



Atlas 19: Bowman, T. E. and M. W. Johnson. Distributional atlas of calanoid copepods in the California Current region, 1949 and 1950. Published June 1973.

16 May 2007

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

the Smithsonian web site,

[http://ravenel.si.edu/iz/copepod/species/species\\_Search.cfm](http://ravenel.si.edu/iz/copepod/species/species_Search.cfm)

Frost, B. and Fleminger, A. 1968. A revision of the genus *Clausocalanus* (Copepoda: Calanopoda) with remarks on distributional patterns in diagnostic characters. Bulletin of the Scripps Institution of Oceanography 12, 1-235.

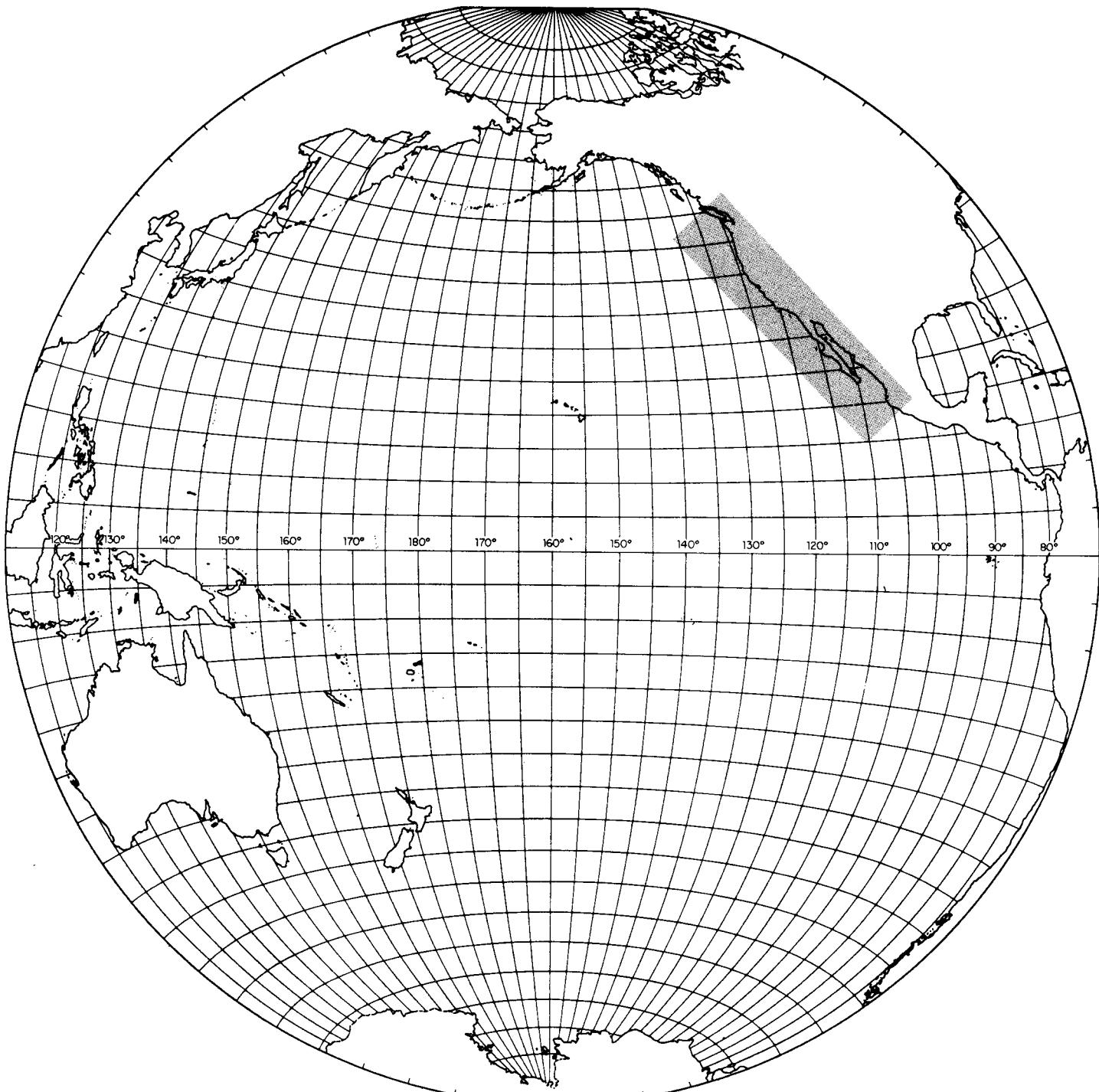
Bradford, J. 1976. Partial Revision of the *Acartia* subgenus *Acartiura* (Copepoda: Calanoida: Acartiidae). N.Z. Journal of Marine and Freshwater Research 19(1): 159-202.

Park, T. 1994. Taxonomy and distribution of the marine calanoid copepod family Euchaetidae. Bulletin of the Scripps Institution of Oceanography 29: 1-203.

Mauchline, J. 1998. The Biology of Calanoid Copepods. Advances in Marine Biology 33: 1-710.

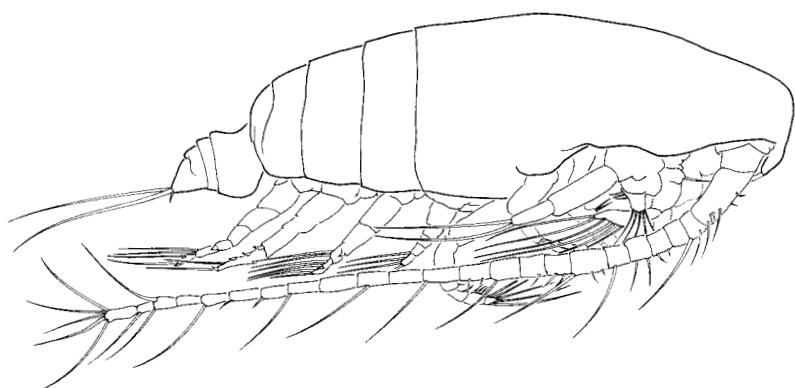
Park, T. 1999. Taxonomy and distribution of the marine calanoid copepod family Heterorhabdidae. Bulletin of the Scripps Institution of Oceanography 31: 1-269.

STATE OF CALIFORNIA  
MARINE RESEARCH COMMITTEE

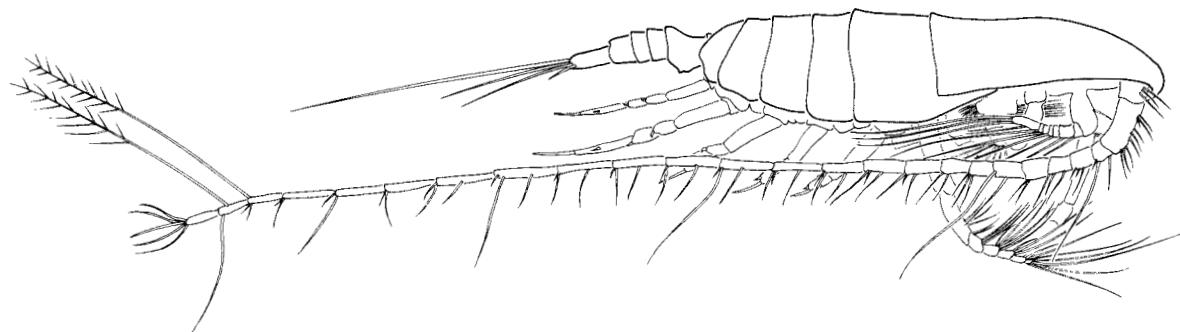


**CALIFORNIA COOPERATIVE OCEANIC  
FISHERIES INVESTIGATIONS**

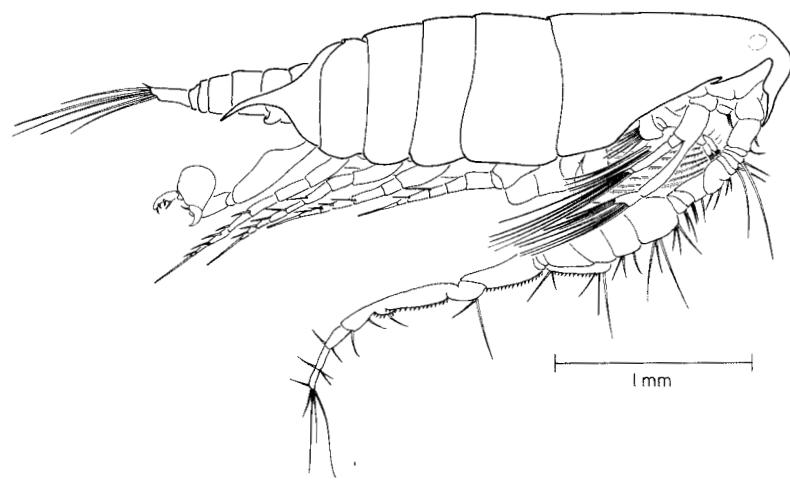
**ATLAS No. 19**



*Eucalanus crassus* ♀



*Calanus lighti* ♀



*Epilabidocera longipedata* ♂

CALIFORNIA  
COOPERATIVE  
OCEANIC  
FISHERIES  
INVESTIGATIONS

*Atlas No. 19*

STATE OF CALIFORNIA  
MARINE RESEARCH COMMITTEE

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UNIVERSITY OF CALIFORNIA, SCRIPPS INSTITUTION OF OCEANOGRAPHY

June, 1973

## THE CALCOFI ATLAS SERIES

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

California Academy of Sciences  
California Department of Fish and Game  
Stanford University, Hopkins Marine Station  
National Oceanic and Atmospheric Administration, National Marine Fisheries Service<sup>2</sup>  
University of California, Scripps Institution of Oceanography

CalCOFI atlases<sup>3</sup> are issued as individual units as they become available. They provide processed physical, chemical and biological measurements of the California Current region. Each number may contain one or more contributions. A general description of the CalCOFI program with its objectives appears in the preface of Atlas No. 2.

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

### CalCOFI Atlas Editorial Staff:

Abraham Fleminger and John G. Wyllie, Editors

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

- No. 1. Anonymous, 1963. CalCOFI atlas of 10-meter temperatures and salinities 1949 through 1959.
- No. 2. Fleminger, A., 1964. Distributional atlas of calanoid copepods in the California Current region, Part I.
- No. 3. Alvarino, A., 1965. Distributional atlas of Chaetognatha in the California Current region.
- No. 4. Wyllie, J. G., 1966. Geostrophic flow of the California Current at the surface and at 200 meters.
- No. 5. Brinton, E., 1967. Distributional atlas of Euphausiacea (Crustacea) in the California Current region, Part I.
- No. 6. McGowan, J. A., 1967. Distributional atlas of pelagic molluscs in the California Current region.
- No. 7. Fleminger, A., 1967. Distributional atlas of calanoid copepods in the California Current region, Part II.
- No. 8. Berner, L. D., 1967. Distributional atlas of Thaliacea in the California Current region.
- No. 9. Kramer, D., and E. H. Ahlstrom, 1968. Distributional atlas of fish larvae in the California Current region: Northern Anchovy, *Engraulis mordax* Girard, 1951 through 1965.
- No. 10. Isaacs, J. D., A. Fleminger and J. K. Miller, 1969. Distributional atlas of zooplankton biomass in the California Current region: Spring and Fall 1955-1959.
- No. 11. Ahlstrom, E. H., 1969. Distributional atlas of fish larvae in the California Current region: jack mackerel, *Trachurus symmetricus*, and Pacific hake, *Merluccius productus*, 1951 through 1966.
- No. 12. Kramer, D., 1970. Distributional atlas of fish eggs and larvae in the California Current region: Pacific sardine, *Sardinops caerulea* (Girard), 1951 through 1966.
- No. 13. Smith, P. E., 1971. Distributional atlas of zooplankton volume in the California Current region, 1951 through 1966.
- No. 14. Isaacs, J. D., A. Fleminger and J. K. Miller, 1971. Distributional atlas of zooplankton biomass in the California Current region: Winter 1955-1959.
- No. 15. Wyllie, J. G., and R. J. Lynn, 1971. Distribution of temperature and salinity at 10 meters, 1960-1969 and mean temperature, salinity and oxygen at 150 meters, 1950-1968 in the California Current.
- No. 16. Crowe, F. J. and R. A. Schwartzlose, 1972. Release and recovery records of drift bottles in the California Current region, 1955 through 1971.
- No. 17. Ahlstrom, E. H., 1972. Distributional atlas of fish larvae in the California Current region: six common mesopelagic fishes—*Vinciguerria lucetia*, *Triphoturus mexicanus*, *Stenobrachius leucopsarus*, *Leuroglossus stilbius*, *Bathylagus wesethi*; and *Bathylagus ochotensis*, 1955 through 1960.
- No. 18. Brinton, E., 1973. Distributional atlas of Euphausiacea (Crustacea) in the California Current region, Part II.
- No. 19. Bowman, T. E., and M. W. Johnson, 1973. Distributional Atlas of Calanoid Copepods in the California Current Region, 1949 and 1950.

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

<sup>2</sup>Formerly called U. S. Fish and Wildlife Service, Bureau of Commercial Fisheries.

<sup>3</sup>For citation this issue in the series should be referred to as CalCOFI Atlas No. 18.

**DISTRIBUTIONAL ATLAS OF CALANOID  
COPEPODS IN THE CALIFORNIA  
CURRENT REGION, 1949 and 1950**

Thomas E. Bowman and Martin W. Johnson

**CALCOFI ATLAS NO. 19**

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

June, 1973

# DISTRIBUTIONAL ATLAS OF CALANOID COPEPODS IN THE CALIFORNIA CURRENT REGION, 1949 and 1950

Thomas E. Bowman<sup>1</sup> and Martin W. Johnson<sup>2</sup>

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## Introduction

The charts in this atlas show the abundance and distribution in the region of the California Current of calanoid copepods during seven CalCOFI cruises, six in 1949 and one in 1950. Charts are presented when five or more positive records of the taxa were found on a cruise; the pagination of these charts is given in Table 1. Some taxa were consistently caught in larger numbers during night hauls. Distribution charts based on night hauls only are included as insets where they clarify the distribution. When there are less than five positive records per cruise the data are listed in Table 2.

Sampling was done with nets measuring one meter in diameter at the mouth and about five meters in length. The body of the net was constructed of number 30xxx grit gauze, the distal 40 centimeters of the cone and the cod-end bag of number 56xxx grit gauze. Sampling was by means of oblique hauls from about 70 meters to the surface at a vessel speed of 1.5 to 2 knots. The net was lowered on 100 meters of wire at the rate of 50 meters a minute, then retrieved at 5 meters a minute. The volume of water strained was measured by an Atlas-type current meter located in the center of the mouth of the net.

Counts were made on aliquots removed from the sample with a small dipper. The displacement volume of the aliquot was measured by straining the sample through a fine grit gauze and adding it to a measured volume of liquid in a graduated cylinder. The aliquots were counted in a plexiglass tray with a grid inscribed on the bottom. After the aliquot was counted part or all of the total sample was examined for species which had not appeared in the aliquot. Counts in individuals of a species were transformed to number per 1000m<sup>3</sup> of sea water filtered using the formula:

$$\frac{1000 D n}{V d} = N$$

where n = number of individuals counted

V = m<sup>3</sup> of water filtered during the tow

D = displacement volume of the sample

d = displacement volume of the aliquot

N = number of individuals in 1000 m<sup>3</sup> filtered

Because of the relative inexperience in copepod identification of the first author at the time the samples were enumerated, some calanoids were identified only to genus, and in other cases two or more closely related species were not distinguished. A number of small calanoids, mainly species of *Calocalanus*, *Clausocalanus*, and *Paracalanus* were counted together as "microcalanids".

We are grateful to Dr. Abraham Fleminger for updating specific names where needed and for his assistance in many other ways during preparation of the manuscript for publication.

- 
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TABLE 1. Pagination of distribution charts. Charts limited to cruises with five or more occurrences per taxonomic group. Fewer occurrences (1 to 4) indicated by T (see Table 2 for data), and no occurrences by O.

TAXONOMIC GROUP	Year and Cruise						
	1949 4905	4906	4907	4908	4909	4910	1950 5002
<i>Aetideus acutus + bradyi + giesbrechti</i>	T	T	T	2	3	T	4
<i>Aetideus divergens + truncatus</i>	T	O	T	T	T	T	T
<i>Arietellus setosus</i>	O	T	T	O	T	T	O
<i>Calanus cristatus</i>	5	6	7	8	T	O	T
<i>gracilis</i>	T	No Data	No Data	9	10	11	12
<i>lighti and tenuicornis</i>	13	14	15	16	17	18	19
<i>minor</i>	20	21	22	23	24	25	26
<i>pacificus</i>	27	28	29	30	31	32	33
<i>plumchrus</i>	34	35	36	T	T	O	37
<i>robustior</i>	38	39	40	T	O	T	O
<i>Candacia bipinnata</i>	41	42	43	44	45	46	47
<i>bispinosa</i>	T	48	49	50	51	52	53
<i>catula</i>	T	O	O	O	O	O	O
<i>columbiae</i>	54	55	56	57	T	T	T
<i>curta</i>	58	59	60	61	62	O	63
<i>ethiopica</i>	64	65	66	67	68	69	70
<i>longimana</i>	O	T	O	O	T	O	O
<i>simplex</i>	71	72	73	74	75	76	77
<i>tenuimana</i>	T	O	O	O	O	O	T
<i>Centropages bradyi</i>	T	T	78	79	80	81	82
<i>elegans + violaceous</i>	T	T	83	84	85	86	87
<i>Epilabidocera longipedata</i>	O	T	88	89	90	O	O
<i>Eucalanus attenuatus s.l.</i>	91	92	93	94	95	T	96
<i>bungii bungii</i>	97	T	98	99	T	O	T
<i>bungii californicus</i>	100	101	102	103	104	105	106
<i>crassus</i>	T	107	T	T	T	O	T
<i>elongatus hyalinus</i>	108	109	110	111	112	113	114
<i>Euchaeta spp.</i>	115	116	117	118	119	120	121
<i>Euchirella curticauda</i>	O	T	T	122	123	124	T
<i>galeata</i>	O	125	T	T	126	127	128
<i>messinensis</i>	O	T	O	T	T	O	O
<i>propria</i>	O	129	130	131	132	T	133
<i>pulchra</i>	O	134	135	136	137	138	139
<i>rostrata</i>	O	140	141	142	T	O	143
<i>truncata</i>	O	O	T	O	O	O	O
<i>Gaidius pungens</i>	144	145	146	147	148	149	150
<i>Haloptilis longicornis</i>	151	152	153	154	155	156	157
<i>Heterorhabdus papilliger</i>	158	159	160	161	162	163	164
<i>Lucicutia flavigornis</i>	165	166	167	168	169	170	171
<i>Mecynocera clausi</i>	172	173	174	175	176	177	178
<i>Metridia pacifica</i>	179	180	181	182	183	184	185
<i>Microcalanids</i>	186	187	188	189	190	191	192
<i>Phaenna spinifera</i>	193	194	195	196	197	198	T
<i>Pleuromamma abdominalis</i>	No Data	No Data	No Data	199	200	201	202
<i>gracilist + piseki</i>	No Data	No Data	No Data	203	204	205	206
<i>xiphias</i>	No Data	No Data	No Data	207	208	209	210
spp.	211	212	213	No Data	No Data	No Data	No Data
<i>Pontellina spp.</i>	O	O	T	T	214	215	T
<i>Pontellopsis spp.</i>	O	T	O	T	T	T	T
<i>Rhincalanus nasutus</i>	216	217	218	219	220	221	222
<i>Scolecithrix danae</i>	223	224	225	226	227	228	229
<i>Scottocalanus persecans</i>	T	230	231	232	T	O	T
<i>Temora discaudata</i>	T	O	O	O	O	O	O
<i>Tortanus discaudatus</i>	O	O	O	O	T	O	T
<i>Undeuchaeta spp.</i>	233	234	235	236	237	238	239

TABLE 2. Record of stations containing 1 to 4 occurrences. "NQ" denotes a station whose data is non-quantitative.

TAXONOMIC GROUP	YEAR	CRUISE	STATION	Number 1000m <sup>3</sup>	TAXONOMIC GROUP	YEAR	CRUISE	STATION	Number 1000m <sup>3</sup>
<i>Aetideus acutus + bradyi + giesbrechti</i>	1949	4905	803	47	<i>Eucalanus crassus</i>	1949	4905	1008	29
			1107	31				1203	20
		4906	910	34				1204	12
			1008	23			4907	807	43
			1009	28				904	108
		4907	1210	23				1205	NQ
		4910	808	33			4908	1102	30
			1004	71				1105	31
			1006	237				1201	NQ
<i>Aetideus divergens + truncatus</i>	1949	4905	201	123			4909	1004	78
		4907	102	26			5002	120.45	218
			207	281				130.35	615
			208	676				130.70	36
			209	101	<i>Euchirella curticauda</i>	1949	4906	810	17
		4908	800	95				1006	68
		4909	501	47				1103	17
		4910	701	93			4907	209	101
			702	37				1009	49
			801	89				1111	13
	1950	5002	70.70	207			5002	50.110	369
<i>Arietellus setosus</i>	1949	4906	810	NQ				90.90	71
		4907	901	NQ				100.60	204
		4909	709	NQ				110.70	257
			806	41	<i>Euchirella galeata</i>	1949	4907	701	157
		4910	1006	79				901	204
<i>Calanus cristatus</i>	1949	4909	209	355				908	51
	1950	5002	60.100	115				1001	191
<i>Calanus gracilis</i>	1949	4905	410	273			4908	405	475
			508	78				805	102
<i>Calanus plumchrus</i>	1949	4908	102	45				901	126
			107	311				904	56
			208	68	<i>Euchirella messinensis</i>	1949	4906	809	24
		4909	201	44				901	218
<i>Calanus robustior</i>	1949	4908	507	8			4908	309	66
			508	21			4909	209	19
			509	583				502	NQ
			605	74	<i>Euchirella propia</i>	1949	4910	803	52
		4910	805	426				806	21
			806	21				807	21
<i>Candacia bispinosa</i>	1949	4905	708	15	<i>Euchirella rostrata</i>	1949	4909	209	19
			709	19				609	109
			1107	31	<i>Euchirella truncata</i>	1949	4907	409	NQ
<i>Candacia catula</i>	1949	4905	102	128	<i>Phaenoides spinifera</i>	1950	5002	130.70	72
<i>Candacia columbiae</i>	1949	4909	202	346	<i>Pontellina</i> spp.	1949	4907	1208	18
			209	56				1210	23
			305	81			4908	910	7
		4910	503	137				911	23
			603	100				1104	104
	1950	5002	60.110	50				1208	29
<i>Candacia longimana</i>	1949	4906	1111	17			5002	100.120	79
		4909	1009	31				110.100	77
			1010	42	<i>Pontellopsis</i> spp.	1949	4906	1005	35
<i>Candacia tenuimana</i>	1949	4905	807	NQ				1010	NQ
	1950	5002	60.80	172				1210	NQ
<i>Centropages bradyi</i>	1949	4905	702	83			4908	1001	26
			707	29				1002	NQ
			803	47				1106	24
			807	NQ				1108	42
		4906	909	54			4909	1109	17
			911	NQ				1202	45
			1102	NQ			4910	707	57
<i>Centropages elegans + violaceous</i>	1949	4905	1011	32			5002	130.60	73
		4906	908	126	<i>Scottocalanus persecans</i>	1949	4905	803	47
			1205	47				1210	39
			1206	69			4909	402	54
<i>Epilabidocera longipedata</i>	1949	4906	402	64				709	NQ
<i>Eucalanus attenuatus</i> s.l.	1949	4910	1006	79				802	142
<i>Eucalanus bungii bungii</i>	1949	4906	402	187				90.90	141
		4909	201	44				100.50	44
			206	602					
			208	42	<i>Temora discaudata</i>	1949	4905	1206	36
	1950	5002	50.80	300	<i>Tortanus discaudatus</i>	1949	4909	501	47
							5002	60.110	50
								100.30	26

Aetideus  
Calanus  
Candacia  
Centropages

Epilabidocera  
Eucalanus  
Euchaeta  
Euchirella

Gaidius  
Haloptilus  
Heterorhabdus

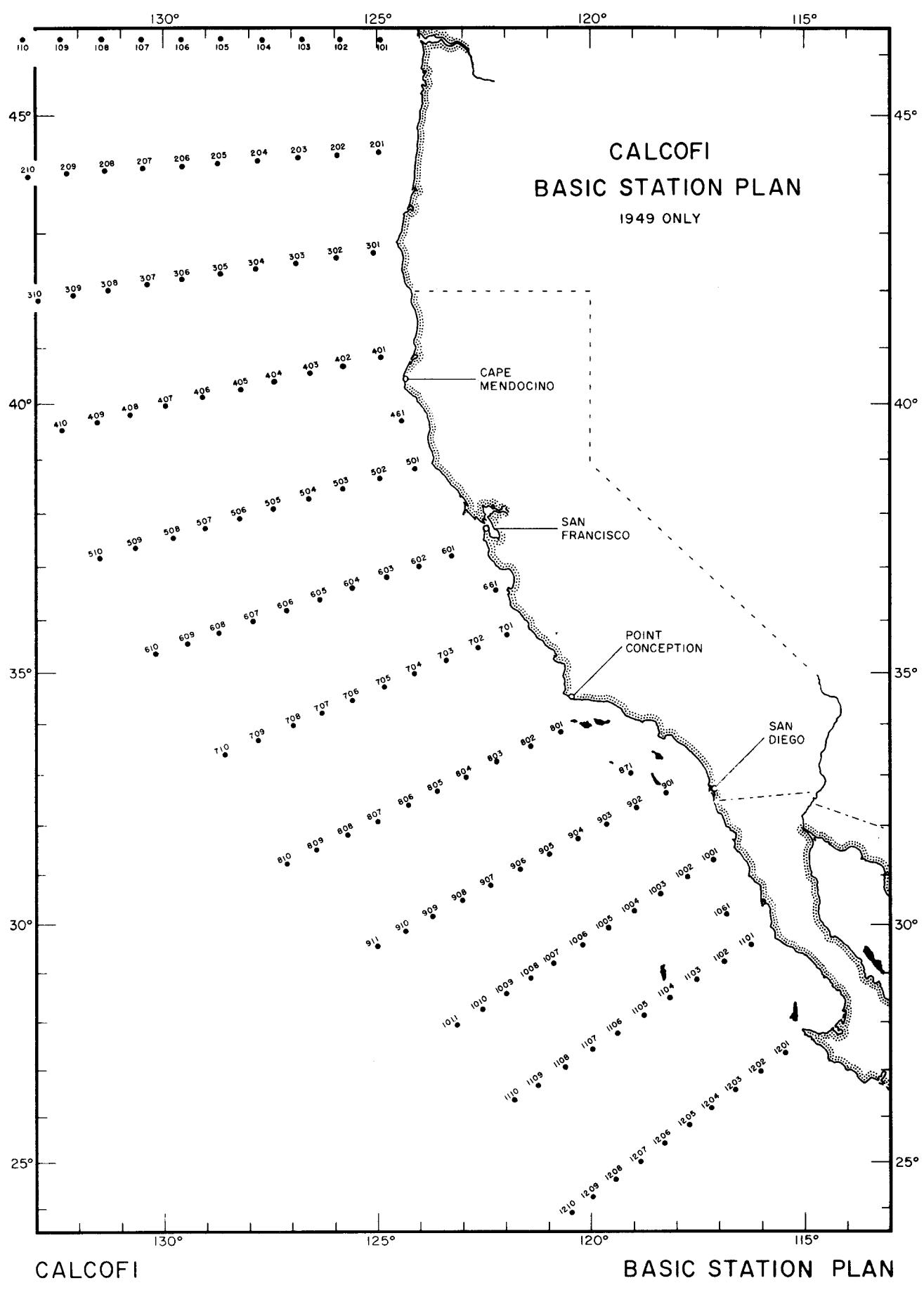
Lucicutia  
Mecynocera  
Metridia  
Microcalanids

Phaenna  
Pleuromamma  
Pontellina

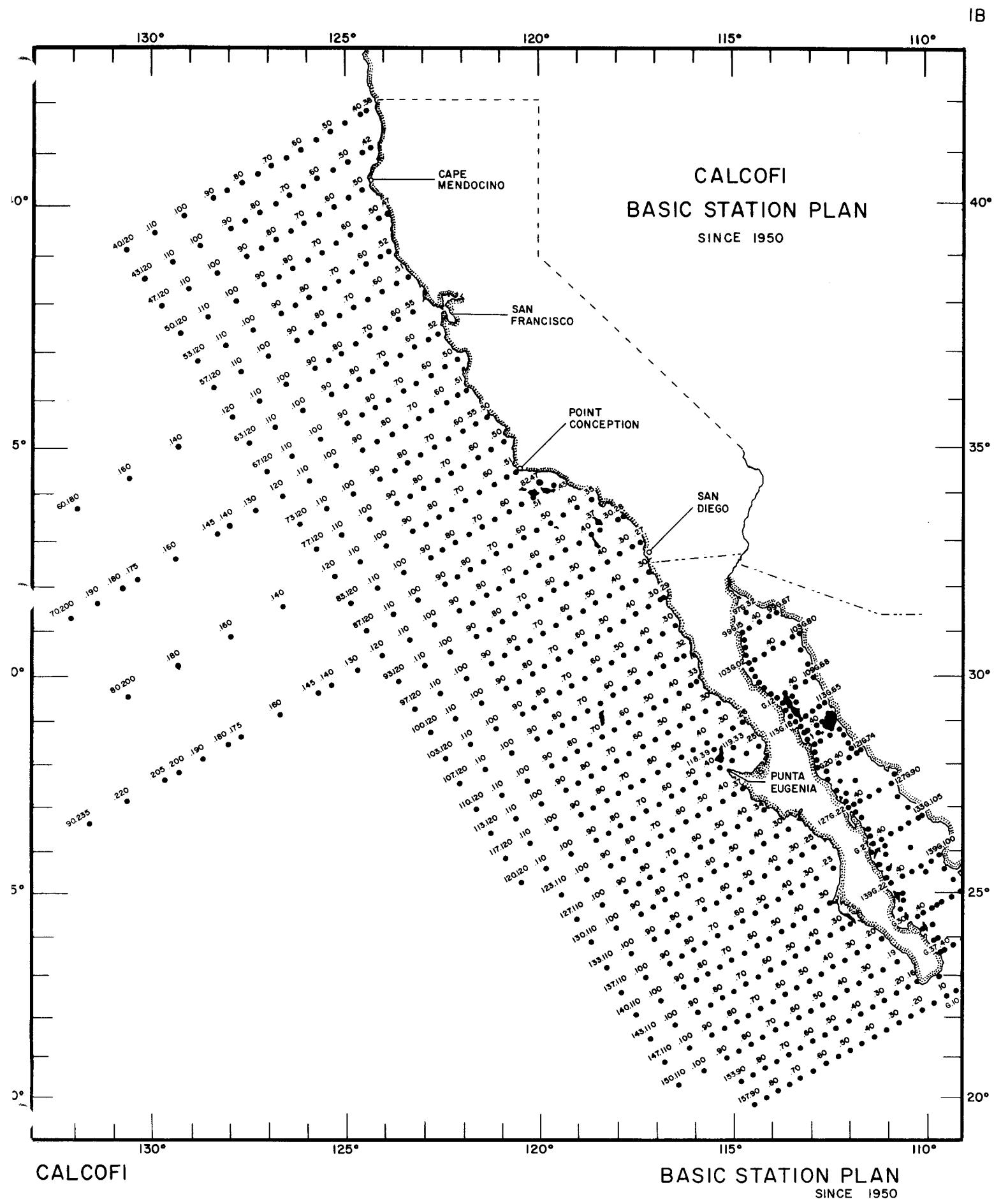
Rhincalanus  
Scolecithrix  
Scottocalanus

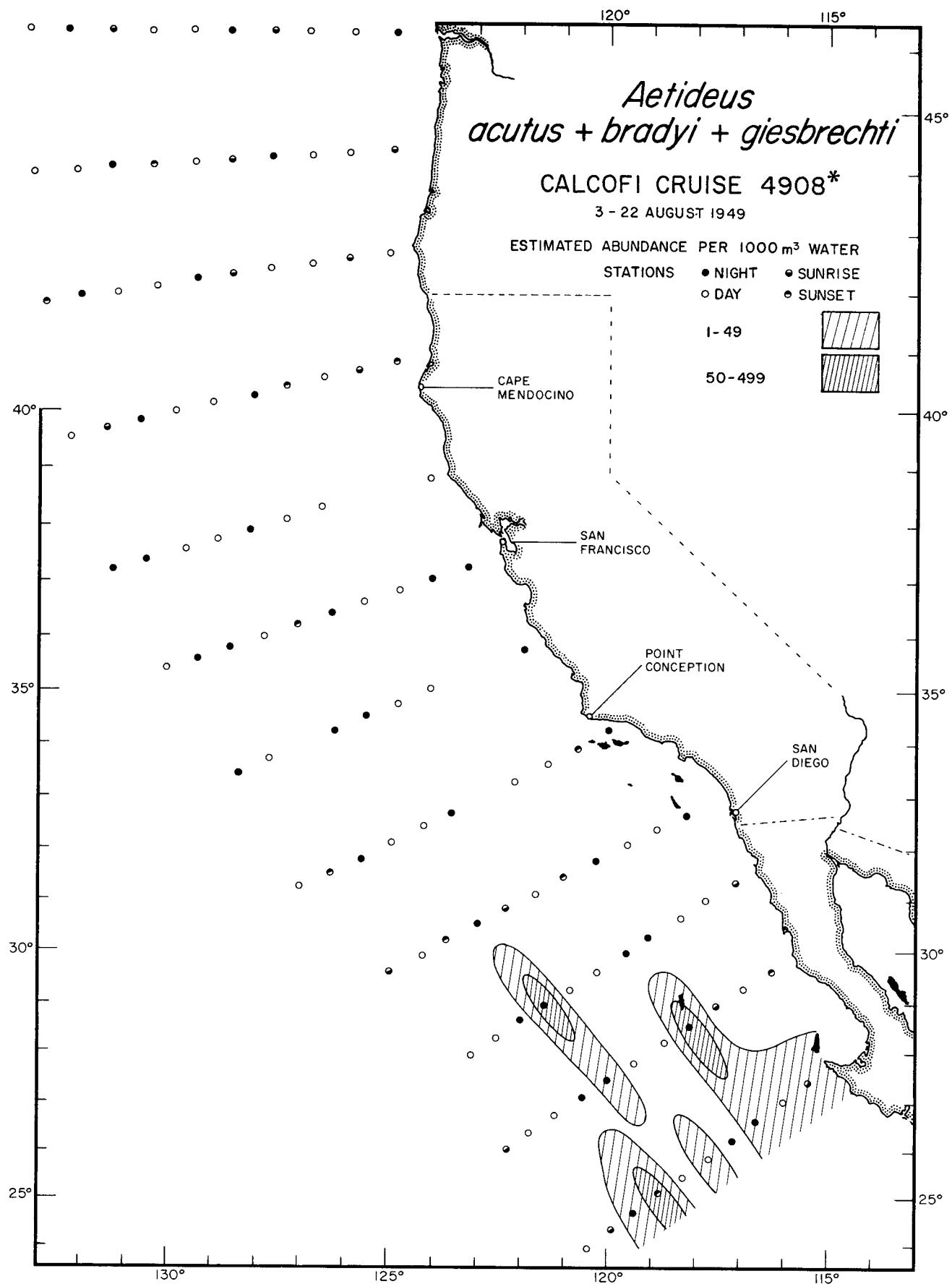
Undeuchaeta

IA



1949 ONLY



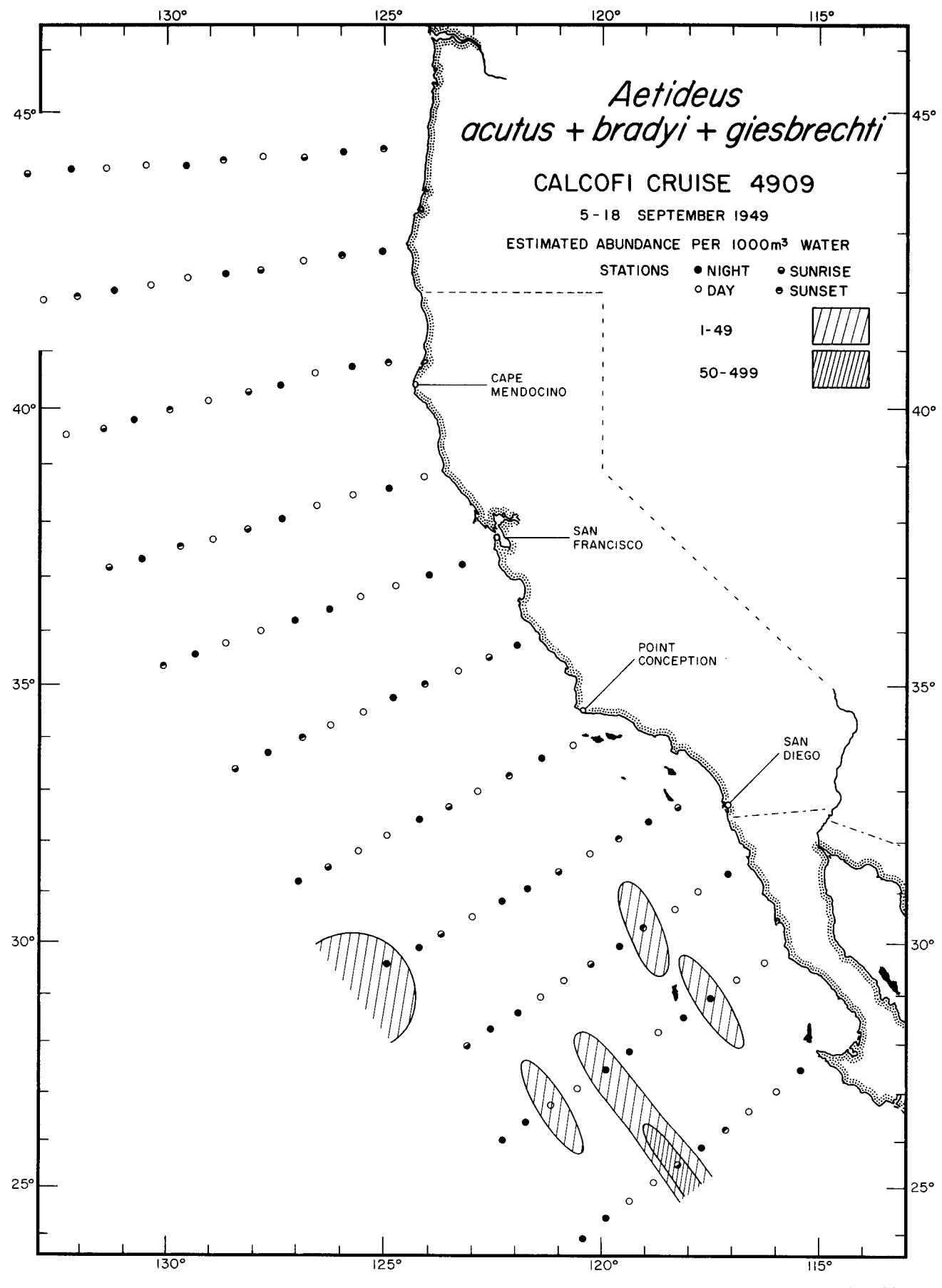


\* See Table 1 for cruises 4905, 6, 7

Calanoida

*Aetideus acutus + bradyi + giesbrechti*

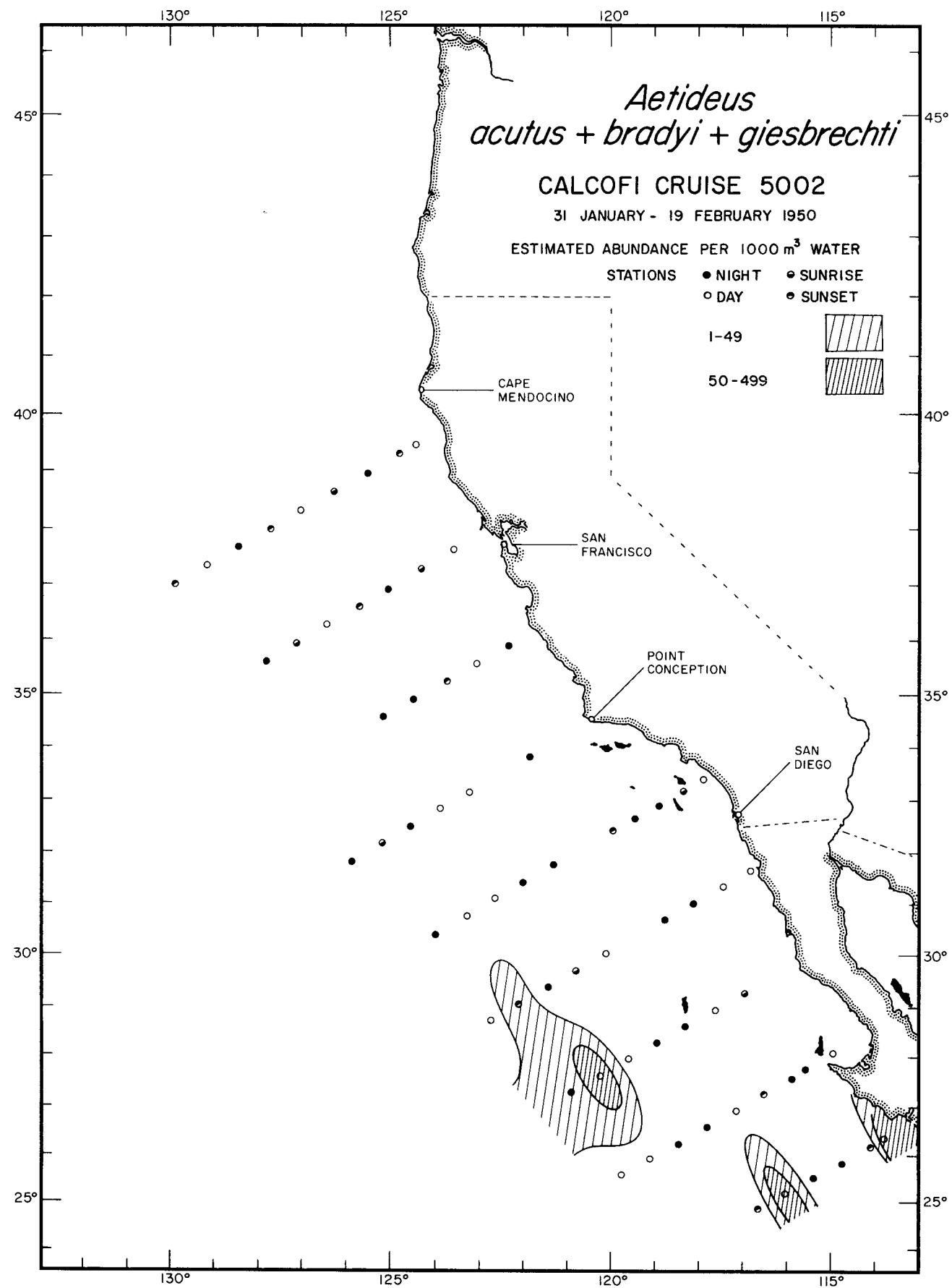
4908



Calanoida

*Aetideus acutus + bradyi + giesbrechti*

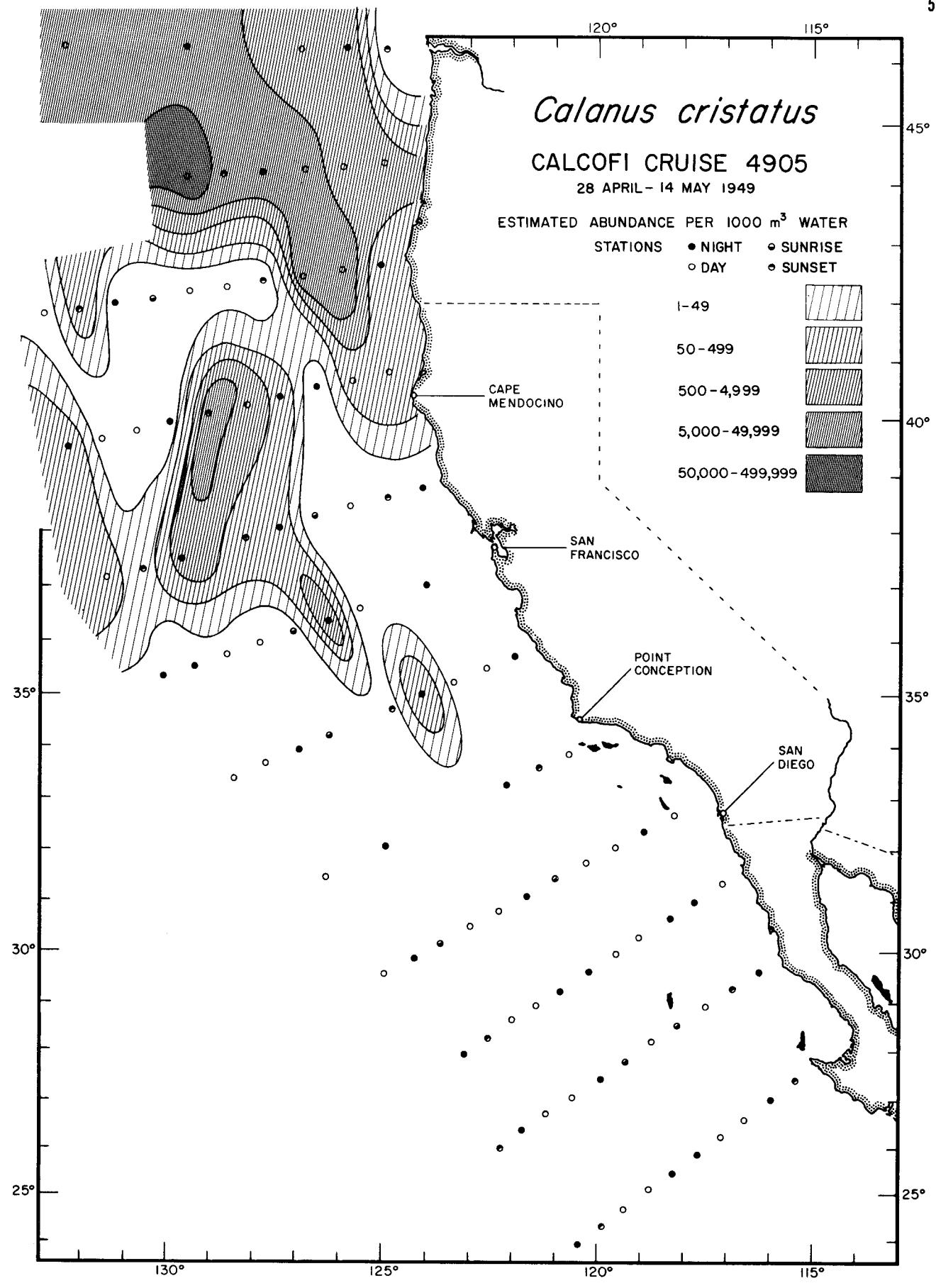
4909



Calanoida

*Aetideus acutus + bradyi + giesbrechti*

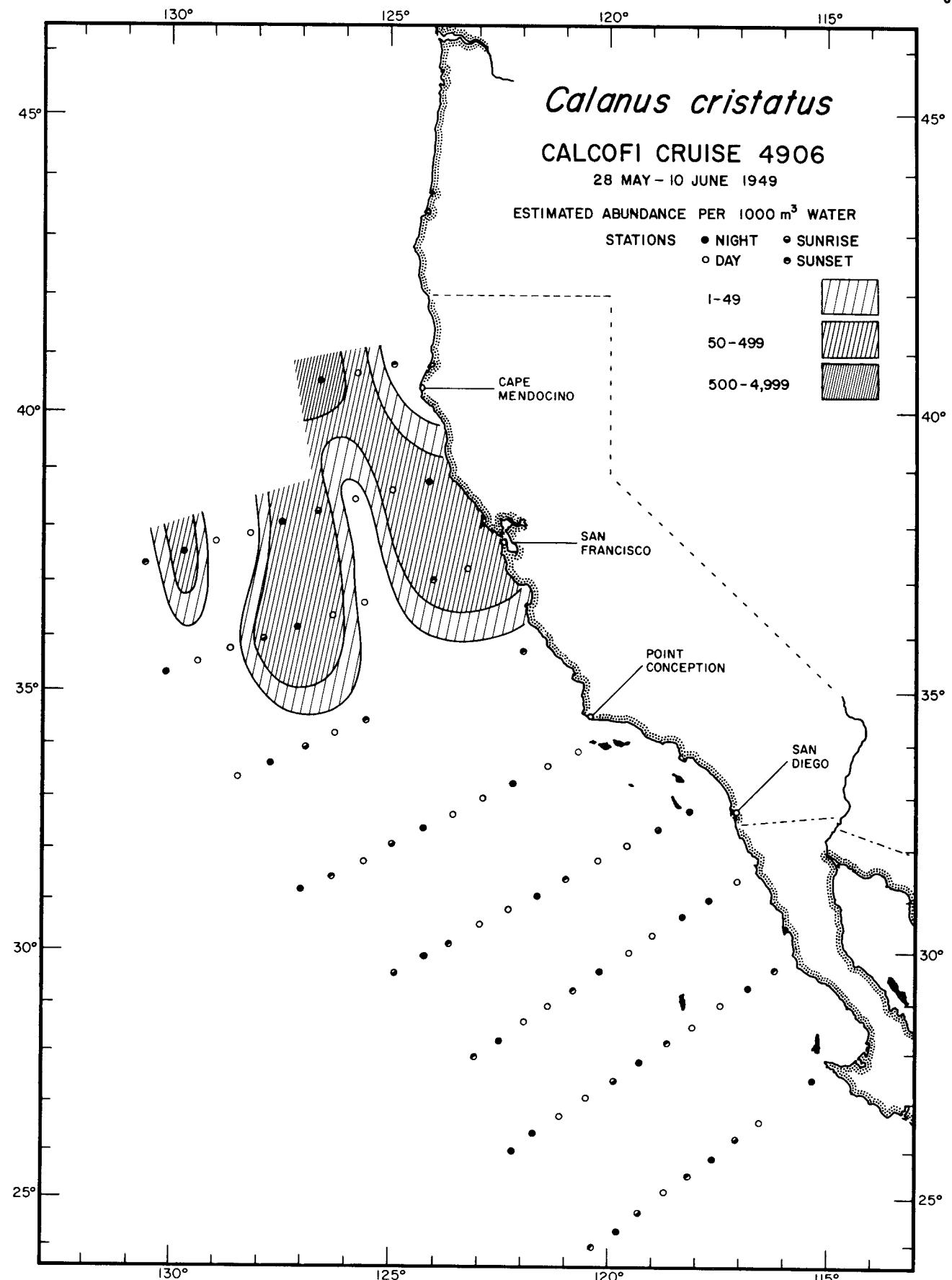
5002



Calanoida

*Calanus cristatus*

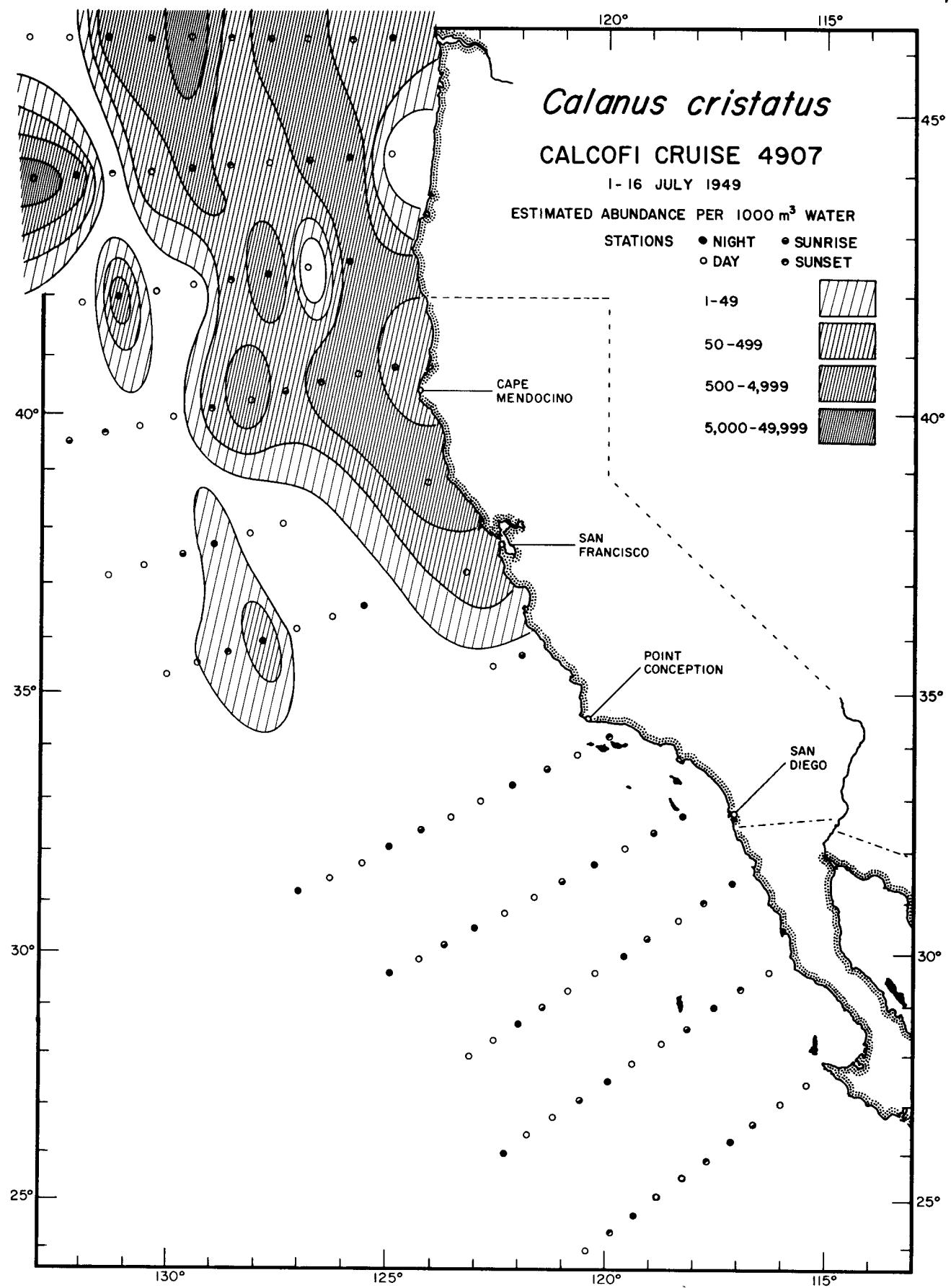
4905



Calanoida

*Calanus cristatus*

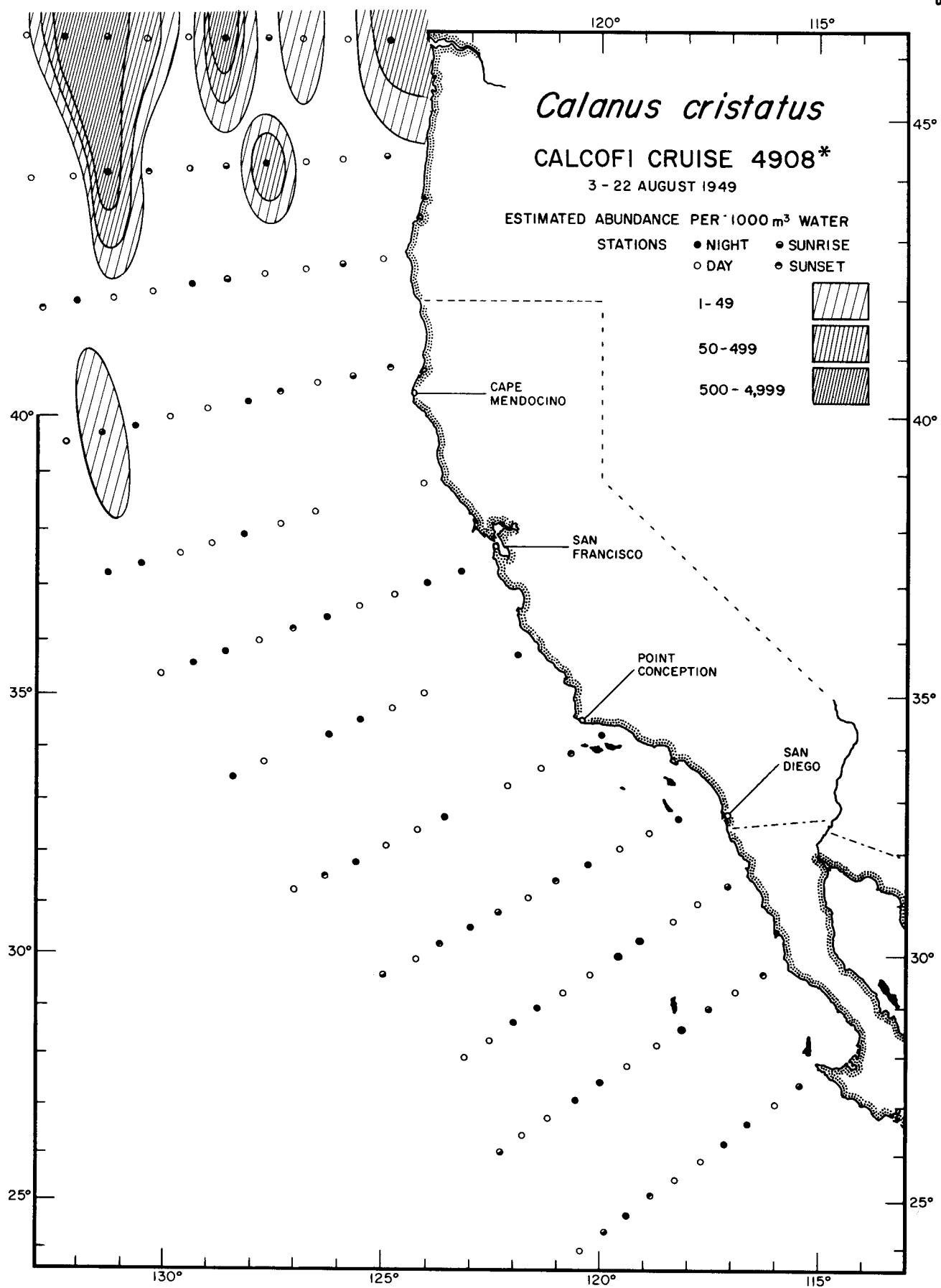
4906



Calanoida

*Calanus cristatus*

4907

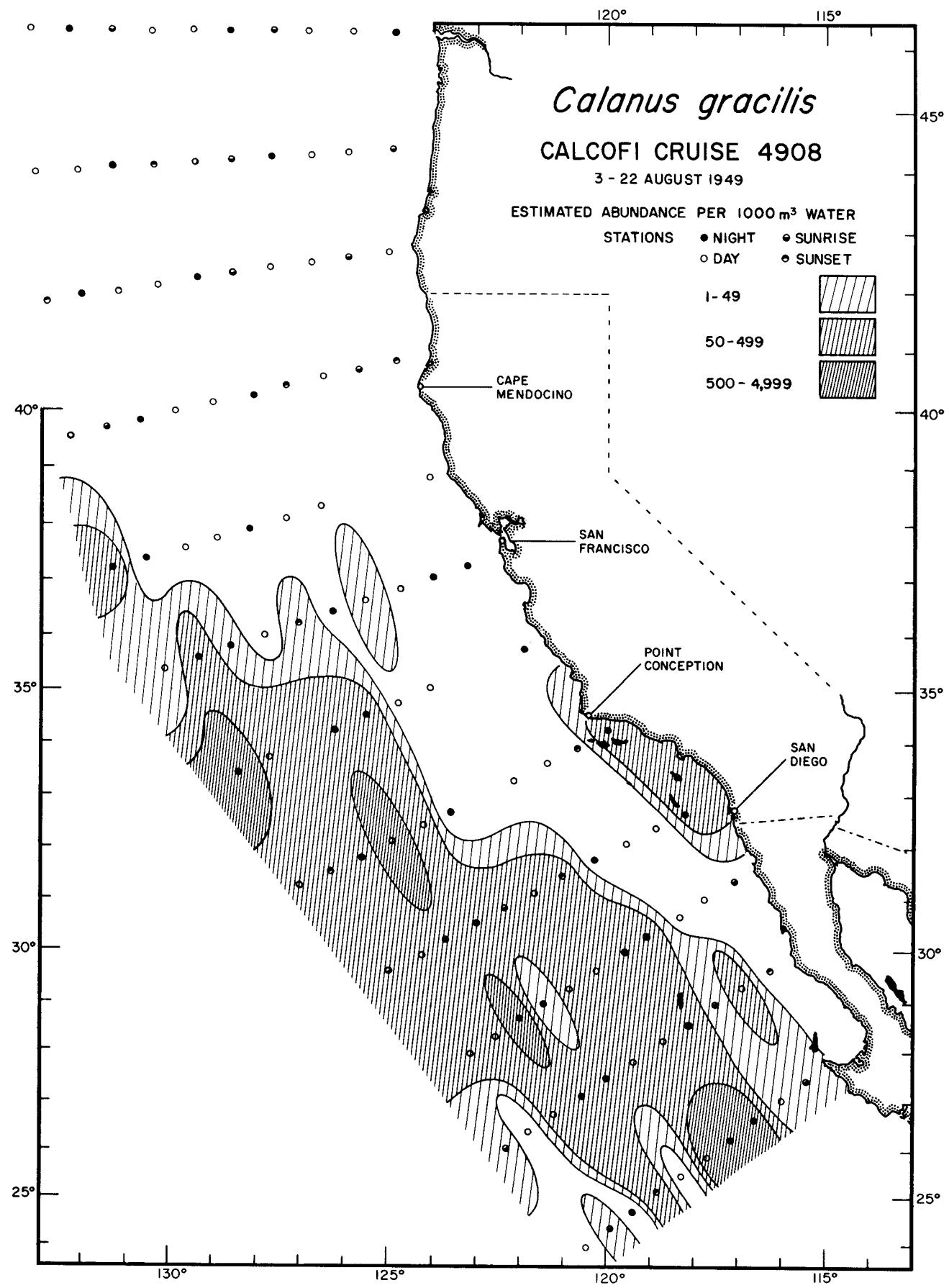


\* See Table 1 for cruises 4909, 10, 5002

Calanoida

*Calanus cristatus*

4908

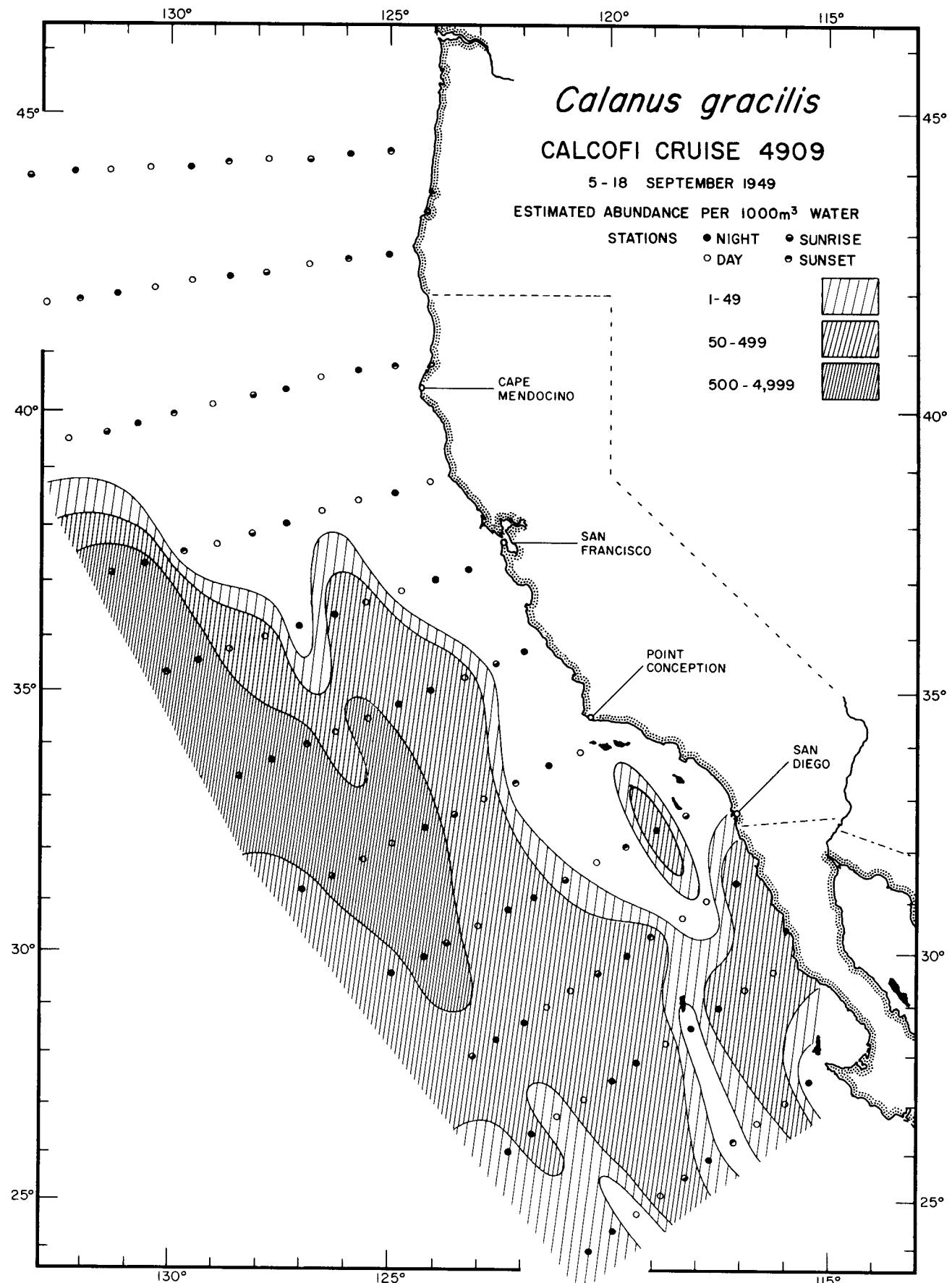


\* See Table 1 for cruise 4905; no data for cruises 4906, 7

Calanoida

*Calanus gracilis*

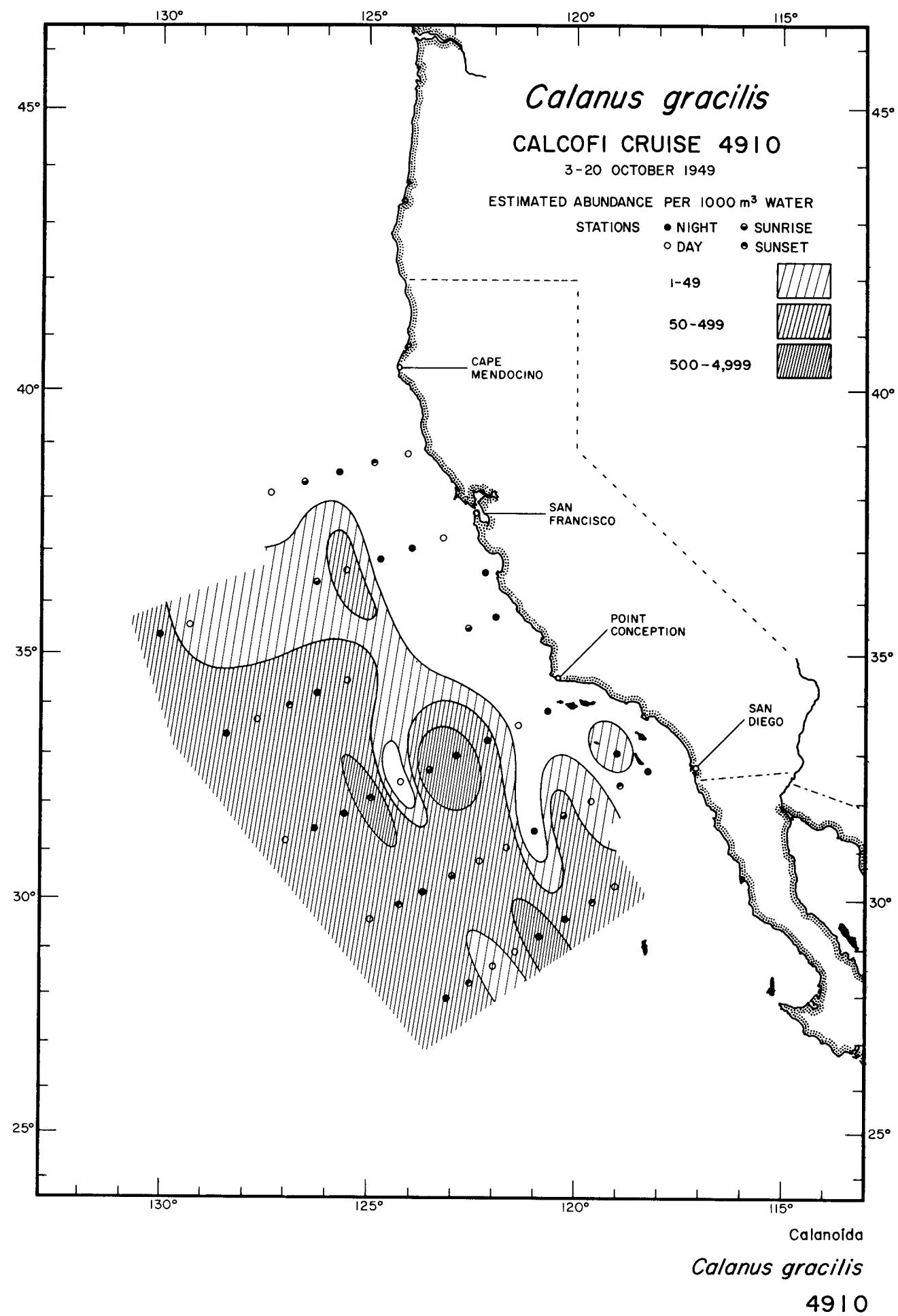
4908

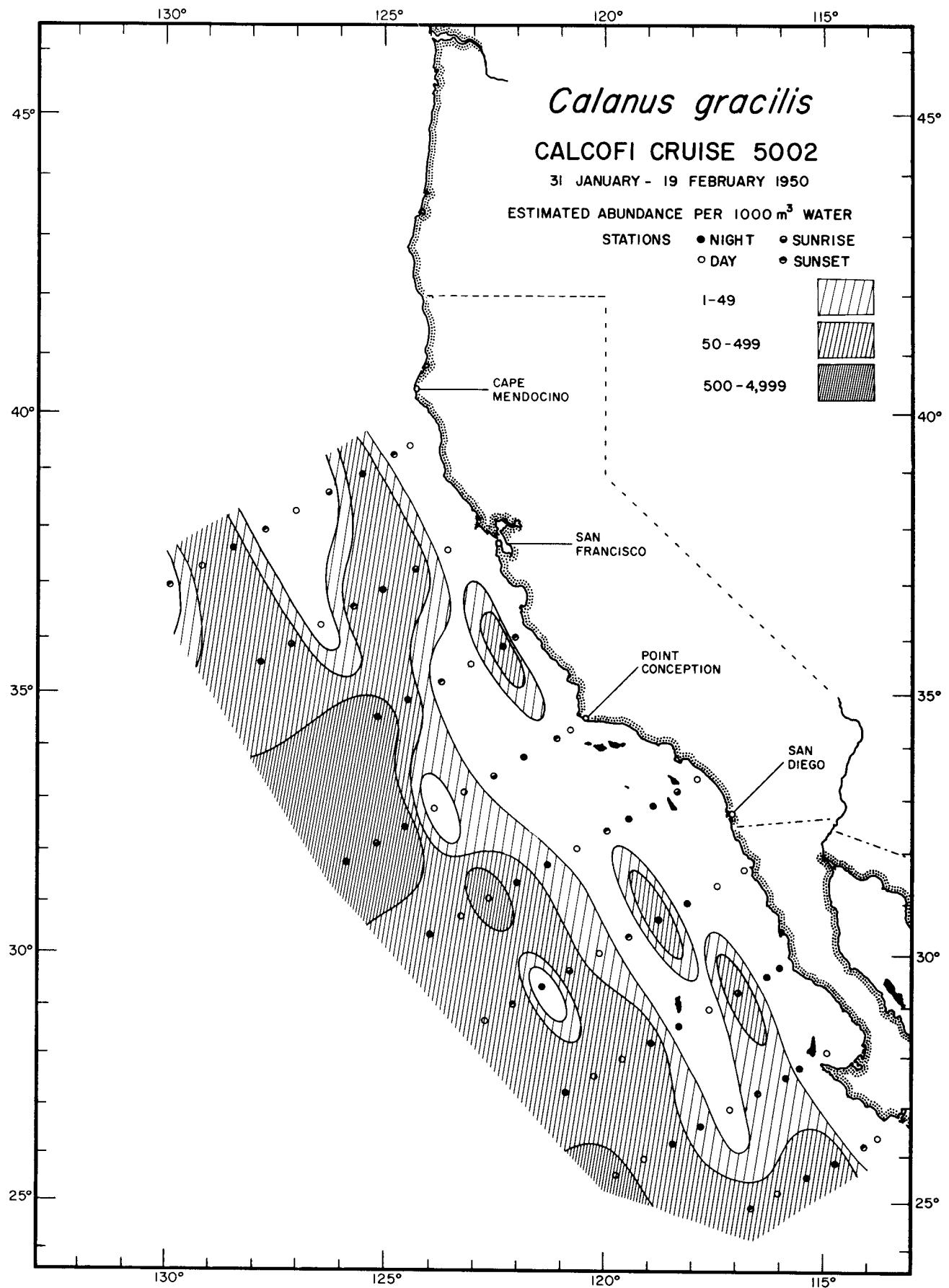


Calanoida

*Calanus gracilis*

4909

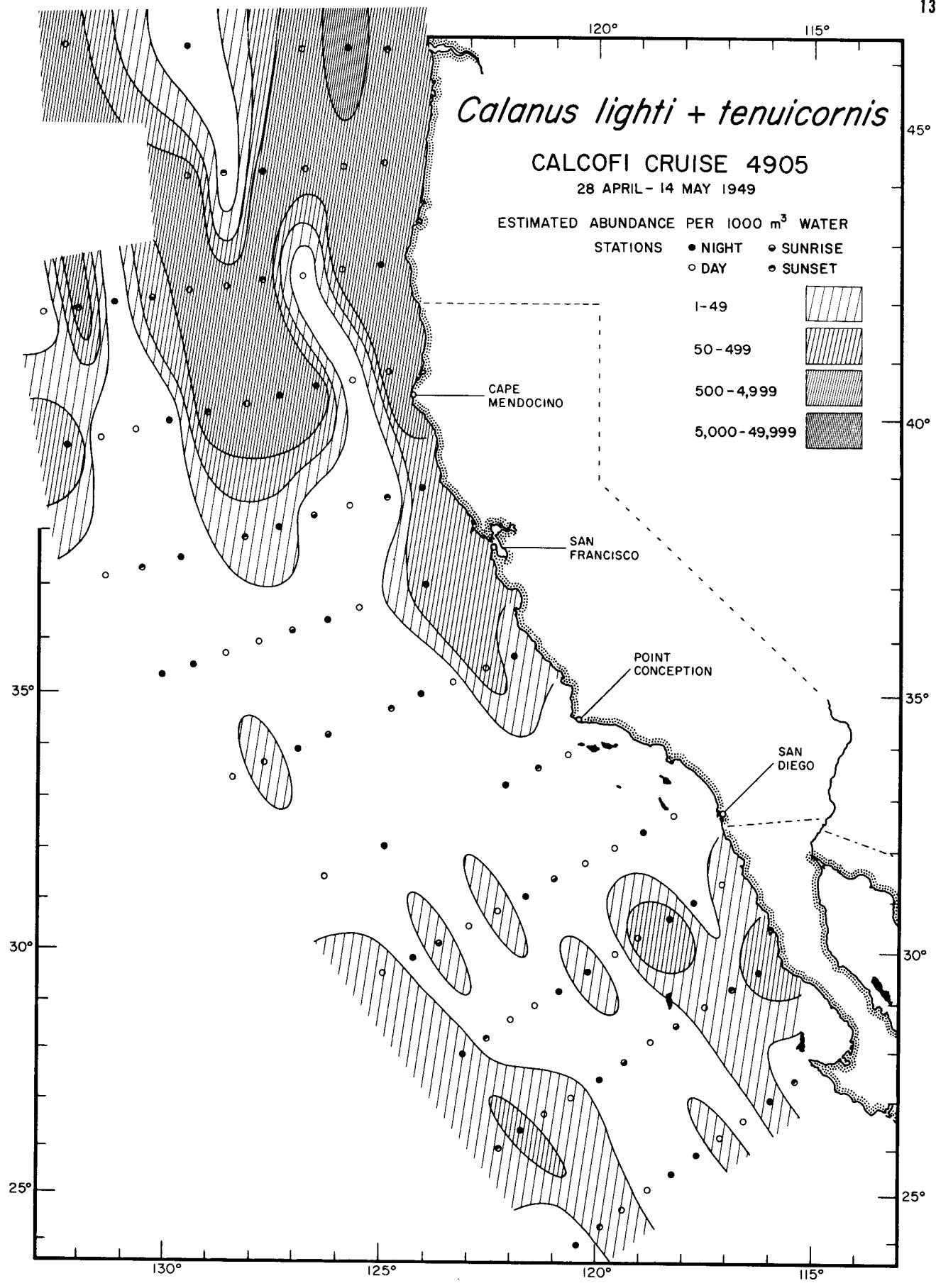




Calanoida

*Calanus gracilis*

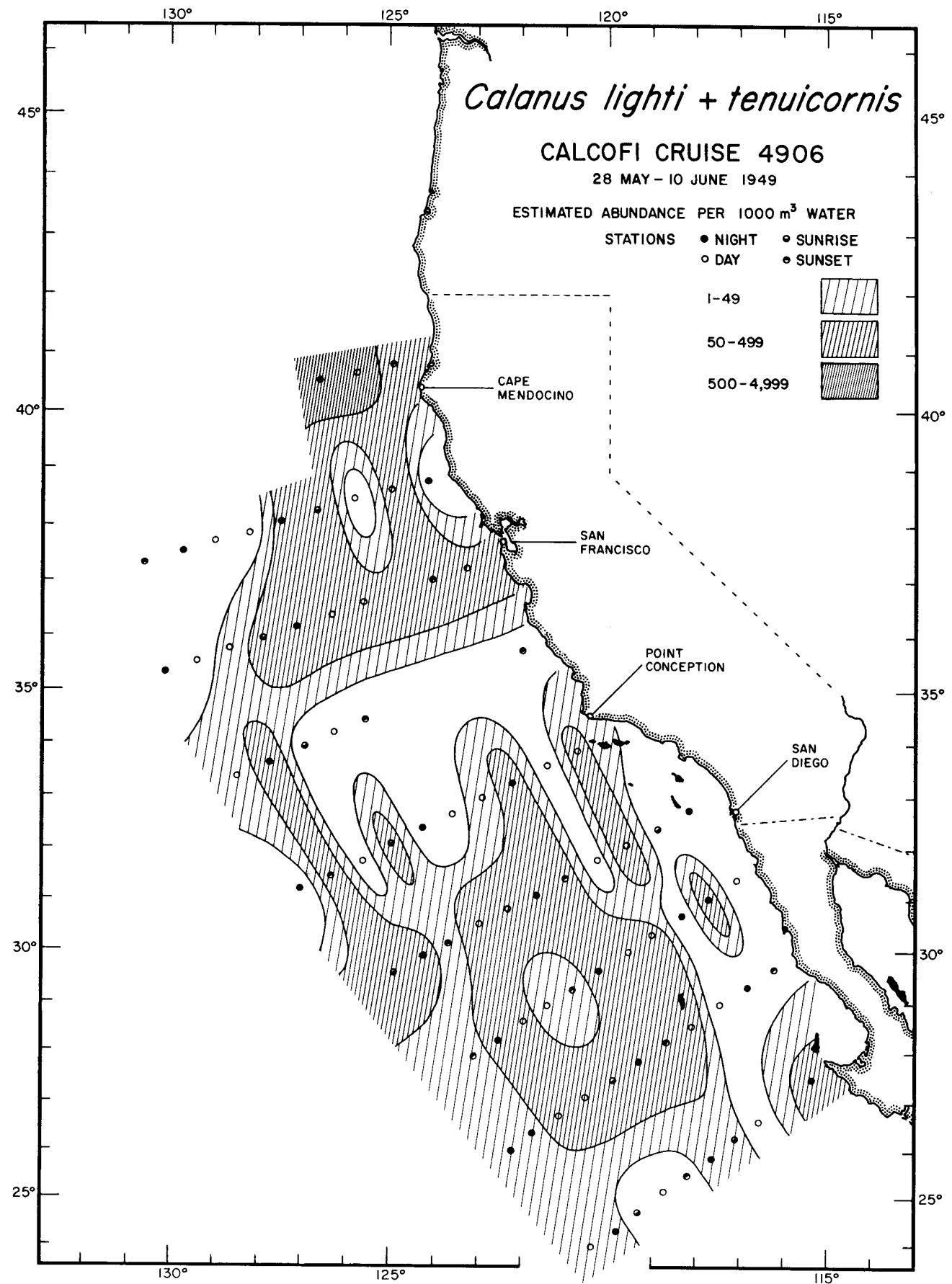
5002



Calanoida

*Calanus lighti + tenuicornis*

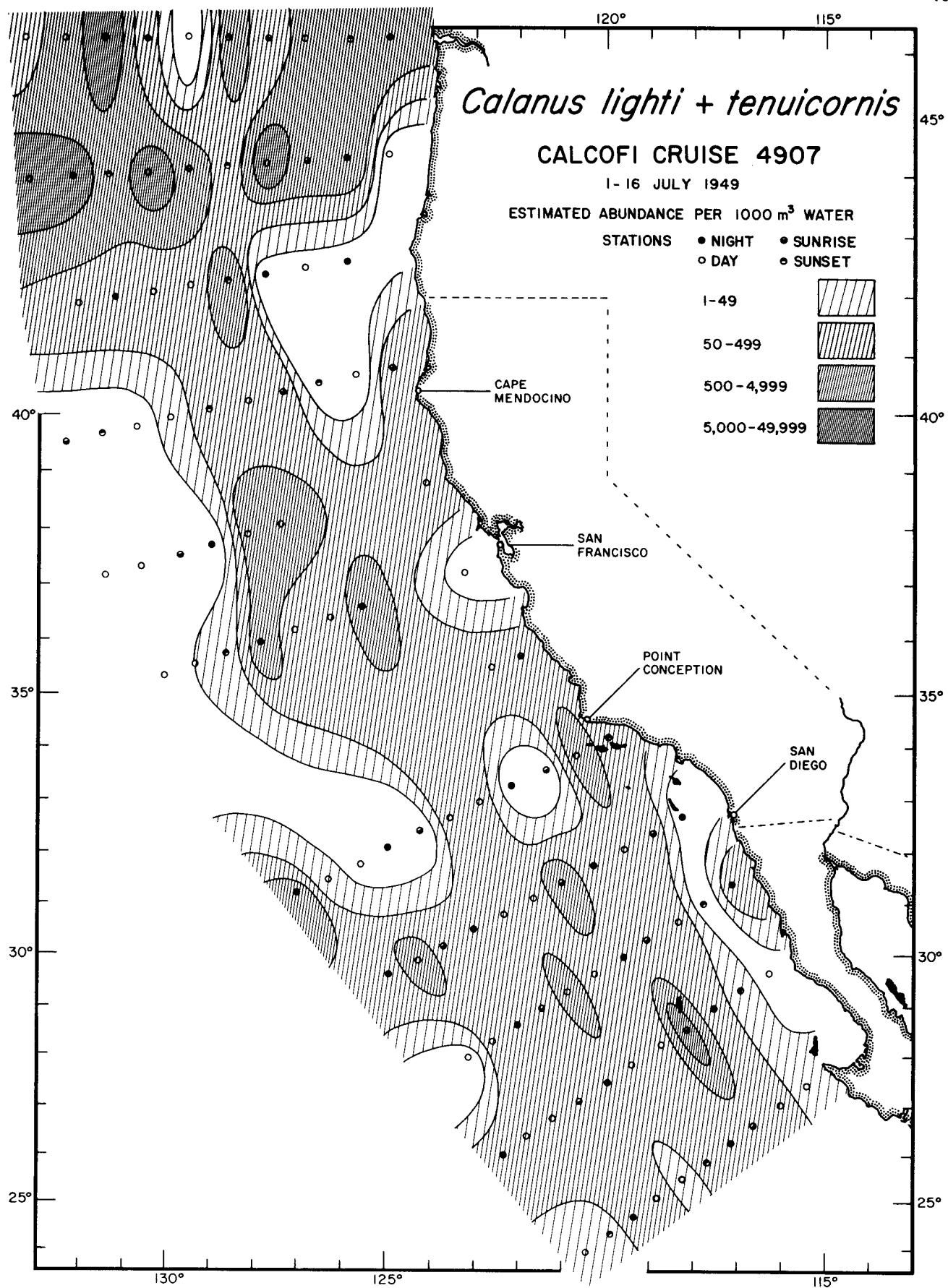
4905



Calanoida

*Calanus lighti + tenuicornis*

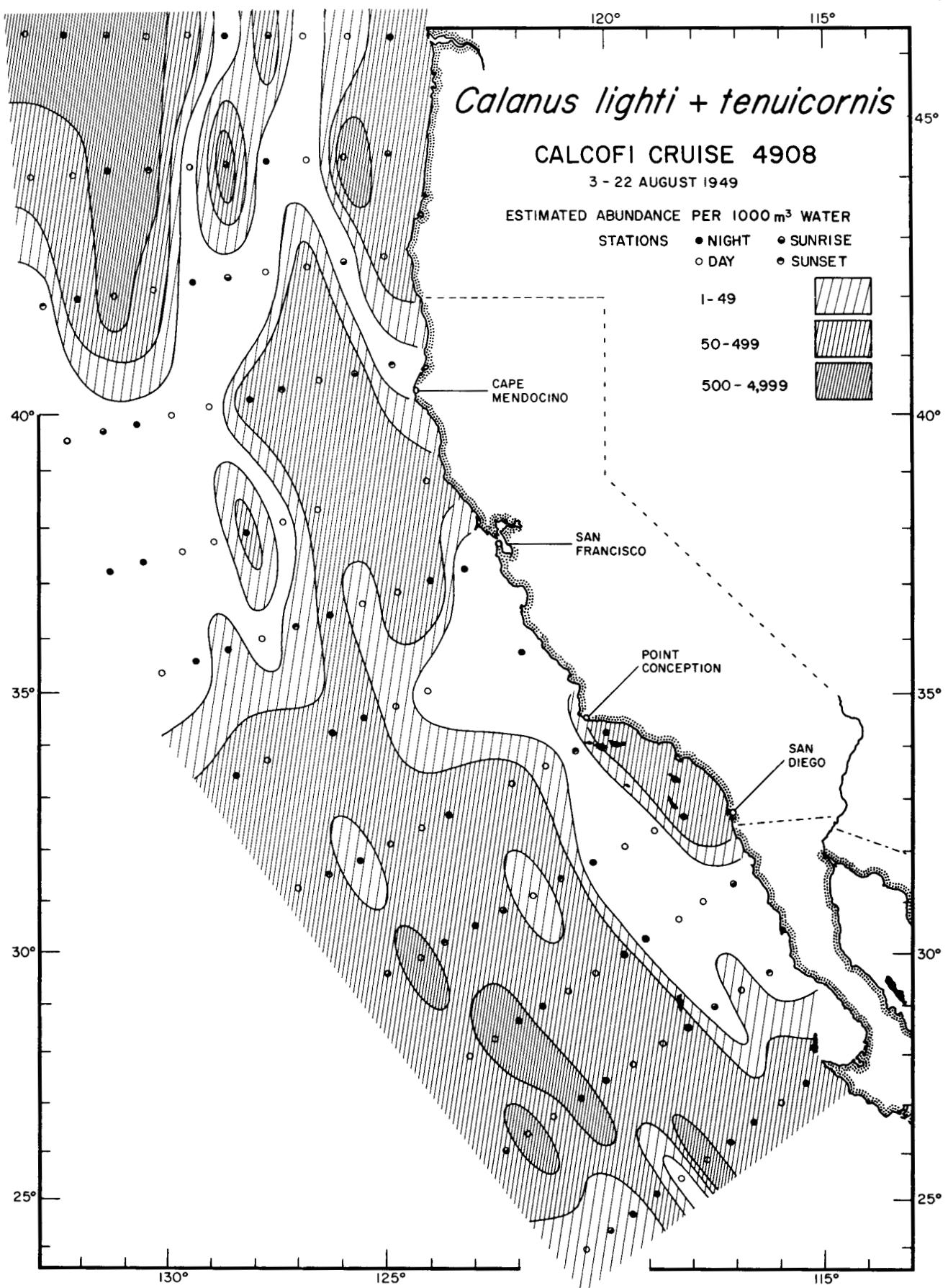
4906



Calanoida

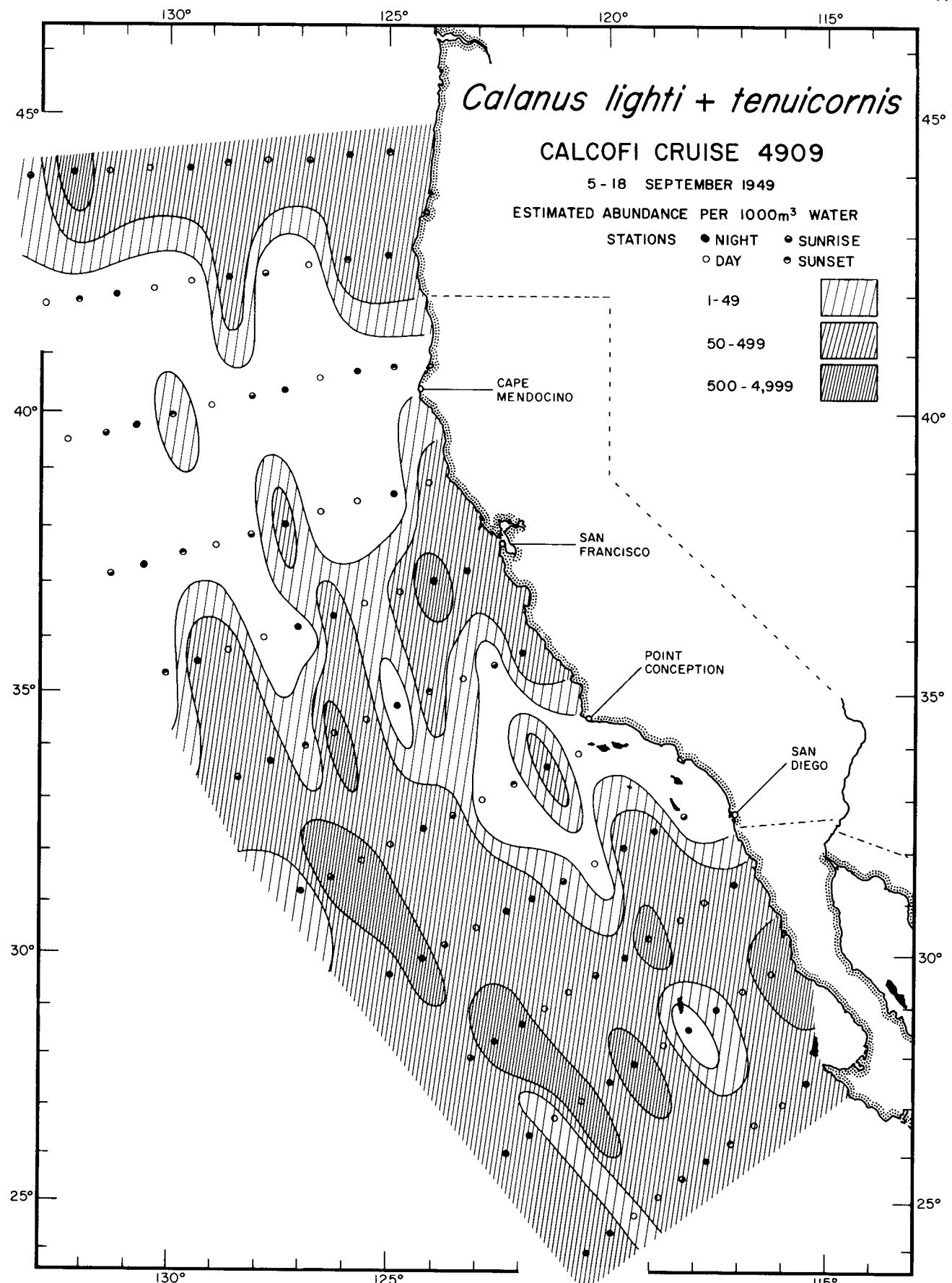
*Calanus lighti + tenuicornis*

4907



*Calanus lighti + tenuicornis*

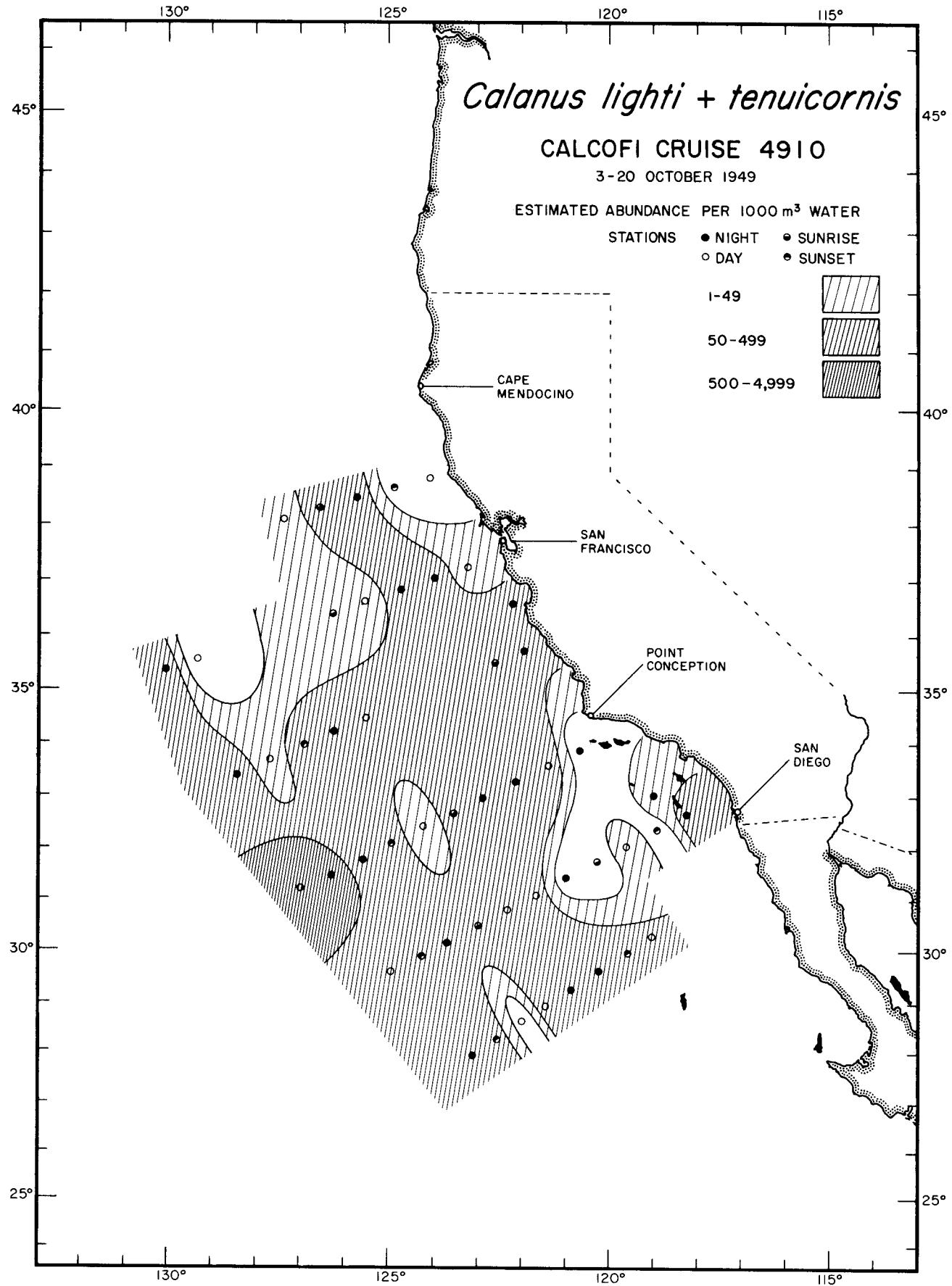
4908



Calanoida

*Calanus lighti + tenuicornis*

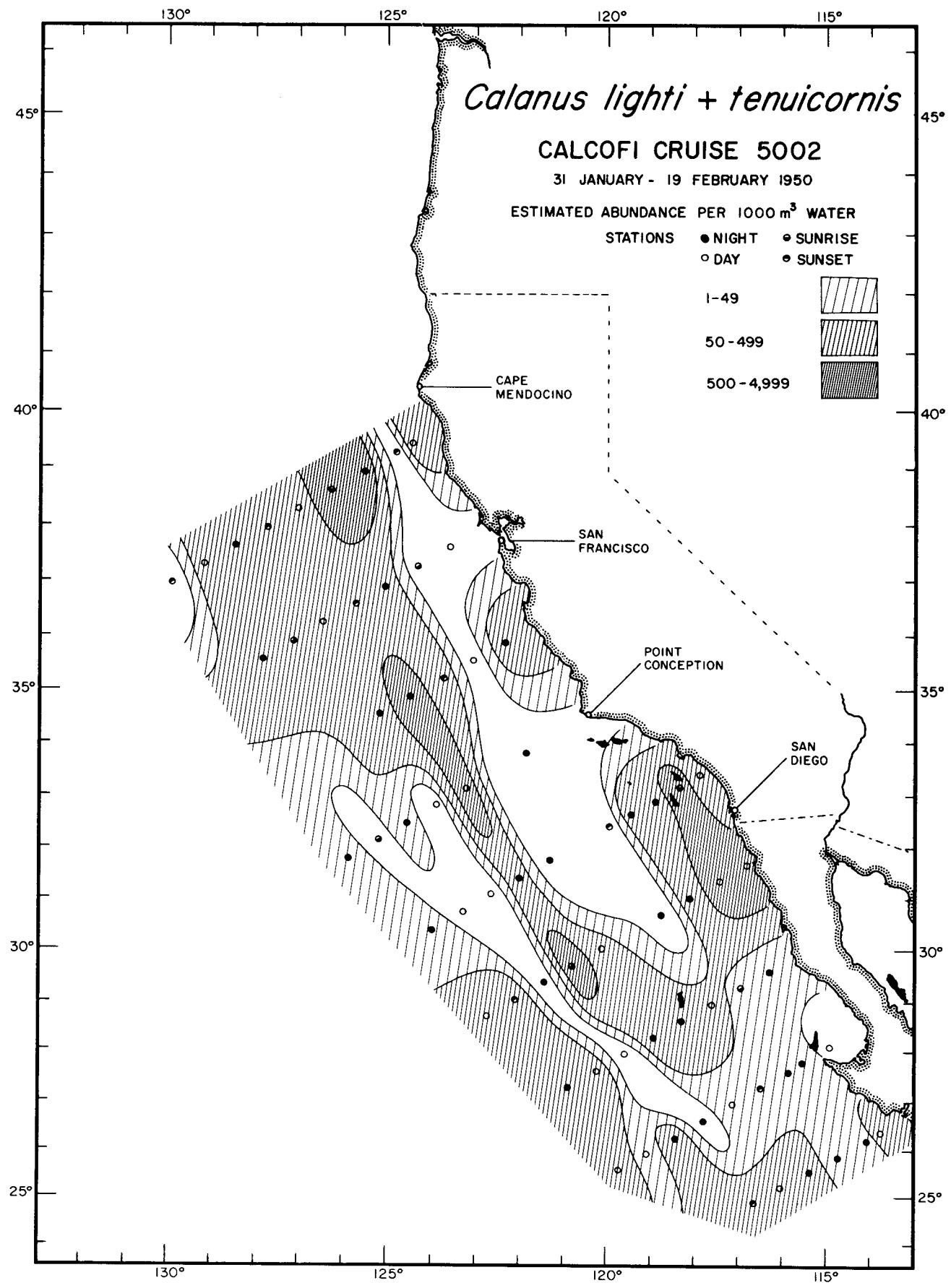
4909



Calanoida

*Calanus lighti + tenuicornis*

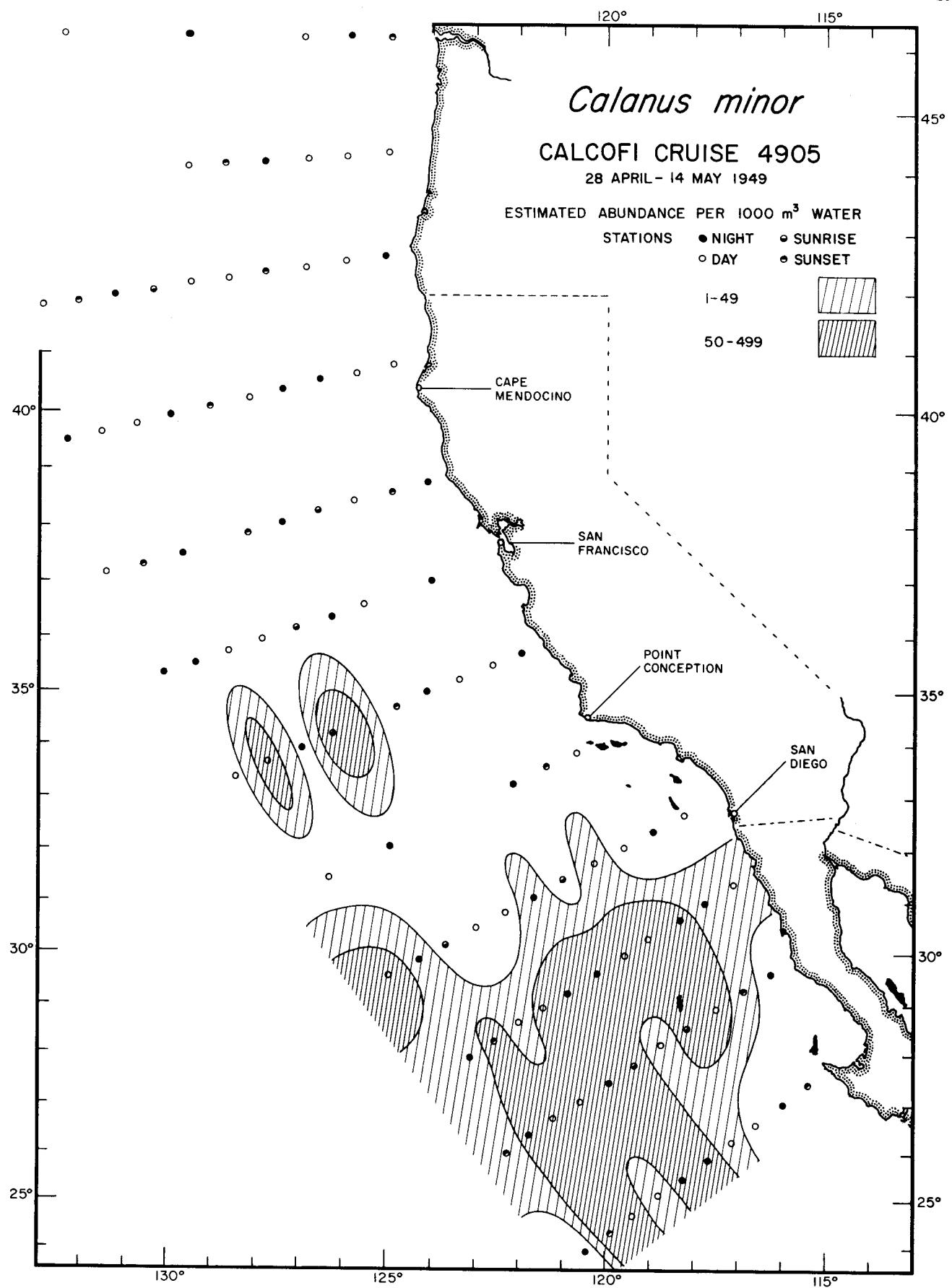
4910

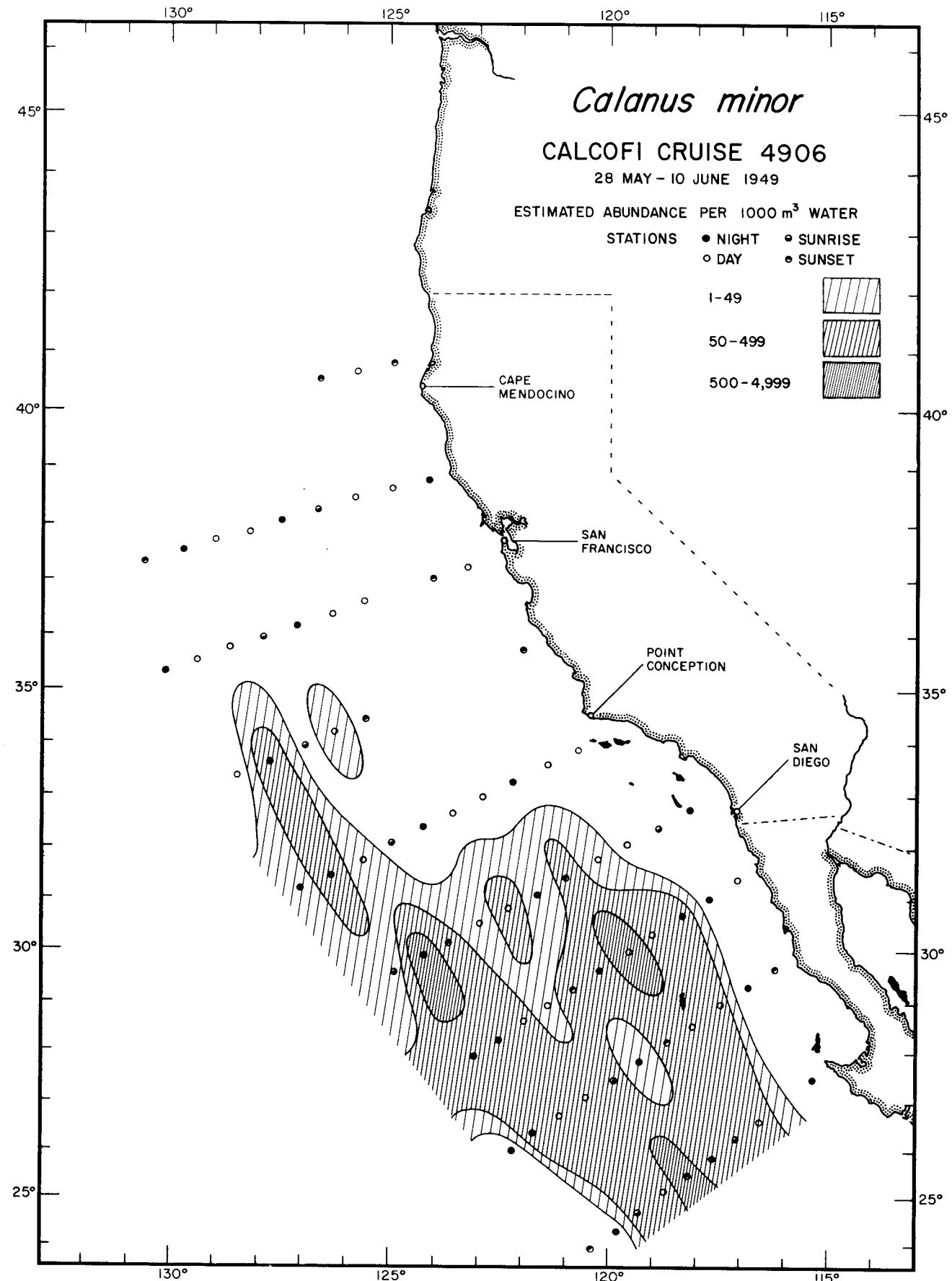


Calanoida

*Calanus lighti + tenuicornis*

5002

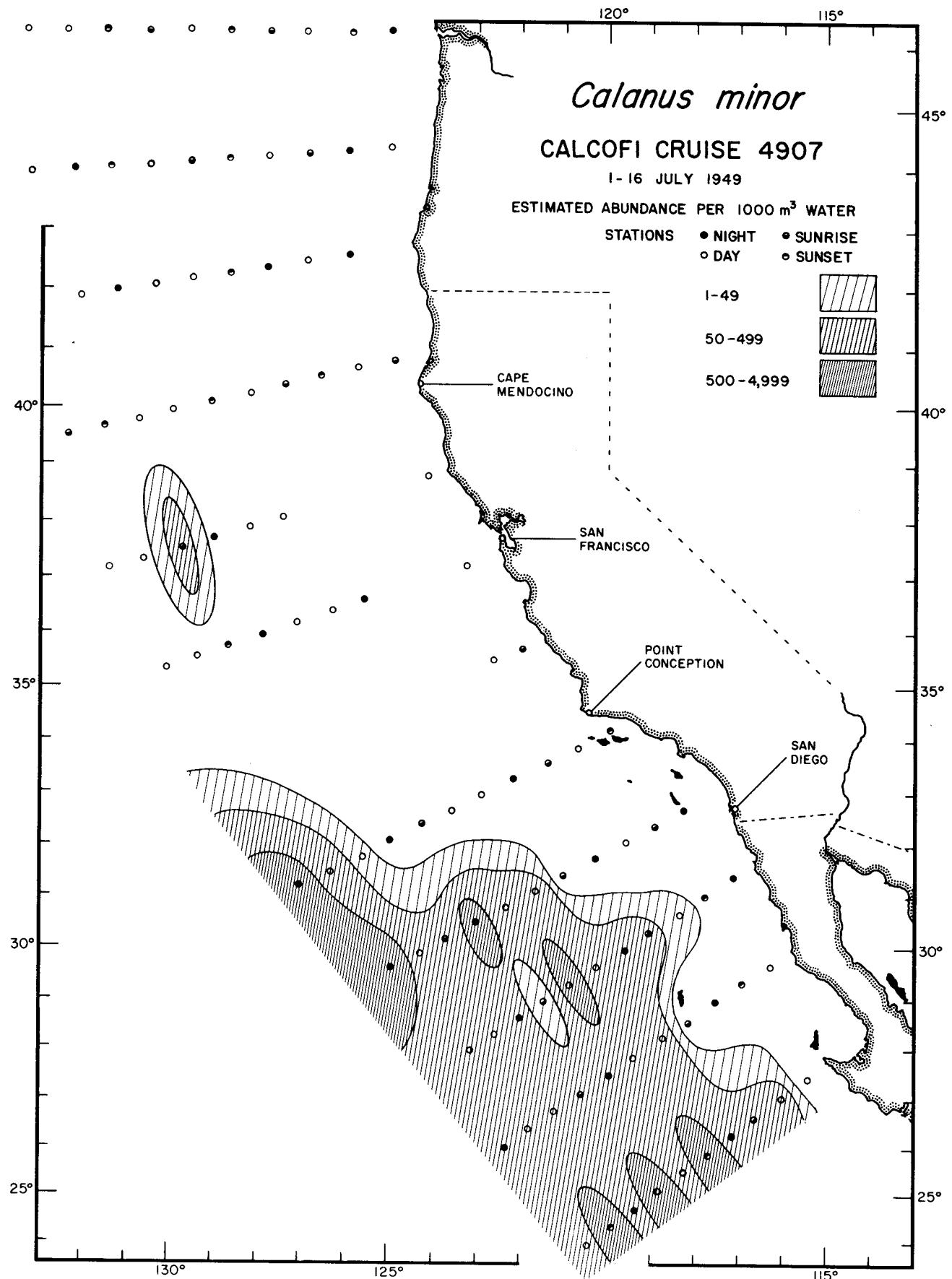




Calanoida

*Calanus minor*

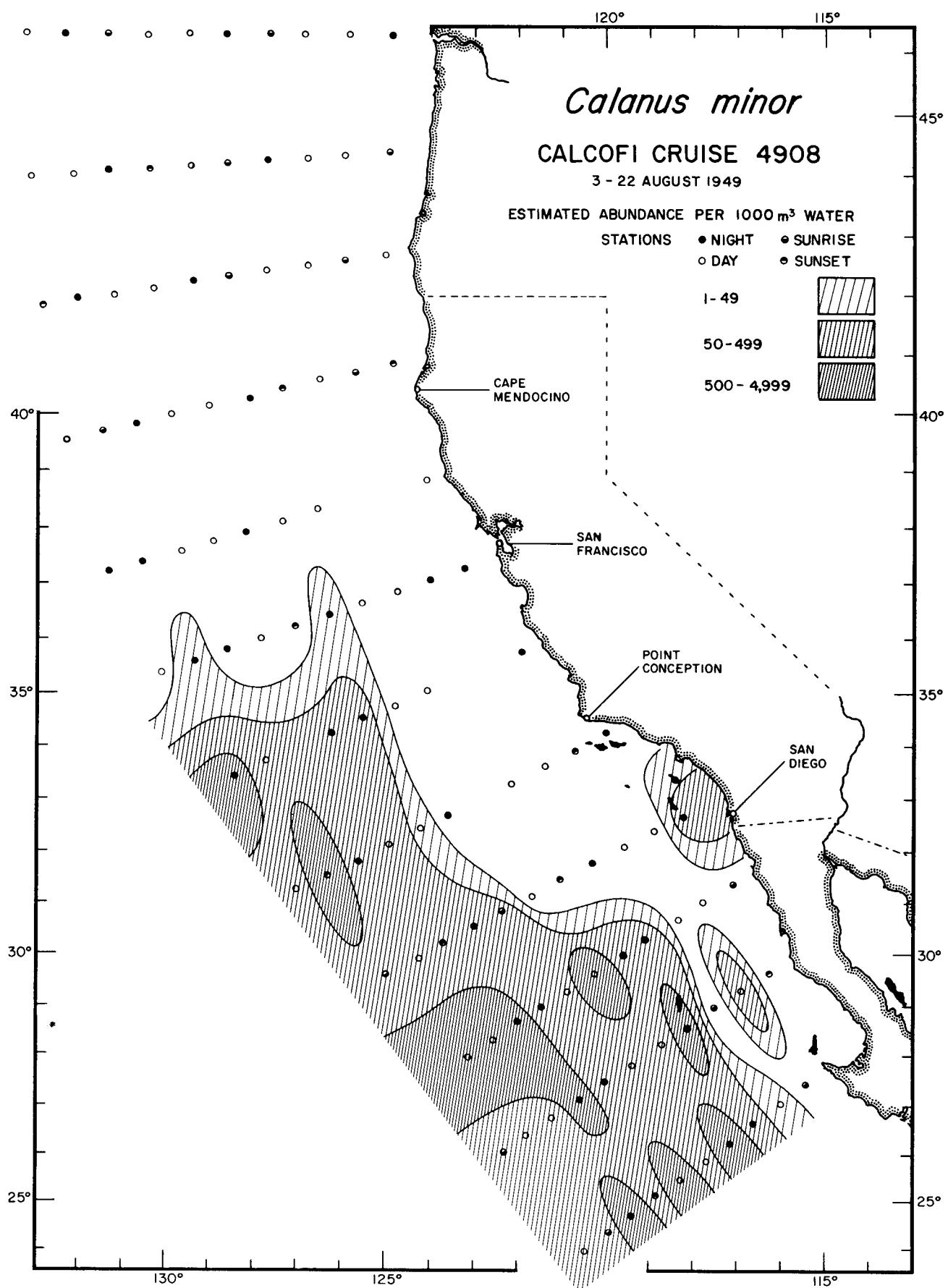
4906



Calanoida

*Calanus minor*

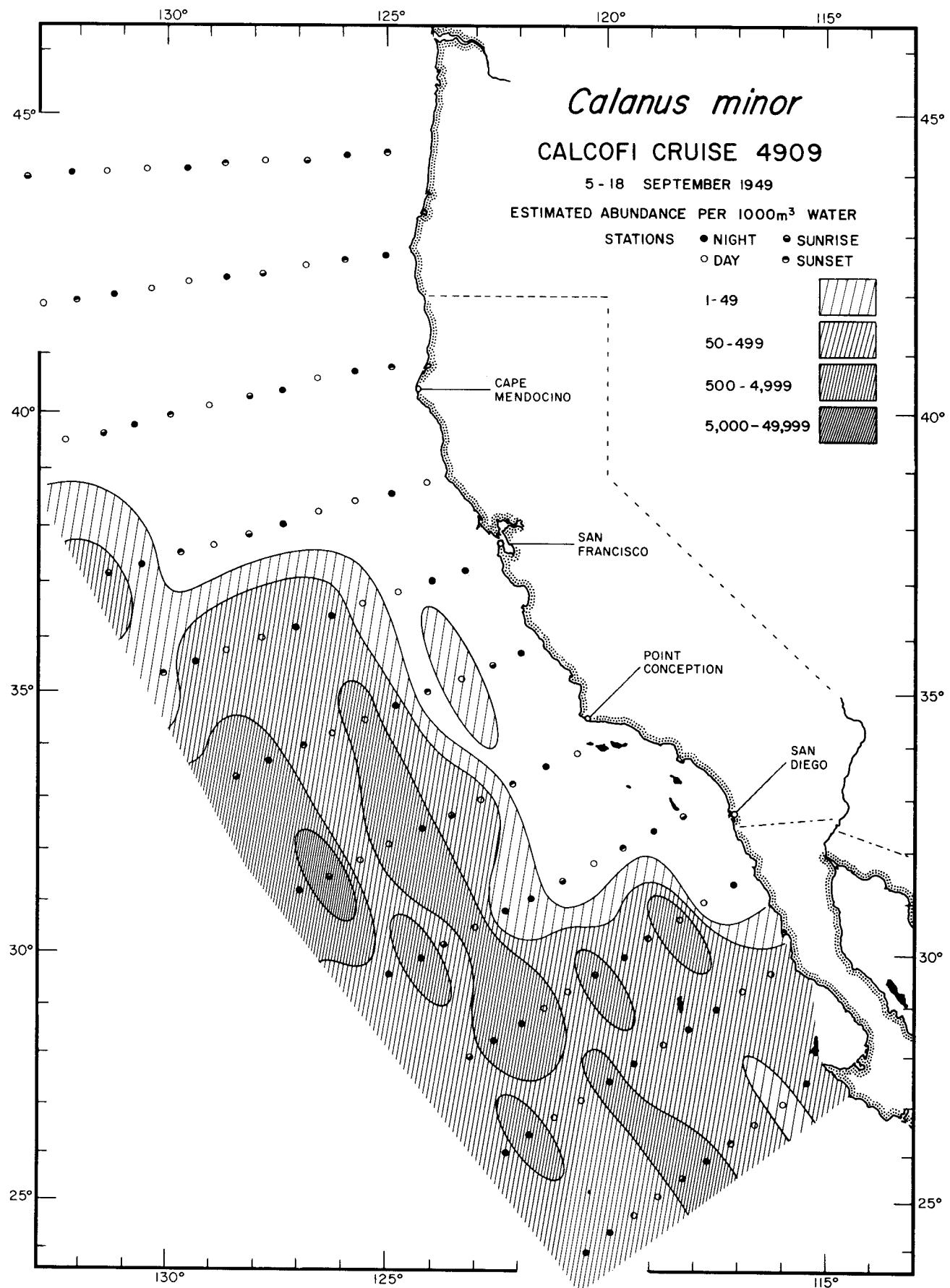
4907



Calanoida

*Calanus minor*

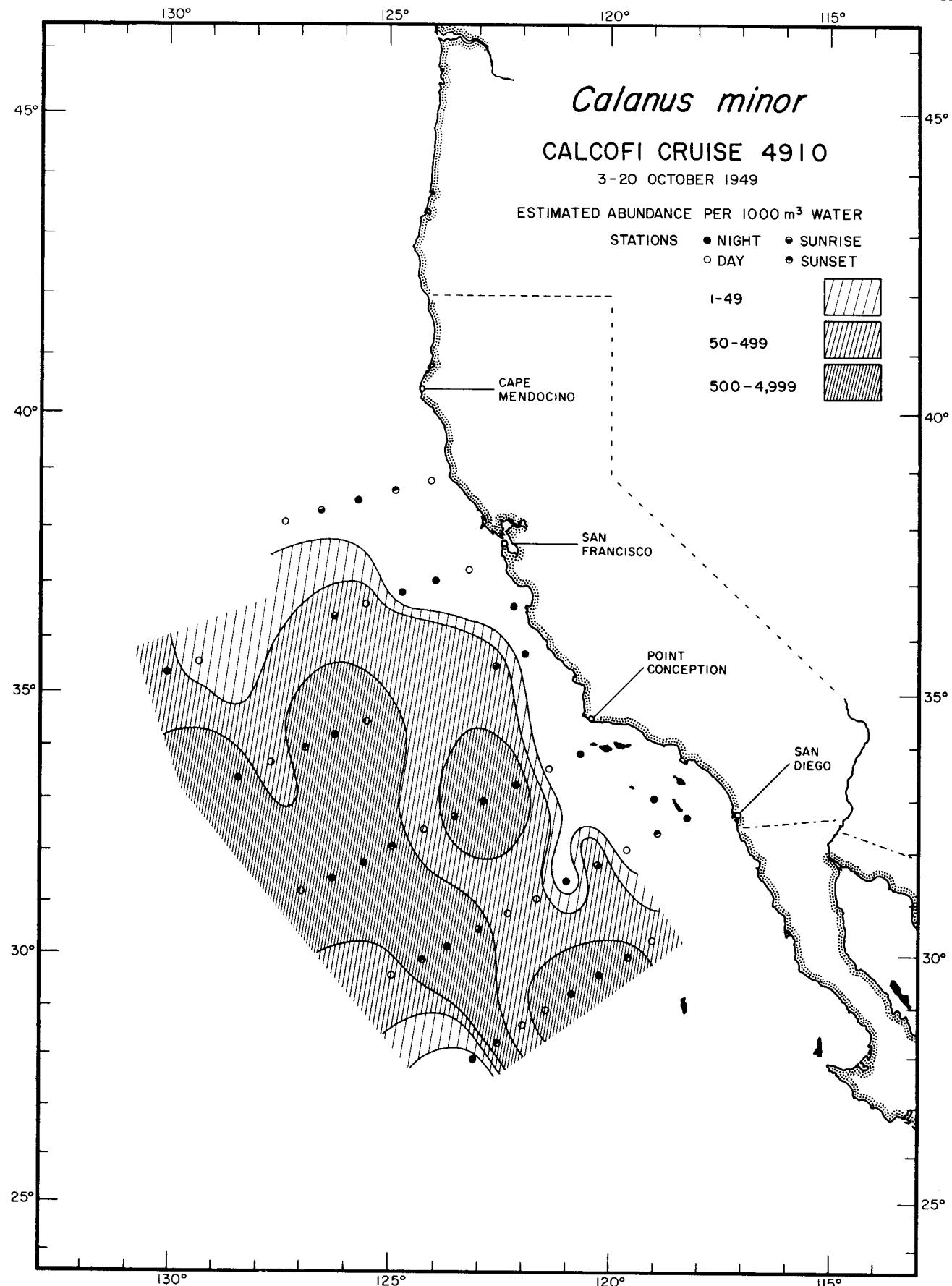
4908



Calanoida

*Calanus minor*

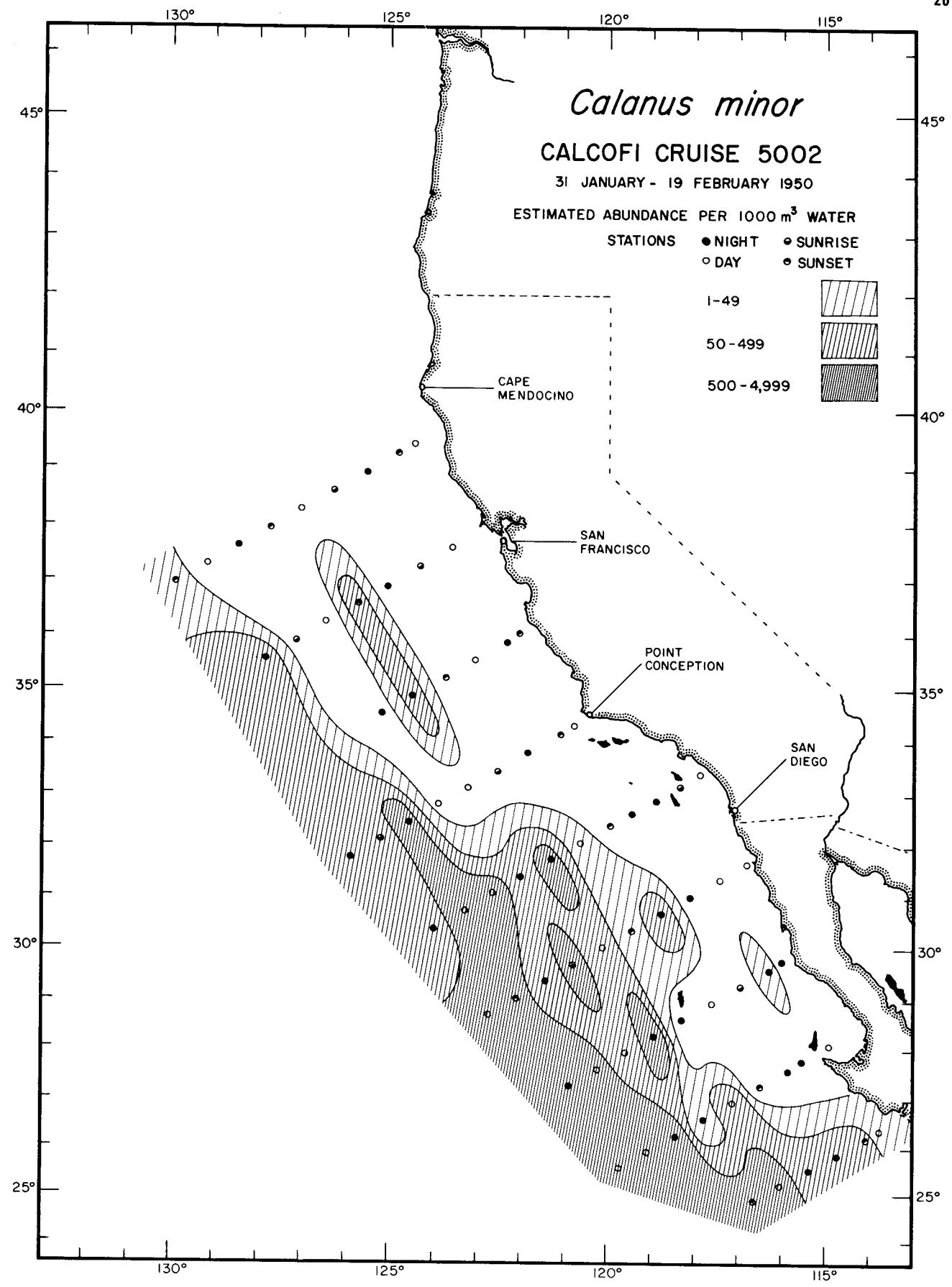
4909



Calanoida

*Calanus minor*

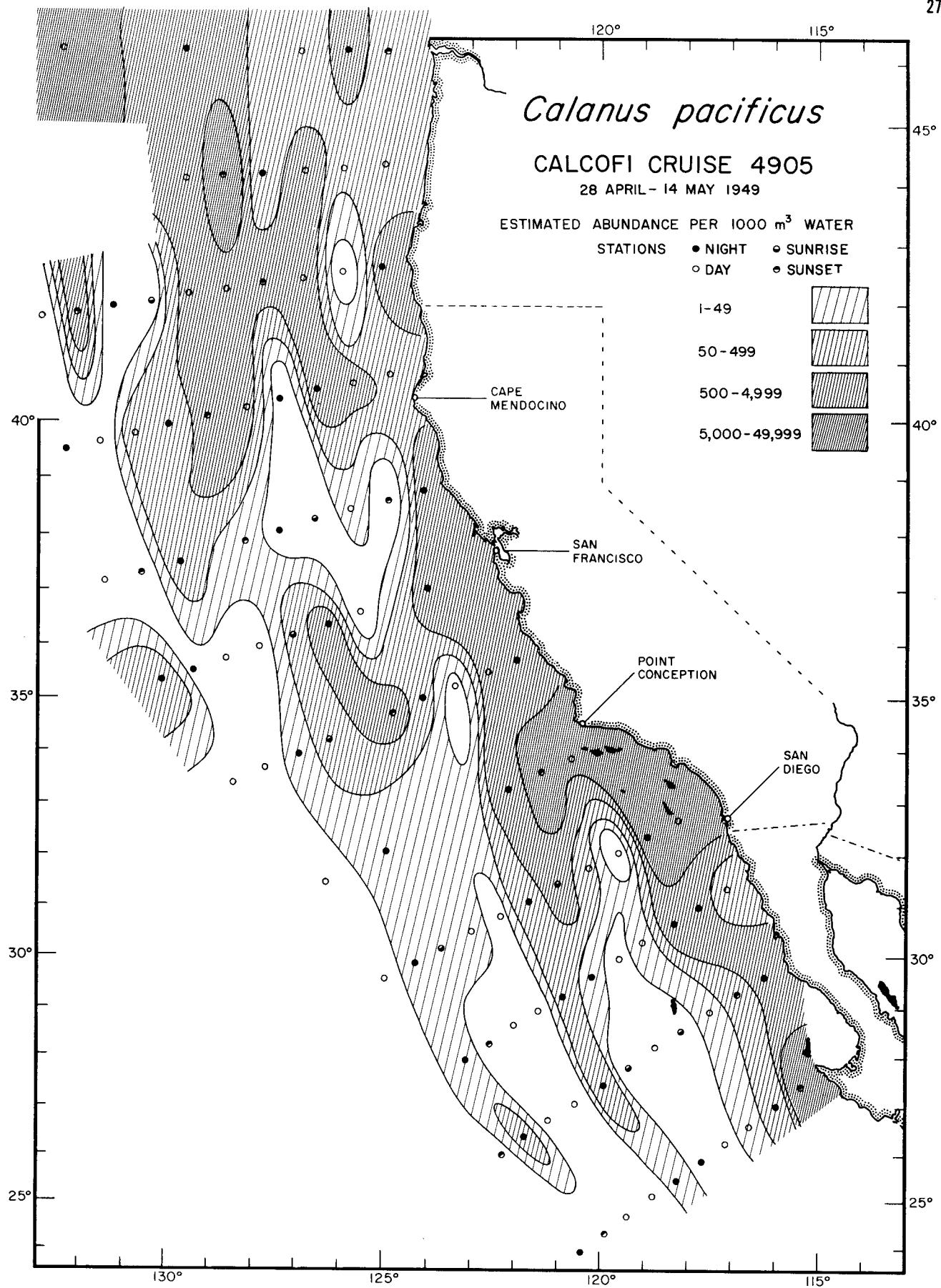
4910



Calanoida

*Calanus minor*

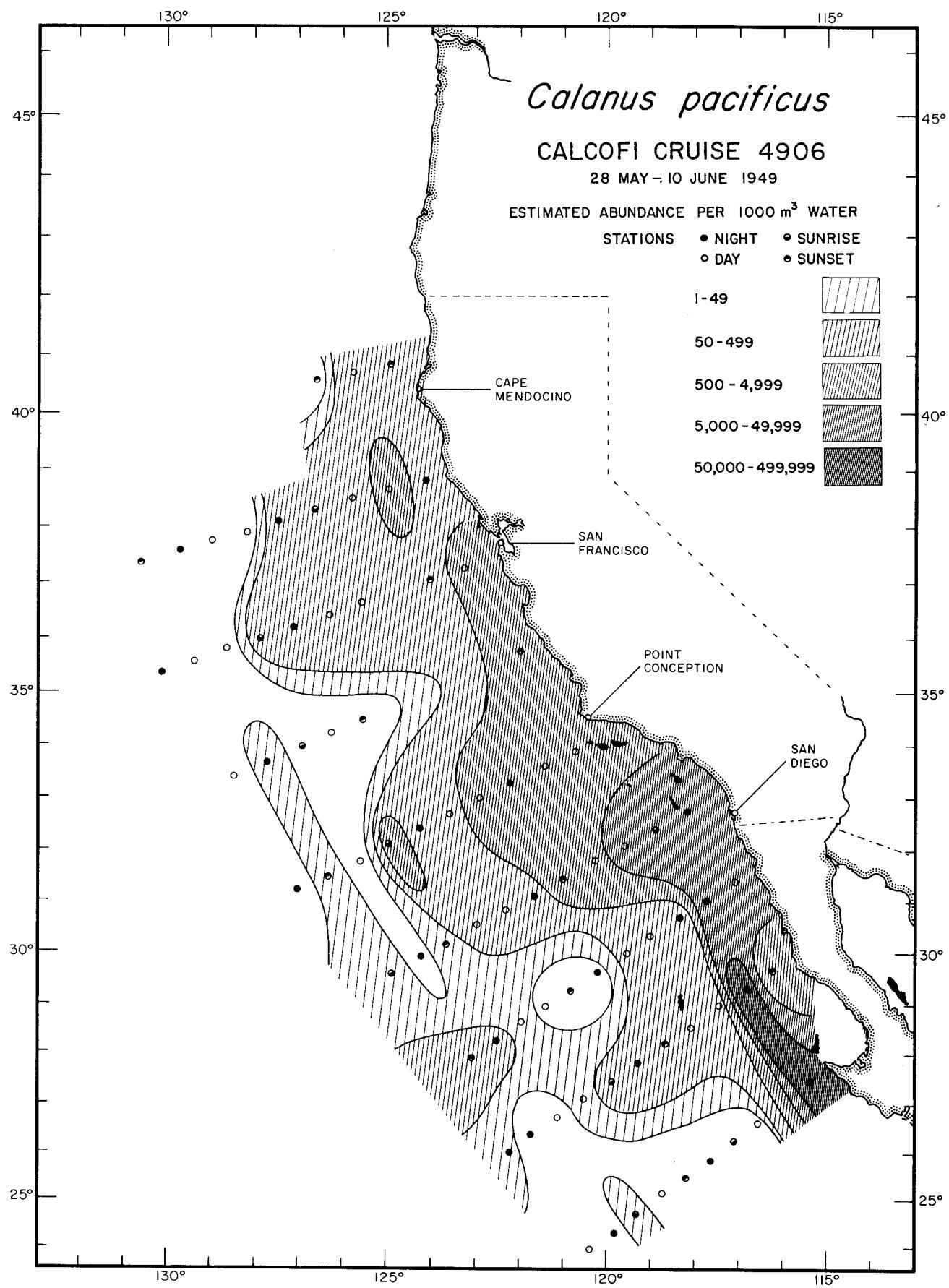
5002



Calanoida

*Calanus pacificus*

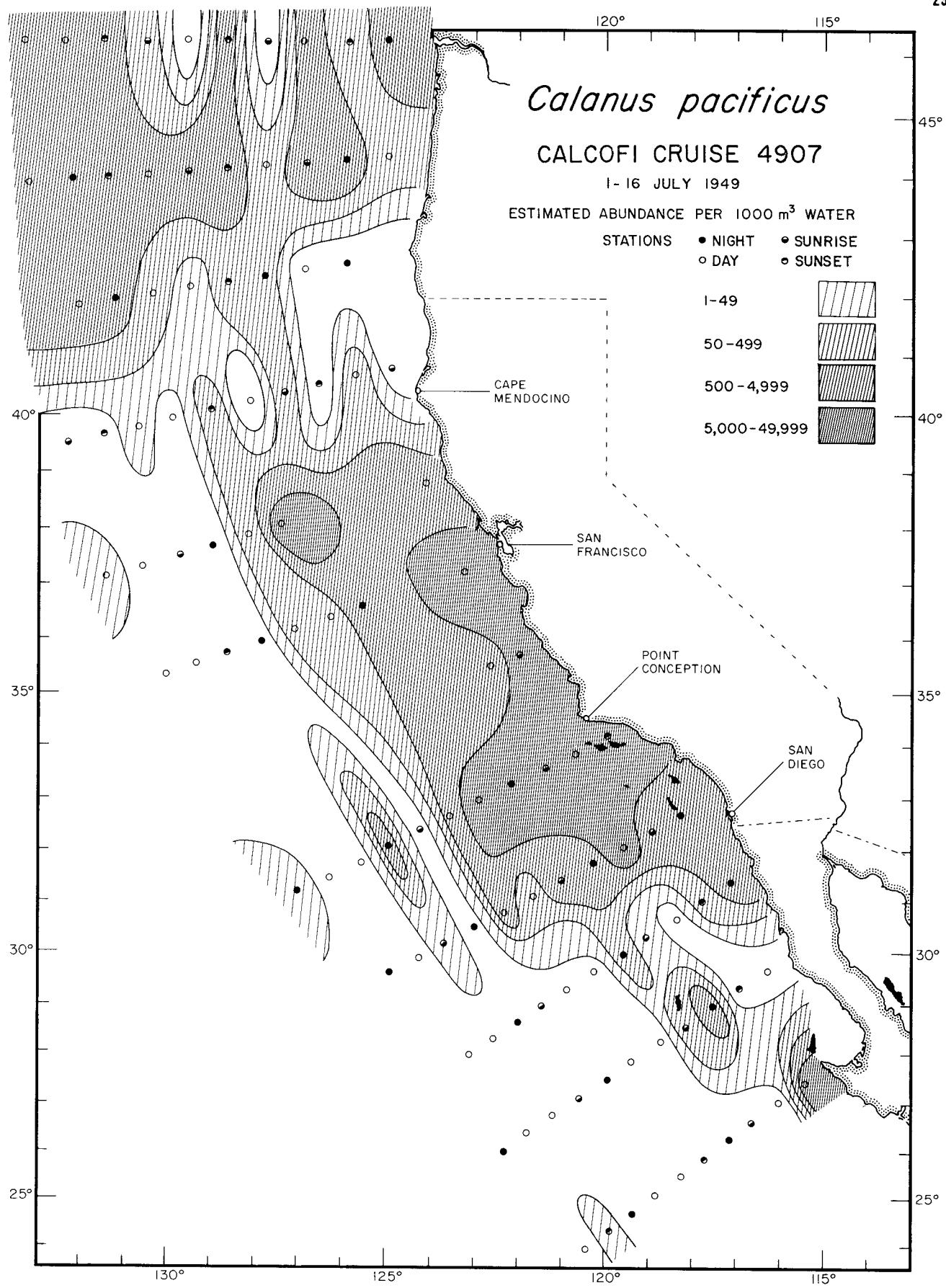
4905



Calanoida

*Calanus pacificus*

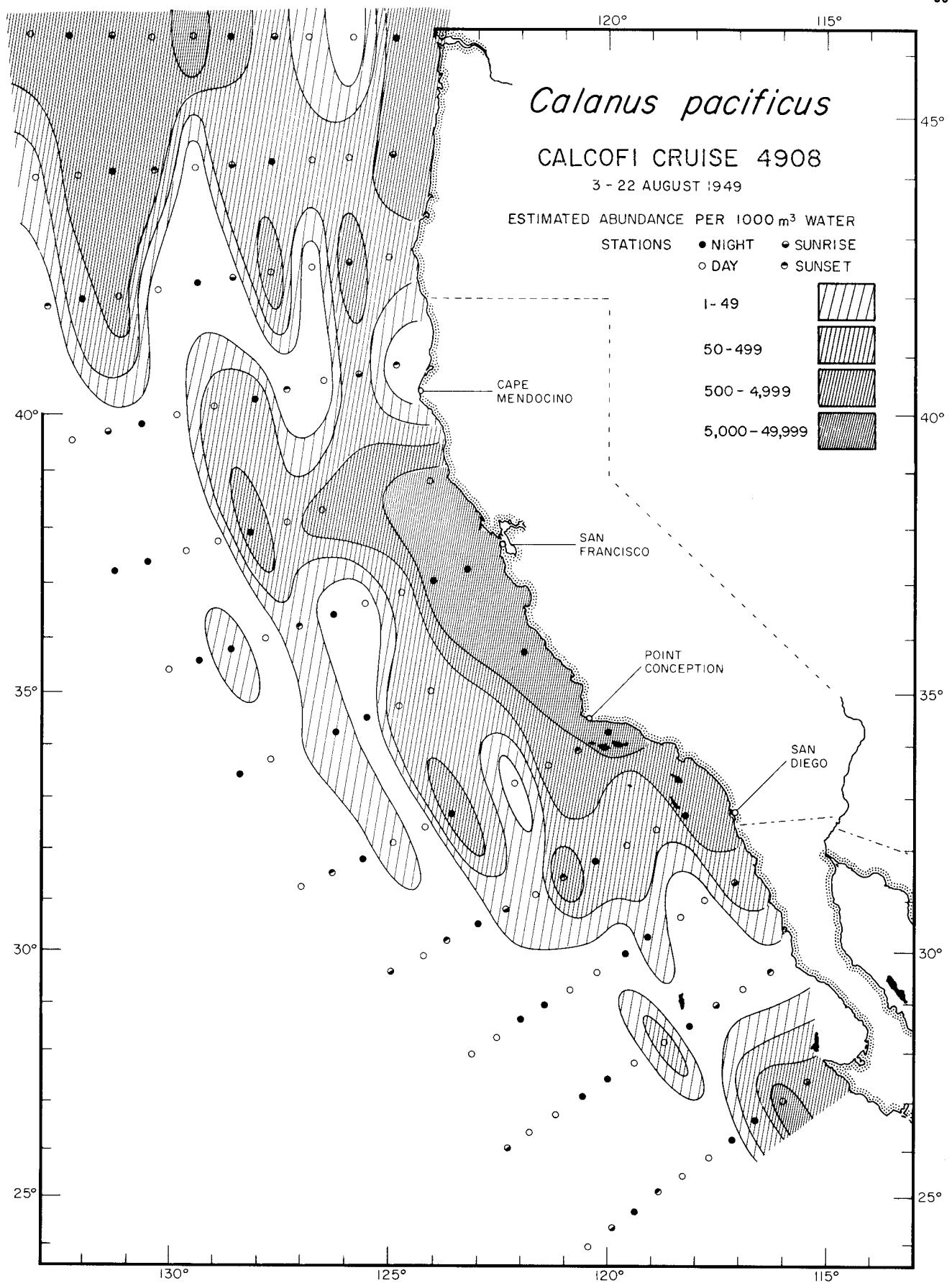
4906



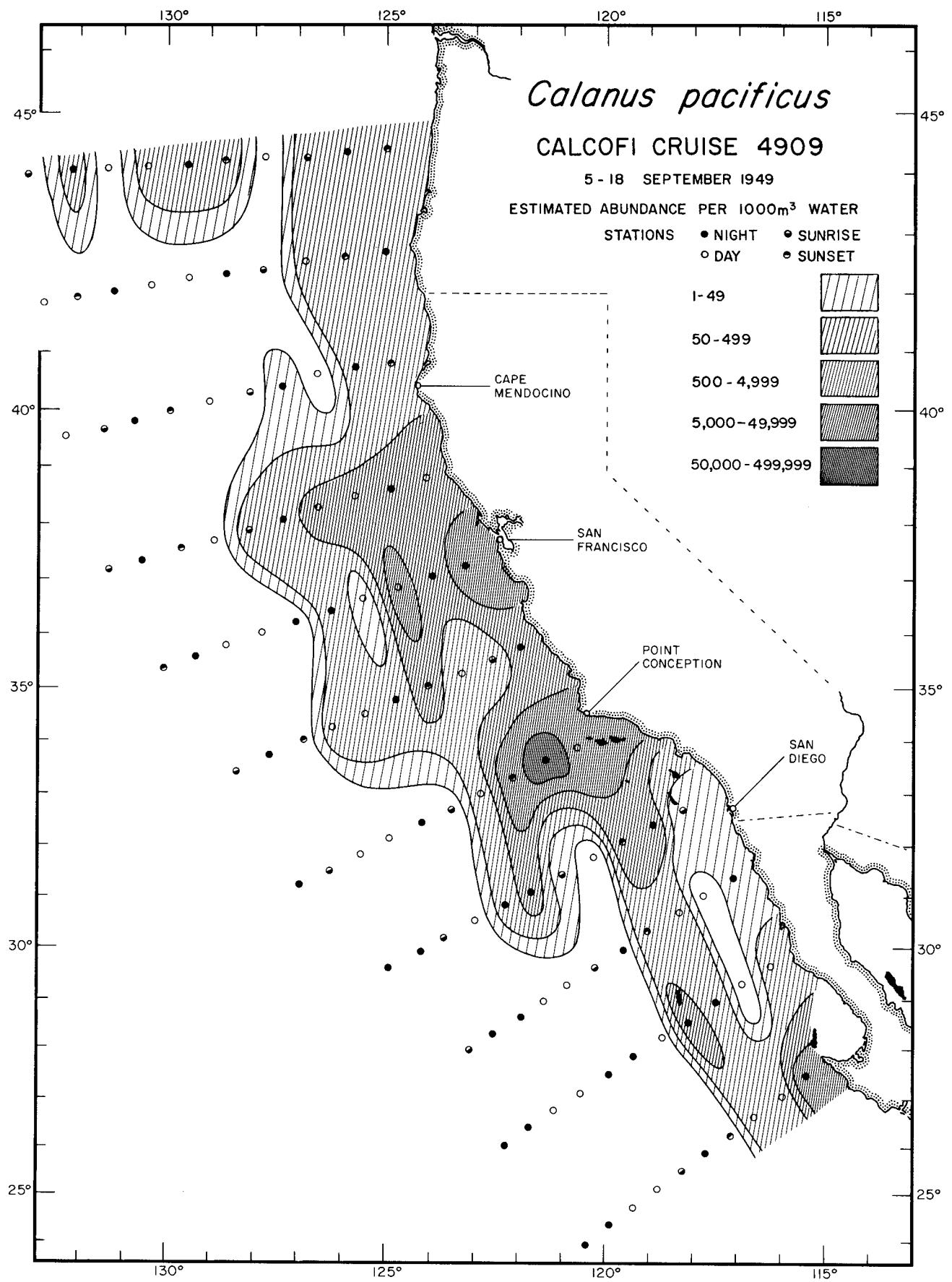
Calanoida

*Calanus pacificus*

4907



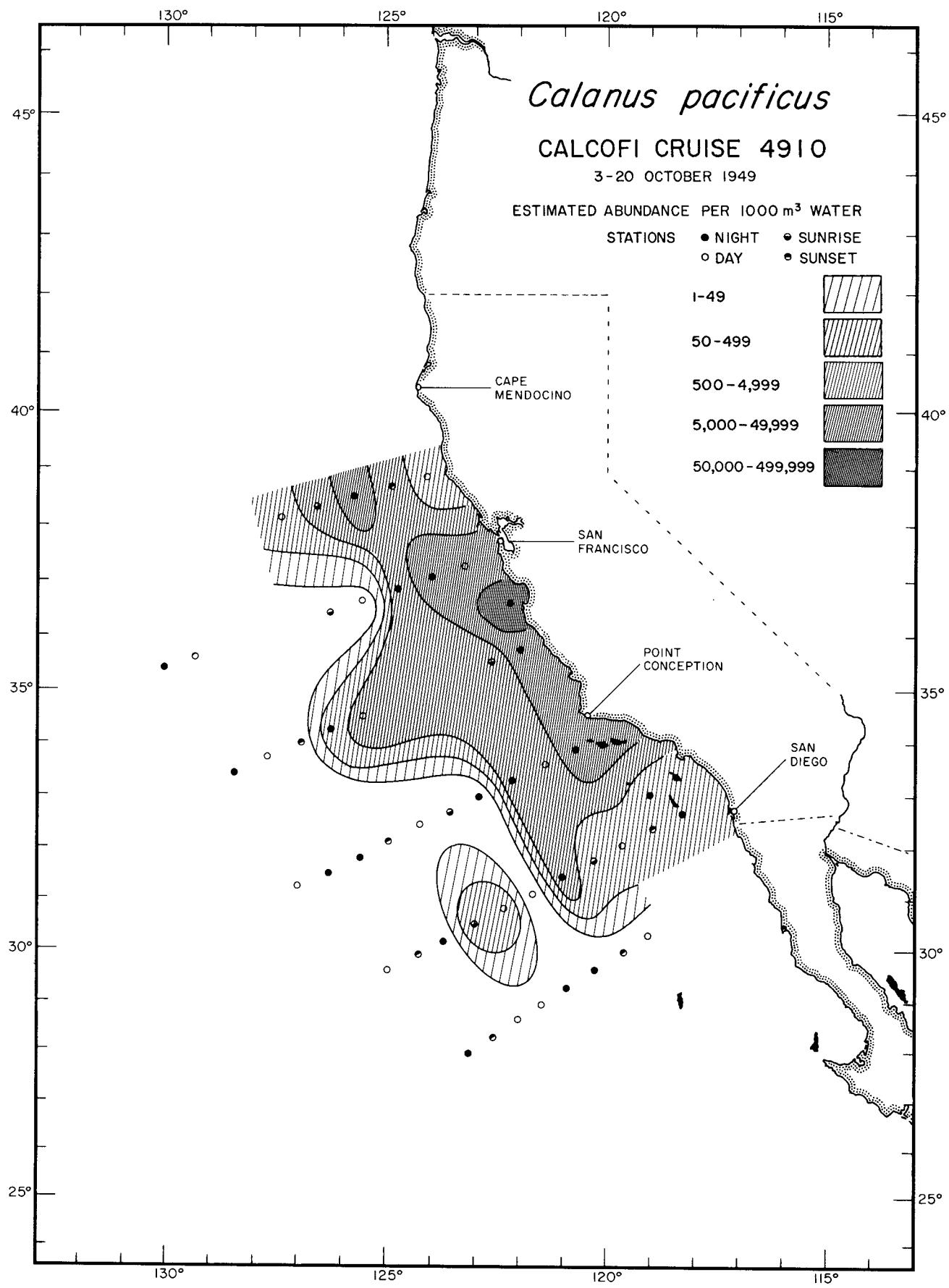
*Calanus pacificus*  
4908



Calanoida

*Calanus pacificus*

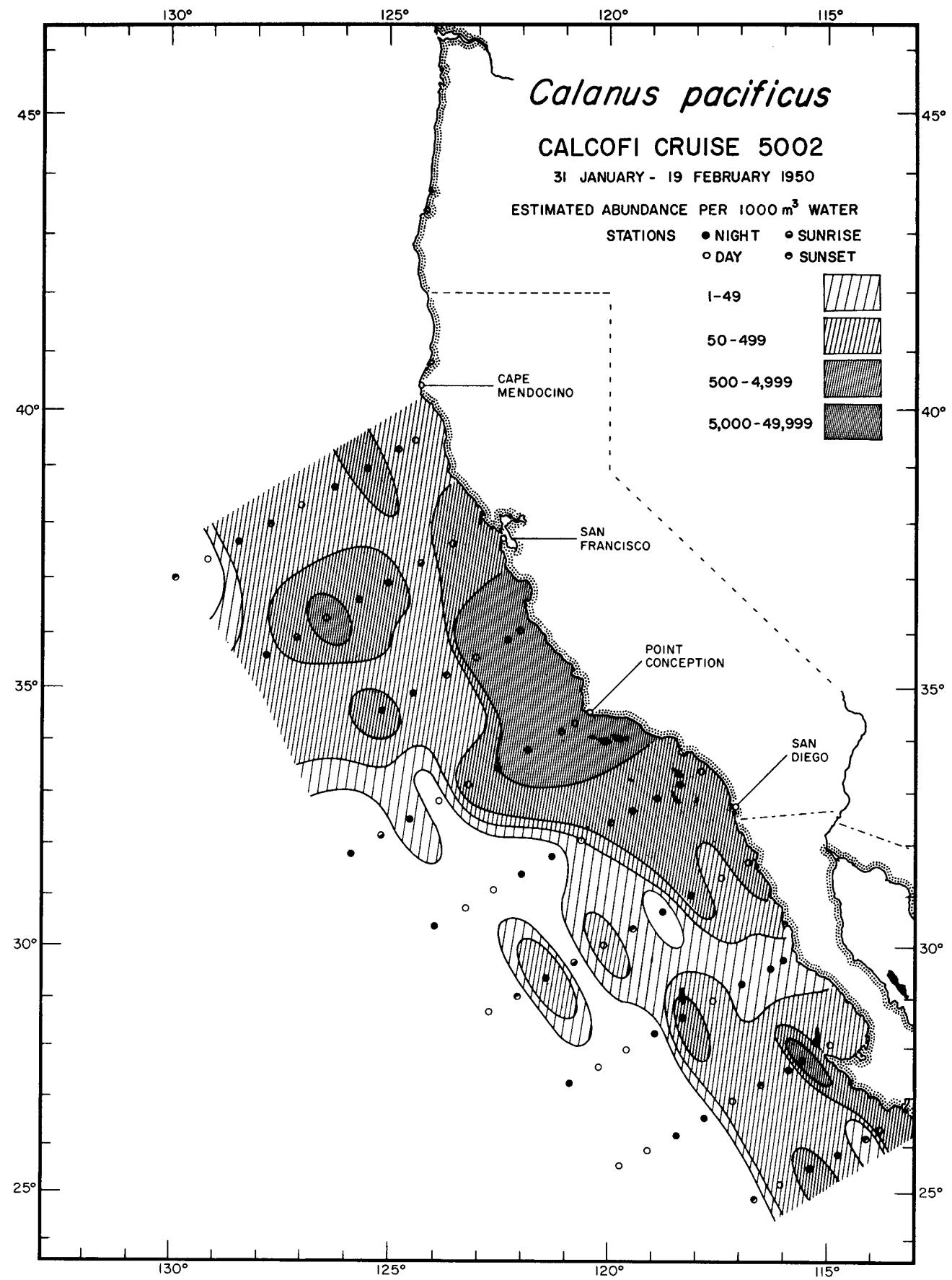
4909



Calanoida

*Calanus pacificus*

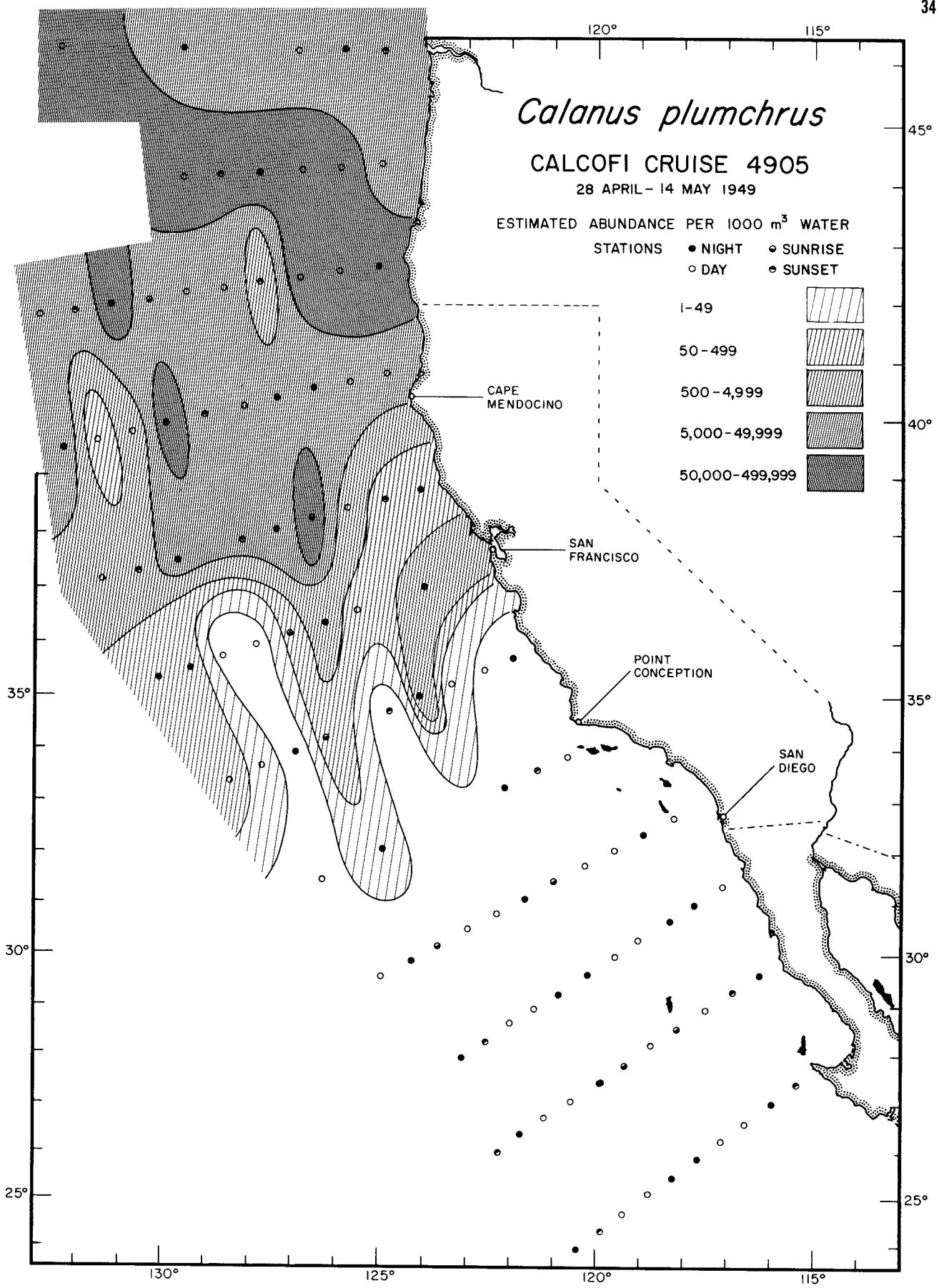
4910



Calanoida

*Calanus pacificus*

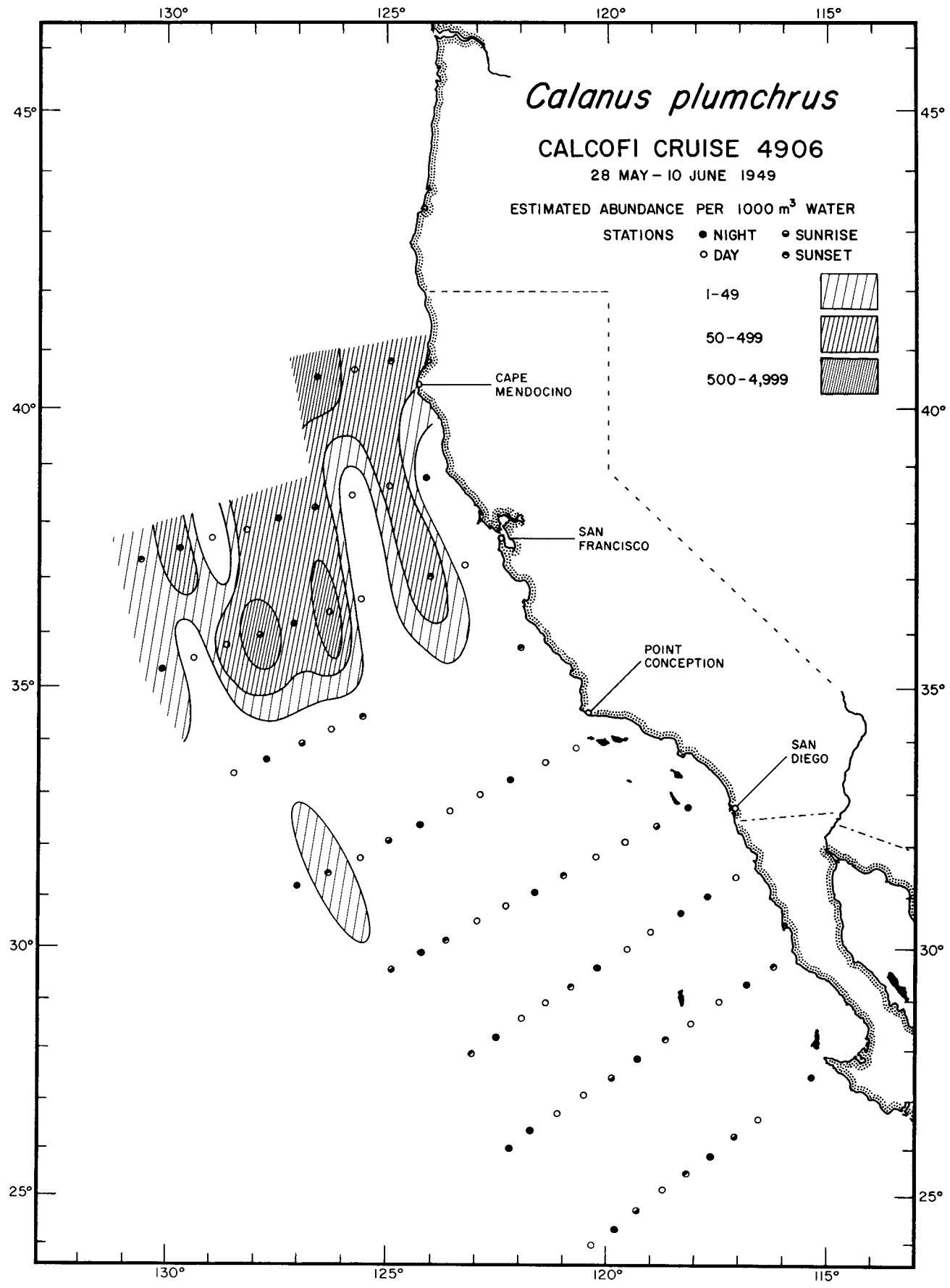
5002



Calanoida

*Calanus plumchrus*

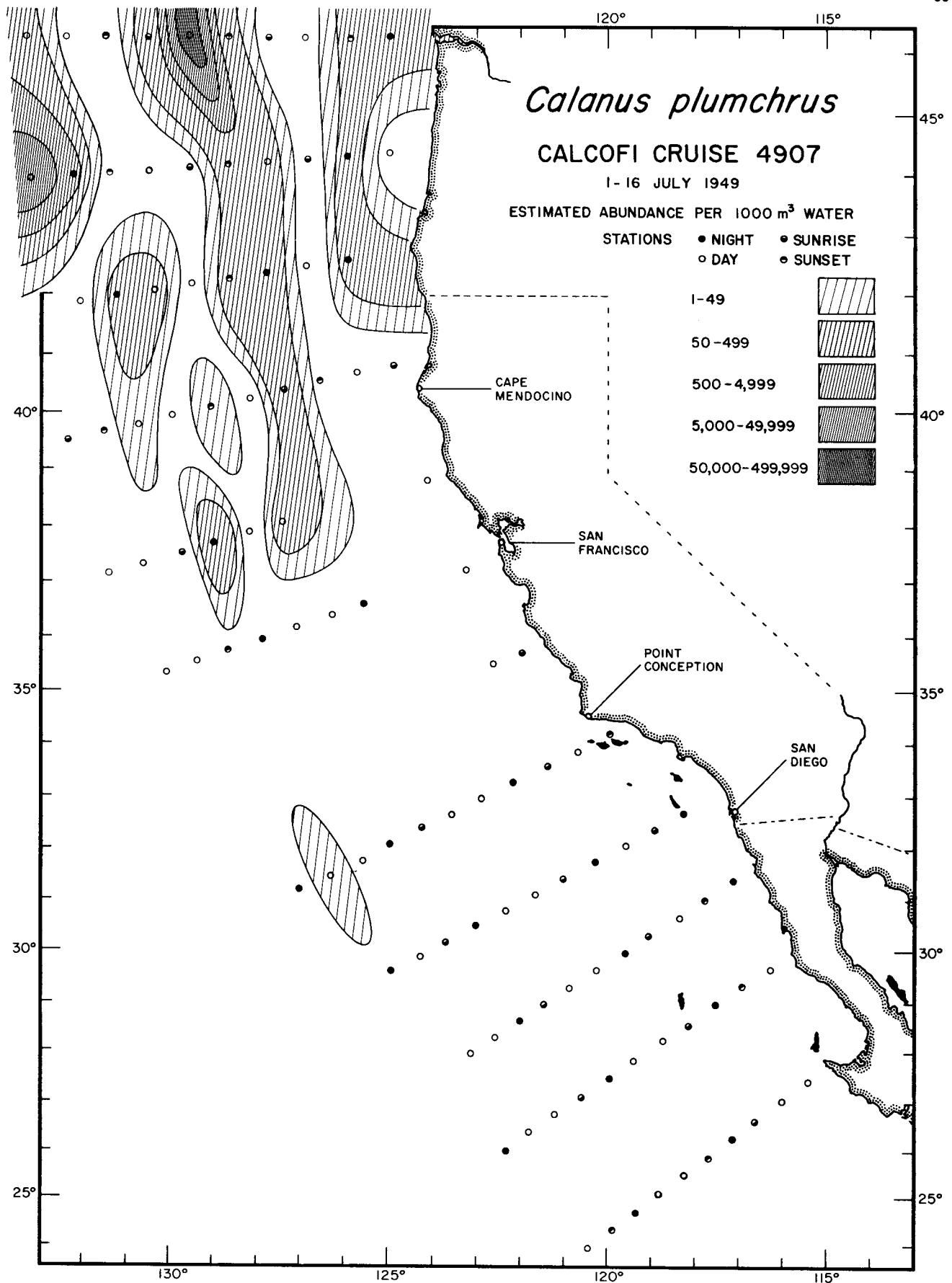
4905



Calanoida

*Calanus plumchrus*

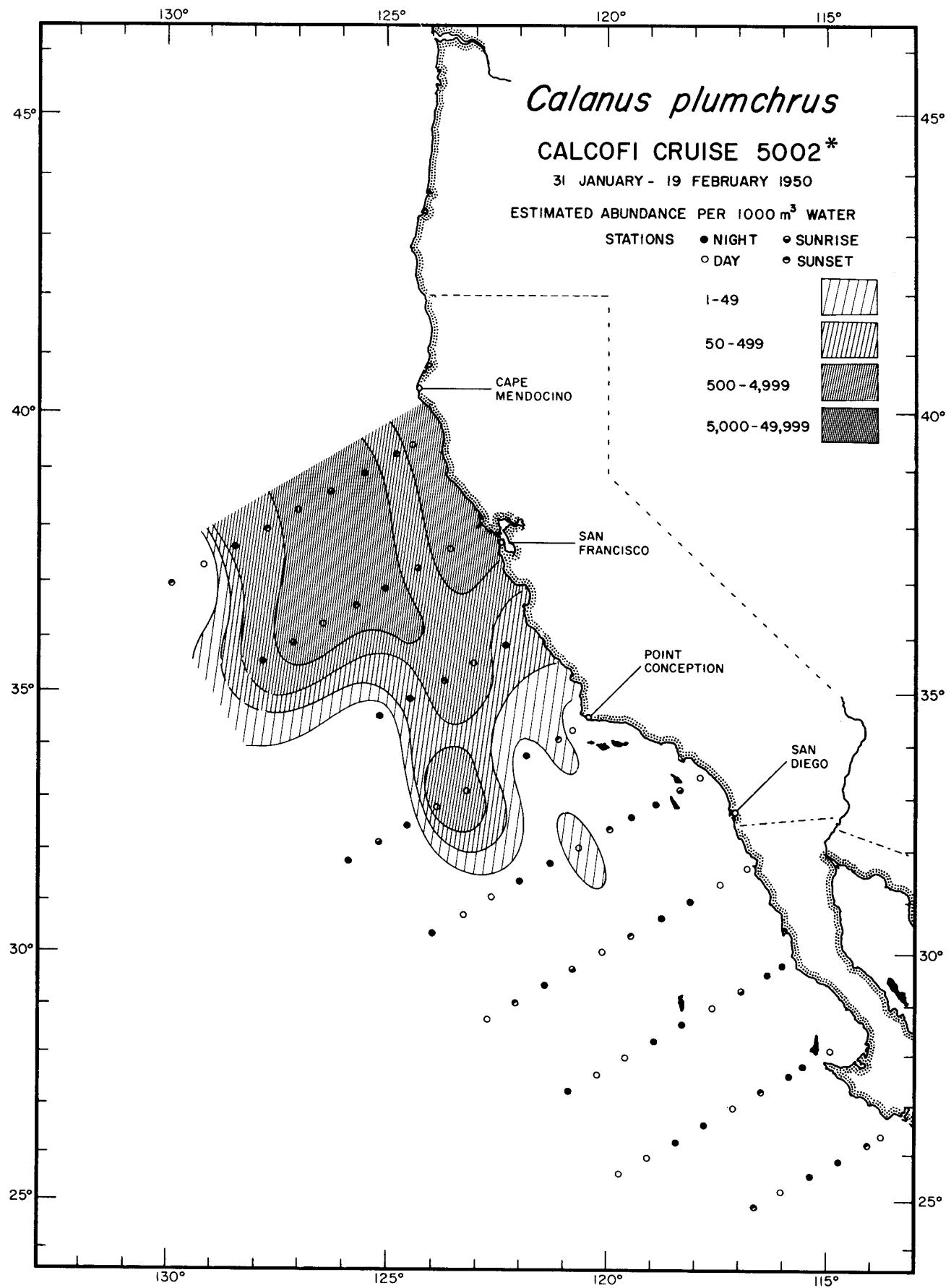
4906



Calanoida

*Calanus plumchrus*

4907

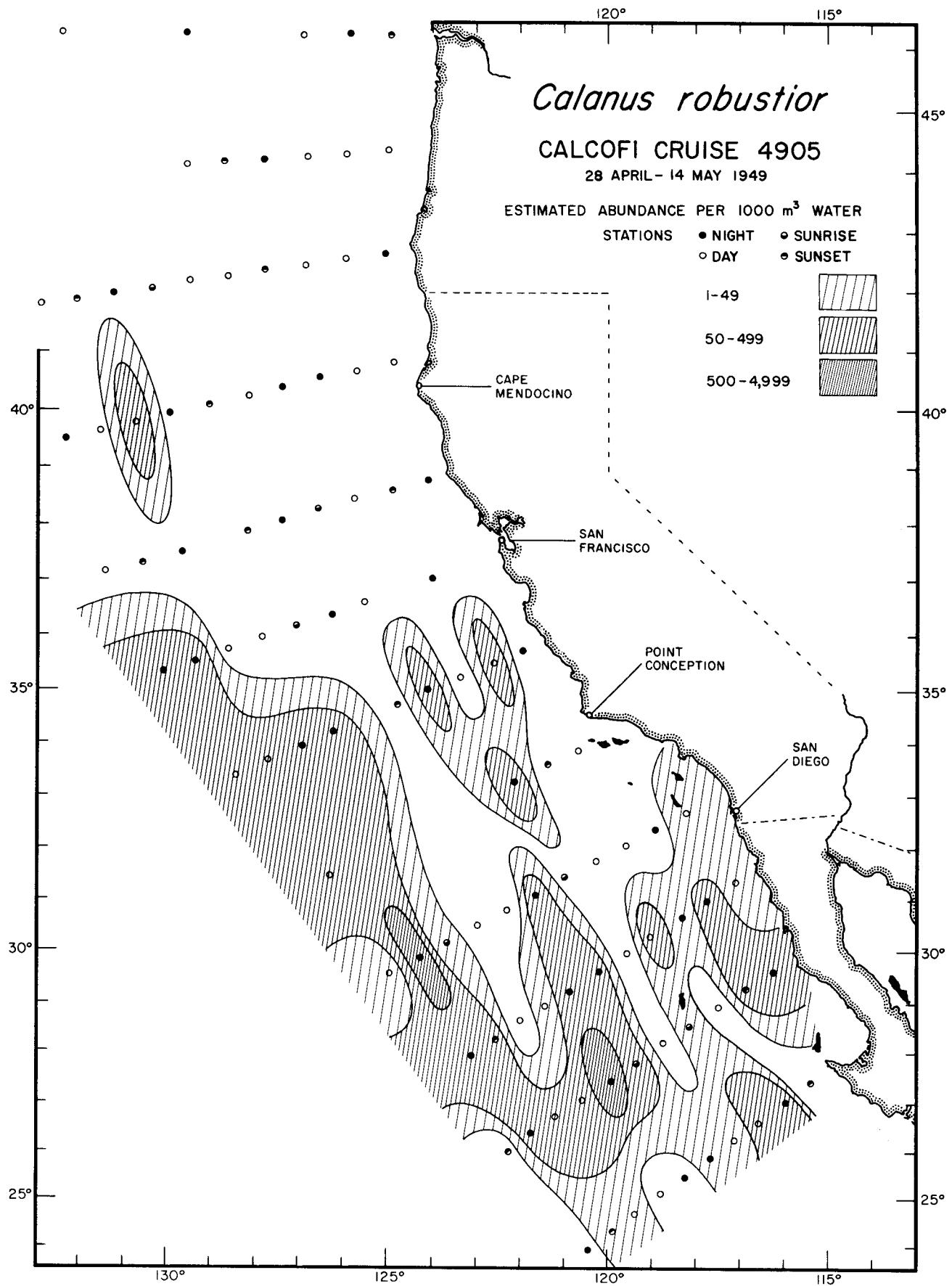


\* See Table 1 for cruises 4908, 9, 10

Calanoida

*Calanus plumchrus*

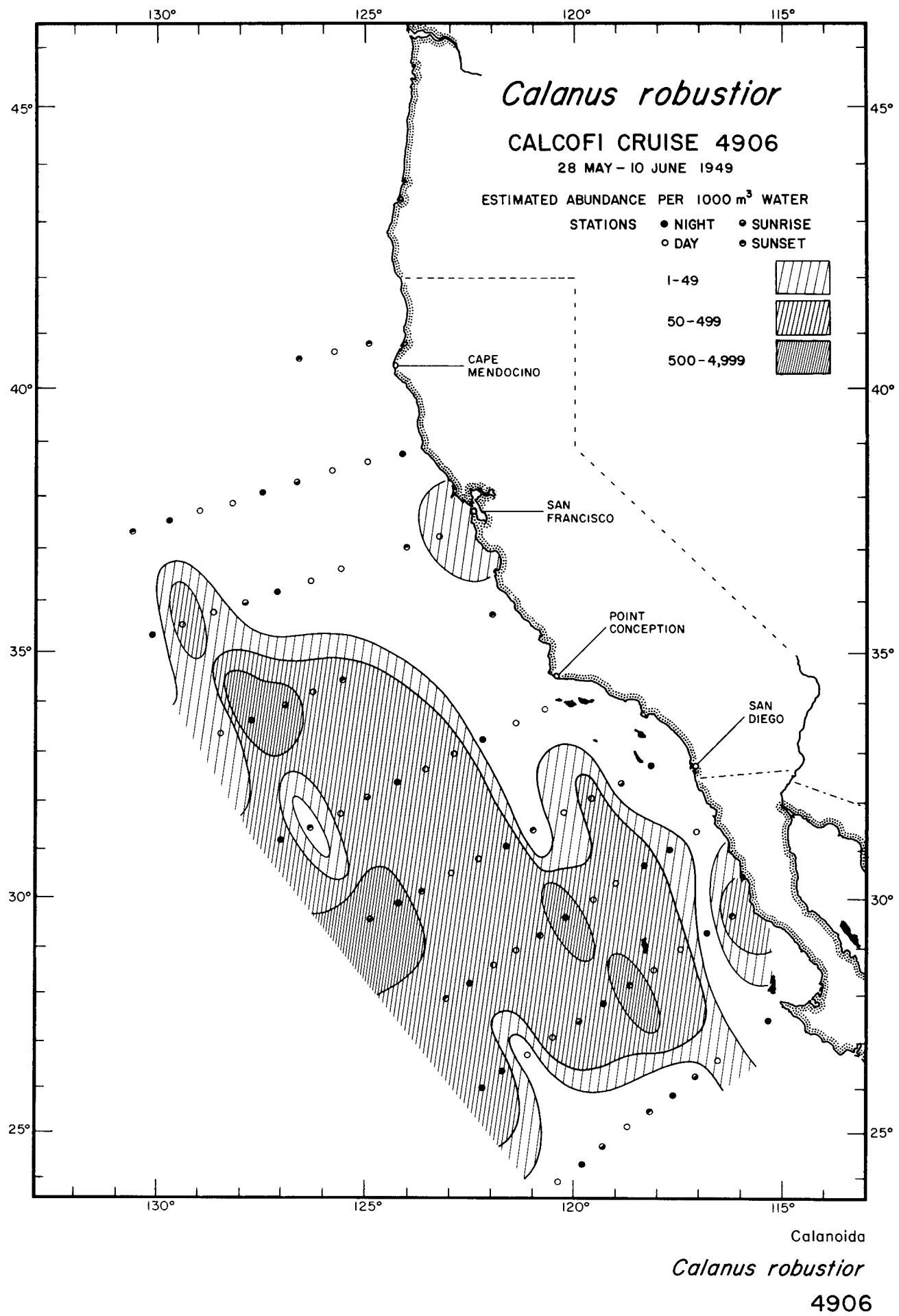
5002

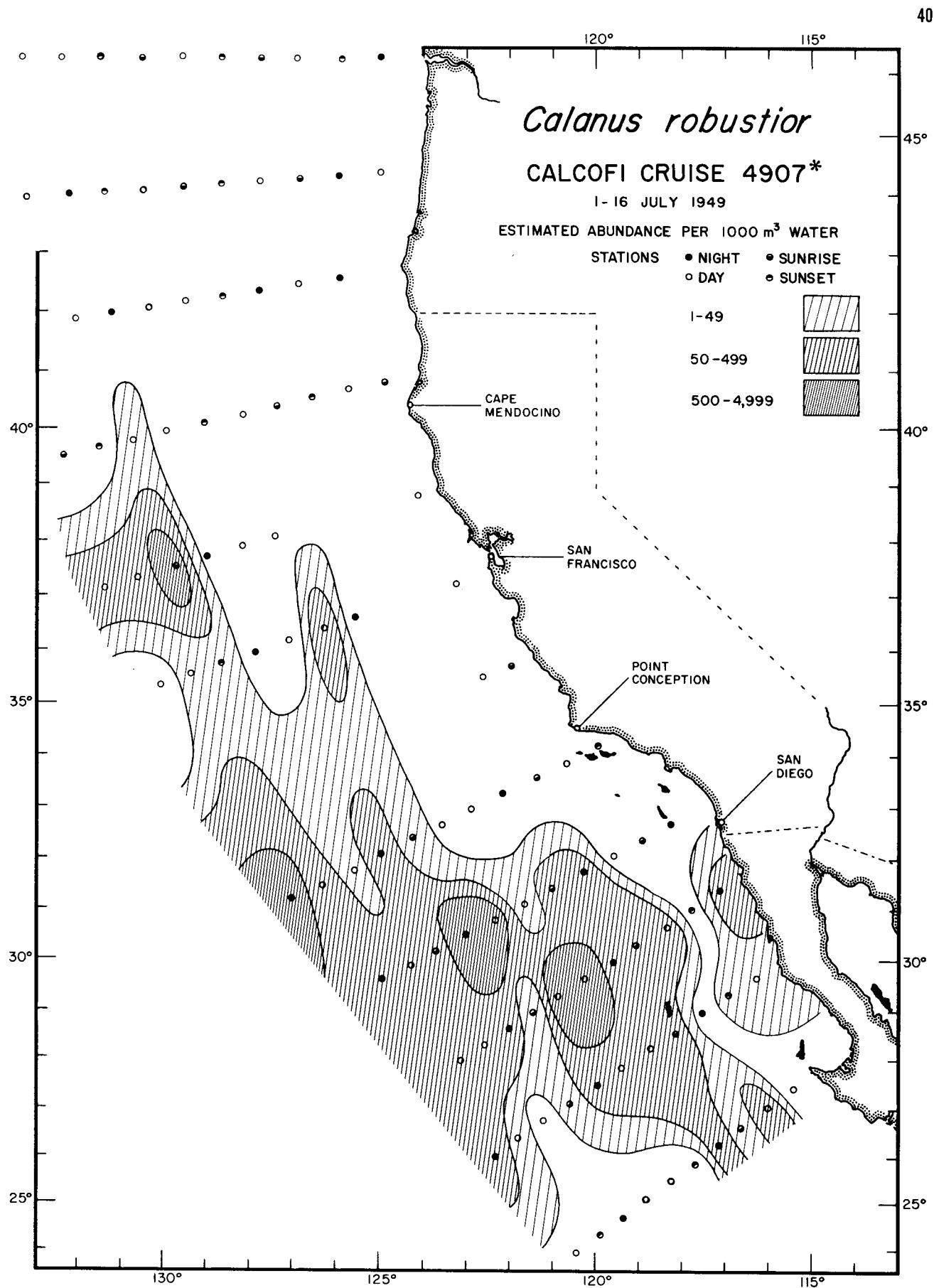


Calanoida

*Calanus robustior*

4905



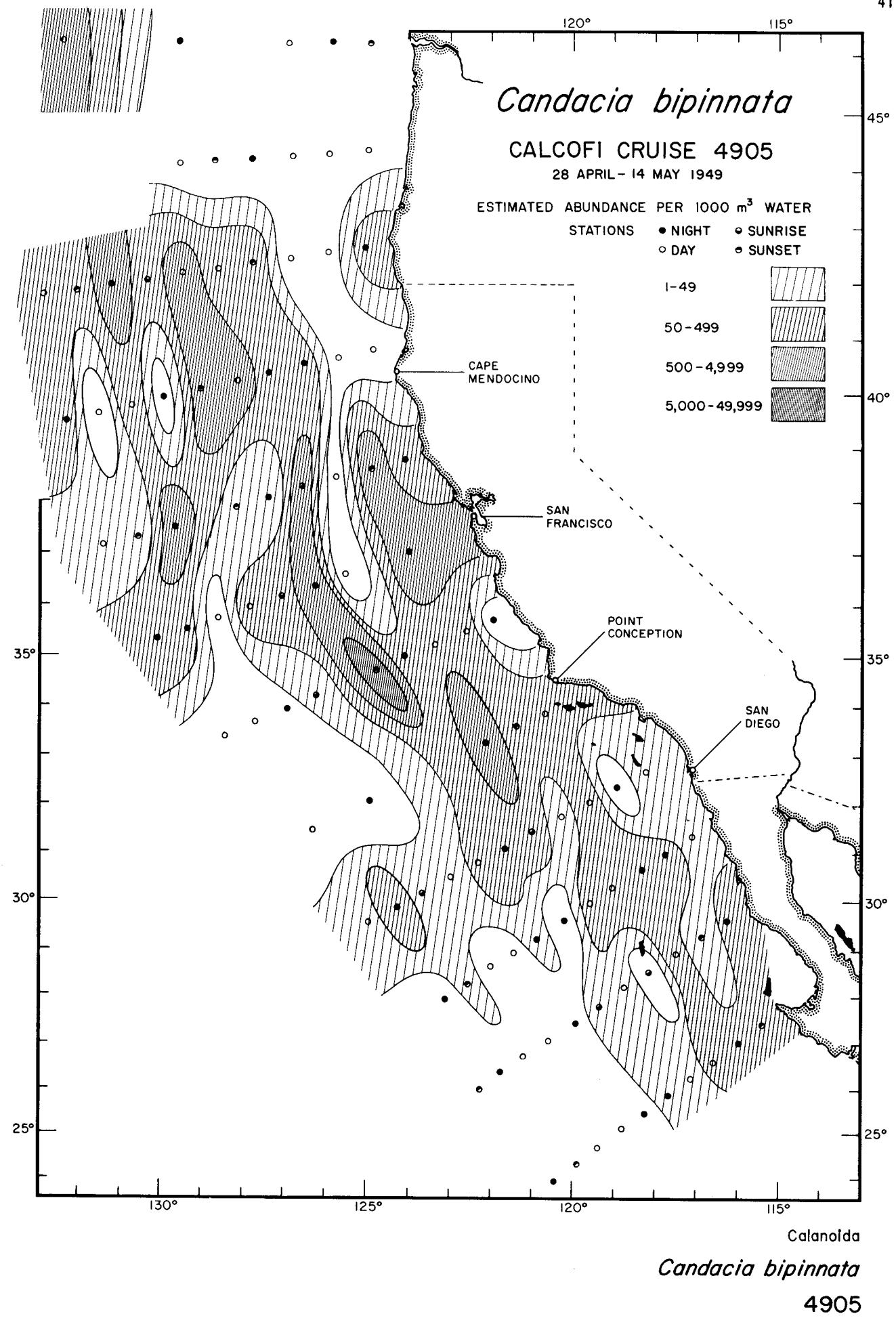


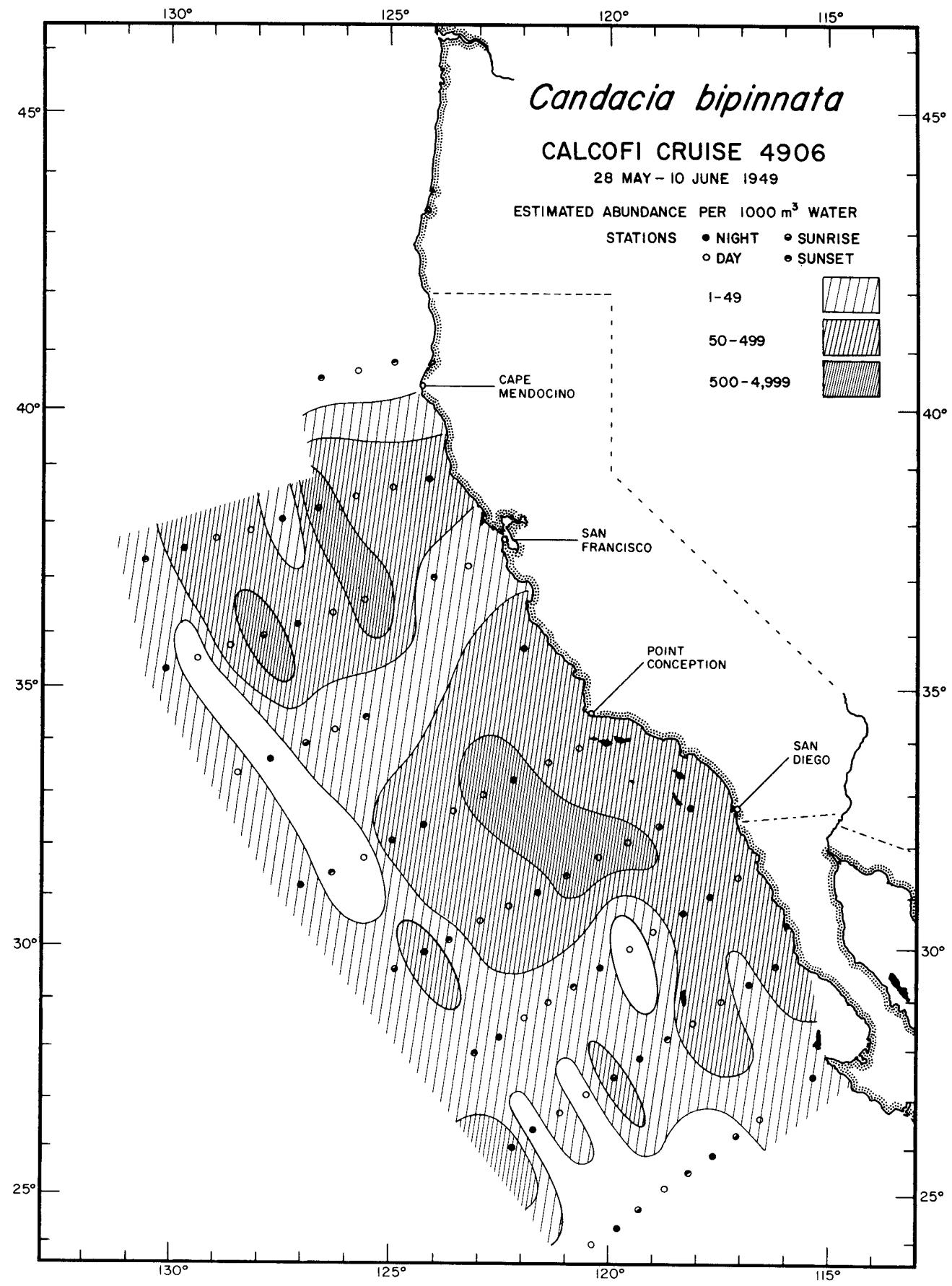
\* See Table 1 for cruises 4908, 9, 10, 5002

Calanoida

*Calanus robustior*

4907

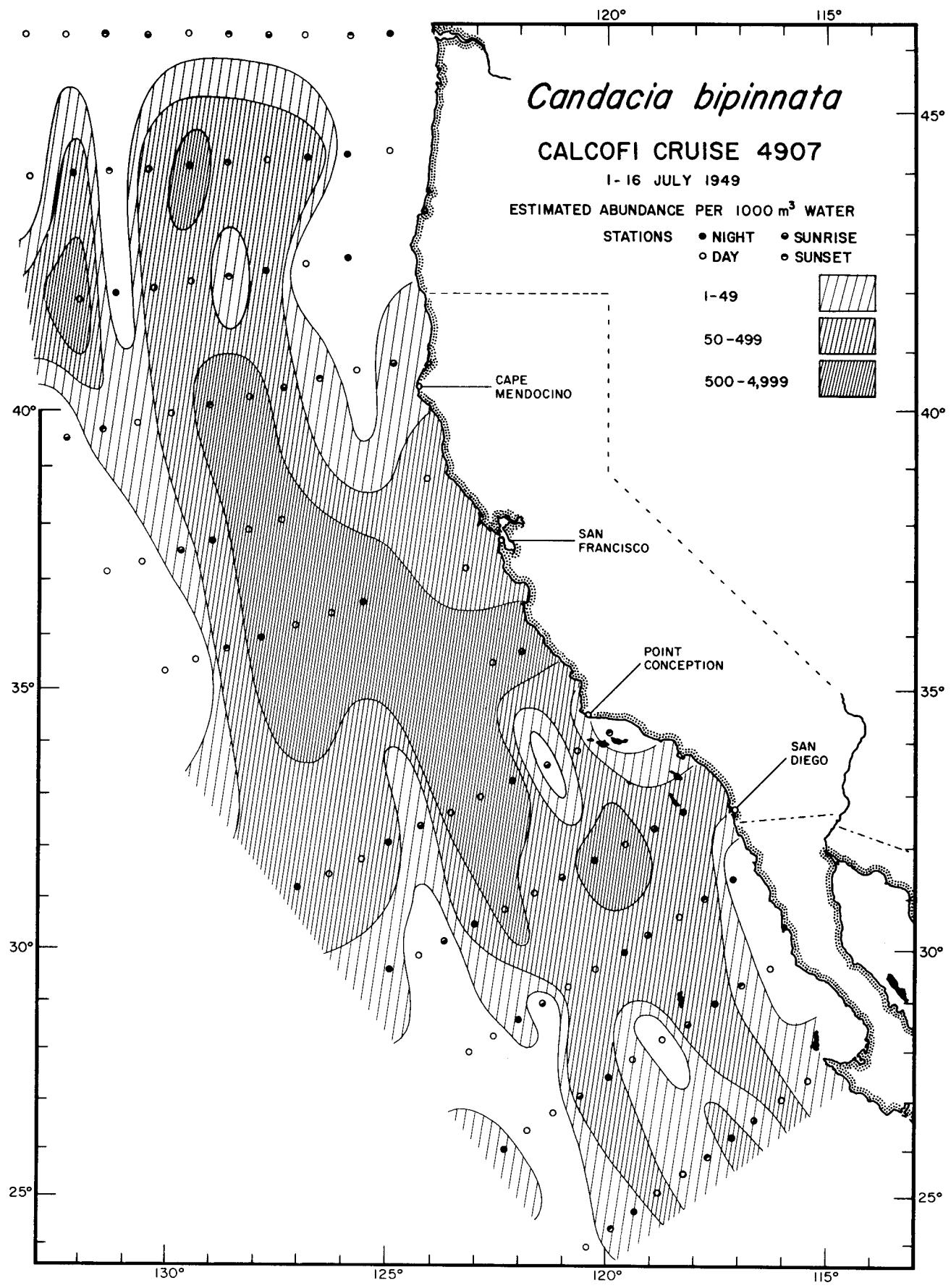




Calanoida

*Candacia bipinnata*

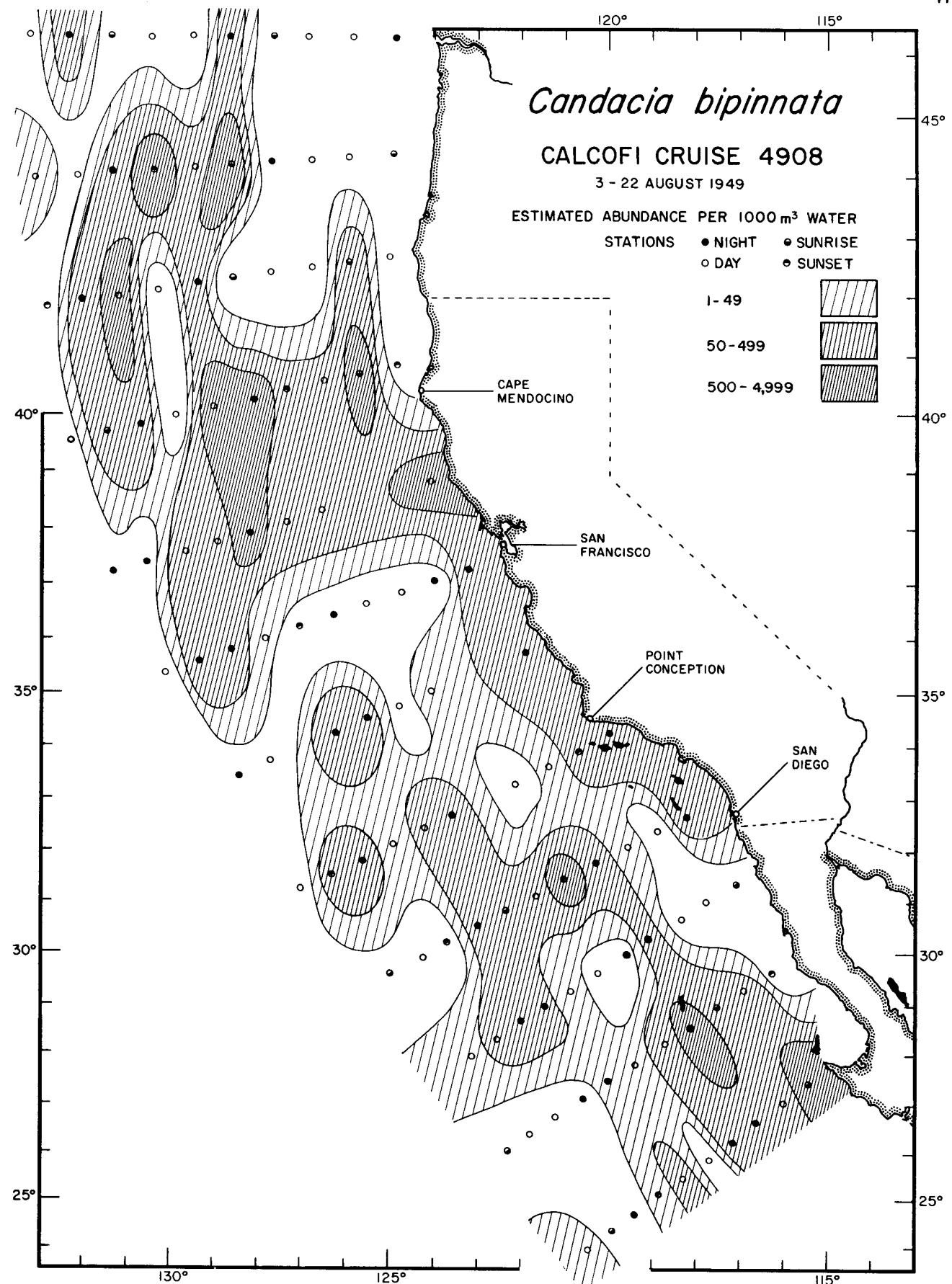
4906



Calanoida

*Candacia bipinnata*

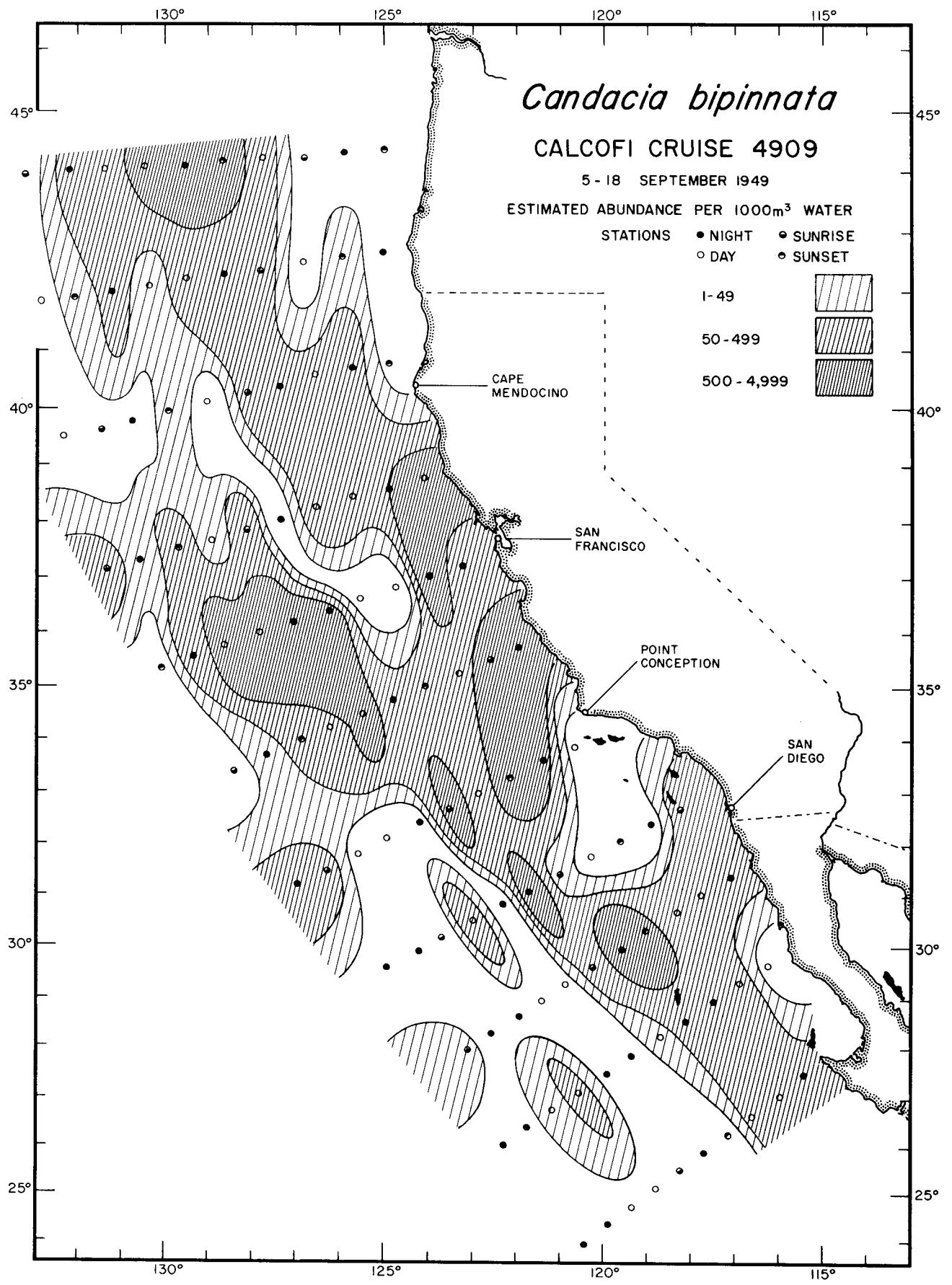
4907



Calanoida

*Candacia bipinnata*

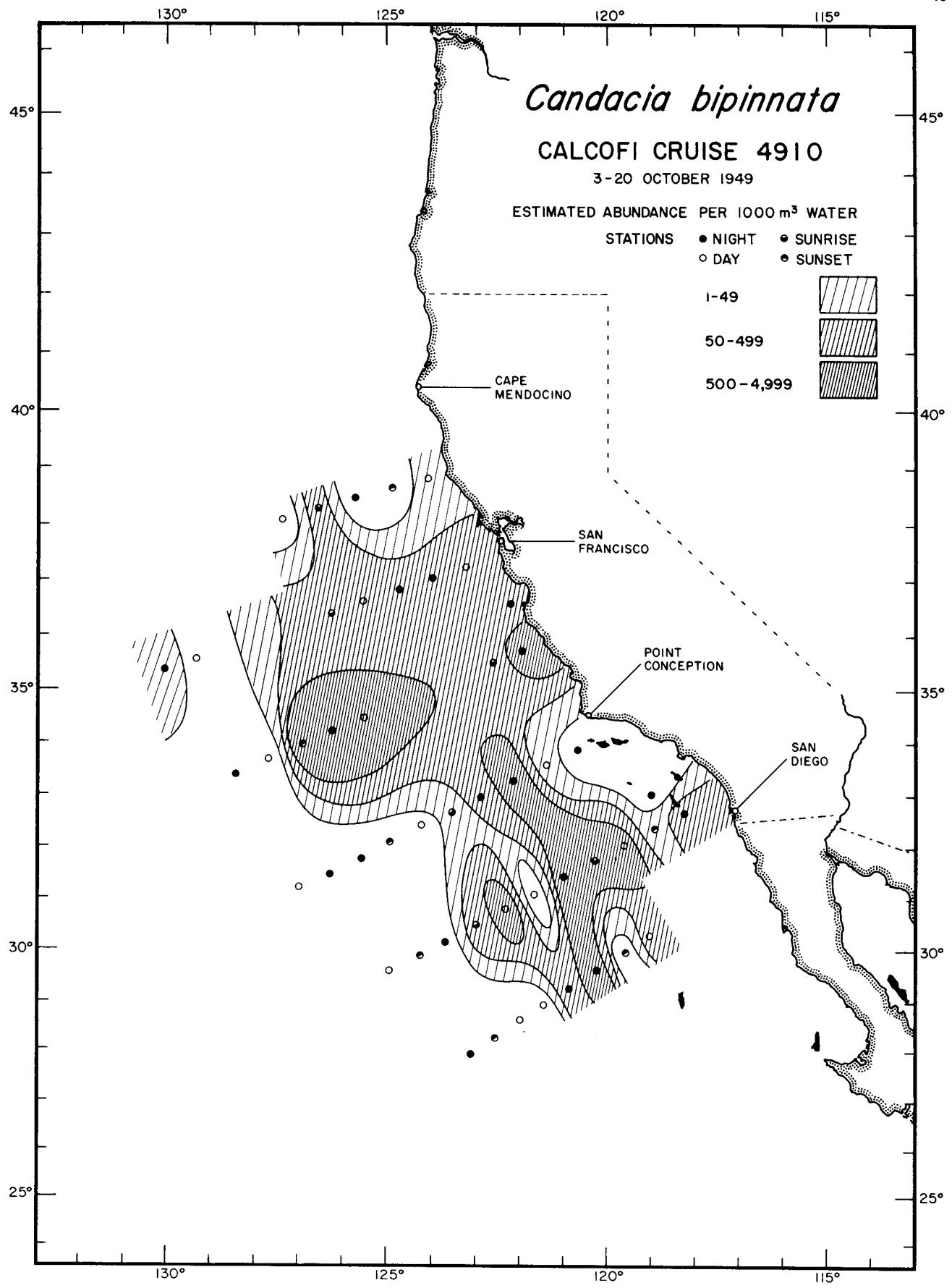
4908



Calanoida

*Candacia bipinnata*

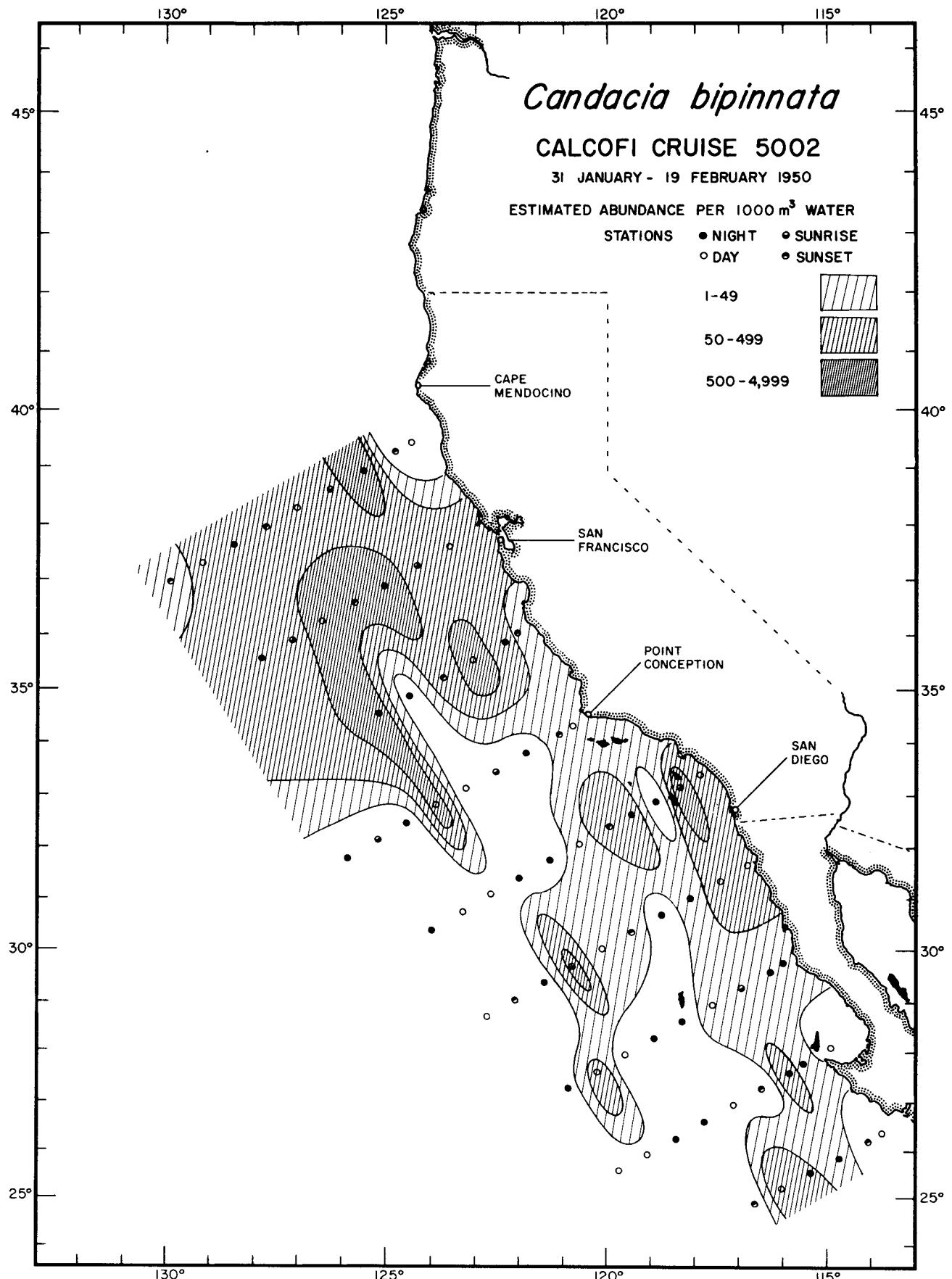
4909



Calanoida

*Candacia bipinnata*

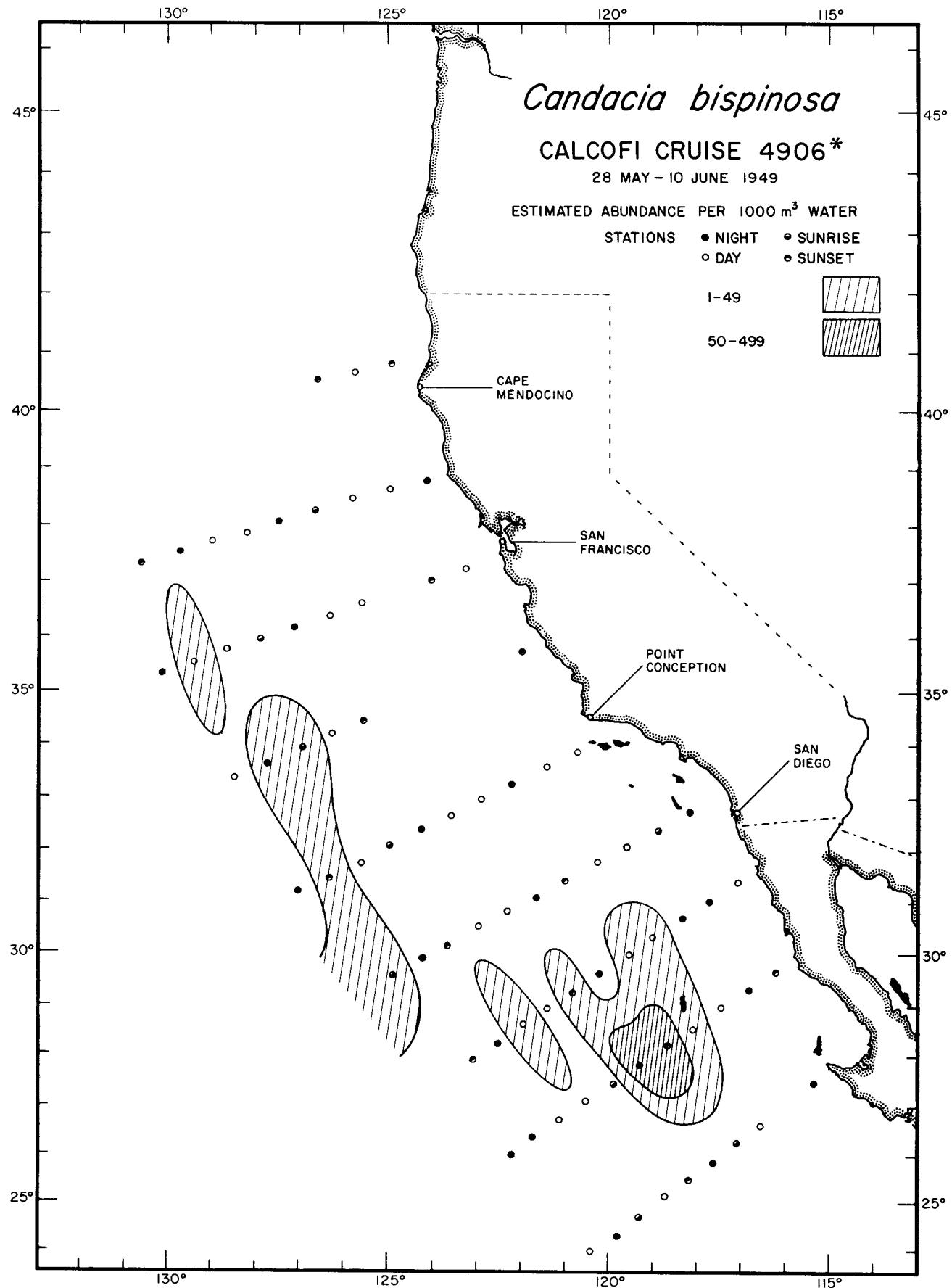
4910



Calanoida

*Candacia bipinnata*

5002

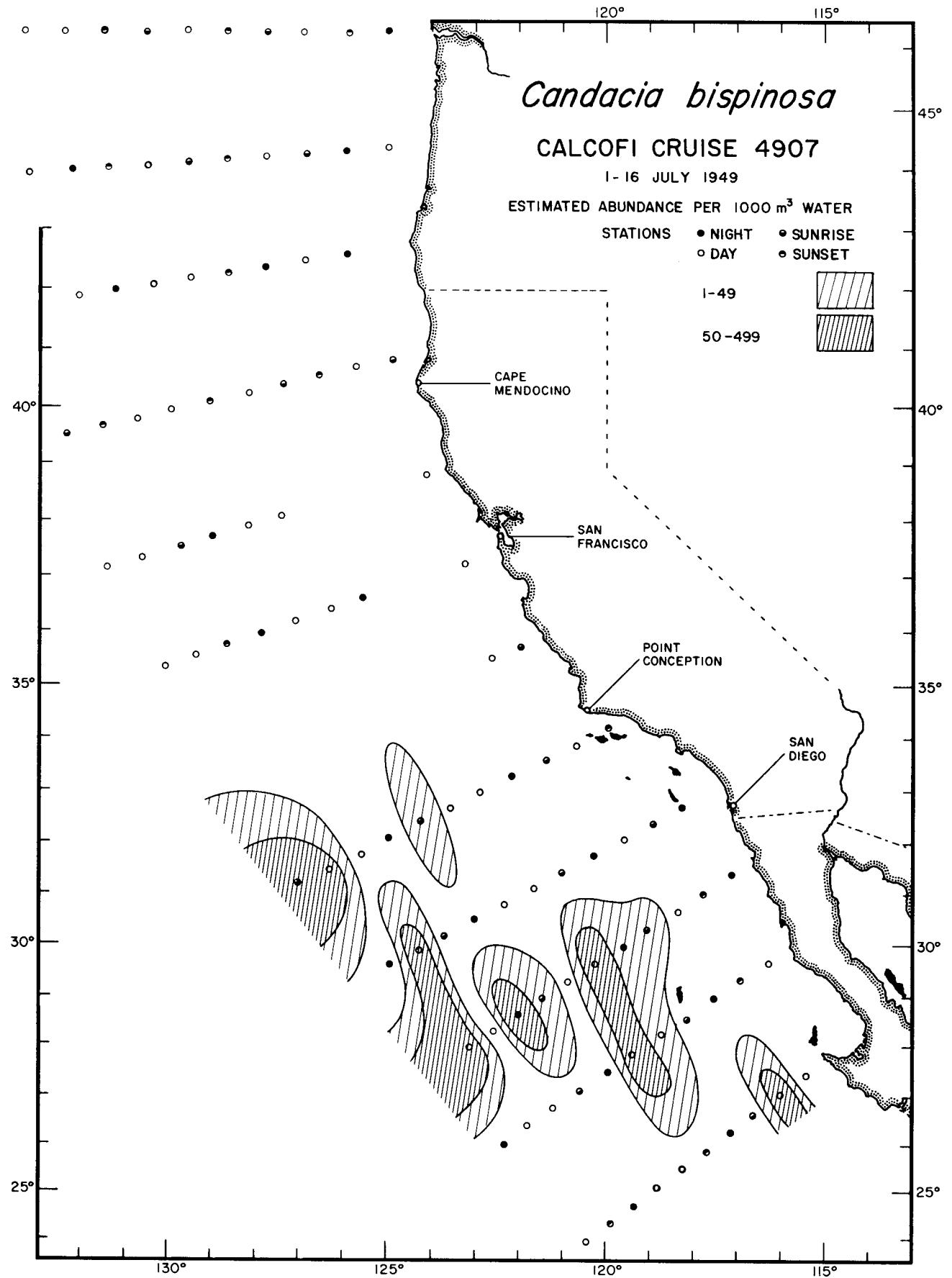


\* See Table 1 for cruise 4905

Calanoida

*Candacia bispinosa*

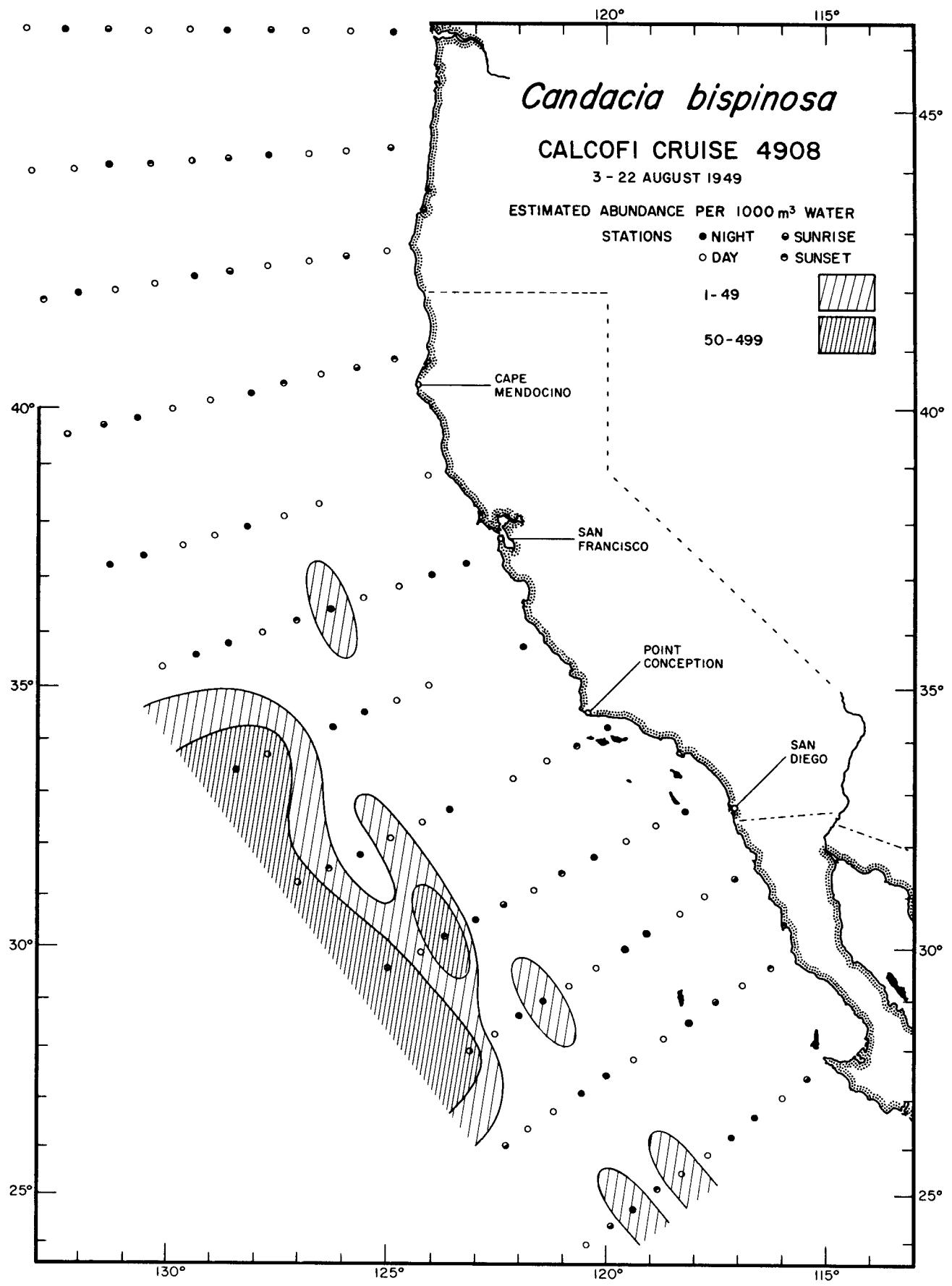
4906



Calanoida

*Candacia bispinosa*

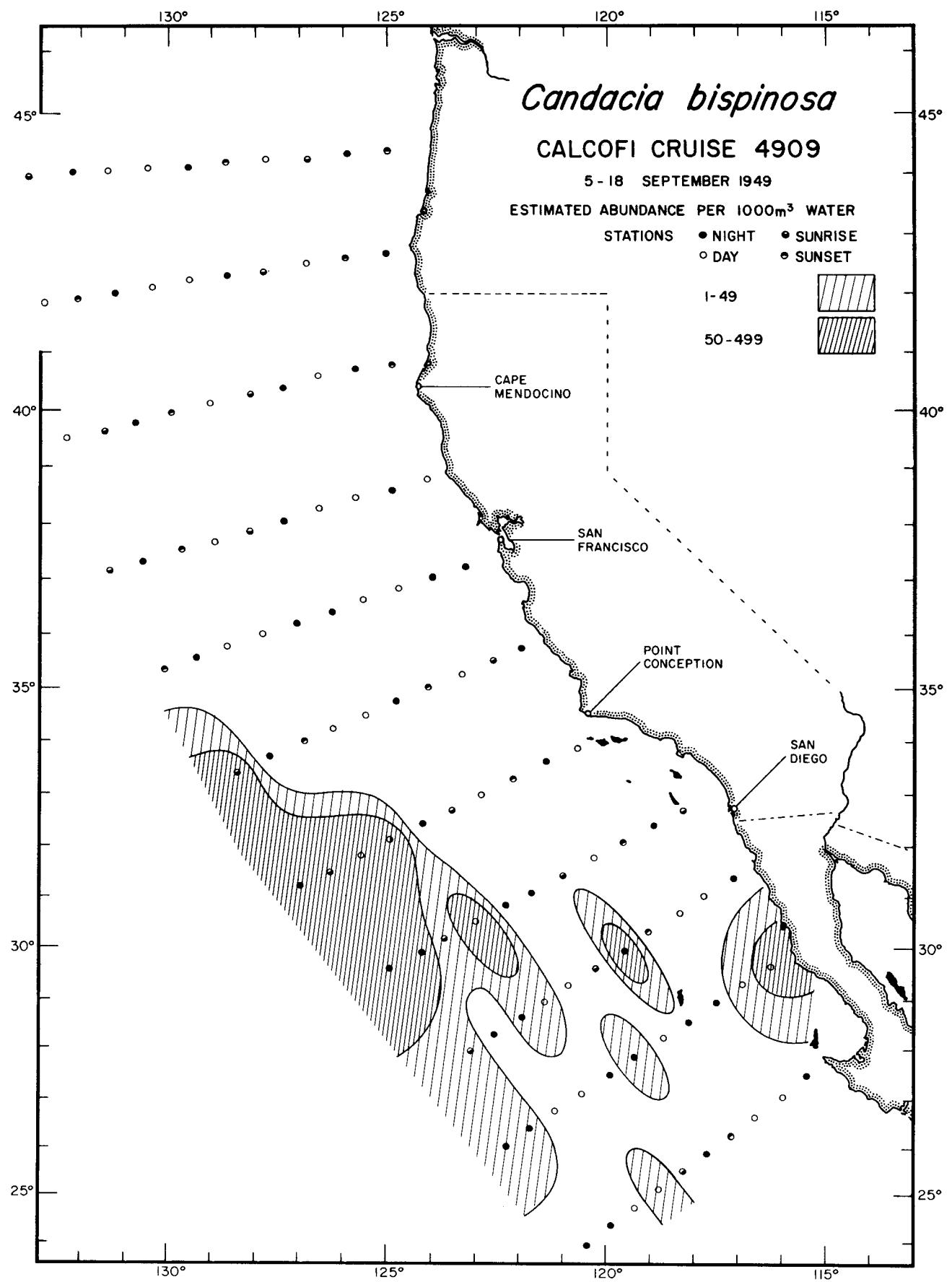
4907



Calanoida

*Candacia bispinosa*

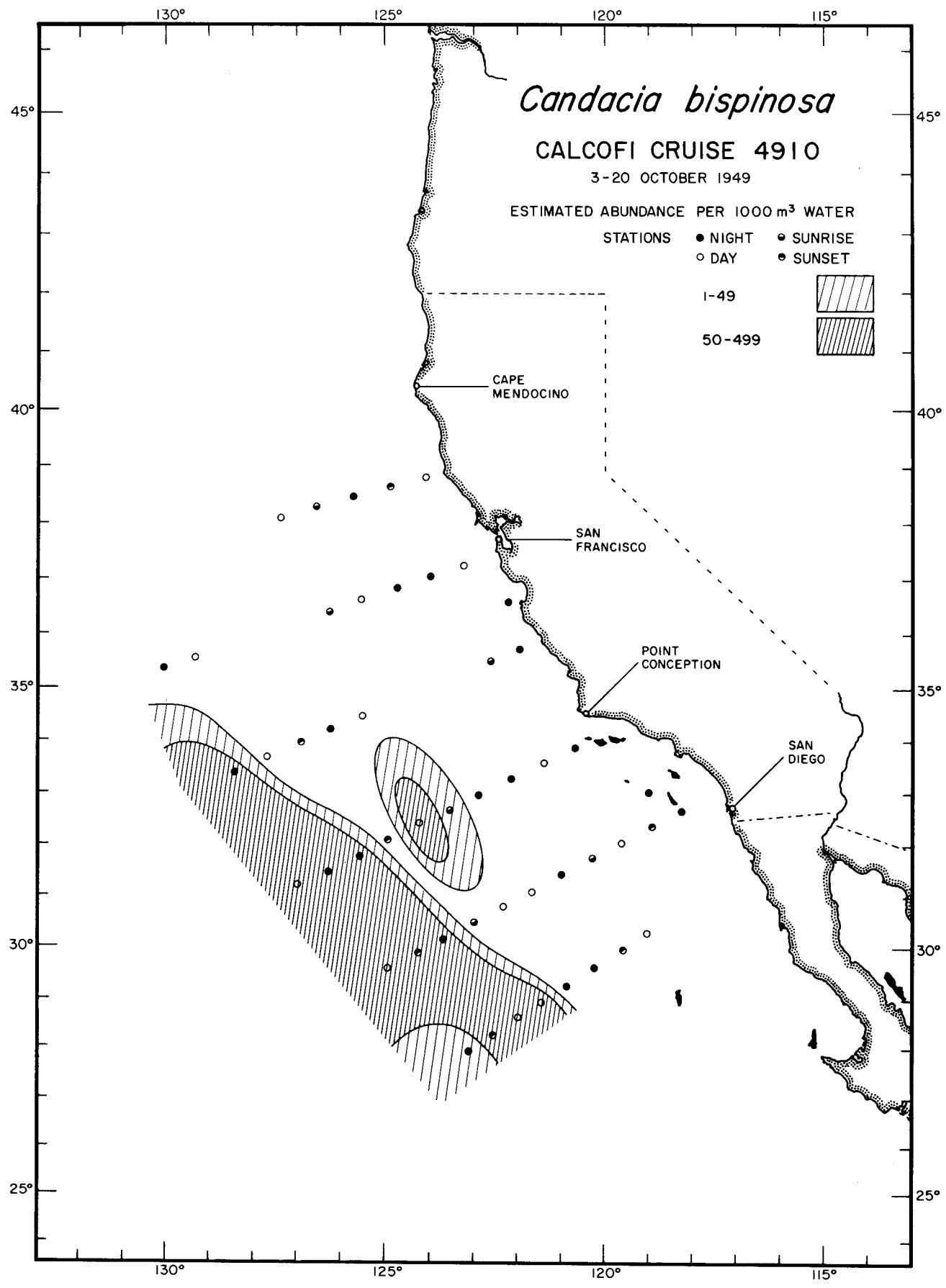
4908



Calanoida

*Candacia bispinosa*

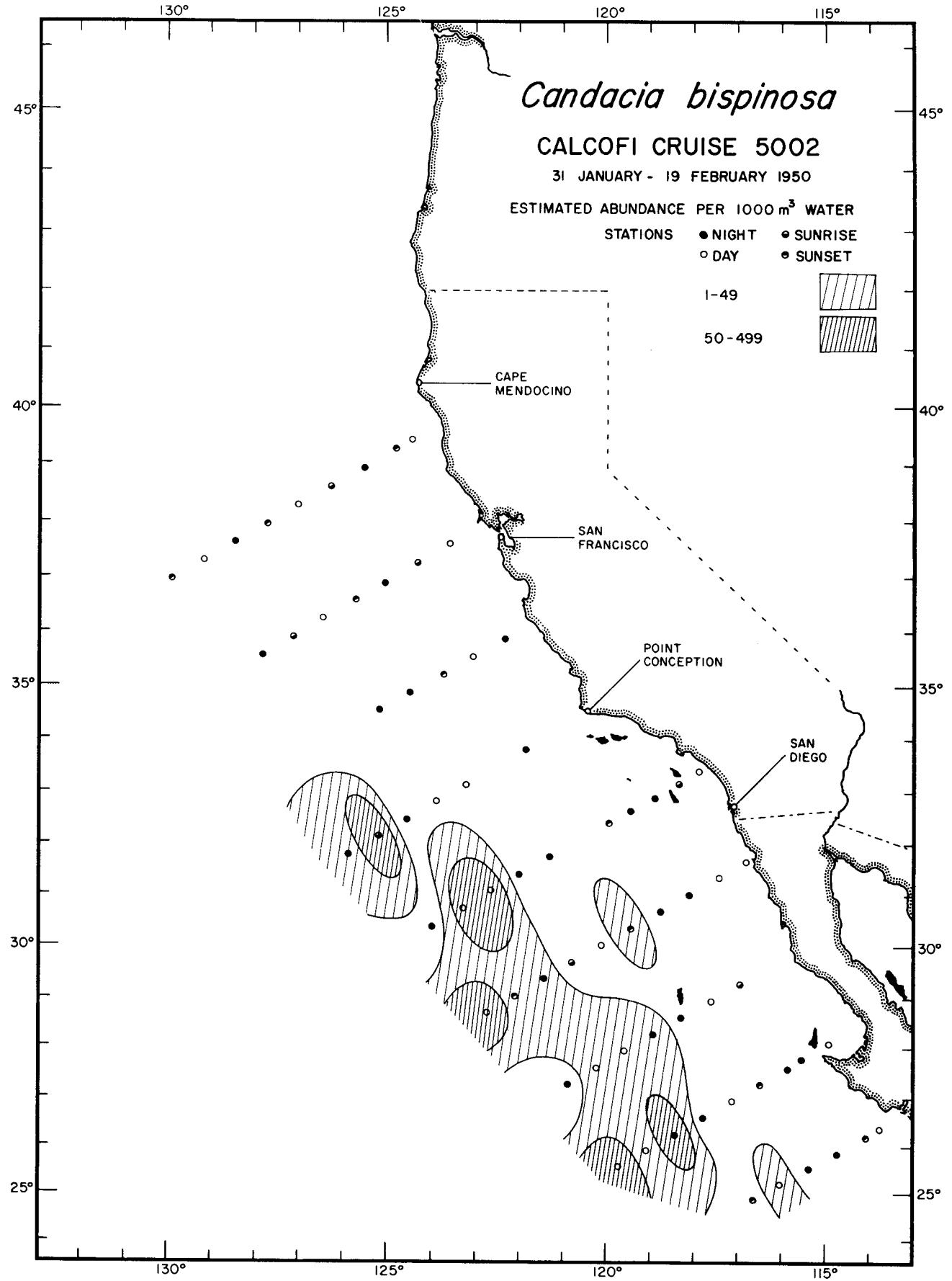
4909



Calanoida

*Candacia bispinosa*

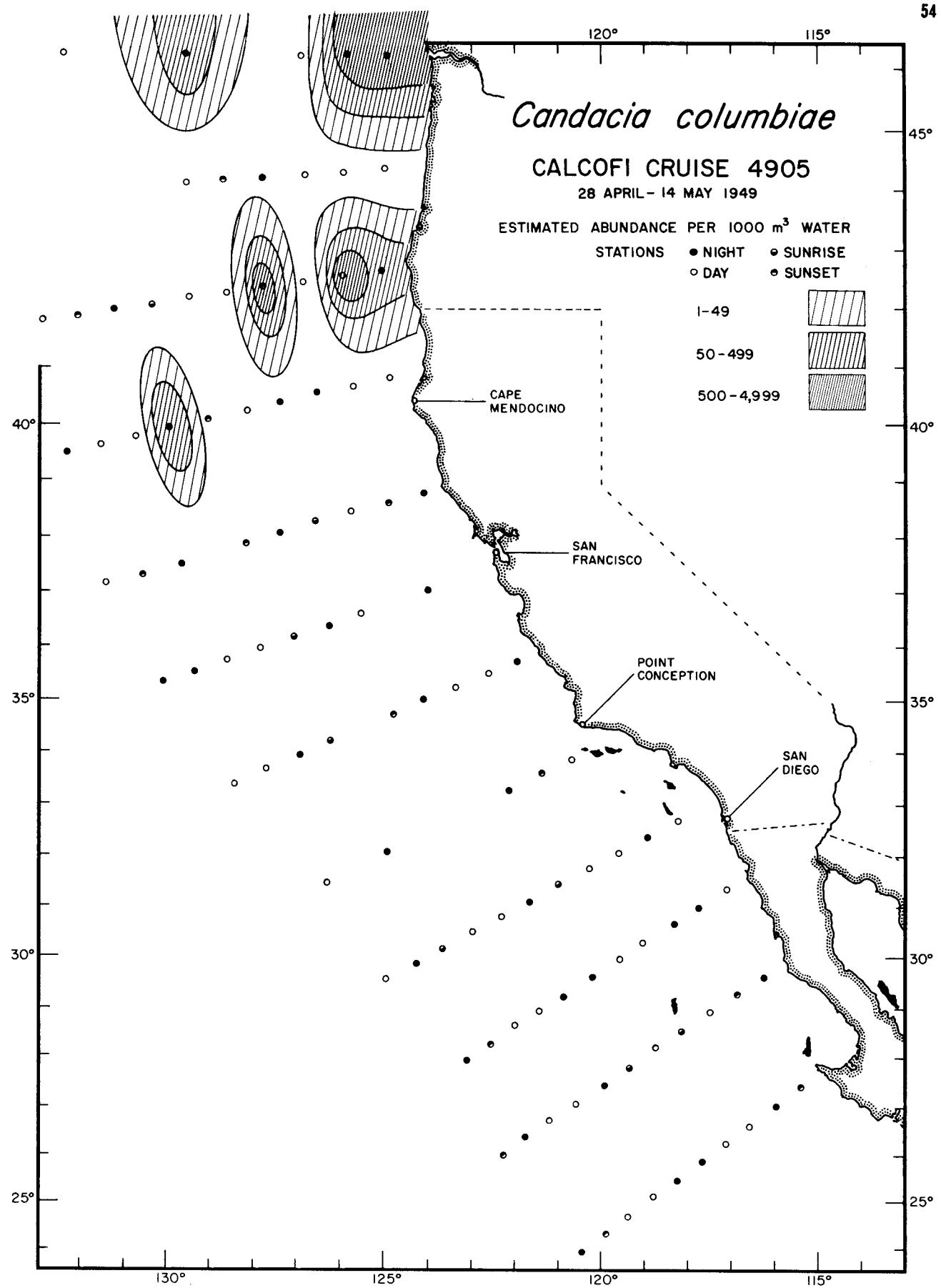
4910



Calanoida

*Candacia bispinosa*

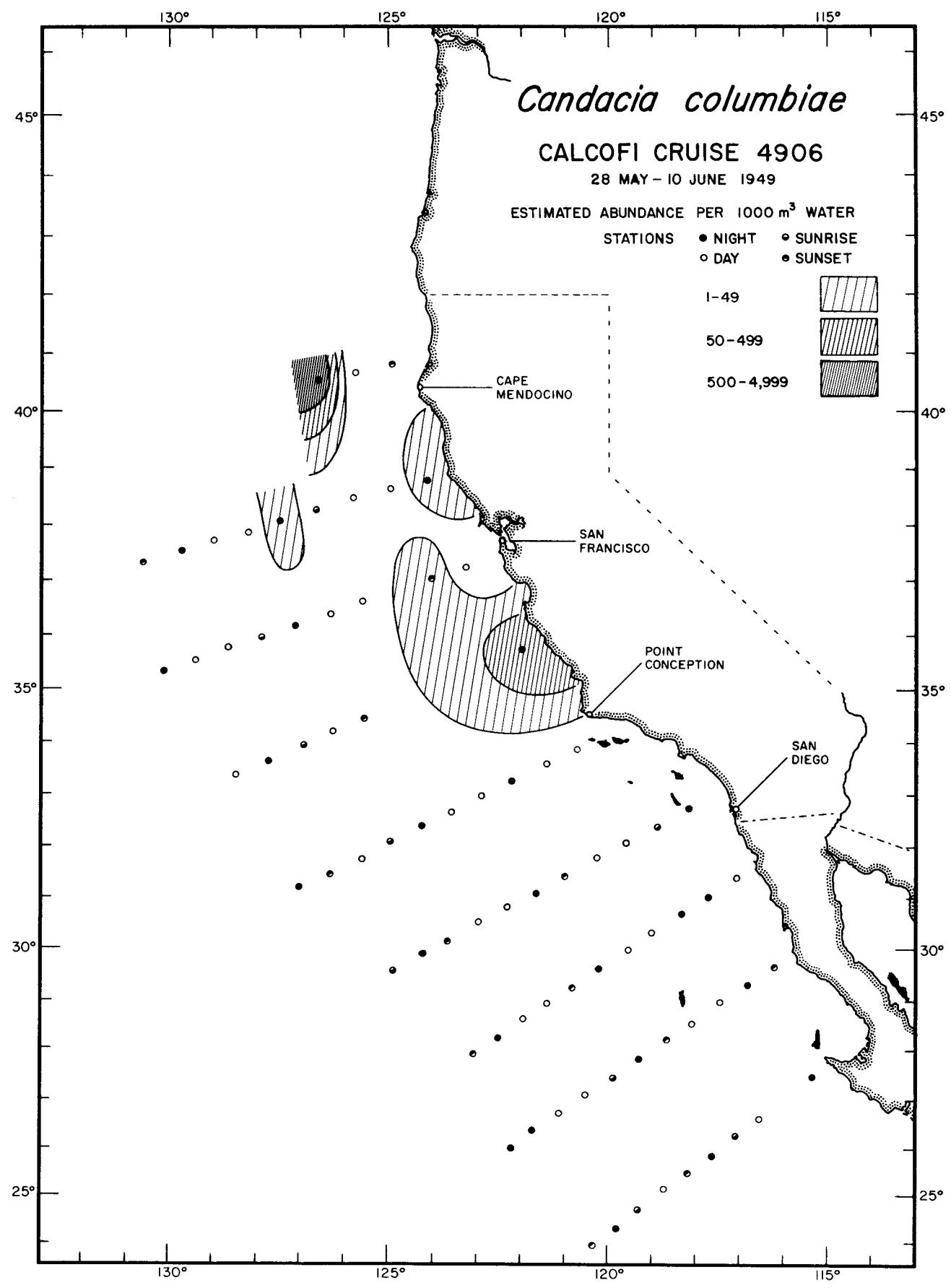
5002



Calanoida

*Candacia columbiae*

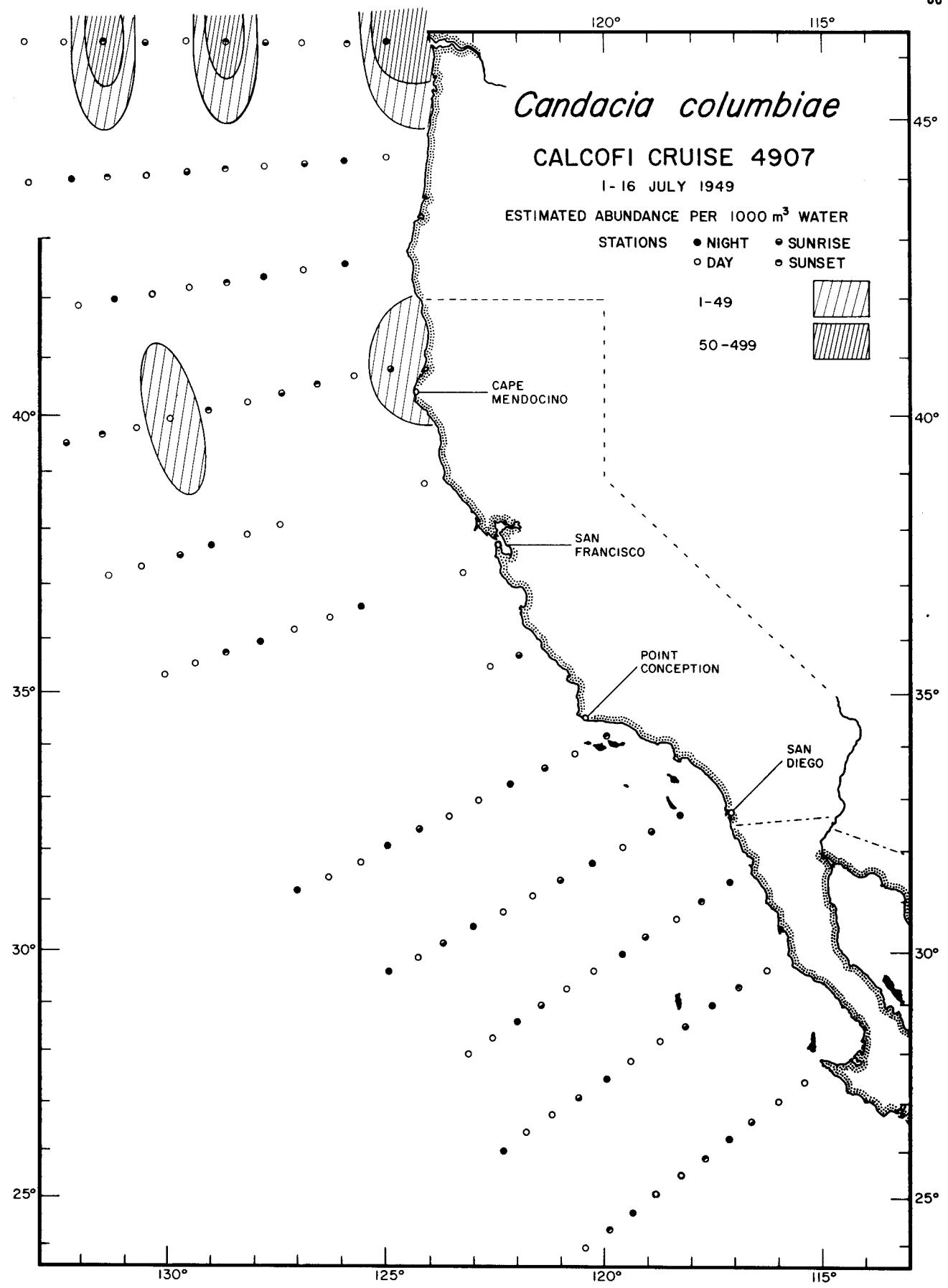
4905



Calanoida

*Candacia columbiae*

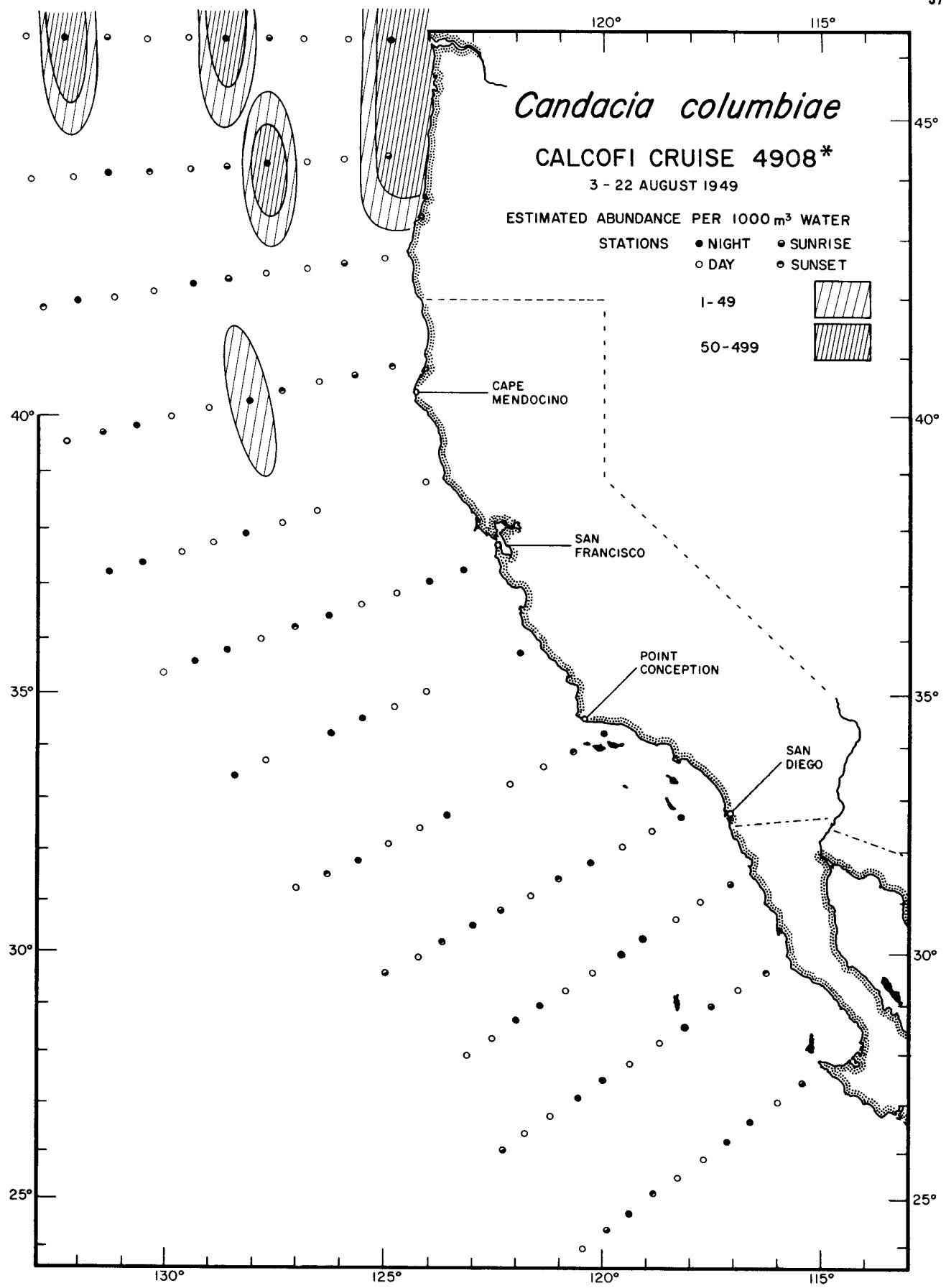
4906



Calanoida

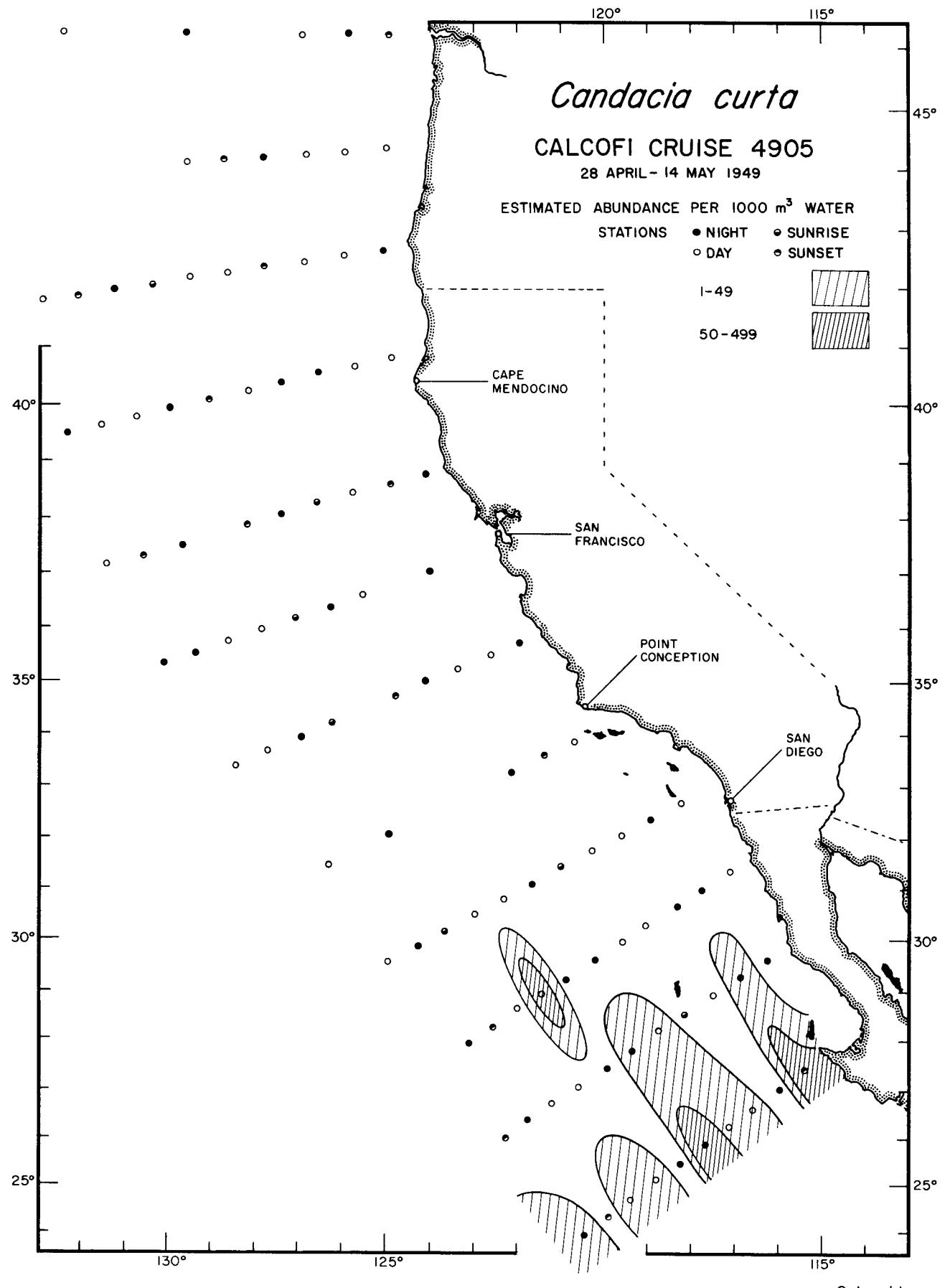
*Candacia columbiae*

4907



\* See Table 1 for cruises 4909, 10, 5002

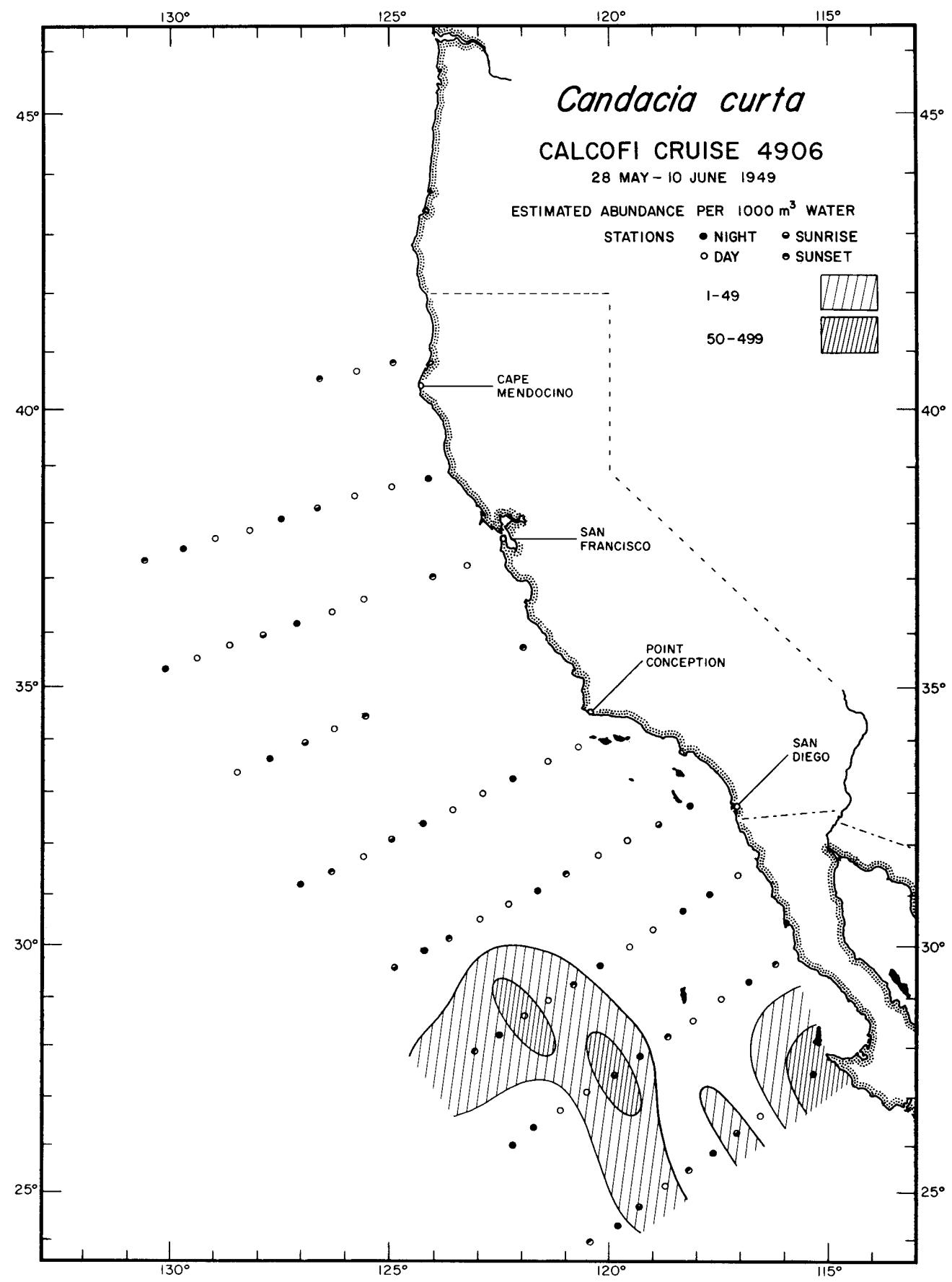
Calanoida  
*Candacia columbiae*  
4908



Calanoida

*Candacia curta*

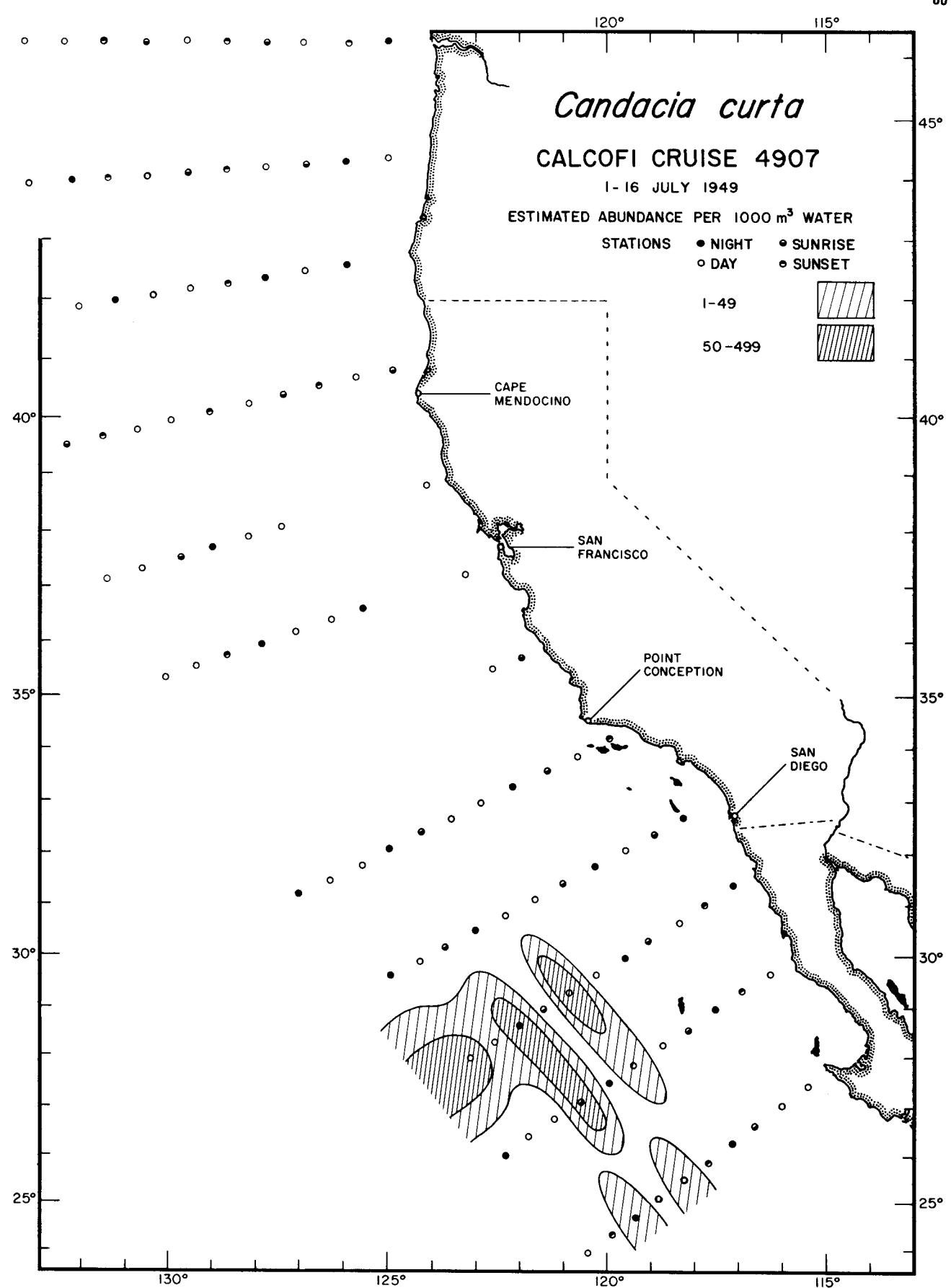
4905



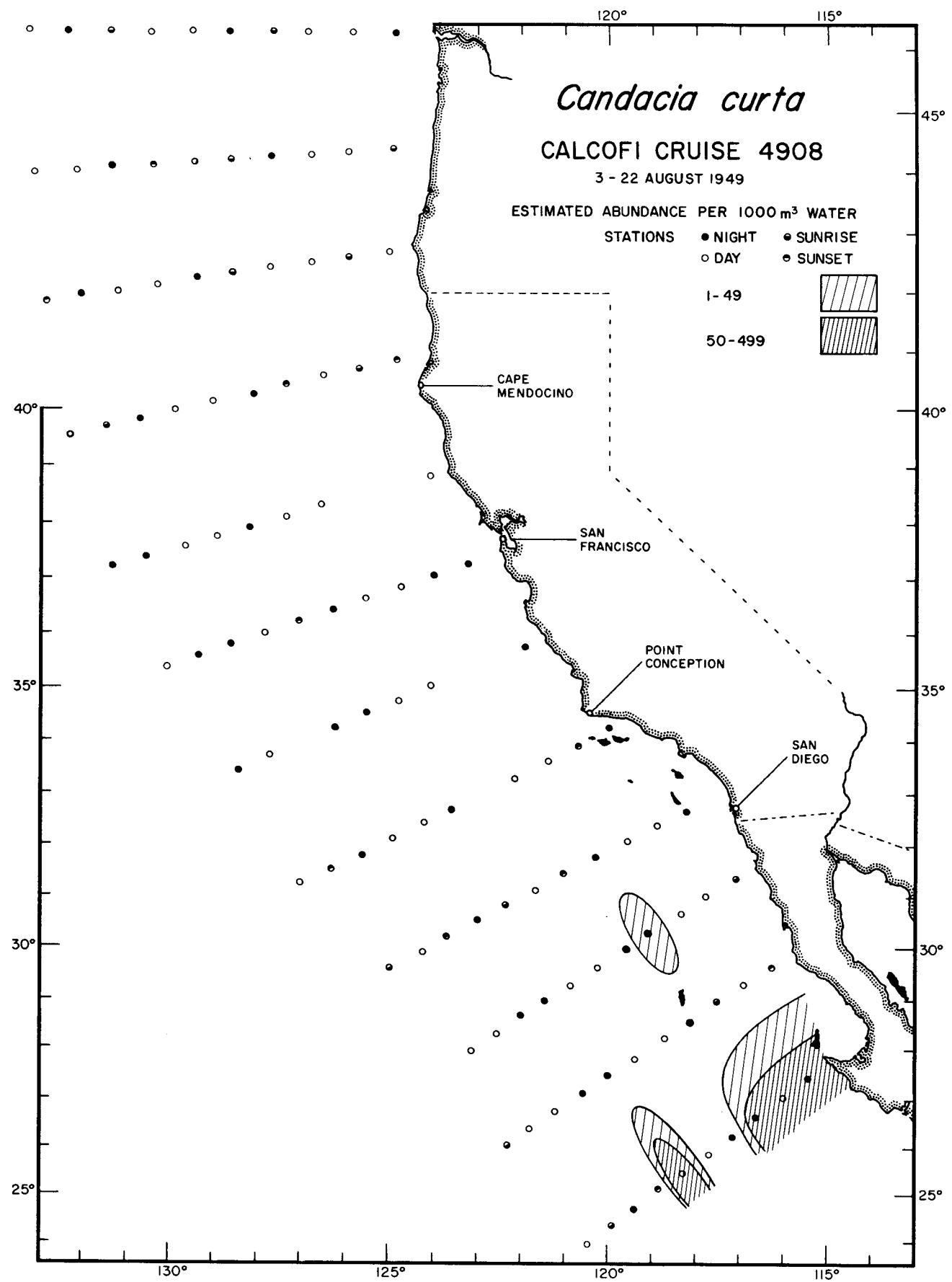
Calanoida

*Candacia curta*

4906

*Candacia curta*

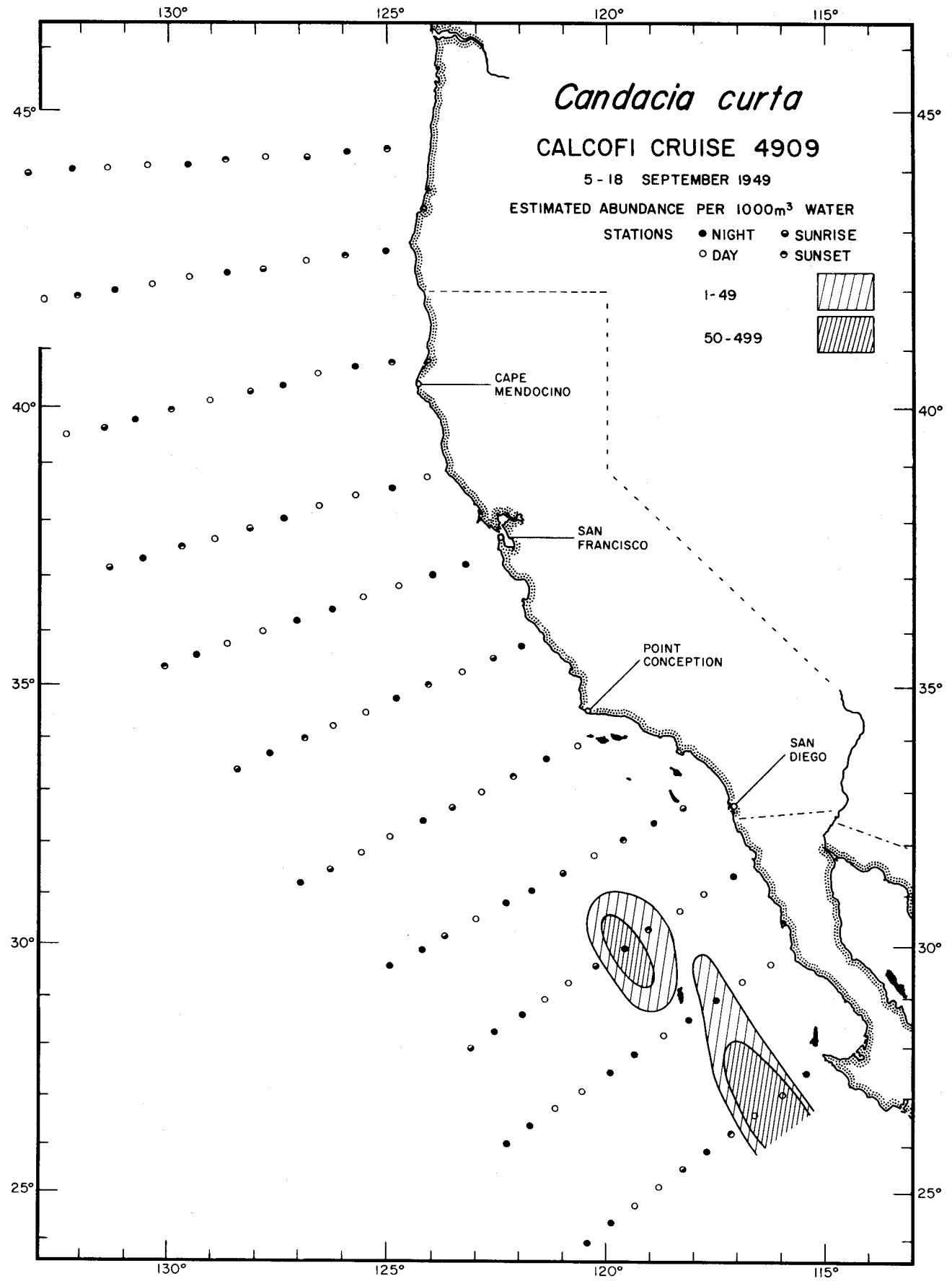
4907



Calanoida

*Candacia curta*

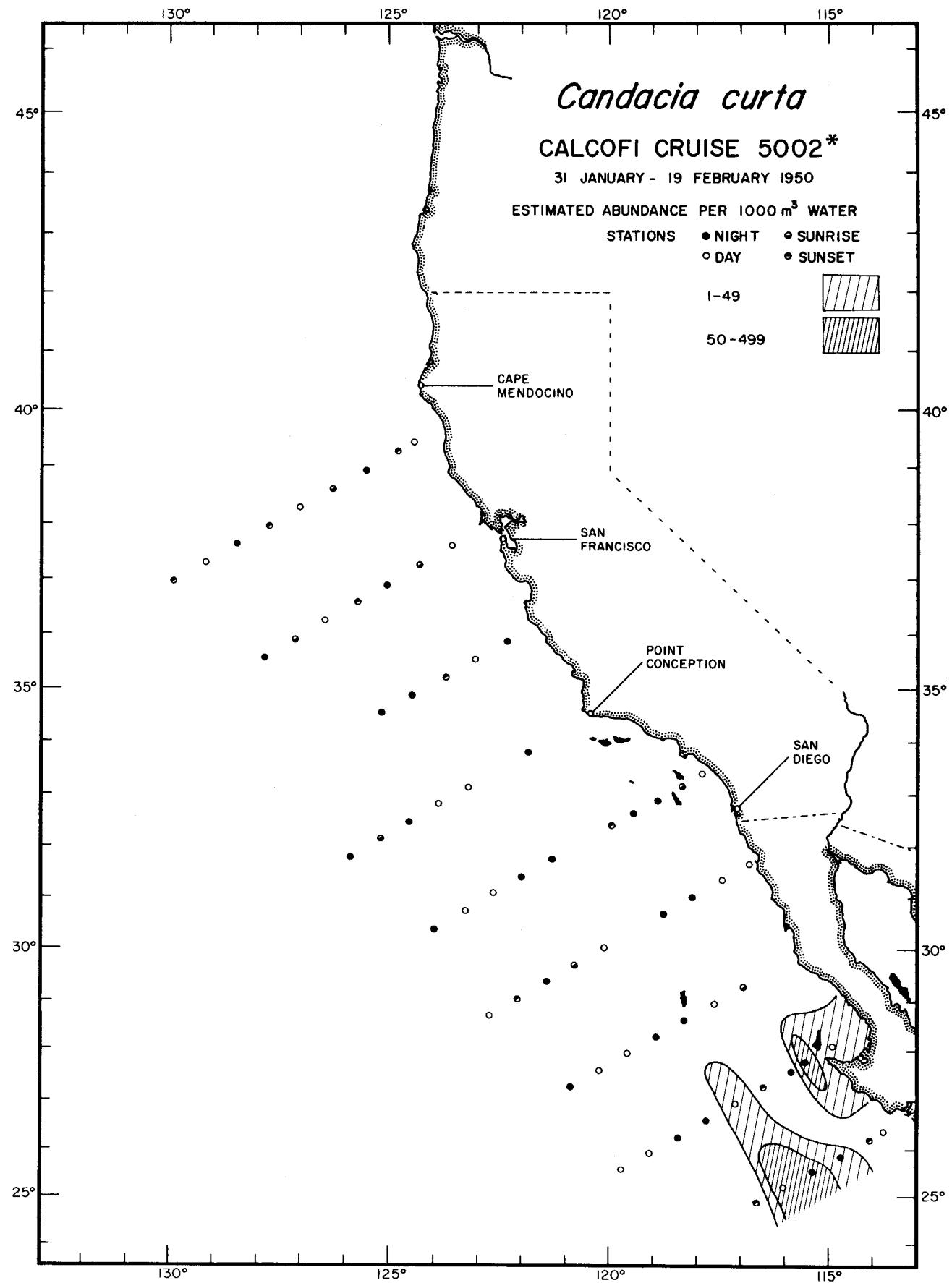
4908



Calanoida

*Candacia curta*

4909

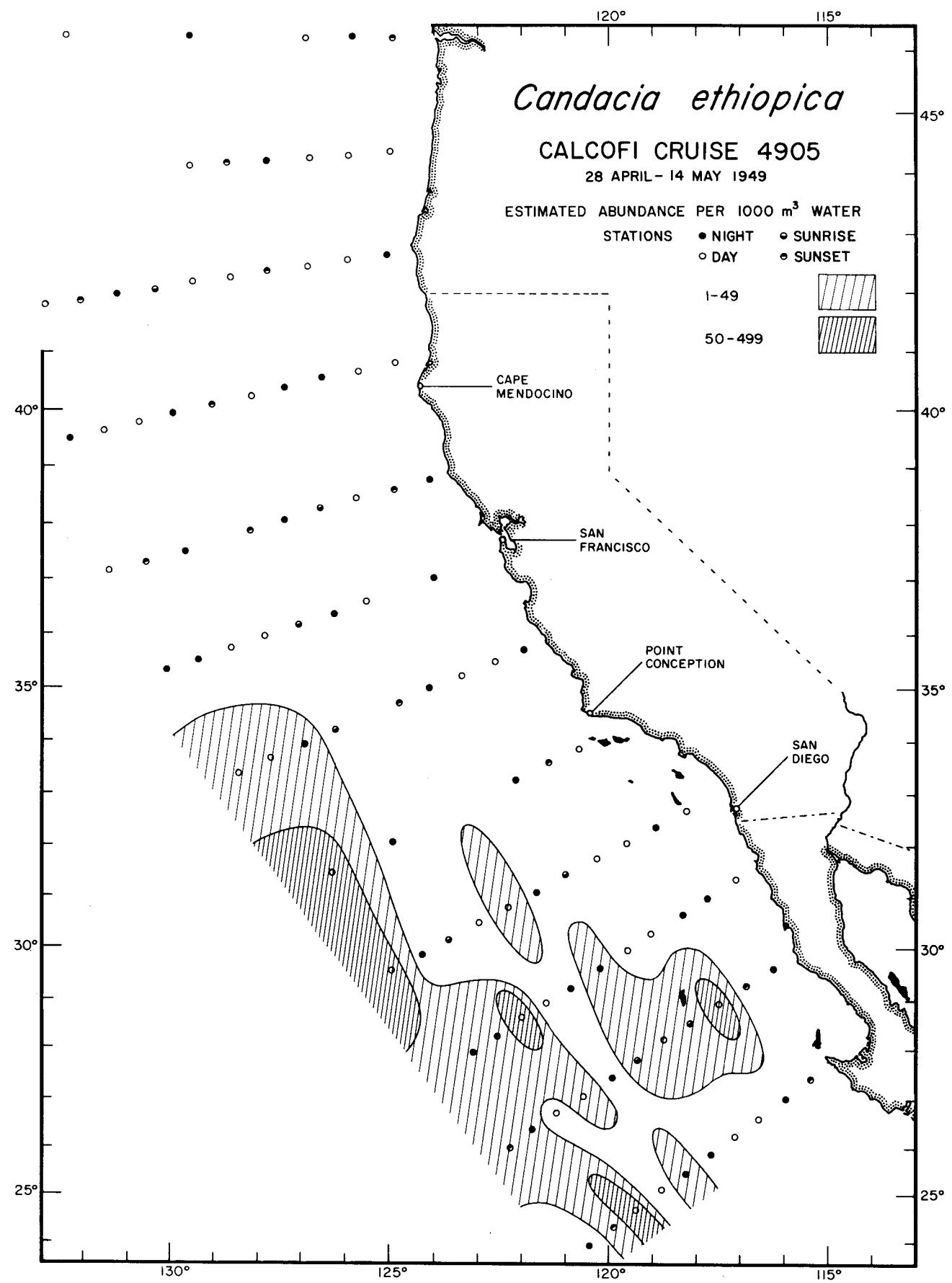


\* See Table 1 for cruise 4910

Calanoida

*Candacia curta*

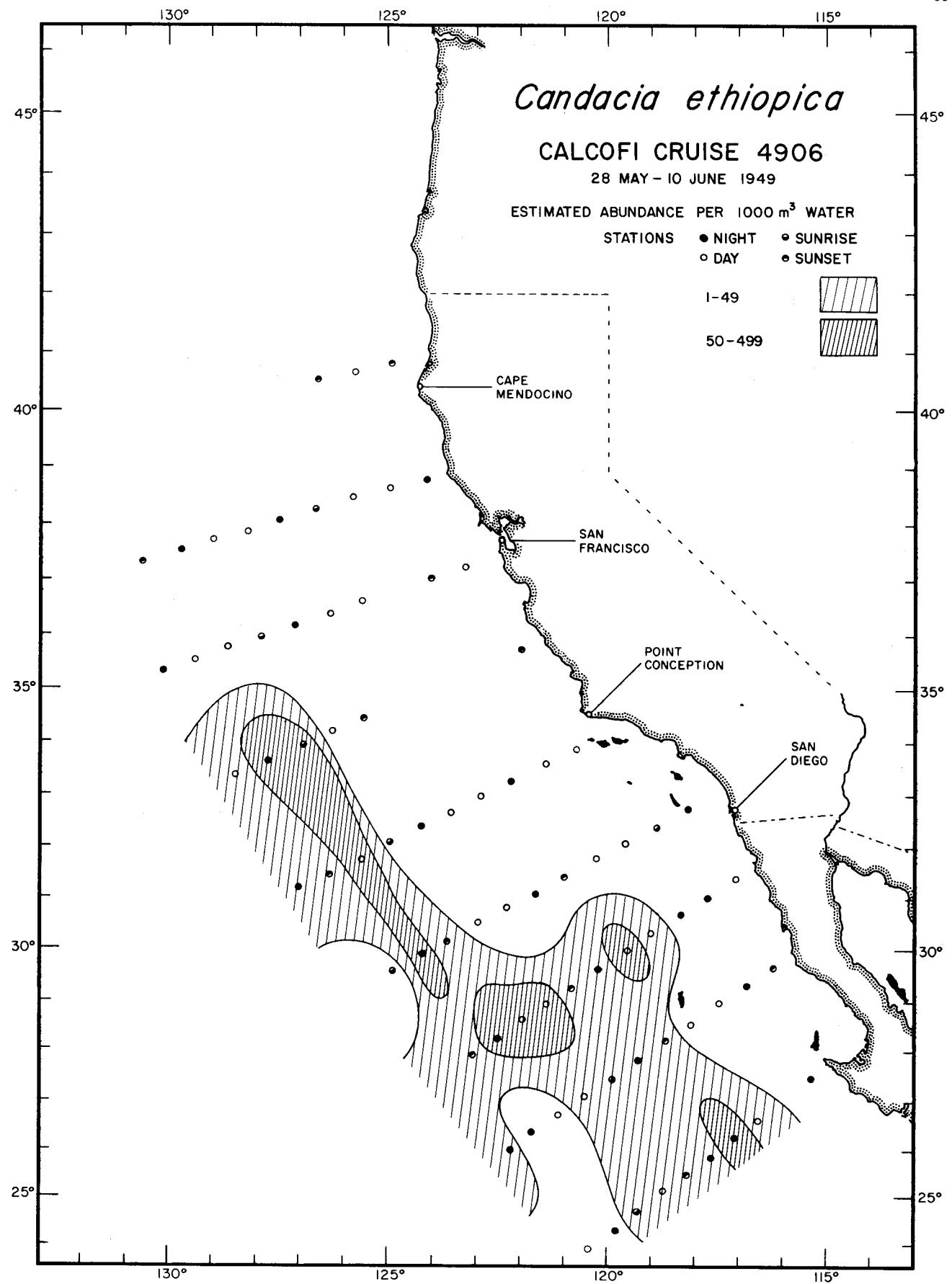
5002



Calanoida

*Candacia ethiopica*

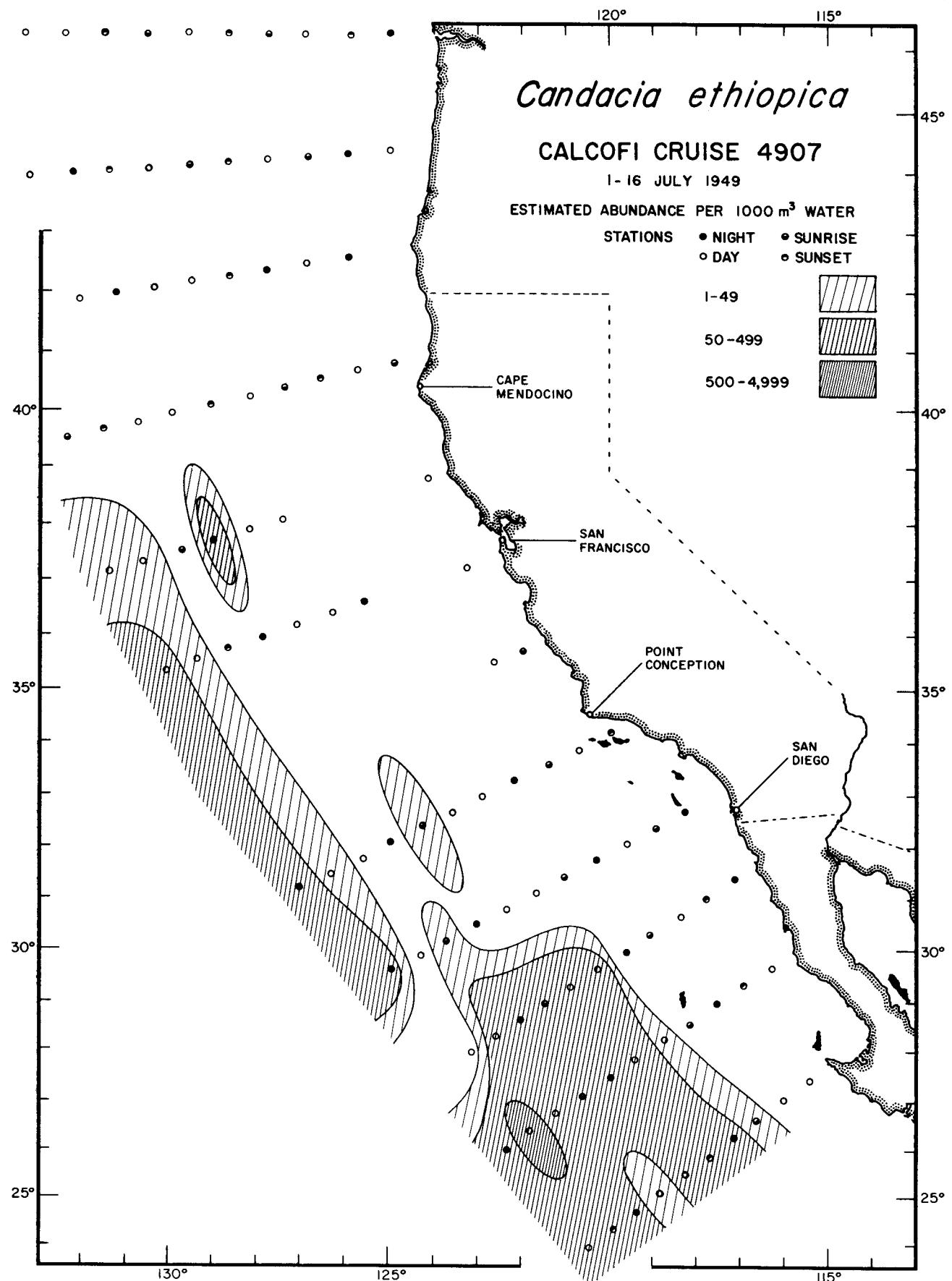
4905



Calanoida

*Candacia ethiopica*

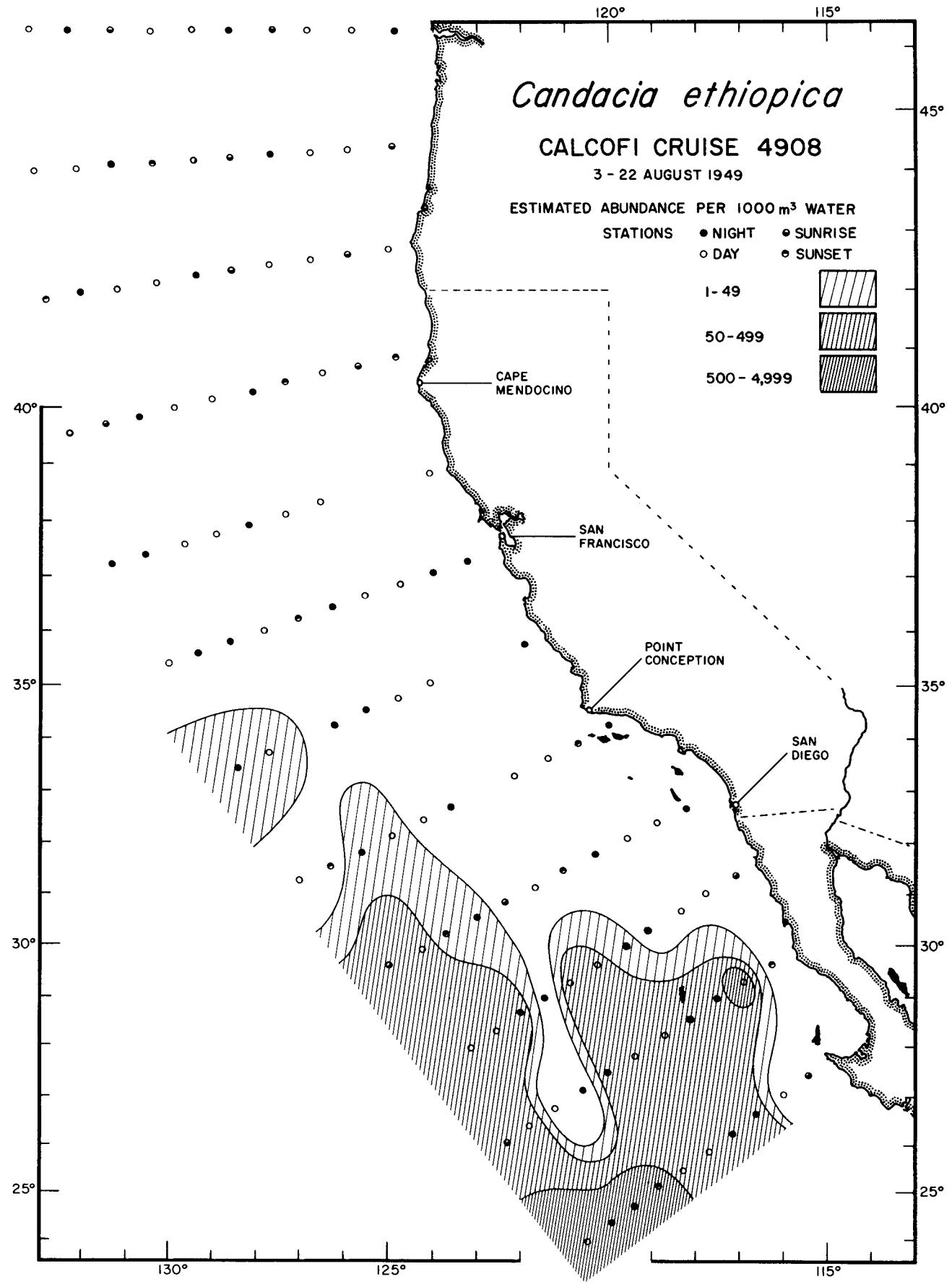
4906



Calanoida

*Candacia ethiopica*

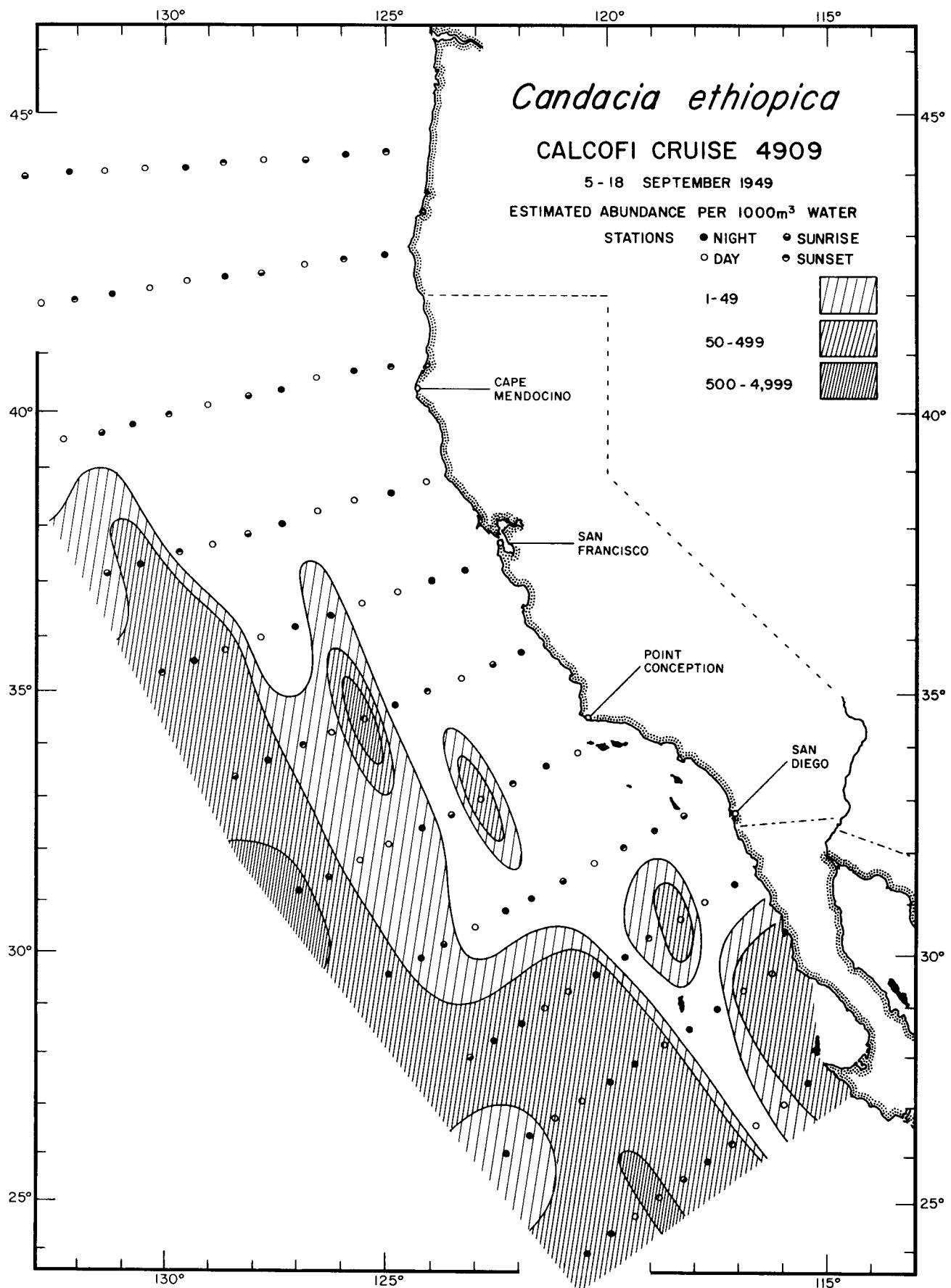
4907



Calanoida

*Candacia ethiopica*

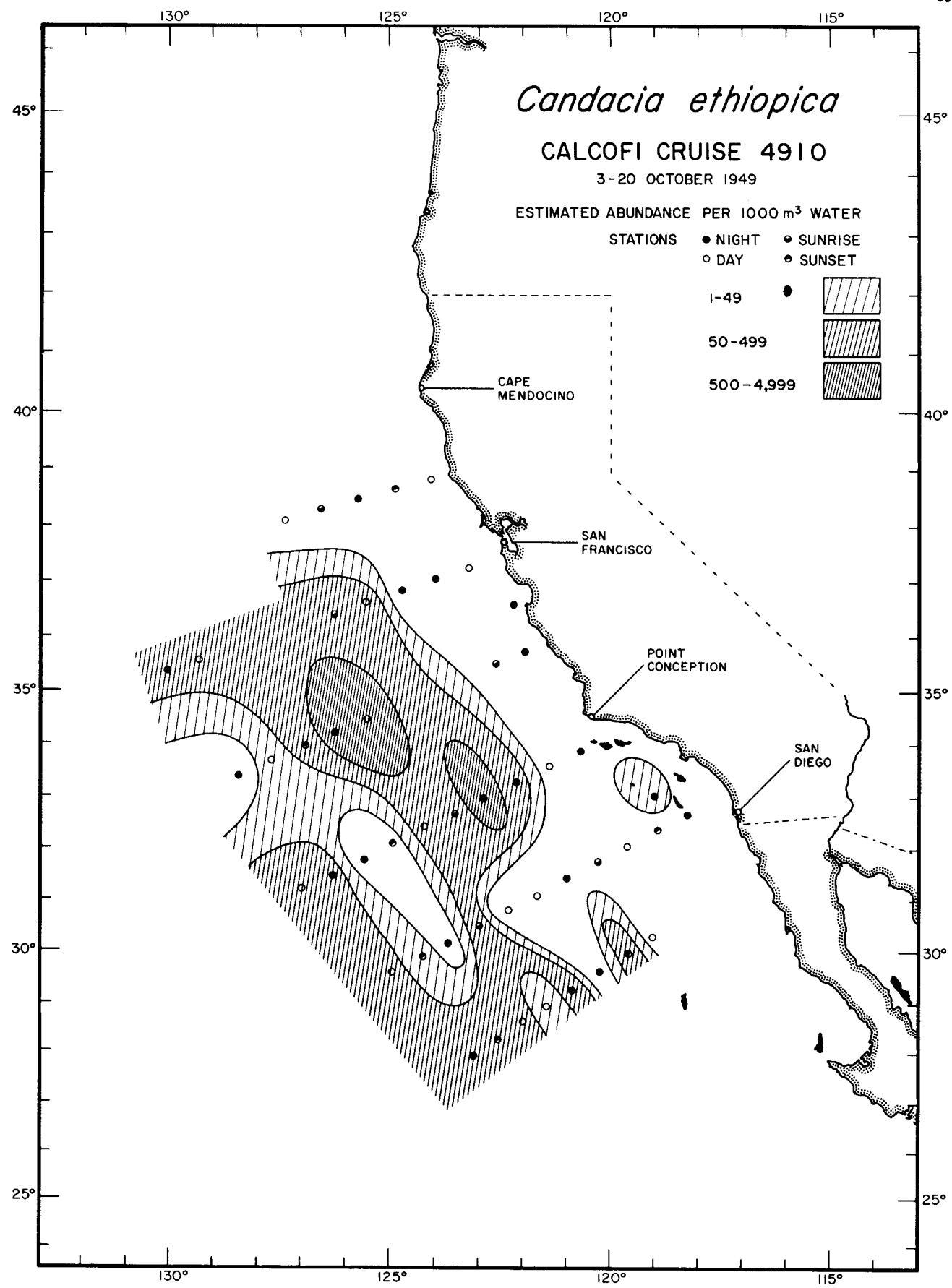
4908



Calanoida

*Candacia ethiopica*

4909

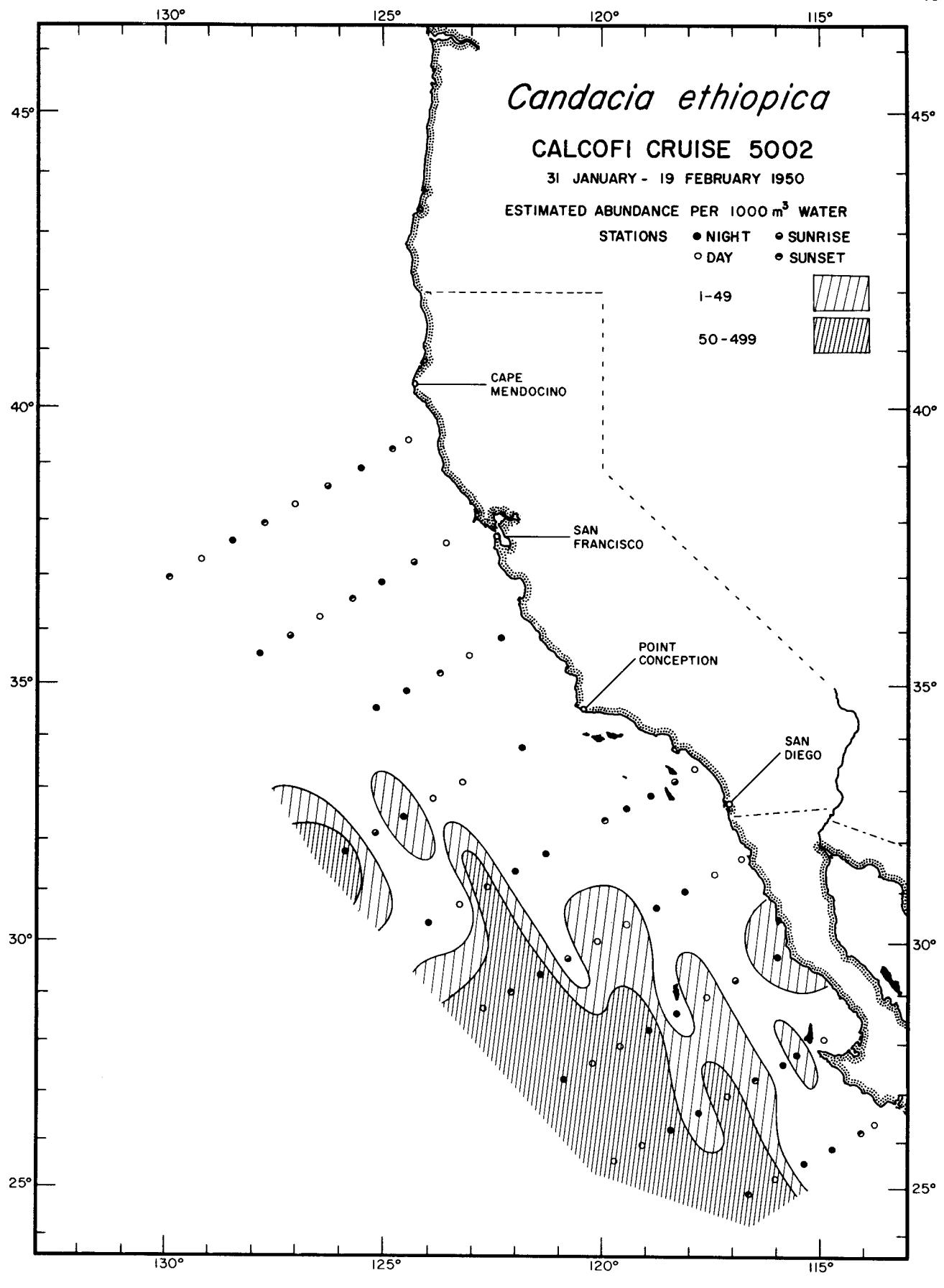


Calanoida

*Candacia ethiopica*

4910

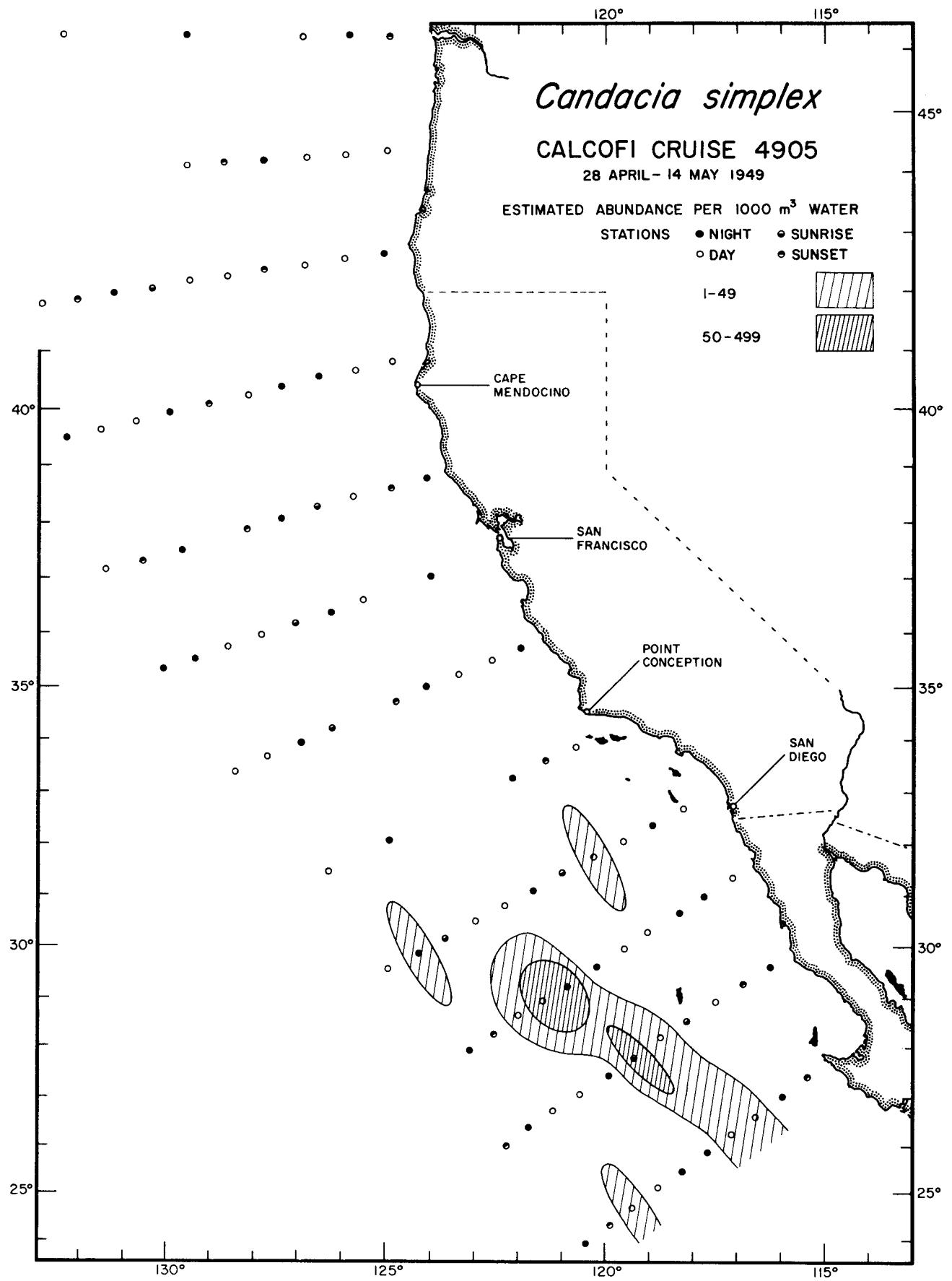
70



## Calanoida

*Candacia ethiopica*

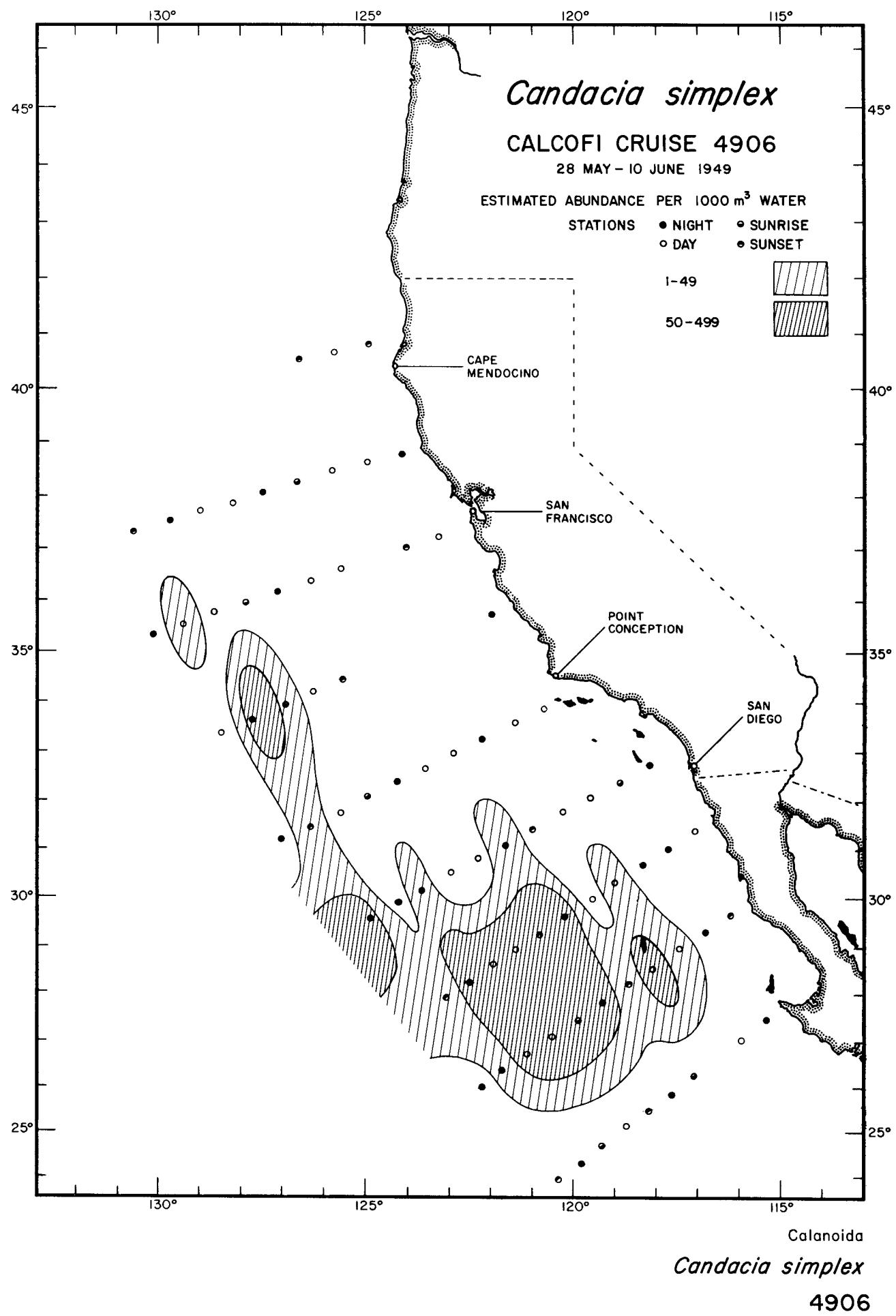
5002

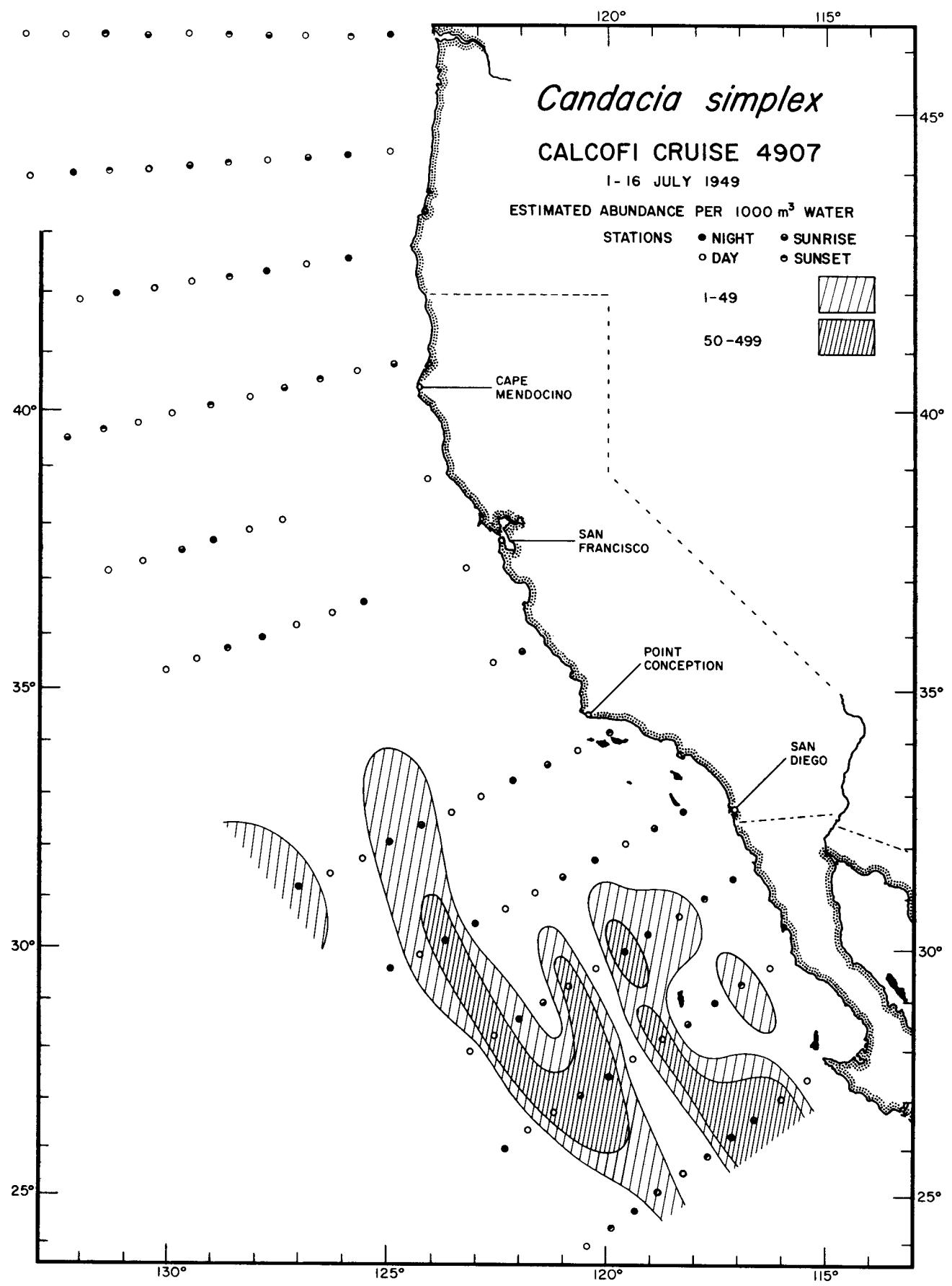


Calanoida

*Candacia simplex*

4905

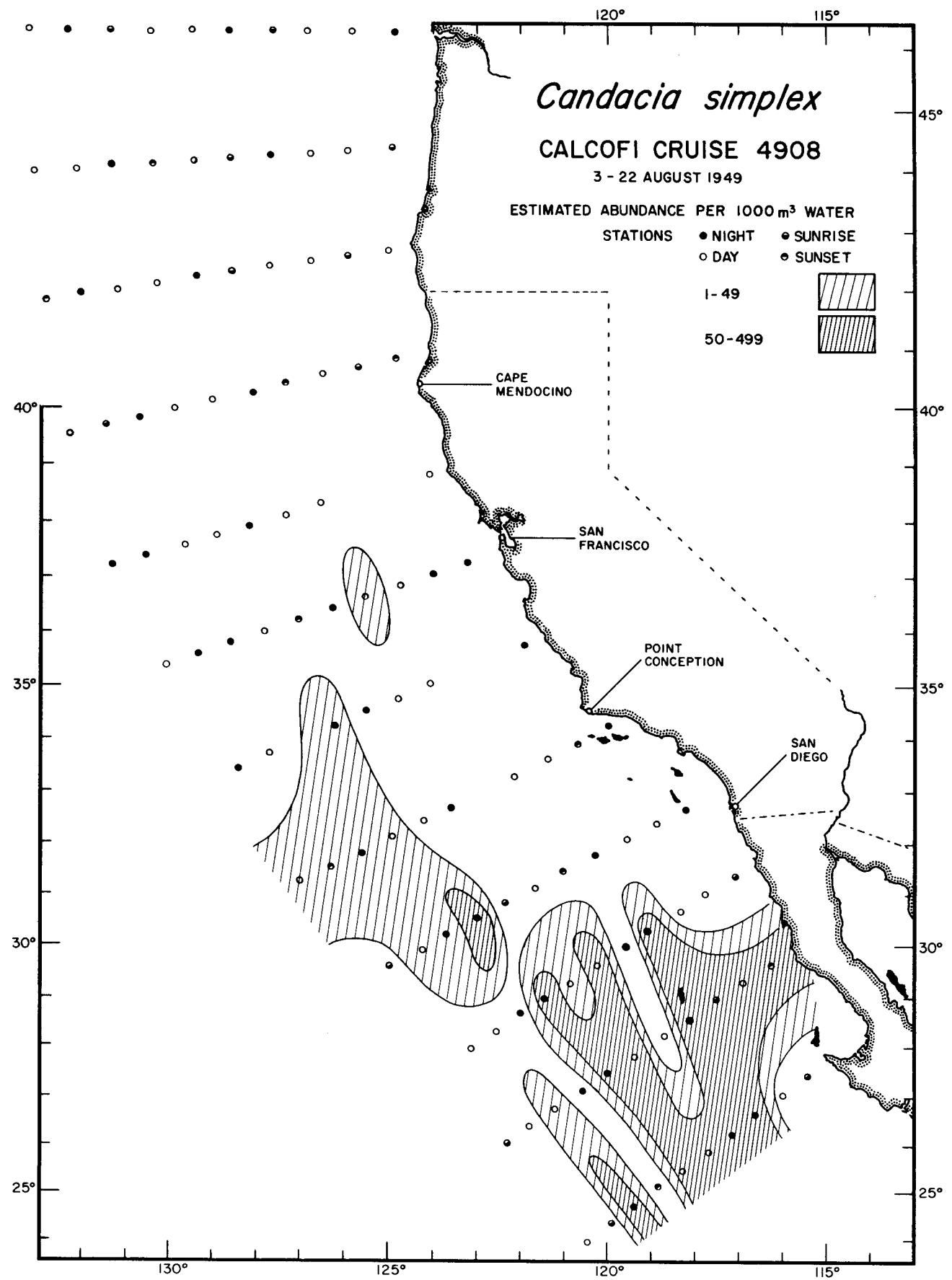




Calanoida

*Candacia simplex*

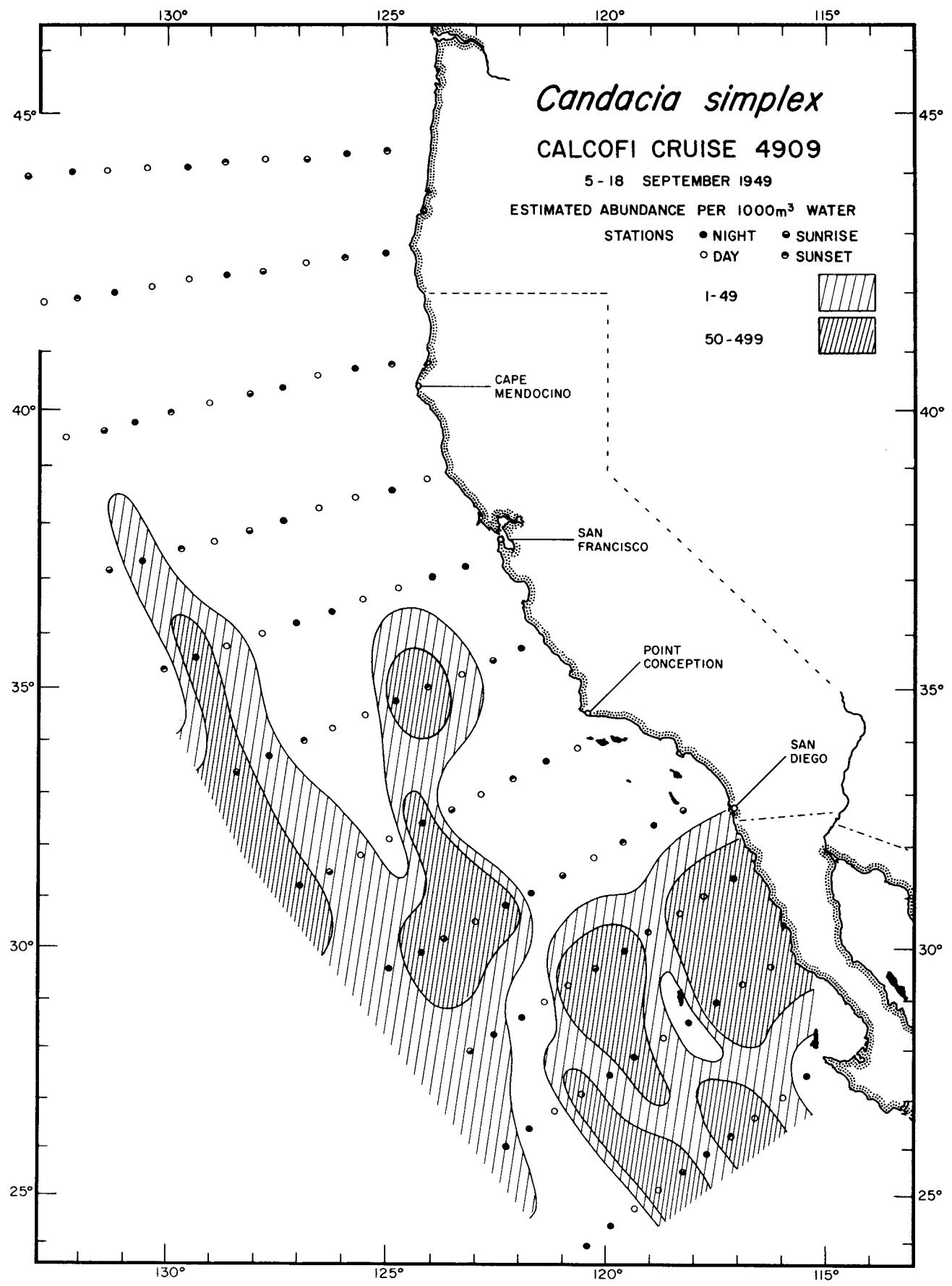
4907



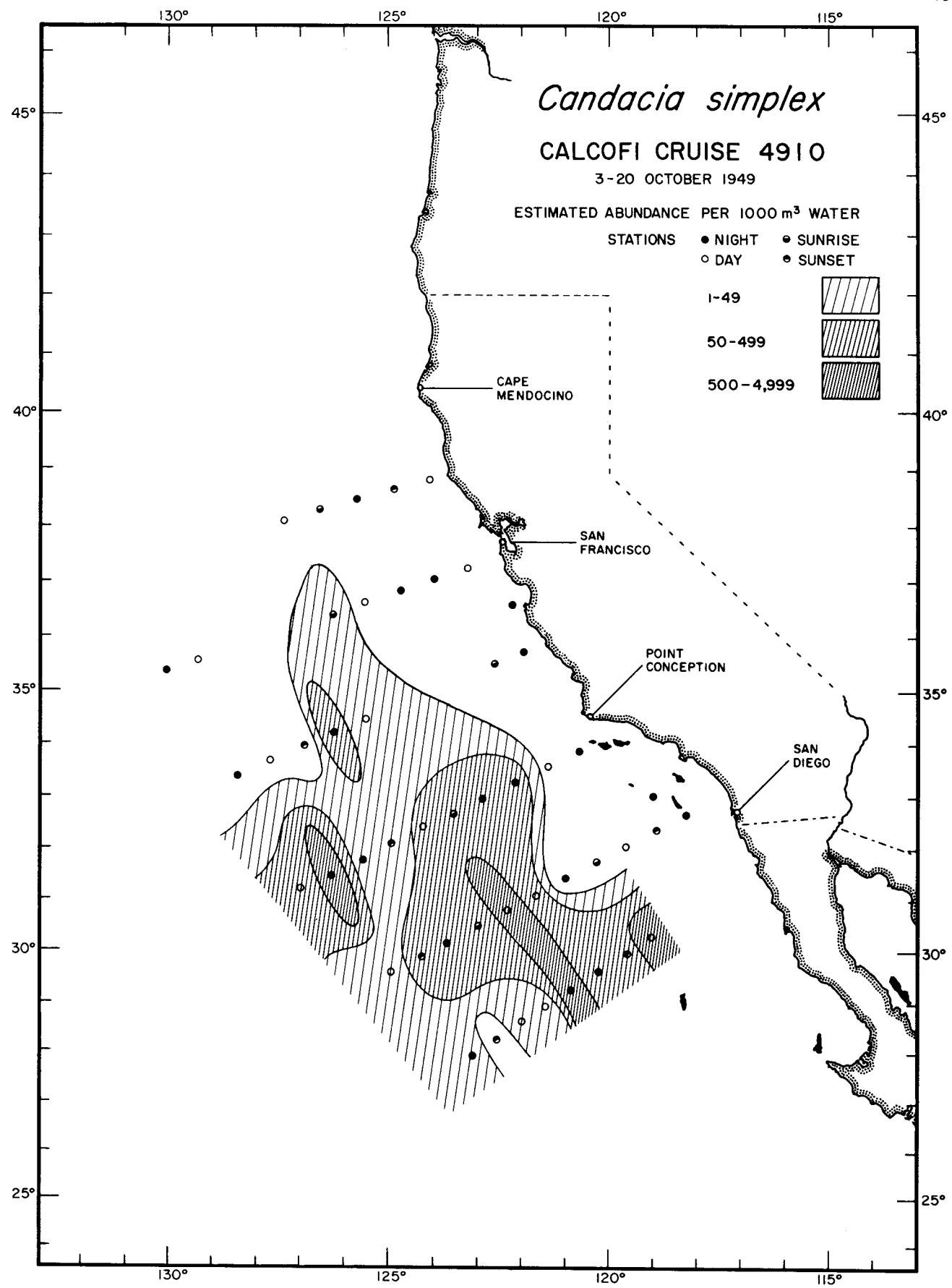
Calanoida

*Candacia simplex*

4908

*Candacia simplex*

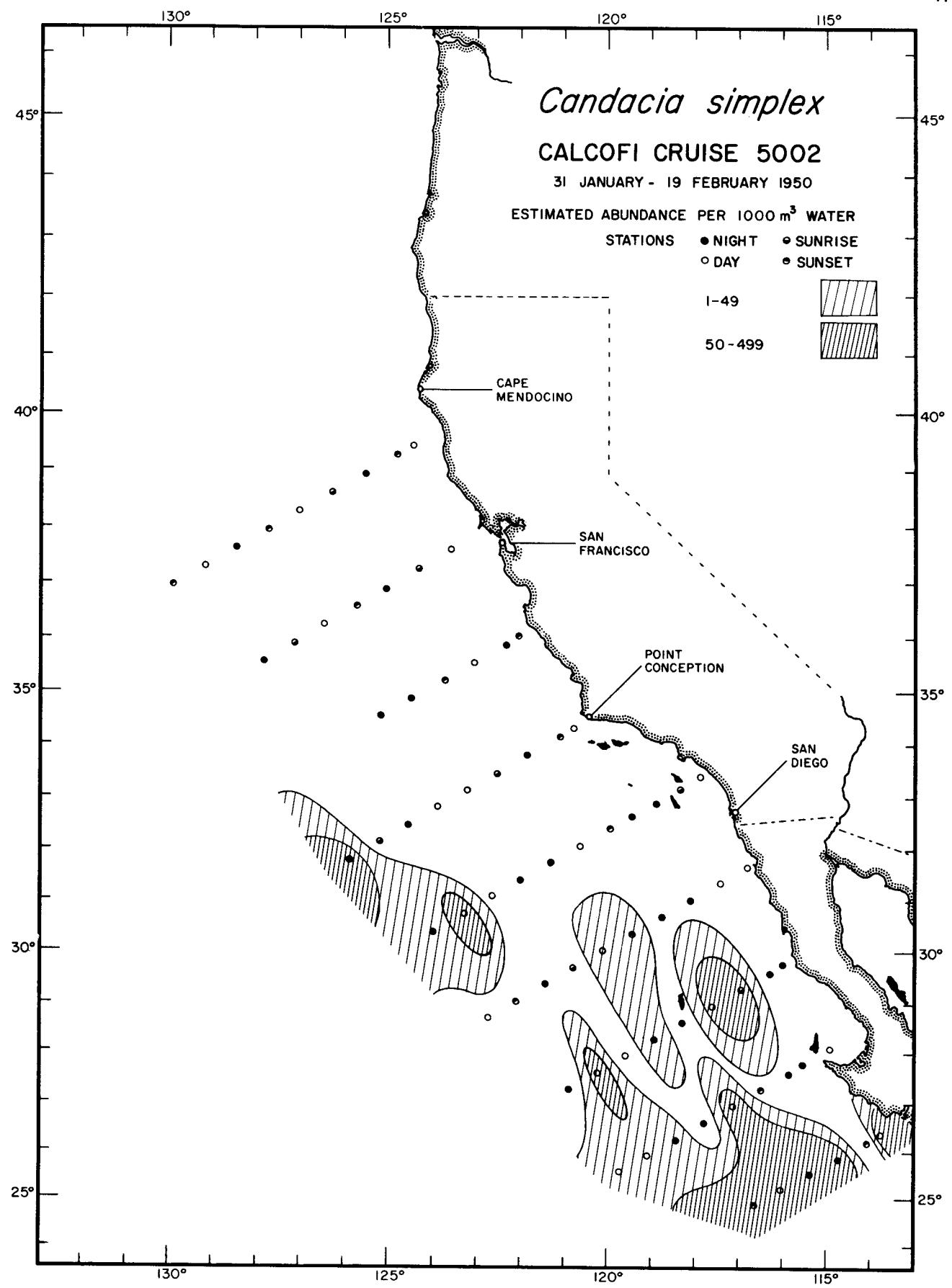
4909



Calanoida

*Candacia simplex*

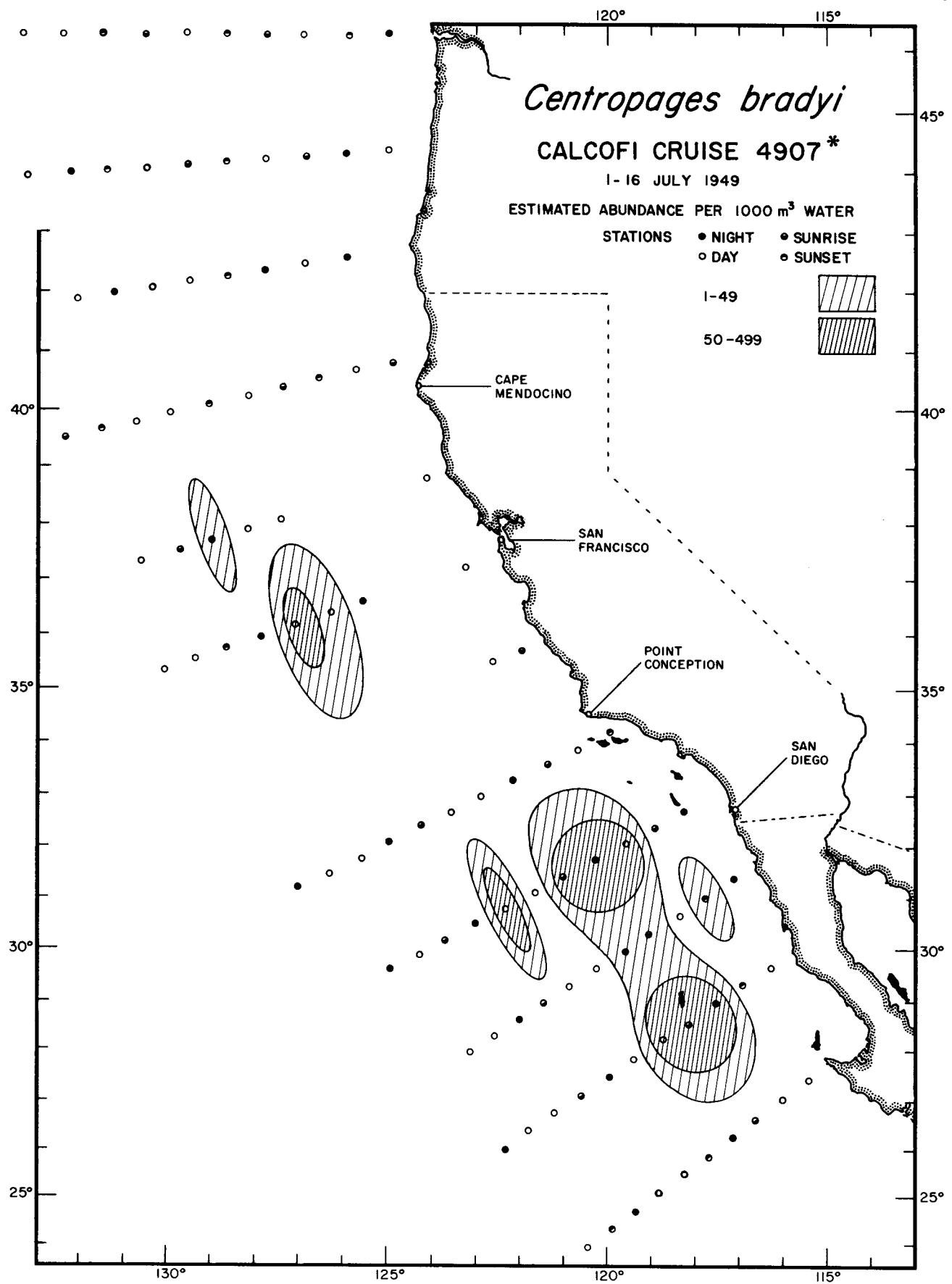
4910



Calanoida

*Candacia simplex*

5002

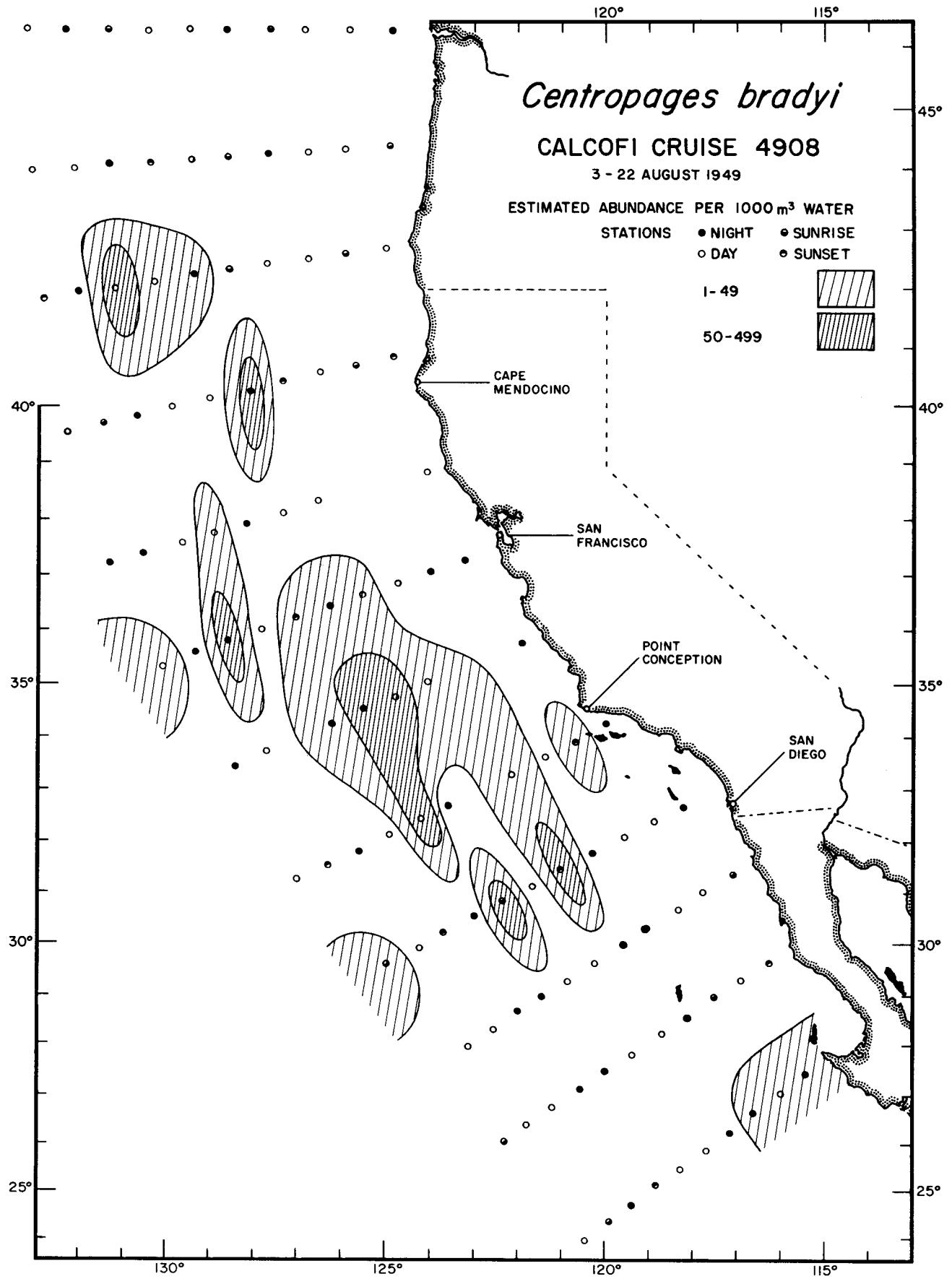


\* See Table 1 for cruises 4905, 6

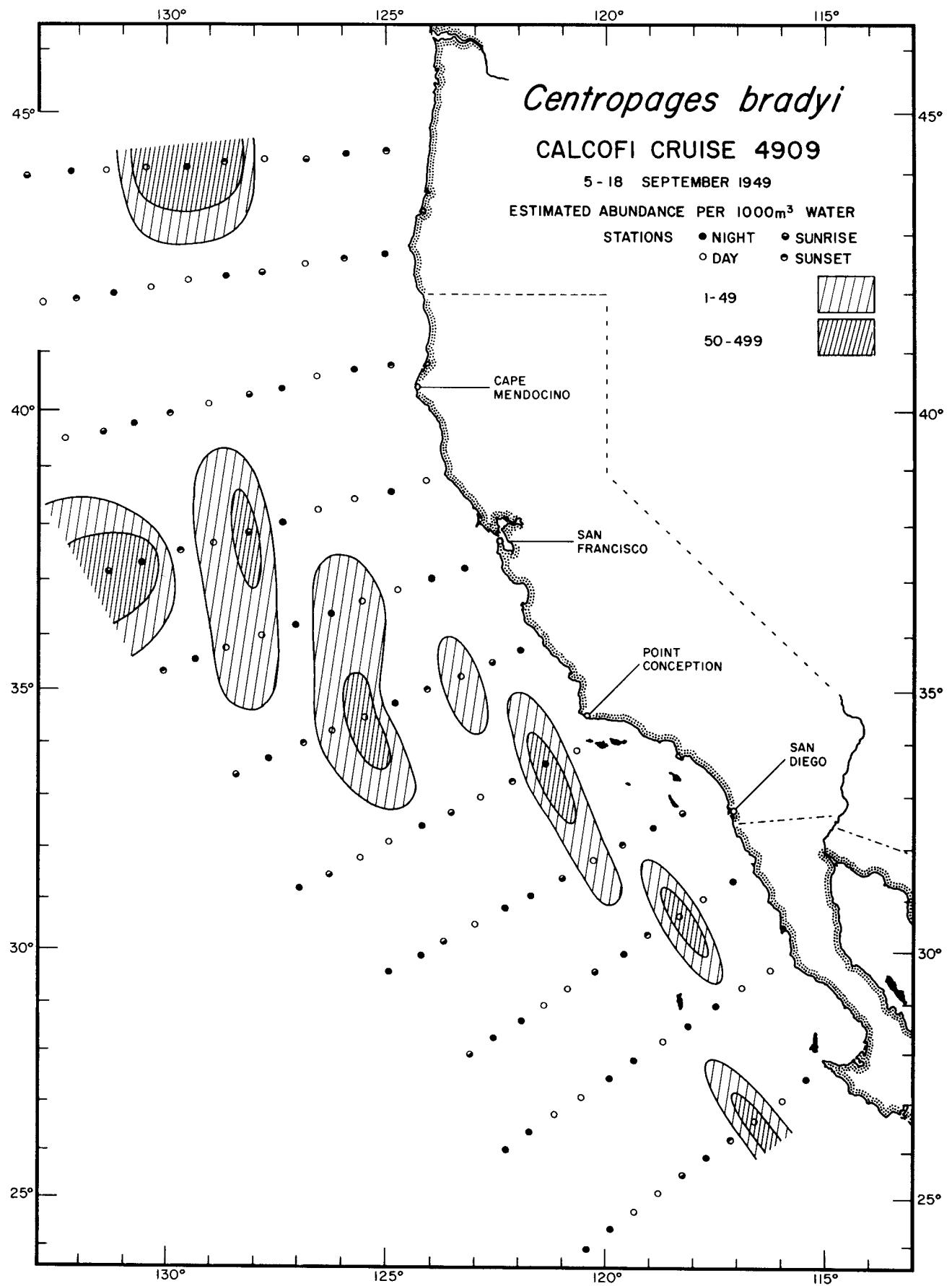
Calanoida

*Centropages bradyi*

4907



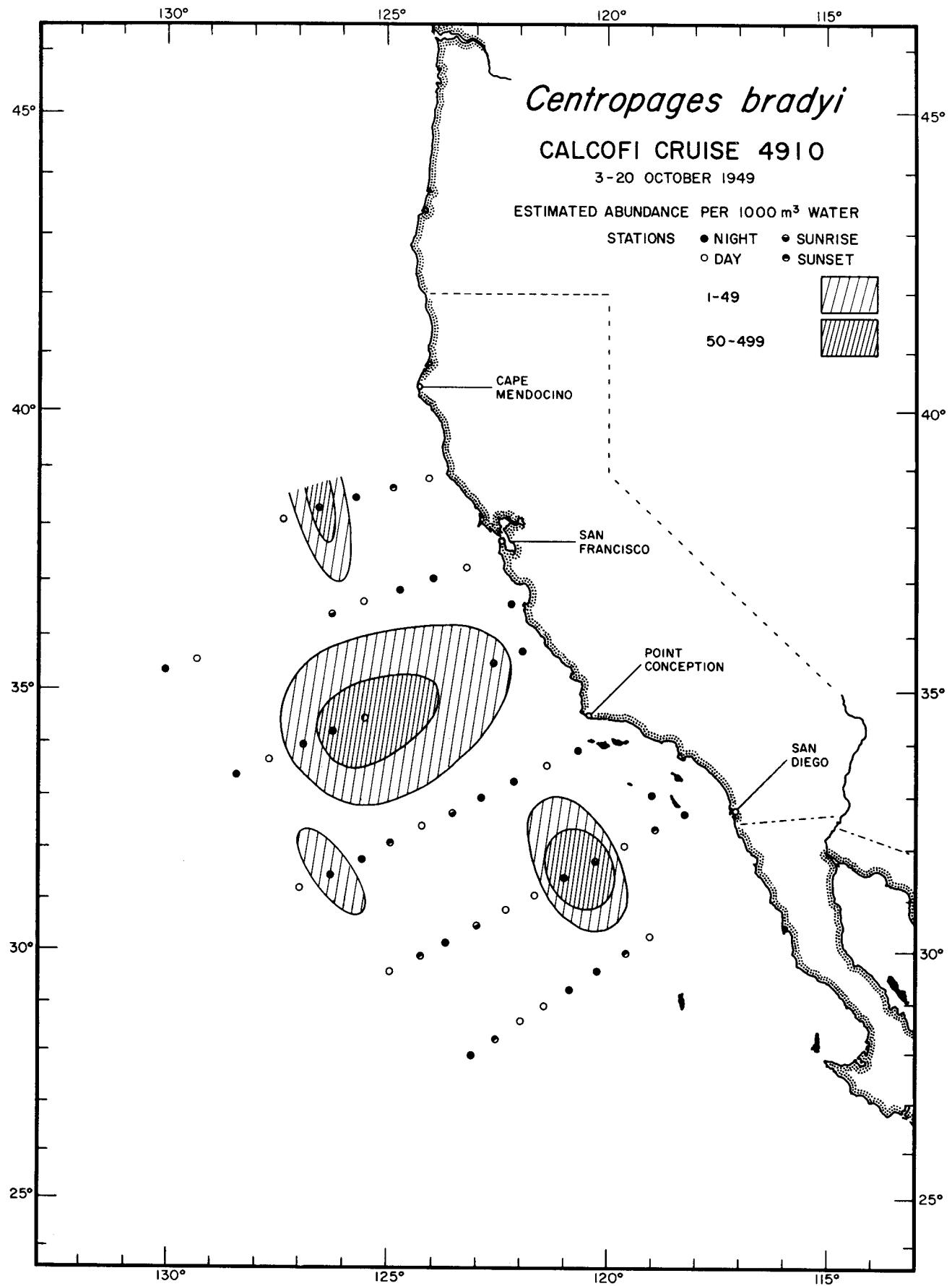
*Centropages bradyi*  
4908



Calanoida

*Centropages bradyi*

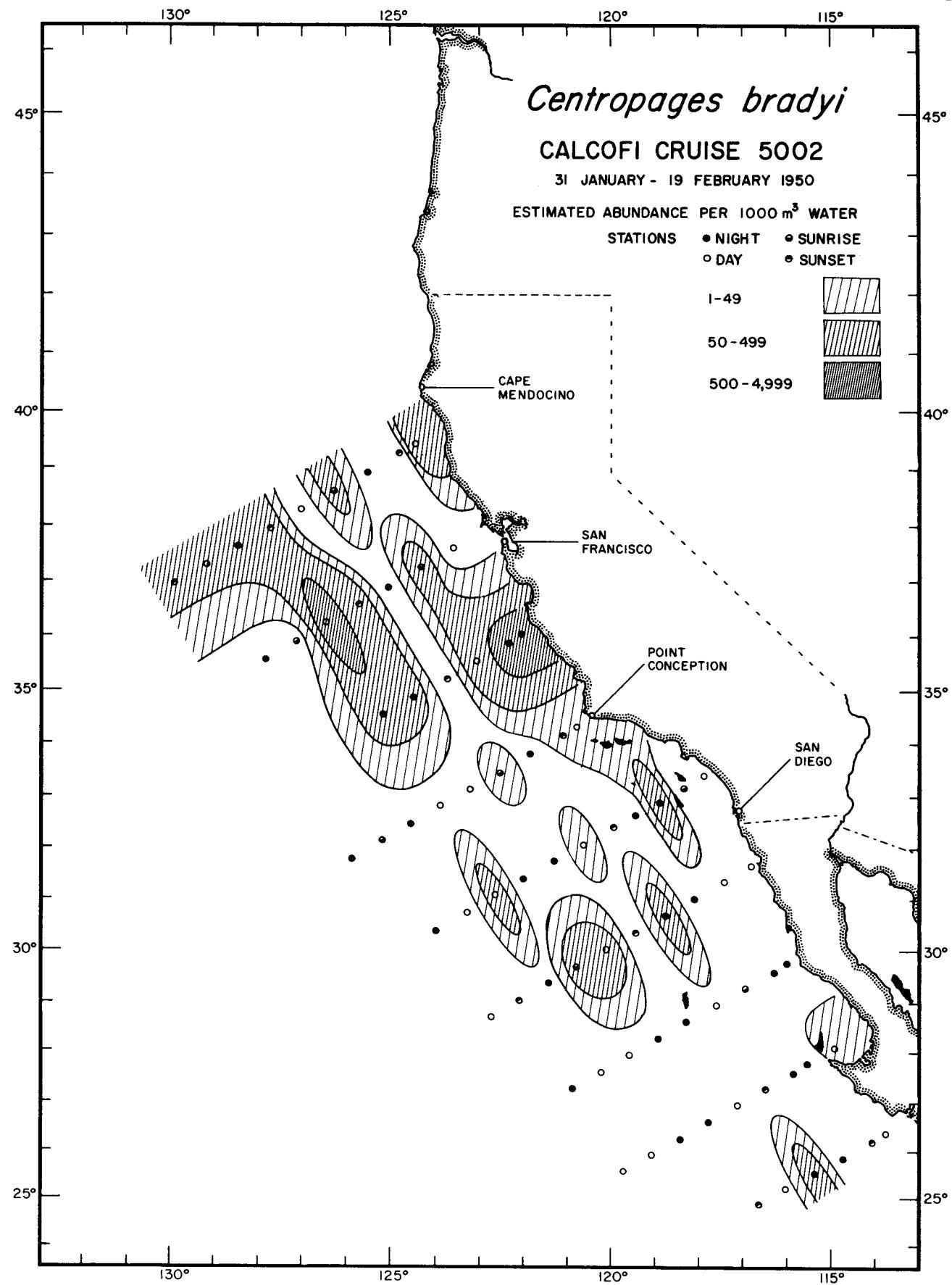
4909



## Calanoida

*Centropages bradyi*

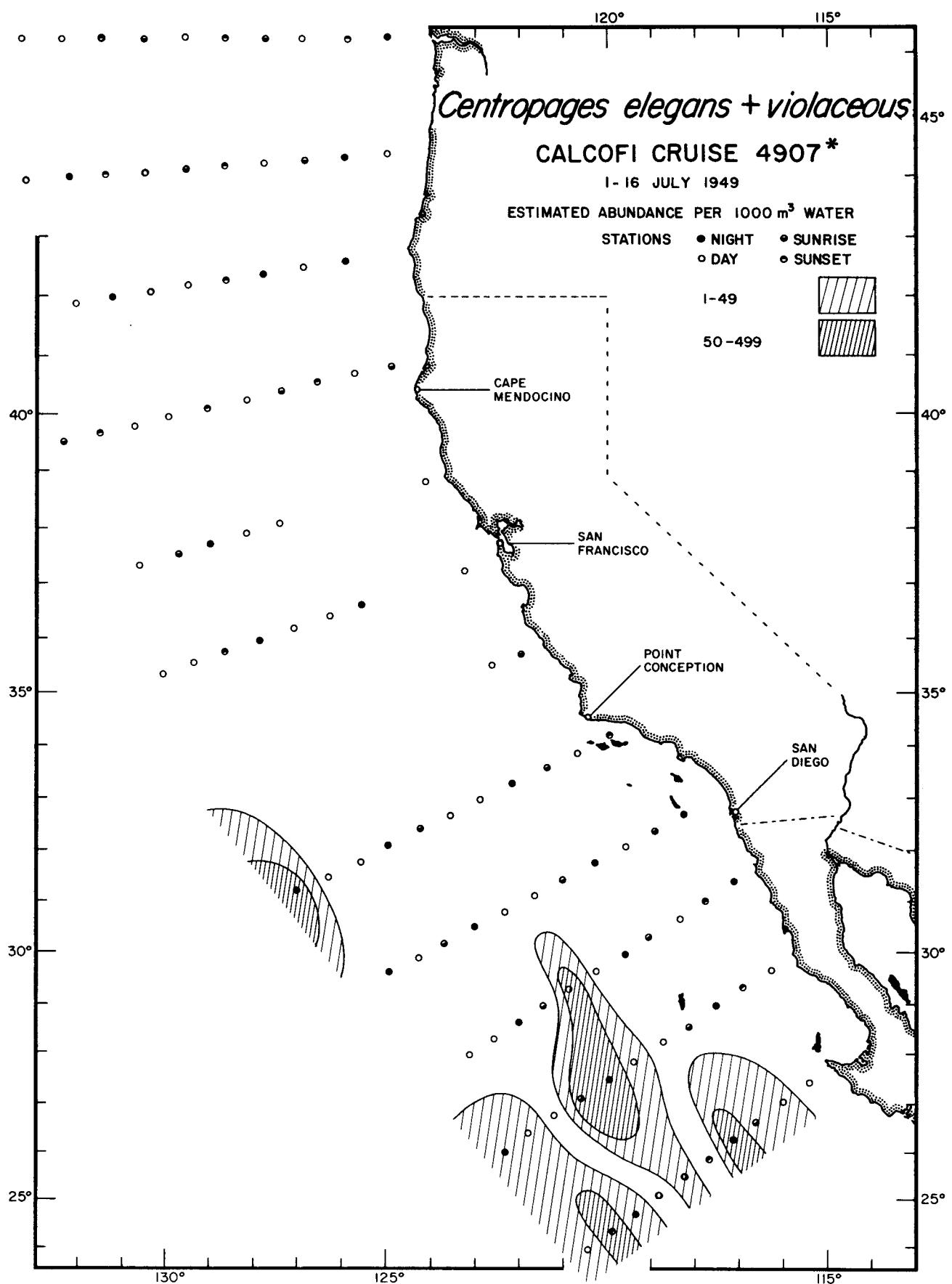
49 | 0



Calanoida

*Centropages bradyi*

5002

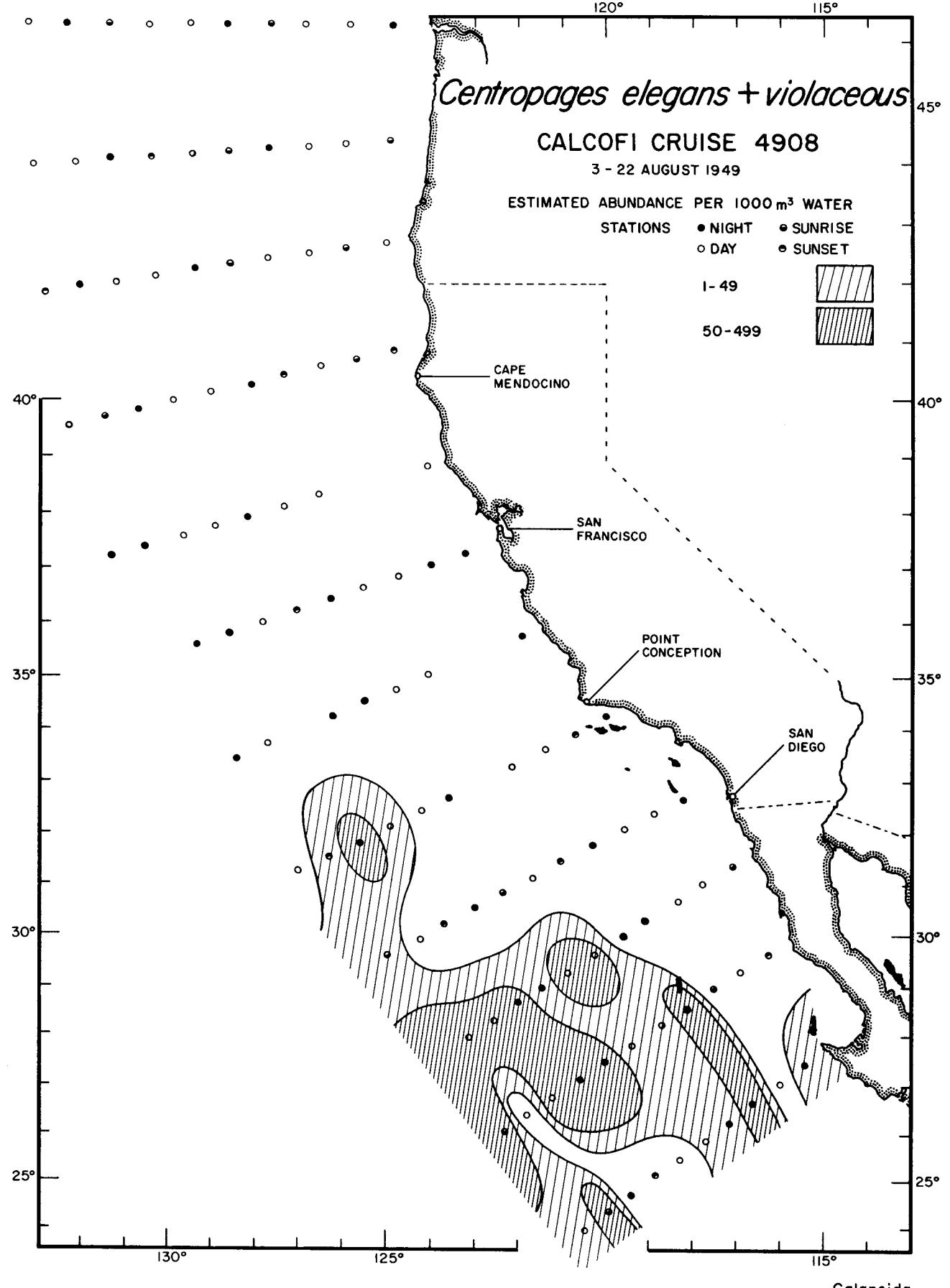


\*See Table 1 for cruises 4905, 6

Calanoida

*Centropages elegans + violaceous*

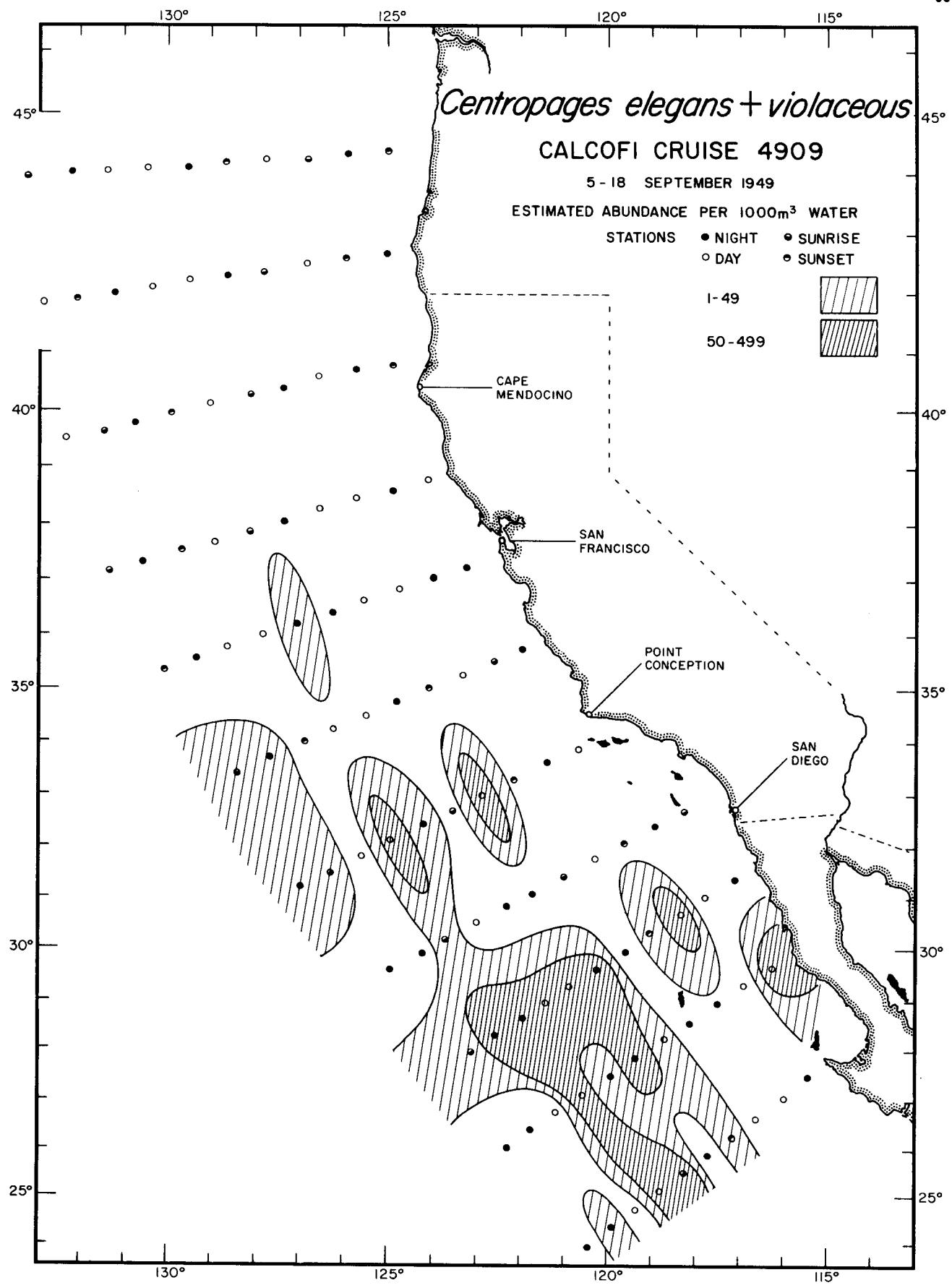
4907



## Calanoida

### *Centropages elegans + violaceous*

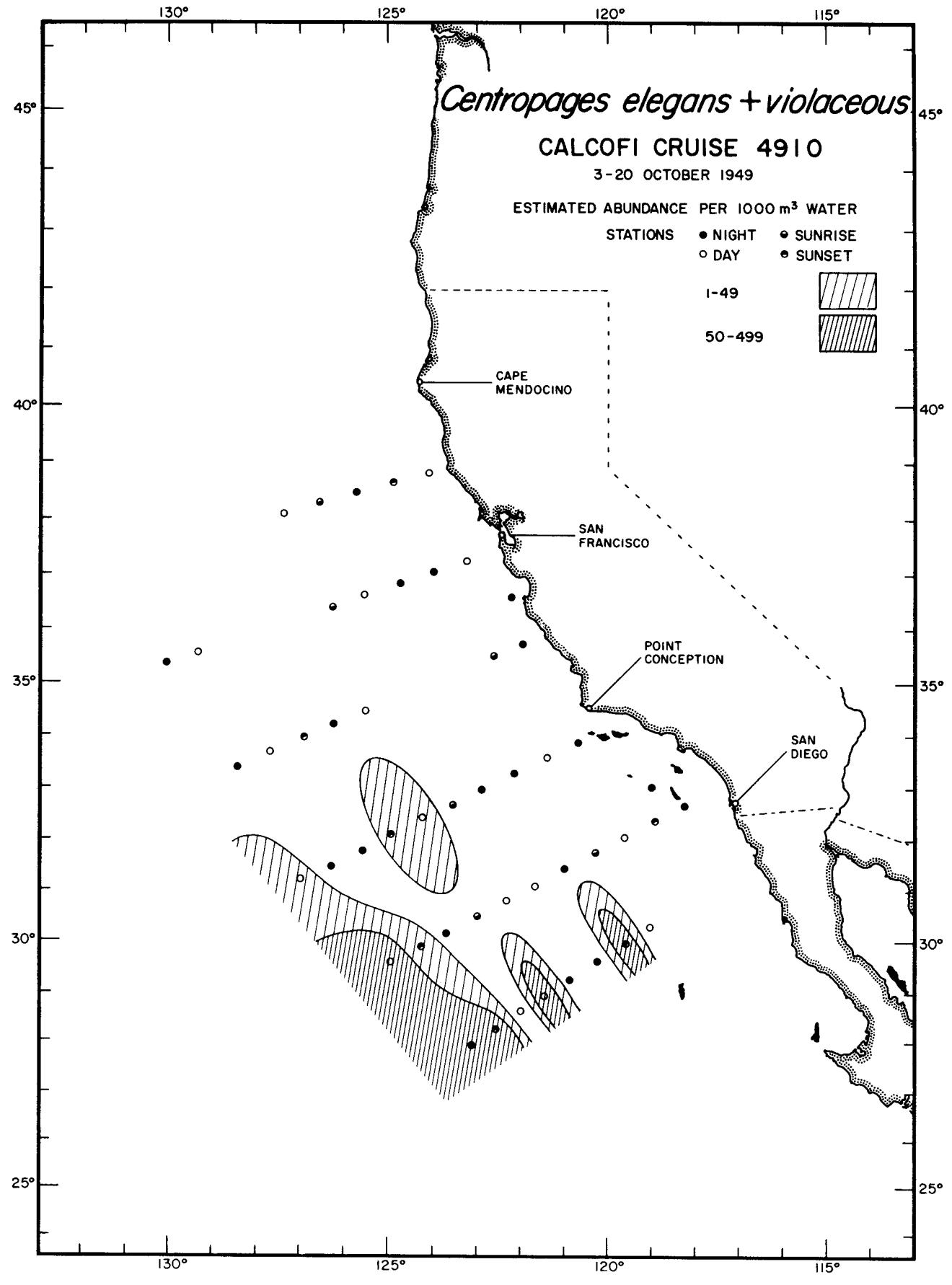
4908



Calanoida

*Centropages elegans + violaceous*

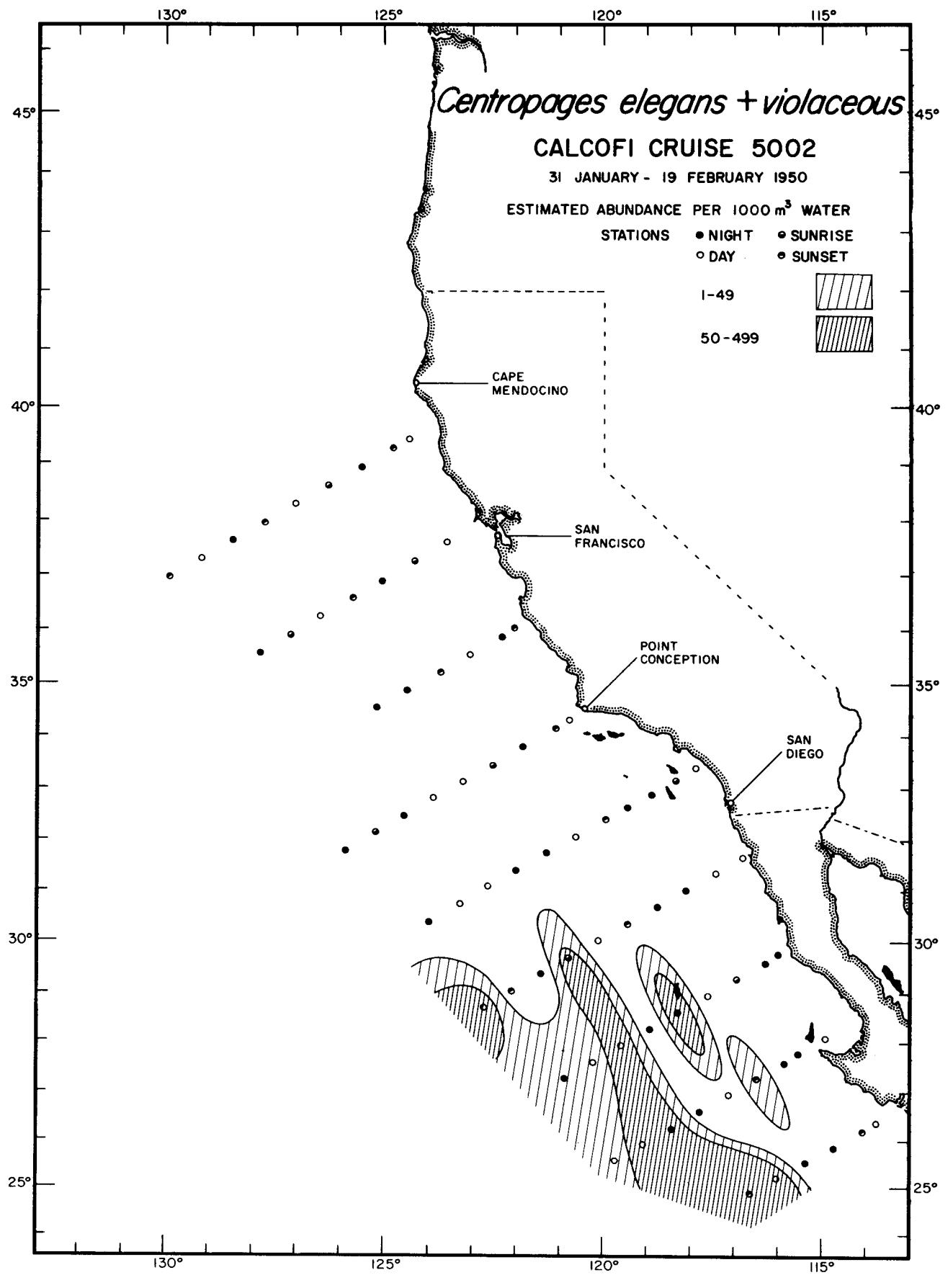
4909



## Calanoida

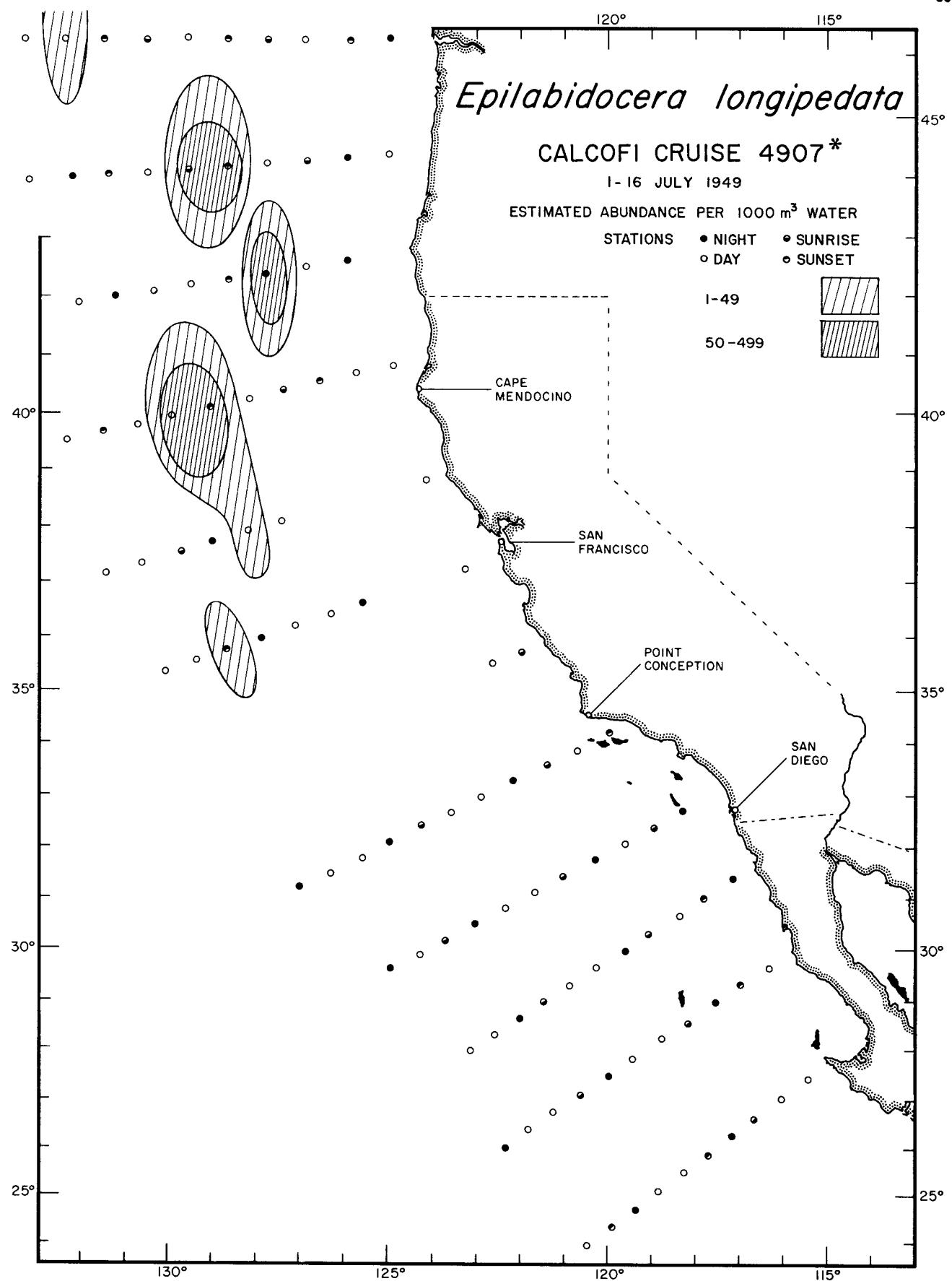
## *Centropages elegans* + *violaceous*

4910



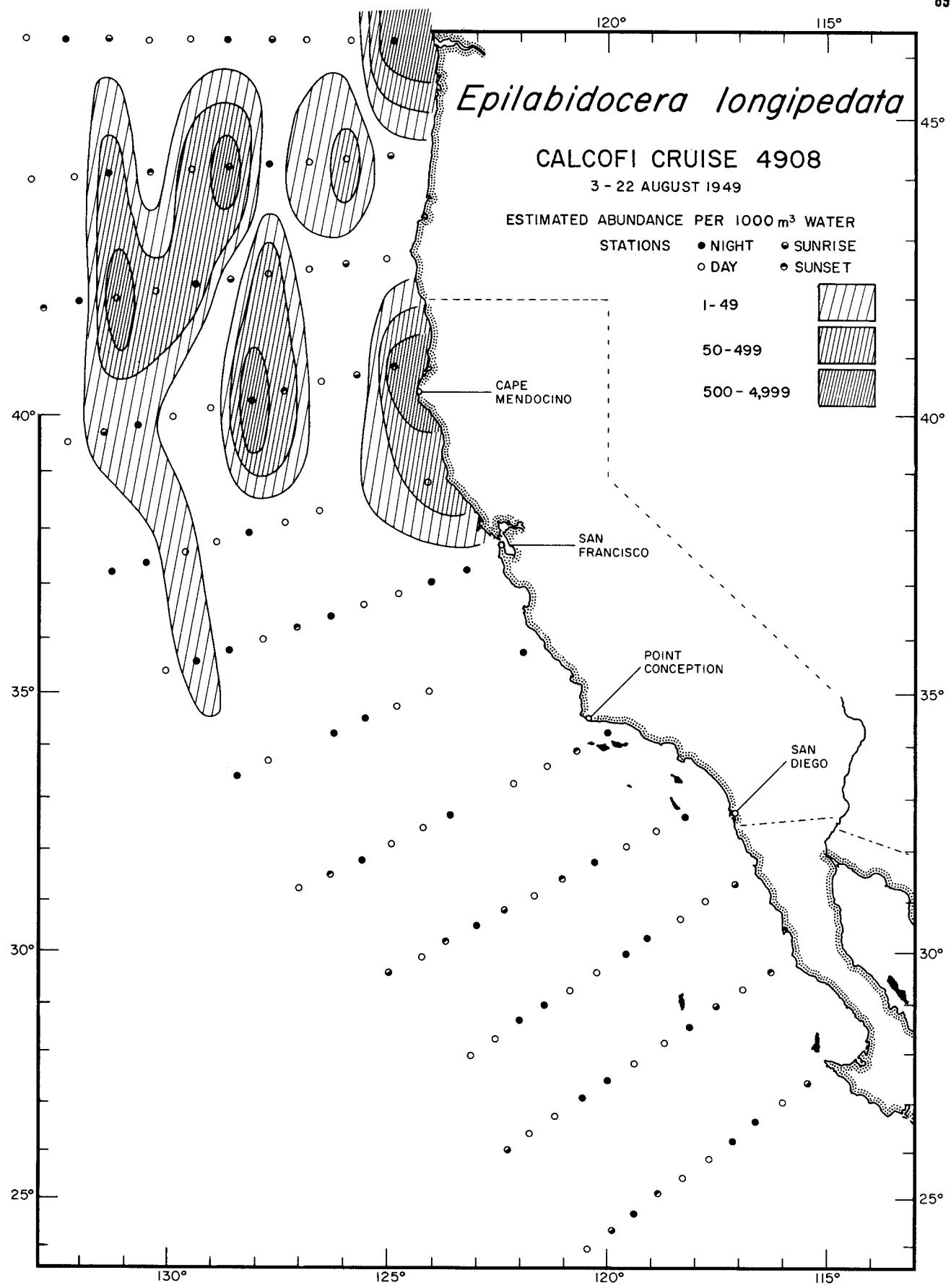
*Centropages elegans + violaceous*

5002



\* See Table 1 for cruises 4905, 6

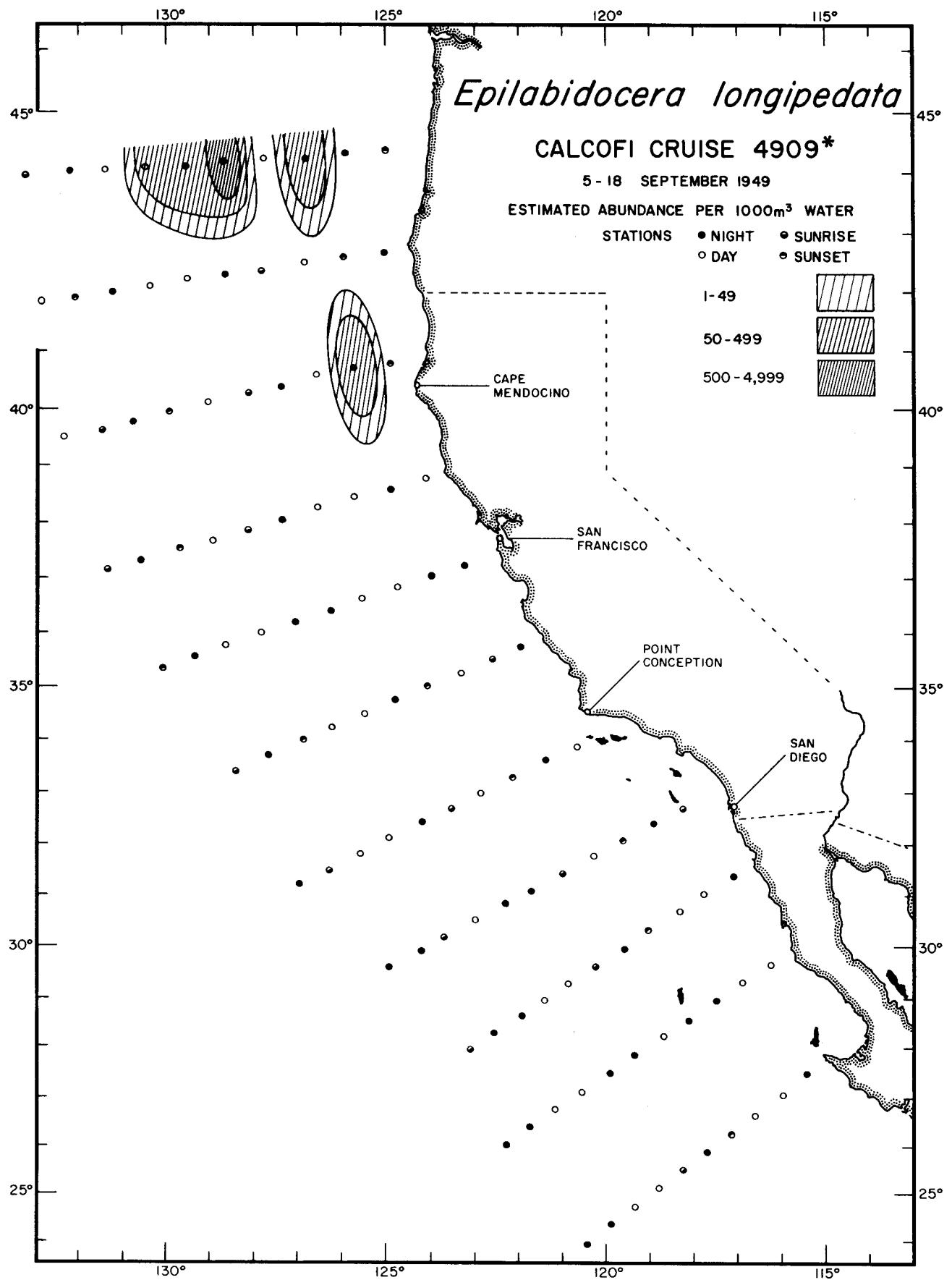
*Epilabidocera longipedata*  
4907



Calanoida

*Epilabidocera longipedata*

4908

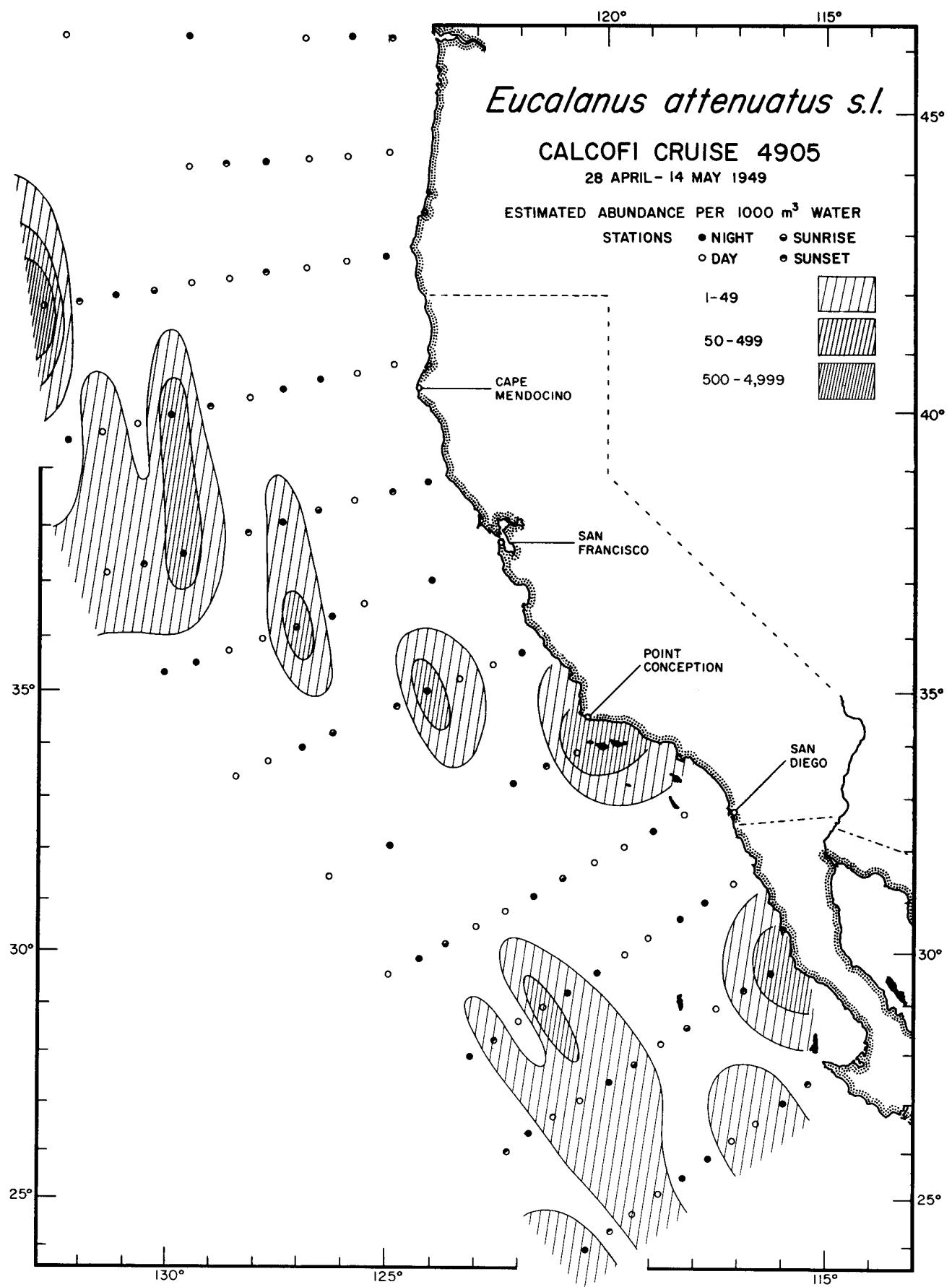


\* See Table 1 for cruises 4910, 5002

Calanoida

*Epilabidocera longipedata*

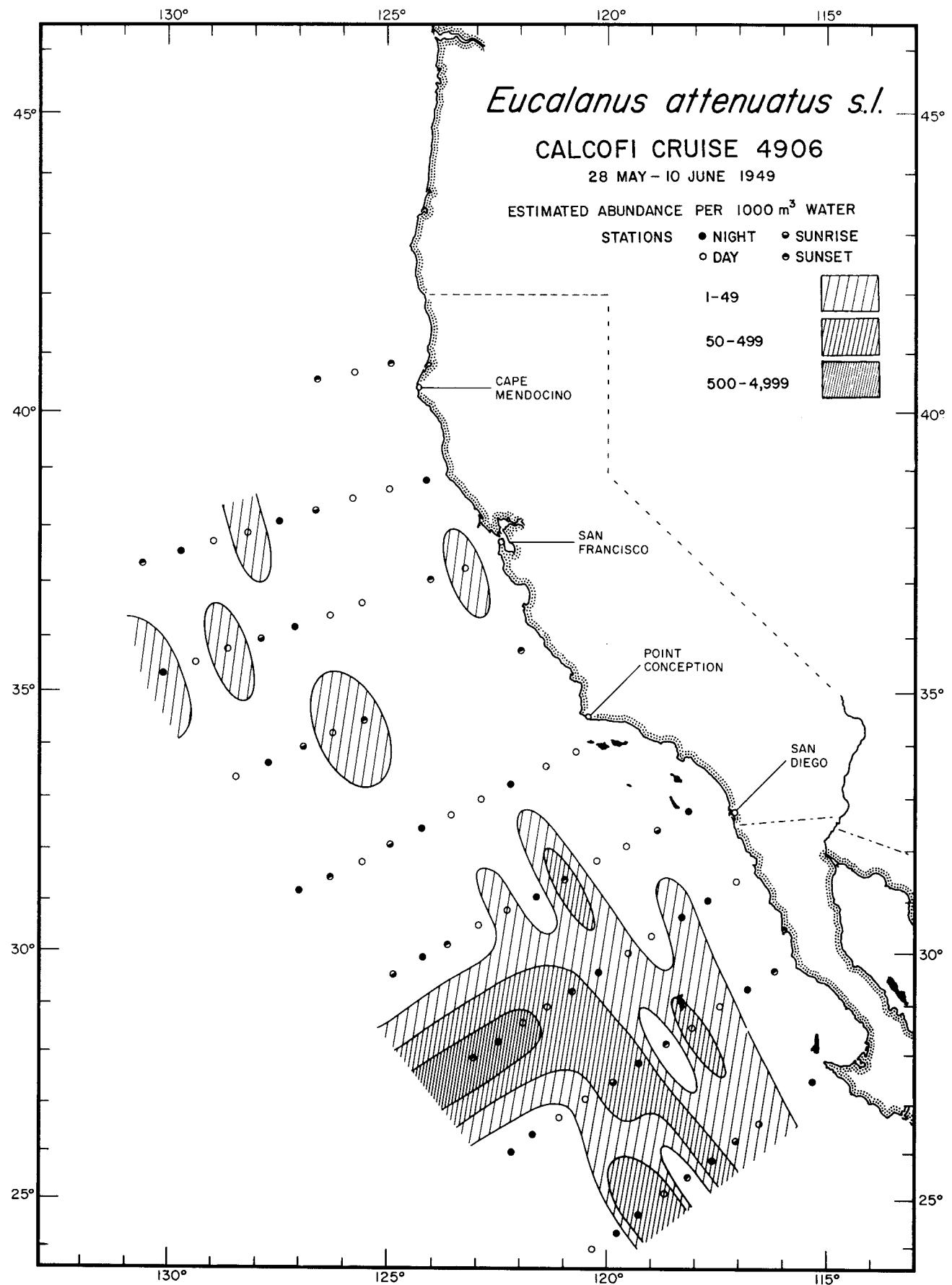
4909



Calanoida

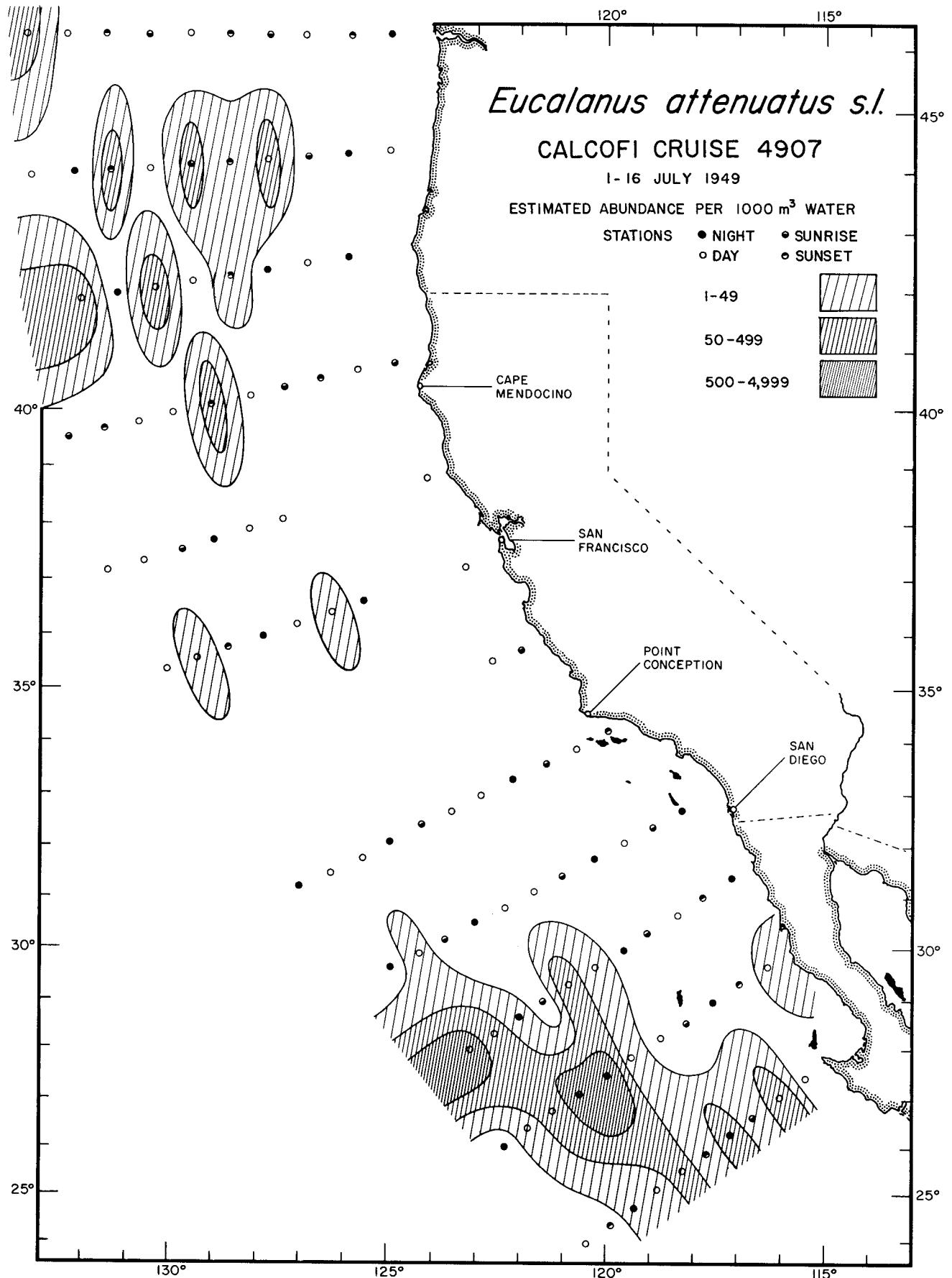
*Eucalanus attenuatus s.l.*

4905



Calanoida  
*Eucalanus attenuatus s.l.*

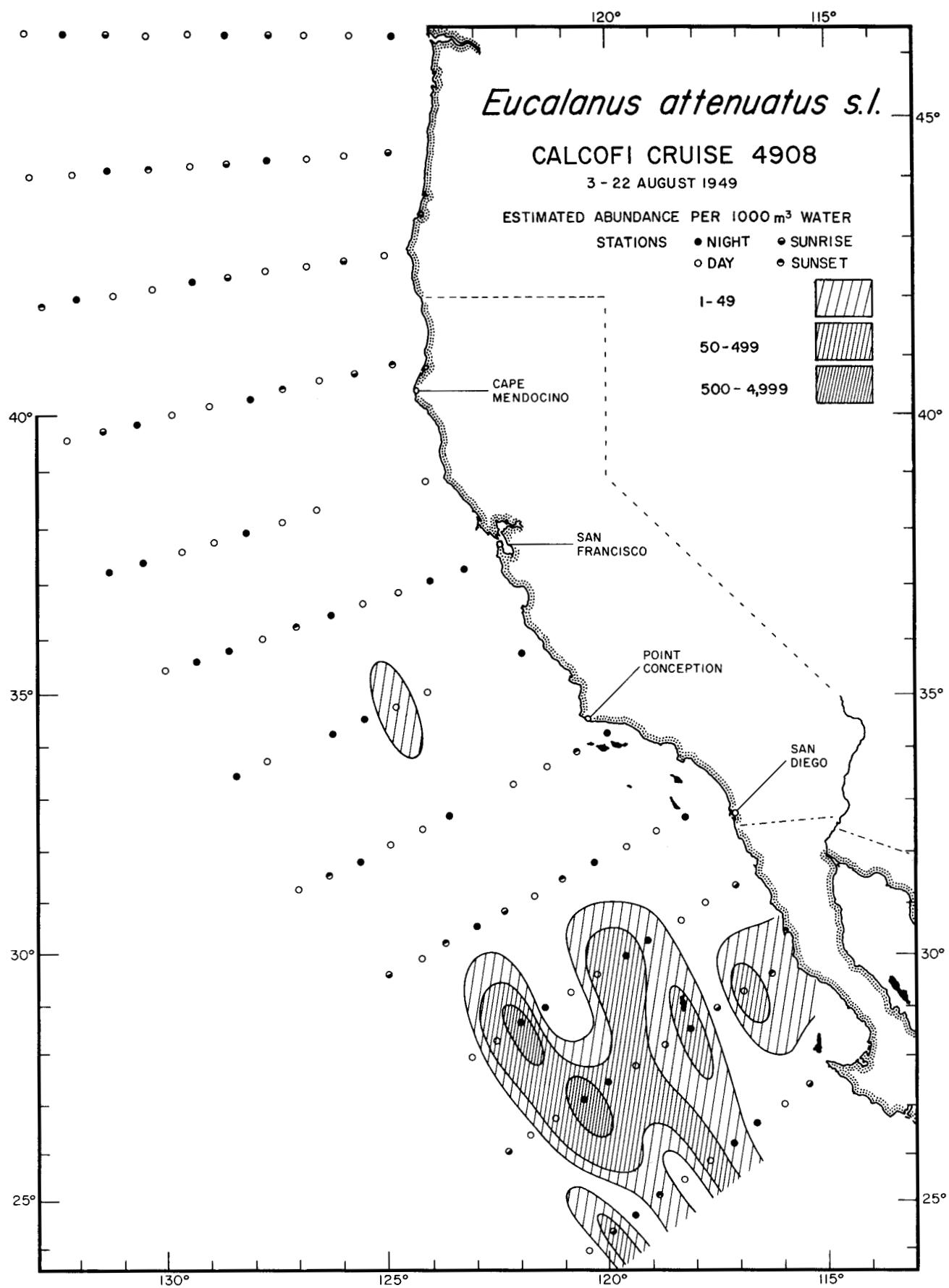
4906



Calanoida

*Eucalanus attenuatus s.l.*

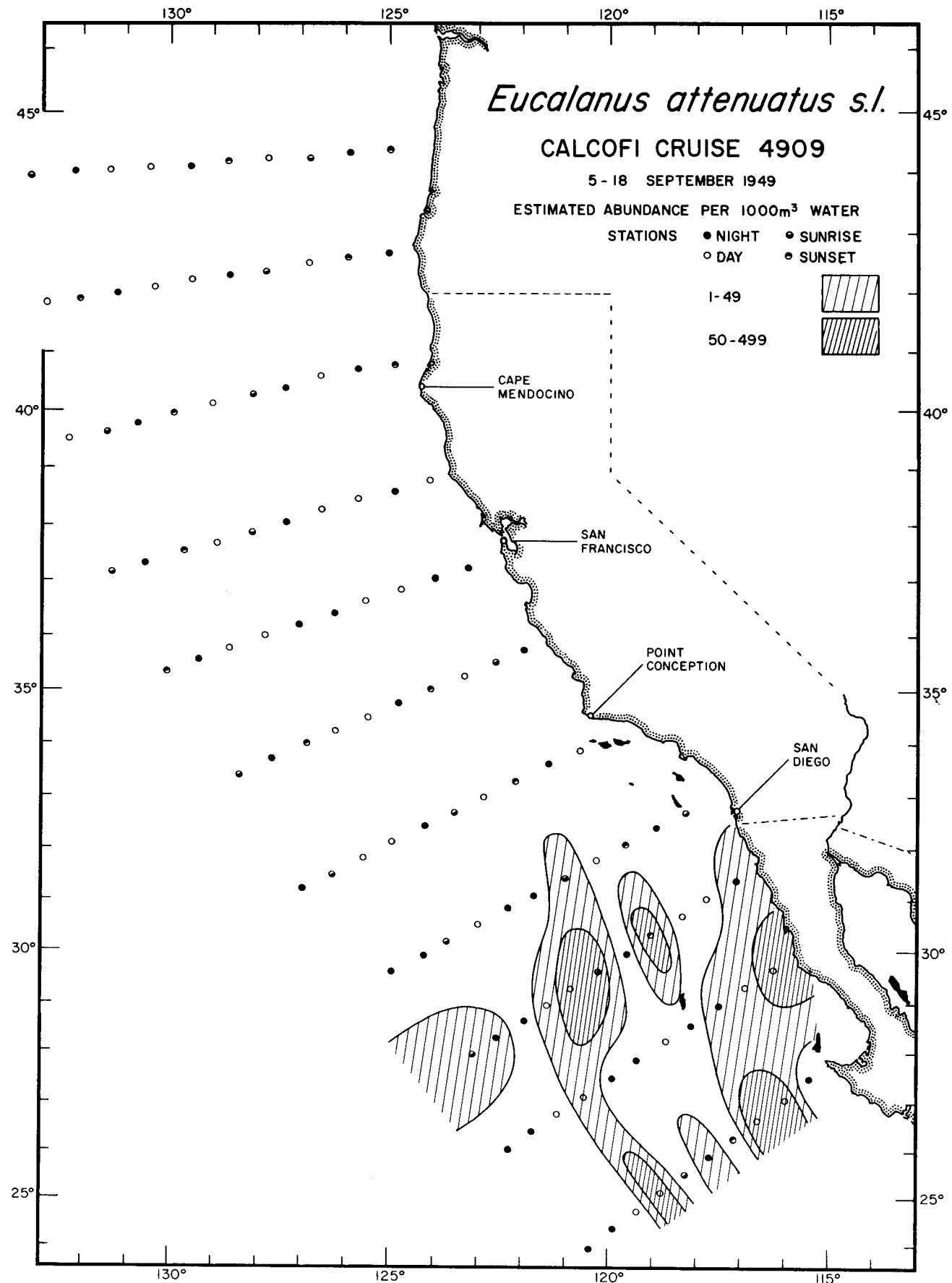
4907



Calanoida

*Eucalanus attenuatus s.l.*

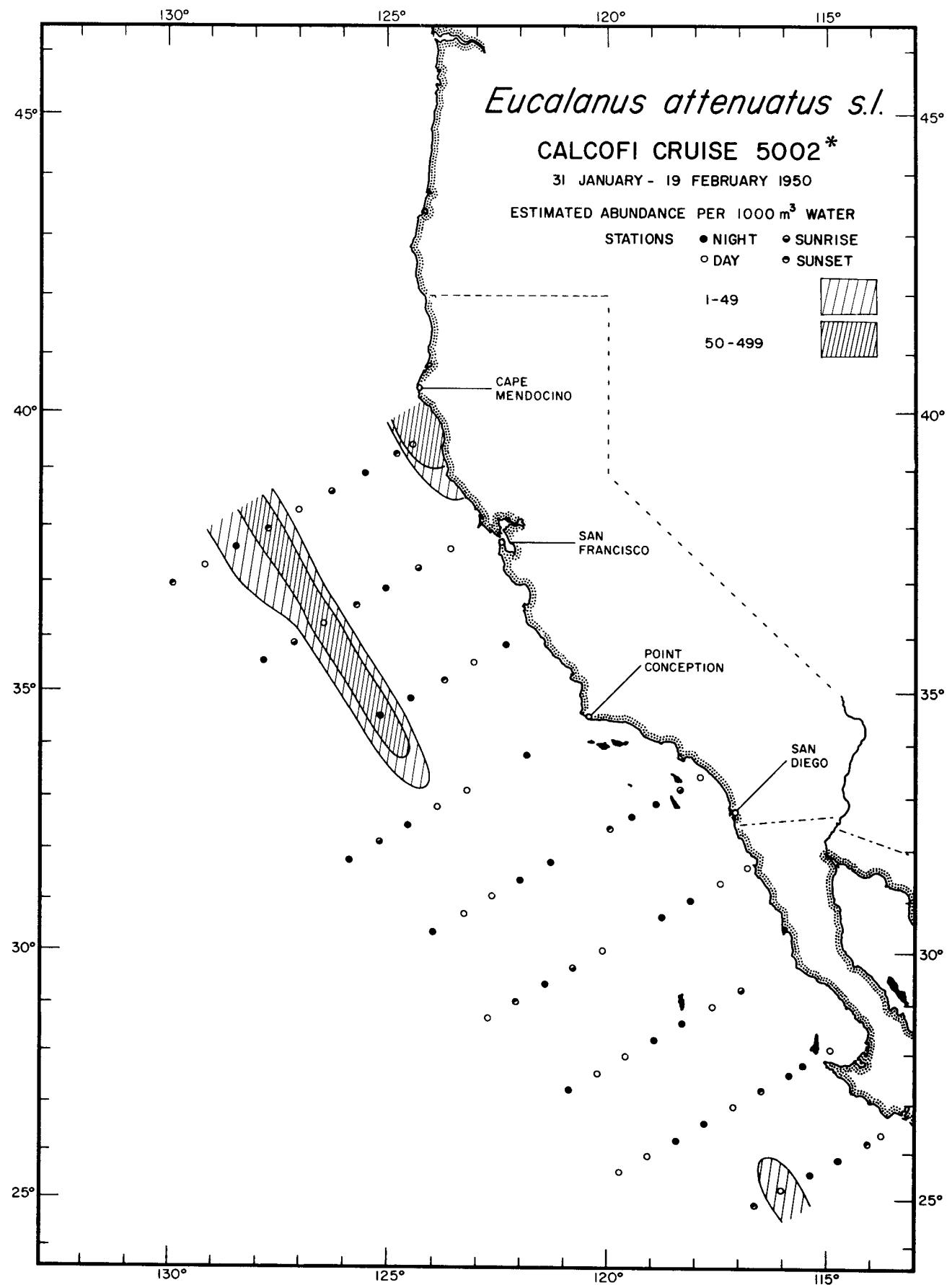
4908



Calanoida

*Eucalanus attenuatus s.l.*

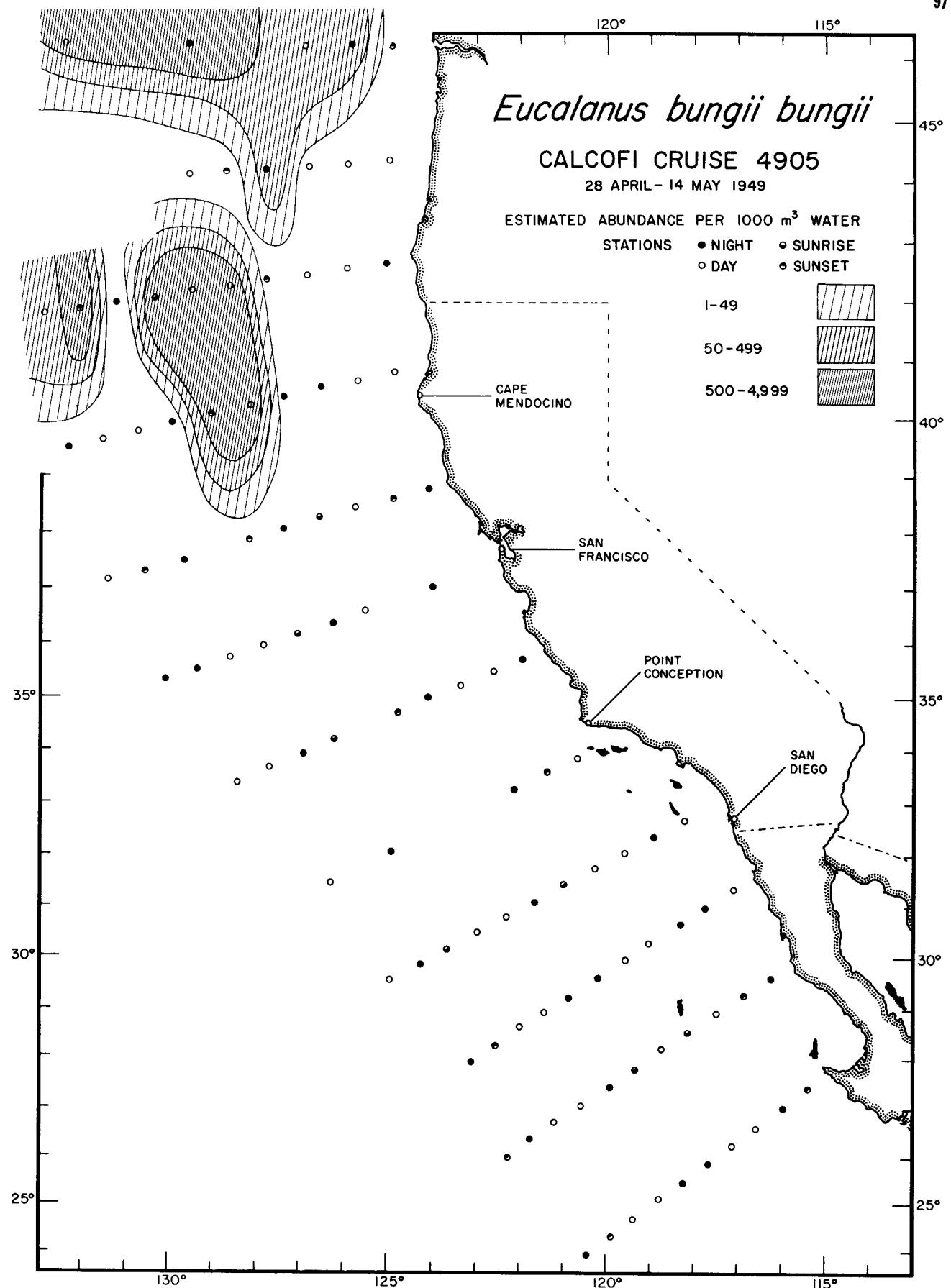
4909



\* See Table 1 for cruise 4910

Calanoida  
*Eucalanus attenuatus s.l.*

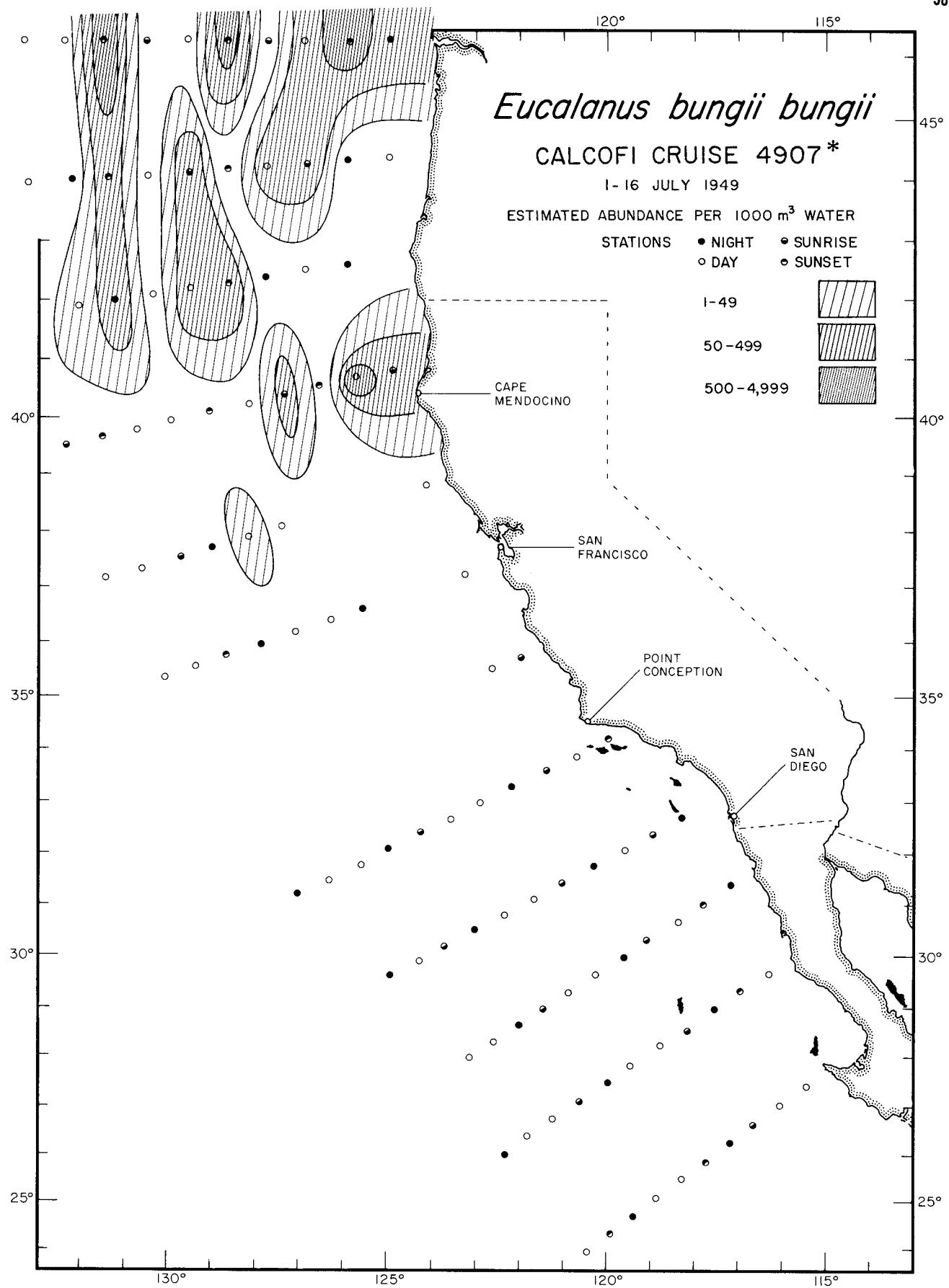
5002



Calanoida

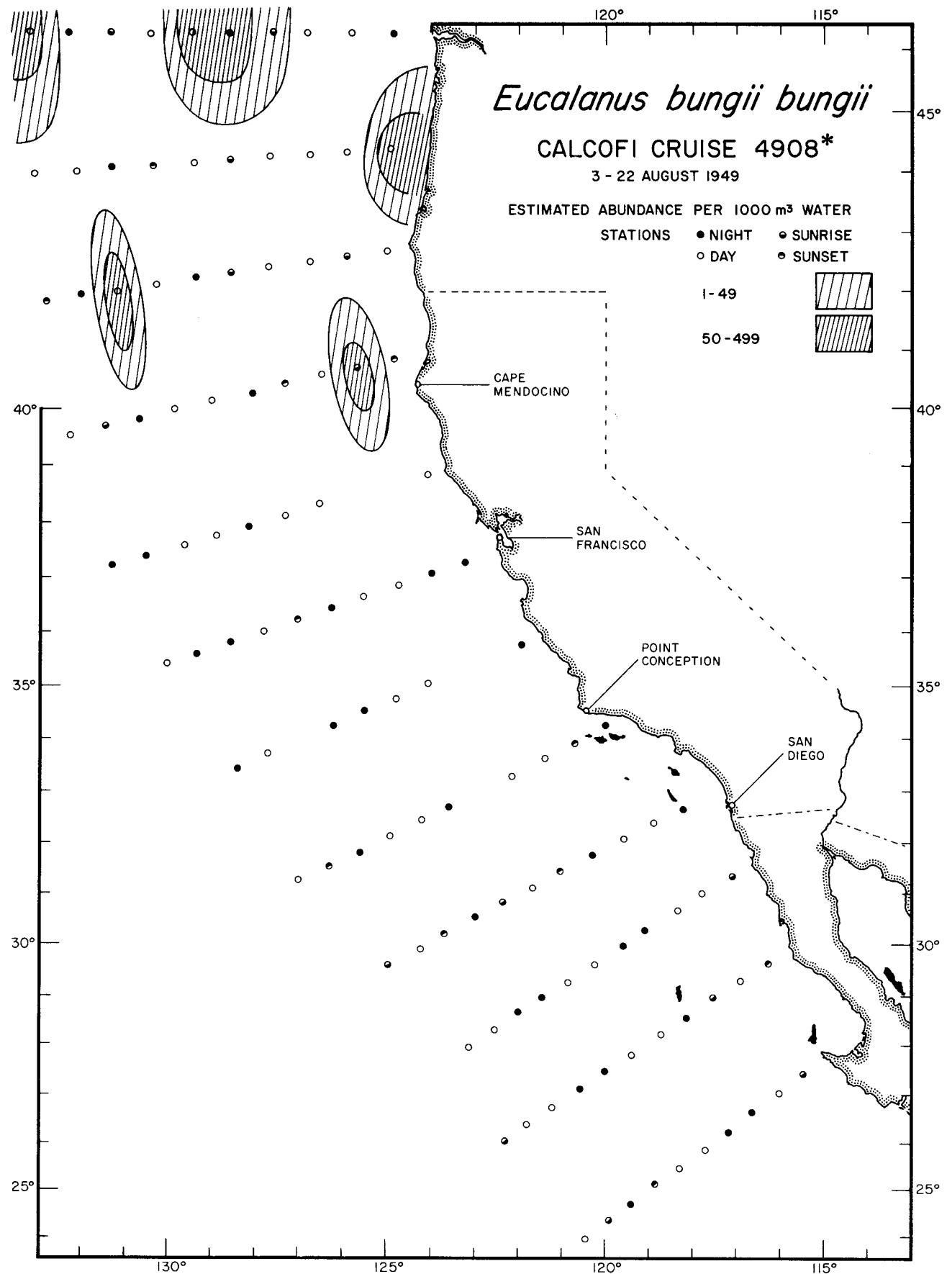
*Eucalanus bungii bungii*

4905



\* See Table 1 for cruise 4906

*Eucalanus bungii bungii*  
4907

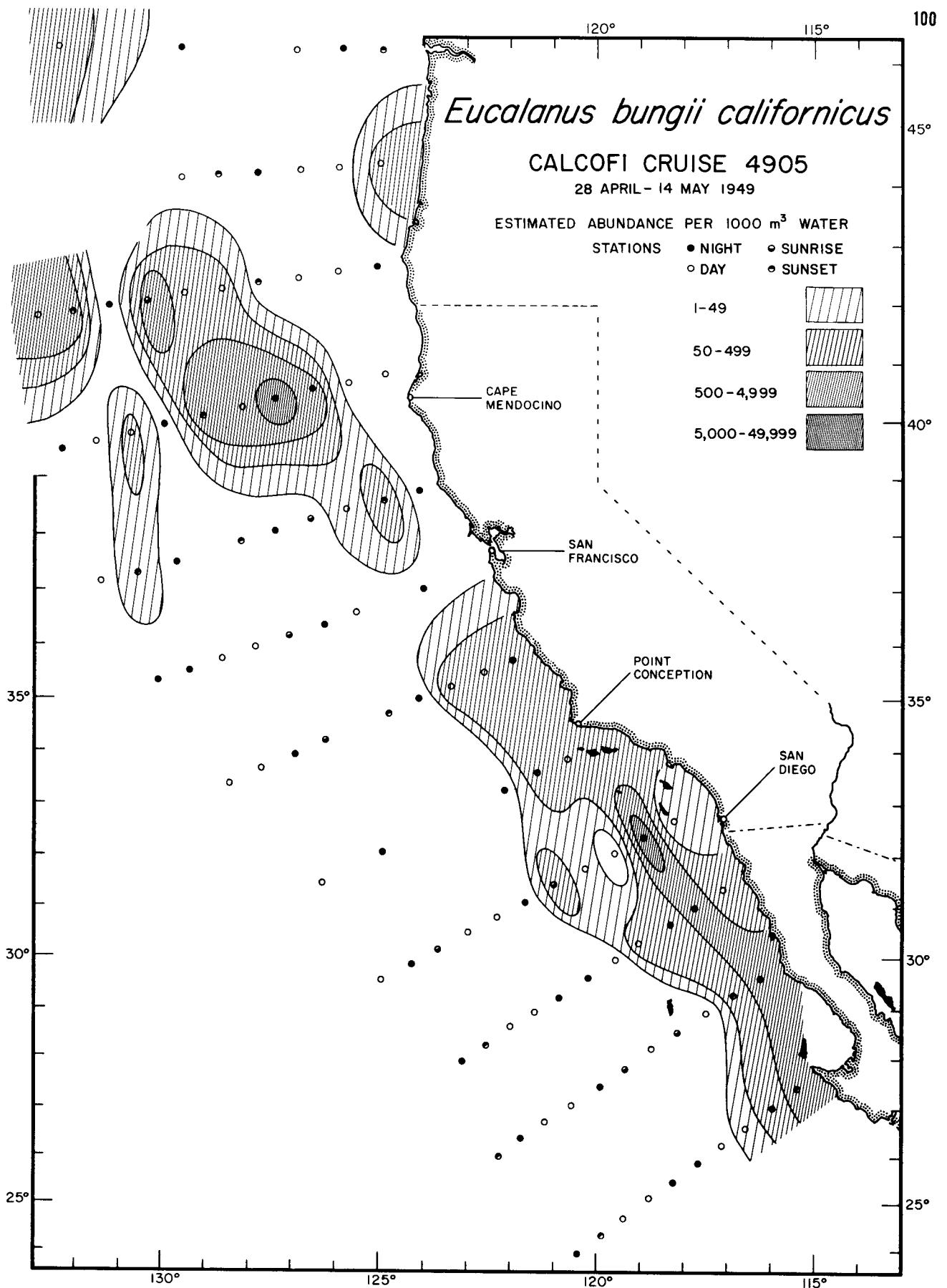


\* See Table 1 for cruises 4909, 10, 5002

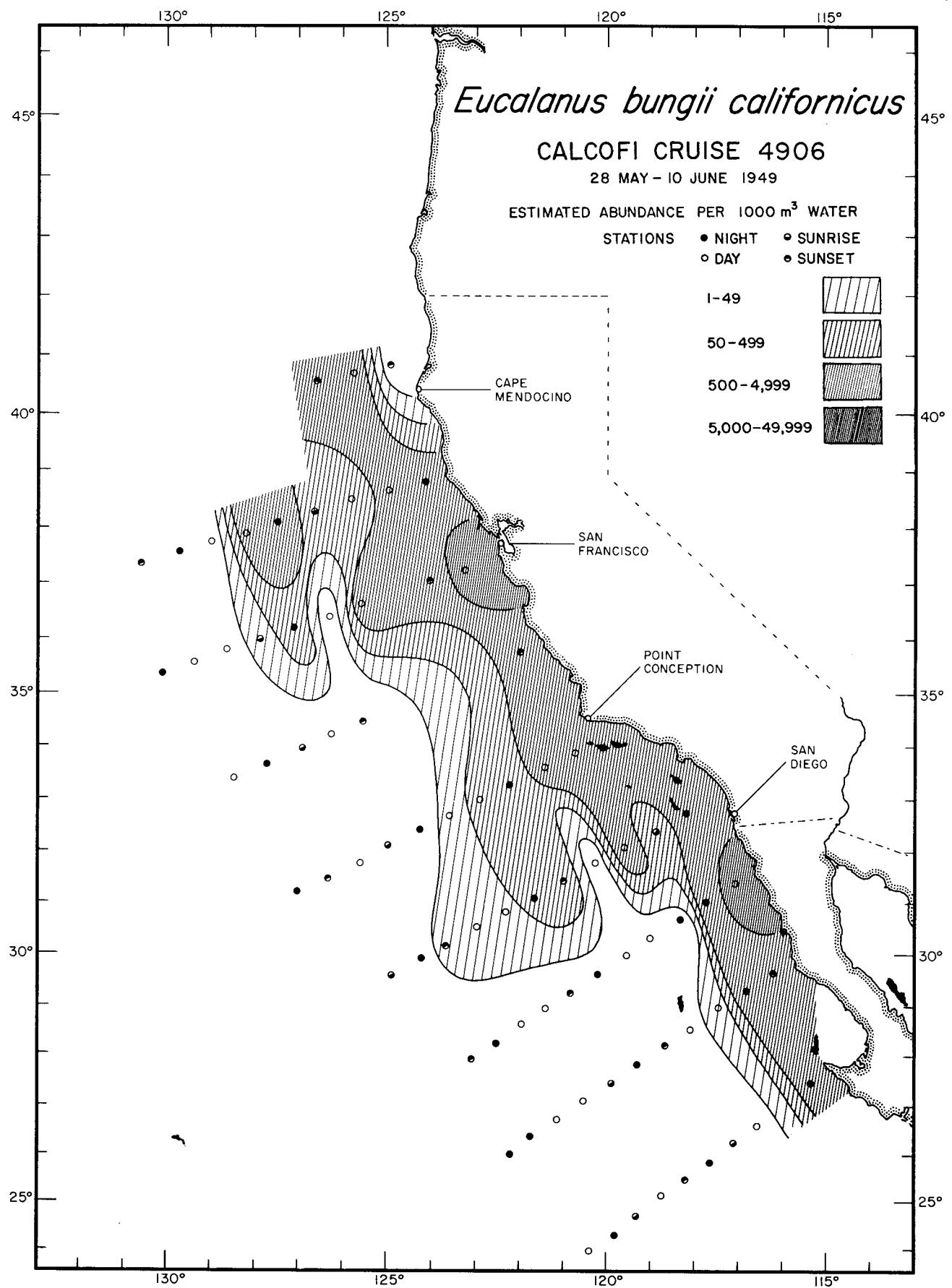
Calanoida

*Eucalanus bungii bungii*

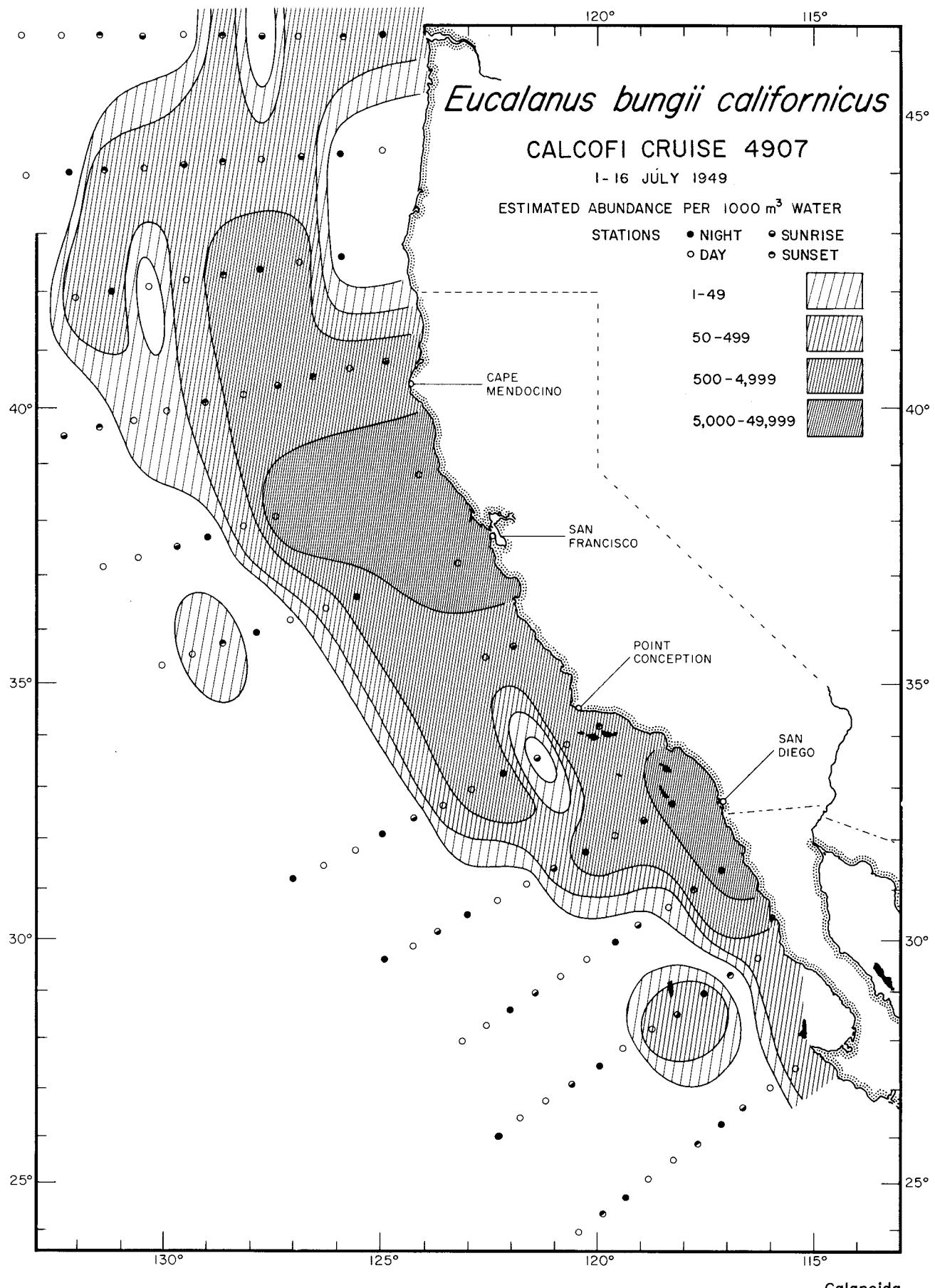
4908



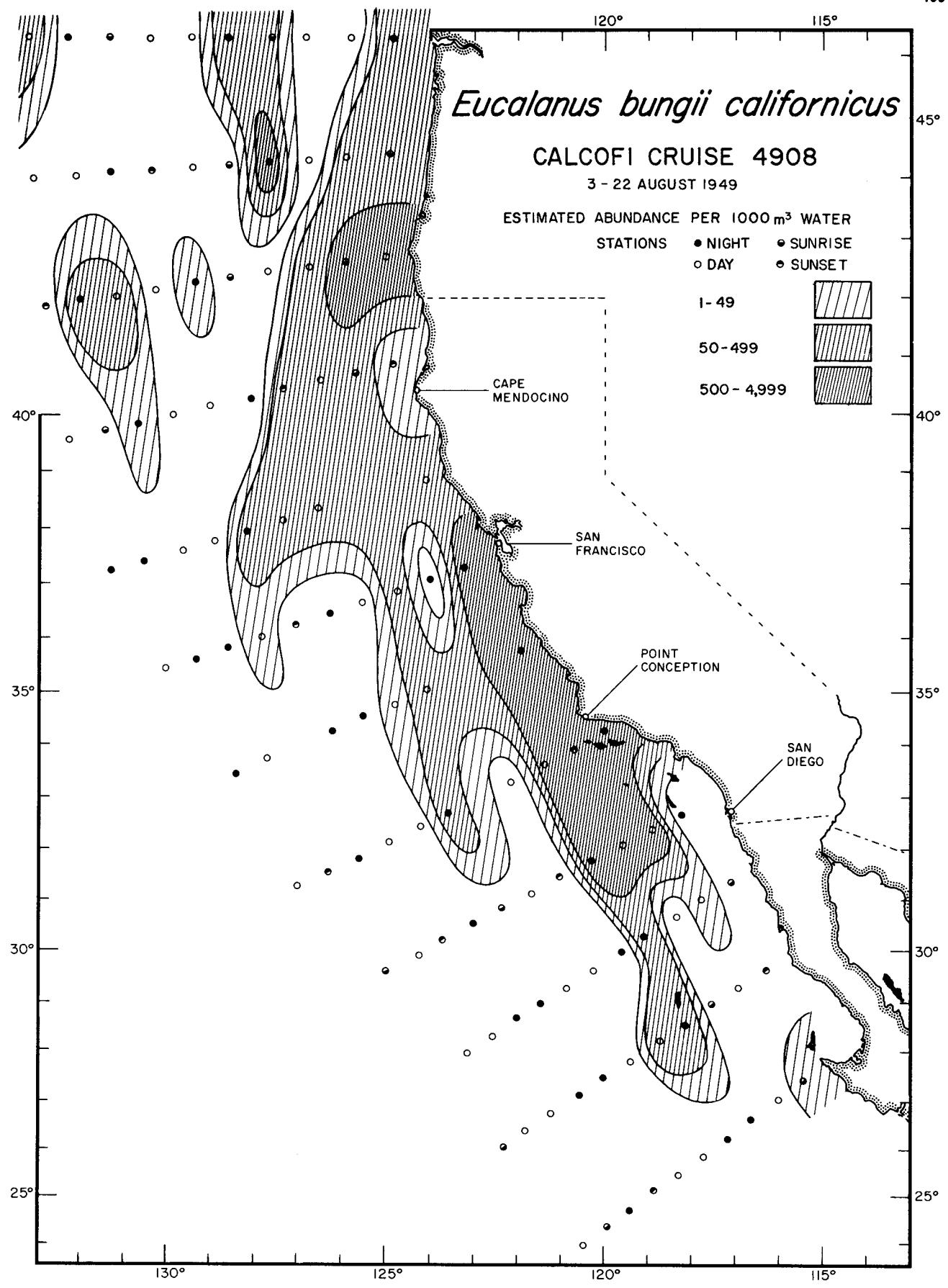
Calanoida  
*Eucalanus bungii californicus*  
4905



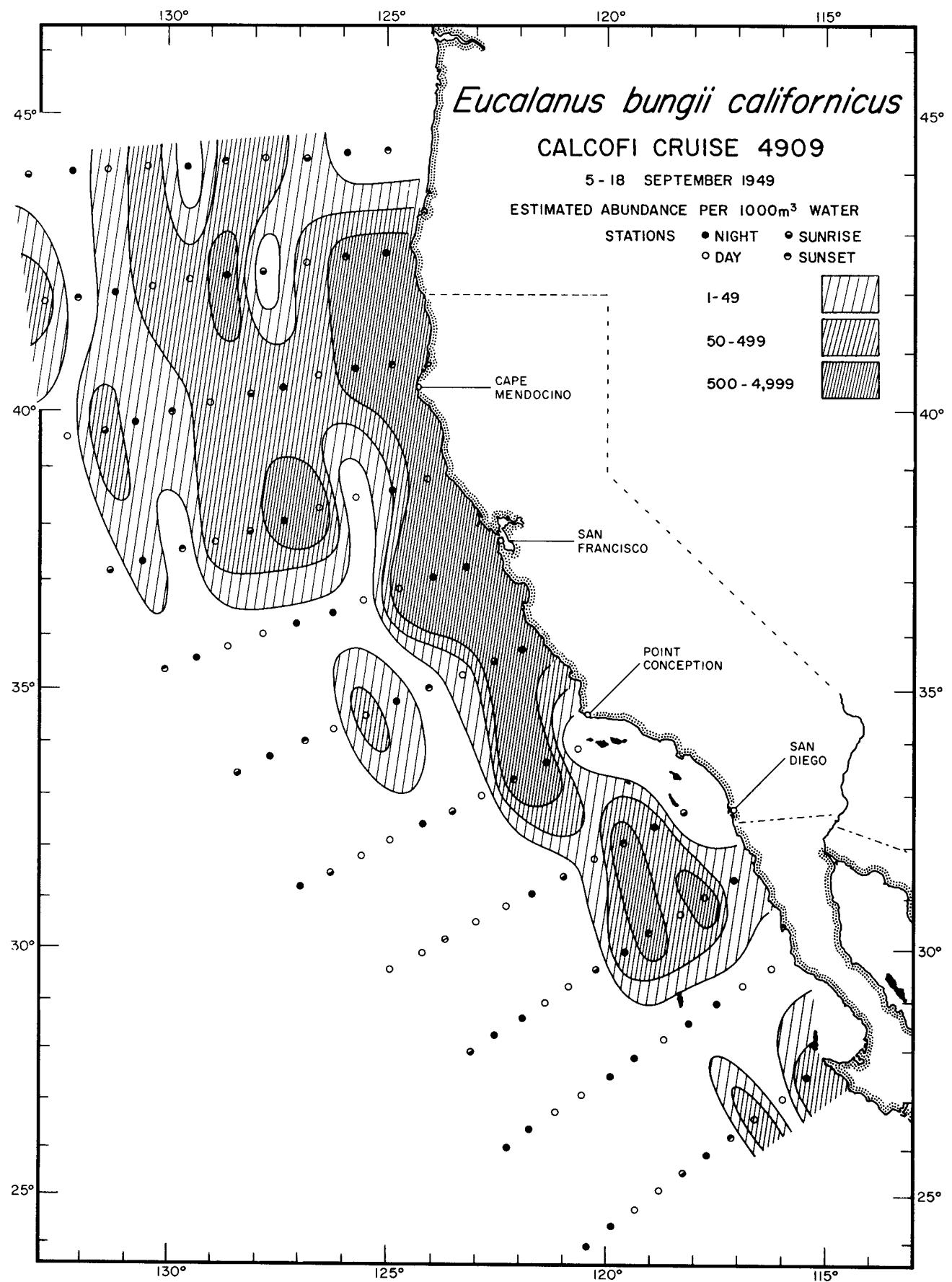
Calanoida  
*Eucalanus bungii californicus*  
4906

*Eucalanus bungii californicus*

4907



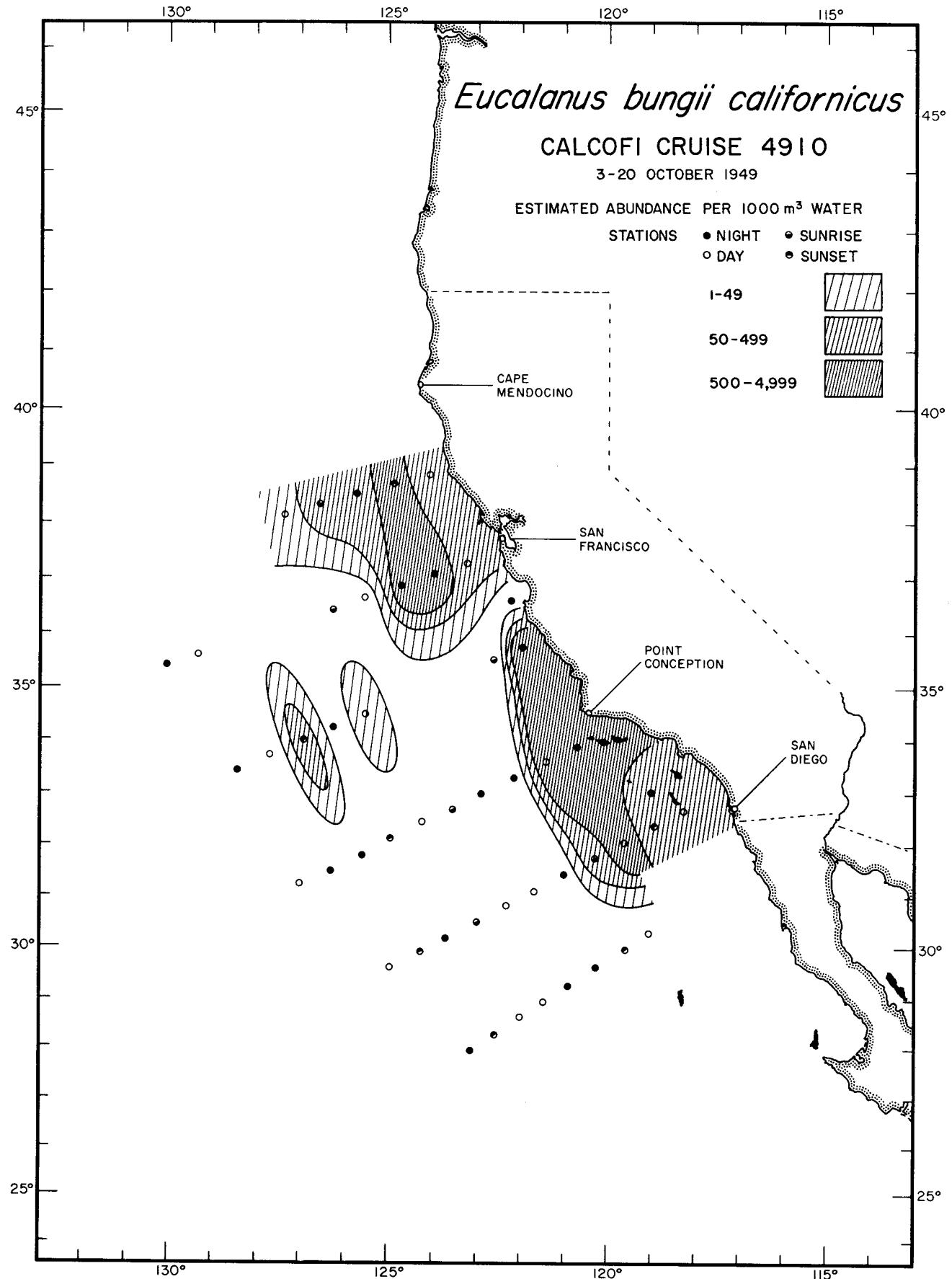
Calanoida  
*Eucalanus bungii californicus*  
 4908



Calanoida

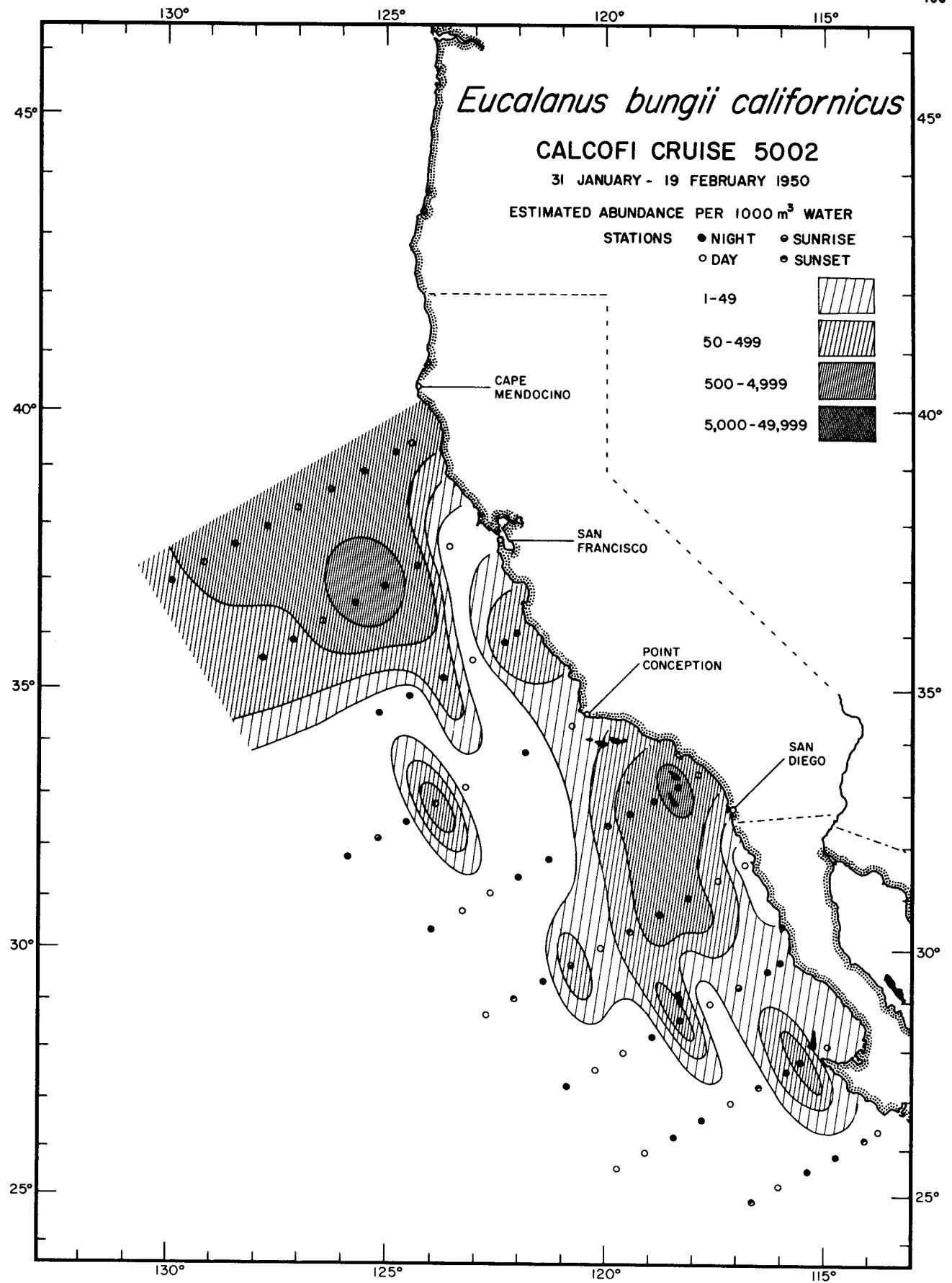
*Eucalanus bungii californicus*

4909

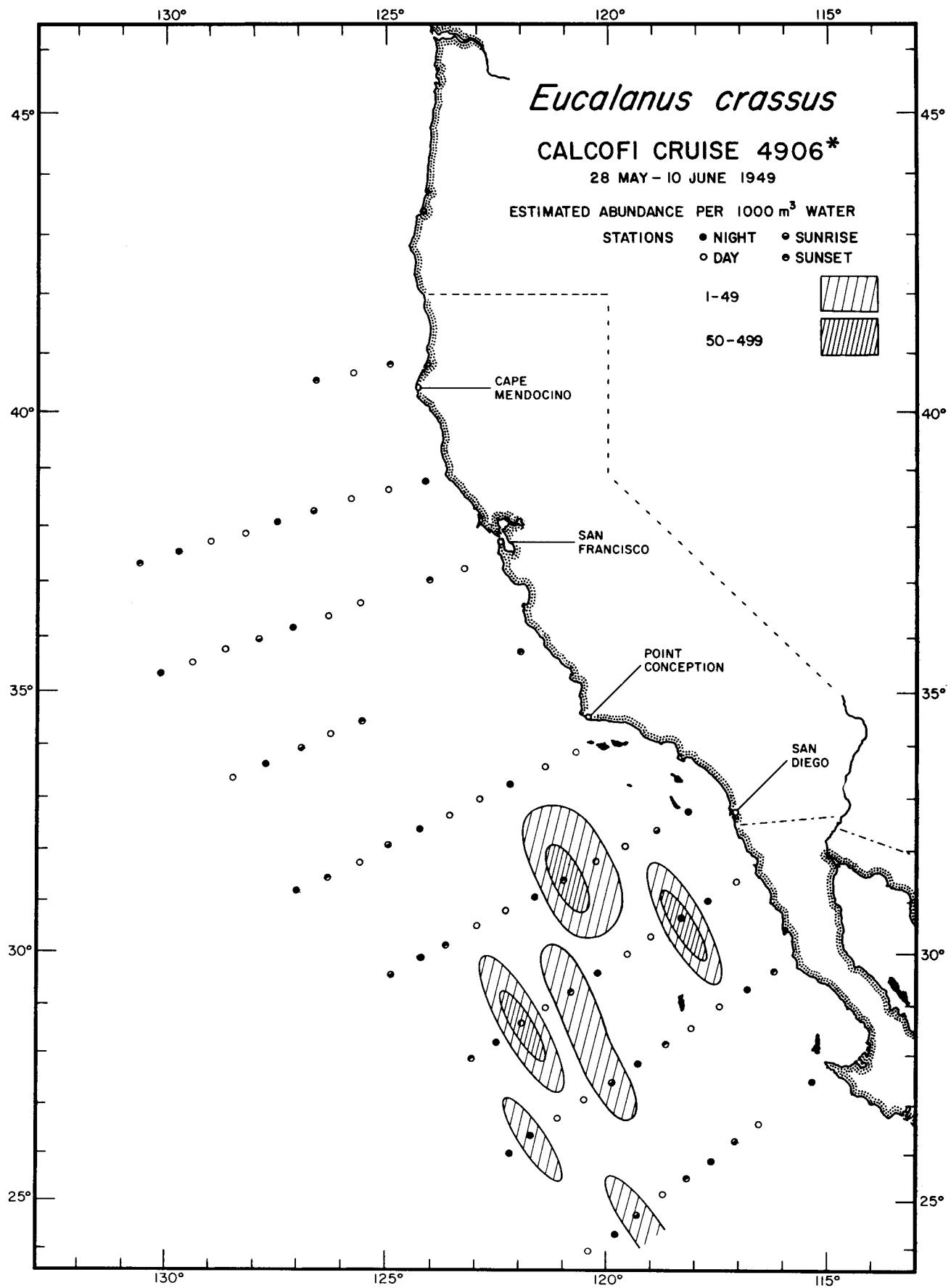


Calanoida  
*Eucalanus bungii californicus*

4910



Calanoida  
*Eucalanus bungii californicus*  
5002

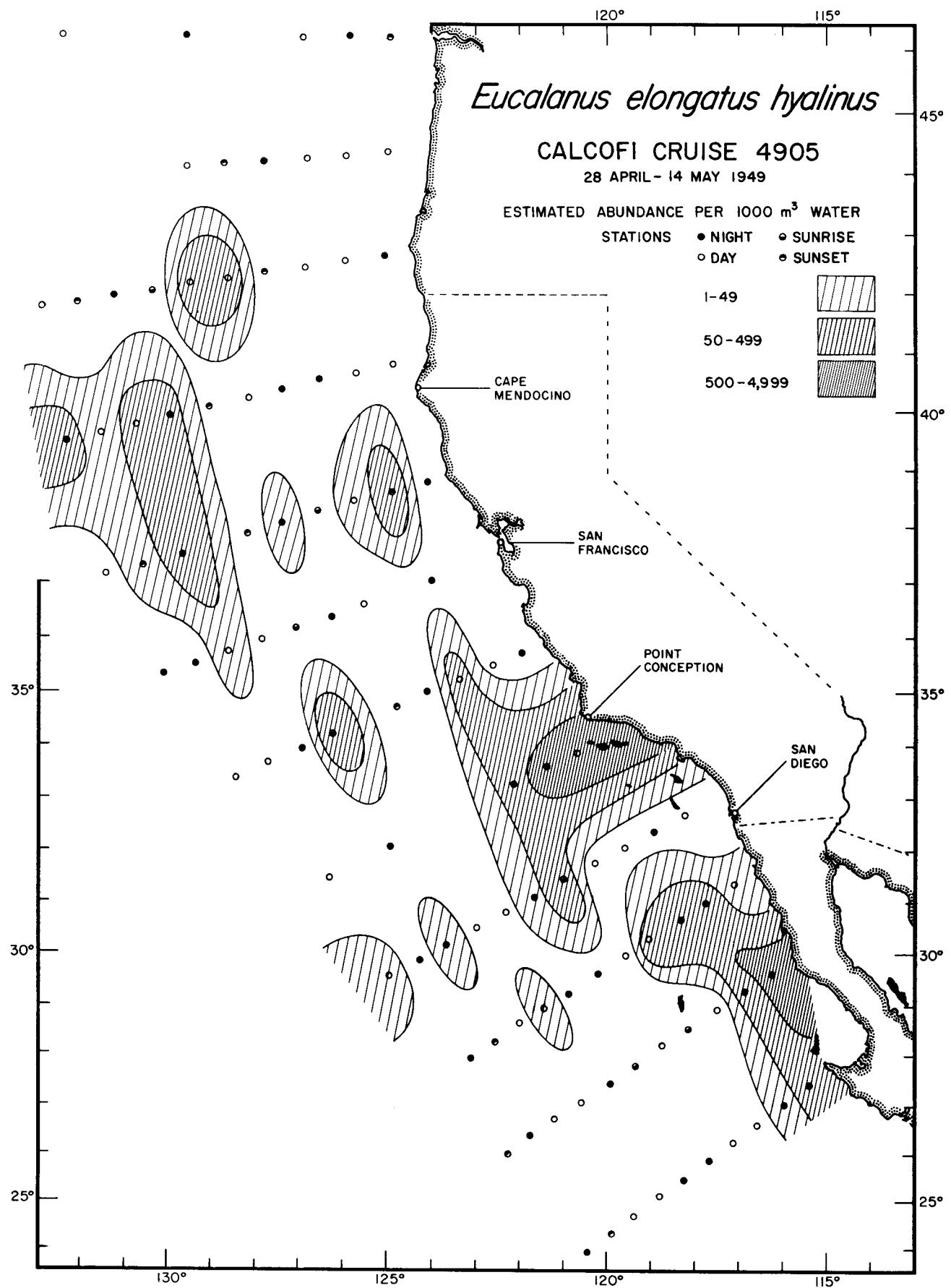


\* See Table 1 for cruises 4905, 7, 8, 9, 10, 5002

Calanoida

*Eucalanus crassus*

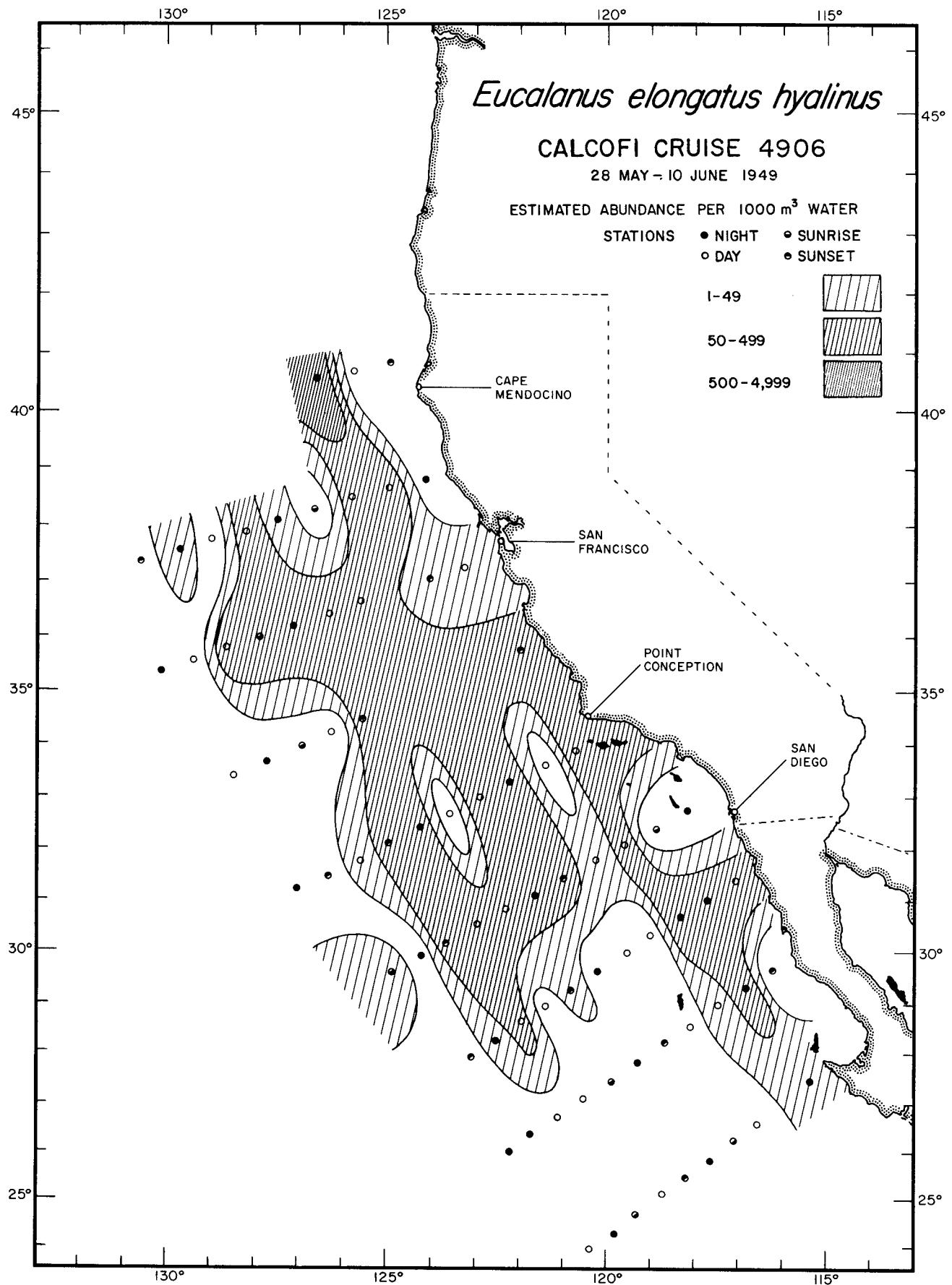
4906



Calanoida

*Eucalanus elongatus hyalinus*

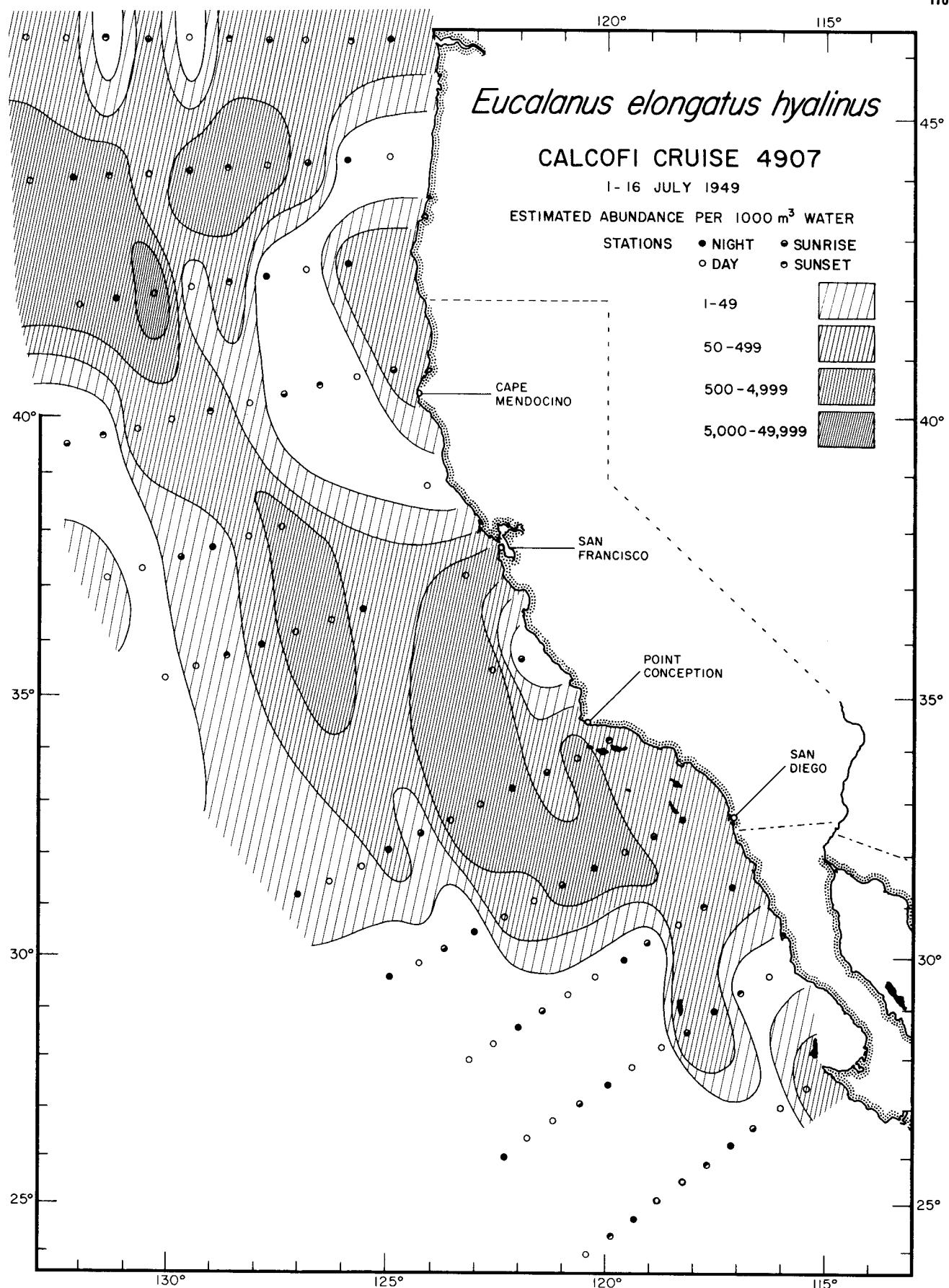
4905



Calanoida

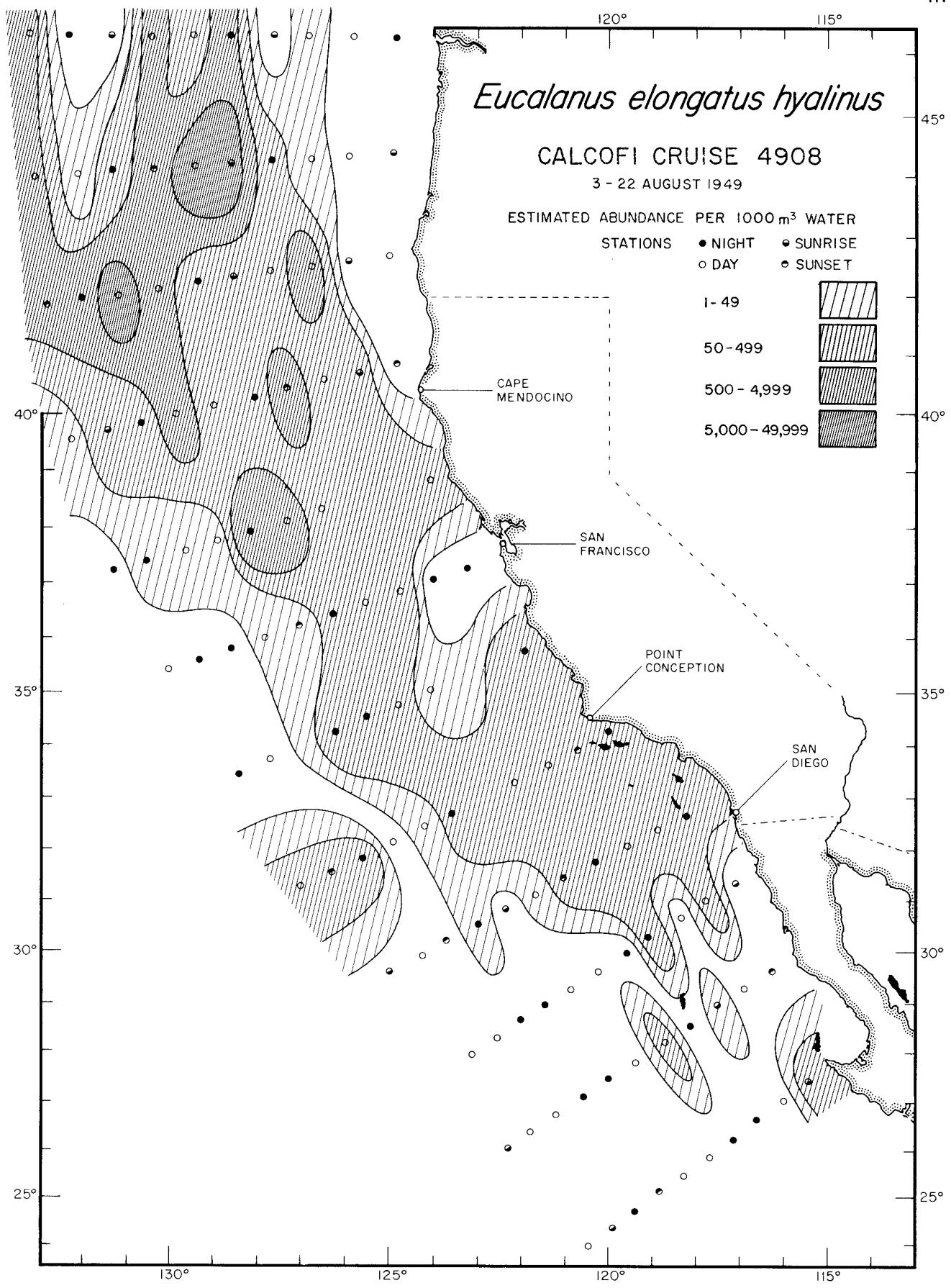
*Eucalanus elongatus hyalinus*

4906



*Eucalanus elongatus hyalinus*

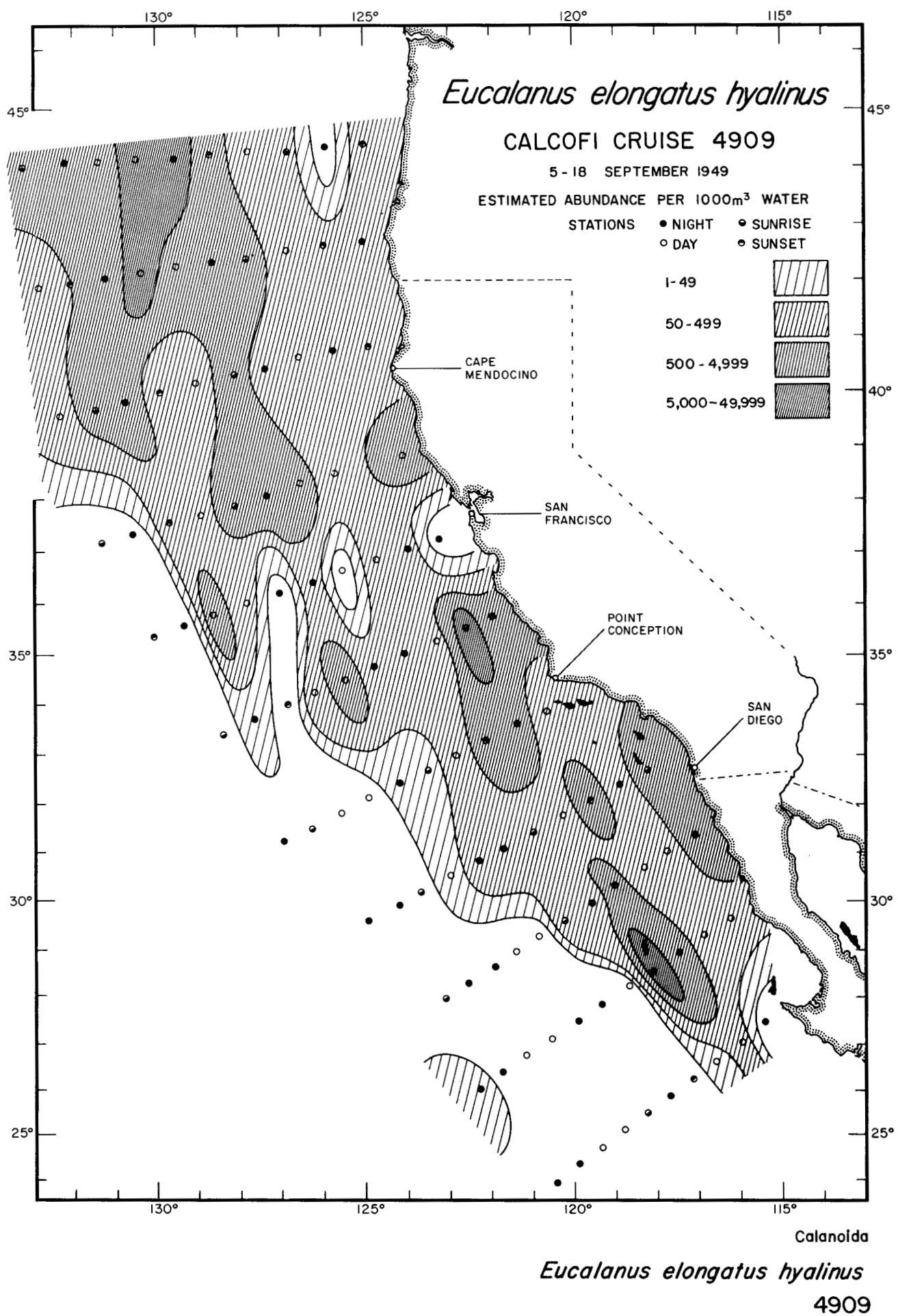
4907

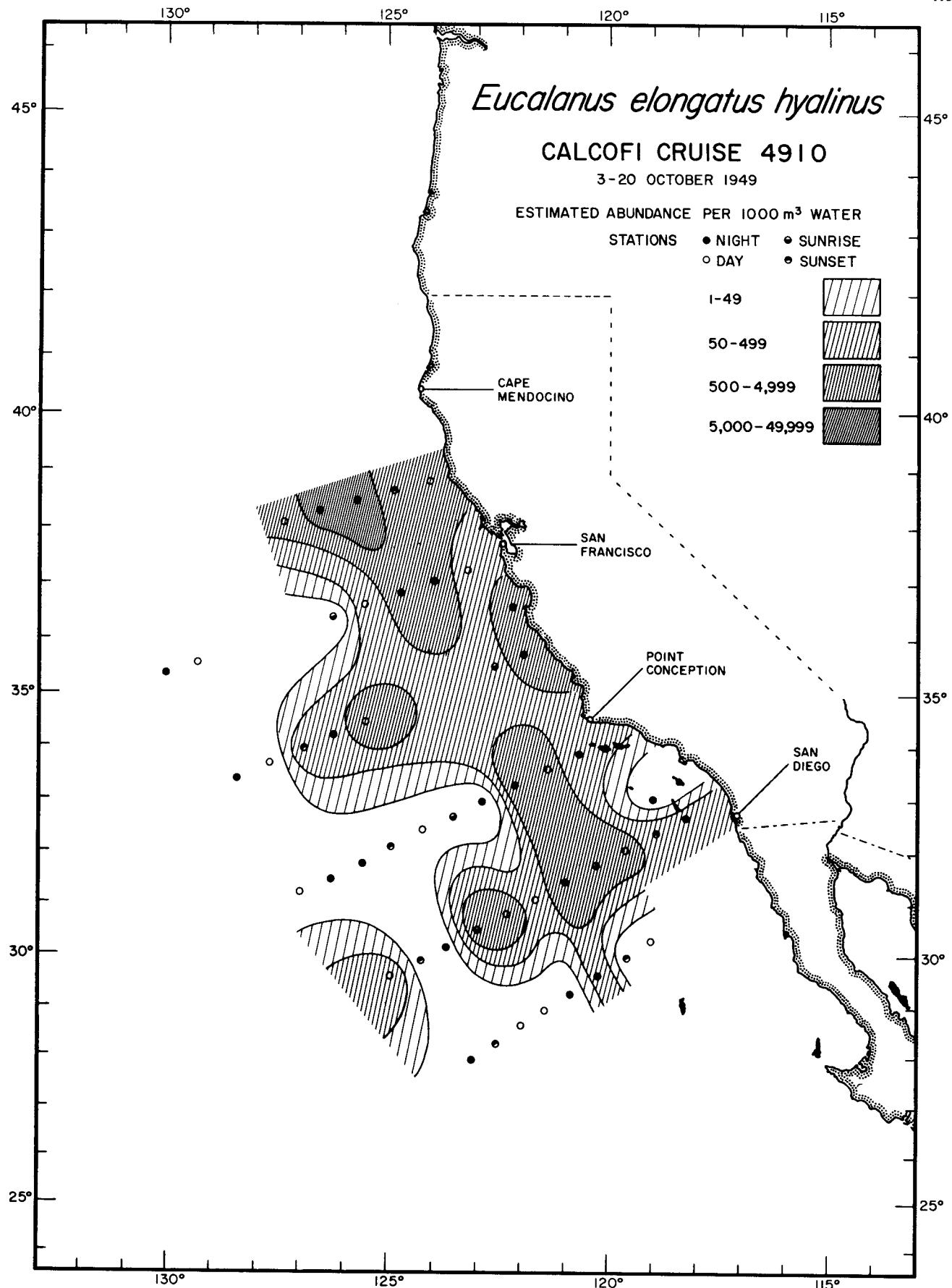


Calanoida

*Eucalanus elongatus hyalinus*

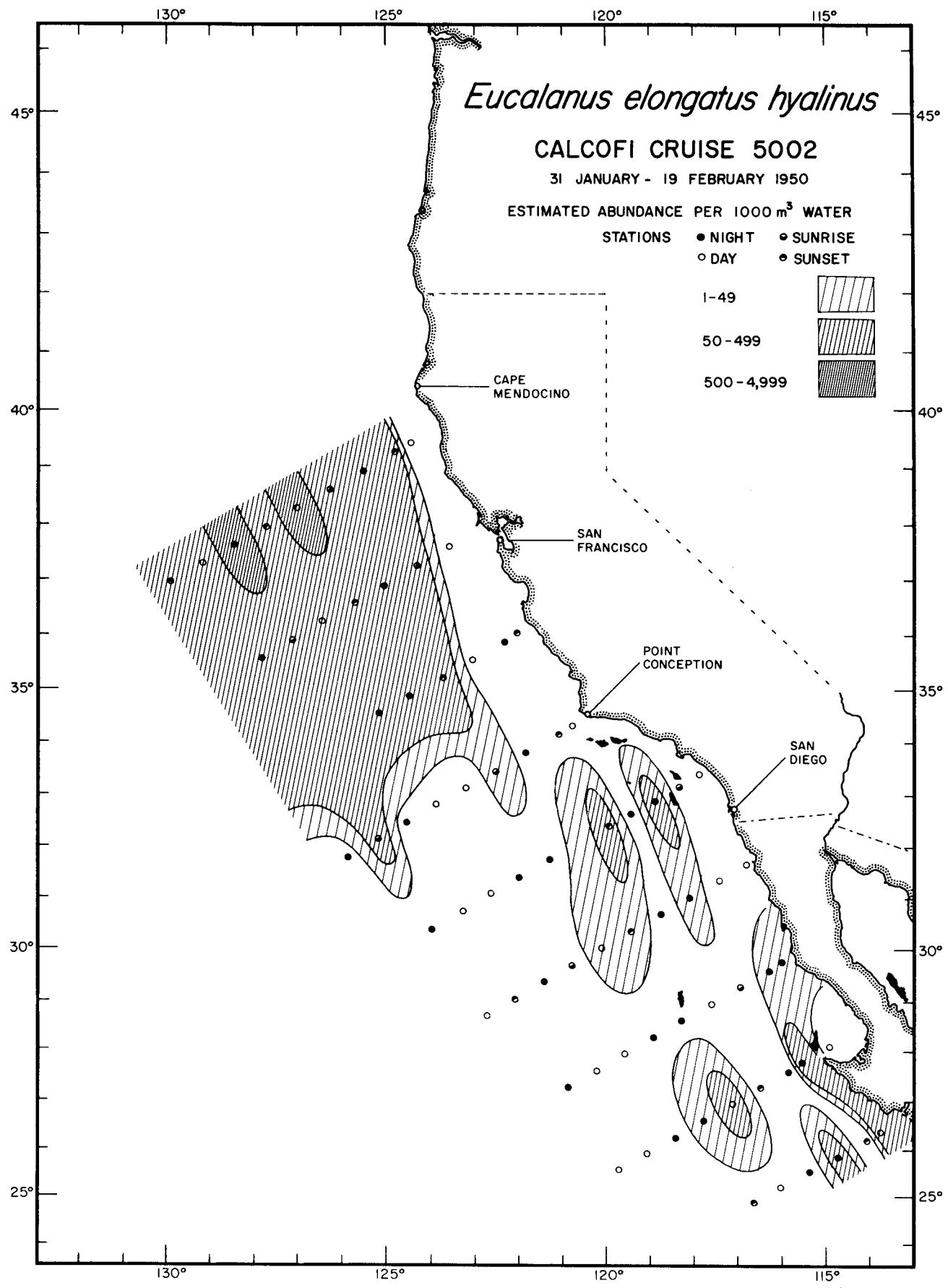
4908





Calanoida  
*Eucalanus elongatus hyalinus*

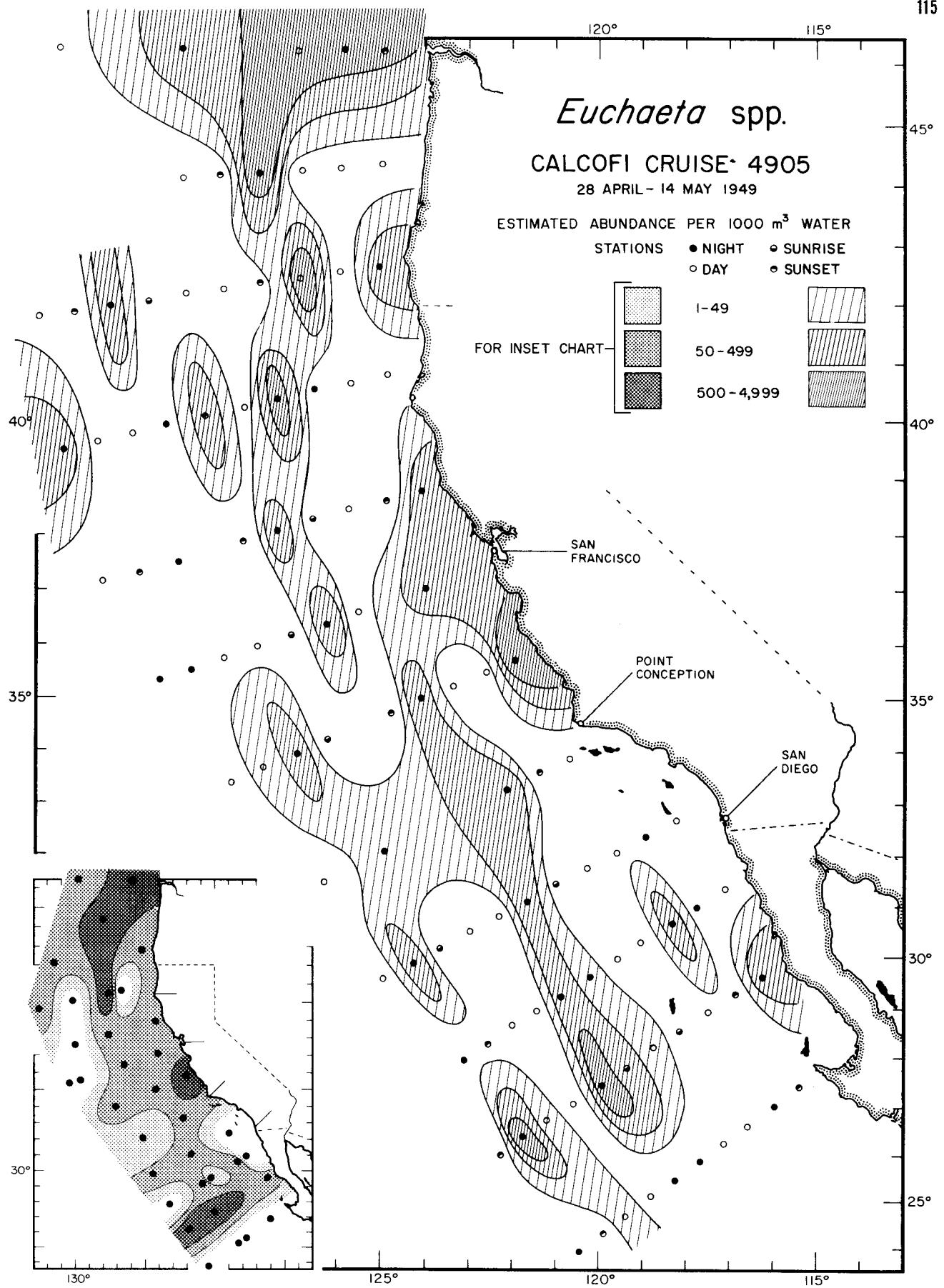
4910



Calanoida

*Eucalanus elongatus hyalinus*

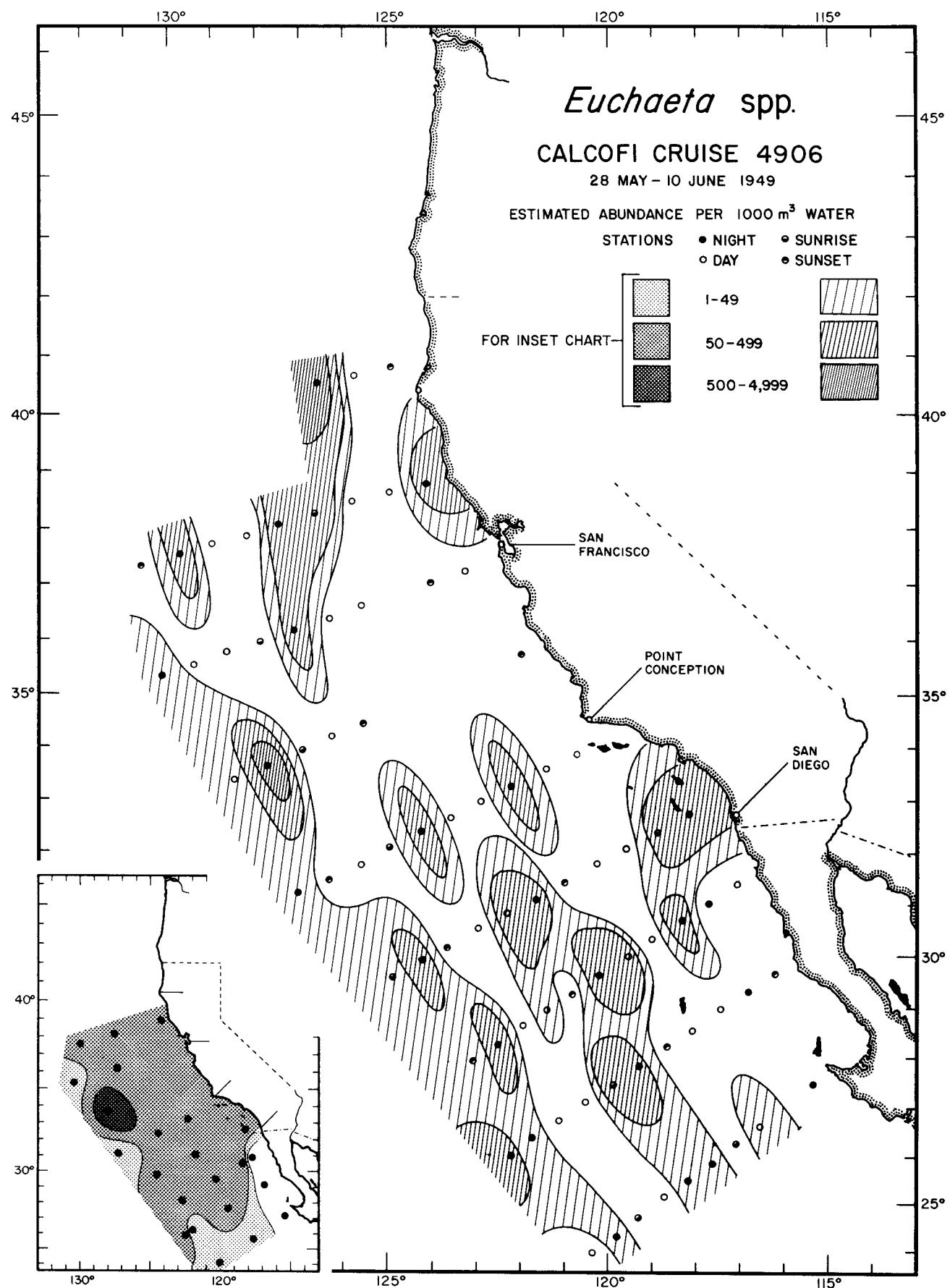
5002



Calanoida

*Euchaeta* spp.

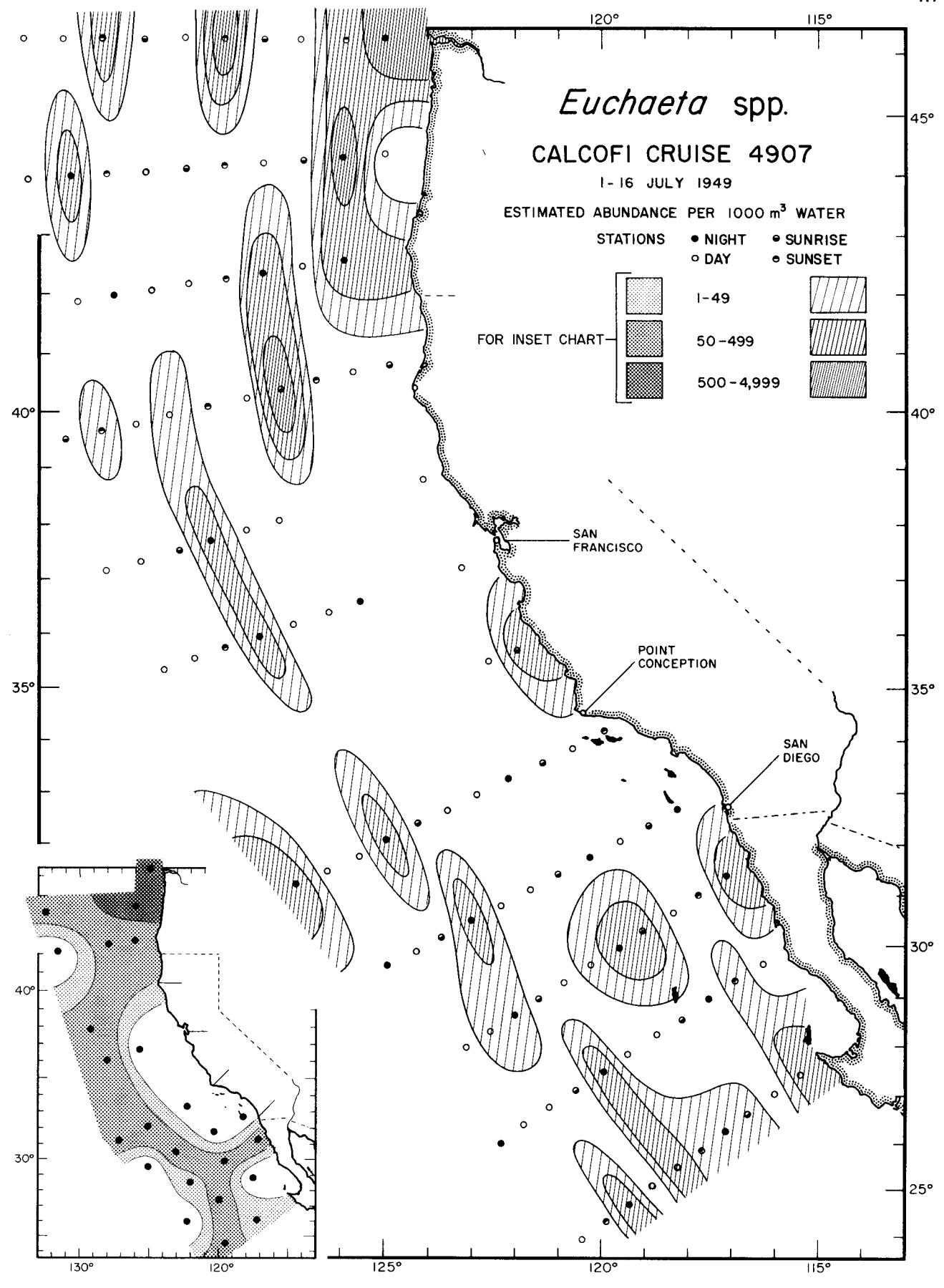
4905



Calanoida

*Euchaeta* spp.

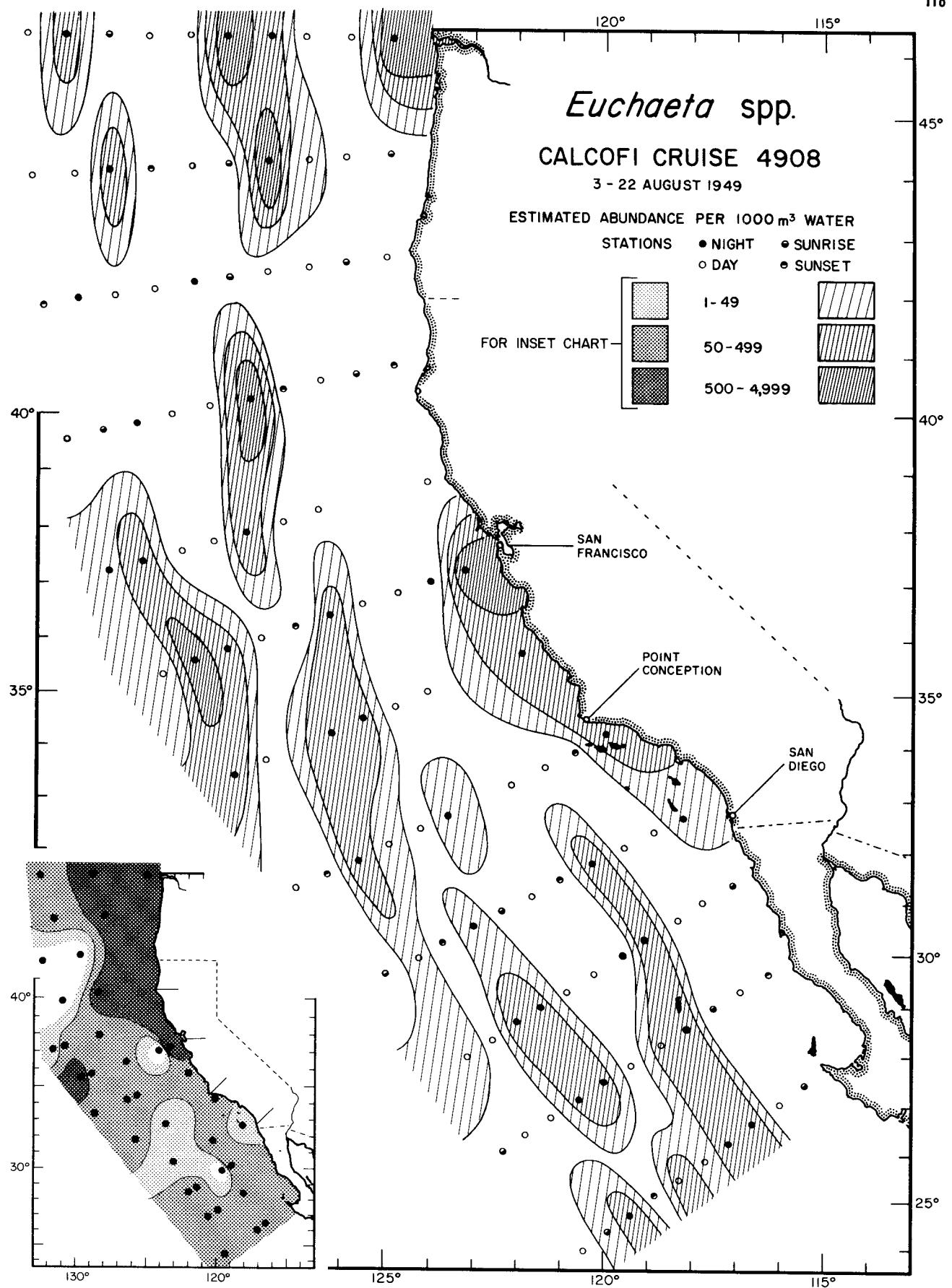
4906



Calanoida

*Euchaeta spp.*

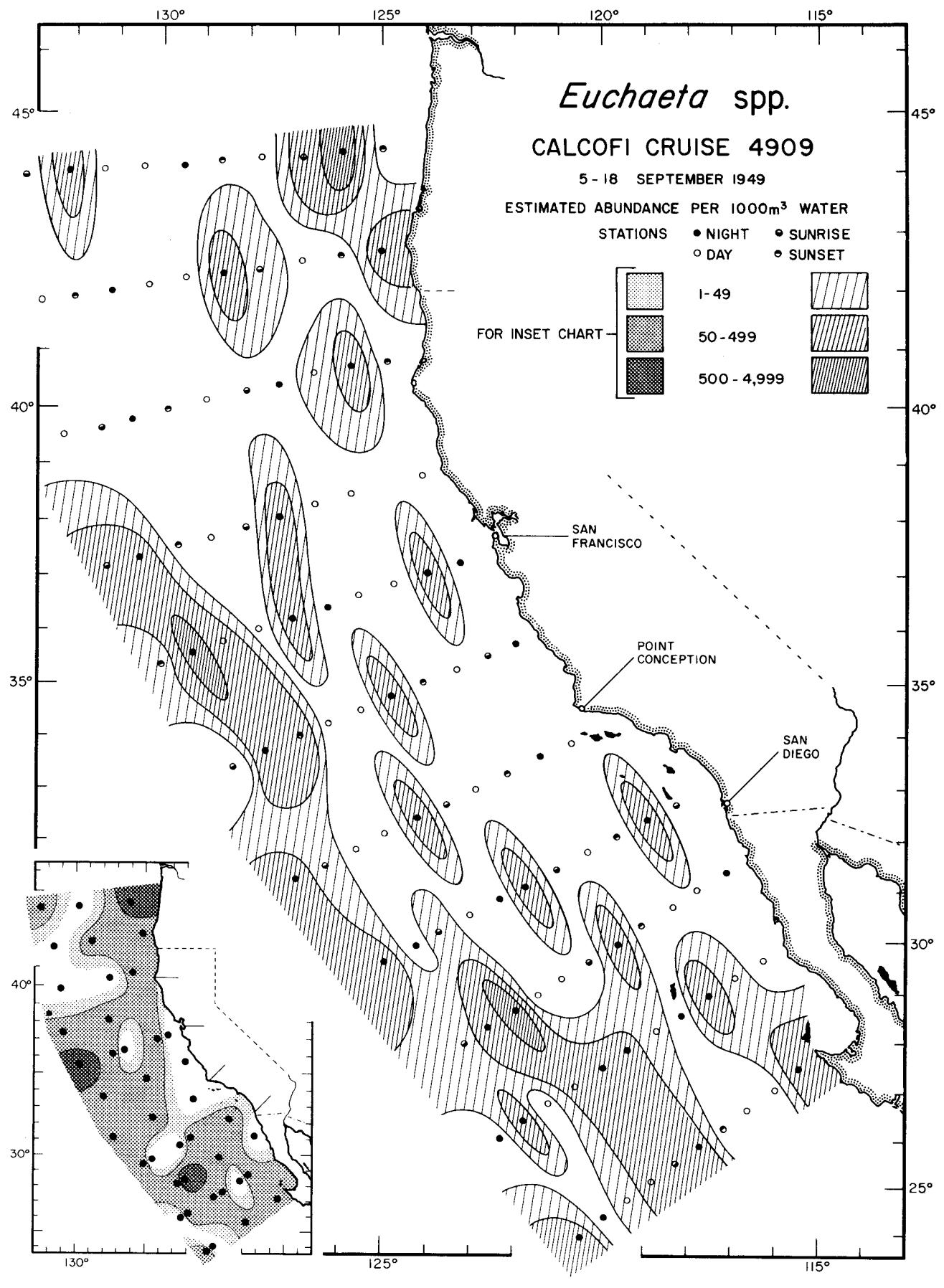
4907



Calanoida

*Euchaeta* spp.

4908

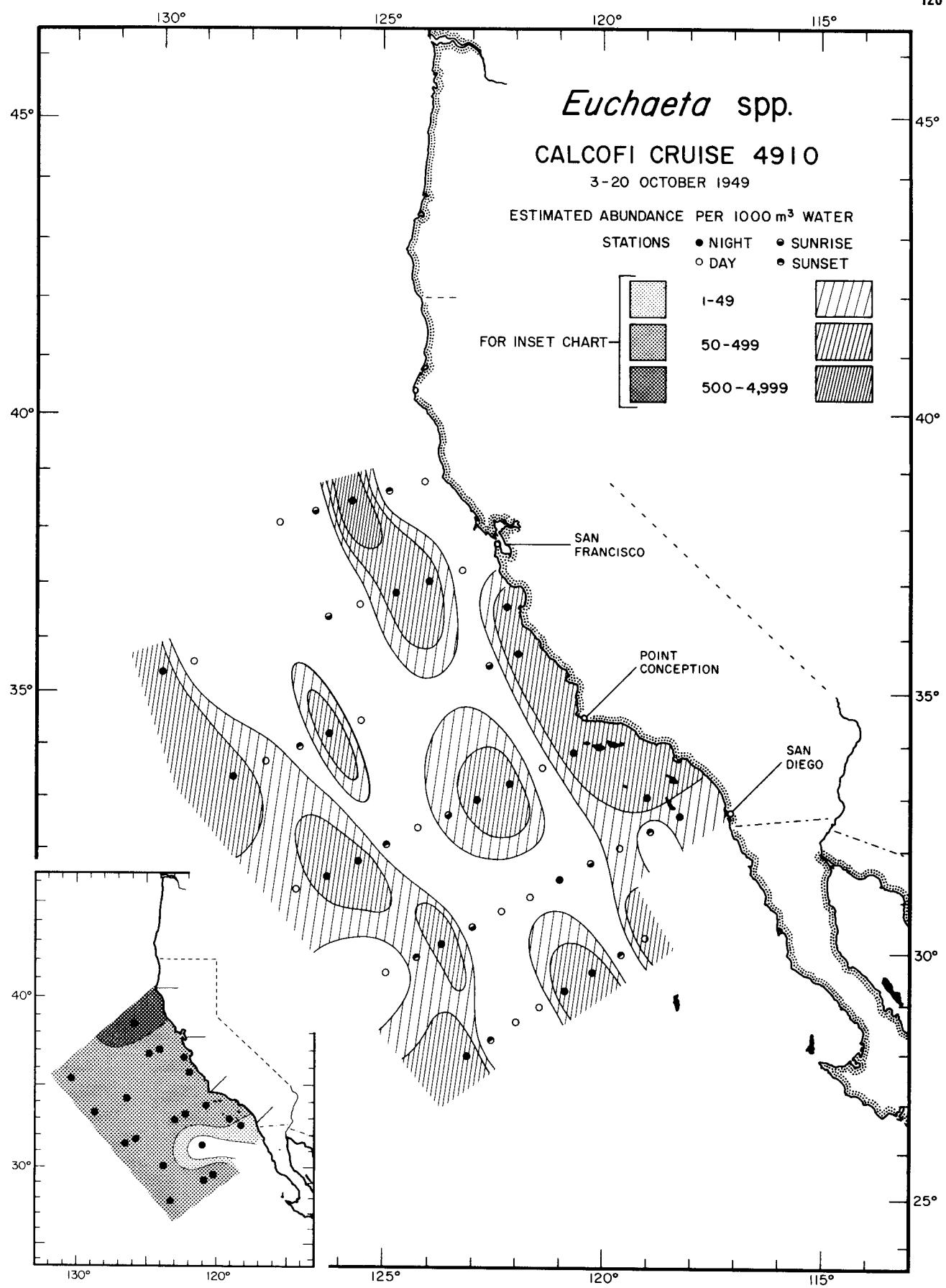


Calanoida

*Euchaeta* spp.

4909

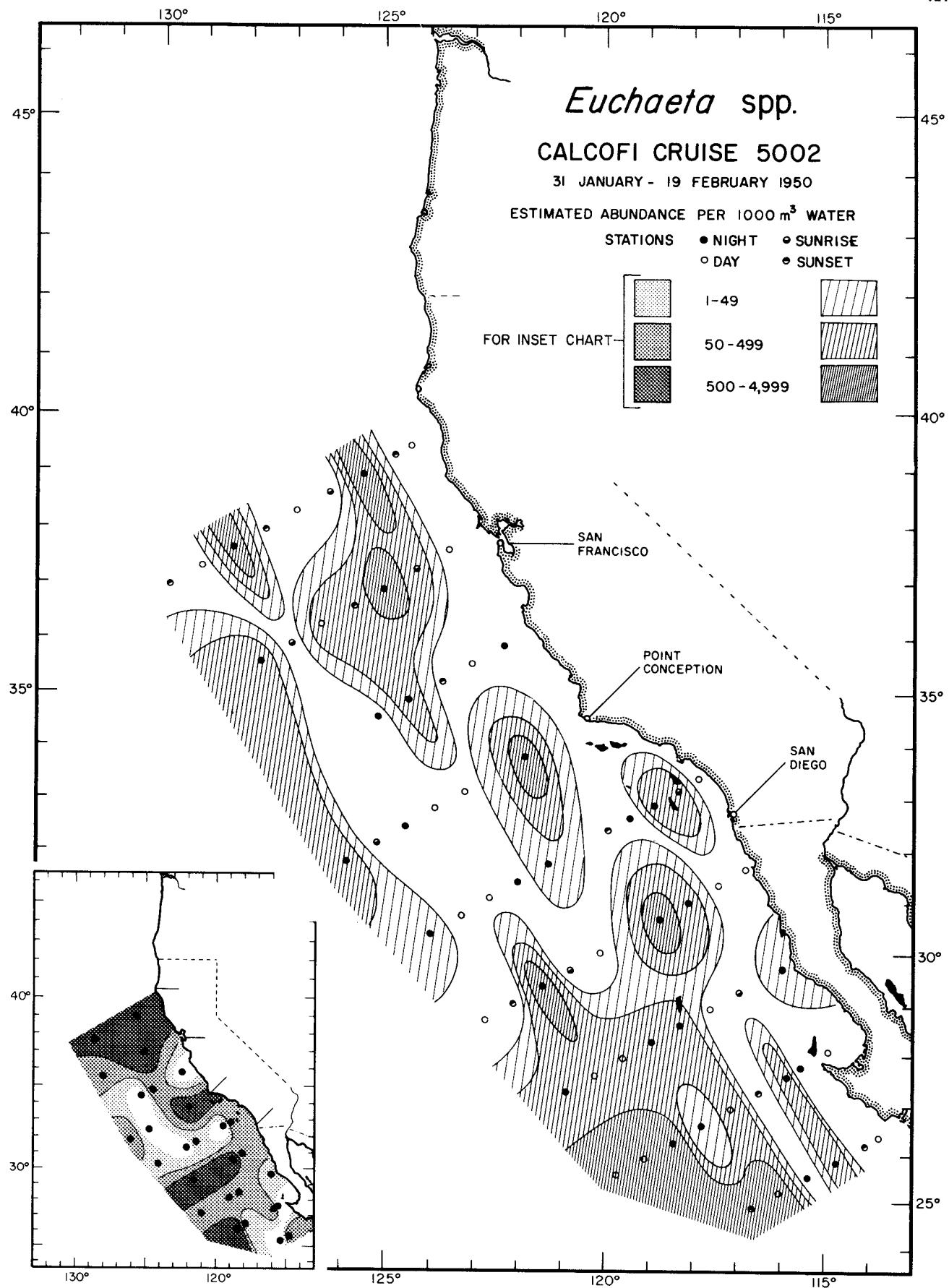
120



Calanoida

*Euchaeta* spp.

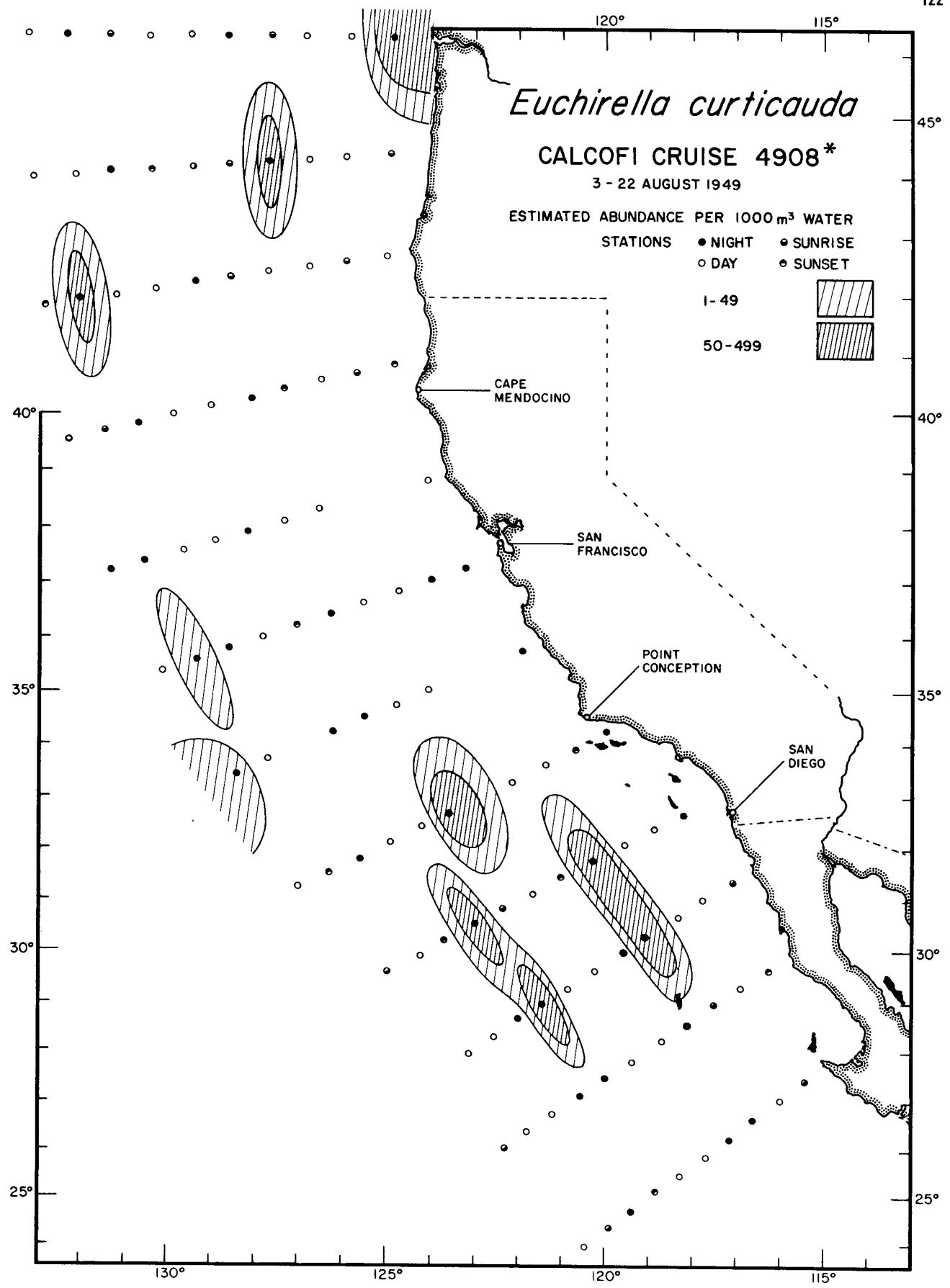
4910



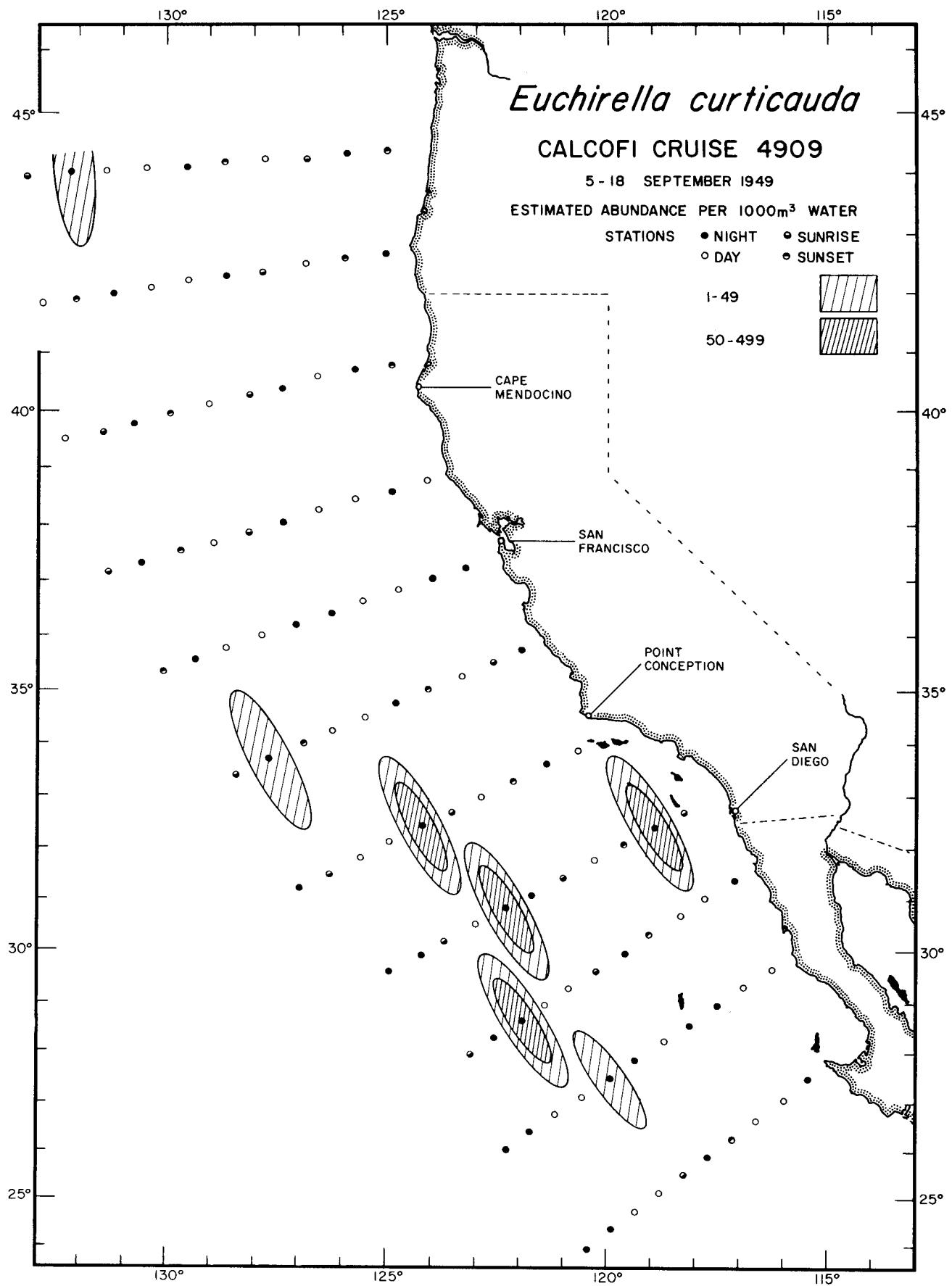
Calanoida

*Euchaeta* spp.

5002



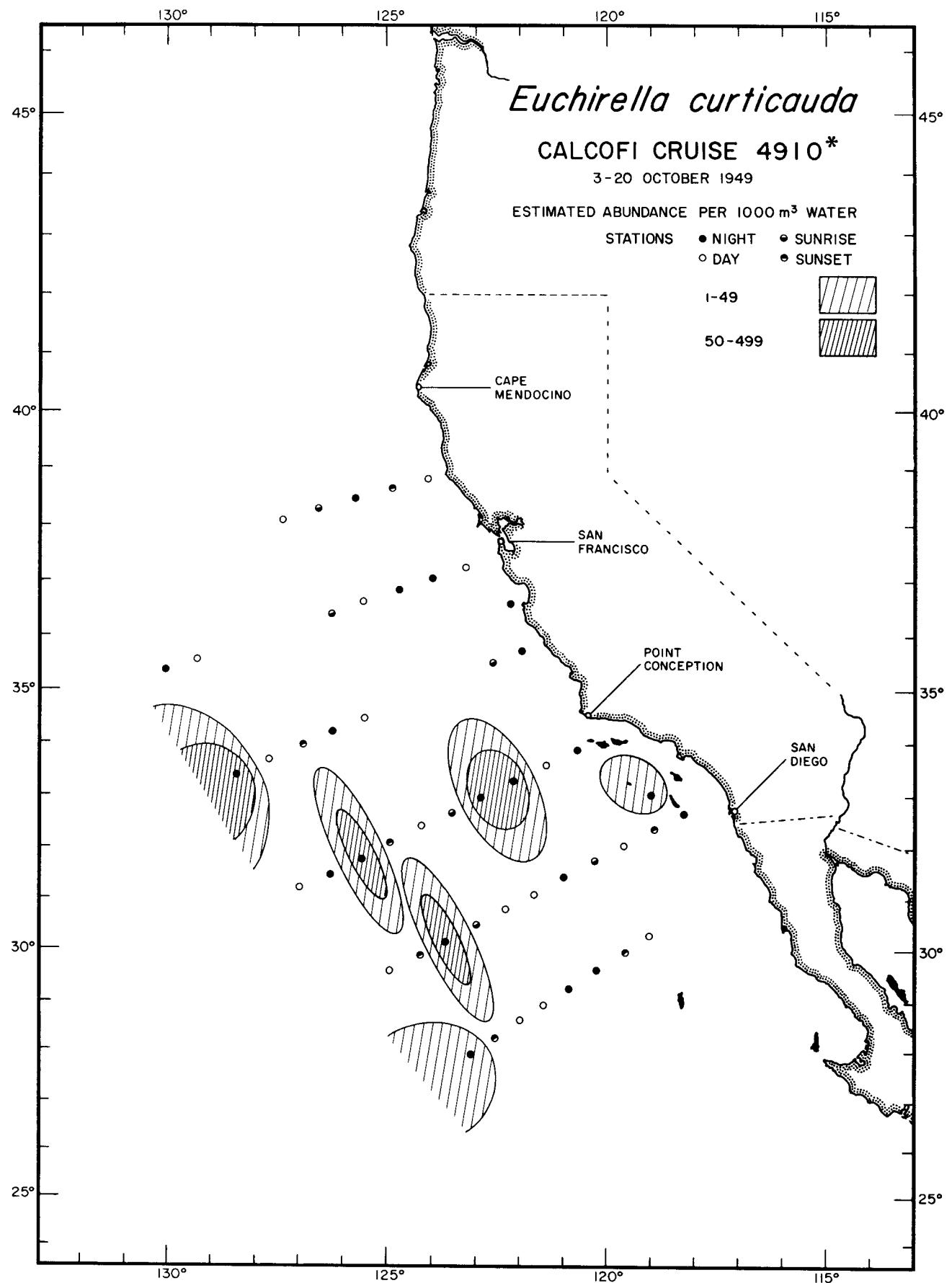
\* See Table 1 for cruises 4905, 6, 7



Calanoida

*Euchirella curticauda*

4909

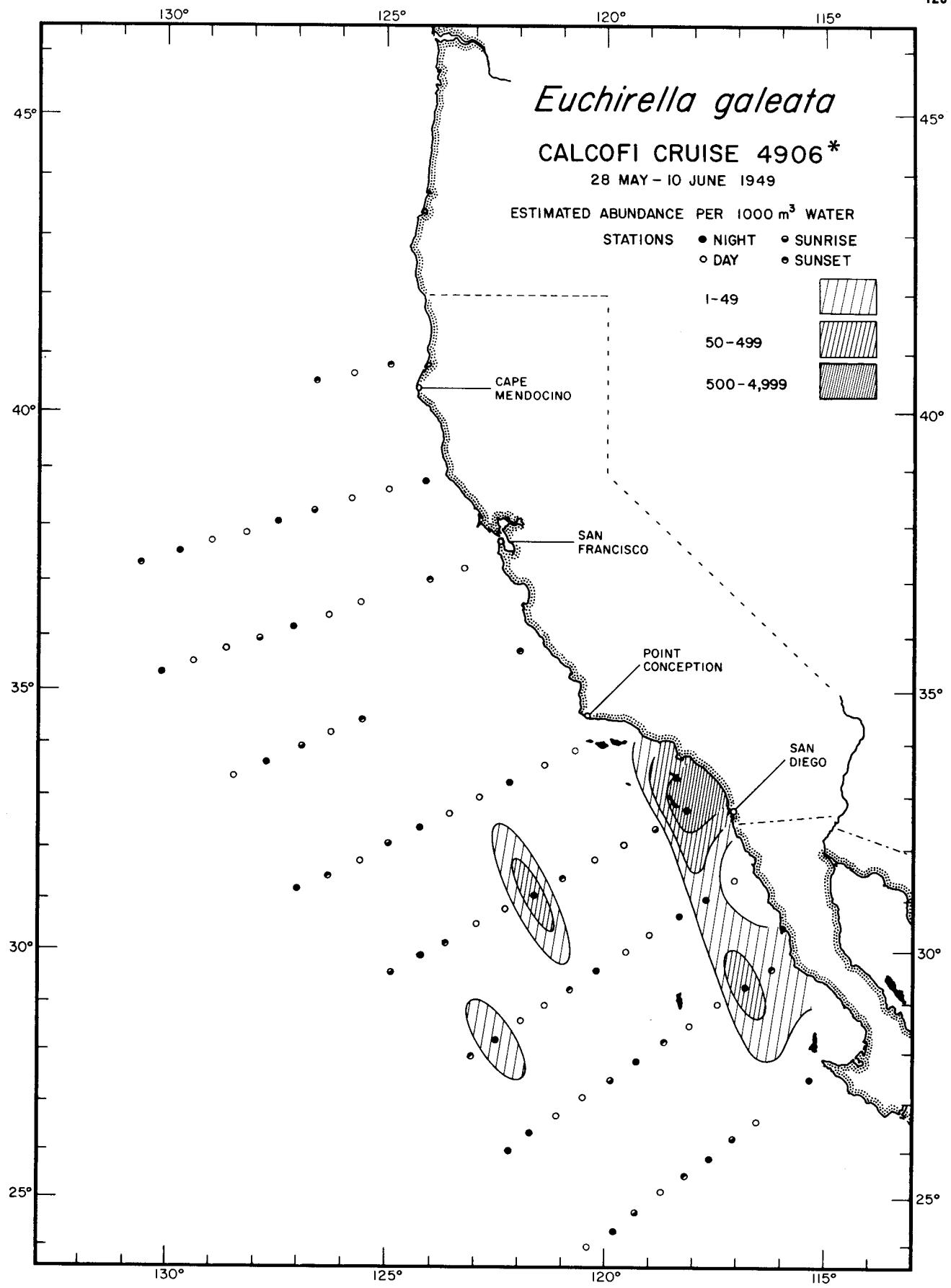


\* See Table 1 for cruise 5002

Calanoida

*Euchirella curticauda*

4910

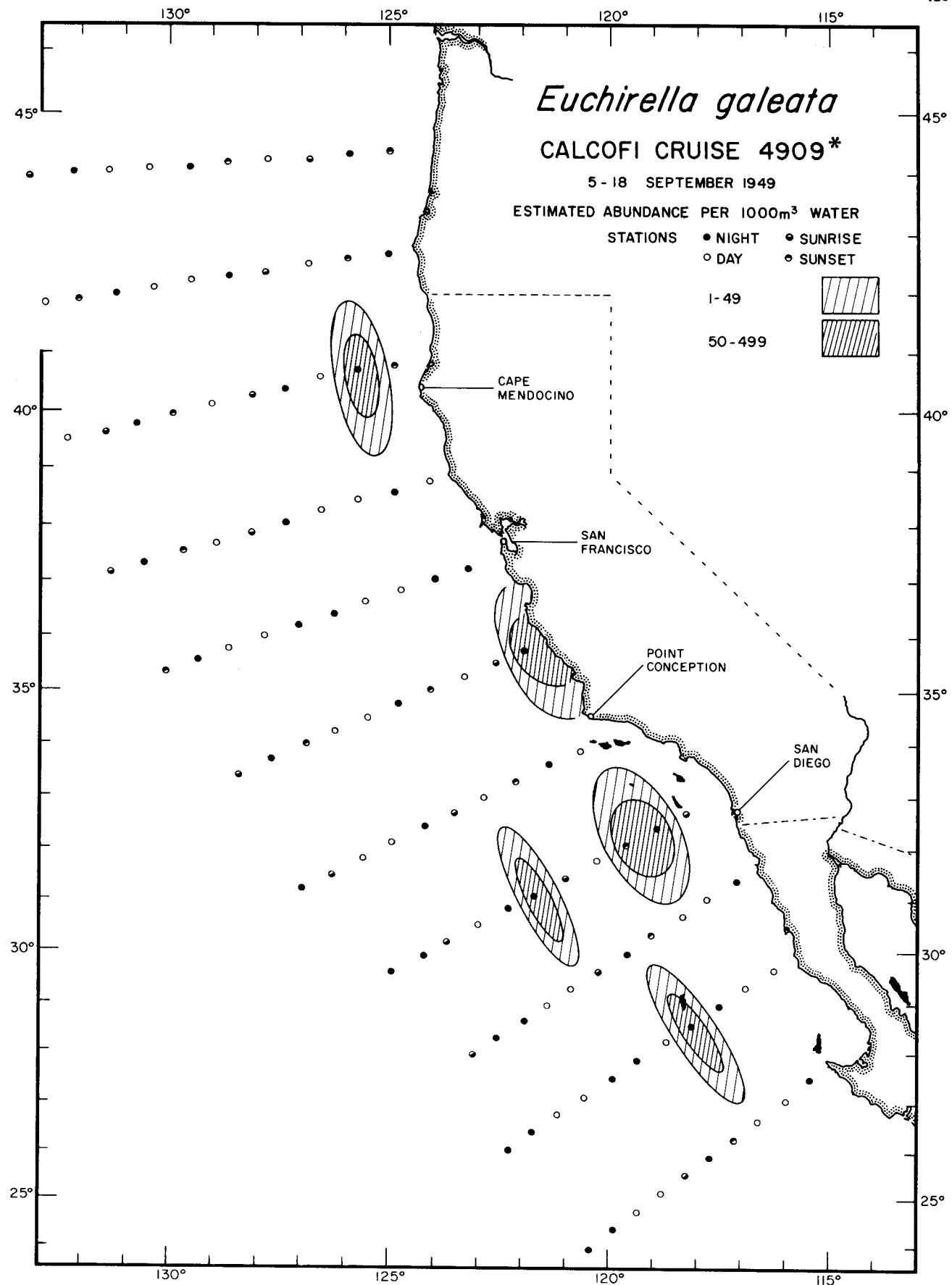


\* See Table 1 for cruise 4905

Calanoida

*Euchirella galeata*

4906

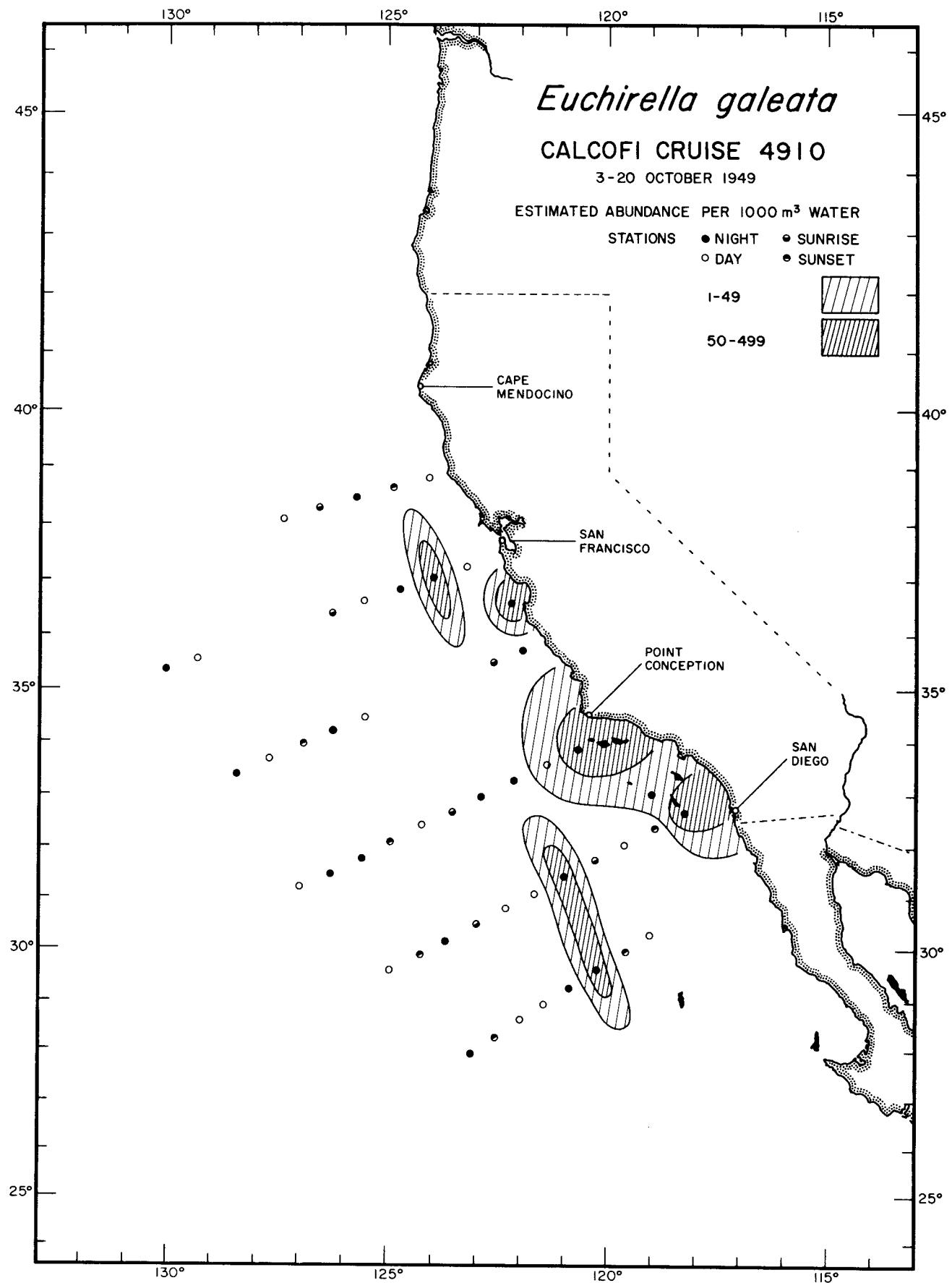


\* See Table 1 for cruises 4907, 8

Calanoida

*Euchirella galeata*

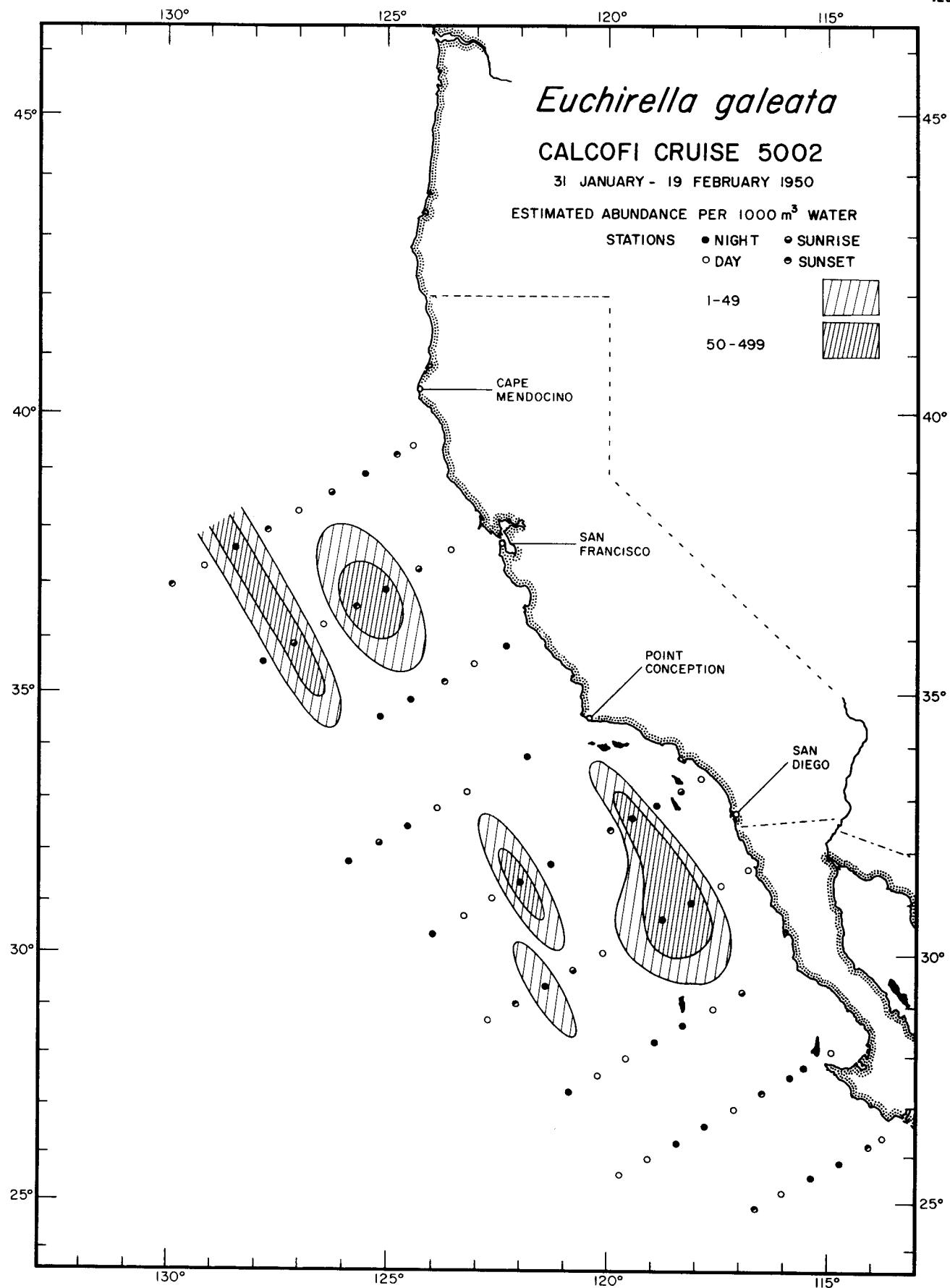
4909



Calanoida

*Euchirella galeata*

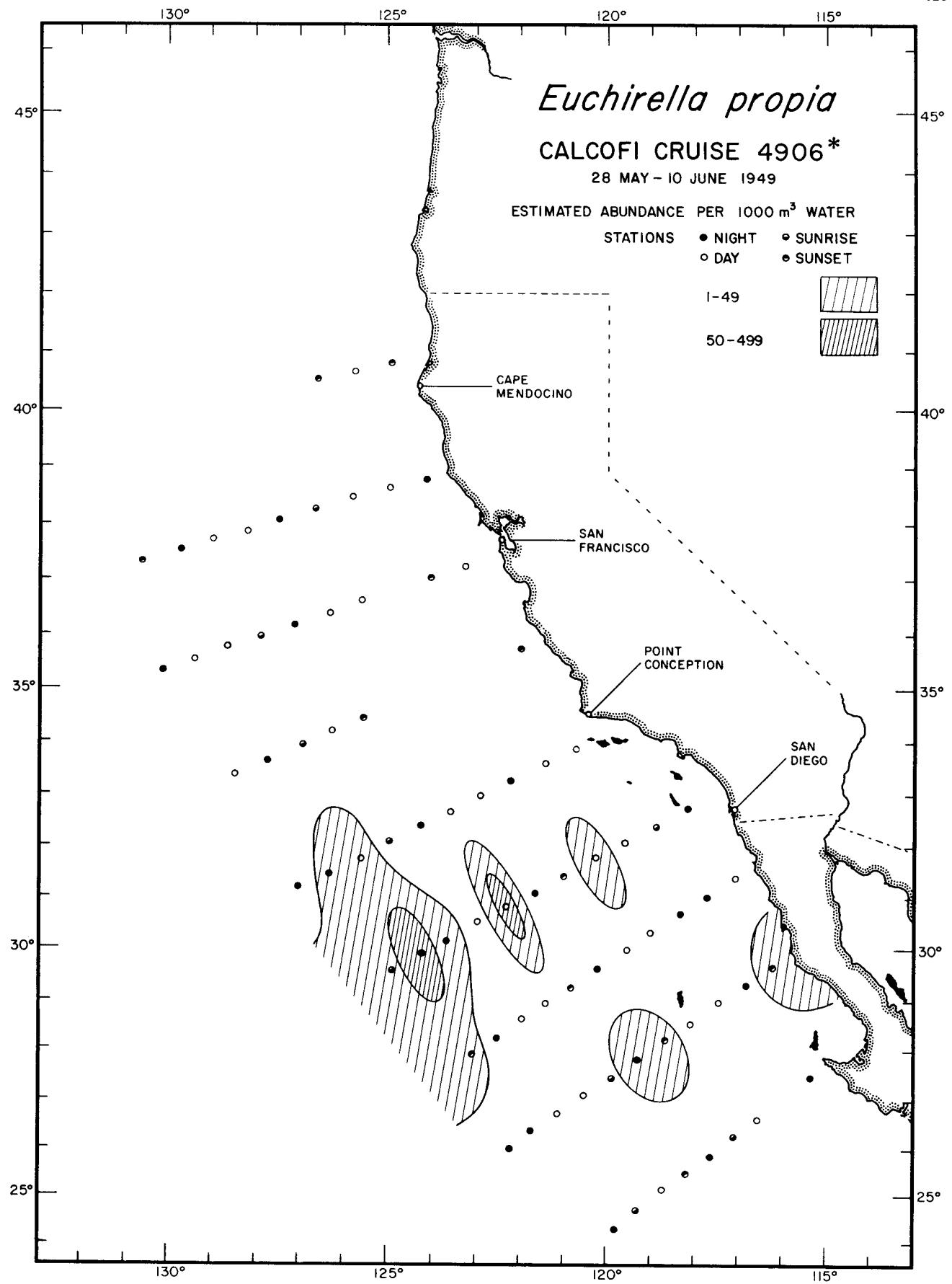
4910



Calanoida

*Euchirella galeata*

5002

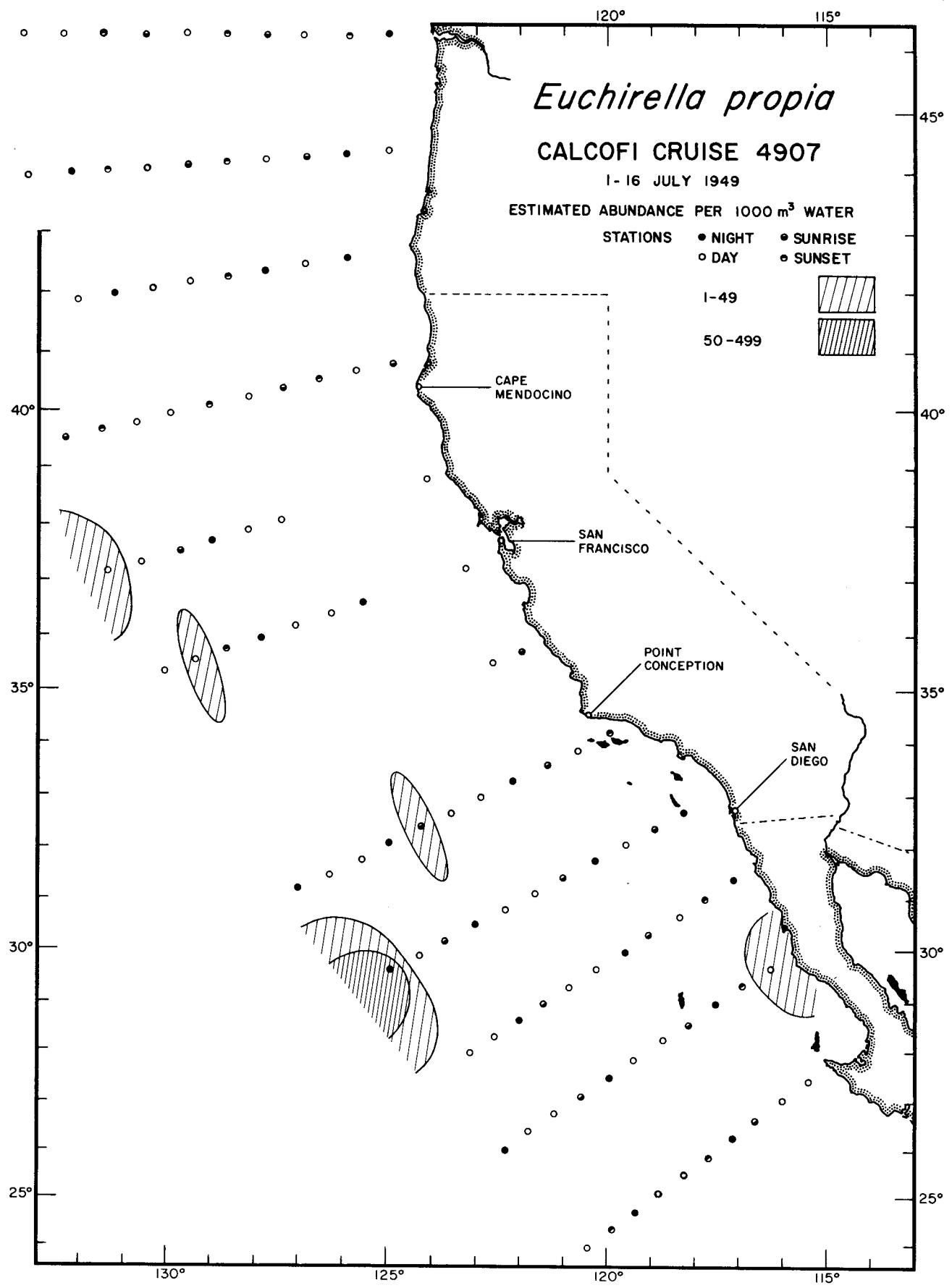


\* See Table 1 for cruise 4905

Calanoida

*Euchirella propria*

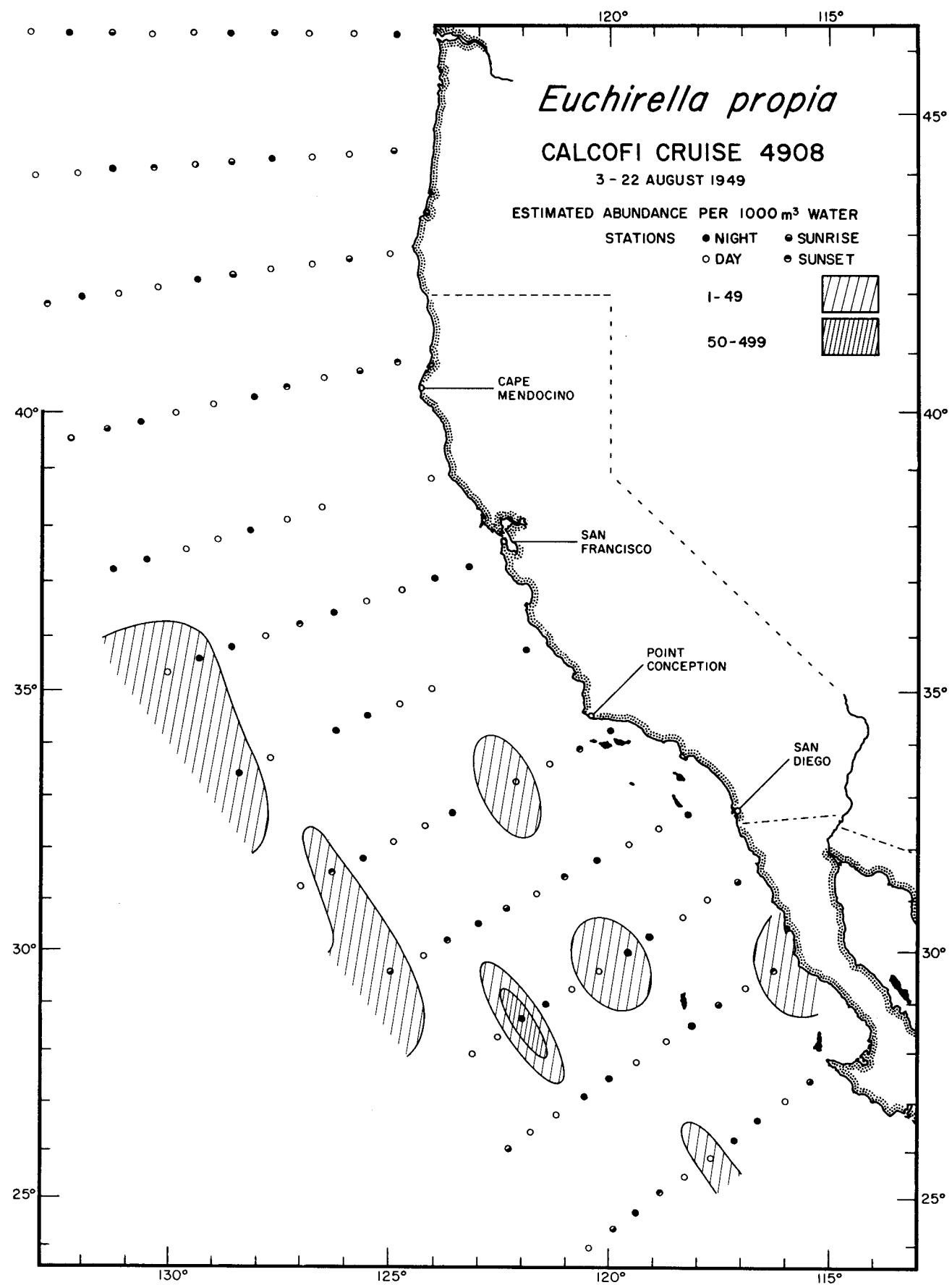
4906



Calanoida

*Euchirella propria*

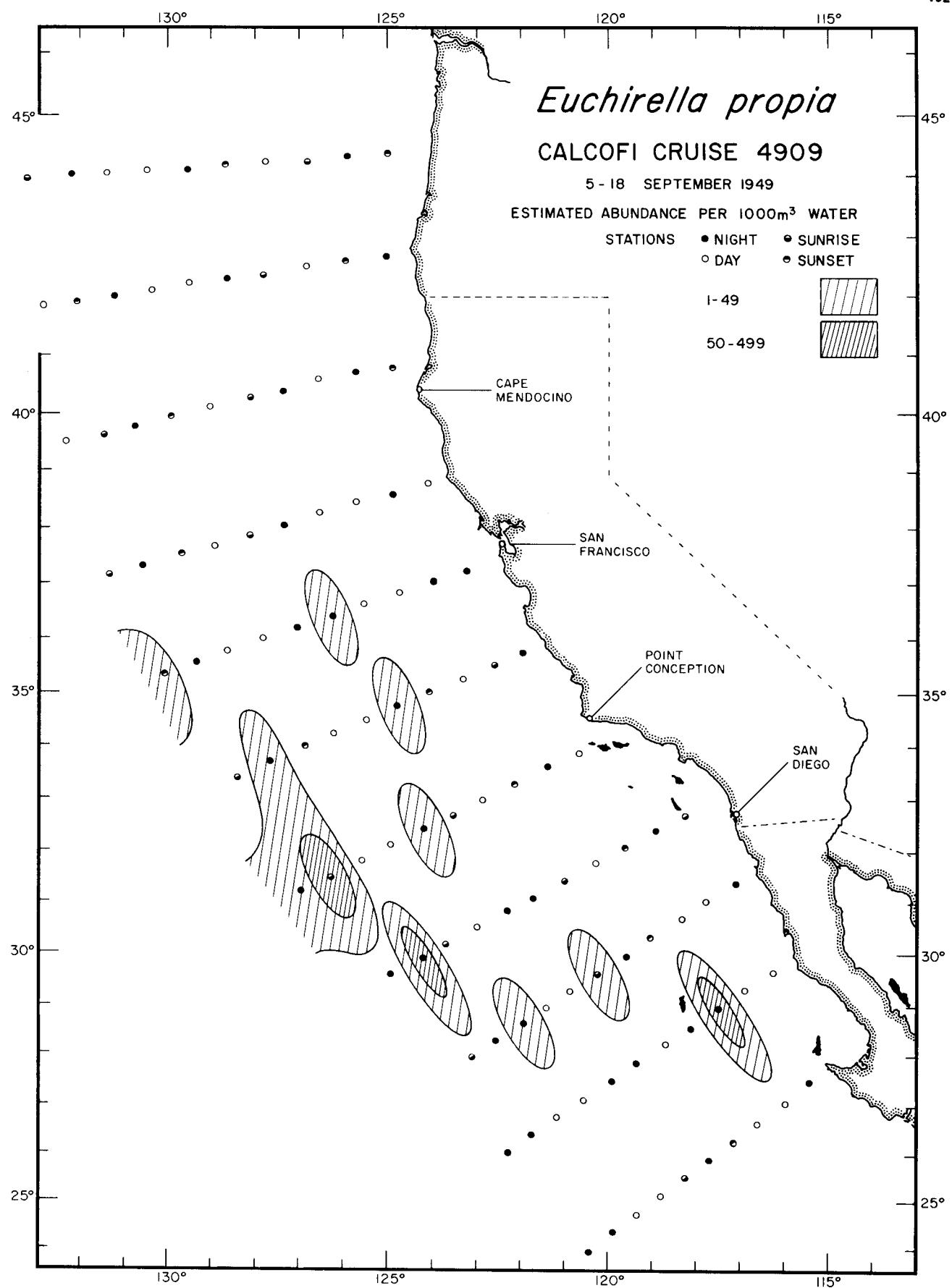
4907



Calanoida

*Euchirella propria*

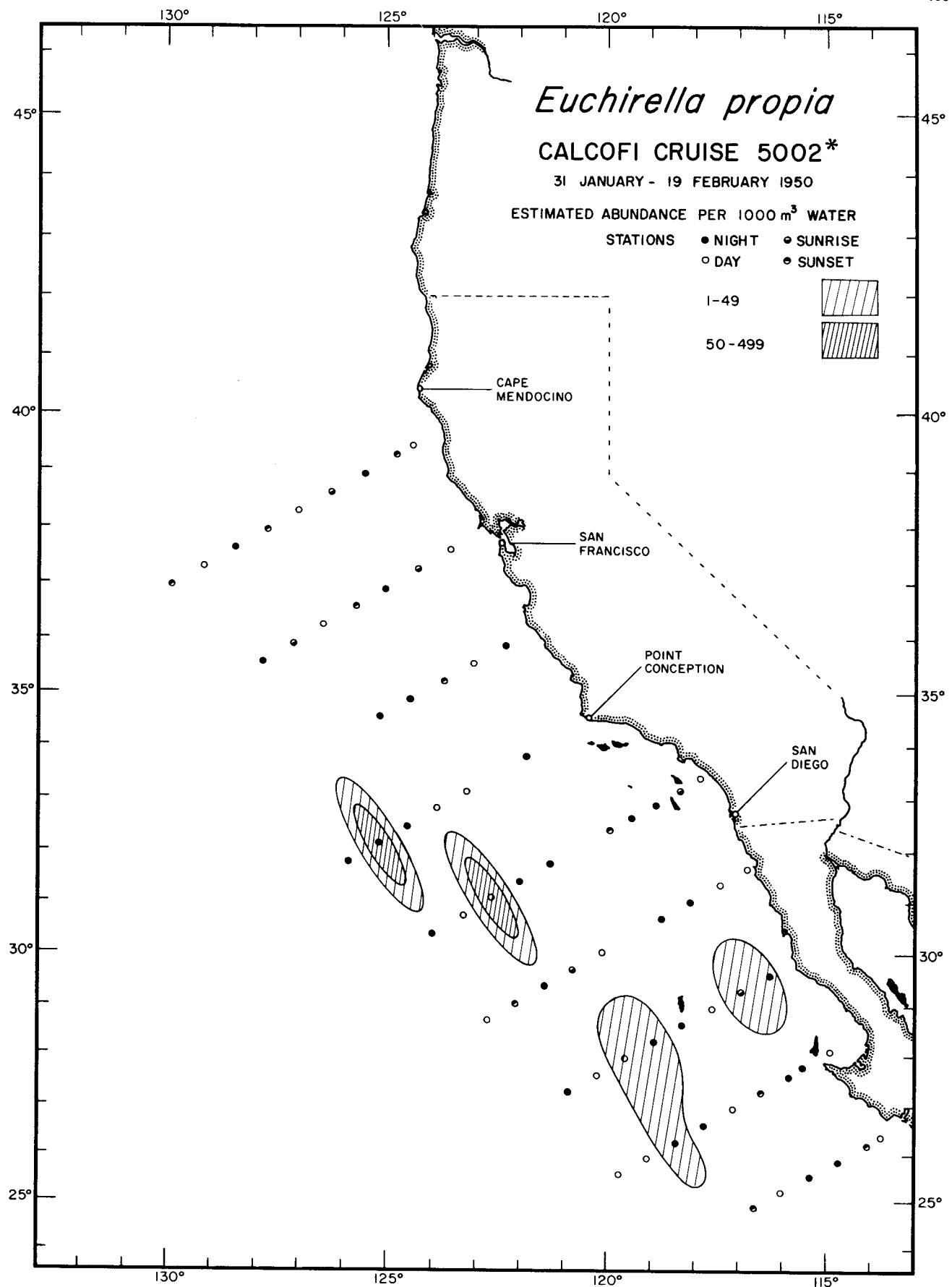
4908



## Calanoida

*Euchirella propria*

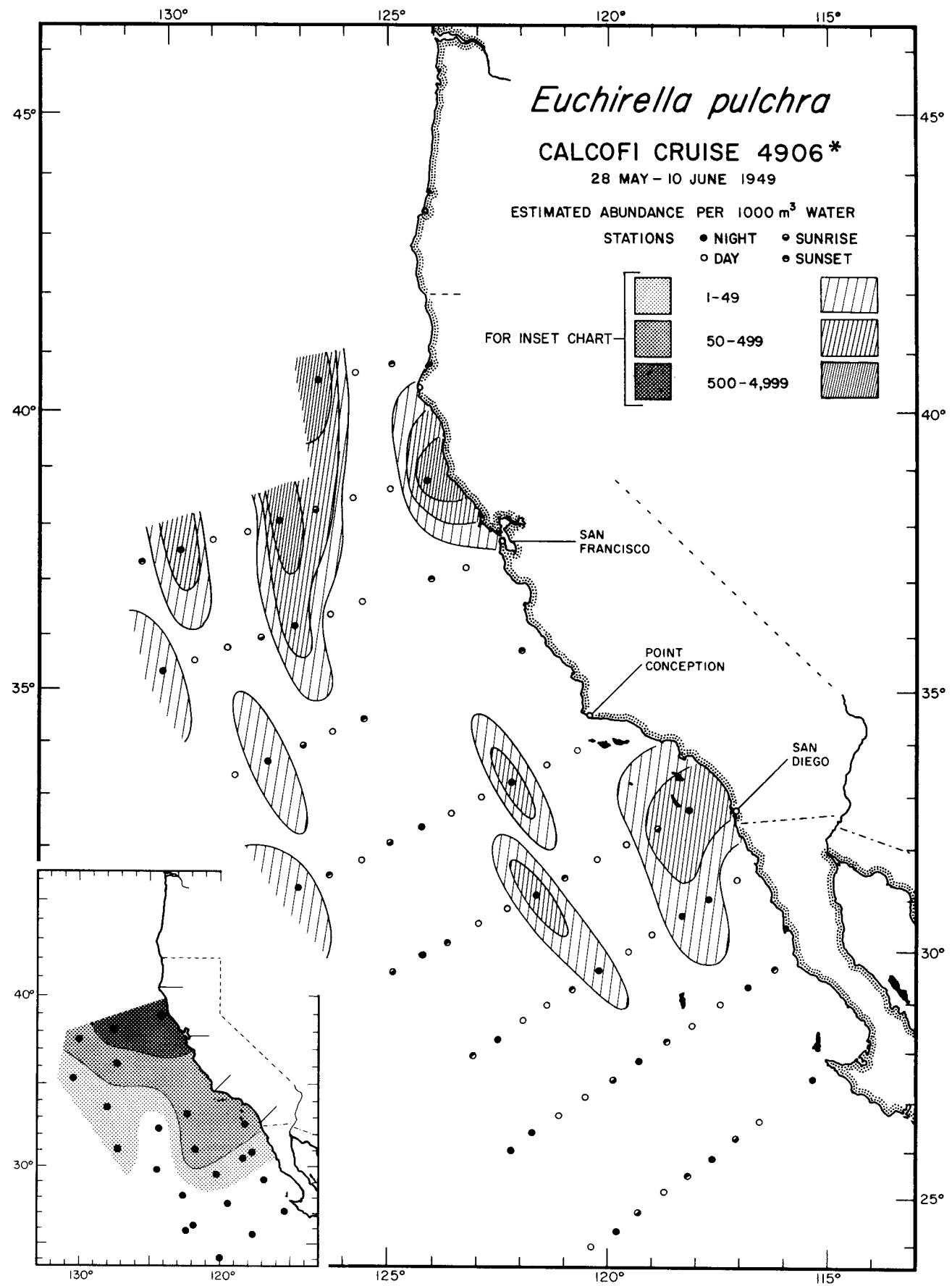
4909



\* See Table 1 for cruise 4910

Calanoida

*Euchirella propria*  
5002

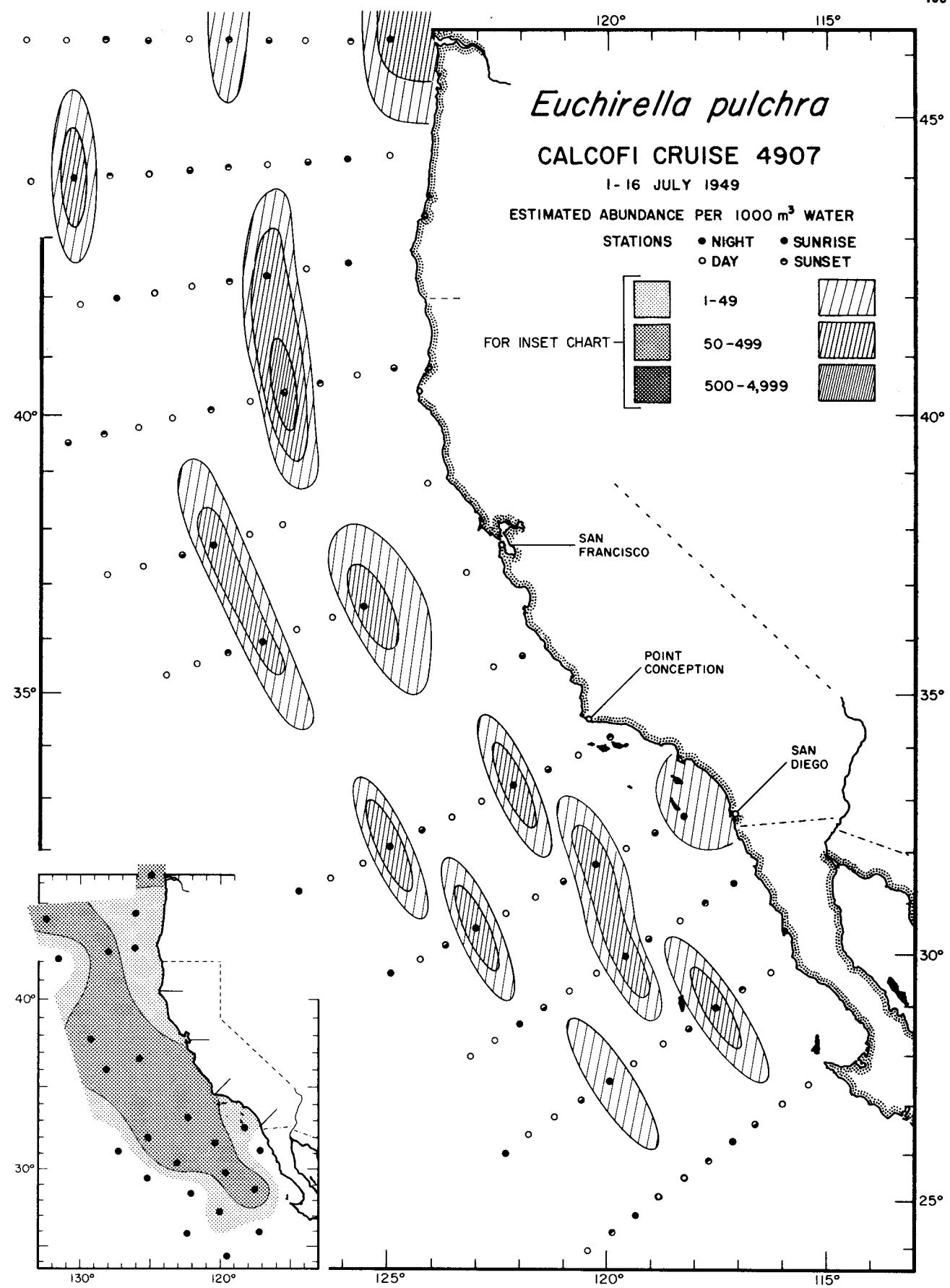


\* See Table 1 for cruise 4905

Calanoida

*Euchirella pulchra*

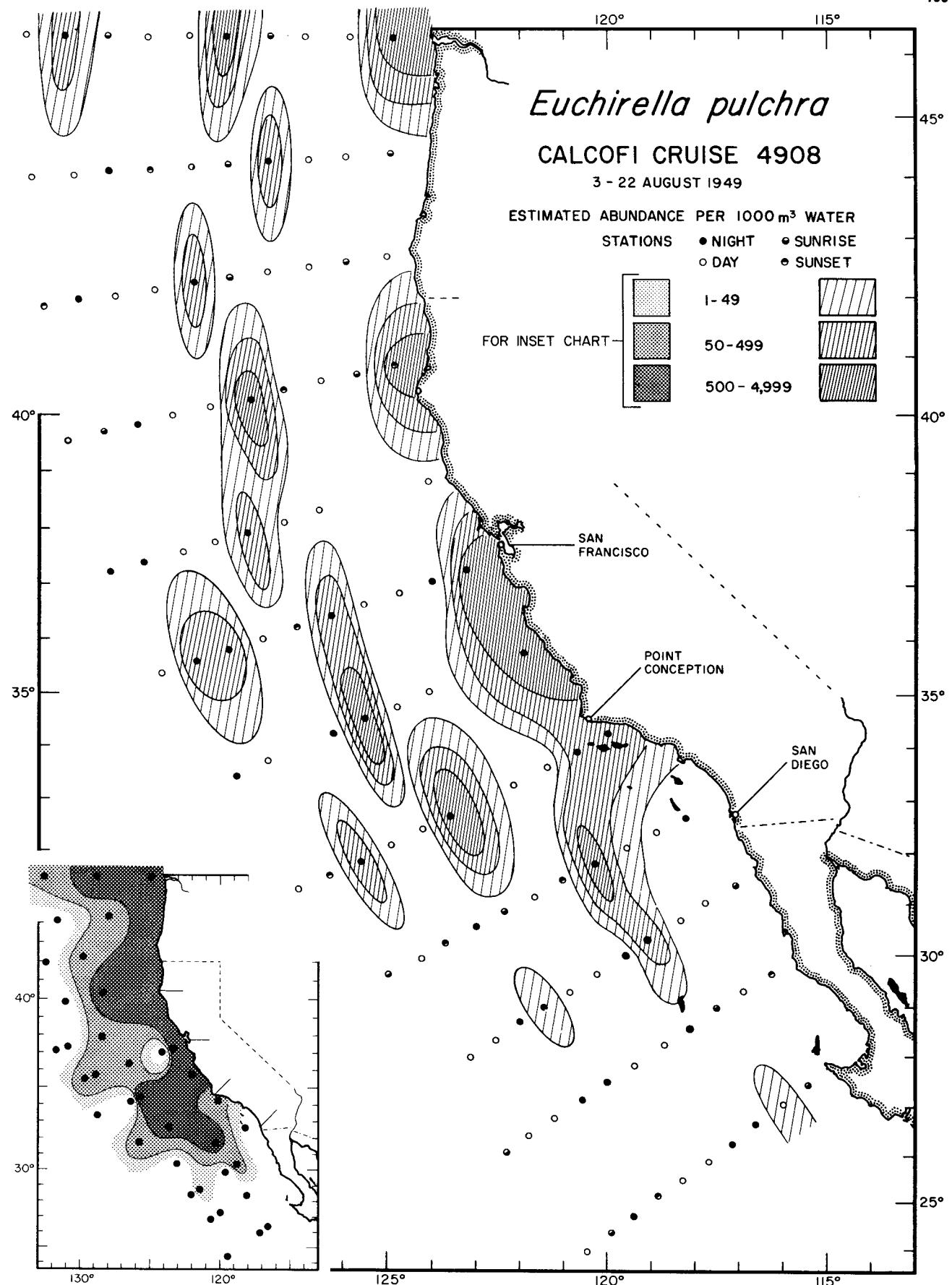
4906



Calanoida

*Euchirella pulchra*

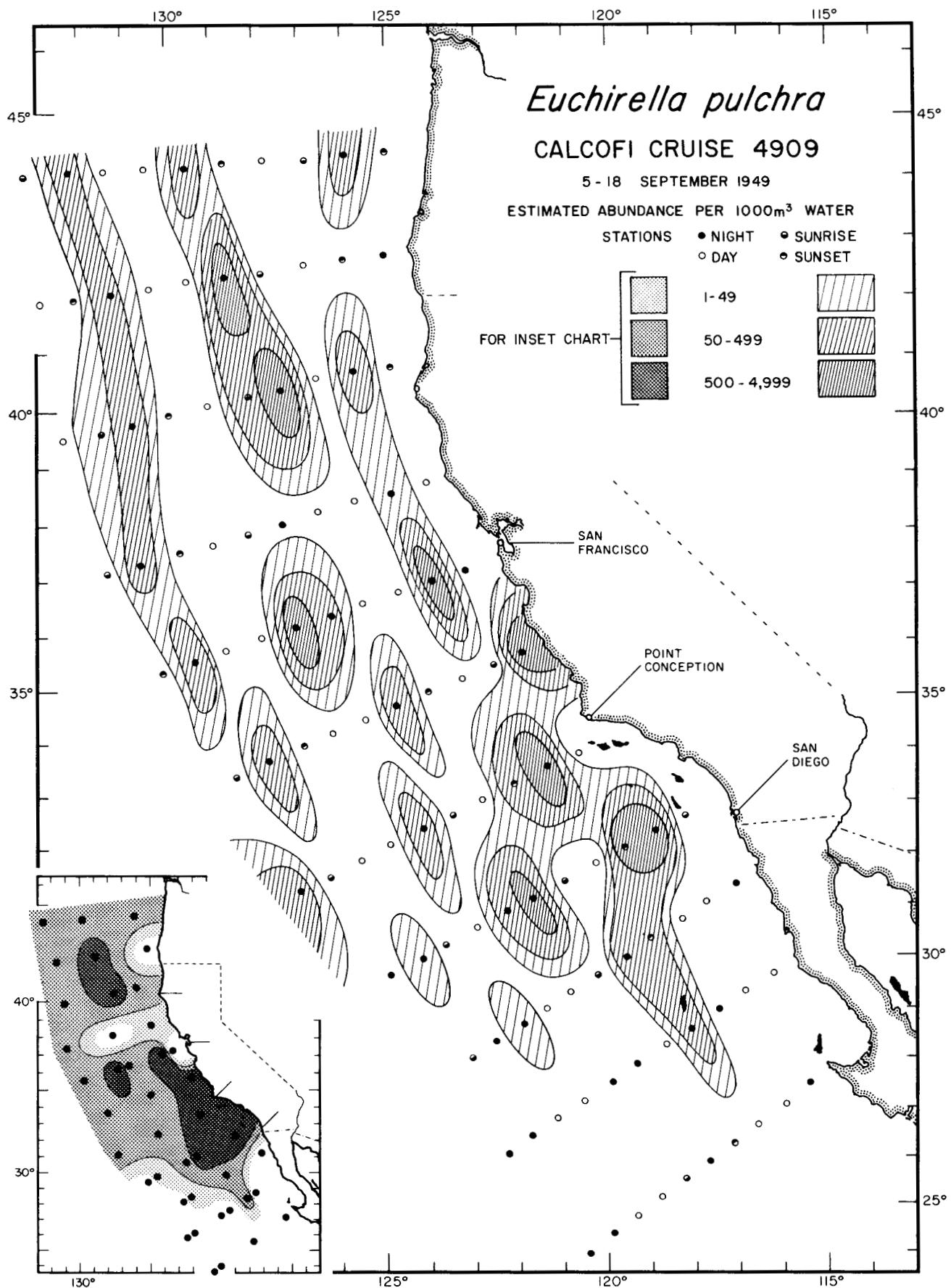
4907



Calanoida

*Euchirella pulchra*

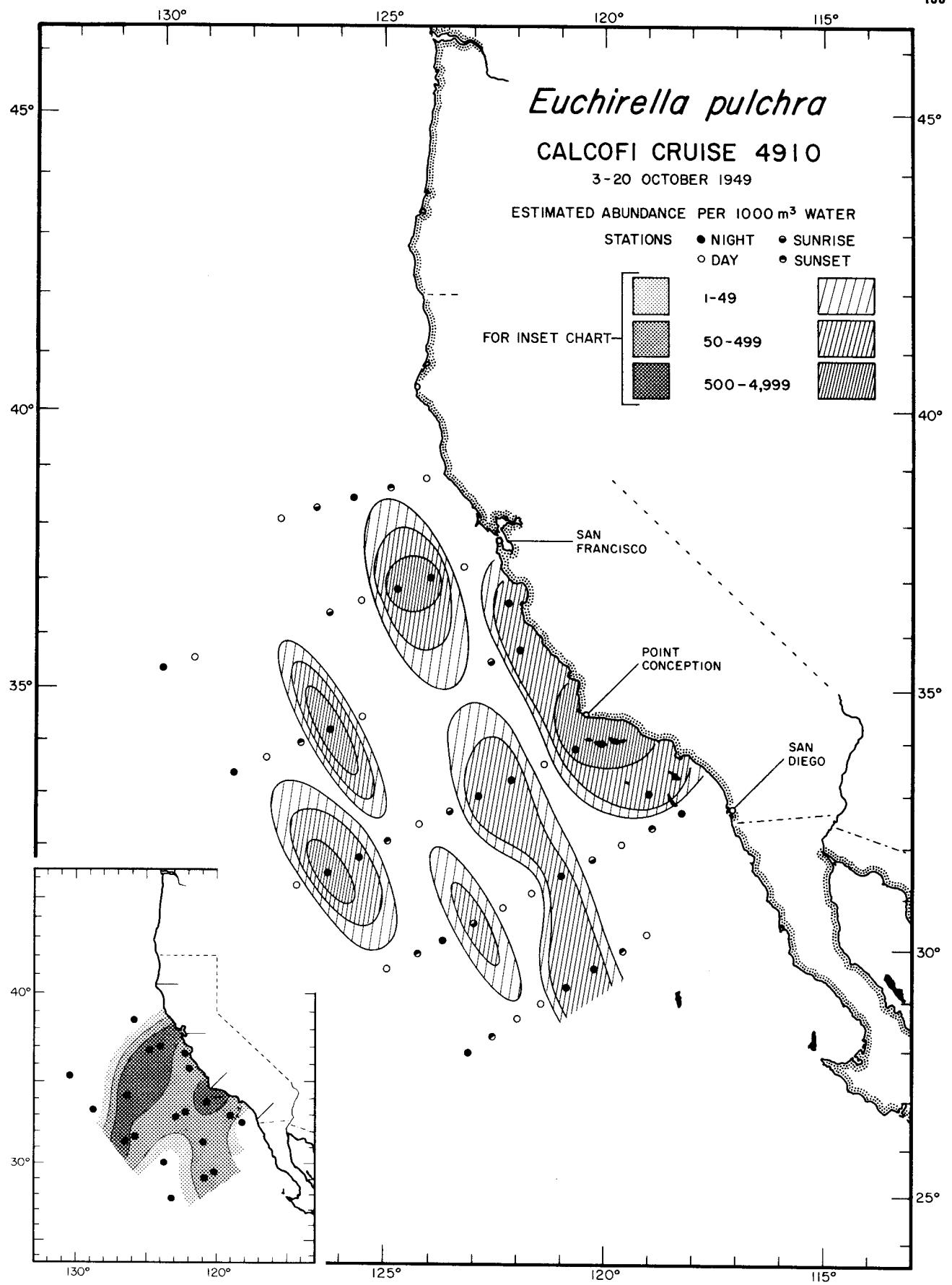
4908



Calanoida

*Euchirella pulchra*

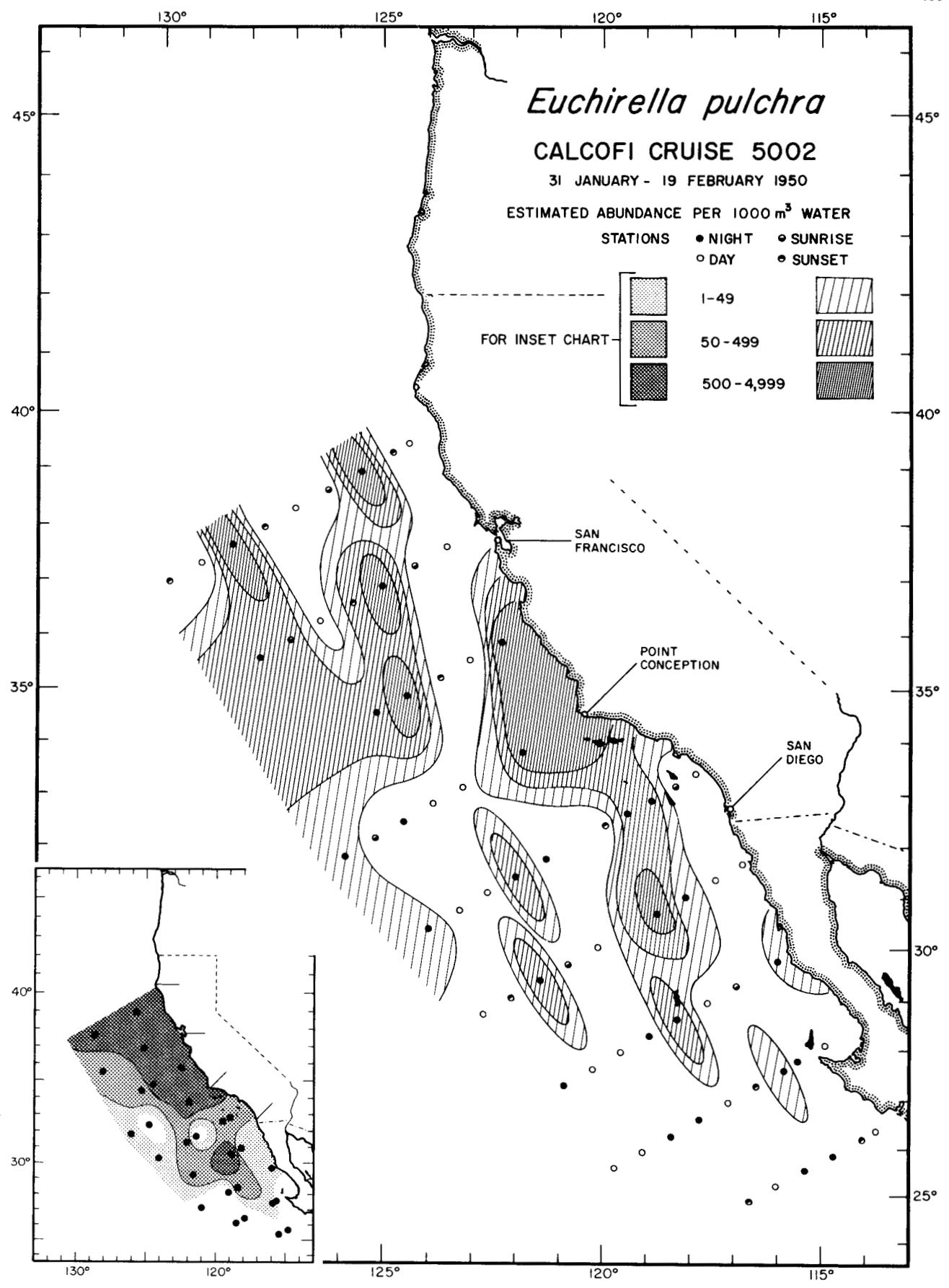
4909



Calanoida

*Euchirella pulchra*

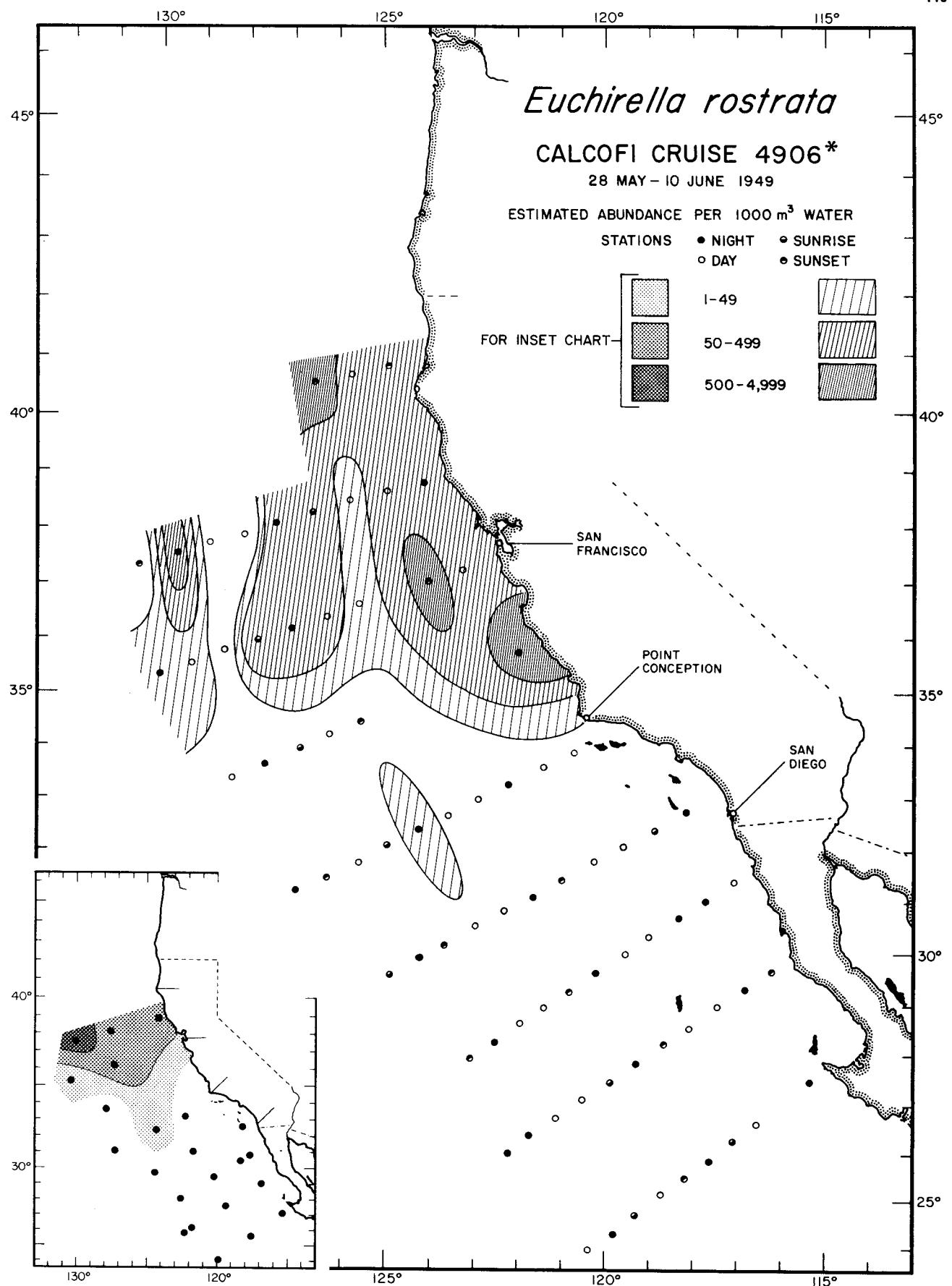
4910



Calanoida

*Euchirella pulchra*

5002

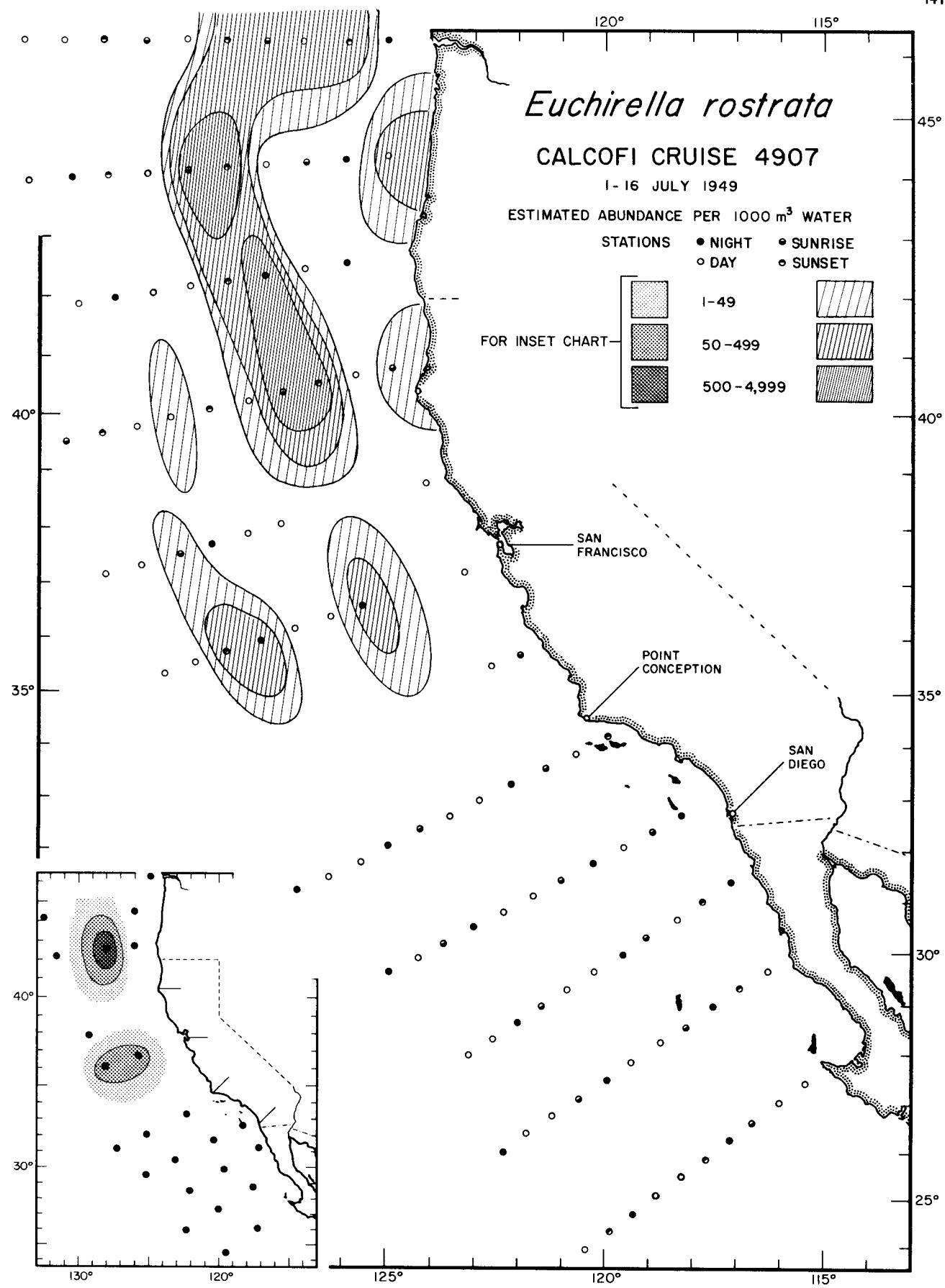


\* See Table 1 for cruise 4905

Calanoida

*Euchirella rostrata*

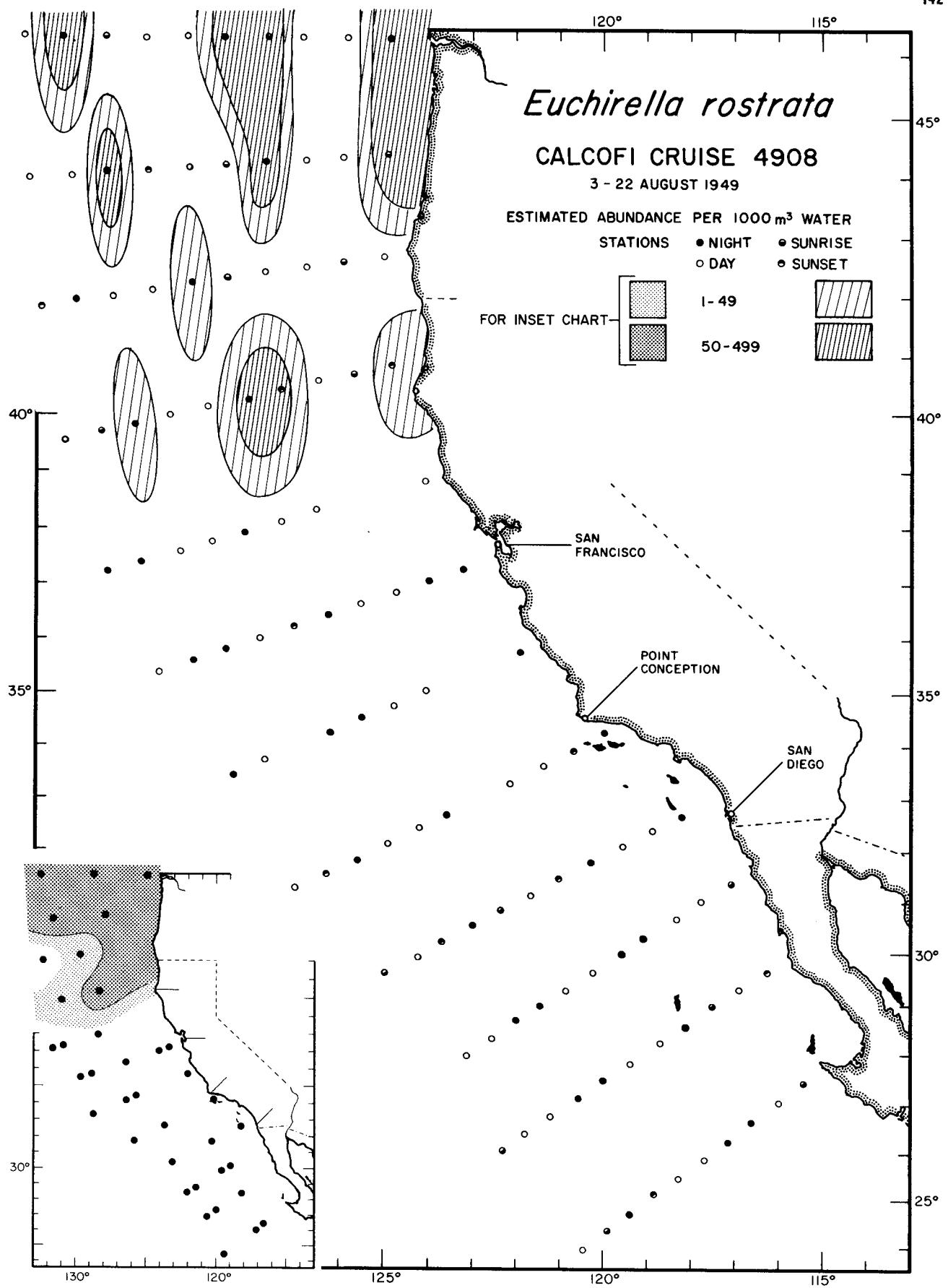
4906



Calanoida

*Euchirella rostrata*

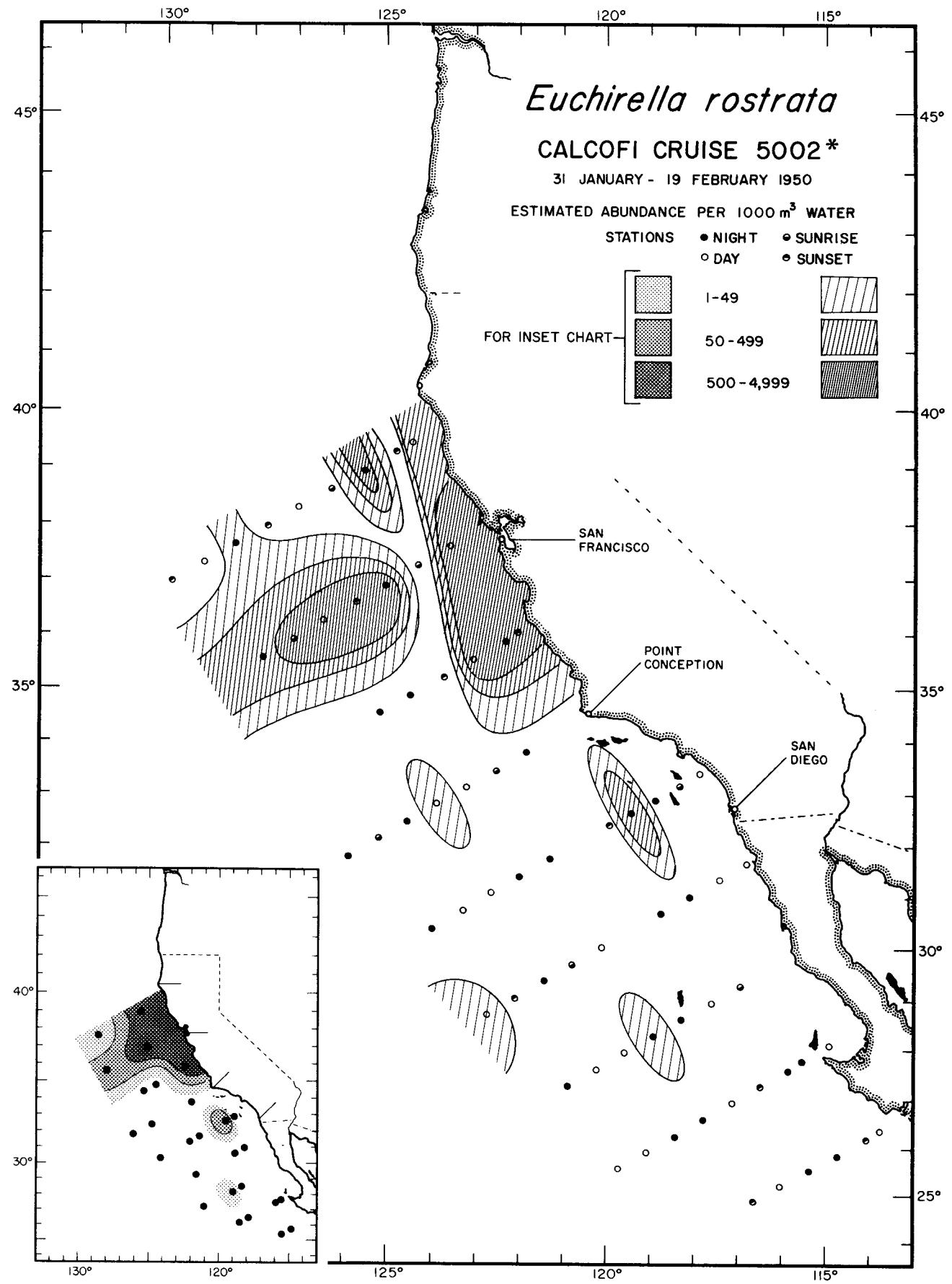
4907



Calanoida

*Euchirella rostrata*

4908

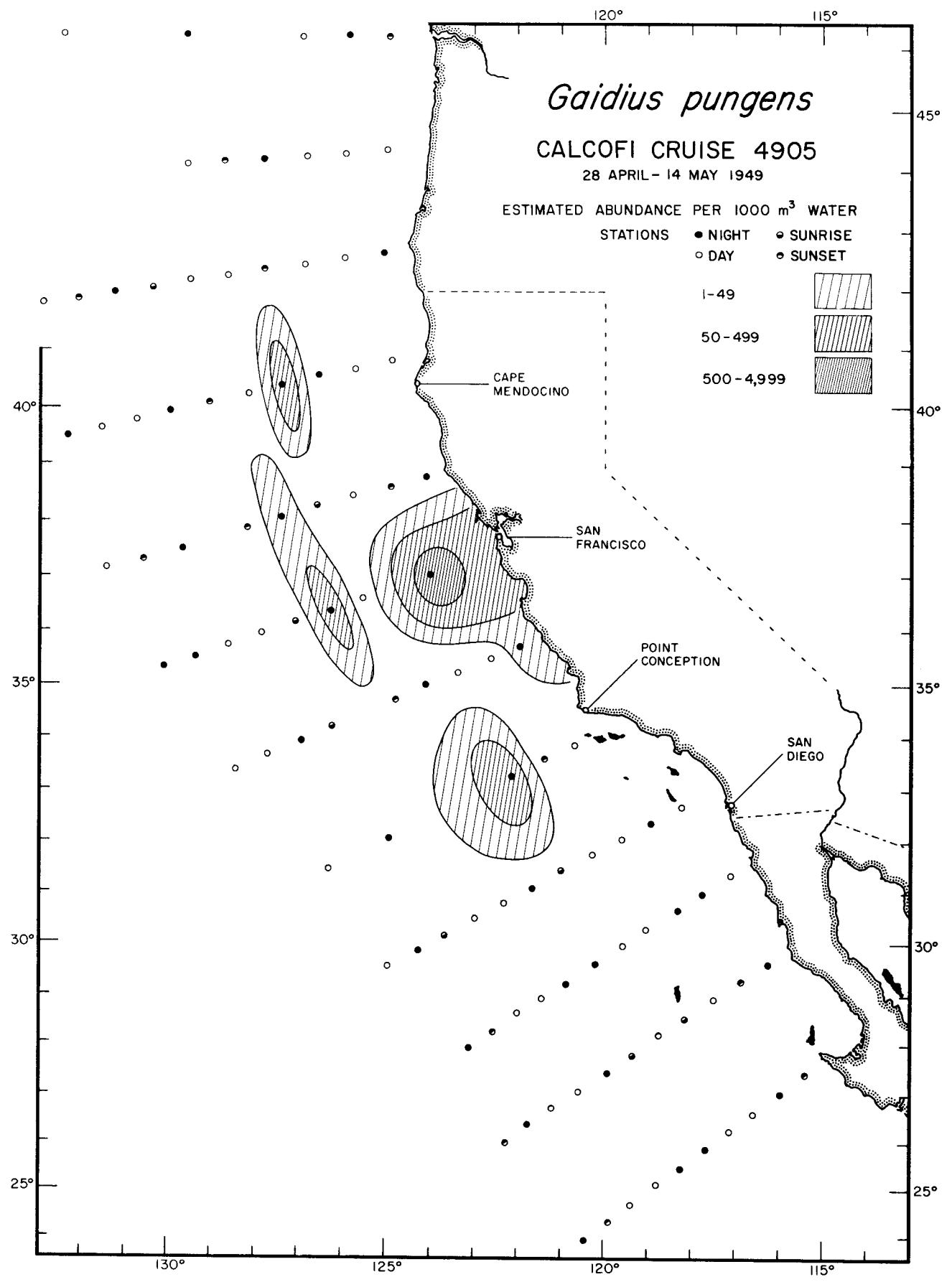


\* See Table 1 for cruises 4909, 10

Calanoida

*Euchirella rostrata*

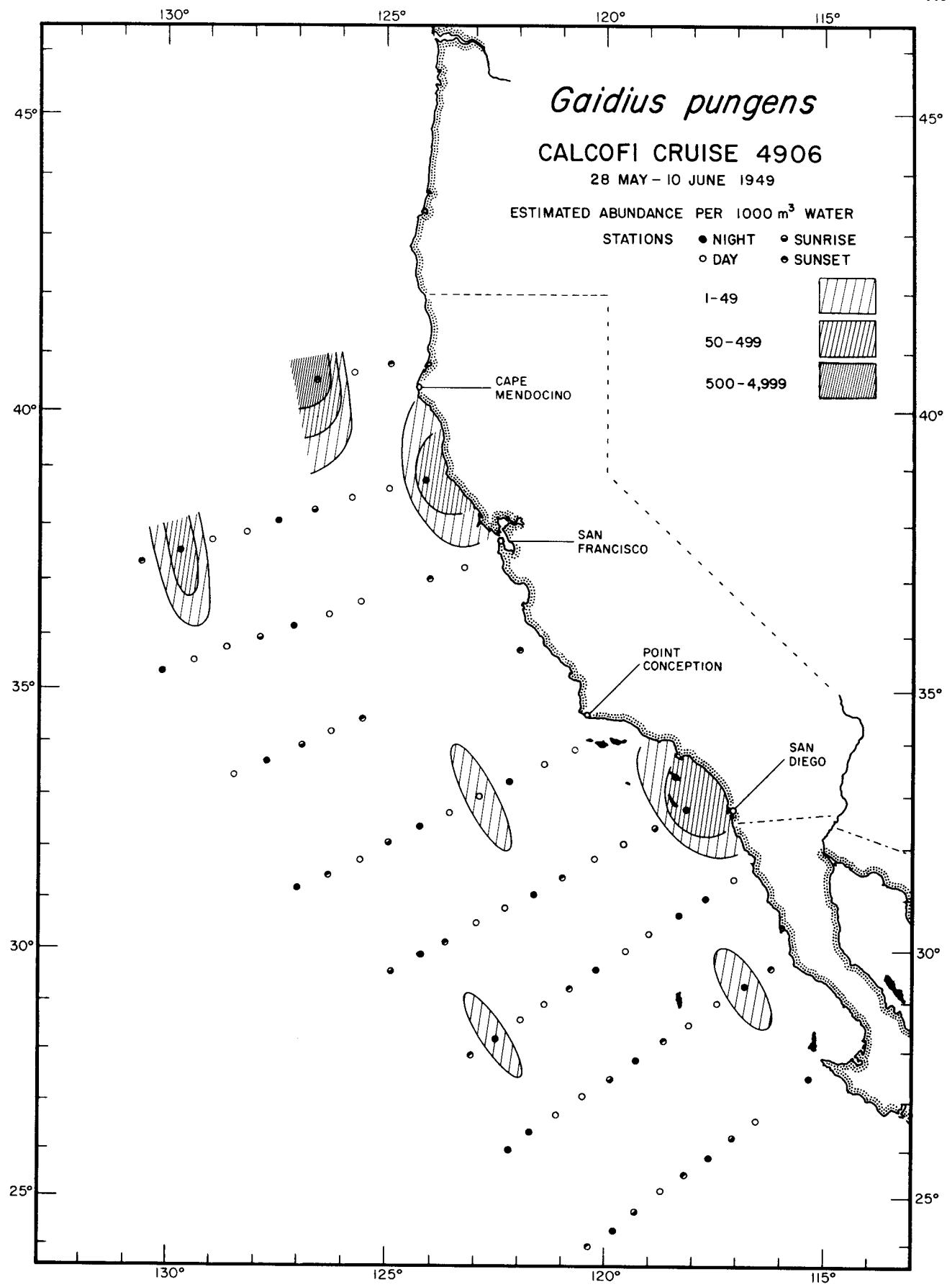
5002



Calanoida

*Gaidius pungens*

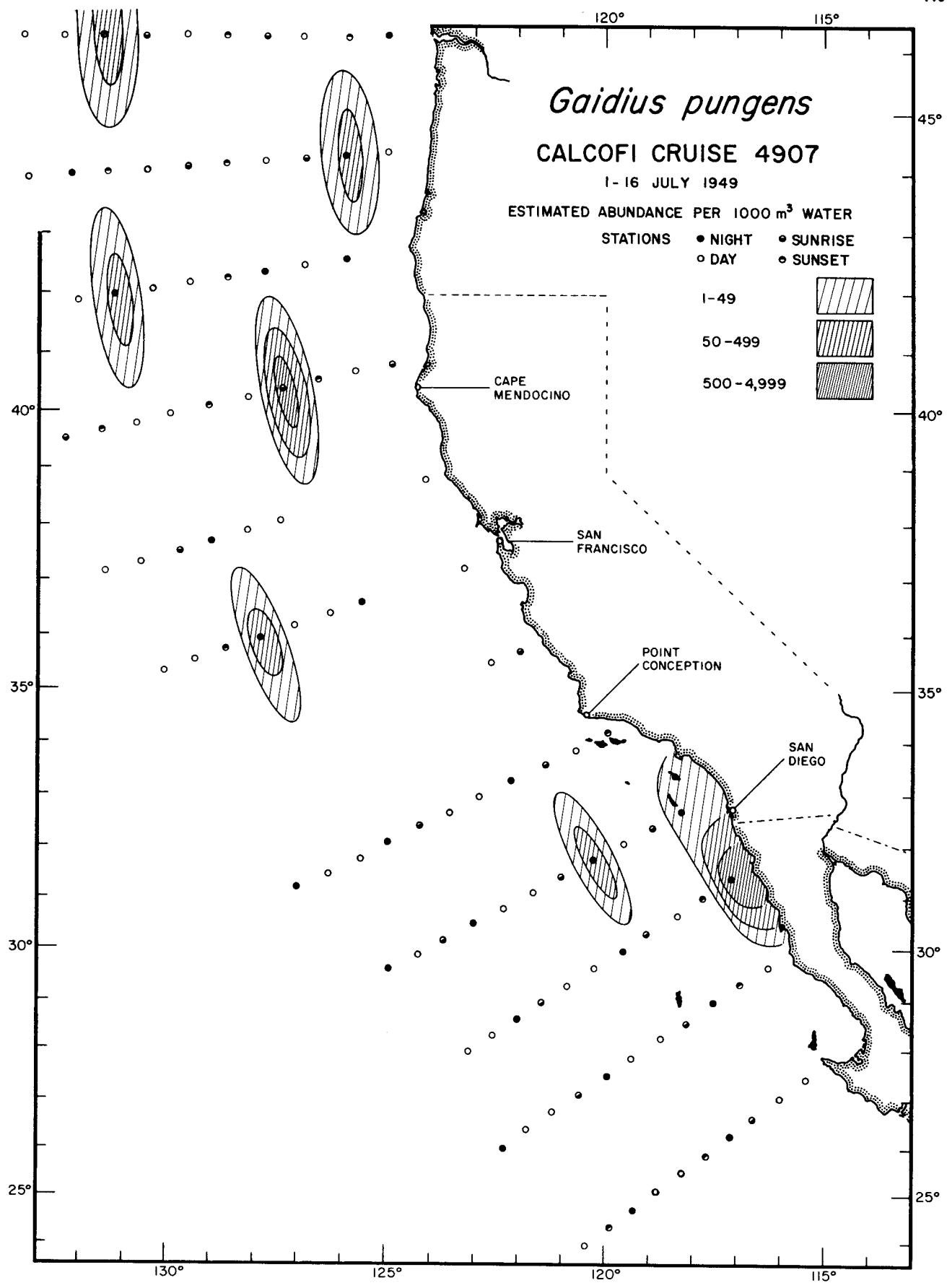
4905



Calanoida

*Gaidius pungens*

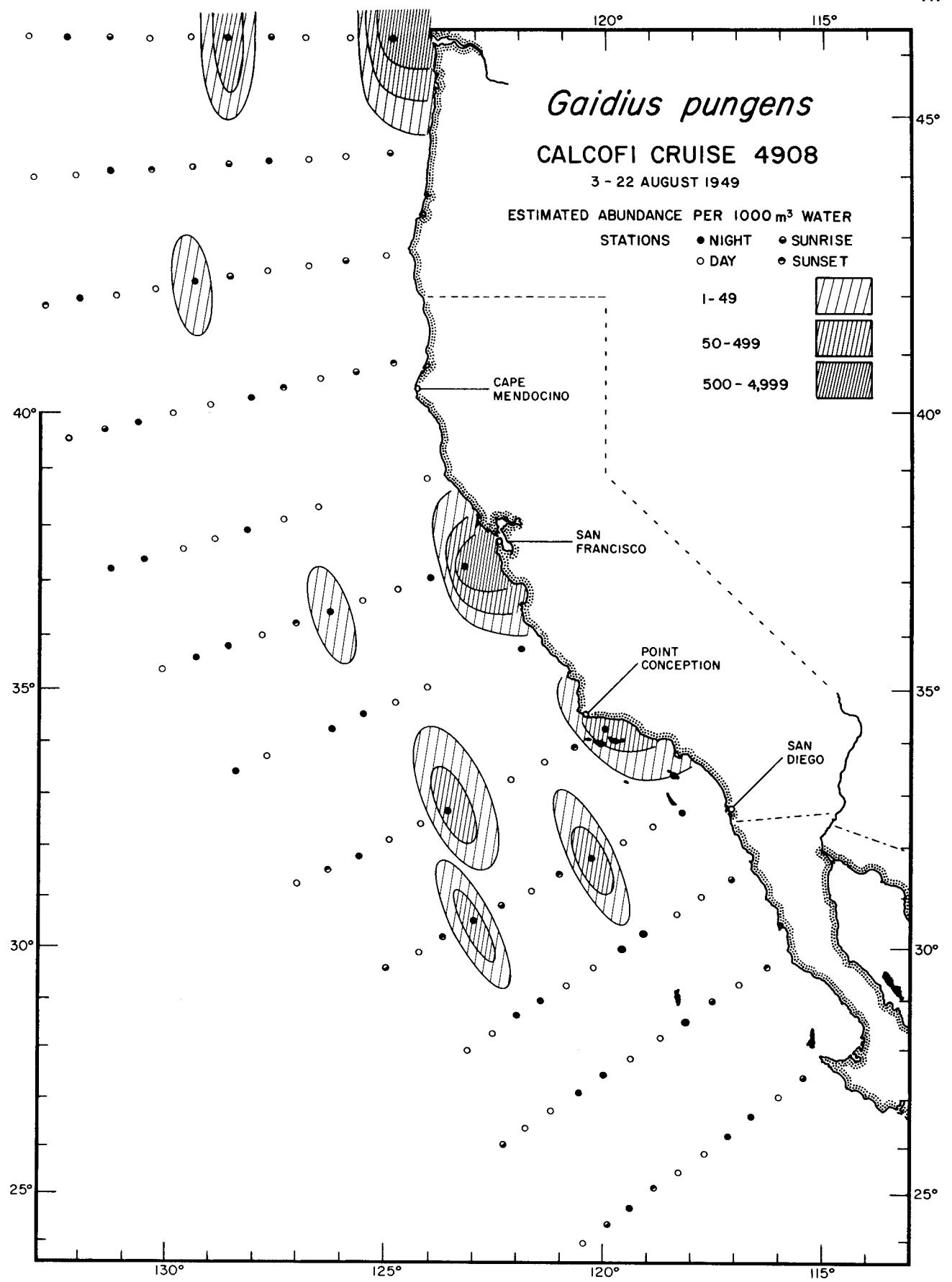
4906



Calanoida

*Gaidius pungens*

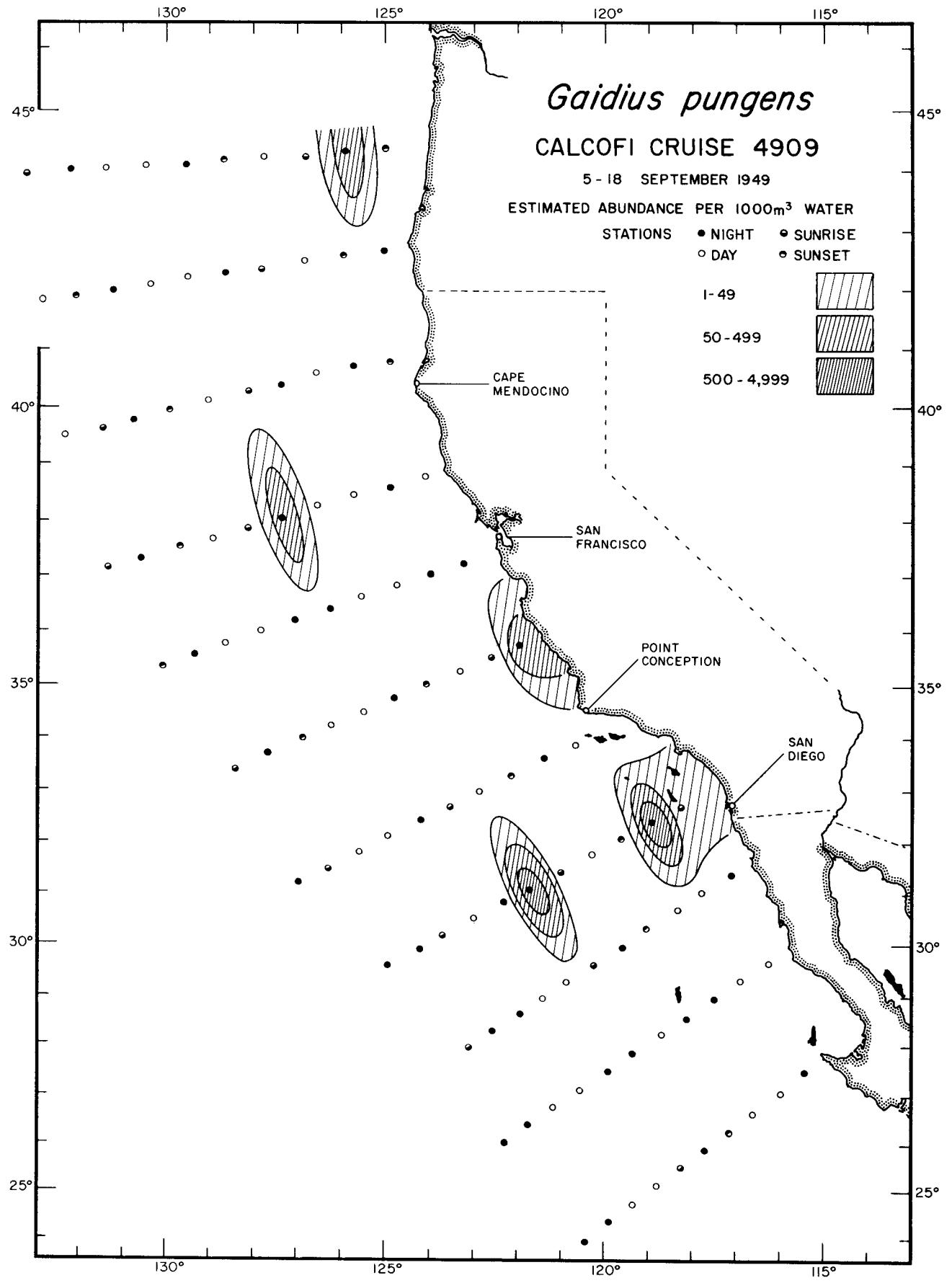
4907



Calanoida

*Gaidius pungens*

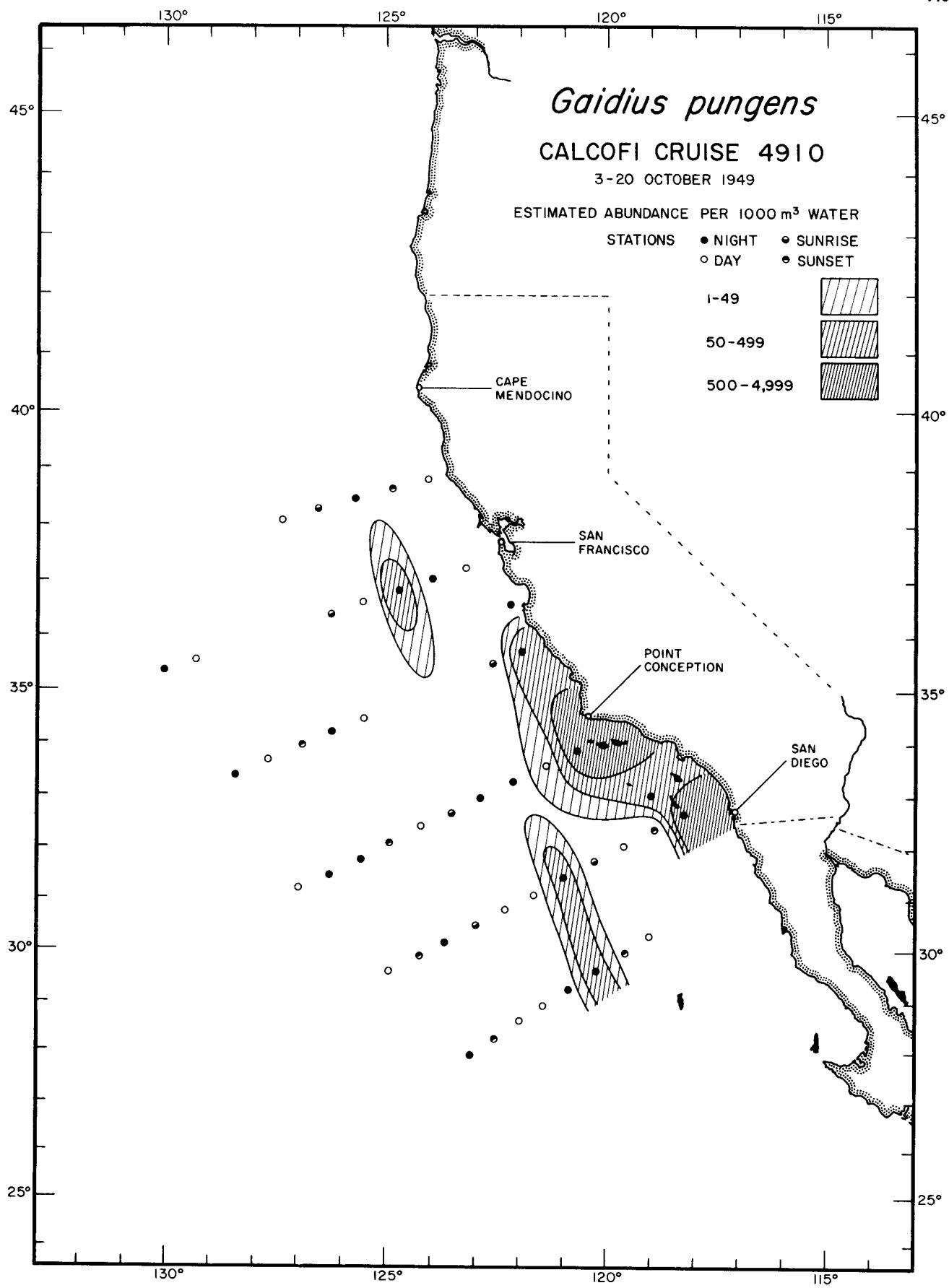
4908



Calanoida

*Gaidius pungens*

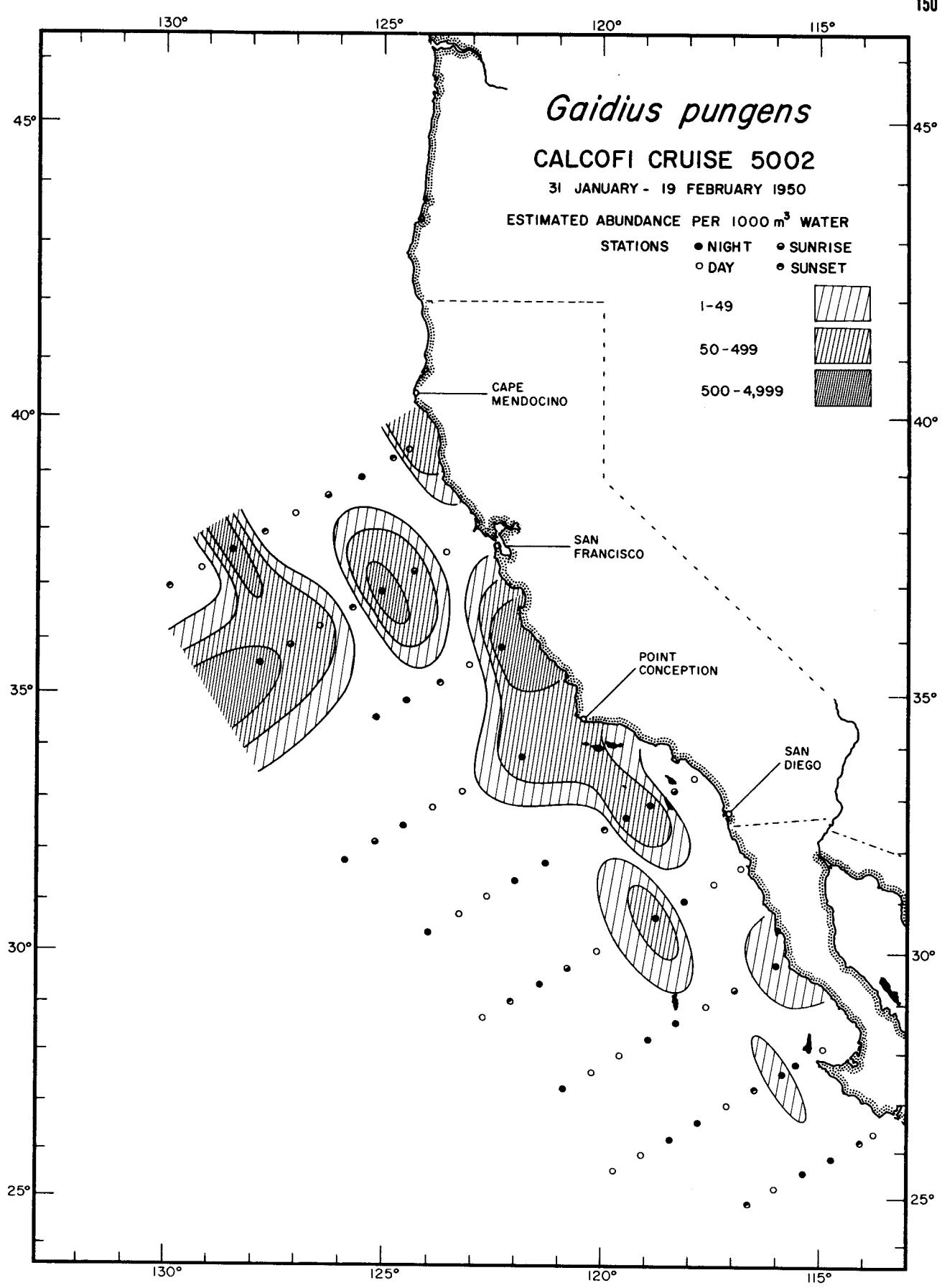
4909



Calanoida

*Gaidius pungens*

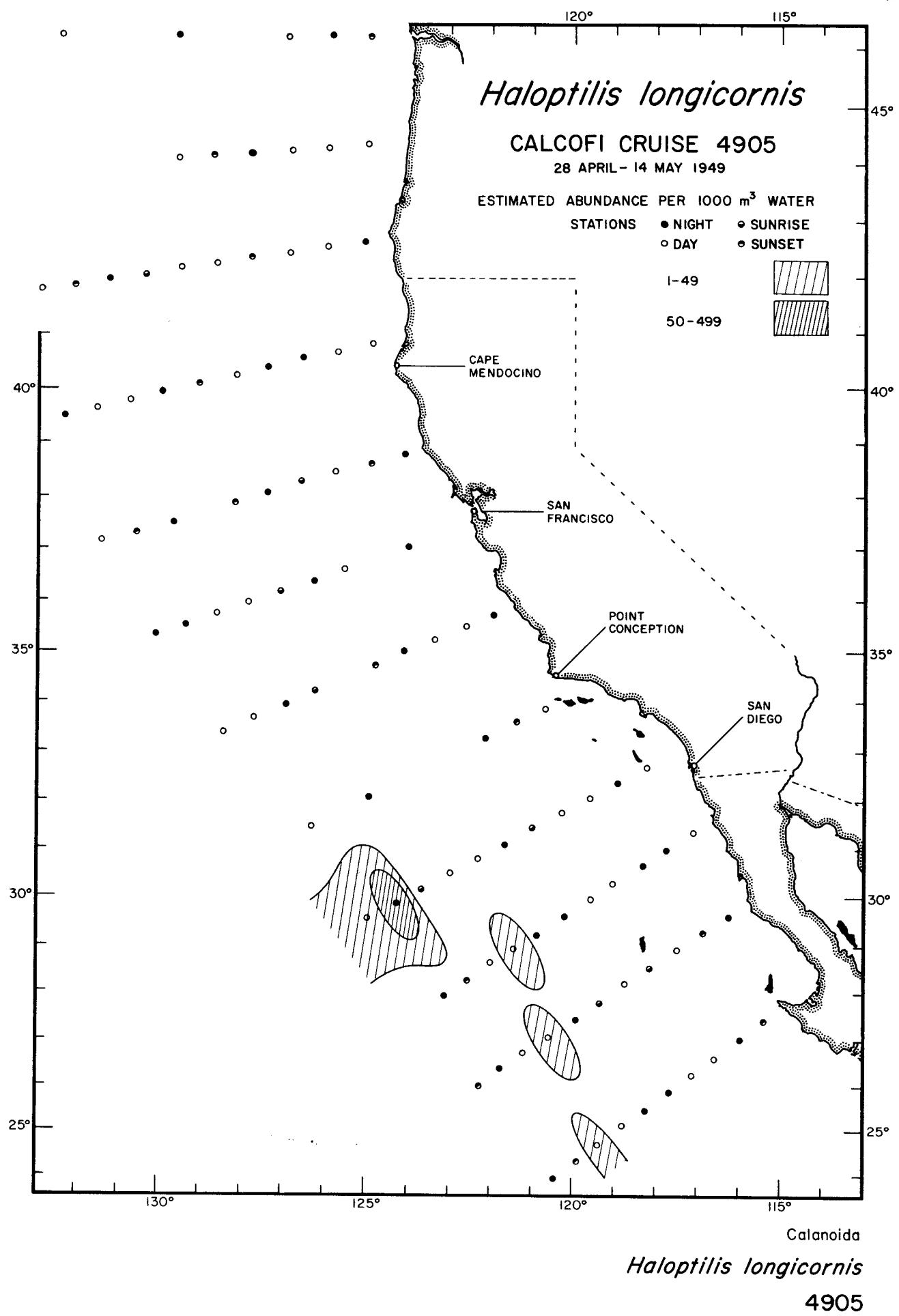
4910

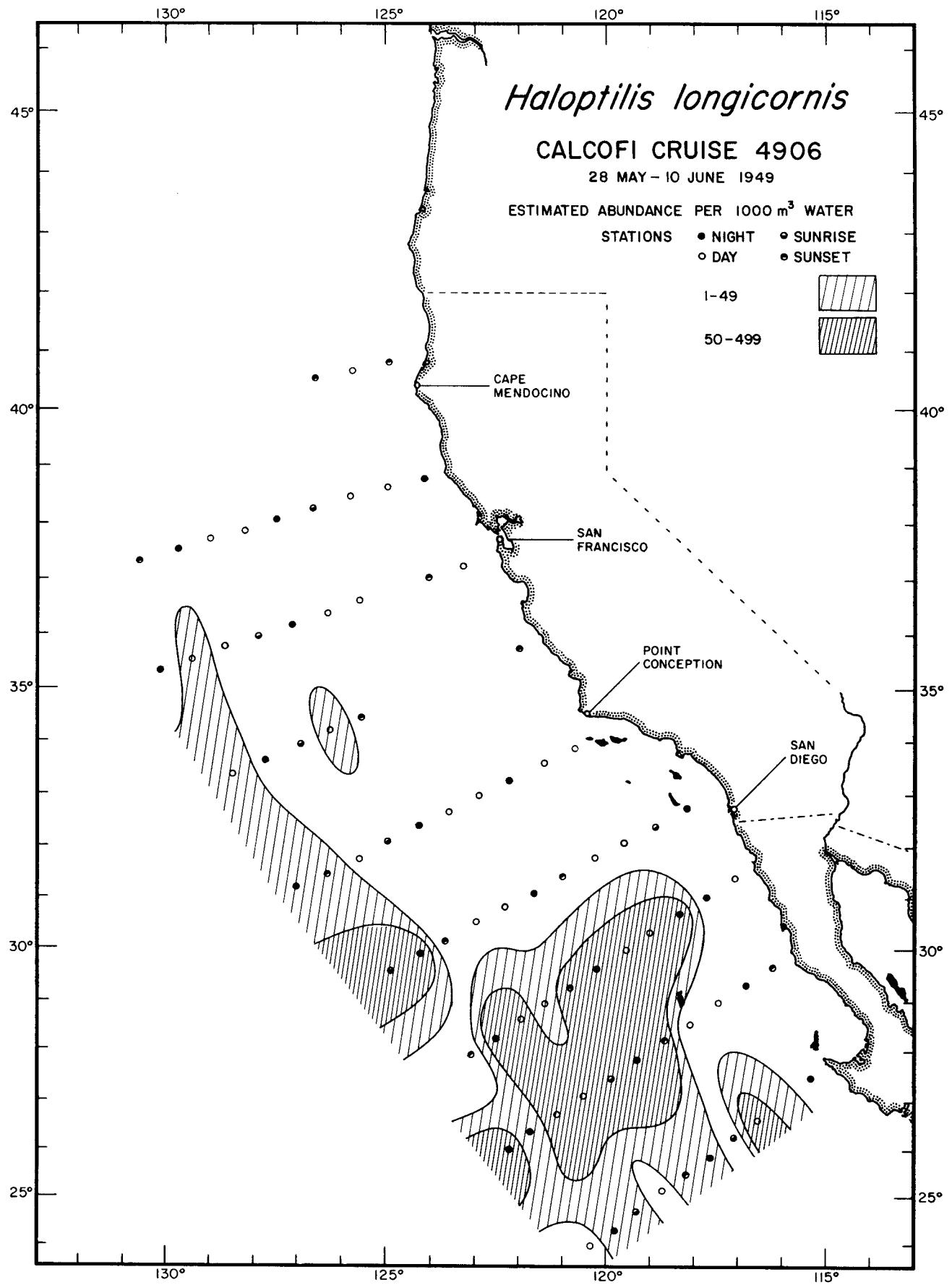


Calanoida

*Gaidius pungens*

5002

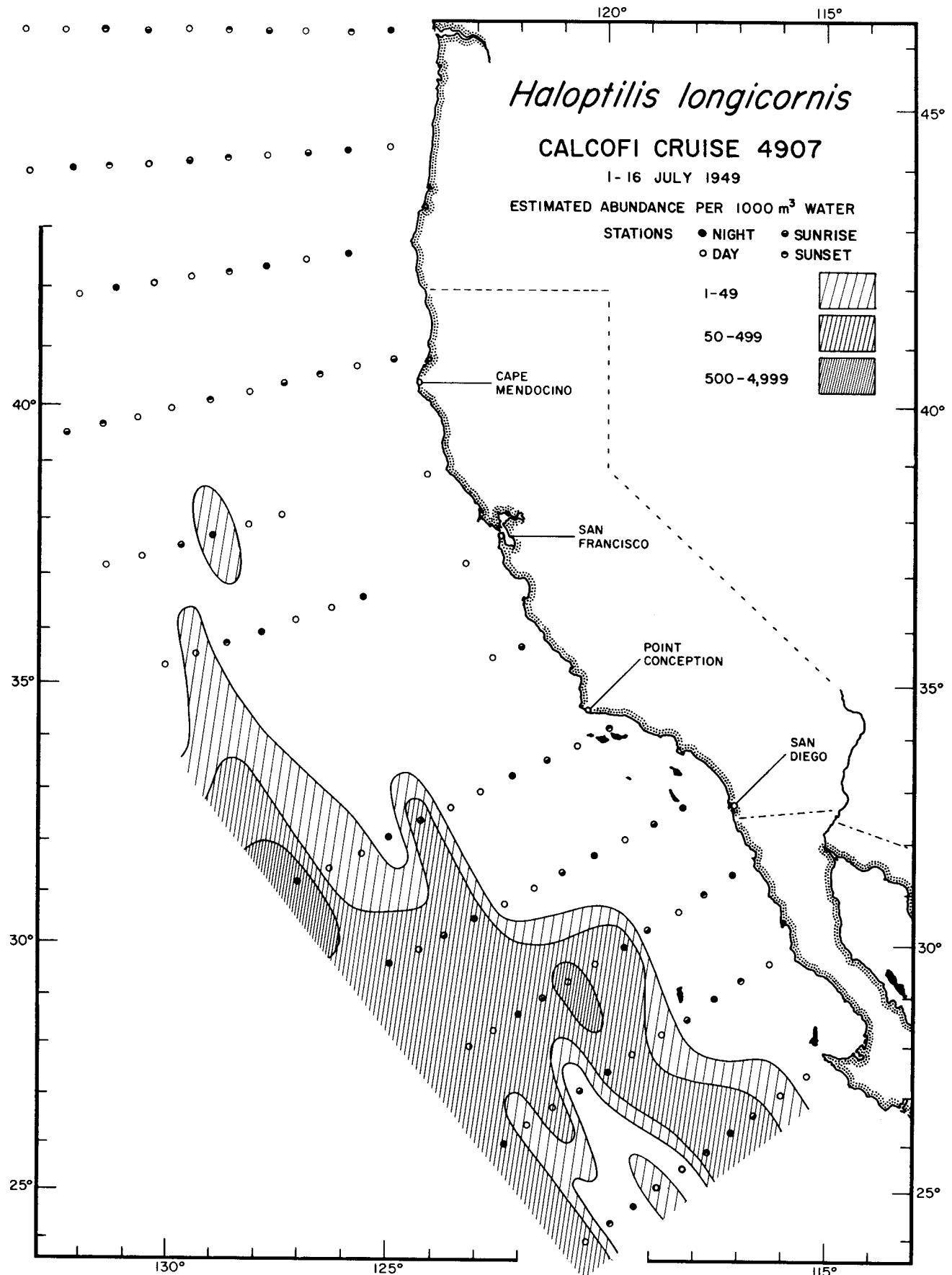




Calanoida

*Haloptilis longicornis*

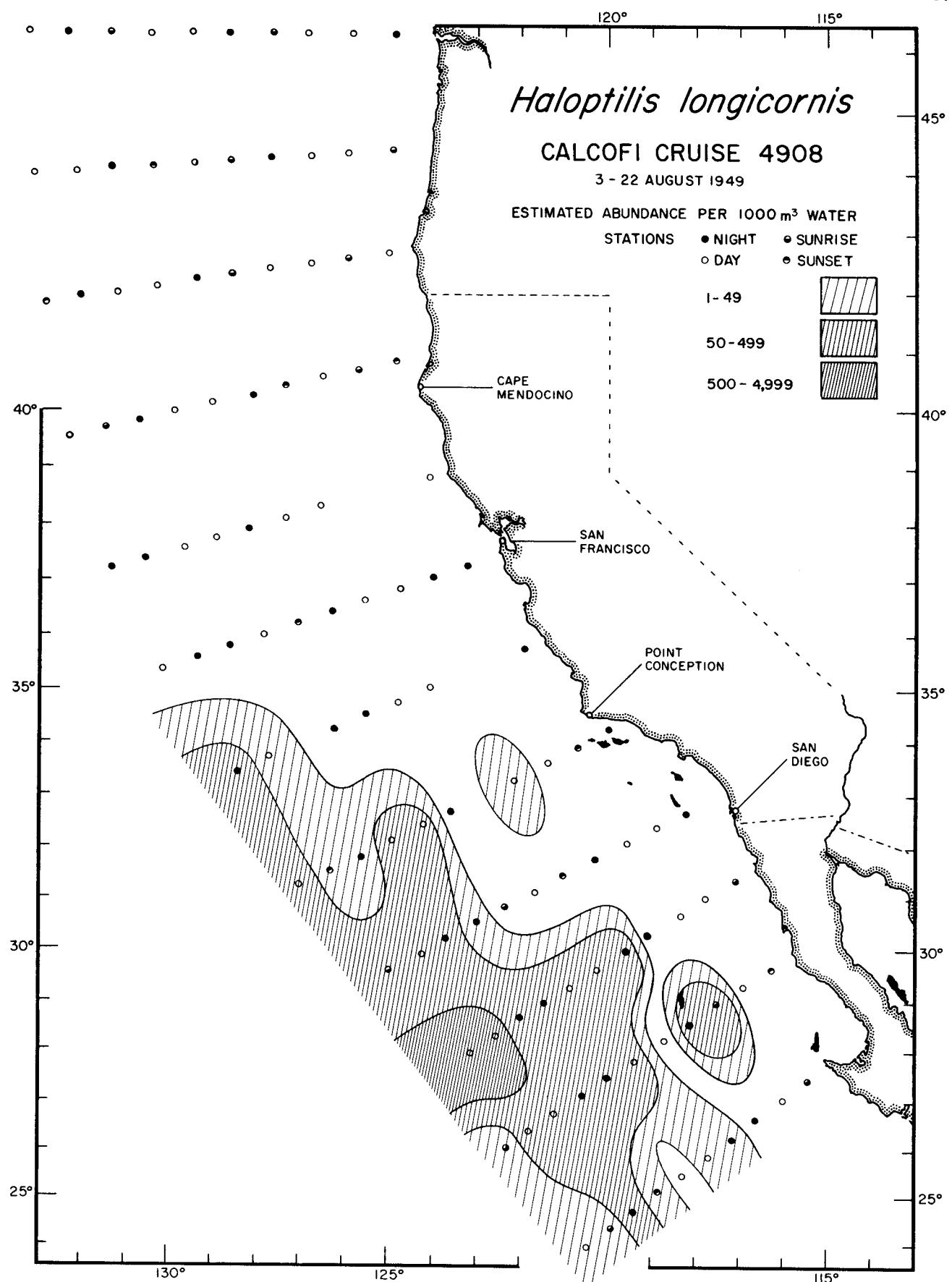
4906



Calanoida

*Haloptilis longicornis*

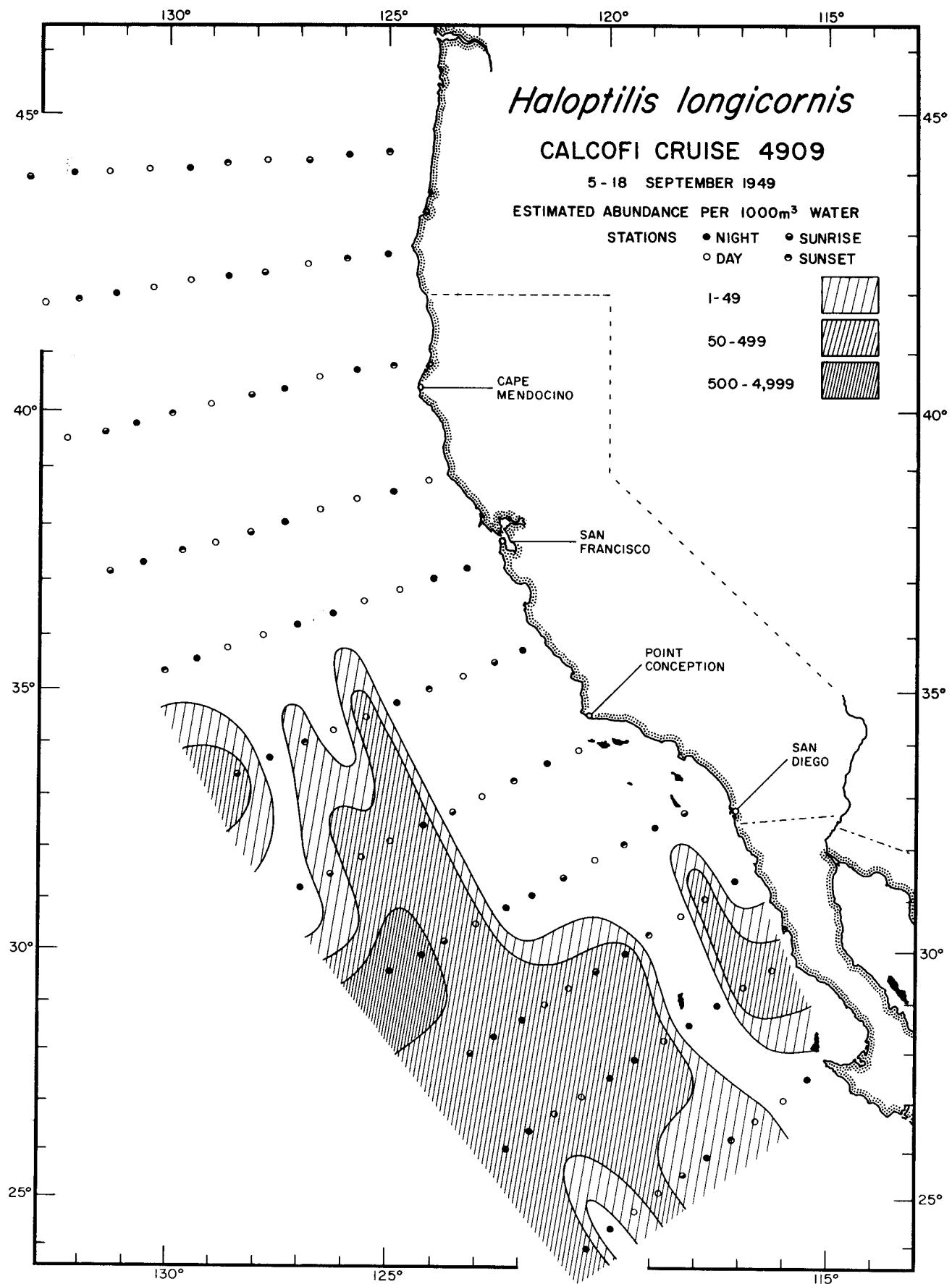
4907



Calanoida

*Haloptilis longicornis*

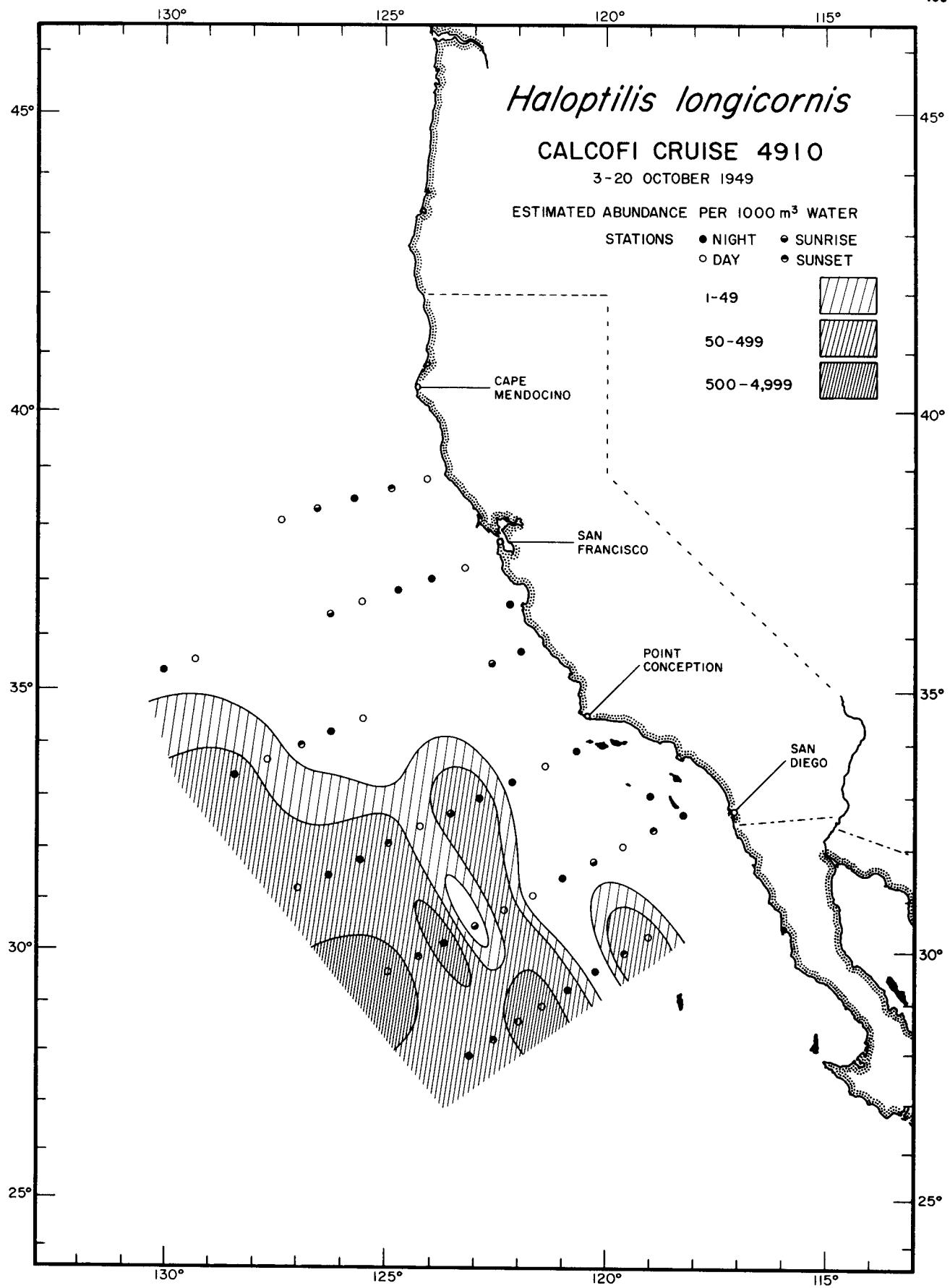
4908



Calanoida

*Haloptilis longicornis*

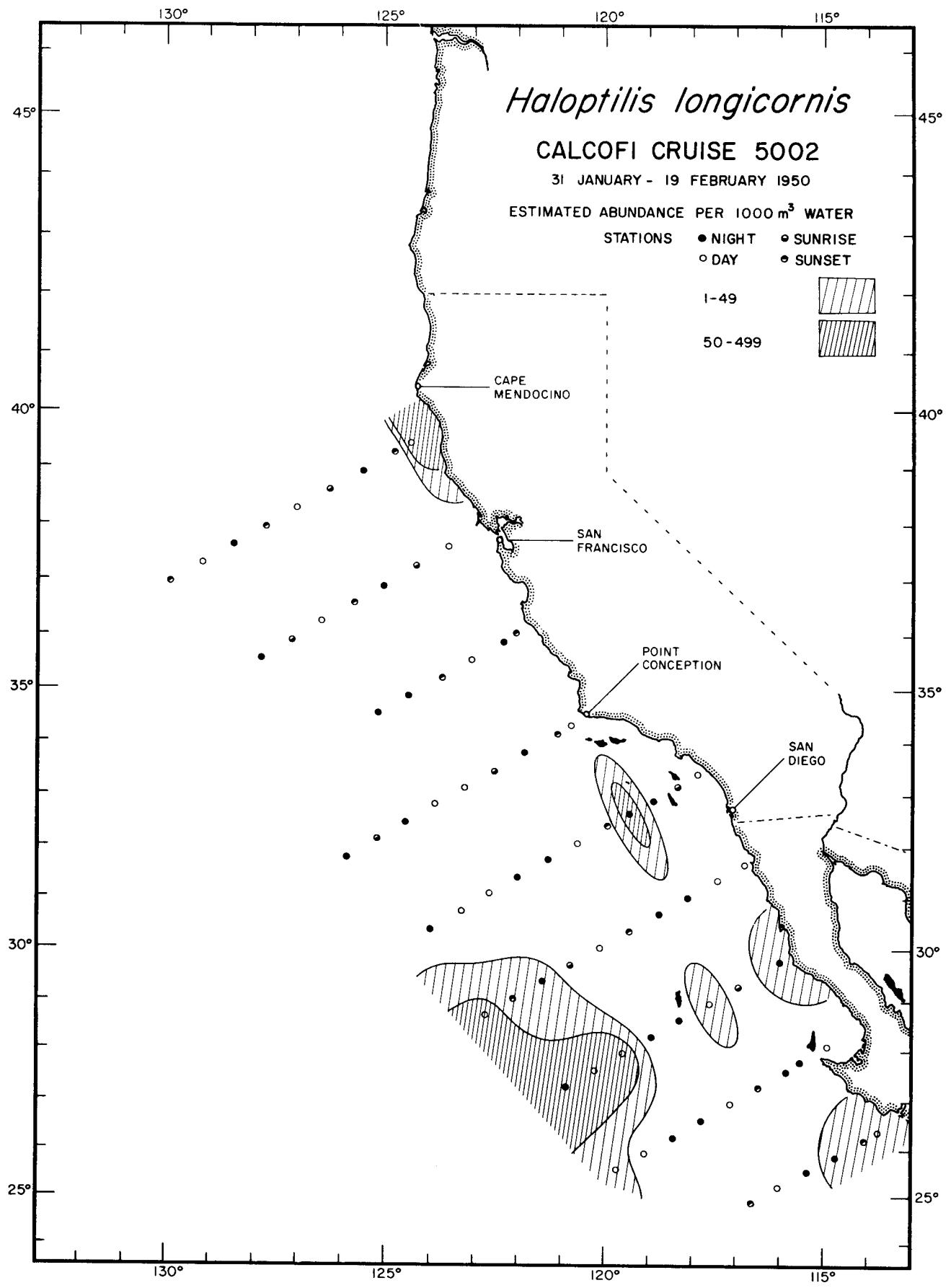
4909



Calanoida

*Haloptilis longicornis*

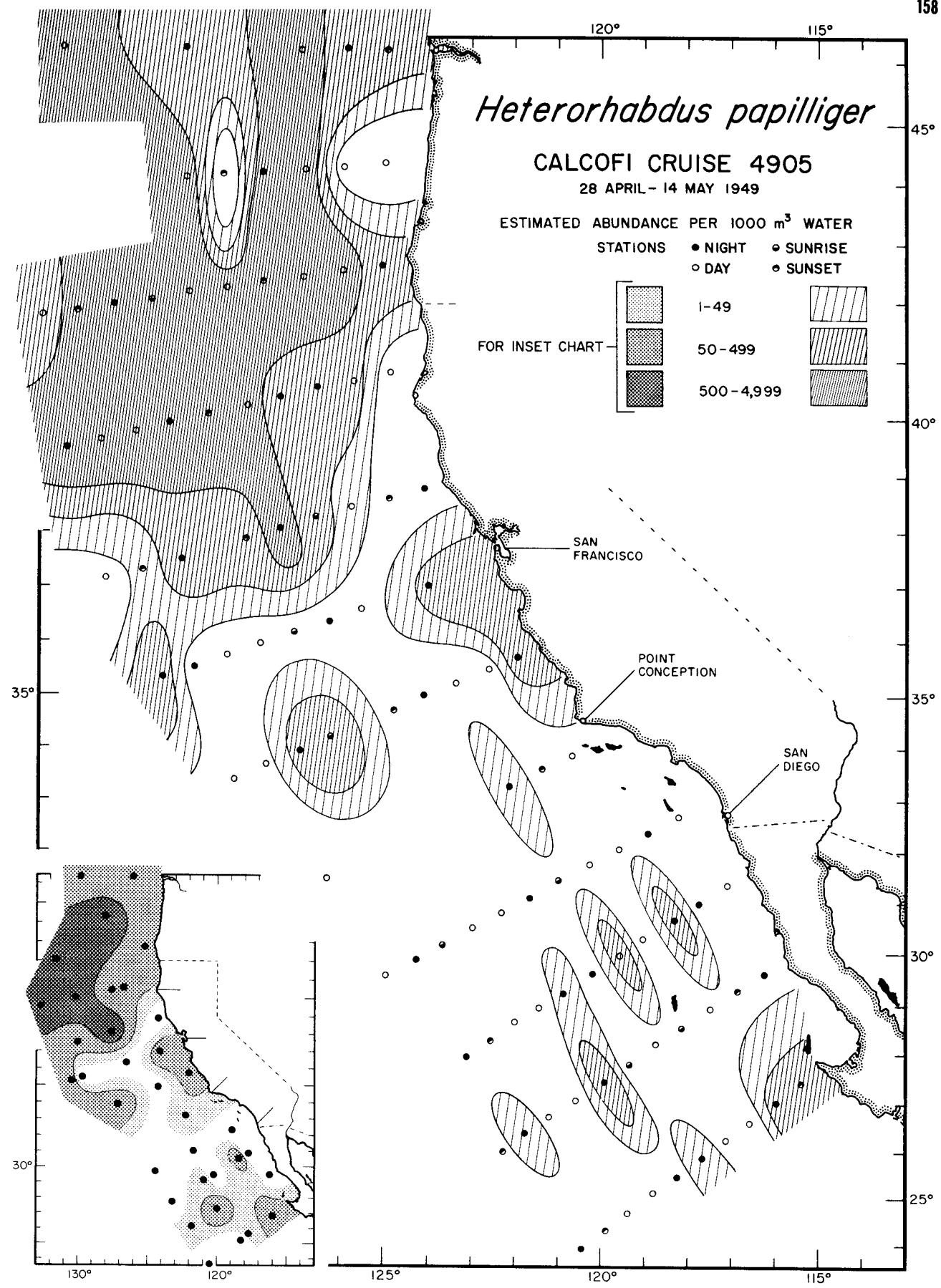
4910



Calanoida

*Haloptilis longicornis*

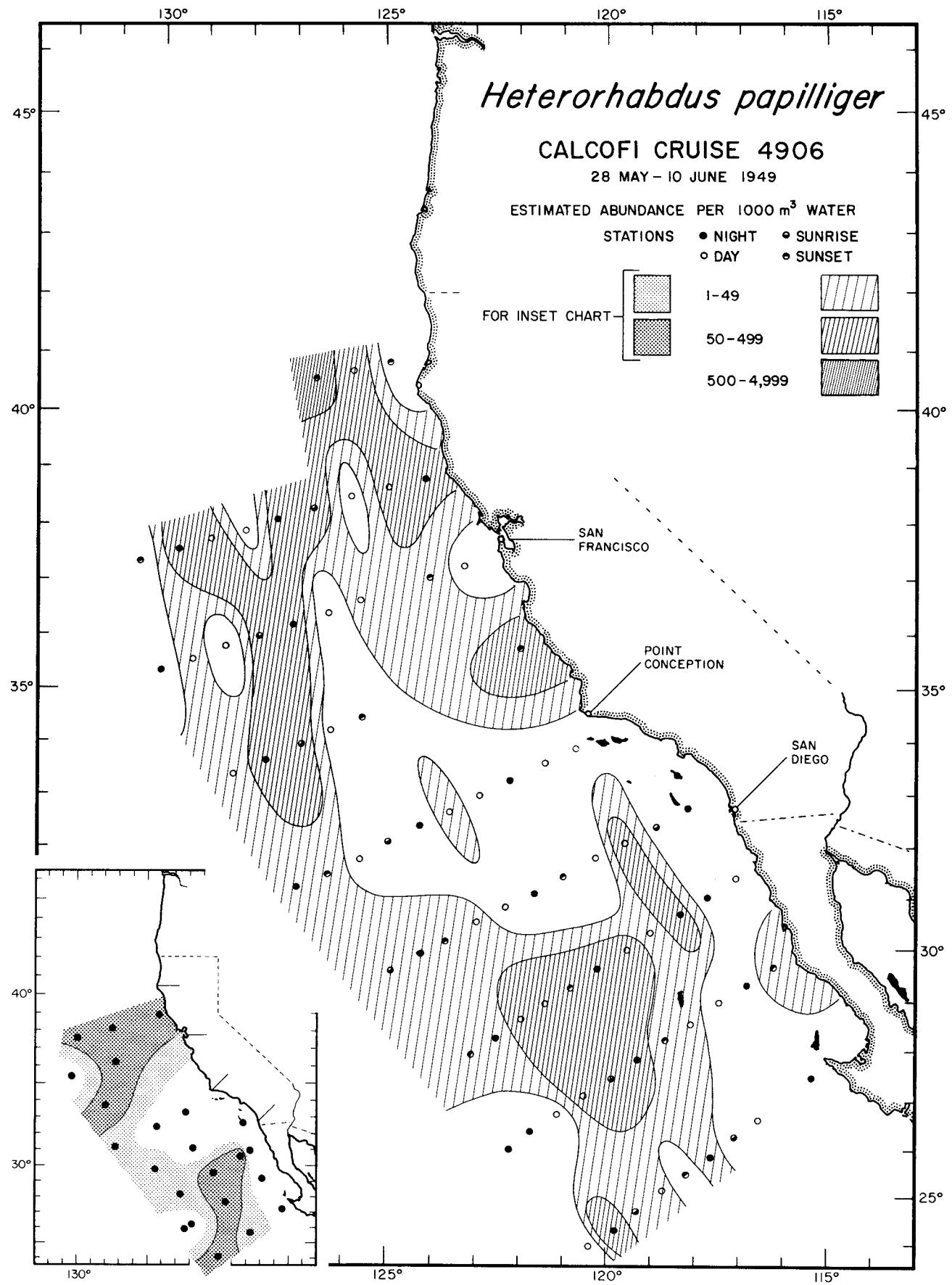
5002



Calanoida

*Heterorhabdus papilliger*

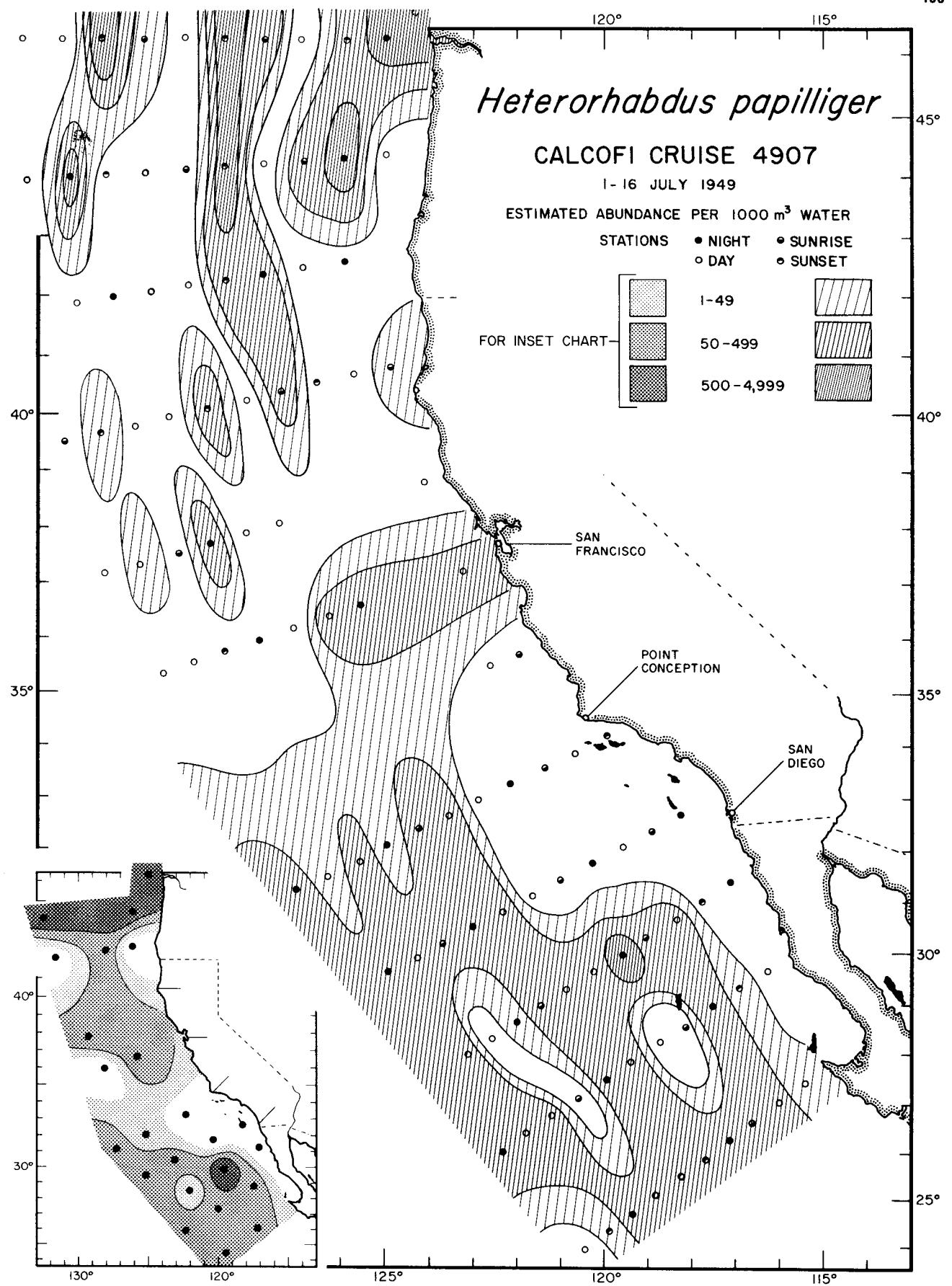
4905



Calanoida

*Heterorhabdus papilliger*

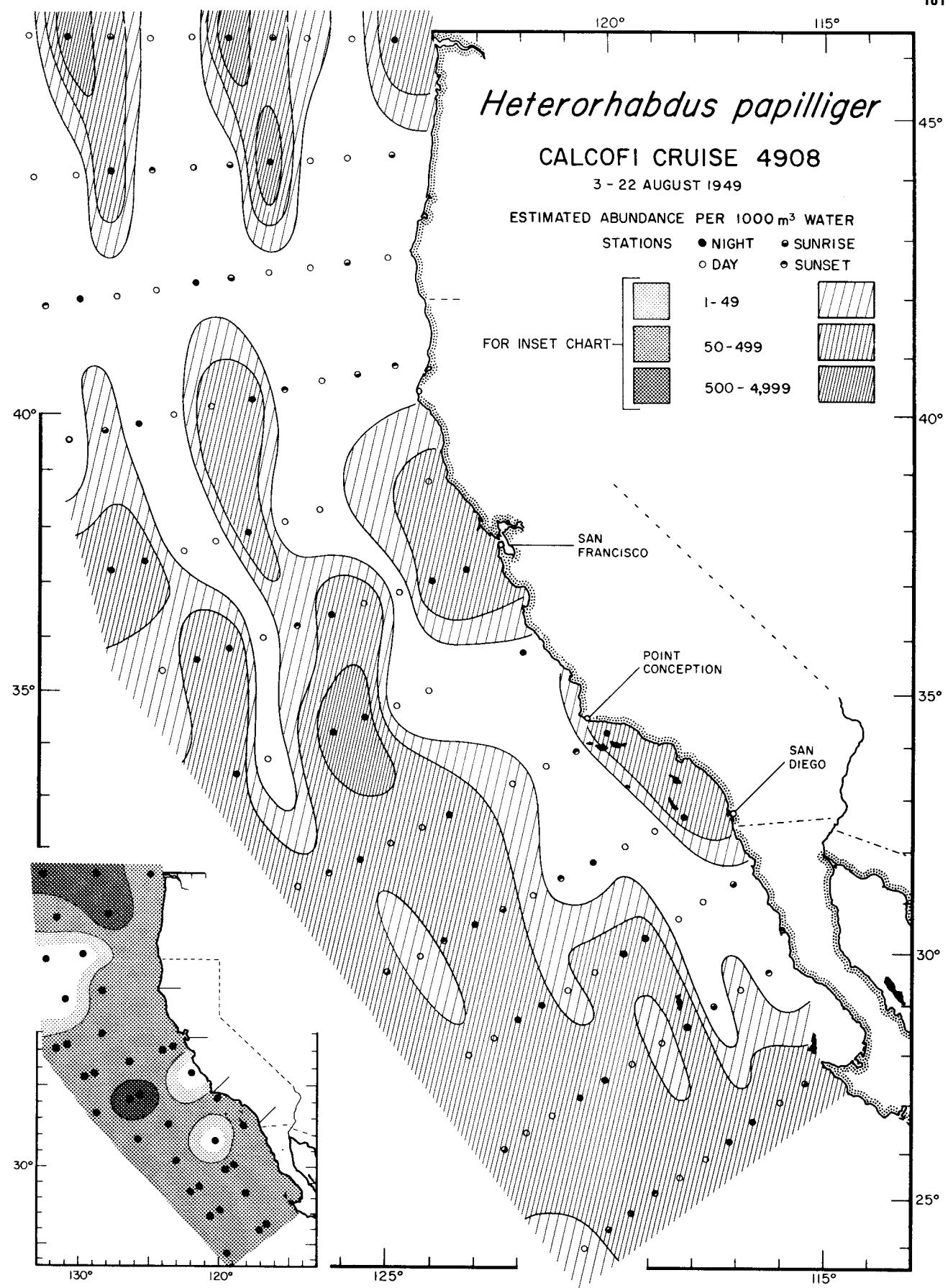
4906



Calanoida

*Heterorhabdus papilliger*

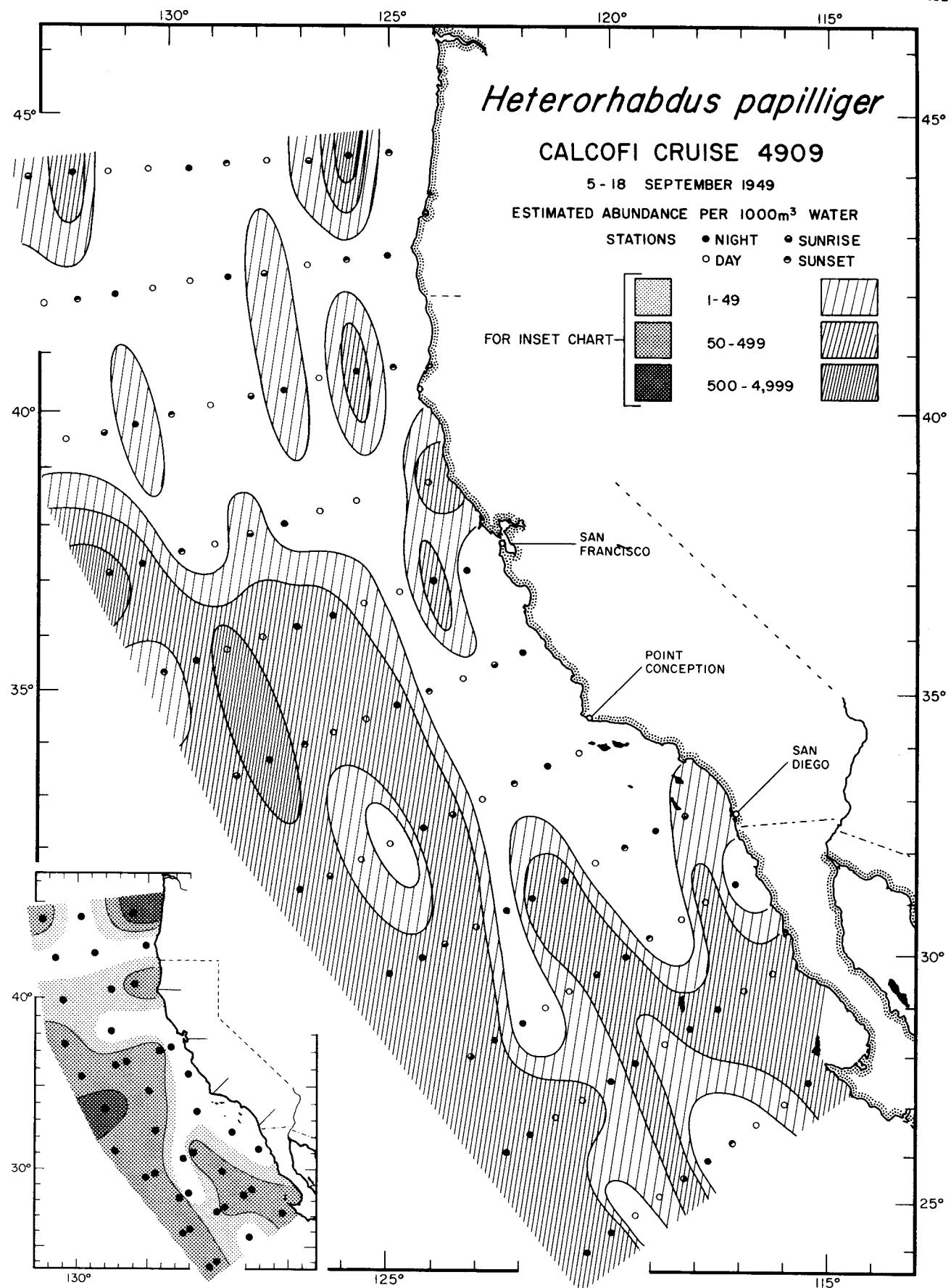
4907



Calanoida

*Heterorhabdus papilliger*

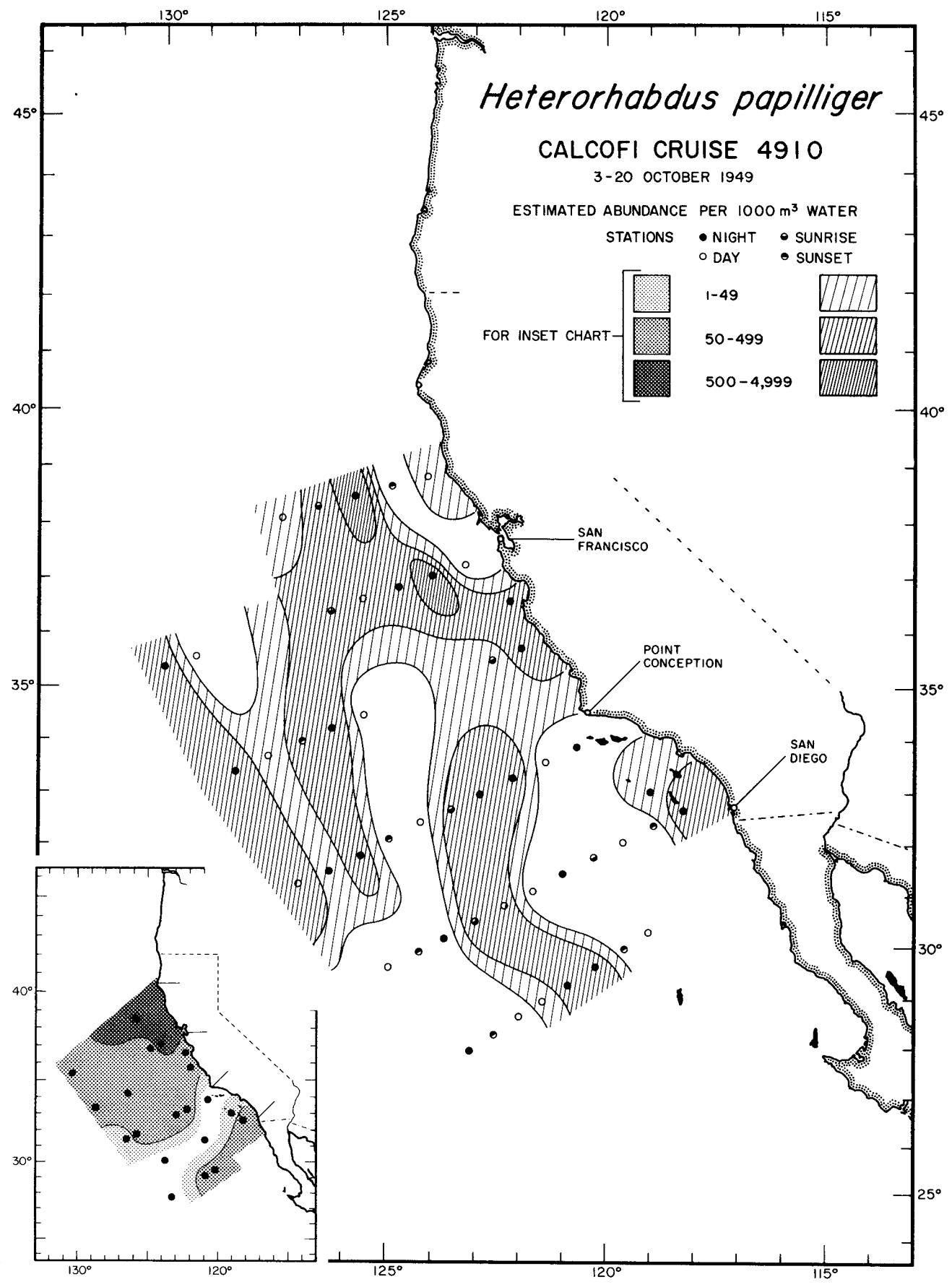
4908



Calanoida

*Heterorhabdus papilliger*

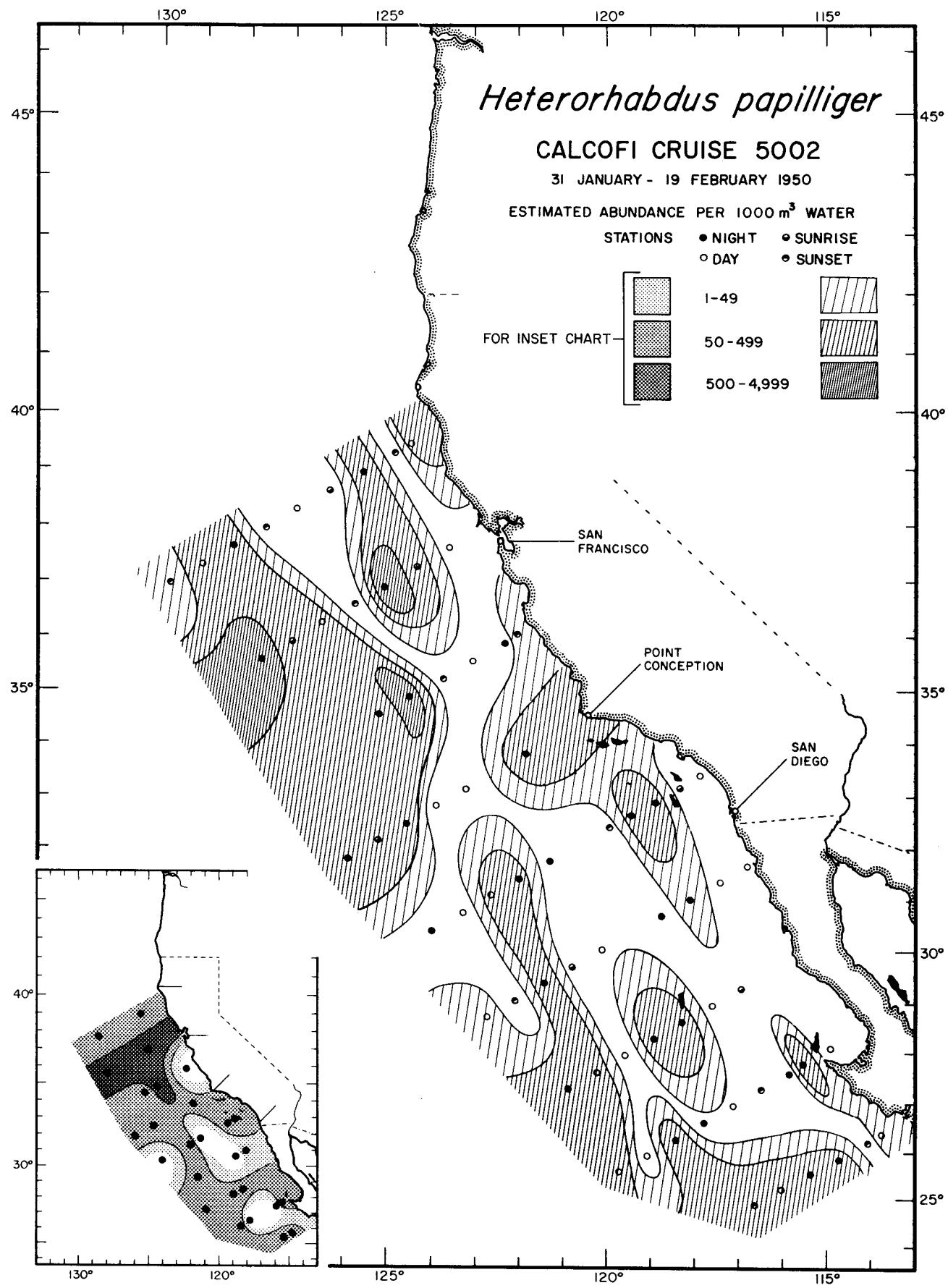
4909



Calanoida

*Heterorhabdus papilliger*

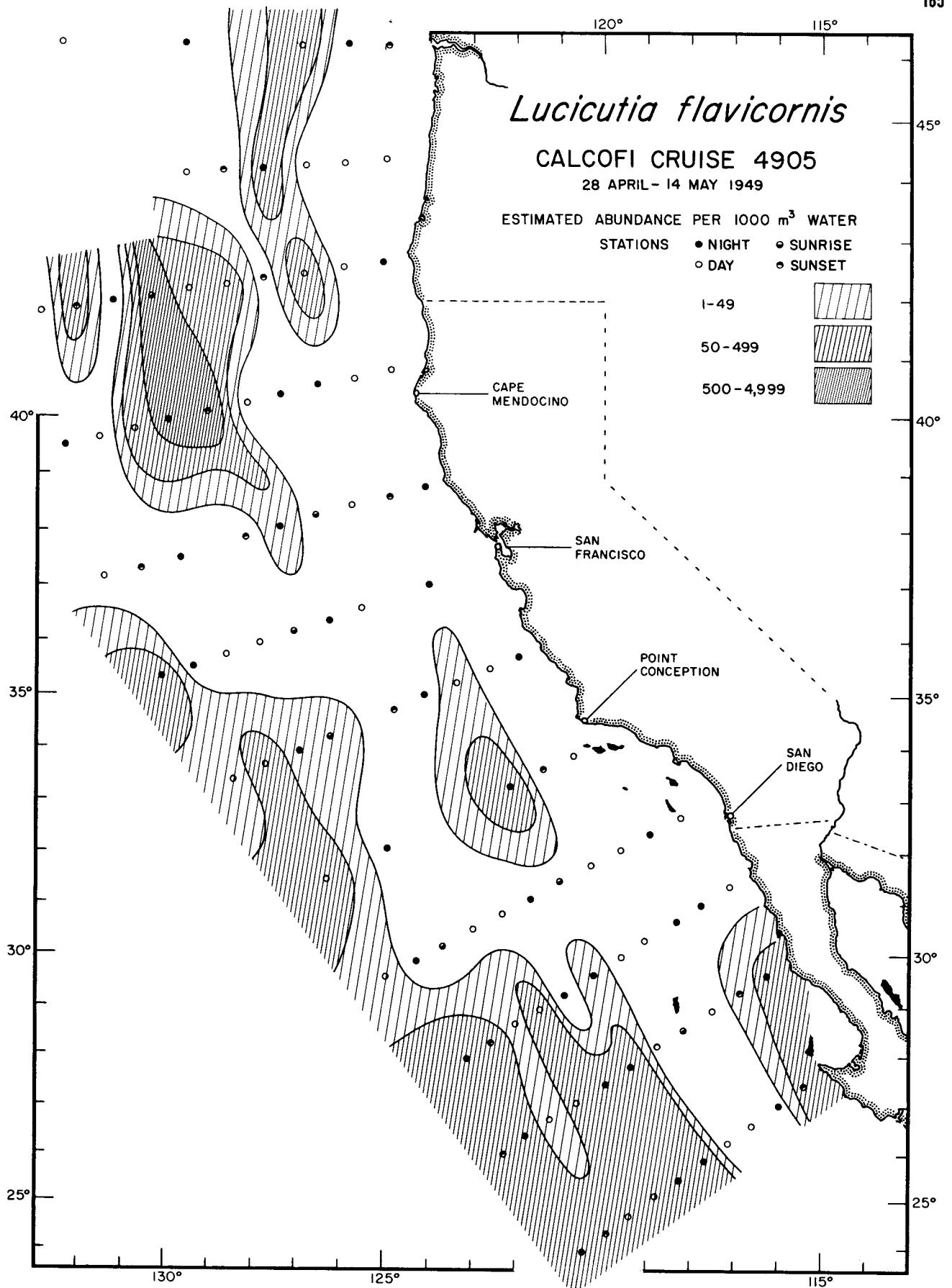
4910



Calanoida

*Heterorhabdus papilliger*

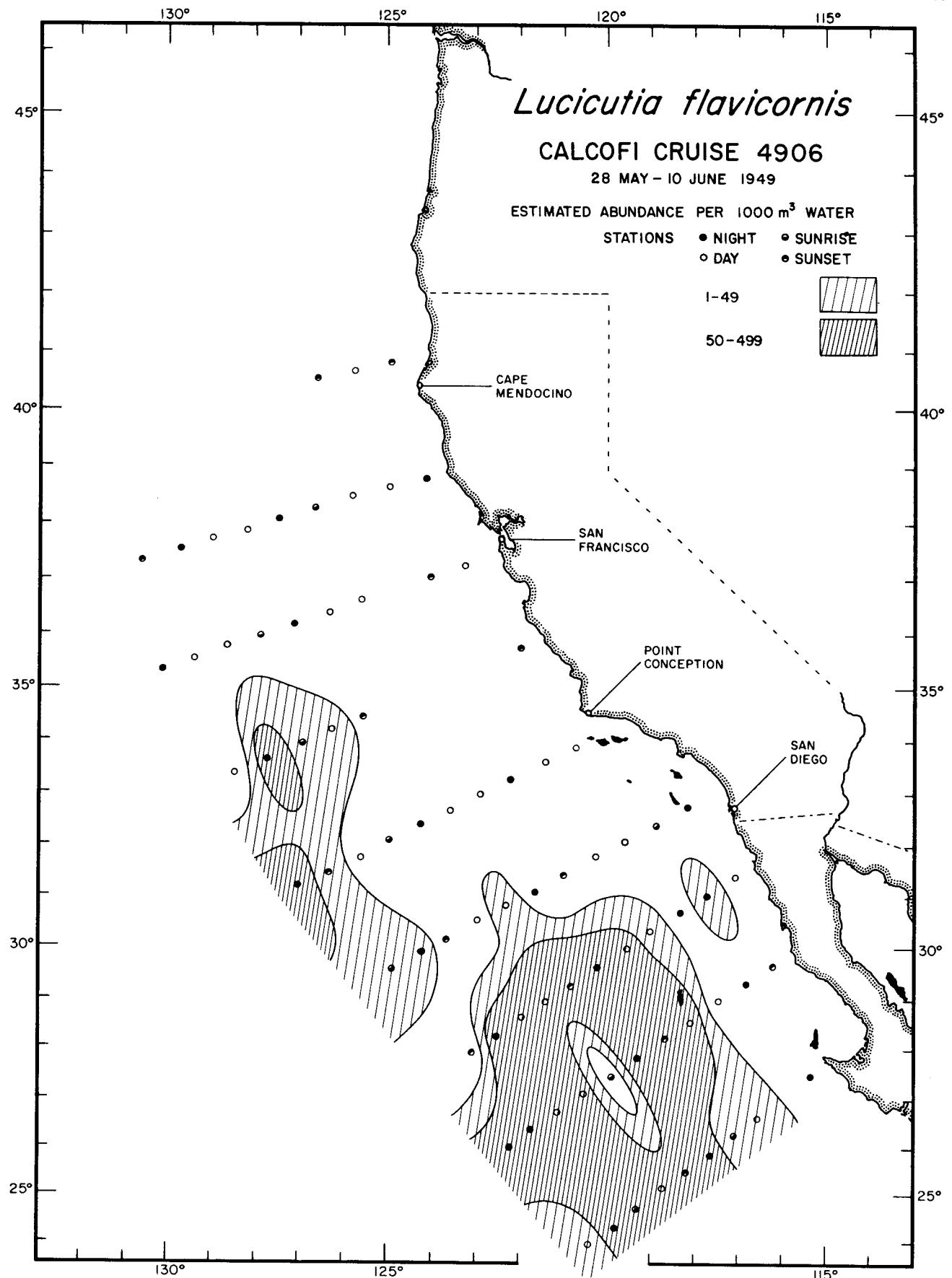
5002



Calanoida

*Lucicutia flavigornis*

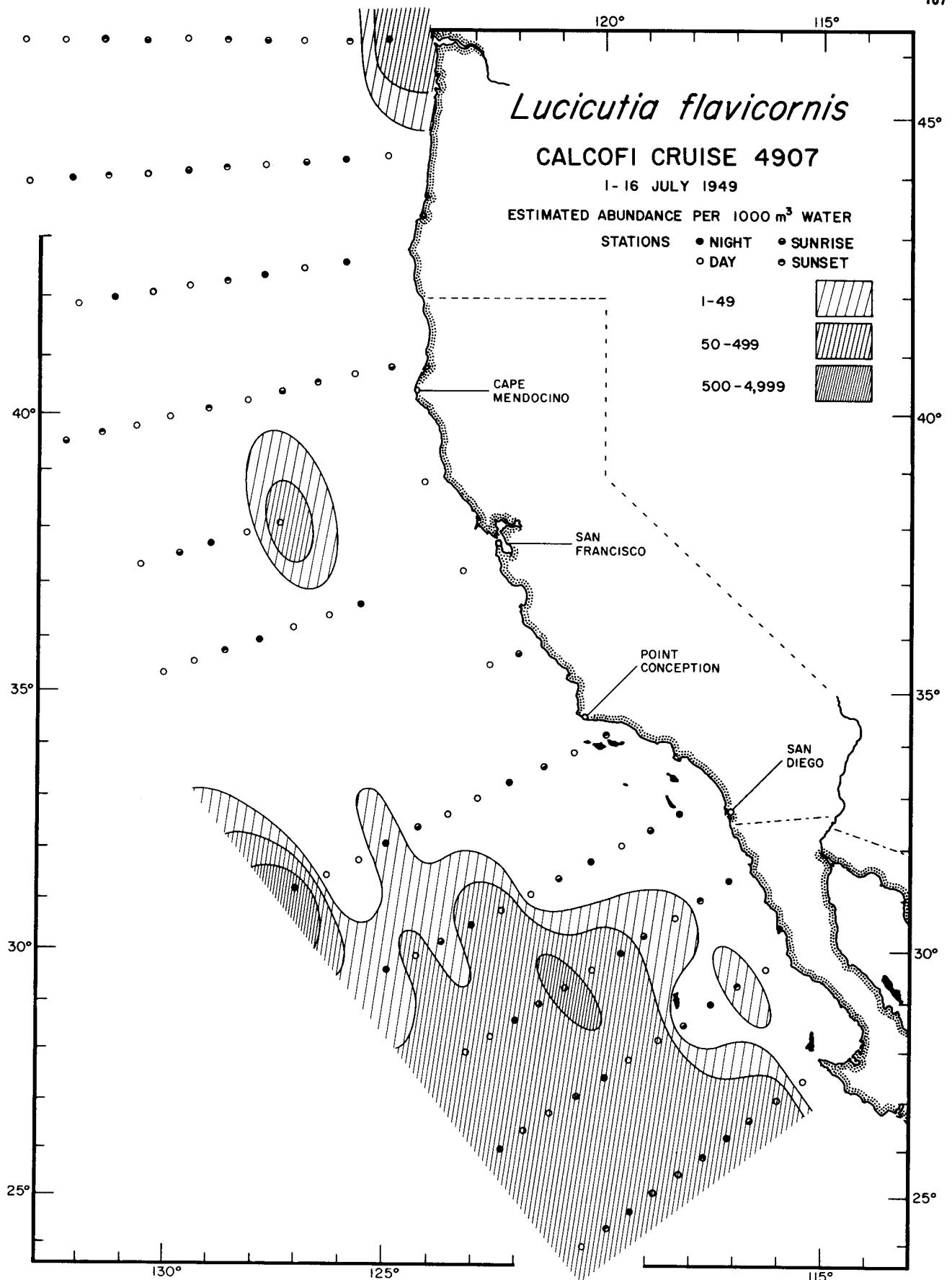
4905



Calanoida

*Lucicutia flavigornis*

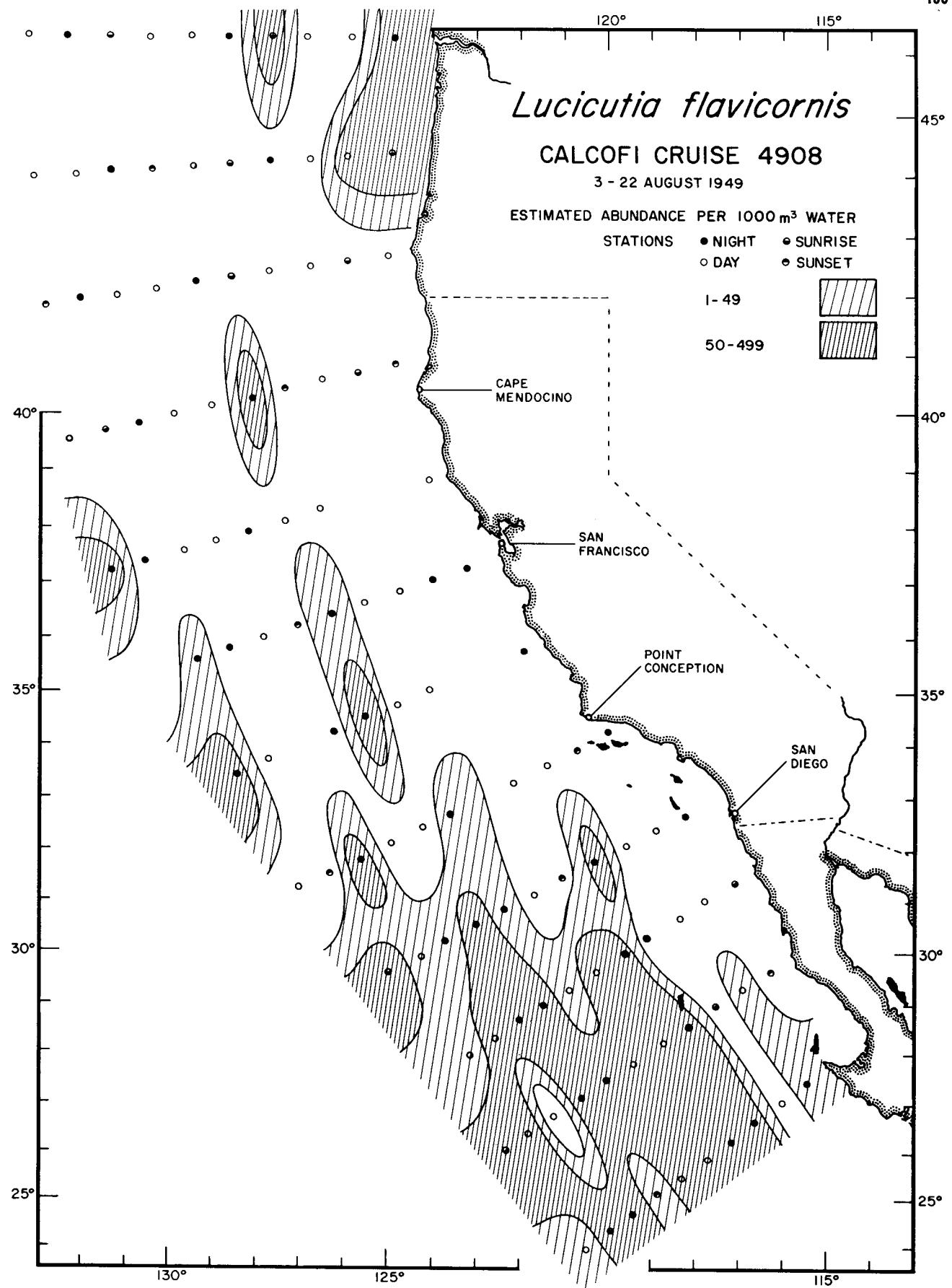
4906



Calanoida

*Lucicutia flavigornis*

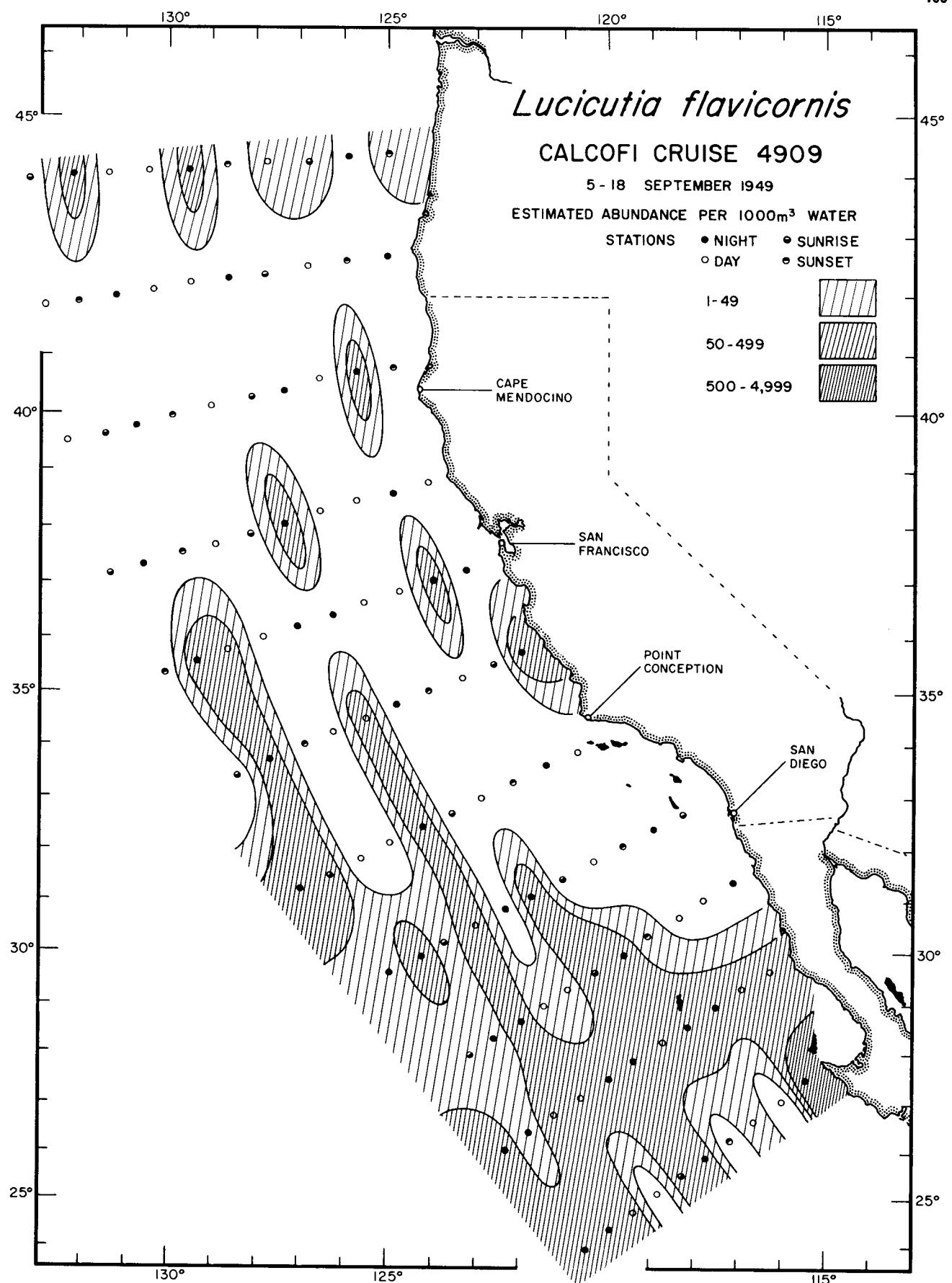
4907



Calanoida

*Lucicutia flavigornis*

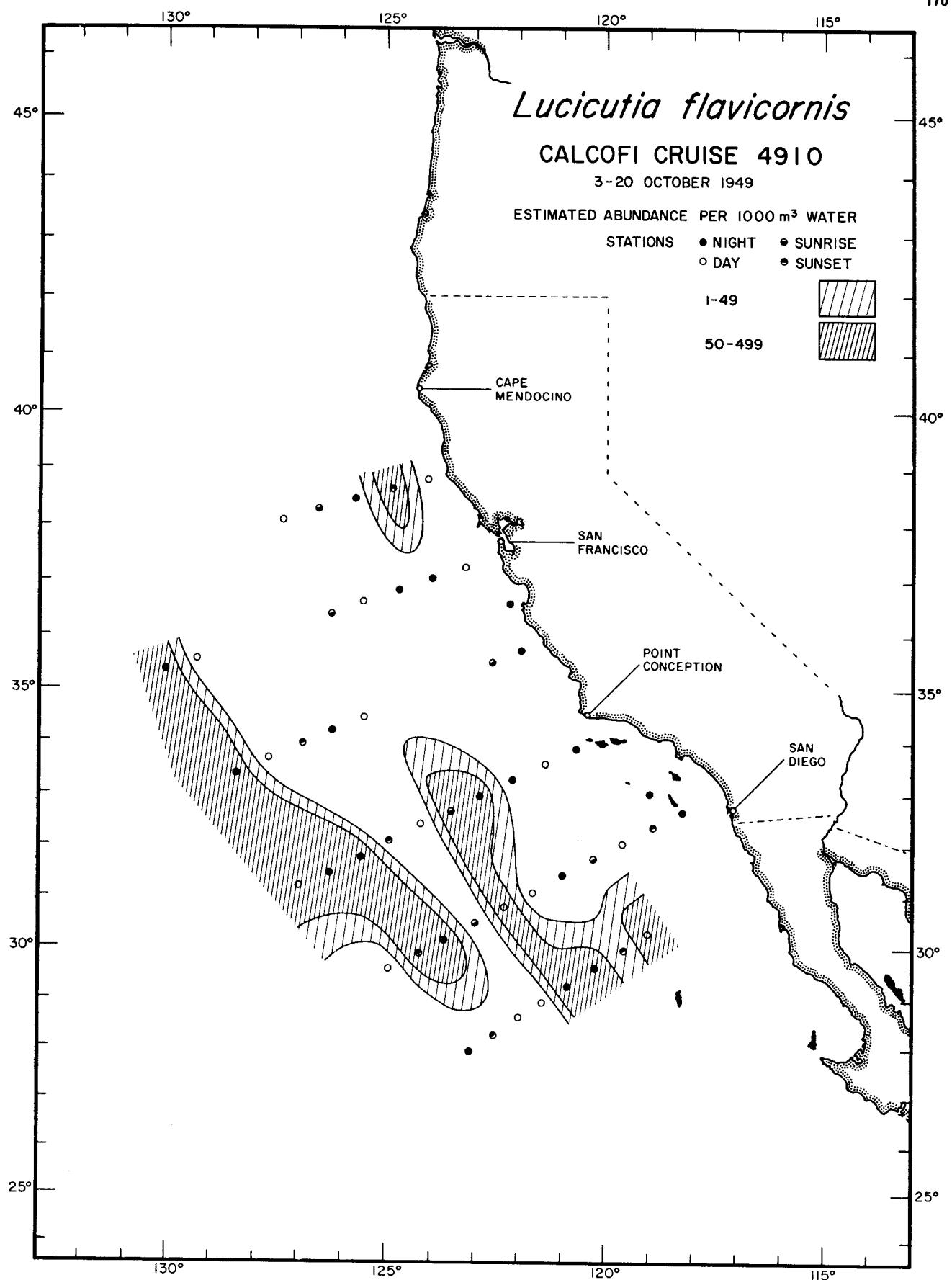
4908



Calanoida

*Lucicutia flavigornis*

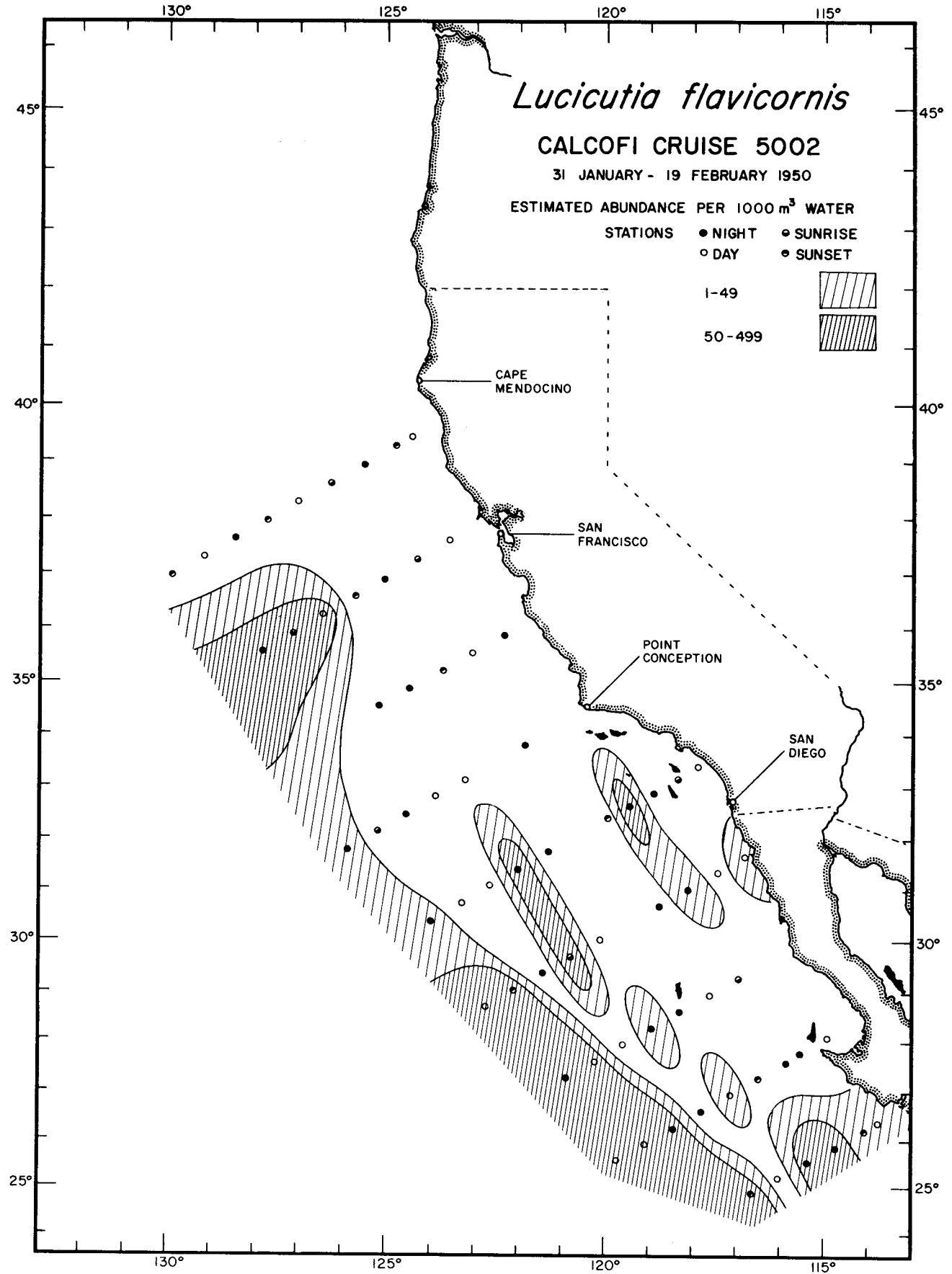
4909



Calanoida

*Lucicutia flavigornis*

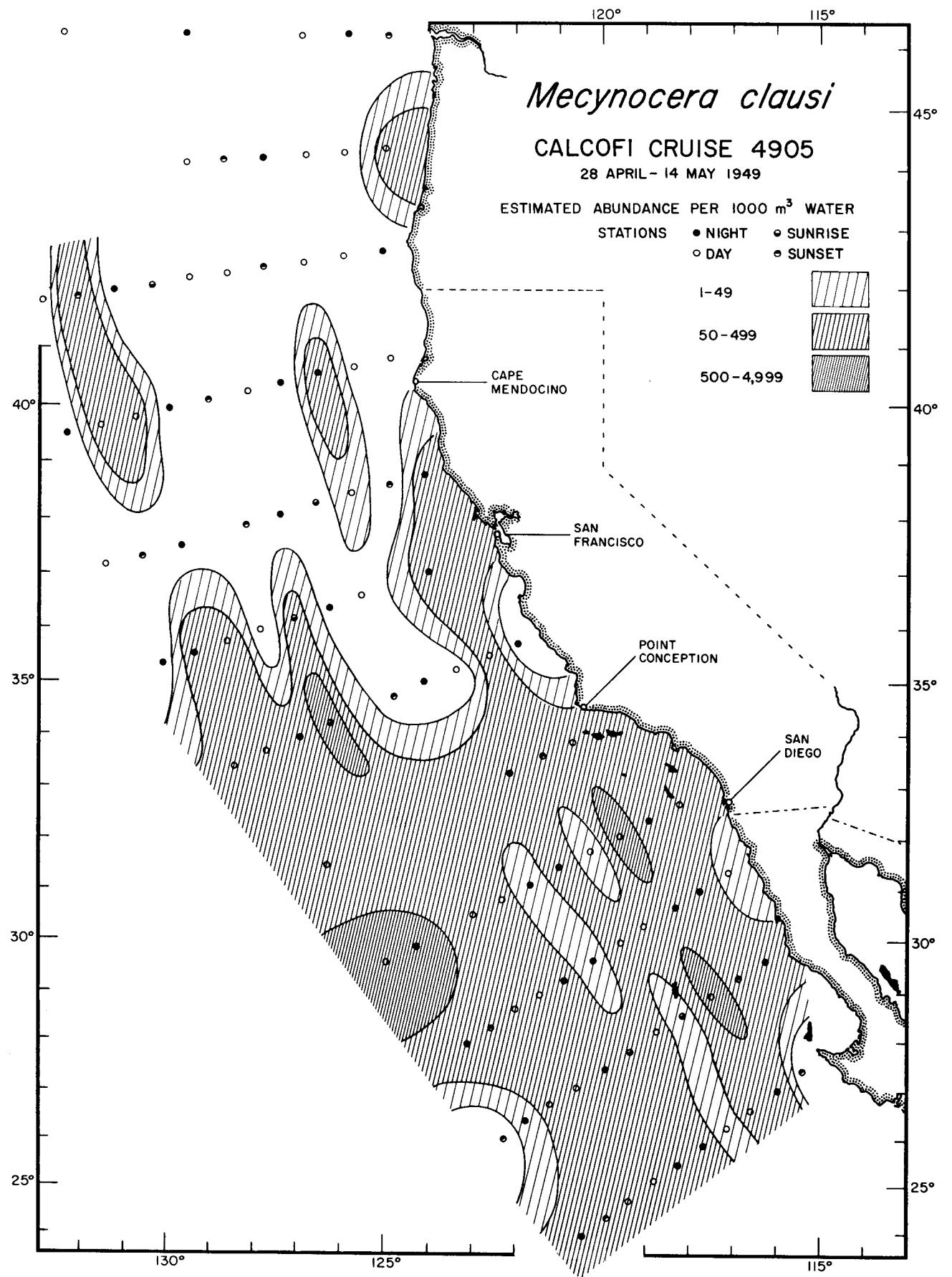
4910



Calanoida

*Lucicutia flavigornis*

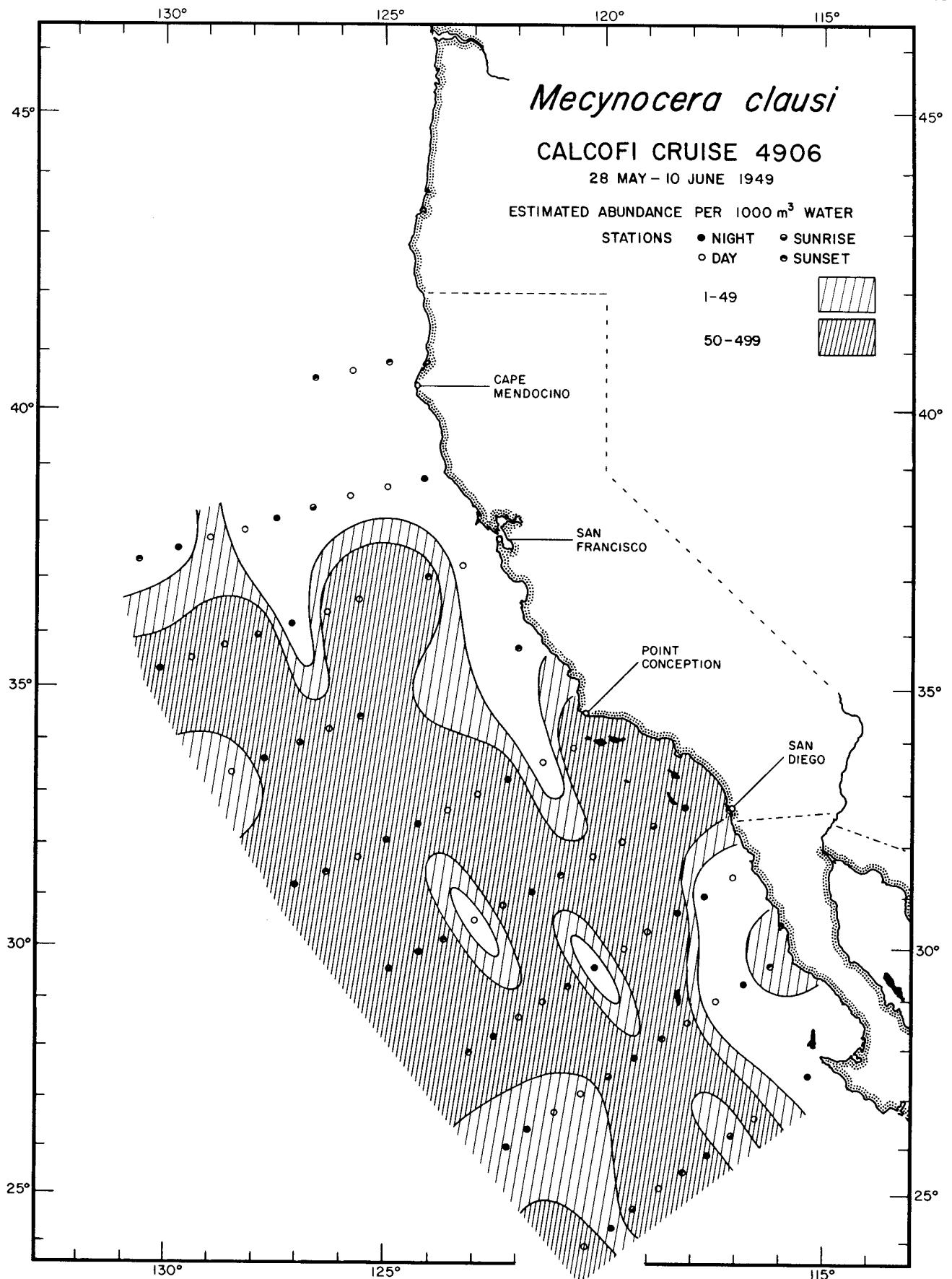
5002



Calanoida

*Mecynocera clausi*

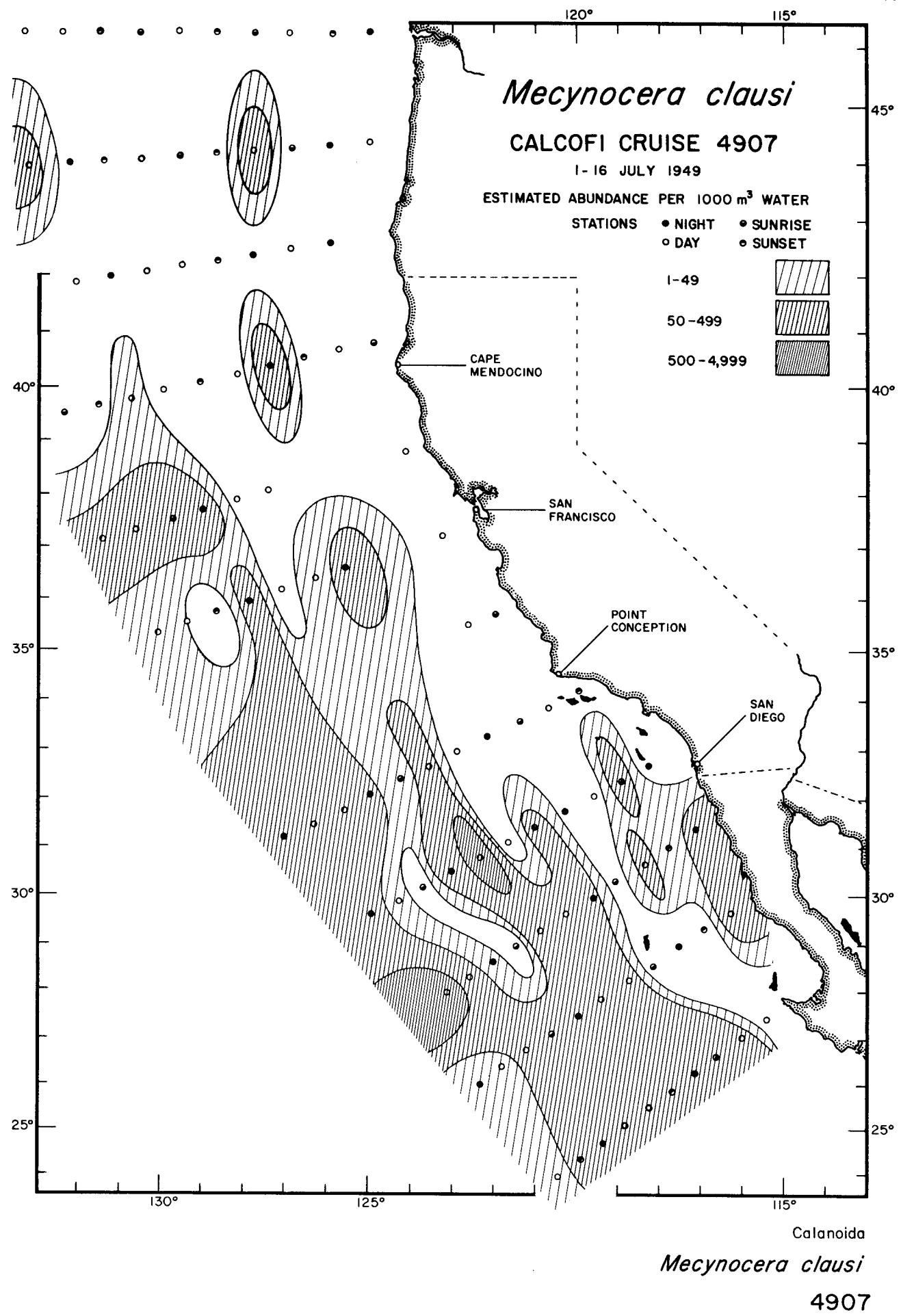
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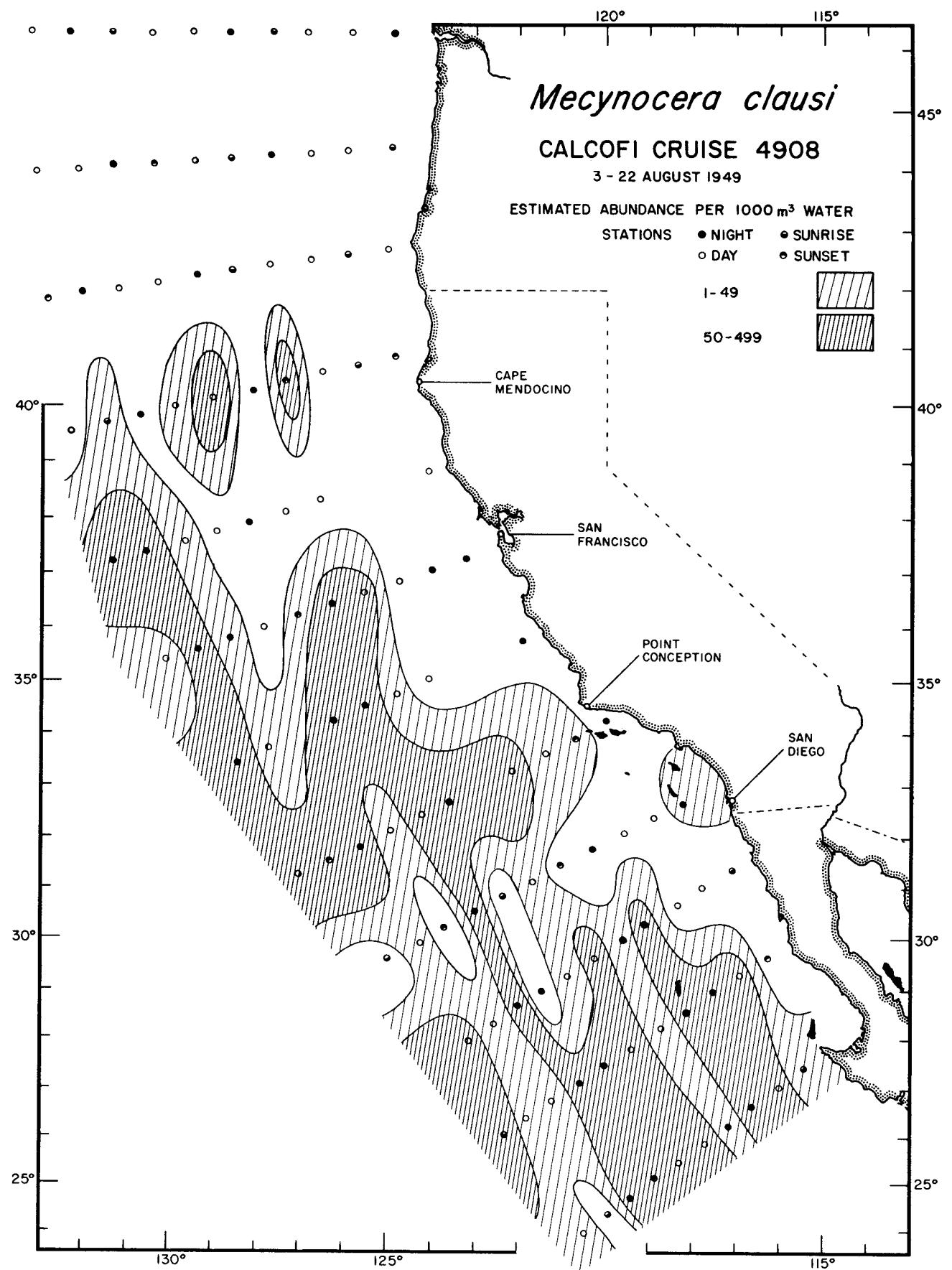


Calanoida

*Mecynocera clausi*

4906

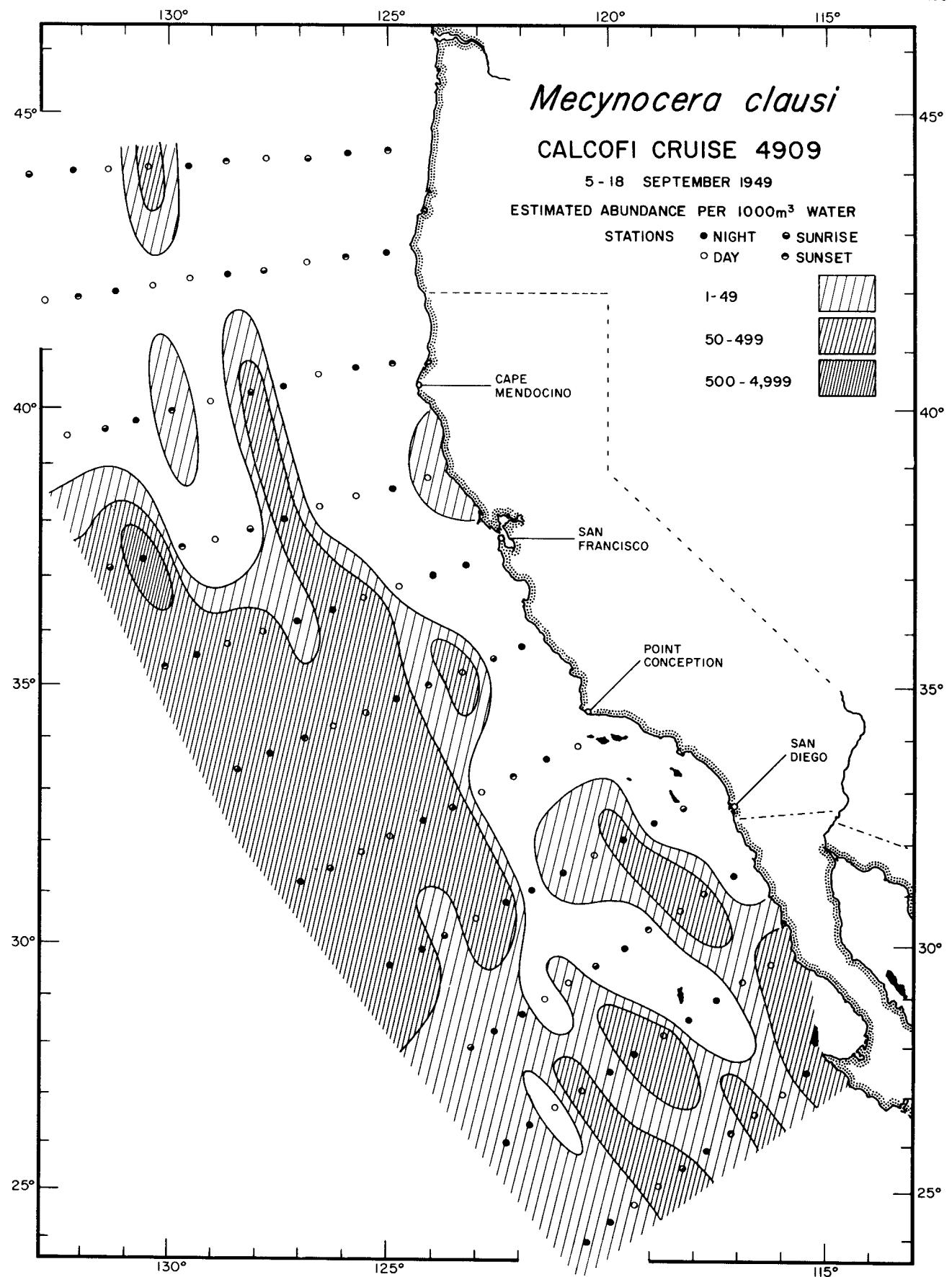




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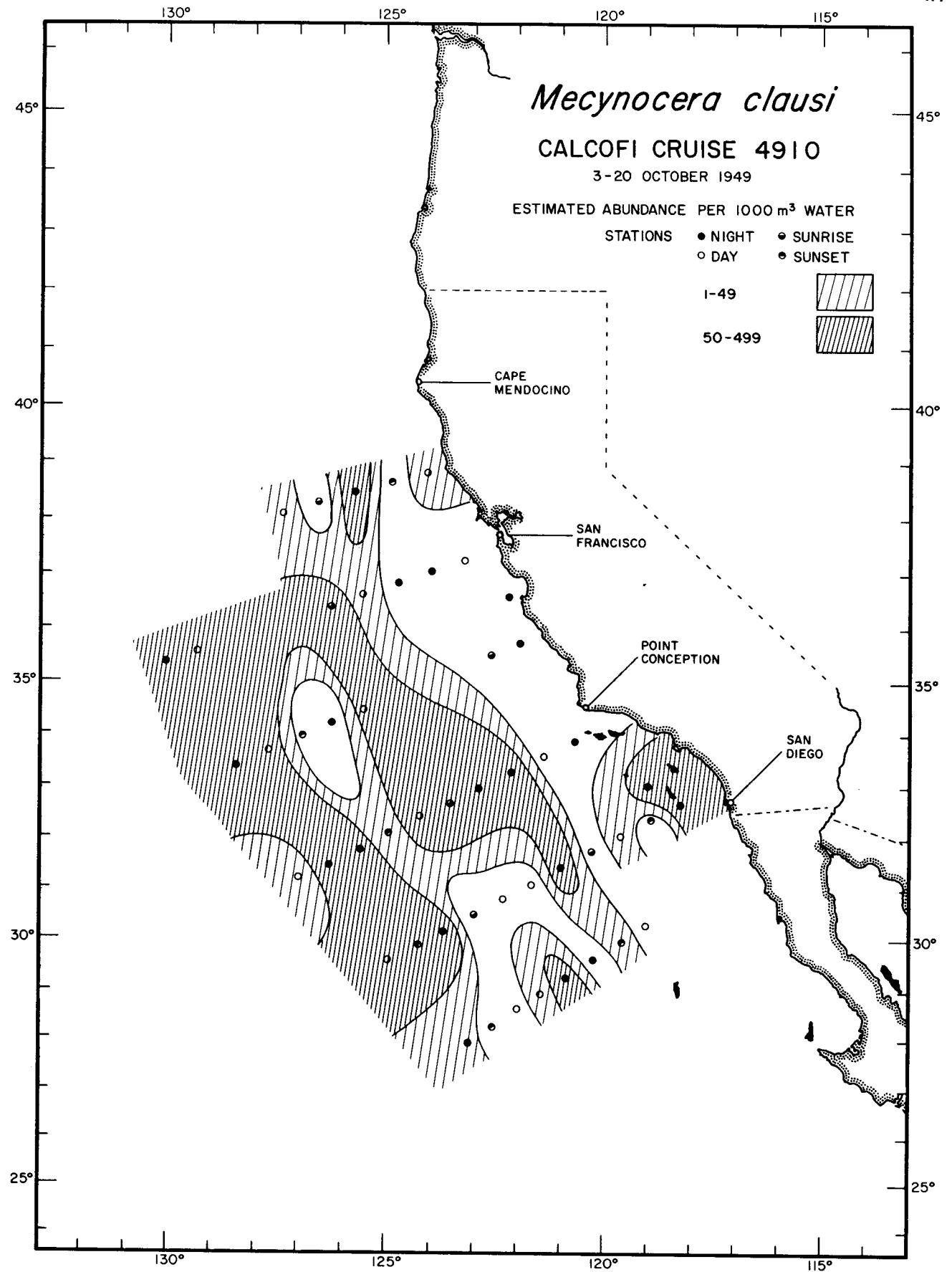
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*Mecynocera clausi*

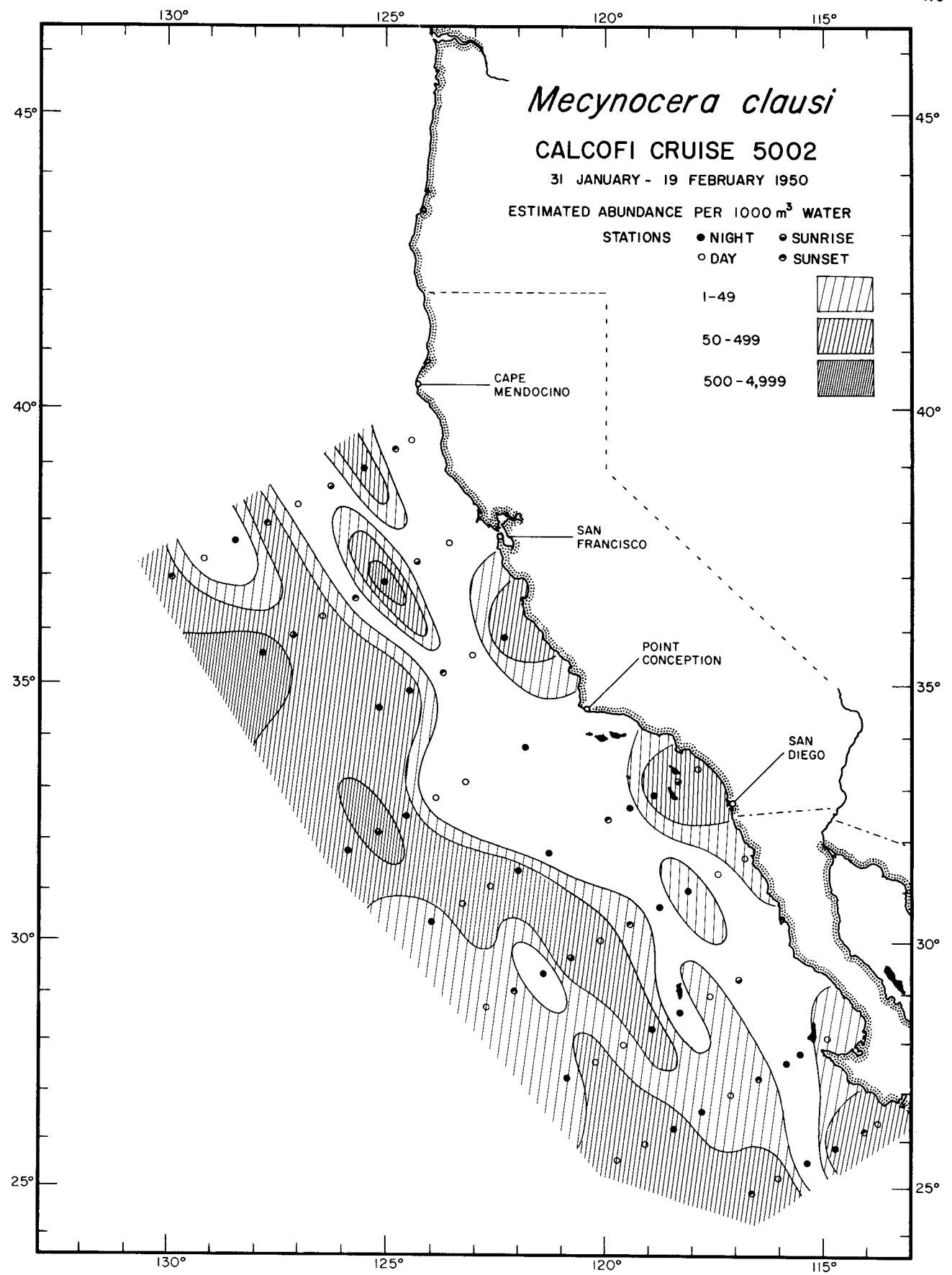
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*Mecynocera clausi*

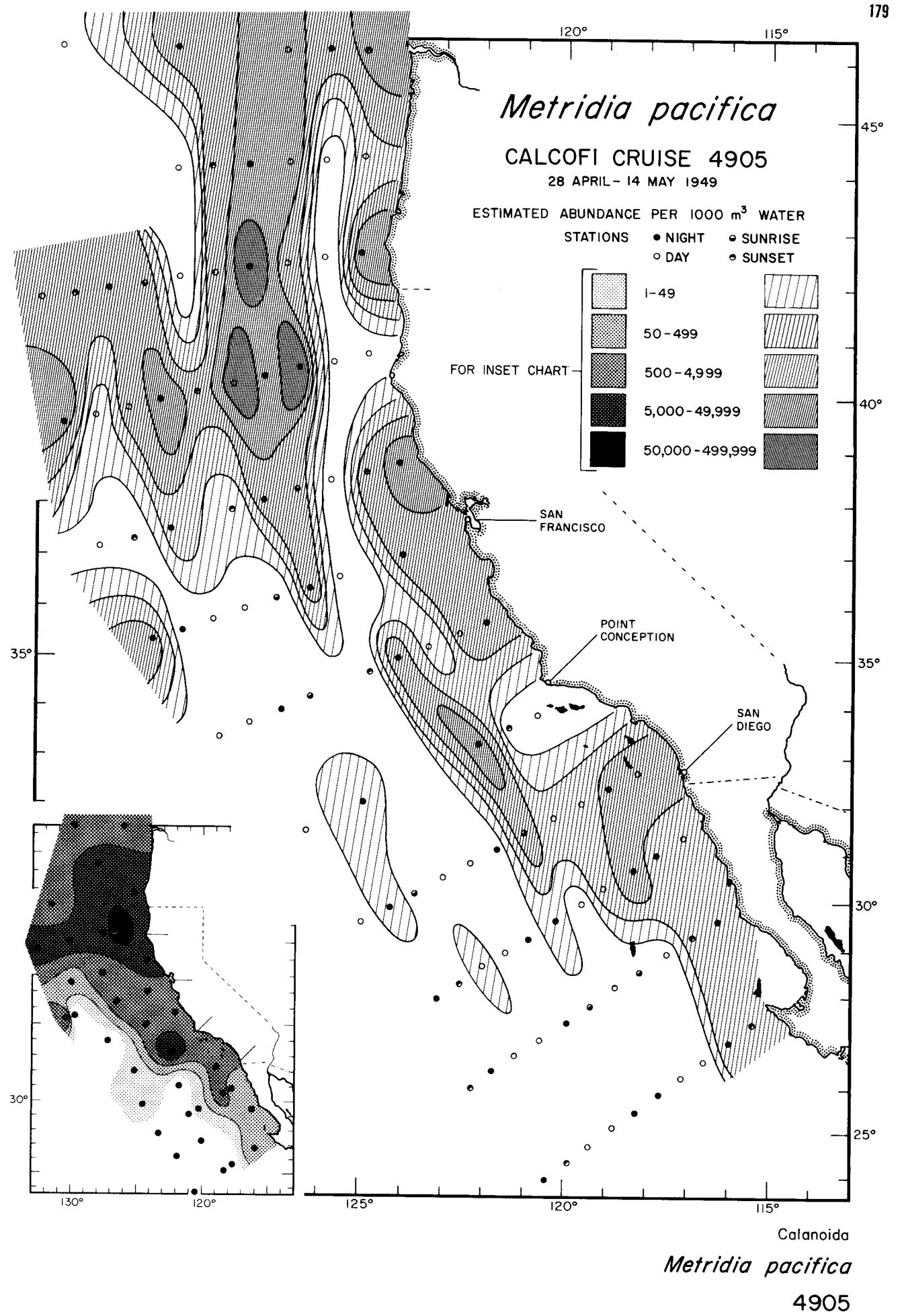
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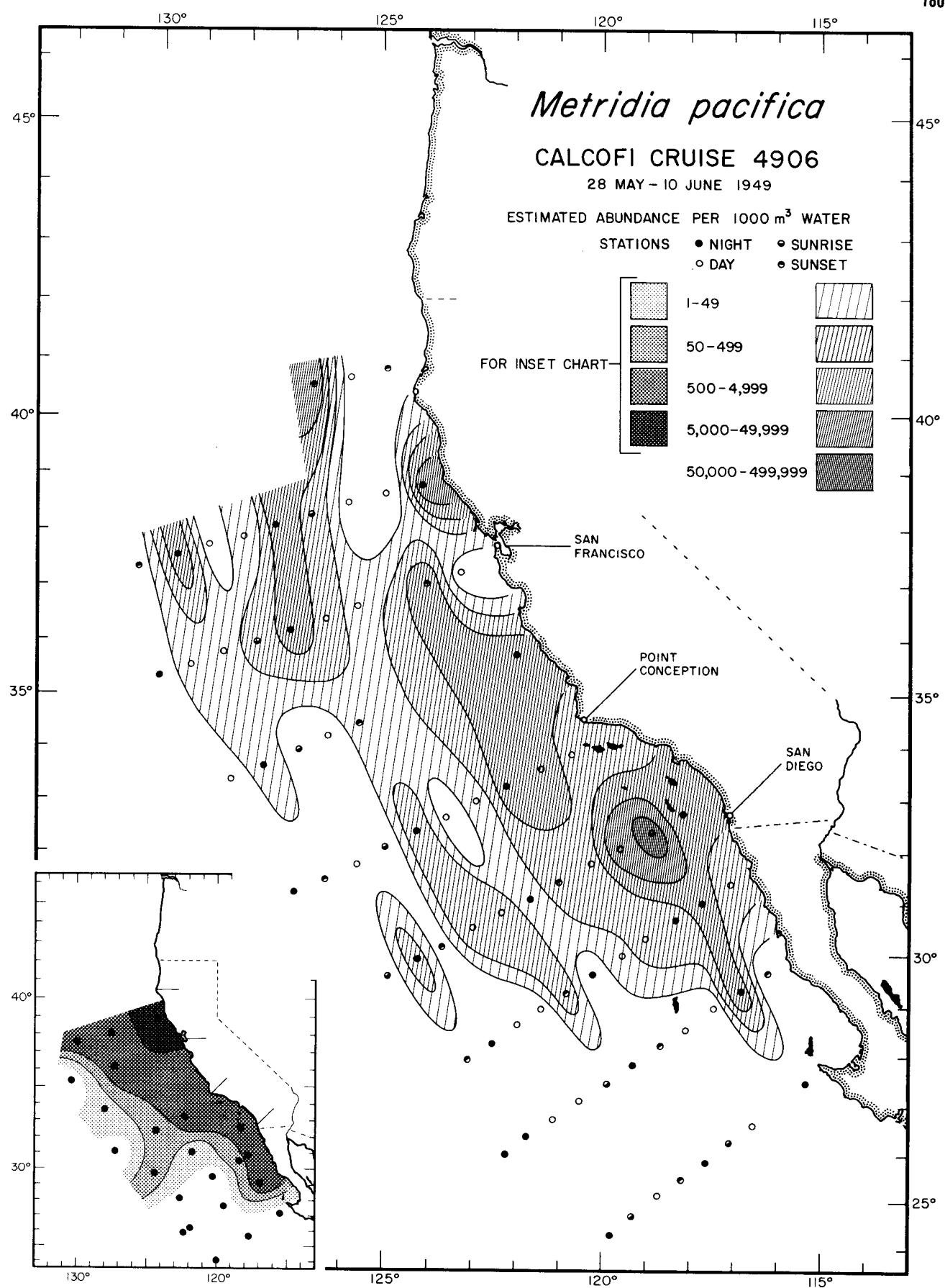


Calanoida

*Mecynocera clausi*

5002

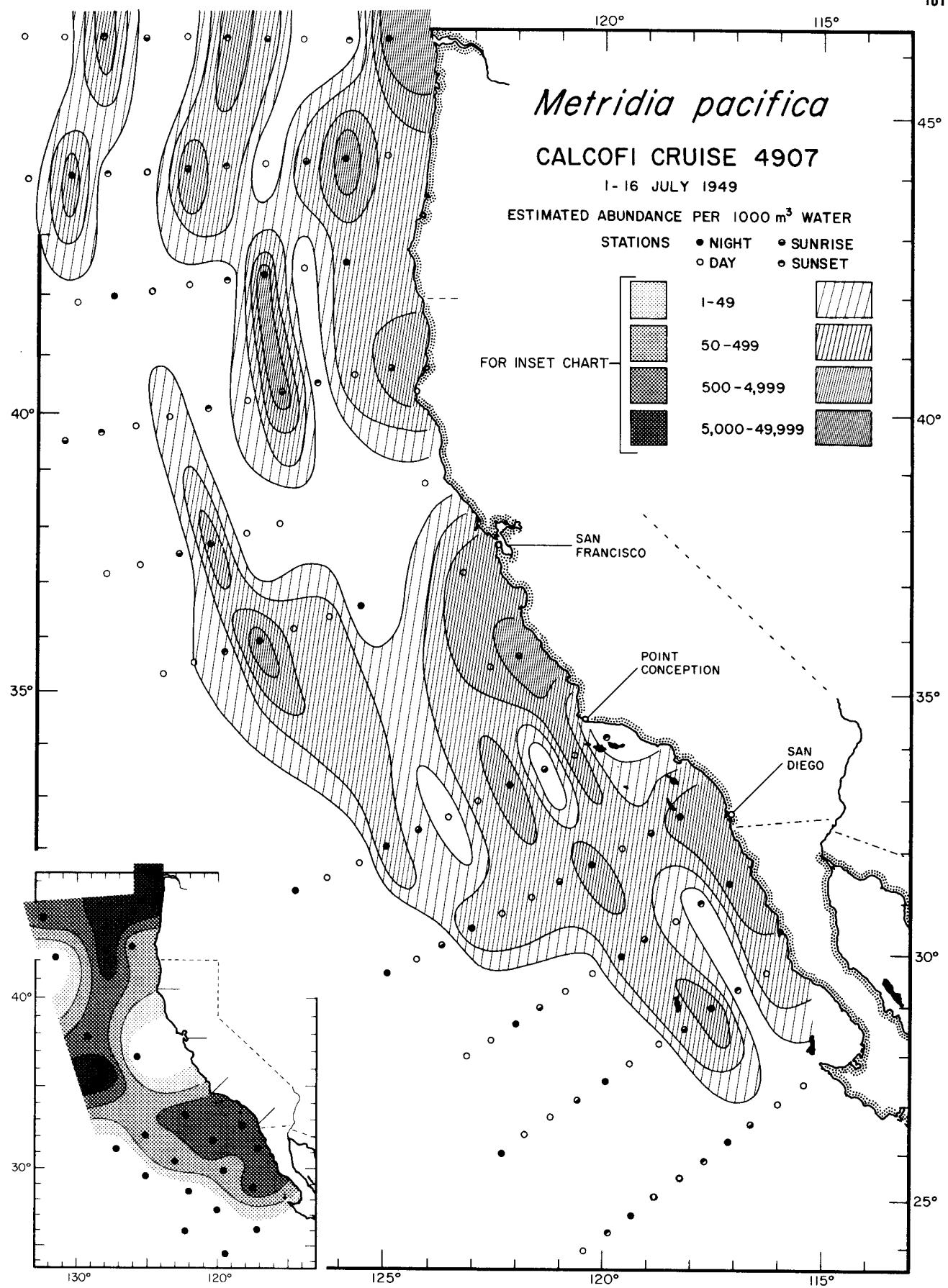




Calanoida

*Metridia pacifica*

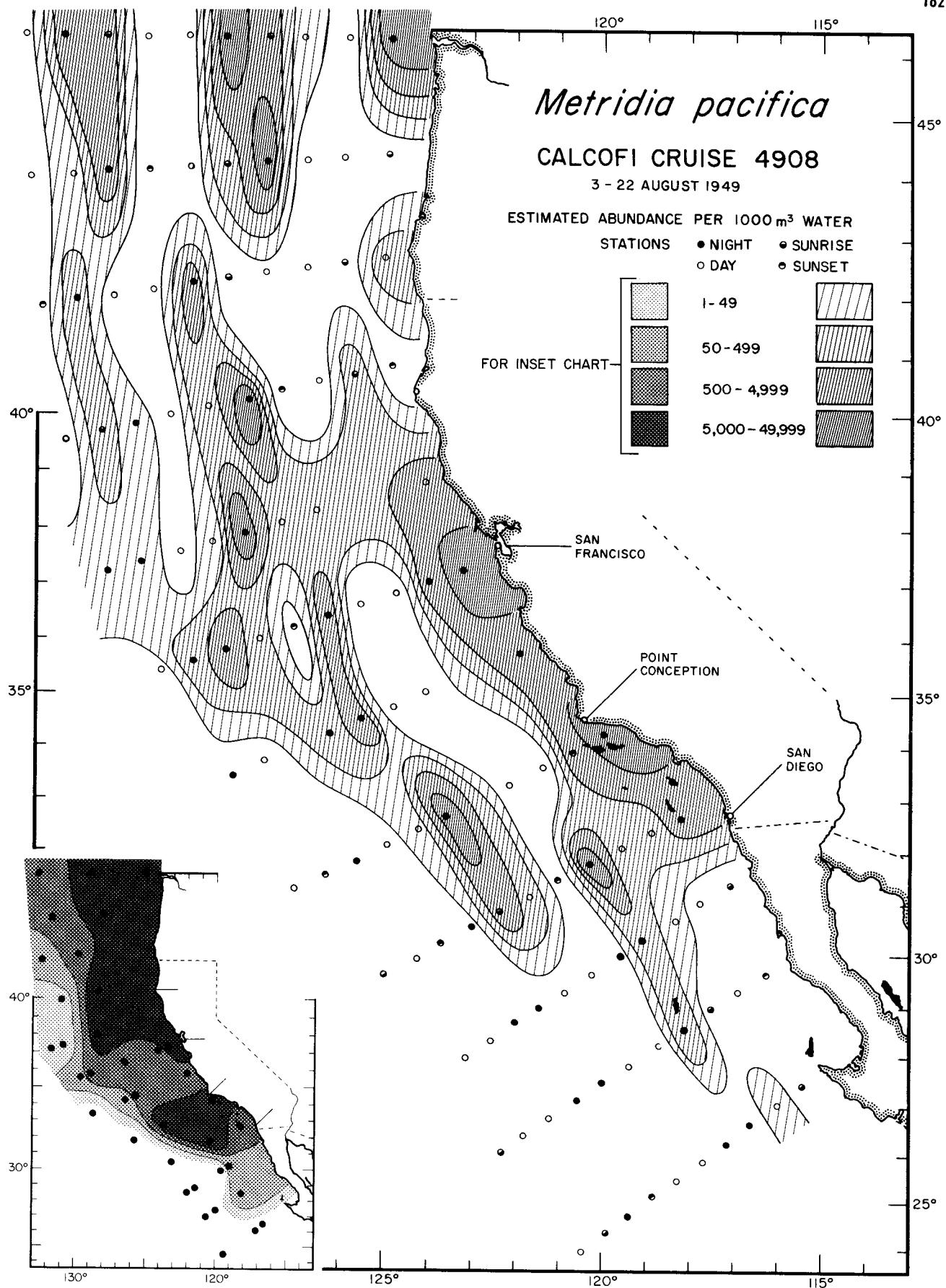
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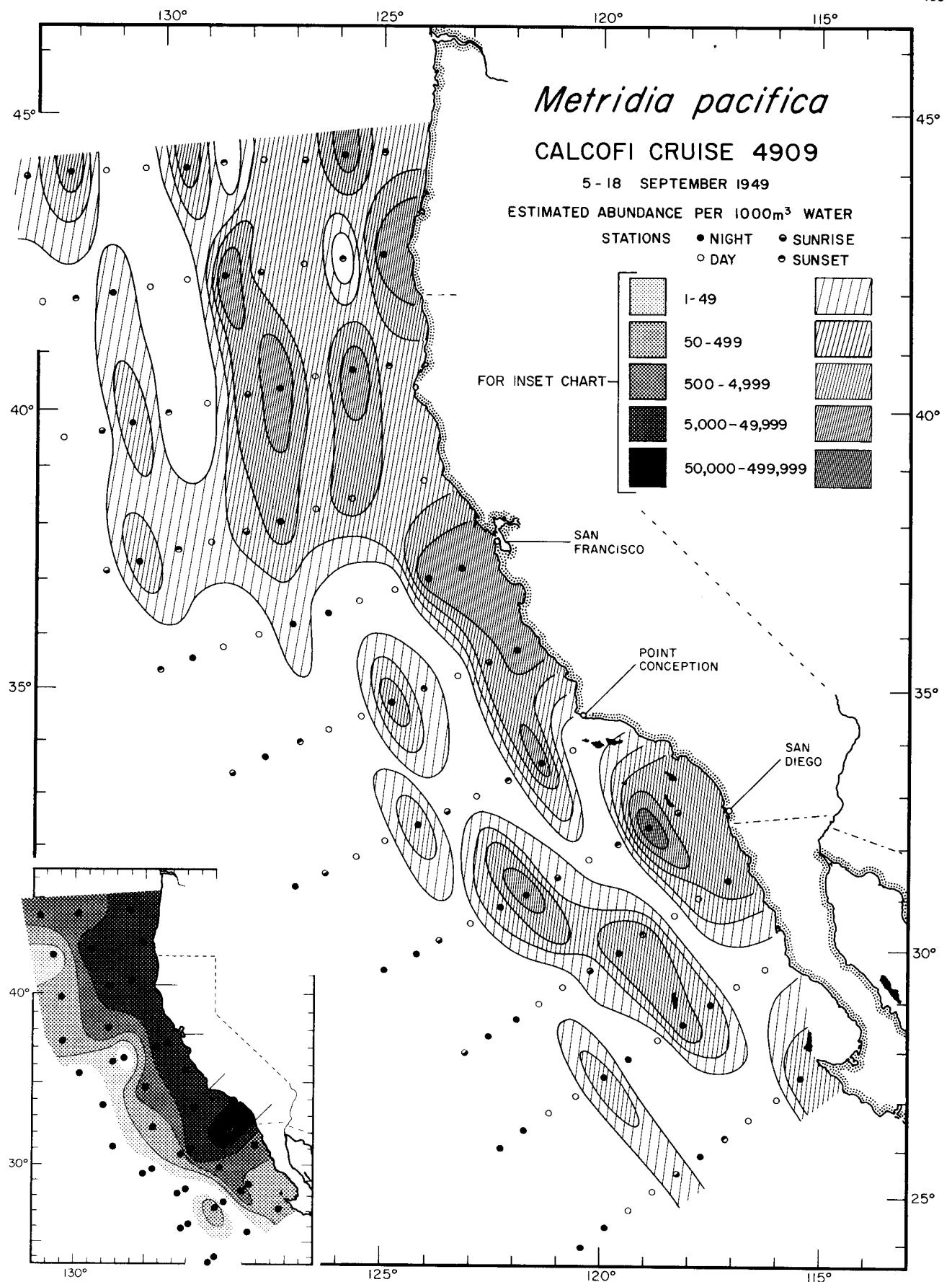
Calanoida

*Metridia pacifica*

4907

*Metridia pacifica*

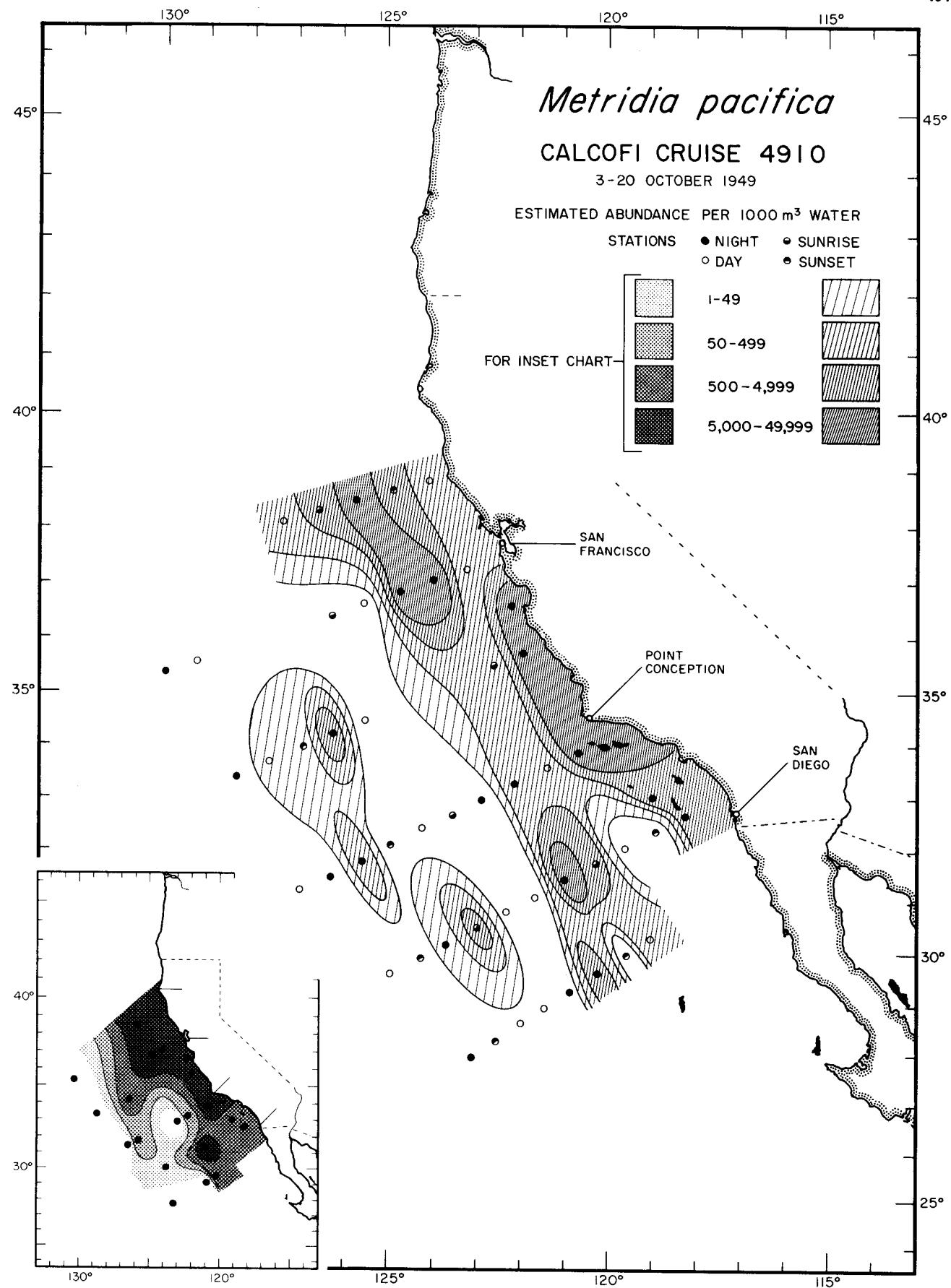
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Calanoida

*Metridia pacifica*

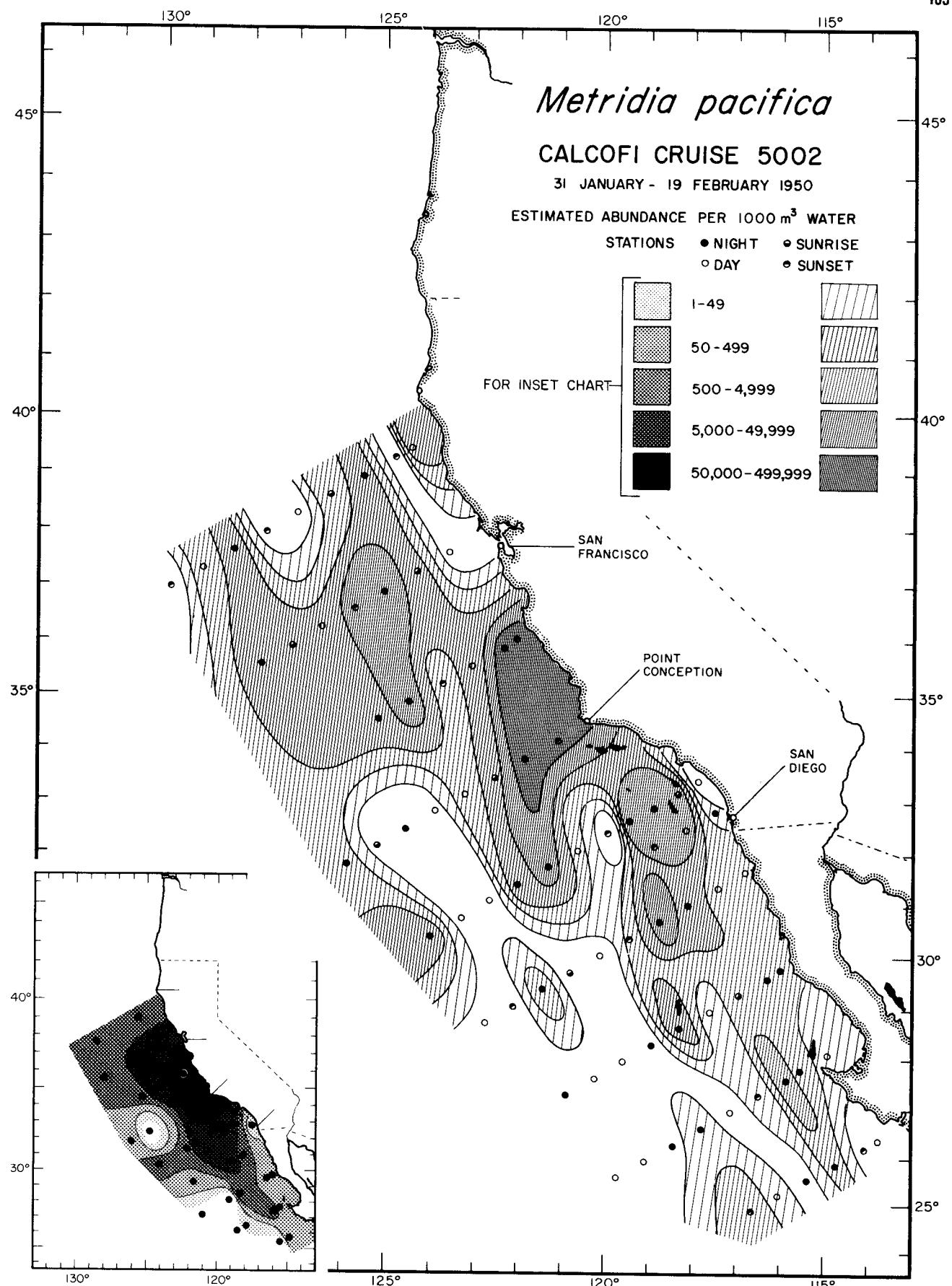
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Calanoida

*Metridia pacifica*

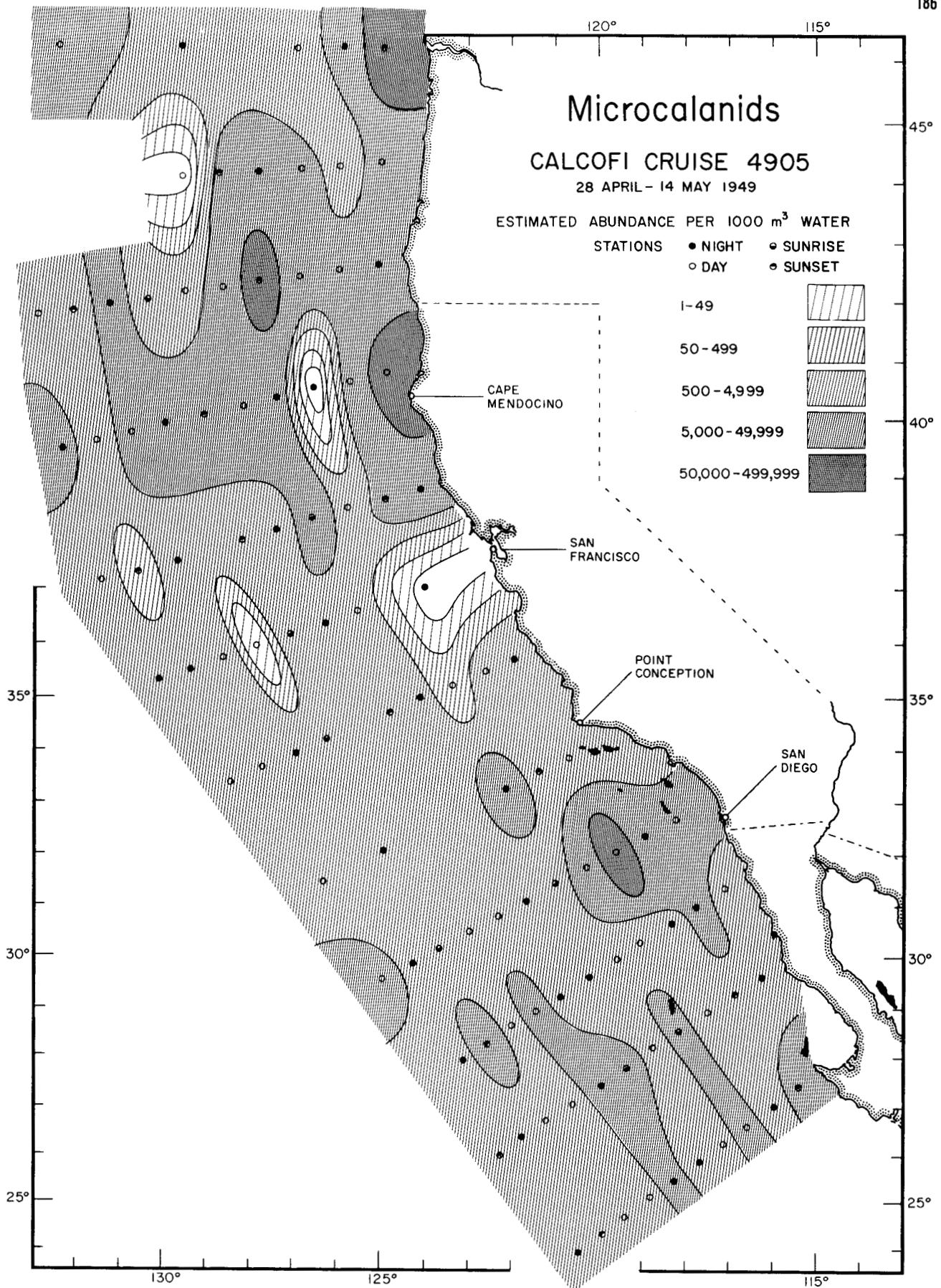
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*Metridia pacifica*

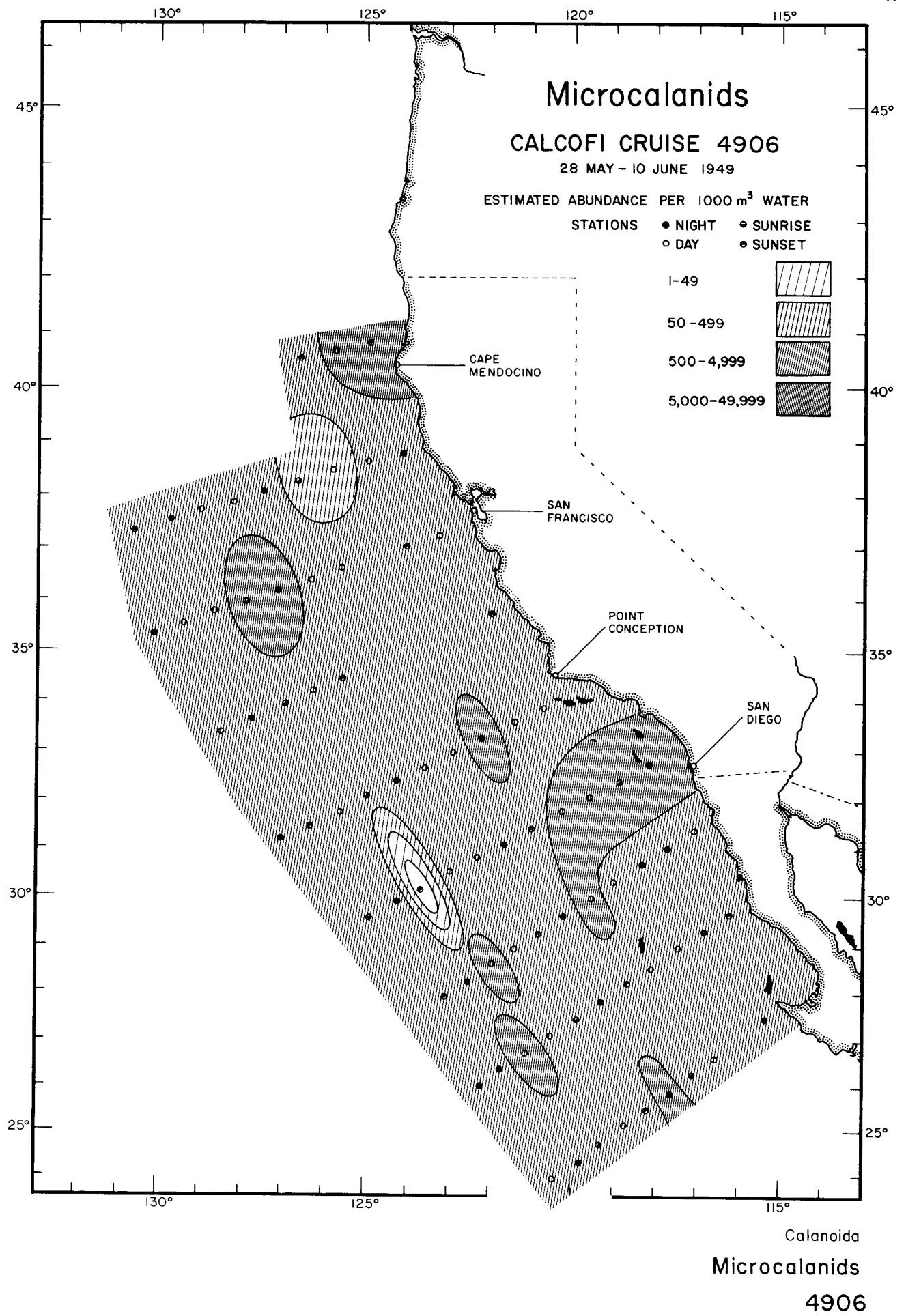
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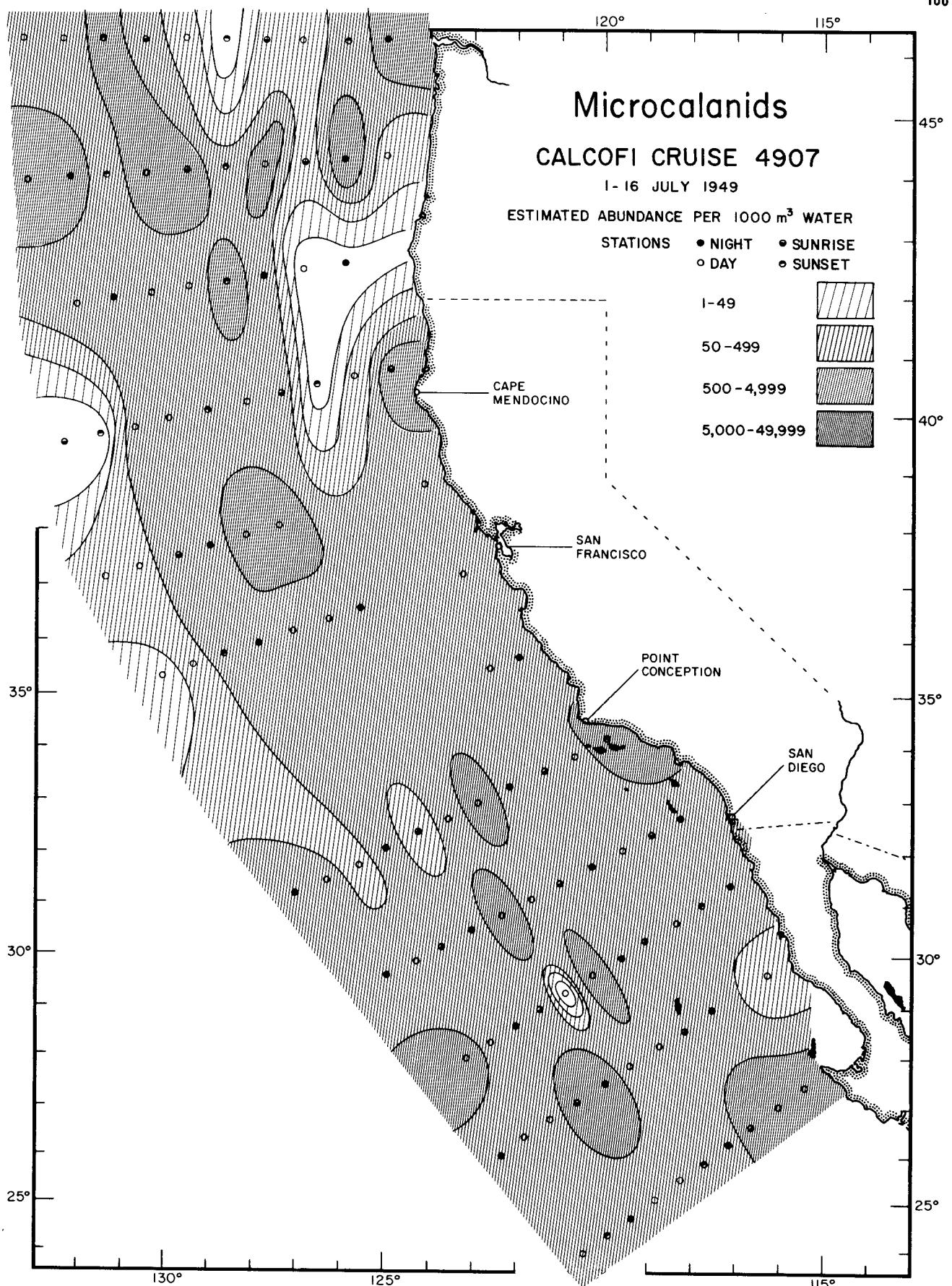


Calanoida

Microcalanids

4905

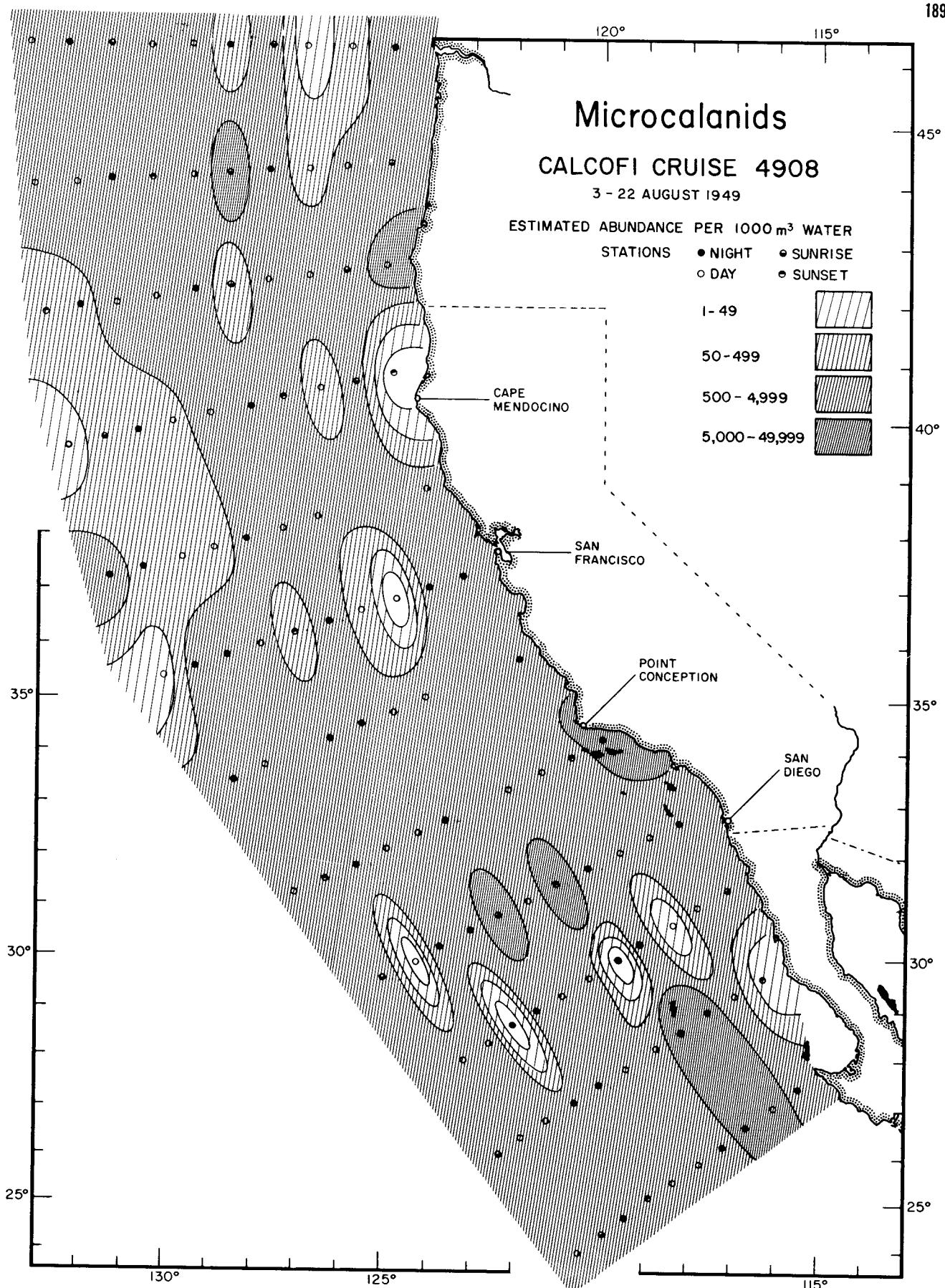




Calanoida

**Microcalanids**

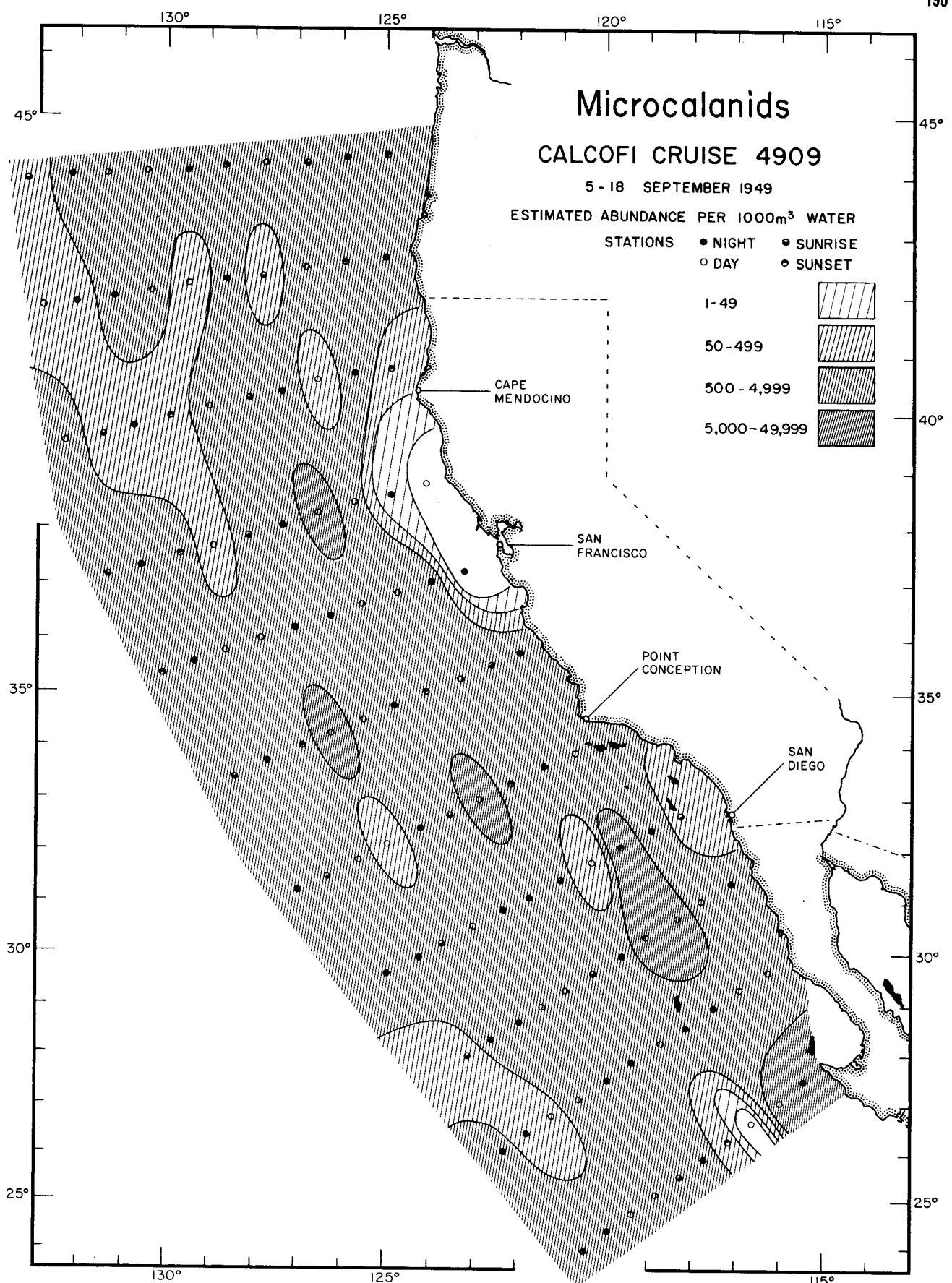
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Calanoida

Microcalanids

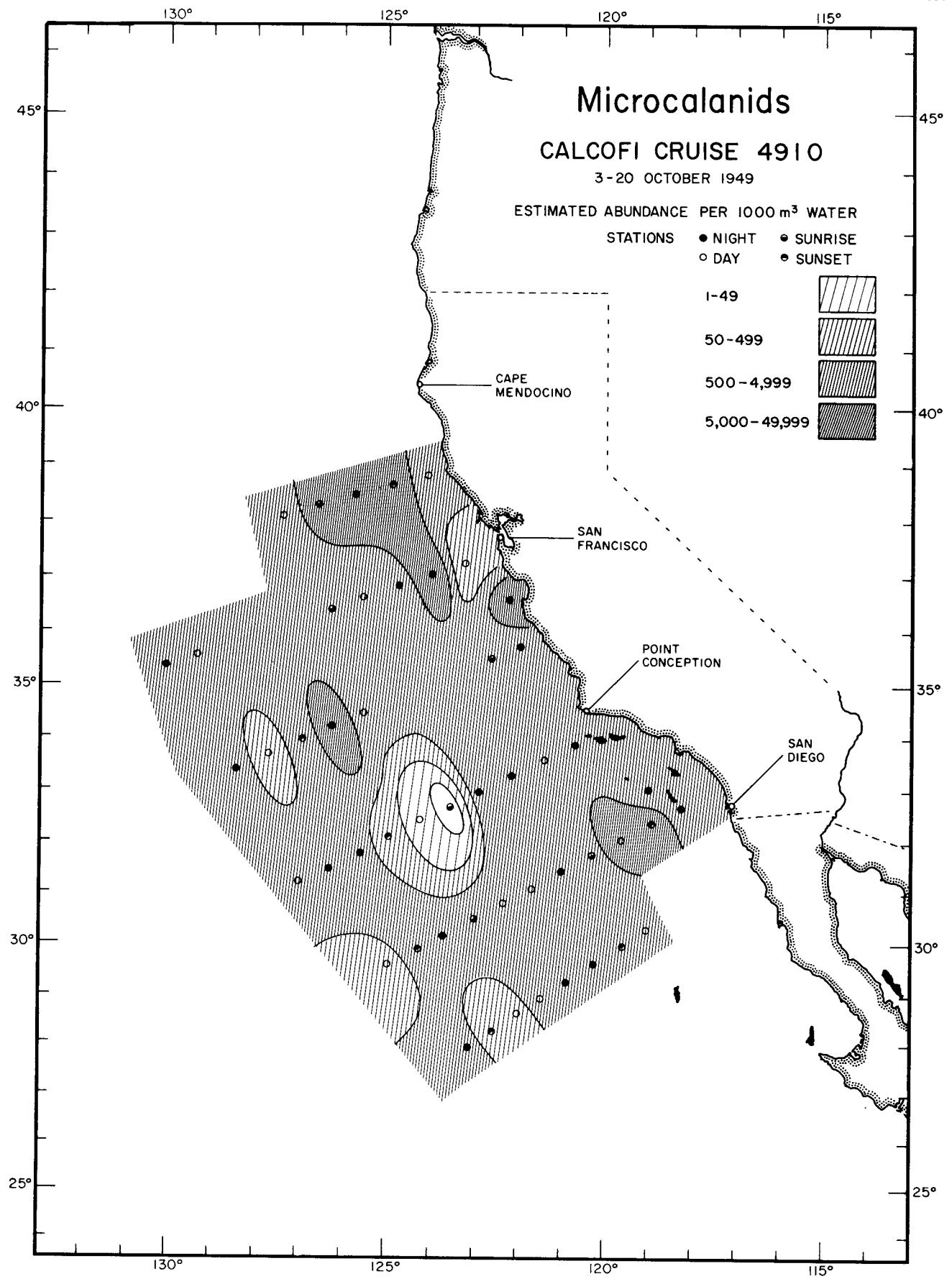
4908



Calanoida

Microcalanids

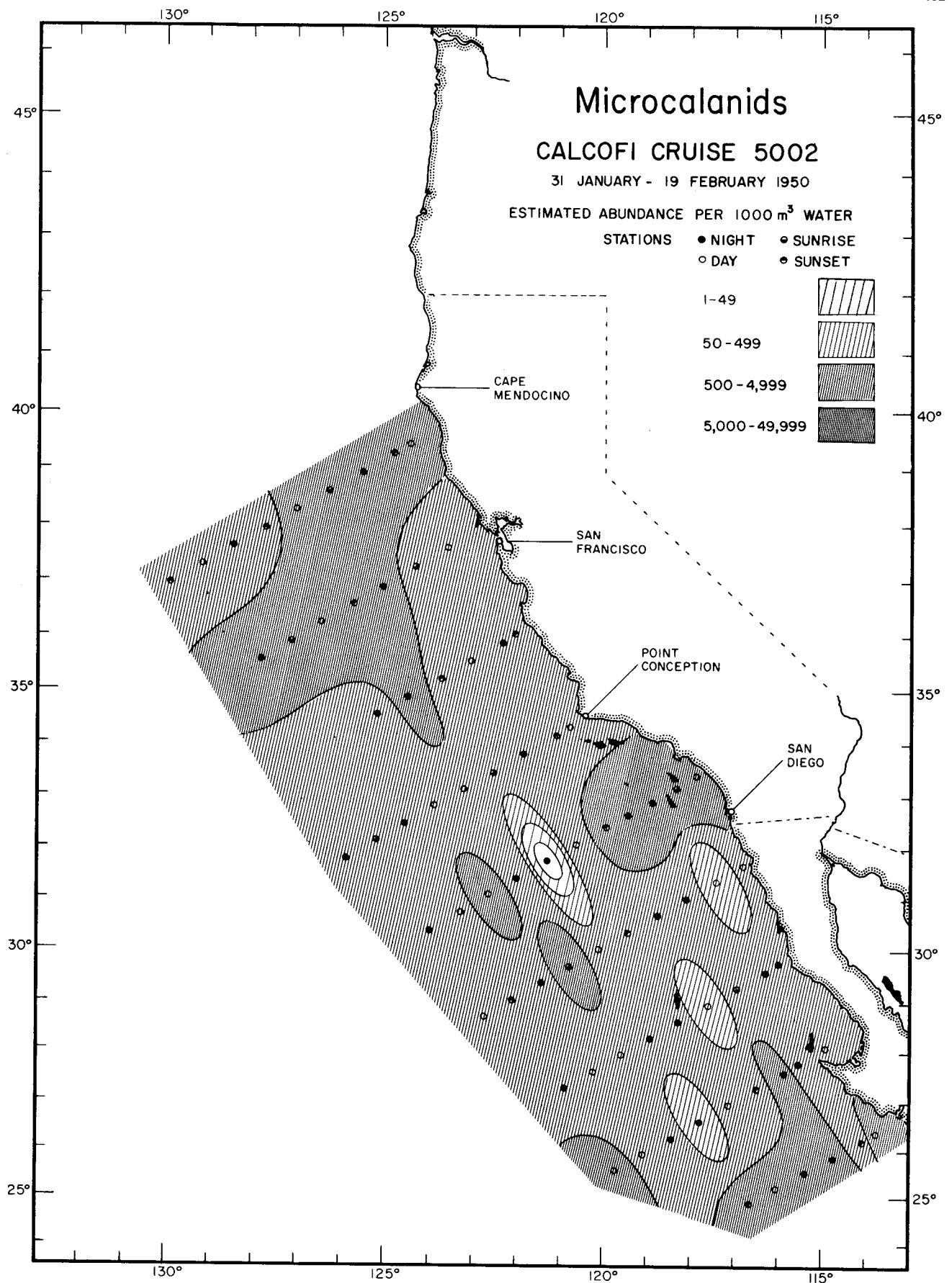
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Calanoida

Microcalanids

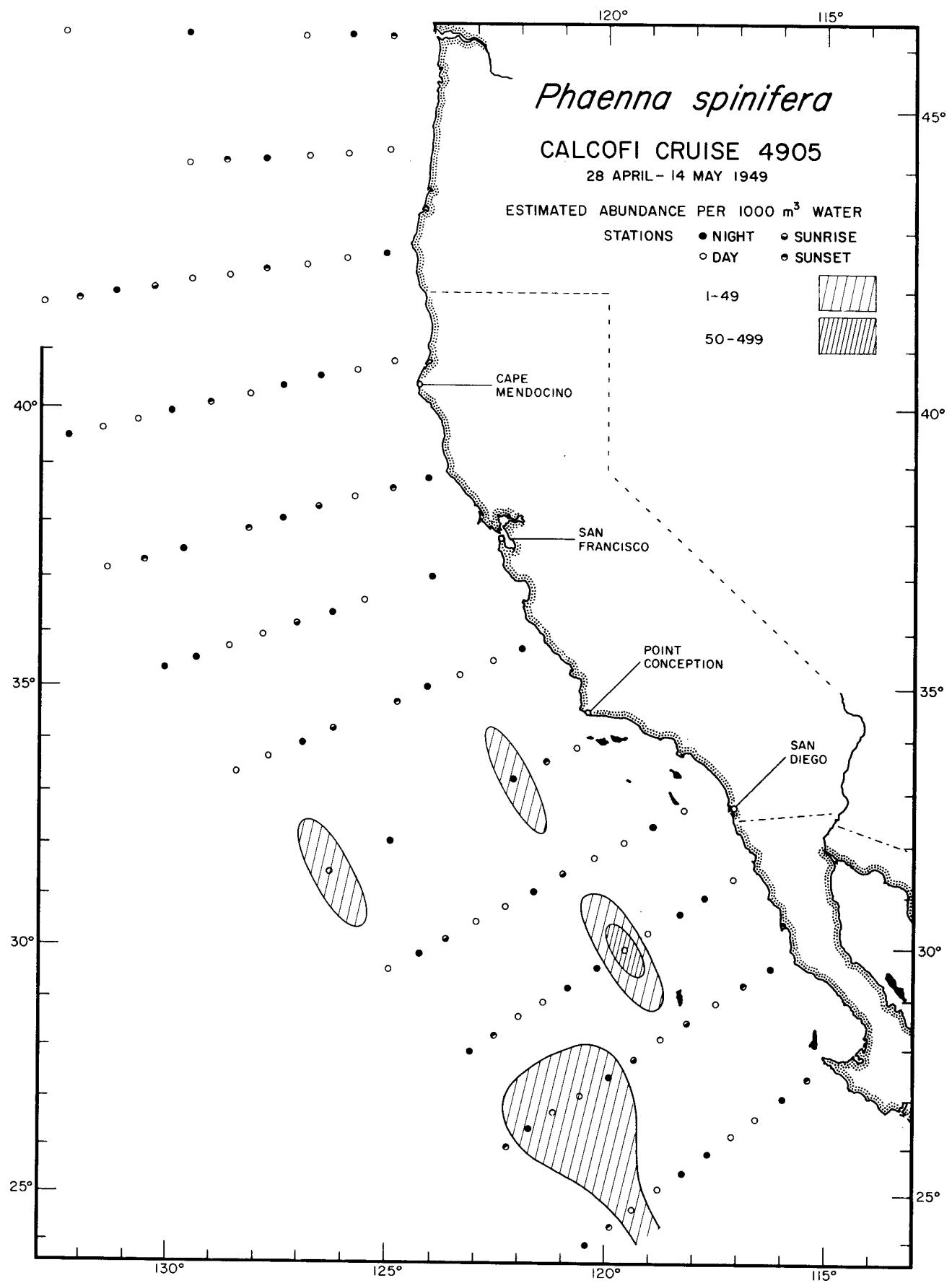
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Calanoida

**Microcalanids**

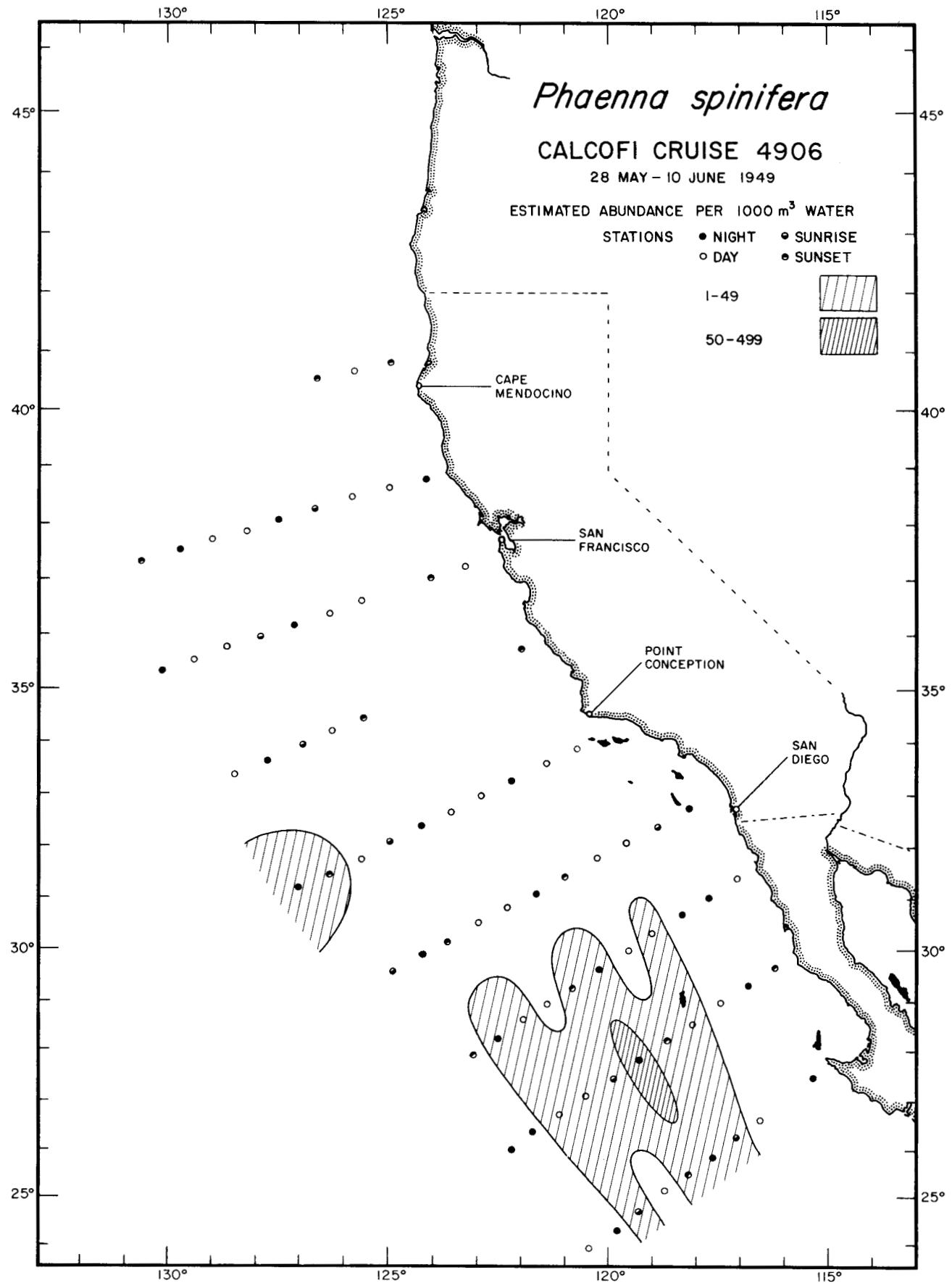
5002



Calanoida

*Phaenna spinifera*

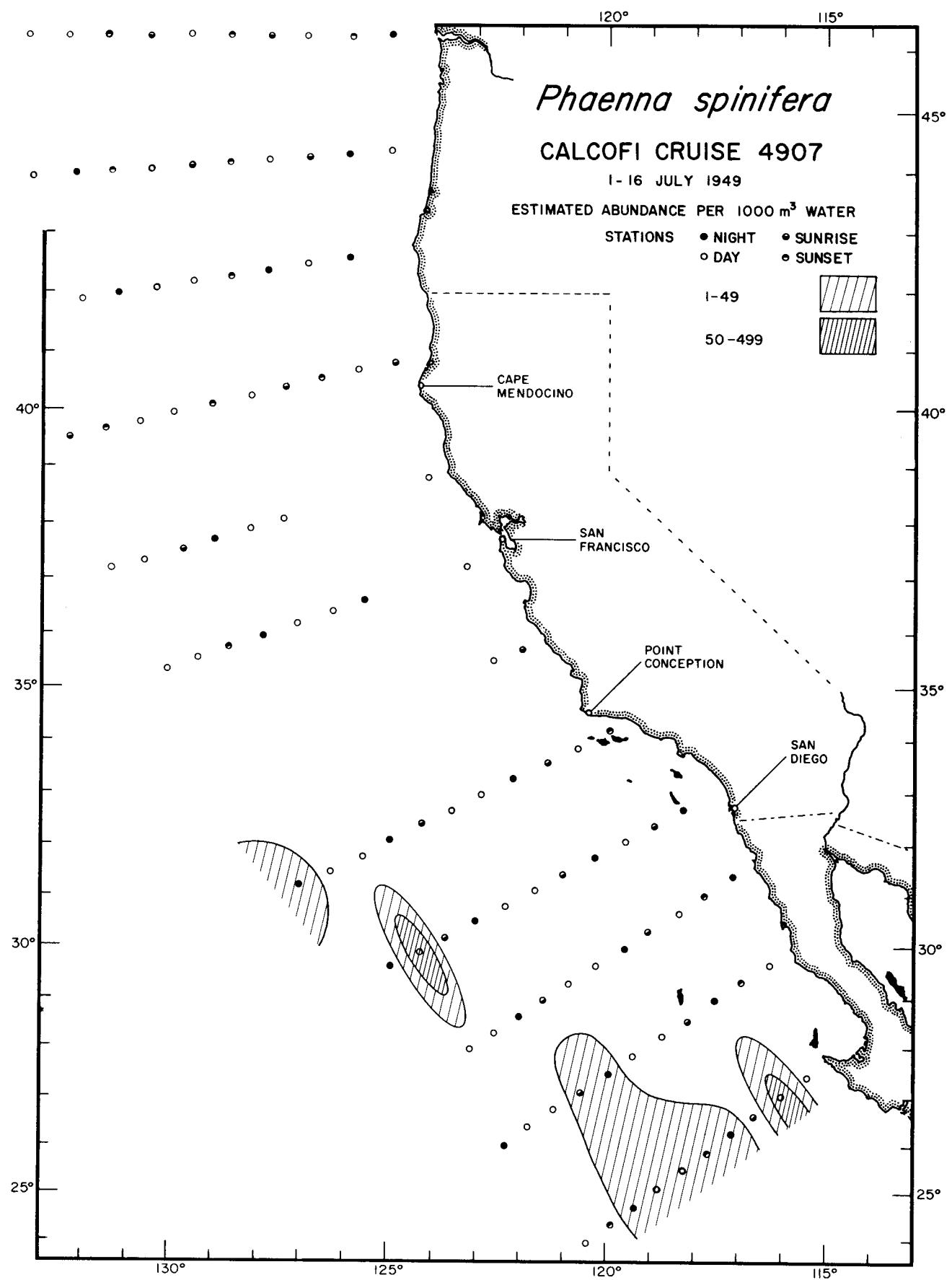
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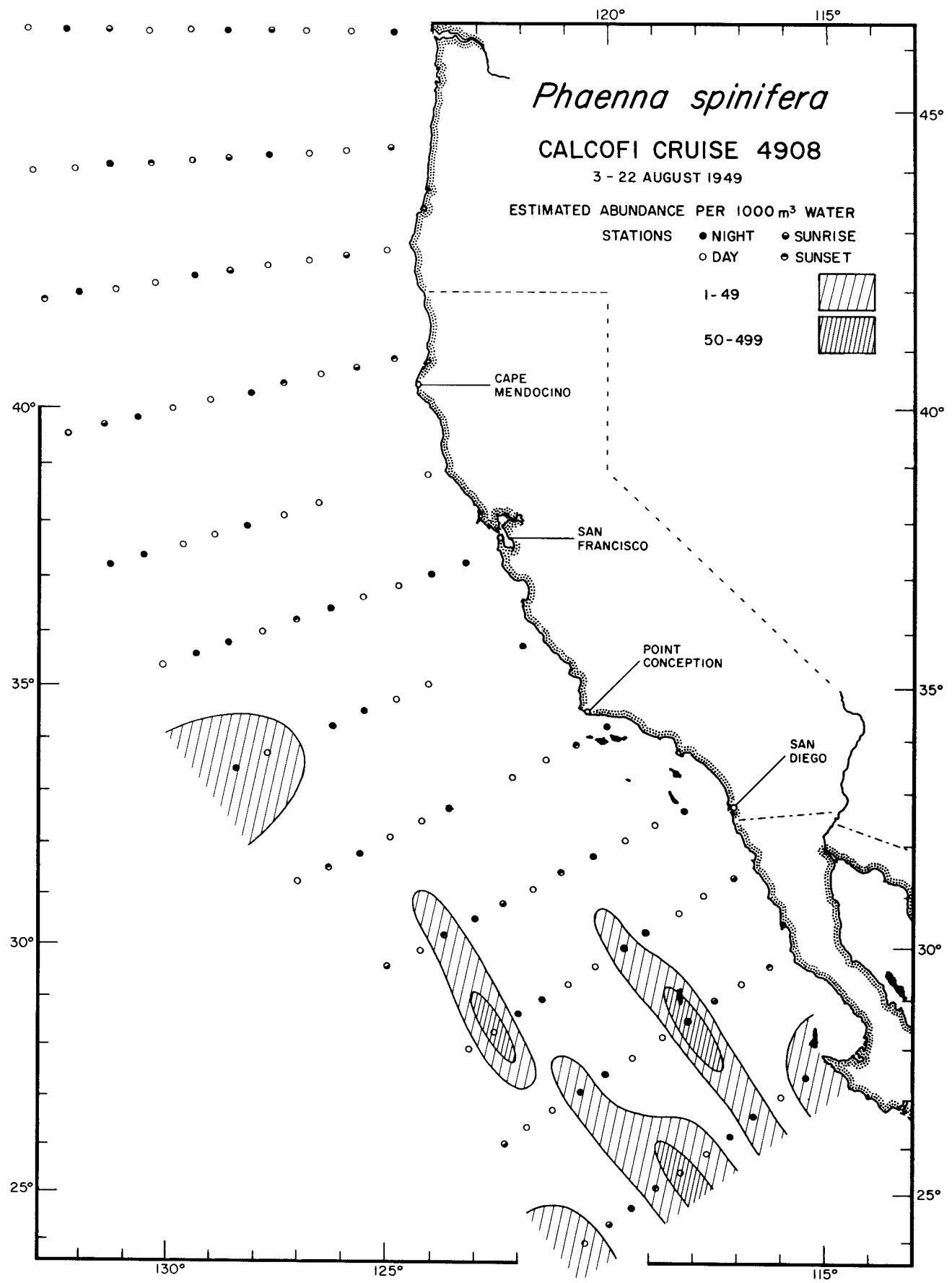
Calanoida

*Phaenna spinifera*

4906

*Phaenna spinifera*

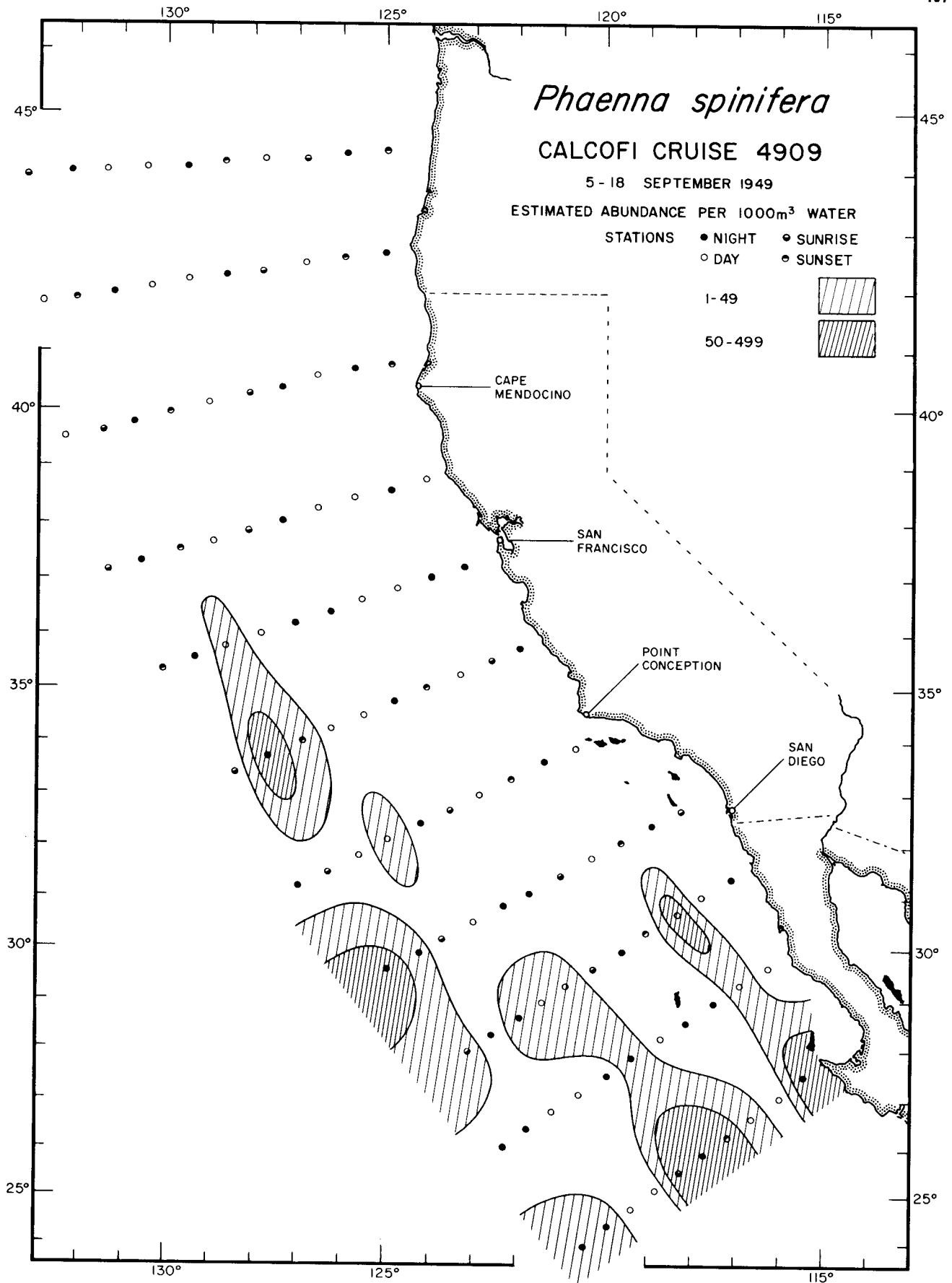
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Calanoida

*Phaenna spinifera*

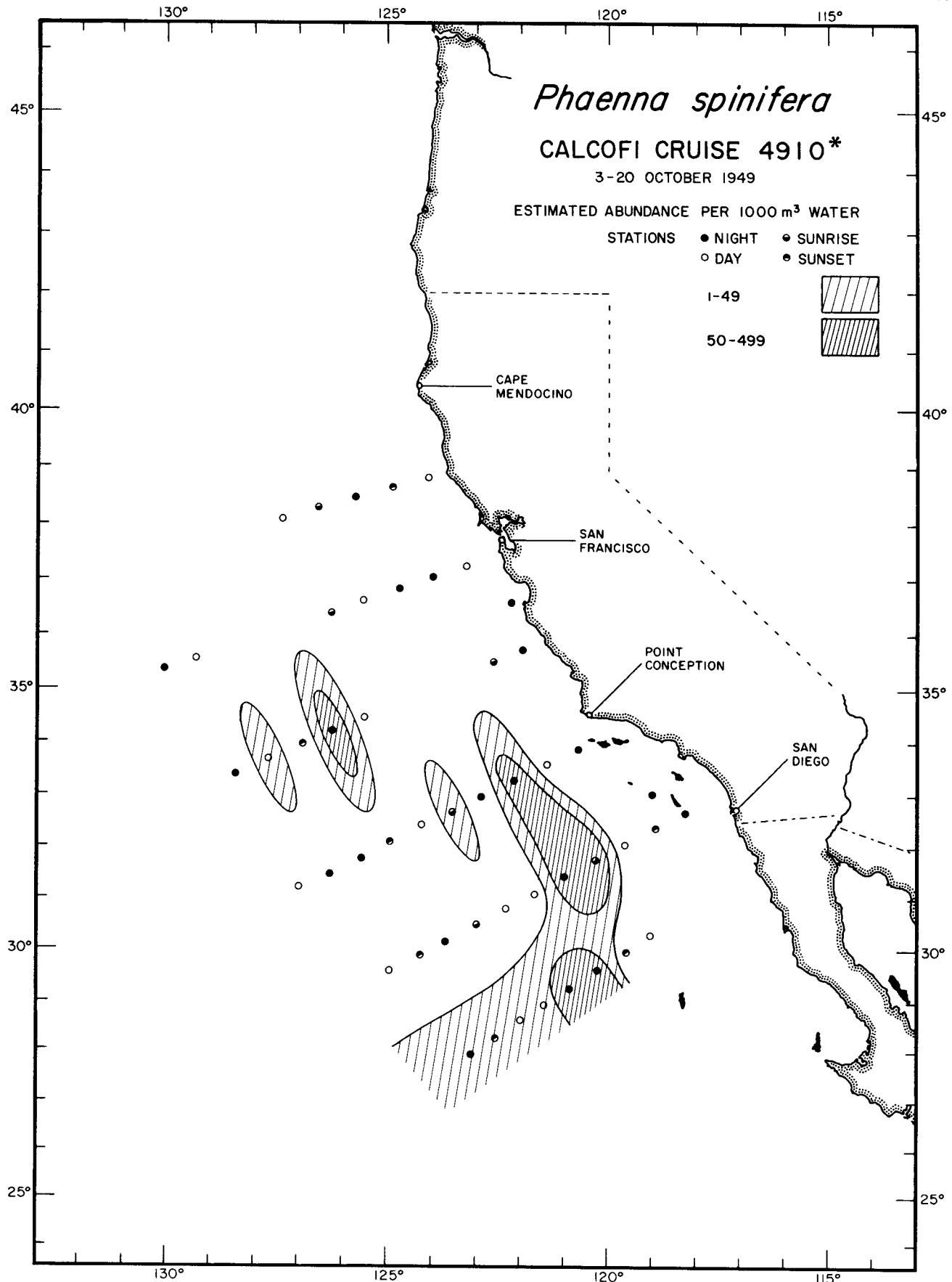
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Calanoida

*Phaenna spinifera*

4909

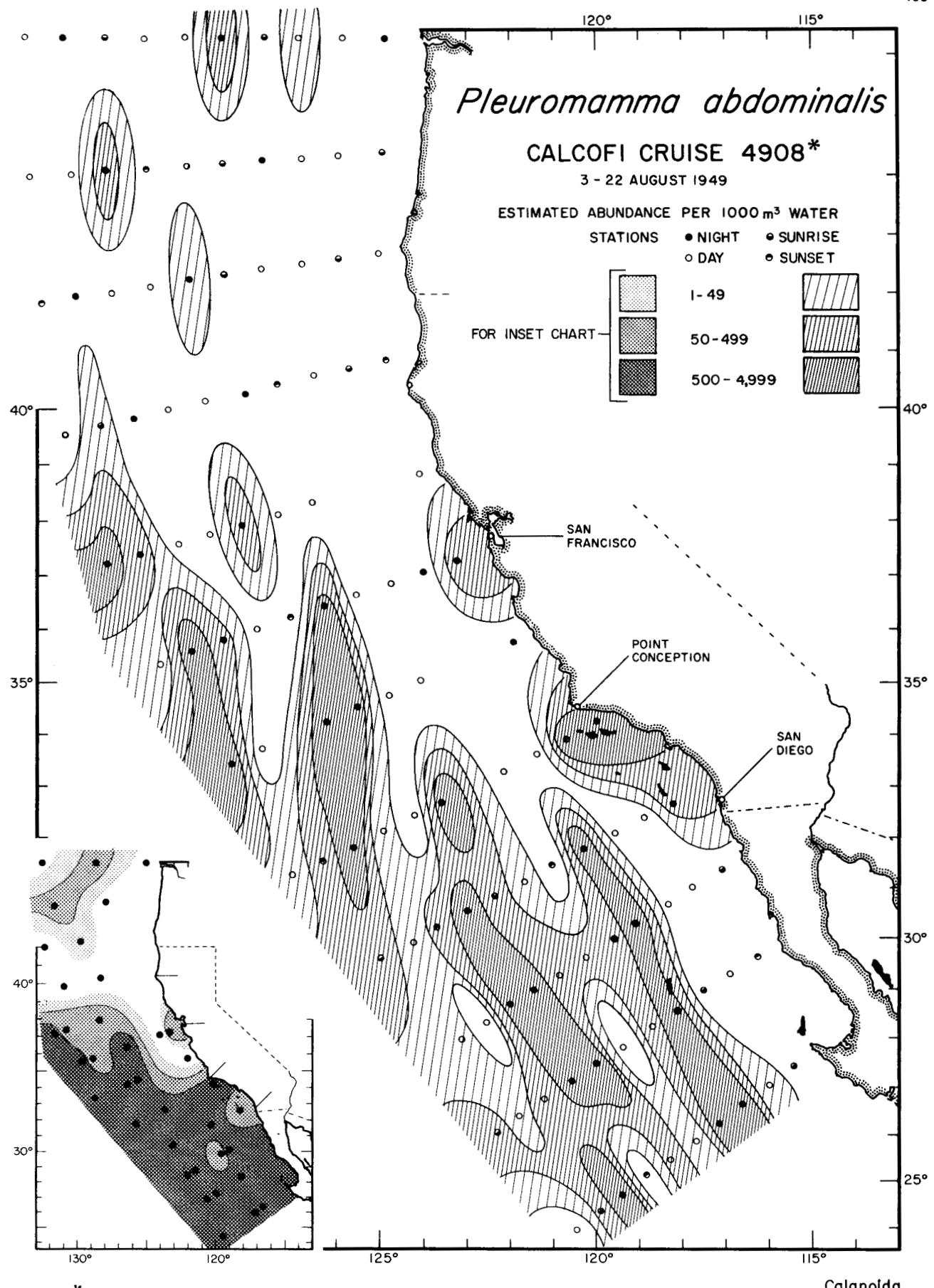


\* See Table 1 for cruise 5002

Calanoida

*Phaenna spinifera*

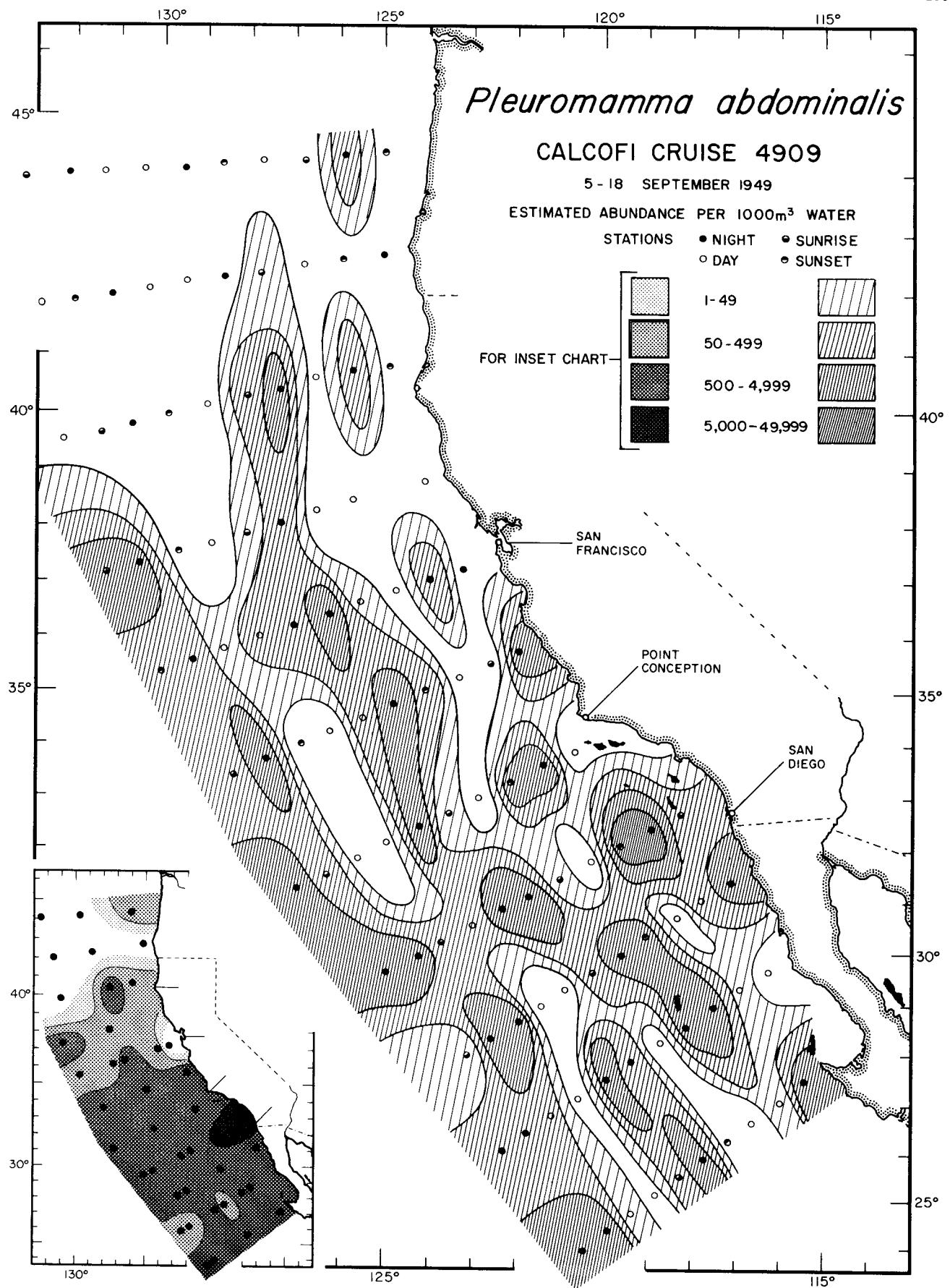
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\* No data for cruises 4905, 6, 7

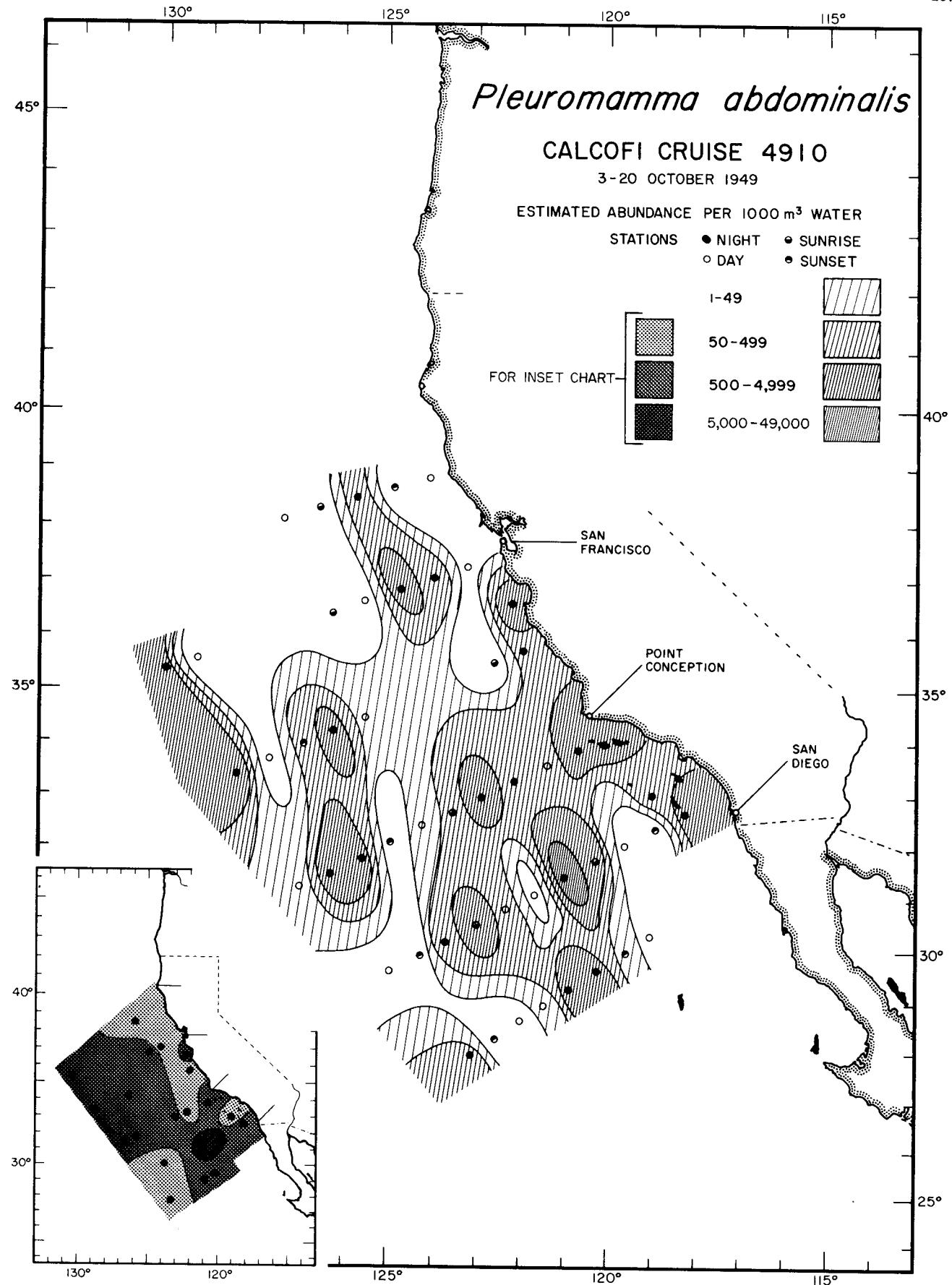
*Pleuromamma abdominalis*

4908



Calanoida  
*Pleuromamma abdominalis*

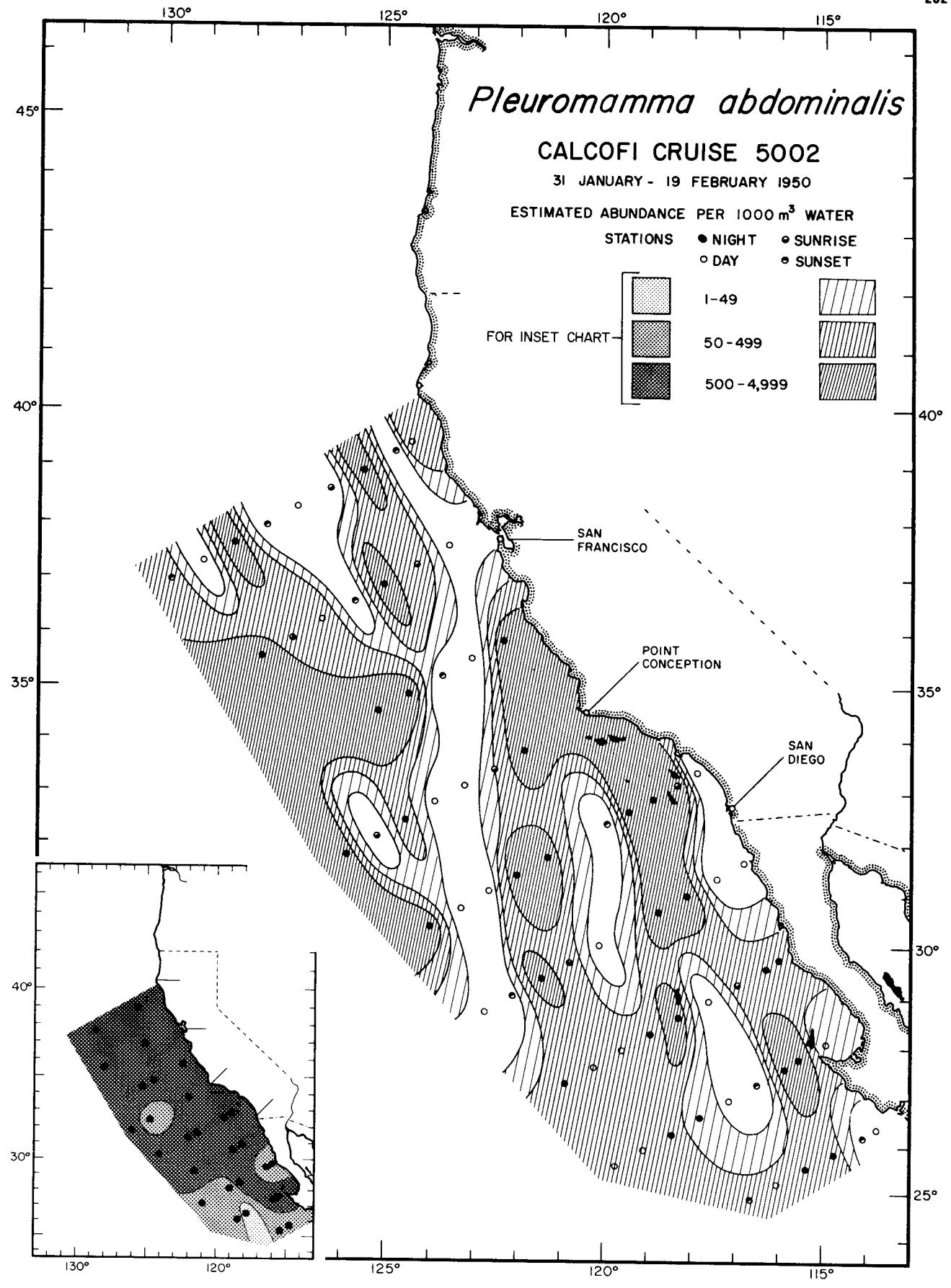
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Calanoida

*Pleuromamma abdominalis*

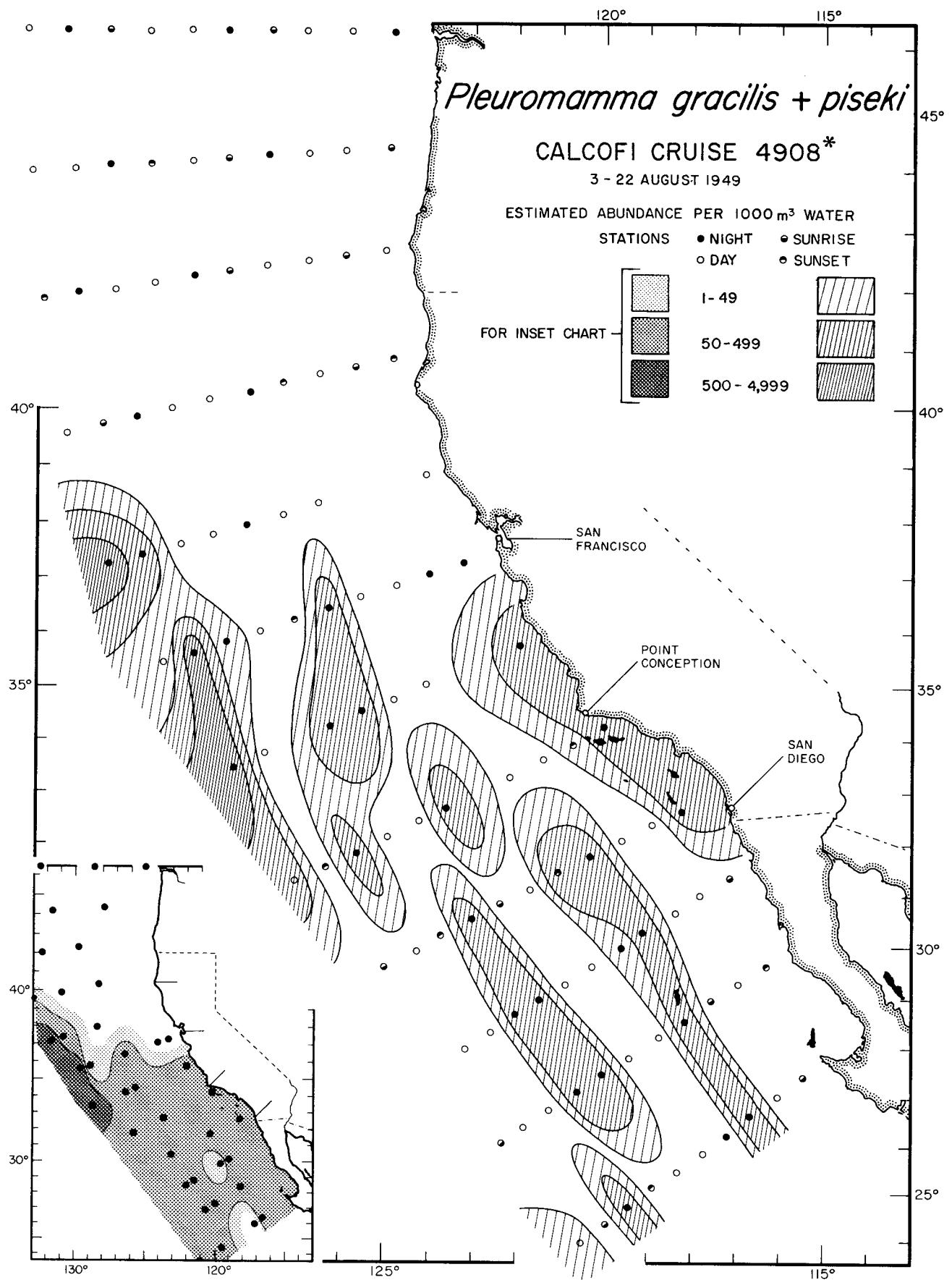
4910



Calanoida

*Pleuromamma abdominalis*

5002

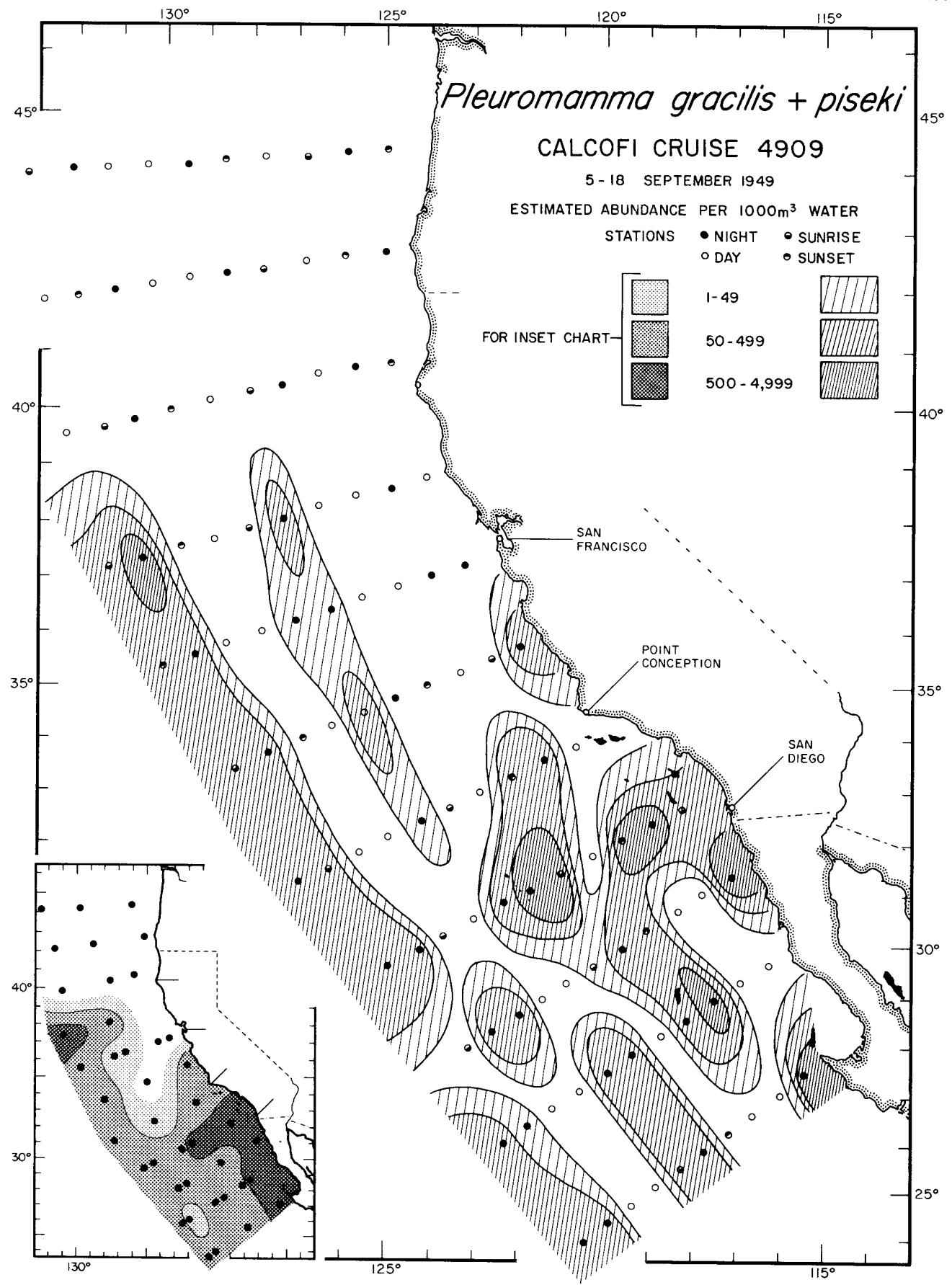


\* No data for cruises 4905, 6, 7

Calanoida

*Pleuromamma gracilis + piseki*

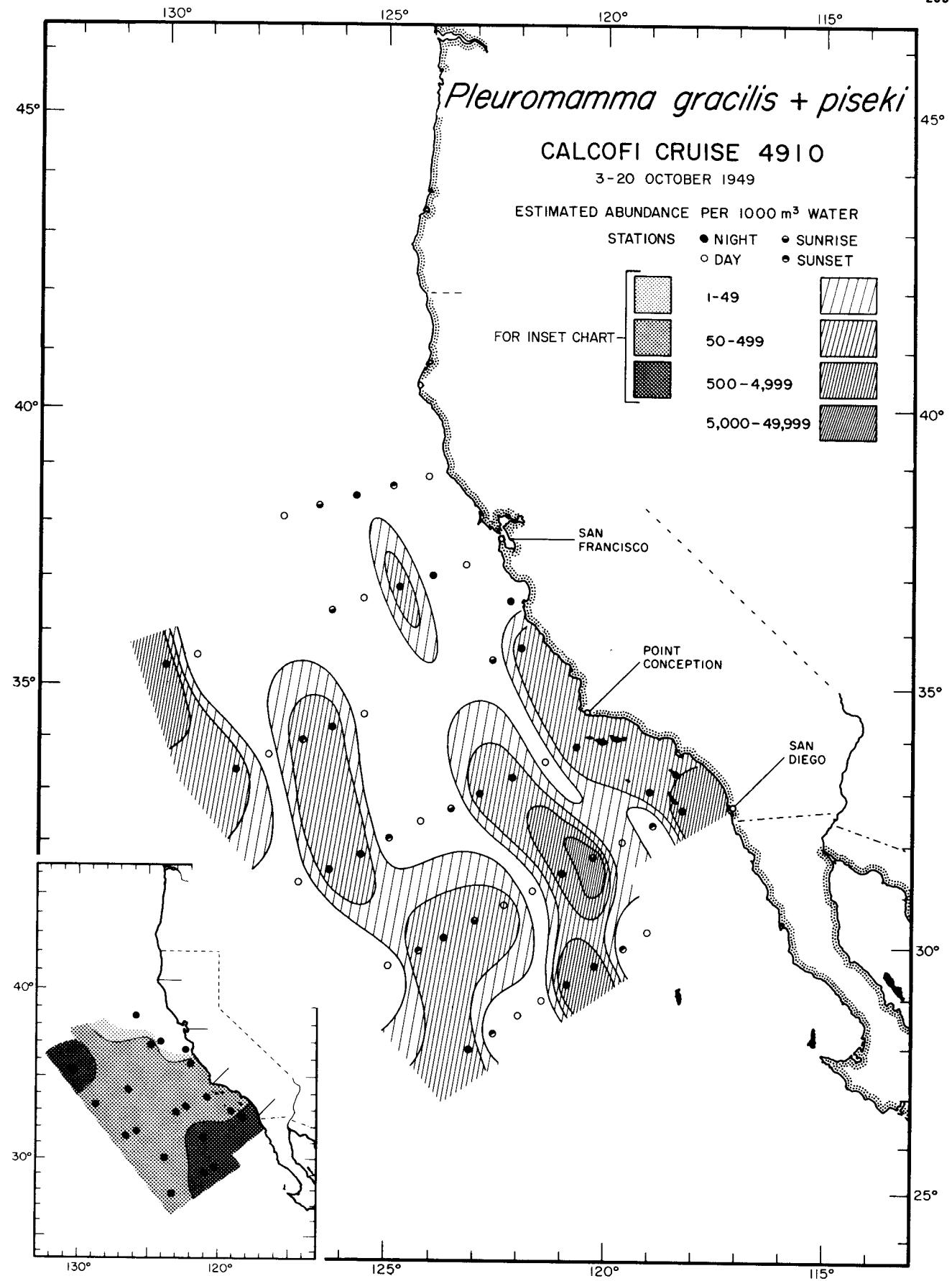
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Calanoida

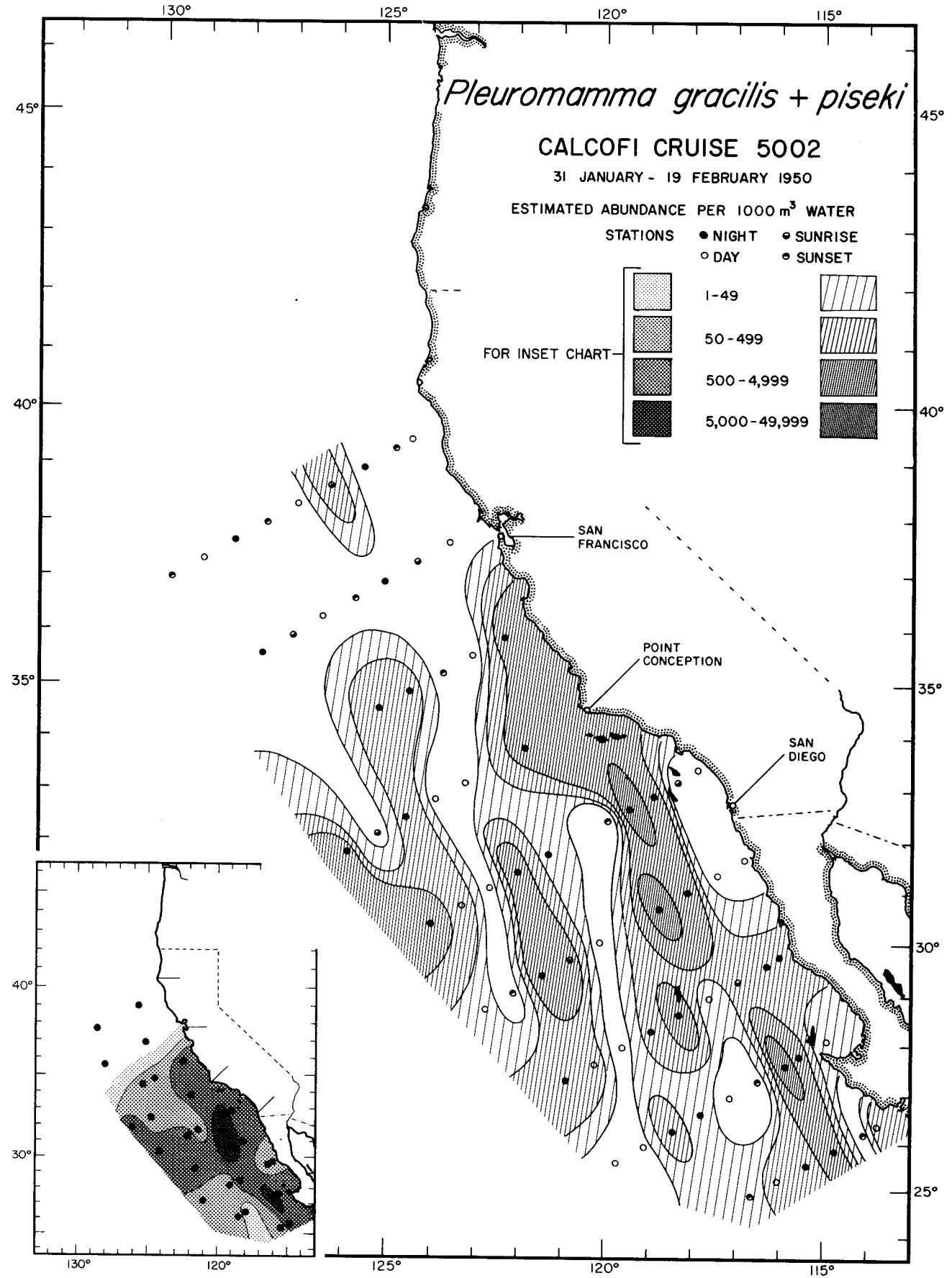
*Pleuromamma gracilis + piseki*

4909

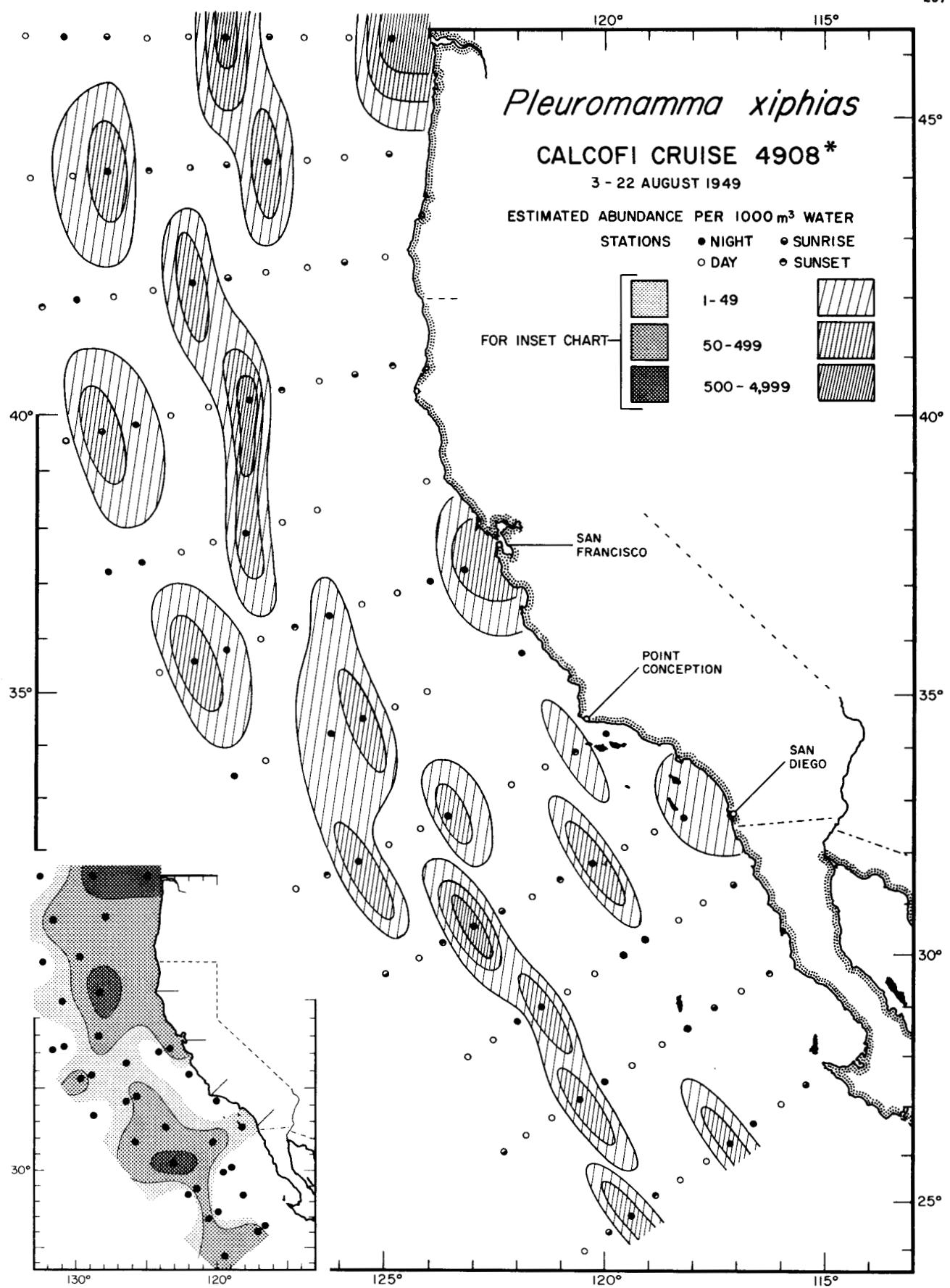


Calanoida  
*Pleuromamma gracilis + piseki*

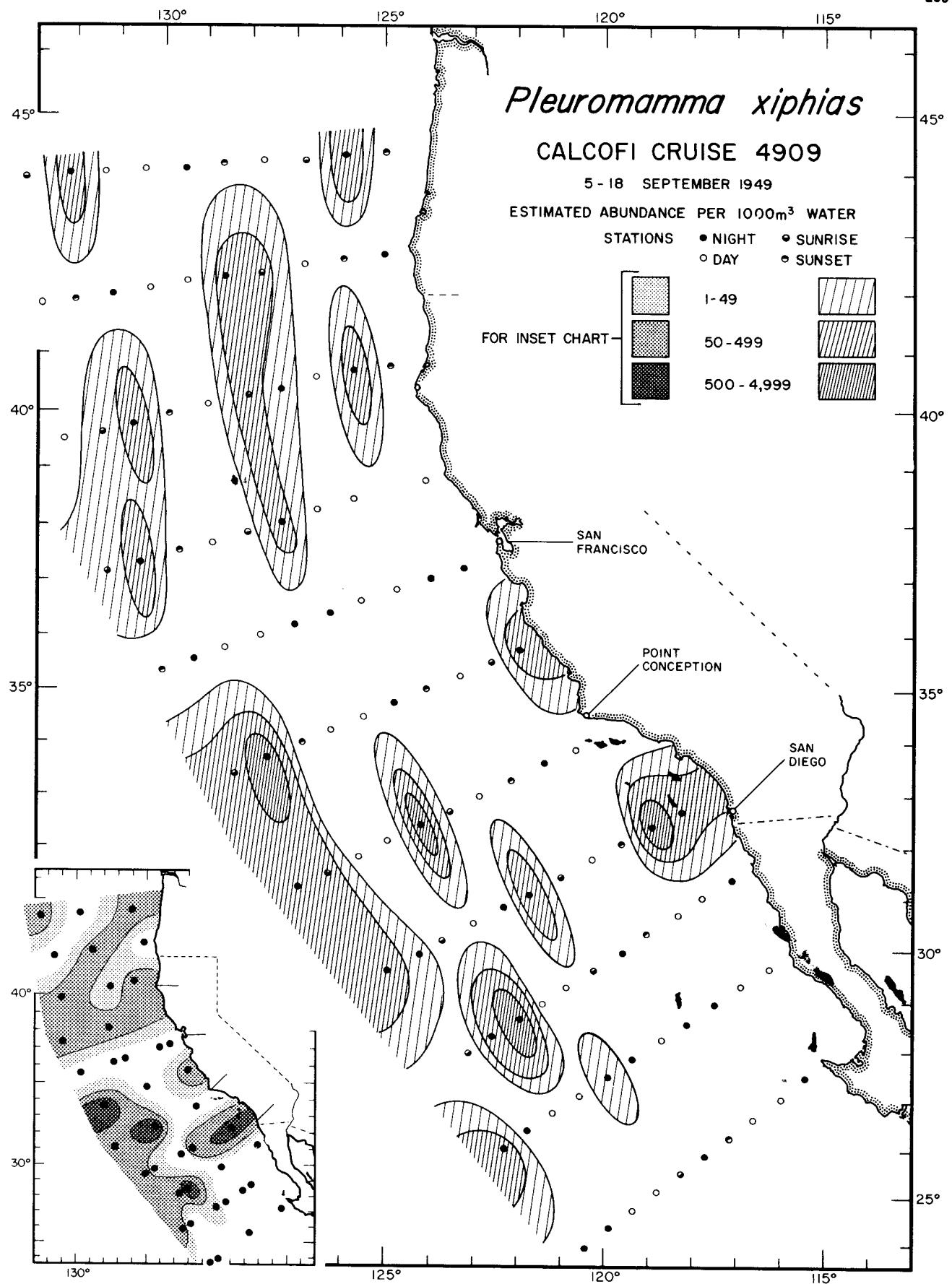
4910



Calanoida  
*Pleuromamma gracilis + piseki*  
 5002



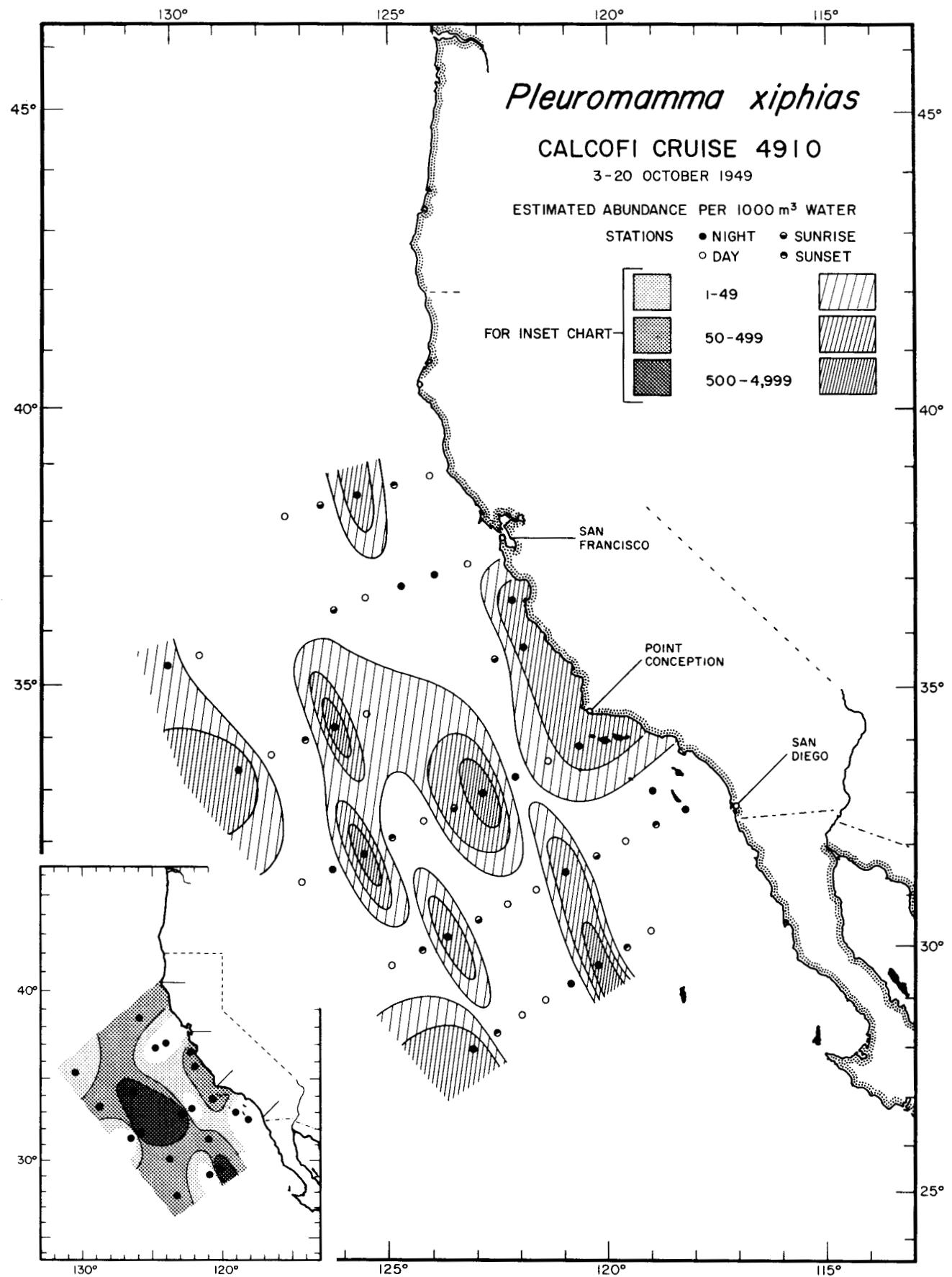
\* No data for cruises 4905, 6, 7



Calanoida

*Pleuromamma xiphias*

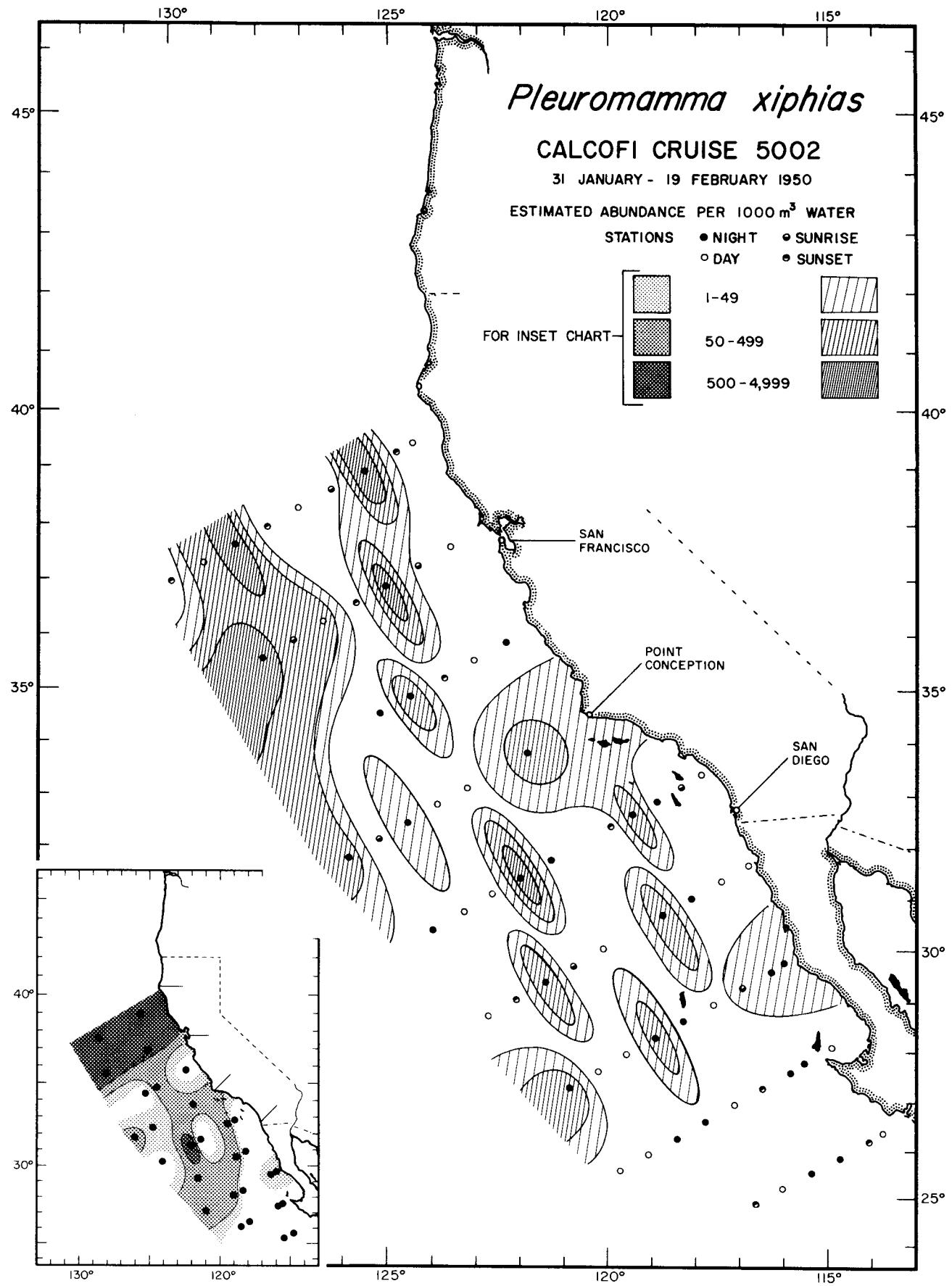
4909



## Calanoida

*Pleuromamma xiphias*

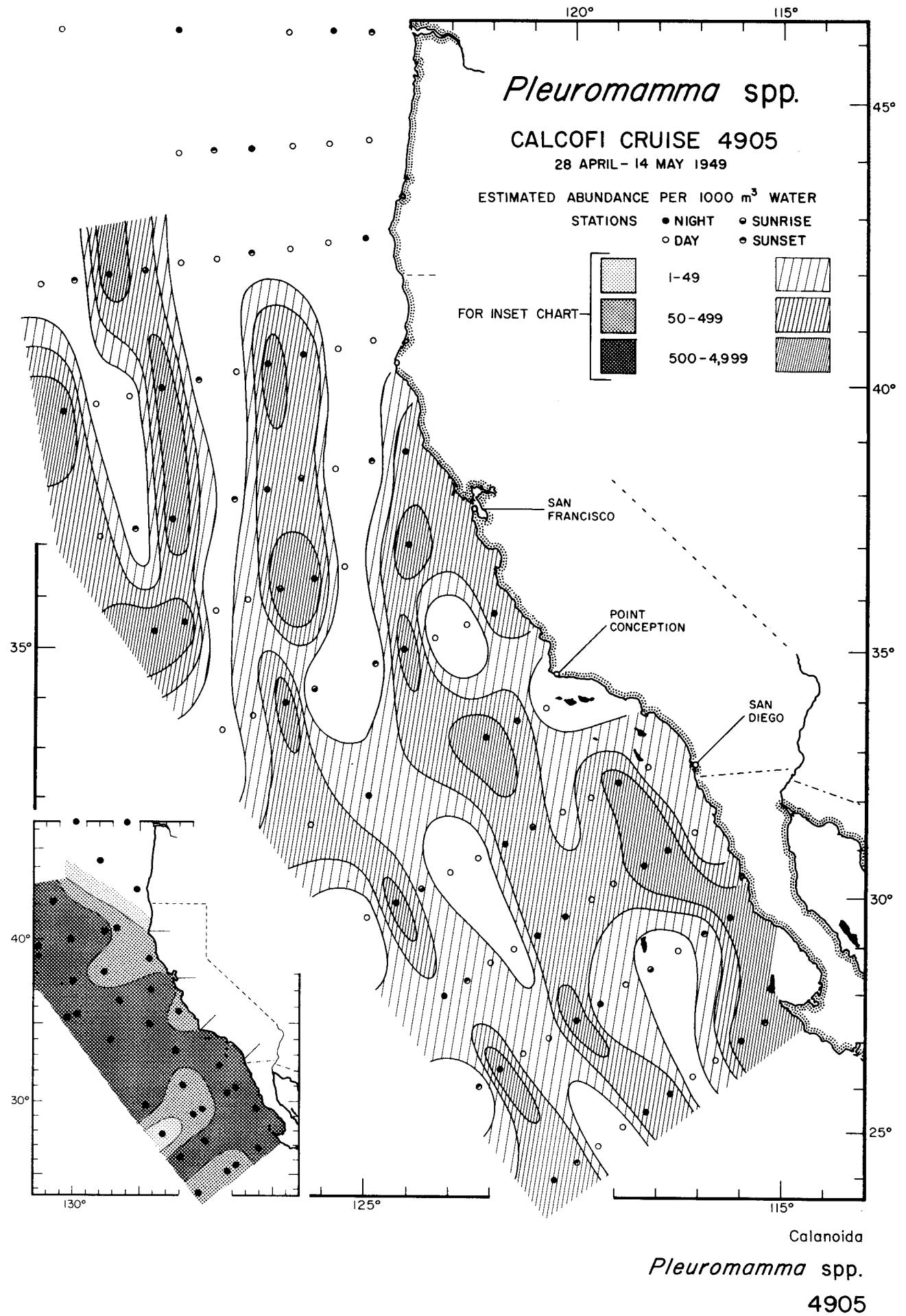
49 | 0

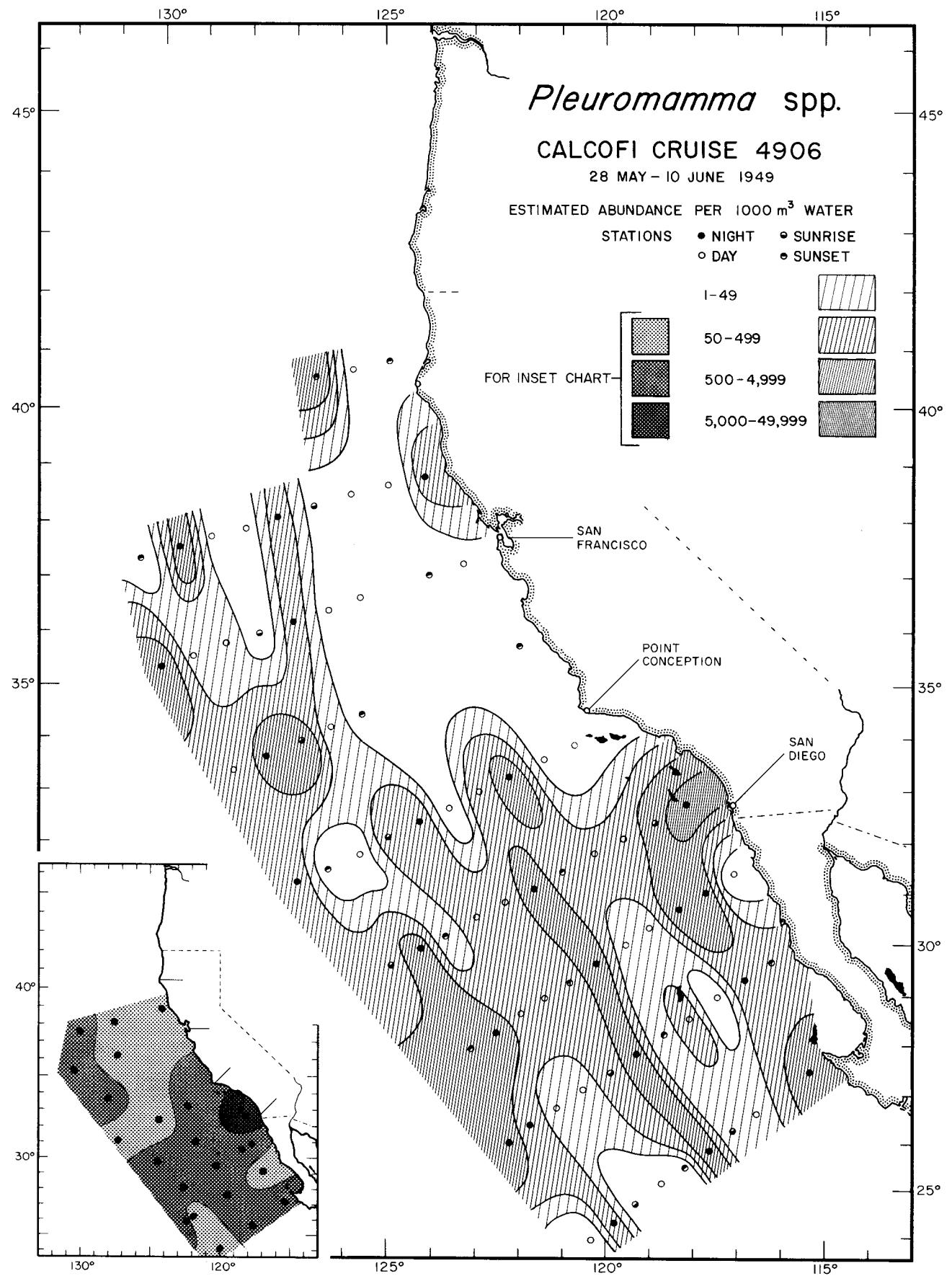


Calanoida

*Pleuromamma xiphias*

5002

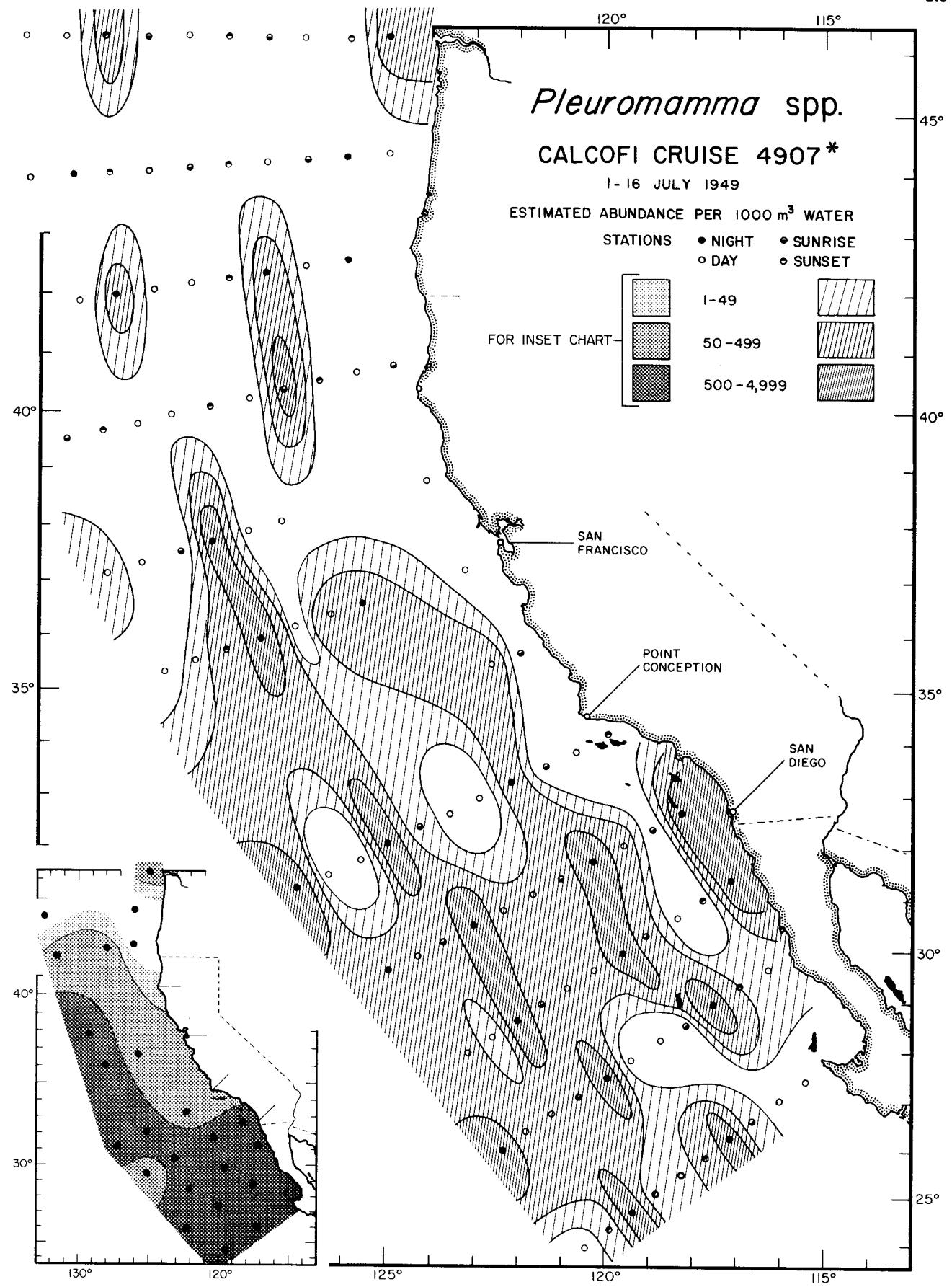




Calanoida

*Pleuromamma* spp.

4906

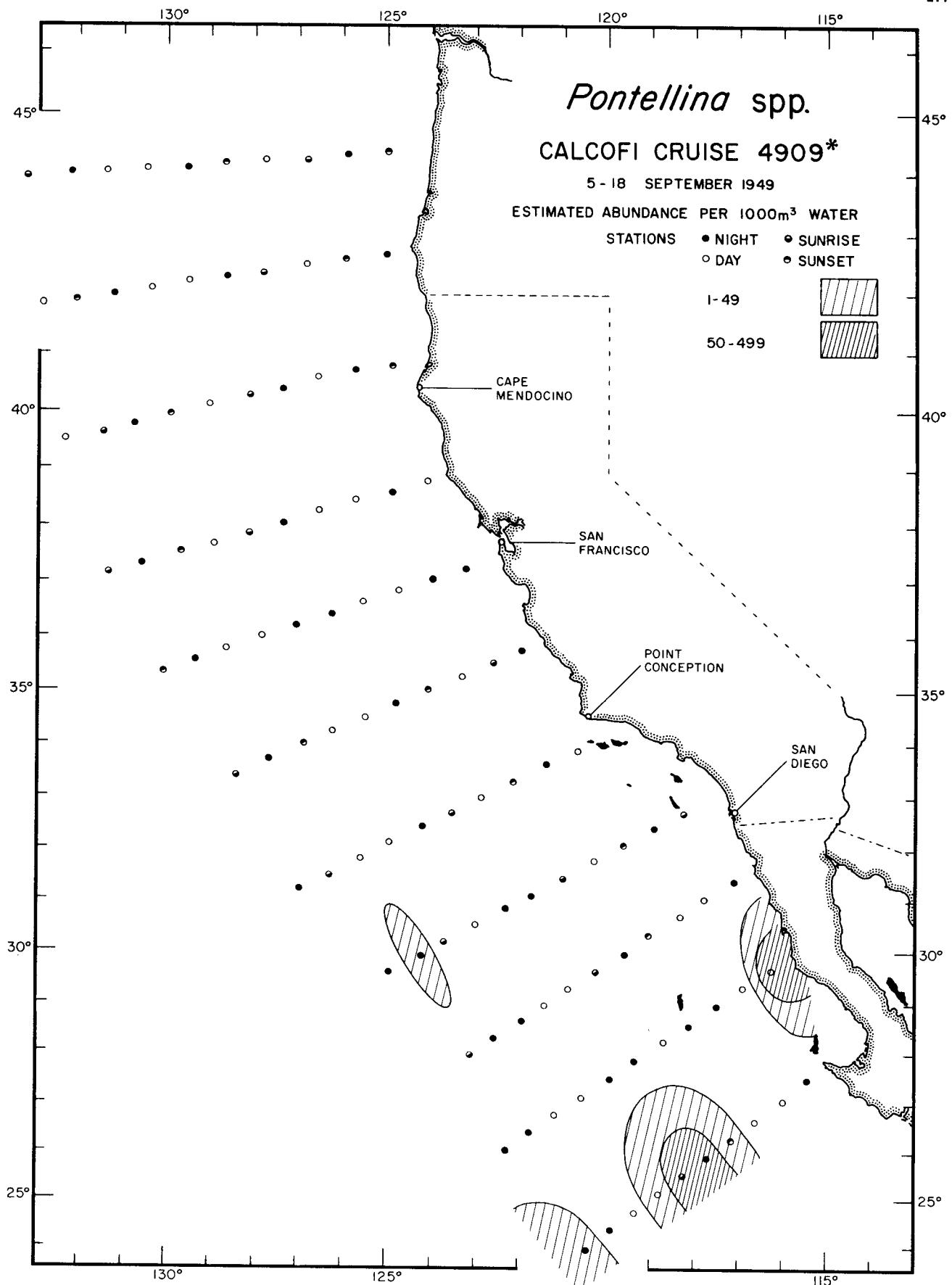


\* No data for cruises 4908, 9, 10, 5002

Calanoida

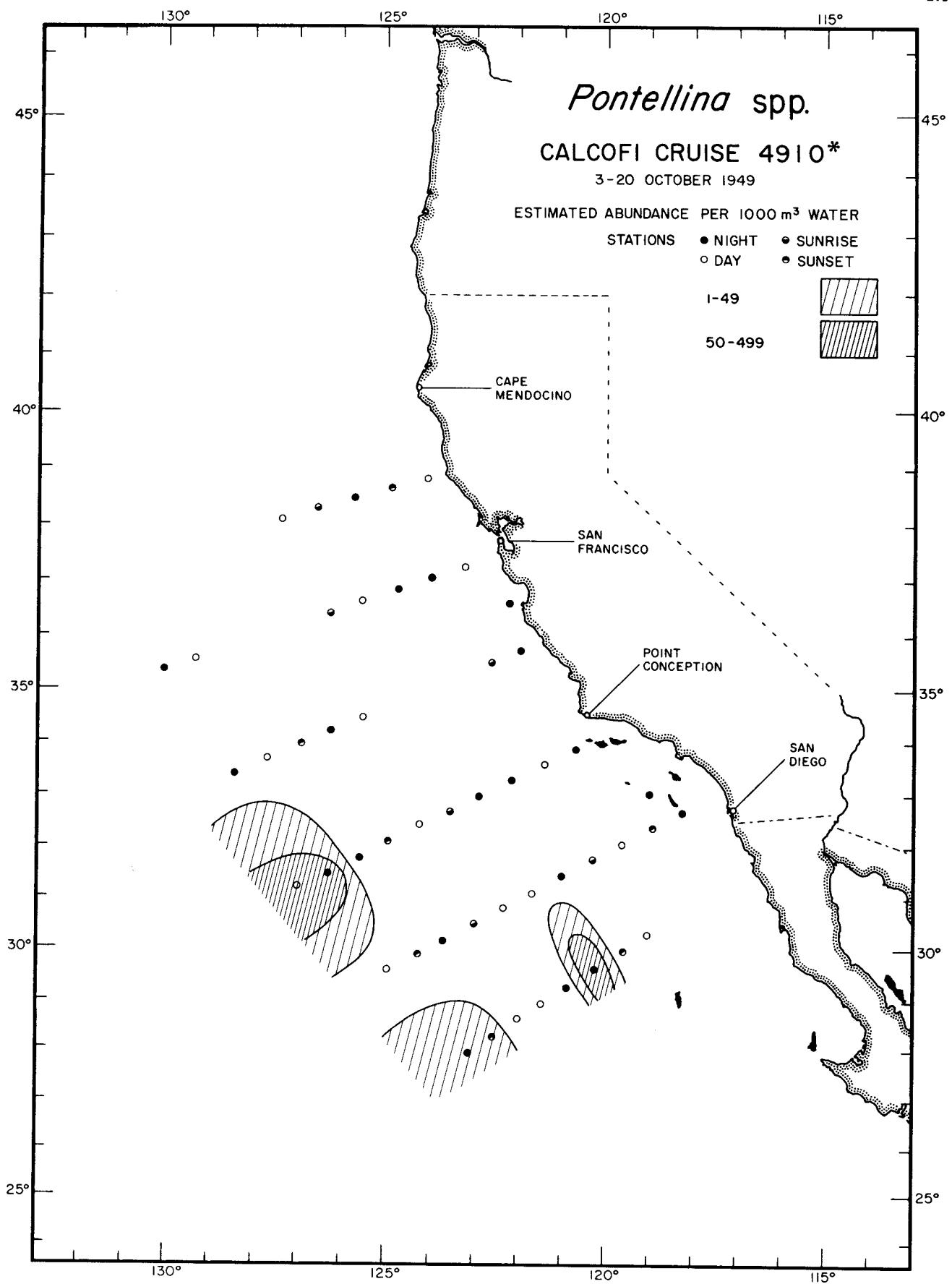
*Pleuromamma* spp.

4907



\* See Table 1 for cruises 4905, 6, 7, 8

Calanoida  
*Pontellina* spp.  
4909

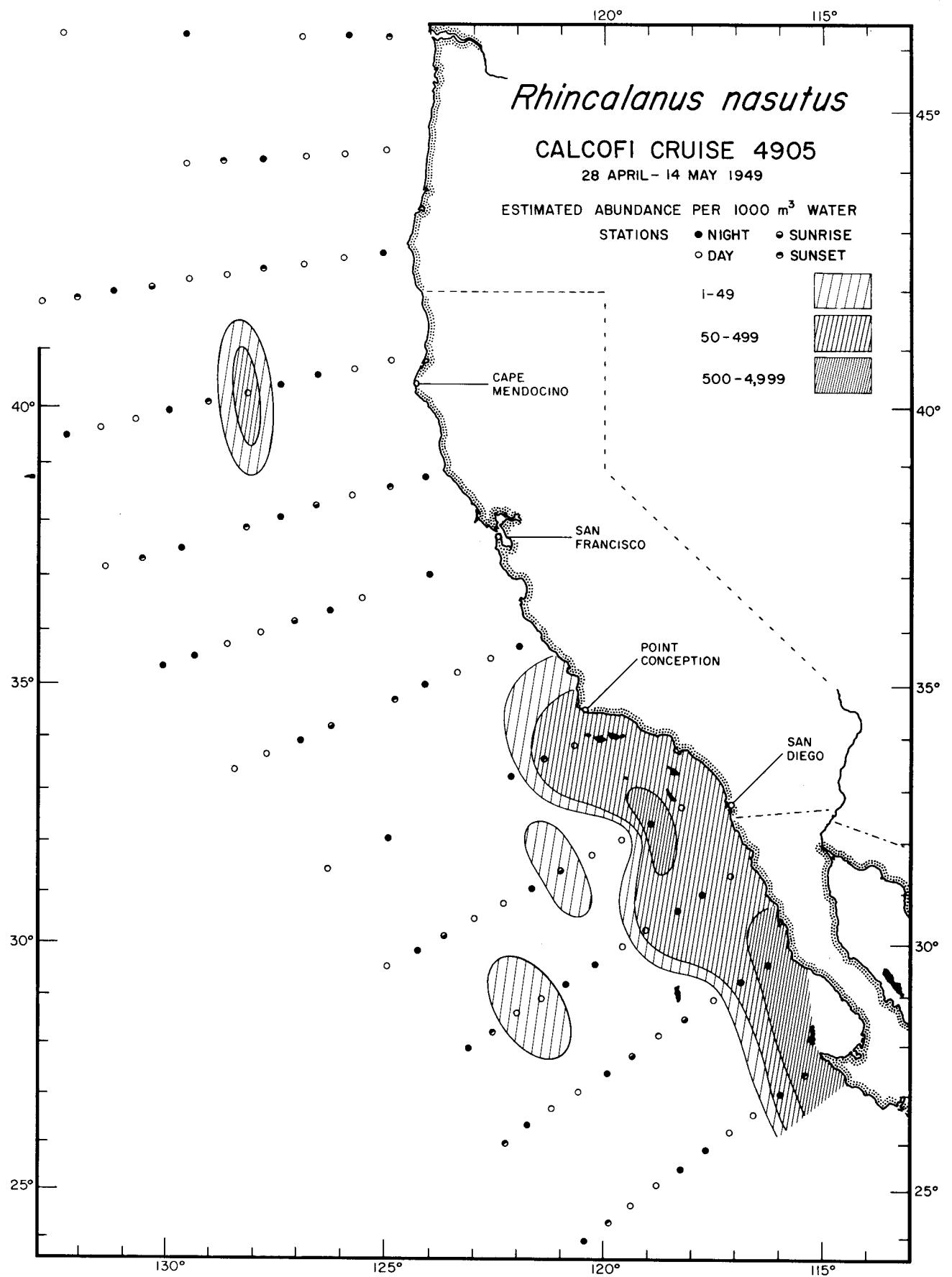


\* See Table 1 for cruise 5002

Calanoida

*Pontellina* spp.

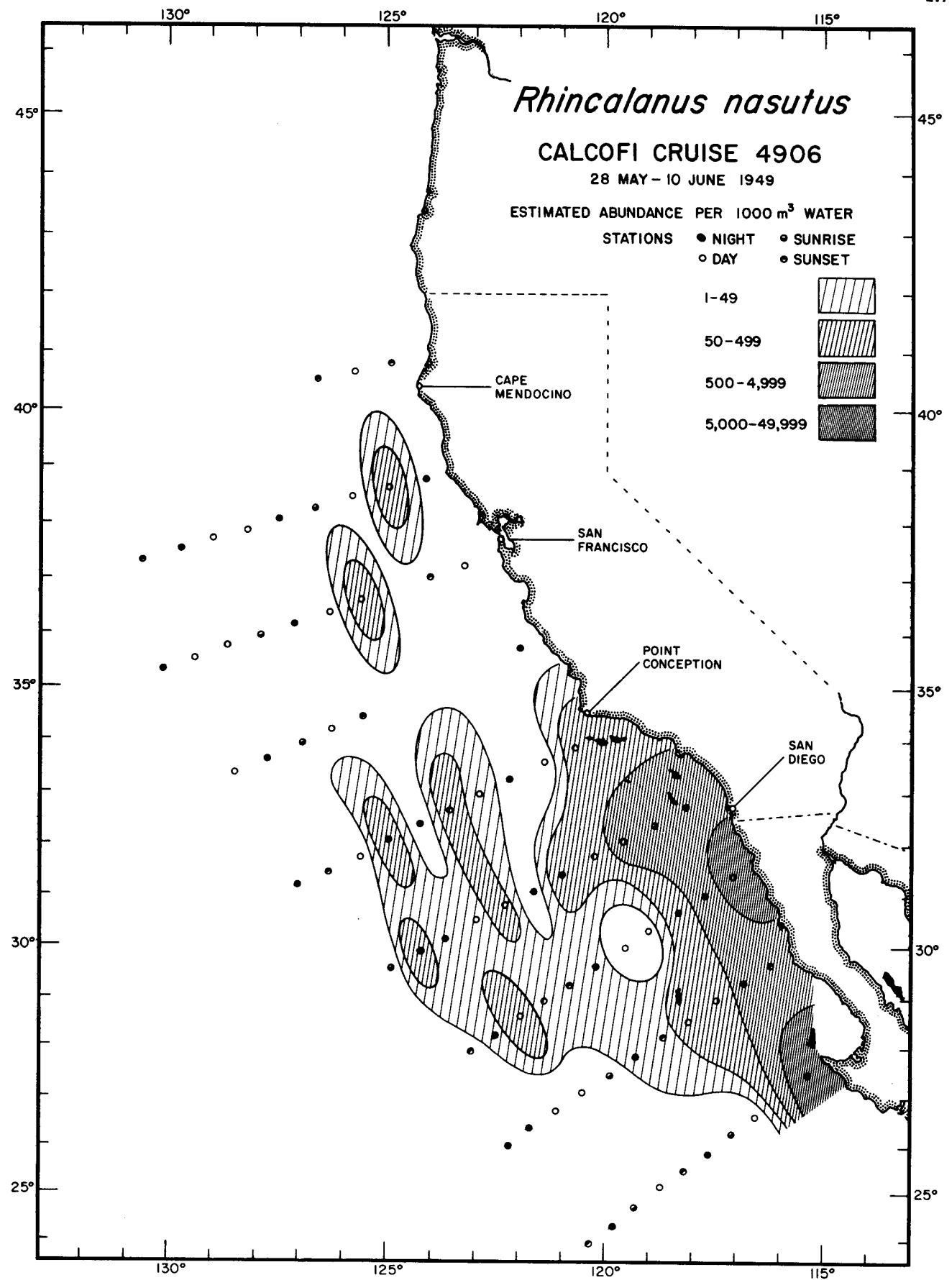
4910



Calanoida

*Rhincalanus nasutus*

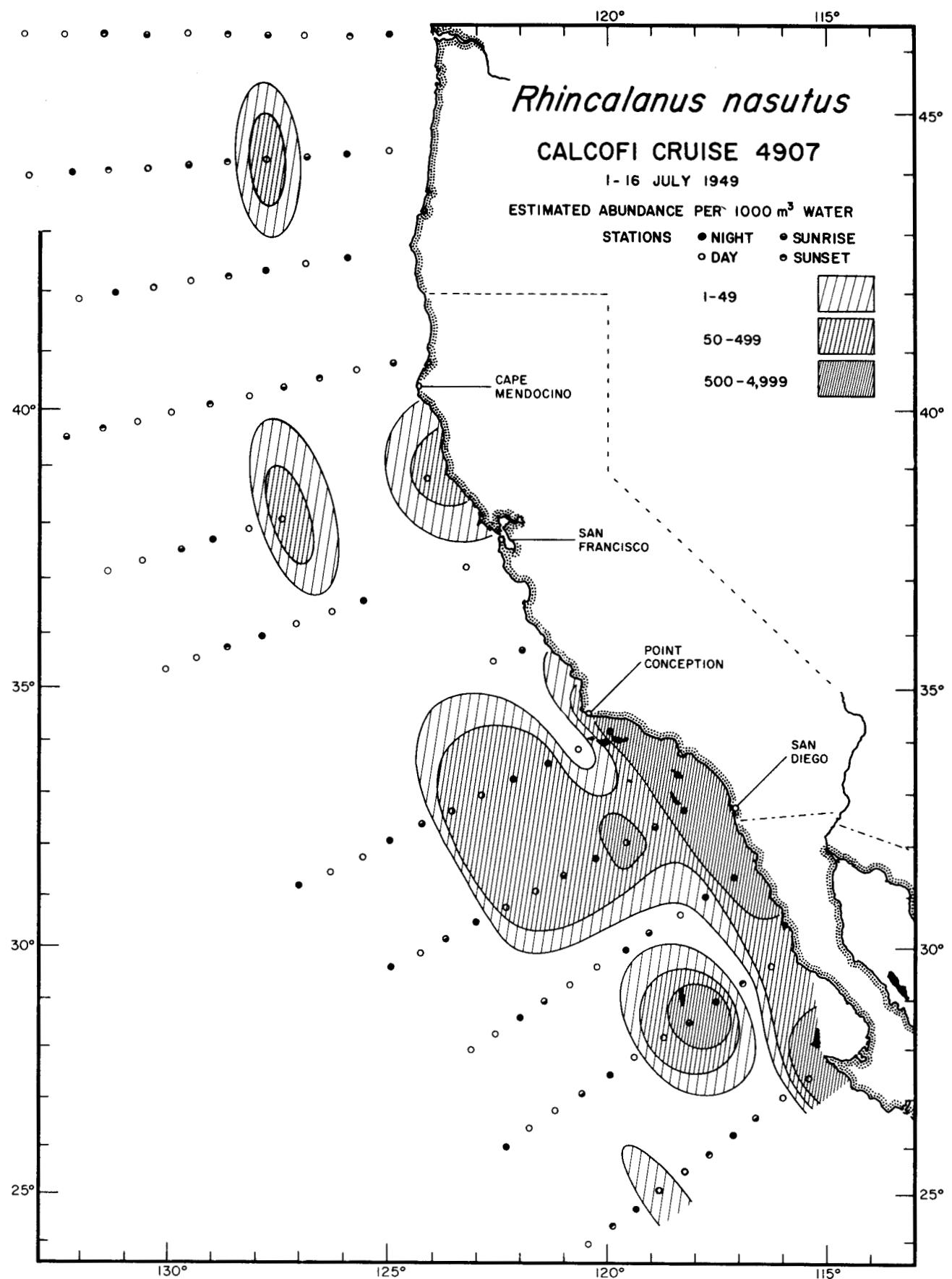
4905



Calanoida

*Rhincalanus nasutus*

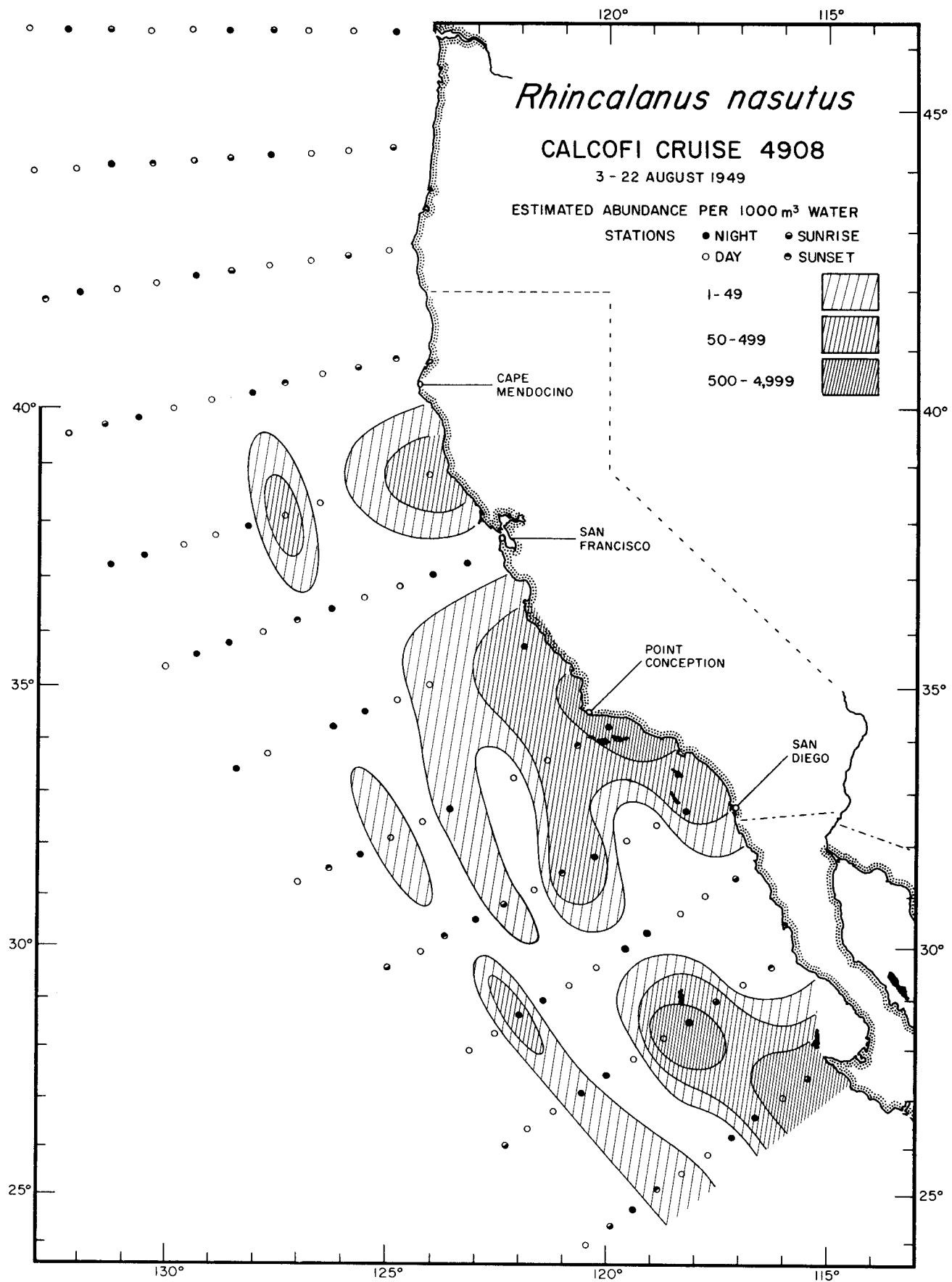
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Calanoida

*Rhincalanus nasutus*

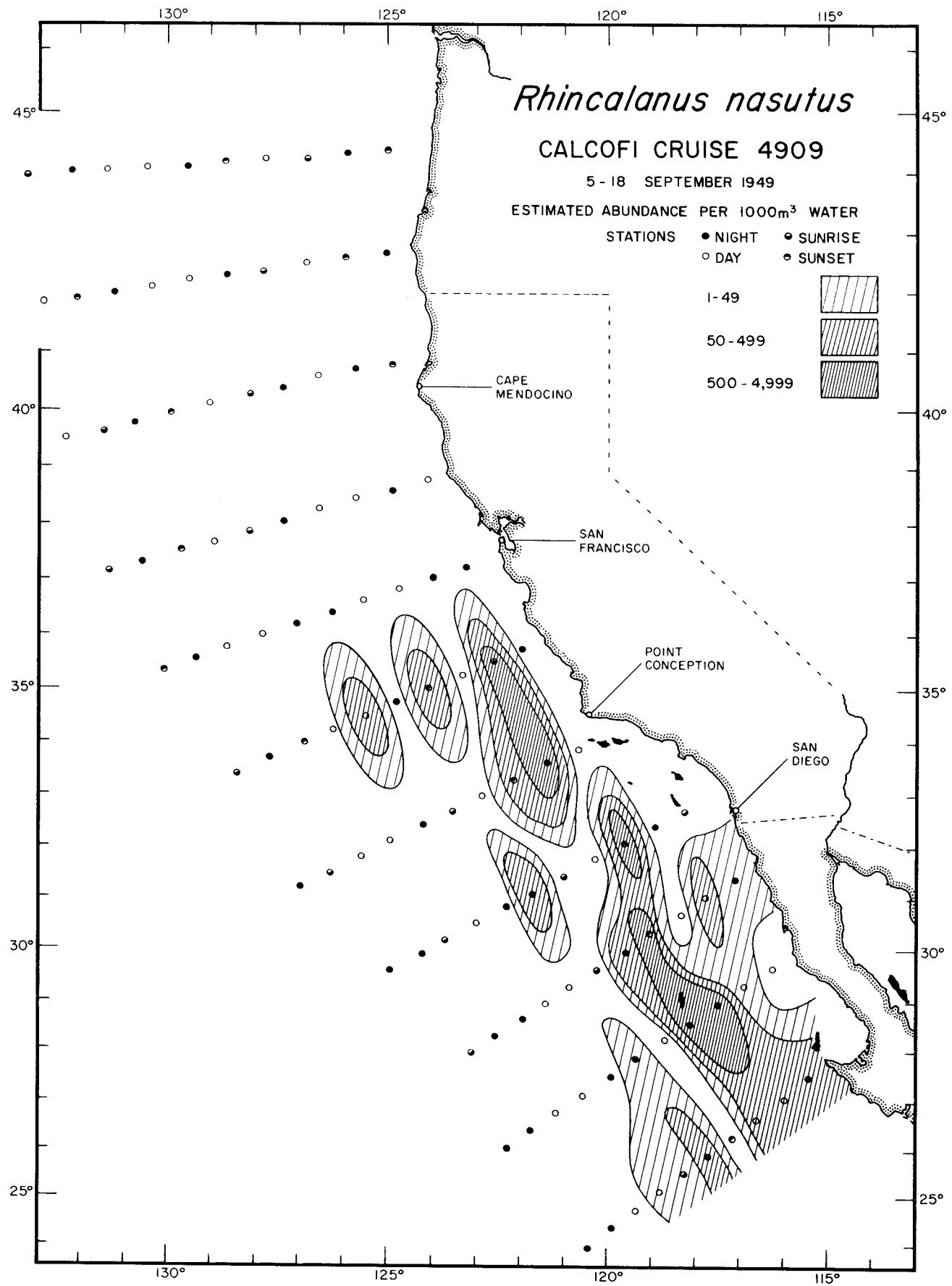
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Calanoida

*Rhincalanus nasutus*

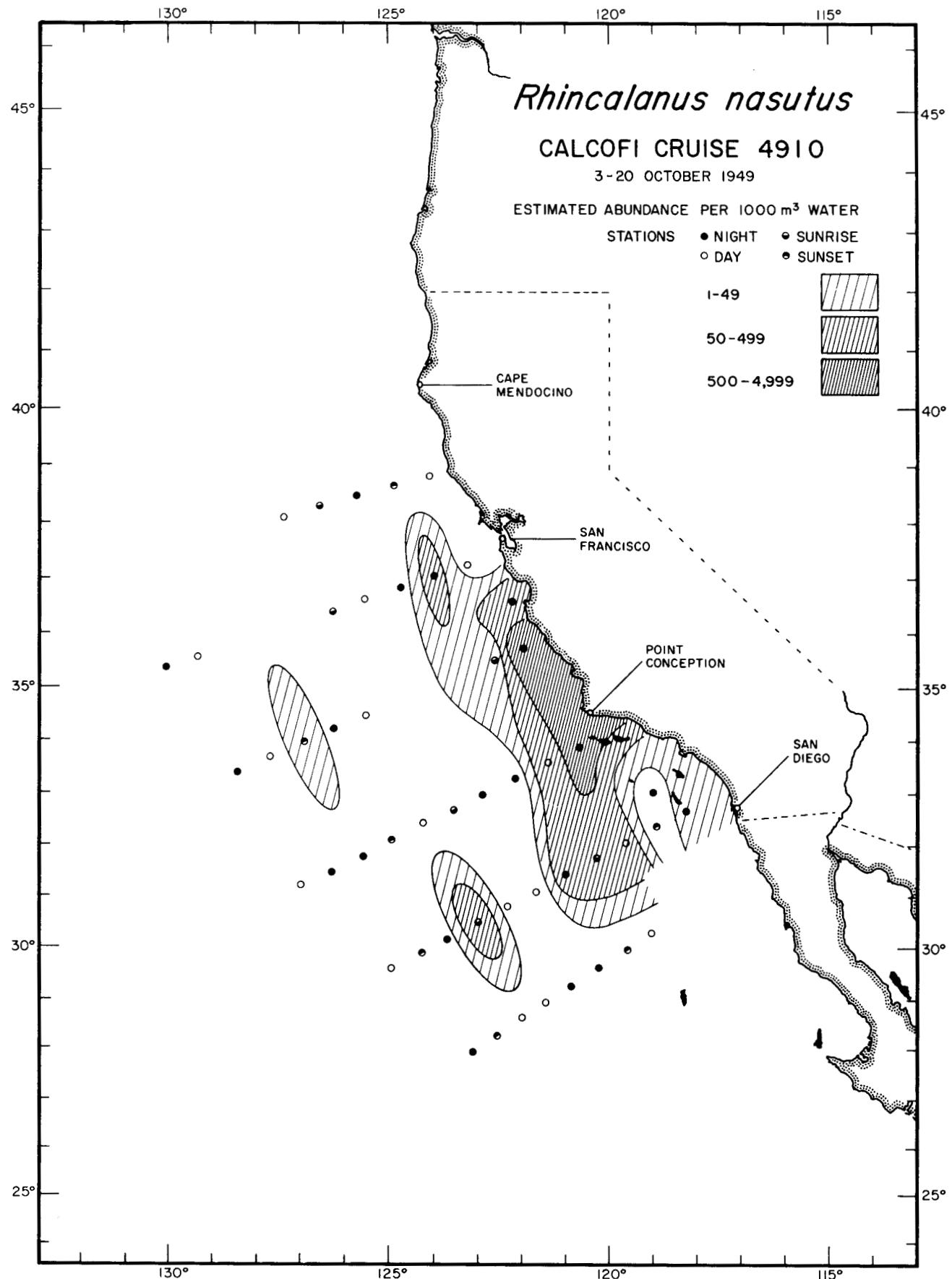
4908



Calanoida

*Rhincalanus nasutus*

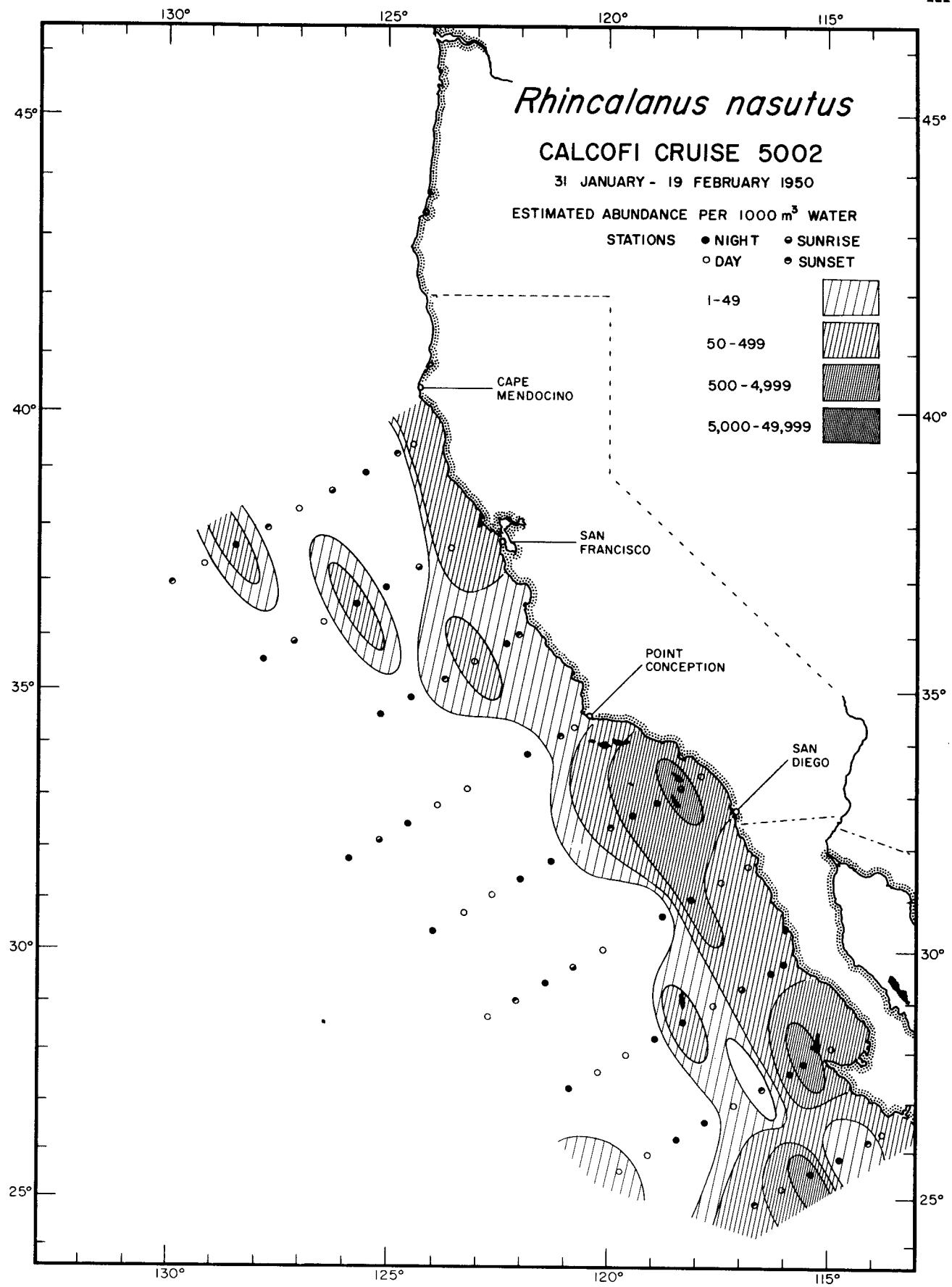
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Calanoida

*Rhincalanus nasutus*

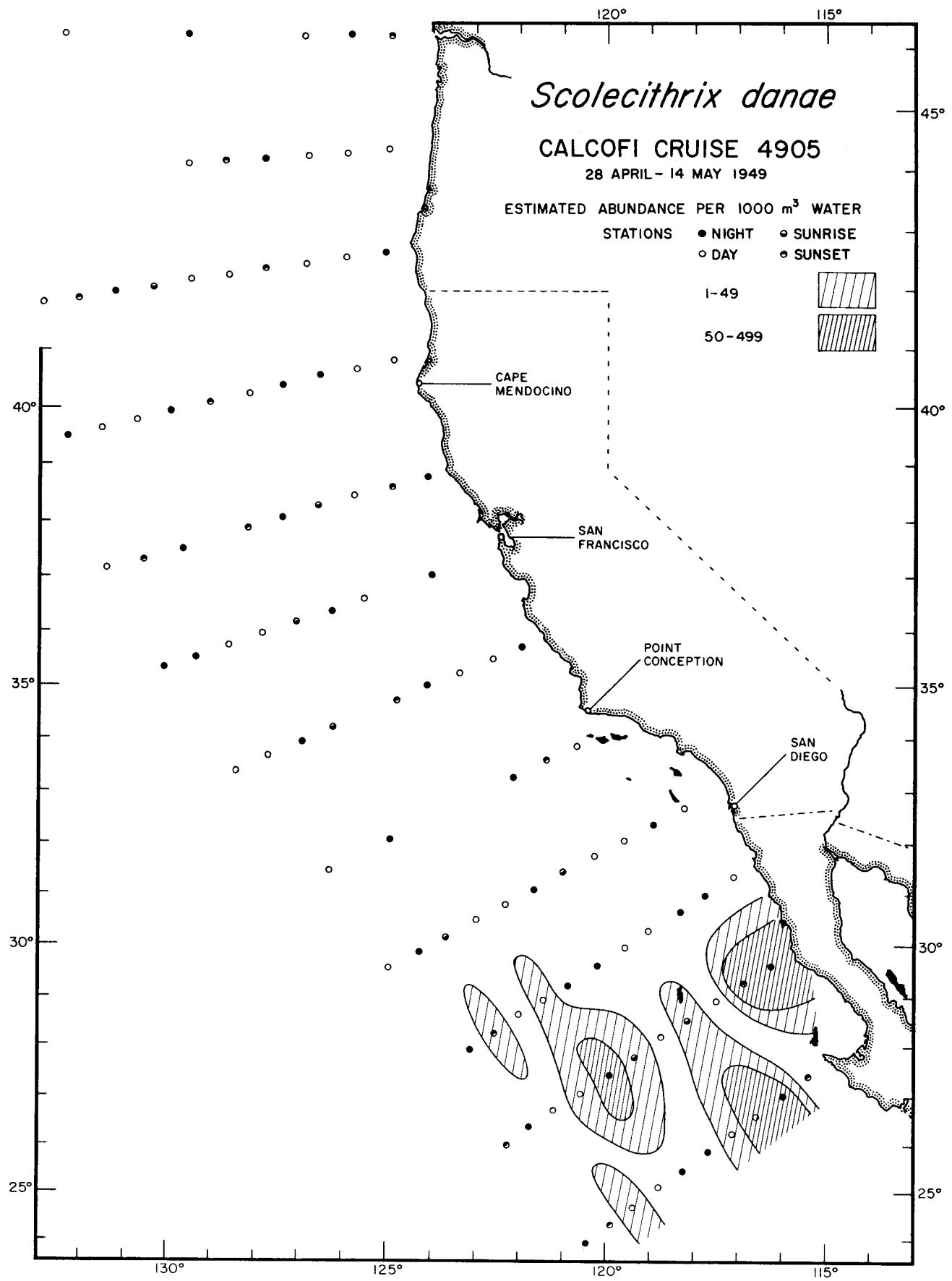
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Calanoida

*Rhincalanus nasutus*

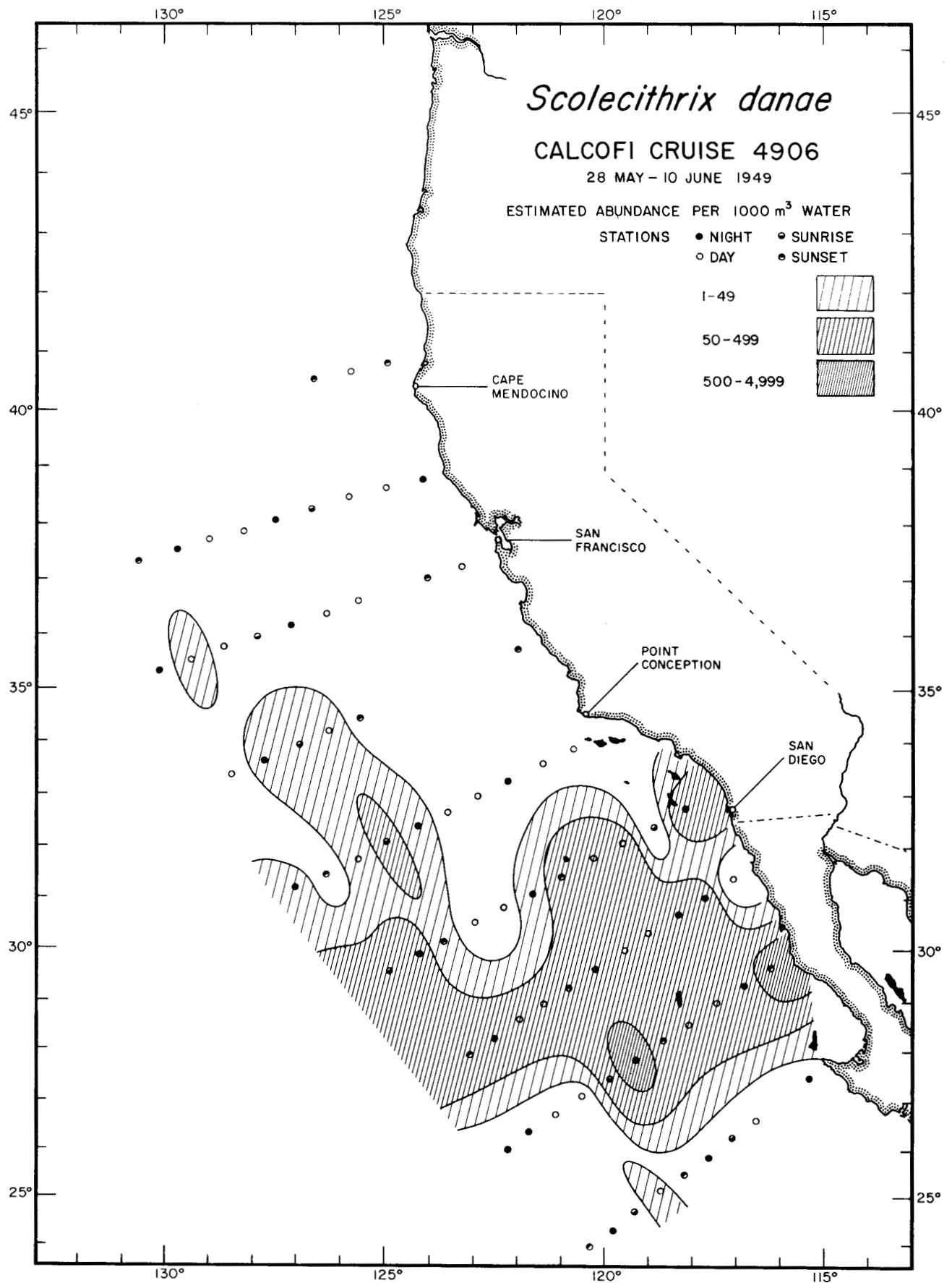
5002



Calanoida

*Scolecithrix danae*

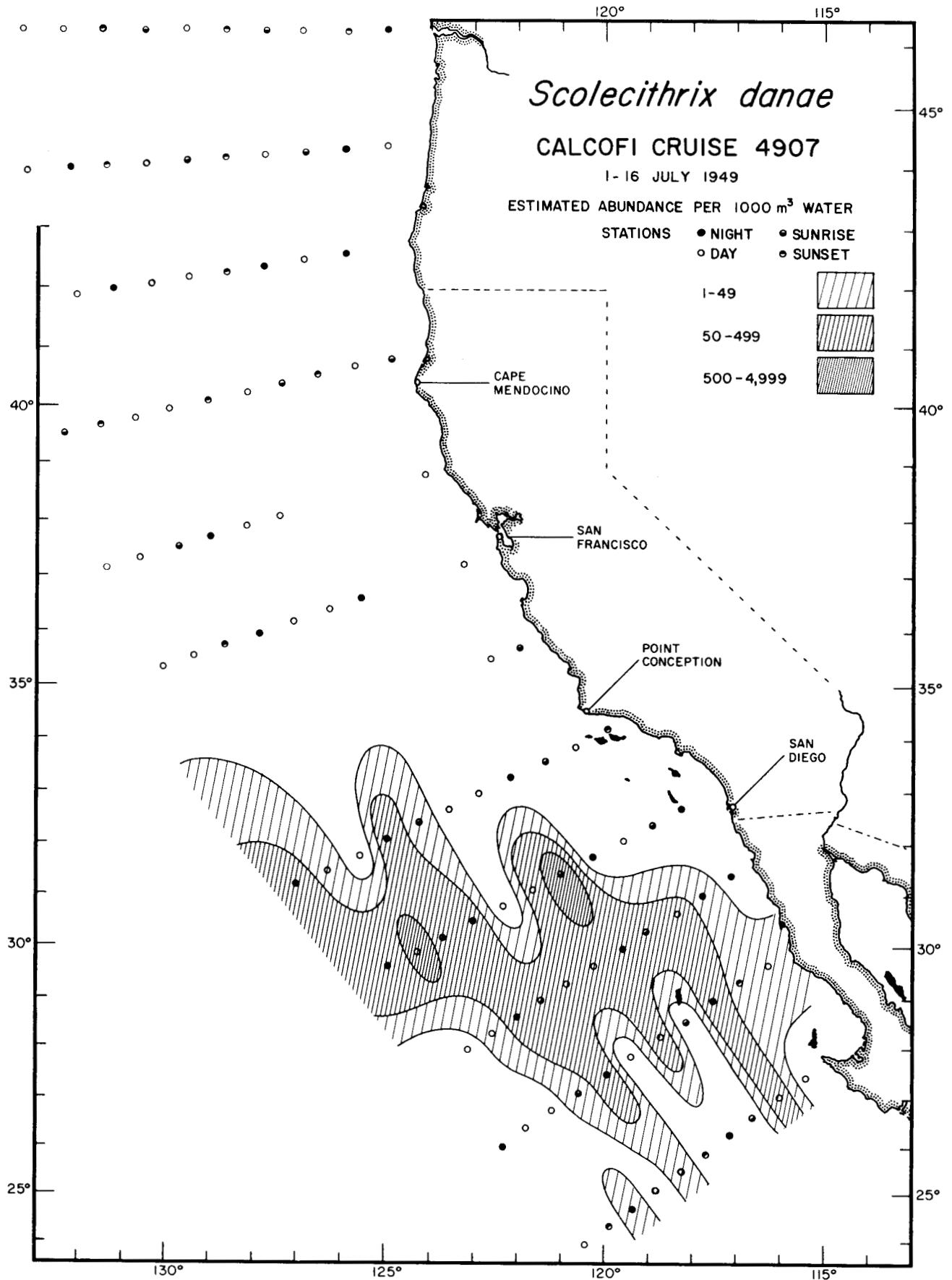
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Calanoida

*Scolecithrix danae*

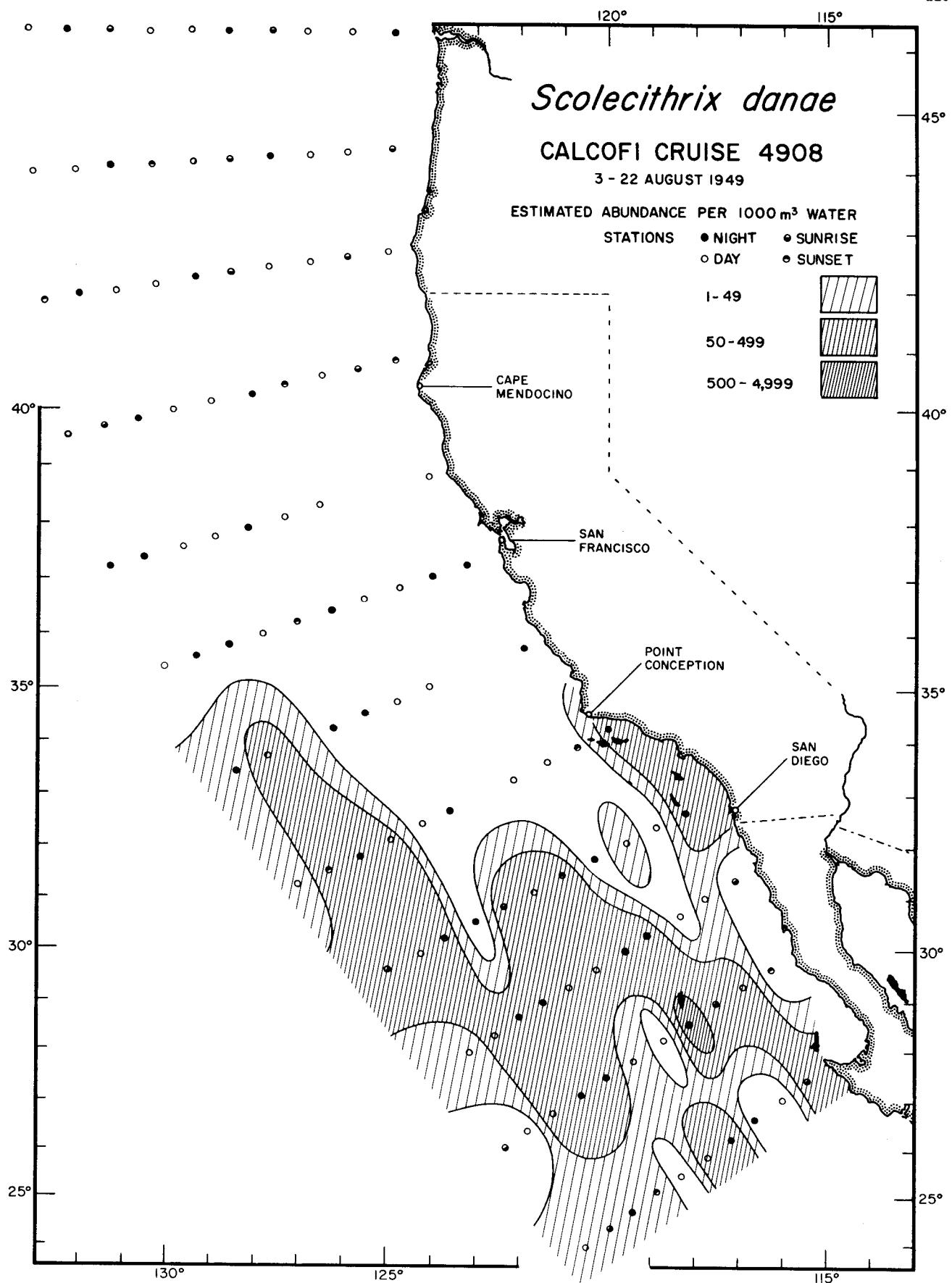
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Calanoida

*Scolecithrix danae*

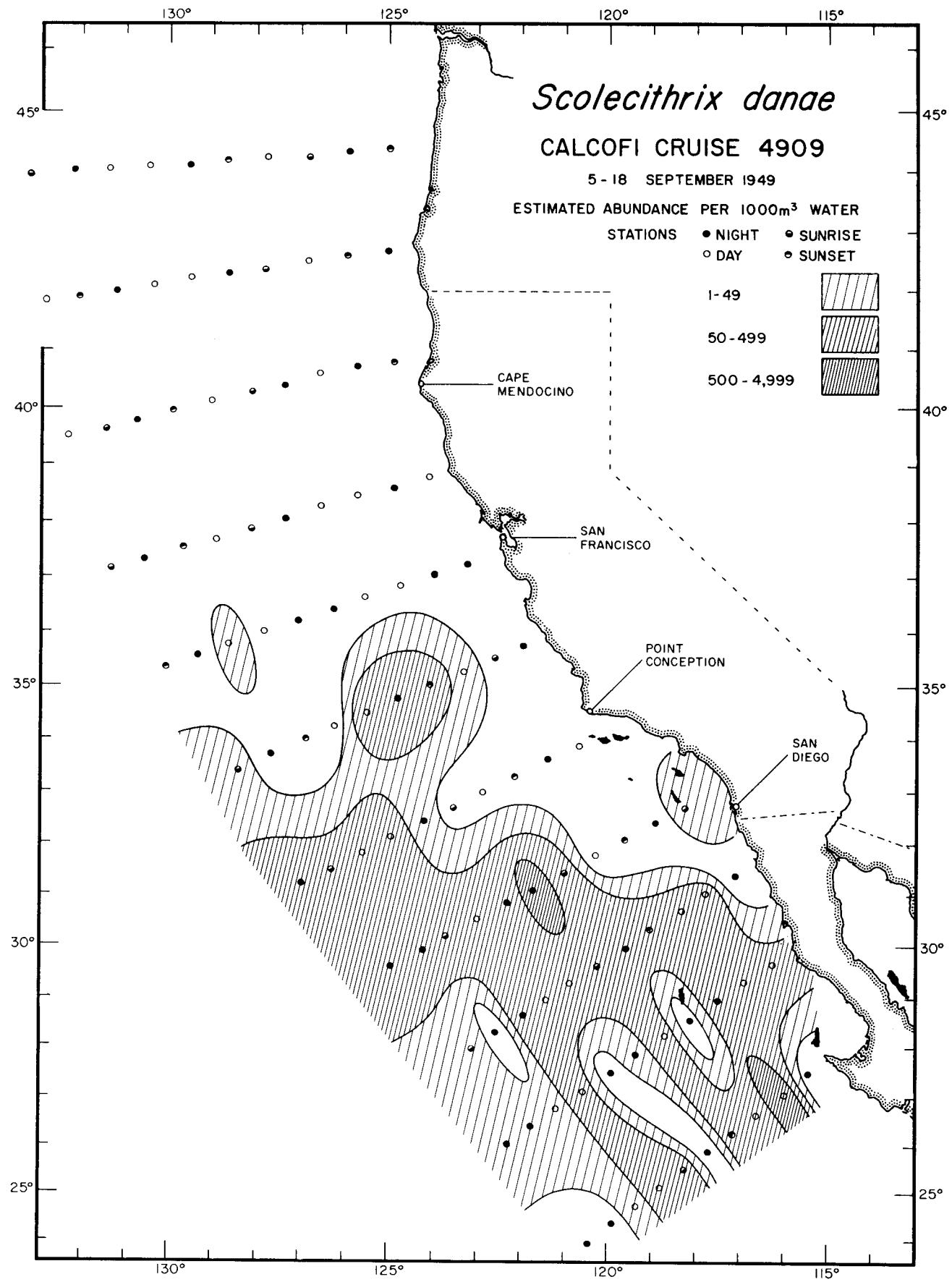
4907



Calanoida

*Scolecithrix danae*

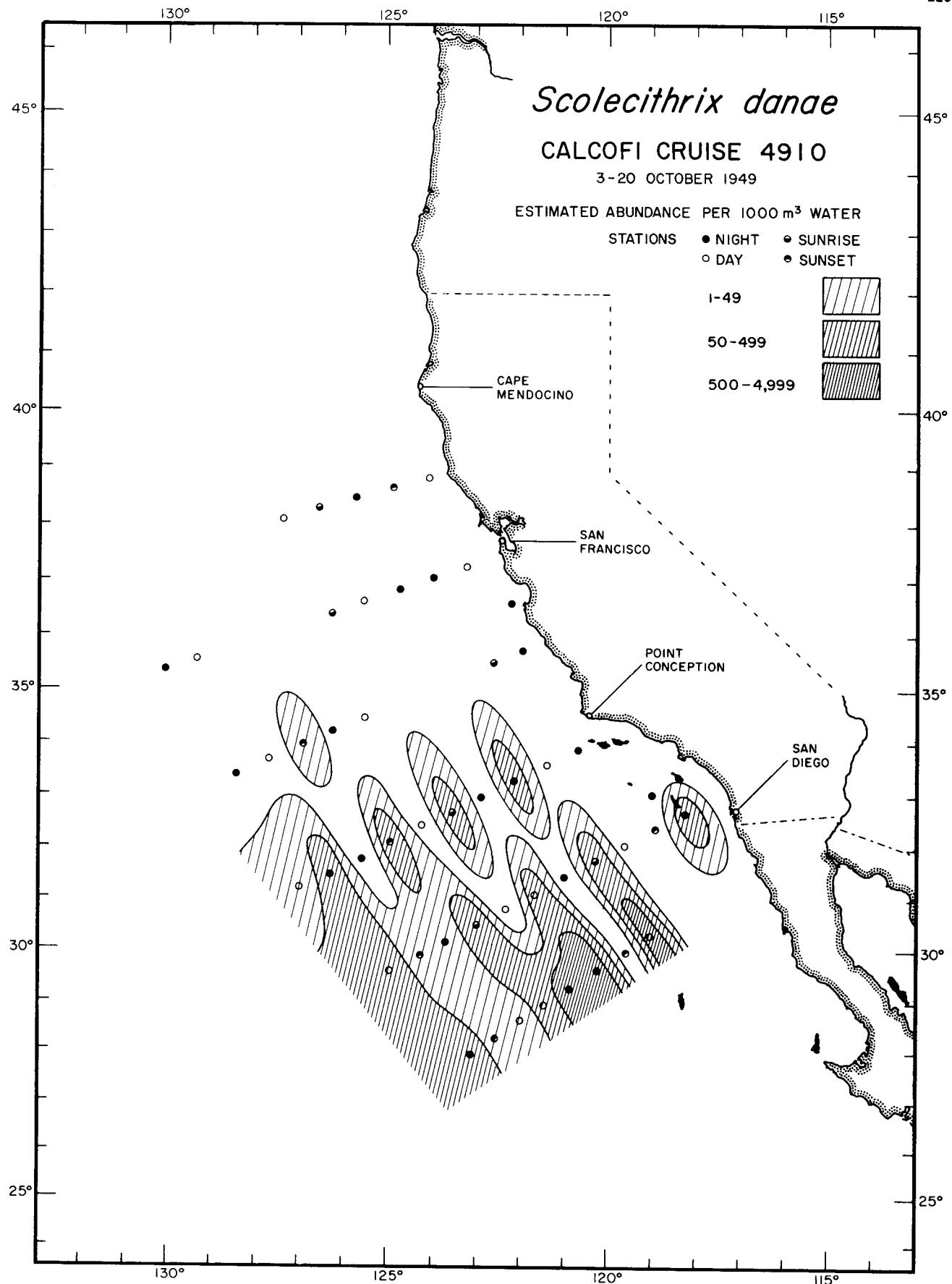
4908



Calanoida

*Scolecithrix danae*

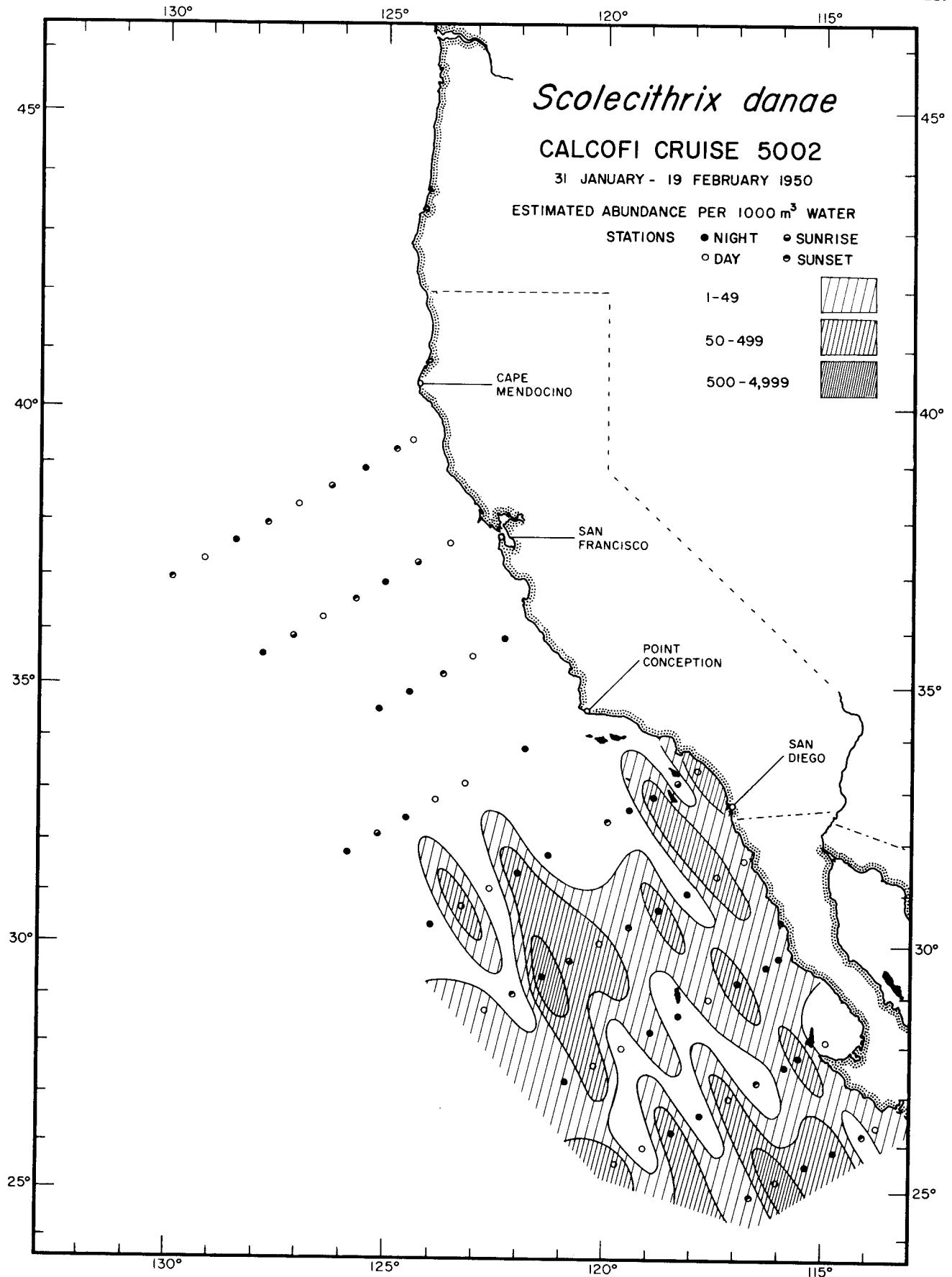
4909



Calanoida

*Scolecithrix danae*

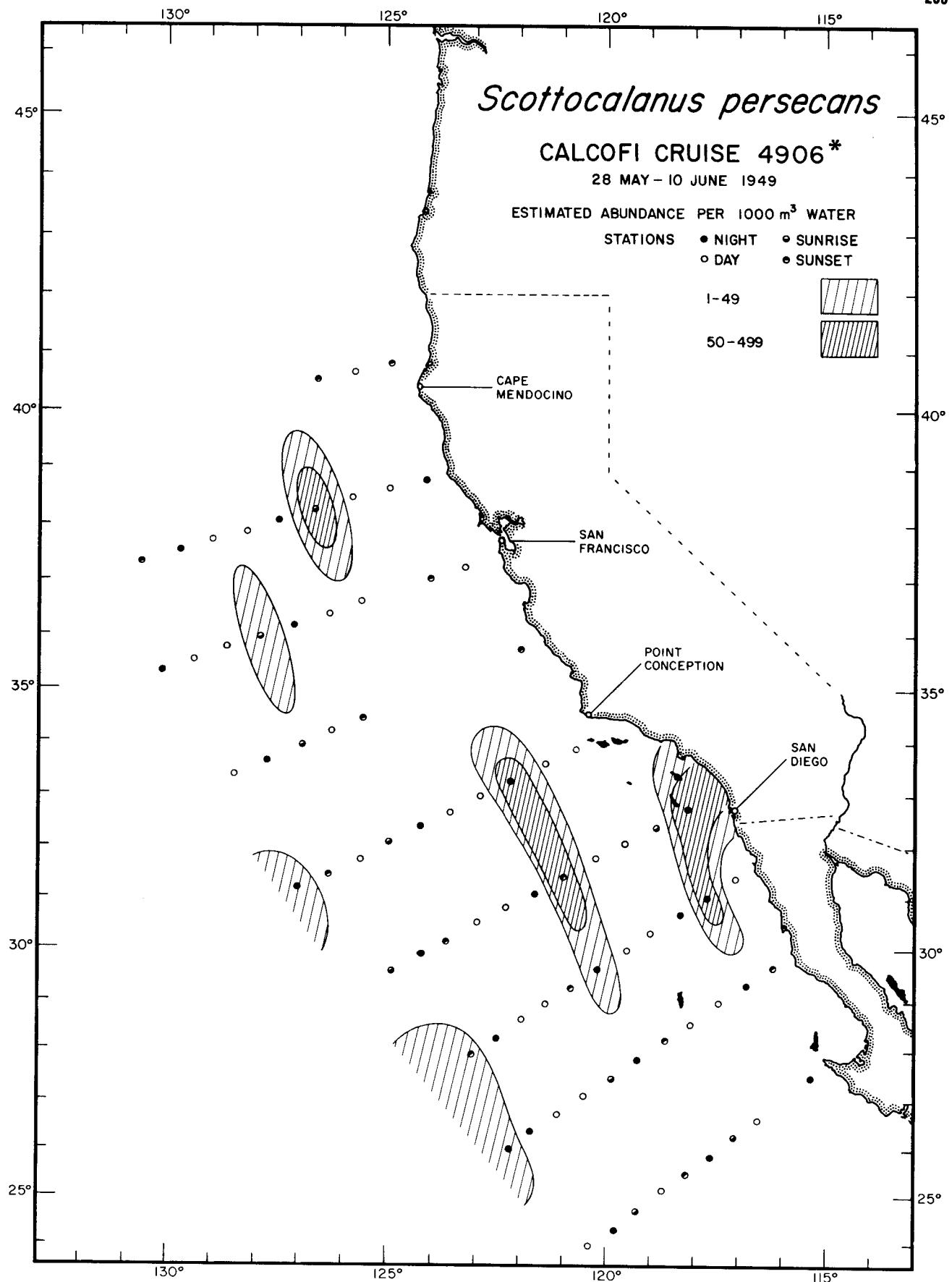
4910



Calanoida

*Scolecithrix danae*

5002

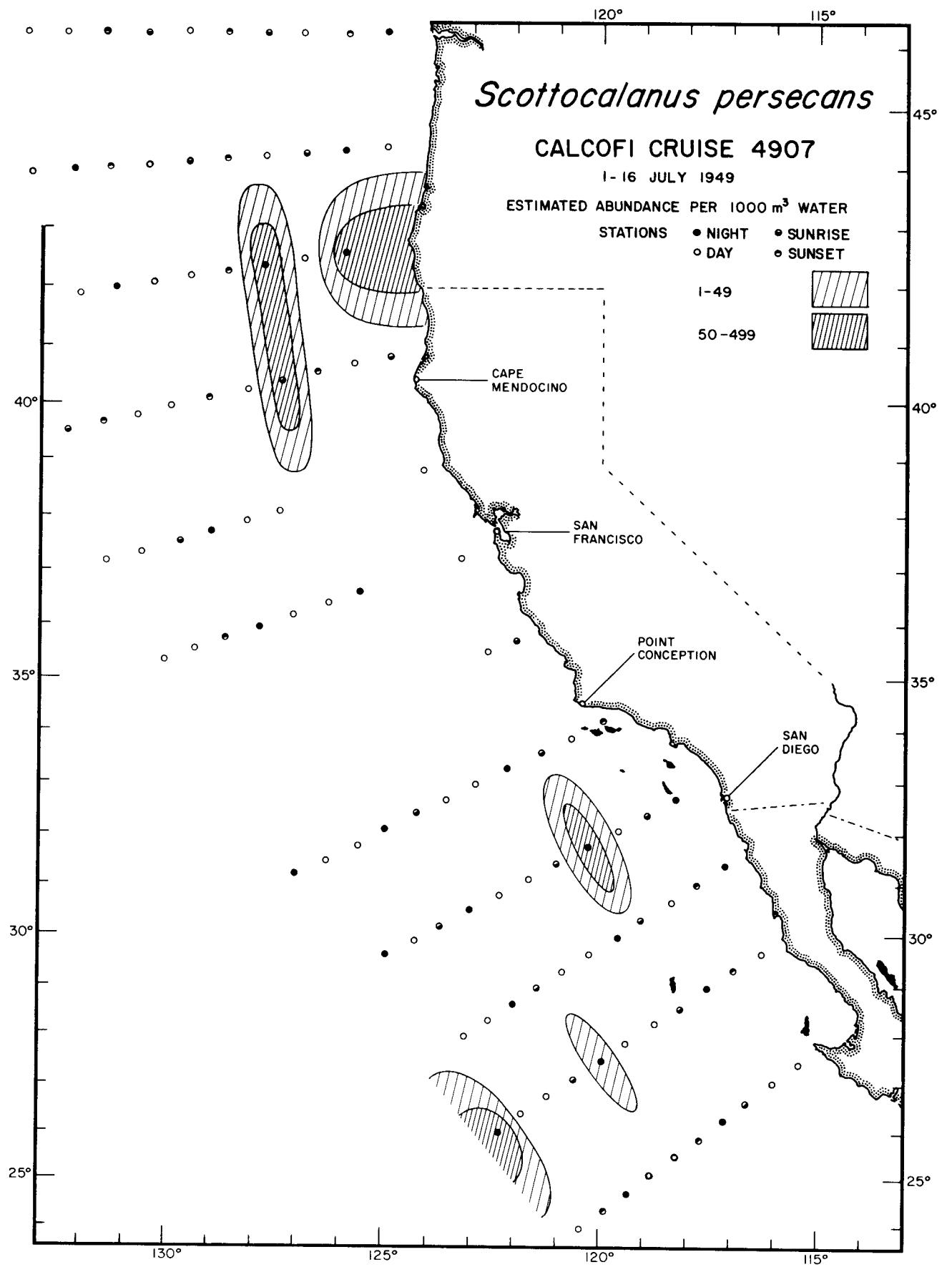


\* See Table 1 for cruise 4905

Calanoida

*Scottocalanus persecans*

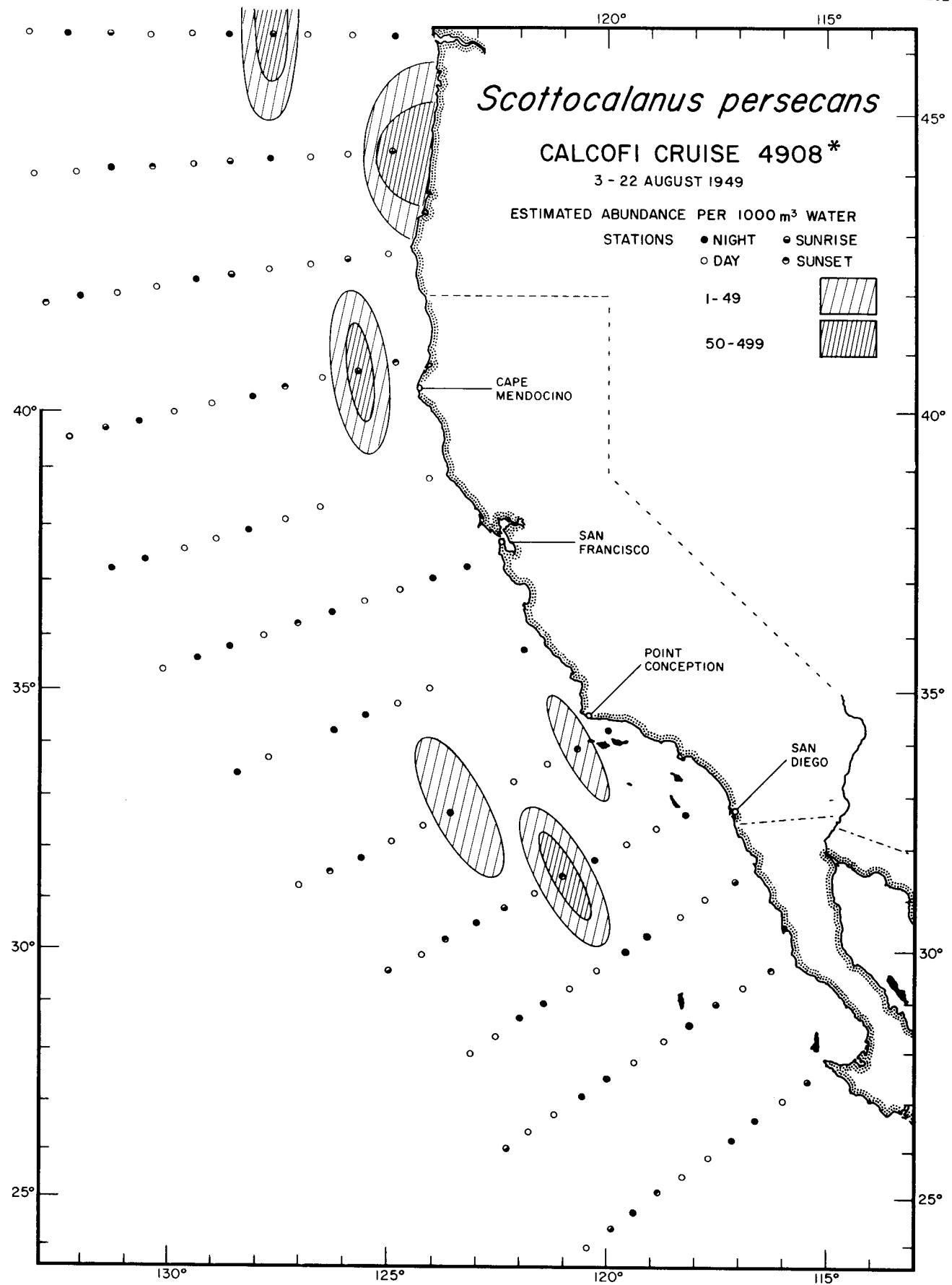
4906



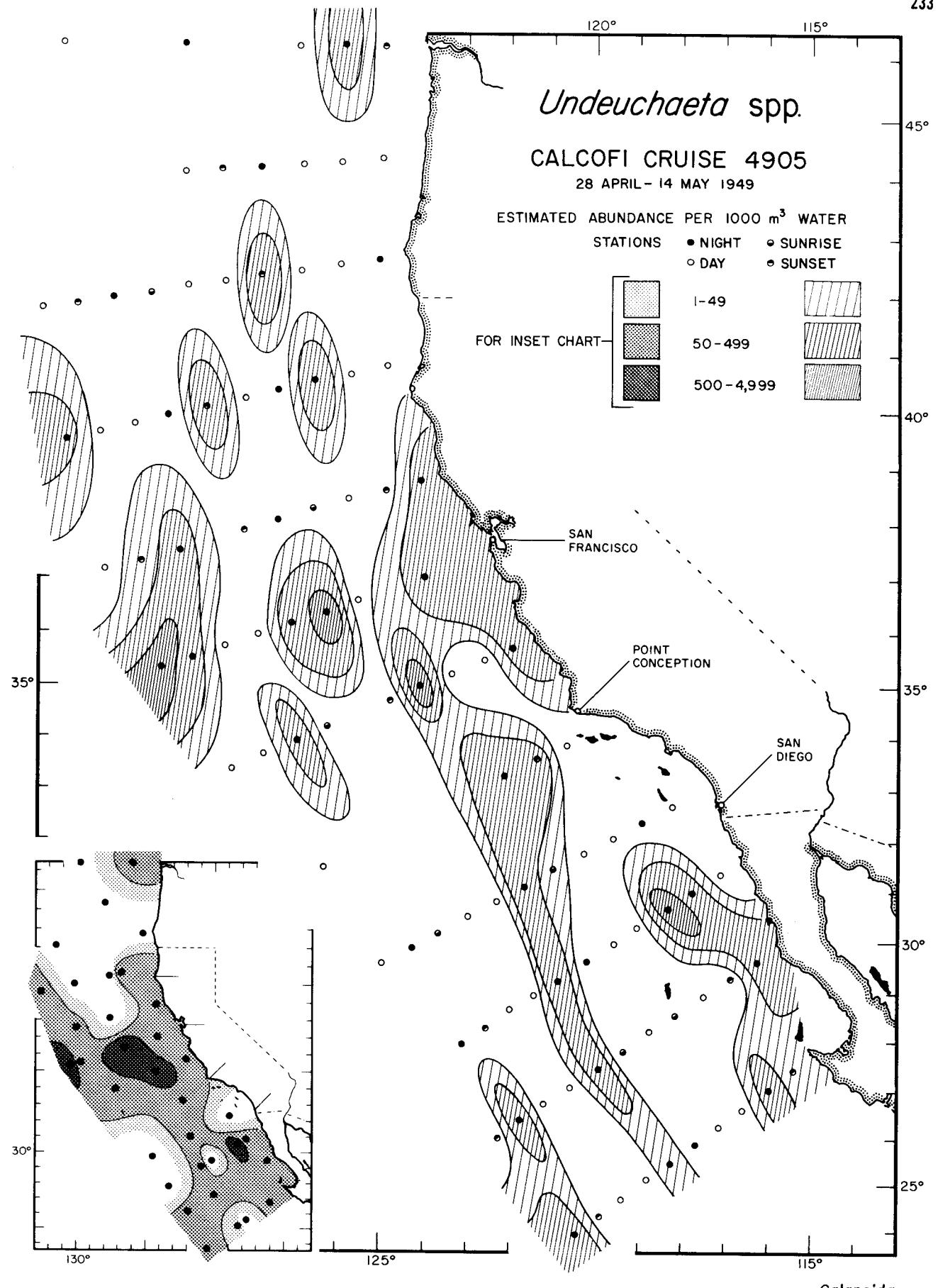
Calanoida

*Scottocalanus persecans*

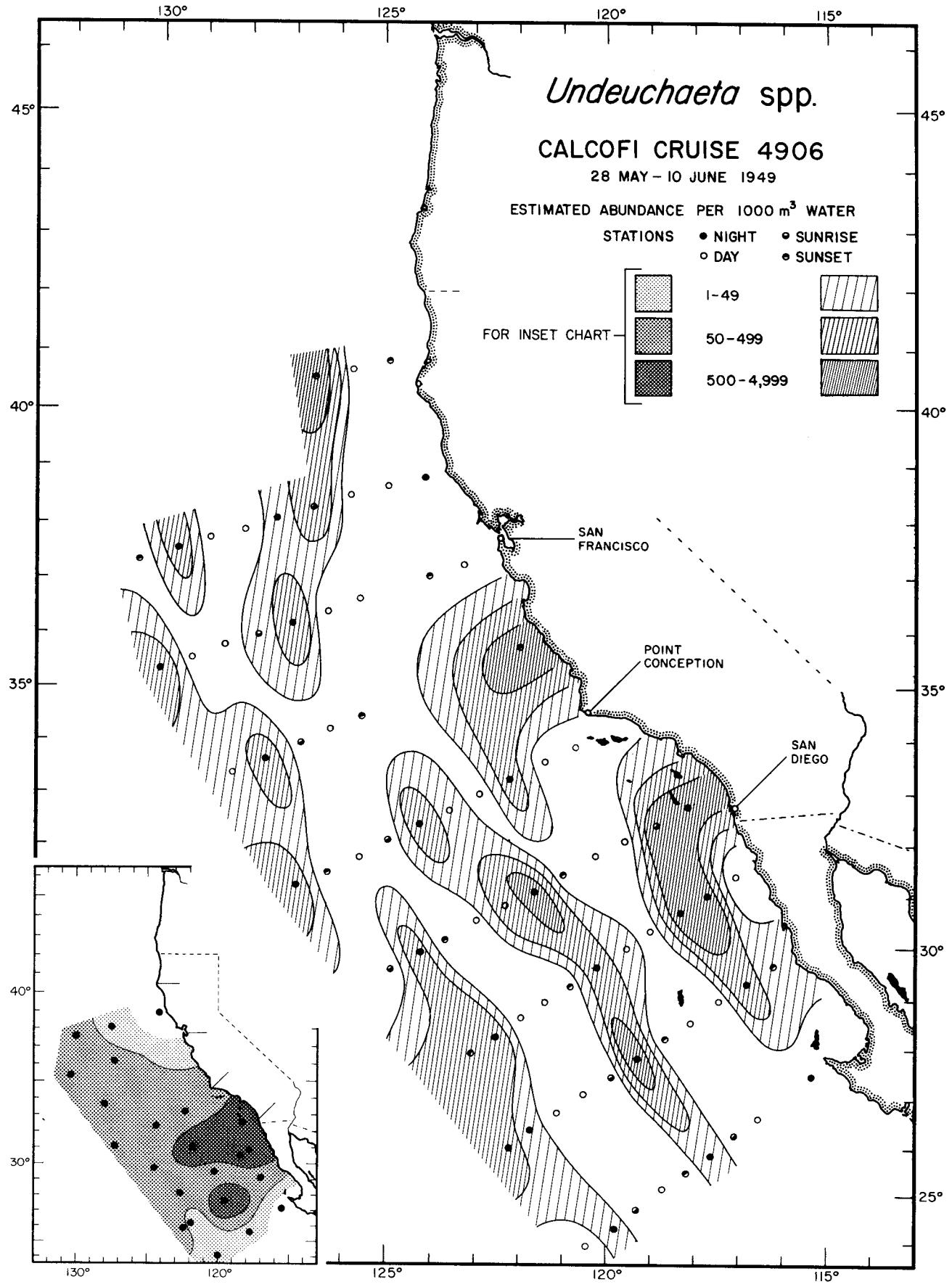
4907



\* See Table 1 for cruises 4909, 10, 5002

*Undeuchaeta* spp.

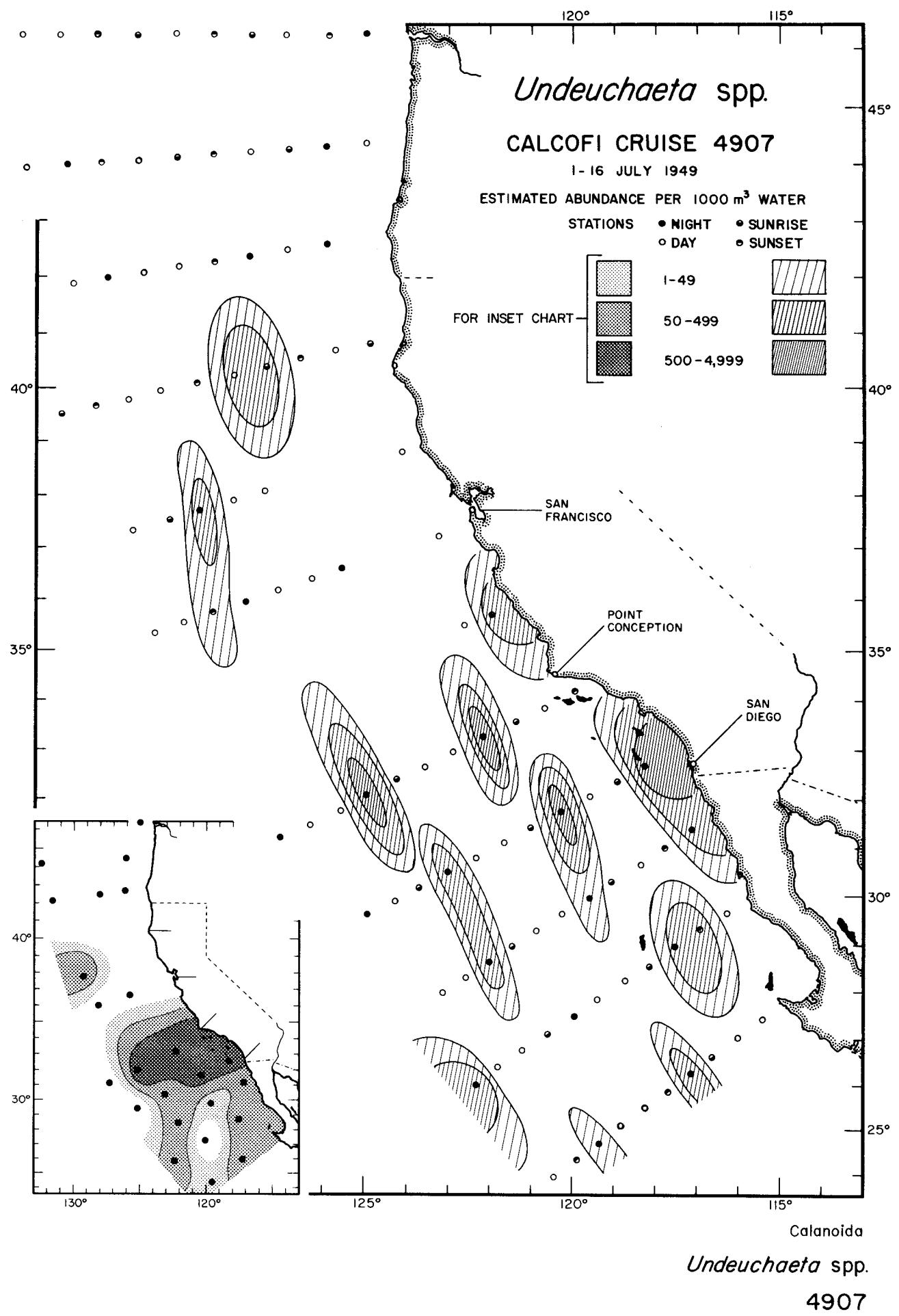
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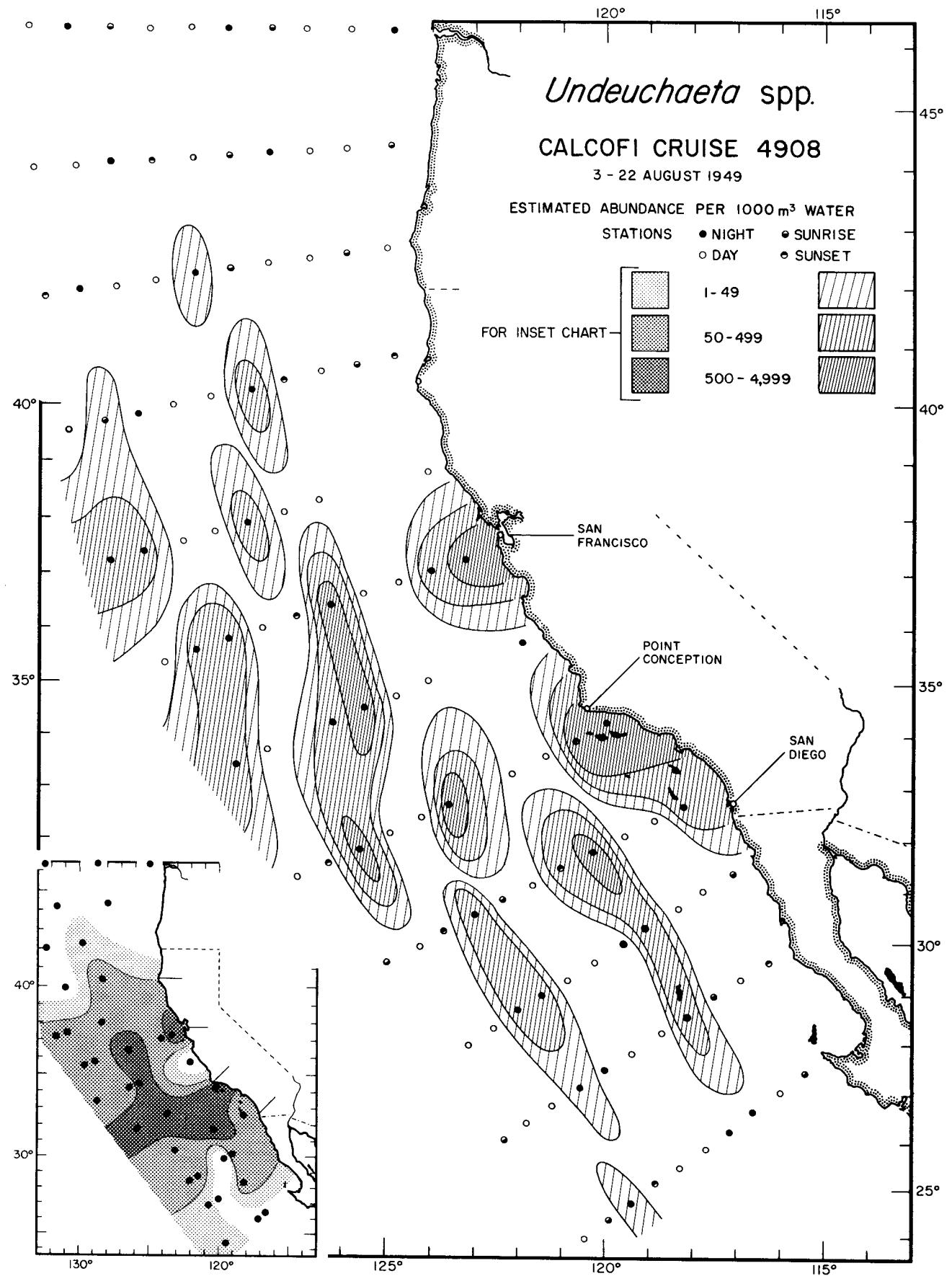


Calanoida

*Undeuchaeta spp.*

4906

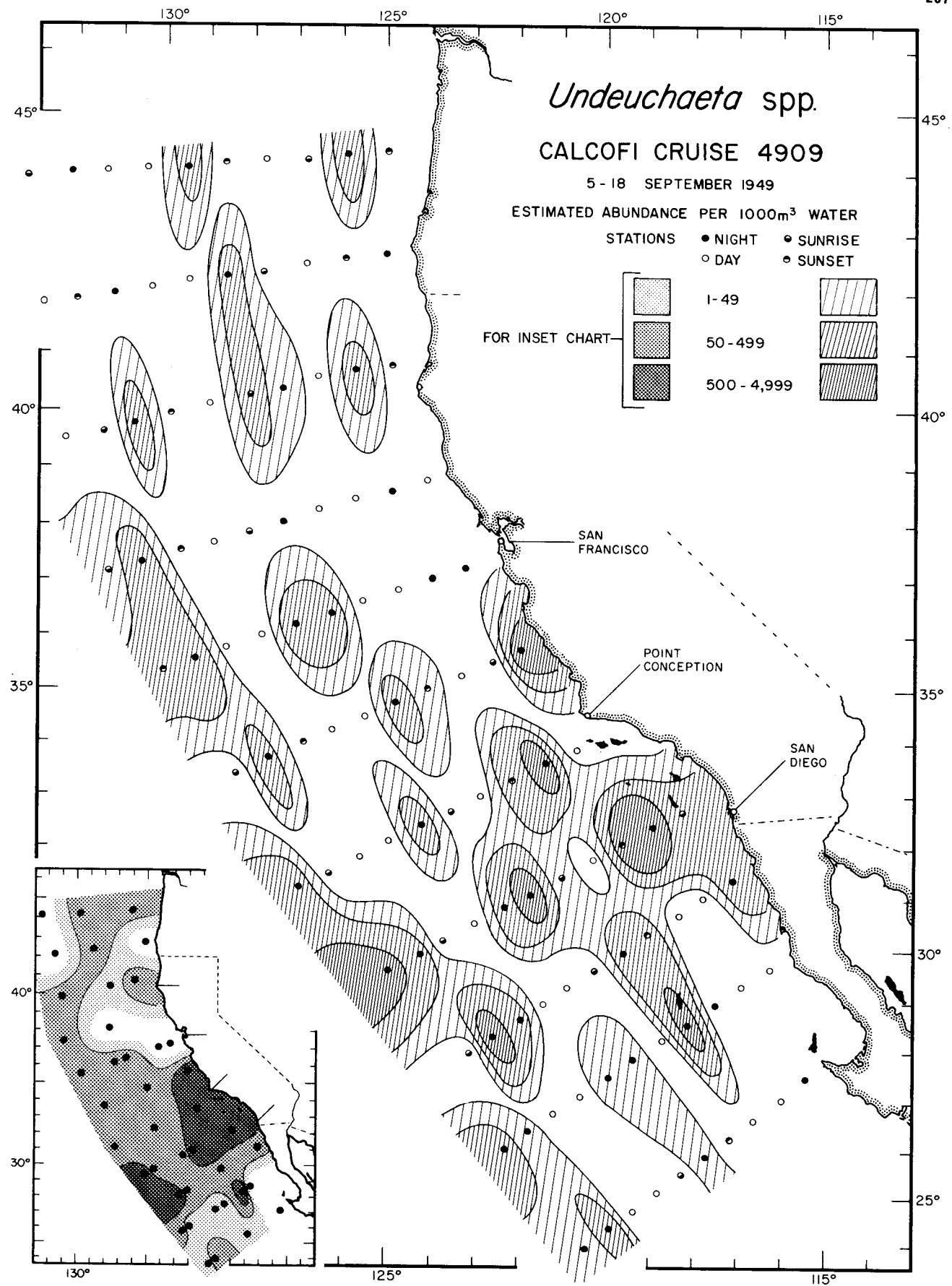




Calanoida

*Undeuchaeta* spp.

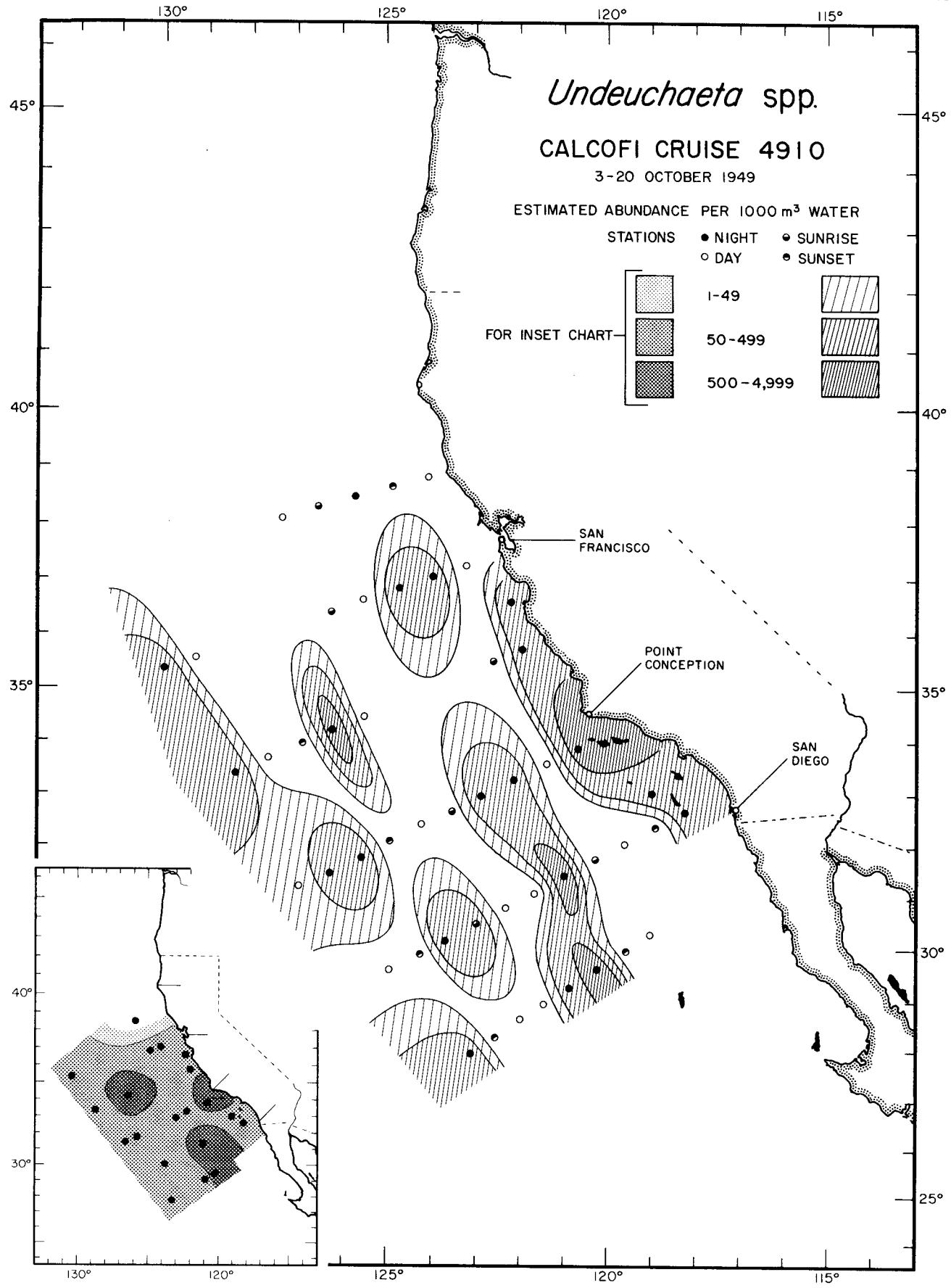
4908



Calanoida

*Undeuchaeta* spp.

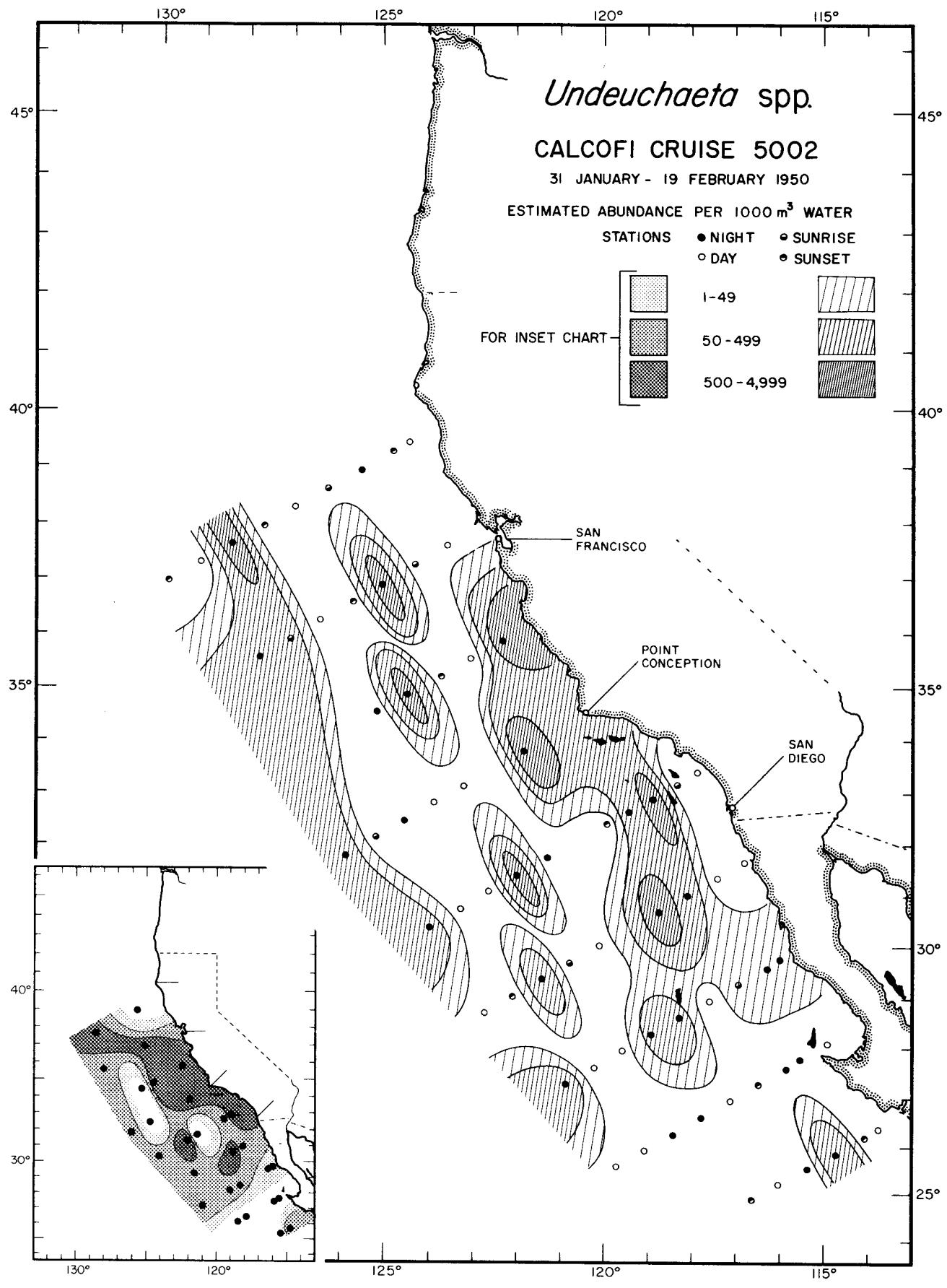
4909



Calanoida

*Undeuchaeta* spp.

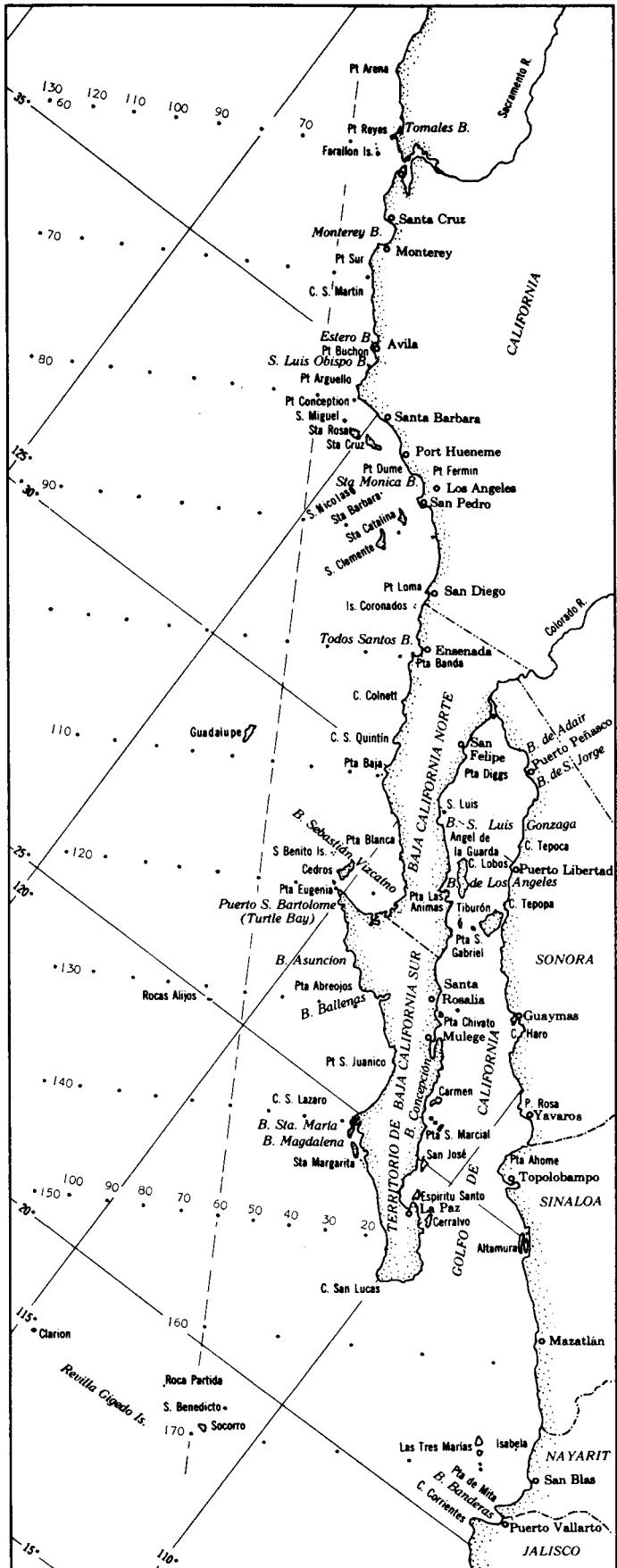
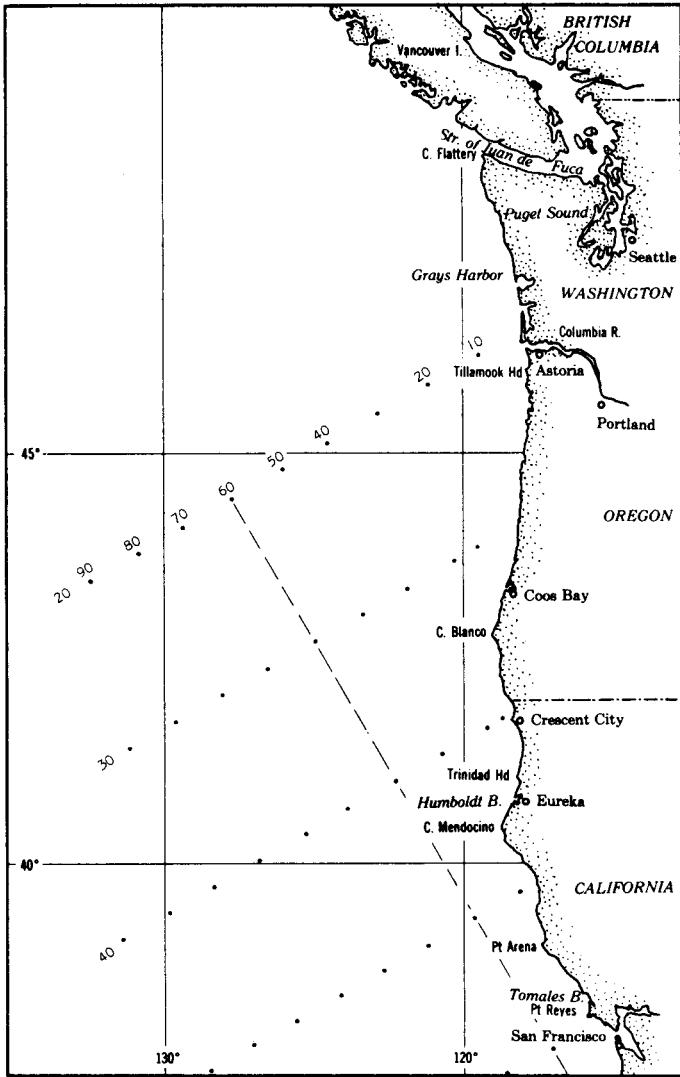
4910



Calanoida

*Undeuchaeta* spp.

5002



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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