



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

16 May 2007

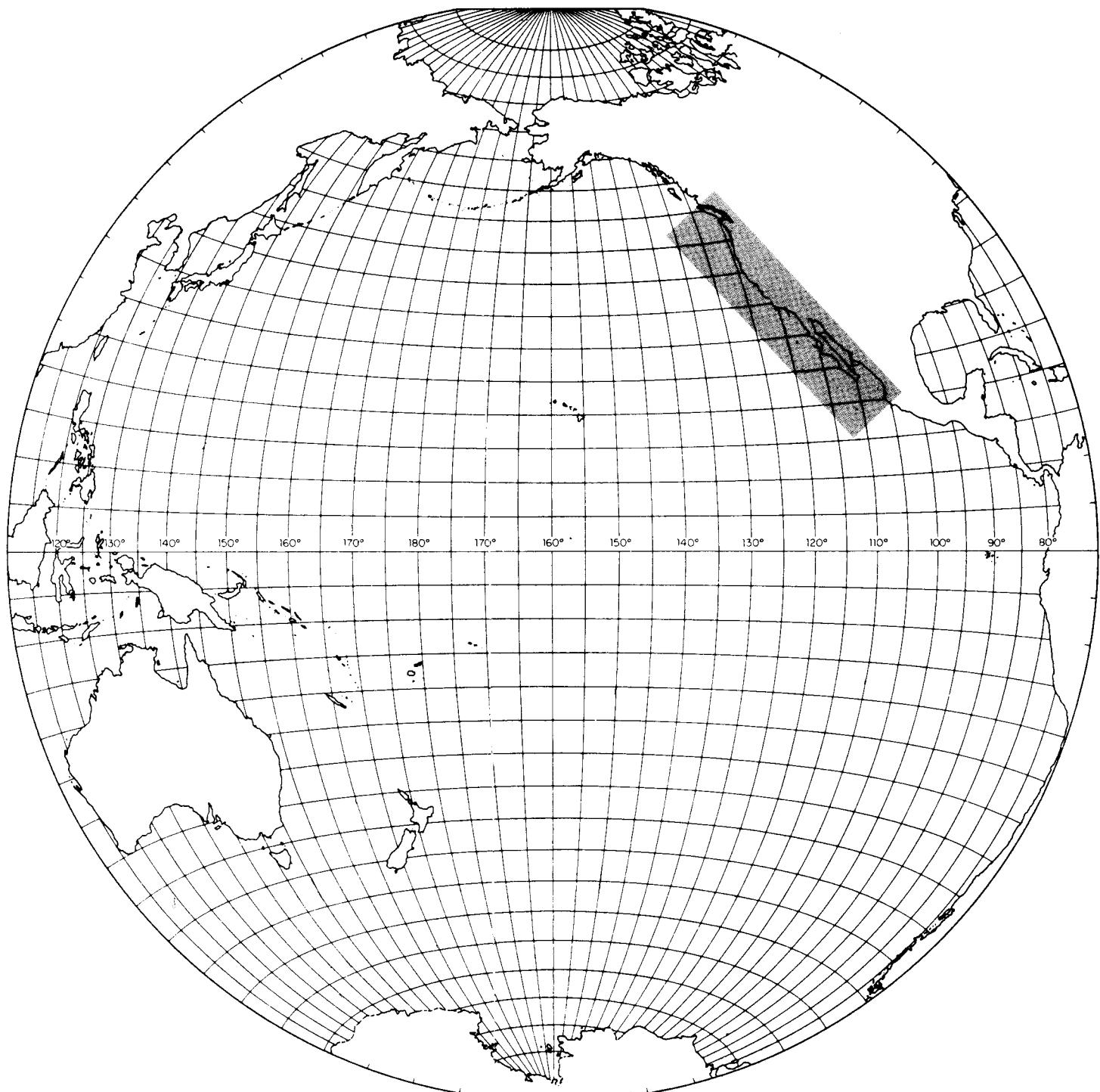
The taxonomic nomenclature in the atlas is exactly as published, even though the euphausiids have undergone taxonomic revision. Below are several references that may be useful in updating the species names:

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.

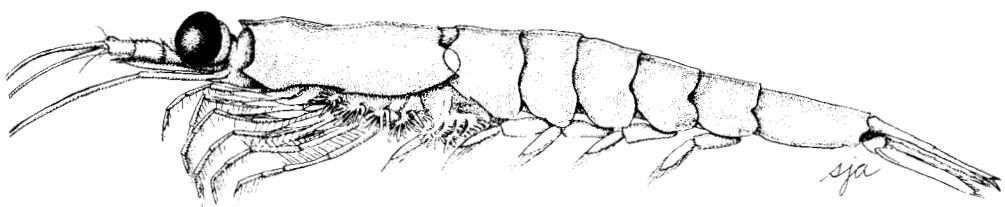
Baker, A. de C., B. P. Boden and E. Brinton. 1990. A Practical Guide to the Euphausiids of the World. Natural History Museum Publications. London, 96 pp.

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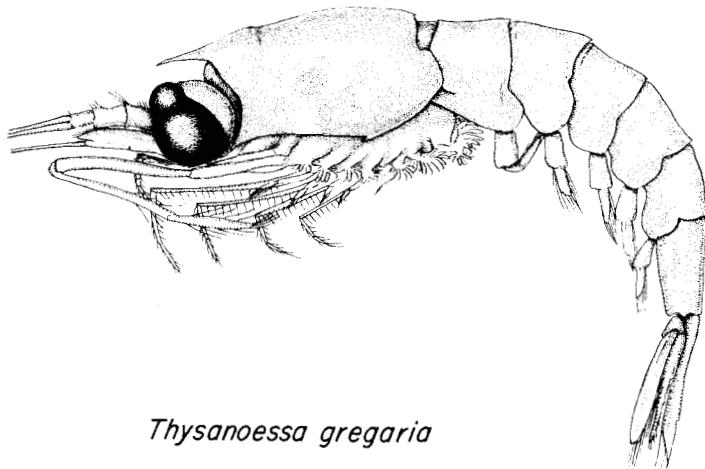
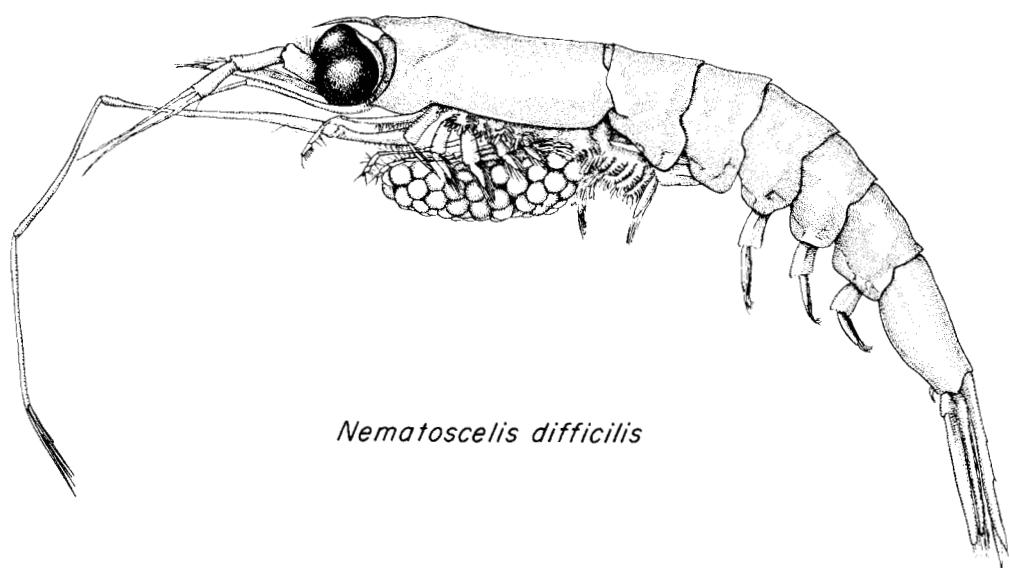


**CALIFORNIA COOPERATIVE OCEANIC
FISHERIES INVESTIGATIONS**

ATLAS No. 5



Euphausia pacifica



Thysanoessa gregaria

CALIFORNIA
COOPERATIVE
OCEANIC
FISHERIES
INVESTIGATIONS

Atlas No. 5

STATE OF CALIFORNIA
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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 (bolting 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 m^3 of water strained. The standard tow commonly strains an estimated 400 m^3 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, Nematobrachion, 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

Nematobrachion

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

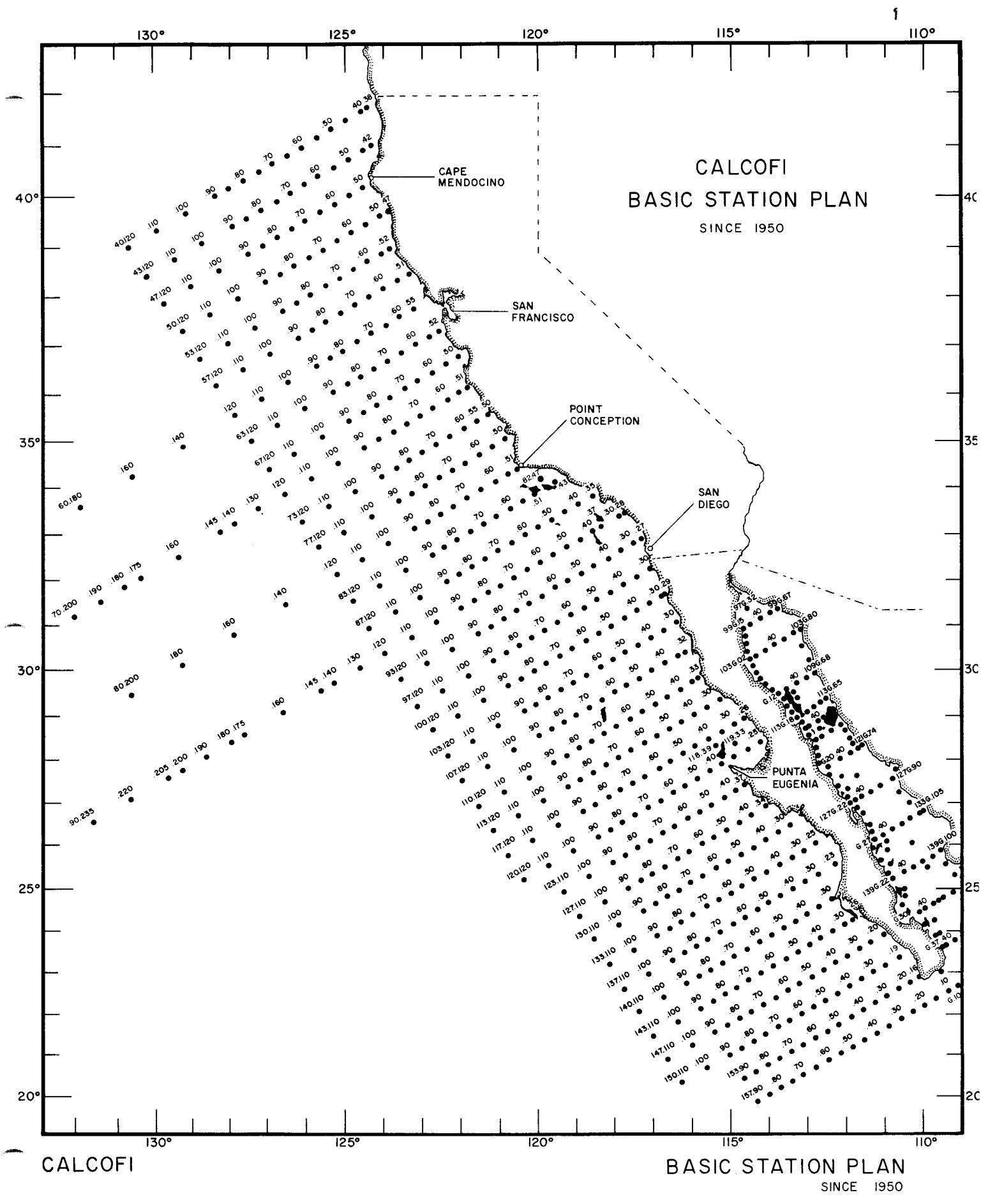
abbreviatum	182 - 189
affine	190 - 199
carinatum	200 - 206
longicorne	207 - 216
maximum	217 - 226
suhmii	227 - 235

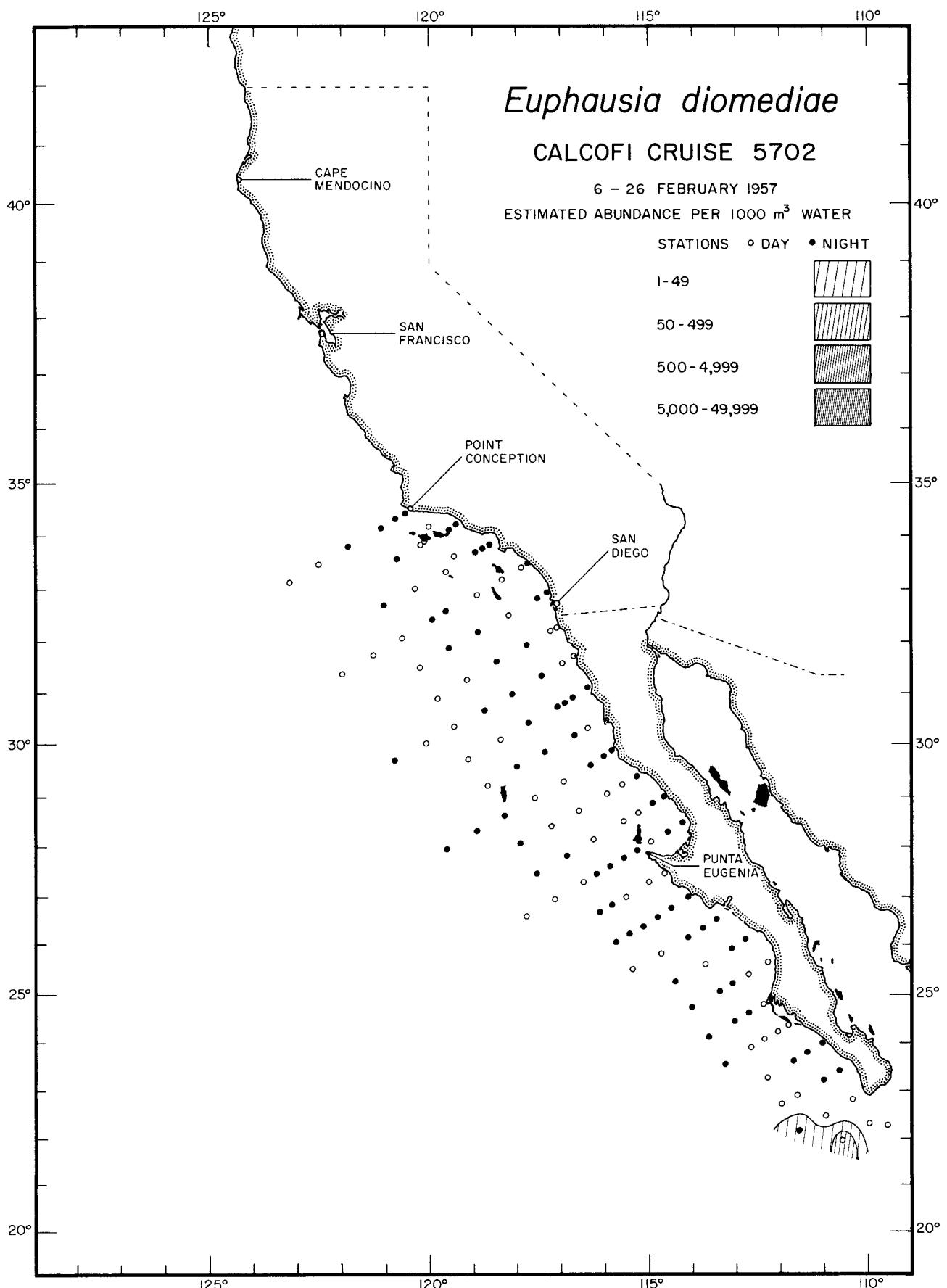
Thysanoessa

gregaria	236 - 245
spinifera	246 - 255

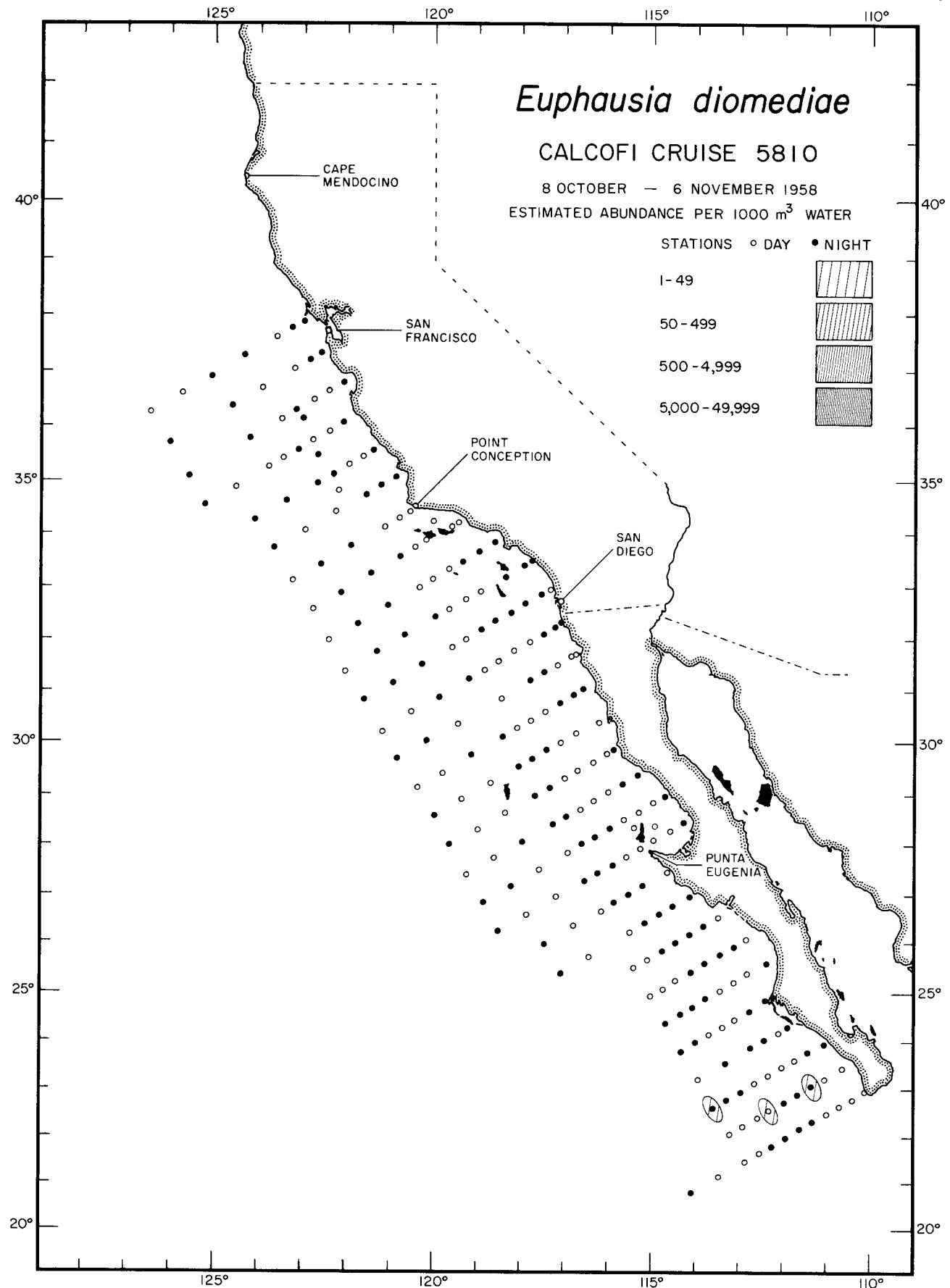
Thysanopoda

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

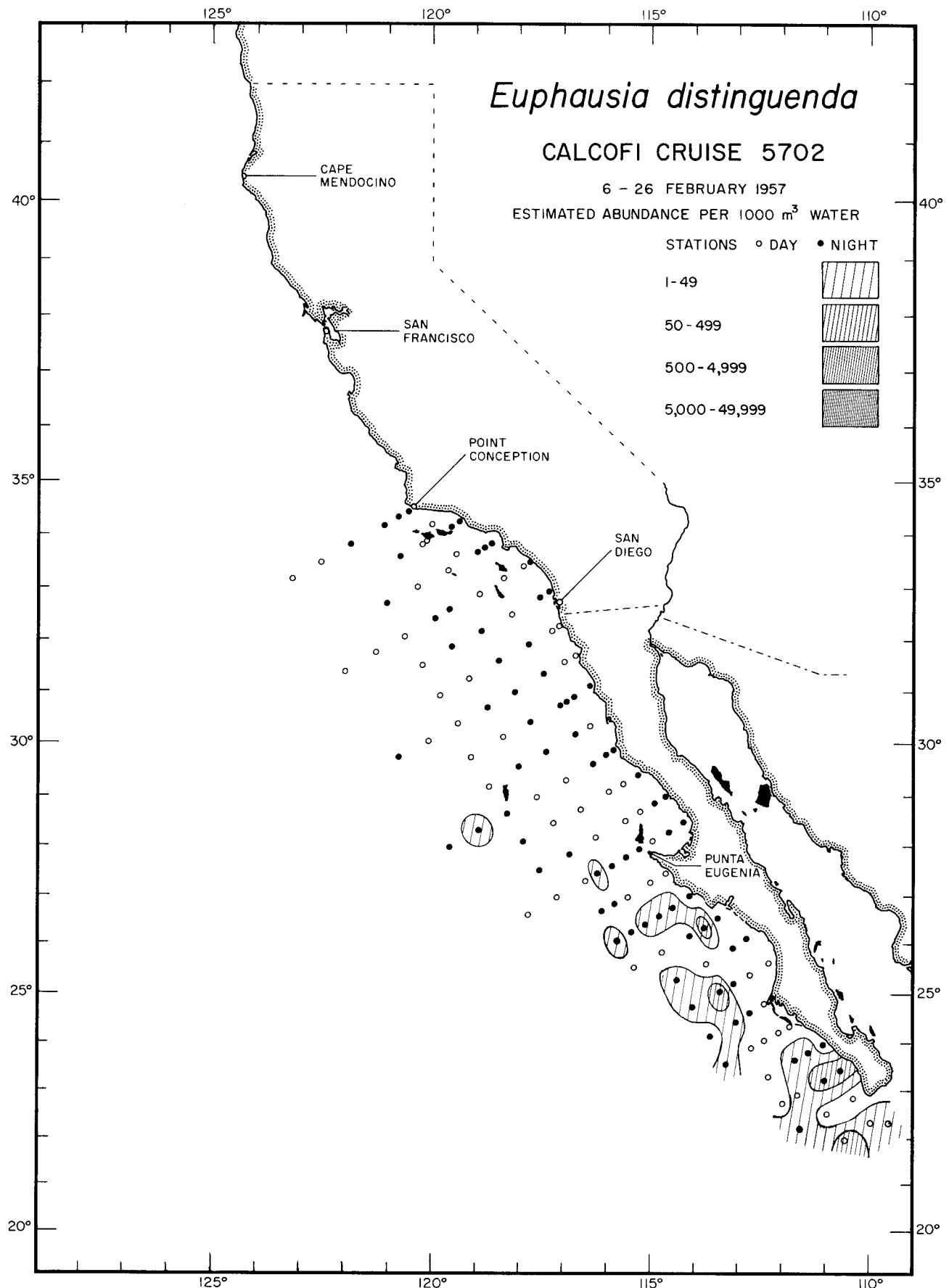




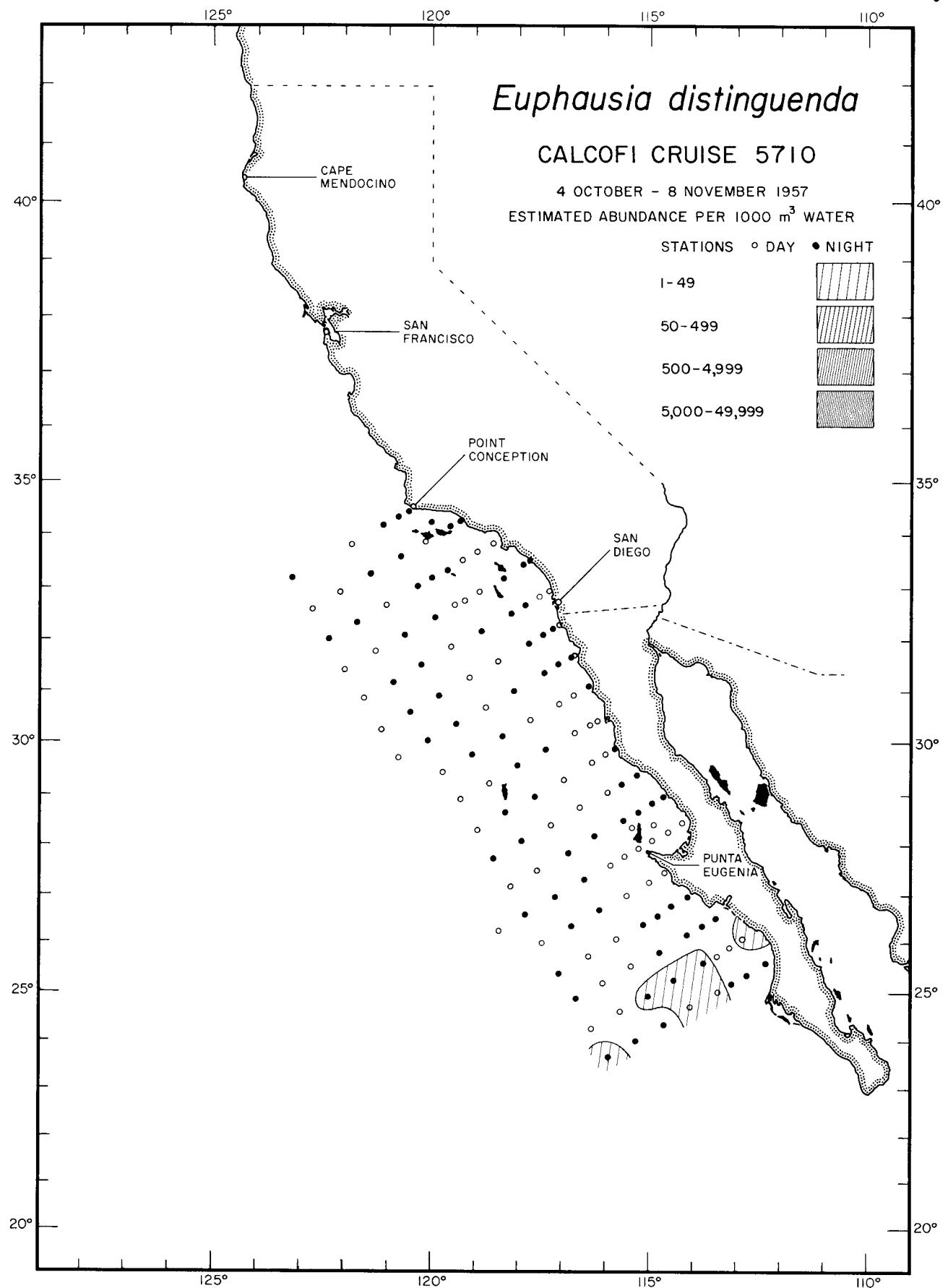
Euphausiacea
Euphausia diomediae
5702



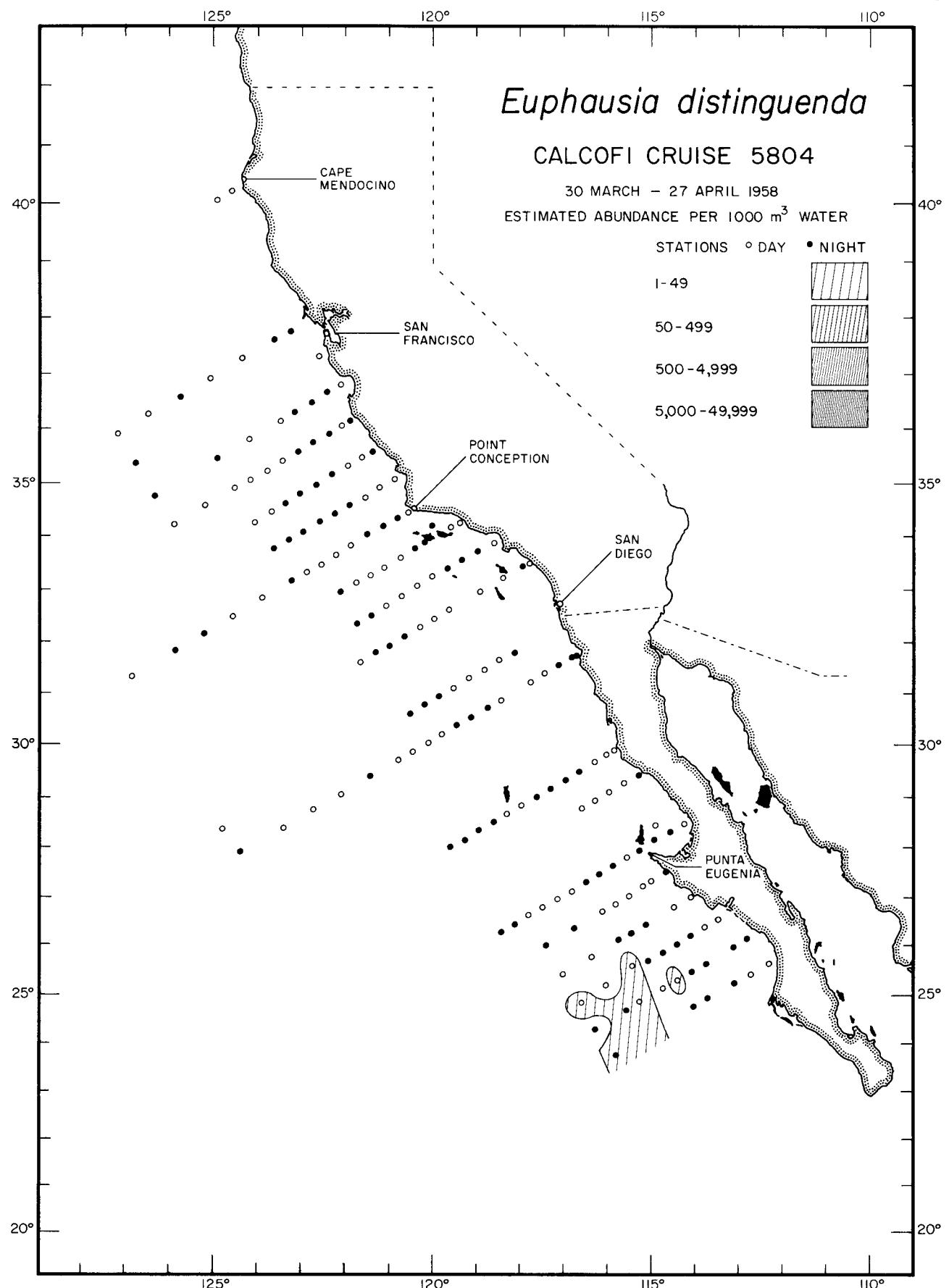
Euphausiacea
Euphausia diomediae
 5810



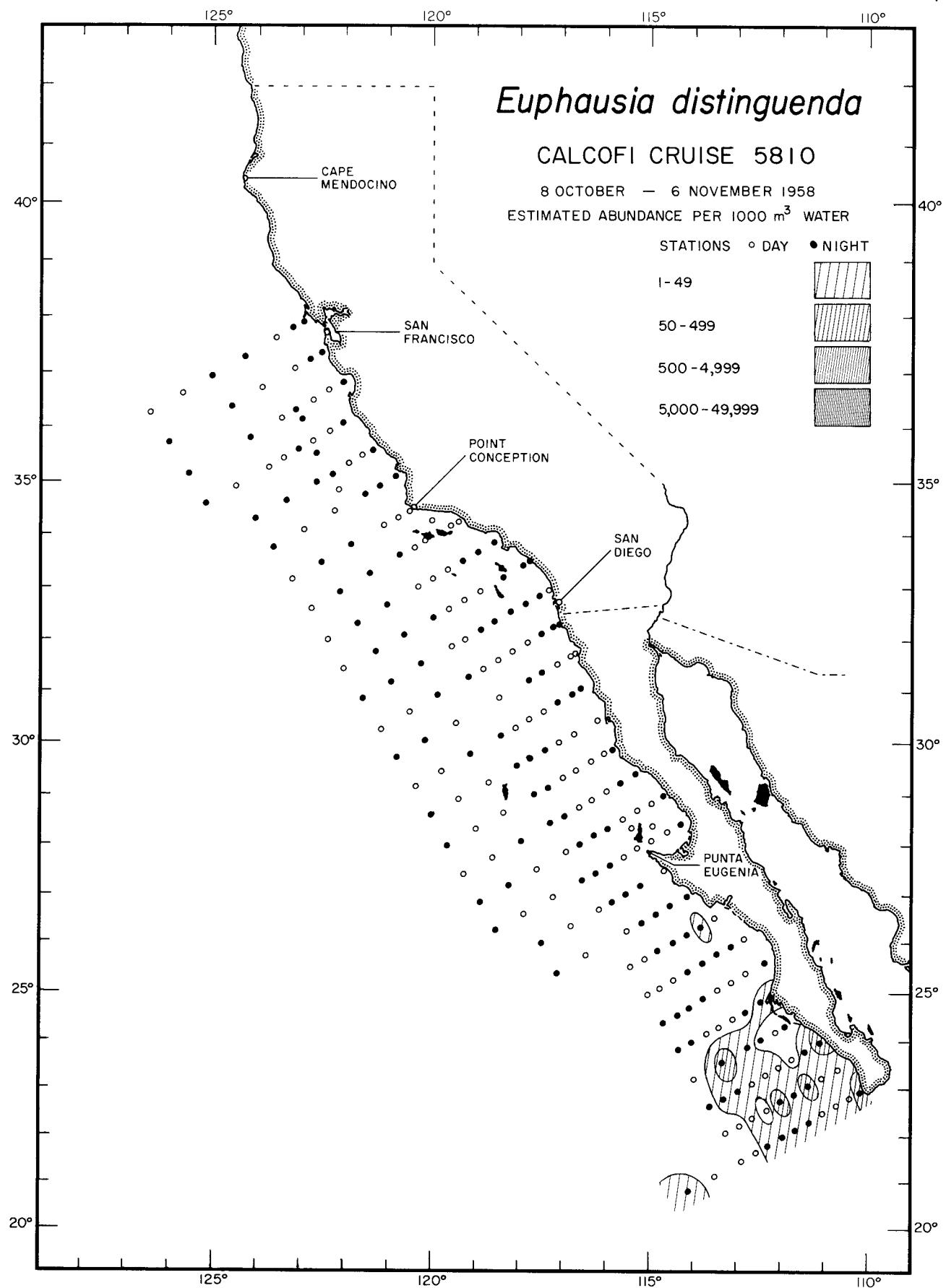
Euphausiaceae
Euphausia distinguenda
5702



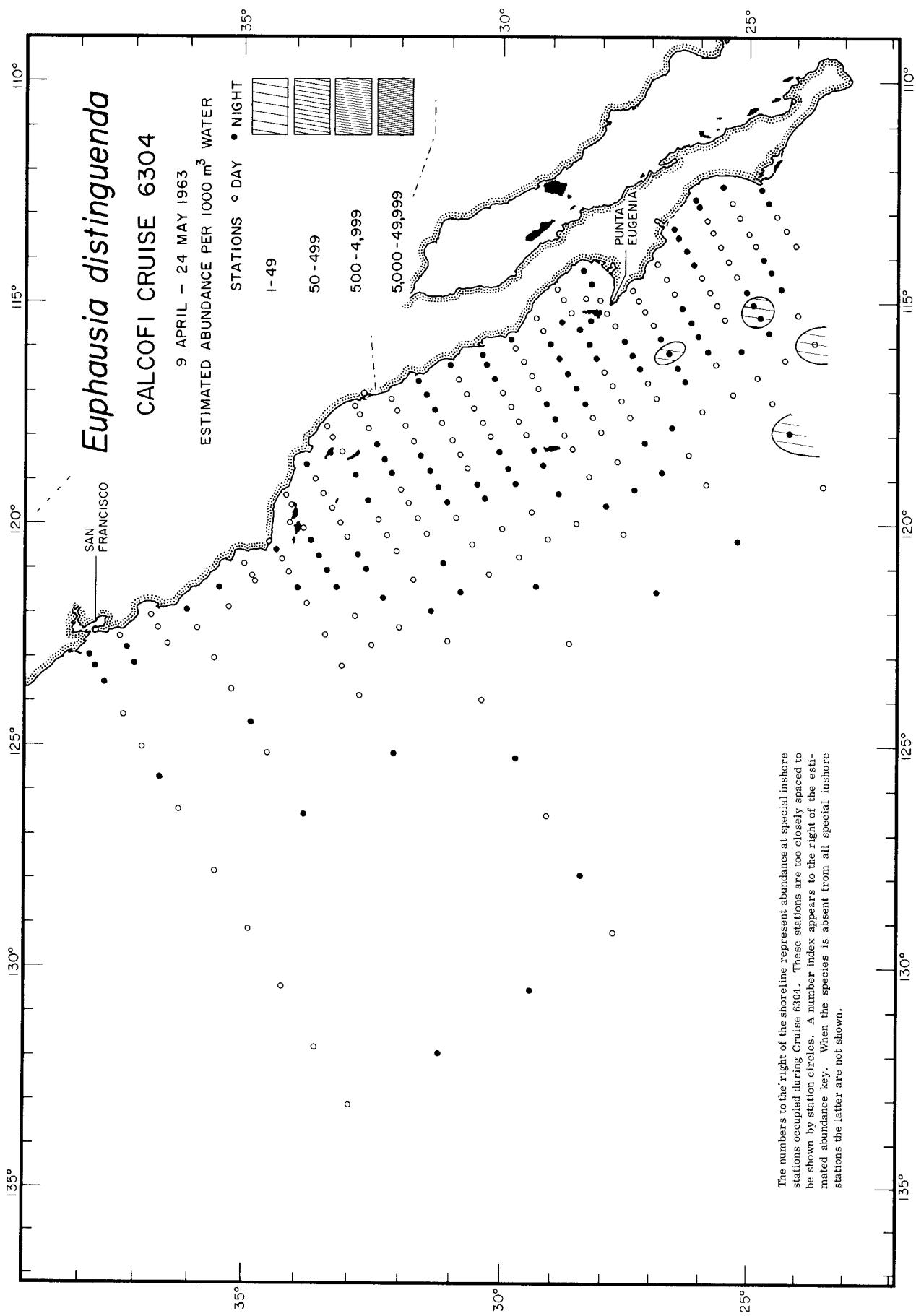
Euphausiacea
Euphausia distinguenda
 5710



Euphausiacea
Euphausia distinguenda
 5804



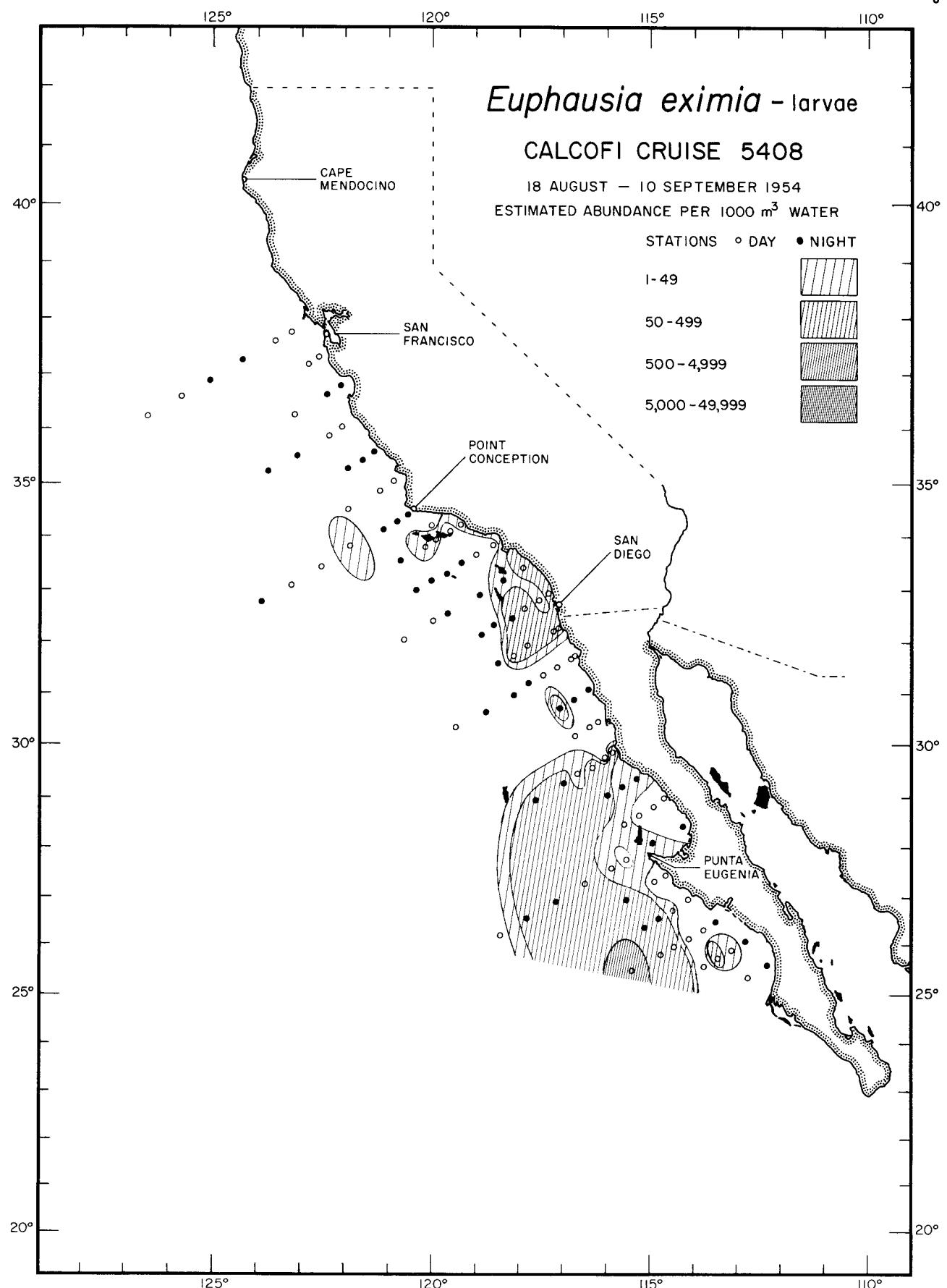
Euphausiacea
Euphausia distinguenda
 5810



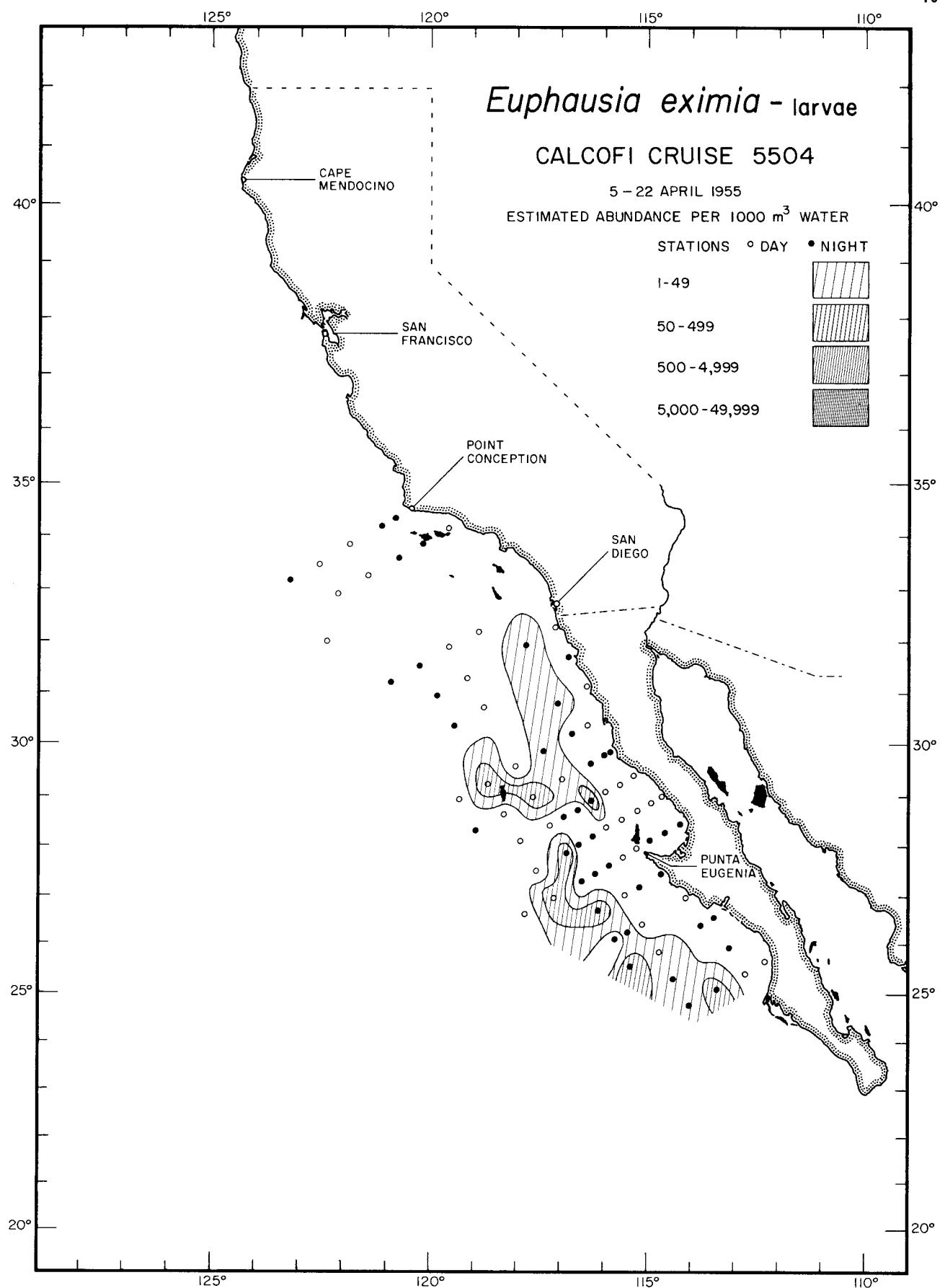
Euphausiacea
Euphausia distinguenda

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. When the species is absent from all special inshore stations the latter are not shown.

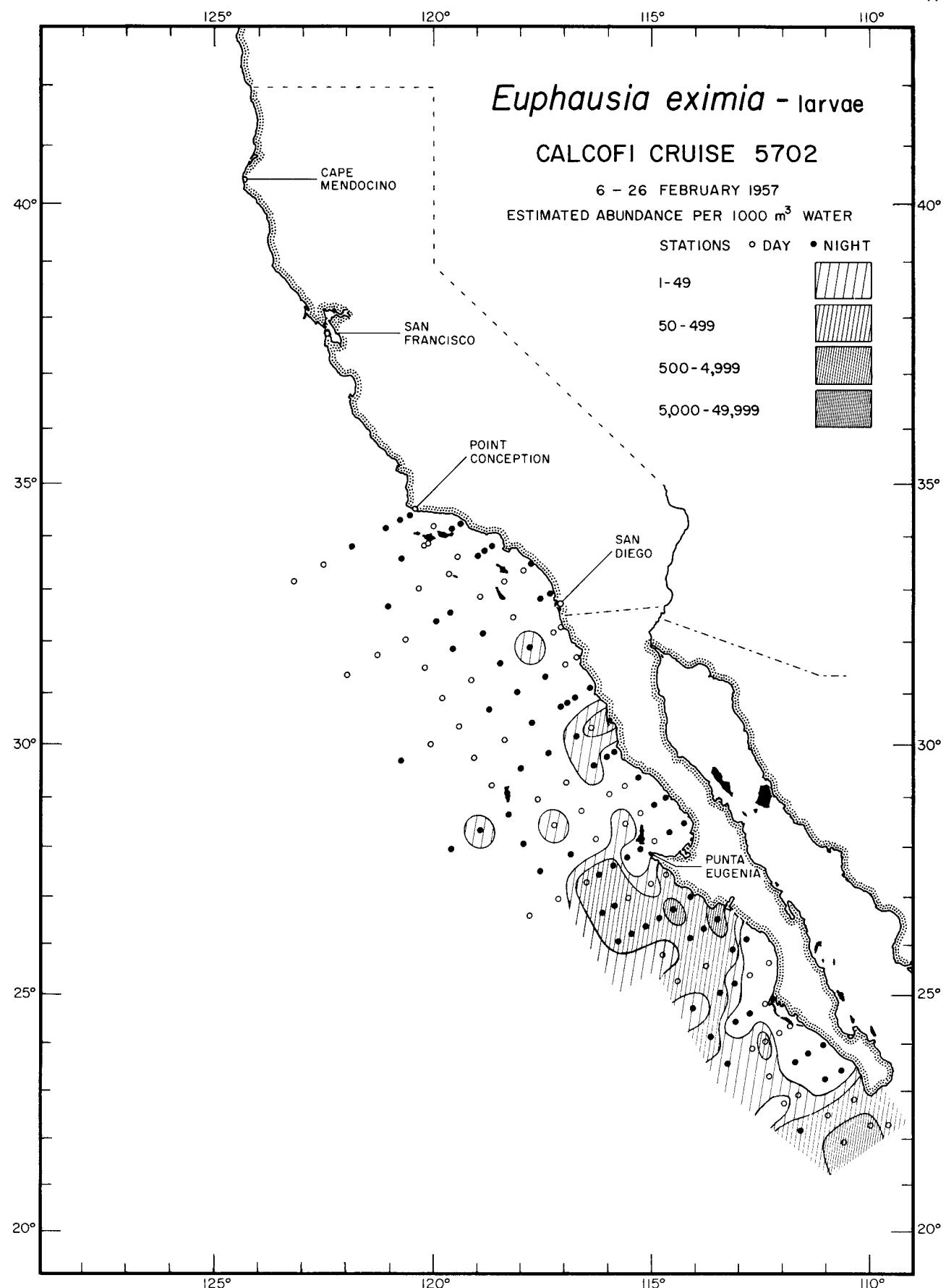


Euphausiacea
Euphausia eximia - larvae
 5408

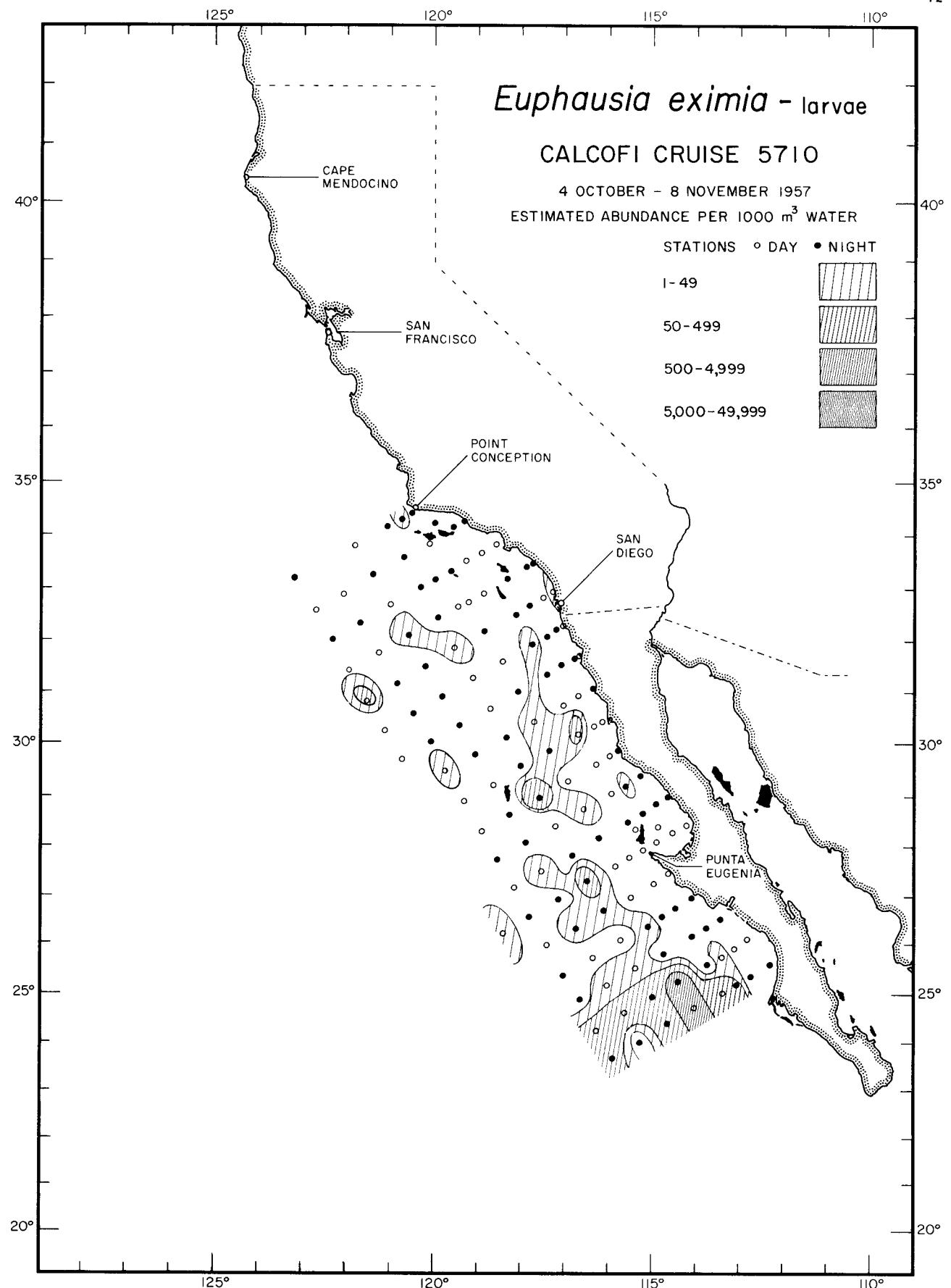


Euphausiacea
Euphausia eximia - larvae

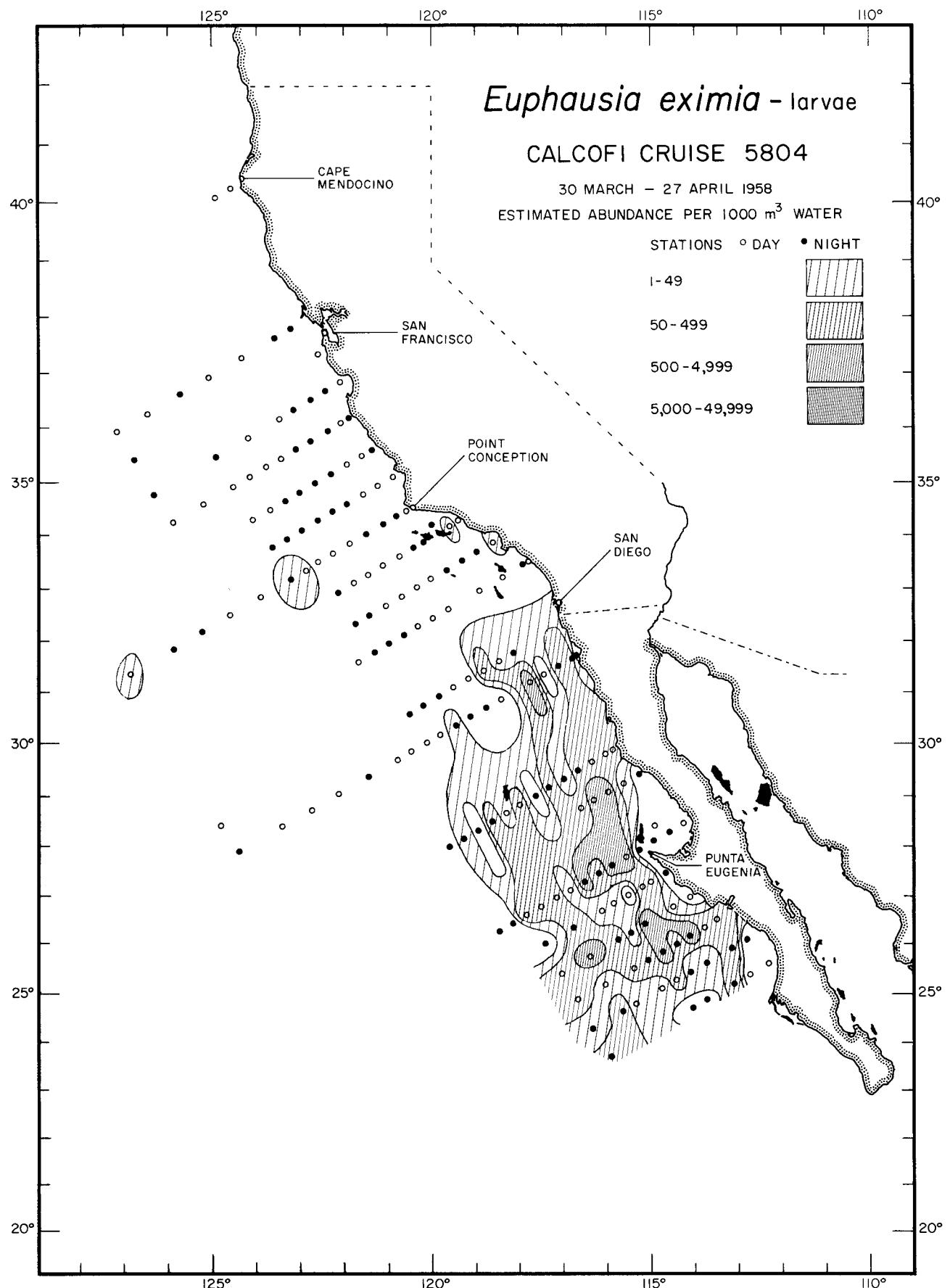
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Euphausiacea
Euphausia eximia - larvae
5702



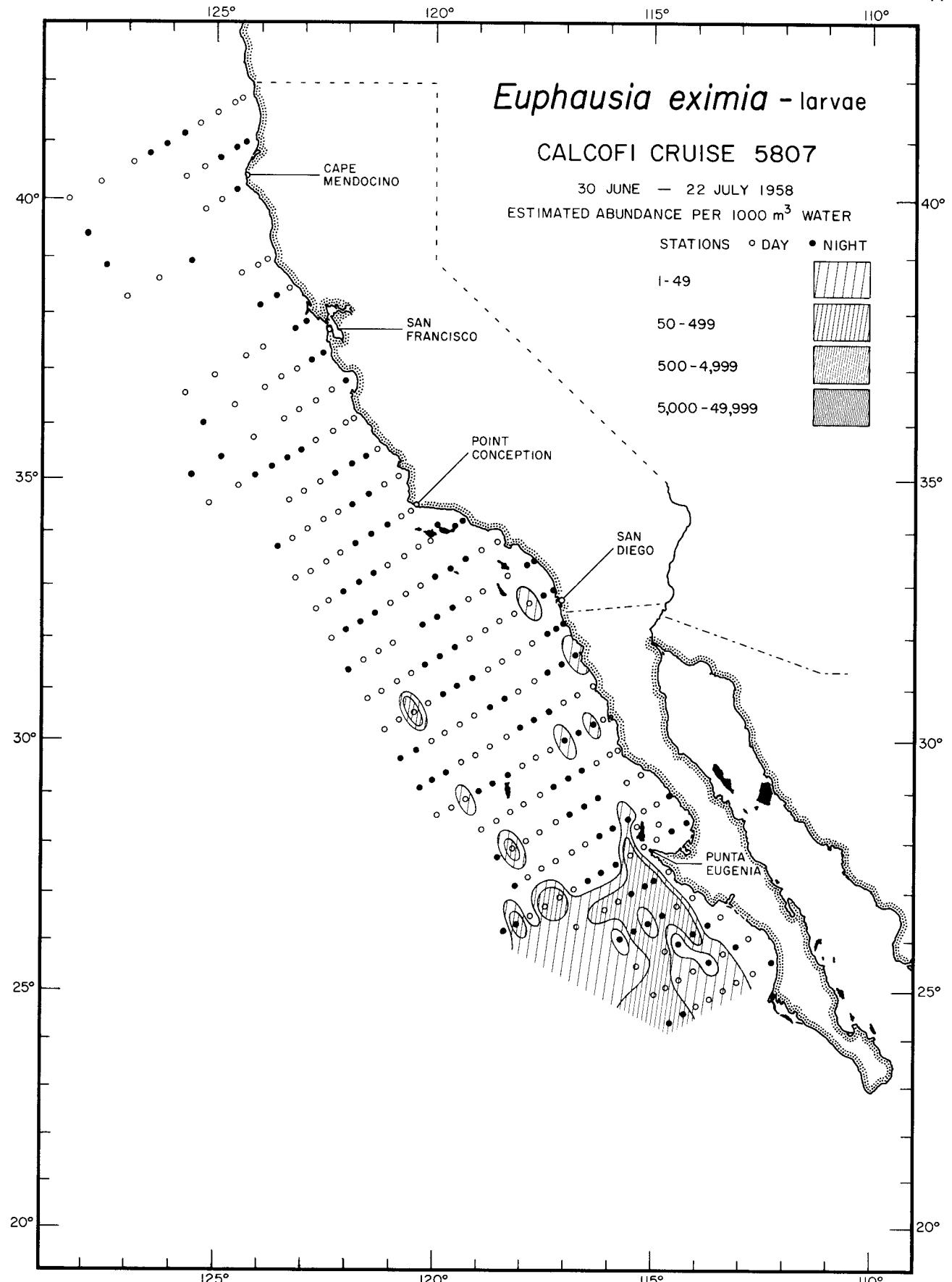
Euphausiacea
Euphausia eximia - larvae
 5710



Euphausiacea

Euphausia eximia - larvae

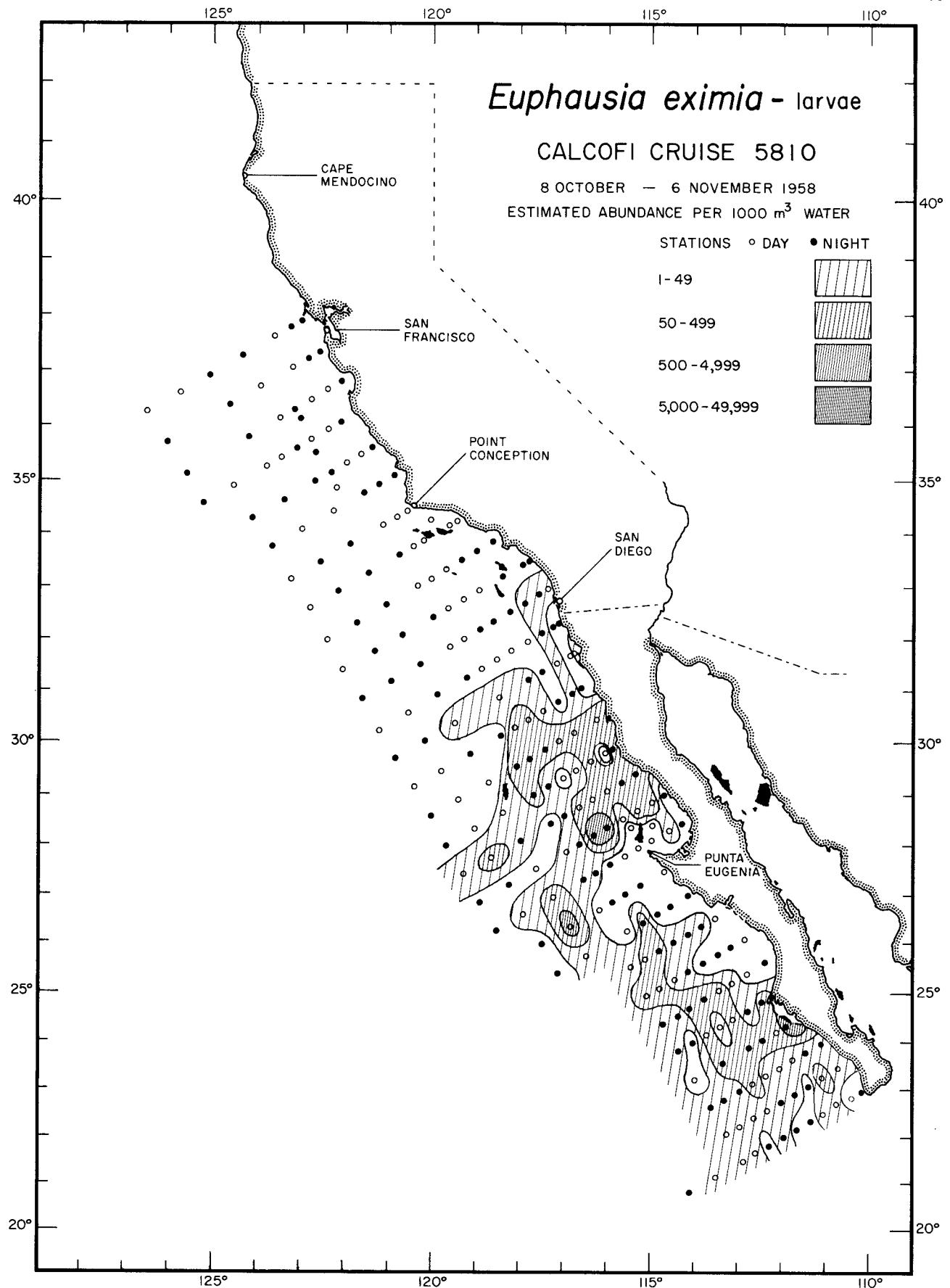
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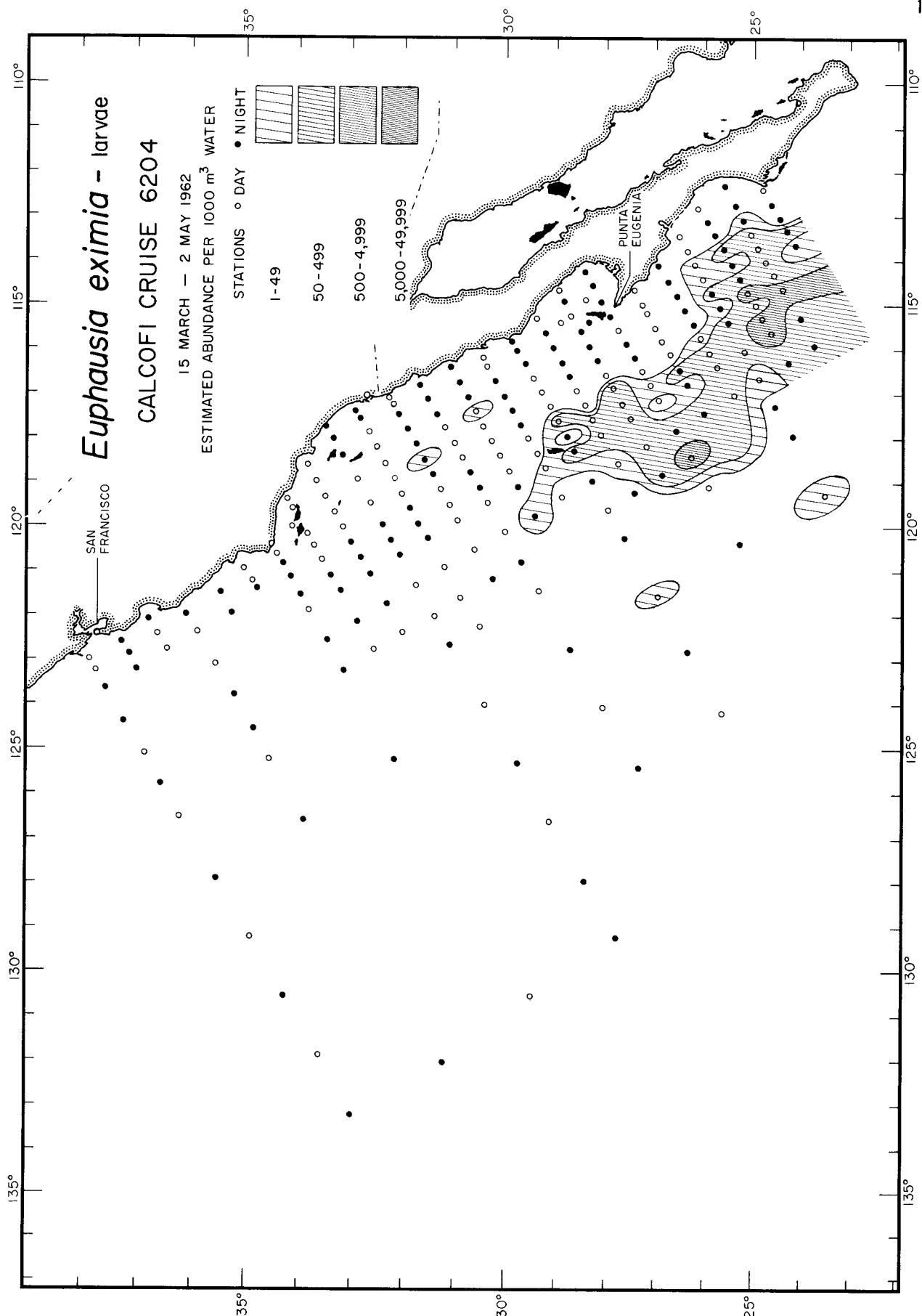
Euphausiacea

Euphausia eximia - larvae

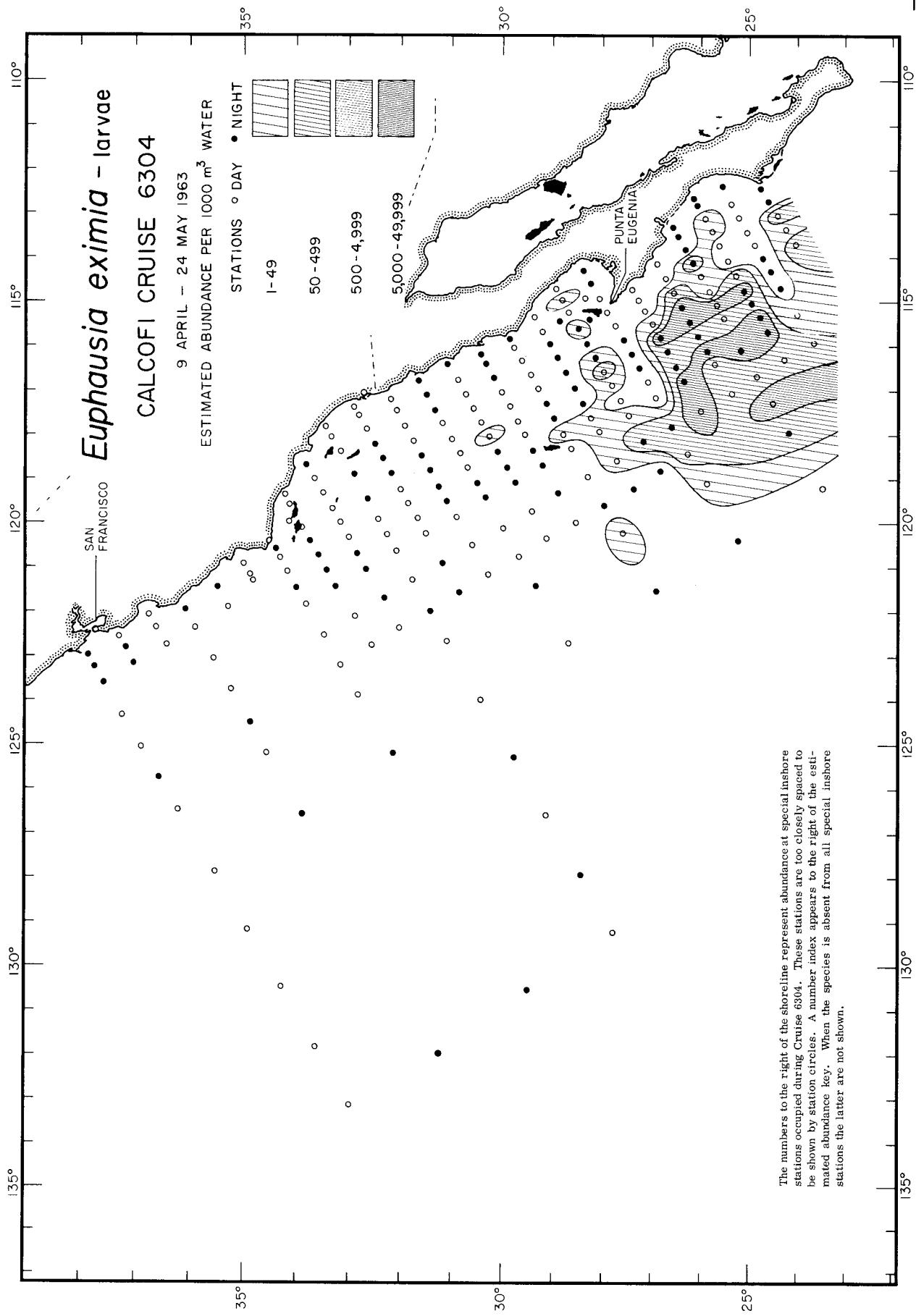
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Euphausiacea
Euphausia eximia - larvae
 5810

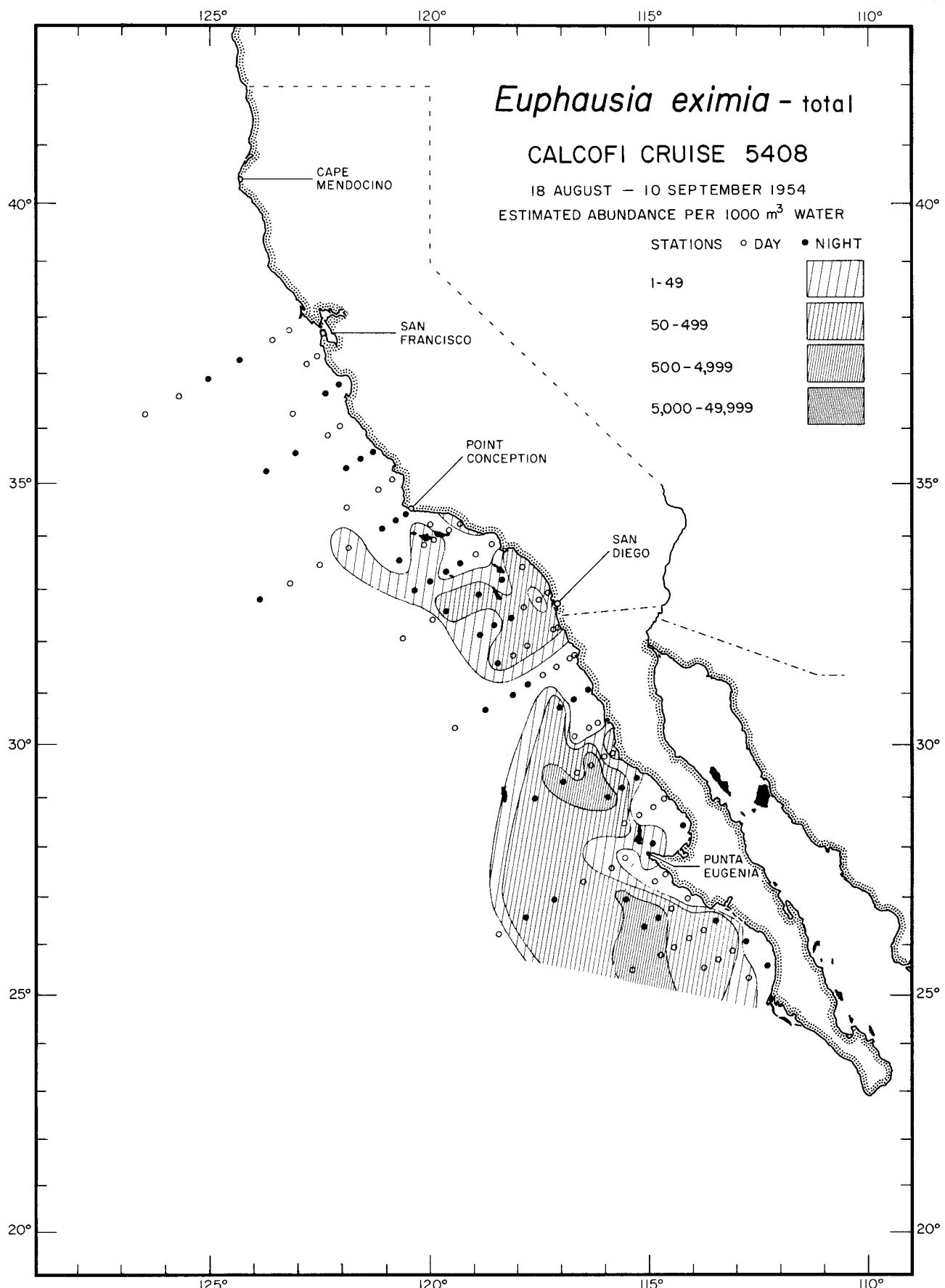


Euphausiacea
Euphausia eximia - larvae
6204

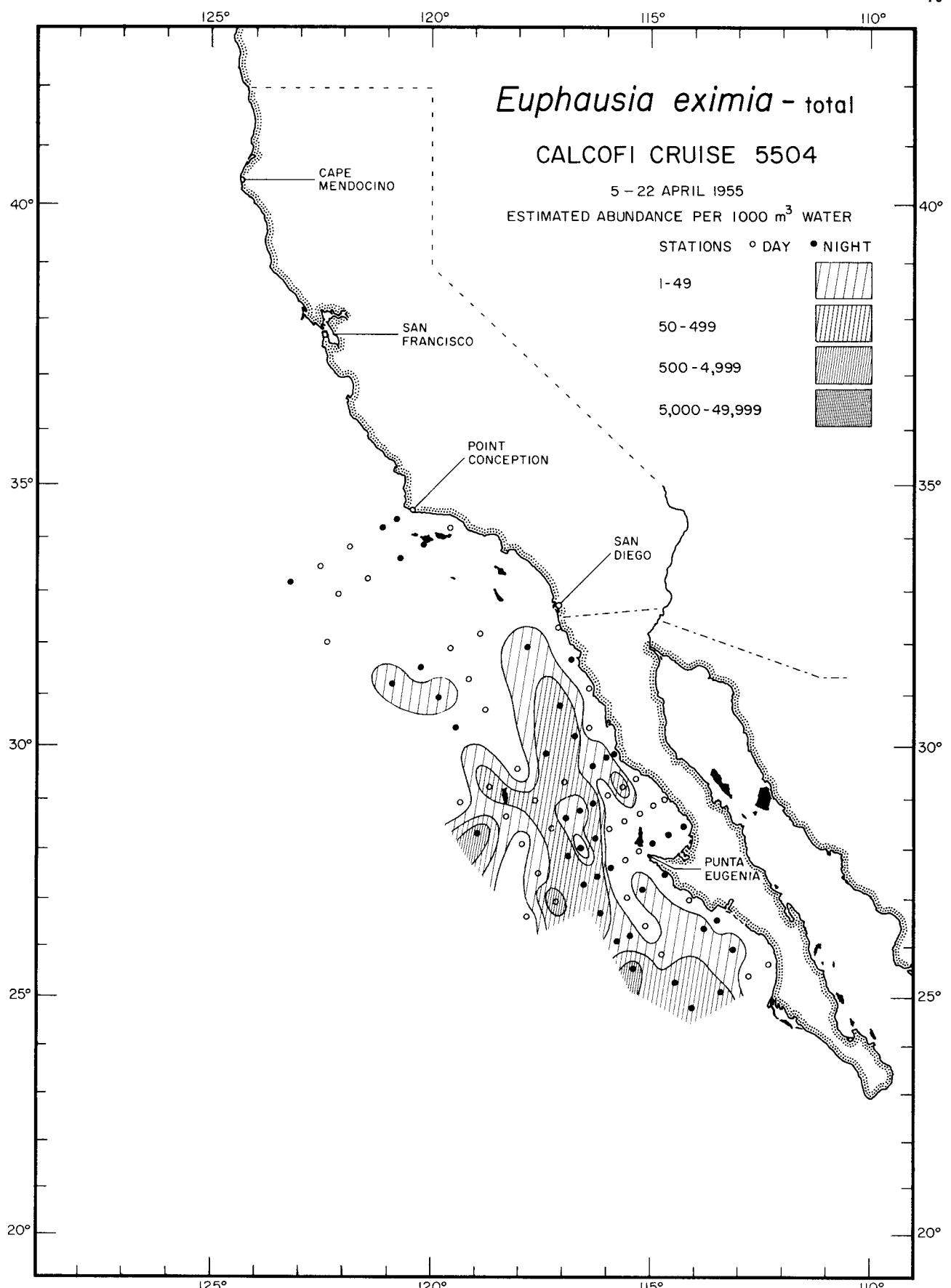


Euphausiacea
Euphausia eximia - larvae
6304

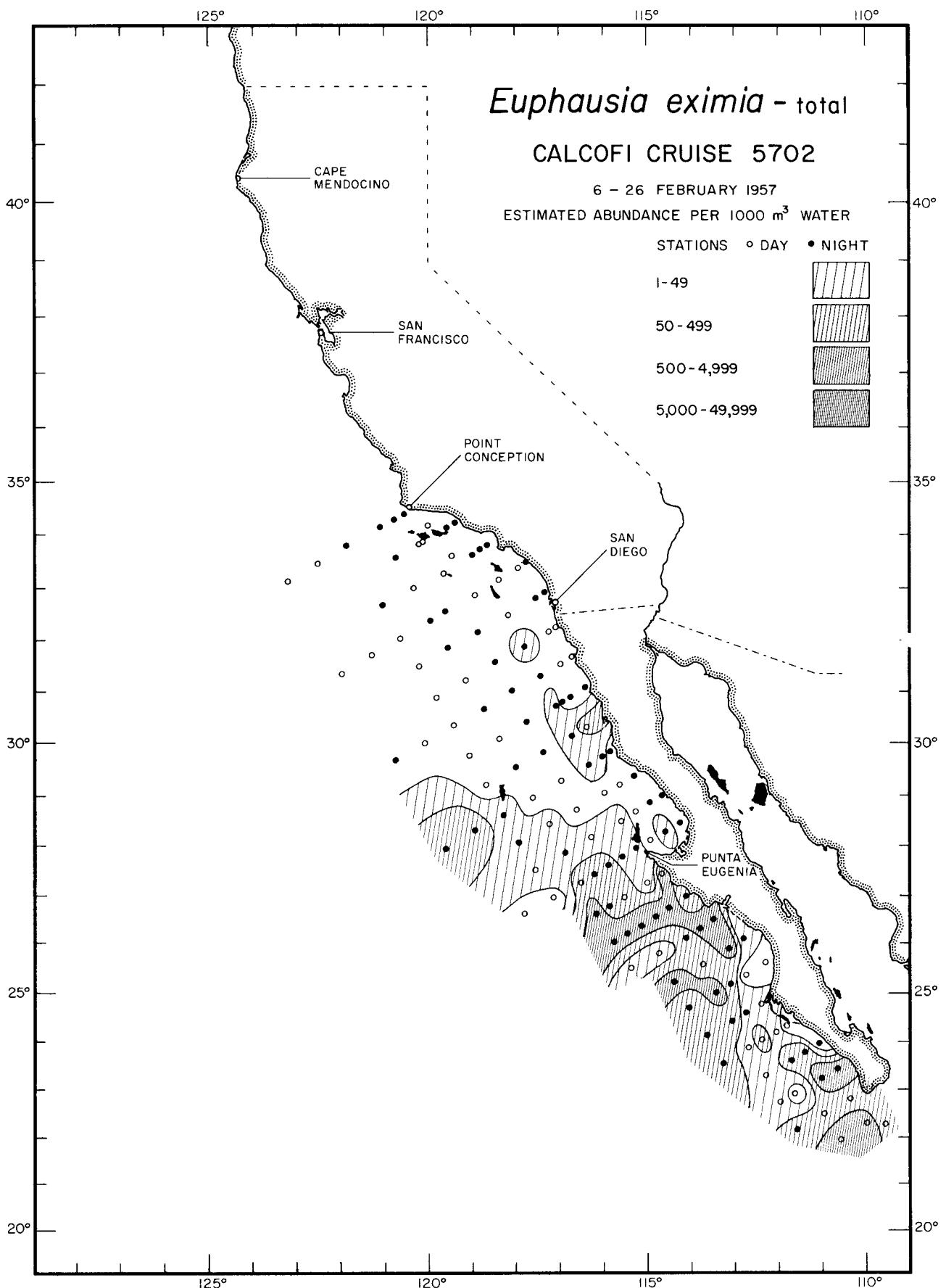
The numbers to the right of the shoreline represent abundance at special inshore stations occupied during Cruise 6304. These stations are too closely spaced to be shown by station circles. A number index appears to the right of the estimated abundance key. When the species is absent from all special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



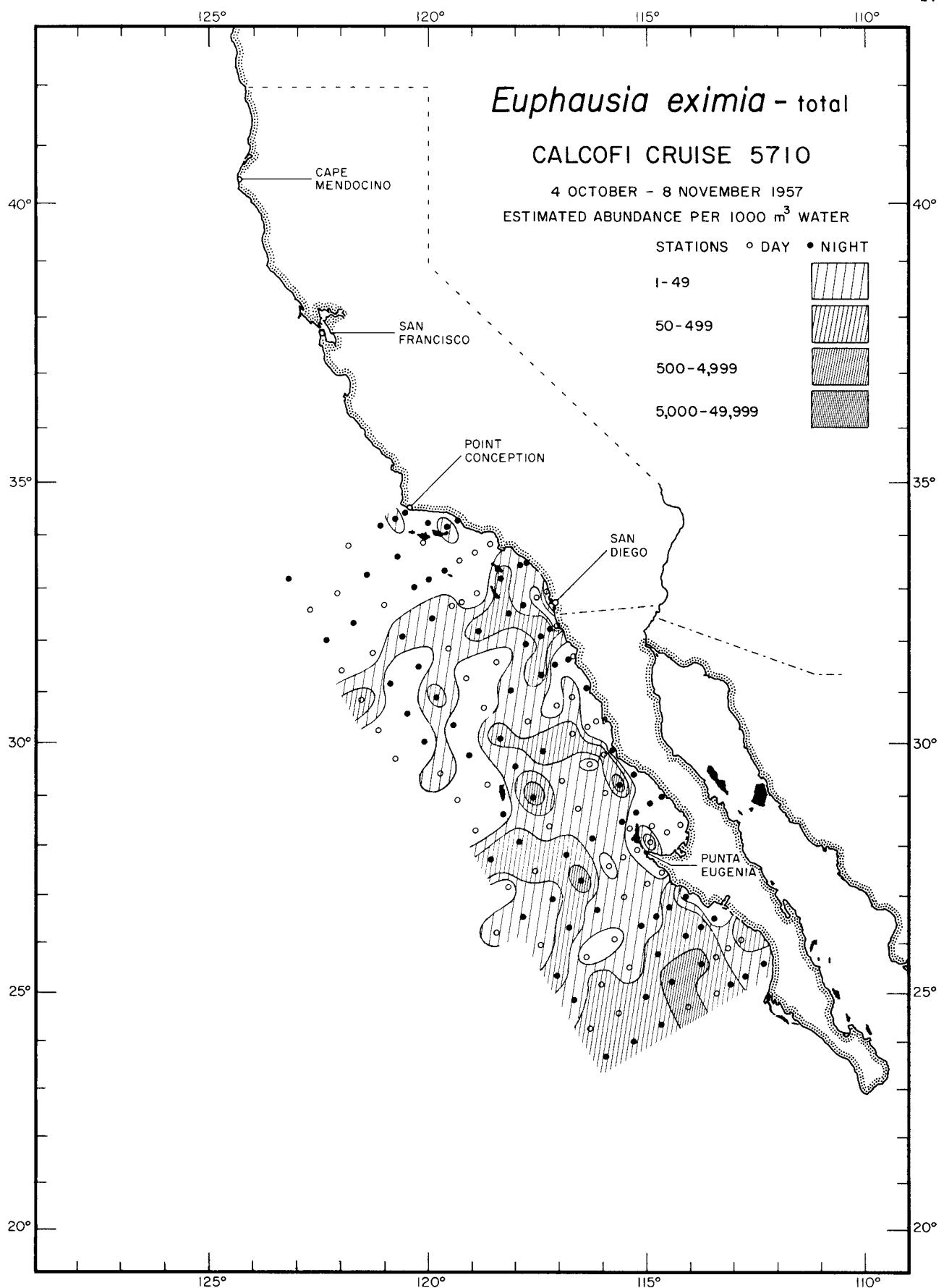
Euphausiacea
Euphausia eximia - total
5408



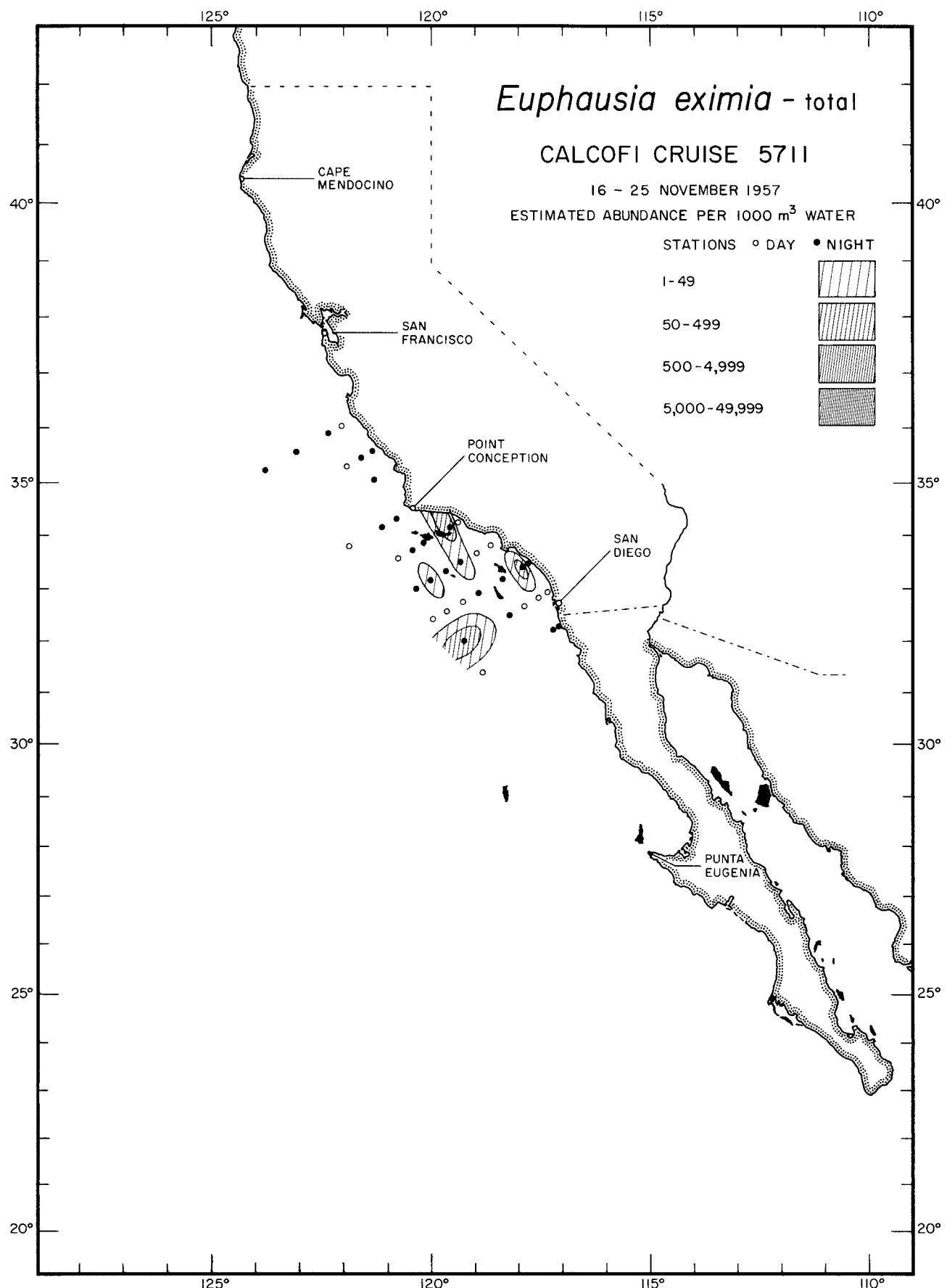
Euphausiacea
Euphausia eximia - total
5504



Euphausiacea
Euphausia eximia - total
5702



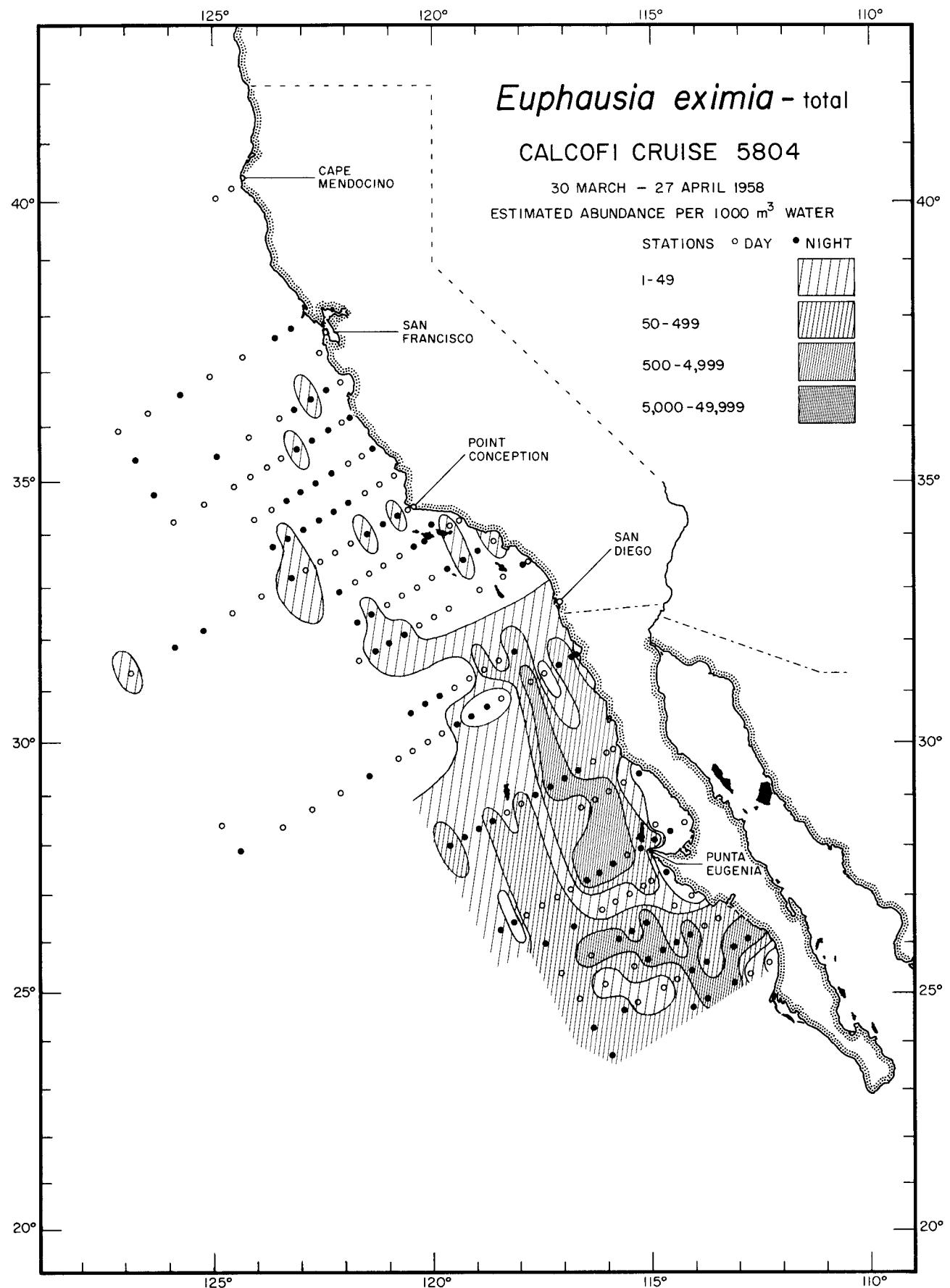
Euphausiacea
Euphausia eximia - total
5710



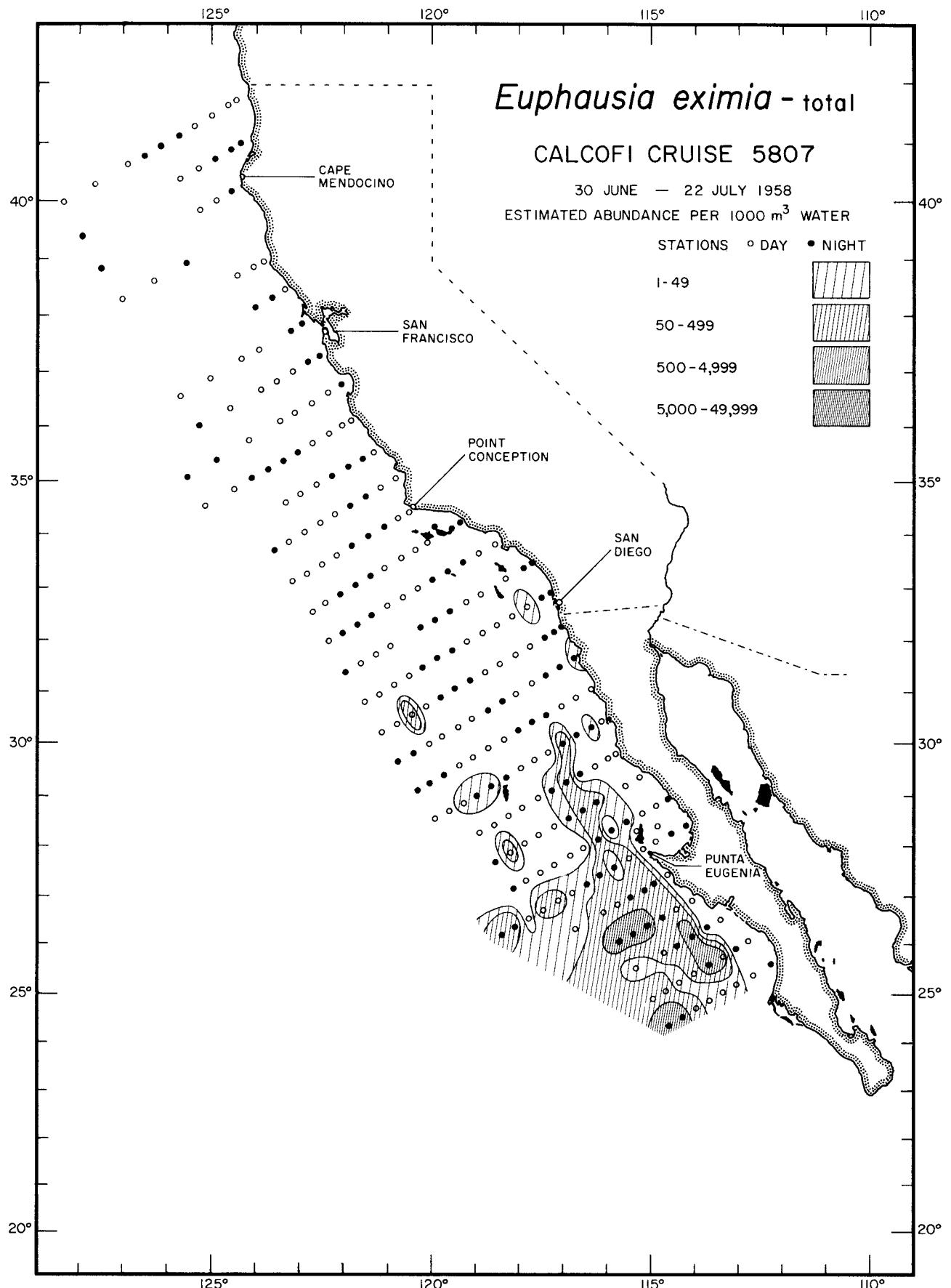
Euphausiacea

Euphausia eximia - total

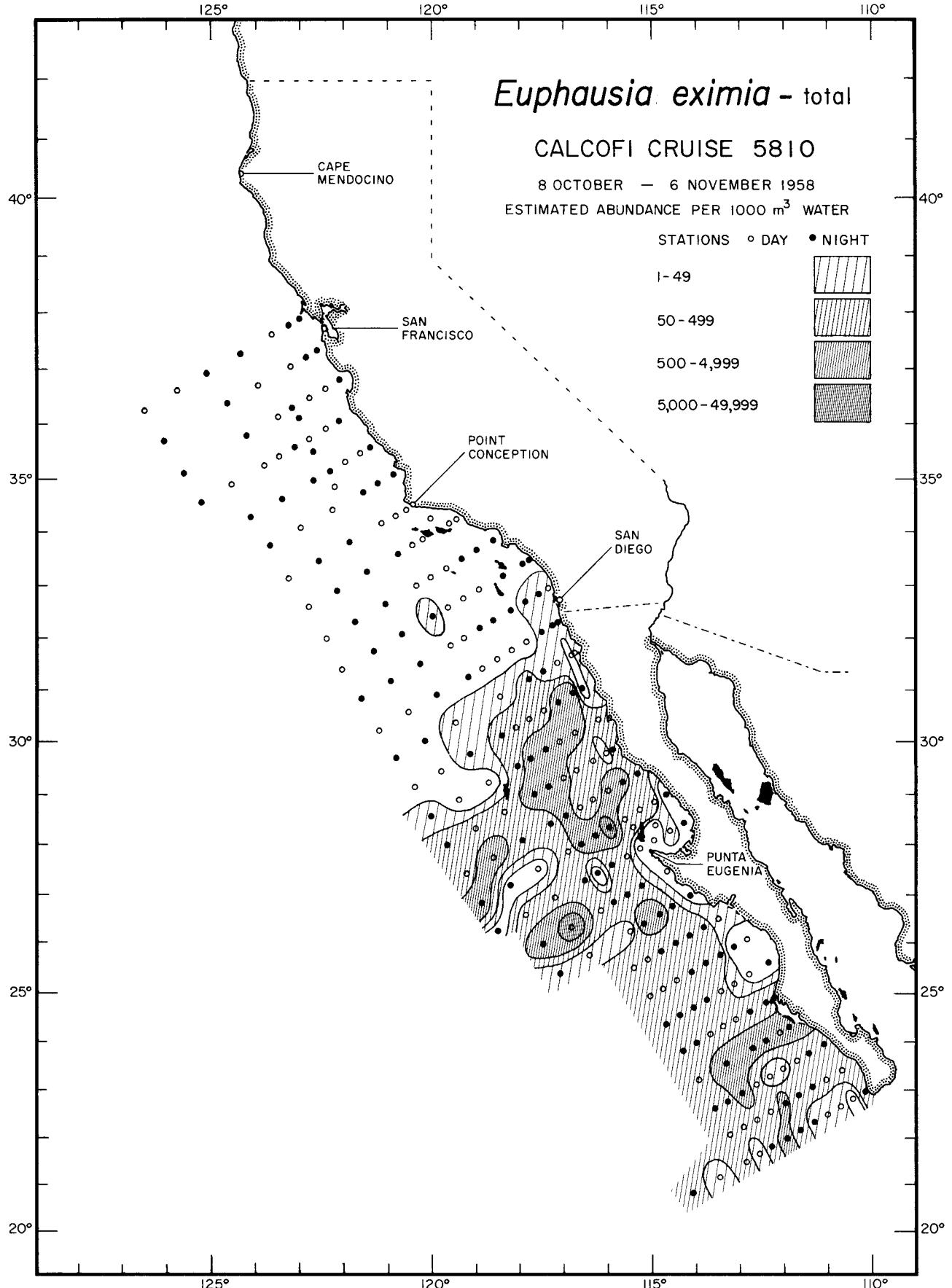
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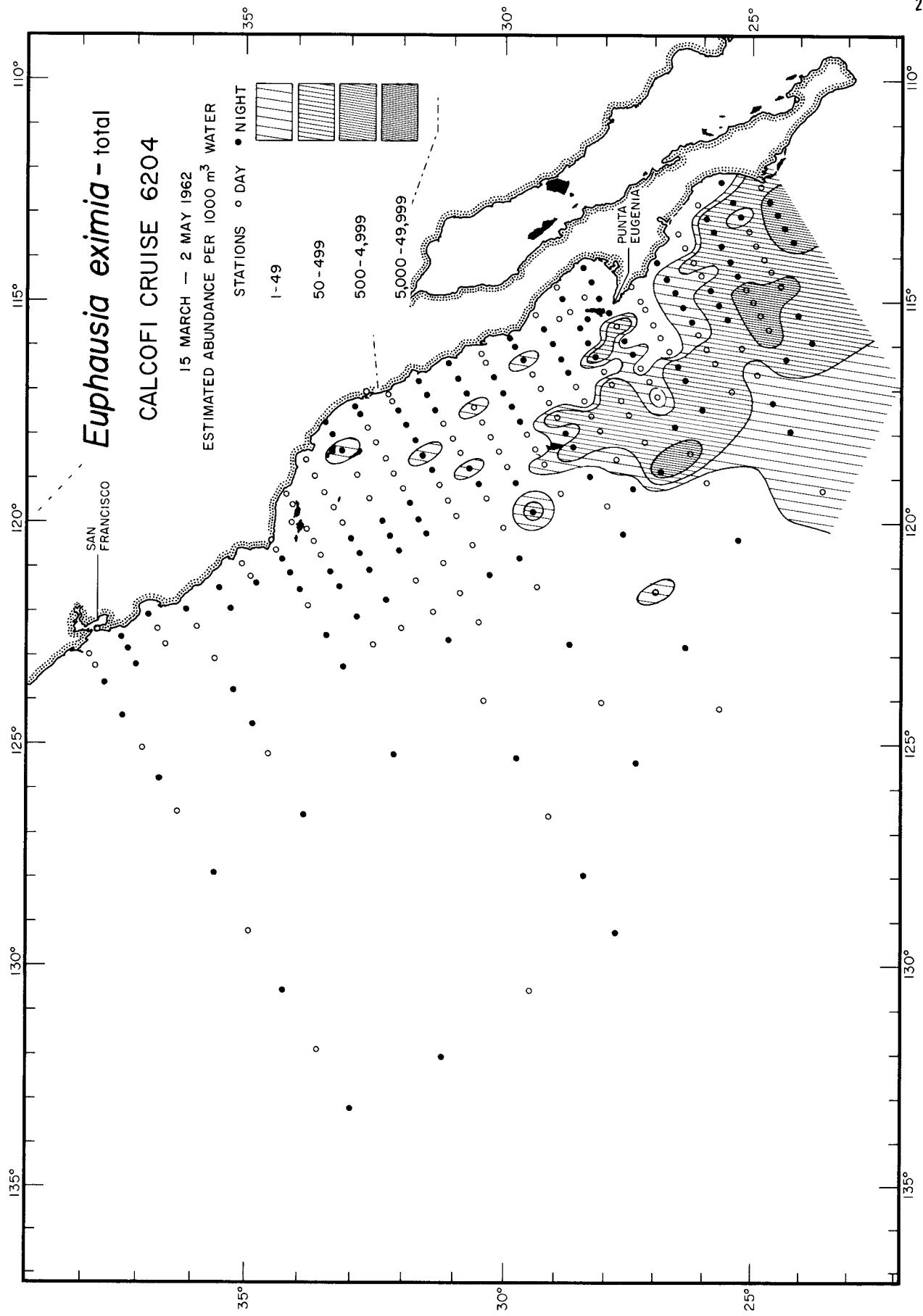
Euphausiacea
Euphausia eximia - total
5804



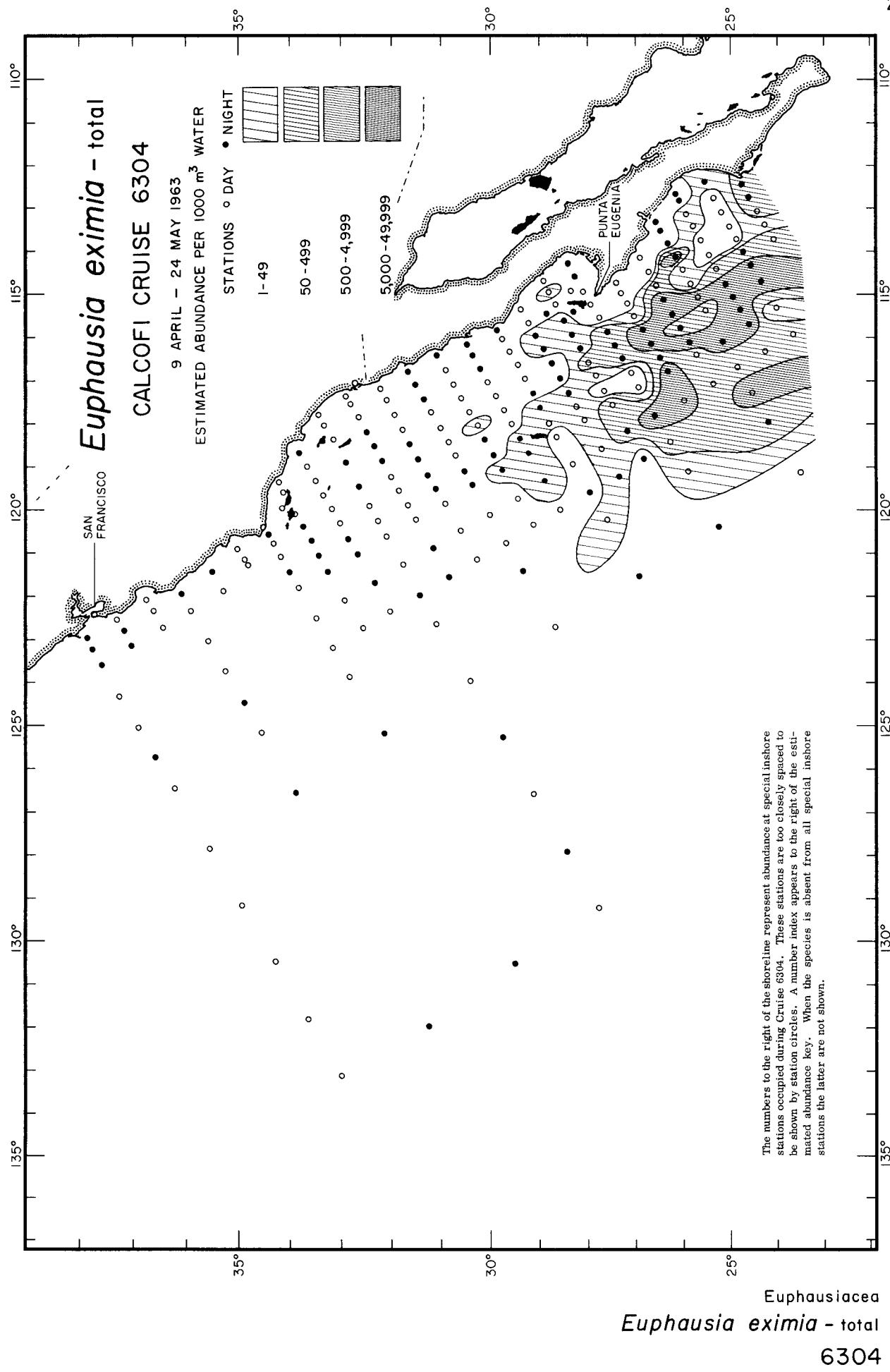
Euphausiacea
Euphausia eximia - total
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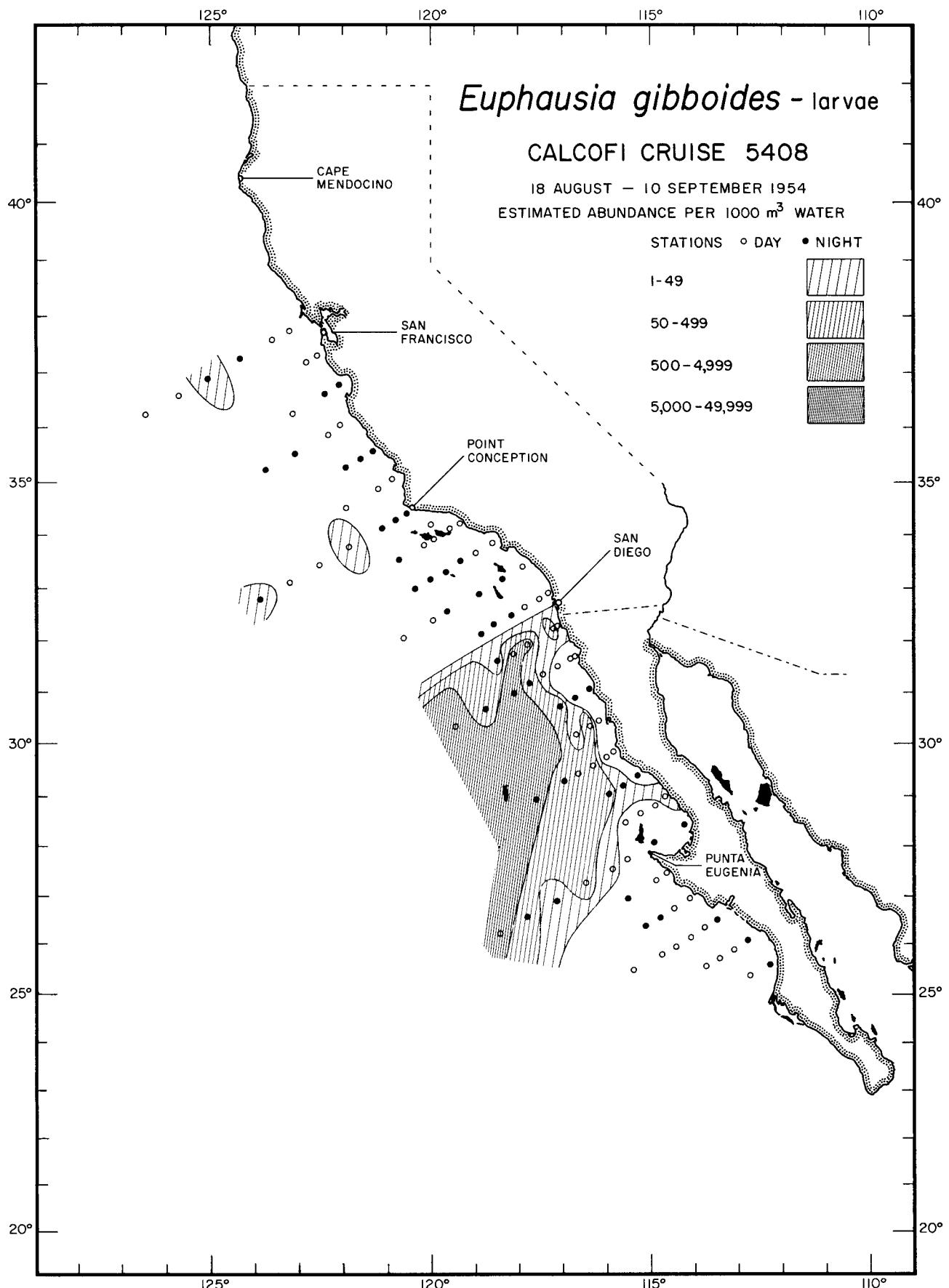


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Euphausia eximia - total
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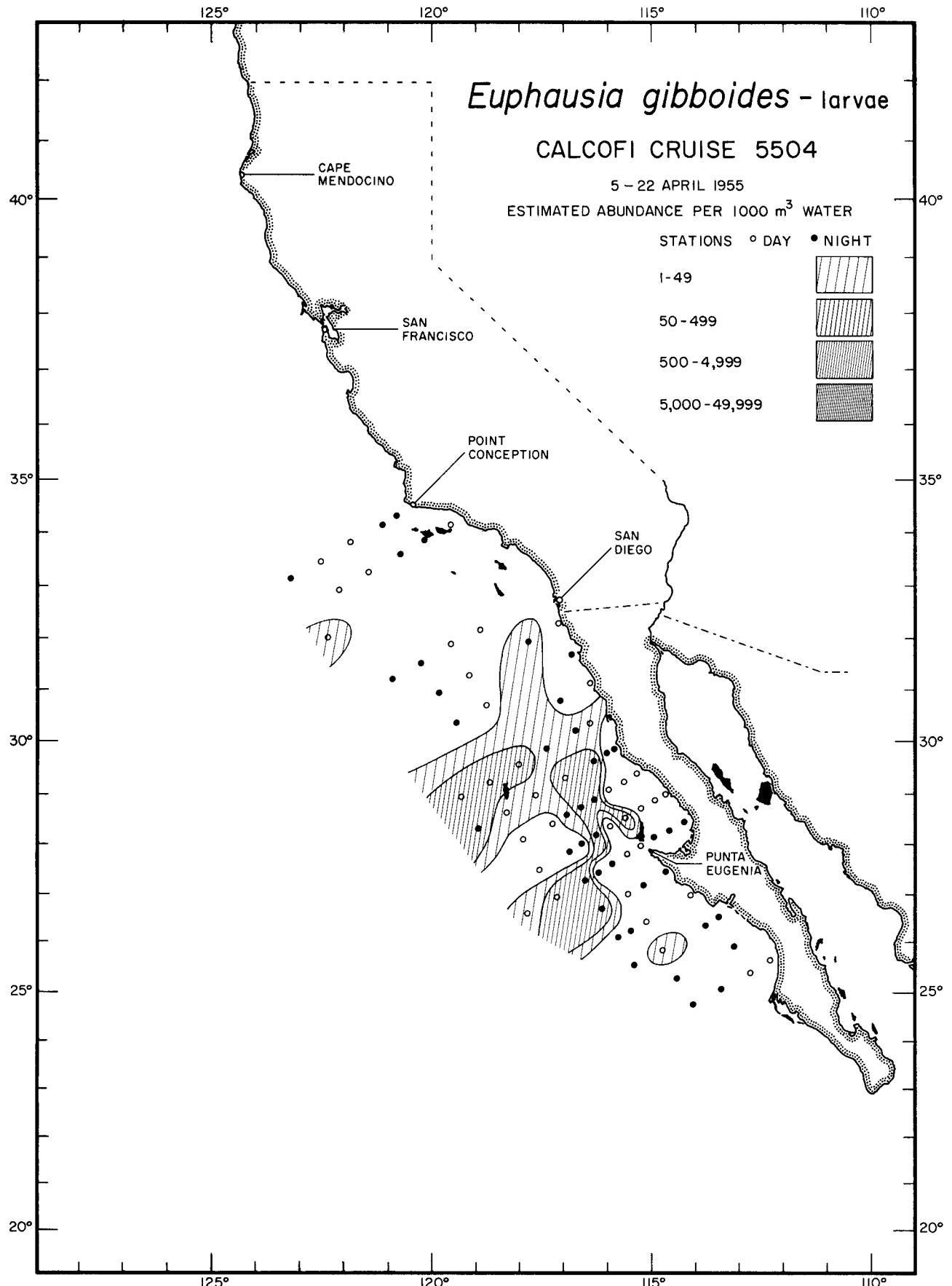


Euphausiacea
Euphausia eximia - total
 6204





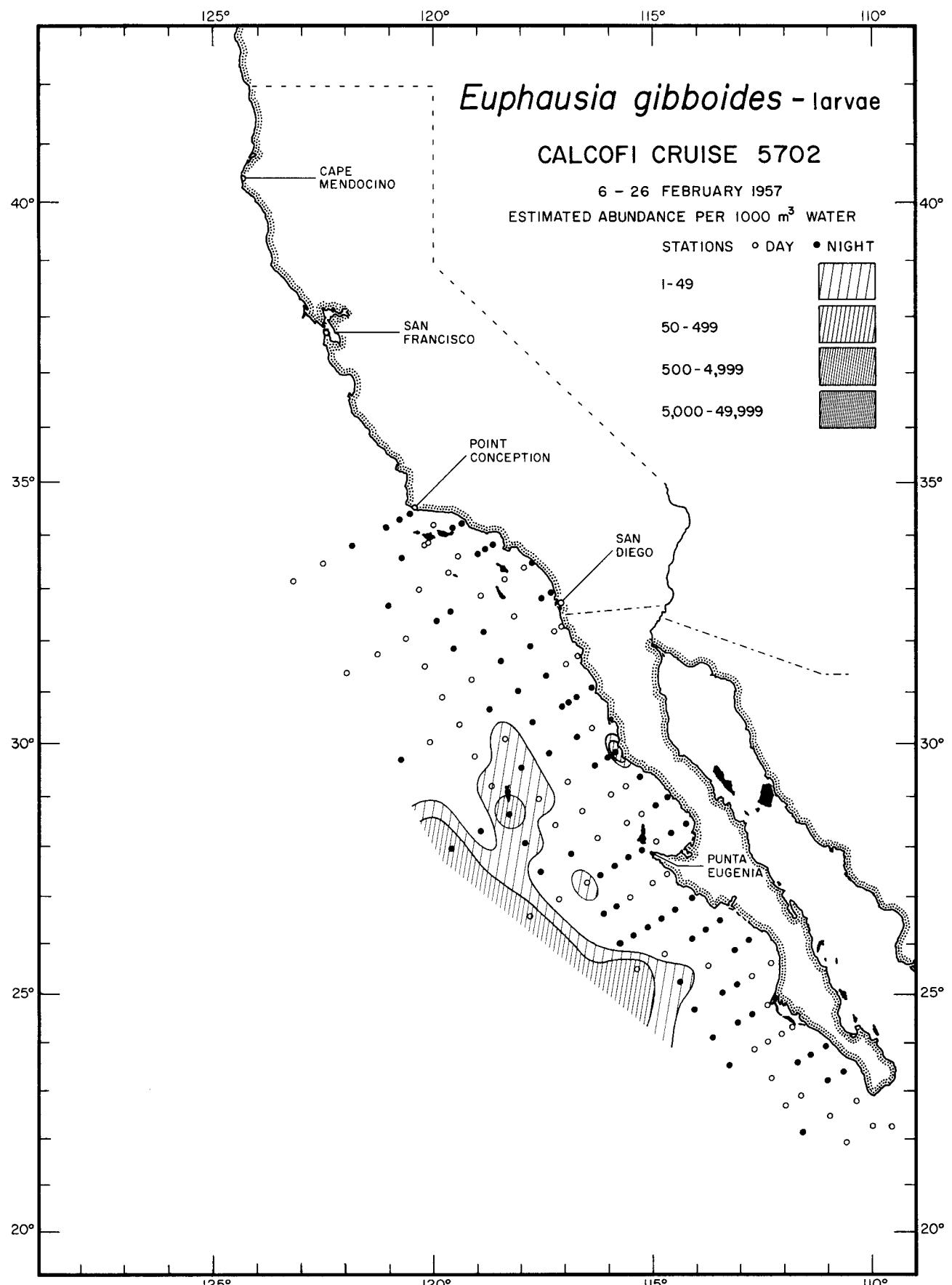
Euphausiacea
Euphausia gibboidea - larvae
5408



Euphausiacea

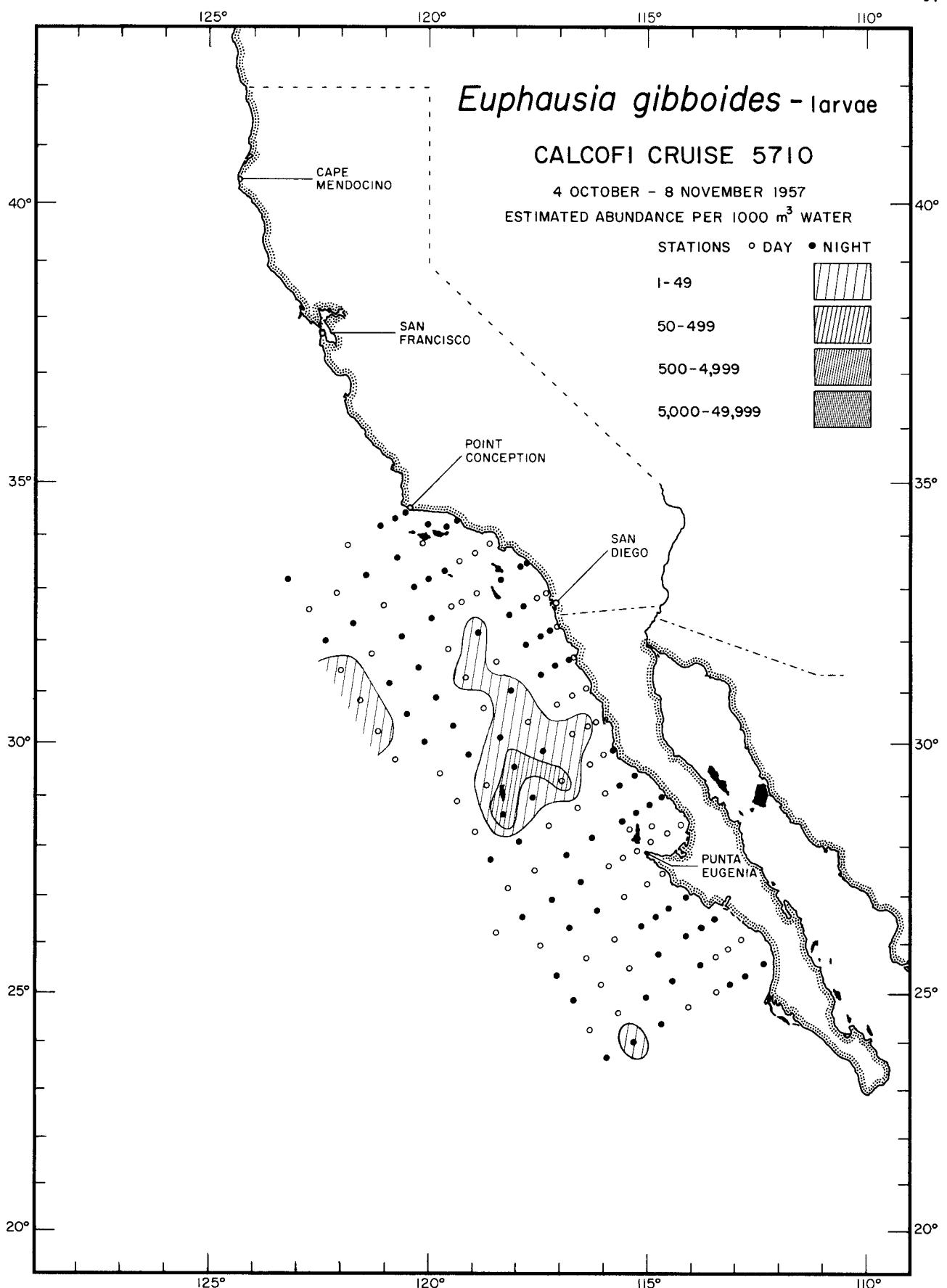
Euphausia gibbooides - larvae

5504

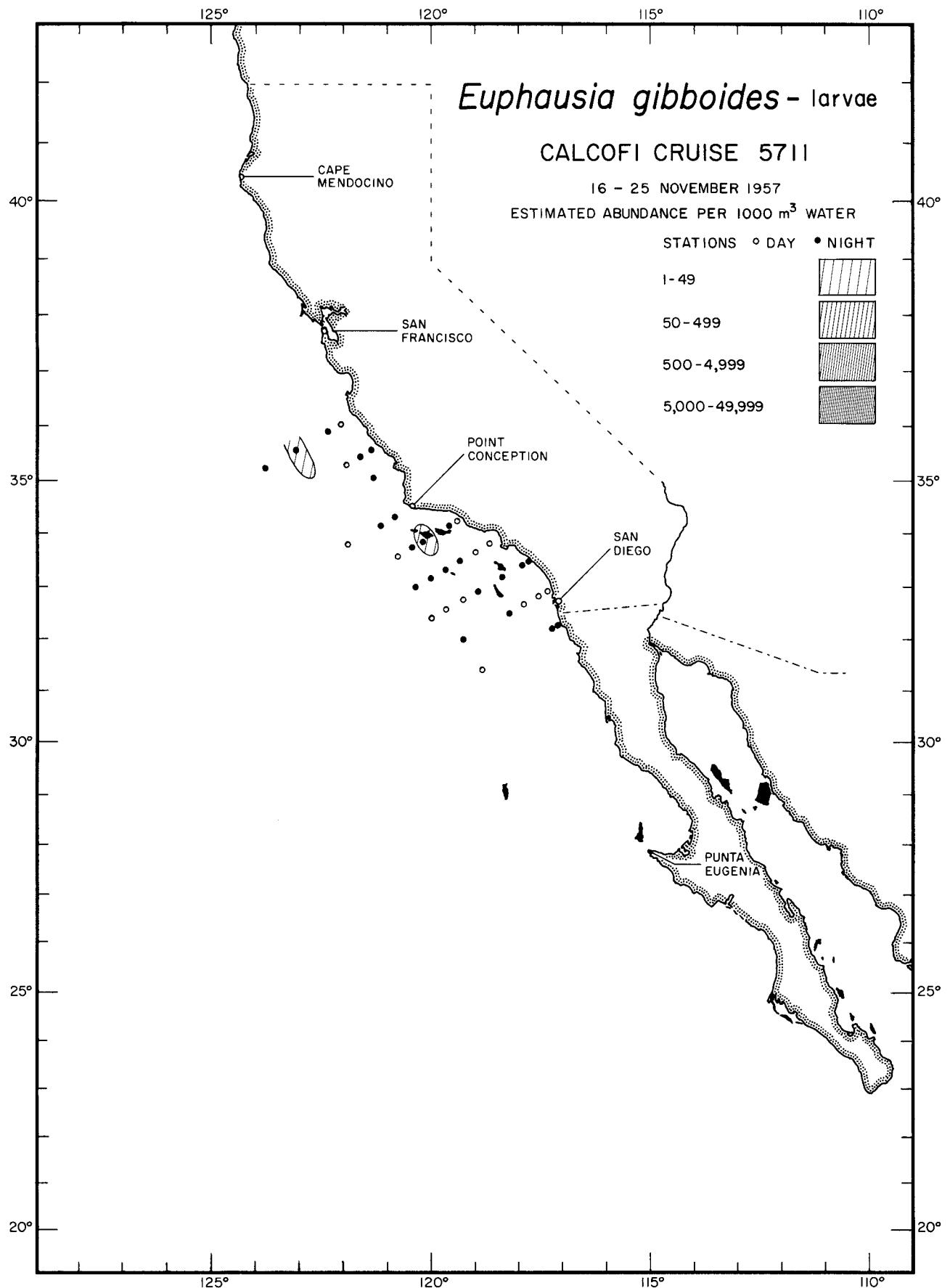


Euphausiacea
Euphausia gibbooides - larvae

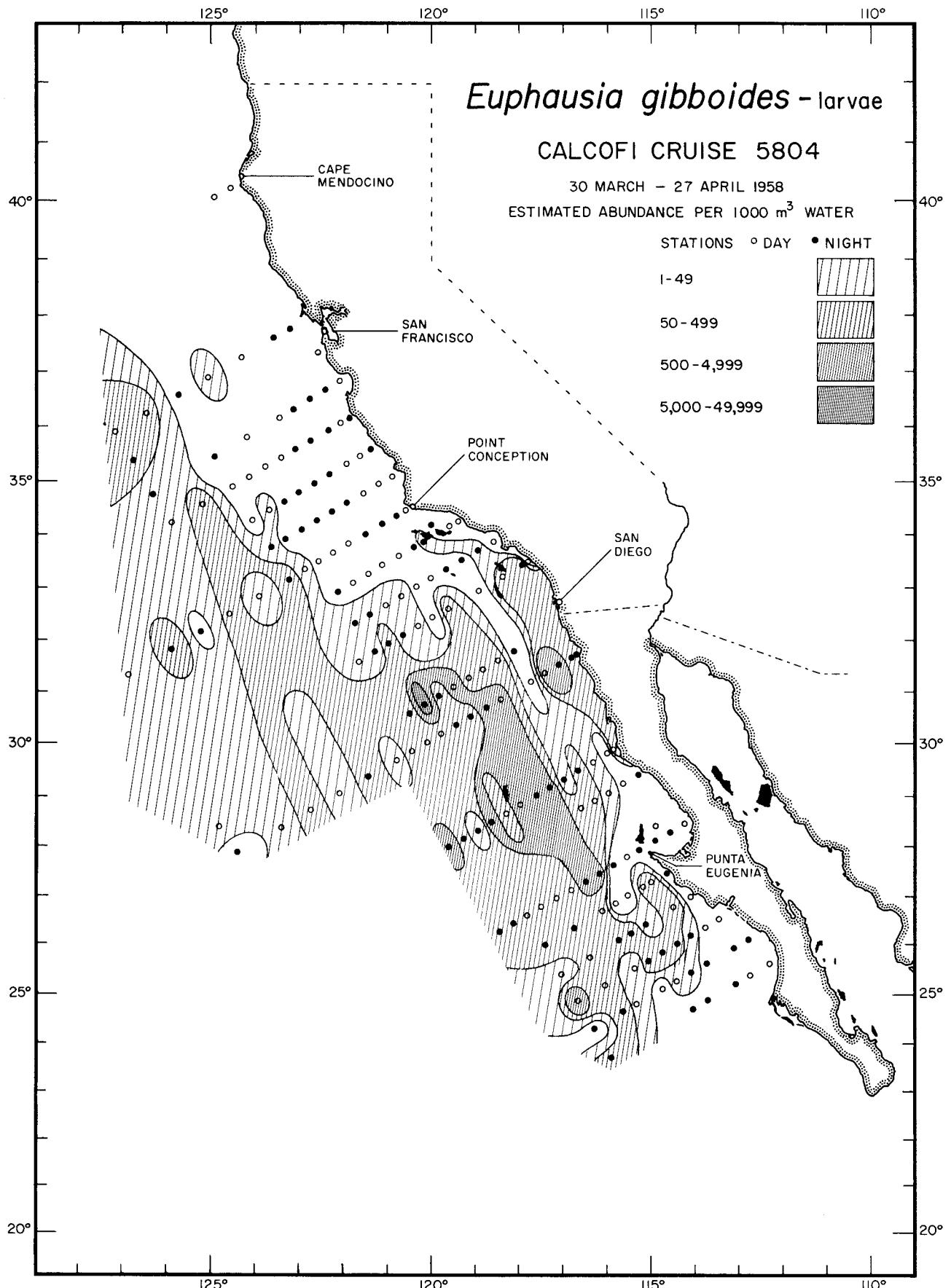
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Euphausiacea
Euphausia gibboidea - larvae
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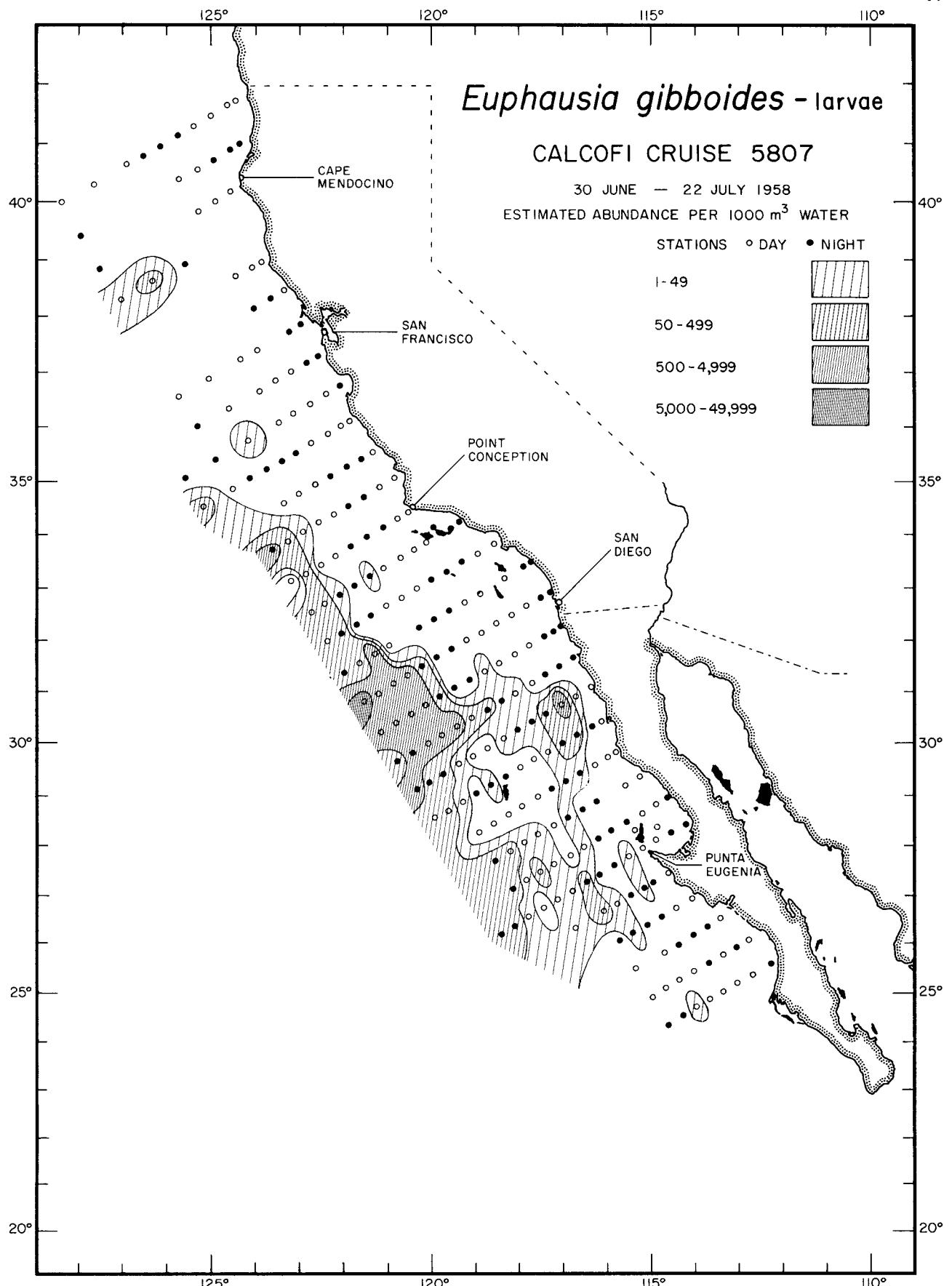


Euphausiacea
Euphausia gibboidea - larvae
 5711



Euphausiacea
Euphausia gibboidea - larvae

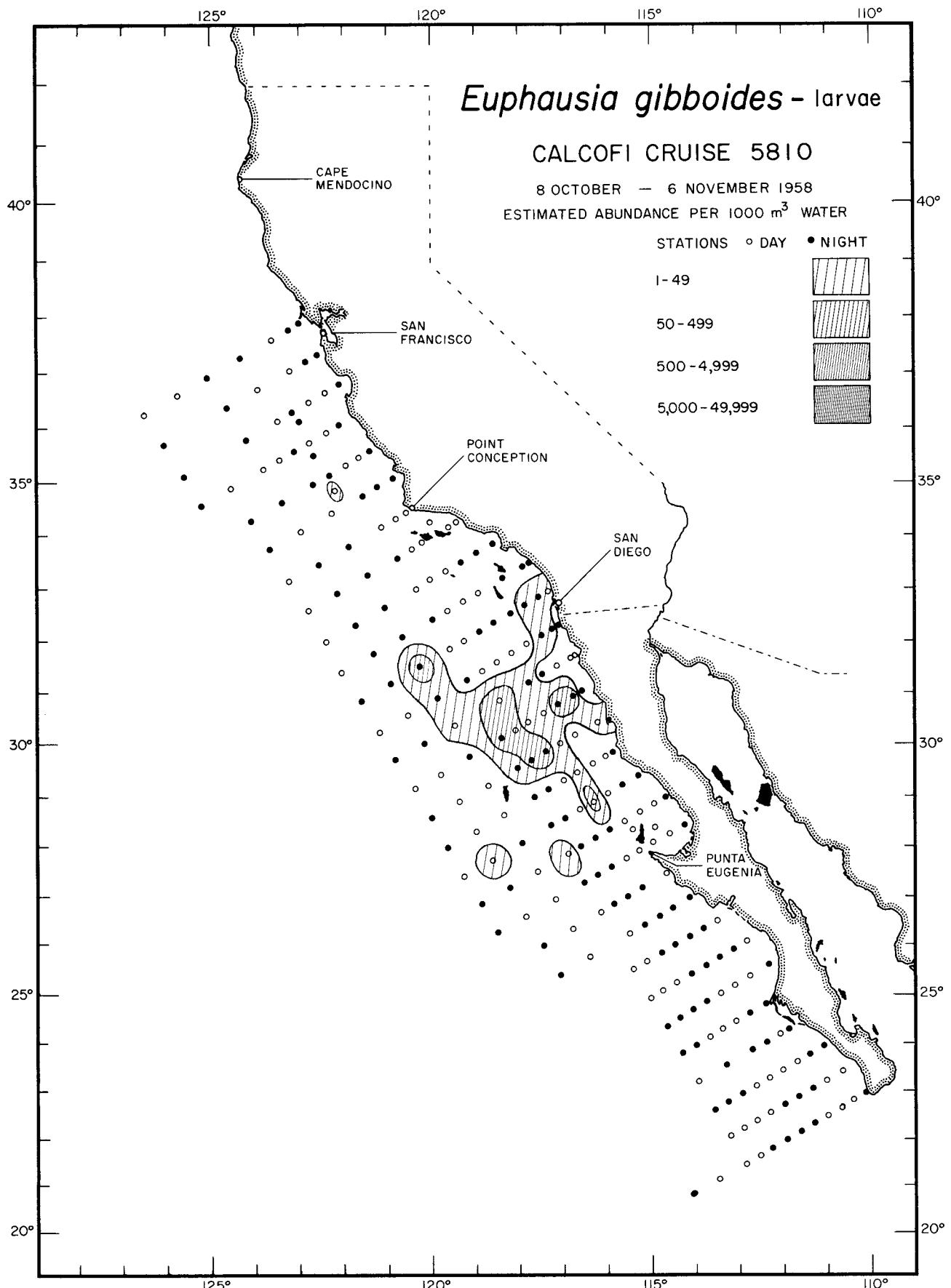
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Euphausiacea

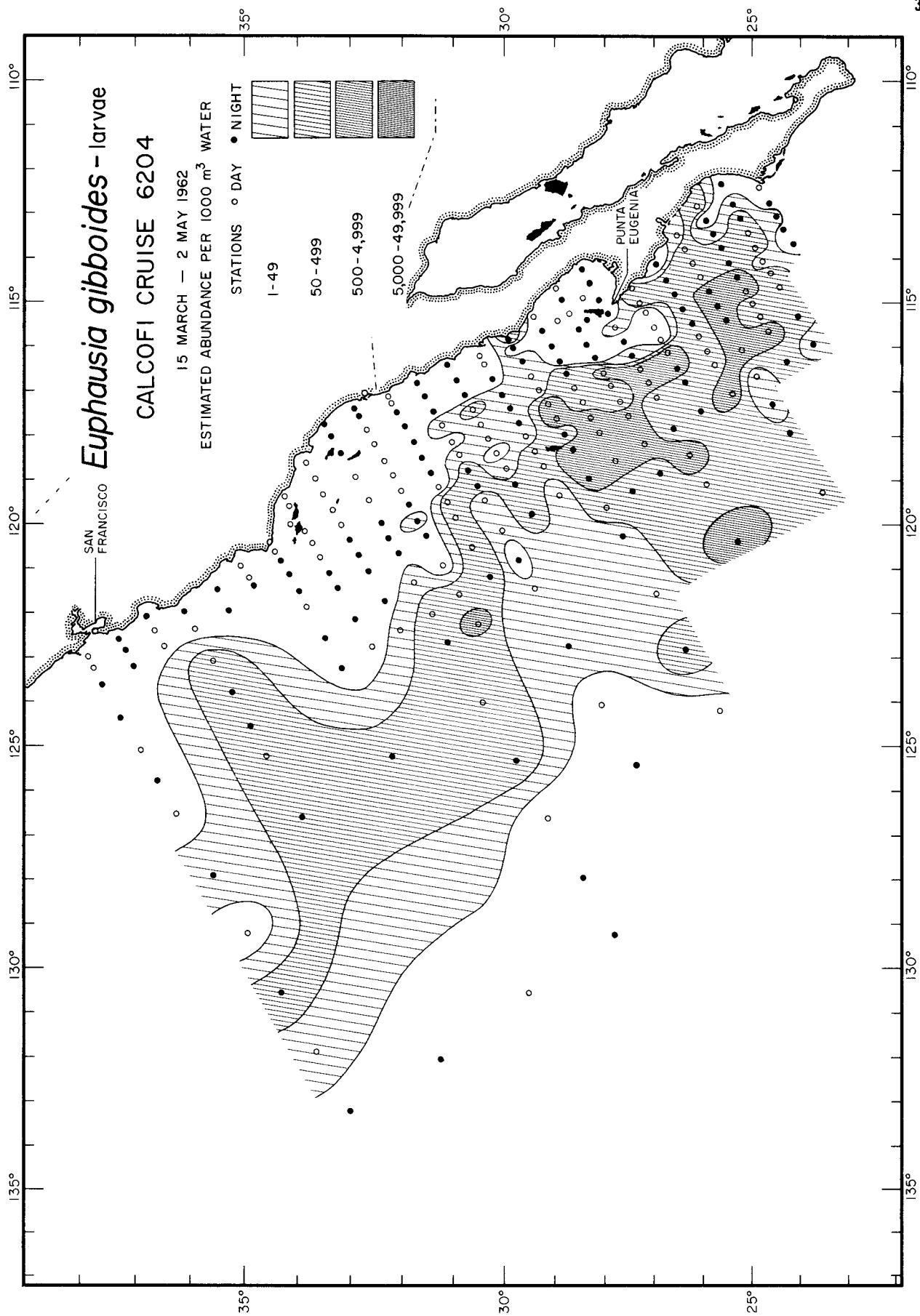
Euphausia gibboides - larvae

5807

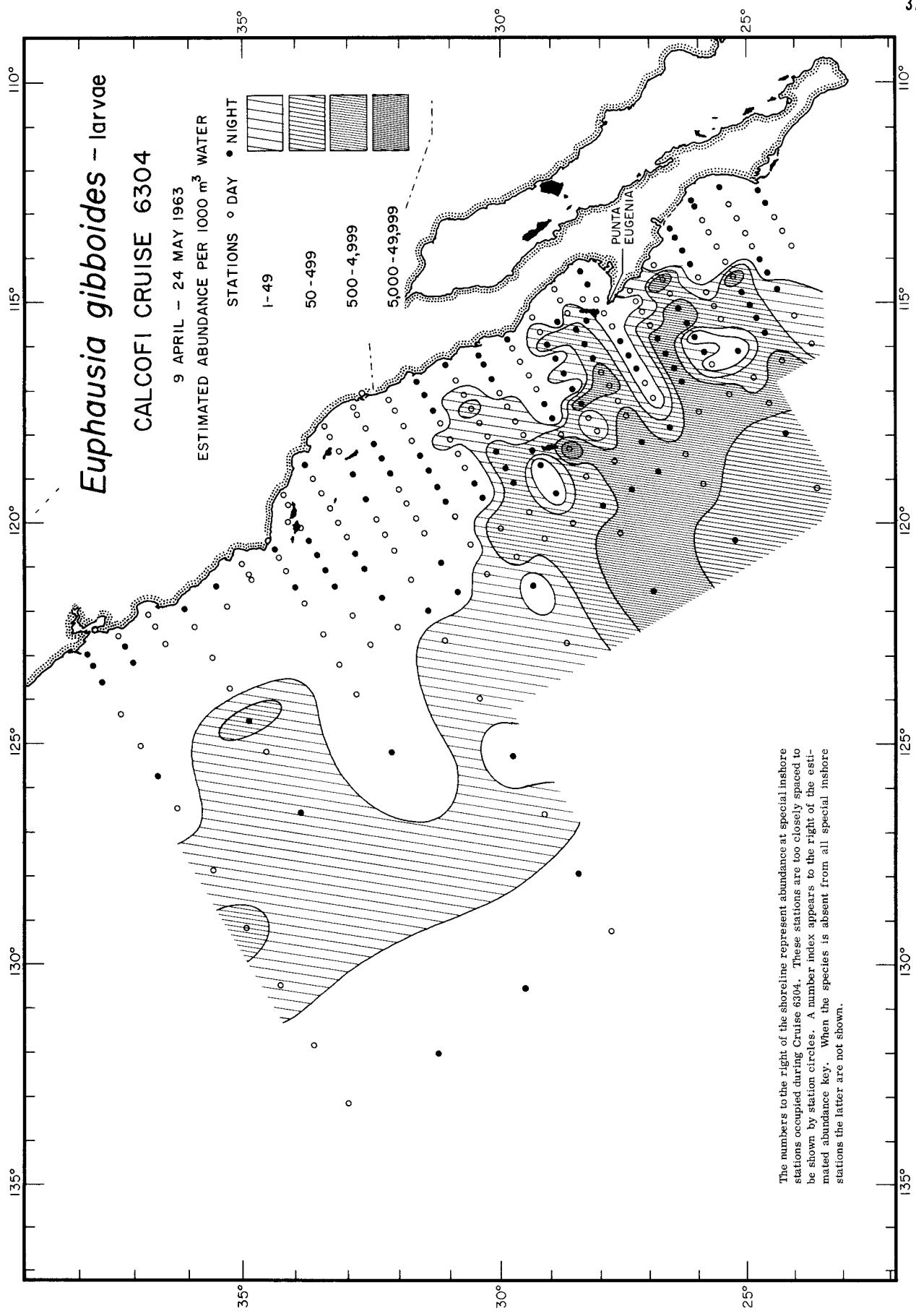


Euphausiacea
Euphausia gibboidea - larvae

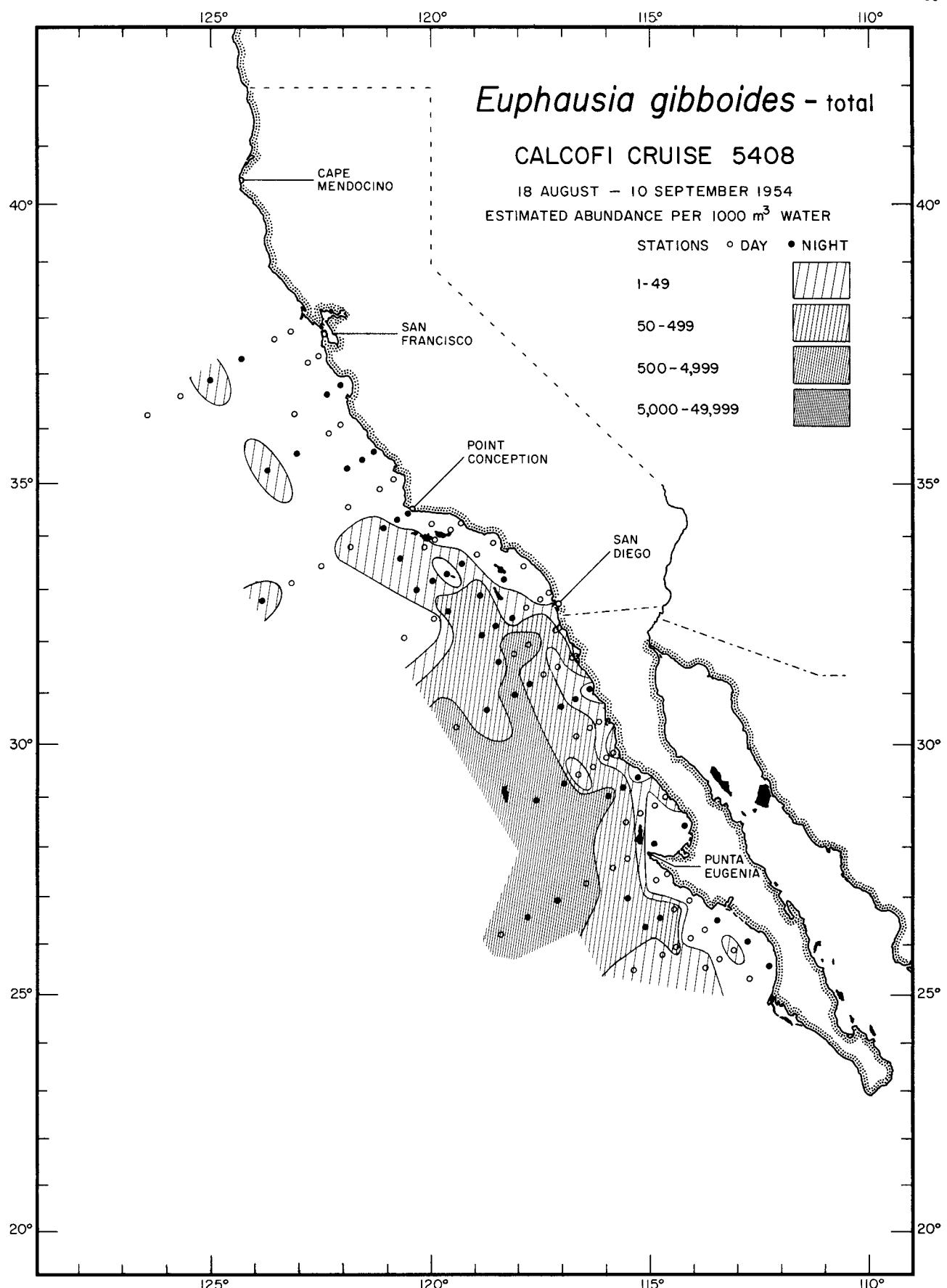
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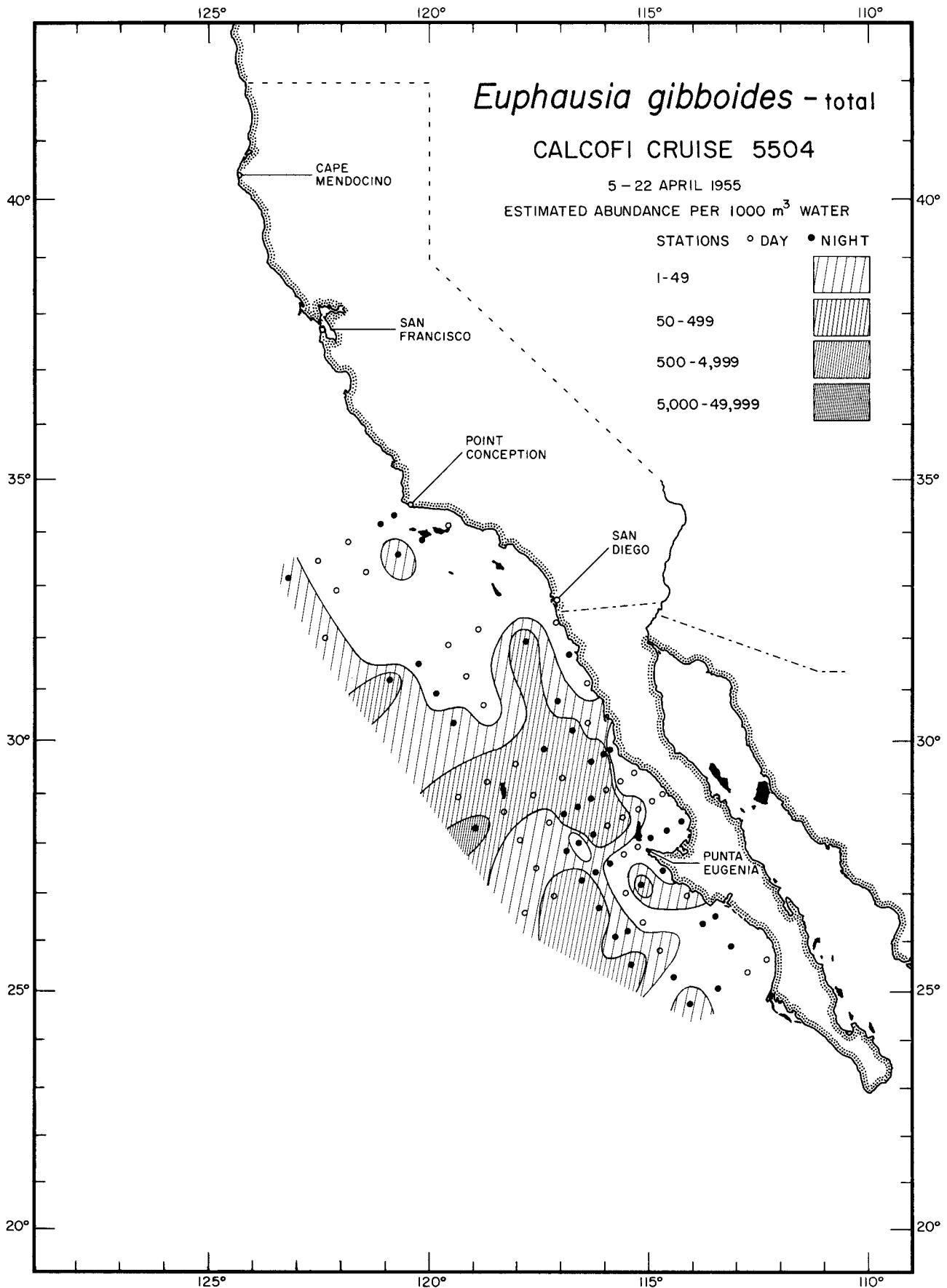
Euphausiacea
Euphausia gibboidea - larvae
 6204



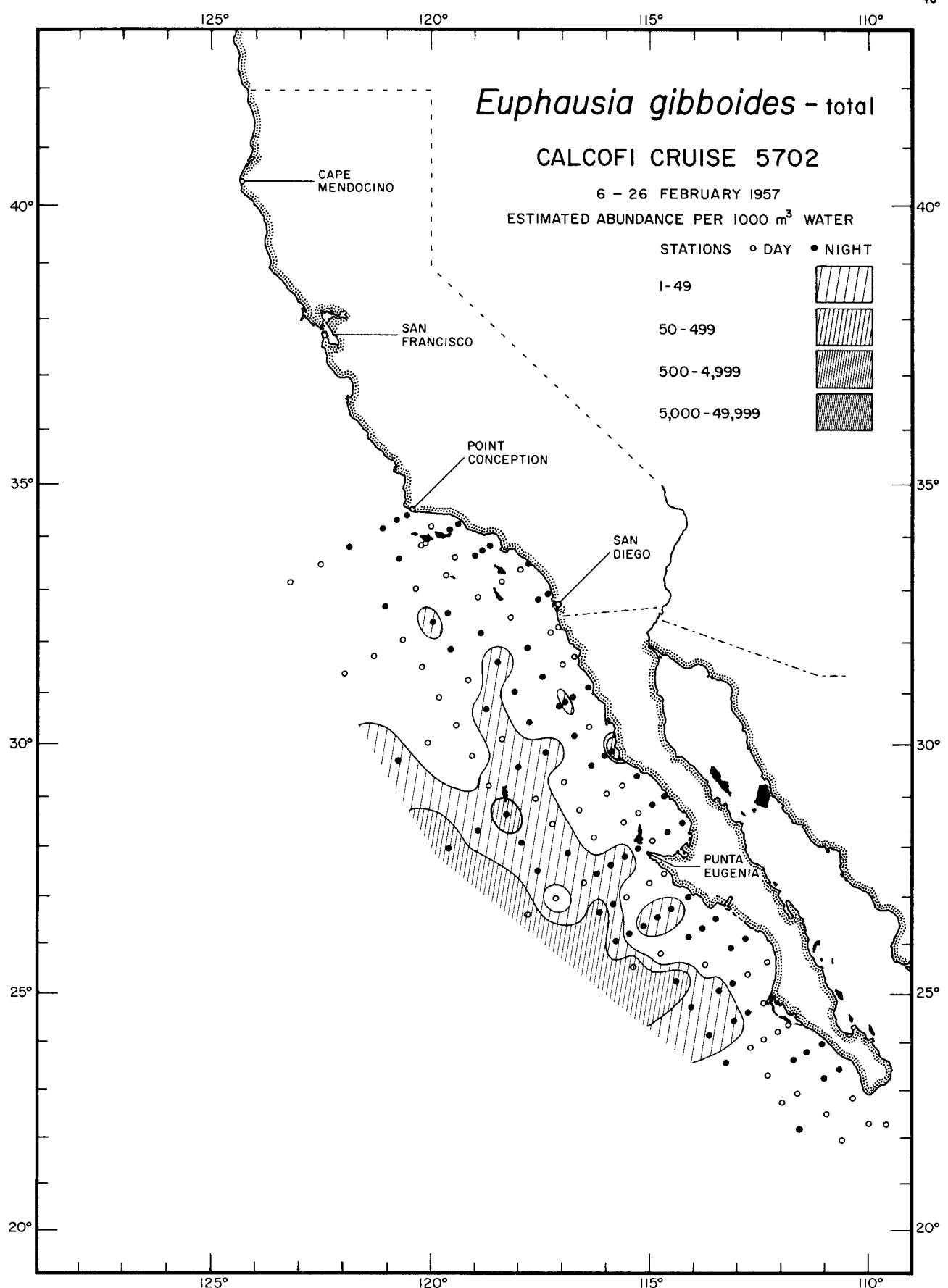
Euphausiacea
Euphausia gibboidea - larvae
 6304



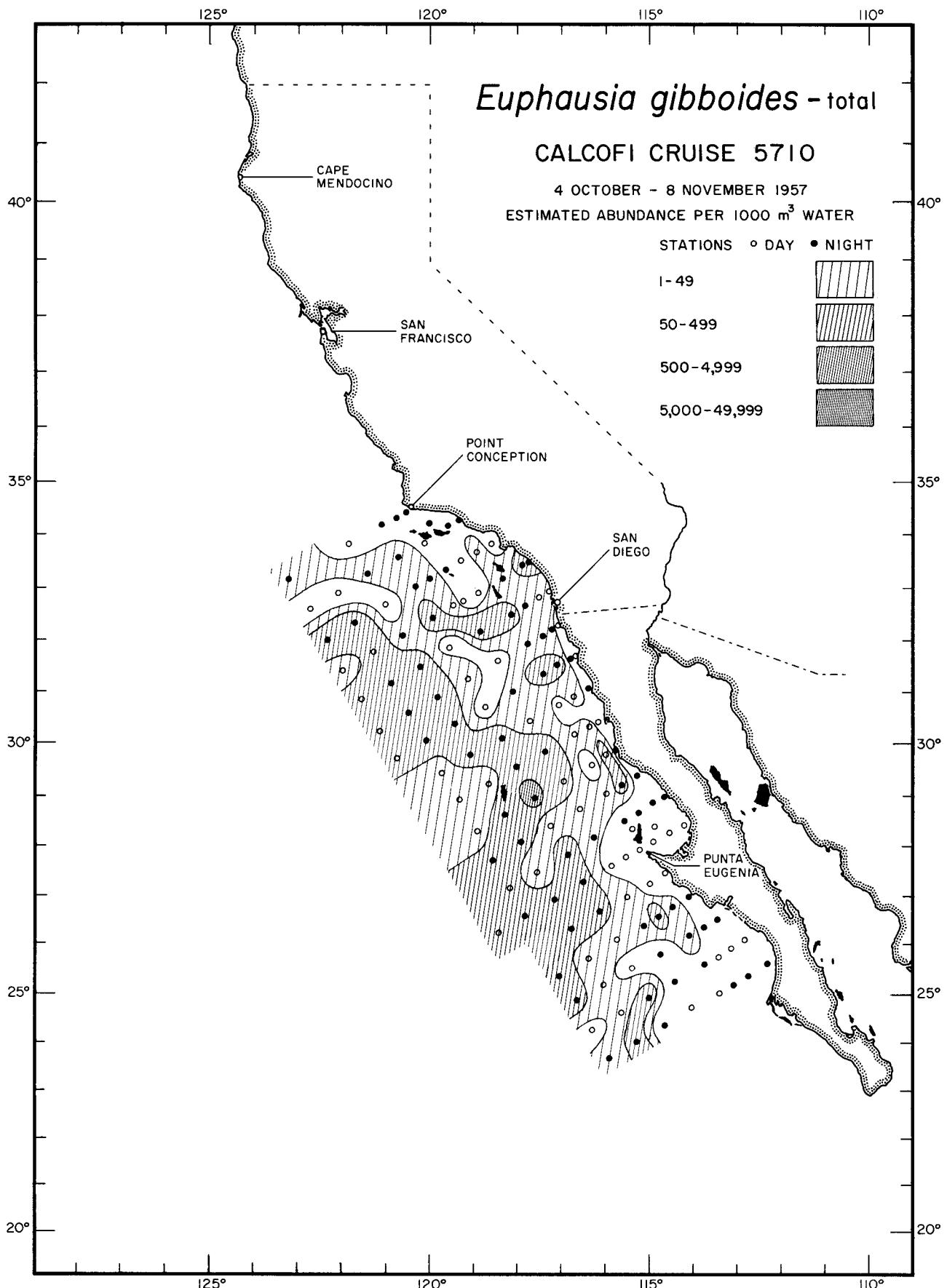
Euphausiacea
Euphausia gibbooides - total
5408



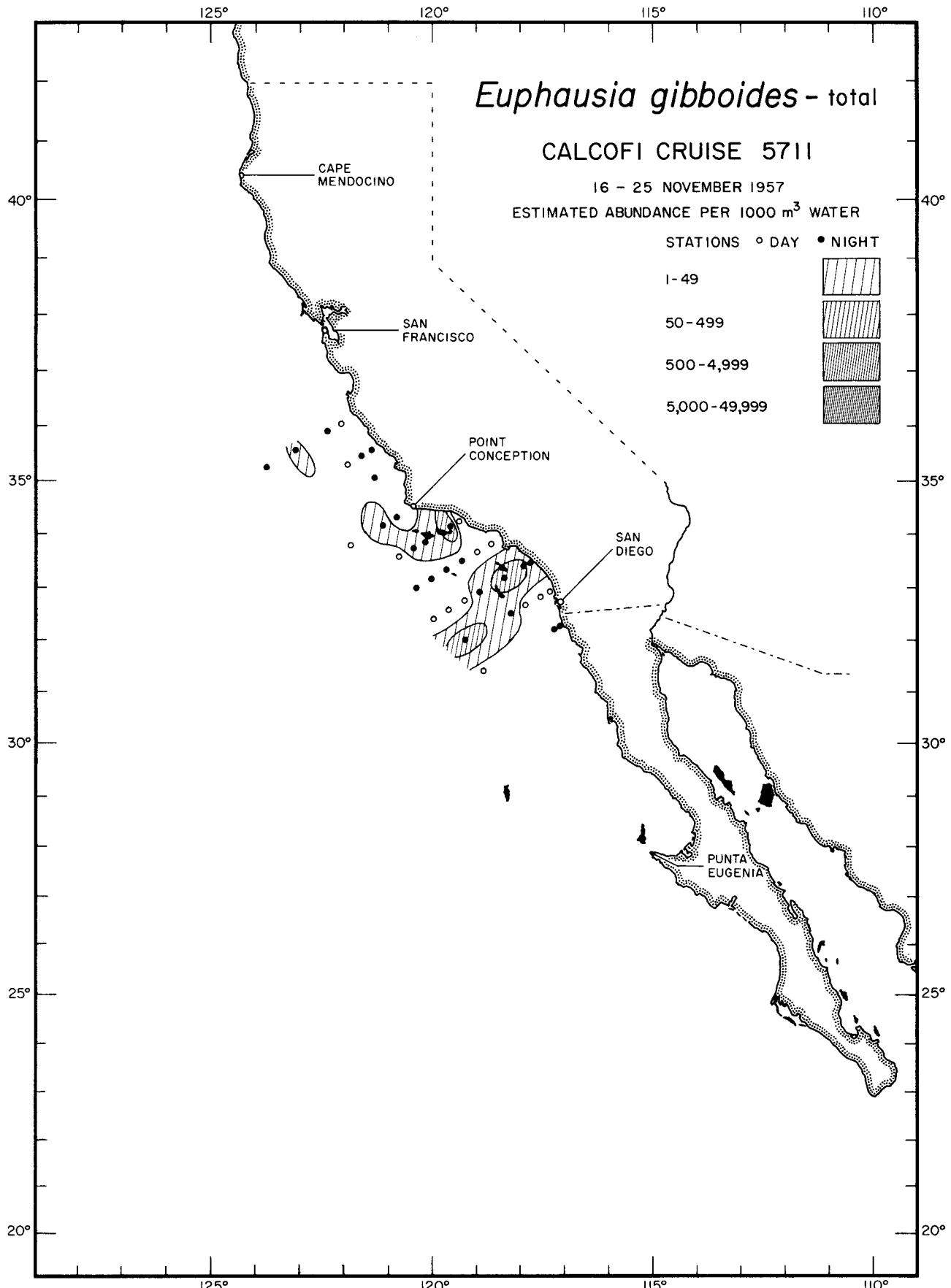
Euphausiacea
Euphausia gibbooides - total
5504



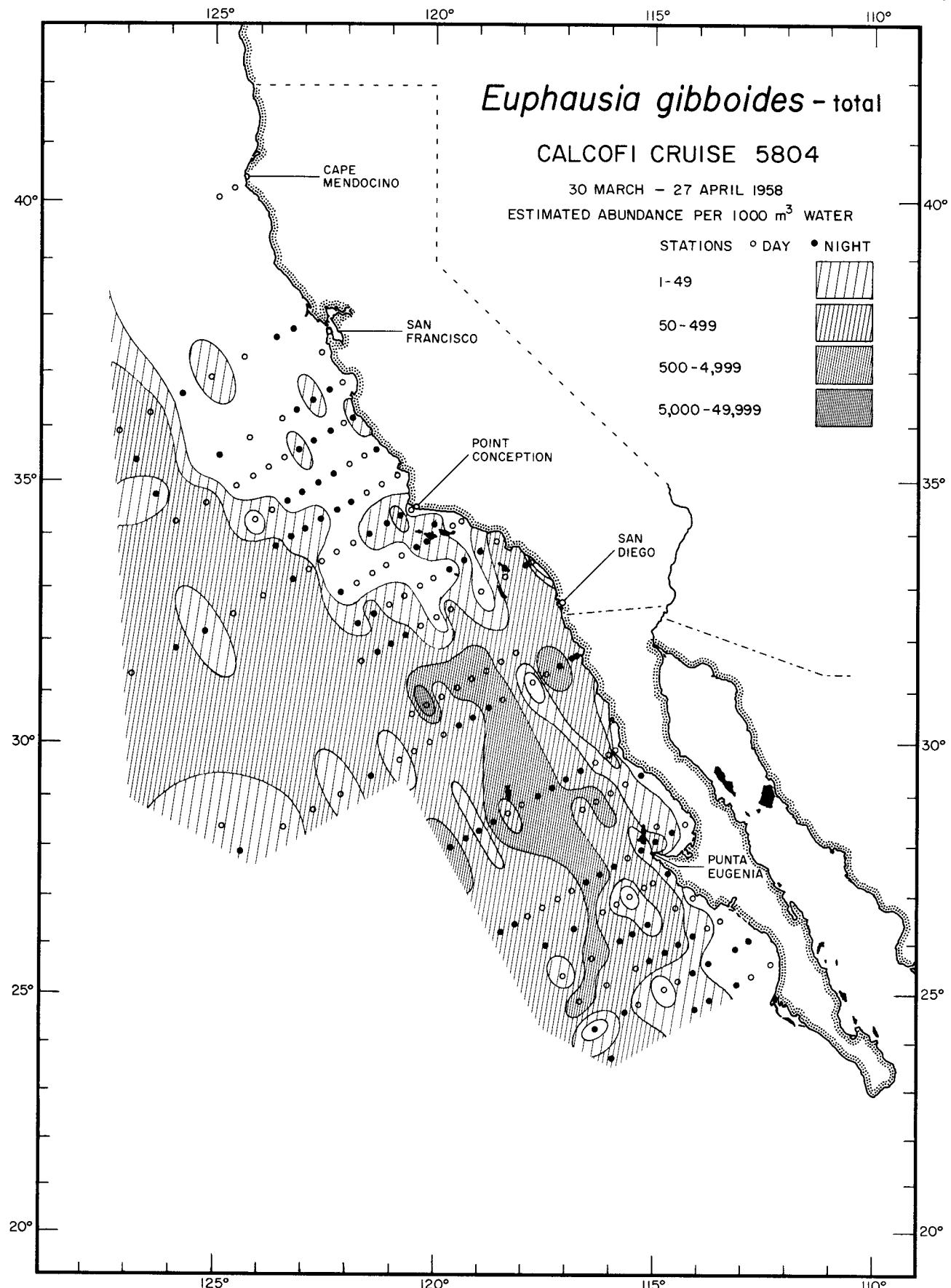
Euphausiacea
Euphausia gibboidea - total
 5702



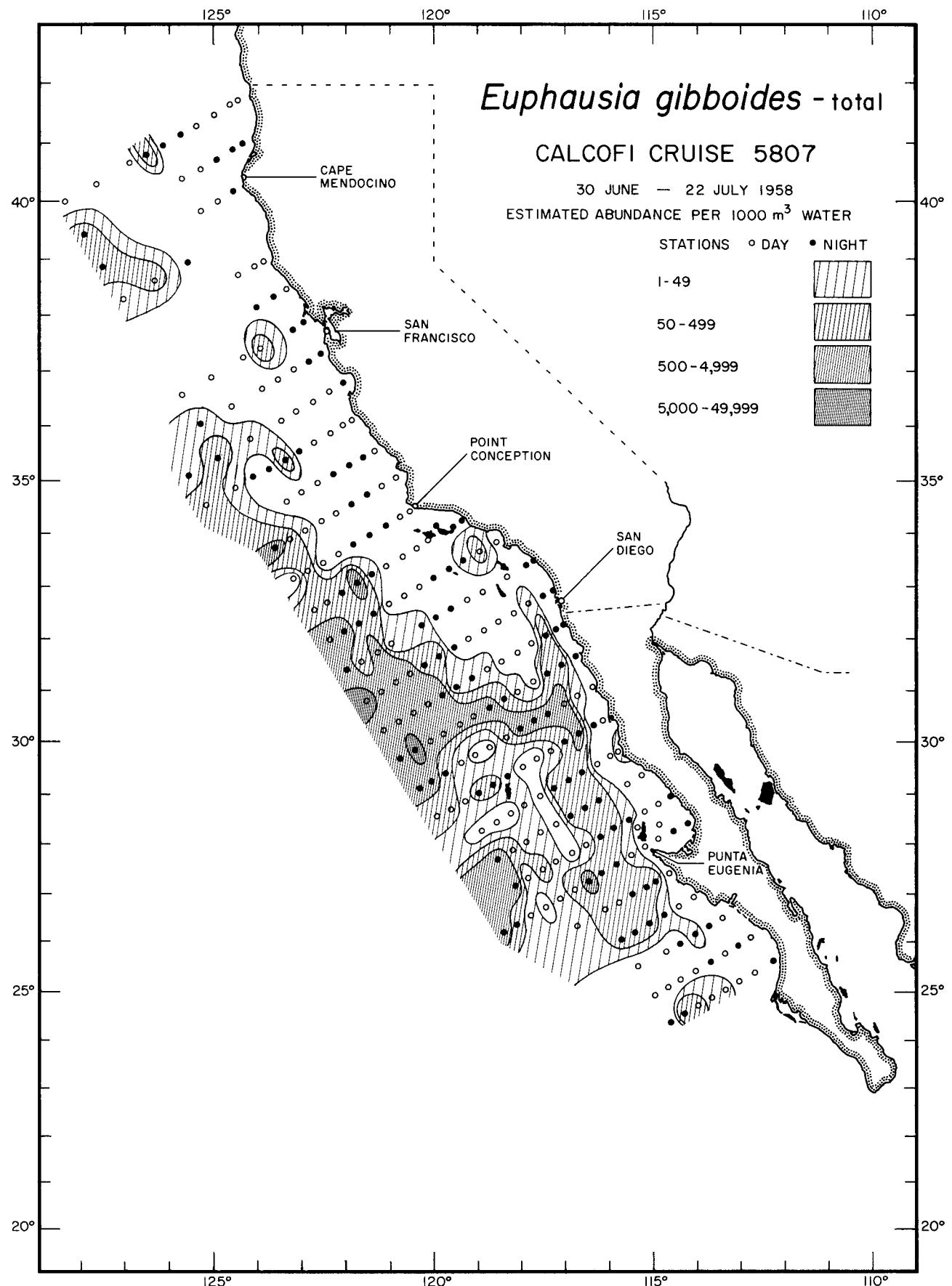
Euphausiacea
Euphausia gibboidea - total
 5710



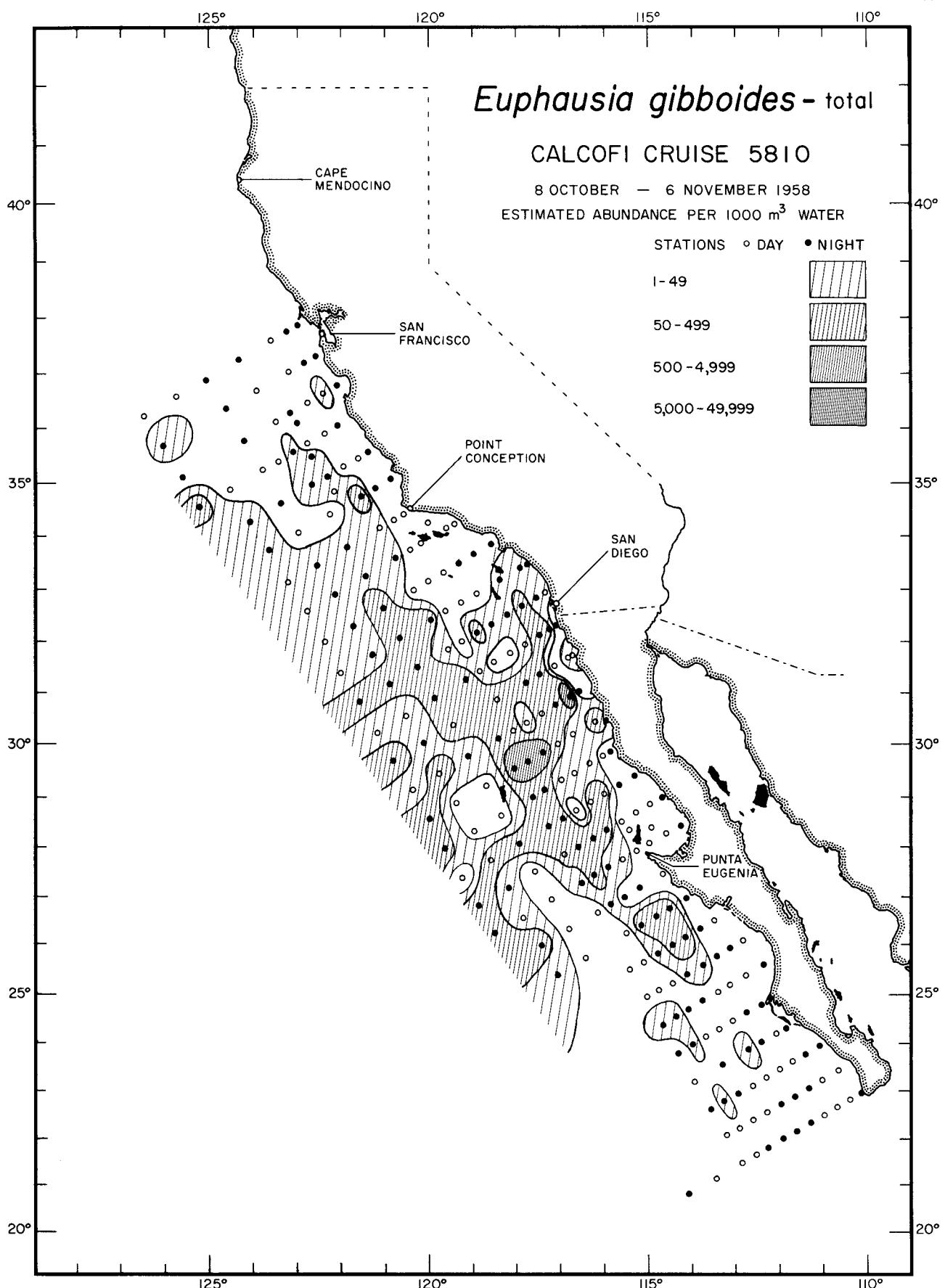
Euphausiacea
Euphausia gibboidea - total
5711



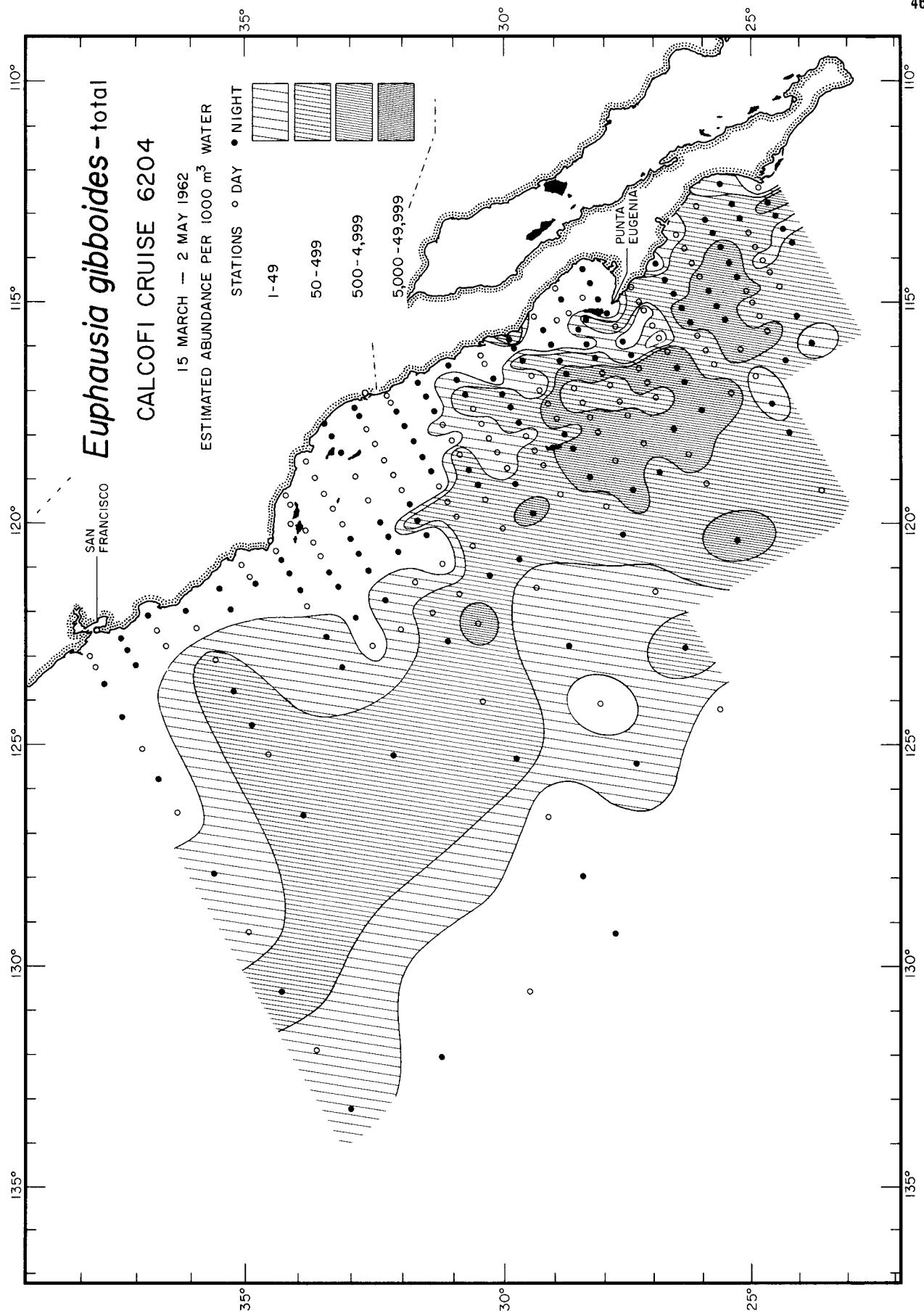
Euphausiaceae
Euphausia gibboidea - total
5804



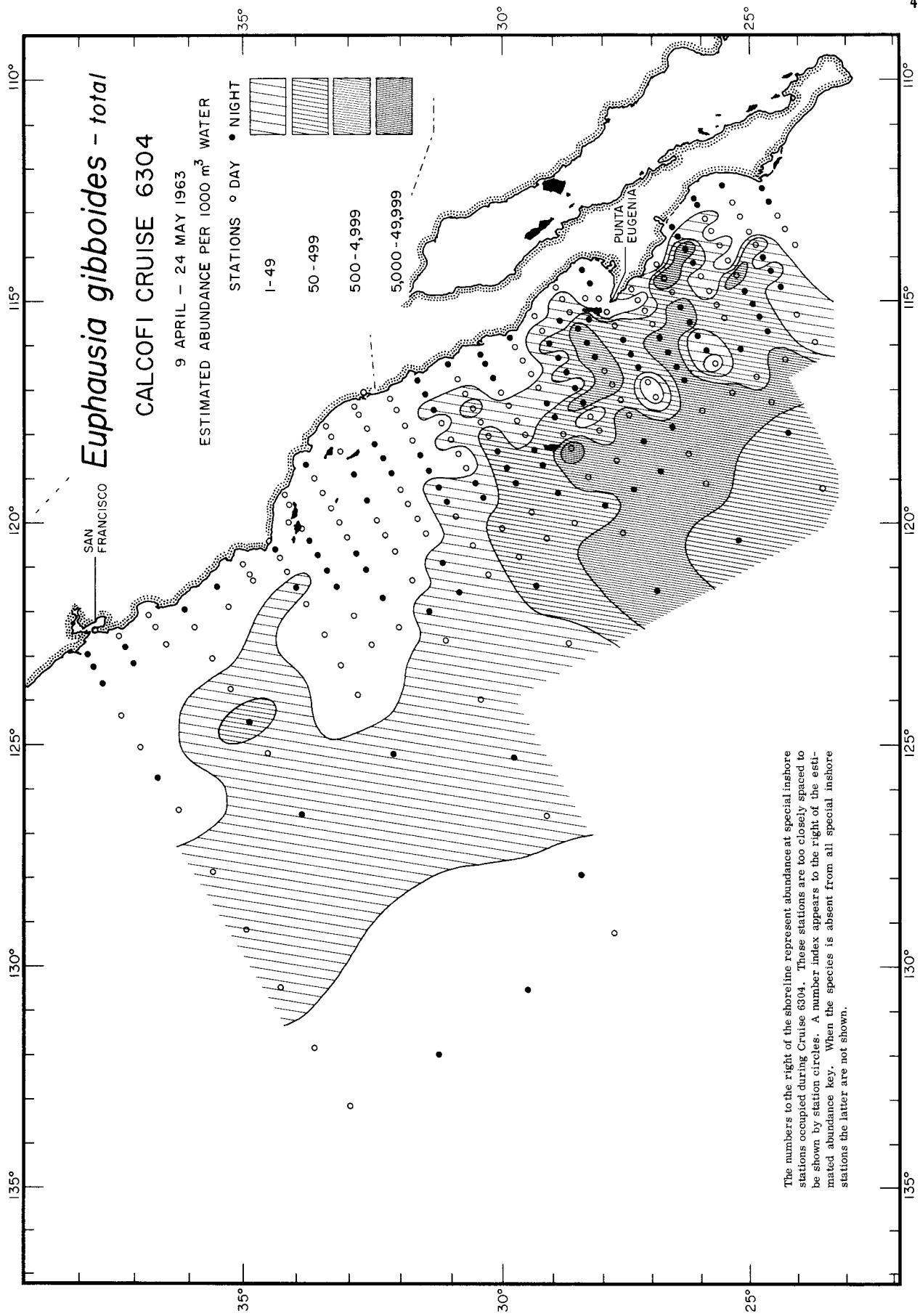
Euphausiacea
Euphausia gibboidea - total
5807



Euphausiacea
Euphausia gibbooides - total
 5810

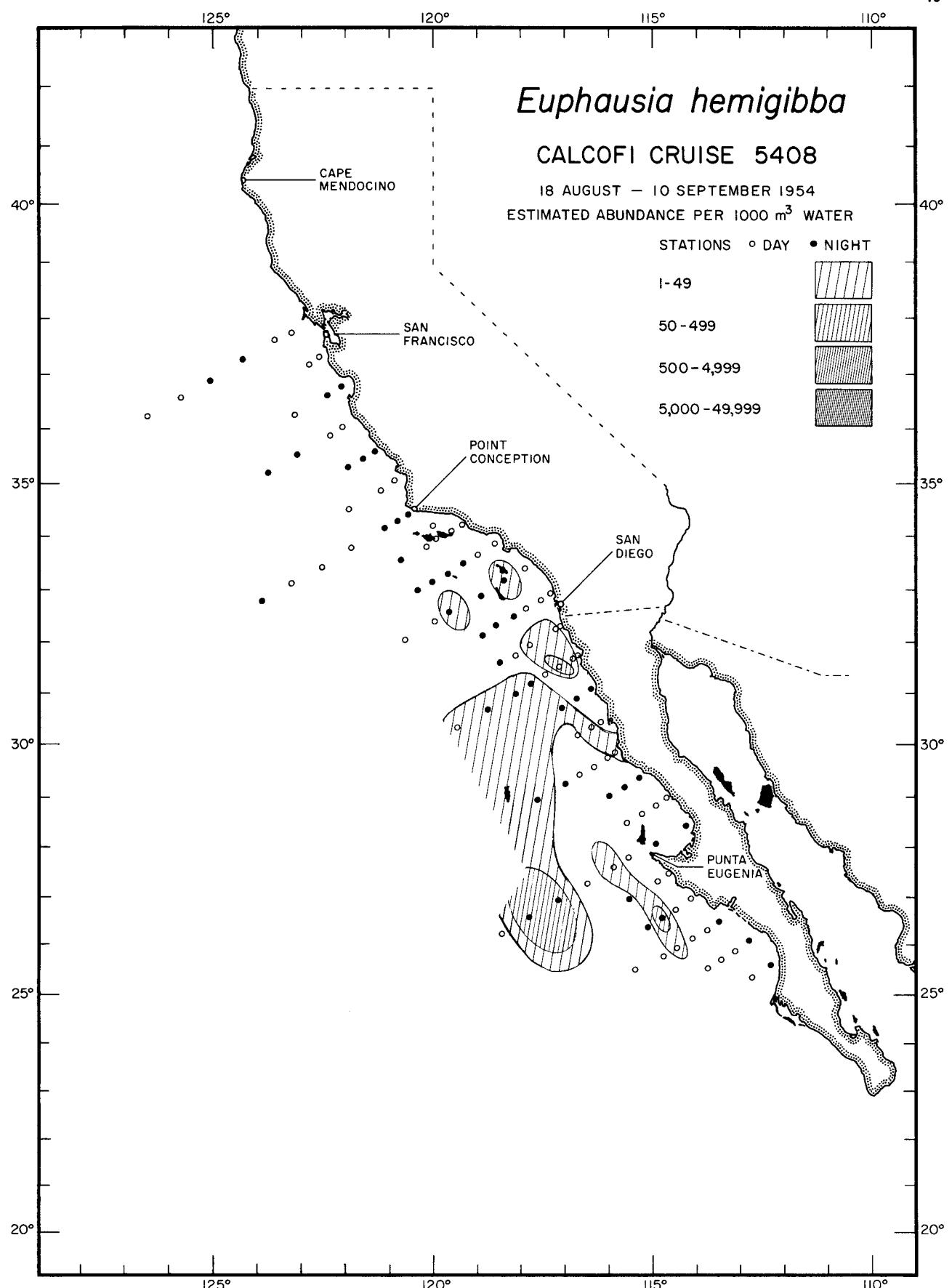


Euphausiacea
Euphausia gibbooides - total
 6204



Euphausiacea
Euphausia gibboidea - total
6304

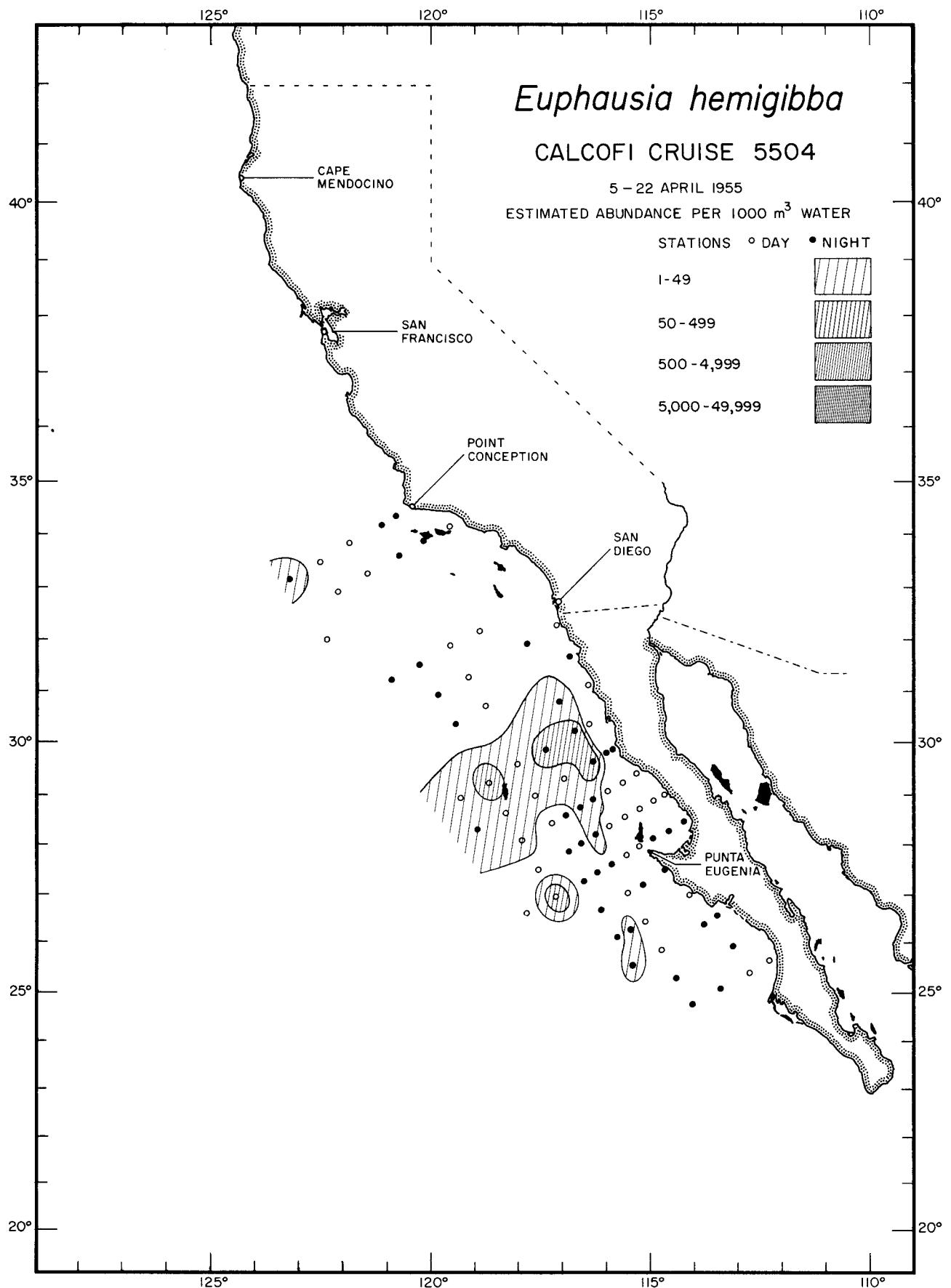
The numbers to the right of the shoreline represent abundance at special inshore stations occupied during Cruise 6304. Those stations are too closely spaced to be shown by station circles. A number index appears to the right of the estimated abundance key. When the species is absent from all special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



Euphausiacea

Euphausia hemigibba

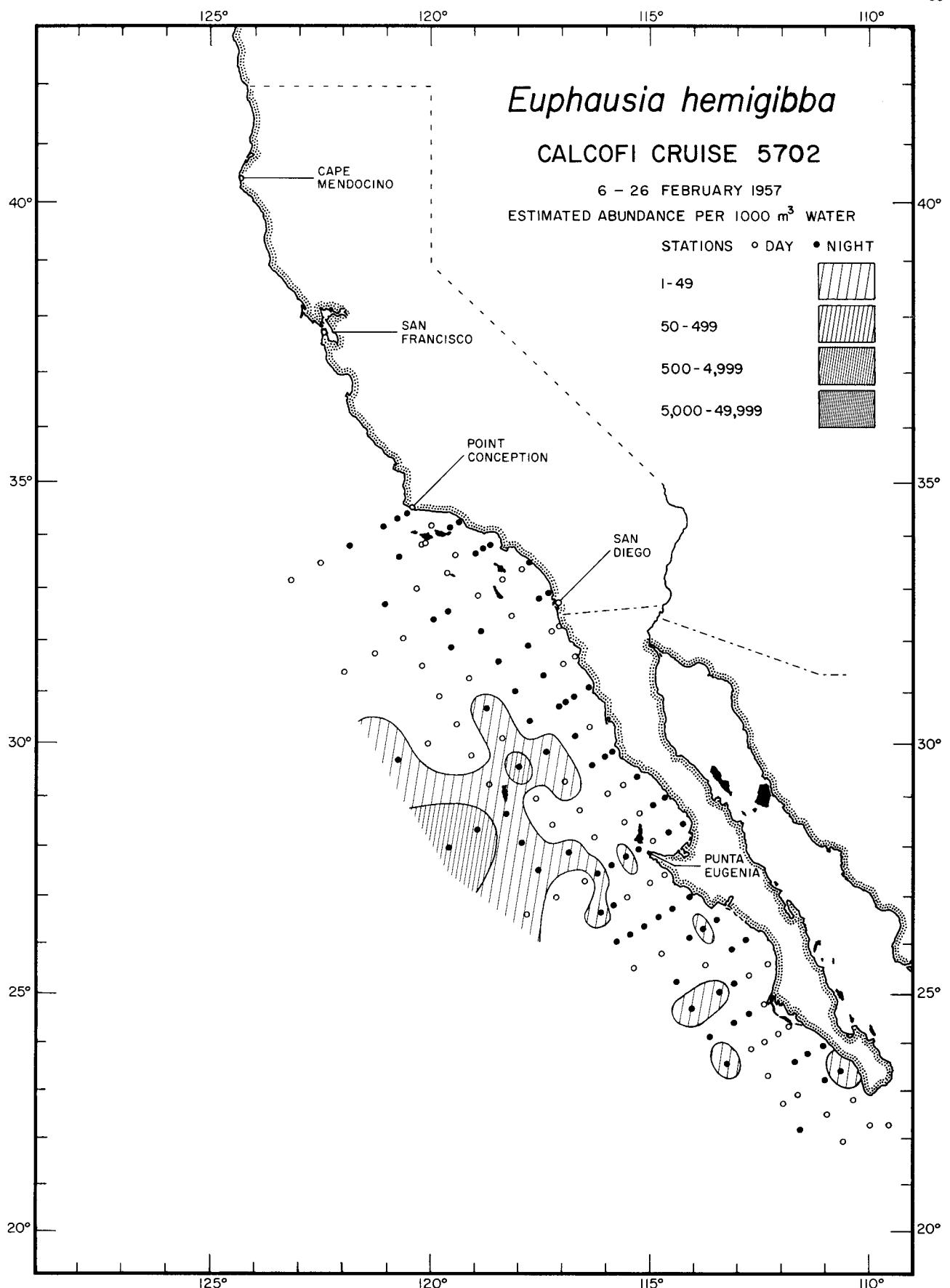
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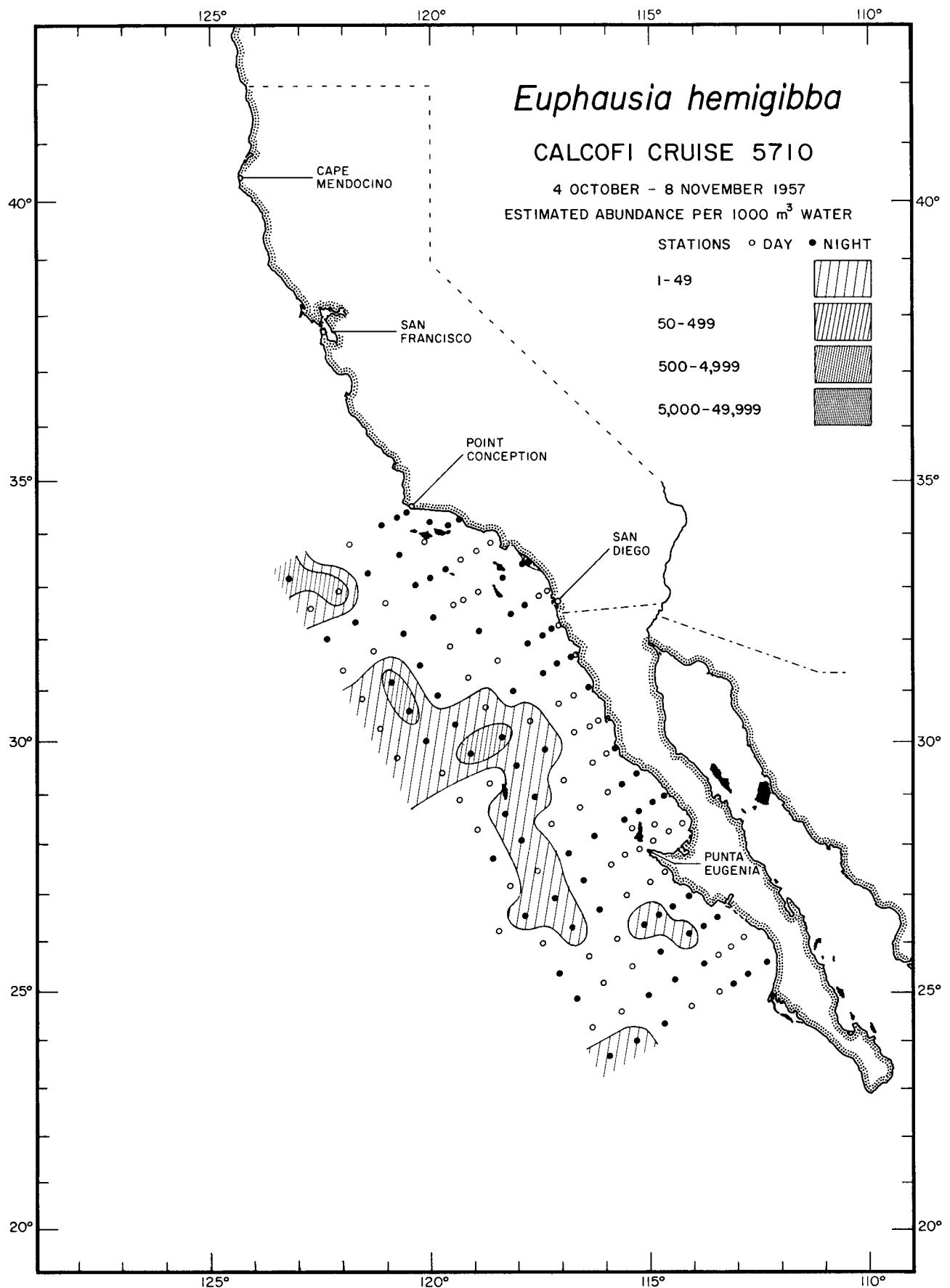
Euphausiacea

Euphausia hemigibba

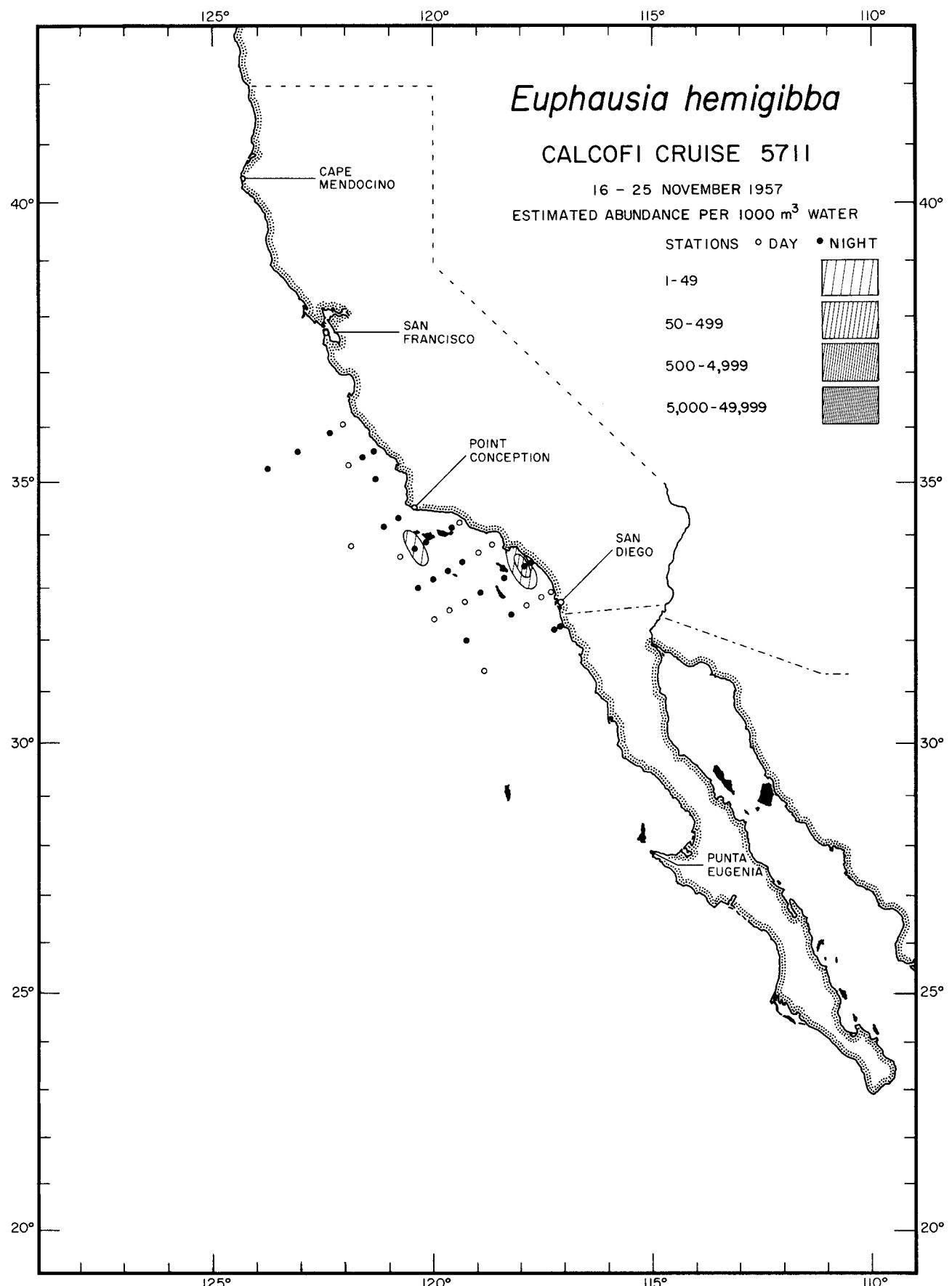
5504



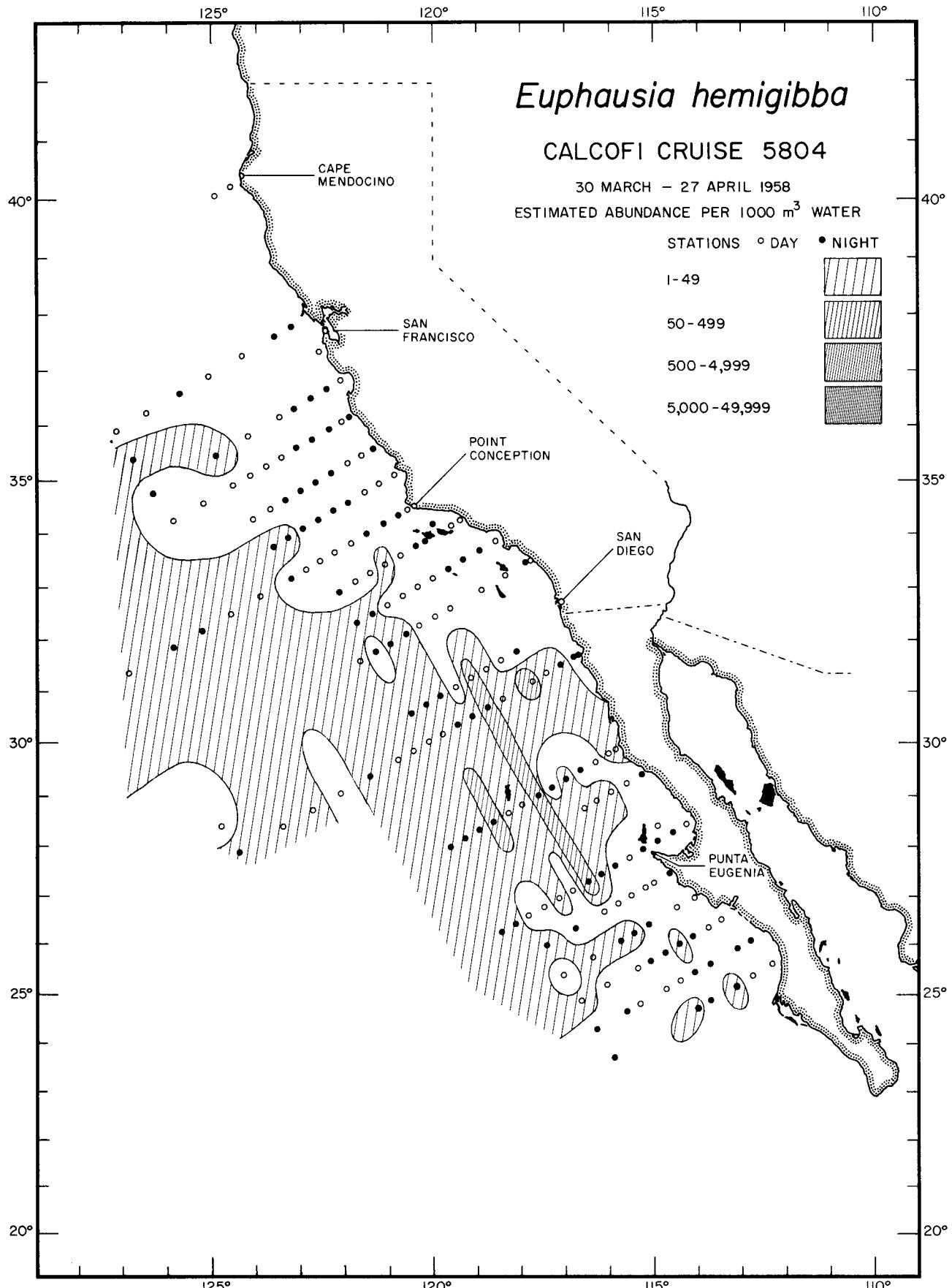
Euphausiacea
Euphausia hemigibba
5702



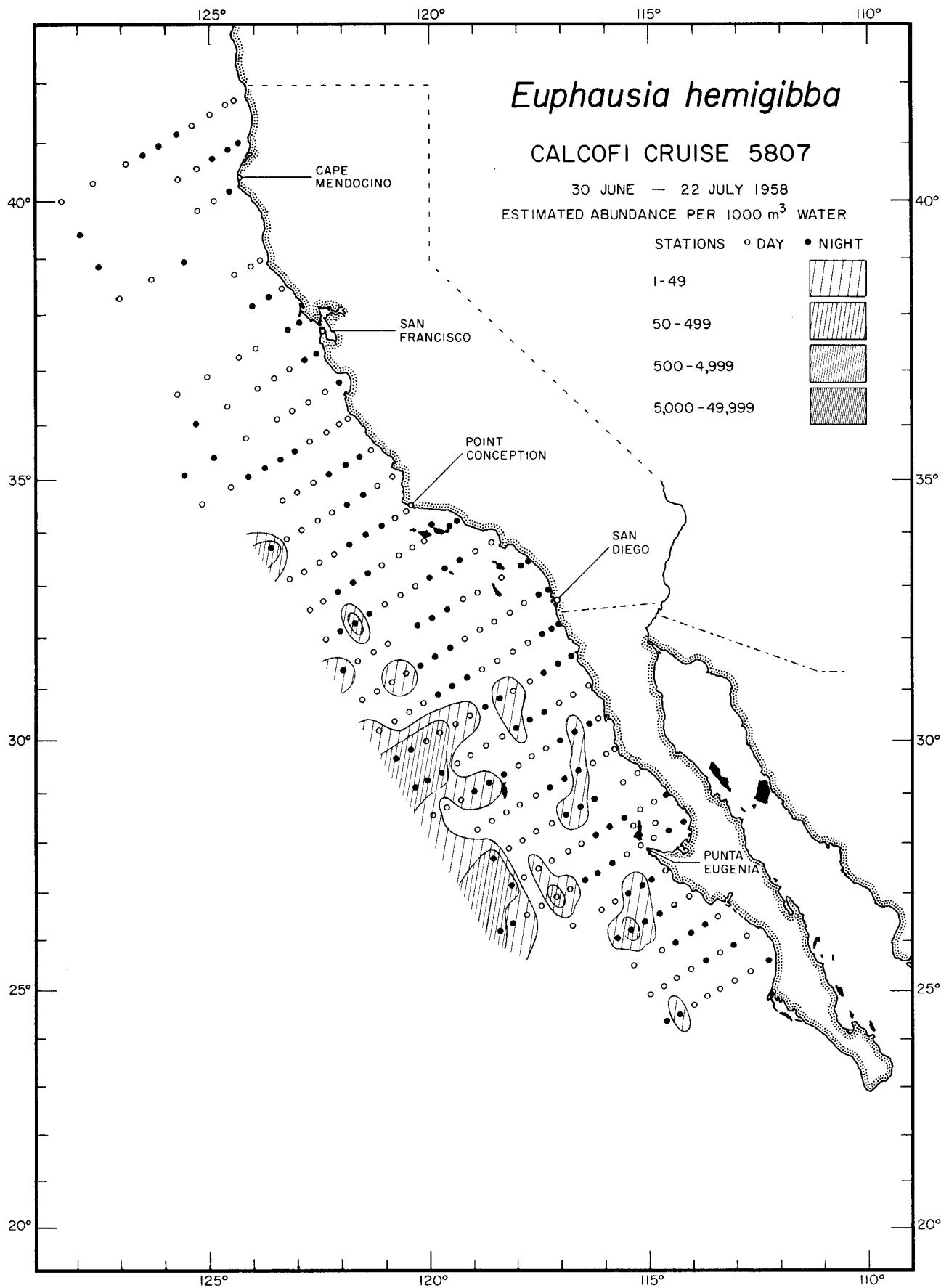
Euphausiacea
Euphausia hemigibba
 5710



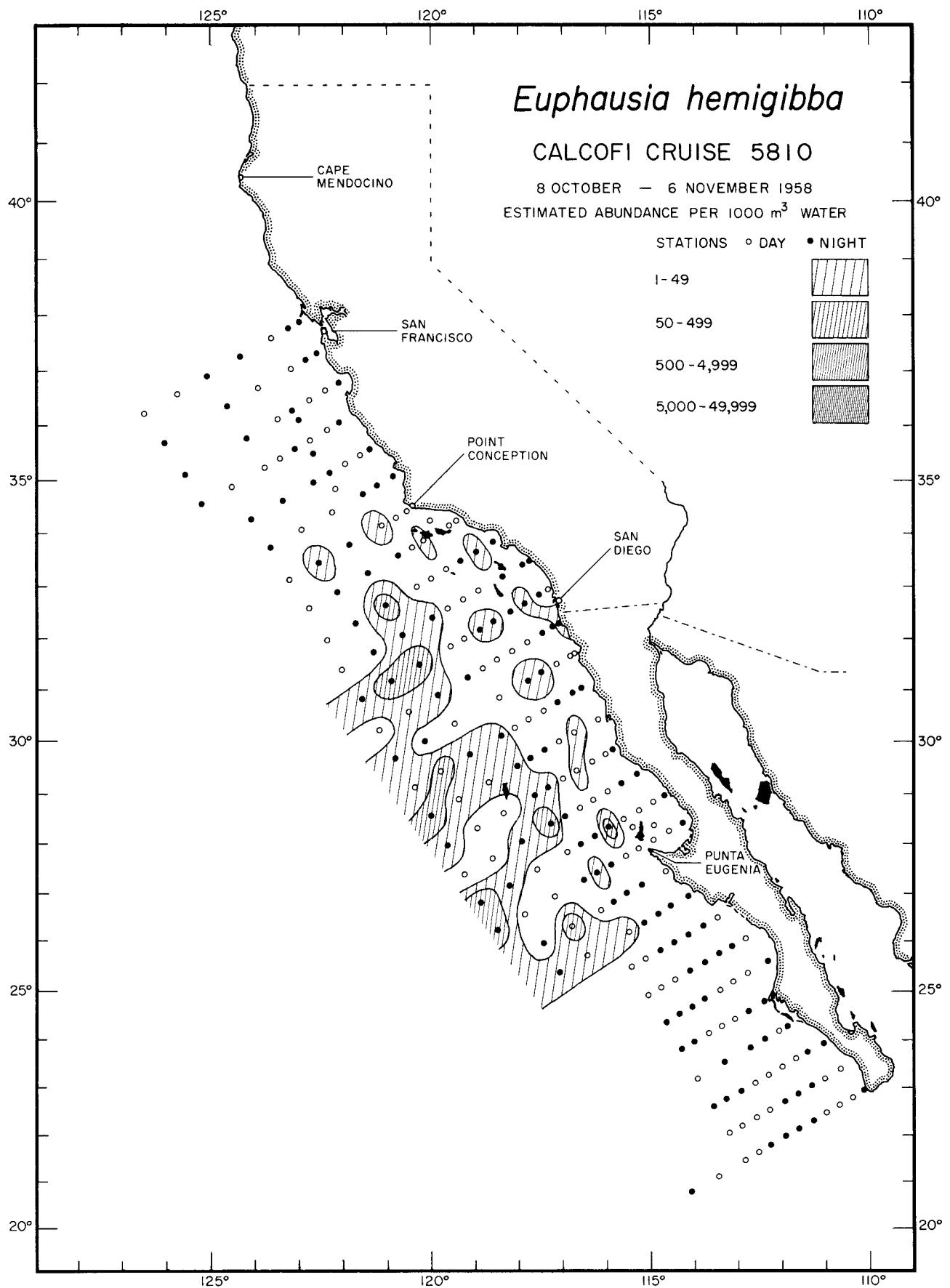
Euphausiacea
Euphausia hemigibba
 5711



Euphausiacea
Euphausia hemigibba
 5804



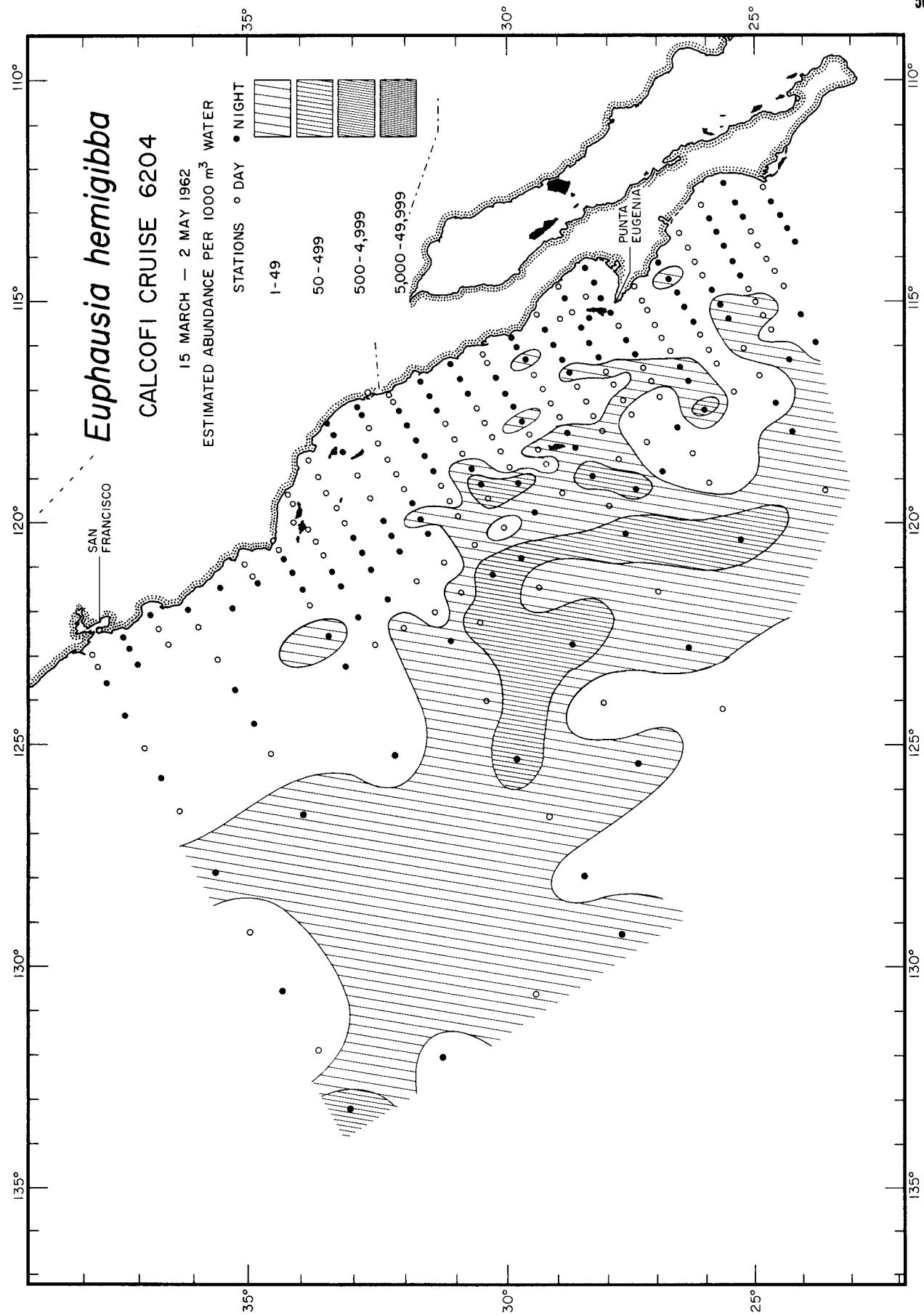
Euphausiacea
Euphausia hemigibba
5807



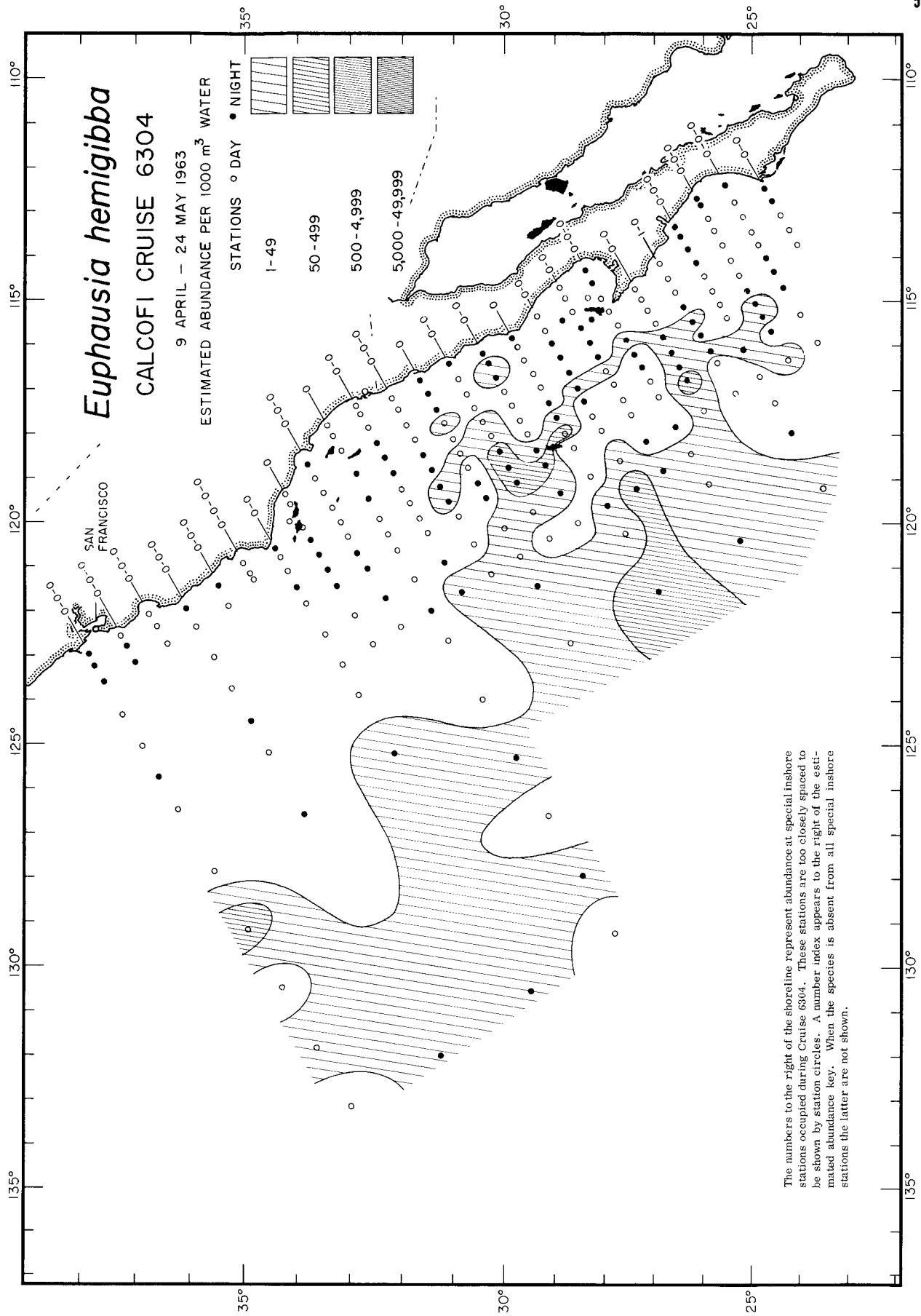
Euphausiacea

Euphausia hemigibba

5810

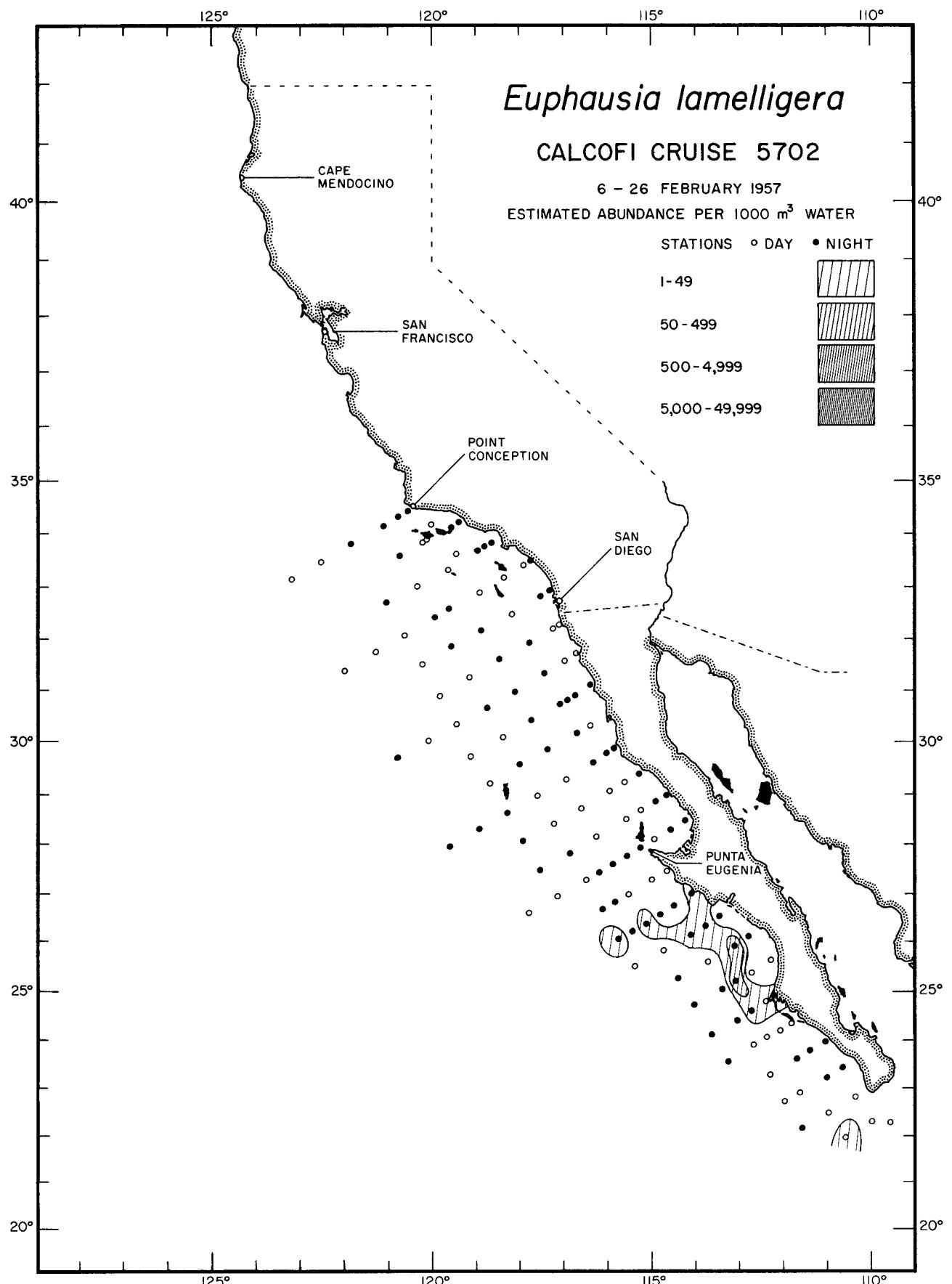


Euphausiacea
Euphausia hemigibba
 6204

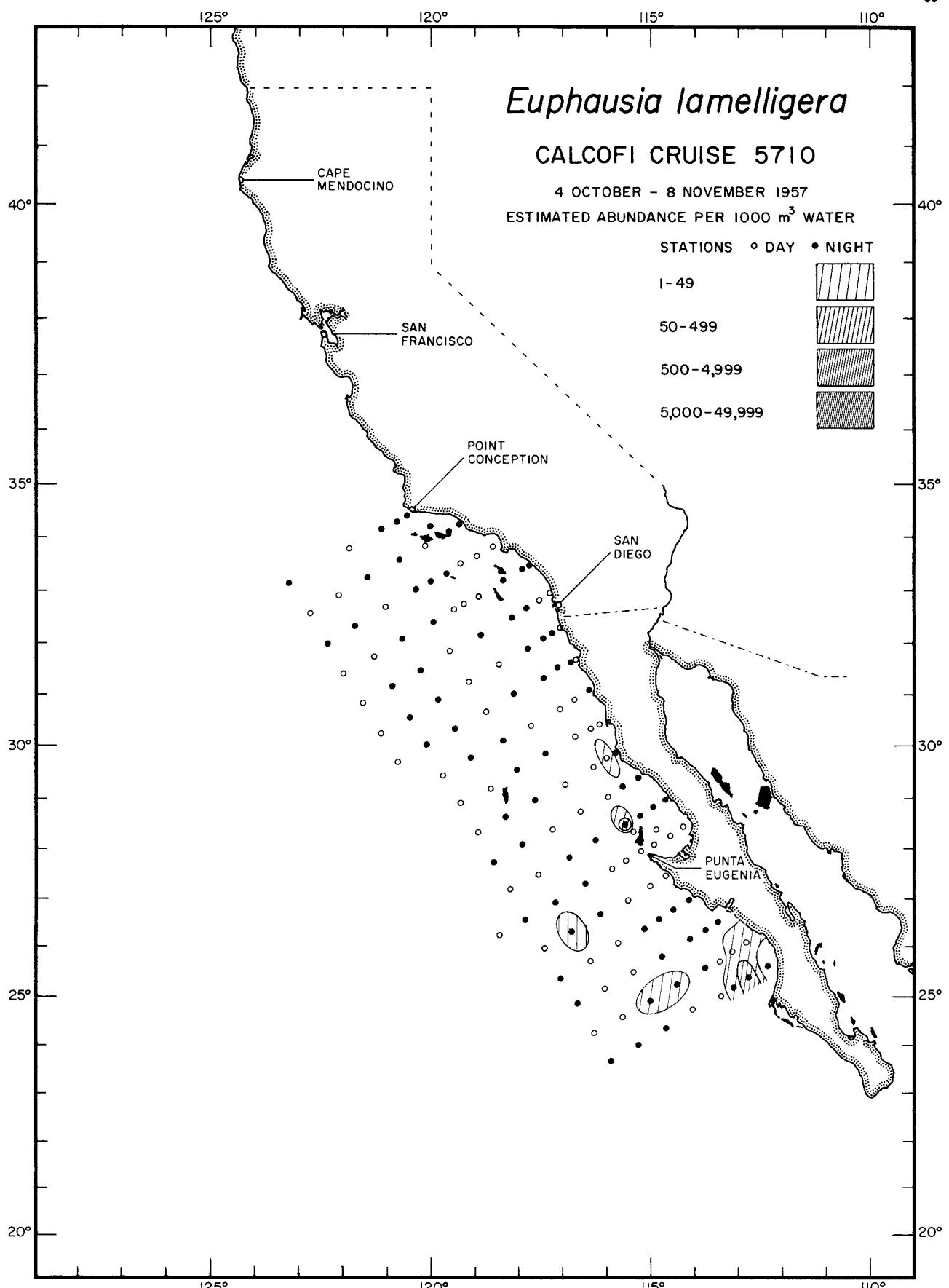


The numbers to the right of the shoreline represent abundance at special instore stations occupied during Cruise 6304. These stations are too closely spaced to be shown by station circles. A number index appears to the right of the estimated abundance key. When the species is absent from all special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

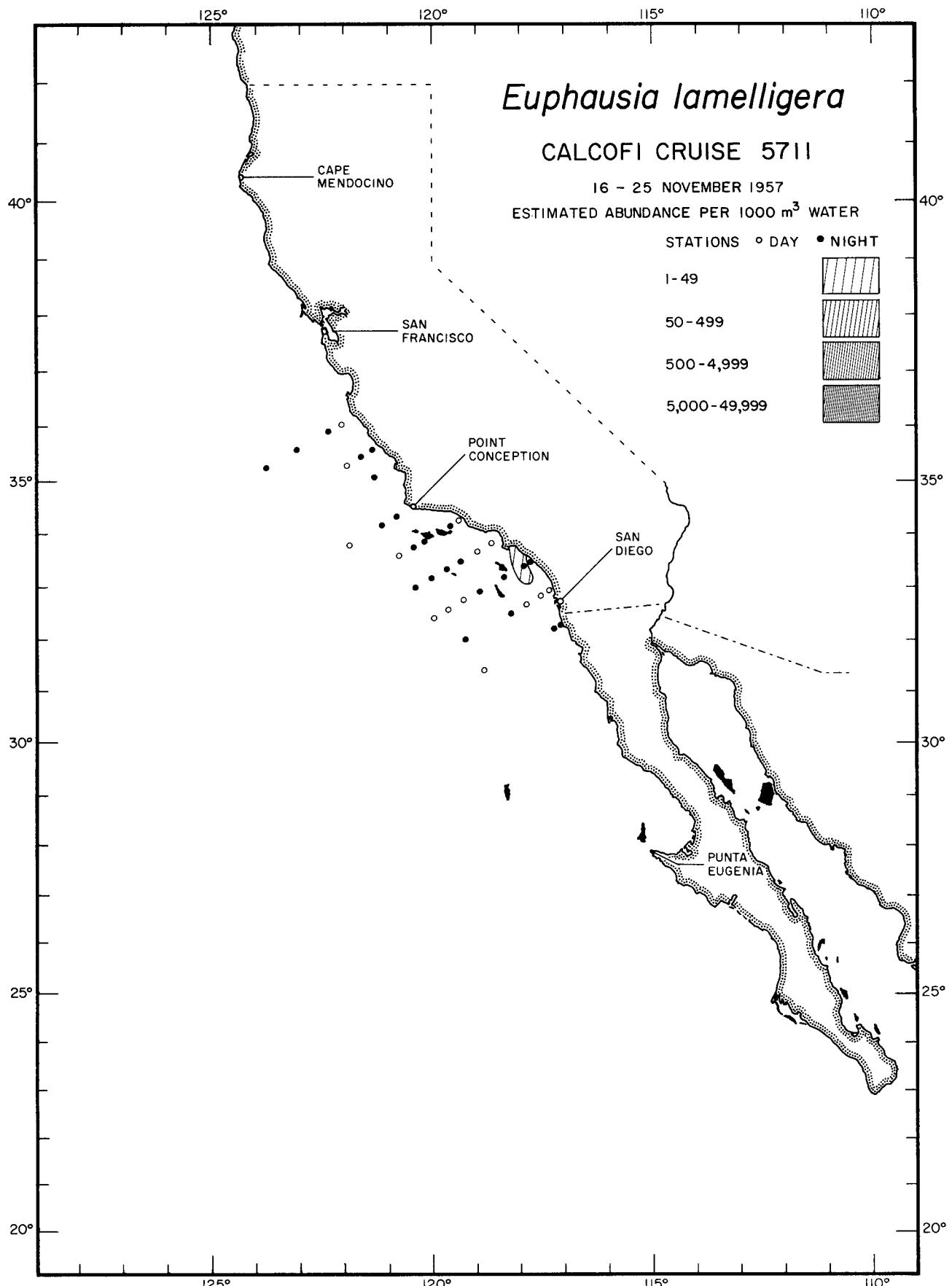
Euphausiacea
Euphausia hemigibba
6304



Euphausiacea
Euphausia lamelligera
5702



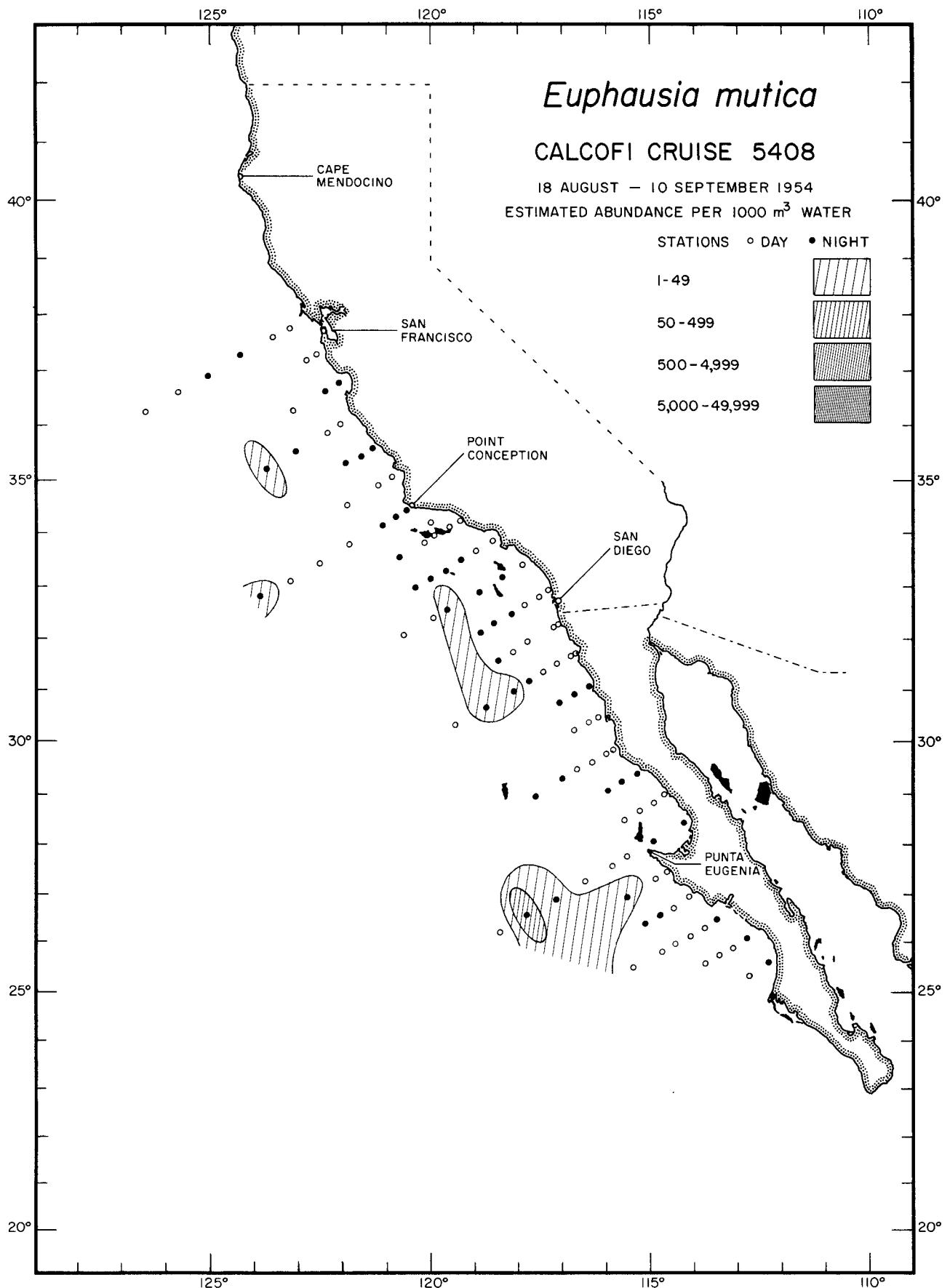
Euphausiacea
Euphausia lamelligera
 5710



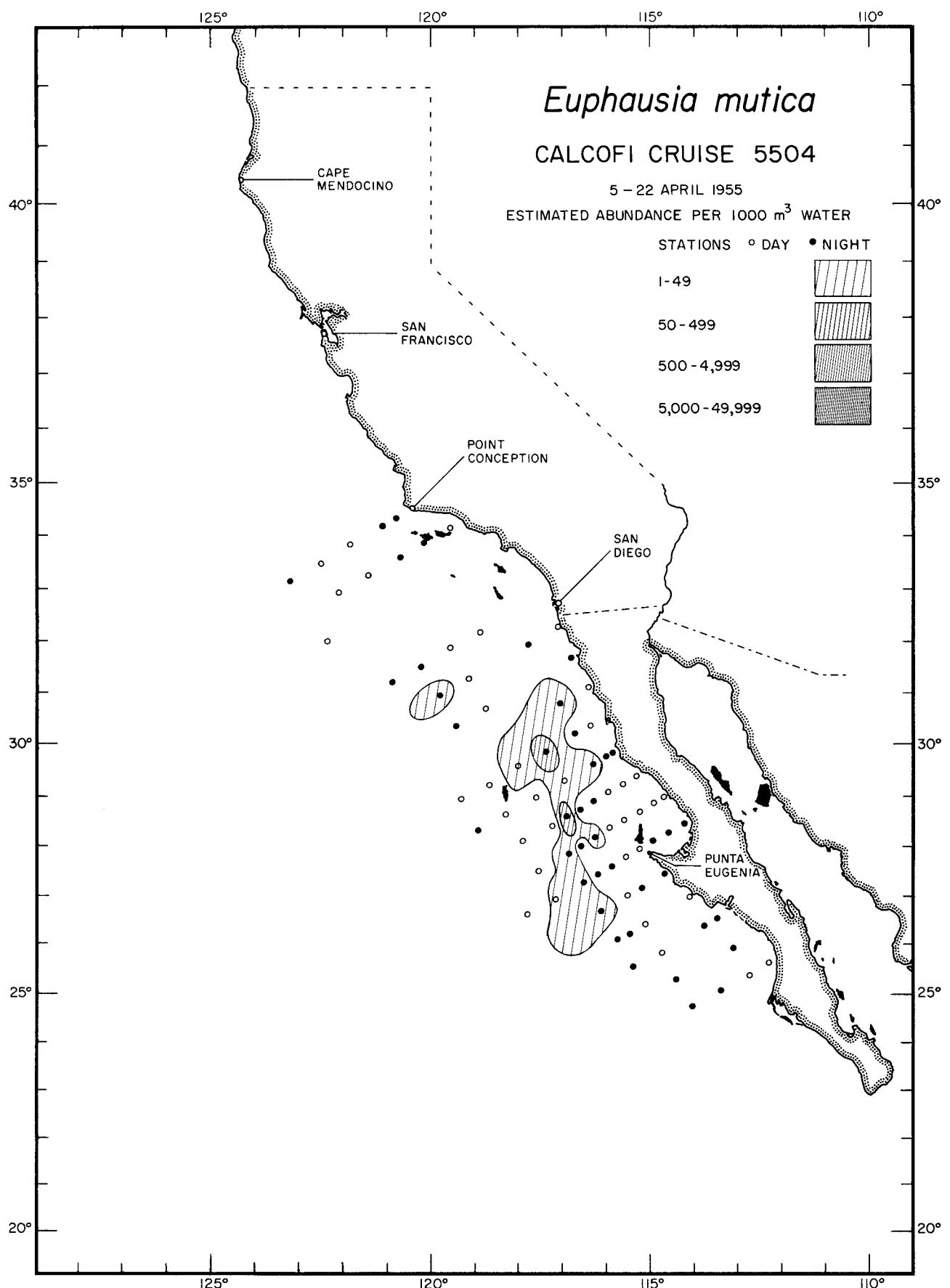
Euphausiacea

Euphausia lamelligera

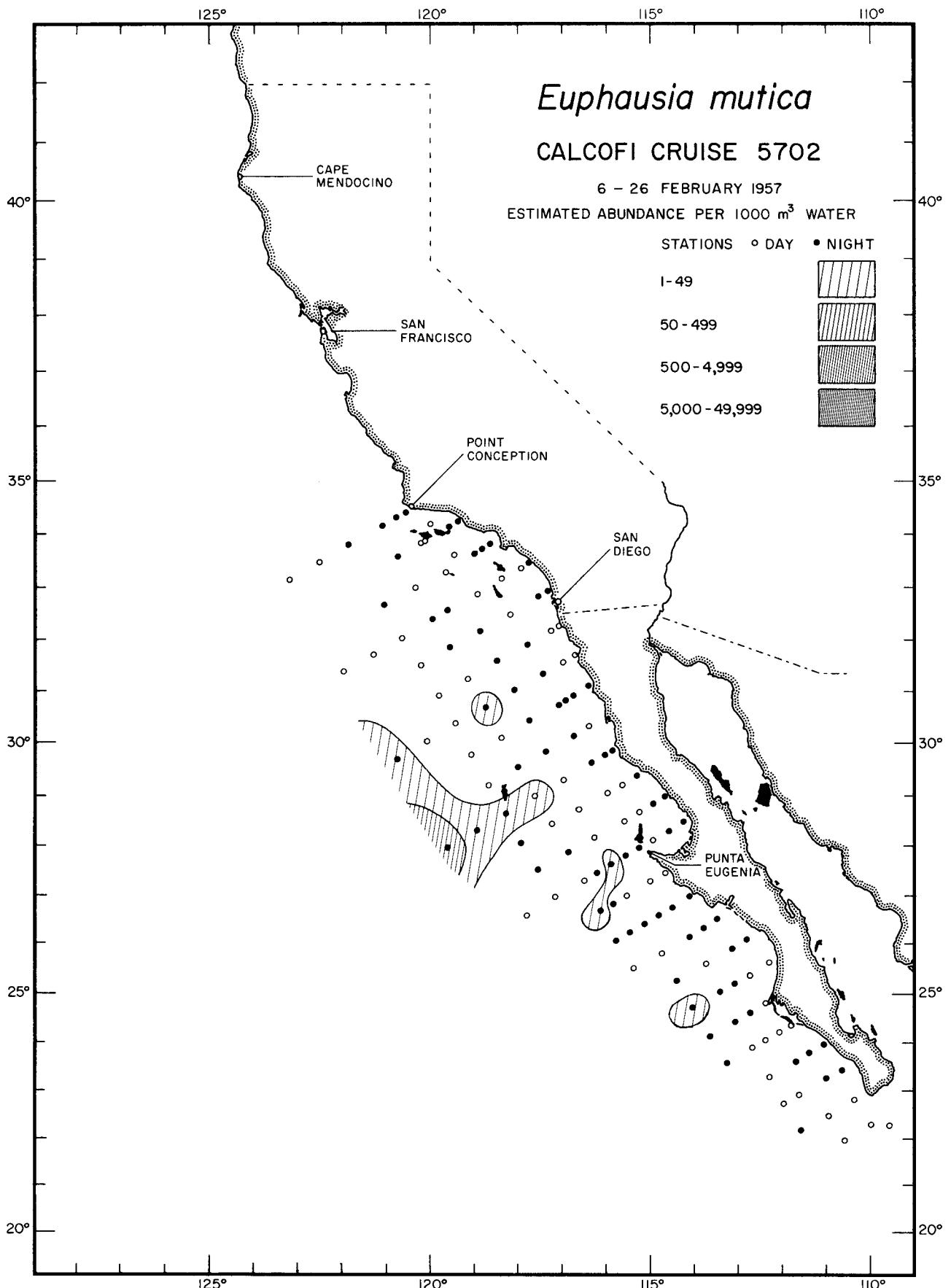
5711



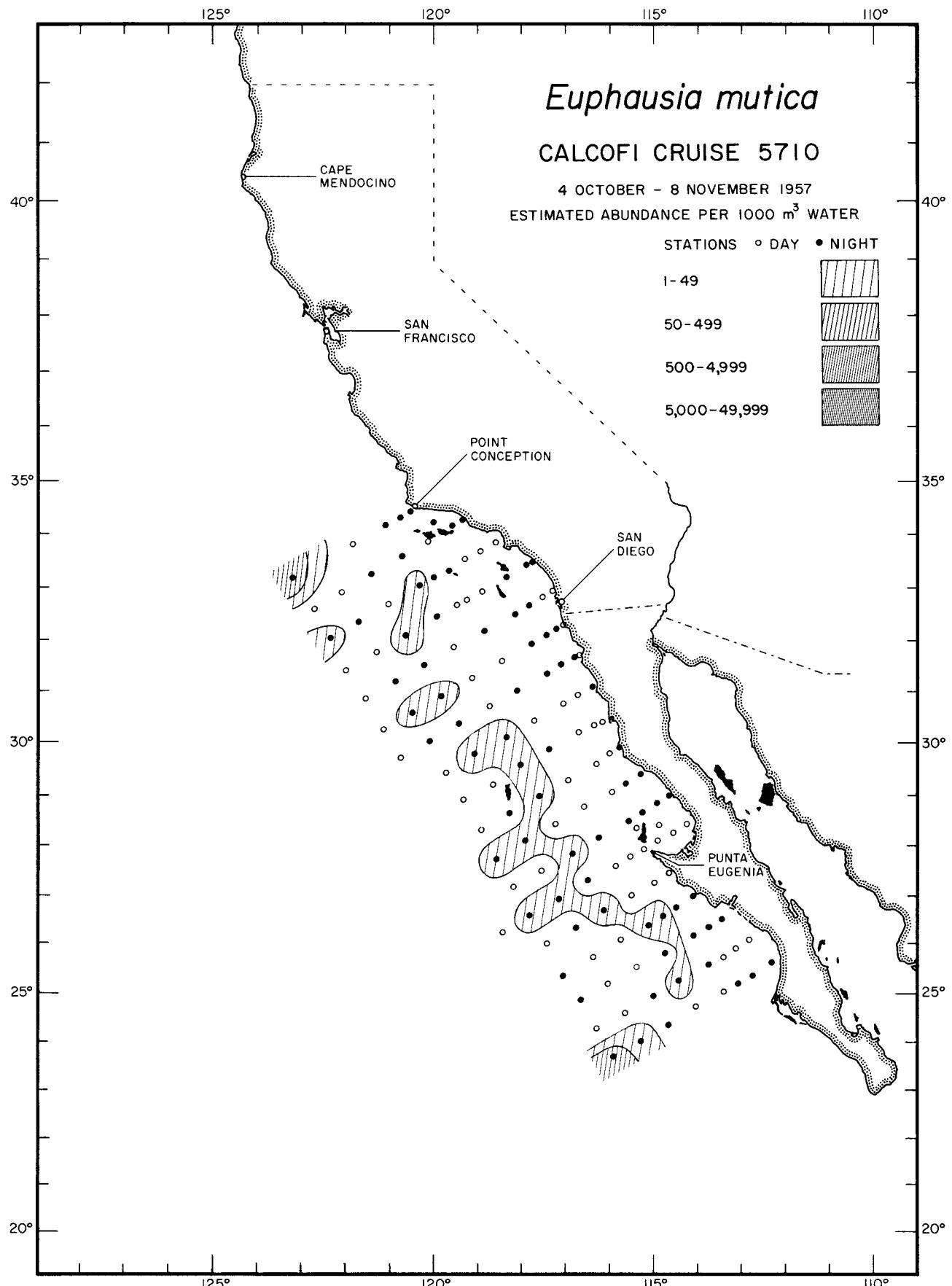
Euphausiacea
Euphausia mutica
 5408



Euphausiacea
Euphausia mutica
5504

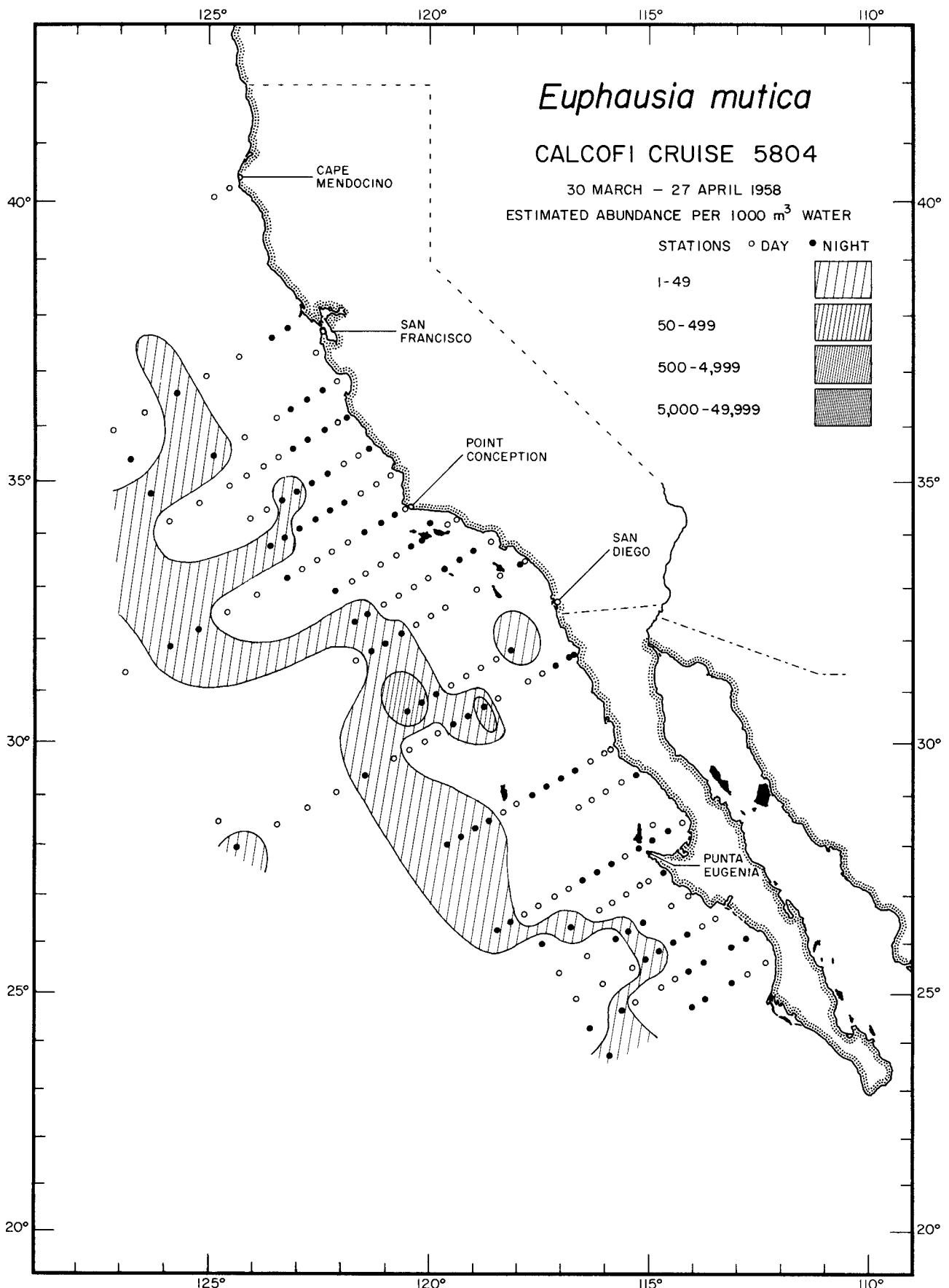


Euphausiacea
Euphausia mutica
5702

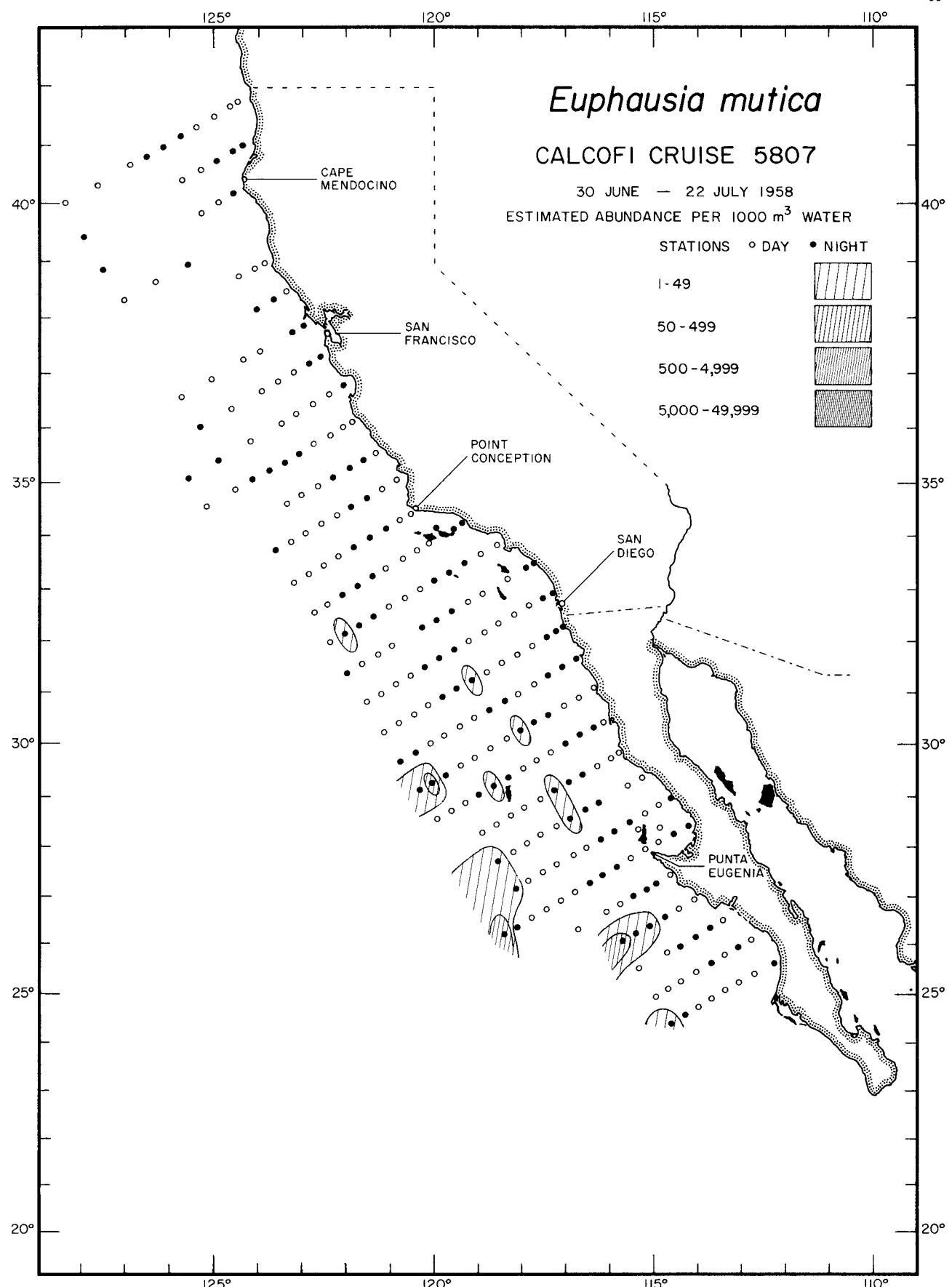


Euphausiacea
Euphausia mutica

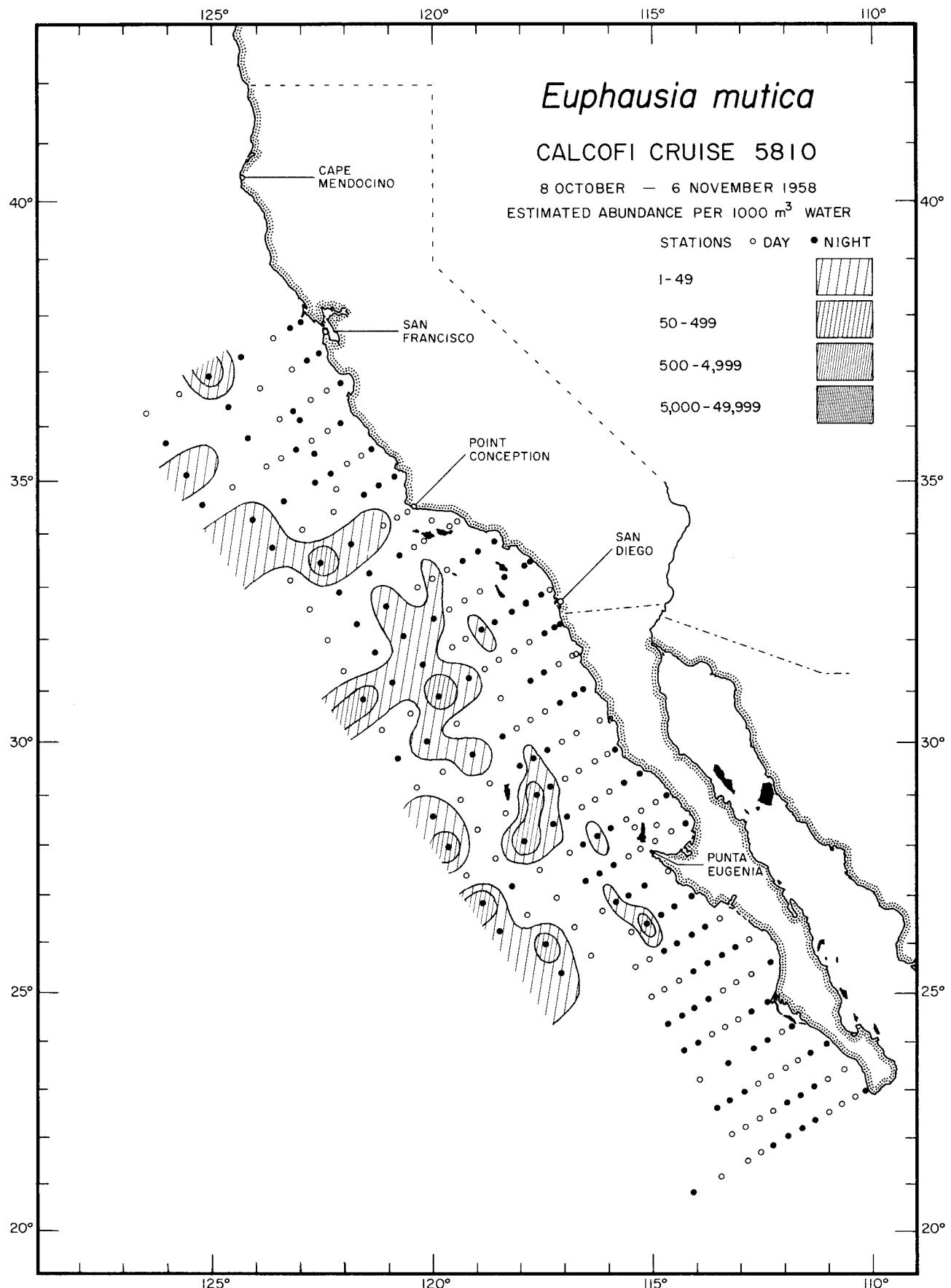
5710



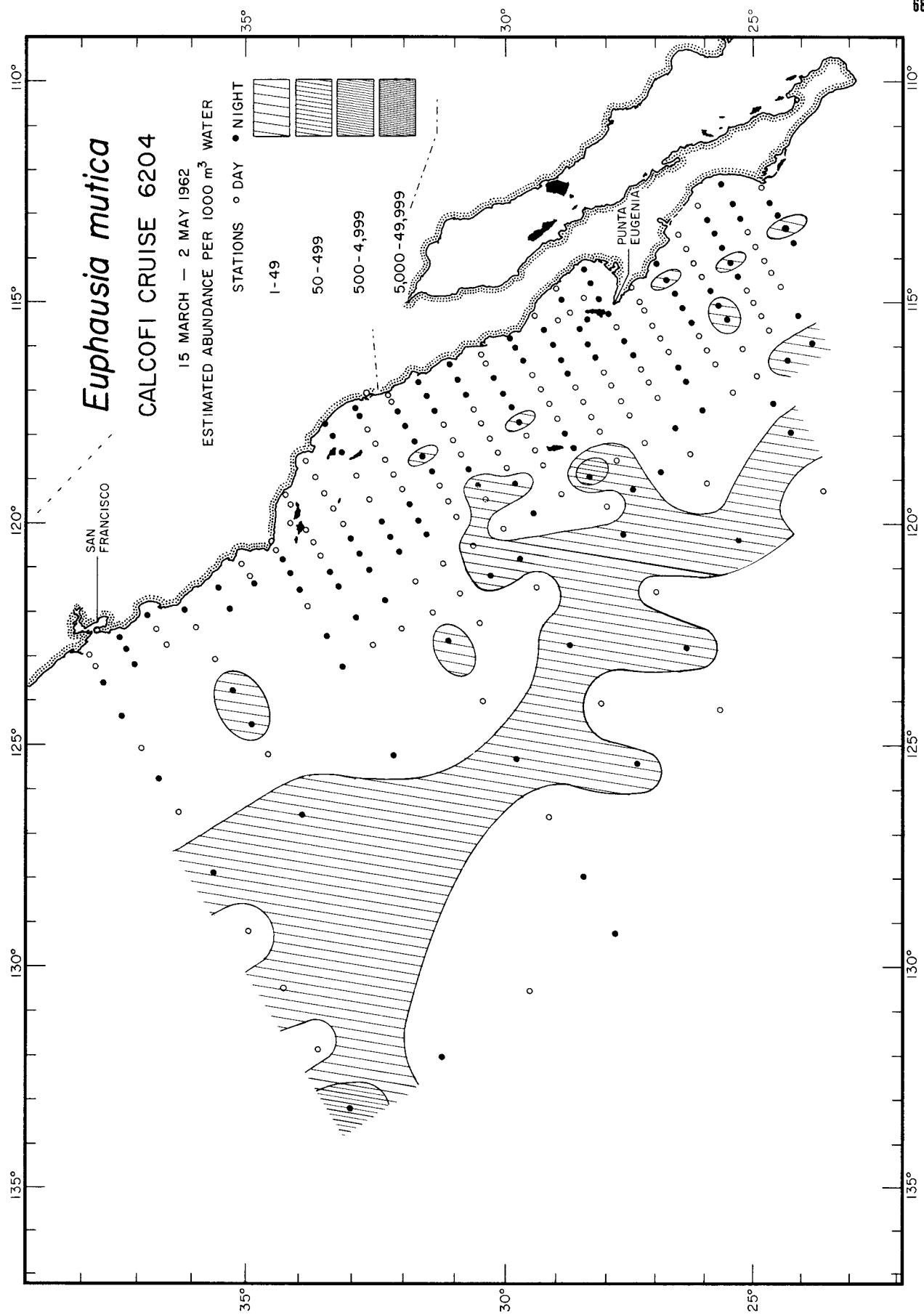
Euphausiacea
Euphausia mutica
5804



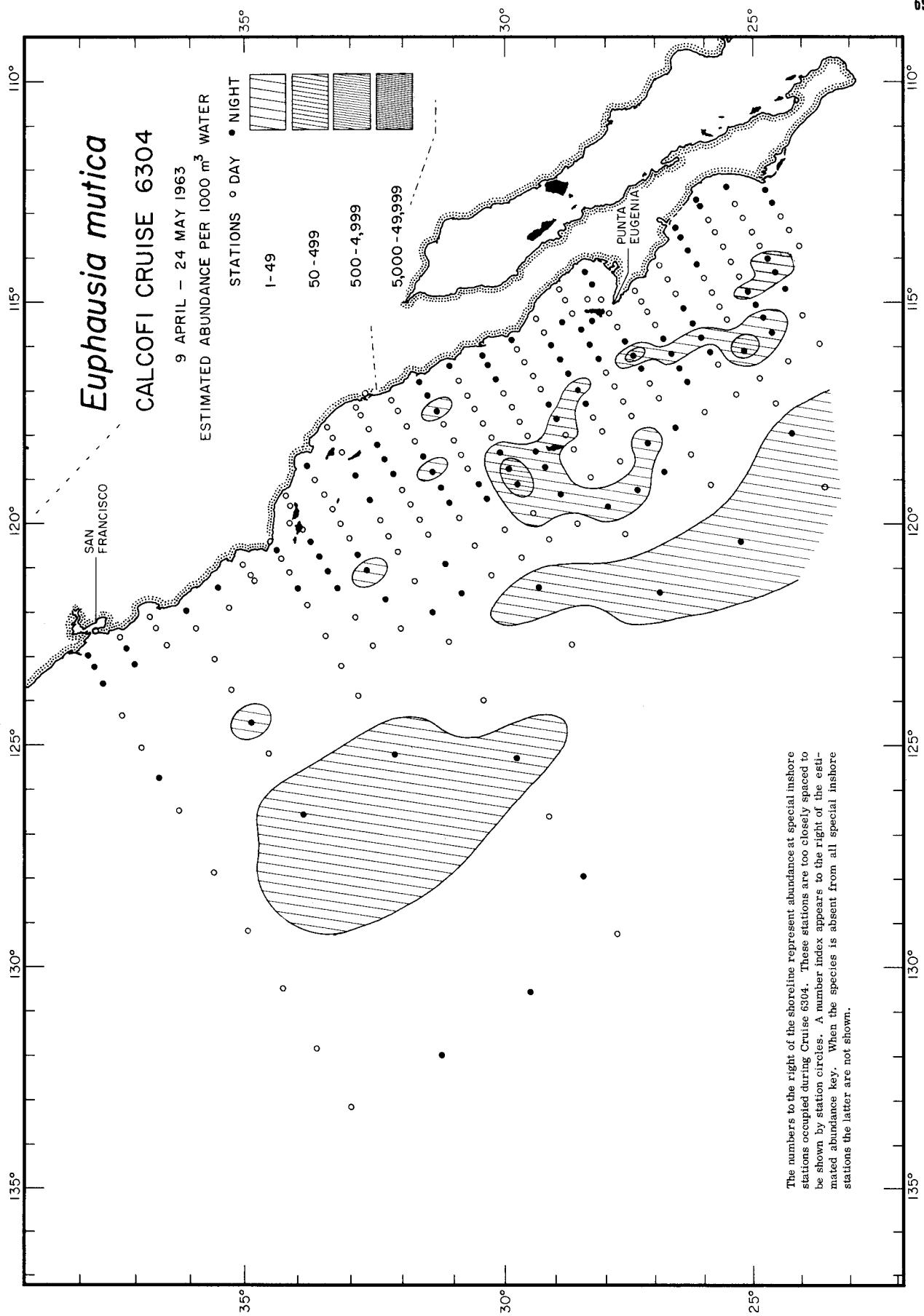
Euphausiacea
Euphausia mutica
5807



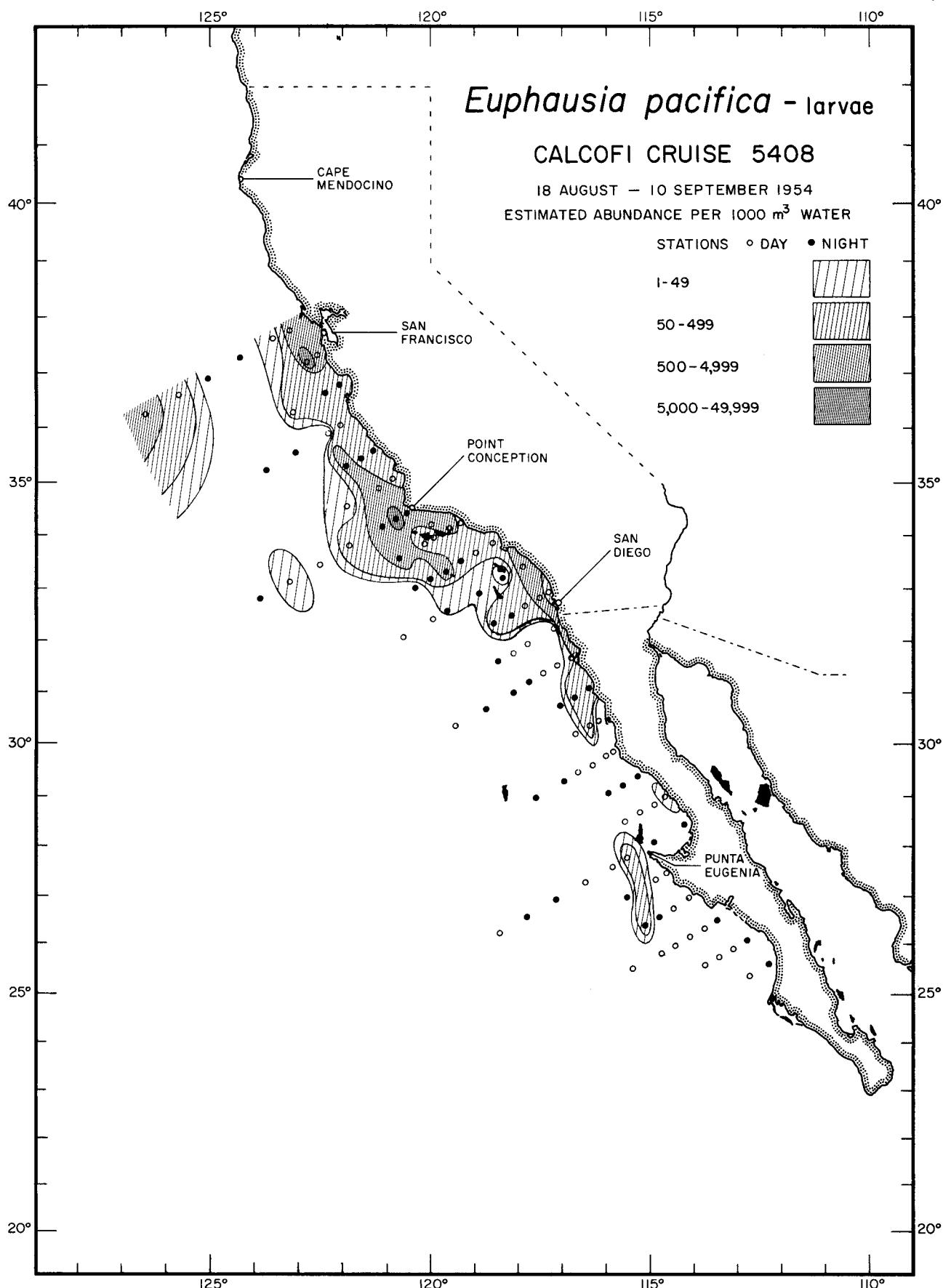
Euphausiacea
Euphausia mutica
5810



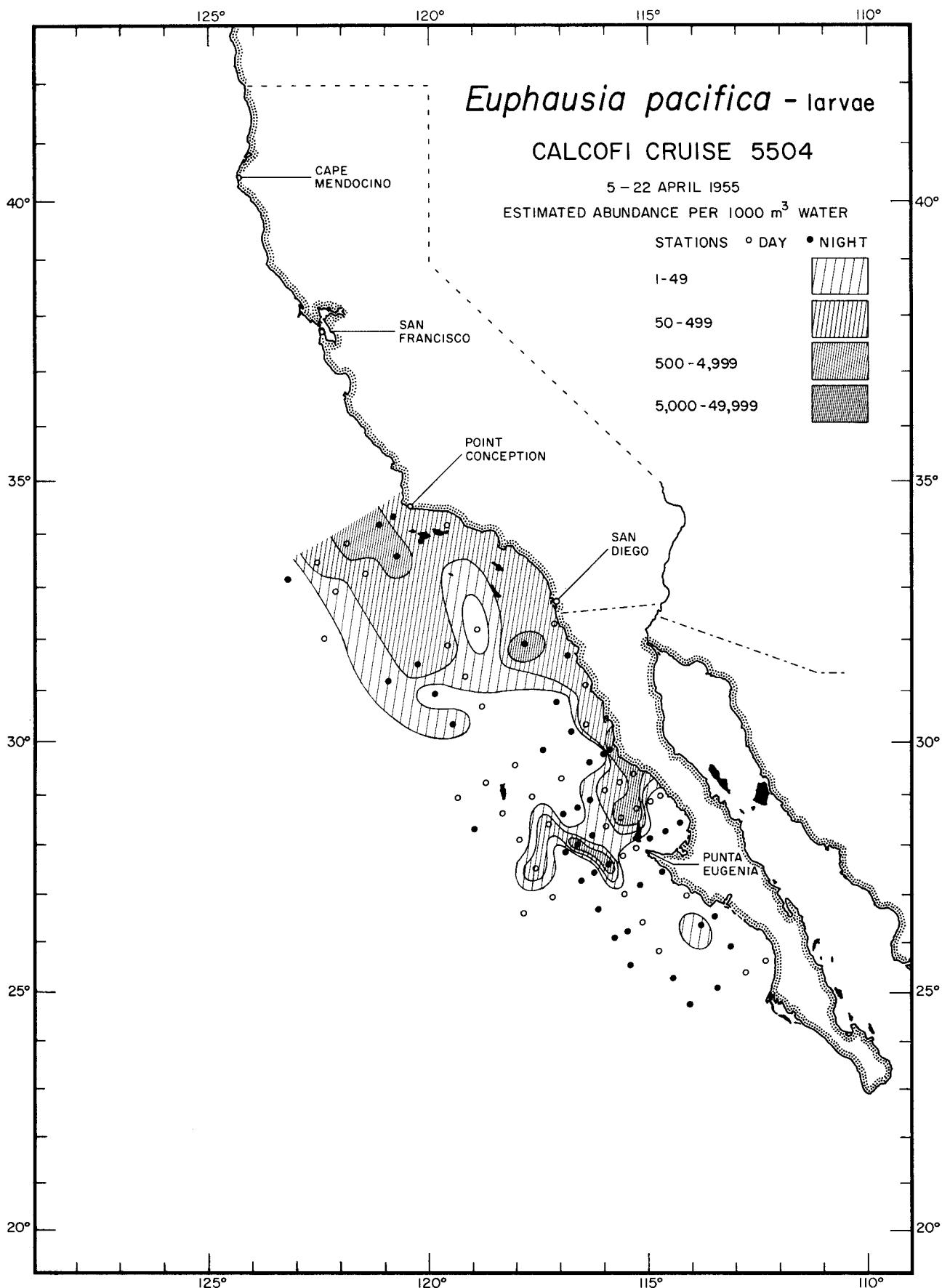
Euphausiacea
Euphausia mutica
6204



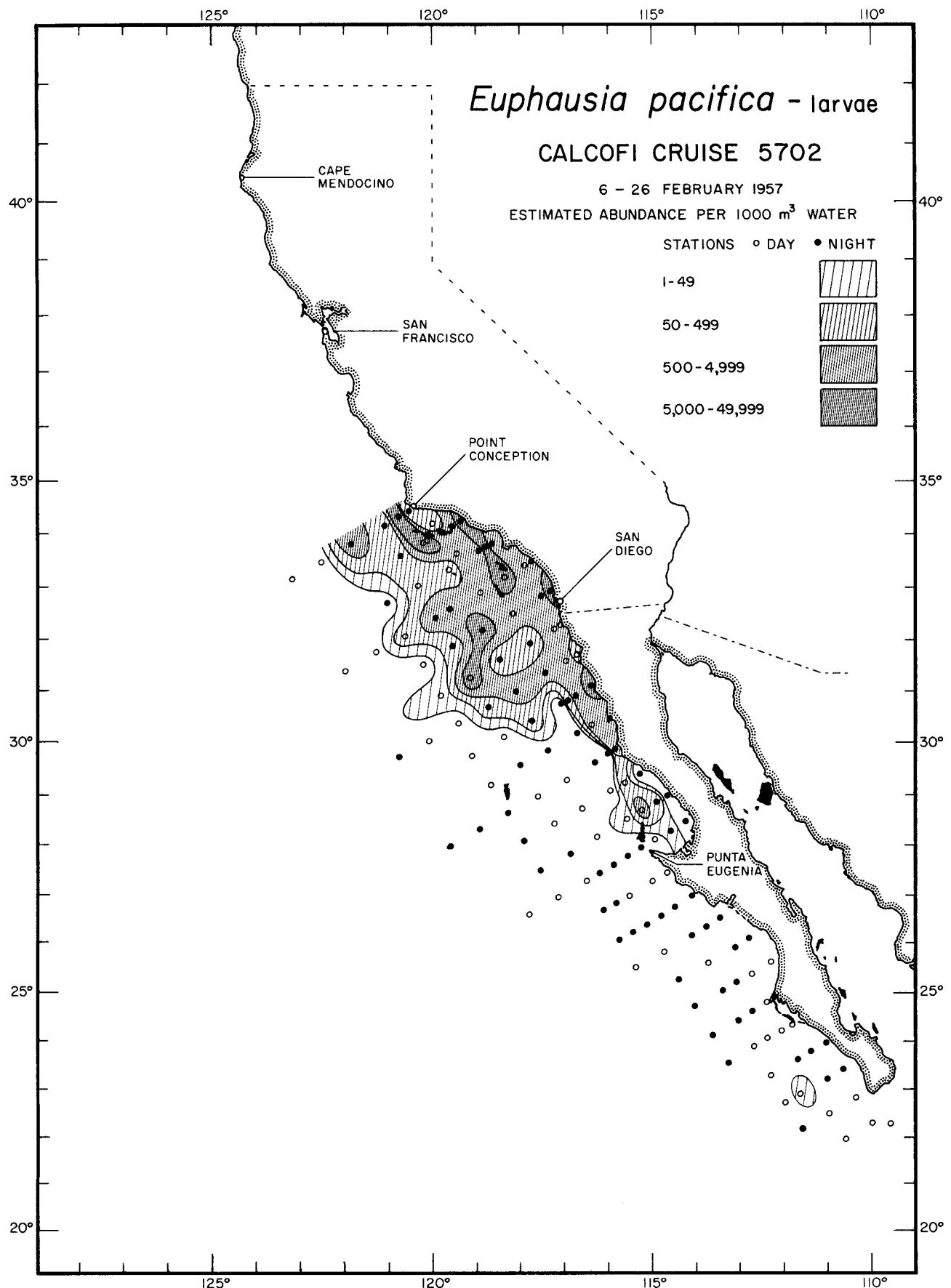
Euphausiacea
Euphausia mutica
6304



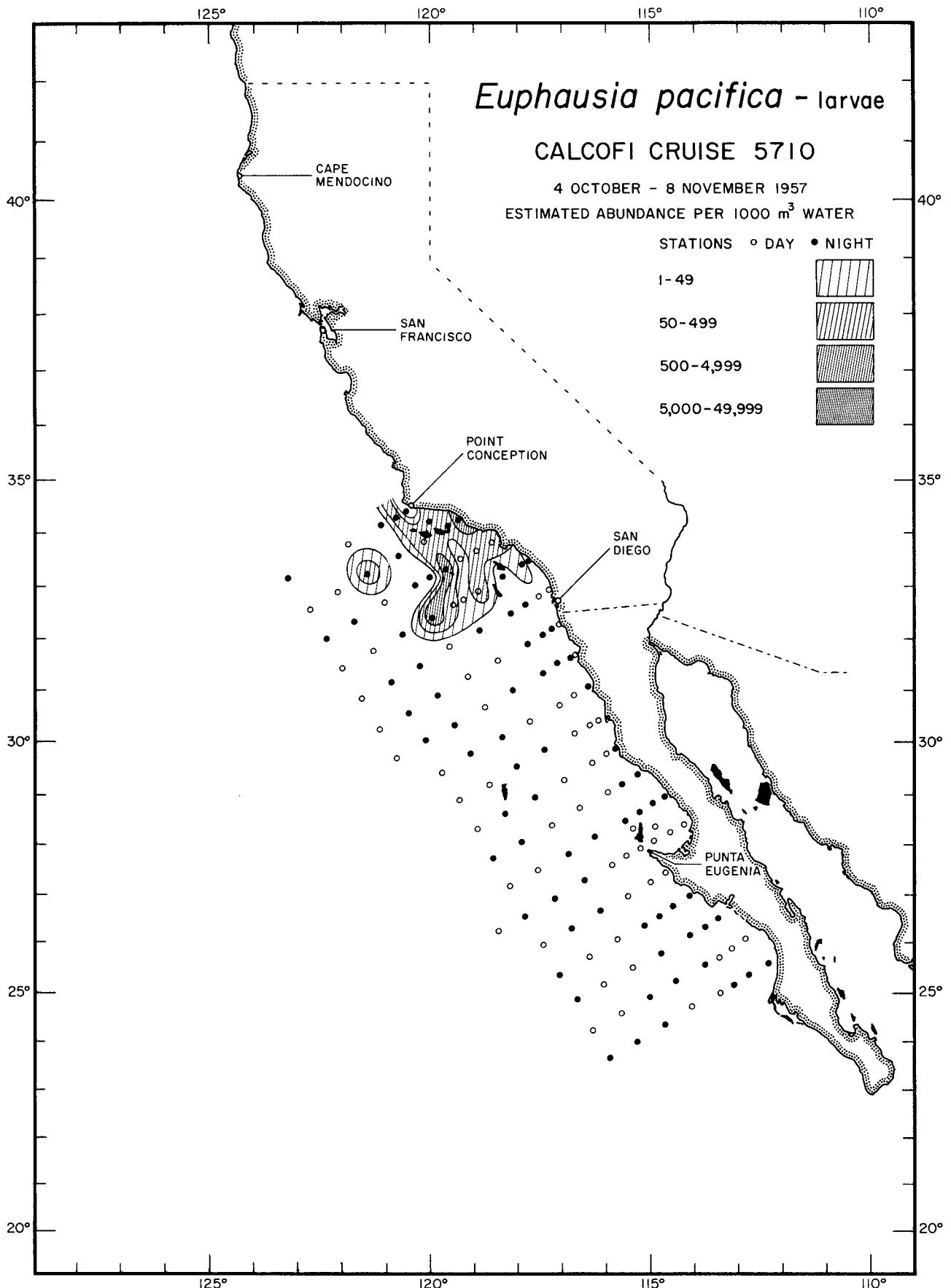
Euphausiacea
Euphausia pacifica - larvae
5408



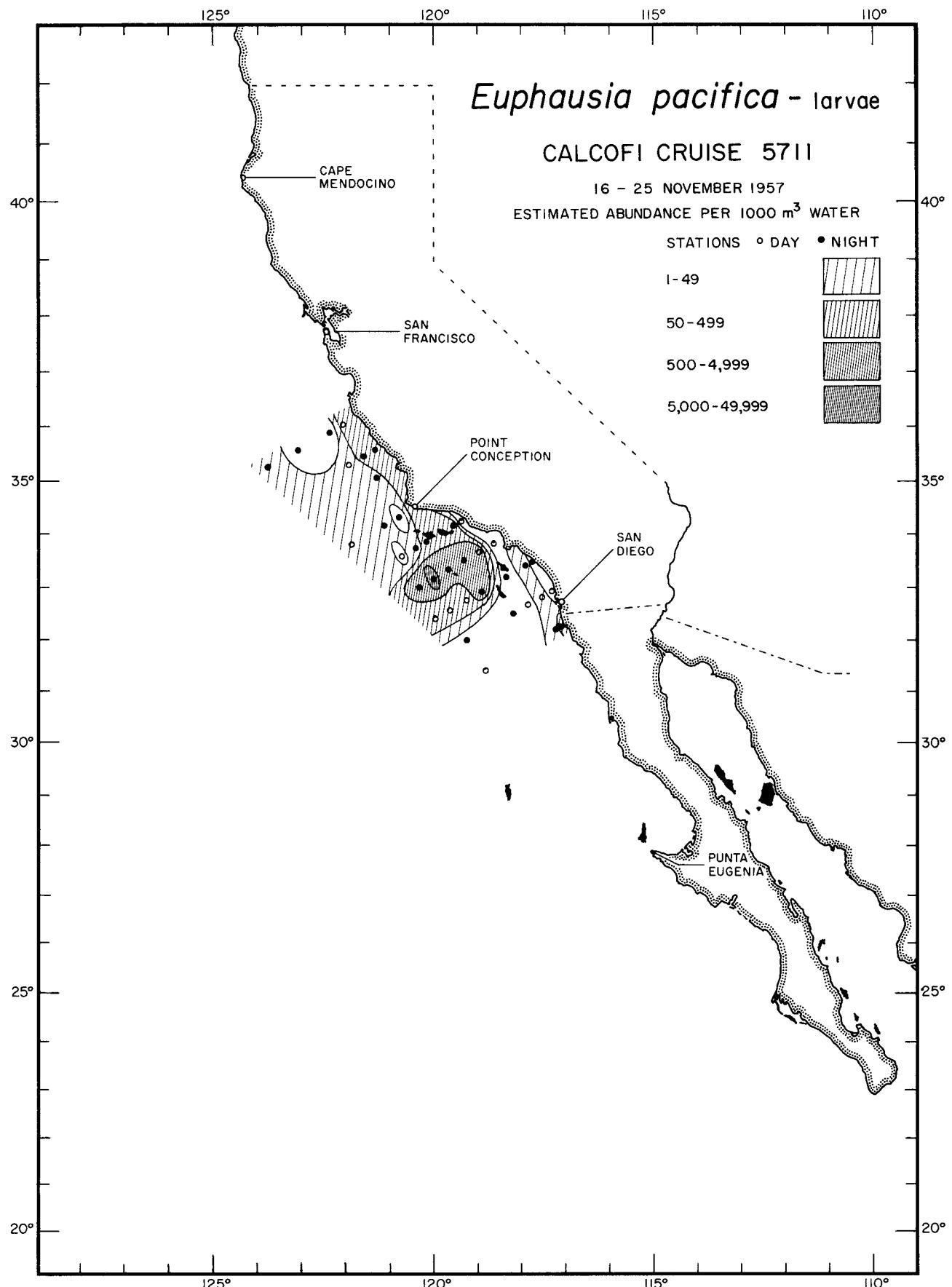
Euphausiacea
Euphausia pacifica - larvae
5504



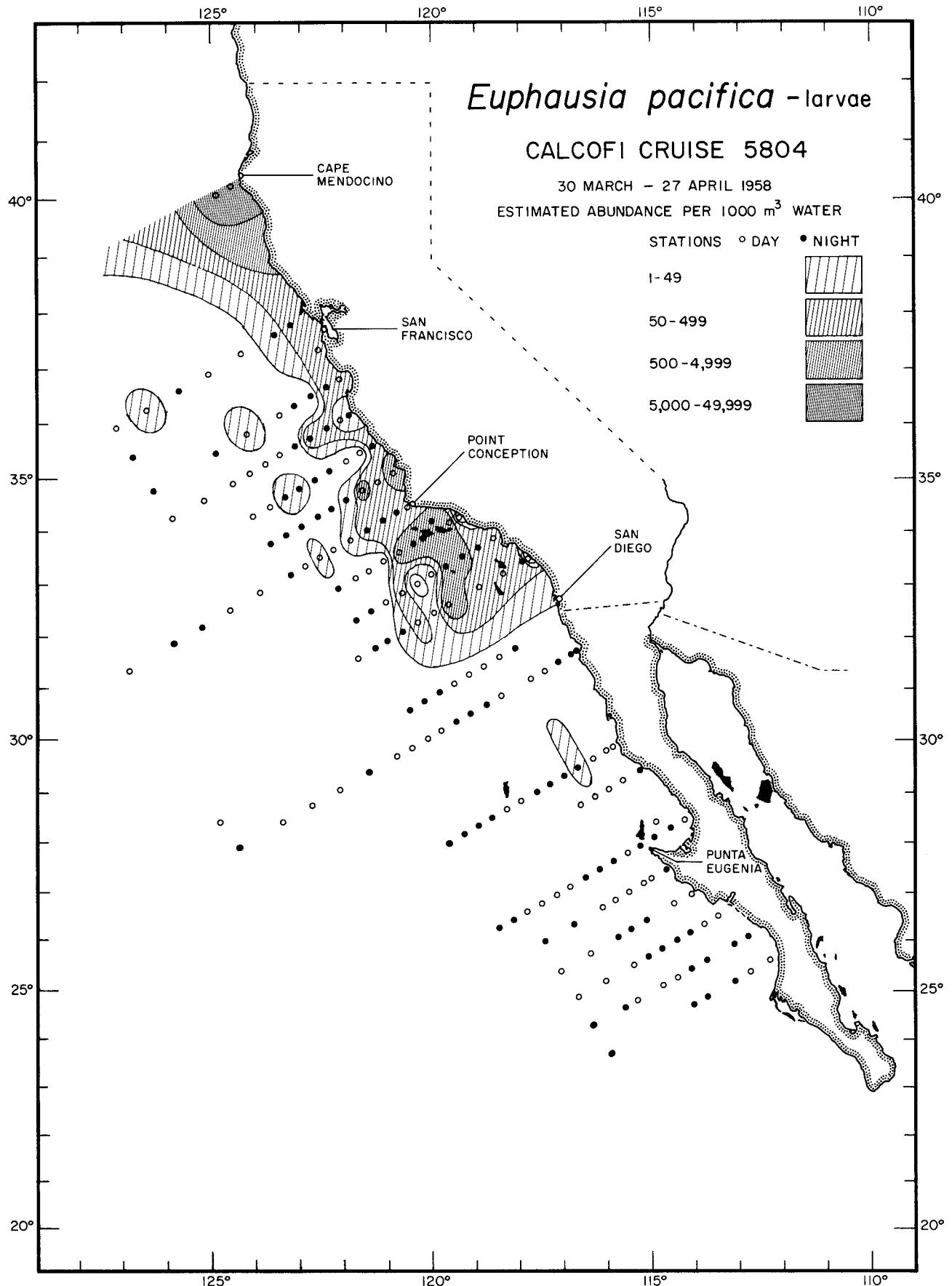
Euphausiacea
Euphausia pacifica - larvae
5702



Euphausiacea
Euphausia pacifica - larvae
5710

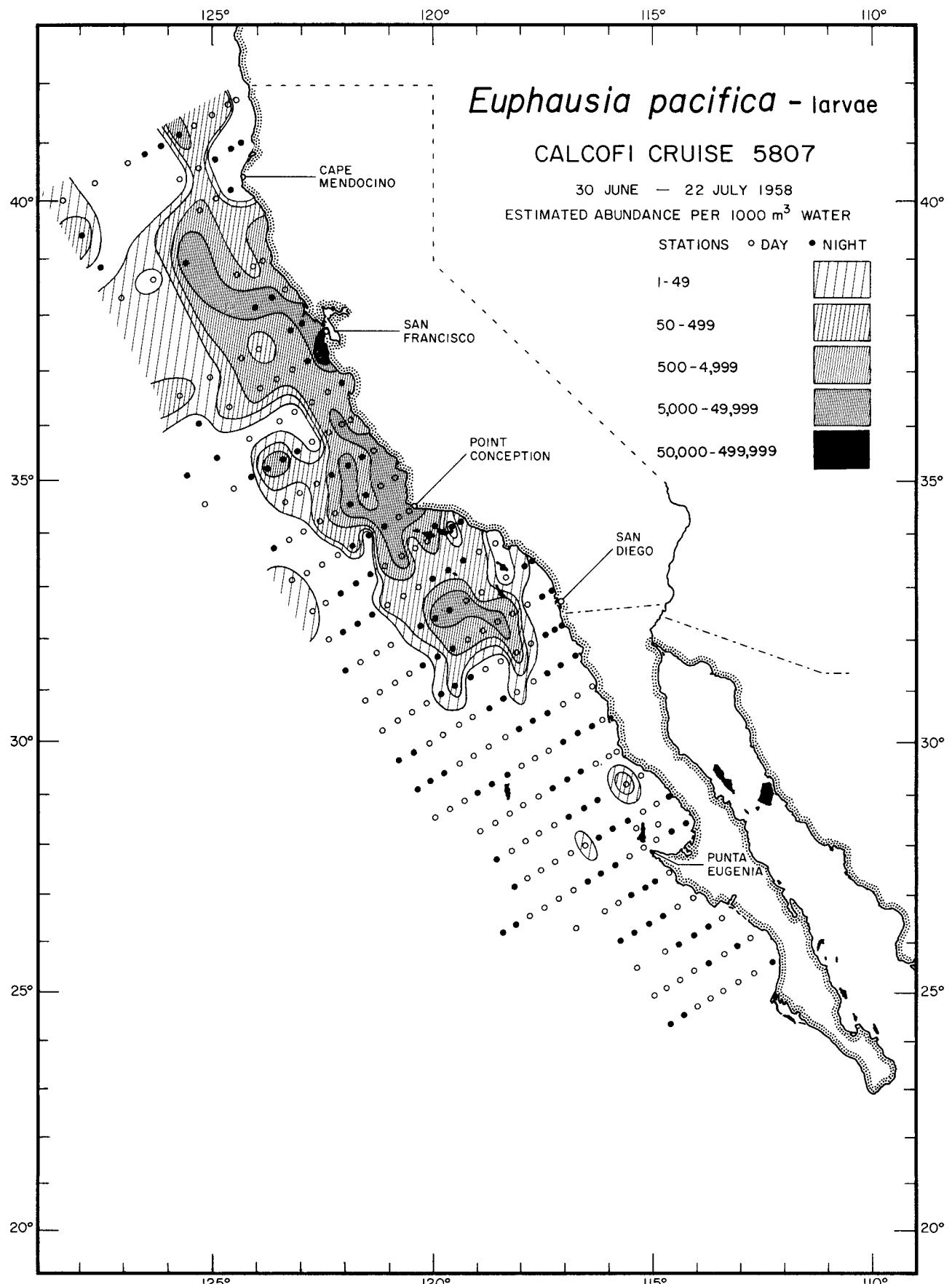


Euphausiacea
Euphausia pacifica - larvae
 5711



Euphausiacea
Euphausia pacifica - larvae

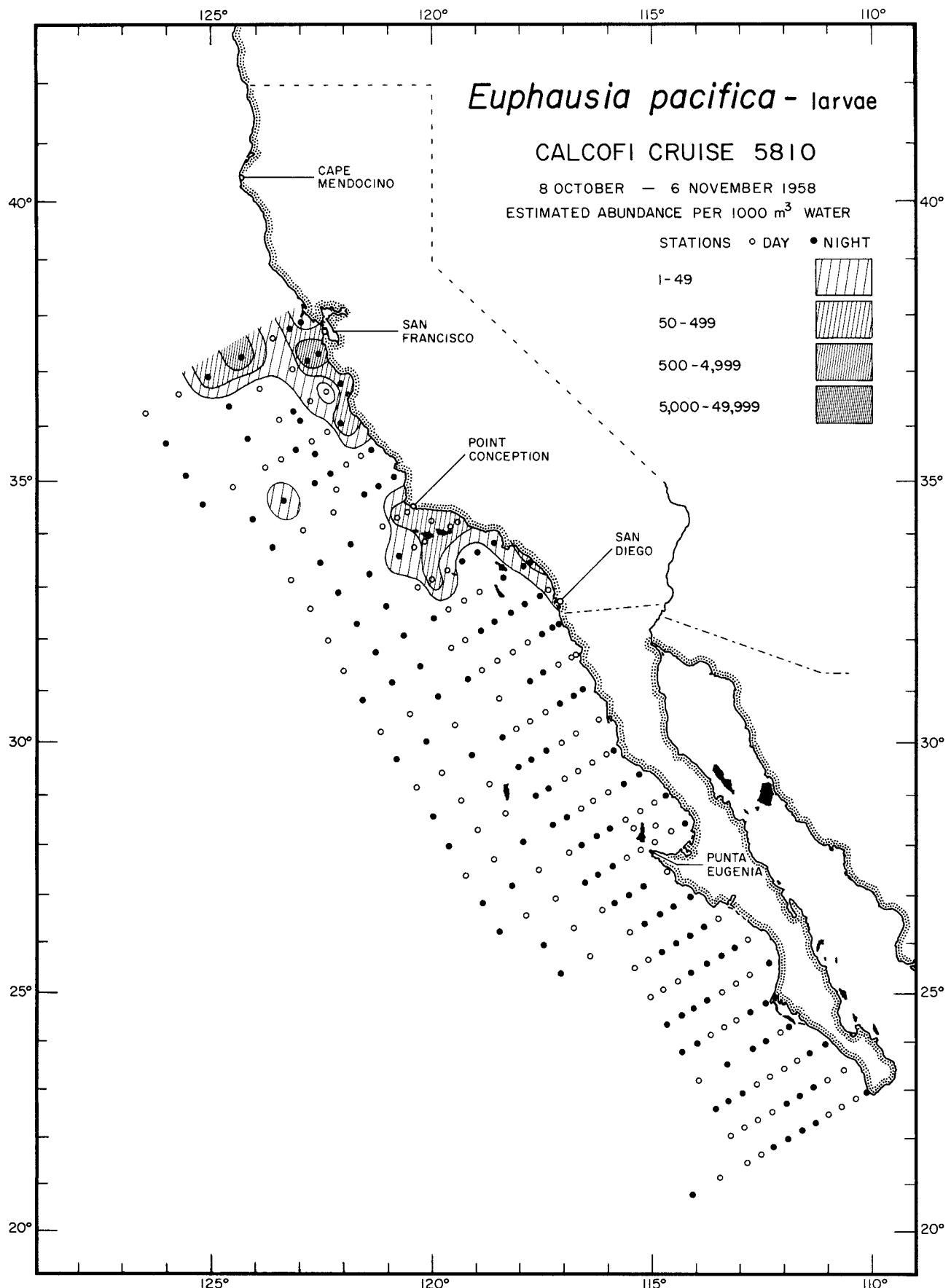
5804



Euphausiacea

Euphausia pacifica - larvae

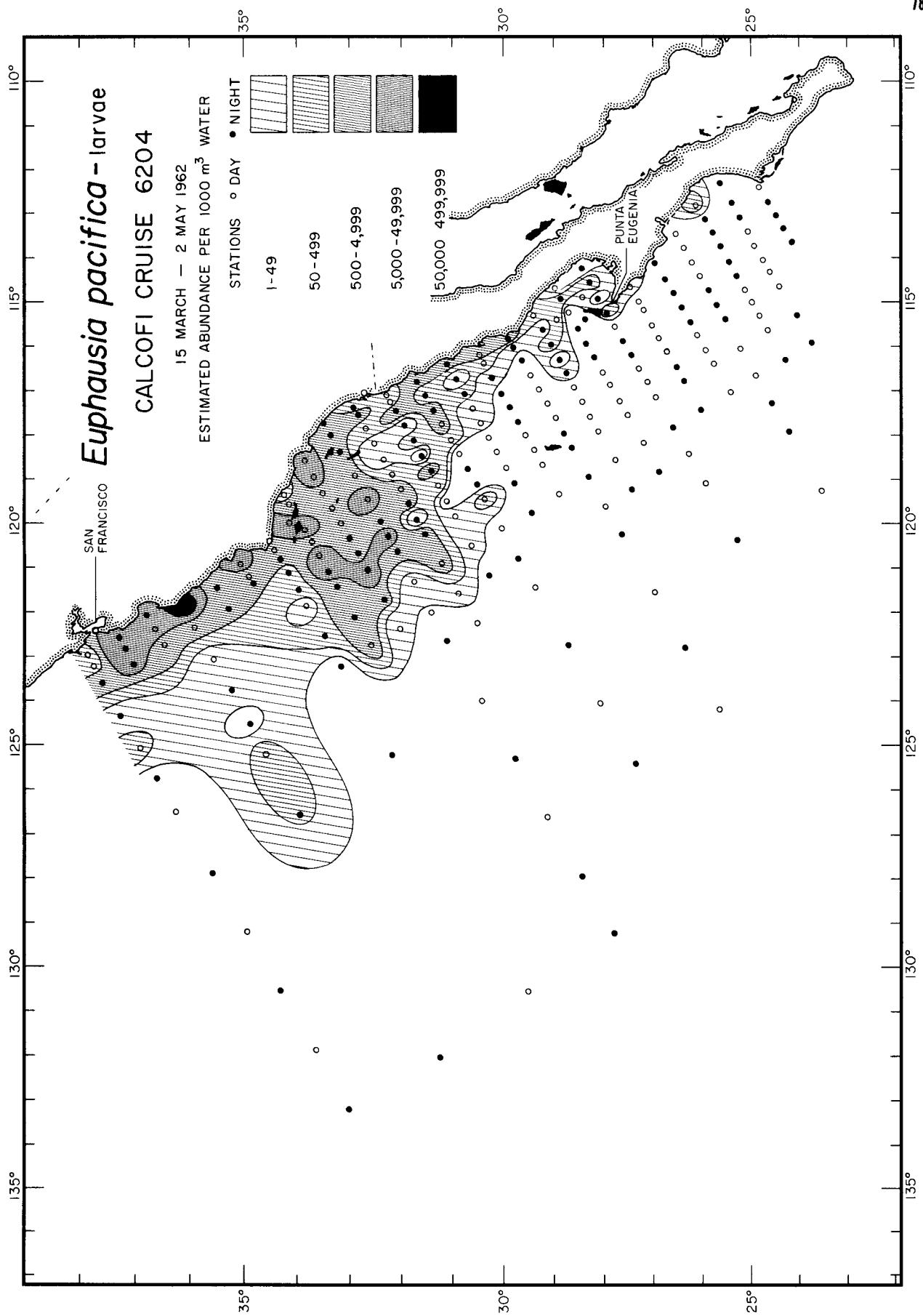
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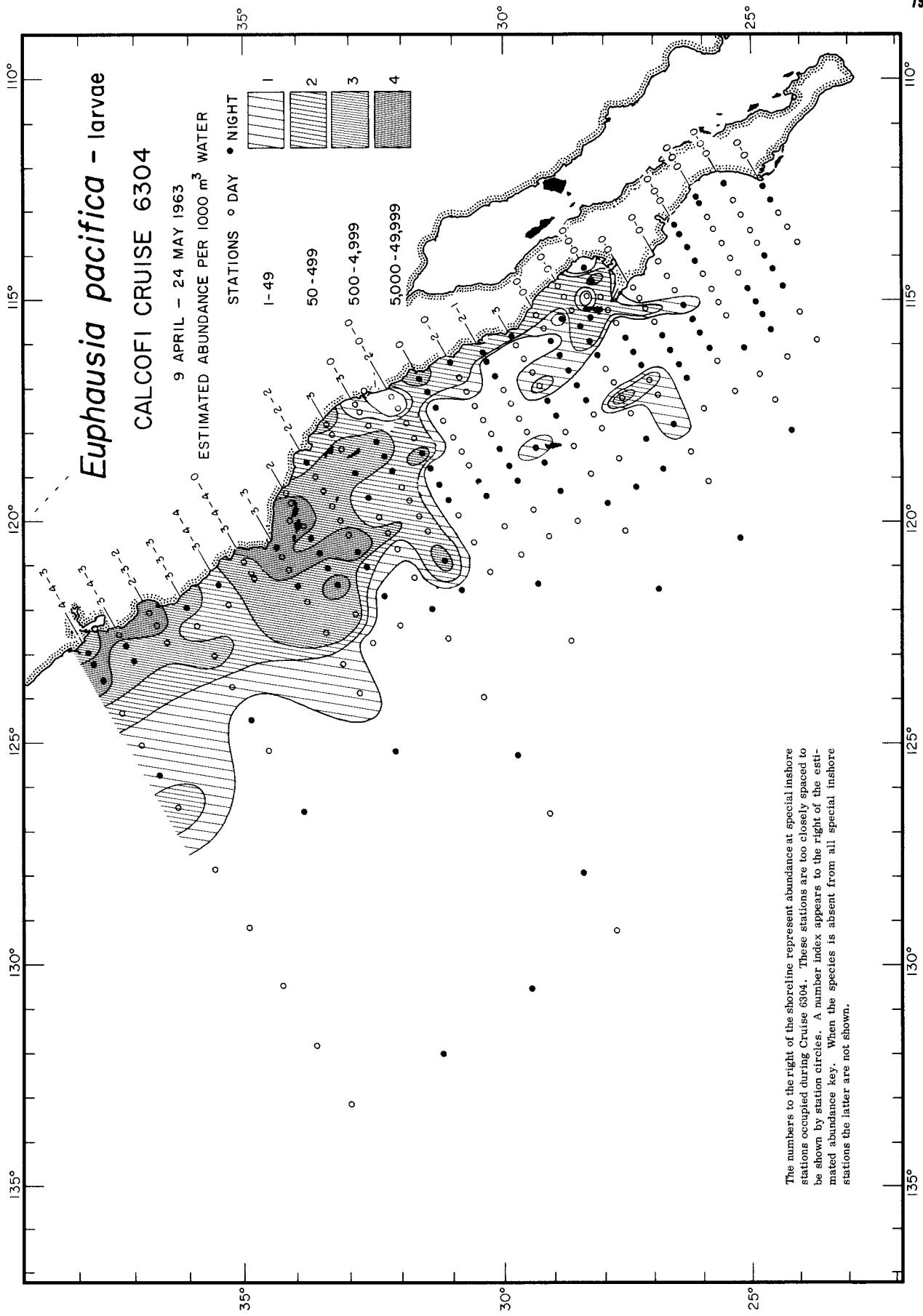
Euphausiacea

Euphausia pacifica - larvae

5810

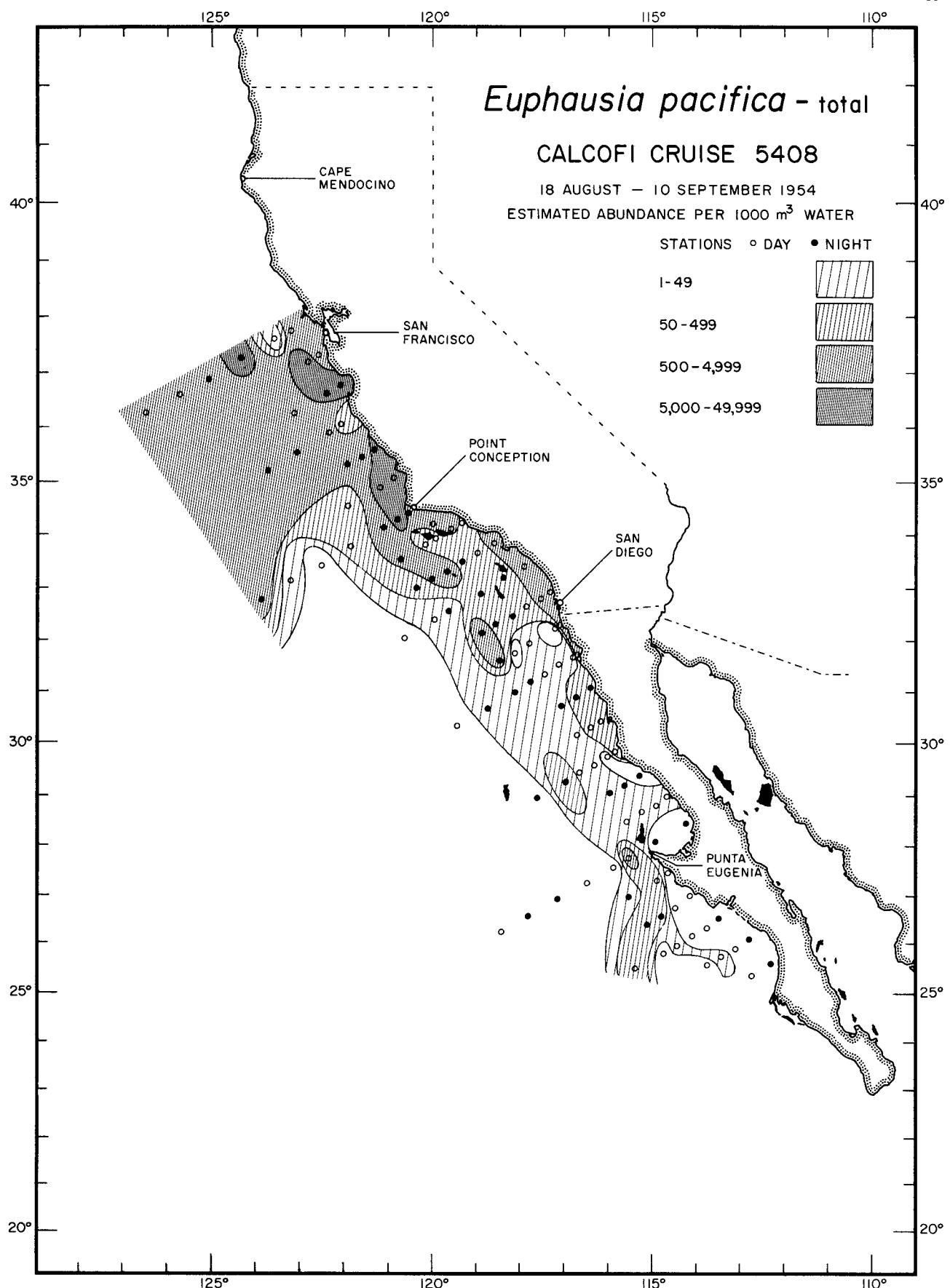


Euphausiacea
Euphausia pacifica - larvae
 6204

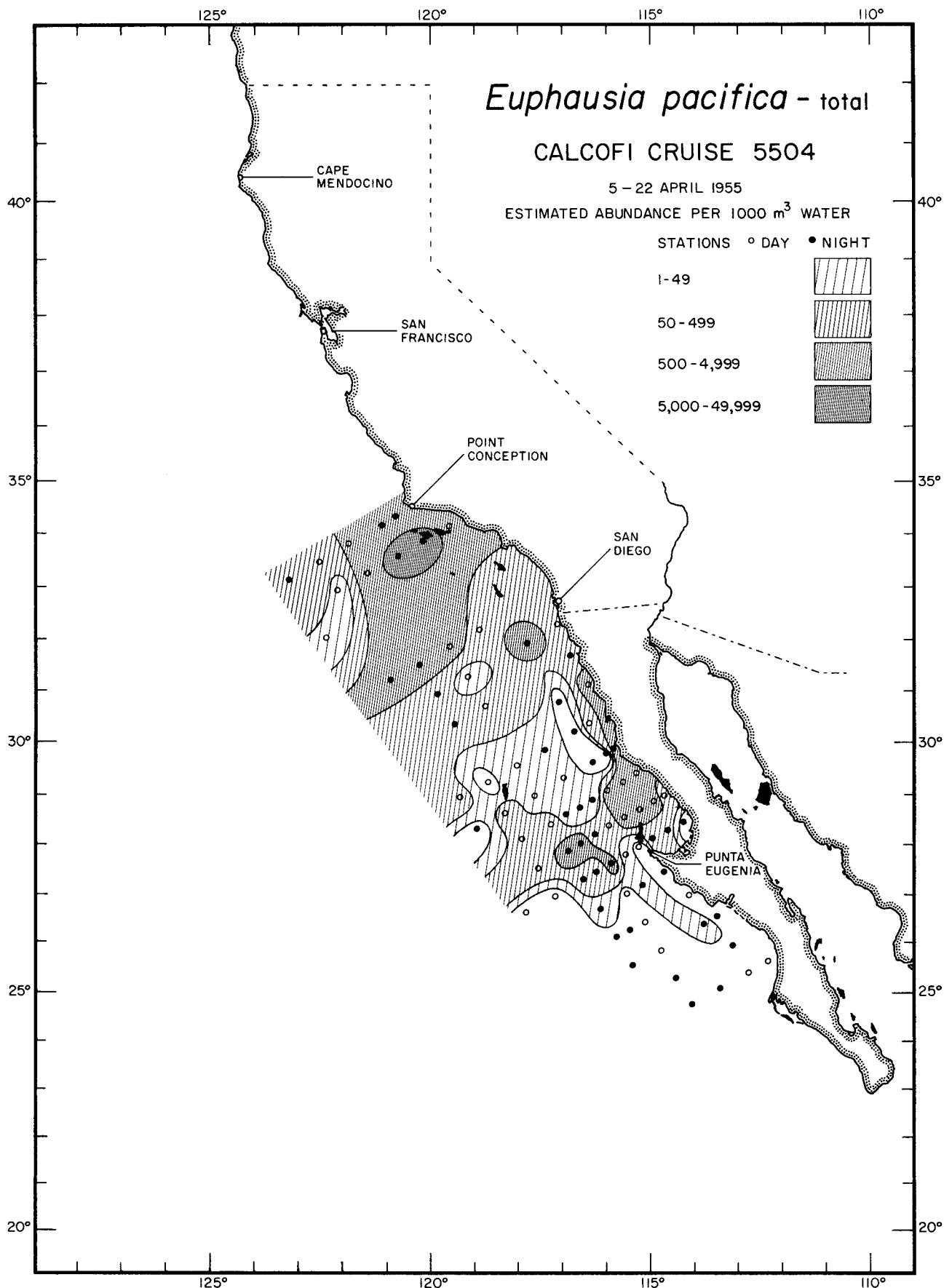


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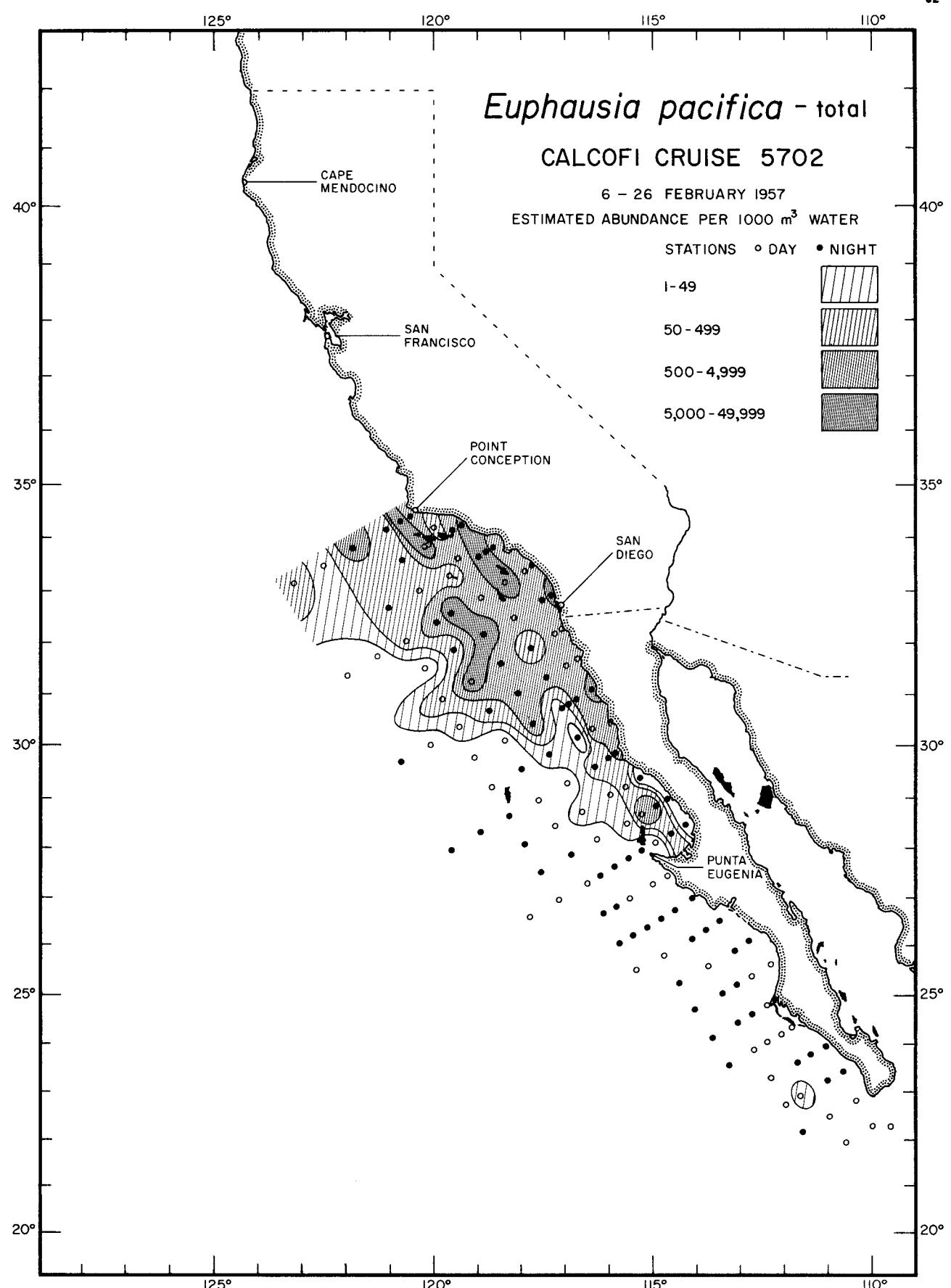
Euphausiaceae
Euphausia pacifica - larvae
6304



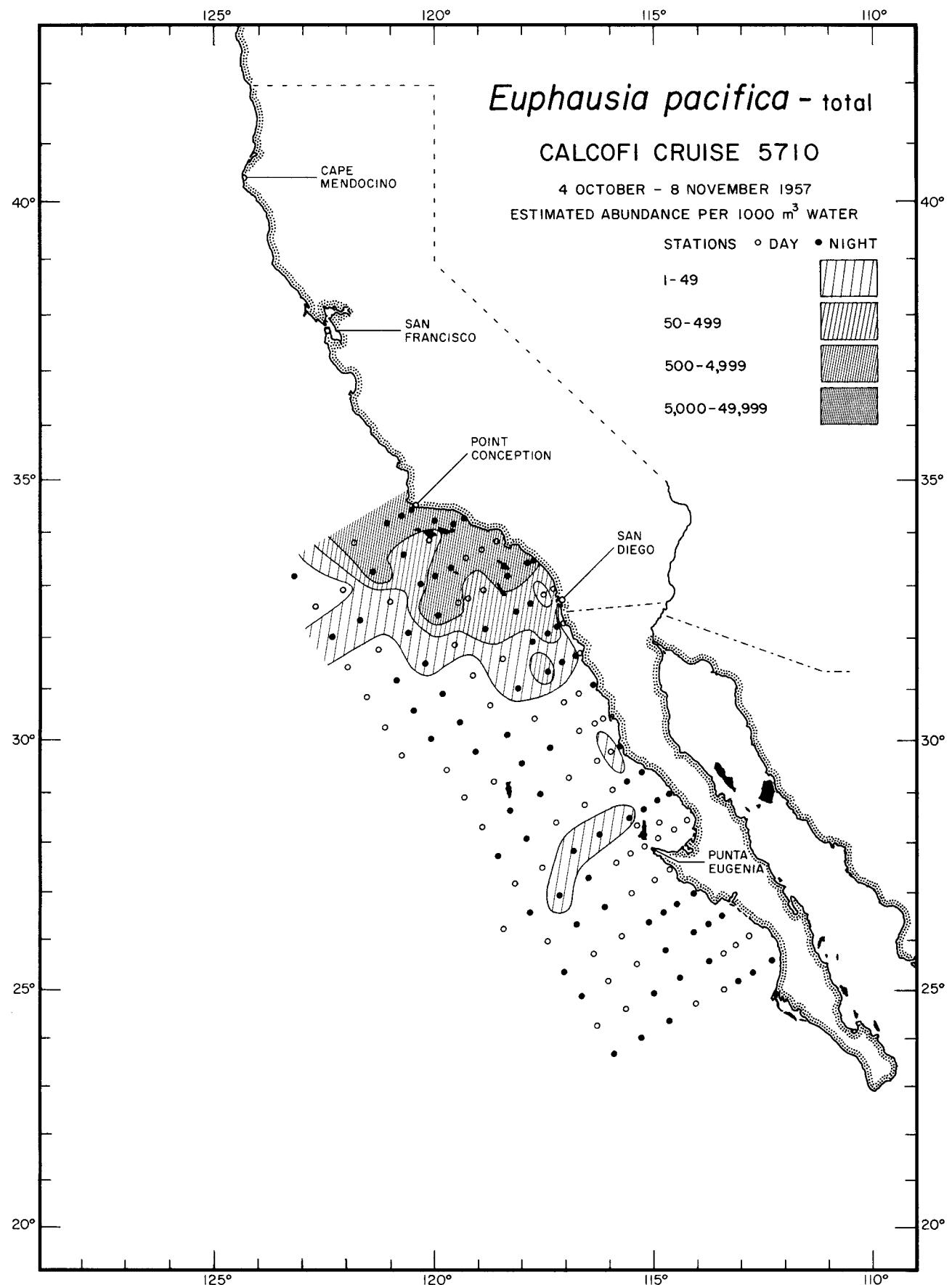
Euphausiacea
Euphausia pacifica - total
5408



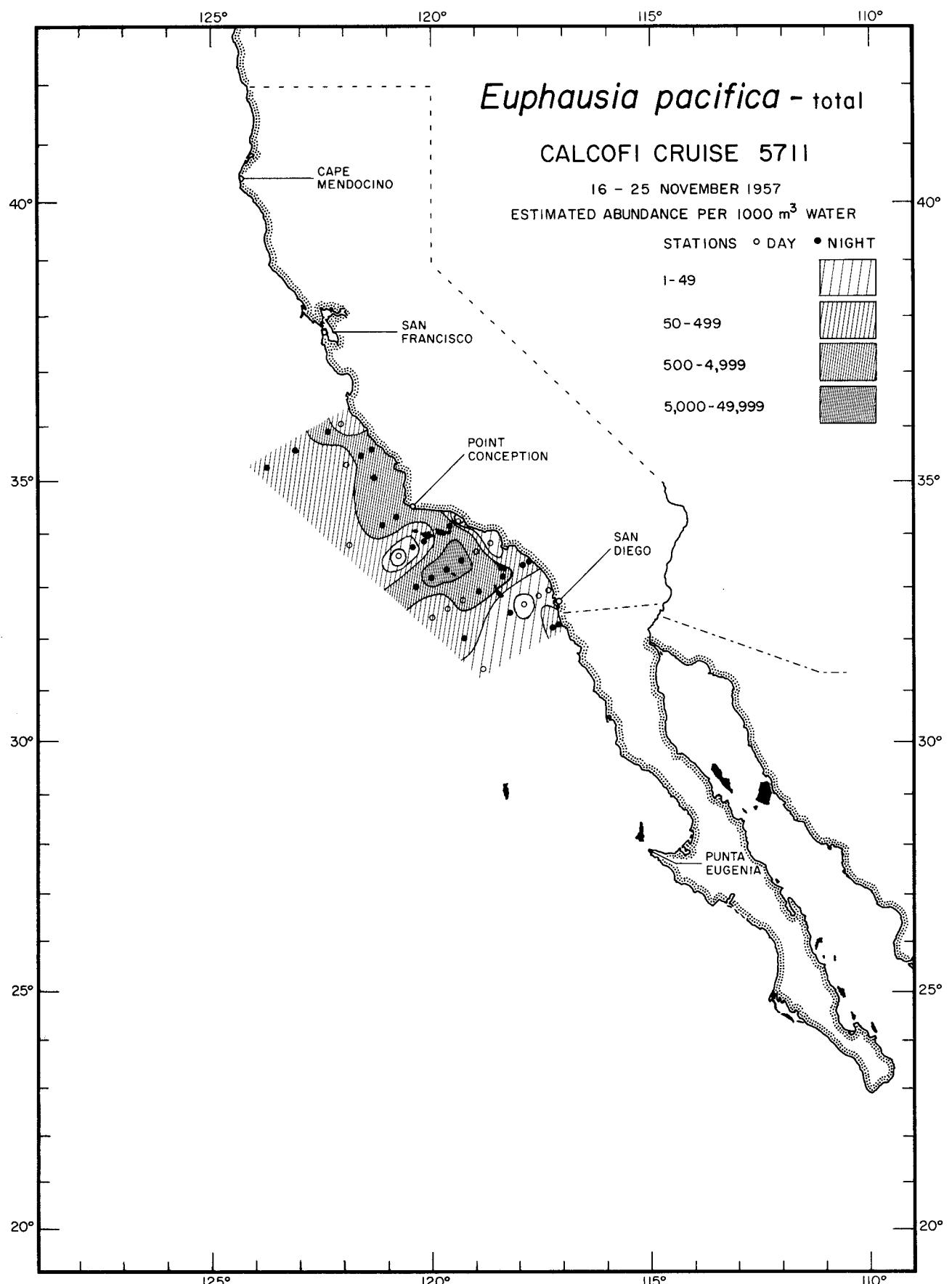
Euphausiacea
Euphausia pacifica - total
5504



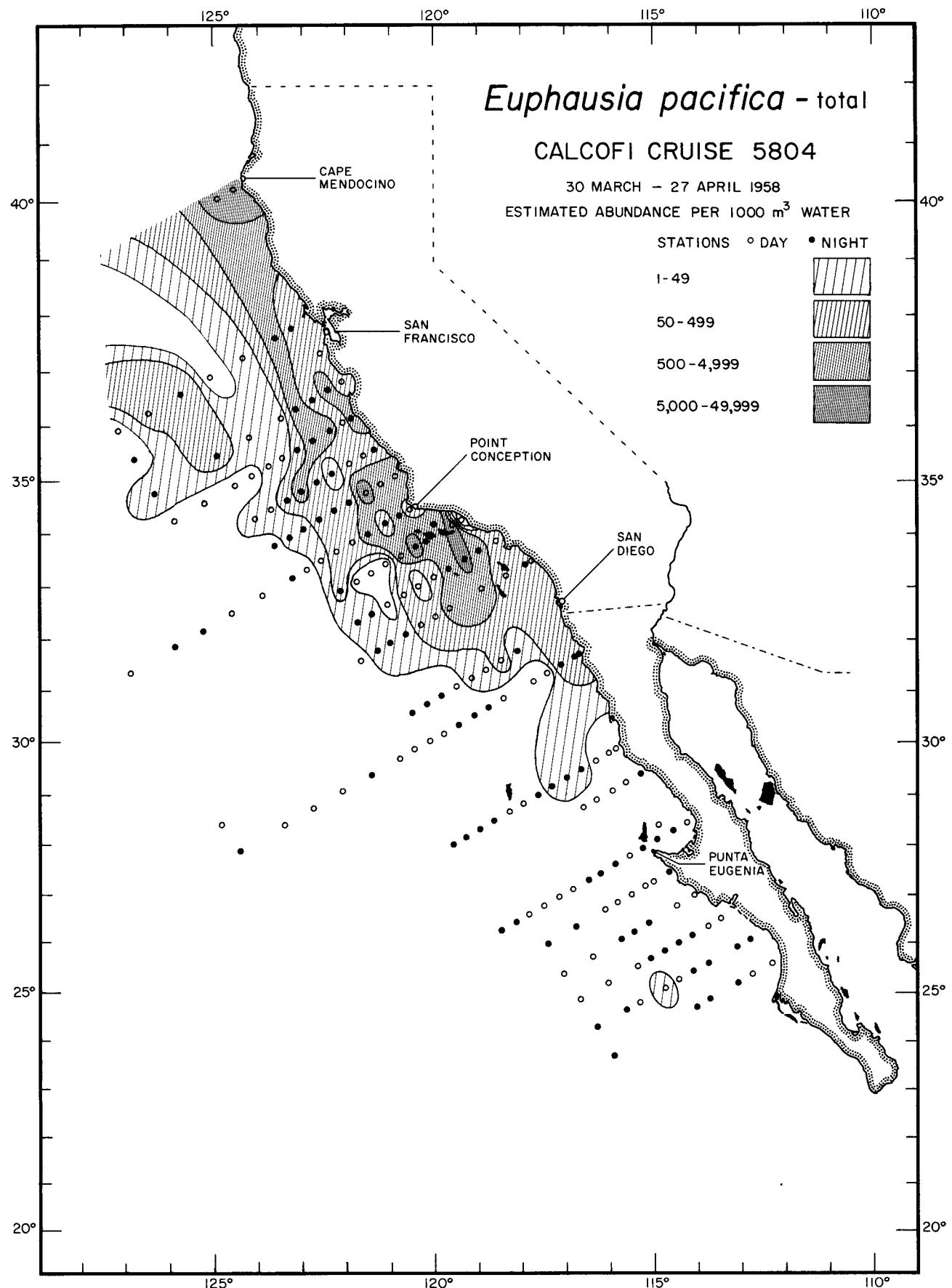
Euphausiacea
Euphausia pacifica - total
5702



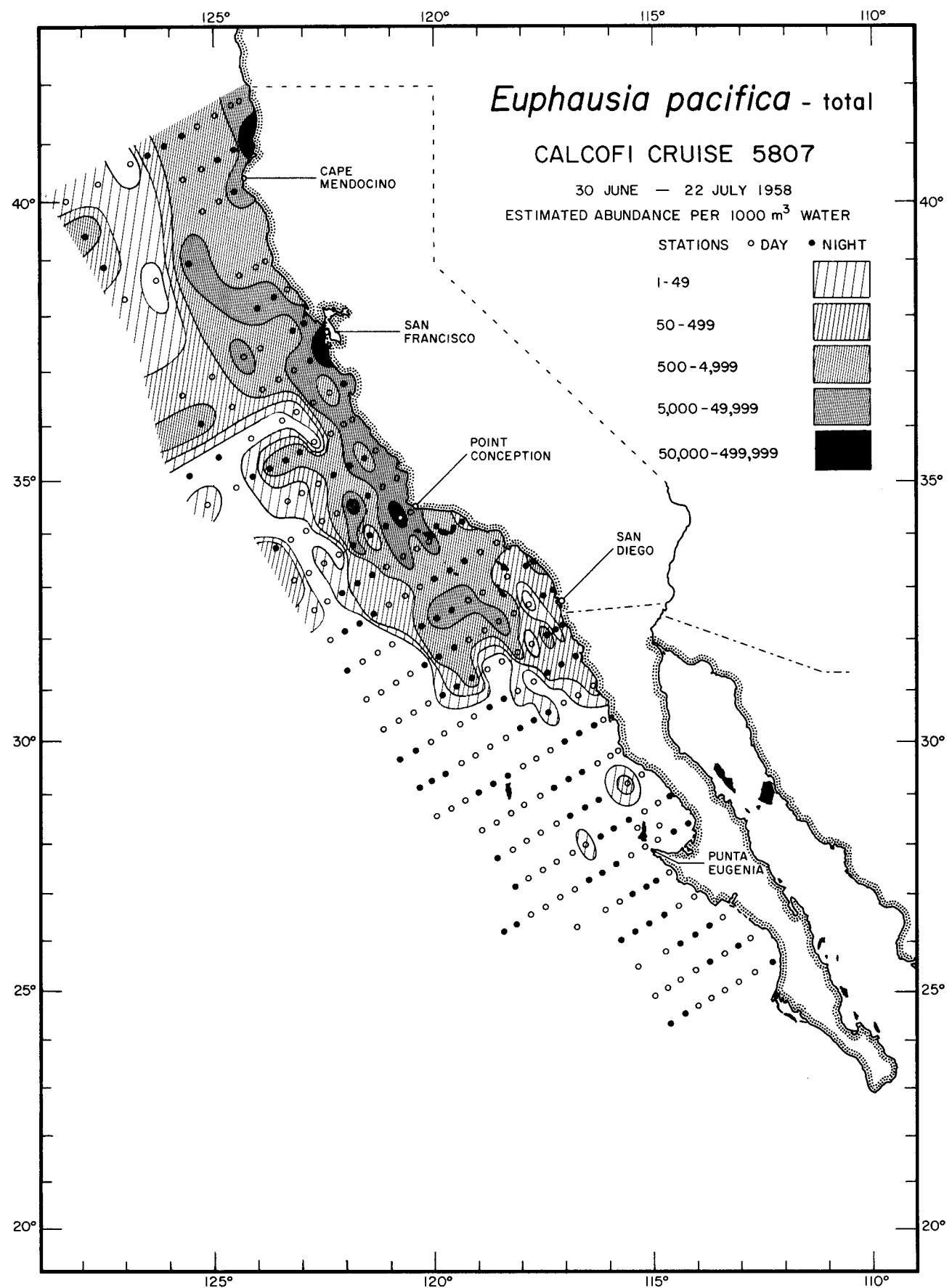
Euphausiacea
Euphausia pacifica - total
5710



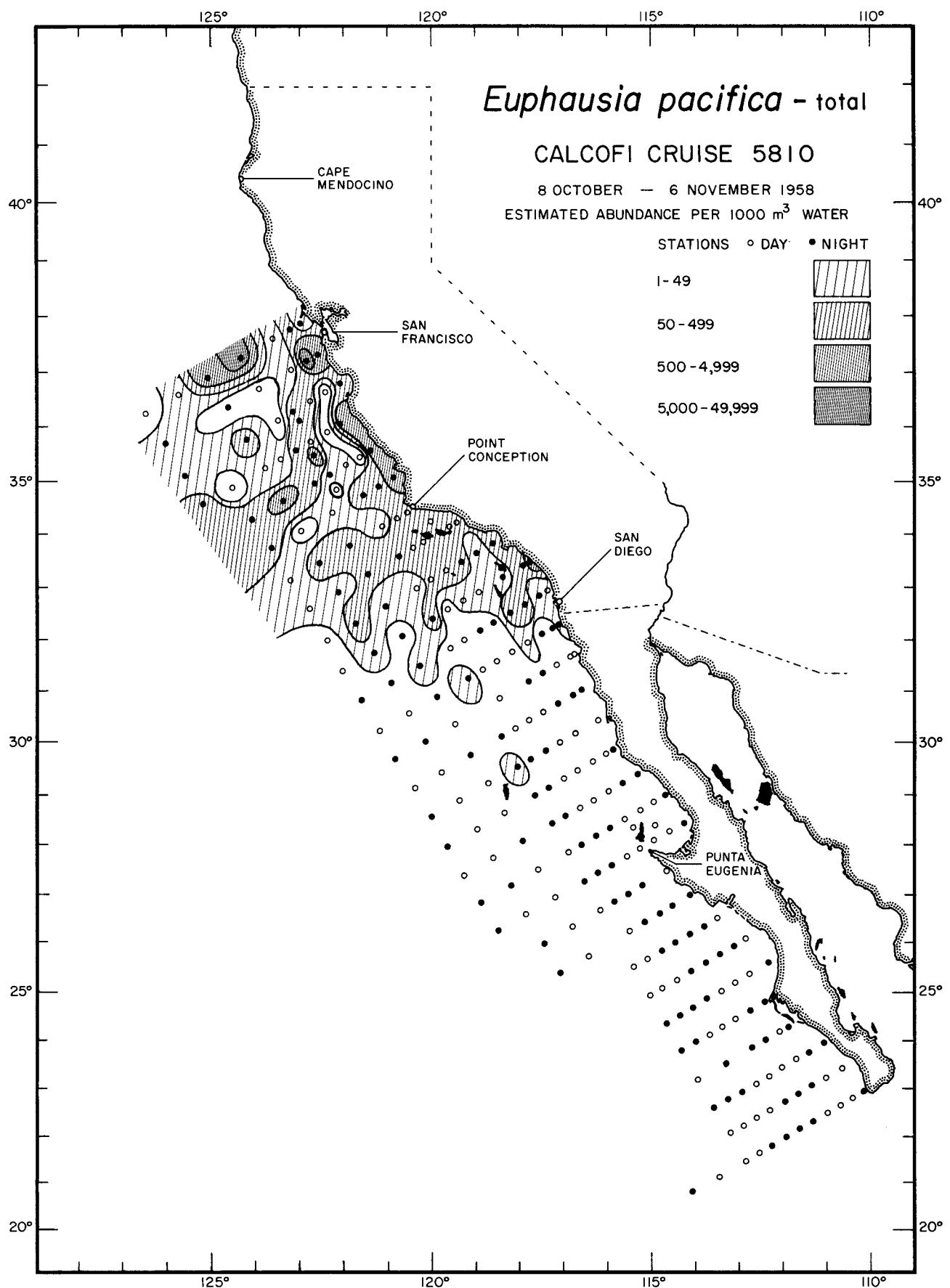
Euphausiacea
Euphausia pacifica - total
5711



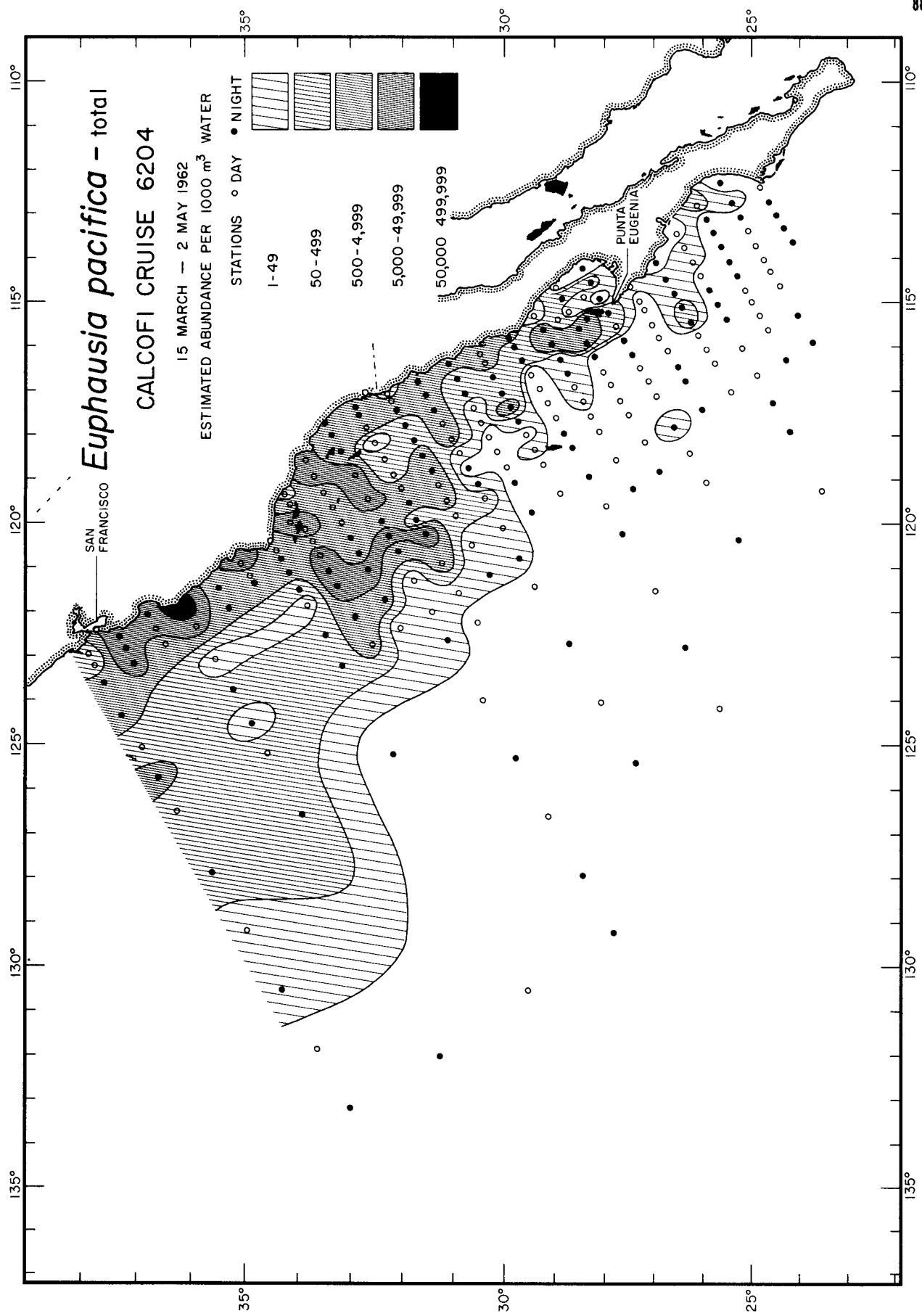
Euphausiacea
Euphausia pacifica - total
5804



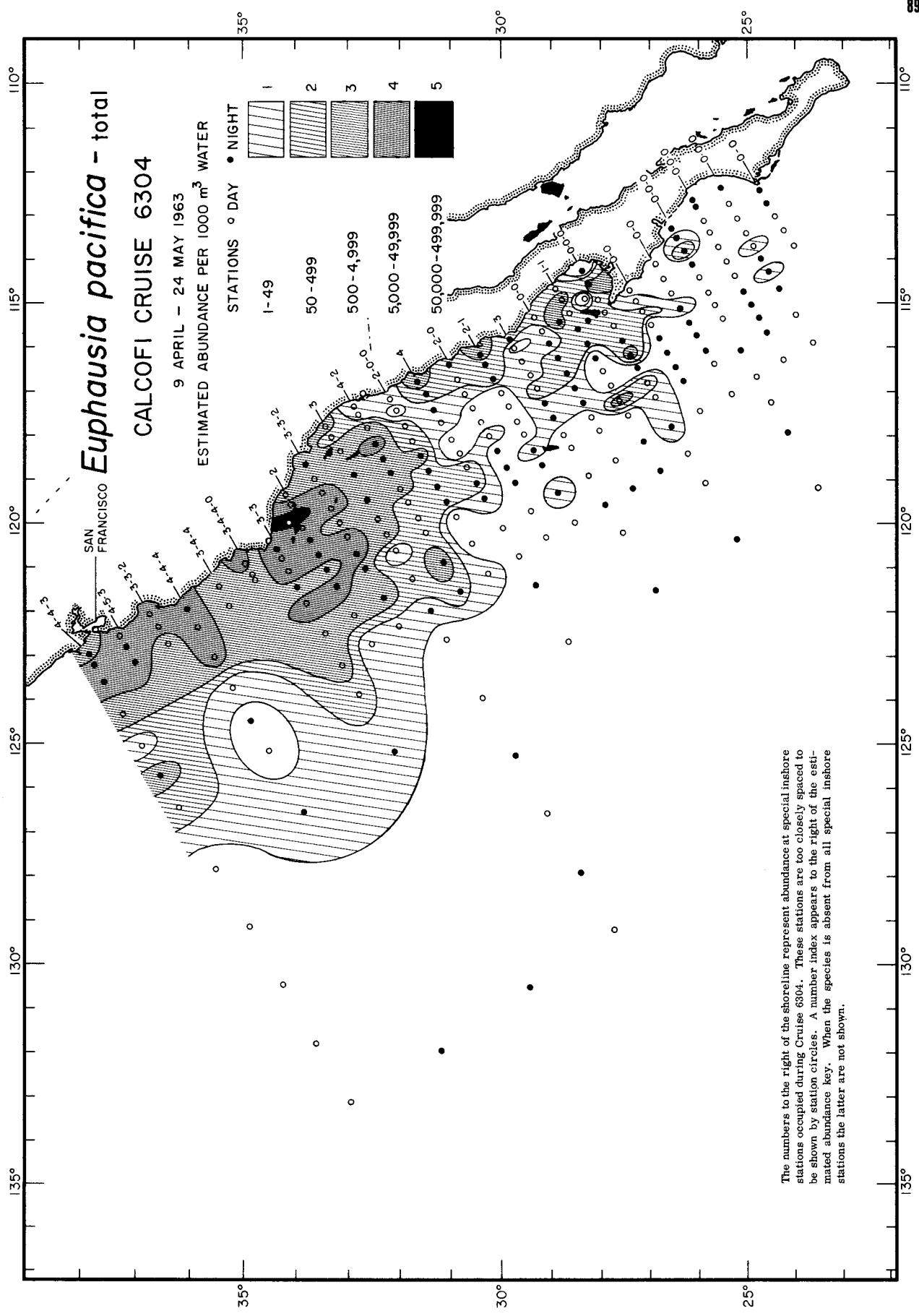
Euphausiacea
Euphausia pacifica - total
5807



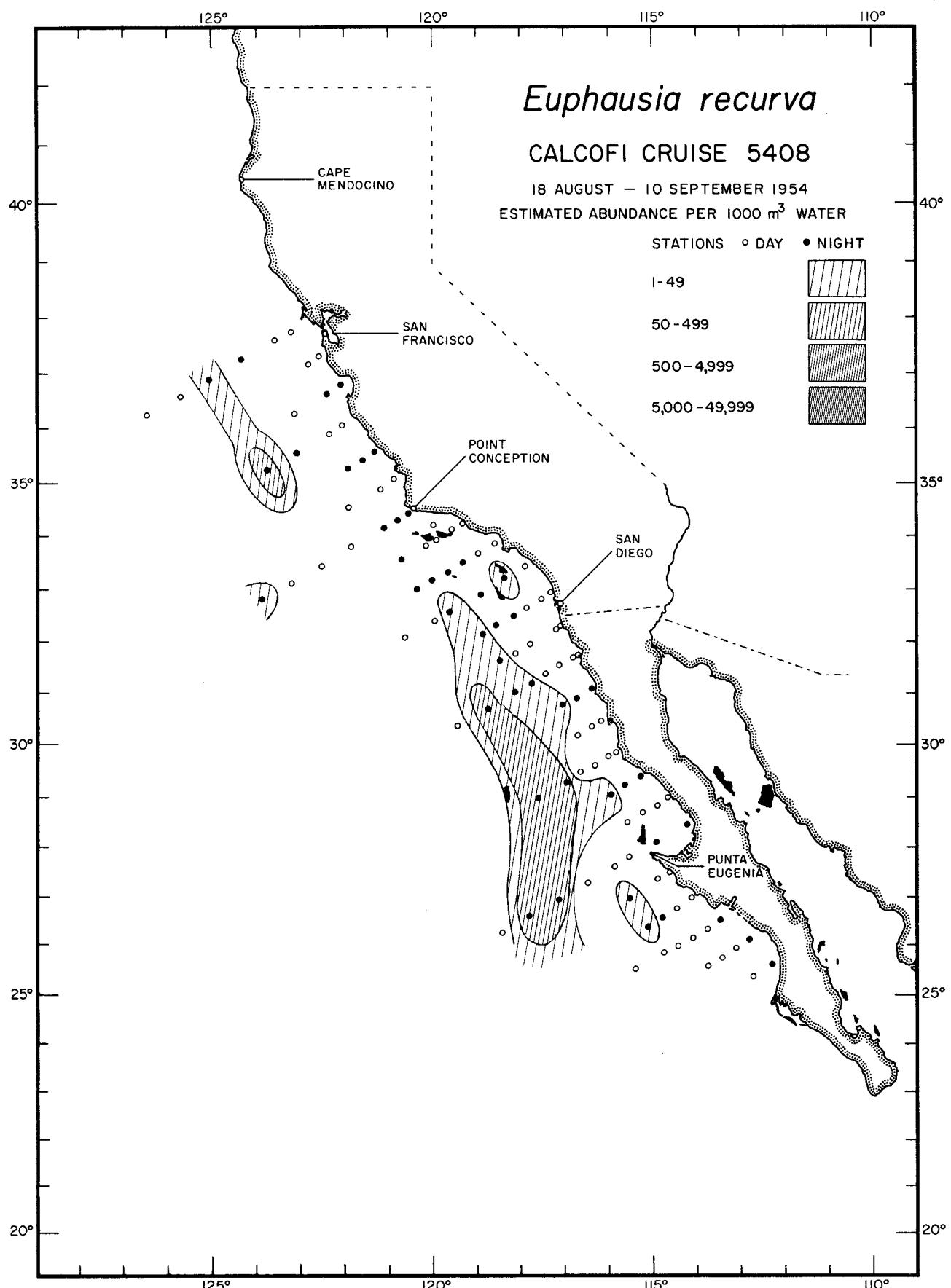
Euphausiacea
Euphausia pacifica - total
5810



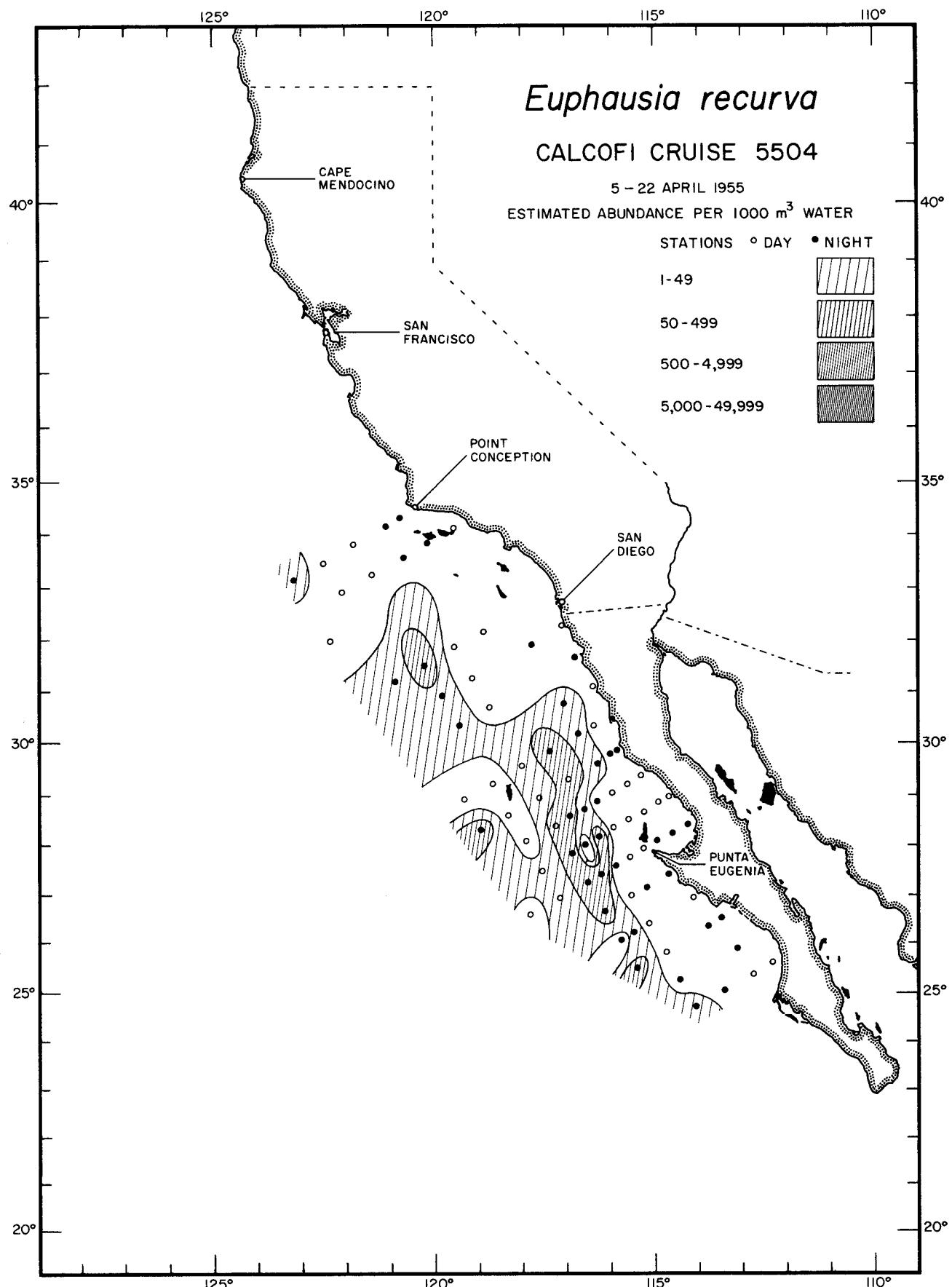
Euphausiacea
Euphausia pacifica - total
6204



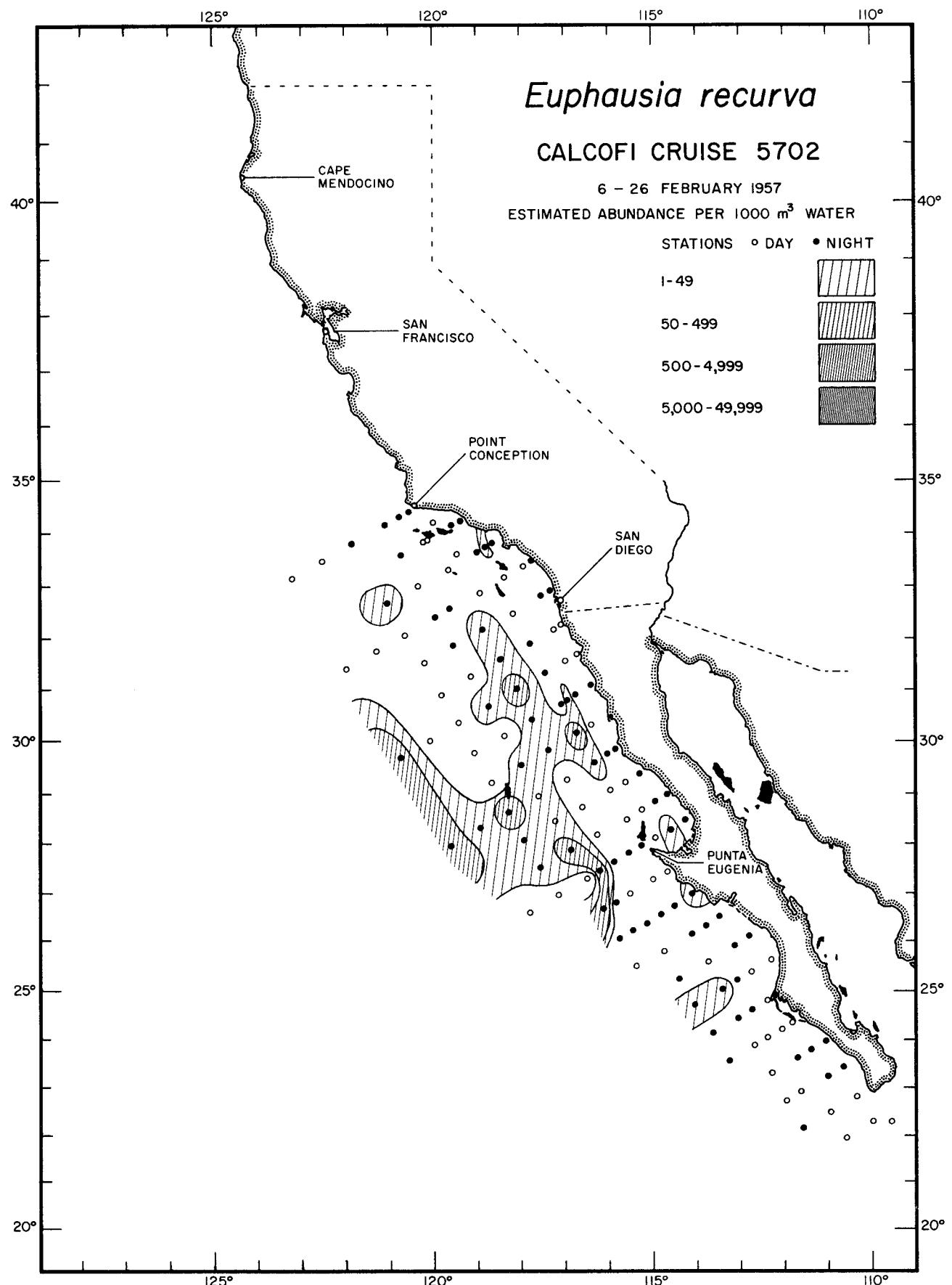
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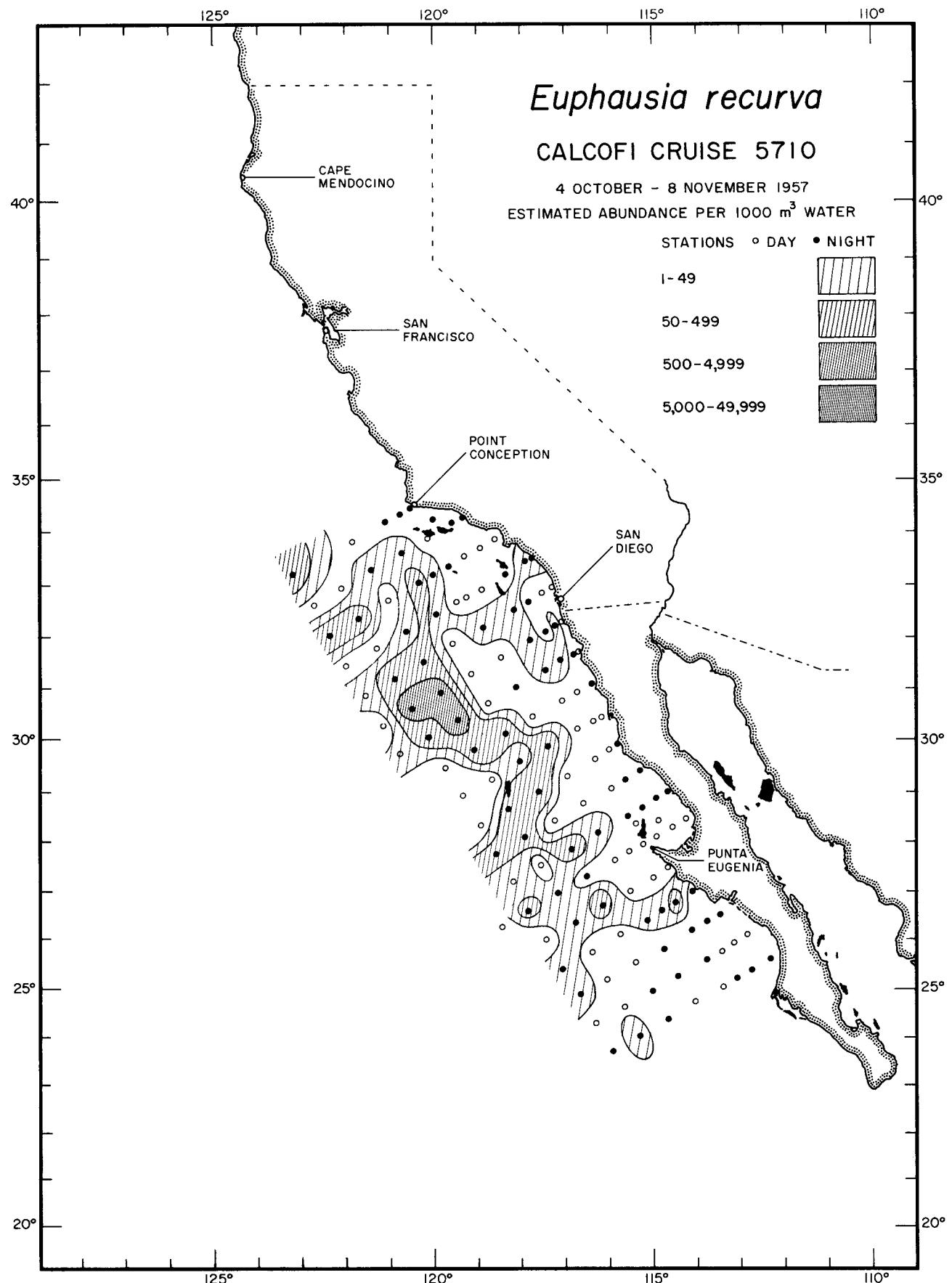
Euphausiacea
Euphausia recurva
5408



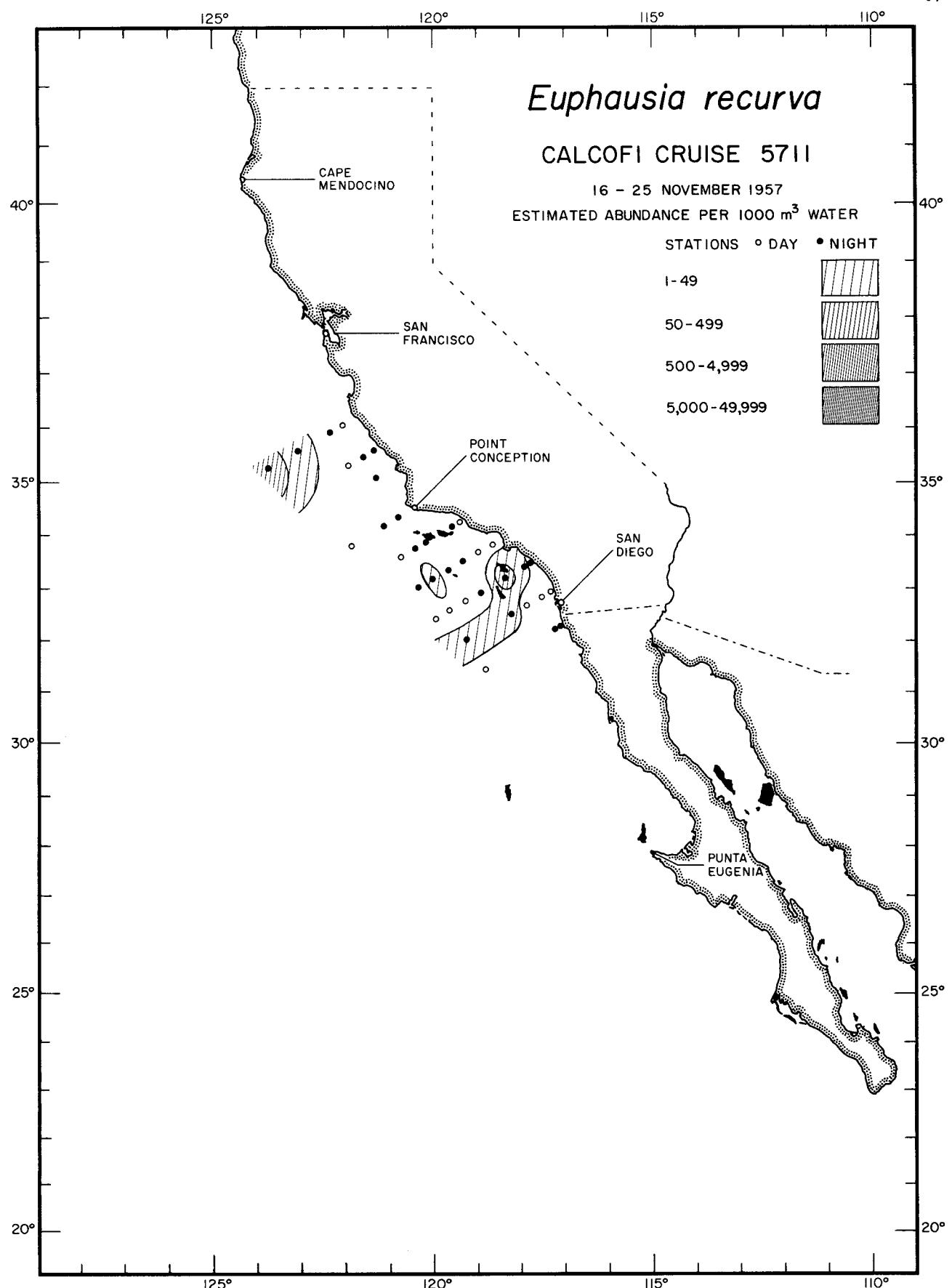
Euphausiacea
Euphausia recurva
5504



Euphausiacea
Euphausia recurva
5702



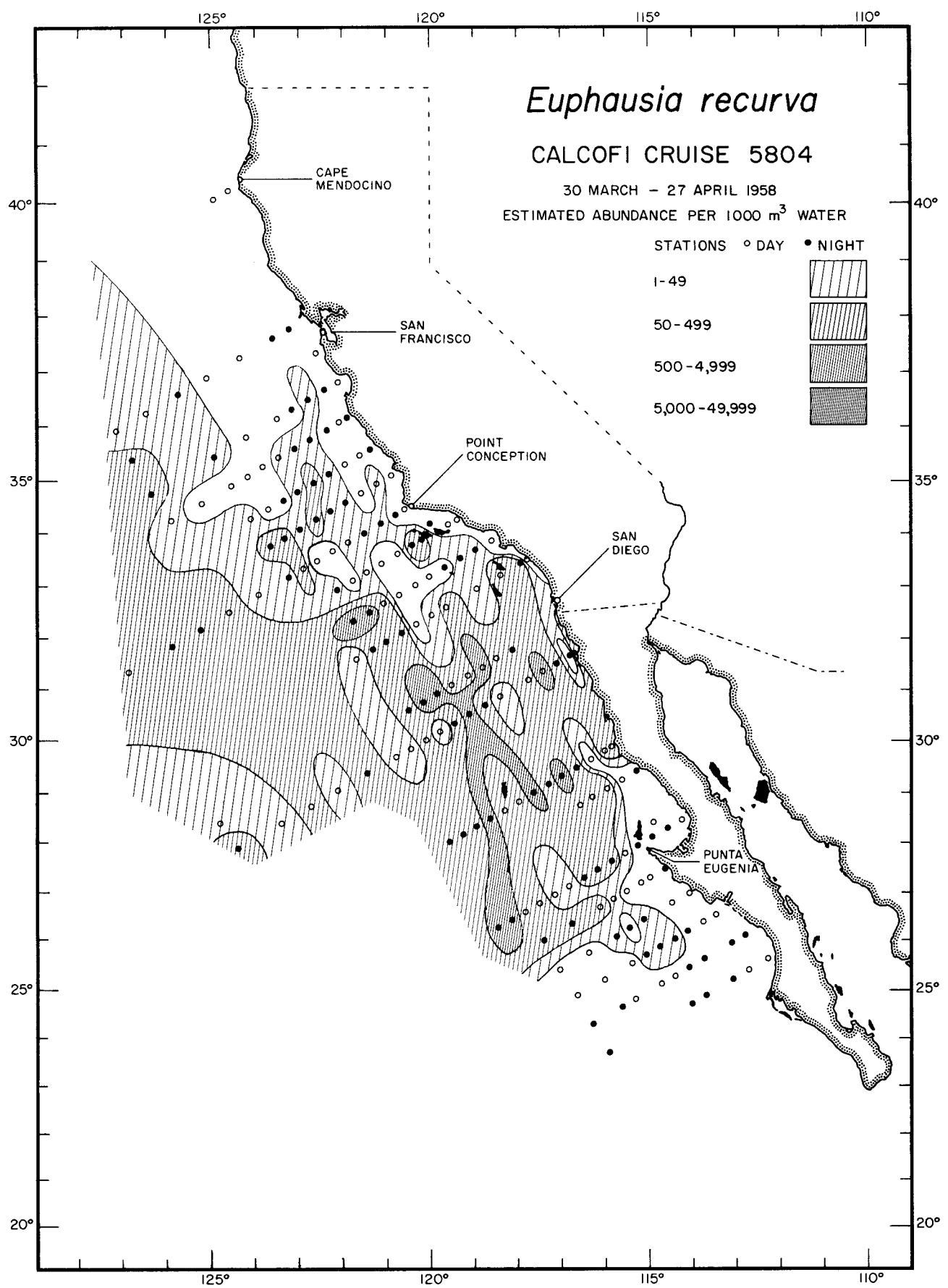
Euphausiacea
Euphausia recurva
5710



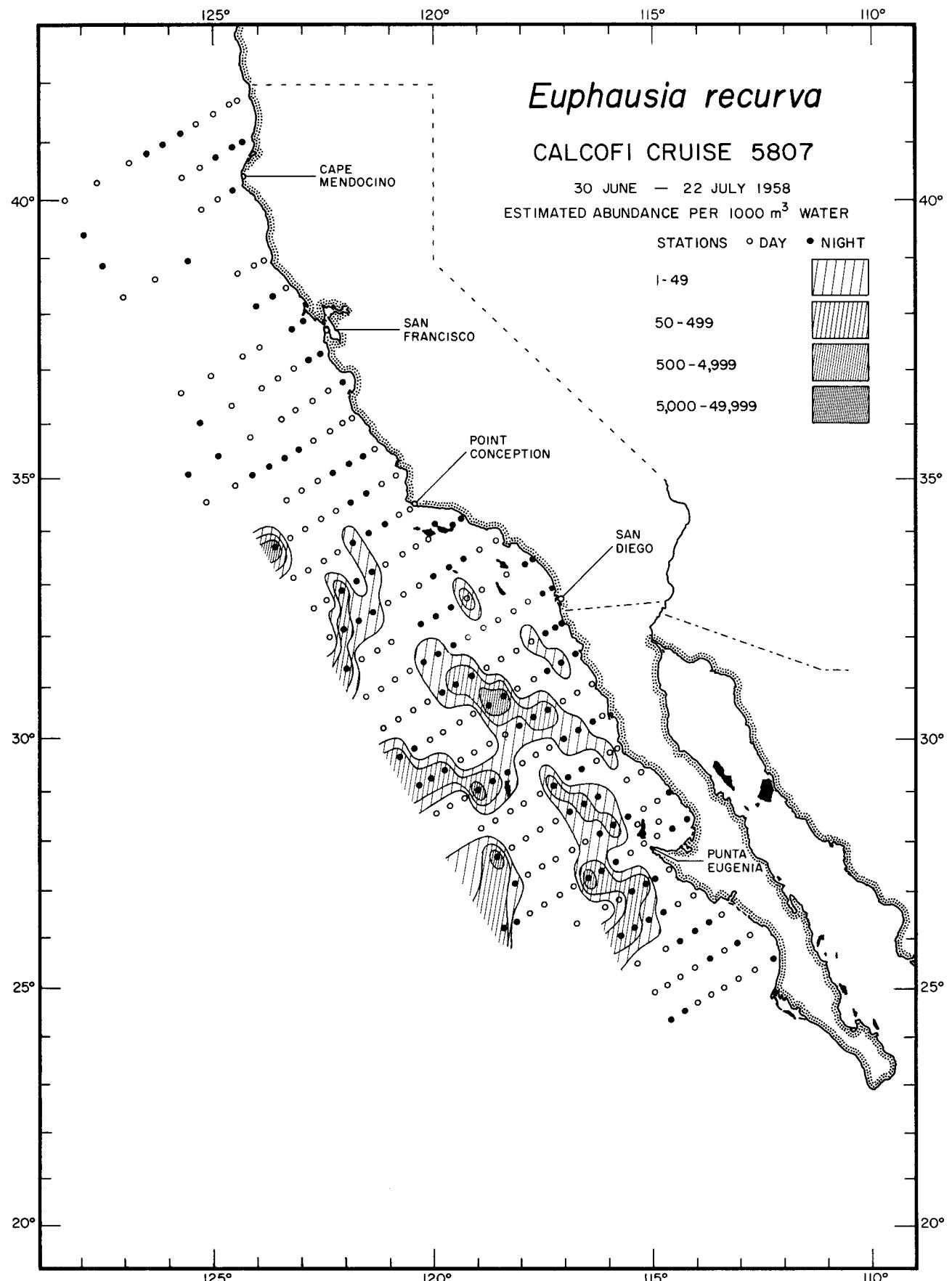
Euphausiacea

Euphausia recurva

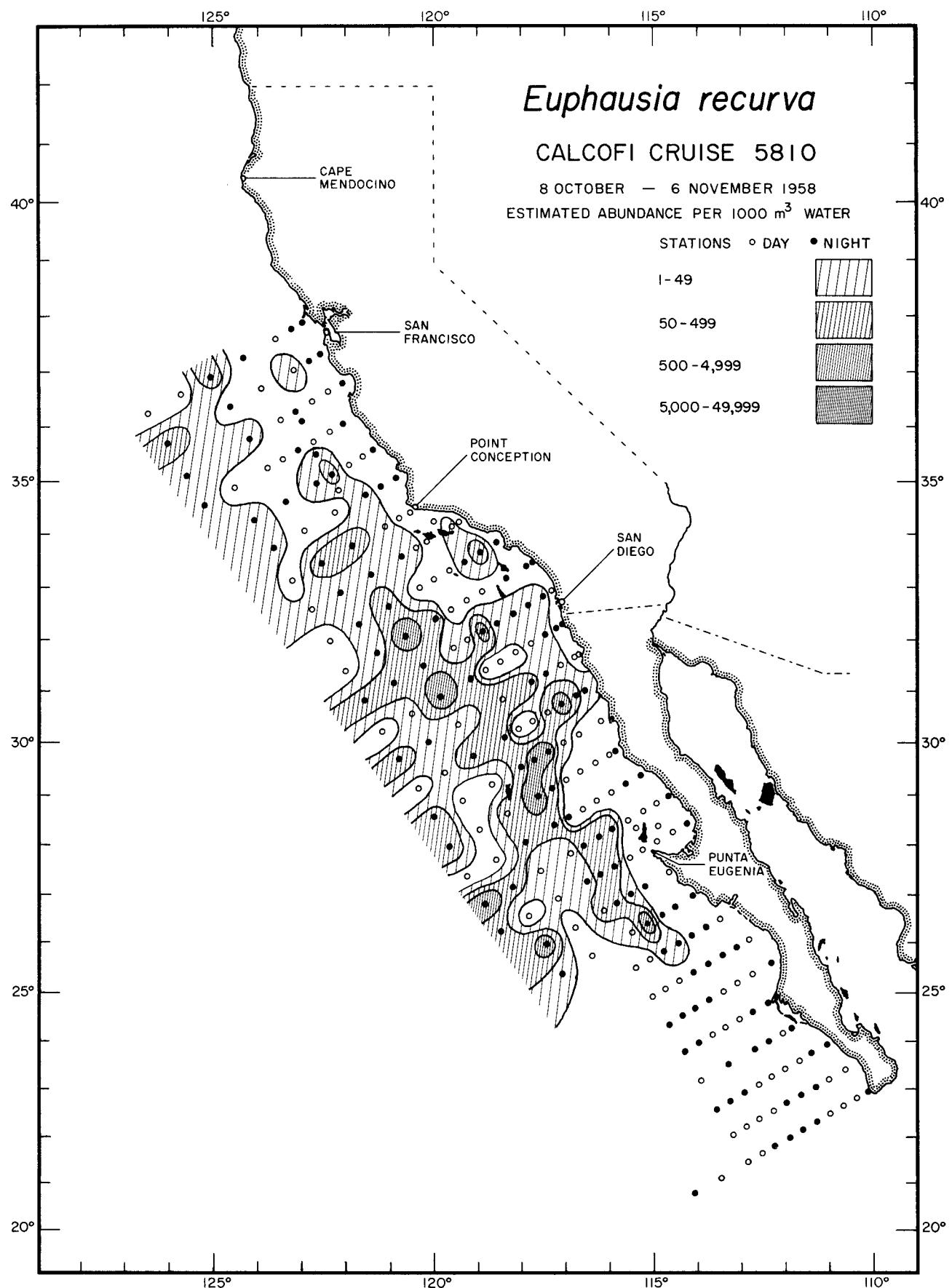
5711



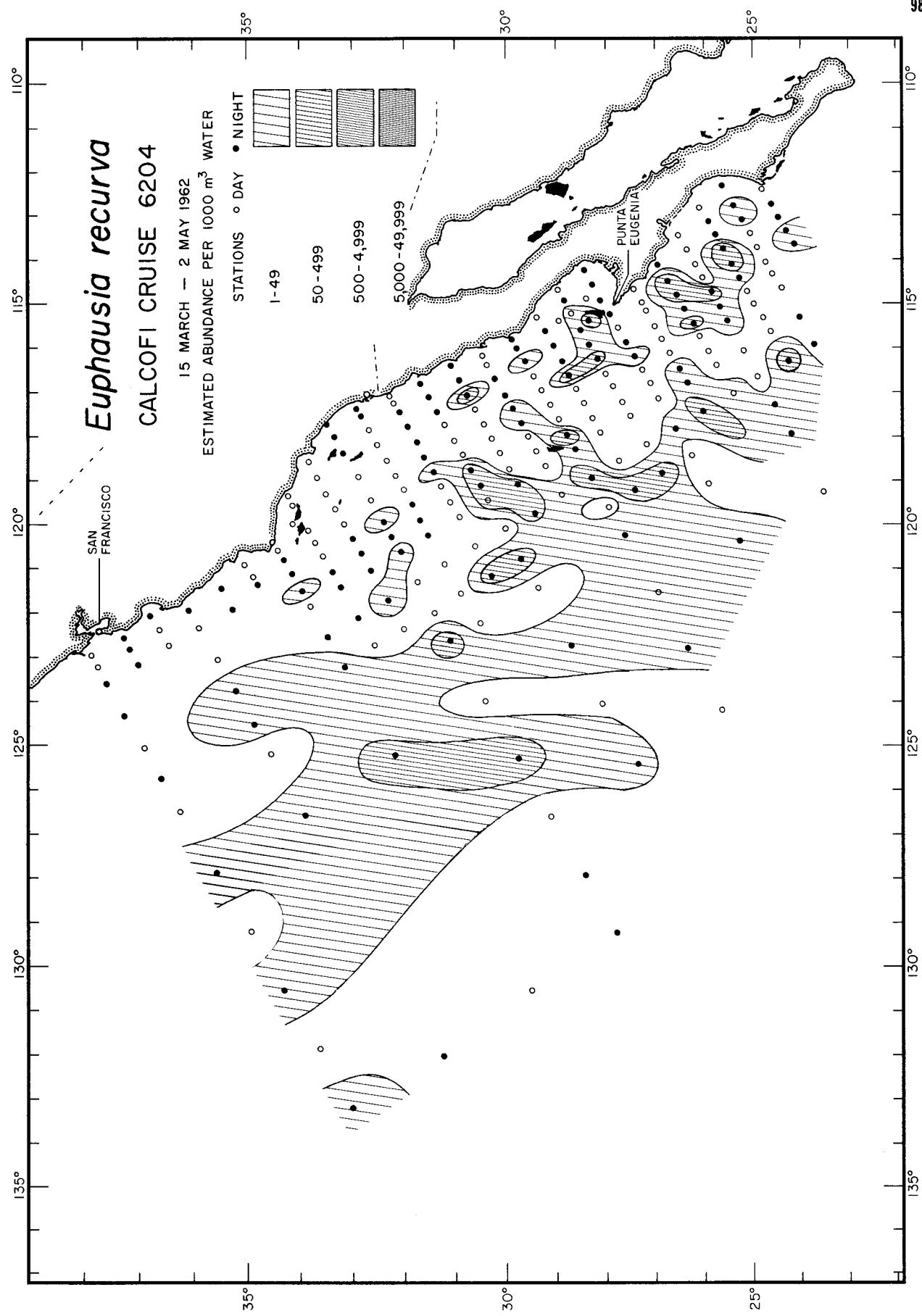
Euphausiacea
Euphausia recurva
5804



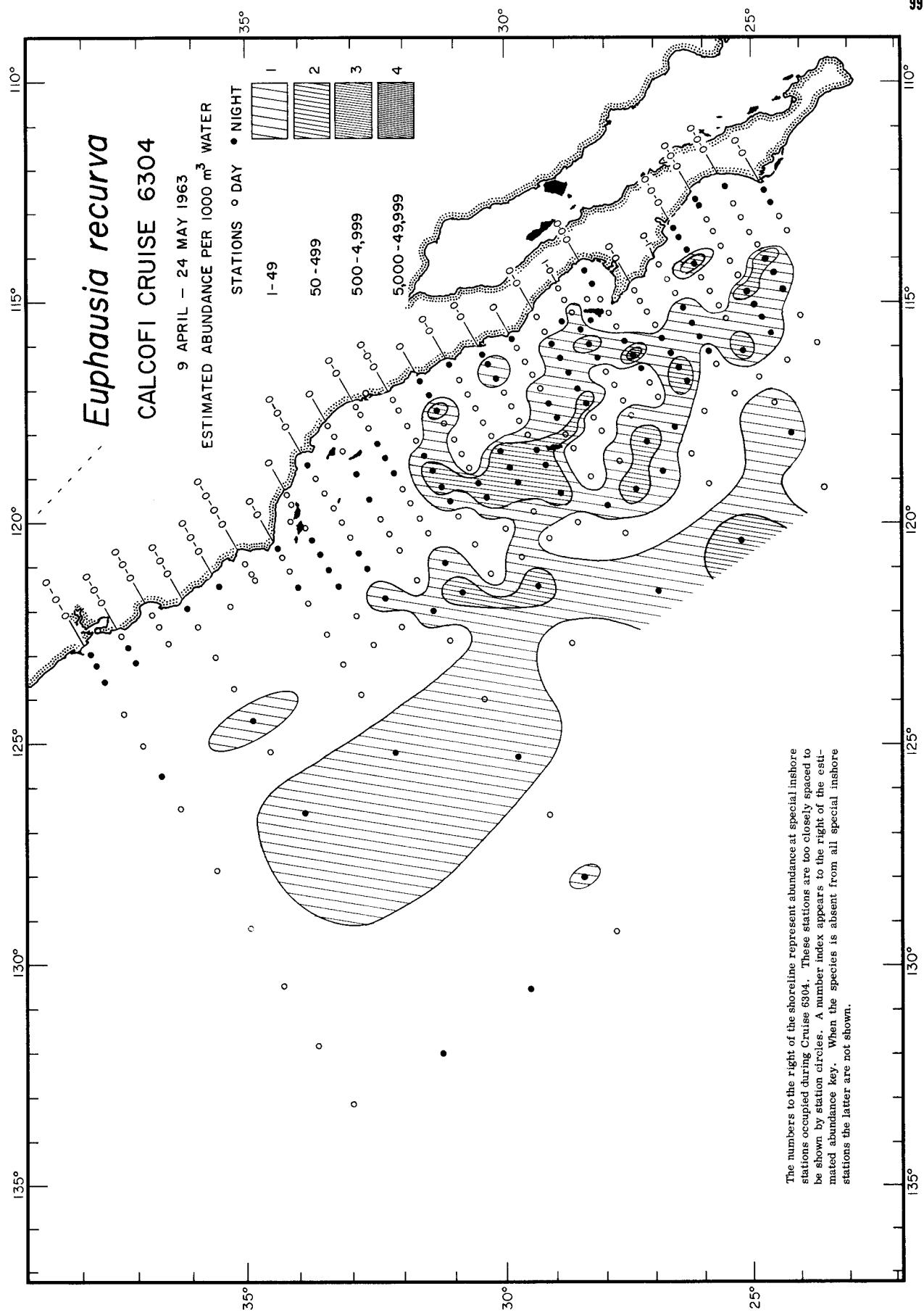
Euphausiacea
Euphausia recurva
5807



Euphausiaceae
Euphausia recurva
5810

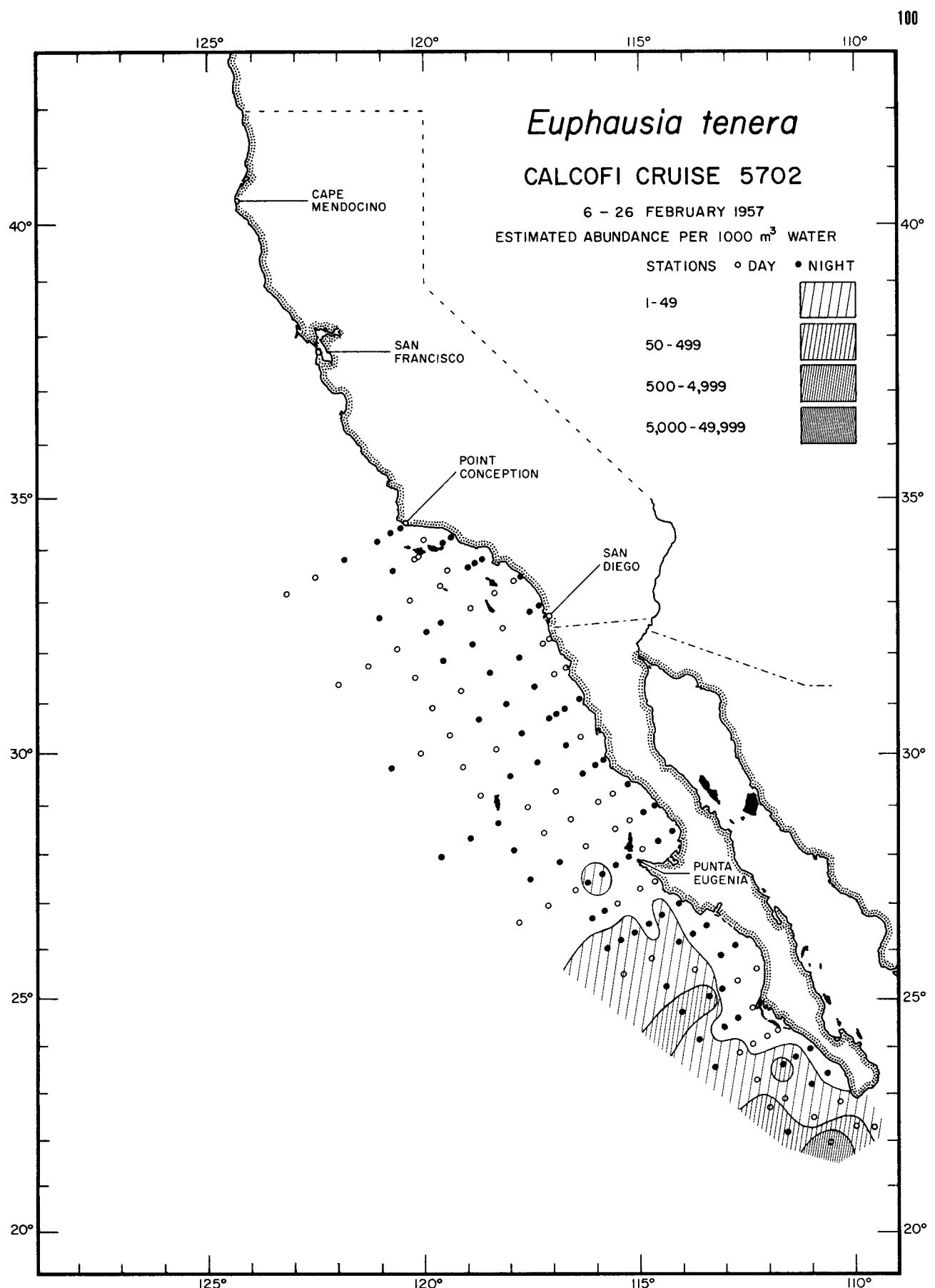


Euphausiacea
Euphausia recurva
6204

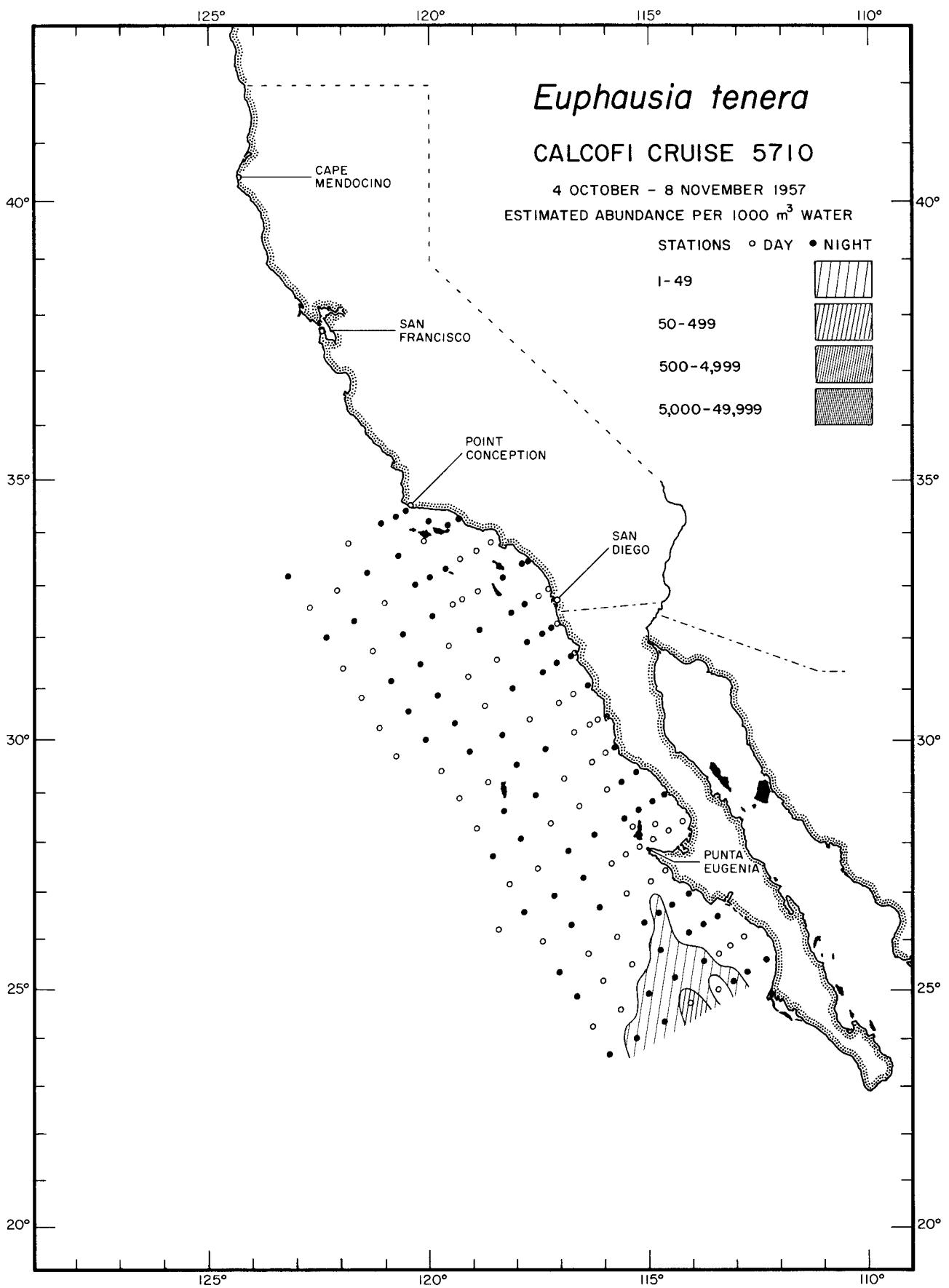


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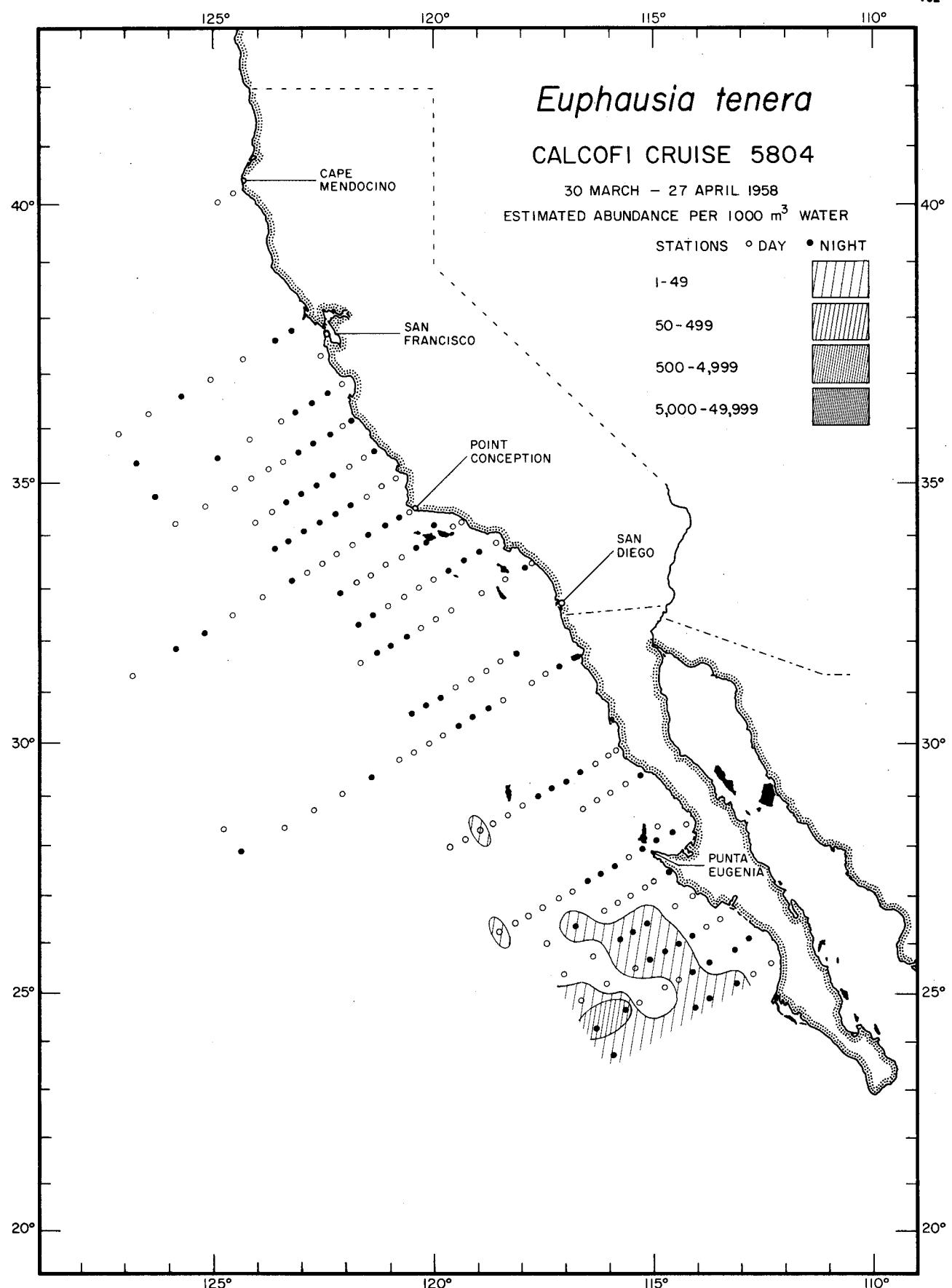
Euphausiacea
Euphausia recurva
6304



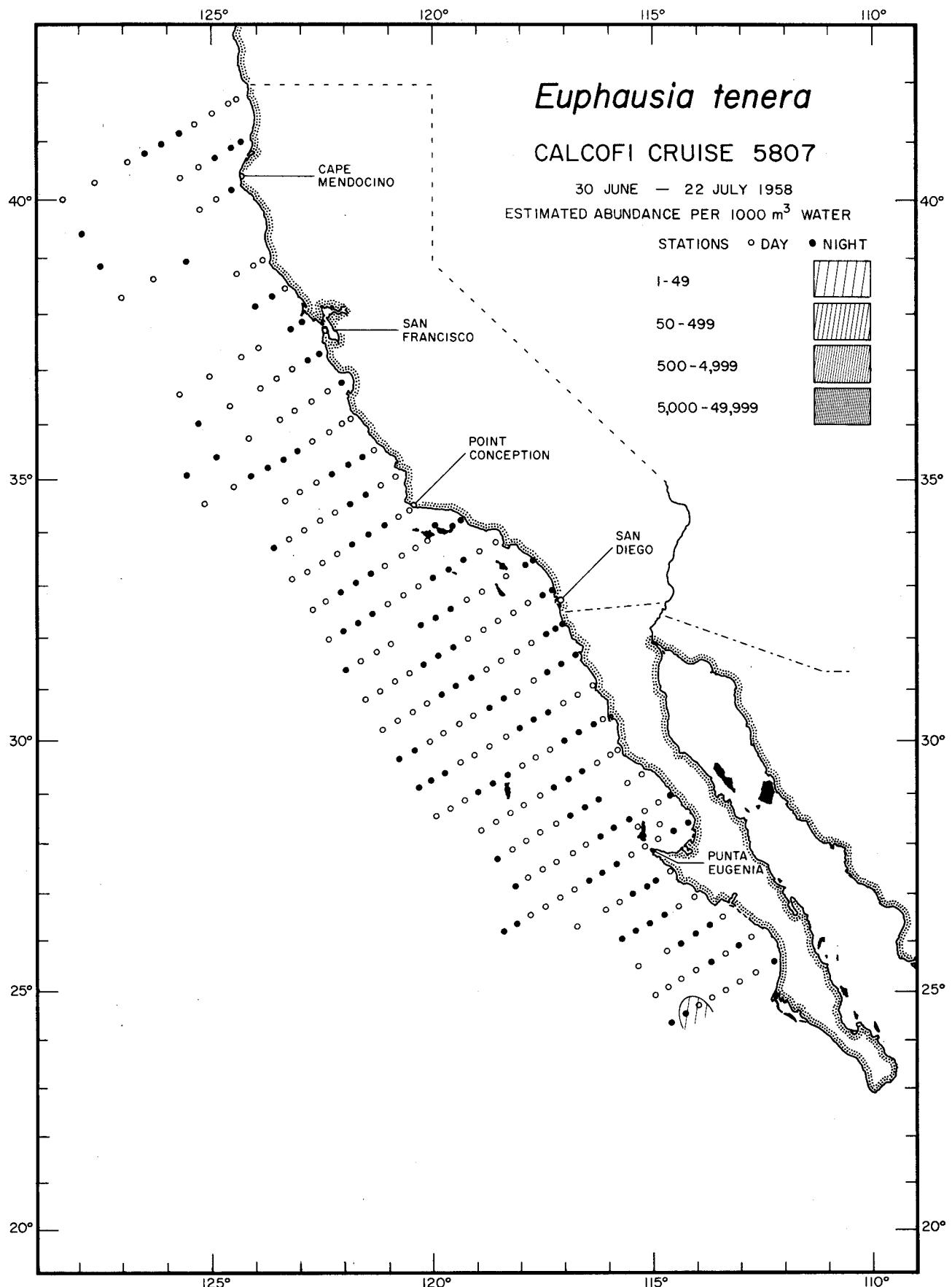
Euphausiacea
Euphausia tenera
5702



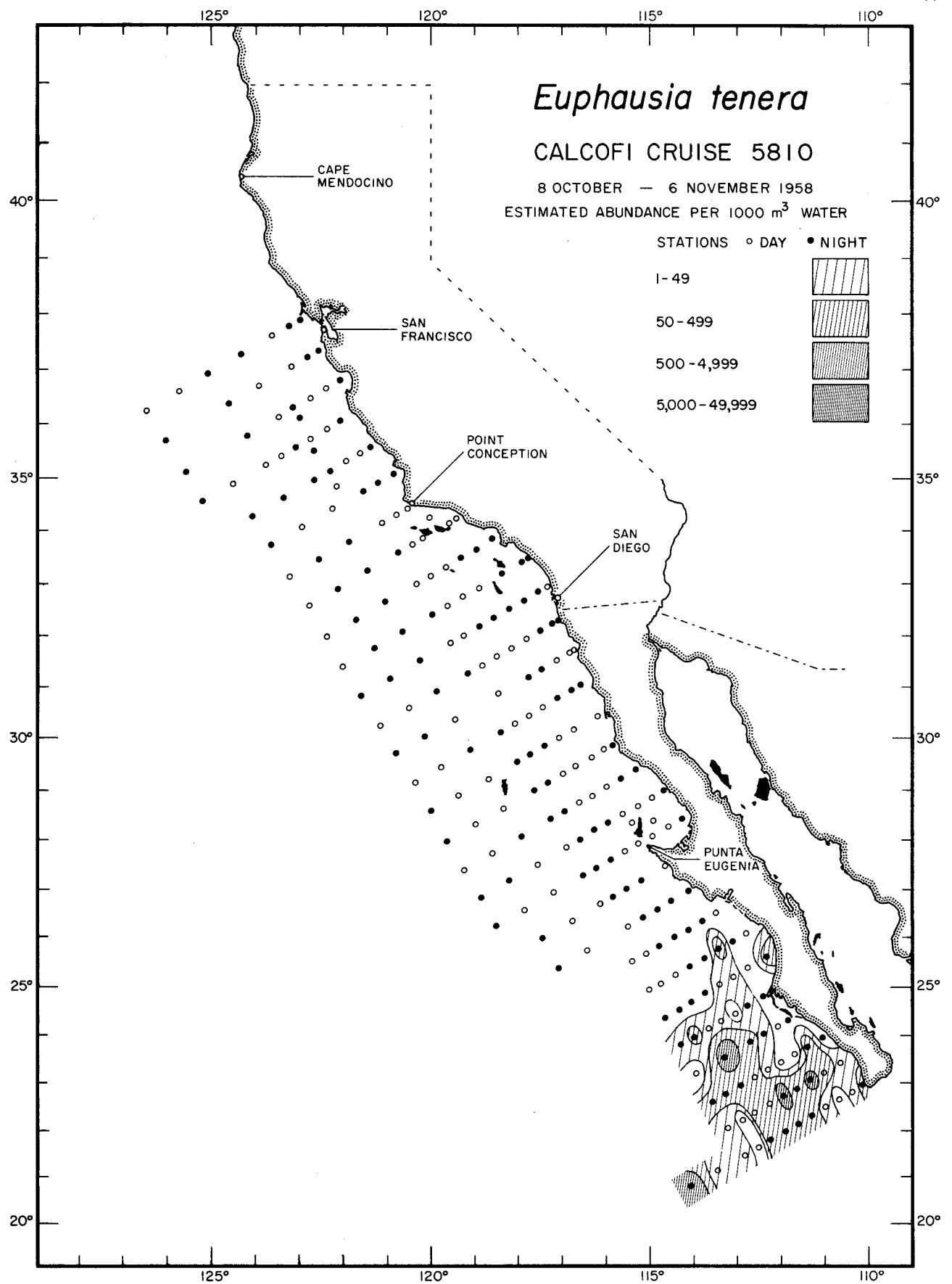
Euphausiacea
Euphausia tenera
5710



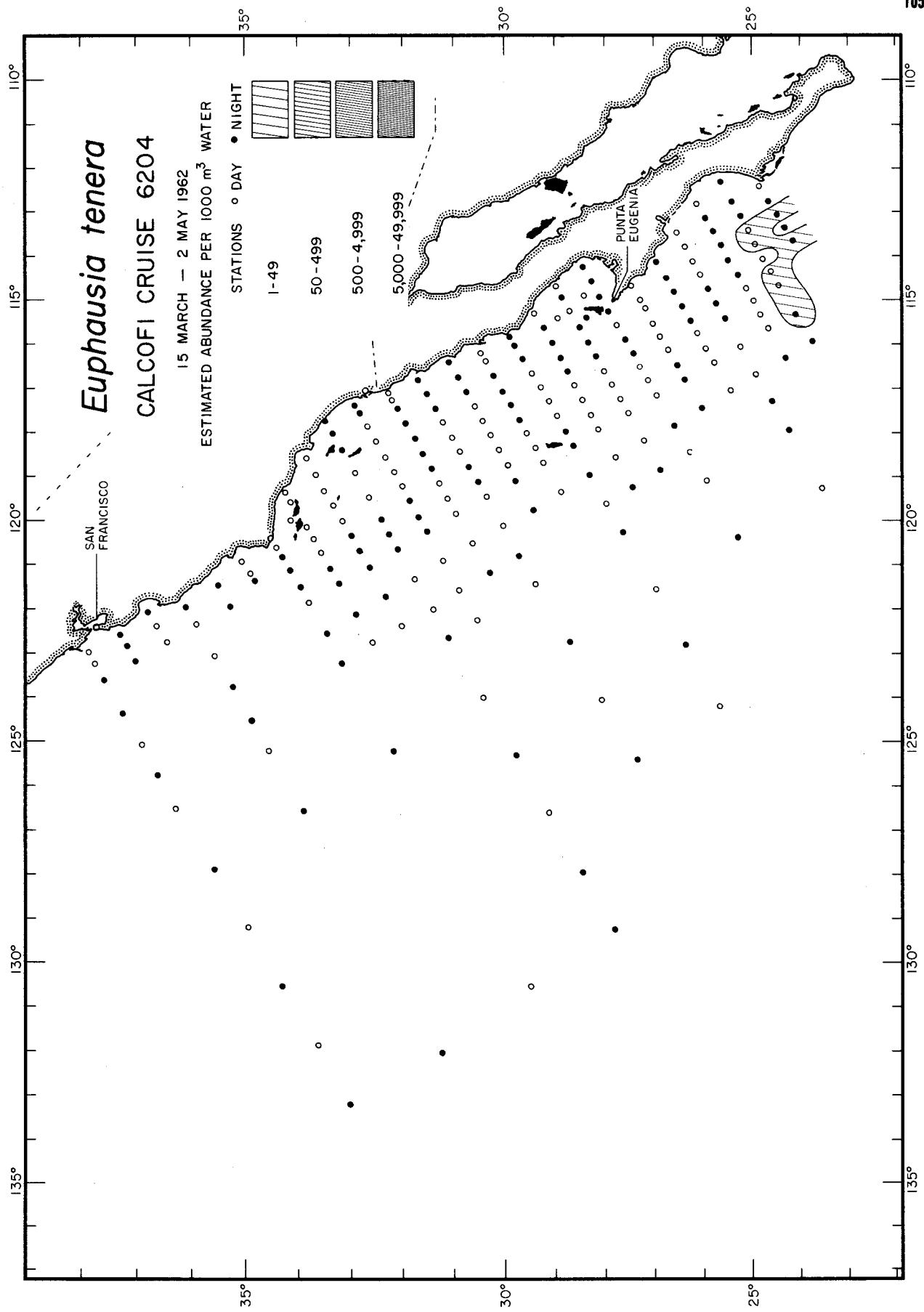
Euphausiacea
Euphausia tenera
5804



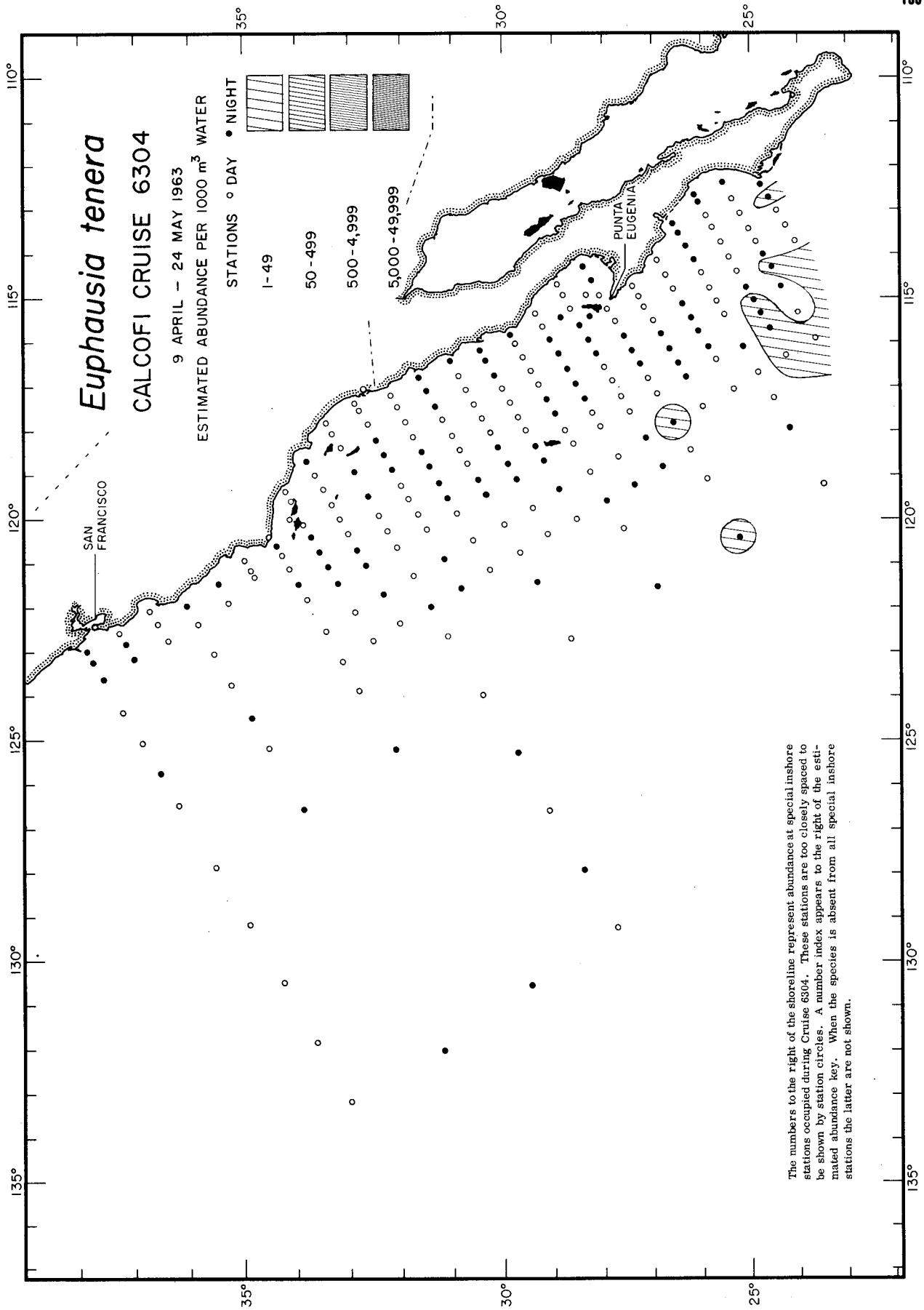
Euphausiacea
Euphausia tenera
5807



Euphausiacea
Euphausia tenera
5810

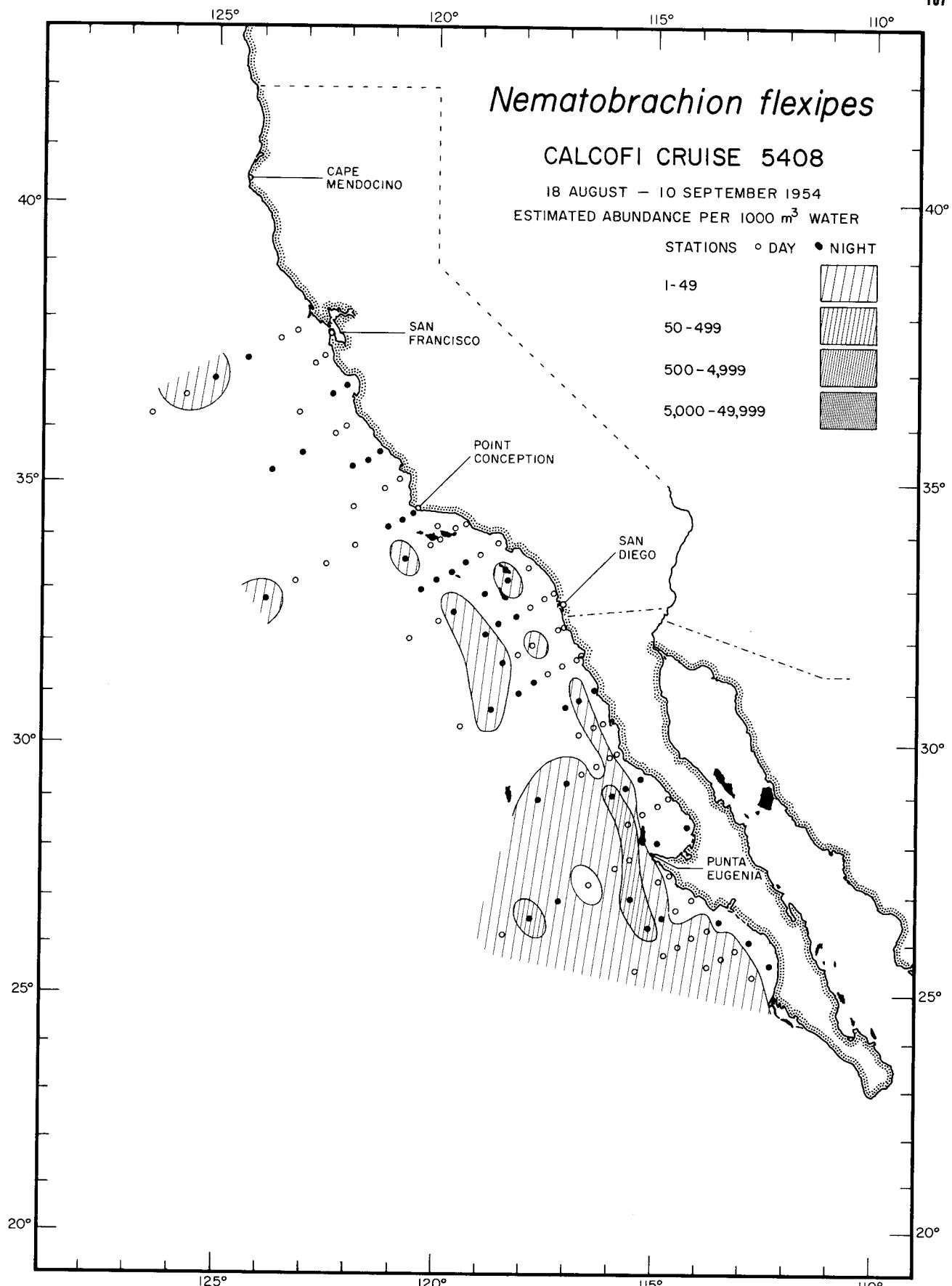


Euphausiacea
Euphausia tenera
6204

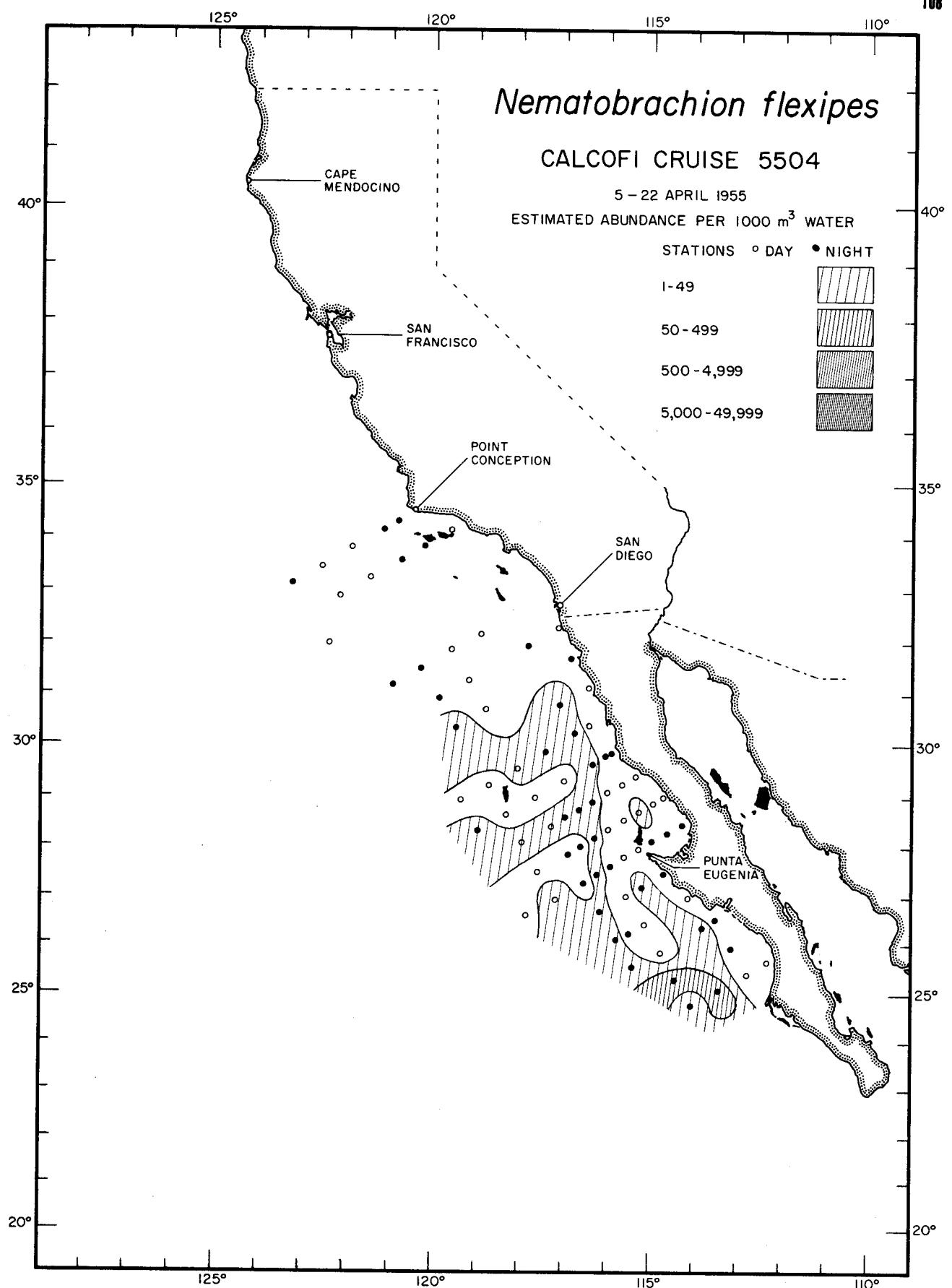


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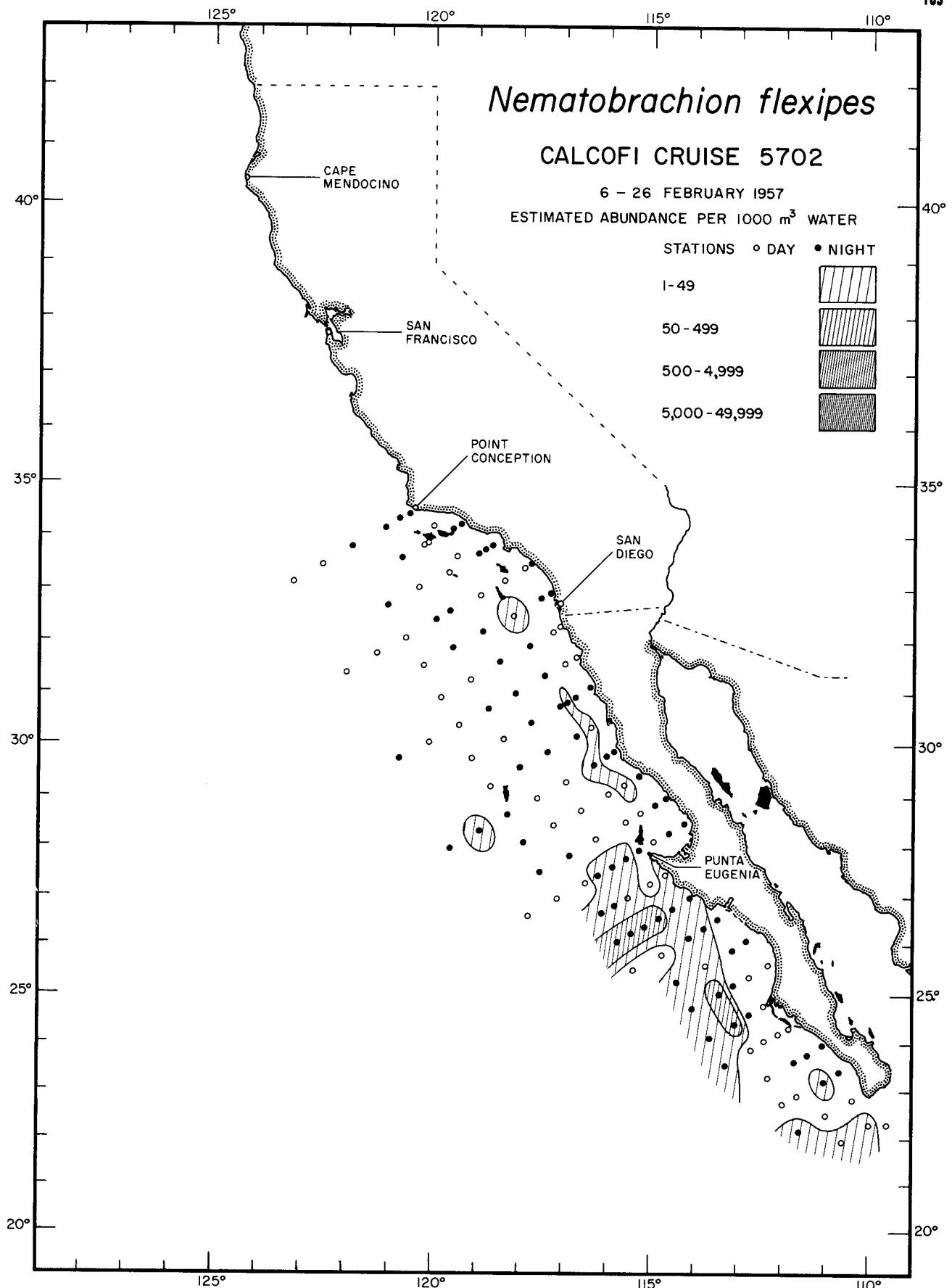
Euphausiacea
Euphausia tenera
6304



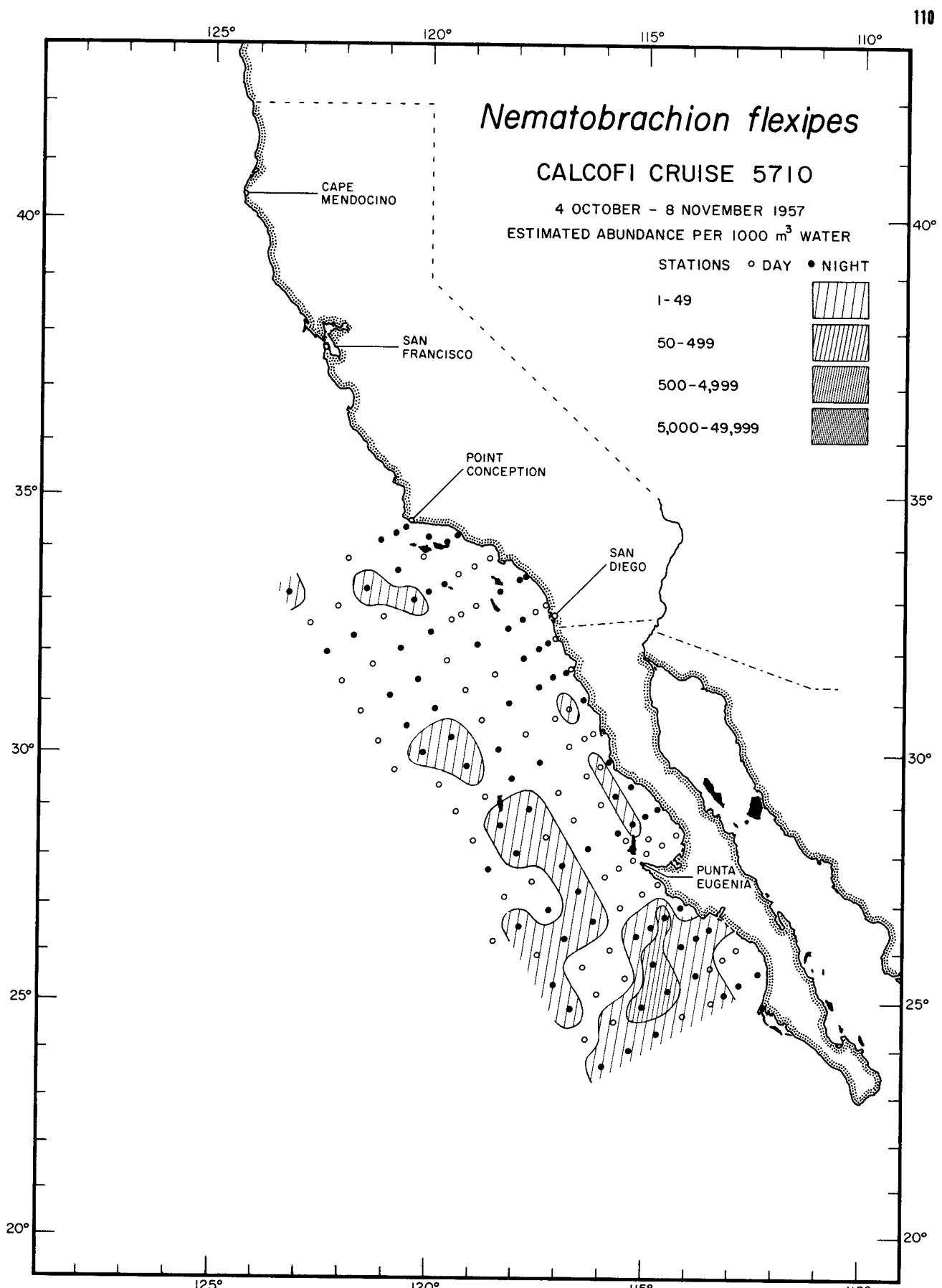
Euphausiacea
Nematobrachion flexipes
5408



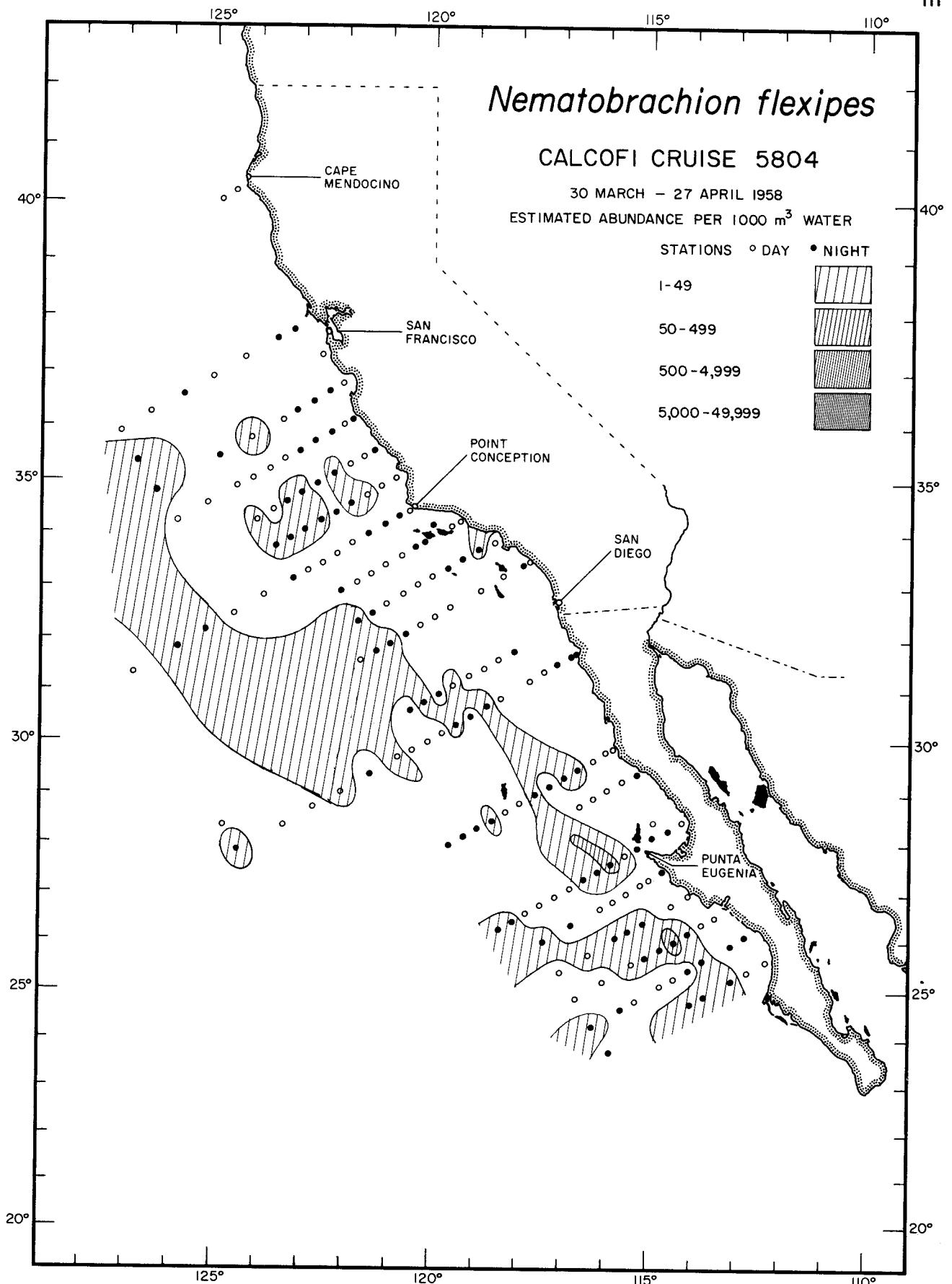
Euphausiacea
Nematobrachion flexipes
 5504



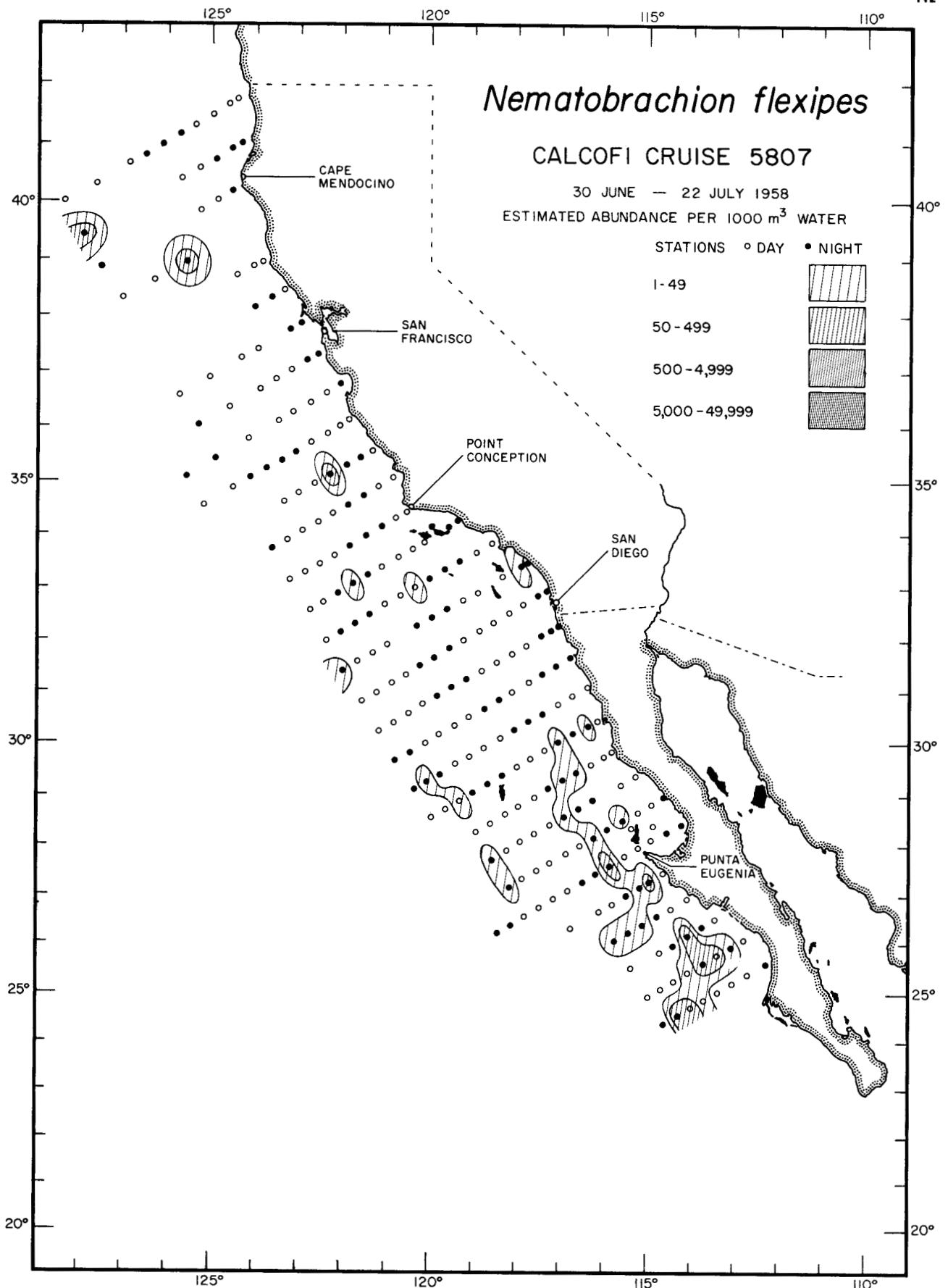
Euphausiacea
Nematobrachion flexipes
 5702



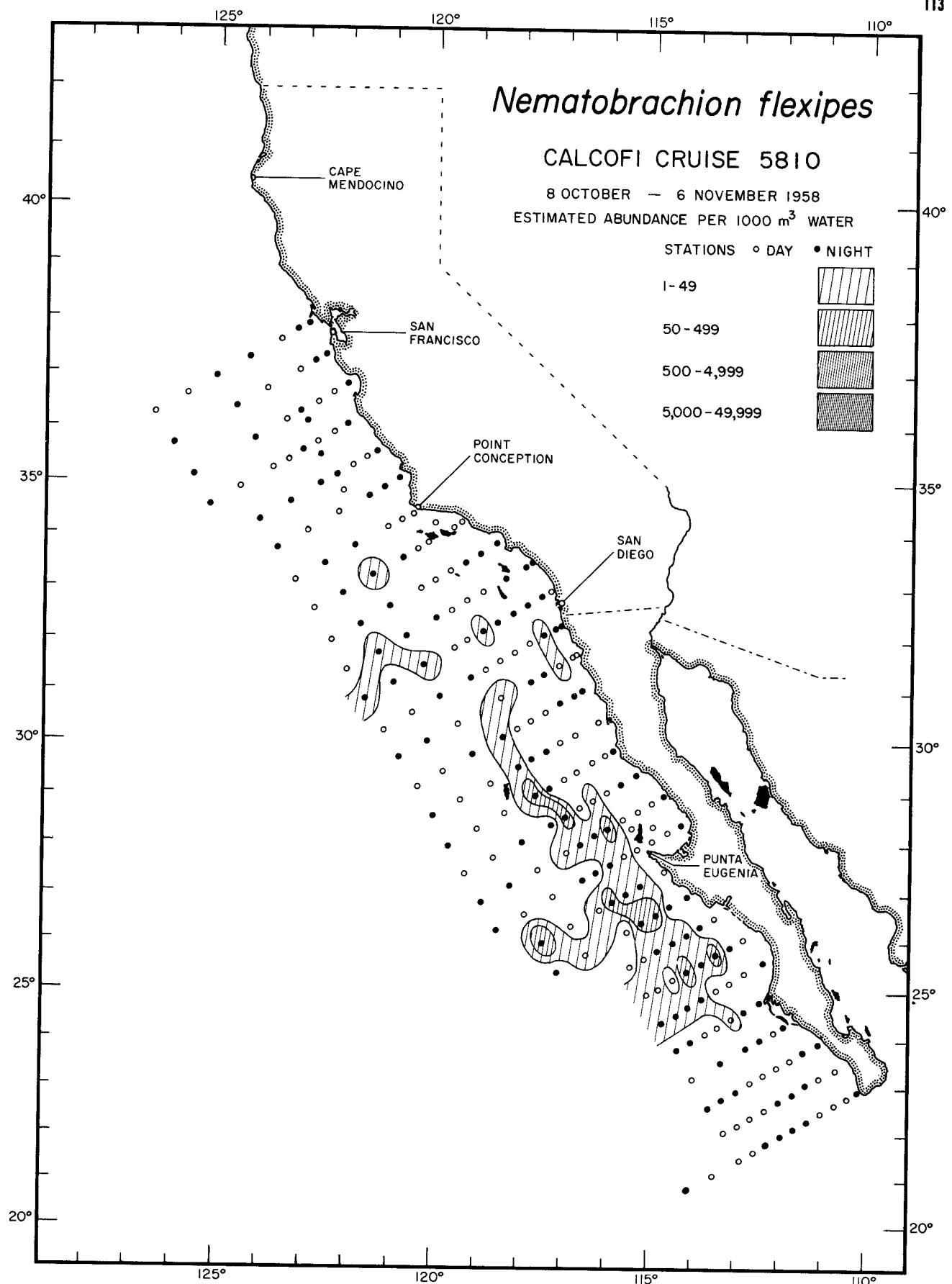
Euphausiacea
Nematobrachion flexipes
5710



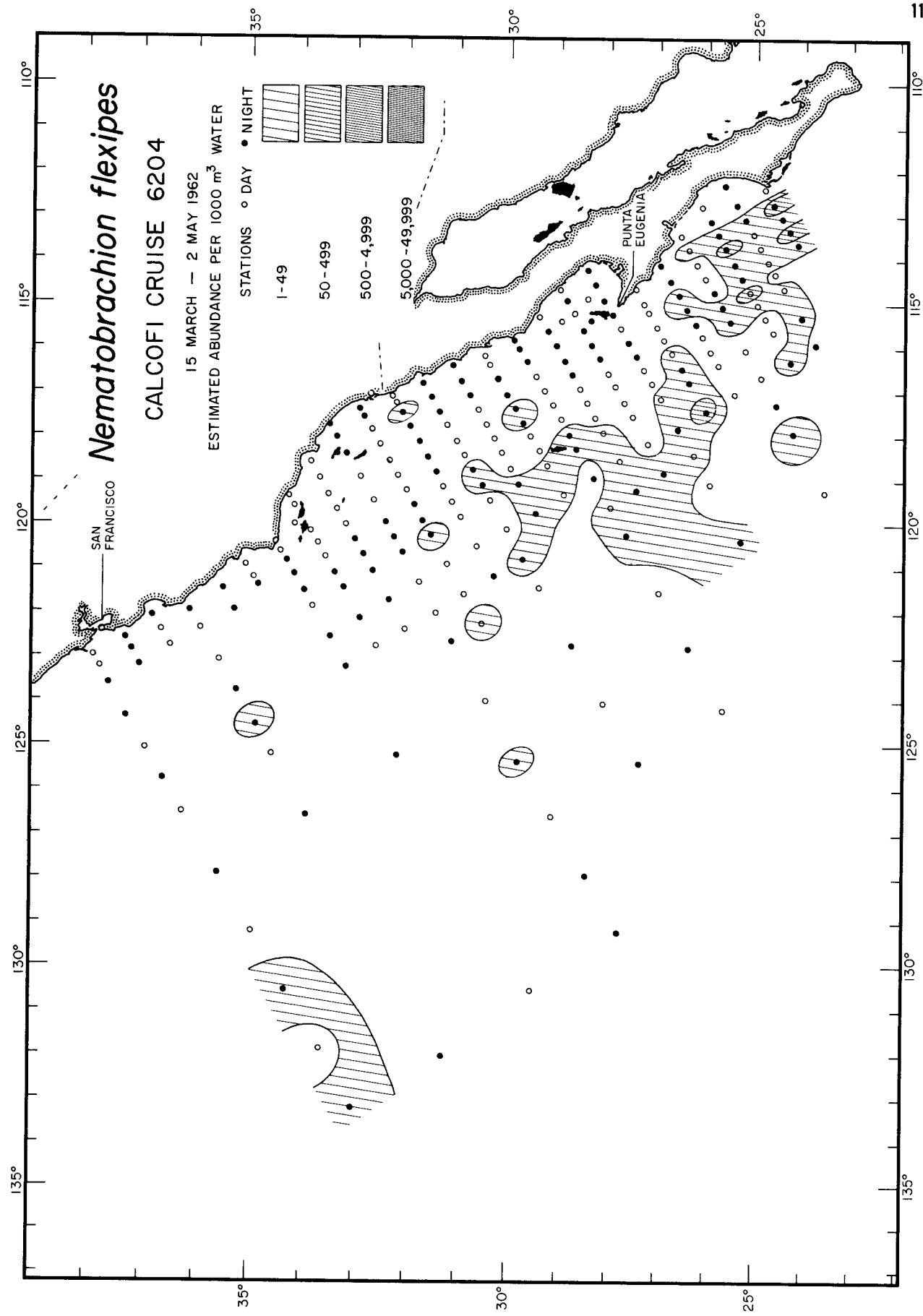
Euphausiacea
Nematobrachion flexipes
5804



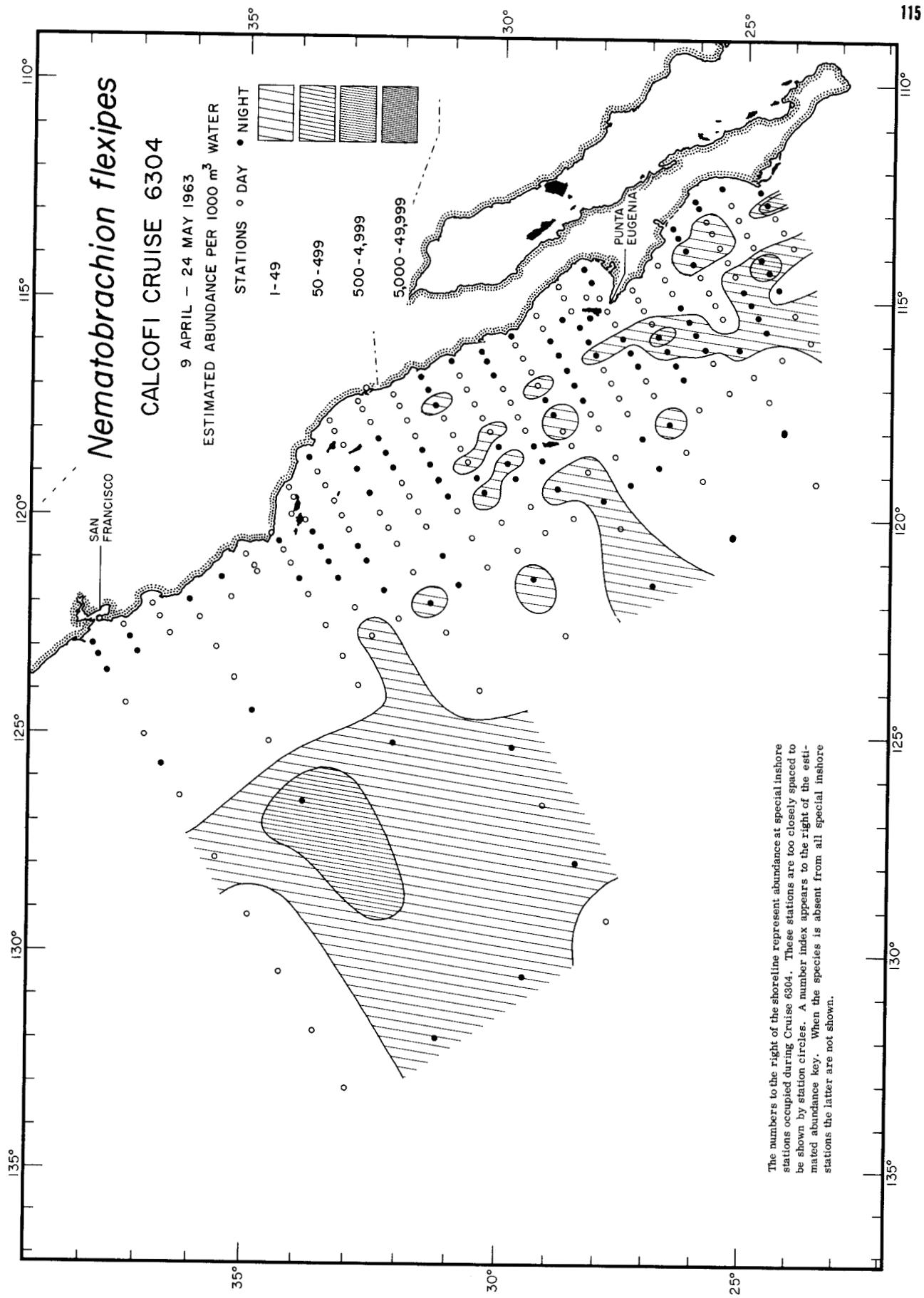
Euphausiacea
Nematobrachion flexipes
5807



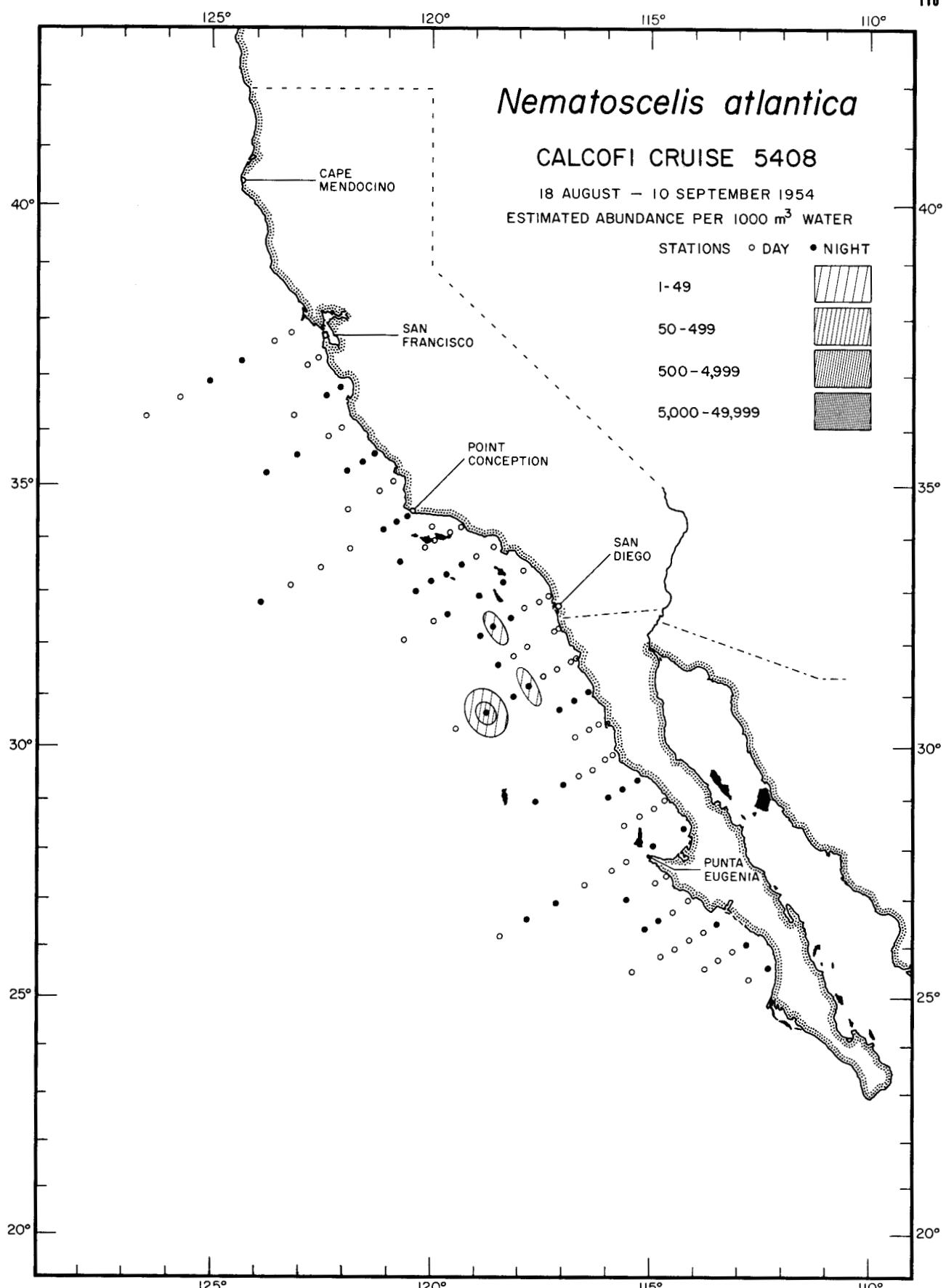
Euphausiacea
Nematobrachion flexipes
 5810



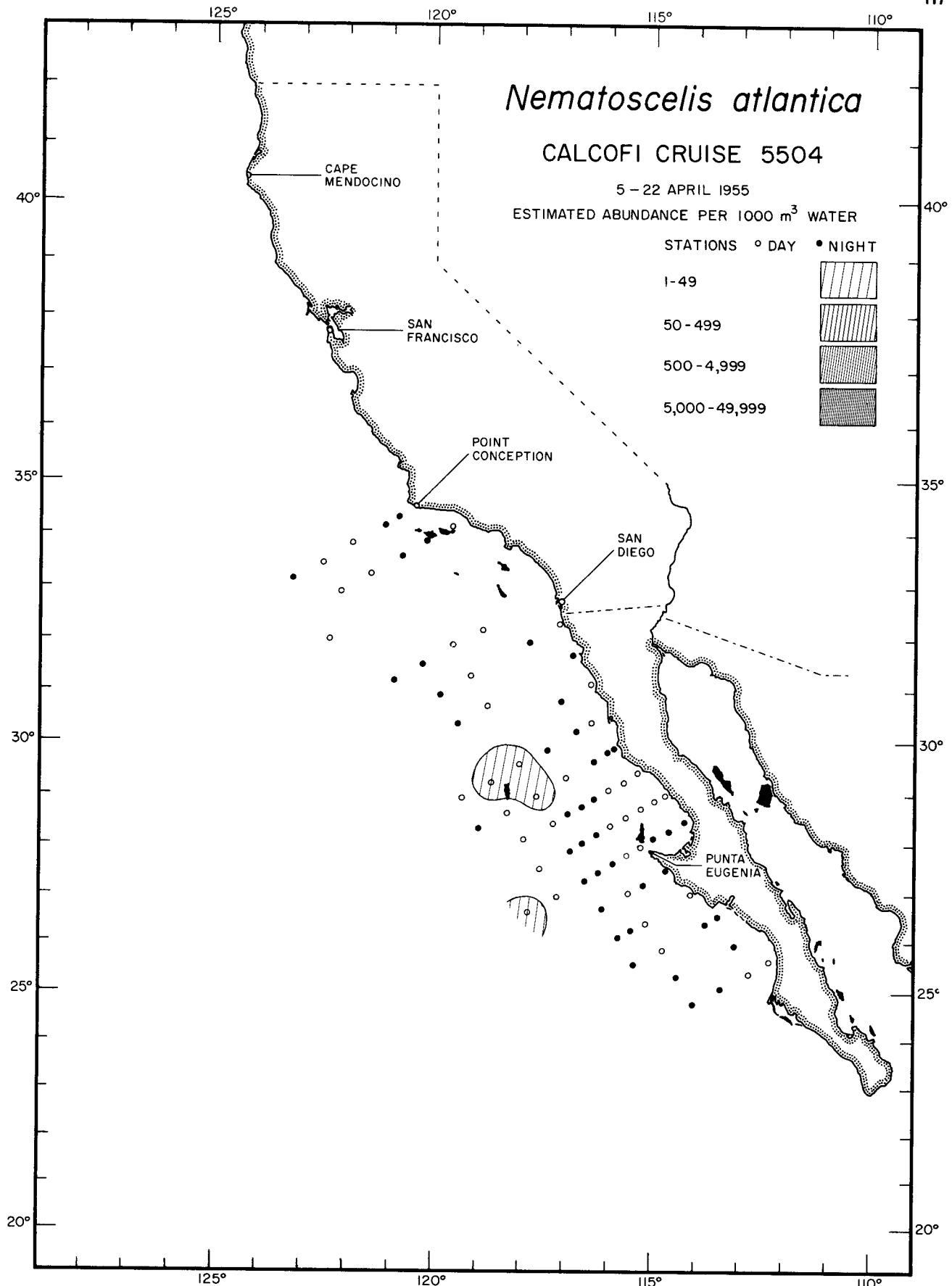
Euphausiacea
Nematobrachion flexipes
6204



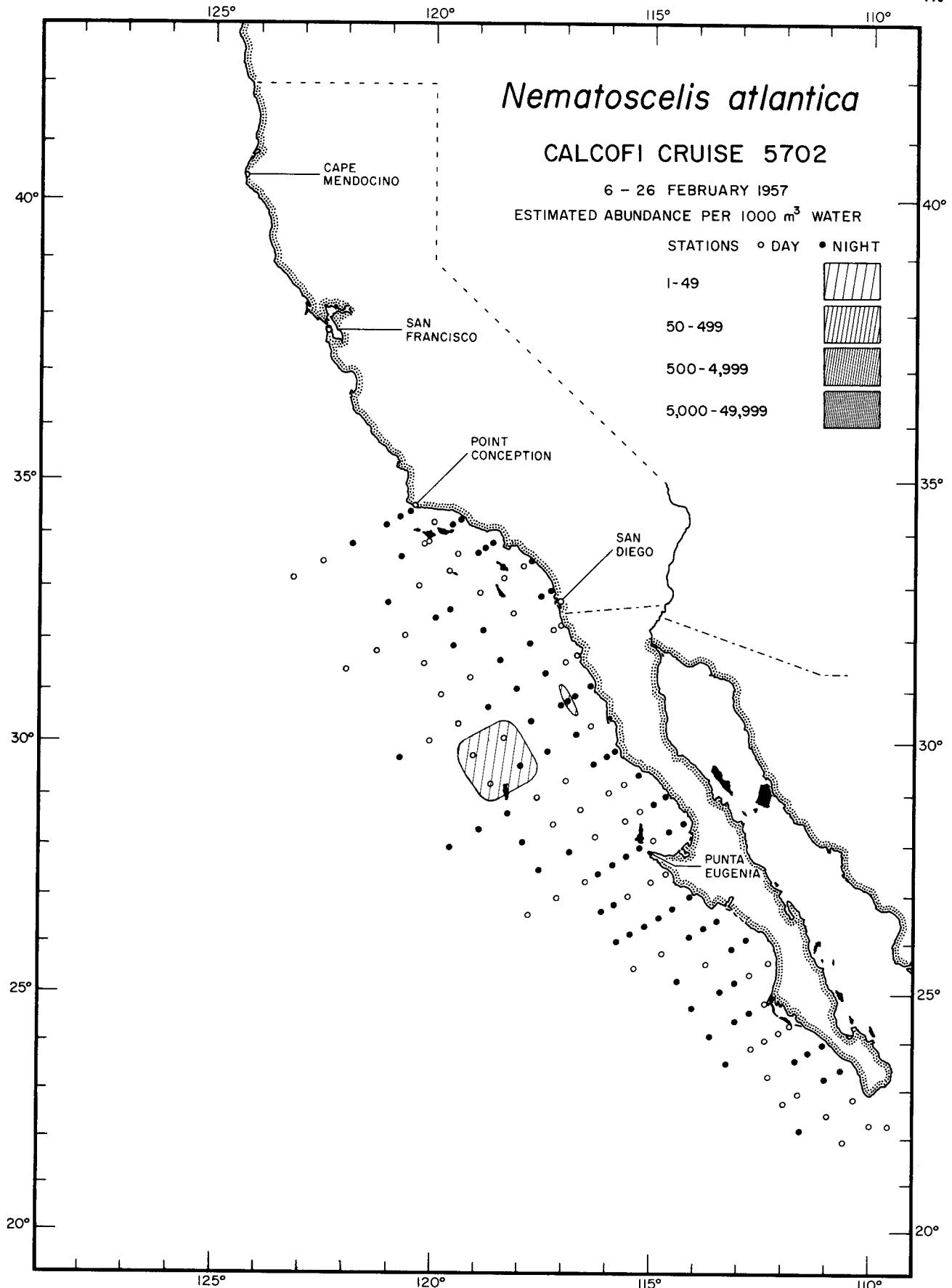
Euphausiacea
Nematobrachion flexipes
6304



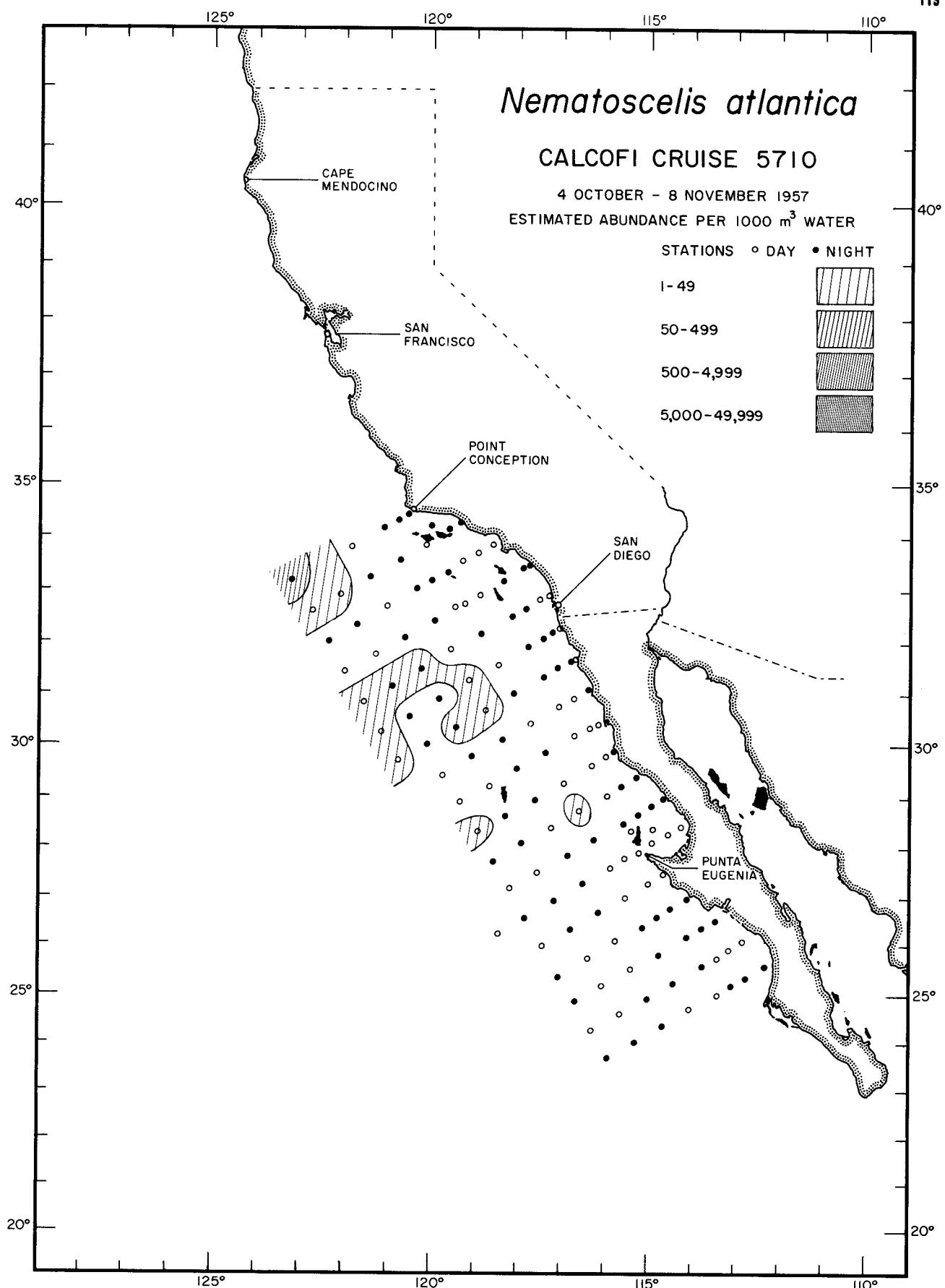
Euphausiacea
Nematoscelis atlantica
 5408



Euphausiacea
Nematoscelis atlantica
 5504

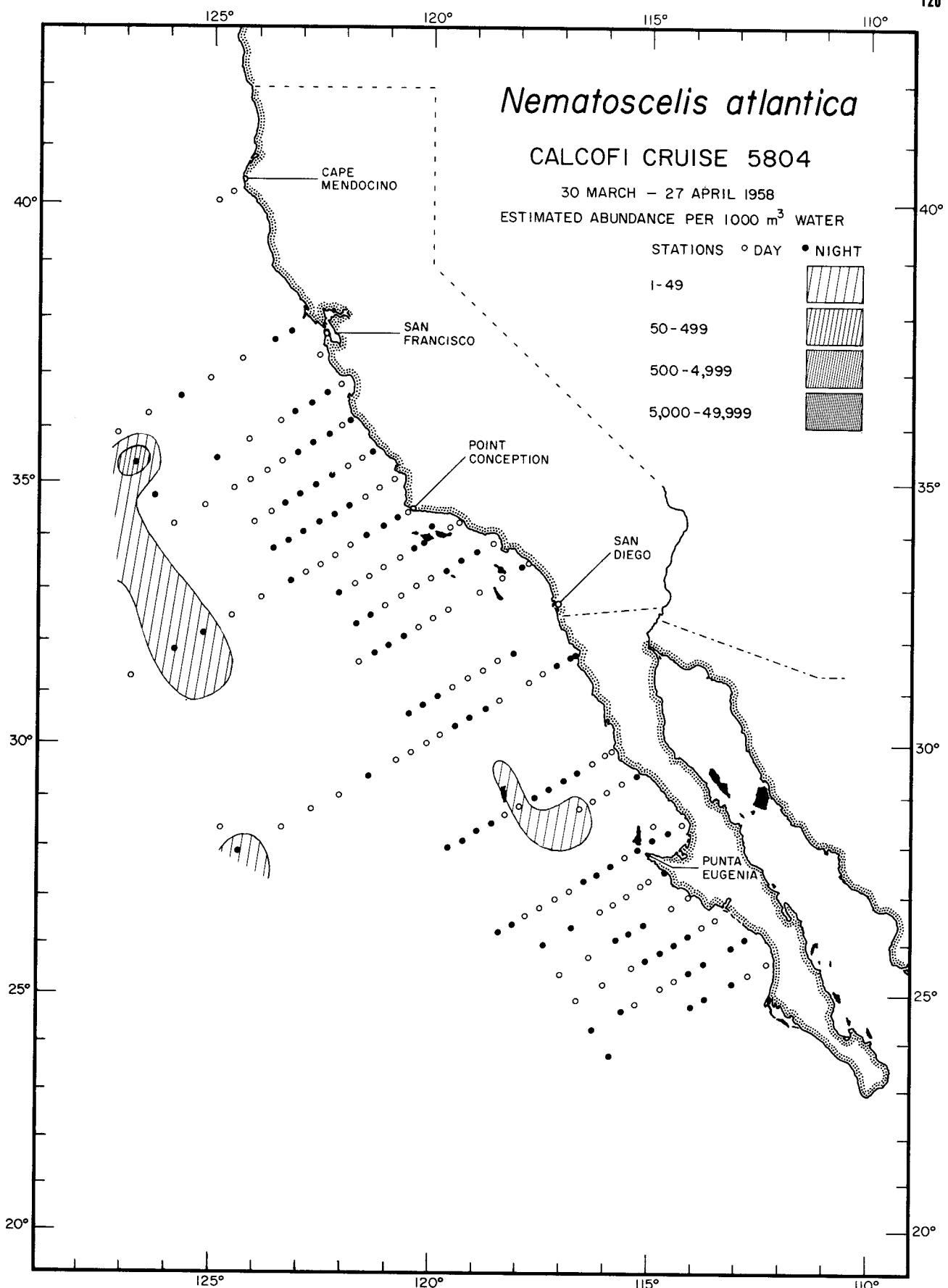


Euphausiacea
Nematoscelis atlantica
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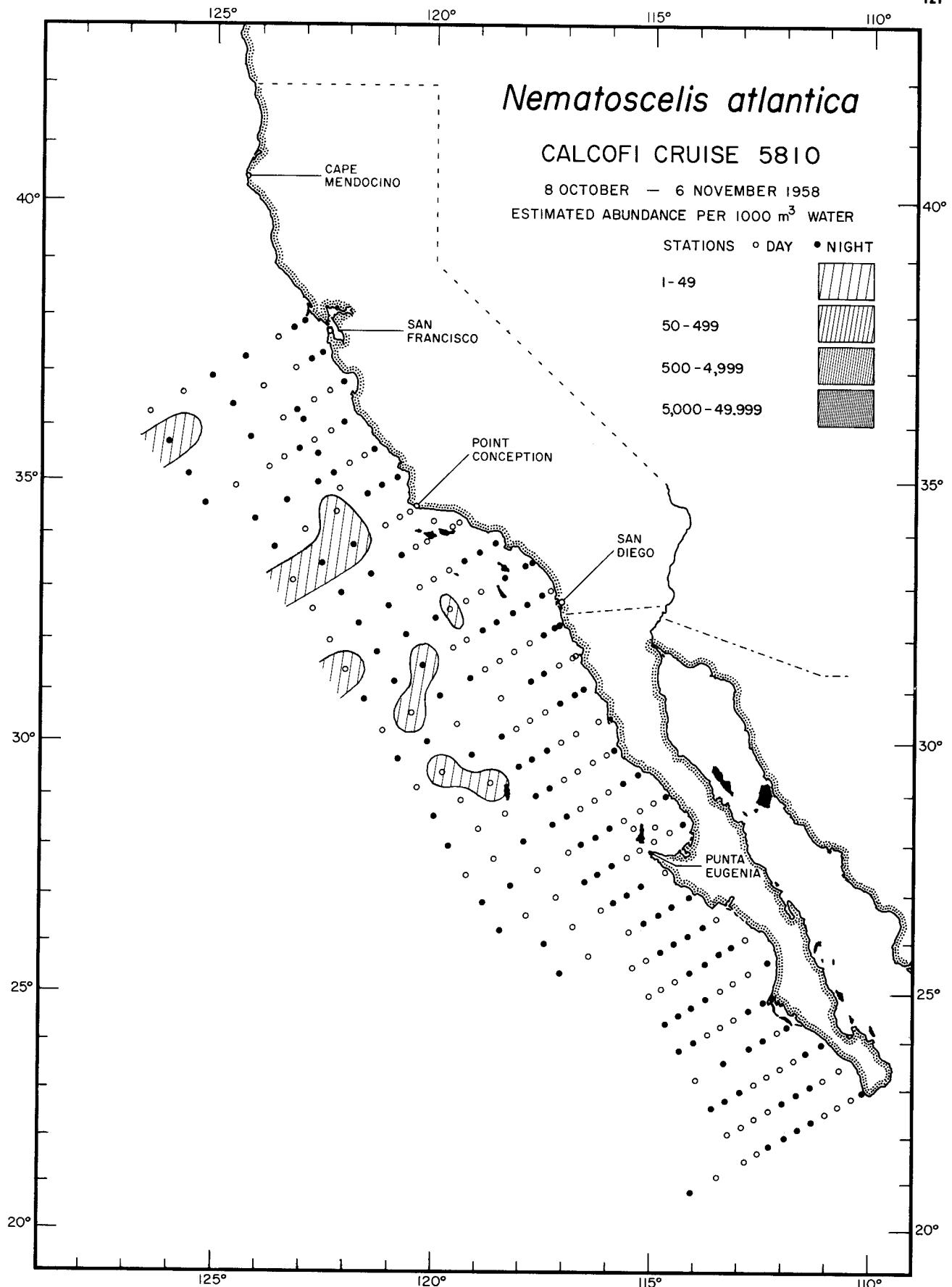


Euphausiacea
Nematoscelis atlantica
 5710

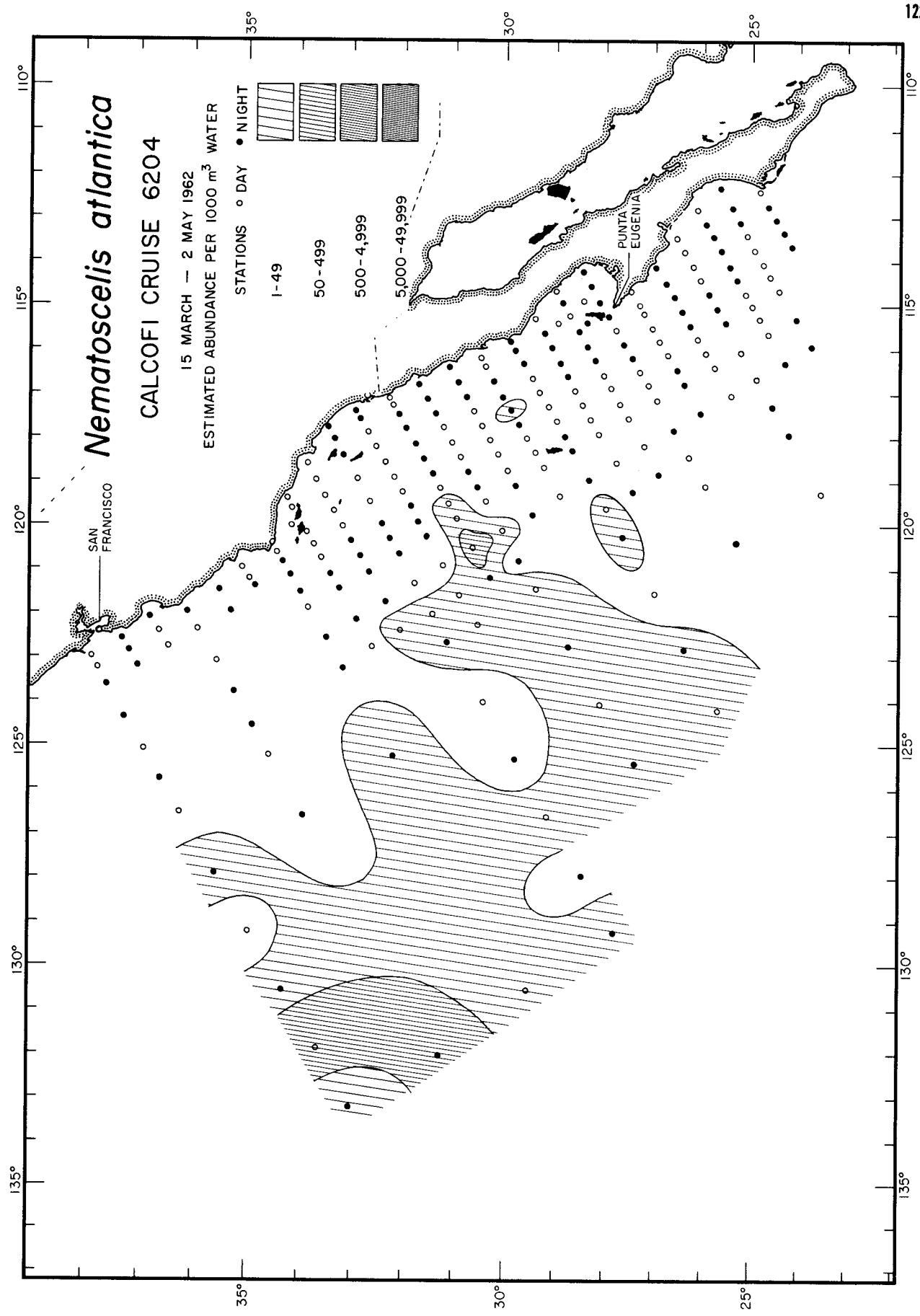
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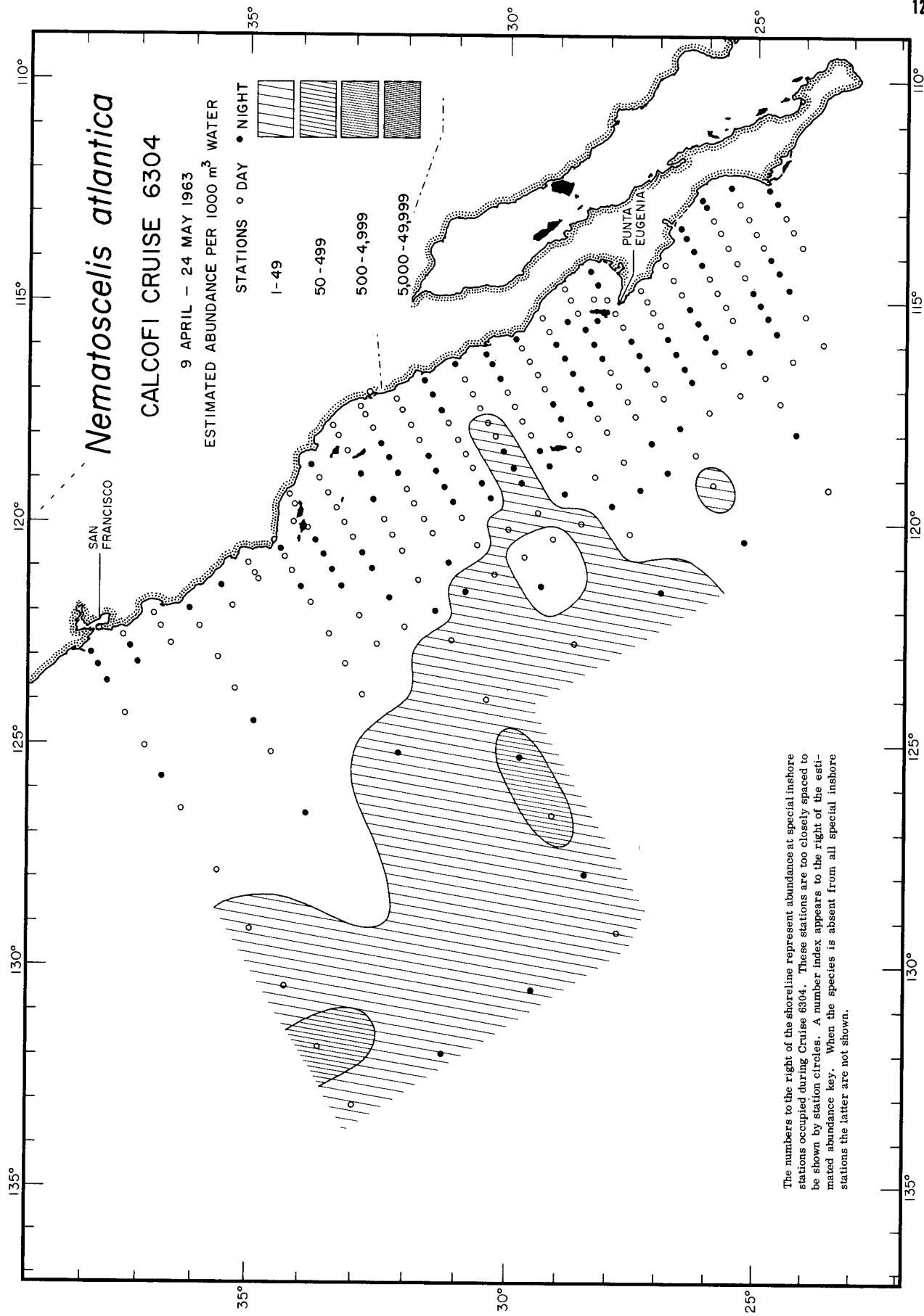
Euphausiacea
Nematoscelis atlantica
 5804



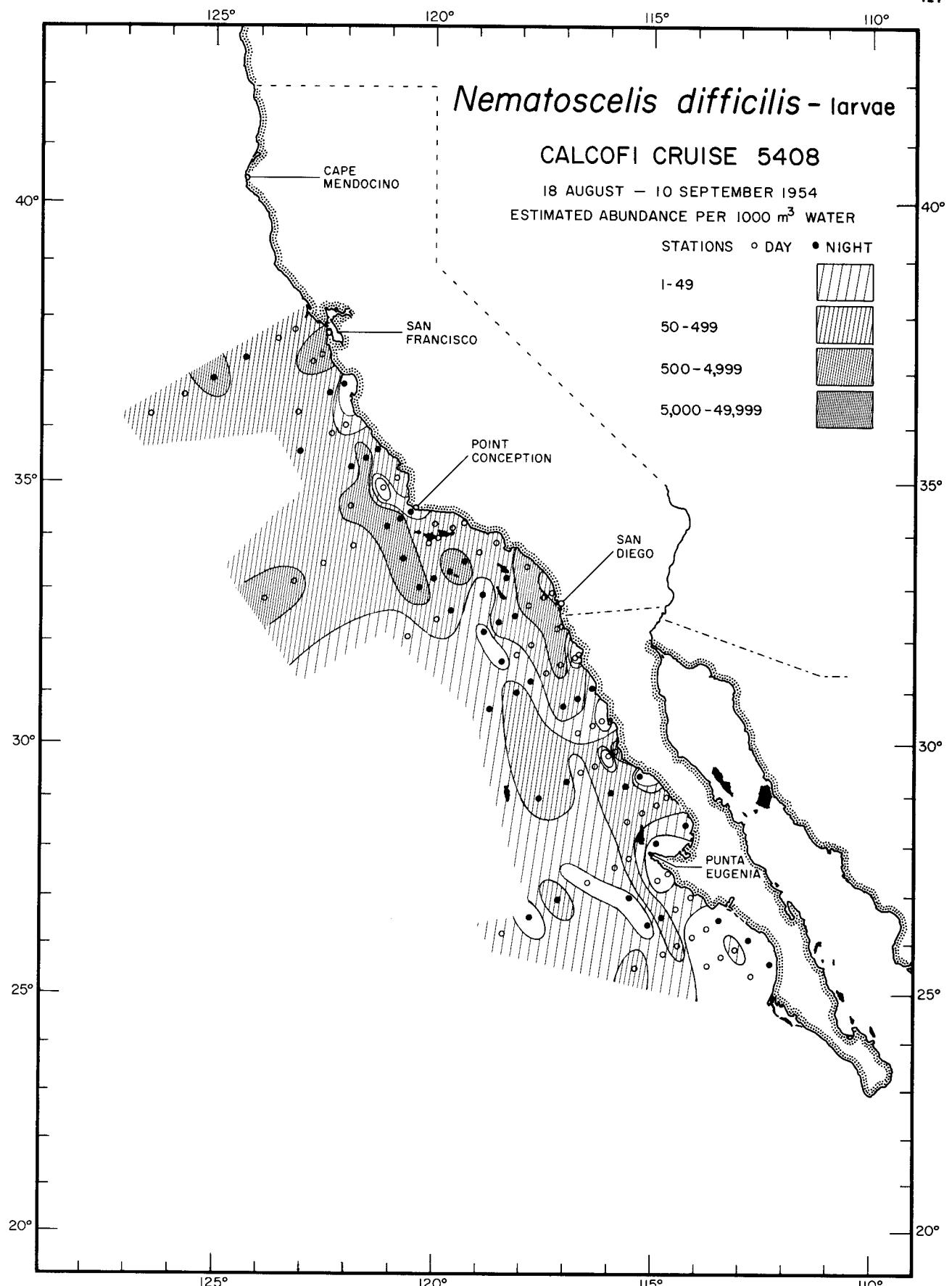
Euphausiacea
Nematoscelis atlantica
5810



Euphausiacea
Nematoscelis atlantica
 6204

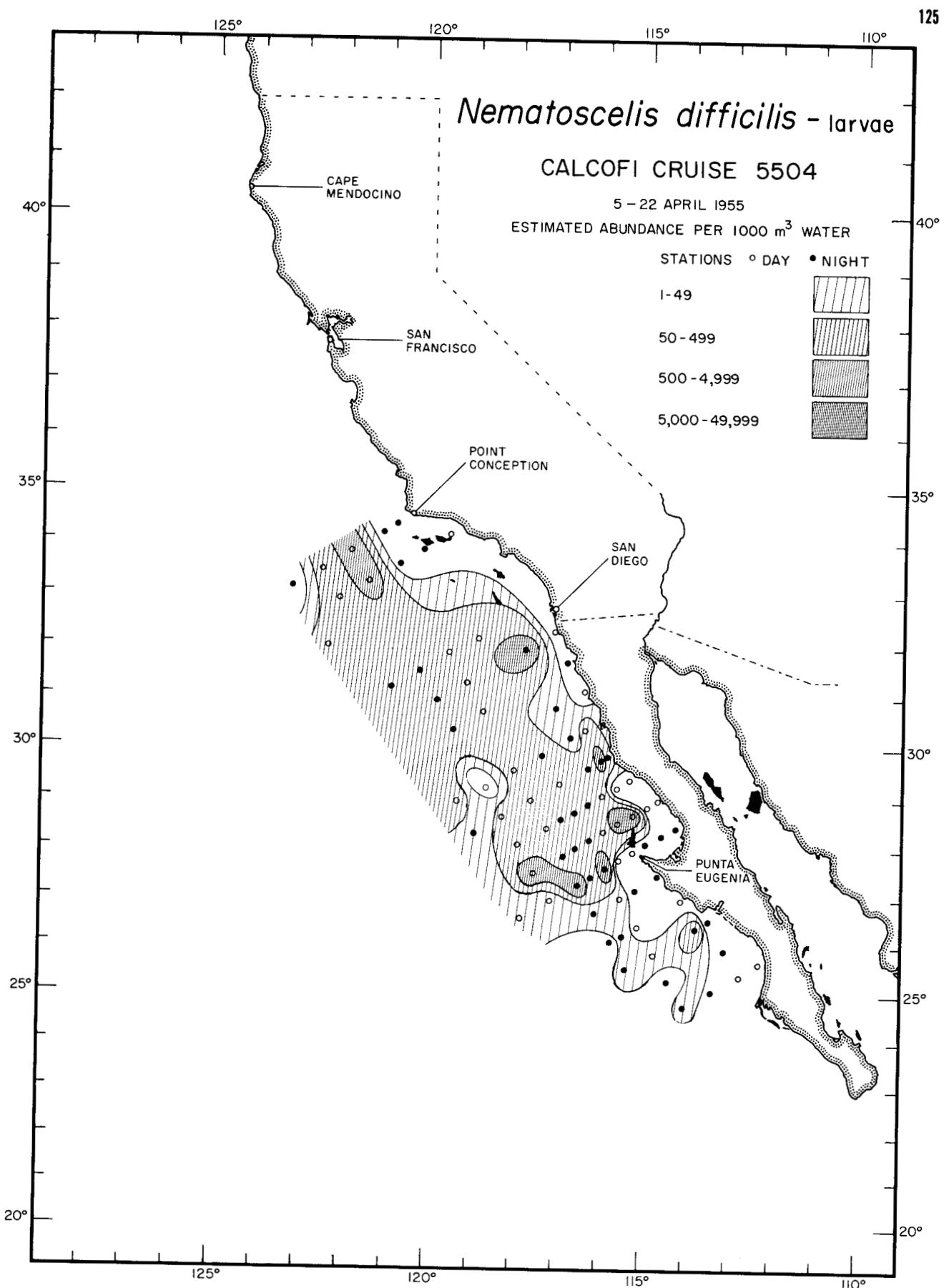


Euphausiacea
Nematocelis atlantica
6304

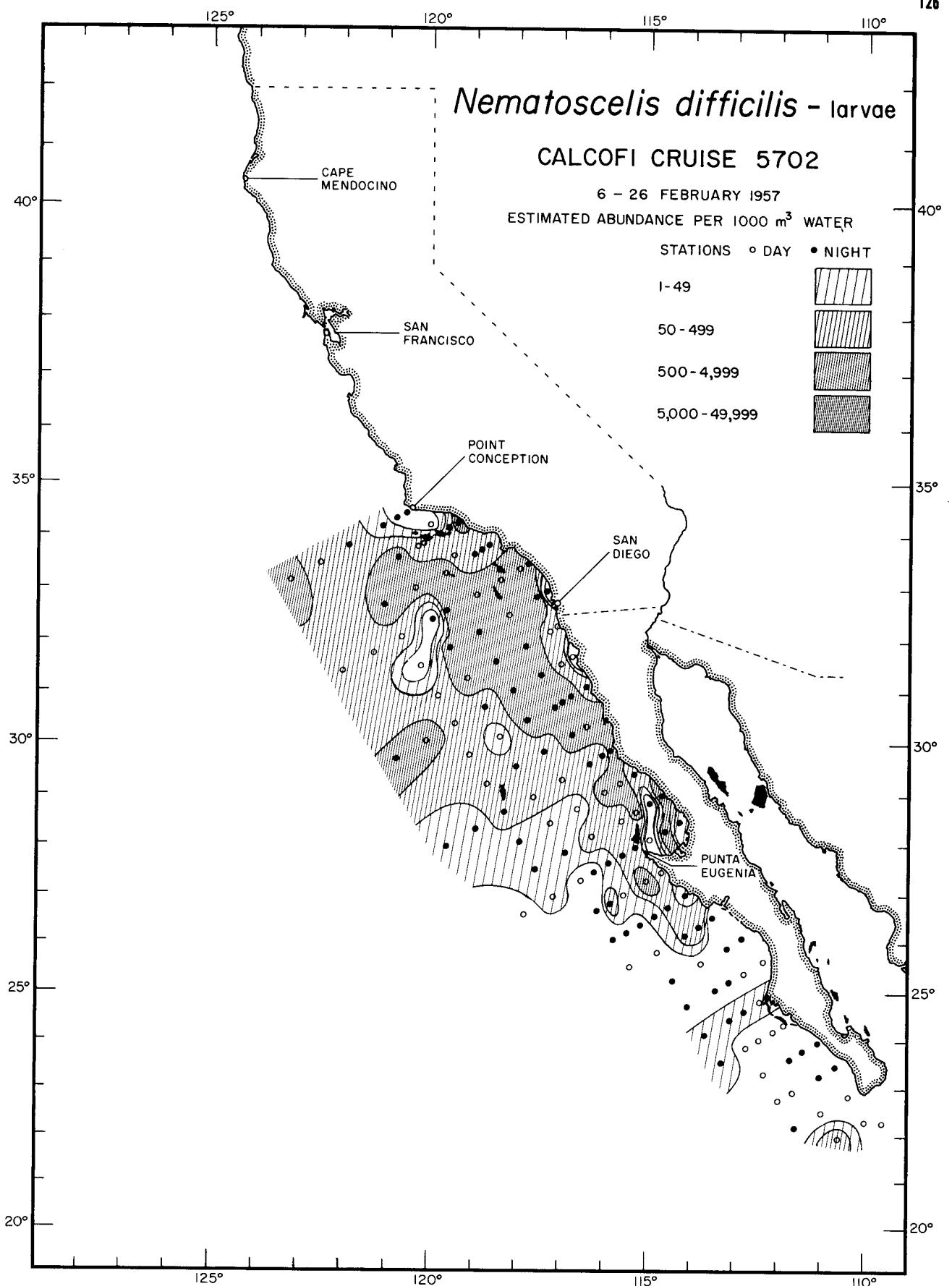


Euphausiacea
Nematoscelis difficilis - larvae

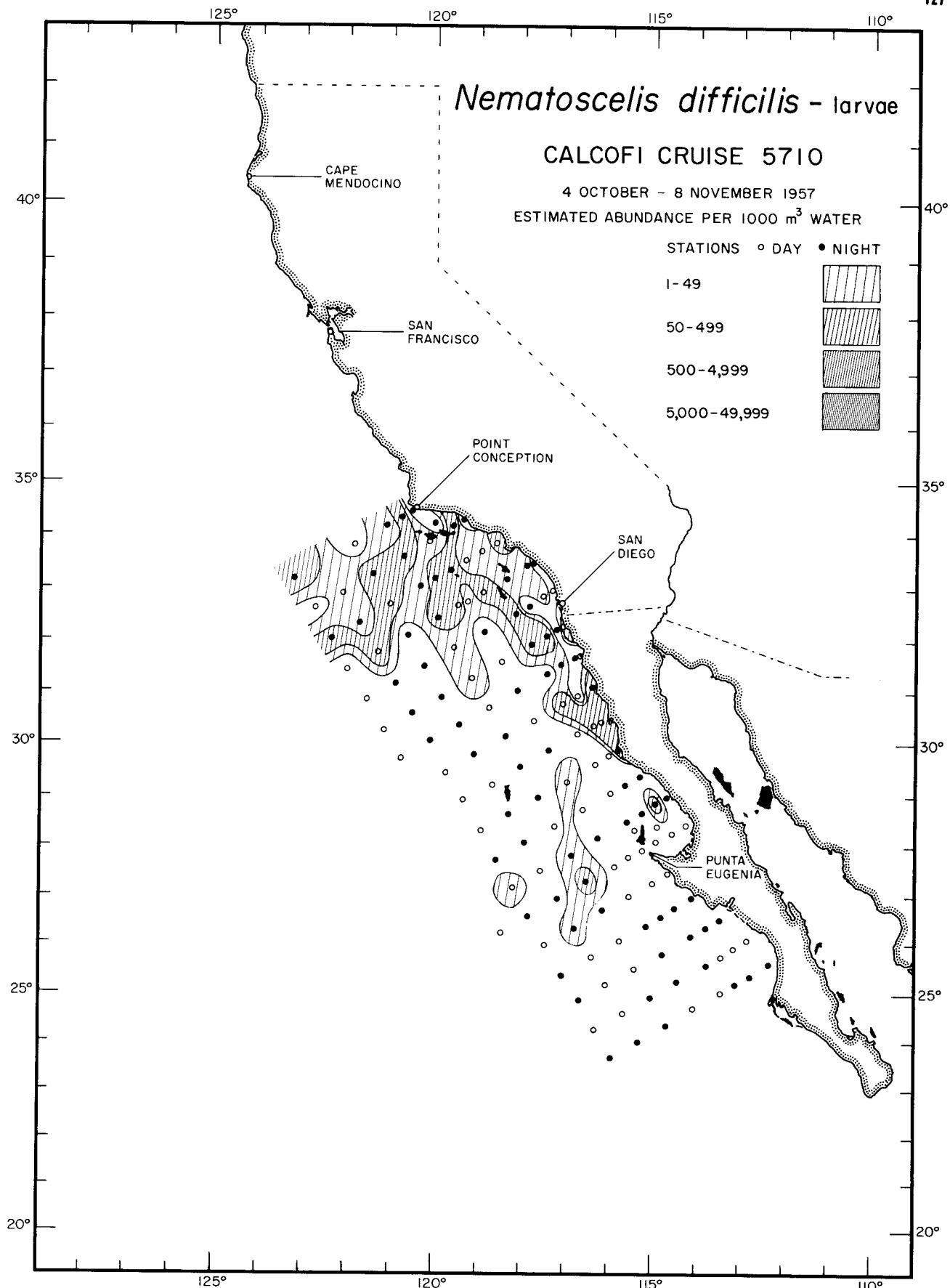
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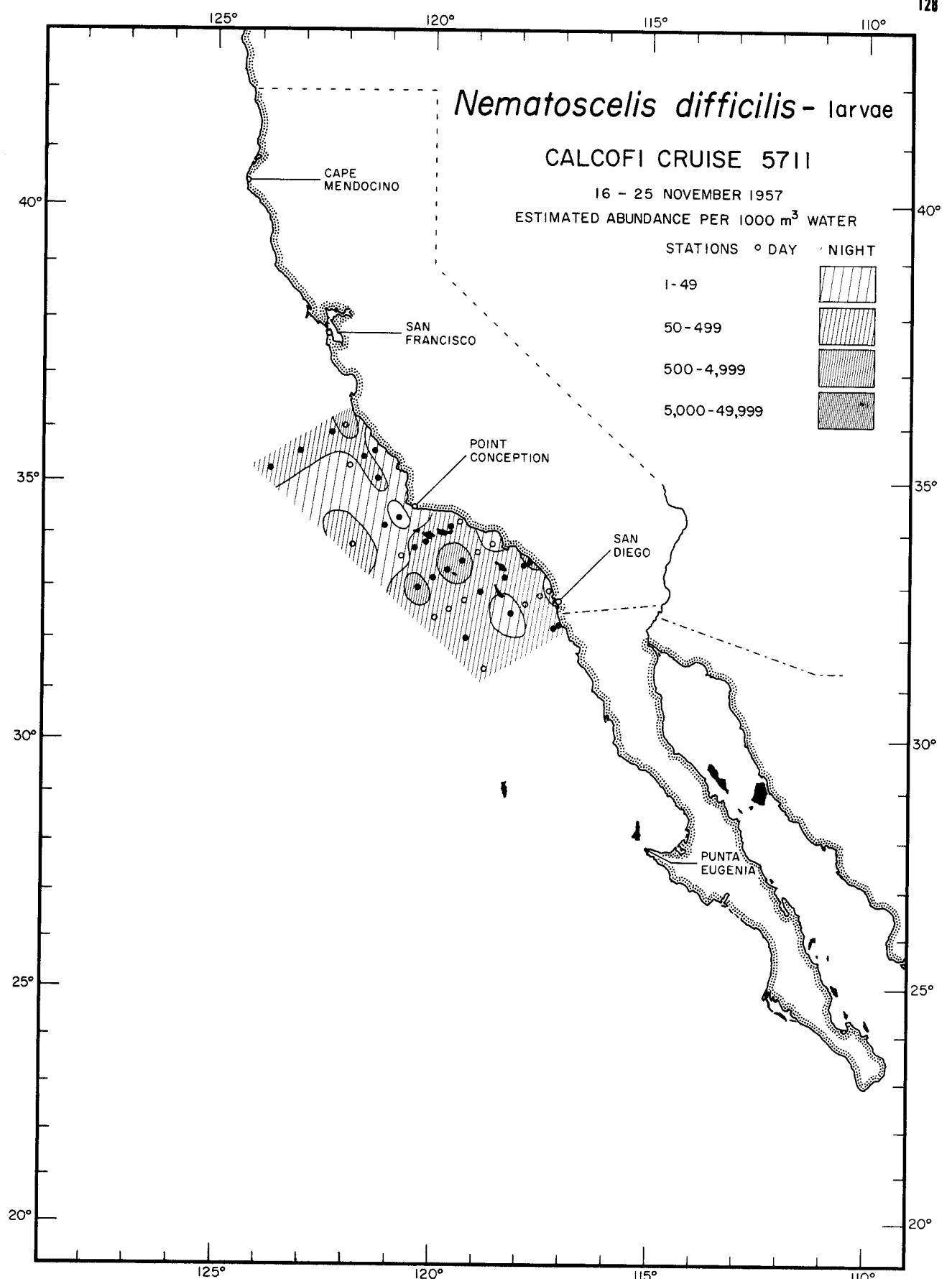
Euphausiacea
Nematoscelis difficilis - larvae
 5504



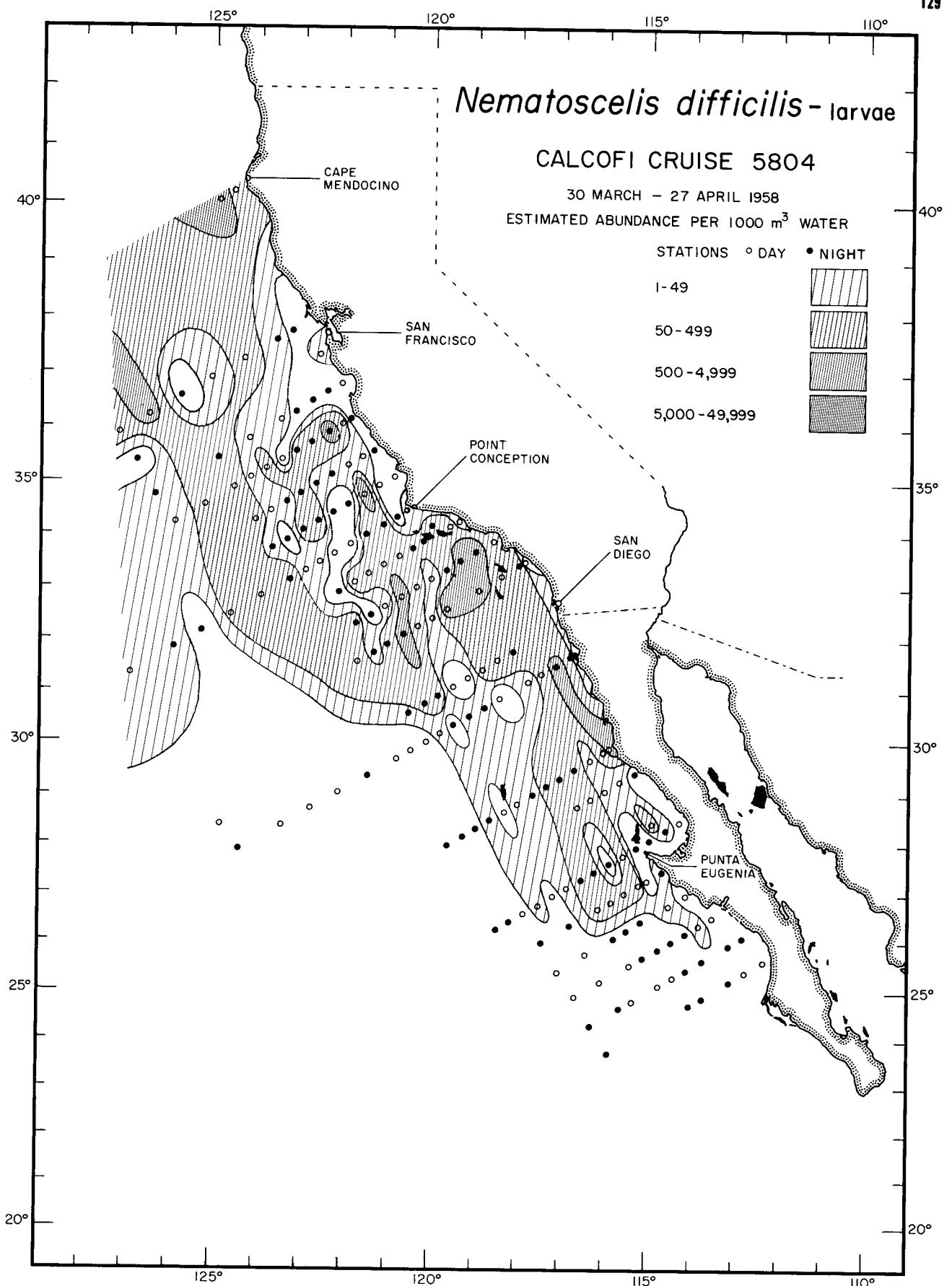
Euphausiacea
Nematoscelis difficilis - larvae
5702



Euphausiacea
Nematoscelis difficilis - larvae
5710

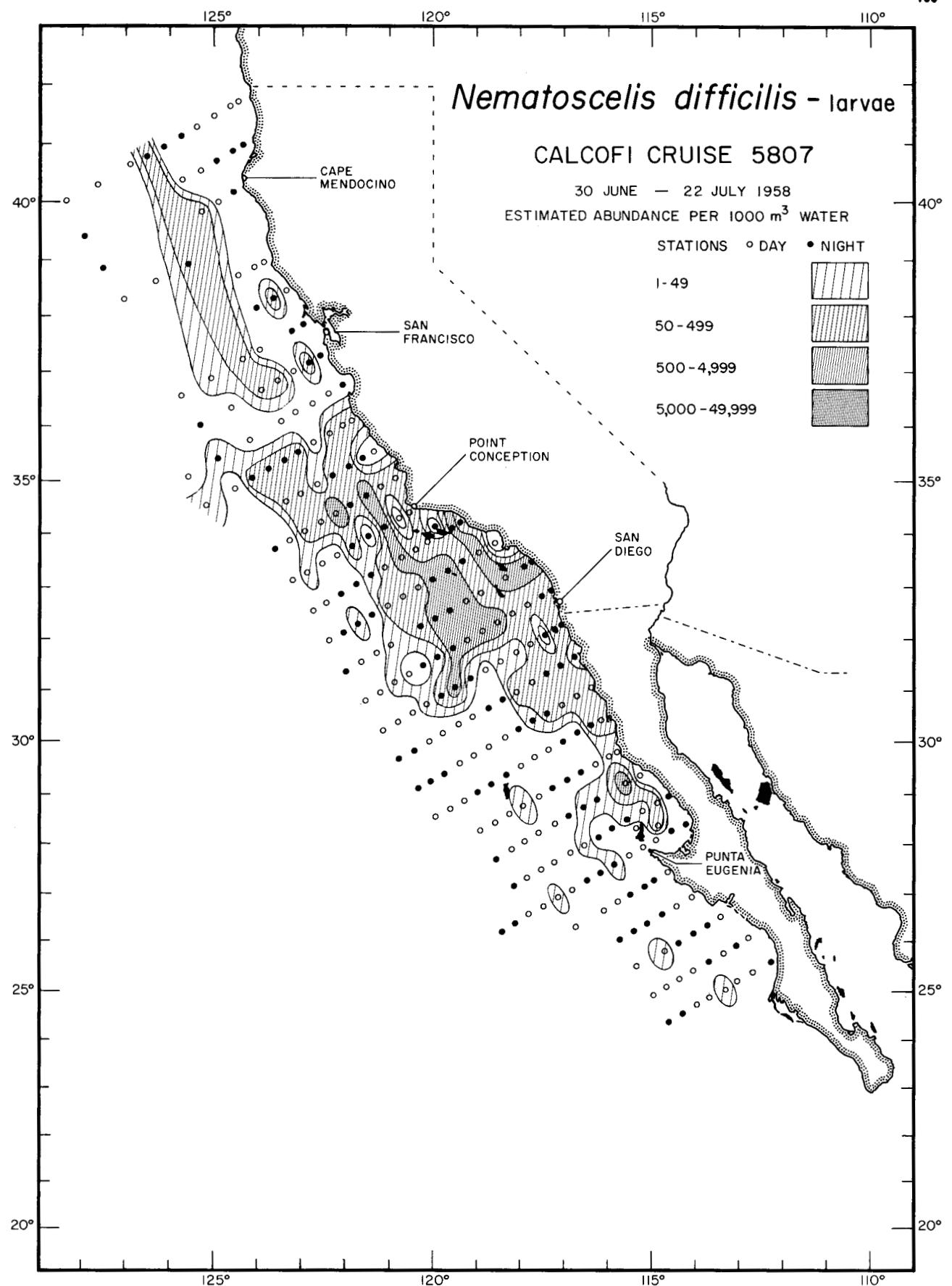


Euphausiacea
Nematoscelis difficilis - larvae
 5711



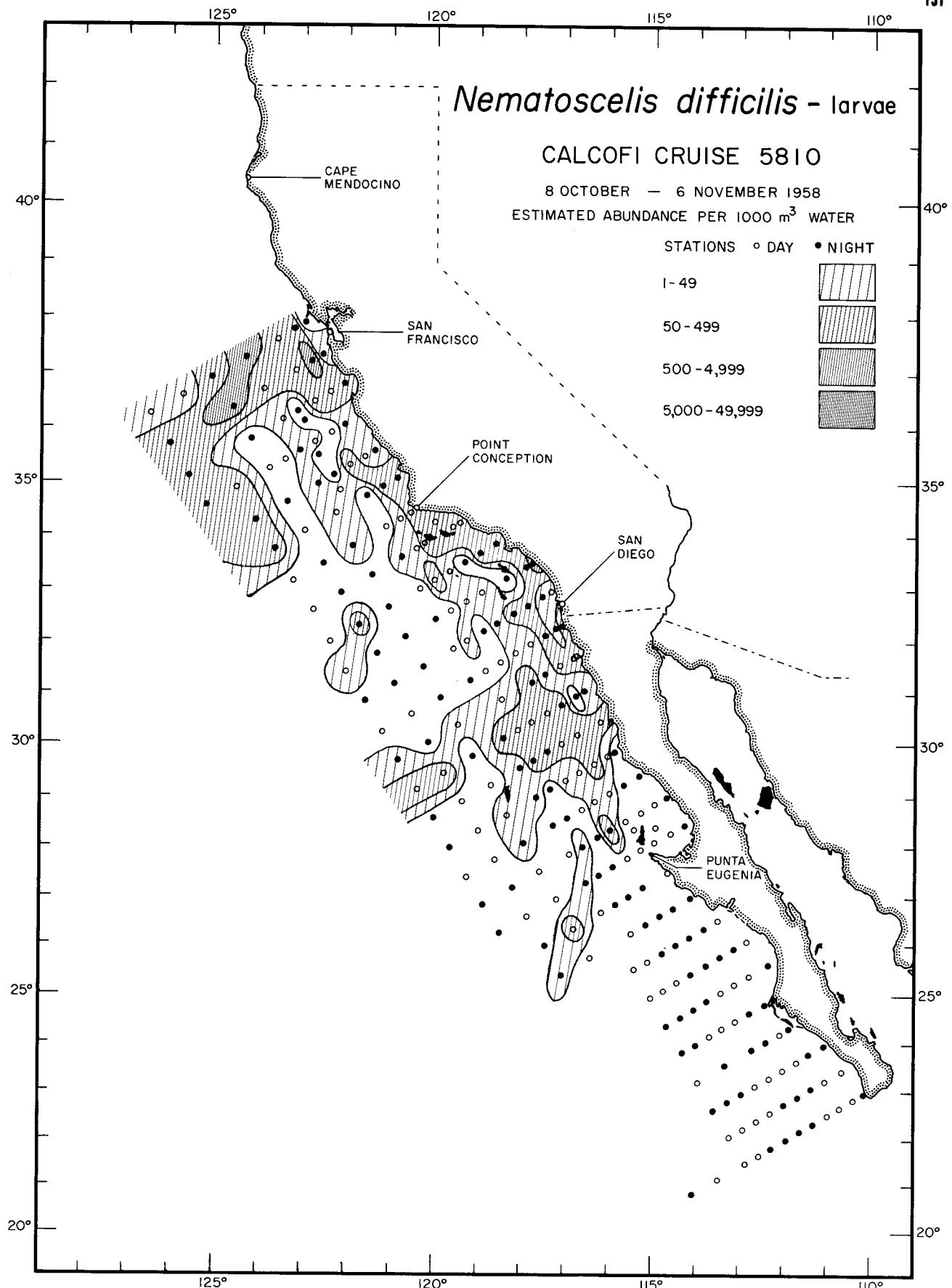
Euphausiacea
Nematoscelis difficilis - larvae

5804



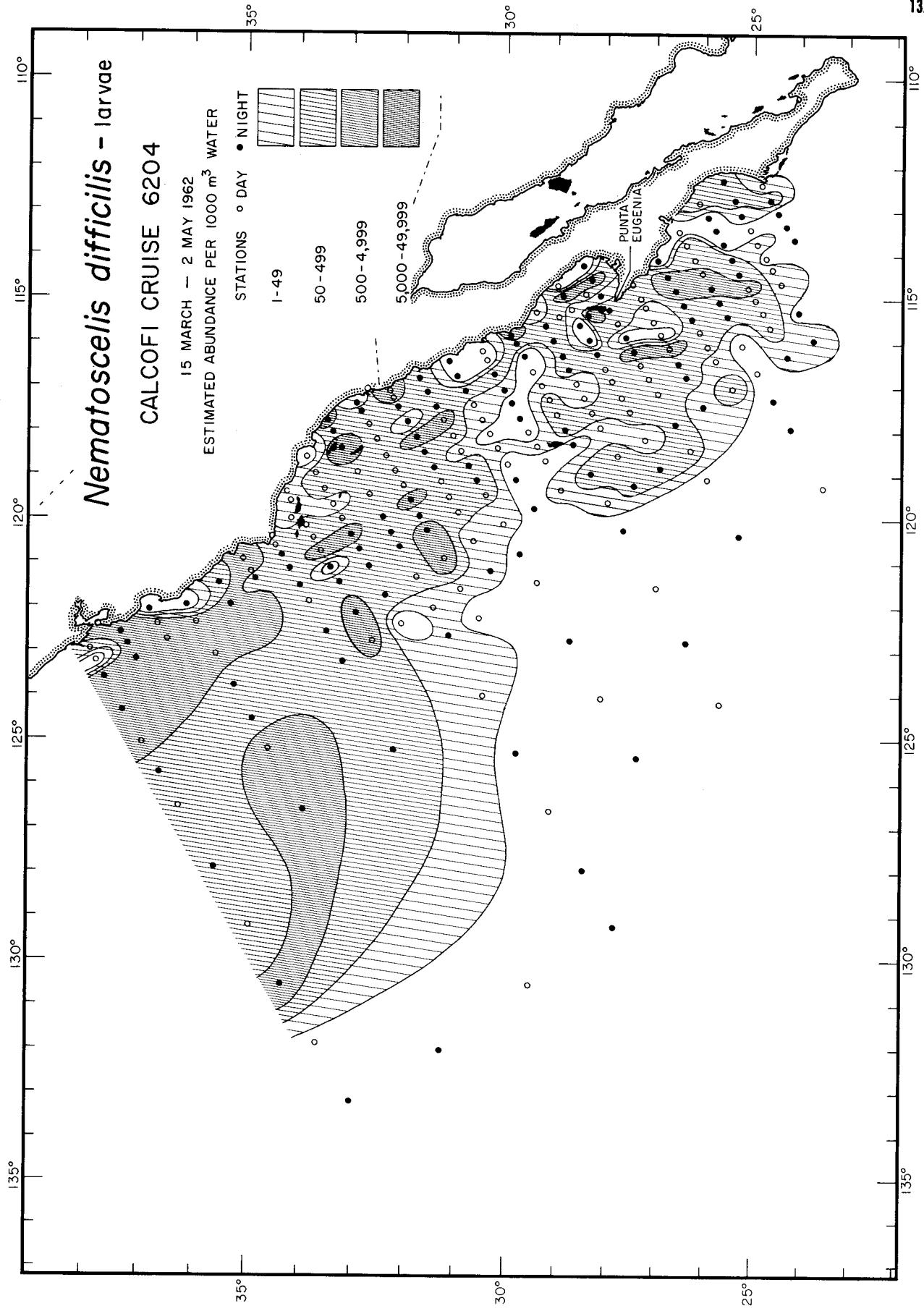
Euphausiacea
Nematoscelis difficilis - larvae

5807

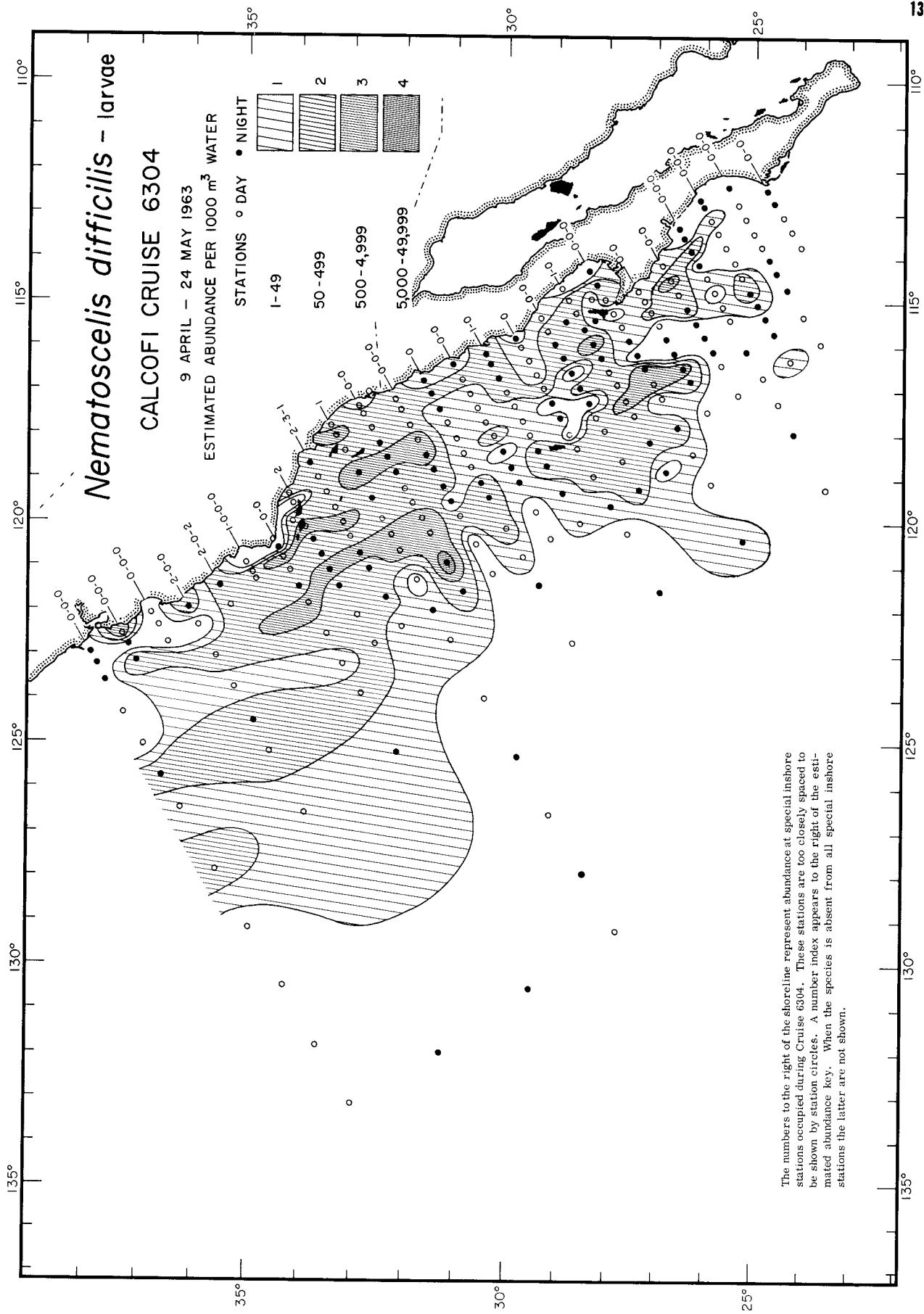


Euphausiacea
Nematoscelis difficilis - larvae

5810

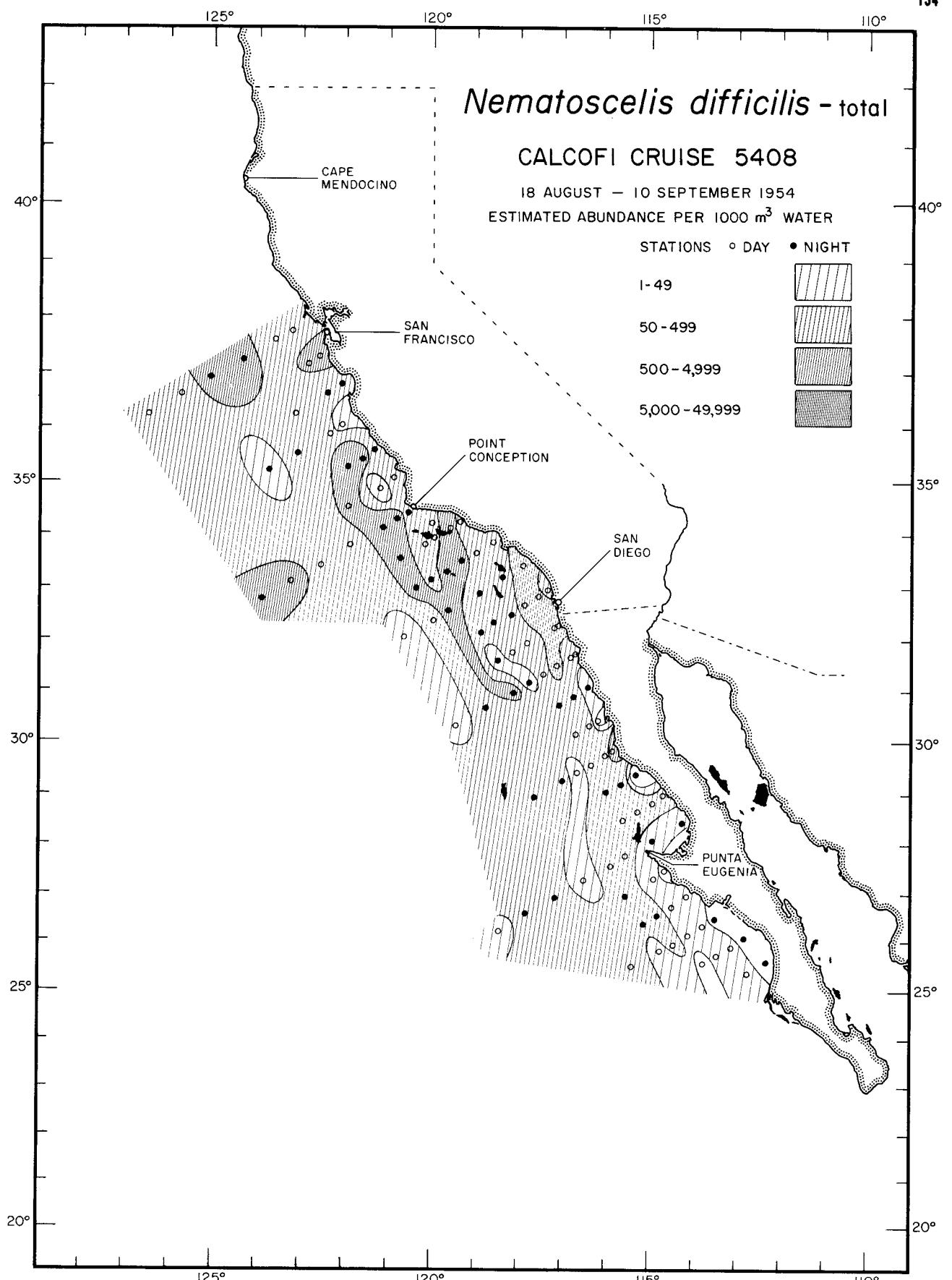


Euphausiacea
Nematoscelis difficilis - larvae
6204



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.

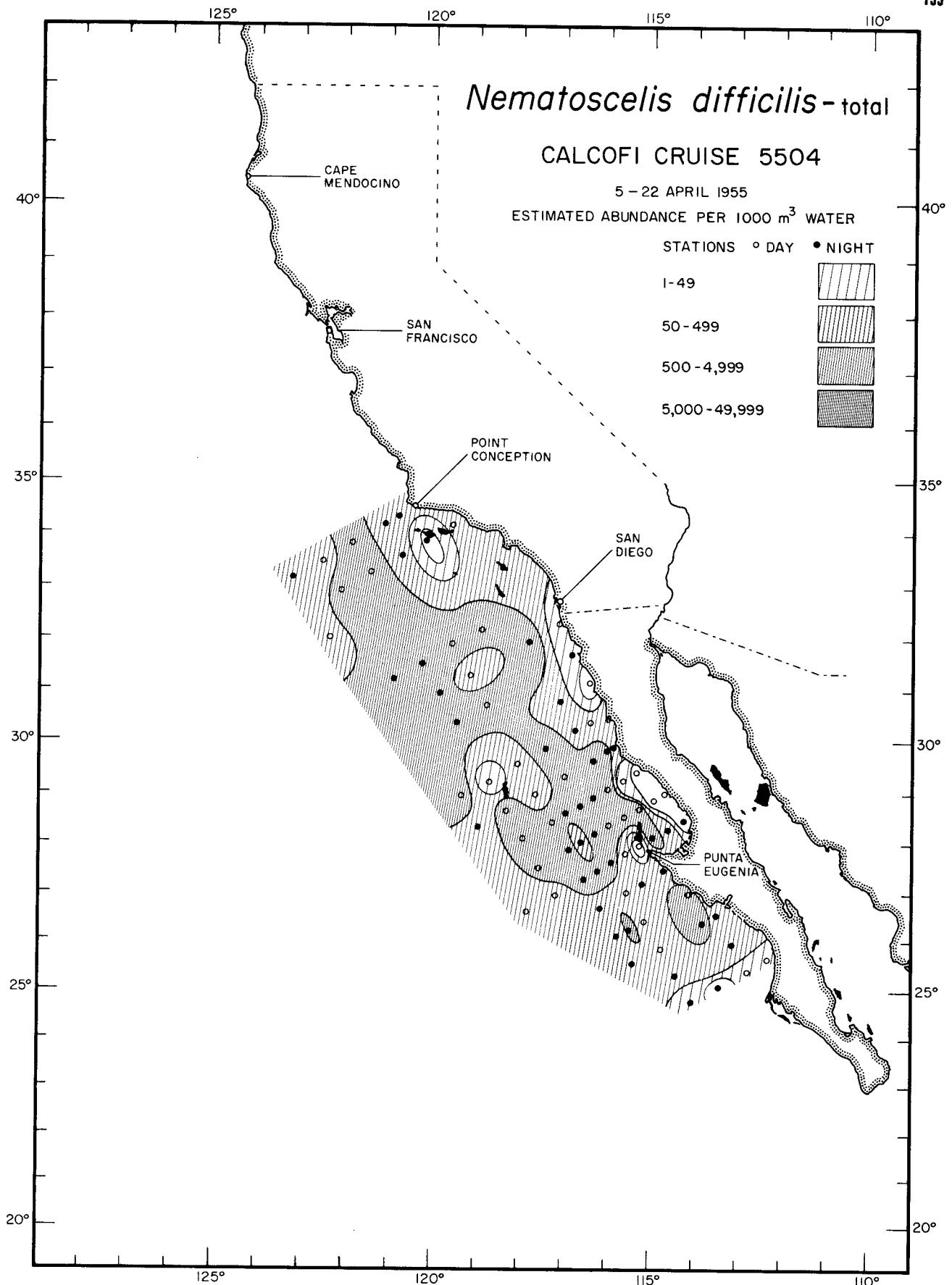
Euphausiacea
Nematoscelis difficilis - larvae
6304



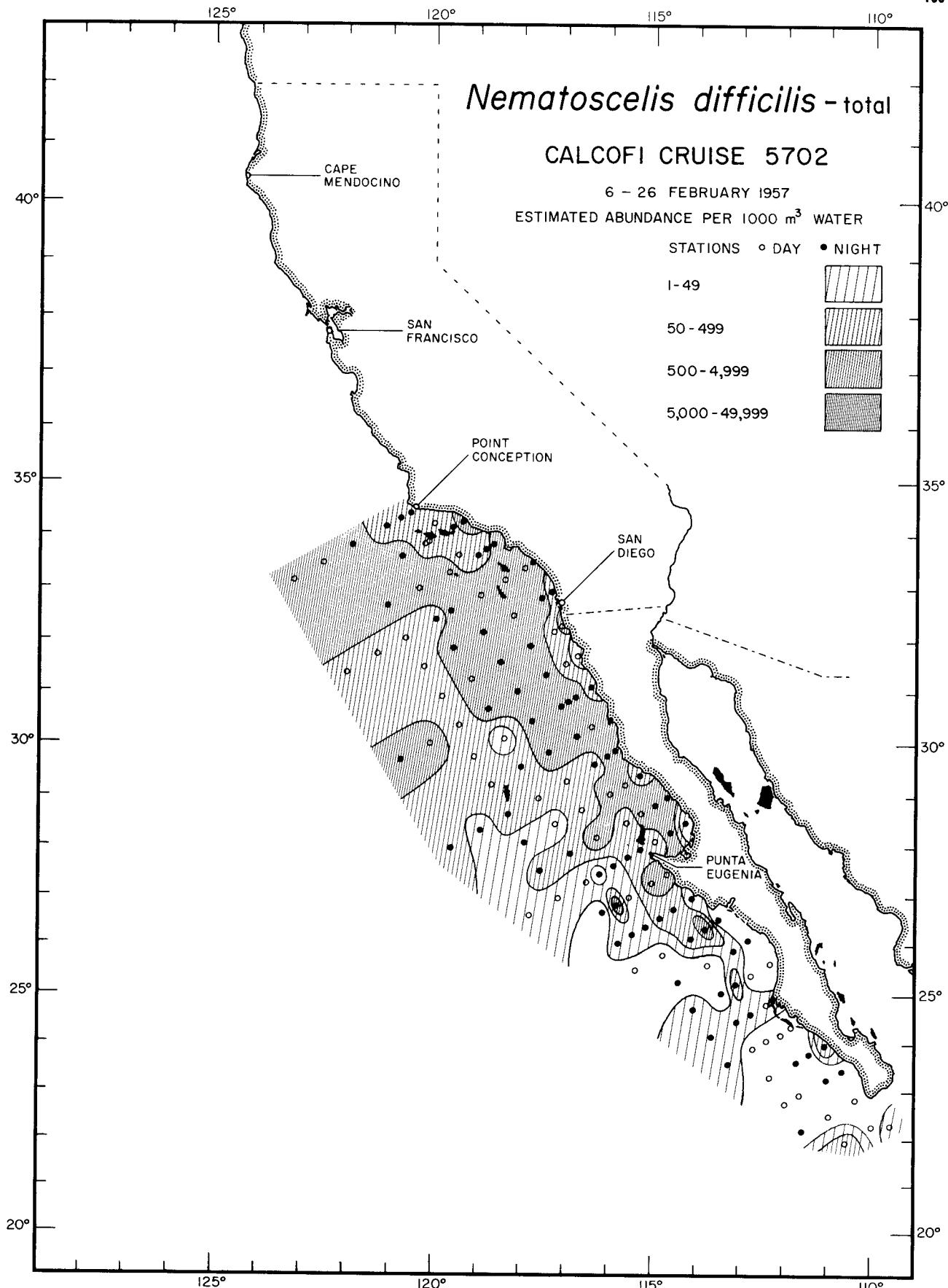
Euphausiacea

Nematoscelis difficilis - total

5408

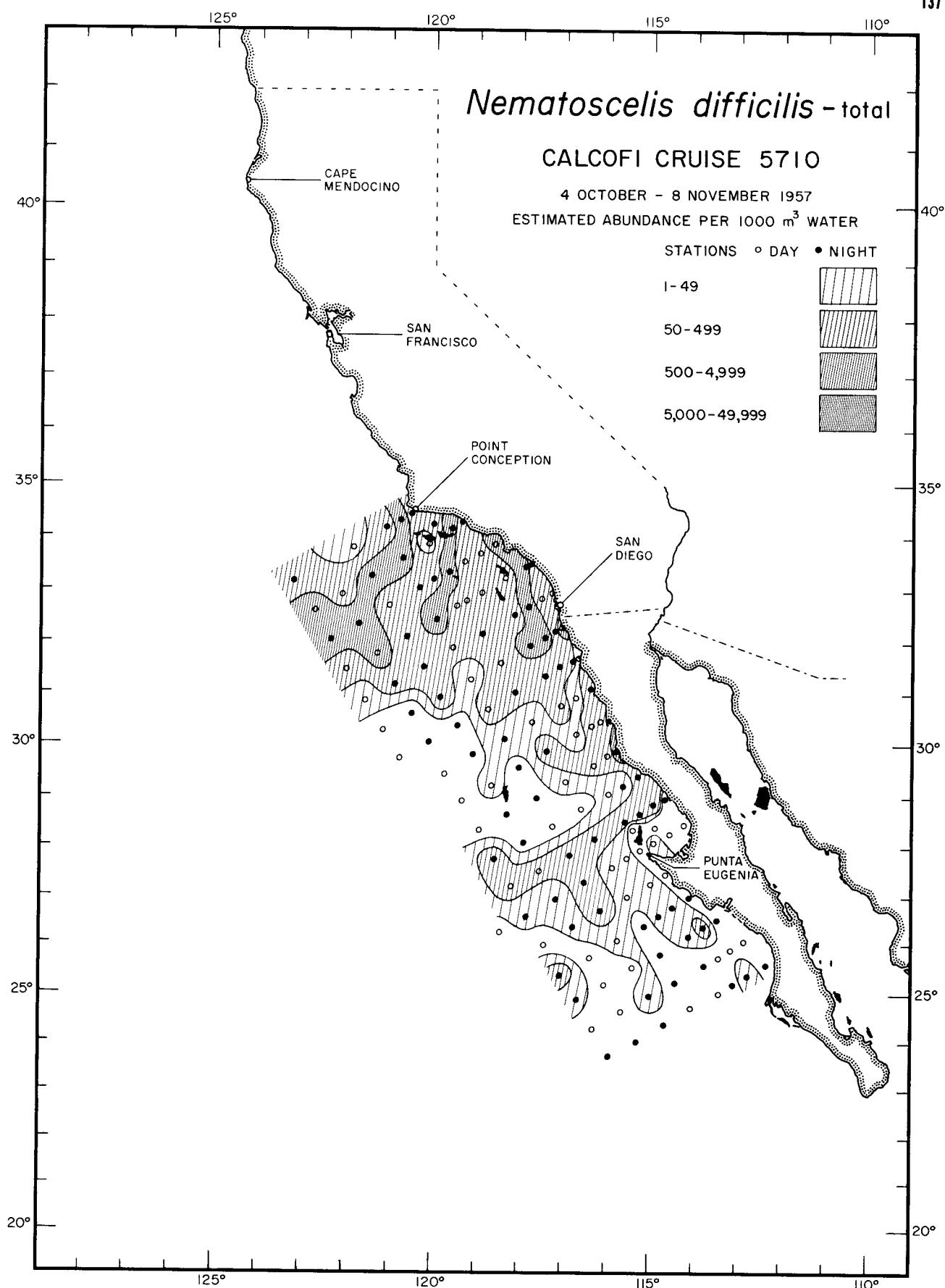


Euphausiacea
Nematoscelis difficilis - total
 5504

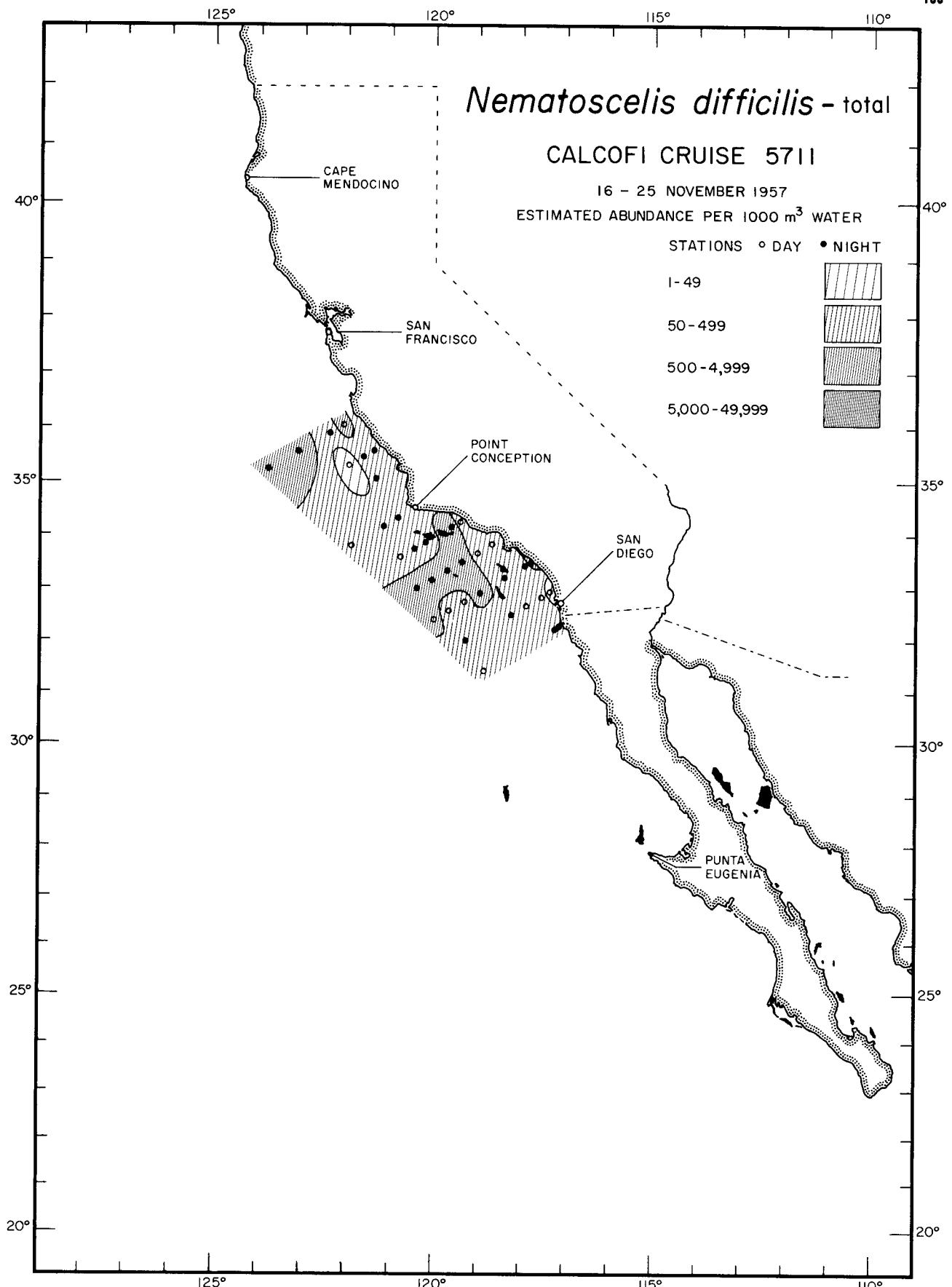


Euphausiacea
Nematoscelis difficilis - total

5702

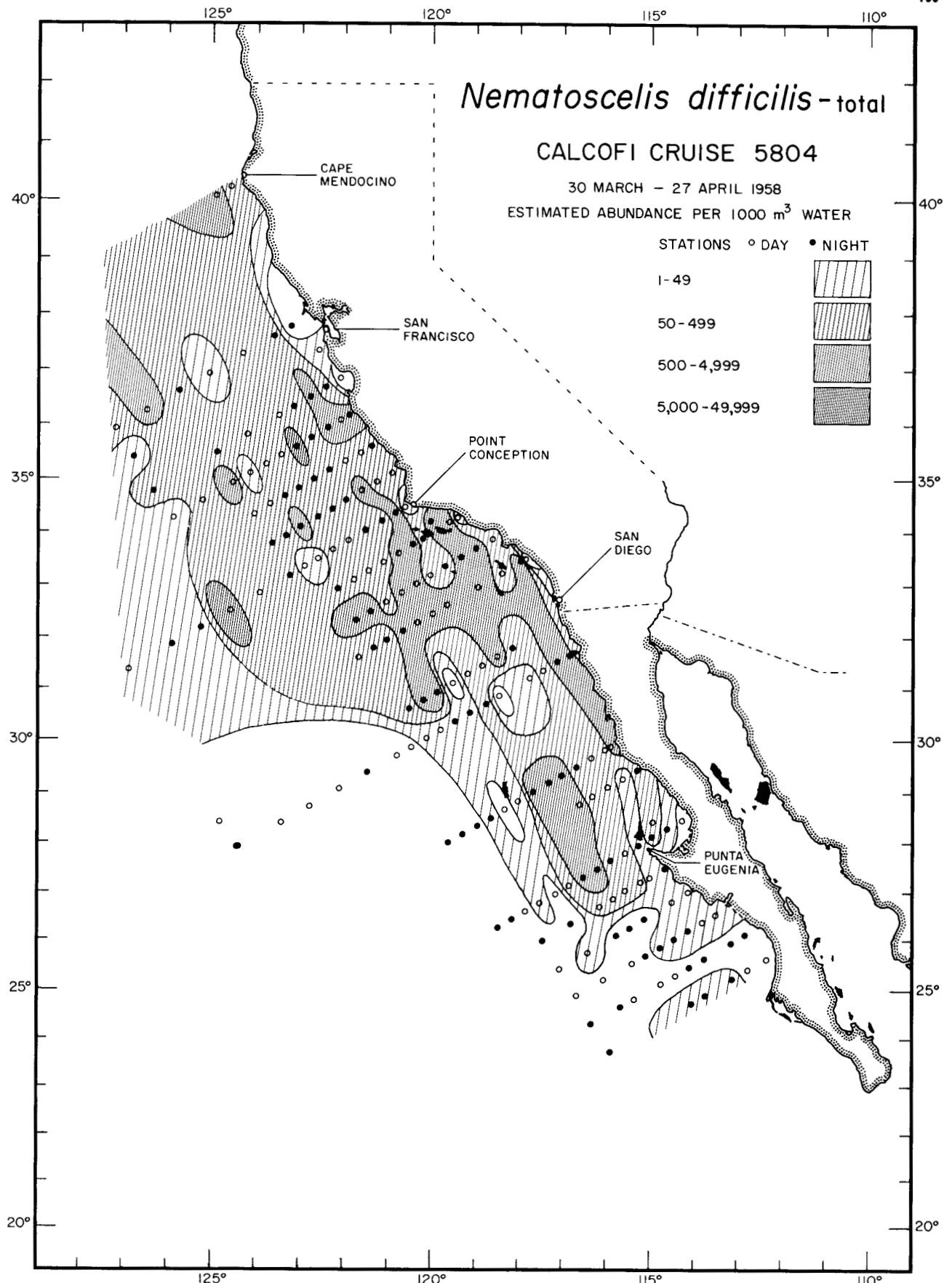


Euphausiacea
Nematoscelis difficilis - total
 5710

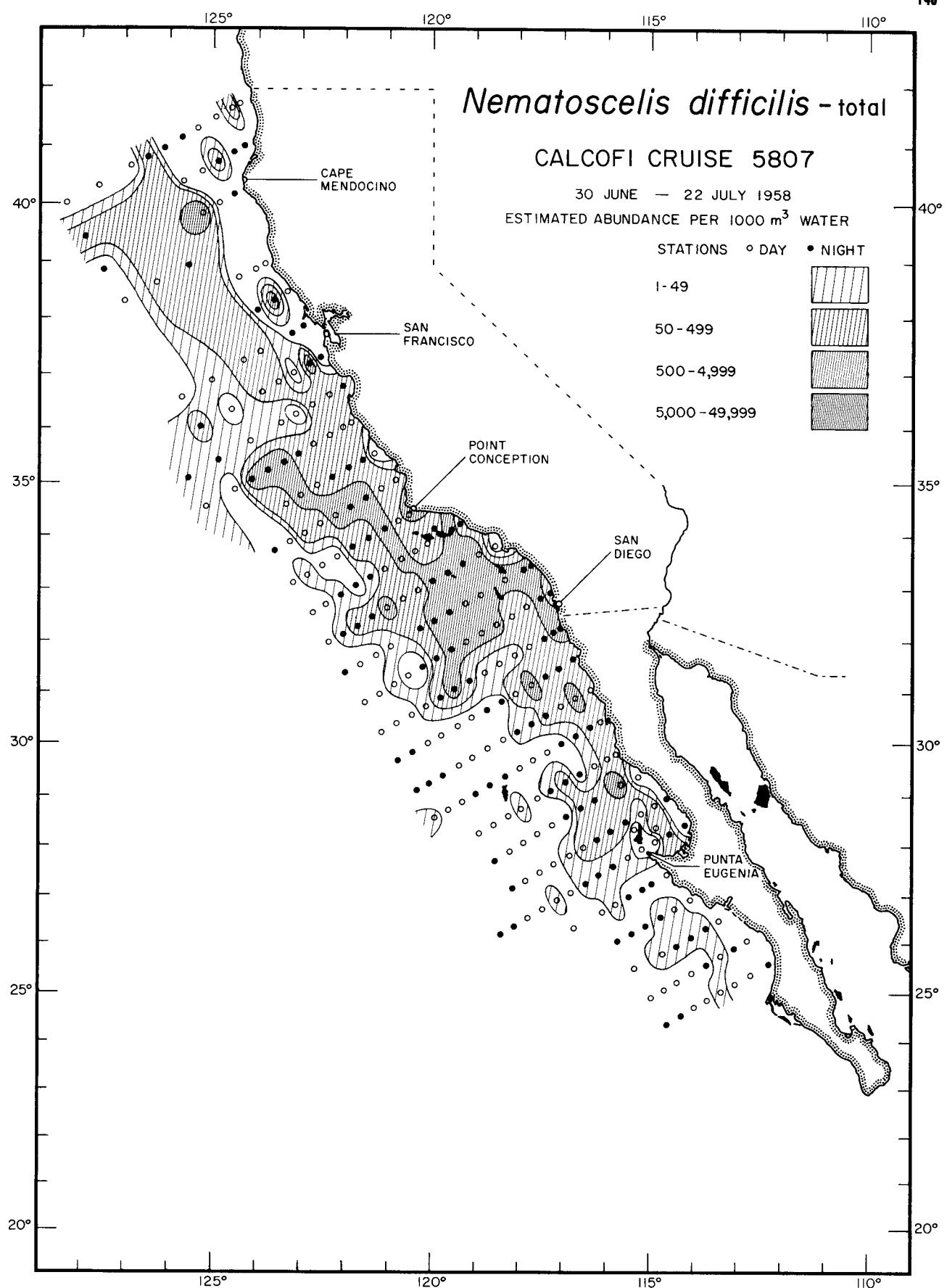


Euphausiacea
Nematoscelis difficilis - total

5711

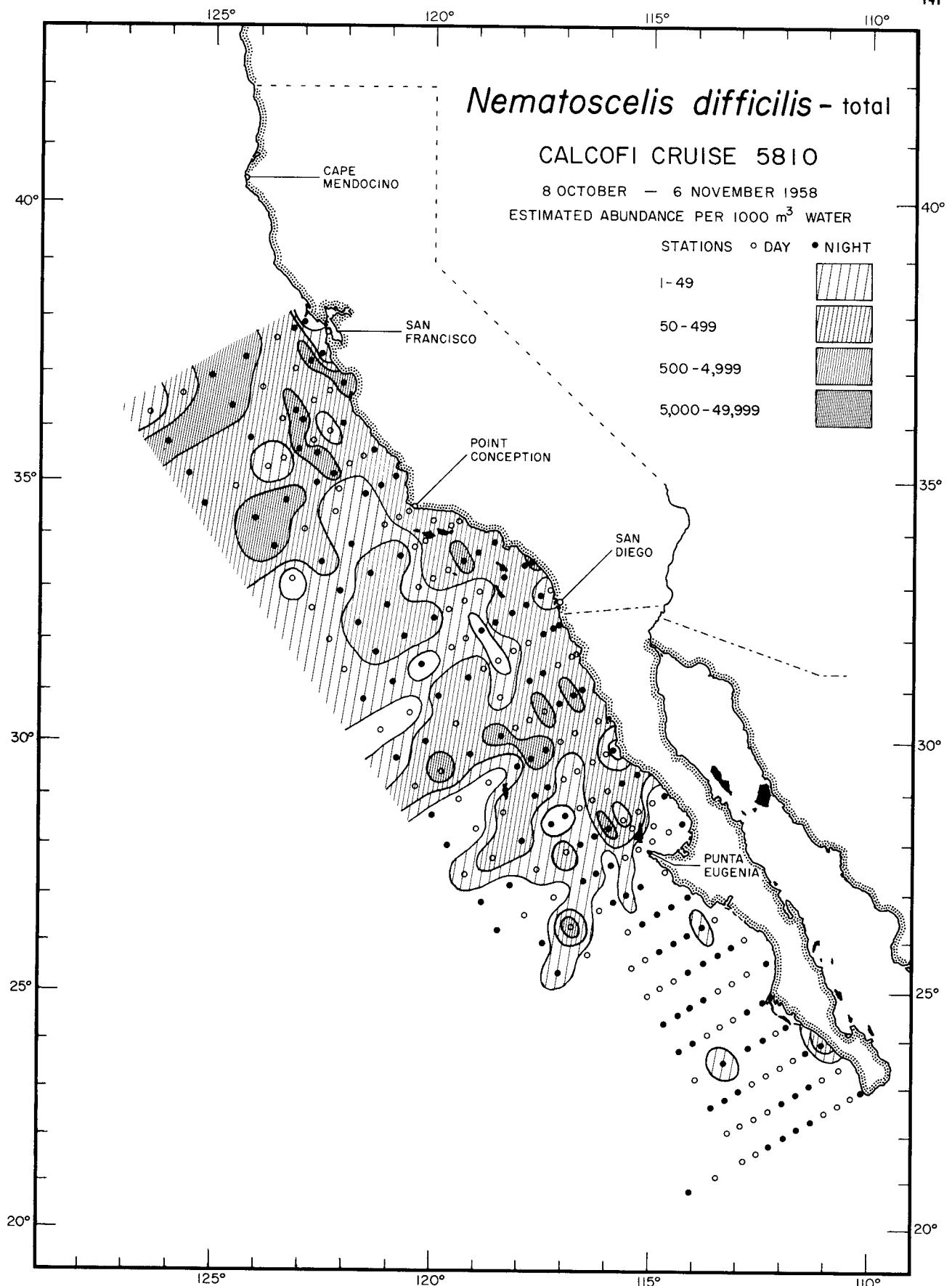


Euphausiacea
Nematoscelis difficilis - total
5804

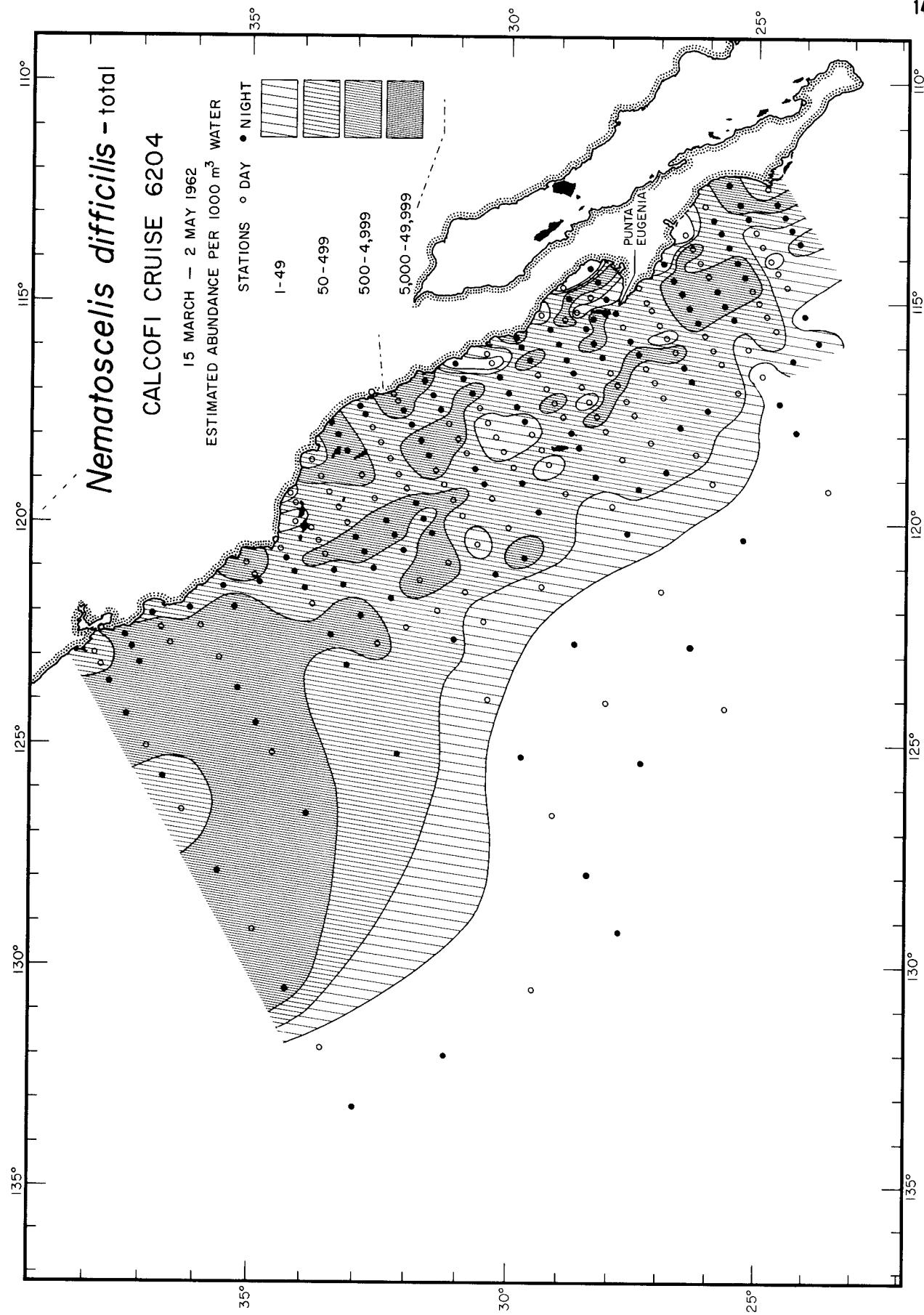


Euphausiacea
Nematoscelis difficilis - total

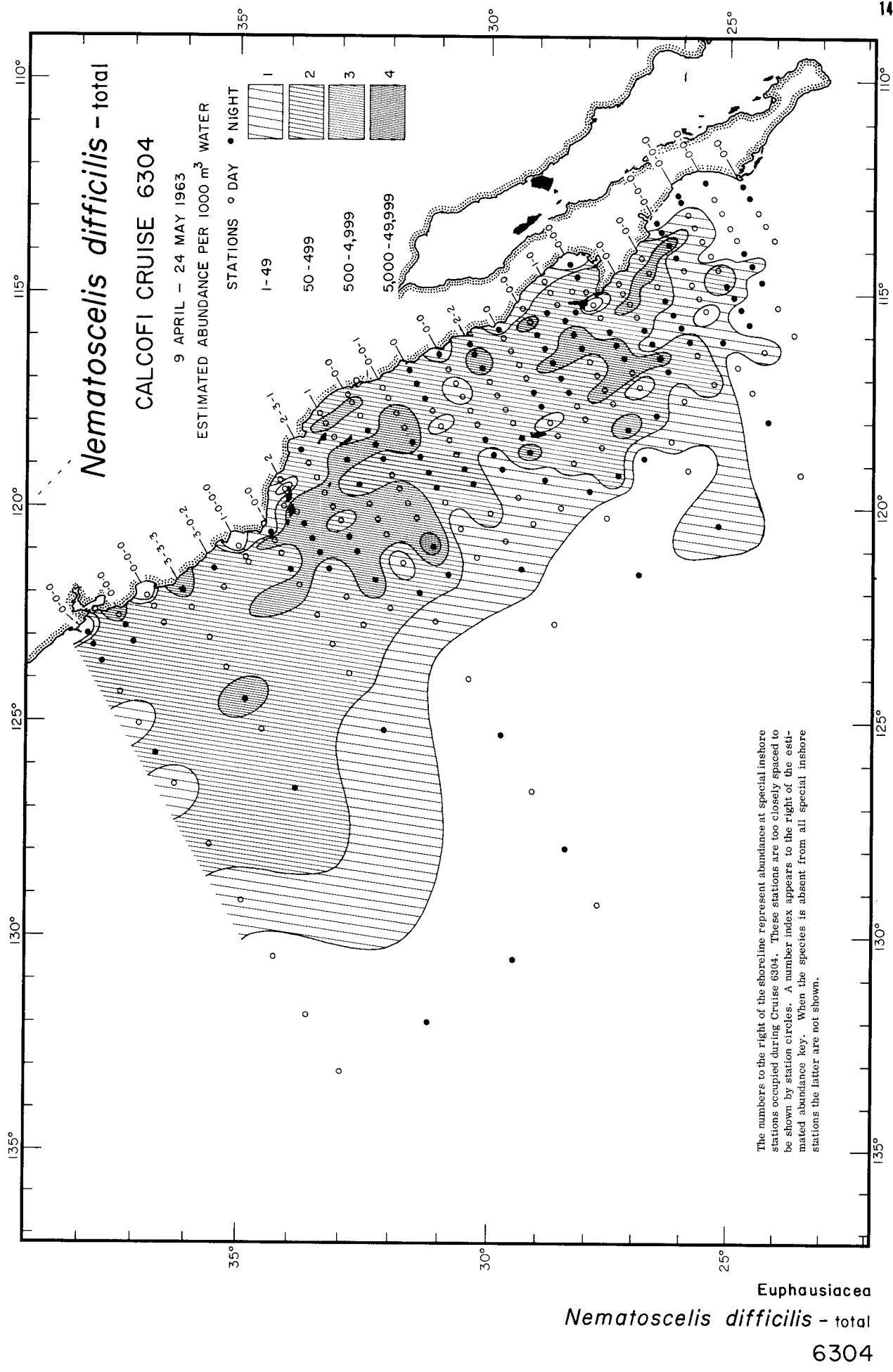
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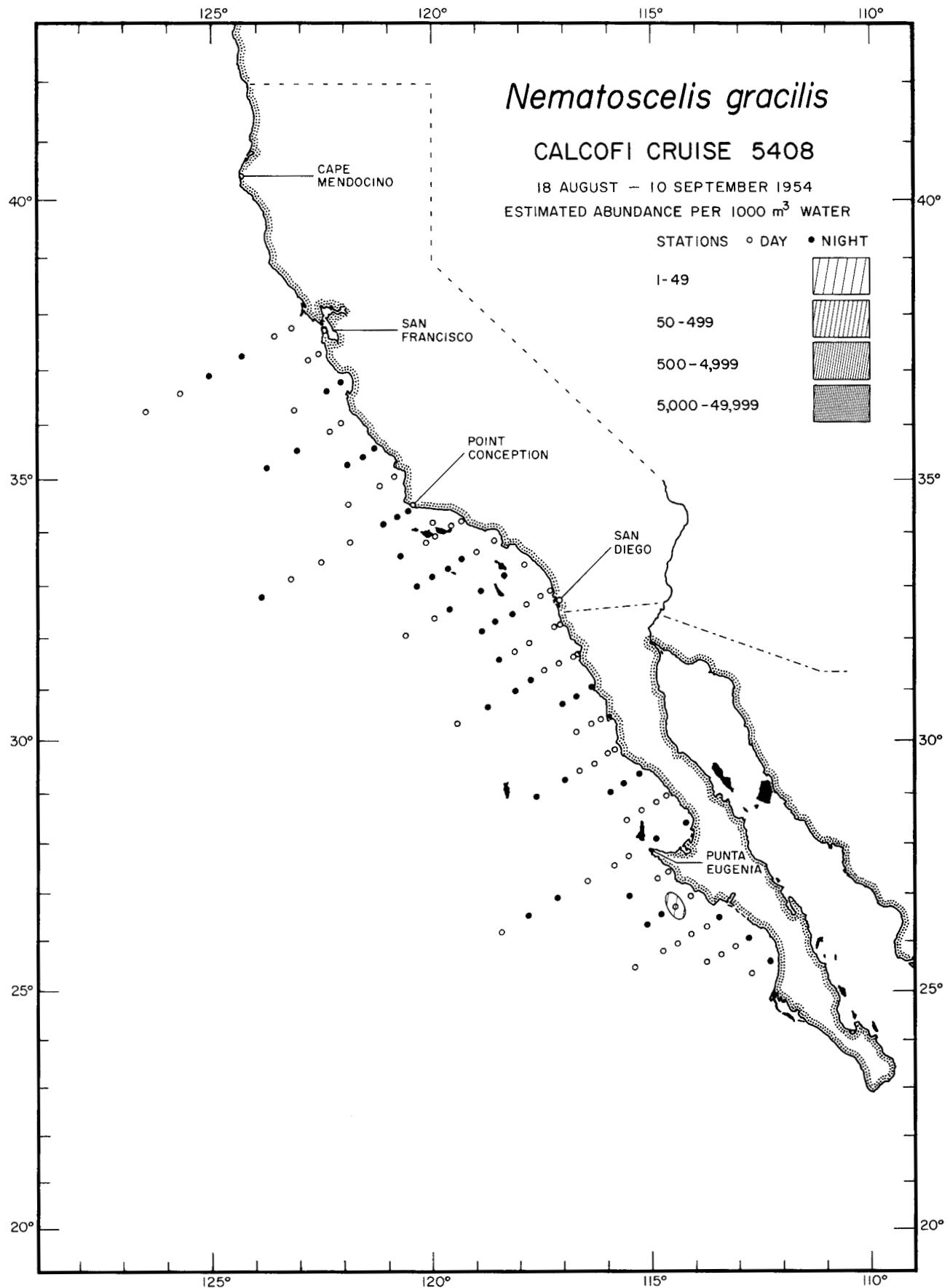


Euphausiacea
Nematoscelis difficilis - total
5810

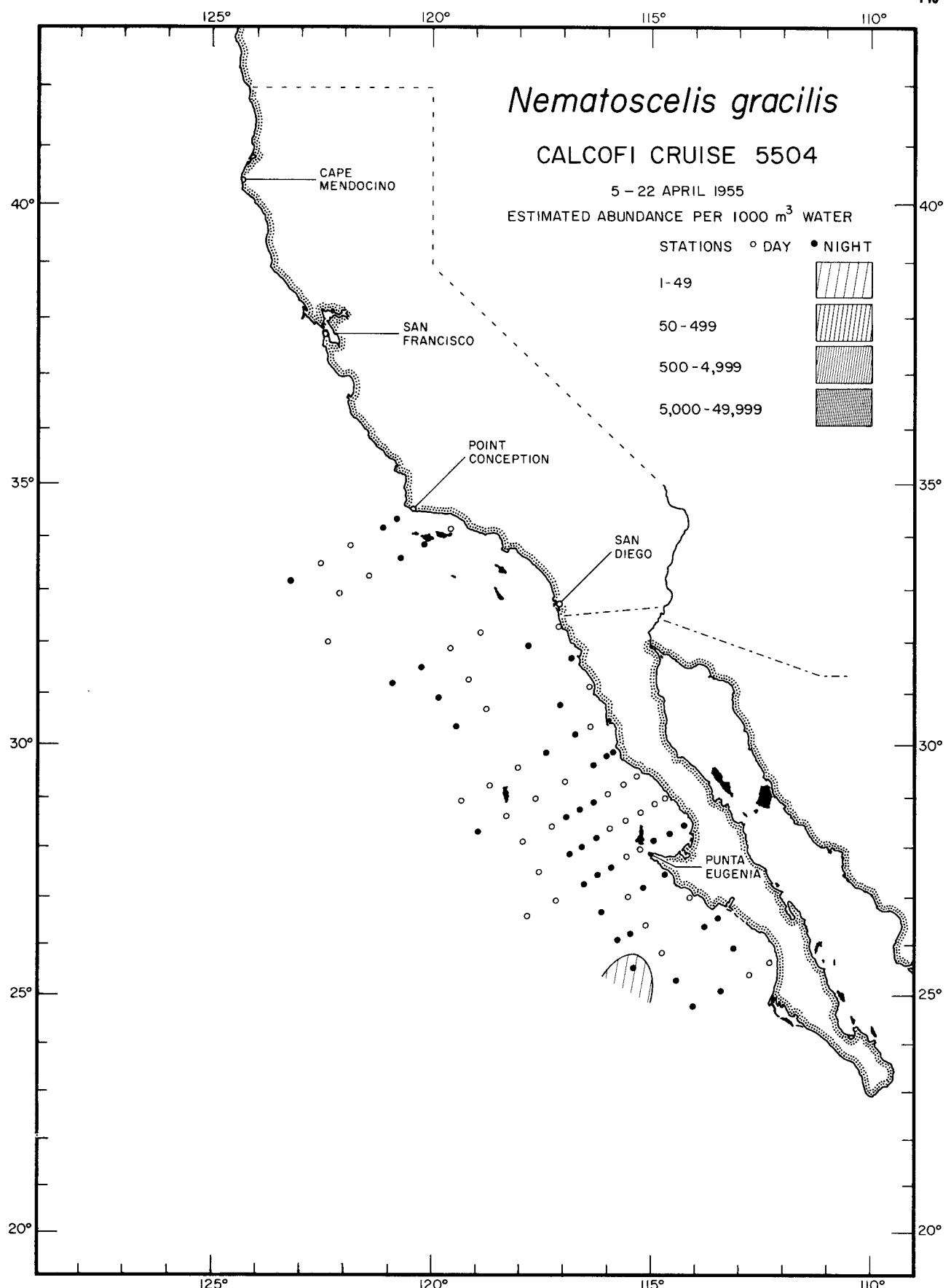


Euphausiacea
Nematoscelis difficilis - total
 6204

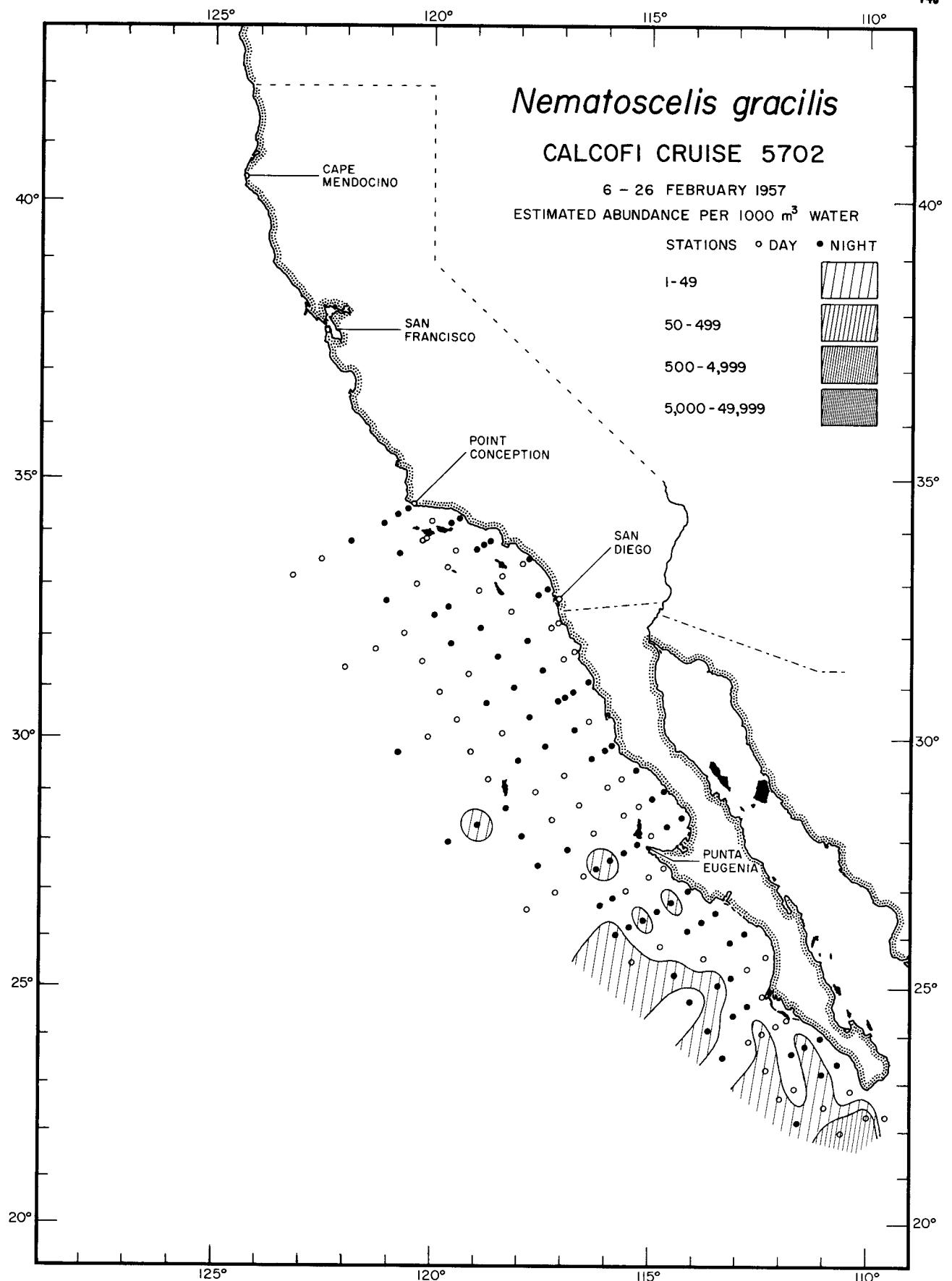




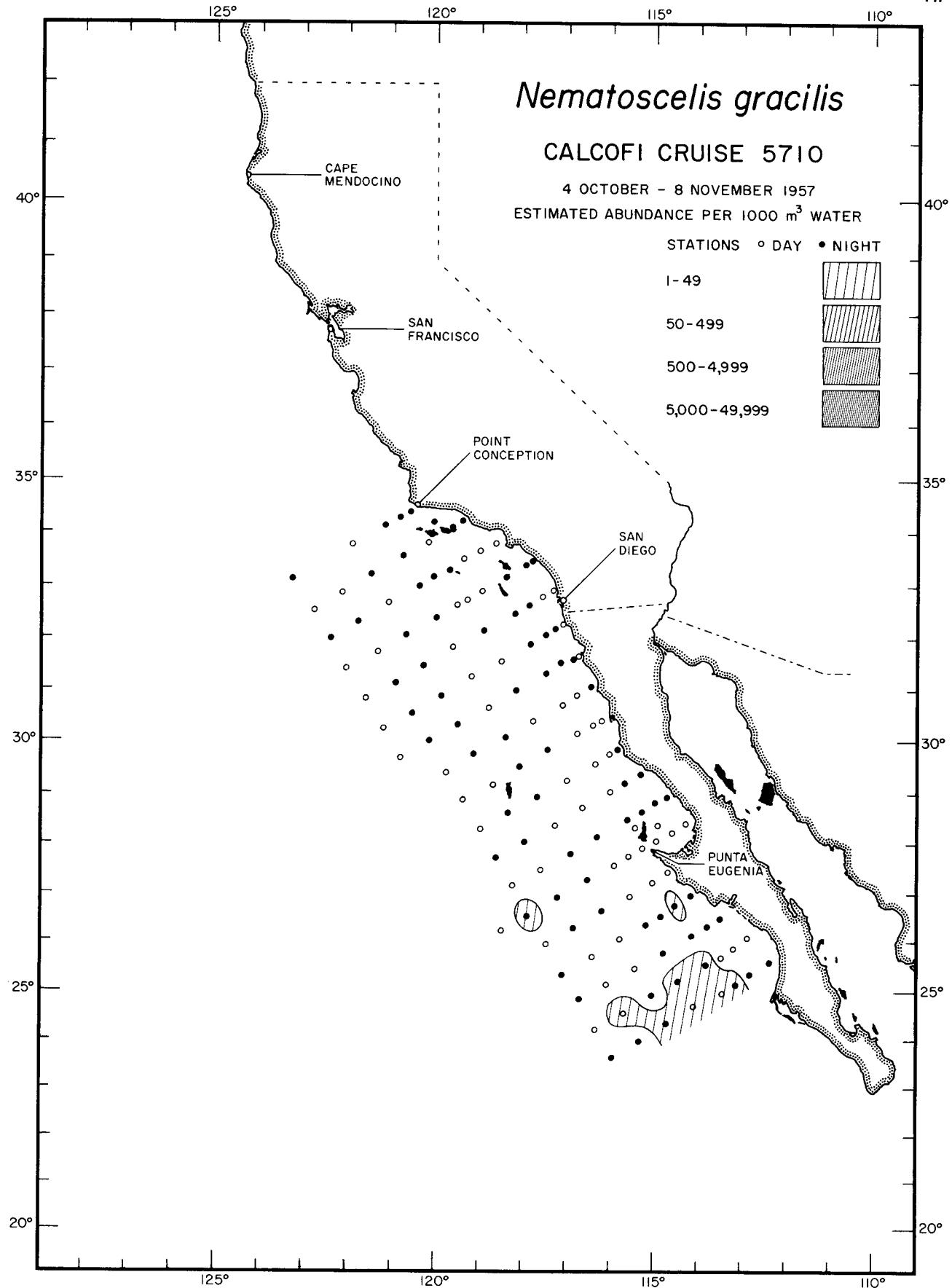
Euphausiacea
Nematoscelis gracilis
 5408



Euphausiacea
Nematoscelis gracilis
 5504

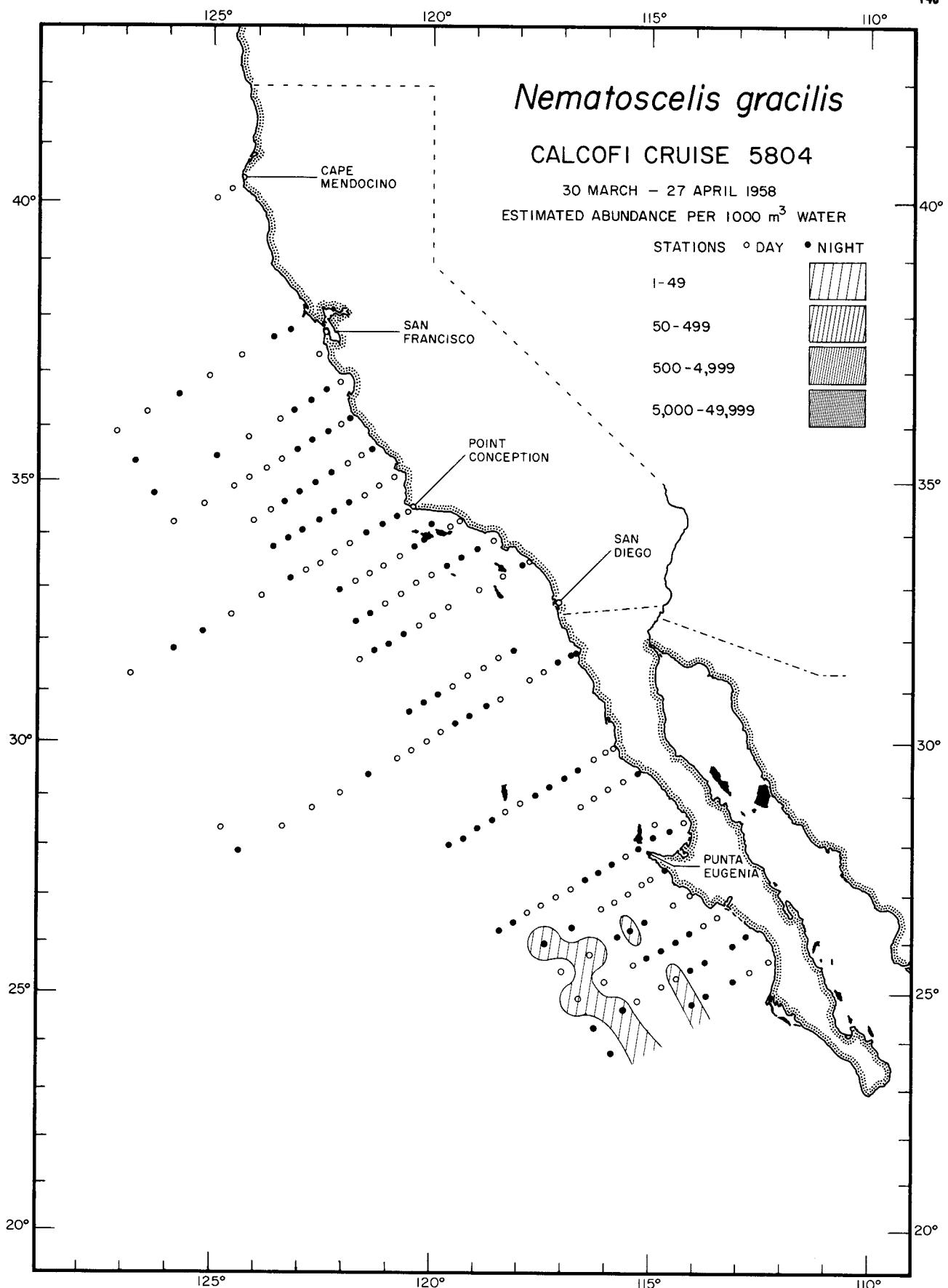


Euphausiacea
Nematoscelis gracilis
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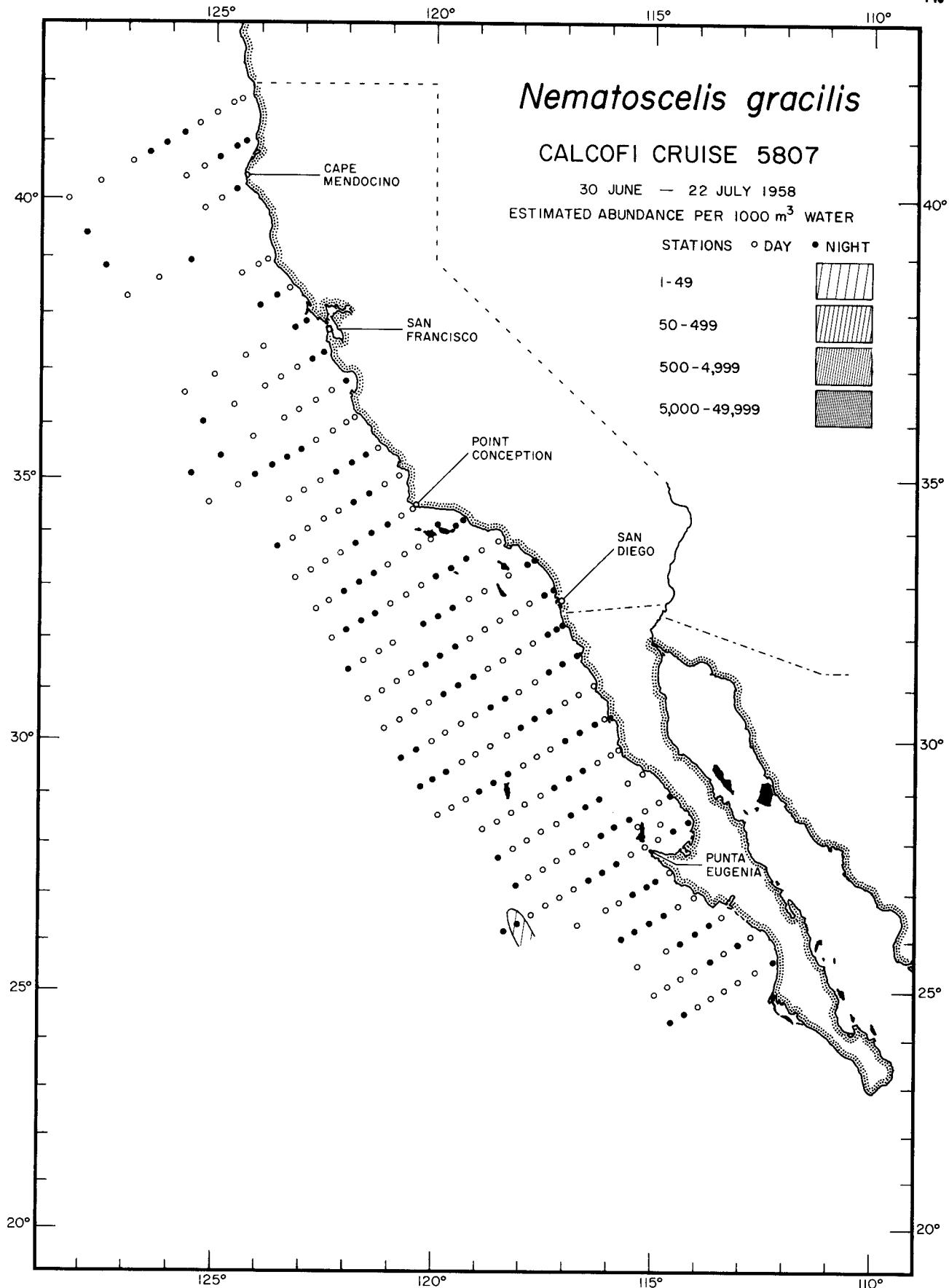


Euphausiacea
Nematoscelis gracilis

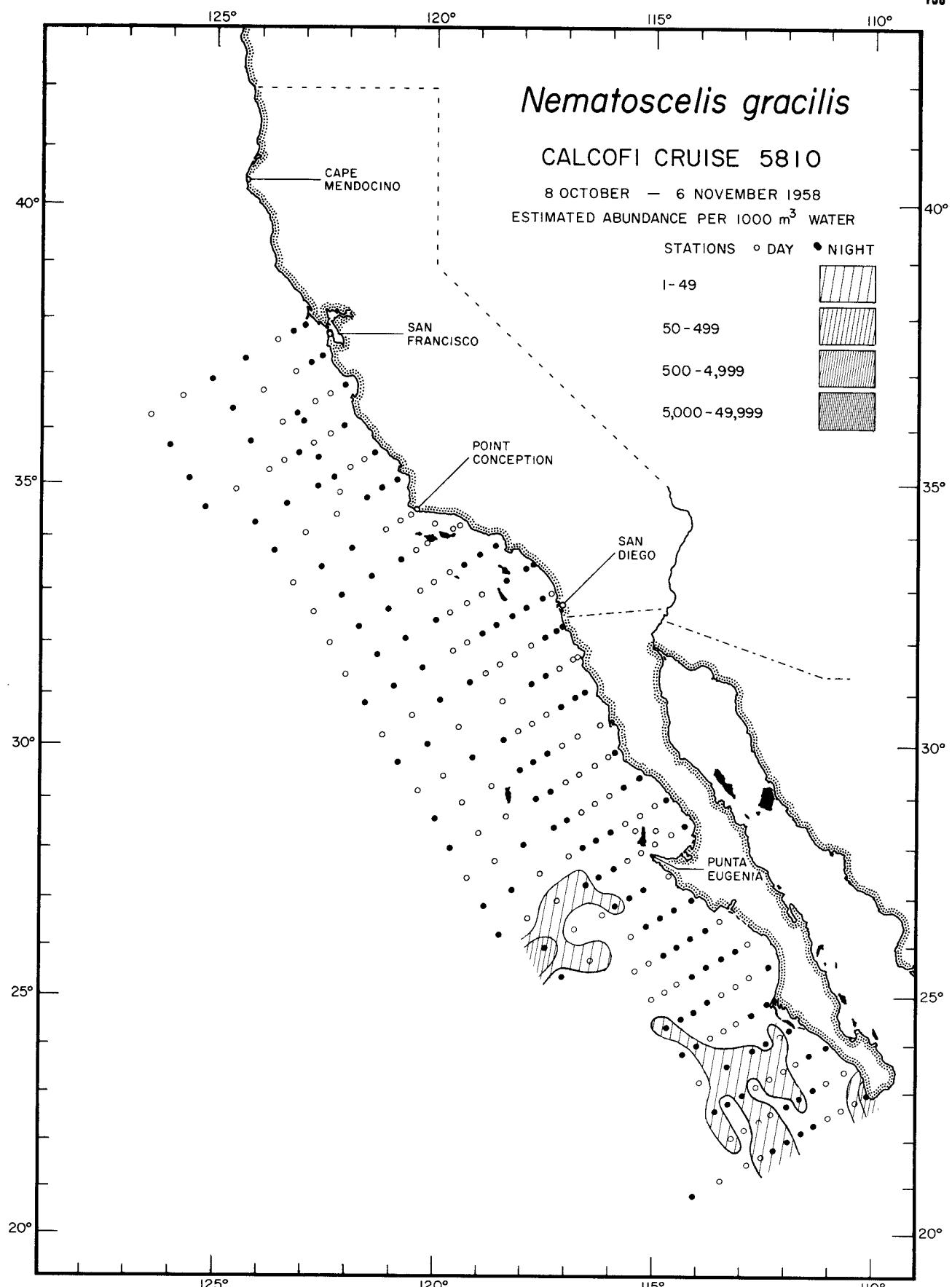
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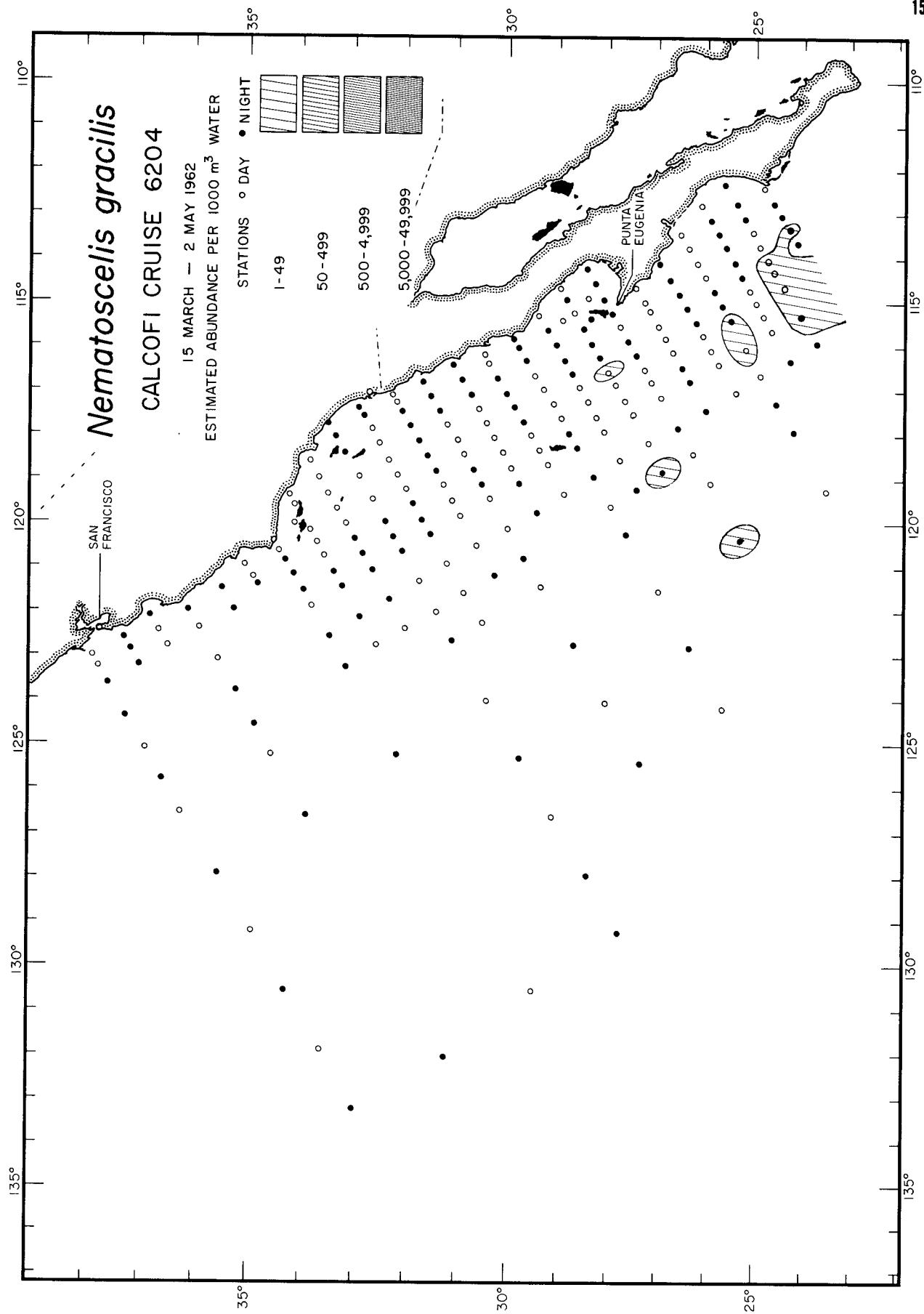
Euphausiacea
Nematoscelis gracilis
5804



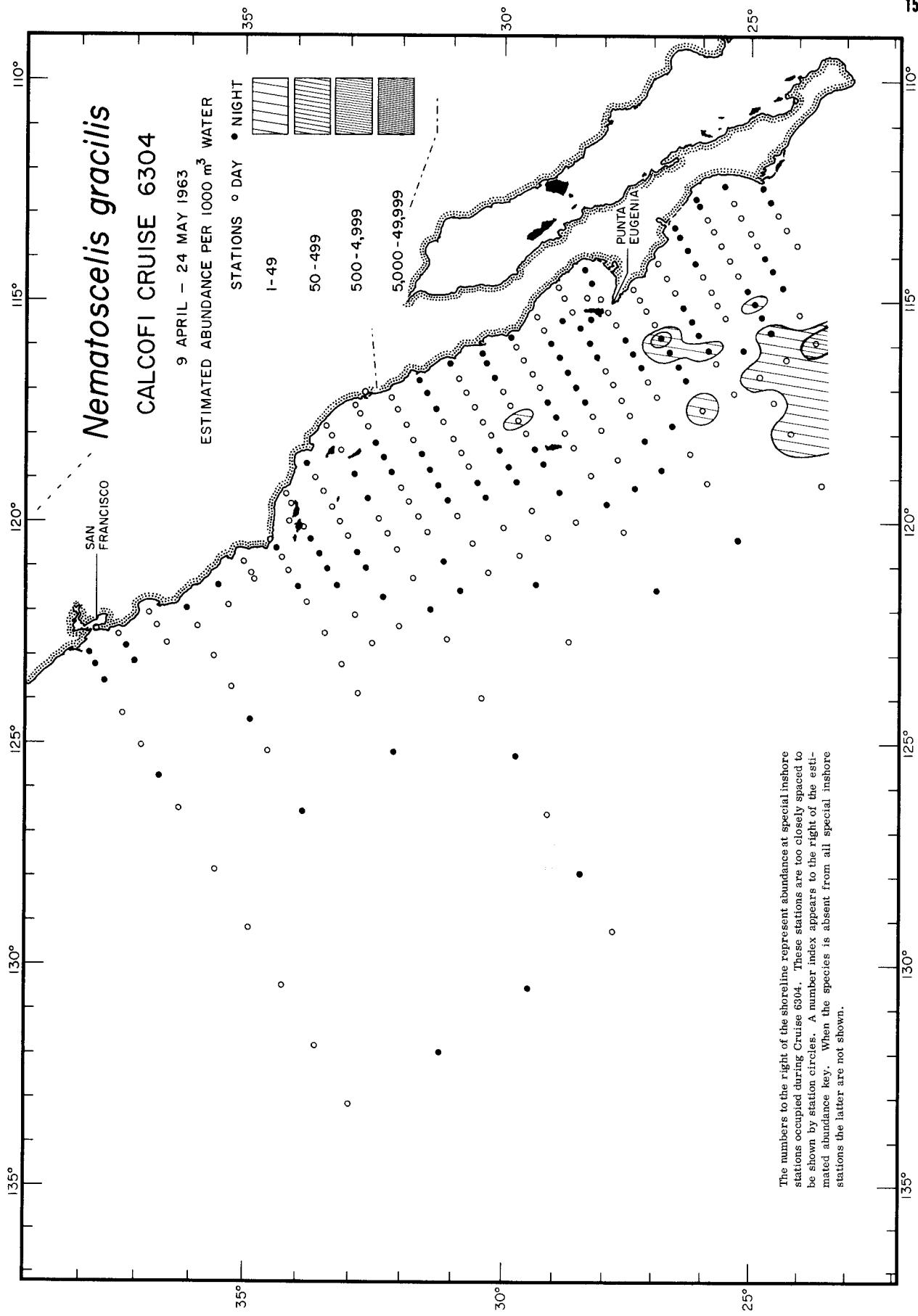
Euphausiacea
Nematoscelis gracilis
 5807



Euphausiacea
Nematoscelis gracilis
5810

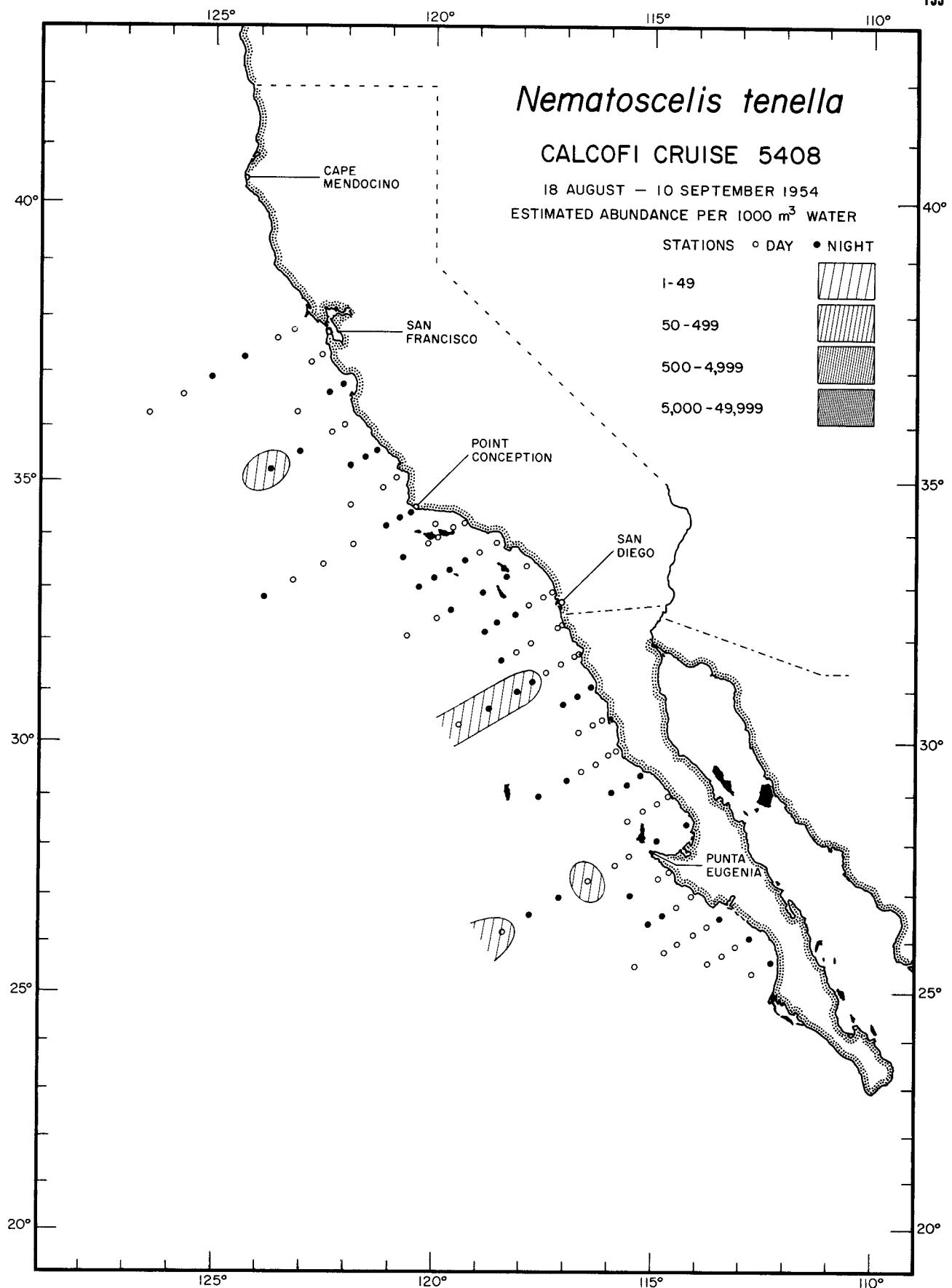


Euphausiacea
Nematoscelis gracilis
6204

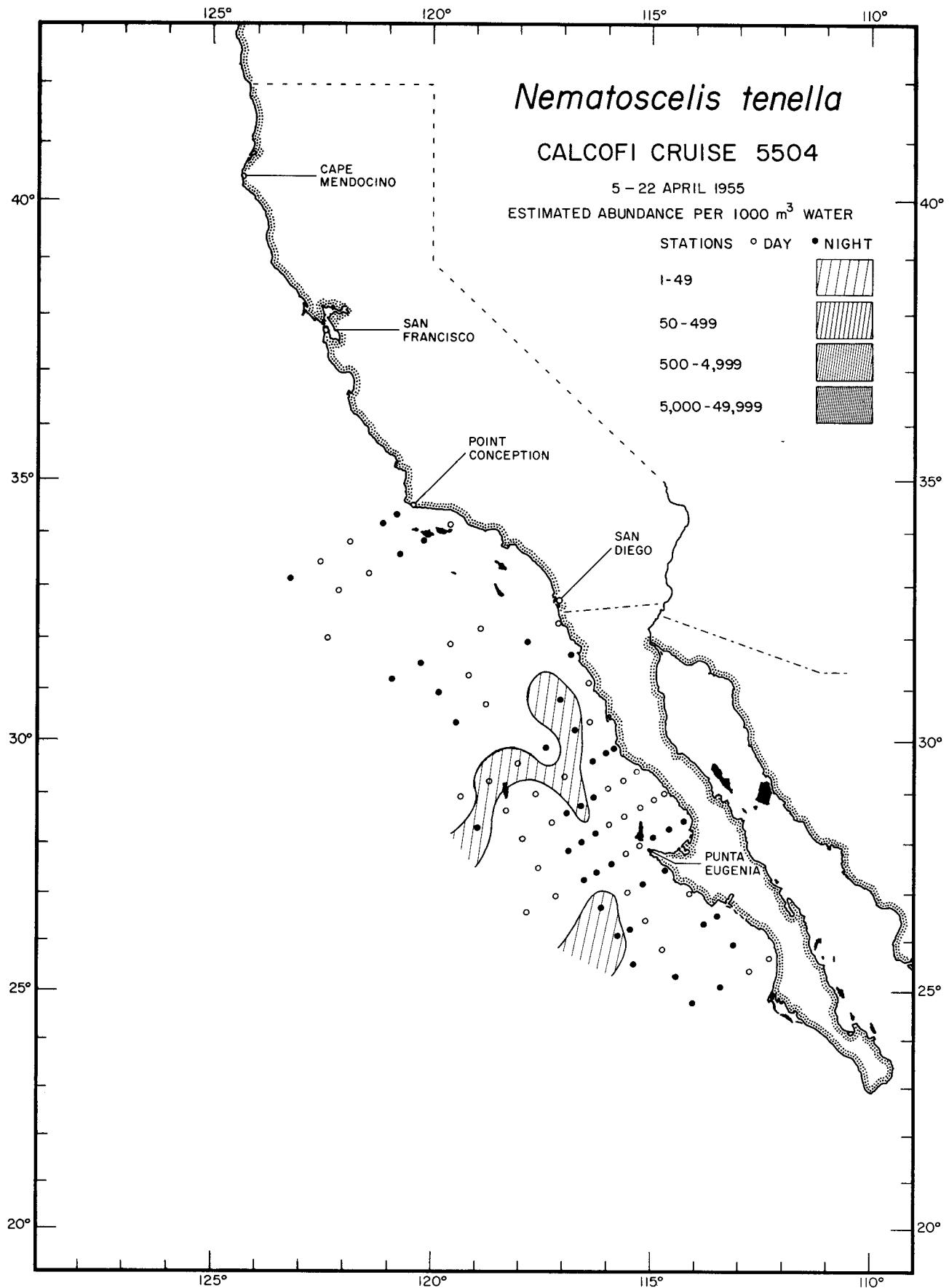


The numbers to the right of the shoreline represent abundance at special inshore stations occupied during Cruise 6304. These stations are too closely spaced to be shown by station circles. A number index appears to the right of the estimated abundance key. When the species is absent from all special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

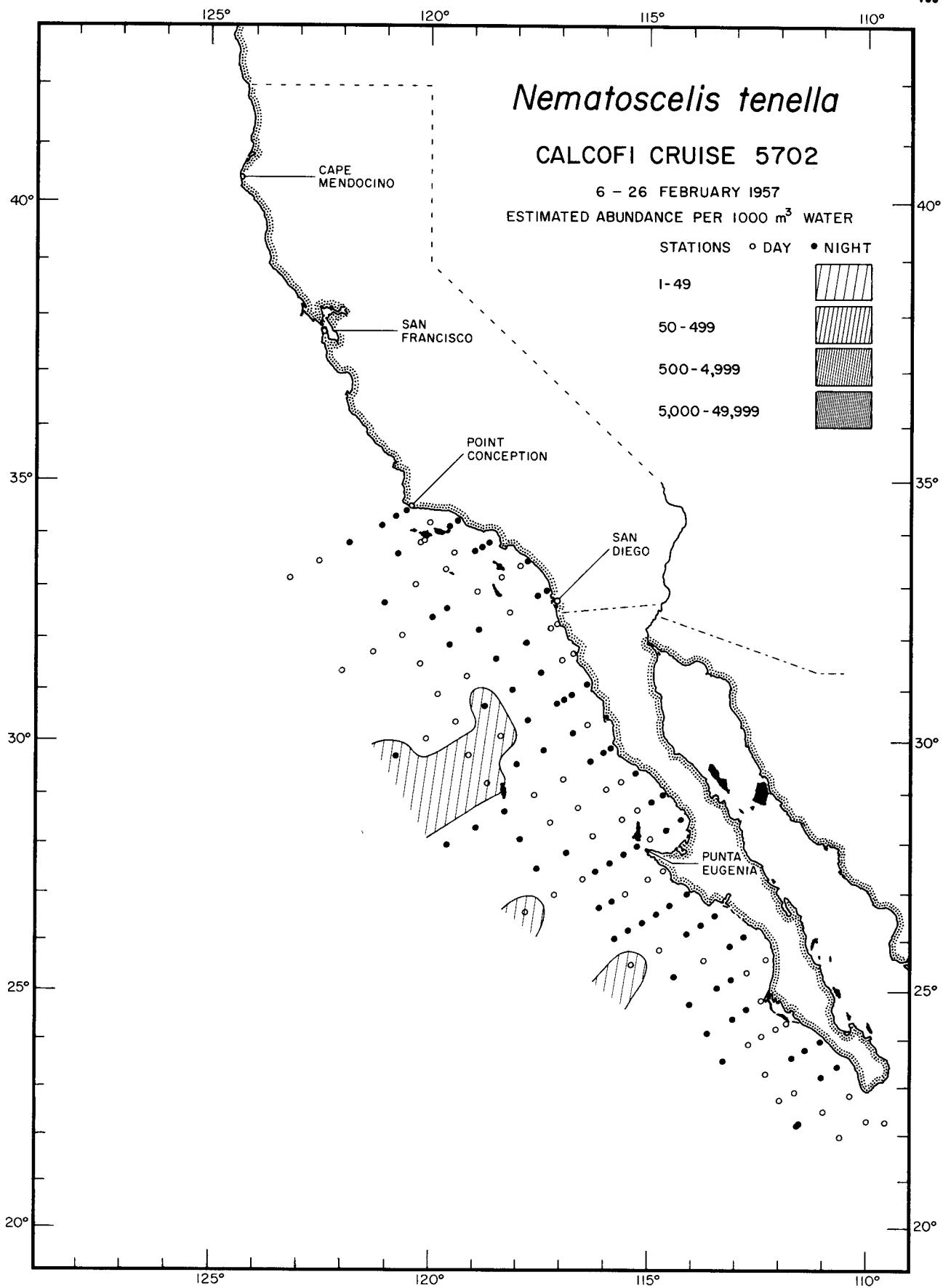
Euphausiacea
Nematoscelis gracilis
6304



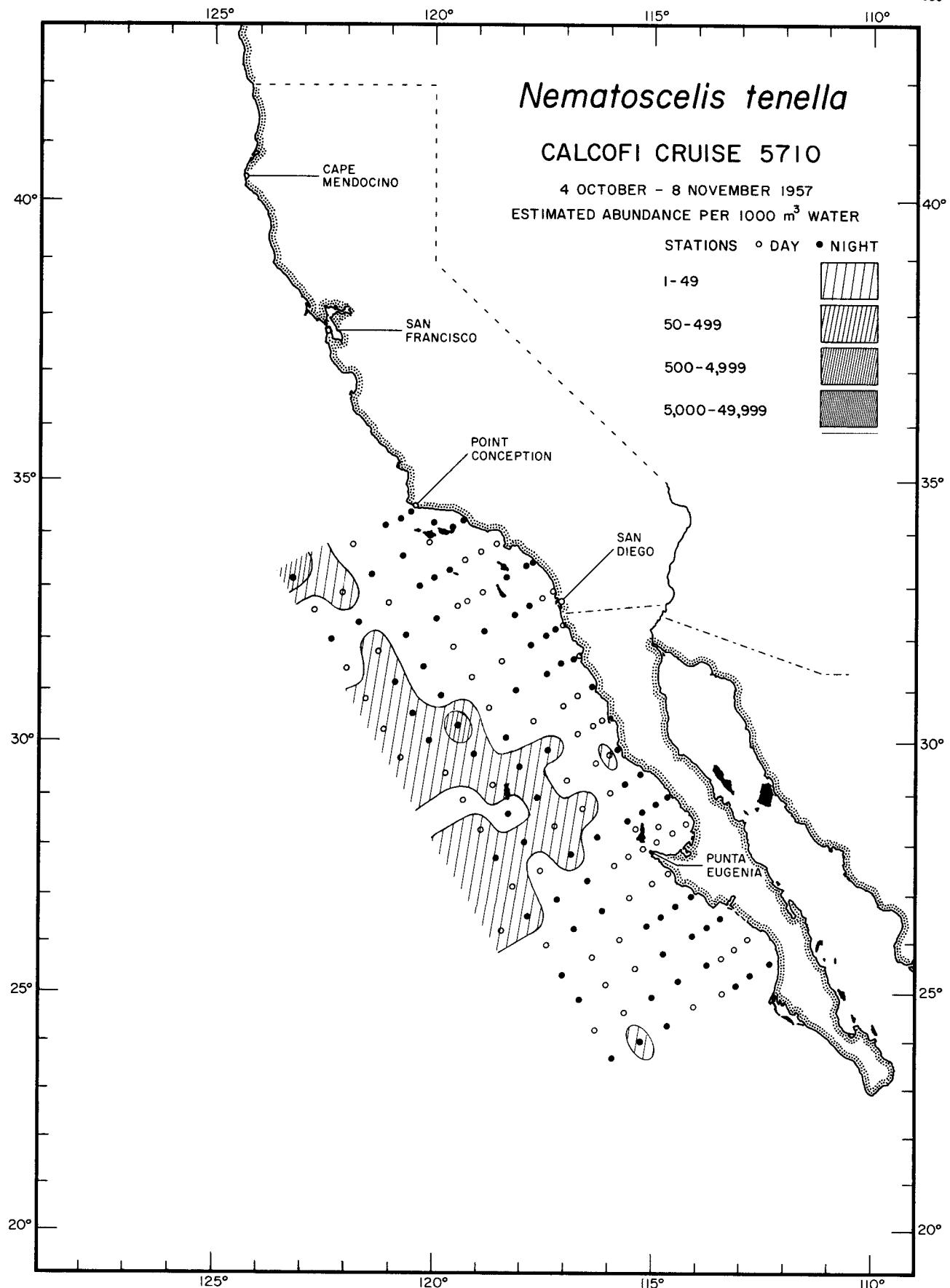
Euphausiacea
Nematoscelis tenella
 5408



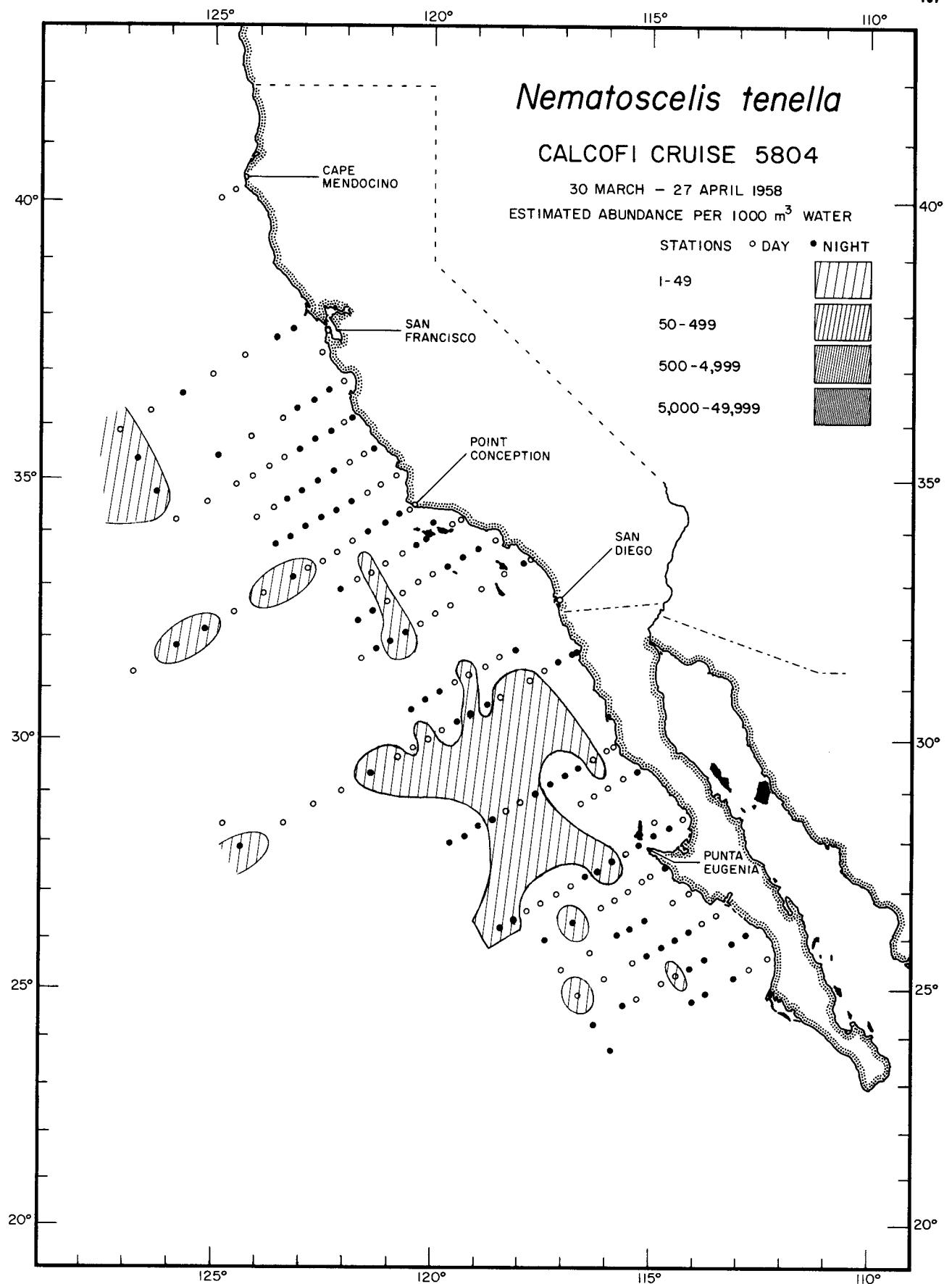
Euphausiacea
Nematoscelis tenella
 5504



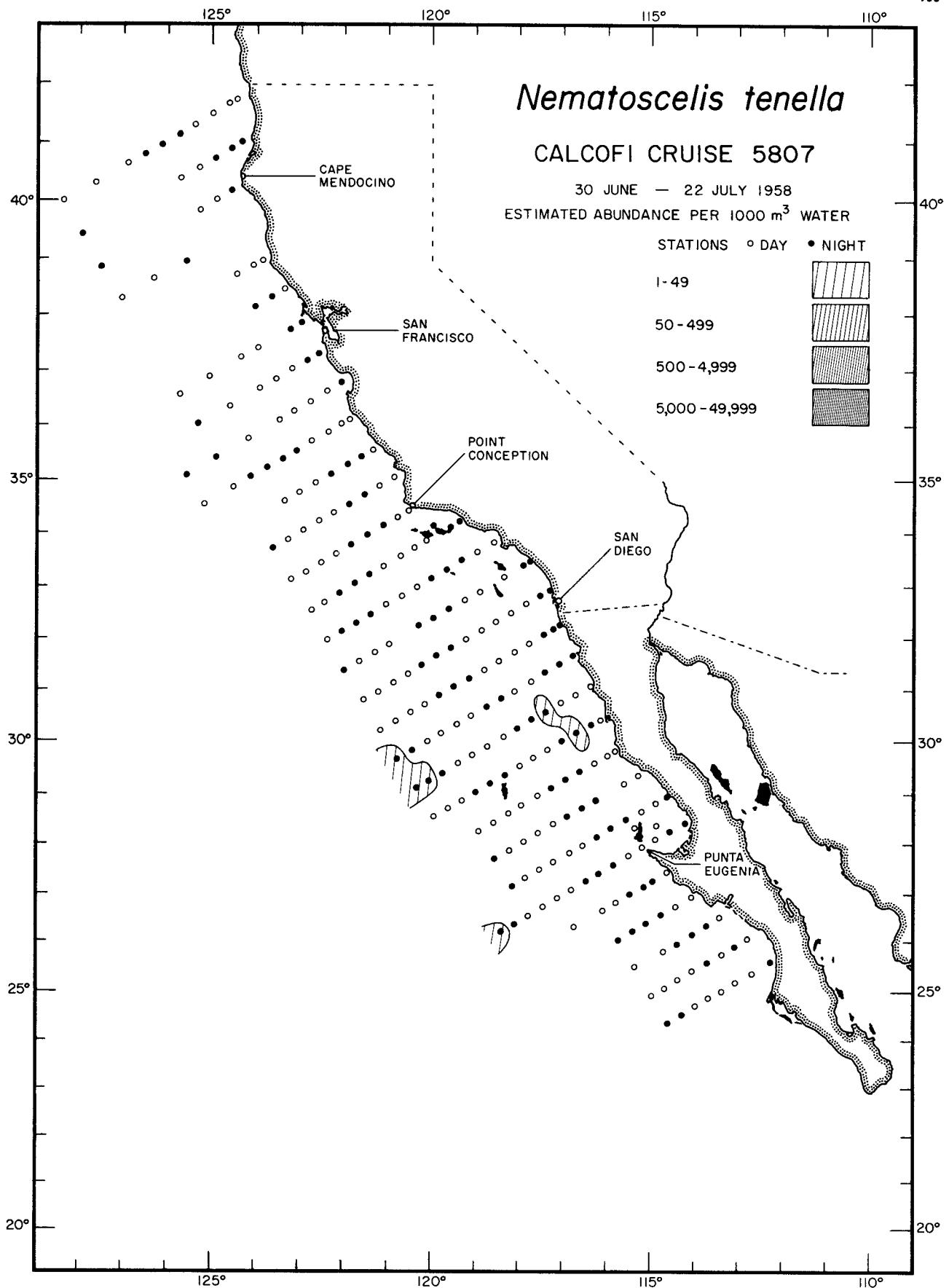
Euphausiacea
Nematoscelis tenella
5702



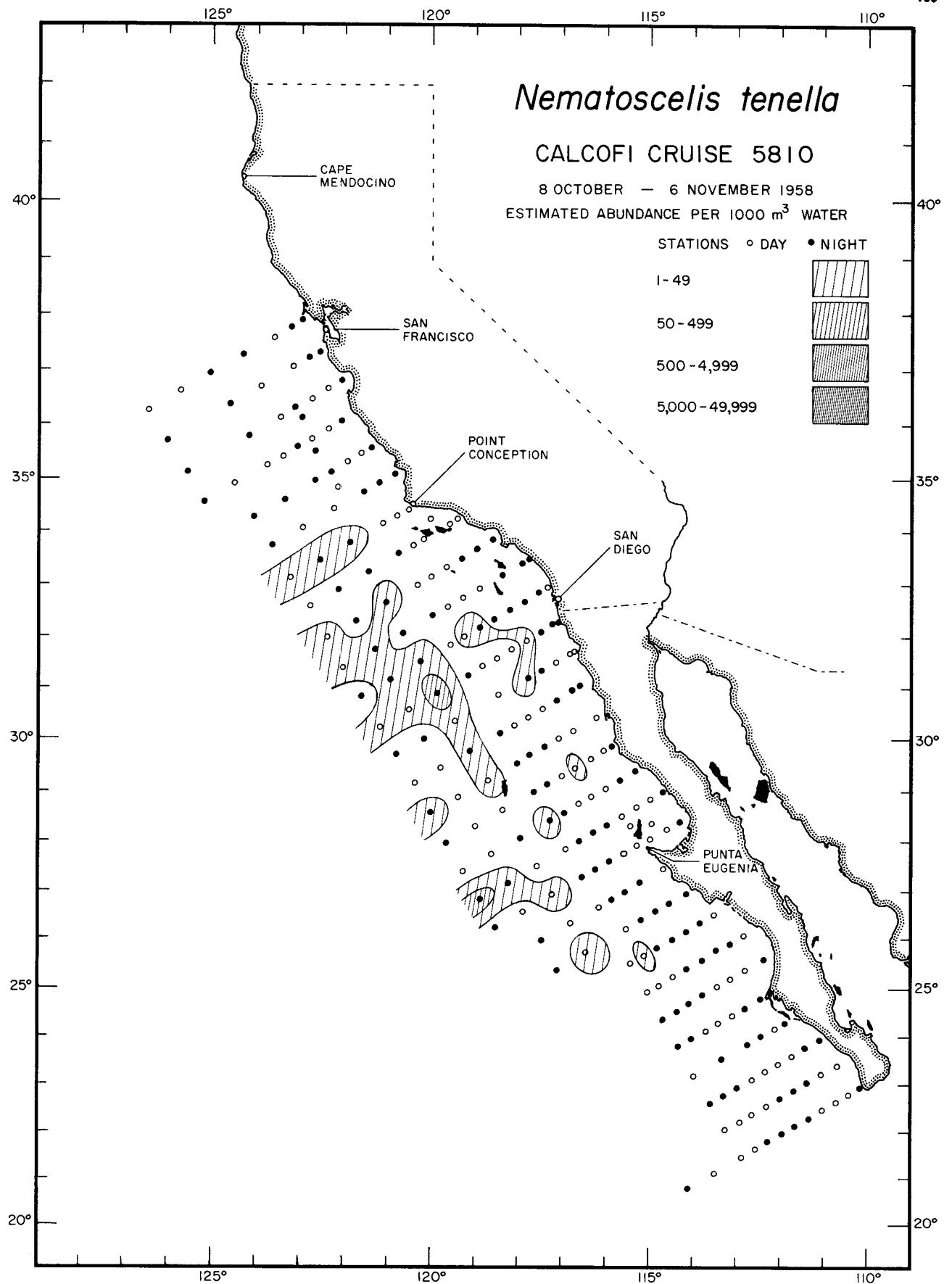
Euphausiacea
Nematoscelis tenella
5710



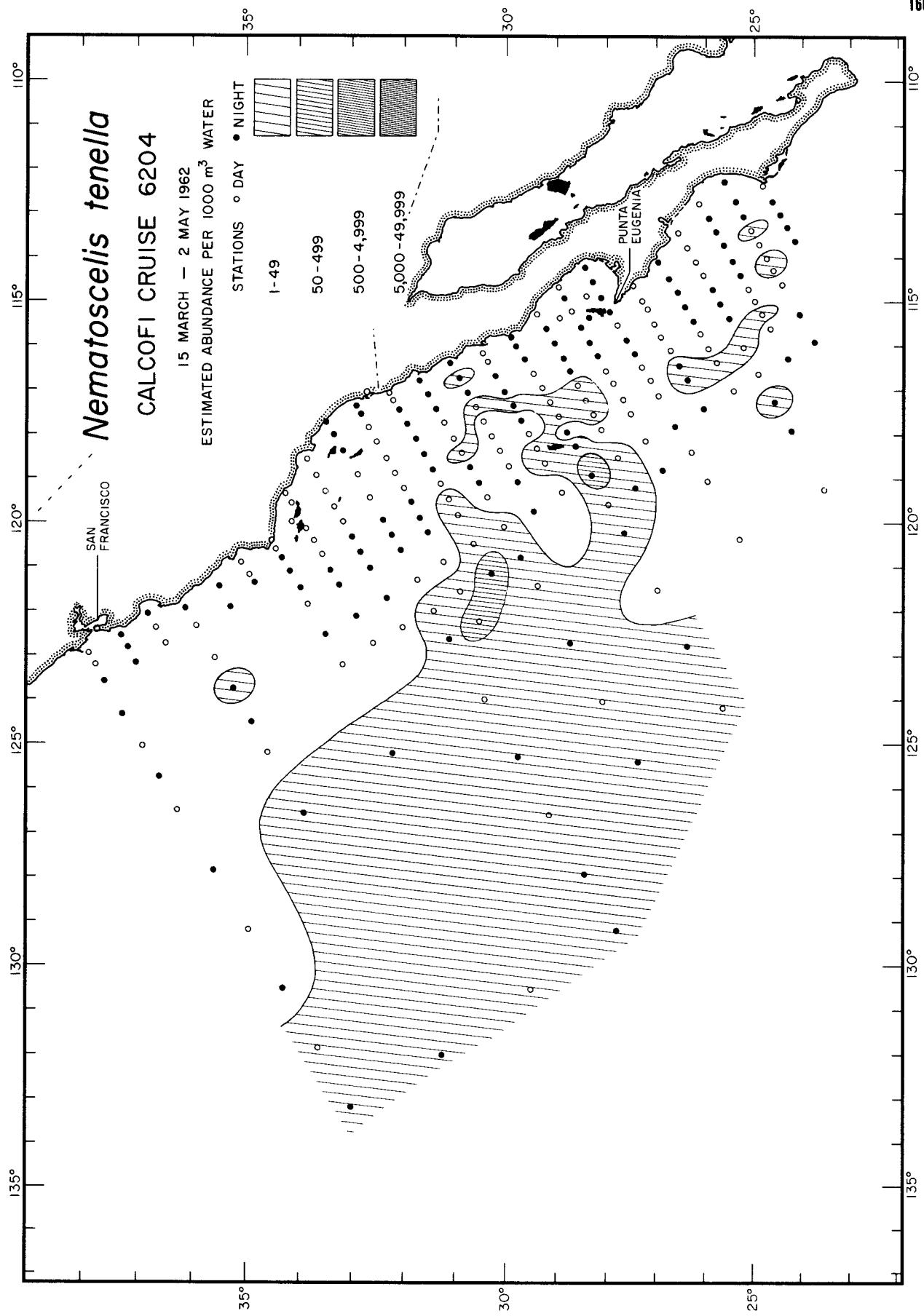
Euphausiacea
Nematoscelis tenella
5804



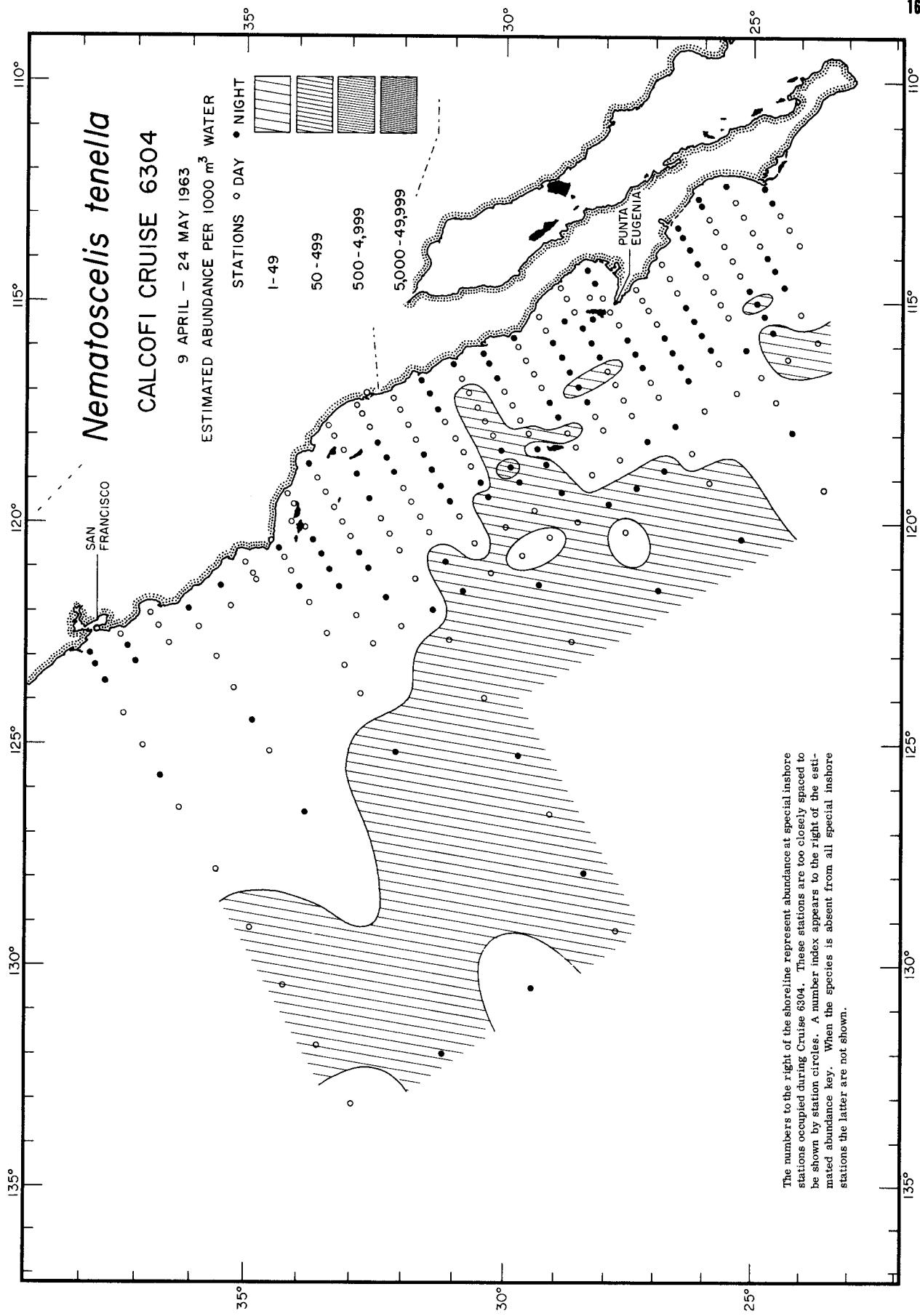
Euphausiacea
Nematoscelis tenella
5807



Euphausiacea
Nematoscelis tenella
 5810

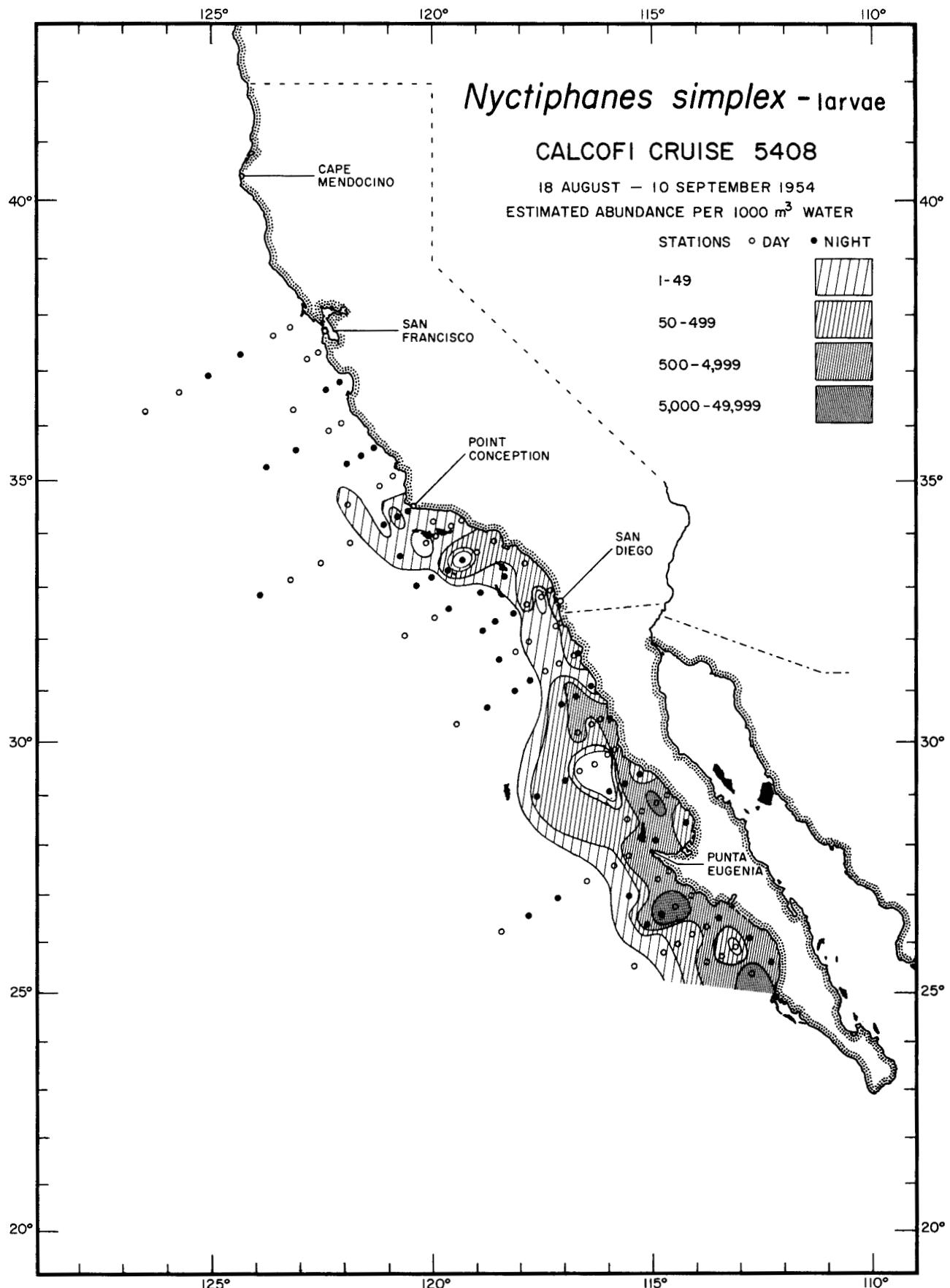


Euphausiacea
Nematoscelis tenella
 6204

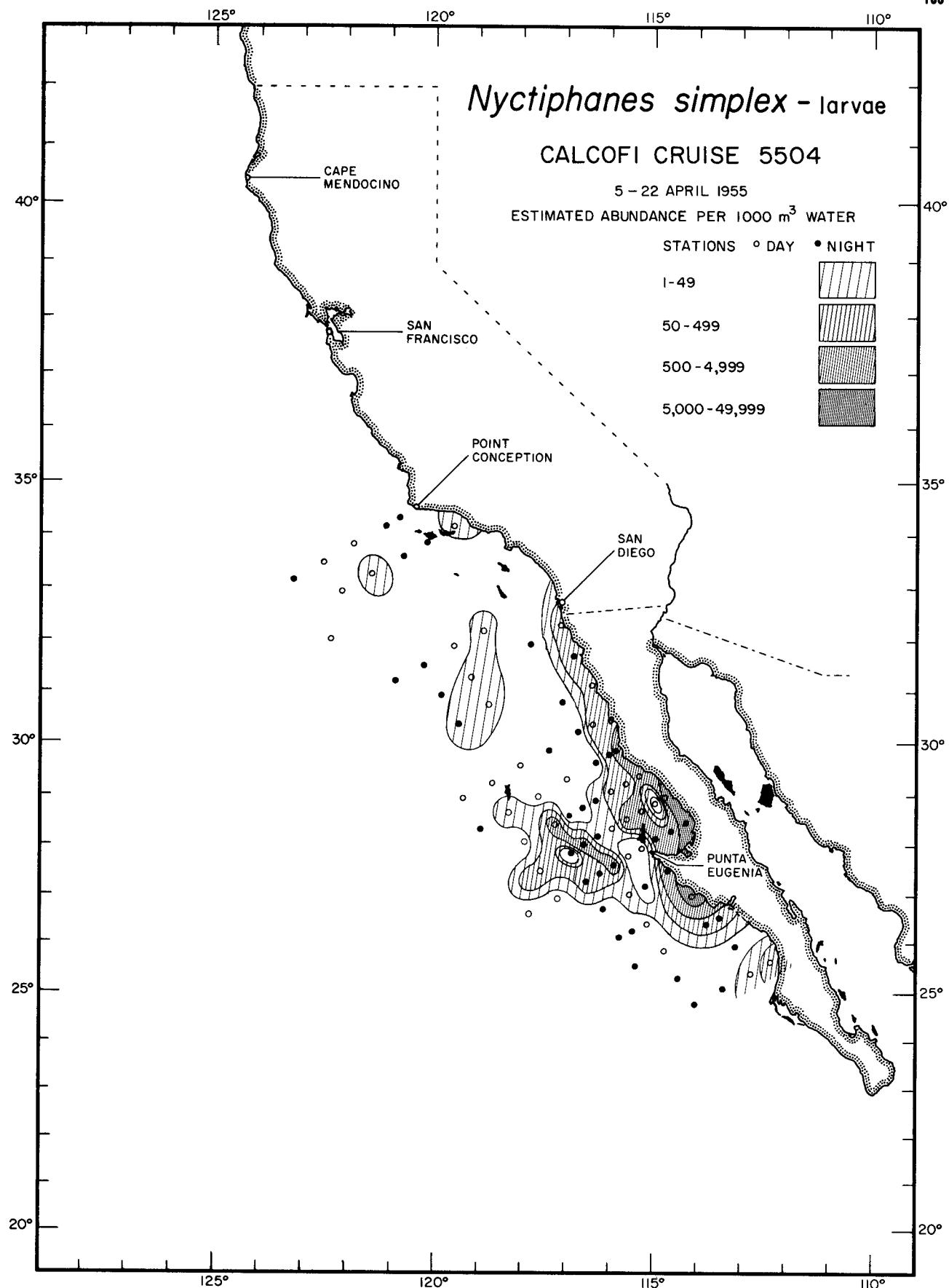


The numbers to the right of the shoreline represent abundance at special inshore stations occupied during Cruise 6304. These stations are too closely spaced to be shown by station circles. A number index appears to the right of the estimated abundance key. When the species is absent from all special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

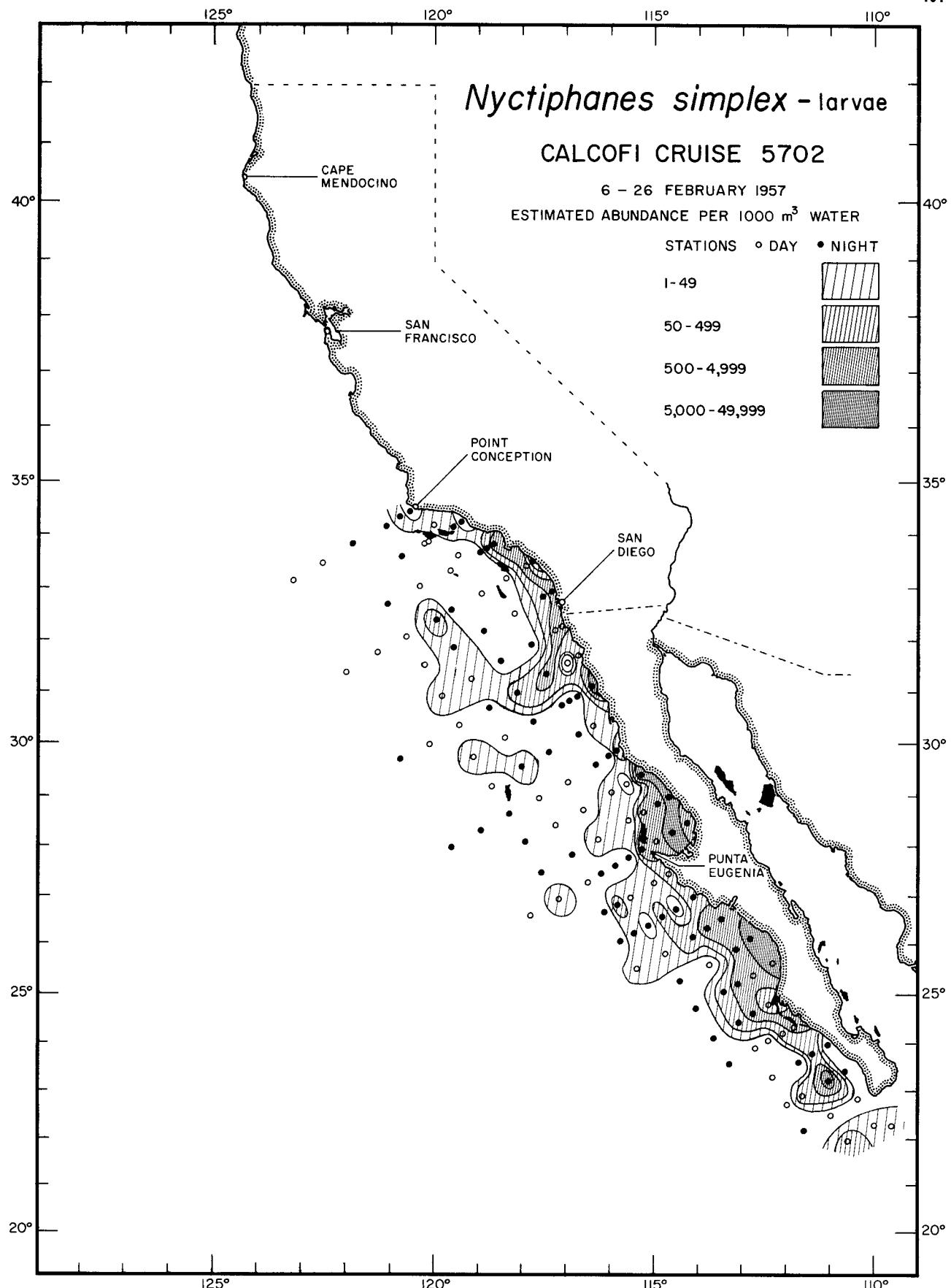
Euphausiacea
Nematoscelis tenella
6304



Euphausiacea
Nyctiphantes simplex-larvae
 5408

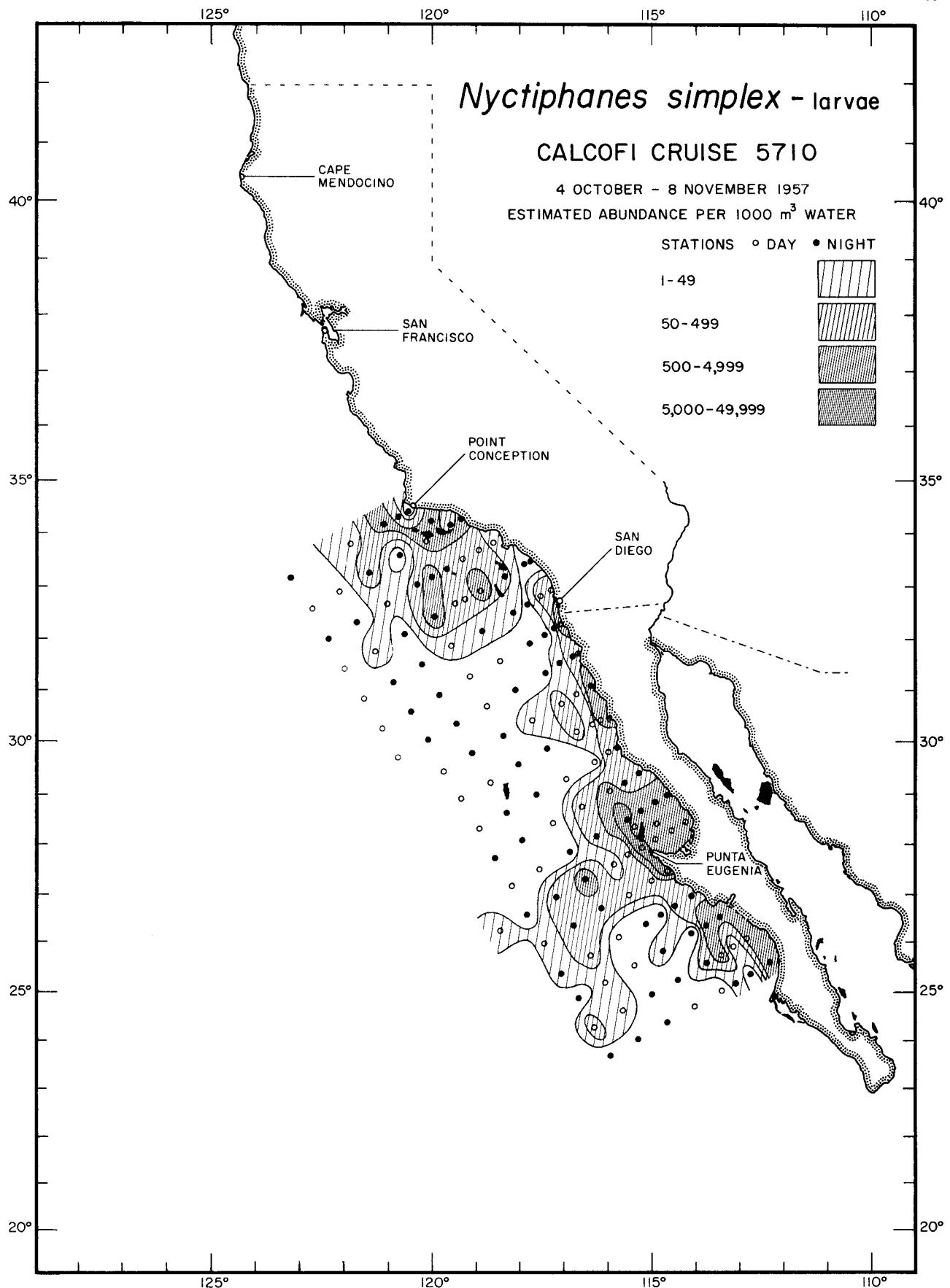


Euphausiacea
Nyctiphanes simplex - larvae
5504

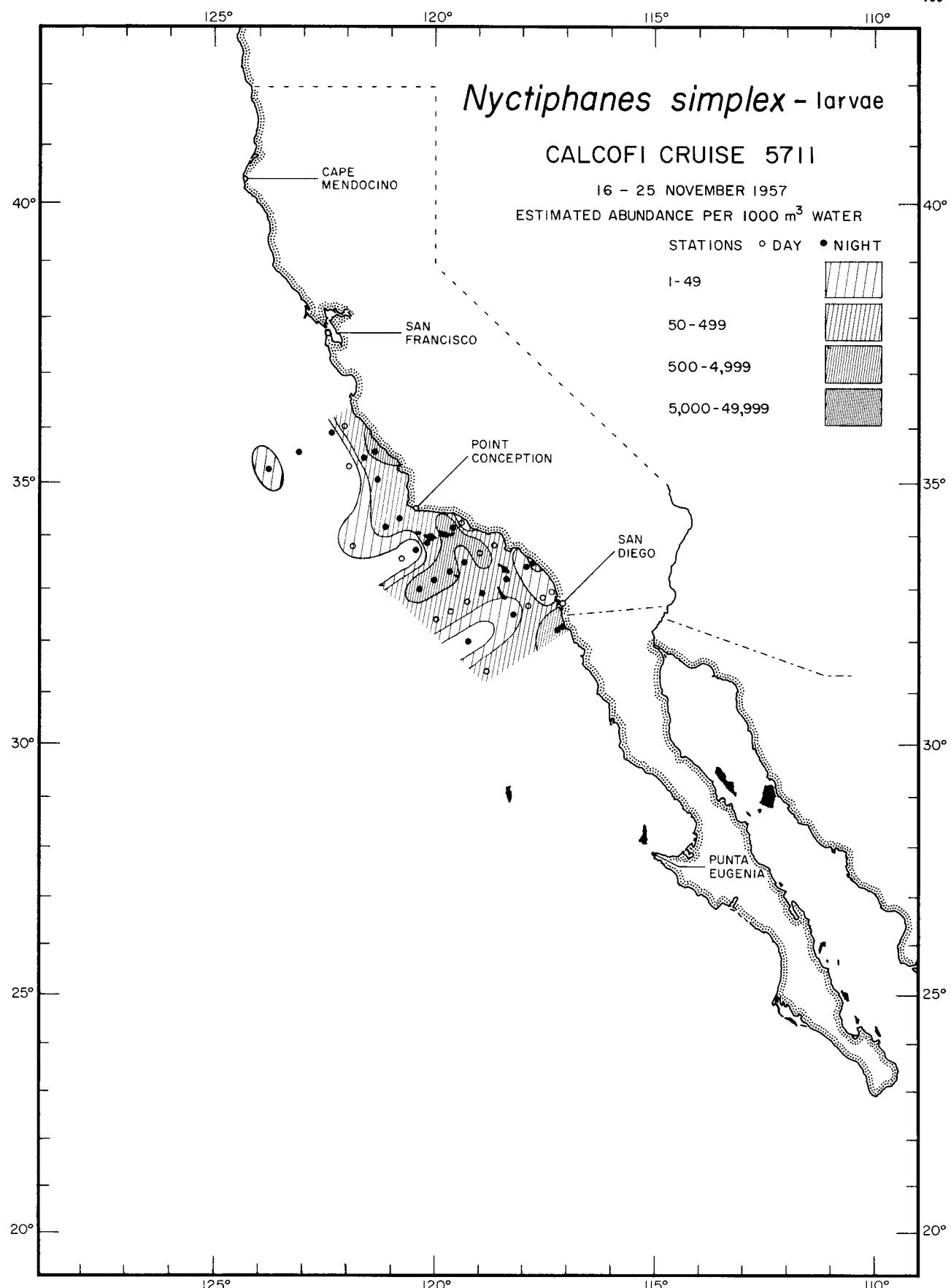


Euphausiacea
Nyctiphanes simplex - larvae

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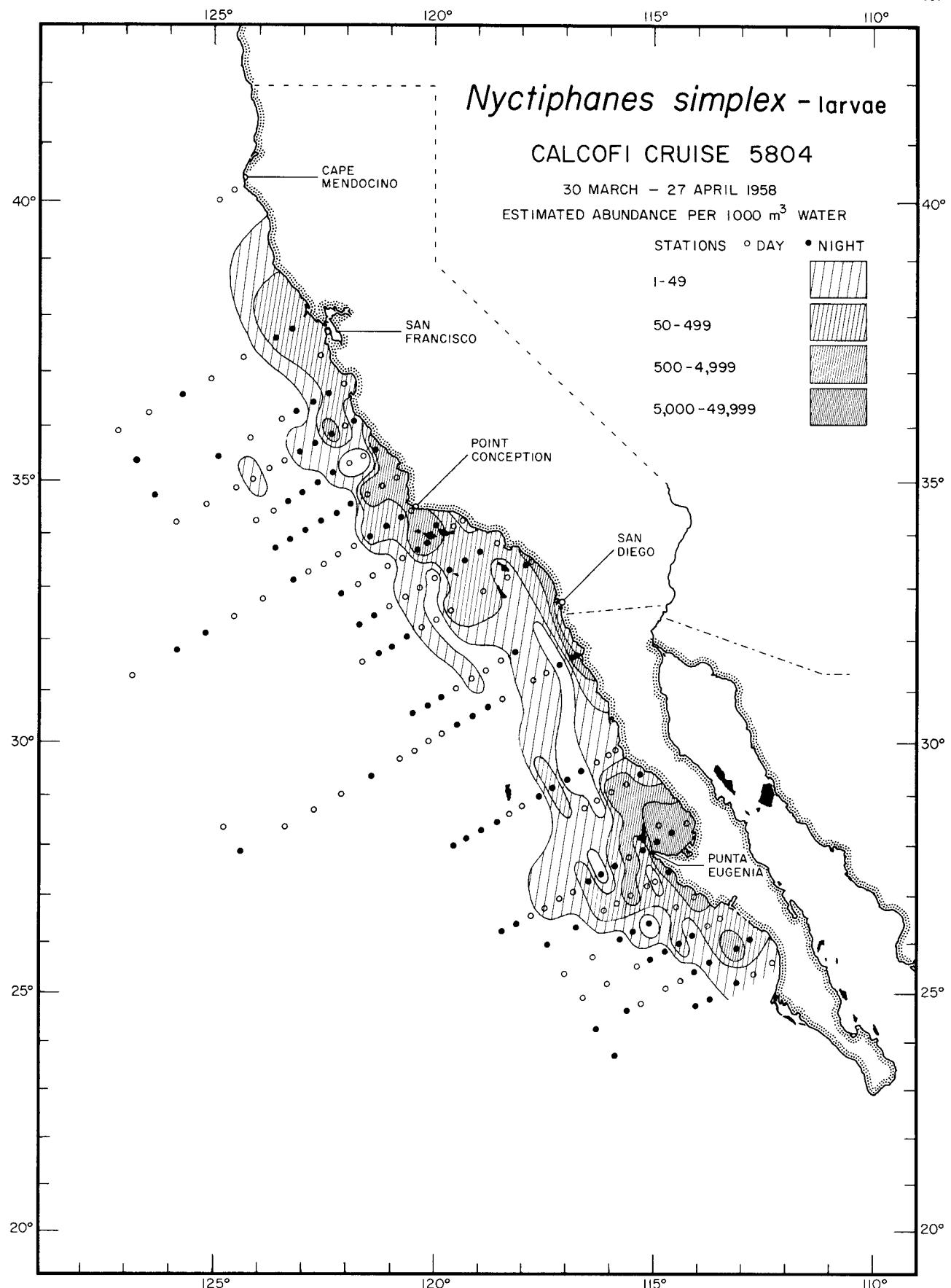


Euphausiacea
Nyctiphanes simplex - larvae
 5710

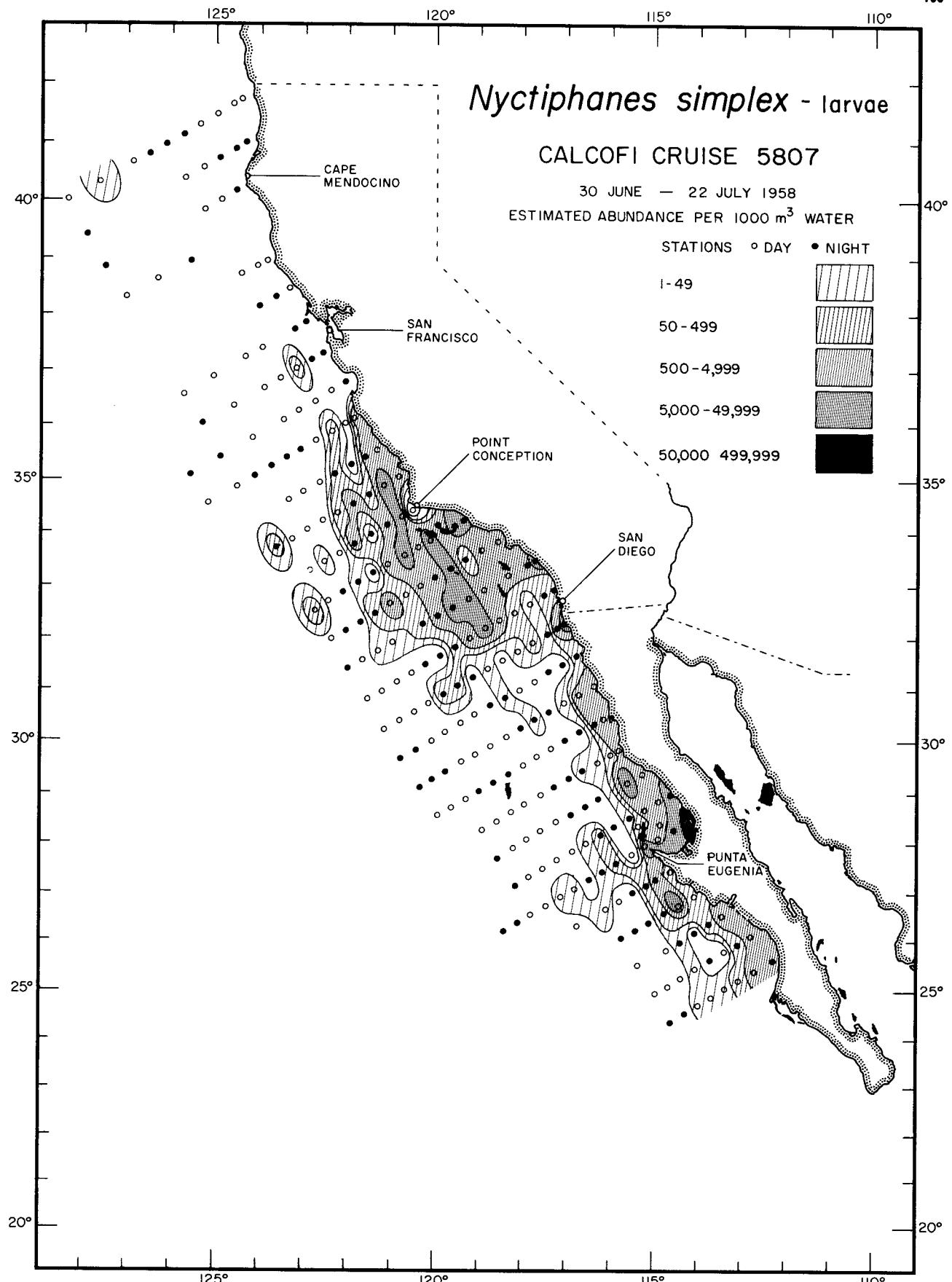


Euphausiacea
Nyctiphanes simplex - larvae

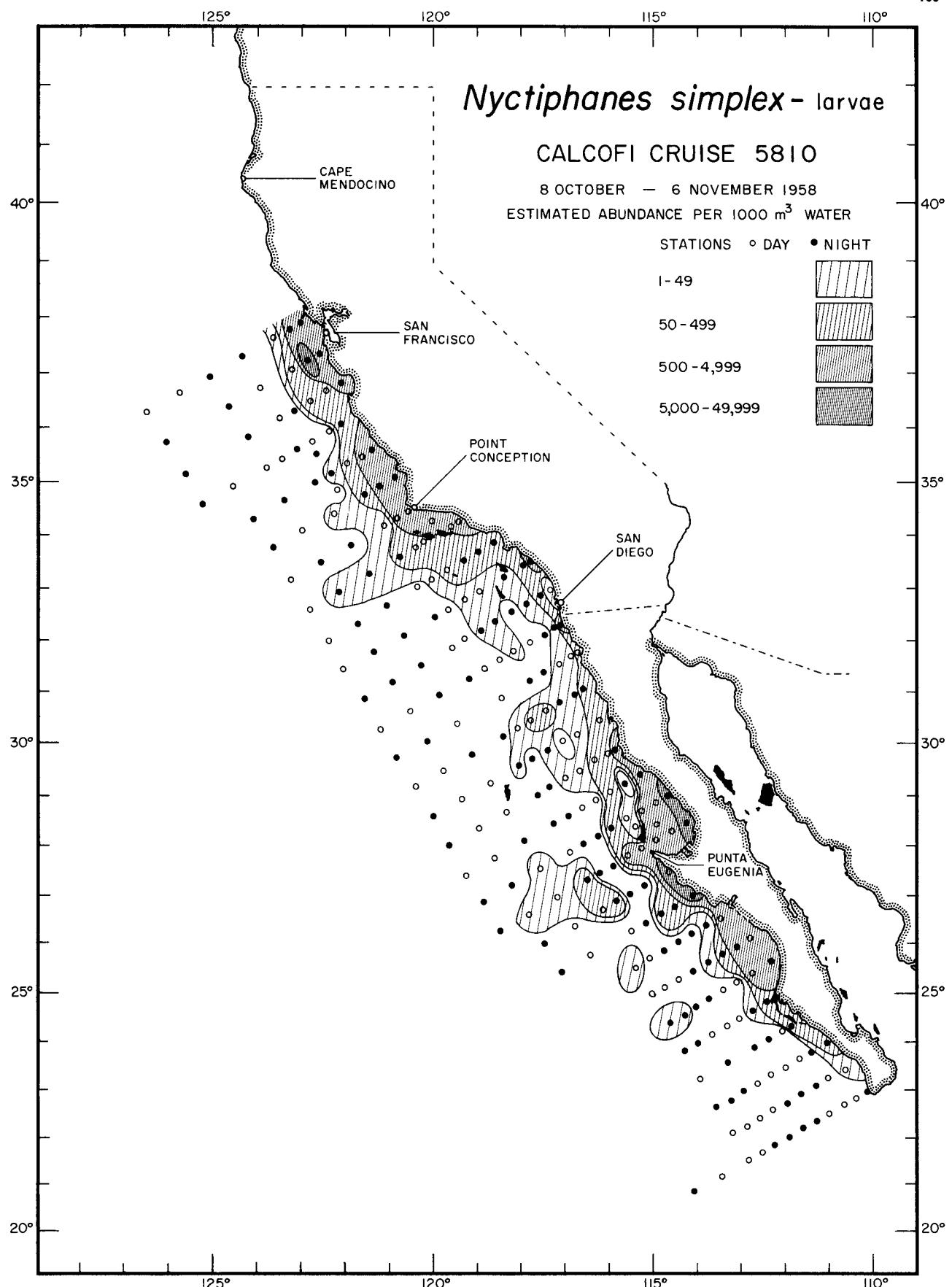
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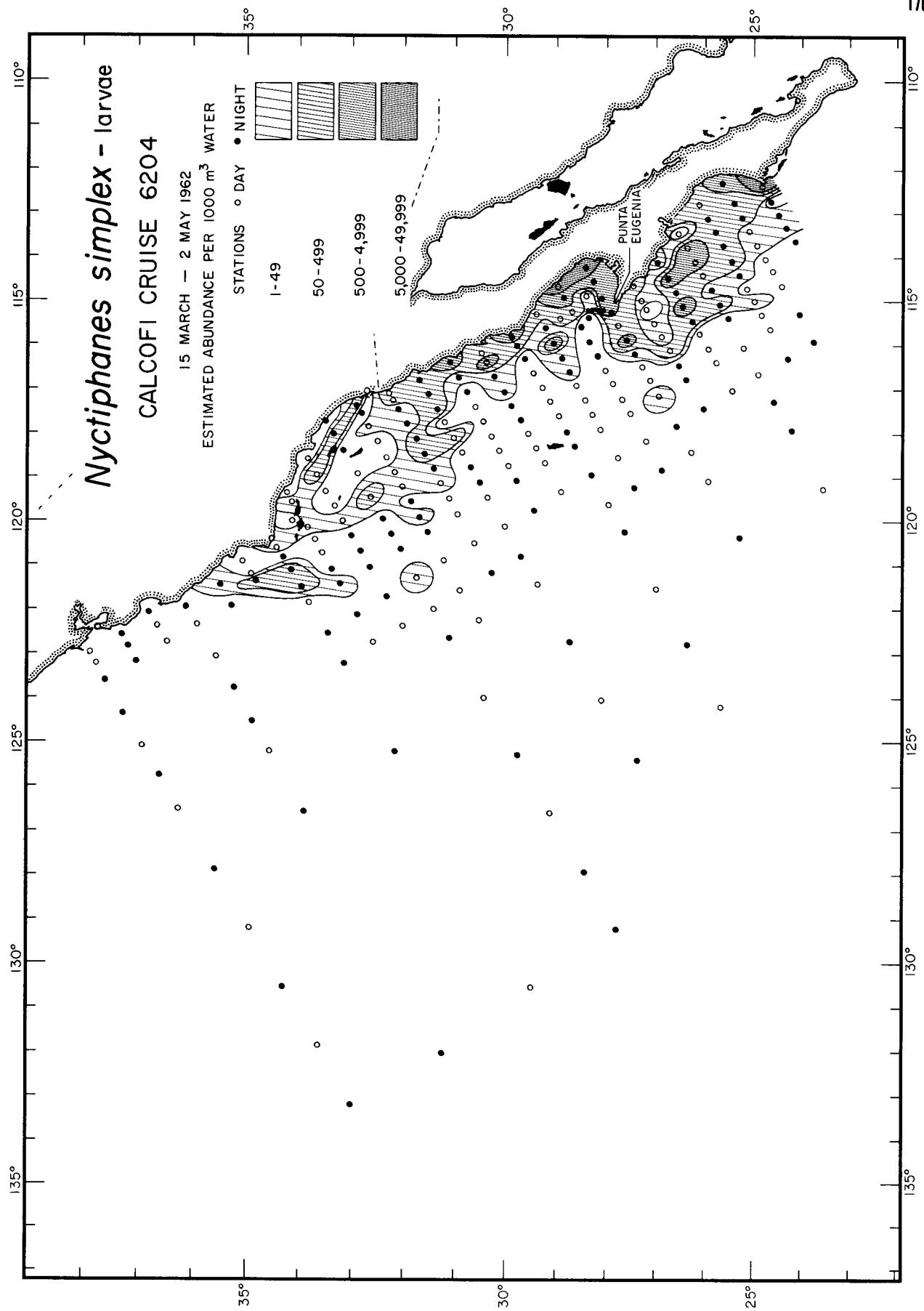
Euphausiacea
Nyctiphanes simplex - larvae
 5804



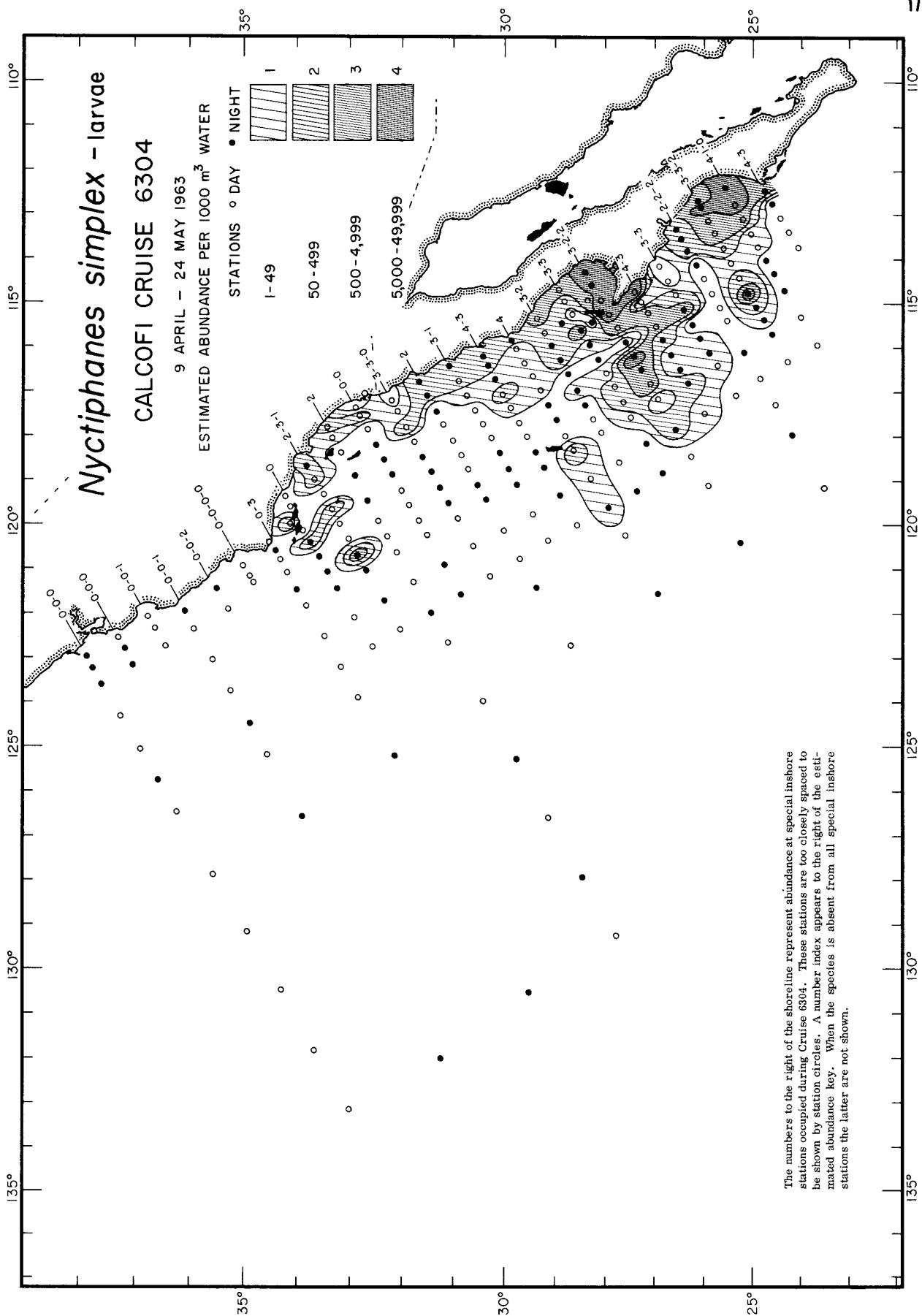
Euphausiacea
Nyctiphanes simplex - larvae
 5807



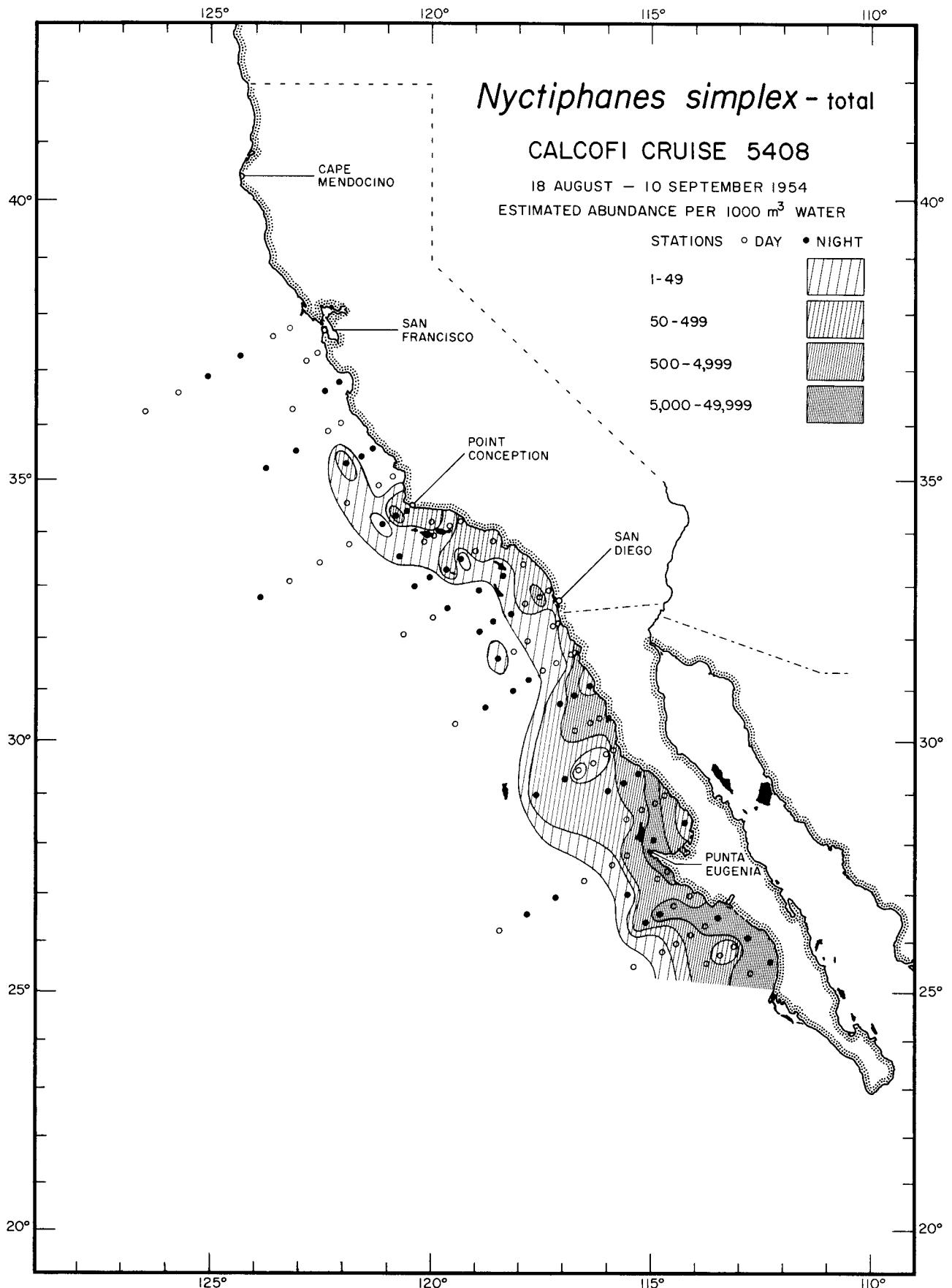
Euphausiacea
Nyctiophanes simplex - larvae
 5810



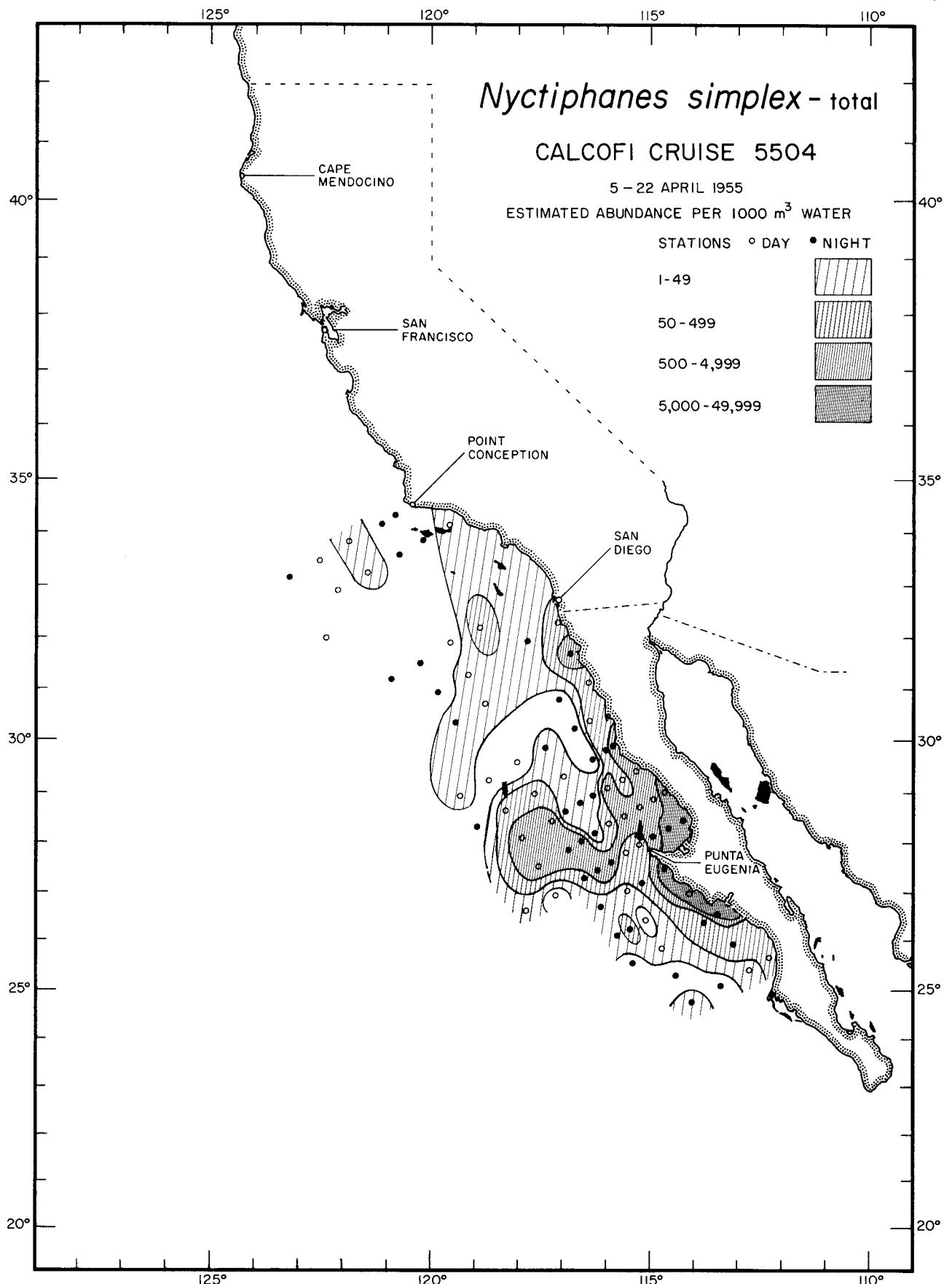
Euphausiacea
Nyctiphanes simplex - larvae
6204



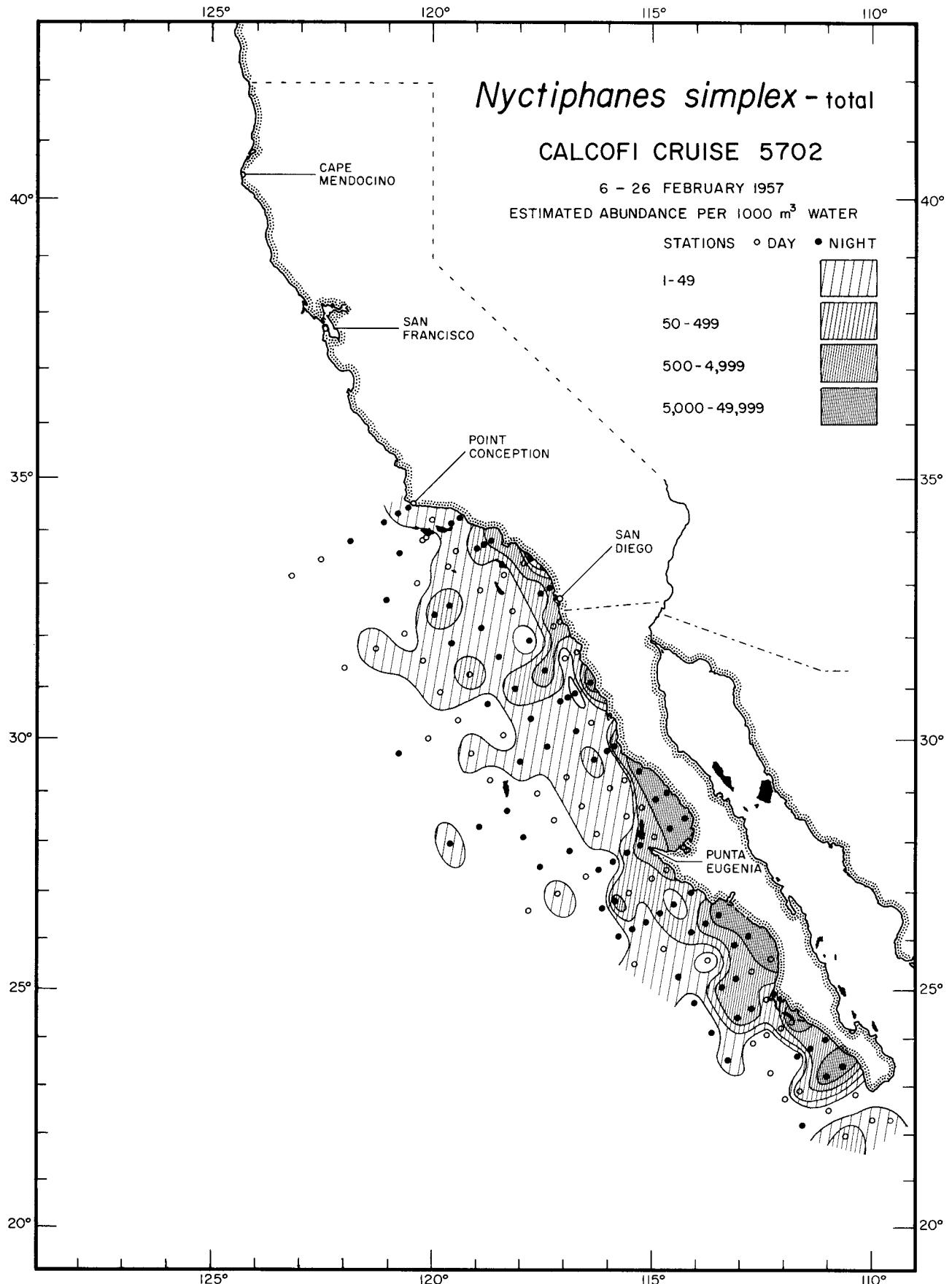
Euphausiacea
Nyctiphanes simplex - larvae
 6304



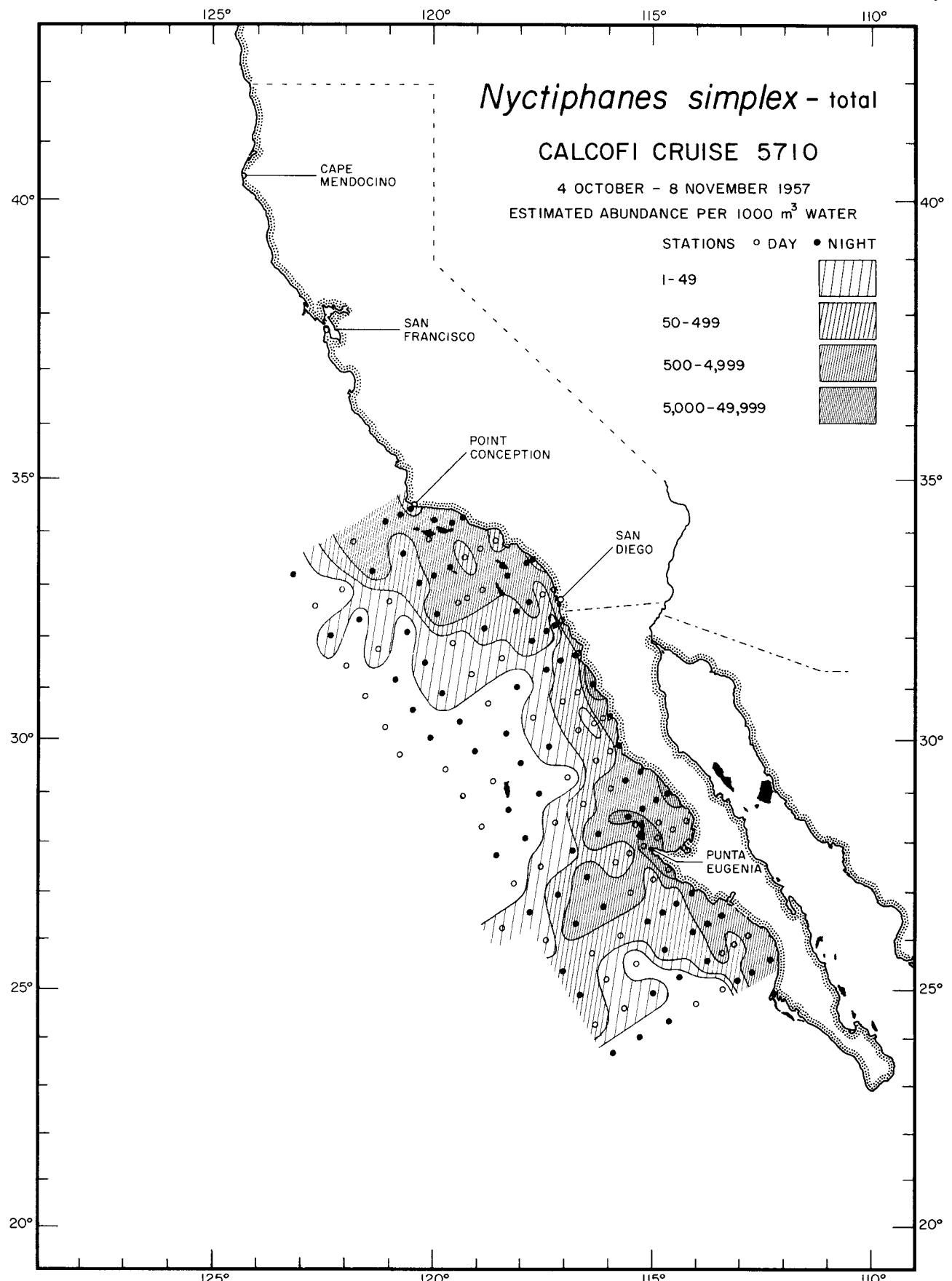
Euphausiacea
Nyctiphanes simplex - total
5408



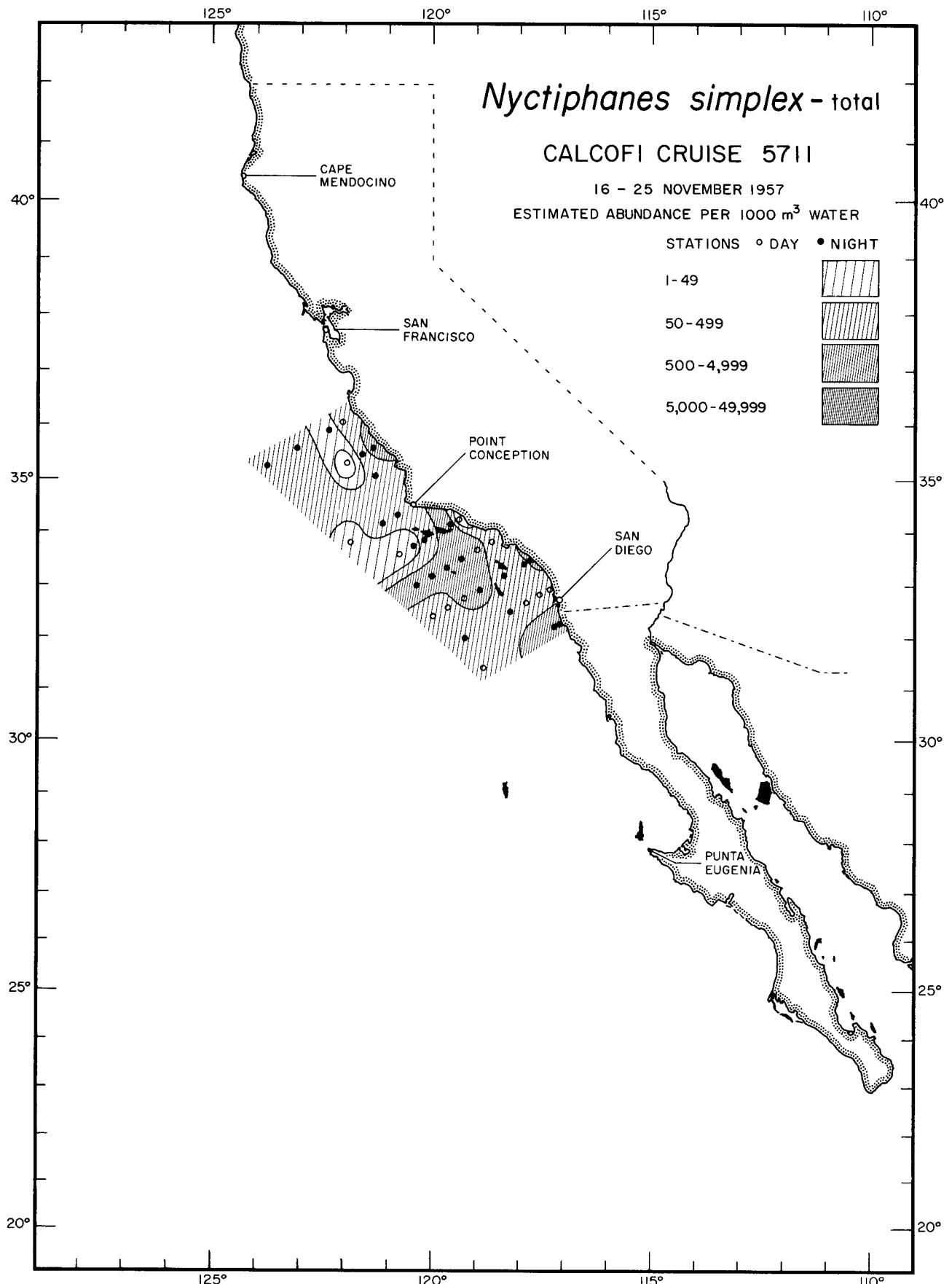
Euphausiacea
Nyctiphanes simplex - total
5504



Euphausiacea
Nyctiphanes simplex - total
5702

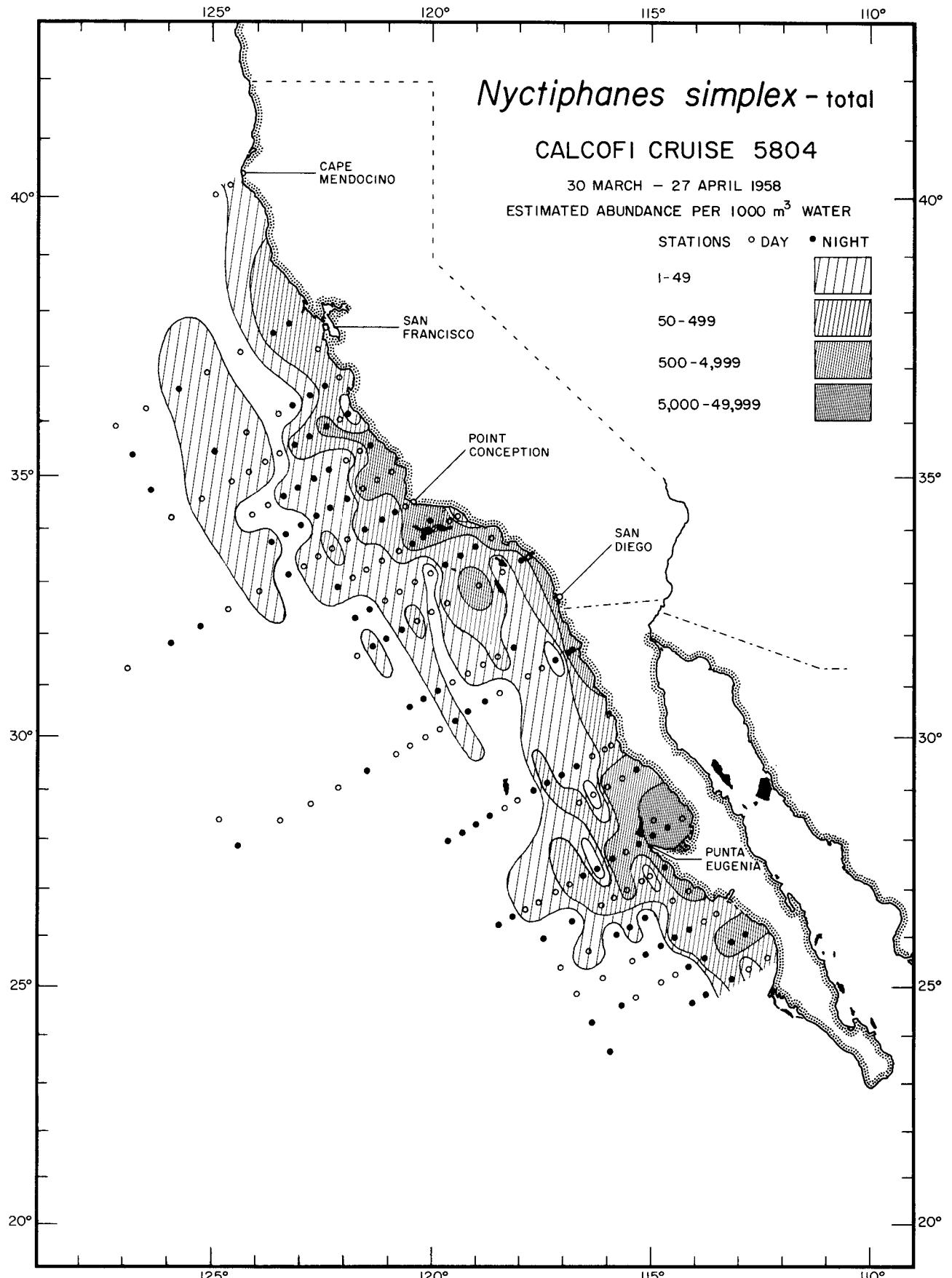


Euphausiacea
Nyctiphanes simplex - total
5710

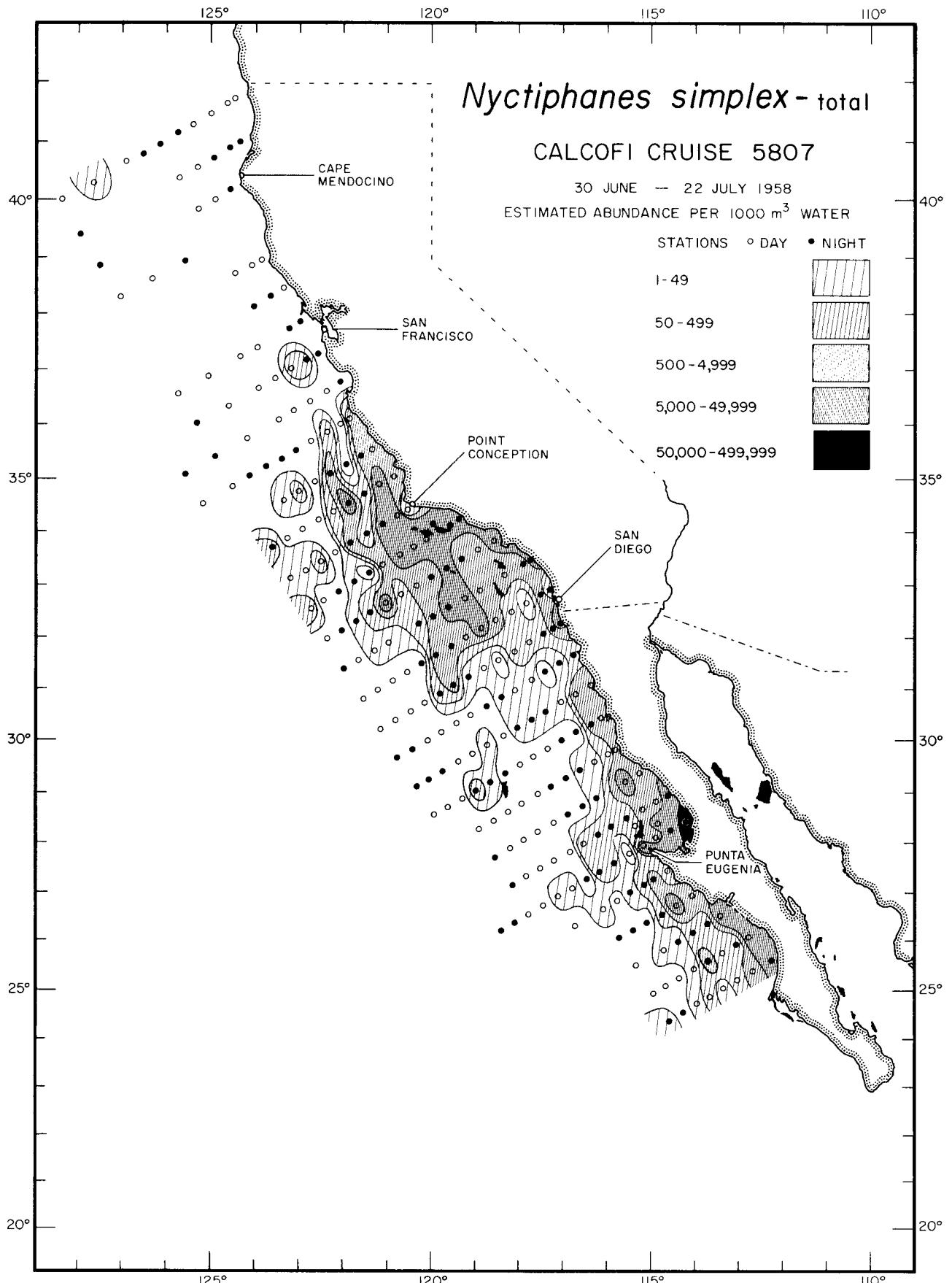


Euphausiacea
Nyctiphanes simplex - total

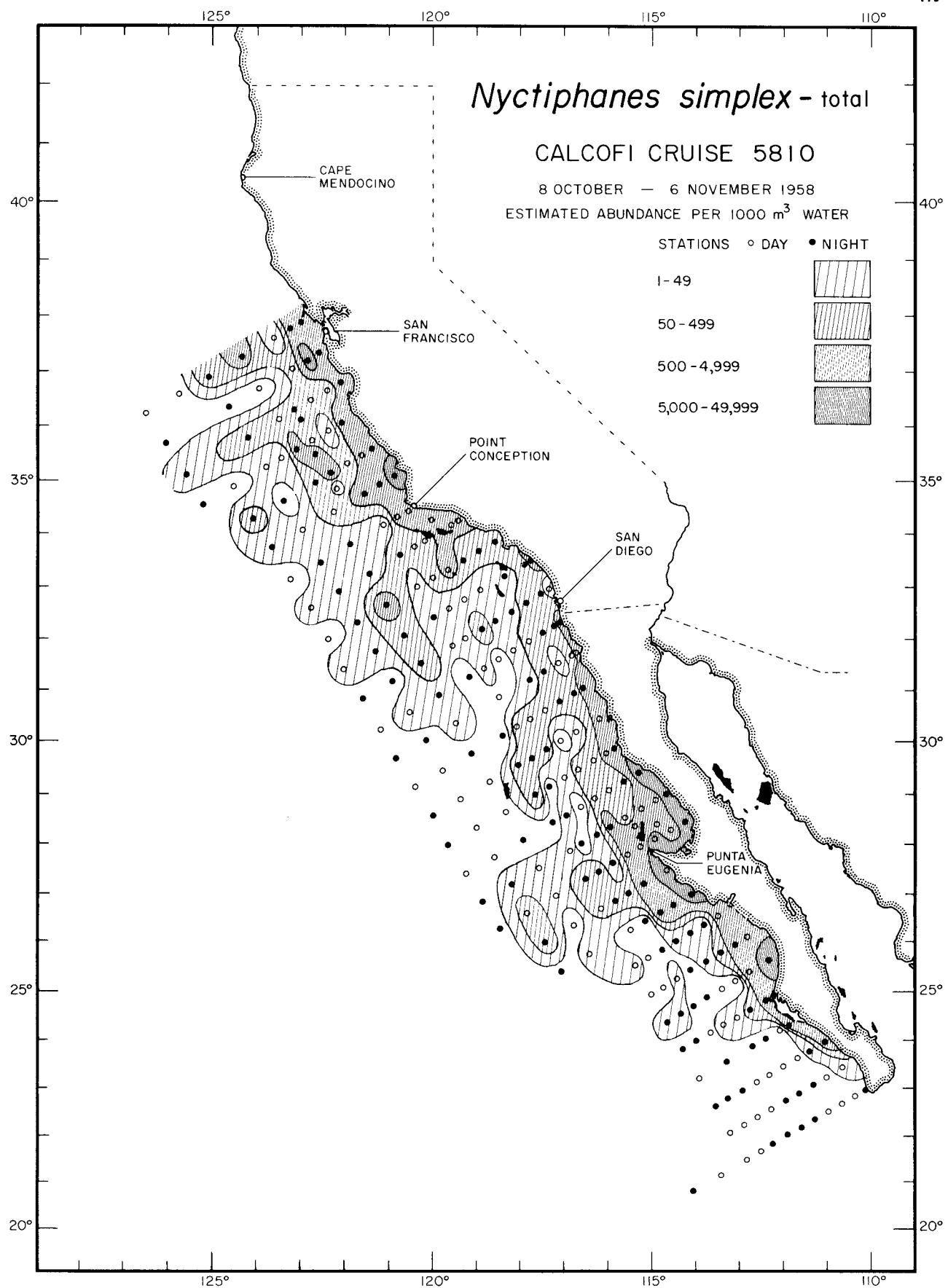
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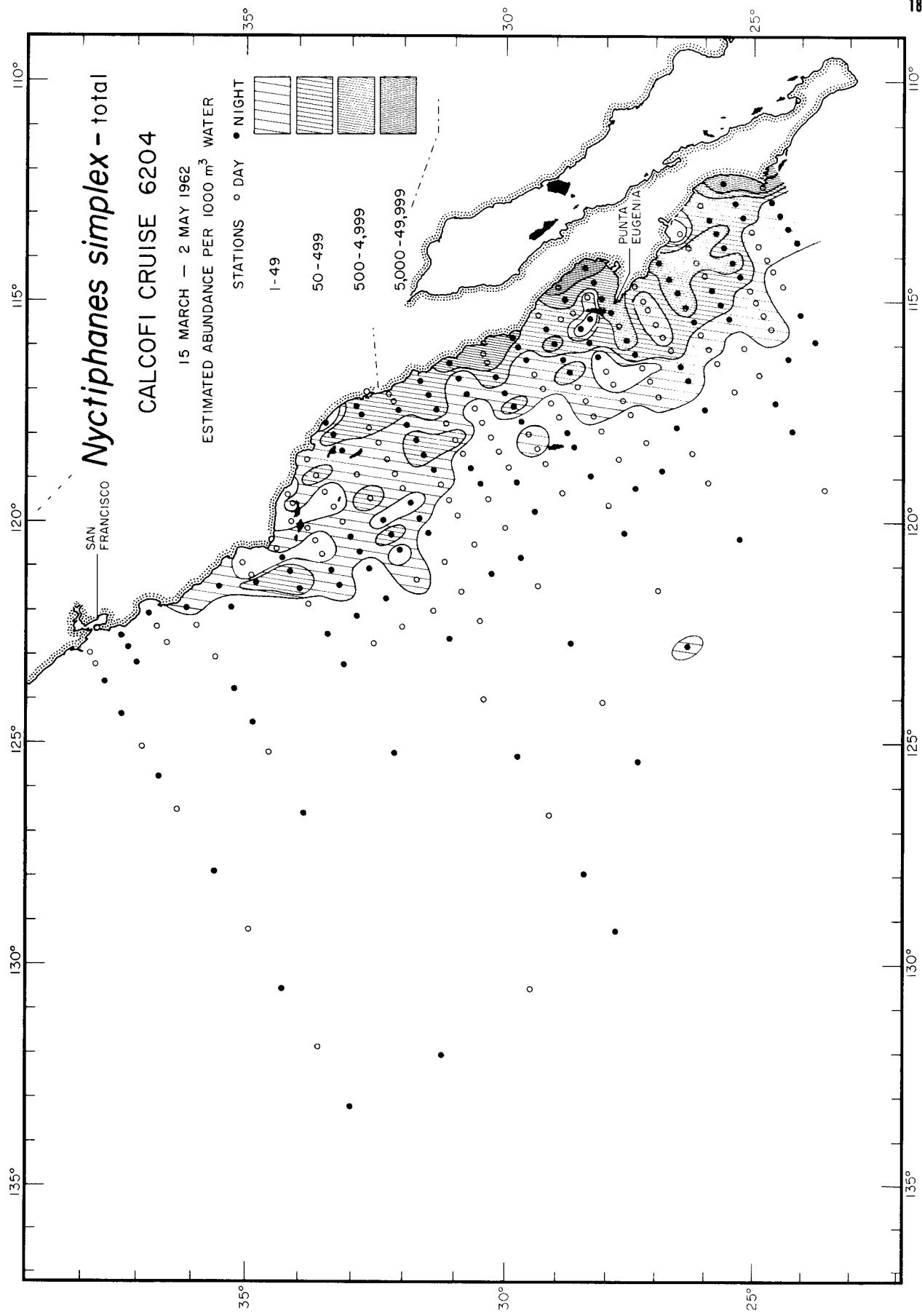
Euphausiacea
Nyctiphanes simplex - total
 5804



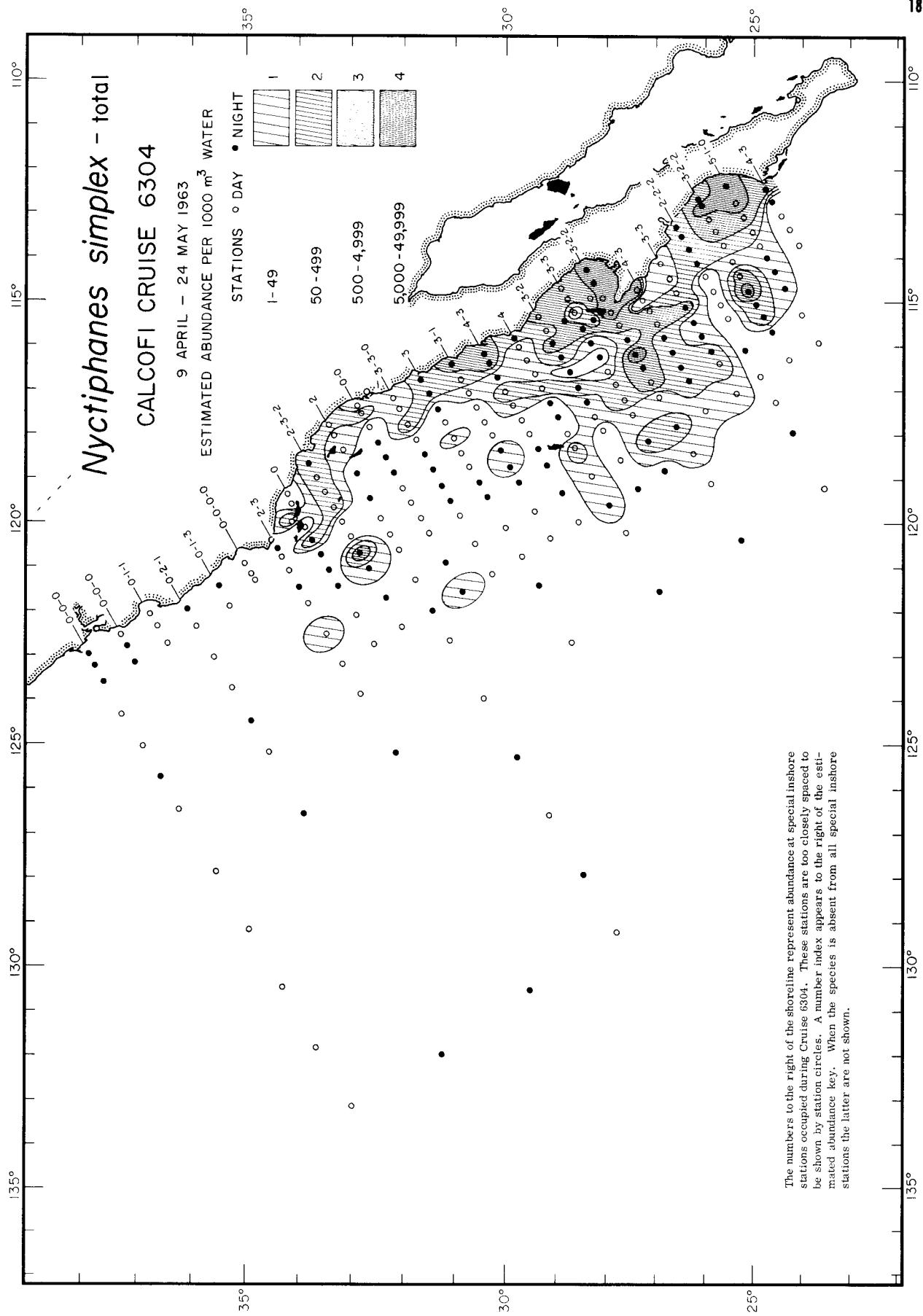
Euphausiacea
Nyctiphanes simplex - total
 5807



Euphausiacea
Nyctiphanes simplex - total
 5810



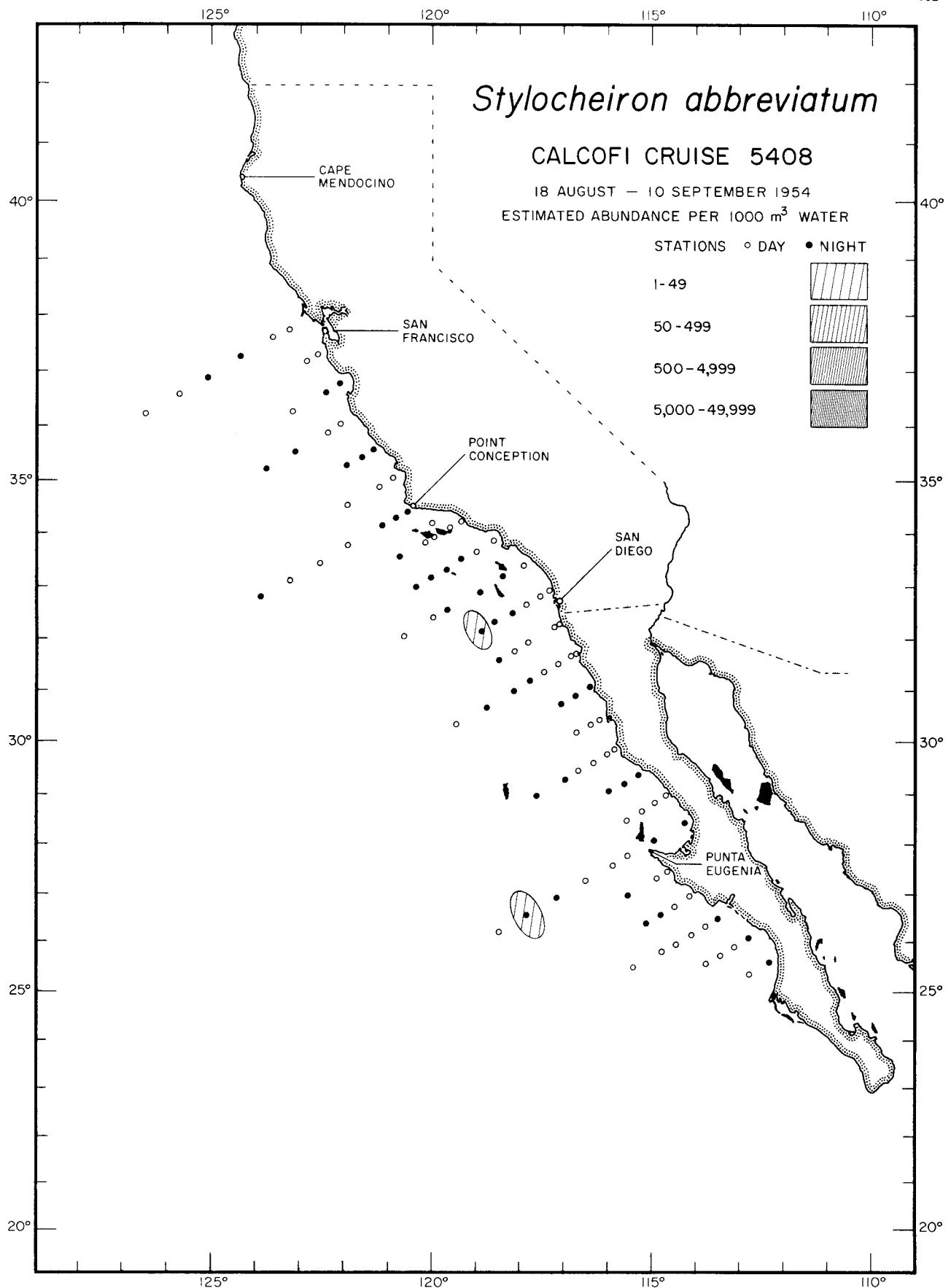
Euphausiacea
Nyctiphanes simplex - total
6204



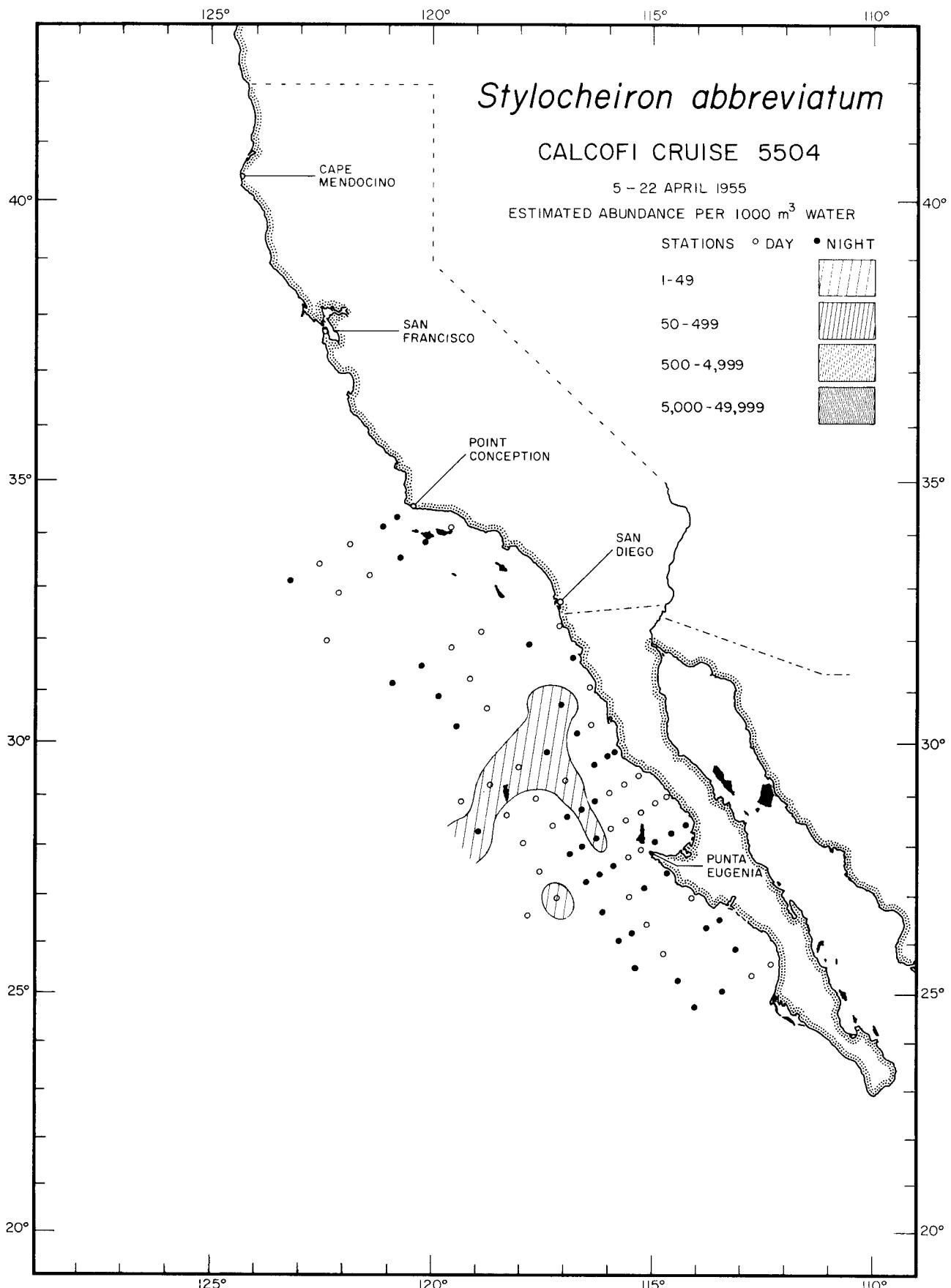
The numbers to the right of the shoreline represent abundance at special instore stations occupied during Cruise 6304. These stations are too closely spaced to be shown by station circles. A number index appears to the right of the estimated abundance key. When the species is absent from all special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

Euphausiacea
Nyctiphanes simplex - total

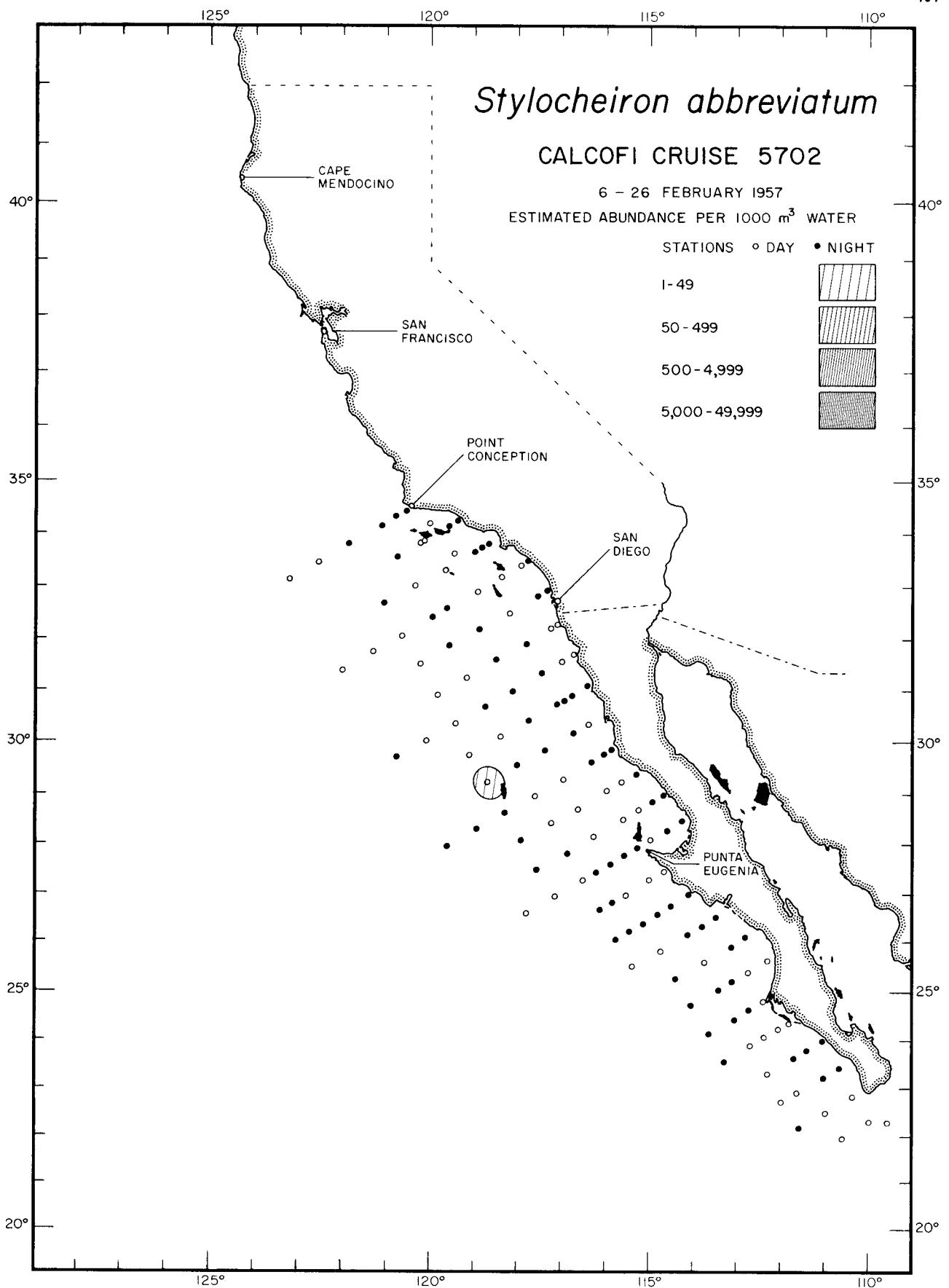
6304



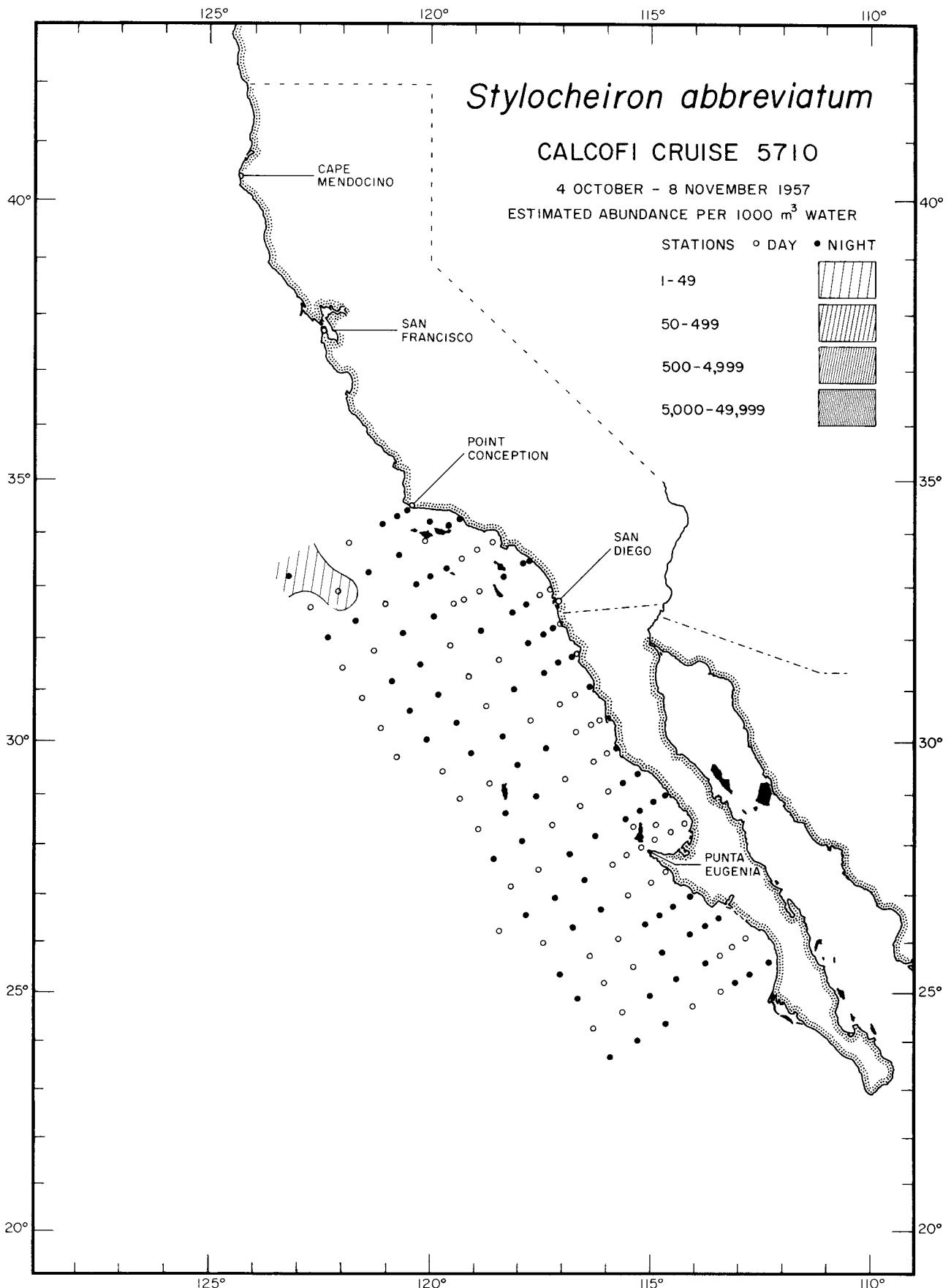
Euphausiacea
Stylocheiron abbreviatum
 5408



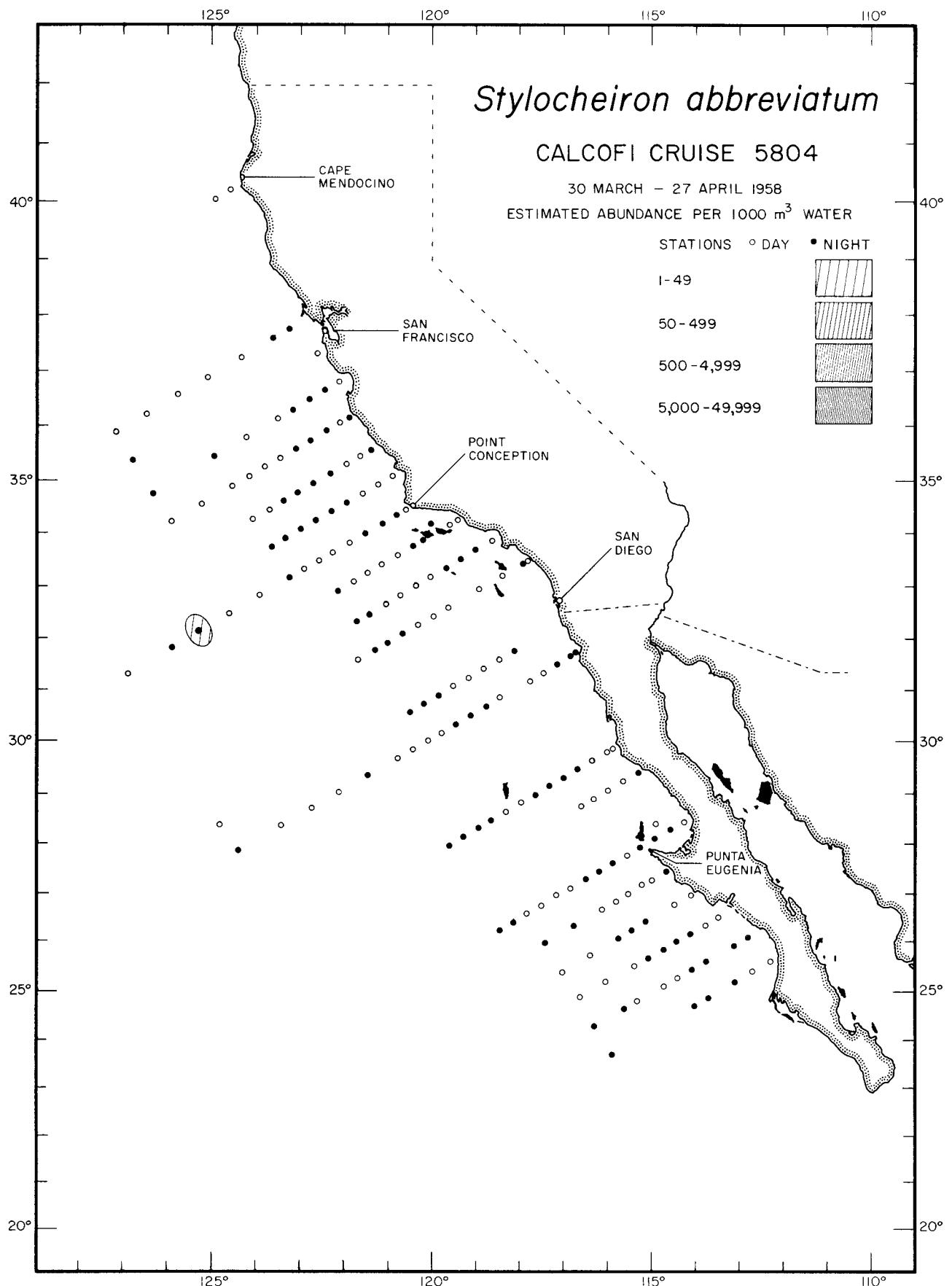
Euphausiaceae
Stylocheiron abbreviatum
 5504



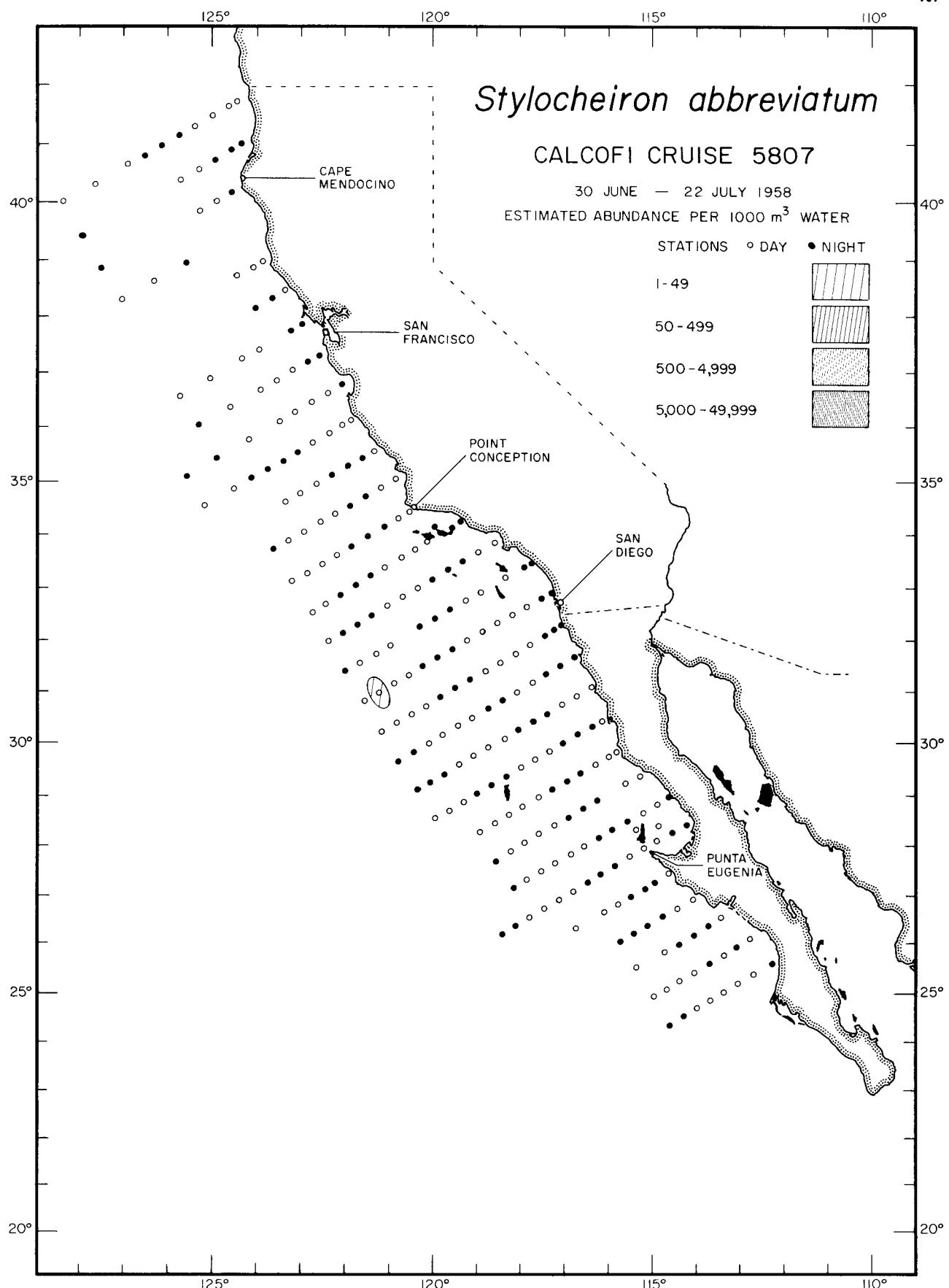
Euphausiacea
Stylocheiron abbreviatum
 5702



Euphausiaceae
Stylocheiron abbreviatum
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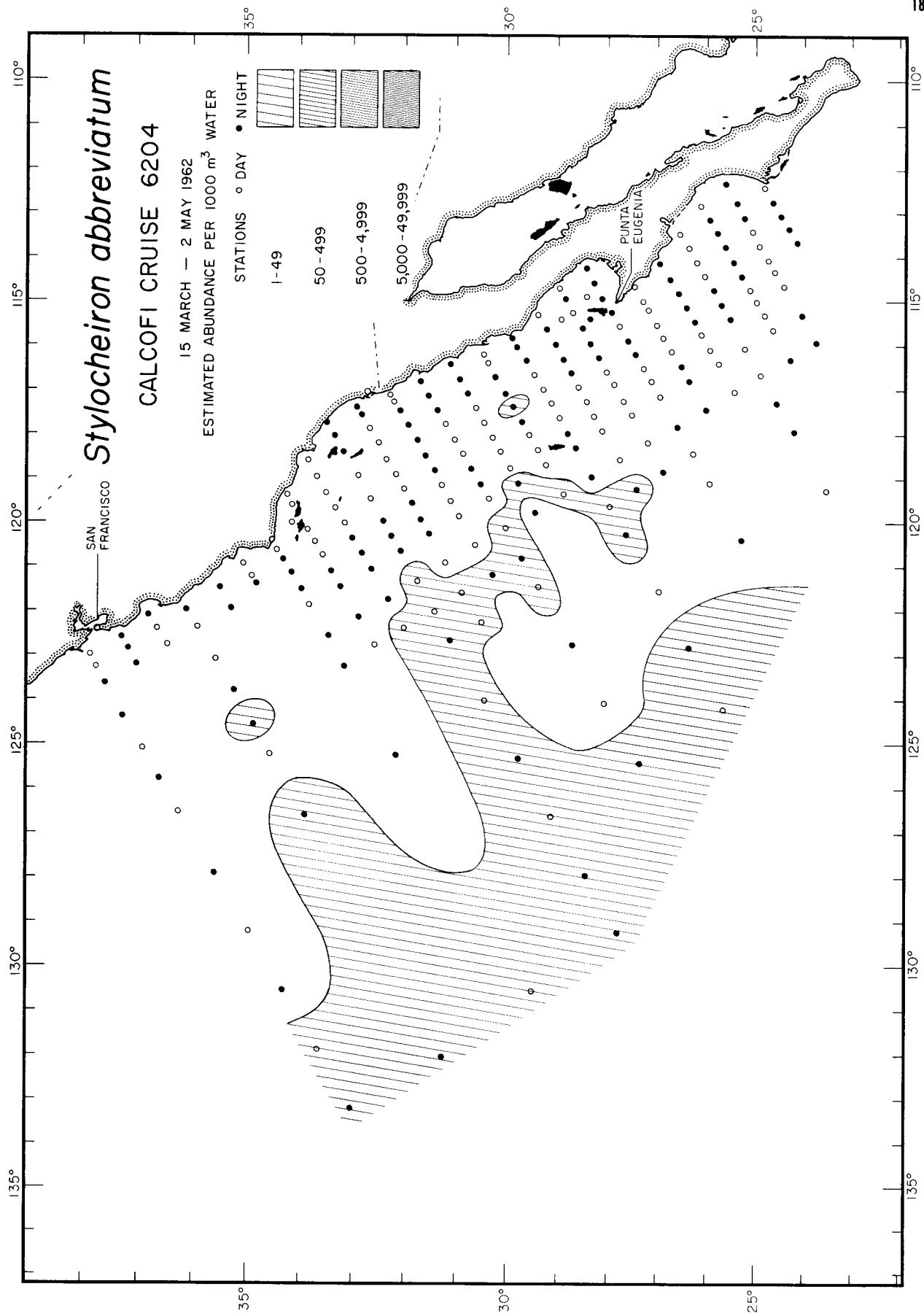


Euphausiaceae
Stylocheiron abbreviatum
 5804

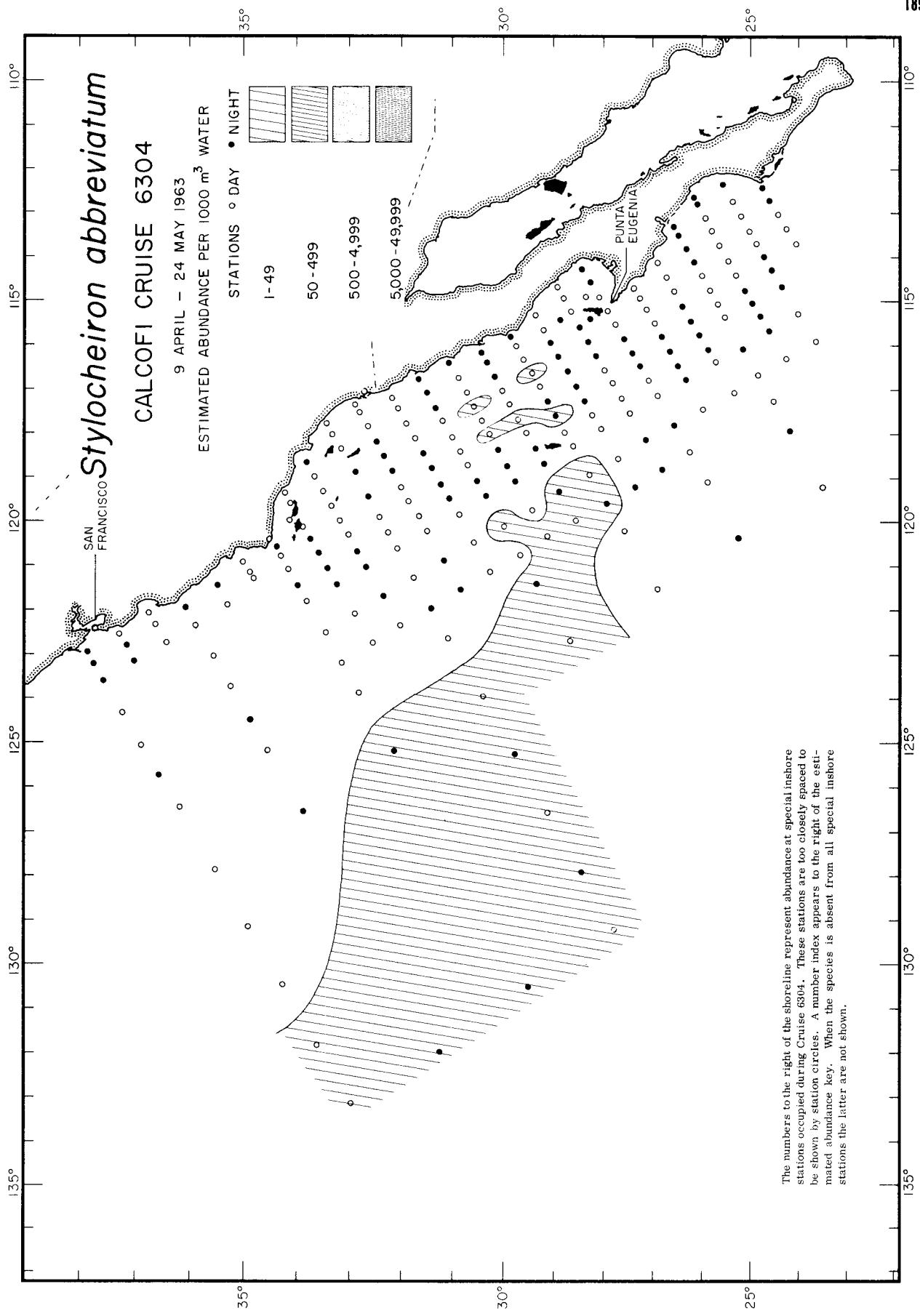


Euphausiacea
Stylocheiron abbreviatum

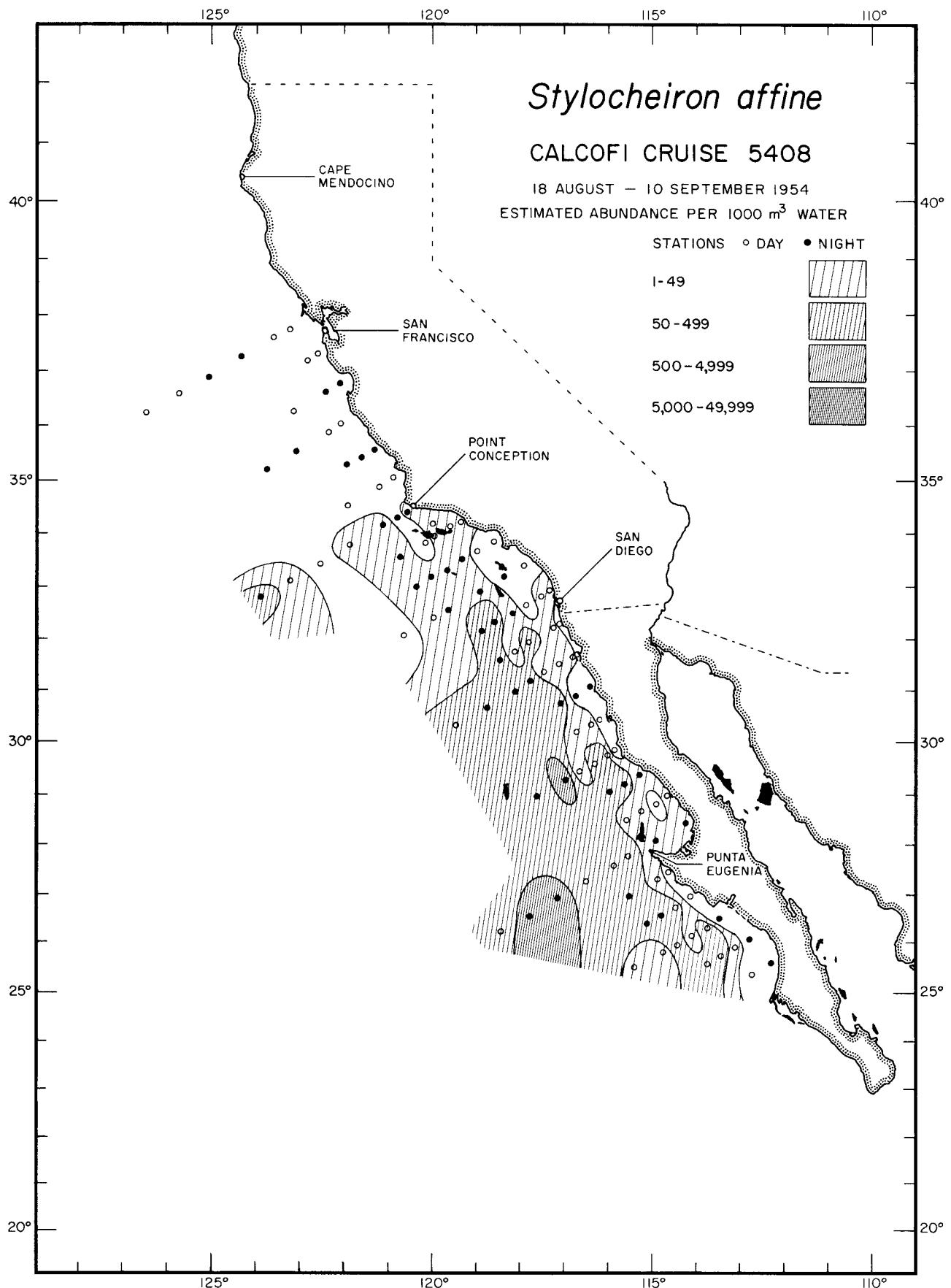
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Euphausiacea
Stylocheiron abbreviatum
 6204

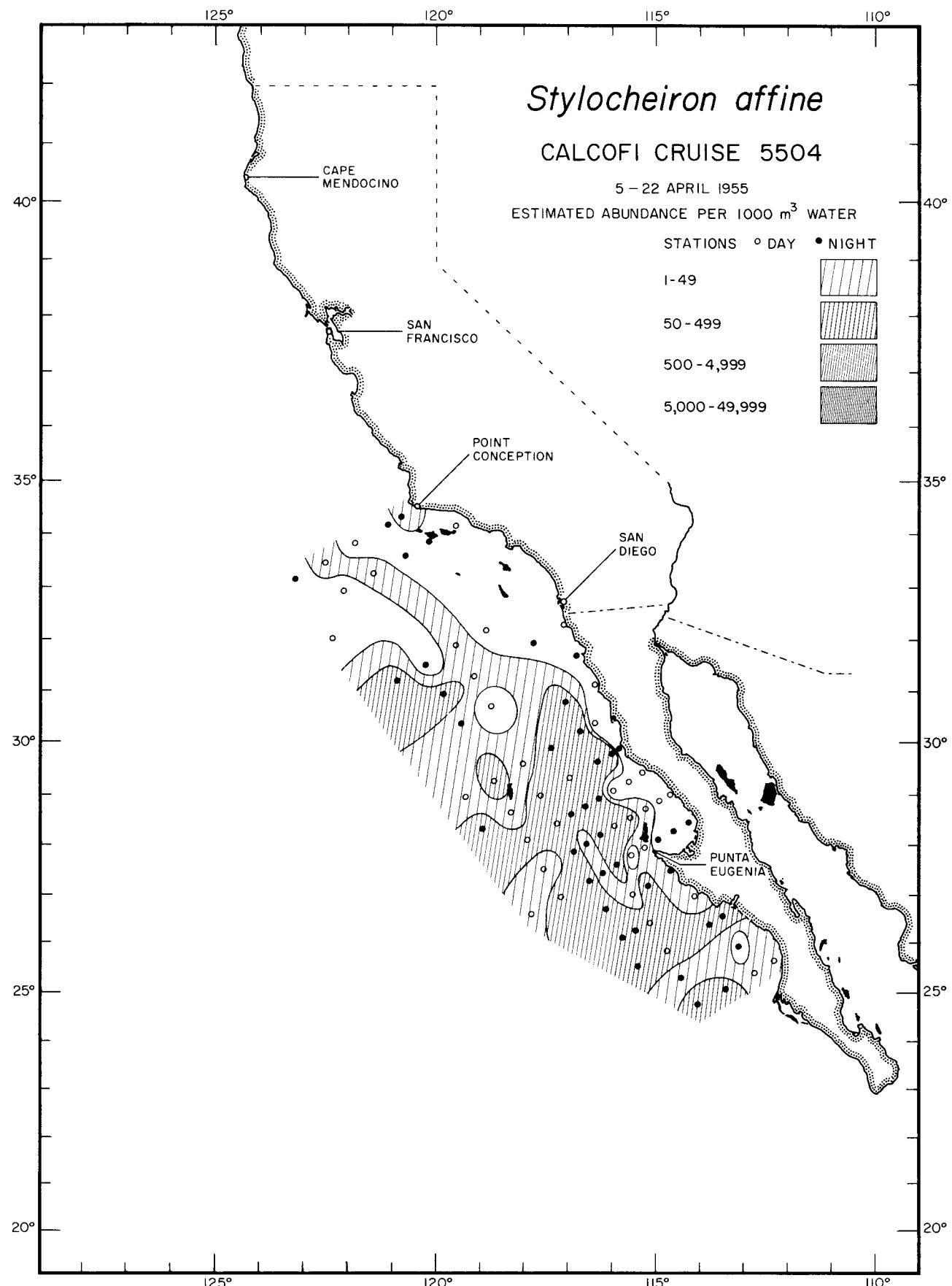


Euphausiacea
Stylocheiron abbreviatum
 6304

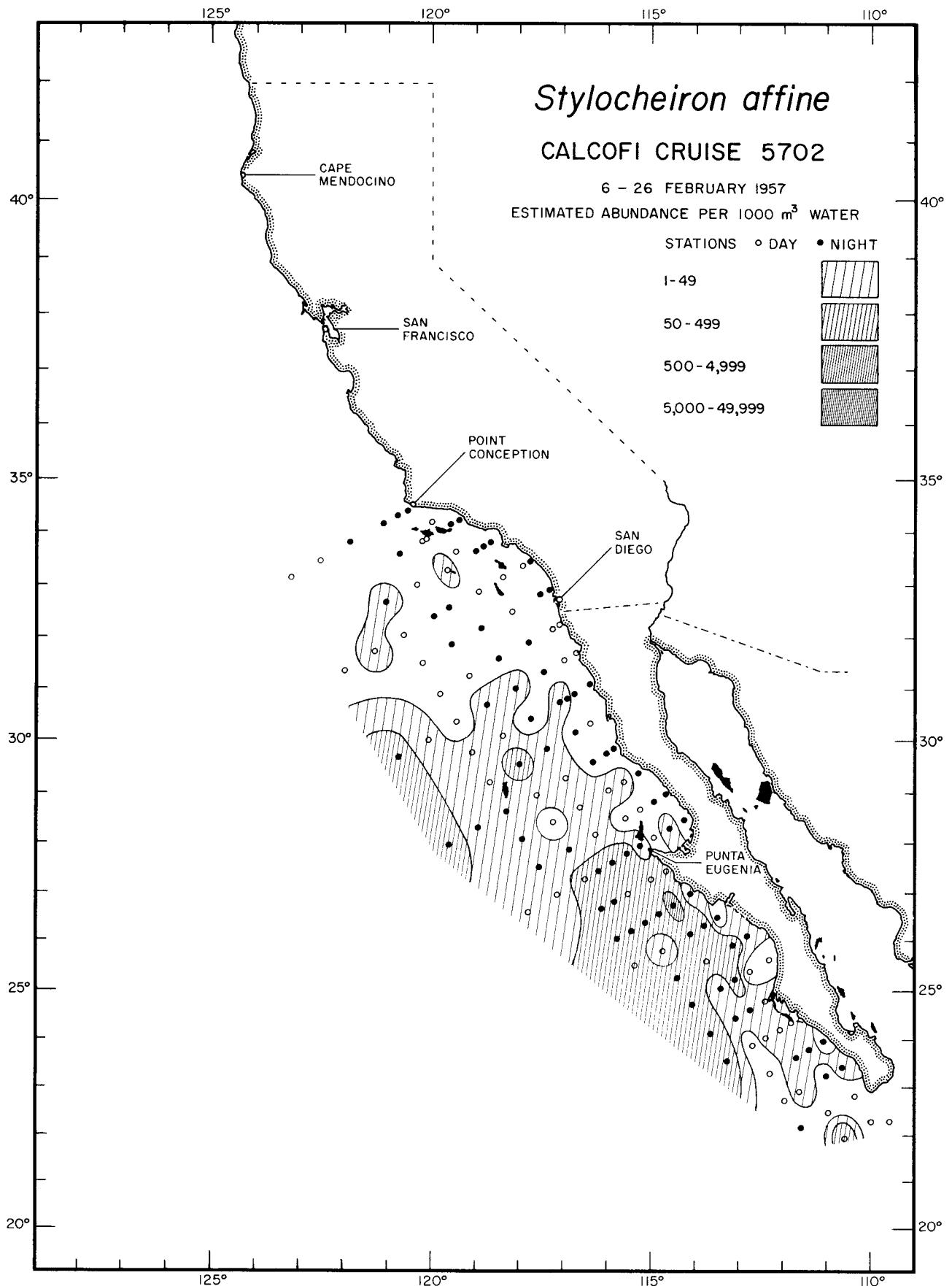


Euphausiacea
Stylocheiron affine

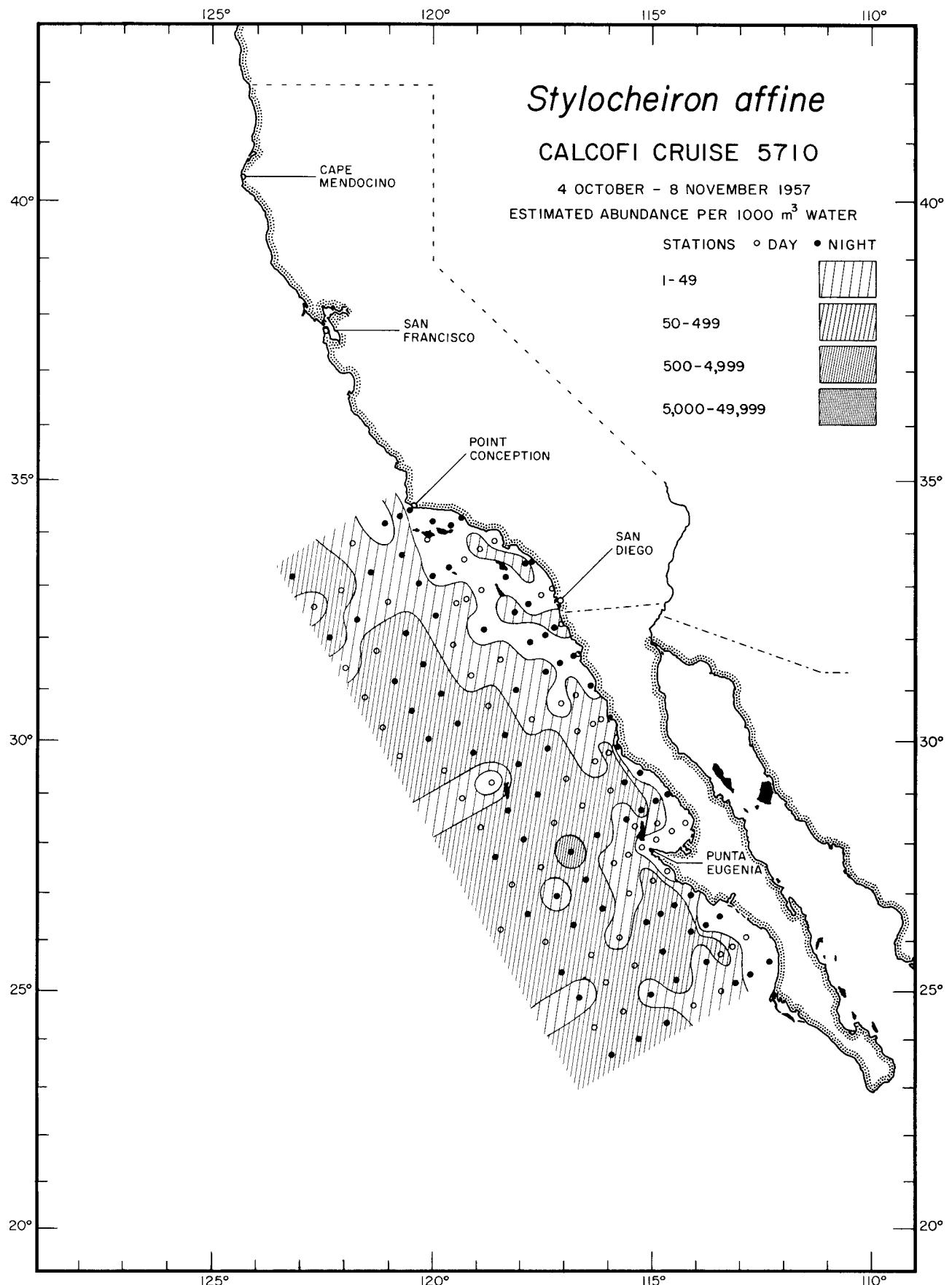
5408



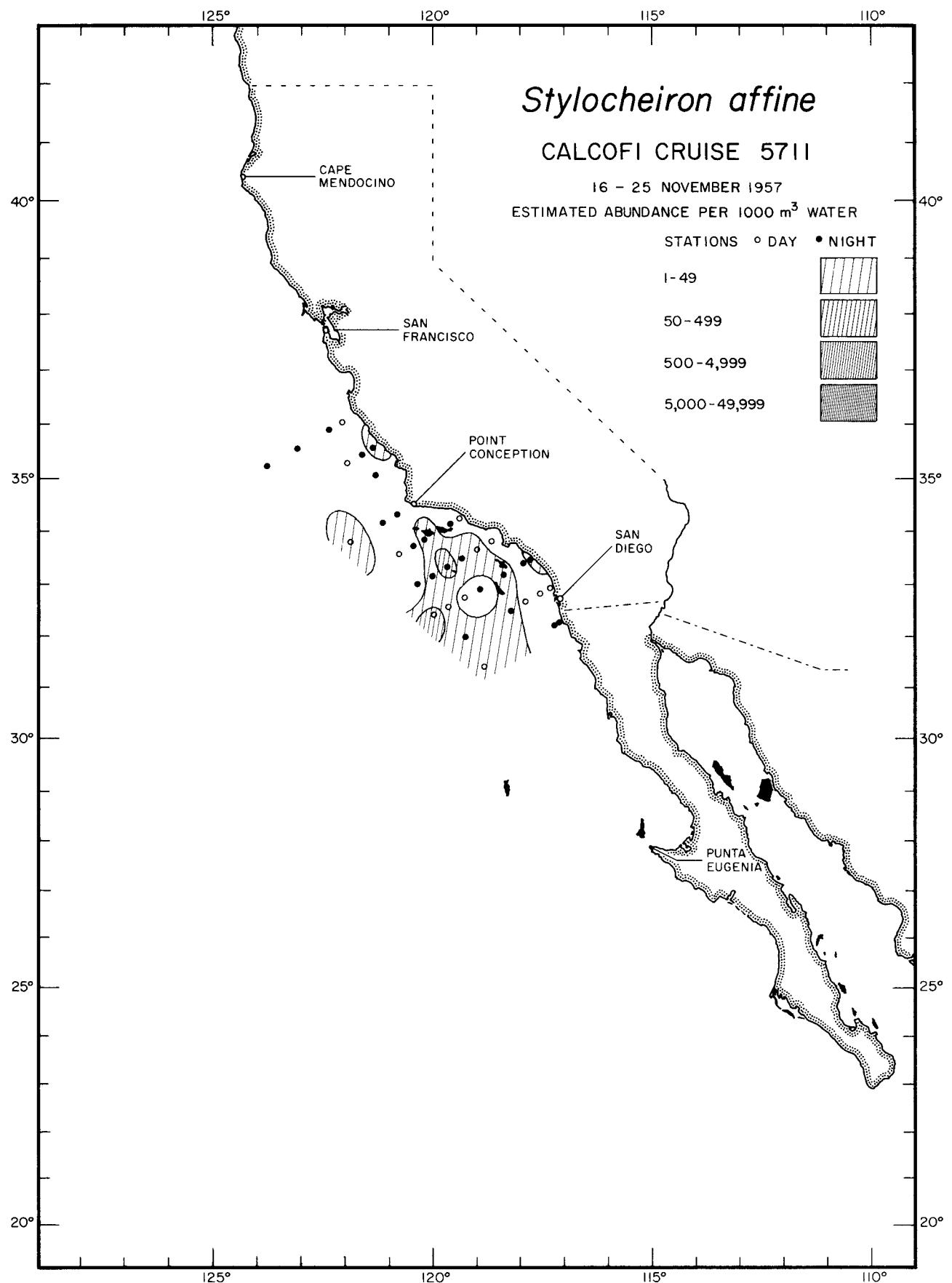
Euphausiacea
Stylocheiron affine
5504



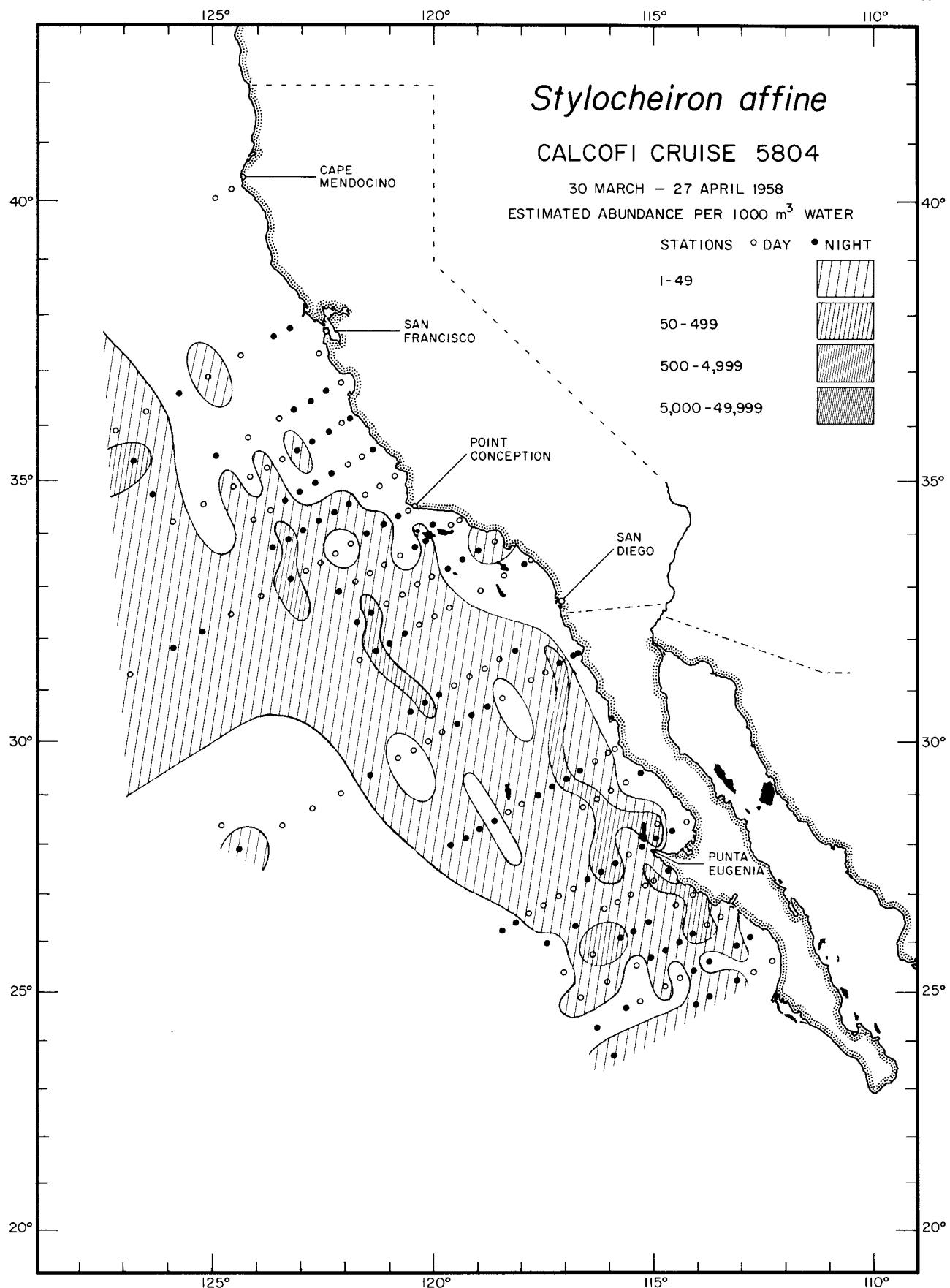
Euphausiacea
Stylocheiron affine
5702



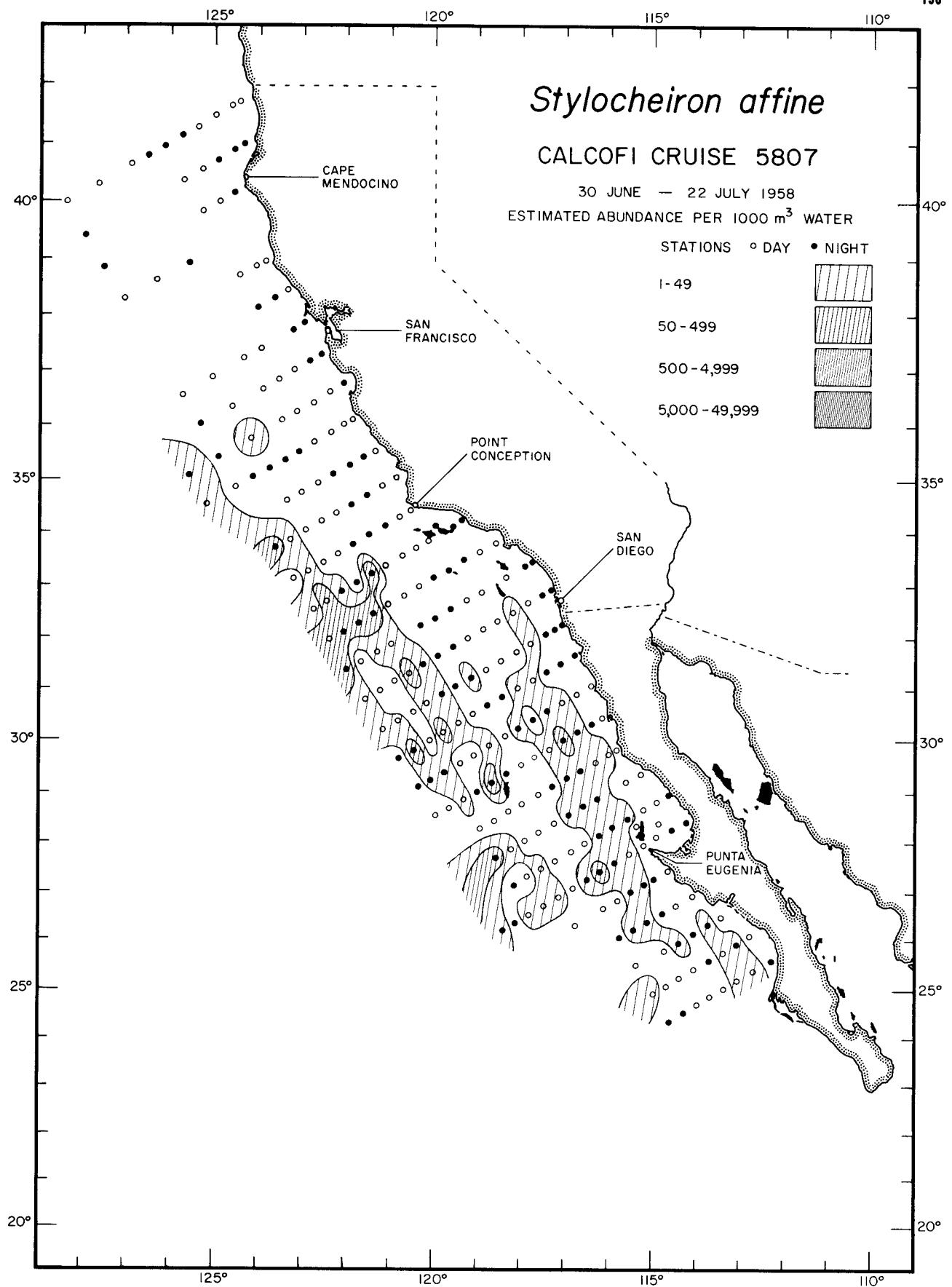
Euphausiacea
Stylocheiron affine
5710



Euphausiacea
Stylocheiron affine
5711

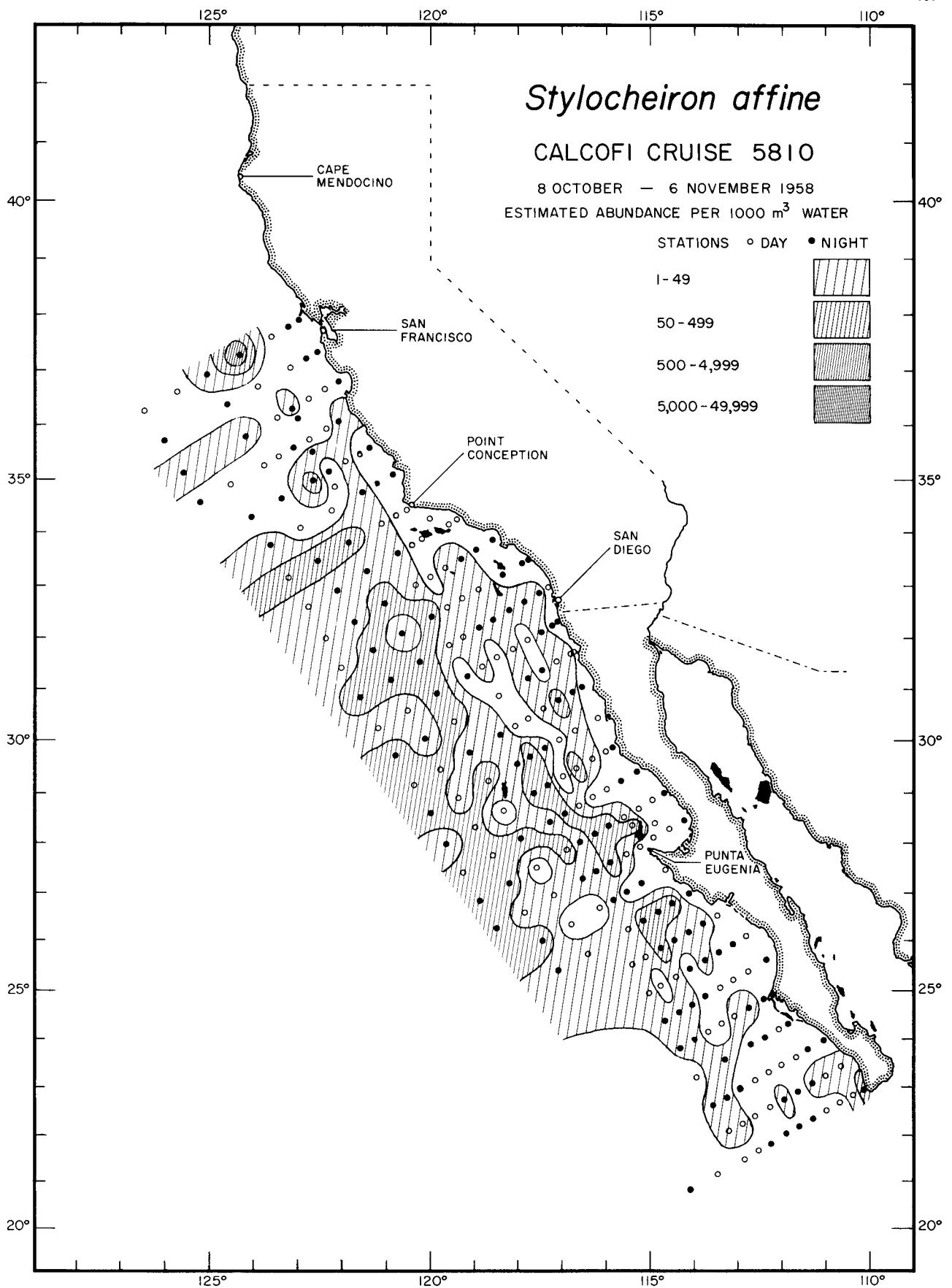


Euphausiacea
Stylocheiron affine
5804

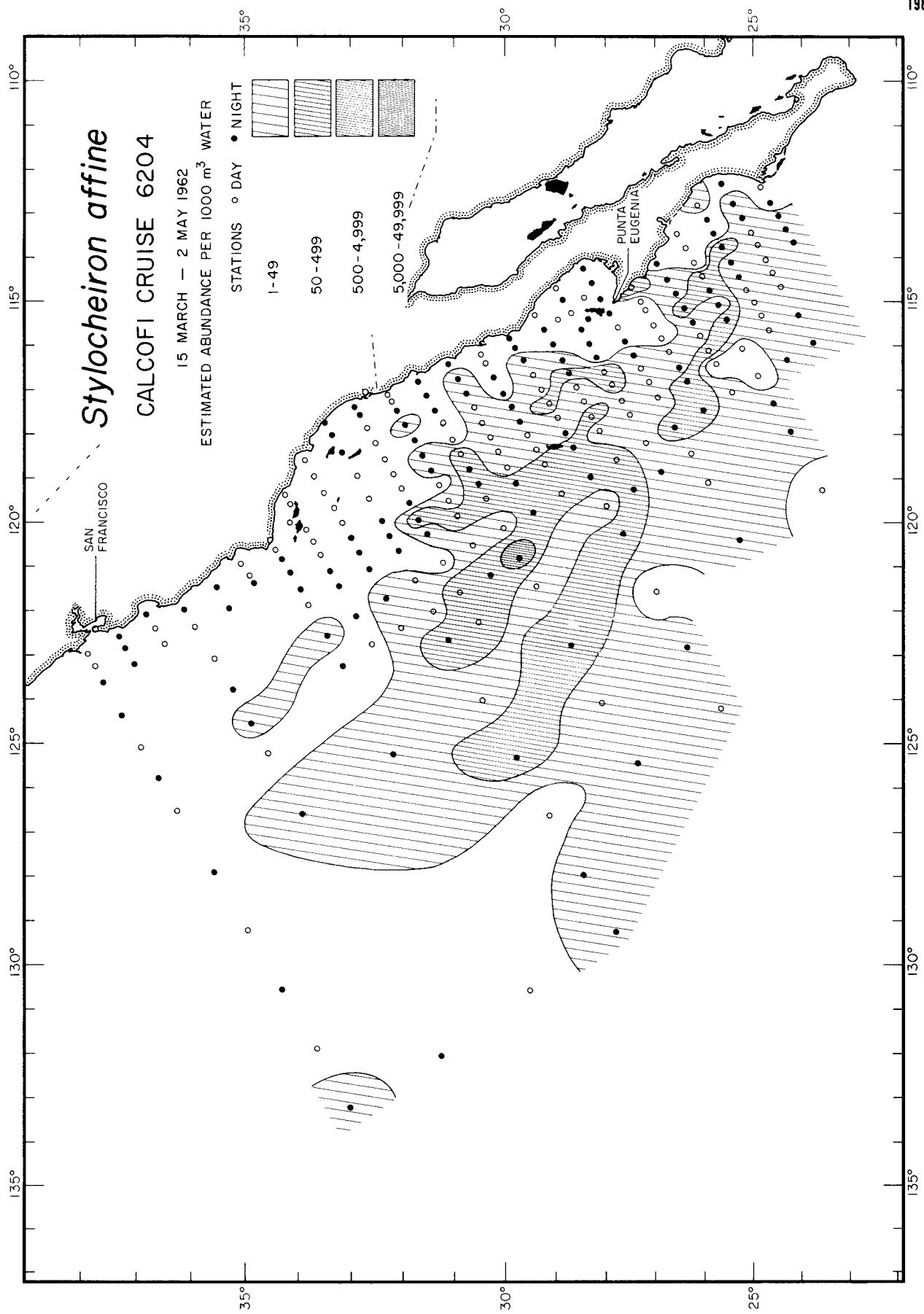


Euphausiacea
Stylocheiron affine

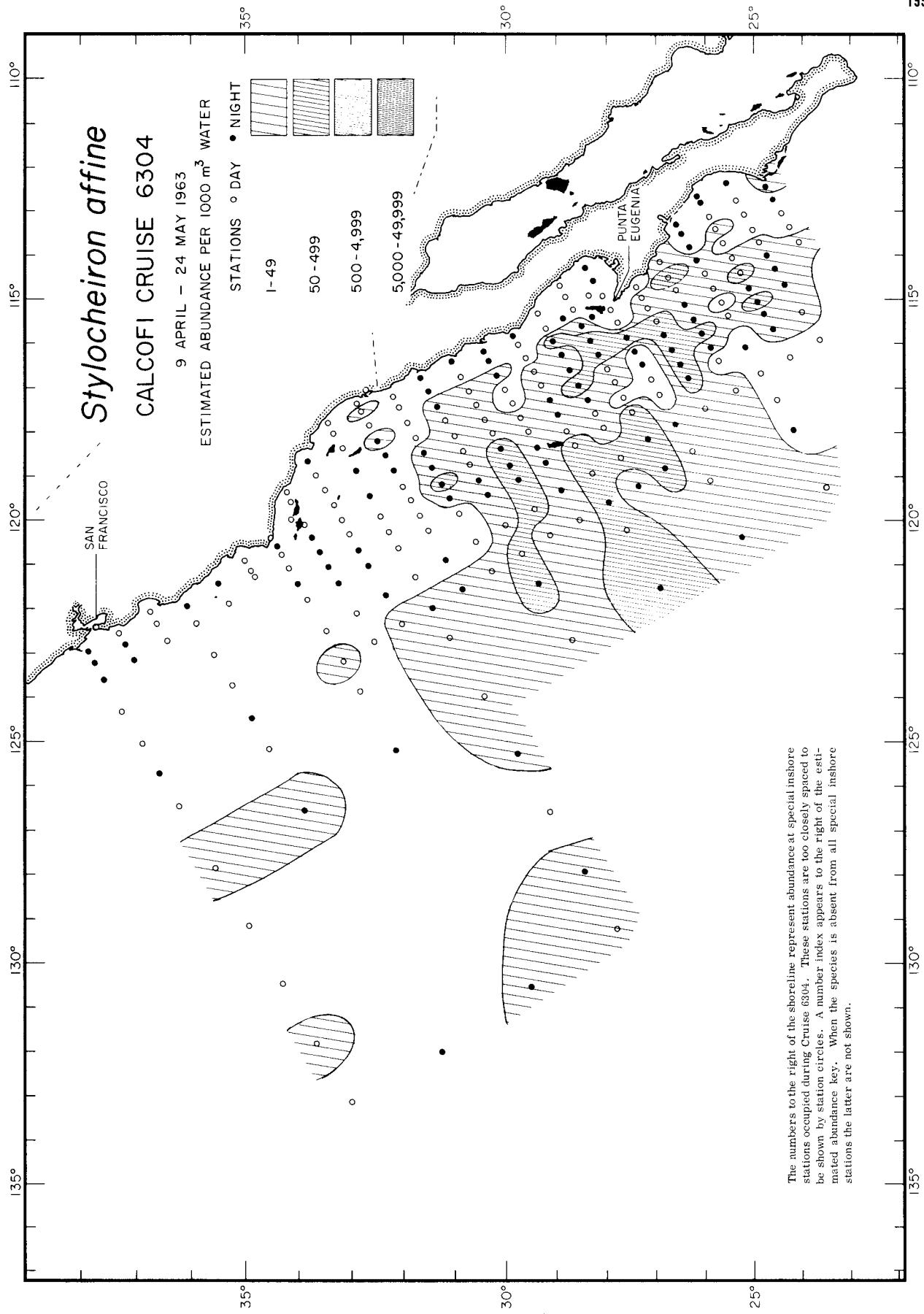
5807



Euphausiacea
Stylocheiron affine
 5810

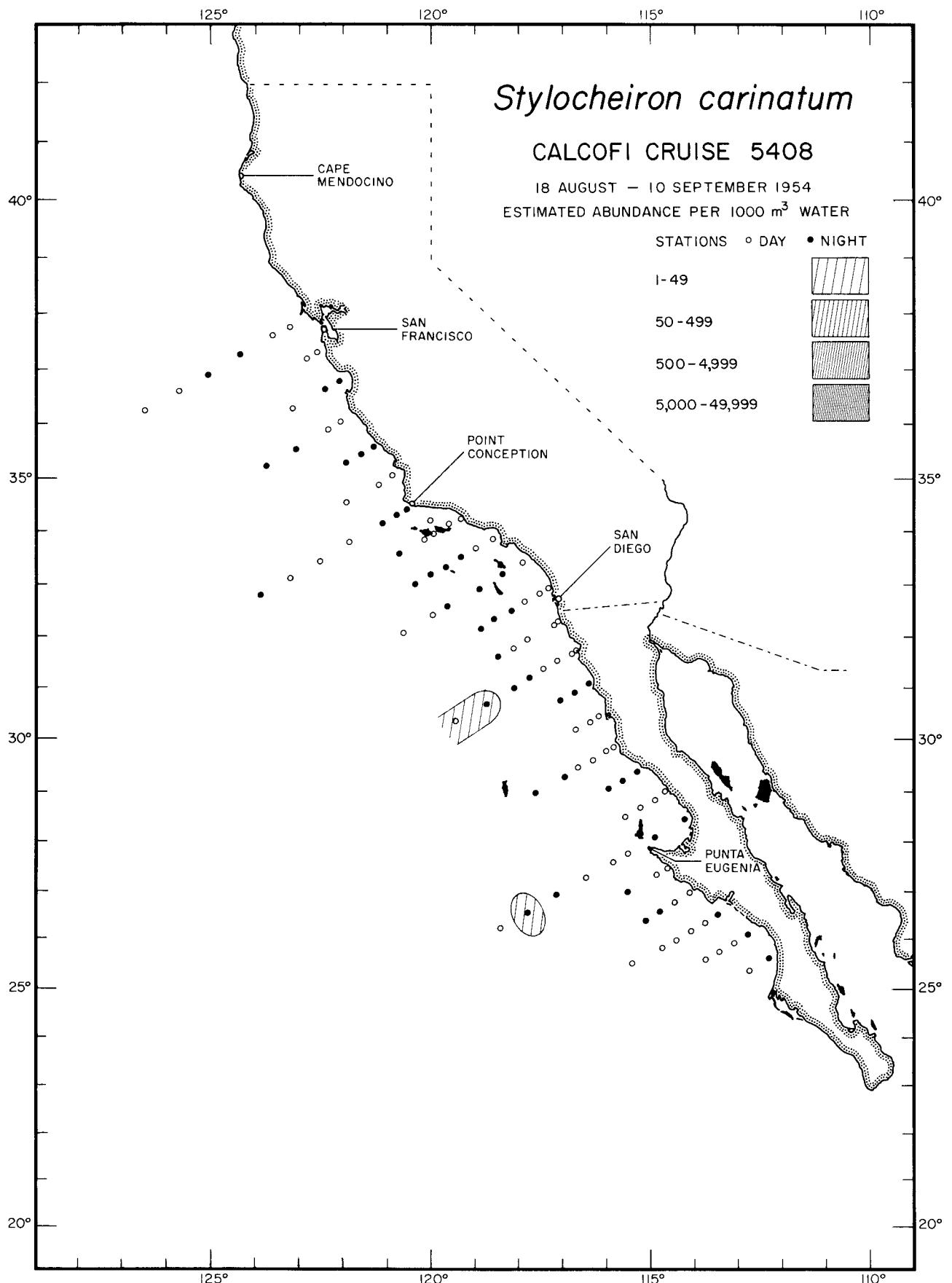


Euphausiacea
Stylocheiron affine
6204



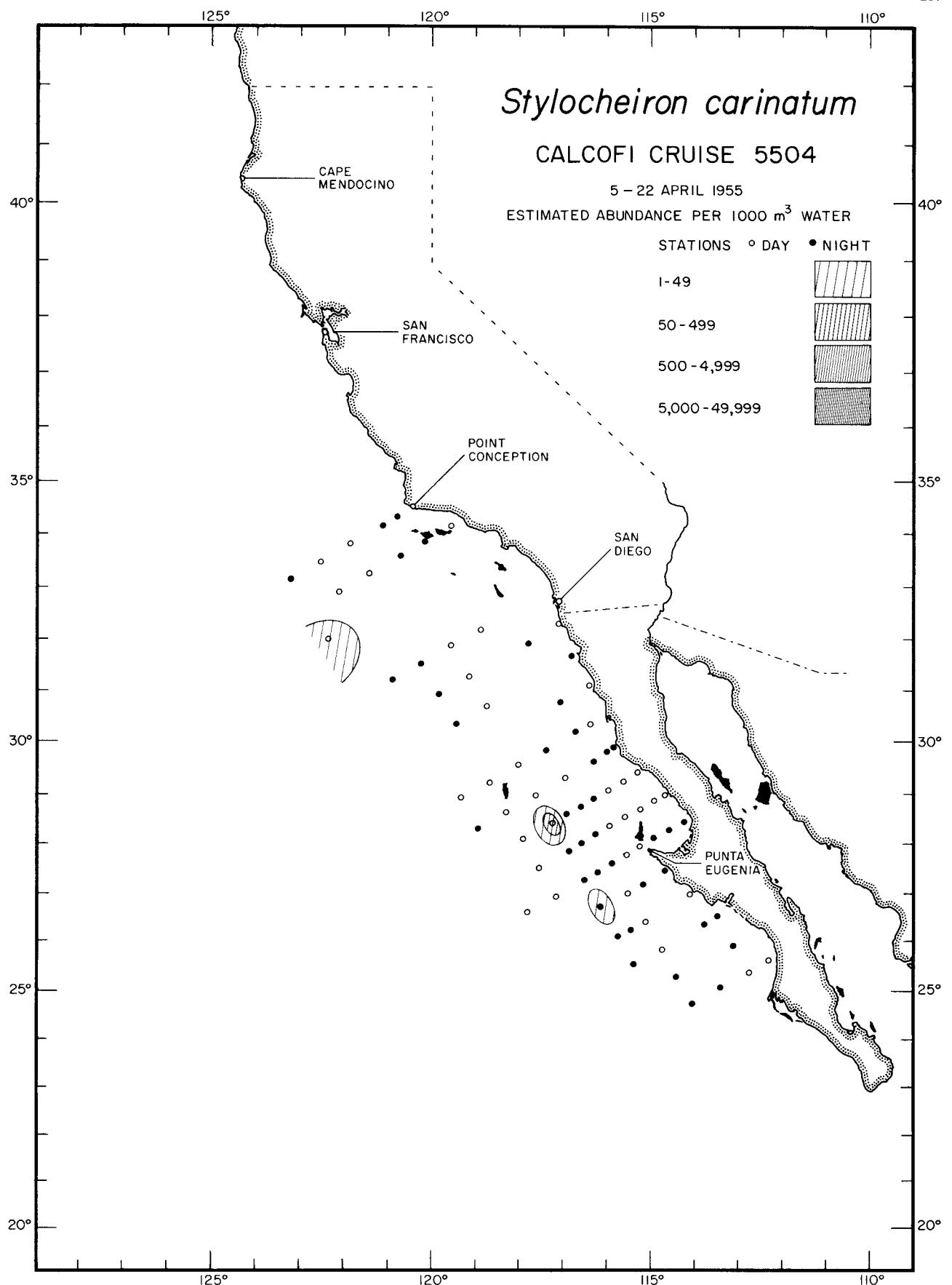
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Euphausiacea
Stylocheiron affine
6304

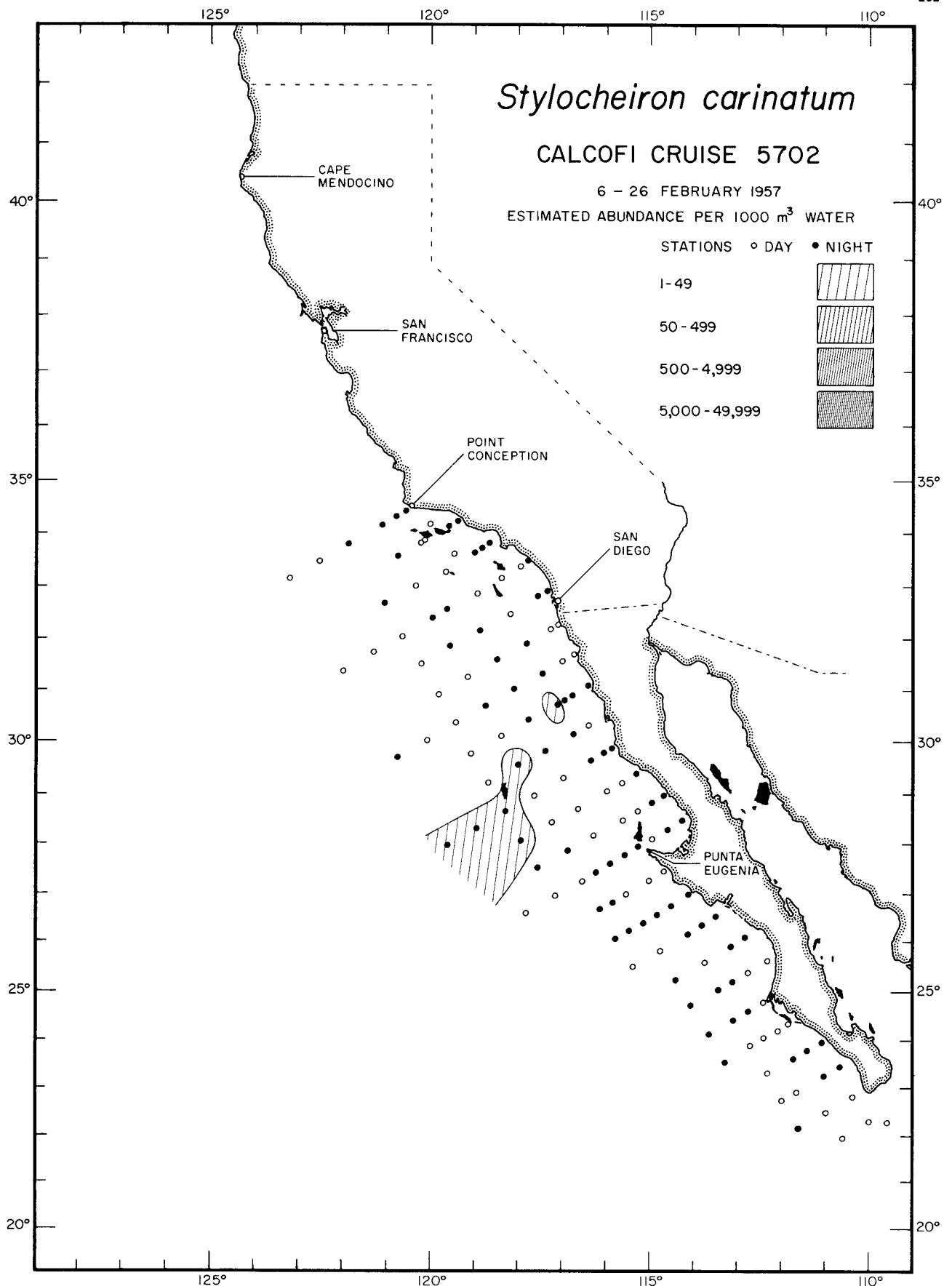


Euphausiacea
Stylocheiron carinatum

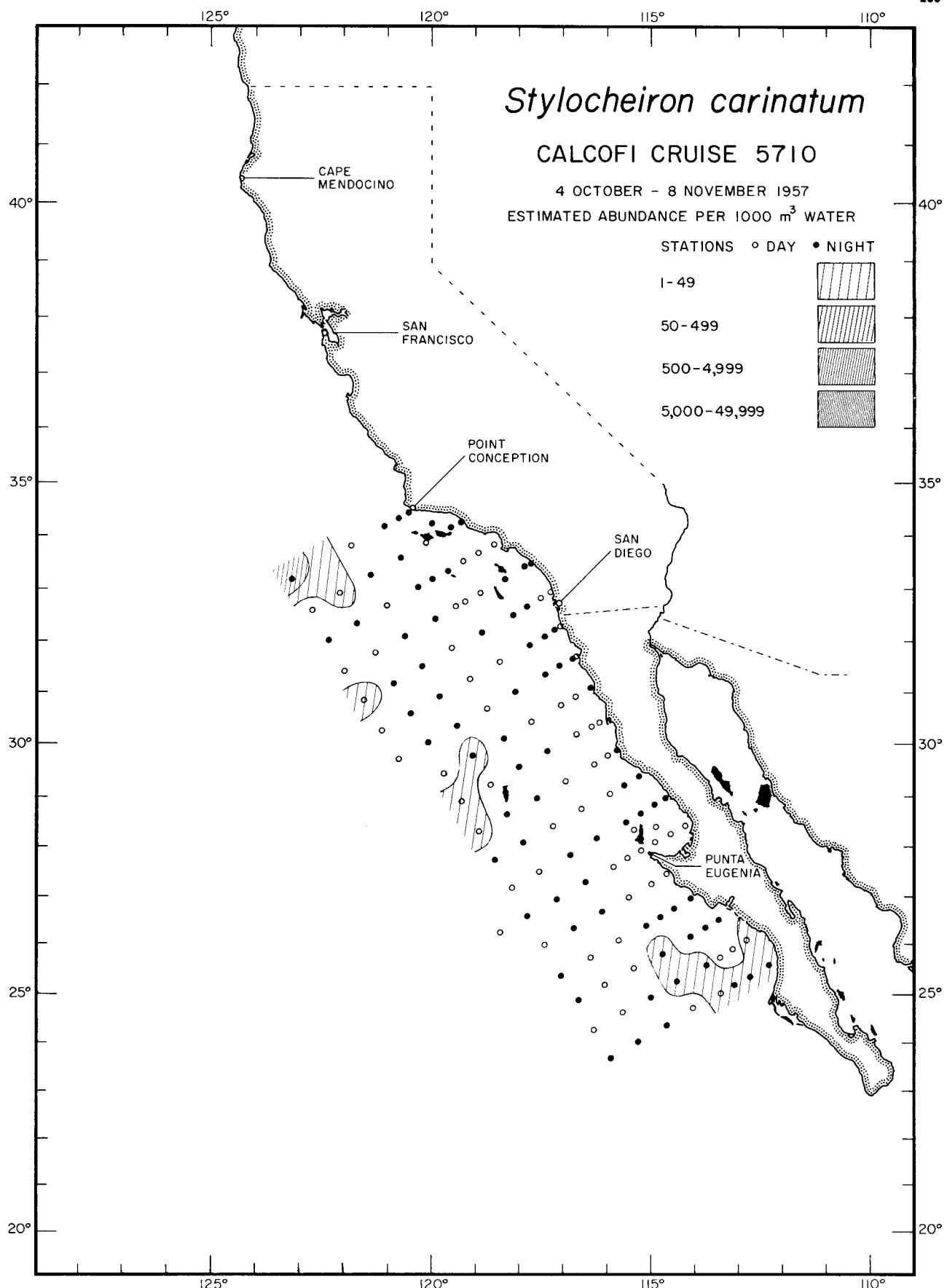
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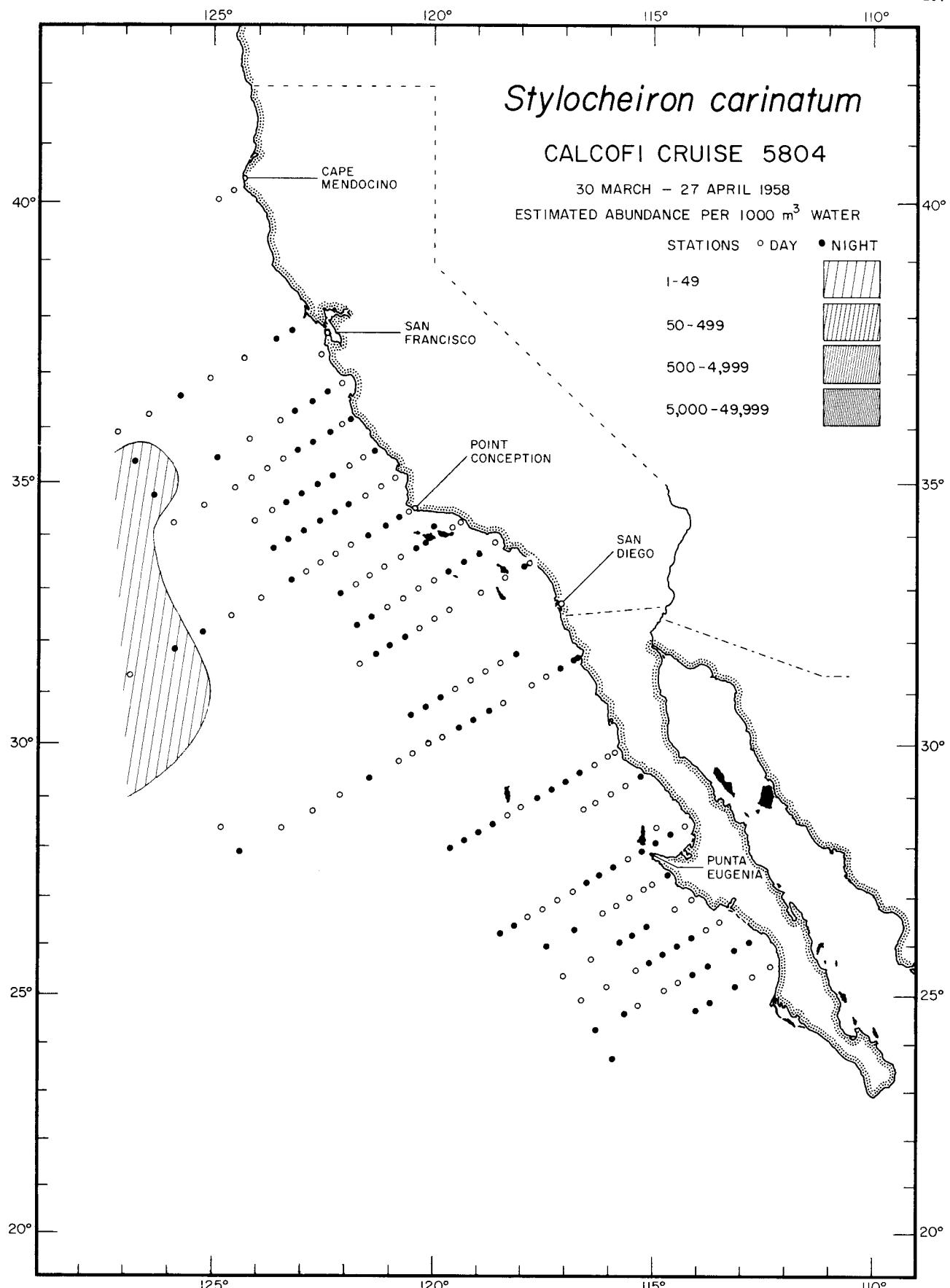
Euphausiacea
Stylocheiron carinatum
5504



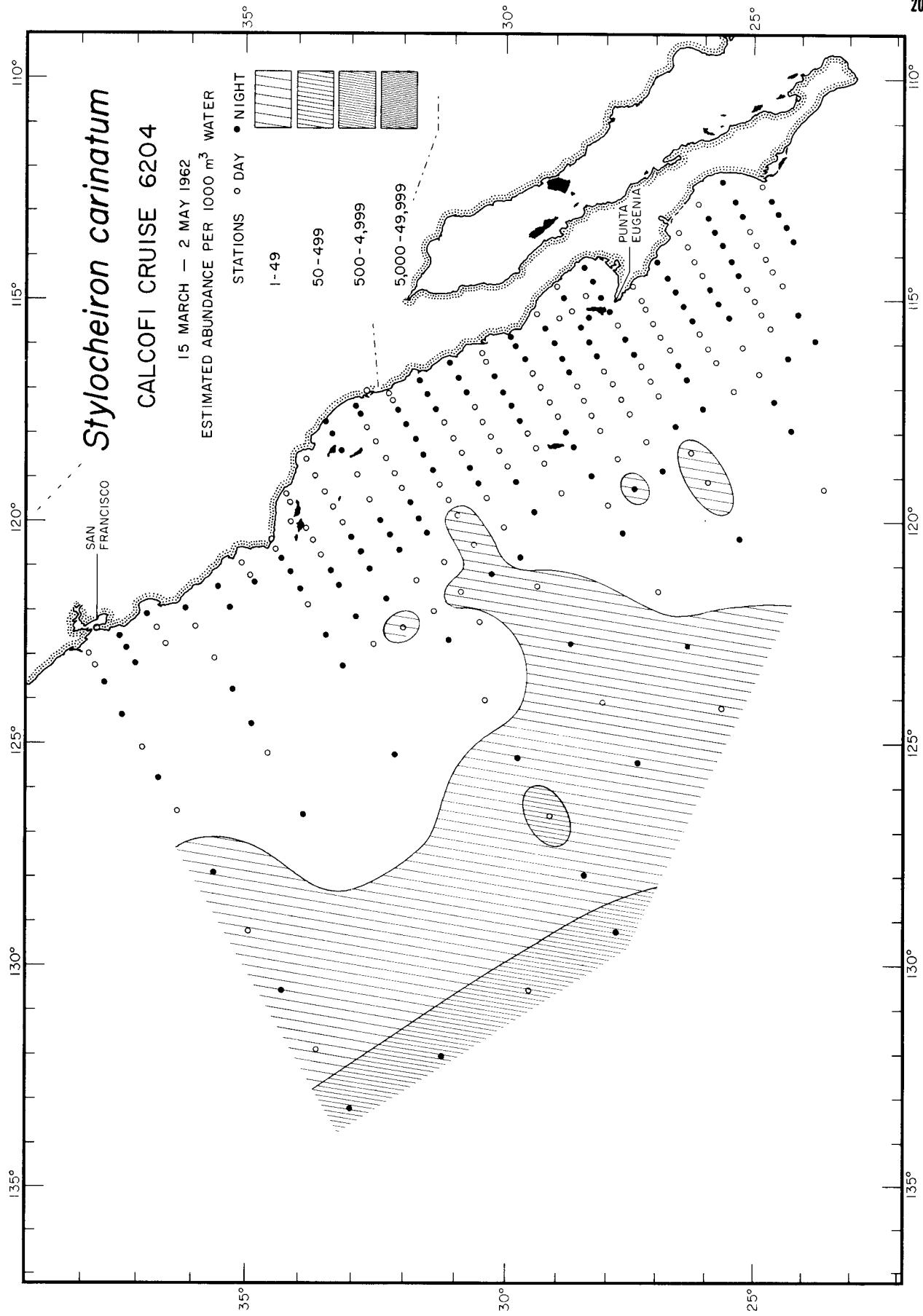
Euphausiacea
Stylocheiron carinatum
 5702



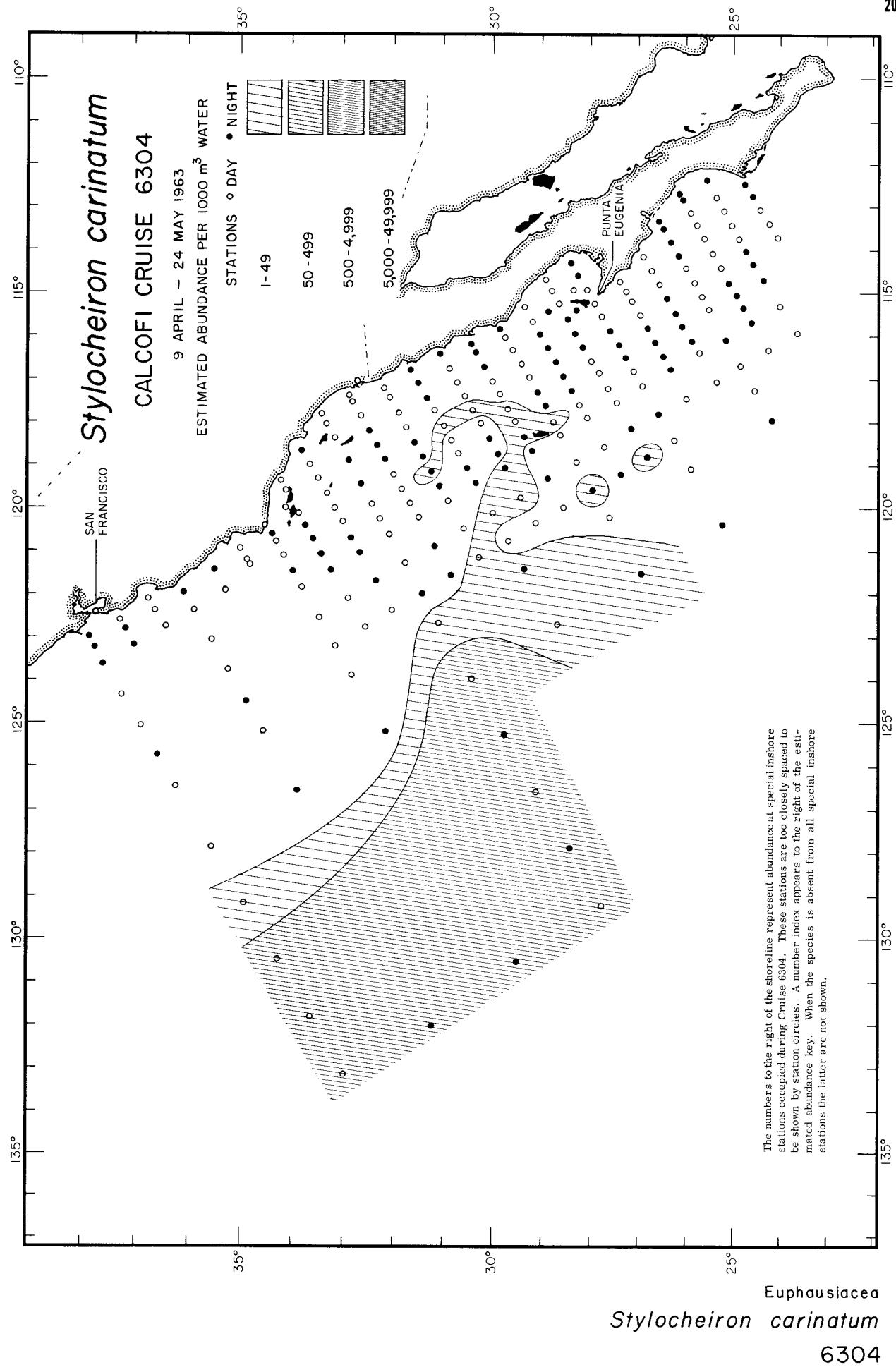
Euphausiaceae
Stylocheiron carinatum
 5710

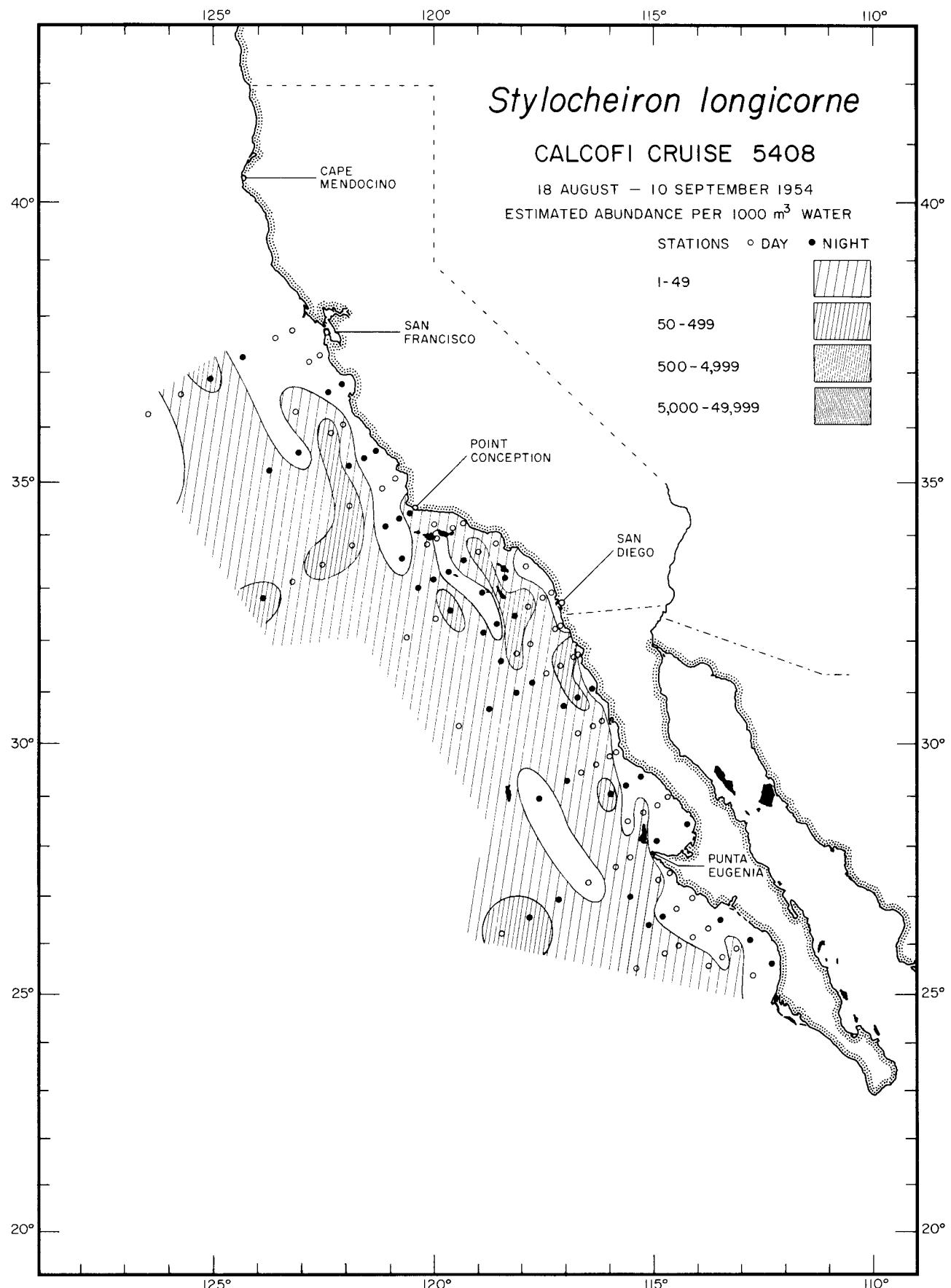


Euphausiacea
Stylocheiron carinatum
5804



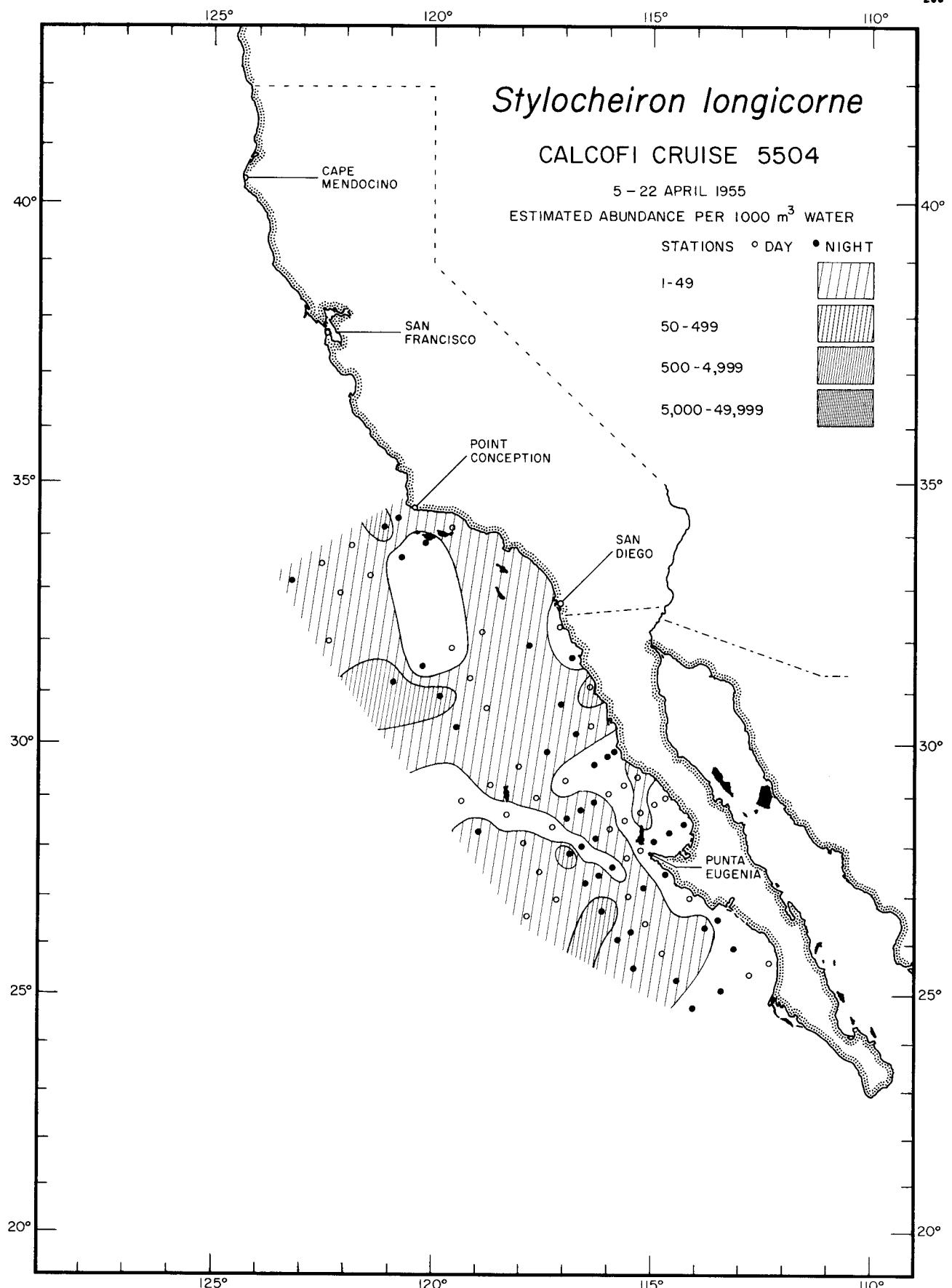
Euphausiacea
Stylocheiron carinatum
6204



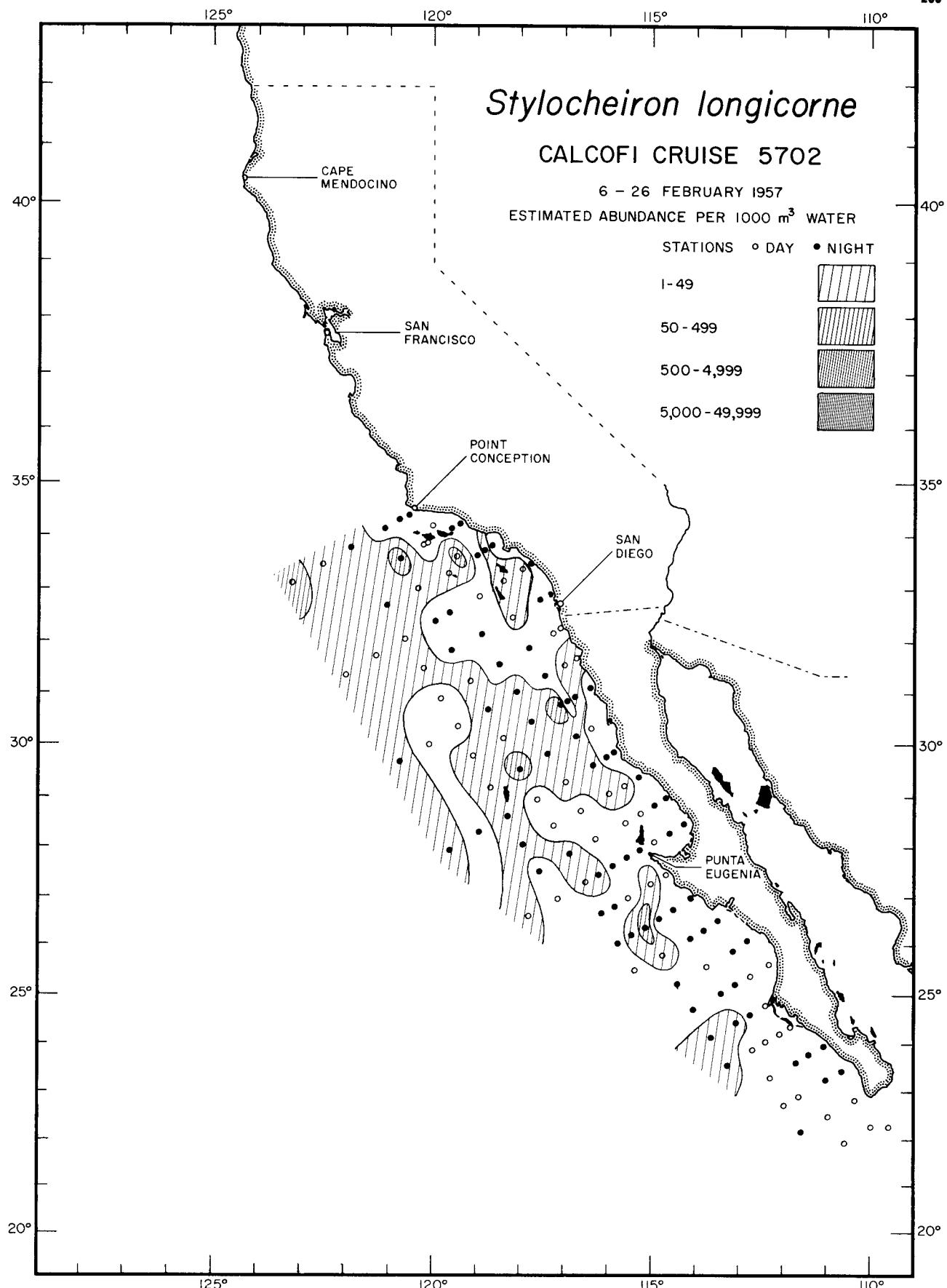


Euphausiacea
Stylocheiron longicorne

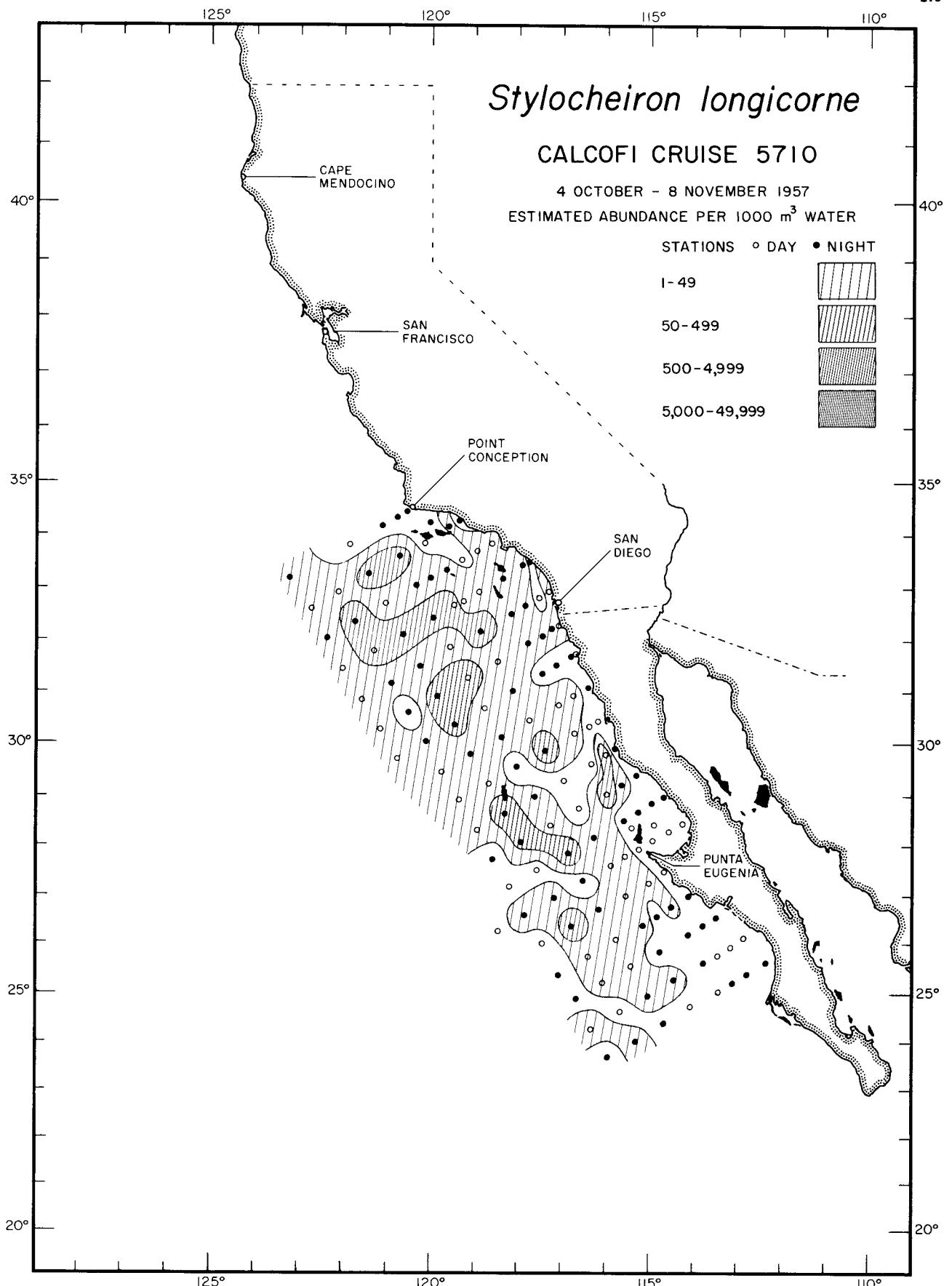
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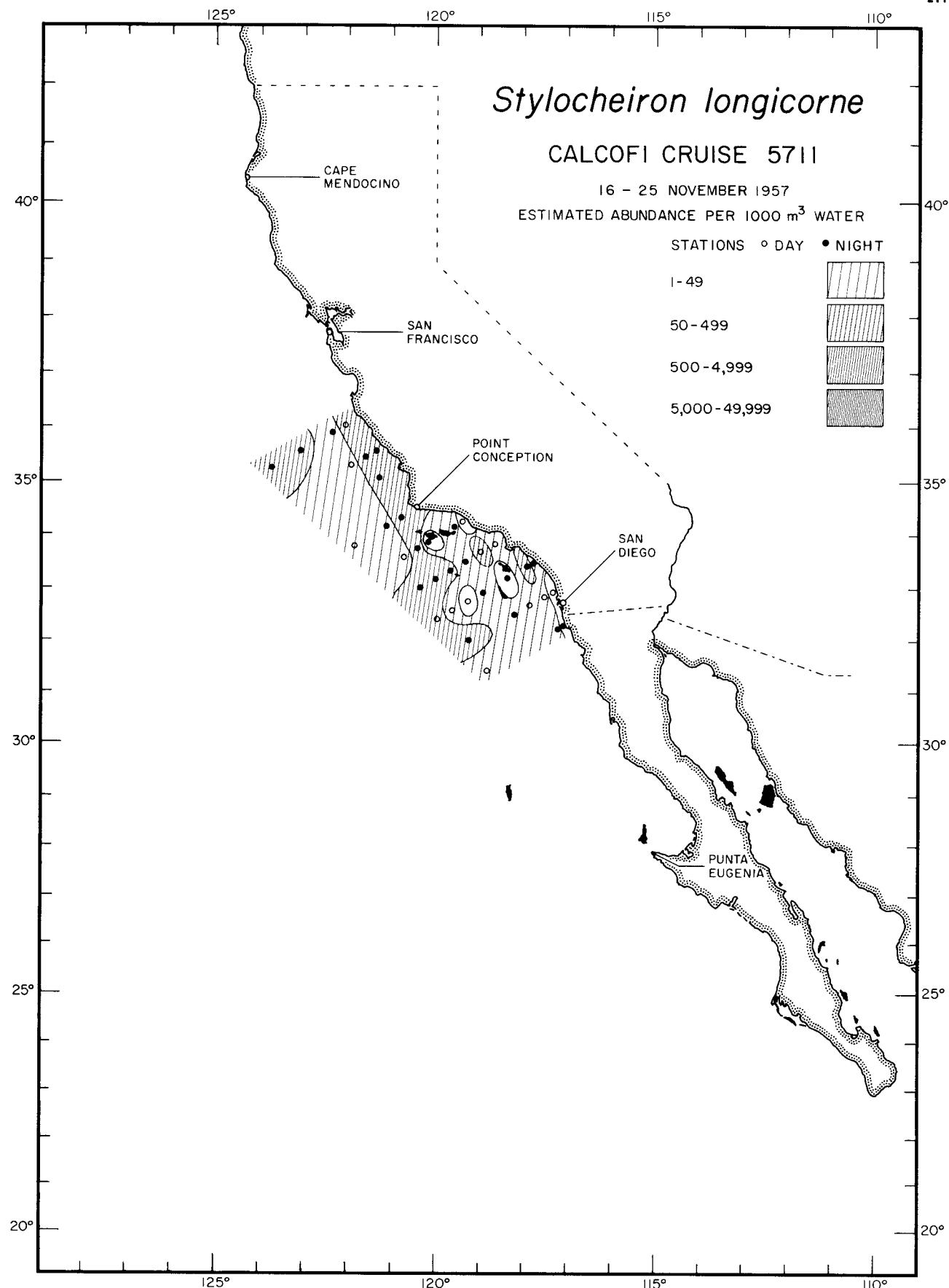
Euphausiacea
Stylocheiron longicorne
 5504



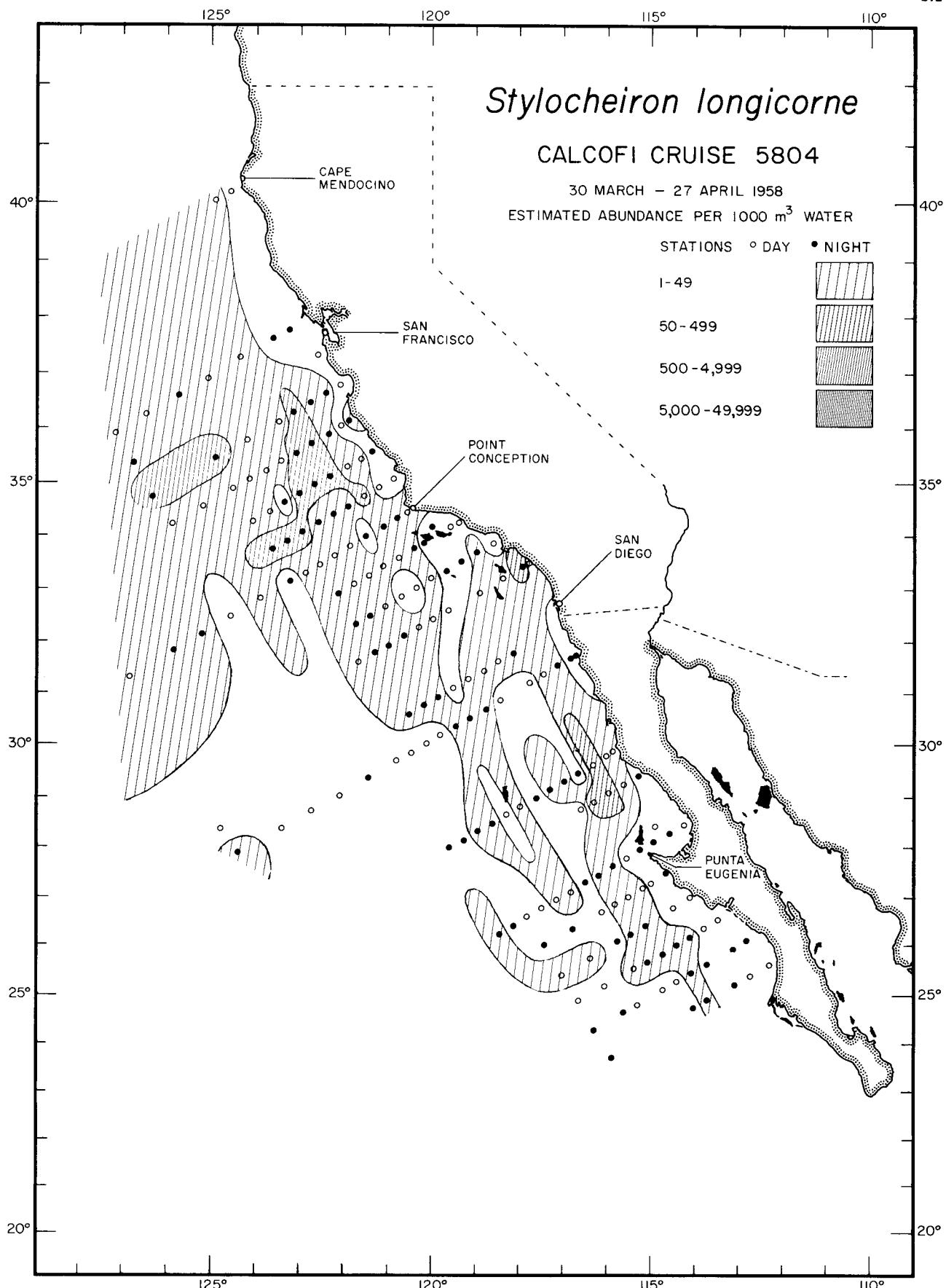
Euphausiacea
Stylocheiron longicornis
5702



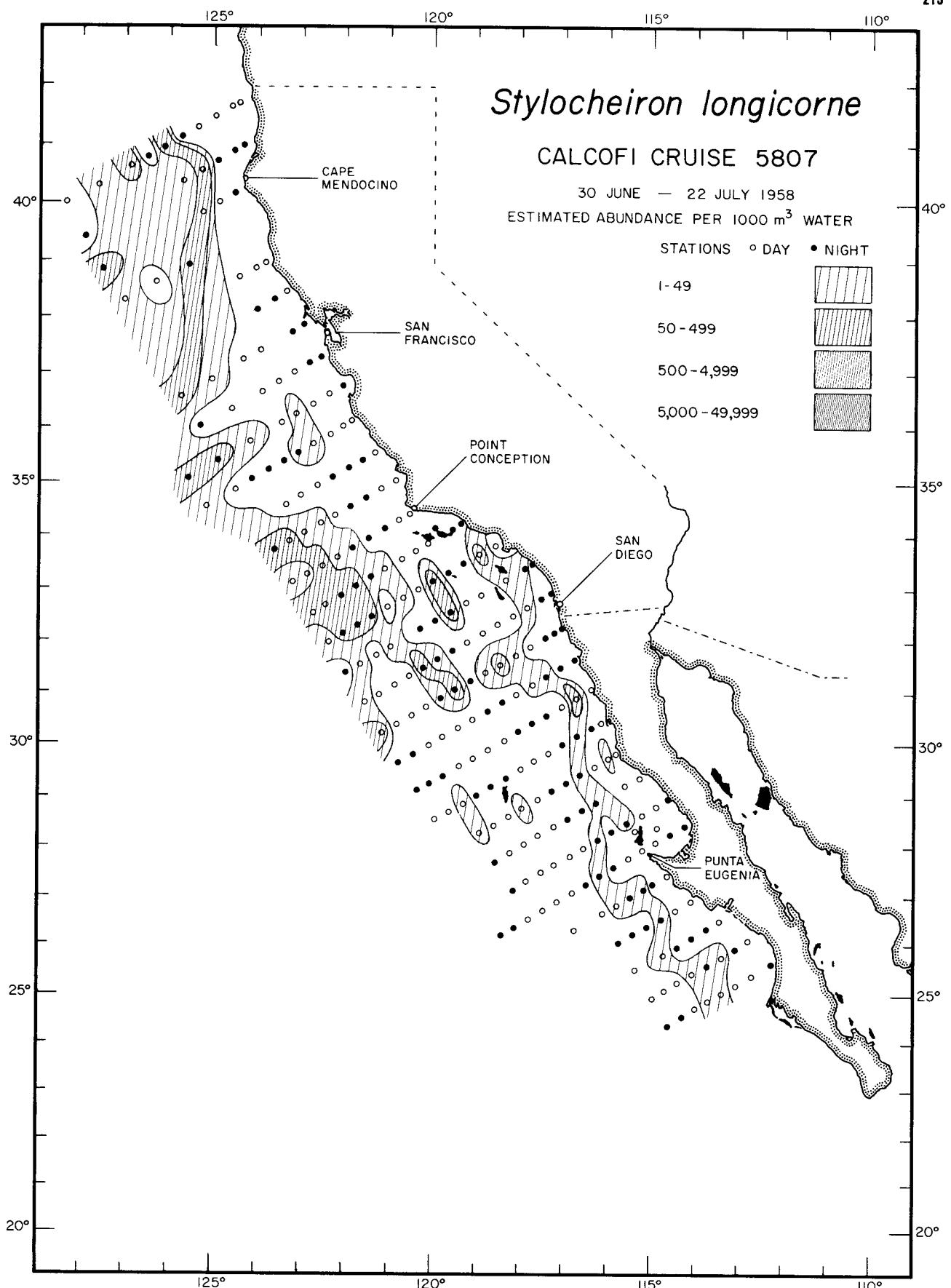
Euphausiacea
Stylocheiron longicornis
 5710



Euphausiacea
Stylocheiron longicorne
 5711



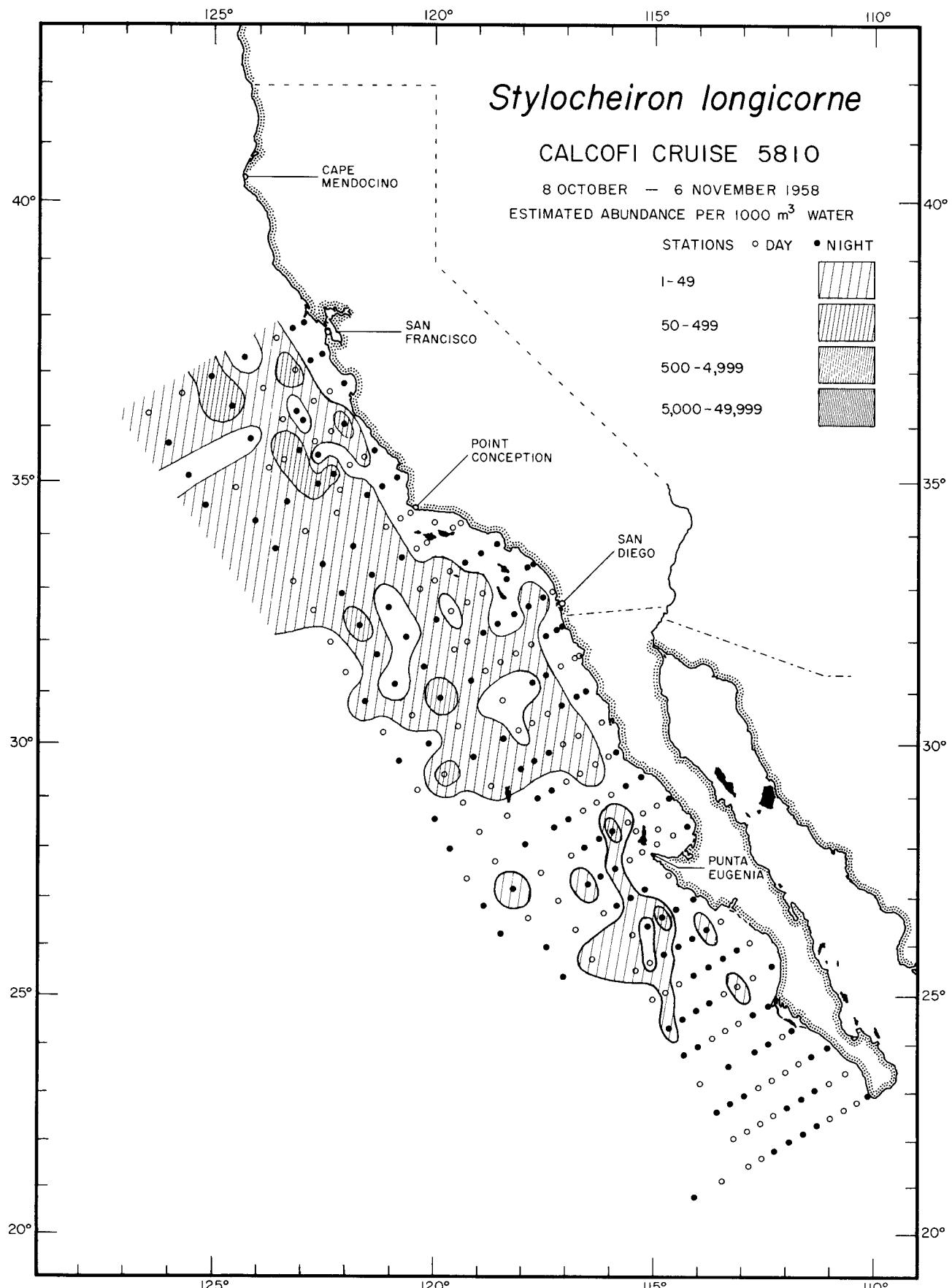
Euphausiacea
Stylocheiron longicorne
5804



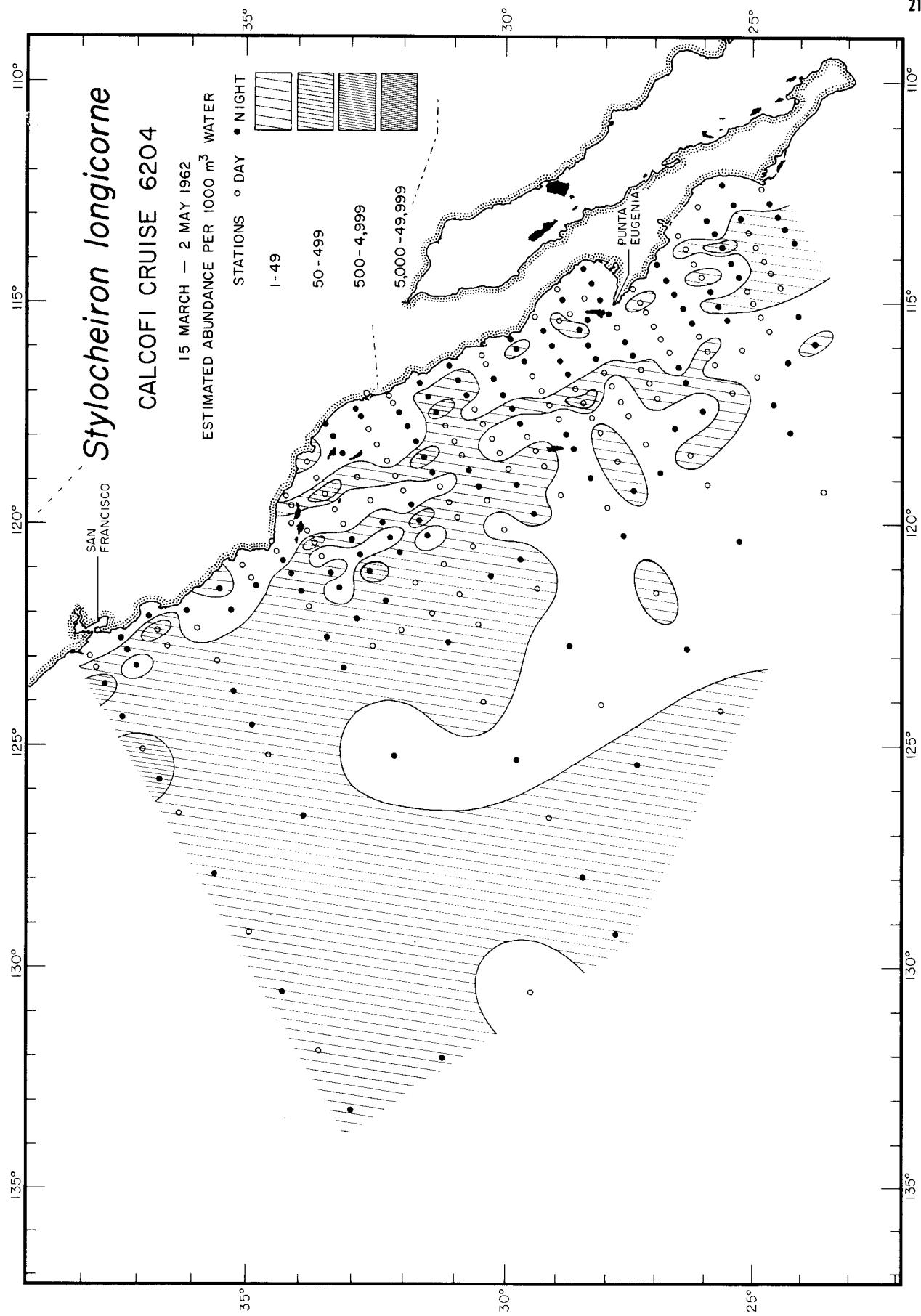
Euphausiacea

Stylocheiron longicornē

5807



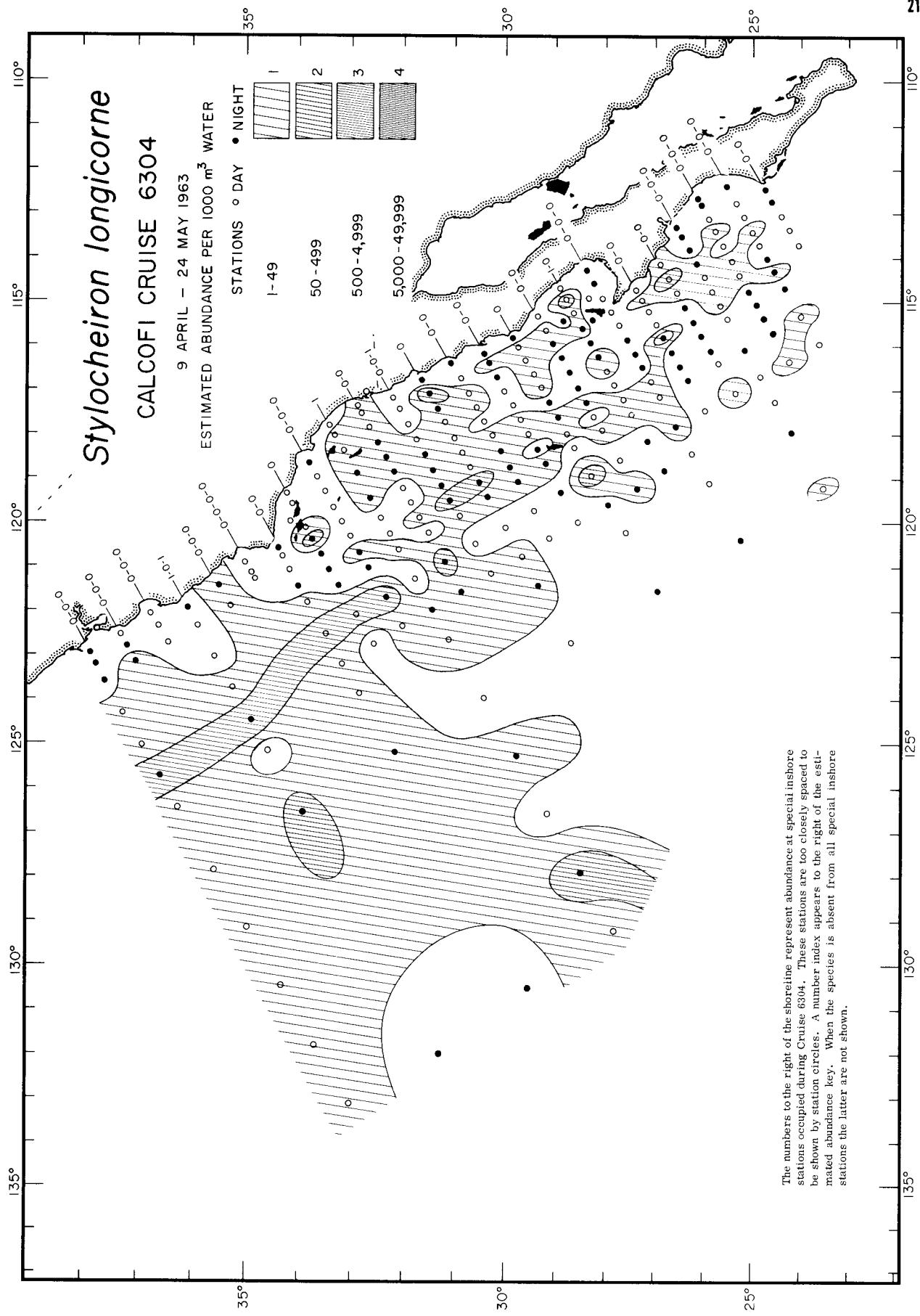
Euphausiacea
Stylocheiron longicornē
 5810



Euphausiacea

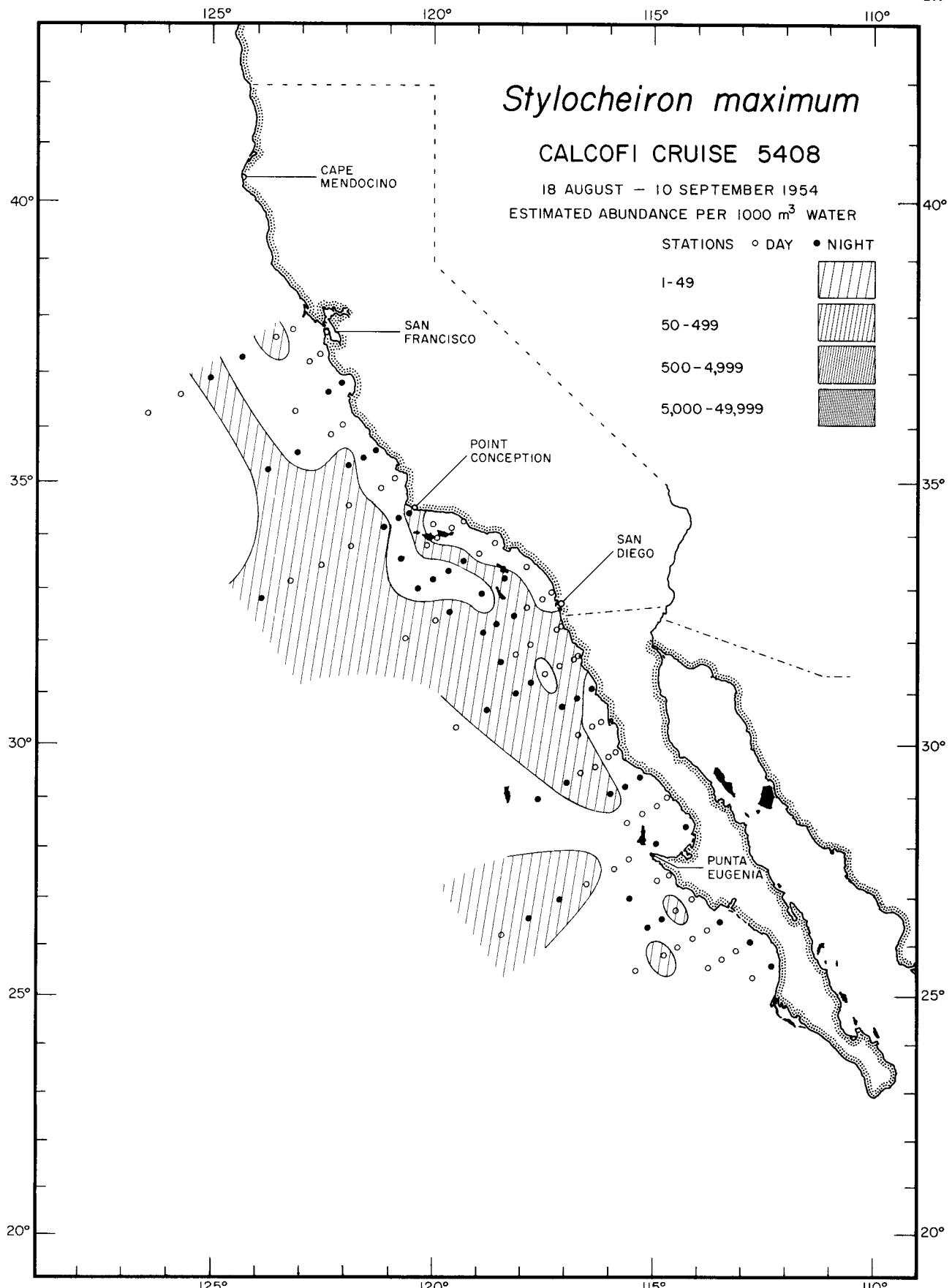
Stylocheiron longicorne

6204



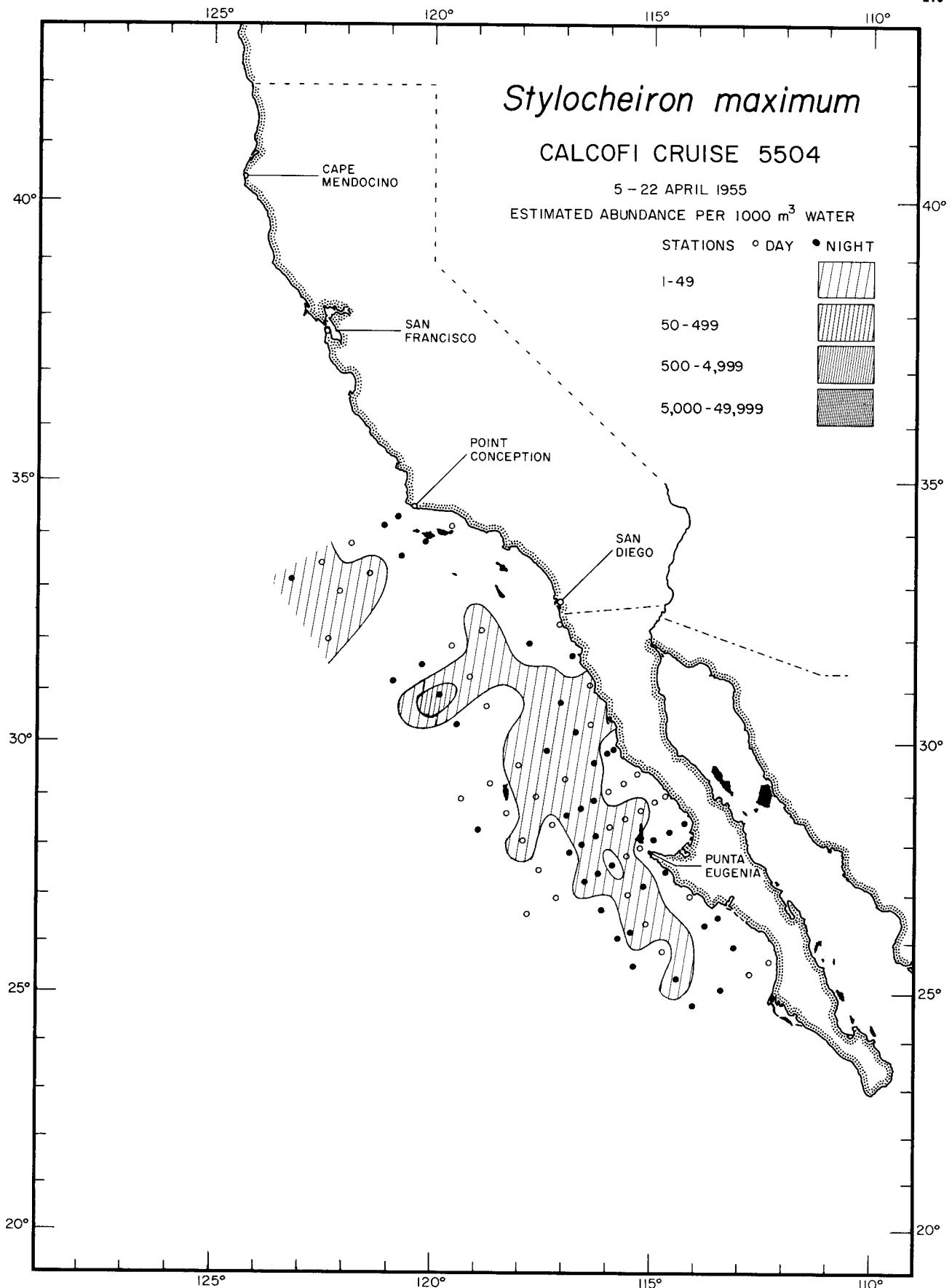
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Euphausiacea
Stylocheiron longicorne
6304

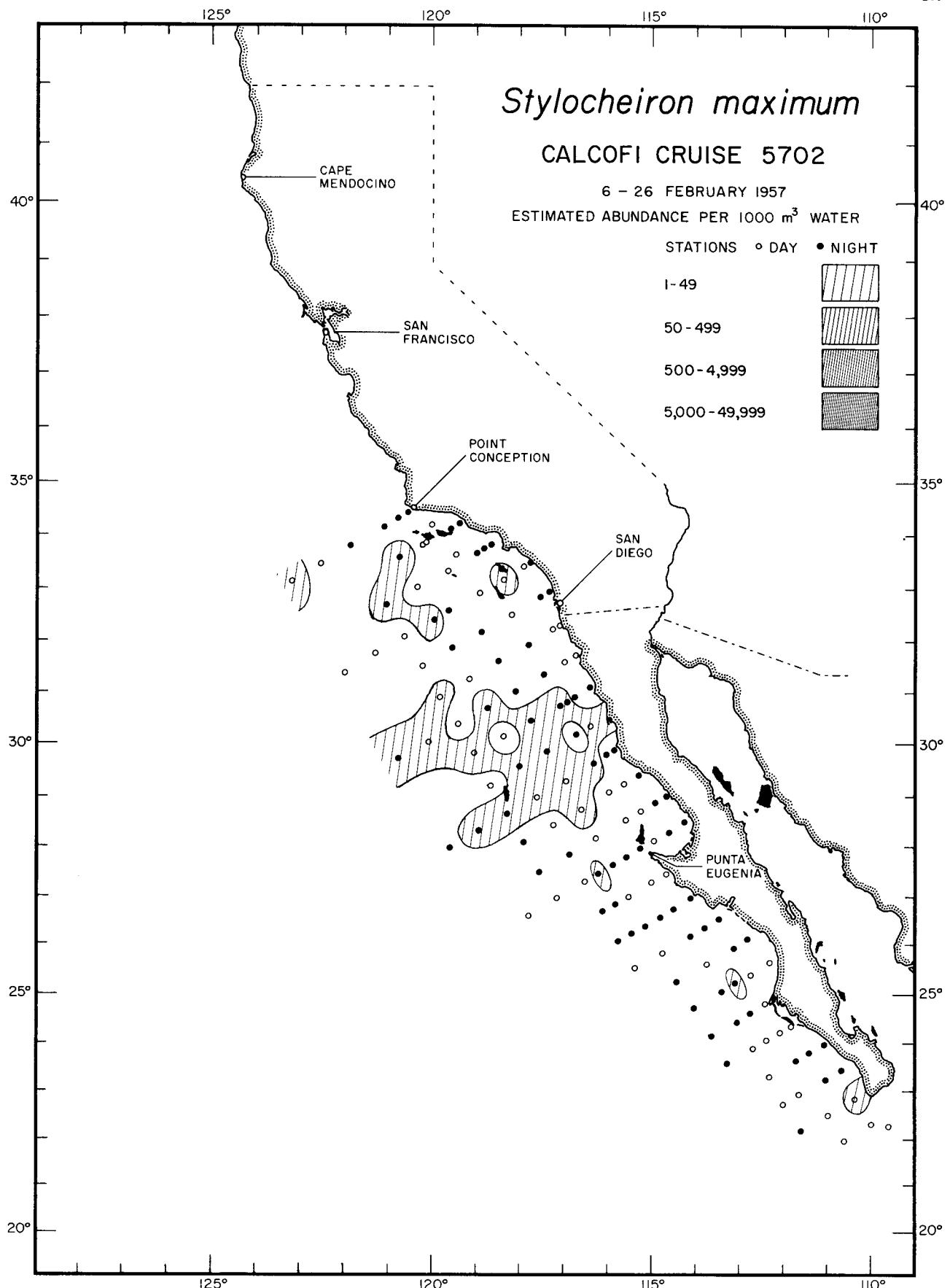


Euphausiacea
Stylocheiron maximum

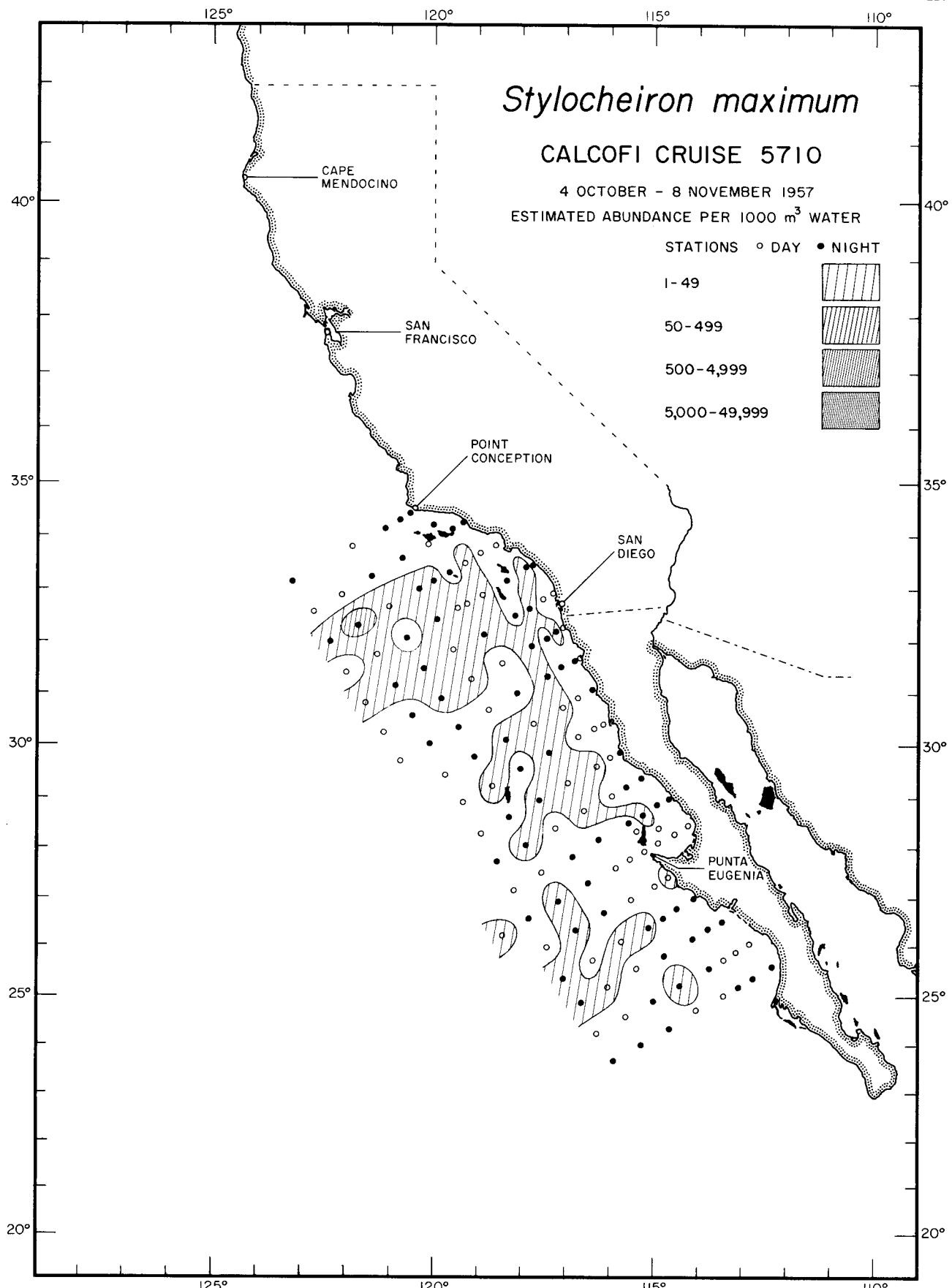
5408



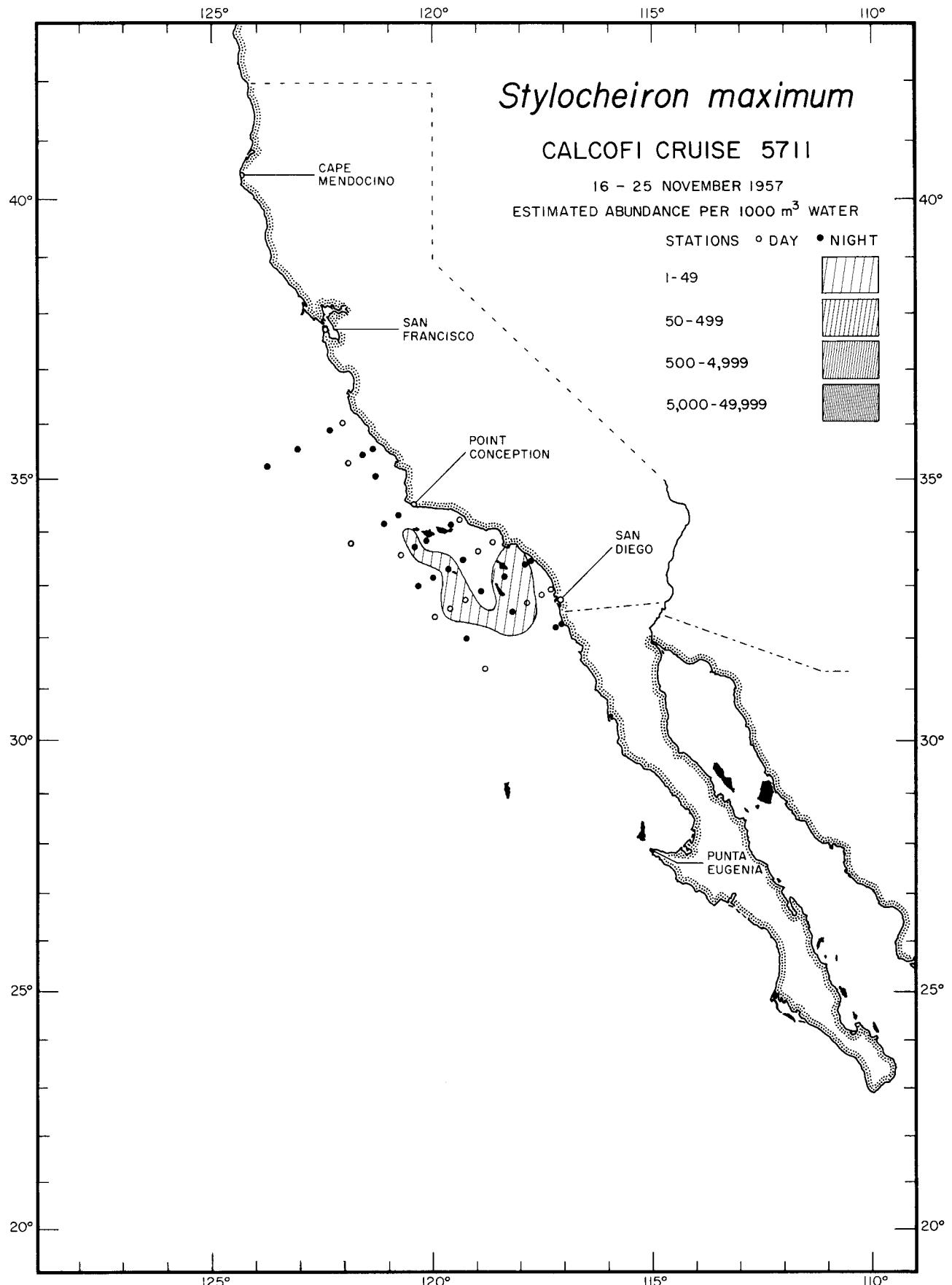
Euphausiacea
Stylocheiron maximum
5504



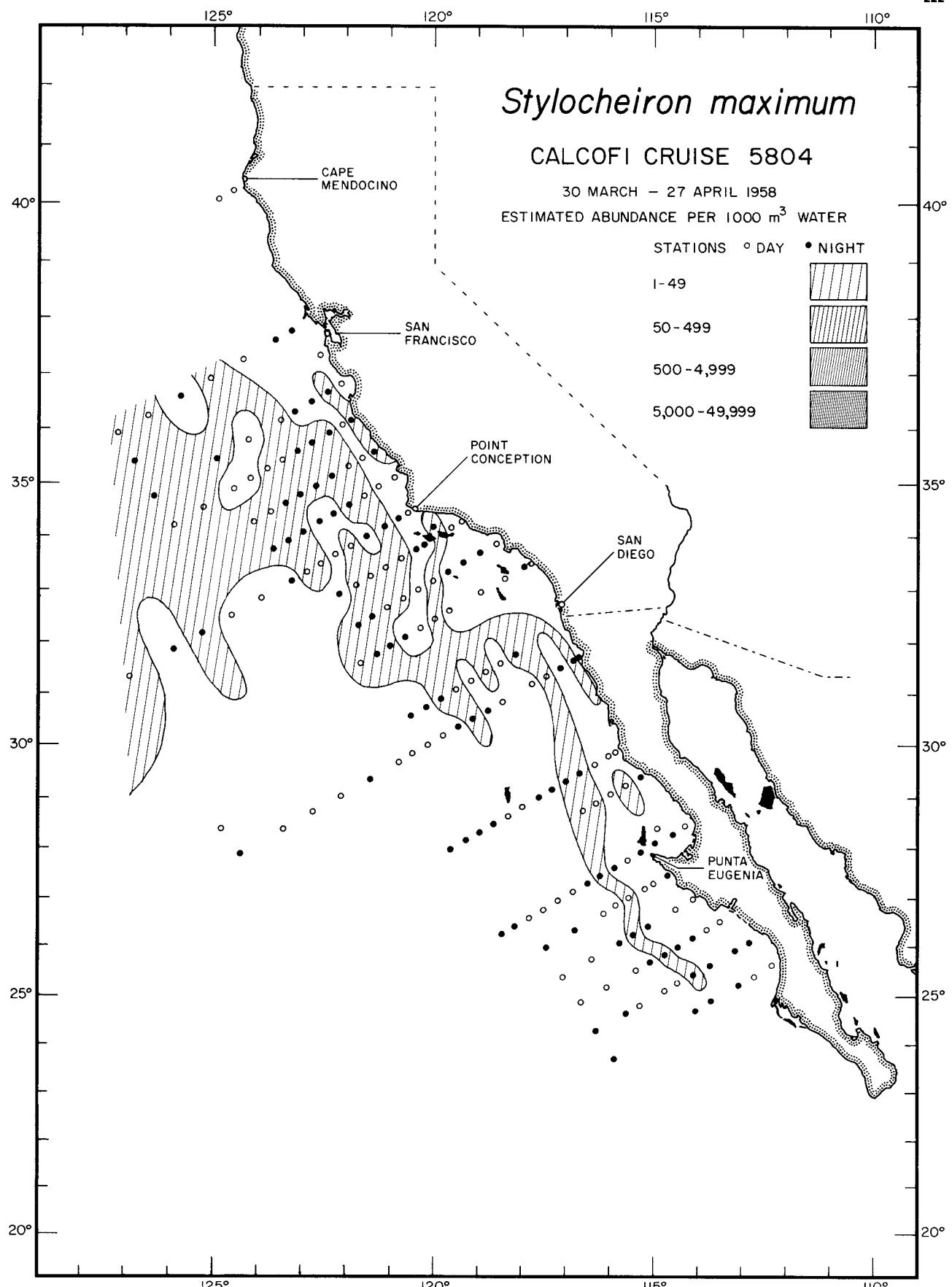
Euphausiacea
Stylocheiron maximum
5702



Euphausiacea
Stylocheiron maximum
5710

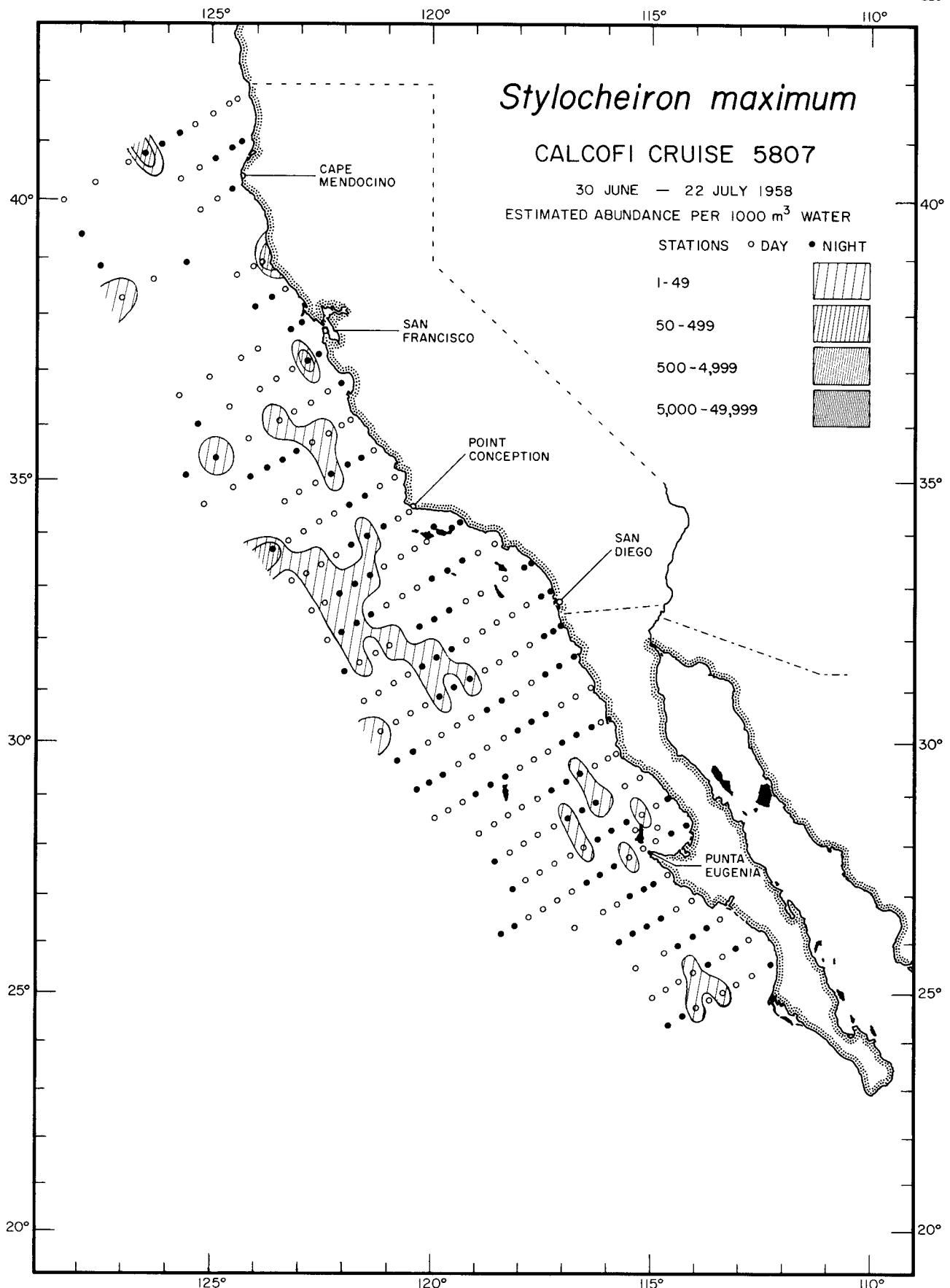


Euphausiaceae
Stylocheiron maximum
5711

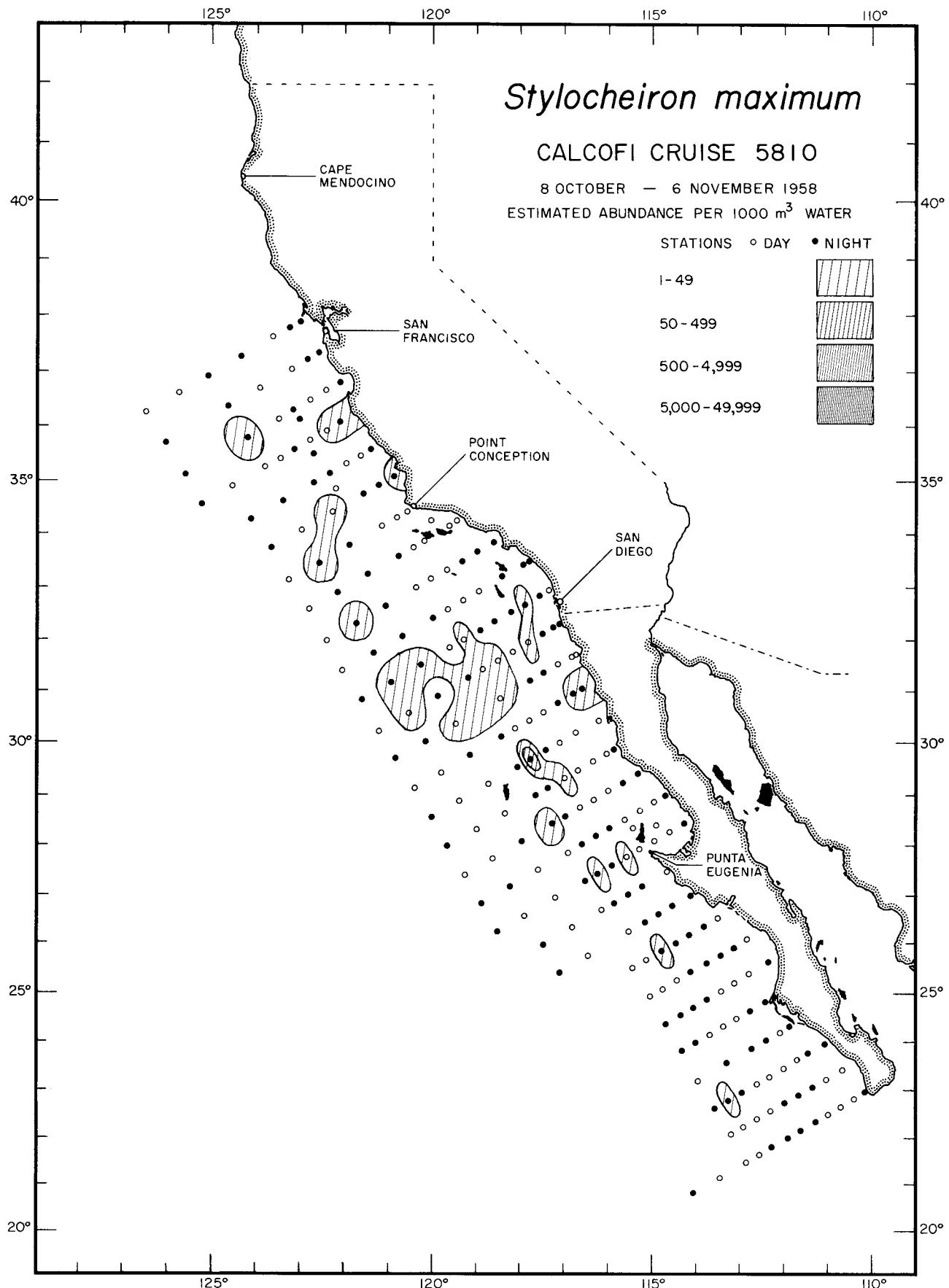


Euphausiacea
Stylocheiron maximum

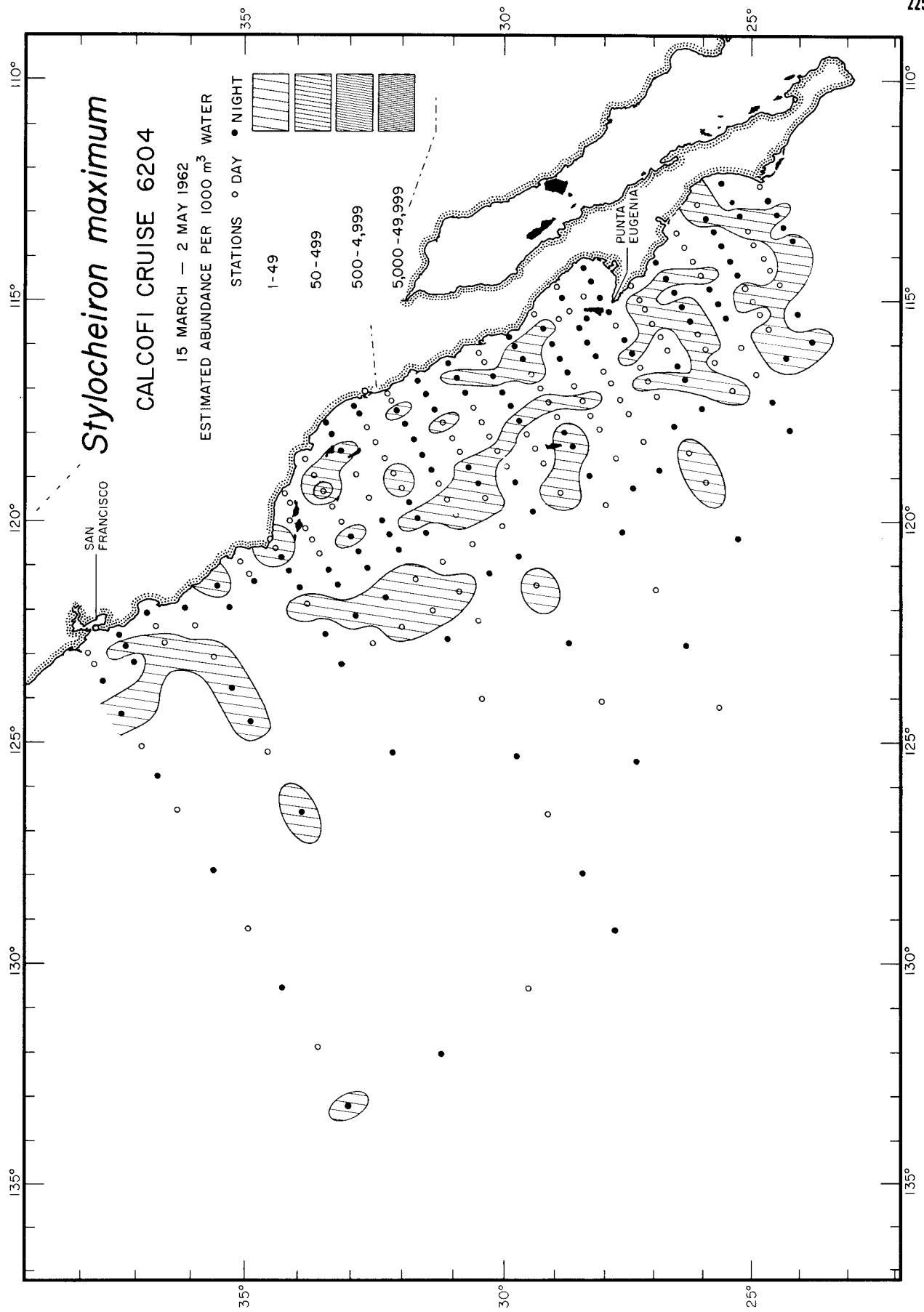
5804



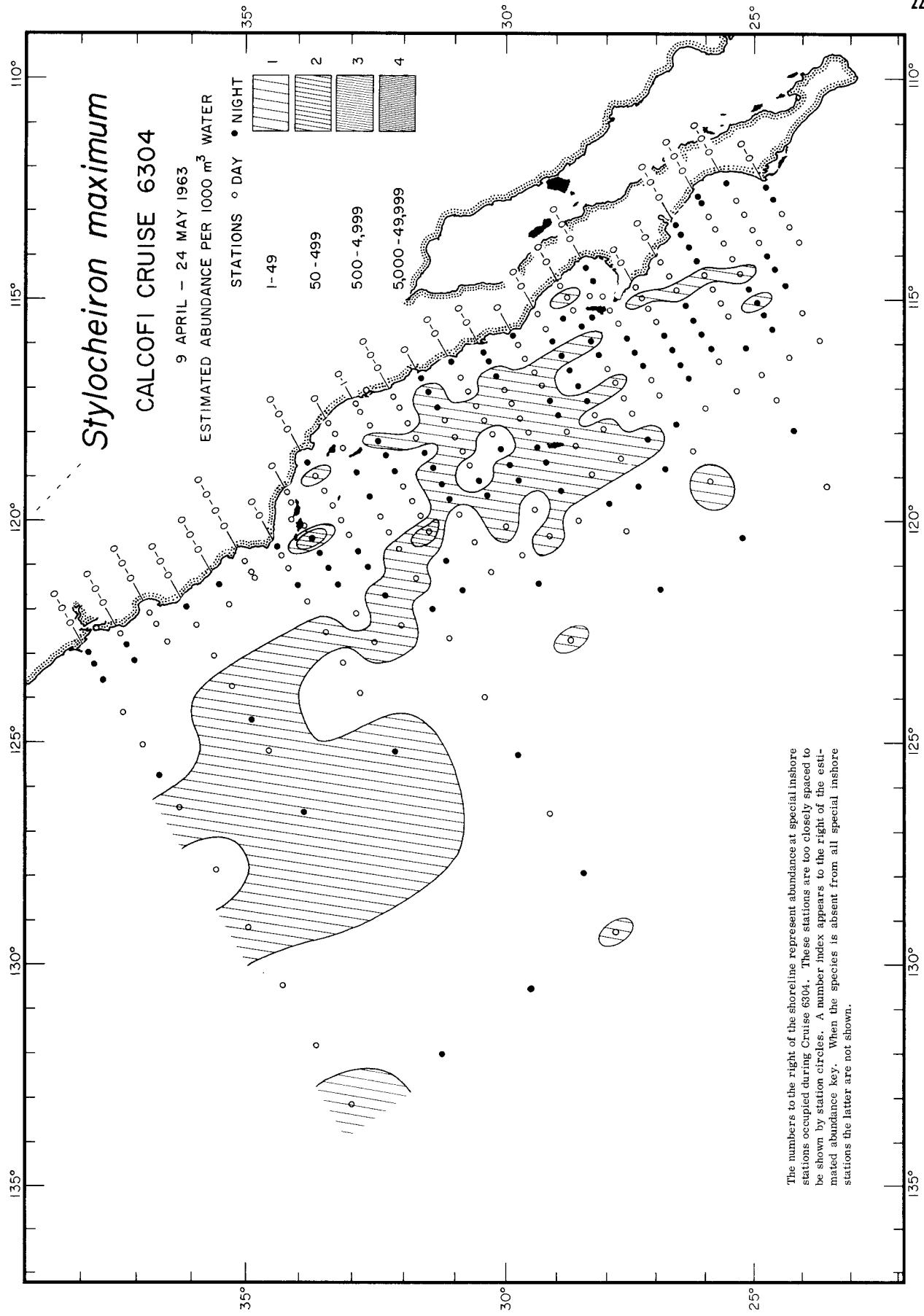
Euphausiacea
Stylocheiron maximum
5807



Euphausiacea
Stylocheiron maximum
 5810

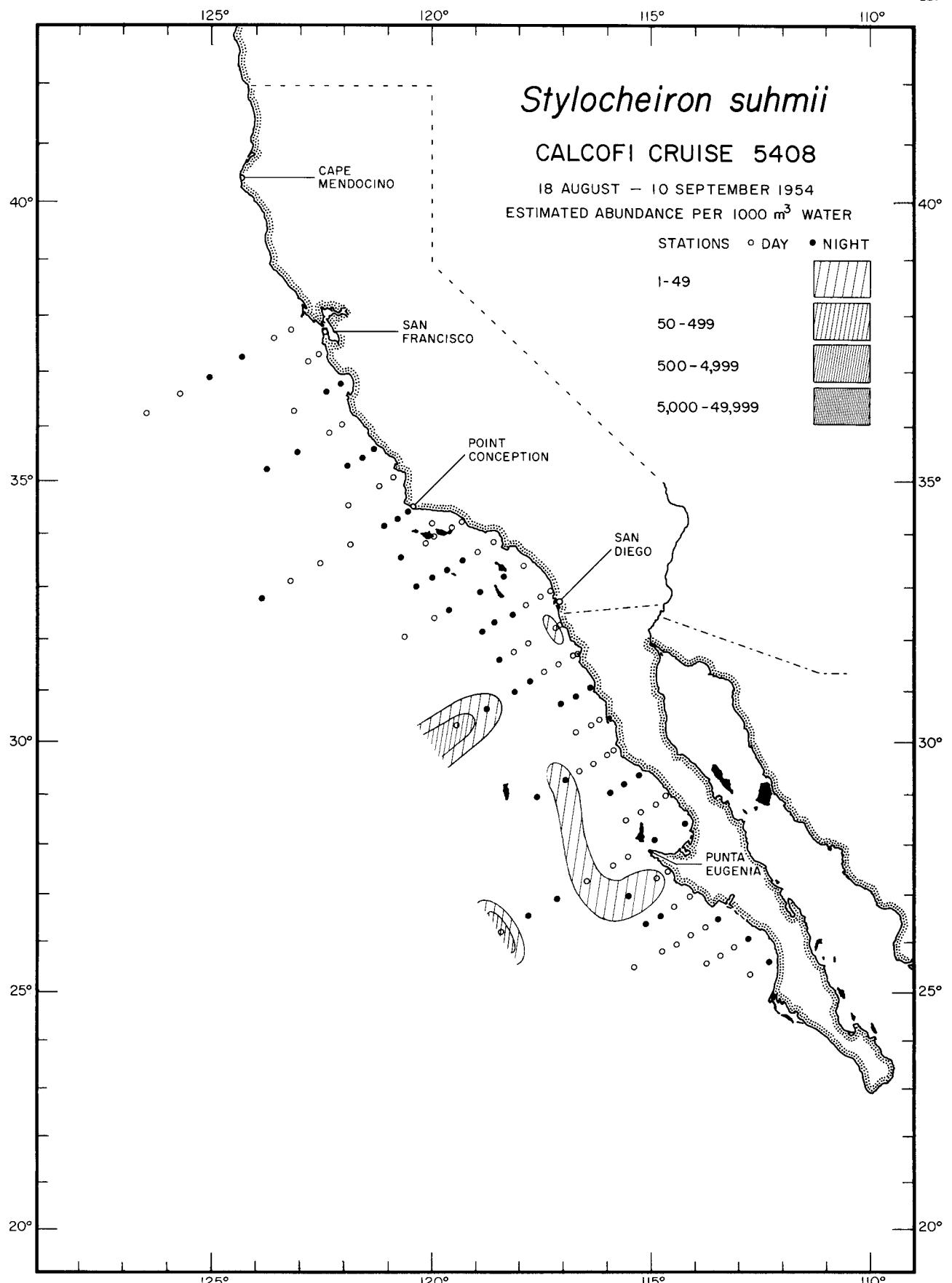


Euphausiacea
Stylocheiron maximum
6204

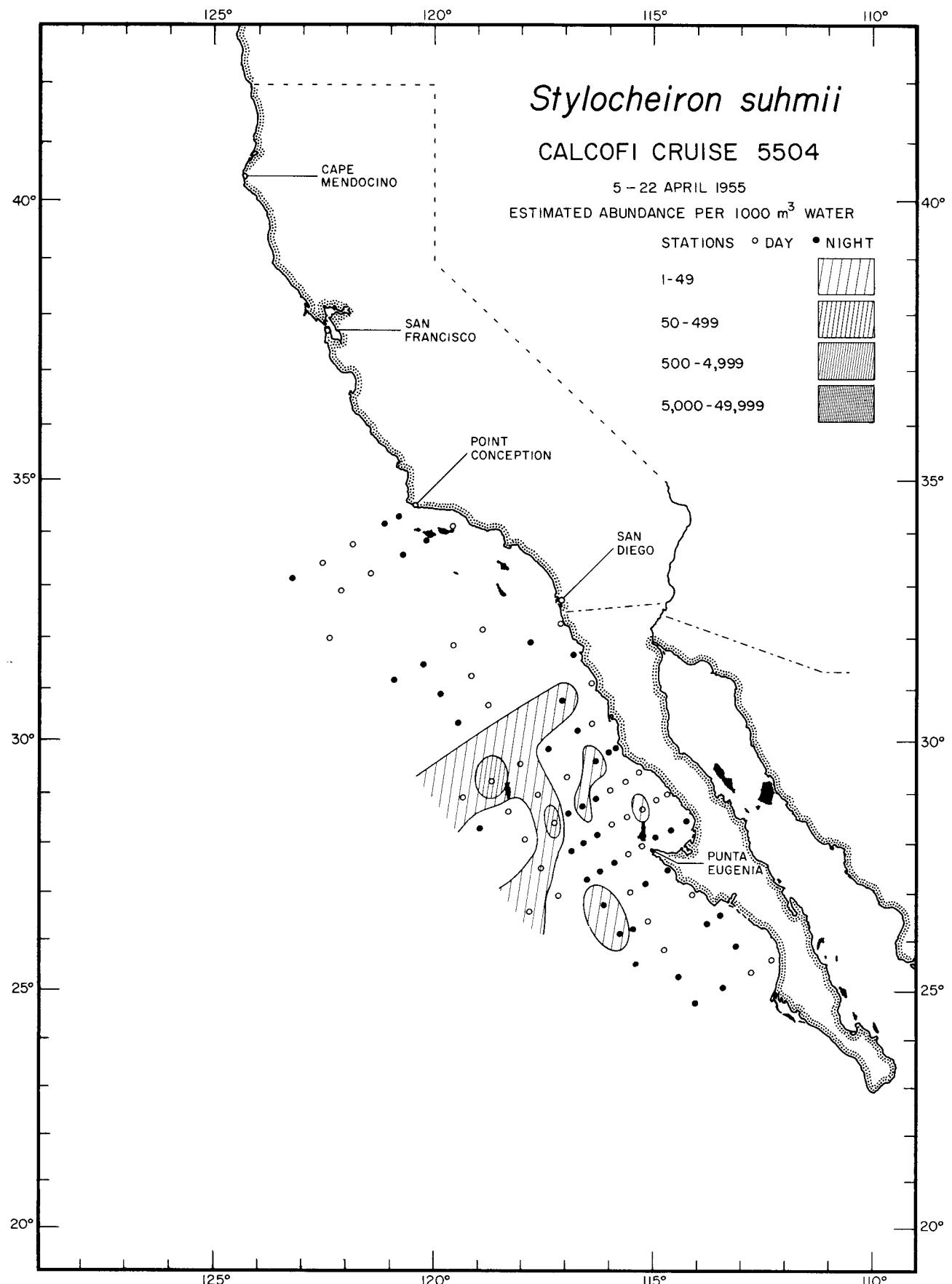


The numbers to the right of the shoreline represent abundance at special inshore stations occupied during Cruise 6304. These stations are too closely spaced to be shown by station circles. A number index appears to the right of the estimated abundance key. When the species is absent from all special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

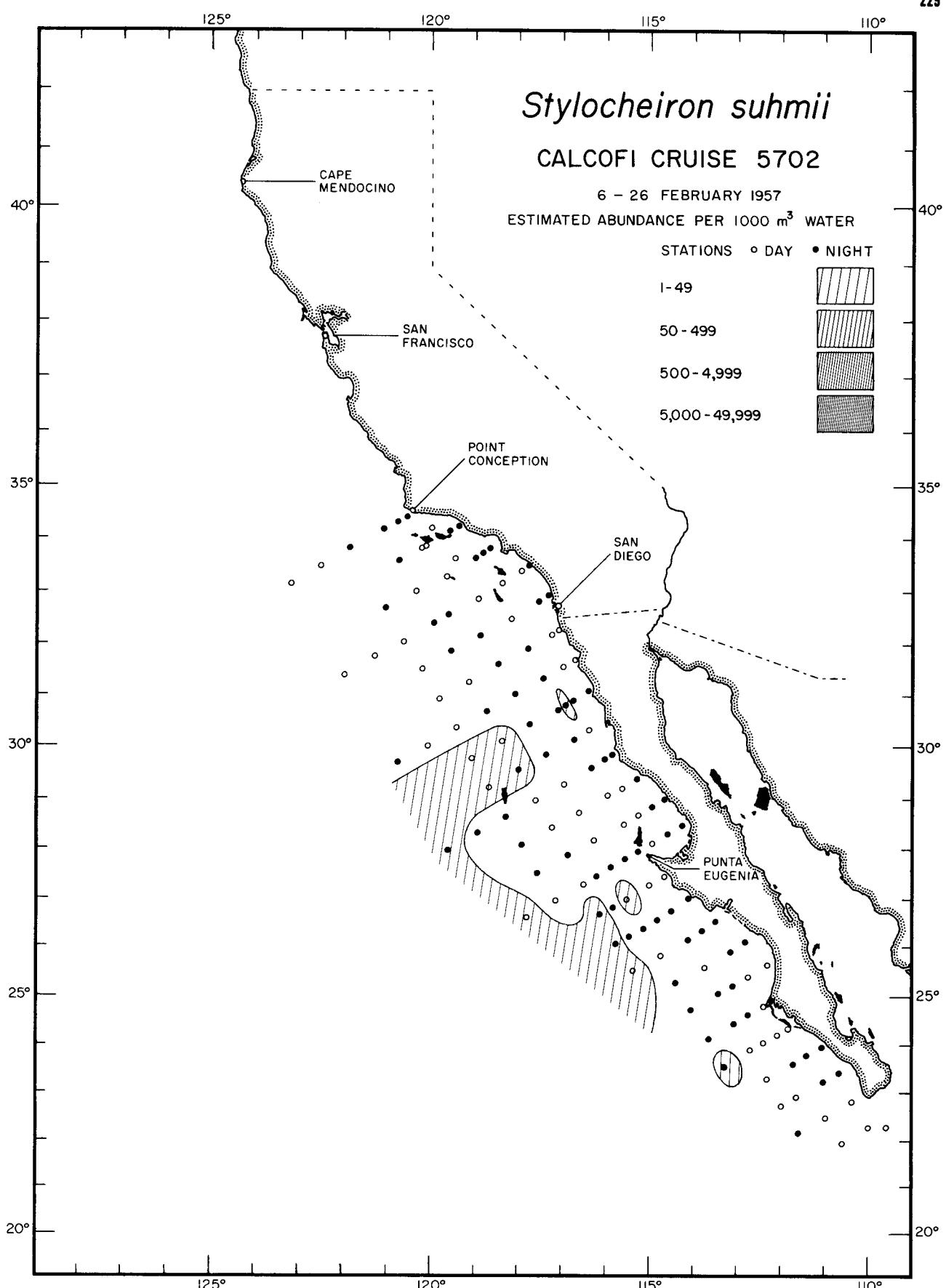
Euphausiacea
Stylocheiron maximum
6304



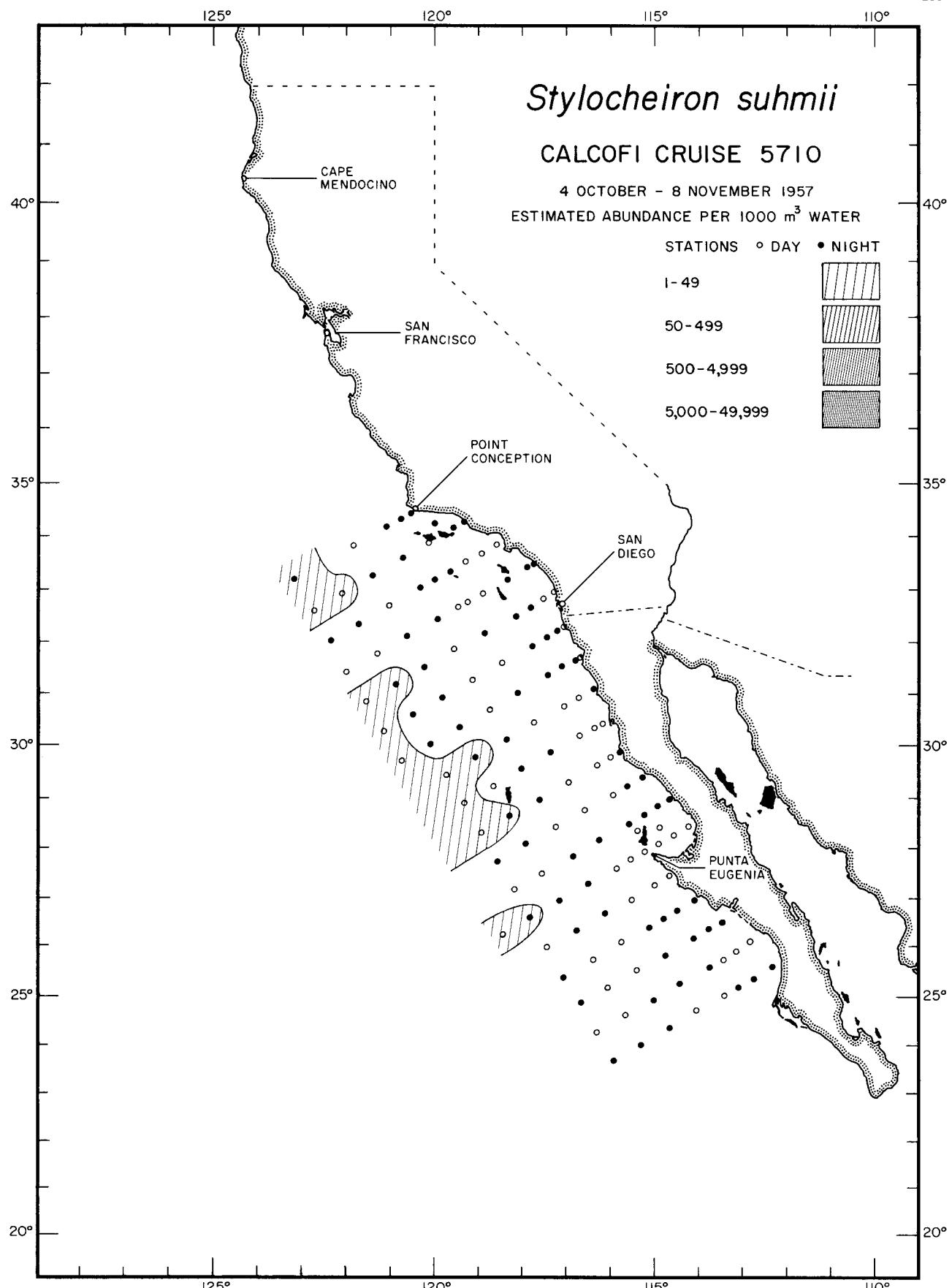
Euphausiaceae
Stylocheiron suhmi
 5408



Euphausiacea
Stylocheiron suhmii
5504



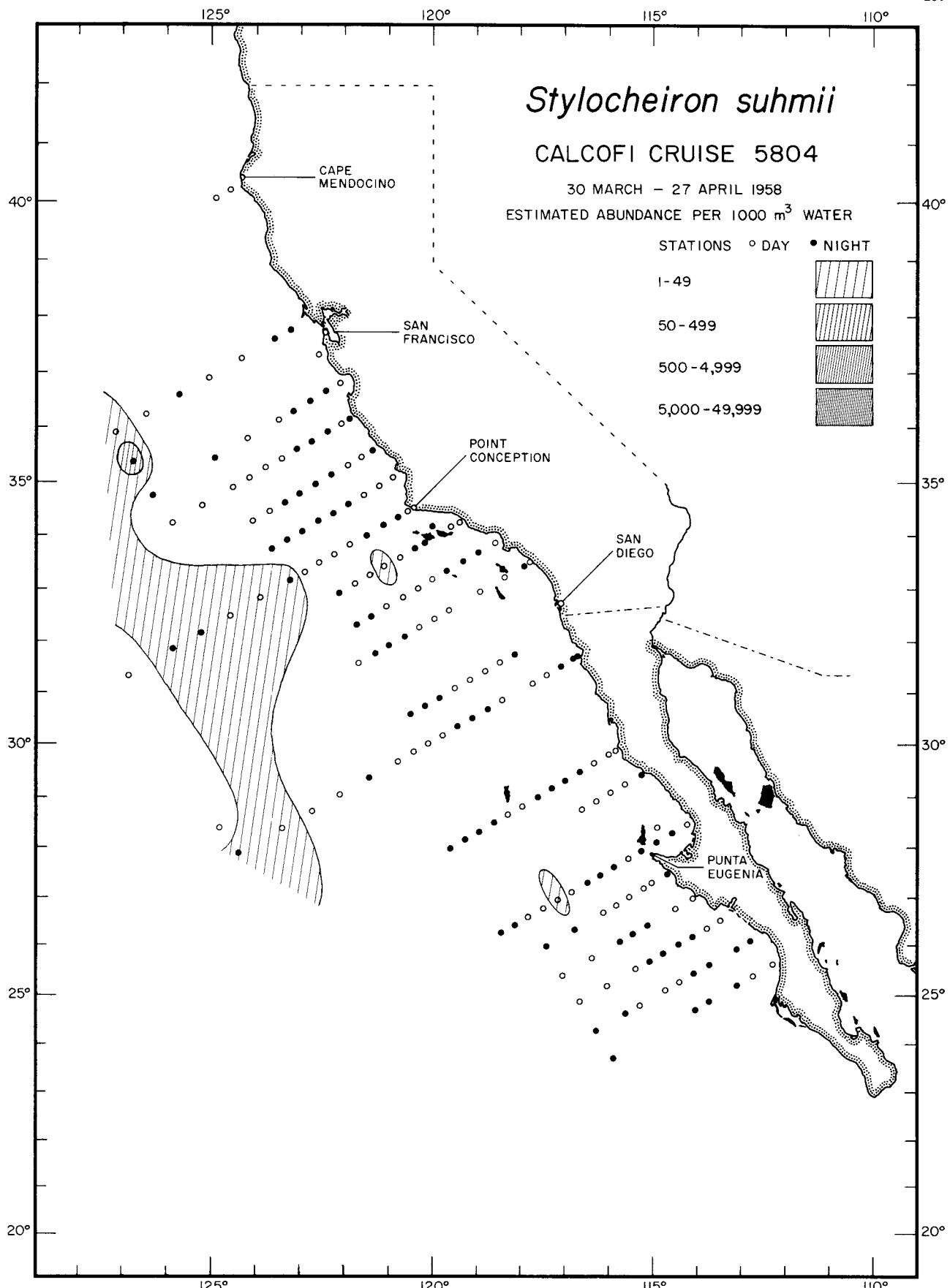
Euphausiacea
Stylocheiron suhmii
5702



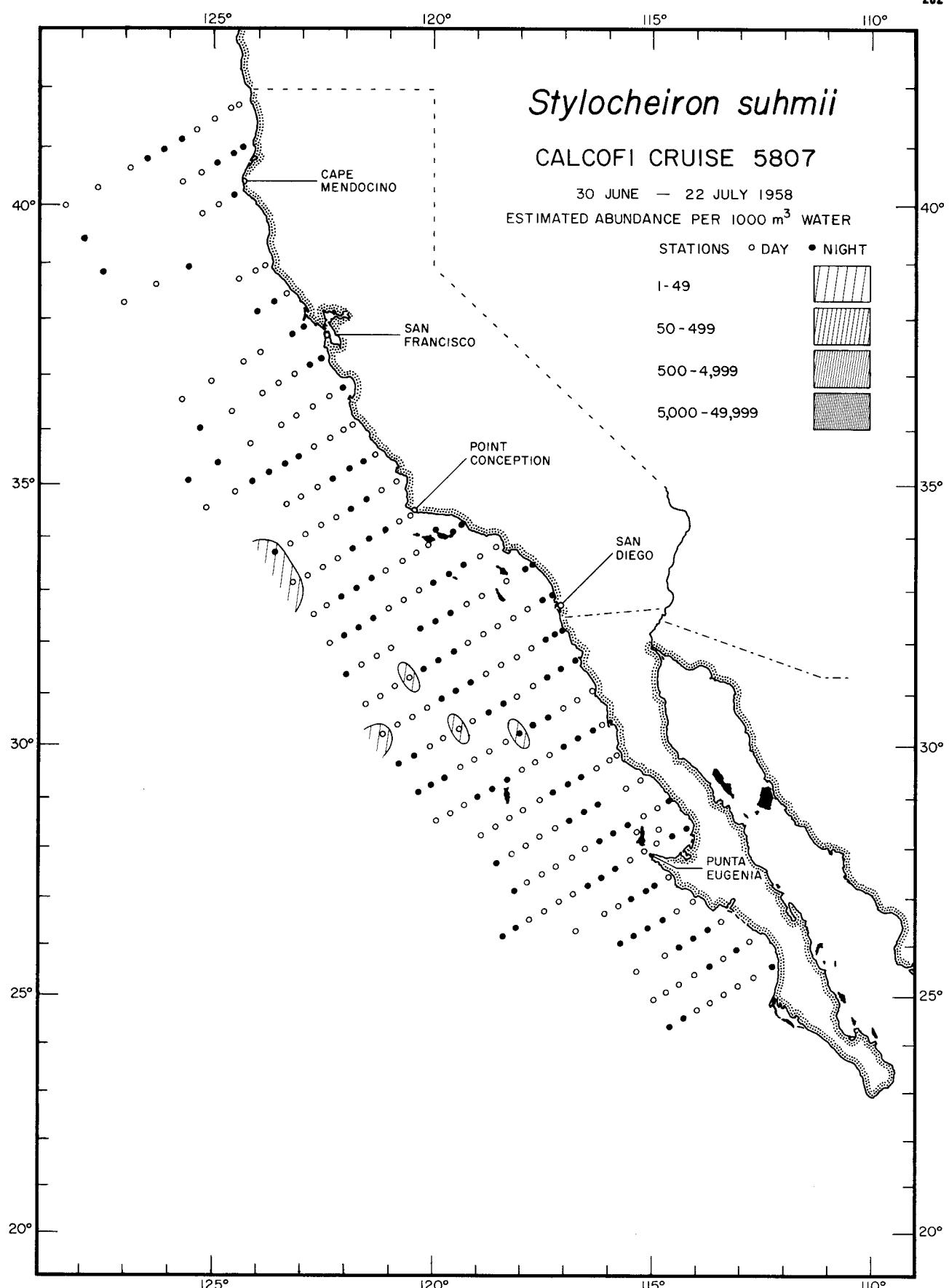
Euphausiacea

Stylocheiron suhmii

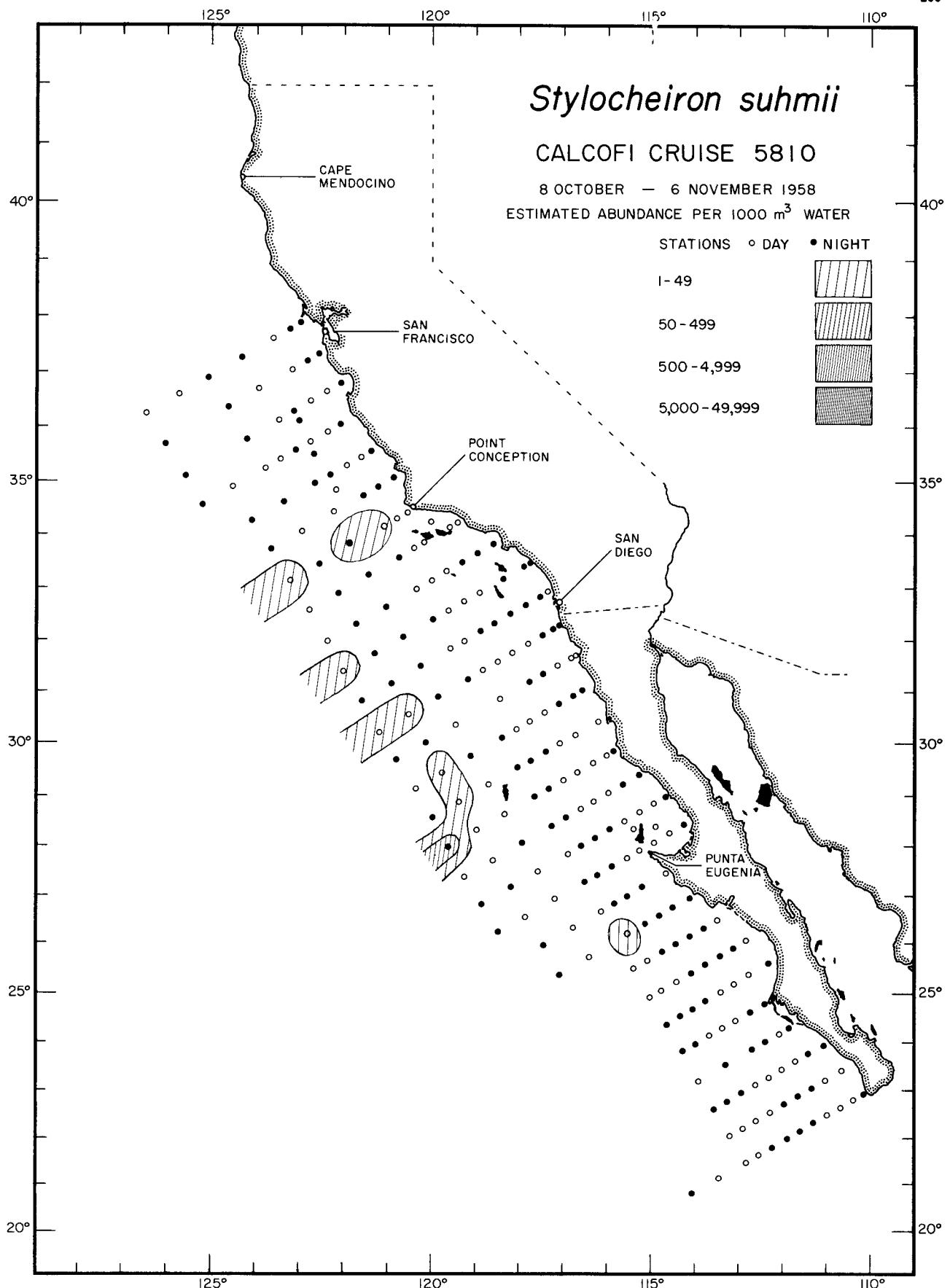
5710



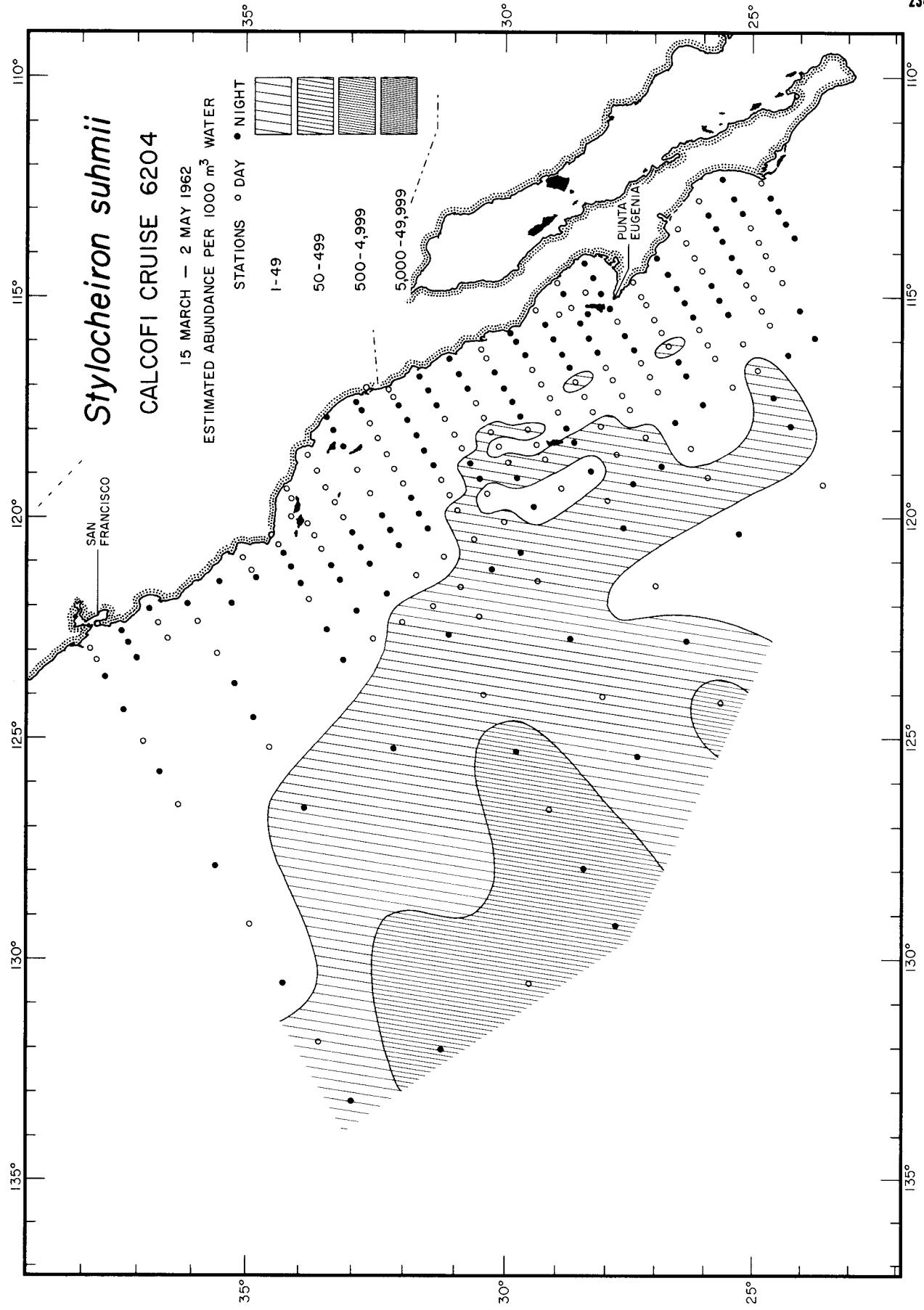
Euphausiacea
Stylocheiron suhmii
5804



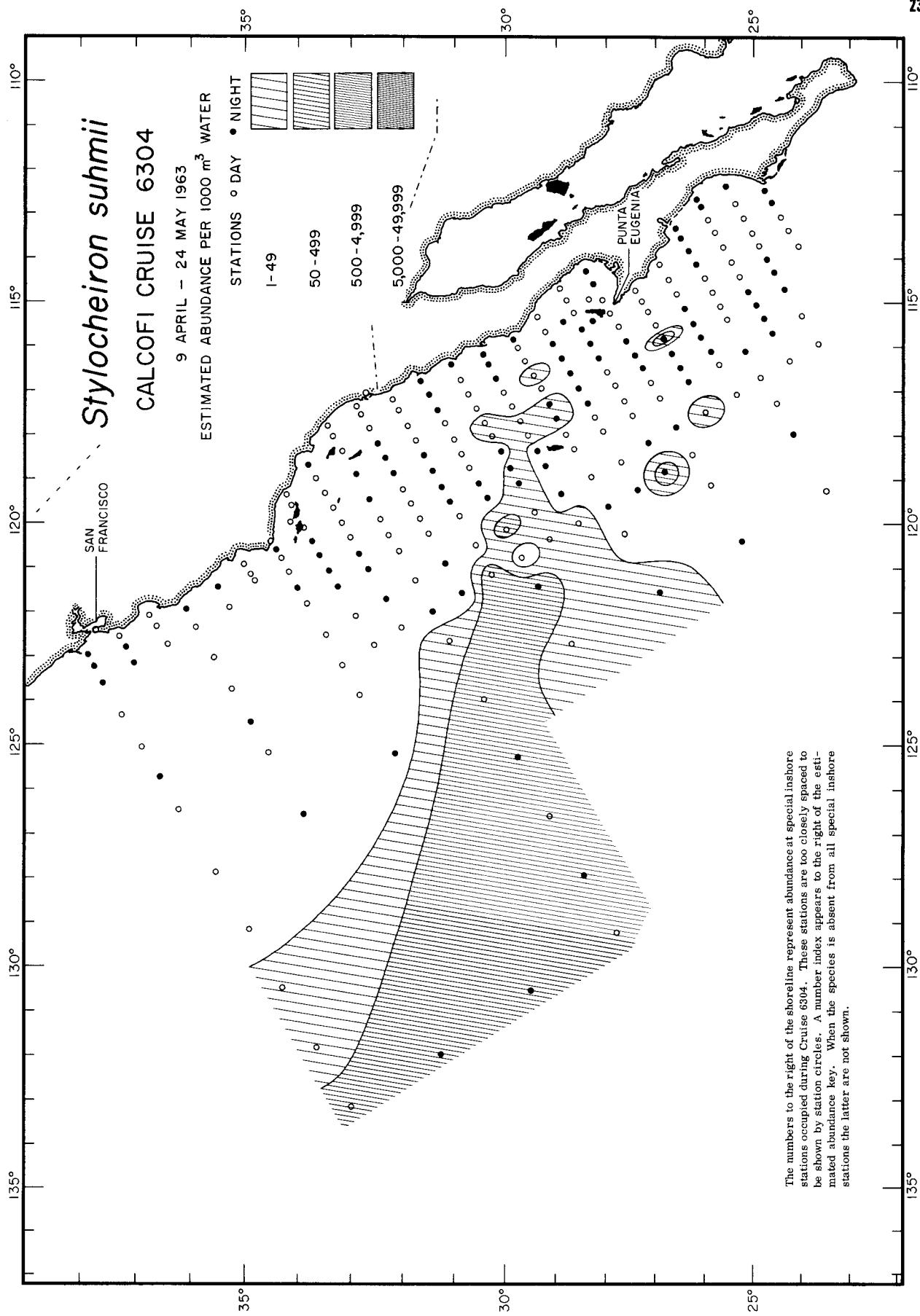
Euphausiacea
Stylocheiron suhmii
5807



Euphausiacea
Stylocheiron suhmii
 5810

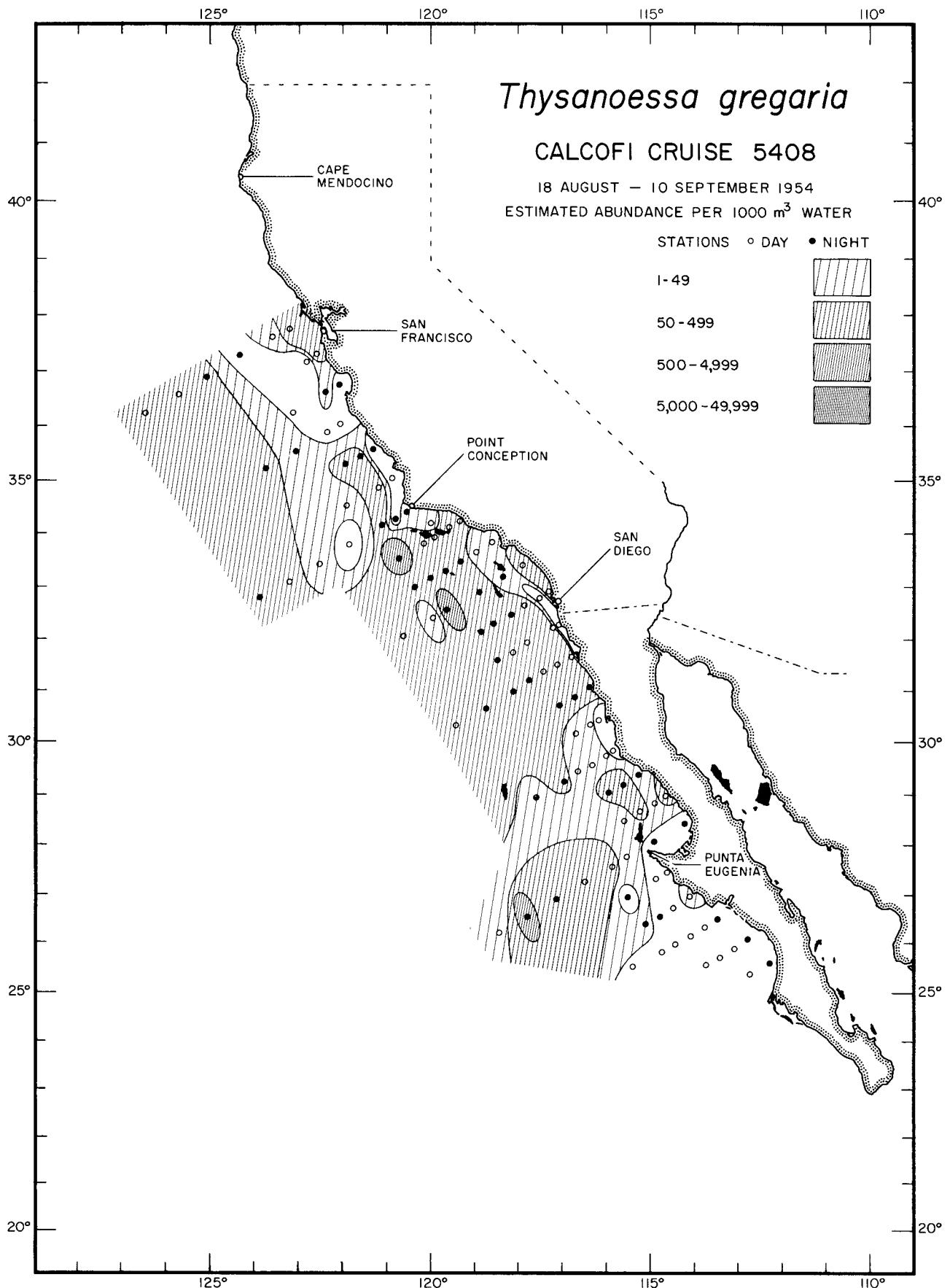


Euphausiacea
Stylocheiron suhmi
6204

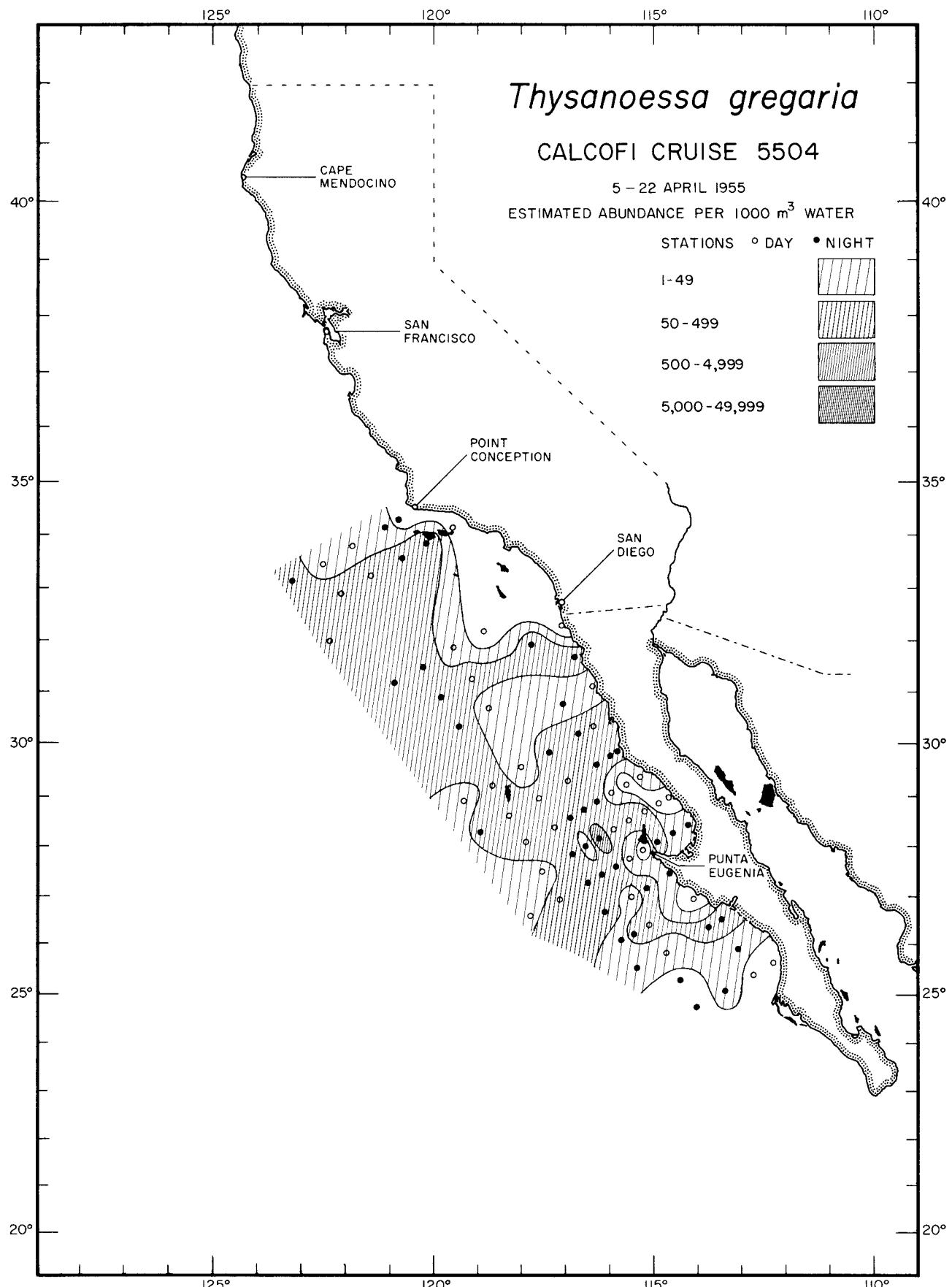


The numbers to the right of the shoreline represent abundance at special insshore stations occupied during Cruise 6304. Those stations are too closely spaced to be shown by station circles. A number index appears to the right of the estimated abundance key. When the species is absent from all special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

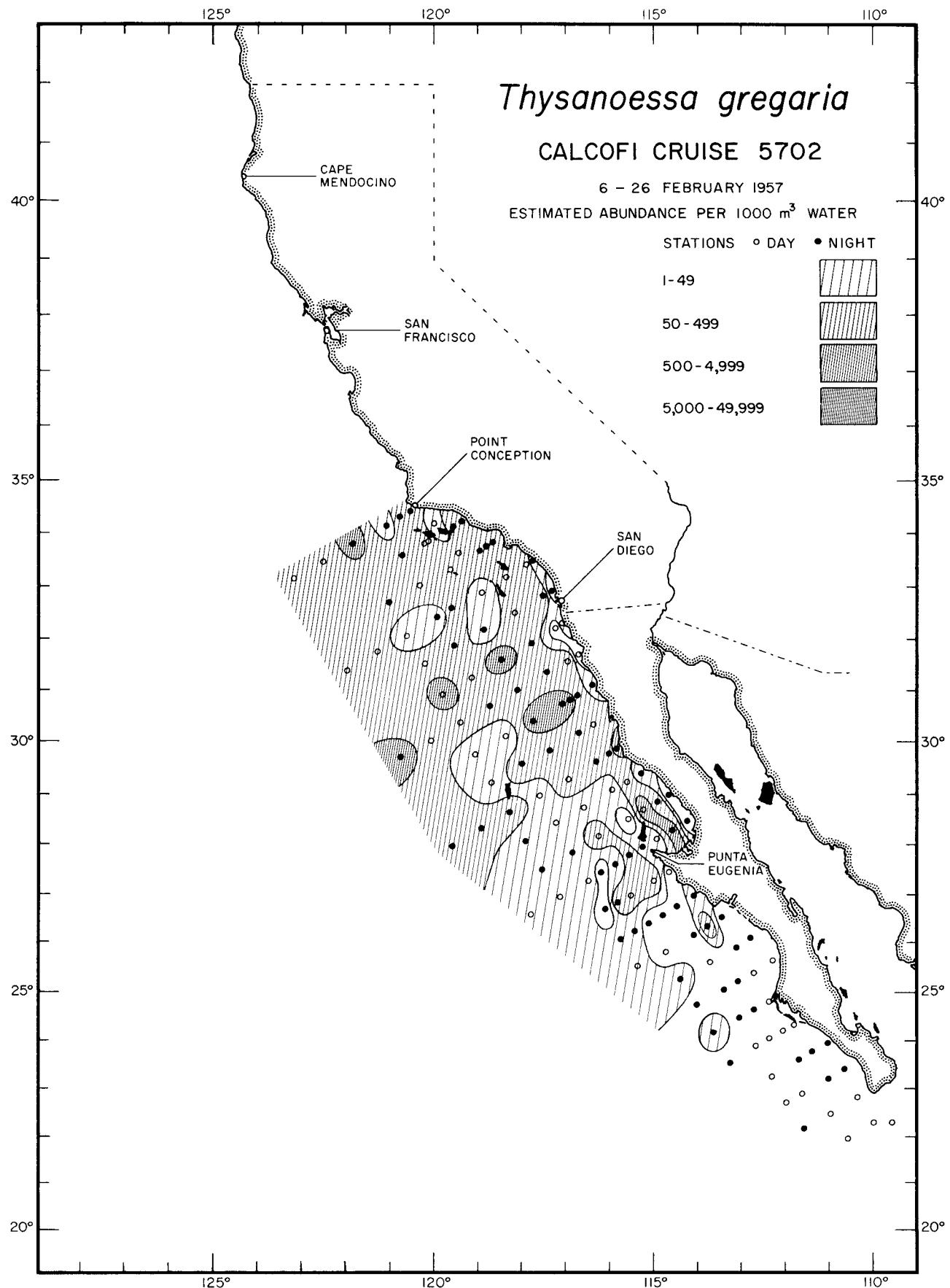
Euphausiacea
Stylocheiron suhmii
6304



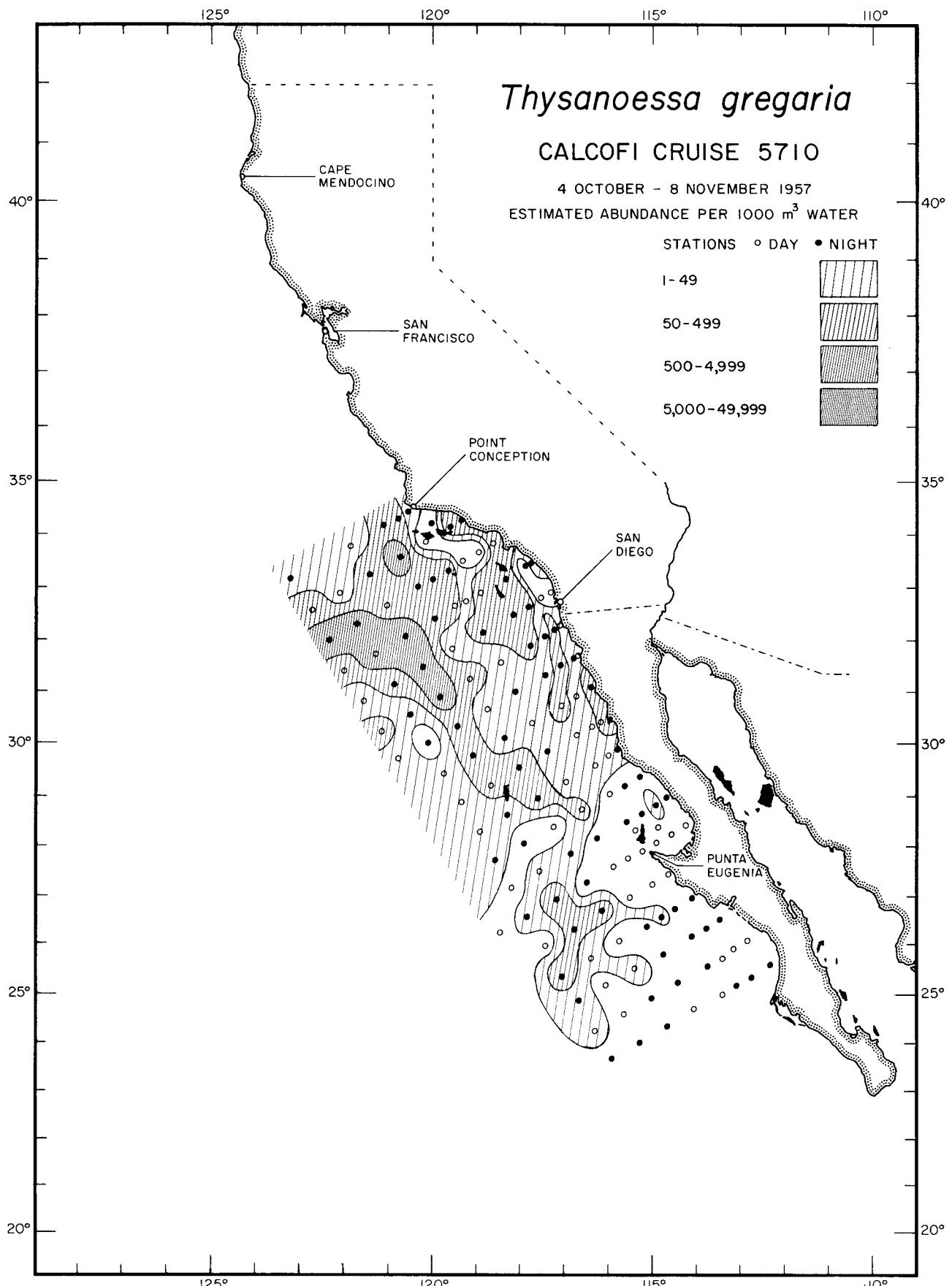
Euphausiacea
Thysanoessa gregaria
5408



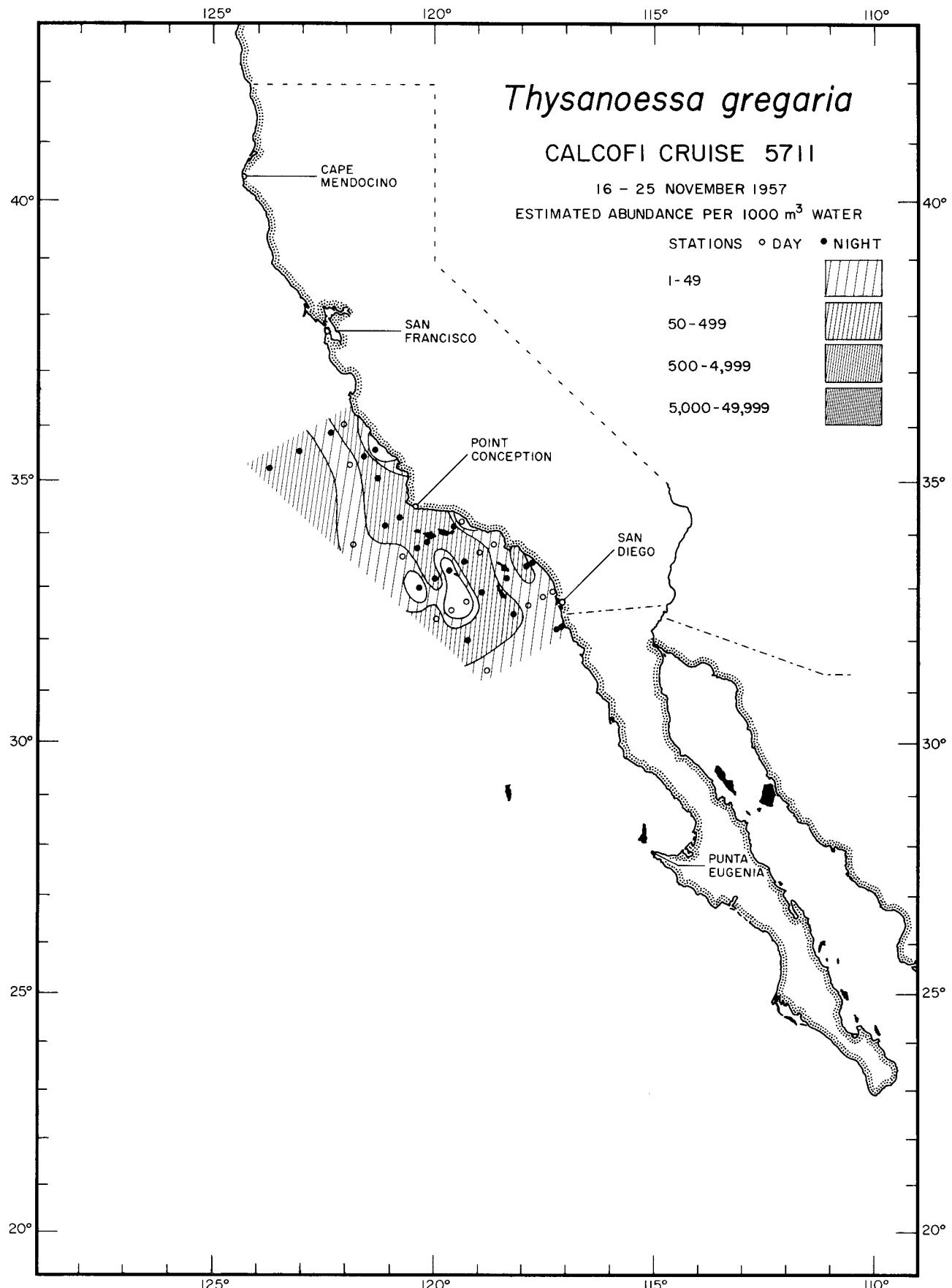
Euphausiacea
Thysanoessa gregaria
5504



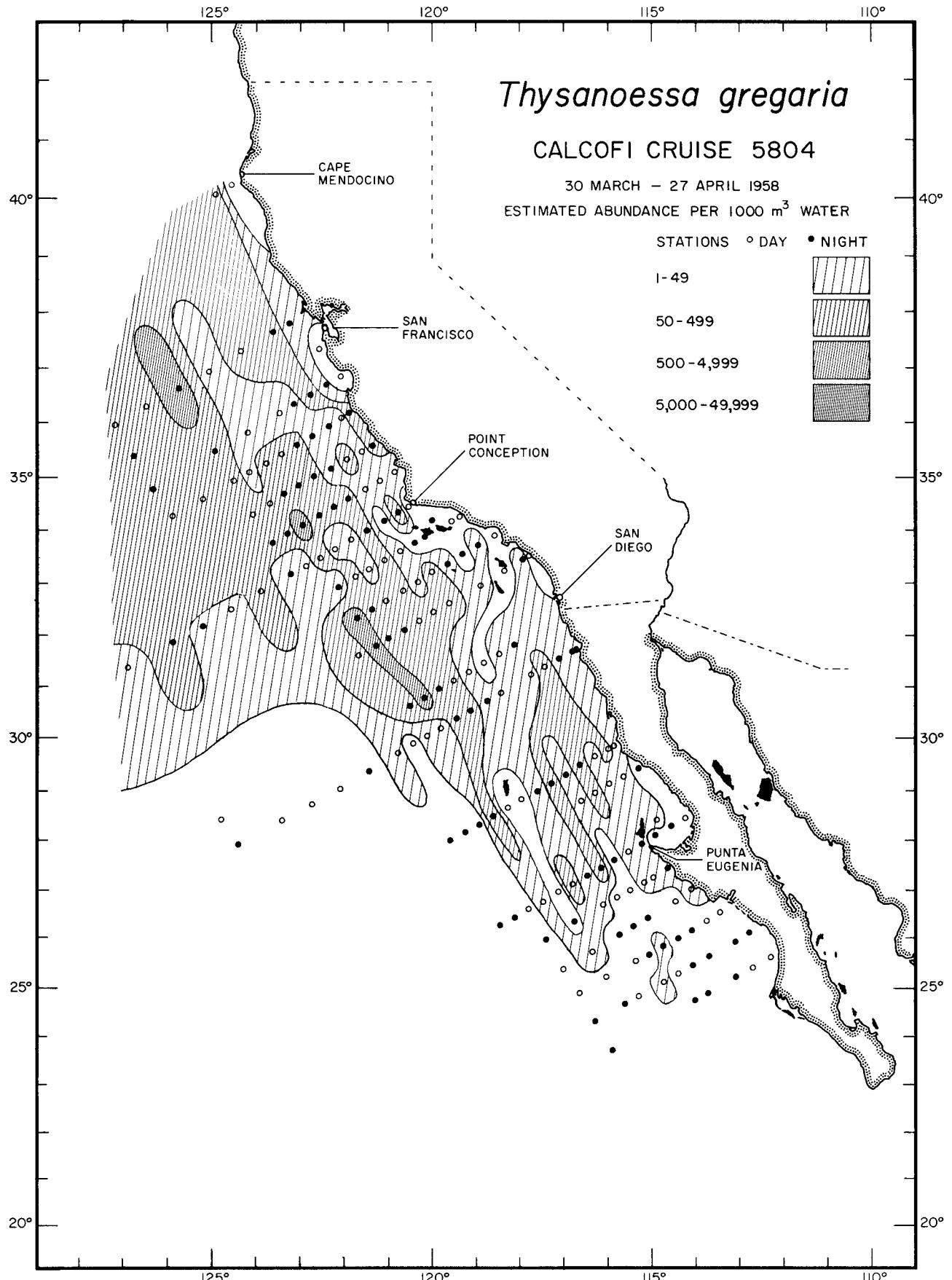
Euphausiacea
Thysanoessa gregaria
 5702



Euphausiacea
Thysanoessa gregaria
5710

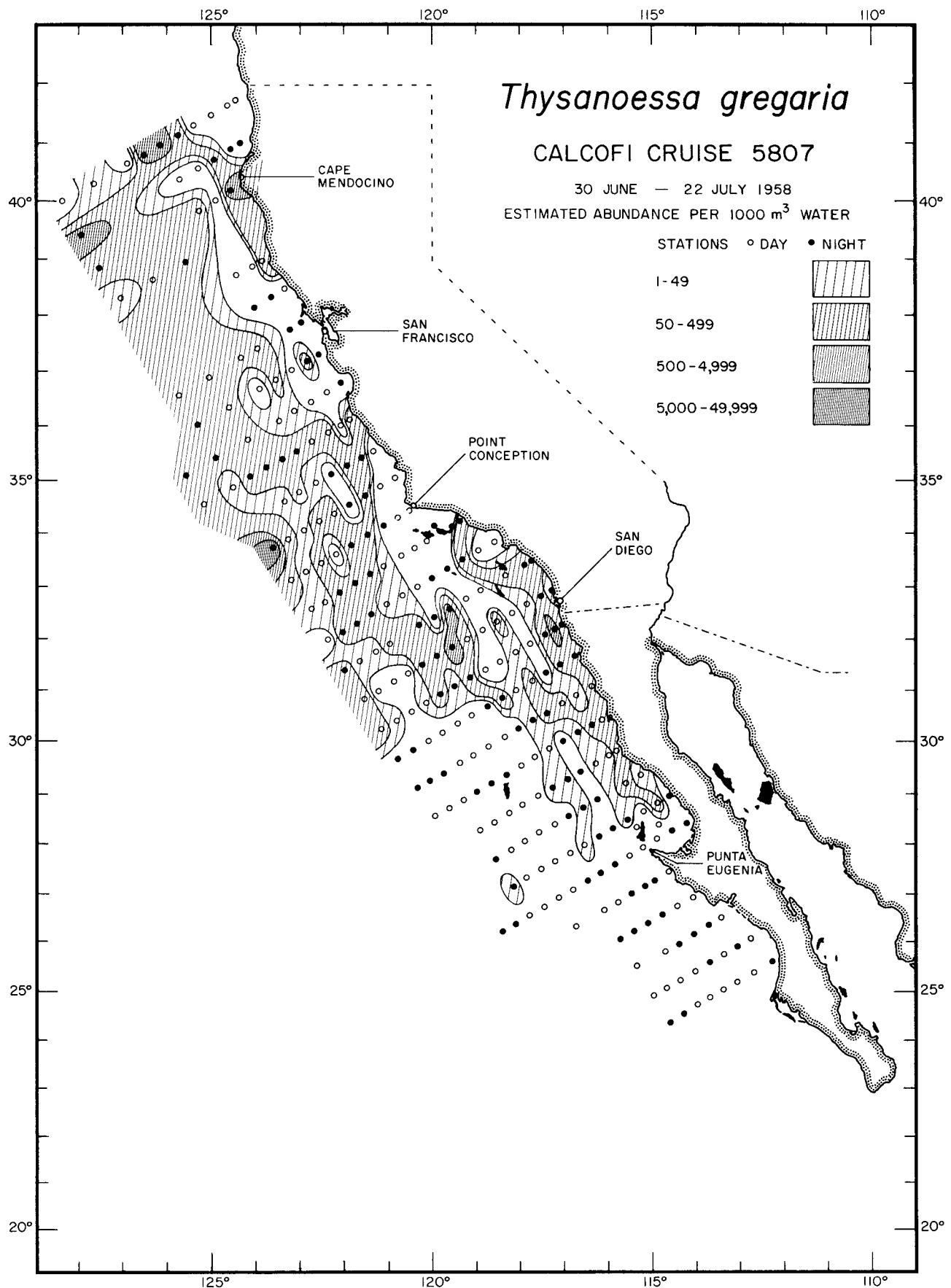


Euphausiacea
Thysanoessa gregaria
5711

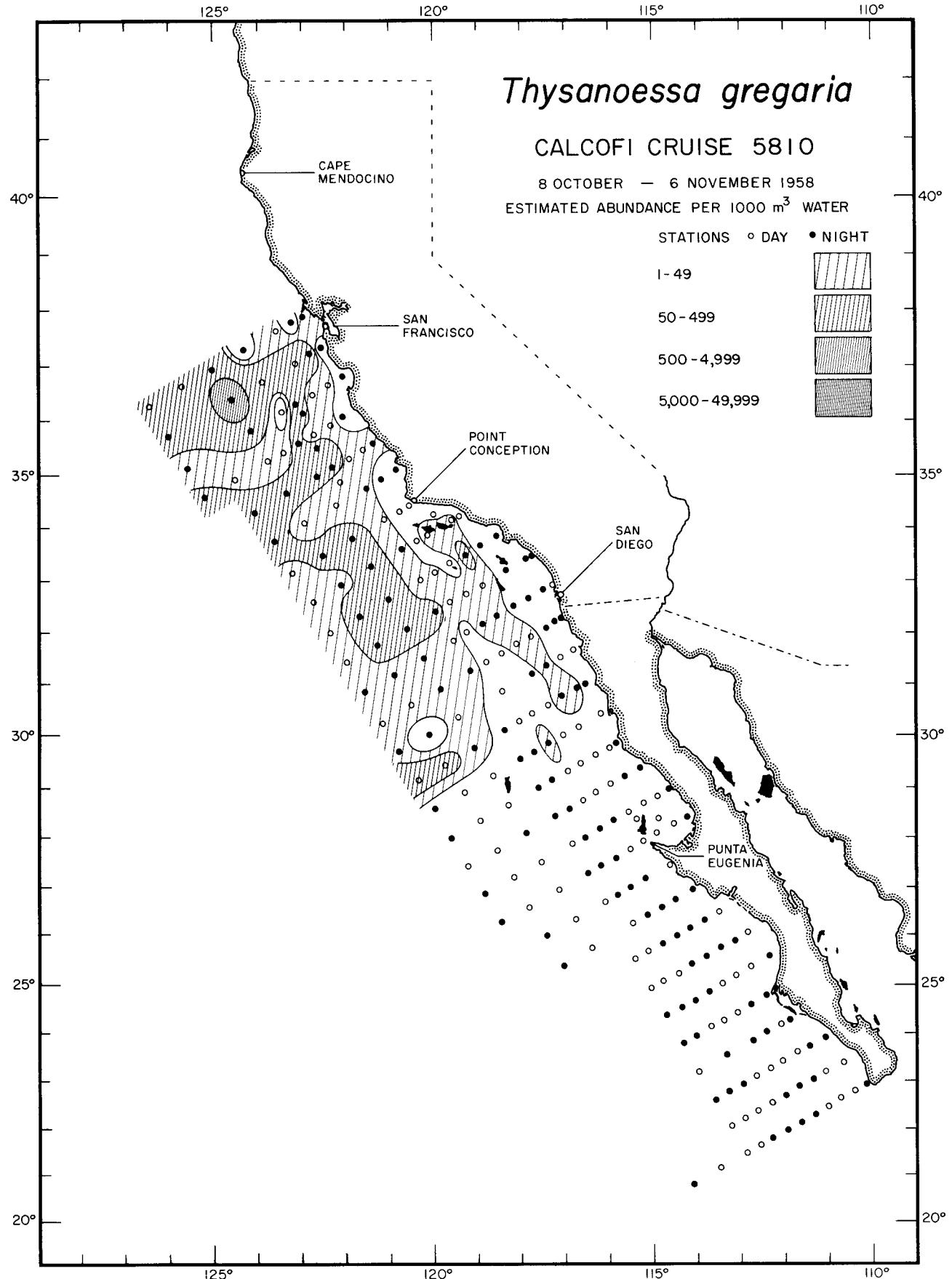


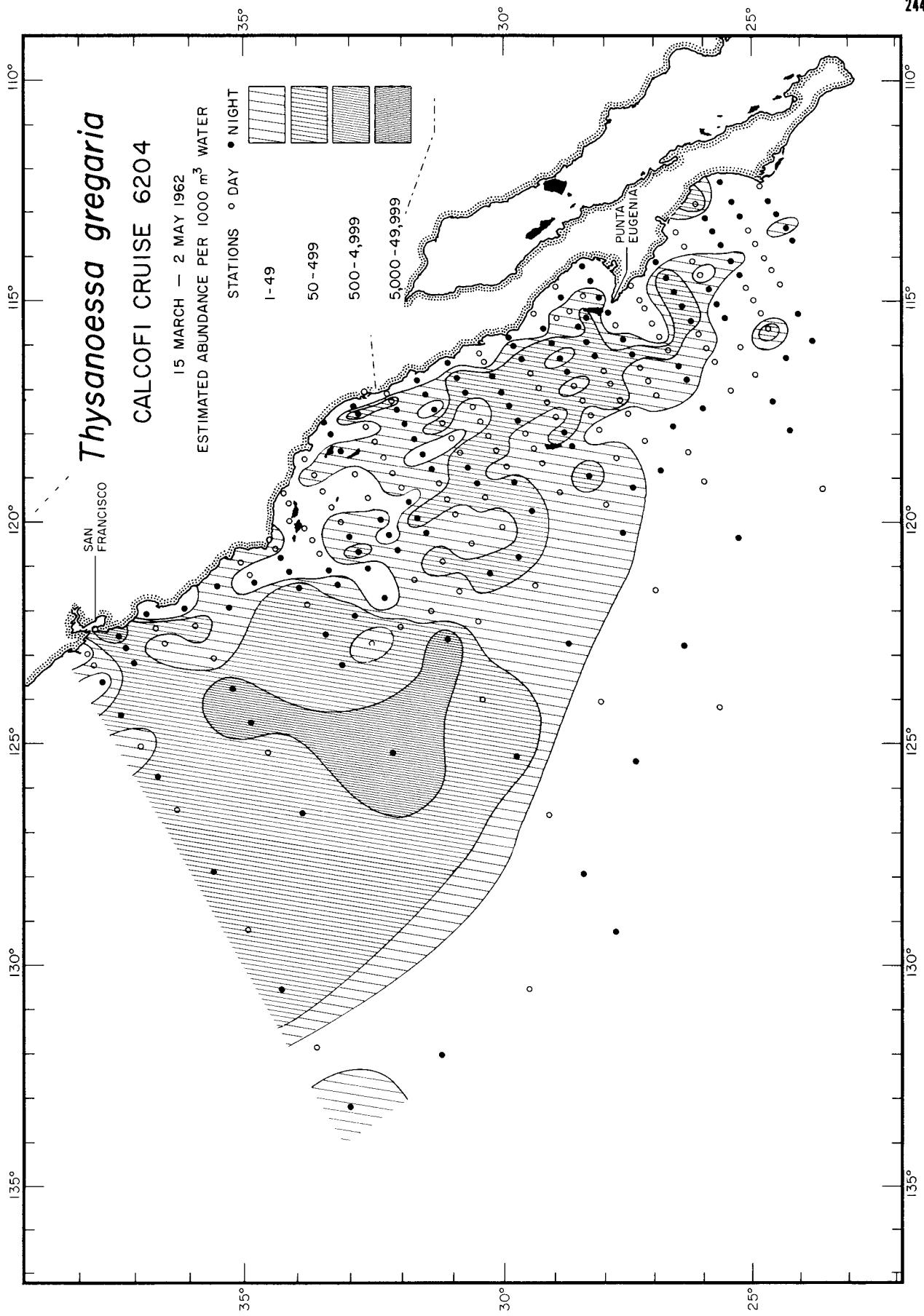
Euphausiacea
Thysanoessa gregaria

5804



Euphausiacea
Thysanoessa gregaria
5807

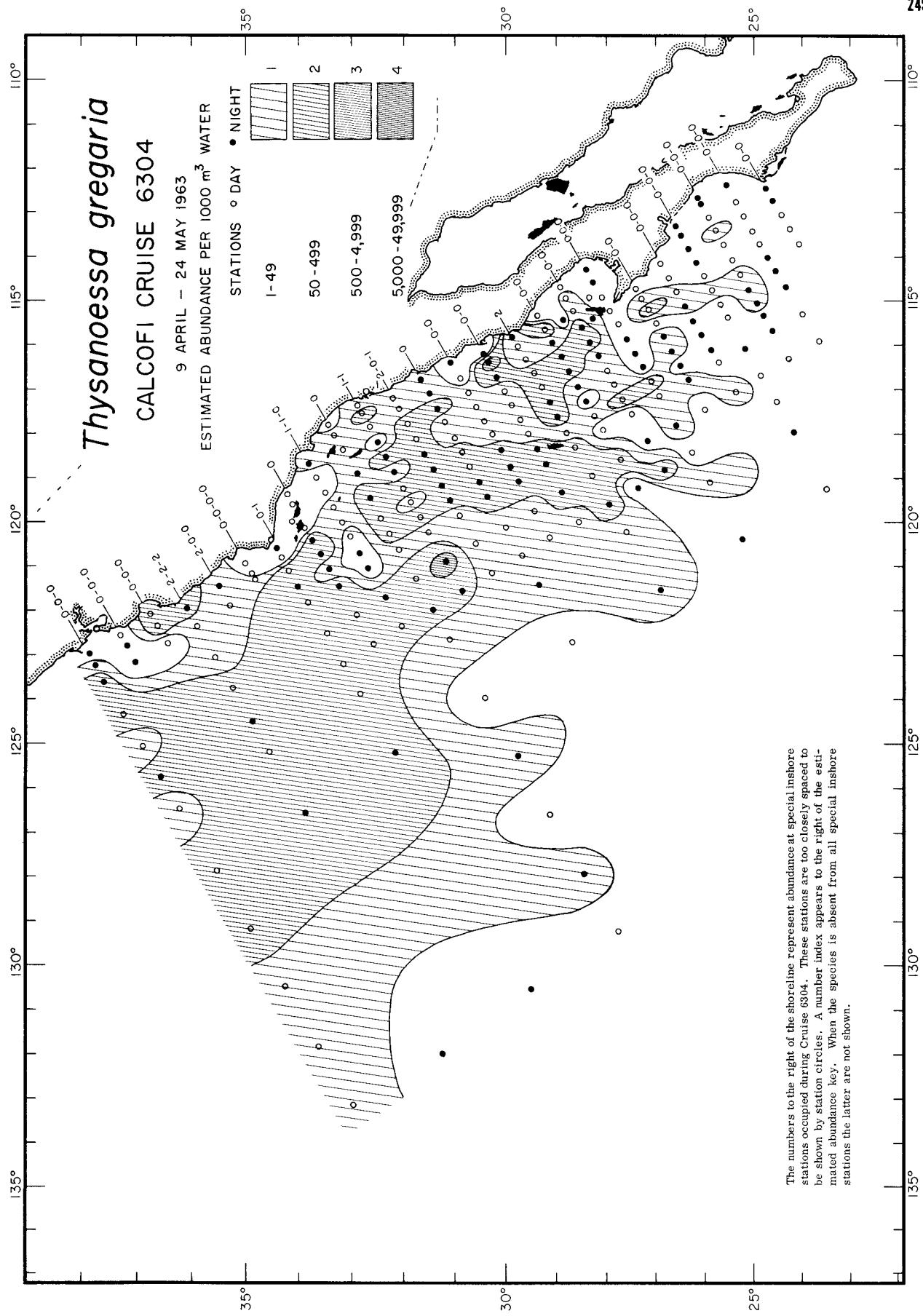




Euphausiacea

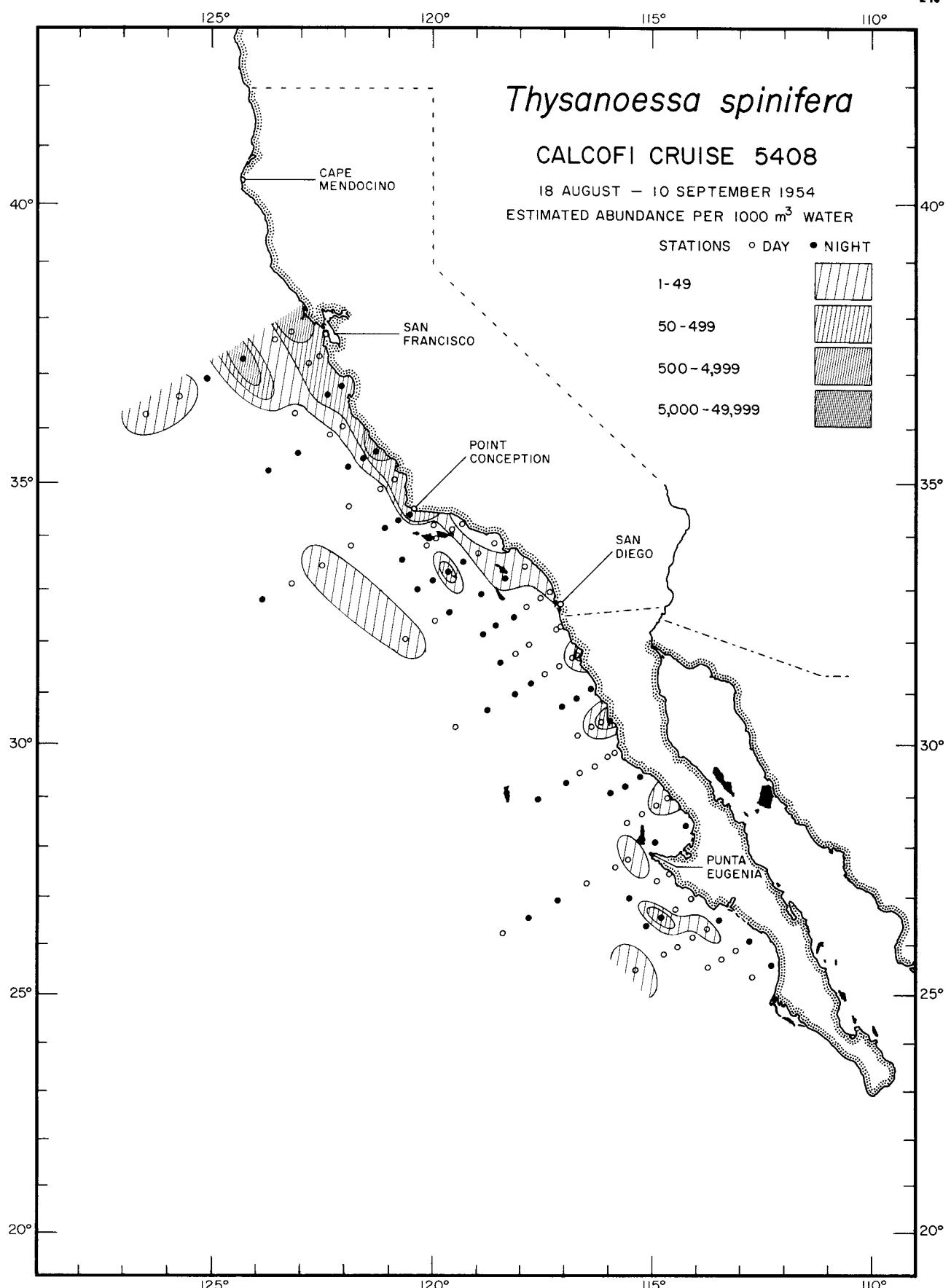
Thysanoessa gregaria

6204



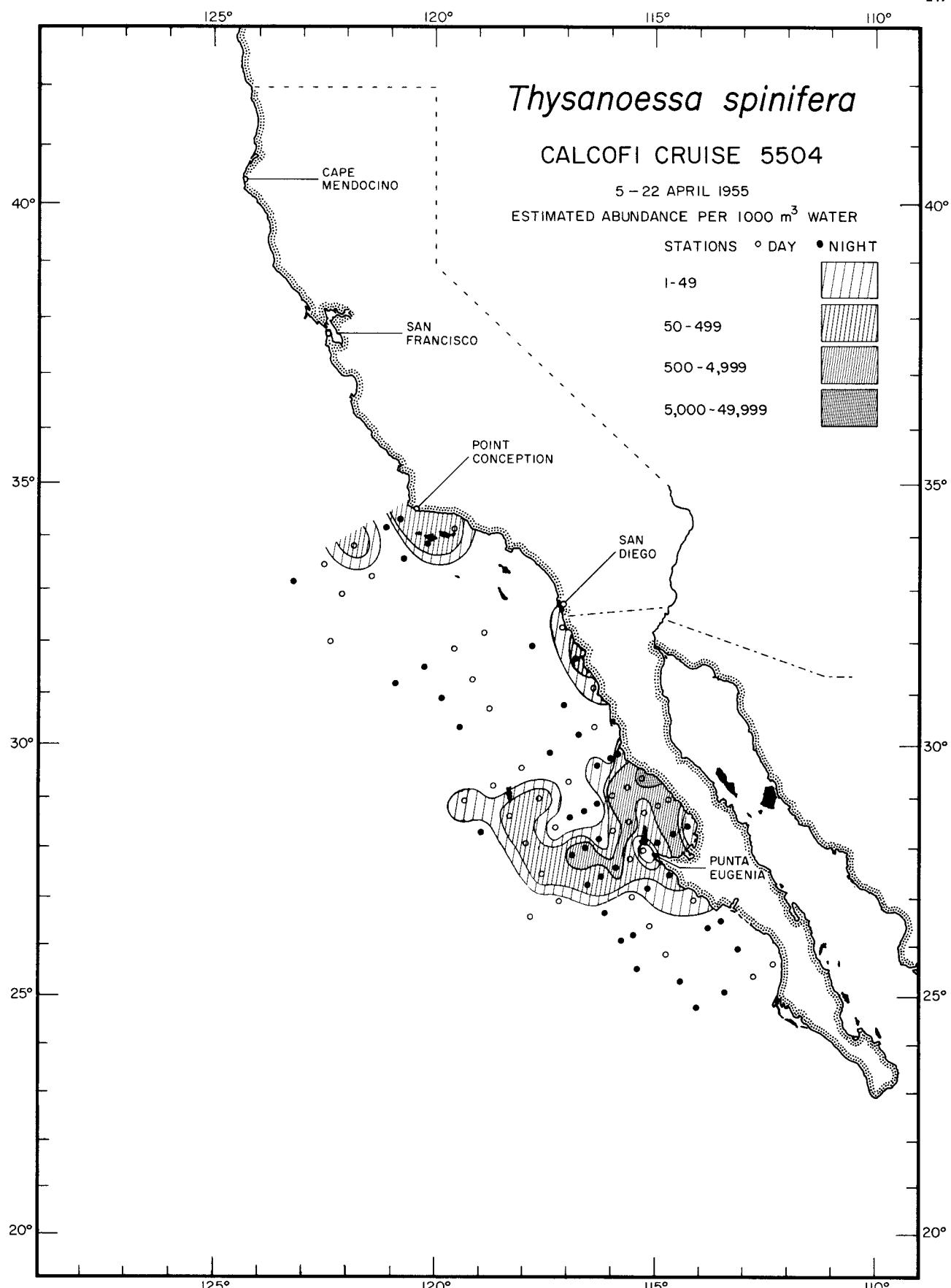
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Euphausiacea
Thysanoessa gregaria
6304

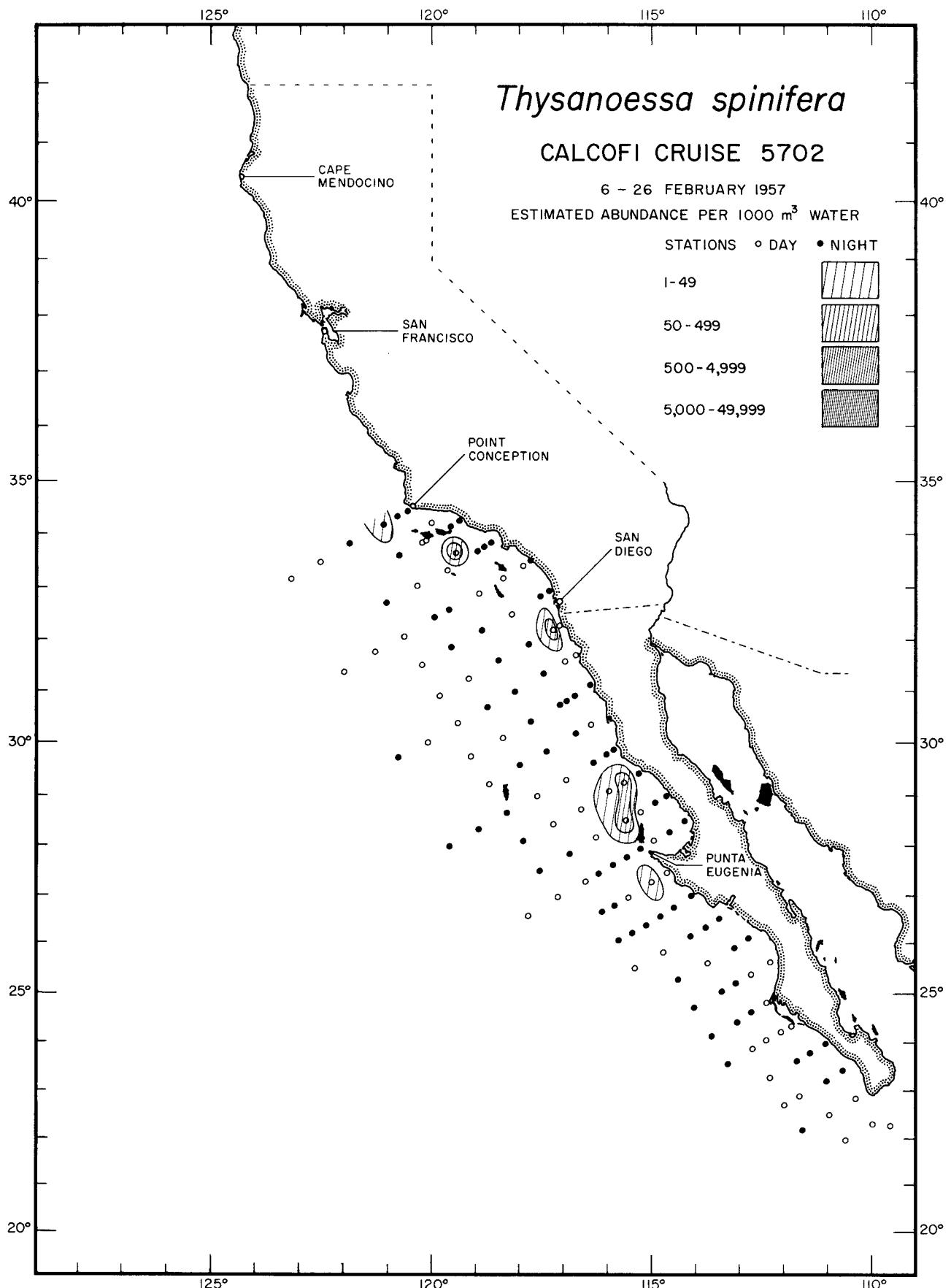


Euphausiacea
Thysanoessa spinifera

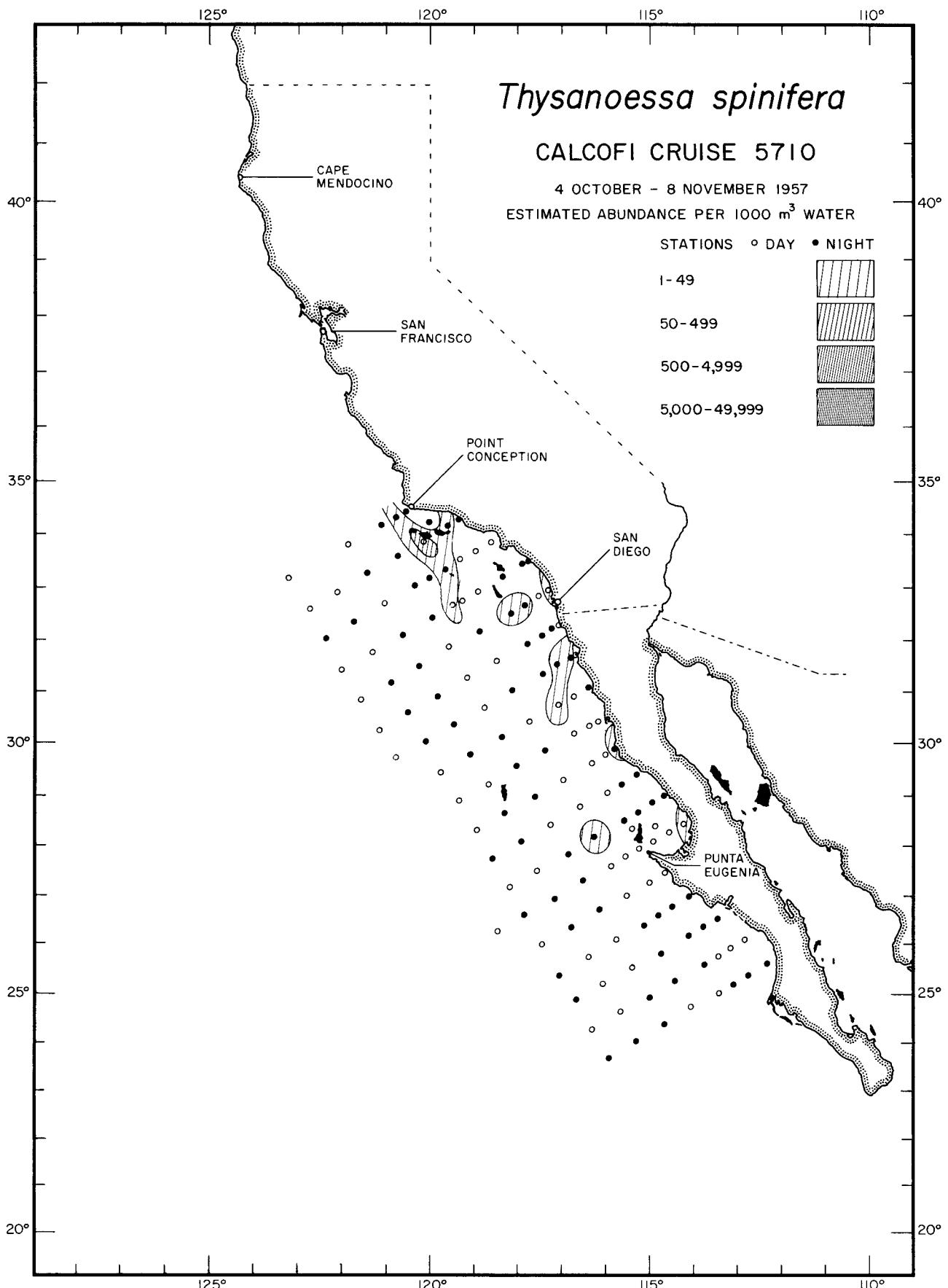
5408



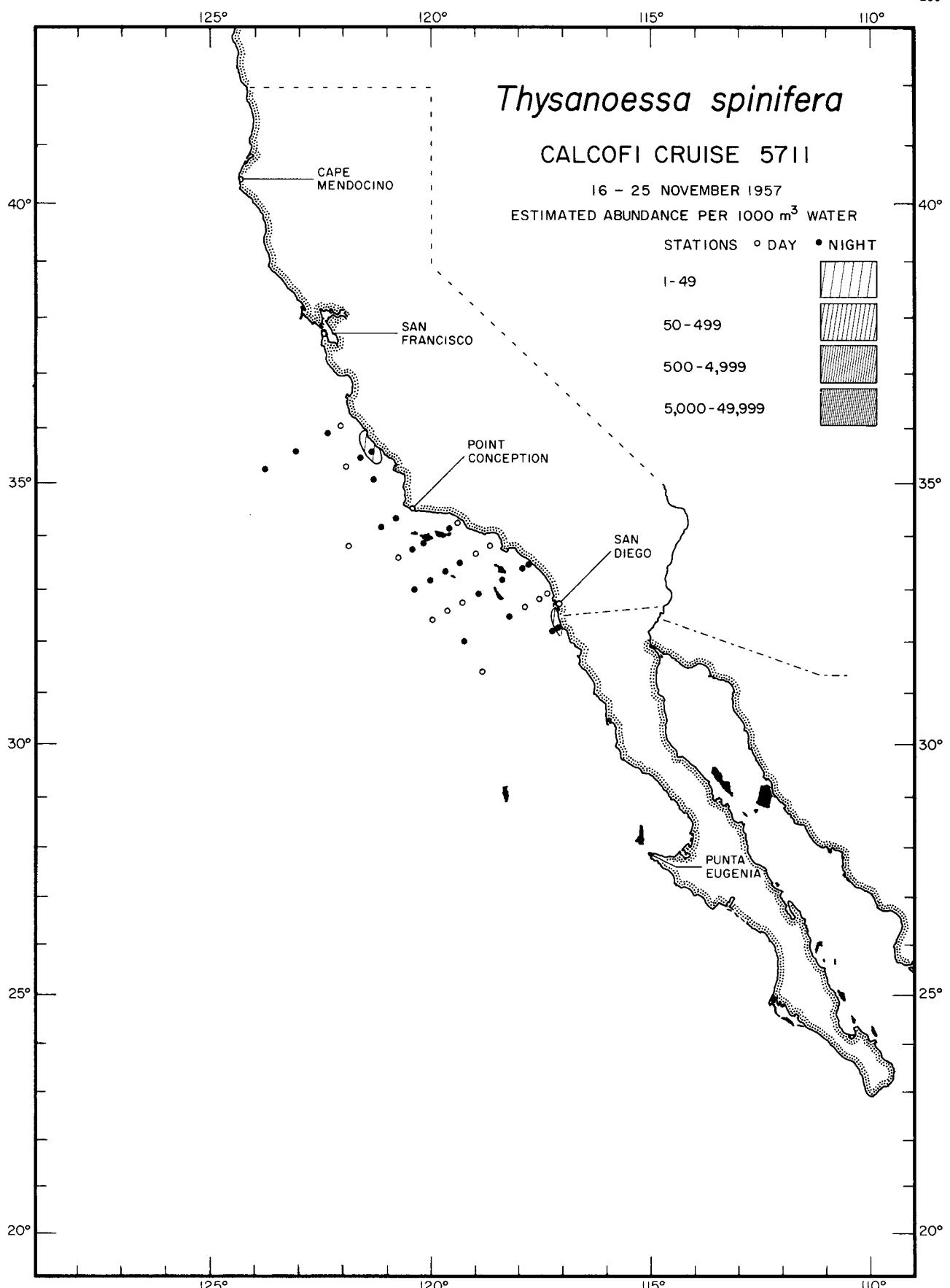
Euphausiacea
Thysanoessa spinifera
5504



Euphausiacea
Thysanoessa spinifera
5702

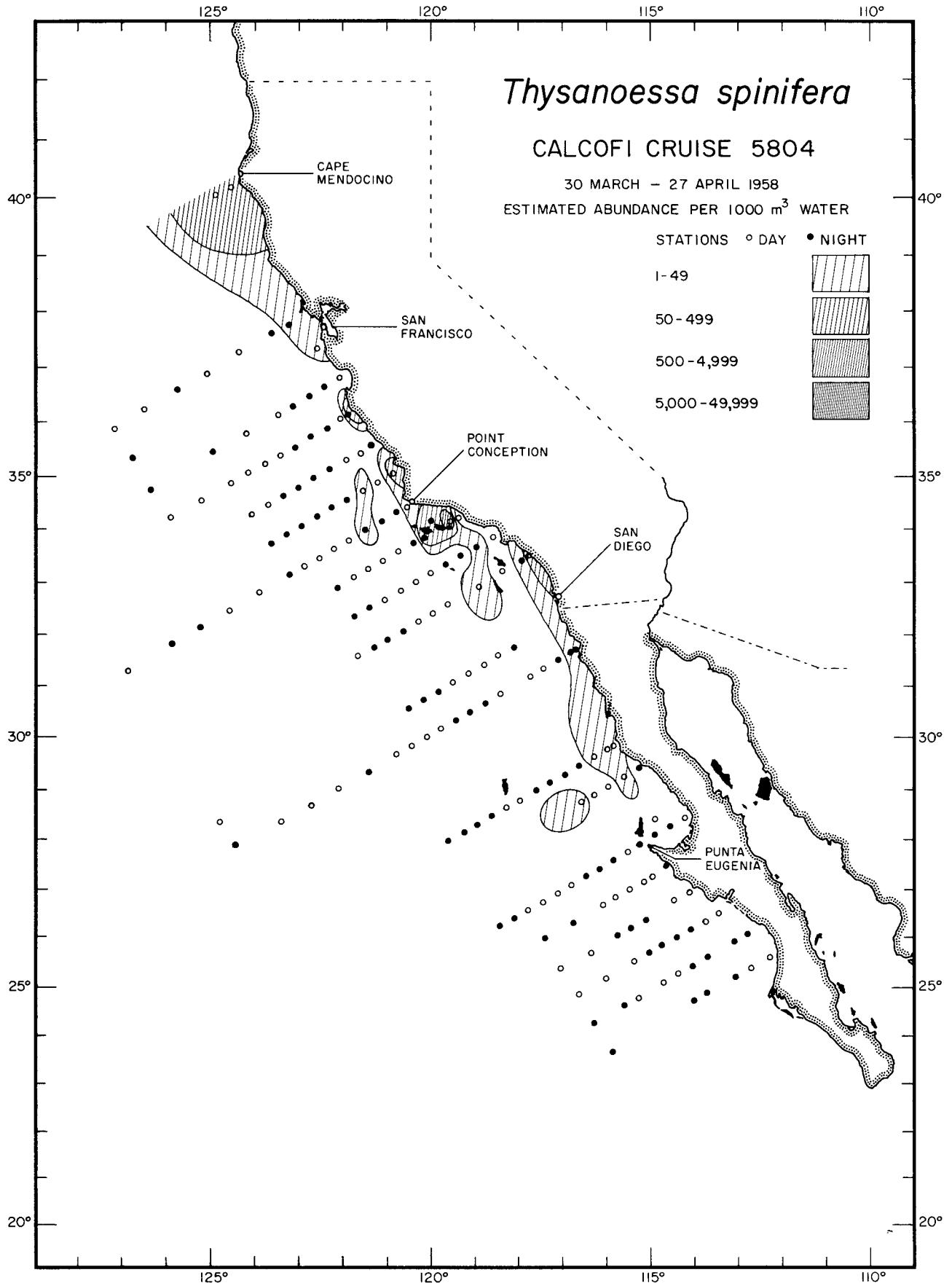


Euphausiacea
Thysanoessa spinifera
5710

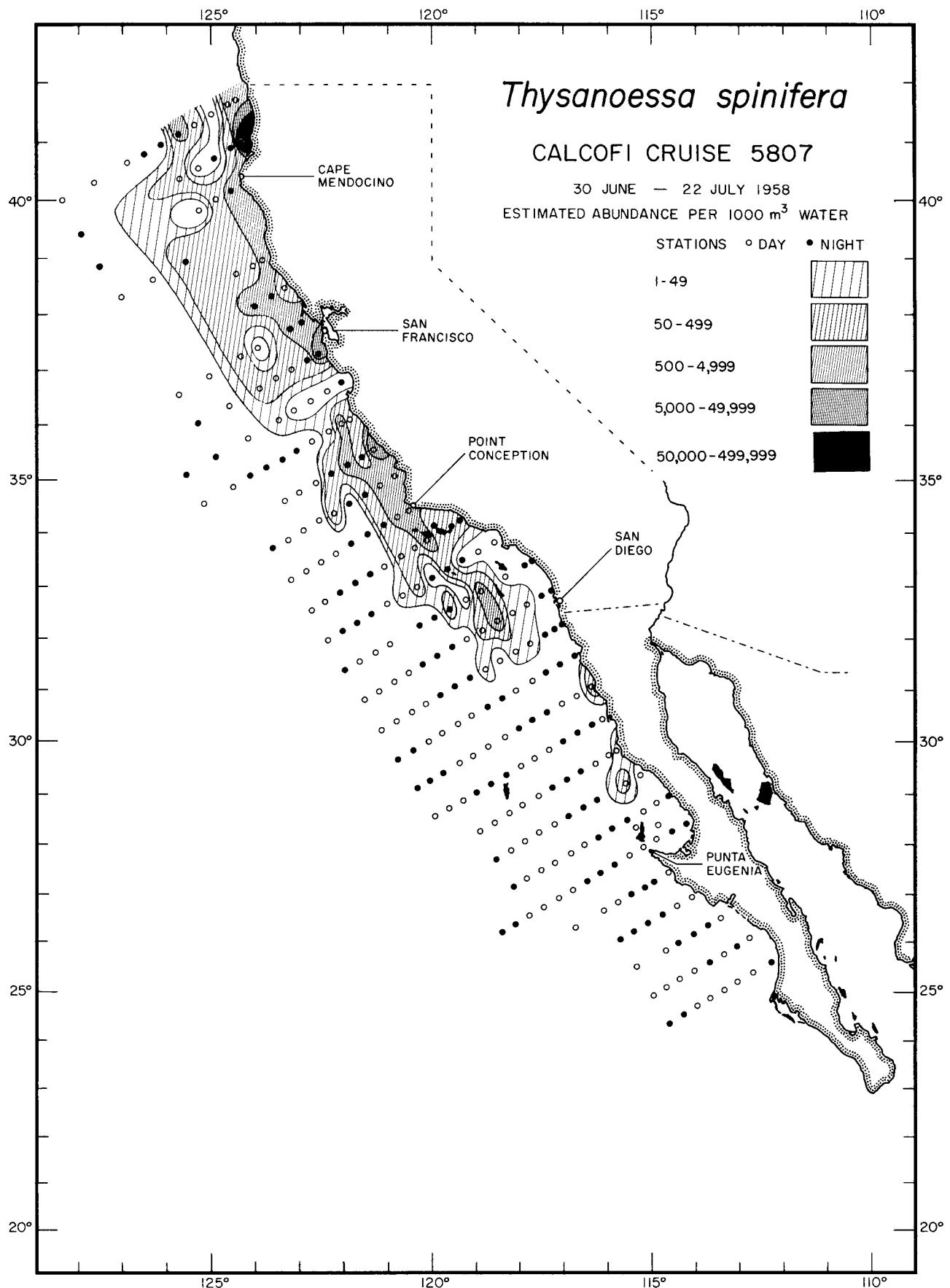


Euphausiacea
Thysanoessa spinifera

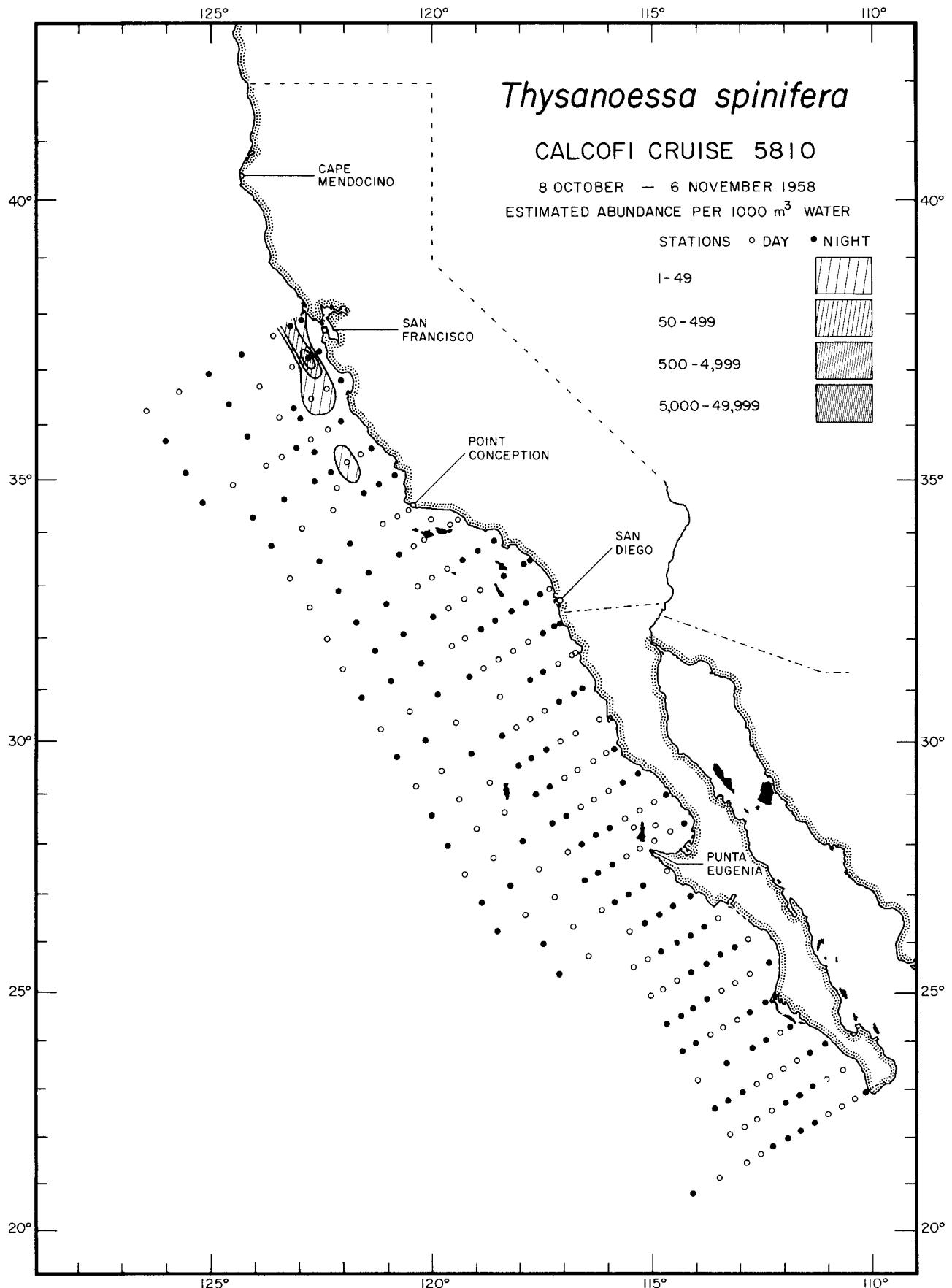
5711



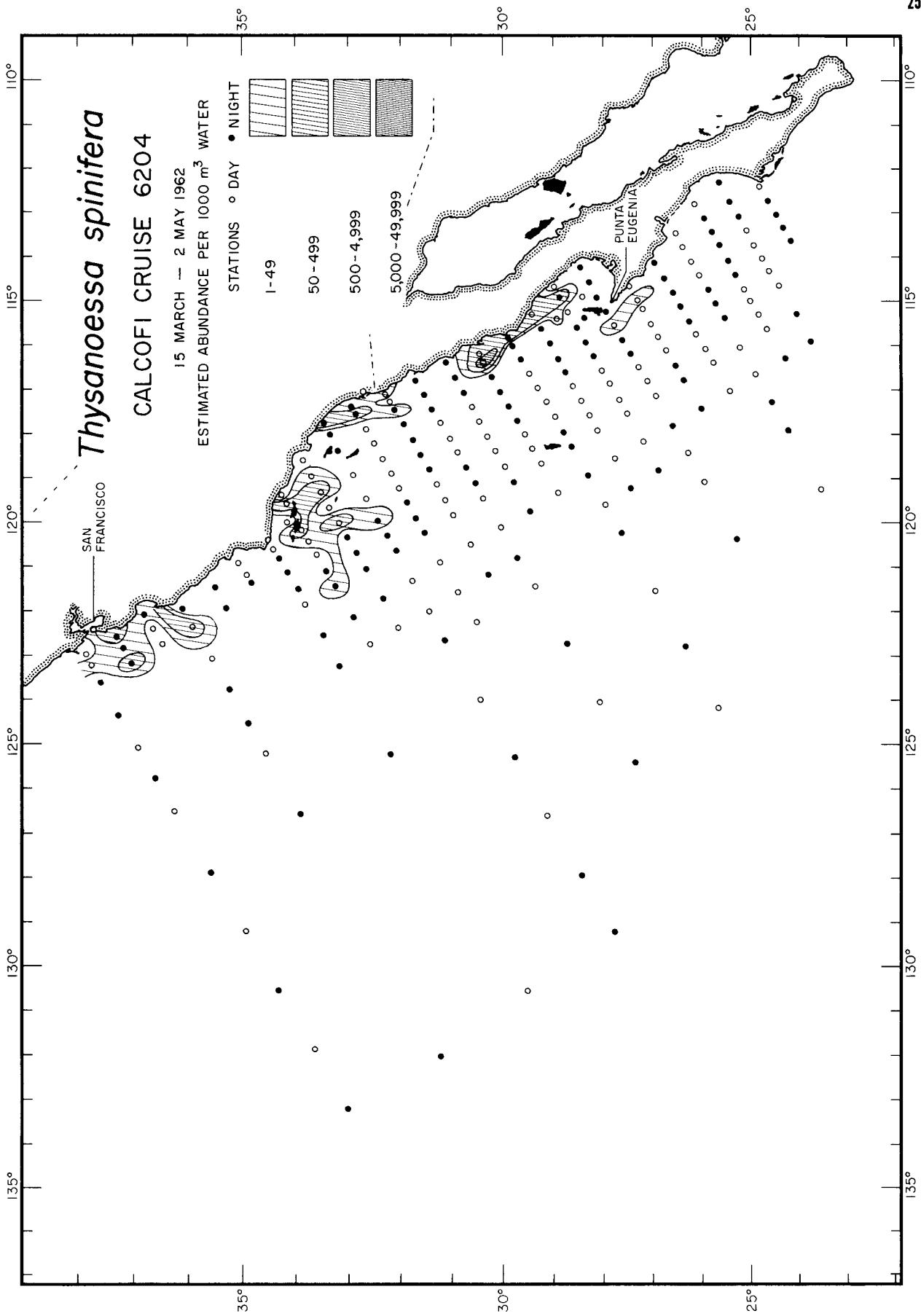
Euphausiacea
Thysanoessa spinifera
5804



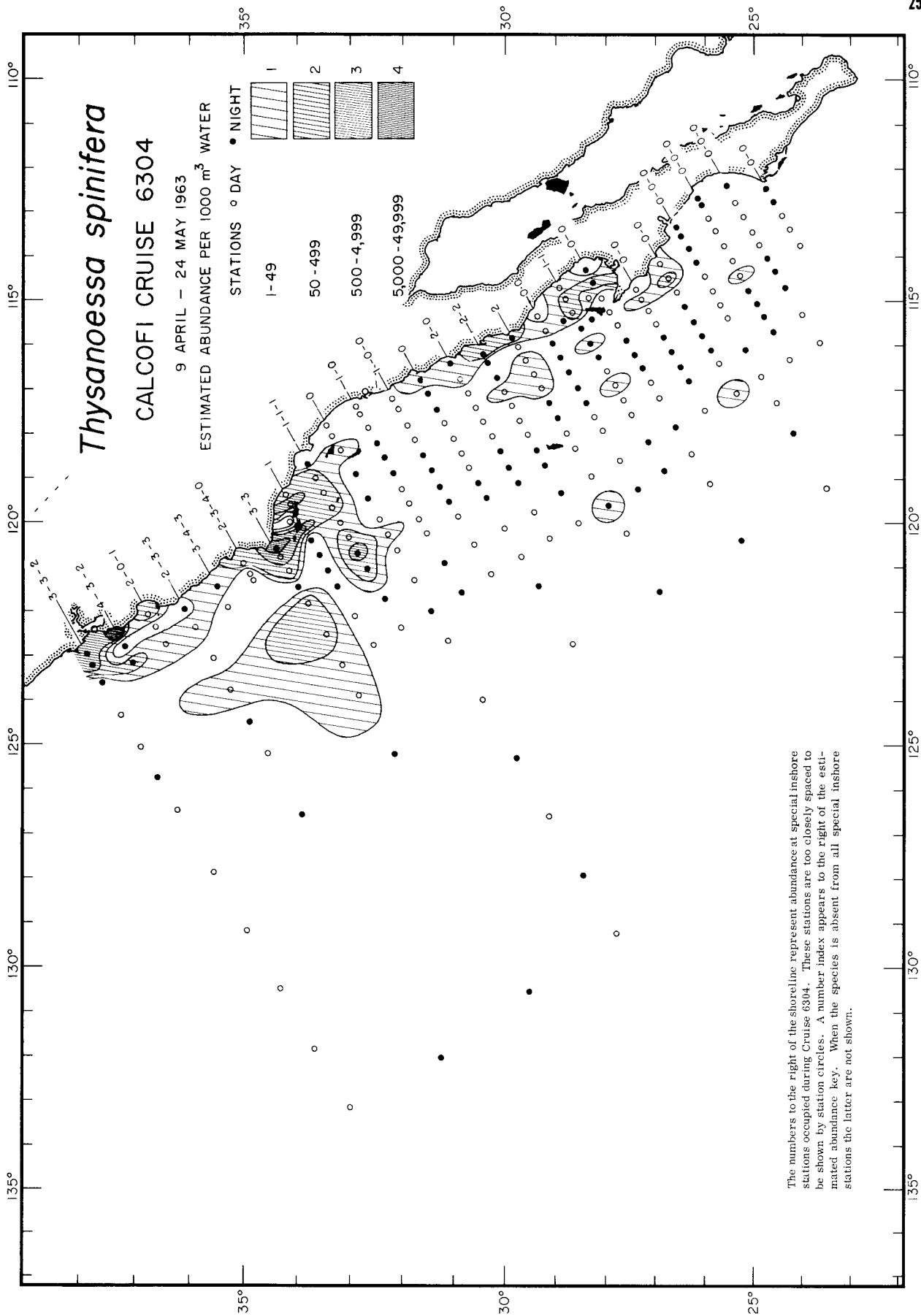
Euphausiacea
Thysanoessa spinifera
 5807



Euphausiacea
Thysanoessa spinifera
 5810

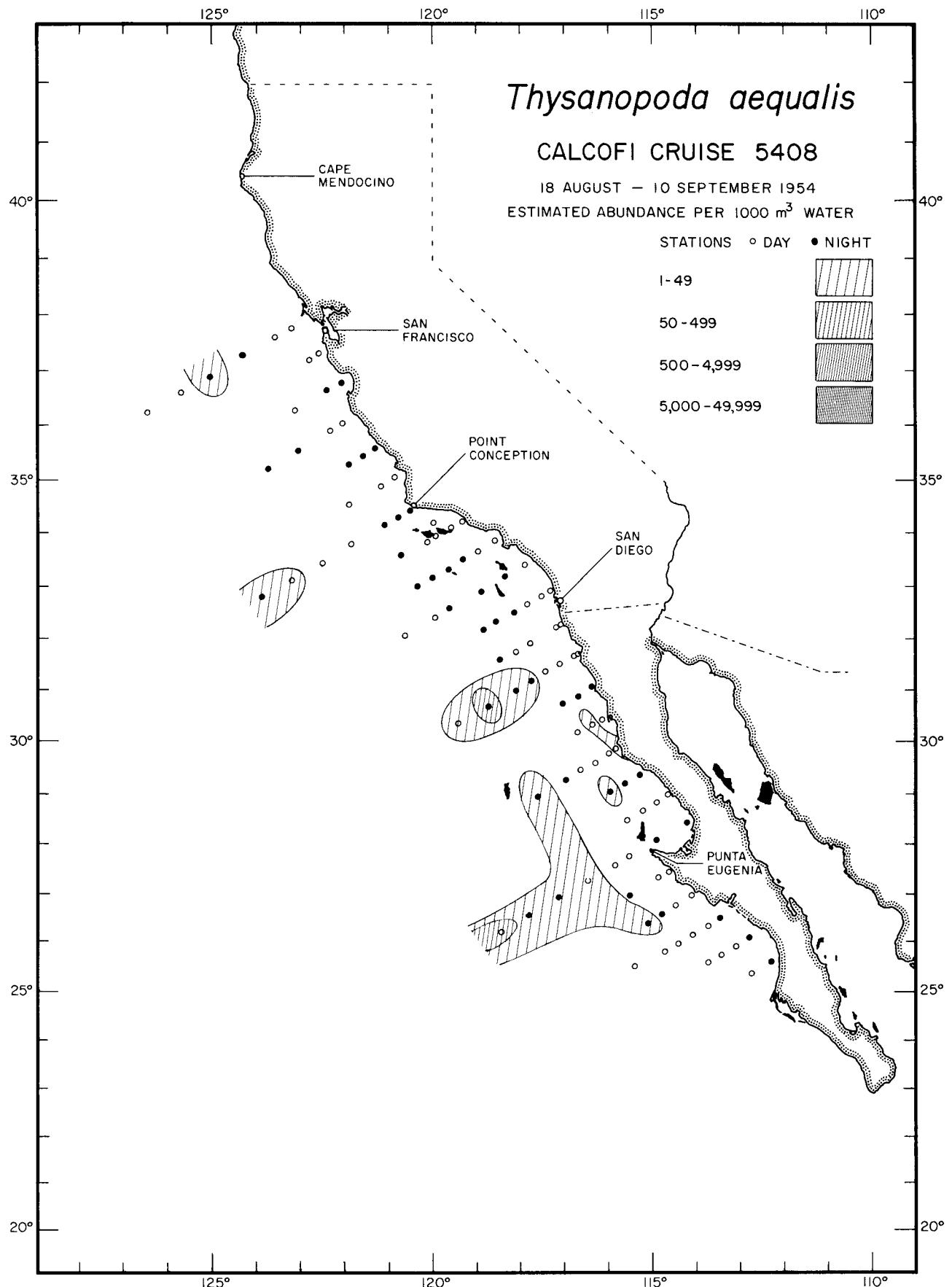


Euphausiacea
Thysanoessa spinifera
6204



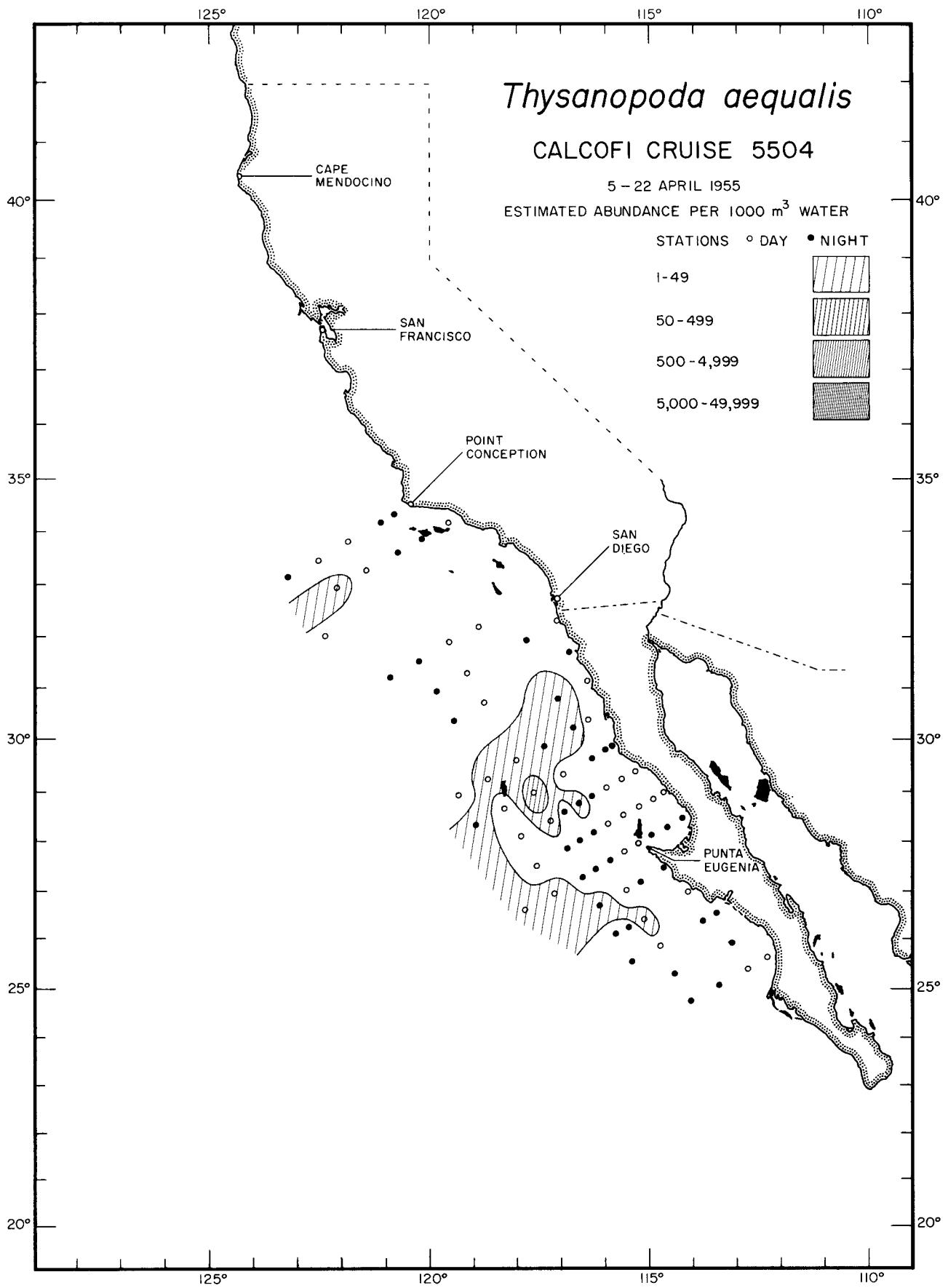
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Euphausiacea
Thysanoessa spinifera
6304

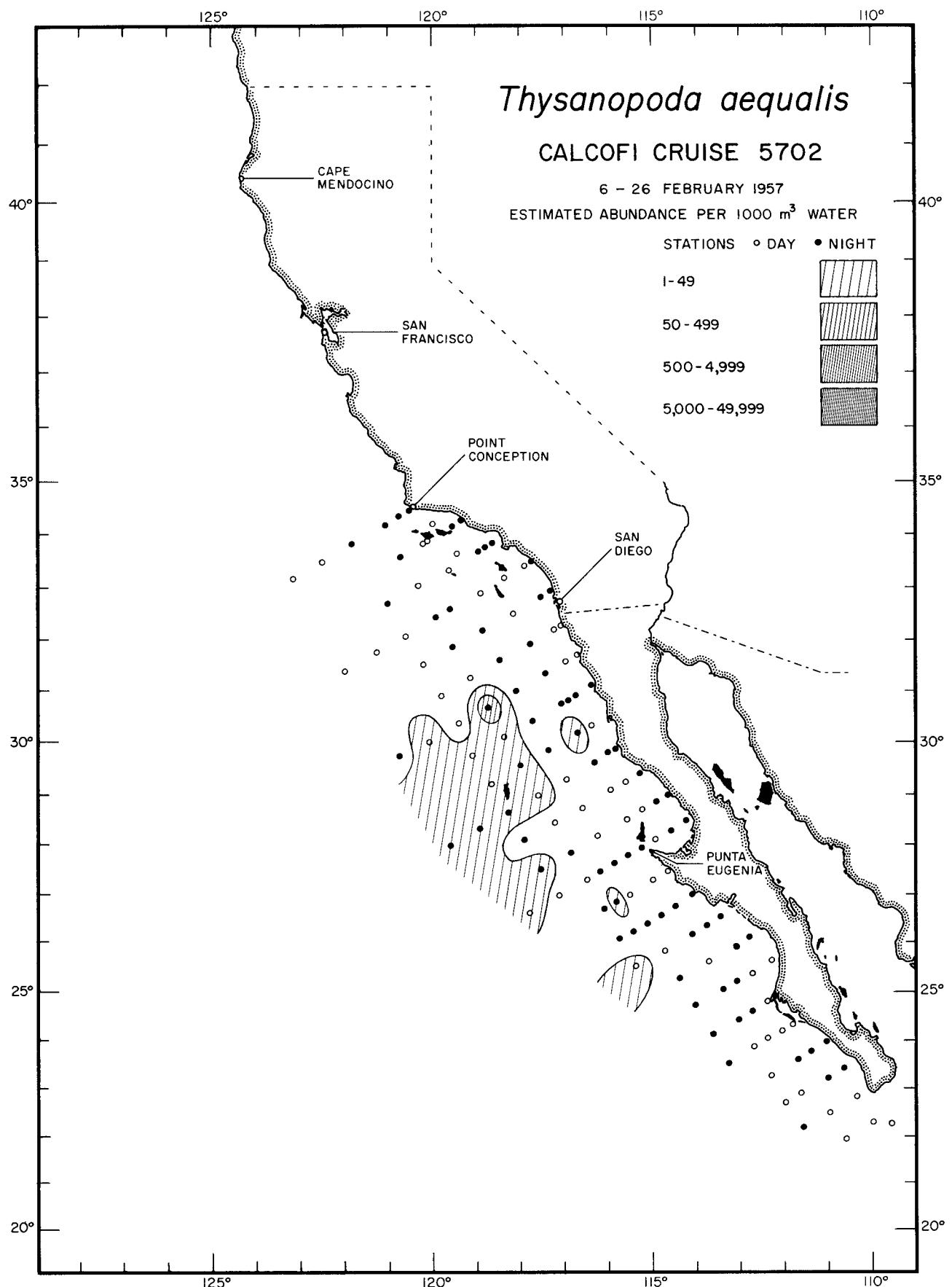


Euphausiacea
Thysanopoda aequalis

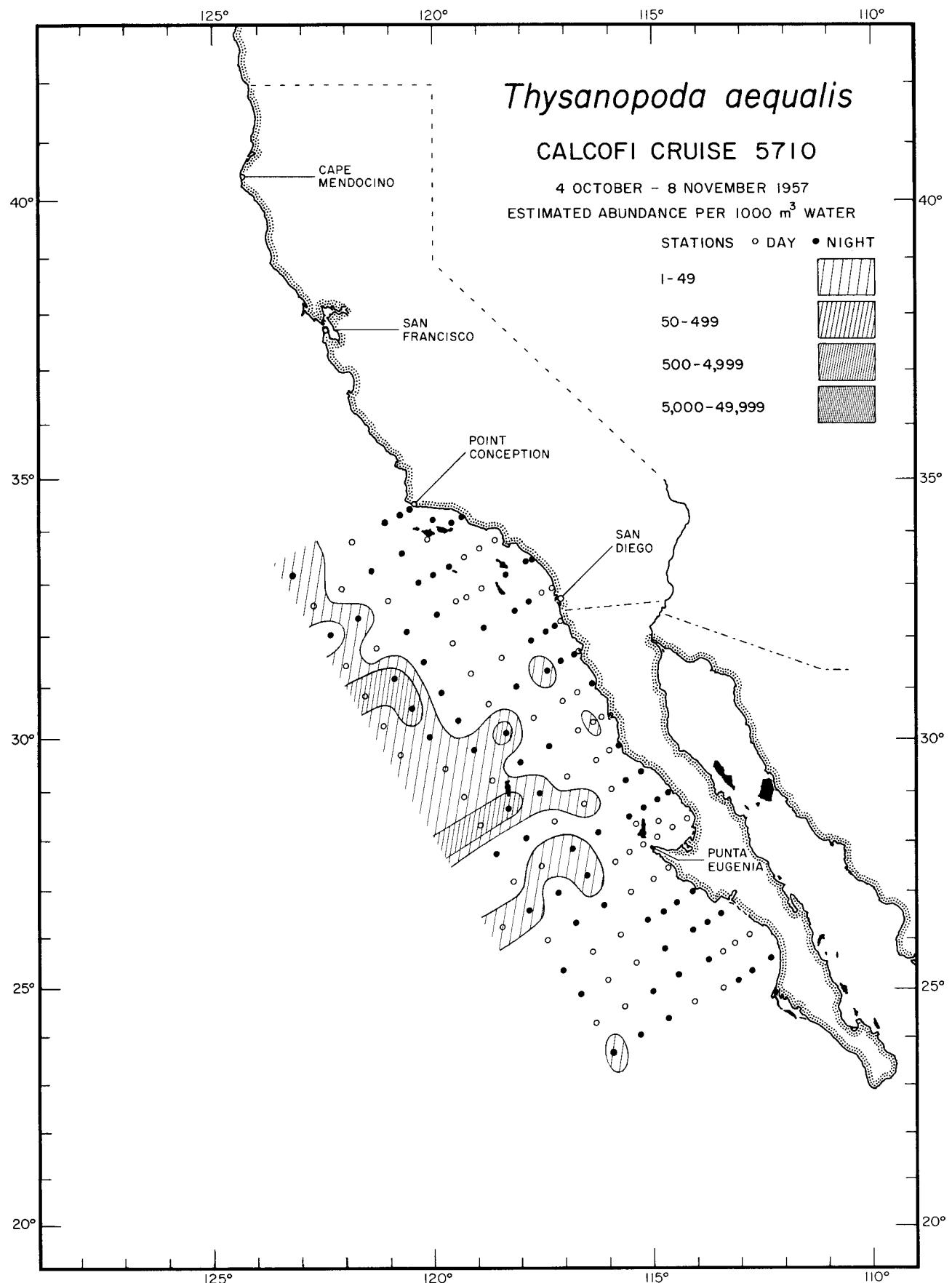
5408



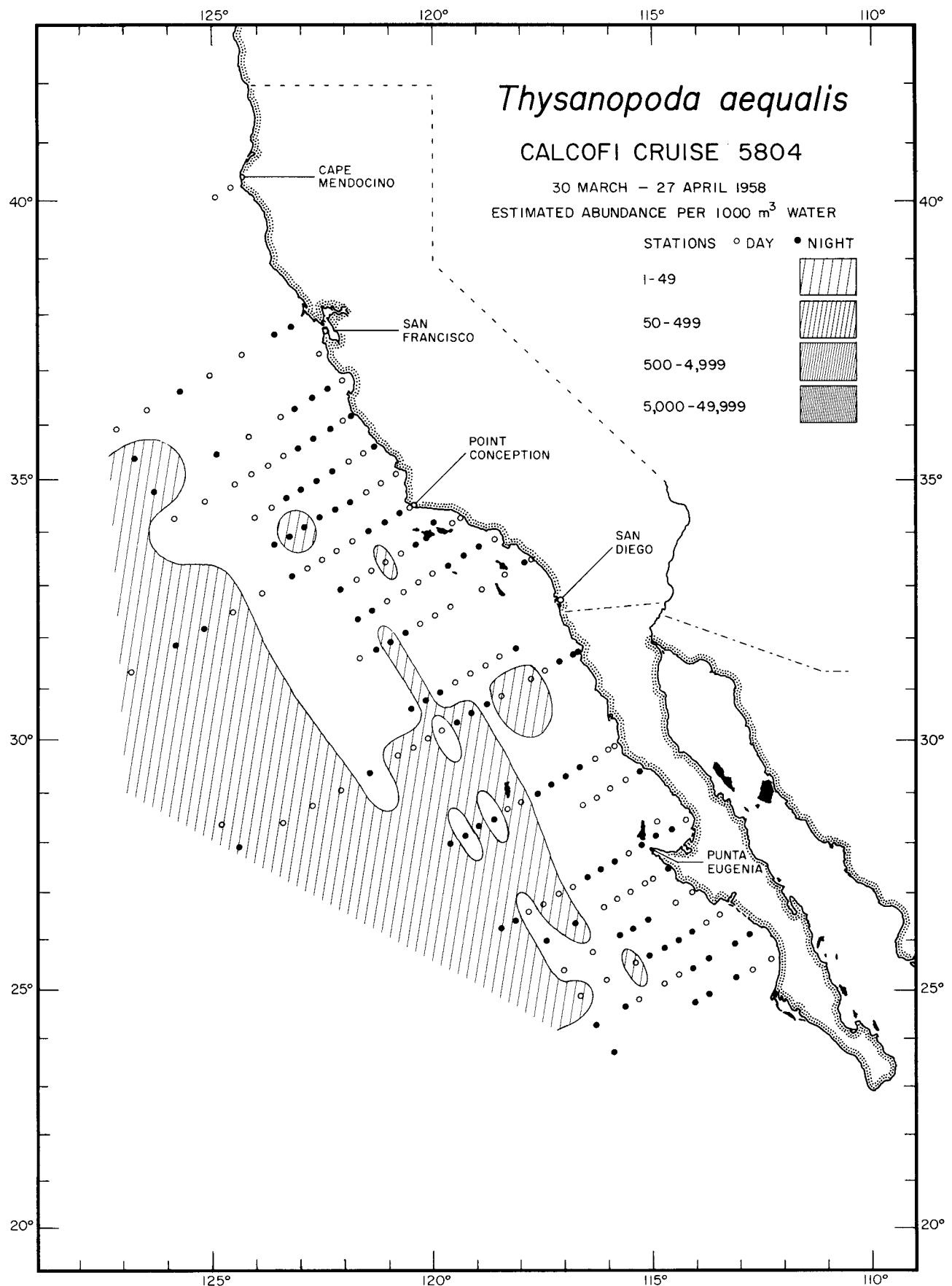
Euphausiacea
Thysanopoda aequalis
5504



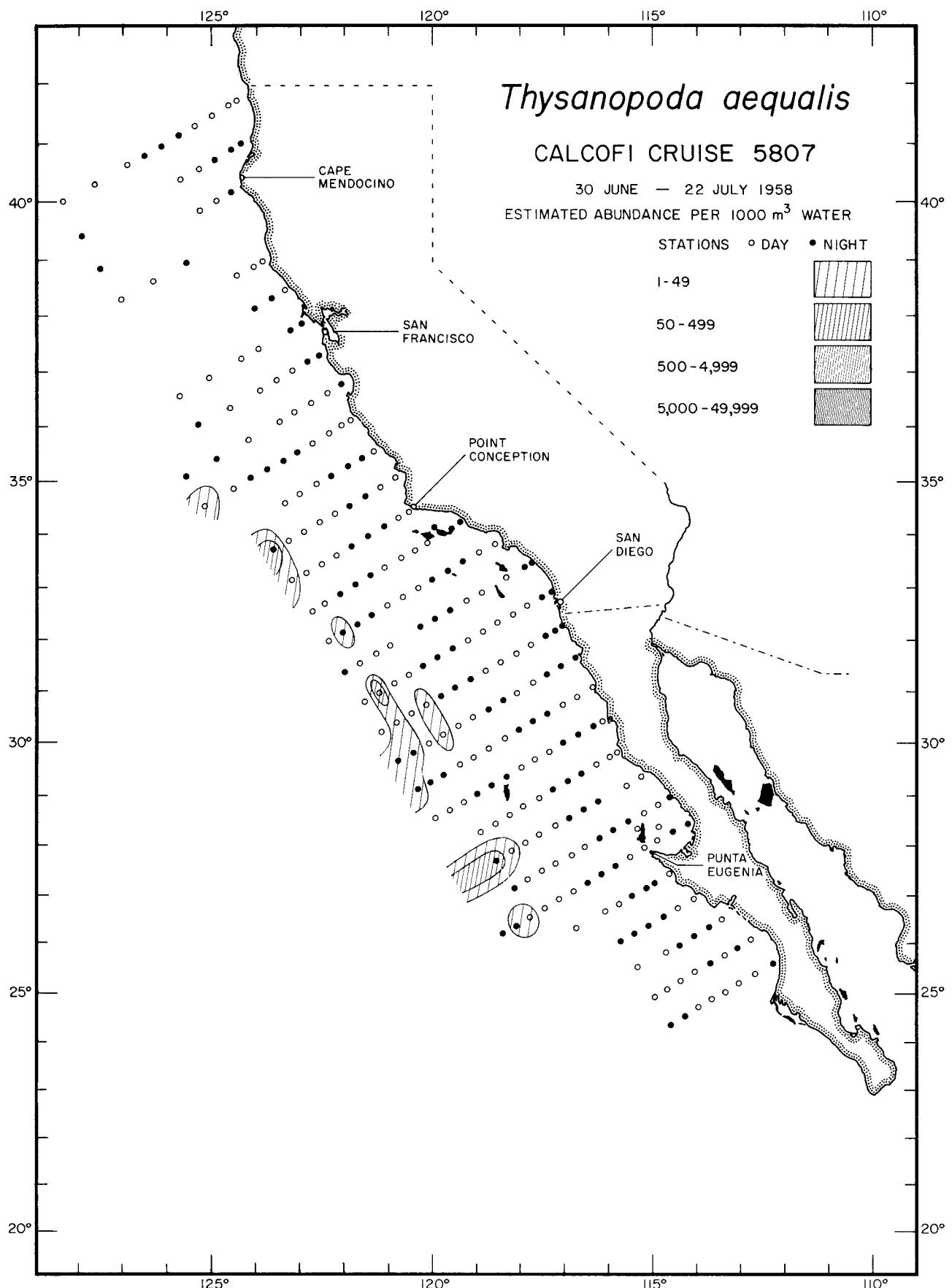
Euphausiacea
Thysanopoda aequalis
5702



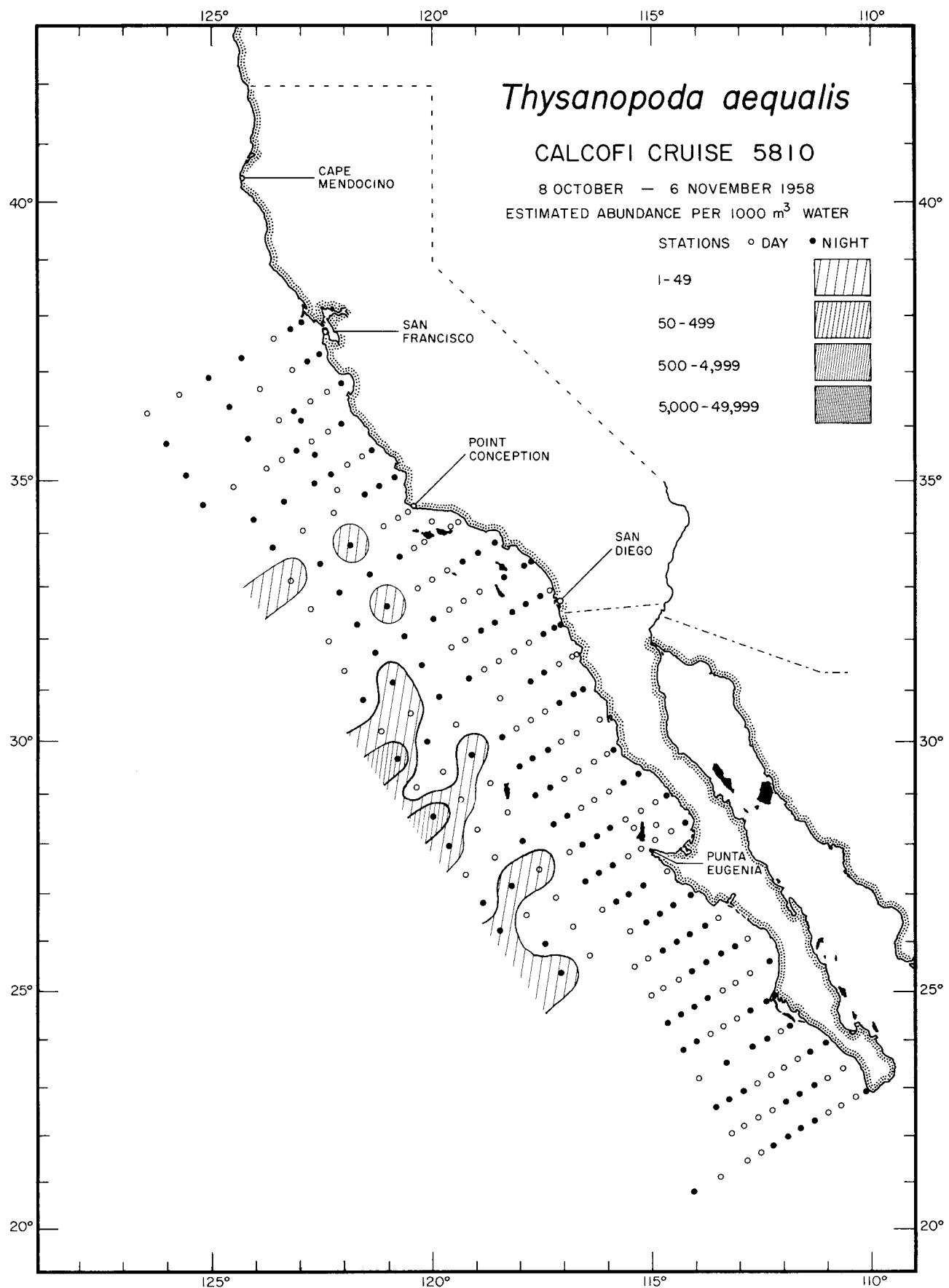
Euphausiacea
Thysanopoda aequalis
 5710



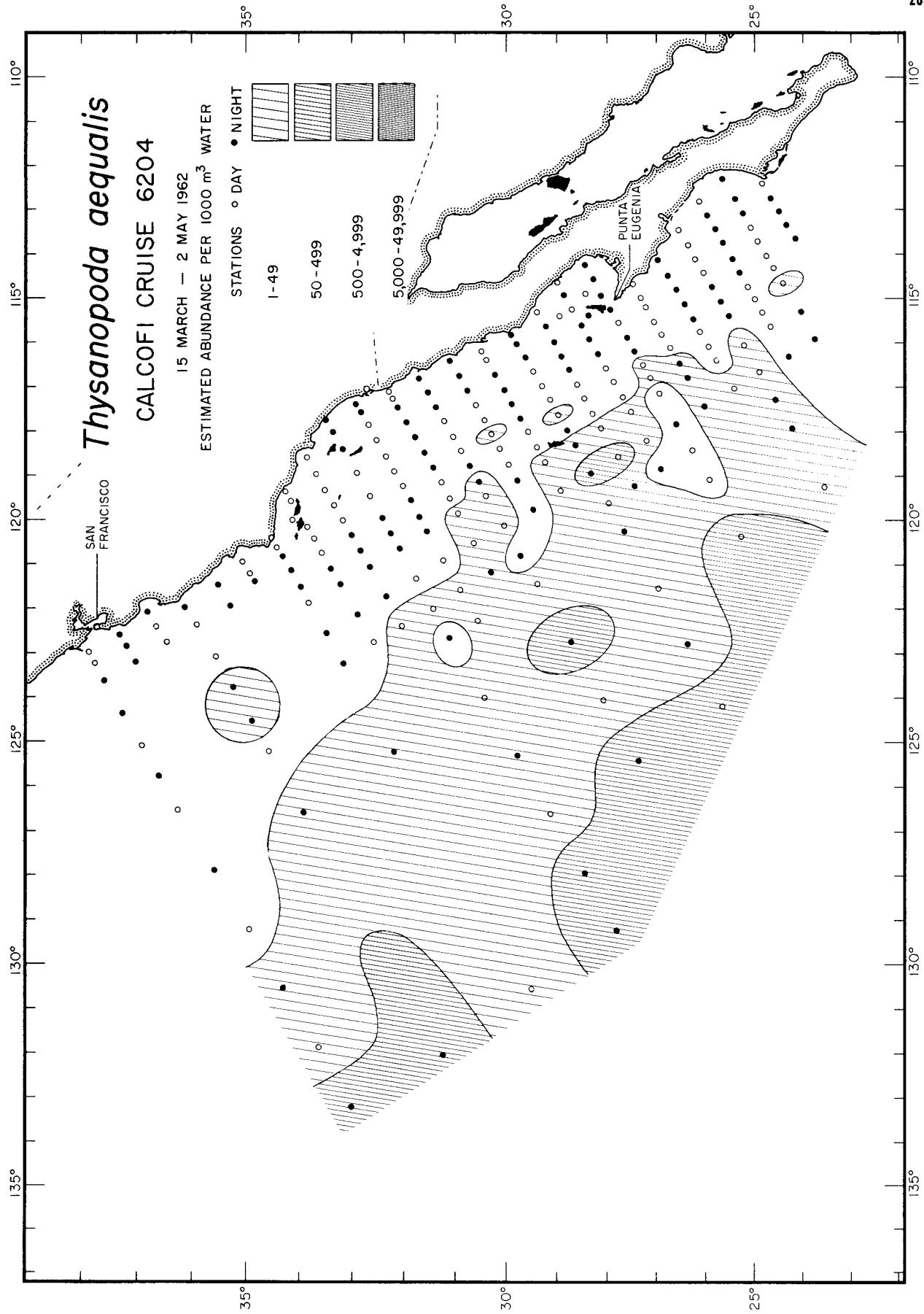
Euphausiacea
Thysanopoda aequalis
5804



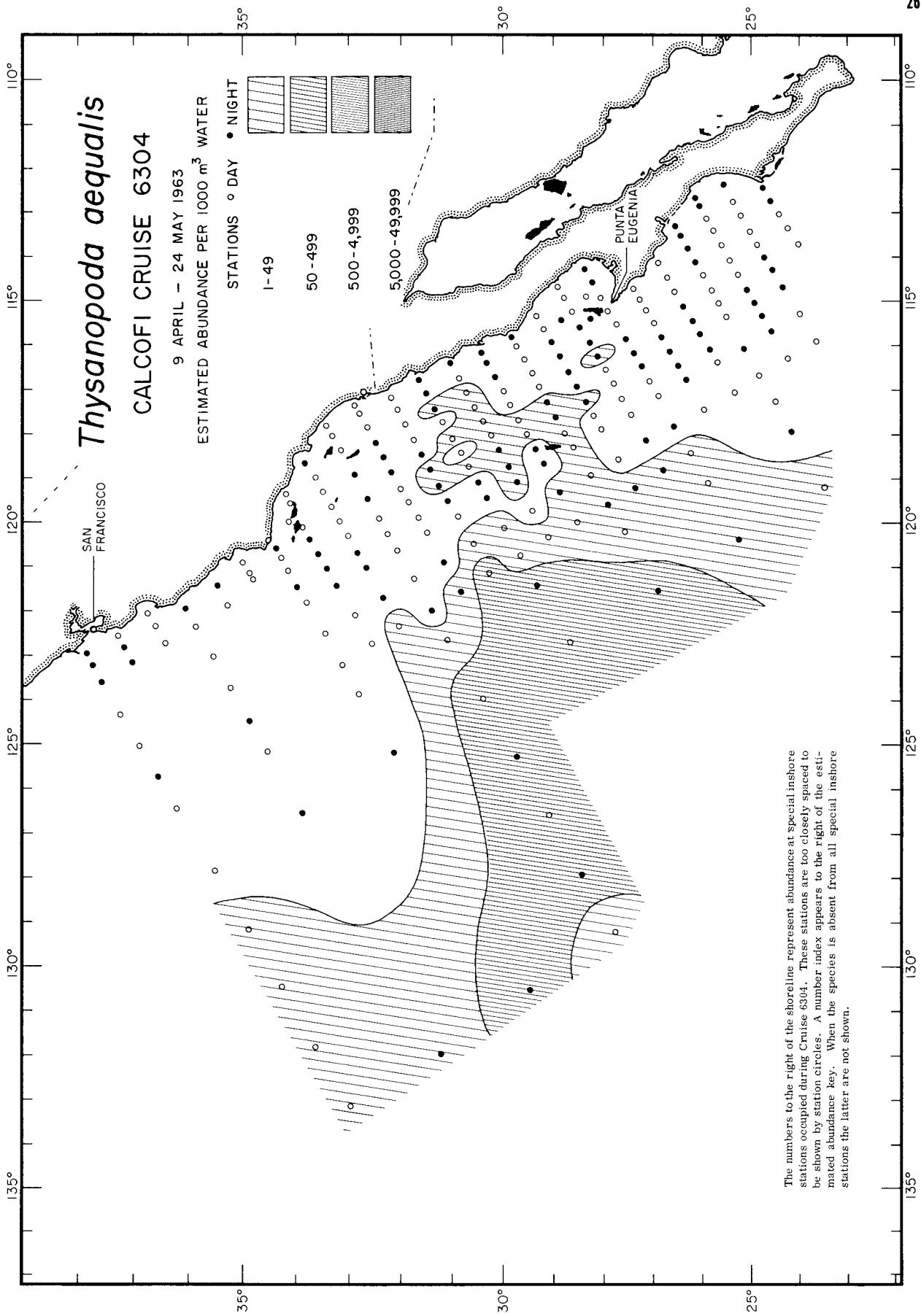
Euphausiacea
Thysanopoda aequalis
 5807



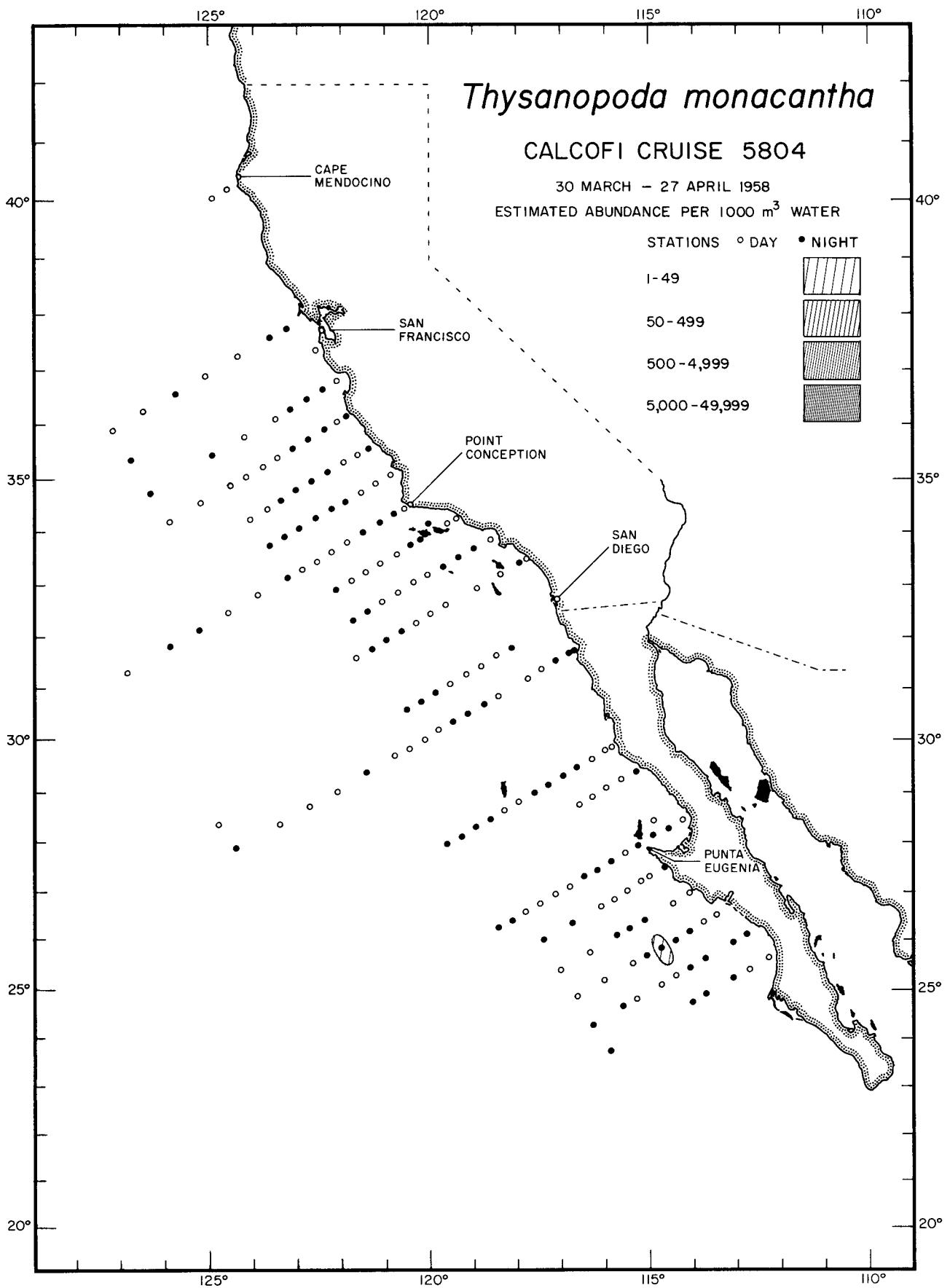
Euphausiacea
Thysanopoda aequalis
5810



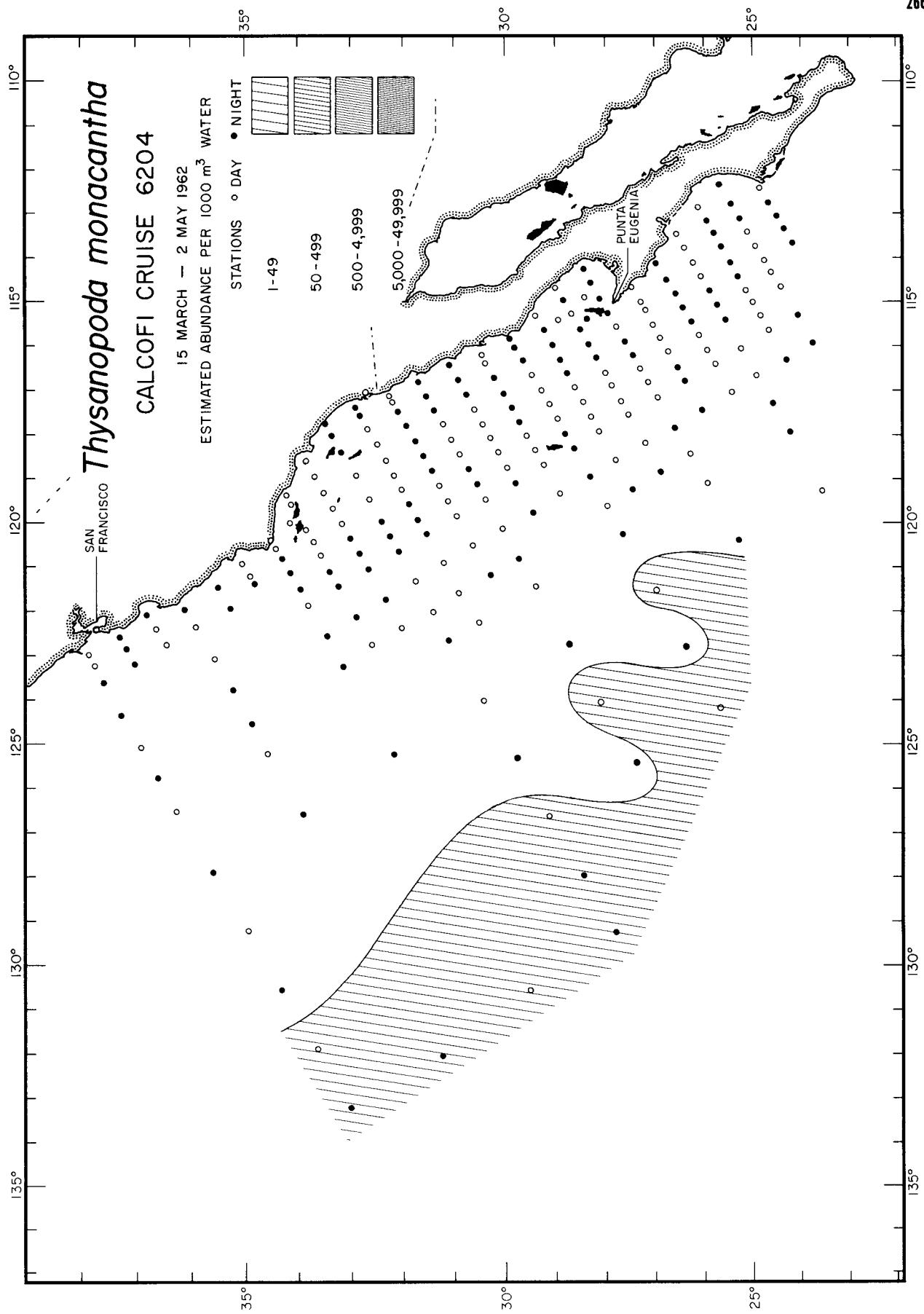
Euphausiacea
Thysanopoda aequalis
 6204



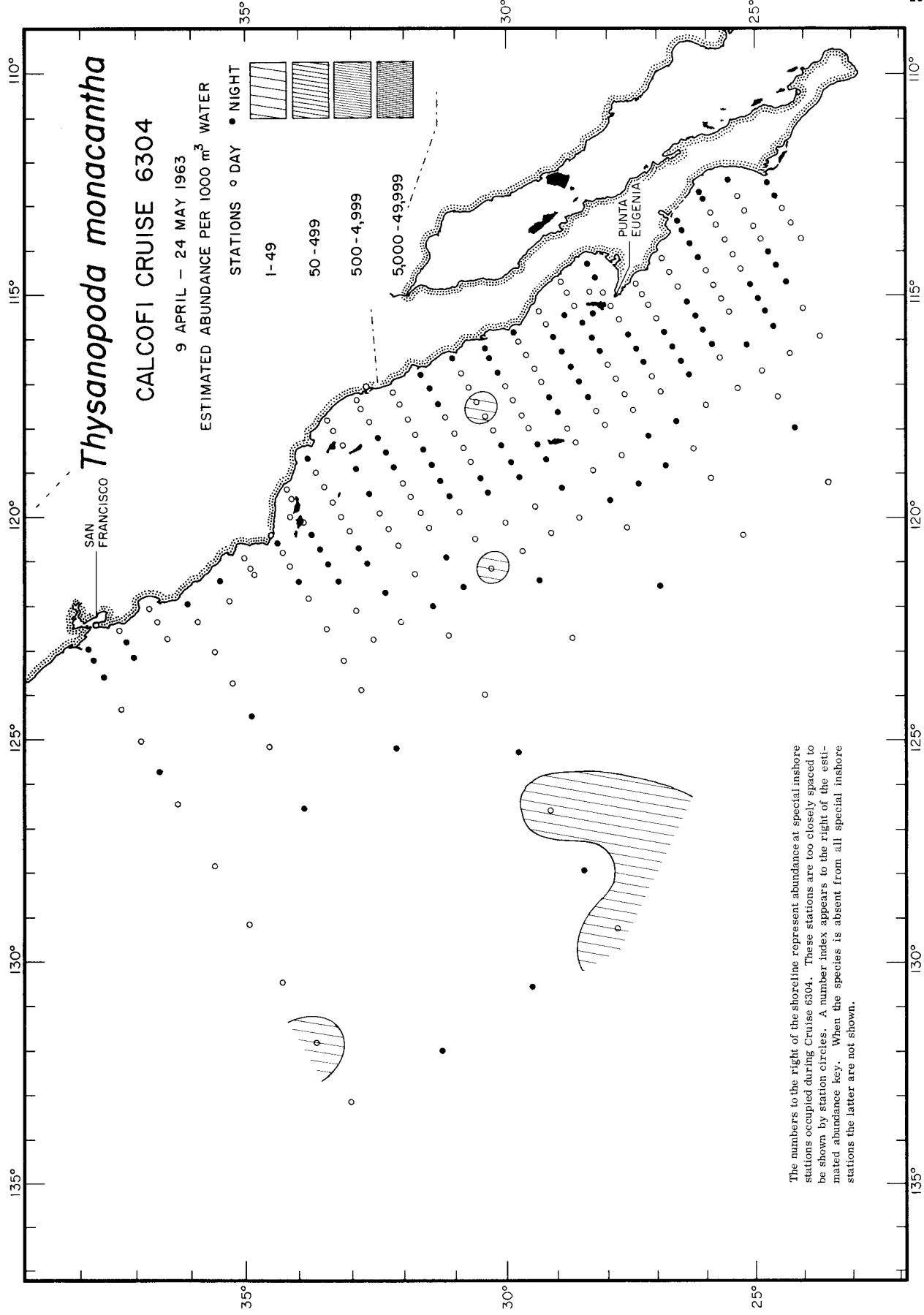
Euphausiacea
Thysanopoda aequalis
6304



Euphausiacea
Thysanopoda monacantha
5804

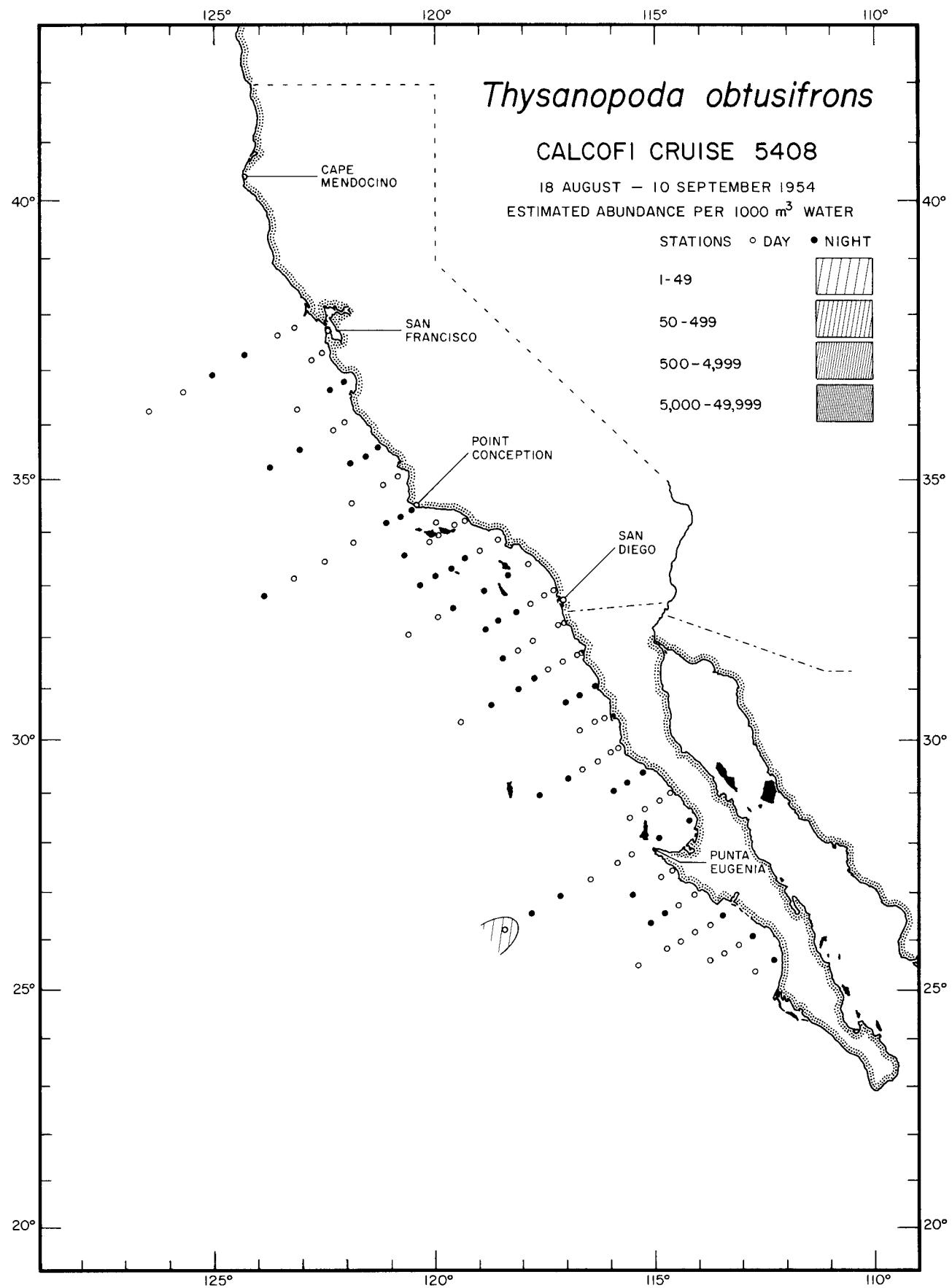


Euphausiacea
Thysanopoda monacantha
 6204

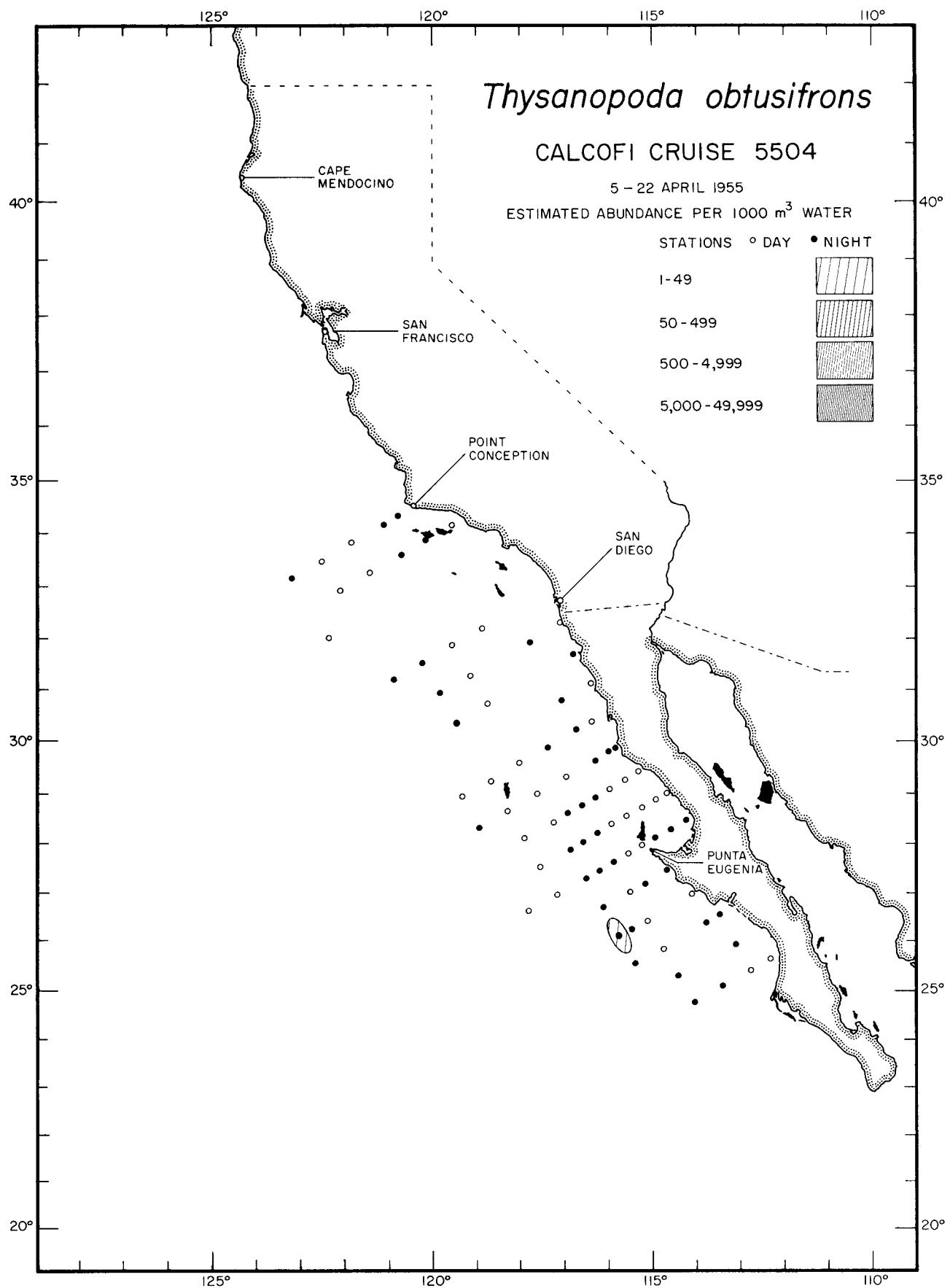


The numbers to the right of the shoreline represent abundance at special instore stations occupied during Cruise 6304. These stations are too closely spaced to be shown by station circles. A number index appears to the right of the estimated abundance key. When the species is absent from all special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

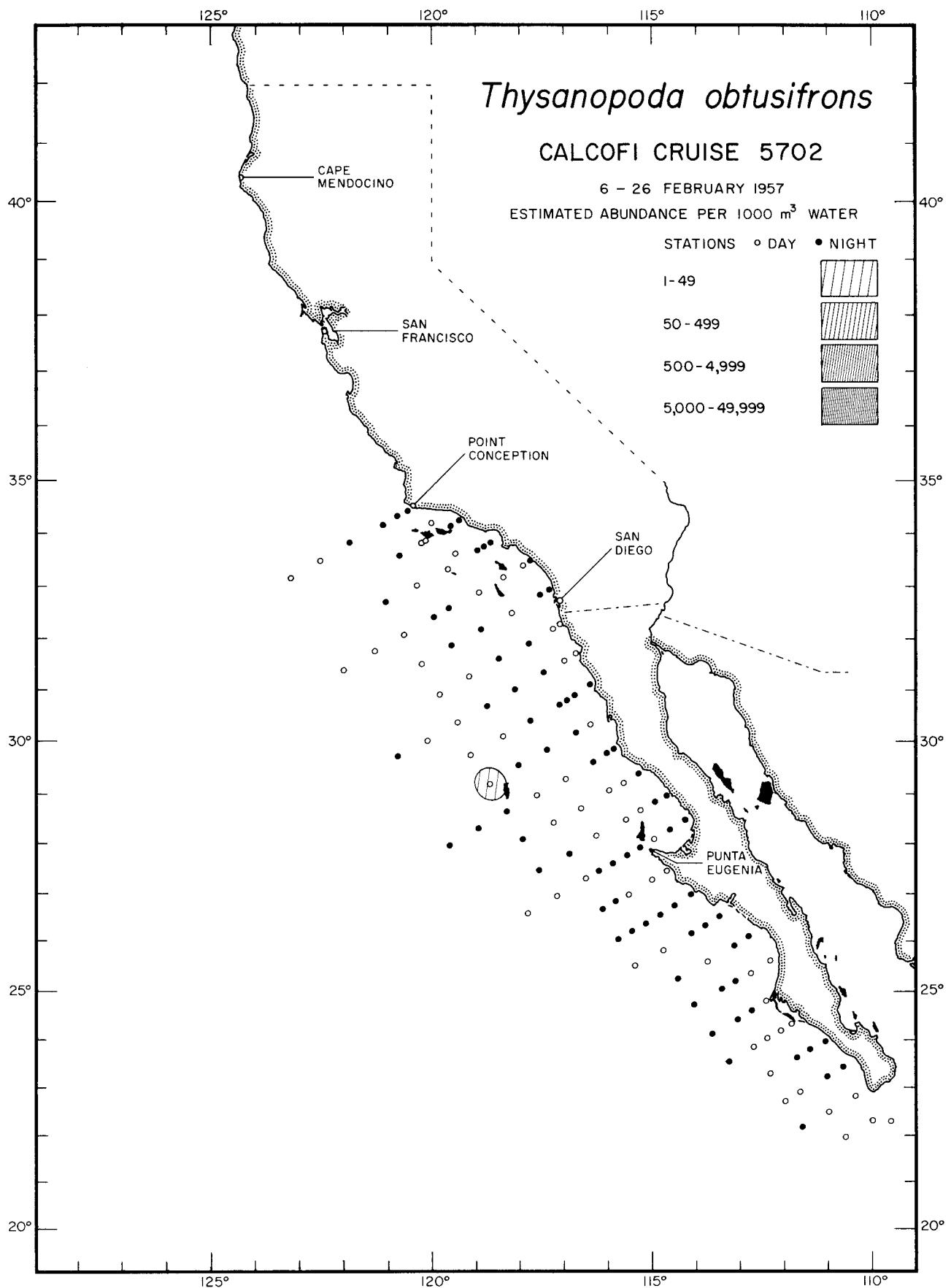
Euphausiacea
Thysanopoda monacantha
6304



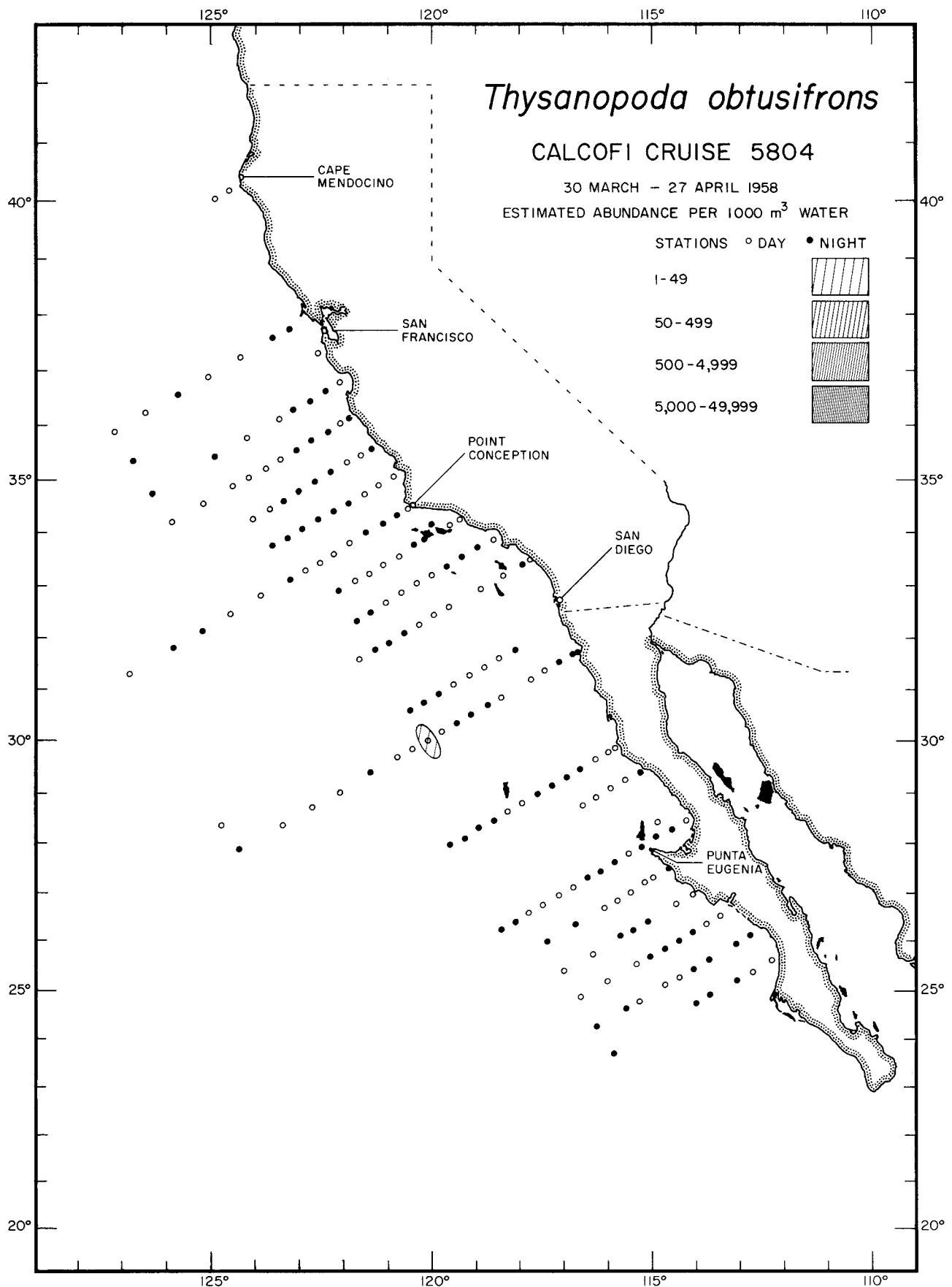
Euphausiacea
Thysanopoda obtusifrons
5408



Euphausiacea
Thysanopoda obtusifrons
 5504

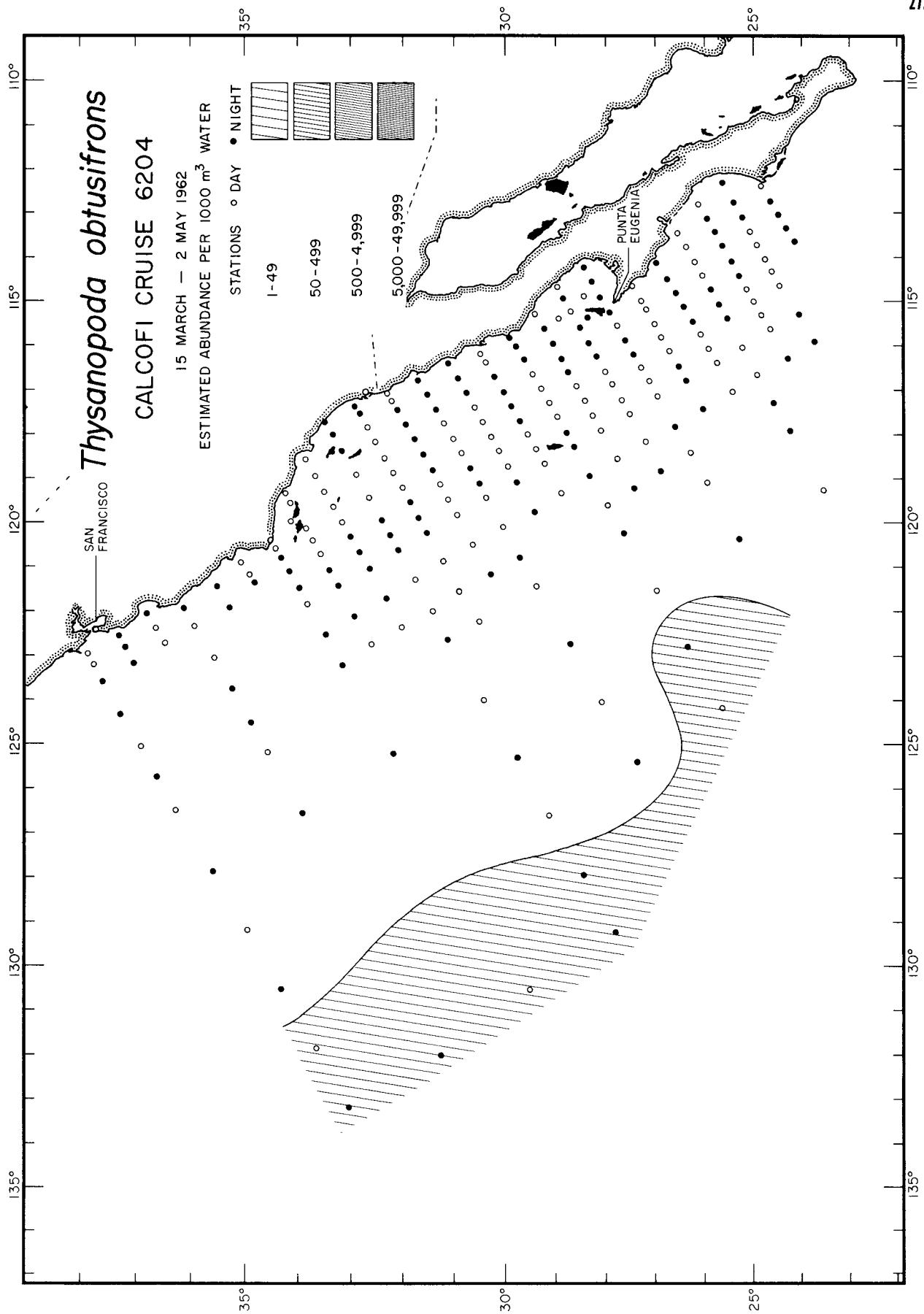


Euphausiacea
Thysanopoda obtusifrons
 5702

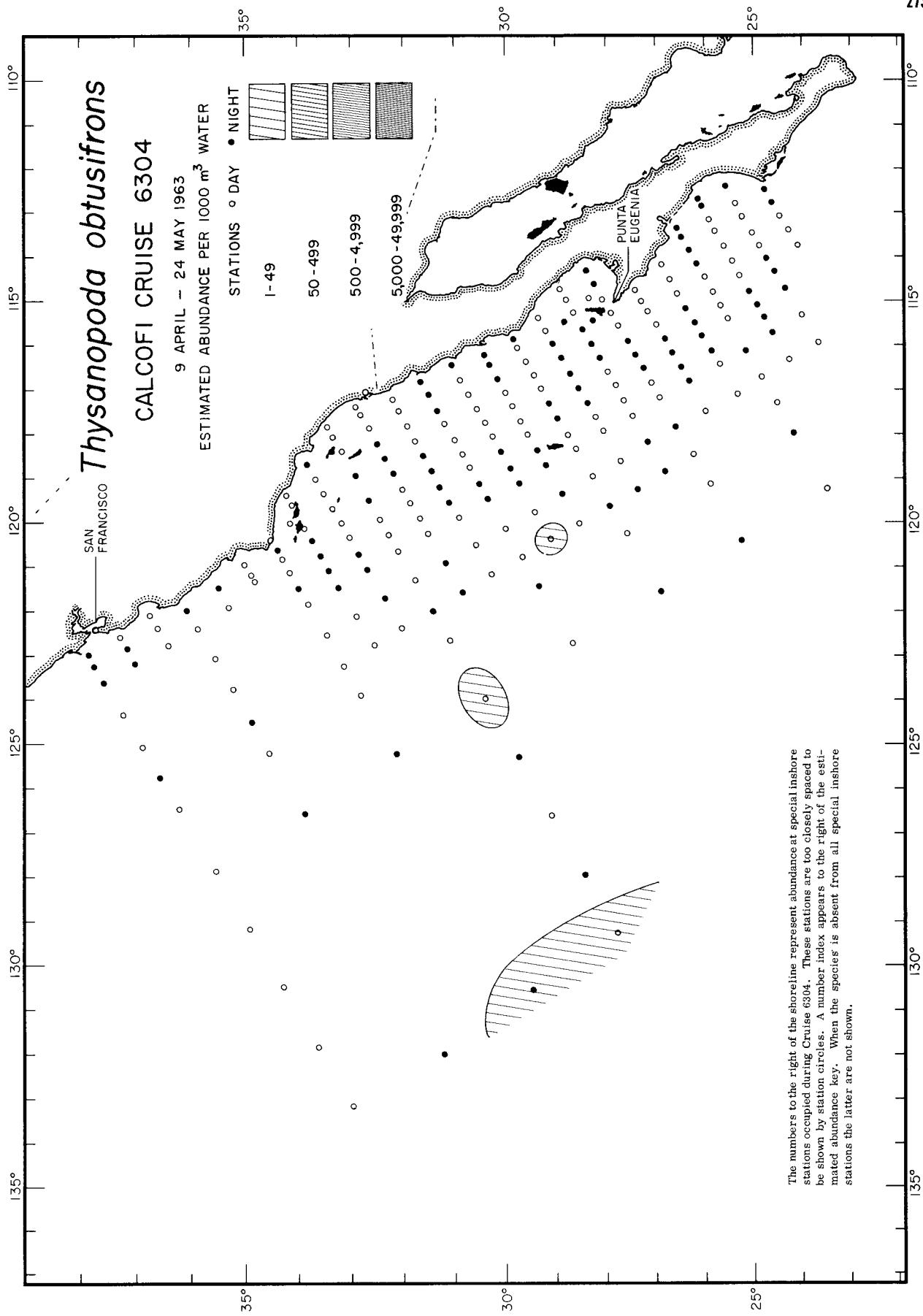


Euphausiacea
Thysanopoda obtusifrons

5804

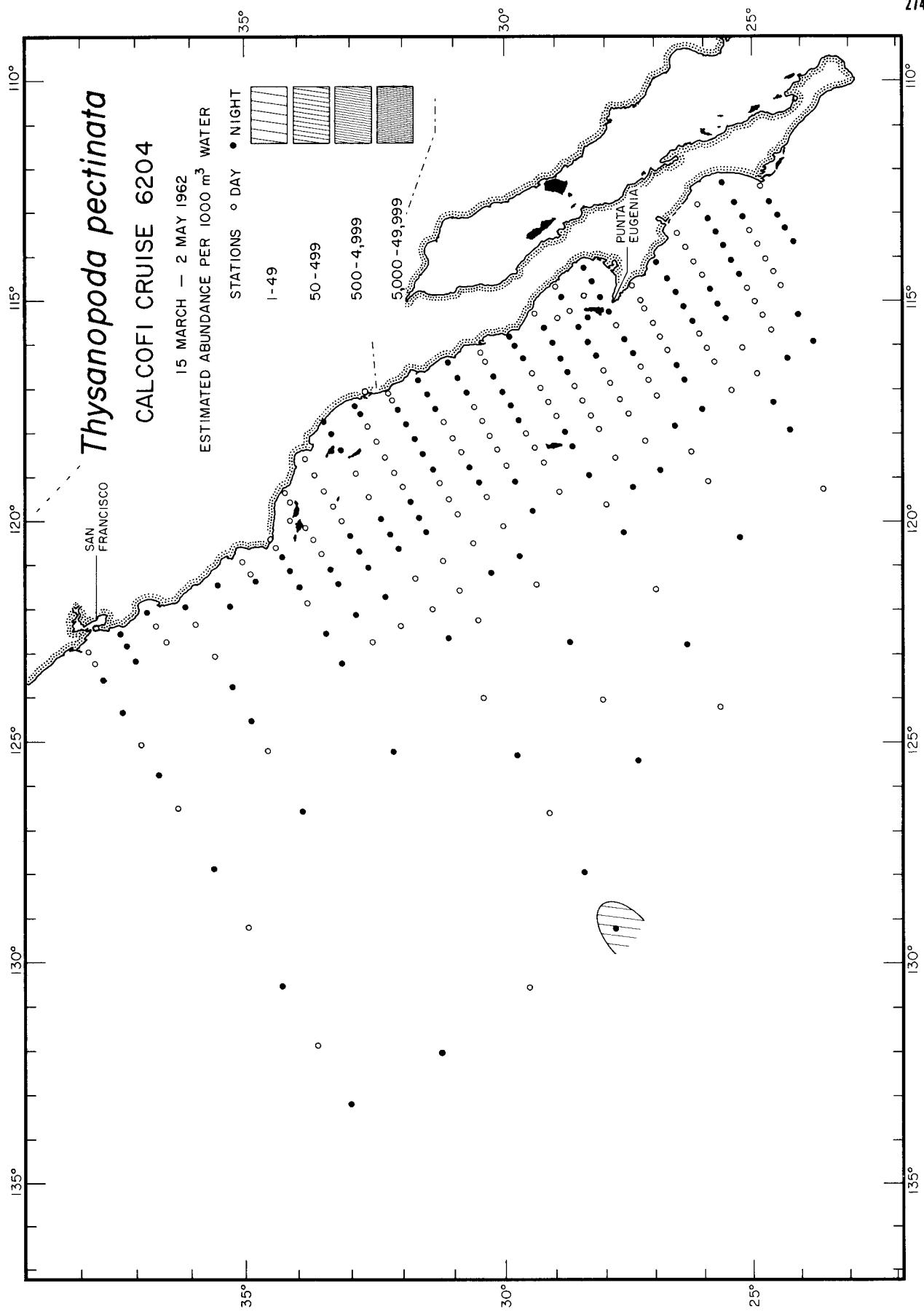


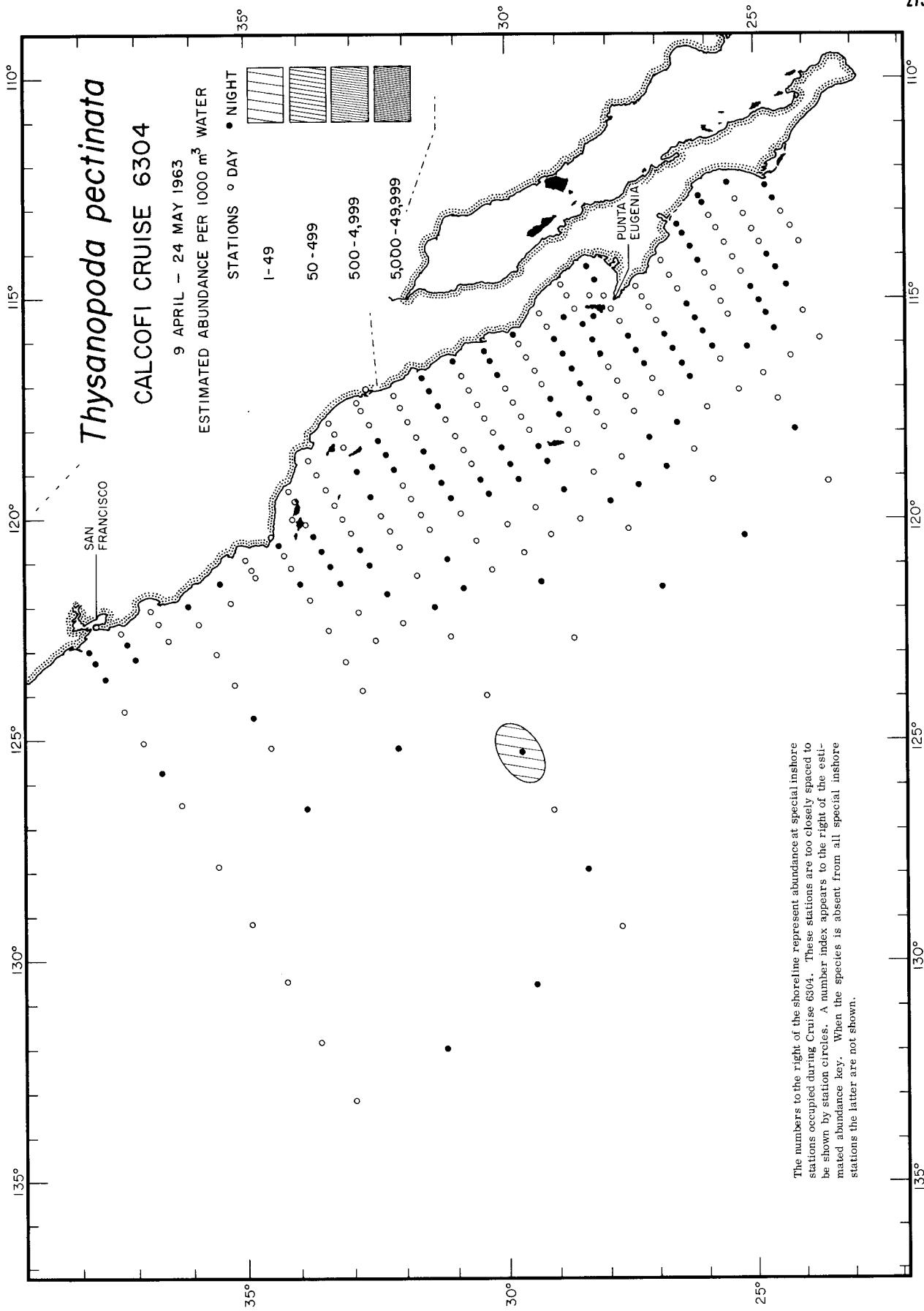
Euphausiacea
Thysanopoda obtusifrons
 6204



Euphausiacea
Thysanopoda obtusifrons
6304

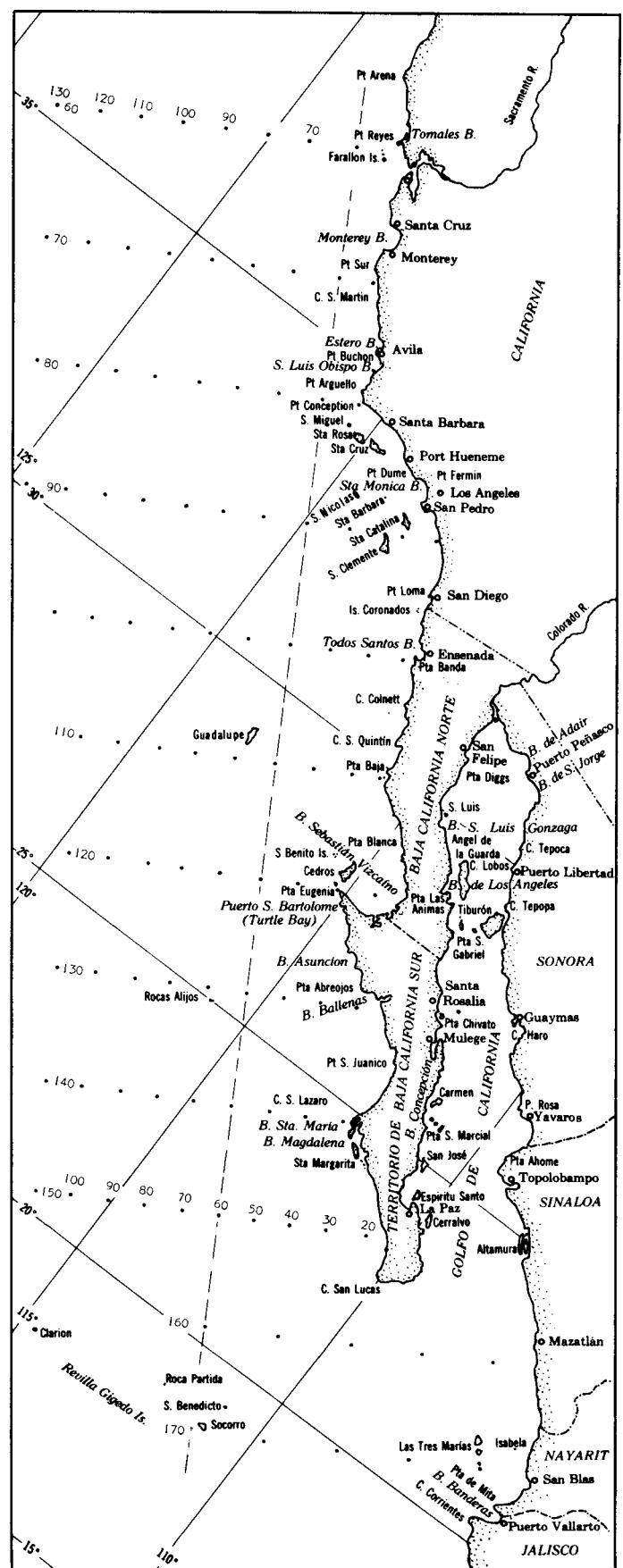
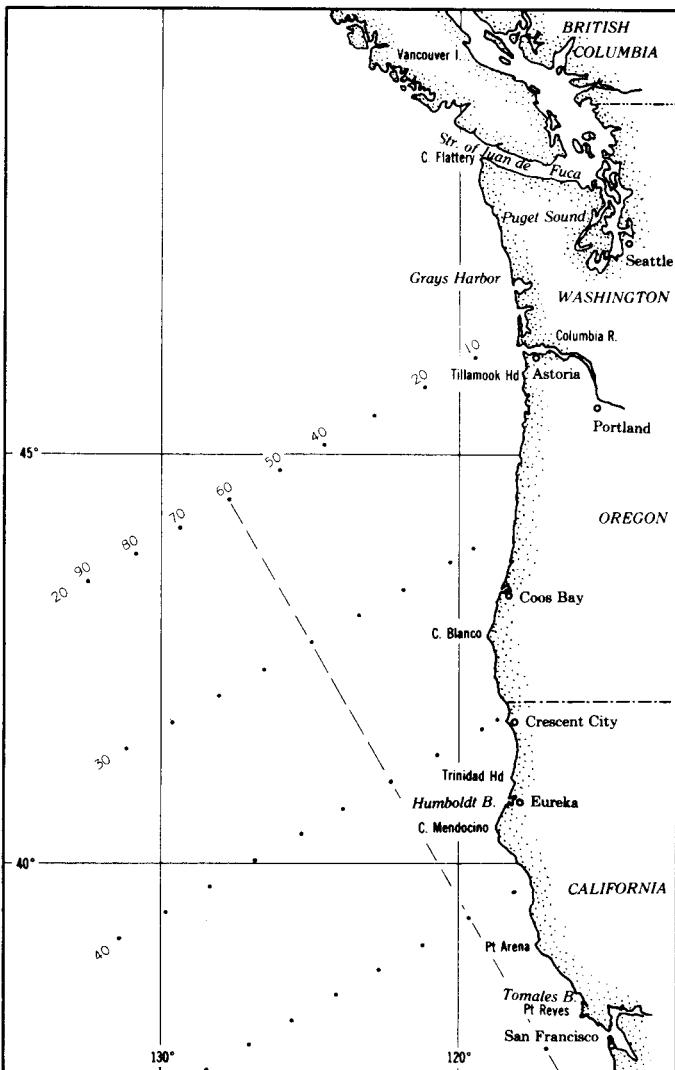
The numbers to the right of the shoreline represent abundance at special inshore stations occupied during Cruise 6304. These stations are too closely spaced to be shown by station circles. A number index appears to the right of the estimated abundance key. When the species is absent from all special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





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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