



**Santa Barbara Coastal**  
Long Term Ecological Research

## **Santa Barbara Coastal-LTER Historical Kelp Database for giant kelp (*Macrocystis pyrifera*) biomass in California and Mexico**

### **INTRODUCTION**

ISP Alginates (formerly Kelco Co.) has collected information on the abundance of giant kelp (*Macrocystis pyrifera*) in California and Mexico from routine aerial surveys since 1958. The standard protocol consists of an observer visually estimating the amount of harvestable giant kelp biomass within designated kelp beds from a small fixed-wing aircraft. Observations are recorded on paper data sheets in the field and archived in notebooks housed at ISP Alginates. With cooperation from ISP Alginates, SBC-LTER converted ISP Alginates long-term records of giant kelp biomass into a digital format. This document describes the organization of the Historical Kelp database and the methods that were used to create it. The format ISP Alginates used to report kelp abundance data changed periodically over the course of the collecting period. This document also describes the steps taken to standardize the historical records of kelp biomass into a consistent format.

### **DATABASE ORGANIZATION**

ISP Alginates' archived data on kelp biomass were entered into a digital database by Santa Barbara Coastal Long Term Ecological Research (SBC-LTER) personnel and are archived on the SBC-LTER server. The database consists of two parts; data on kelp biomass and maps and descriptions of designated kelp beds.

### **DATA ON KELP BIOMASS**

The data portion contains a comma-delimited data file and an associated log file. Missing data points are entered as -99999. Missing values were mainly attributed to weather conditions such as fog or rain that prevented aerial surveys. Also, naval activities in certain areas of the Channel Islands prevented aerial surveys and resulted in missing data. Entries marked by "none" or "0" in the original data sheets were entered as having zero (0) biomass.



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The data file contains the following variables.

### **DATE\_OF\_SURVEY**

Date of ISP Alginates aerial survey.

### **YEAR**

Year of ISP Alginates aerial survey.

### **MONTH**

Month of ISP Alginates aerial survey.

### **DAY**

Day of ISP Alginates aerial survey.

### **REGION**

Geographic region of kelp bed. Central refers to central California (Halfmoon Bay to Purisima Point), Southern refers to southern California (Point Arguello to the United States/Mexico border including the Channel Islands) and Baja refers to the Baja California (points south of the United States/Mexico border including several offshore islands).

### **BED**

Bed number designations in Central and Southern California are those assigned by the California Department of Fish and Game; bed number designations in Baja California were assigned by ISP Alginates. Note that there are some duplicate bed numbers in the Southern and Baja regions that refer to distinct beds in each region. A table of bed numbers and corresponding name, location, length of coastline encompassed by the bed, size, and description of the bed boundaries is shown in Table 1.

### **BED\_NAME**

Common name of kelp bed.

### **HARVESTED**

Amount of kelp harvested (measured in US tons) since the previous survey. Note: harvest data are only available since March 25, 1991.

### **TOTAL**

Total biomass (measured in US tons) of kelp in the bed as observed by the aerial survey. In earlier surveys, ISP Alginates labeled this column "Maximum".

### **AVAILABLE**

Amount of kelp (in US tons) available and accessible for harvesting. In earlier surveys ISP Alginates labeled this column "Minimum".



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### **DATE\_PREVIOUS\_SURVEY**

Date of the previous aerial survey.

Beginning in January 8, 1968, data on kelp biomass were occasionally reported as the sum of multiple beds (e.g. a single value was reported for beds 2 and 3.) In such cases, the reported tonnage was split evenly among the combined beds in the digital database. Also, prior to September 17, 1962, some of the bed designations used by ISP Alginates differed from those of the California Department of Fish and Game. Data recorded under these earlier ISP Alginates bed designations were entered into the database under the corresponding CDFG bed number. A conversion table of ISP Alginate bed numbers and CDFG bed numbers is shown below.

### **ISP Alginates beds**

#### **9/17/1962 to 3/11/1958**

#### **Corresponding CDFG bed**

1-29	1-29
30	30 & 31
31	31 & 32
32	117 & 118
33	115
34	114
35	113 & 116
36	112
37	111
38	110
39	109
40	106
41	107 & 108
42	104 & 105
43	103
44	102
45	101

ISP Alginates beds 30, 31, 32, 35, 41, 42 consisted of two CDFG beds. Kelp biomass recorded under these ISP Alginate bed numbers was evenly split between the two corresponding CDFG beds. CDFG bed 31 was included in ISP Alginate beds 30 and 31. In this case the 50 % fraction of kelp in ISP Alginate beds 30 and 31 were added together to produce CDFG bed 31. Occasionally data from some of the early surveys were reported as number of "loads" instead of tonnage. A load is equal to approximately 300 US tons (D. Glantz, personal communication). Values entered as "loads" were converted to tons by multiplying the "load" value by 300. "Loads" refer to the capacity of the kelp harvesting vessel "El Rey" not the smaller vessel "Ellwood" that was also sometimes used.



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## **MAPS AND DESCRIPTIONS OF DESIGNATED KELP BEDS**

The Map section of the database consists of twenty-four jpeg files showing the geographic location of the numbered kelp beds found in the data file. California Department of Fish and Game (CDFG) bed numbers apply only to beds in the Central and Southern California regions. Bed numbers in the Baja region were assigned by ISP Alginates and have no data for Latitude, Longitude, Length, Bed Size or Bed Boundary. Maps showing the location of each kelp bed listed here are included at the end of this document.

**Baja Bed #101N.jpg**

**Baja Bed 101S.jpg**

**Baja Bed 101W.jpg**

**Baja Bed 102N.jpg**

**Baja Bed 103.jpg**

**Baja Bed 104.jpg**

**Baja Bed 105.jpg**

**Baja Bed 106.jpg**

**Baja Bed 107-8.jpg**

**Baja Bed 109N.jpg**

**Baja Bed 109S.jpg**

**Baja Bed 110.jpg**

**Baja Bed 111N.jpg**

**Baja Bed 111S.jpg**

**Baja Bed 112Is.jpg**

**Baja Bed 112S.jpg**

**Baja Bed 113N.jpg**

**Baja Bed 113S.jpg**

**Baja Bed 114.jpg**

**Baja Bed 115.jpg**

**Central California Bed 208-225.jpg**

**Central California Bed 33-34 202-207.jpg**

**Southern California Bed 1-10 101-104.jpg**

**Southern California Bed 13-15 105-108.jpg**

**Southern California Bed 17-32 109-118.jpg**

**Table 1.** Locations and descriptions for giant kelp beds in Southern, Central and Baja California. The following table describes the number, name, latitude, longitude, length, size and boundaries for each of the kelp beds in the database. The column variables are as follows: **Bed** is the number assigned to each kelp bed. Numbers for kelp beds in Southern and Central California regions are those assigned by the California Department of Fish and Game; numbers for kelp beds in the Baja California region were assigned by ISP Alginates. **Bed\_Name** is the common name assigned to each kelp bed that indicates its location. **Latitude** (in decimal degrees) is the center of the polygon that defines each bed (the polygon projects 3 miles offshore from each boundary). **Longitude** (in decimal degrees) is the center of the polygon that defines each bed (the polygon projects 3 miles offshore from each boundary). **Length\_(km)** is the length of coastline encompassed by bed designation. **Bed\_Size\_(km<sup>2</sup>)** is the area of kelp bed, measured in square kilometers. **Bed\_Boundaries** are the geographic boundaries assigned by the California Department of Fish and Game to Central and Southern California region kelp beds.

### Southern California Region

<b>Bed #</b>	<b>Bed Name</b>	<b>Latitude</b>	<b>Longitude</b>	<b>Length (km)</b>	<b>Bed Size (km<sup>2</sup>)</b>	<b>Bed Boundaries</b>
1	Imperial Beach	32.56617	- 117.15418	7.691	0.518	From a line drawn 264° from the U.S.A.-Mexico International Boundary to a line drawn 270° from the southern tip of San Diego Bay.
2	Coronado	32.64397	- 117.21350	16.508	0.259	From a line drawn 270° from the southern tip of San Diego Bay to a line drawn 259° from the southern tip of Point Loma.
3	Point Loma	32.70802	- 117.27556	11.326	6.682	From a line drawn 259° from the southern tip of Point Loma to a line drawn 272° from the south jetty of Mission Bay.
4	Del Mar	32.81779	- 117.29241	15.507	6.553	From a line drawn 272° from the south jetty of Mission Bay to a line drawn 283° from Scripps Pier.
5	Encinitas	32.92137	- 117.28669	12.437	.	From a line drawn 283° from Scripps Pier to a line drawn 269° from the mouth of the San Dieguito River.
6	Las Flores	33.07673	- 117.34160	23.159	3.937	From a line drawn 269° from the mouth of the San Dieguito River to a line drawn 236° from the middle of Loma Alta Lagoon (at South Oceanside).

7	San Onofre	33.26323	- 117.48263	27.891	1.709	From a line drawn 236° from the middle of Loma Alta Lagoon to a line drawn 215° from the middle of the city of San Onofre.
8	Capistrano Beach	33.39988	- 117.64585	16.531	3.963	From a line drawn 215° from the middle of the city of San Onofre to a line drawn 219° from the middle of San Juan Creek.
9	San Clemente	33.48594	- 117.76860	19.304	1.010	From a line drawn 219° from the middle of San Juan Creek to a line drawn 220° from Abalone Pt.
10	Corona Del Mar	33.55678	- 117.86522	7.275	.	From a line drawn 220° from Abalone Pt. to a line drawn 220° from the south jetty of Newport Bay.
13	Palos Verdes	33.70135	- 118.34431	20.671	1.399	From a line drawn 156° from the San Pedro Breakwater Lighthouse to a line drawn 232° from Pt. Vicente.
14	Redondo Beach	33.78163	- 118.43484	15.579	1.917	From a line drawn 232° from Pt. Vicente to a line drawn 256° from the southern tip of the Redondo Beach Breakwater.
15	Pacific Palisades	34.00874	- 118.58916	16.018	0.104	From a line drawn 223° from the Santa Monica Pier to a line drawn 156° from Malibu Pt.
16	Malibu	33.99489	- 118.73574	14.114	0.544	From a line drawn 156° from Malibu Pt. to a line drawn 185° from Pt. Dume.
17	Point Dume	34.02147	- 118.94494	27.429	1.606	From a line drawn 185° from Pt. Dume to a line drawn 207° from Pt. Mugu.
18	Ventura	34.28041	- 119.36339	9.373	0.363	From a line drawn 217° from the middle of the mouth of Ventura River to a line drawn 214° from Pitas Pt.
19	Rincon Point	34.32891	- 119.44945	10.872	0.129	From a line drawn 214° from Pitas Pt. to a line drawn 218° from Rincon Pt.
20	Carpinteria	34.37760	- 119.53019	9.161	0.622	From a line drawn 218° from Rincon Pt. to a line drawn 198° from Loon Pt.

21	Summerland	34.39543	- 119.60990	6.139	0.492	From a line drawn 198° from Loon Pt. to a line drawn 184° from the eastern boundary of the Montecito Hotel (2.4 miles 072° from tip of S.B. Breakwater).
22	Santa Barbara	34.38910	- 119.66466	4.320	0.129	From a line drawn 184° from the eastern boundary of the Montecito Hotel to a line drawn 166° from the tip of the Santa Barbara Breakwater.
23	Santa Barbara Breakwater	34.38150	- 119.70467	5.476	0.259	From a line drawn 166° from the tip of the Santa Barbara Breakwater to a line drawn 195° from the Santa Barbara Lighthouse.
24	Arroyo Burro	34.37791	- 119.74023	2.291	0.129	From a line drawn 195° from the Santa Barbara Lighthouse to a line drawn 197° from the middle of Rogue Creek (Arroyo Burro).
25	Hope Ranch	34.38725	- 119.76355	3.263	0.466	From a line drawn 197° from the middle of Rogue Creek to a line drawn 185° from the middle of Hope Ranch Creek.
26	Goleta	34.38961	- 119.81113	6.344	1.554	From a line drawn 185° from the middle of Hope Ranch Creek to a line drawn 176° from Goleta Pt.
27	Coal Oil Point	34.38497	- 119.87155	4.765	1.114	From a line drawn 176° from Goleta Pt. to a line drawn 210° from Coal Oil Pt.
28	Naples	34.40994	- 119.94224	11.475	1.554	From a line drawn 210° from Coal Oil Pt. to a line drawn 200° from the Middle of Gato Canyon (about 1.5 miles west of Naples).
29	El Refugio	34.43599	- 120.03029	7.342	0.440	From a line drawn 200° from the middle of Gato Canyon to a line drawn 183° from the middle of Refugio Creek.
30	Tajiguas	34.44507	- 120.11807	9.470	1.010	From a line drawn 183° from the middle of Refugio Creek to a line drawn 180° from the middle of Canada de Molino (about 5 miles west of Refugio Creek).
31	Gaviota	34.44724	- 120.21912	9.672	0.414	From a line drawn 180° from the middle of Canada de Molino to a line drawn 180° from the middle of Alegria Canyon (about 3.4 miles west of Gaviota).
32	San Augustine	34.43459	- 120.37078	19.945	7.148	From a line drawn 180° from the middle of Alegria Canyon to a line drawn 180° from Pt. Conception.

33	Point Conception	34.46654	- 120.51915	13.618	2.512	From a line drawn 180° from Pt. Conception to a line drawn 231° from Espada Bluff.
34	Point Arguello	34.53884	- 120.61256	16.259	0.803	From a line drawn 231° from Espada Bluff to a line drawn 270° from Pt. Arguello.
101	San Clemente Island (S)	32.79134	- 118.37775	12.736	1.709	San Clemente Island. From a line drawn 120° from Pyramid Head to a line drawn 210° from China Pt.
102	San Clemente Island (W)	32.83317	- 118.49662	17.963	6.190	San Clemente Island. From a line drawn 210° from China Pt. to a line drawn 226° from Seal Cove.
103	San Clemente Island (N)	32.97531	- 118.59337	26.510	7.485	San Clemente Island. From a line drawn 226° from Seal Cove to a line drawn 0° from Northwest Harbor.
104	San Clemente Island (E)	32.93777	- 118.43967	39.444	0.570	San Clemente Island. From a line drawn 0° from Northwest Harbor to a line drawn 120° from Pyramid Head.
105	Santa Catalina Island	33.38894	- 118.51550	95.641	1.942	Santa Catalina Island. Entire island.
106	Santa Barbara Island	33.47570	- 119.07074	18.447	0.596	Santa Barbara Island. Entire island.
107	San Nicolas Island South (includes 107A San Nicolas Island and 107B San Nicolas Island (Foul) in database)	33.22037	- 119.55282	26.267	2.978	San Nicolas Island. South of a line drawn 75° from the east end to a line drawn 283° from the west end.
108	San Nicolas Island North (includes 108A San Nicolas Island (Rockpile), 108B San Nicolas Island (Westend) and 108C San Nicolas Island (Barrack) in database)	33.27869	- 119.50030	26.755	7.381	San Nicolas Island. North of a line drawn 283° from the west end to a line drawn 75° from the east end.

109	Anacapa Island	34.01010	- 119.39709	26.991	0.829	Anacapa Islands. All islands.
110	Santa Cruz Island (N)	33.97676	- 119.59793	25.657	1.658	Santa Cruz Island. From a line drawn 86° from San Pedro Pt. to a line drawn 170° from Bowen Pt.
111	Santa Cruz Island (W)	34.00928	- 119.91733	35.653	1.580	Santa Cruz Island. From a line drawn 170° from Bowen Pt. to a line drawn 306° from West Pt.
112	Santa Cruz Island (N)	34.06700	- 119.71573	51.132	0.285	Santa Cruz Island. From a line drawn 306° from West Pt. to a line drawn 86° from San Pedro Pt.
113	Santa Rosa Island (SE)	33.92445	- 120.01435	24.957	1.528	Santa Rosa Island. From a line drawn 61° from Skunk Pt. to a line drawn 180° from South Pt.
114	Santa Rosa Island (SW)	33.92908	- 120.20343	21.946	5.620	Santa Rosa Island. From a line drawn 180° from South Pt. to a line drawn 285° from Sandy Pt.
115	Santa Rosa Island (NW)	34.04119	- 120.14118	25.156	4.118	Santa Rosa Island. From a line drawn 285° from Sandy Pt. to a line drawn 45° from Carrington Pt.
116	Santa Rosa Island (NE)	34.02307	- 119.99676	10.826	1.606	Santa Rosa Island. From a line drawn 45° from Carrington Pt. to a line drawn 61° from Skunk Pt.
117	San Miguel Island (S)	34.00467	- 120.37598	21.154	3.496	San Miguel Island. South of a line drawn 60° from Cardwell Pt. to a line drawn 231° from Pt. Bennett.
118	San Miguel Island (N)	34.06106	- 120.37882	29.511	3.911	San Miguel Island. North of a line drawn 231° from Pt. Bennett to a line drawn 60° from Cardwell Pt.

### Central California Region

202	Purisma Point	34.73997	- 120.66150	42.414	0.259	From a line drawn 270° from Pt. Arguello to a line drawn 270° from Point Sal.
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203	Point Sal	35.02065	- 120.66173	33.318	.	From a line drawn 270° from Point Sal to a line drawn 270° from Pismo Beach Pier.
204	Port San Luis	35.15877	- 120.69993	8.871	1.865	From a line drawn 270° from Pismo Beach Pier to a line drawn 180° from Point San Luis.
205	Point San Luis	35.18562	- 120.85285	22.066	1.658	From a line drawn 180° from Point San Luis to a line drawn 250° from Point Buchon.
206	Point Buchon	35.30452	- 120.90592	15.158	0.104	From a line drawn 250° from Point Buchon to a line drawn 270° from Morro Rock.
207	Cayucos	35.41638	- 120.93666	16.416	3.781	From a line drawn 270° from Morro Rock to a line drawn 190° from Point Estero.
208	Point Estero	35.48310	- 121.07043	15.777	6.760	From a line drawn 190° from Point Estero to a line drawn 230° from Von Helm Rock.
209	Cambria	35.58116	- 121.15496	13.807	5.698	From a line drawn 230° from Von Helm Rock to a line drawn 200° from San Simeon Point.
210	San Simeon	35.63028	- 121.26035	11.035	5.232	From a line drawn 200° from San Simeon Point to a line drawn 230° from Point Piedras Blancas.
211	Ragged Point	35.72431	- 121.35183	20.974	3.885	From a line drawn 230° from Point Piedras Blancas to a line drawn 240° from Salmon Head.
212	Bird Rock	35.83911	- 121.44096	12.400	3.263	From a line drawn 240° from Salmon Head to a line drawn 240° from Cape San Martin.
213	Cape San Martin	35.94313	- 121.50660	20.632	5.543	From a line drawn 240° from Cape San Martin to a line drawn 240° from Lopez Point.
214	Lopez Point	36.08622	- 121.65520	22.530	5.258	From a line drawn 240° from Lopez Point to a line drawn 240° from Partington Point.

215	Pfeiffer Point	36.19386	- 121.76431	11.579	2.072	From a line drawn 240° from Partington Point to a line drawn 200° from Pfeiffer Point.
216	Big Sur	36.24989	- 121.86636	12.299	7.977	From a line drawn 200° from Pfeiffer Point to a line drawn 200° from Point Sur.
217	Point Sur	36.37752	- 121.94550	27.429	6.164	From a line drawn 200° from Point Sur to a line drawn 270° from Yankee Point.
218	Point Lobos	36.50646	- 121.97169	4.413	1.295	From a line drawn 270° from Yankee Point to a line drawn 270° from Point Lobos.
219	Carmel Bay	36.55107	- 121.97787	11.879	3.315	From a line drawn 270° from Point Lobos to a line drawn 270° from Point Cypress.
220	Monterey	36.63160	- 121.95977	18.815	4.869	From a line drawn 270° from Point Cypress to a line drawn 000° from Monterey Pier.
221	Moss Landing	36.78996	- 121.82029	52.445	2.331	From a line drawn 000° from Monterey Pier to a line drawn 180° from Santa Cruz Pier.
222	Santa Cruz	36.94118	- 122.10621	17.591	2.098	From a line drawn 180° from Santa Cruz Pier to a line drawn 240° from Sand Hill Bluff.
223	Davenport	37.03579	- 122.26480	24.553	0.492	From a line drawn 240° from Sand Hill Bluff to a line drawn 240° from Point Año Nuevo.
224	Pigeon Point	37.16570	- 122.40048	19.746	0.155	From a line drawn 240° from Point Año Nuevo to a line drawn 270° from Pescadero Point.
225	Halfmoon Bay	37.38907	- 122.44794	38.985	.	From a line drawn 270° from Pescadero Point to a line drawn 270° from Point Montara.

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### Baja California Region

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**ISP\_Alginata\_Bed\_#**

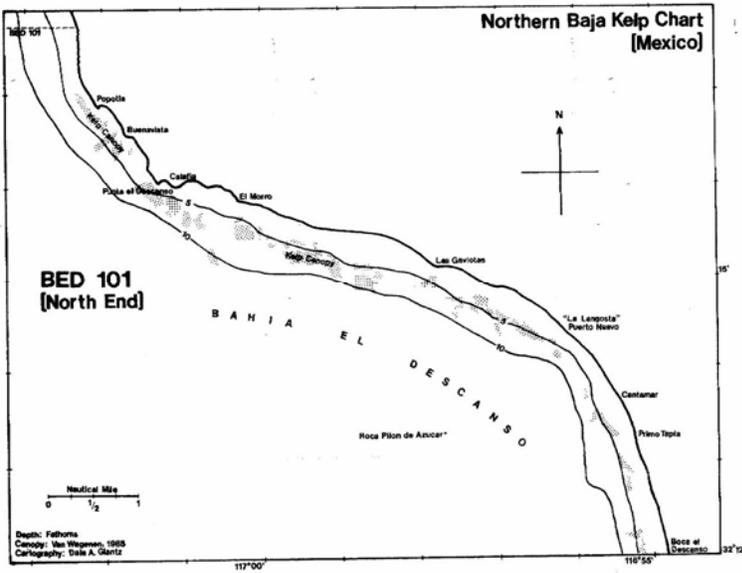
	<b>Bed_Name</b>	<b>Latitude</b>	<b>Longitude</b>	<b>Length_(km)</b>	<b>Bed Size_(km<sup>2</sup>)</b>	<b>Bed_Boundaries</b>
101A	W. Coronado Islands	32.25	-117.14	.	.	.
101B	Tijuana	.	.	.	.	.
101C	Potpolá	32.17	-117.20	.	.	.
101D	Descanso Bay	32.16	-117.10	.	.	.
101E	Punta Mesquite	32.10	-115.54	.	.	.
102	.	32.02	-116.50	.	.	.
103	.	31.55	-116.43	.	.	.
104	Todos Santos Island	31.48	-116.48	.	.	.
105	Punta Banda	31.42	-116.42	.	.	.
106	.	31.37	-116.40	.	.	.
107	Santo Tomas	31.32.5	-116.41	.	.	.

108	Punta Prieta	31.28	-116.38	.	.	.
109		31.25	-116.31	.	.	.
110	San Isidro	31.17	-116.24	.	.	.
111	.	30.54	-116.14	.	.	.
112	Isle San Martin	30.29	-116.06	.	.	.
113	Rosario Bay	29.55	-115.45	.	.	.
114A	Geronimo Island	29.46	-115.45			
114B	Sacramento Reef	29.39	-115.33	.	.	.
115	Punta San Carlos	.	.	.	.	.
150	San Benitos Island	.	.	.	.	.
151A	N. Cedros Island	.	.	.	.	.
151B	S. Cedros Island	.	.	.	.	.

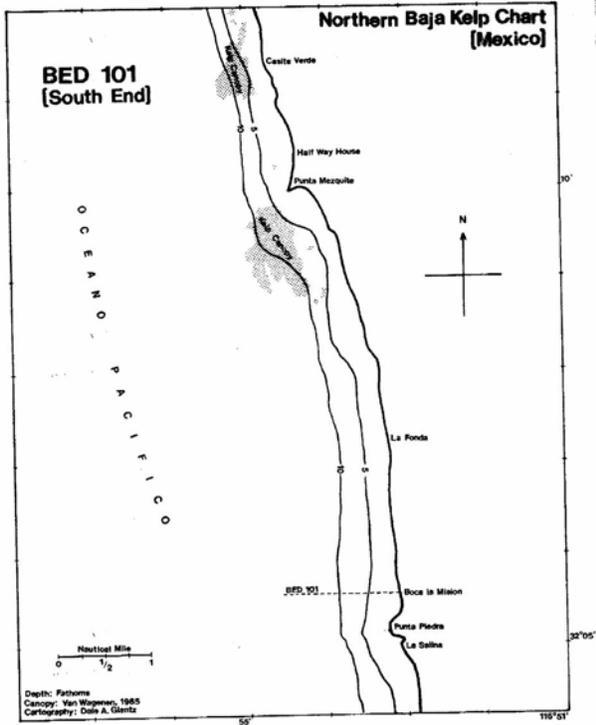
152	Natividad Island	.	.	.	.	.
153	Punta Eugenia	.	.	.	.	.
154A	S. Punta Eugenia	.	.	.	.	.
154B	N. Turtle Bay	.	.	.	.	.
155	S. Turtle Bay	.	.	.	.	.
156	San Pablo to Asuncion	.	.	.	.	.

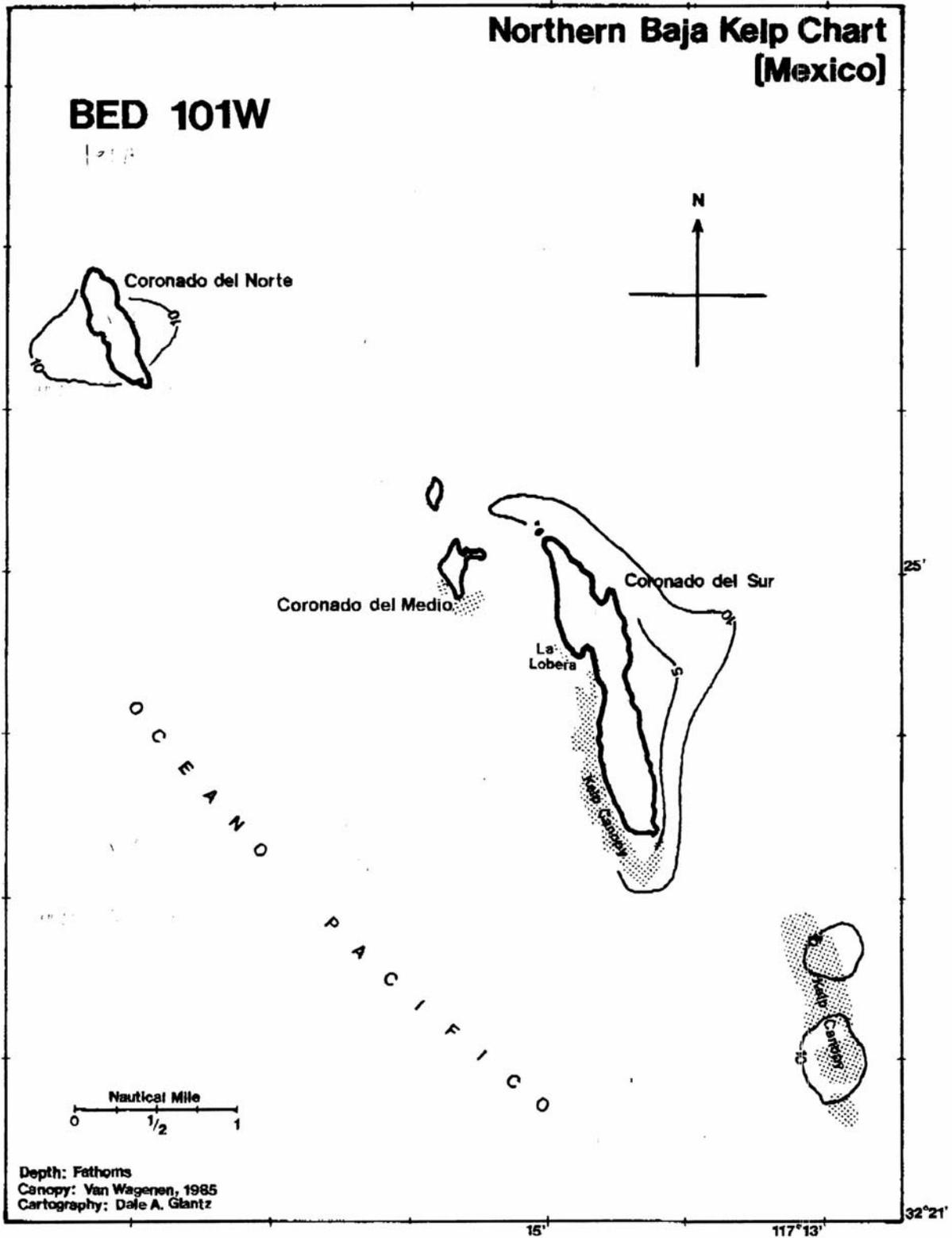
# MAPS OF KELP BEDS

## Baja Bed #101N.jpg

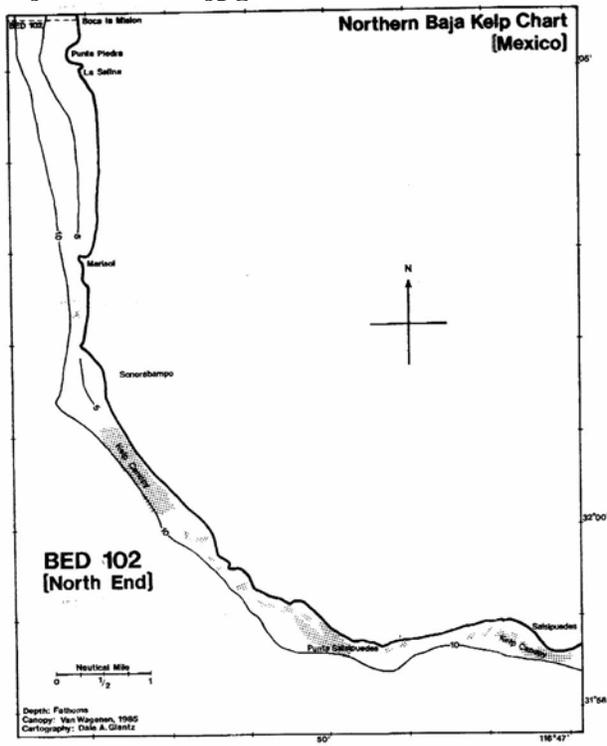


## Baja Bed 101S.jpg

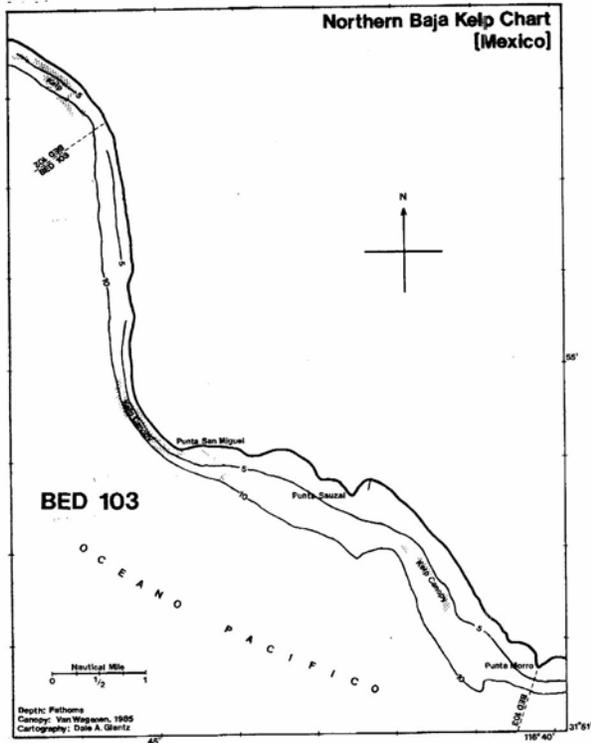




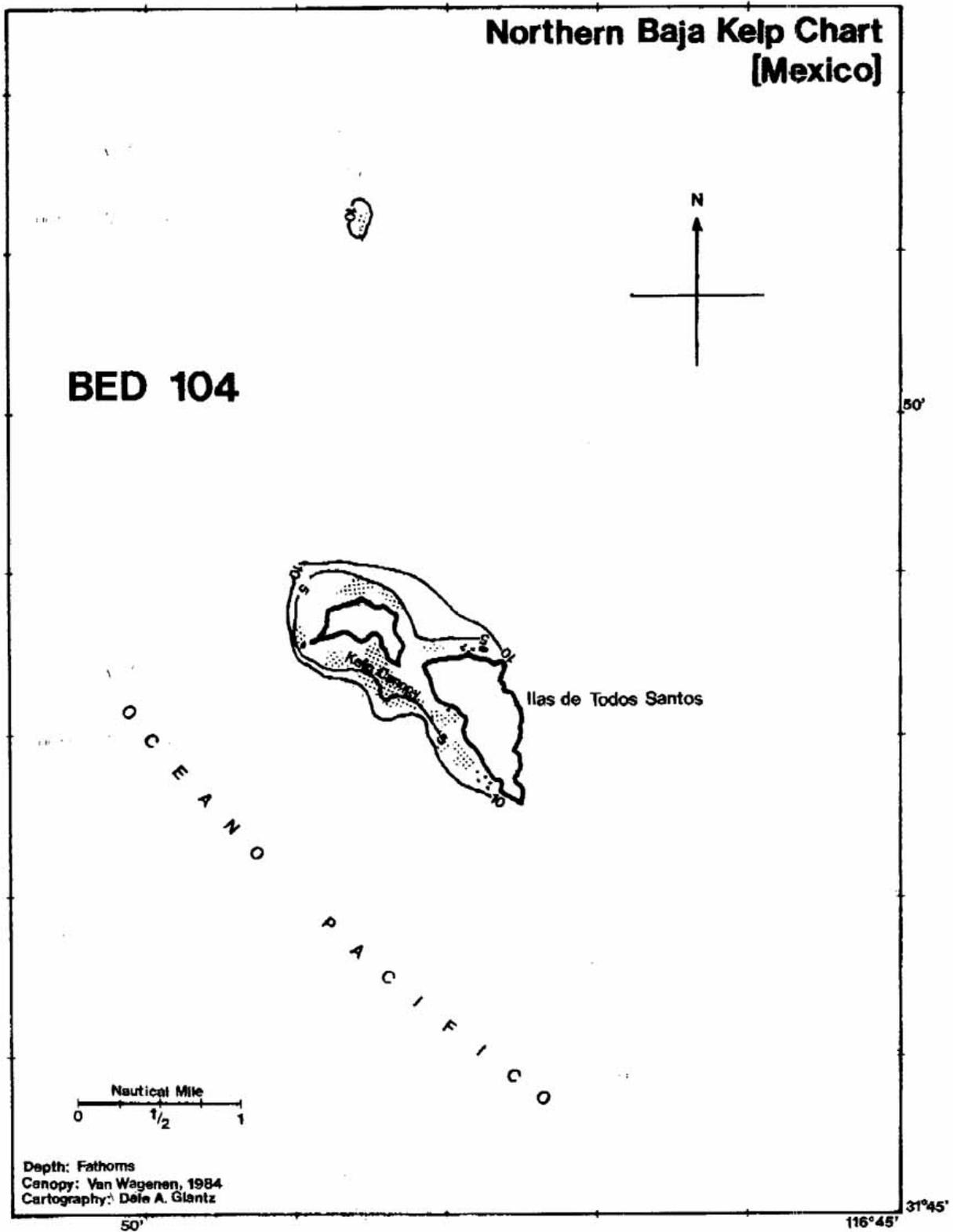
Baja Bed 102N.jpg



Baja Bed 103.jpg

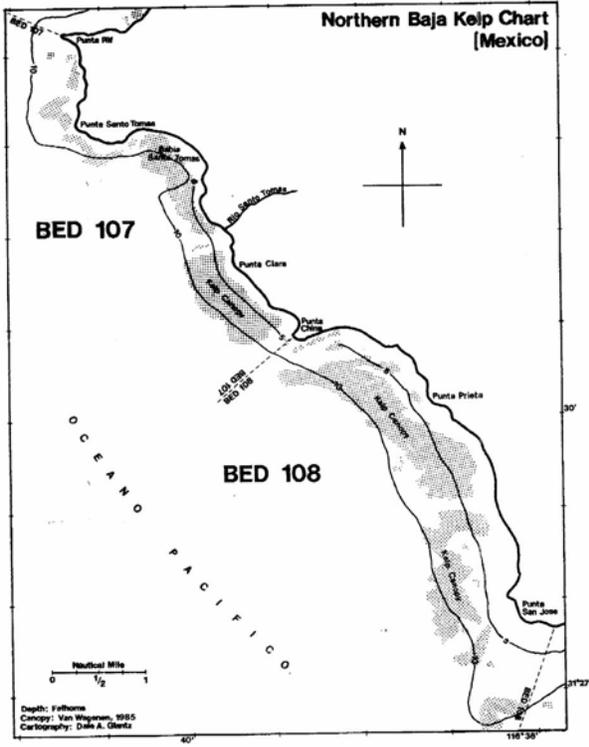


Baja Bed 104.jpg

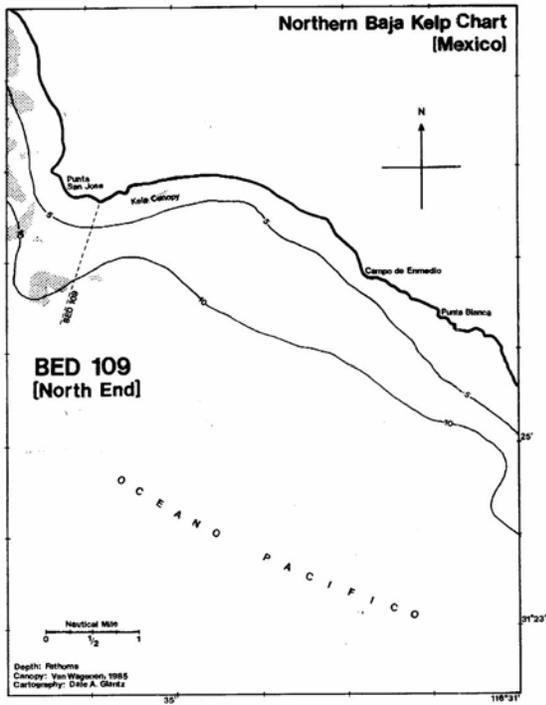




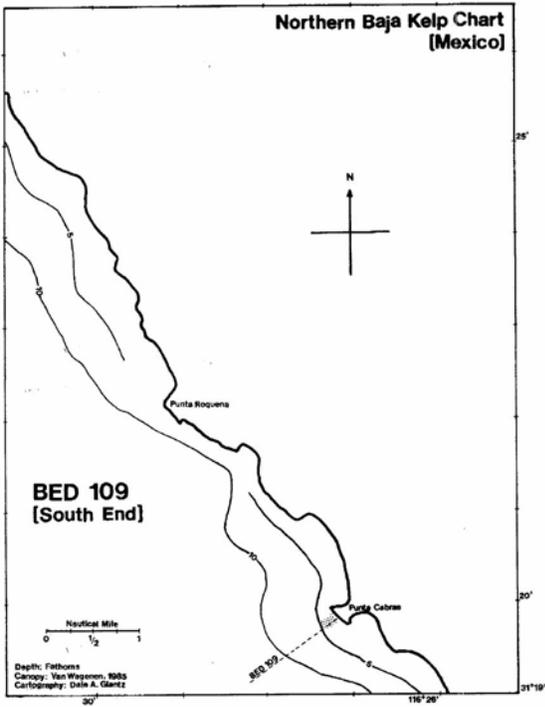
Baja Bed 107-8.jpg



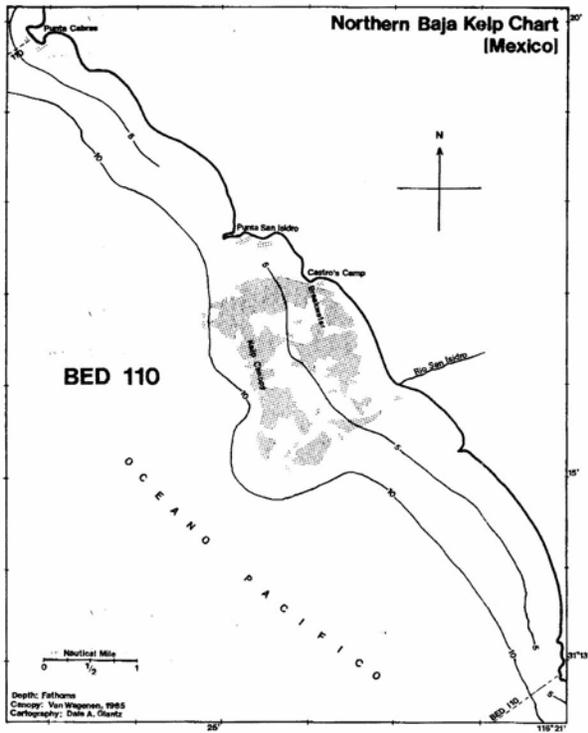
Baja Bed 109N.jpg



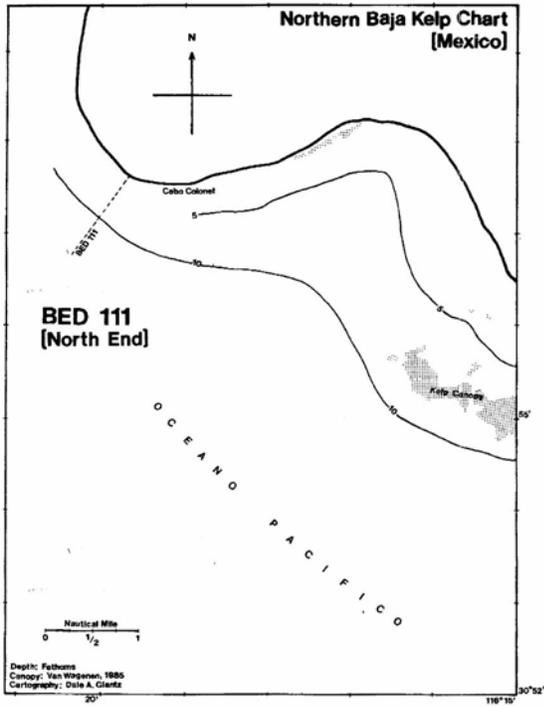
Baja Bed 109S.jpg



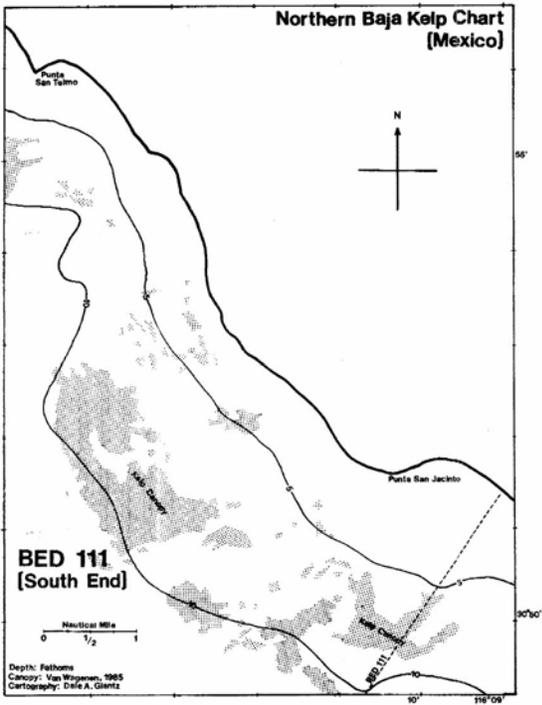
Baja Bed 110.jpg



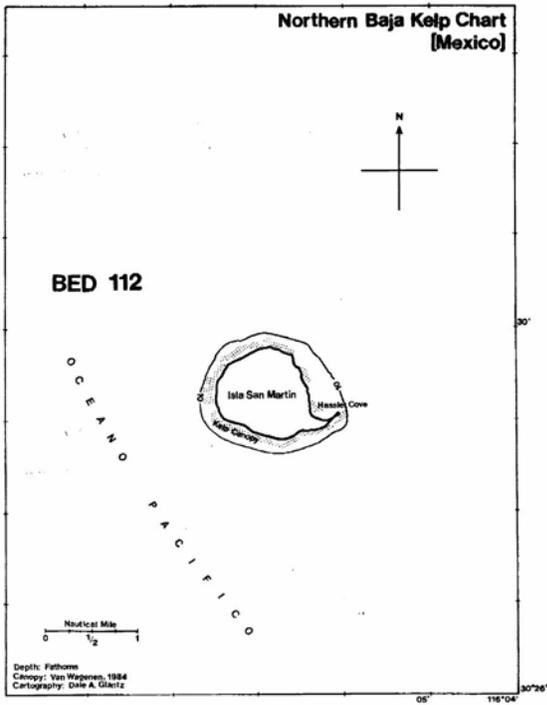
Baja Bed 111N.jpg



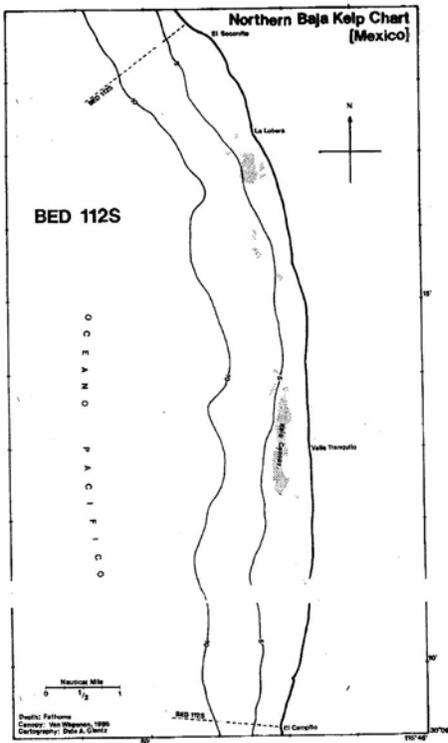
Baja Bed 111S.jpg



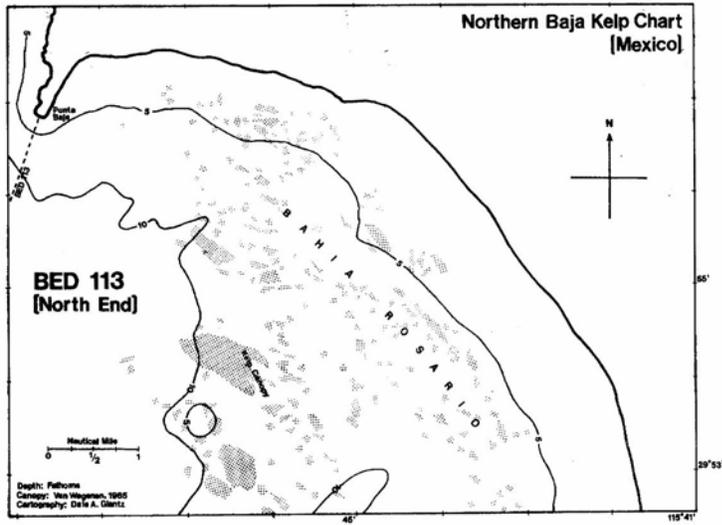
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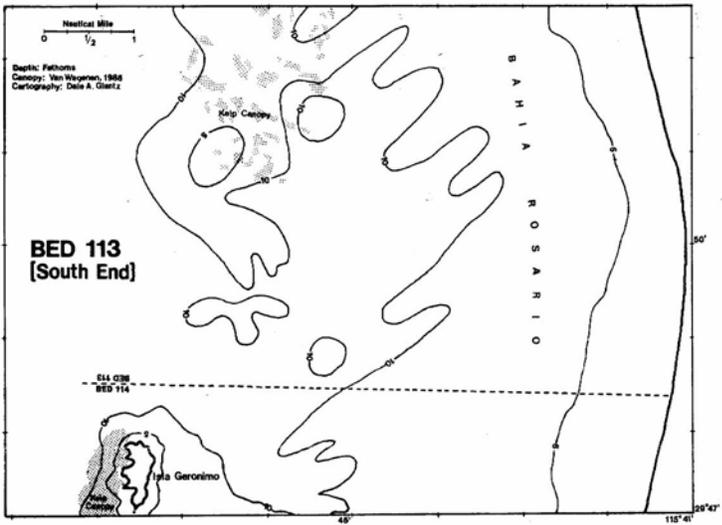
Baja Bed 112S.jpg



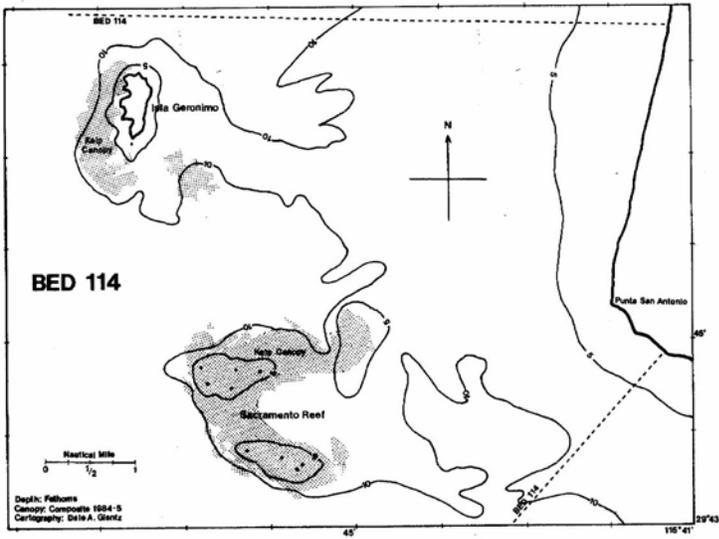
Baja Bed 113N.jpg



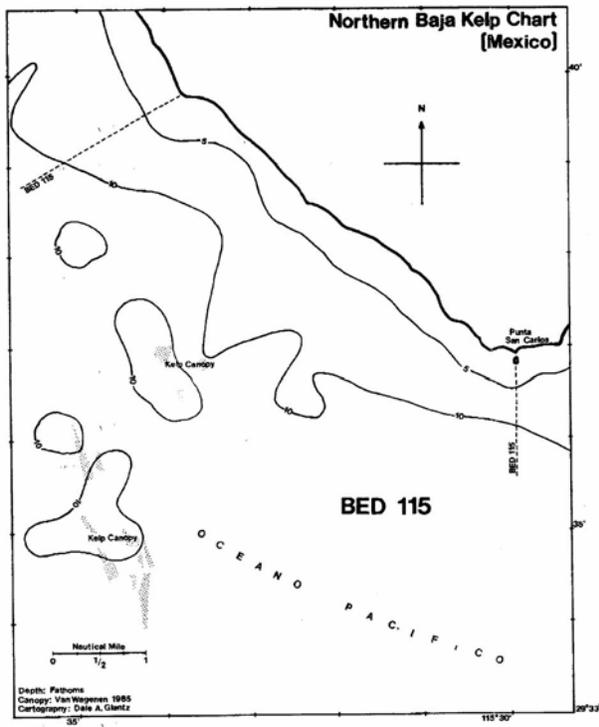
Baja Bed 113S.jpg



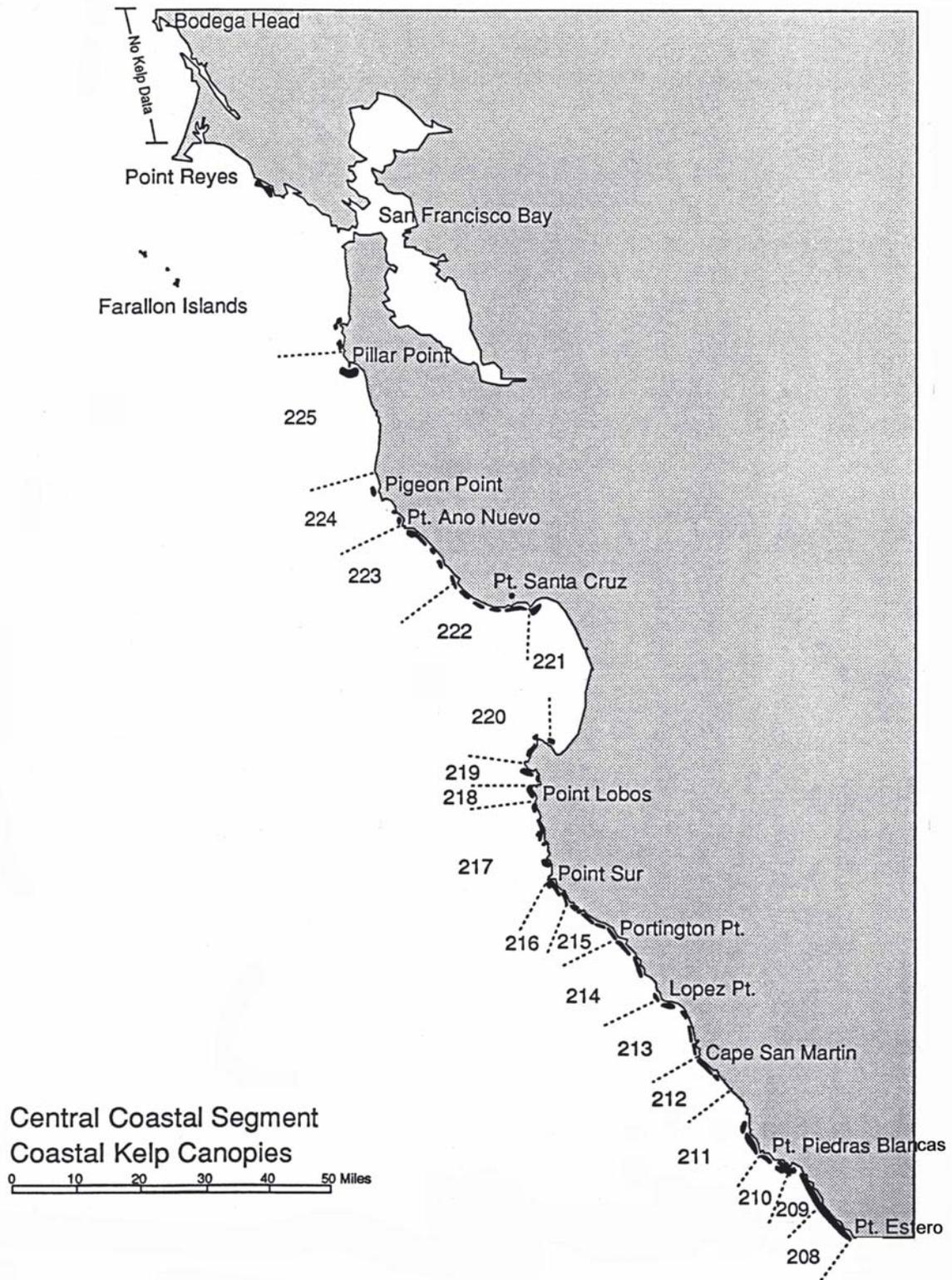
Baja Bed 114.jpg



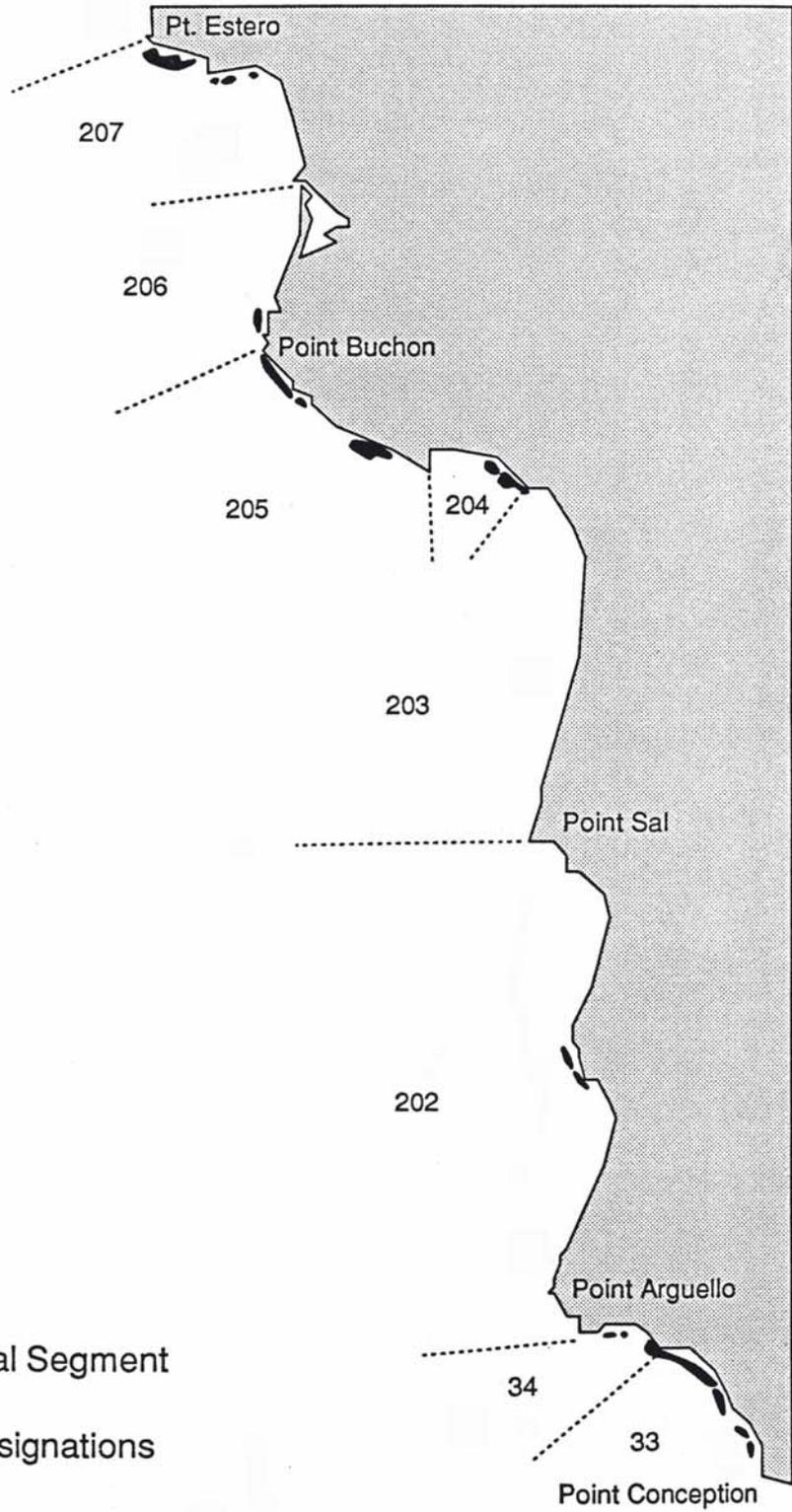
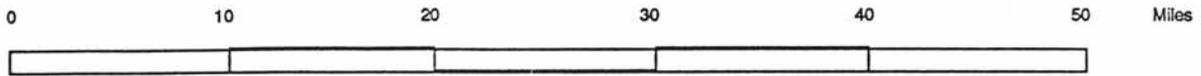
Baja Bed 115.jpg



# Central California Bed 208-225.jpg



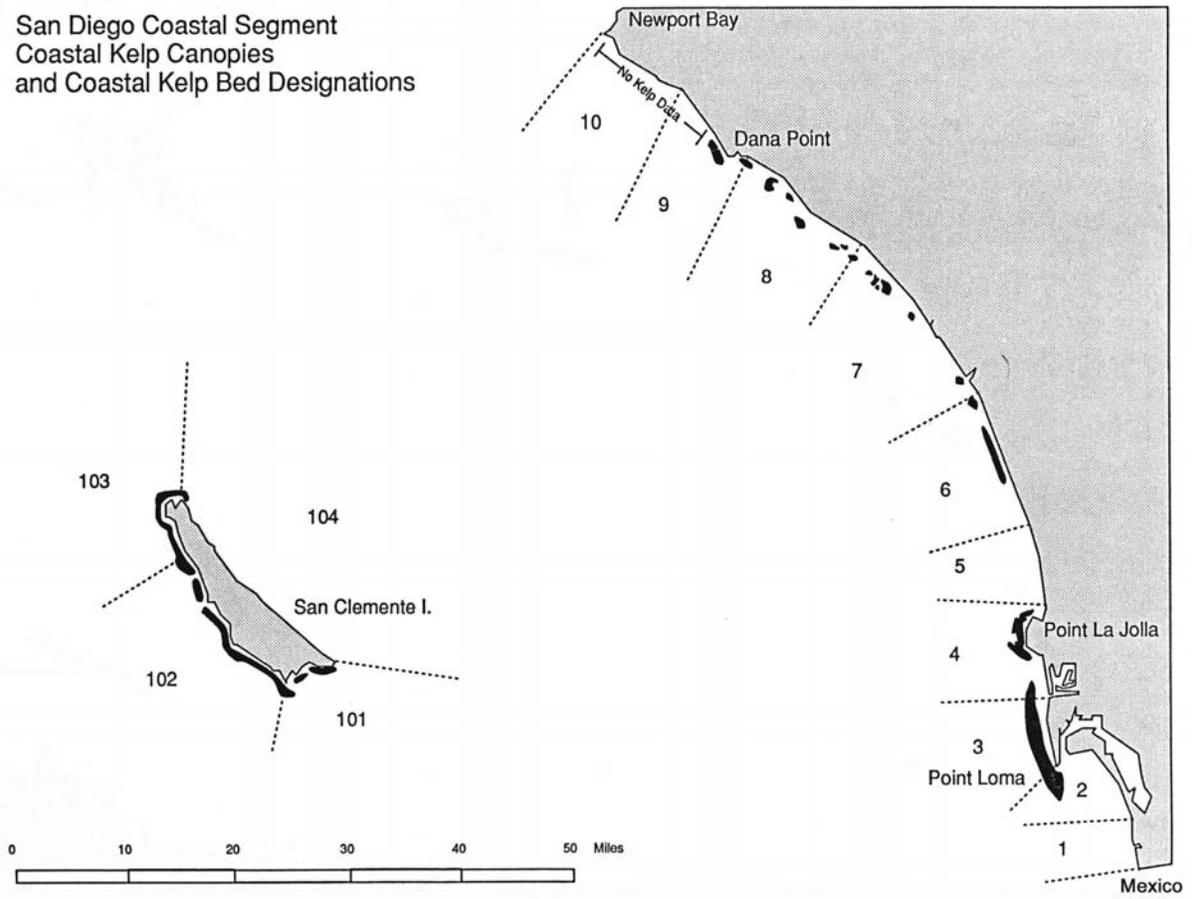
Central California Bed 33-34 202-207.jpg



Santa Maria Basin Coastal Segment  
Coastal Kelp Canopies  
and Coastal Kelp Bed Designations

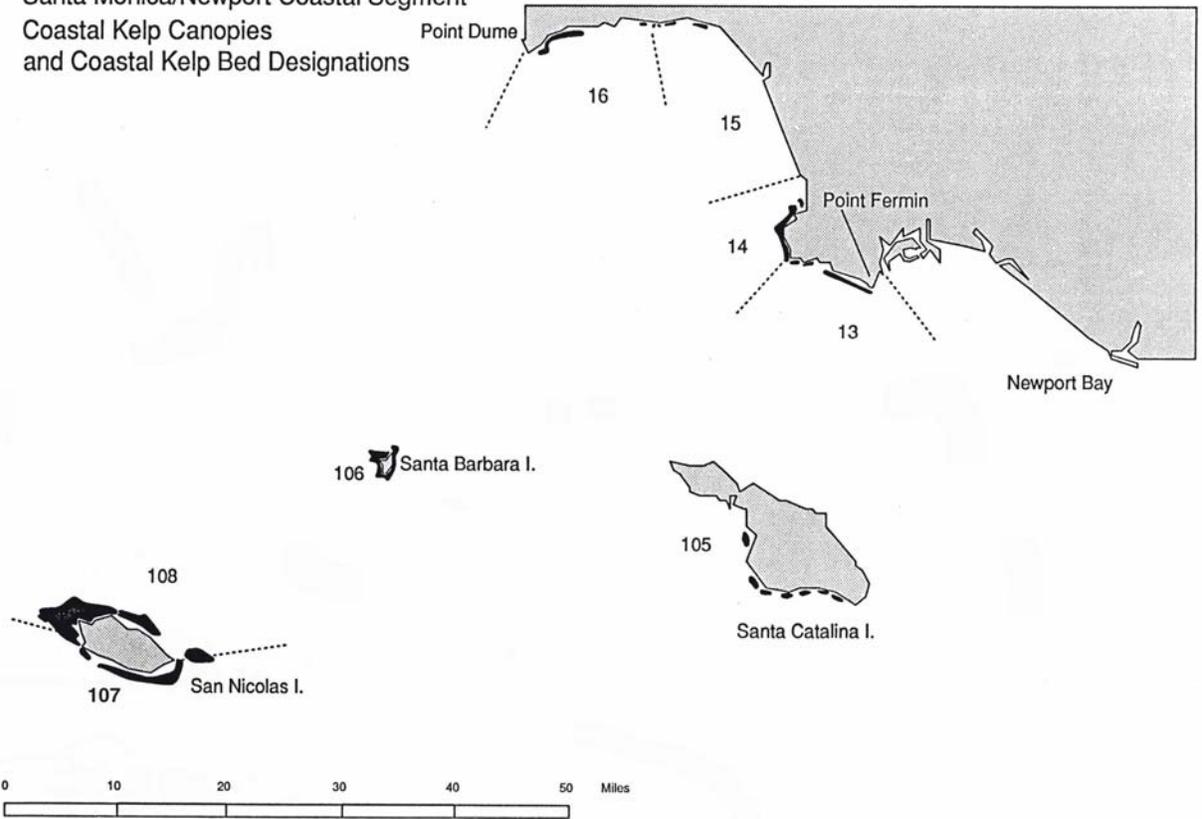
# Southern California Bed 1-10 101-104.jpg

San Diego Coastal Segment  
Coastal Kelp Canopies  
and Coastal Kelp Bed Designations



# Southern California Bed 13-15 105-108.jpg

Santa Monica/Newport Coastal Segment  
Coastal Kelp Canopies  
and Coastal Kelp Bed Designations



# Southern California Bed 17-32 109-118.jpg

Santa Barbara Channel Coastal Segment

Coastal Kelp Canopies and Coastal Kelp Bed Designations

