



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

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.

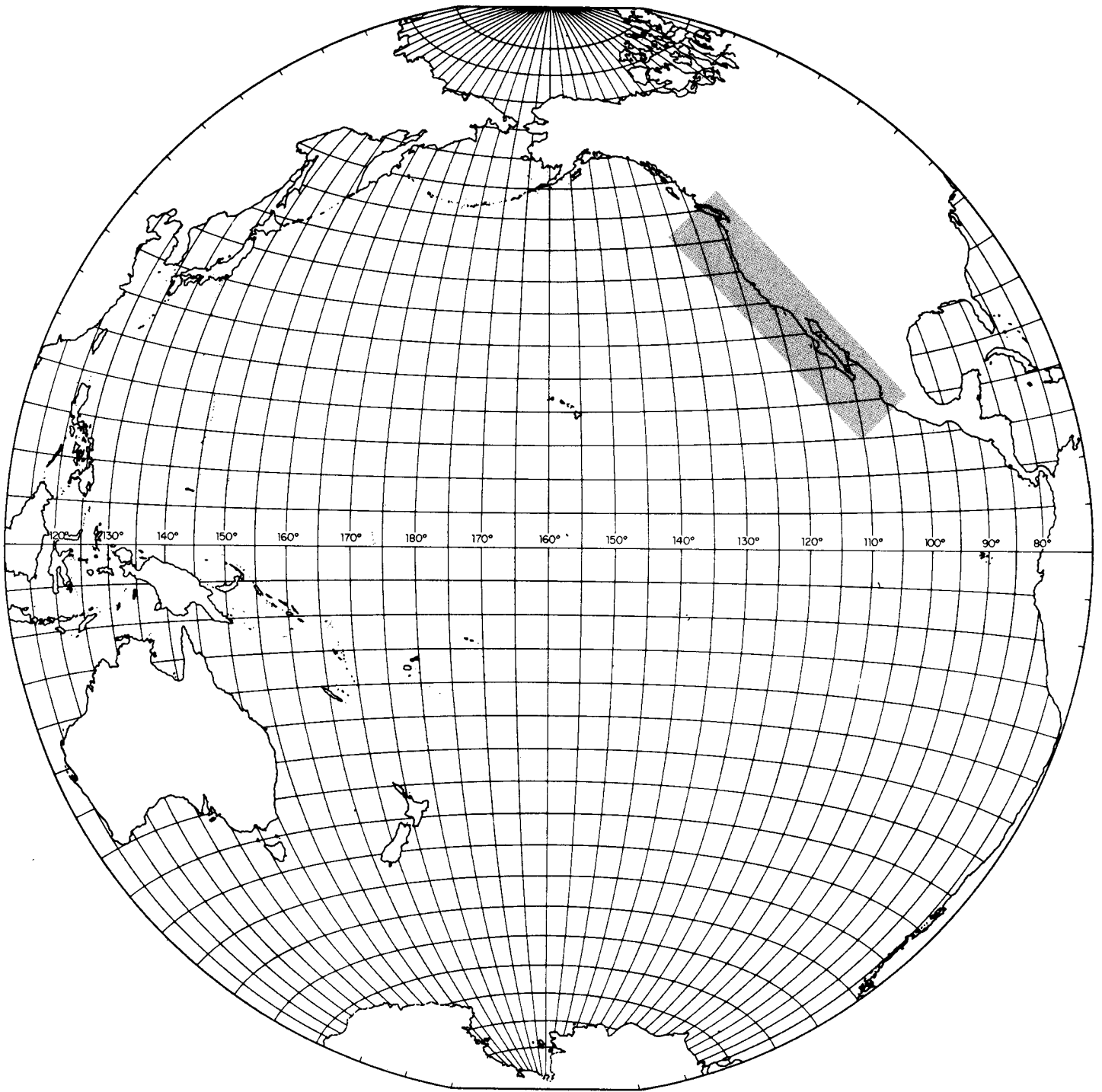
Bradford, J. 1976. Partial Revision of the *Acartia* subgenus *Acartiura* (Copepoda: Calanoida: Acartiidae). *N.Z. Journal of Marine and Freshwater Research* 19(1): 159-202.

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.

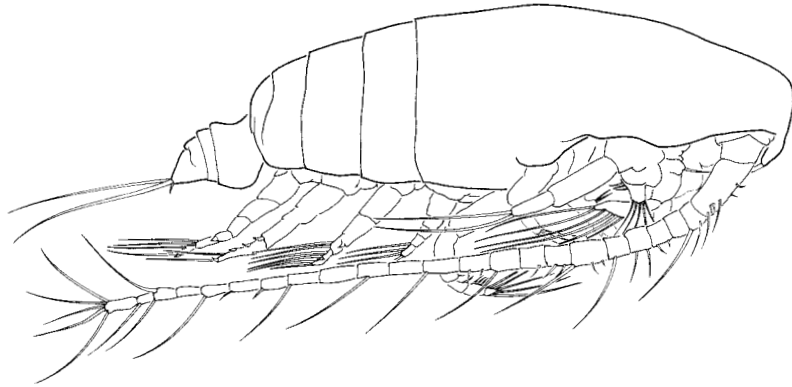
Park, T. 1999. Taxonomy and distribution of the marine calanoid copepod family Heterorhabdidae. *Bulletin of the Scripps Institution of Oceanography* 31: 1-269.

STATE OF CALIFORNIA
MARINE RESEARCH COMMITTEE

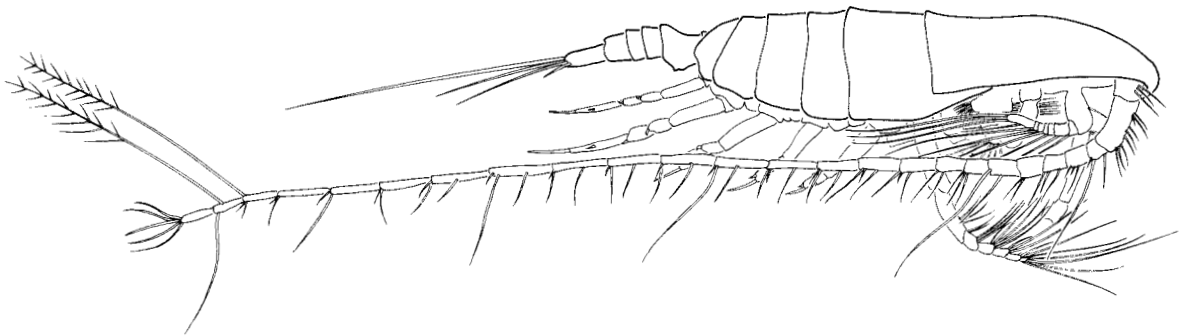


CALIFORNIA COOPERATIVE OCEANIC FISHERIES INVESTIGATIONS

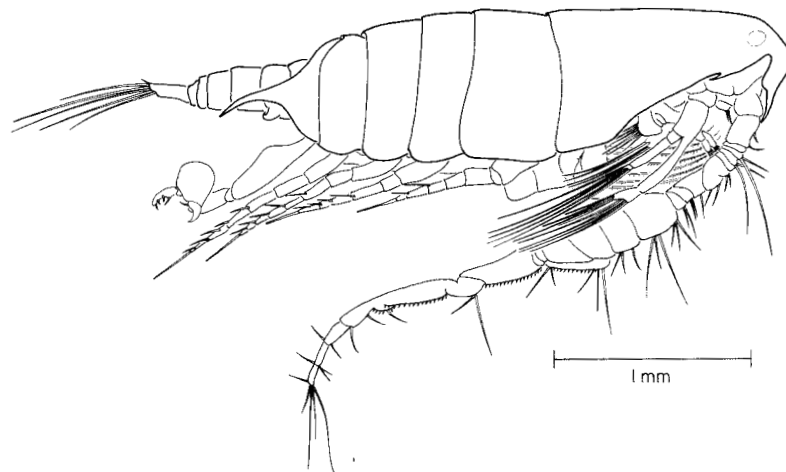
ATLAS No. 19



Eucalanus crassus ♀



Calanus lighti ♀



Epilabidocera longipedata ♂

CALIFORNIA
COOPERATIVE
OCEANIC
FISHERIES
INVESTIGATIONS

Atlas No. 19

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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,¹ a program sponsored by the State of California under the direction of the State's Marine Research Committee. The Cooperating agencies in the program are:

California Academy of Sciences
California Department of Fish and Game
Stanford University, Hopkins Marine Station
National Oceanic and Atmospheric Administration, National Marine Fisheries Service²
University of California, Scripps Institution of Oceanography

CalCOFI atlases³ are issued as individual units as they become available. They provide processed physical, chemical and biological measurements of the California Current region. Each number may contain one or more contributions. A general description of the CalCOFI program with its objectives appears in the preface of Atlas No. 2.

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

CalCOFI Atlas Editorial Staff:

Abraham Fleminger and John G. Wyllie, Editors

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

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

¹ Usually abbreviated CalCOFI, sometimes CALCOFI or CCOFI.

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

³ 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
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Scripps Institution of Oceanography
La Jolla, California

June, 1973

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

Thomas E. Bowman¹ and Martin W. Johnson²

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Charts

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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 1000m³ of sea water filtered using the formula:

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

where n = number of individuals counted
V = m³ of water filtered during the tow
D = displacement volume of the sample
d = displacement volume of the aliquot
N = number of individuals in 1000 m³ 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</i> s.l.	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</i> spp.	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>propia</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 flavicornis</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
Microcalanids	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</i> spp.	O	O	T	T	214	215	T
<i>Pontellopsis</i> spp.	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</i> spp.	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 ³	TAXONOMIC GROUP	YEAR	CRUISE	STATION	Number 1000m ³						
<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						
			4905	201				123	4909	1004	78				
<i>Aetideus divergens + truncatus</i>	1949	4907	102	26	<i>Euchirella curticauda</i>	1950	5002	120.45	218						
			207	281				130.35	615						
			208	676				130.70	36						
			209	101				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	1950	5002	50.110	369		
<i>Arietellus setosus</i>	1949	4906	810	NQ	<i>Euchirella galeata</i>	1949	4907	701	157						
			4907	901				NQ	901	204					
			4909	709				NQ	908	51					
			806	41				1001	191						
<i>Calanus cristatus</i>	1949	4909	209	355	<i>Euchirella messinensis</i>	1949	4906	809	24						
			4910	1006				79	901	218					
<i>Calanus gracilis</i>	1949	4905	410	273	<i>Euchirella propia</i>	1949	4910	803	52						
			508	78				806	21						
<i>Calanus plumchrus</i>	1949	4908	102	45	<i>Euchirella rostrata</i>	1949	4909	209	19						
			107	311				502	NQ						
			208	68				4908	309	66					
			4909	201				44	4909	209	19				
<i>Calanus robustior</i>	1949	4908	507	8	<i>Euchirella truncata</i>	1949	4907	409	NQ						
			508	21				<i>Phaenna spinifera</i>	1950	5002	130.70	72			
			509	583							<i>Pontellina</i> spp.	1949	4907	1208	18
			605	74										4908	910
4910	805	426	911	23											
806	21	914	104												
<i>Candacia bispinosa</i>	1949	4905	708	15	<i>Pontellopsis</i> spp.	1949	4906	1005	35						
			709	19				1010	NQ						
<i>Candacia catula</i>	1949	4905	102	128	<i>Scottocalanus persecans</i>	1950	5002	130.60	73						
			1107	31				4905	803	47					
<i>Candacia columbiae</i>	1949	4909	202	346	<i>Temora discaudata</i>	1949	4905	1210	39						
			209	56				4909	402	54					
<i>Candacia longimana</i>	1949	4905	305	81	<i>Tortanus discaudatus</i>	1949	4909	501	47						
			4910	503				137	1950	5002	50.110	307			
			603	100				1104	141						
			603	100				1104	104						
<i>Candacia tenuimana</i>	1949	4905	807	NQ	<i>Temora discaudata</i>	1949	4905	1206	36						
			1010	42				4909	501	47					
<i>Centropages bradyi</i>	1949	4905	702	83	<i>Temora discaudata</i>	1950	5002	60.110	50						
			707	29				100.30	26						
<i>Centropages elegans + violaceous</i>	1949	4905	803	47	<i>Temora discaudata</i>	1949	4905	1206	36						
			807	NQ				4909	1109	17					
			4906	909				54	4910	707	57				
			911	NQ				1202	45						
			1102	NQ				4910	707	57					
			1011	32				5002	130.60	73					
			4906	908				126	4905	803	47				
			1205	47				1210	39						
			1206	69				4909	402	54					
			402	64				709	NQ						
<i>Epilabidocera longipedata</i>	1949	4910	1006	79	<i>Temora discaudata</i>	1949	4909	501	47						
			402	187				1950	5002	50.110	307				
<i>Eucalanus attenuatus</i> s.l.	1949	4906	402	187	<i>Temora discaudata</i>	1949	4905	1206	36						
			4909	201				44	4909	501	47				
<i>Eucalanus bungii bungii</i>	1949	4909	206	602	<i>Tortanus discaudatus</i>	1950	5002	60.110	50						
			208	42				100.90	141						
			208	42				100.50	44						
			50.80	300				1206	36						

Aetideus
Calanus
Candacia
Centropages



Epilabidocera
Eucalanus
Euchaeta
Euchirella



Gaidius
Haloptilus
Heterorhabdus



Lucicutia
Mecynocera
Metridia
Microcalanids



Phaenna
Pleuromamma
Pontellina

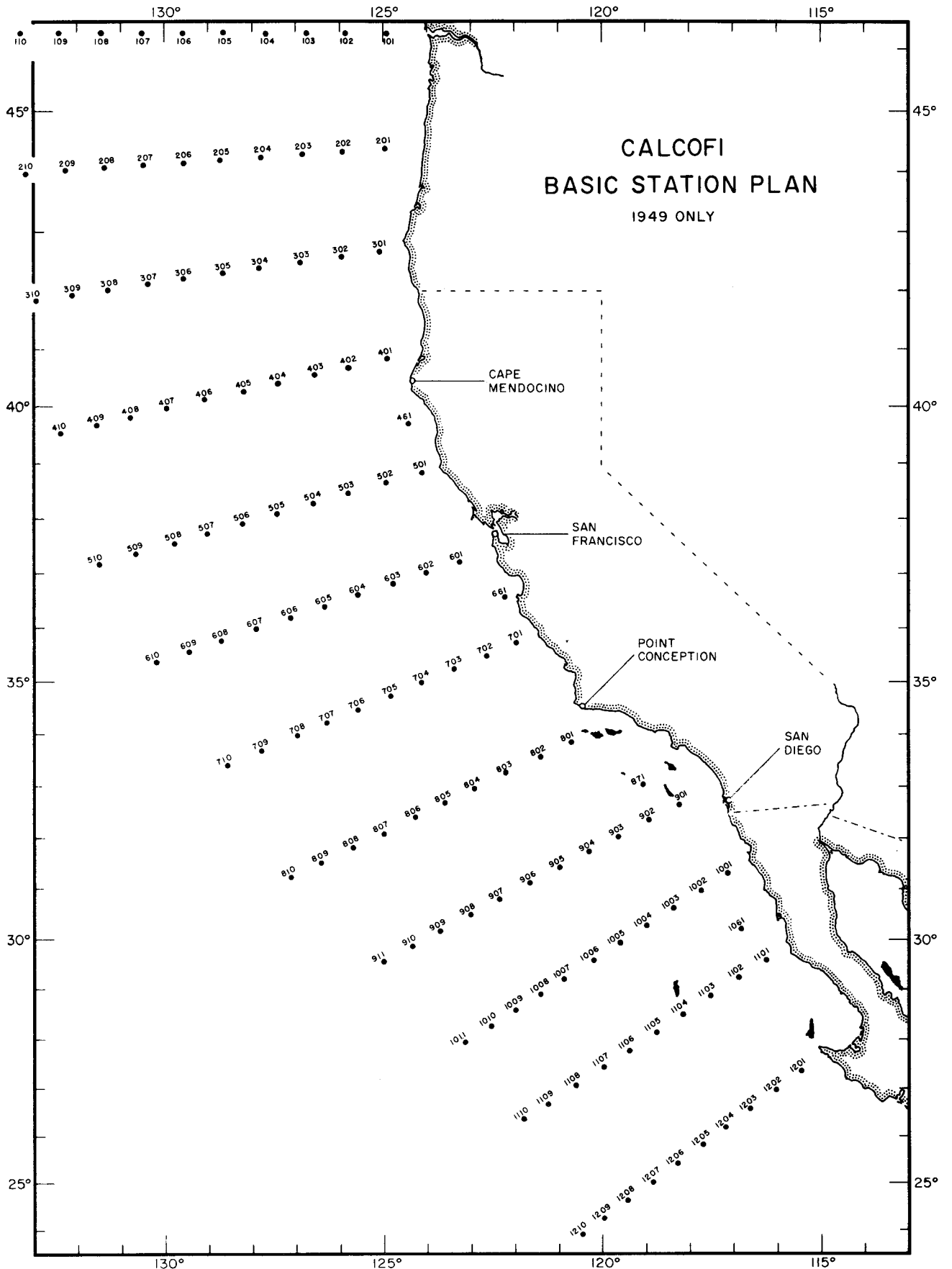


Rhincalanus
Scolecithrix
Scottocalanus



Undeuchaeta

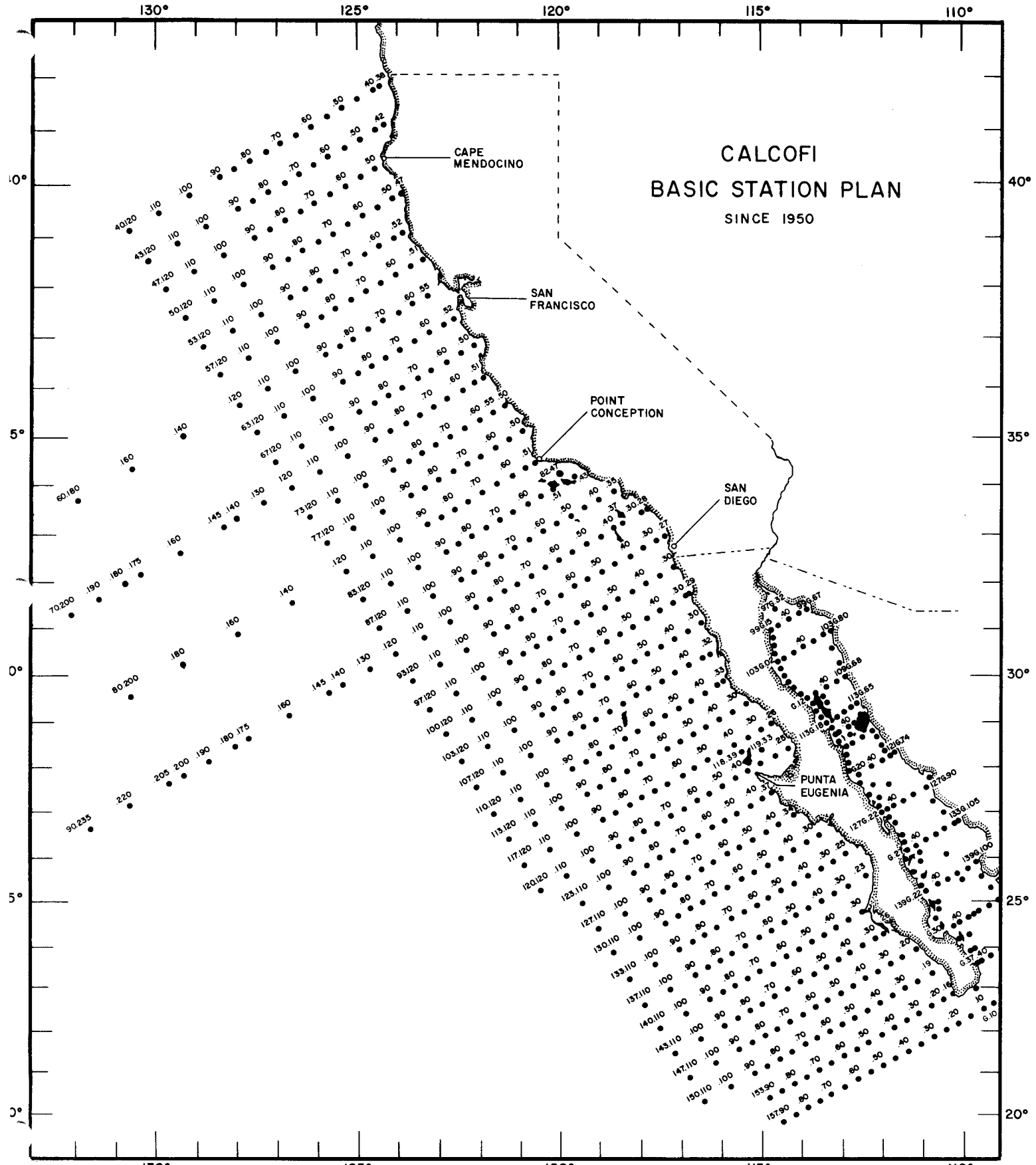




CALCOFI

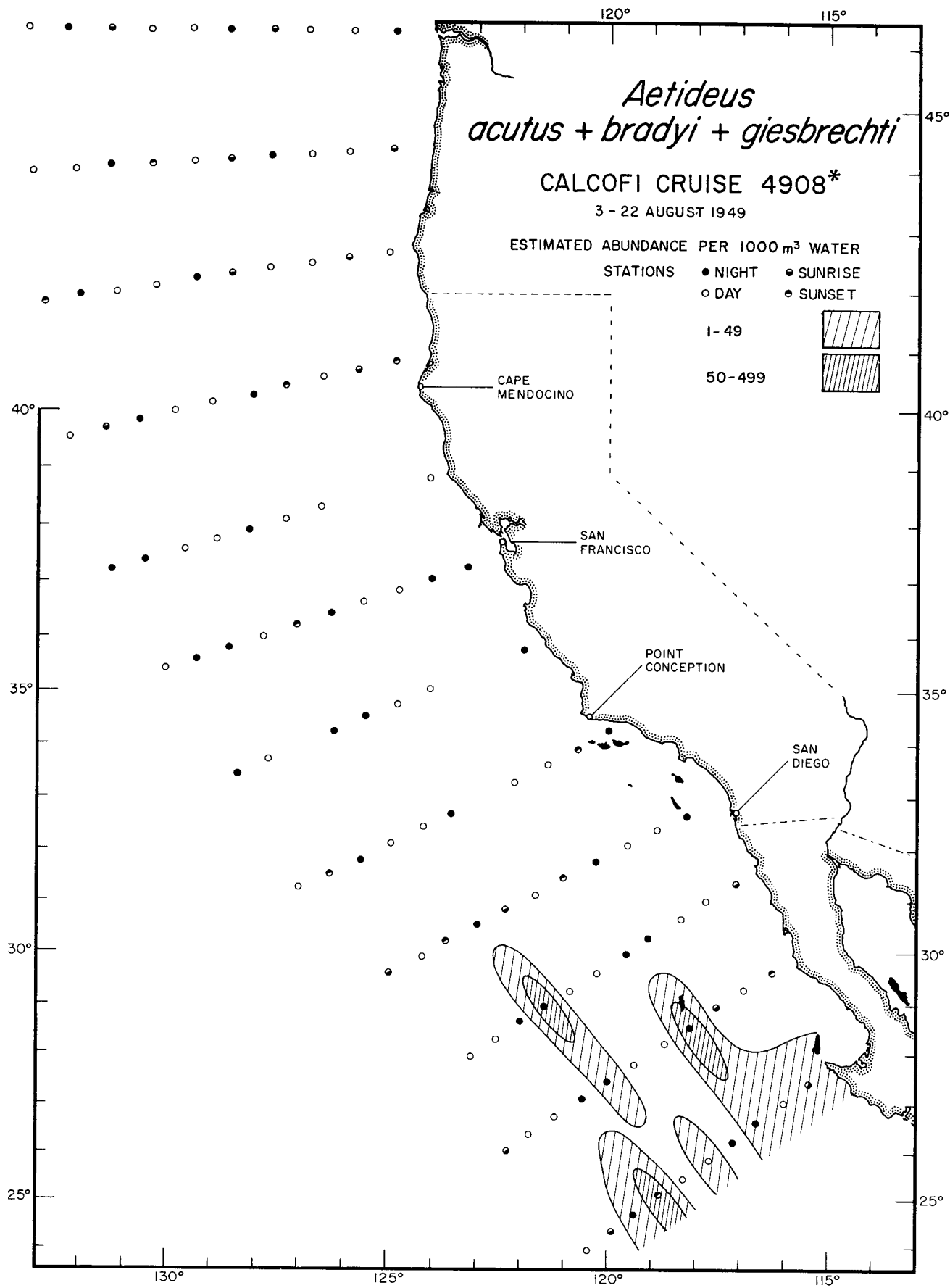
BASIC STATION PLAN

1949 ONLY



CALCOFI

BASIC STATION PLAN
SINCE 1950

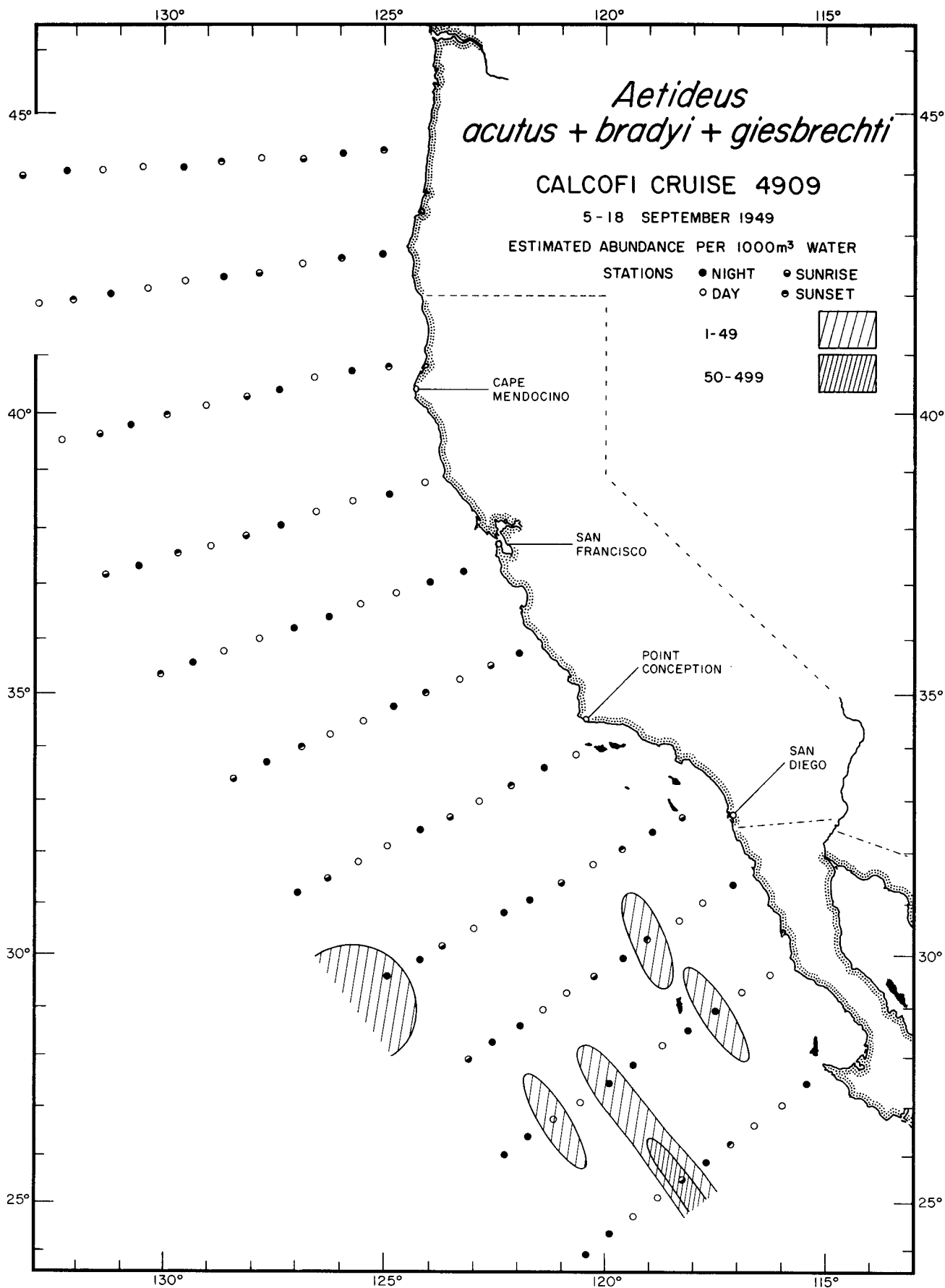


* See Table 1 for cruises 4905, 6, 7

Calanoida

Aetideus acutus + bradyi + giesbrechti

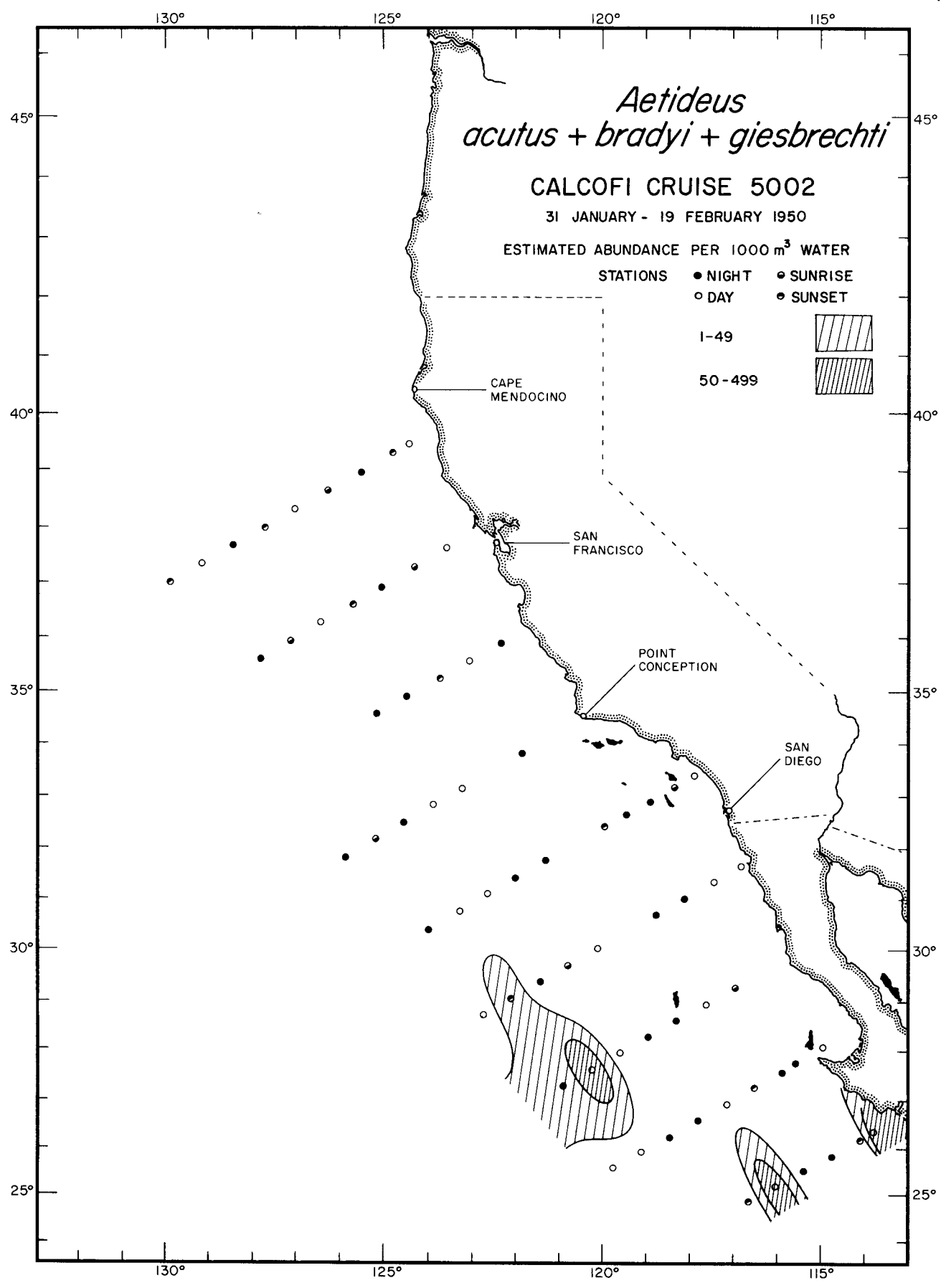
4908



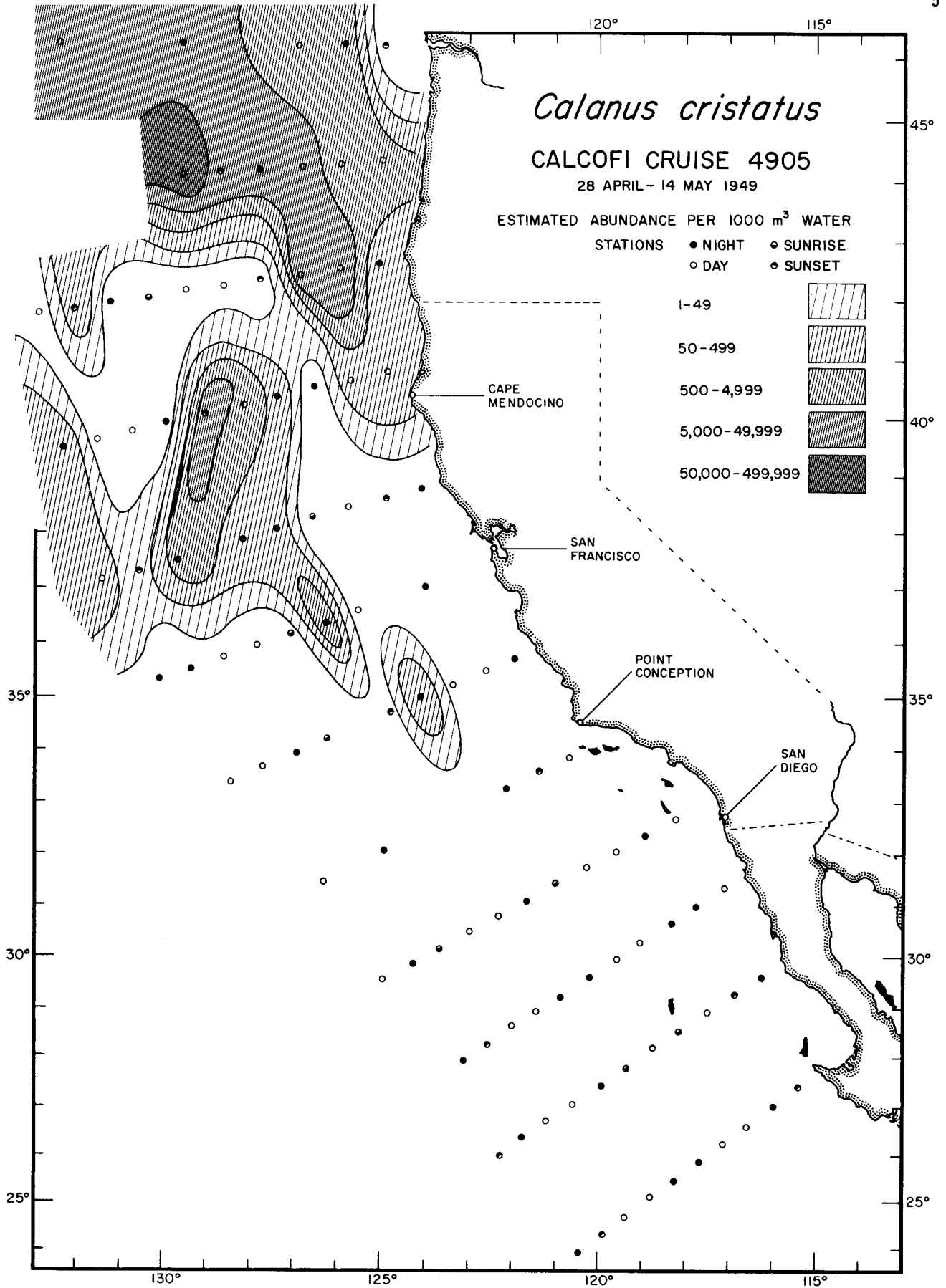
Calanoida

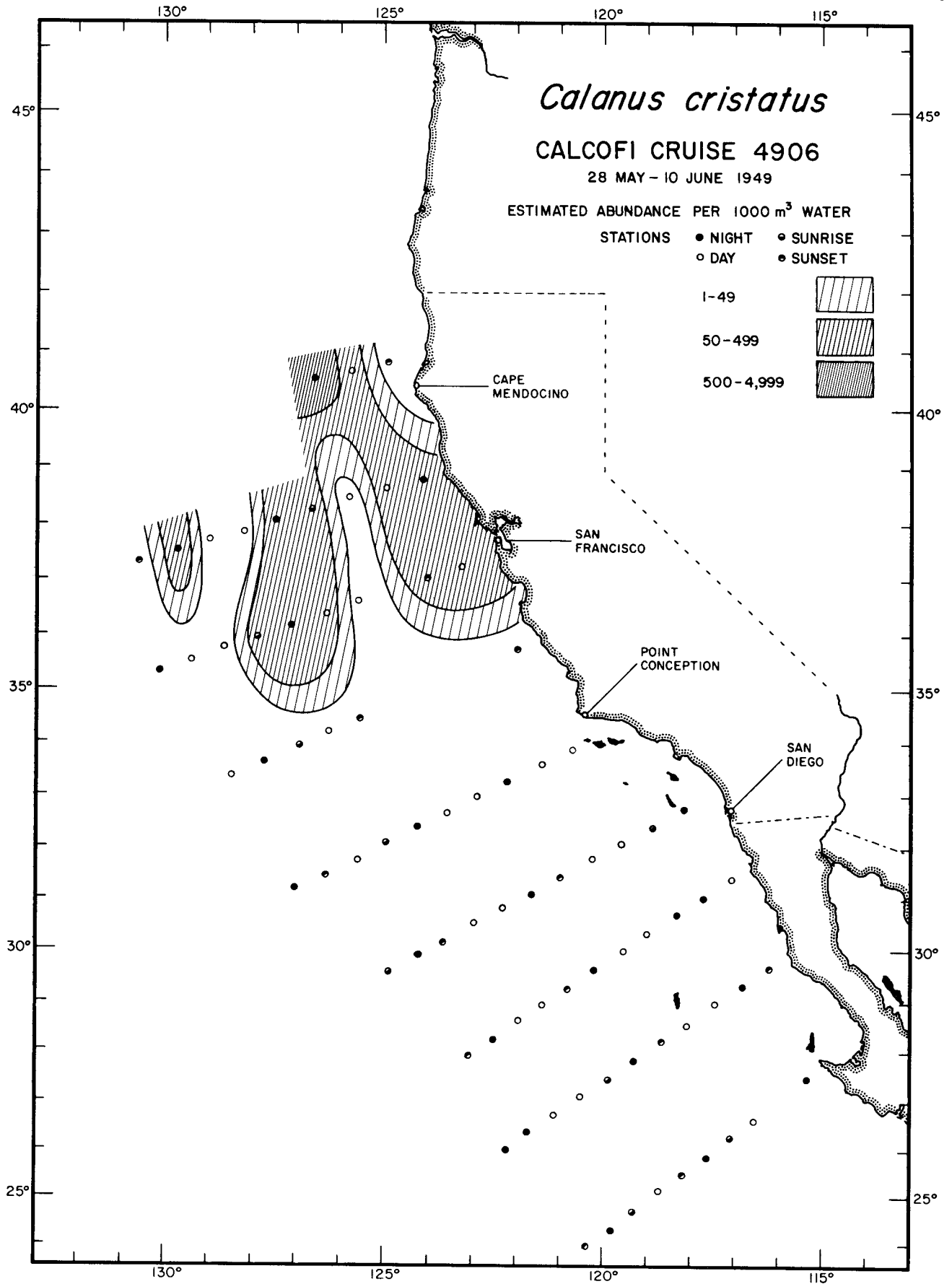
Aetideus acutus + bradyi + giesbrechti

4909

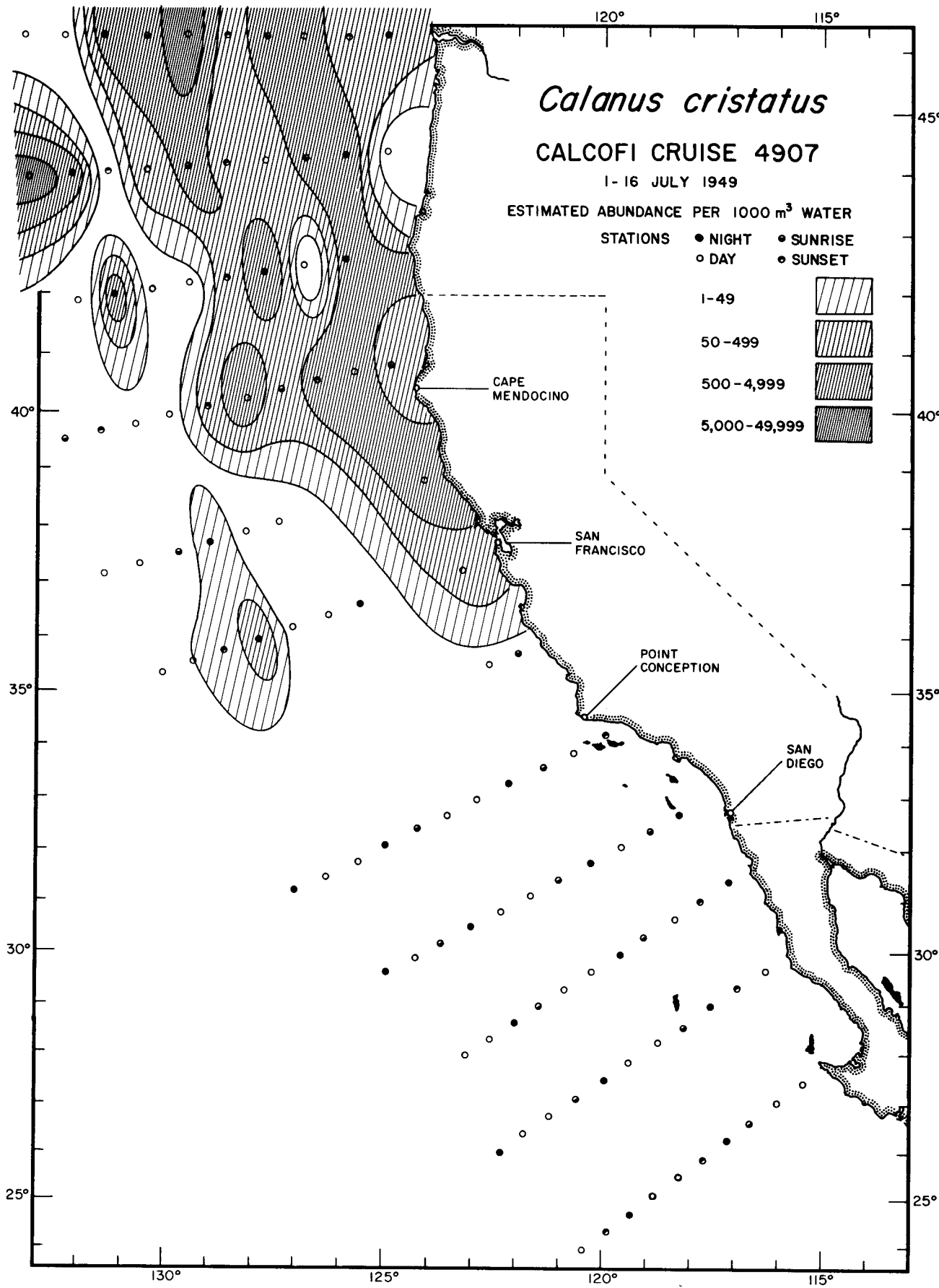


* See Table 1 for cruise 4910

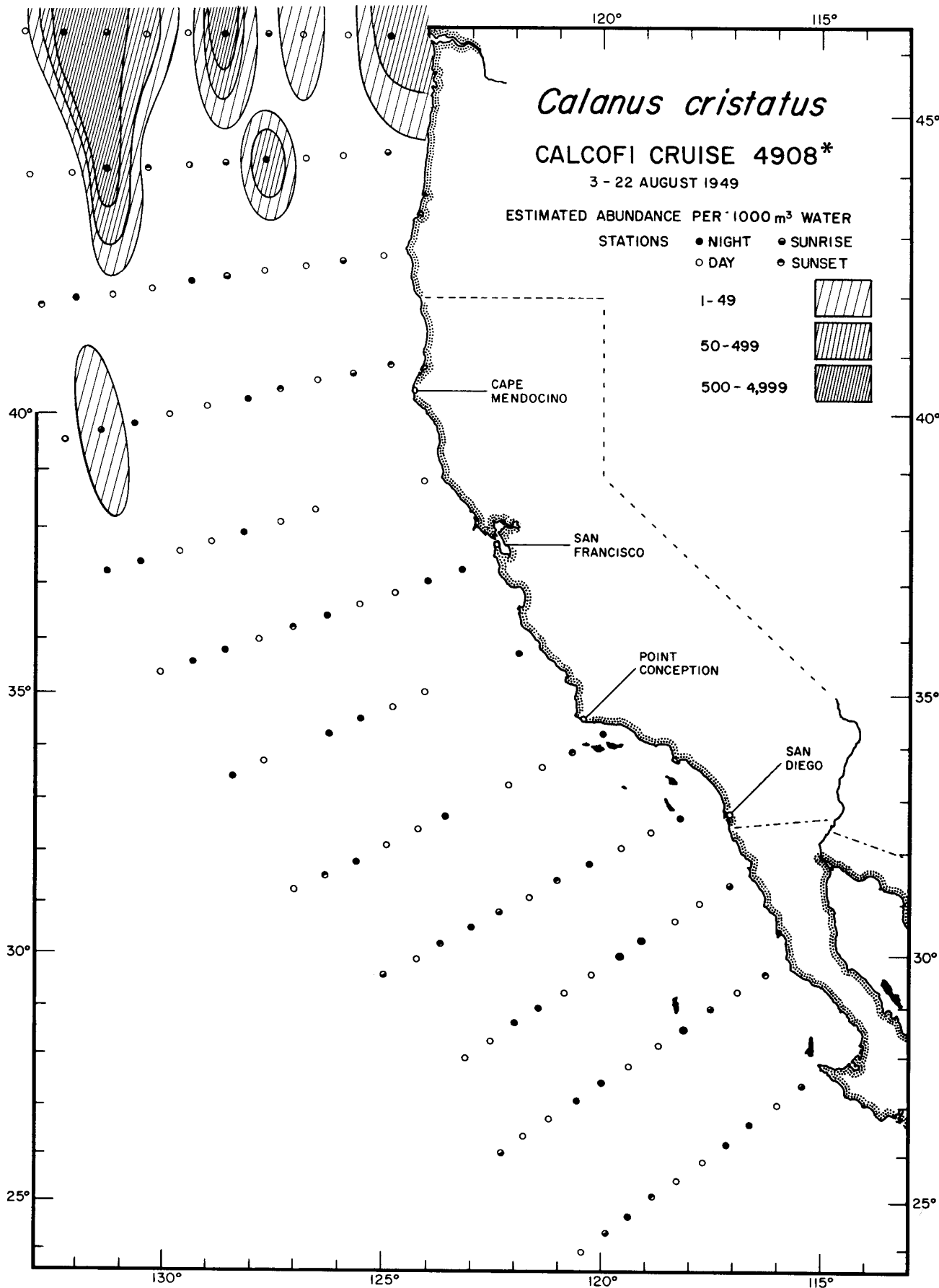




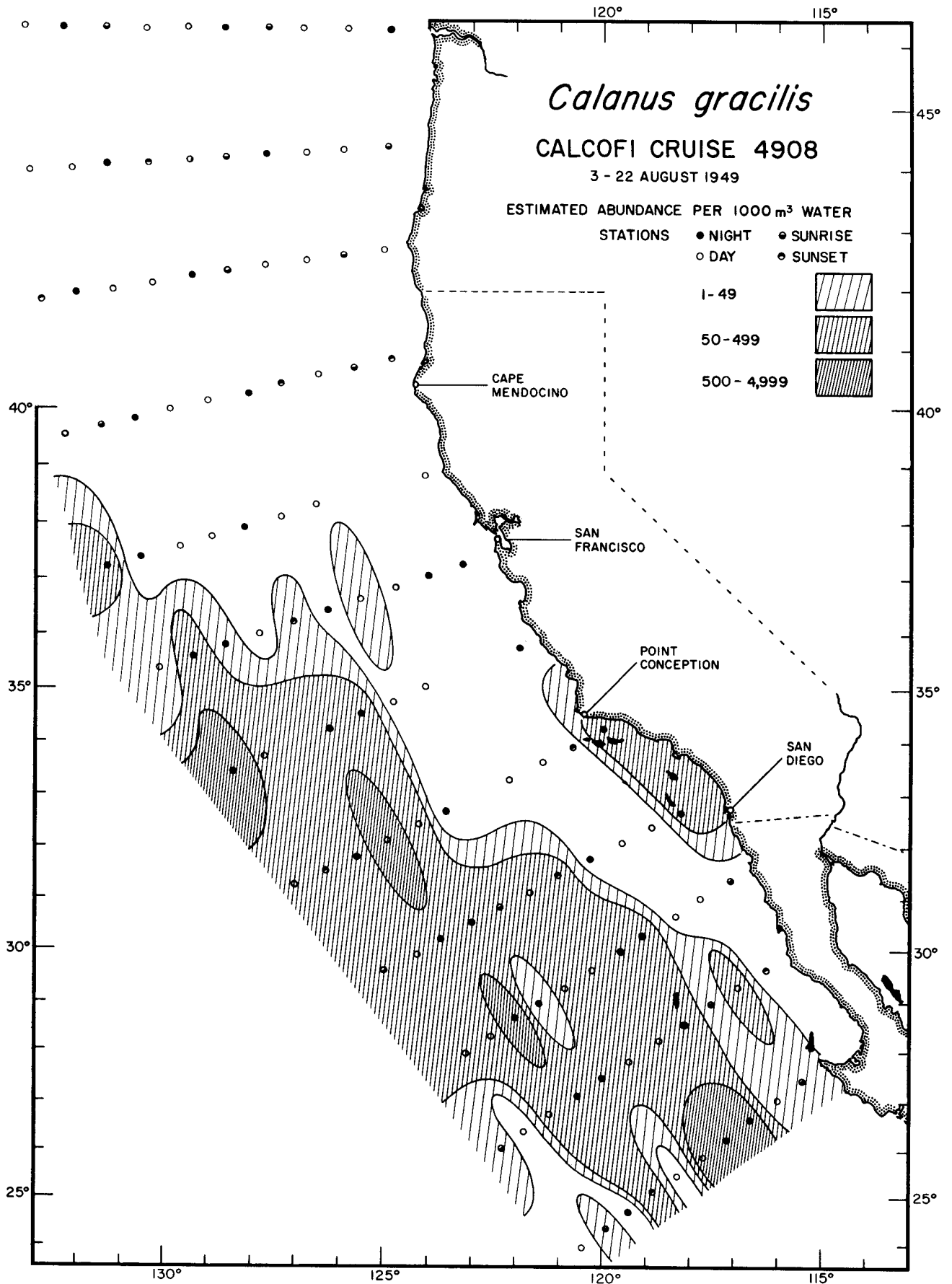
Calanoida
Calanus cristatus
4906



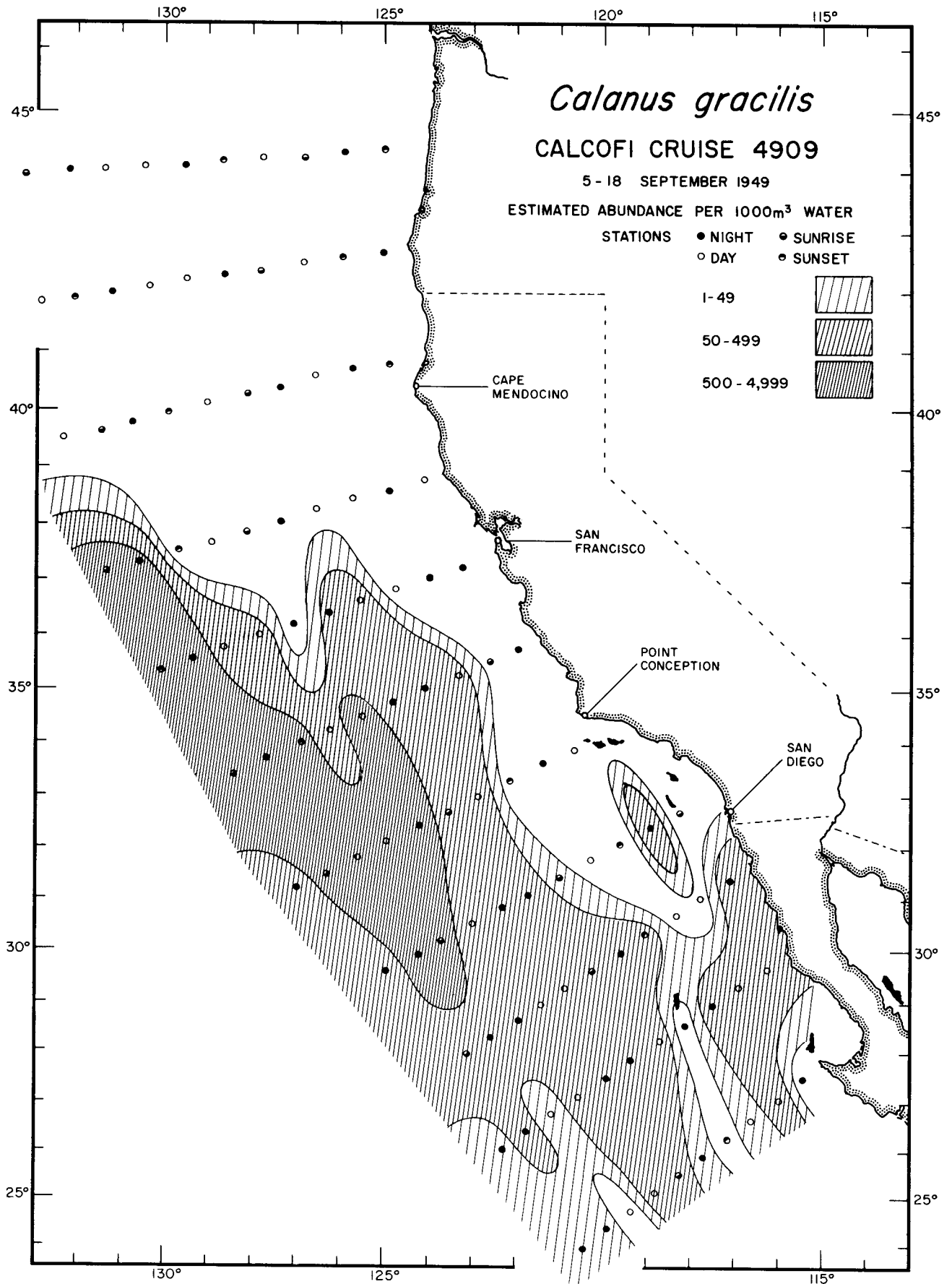
Calanoida
Calanus cristatus
4907



* See Table 1 for cruises 4909, 10, 5002



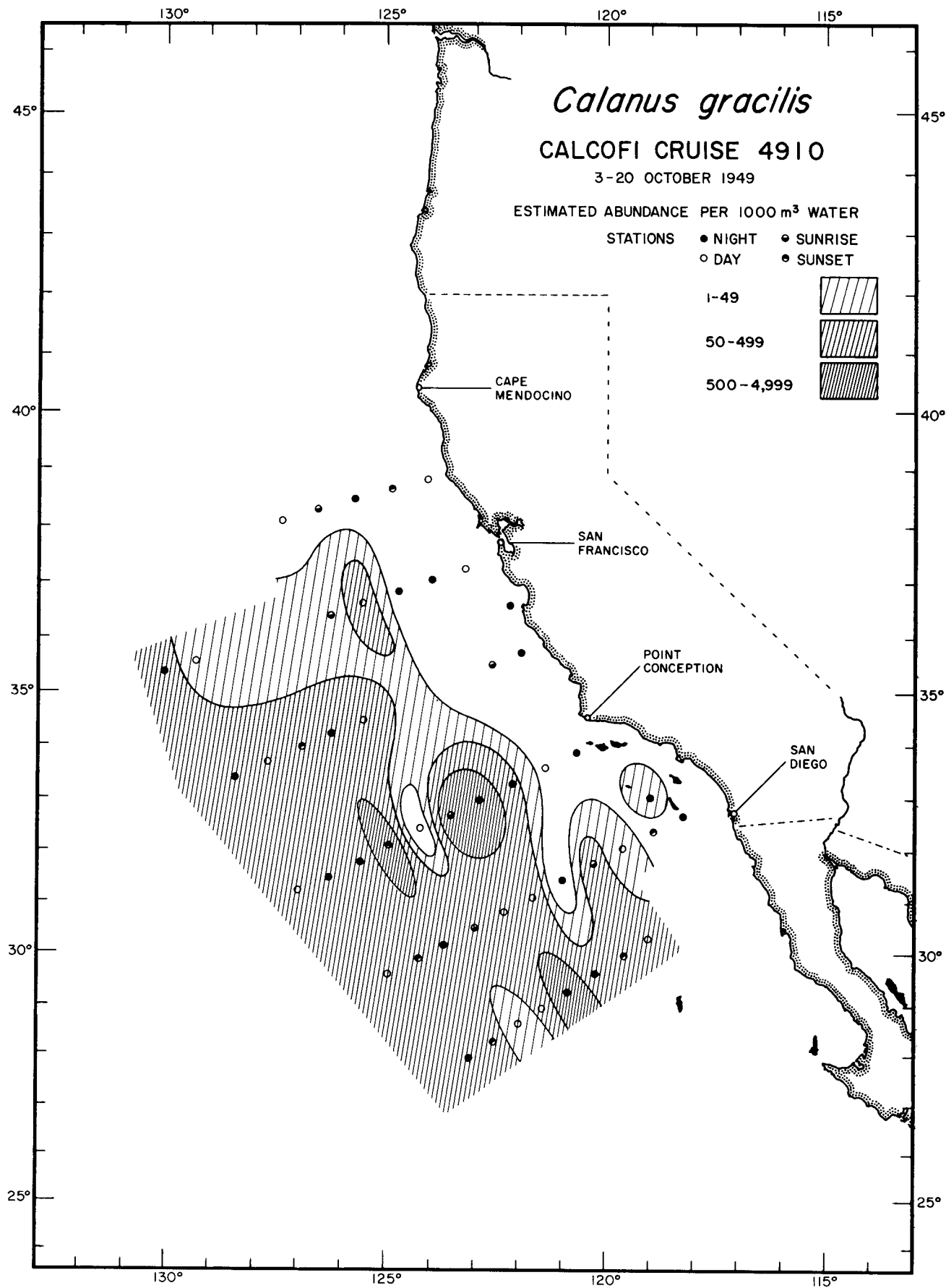
* See Table 1 for cruise 4905; no data for cruises 4906, 7



Calanoida

Calanus gracilis

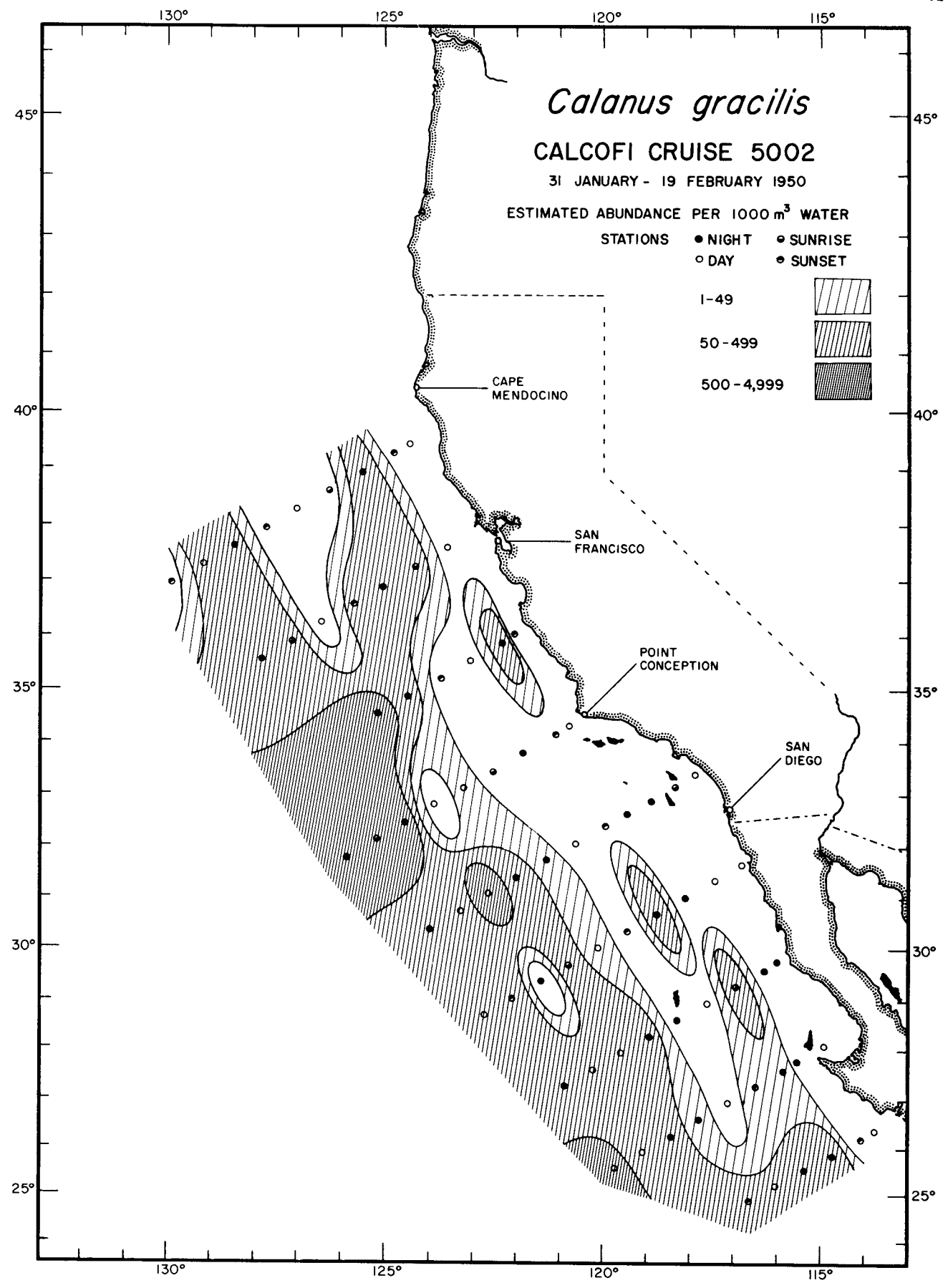
4909



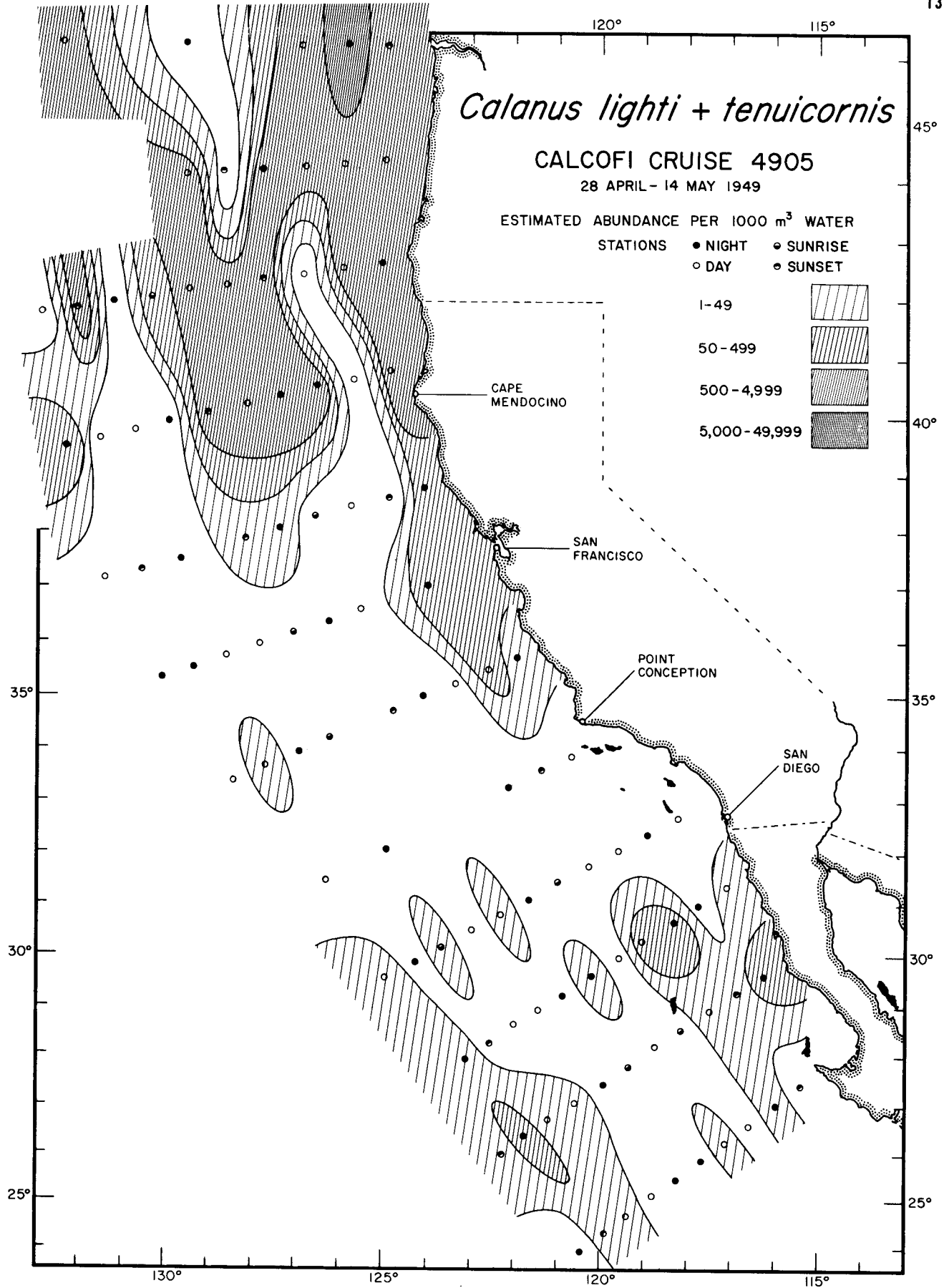
Calanoida

Calanus gracilis

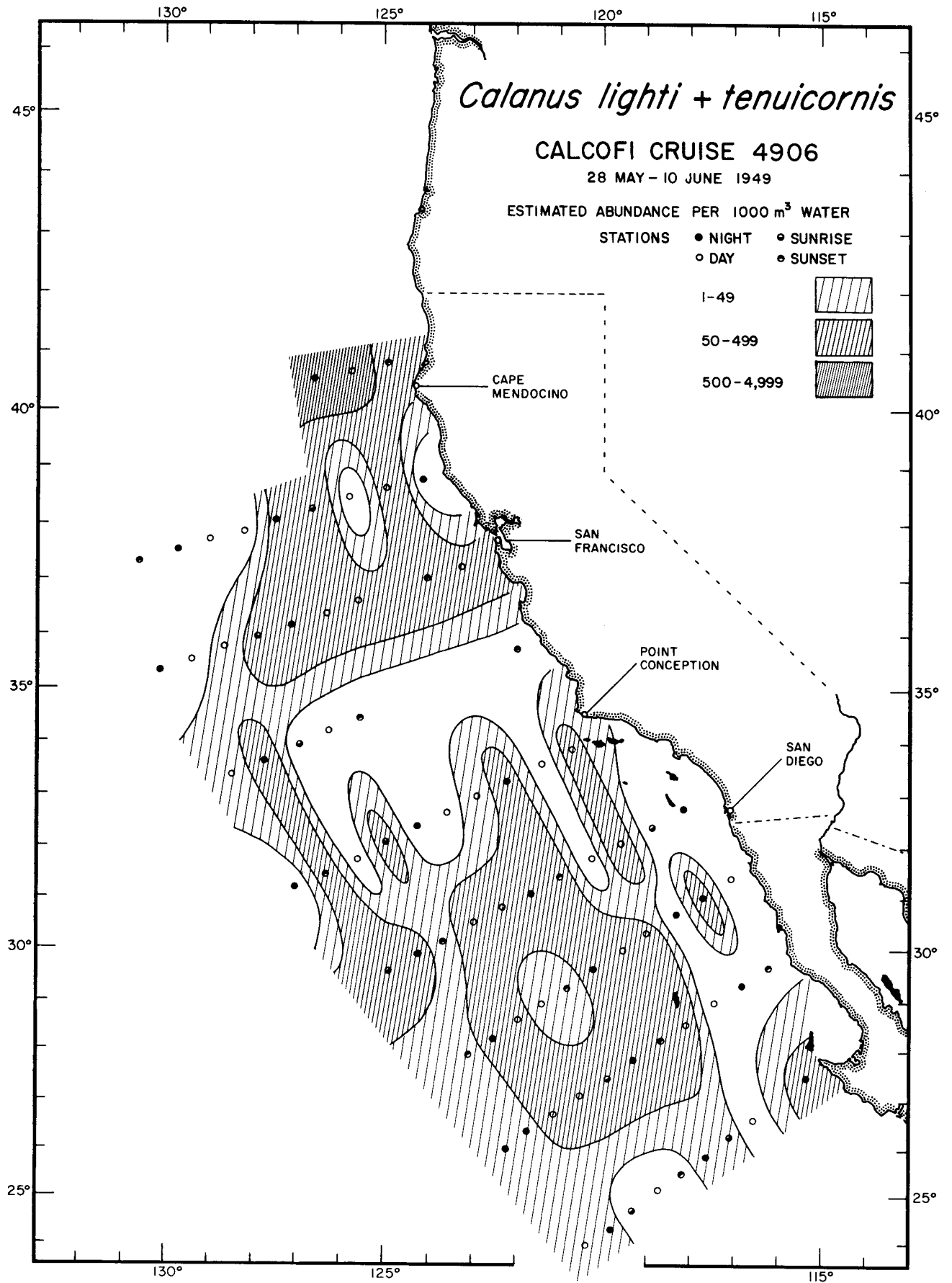
4910



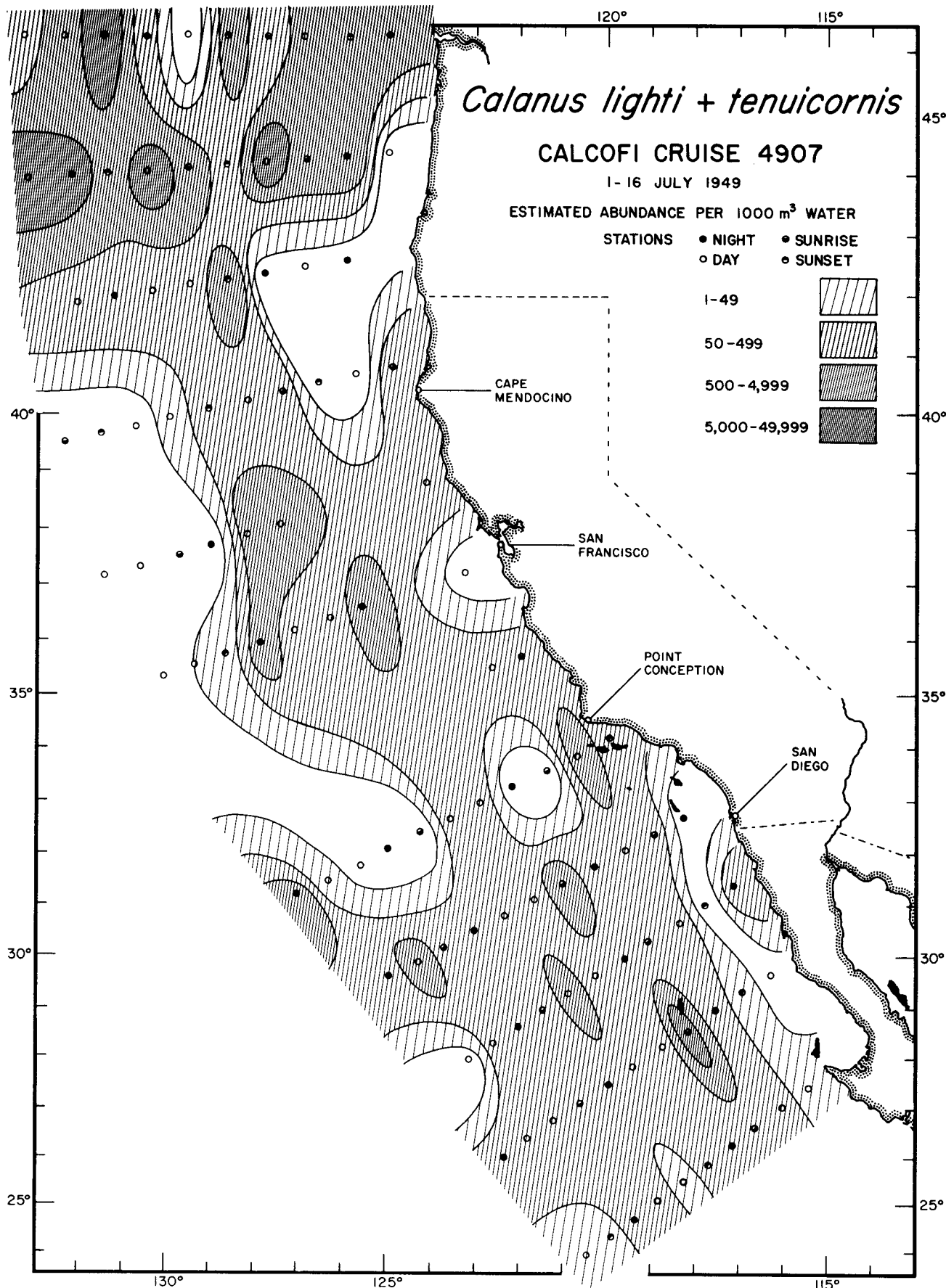
Calanoida
Calanus gracilis
5002



Calanoida
Calanus lighti + tenuicornis
4905



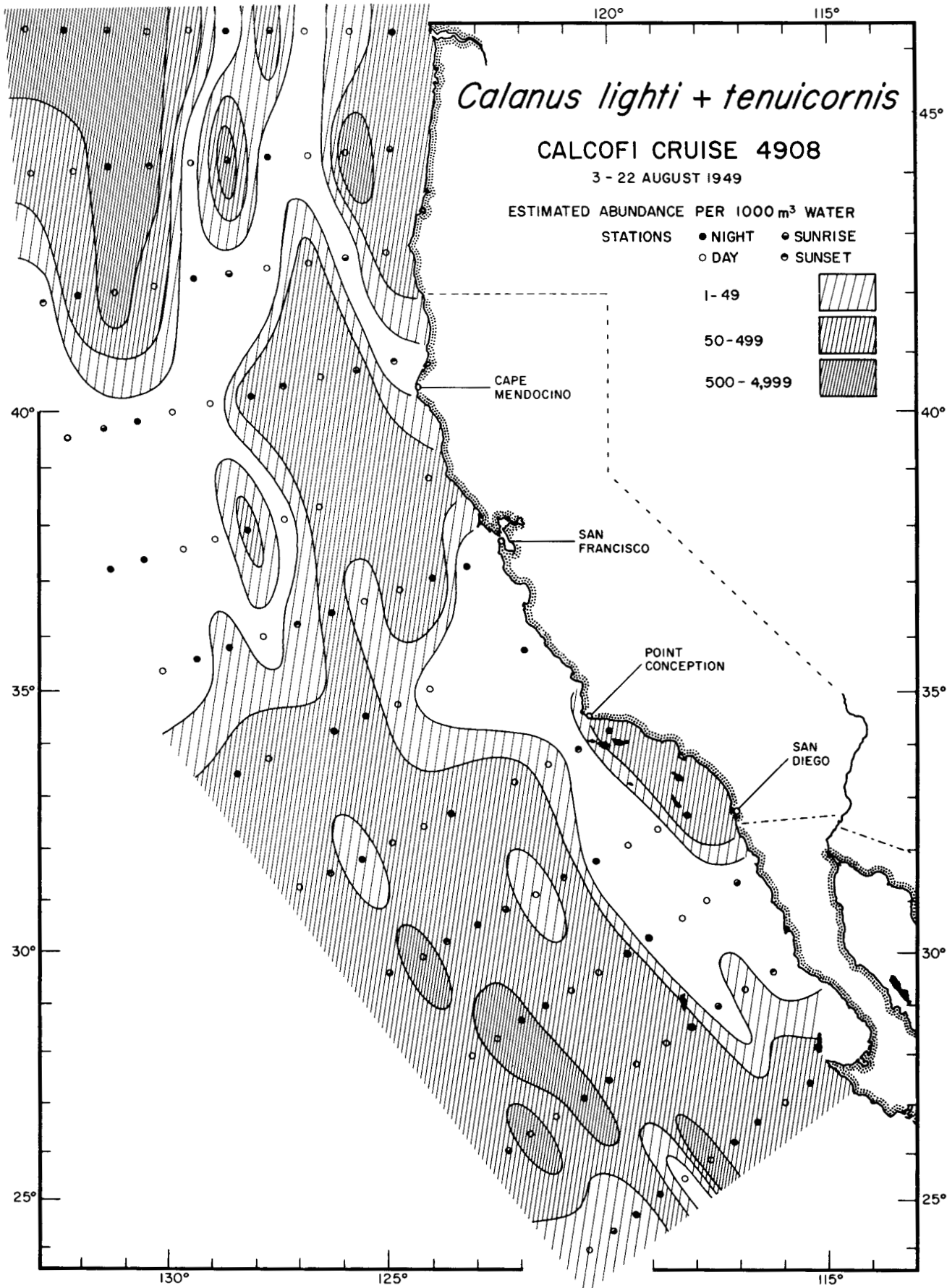
Calanoida
Calanus lighti + tenuicornis
4906



Calanoida

Calanus lighti + tenuicornis

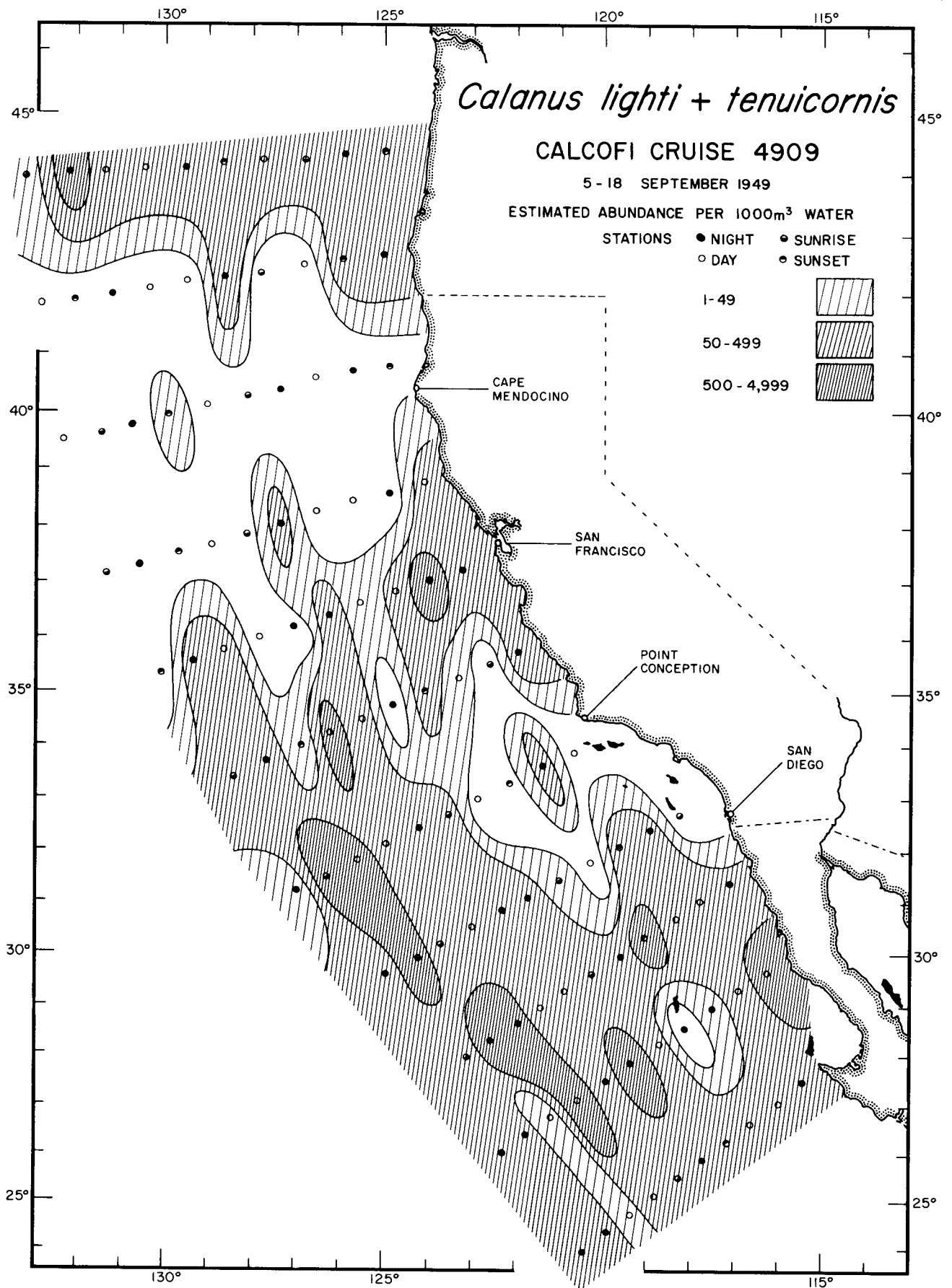
4907



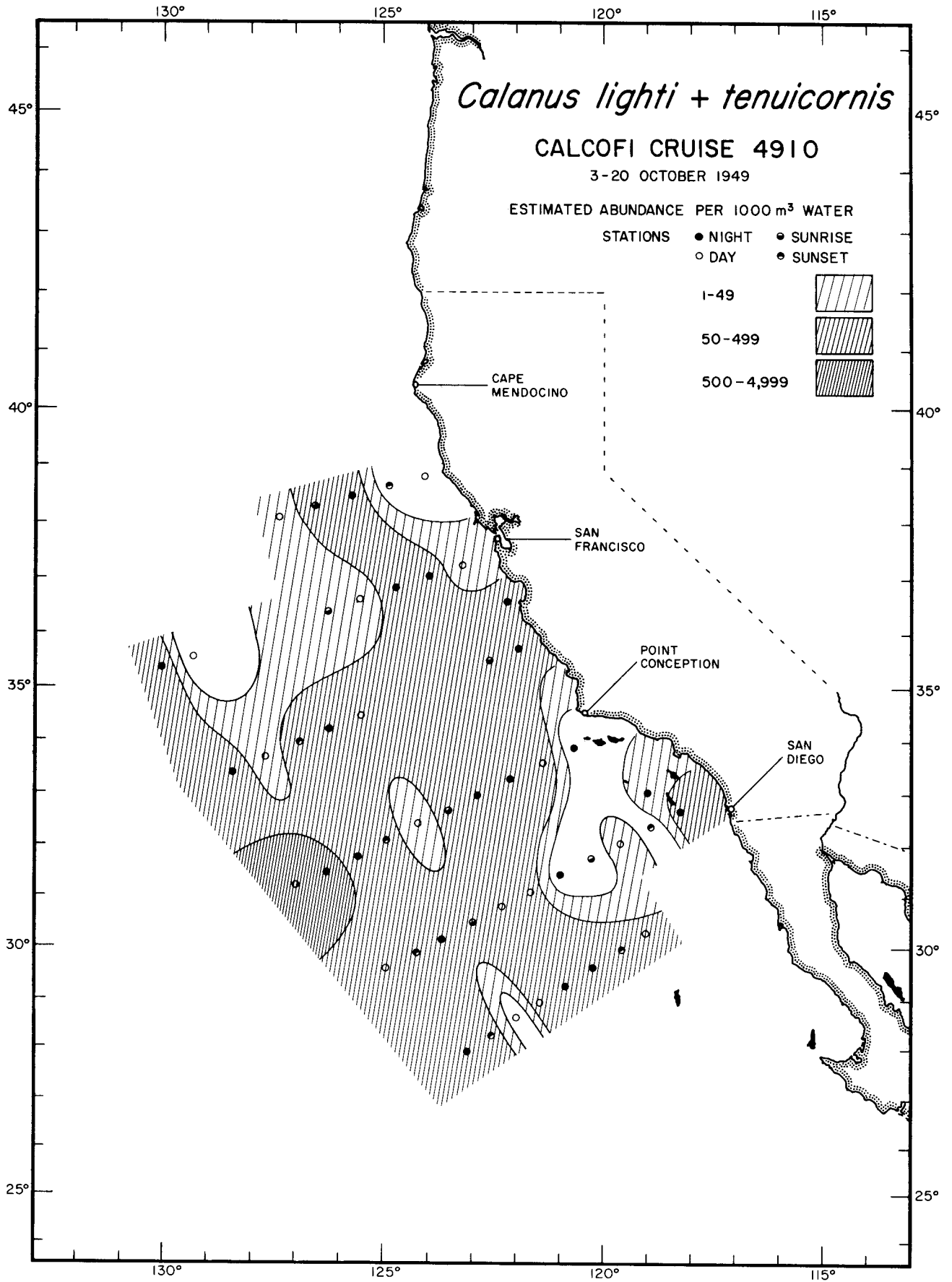
Calanoida

Calanus lighti + tenuicornis

4908



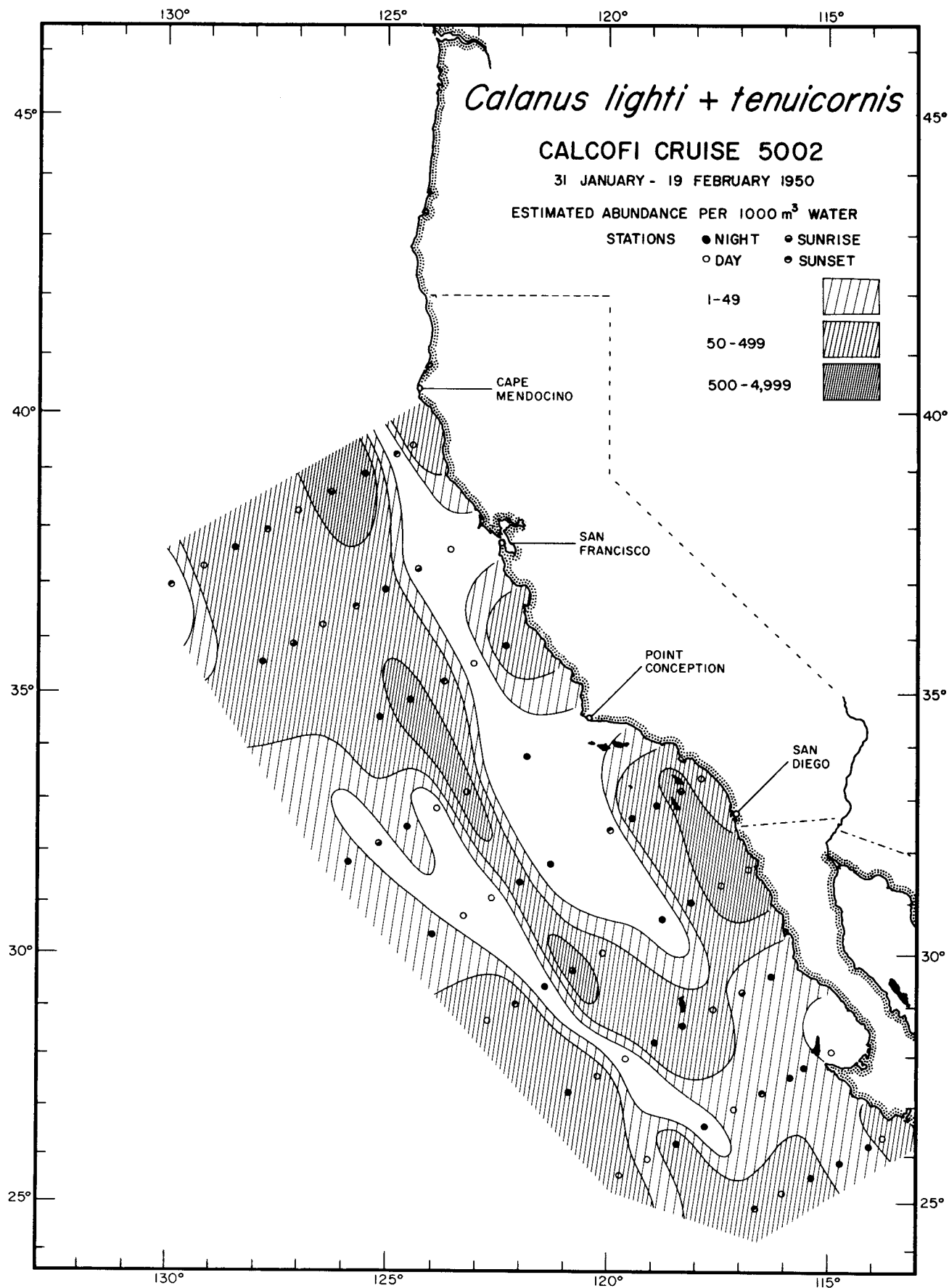
Calanoida
Calanus lighti + tenuicornis
4909



Calanoida

Calanus lighti + tenuicornis

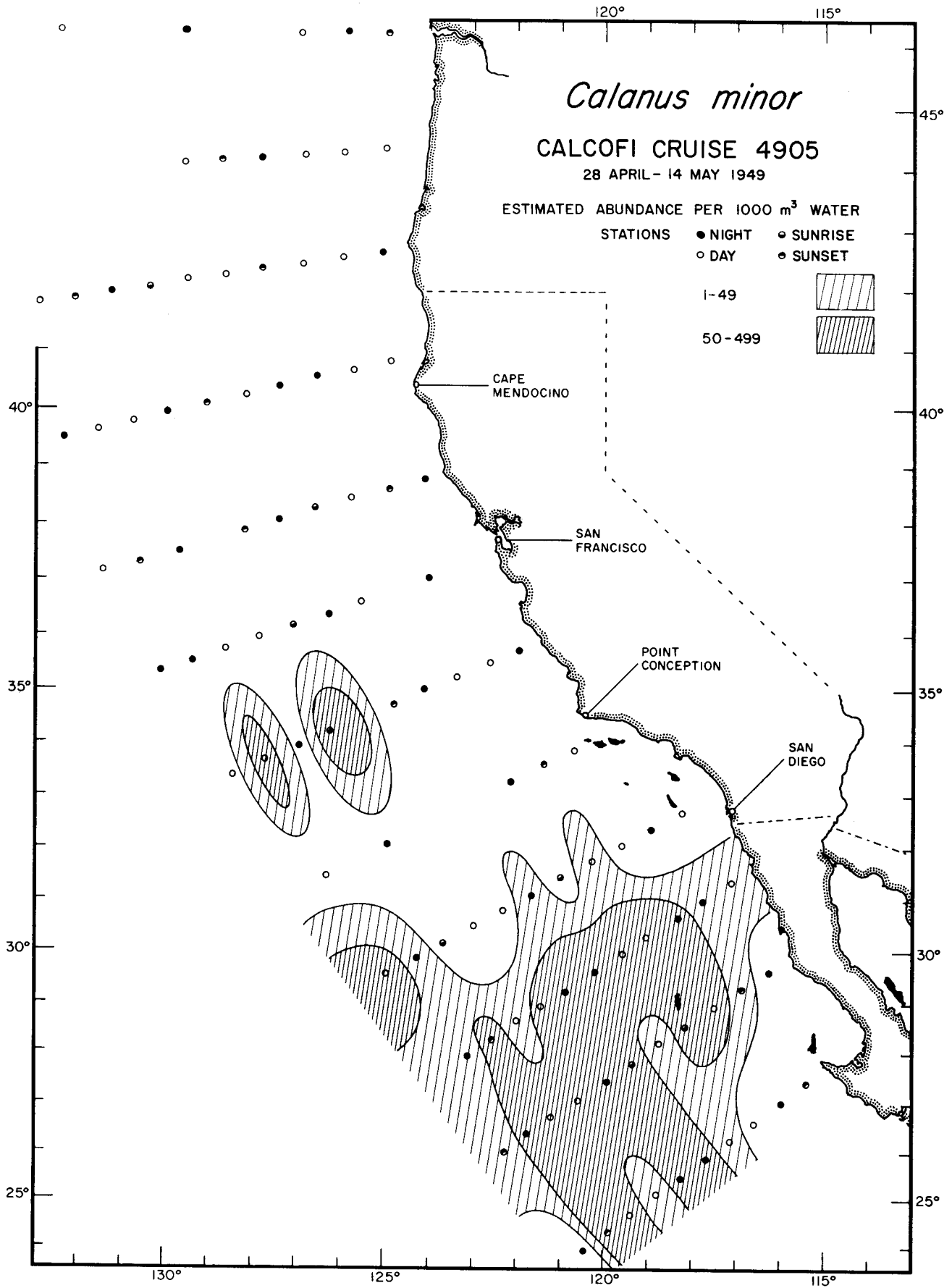
4910



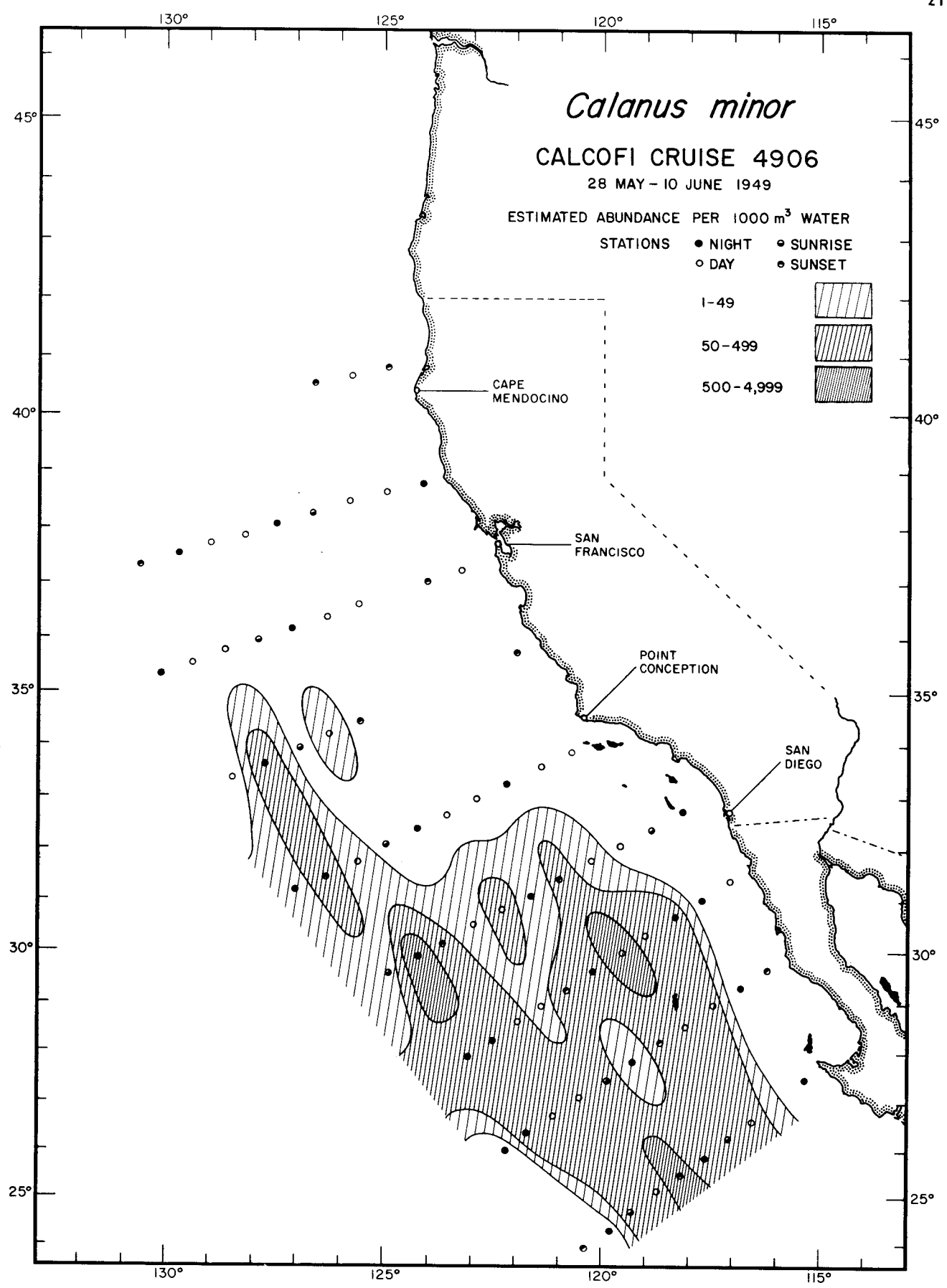
Calanoida

Calanus lighti + tenuicornis

5002



Calanoida
Calanus minor
4905



Calanus minor

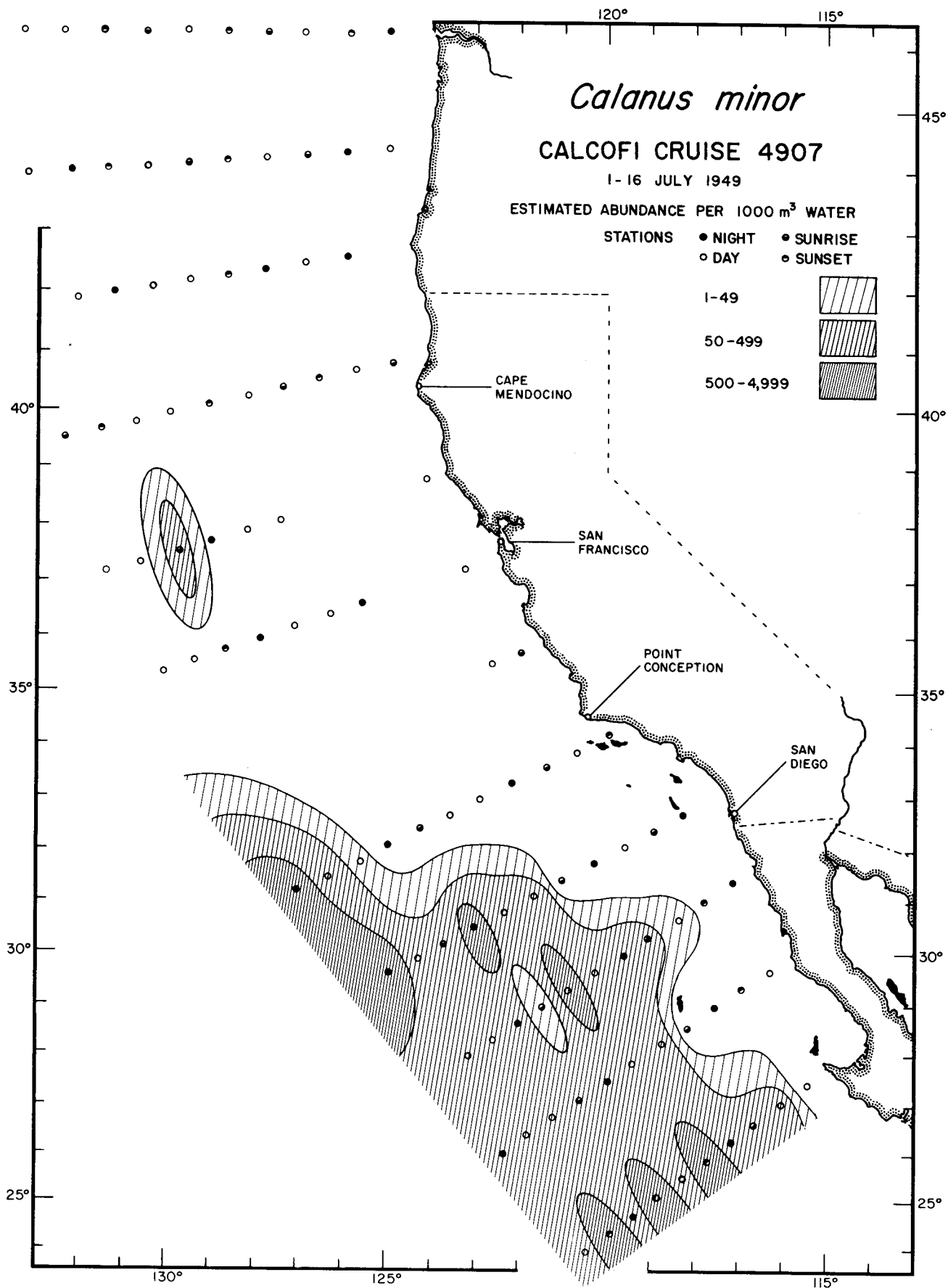
CALCOFI CRUISE 4906

28 MAY - 10 JUNE 1949

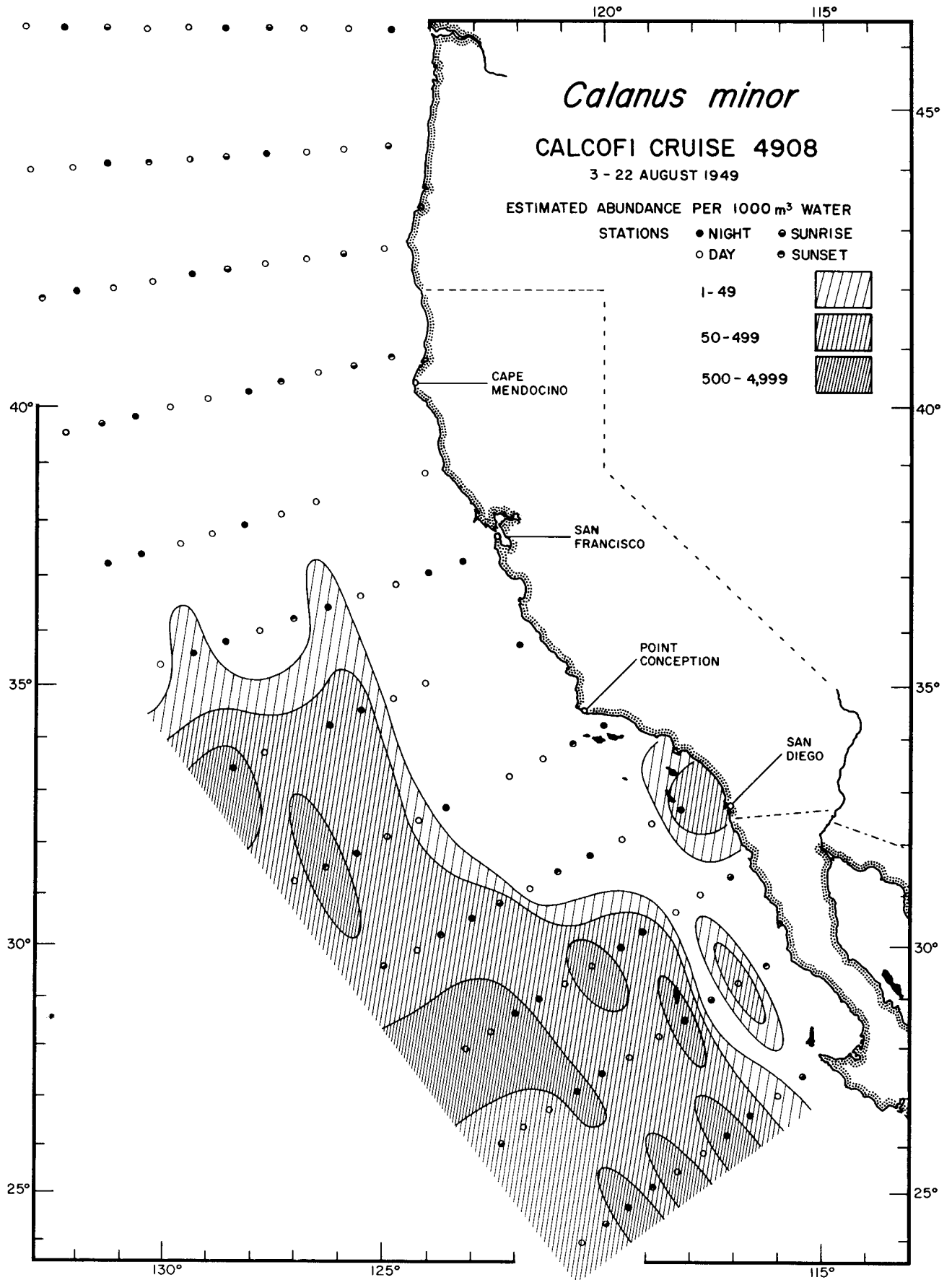
ESTIMATED ABUNDANCE PER 1000 m³ WATER

STATIONS ● NIGHT ○ DAY
○ SUNRISE ● SUNSET

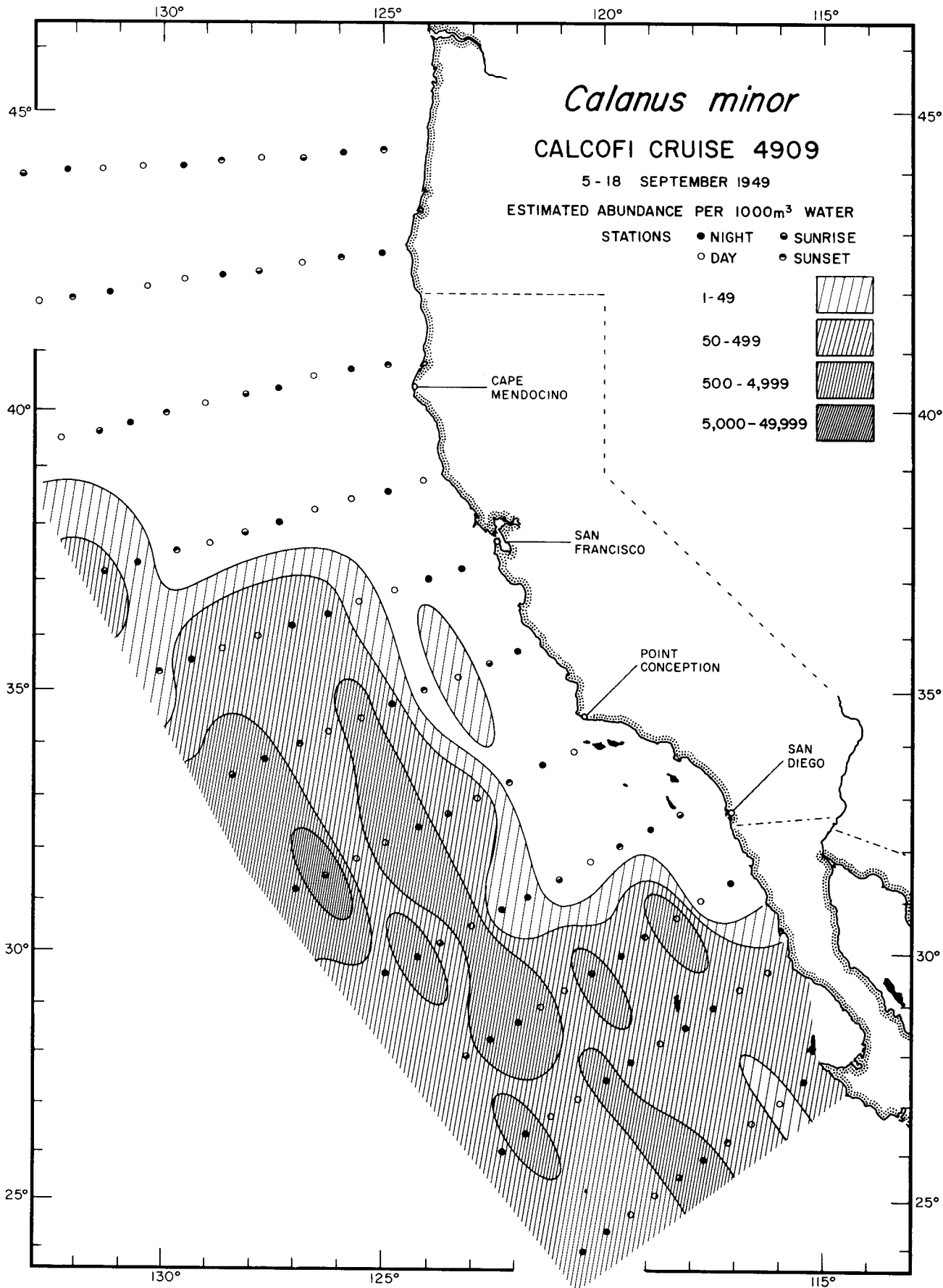
1-49	
50-499	
500-4,999	



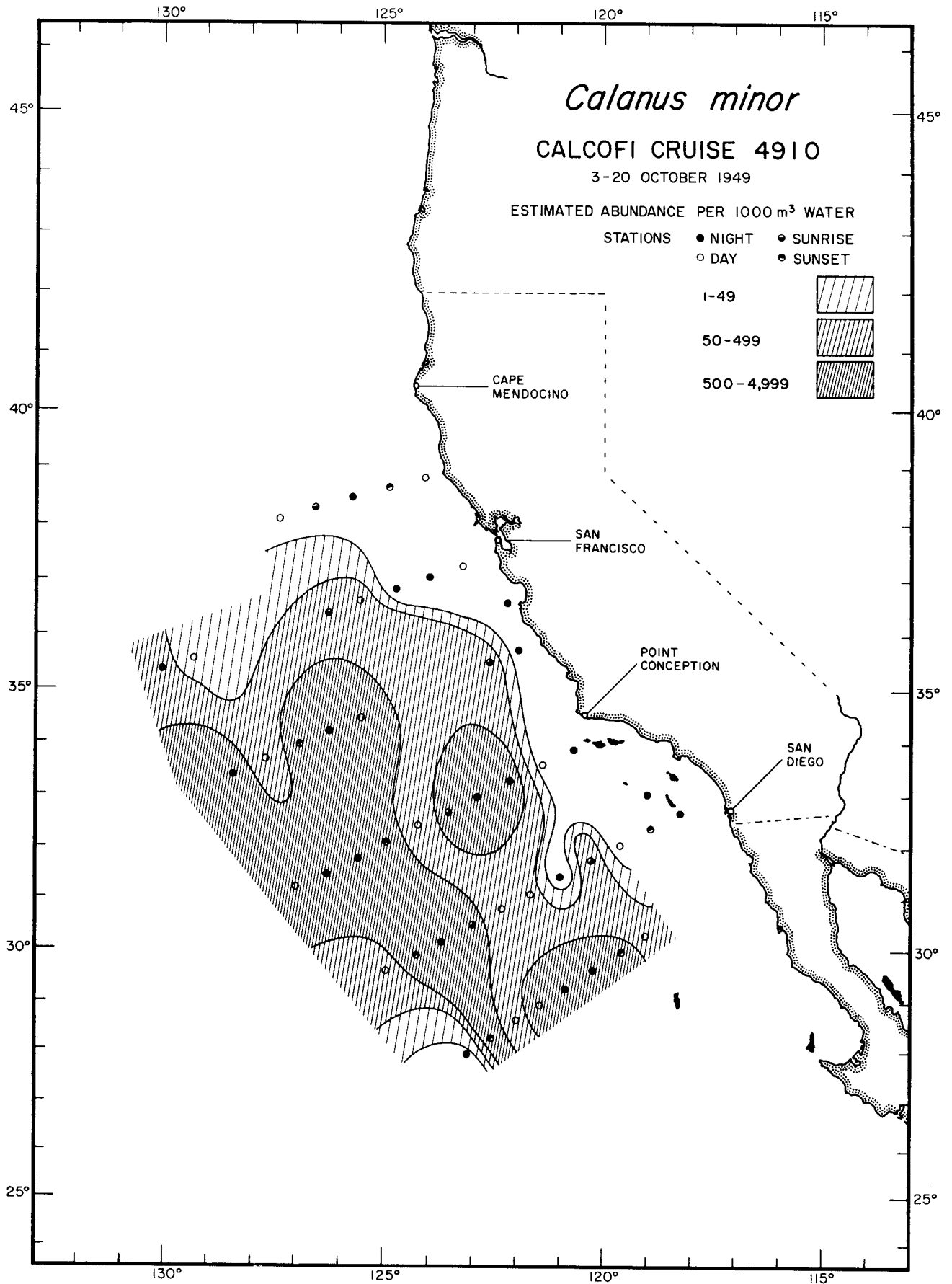
Calanoida
Calanus minor
4907

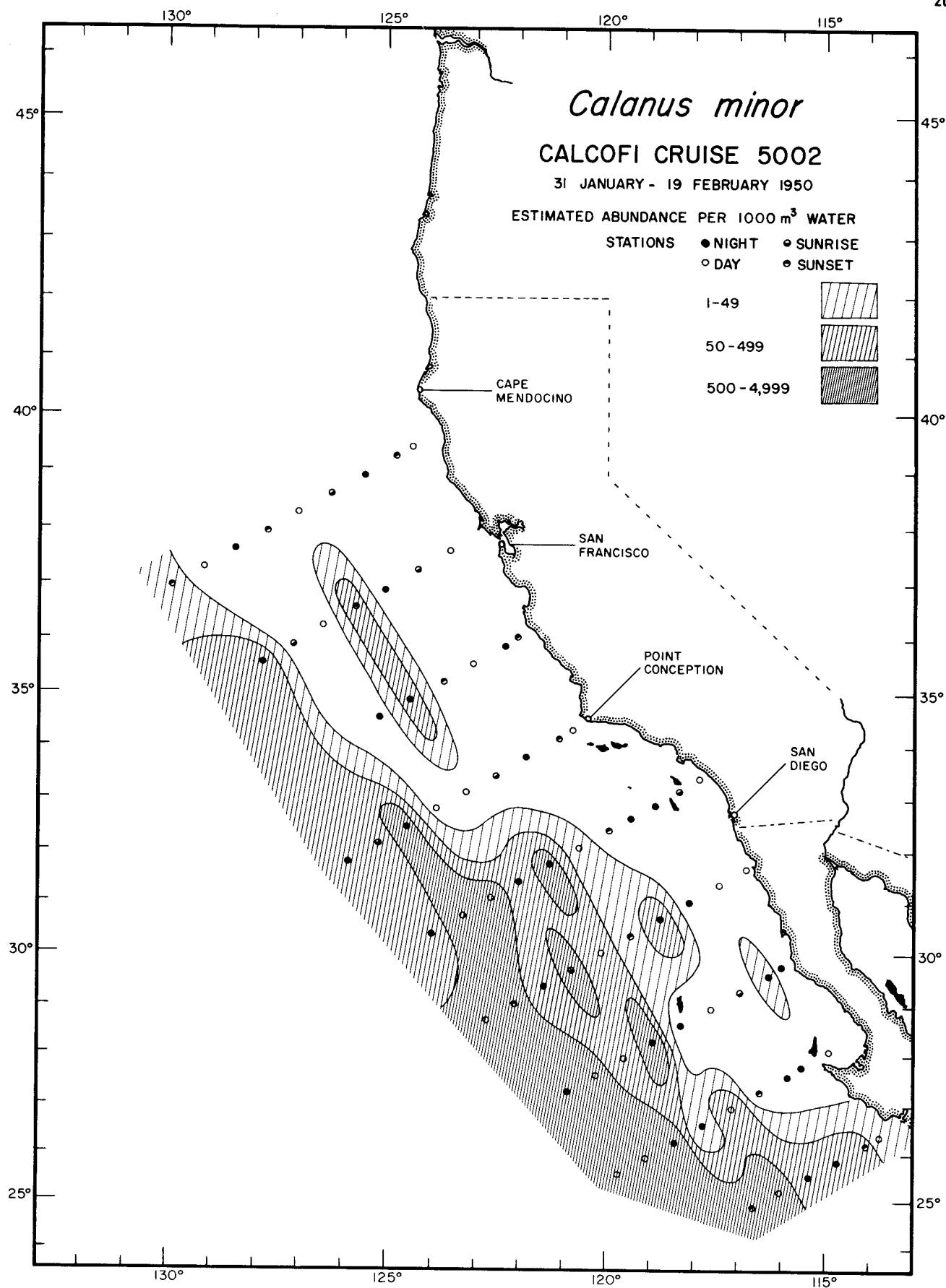


Calanoida
Calanus minor
4908



Calanoida
Calanus minor
4909

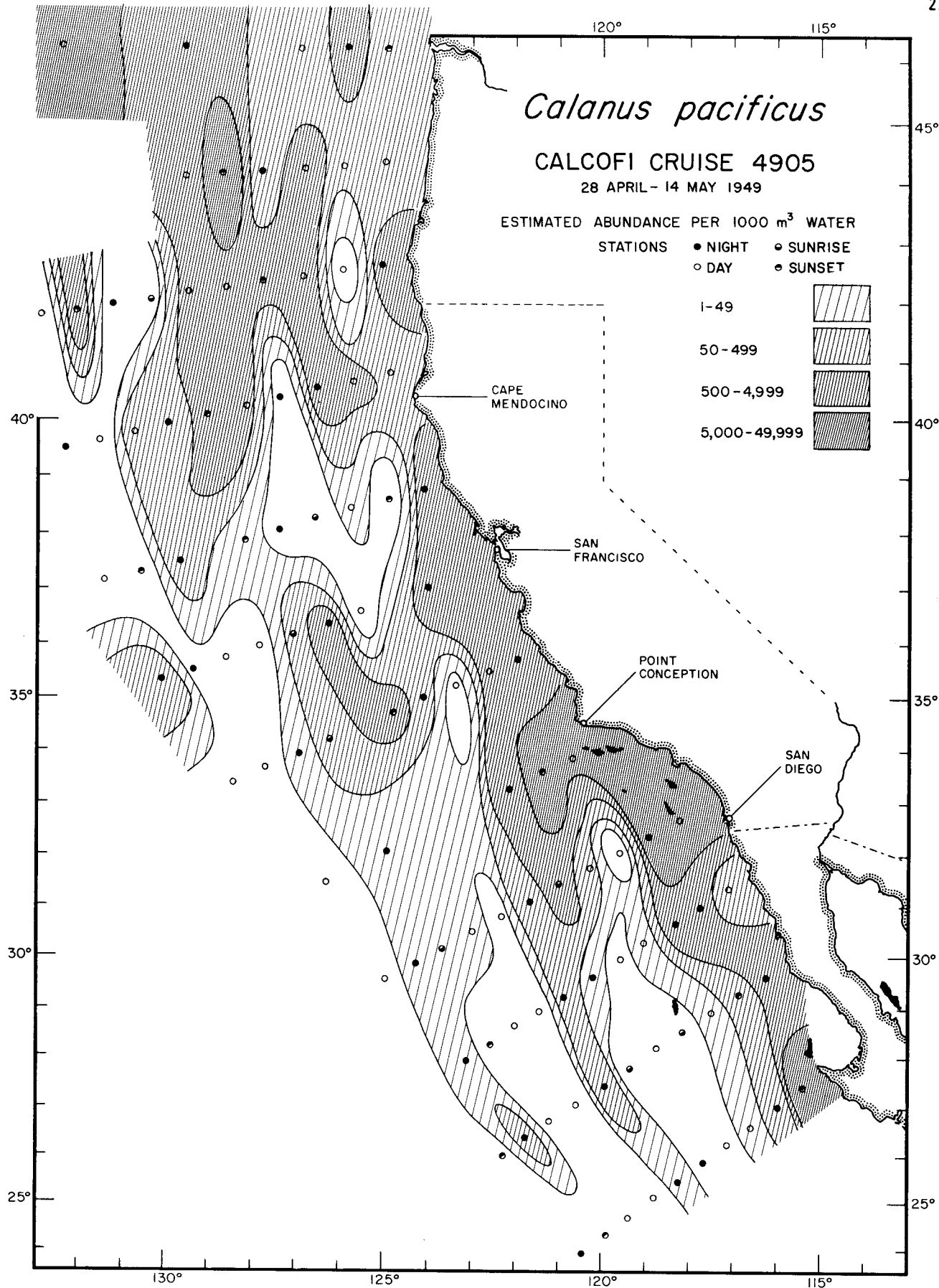




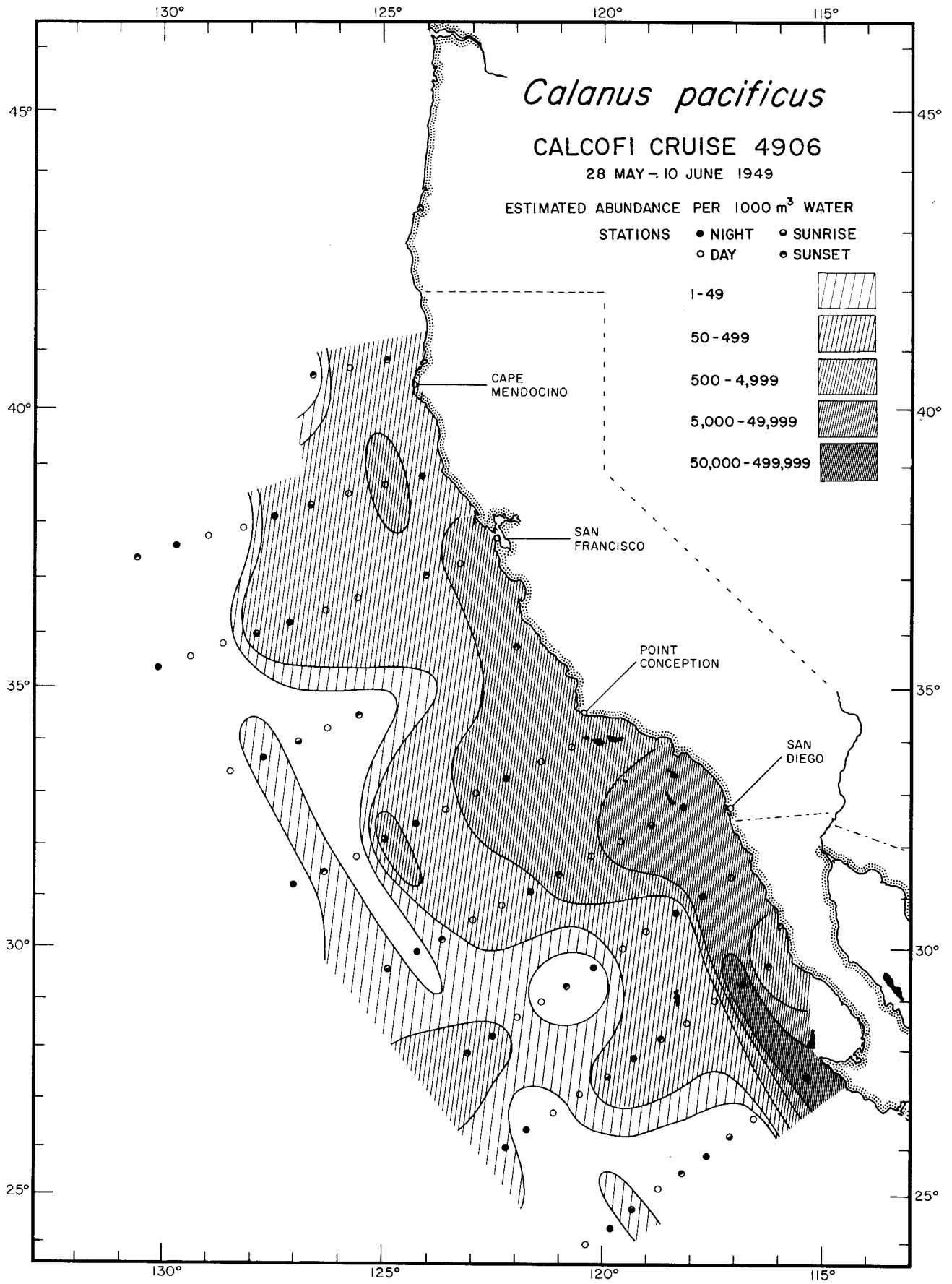
Calanoida

Calanus minor

5002



Calanoida
Calanus pacificus
4905



Calanus pacificus

CALCOFI CRUISE 4906

28 MAY - 10 JUNE 1949

ESTIMATED ABUNDANCE PER 1000 m³ WATER

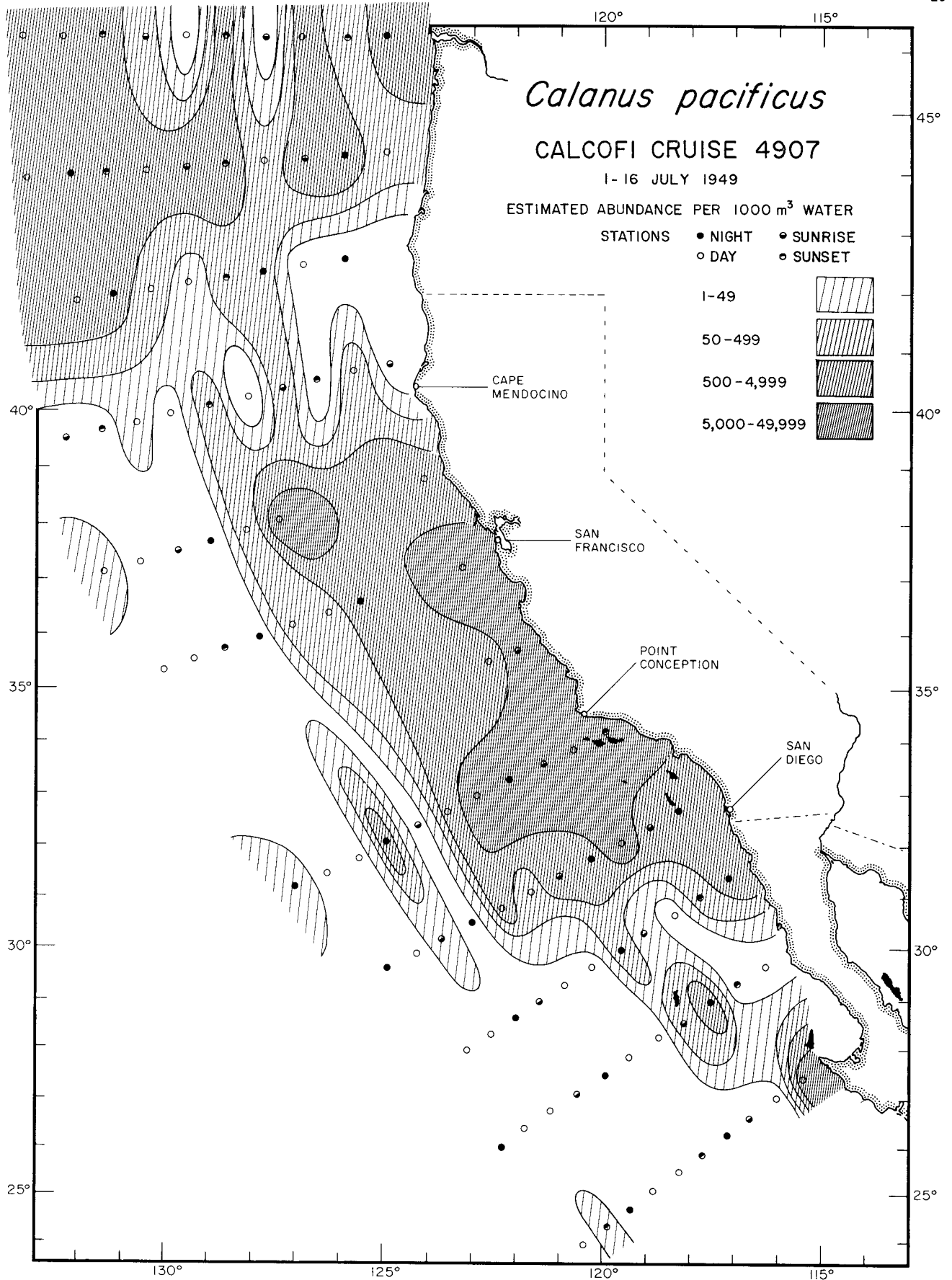
STATIONS ● NIGHT ○ DAY ○ SUNRISE ○ SUNSET

1-49	[diagonal lines]
50-499	[diagonal lines]
500-4,999	[diagonal lines]
5,000-49,999	[diagonal lines]
50,000-499,999	[solid black]

Calanoida

Calanus pacificus

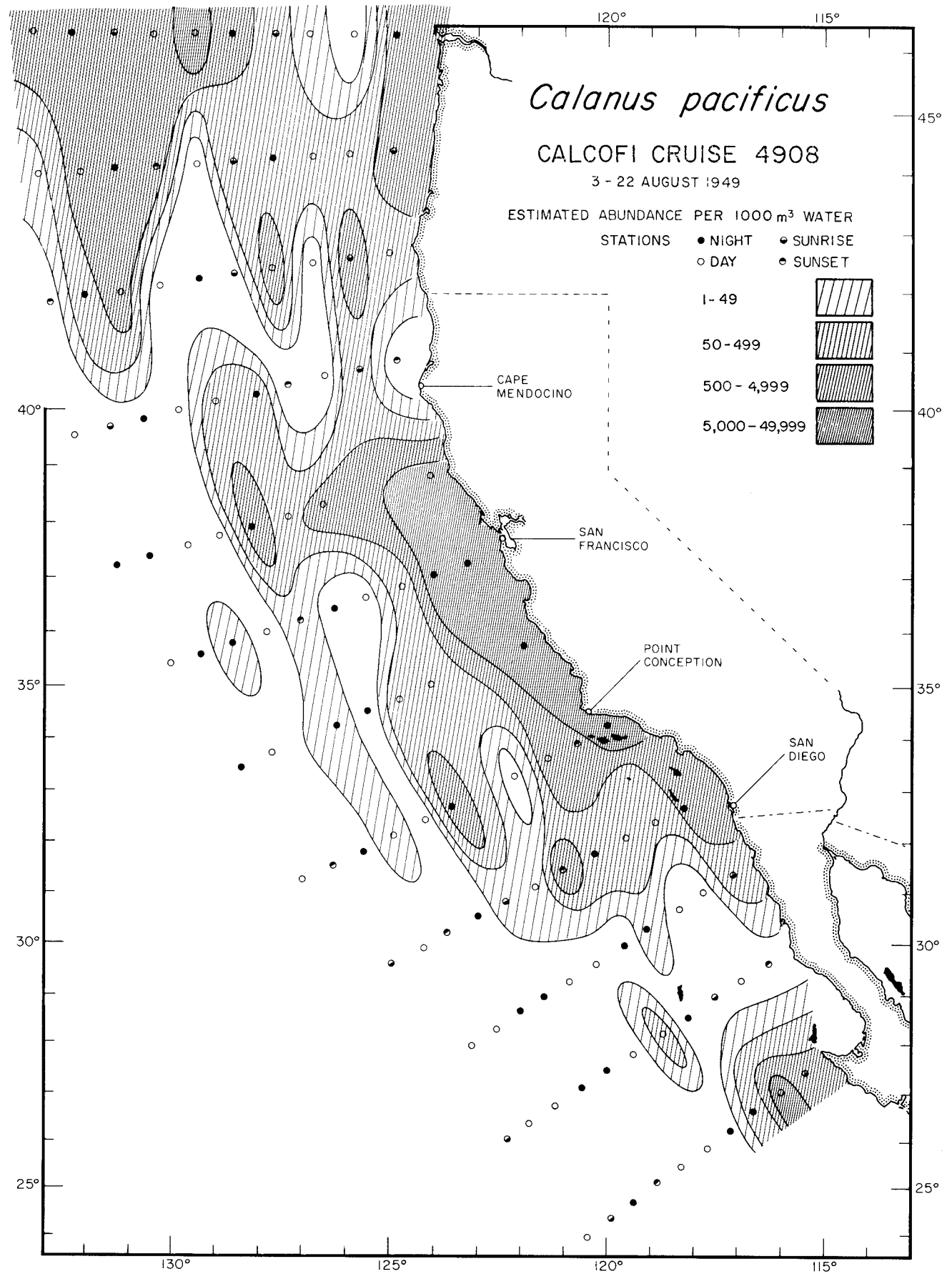
4906



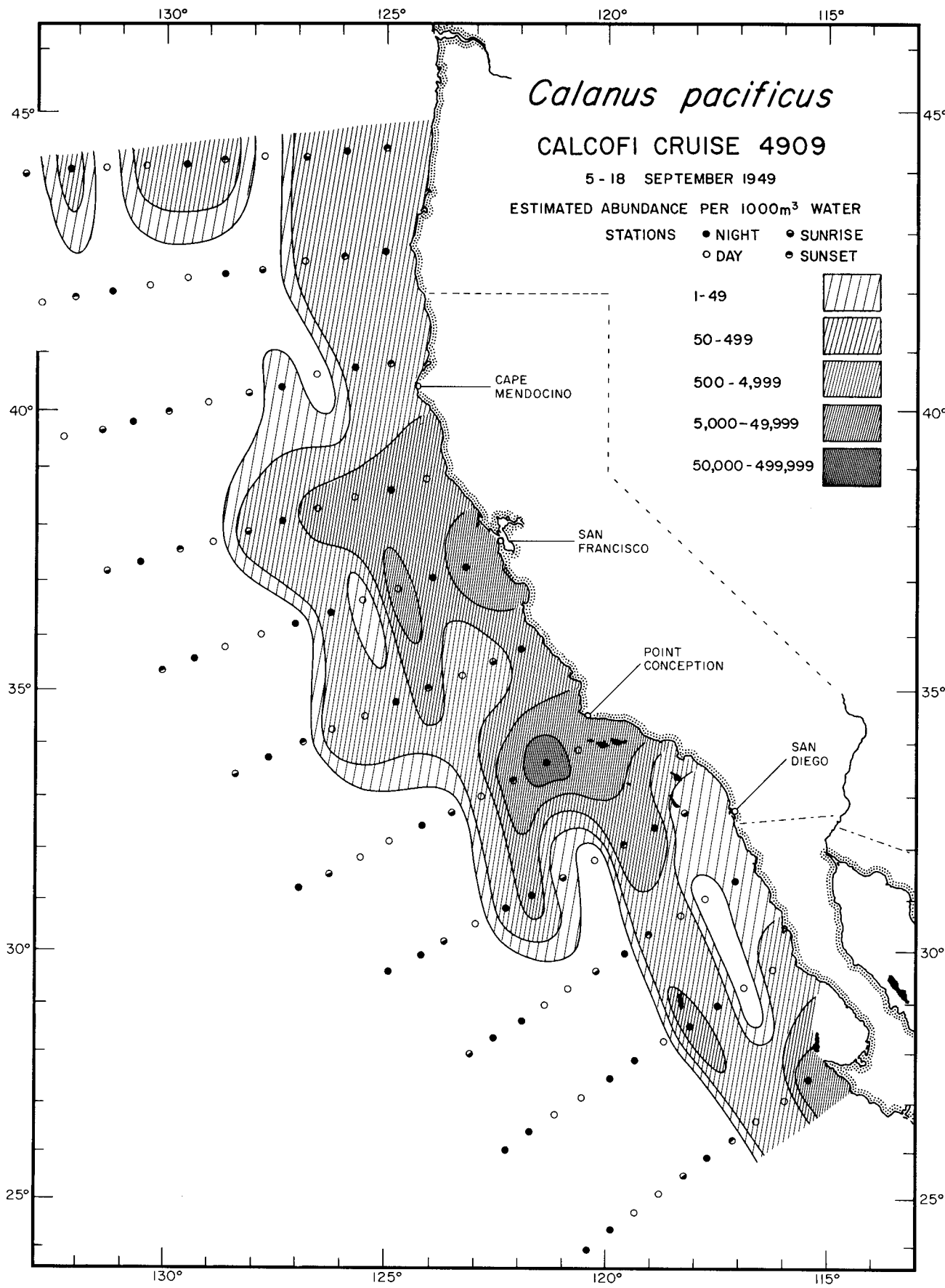
Calanoida

Calanus pacificus

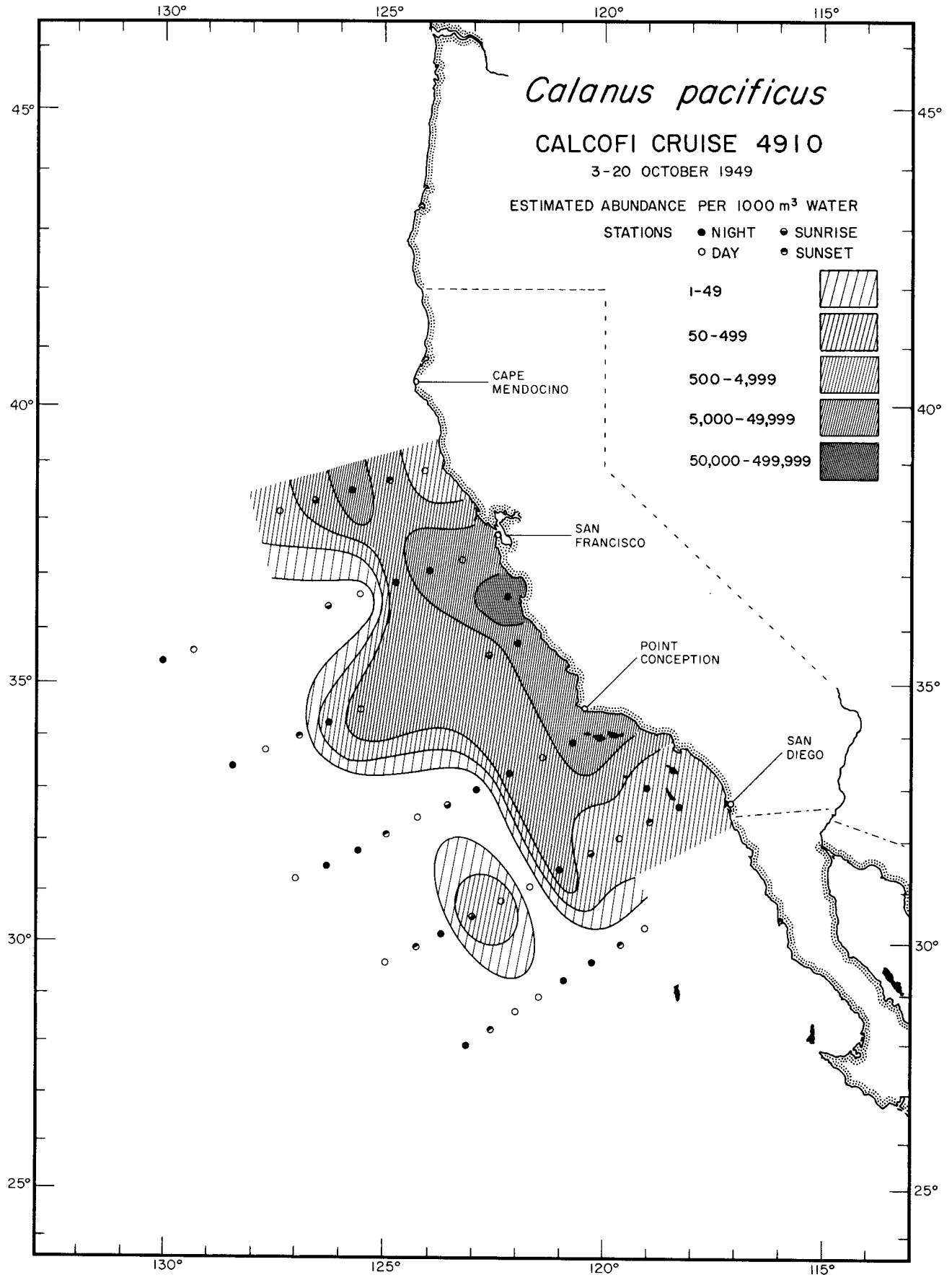
4907



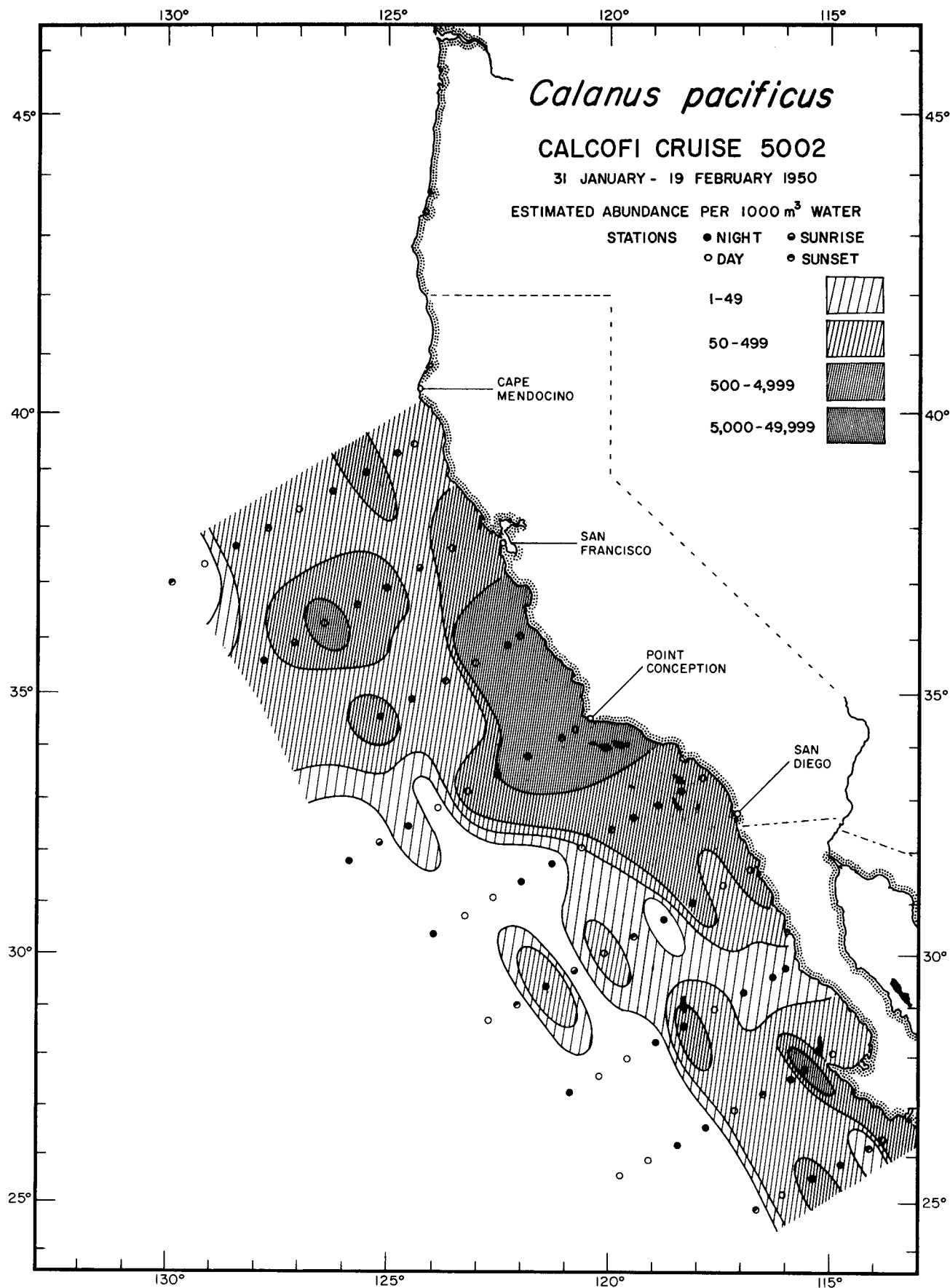
Calanoida
Calanus pacificus
4908



Calanoida
Calanus pacificus
4909



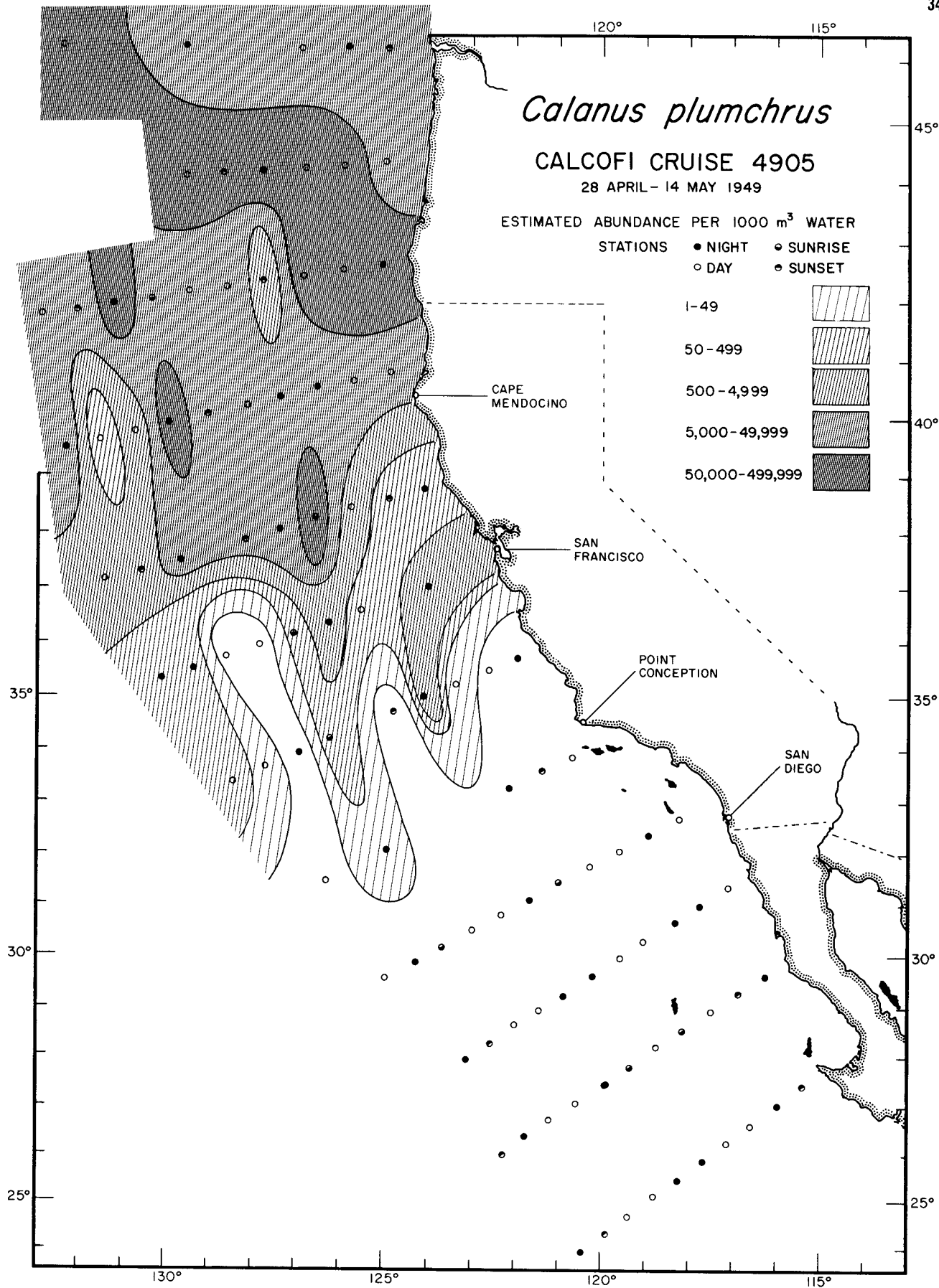
Calanoida
Calanus pacificus
4910



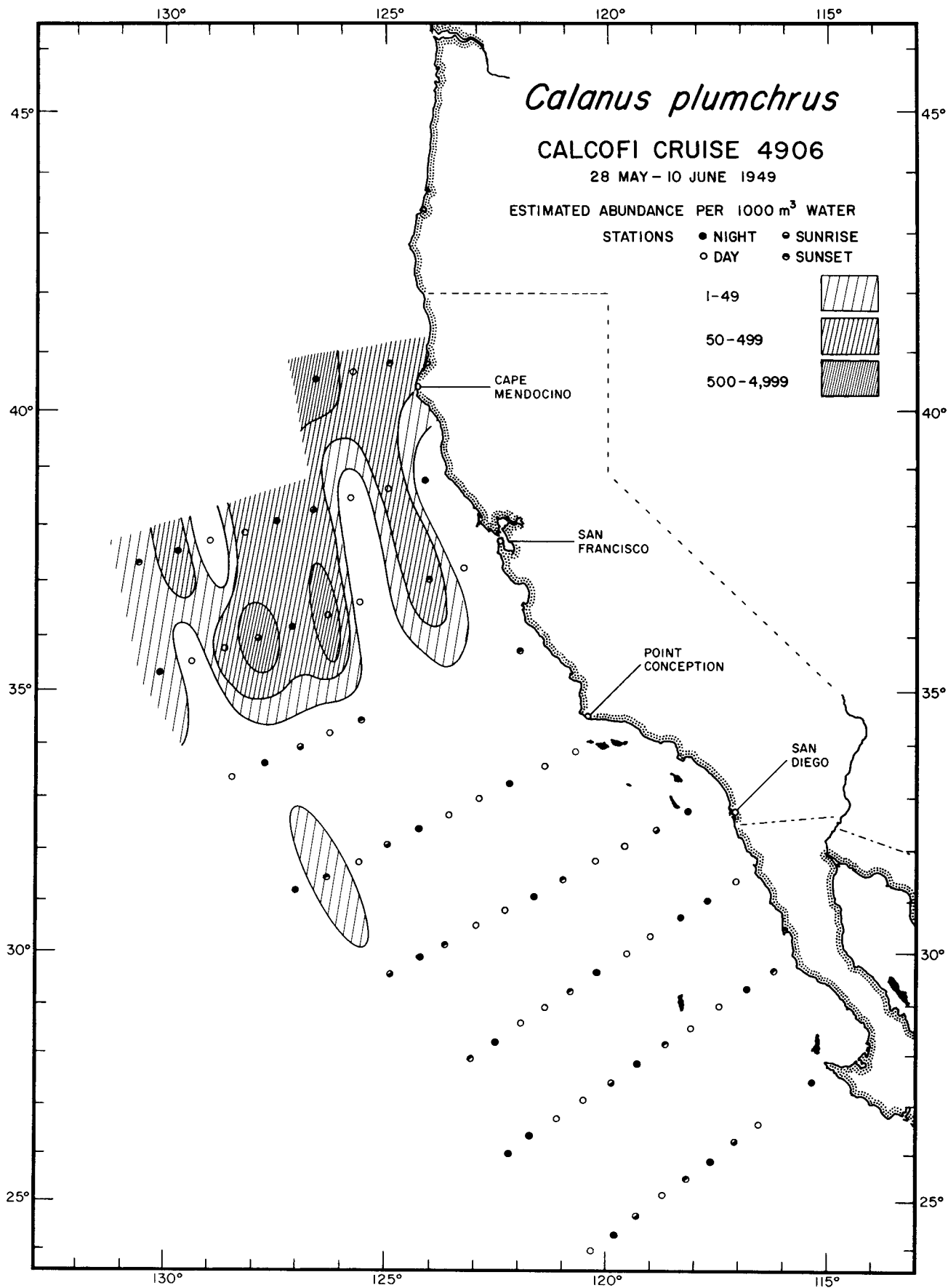
Calanoida

Calanus pacificus

5002



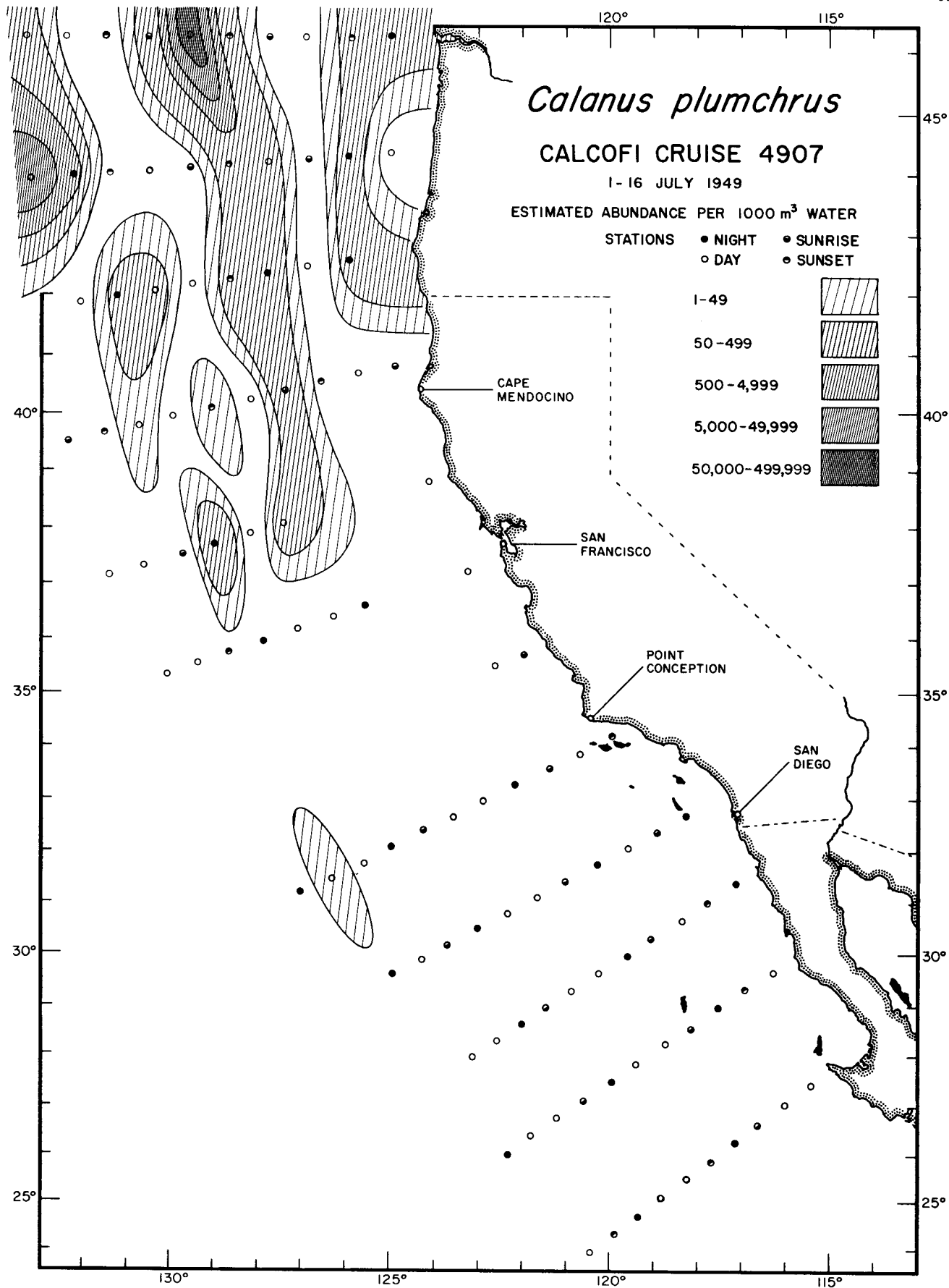
Calanoida
Calanus plumchrus
4905



Calanoida

Calanus plumchrus

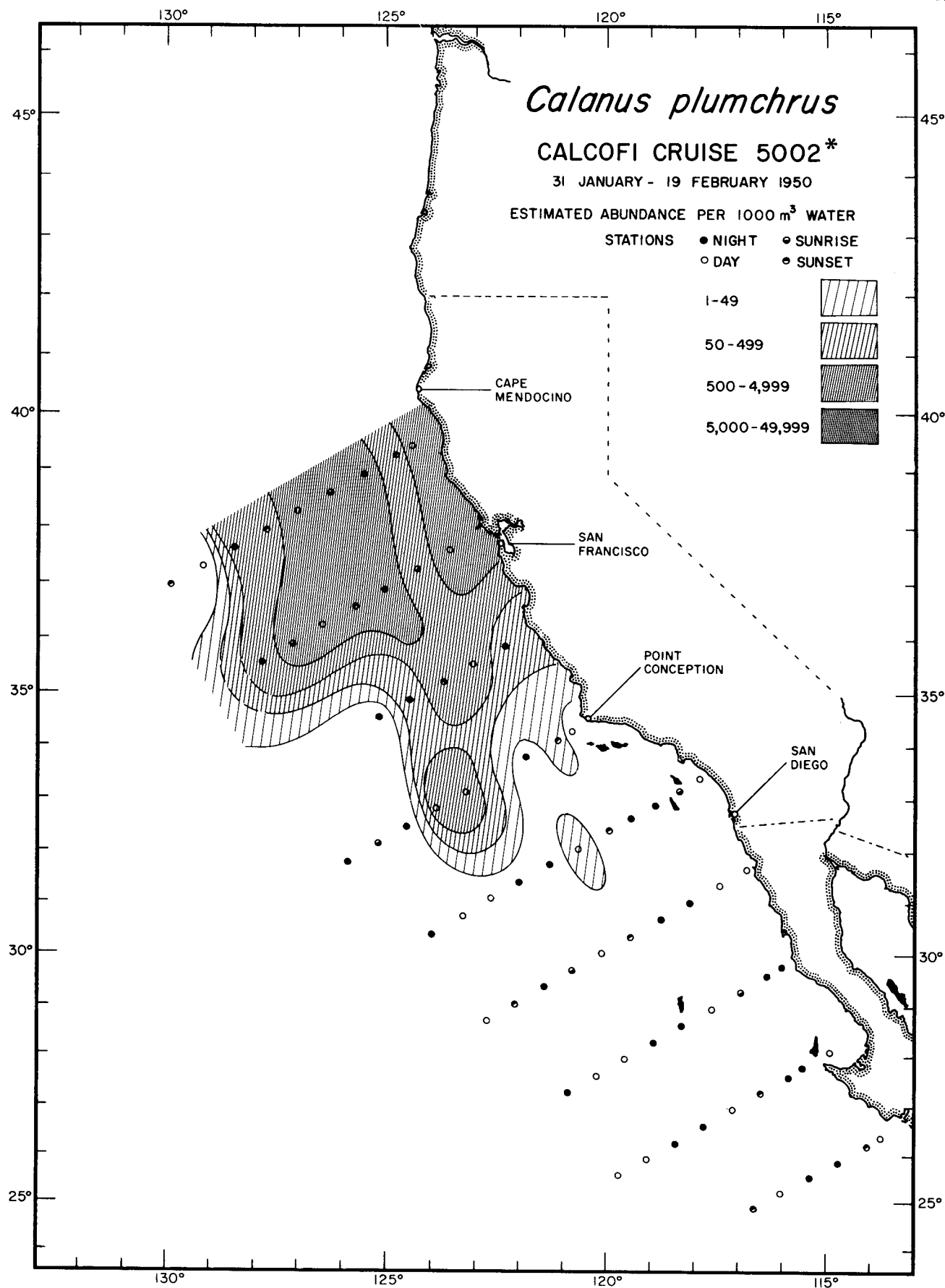
4906



Calanoida

Calanus plumchrus

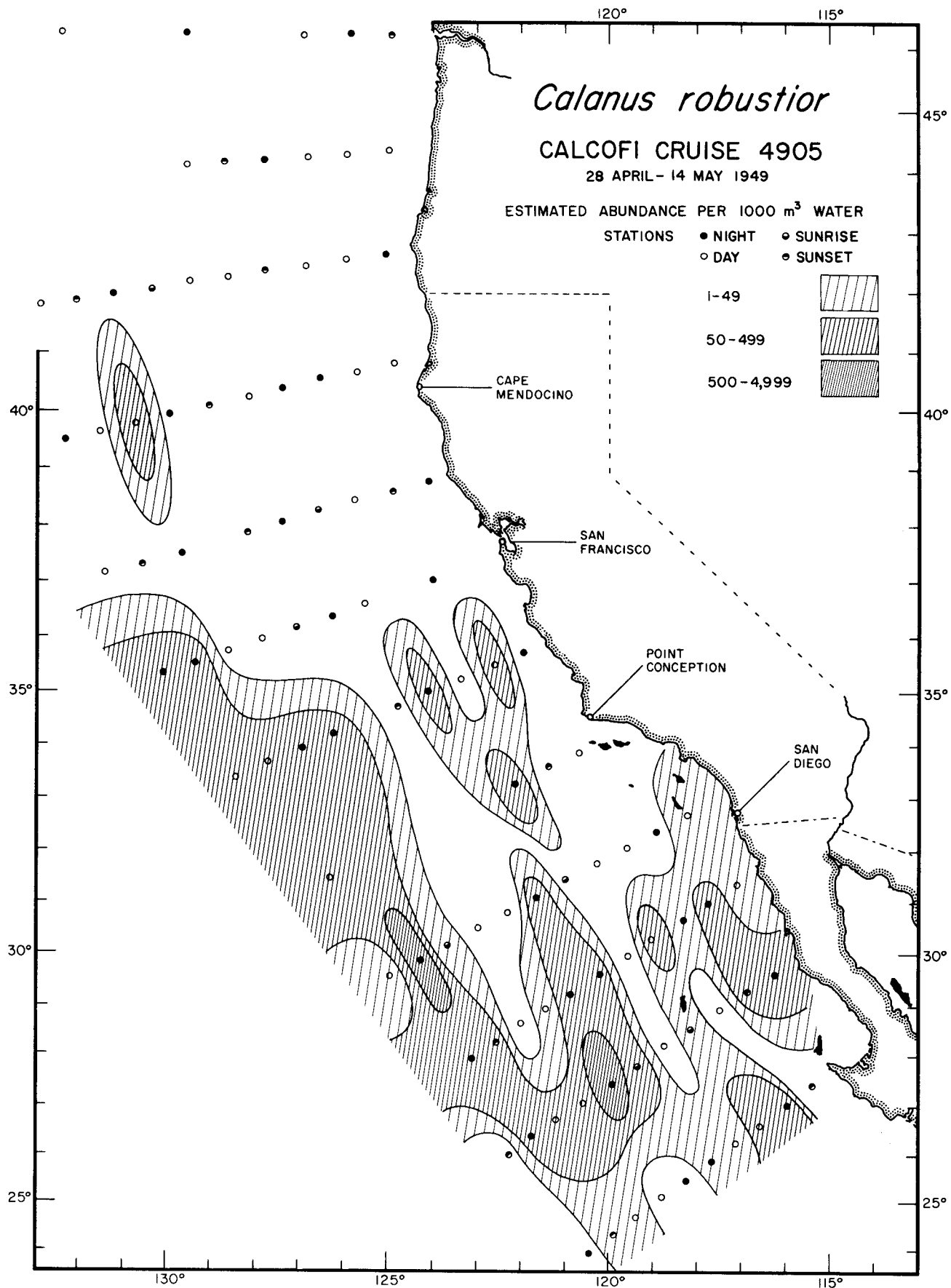
4907



Calanoida

Calanus plumchrus

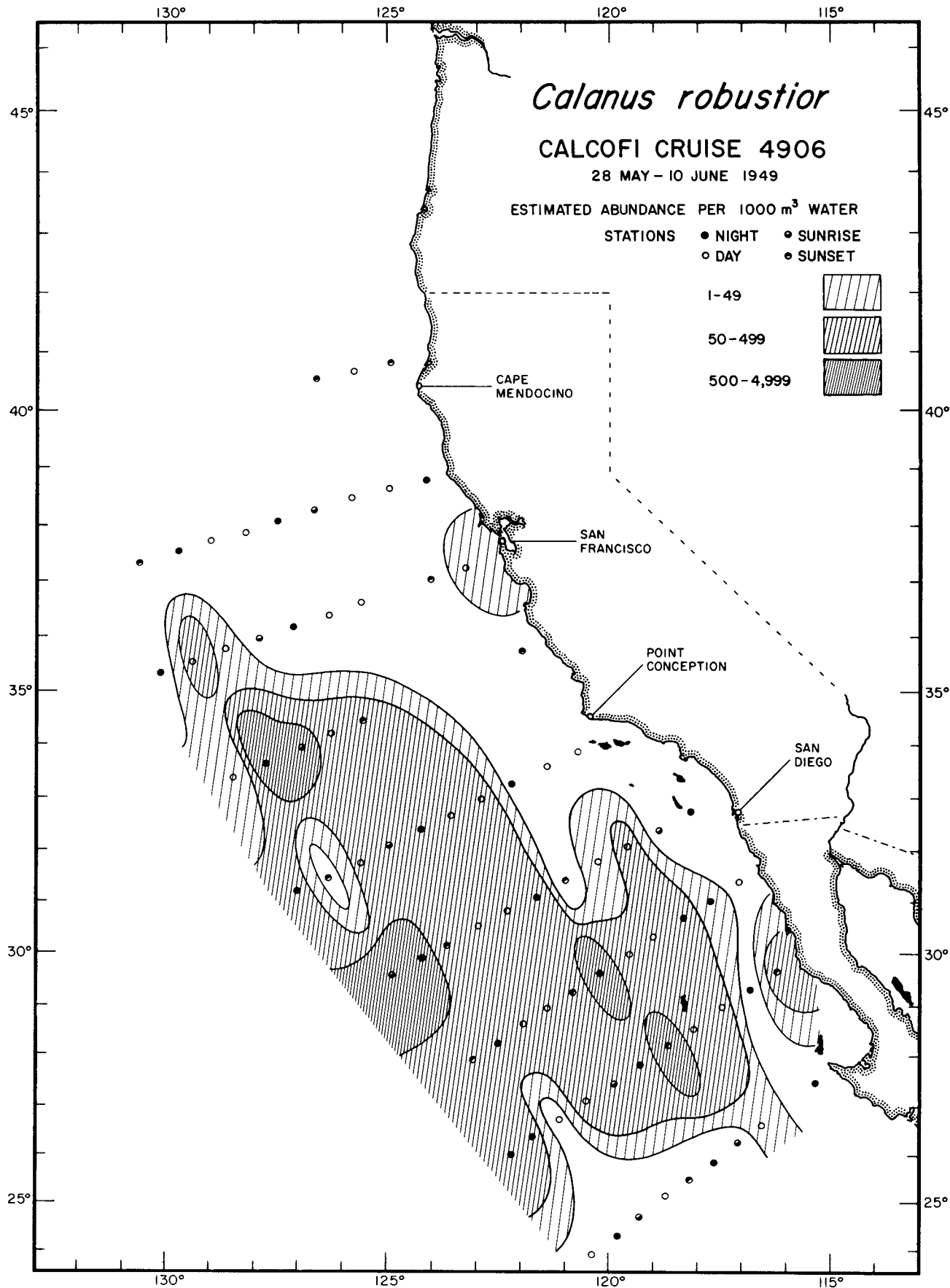
5002



Calanoida

Calanus robustior

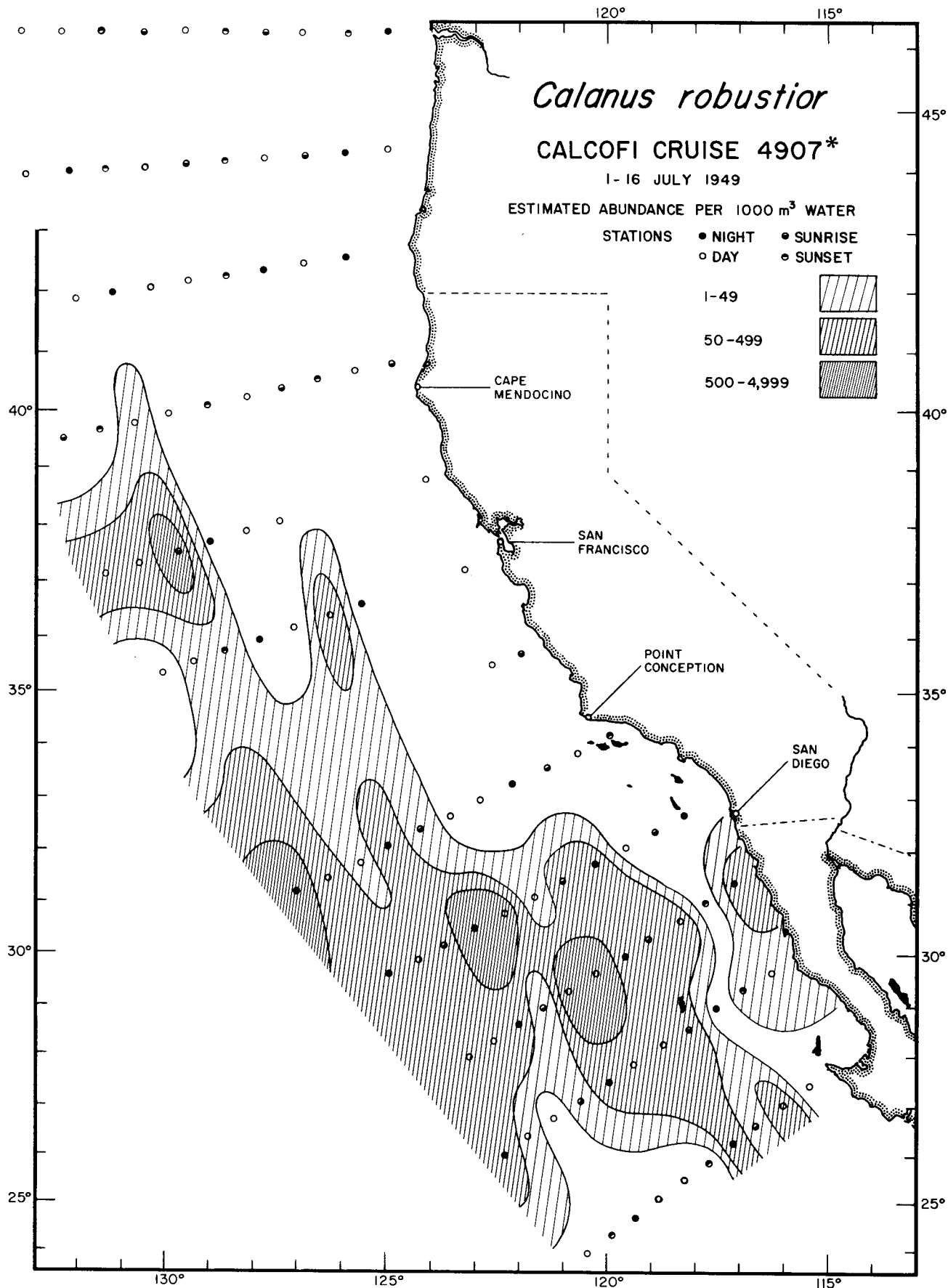
4905



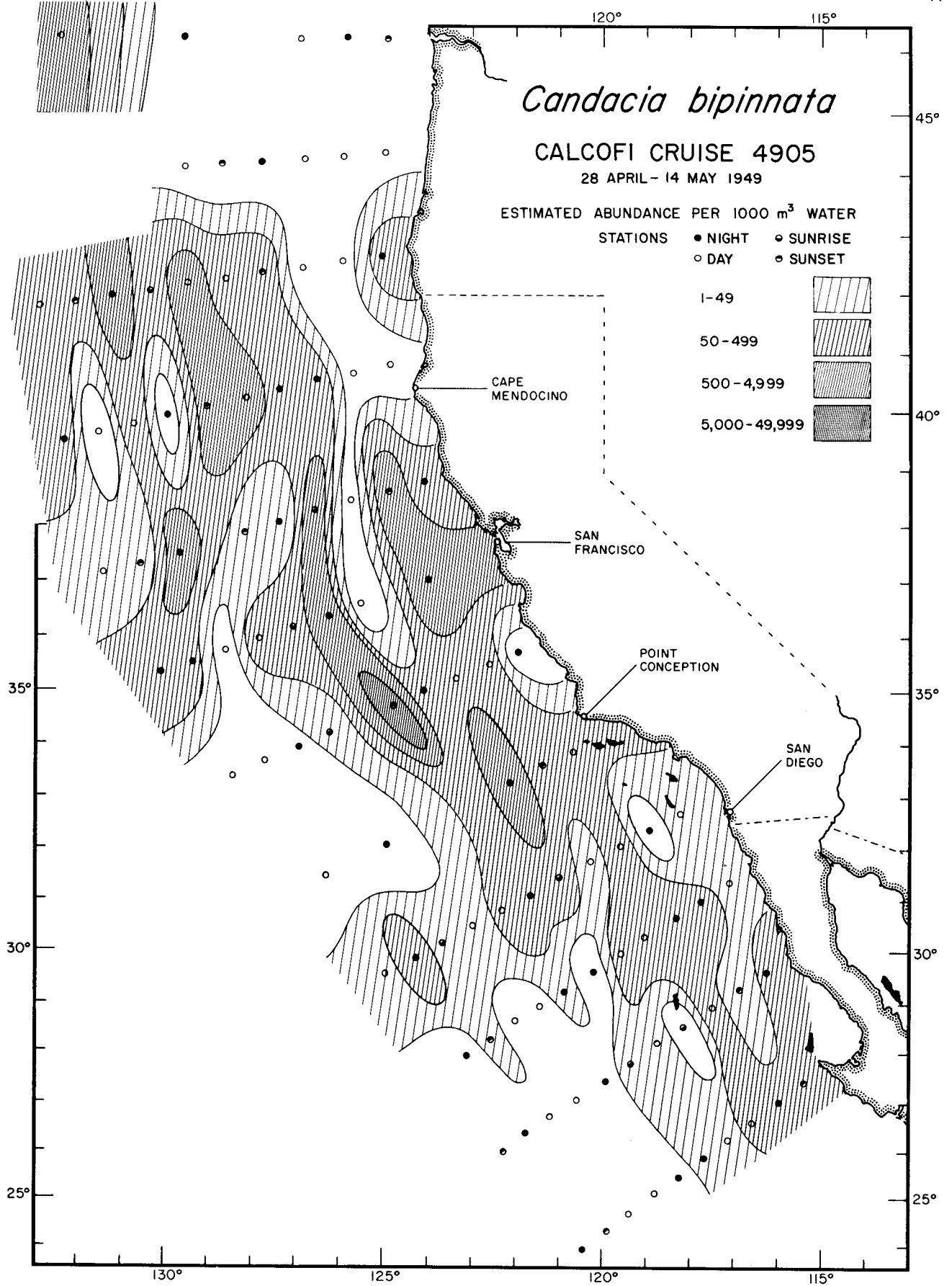
Calanoida

Calanus robustior

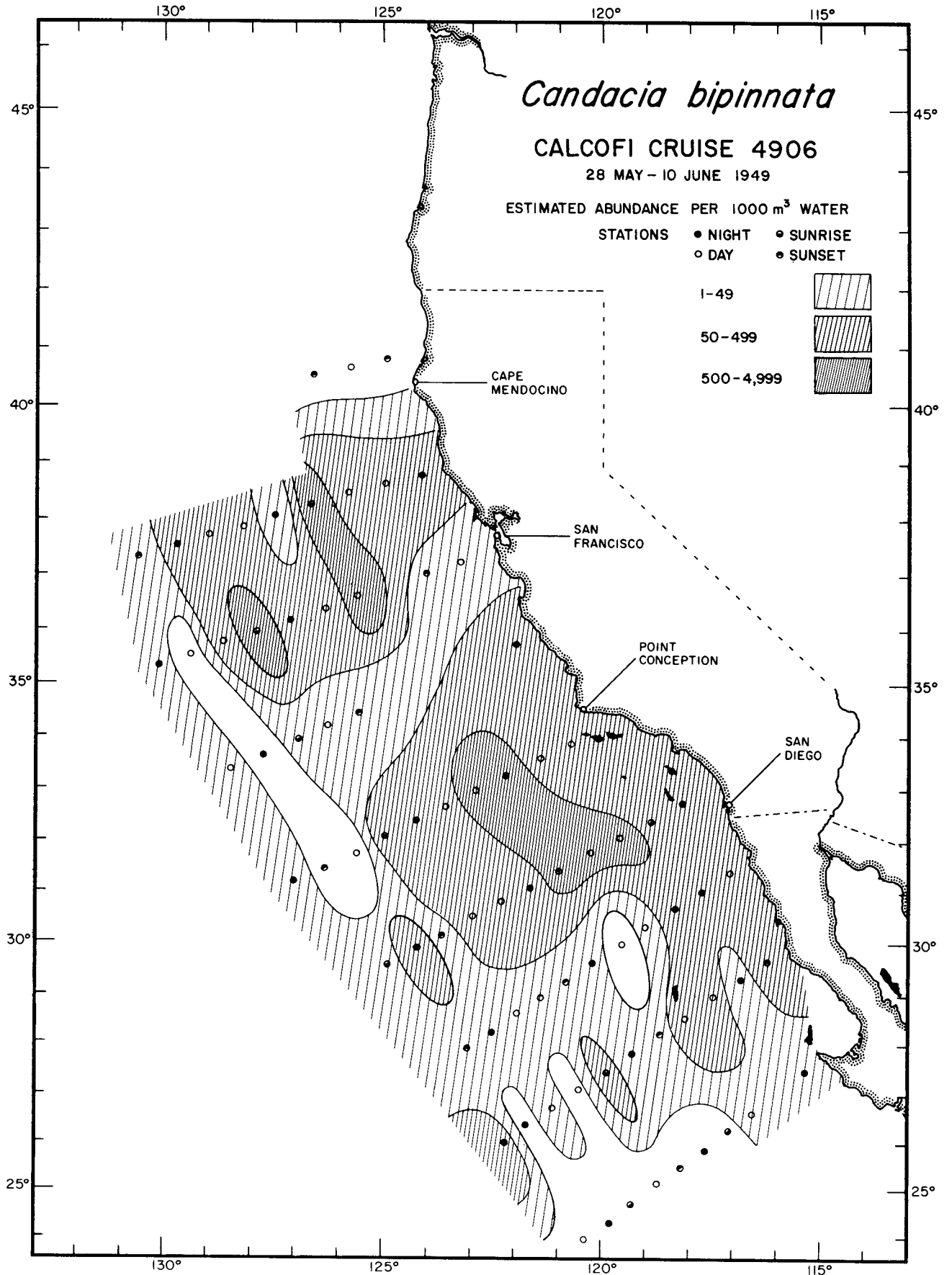
4906



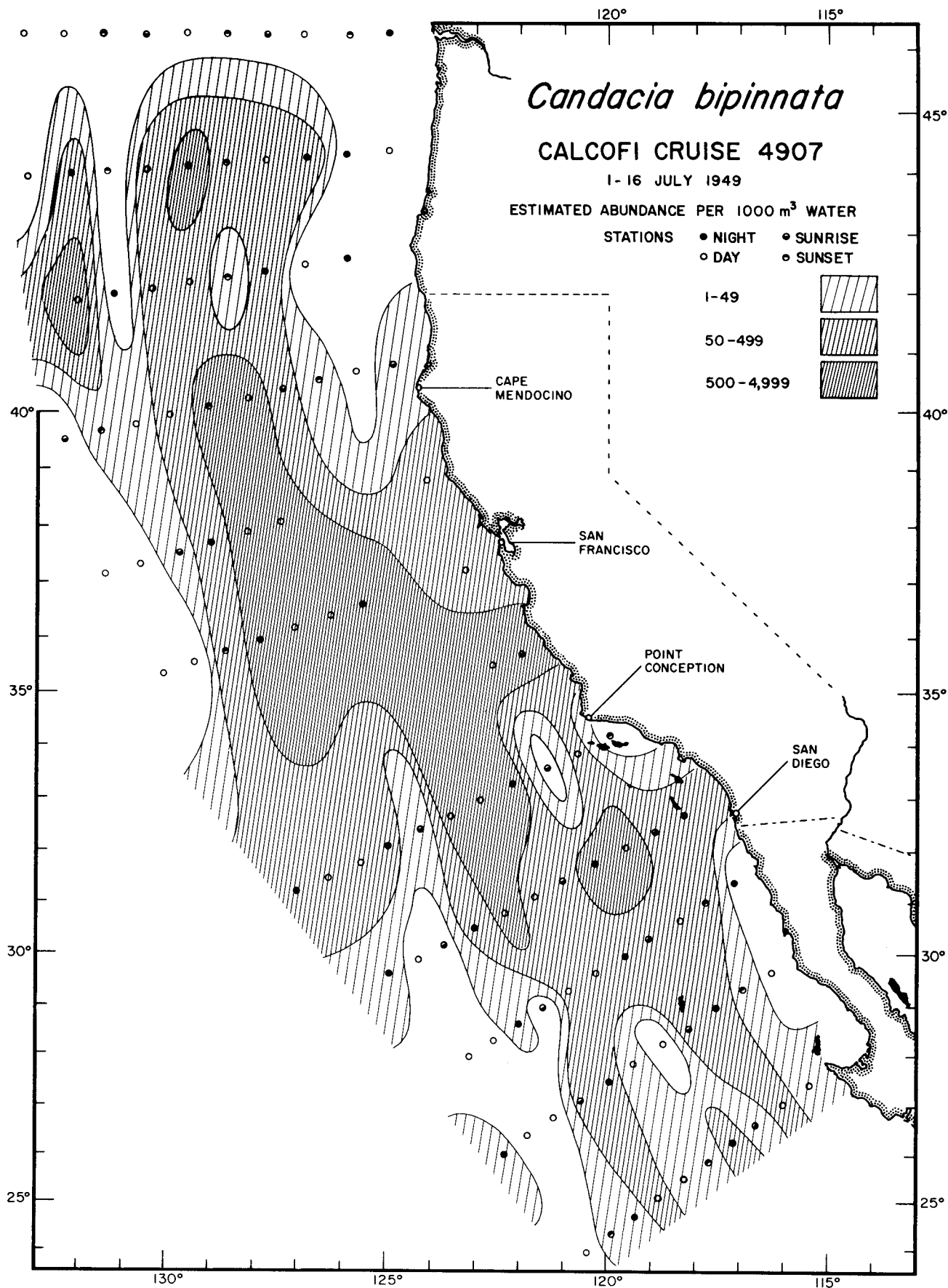
* See Table 1 for cruises 4908, 9, 10, 5002



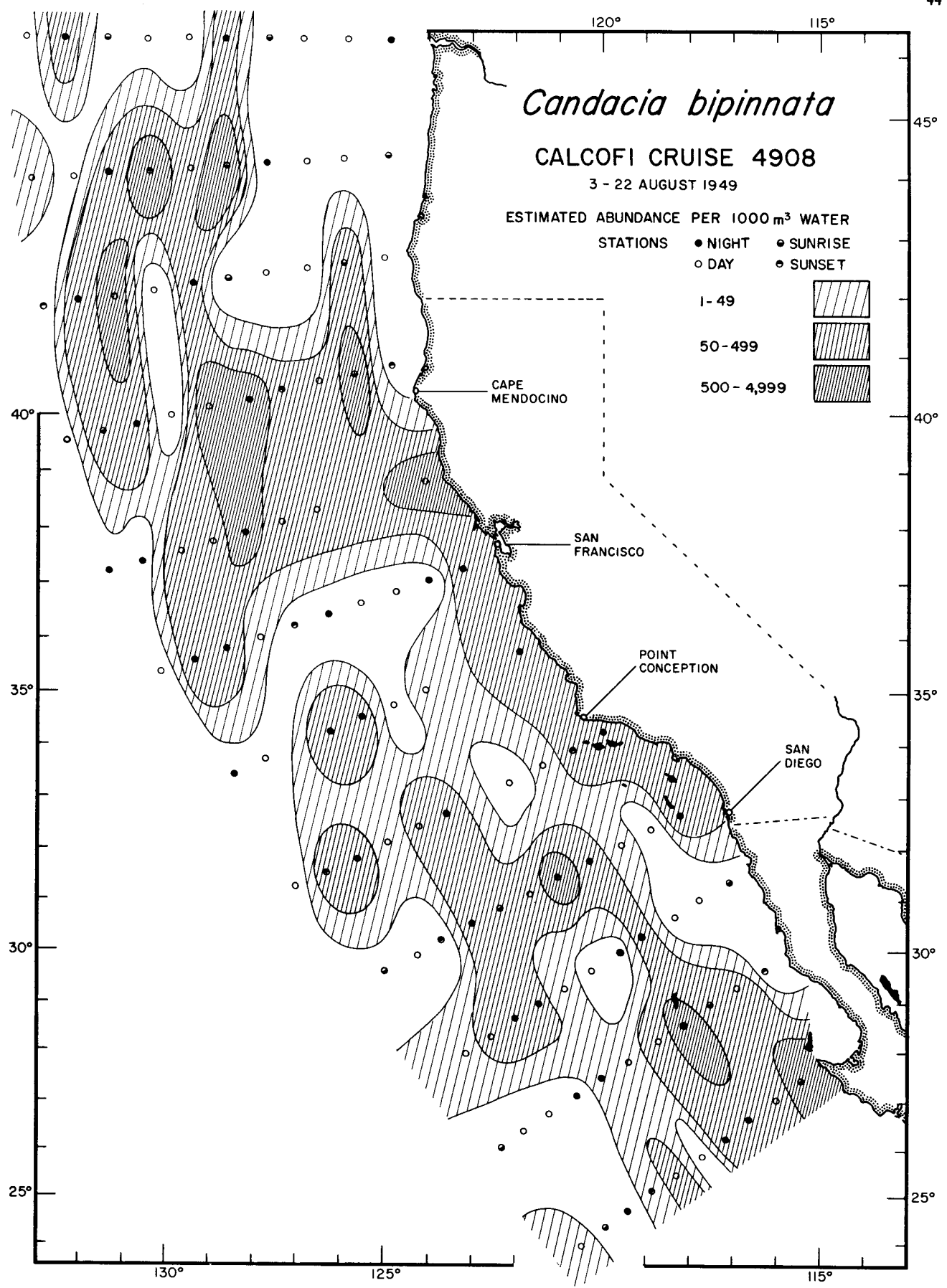
Calanoida
Candacia bipinnata
 4905



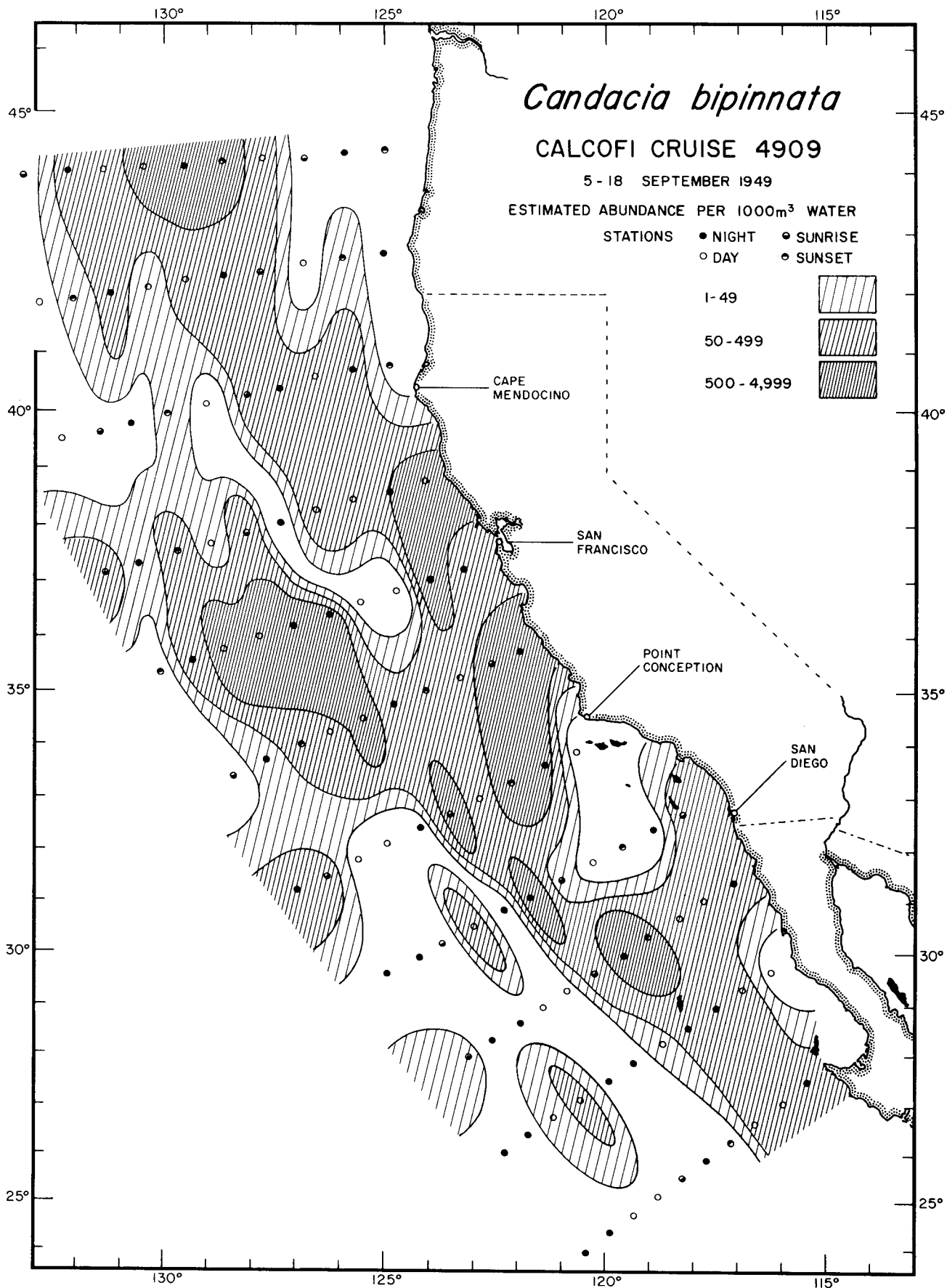
Calanoida
Candacia bipinnata
 4906



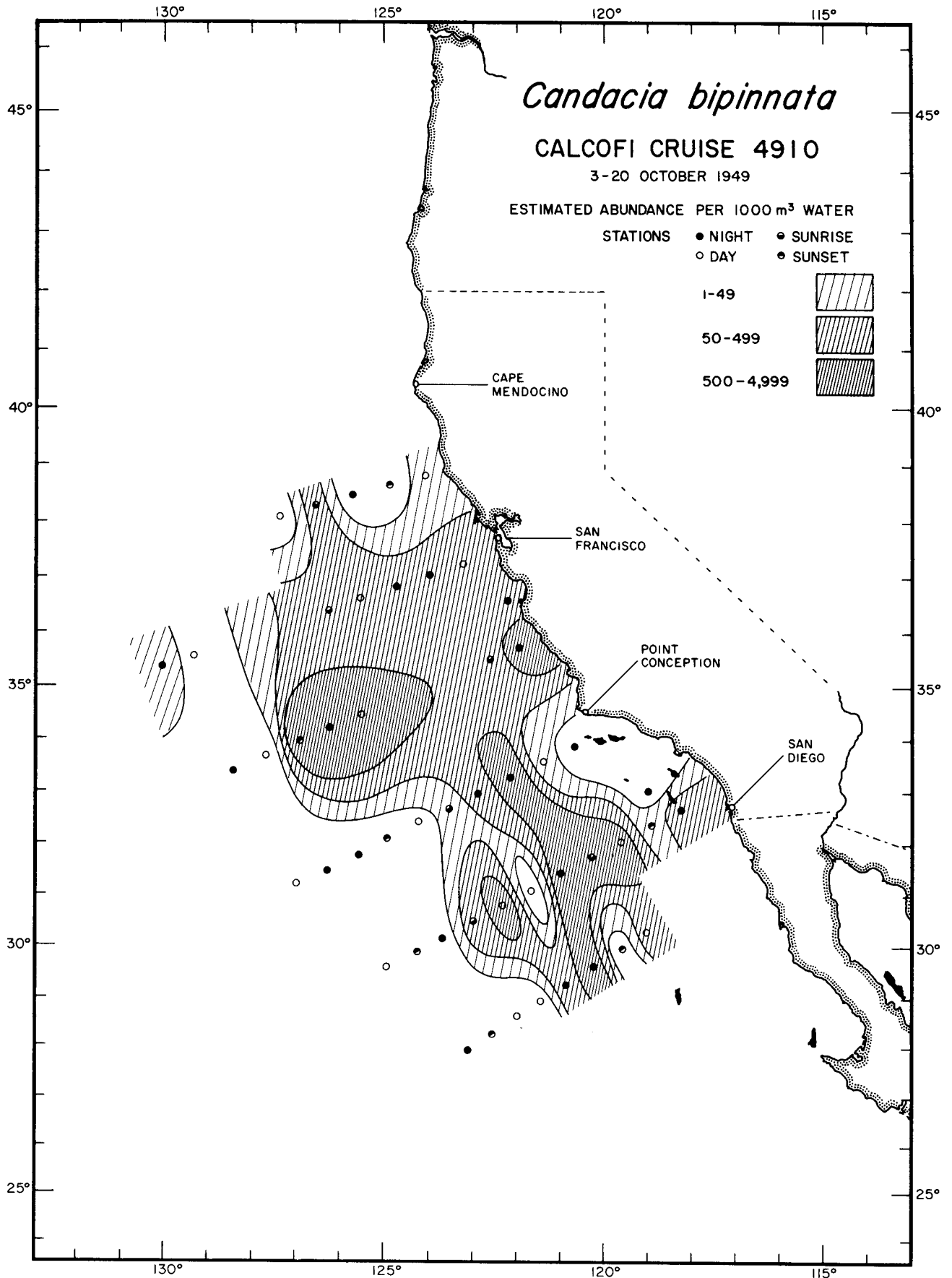
Calanoida
Candacia bipinnata
 4907



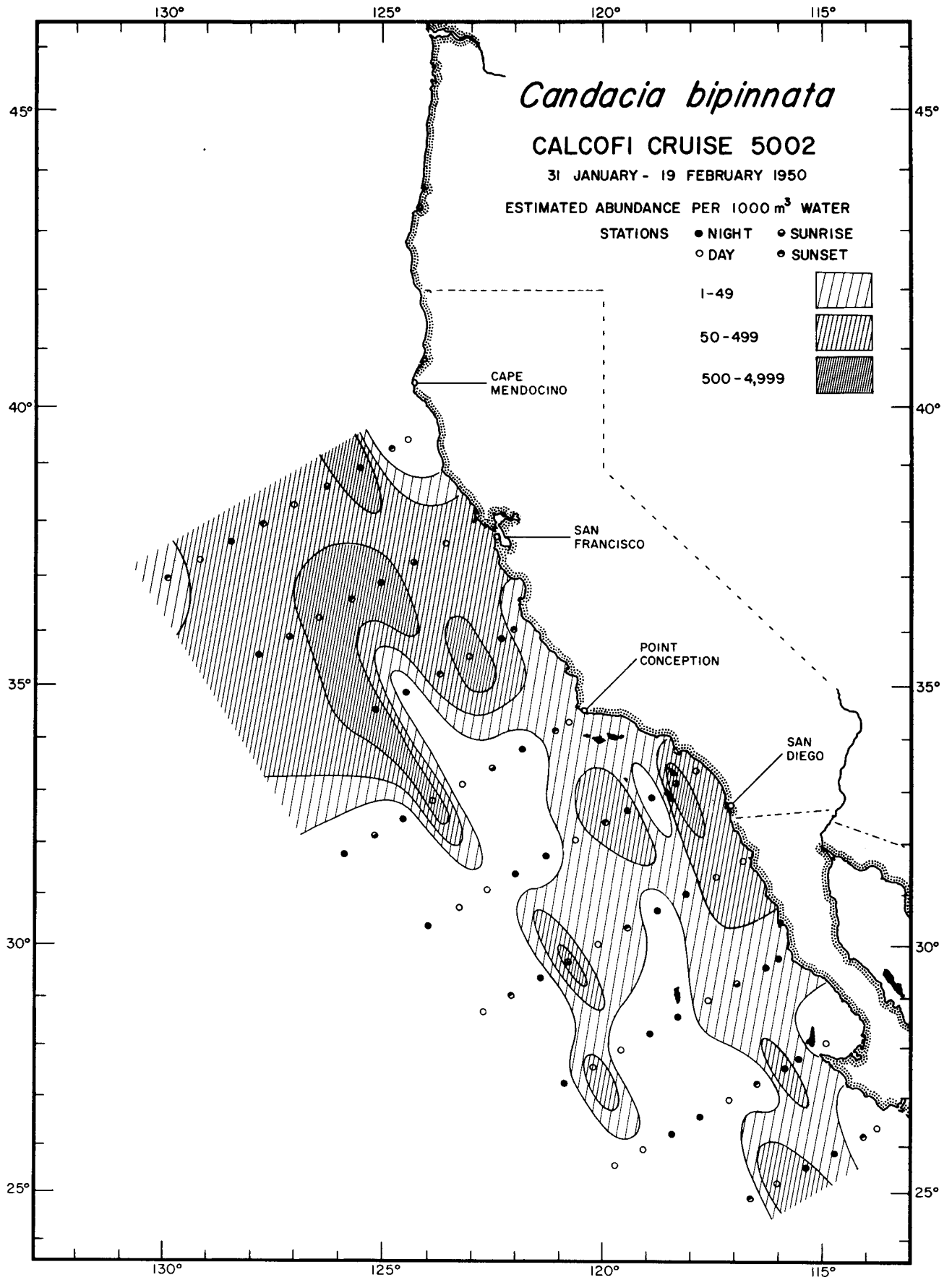
Calanoida
Candacia bipinnata
4908



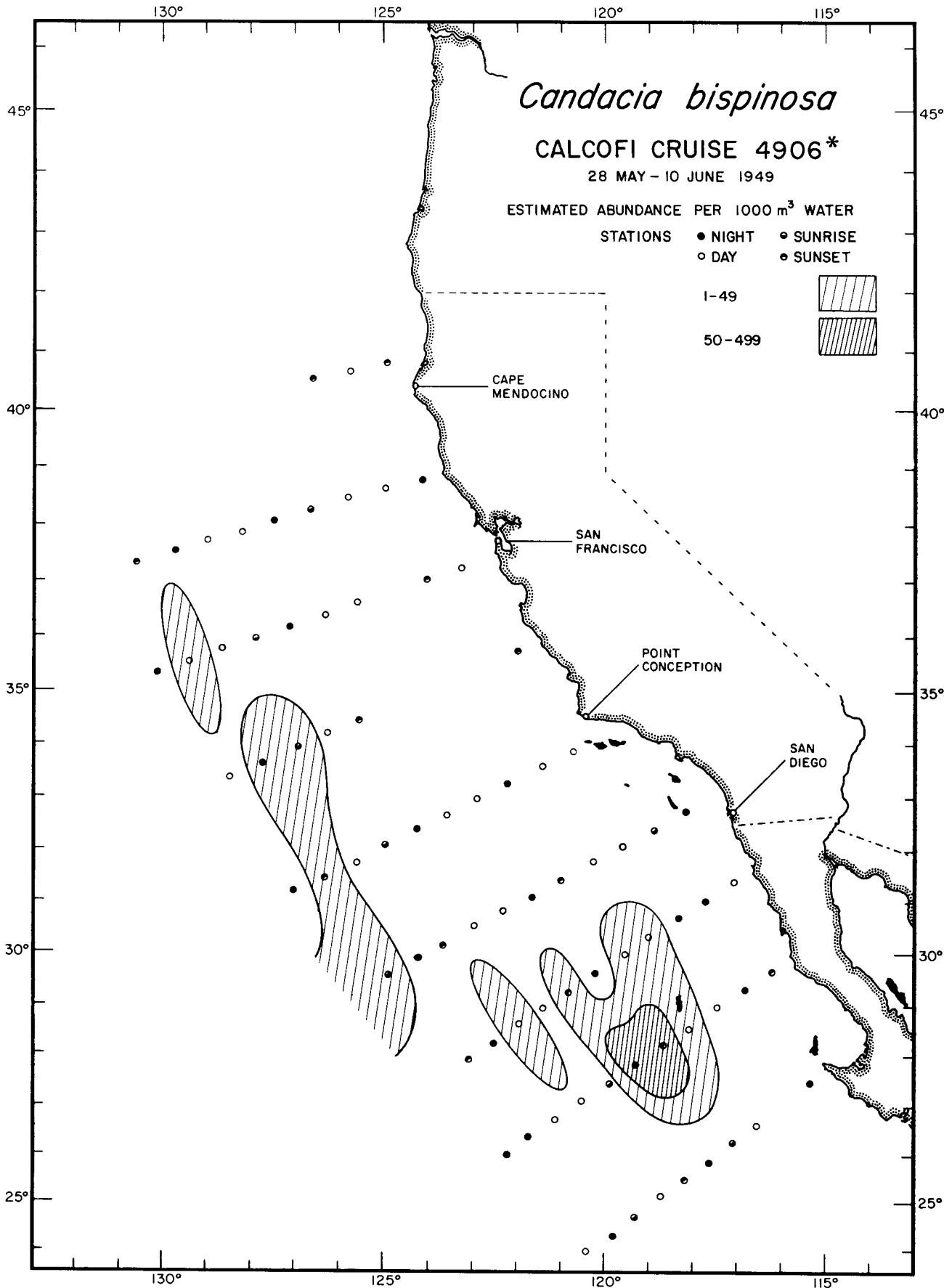
Calanoida
Candacia bipinnata
 4909



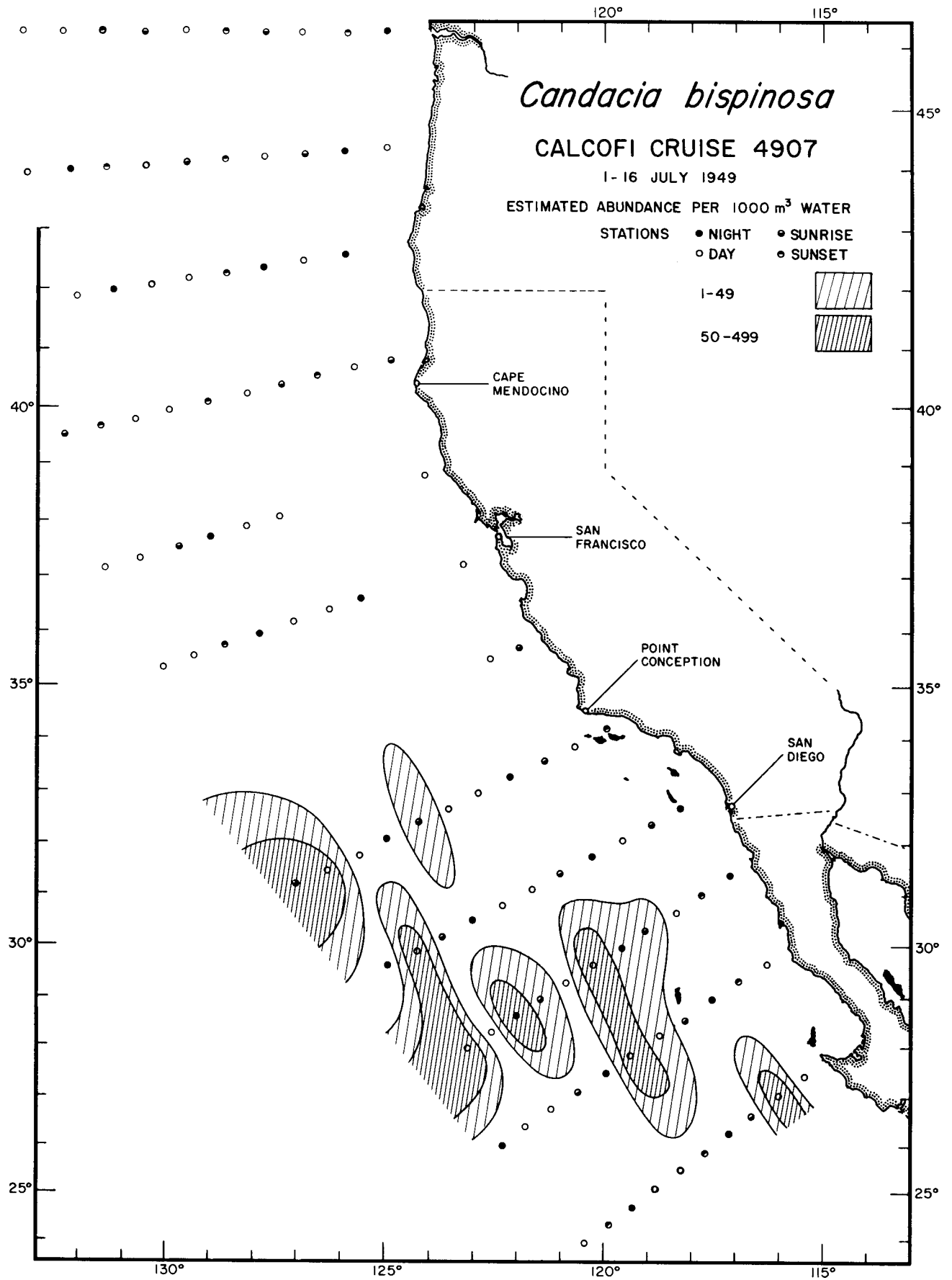
Calanoida
Candacia bipinnata
4910



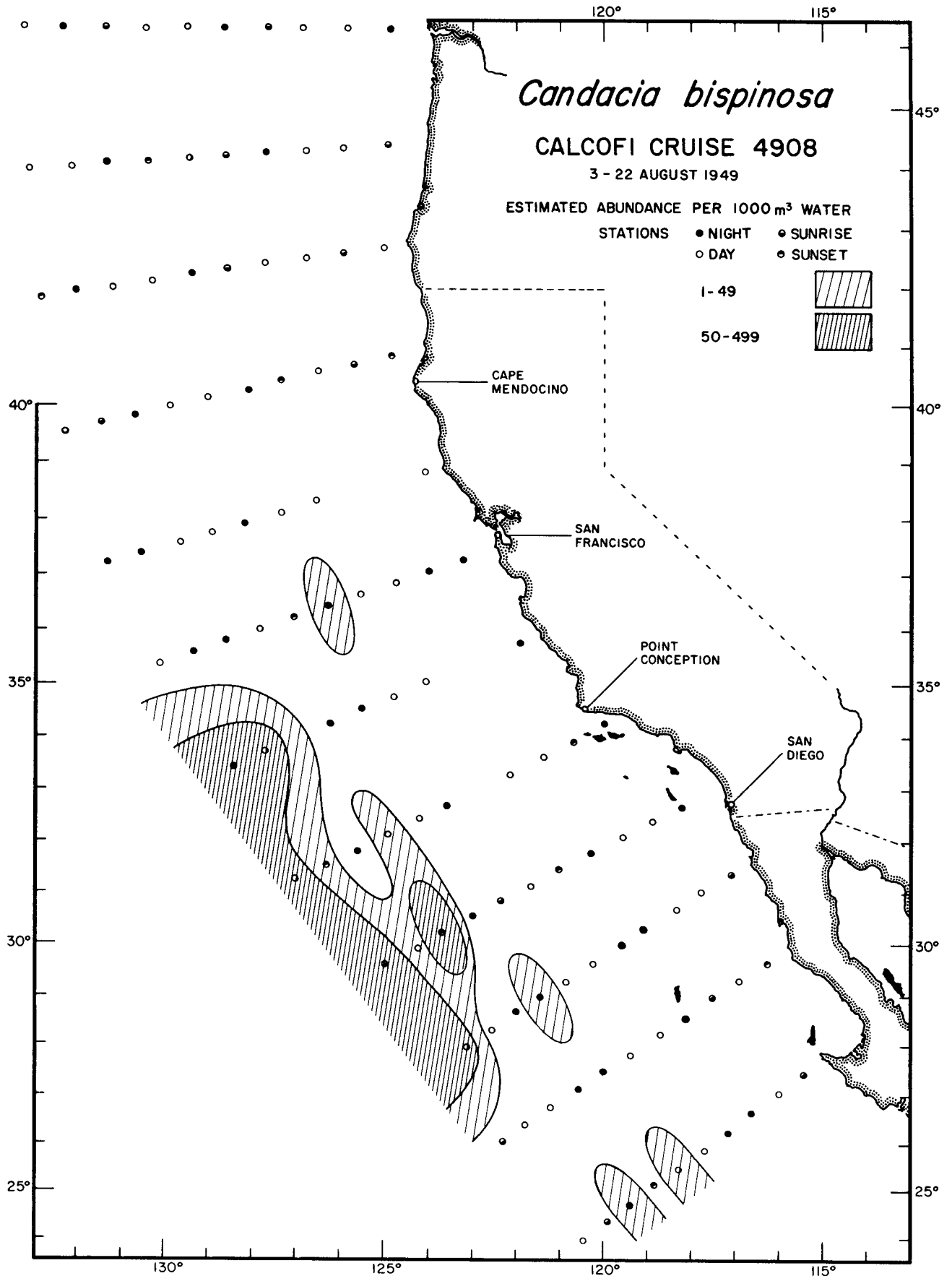
Calanoida
Candacia bipinnata
5002



* See Table 1 for cruise 4905



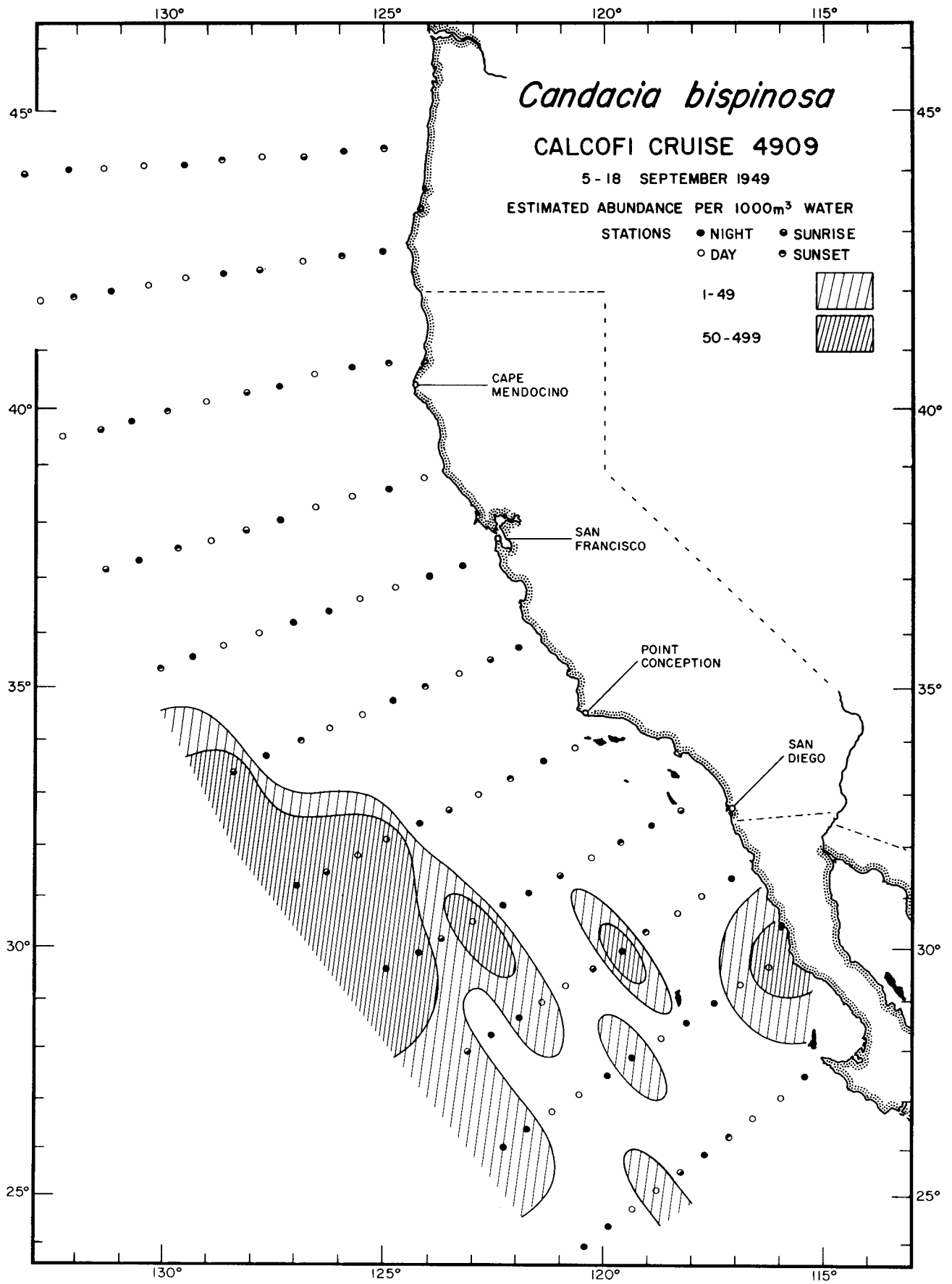
Calanoida
Candacia bispinosa
4907



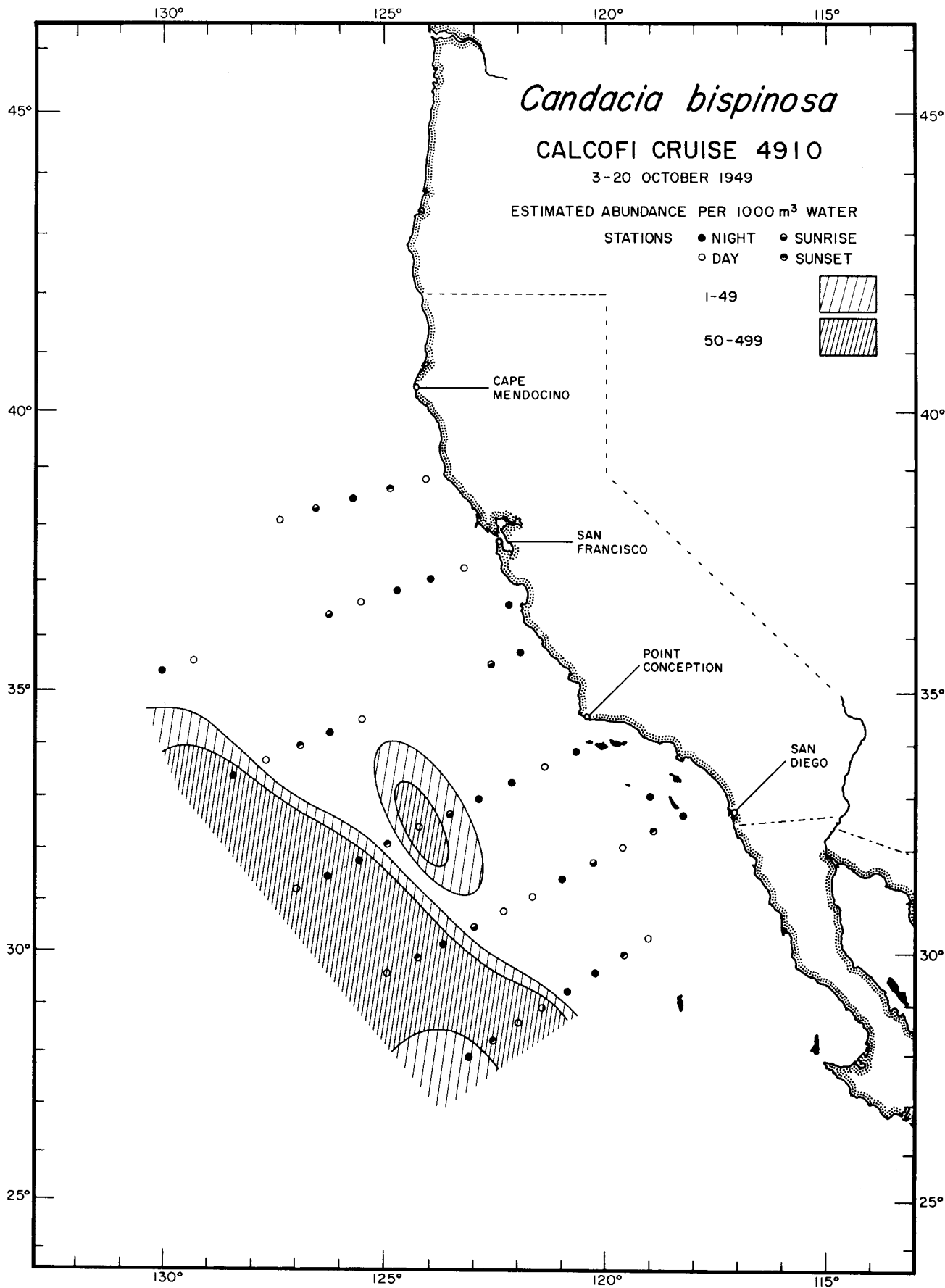
Calanoida

Candacia bispinosa

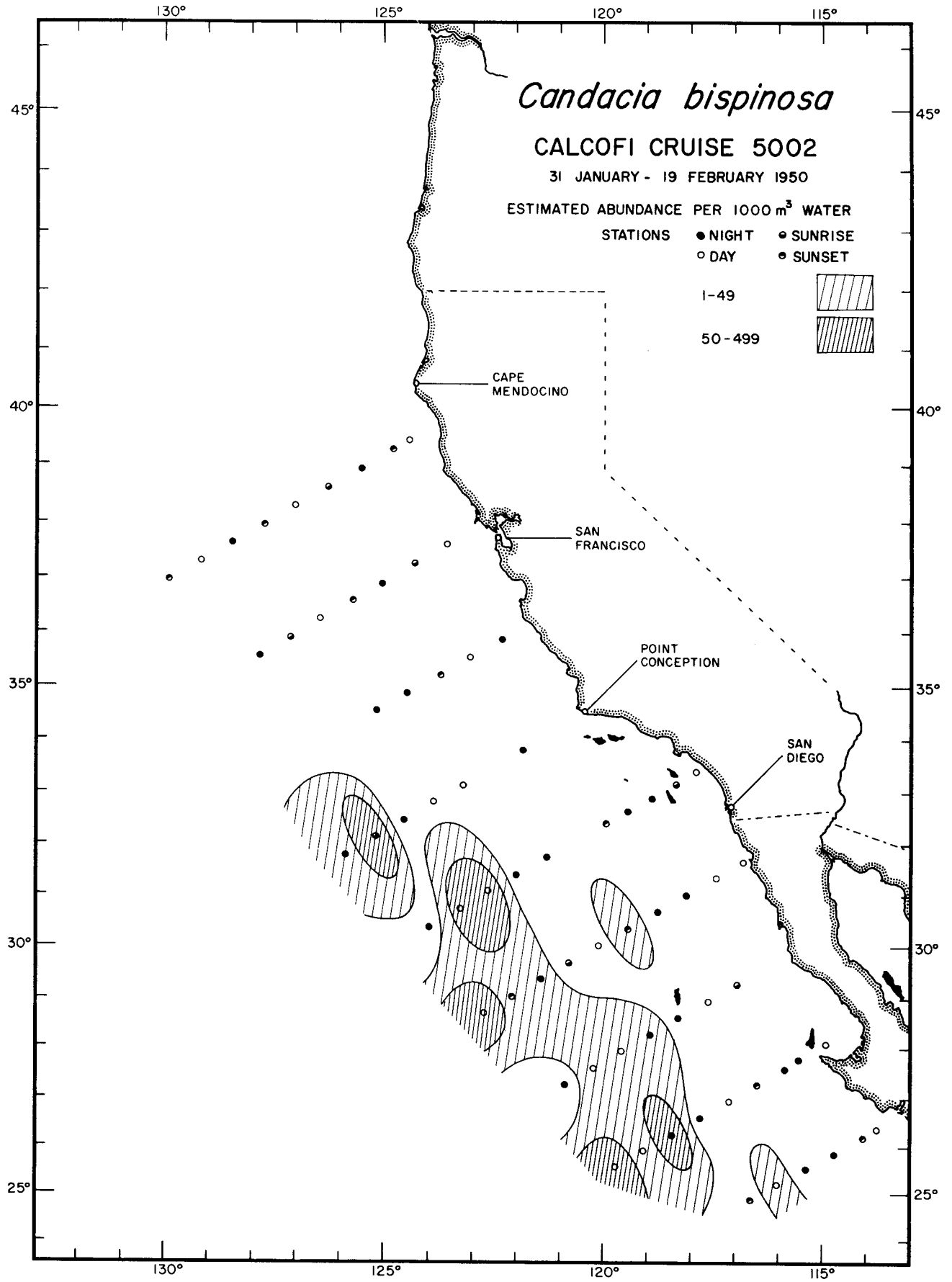
4908



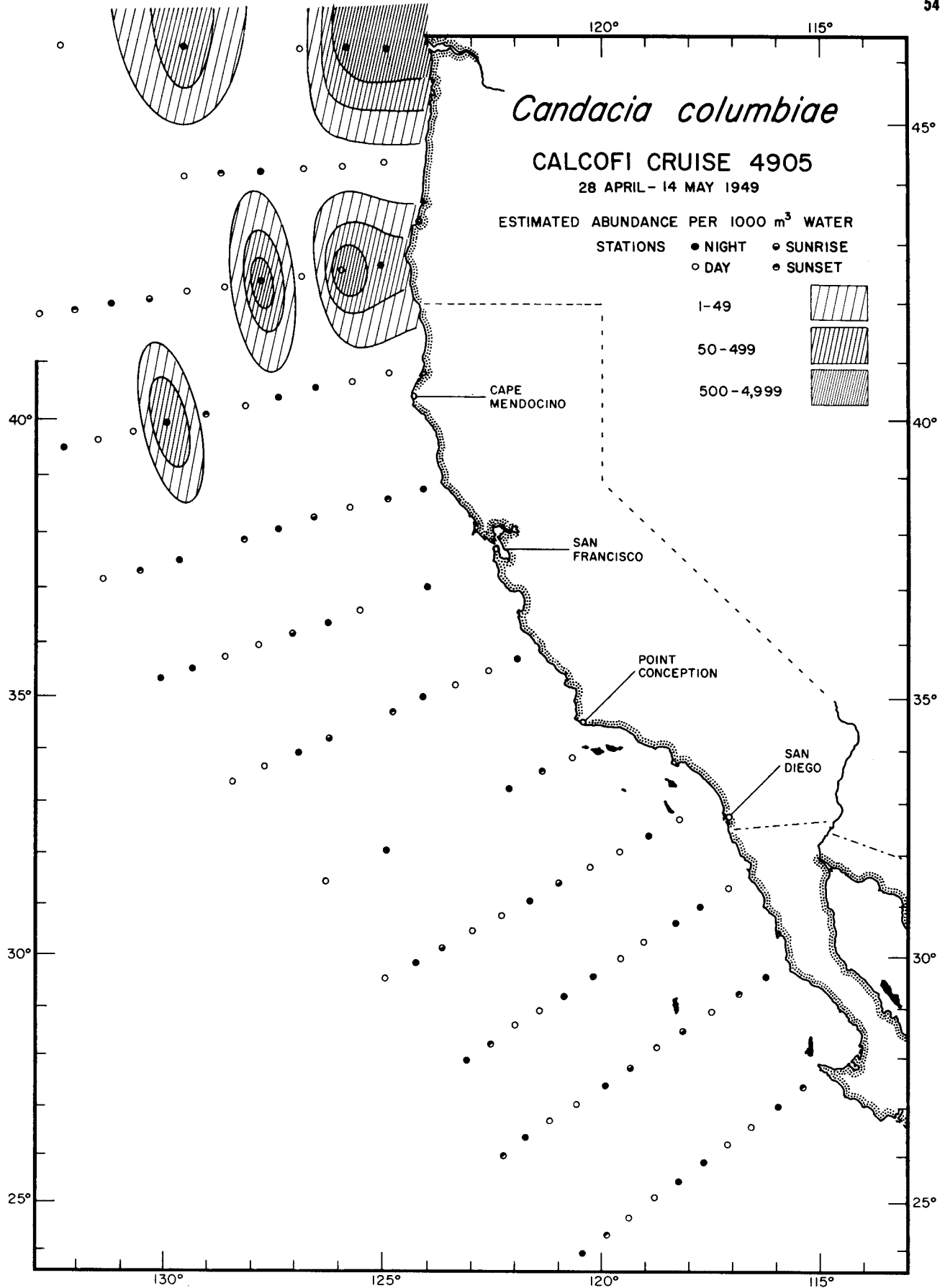
Calanoida
Candacia bispinosa
4909



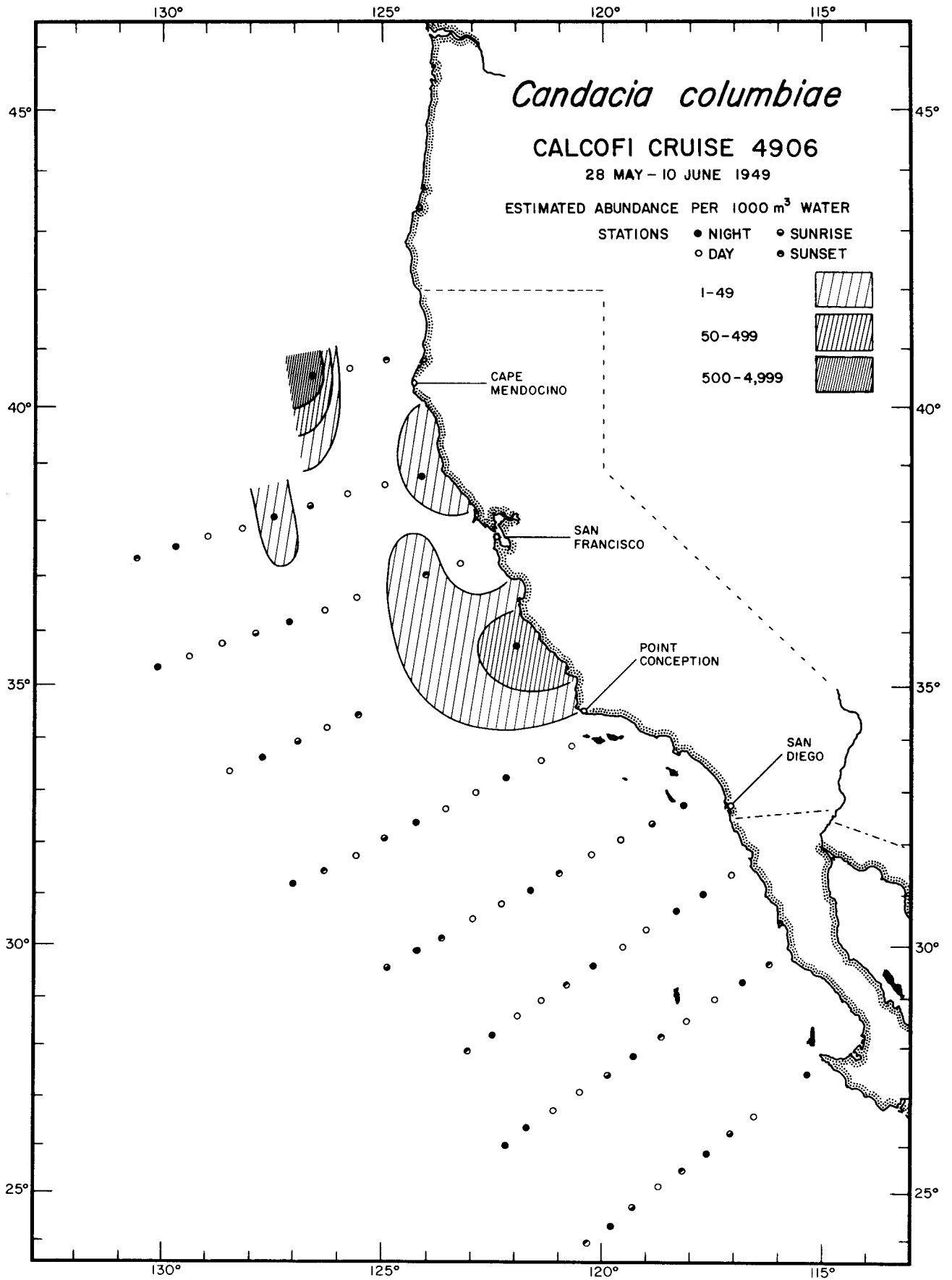
Calanoida
Candacia bispinosa
4910



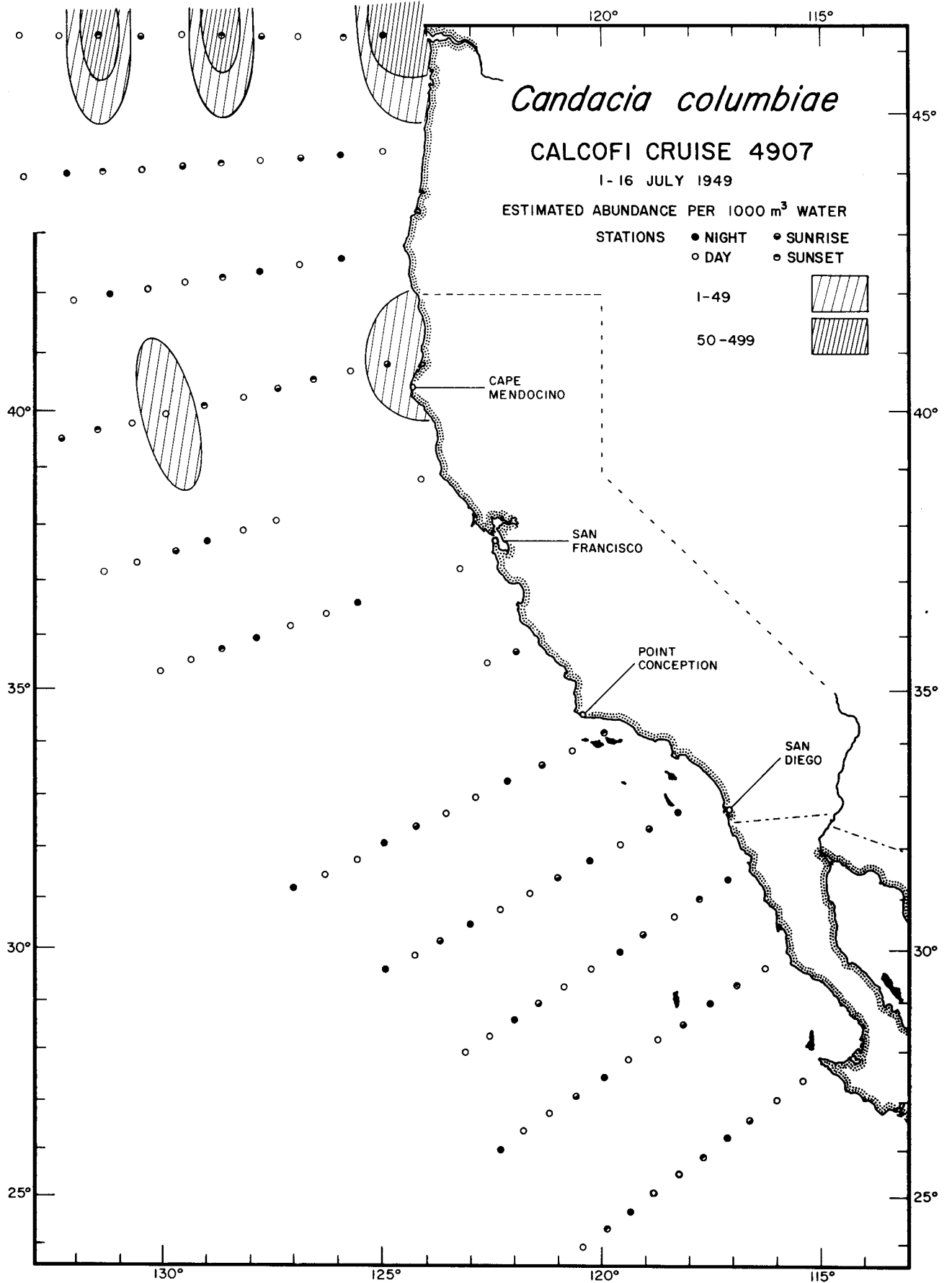
Calanoida
Candacia bispinosa
5002



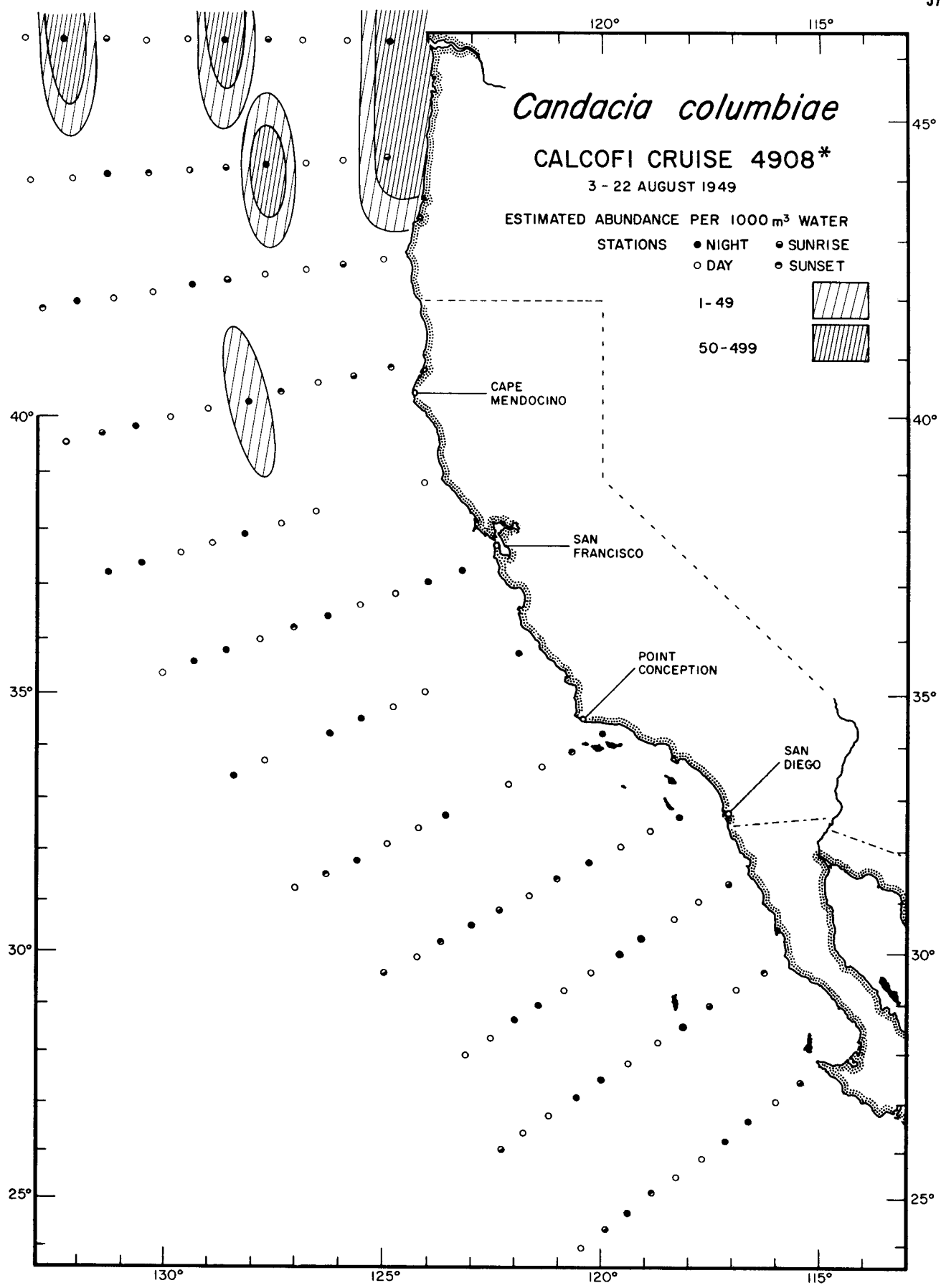
Calanoida
Candacia columbiae
 4905



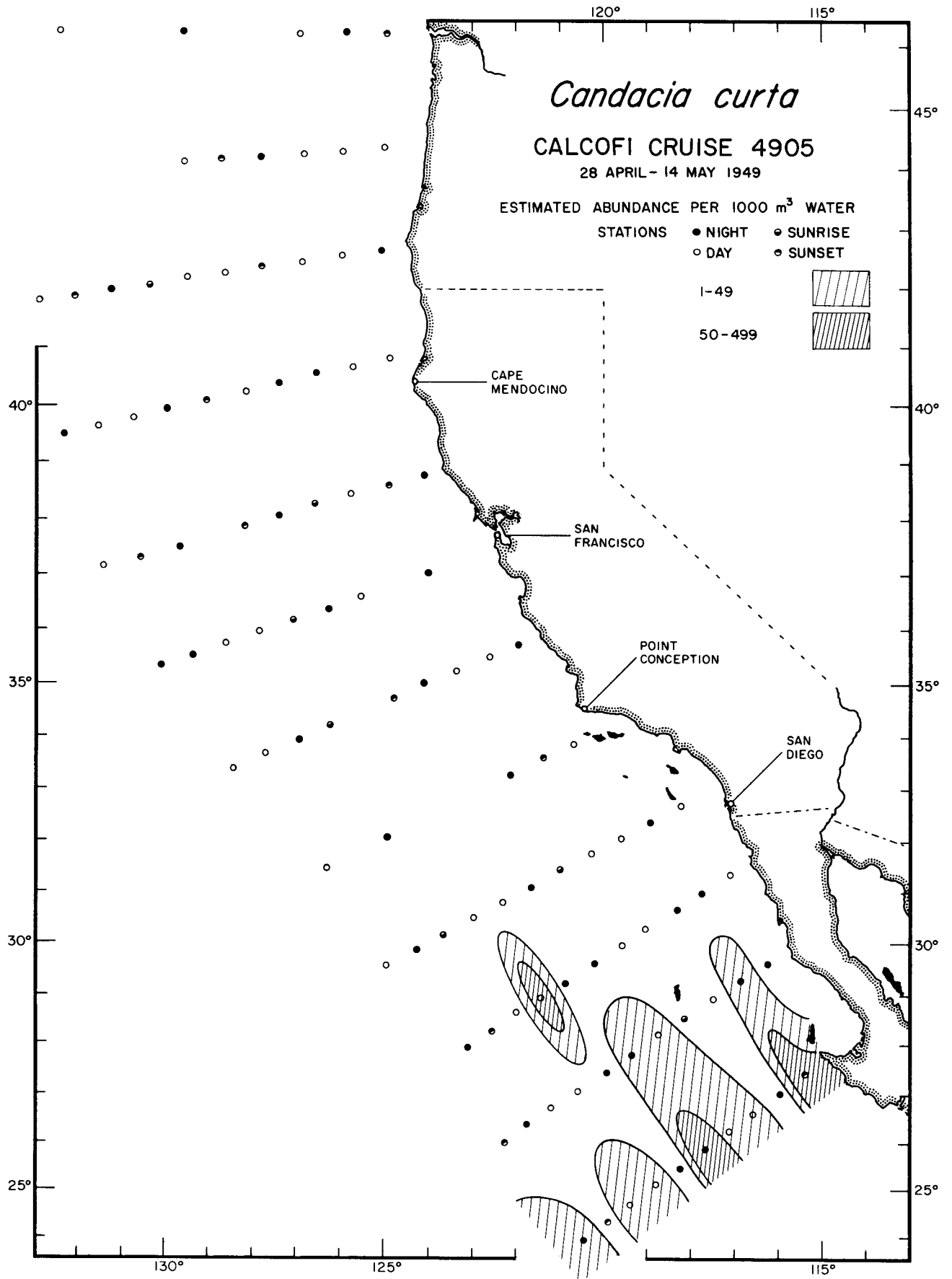
Calanoida
Candacia columbiae
4906



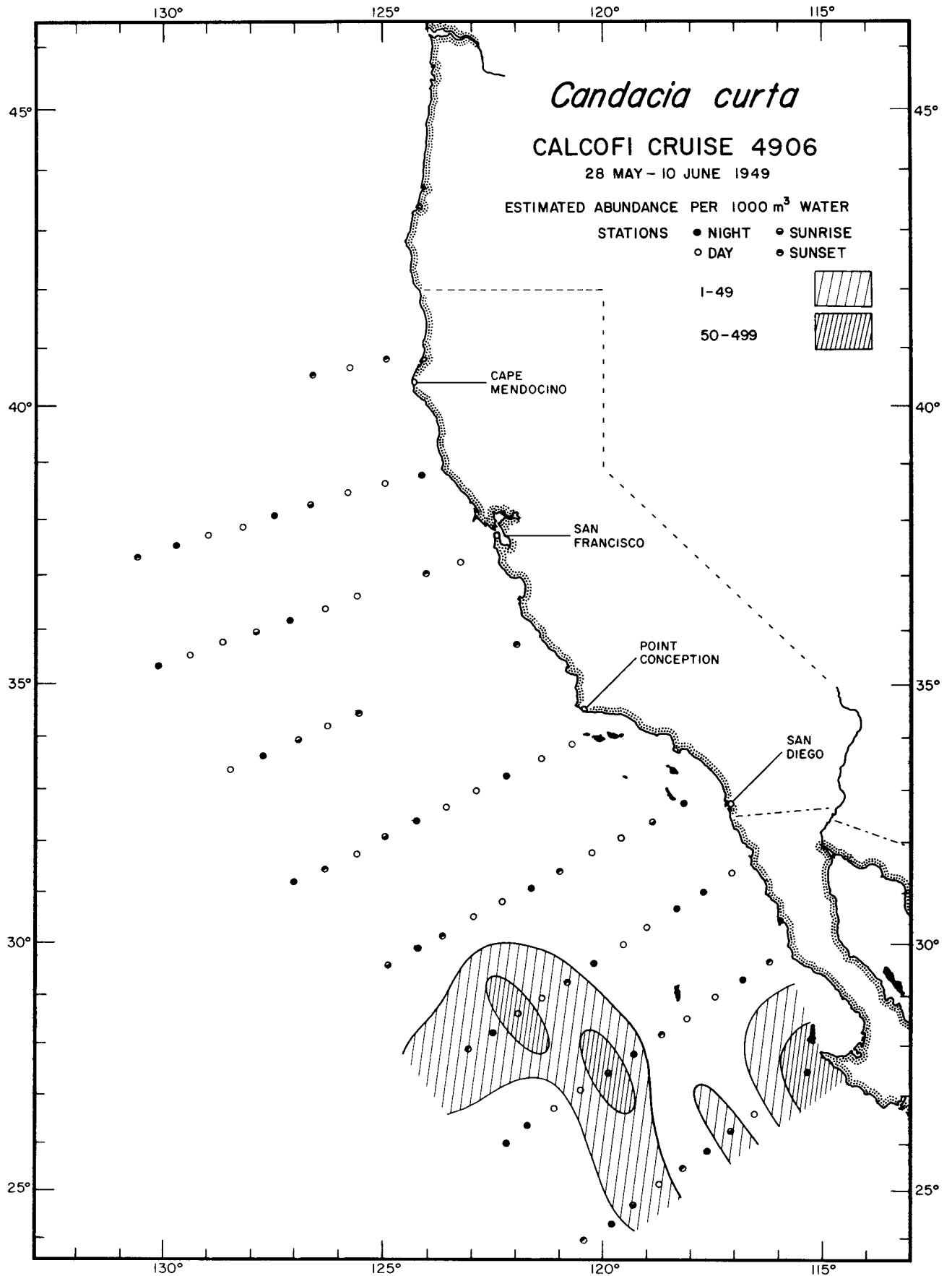
Calanoida
Candacia columbiae
4907



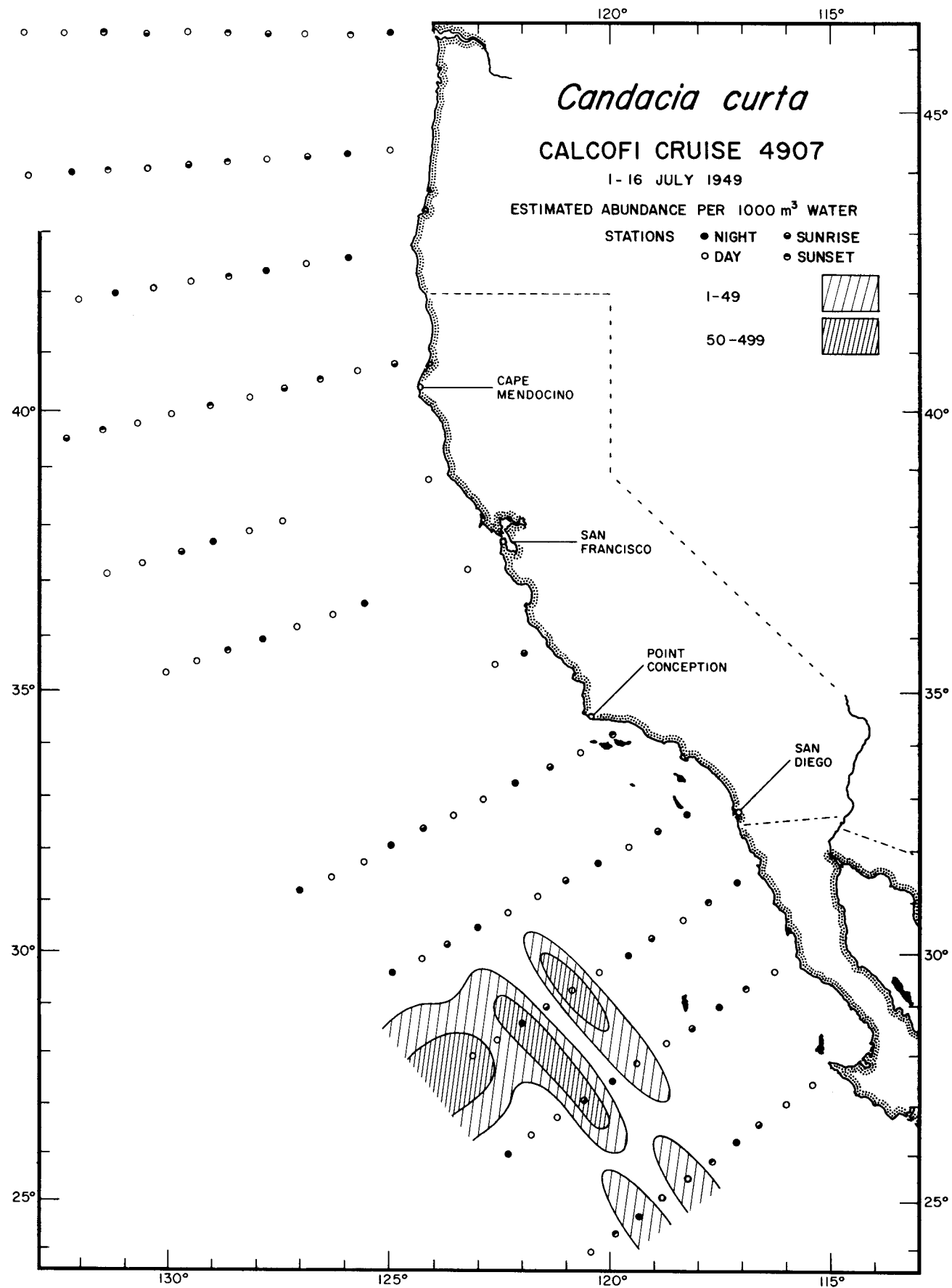
* See Table 1 for cruises 4909, 10, 5002



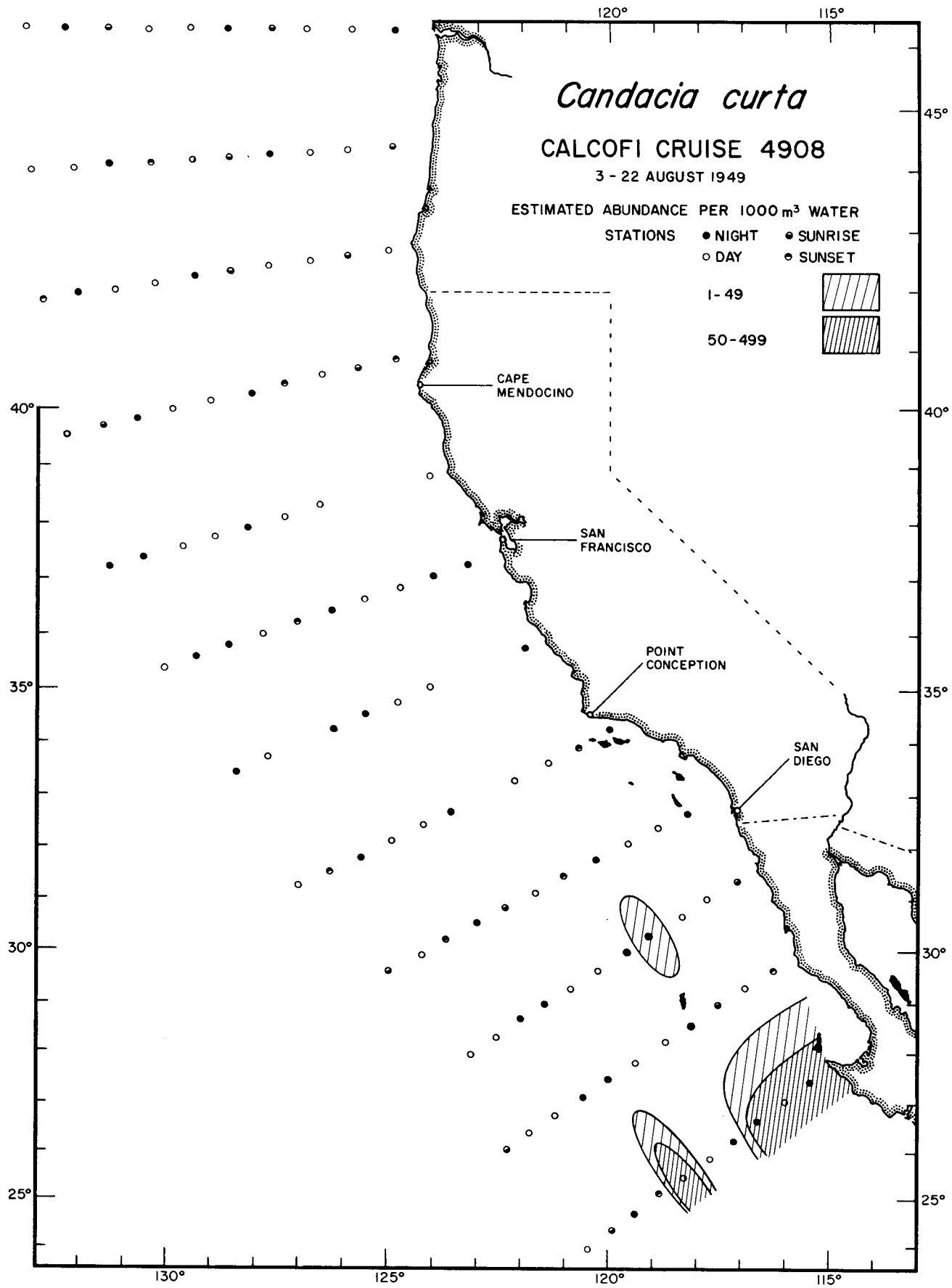
Calanoida
Candacia curta
4905



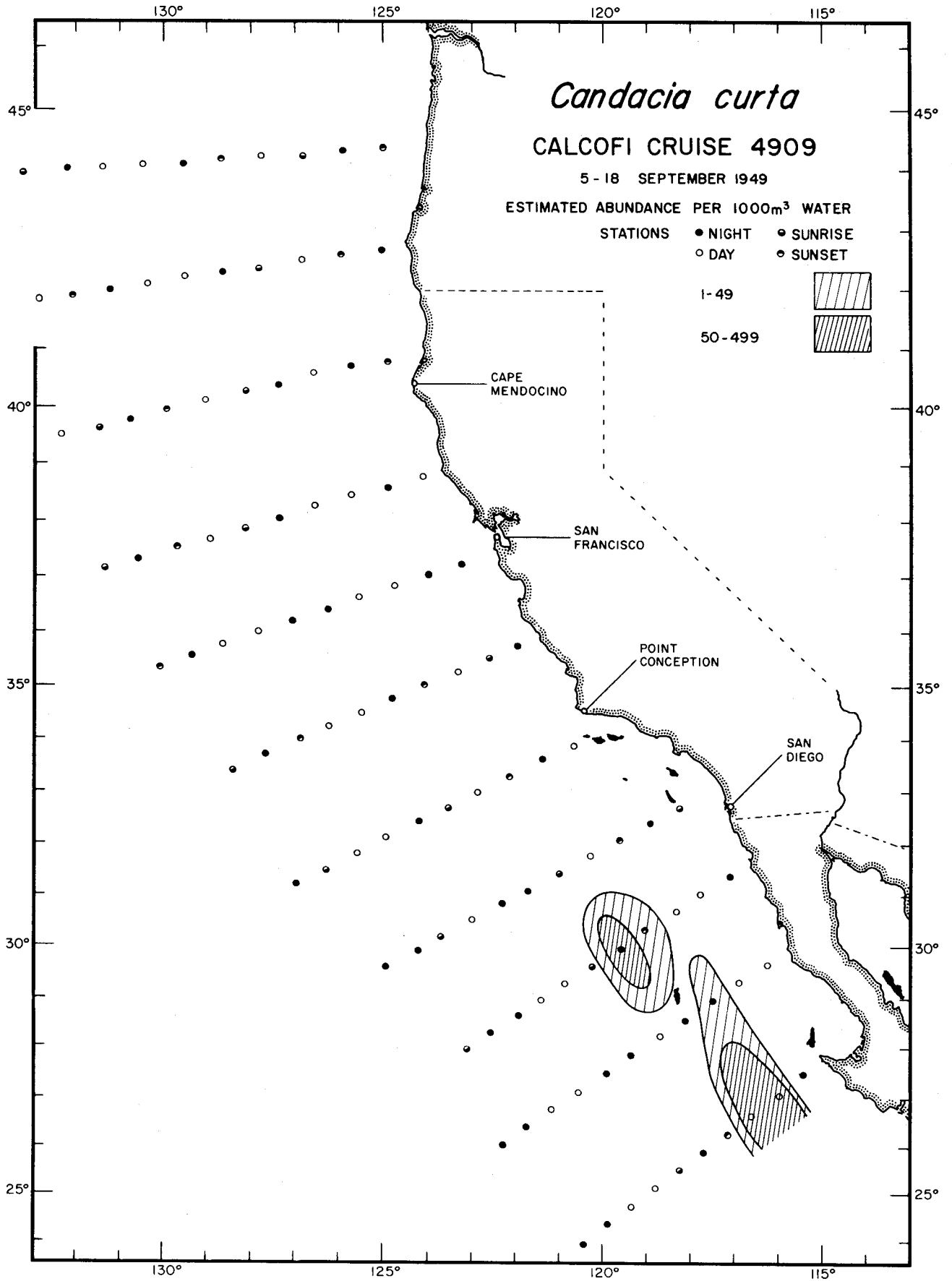
Calanoida
Candacia curta
4906



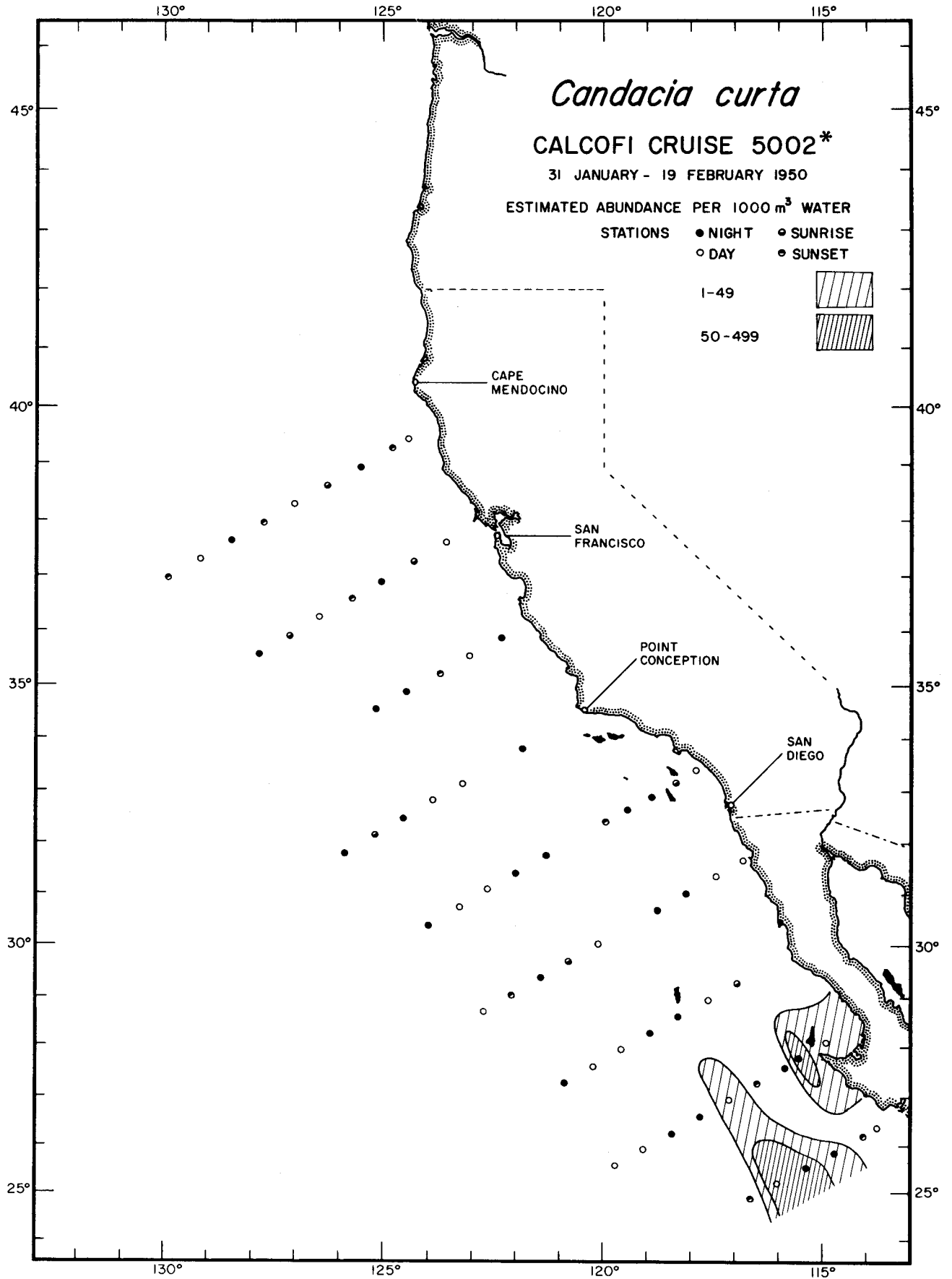
Calanoida
Candacia curta
4907



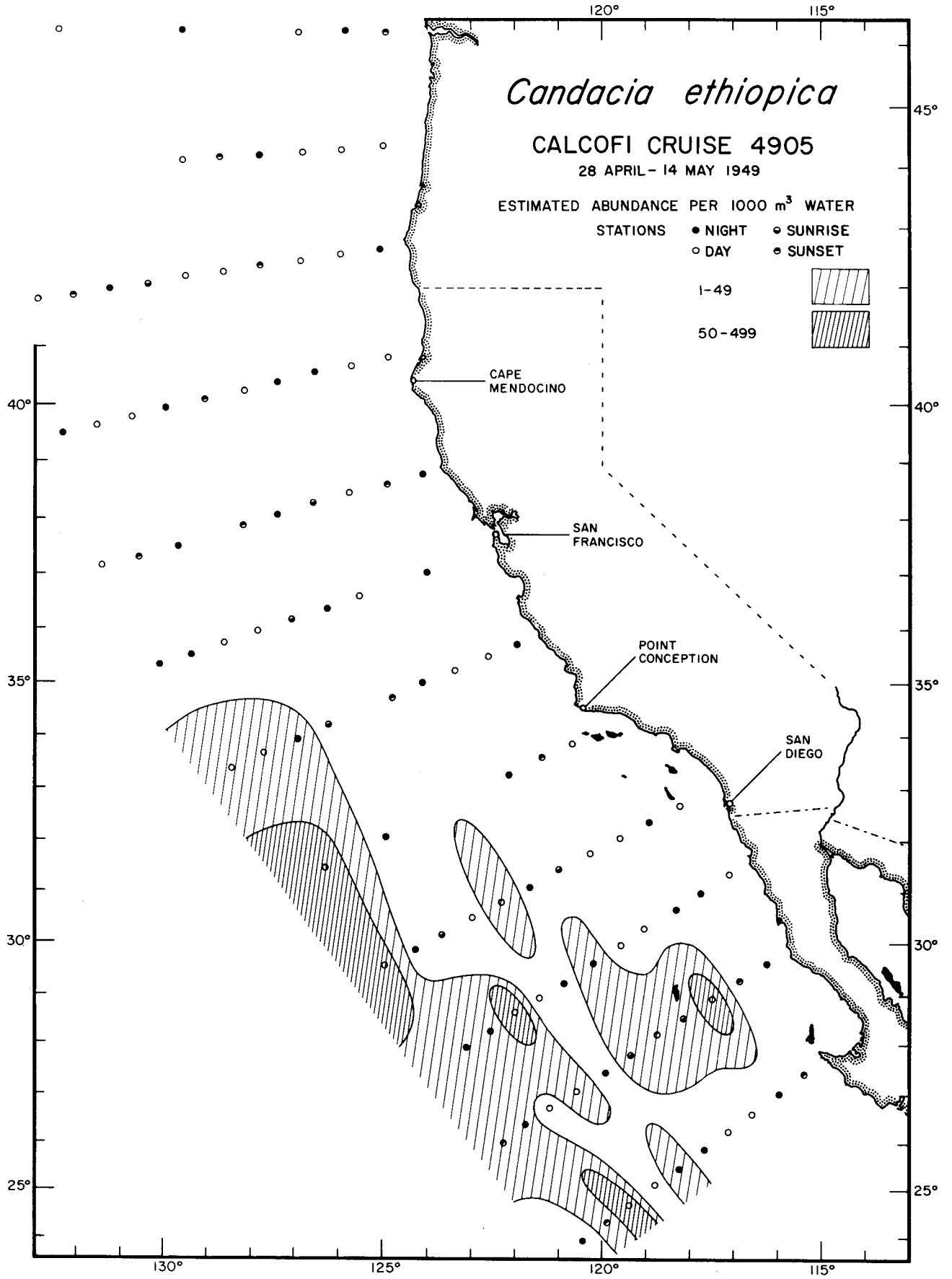
Calanoida
Candacia curta
4908



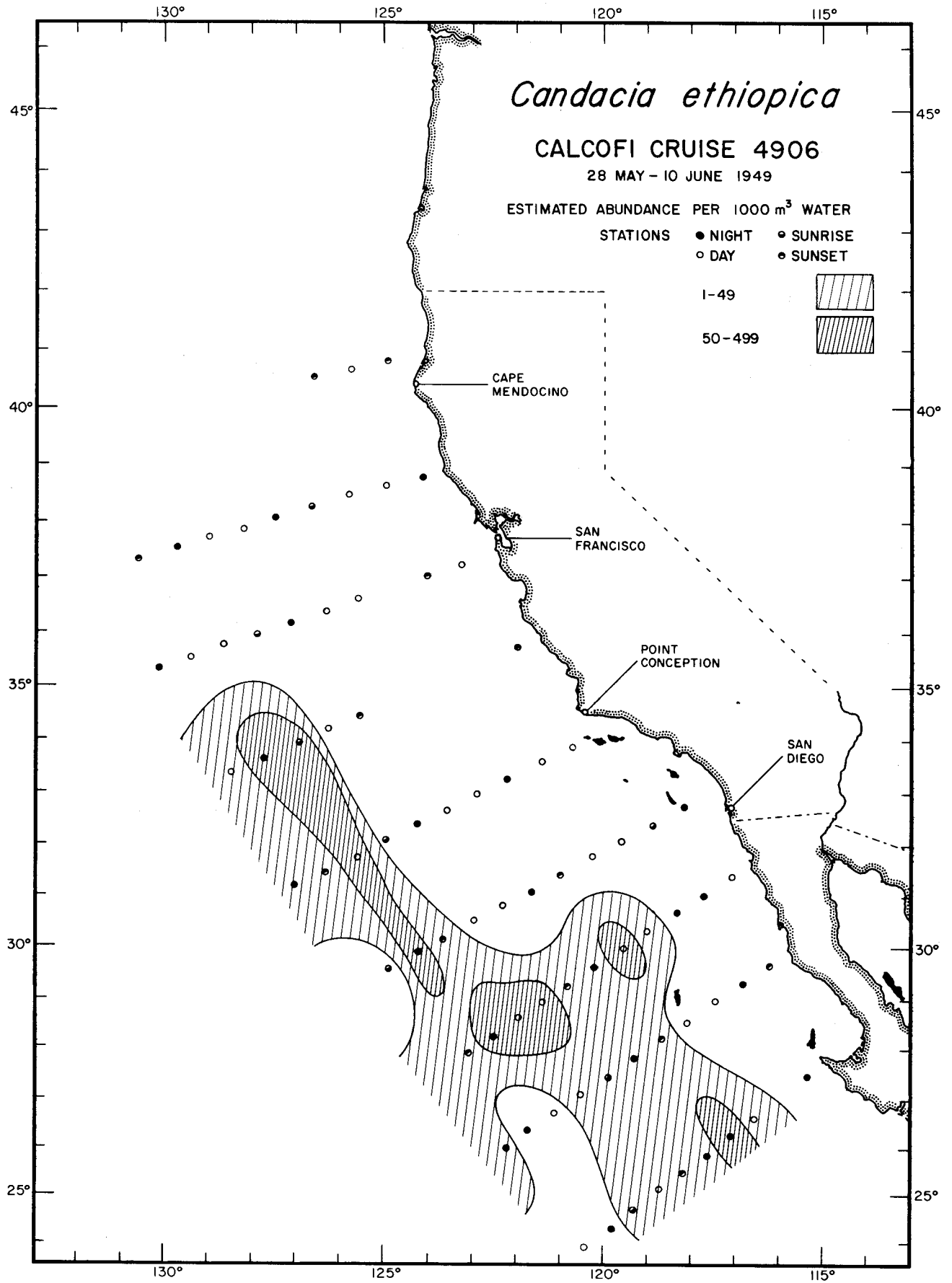
Calanoida
Candacia curta
4909



* See Table 1 for cruise 4910



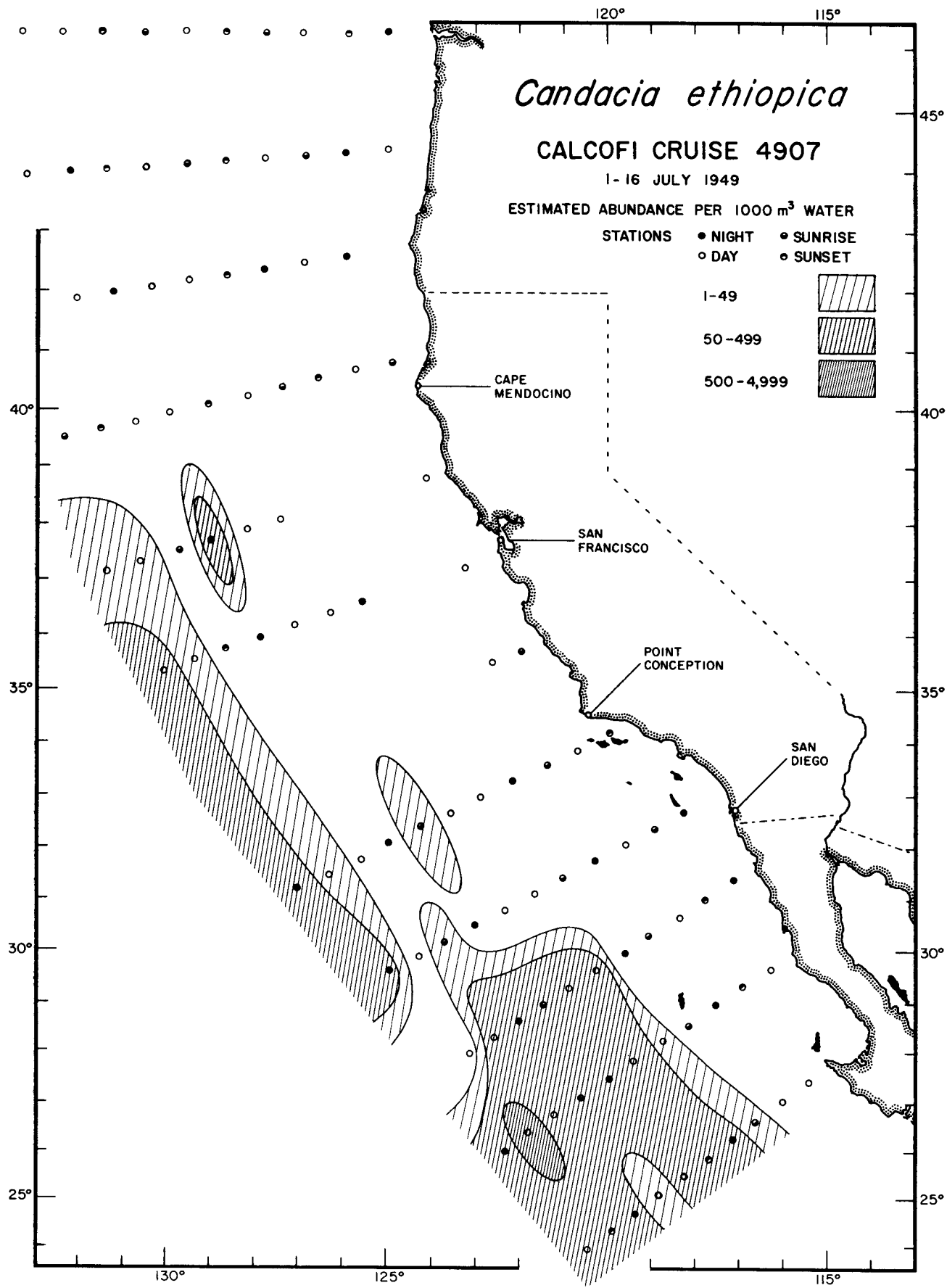
Calanoida
Candacia ethiopica
4905



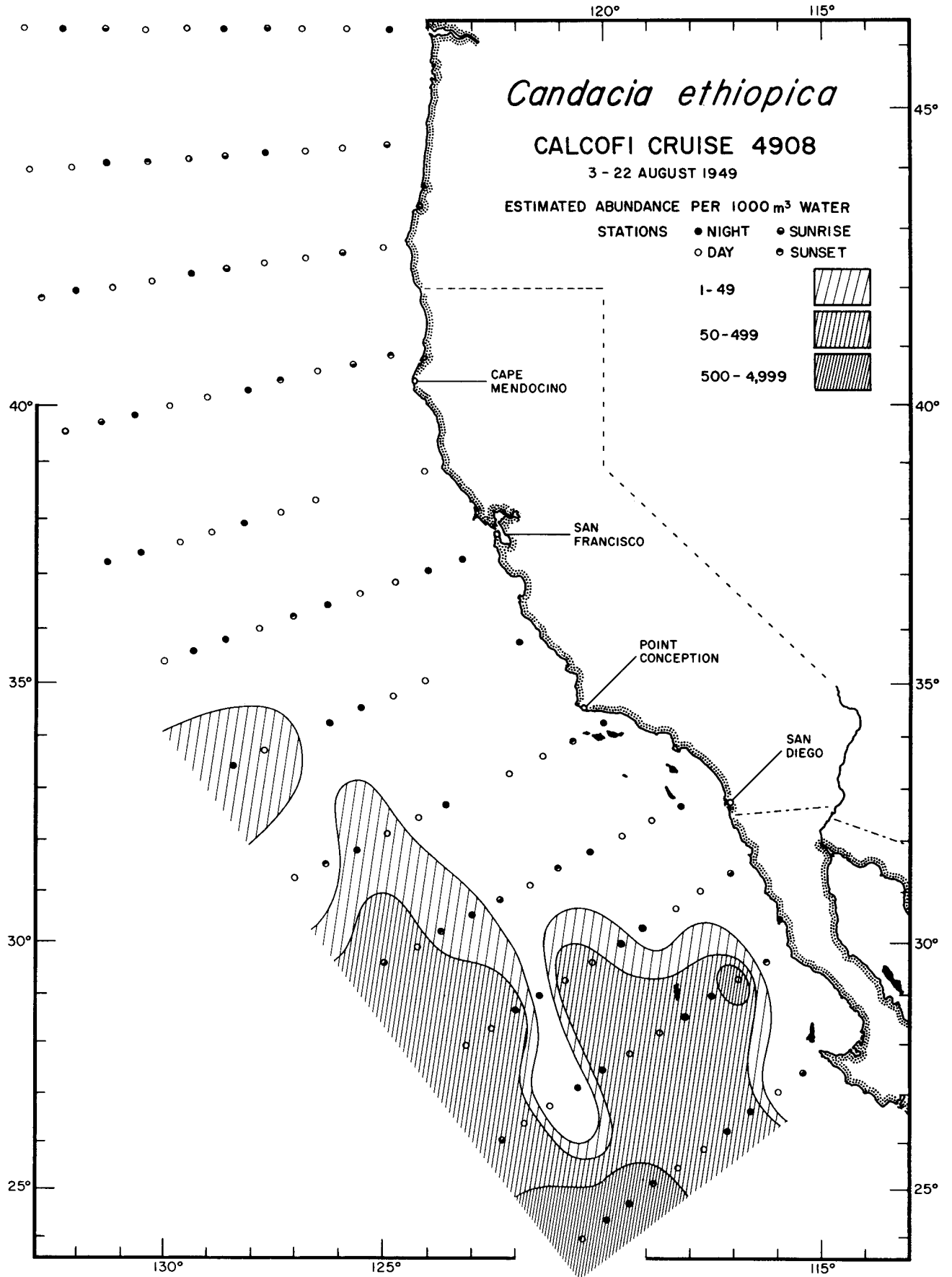
Calanoida

Candacia ethiopica

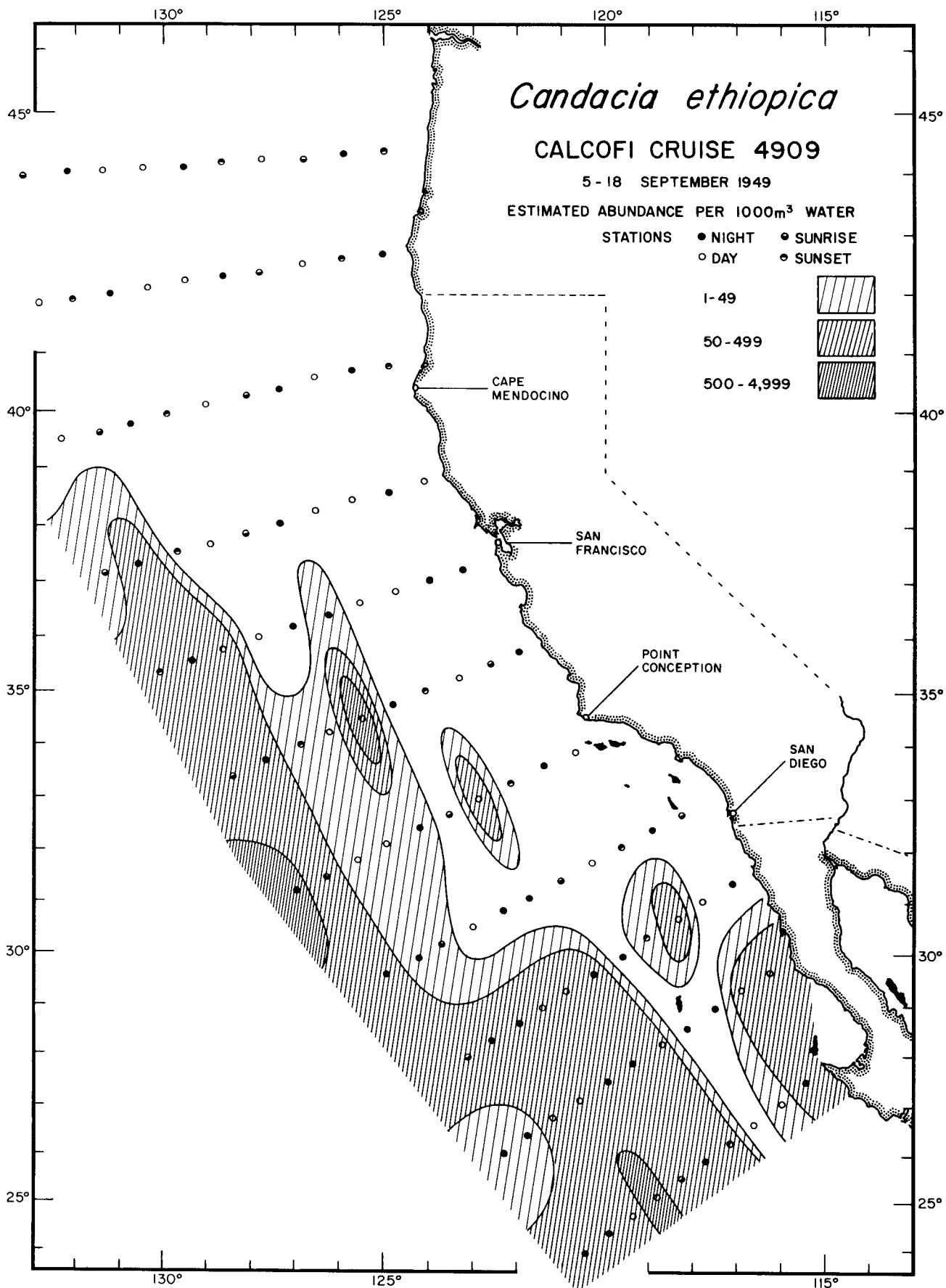
4906



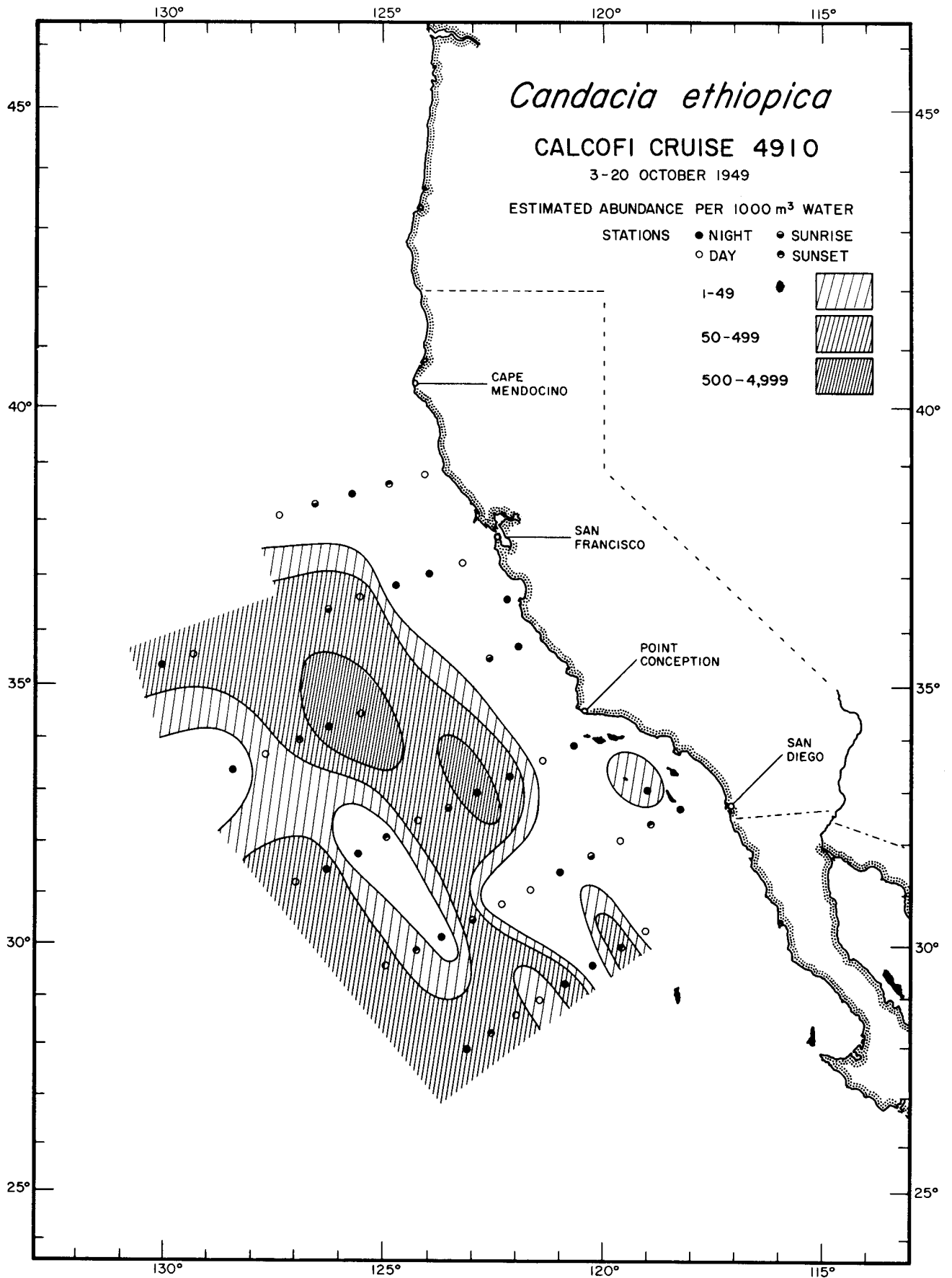
Calanoida
Candacia ethiopica
4907



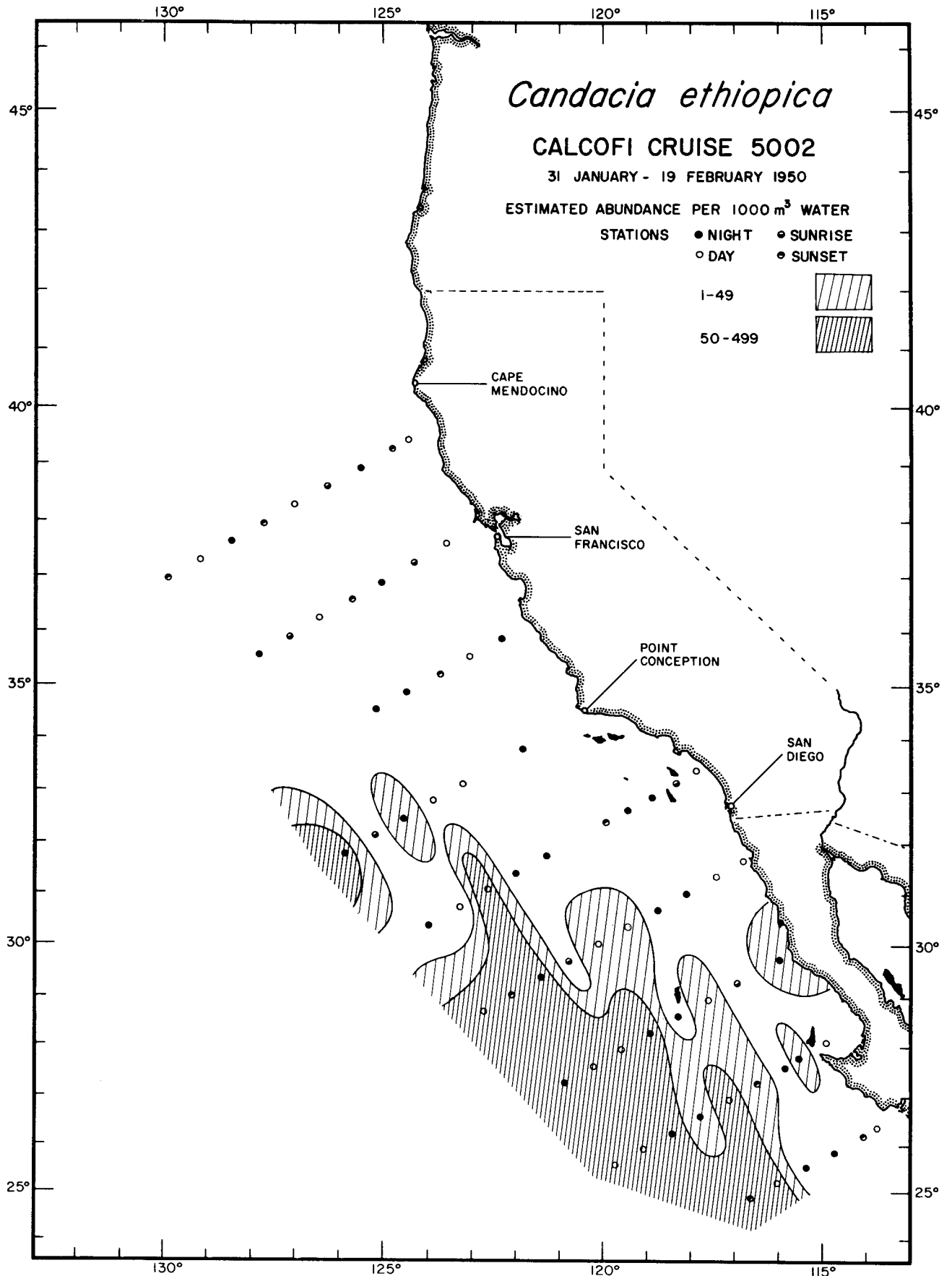
Calanoida
Candacia ethiopica
4908



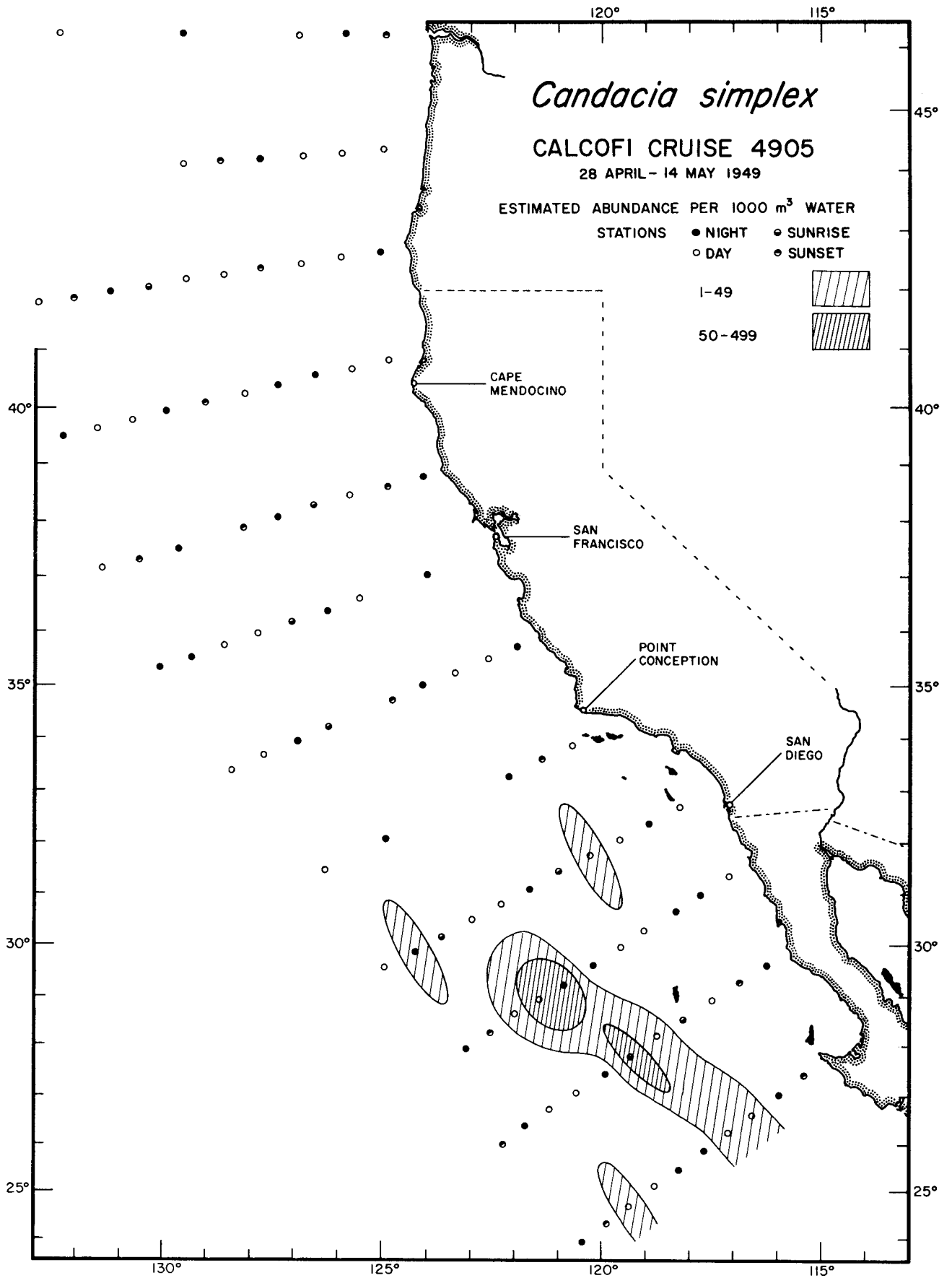
Calanofda
Candacia ethiopica
4909



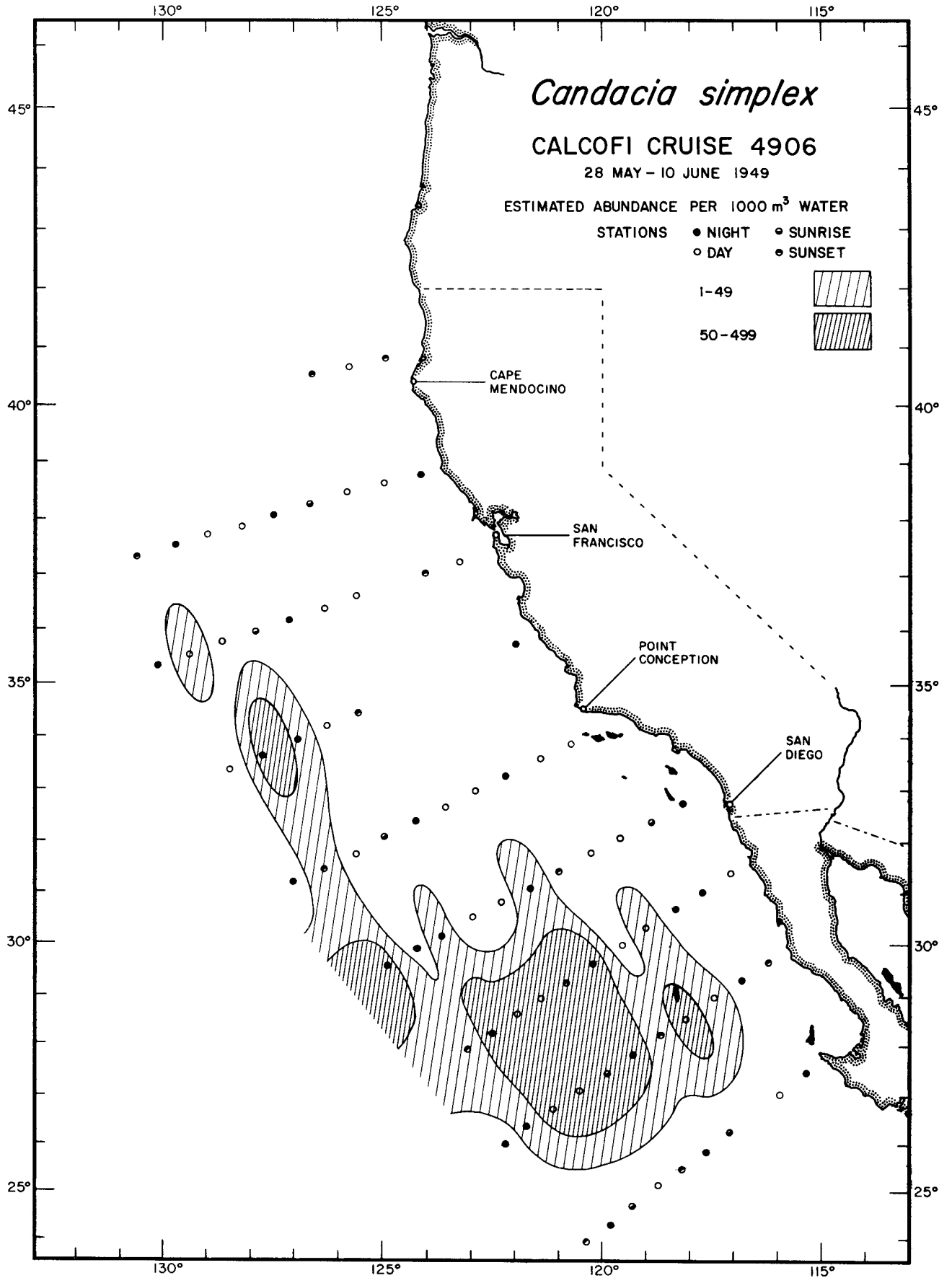
Calanoida
Candacia ethiopica
4910



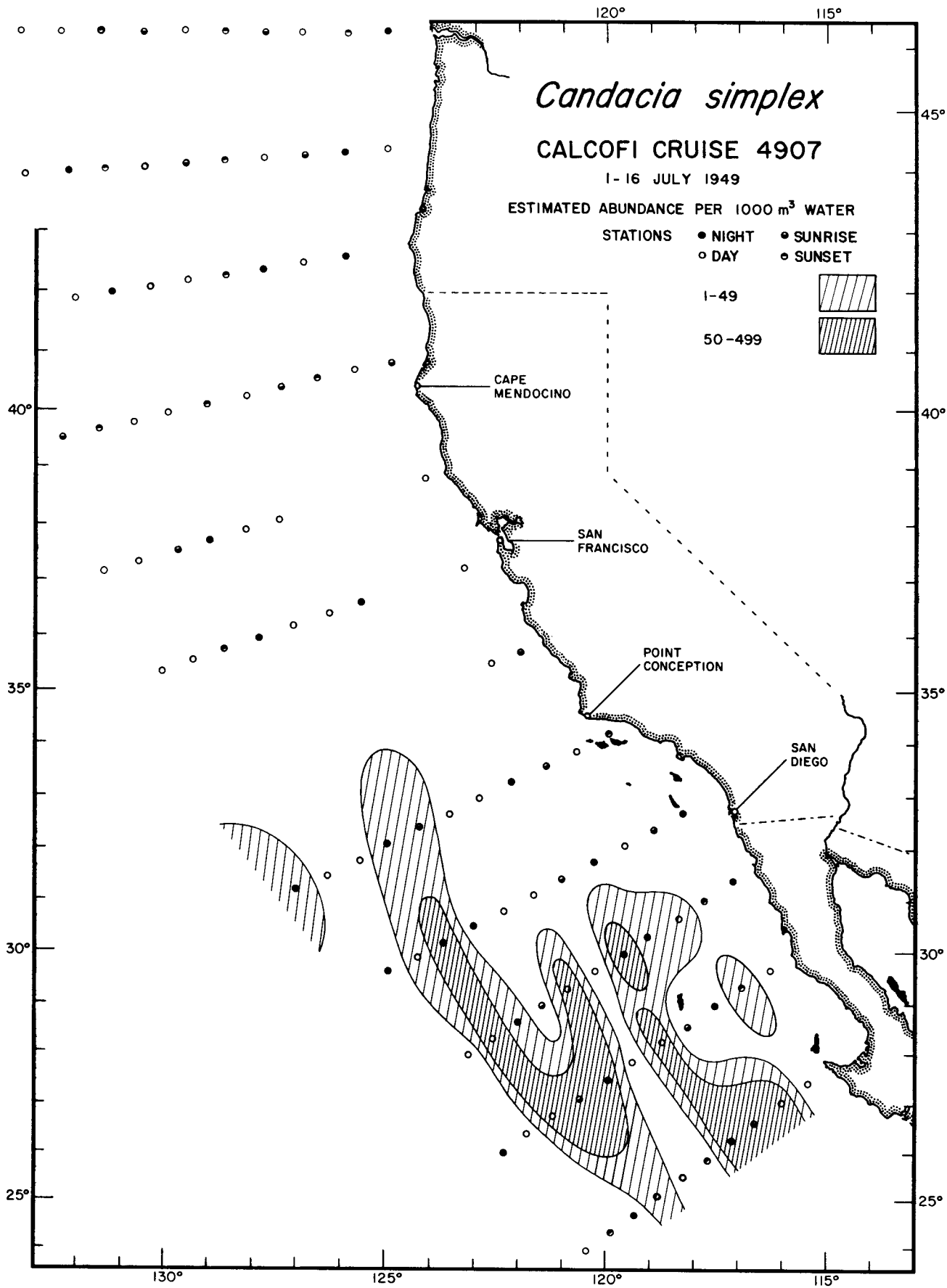
Calanoida
Candacia ethiopica
5002



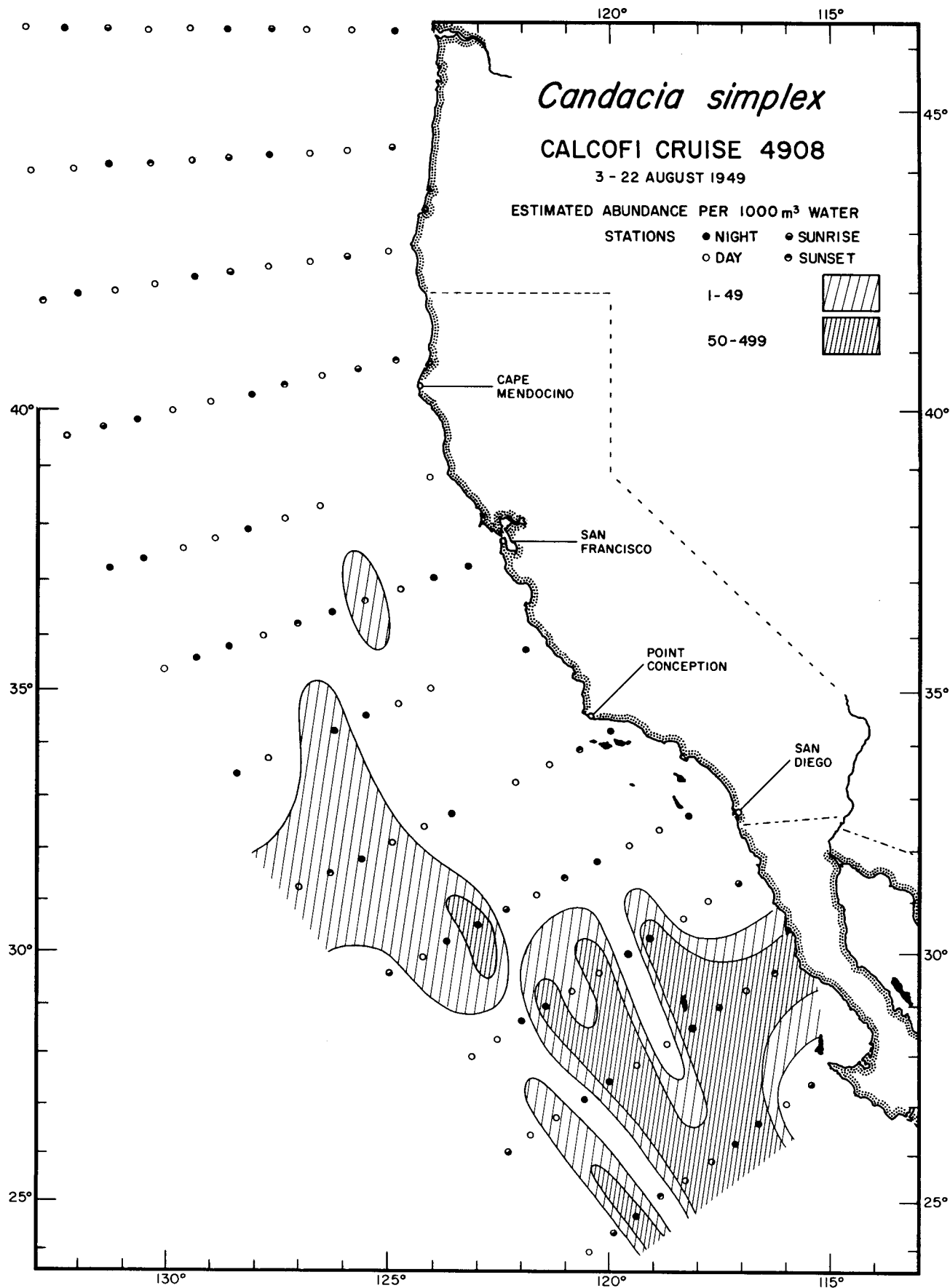
Calanoida
Candacia simplex
4905



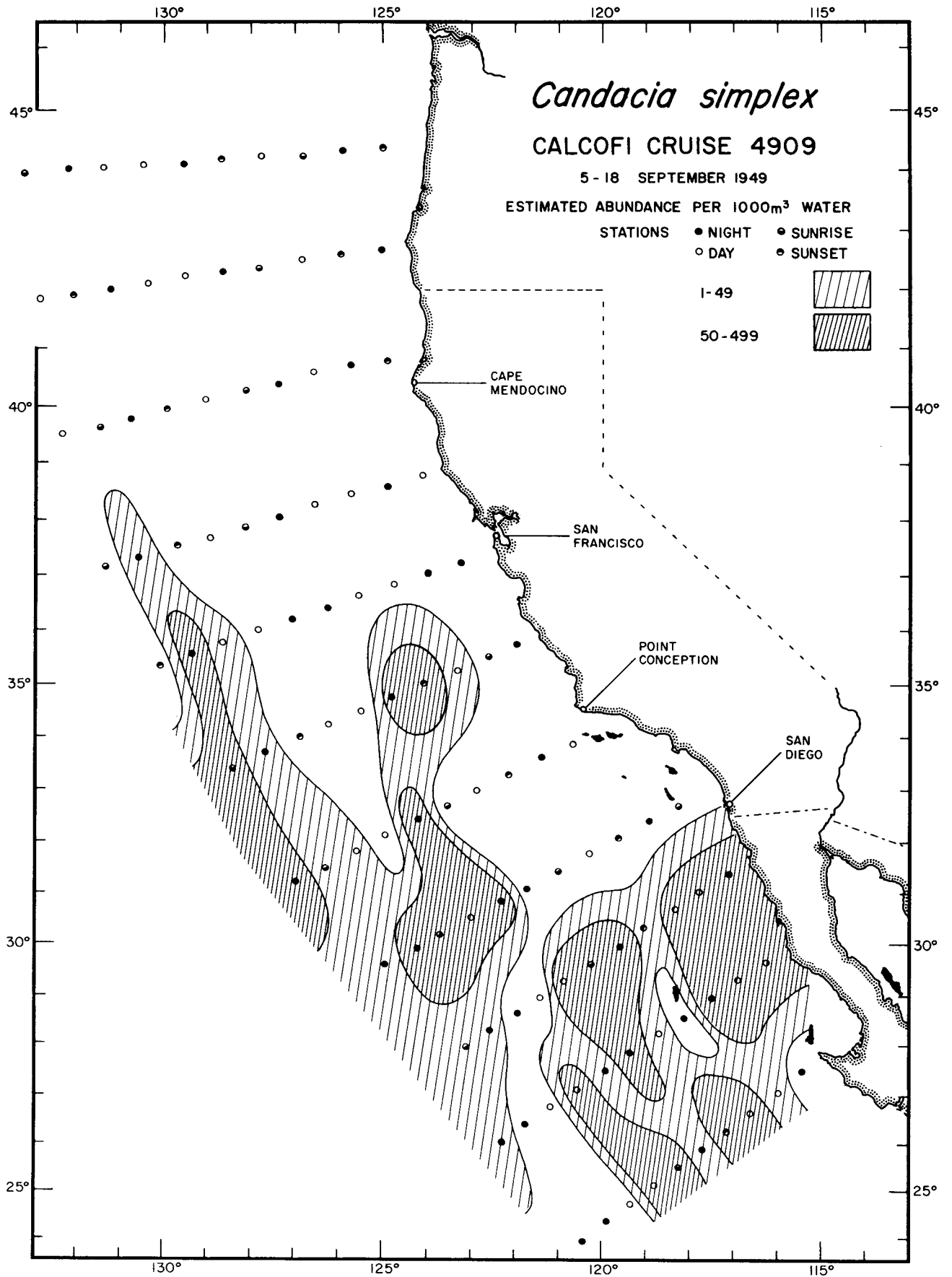
Calanoida
Candacia simplex
4906



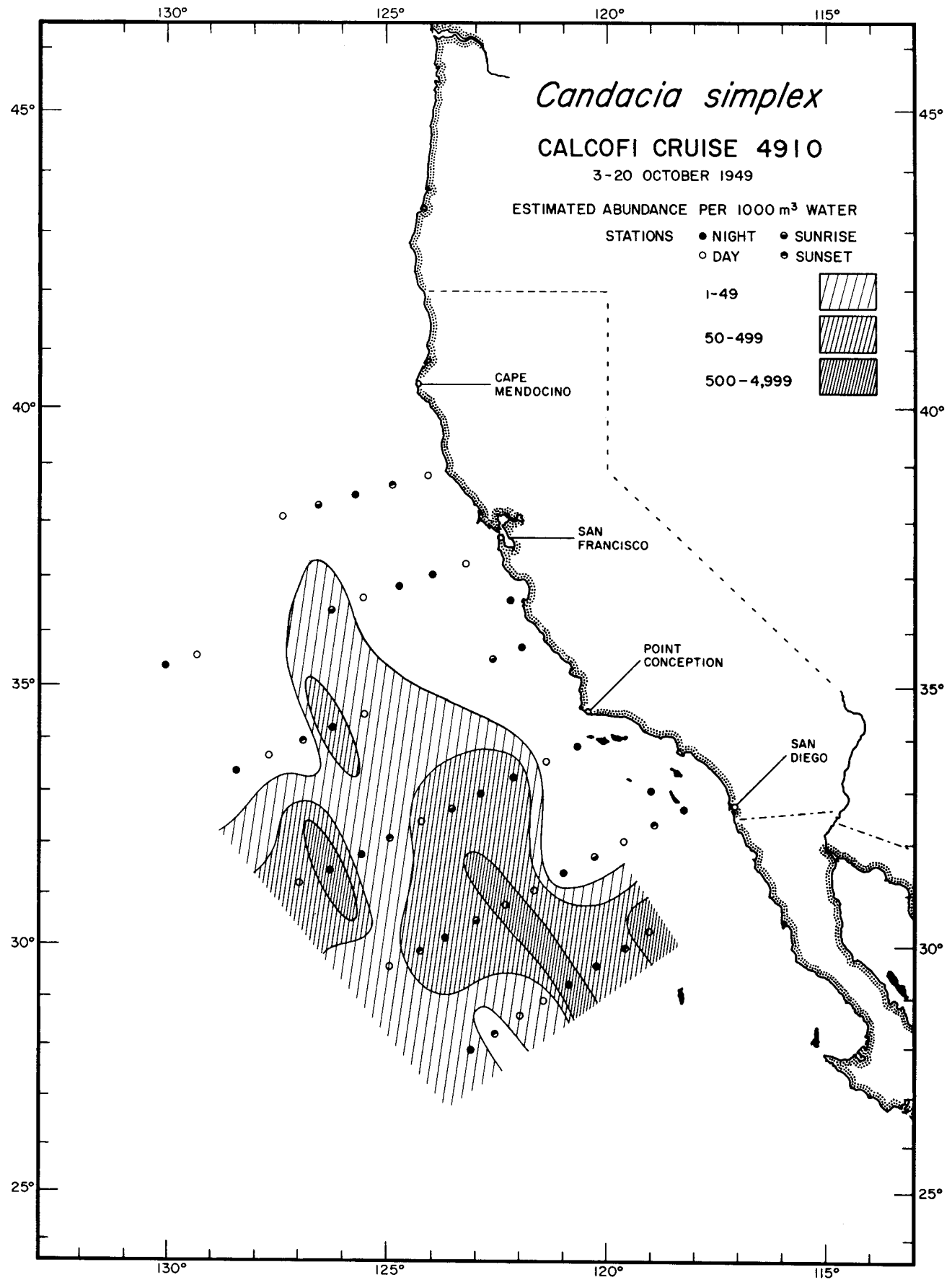
Calanoida
Candacia simplex
4907



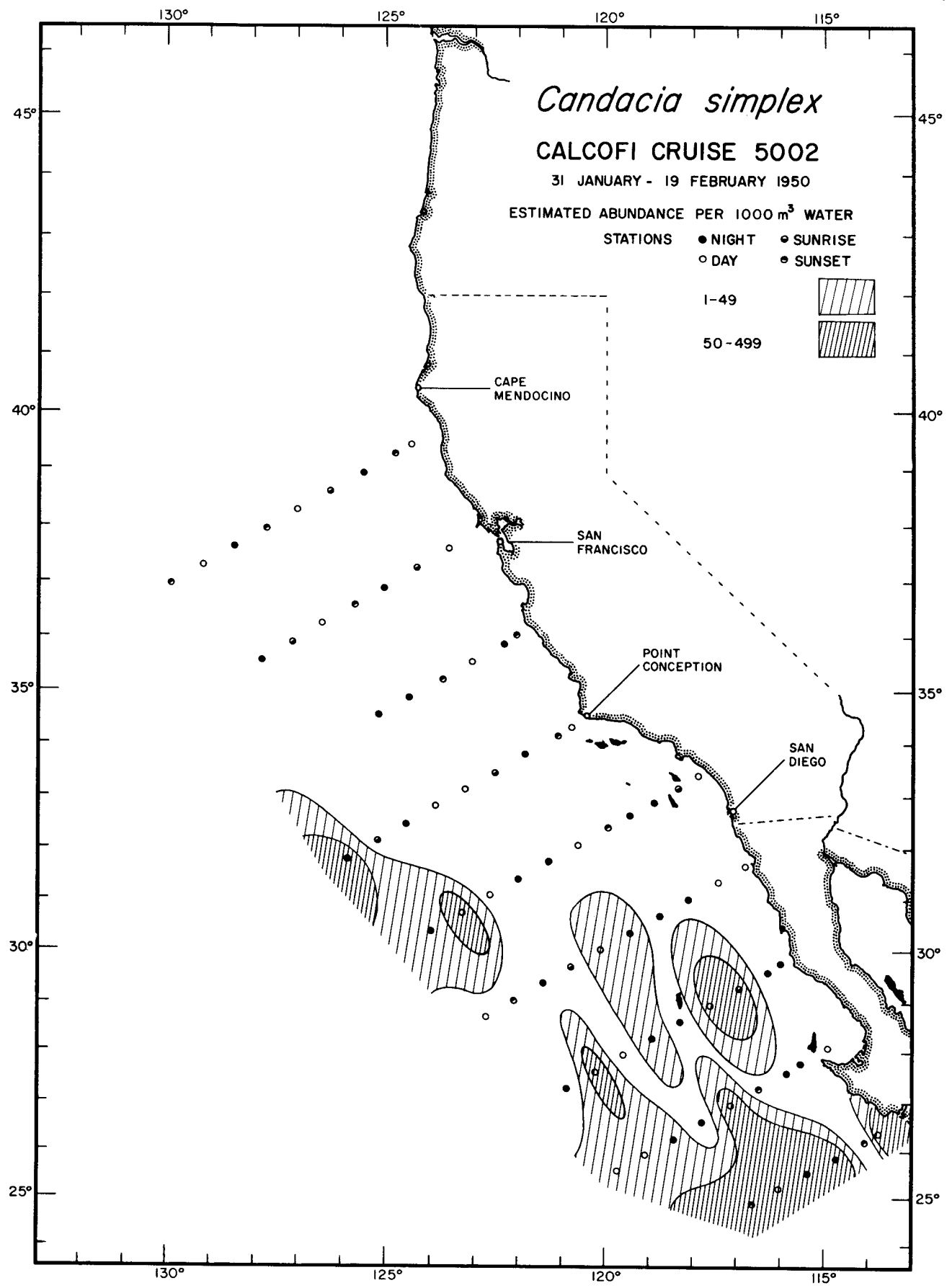
Calanoida
Candacia simplex
4908



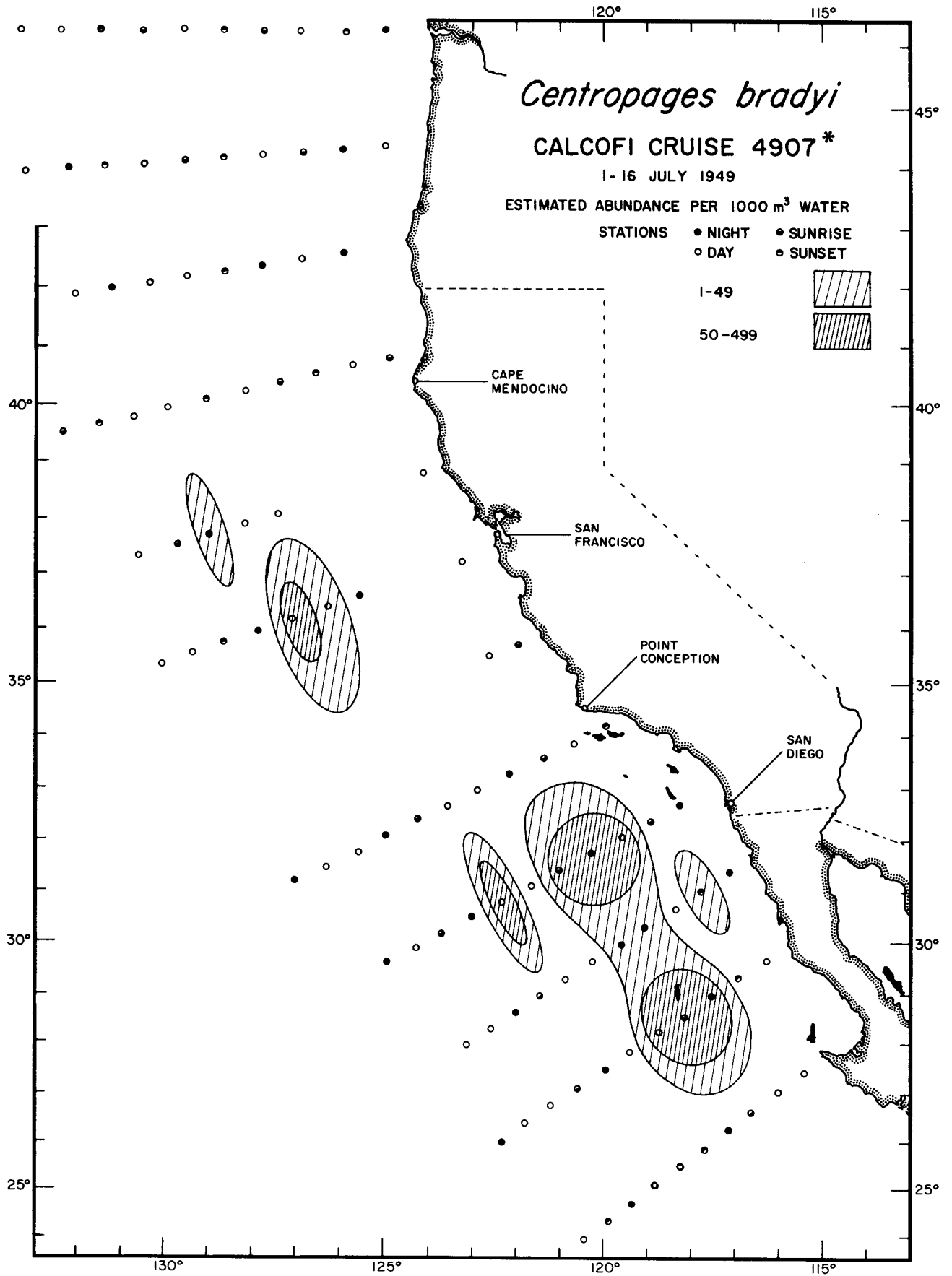
Calanoida
Candacia simplex
4909



Calanoida
Candacia simplex
4910



Calanoida
Candacia simplex
5002

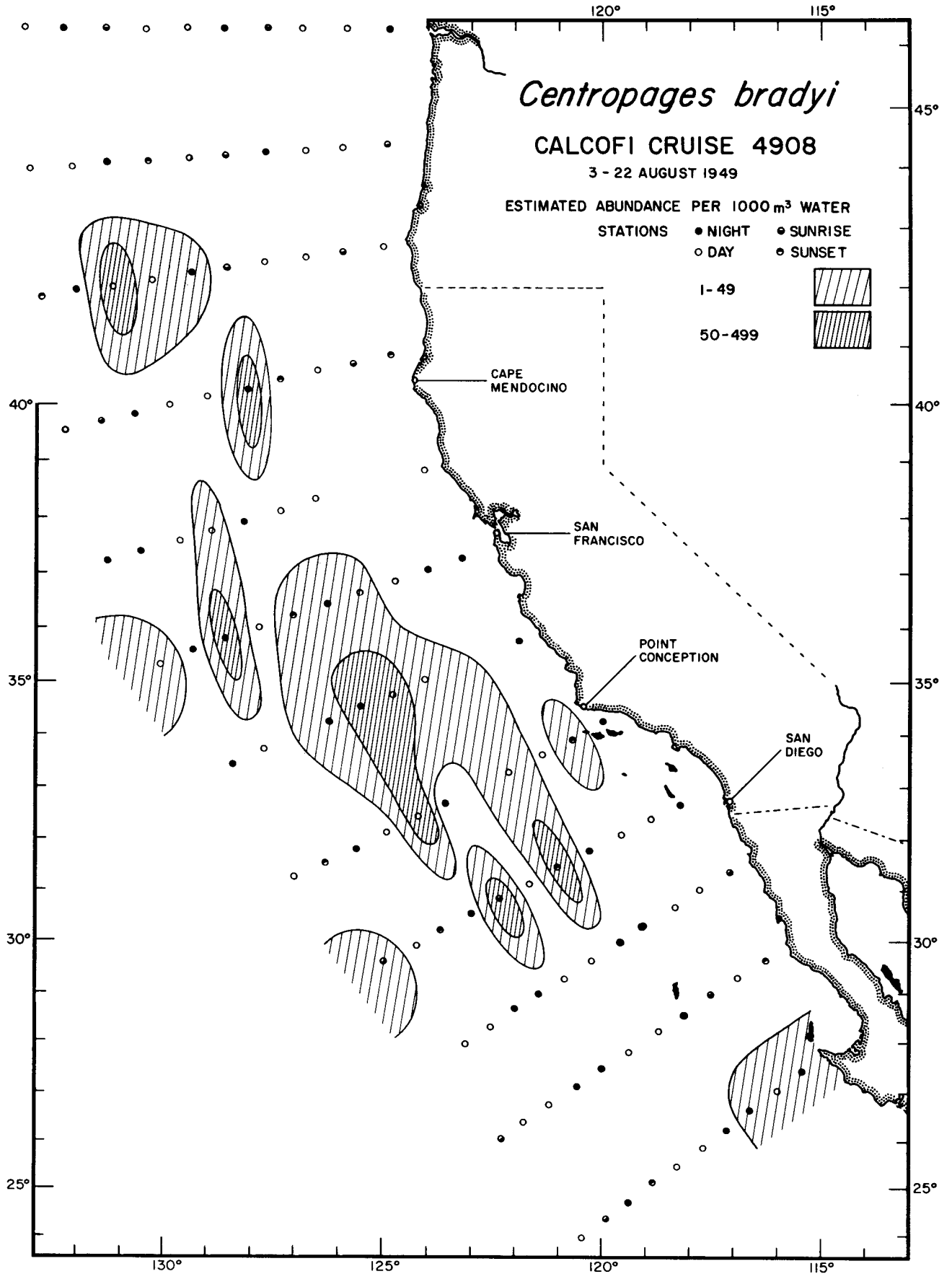


* See Table 1 for cruises 4905, 6

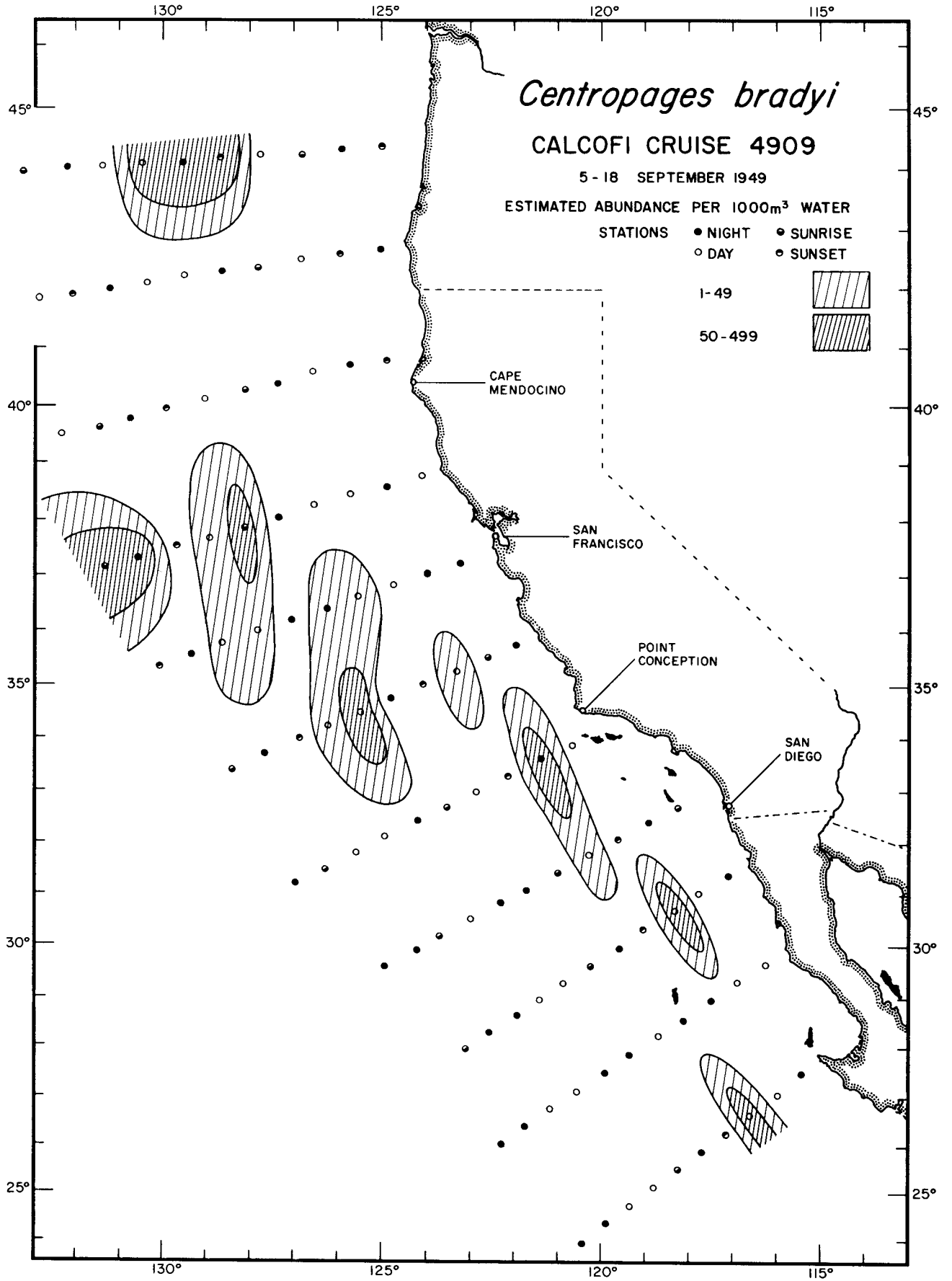
Calanoida

Centropages bradyi

4907



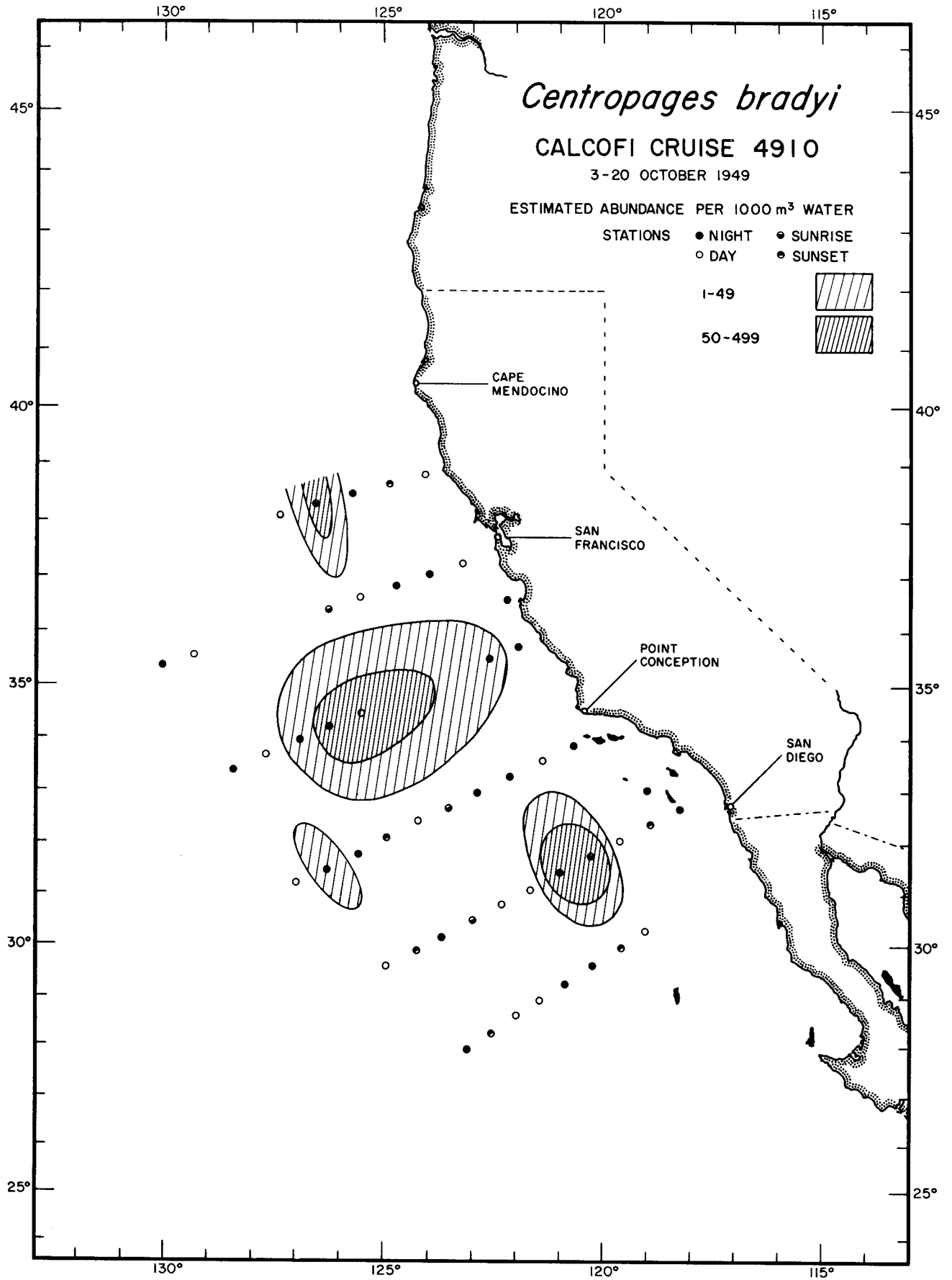
Calanoida
Centropages bradyi
4908



Calanoida

Centropages bradyi

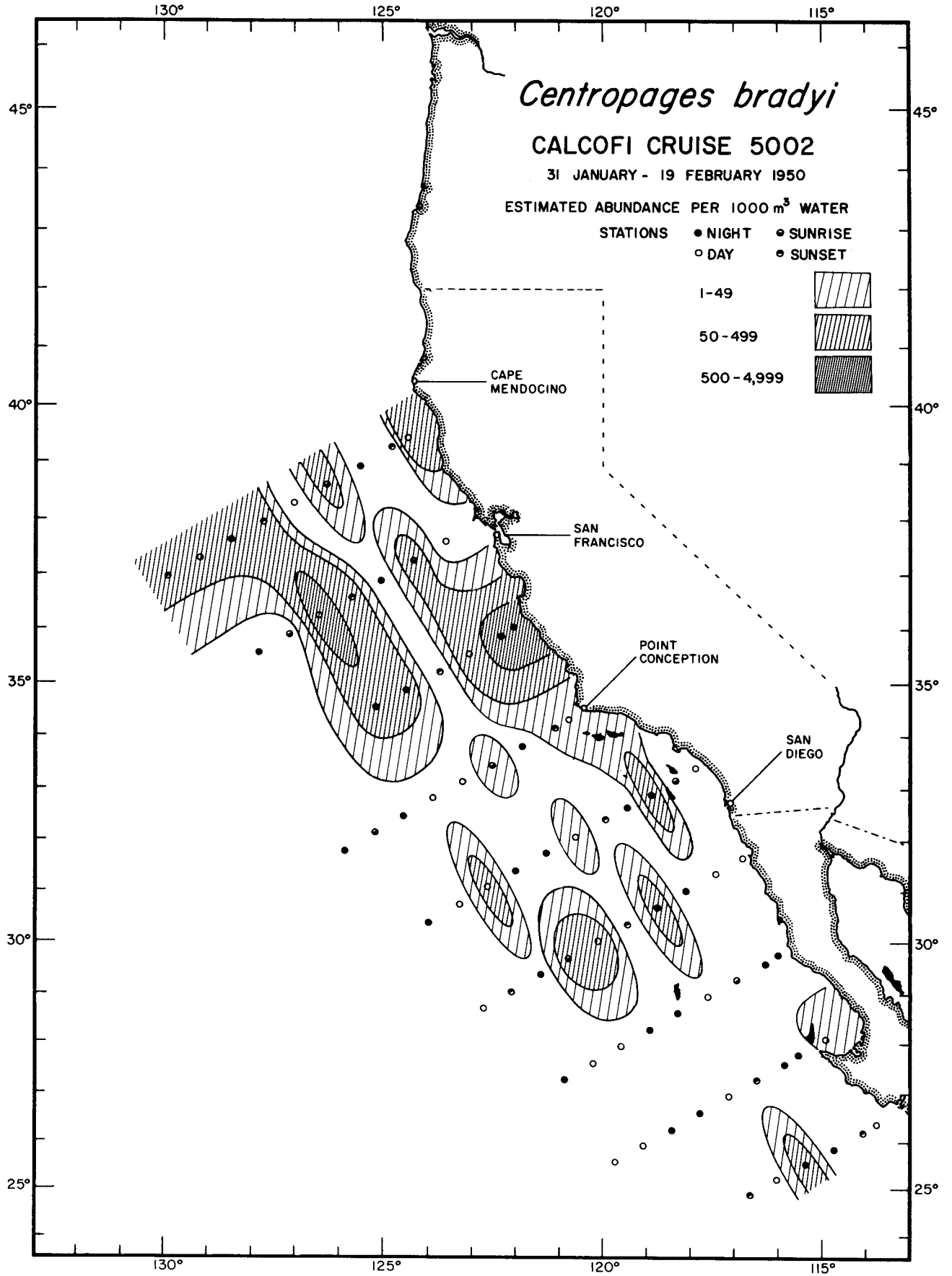
4909



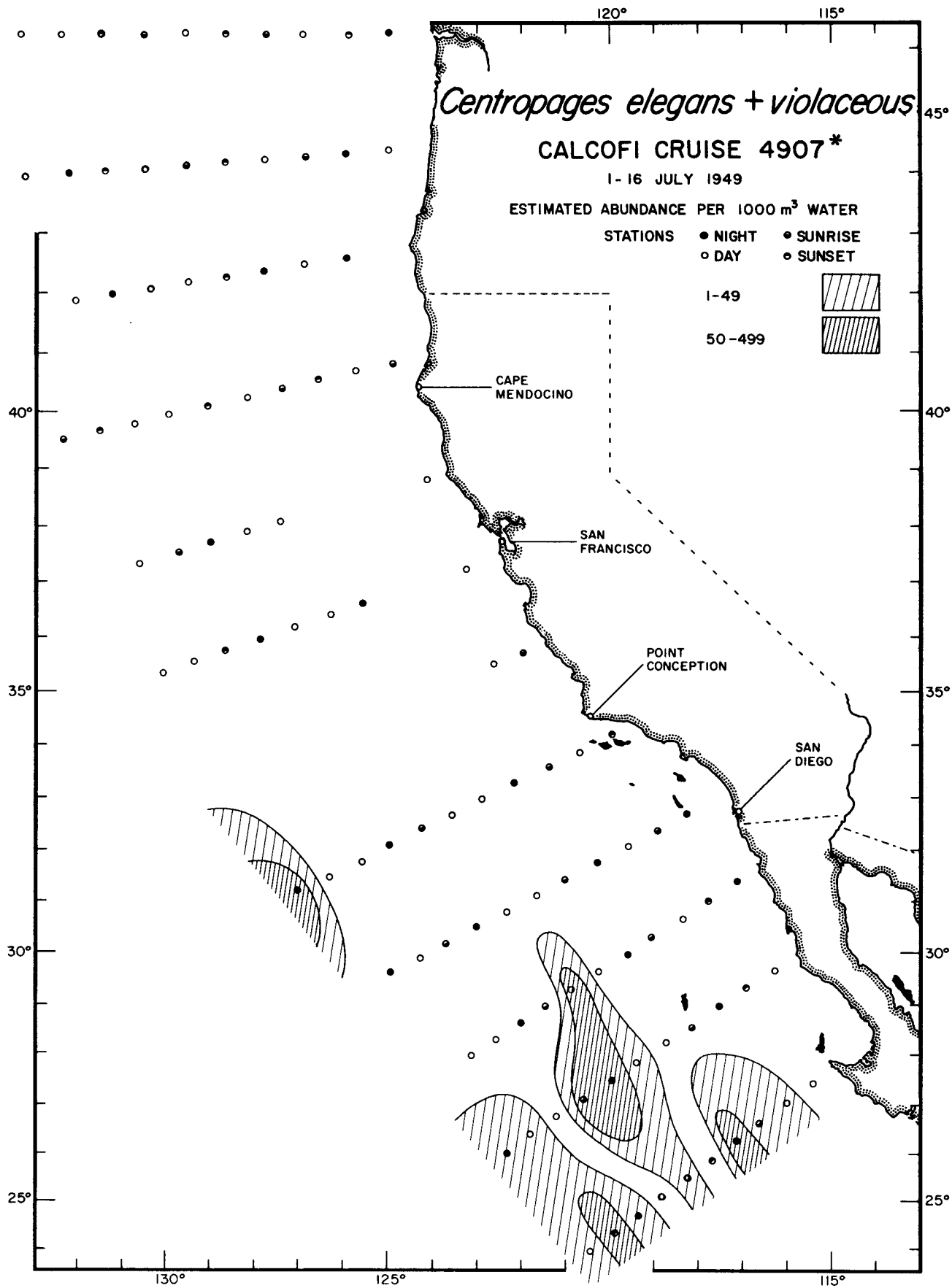
Calanoida

Centropages bradyi

4910



Calanoida
Centropages bradyi
5002

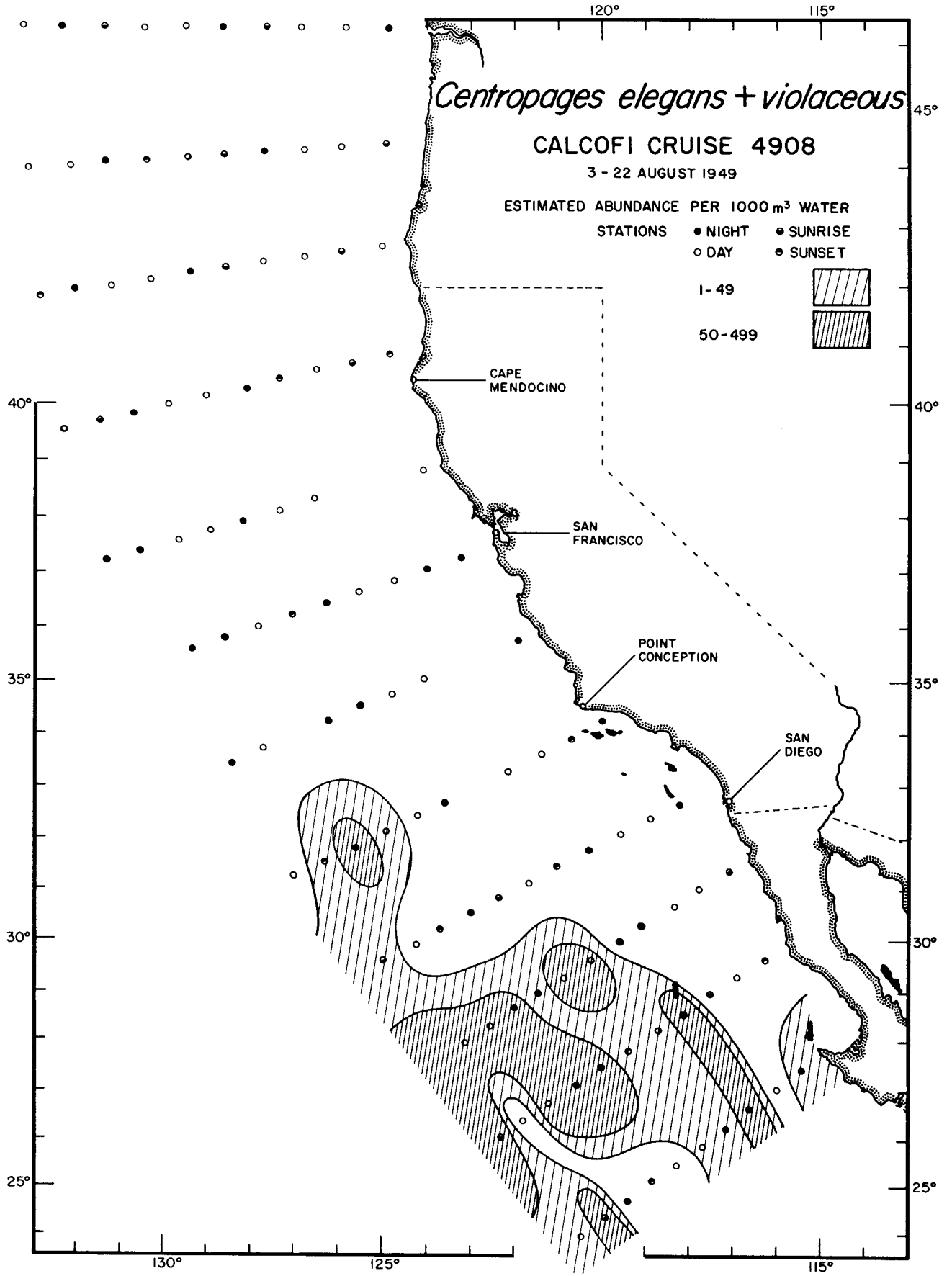


*See Table 1 for cruises 4905, 6

Calanoida

Centropages elegans + violaceus

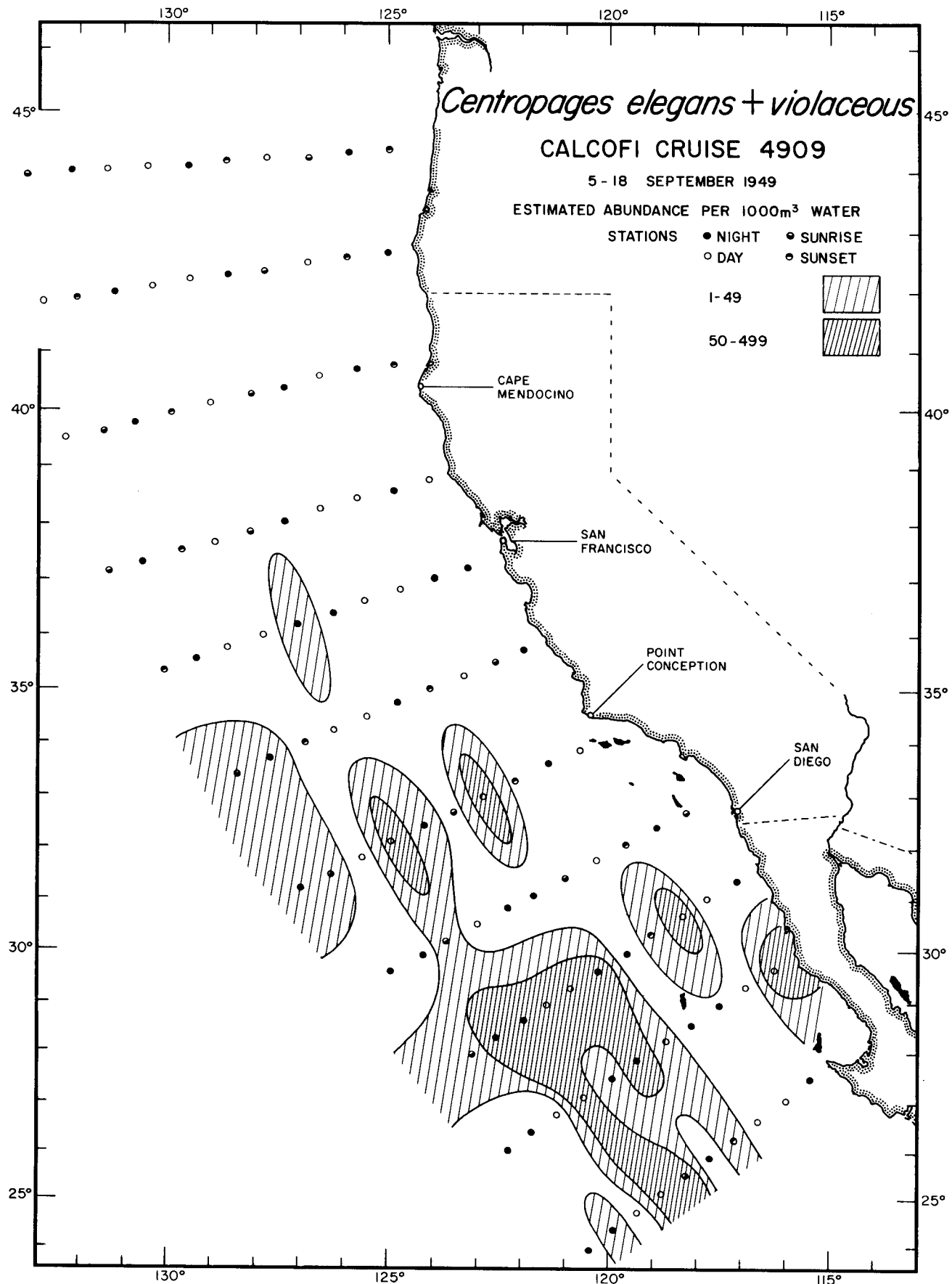
4907



Calanoida

Centropages elegans + violaceus

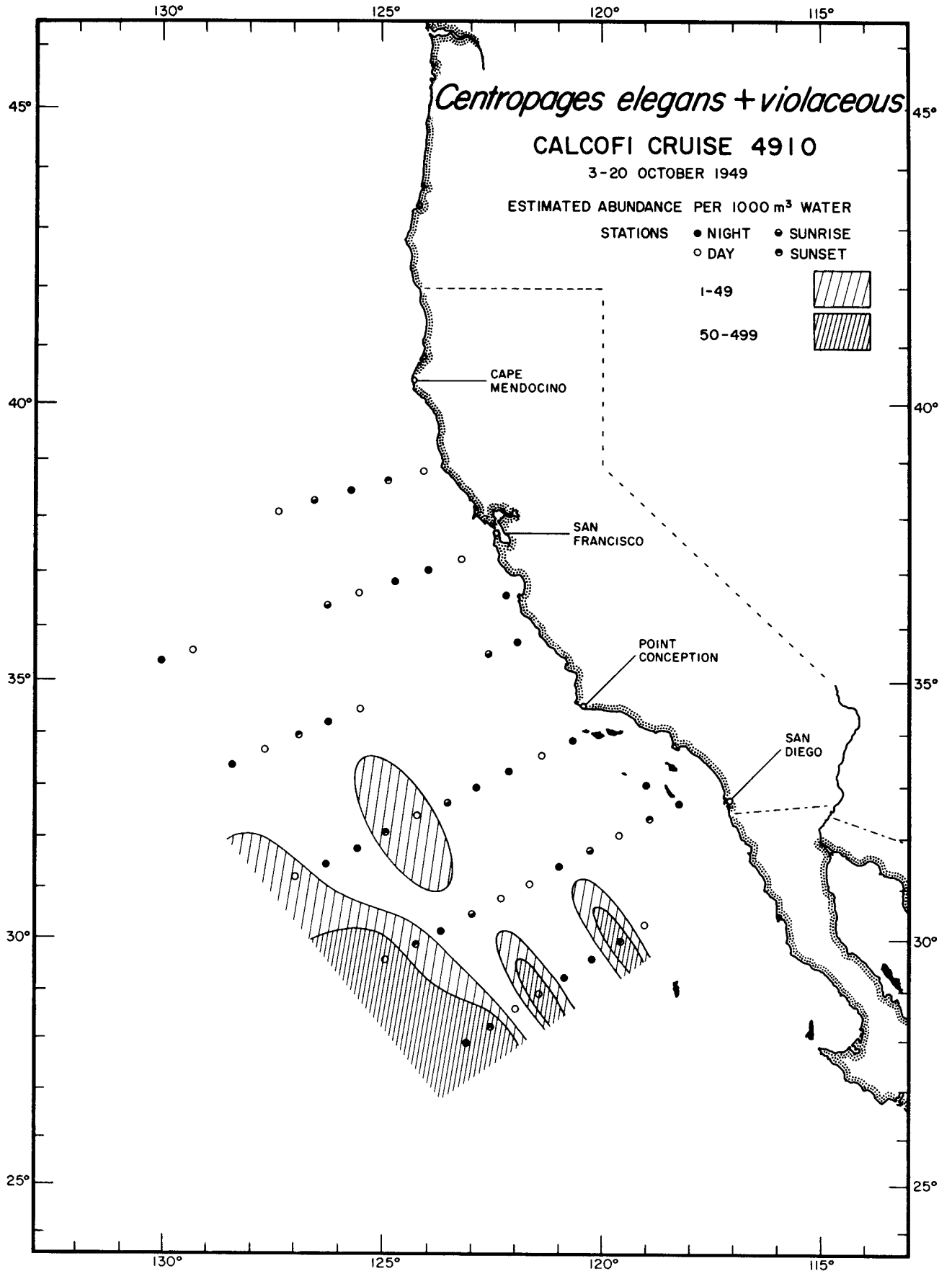
4908



Calanoida

Centropages elegans + violaceus

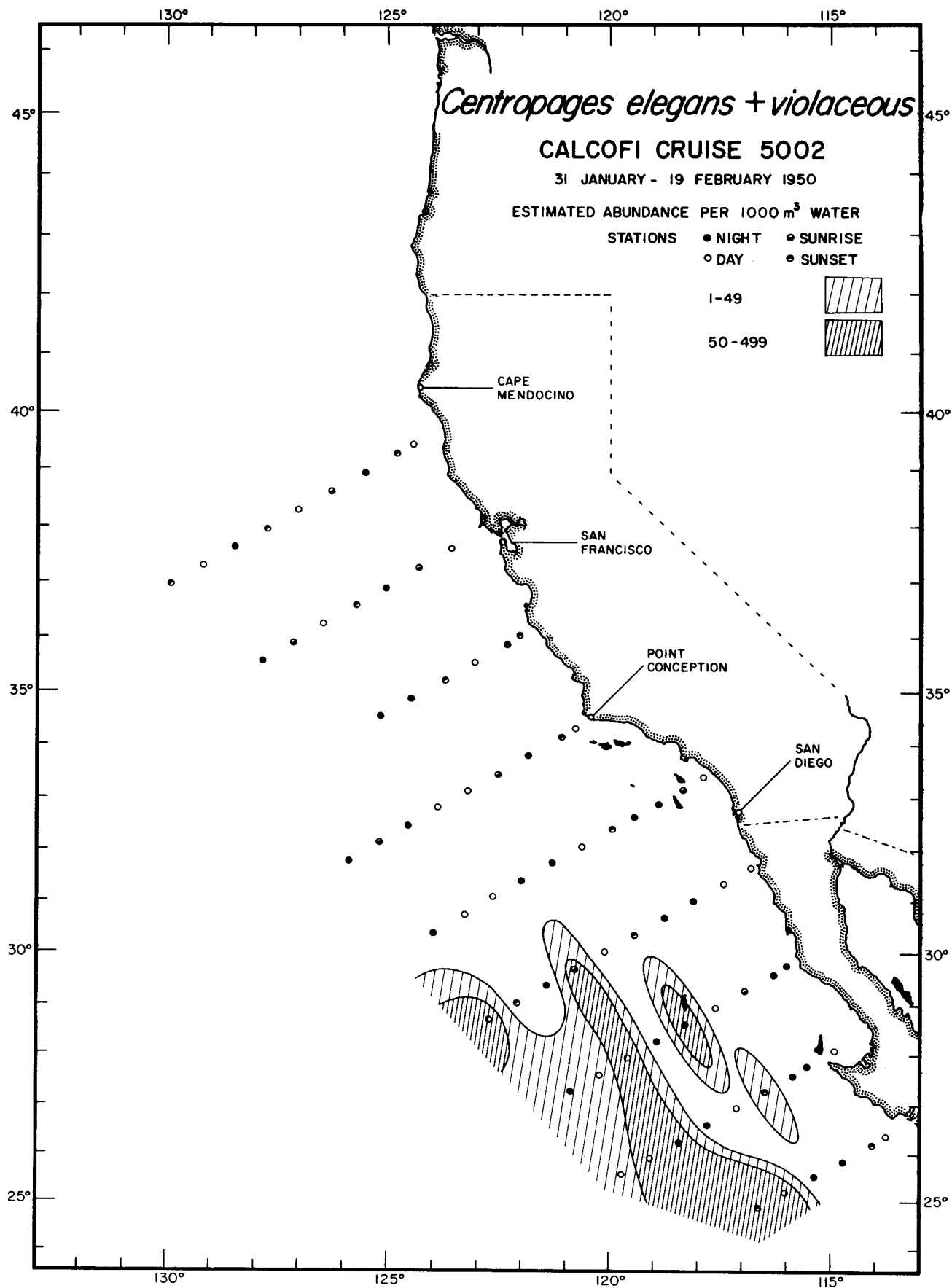
4909



Calanoida

Centropages elegans + violaceus

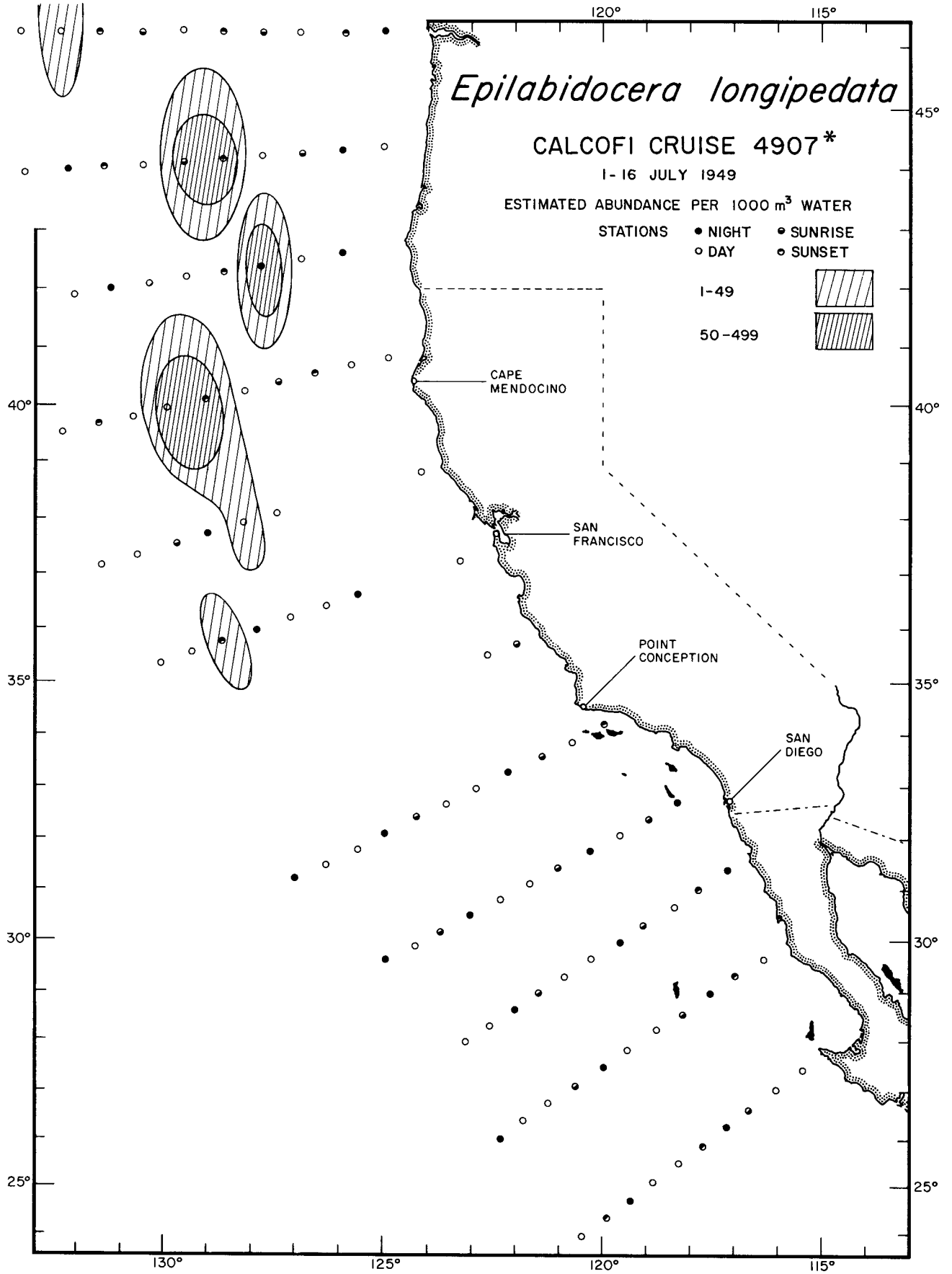
4910



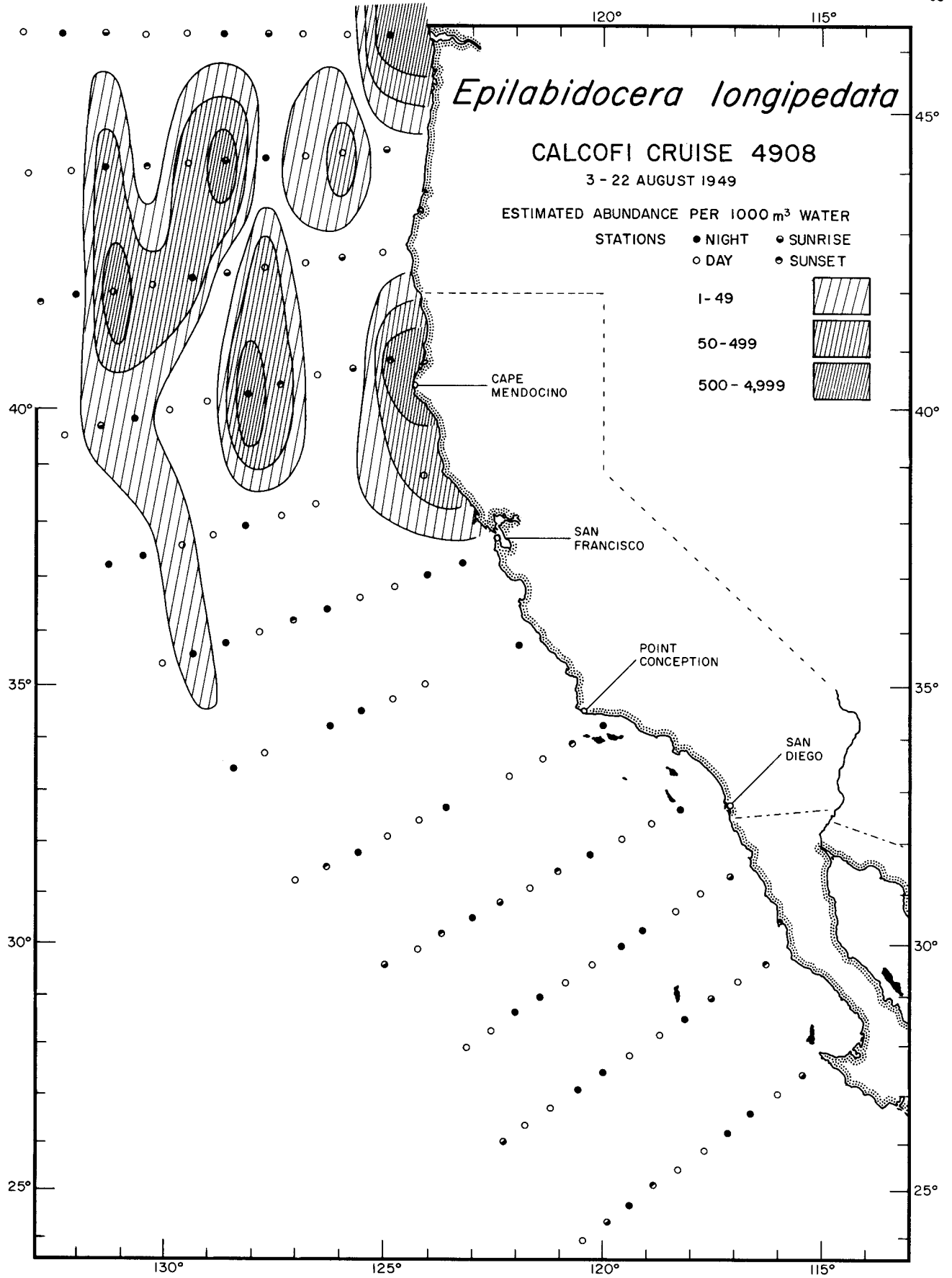
Calanoida

Centropages elegans + violaceus

5002



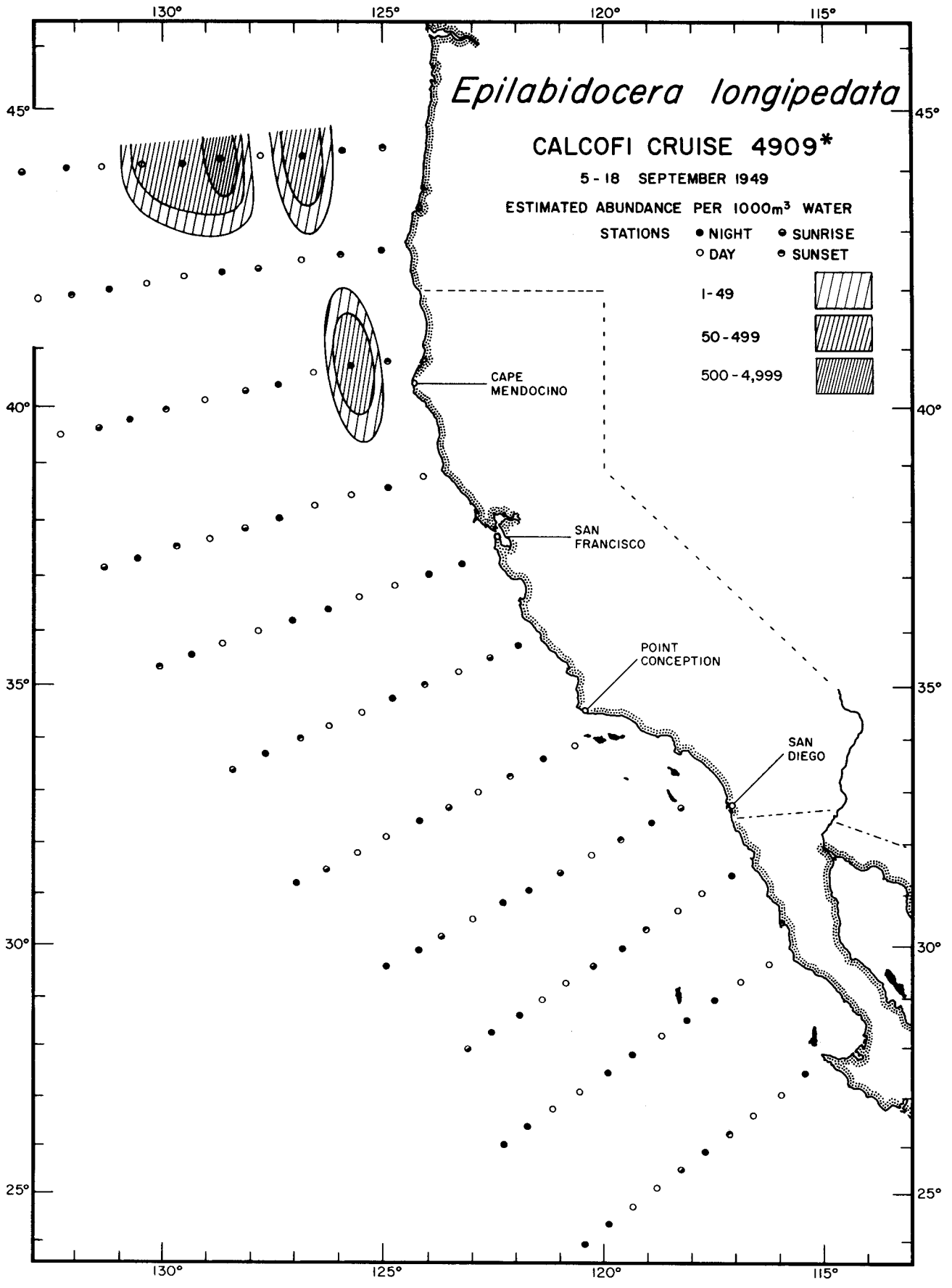
* See Table 1 for cruises 4905, 6



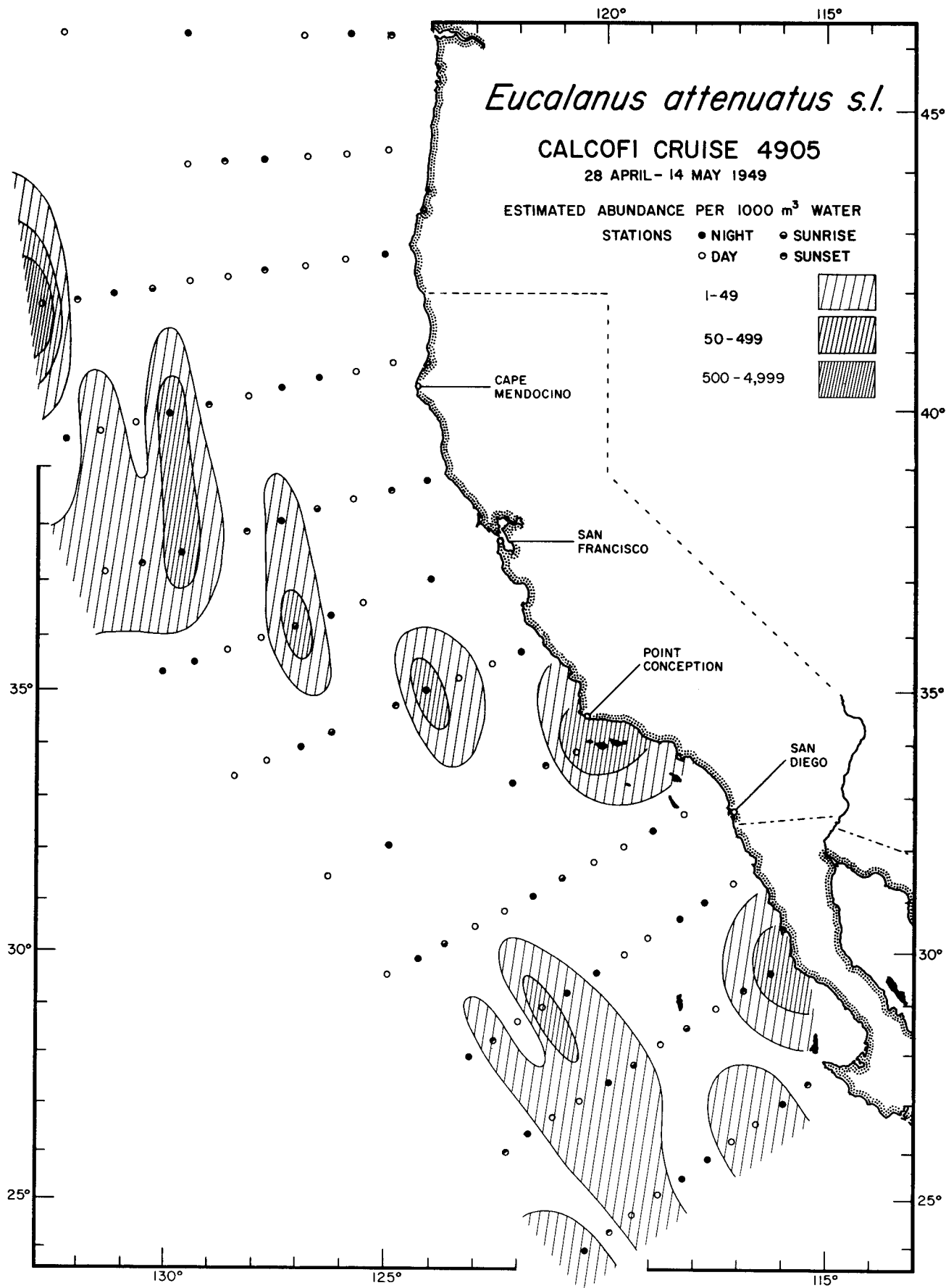
Calanoida

Epilabidocera longipedata

4908



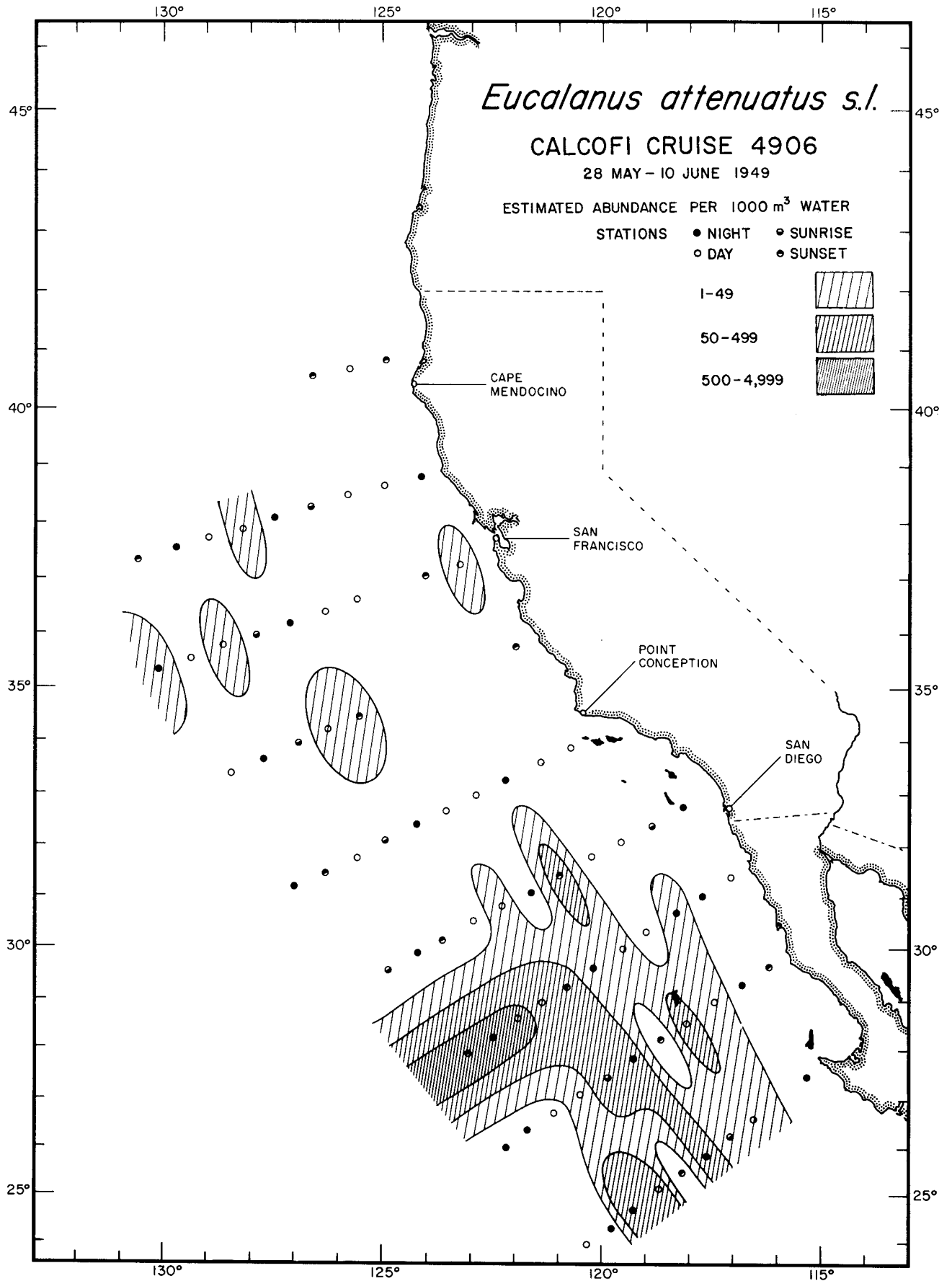
* See Table 1 for cruises 4910, 5002



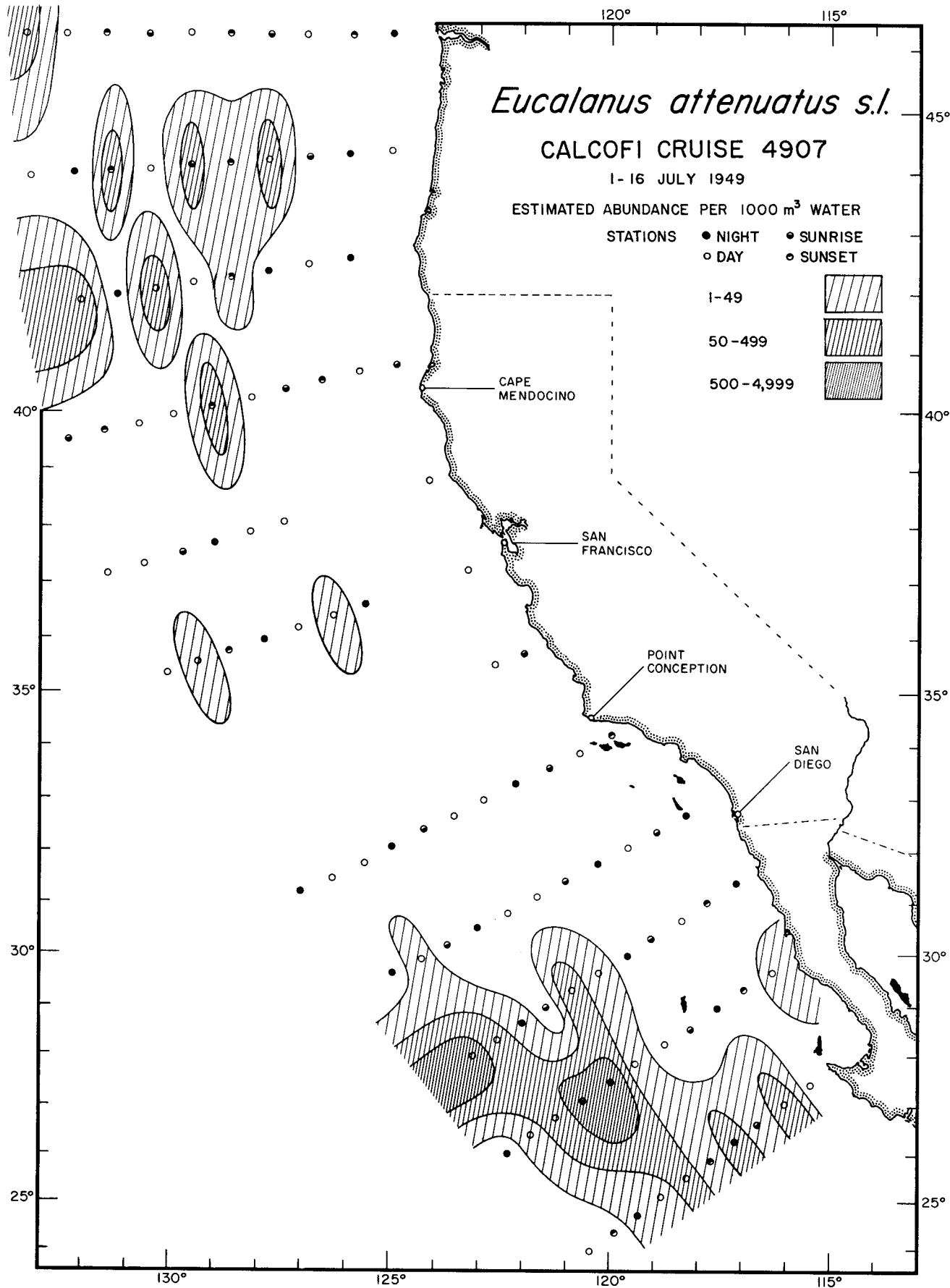
Calanoida

Eucalanus attenuatus s.l.

4905



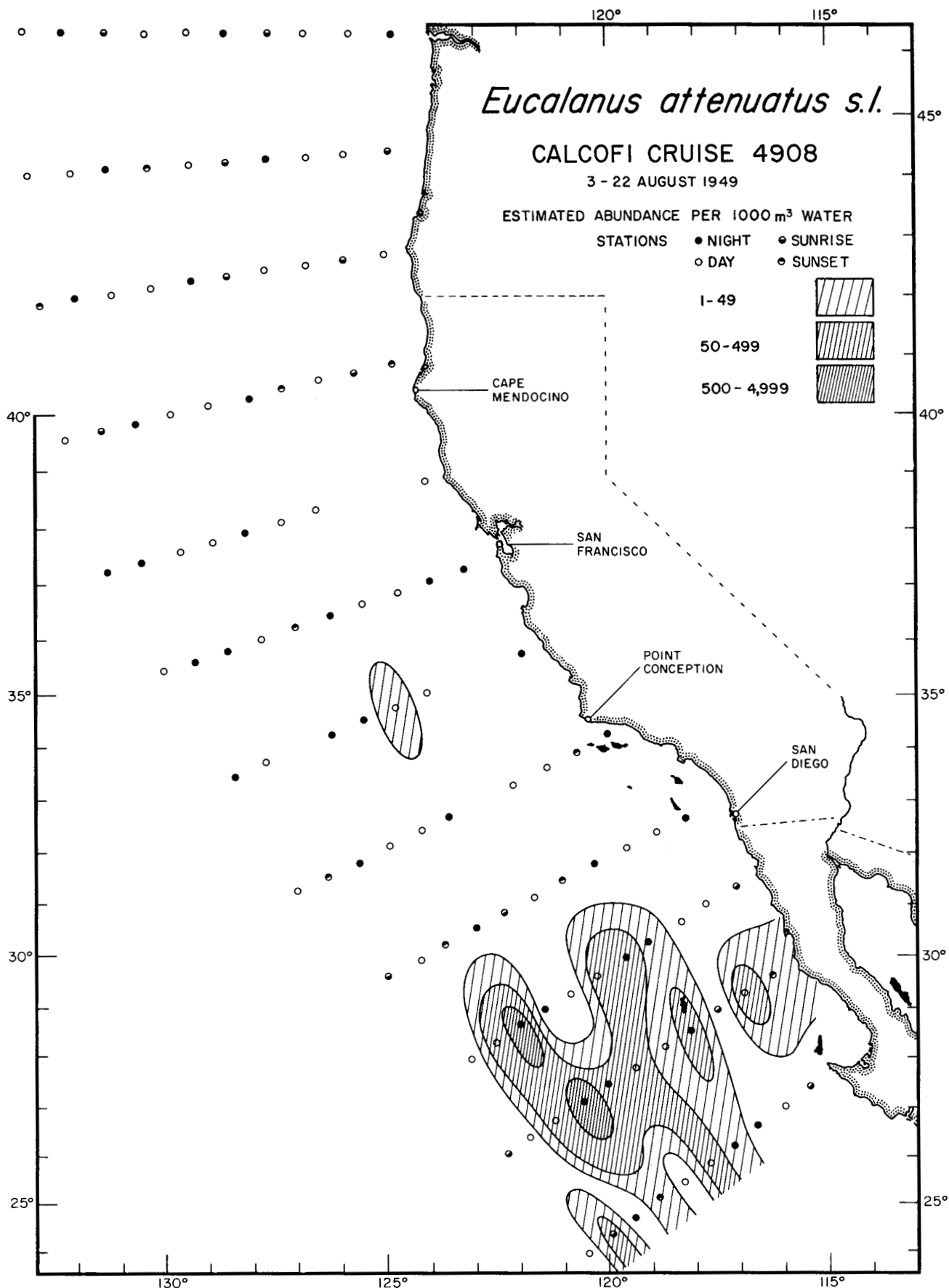
Calanoida
Eucalanus attenuatus s.l.
4906



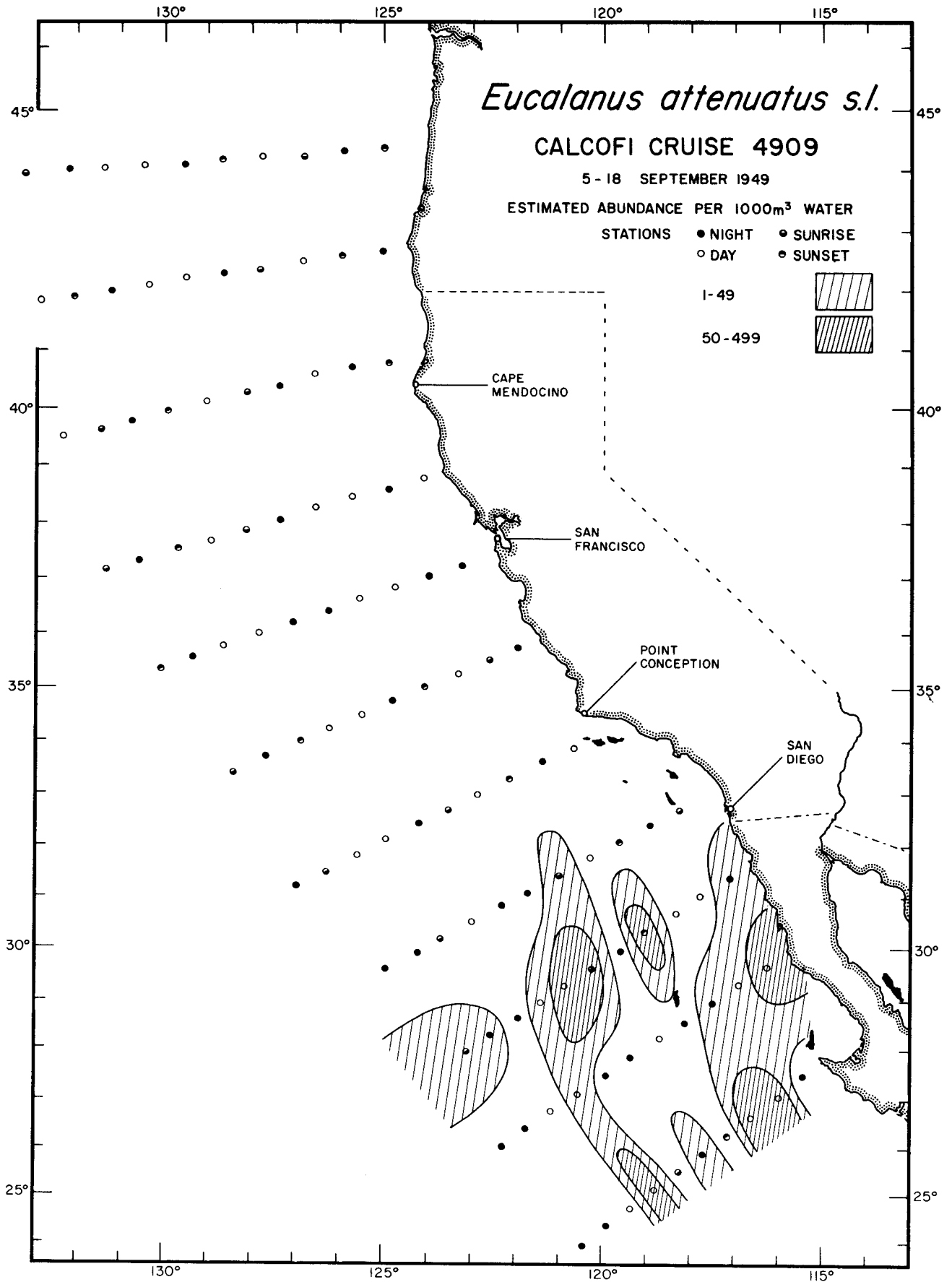
Calanoida

Eucalanus attenuatus s.l.

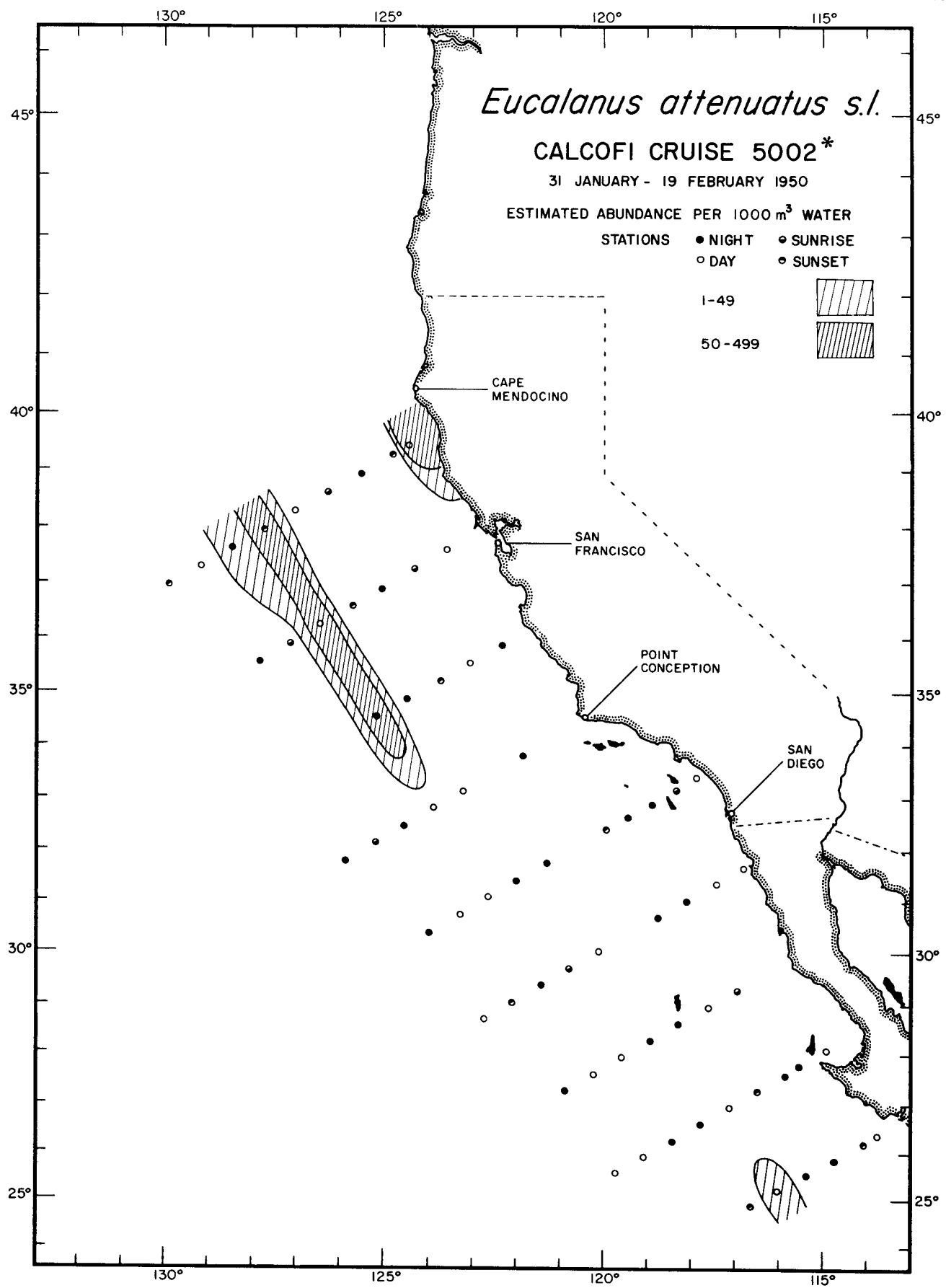
4907



Calanoida
Eucalanus attenuatus s.l.
4908



Calanoida
Eucalanus attenuatus s.l.
4909

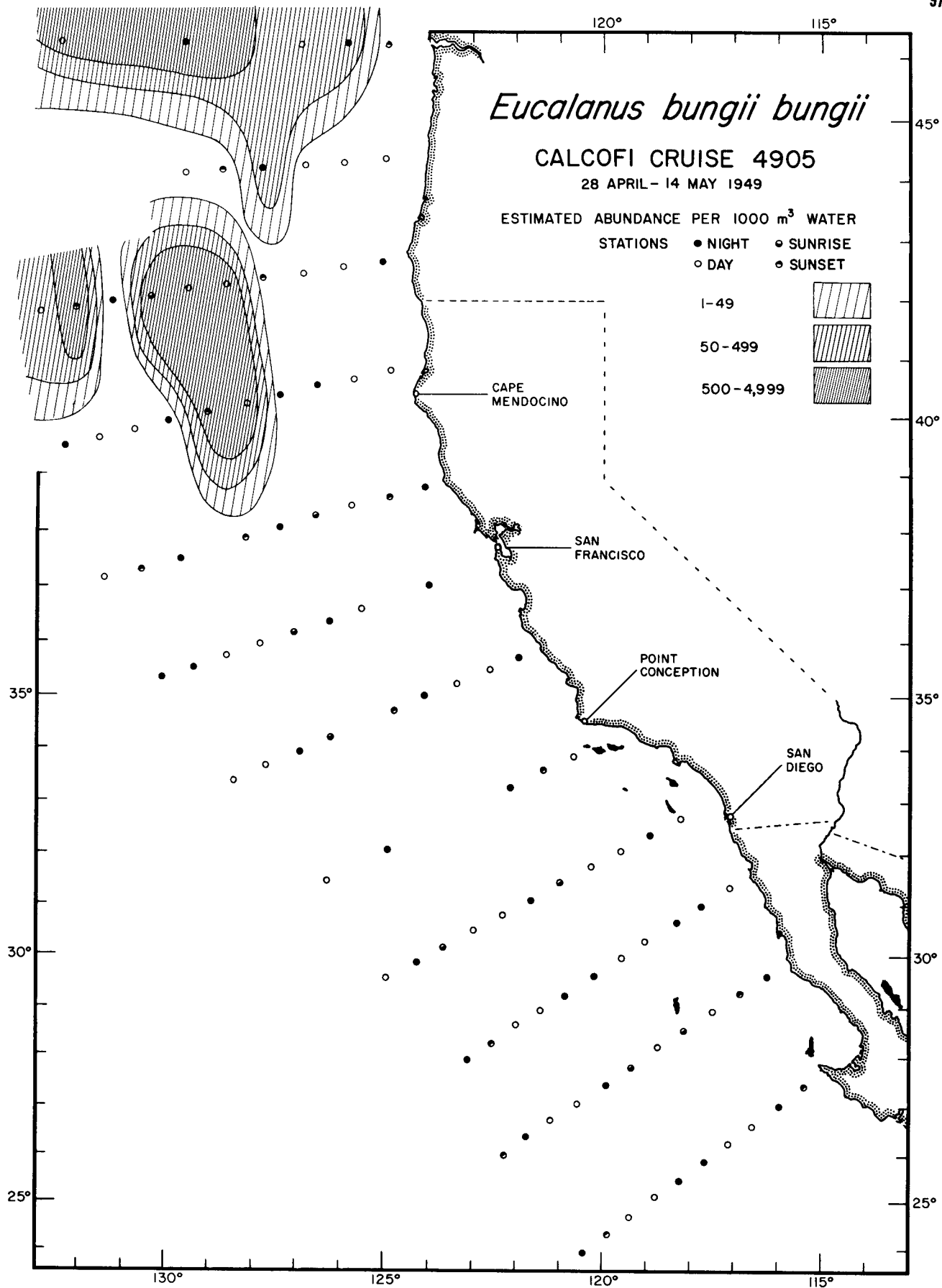


* See Table 1 for cruise 4910

Calanoida

Eucalanus attenuatus s.l.

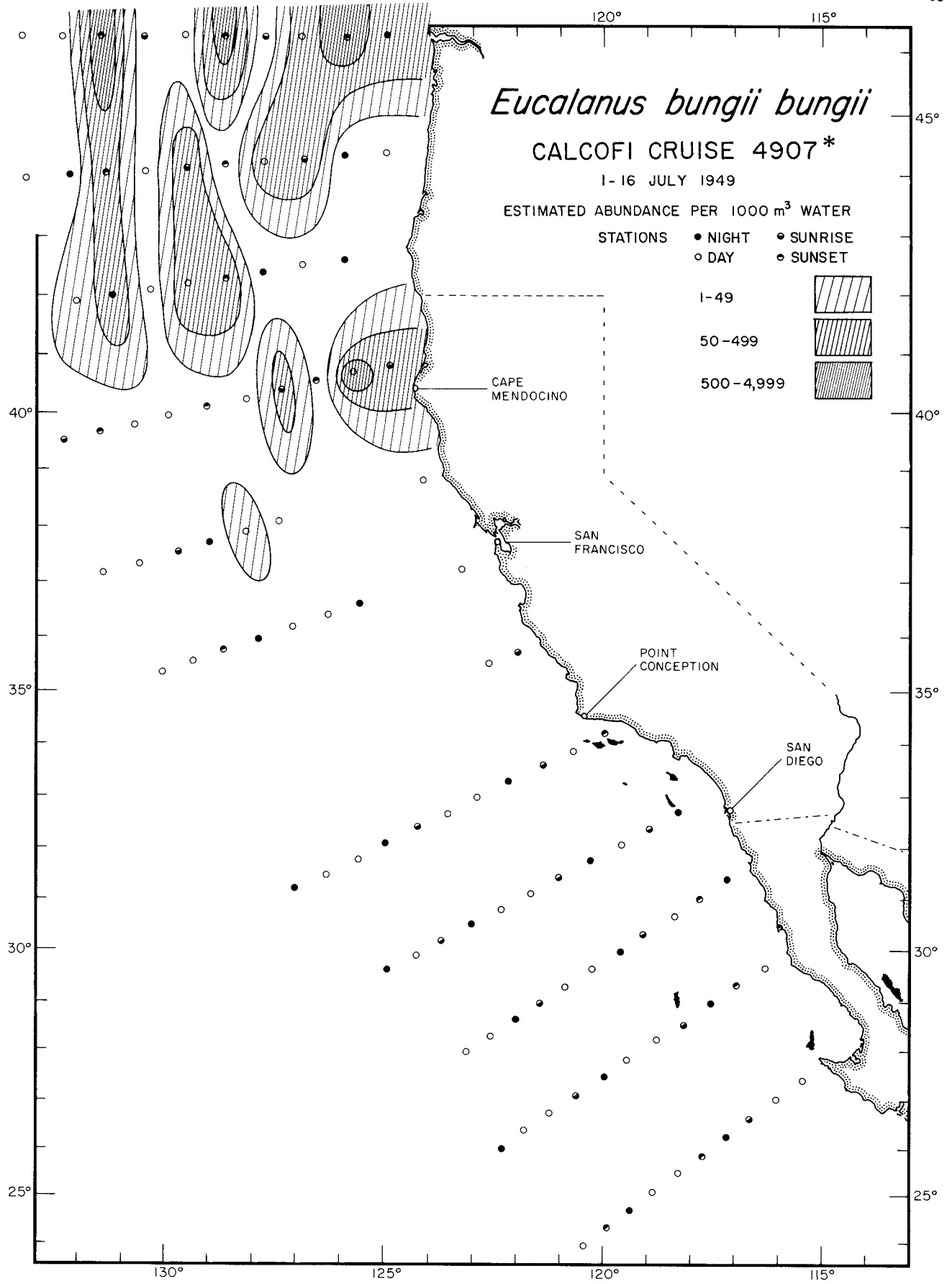
5002



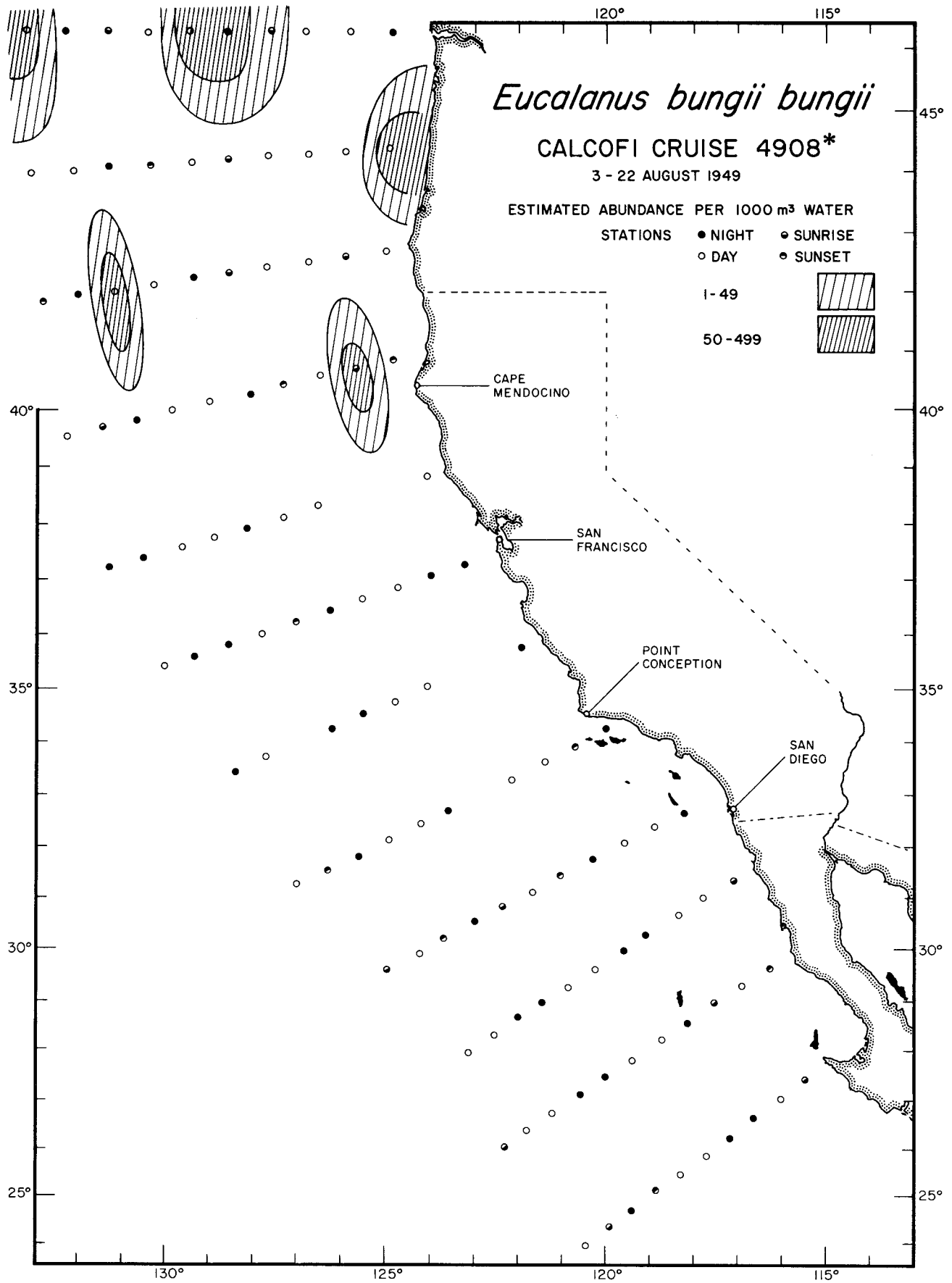
Calanoida

Eucalanus bungii bungii

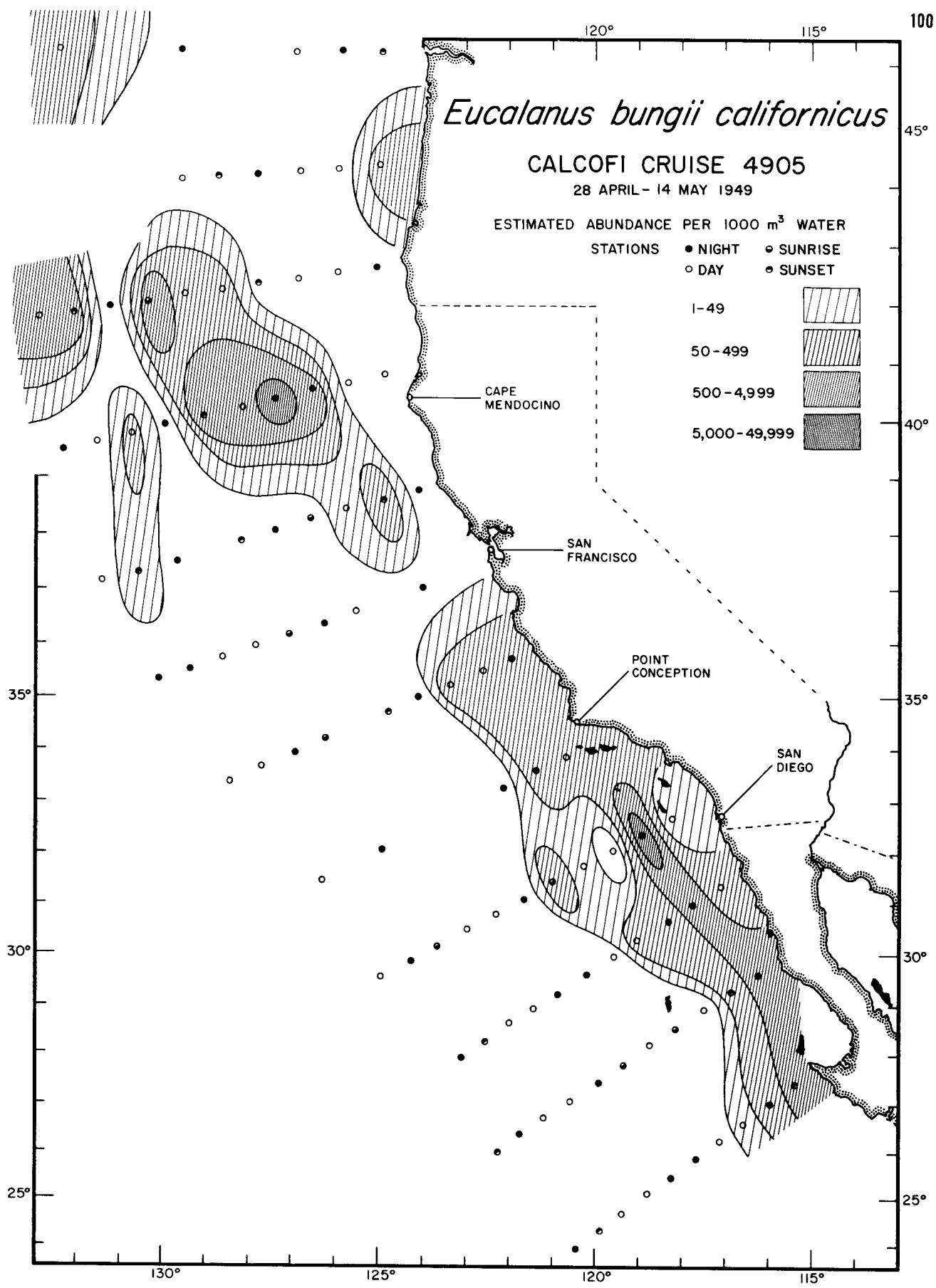
4905



* See Table 1 for cruise 4906



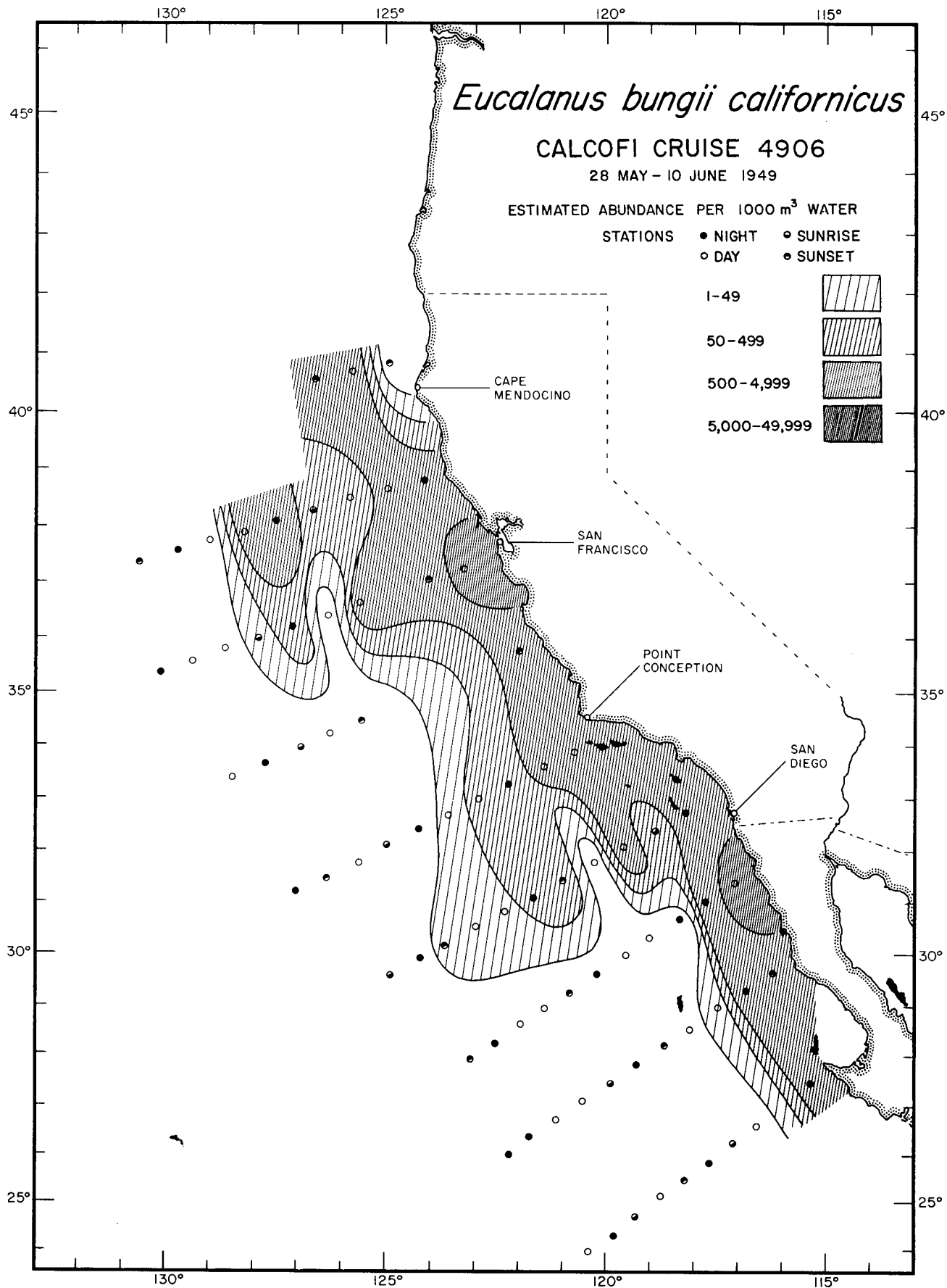
* See Table 1 for cruises 4909, 10, 5002



Calanoida

Eucalanus bungii californicus

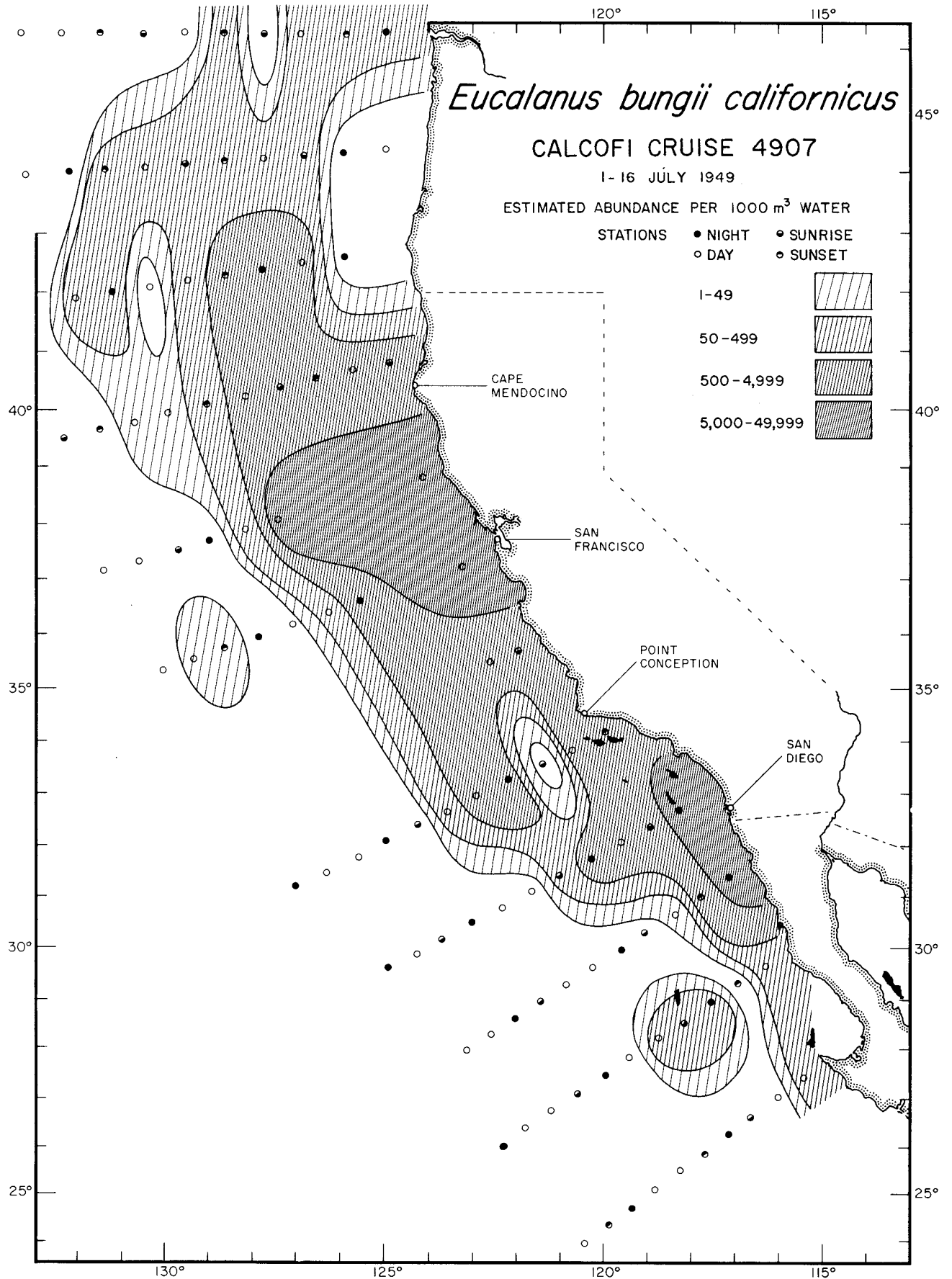
4905



Calanoida

Eucalanus bungii californicus

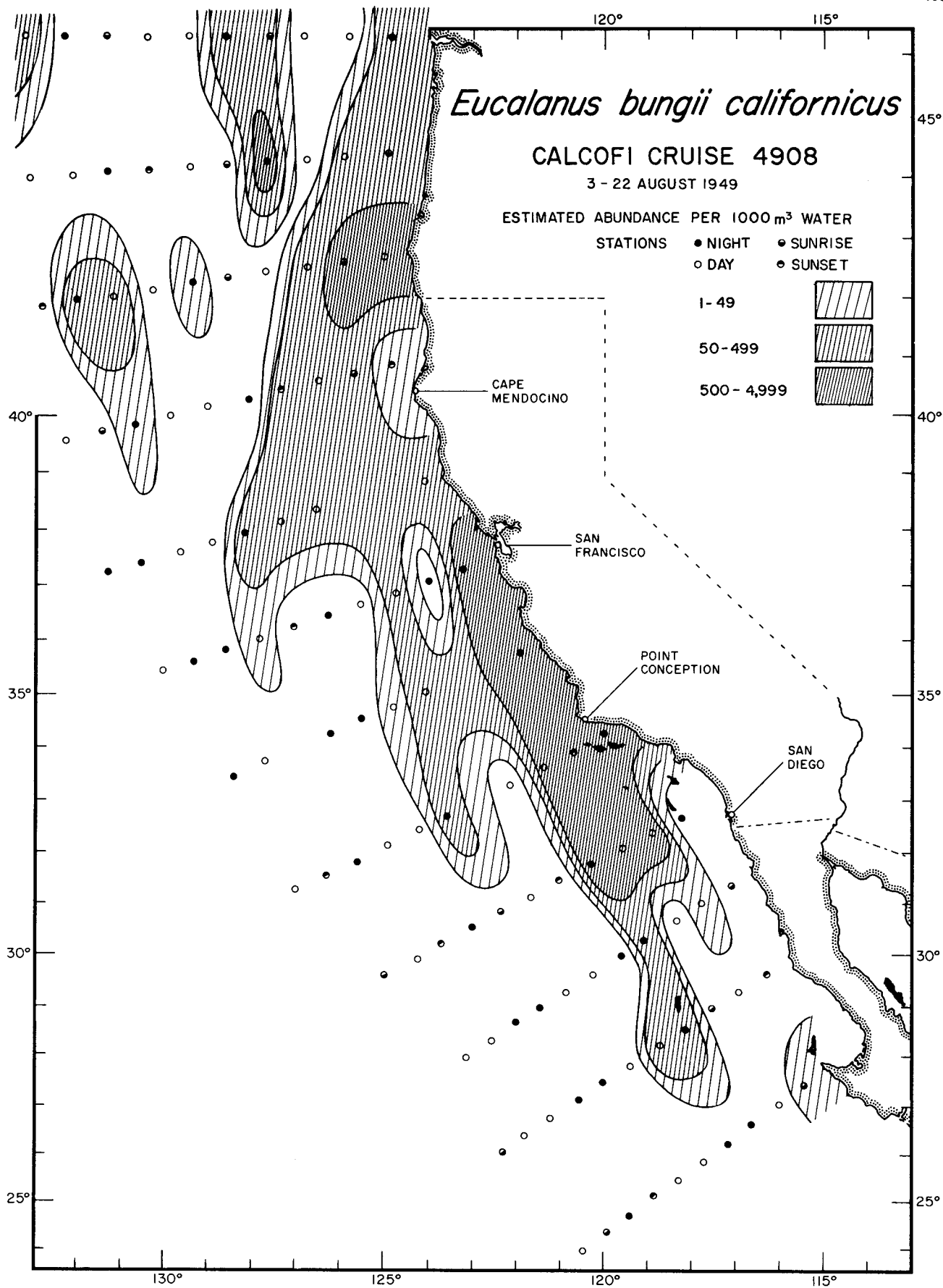
4906



Calanoida

Eucalanus bungii californicus

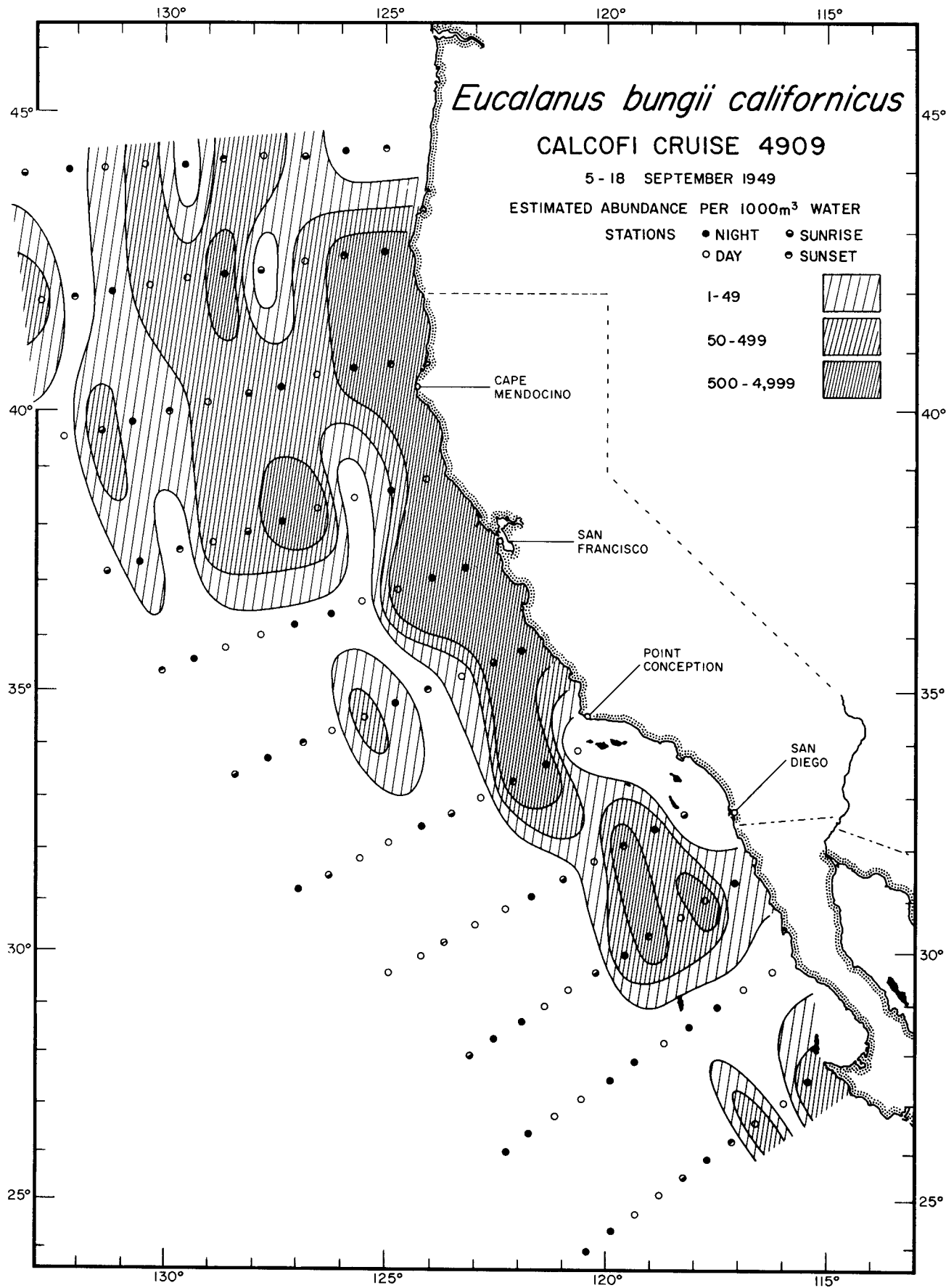
4907



Calanoida

Eucalanus bungii californicus

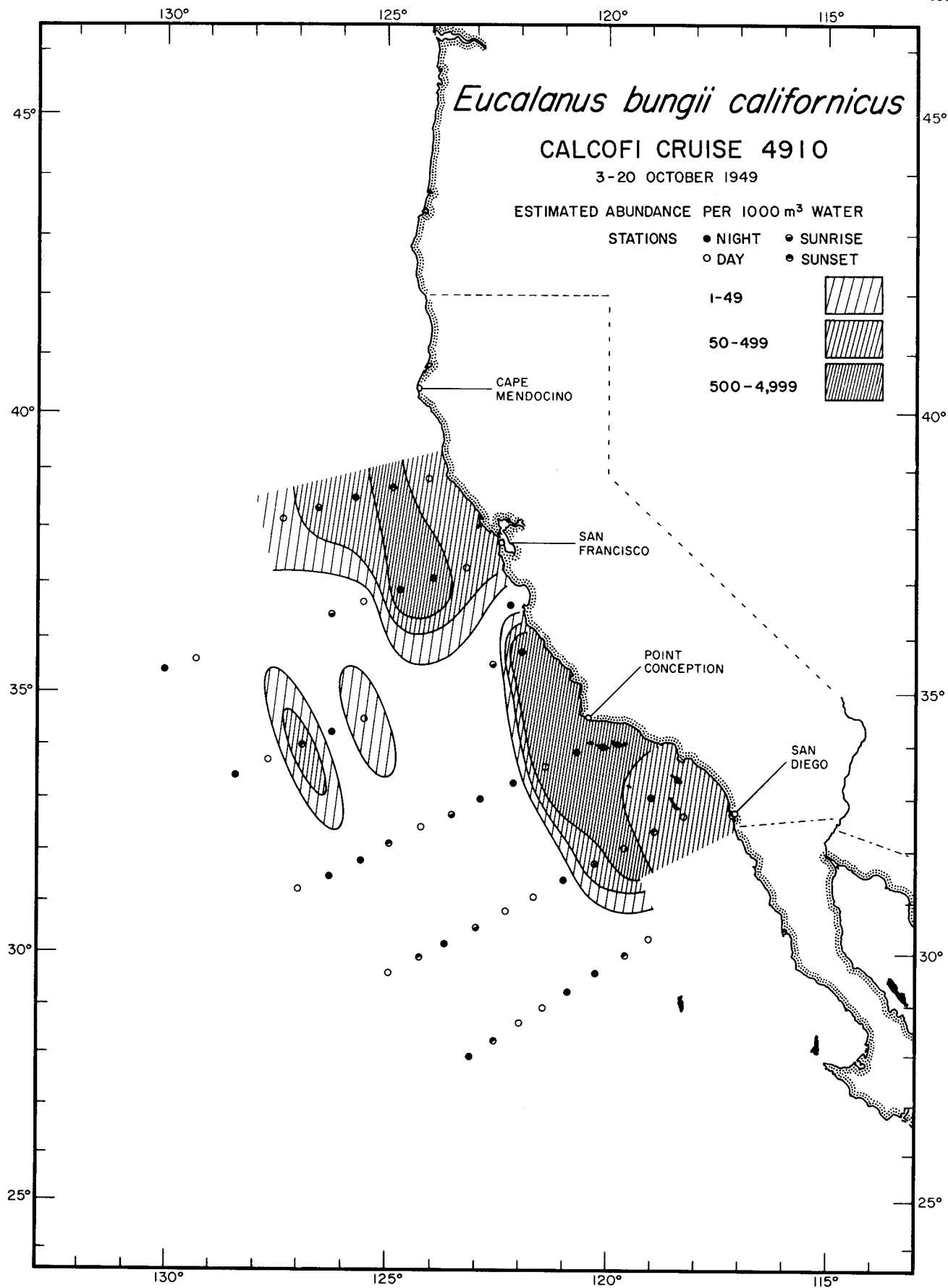
4908



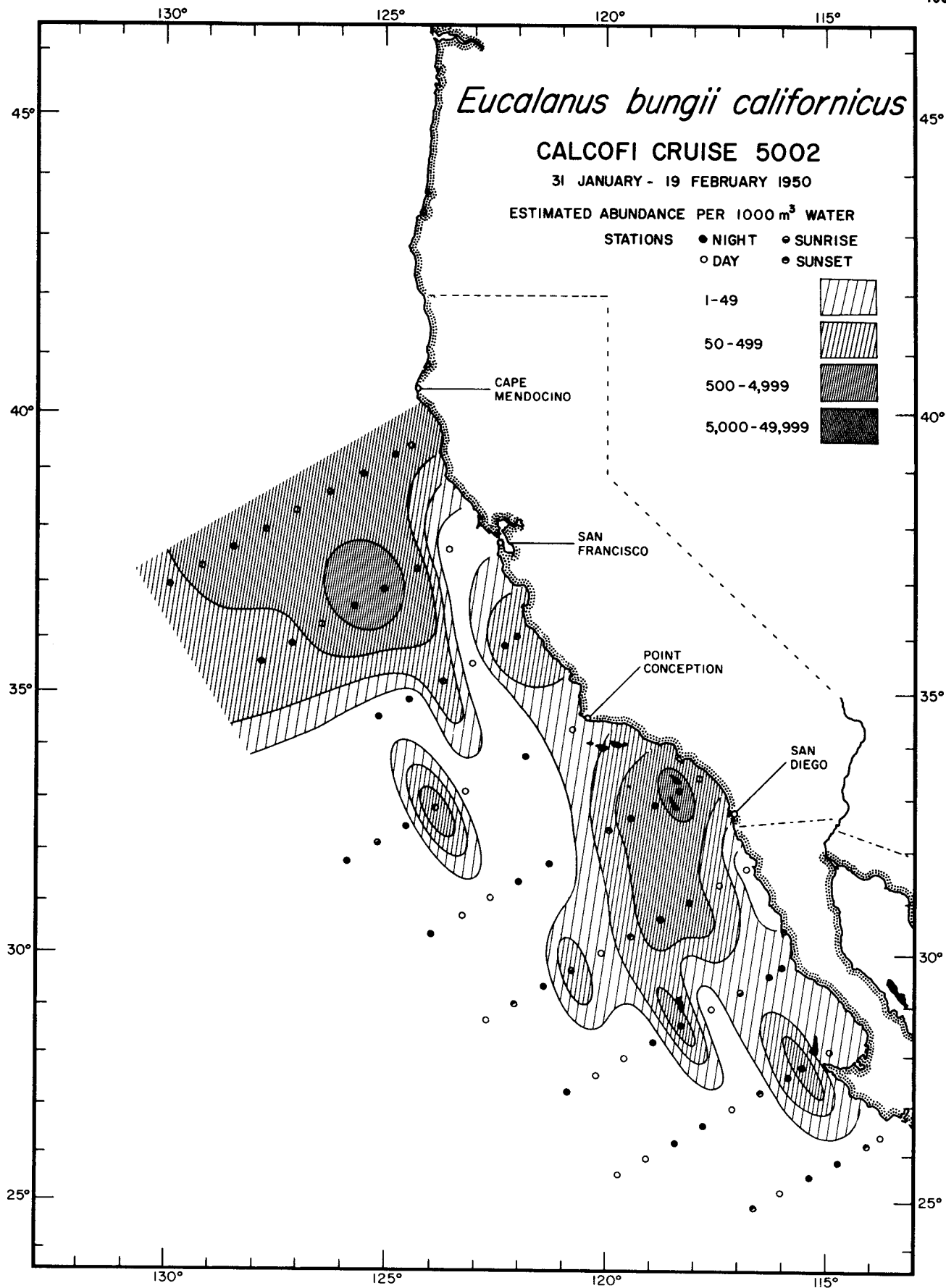
Calanoida

Eucalanus bungii californicus

4909



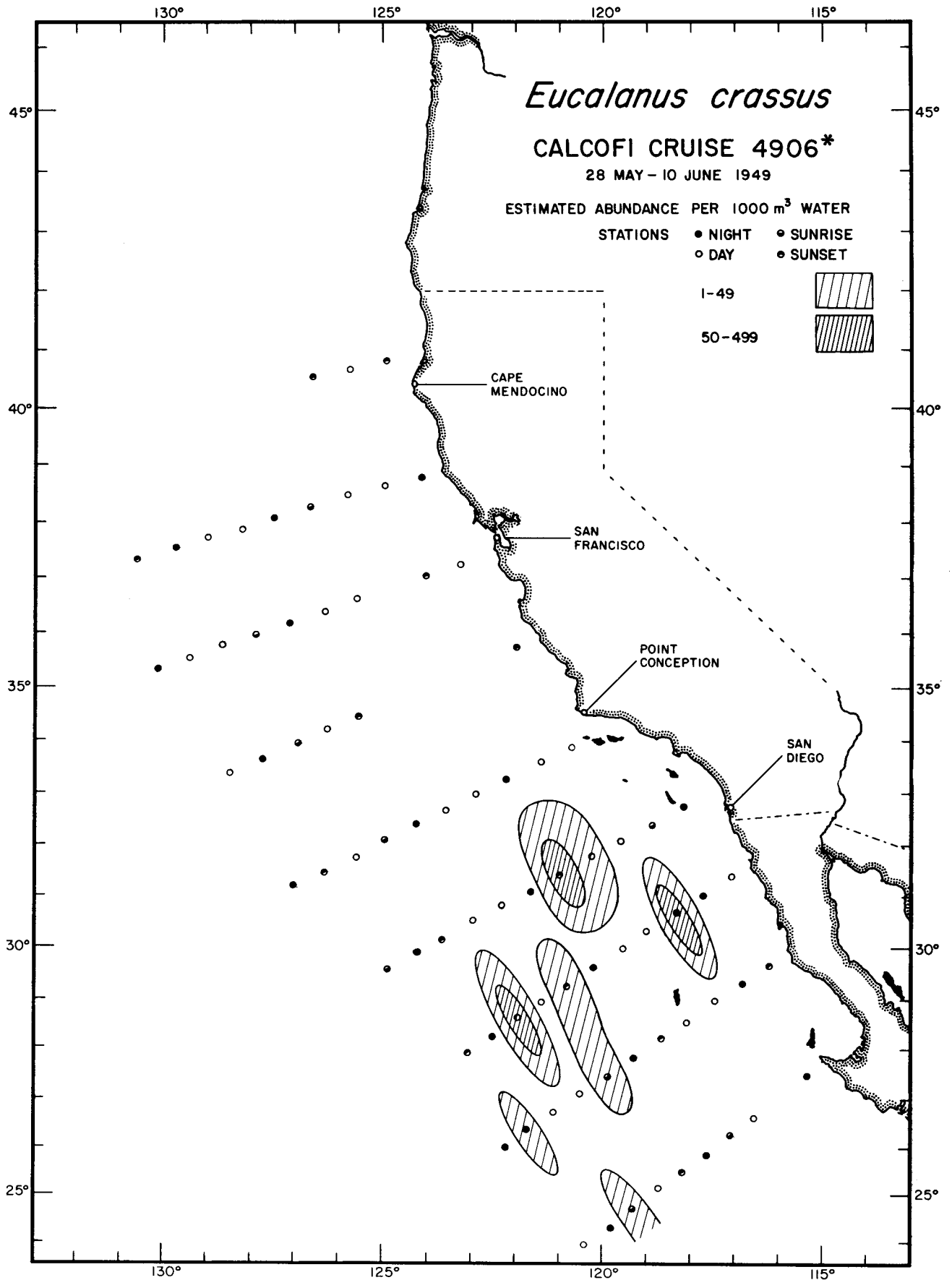
Calanoida
Eucalanus bungii californicus
4910



Calanoida

Eucalanus bungii californicus

5002

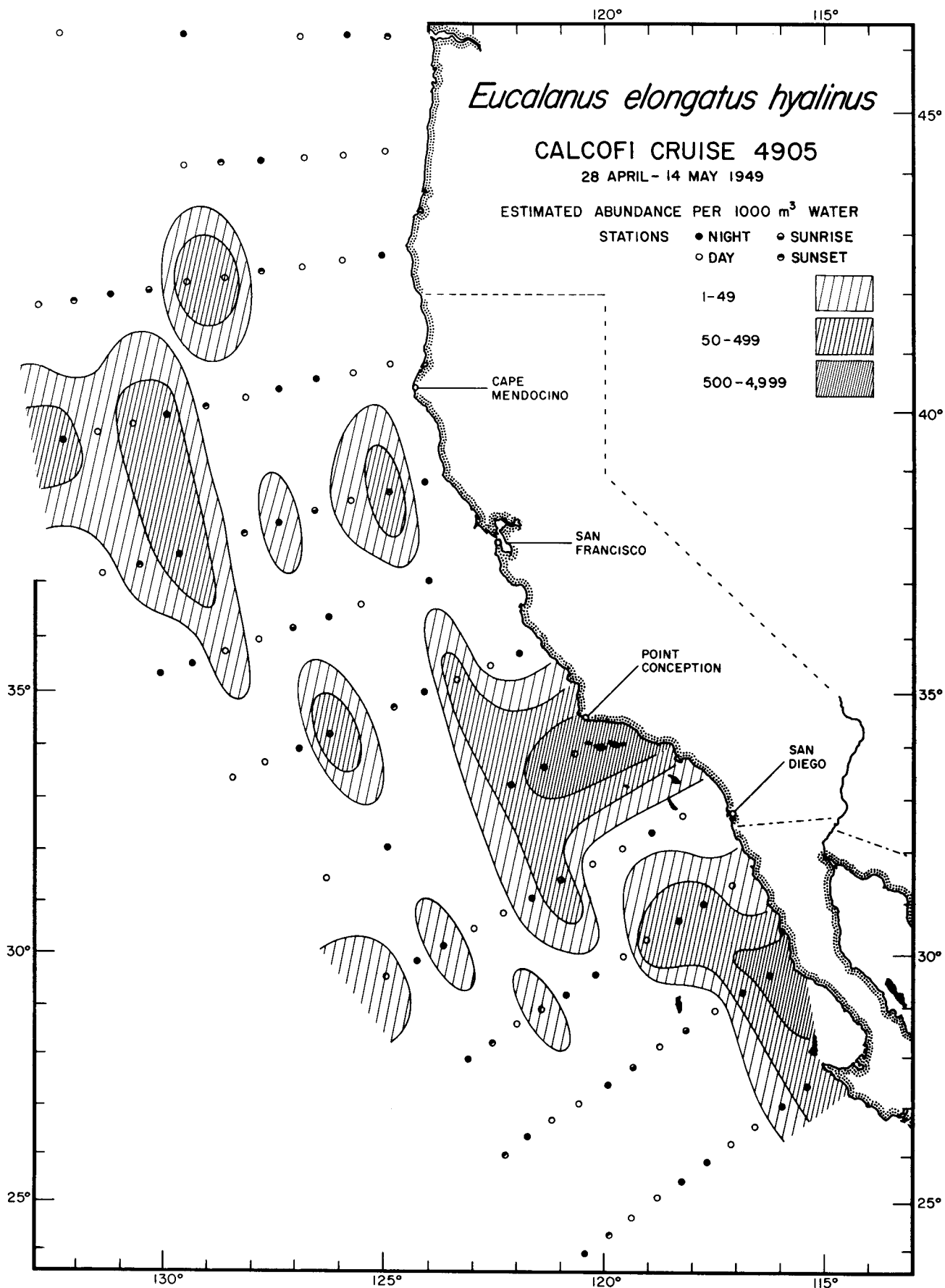


* See Table 1 for cruises 4905, 7, 8, 9, 10, 5002

Calanoida

Eucalanus crassus

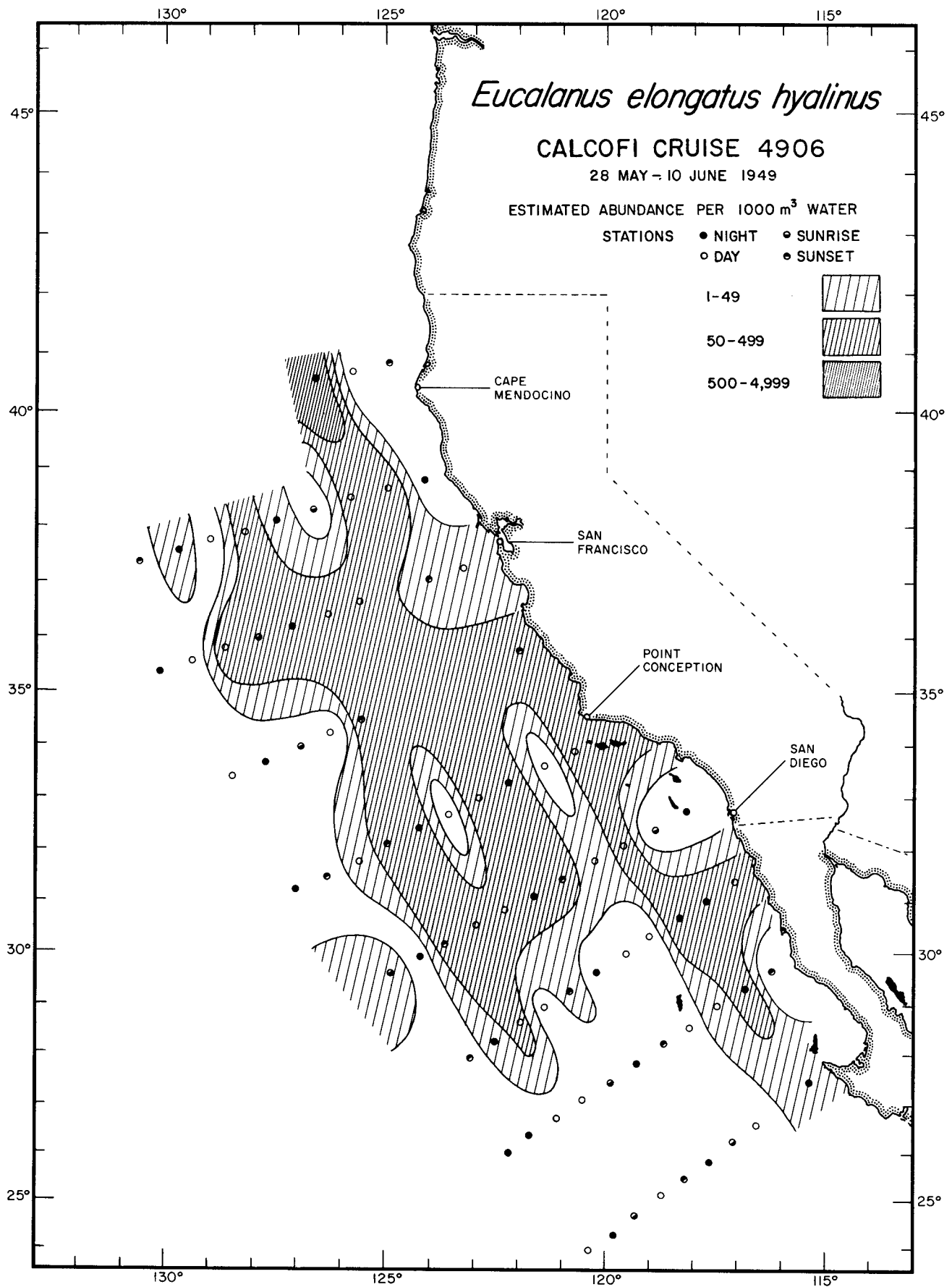
4906



Calanoida

Eucalanus elongatus hyalinus

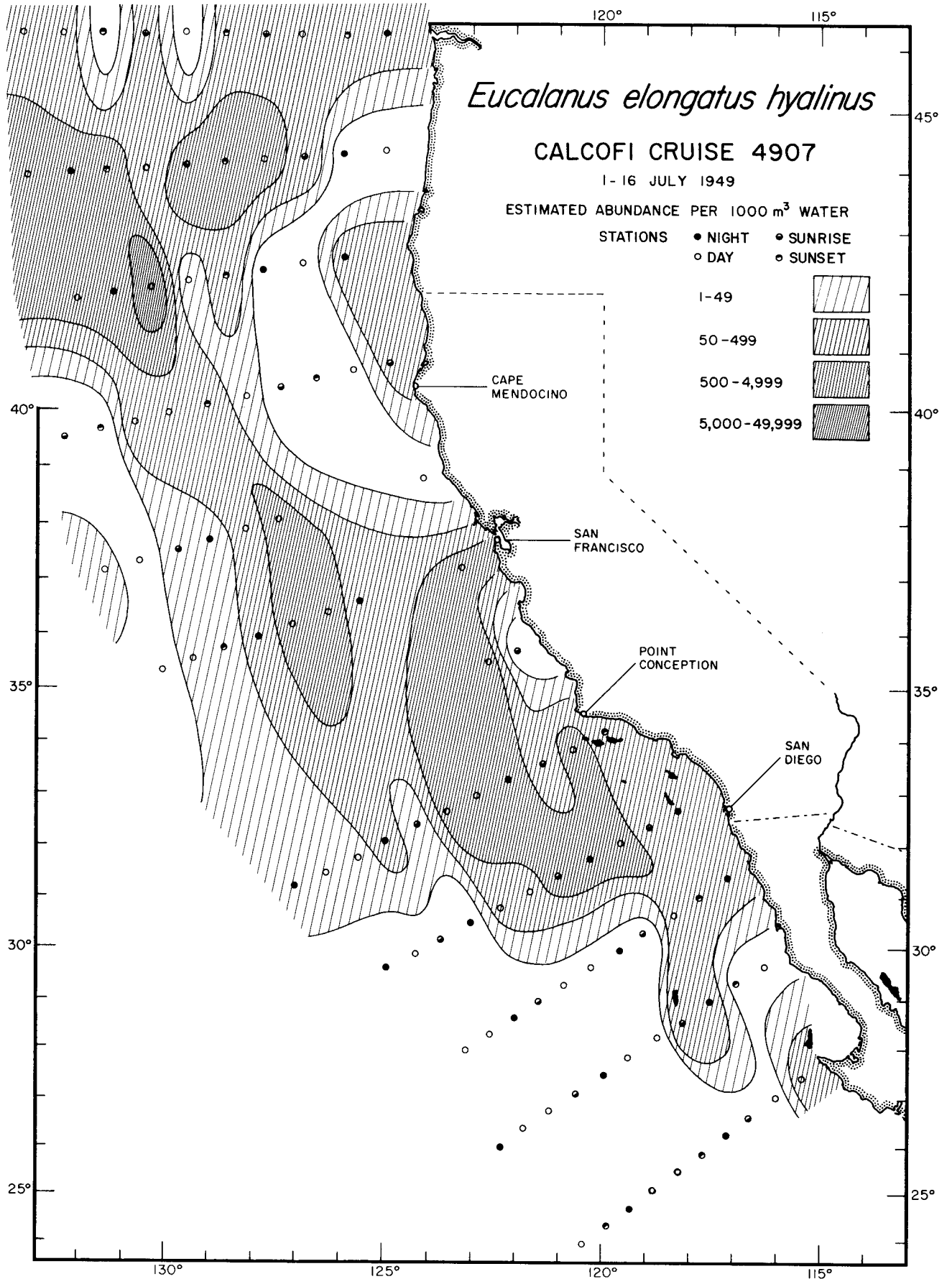
4905



Calanoida

Eucalanus elongatus hyalinus

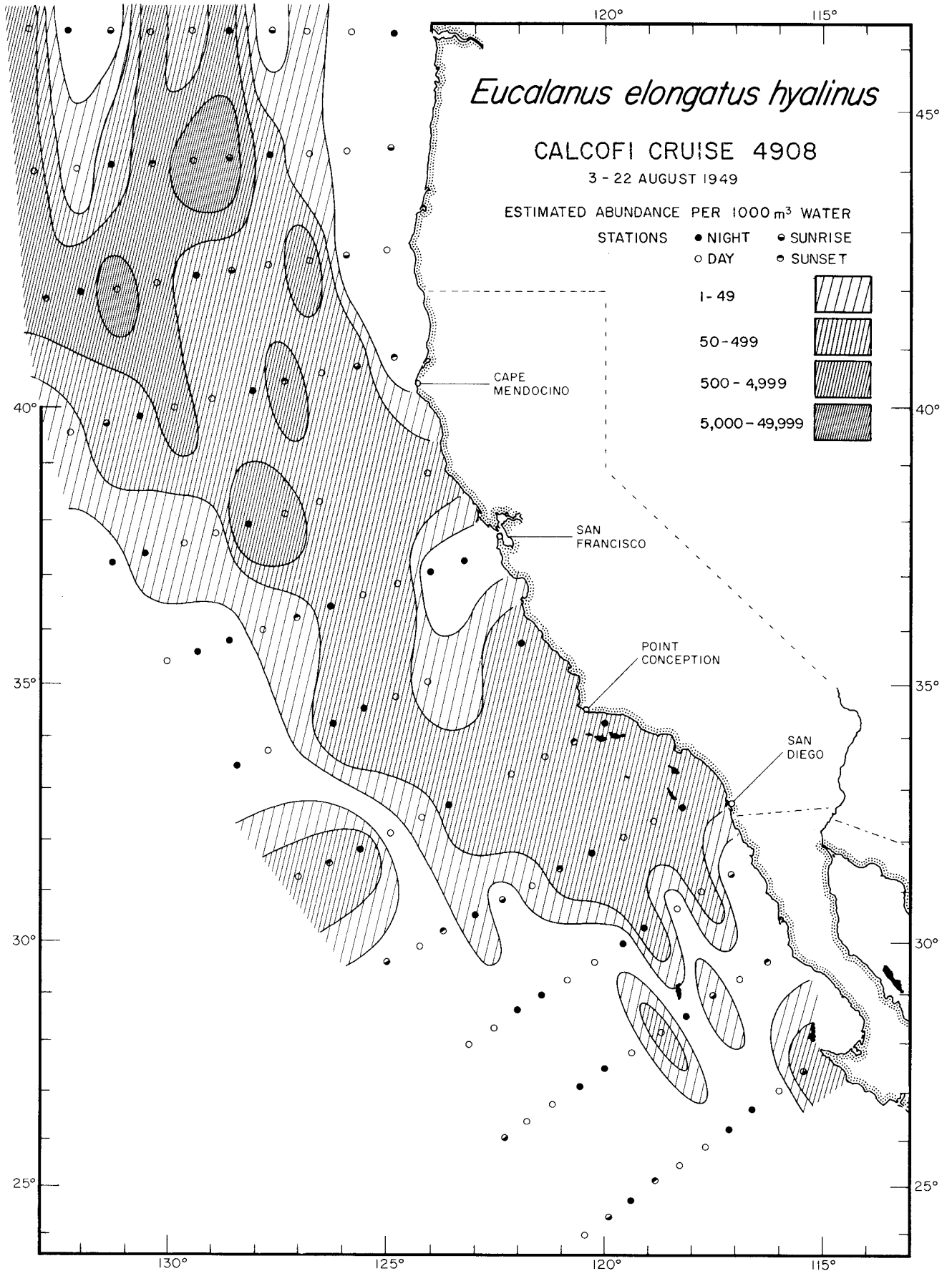
4906



Calanoida

Eucalanus elongatus hyalinus

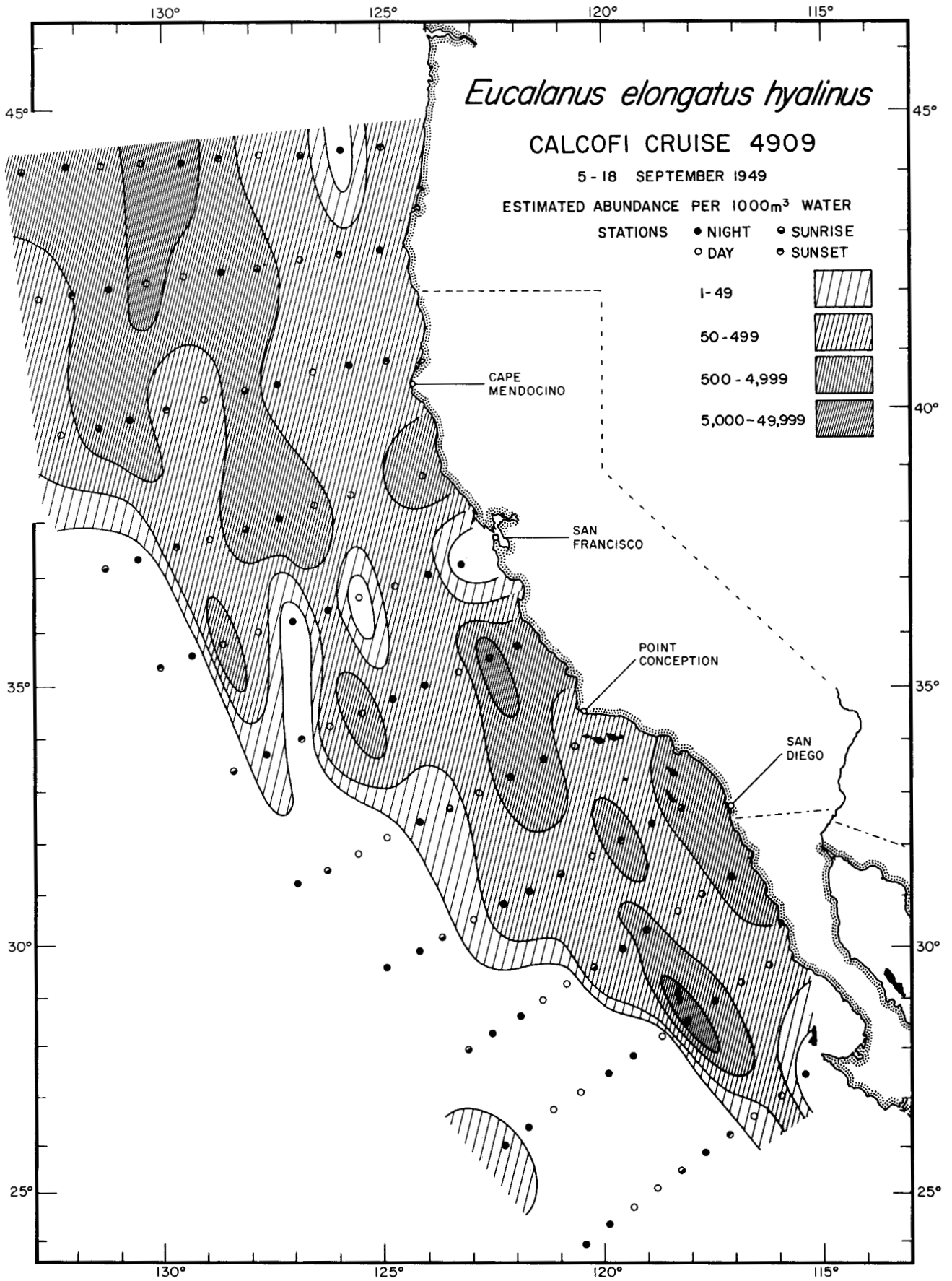
4907



Calanoida

Eucalanus elongatus hyalinus

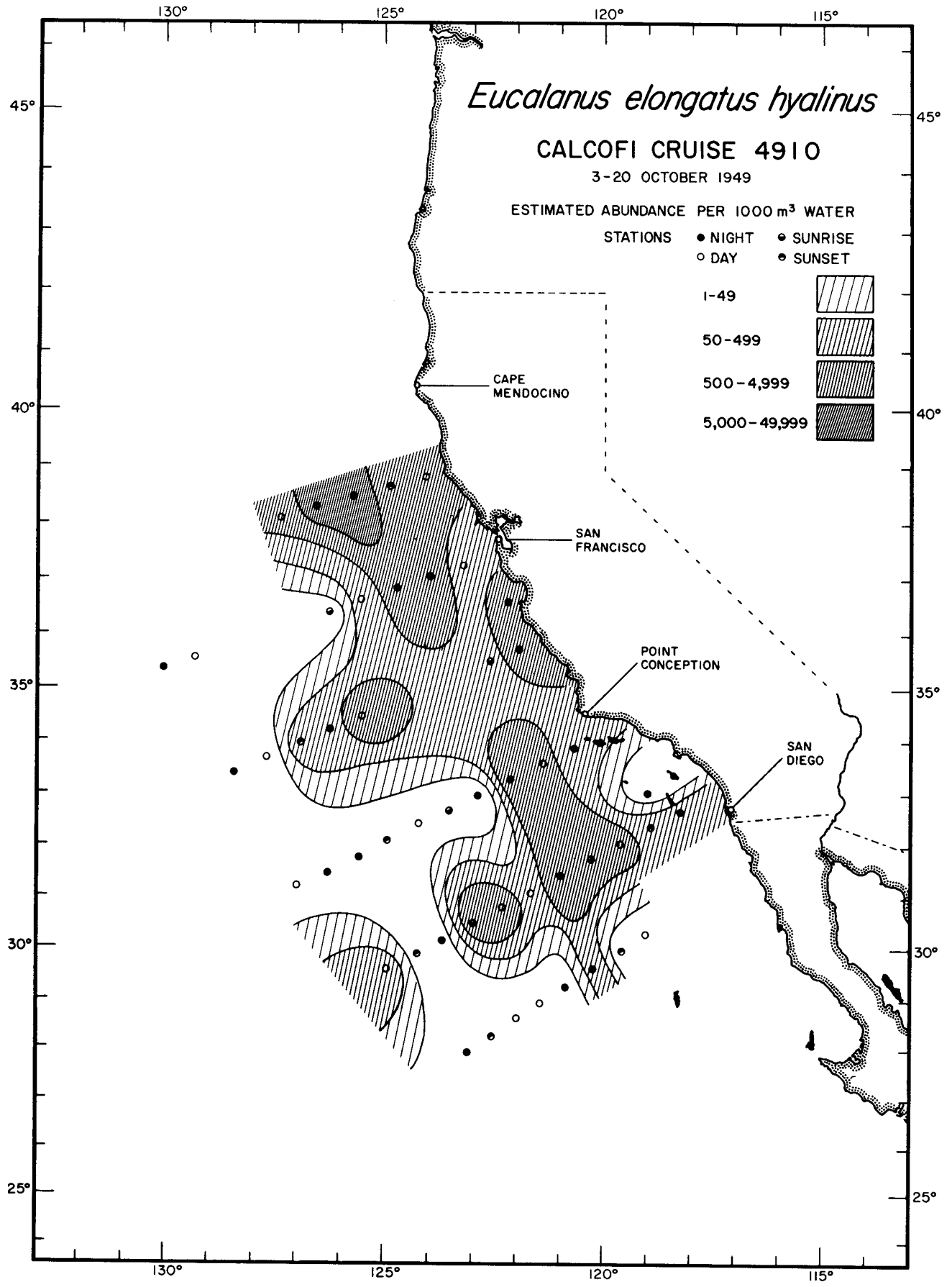
4908



Calanoida

Eucalanus elongatus hyalinus

4909



Eucalanus elongatus hyalinus

CALCOFI CRUISE 4910

3-20 OCTOBER 1949

ESTIMATED ABUNDANCE PER 1000 m³ WATER

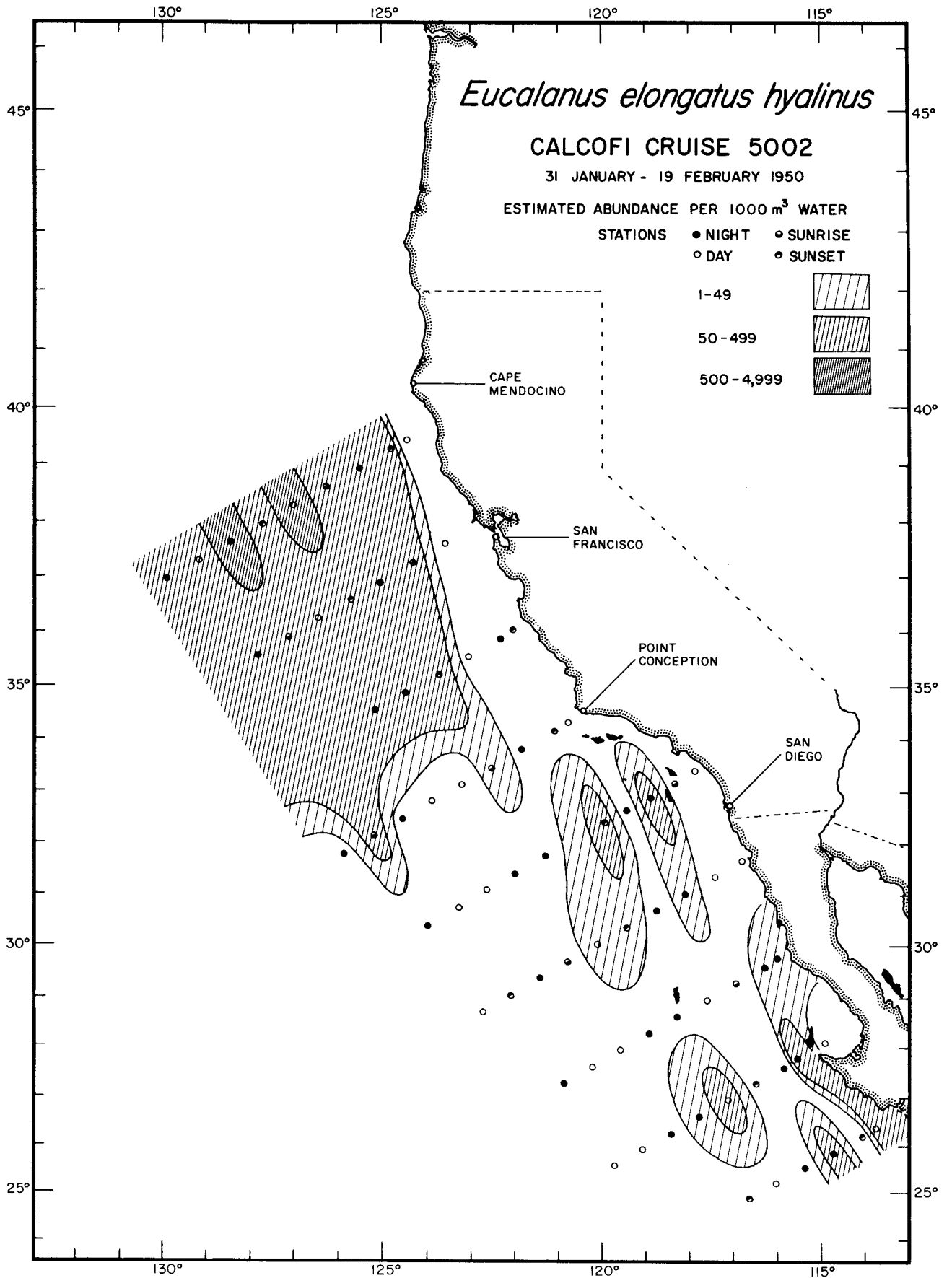
STATIONS ● NIGHT ● SUNRISE
○ DAY ● SUNSET

1-49	[diagonal lines]
50-499	[cross-hatch]
500-4,999	[vertical lines]
5,000-49,999	[horizontal lines]

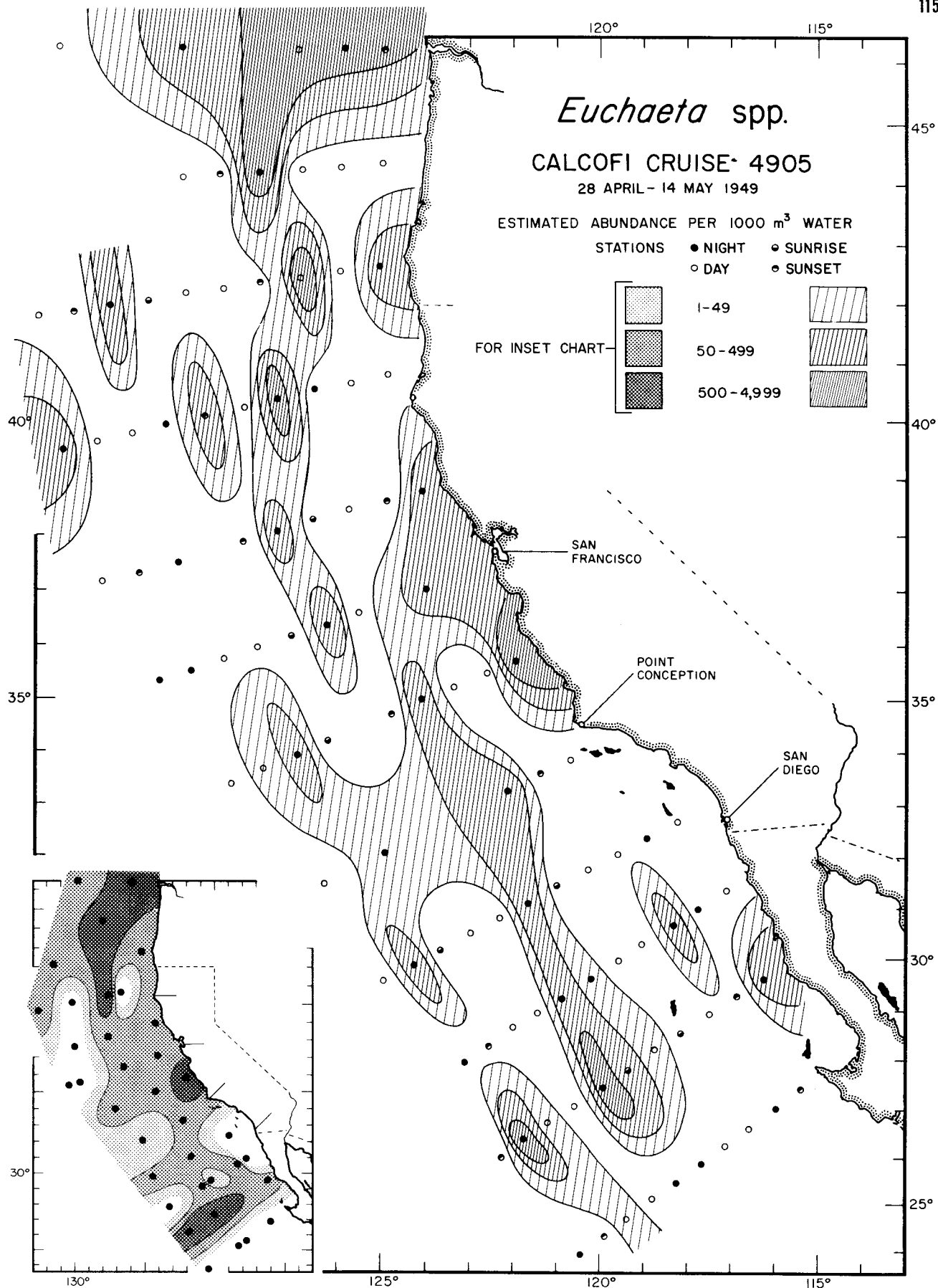
Calanoida

Eucalanus elongatus hyalinus

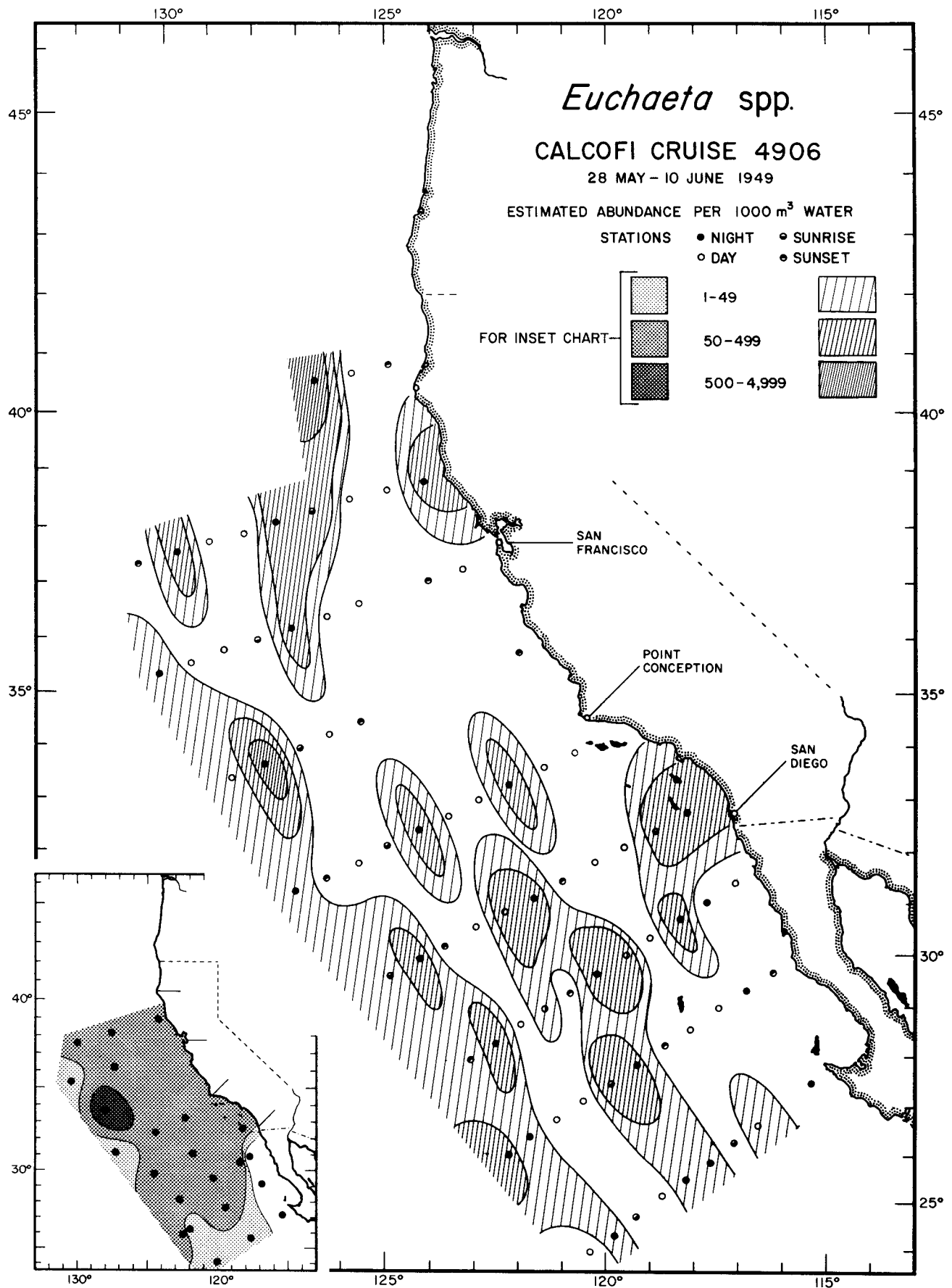
4910



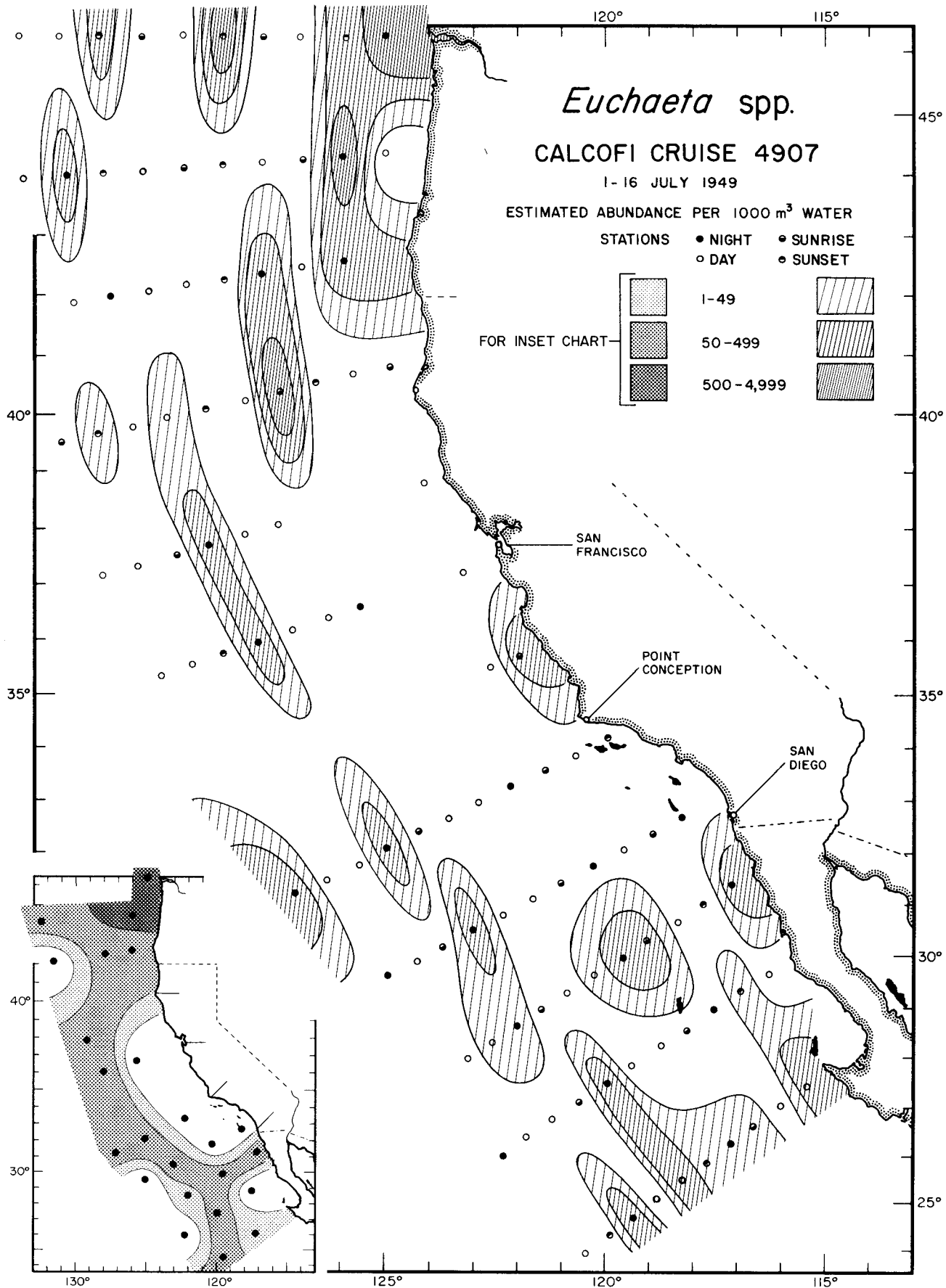
Calanoida
Eucalanus elongatus hyalinus
5002



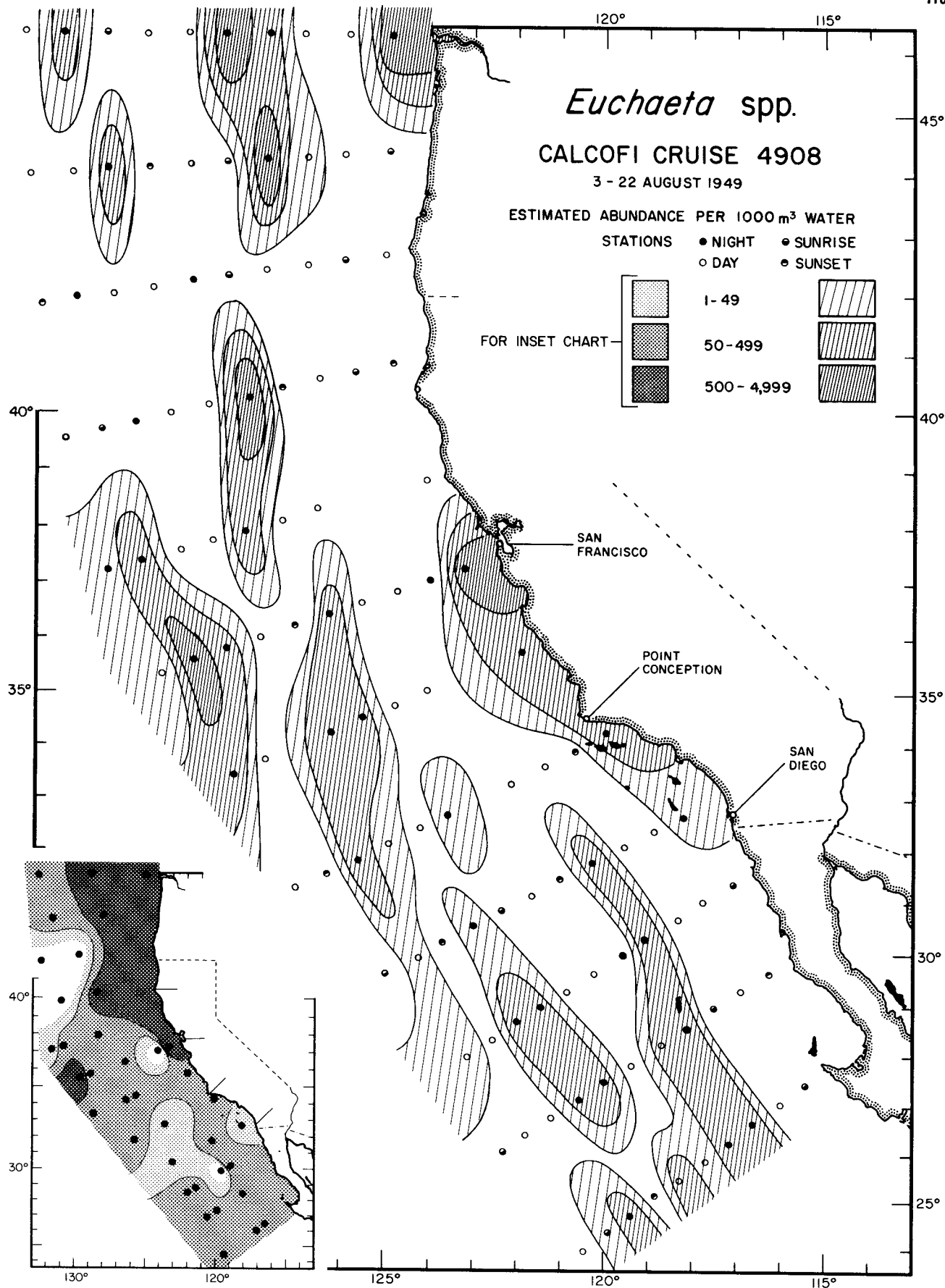
Calanoida
Euchaeta spp.
4905



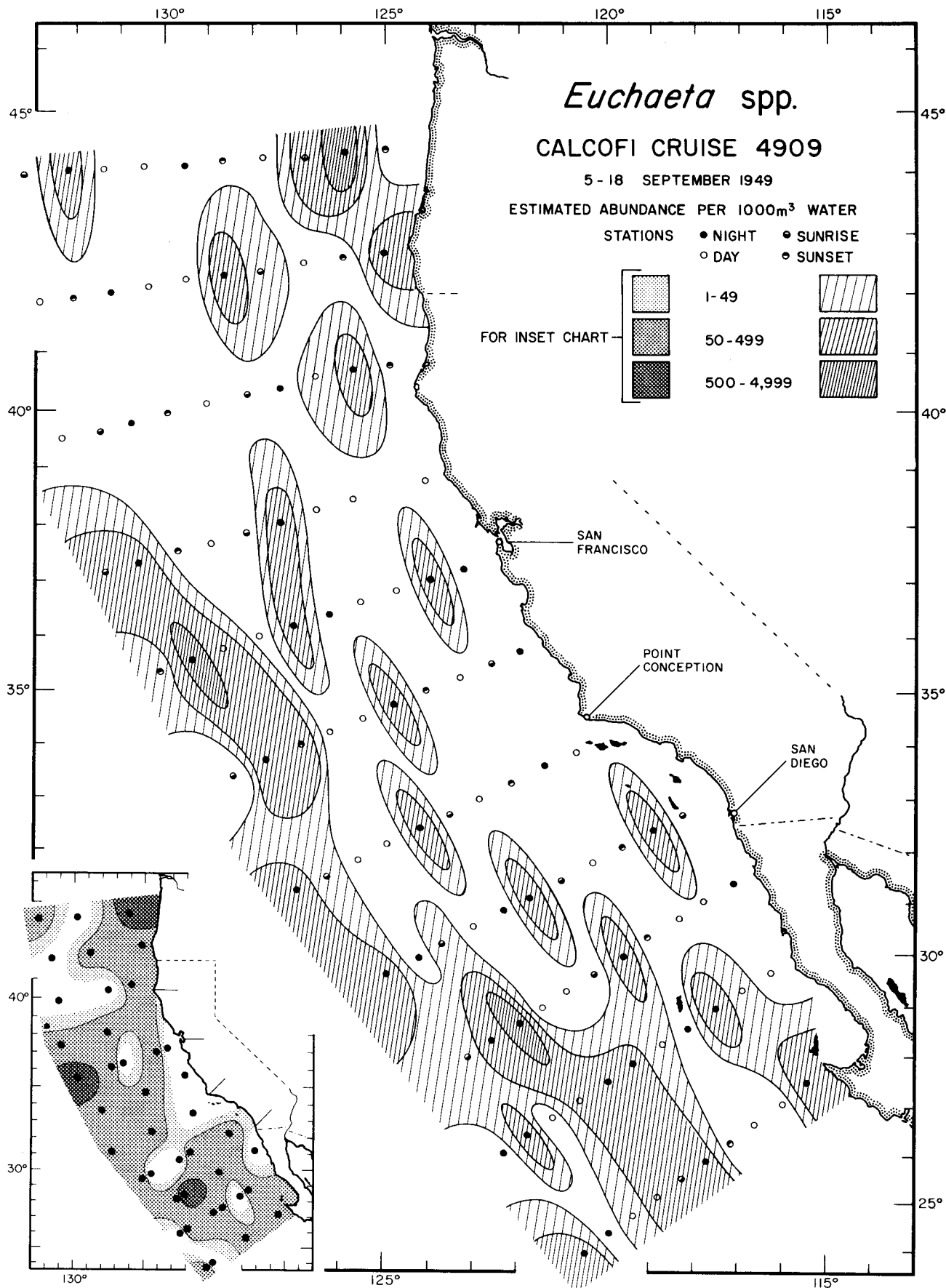
Calanoida
Euchaeta spp.
4906



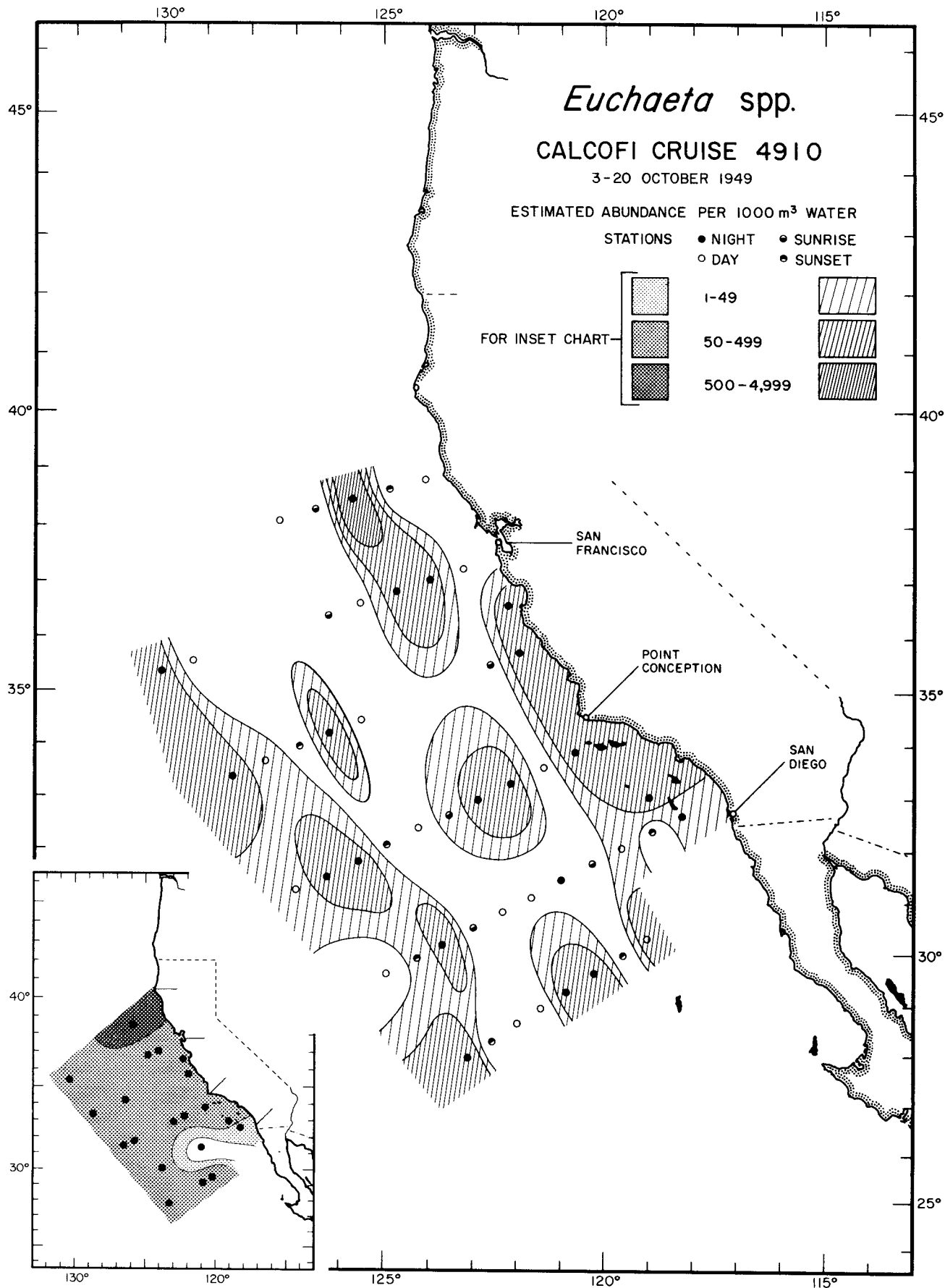
Calanoida
Euchaeta spp.
 4907



Calanoida
Euchaeta spp.
4908

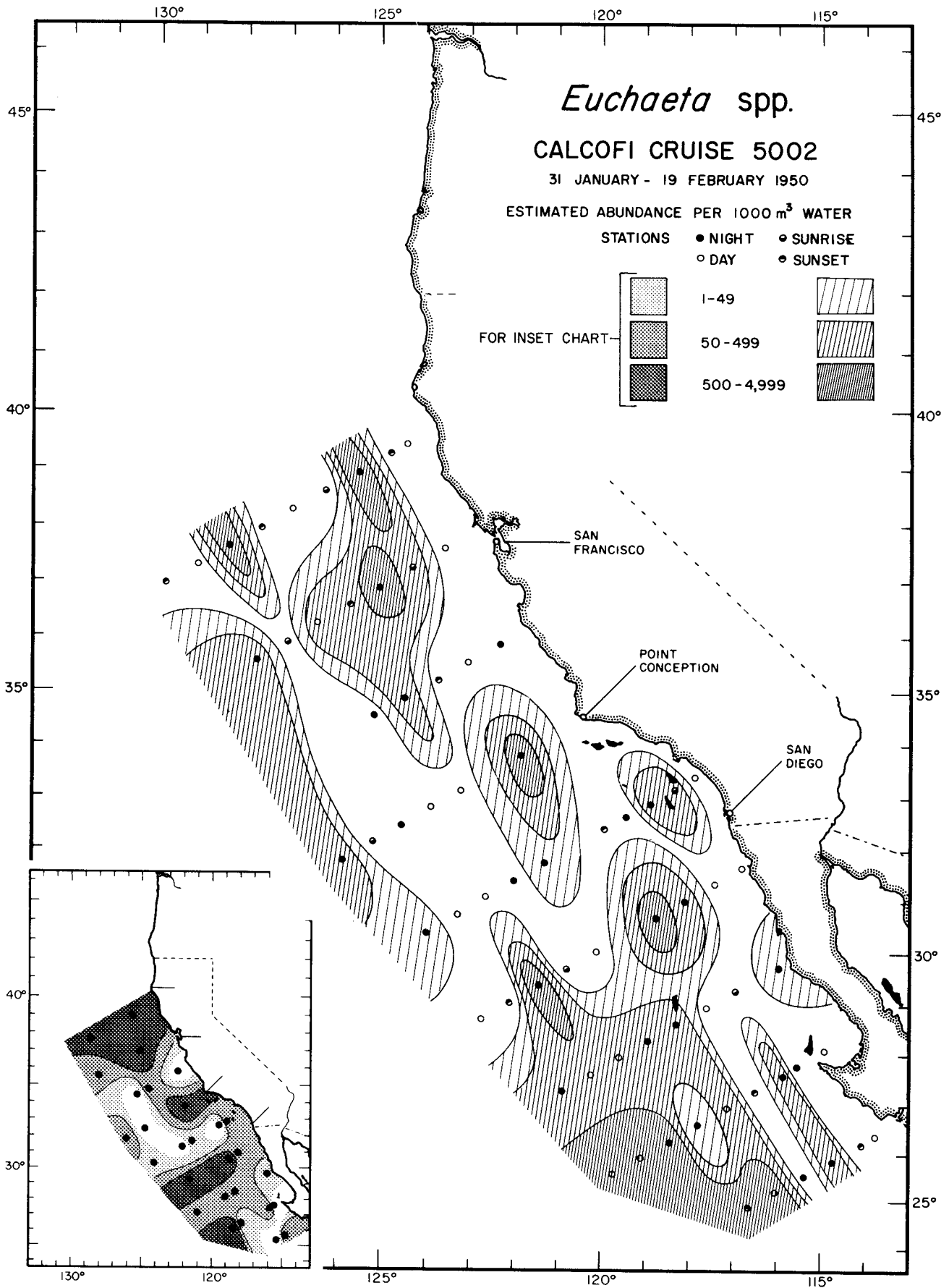


Calanoida
Euchaeta spp.
4909



Calanoida
Euchaeta spp.

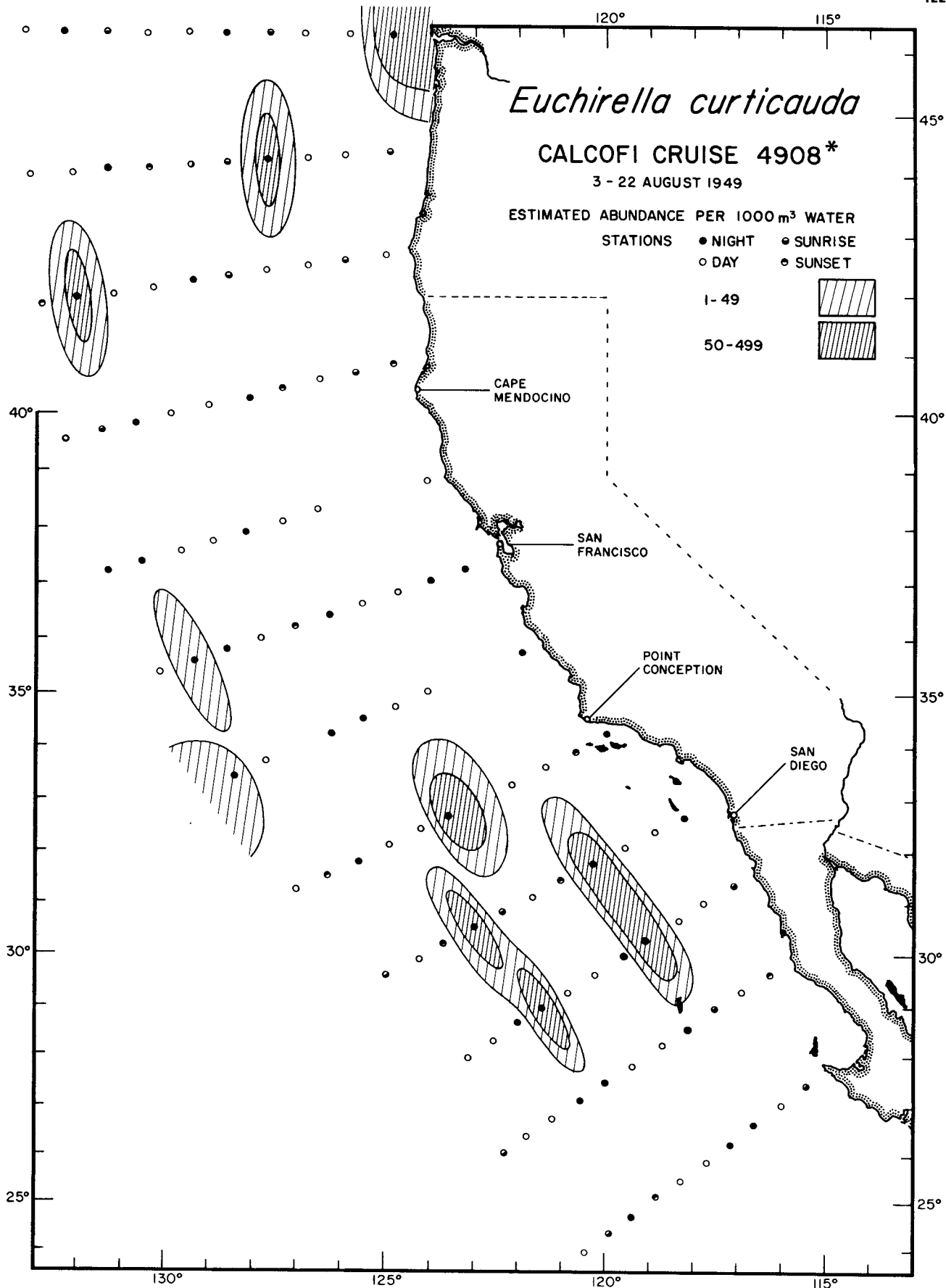
4910



Calanoida

Euchaeta spp.

5002

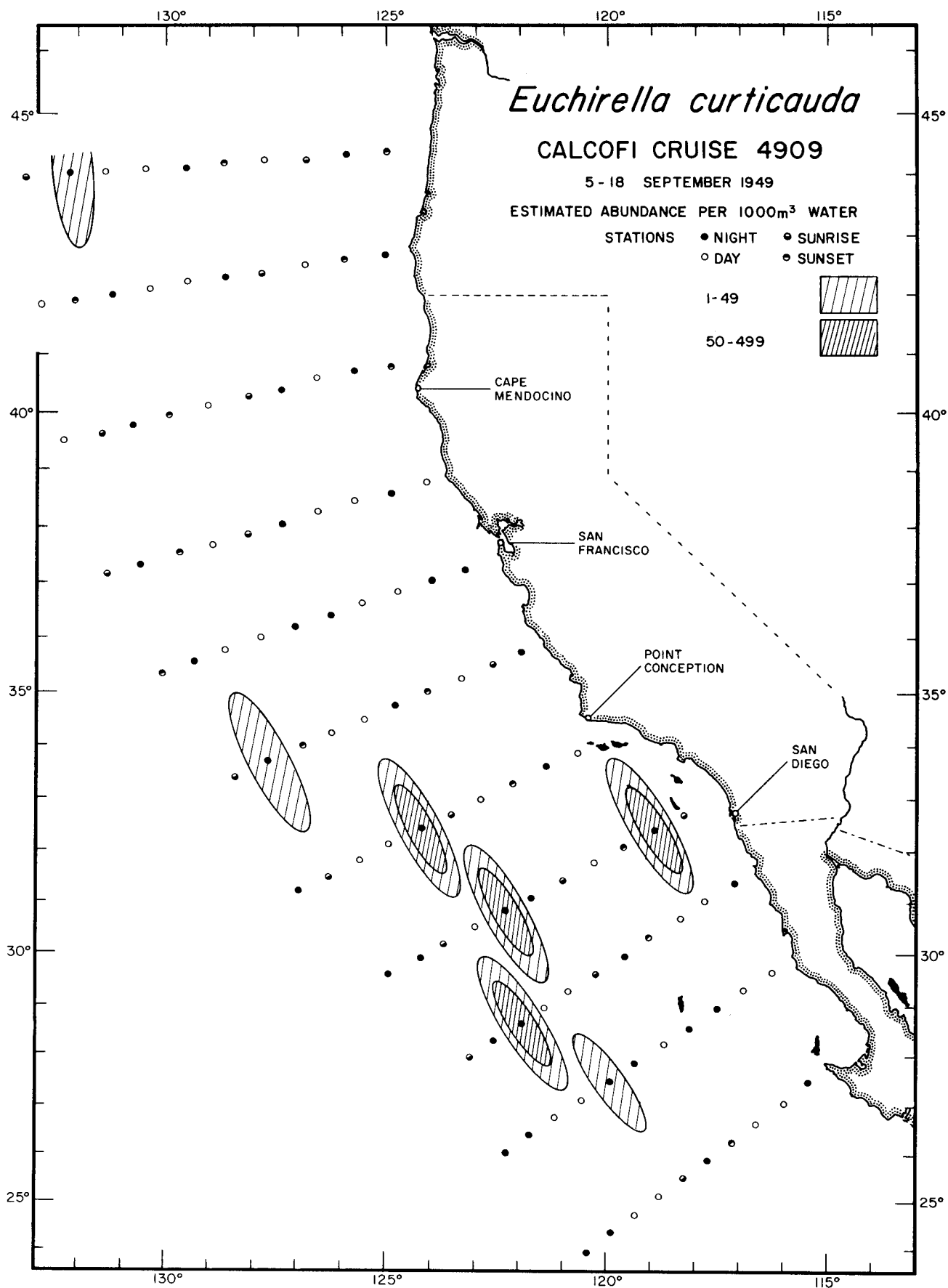


* See Table 1 for cruises 4905, 6, 7

Calanoida

Euchirella curticauda

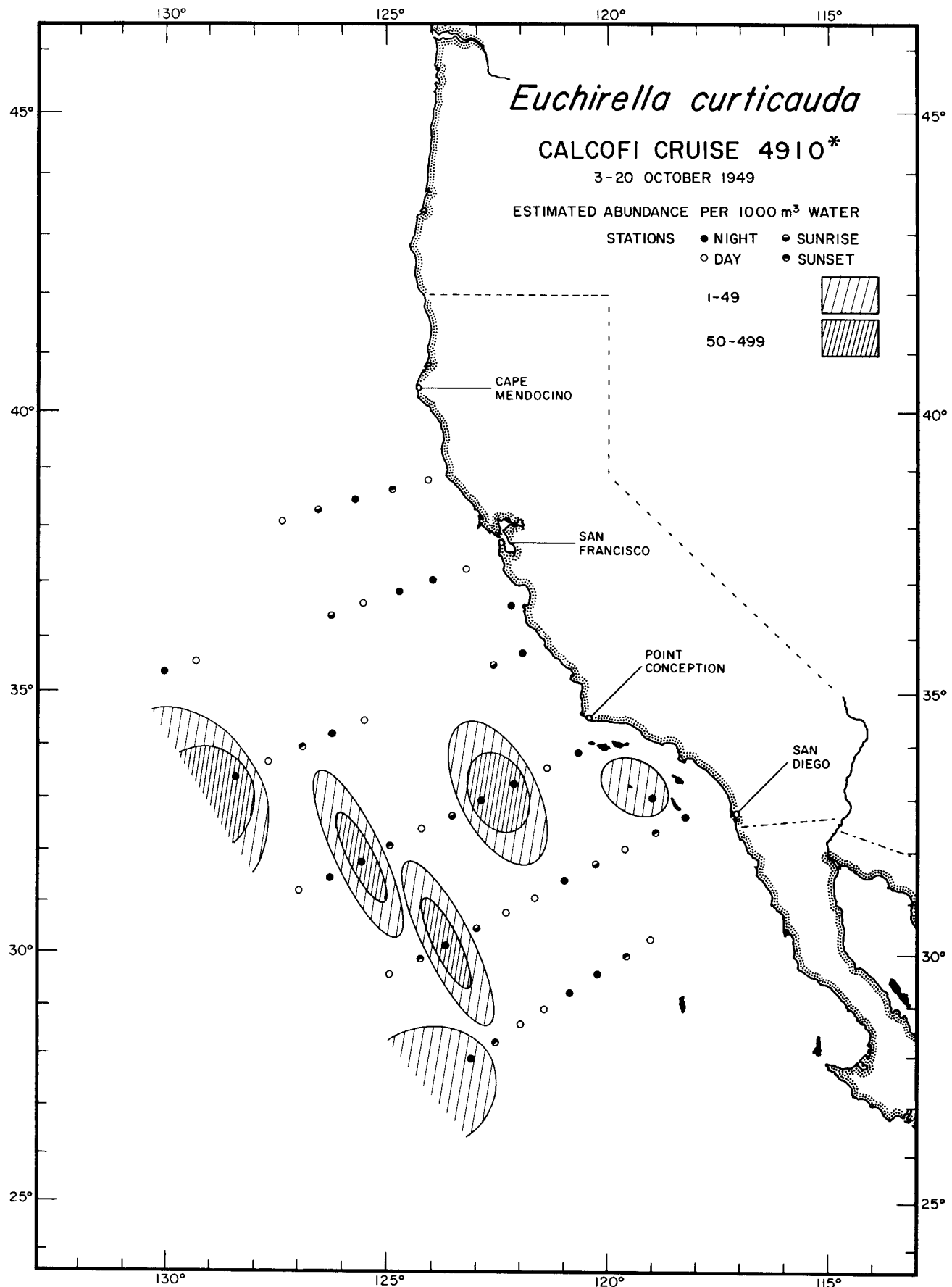
4908



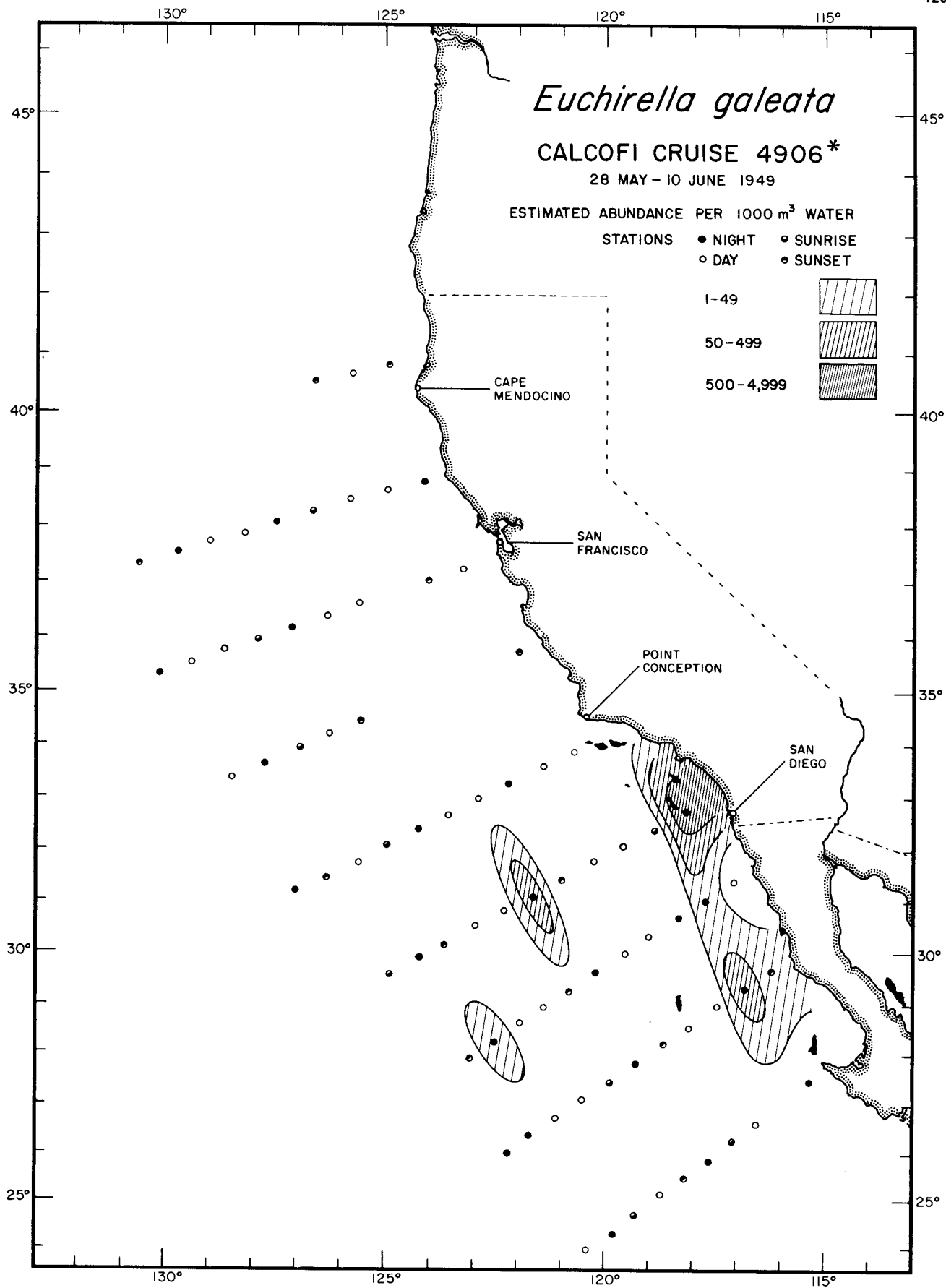
Calanoida

Euchirella curticauda

4909



* See Table 1 for cruise 5002

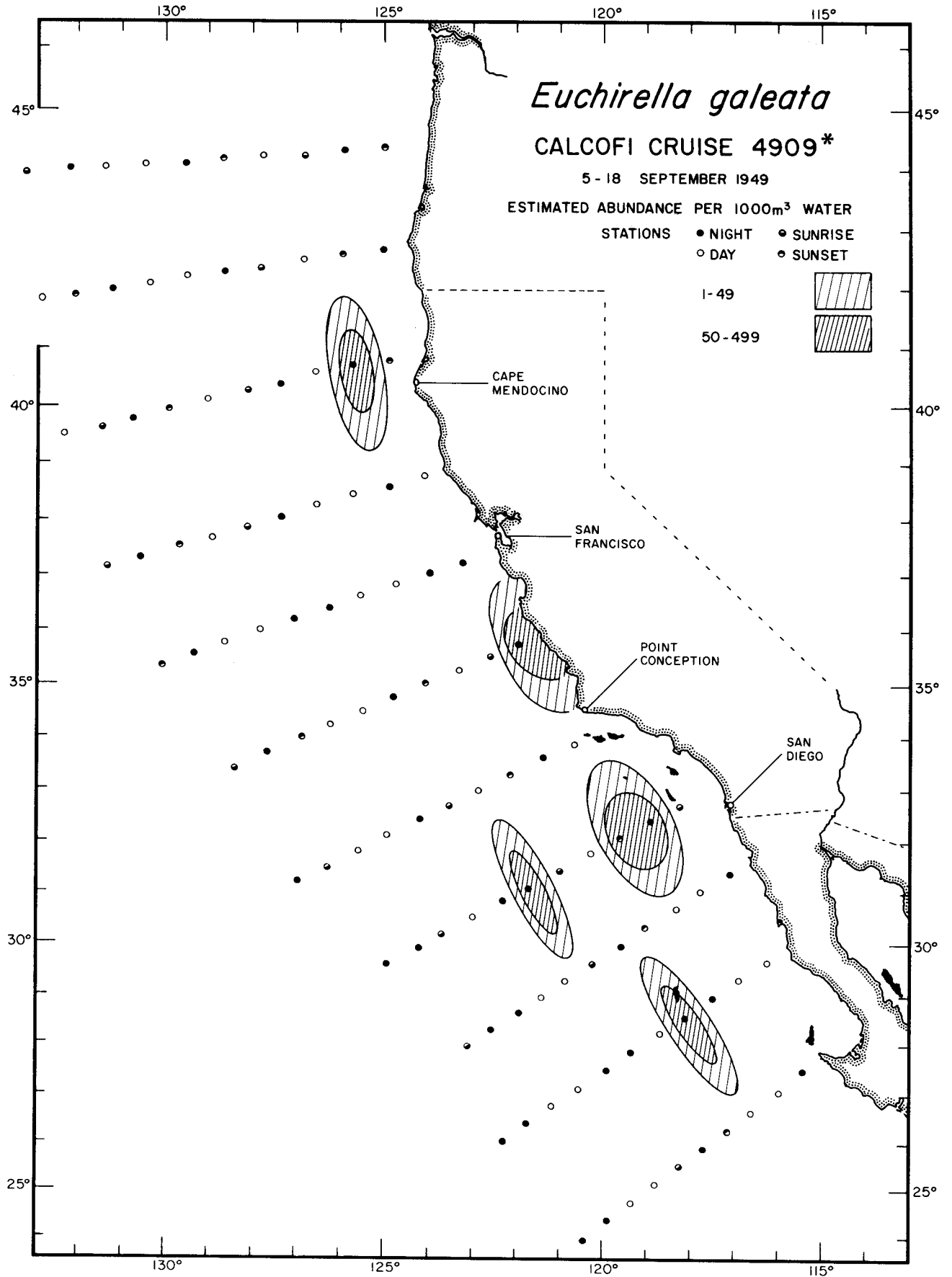


* See Table 1 for cruise 4905

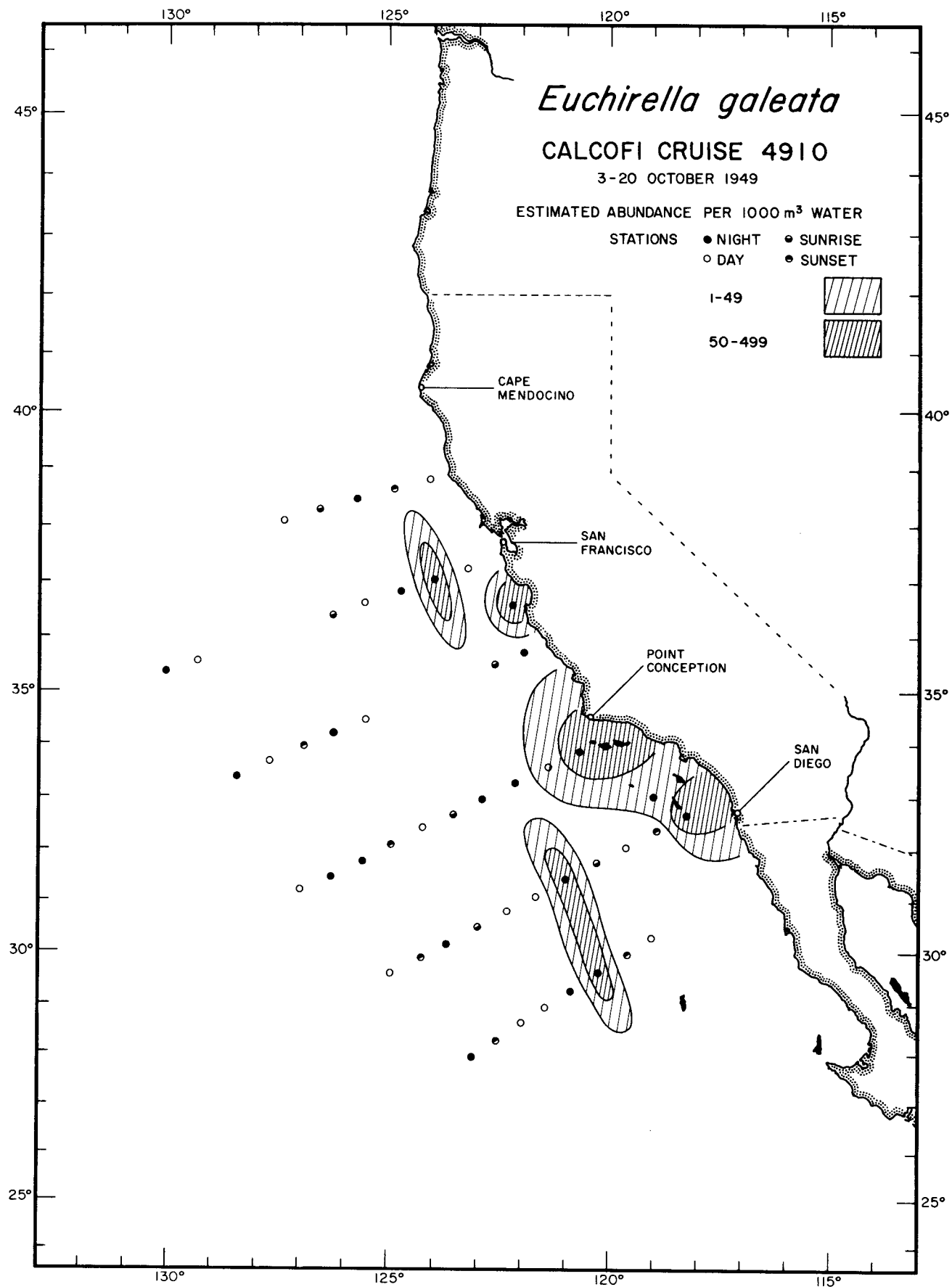
Calanoida

Euchirella galeata

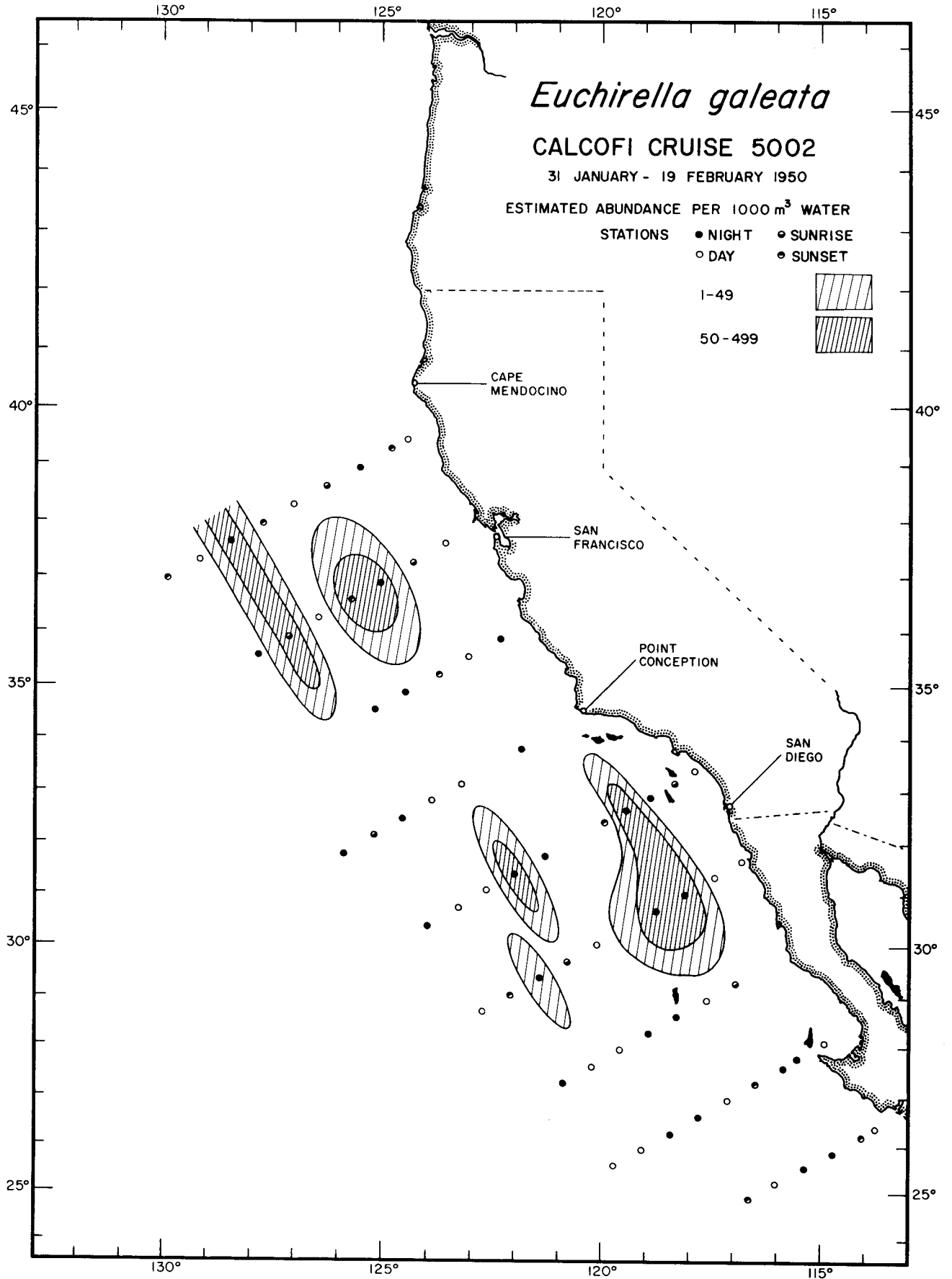
4906



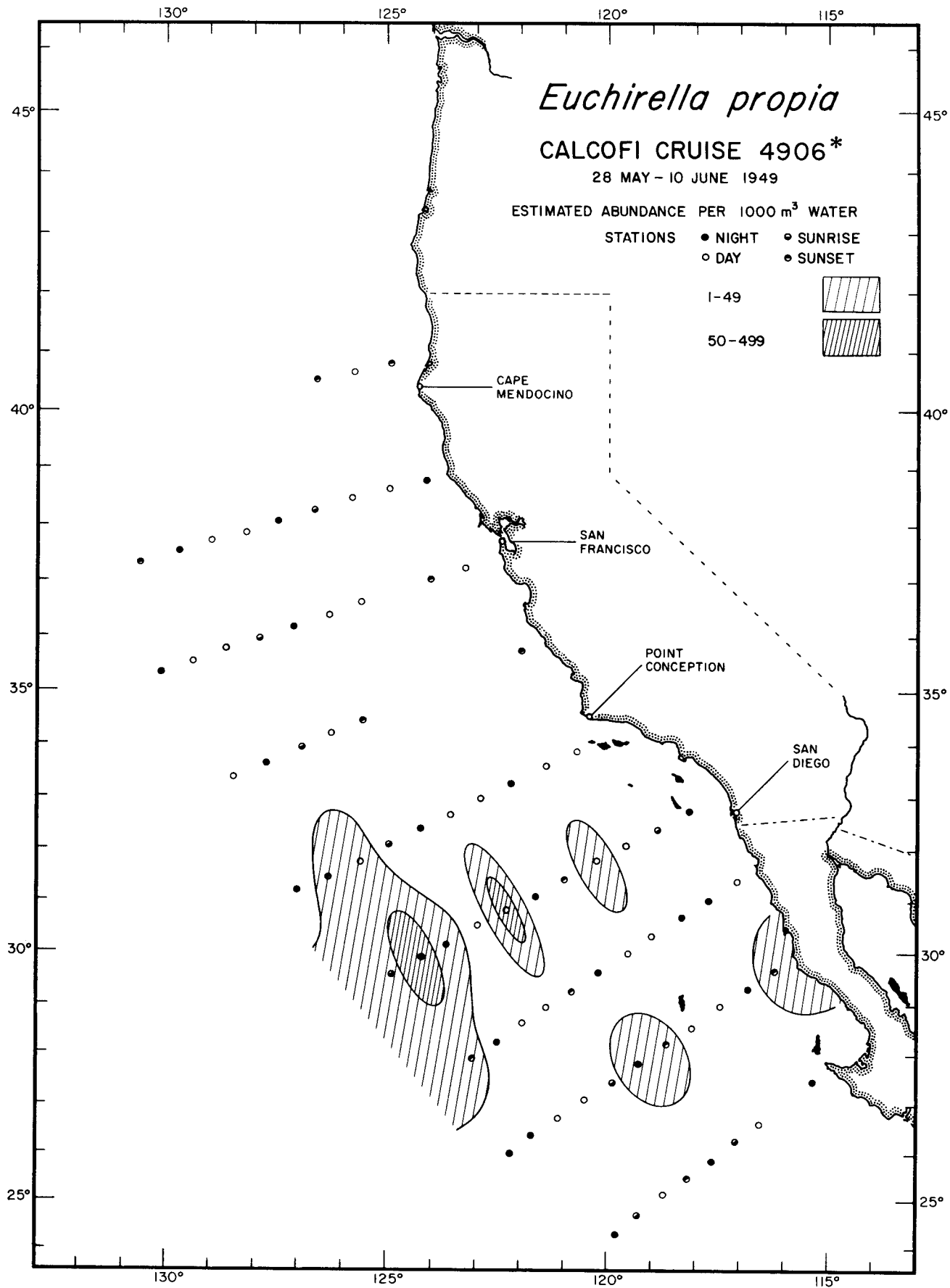
* See Table 1 for cruises 4907, 8



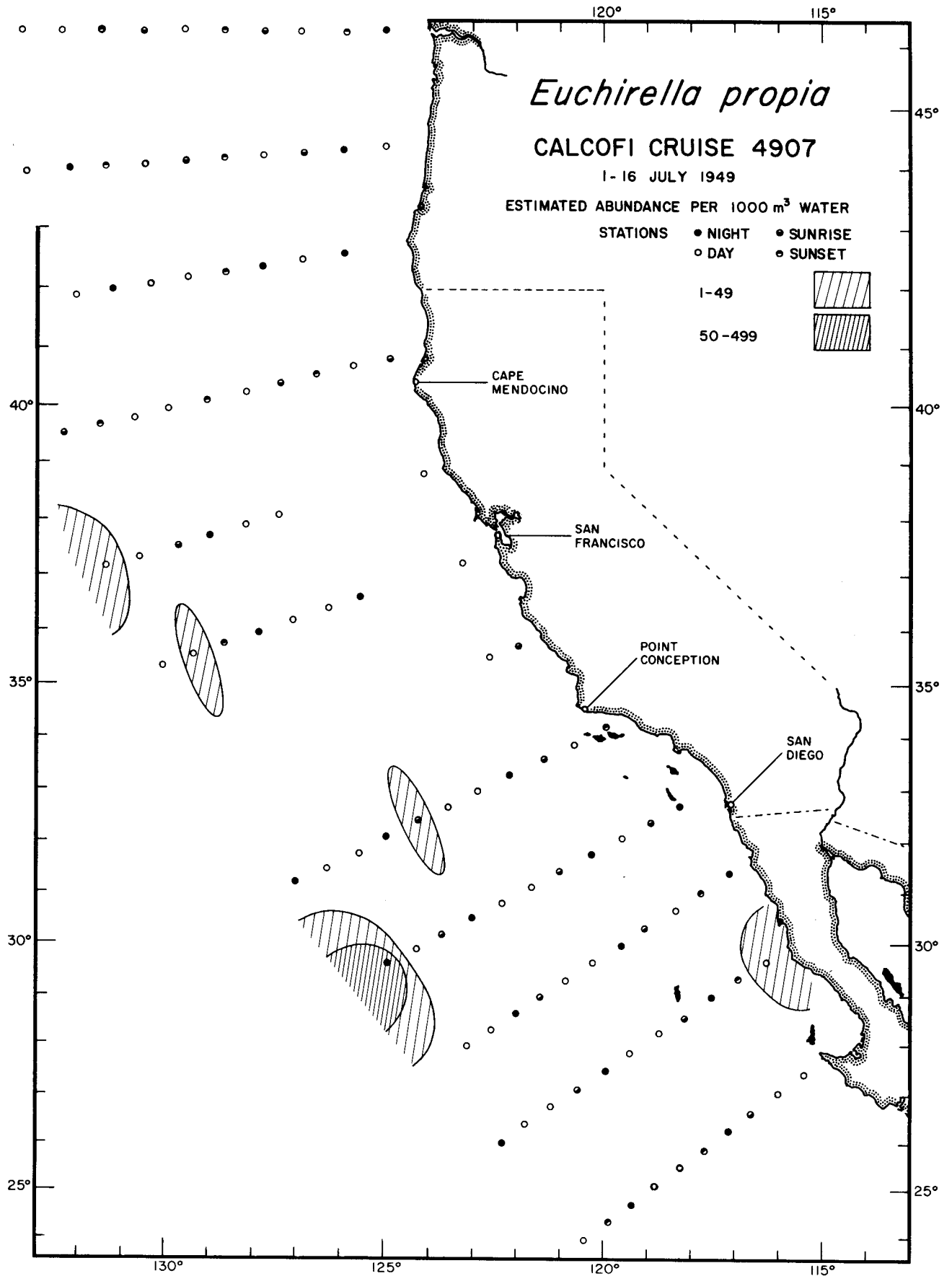
Calanoida
Euchirella galeata
4910



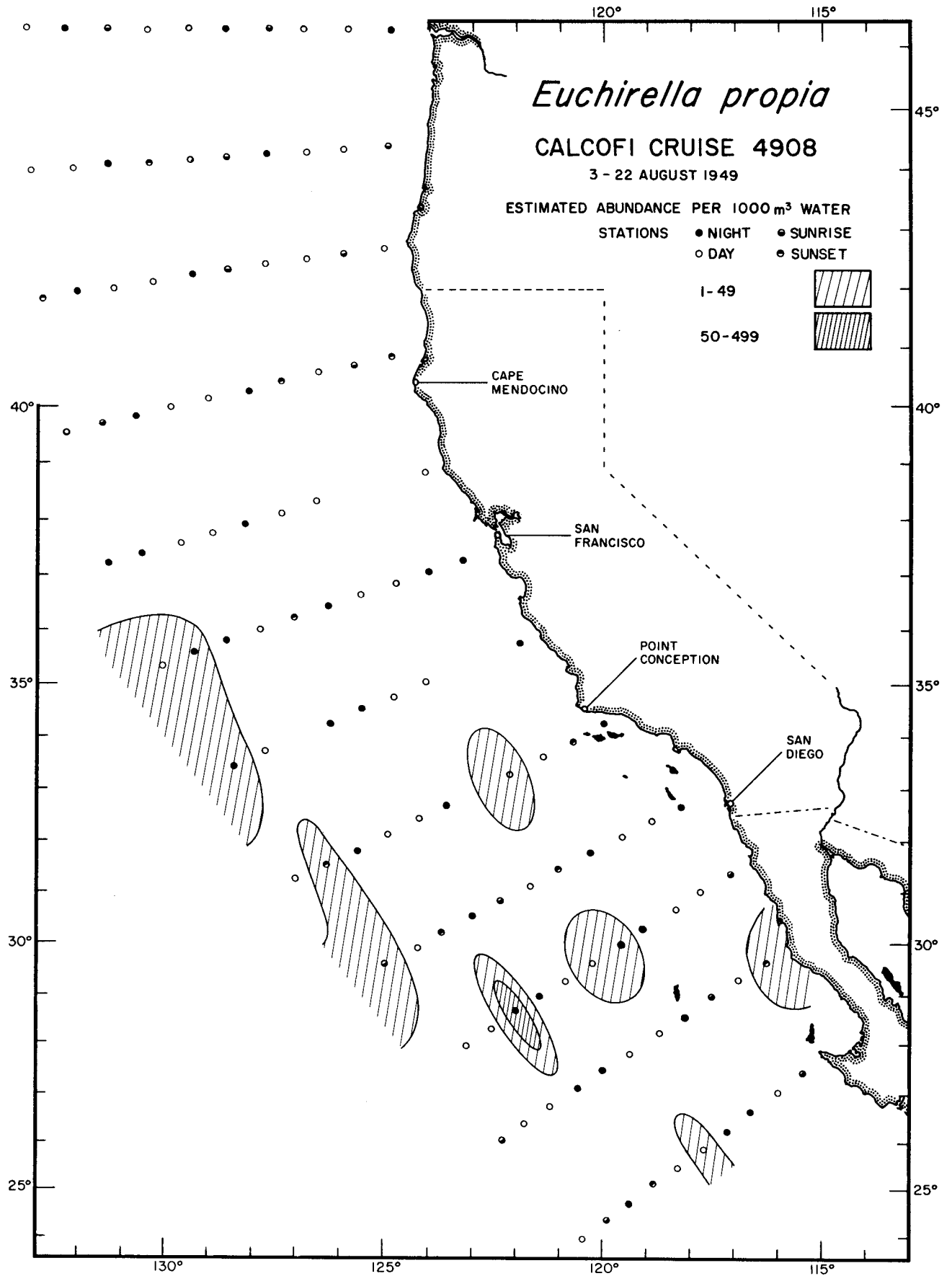
Calanoida
Euchirella galeata
5002



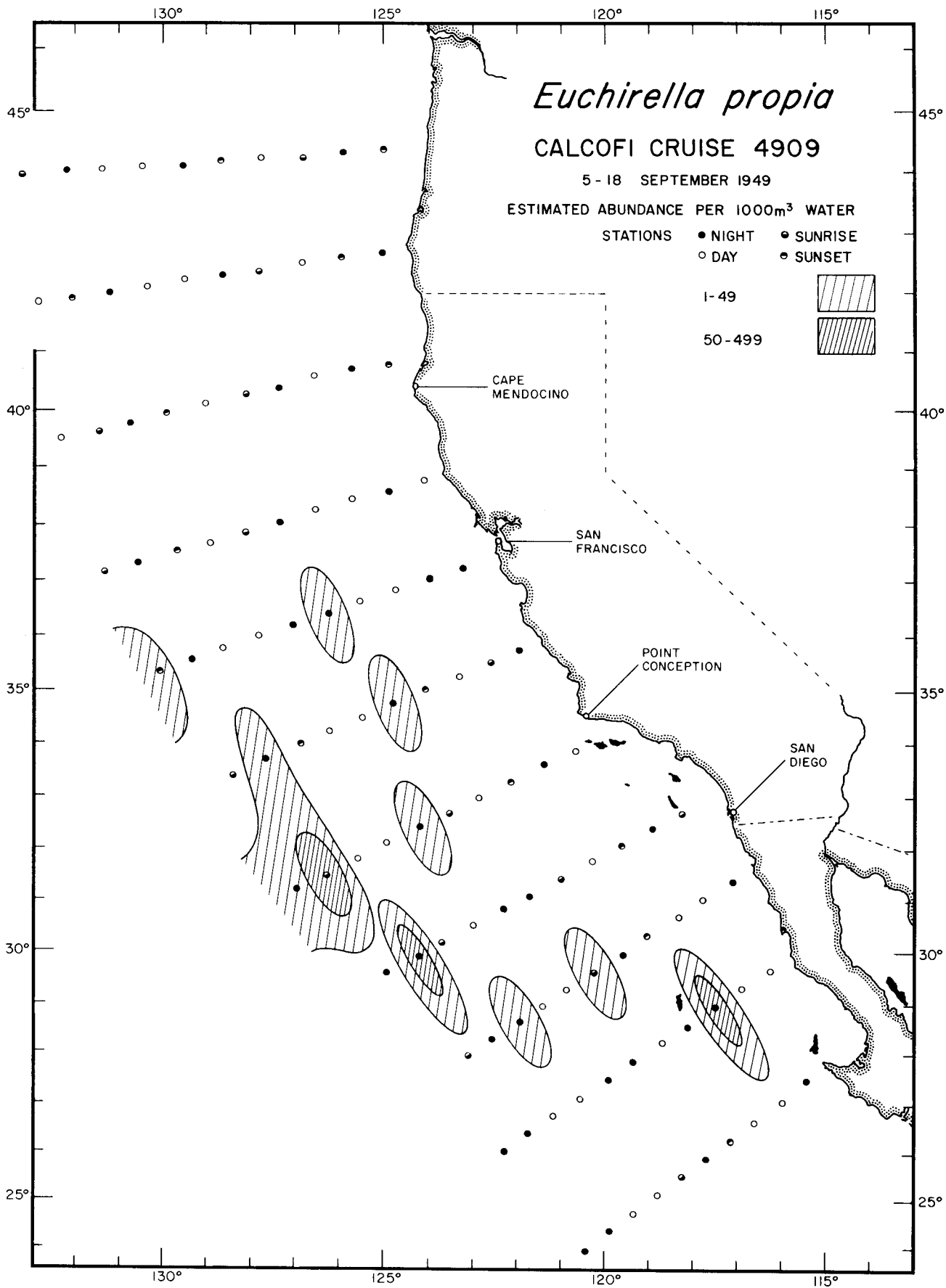
* See Table 1 for cruise 4905



Calanoida
Euchirella propia
4907



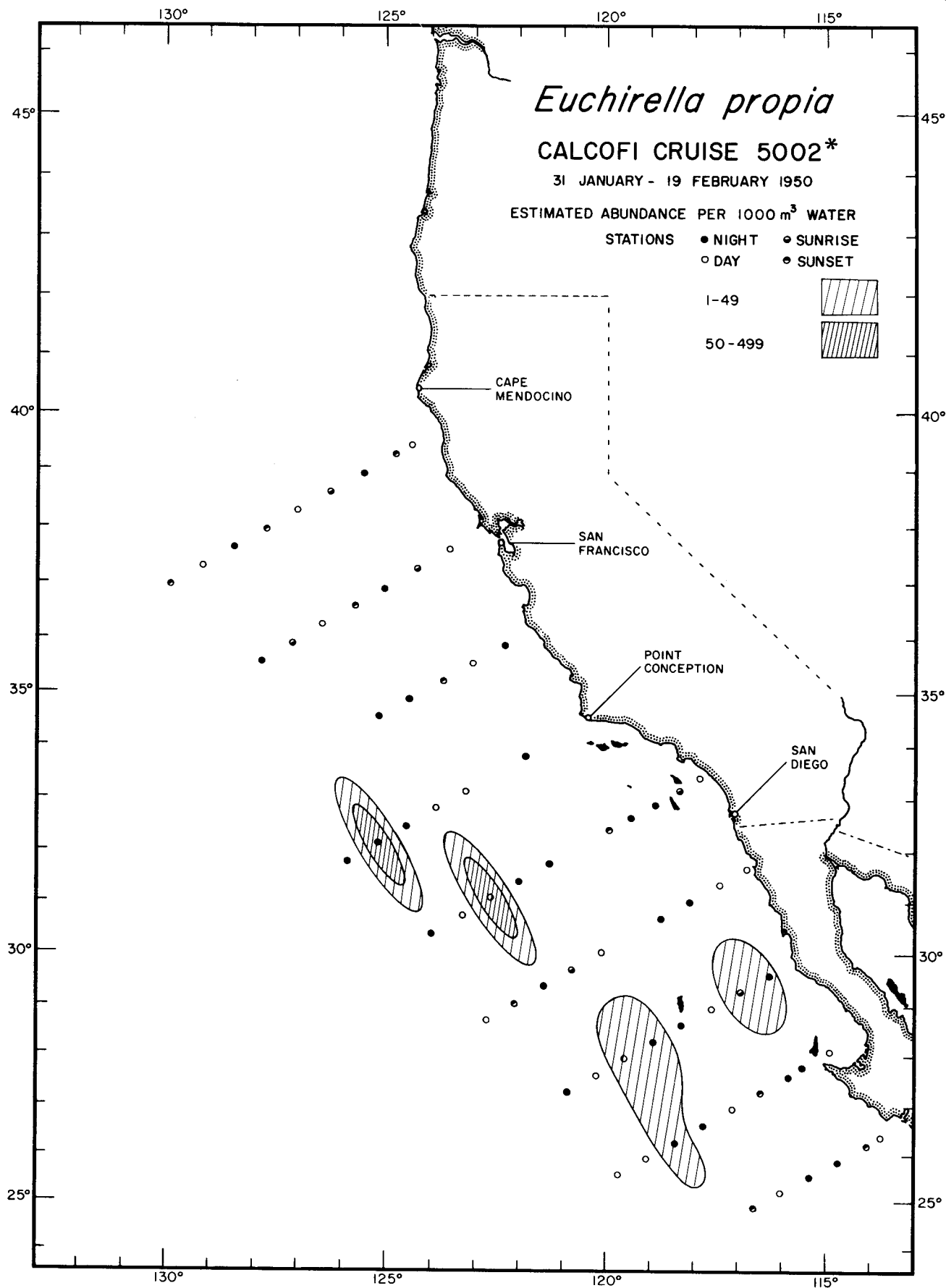
Calanoida
Euchirella propia
4908



Calanoida

Euchirella propia

4909

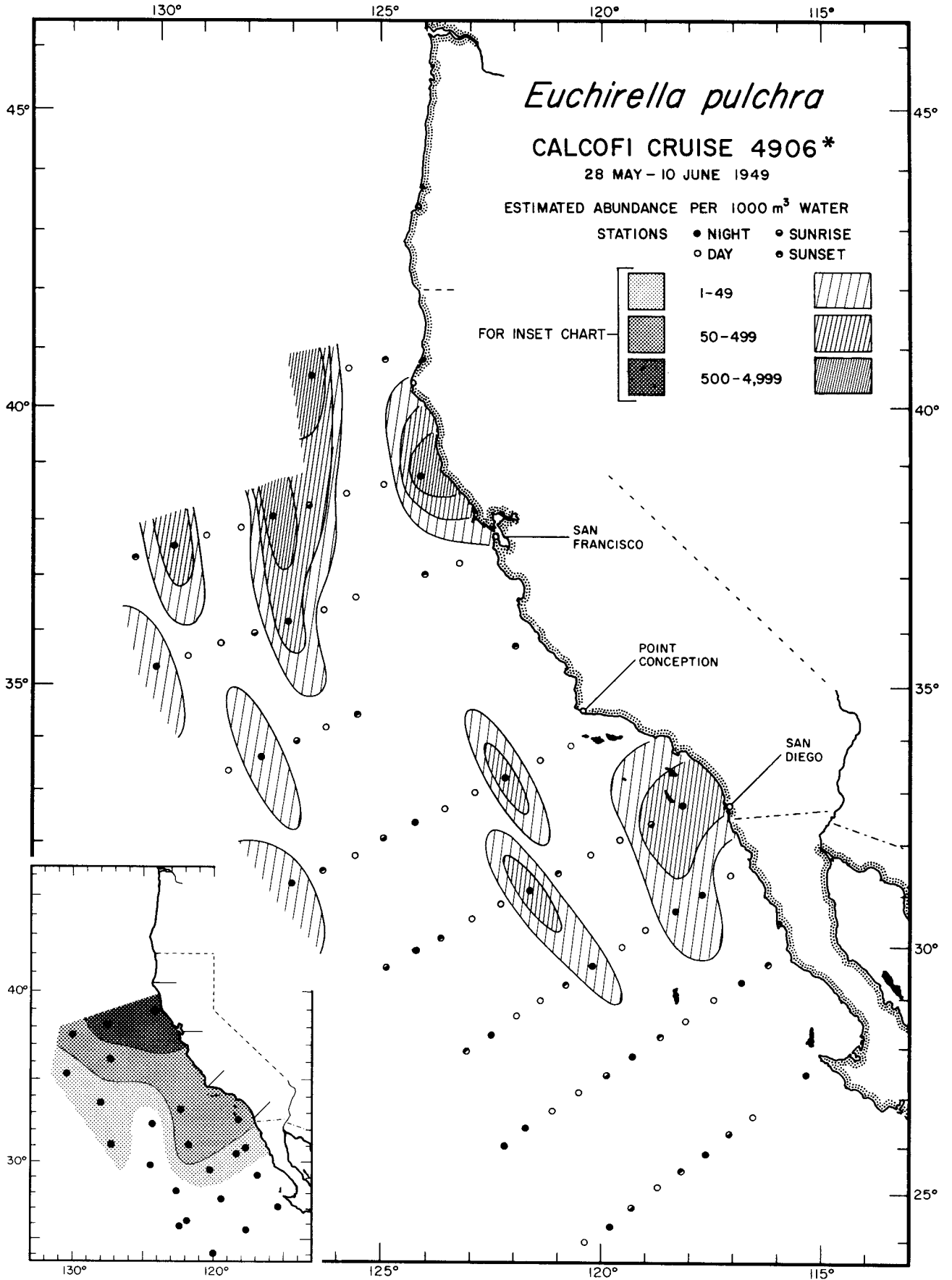


* See Table 1 for cruise 4910

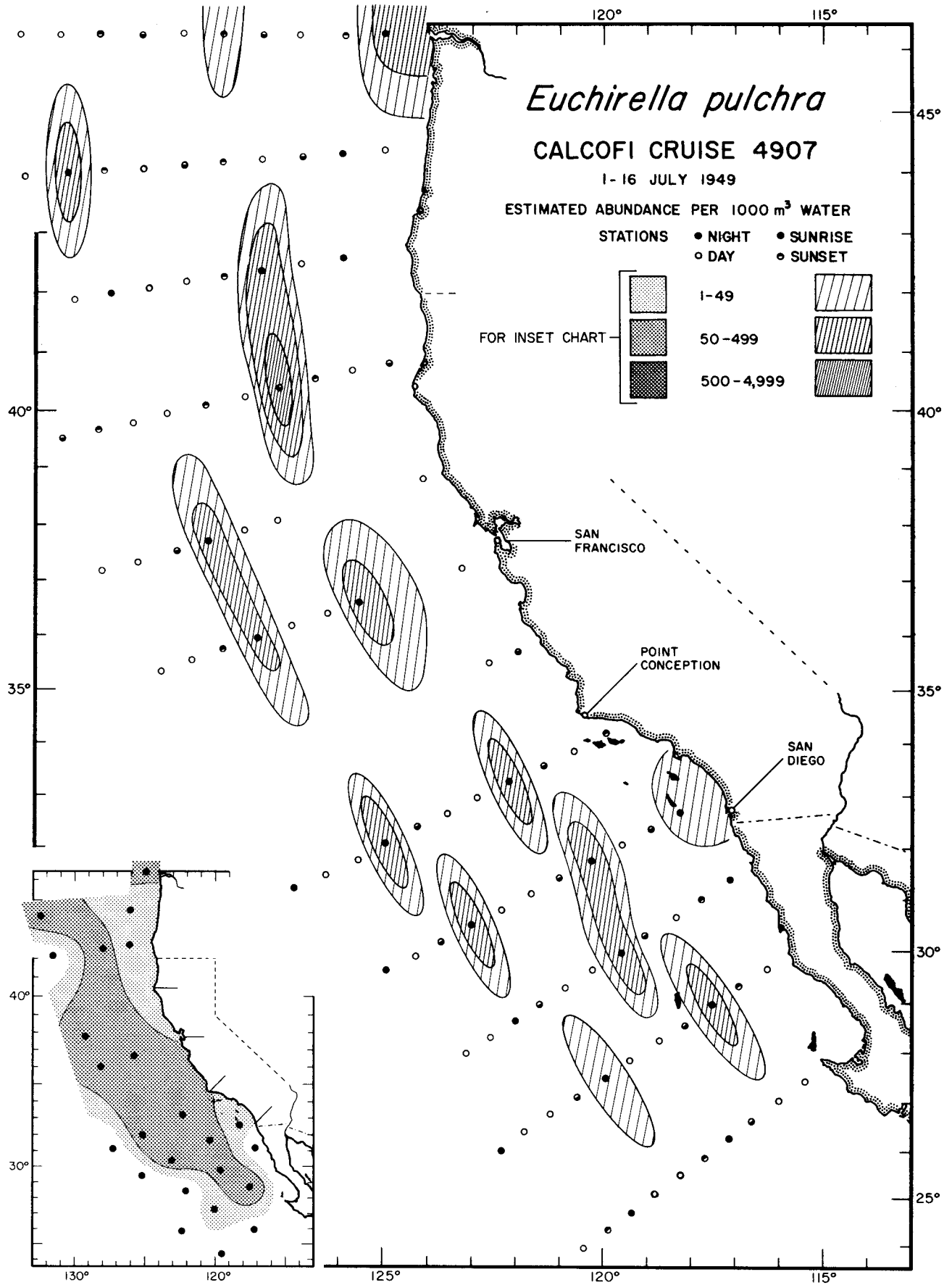
Calanoida

Euchirella propia

5002

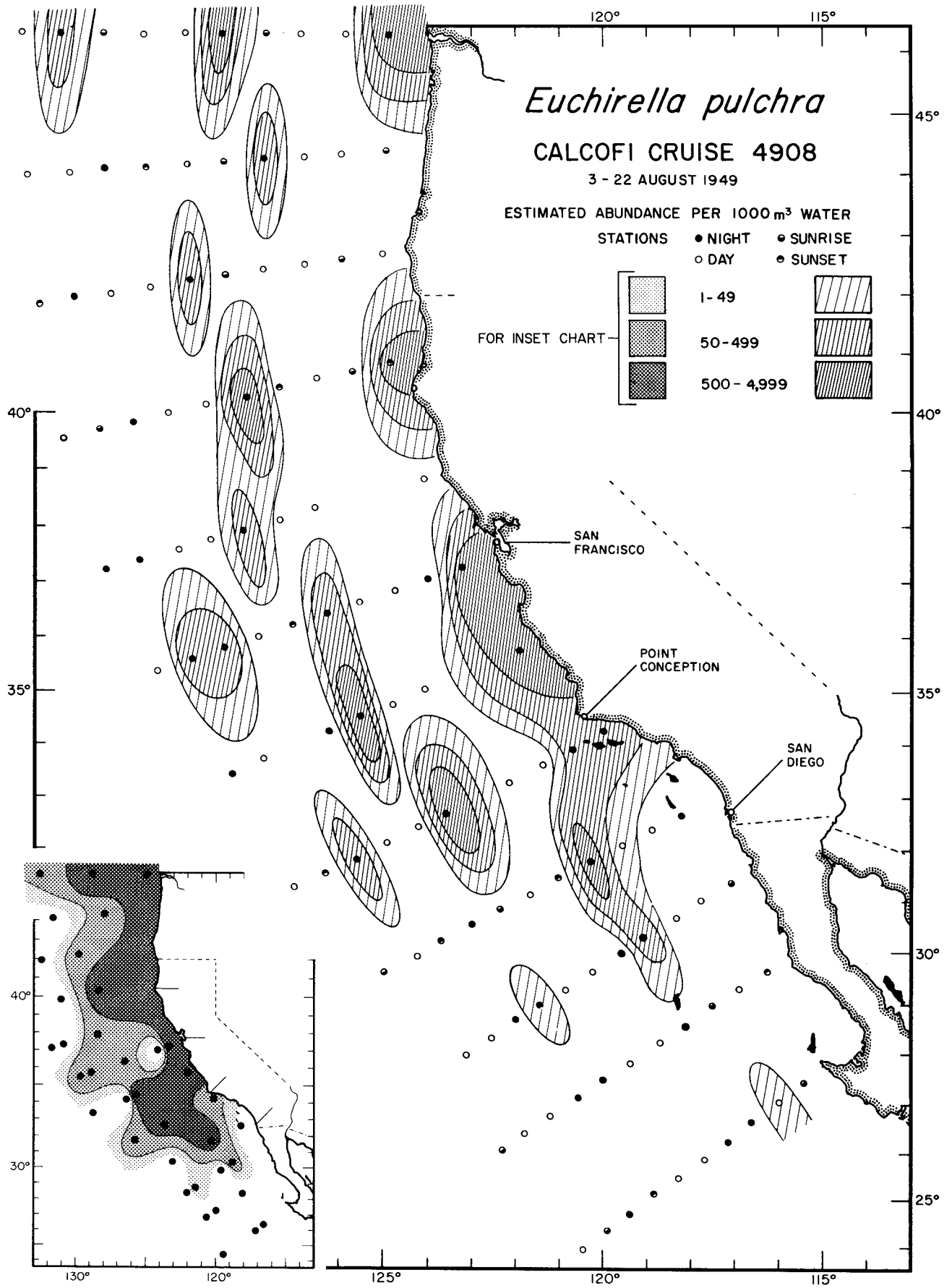


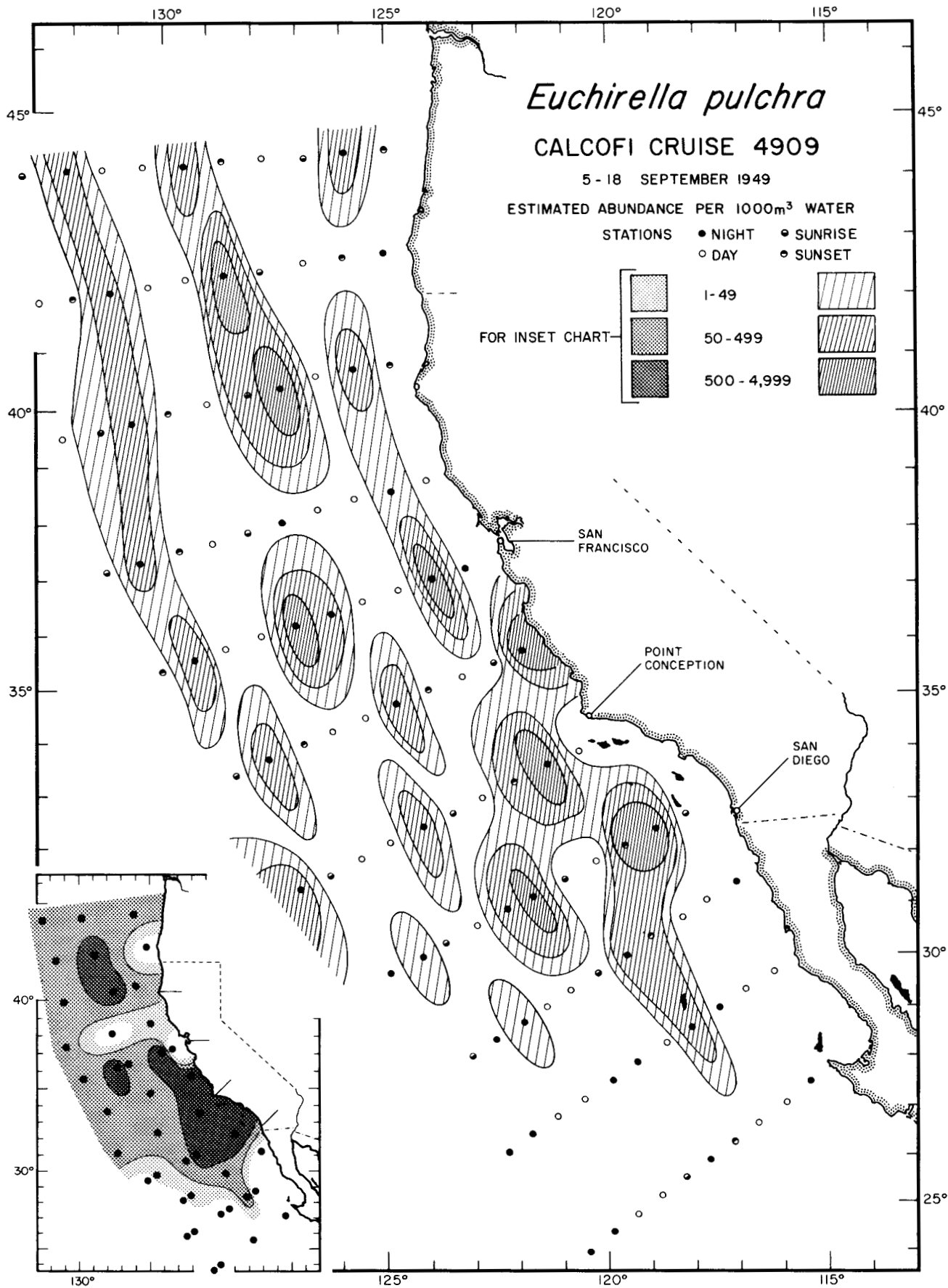
* See Table 1 for cruise 4905

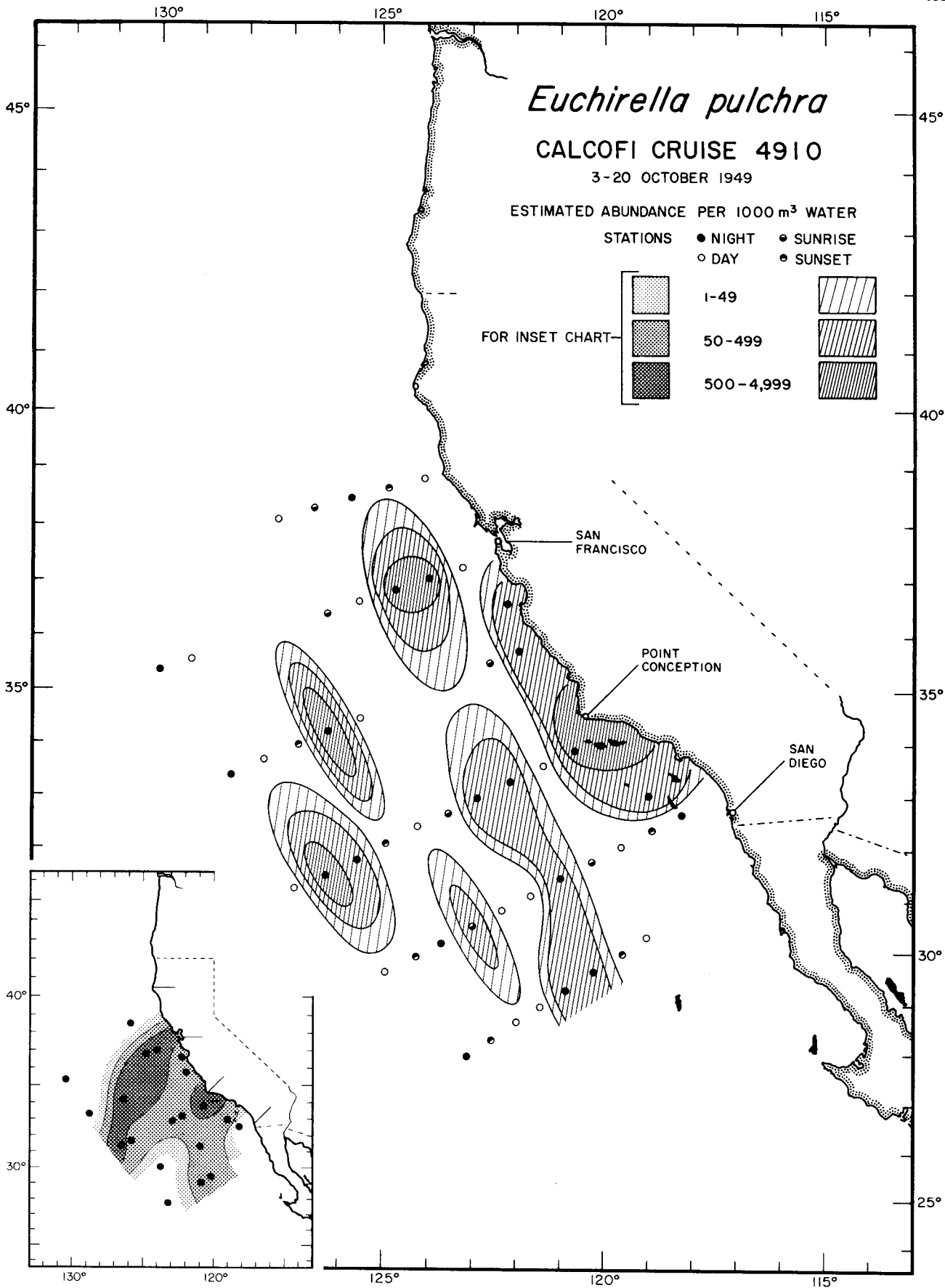


Calanoida
Euchirella pulchra

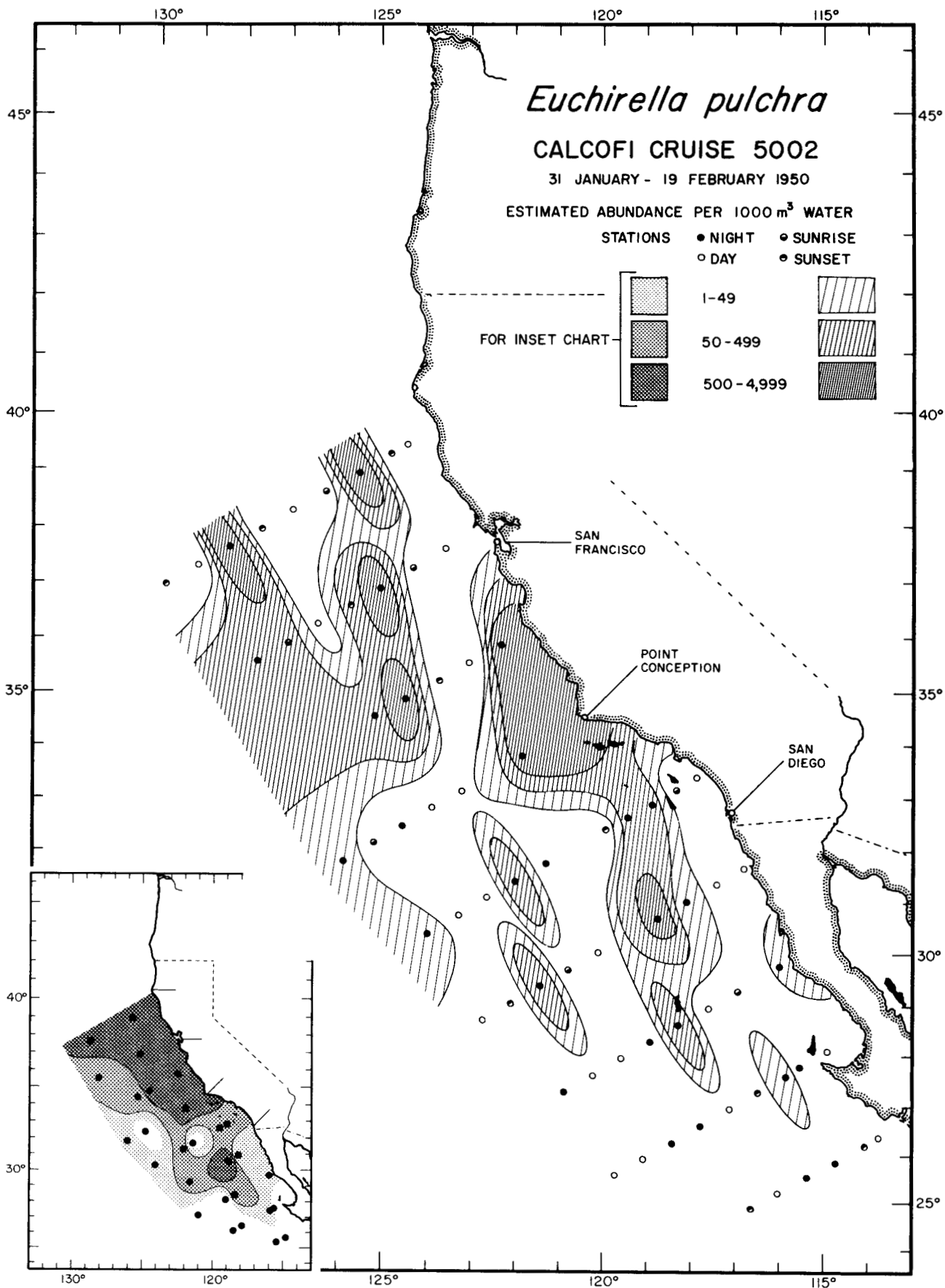
4907



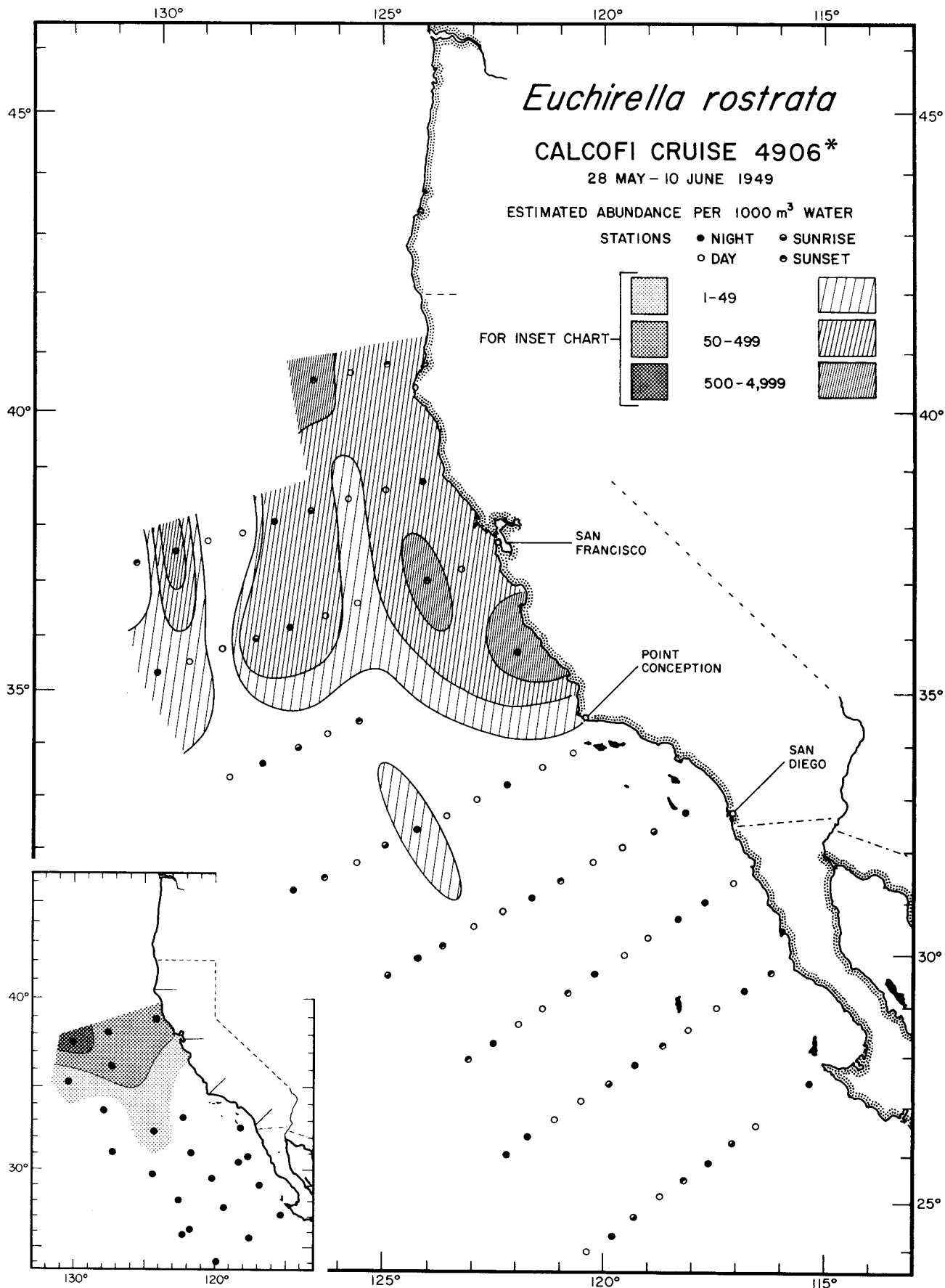




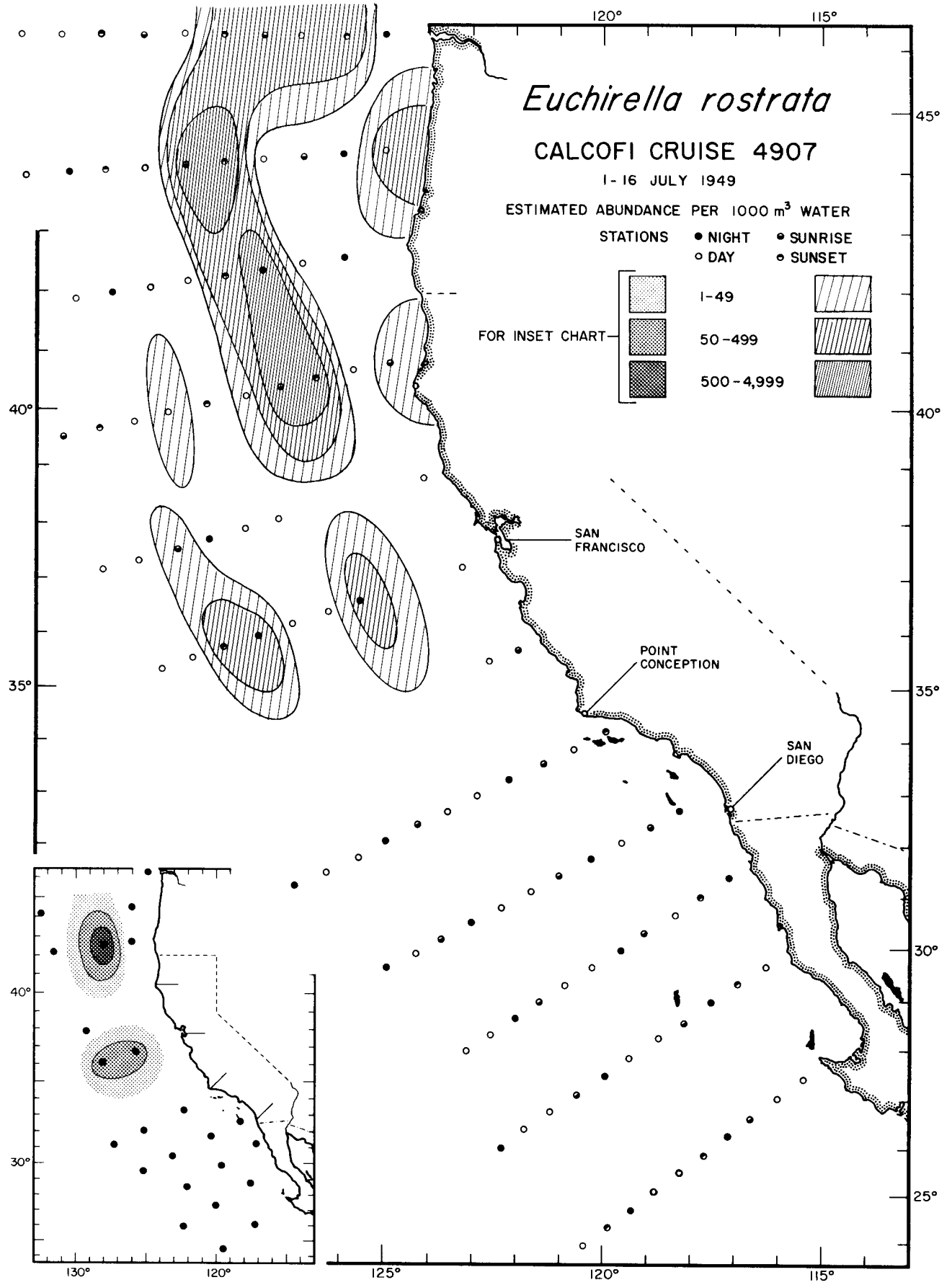
Calanoida
Euchirella pulchra
4910



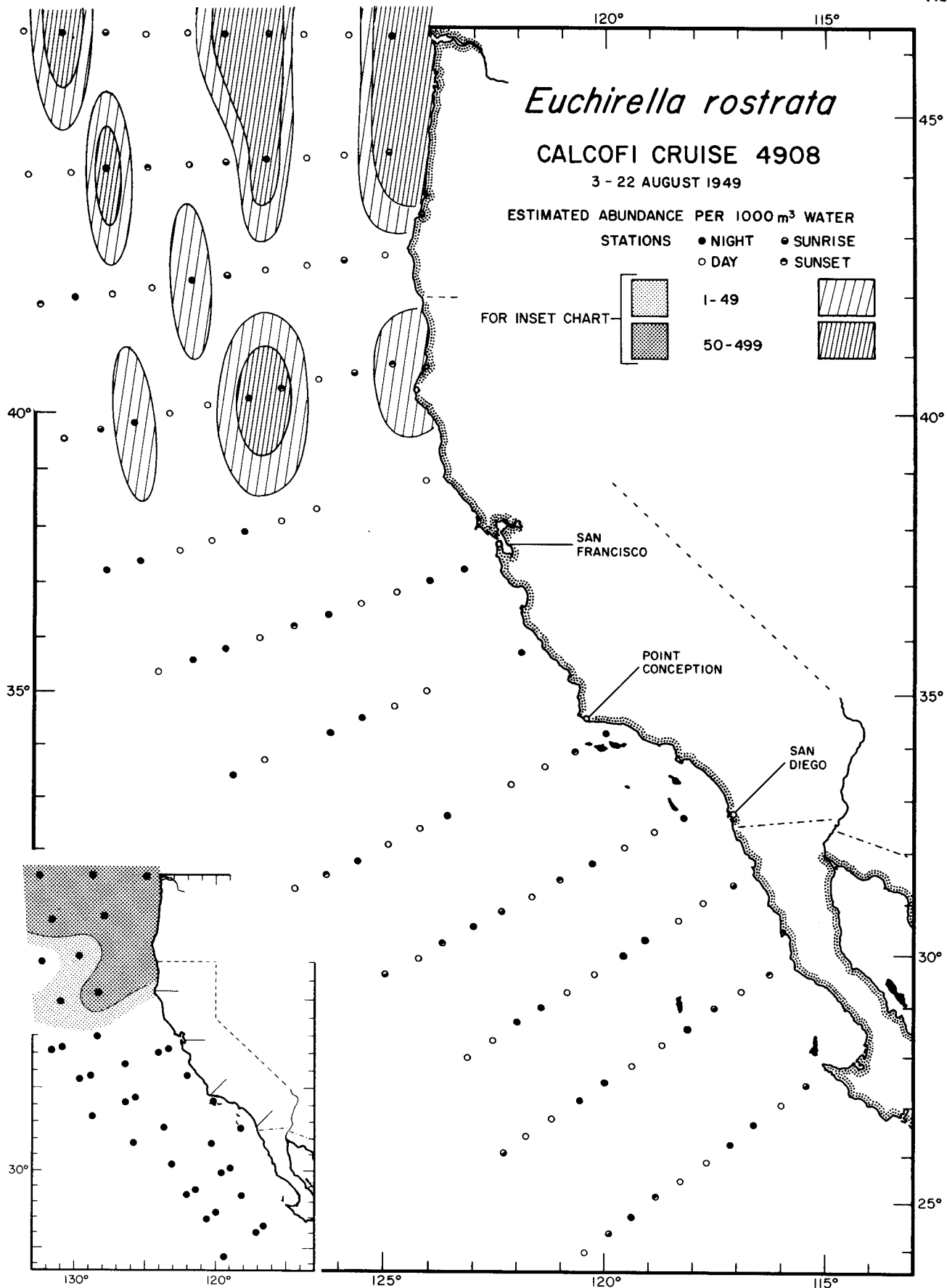
Calanoida
Euchirella pulchra
 5002



* See Table 1 for cruise 4905



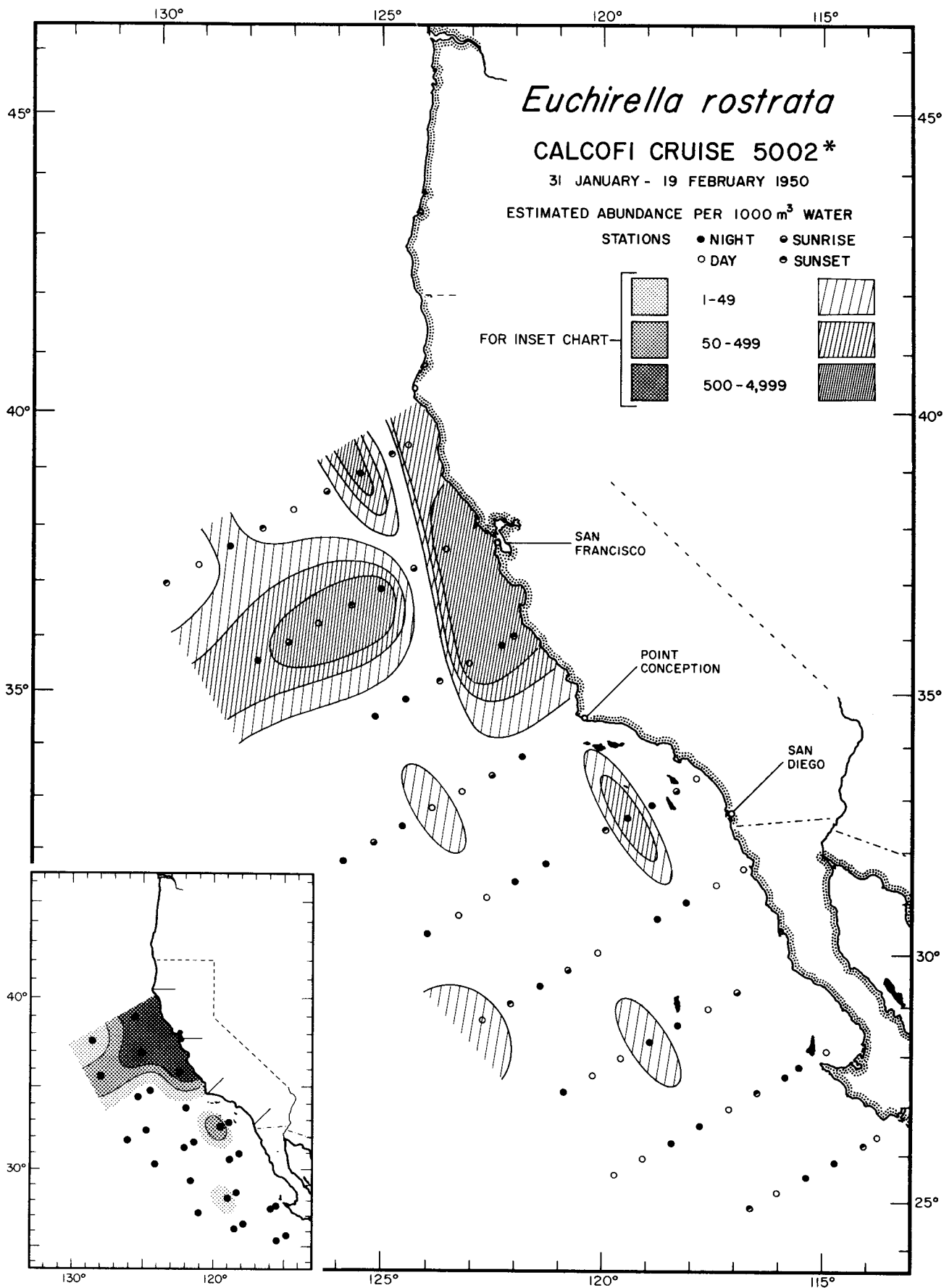
Calanoida
Euchirella rostrata
4907



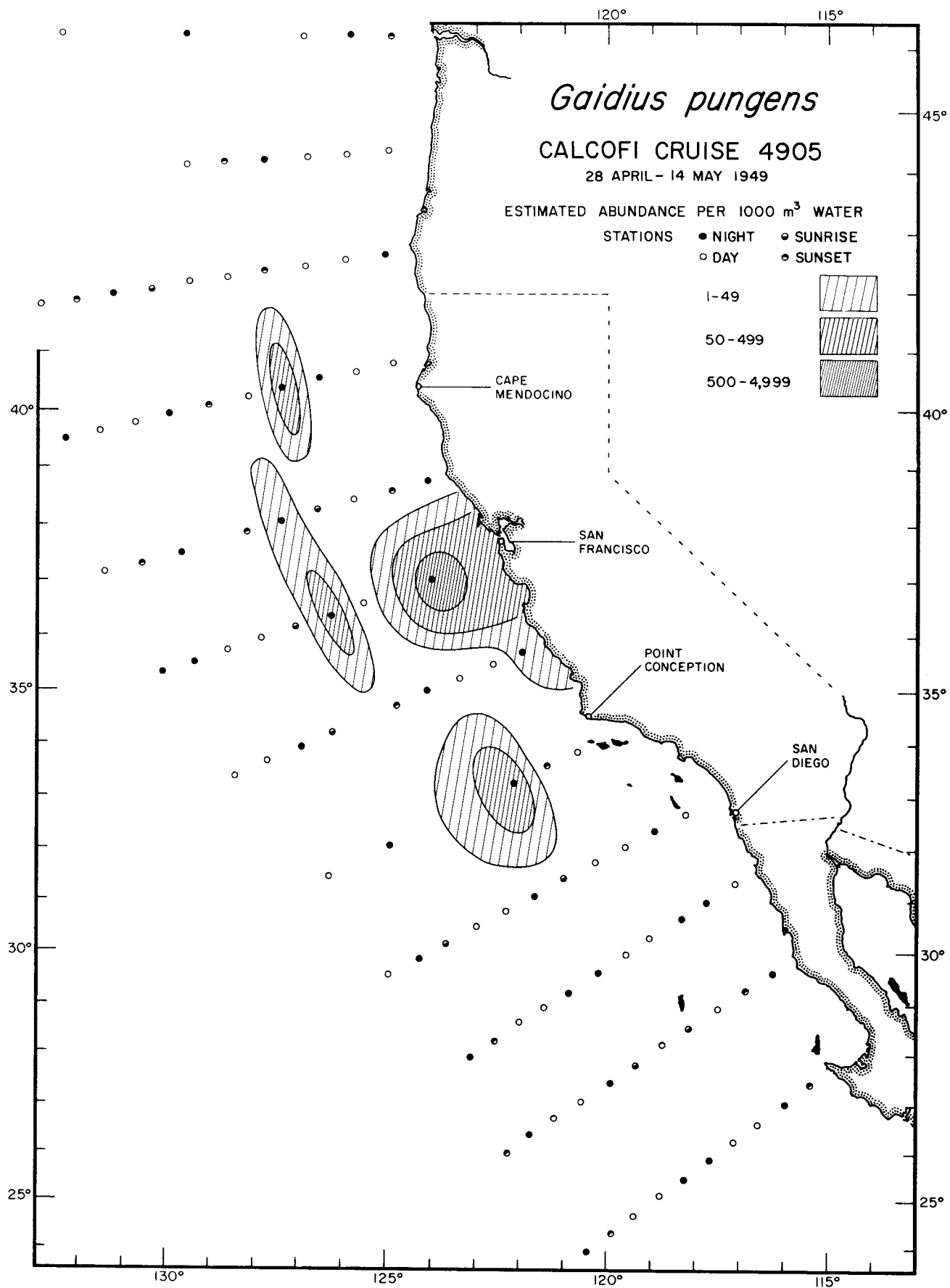
Calanoida

Euchirella rostrata

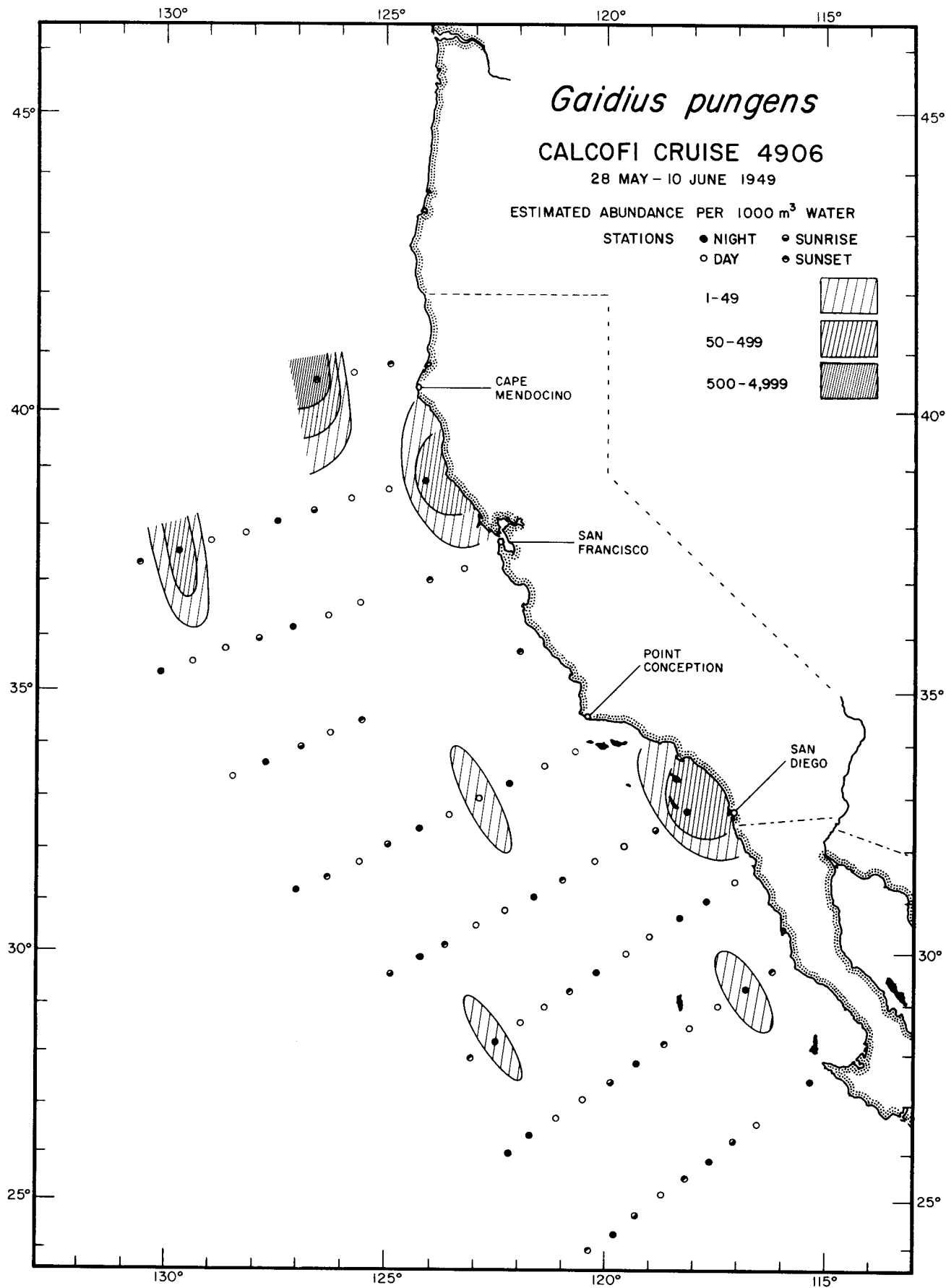
4908



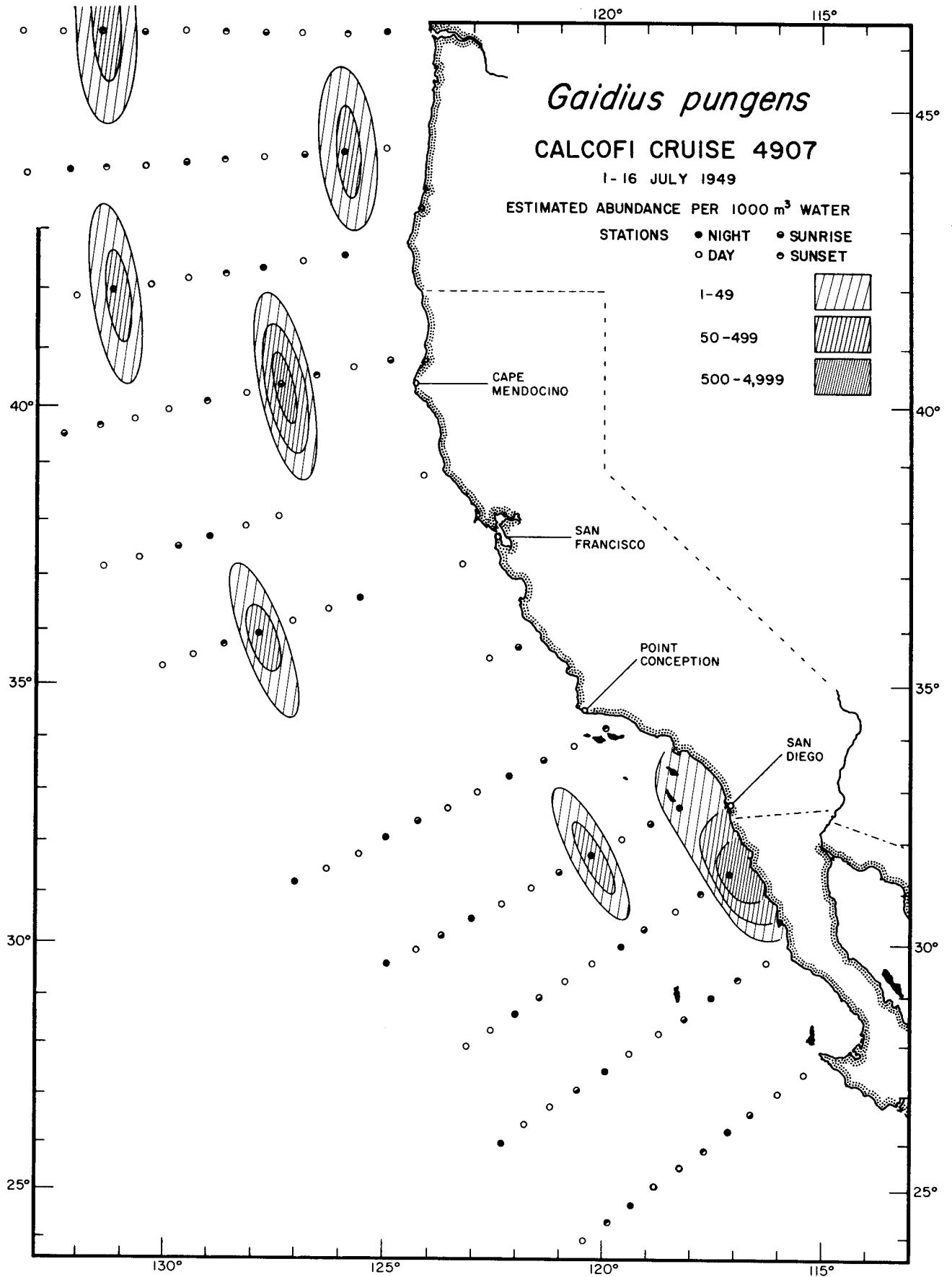
* See Table 1 for cruises 4909, 10



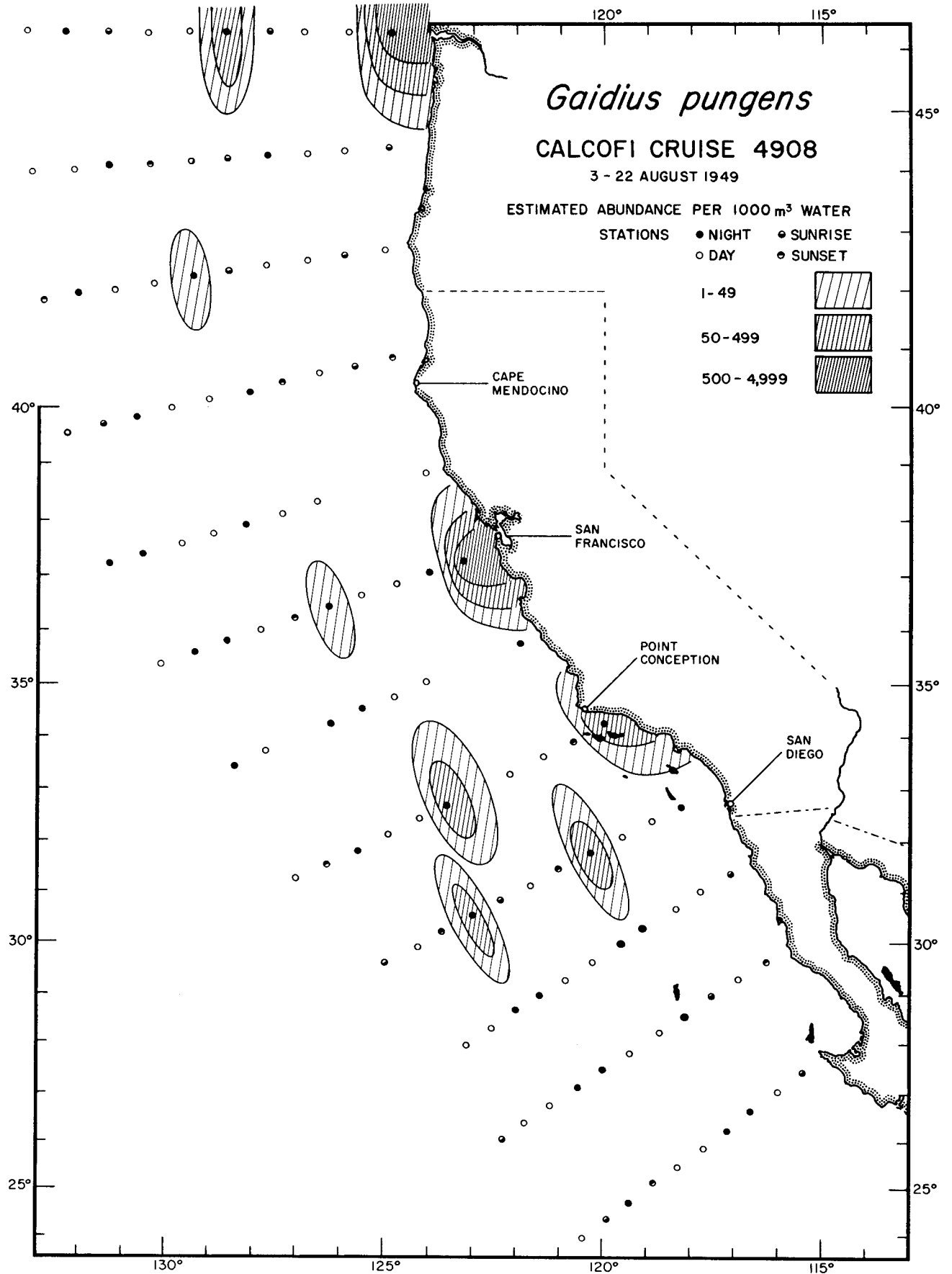
Calanoida
Gaidius pungens
4905



Calanoida
Gaidius pungens
4906



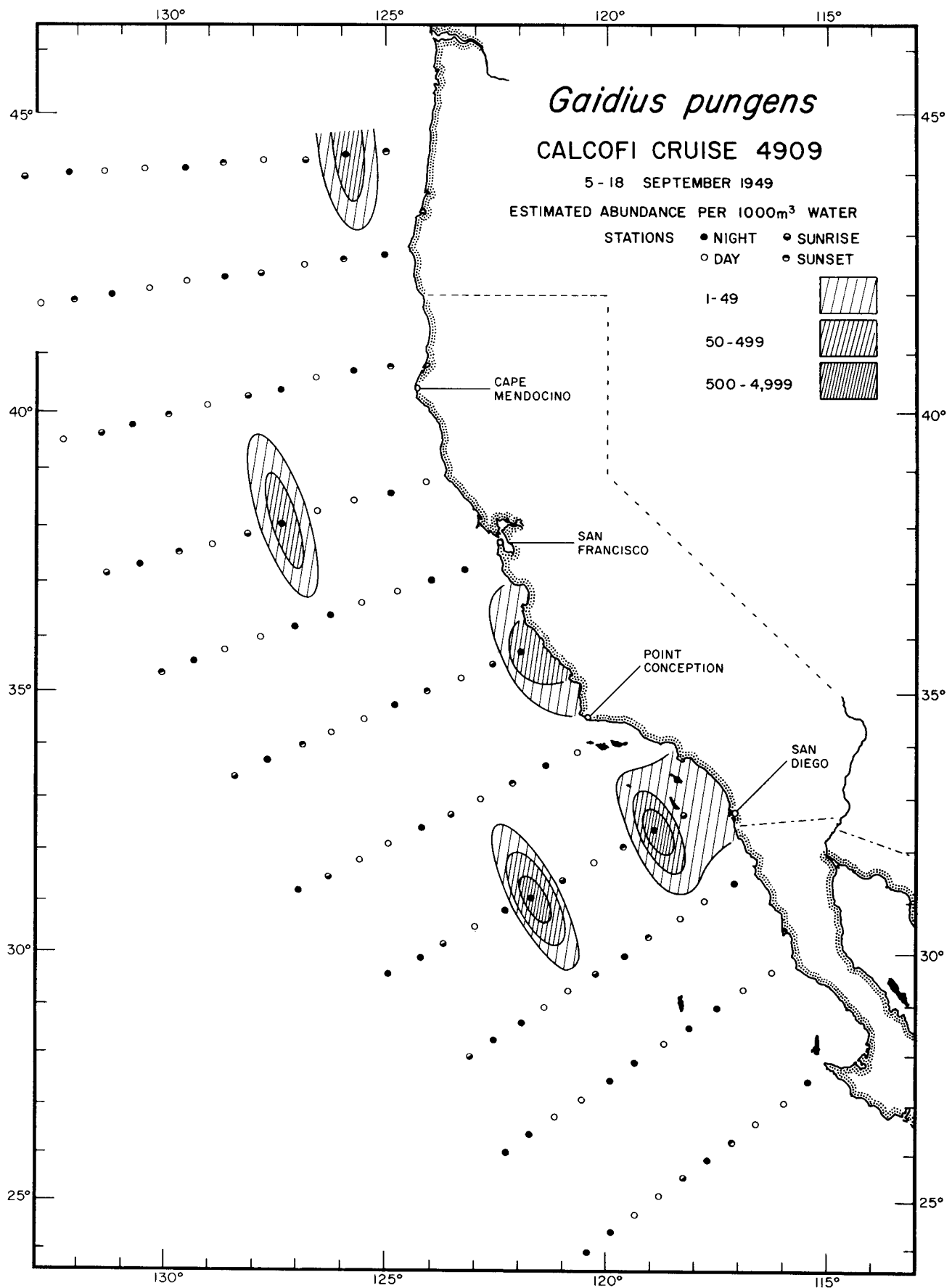
Calanoida
Gaidius pungens
4907



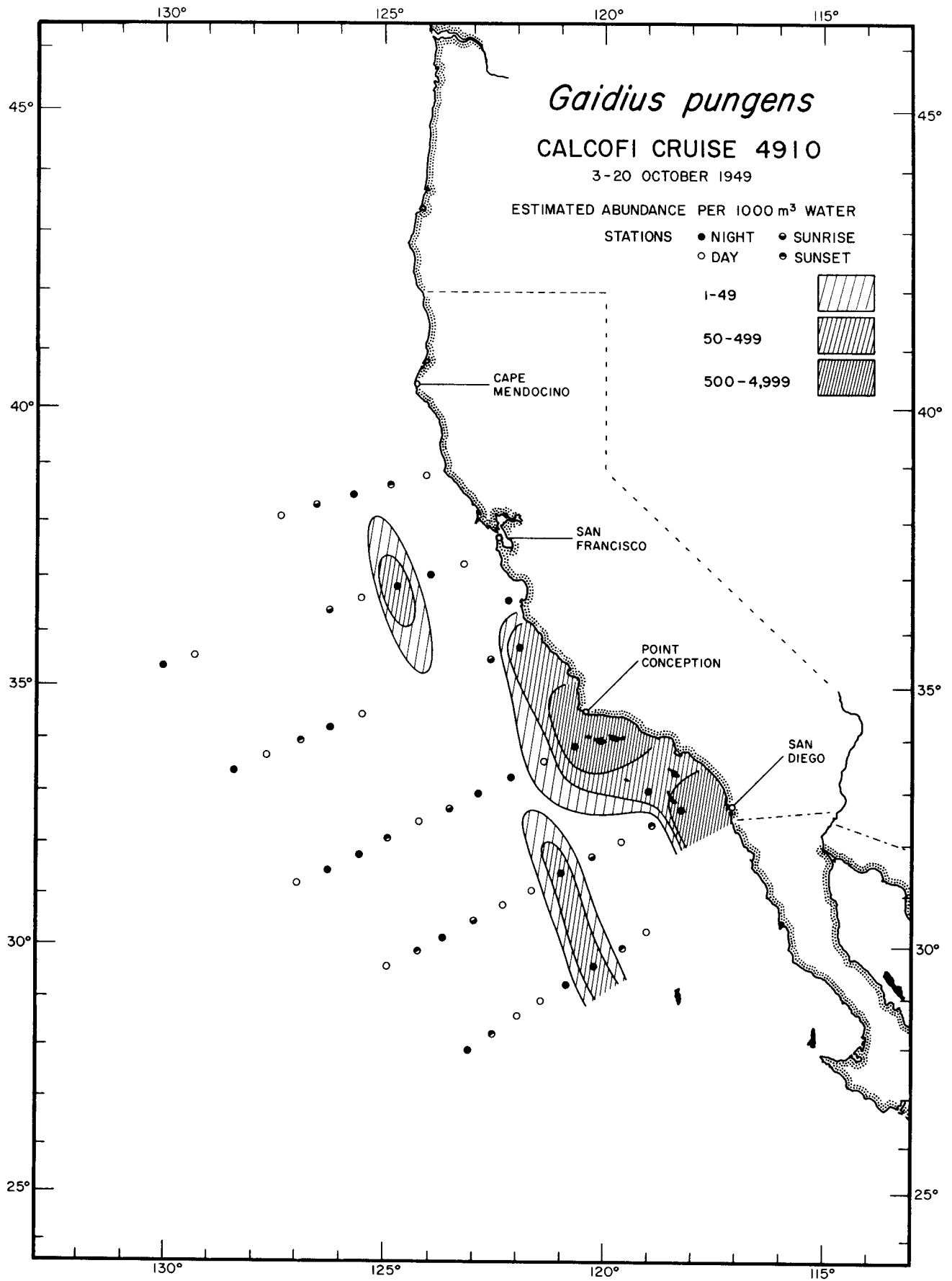
Calanoida

Gaidius pungens

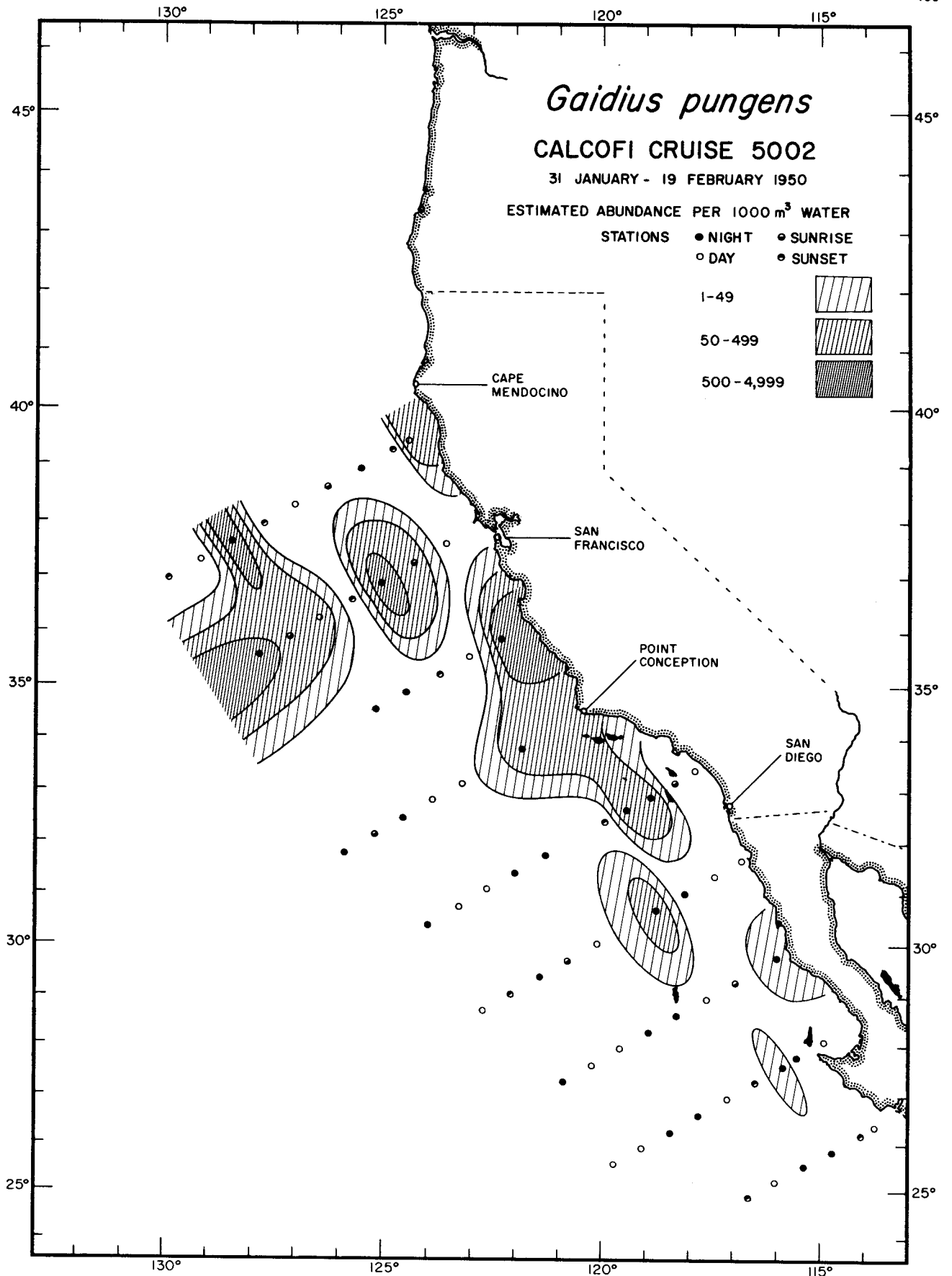
4908



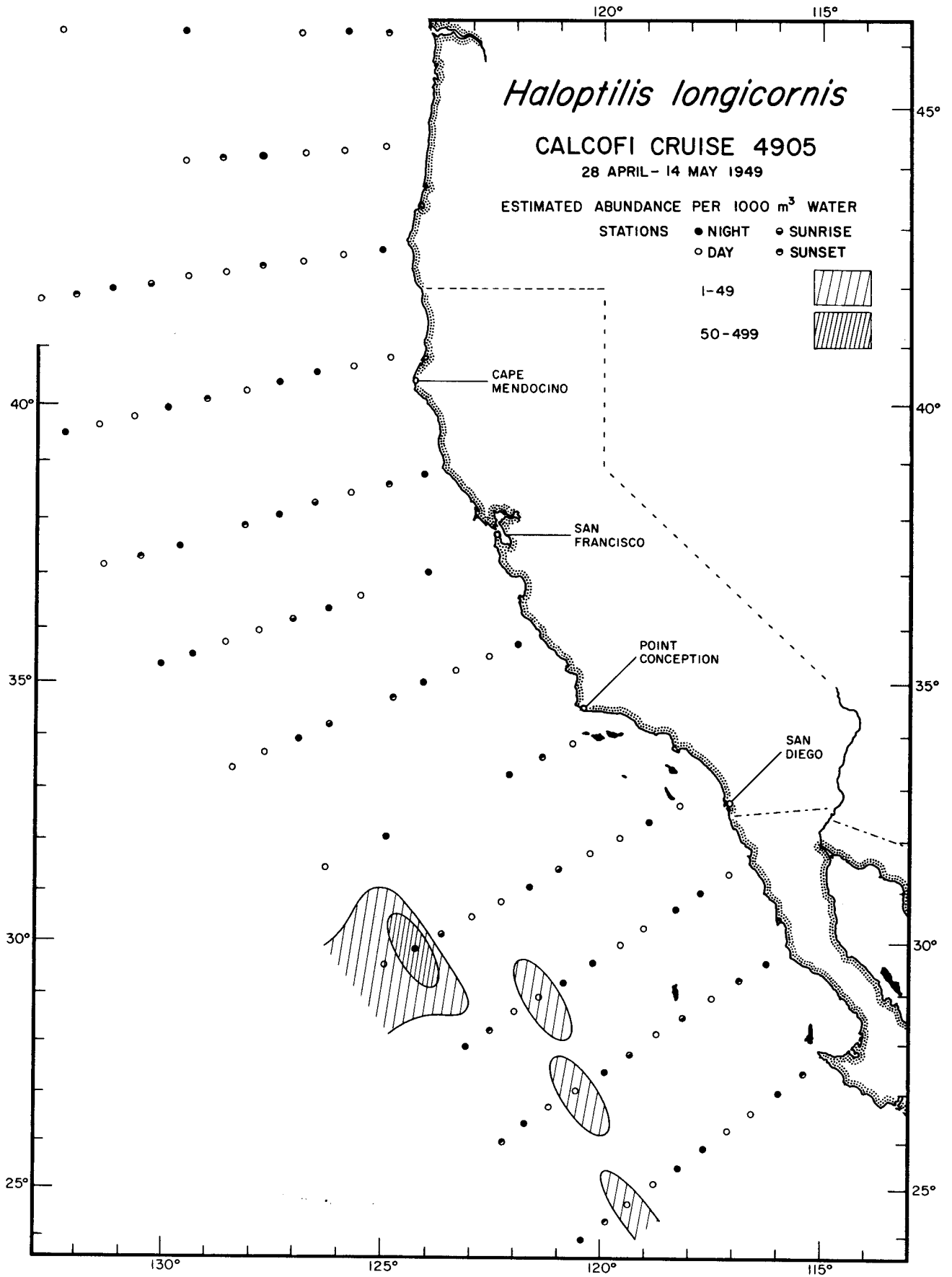
Calanoida
Gaidius pungens
4909



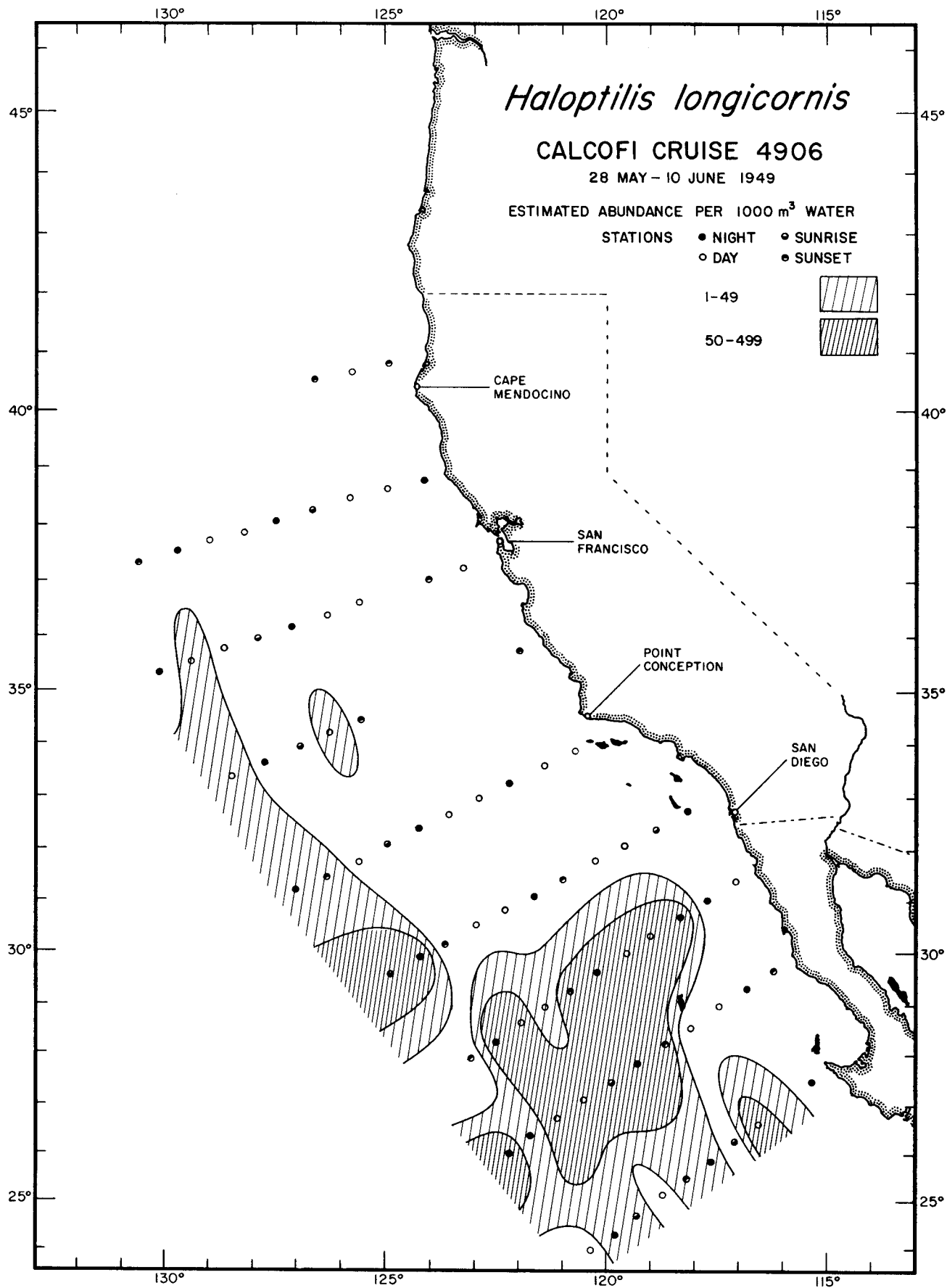
Calanoida
Gaidius pungens
4910



Calanoida
Gaidius pungens
5002



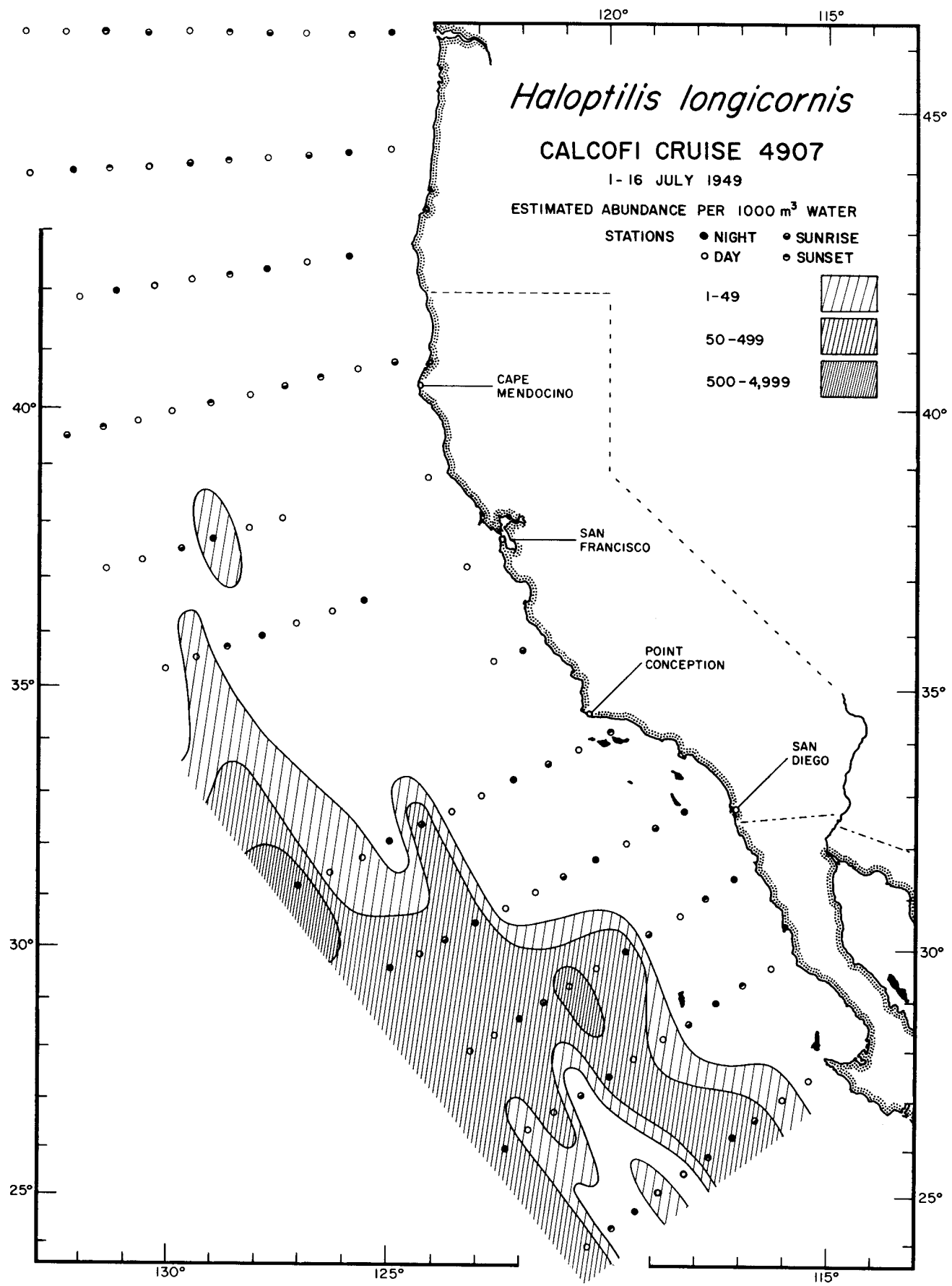
Calanoida
Haloptilis longicornis
4905



Calanoida

Haloptilis longicornis

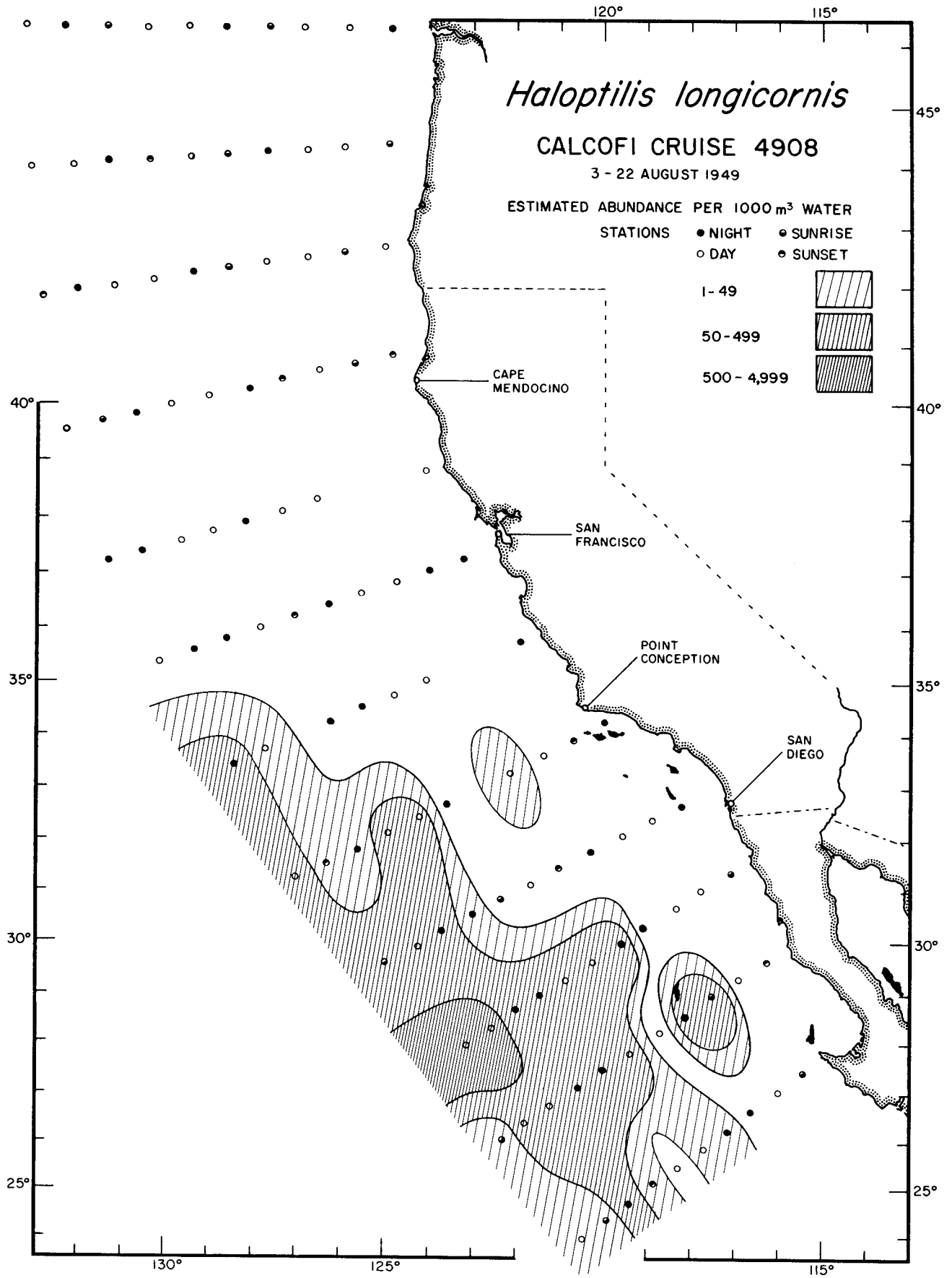
4906



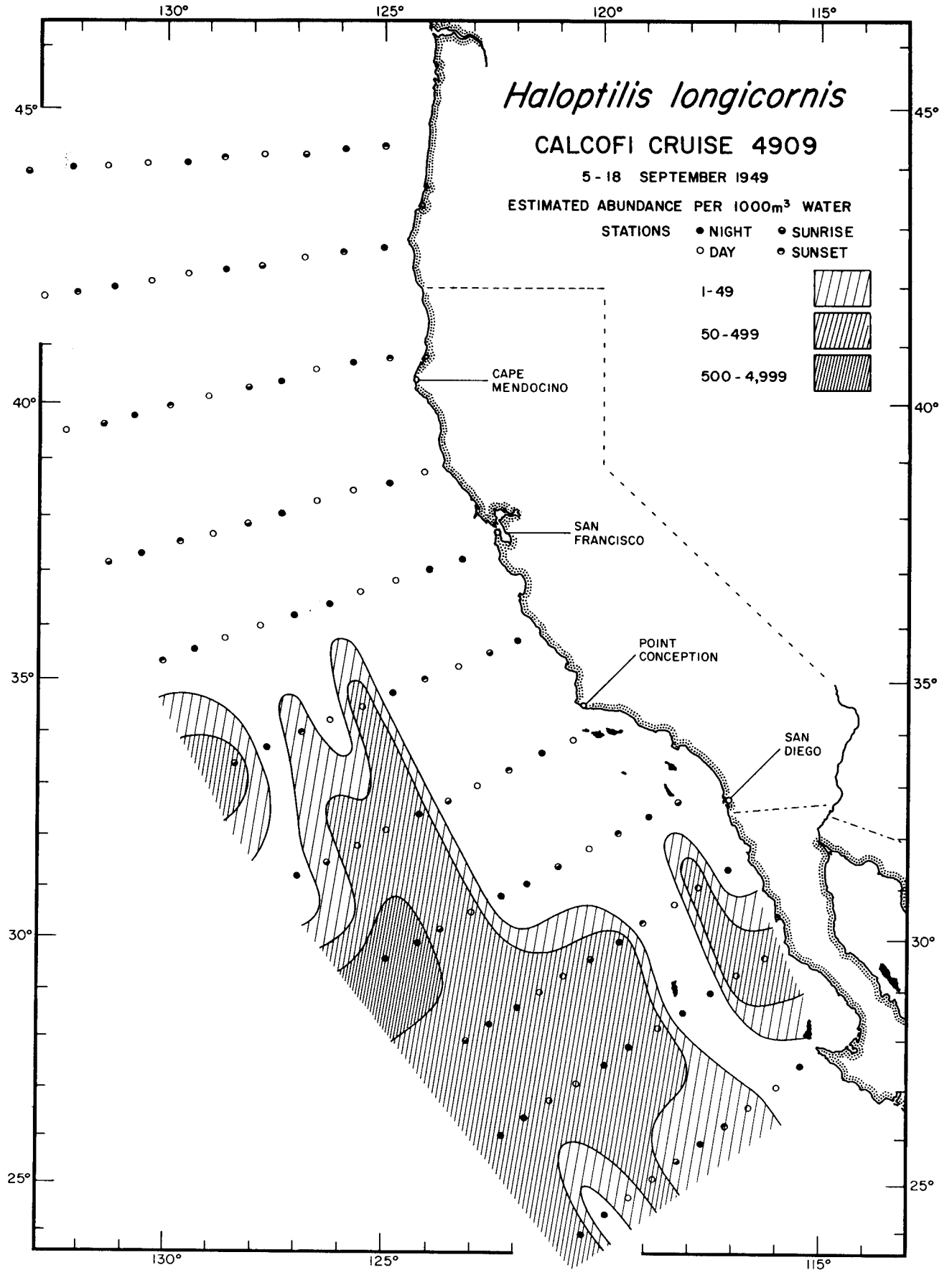
Calanoida

Haloptilis longicornis

4907



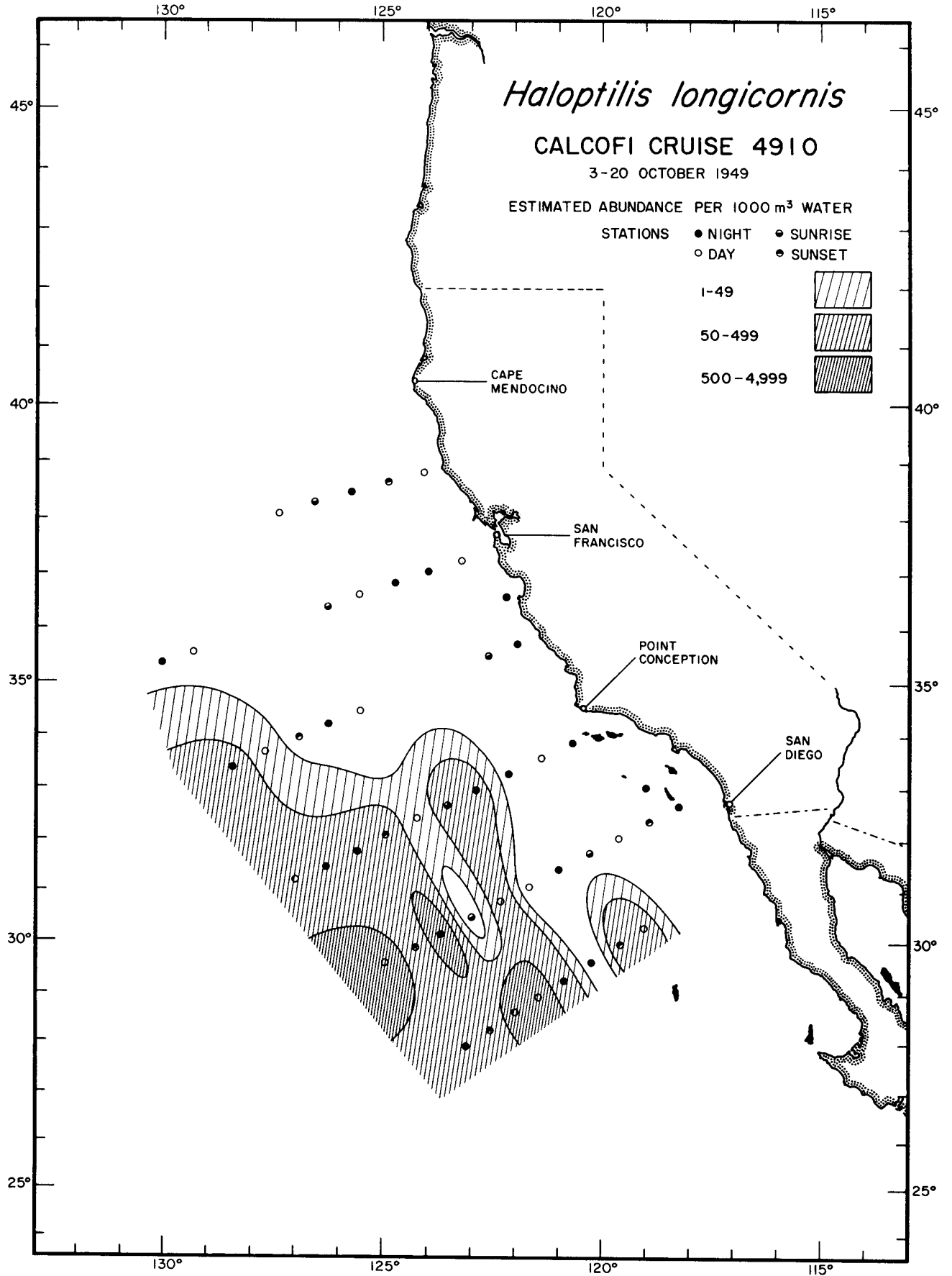
Calanoida
Haloptilis longicornis
4908



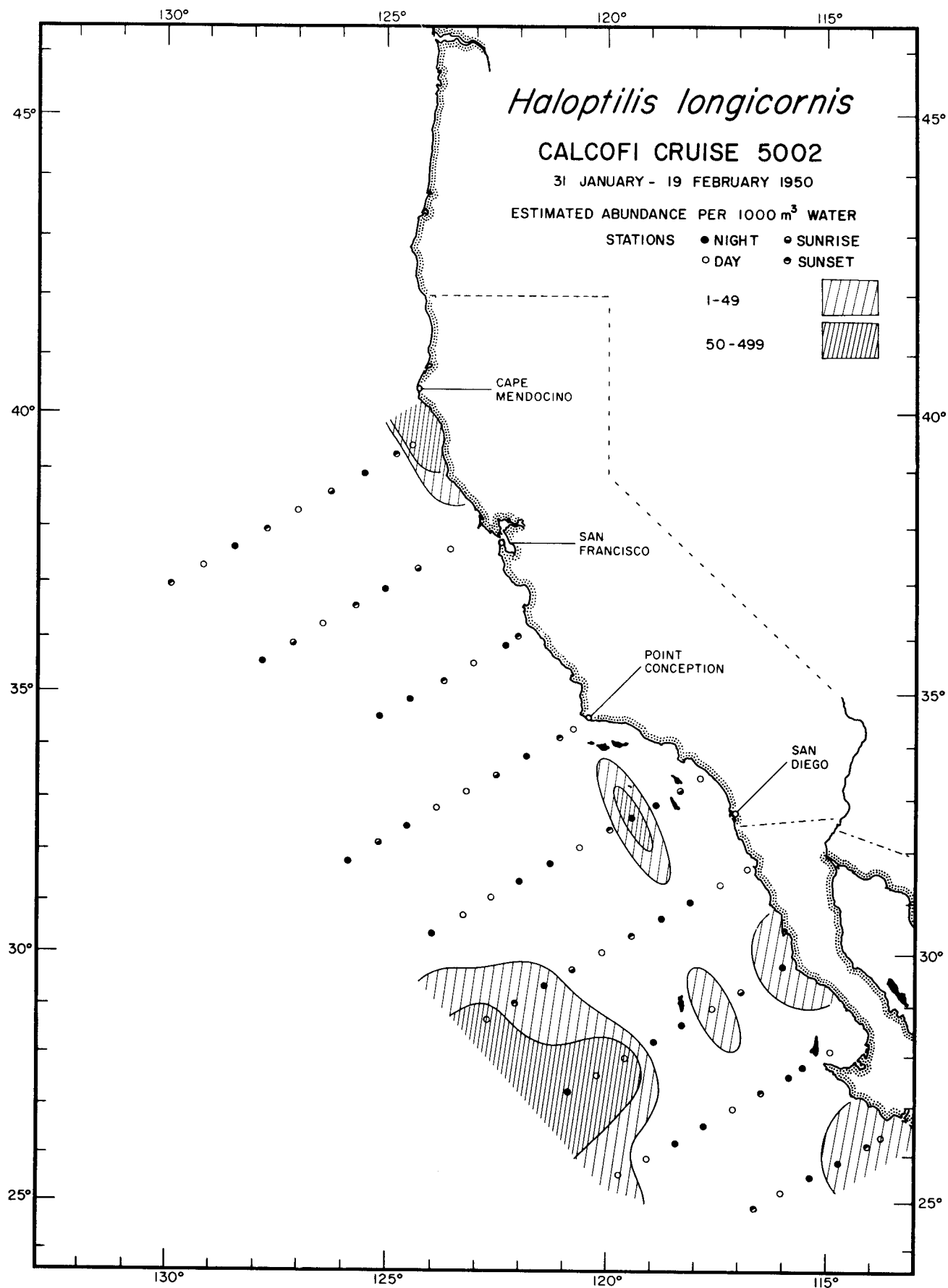
Calanoida

Haloptilis longicornis

4909



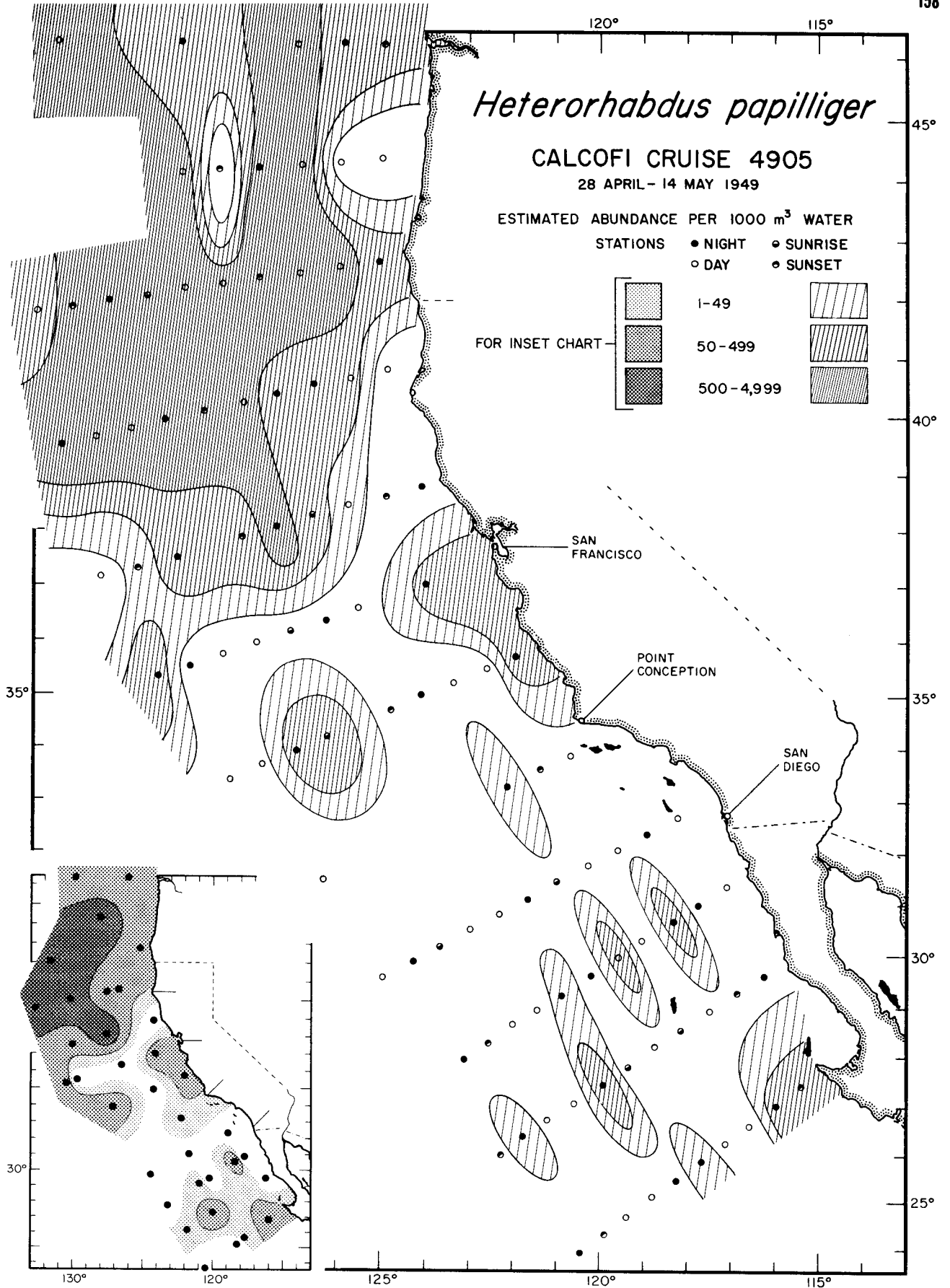
Calanoida
Haloptilis longicornis
4910



Calanoida

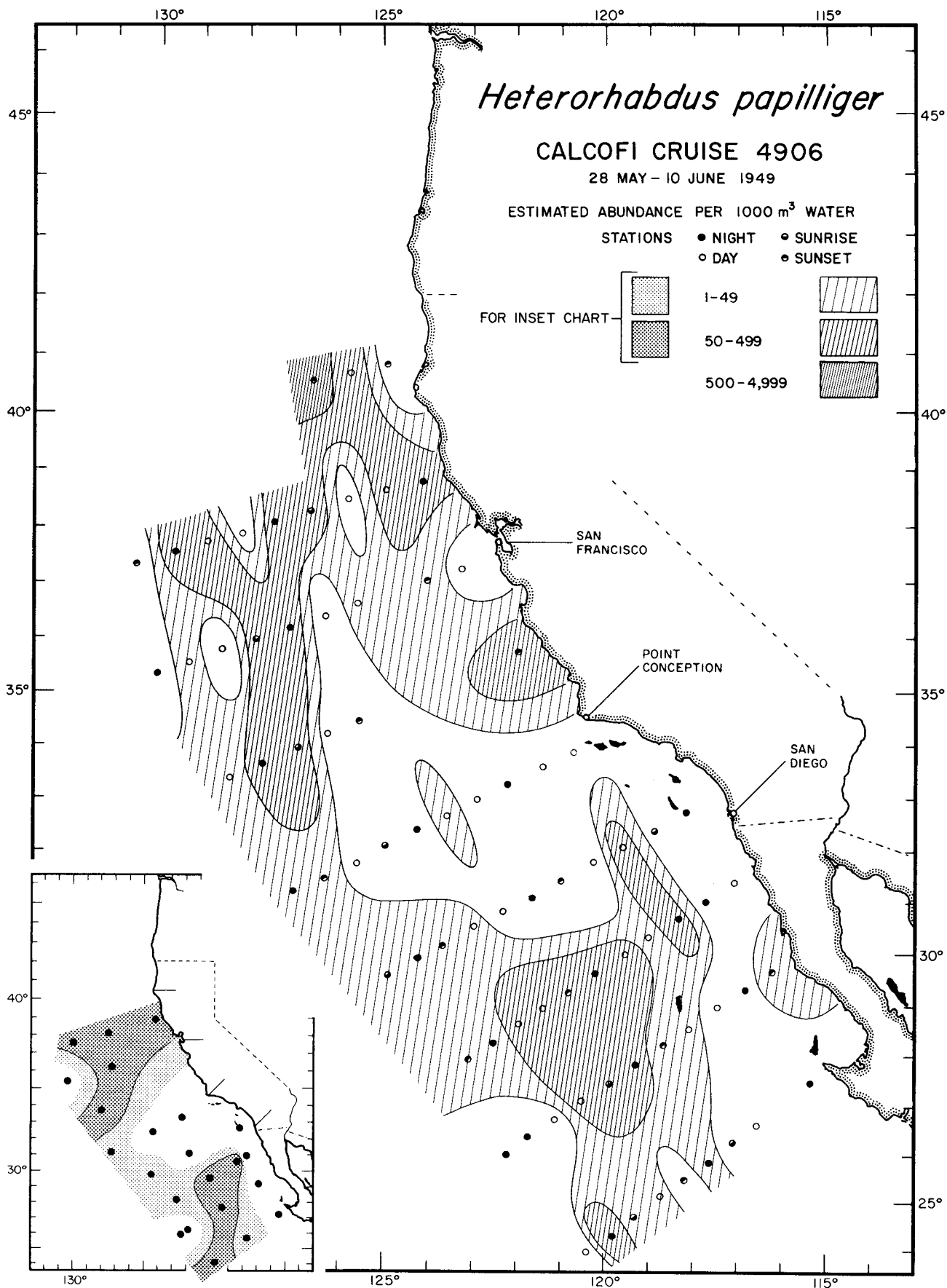
Haloptilis longicornis

5002



Calanoida
Heterorhabdus papilliger

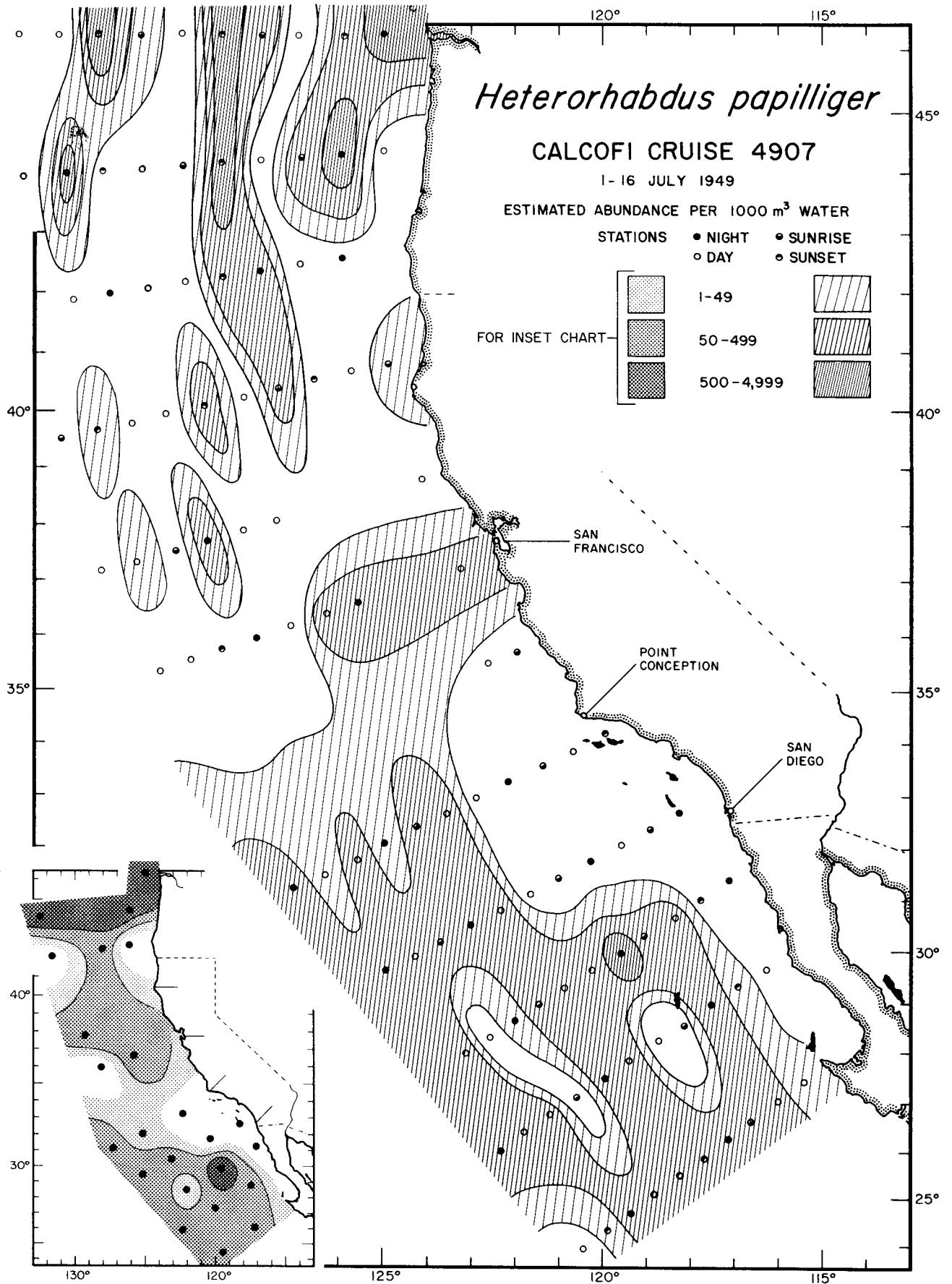
4905



Calanoida

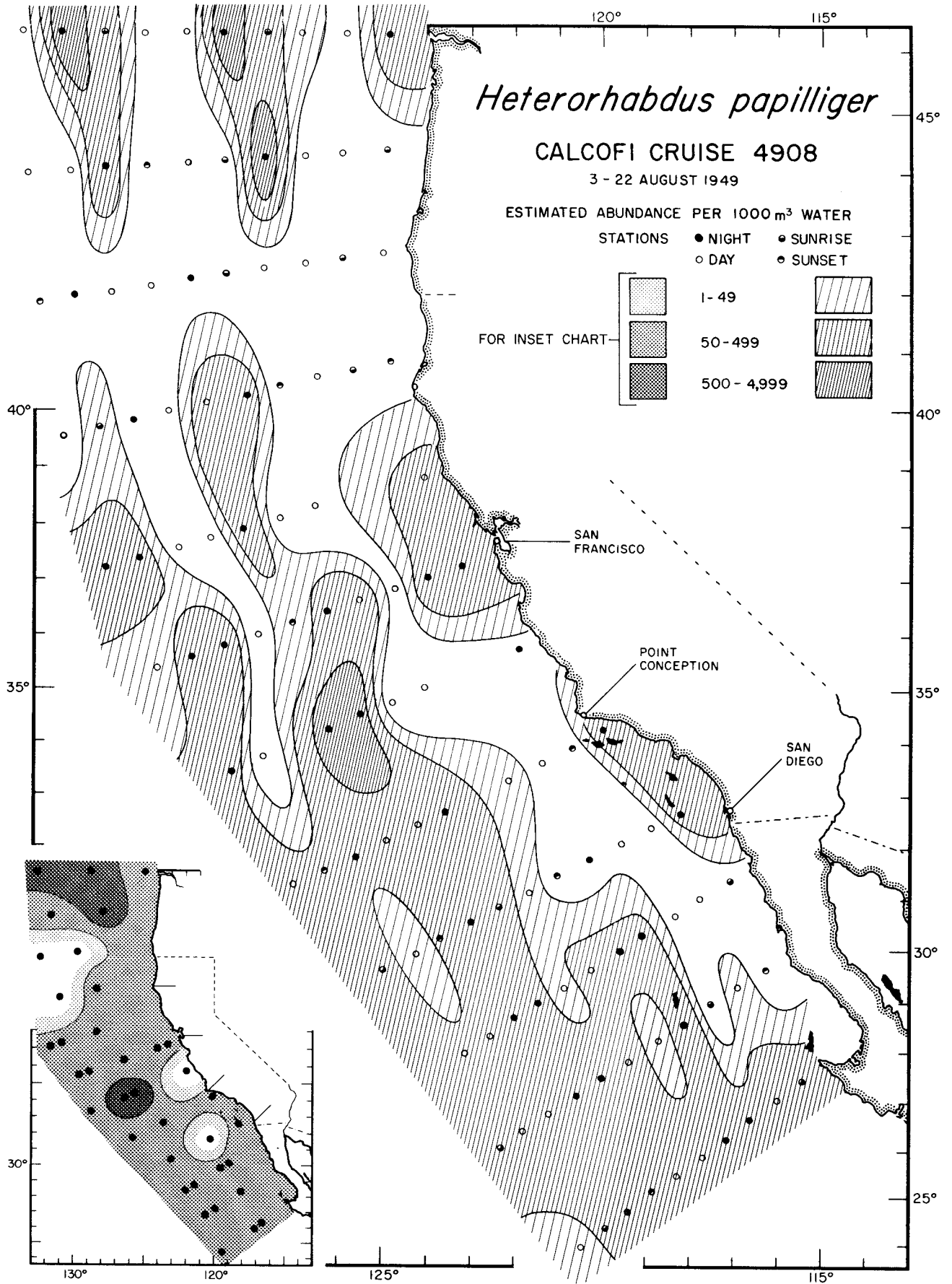
Heterorhabdus papilliger

4906



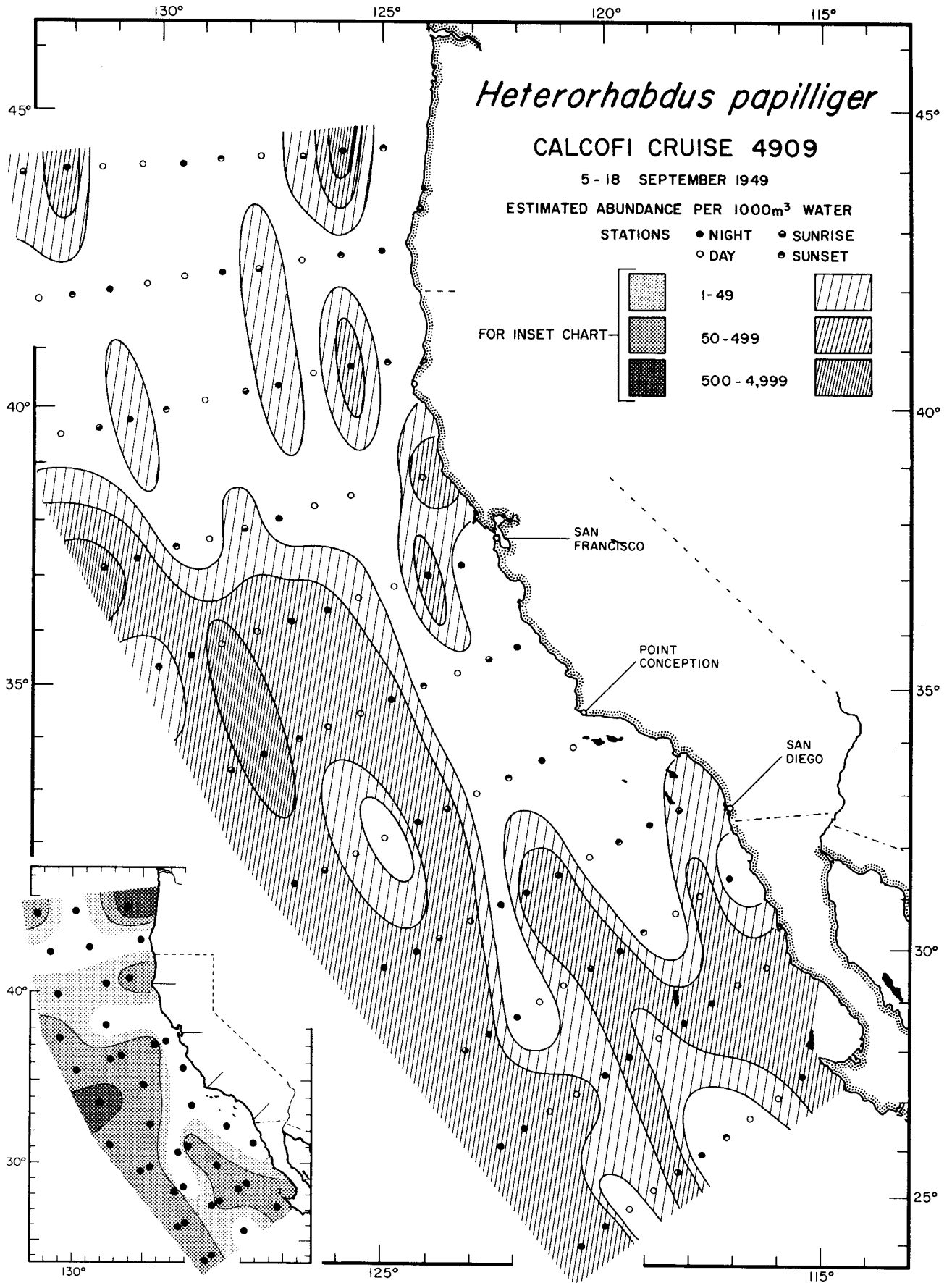
Calanoida
Heterorhabdus papilliger

4907



Calanoida
Heterorhabdus papilliger

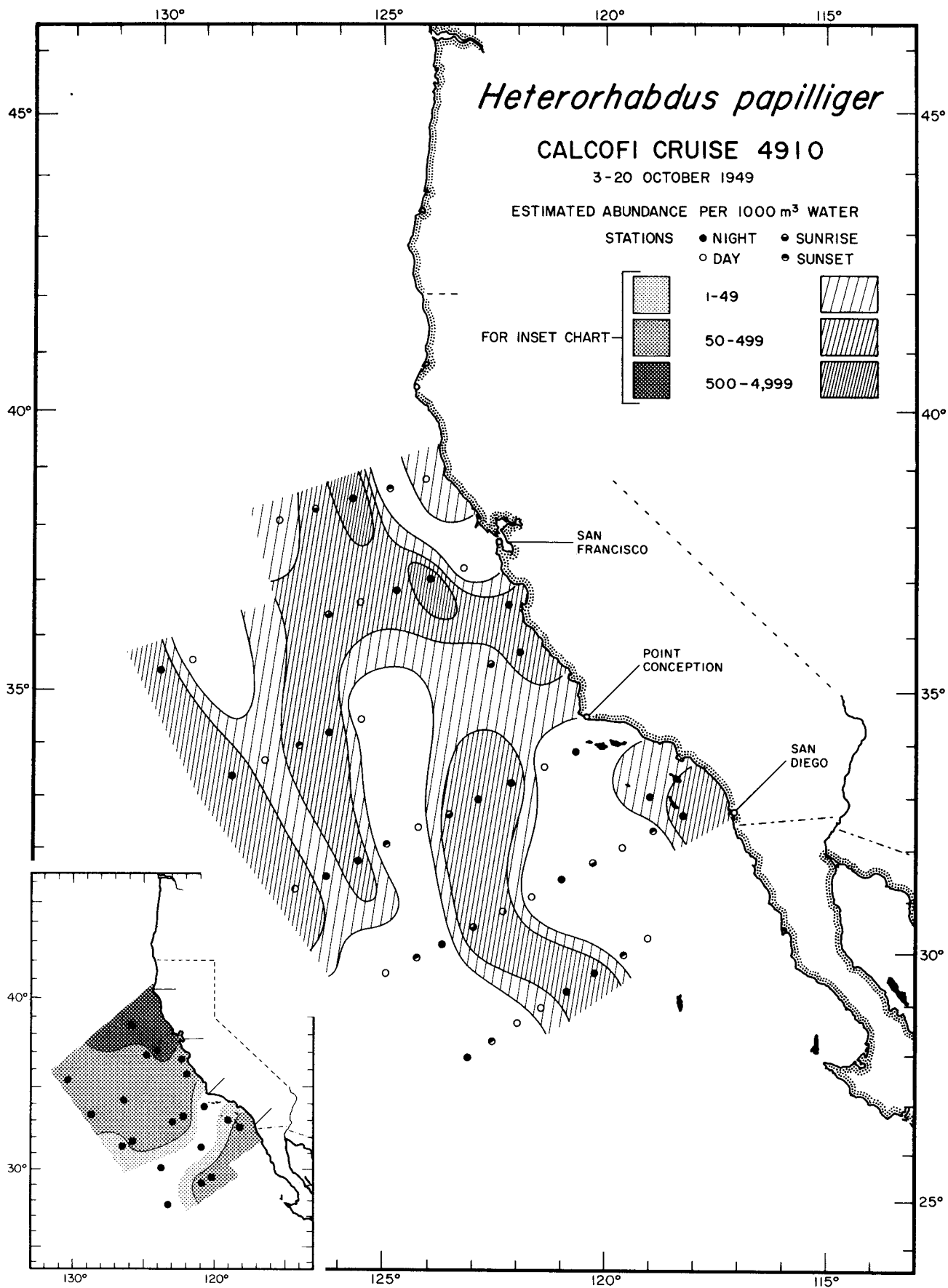
4908



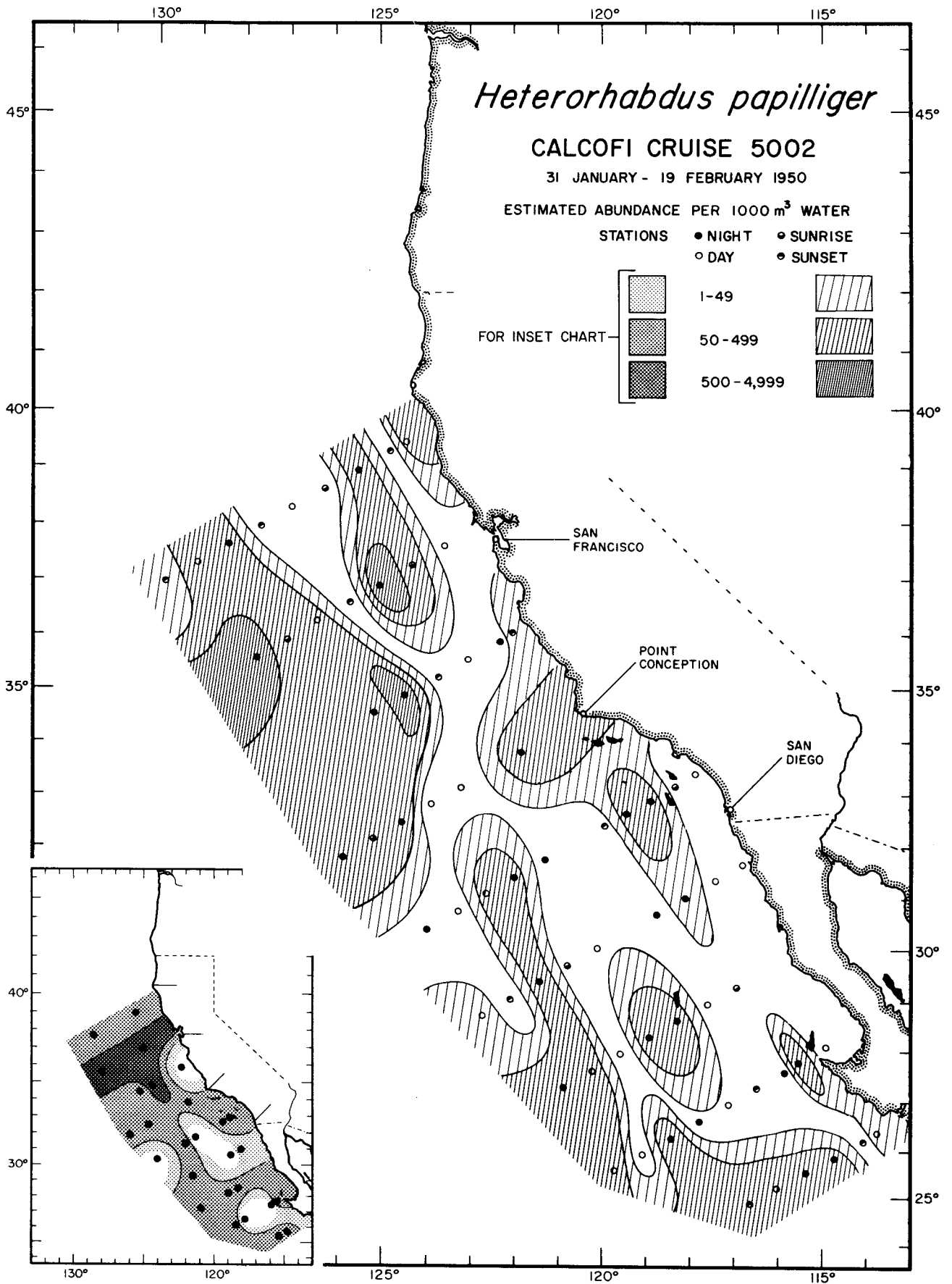
Calanoida

Heterorhabdus papilliger

4909



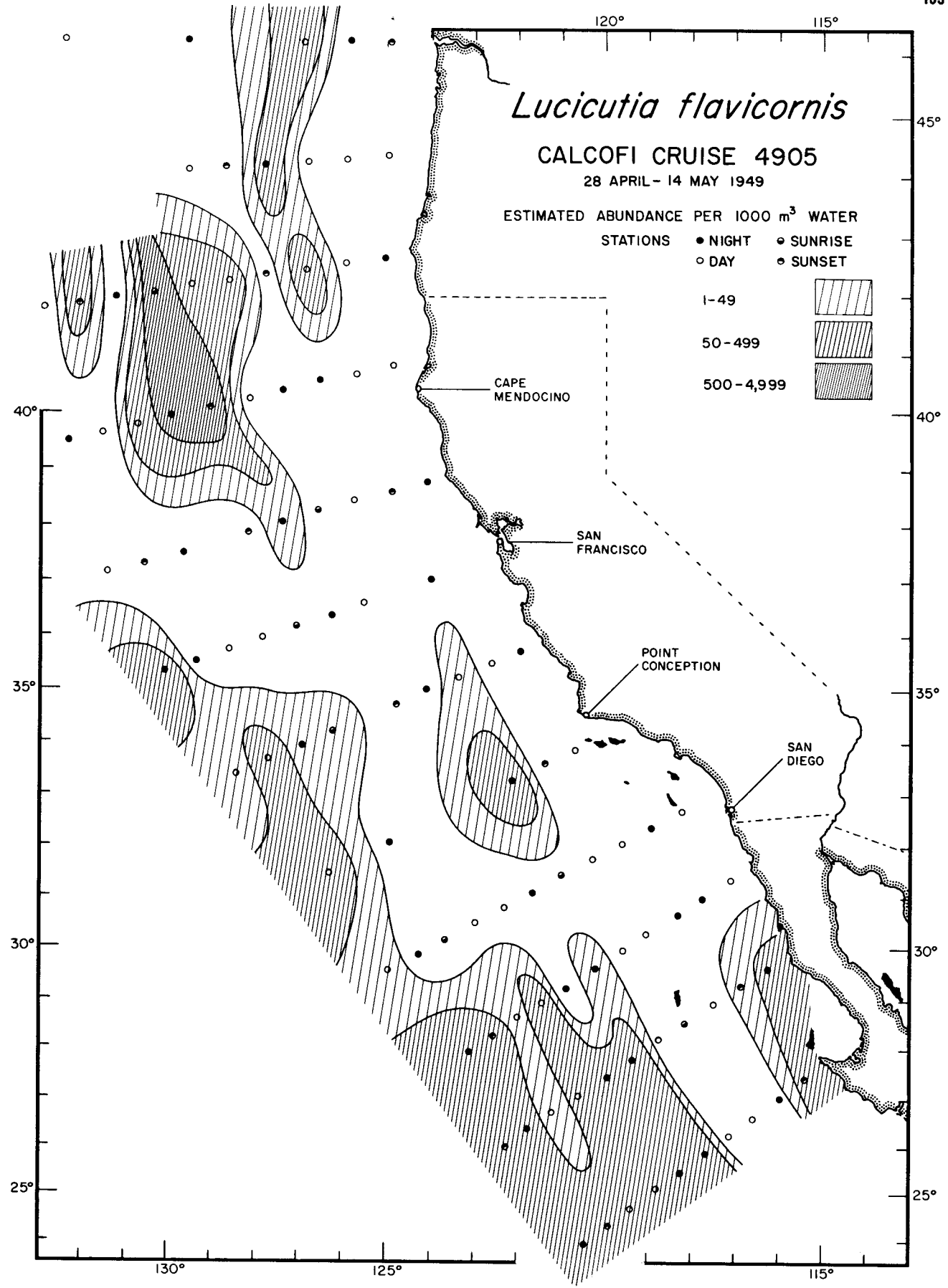
Calanoida
Heterorhabdus papilliger
4910



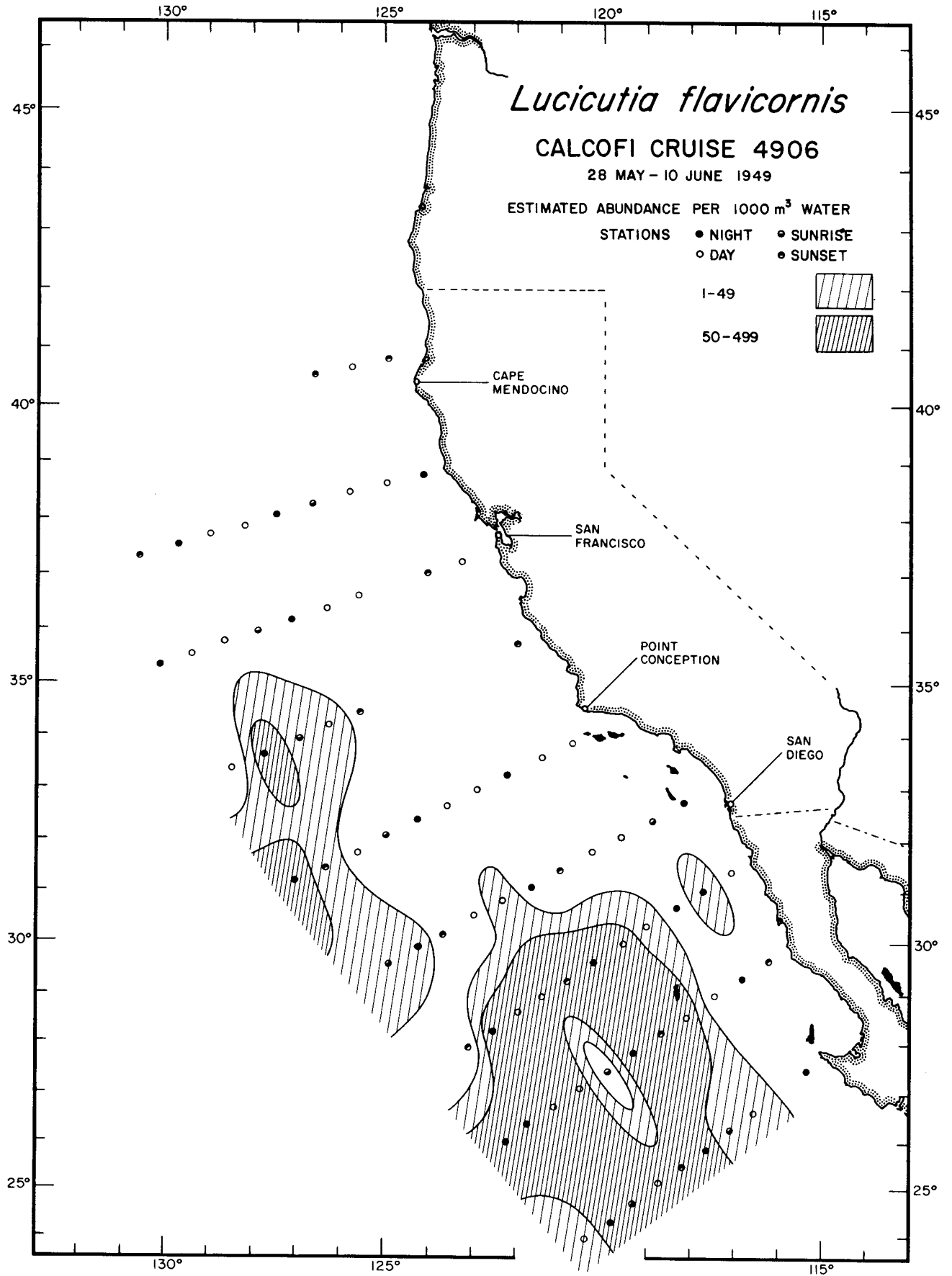
Calanoida

Heterorhabdus papilliger

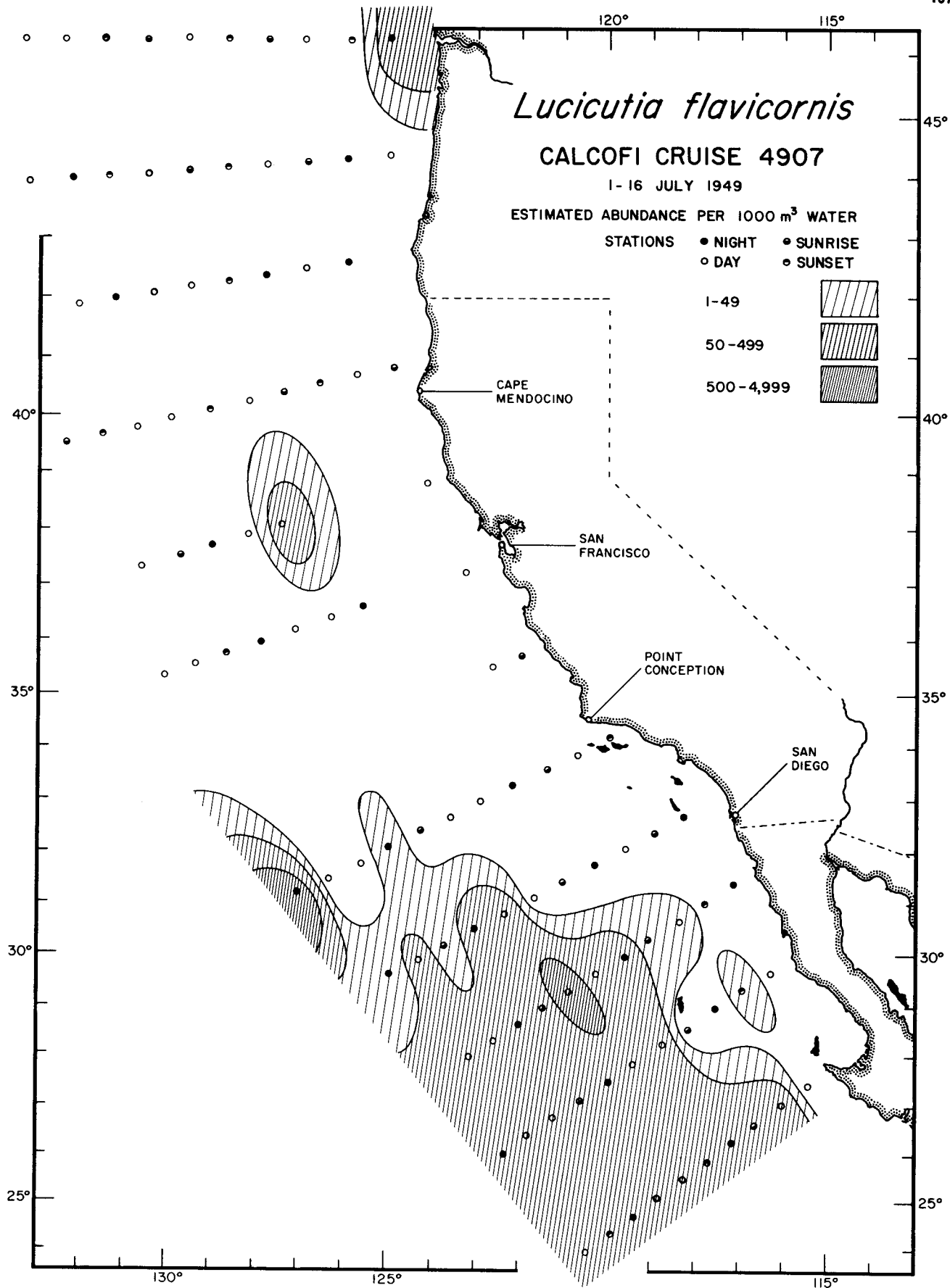
5002



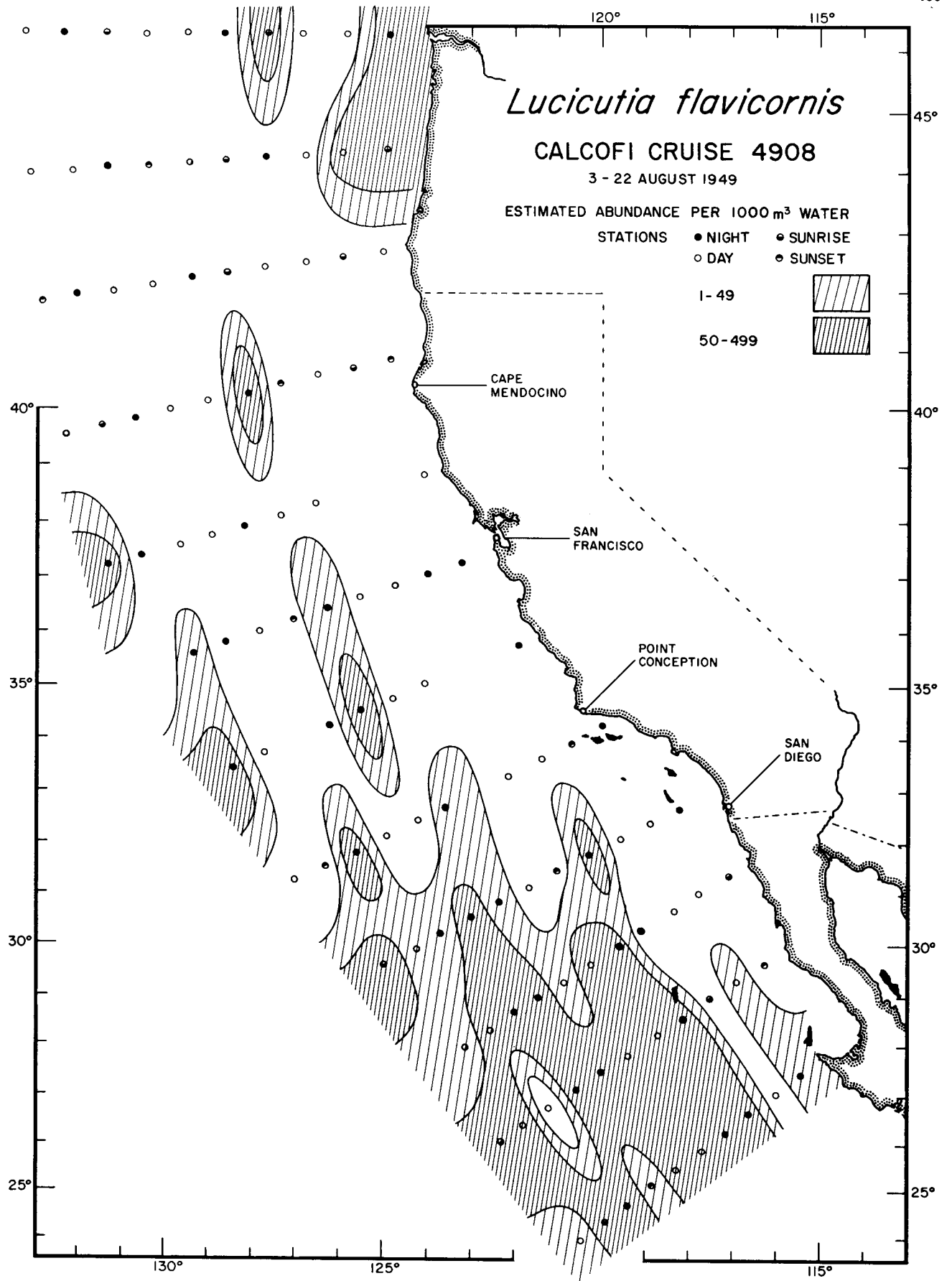
Calanoida
Lucicutia flavicornis
4905



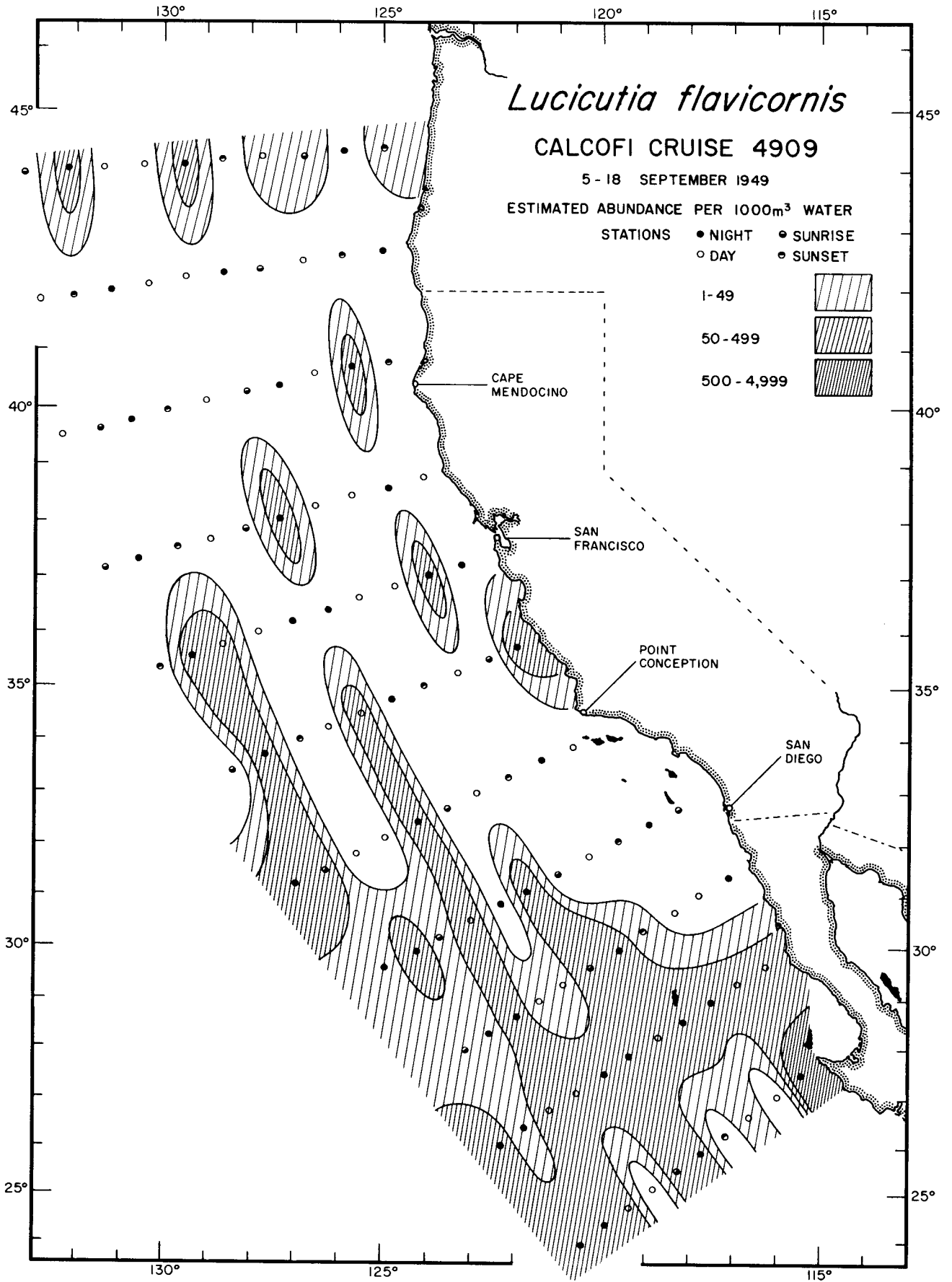
Calanoida
Lucicutia flavicornis
4906



Calanoida
Lucicutia flavicornis
 4907



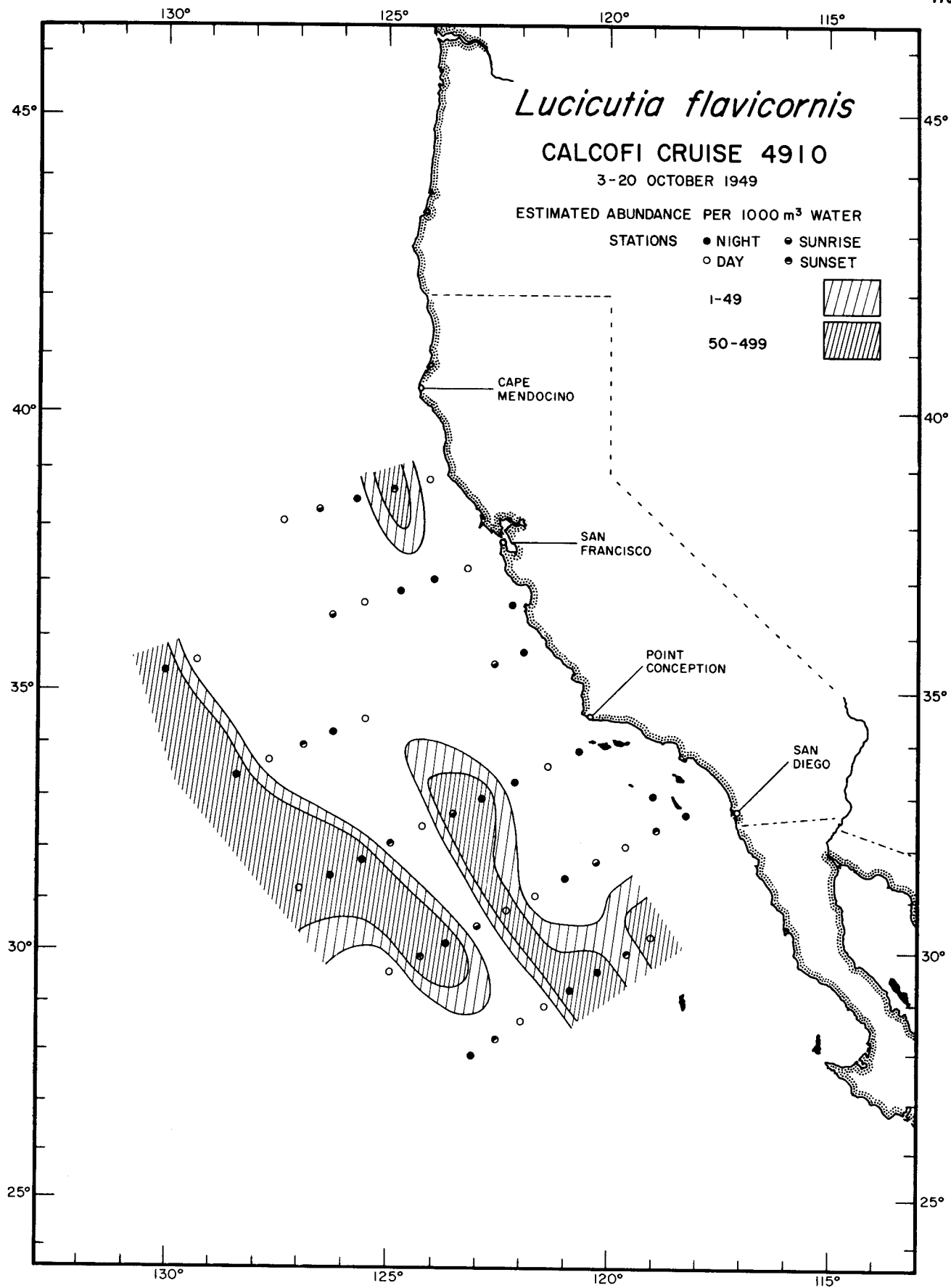
Calanoida
Lucicutia flavicornis
4908



Calanoida

Lucicutia flavicornis

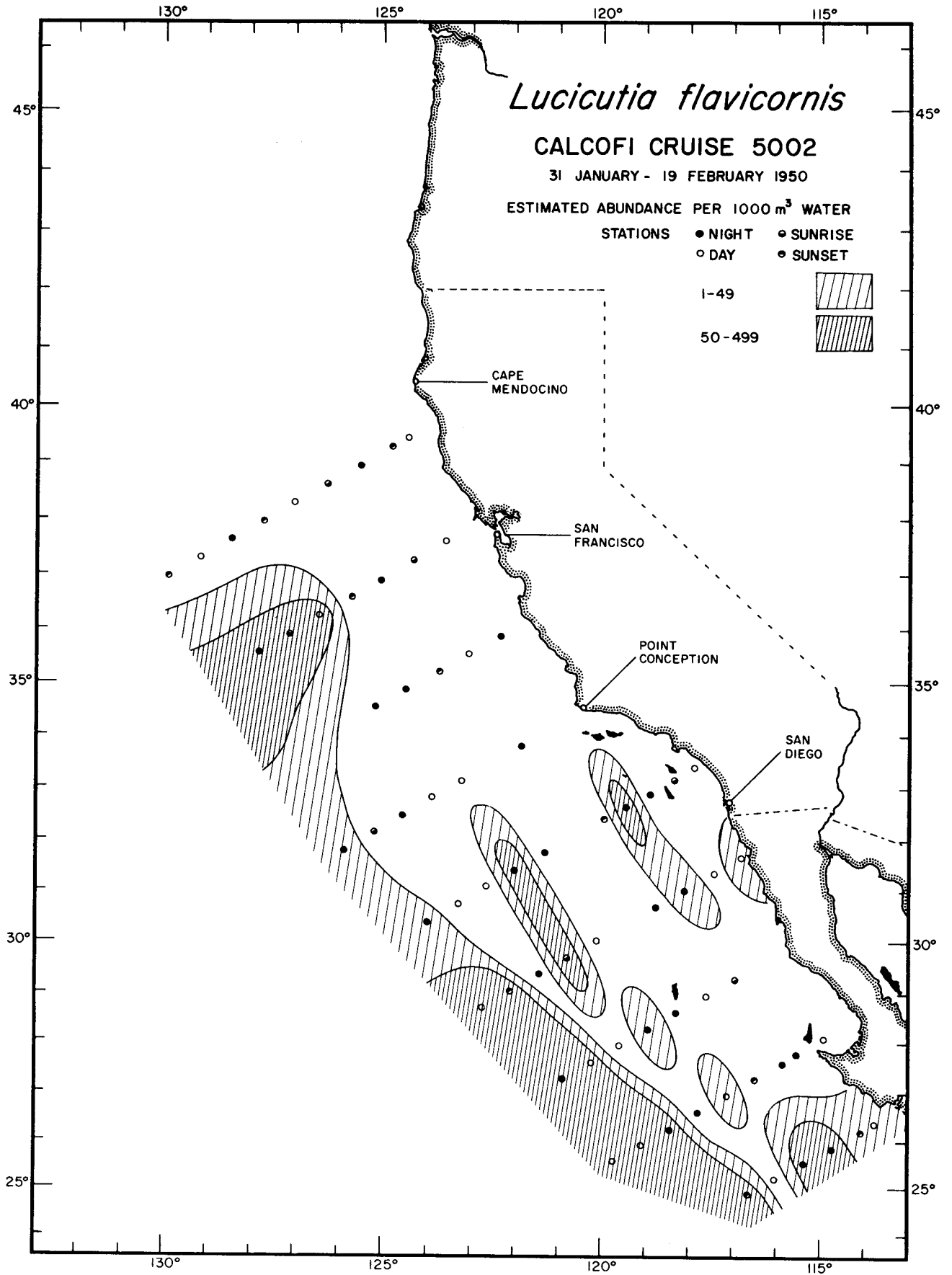
4909



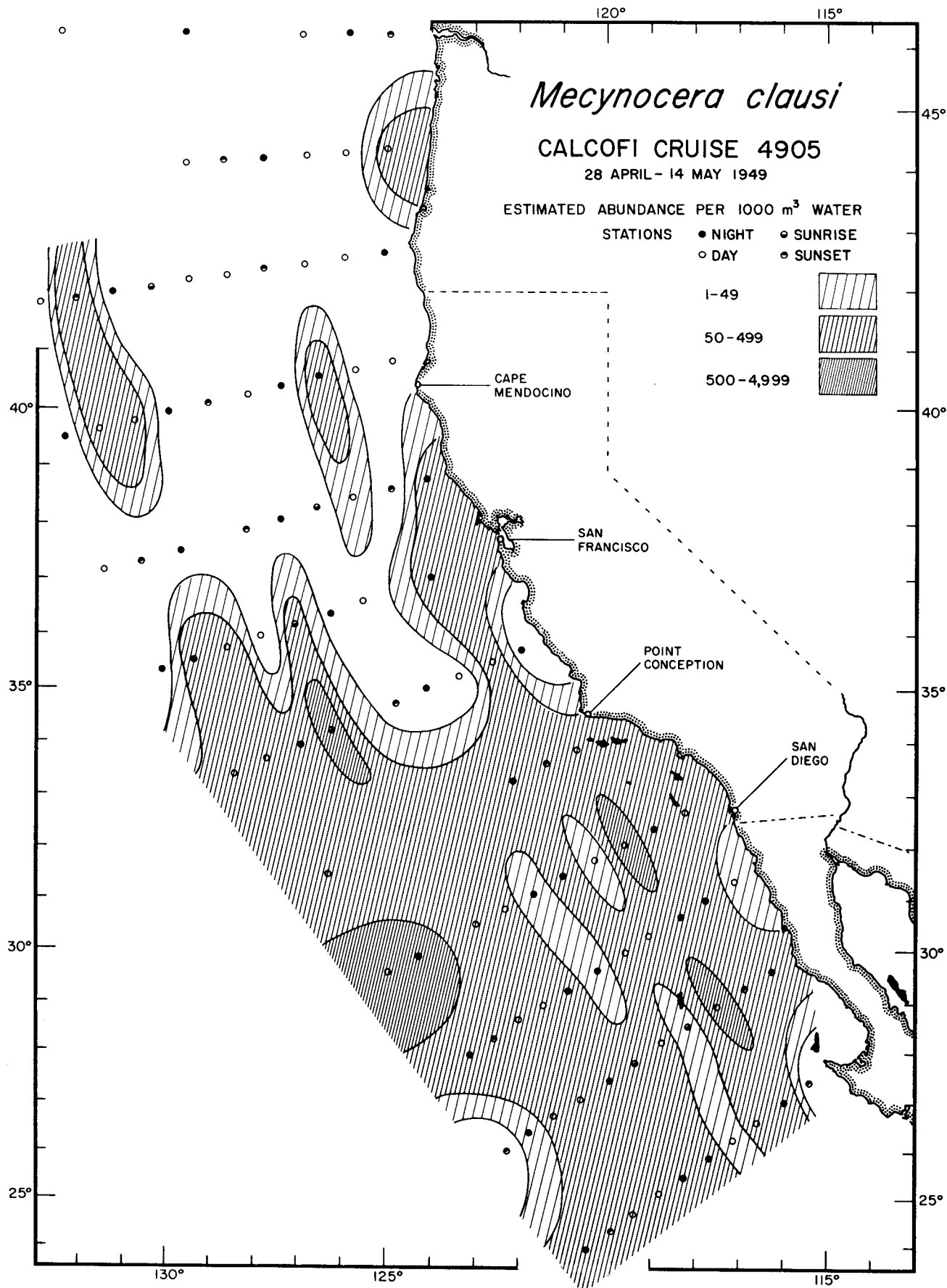
Calanoida

Lucicutia flavicornis

4910



Calanoida
Lucicutia flavicornis
5002



Mecynocera clausi

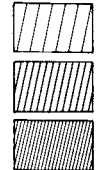
CALCOFI CRUISE 4905

28 APRIL - 14 MAY 1949

ESTIMATED ABUNDANCE PER 1000 m³ WATER

STATIONS ● NIGHT ○ SUNRISE
○ DAY ○ SUNSET

1-49
50-499
500-4,999



CAPE MENDOCINO

SAN FRANCISCO

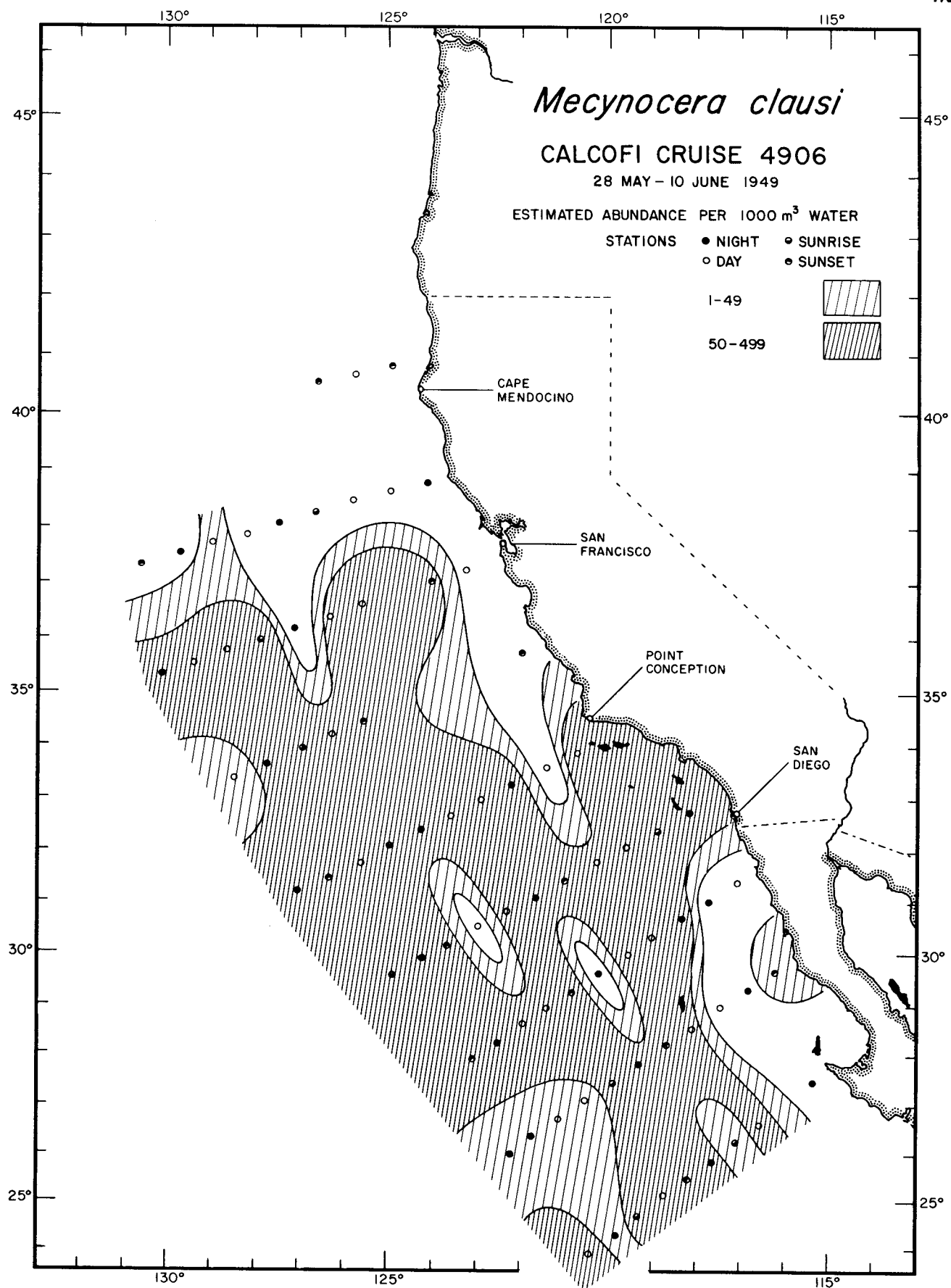
POINT CONCEPTION

SAN DIEGO

Calanoida

Mecynocera clausi

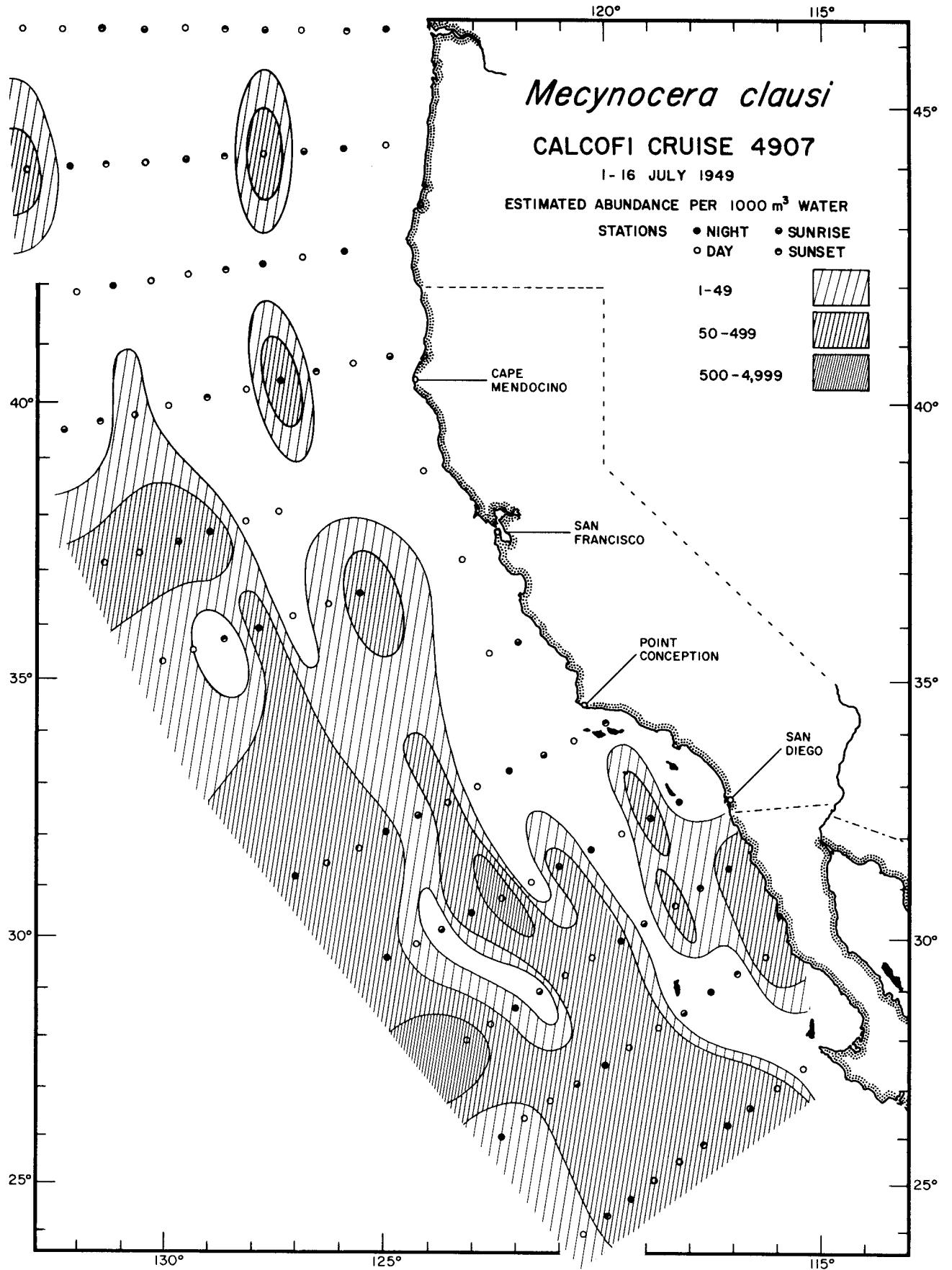
4905



Calanoida

Mecynocera clausi

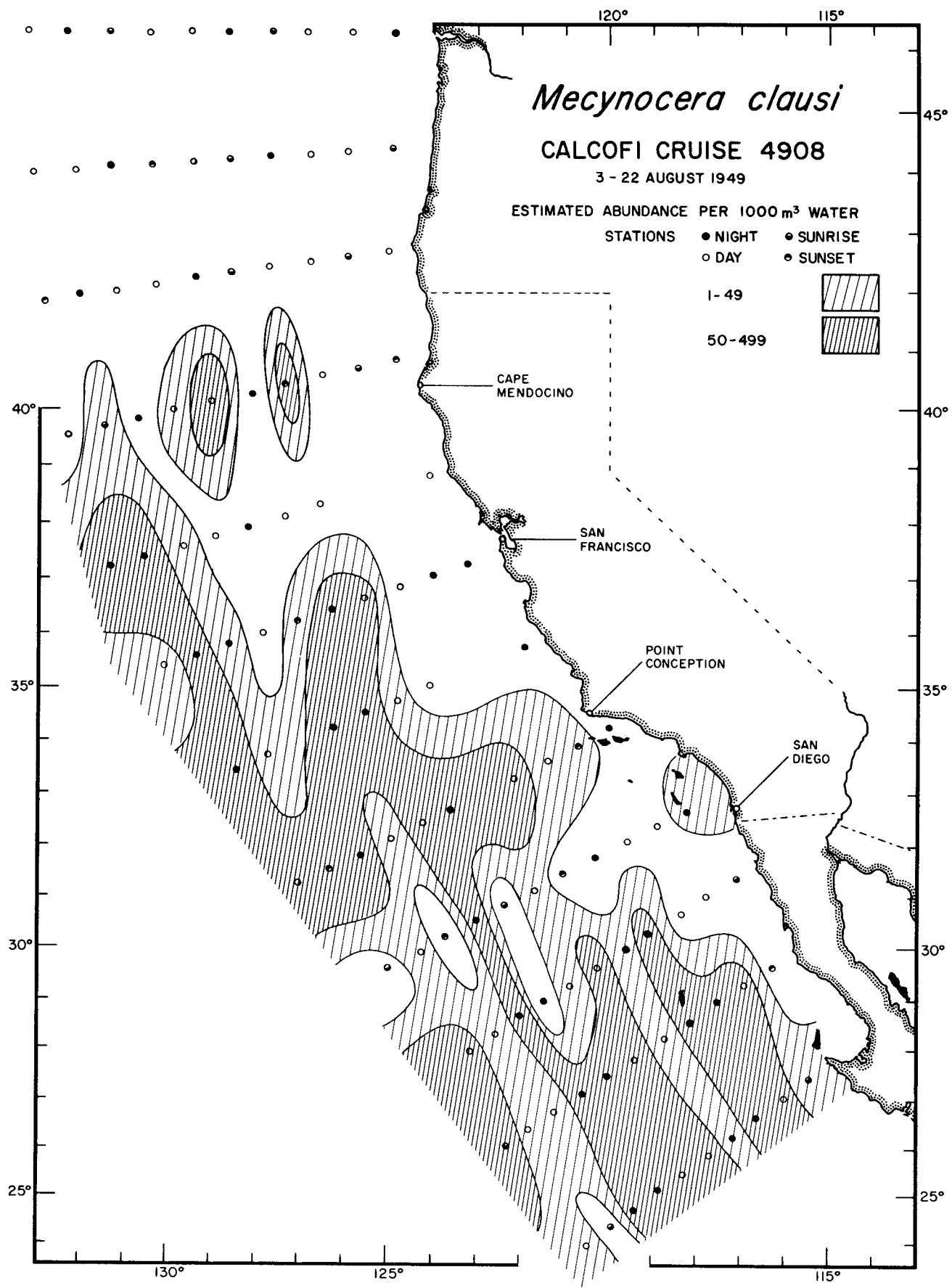
4906



Calanoida

Mecynocera clausi

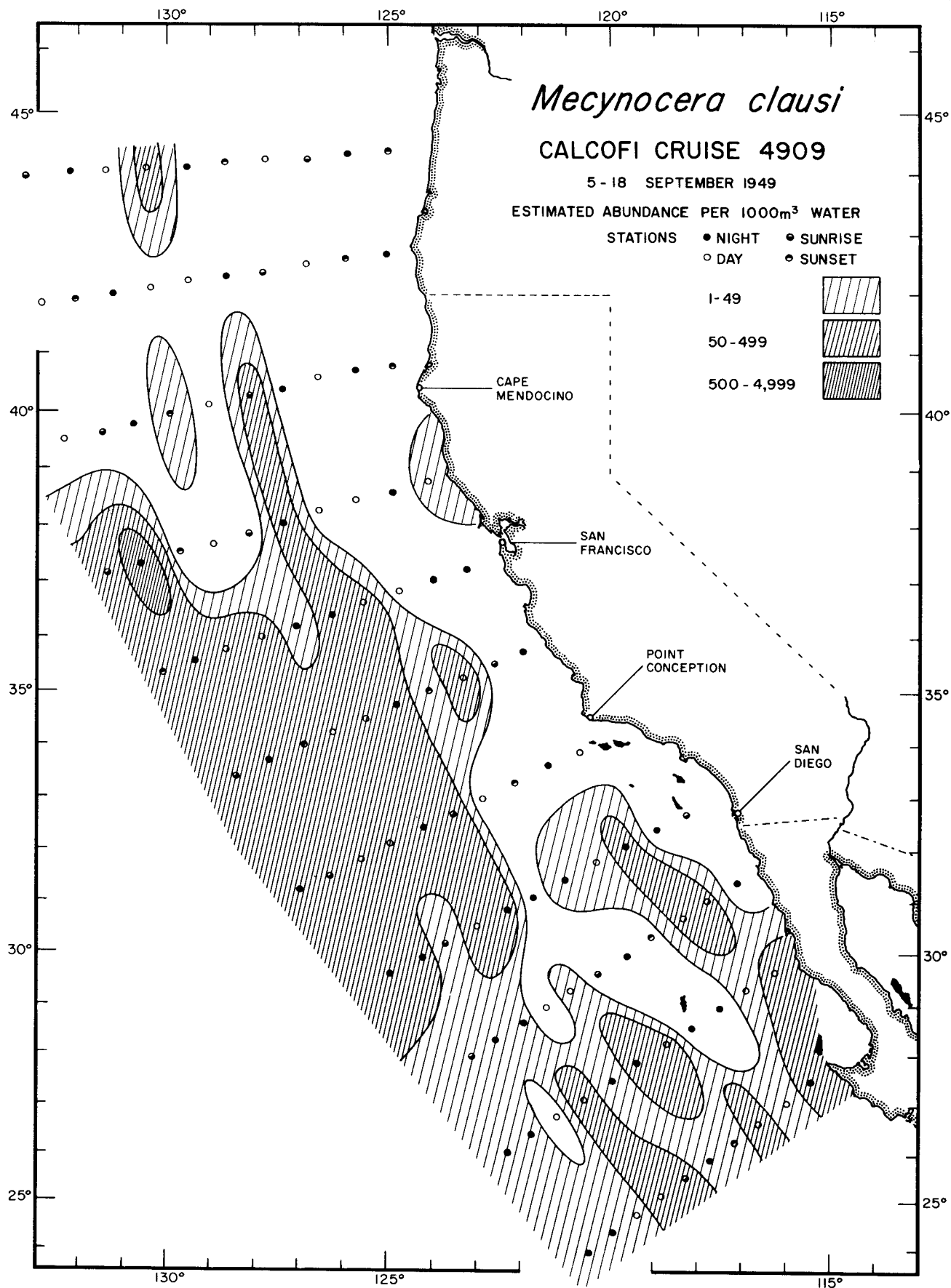
4907



Calanoida

Mecynocera clausi

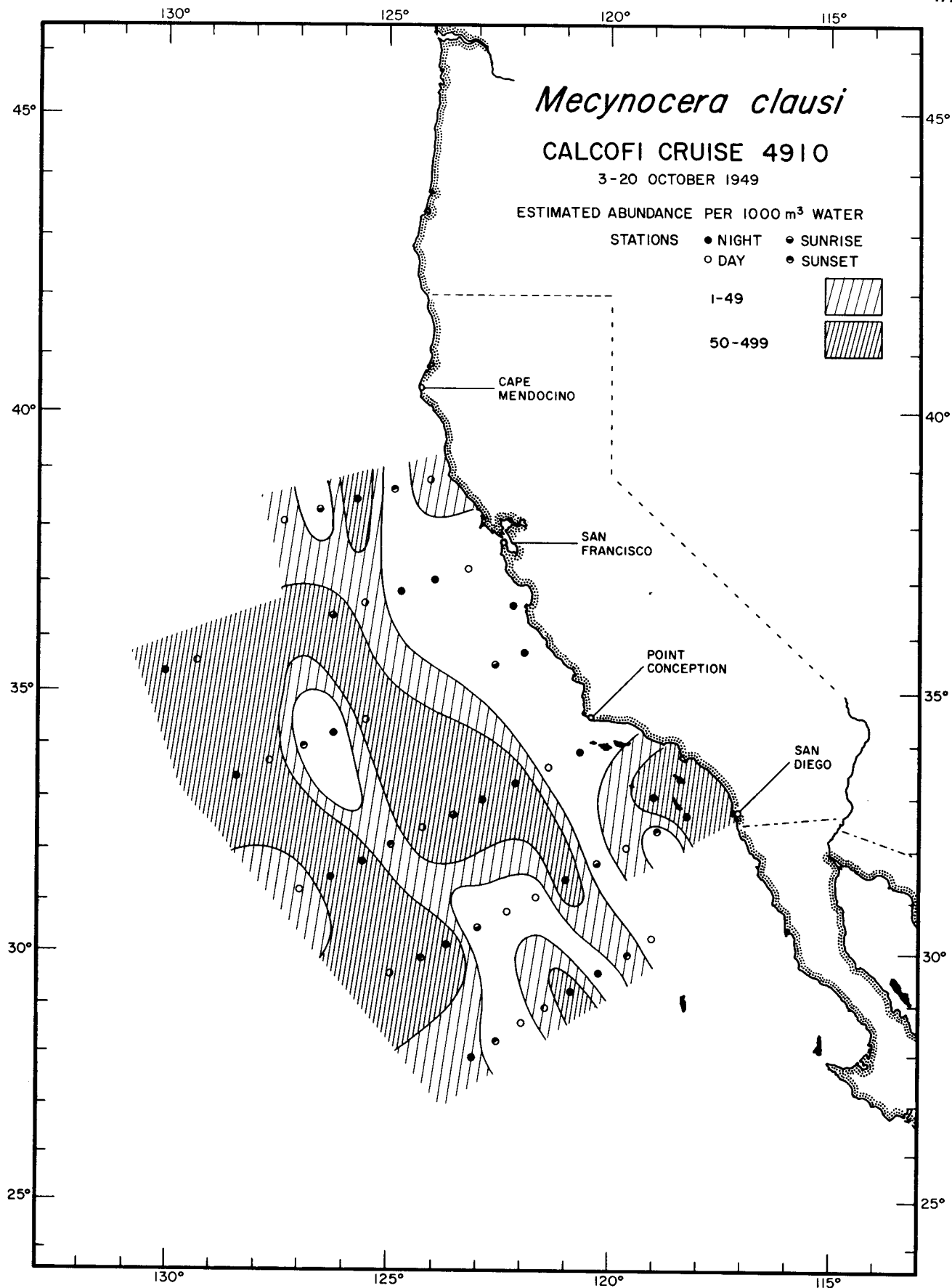
4908



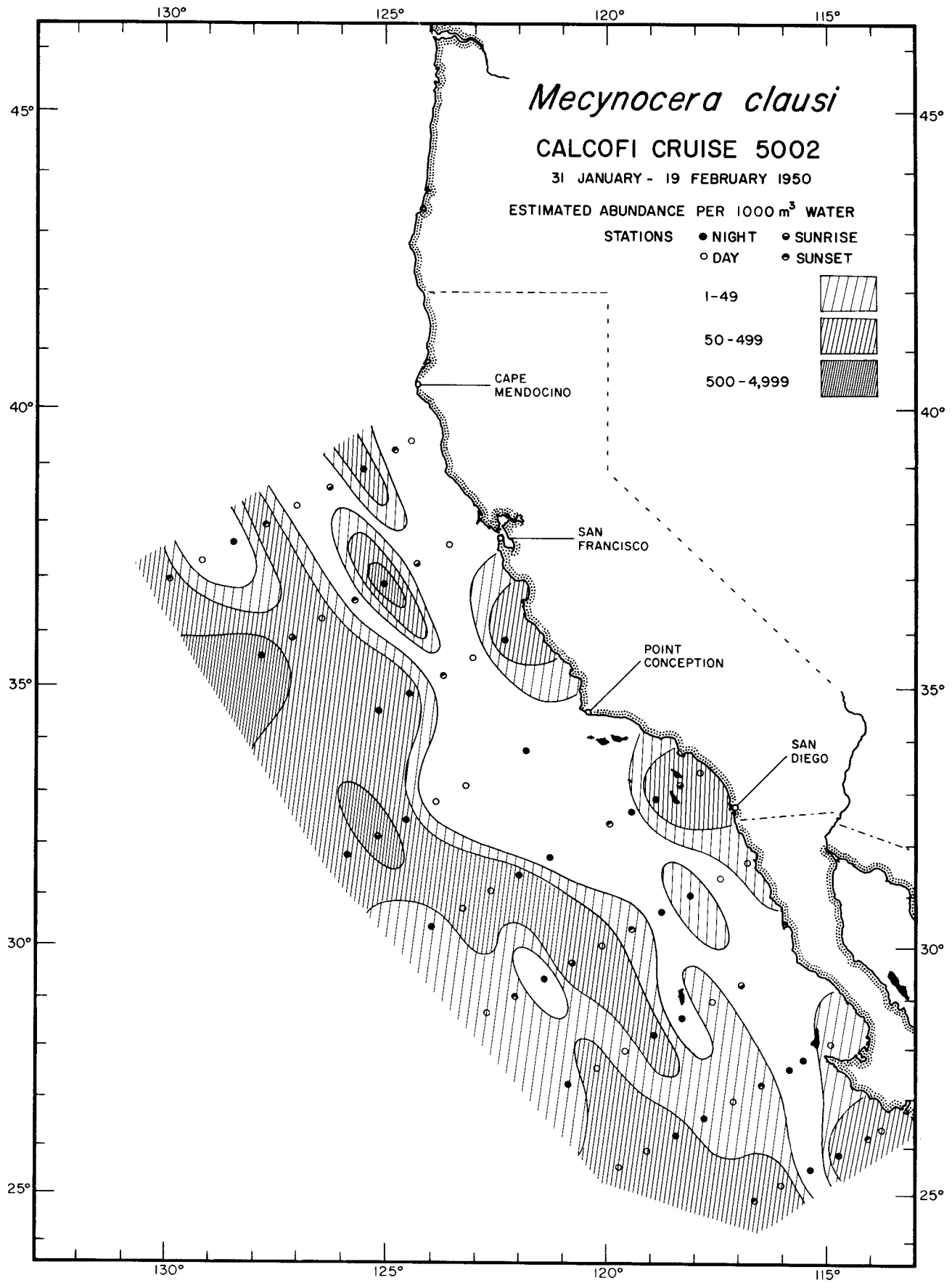
Calanoida

Mecynocera clausi

4909



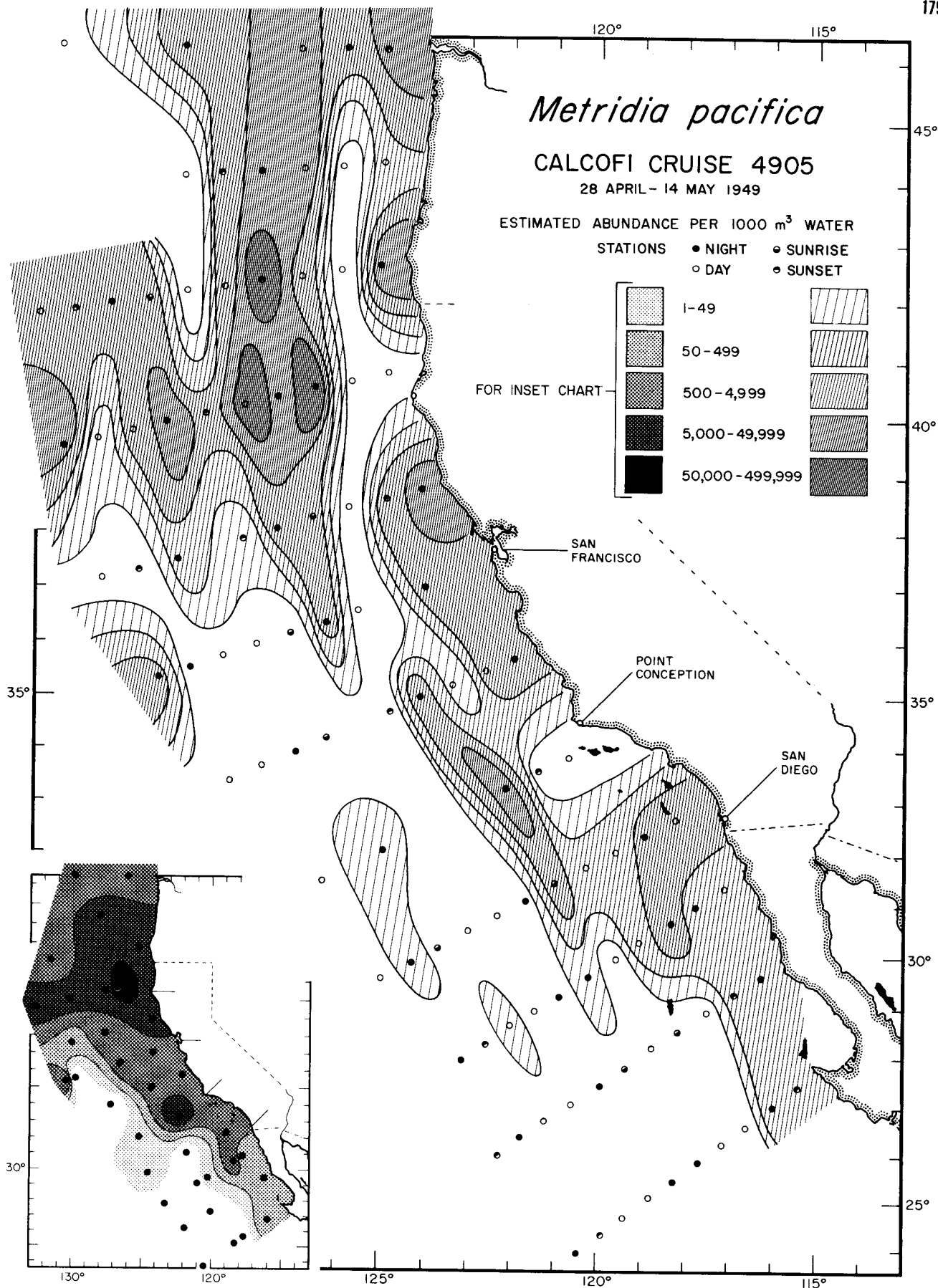
Calanoida
Mecynocera clausi
4910



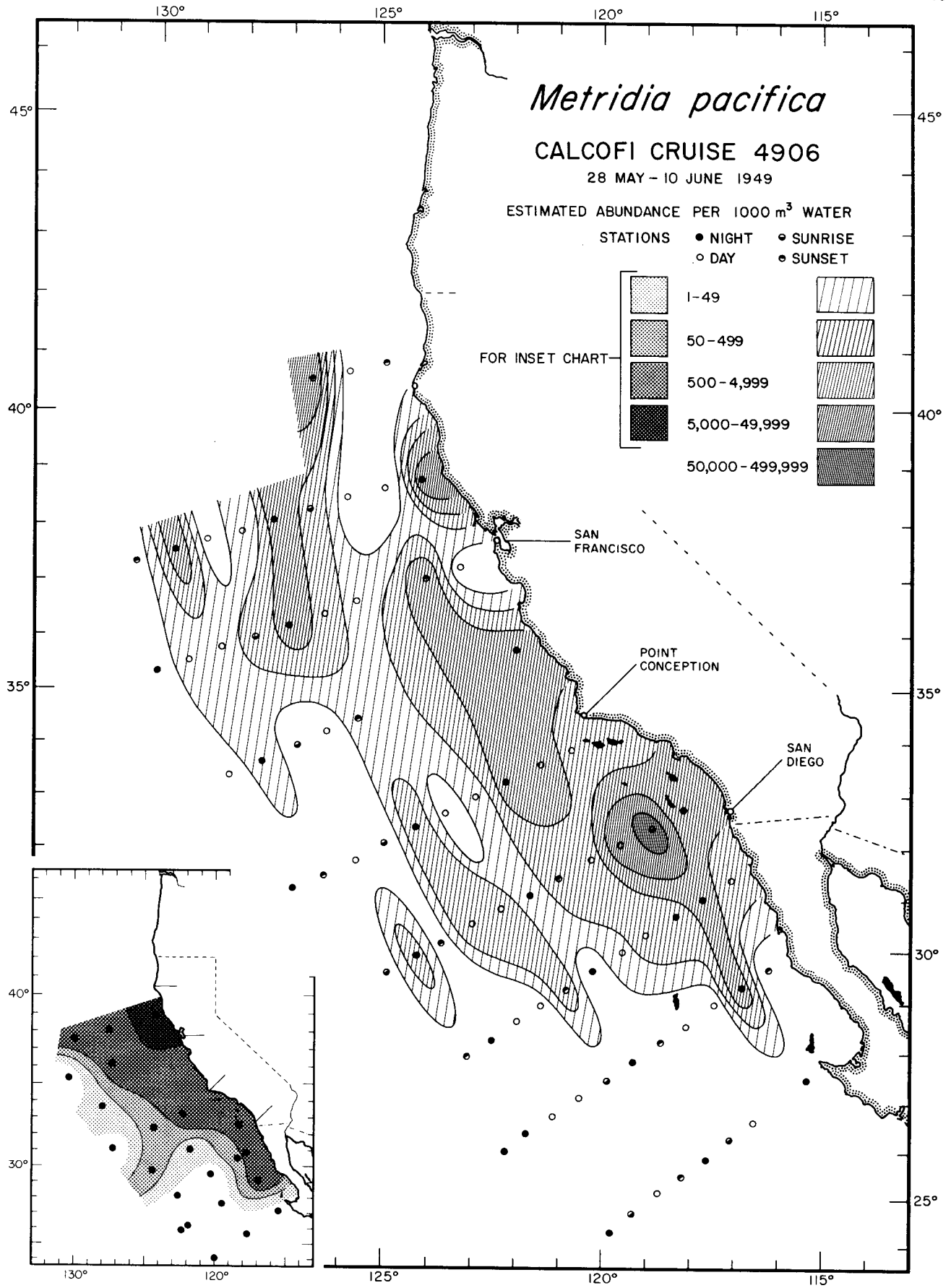
Calanoida

Mecynocera clausi

5002



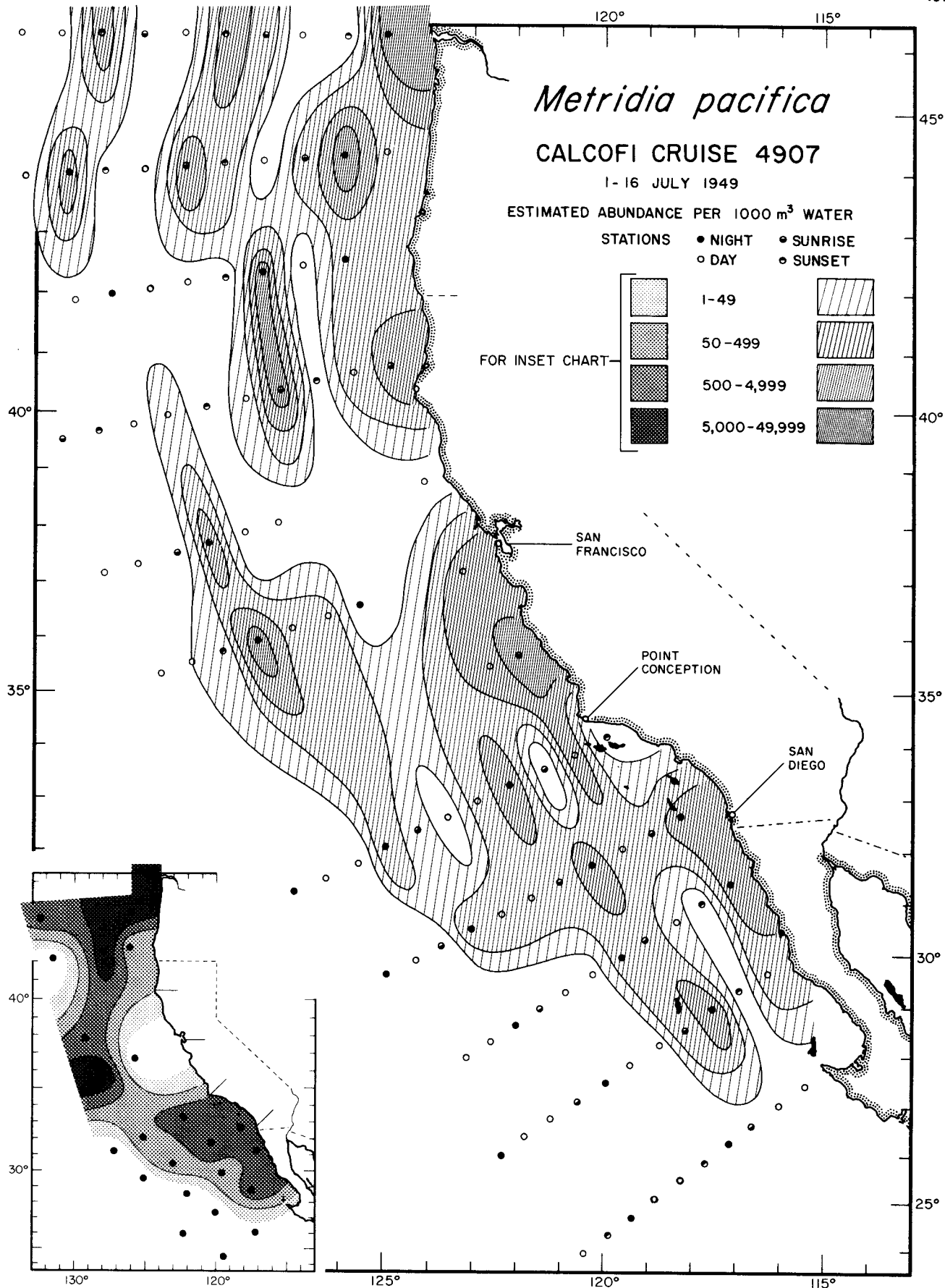
Calanoida
Metridia pacifica
4905

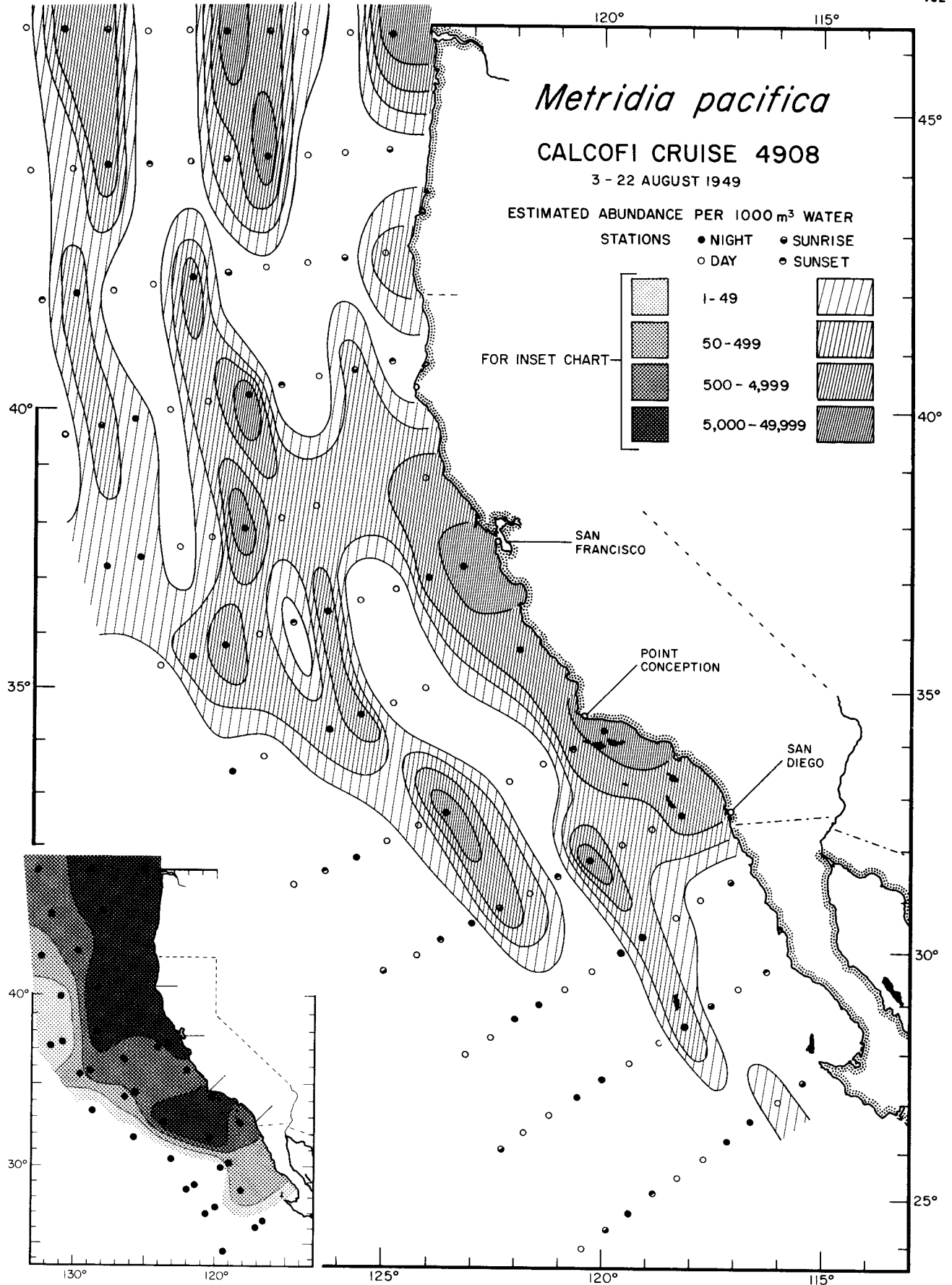


Calanoida

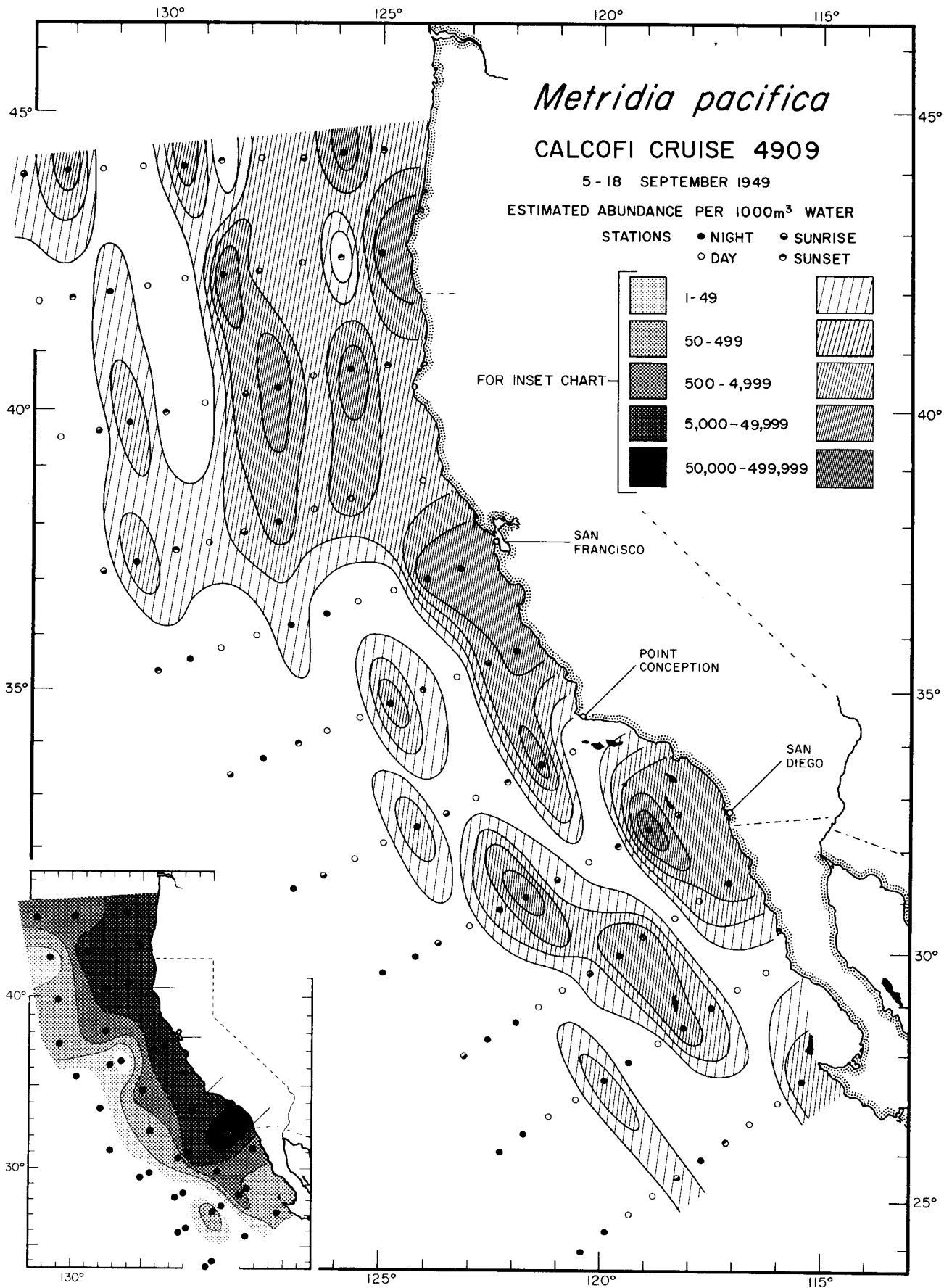
Metridia pacifica

4906





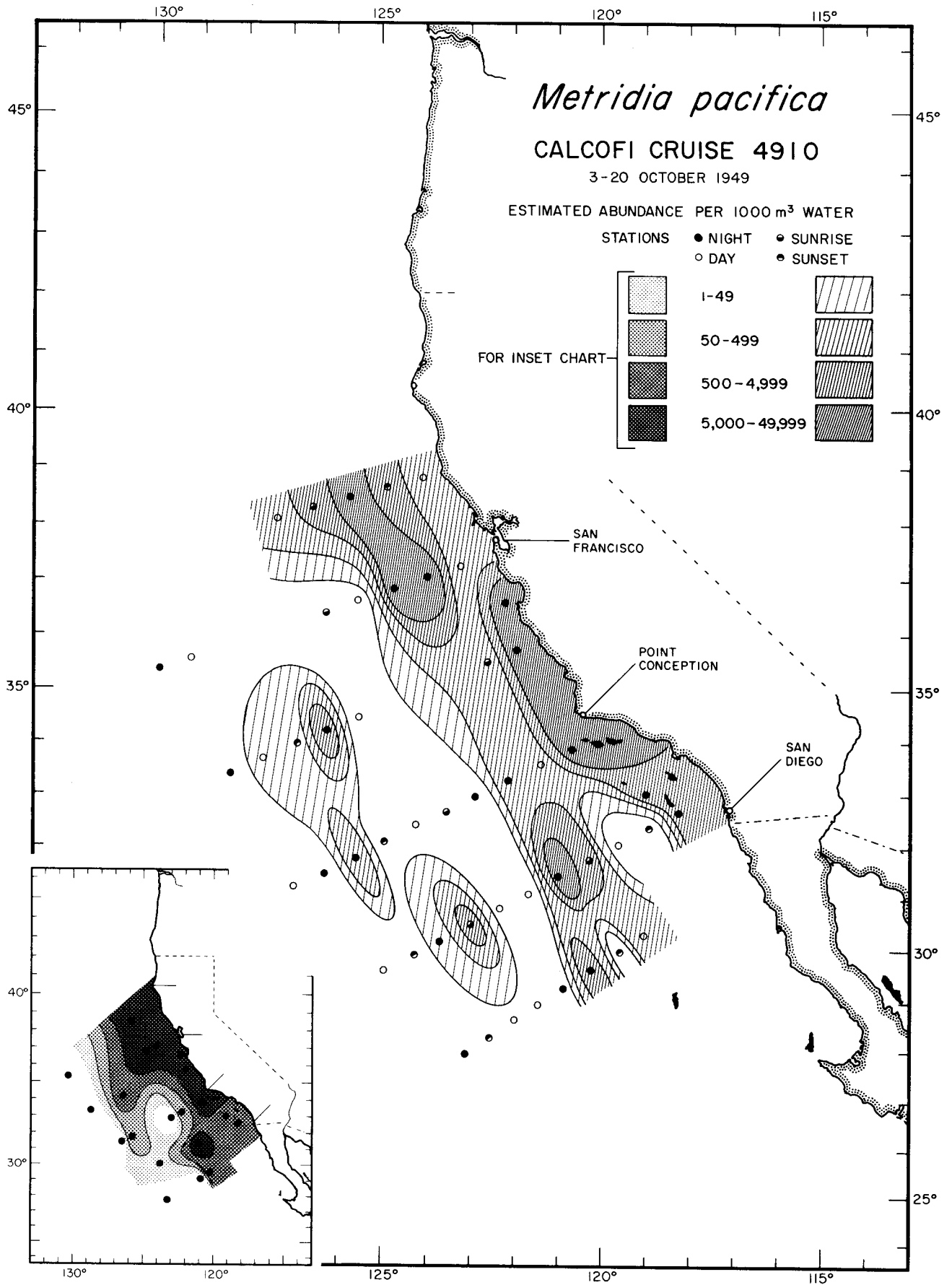
Calanoida
Metridia pacifica
4908



Calanoida

Metridia pacifica

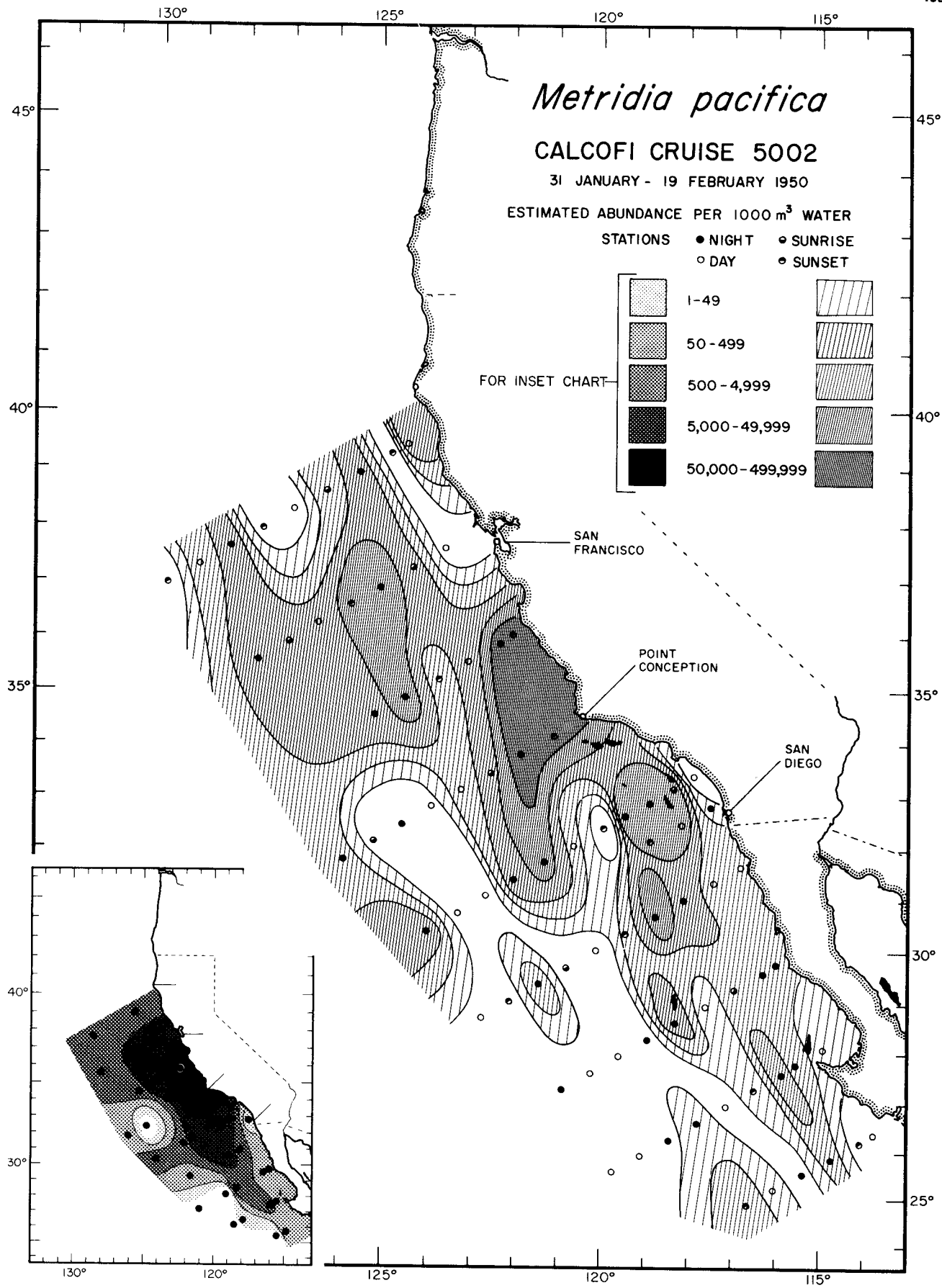
4909



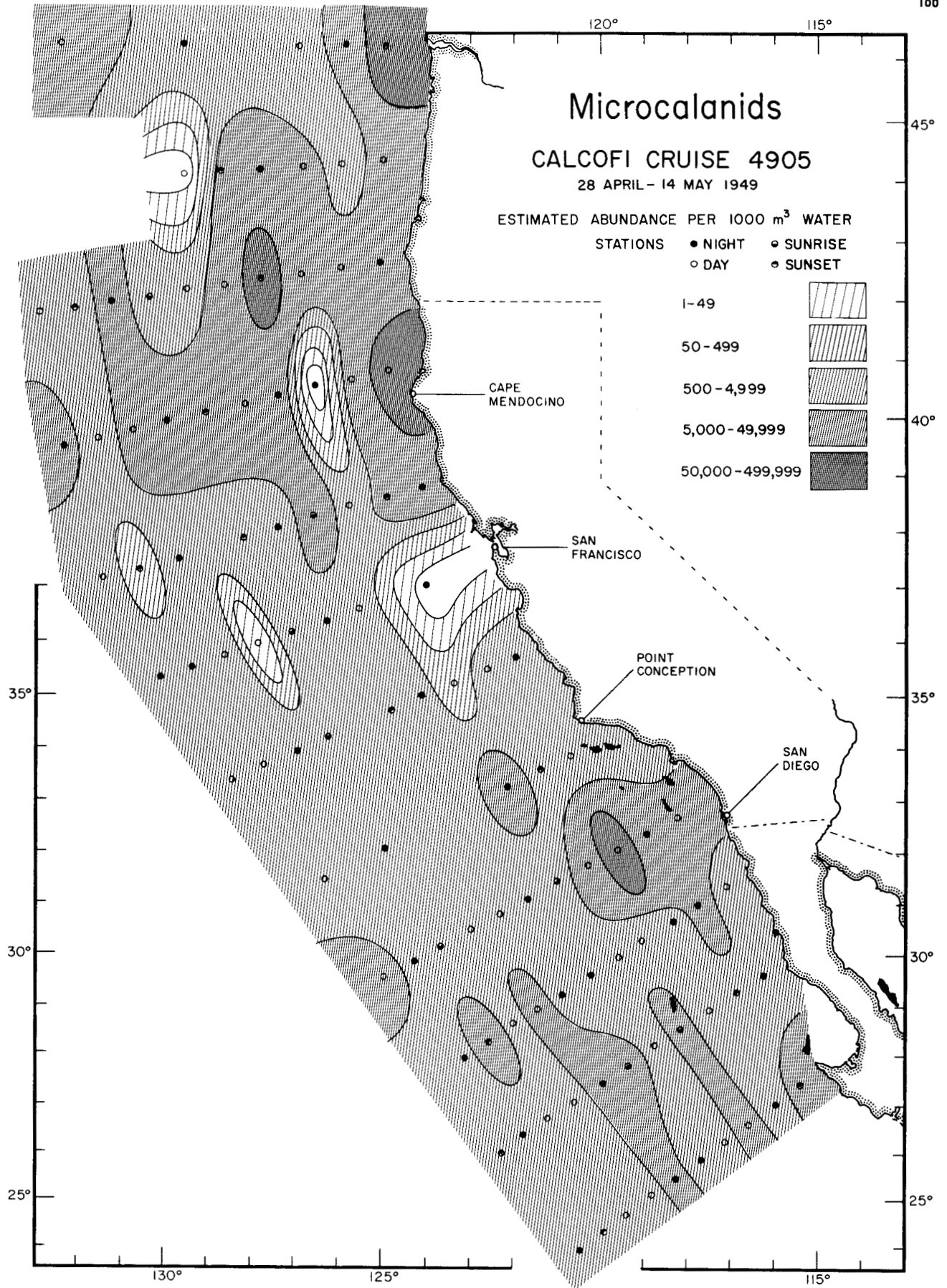
Calanoida

Metridia pacifica

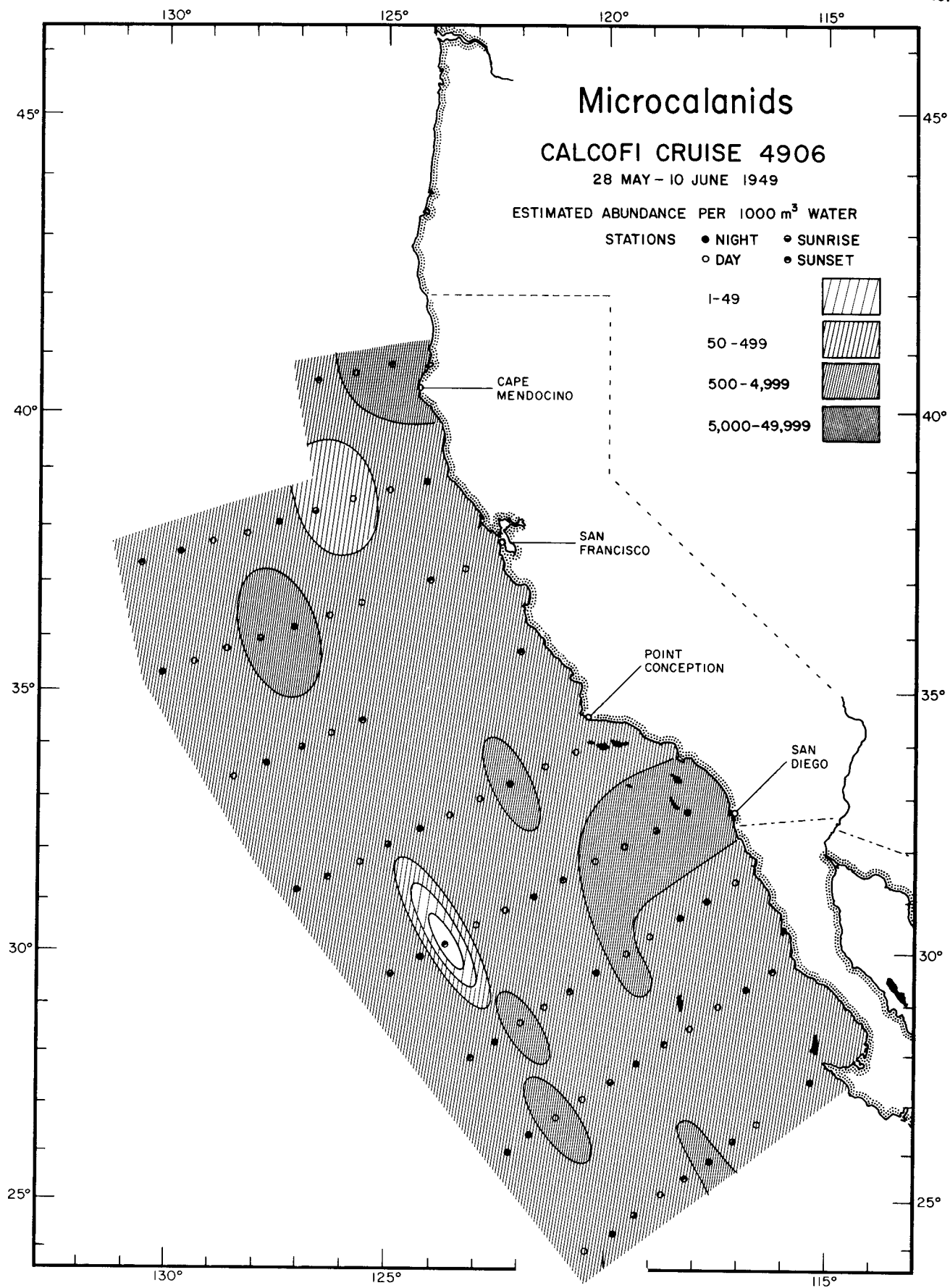
4910



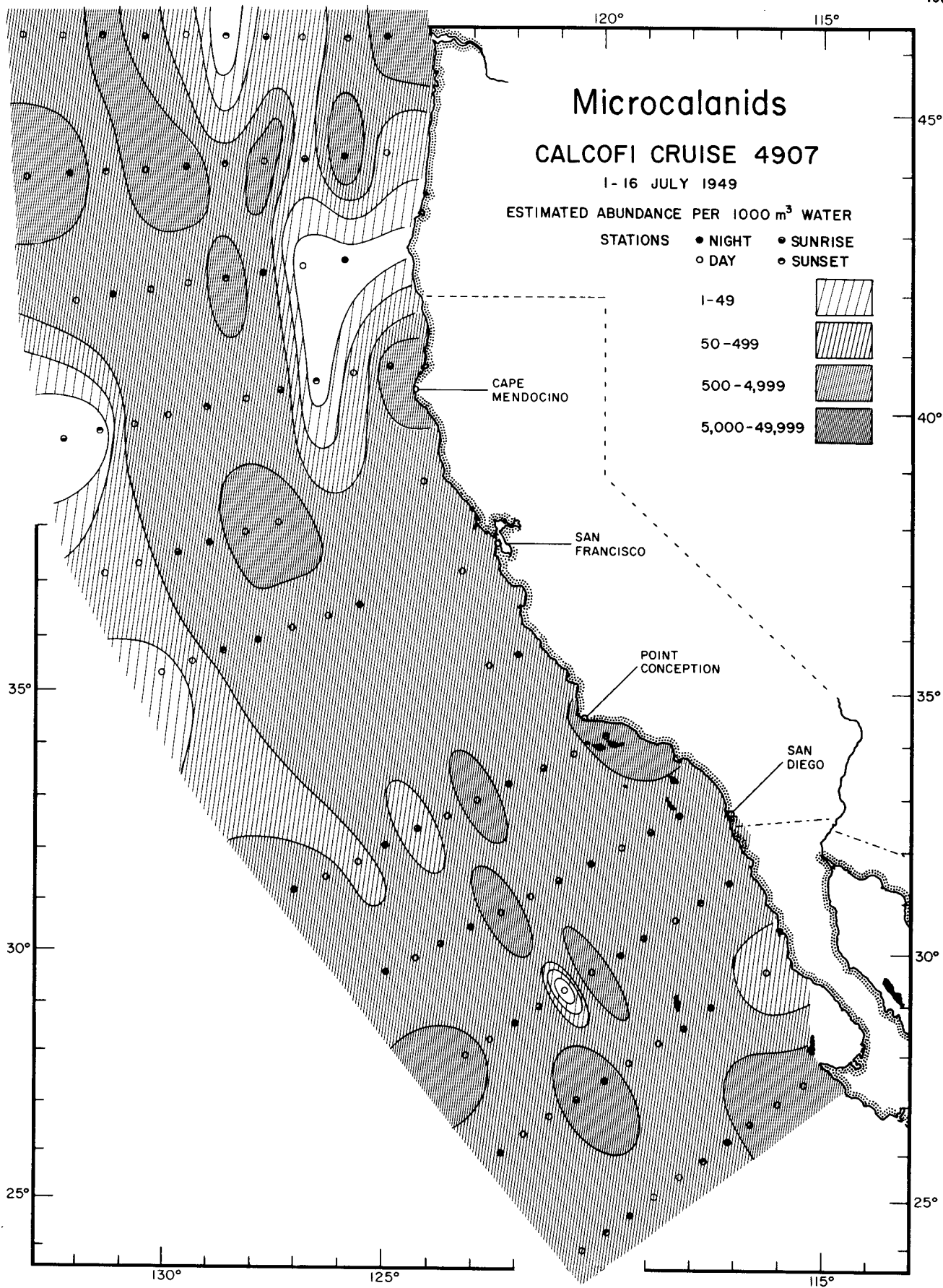
Calanoida
Metridia pacifica
5002



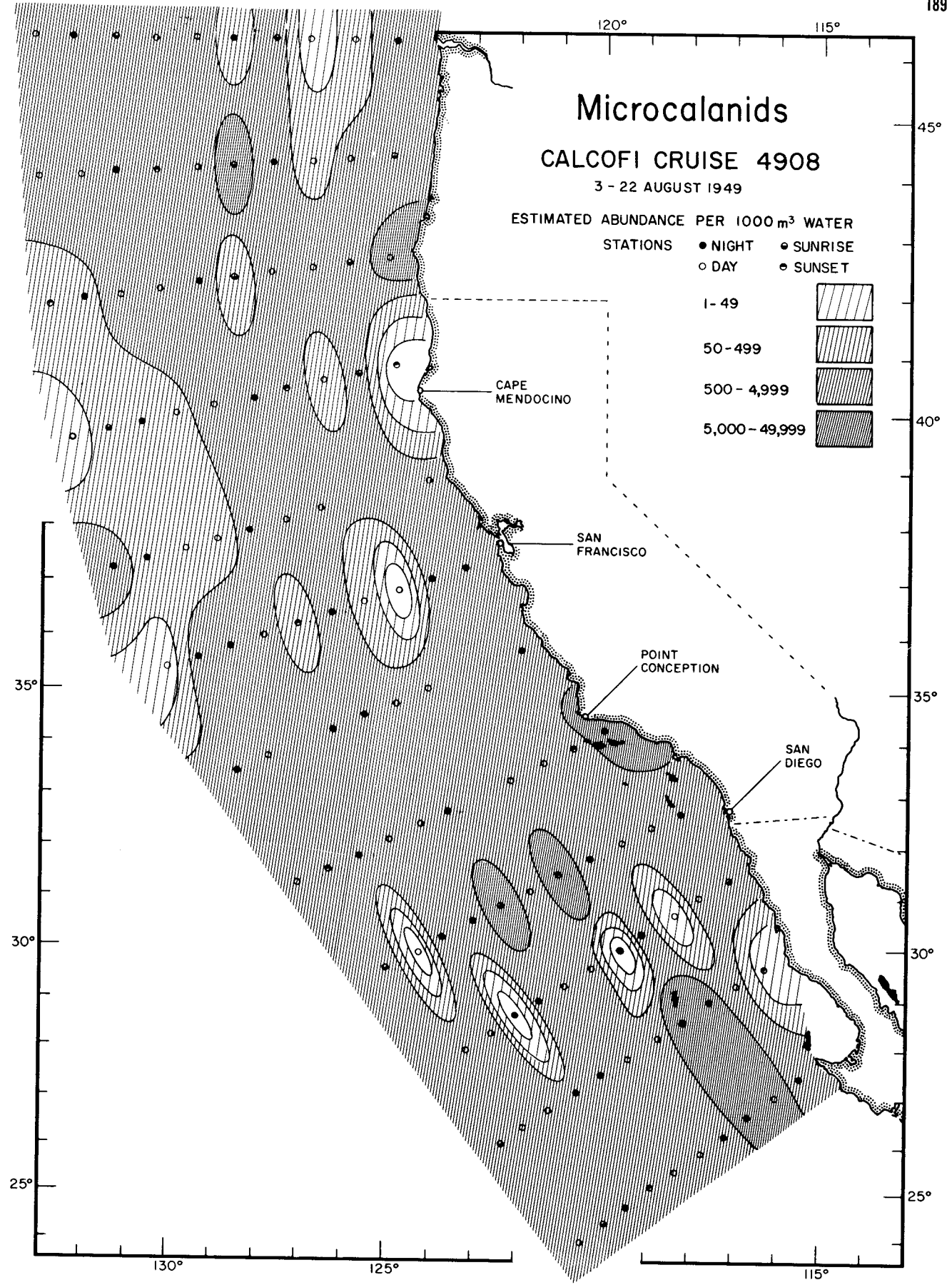
Calanoida
Microcalanids
4905



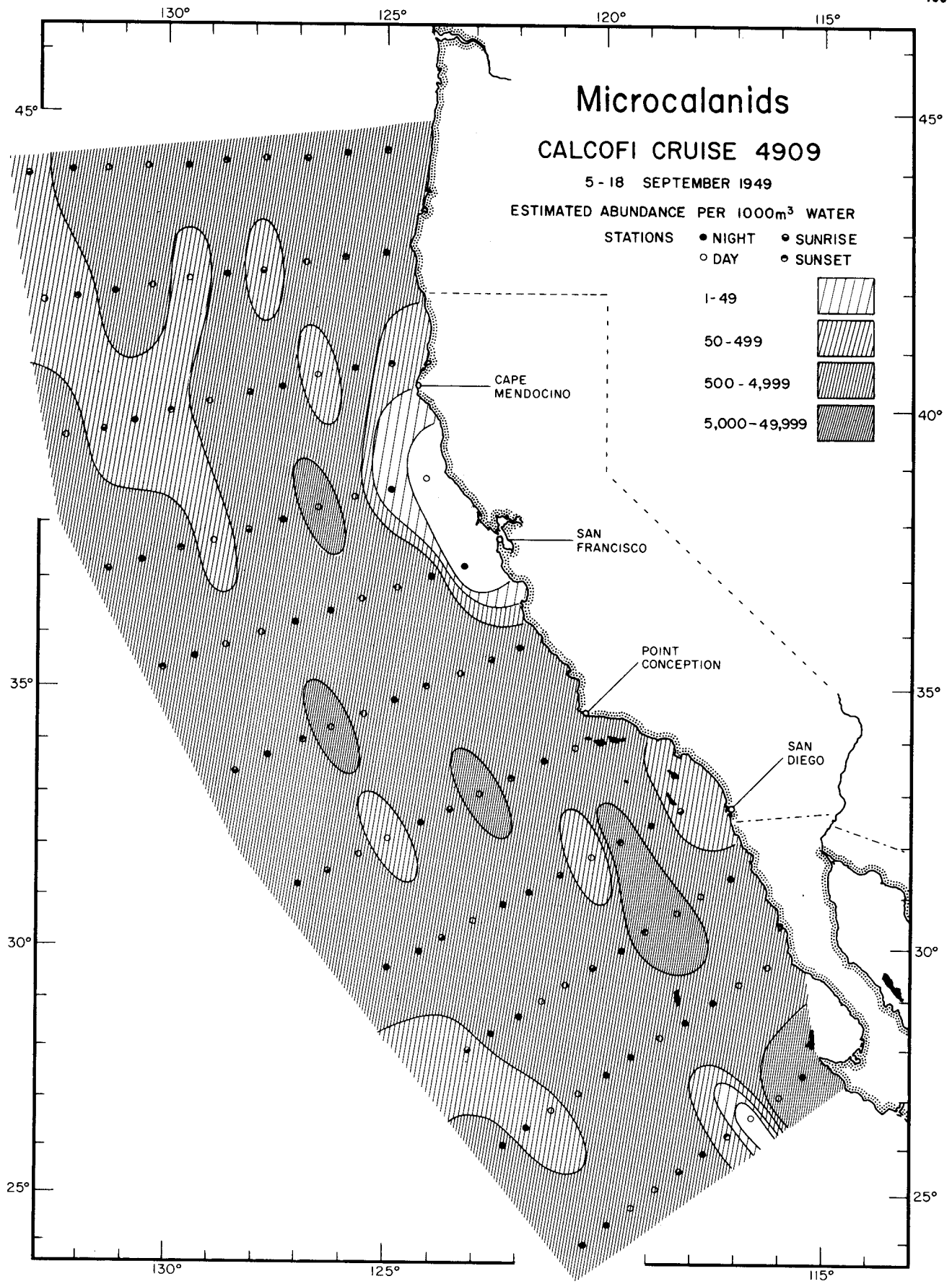
Calanoida
Microcalanids
4906



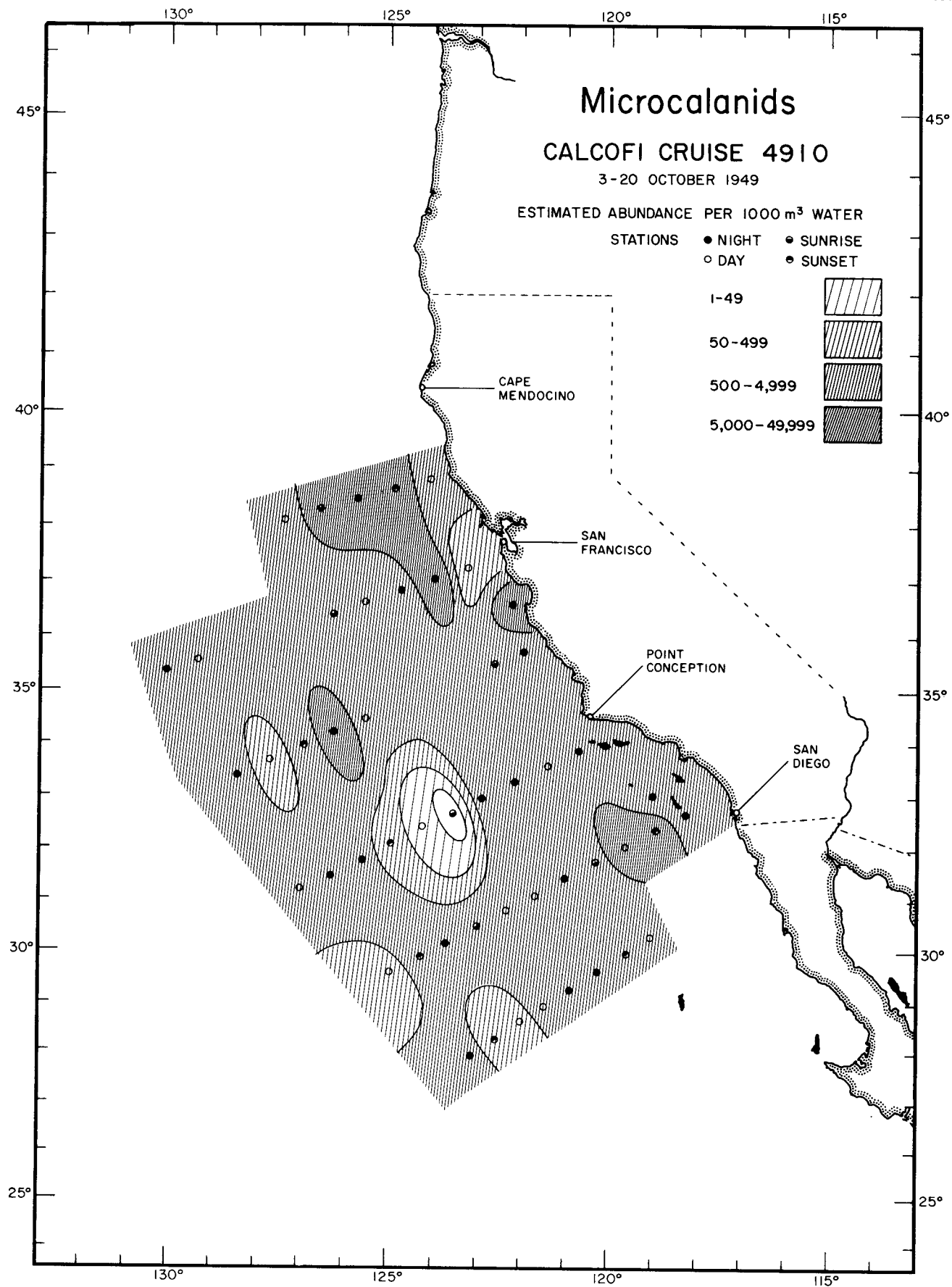
Calanoida
Microcalanids
4907



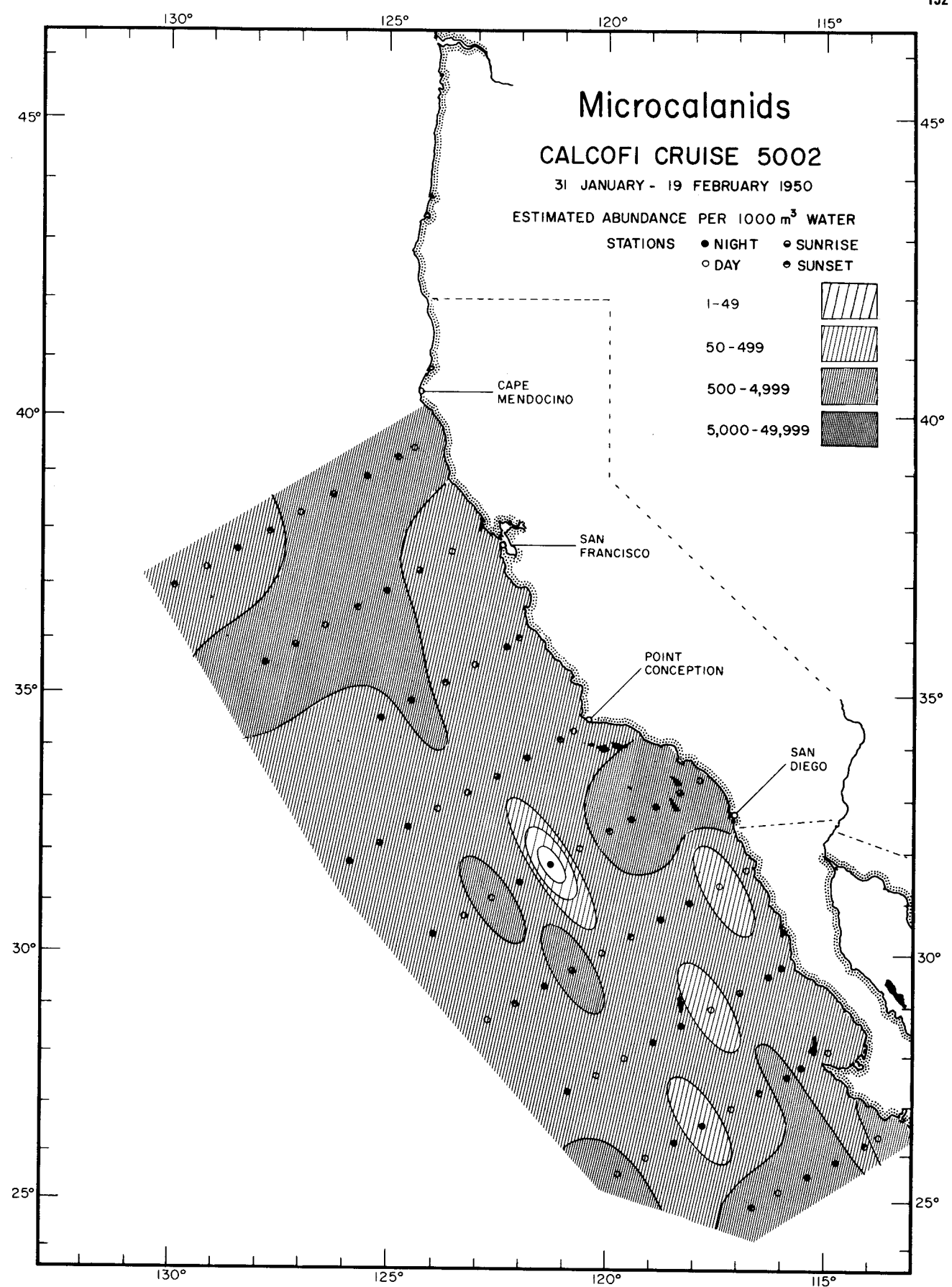
Calanoida
Microcalanids
4908



Calanoida
Microcalanids
4909



Calanoida
Microcalanids
4910



Microcalanids

CALCOFI CRUISE 5002

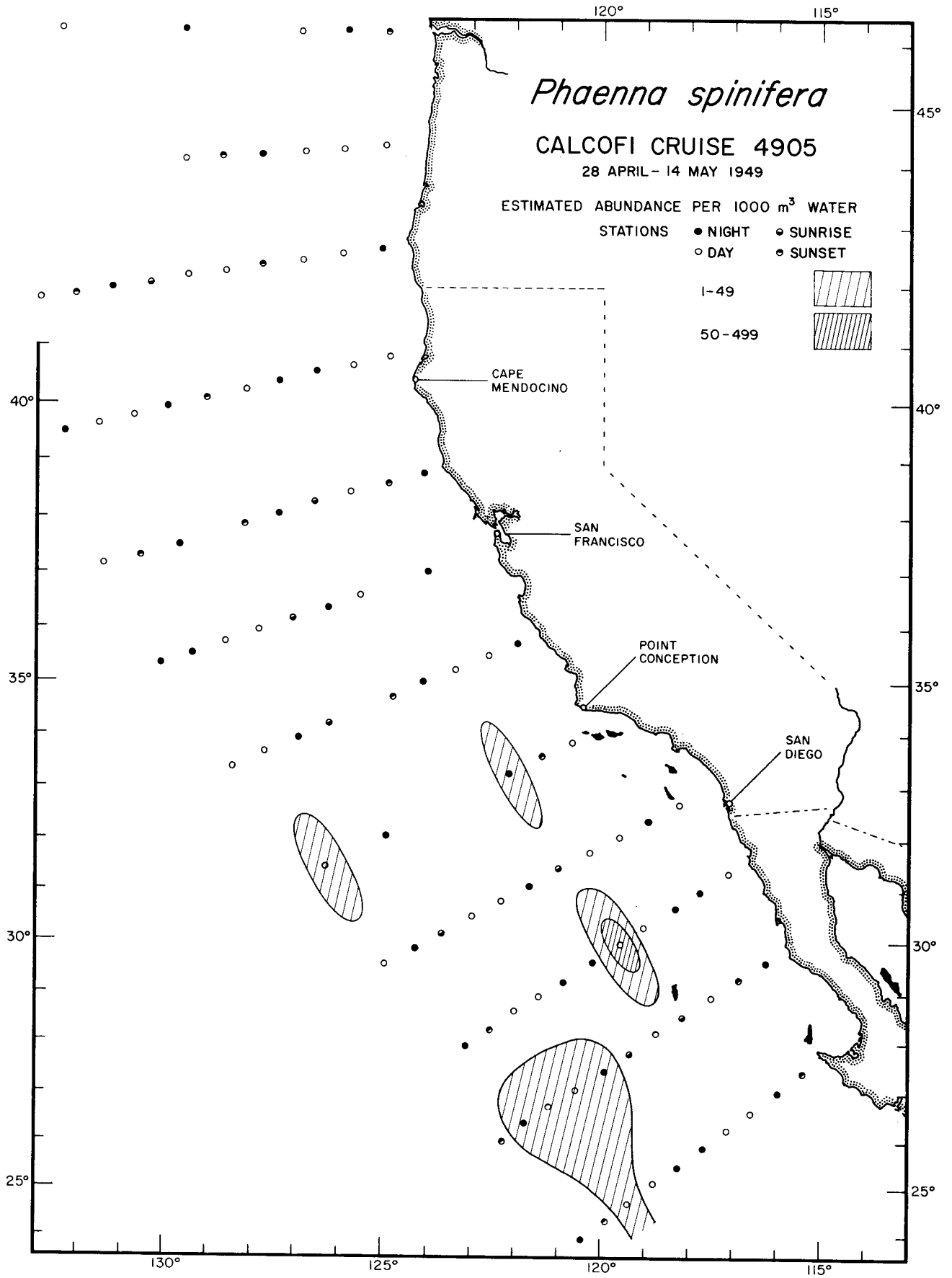
31 JANUARY - 19 FEBRUARY 1950

ESTIMATED ABUNDANCE PER 1000 m³ WATER

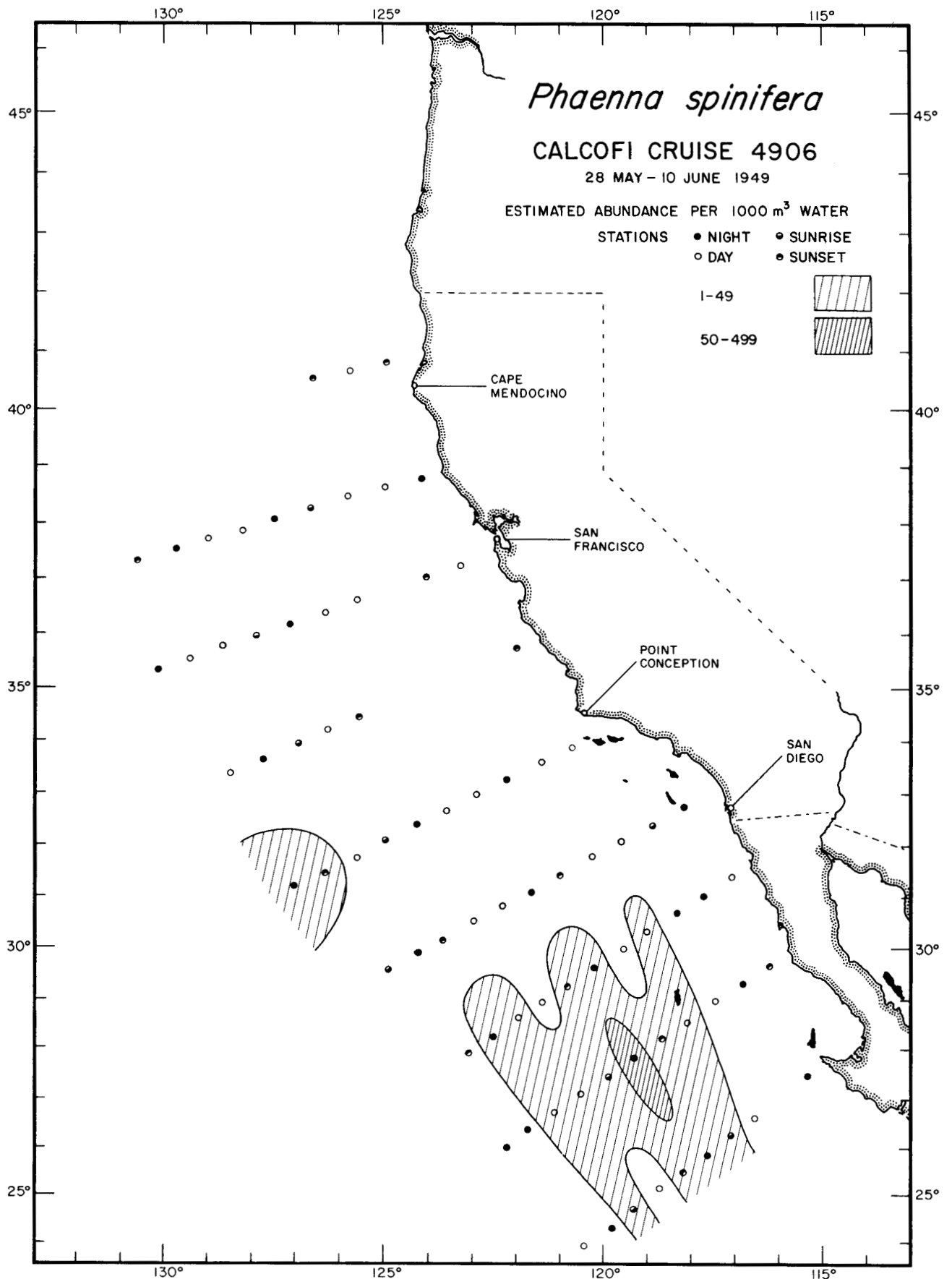
STATIONS ● NIGHT ○ DAY ● SUNRISE ○ SUNSET

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

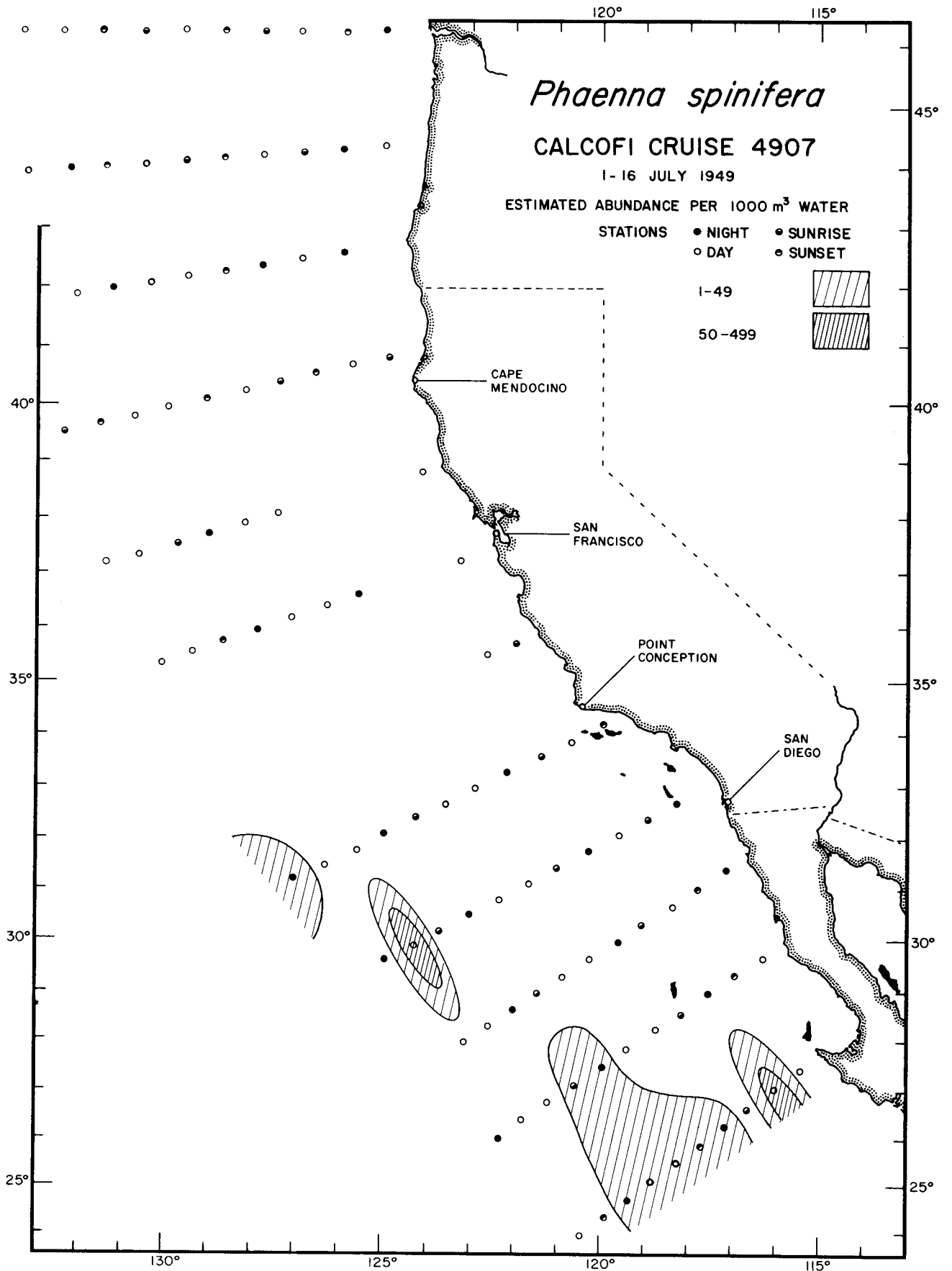
Calanoida
Microcalanids
5002



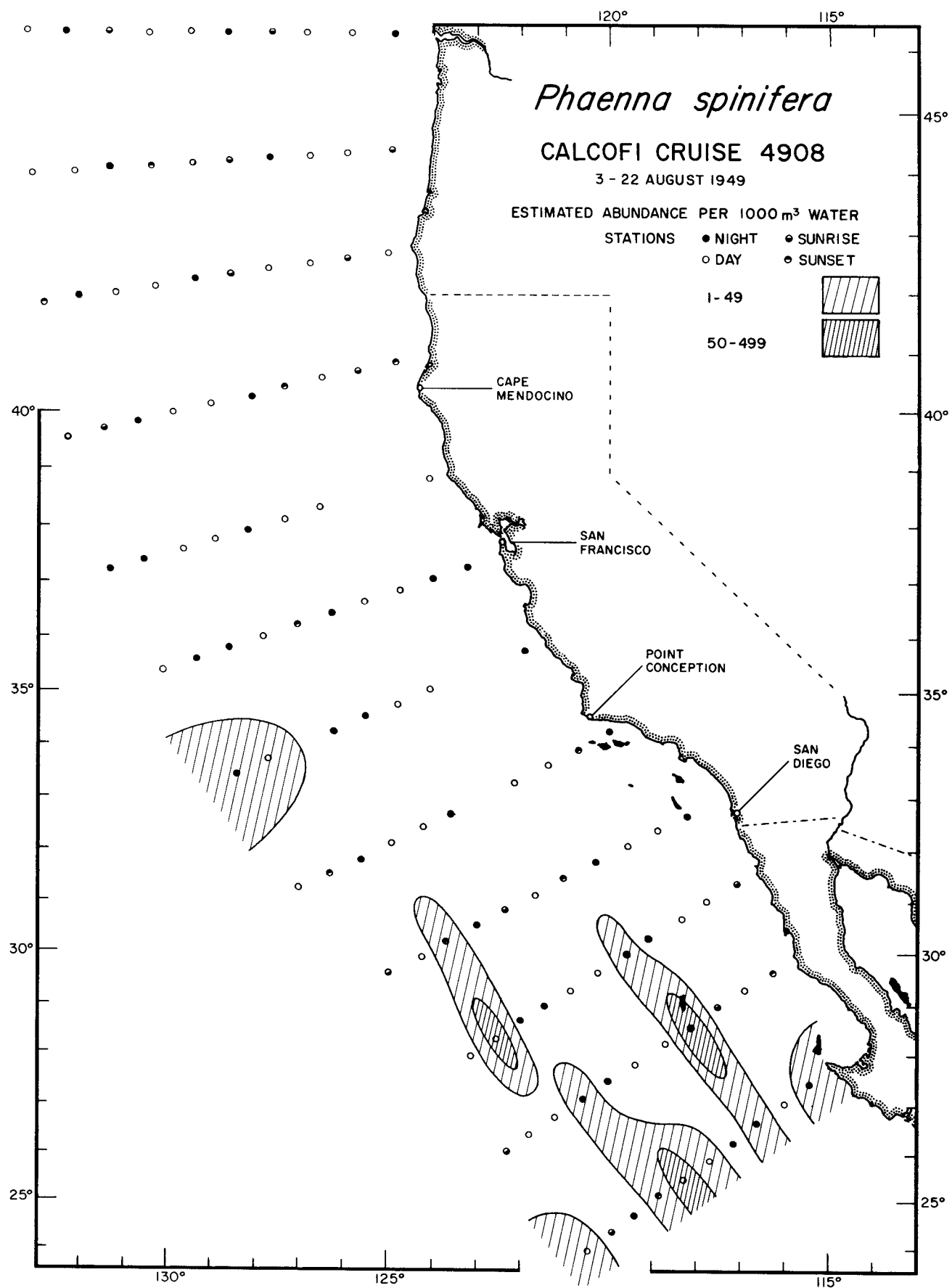
Calanoida
Phaenna spinifera
4905



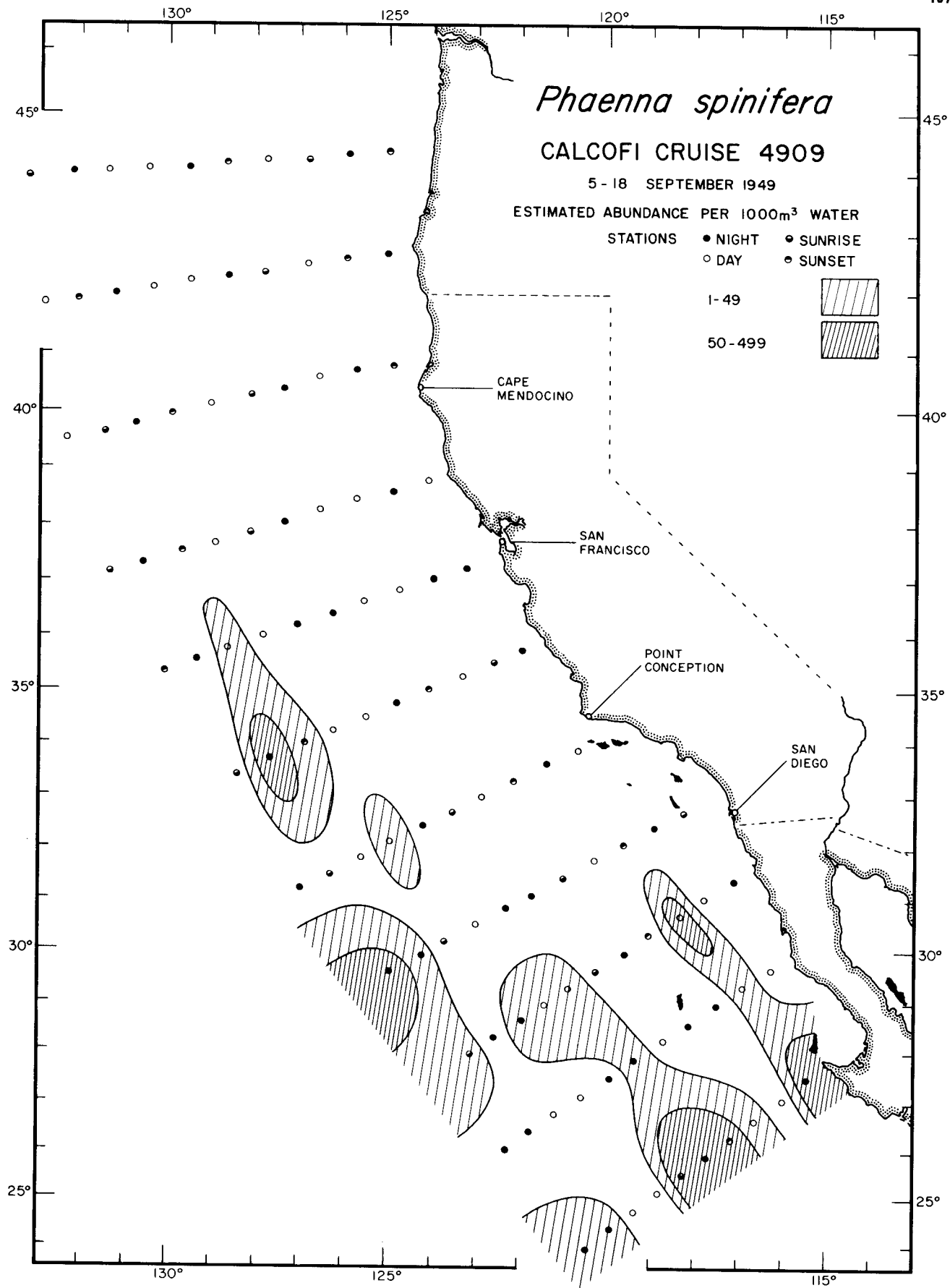
Calanoida
Phaenna spinifera
4906



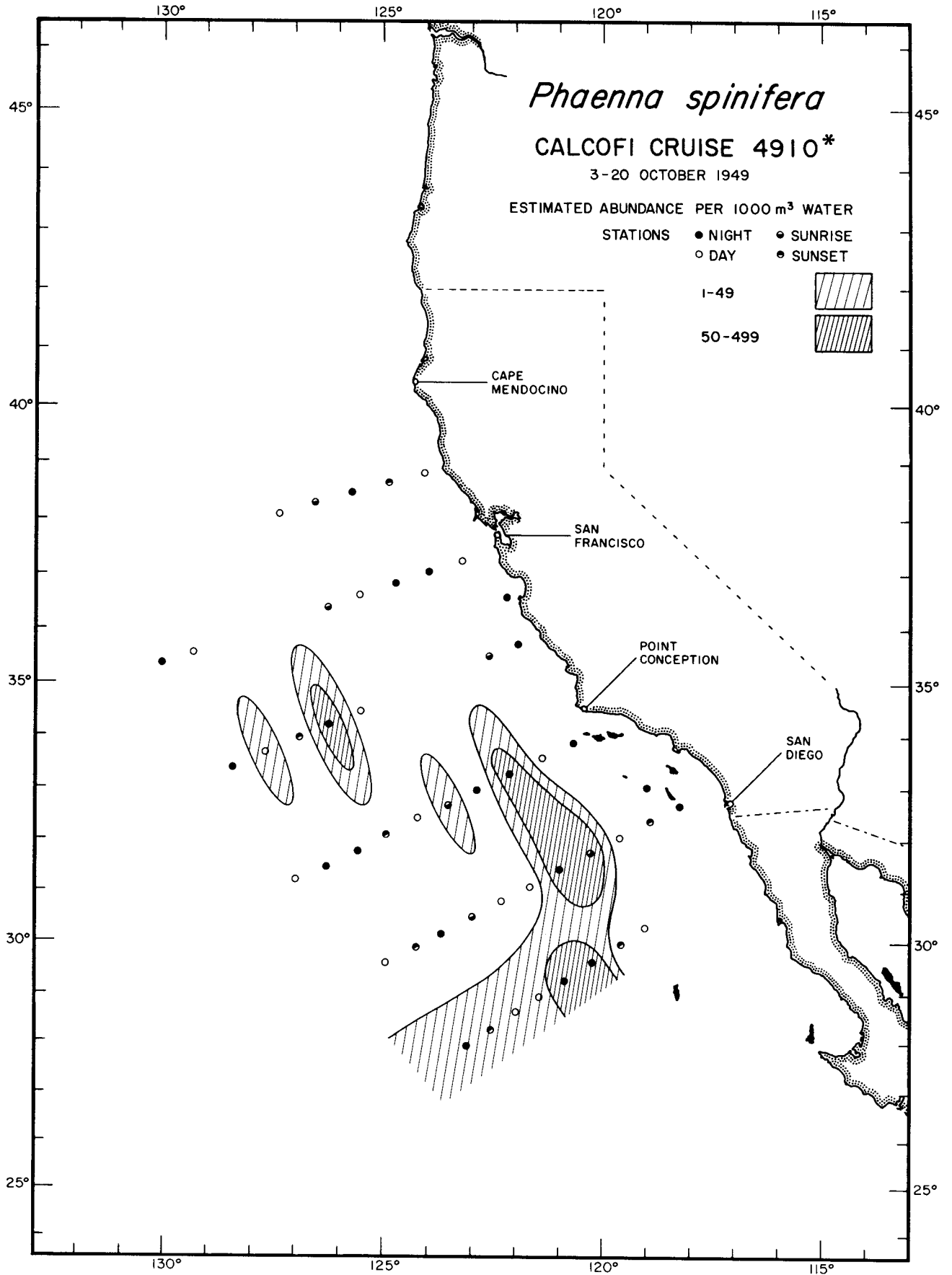
Calanoida
Phaenna spinifera
4907



Calanoida
Phaenna spinifera
4908

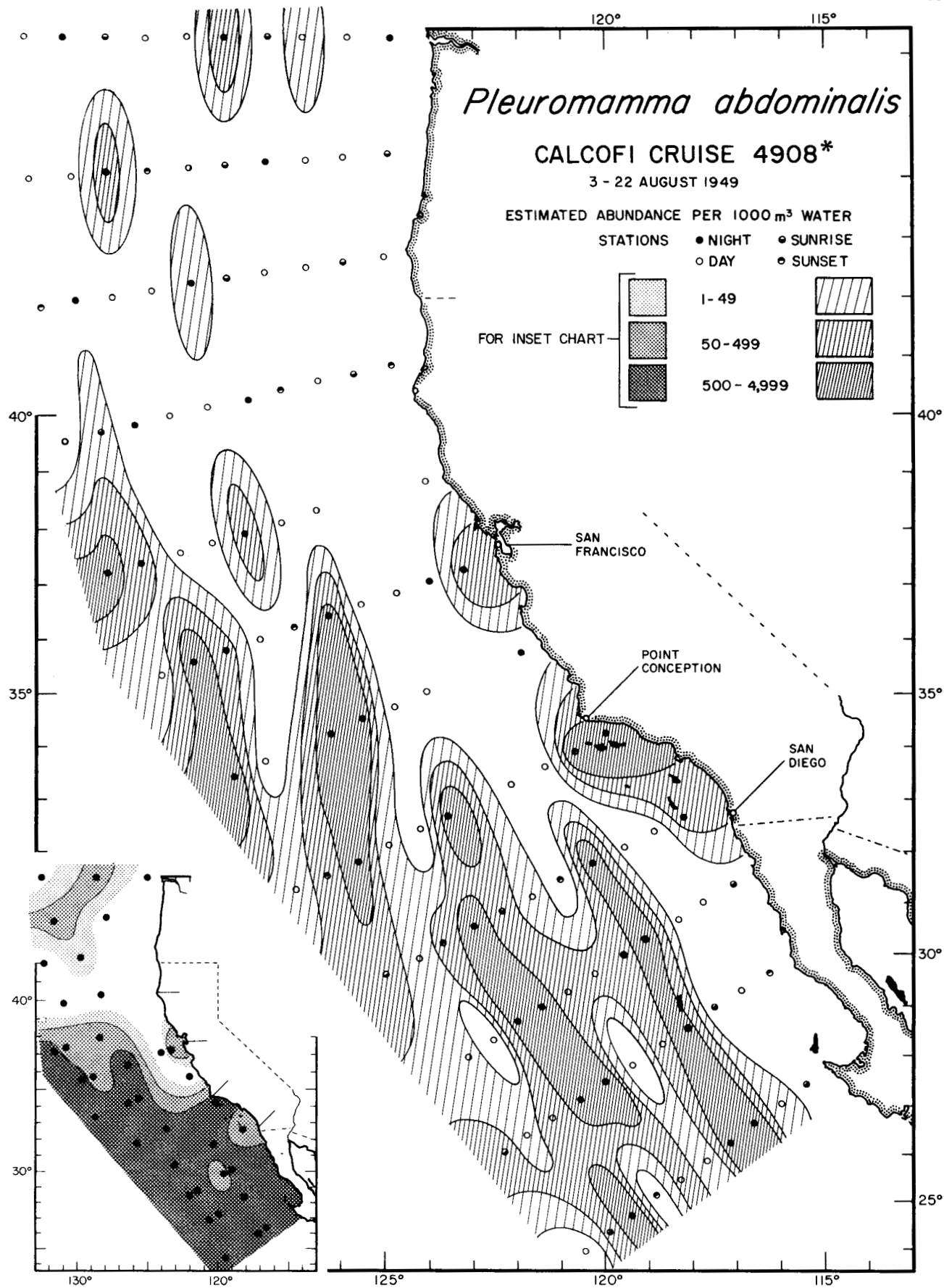


Calanoida
Phaenna spinifera
4909



* See Table 1 for cruise 5002

Calanoida
Phaenna spinifera
4910

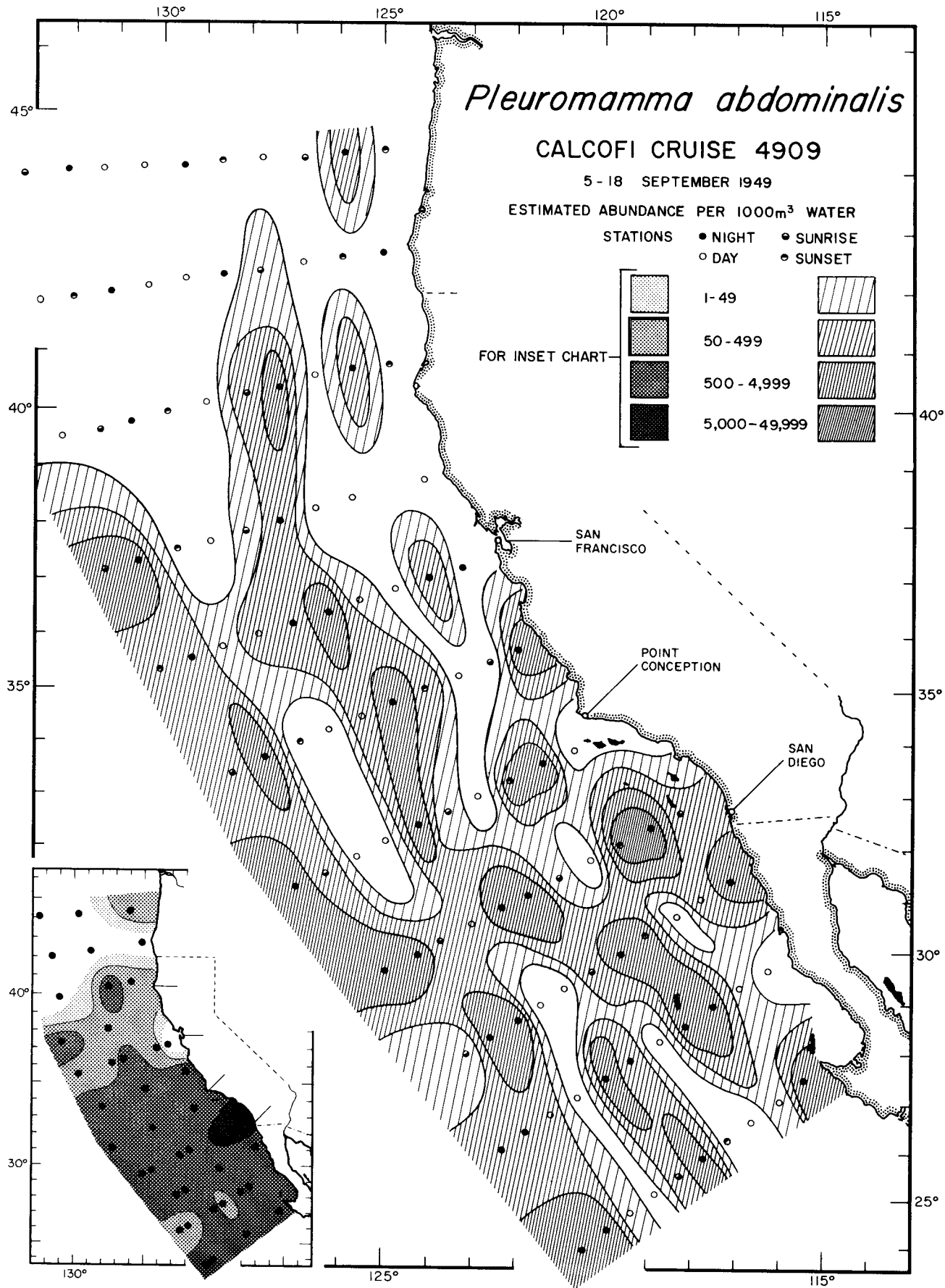


* No data for cruises 4905, 6, 7

Calanoida

Pleuromamma abdominalis

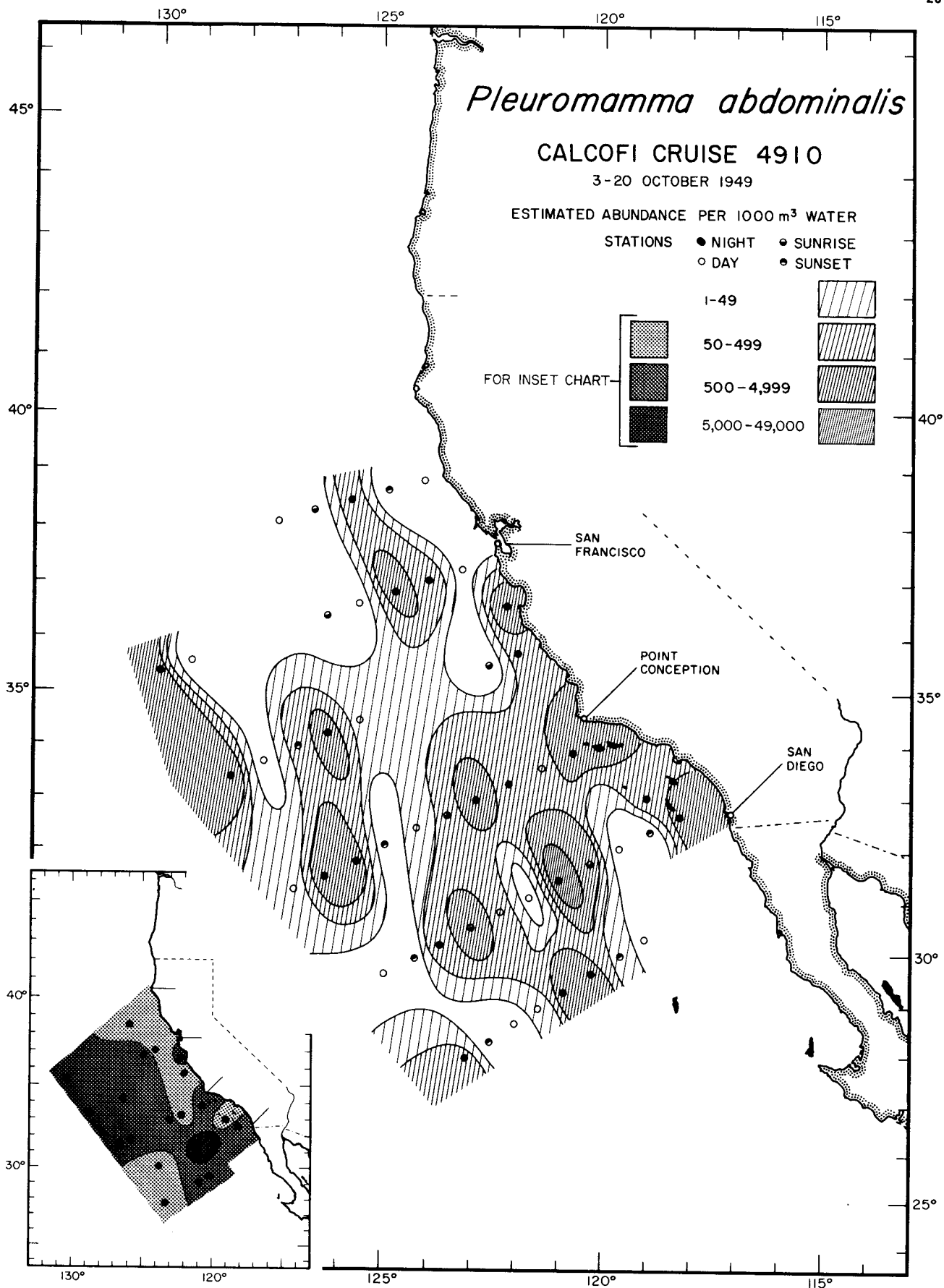
4908



Calanoida

Pleuromamma abdominalis

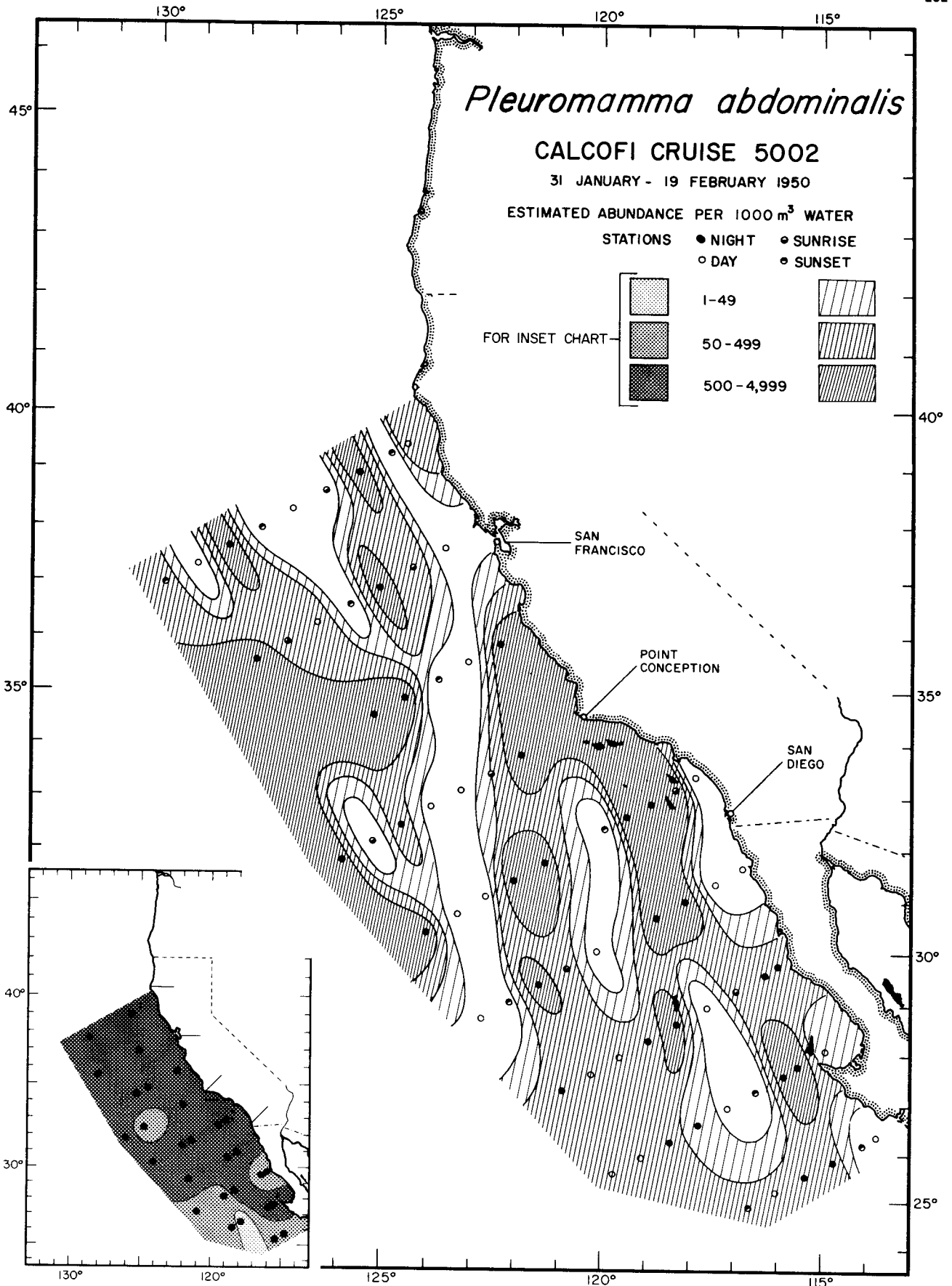
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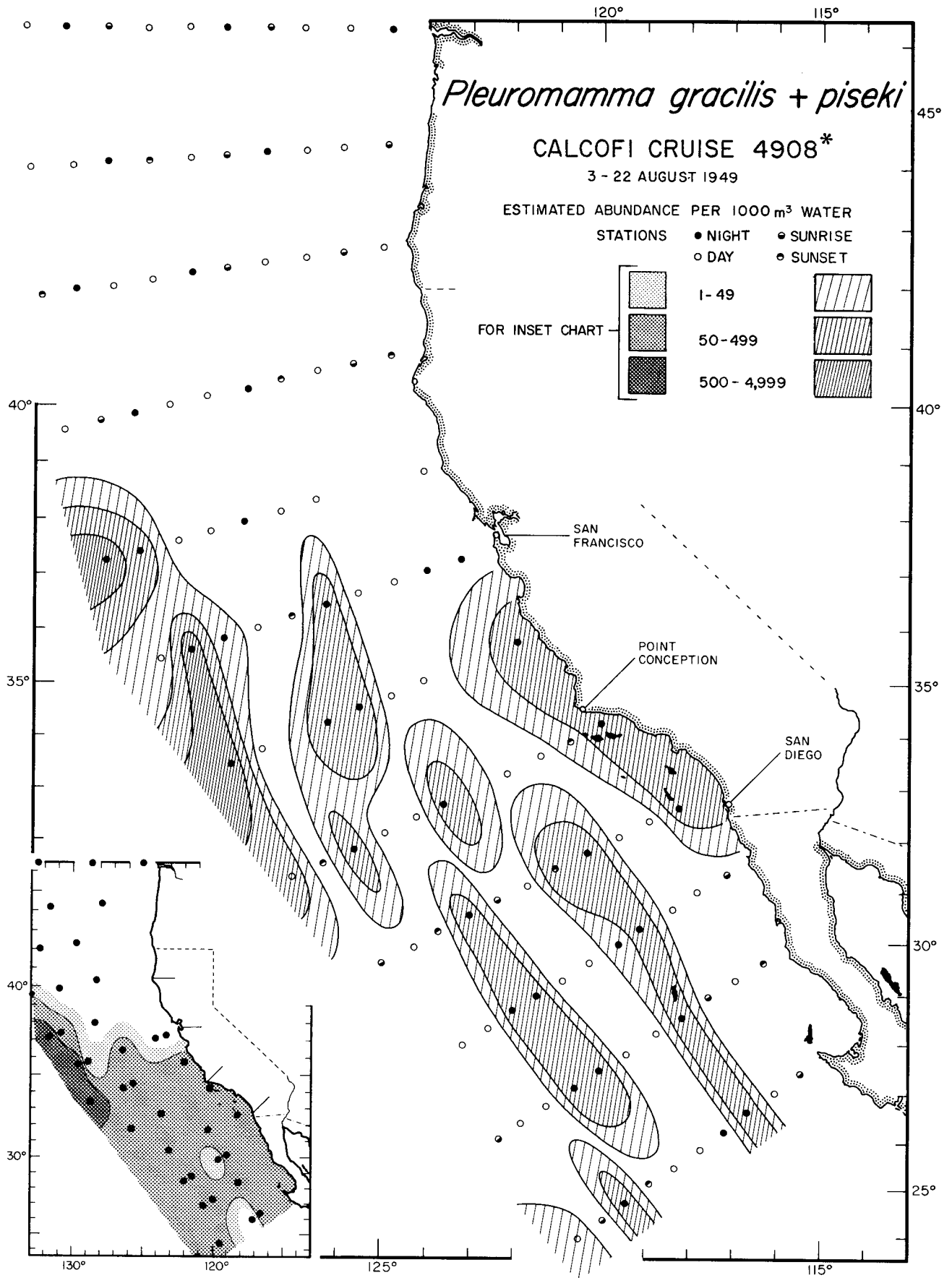
Calanoida

Pleuromamma abdominalis

4910



Calanoida
Pleuromamma abdominalis
5002

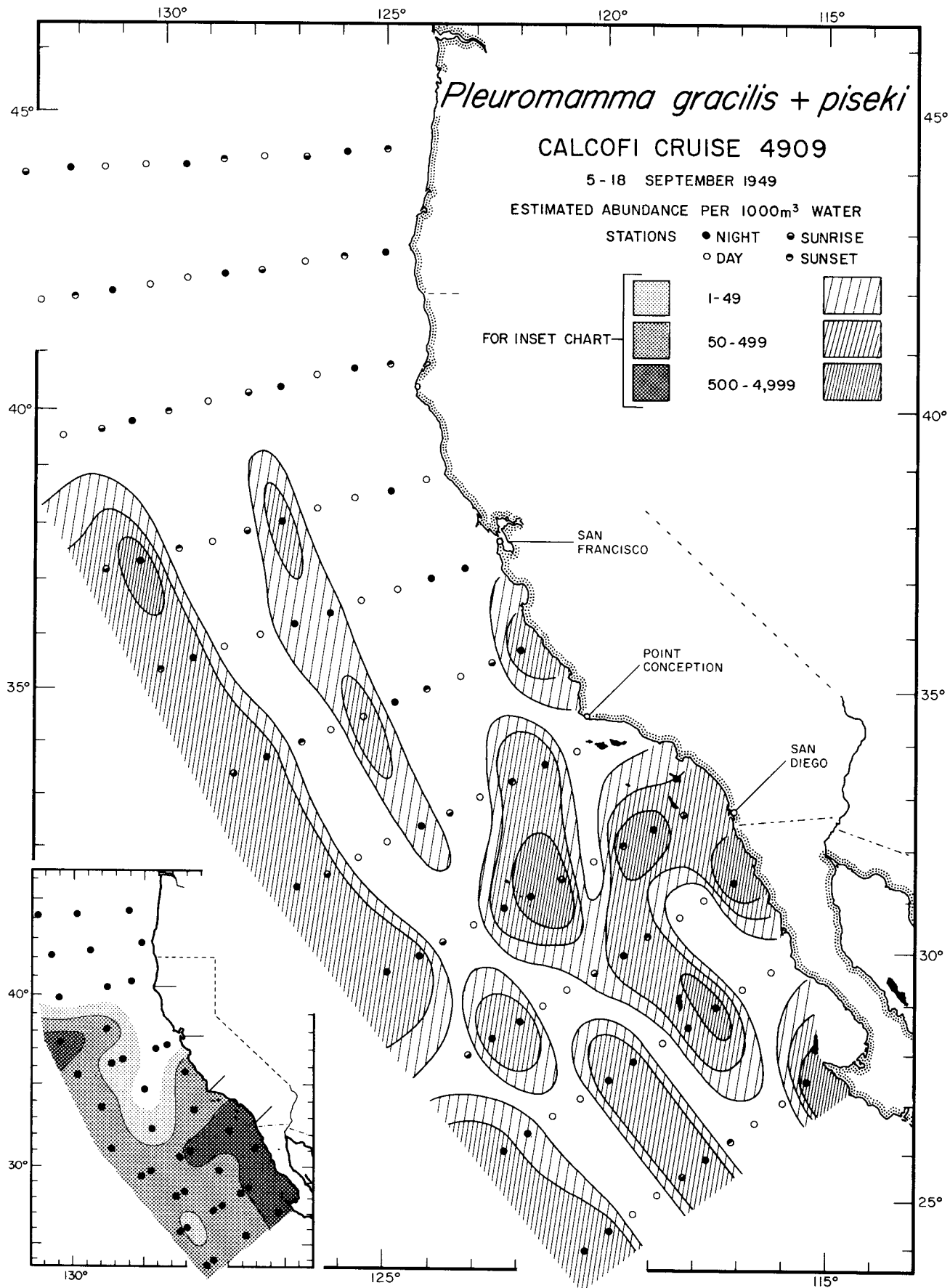


* No data for cruises 4905, 6, 7

Calanoida

Pleuromamma gracilis + piseki

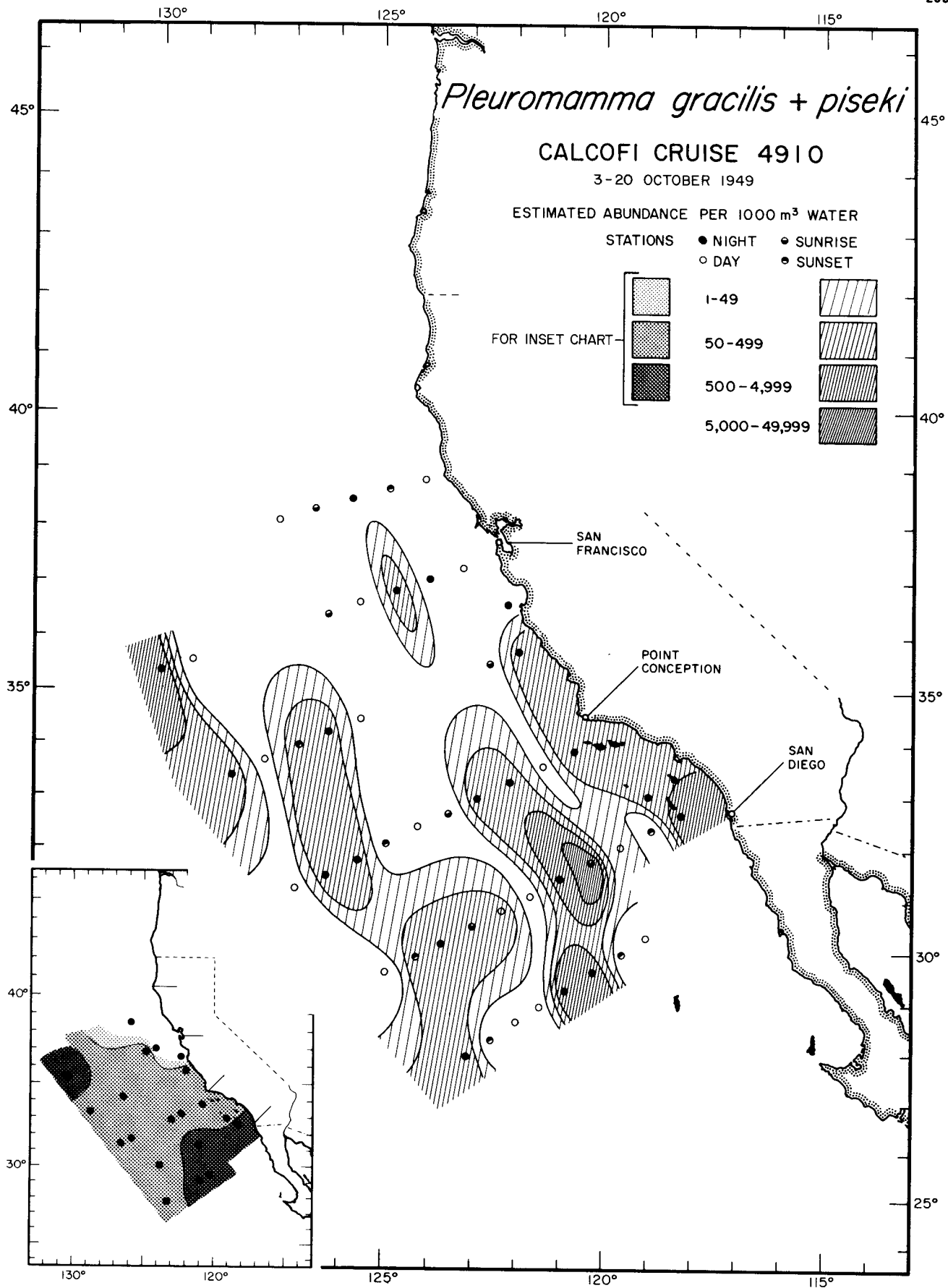
4908



Calanoida

Pleuromamma gracilis + piseki

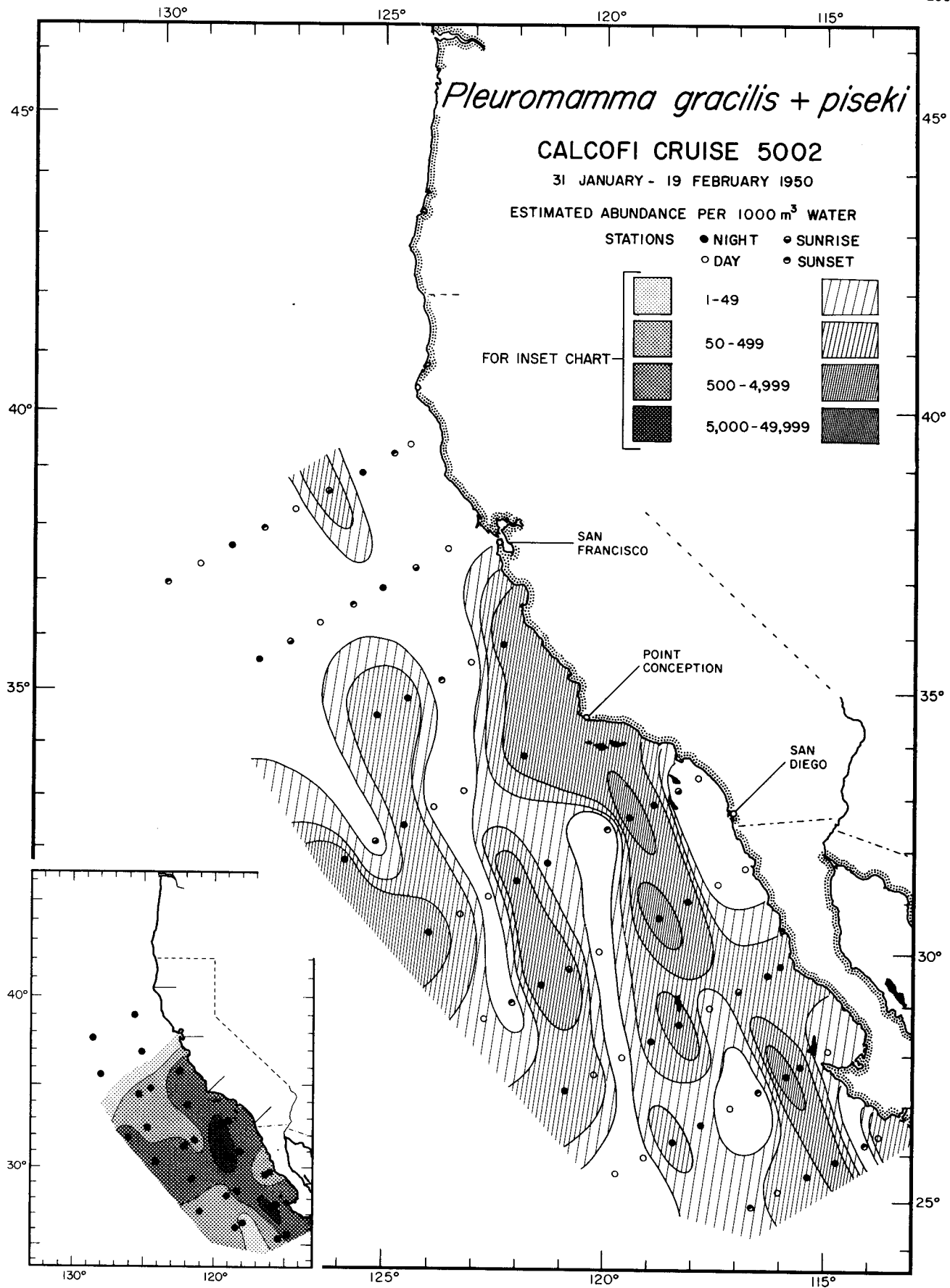
4909



Calanoida

Pleuromamma gracilis + piseki

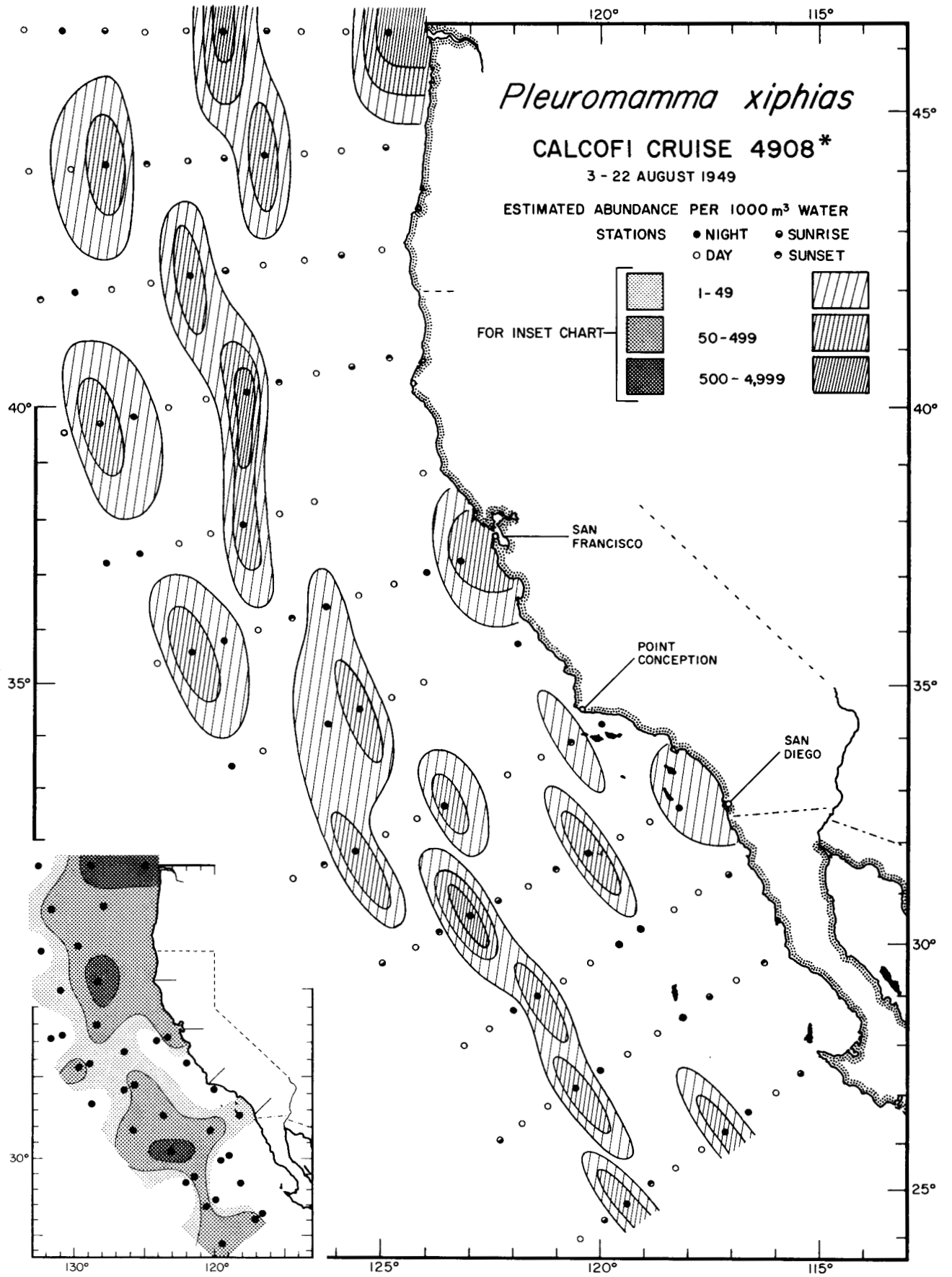
4910



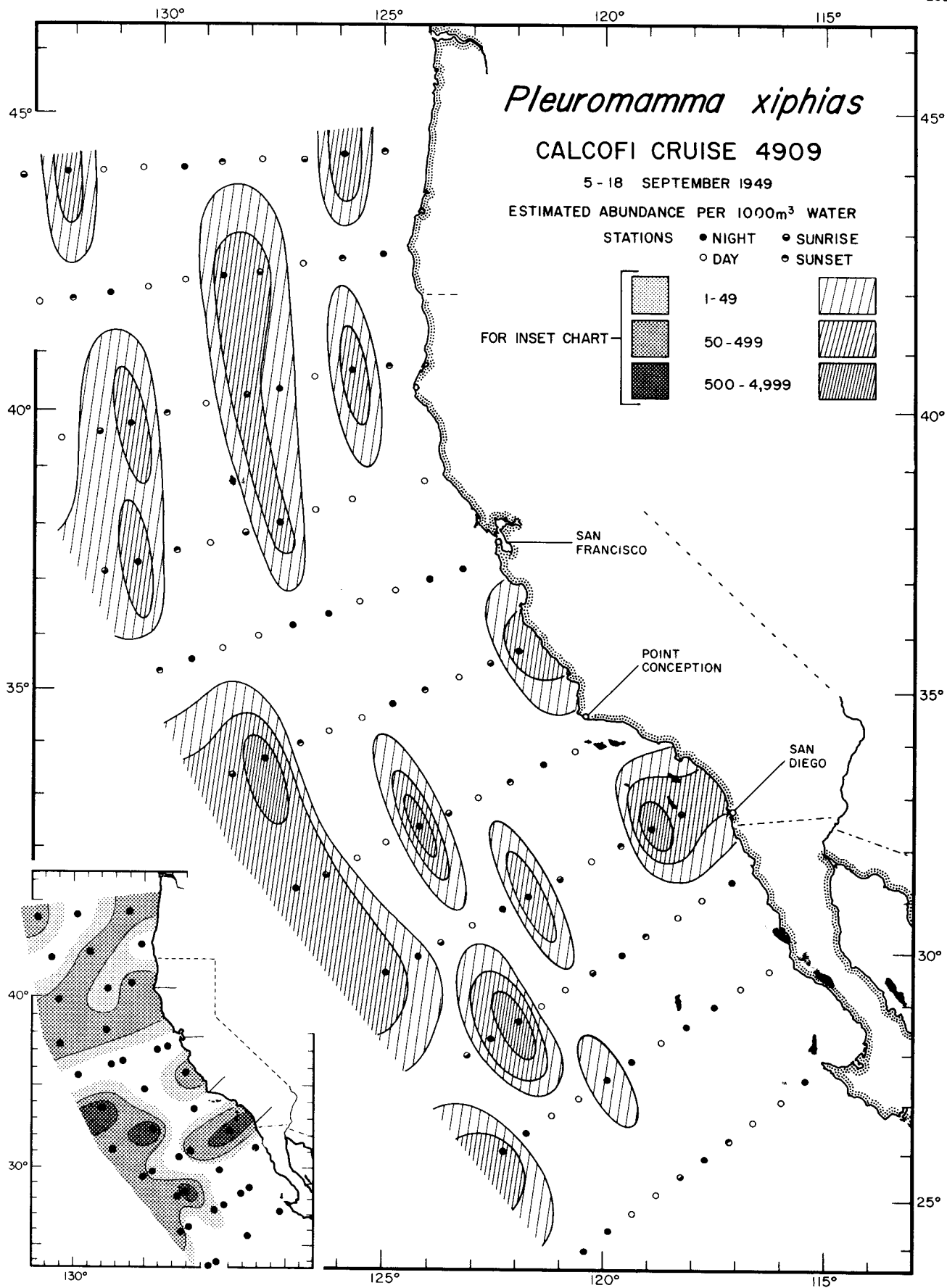
Calanoida

Pleuromamma gracilis + piseki

5002



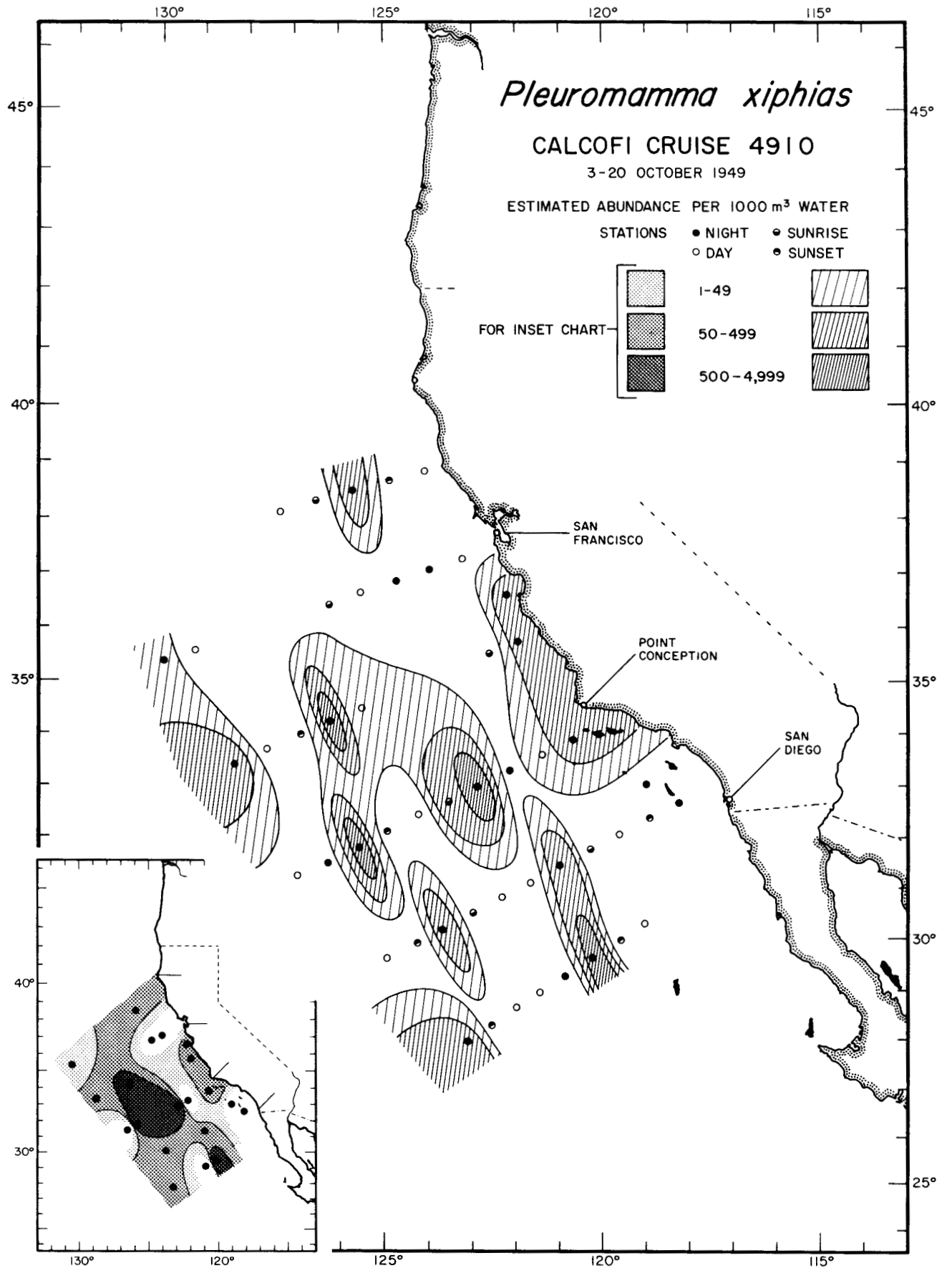
* No data for cruises 4905, 6, 7



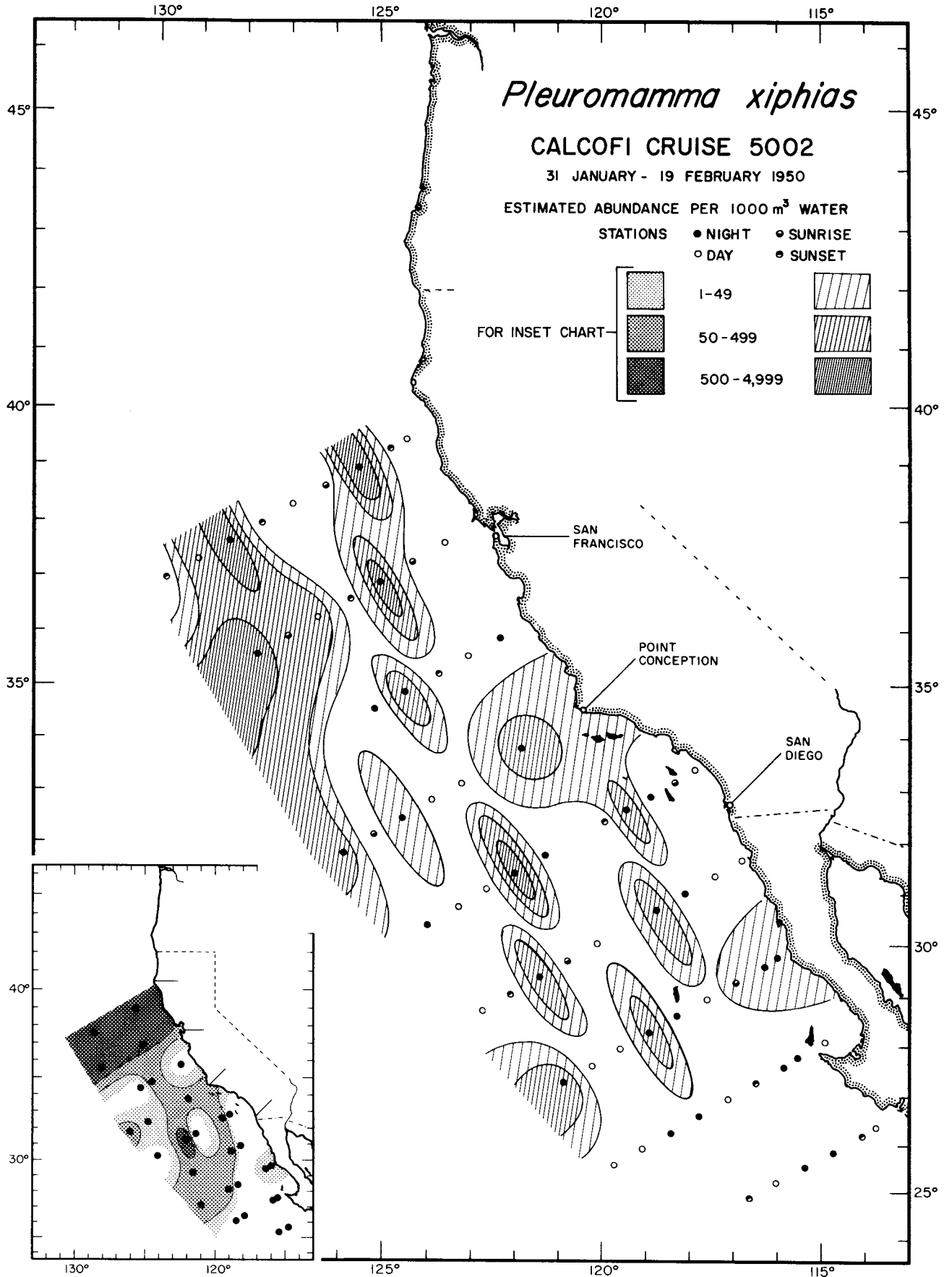
Calanoida

Pleuromamma xiphias

4909



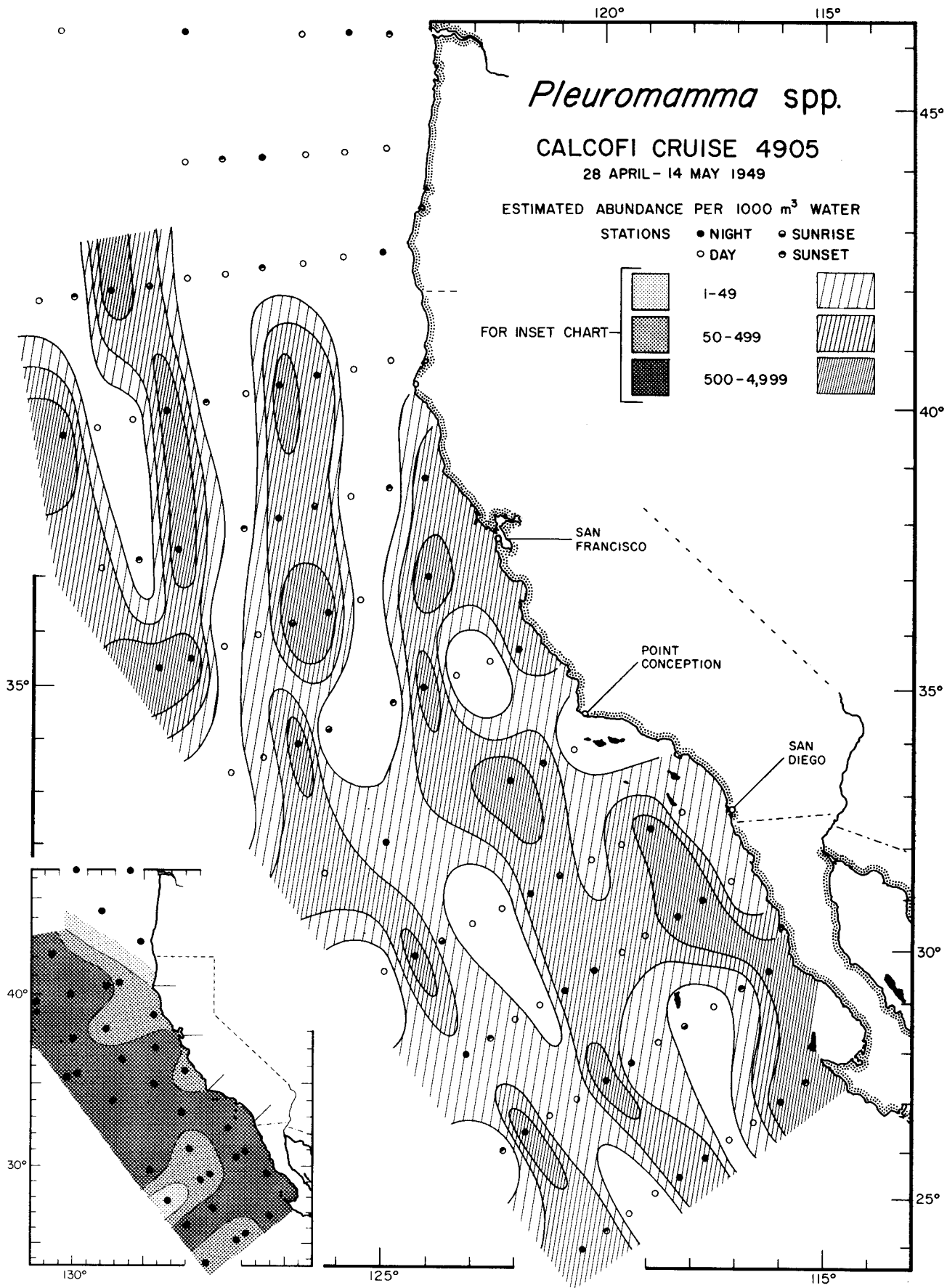
Calanoida
Pleuromamma xiphias
4910



Calanoida

Pleuromamma xiphias

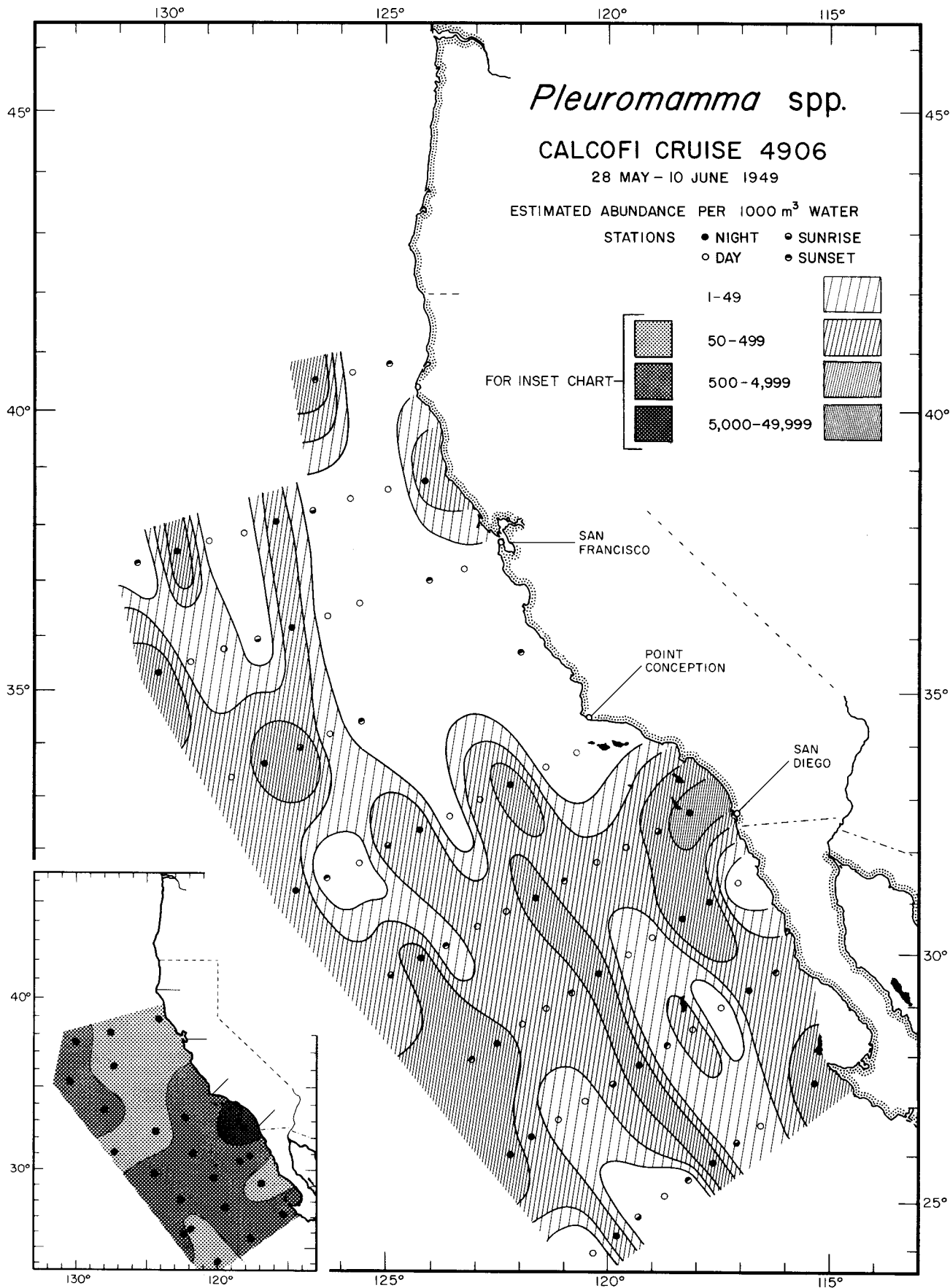
5002



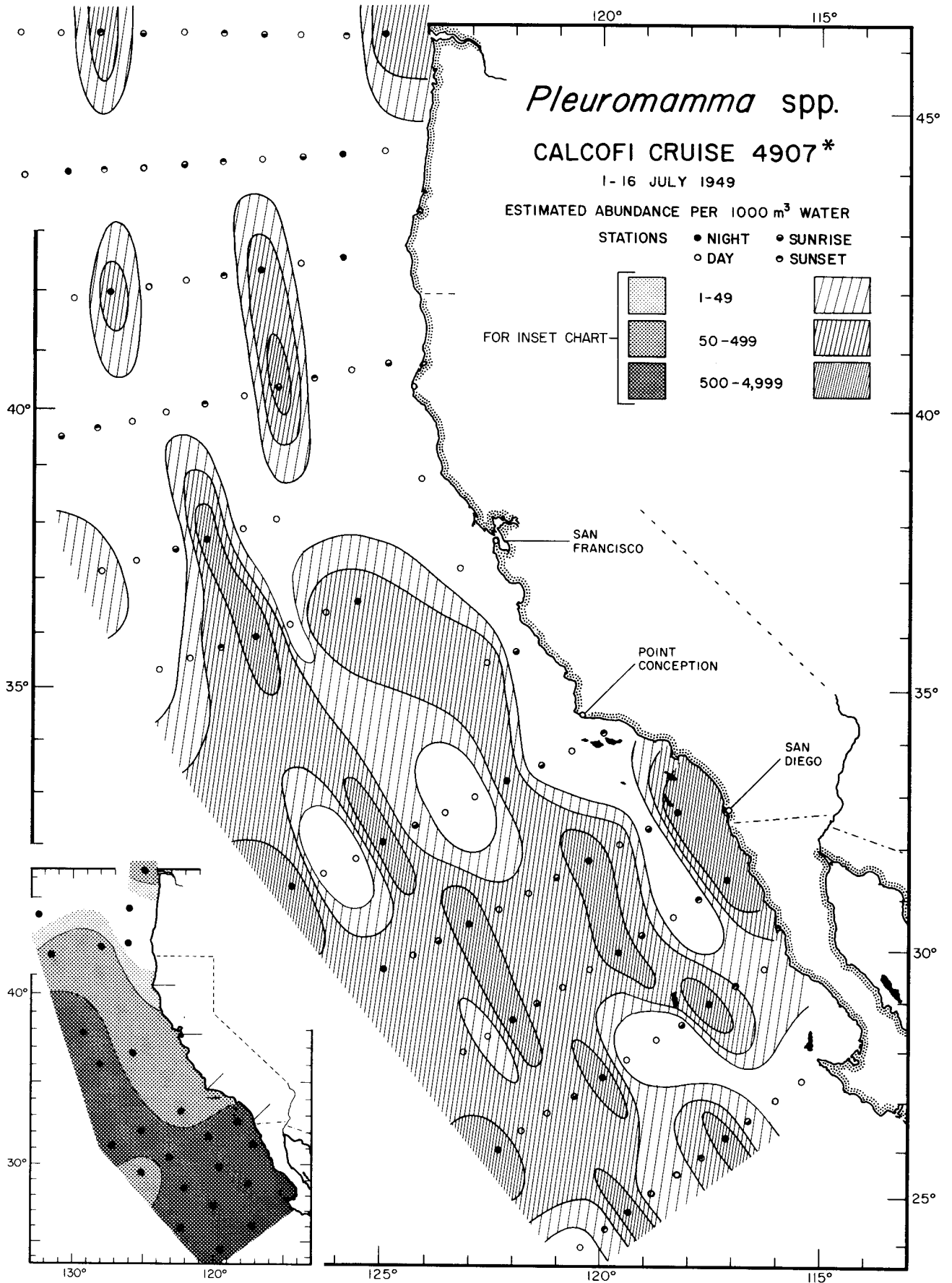
Calanoida

Pleuromamma spp.

4905

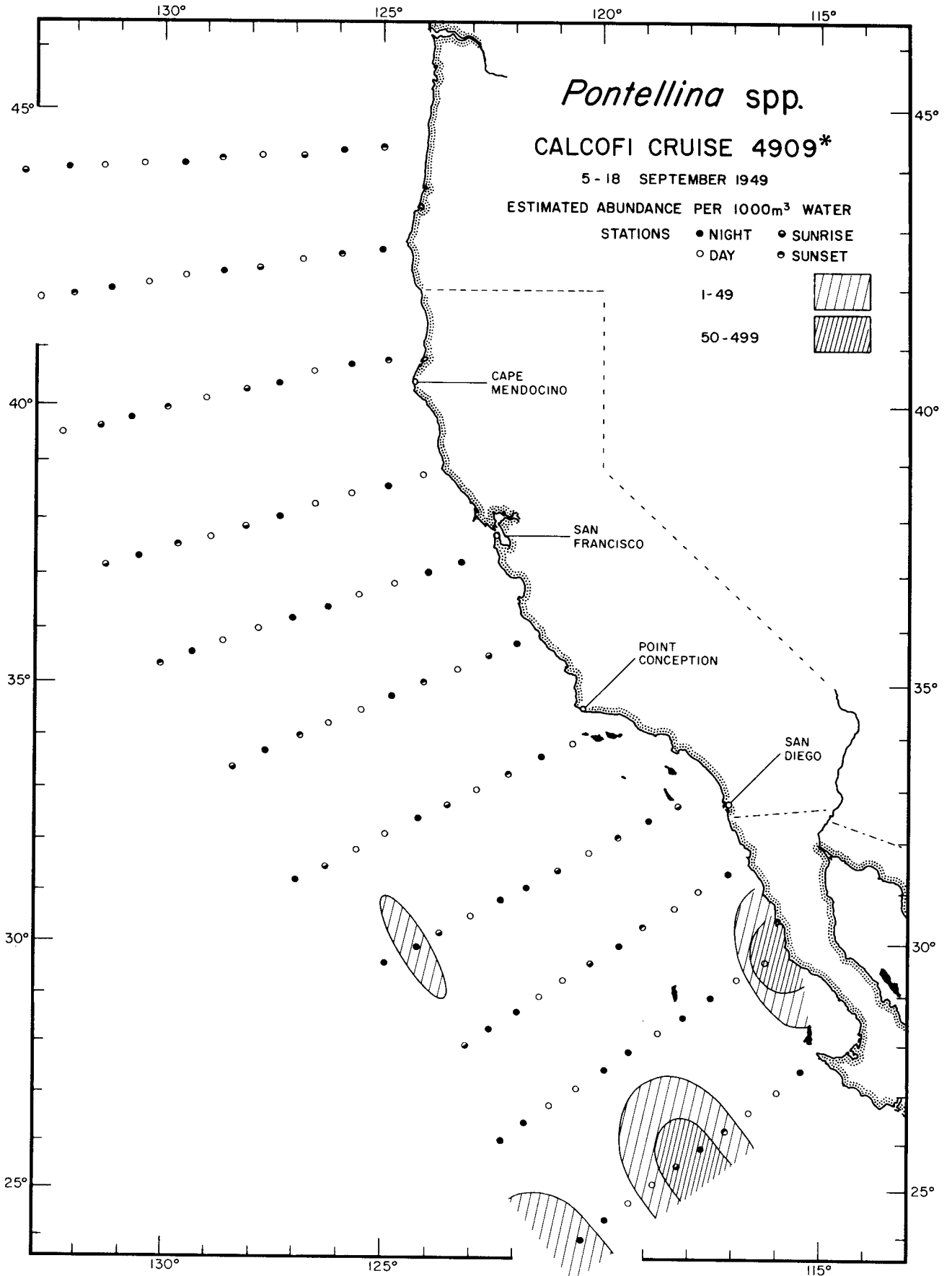


Calanoida
Pleuromamma spp.
4906

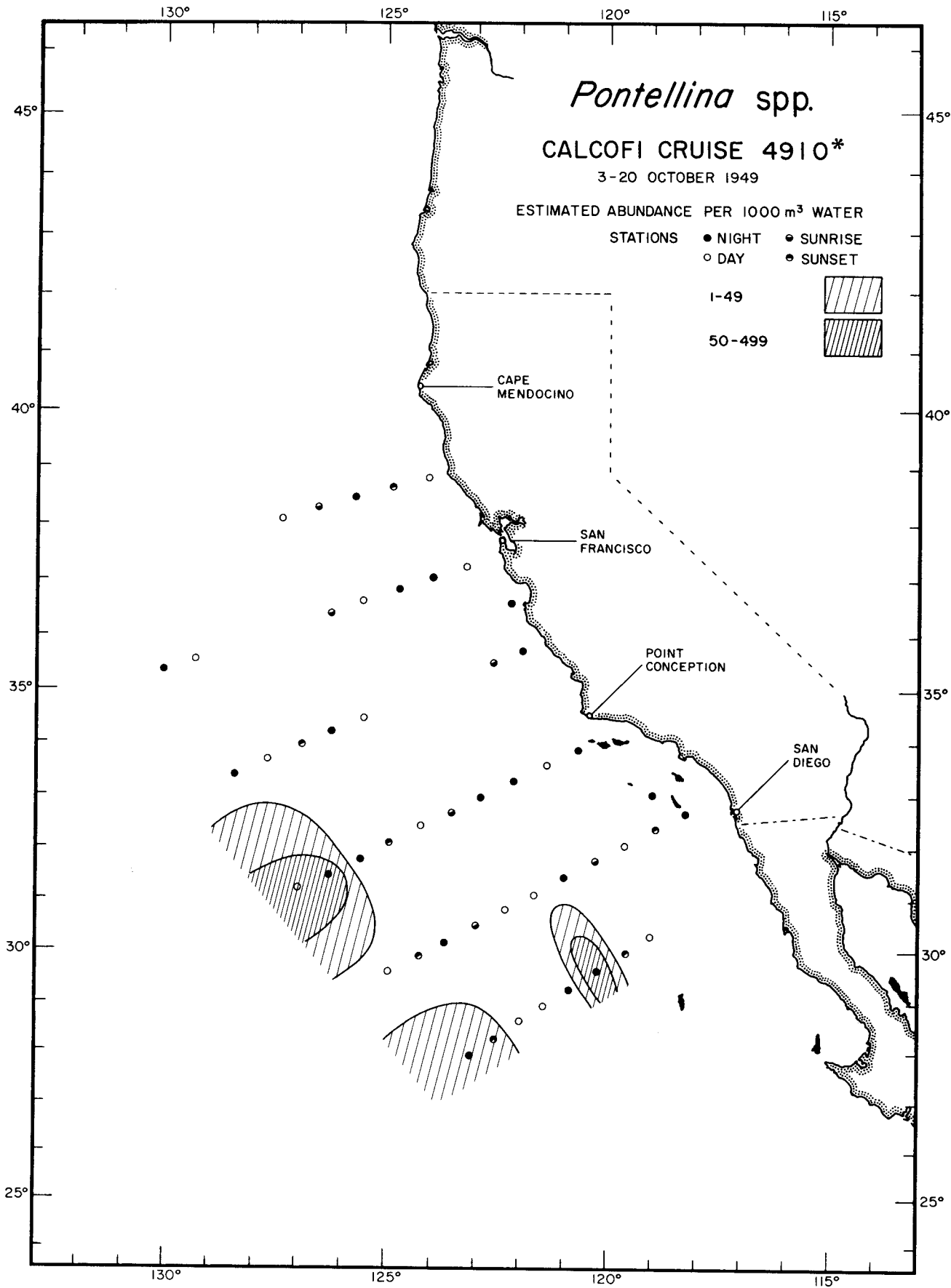


* No data for cruises 4908, 9, 10, 5002

Calanoida
Pleuromamma spp.
4907

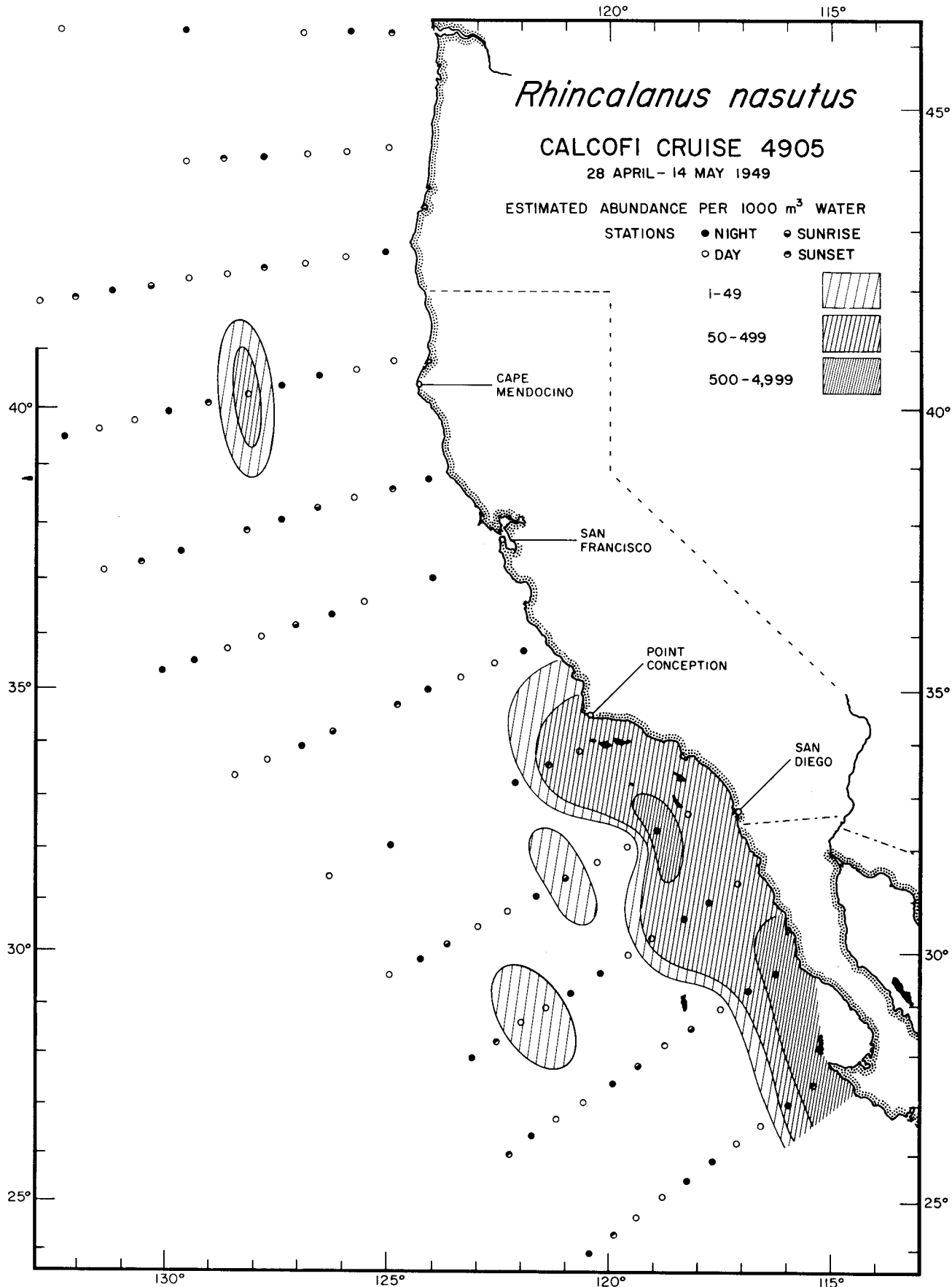


* See Table 1 for cruises 4905, 6, 7, 8

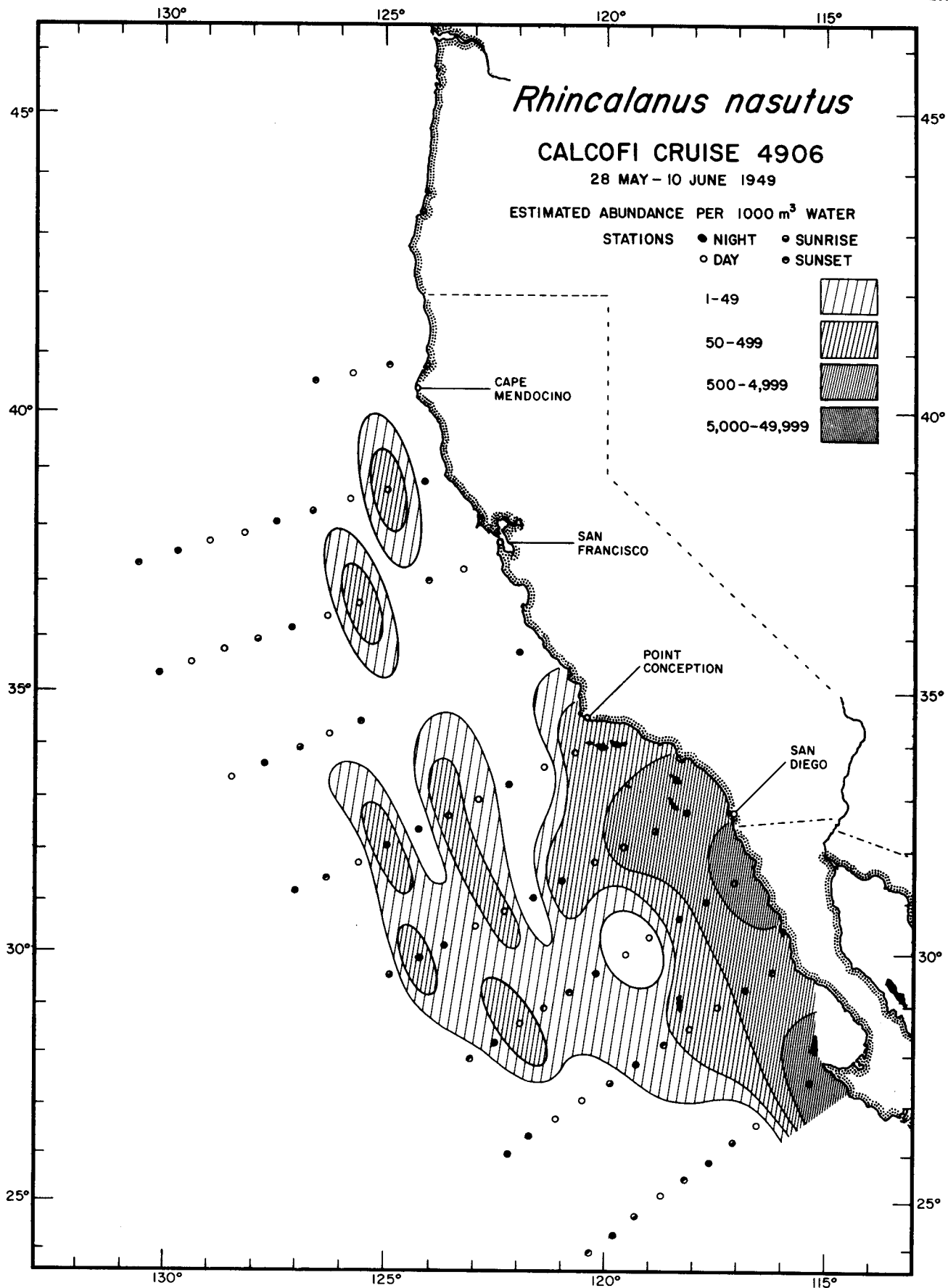


* See Table 1 for cruise 5002

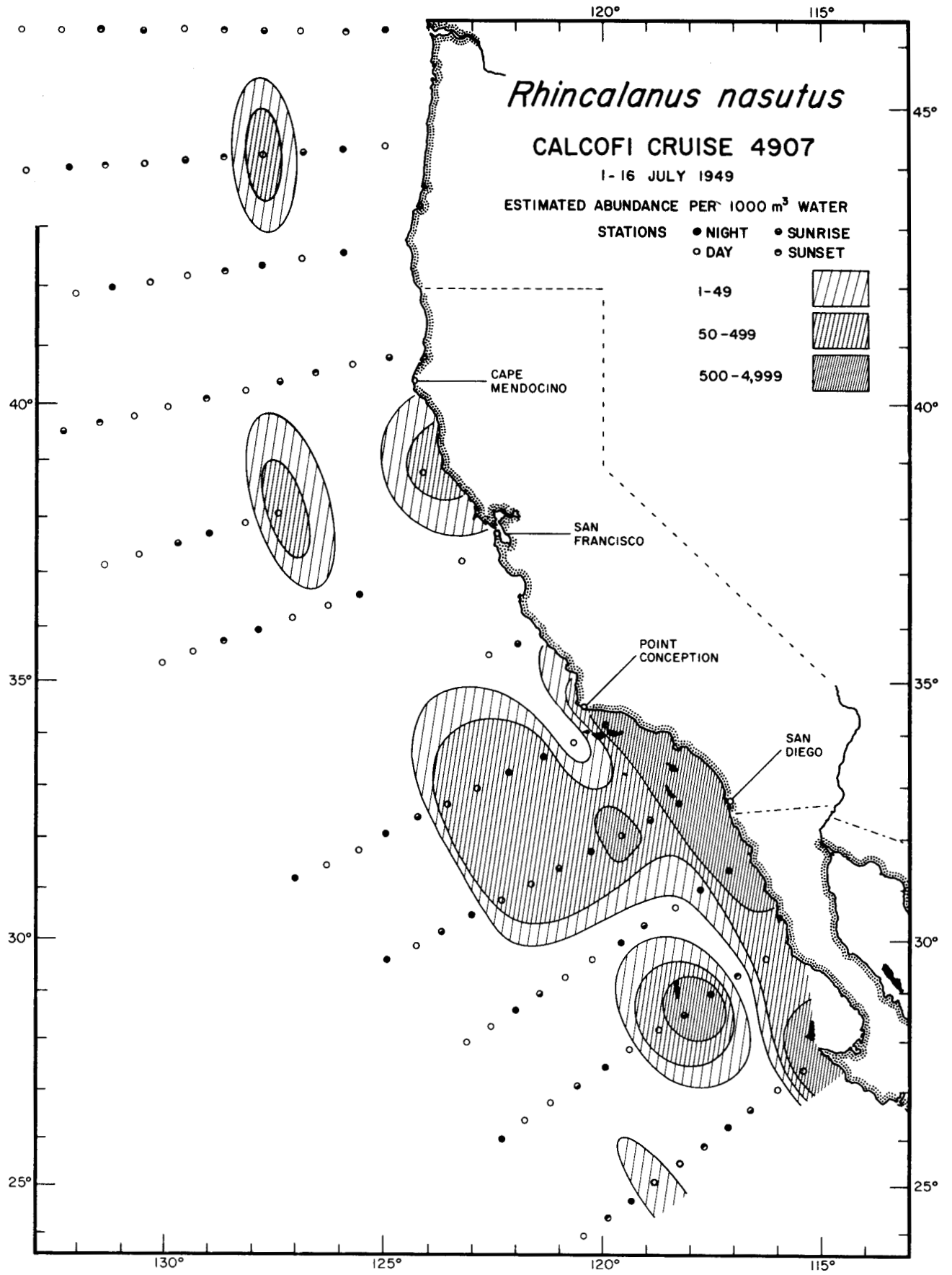
Calanoida
Pontellina spp.
4910



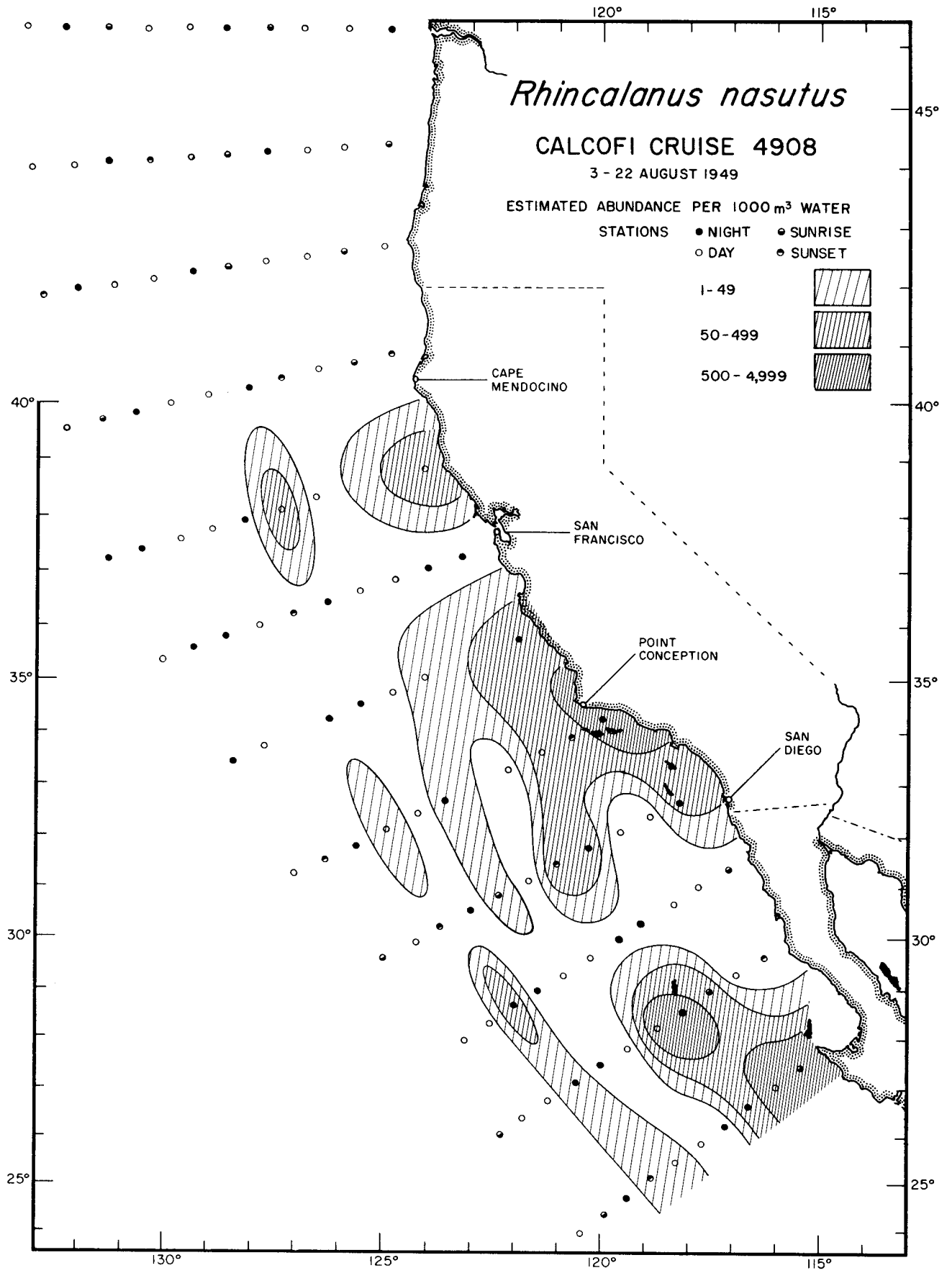
Calanoida
Rhincalanus nasutus
4905



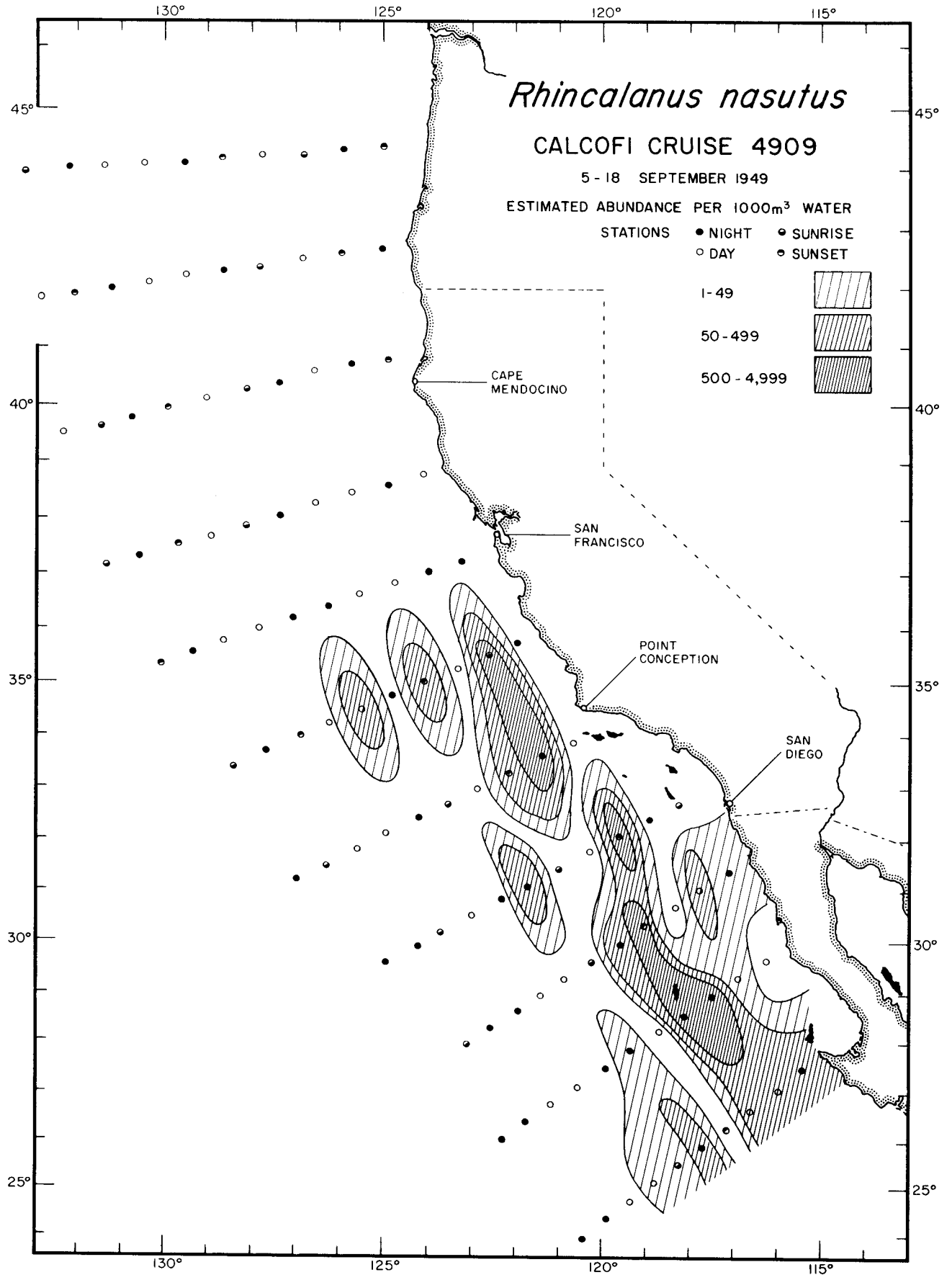
Calanoida
Rhincalanus nasutus
 4906



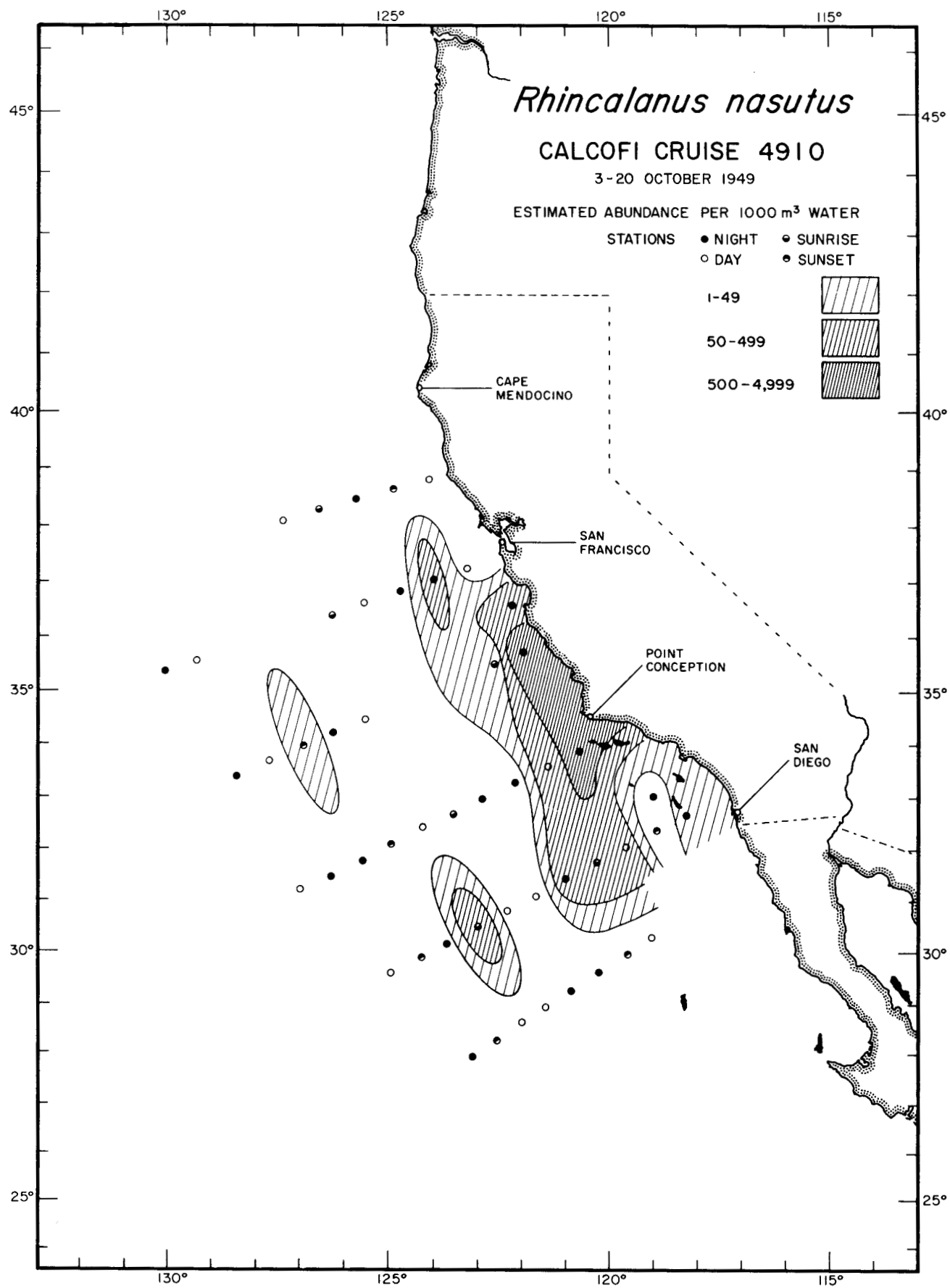
Calanoida
Rhincalanus nasutus
4907



Calanoida
Rhinocalanus nasutus
4908



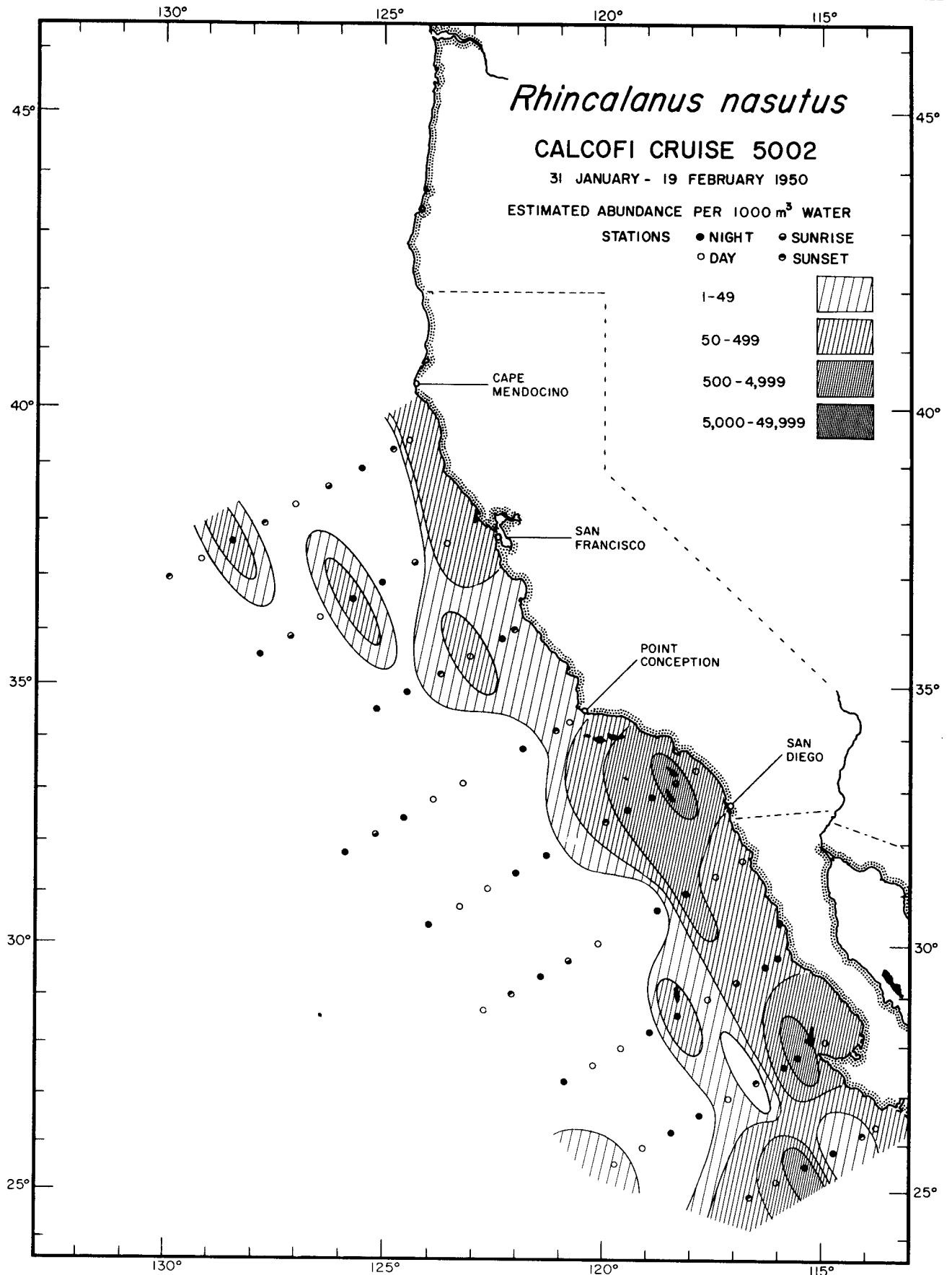
Calanoida
Rhinocalanus nasutus
4909



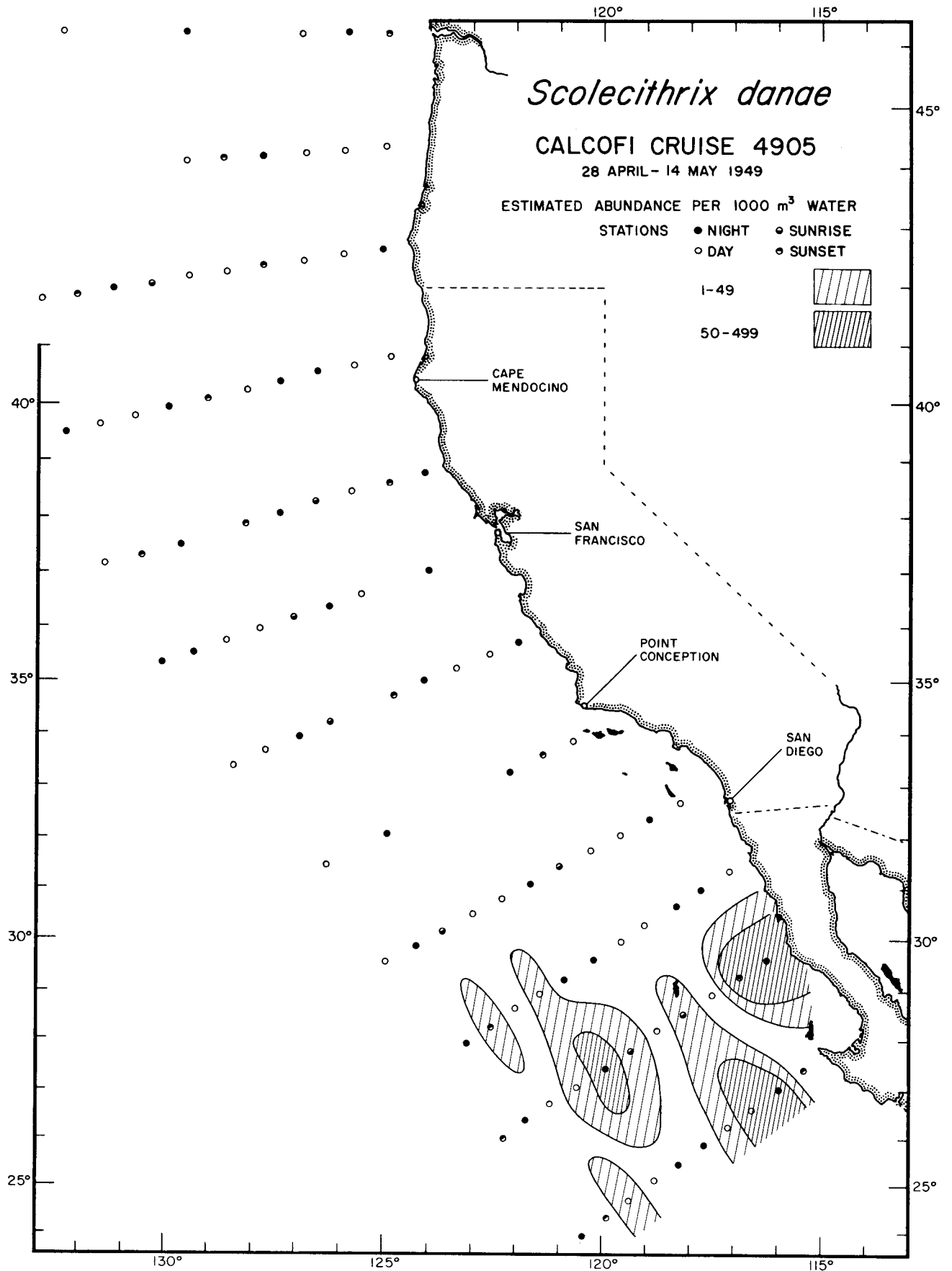
Calanoida

Rhincalanus nasutus

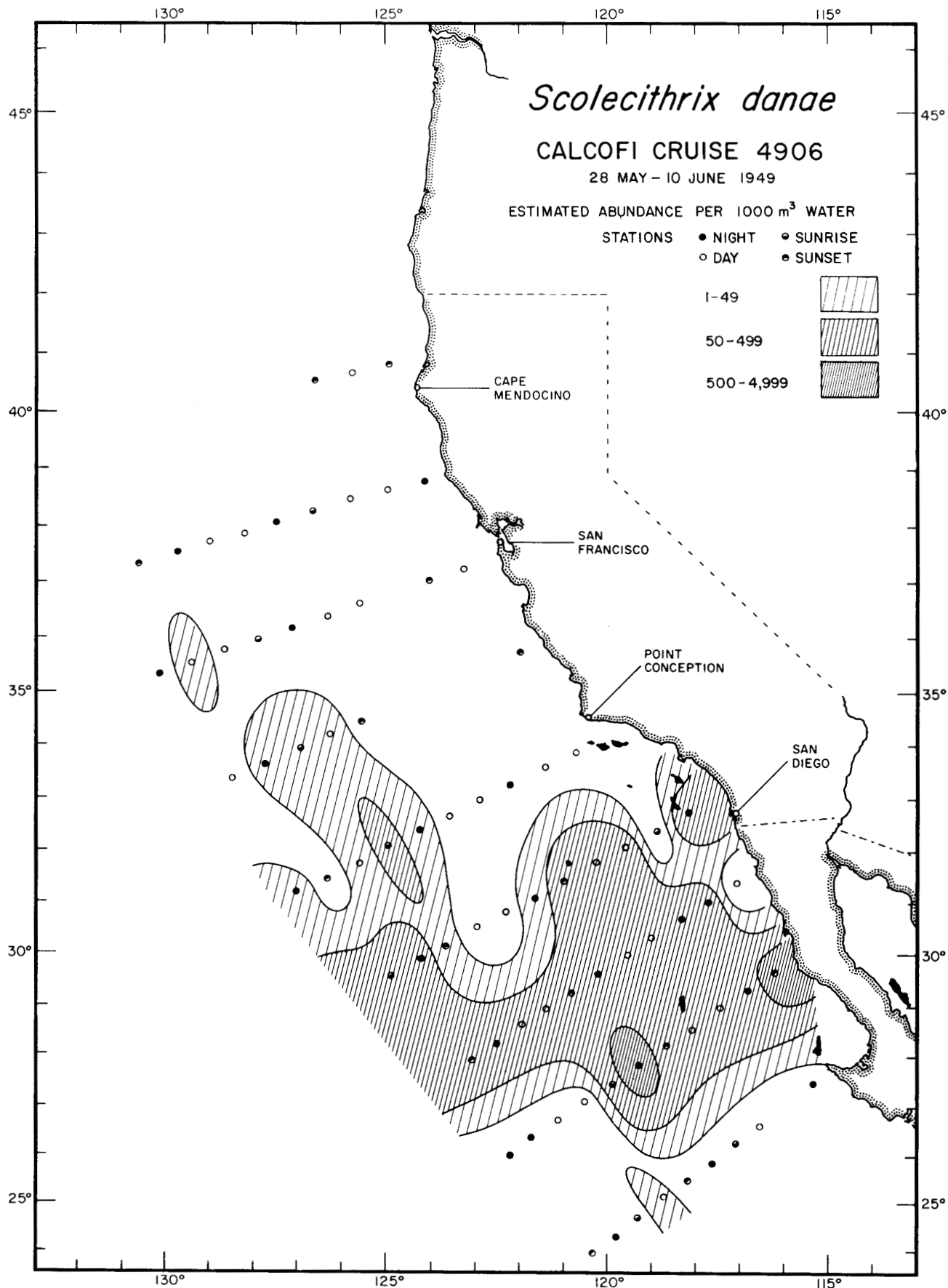
4910



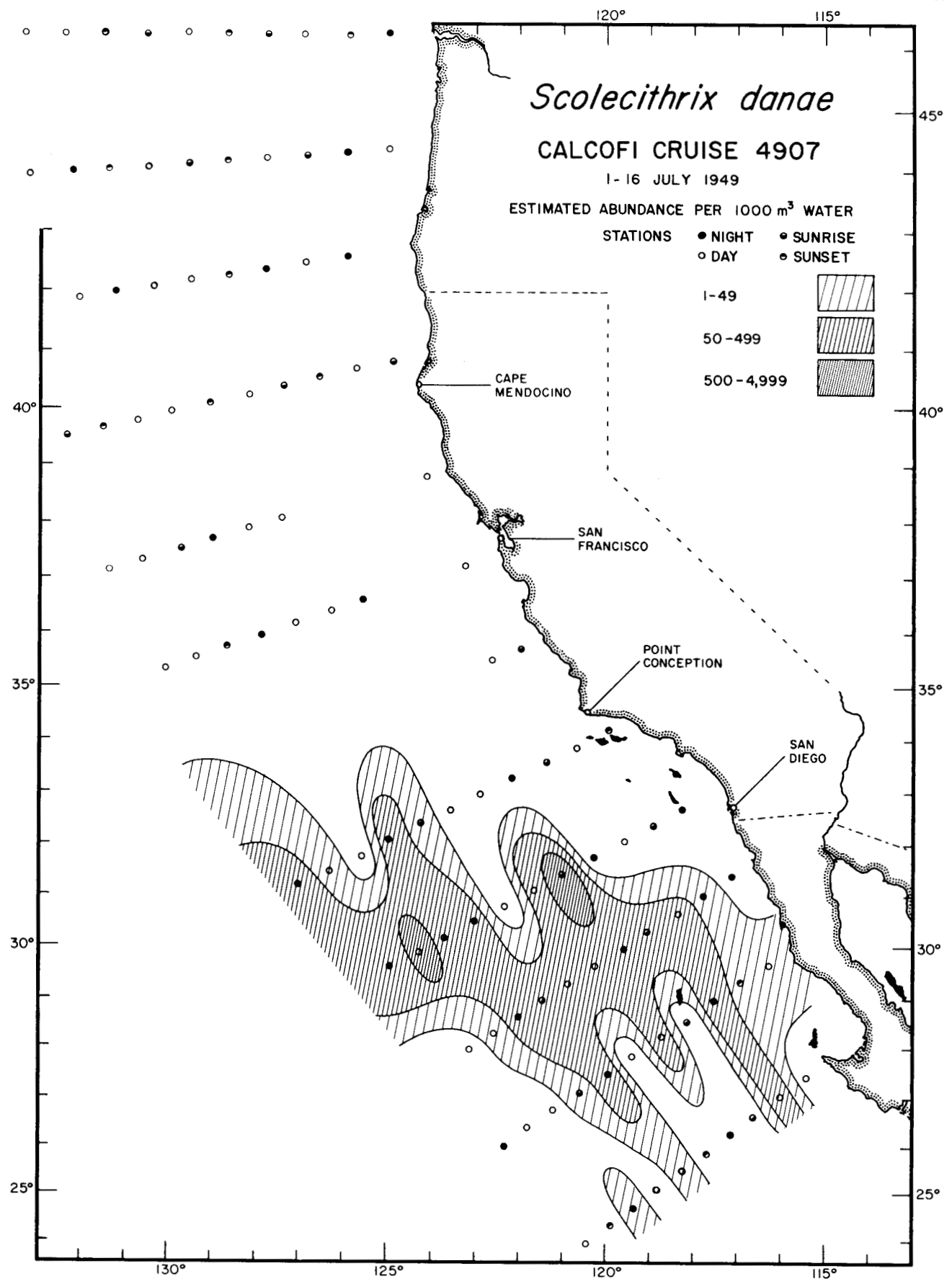
Calanoida
Rhinocalanus nasutus
5002



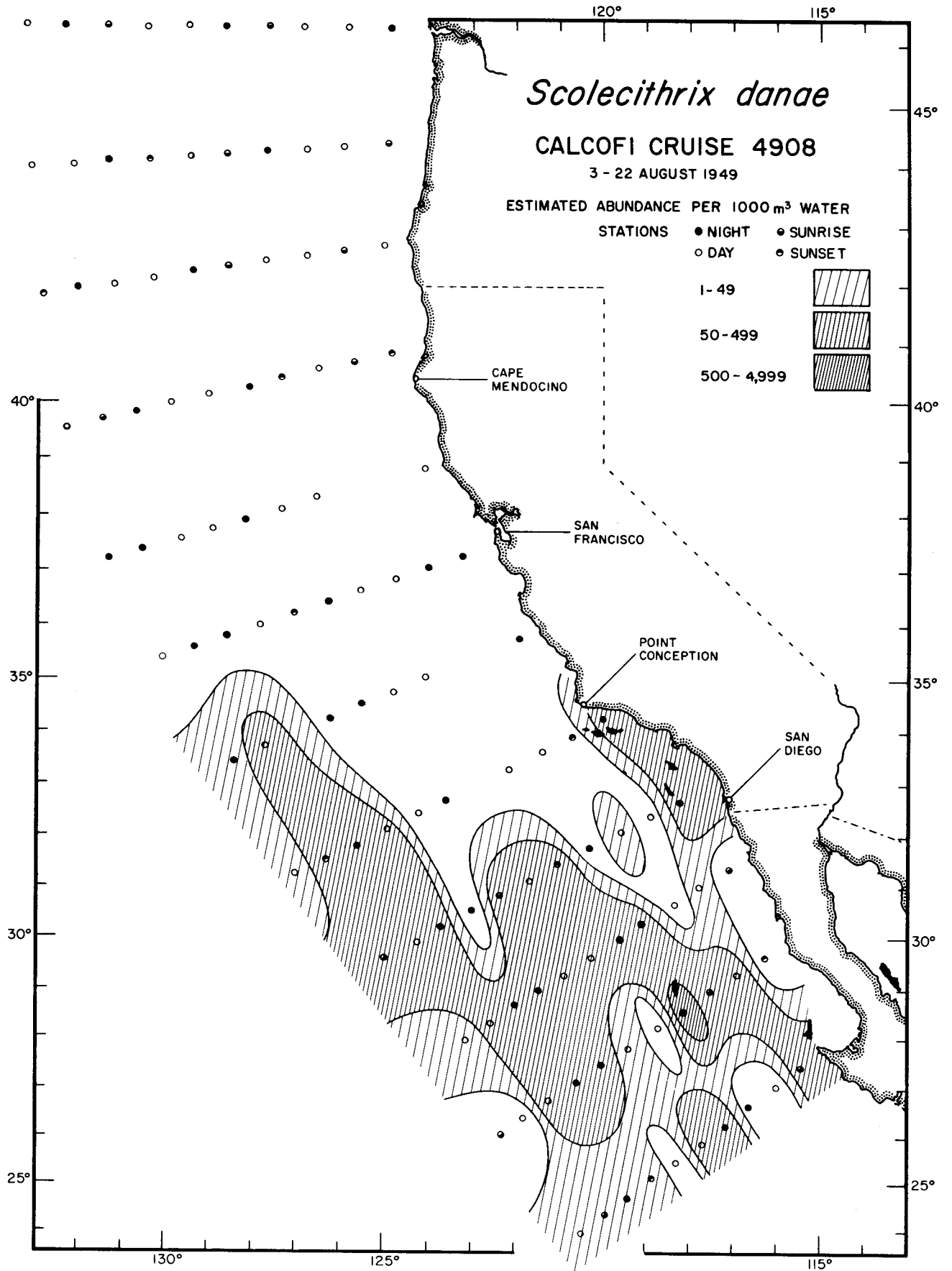
Calanoida
Scolecithrix danae
4905



Calanoida
Scolecithrix danae
4906



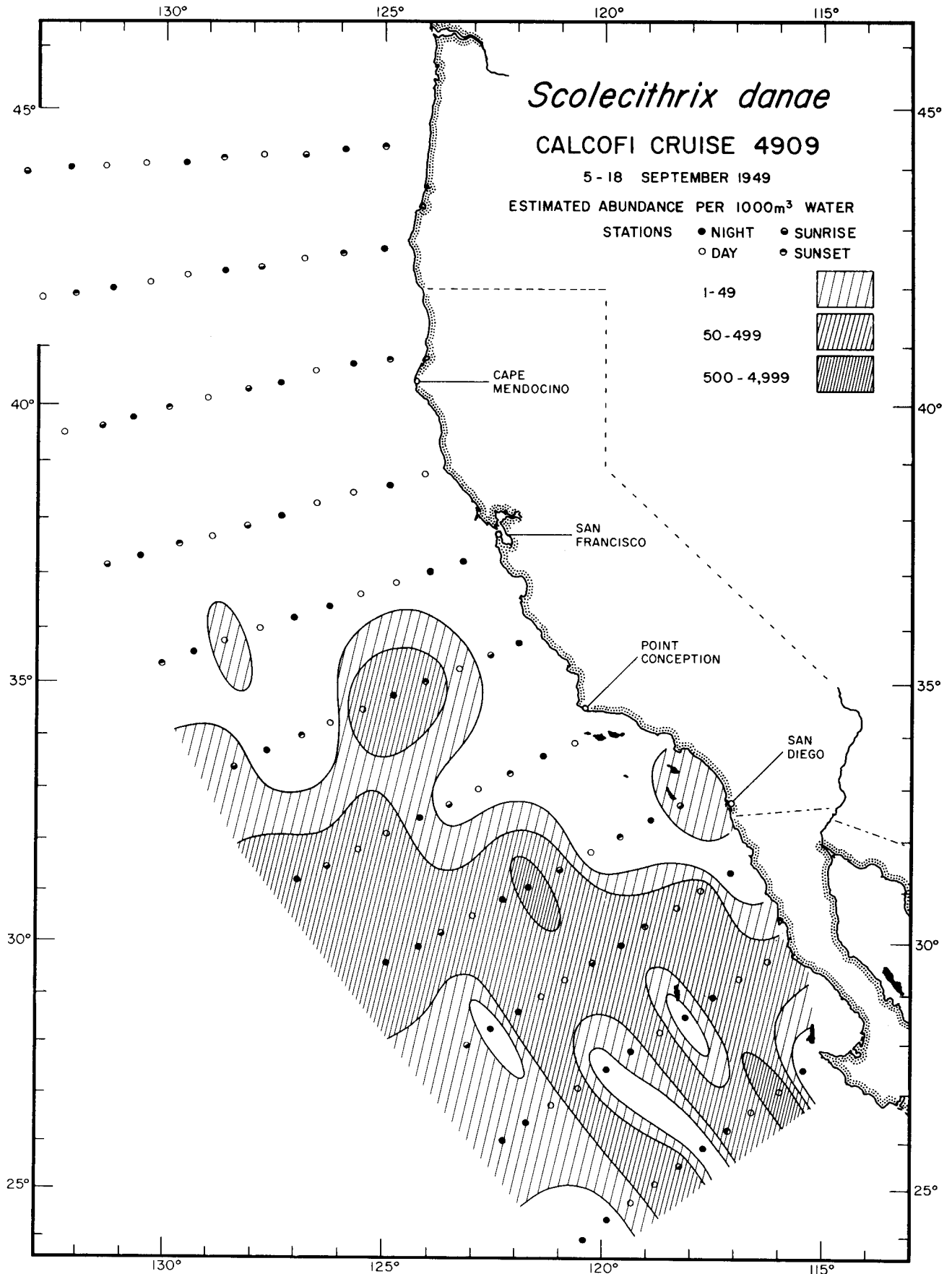
Calanoida
Scolecithrix danae
4907



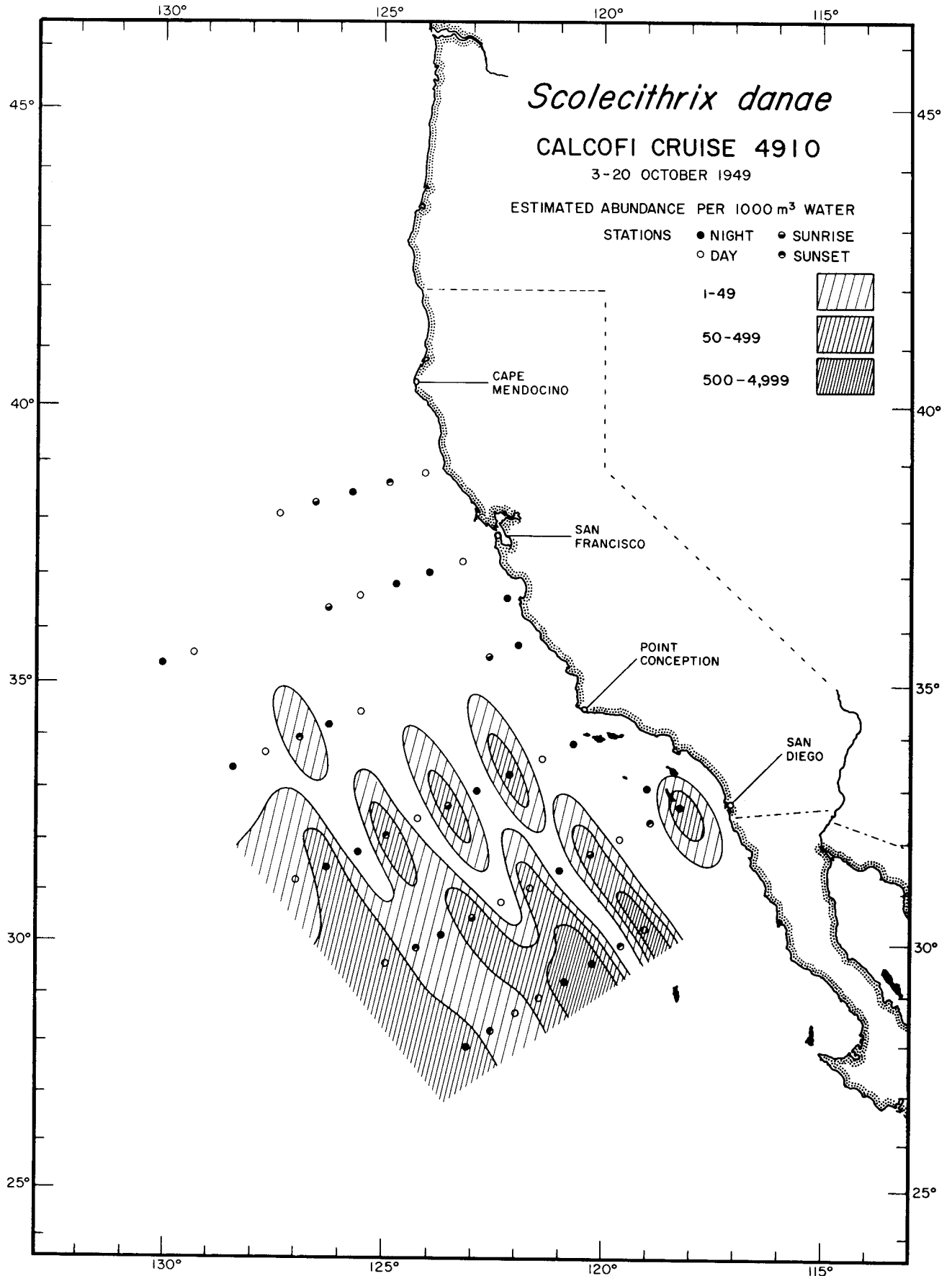
Calanoida

Scolecithrix danae

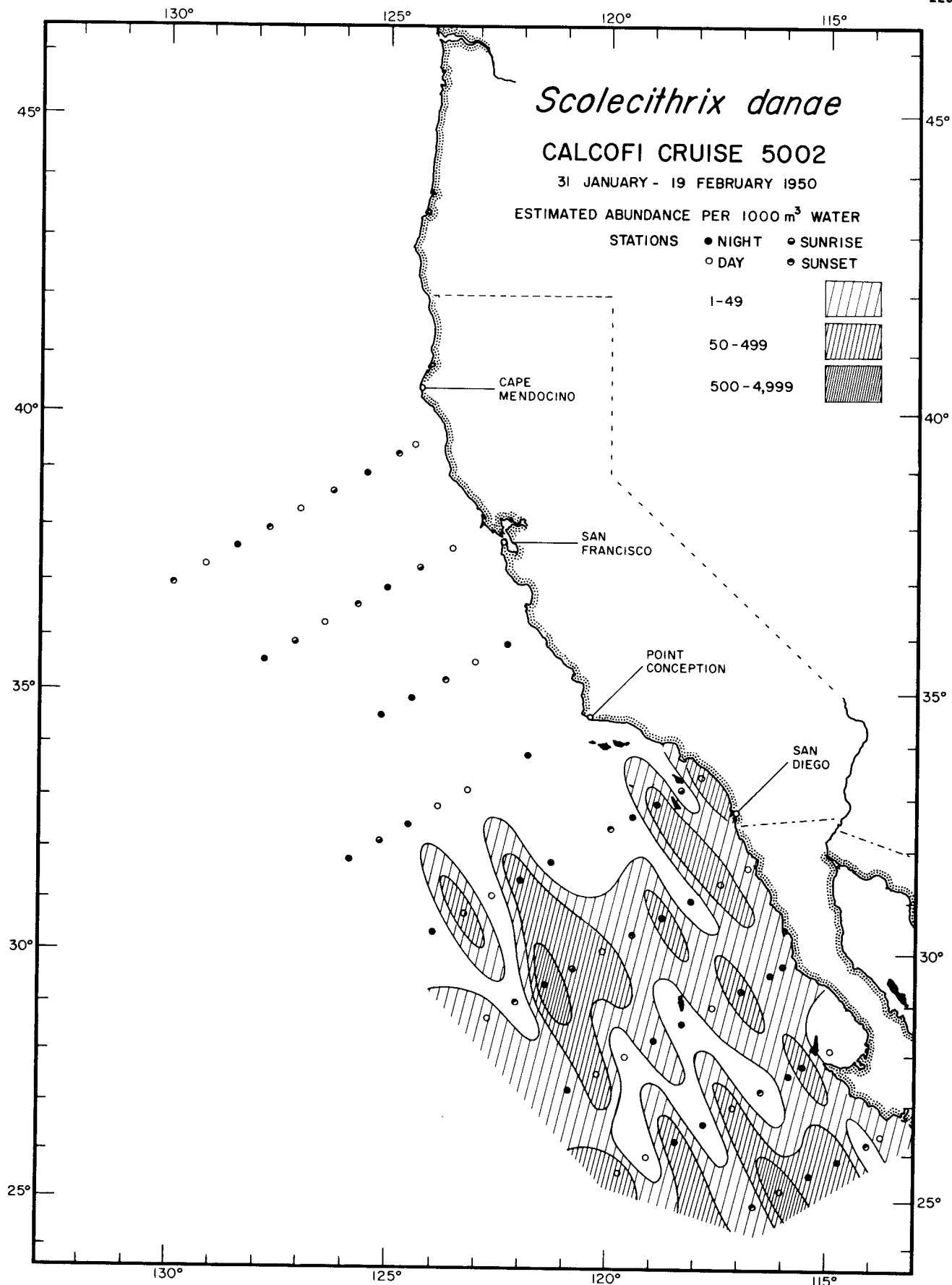
4908



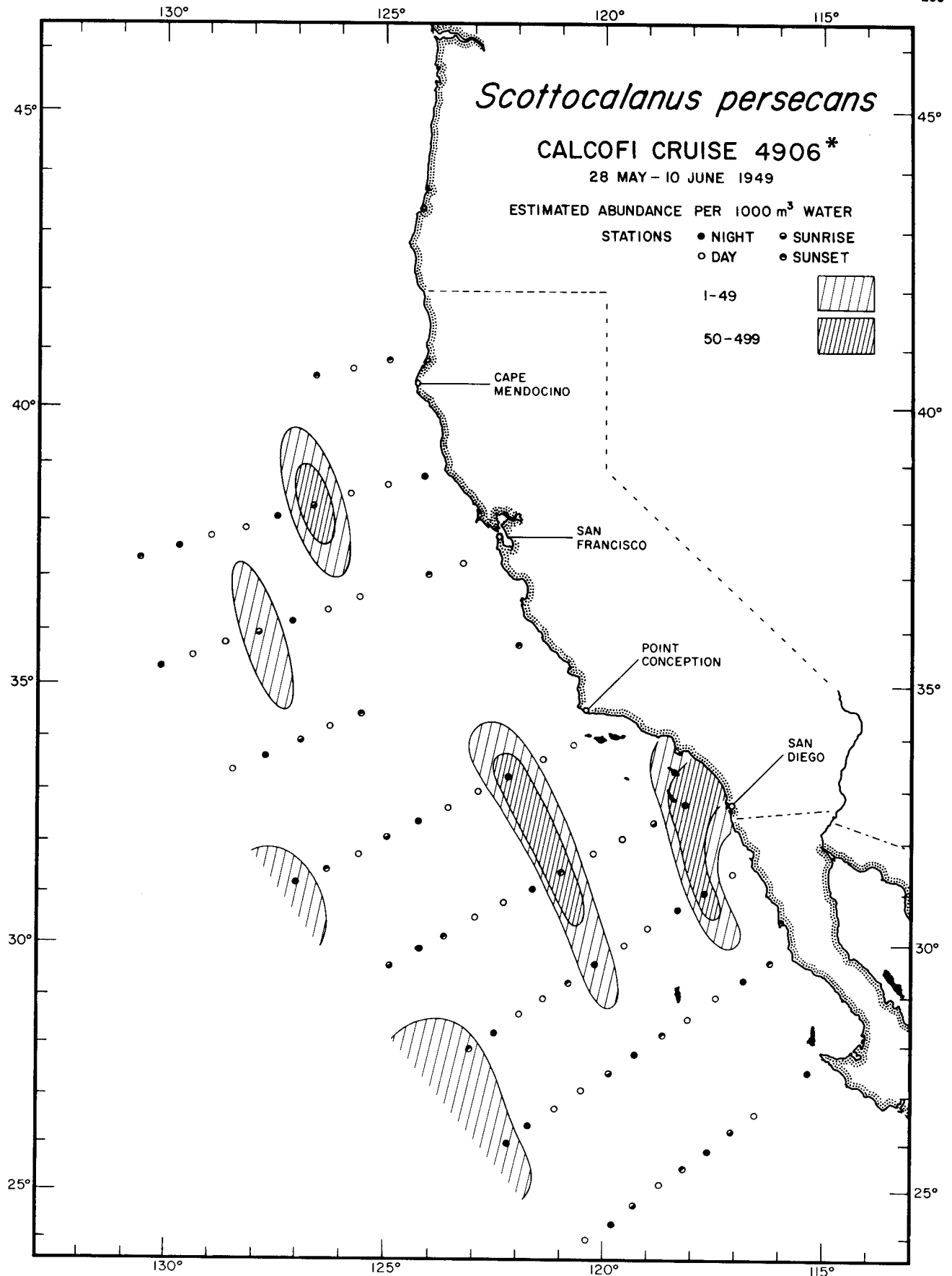
Calanoida
Scolecithrix danae
4909



Calanoida
Scolecithrix danae
4910



Calanoida
Scolecithrix danae
5002

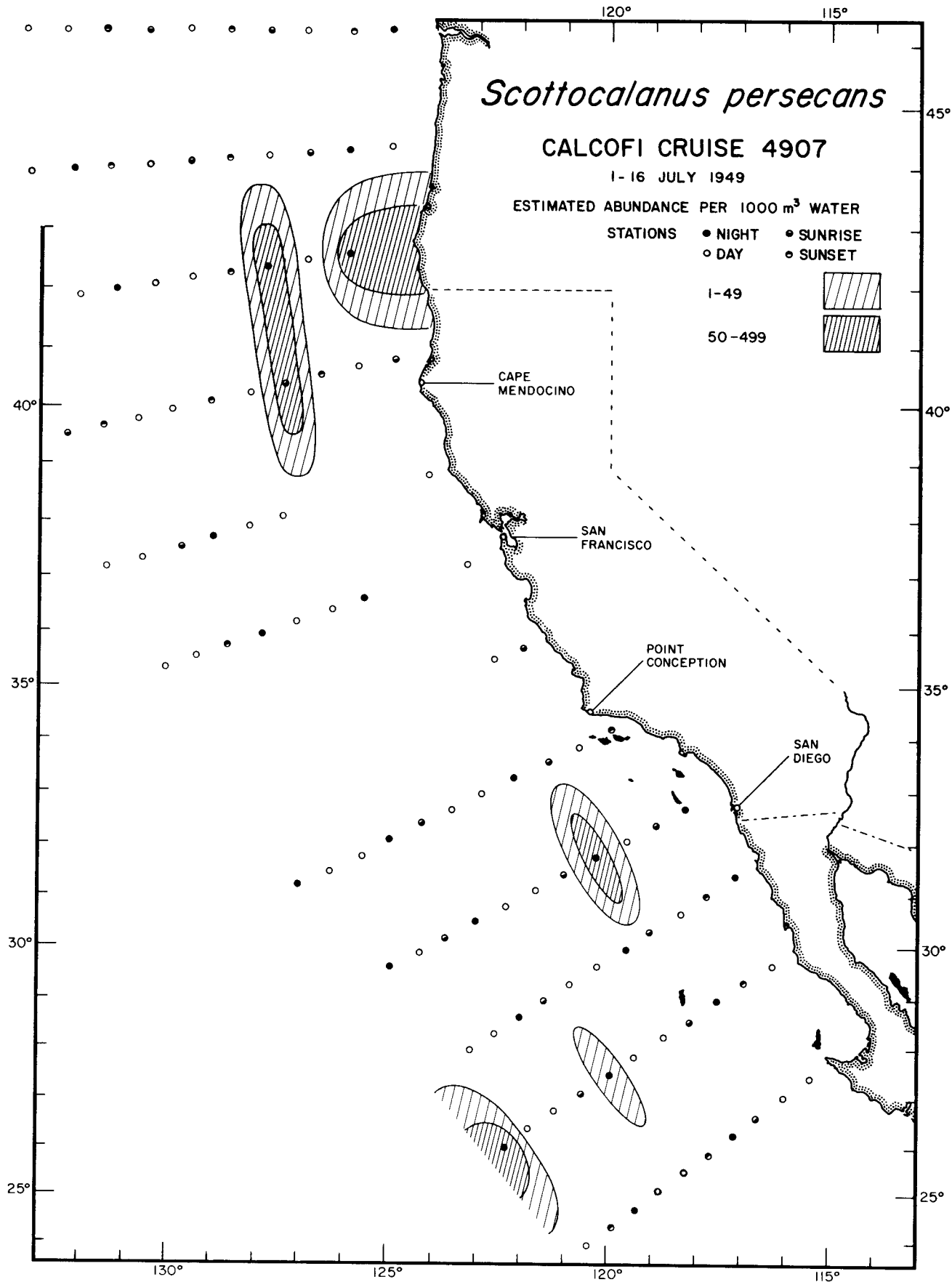


* See Table 1 for cruise 4905

Calanoida

Scottocalanus persecans

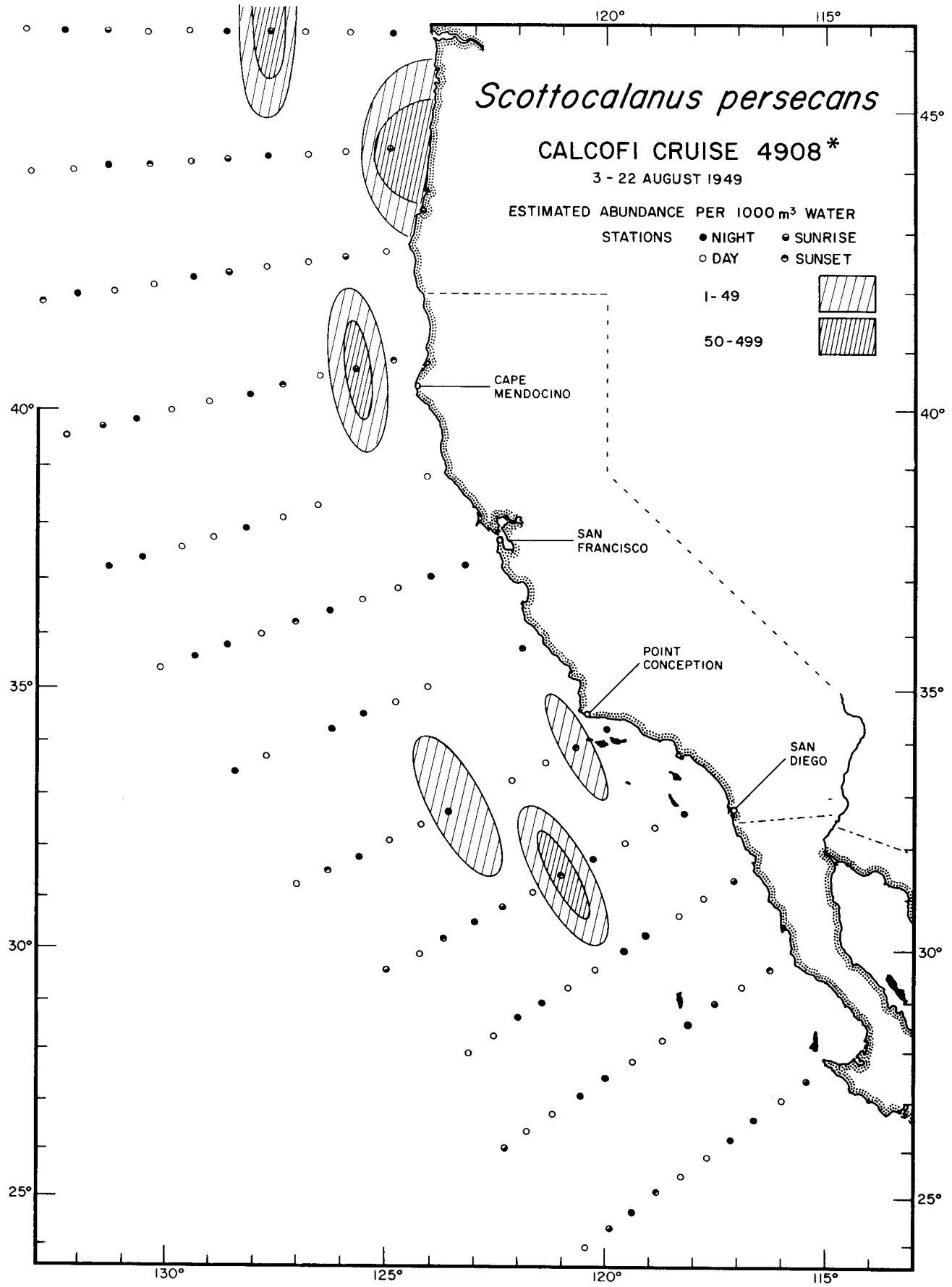
4906



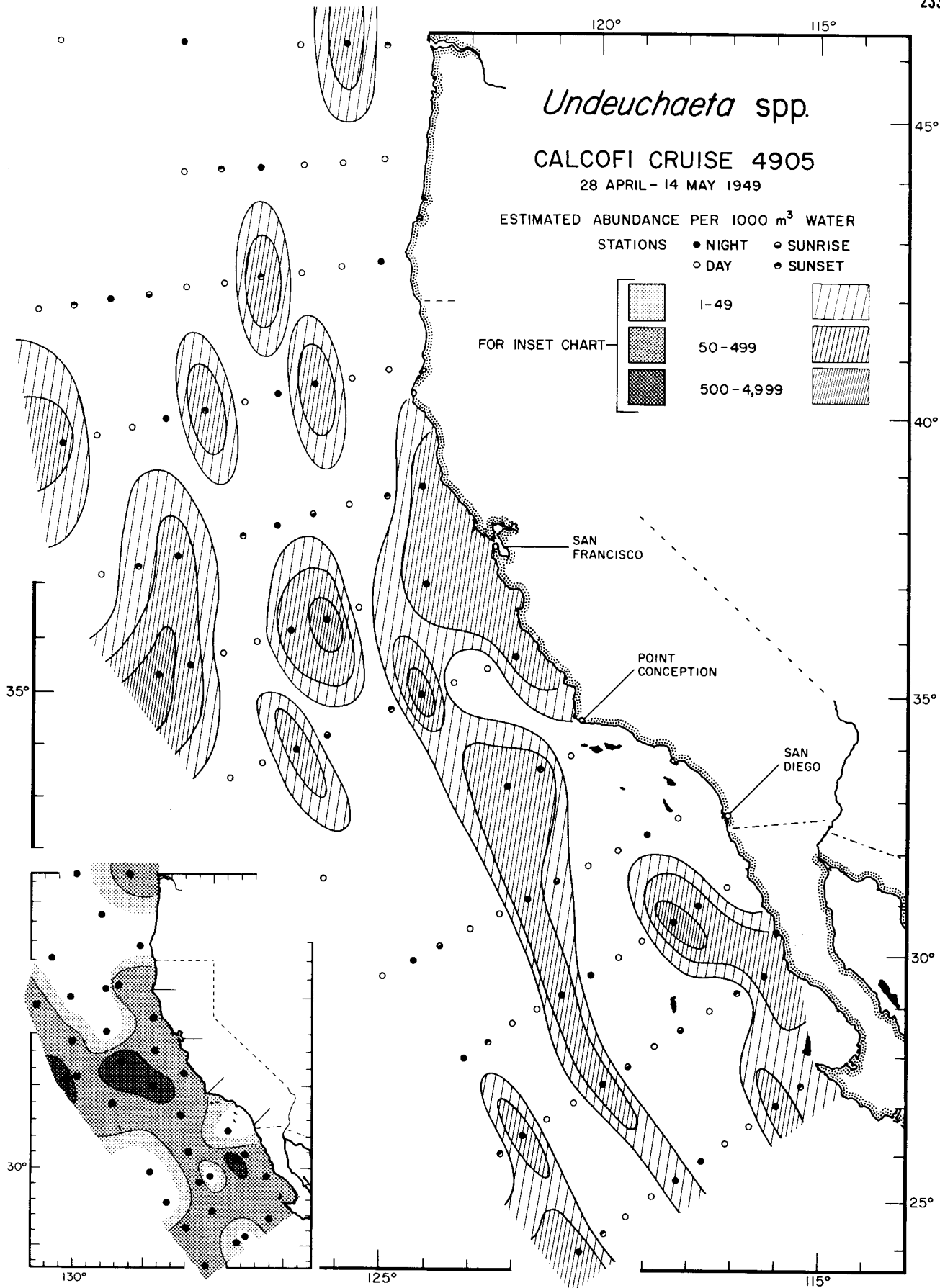
Calanoida

Scottocalanus persekans

4907



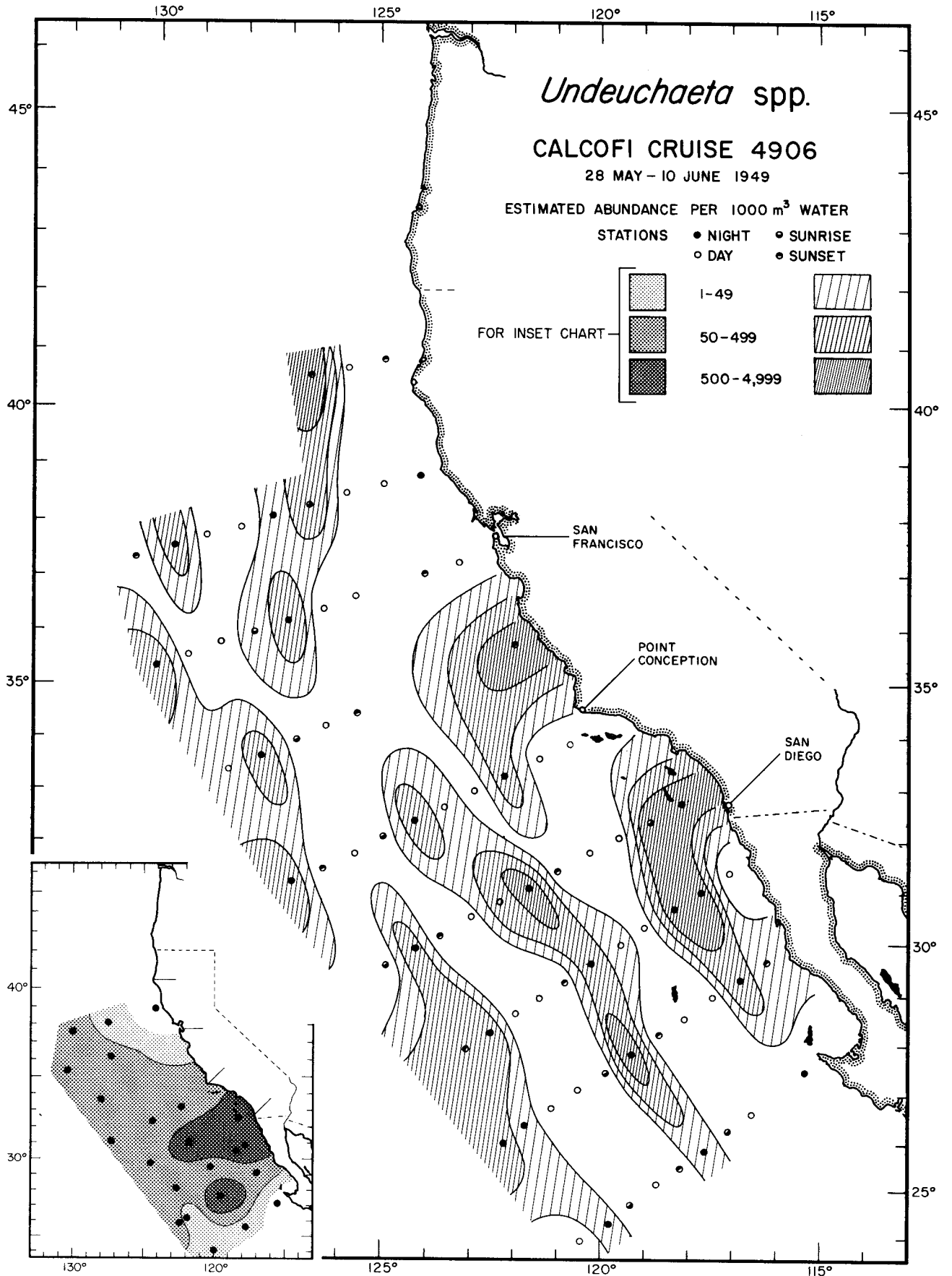
* See Table 1 for cruises 4909, 10, 5002



Calanoida

Undeuchaeta spp.

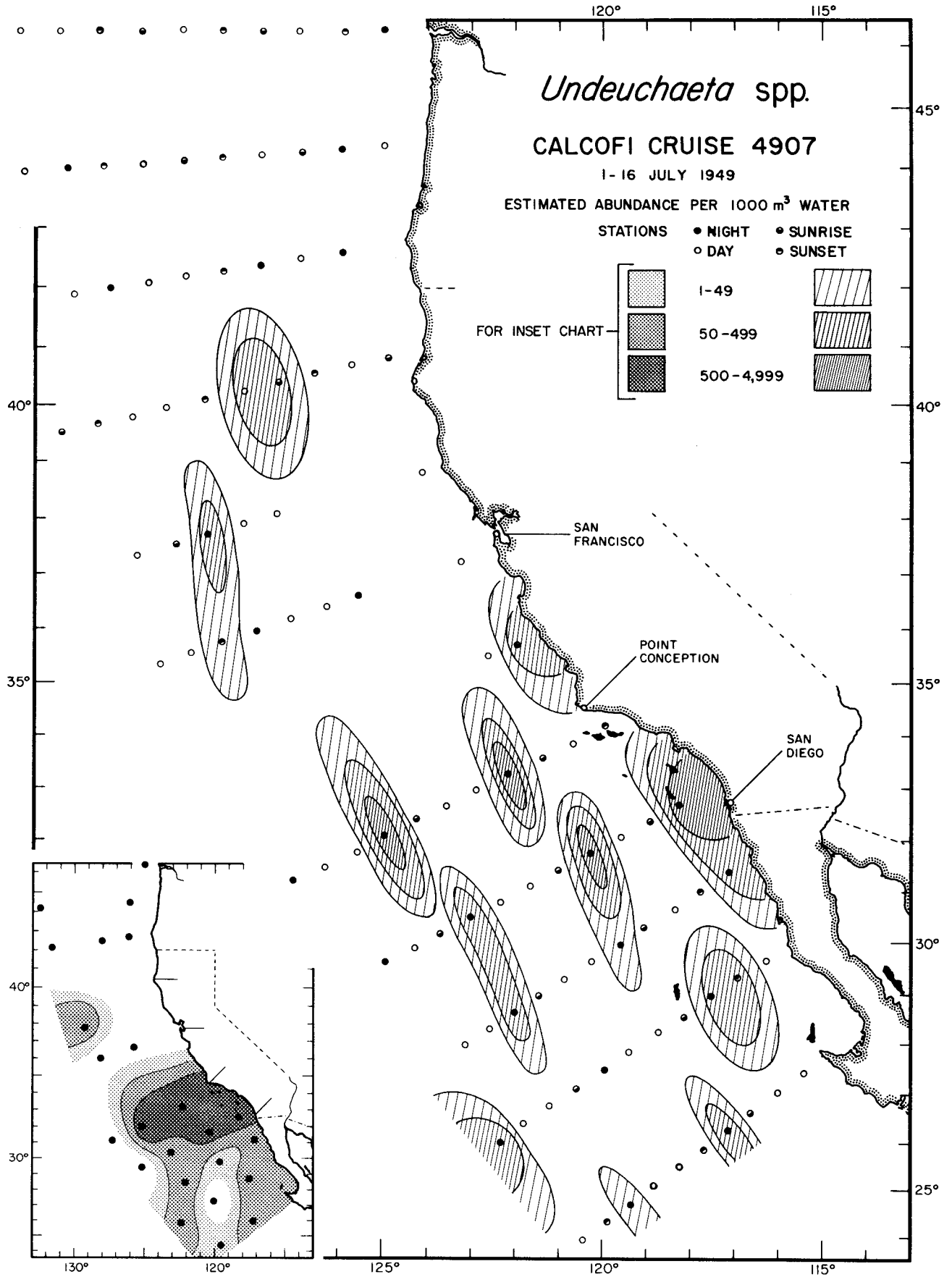
4905



Calanoida

Undeuchaeta spp.

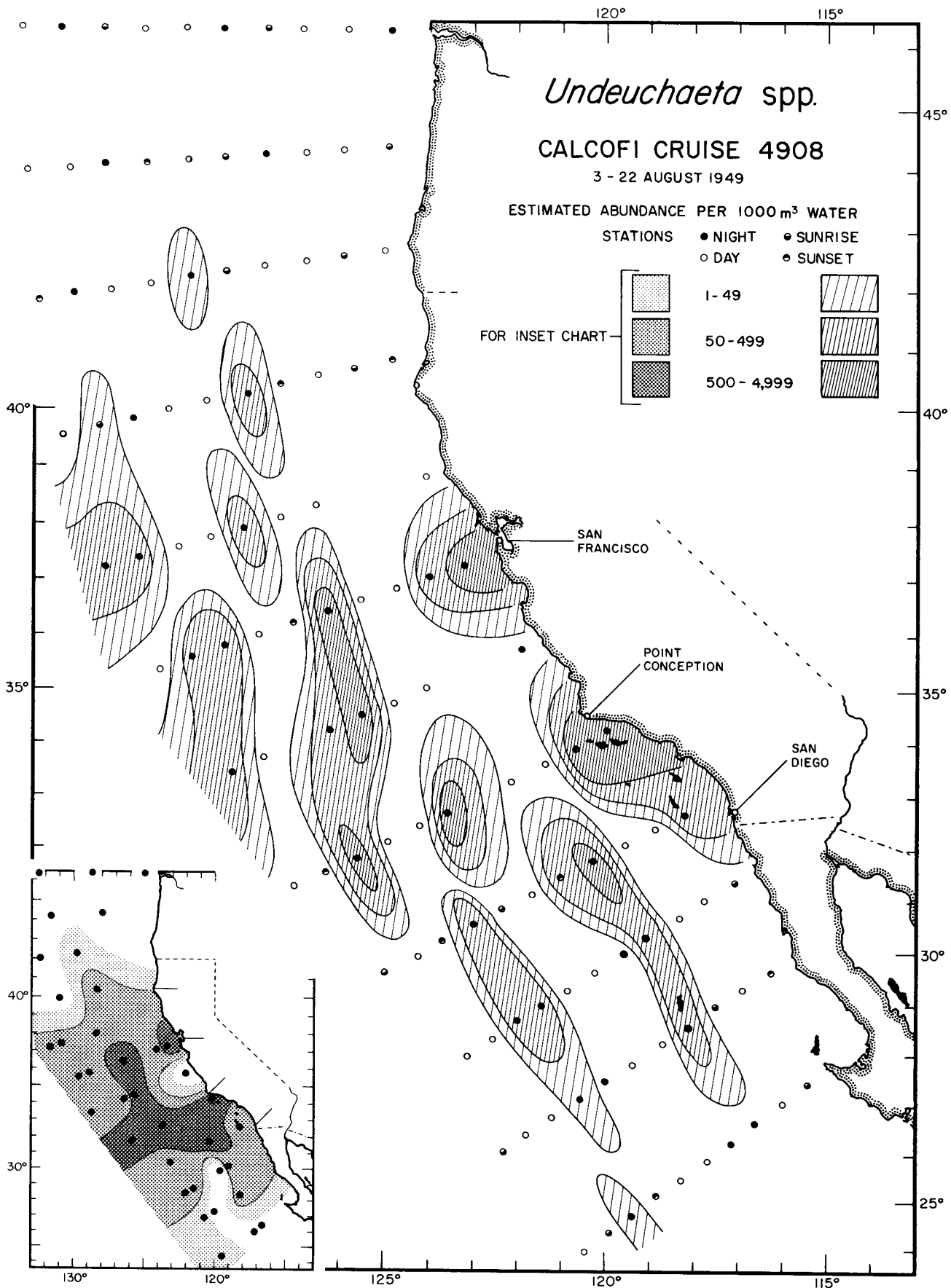
4906

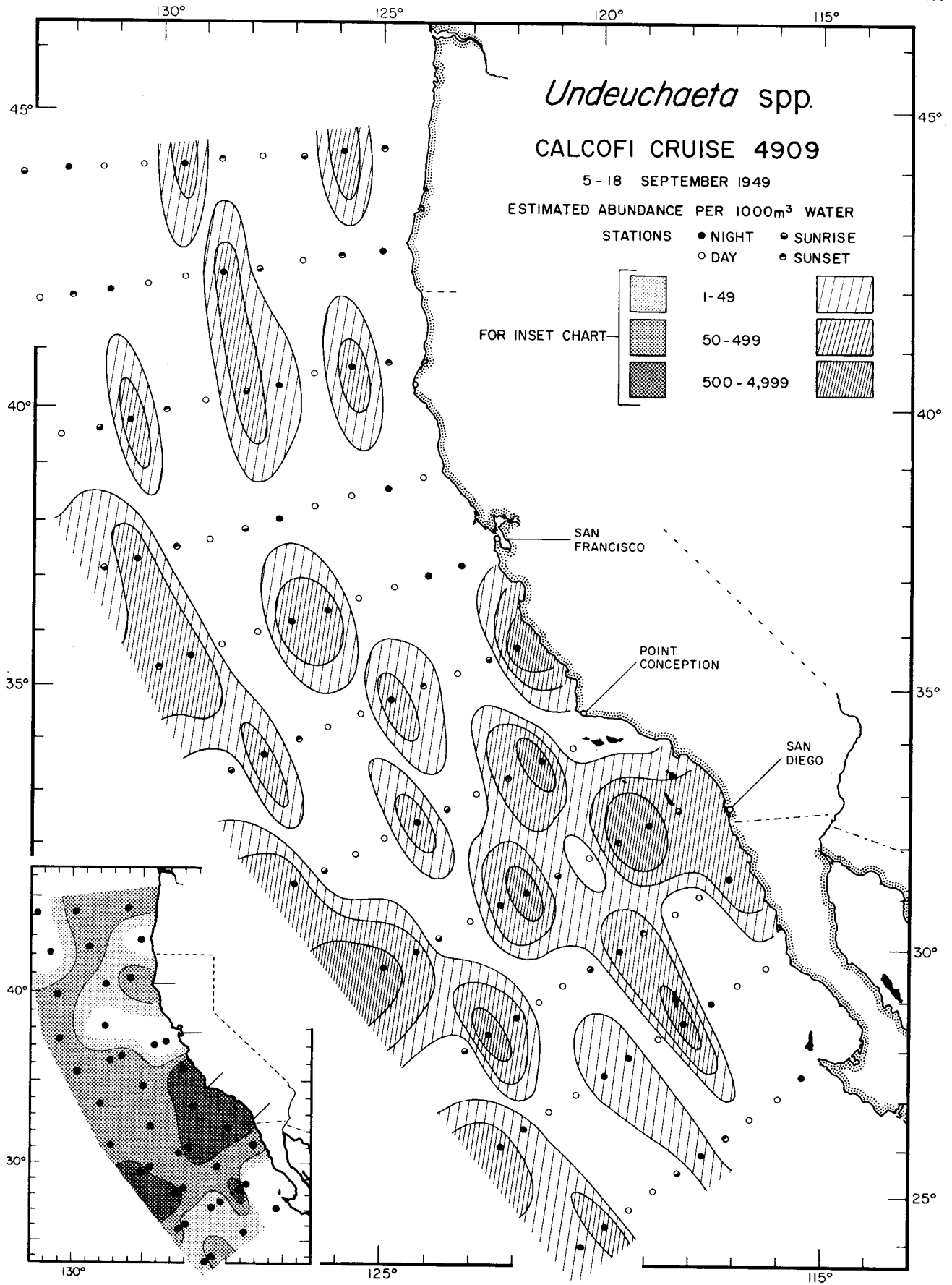


Calanoida

Undeuchaeta spp.

4907

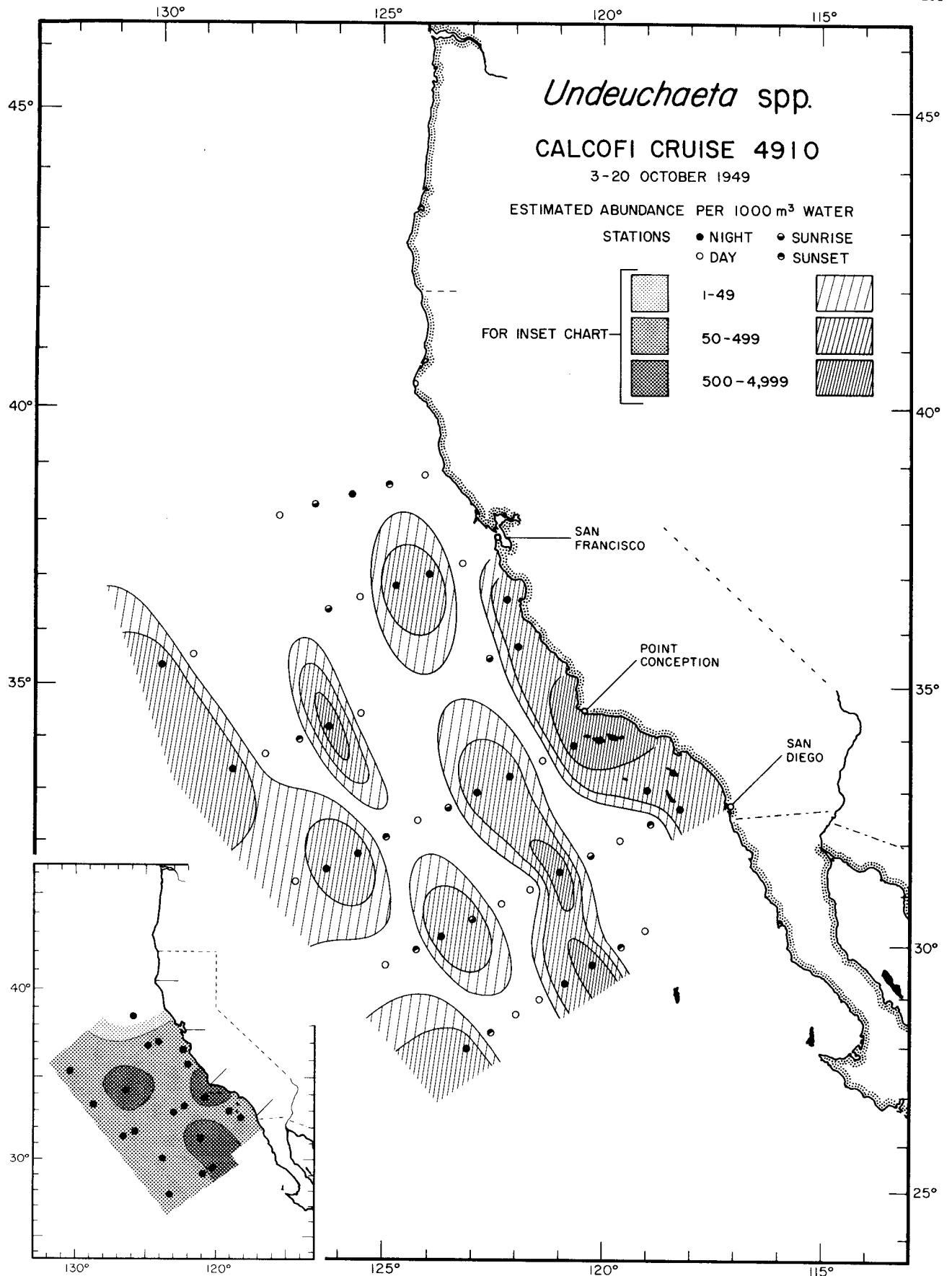




Calanoida

Undeuchaeta spp.

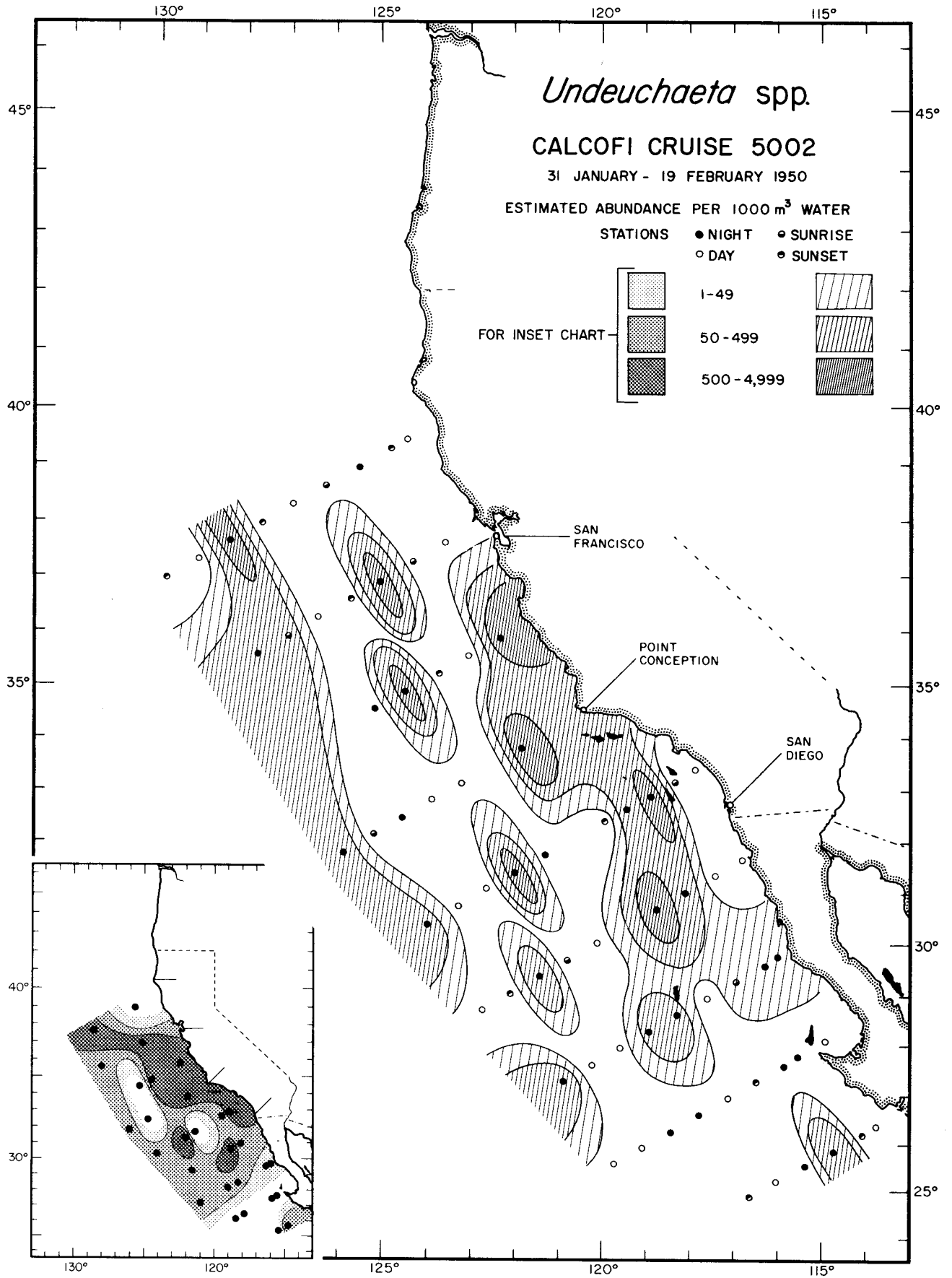
4909



Calanoida

Undeuchaeta spp.

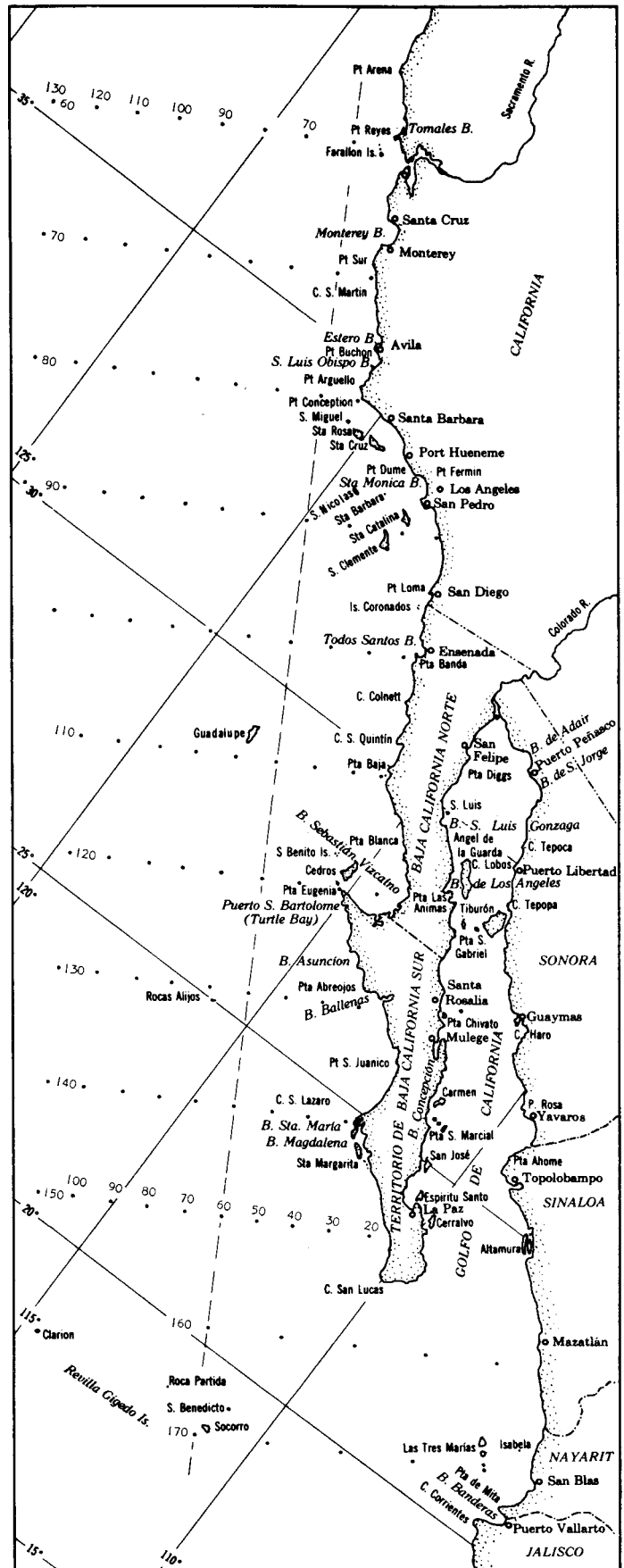
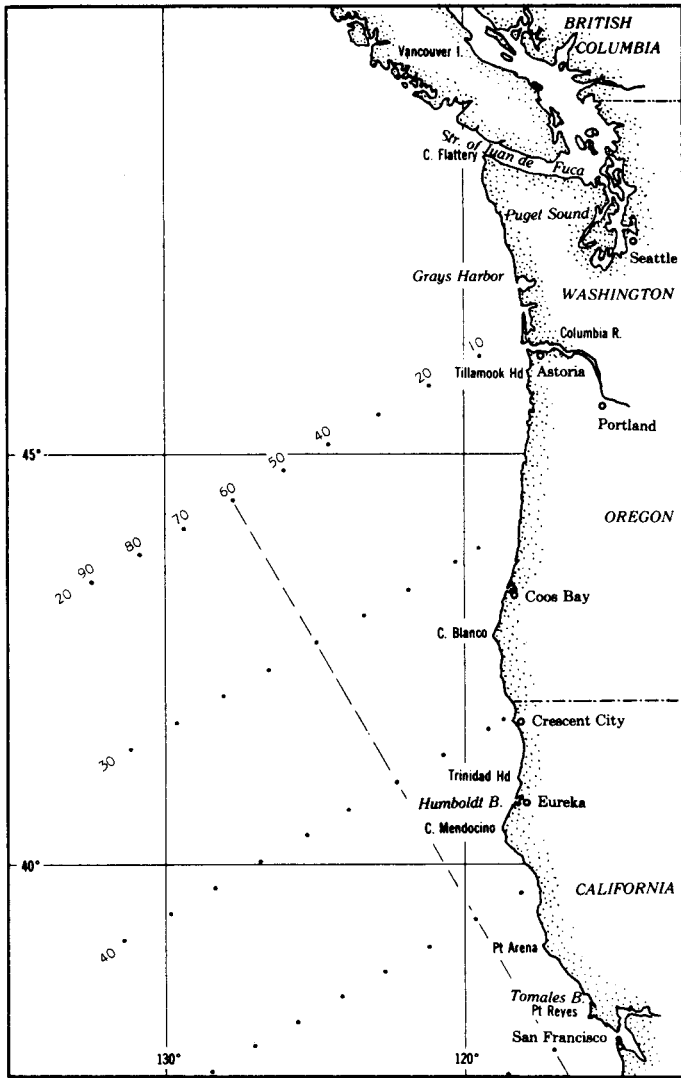
4910



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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