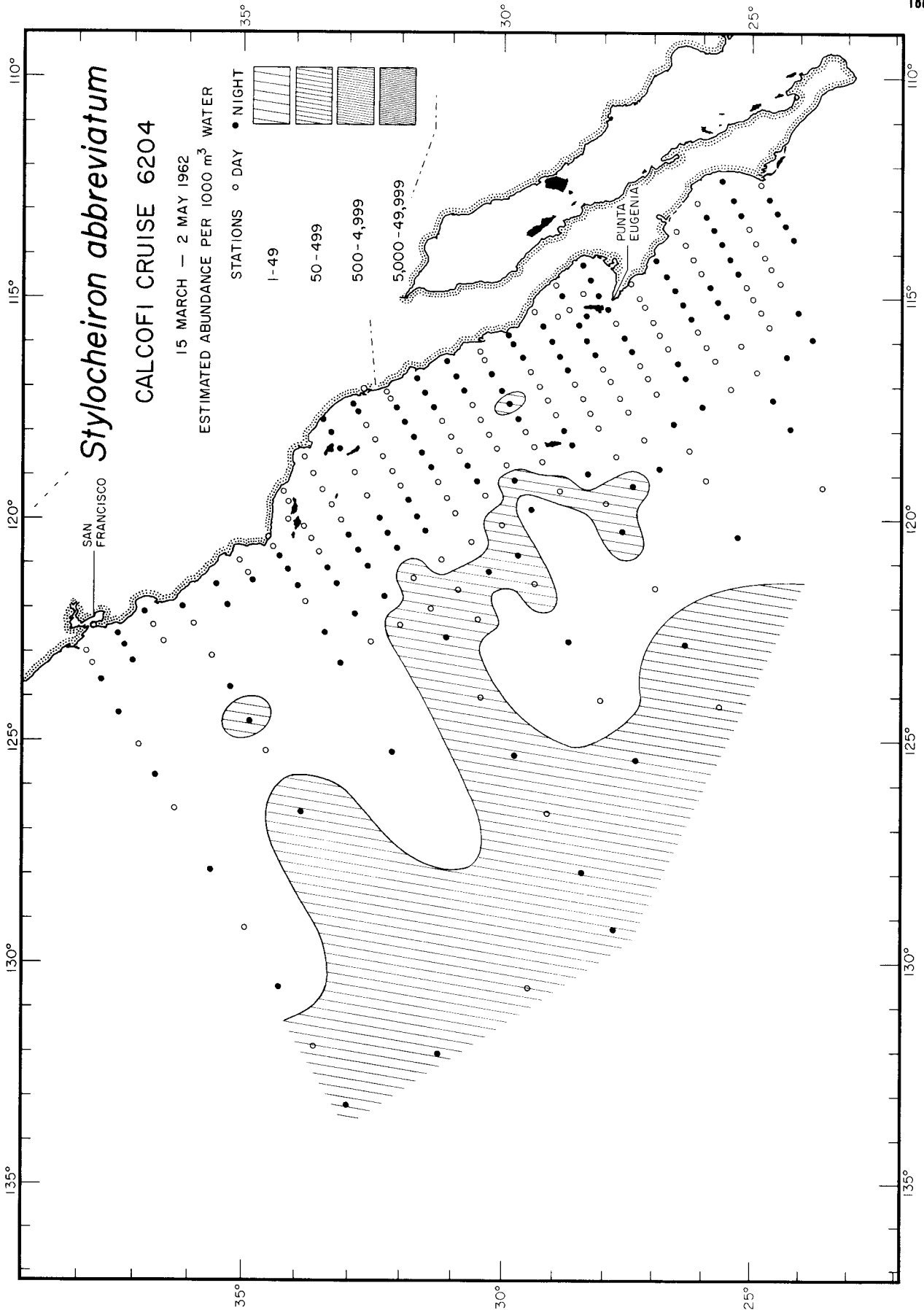
Euphausiacea
Stylocheiron abbreviatum
5710



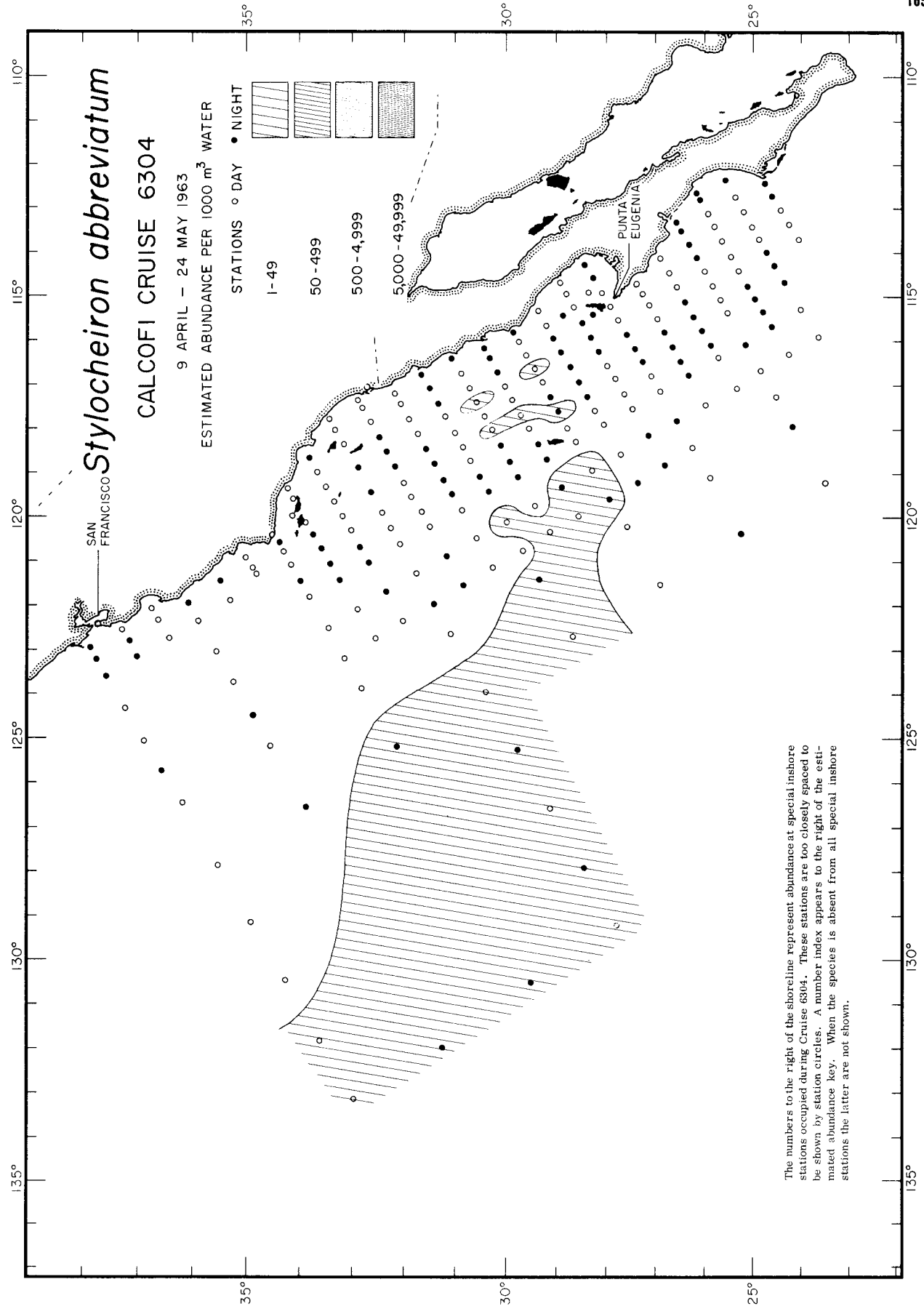
Euphausiacea
Stylocheiron abbreviatum
 5804



Euphausiacea
Stylocheiron abbreviatum
 5807

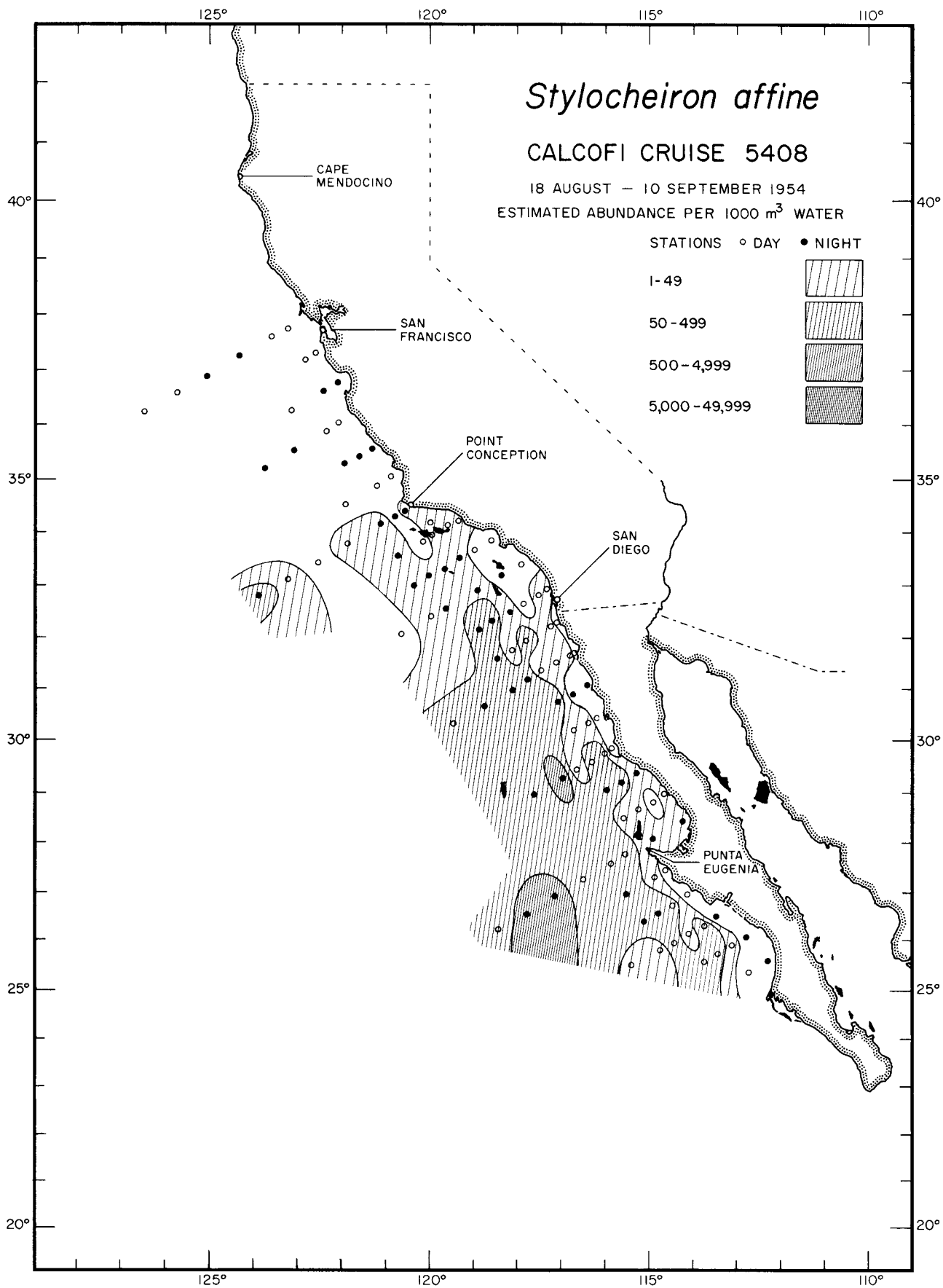


Euphausiacea
Stylocheiron abbreviatum
6204



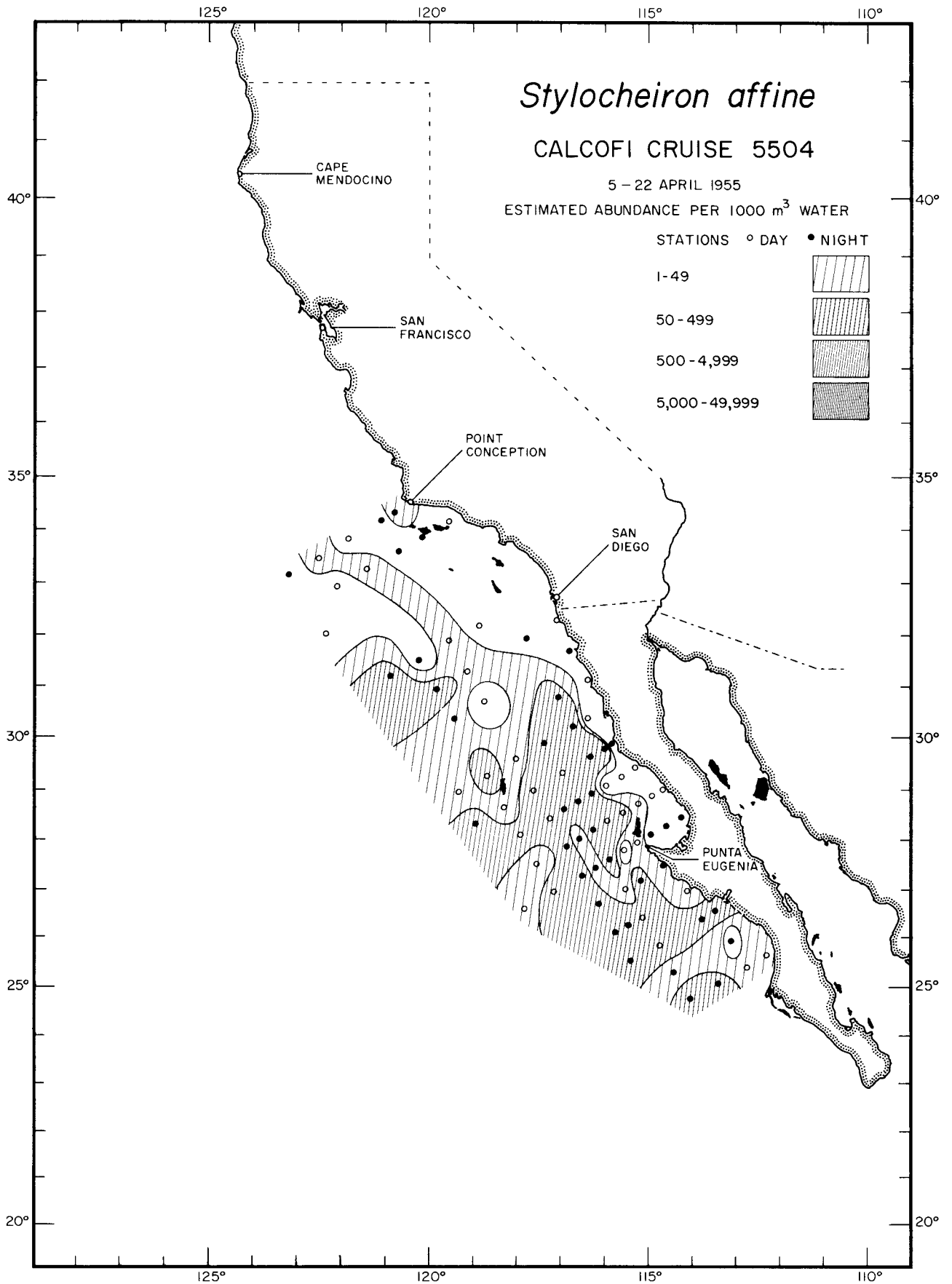
The numbers to the right of the shoreline represent abundance at special inshore stations occupied during Cruise 6304. These stations are too closely spaced to be shown by station circles. A number index appears to the right of the estimated abundance key. When the species is absent from all special inshore stations the latter are not shown.

Euphausiacea
Stylocheiron abbreviatum
 6304

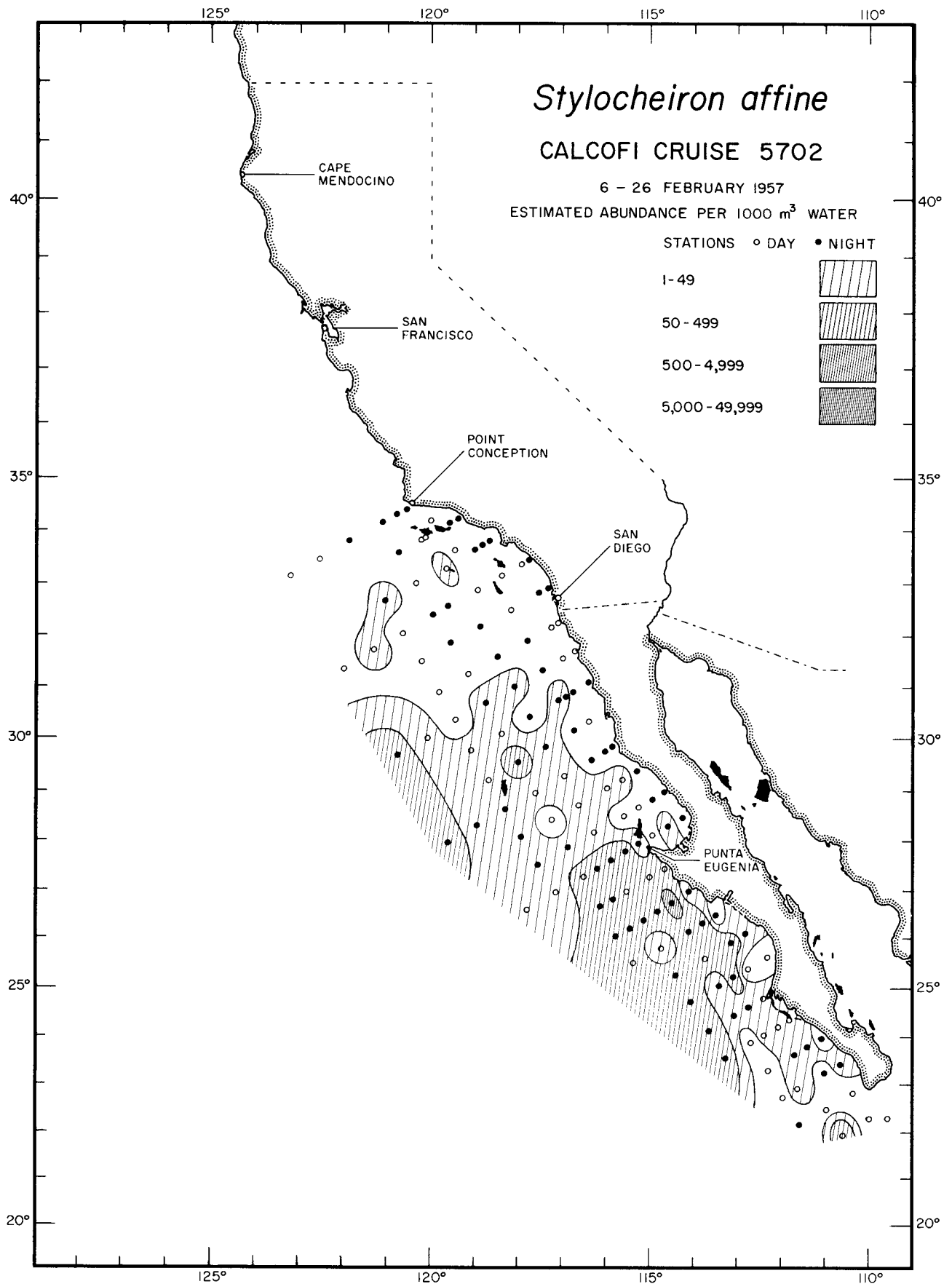


Euphausiacea
Stylocheiron affine

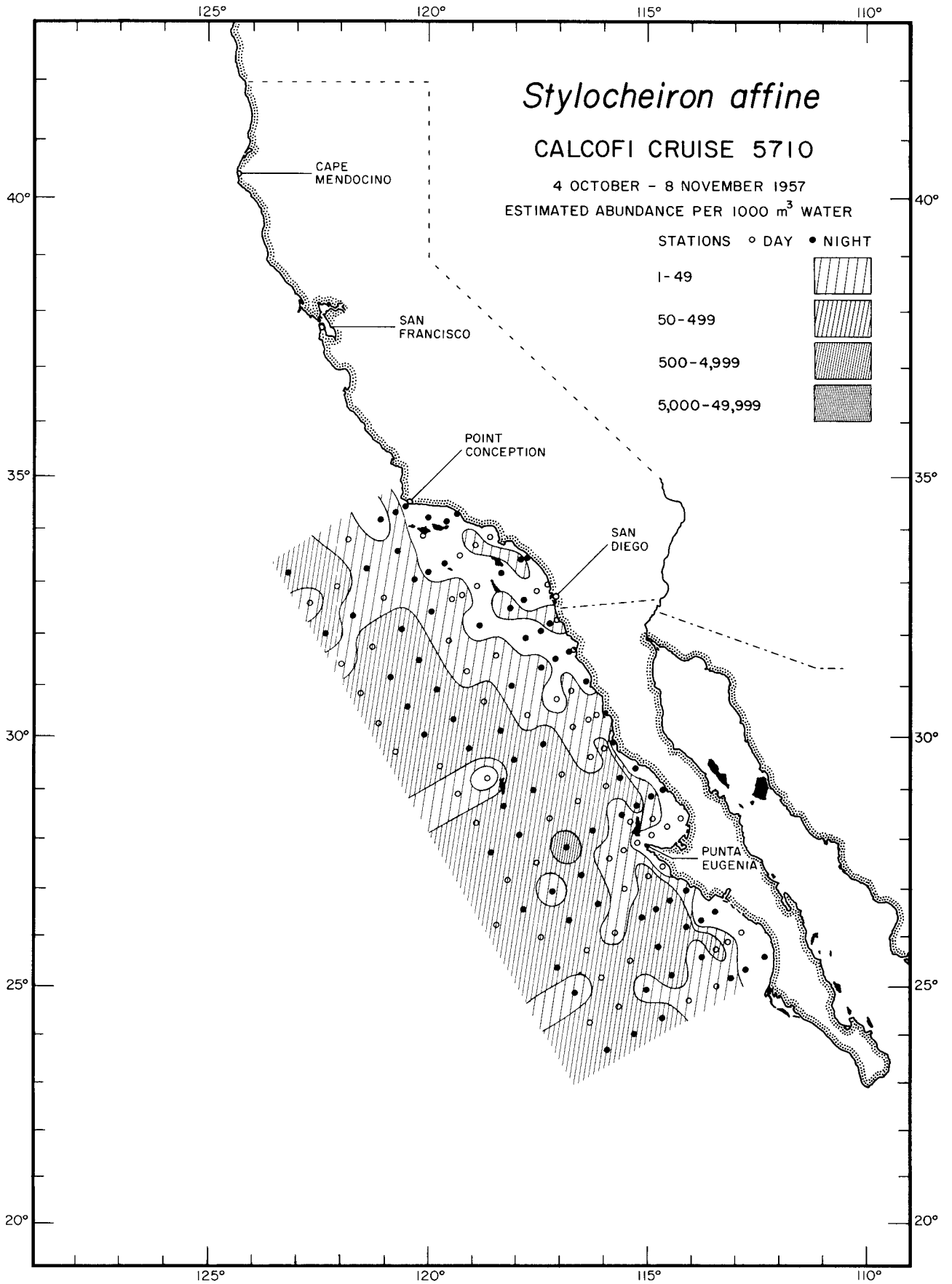
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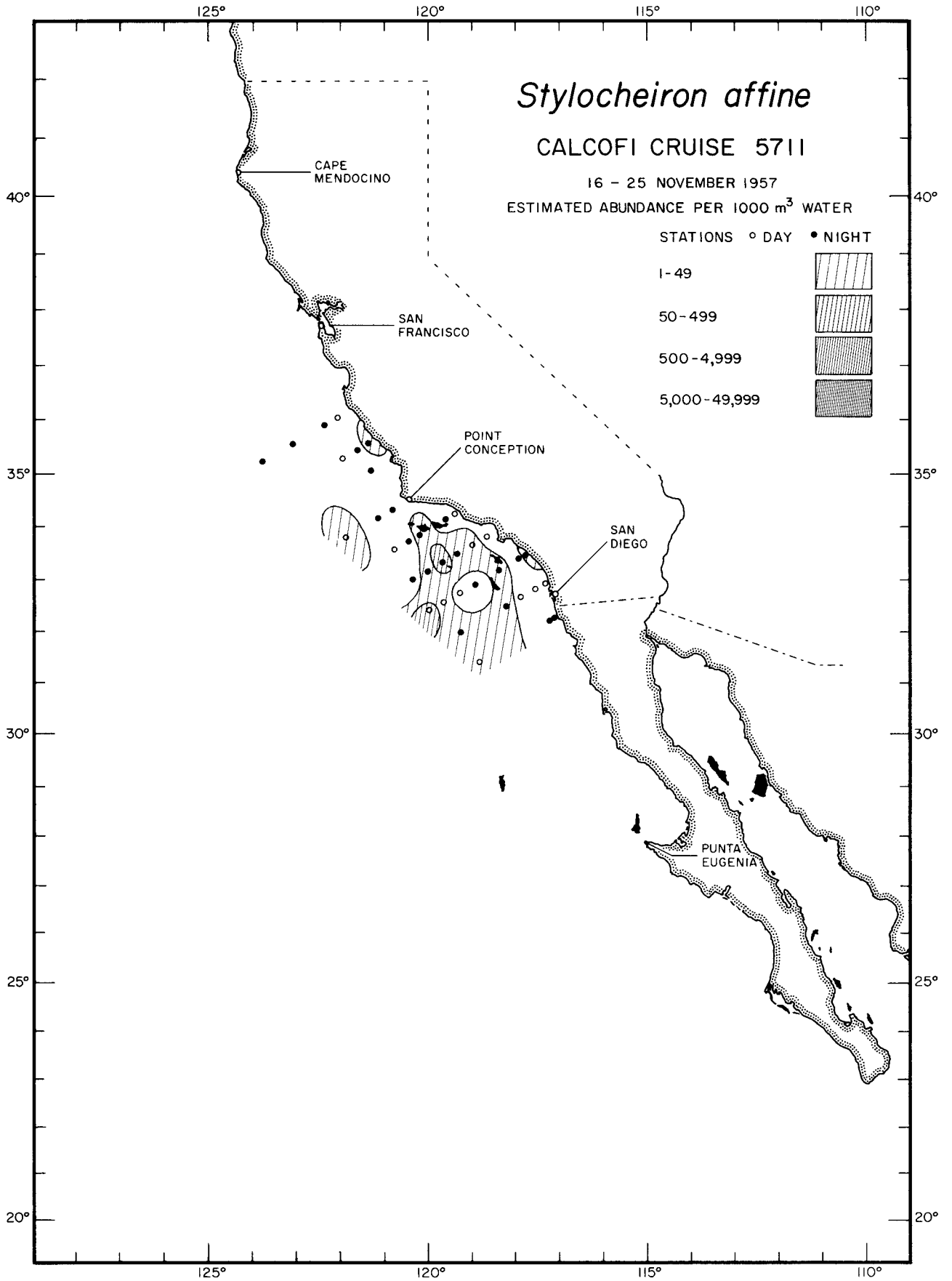
Euphausiacea
Stylocheiron affine
5504



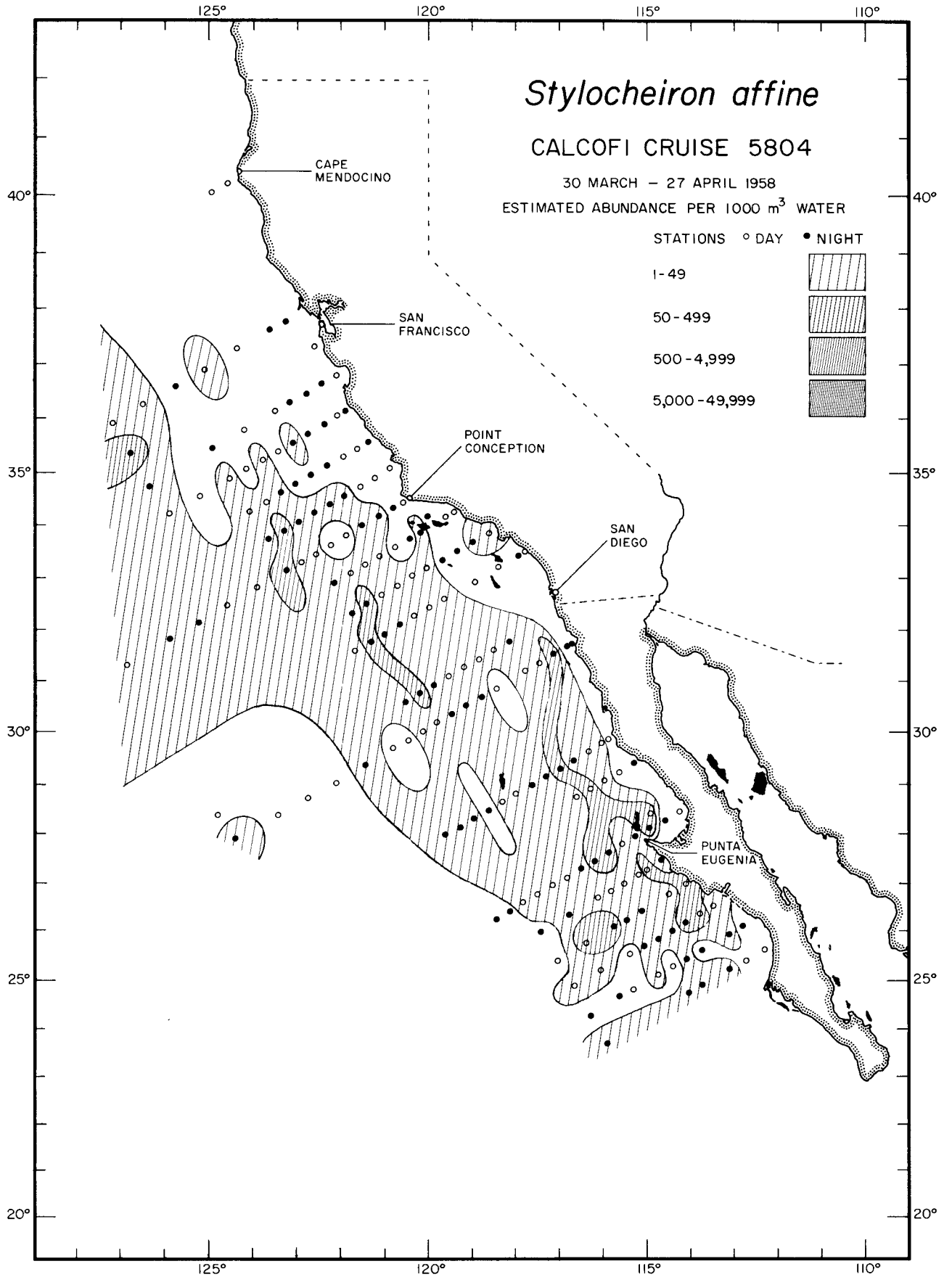
Euphausiacea
Stylocheiron affine
5702



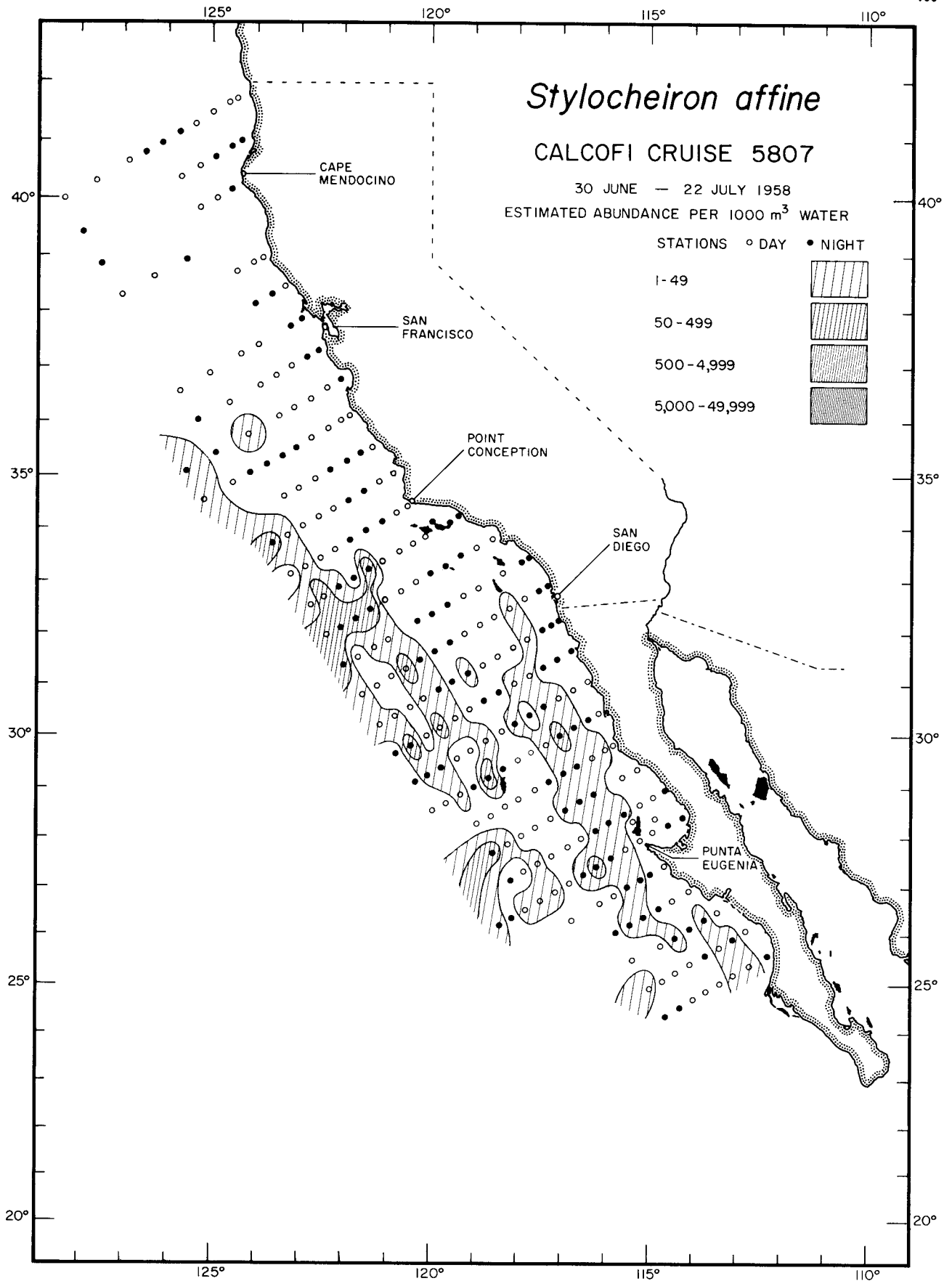
Euphausiacea
Stylocheiron affine
5710



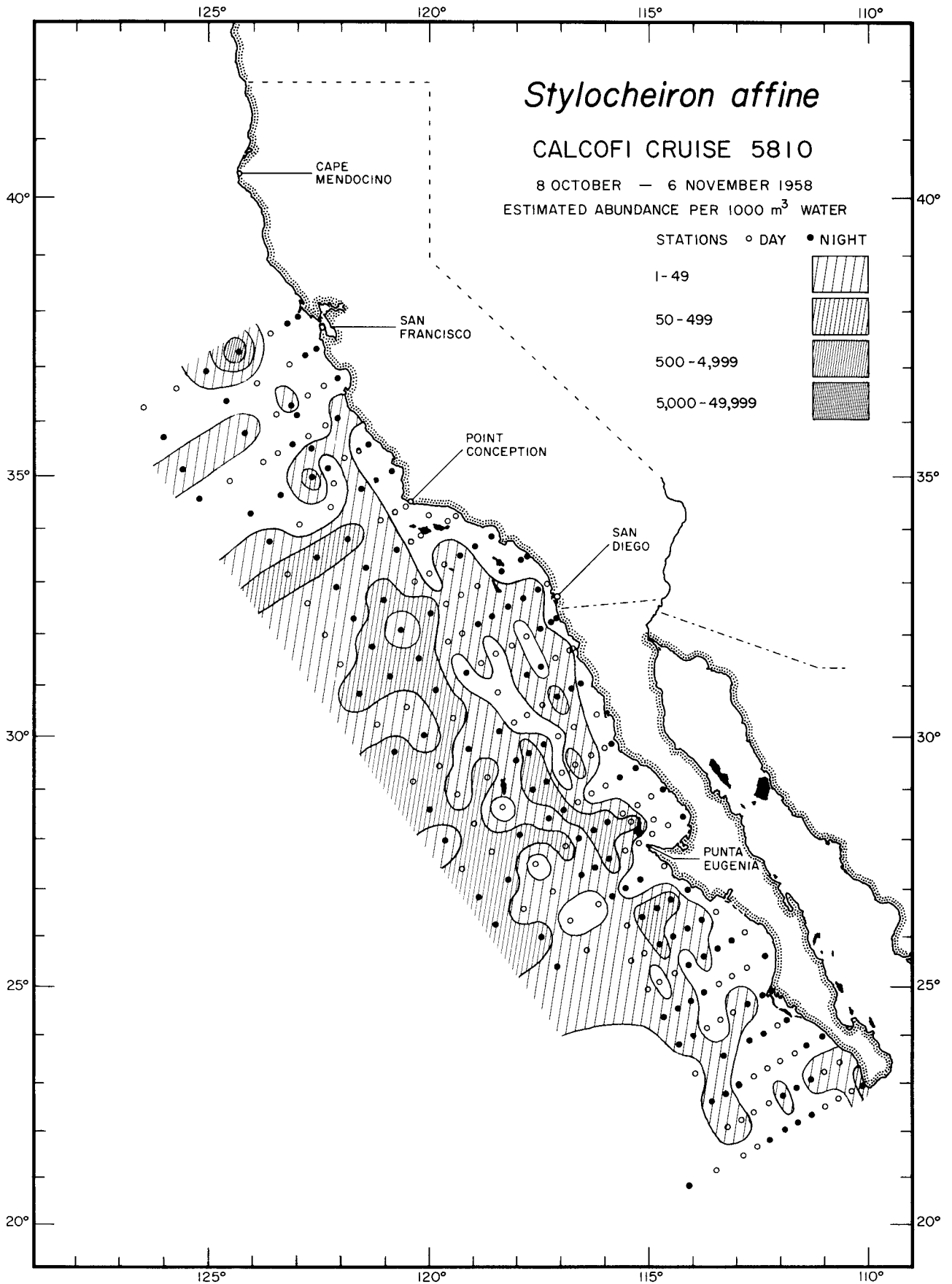
Euphausiacea
Stylocheiron affine
5711



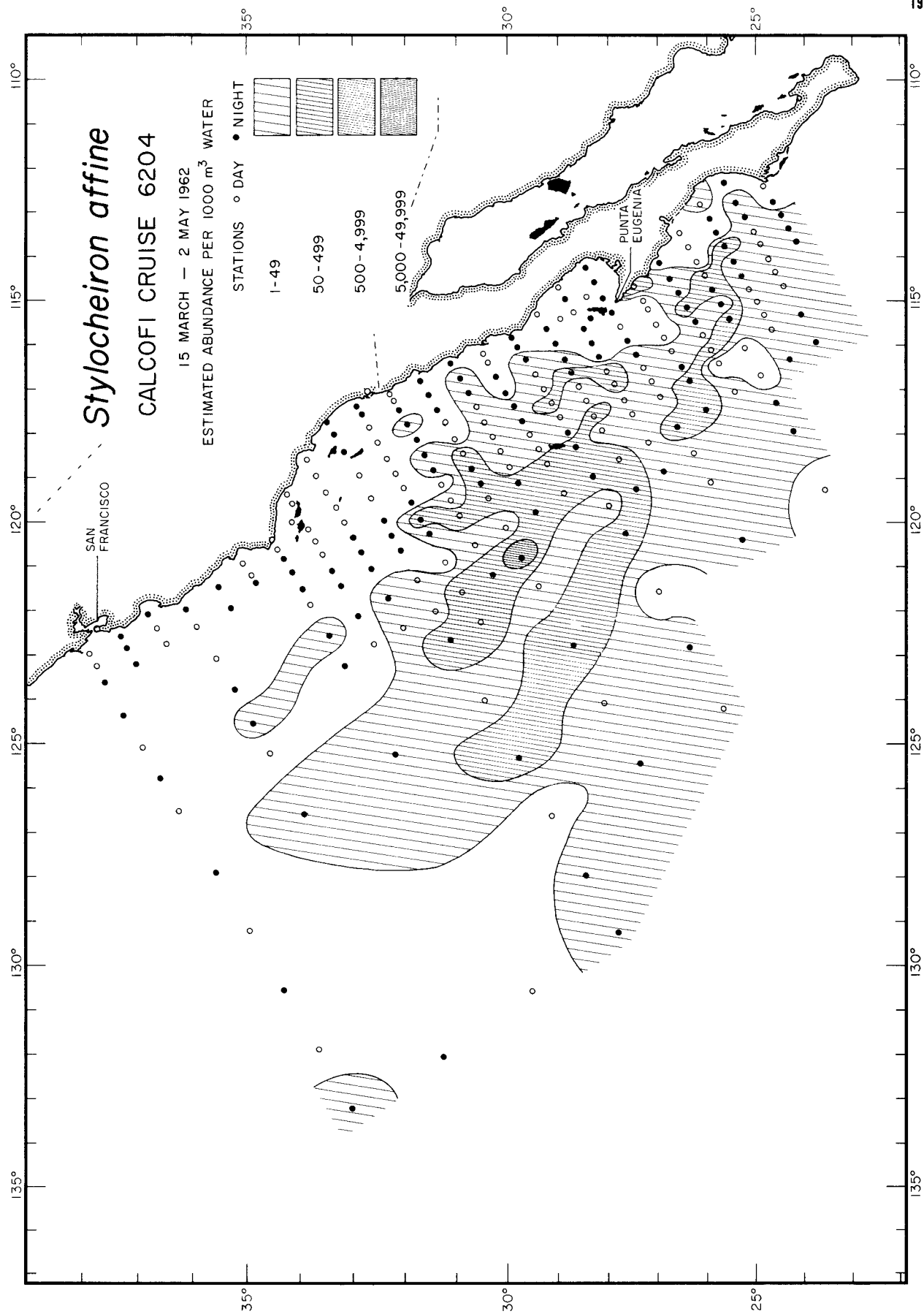
Euphausiacea
Stylocheiron affine
 5804



Euphausiacea
Stylocheiron affine
5807



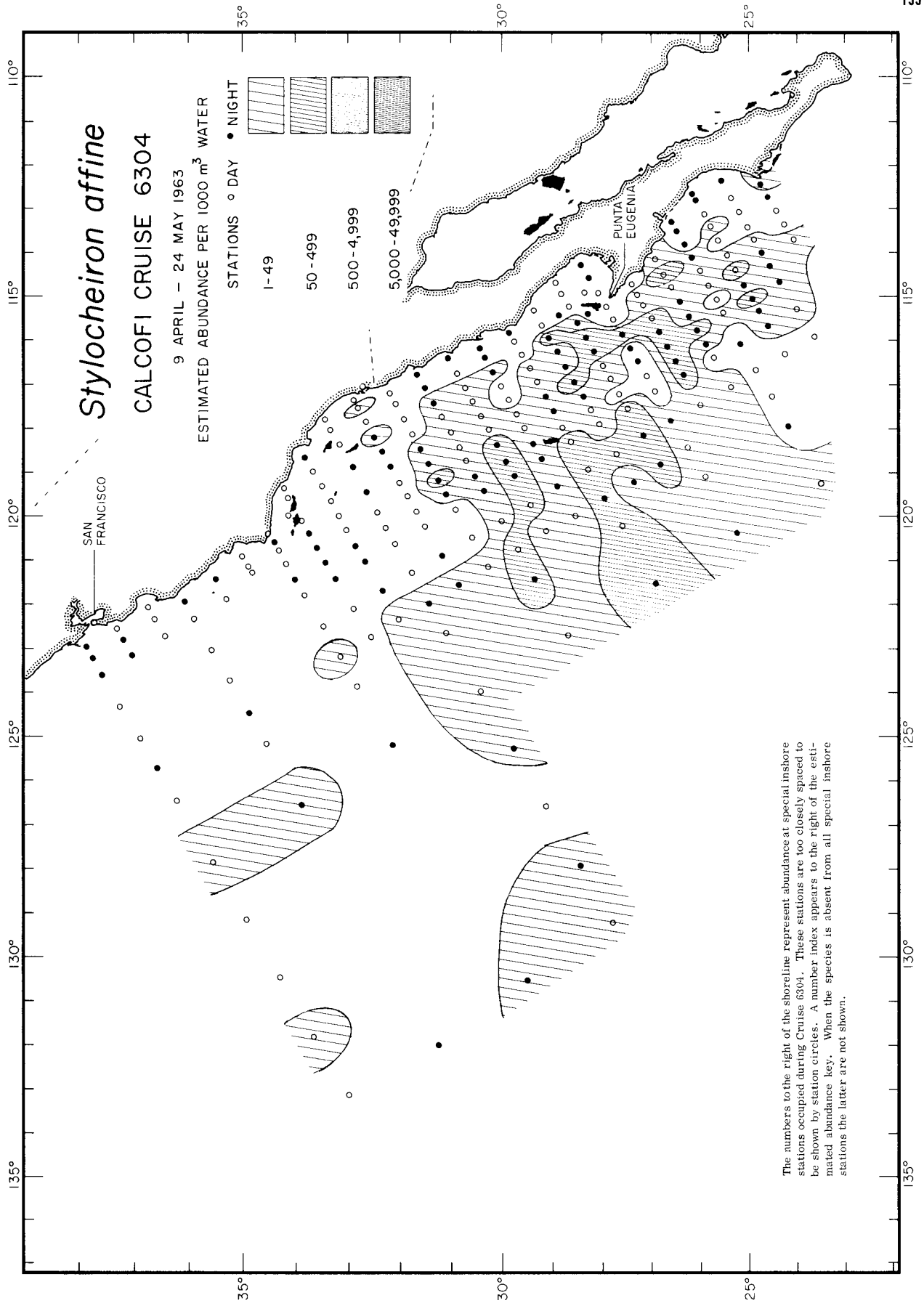
Euphausiacea
Stylocheiron affine
 5810



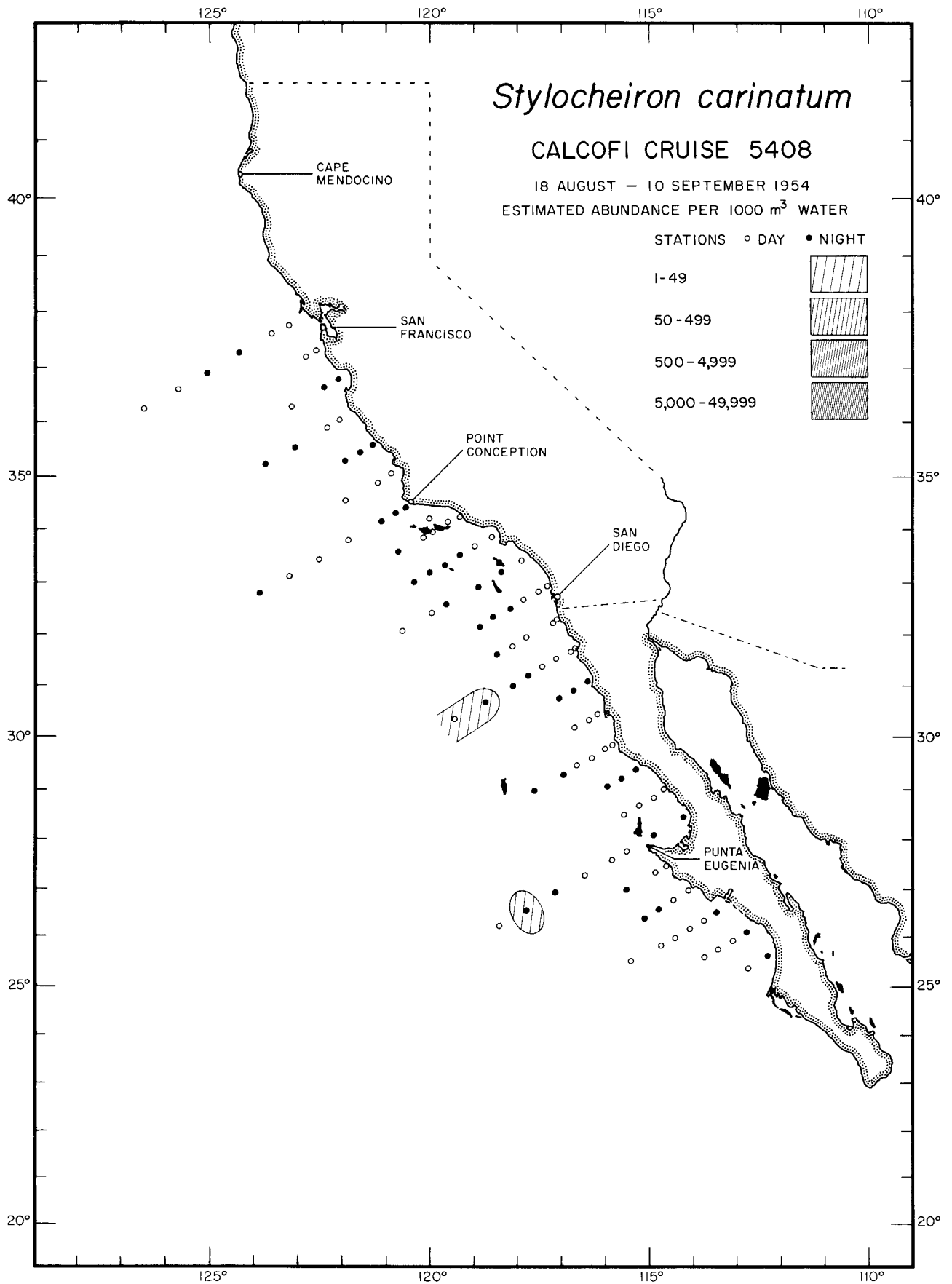
Euphausiacea

Stylocheiron affine

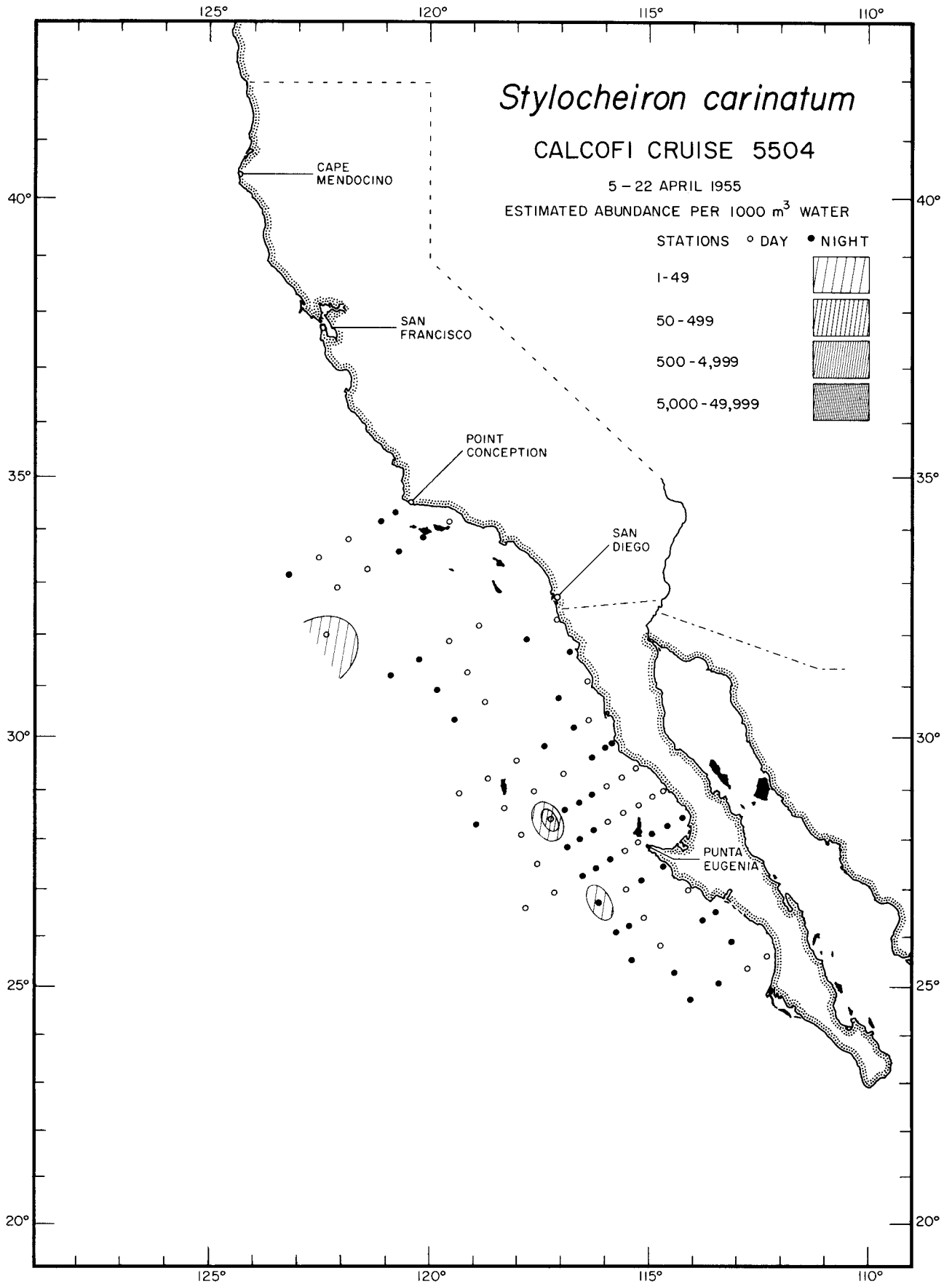
6204



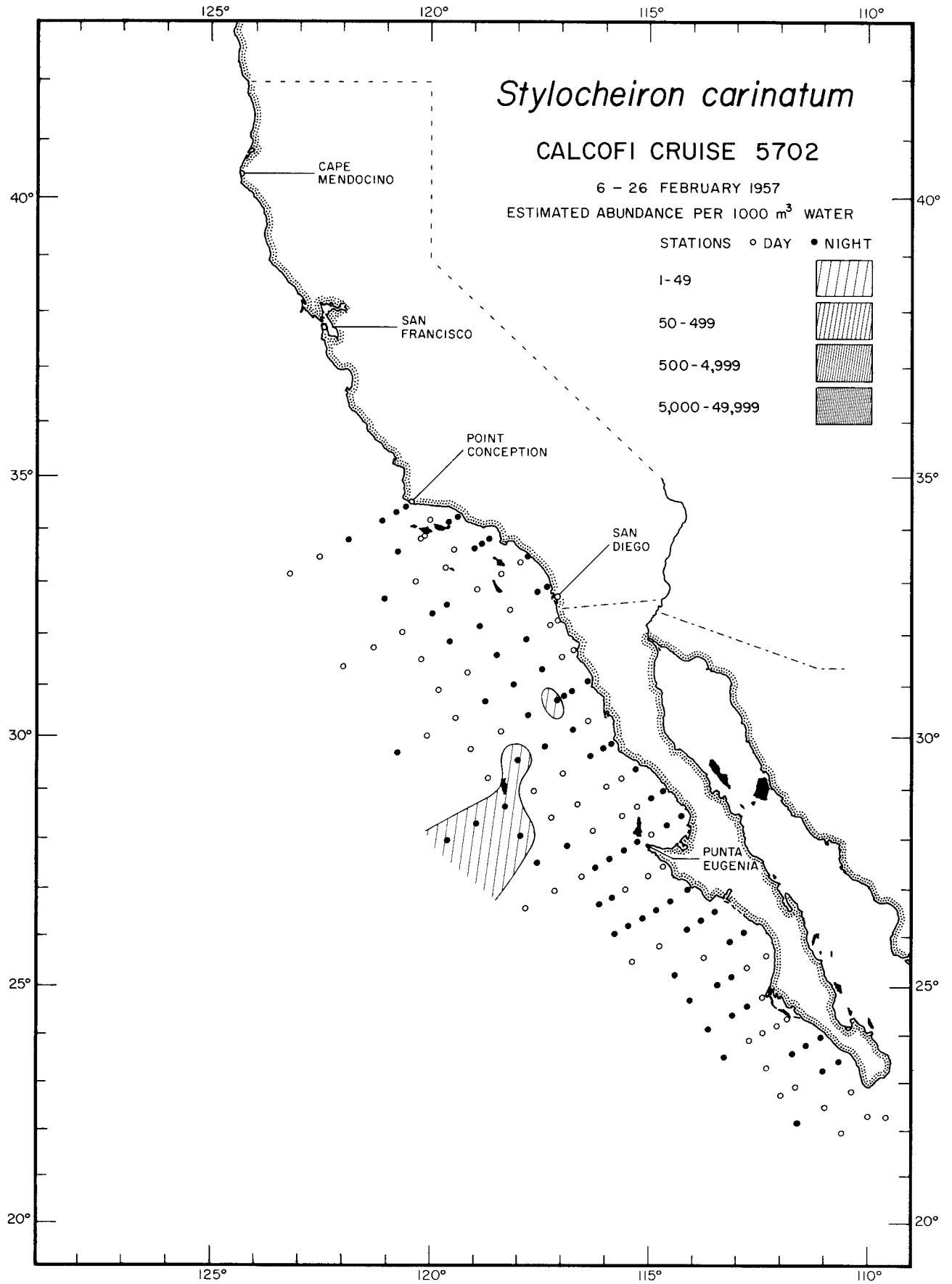
Euphausiacea
Stylocheiron affine
6304



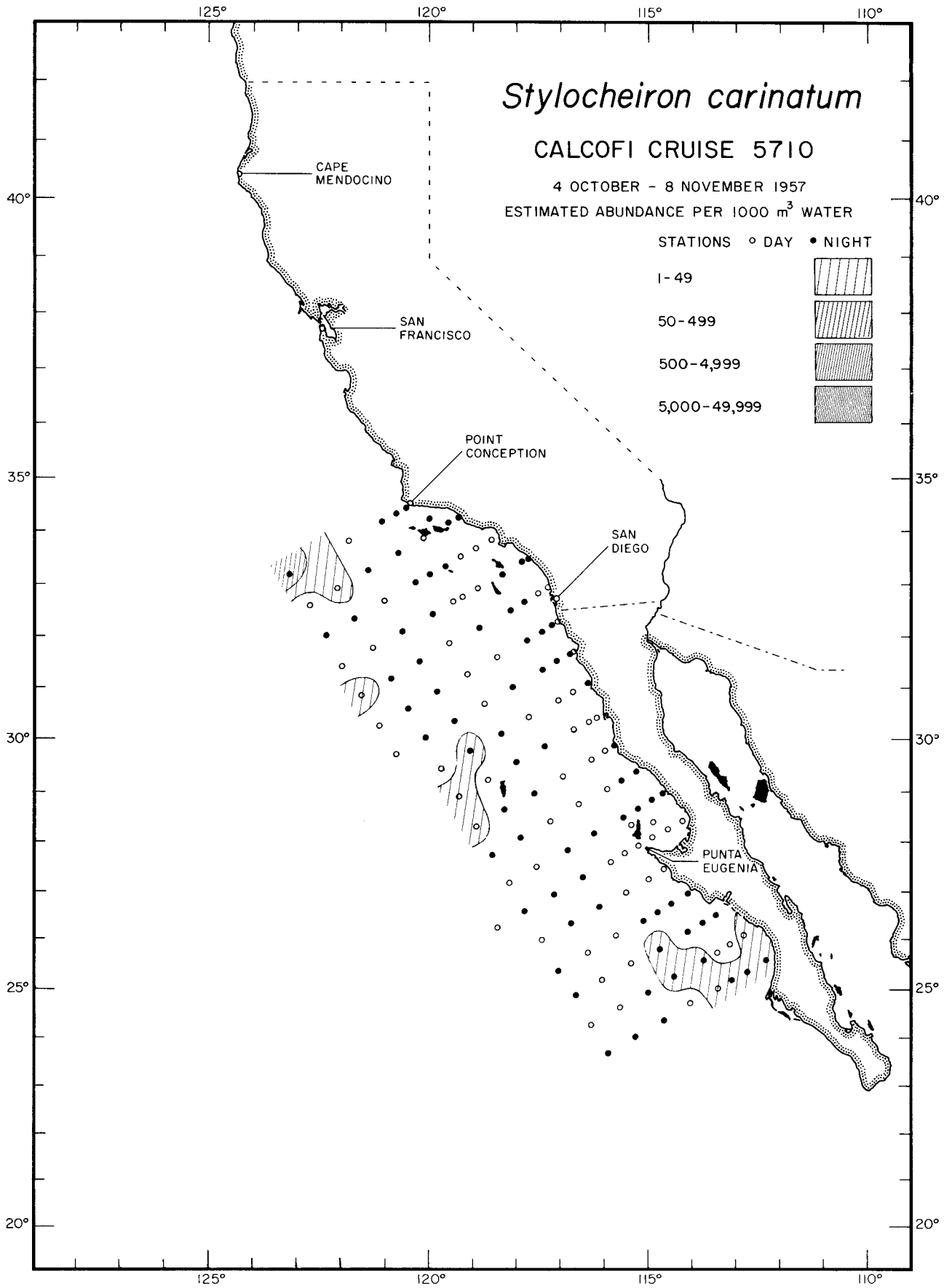
Euphausiacea
Stylocheiron carinatum
5408



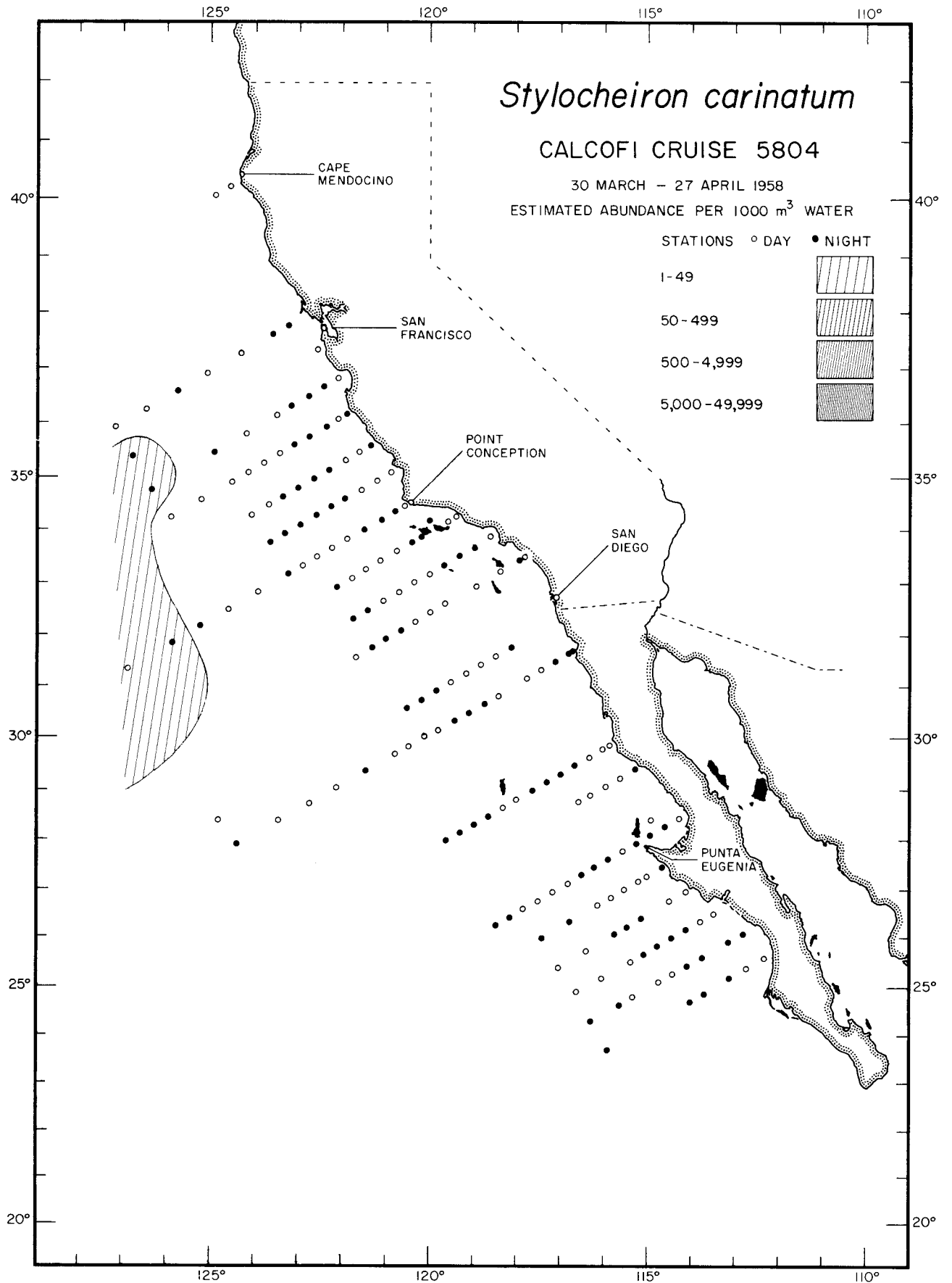
Euphausiacea
Stylocheiron carinatum
5504



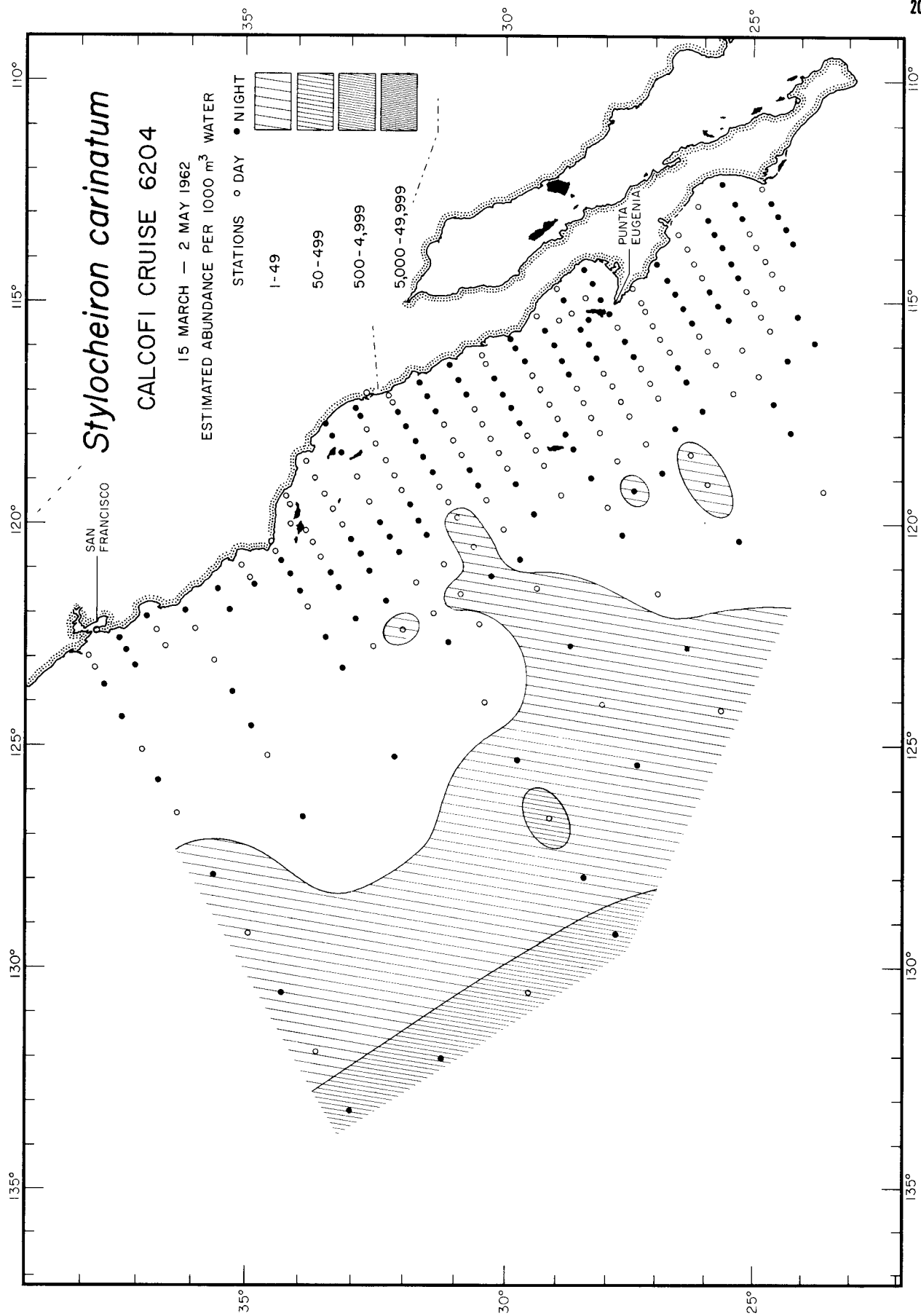
Euphausiacea
Stylocheiron carinatum
5702



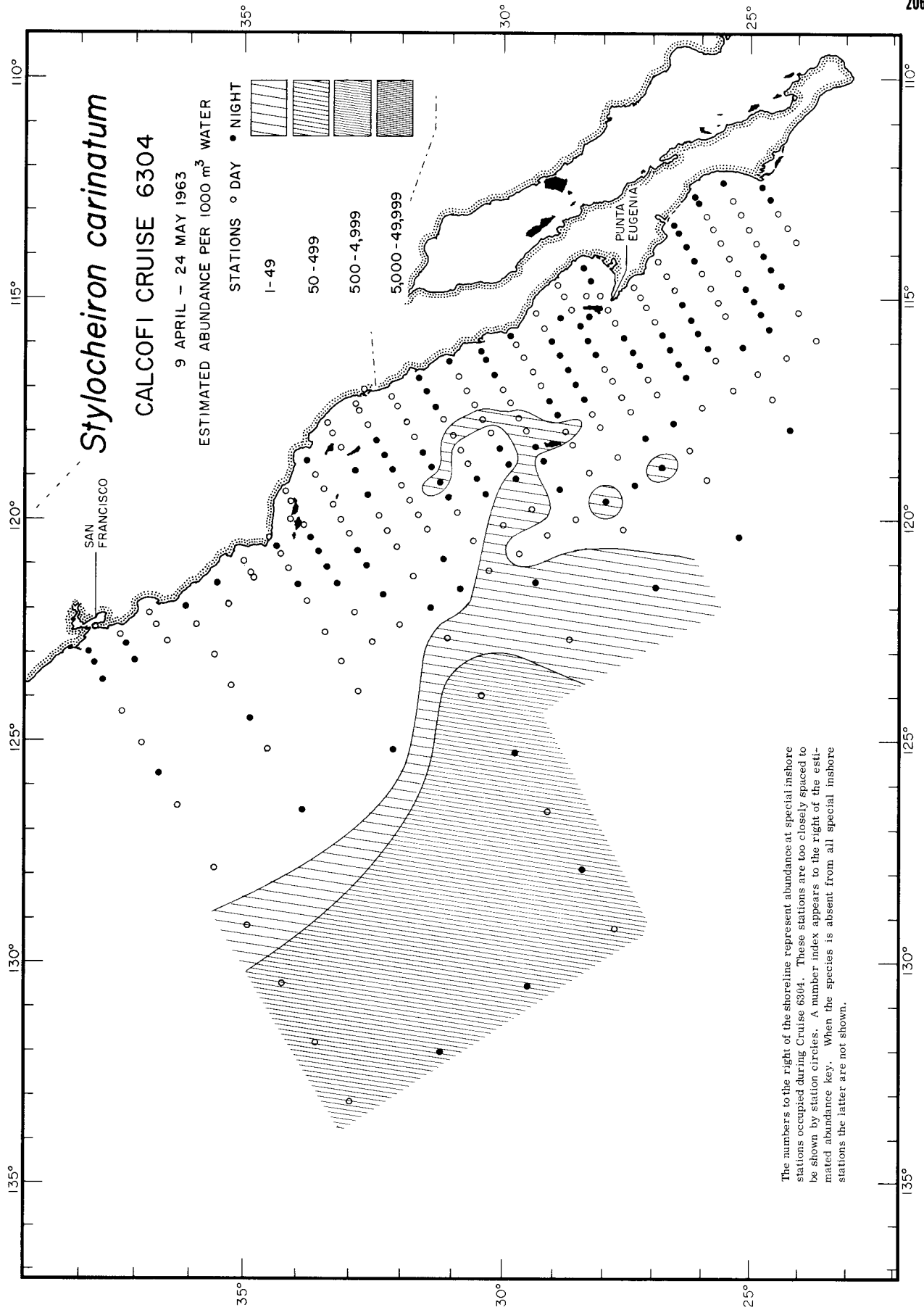
Euphausiacea
Stylocheiron carinatum
 5710



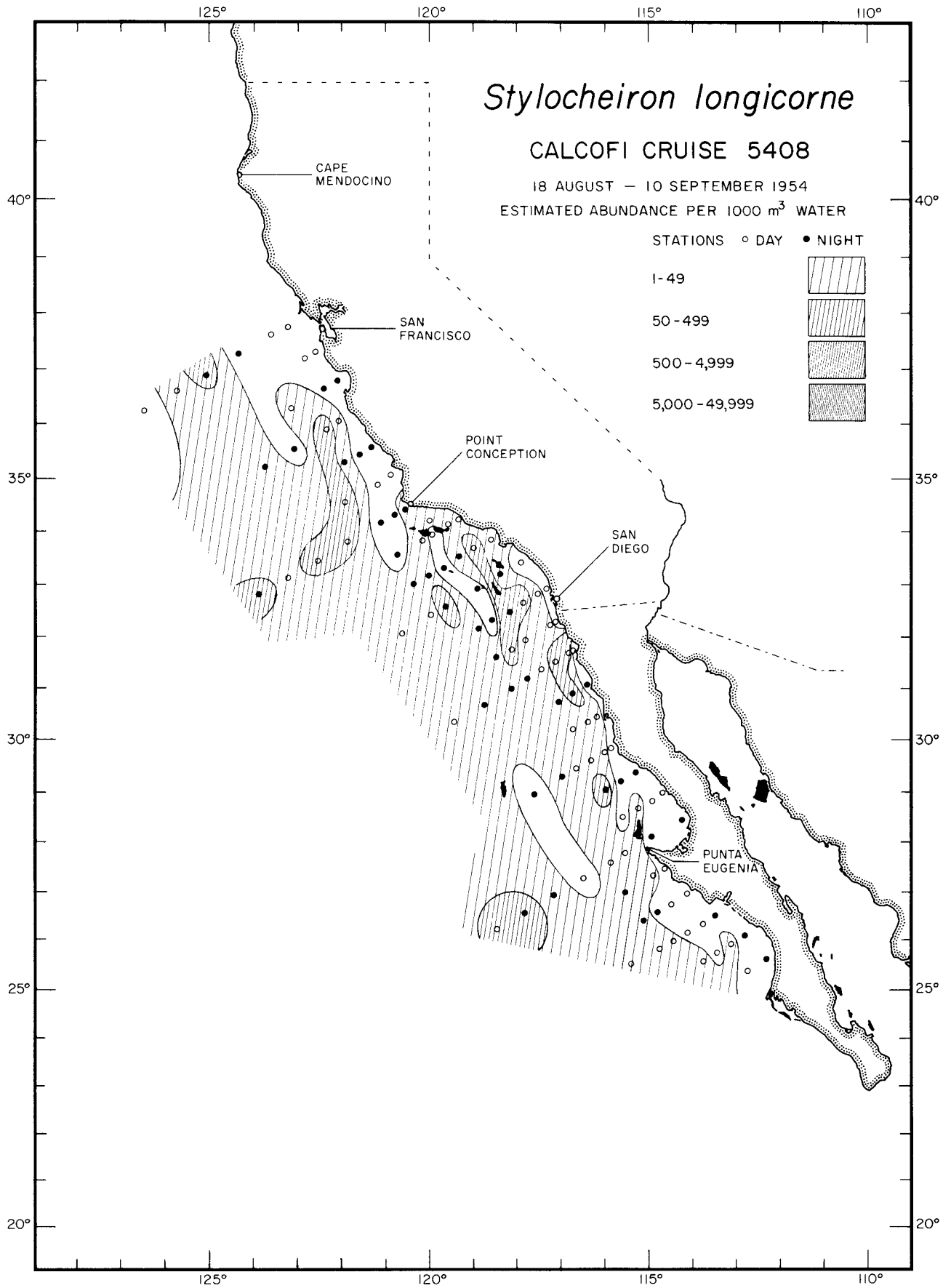
Euphausiacea
Stylocheiron carinatum
5804



Euphausiacea
Stylocheiron carinatum
 6204

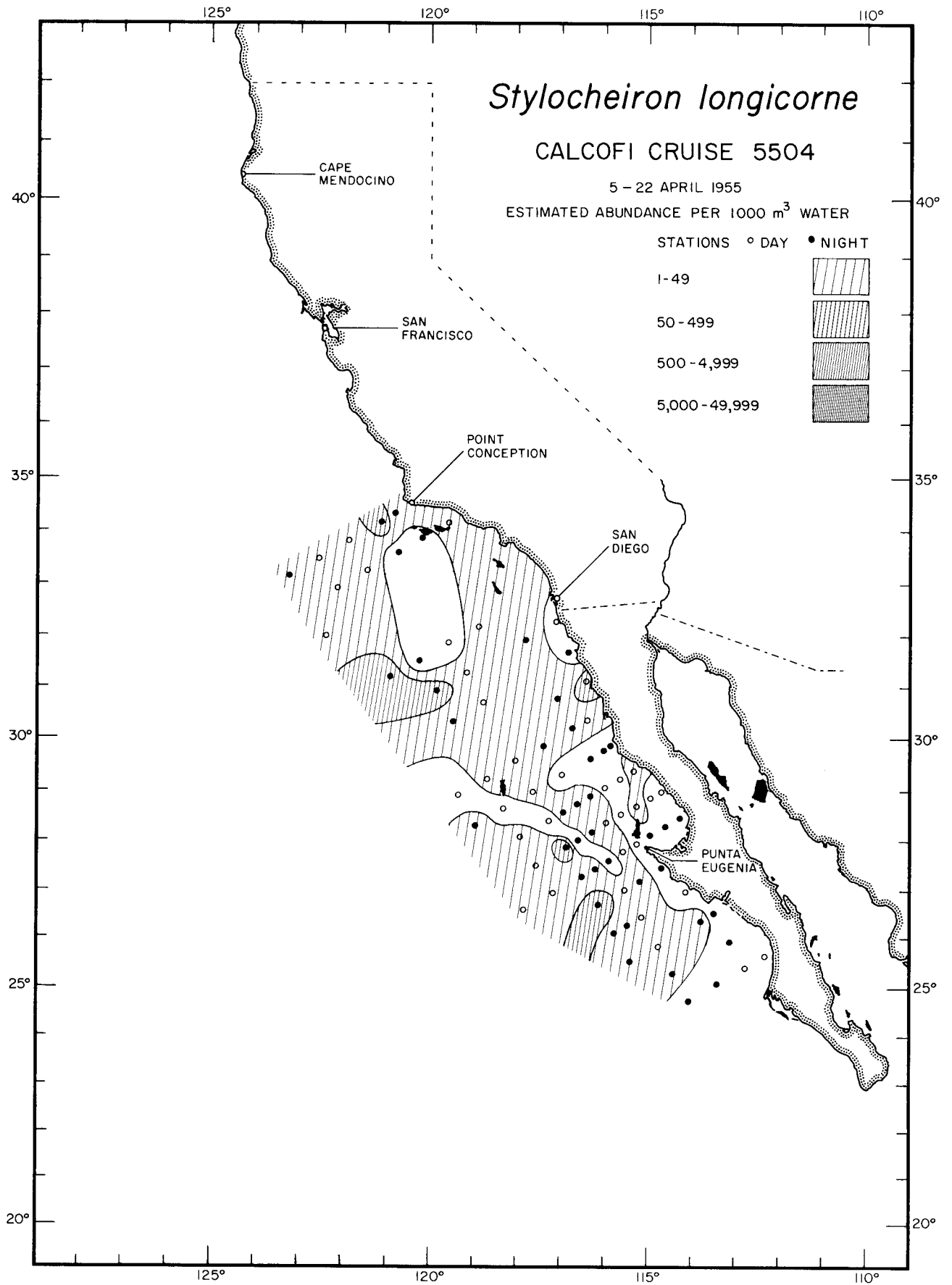


Euphausiacea
Stylocheiron carinatum
6304

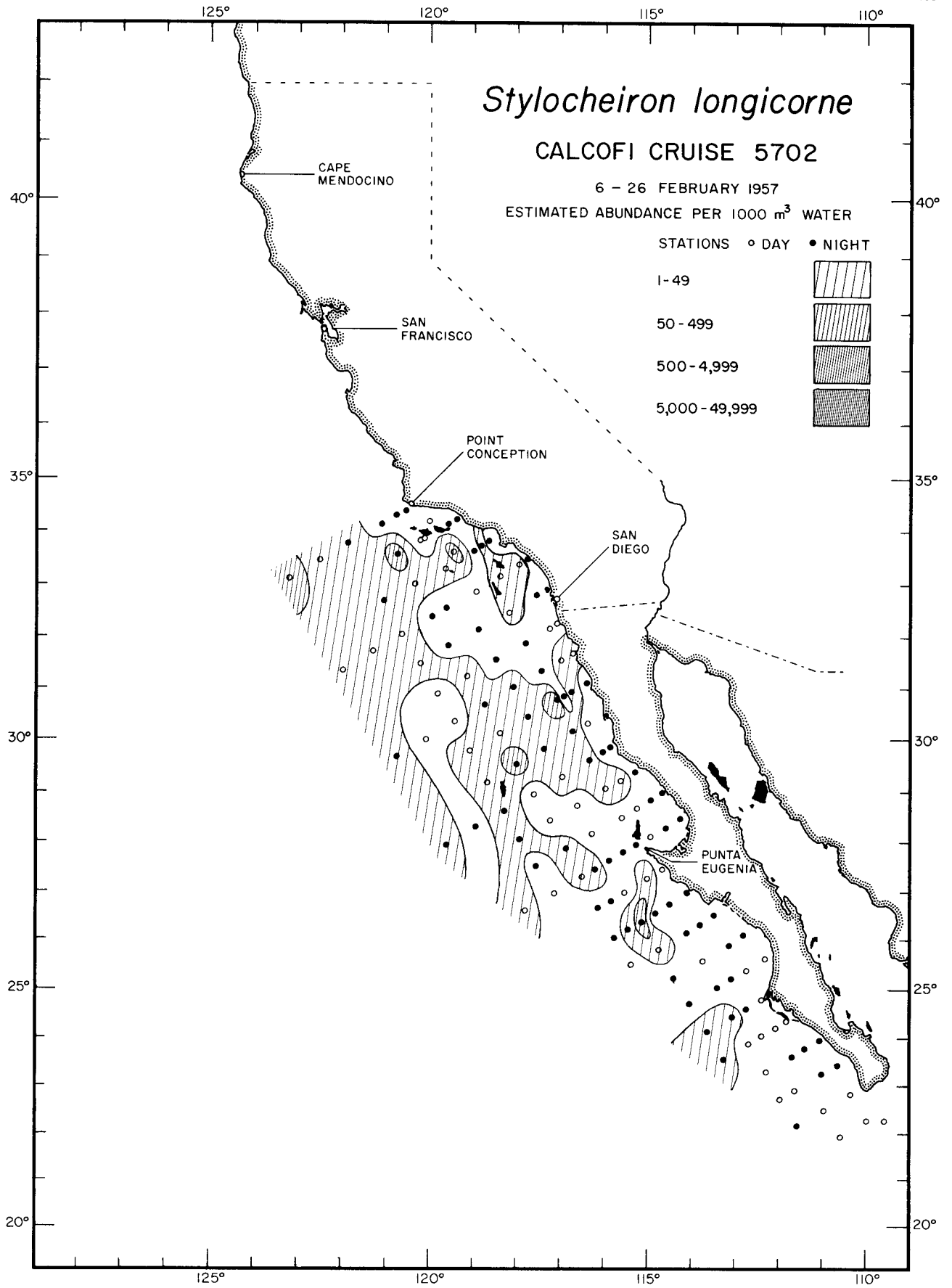


Euphausiacea
Stylocheiron longicorne

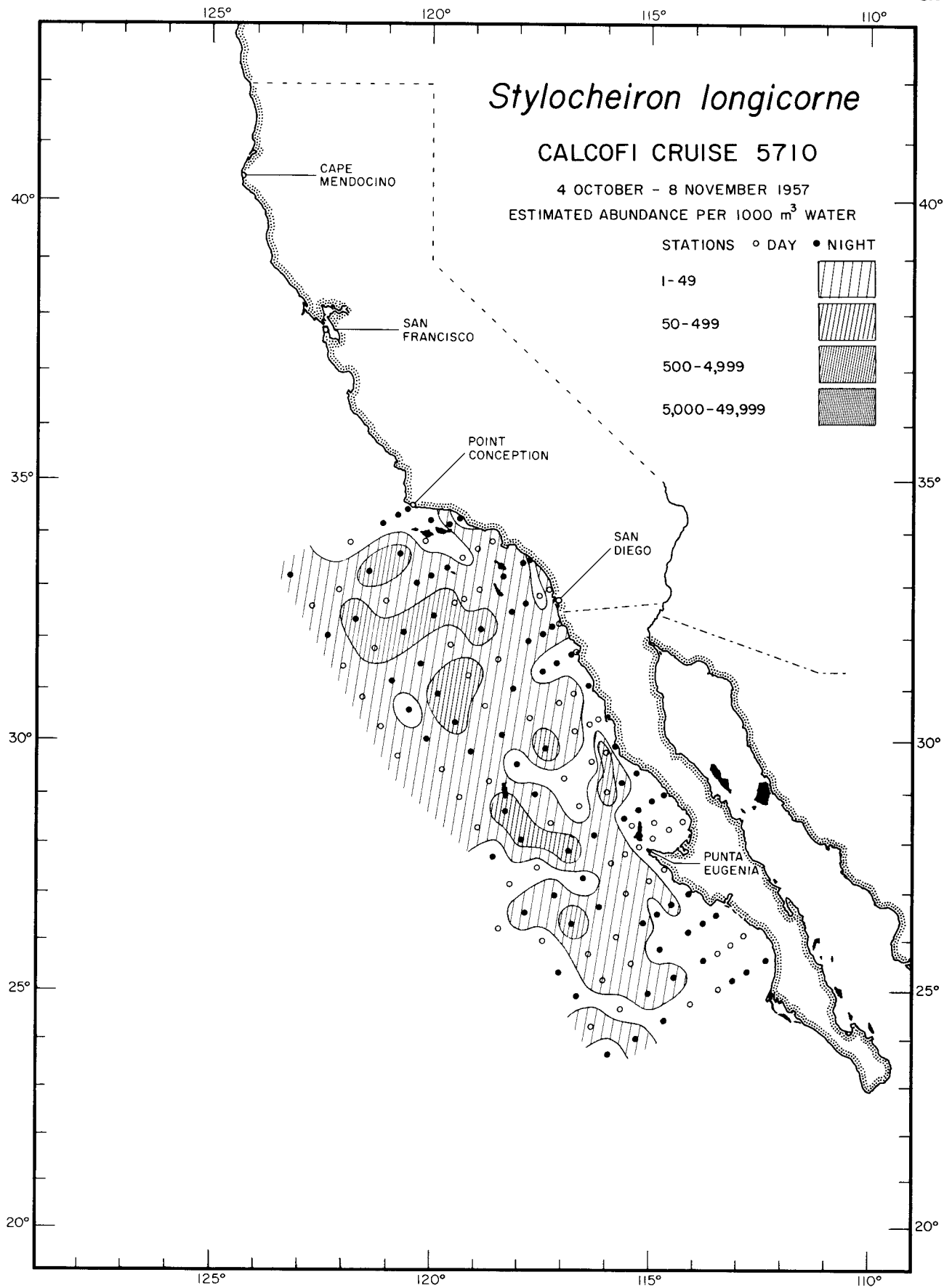
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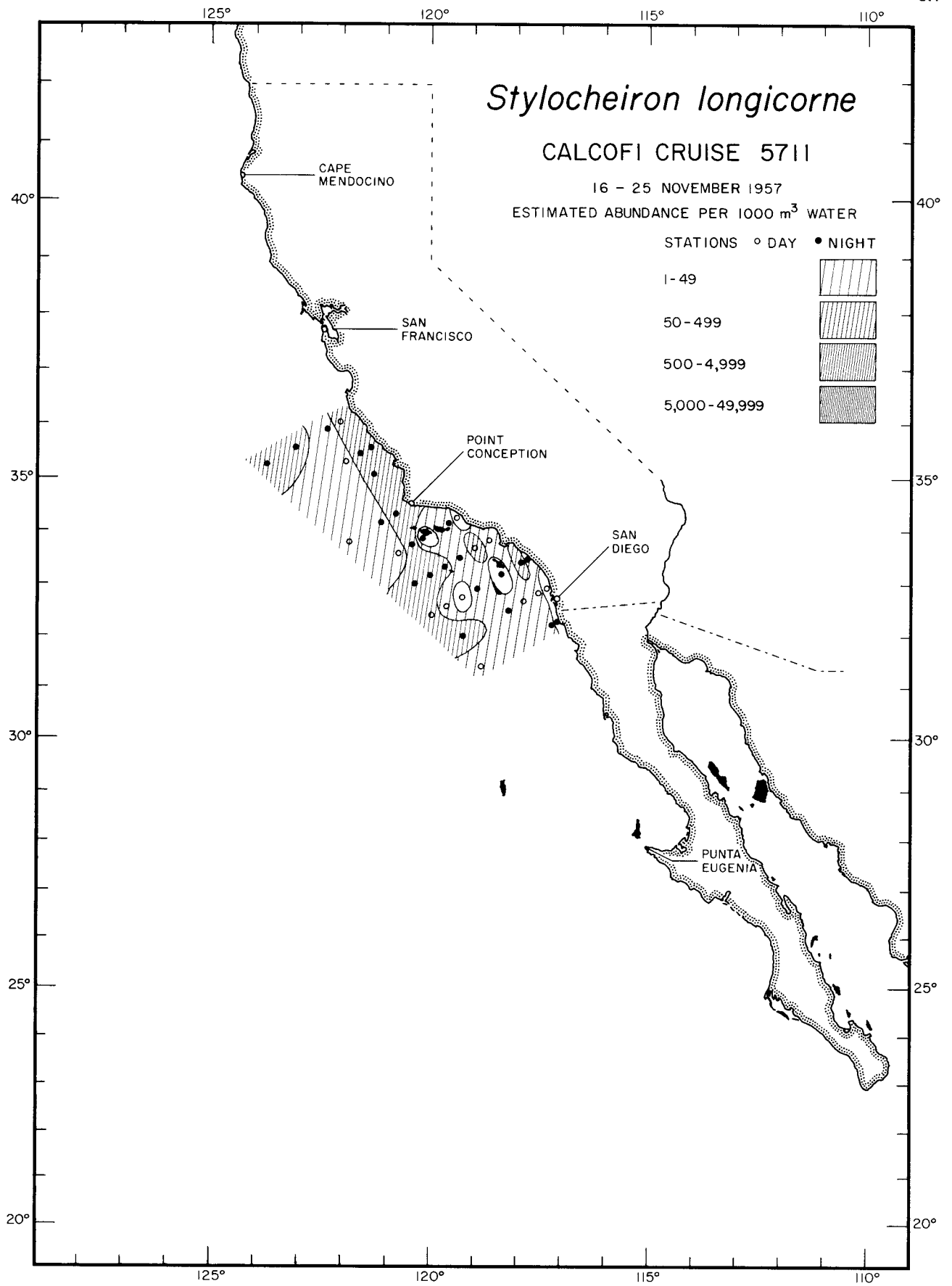
Euphausiacea
Stylocheiron longicorne
5504



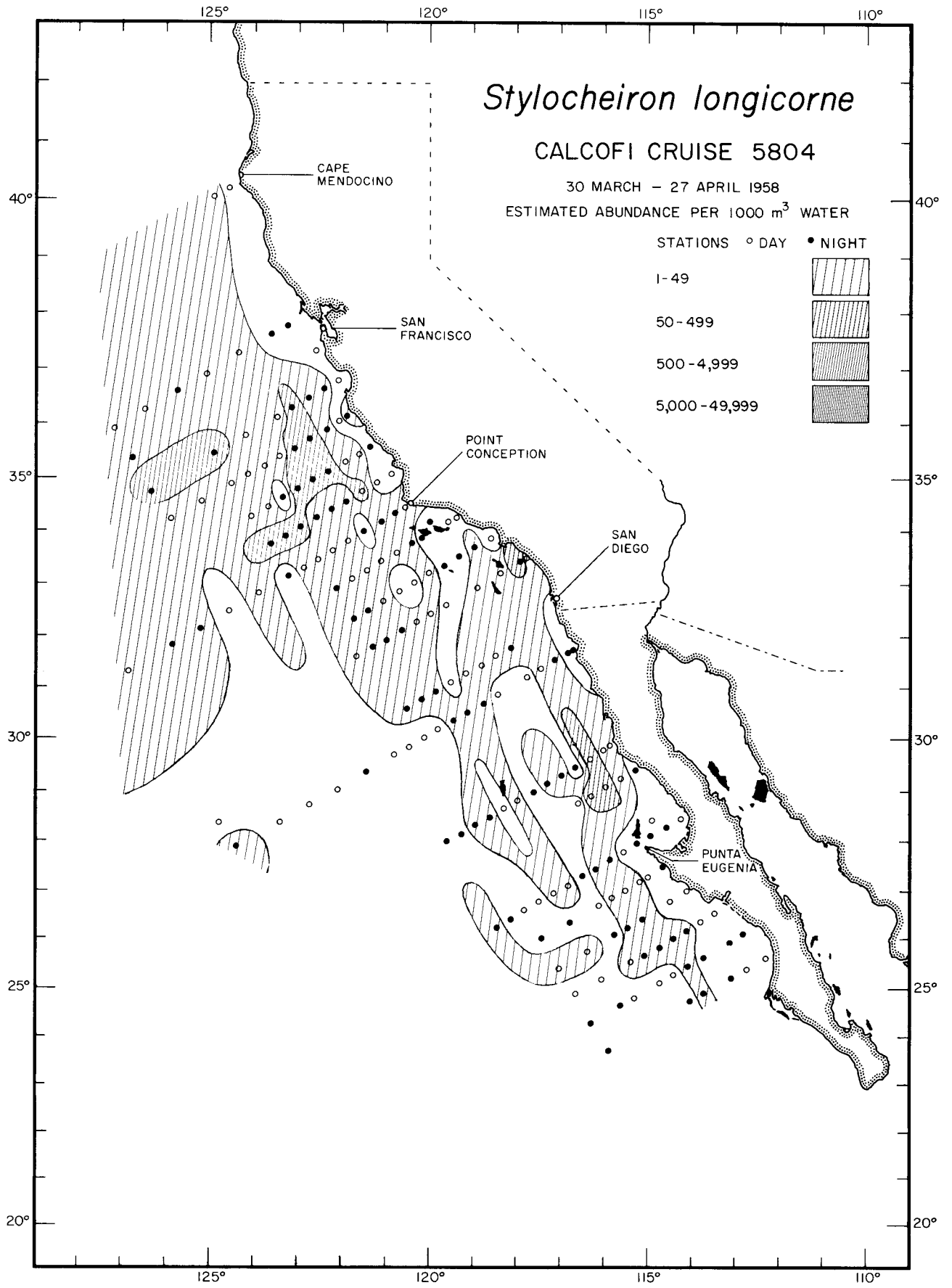
Euphausiacea
Stylocheiron longicorne
5702



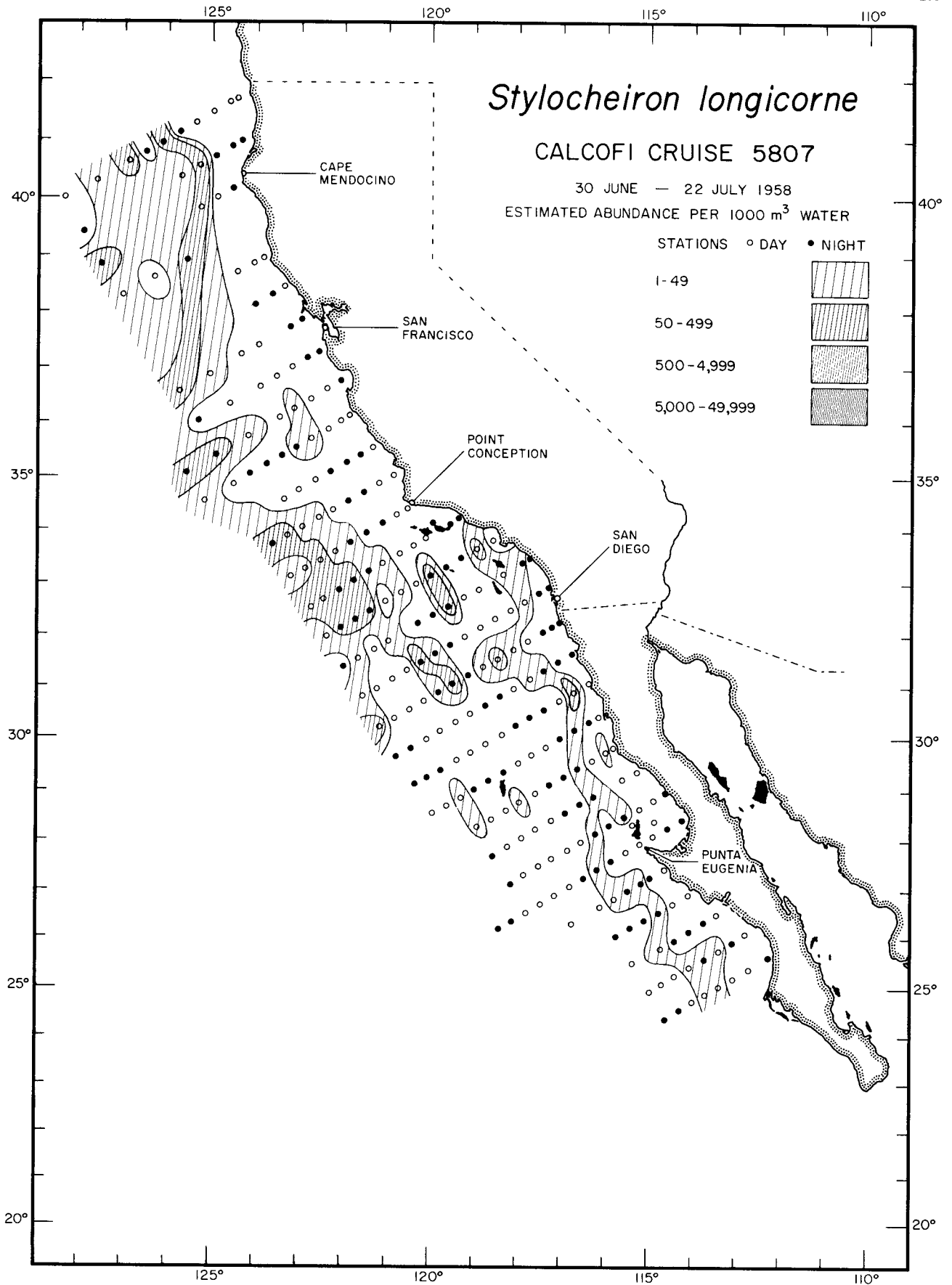
Euphausiacea
Stylocheiron longicorne
5710



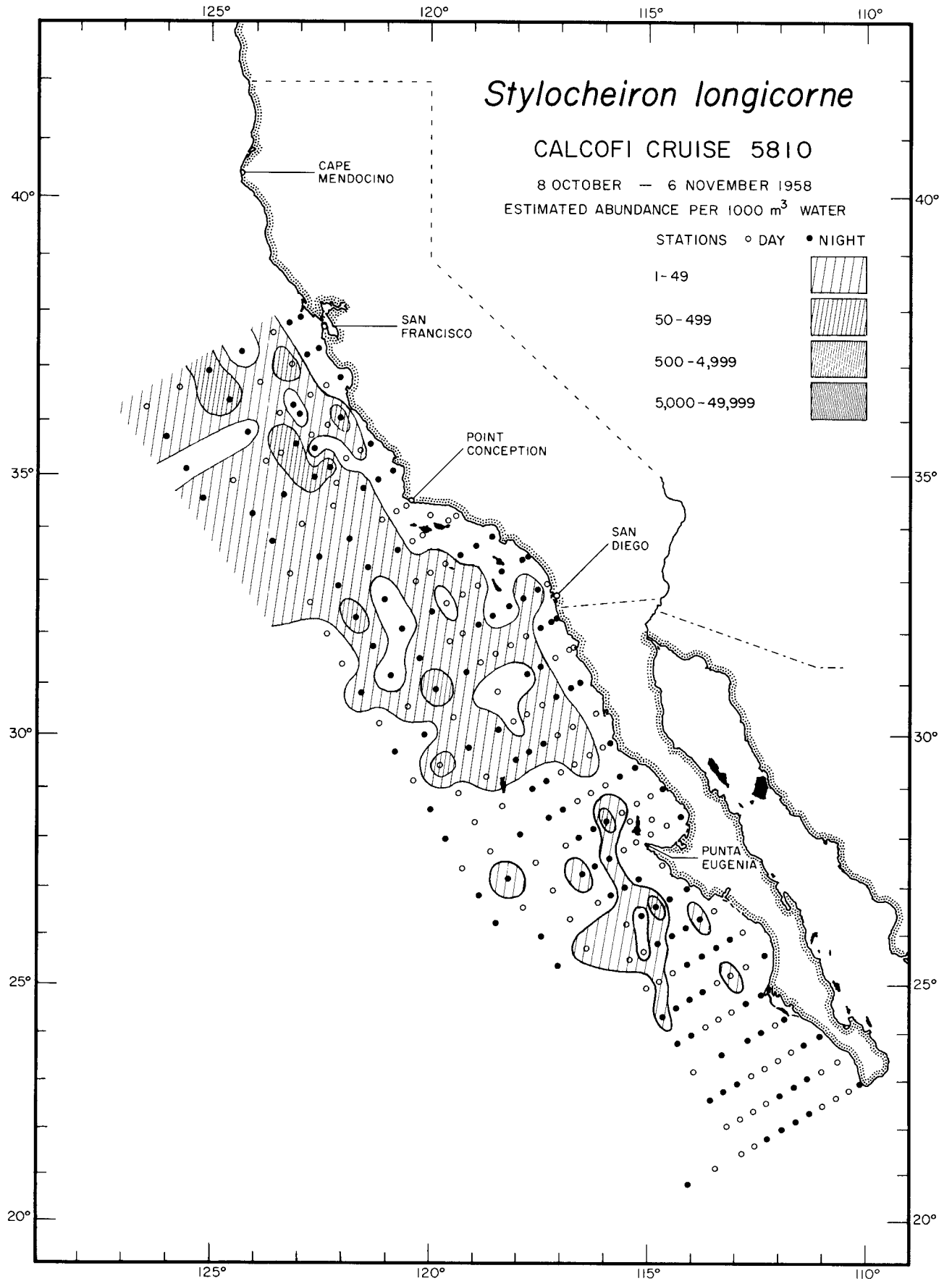
Euphausiacea
Stylocheiron longicorne
5711



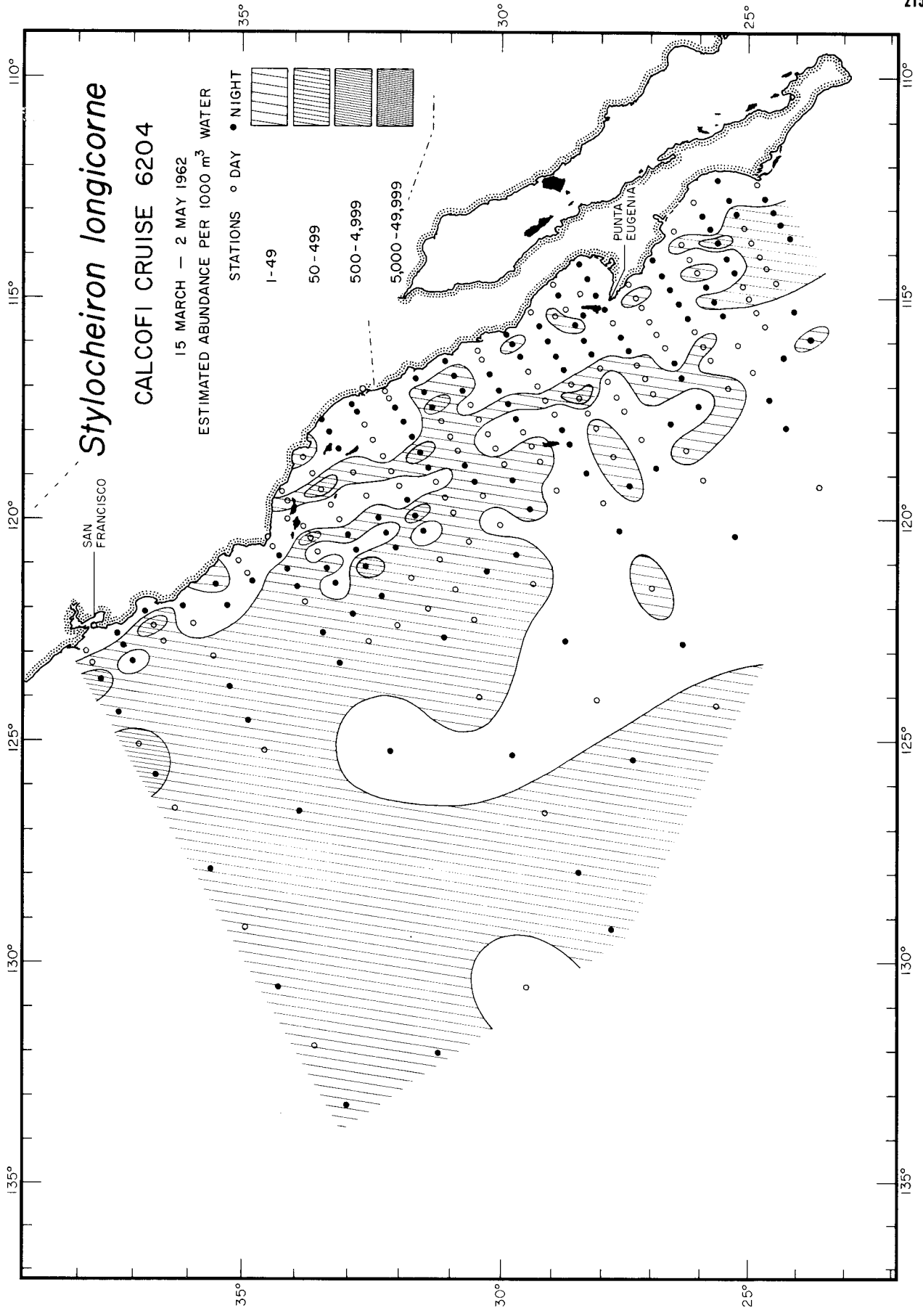
Euphausiacea
Stylocheiron longicorne
 5804



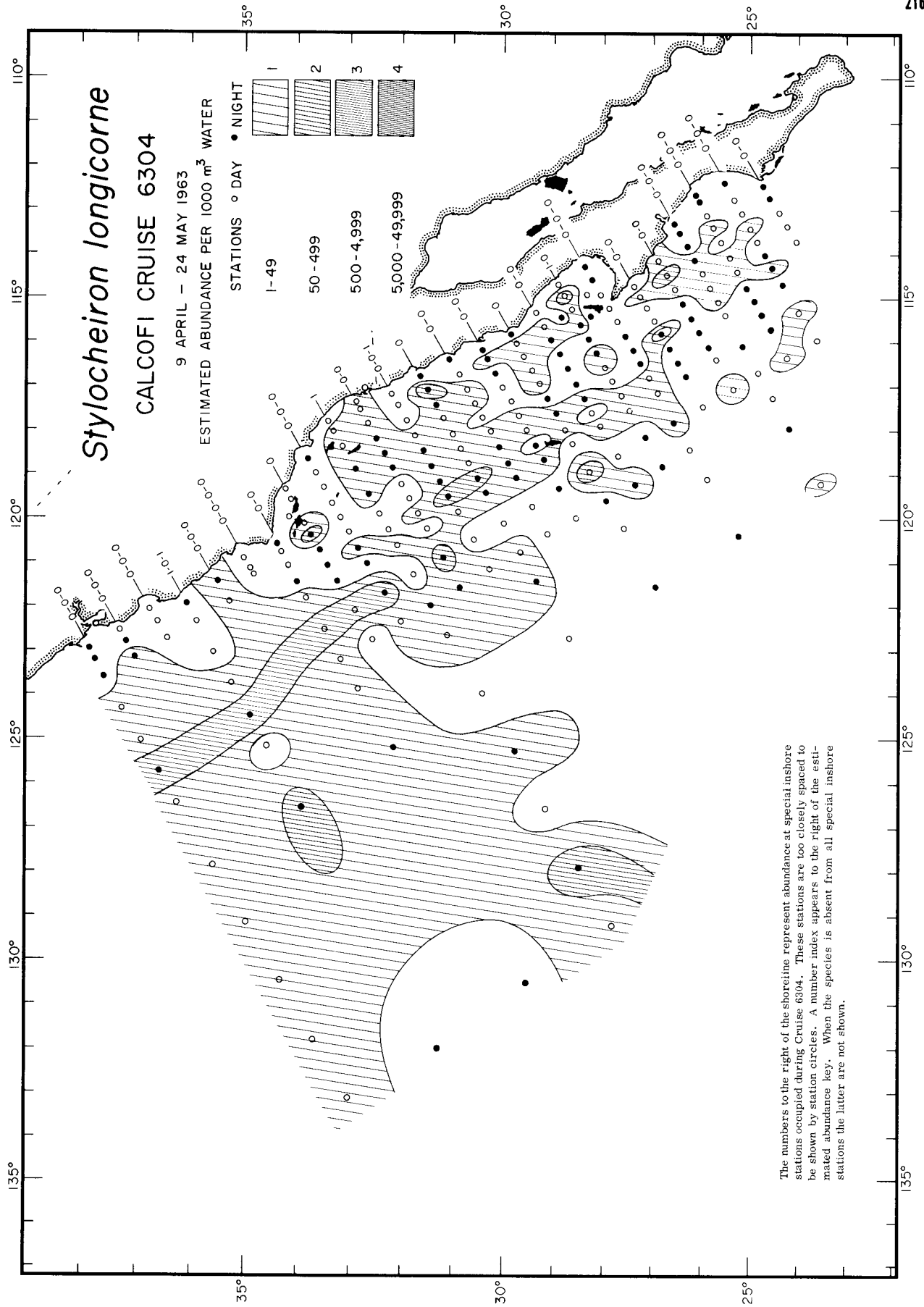
Euphausiacea
Stylocheiron longicorne
5807



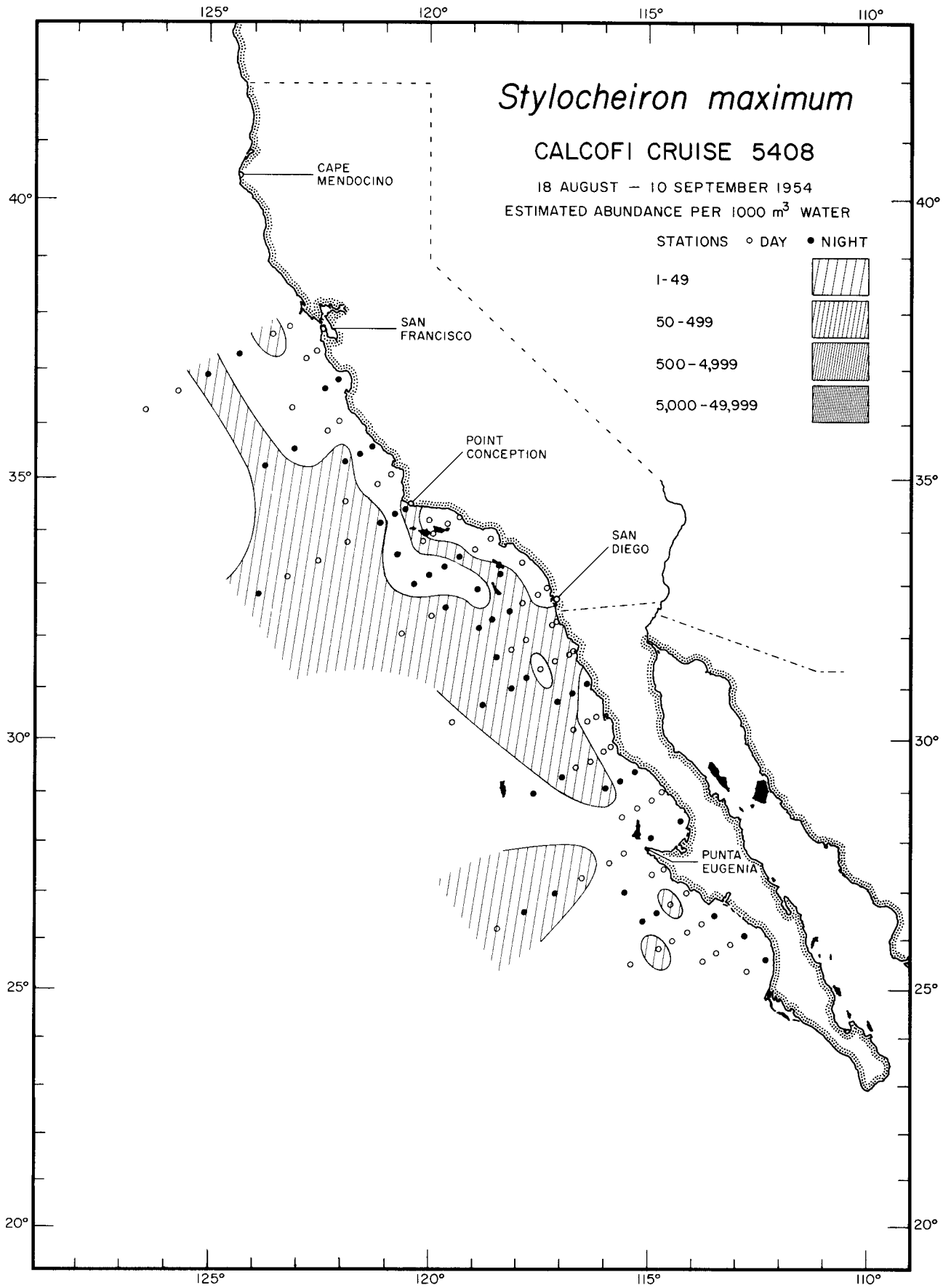
Euphausiacea
Stylocheiron longicorne
5810



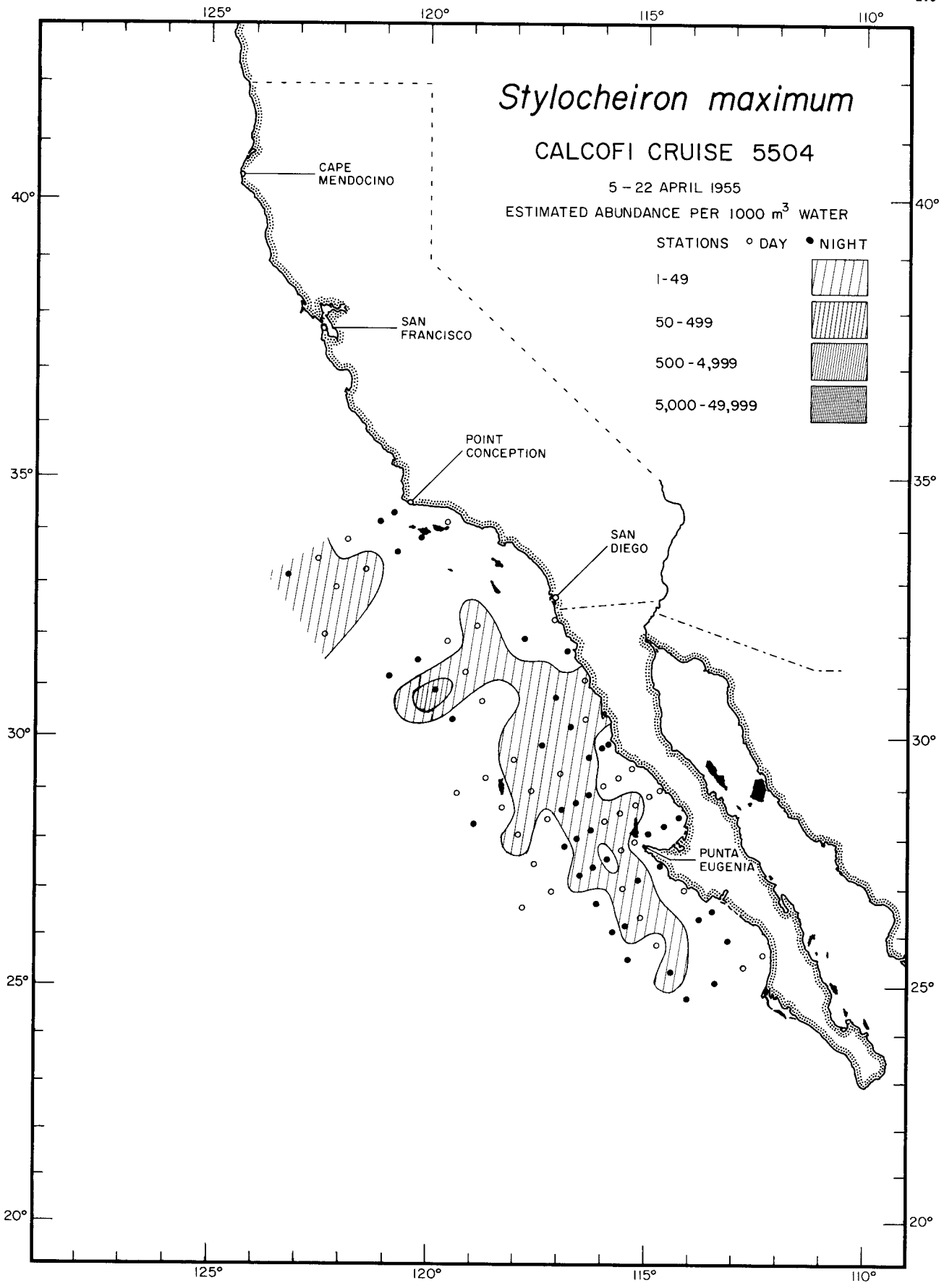
Euphausiacea
Stylocheiron longicorne
 6204



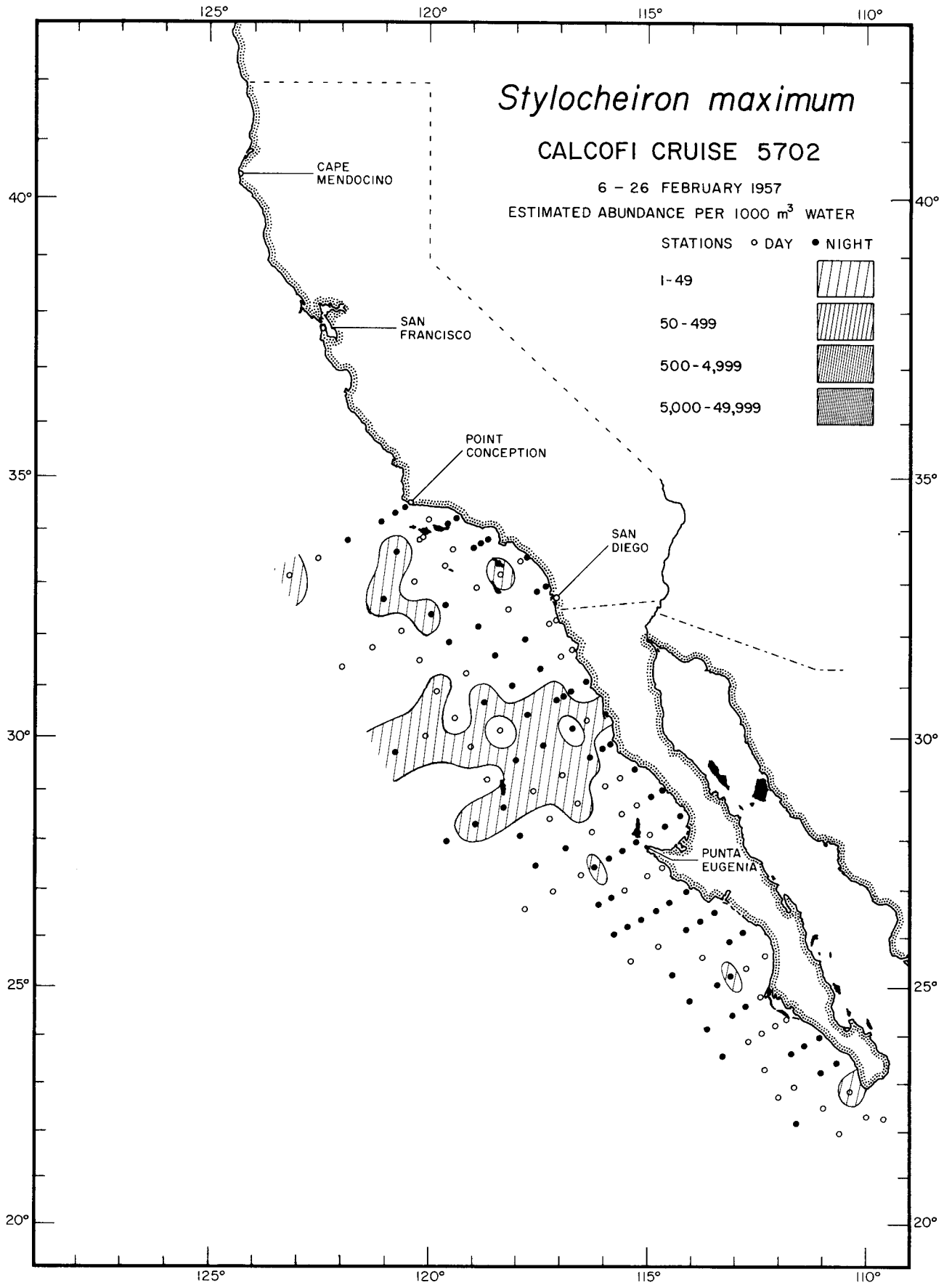
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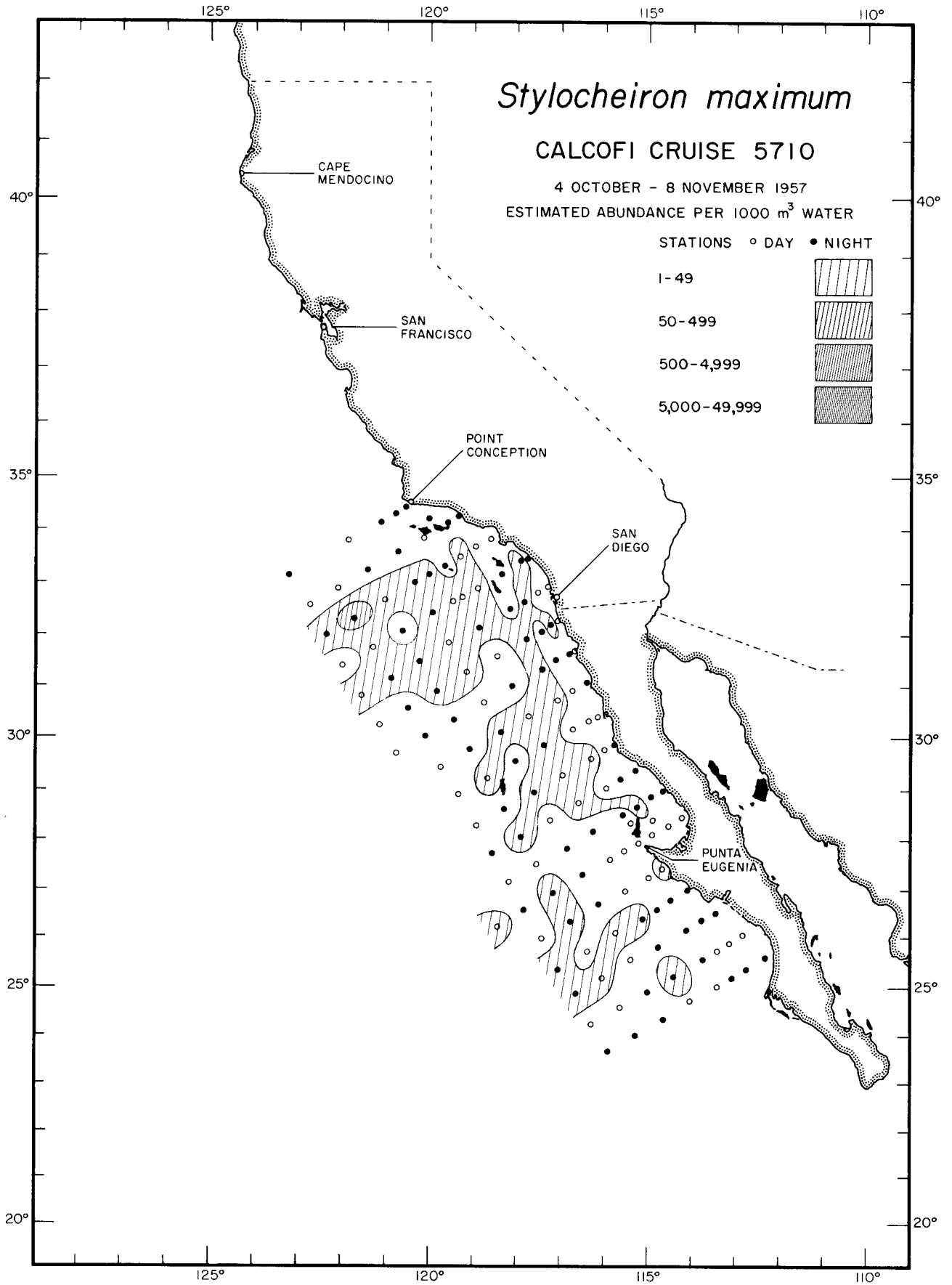
Euphausiacea
Stylocheiron maximum
5408



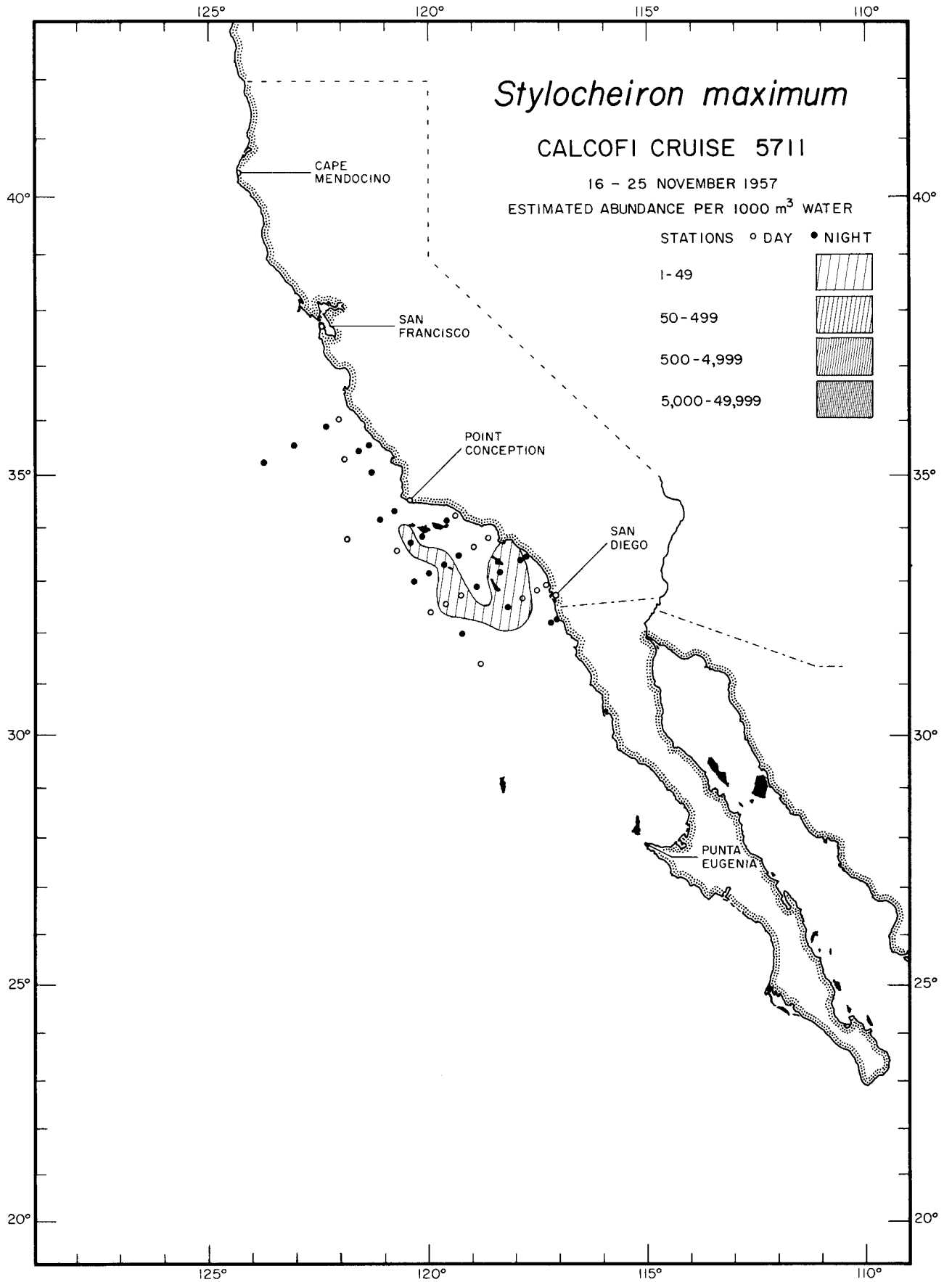
Euphausiacea
Stylocheiron maximum
5504



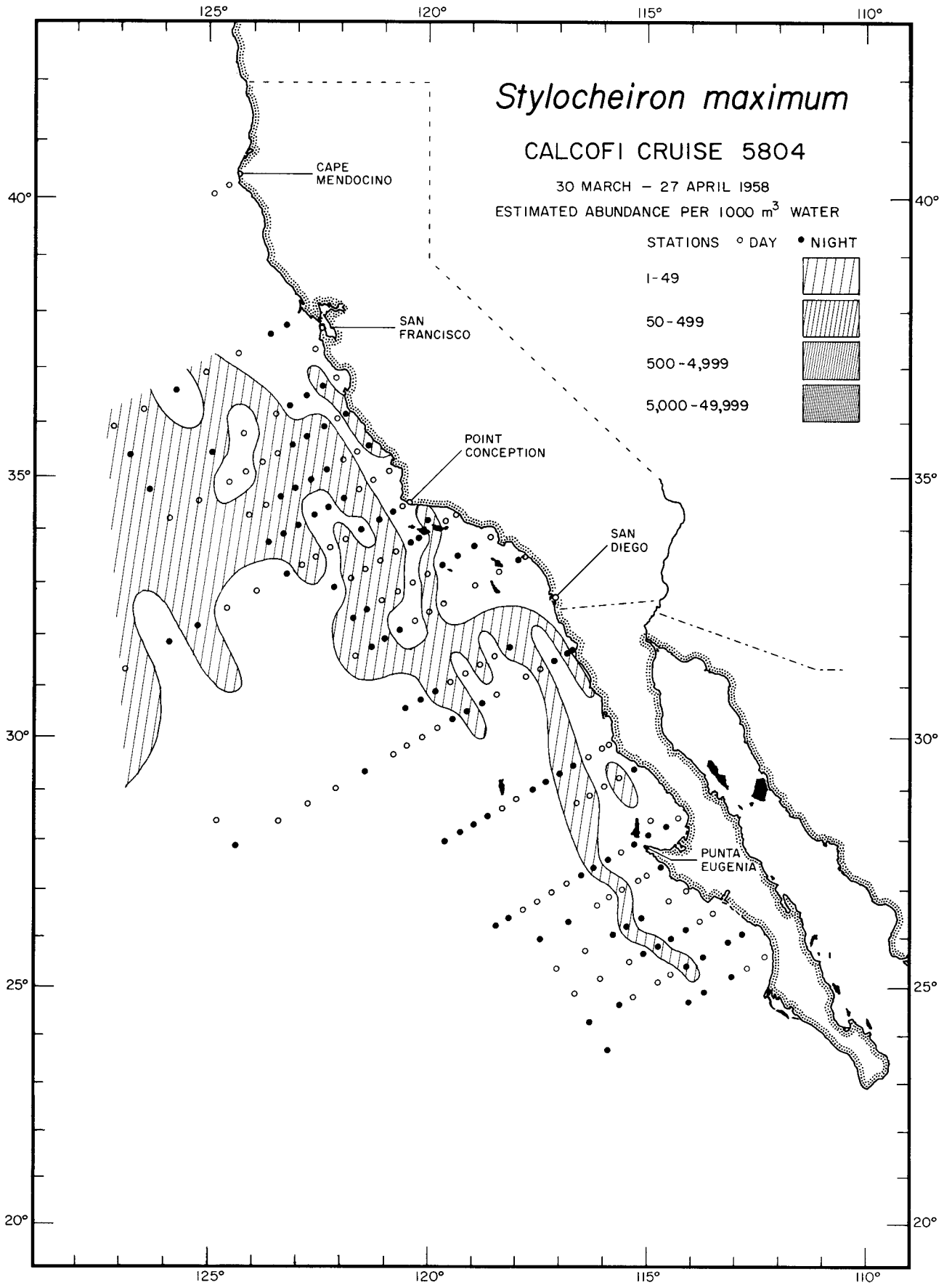
Euphausiacea
Stylocheiron maximum
 5702



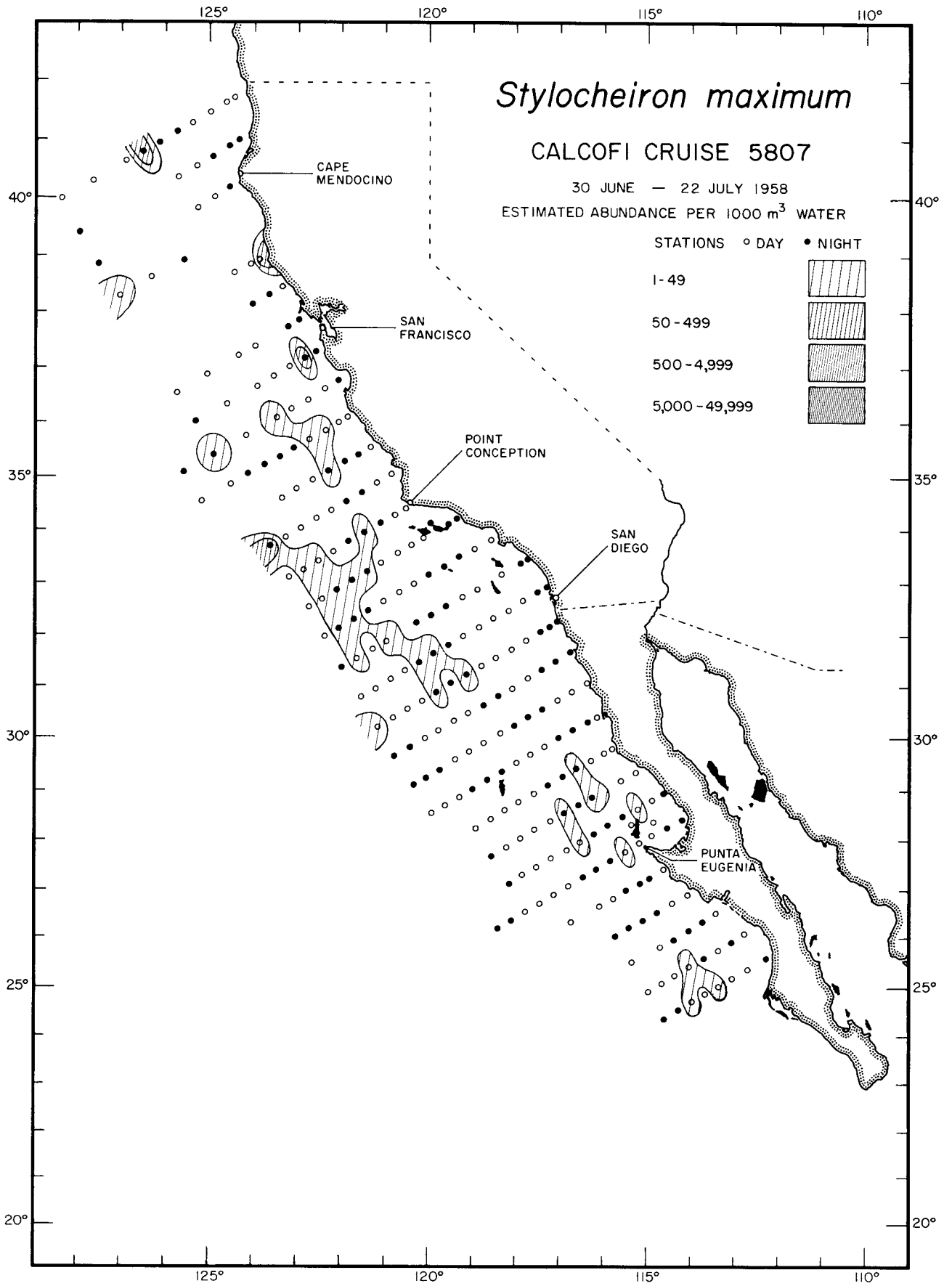
Euphausiacea
Stylocheiron maximum
5710



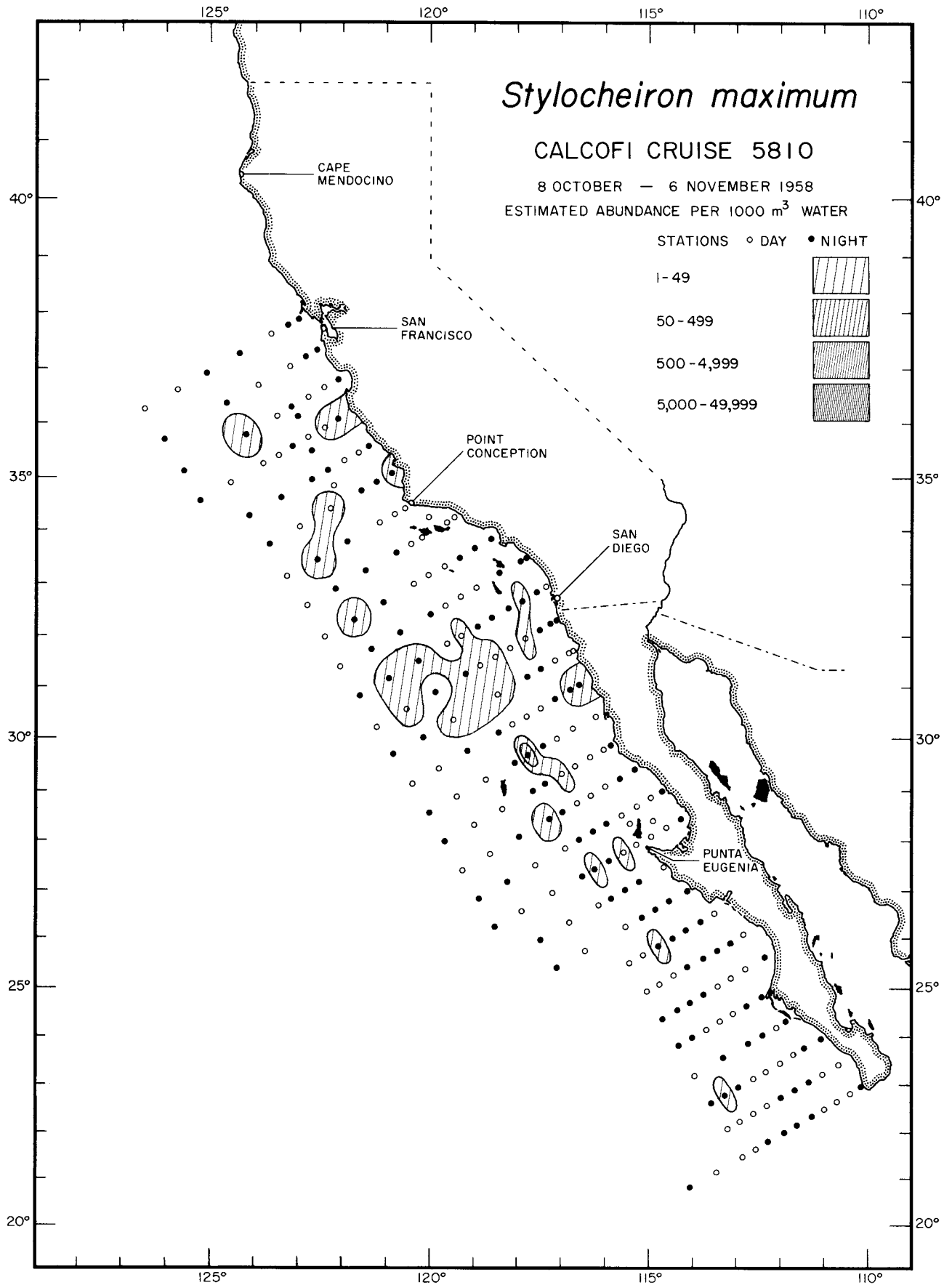
Euphausiacea
Stylocheiron maximum
5711



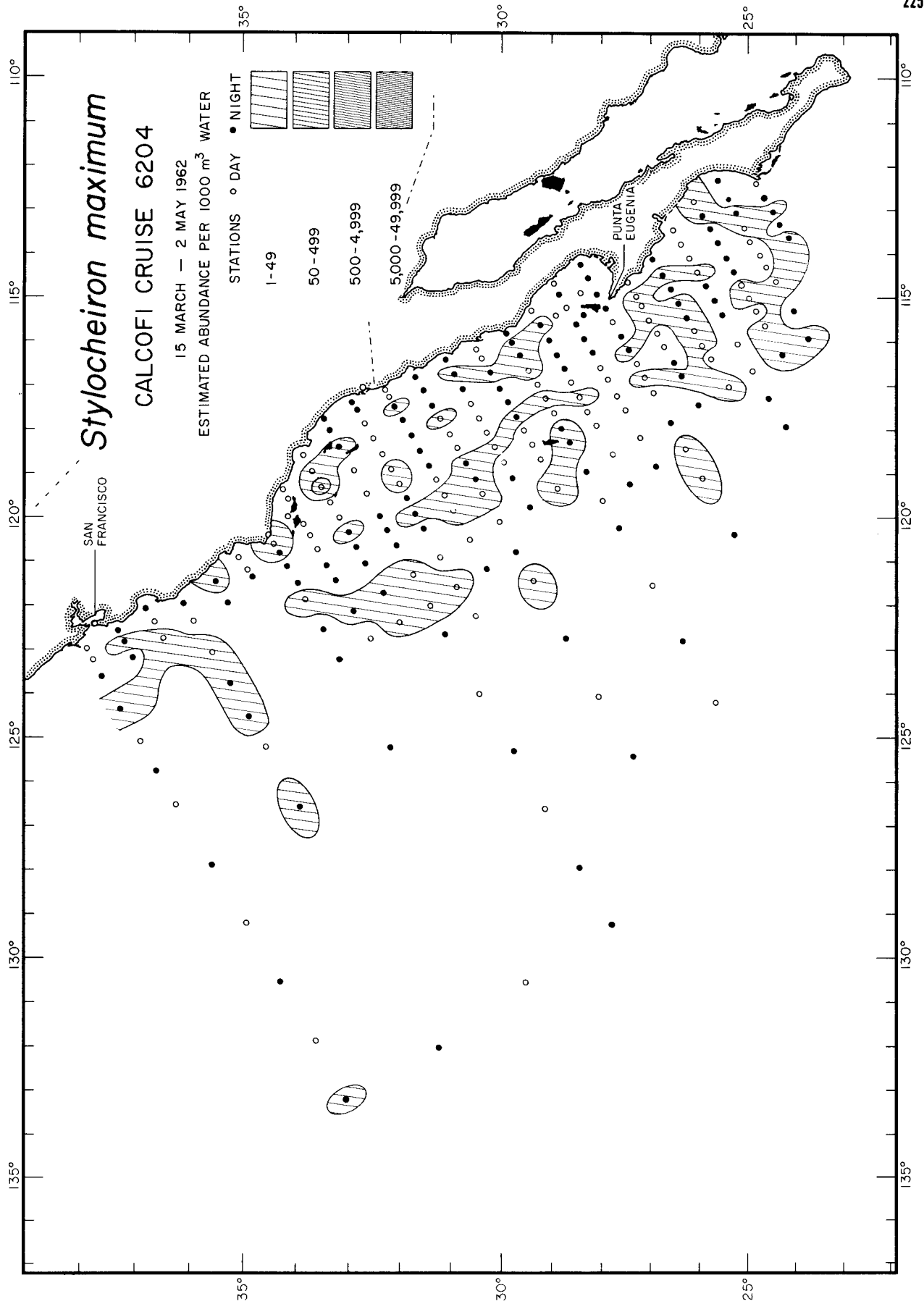
Euphausiacea
Stylocheiron maximum
 5804



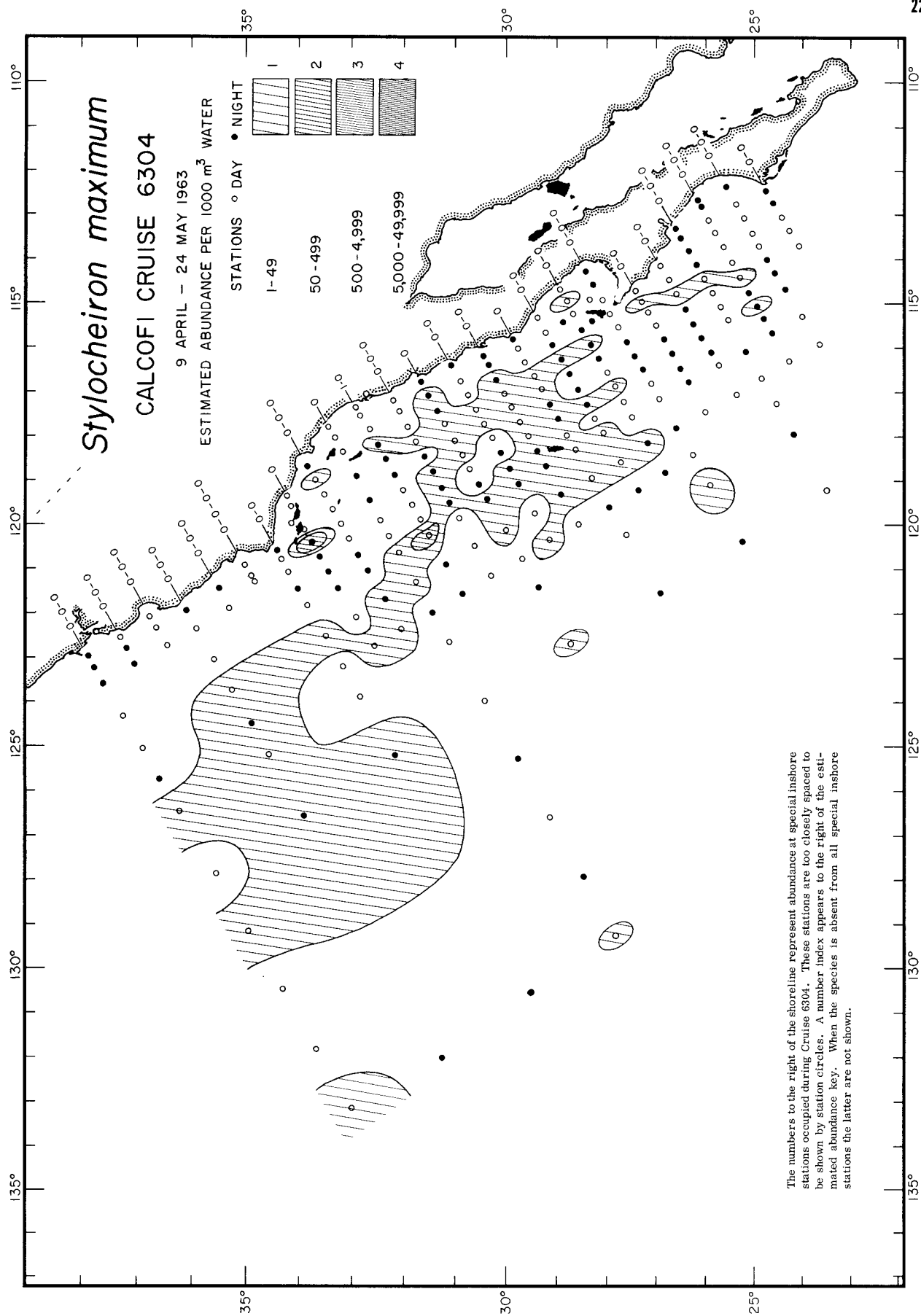
Euphausiacea
Stylocheiron maximum
 5807



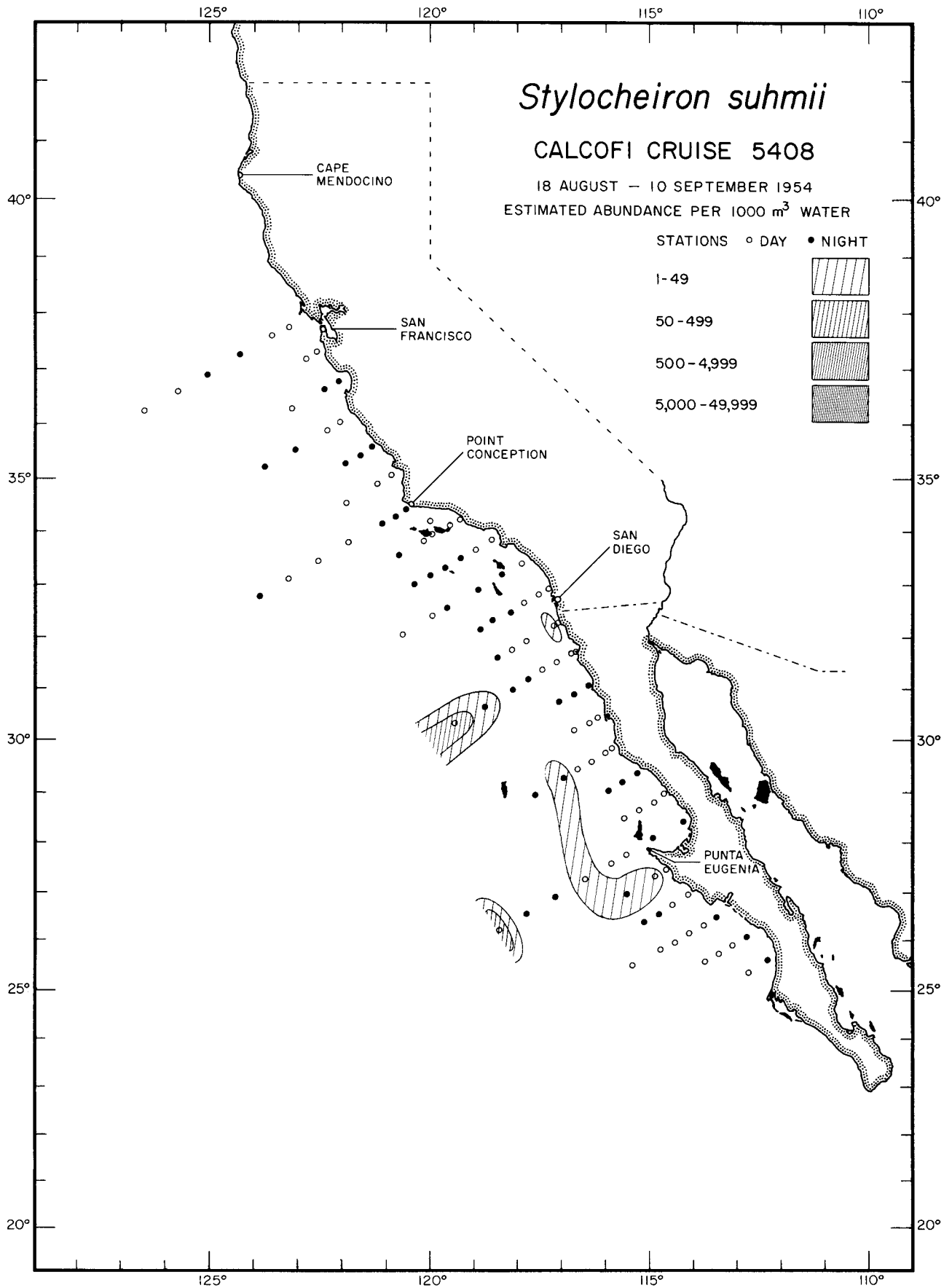
Euphausiacea
Stylocheiron maximum
5810



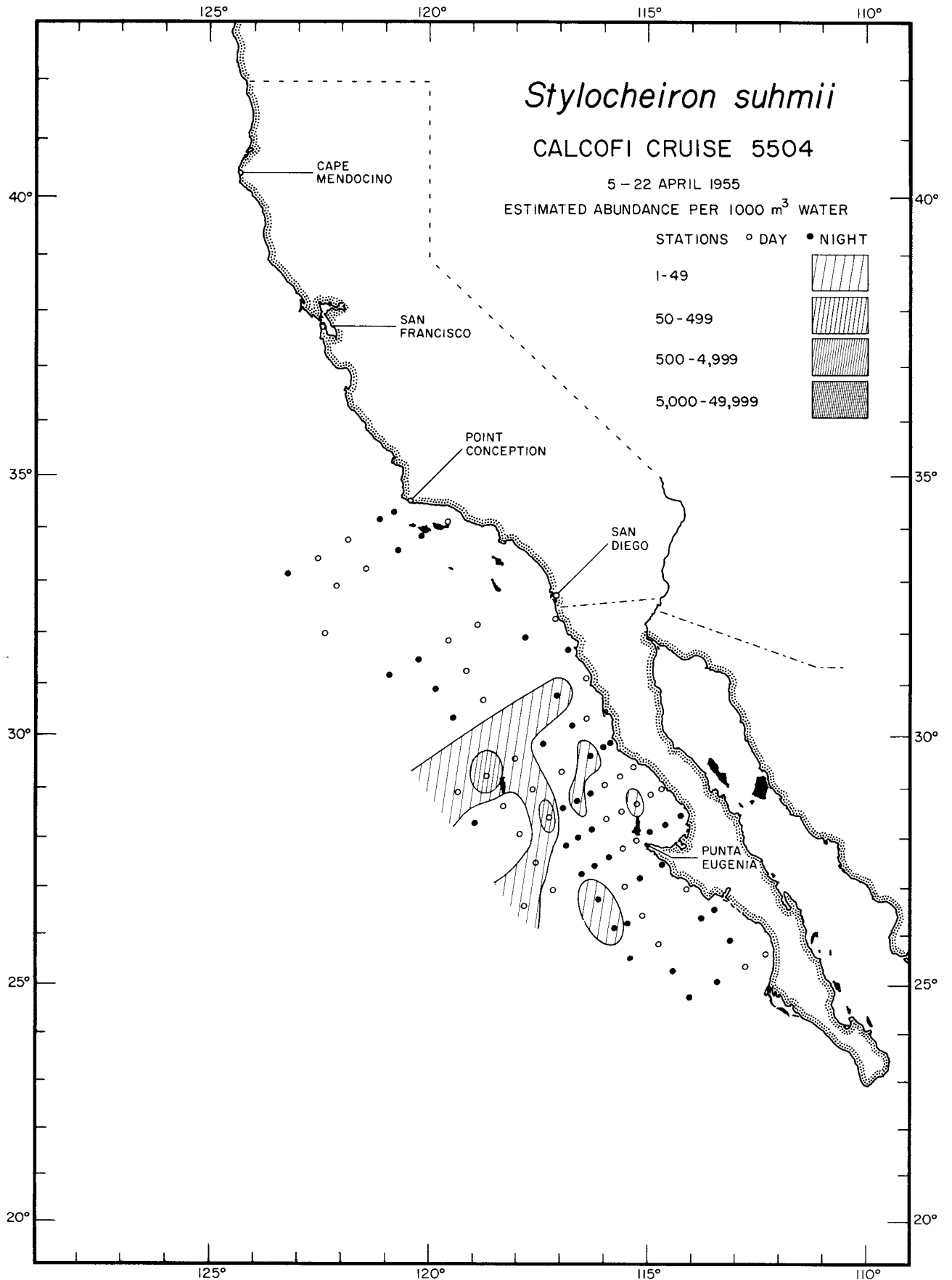
Euphausiacea
Stylocheiron maximum
6204



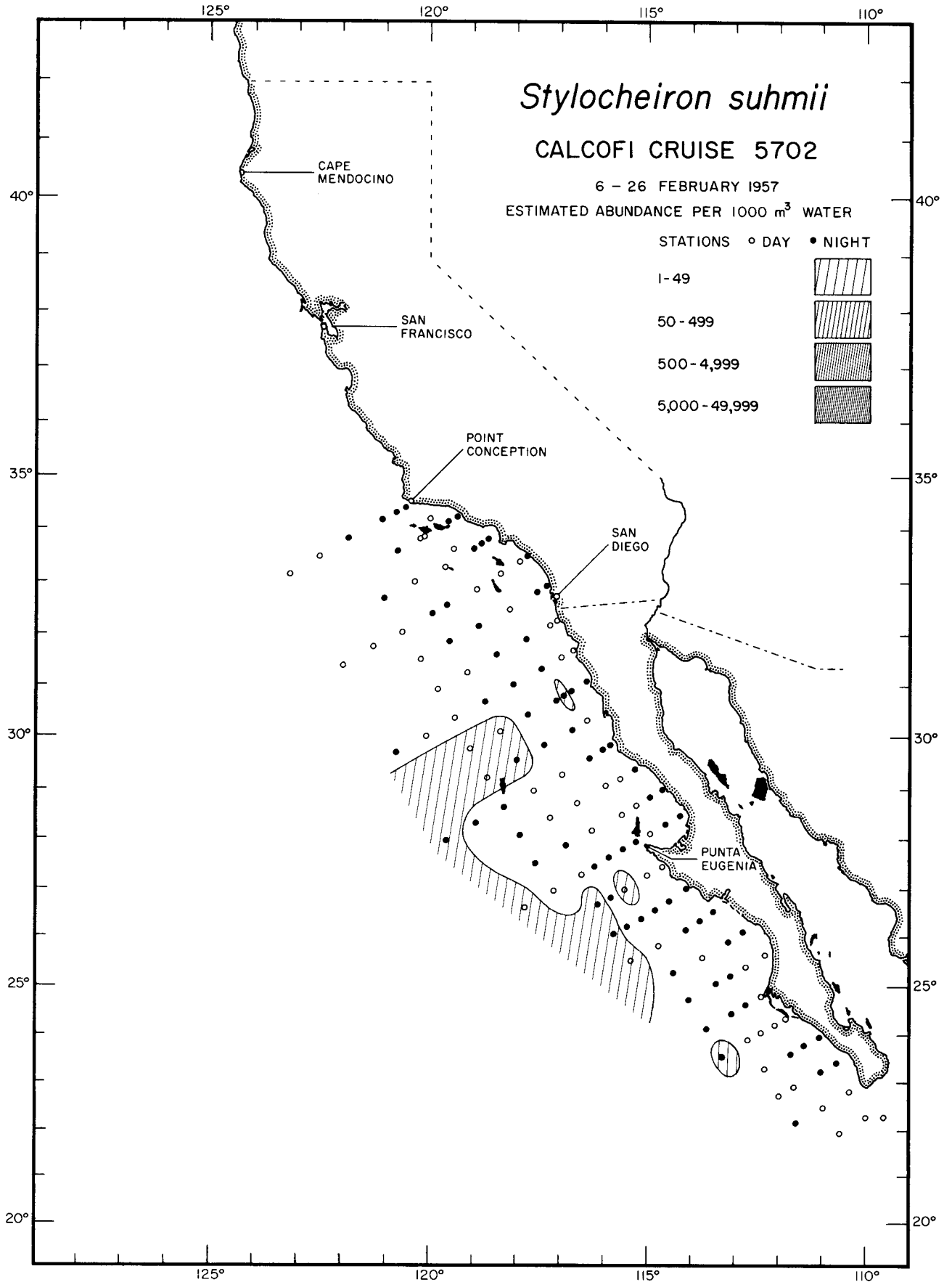
Euphausiacea
Stylocheiron maximum
6304



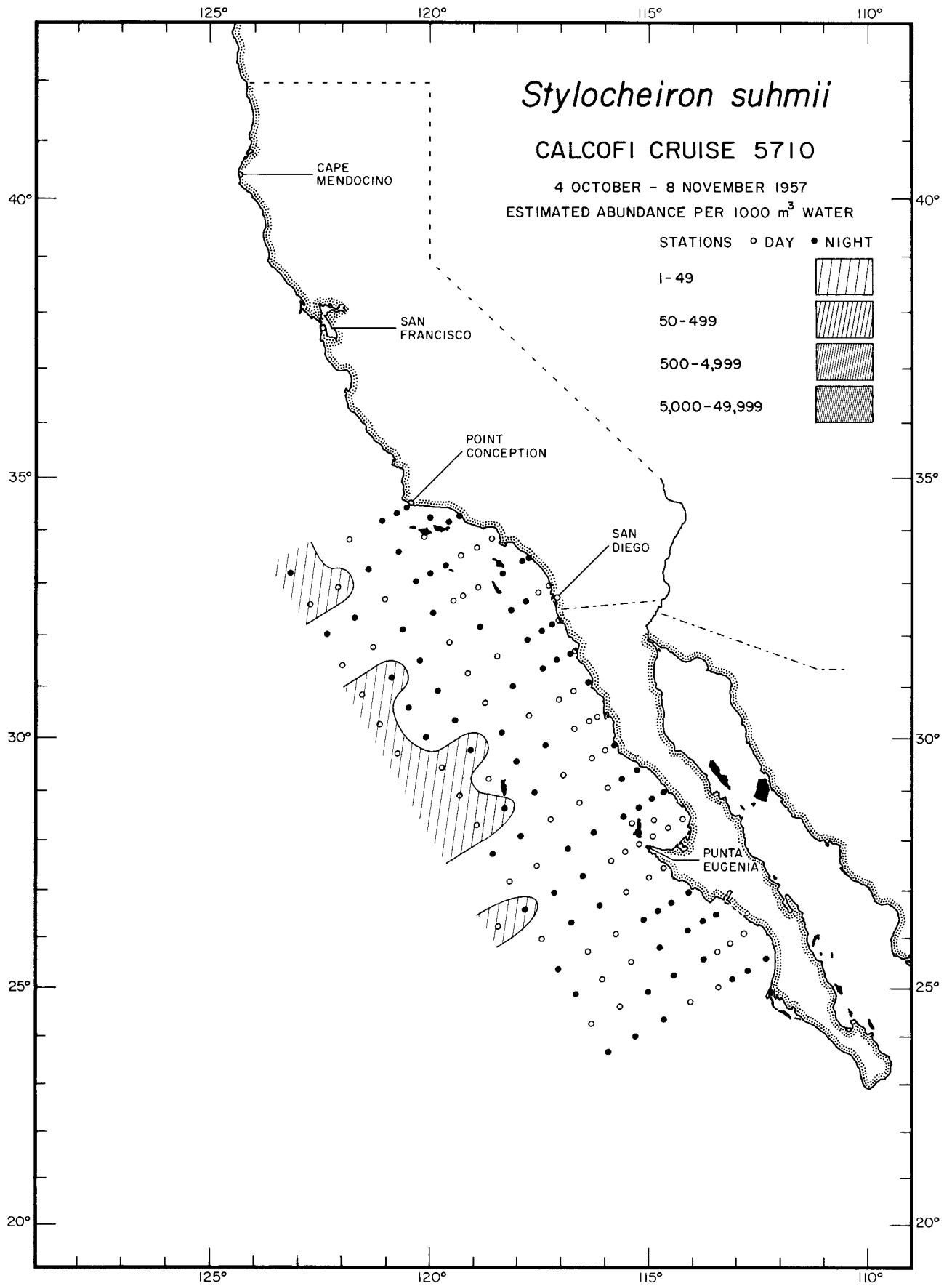
Euphausiacea
Stylocheiron suhmii
5408



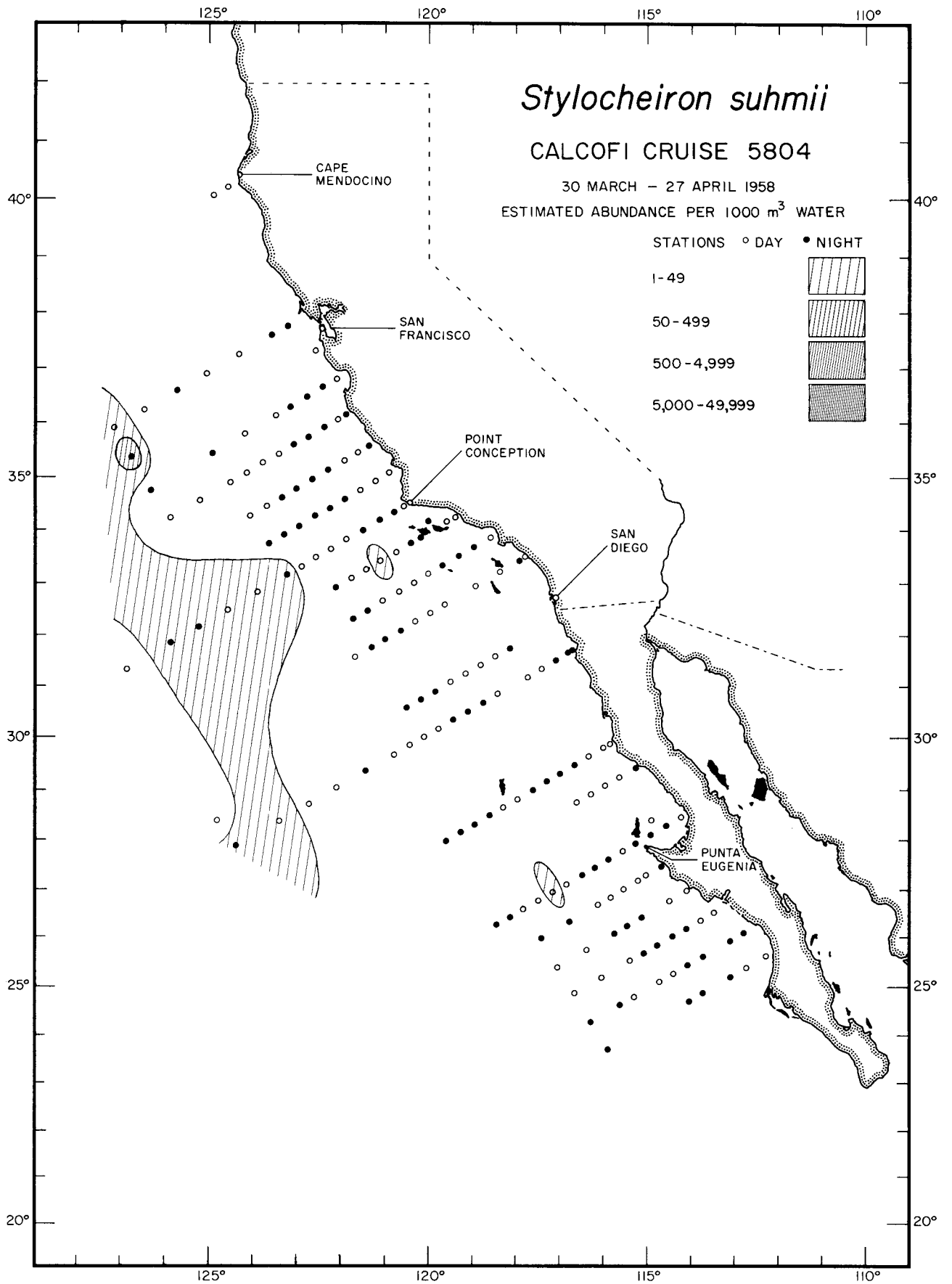
Euphausiacea
Stylocheiron suhmii
 5504



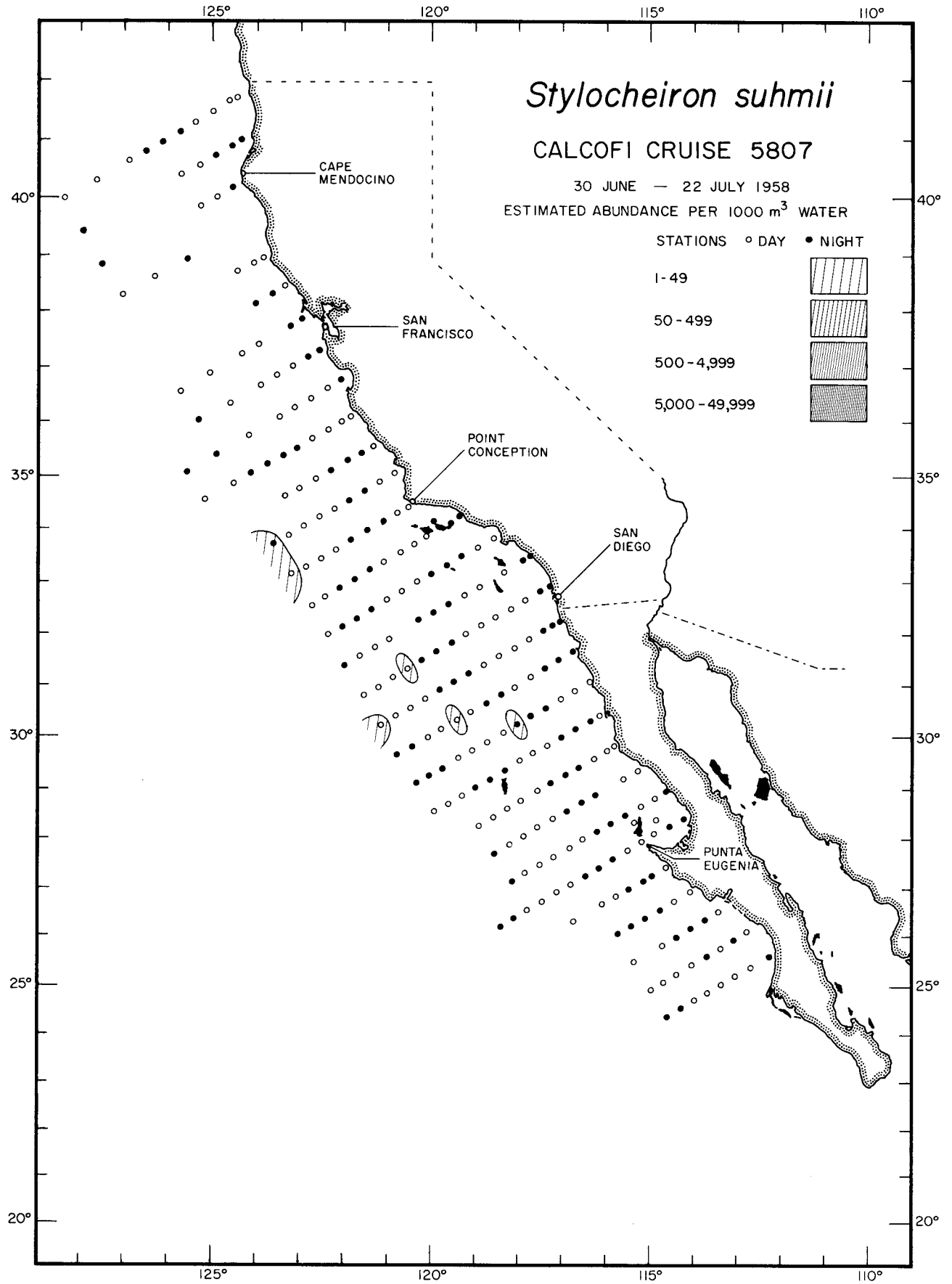
Euphausiacea
Stylocheiron suhmii
5702



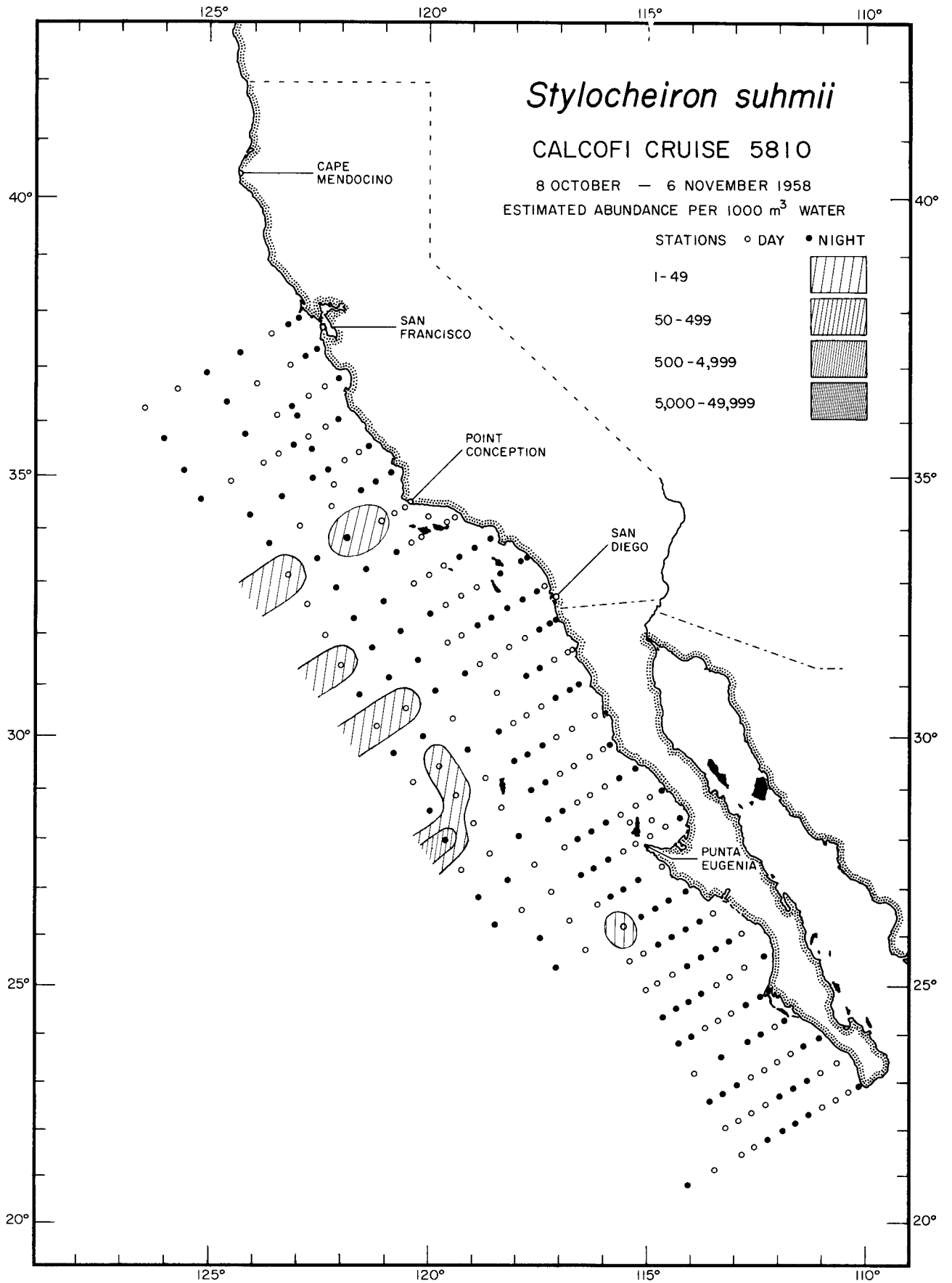
Euphausiacea
Stylocheiron suhmii
5710



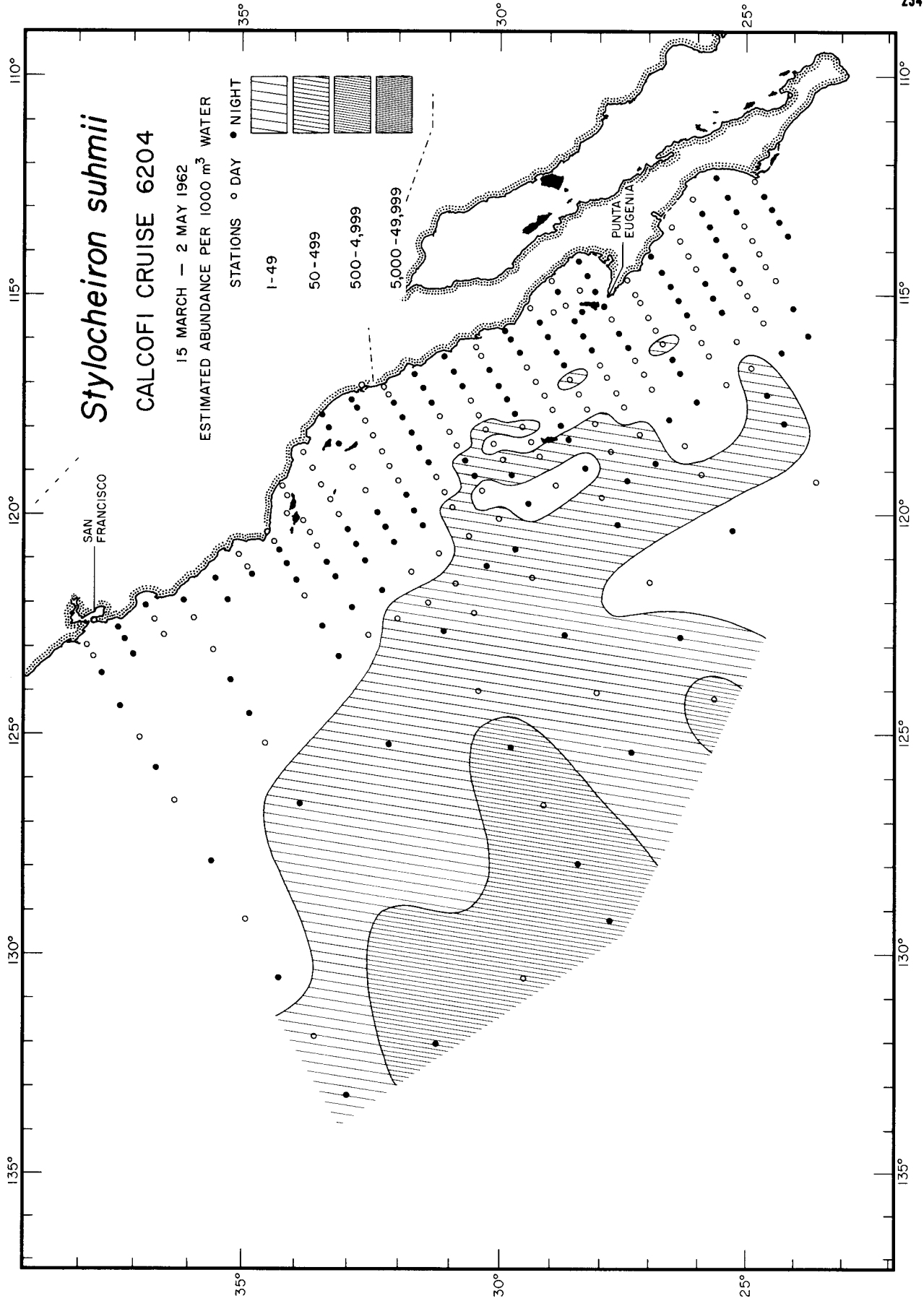
Euphausiacea
Stylocheiron suhmii
5804



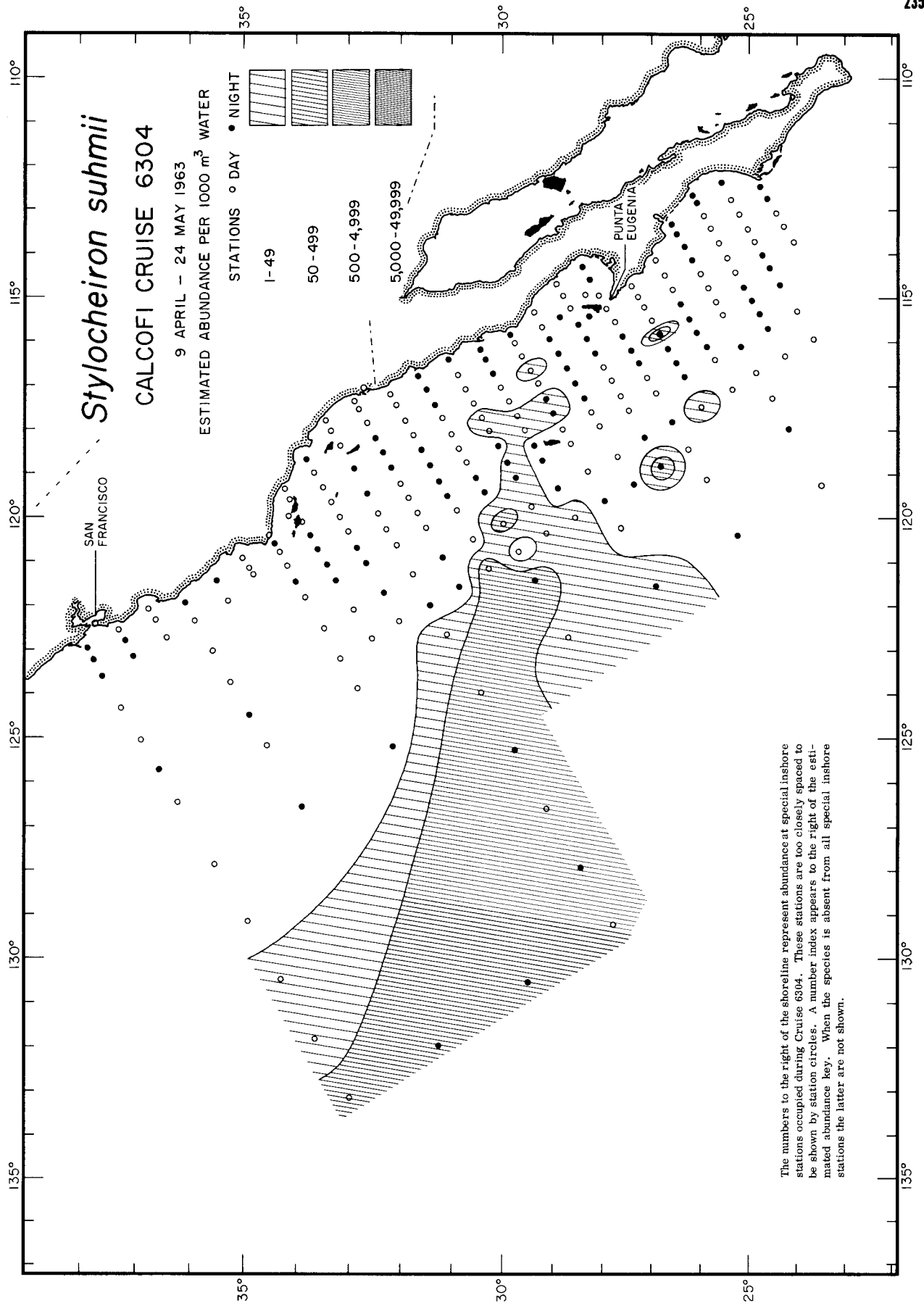
Euphausiacea
Stylocheiron suhmii
 5807



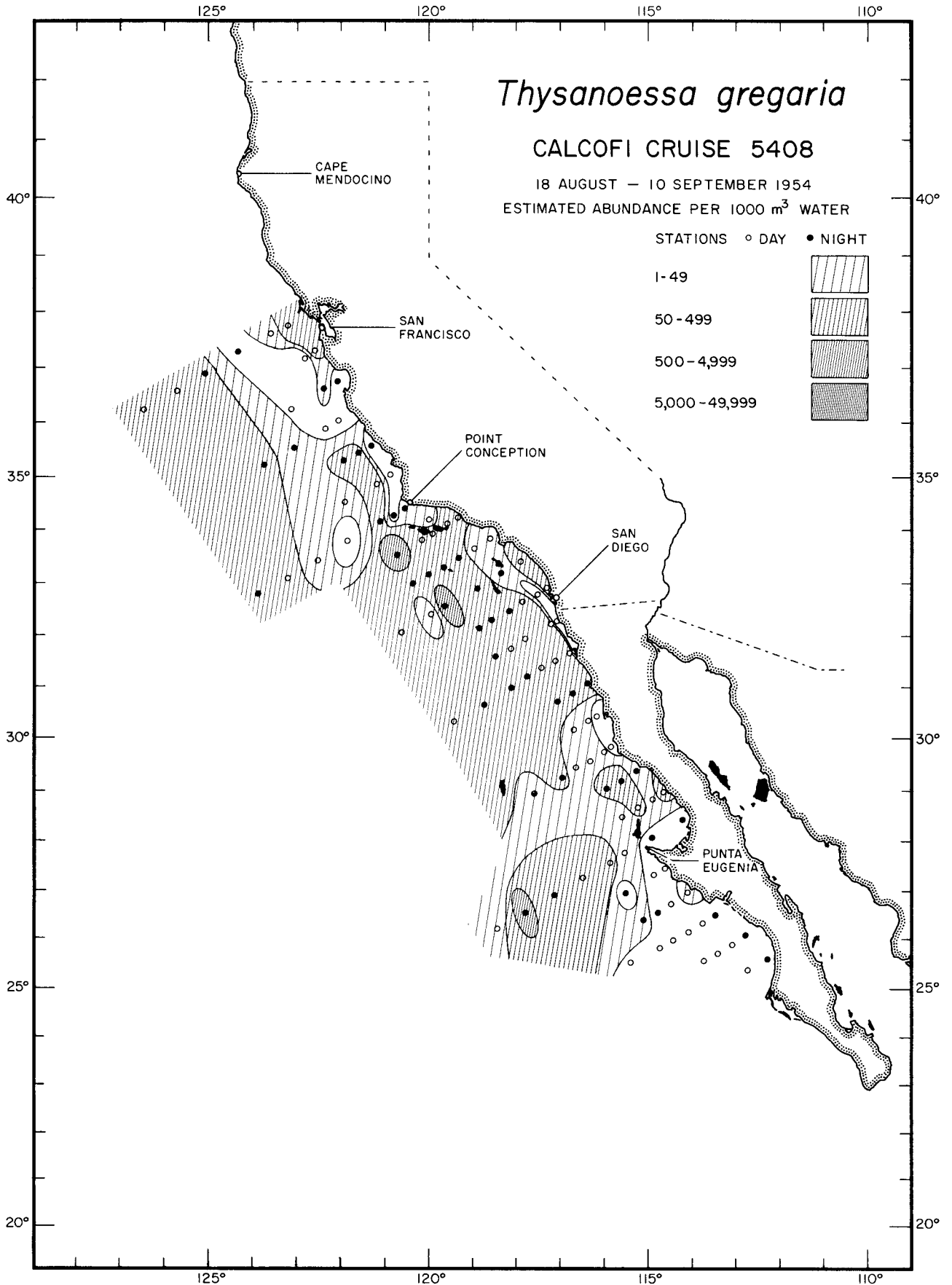
Euphausiacea
Stylocheiron suhmii
5810



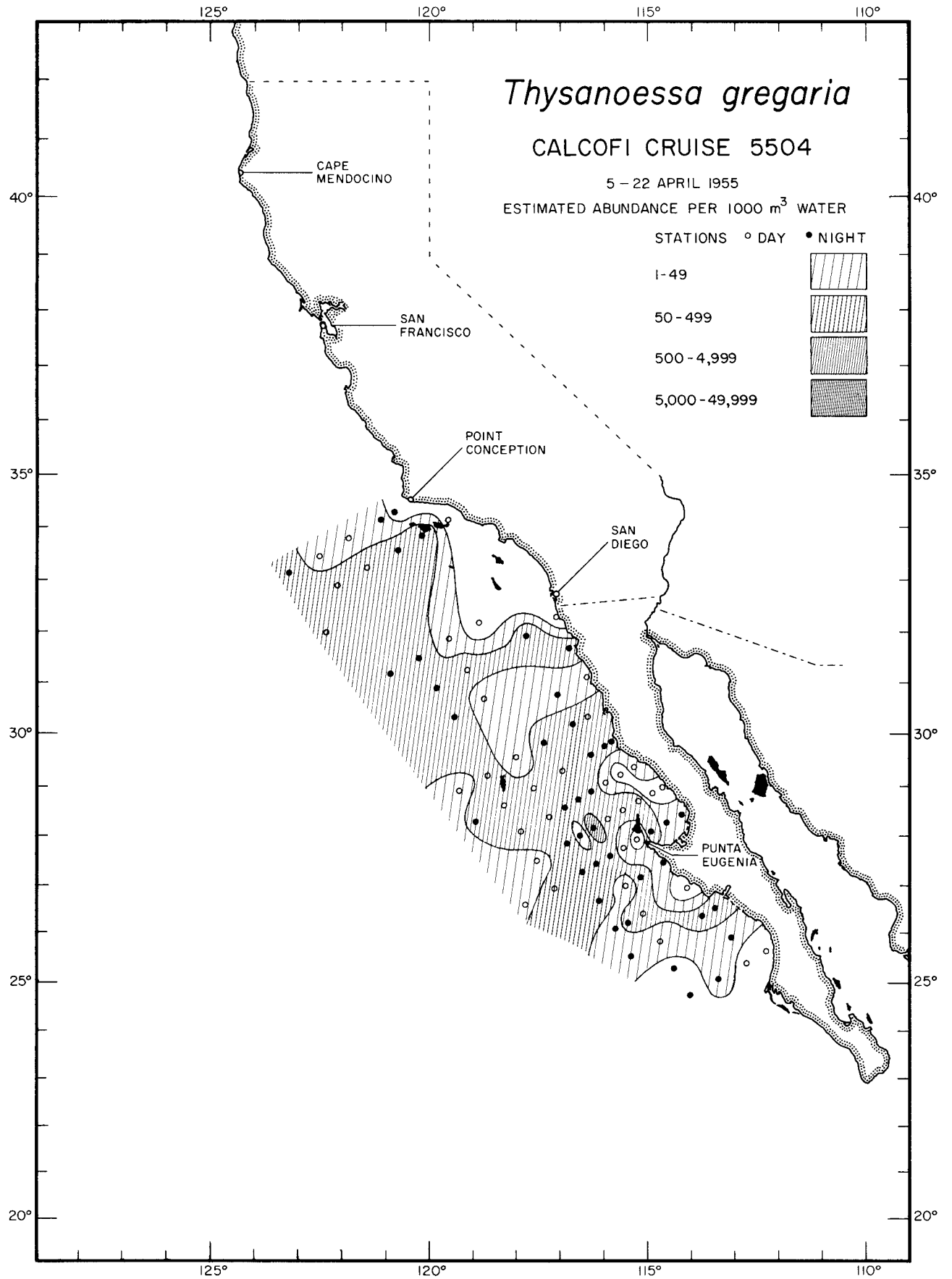
Euphausiacea
Stylocheiron submii
6204



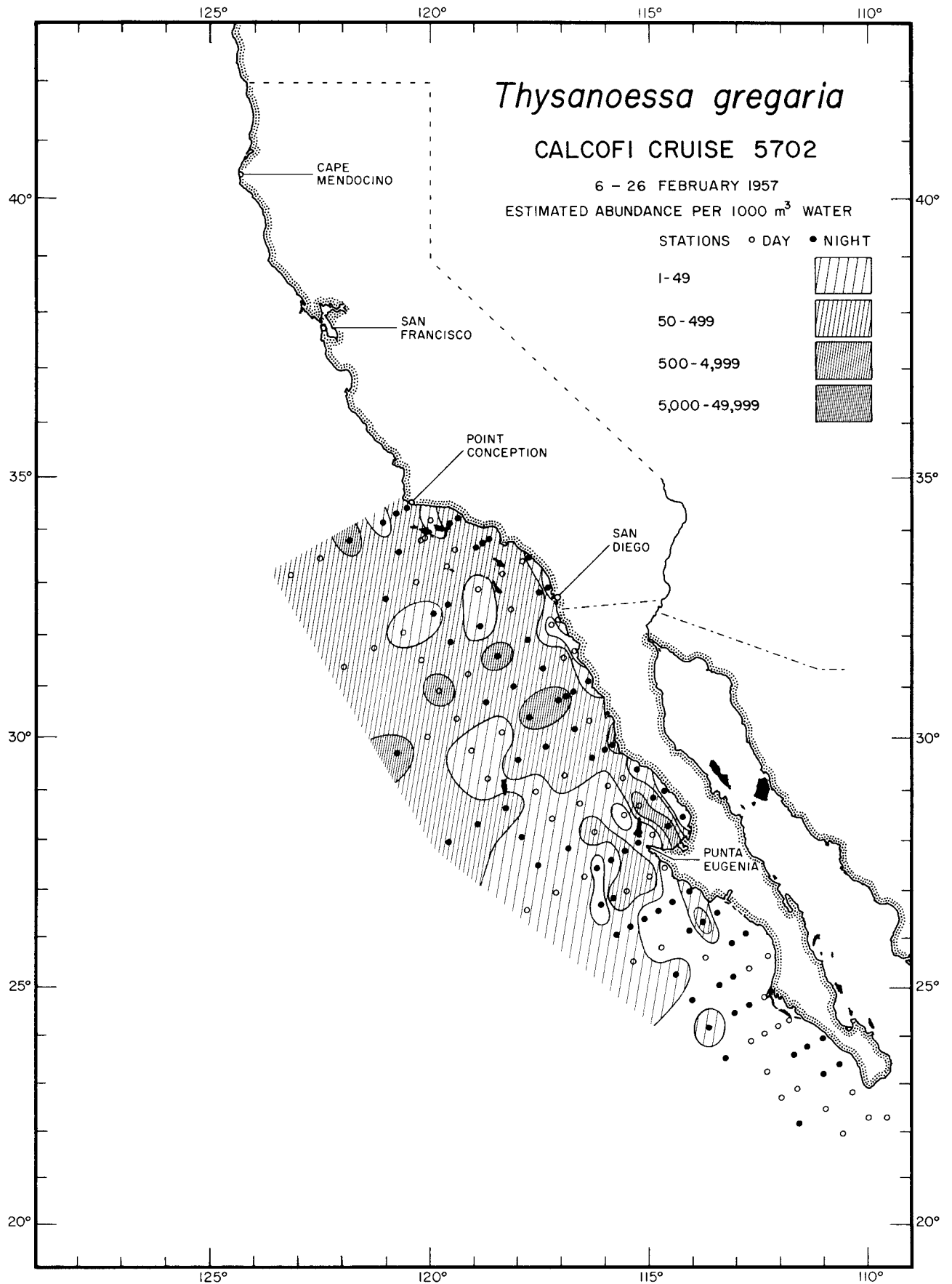
Euphausiacea
Stylocheiron summii
6304



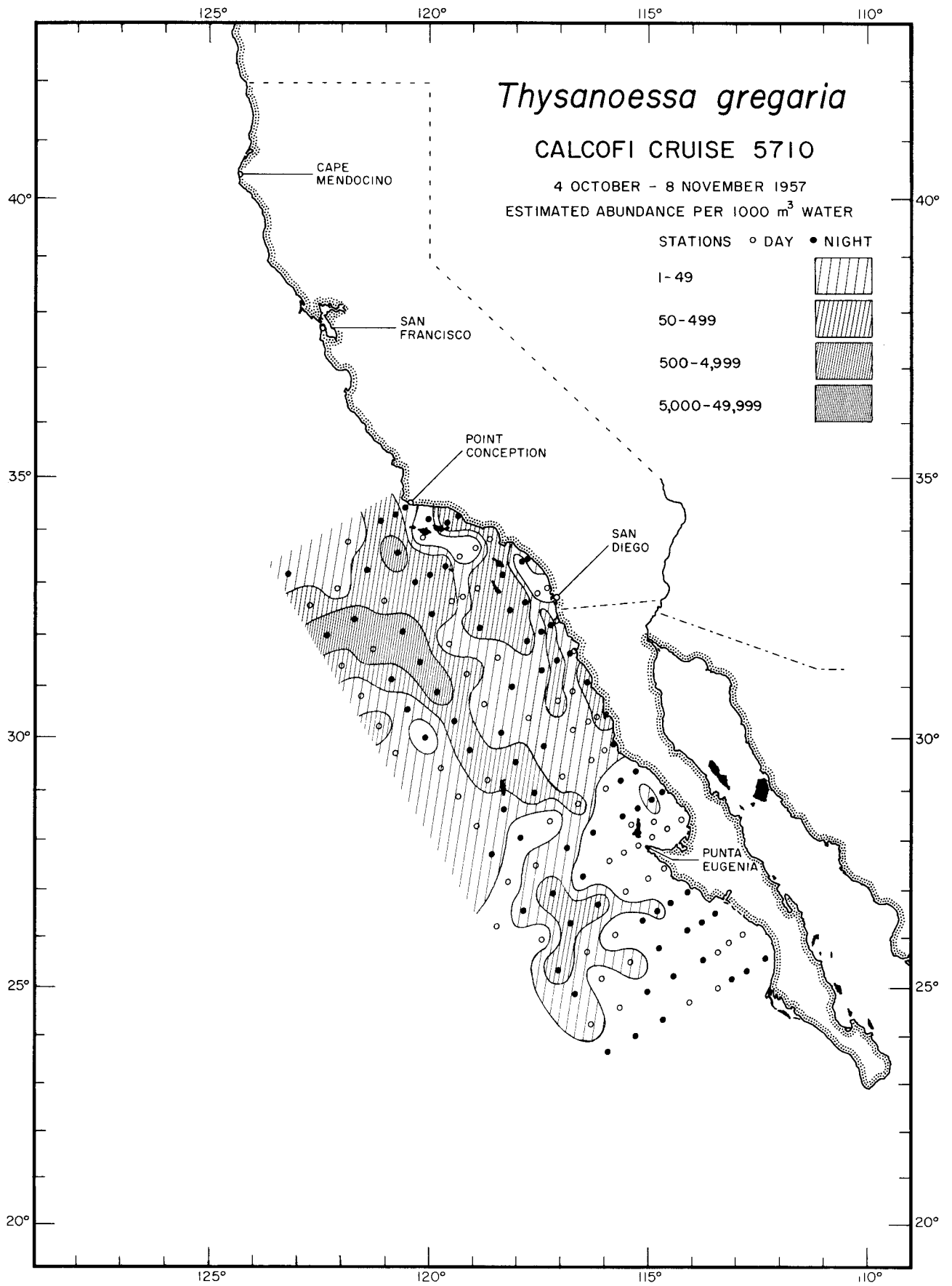
Euphausiacea
Thysanoessa gregaria
5408



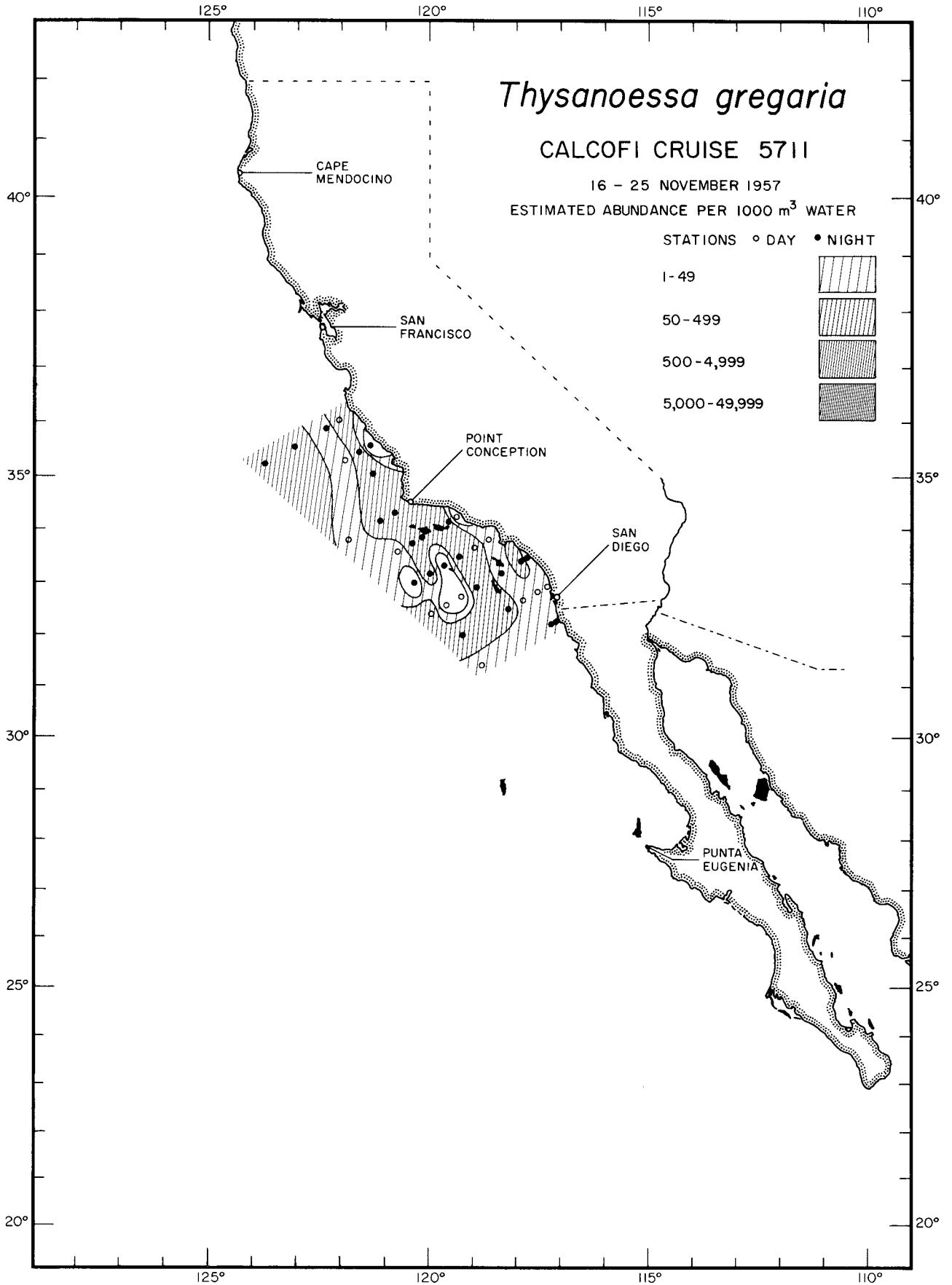
Euphausiacea
Thysanoessa gregaria
5504



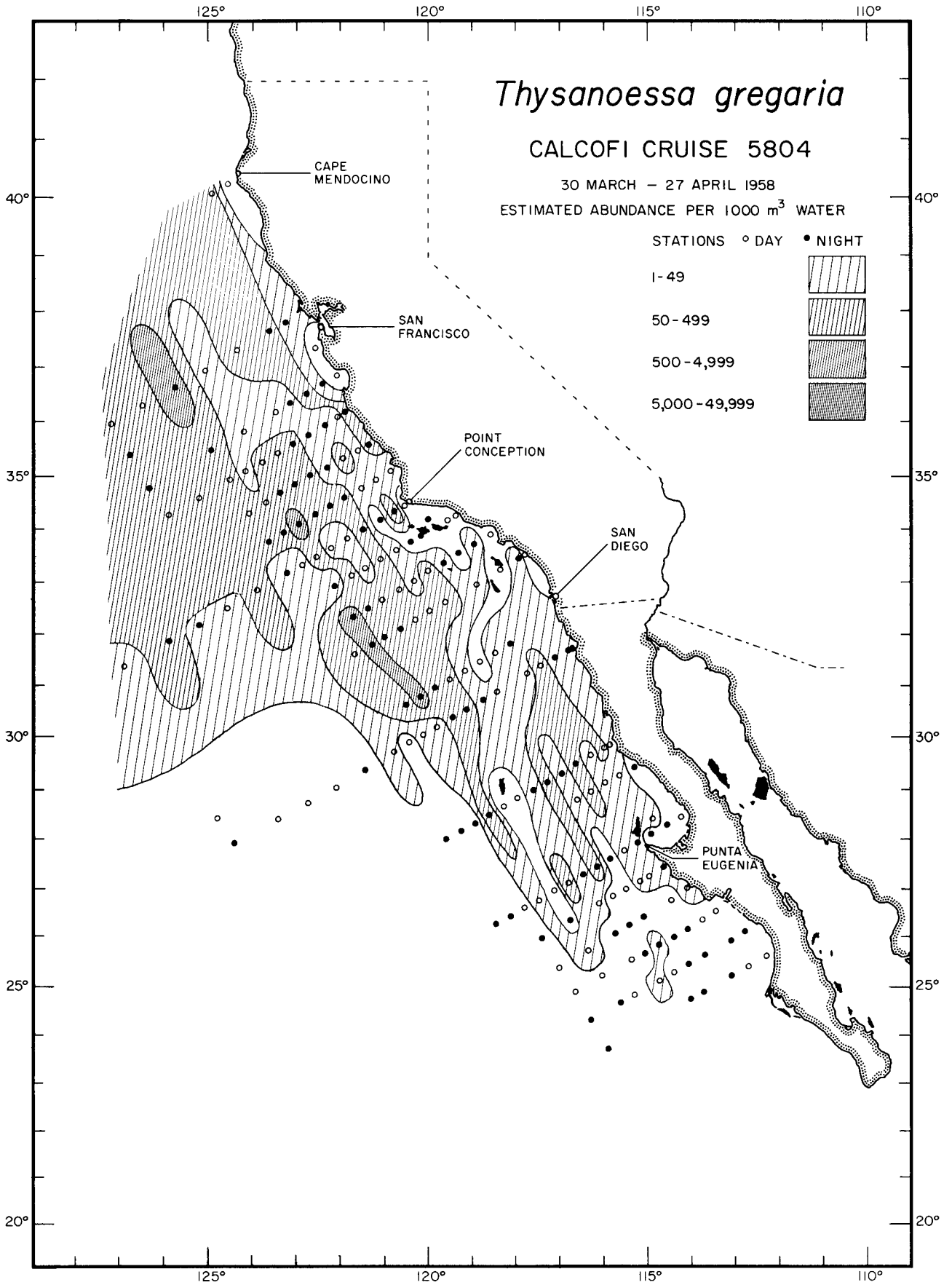
Euphausiacea
Thysanoessa gregaria
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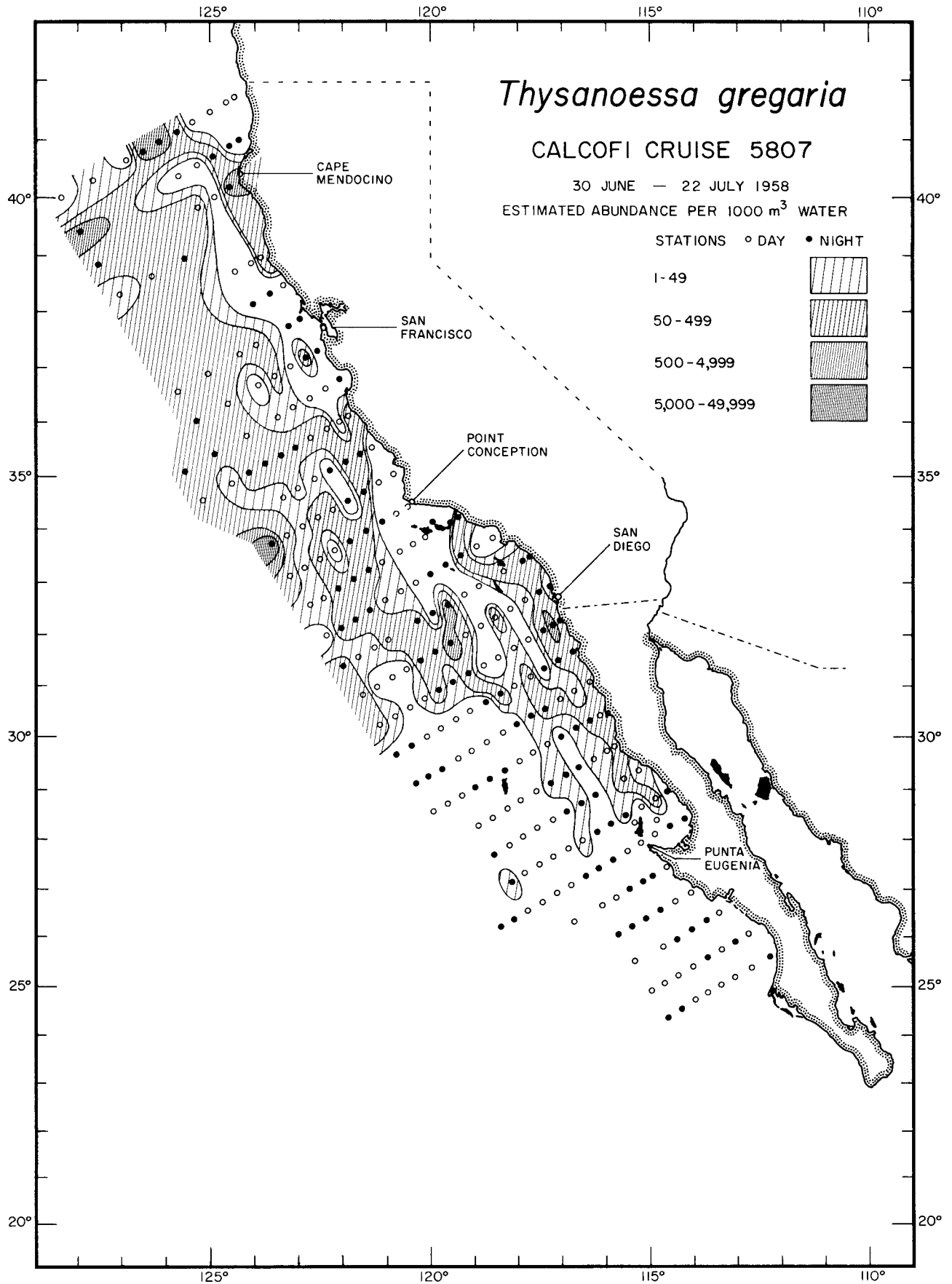
Euphausiacea
Thysanoessa gregaria
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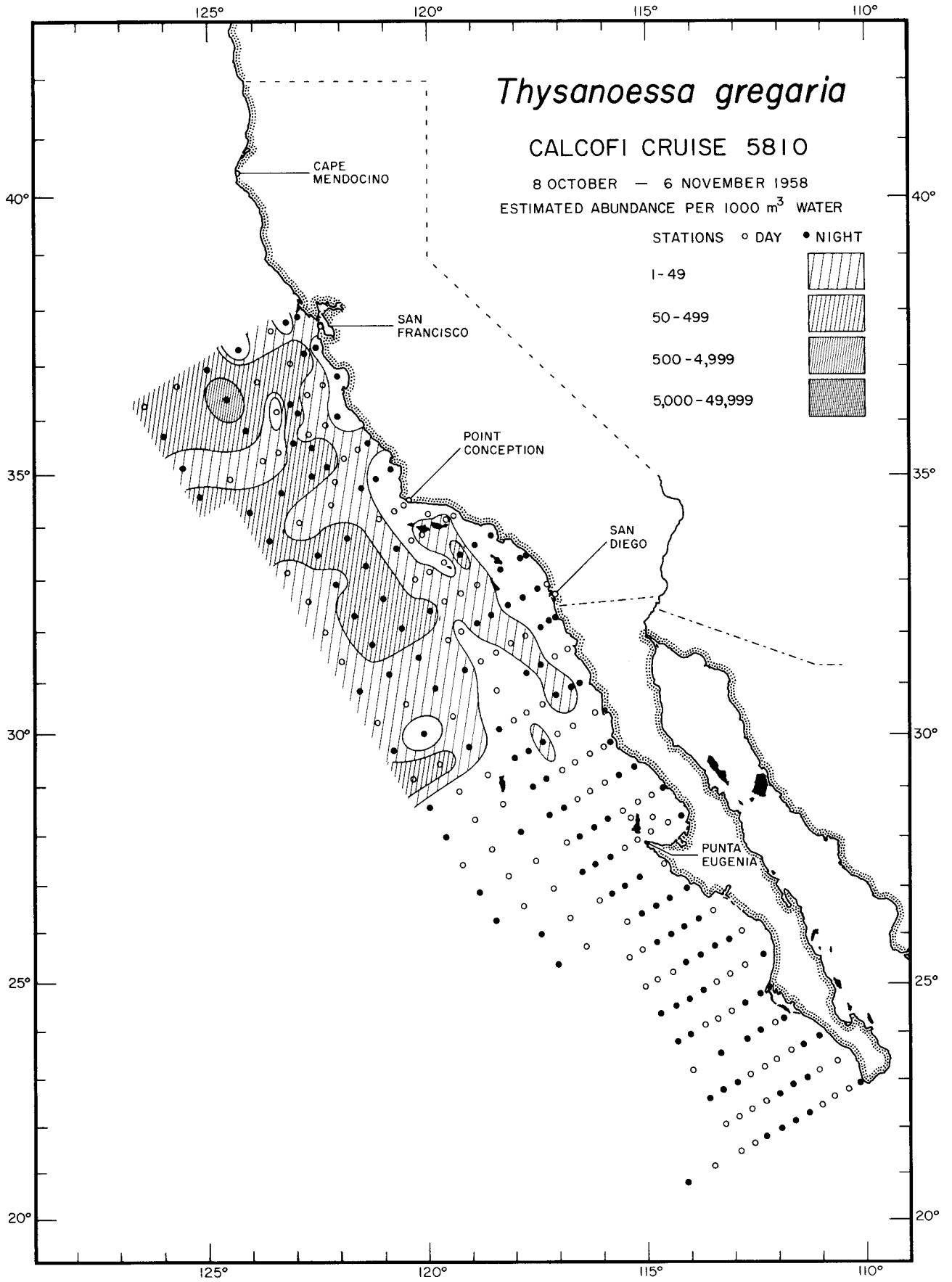
Euphausiacea
Thysanoessa gregaria
 5711



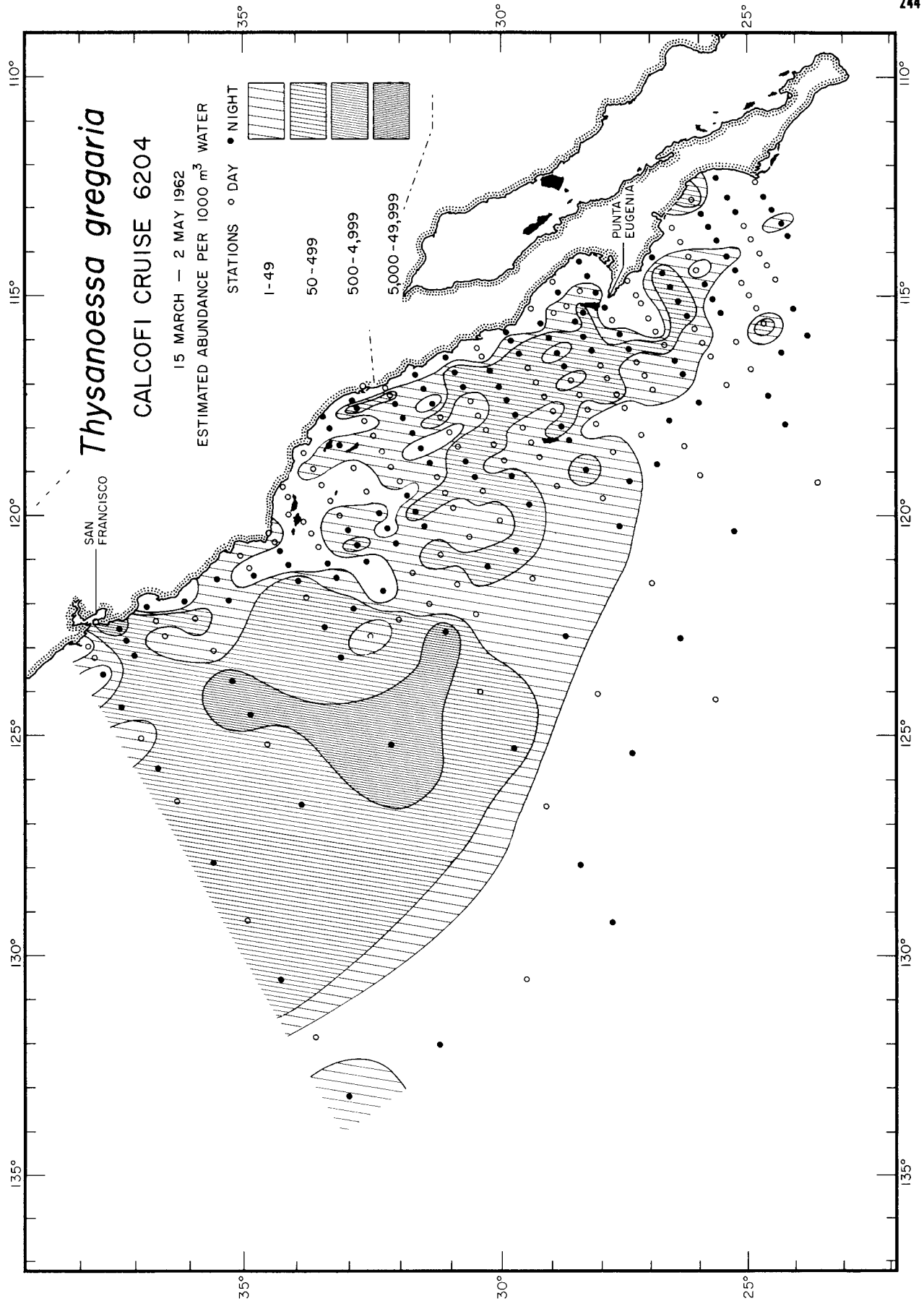
Euphausiacea
Thysanoessa gregaria
5804



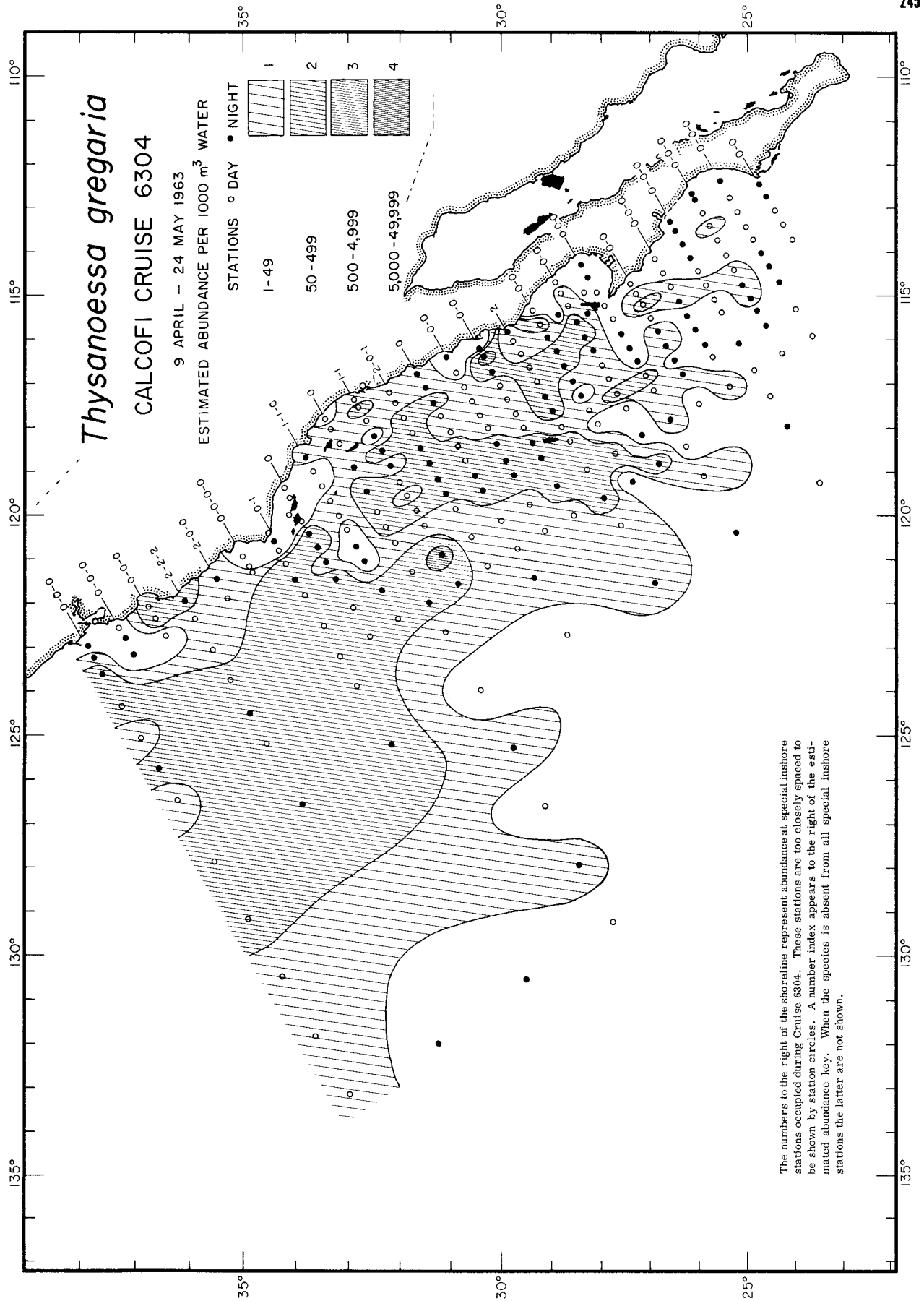
Euphausiacea
Thysanoessa gregaria
5807



Euphausiacea
Thysanoessa gregaria
 5810

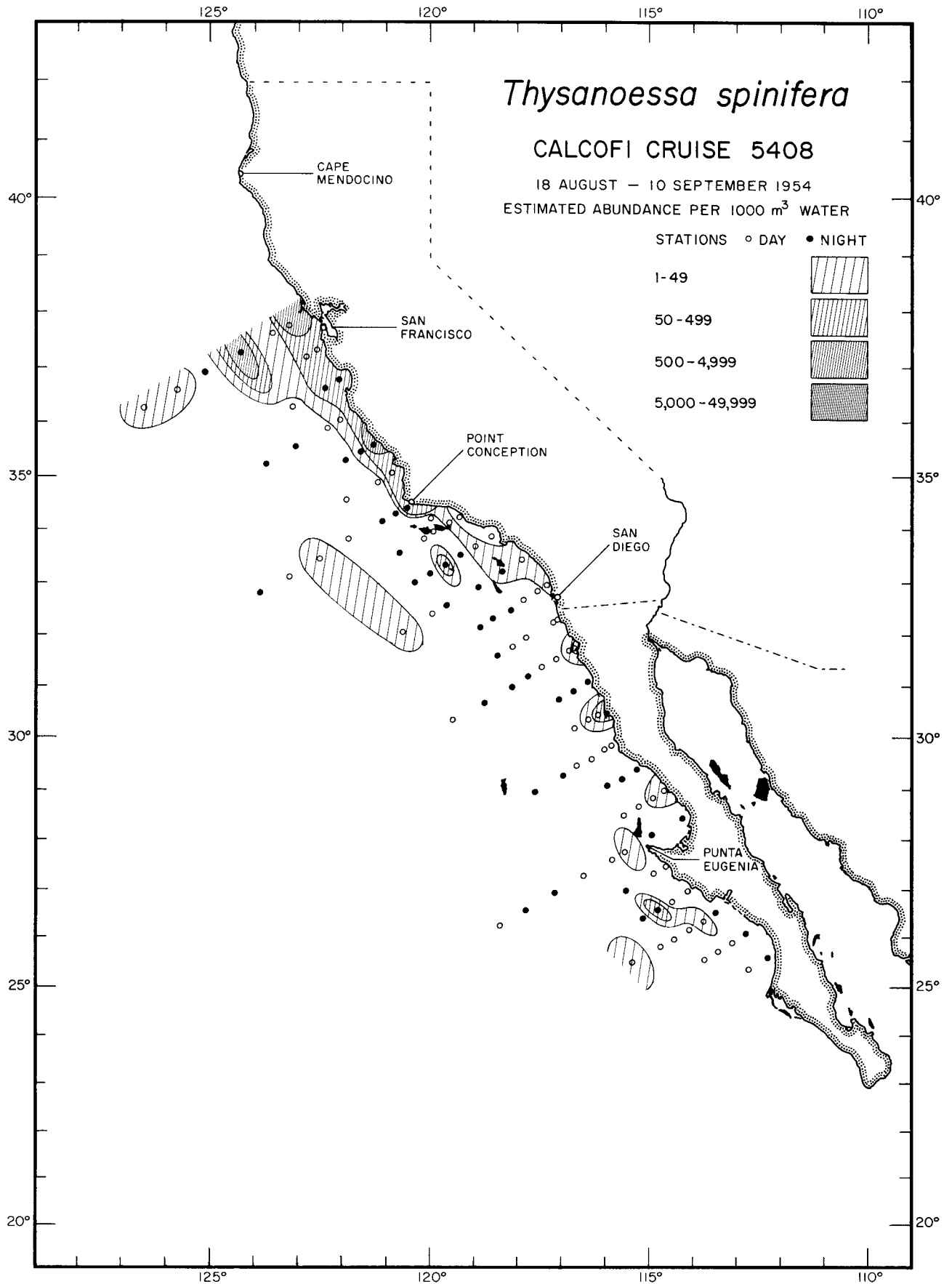


Euphausiacea
Thysanoessa gregaria
6204



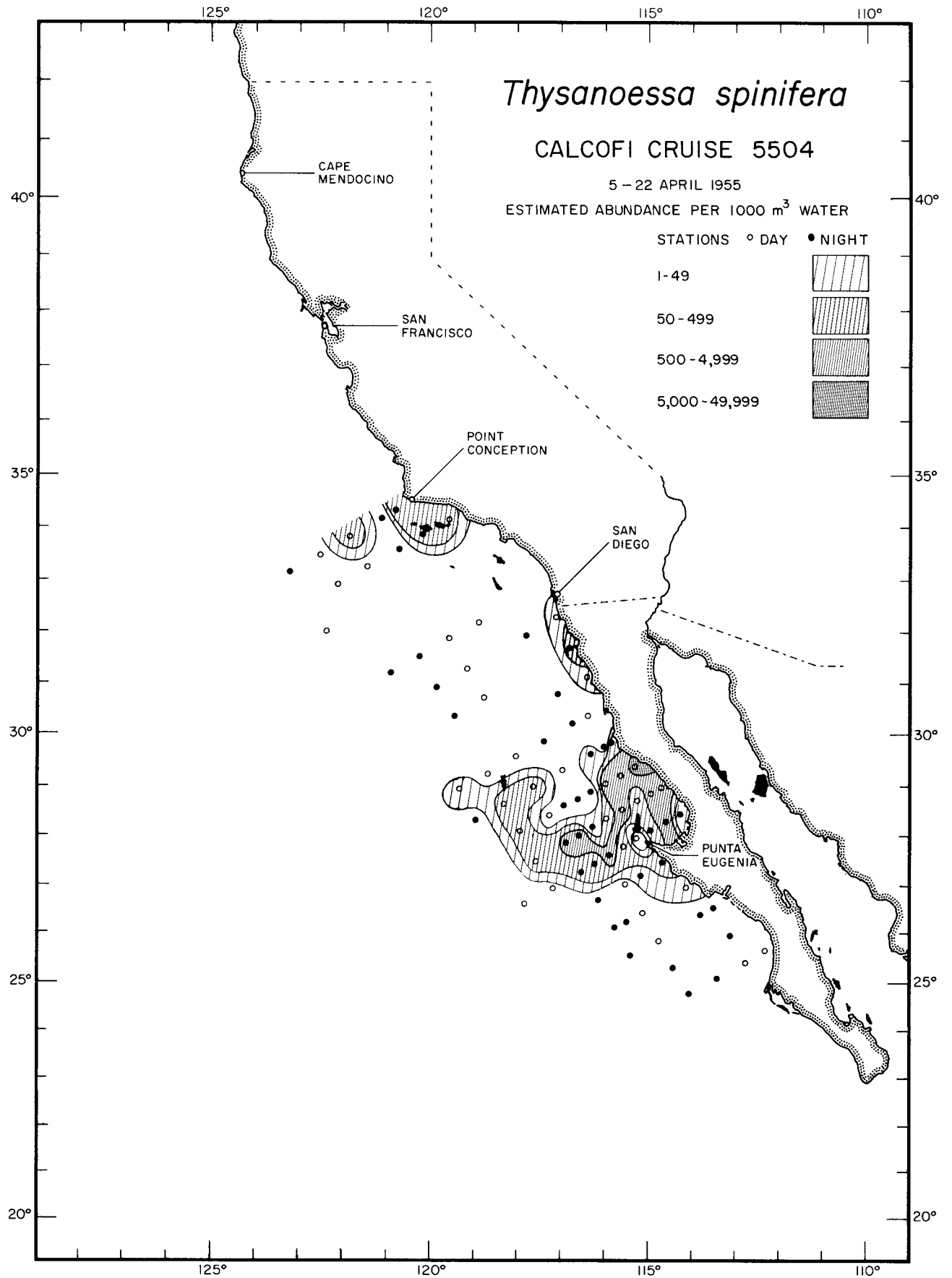
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Euphausiacea
Thysanoessa gregaria
6304

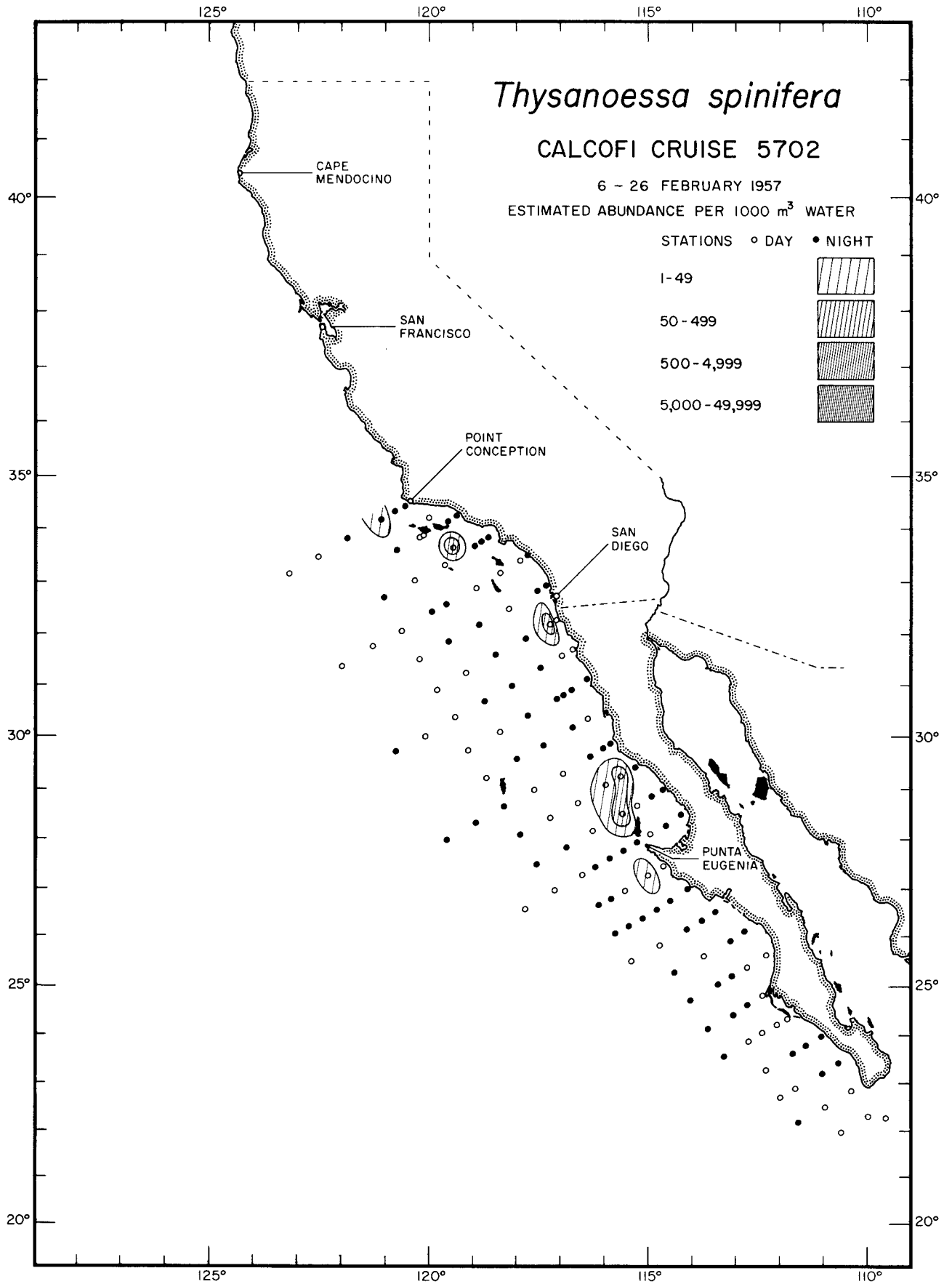


Euphausiacea
Thysanoessa spinifera

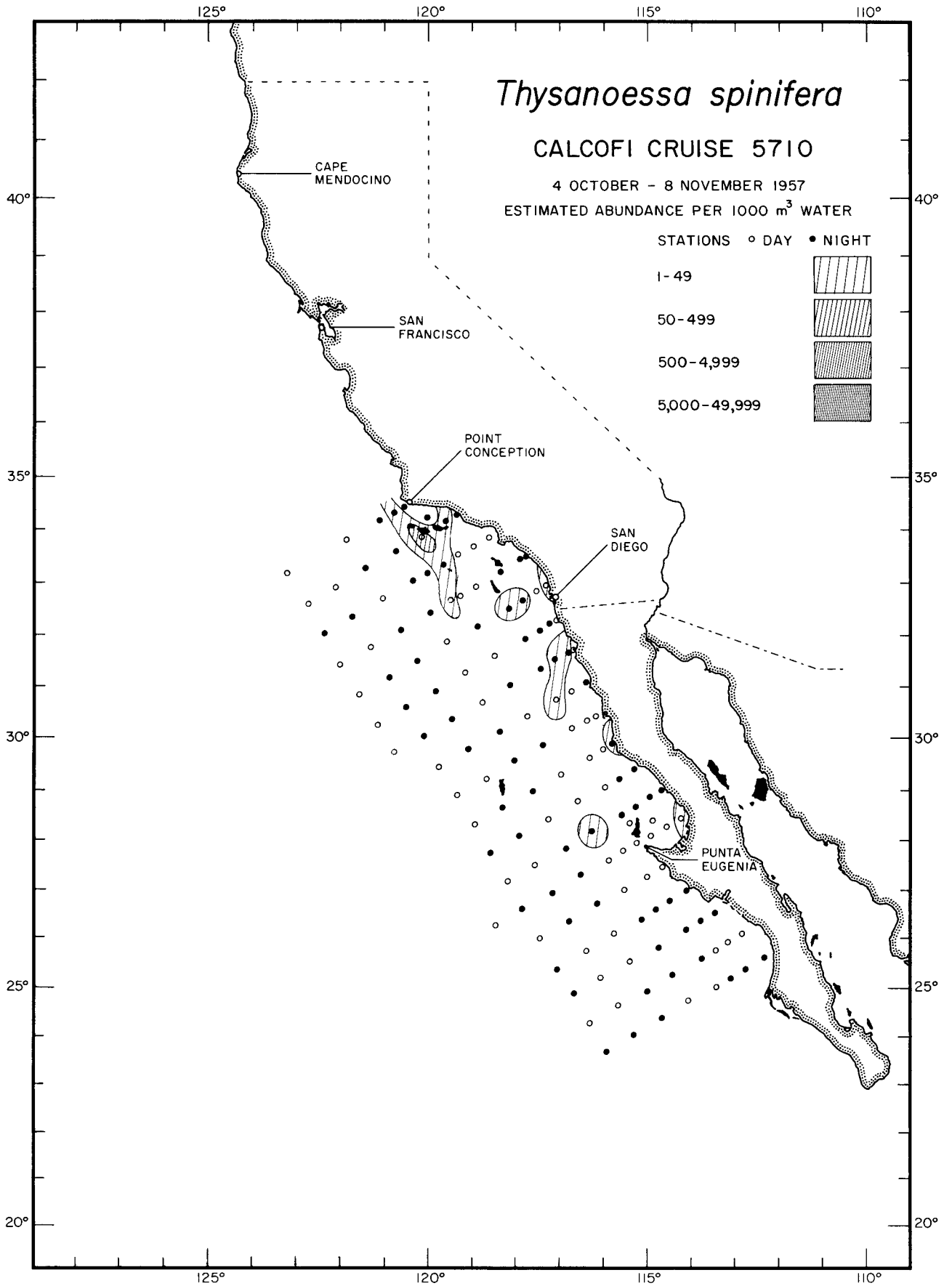
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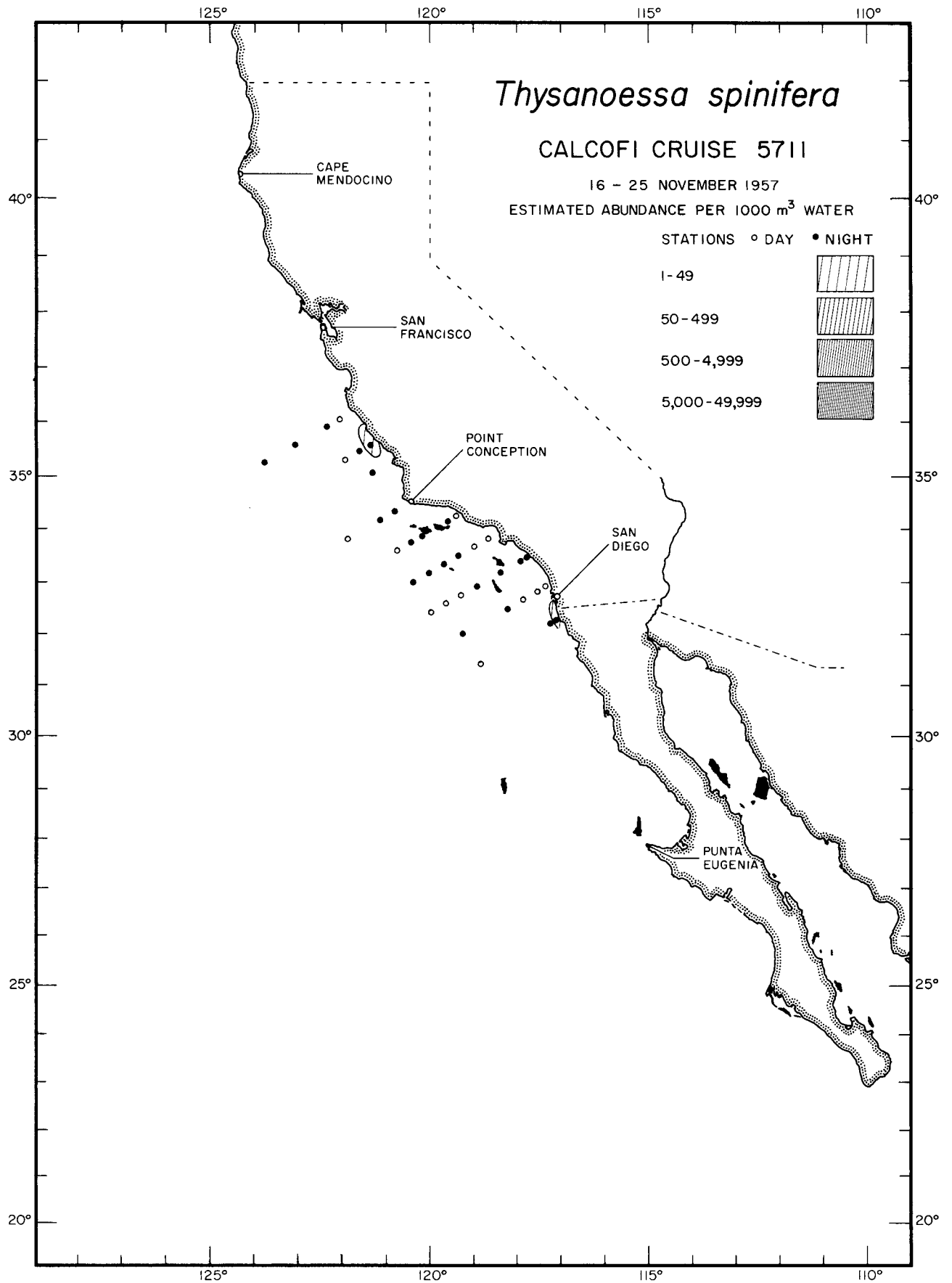
Euphausiacea
Thysanoessa spinifera
5504



Euphausiacea
Thysanoessa spinifera
5702

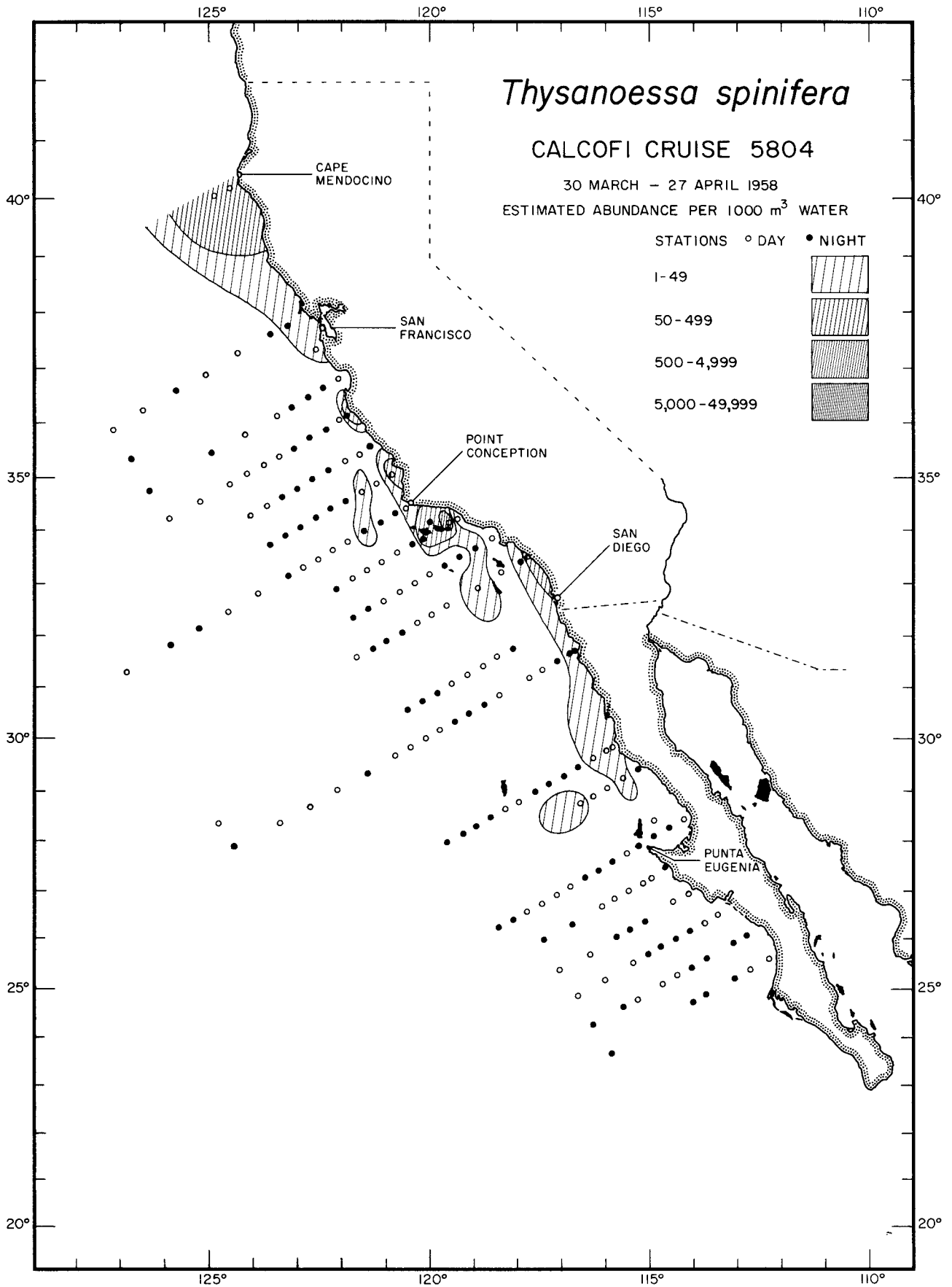


Euphausiacea
Thysanoessa spinifera
5710

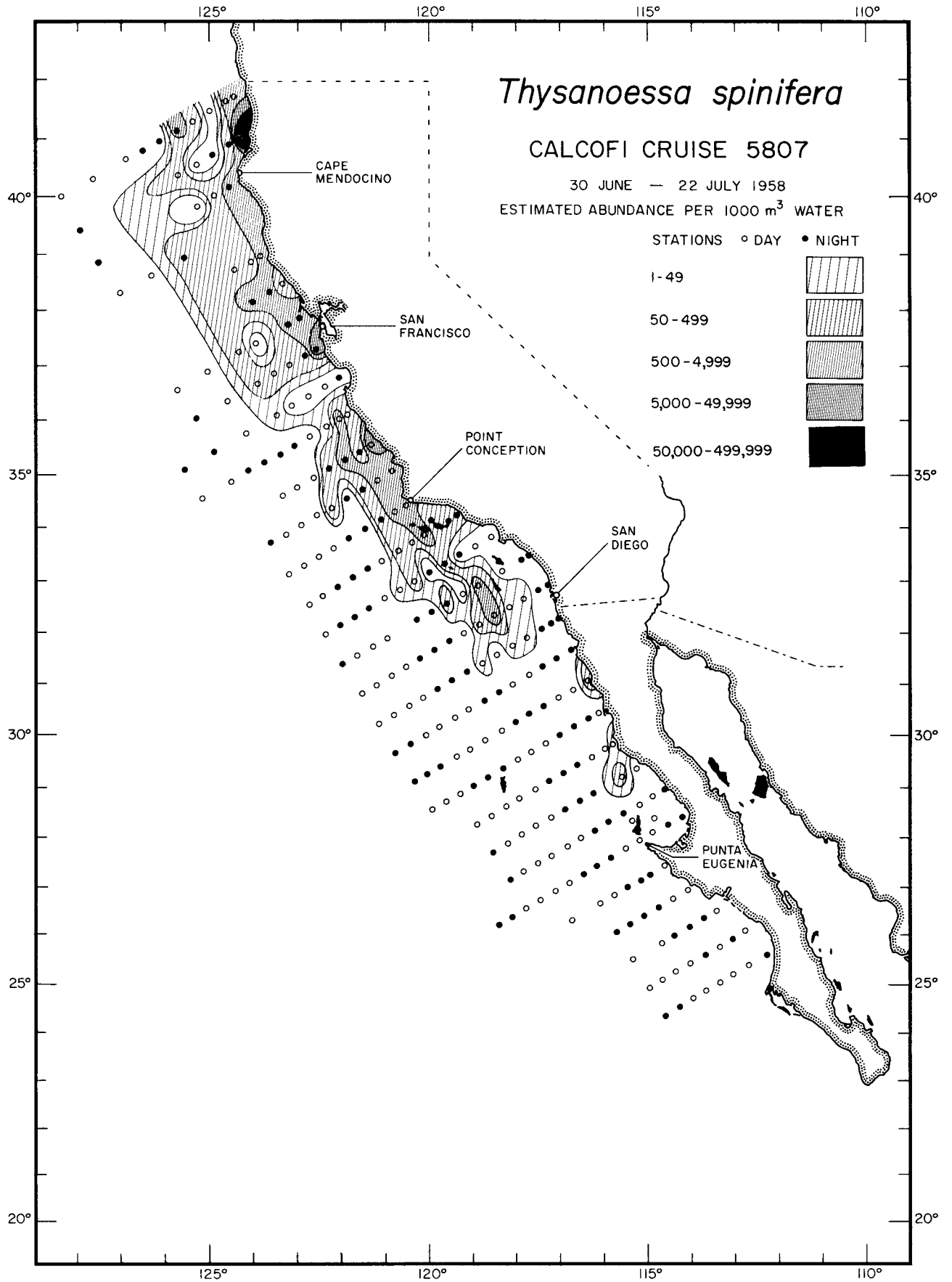


Euphausiacea
Thysanoessa spinifera

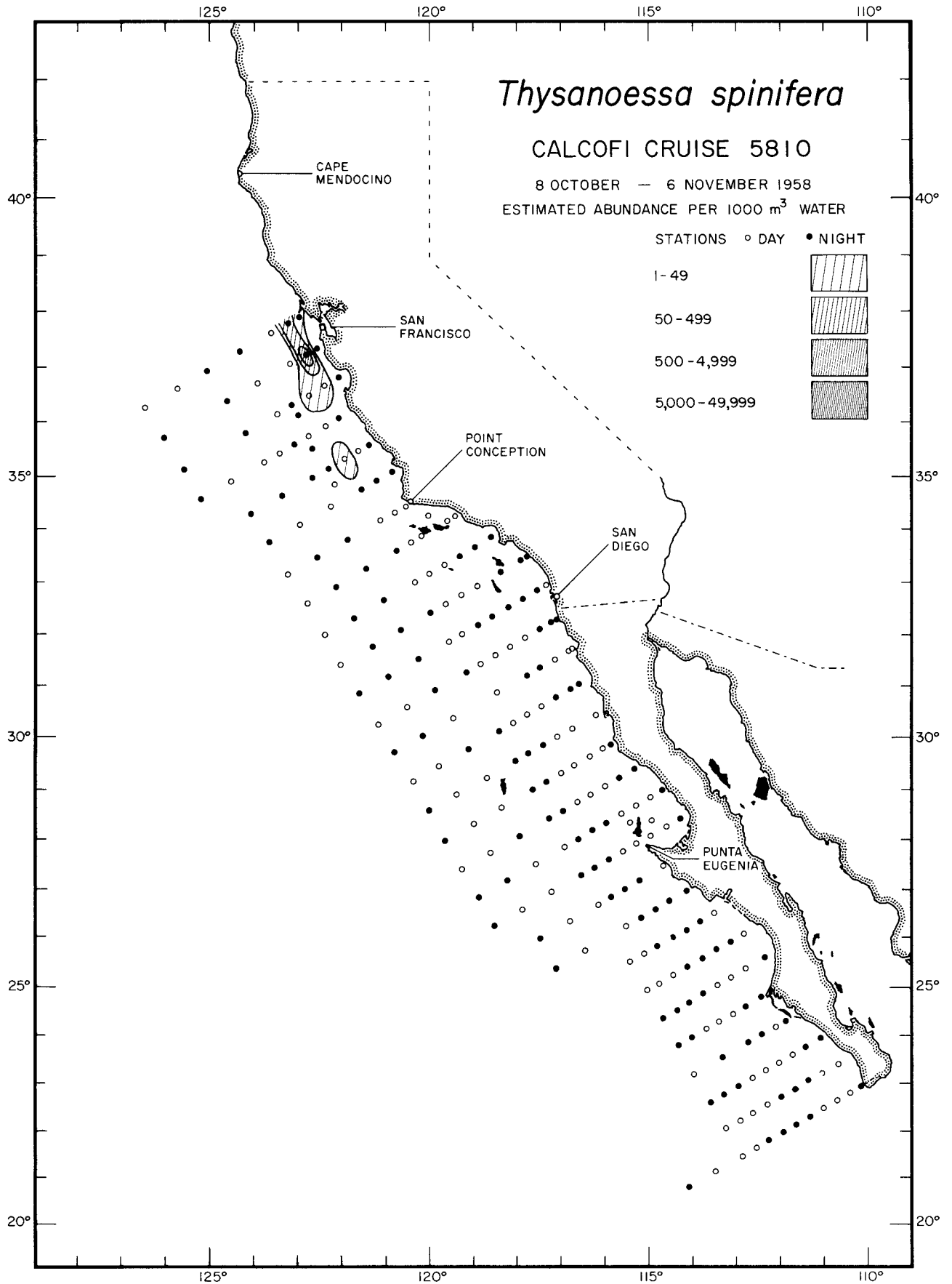
5711



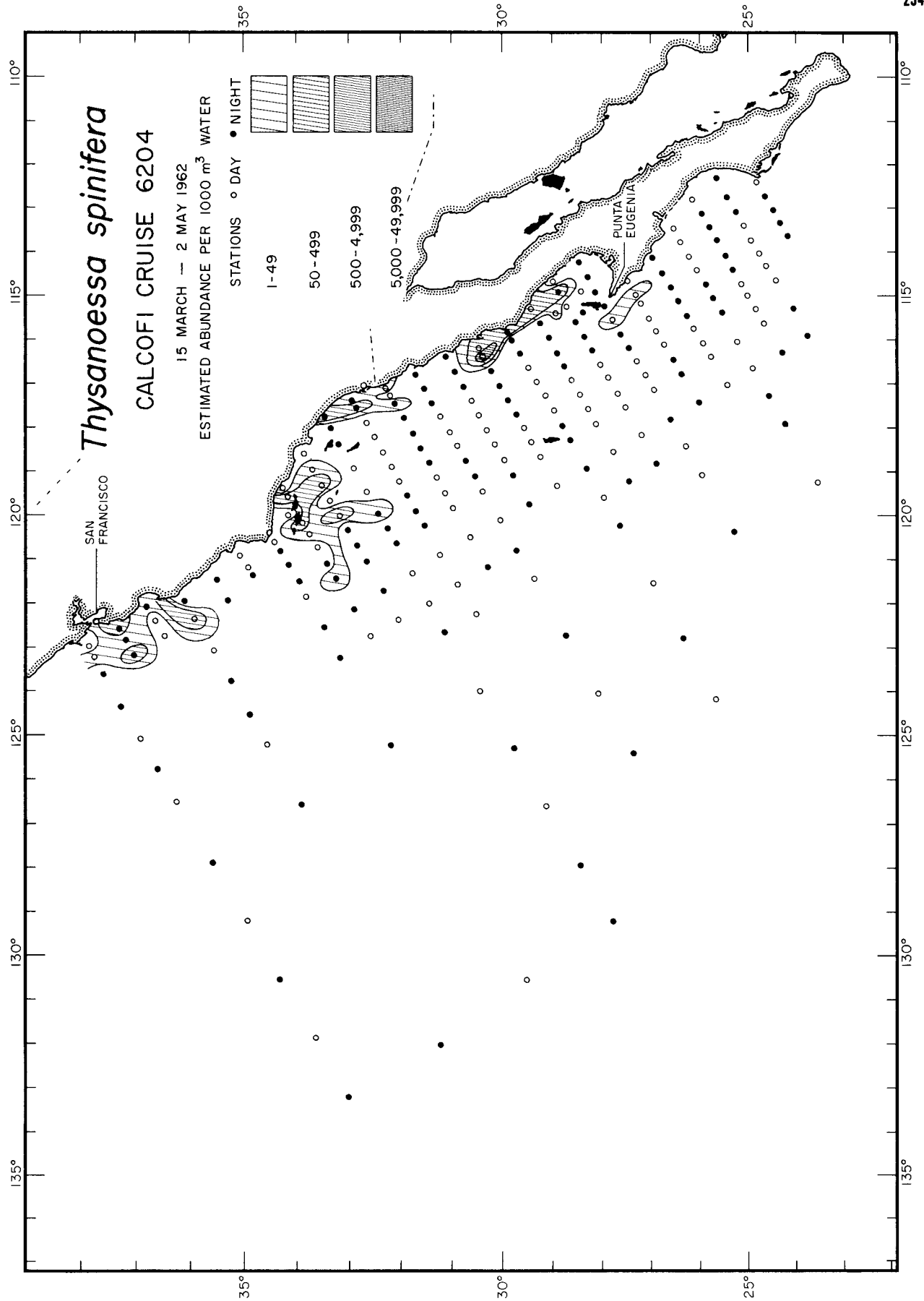
Euphausiacea
Thysanoessa spinifera
5804



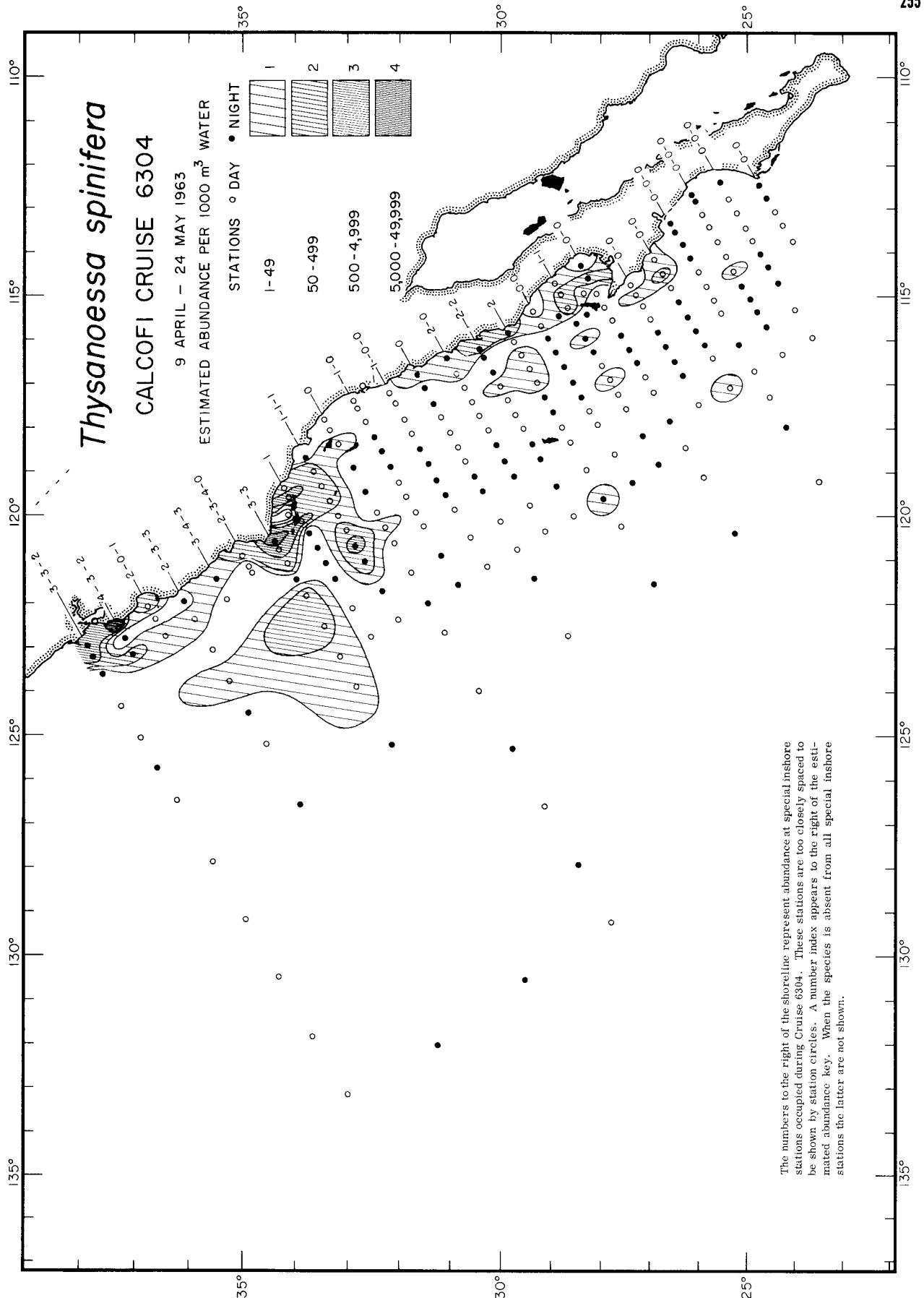
Euphausiacea
Thysanoessa spinifera
5807



Euphausiacea
Thysanoessa spinifera
5810

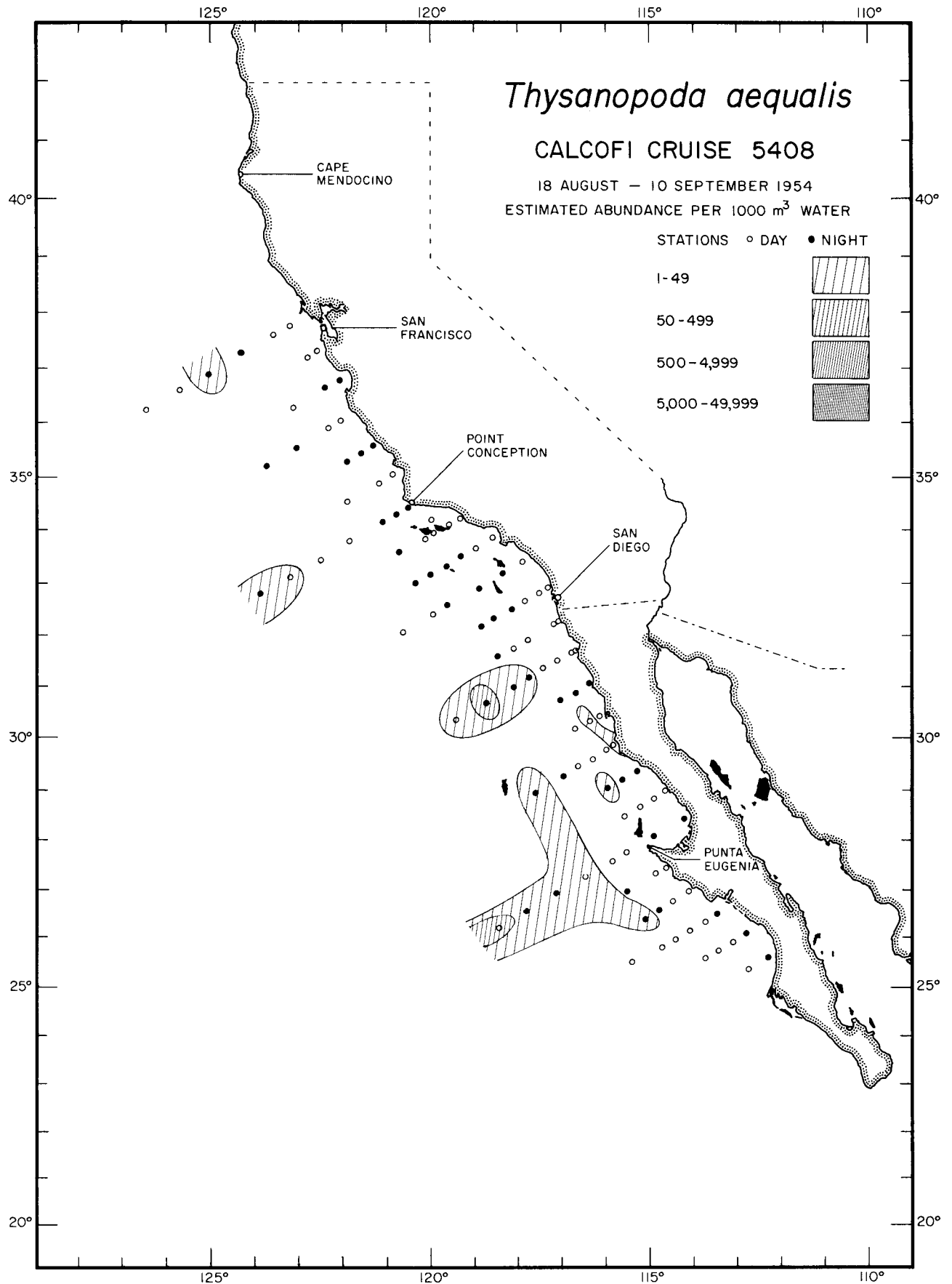


Euphausiacea
Thysanoessa spinifera
6204



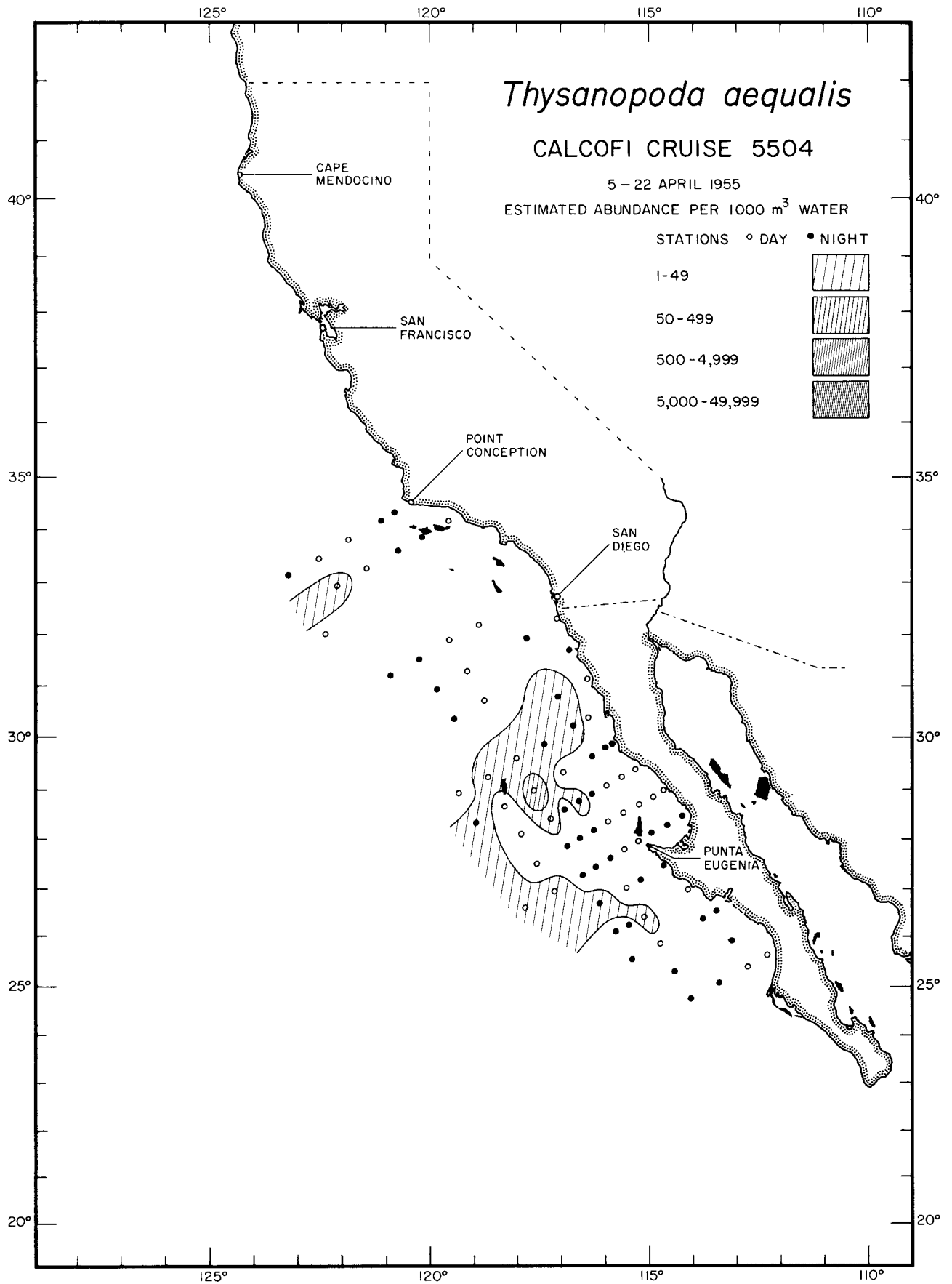
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Euphausiacea
Thysanoessa spinifera
 6304

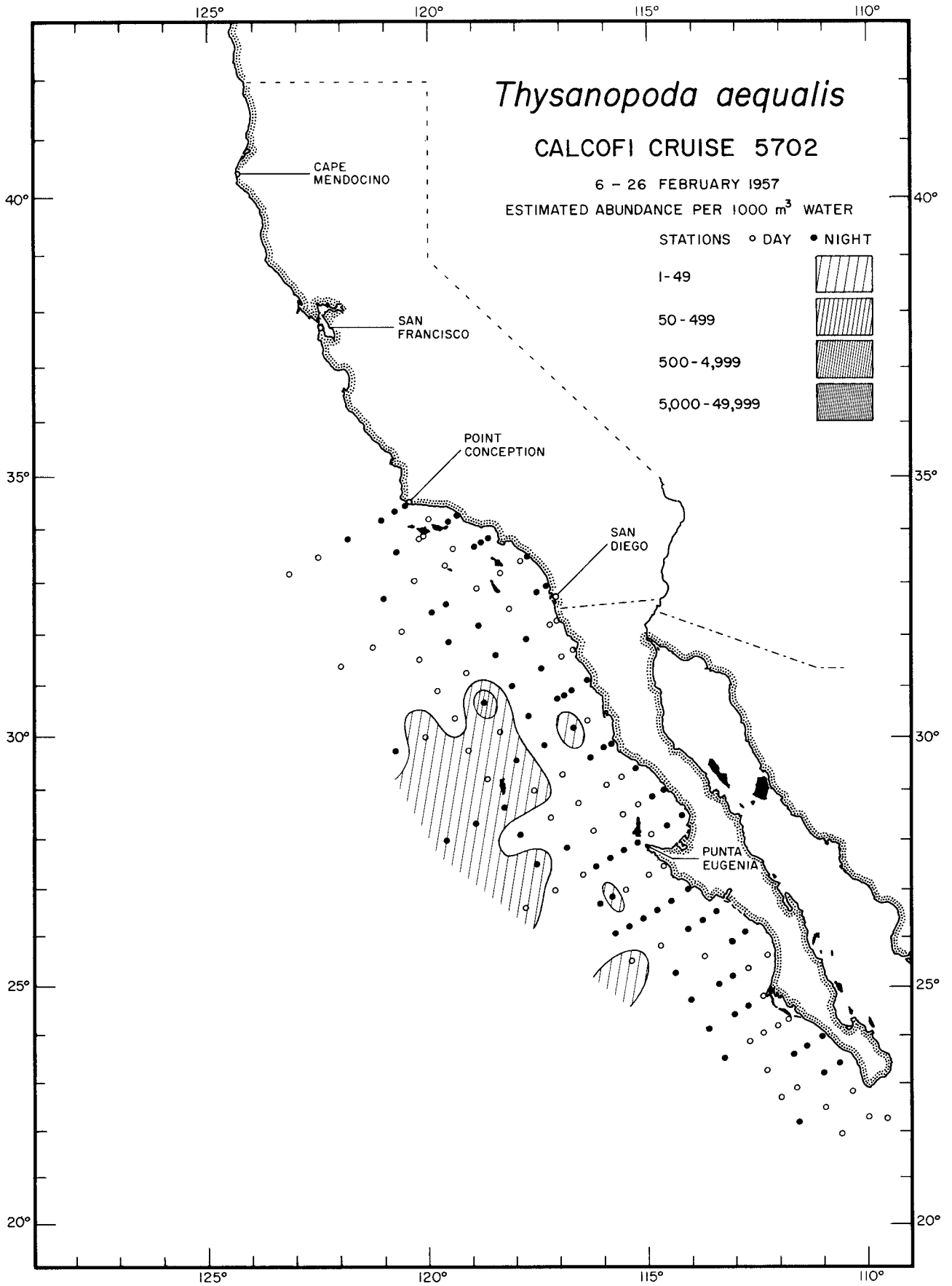


Euphausiacea
Thysanopoda aequalis

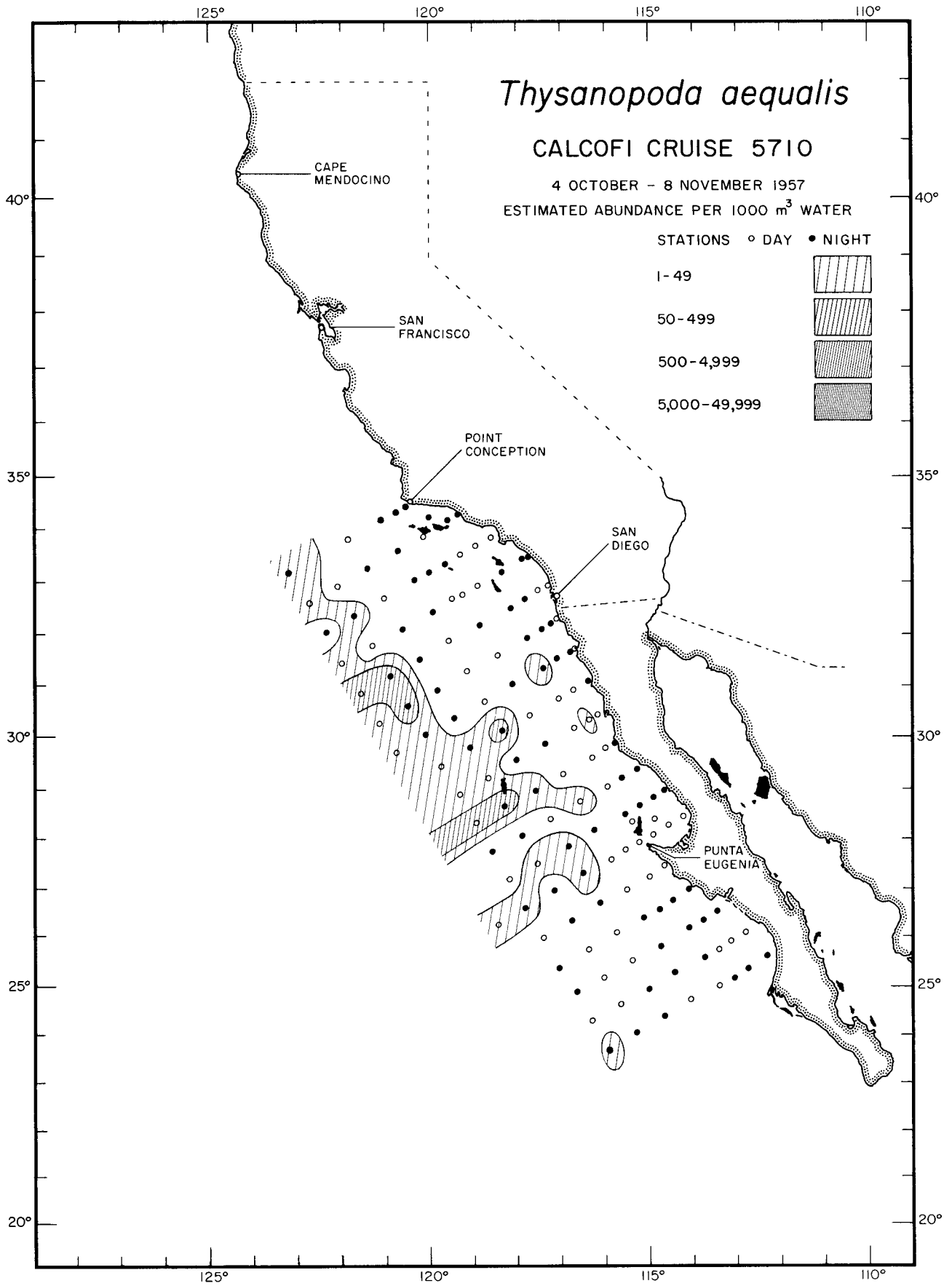
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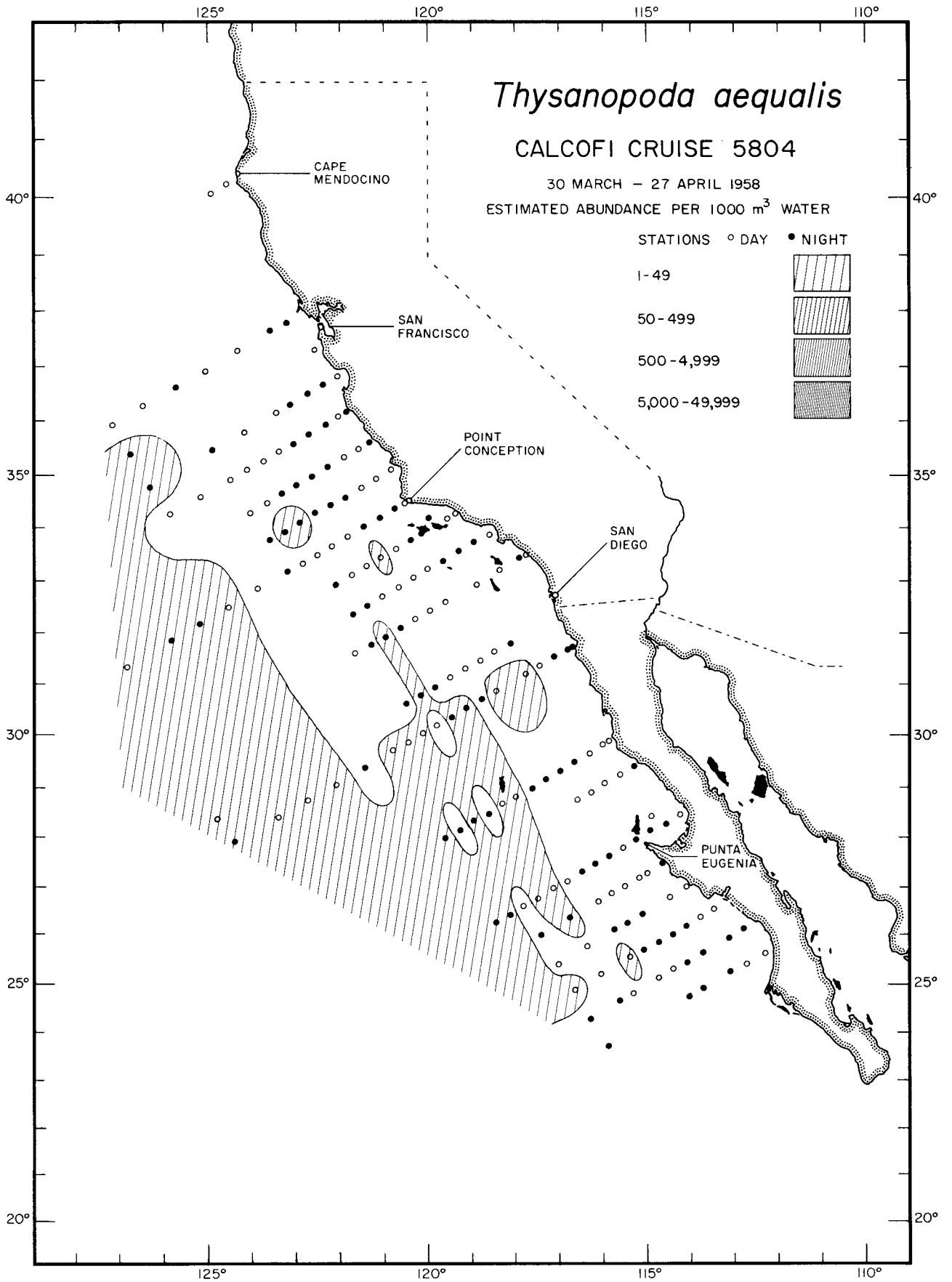
Euphausiacea
Thysanopoda aequalis
5504



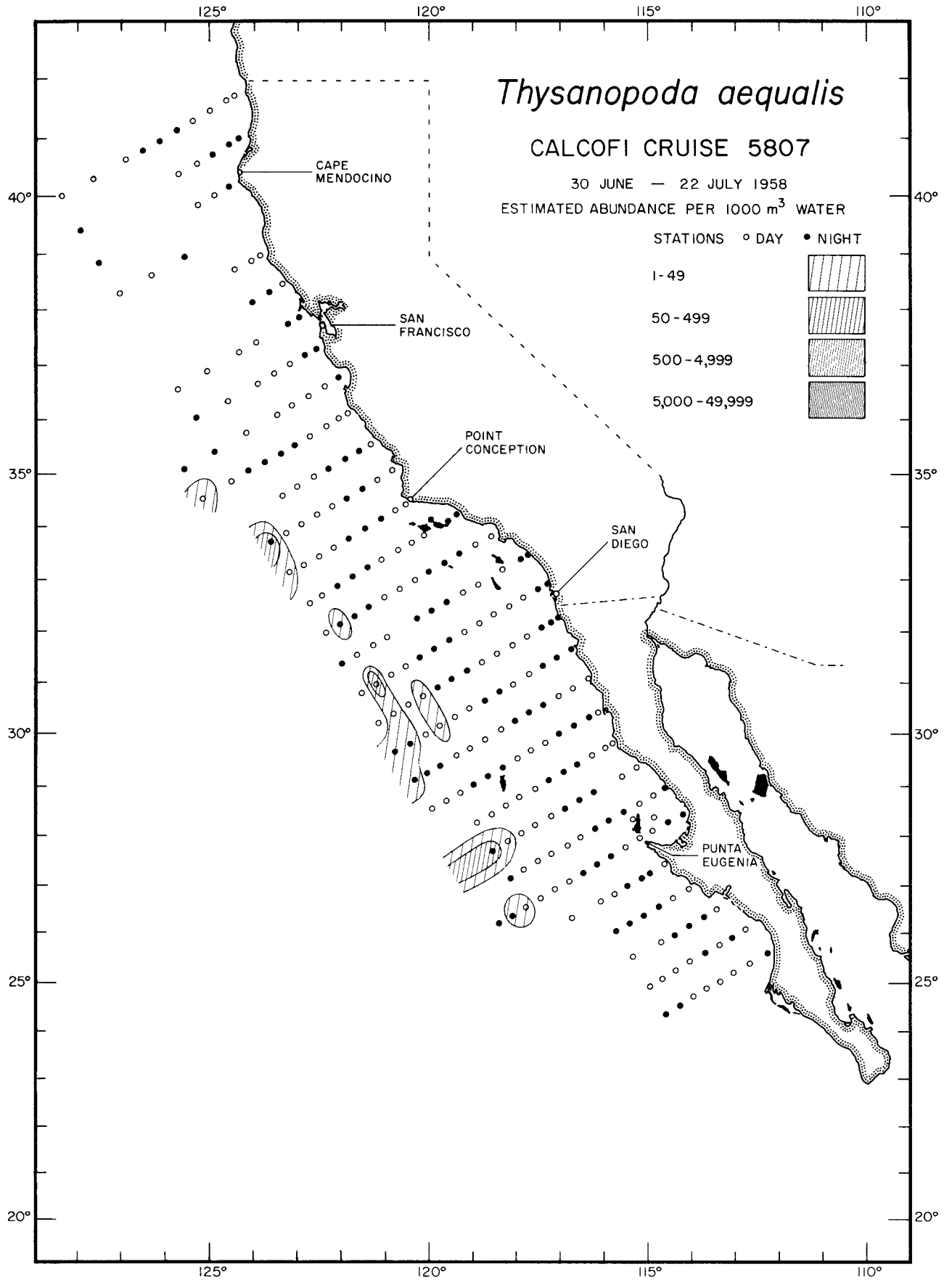
Euphausiacea
Thysanopoda aequalis
5702



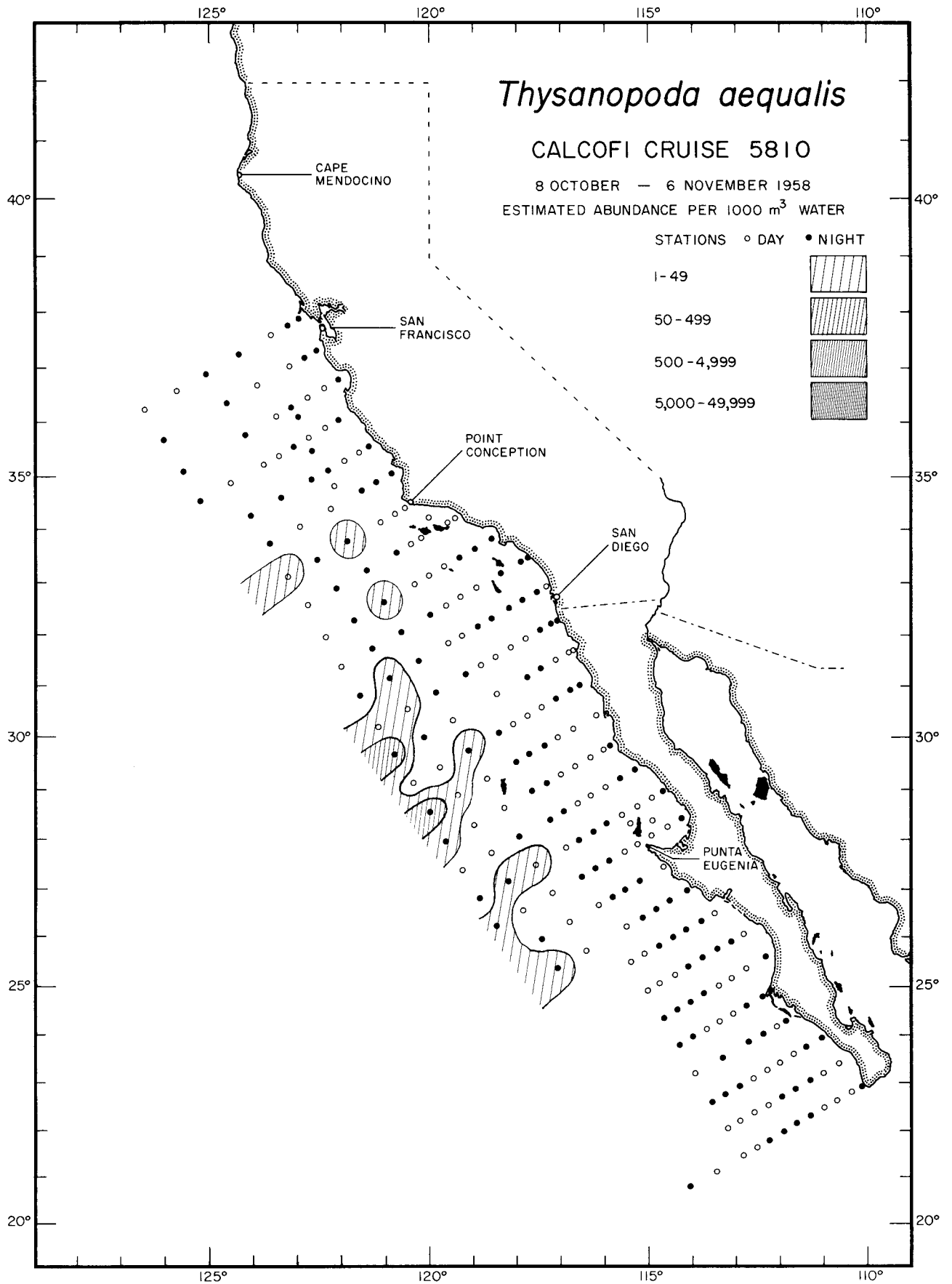
Euphausiacea
Thysanopoda aequalis
5710



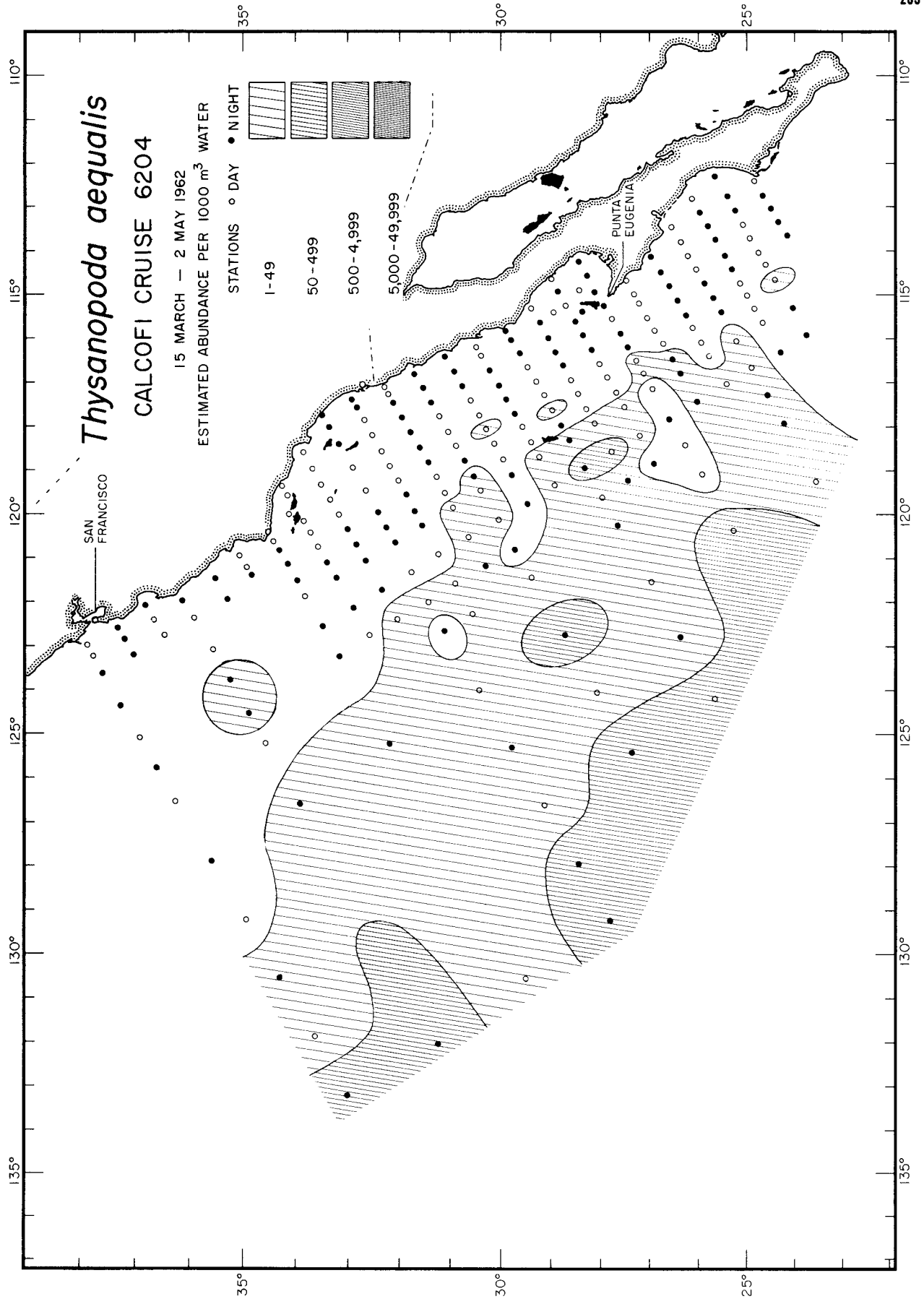
Euphausiacea
Thysanopoda aequalis
5804



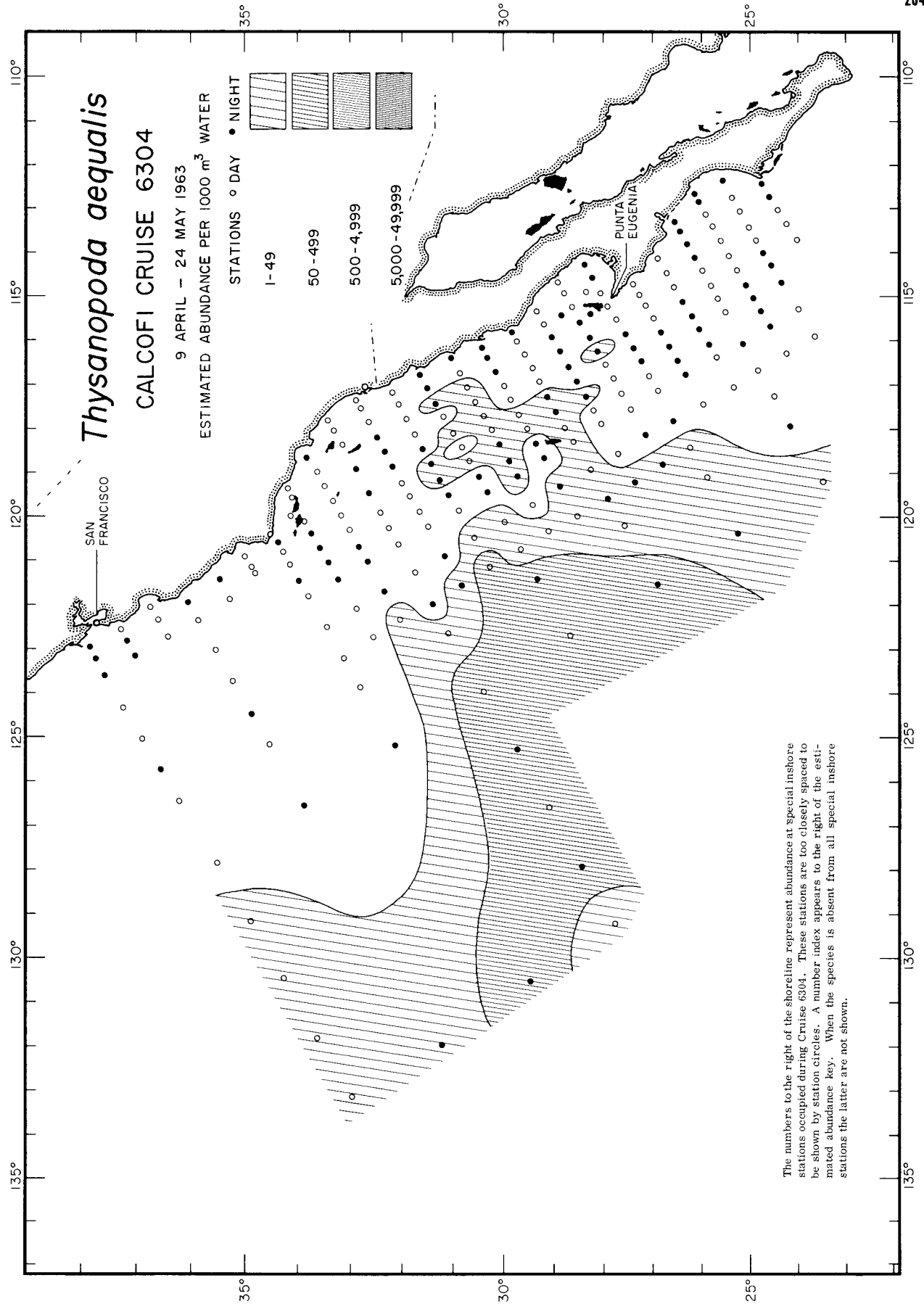
Euphausiacea
Thysanopoda aequalis
 5807



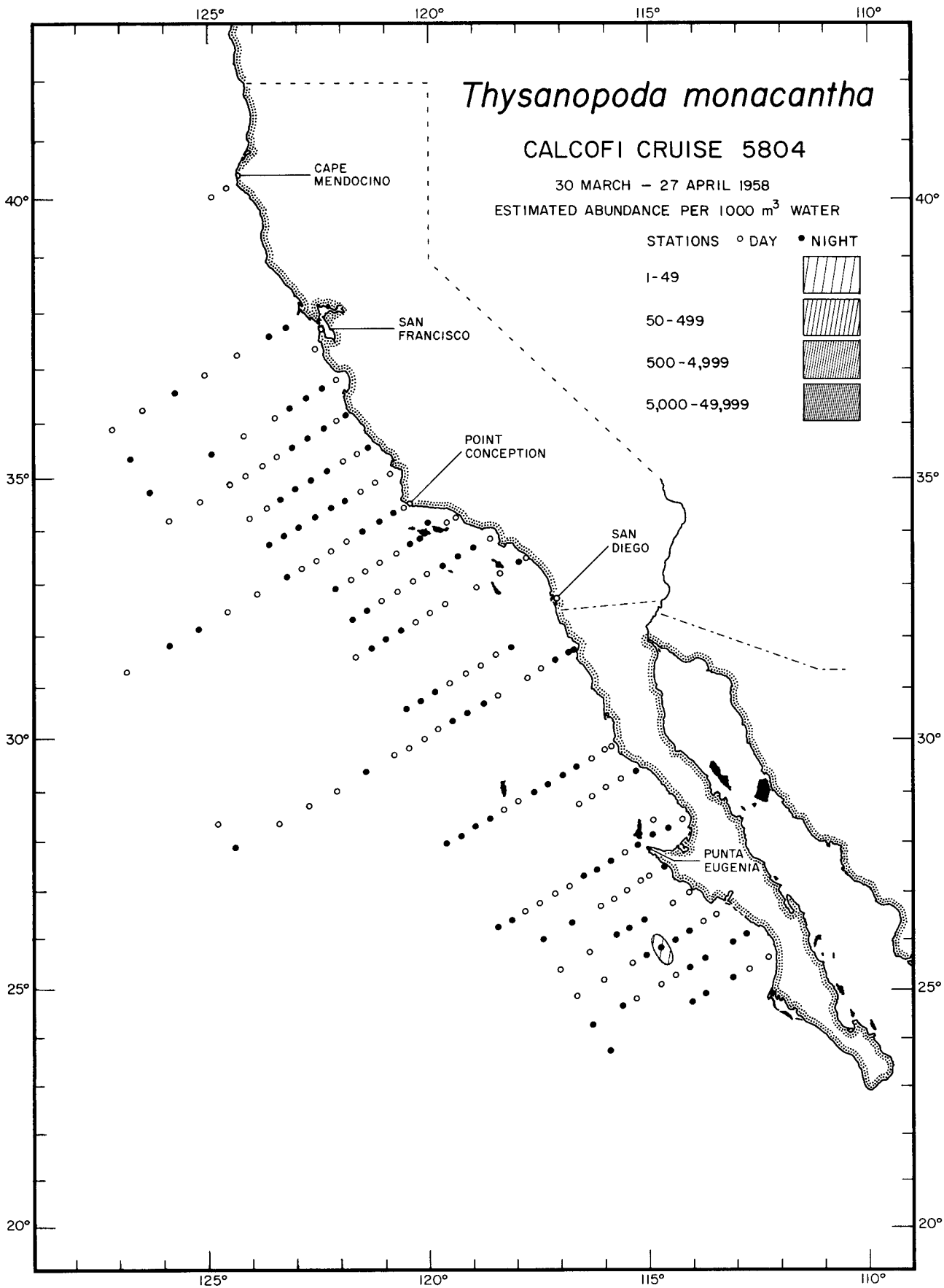
Euphausiacea
Thysanopoda aequalis
5810



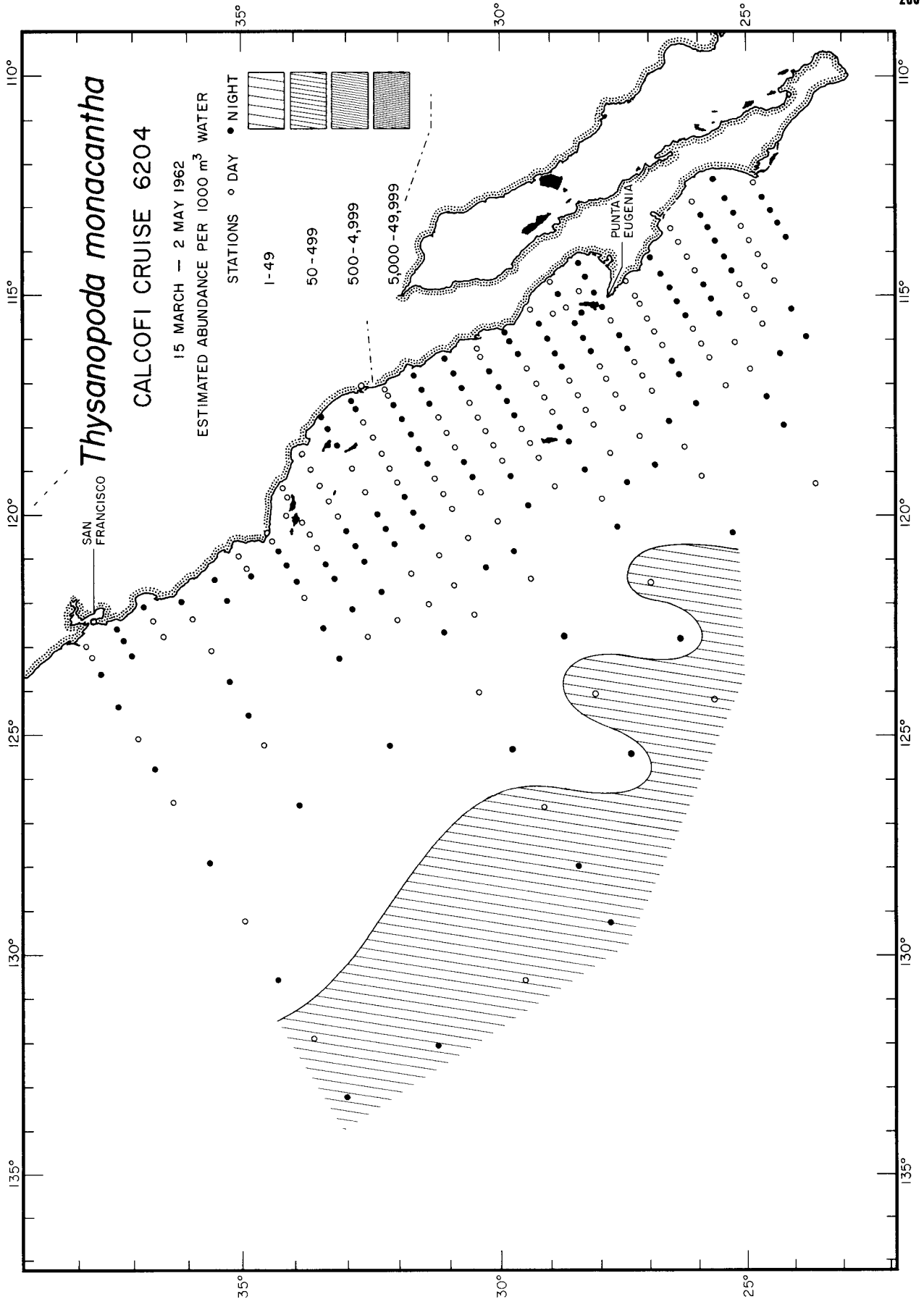
Euphausiacea
Thysanopoda aequalis
6204



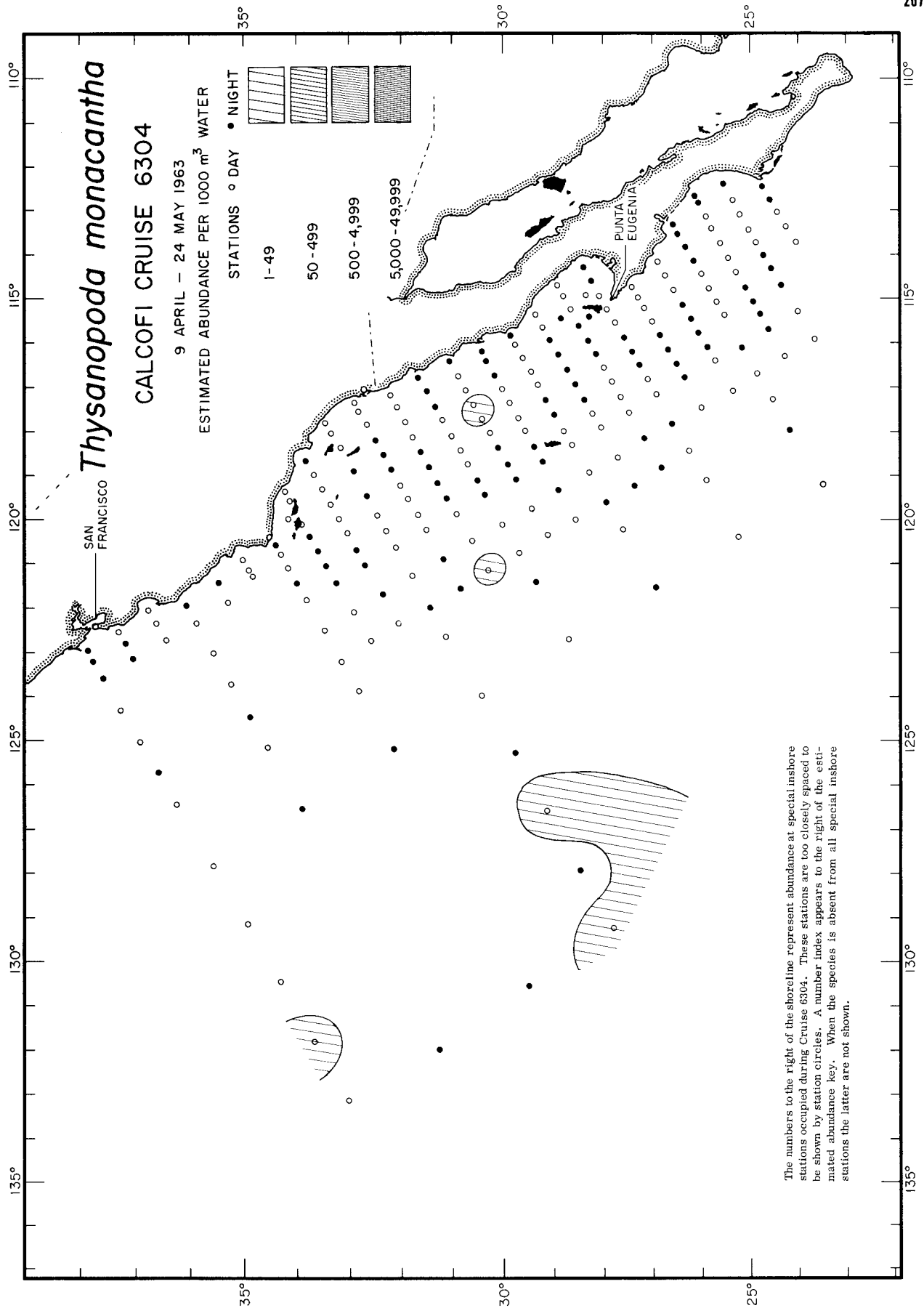
Euphausiacea
Thysanopoda aequalis
6304



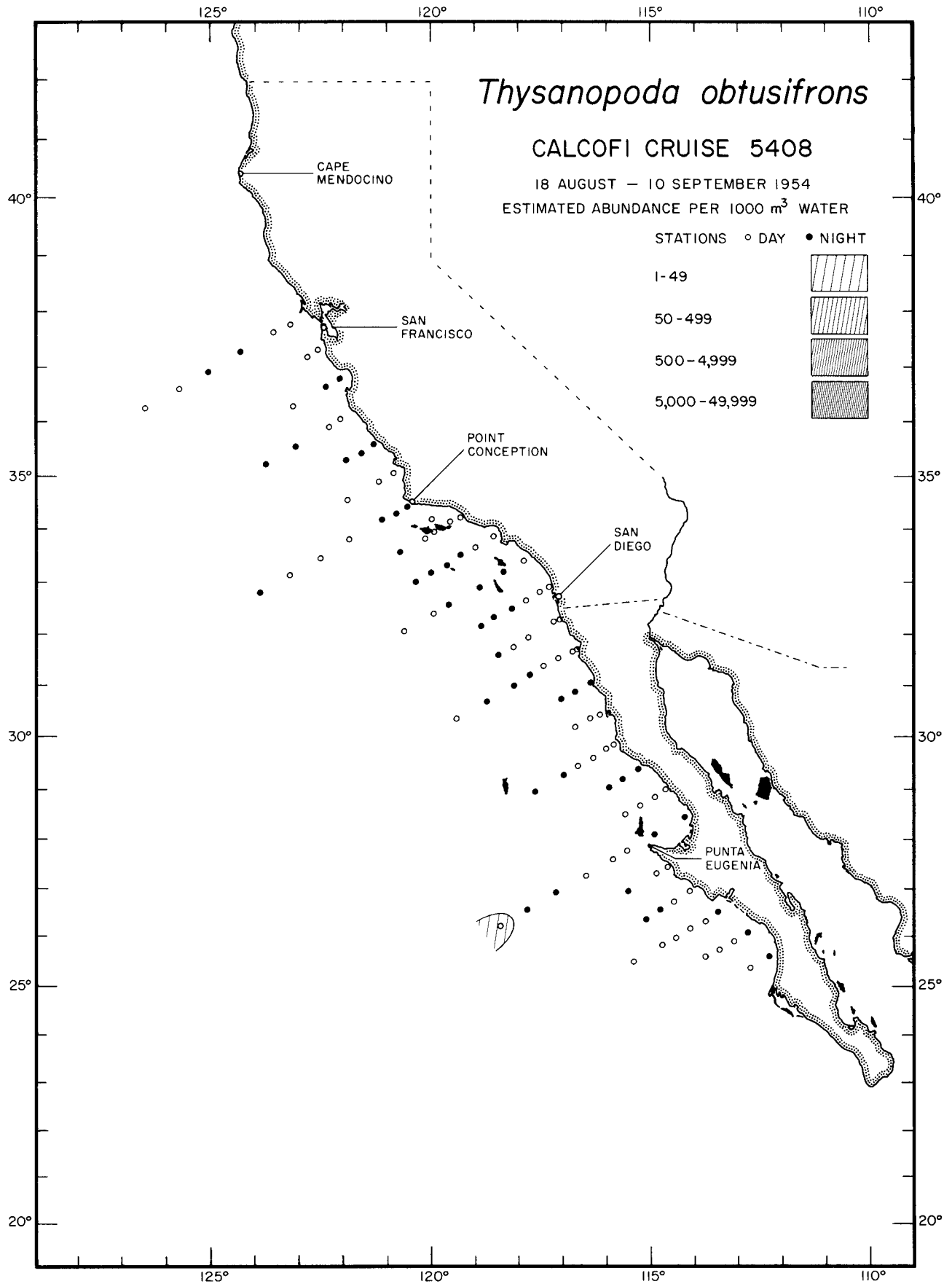
Euphausiacea
Thysanopoda monacantha
5804



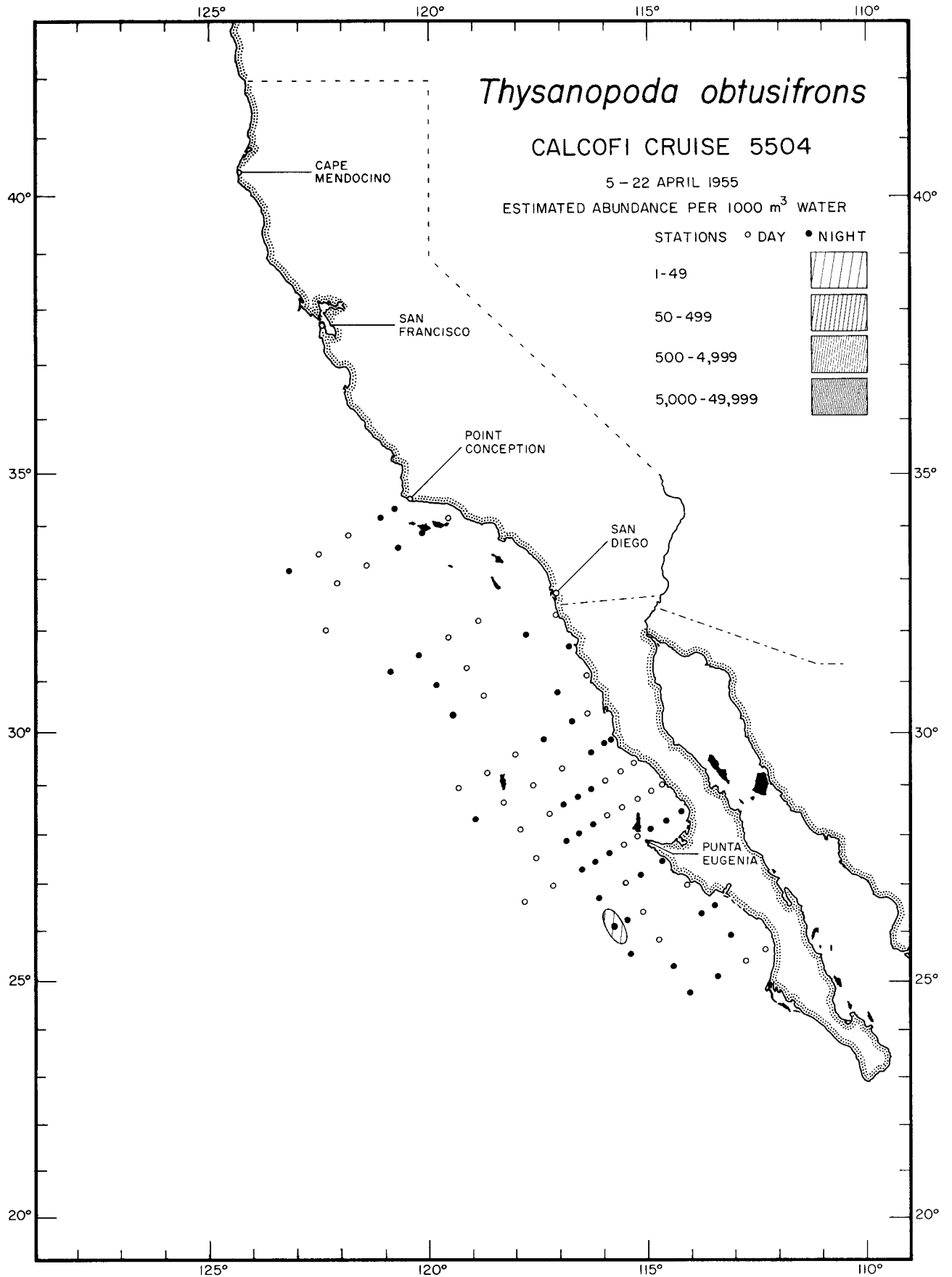
Euphausiacea
Thysanopoda monacantha
6204



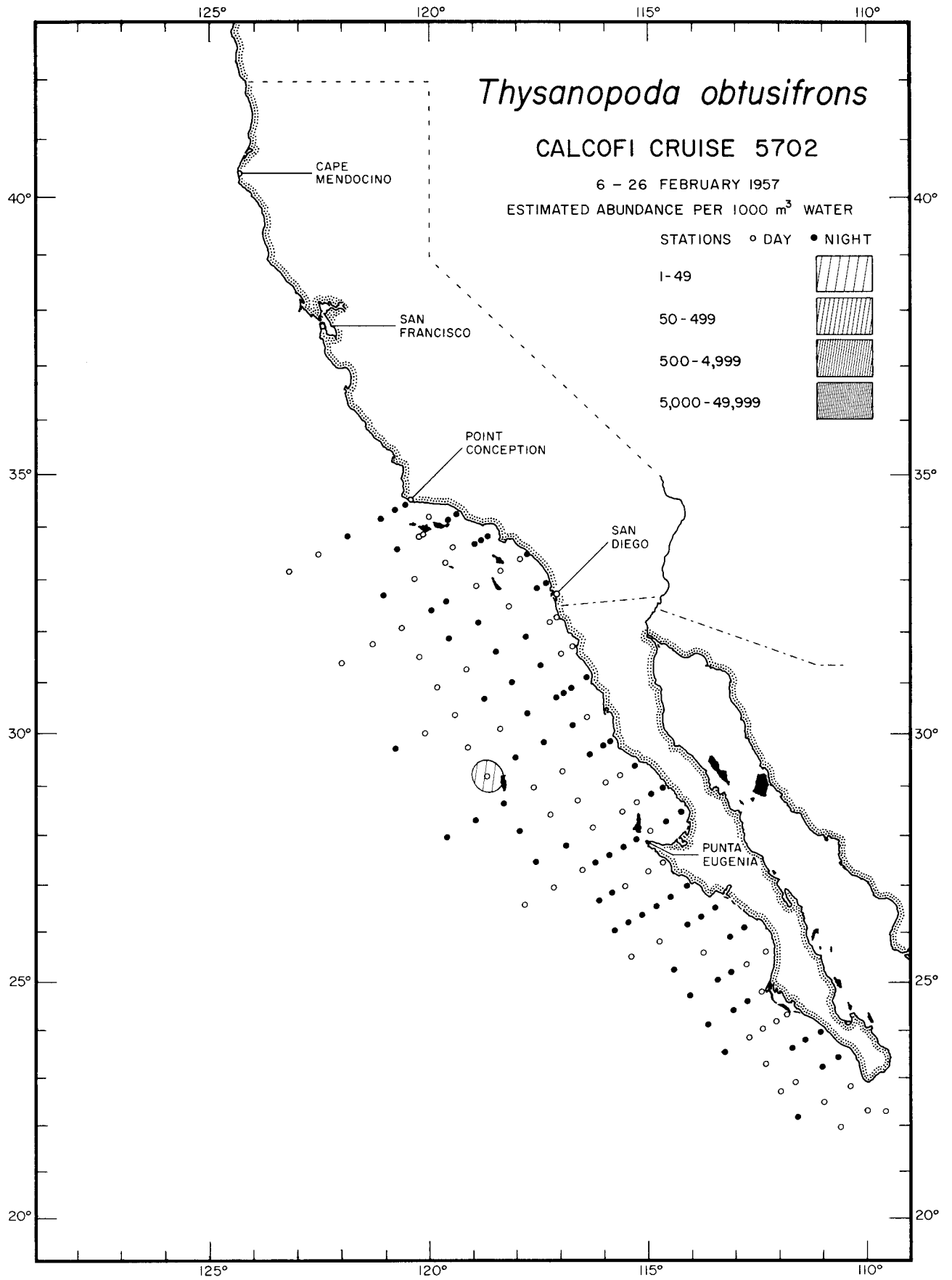
Euphausiacea
Thysanopoda monacantha
6304



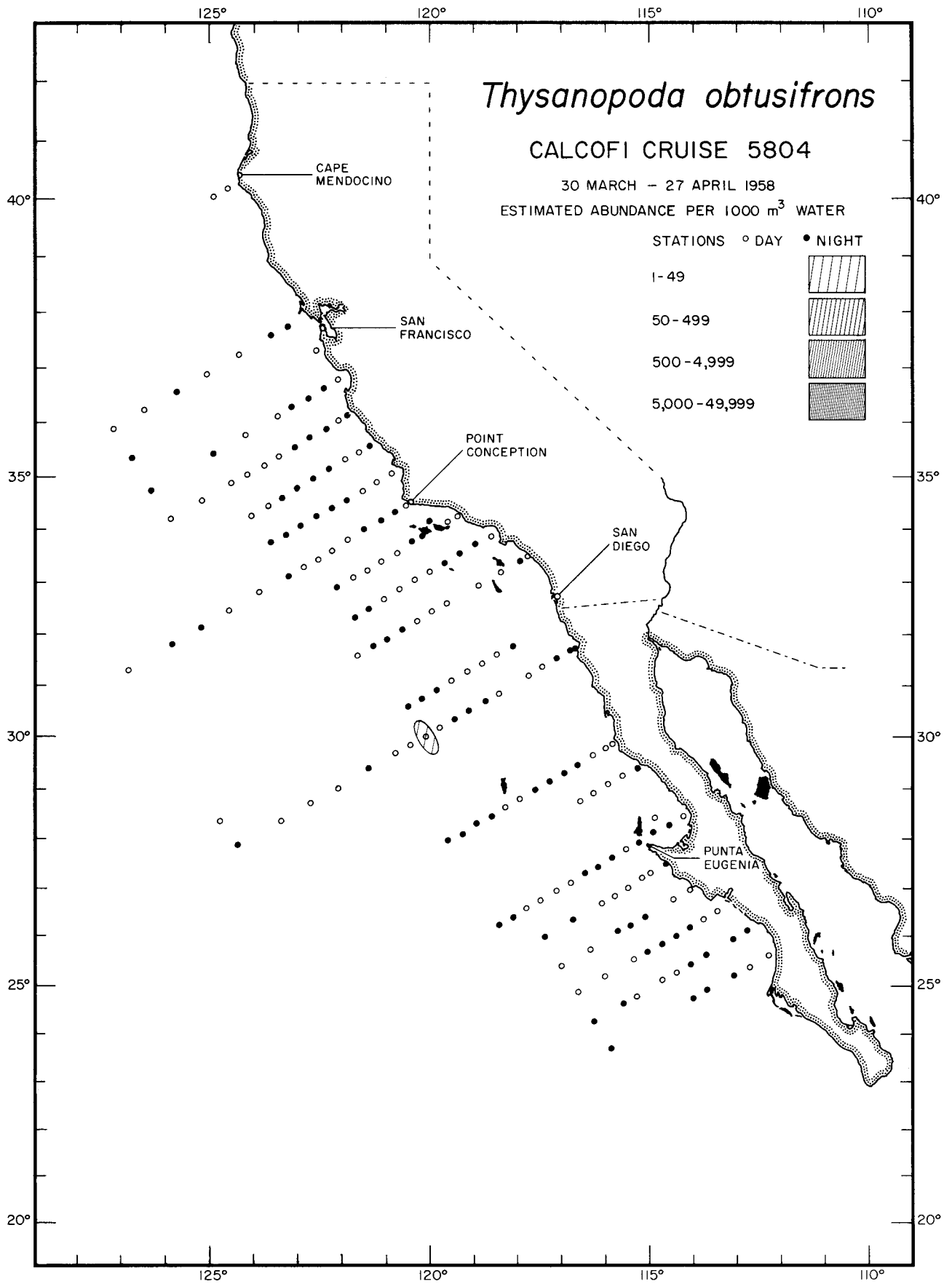
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Thysanopoda obtusifrons
5408



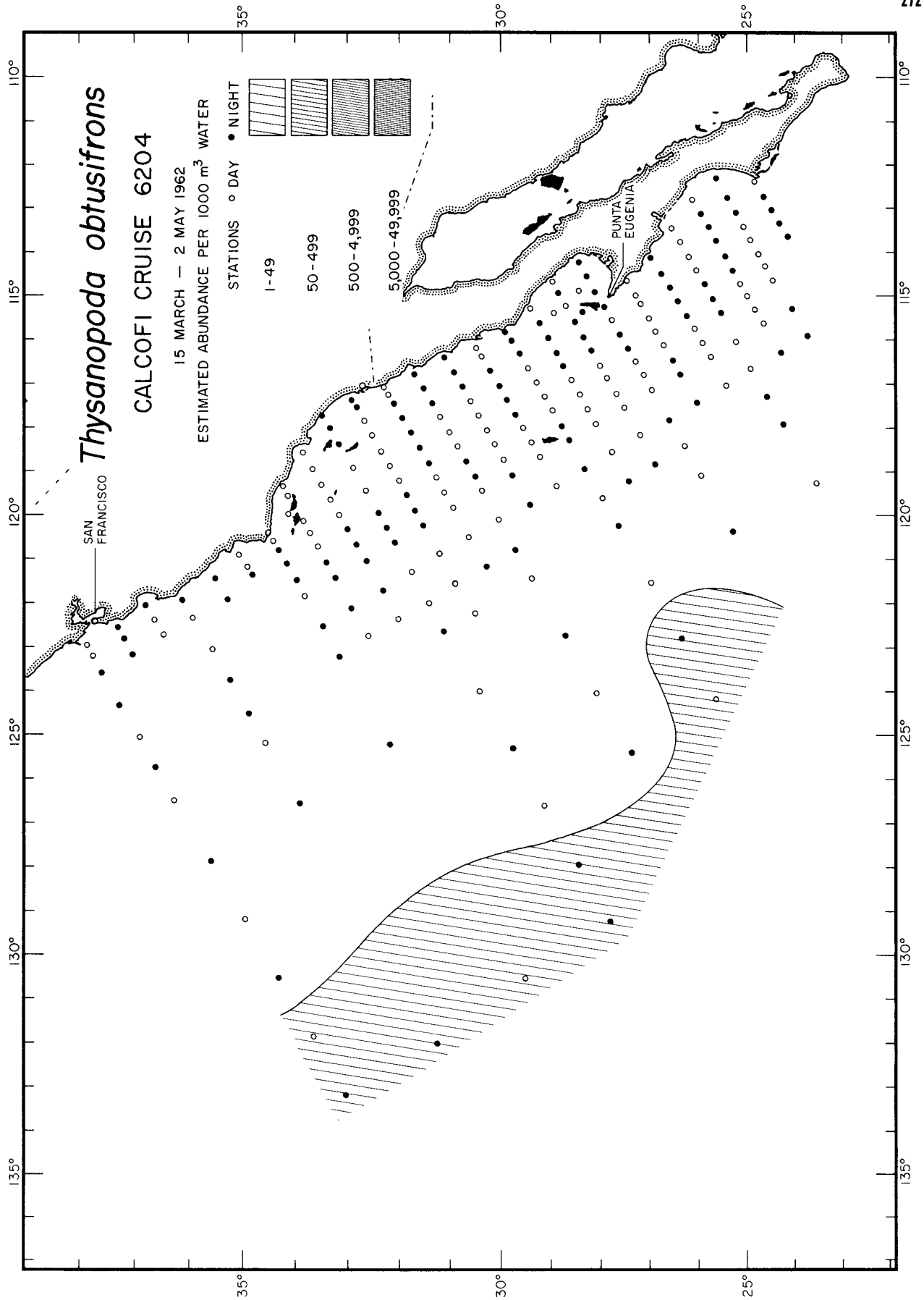
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Thysanopoda obtusifrons
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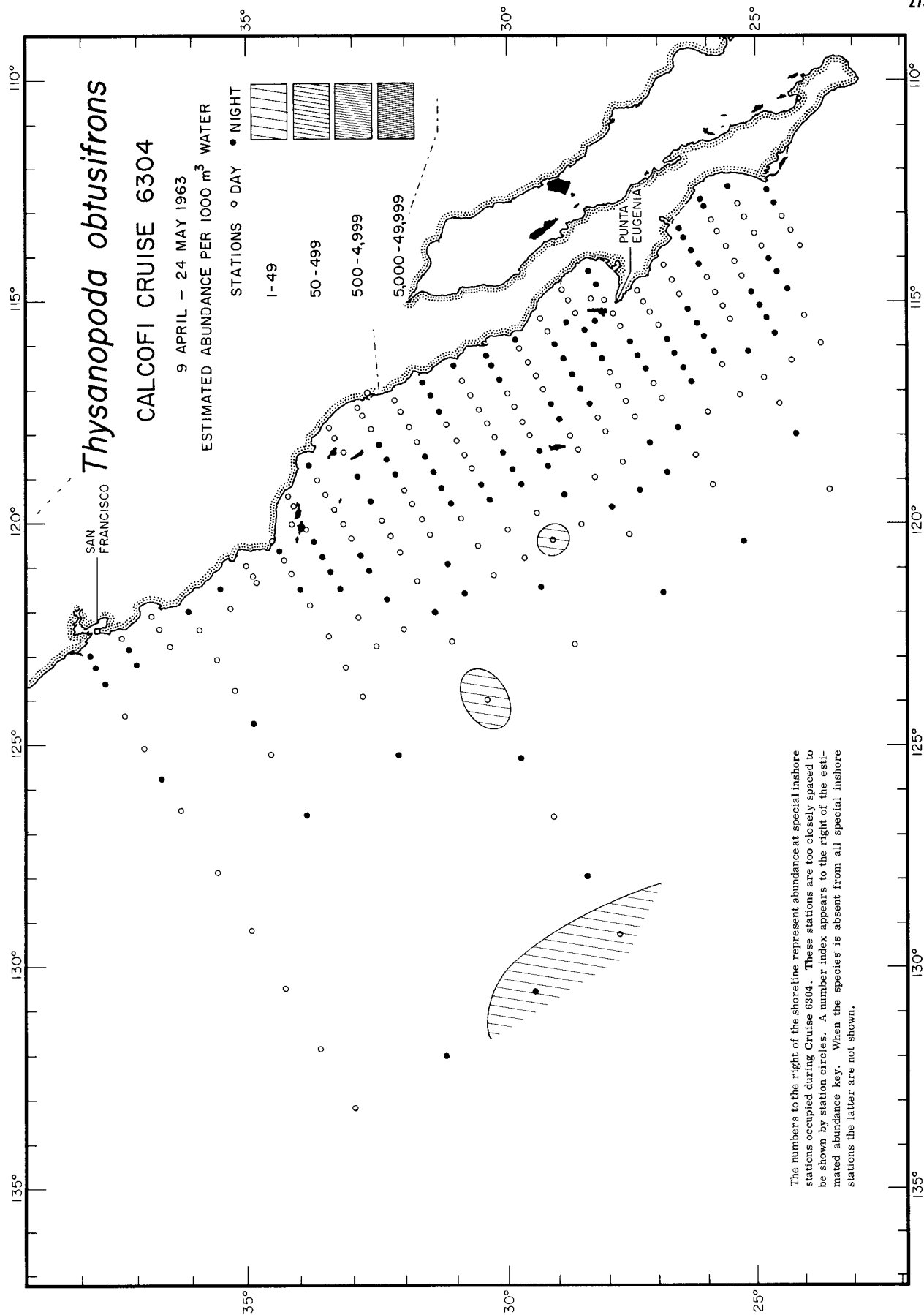
Euphausiacea
Thysanopoda obtusifrons
 5702



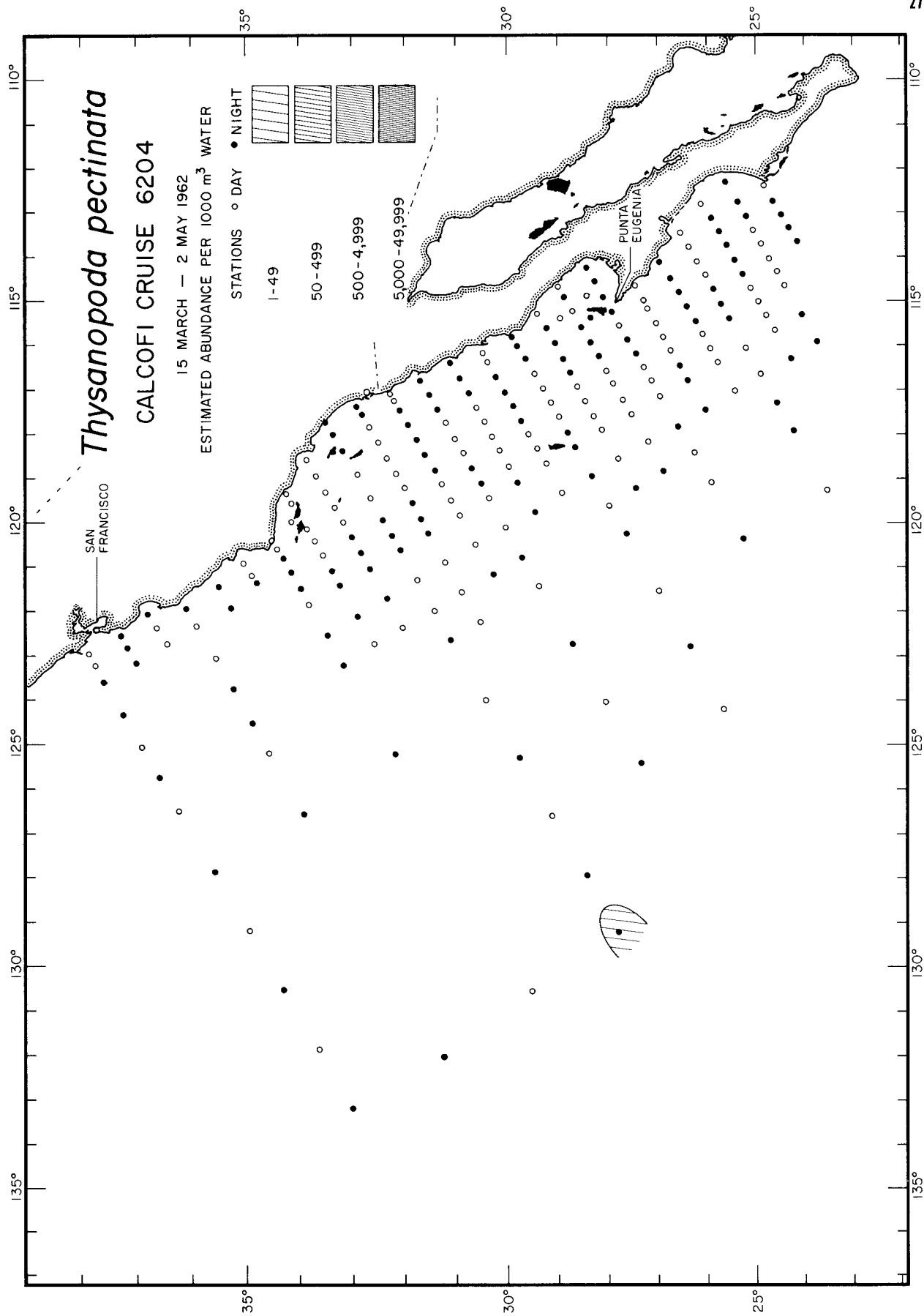
Euphausiacea
Thysanopoda obtusifrons
 5804



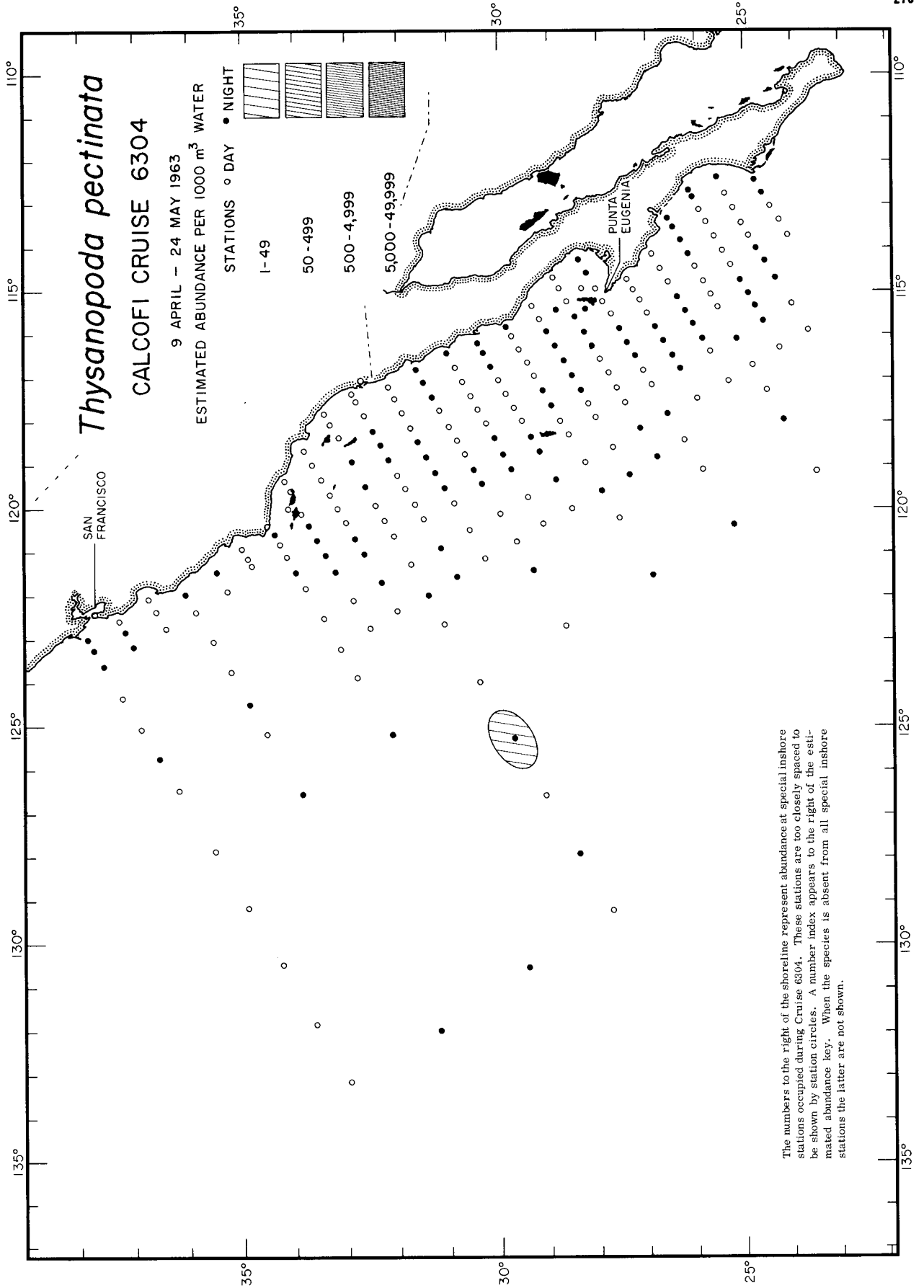
Euphausiacea
Thysanopoda obtusifrons
 6204



Euphausiacea
Thysanopoda obtusifrons
6304

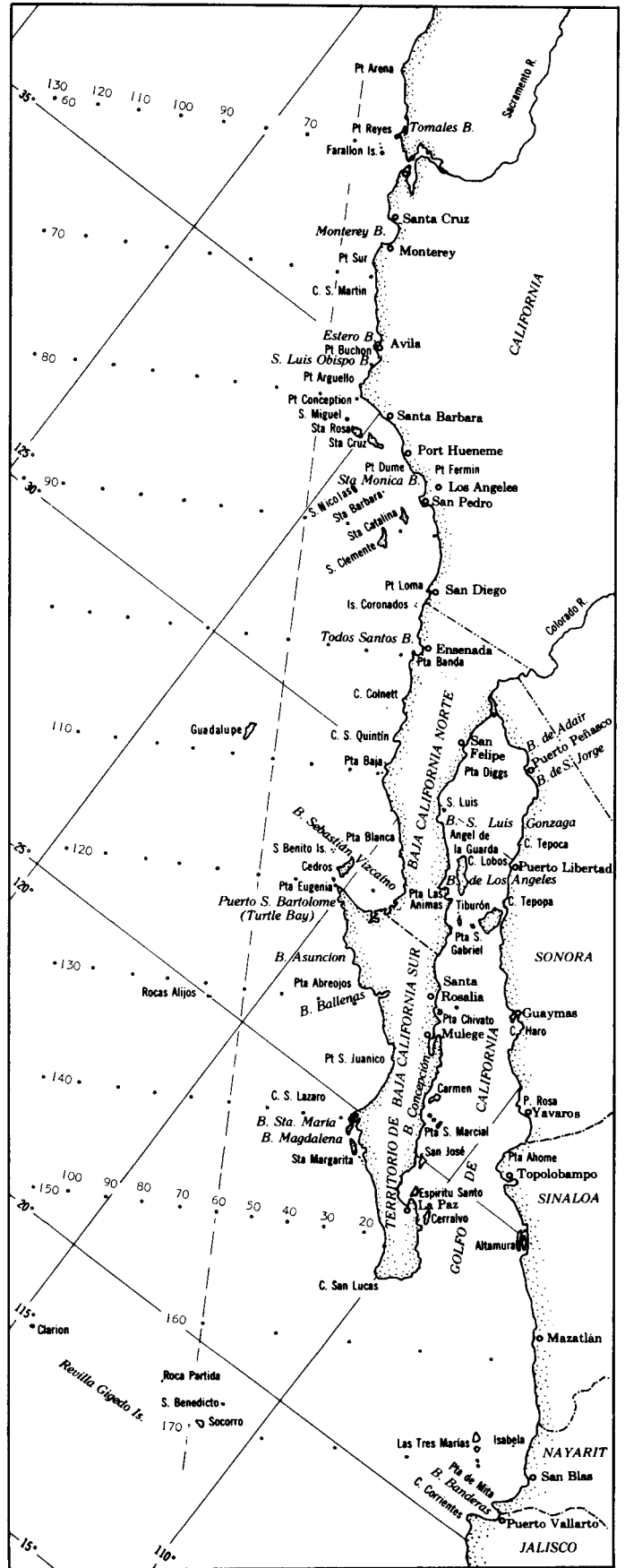
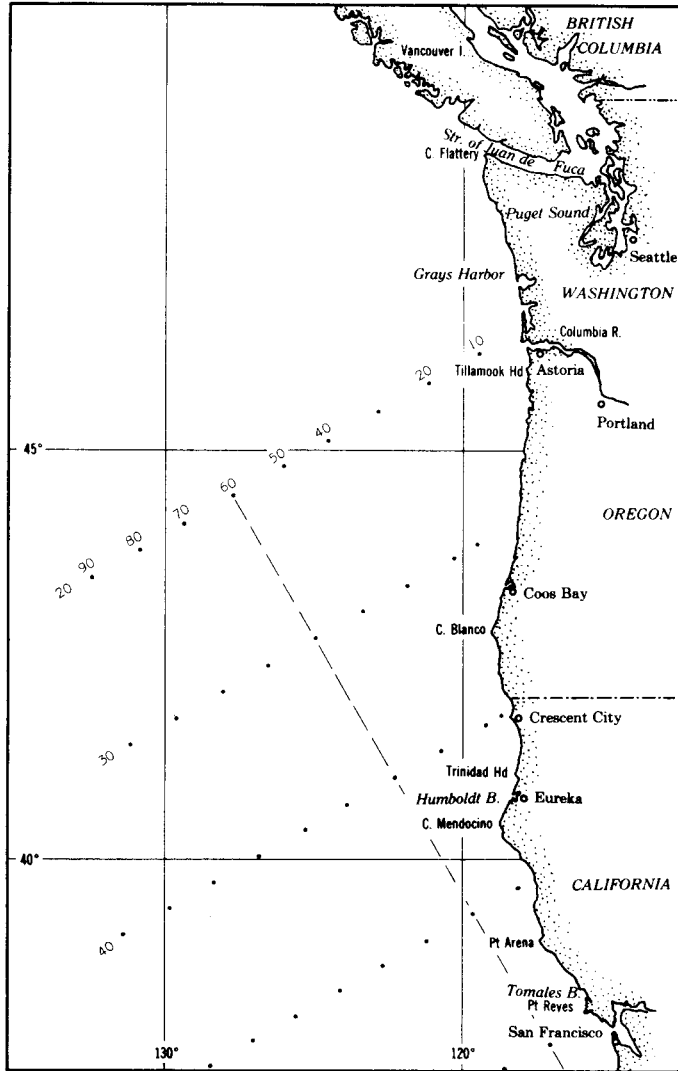


Euphausiacea
Thysanopoda pectinata
6204



The numbers to the right of the shoreline represent abundance at special inshore stations occupied during Cruise 6304. These stations are too closely spaced to be shown by station circles. A number index appears to the right of the estimated abundance key. When the species is absent from all special inshore stations the latter are not shown.

Euphausiacea
Thysanopoda pectinata
6304



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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