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NOAA Technical Memorandum NMFS

JULY 1993

REPORT OF ECOSYSTEM STUDIES CONDUCTED DURING THE 1991 CALIFORNIA COASTAL MARINE MAMMAL SURVEY ABOARD THE RESEARCH VESSEL *McARTHUR*

Valerie A. Philbrick
Paul C. Fiedler
Stephen B. Reilly

NOAA-TM-NMFS-SWFSC-184

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southwest Fisheries Science Center

NOAA Technical Memorandum NMFS

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Valerie A. Philbrick
Paul C. Fiedler
Stephen B. Reilly,

La Jolla Laboratory, SWFSC
National Marine Fisheries Service, NOAA
P.O. Box 271
La Jolla, California 92038-0271

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U.S. DEPARTMENT OF COMMERCE
Ronald H. Brown, Secretary
National Oceanic and Atmospheric Administration
D. James Baker, Under Secretary for Oceans and Atmosphere
National Marine Fisheries Service
Nancy Foster, Acting Assistant Administrator for Fisheries

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INTRODUCTION

In 1991, the Marine Mammal Division of the Southwest Fisheries Science Center (SWFSC) conducted a survey of marine mammals in the coastal waters of California. This study was prompted by evidence of an increase in cetacean and pinniped mortality due to gillnet fisheries in this region. The estimates of abundance of the major stocks needed to be updated, so that the impact of this incidental fishery mortality could be determined (Hill and Barlow 1992).

The NOAA vessel *McArthur* was used as the research platform for this survey from July 28 through November 5, 1991. This report describes the types of oceanographic data collected, the sampling techniques used and the disposition of the data. Summaries of some data are presented.

OBJECTIVES

The primary objectives were to estimate the abundance and understand the distribution of cetacean and pinniped species that are commonly found in these waters (Hill and Barlow 1992). The secondary objective was to collect physical, biological and oceanographic data in the survey area. This ecosystem approach provides information necessary for understanding the biological basis of the distribution and abundance of animals. Environmental data are collected concurrently with the marine mammal sighting data. We measured temperature, salinity and phytoplankton biomass and productivity. These parameters can fluctuate both seasonally and as a result of large scale ocean-atmosphere interactions such as the El Niño-Southern Oscillation (ENSO) phenomena. Studying oceanographic patterns and variability concurrently with the fauna may reveal regional or local associations as described by Reilly and Fiedler (1993).[1]

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[1] Reilly, S.B. and P.C. Fiedler. 1993. Interannual variability in dolphin habitats in the eastern tropical Pacific, 1986-1989. Fish. Bull., in press.

STUDY AREA AND ITINERARY

The *McArthur* departed San Diego, California on 28 July 1991. The cruise was conducted in four legs of approximately 22 days each, with scheduled port calls in Eureka, San Diego and San Francisco. The cruise tracks were chosen to cover uniformly the California coastal waters to approximately 300 nmi. (555 km) from shore.

The itinerary for the *McArthur* was as follows:

Leg 1

Departure	28 July	San Diego, California
Arrival	20 August	Eureka, California

Leg 2

Departure	24 August	Eureka, California
Arrival	15 September	San Diego, California

Leg 3

Departure	18 September	San Diego, California
Arrival	07 October	San Francisco, California

Leg 4

Departure	13 October	San Francisco, California
Arrival	05 November	San Francisco, California

MATERIALS AND METHODS

Oceanography

While the ship was underway, temperature, salinity and fluorescence of surface water were measured and recorded continuously in digital form and on strip-charts. Sea water was sampled continuously from a bow intake 3 meters below the surface. Temperature and salinity were measured with a Sea-Bird SBE-21 thermosalinograph.[2] *In vivo* fluorescence was measured with a Turner Designs (model 10-005R) fluorometer. These data were recorded on a data acquisition system consisting of an AI08 A/D board (Industrial Computer Source) connected to an IBM PC

[2] Reference to trade names does not imply endorsement by the NMFS.

compatible microcomputer (Holland 1990). Discrete water samples were collected at regular intervals to verify continuous data.

Conductivity, temperature and depth (CTD) casts were made each morning before sunrise using a Sea-Bird 9/11 CTD and General Oceanics rosette system. Each CTD cast lasted approximately 60 minutes. The CTD was lowered to 1000 meters and sensors connected to shipboard computers measured conductivity (salinity), temperature and pressure (depth). Water samples were collected on all morning CTD casts for salinity calibration, phytoplankton pigment analysis and for ^{14}C-uptake incubations. Productivity samples were not taken on evening stations that were done when normal morning operations were not possible.

Eleven acid and Micro®-washed 1.7-liter General Oceanics Niskin bottles were retrofitted with silicon rubber O-rings in the valves and endcaps. Silicon rubber tubing was used as the closing mechanism. The rosette-mounted bottles collected water from seven variable light depths, plus up to three additional standard depths ($\leq$ 150 m) for primary productivity casts as described below. Two 150 ml salinity samples were collected from each cast (0 and 1000m) and analyzed on an AutoSal (Model 8400) salinometer for the purpose of CTD calibration. Ten samples (275 ml each) from $\leq$150 meters were collected for chlorophyll analysis at each station. Extracted chlorophyll and phaeophytin were measured with a Turner Designs Model 10-005R fluorometer.

Water samples for determination of dissolved inorganic carbon uptake were collected from depths to which 100, 50, 30, 15, 5, 1 and 0.1% of the incident light penetrated. The euphotic zone depth, which determined the light depths, was estimated from a gridded climatology derived from historical observations of 3 times secchi depth at 546 CalCOFI (California Cooperative Oceanic Fisheries Investigations) stations that were occupied during July - November, 1978 and 1984-1989. This climatological euphotic zone depth (Z_e') was a good estimate of observed euphotic zone depth (Z_e) calculated from phytoplankton pigment profiles according to Morel (1988): $Z_e' = 0.926\ Z_e + 13.42$, r=0.79, n=94. Samples were drawn into aged, screw cap "Vitro" glass 150-ml bottles (Wheaton Corporation) rinsed twice with sample water. 10 µCi of $NaH^{14}CO_3$ were added to each sample bottle. The sample bottles were incubated in nickel screens (Perforated Products) in an on-deck seawater-cooled Plexiglas® incubator with natural sunlight as the light source. The screens act as neutral density filters, reducing the light intensity to the same level as that occurring at the depth from which the sample was collected. Two extra samples at the 100% and 0.1% light levels were inoculated with radioactive tracer and filtered immediately without incubation to determine abiotic particulate ^{14}C incorporation (Chavez and Barber 1987). Every other day, two sets of samples from each light depth were taken for a comparison of either 6, 12 or replicate 24-hour incubations.

For determination of particulate carbon fixation, the water was filtered onto Whatman GF/F filters at <10 psi of vacuum. The filter was acidified with 0.5 N HCl for 12 hours, immersed in 10 ml of CytoScint ES and counted on a liquid scintillation counter following the end of the cruise. The total inorganic carbon activity was determined by adding 1.0 ml of incubated sample water (from the 100% and 30% light levels) to a scintillation vial containing 20 ml of CytoScint ES scintillation cocktail and 1 ml β-phenylethylamine. An average of these two values was used as

the total amount of added activity for each station in the calculation of carbon uptake for each sample.

Expendable bathythermograph (XBT) drops were made daily at 1000 and 1400 hours (local time). A Shipboard Environmental data Acquisition System (SEAS) was utilized to collect these data. The XBT drops were transmitted to shore via the GOES (Geostationary Operational Environmental Satellite) system. Position, date and time for each drop were recorded on NOAA XBT logs and floppy disks.

RESULTS

Hill and Barlow (1992) reported on the dolphin assessment methods and data collected from the 1991 marine mammal cruise (CAMMS) aboard the *McArthur*.

The cruise tracks for the *McArthur* are plotted in Figure 1. Table 2 lists the total numbers of environmental and biological samples, by category, collected during the cruise.

Oceanography

Figure 2 shows the locations of the 75 *McArthur* CTD casts. Four of the CTD casts did not have associated bottle data due to rosette malfunctions. The Seabird 9/11 CTD that was used for this cruise was found to have a faulty temperature probe. This malfunction of the sensor was determined by the post-cruise calibration. Therefore, the CTD temperature (as well as the salinity) data was not used in any analyses.

XBT data were sent by the SEAS to the National Ocean Service, NOAA.[3] Digital XBT data were edited at the SWFSC. Figure 2 shows all XBT deployment locations.

Digital records of continuous surface data from the thermosalinograph have been analyzed at the SWFSC. Sea surface temperature and salinity from thermosalinograph data are shown in Figures 3 and 4, respectively.

Discrete chlorophyll samples were analyzed at sea and data were processed at the SWFSC in La Jolla. Surface chlorophyll concentrations from the *McArthur* are mapped in Figure 5.

Primary productivity in the region (Figure 6) shows several areas of high productivity in areas of localized upwelling. Results of the pigment and primary productivity analyses are presented in Appendix A. Table 2 shows linear regressions of the standard 24-hour integrated productivity values and 6-, 12- and replicate 24-hour values. All three are significantly correlated at $P < 0.001$ with the standard 24-hour values. Results are presented in Tables 3a, 3b and 3c. We found that

[3] Persons wishing to receive copies of these data should write to: National Ocean Service, Universal Bldg. South, Rm. 618, 1825 Connecticut Ave., NW, Washington, D.C., 20235.

dark uptake values were insignificant compared to overall primary productivity levels, and were not used in any calculations.

ACKNOWLEDGEMENTS

Many people contributed to the success of this cruise. We especially wish to thank the following people whose invaluable efforts made this project possible: Jay Barlow (Chief Scientist) and P. Scott Hill (Survey Coordinator); the officers and crew of the NOAA ship *McArthur* for their considerable time and skilled efforts, especially survey technicians Julie Ellingson and Deanna Niemer; the marine mammal observers and other cruise participants for their assistance with data collection on ancillary projects; R. Holland for some of the plots and assisting in procurement and computer logistics, and B. Watkins for providing support in procurement. We are grateful to I. Barrett, R. Neal, D. DeMaster and T. Gerrodette for their continued support during the cruise preparations and during the cruise itself.

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Hill, P. Scott and J. Barlow. 1992. Report of a marine mammal survey of the California coast aboard the research vessel *McArthur*, July 28 - November 5, 1991. NOAA-TM-NMFS-SWFSC-169,103 pp.

Holland, R.C. 1992. A program for the Microsoft® Windows™ environment to collect analog-to-digital and serial communication data on a personal computer based system. NOAA-TM-NMFS-SWFSC-170, 11 pp.

Morel, A. 1988. Optical modeling of the upper ocean in relation to its biogenous matter content (Case I waters). J. Geophys. Res. **93**: 10,749-10, 768.

Table 1. Summary of environmental and biological data collected, *McArthur*, 28 July - 5 November, 1991[1].

	LEG #				
	1	2	3	4	TOTALS
CTD casts w/rosette	22	18	20	15	75
XBT drops - successful	35	23	25	17	100
CTD chlorophyll samples	150	190	203	135	678
Surface chlorophyll samples	137	145	117	97	496
Primary productivity samples (^{14}C uptake)	196	165	175	126	662

Table 2. Linear regressions of standard 24-hour integrated productivity values and 6-, 12- and replicate 24-hour values.

$PP_{6\text{-hour}} = 0.59(PP_{24\text{-hour}}) - 44.0$	r=0.89	n = 12
$PP_{12\text{-hour}} = 1.25(PP_{24\text{-hour}}) - 38.8$	r=0.99	n = 11
$PP_{\text{replicate 24-hr.}} = 1.00(PP_{24\text{-hour}}) - 5.5$	r=0.97	n = 9

[1] Continuous sea surface temperature and salinity was recorded during all three legs on both ships.

Table 3a. Six - hour incubation primary productivity data.

Station number (leg#-sta#)	Depth (meters)	Productivity ($mgC/m^3/6hr$)	Station number (leg#-sta#)	Depth (meters)	Productivity ($mgC/m^3/6hr$)
1-003A	0	107.30	1-009A	0	12.64
	8	80.46		7	14.03
	14	92.29		12	15.26
	23	40.21		19	8.87
	36	37.95		29	9.07
	55	73.73		45	2.37
	82	64.77		68	1.65
1-017A	0	2.52	2-024A	0	12.26
	14	2.71		10	12.45
	24	2.21		17	12.49
	37	1.80		27	4.80
	59	1.45		42	8.53
	90	0.98		65	9.68
	135	0.62		98	8.76
2-031A	0	13.08	2-035A	0	8.00
	6	10.97		11	7.70
	10	12.32		20	6.35
	16	9.68		31	2.39
	26	2.91		49	1.49
	40	0.81		75	0.92
	60	0.74		113	0.51
3-042A	0	3.60	3-048A	0	81.08
	12	3.29		7	104.40
	21	2.39		12	90.07
	33	2.89		19	20.15
	52	1.45		29	9.66
	80	1.13		45	2.66
	120	0.62		68	1.57
3-055A	0	43.16	4-062A	0	27.01
	7	42.65		8	25.86
	12	46.87		14	24.74
	19	25.35		23	14.26
	29	13.23		36	2.83
	45	2.29		55	0.91
	68	0.78		82	0.60

Station number (leg#-sta#)	Depth (meters)	Productivity ($mgC/m^3/6hr$)	Station number (leg#-sta#)	Depth (meters)	Productivity ($mgC/m^3/6hr$)
4-069A	0	3.41	4-074A	0	3.82
	9	3.77		14	3.68
	16	3.56		25	2.87
	25	2.82		39	2.08
	39	2.47		62	2.57
	60	1.17		95	0.84
	90	0.54		143	0.73

Table 3b. Twelve - hour incubation primary productivity data.

Station number (leg#-sta#)	Depth (meters)	Productivity ($mgC/m^3/12hr$)	Station number (leg#-sta#)	Depth (meters)	Productivity ($mgC/m^3/12hr$)
1-005B	0	6.12	1-011B	0	5.64
	12	6.46		14	6.77
	21	7.81		24	9.98
	33	5.28		37	7.54
	52	4.13		59	6.54
	80	3.14		90	2.59
	120	3.26		135	2.22
1-015B	0	44.44	2-026B	0	120.30
	8	46.14		8	131.70
	14	37.41		14	122.00
	23	21.07		23	111.60
	36	8.02		36	90.58
	55	3.80		55	89.90
	82	2.75		82	97.48
2-029B	0	4.94	2-037B	0	4.57
	8	5.48		11	4.53
	14	5.28		18	3.94
	23	3.54		29	2.77
	36	1.05		46	1.64
	55	2.41		70	1.00
	82	0.68		105	0.59

Station number (leg#-sta#)	Depth (meters)	Productivity ($mgC/m^3/12hr$)
3-044B	0	5.26
	13	6.71
	22	6.52
	35	5.35
	55	3.62
	85	1.70
	127	0.76
3-057B	0	
	14	5.40
	24	4.83
	37	4.00
	59	2.91
	90	2.39
	135	1.01
4-070B	0	15.95
	8	18.58
	13	19.24
	21	13.92
	33	9.08
	50	1.11
	75	0.56

Station number (leg#-sta#)	Depth (meters)	Productivity ($mgC/m^3/12hr$)
3-049B	0	22.50
	7	28.29
	12	40.78
	19	27.77
	29	19.12
	45	3.46
	68	0.67
4-064B	0	1.73
	14	4.99
	24	9.67
	37	7.39
	59	3.89
	90	1.72
	135	1.01

Table 3c. Replicate twenty-four - hour primary productivity data.

Station number (leg#-sta#)	Depth (meters)	Productivity ($mgC/m^3/24hr$)	Station number (leg#-sta#)	Depth (meters)	Productivity ($mgC/m^3/24hr$)
1-007C	0	14.38	1-013C	0	14.72
	8	18.26		6	19.66
	13	15.72		10	21.49
	21	5.92		16	18.24
	33	4.04		26	6.64
	50	1.89		40	2.72
	75	1.54		60	1.93
1-019C	0	19.09	2-028C	0	11.17
	7	18.93		8	22.14
	12	17.43		14	23.45
	19	13.84		23	15.57
	29	8.44		36	19.13
	45	2.34		55	3.25
	68	1.58		82	1.19
2-033C	0	8.57	3-046C	0	10.27
	9	9.33		9	11.11
	16	10.58		16	11.50
	25	8.41		25	18.44
	39	3.74		39	14.45
	60	2.13		60	1.64
	90	1.26		90	1.09
3-053C	0	6.84	4-067C	0	17.15
	8	9.00		8	14.30
	14	6.29		13	14.50
	23	10.81		21	10.63
	36	8.86		33	4.99
	55	2.15		50	1.40
	82	0.76		75	0.61
4-072C	0	9.18			
	11	9.15			
	18	8.43			
	29	5.07			
	46	2.46			
	70	1.21			
	105	0.68			

Figure 1. Cruise tracks, *McArthur*, 28 July - 5 November, 1991.

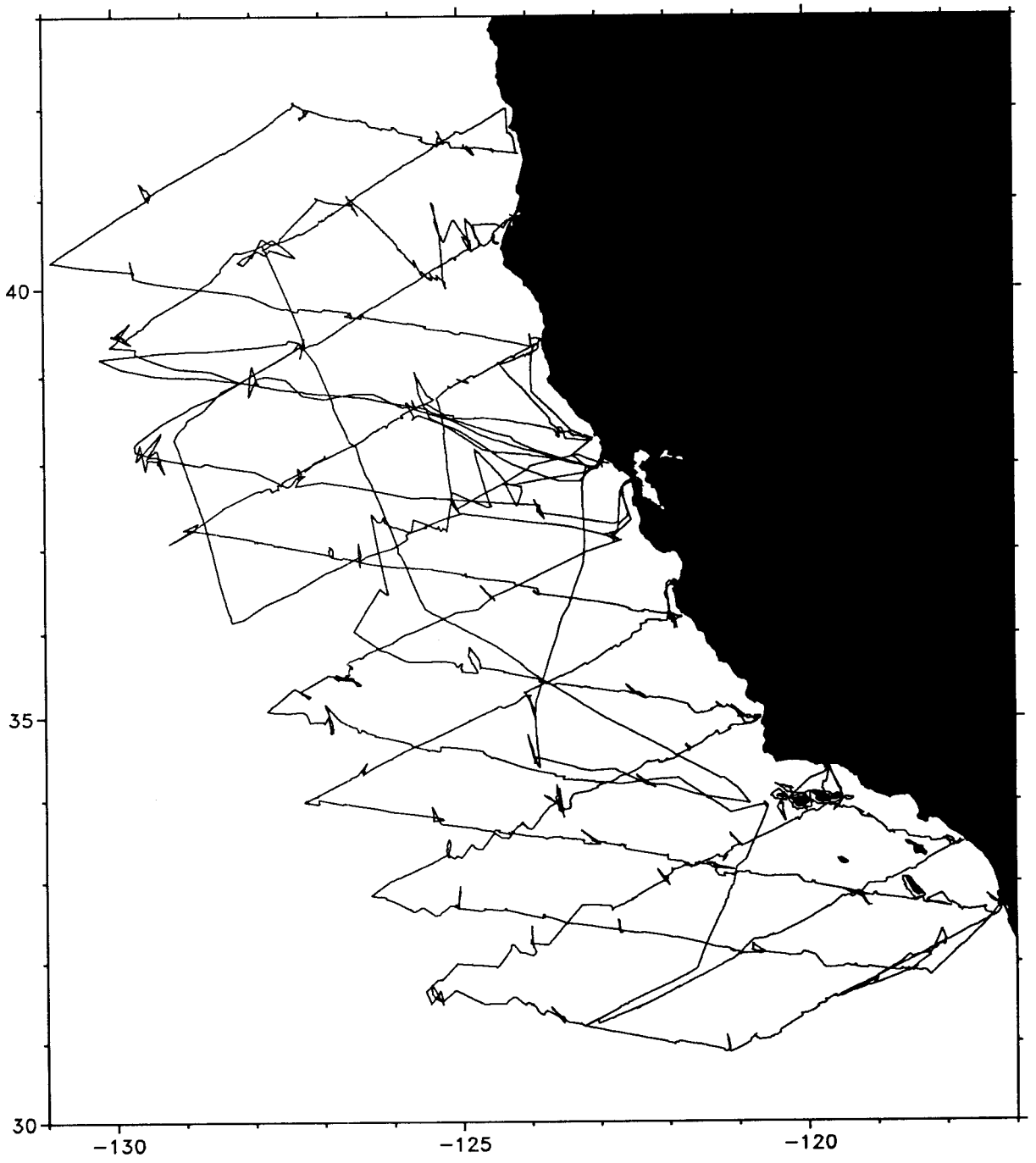


Figure 2. Locations of 75 CTD stations (o) and XBT deployments (+), *McArthur*, 28 July - 5 November, 1991.

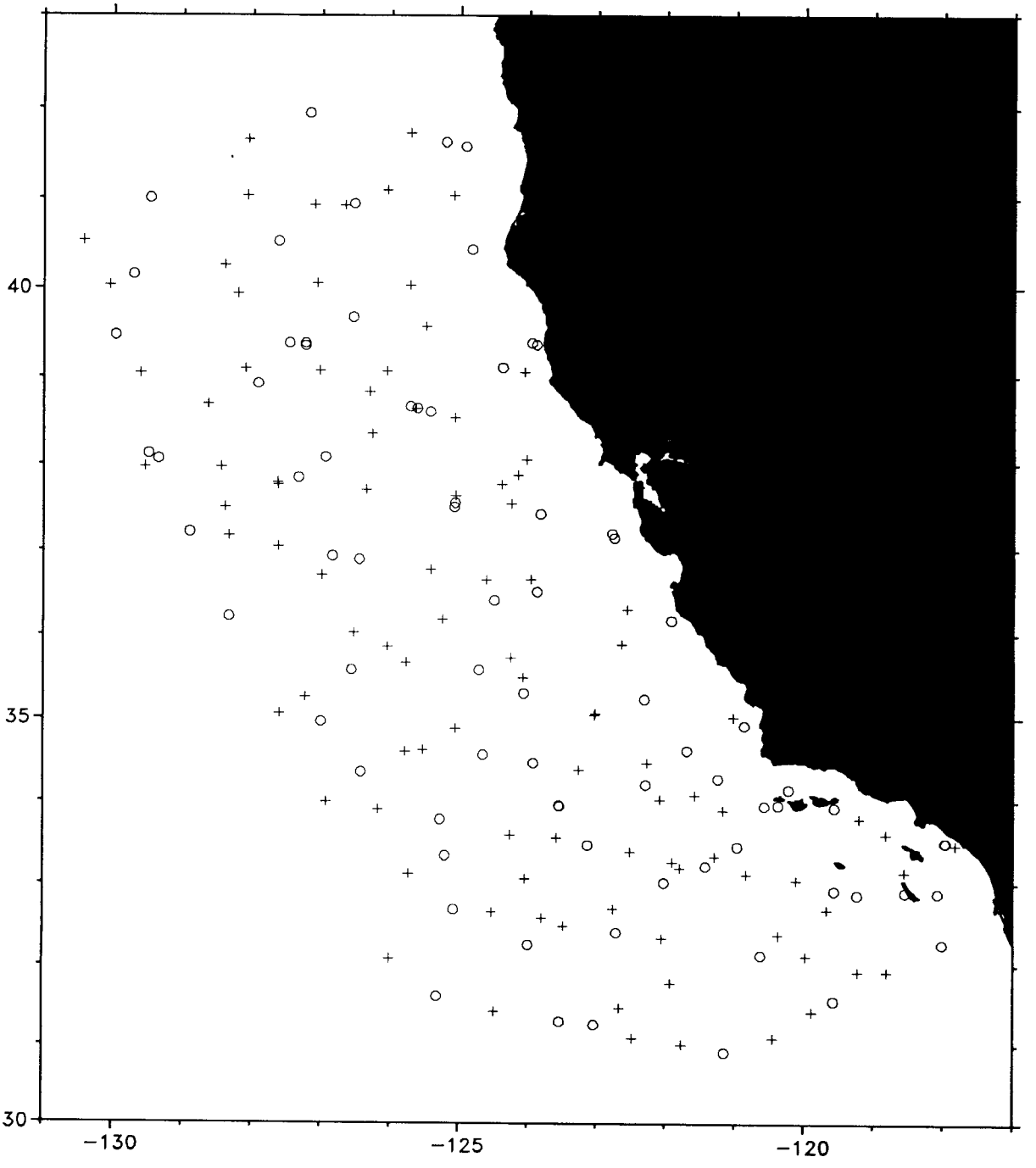


Figure 3. Sea surface temperature (°C), from thermosalinograph data, *McArthur*, 28 July - 5 November, 1991.

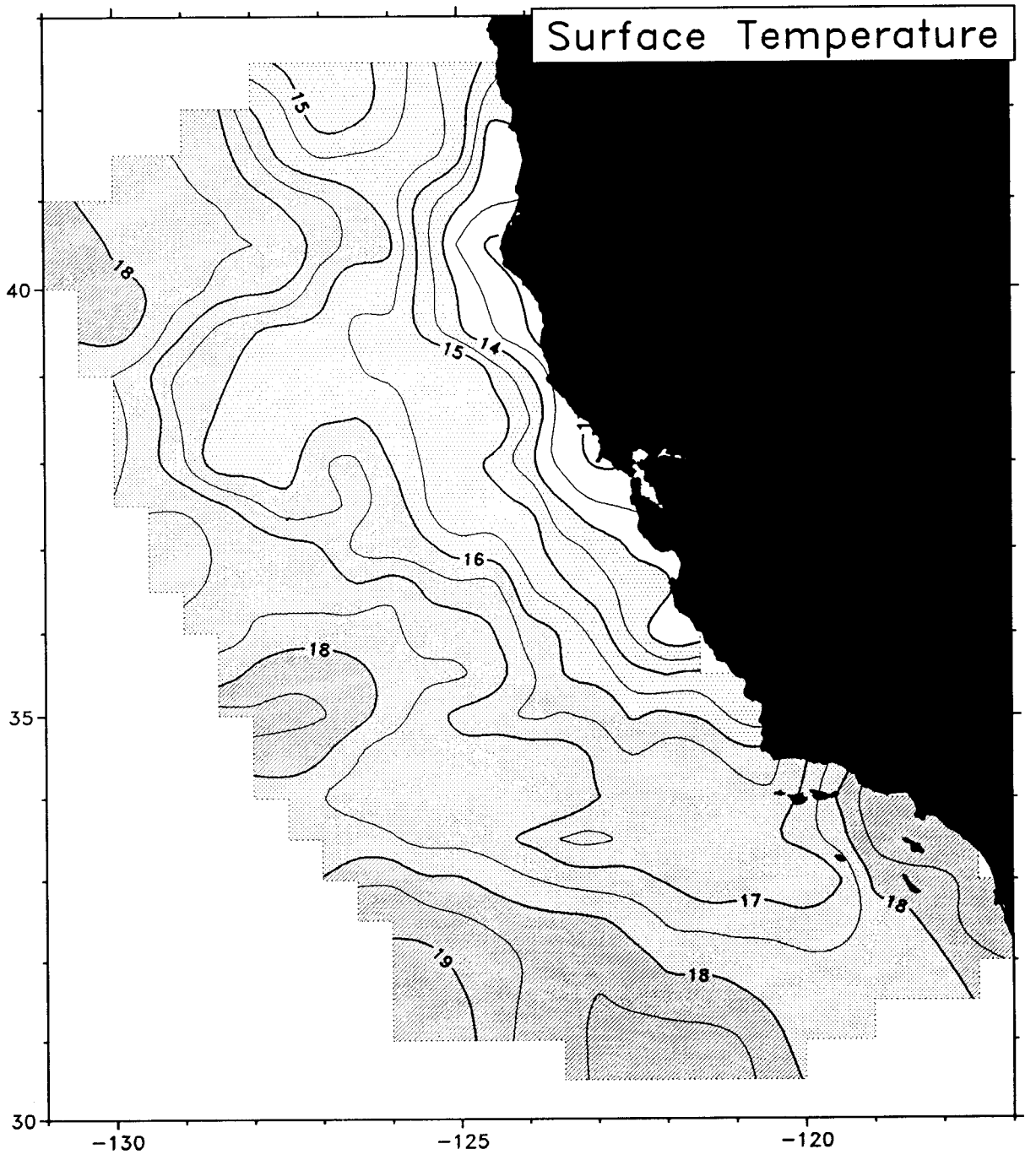


Figure 4. Sea surface salinity (PSU), from thermosalinograph data, *McArthur*, 28 July - 5 November, 1991.

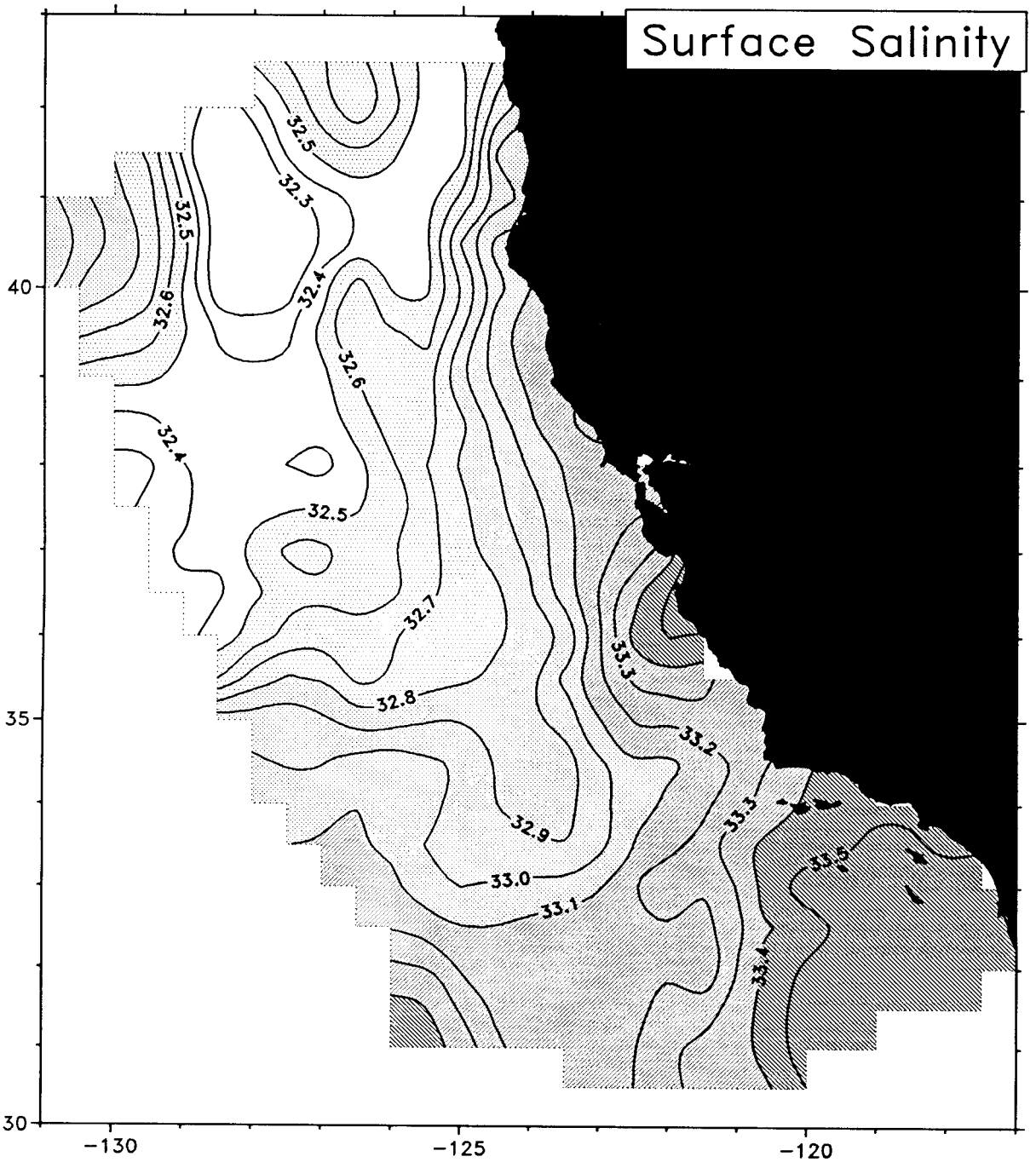


Figure 5. Sea surface chlorophyll *a* concentration ($mg \cdot m^{-3}$), from productivity stations and underway samples, *McArthur*, 28 July - 5 November, 1991.

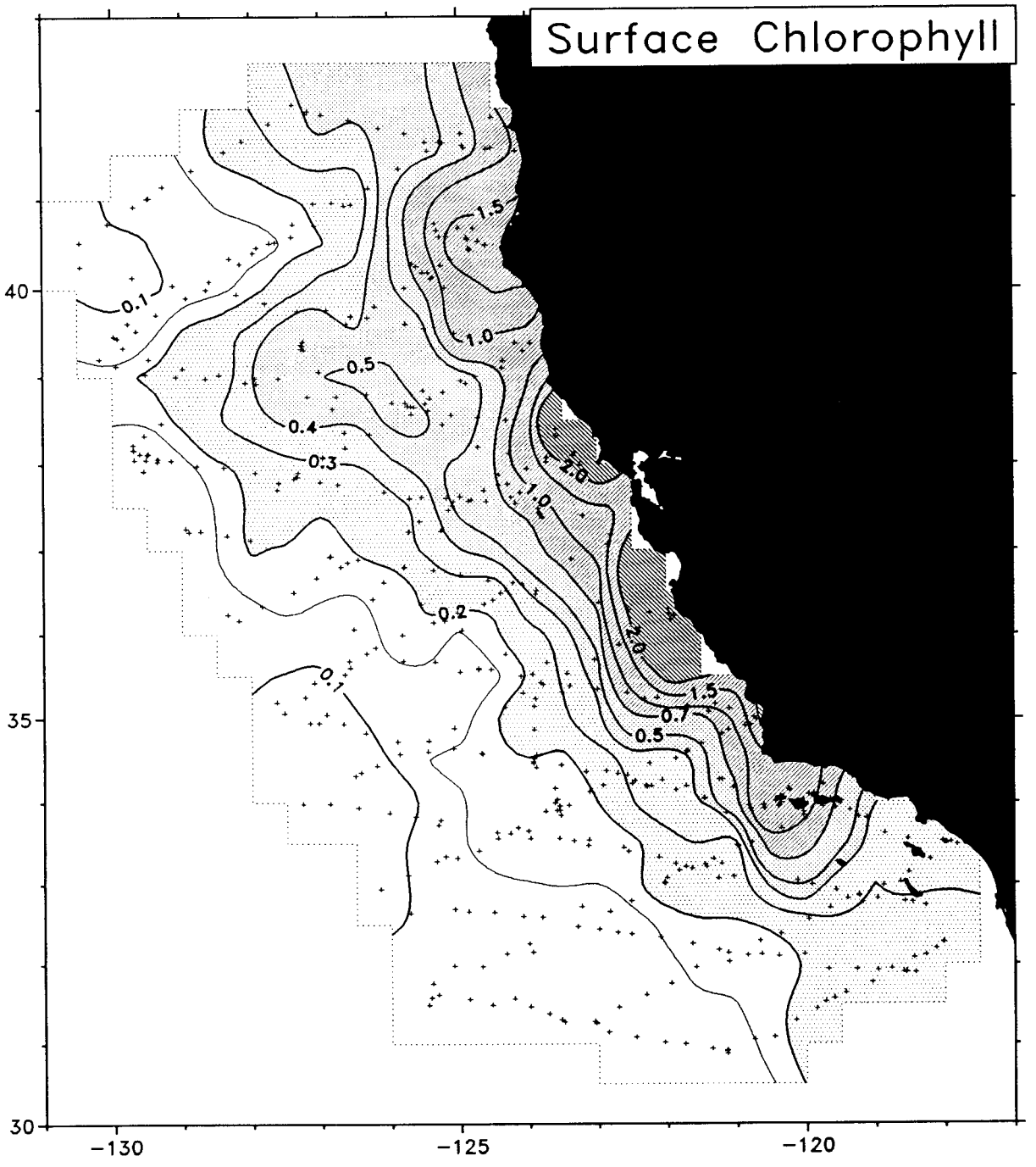
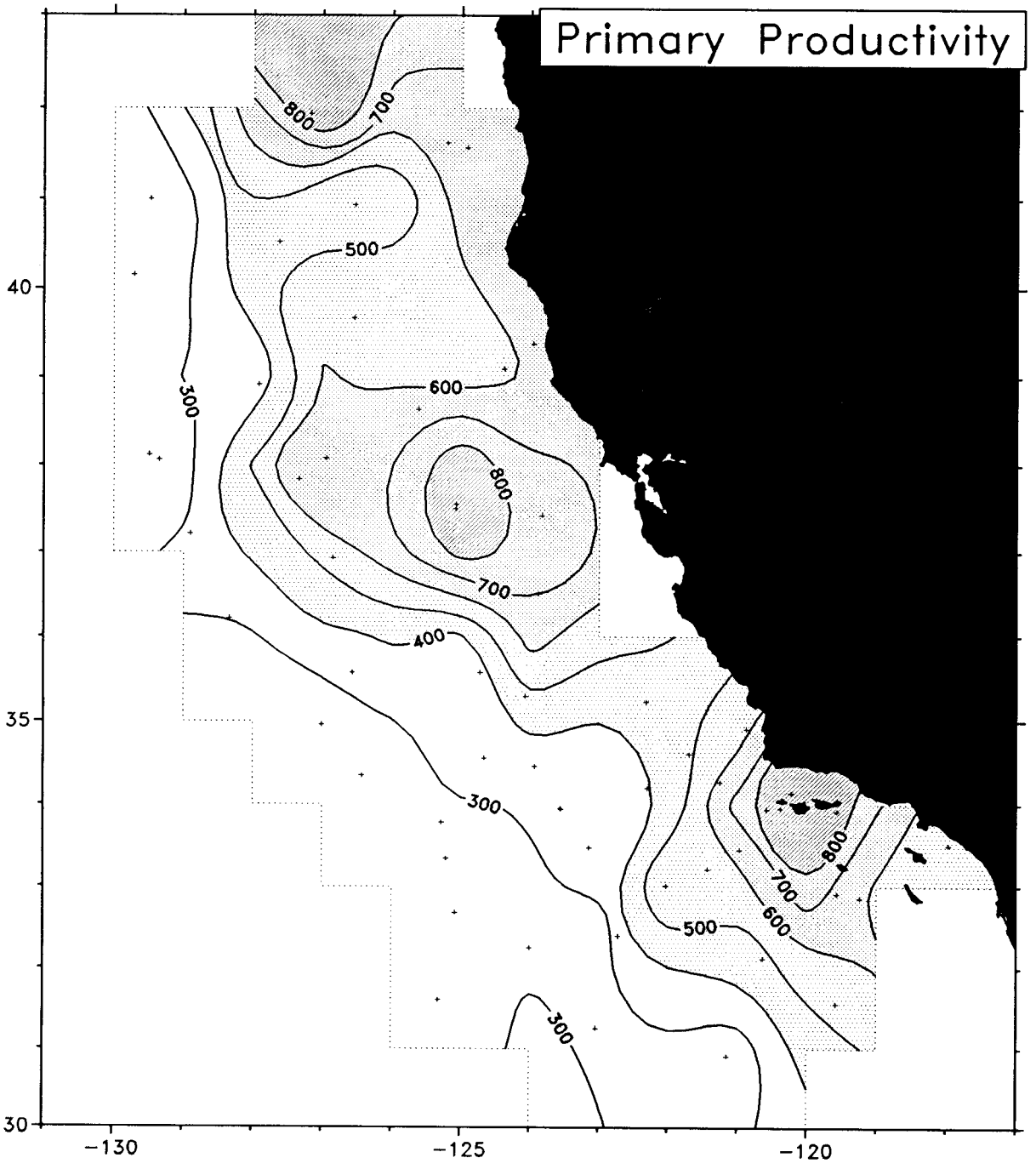


Figure 6. Integrated primary productivity, *McArthur*, 28 July - 5 November, 1991.



Station No.	1-002	Station Name:	MAC911-002
Latitude	32.54.6 N	Date - Local	30 JUL 91
Longitute	119.34.2 W	Time - Local	0517

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	46.87	0.28	0.12
8	42.84	0.31	0.15
14	18.82	0.46	0.00
23	10.79	0.48	0.24
36	6.30	0.31	0.21
55	3.08	0.22	0.23
82	6.31	0.05	0.06
100	--	0.03	0.04
125	--	0.00	0.11
150	--	0.02	0.05

Station No.	1-003	Station Name:	MAC911-003
Latitude	33.12.7 N	Date - Local	31 JUL 91
Longitute	121.25.9 W	Time - Local	0513

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	8.38	0.28	0.06
8	10.66	0.26	0.06
14	9.87	0.27	0.07
23	6.60	0.27	0.08
36	3.10	0.44	0.16
55	2.19	0.48	0.44
82	0.88	0.14	0.15
100	--	--	--
125	--	0.04	0.00
150	--	0.05	0.00

Station No.	1-004	Station Name:	MAC911-004
Latitude	33.28.0 N	Date - Local	01 AUG 91
Longitute	123. 8.2 W	Time - Local	0516

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	2.90	0.15	0.03
10	4.66	0.16	0.03
17	4.52	0.21	0.00
27	6.14	0.25	0.04
42	5.71	0.60	0.18
65	1.63	0.19	0.26
98	1.11	0.19	0.25
150	--	0.05	0.06

Station No.	1-005	Station Name:	MAC911-005
Latitude	33.46.5 N	Date - Local	02 AUG 91
Longitude	125.16.8 W	Time - Local	0518

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	3.39	0.11	0.00
12	4.23	0.11	0.00
21	4.15	0.12	0.00
33	3.52	0.09	0.01
52	2.41	0.16	0.02
60	--	0.18	0.04
80	2.38	0.24	0.20
100	--	0.04	0.62
120	1.55	0.16	0.24
150	--	0.07	0.09

Station No.	1-006	Station Name:	MAC911-006
Latitude	34.20.7 N	Date - Local	03 AUG 91
Longitude	126.25.5 W	Time - Local	0518

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	2.77	0.05	0.00
13	4.16	0.06	0.00
22	4.23	0.07	0.00
35	3.52	--	--
55	2.56	0.10	0.00
60	--	0.08	0.02
85	1.94	0.13	0.06
100	--	0.27	0.16
127	1.03	0.14	0.14
150	--	0.09	0.02

Station No.	1-007	Station Name:	MAC911-007
Latitude	35.18.0 N	Date - Local	04 AUG 91
Longitude	124. 4.2 W	Time - Local	0515

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	--	0.23	0.04
8	17.04	0.22	0.05
13	14.41	0.24	0.04
21	10.43	0.23	0.05
33	5.30	0.29	0.03
50	2.73	0.26	0.10
75	1.55	--	--
100	--	--	--
125	--	0.04	0.04
150	--	0.02	0.03

Station No.	1-008	Station Name:	MAC911-008
Latitude	36.10.5 N	Date - Local	05 AUG 91
Longitute	121.55.5 W	Time - Local	0509

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	377.30	12.25	1.84
6	--	--	--
10	307.20	12.17	1.92
16	148.70	8.34	1.23
26	18.84	2.78	0.79
40	1.61	0.24	0.29
60	1.23	0.11	0.24
80	--	0.00	0.39
100	--	0.07	0.19
125	--	0.03	0.04

Station No.	1-009	Station Name:	MAC911-009
Latitude	36.30.6 N	Date - Local	06 AUG 91
Longitute	123.52.5 W	Time - Local	0516

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	16.04	0.31	0.08
7	31.00	0.35	0.09
12	27.09	0.35	0.10
19	21.58	0.26	0.07
29	22.19	0.59	0.31
45	5.13	0.47	0.26
68	1.90	0.19	0.15
80	--	0.12	0.14
100	--	0.09	0.13
125	--	0.03	0.10

Station No.	1-010	Station Name:	MAC911-010
Latitude	36.55.9 N	Date - Local	07 AUG 91
Longitute	126.50.7 W	Time - Local	0517

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	6.44	0.15	0.00
13	7.83	0.17	0.04
22	11.20	0.22	0.06
35	9.75	0.22	0.09
55	6.81	0.37	0.18
60	--	0.62	0.43
85	3.27	0.43	0.33
100	--	--	--
127	0.86	0.04	0.07
150	--	0.04	0.05

Station No.	1-011	Station Name:	MAC911-011
Latitude	37.12.4 N	Date - Local	08 AUG 91
Longitude	128.54.0 W	Time - Local	0505

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	4.06	0.08	0.01
14	4.11	0.09	0.01
24	5.71	0.15	0.03
37	4.72	0.19	0.03
59	4.82	0.33	0.19
90	2.33	0.22	0.29
100	--	0.16	0.16
125	--	0.07	0.05
135	1.22	0.05	0.03
150	--	--	--

Station No.	1-012	Station Name:	MAC911-012
Latitude	38. 4.8 N	Date - Local	09 AUG 91
Longitude	126.57.1 W	Time - Local	0520

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	23.85	0.33	0.10
13	21.85	0.29	0.10
22	23.08	0.50	0.12
35	7.32	0.56	0.19
55	22.39	0.52	0.56
85	1.85	0.12	0.22
100	--	0.07	0.19
127	1.22	0.03	0.09
150	--	0.02	0.08

Station No.	1-013	Station Name:	MAC911-013
Latitude	39. 6.0 N	Date - Local	11 AUG 91
Longitude	124.22.5 W	Time - Local	0521

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	10.78	0.56	0.16
6	15.37	0.54	0.17
10	15.54	0.57	0.16
16	11.85	0.17	0.05
26	4.36	0.55	0.14
40	2.59	0.63	0.17
60	1.15	0.44	0.61
80	--	0.06	0.11
100	--	0.05	0.11
125	--	0.03	0.12

Station No.	1-014	Station Name:	MAC911-014
Latitude	39.23.1 N	Date - Local	12 AUG 91
Longitute	123.57.7 W	Time - Local	0506

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	50.22	0.86	0.21
5	50.61	0.87	0.23
9	37.71	0.95	0.32
14	31.50	0.84	0.31
23	5.49	0.48	0.27
35	2.32	0.23	0.30
53	1.59	0.16	0.27
60	--	0.14	0.24
80	--	0.11	0.24
100	--	0.08	0.20

Station No.	1-015	Station Name:	MAC911-015
Latitude	39.40.2 N	Date - Local	13 AUG 91
Longitute	126.32.8 W	Time - Local	0522

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	28.82	0.42	0.08
8	27.32	0.18	0.10
14	24.24	0.37	0.13
23	13.17	0.42	0.17
36	5.01	0.63	0.24
55	2.10	0.34	0.35
82	1.54	0.05	0.13
100	--	0.04	0.14
125	--	0.08	0.07
150	--	0.03	0.12

Station No.	1-016	Station Name:	MAC911-016
Latitude	40. 9.2 N	Date - Local	14 AUG 91
Longitute	129.42.4 W	Time - Local	0516

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	4.34	--	--
14	4.70	0.09	0.02
25	3.31	0.08	0.02
39	2.51	0.07	0.02
62	1.33	0.15	0.05
95	1.53	0.37	0.44
125	--	0.12	0.17
143	0.76	0.07	0.09
150	--	0.07	0.05
1000	--	0.01	0.01

Station No.	1-017	Station Name:	MAC911-017
Latitude	40.59.9 N	Date - Local	15 AUG 91
Longitude	129.28.4 W	Time - Local	0522

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	4.08	0.11	0.02
14	4.37	0.10	0.03
24	4.00	0.11	0.03
37	2.50	0.13	0.04
59	1.77	0.20	0.08
80	--	0.55	0.49
90	1.47	0.36	0.38
125	--	0.07	0.07
135	0.64	0.06	0.05
150	--	0.02	0.04

Station No.	1-018	Station Name:	MAC911-018
Latitude	41.56.7 N	Date - Local	16 AUG 91
Longitude	127.11.1 W	Time - Local	0518

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	32.08	0.63	0.22
9	33.83	0.63	0.26
16	28.55	0.69	0.32
25	23.26	0.74	0.37
39	11.28	0.95	0.49
60	1.28	0.17	0.24
90	0.90	0.14	0.24
100	--	--	--
125	--	0.04	0.15
150	--	0.04	0.17
1000	--	0.01	0.04

Station No.	1-019	Station Name:	MAC911-019
Latitude	41.34.4 N	Date - Local	17 AUG 91
Longitute	124.55.0 W	Time - Local	0525

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	19.32	0.42	0.14
7	20.95	0.36	0.15
12	17.22	0.33	0.13
19	15.95	0.48	0.16
29	9.20	0.60	0.22
45	2.29	0.35	0.30
68	1.30	0.30	0.32
80	--	0.24	0.30
100	--	0.06	0.09
125	--	0.02	0.10

Station No.	1-020	Station Name:	MAC911-020
Latitude	41.37.0 N	Date - Local	18 AUG 91
Longitute	125.12.5 W	Time - Local	0517

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	34.28	0.52	0.14
7	36.28	0.52	0.16
12	29.28	0.60	0.17
19	24.22	0.61	0.17
29	10.42	0.69	0.23
45	2.94	0.91	0.43
68	1.34	0.24	0.23
80	--	0.08	0.18
100	--	0.04	0.16
125	--	0.02	0.16

Station No.	1-021	Station Name:	MAC911-021
Latitude	39.20.7 N	Date - Local	19 AUG 91
Longitute	127.14.4 W	Time - Local	0522

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	--	0.18	0.01
9	--	0.17	0.06
16	--	0.22	0.09
25	--	0.56	0.20
39	--	0.63	0.26
60	--	0.45	0.23
90	--	0.12	0.15
100	--	0.15	0.18
125	--	0.03	0.14
150	--	0.03	0.16

Station No.	1-022	Station Name:	MAC911-022
Latitude	40.25.8 N	Date - Local	20 AUG 91
Longitute	124.49.8 W	Time - Local	0513

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	--	3.64	0.83
6	--	3.21	1.23
10	--	2.66	1.63
16	--	1.97	0.91
26	--	0.62	0.55
40	--	0.59	0.49
60	--	0.39	0.47
80	--	0.24	0.31
100	--	0.31	0.36
125	--	0.03	0.19

Station No.	2-023	Station Name:	MAC912-023
Latitude	40.56.4 N	Date - Local	27 AUG 91
Longitute	126.32.2 W	Time - Local	0519

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	7.82	0.13	0.04
8	8.41	0.12	0.05
13	7.33	0.12	0.05
21	7.20	0.23	0.14
33	--	--	--
50	--	--	--
75	--	--	--
80	--	--	--

Station No.	2-024	Station Name:	MAC912-024
Latitude	40.31.2 N	Date - Local	28 AUG 91
Longitute	127.37.8 W	Time - Local	0529

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	7.09	0.12	0.04
10	9.68	0.11	0.05
17	9.73	0.12	0.05
27	8.24	0.15	0.05
42	7.32	0.22	0.10
65	9.25	0.70	0.52
98	4.58	0.07	0.09
125	--	0.07	0.16
150	--	0.05	0.17

Station No.	2-025	Station Name:	MAC912-025
Latitude	39.27.9 N	Date - Local	29 AUG 91
Longitute	129.58.1 W	Time - Local	0519

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	38.41	0.10	0.03
14	49.87	0.10	0.04
25	44.43	0.09	0.03
39	41.56	0.15	0.06
62	149.20	0.34	0.27
95	42.06	0.19	0.31
143	40.03	0.04	0.10
150	--	0.05	0.07

Station No.	2-026	Station Name:	MAC912-026
Latitude	38.39.7 N	Date - Local	30 AUG 91
Longitute	125.43.4 W	Time - Local	0525

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	7.26	0.40	0.12
8	96.59	0.44	0.13
14	83.64	0.41	0.16
23	73.87	0.58	0.25
36	71.17	0.69	0.38
55	57.20	0.36	0.32
82	64.39	0.10	0.11
100	--	0.03	0.10
125	--	0.01	0.05
150	--	0.01	0.02

Station No.	2-027	Station Name:	MAC912-027
Latitude	39.21.7 N	Date - Local	31 AUG 91
Longitute	123.53.2 W	Time - Local	0506

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	123.00	0.01	0.00
5	133.00	0.01	0.00
9	107.90	0.01	0.00
14	113.90	0.02	0.00
23	103.20	0.02	0.01
35	84.17	--	--
53	100.60	--	--
60	--	0.08	0.03
80	--	0.05	0.10

Station No.	2-028	Station Name:	MAC912-028
Latitude	37.29.9 N	Date - Local	01 SEP 91
Longitute	125. 5.0 W	Time - Local	0522

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	12.84	0.36	0.10
8	24.13	0.36	0.12
14	21.84	0.37	0.13
23	16.87	0.38	0.15
36	10.70	0.68	0.40
55	3.30	0.42	0.32
82	1.10	0.07	0.08
100	--	0.04	0.08
125	--	0.01	0.07
150	--	0.02	0.07

Station No.	2-029	Station Name:	MAC912-029
Latitude	35.34.6 N	Date - Local	04 SEP 91
Longitute	124.43.2 W	Time - Local	0517

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	4.47	0.12	0.04
8	4.89	0.11	0.04
14	4.18	0.12	0.04
23	2.45	0.11	0.05
36	1.58	0.17	0.07
55	0.86	0.33	0.41
82	0.78	0.23	0.20
100	--	0.16	0.22
125	--	0.04	0.06
150	--	0.02	0.02

Station No.	2-030	Station Name:	MAC912-030
Latitude	35.13.9 N	Date - Local	05 SEP 91
Longitute	122.19.1 W	Time - Local	0518

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	32.00	1.27	0.57
8	31.86	1.01	0.58
13	11.83	0.42	0.33
21	8.33	1.25	1.36
33	1.68	0.75	1.74
50	0.81	0.54	1.84
75	0.56	0.26	1.18
100	--	0.11	0.54
125	--	0.06	0.29
150	--	0.05	0.24

Station No.	2-031	Station Name:	MAC912-031
Latitude	34.54.6 N	Date - Local	06 SEP 91
Longitute	120.52.2 W	Time - Local	0505

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	22.22	0.45	0.22
6	23.45	0.40	0.23
10	25.07	0.57	0.28
16	19.56	0.68	0.41
26	3.92	0.46	0.36
40	1.31	0.24	0.24
60	0.84	0.09	0.19
80	--	0.05	0.15
100	--	0.04	0.12
125	--	0.04	0.21

Station No.	2-032	Station Name:	MAC912-032
Latitude	34.36.5 N	Date - Local	07 SEP 91
Longitute	121.42.1 W	Time - Local	0515

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	9.92	0.23	0.09
8	11.60	0.25	0.12
13	14.08	0.31	0.18
21	8.12	0.33	0.16
33	3.92	0.24	0.14
50	1.67	0.77	0.36
75	0.92	0.31	0.25
100	--	0.11	0.13
125	--	0.04	0.09
150	--	0.01	0.06

Station No.	2-033	Station Name:	MAC912-033
Latitude	33.56.7 N	Date - Local	08 SEP 91
Longitute	123.33.2 W	Time - Local	0525

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	7.21	0.18	0.04
9	7.95	0.18	0.05
16	8.99	0.22	0.06
25	6.70	0.31	0.12
39	2.76	0.32	0.15
60	1.59	0.47	0.24
90	1.05	0.19	0.15
100	--	0.15	0.13
125	--	0.04	0.06
150	--	0.01	0.06

Station No.	2-034	Station Name:	MAC912-034
Latitude	33.56.9 N	Date - Local	09 SEP 91
Longitute	123.33.4 W	Time - Local	0504

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	6.92	0.13	0.04
9	7.75	0.14	0.04
16	6.97	0.15	0.04
25	8.30	0.24	0.08
39	4.09	0.38	0.16
60	1.82	0.32	0.23
90	1.30	0.14	0.13
100	--	0.11	0.09
125	--	0.03	0.06
150	--	0.02	0.05

Station No.	2-035	Station Name:	MAC912-035
Latitude	33.20.3 N	Date - Local	10 SEP 91
Longitute	125.12.4 W	Time - Local	0514

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	7.15	0.24	0.07
11	11.35	0.23	0.07
20	12.18	0.24	0.05
31	3.81	0.19	0.07
49	1.56	0.23	0.09
75	1.18	0.47	0.39
113	0.50	0.09	0.15
125	--	0.05	0.11
150	--	0.02	0.04

Station No.	2-036	Station Name:	MAC912-036
Latitude	32.40.9 N	Date - Local	11 SEP 91
Longitute	125. 4.6 W	Time - Local	0517

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	2.44	0.09	0.00
11	3.26	0.09	0.02
20	2.63	0.08	0.03
31	1.95	0.08	0.03
49	1.17	0.13	0.06
75	0.79	0.20	0.16
113	0.65	0.22	0.22
125	--	0.14	0.23
150	--	0.05	0.13

Station No.	2-037	Station Name:	MAC912-037
Latitude	32.23.8 N	Date - Local	12 SEP 91
Longitute	122.43.0 W	Time - Local	0515

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	4.02	0.09	0.03
11	4.30	0.09	0.02
18	7.78	0.11	0.04
29	2.21	0.09	0.03
46	1.08	0.16	0.07
70	0.89	0.24	0.31
105	0.68	0.15	0.29
125	--	0.07	0.14
150	--	0.09	0.02

Station No.	2-038	Station Name:	MAC912-038
Latitude	32. 7.3 N	Date - Local	13 SEP 91
Longitute	120.37.8 W	Time - Local	0516

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	9.49	0.21	0.08
10	12.40	0.19	0.09
17	10.28	0.25	0.11
27	7.13	0.28	0.16
42	2.03	0.23	0.19
65	1.01	0.11	0.21
98	0.73	0.02	0.07
125	--	0.01	0.04
150	--	0.01	0.04

Station No.	2-039	Station Name:	MAC912-039
Latitude	32.15.6 N	Date - Local	14 SEP 91
Longitute	118. 1.2 W	Time - Local	0515

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	--	0.22	0.08
9	--	0.22	0.09
16	--	0.21	0.08
25	--	0.21	0.09
39	--	0.28	0.23
60	--	0.30	0.31
90	--	0.08	0.15
100	--	0.03	0.06
125	--	0.01	0.06
150	--	0.01	0.04

Station No.	2-040	Station Name:	MAC912-040
Latitude	32.53.3 N	Date - Local	15 SEP 91
Longitute	118.33.1 W	Time - Local	0515

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	--	0.24	0.11
10	--	0.50	0.28
17	--	0.69	0.49
27	--	0.19	0.20
42	--	0.10	0.14
65	--	0.02	0.08
98	--	0.01	0.06
125	--	0.15	0.07
150	--	0.01	0.29

Station No.	3-041	Station Name:	MAC913-041
Latitude	31.33.8 N	Date - Local	19 SEP 91
Longitute	119.35.1 W	Time - Local	0516

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	11.74	0.21	0.08
11	12.51	0.22	0.10
18	11.04	0.27	0.13
29	13.46	0.55	0.32
46	1.58	0.46	0.32
70	0.89	0.09	0.15
85	--	0.04	0.08
105	0.67	0.01	0.04
125	--	0.01	0.04
150	--	0.01	0.05

Station No.	3-042	Station Name:	MAC913-042
Latitude	30.54.4 N	Date - Local	20 SEP 91
Longitute	121. 8.9 W	Time - Local	0517

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	4.27	0.10	0.01
12	4.58	0.10	0.02
21	4.30	0.10	0.02
33	3.89	0.14	0.03
52	1.98	0.14	0.04
80	1.91	0.28	0.38
90	--	0.23	0.35
100	--	0.21	0.31
120	0.68	0.12	0.19

Station No.	3-043	Station Name:	MAC913-043
Latitude	31.18.0 N	Date - Local	21 SEP 91
Longitute	123.32.2 W	Time - Local	0518

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	6.12	0.14	0.04
14	6.92	0.13	0.04
24	6.50	0.17	0.06
37	4.70	0.21	0.11
59	5.48	0.37	0.37
80	--	0.29	0.42
90	1.79	0.25	0.38
100	--	0.31	0.05
135	0.90	0.02	0.04
150	--	0.01	0.02

Station No.	3-044	Station Name:	MAC913-044
Latitude	31.36.5 N	Date - Local	22 SEP 91
Longitute	125.19.1 W	Time - Local	0519

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	4.51	0.13	0.00
13	5.14	0.10	0.03
22	4.90	0.11	0.03
35	3.60	0.13	0.04
45	--	0.16	0.05
55	2.85	0.20	0.06
85	1.82	0.25	0.27
100	--	0.22	0.27
127	0.78	0.15	0.25
150	--	0.07	0.11

Station No.	3-045	Station Name:	MAC913-045
Latitude	32.15.1 N	Date - Local	23 SEP 91
Longitute	124. 0.0 W	Time - Local	0520

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	4.99	0.15	0.00
11	6.01	0.11	0.04
18	5.71	0.15	0.00
29	4.45	0.13	0.04
46	3.67	0.20	0.09
70	1.97	0.24	0.19
90	--	0.26	0.35
105	1.07	0.17	0.33
125	--	0.23	0.32
150	--	0.03	0.04

Station No.	3-046	Station Name:	MAC913-046
Latitude	33. 0.4 N	Date - Local	24 SEP 91
Longitute	122. 1.8 W	Time - Local	0511

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	11.22	0.26	0.07
9	11.90	0.24	0.08
16	11.91	0.26	0.09
25	17.50	0.63	0.30
39	15.95	0.82	0.63
60	1.78	0.18	0.19
90	1.05	0.04	0.07
100	--	0.03	0.06
125	--	0.02	0.06
150	--	0.03	0.03

Station No.	3-047	Station Name:	MAC913-047
Latitude	33.27.1 N	Date - Local	25 SEP 91
Longitute	120.58.1 W	Time - Local	0516

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	7.78	0.22	0.08
8	11.24	0.21	0.06
14	11.29	0.21	0.06
23	5.12	0.24	0.05
36	15.72	0.70	0.48
55	2.35	0.16	0.16
82	1.31	0.04	0.07
100	--	0.02	0.02
125	--	0.01	0.04
150	--	0.01	0.03

Station No.	3-048	Station Name:	MAC913-048
Latitude	33.56.8 N	Date - Local	26 SEP 91
Longitute	120.22.6 W	Time - Local	0517

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	149.40	1.72	0.52
7	90.17	1.79	0.60
12	98.29	1.80	0.44
19	31.36	0.78	0.43
29	11.08	0.58	0.37
45	3.55	0.40	0.33
68	1.70	0.21	0.26
80	--	0.18	0.15
100	--	0.04	0.10
125	--	0.05	0.12

Station No.	3-049	Station Name:	MAC913-049
Latitude	34. 8.3 N	Date - Local	27 SEP 91
Longitute	120.13.6 W	Time - Local	0504

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	21.81	0.80	0.22
7	28.54	0.73	0.18
12	29.16	0.79	0.19
19	33.69	1.82	0.66
29	10.75	0.85	0.79
45	1.36	0.15	0.23
68	0.64	0.12	0.31
80	--	0.08	0.23
100	--	0.09	0.22
125	--	0.04	0.15

Station No.	3-050	Station Name:	MAC913-050
Latitude	33.55.5 N	Date - Local	28 SEP 91
Longitute	119.33.9 W	Time - Local	0515

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	14.40	0.33	0.09
7	15.06	0.33	0.11
12	23.51	0.47	0.15
19	16.45	0.44	0.16
29	10.37	0.66	0.22
45	2.32	0.52	0.46
68	0.47	0.16	0.28
80	--	0.10	0.19
100	--	0.11	0.07
125	--	0.02	0.08

Station No.	3-051	Station Name:	MAC913-051
Latitude	33.29.9 N	Date - Local	28 SEP 91
Longitute	117.58.6 W	Time - Local	2038

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	--	0.42	0.09
10	--	0.50	0.12
20	--	0.74	0.30
40	--	0.82	0.72
60	--	0.26	0.33
80	--	0.15	0.22
100	--	0.10	0.25
125	--	0.05	0.06
150	--	0.02	0.05

Station No.	3-052	Station Name:	MAC913-052
Latitude	33.30.1 N	Date - Local	29 SEP 91
Longitute	117.58.5 W	Time - Local	0510

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	19.61	0.44	0.12
8	19.26	0.47	0.16
14	14.86	0.56	0.23
23	10.33	0.48	0.28
36	7.13	0.72	0.65
55	1.20	0.26	0.39
82	0.50	0.13	0.23
100	--	0.09	0.18
125	--	0.03	0.09
150	--	0.08	0.02

Station No.	3-053	Station Name:	MAC913-053
Latitude	32.51.7 N	Date - Local	30 SEP 91
Longitute	119.14.6 W	Time - Local	0511

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	7.62	0.19	0.07
8	11.82	0.20	0.06
14	10.16	0.24	0.08
23	11.72	0.32	0.16
36	9.63	0.41	0.16
55	2.62	0.44	0.38
82	0.91	0.18	0.21
100	--	0.06	0.09
125	--	0.03	0.04
150	--	0.03	0.02

Station No.	3-054	Station Name:	MAC913-054
Latitude	31.15.7 N	Date - Local	01 OCT 91
Longitute	123. 2.3 W	Time - Local	0518

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	3.93	0.11	0.03
13	5.42	0.12	0.03
22	5.20	0.12	0.04
35	4.11	0.14	0.05
45	--	0.17	0.06
55	2.87	0.18	0.08
85	2.33	0.33	0.26
95	--	0.17	0.19
127	0.74	0.06	0.10
150	--	0.03	0.02

Station No.	3-055	Station Name:	MAC913-055
Latitude	33.56.3 N	Date - Local	02 OCT 91
Longitude	120.35.0 W	Time - Local	0520

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	44.17	0.95	0.35
7	45.84	0.94	0.31
16	--	0.96	0.36
19	27.61	0.90	0.33
29	12.77	0.80	0.42
45	1.99	0.44	0.25
68	0.85	0.21	0.19
80	--	0.11	0.12
100	--	0.04	0.12
125	--	0.02	0.06

Station No.	3-056	Station Name:	MAC913-056
Latitude	34.33.8 N	Date - Local	03 OCT 91
Longitude	124.39.7 W	Time - Local	0519

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	5.81	0.21	0.08
10	7.85	0.20	0.09
17	8.27	0.20	0.08
27	12.86	0.52	0.35
42	10.56	0.60	0.57
55	--	0.35	0.38
65	1.69	0.22	0.24
98	0.82	0.02	0.06
125	--	0.02	0.05
150	--	0.01	0.01

Station No.	3-057	Station Name:	MAC913-057
Latitude	34.57.5 N	Date - Local	04 OCT 91
Longitude	127. 0.6 W	Time - Local	0520

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	3.54	0.09	0.01
14	3.80	0.08	0.02
24	3.46	0.06	0.01
37	2.57	0.09	0.02
59	2.01	0.16	0.06
80	--	0.24	0.24
90	1.46	0.19	0.19
100	--	0.25	0.33
135	0.97	0.09	0.17
150	--	0.07	0.11

Station No.	3-058	Station Name:	MAC913-058
Latitude	35.35.0 N	Date - Local	05 OCT 91
Longitude	126.34.2 W	Time - Local	0517

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	4.94	0.13	0.03
13	5.25	0.13	0.03
22	7.56	0.20	0.06
35	4.55	0.22	0.10
45	--	0.25	0.12
55	3.68	0.30	0.22
85	2.40	0.28	0.32
95	--	0.32	0.25
127	1.33	0.03	0.04
150	--	0.03	0.03

Station No.	3-059	Station Name:	MAC913-059
Latitude	36.24.6 N	Date - Local	06 OCT 91
Longitude	124.30.0 W	Time - Local	0519

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	--	0.15	0.04
10	--	0.13	0.04
20	--	0.27	0.10
40	--	0.76	0.50
60	--	0.34	0.33
80	--	0.12	0.11
100	--	0.05	0.06
125	--	0.04	0.06
140	--	0.02	0.05
150	--	0.01	0.03

Station No.	3-060	Station Name:	MAC913-060
Latitude	37.11.6 N	Date - Local	06 OCT 91
Longitude	122.47.6 W	Time - Local	1937

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	--	1.11	0.37
10	--	1.15	0.36
20	--	0.05	1.34
40	--	1.10	0.69
60	--	0.22	0.35
80	--	0.10	0.19
100	--	0.11	0.20
125	--	0.03	0.17
150	--	0.03	0.17

Station No.	4-061	Station Name:	MAC914-061
Latitude	37.25.4 N	Date - Local	14 OCT 91
Longitute	123.49.9 W	Time - Local	0516

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	31.32	0.60	0.22
6	35.17	0.56	0.19
10	34.10	0.74	0.30
16	8.67	0.69	0.36
26	11.41	0.55	0.35
40	1.90	0.67	0.45
60	0.69	0.10	0.19
80	--	0.06	0.19
100	--	0.03	0.13
125	--	0.02	0.09

Station No.	4-062	Station Name:	MAC914-062
Latitude	37.32.9 N	Date - Local	15 OCT 91
Longitute	125. 4.4 W	Time - Local	0516

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	38.95	0.79	0.21
8	49.62	0.75	0.21
14	46.97	1.01	0.32
23	27.29	0.83	0.33
36	5.99	0.44	0.24
55	1.74	0.29	0.24
82	0.76	0.12	0.11
100	--	0.02	0.09
125	--	0.04	0.08
150	--	0.02	0.07

Station No.	4-063	Station Name:	MAC914-063
Latitude	37.50.3 N	Date - Local	16 OCT 91
Longitute	127.20.3 W	Time - Local	0521

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	11.28	0.24	0.07
12	16.97	0.34	0.11
21	19.02	0.44	0.23
33	15.18	0.60	0.42
52	3.95	0.33	0.32
60	--	0.22	0.24
80	1.19	0.11	0.12
100	--	0.03	0.05
120	0.77	0.08	0.00
150	--	0.02	0.05

Station No.	4-064	Station Name:	MAC914-064
Latitude	38. 3.3 N	Date - Local	17 OCT 91
Longitute	129.21.3 W	Time - Local	0516

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	2.24	0.13	0.05
14	5.98	0.13	0.05
24	5.08	0.12	0.04
37	3.88	0.13	0.05
59	2.04	0.40	0.40
80	--	0.28	0.36
90	0.90	0.19	0.23
100	--	0.12	0.17
135	0.55	0.02	0.05
150	--	0.01	0.04

Station No.	4-065	Station Name:	MAC914-065
Latitude	38. 7.1 N	Date - Local	18 OCT 91
Longitute	129.29.2 W	Time - Local	0504

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	3.93	0.14	0.06
14	2.64	0.14	0.09
24	4.54	0.14	0.05
37	3.90	0.14	0.06
59	3.88	0.37	0.35
80	--	0.25	0.39
90	1.27	0.16	0.24
100	--	0.20	0.14
135	0.66	0.04	0.05

Station No.	4-067	Station Name:	MAC914-067
Latitude	34.16.1 N	Date - Local	21 OCT 91
Longitute	121.14.8 W	Time - Local	0520

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	15.98	0.32	0.15
8	14.99	0.28	0.14
13	13.74	0.32	0.18
21	10.92	0.57	0.36
33	4.68	0.61	0.33
50	1.96	0.56	0.52
75	0.72	0.18	0.26
100	--	0.04	0.10
125	--	0.01	0.05
150	--	0.03	0.03

Station No.	4-068	Station Name:	MAC914-068
Latitude	34.12.1 N	Date - Local	22 OCT 91
Longitude	122.18.2 W	Time - Local	0520

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	17.38	0.52	0.21
8	13.80	0.51	0.22
14	9.68	0.48	0.21
23	5.51	0.48	0.25
36	3.14	0.80	0.74
55	0.70	0.20	0.19
82	0.54	0.05	0.10
100	--	0.01	0.05
125	--	0.06	0.01
150	--	0.01	0.05

Station No.	4-069	Station Name:	MAC914-069
Latitude	34.27.8 N	Date - Local	23 OCT 91
Longitude	123.56.1 W	Time - Local	0519

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	4.07	0.20	0.08
9	6.13	0.18	0.08
16	5.72	0.08	0.03
25	4.57	0.19	0.07
39	3.27	0.35	0.19
60	1.93	0.48	0.49
90	0.68	0.11	0.16
100	--	0.05	0.08
125	--	0.02	0.04
150	--	0.01	0.03

Station No.	4-070	Station Name:	MAC914-070
Latitude	38.38.5 N	Date - Local	29 OCT 91
Longitude	125.37.3 W	Time - Local	0518

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	17.23	0.56	0.16
8	16.68	0.55	0.17
13	19.71	0.56	0.16
21	11.79	0.52	0.17
33	6.52	0.57	0.17
50	1.36	0.22	0.22
75	0.68	0.08	0.09
100	--	0.05	0.05
125	--	0.02	0.03

Station No.	4-072	Station Name:	MAC914-072
Latitude	38.55.2 N	Date - Local	01 NOV 91
Longitute	127.55.1 W	Time - Local	0521

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	8.61	0.27	0.13
11	9.05	0.28	0.13
18	9.49	0.28	0.12
29	4.98	0.27	0.12
46	2.89	0.28	0.11
70	1.30	0.34	0.26
105	0.91	0.05	0.06
125	--	0.02	0.05
150	--	0.01	0.03

Station No.	4-074	Station Name:	MAC914-074
Latitude	36.13.3 N	Date - Local	03 NOV 91
Longitute	128.20.5 W	Time - Local	0518

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	4.57	0.15	0.06
14	5.09	0.14	0.05
25	4.40	0.15	0.05
39	3.57	0.16	0.06
62	3.69	0.38	0.42
95	1.43	0.17	0.26
125	--	0.04	0.07
143	0.92	0.01	0.03
150	--	0.01	0.03

Station No.	4-075	Station Name:	MAC914-075
Latitude	36.53.6 N	Date - Local	04 NOV 91
Longitute	126.27.8 W	Time - Local	0519

Depth (m)	Productivity (mgC/m3/day)	Chlorophyll (mg/m3)	Phaeophytin (mg/m3)
0	--	0.23	0.09
12	--	0.24	0.09
21	--	0.23	0.11
33	--	0.24	0.10
52	--	0.51	0.24
80	--	0.23	0.32
100	--	0.13	0.16
125	--	0.03	0.05
150	--	0.02	0.05

APPENDIX B

SCIENTIFIC PERSONNEL

Cruise Leaders	Leg #s
Jay Barlow, SWFSC	1
P. Scott Hill, NOAA Corps, SWFSC	2
Mark Lowry, SWFSC	3
Paul Wade, SWFSC	4
Marine Mammal Identification Experts	
Scott Benson, SWFSC	1-4
James Cotton, SWFSC	1-4
Marine Mammal Observers	
Wes Armstrong, SWFSC	1-4
Darlene Everhart, SWFSC	1-4
Mary Lycan, SWFSC	1-4
Robyn Mellon, SWFSC	1-4
Independent Observers	
Barb Taylor, SWFSC	1
Eric Archer, SIO	2
Karin Forney, SWFSC	3
Susan Kruse, SWFSC	4
Environmental Data Collection	
Julie Ellingson, NOAA Ship *McArthur*	1-4
Deanna Niemer, NOAA Ship *McArthur*	1-4
Oceanographer	
Valerie Philbrick, SWFSC	3