

**REDWOOD NATIONAL AND STATE PARKS
SUBTIDAL FISH SURVEY – FINAL REPORT
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Introduction

The marine finfish inhabiting the subtidal waters off Redwood National and State Parks have not been studied. Currently, the limited and highly fragmented data available on the abundance and distribution of fishes, in this area, can only be obtained from commercial landings compiled by the California Department of Fish and Game. The goal of this study was to provide a preliminary species list of fishes inhabiting the subtidal waters off Redwood National and State Parks.

Methods

Fish sampling was done in the subtidal waters off Redwood National and State Parks (RNSP), Humboldt and Del Norte counties, CA (Figure 1). All fish surveys were done from Humboldt State University's R/V Coral Sea. This vessel is 90' in length with a fully loaded displacement of 210 tons. In addition to the Captain our surveys required an engineer, one crew member, and a scientific party of six to seven. Nine, two day sampling trips were conducted in June, July and September 2005; January, May, June and December 2006; and March and July 2007. Each leg (day 1, Eureka to Crescent City; day 2, Crescent City to Eureka) typically took 13-14 hours, depending on sea conditions. In spite of several trips having to be postponed due to weather, sampling was conducted during all seasons. A 32' (mouth opening) benthic otter trawl, with 1 inch stretch mesh, was used to sample subtidal fishes, over sandy bottoms, off of Gold Bluffs Beach, False Klamath Cove, and Enderts Beach. Two replicate, 12 minute tows, at 1-2 knots, were taken at each site on one or both days of a trip as time and weather allowed. Depths ranged from 11 to 30 m. Subtidal fishes over rocky reefs, off Redwood and Damnation Creeks, were sampled by hook and line beginning July 2005. Fishing was conducted for 1.25 hrs/trip/day,

over each reef, by six to eight experienced anglers using six or eight inch scampy jigs with 8/0 or 9/0 size hooks as bait. Depths ranged from 10 to 29 m. Unless injured, all fishes sampled were identified, measured and released. The goal of this project was to provide a preliminary inventory of the subtidal fishes inhabiting the waters off RNSP. Consequently no attempt was made to statistically compare abundances or diversities between or among sites, seasons, or years. Surface temperatures, salinities, and dissolved oxygen were measured, in the field, concurrently with fish sampling using either hand held thermometers, refractometers or a YSI model 600XL data sonde.

Results and Discussion

Cruise dates along with specific sites sampled by date are shown in Table 1. Site locations/descriptions including GPS coordinates, substrate type, depth, distance from shore and sampling method are shown in Table 2 and Appendices 1-5. Sea surface temperatures, salinities, and dissolved oxygen are noted in Table 3.

A total of 46 fish species, representing 21 families, was collected (Table 4). The 12 most abundant species made up 96% of the 16,020 fish sampled (Table 5, Figure 2). Thirty seven species were taken over the sandy bottom sites, Gold Bluffs Beach, False Klamath Cove, and Enderts Beach, while 12 species were caught over the rocky reef sites, Redwood and Damnation Creeks (Tables 6 and 7). Trawl sites were dominated by night smelt, *Spirinchus starksi*, northern anchovy, *Engraulis mordax*, and Osmeridae spp. (juveniles), while the rocky reef sites were highly dominated by black rockfish, *Sebastes melanops*. Although effort varied slightly among the sandy bottom sites and between the rocky reef sites (Table 1) general comparisons can be made between and among sites. Overall species diversity, at the three trawl sites, is similar ranging from 25 species at Gold Bluffs Beach to 38 species at False Klamath Cove. The overall higher abundance noted at False Klamath Cove, 7,077 individuals, is due primarily to the greater catches of night smelt and northern anchovy taken at this site. At the two hook and line sites, Damnation Creek and Redwood Creek, overall abundances were similar, with 418 and 409 individuals taken, respectively. However, species diversity is higher at Damnation Creek due to

the greater number of rockfish species taken. Species diversity noted in successive days of sampling, within a site, did not appear to fluctuate greatly (Table 8). Not surprisingly a greater amount of variation is evident in abundances taken in successive days, within sites, which can be attributed to the sampling of small schooling pelagic fishes by trawling and the nature of fishing by hook and line techniques. The twelve most abundant species show some seasonal trends in abundance (Table 9). The greatest numbers of spiny dogfish and blue rockfish were clearly taken during the fall, while greater numbers of Pacific tomcod, black rockfish and flatfish were noted during the summer months. No clear trends in abundance are evident for small schooling pelagic fishes (i.e. northern anchovy, whitebait smelt, night smelt, *Osmeridae*, spp.) except that far fewer individuals were taken during the winter months. No seasonal differences in size are obvious for the twelve most abundant species (Table 10). Finally, Table 11 suggests high inter-annual variation in abundance both between and within the hook and line sites which may be attributable to this sampling technique.

Juvenile (< 4") Dungeness crabs, *Cancer magister*, were far more abundant at False Klamath Cove (FKC) than at the two other trawl sites (Table 12). In addition, this was the only site with a higher female:male sex ratio. More adult Dungeness crabs were also taken at False Klamath Cove (Figure 3). Overall, adult females dominated the catch except during September 2005 at FKC.

The nearshore subtidal species inventory, described above, provides important baseline data for this poorly studied region. Although obvious differences exist in the species composition between sandy bottom and rocky reef sites much additional study is needed. With the aid of future mapping efforts, additional areas encompassing both habitats should be identified and examined. Tagging studies to examine site fidelity and movement patterns of commercially important species such as rockfish, lingcod, cabezon and greenling would be highly informative and could involve local fishers working out of the Ports of Trinidad and Crescent City. It should be noted that greater than 50% of the species identified in this survey are listed in Appendix G, (Master list of species likely to benefit from MPAs) of the recently circulated CDFG Master Plan

for Marine Protected Areas (2008). Consequently this and similar studies will provide critical information for future MPA deliberations involving the northern California coast.

References

California Department of Fish and Game. 2008. The California Marine Life Protection Act Master Plan for Marine Protected Areas.

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Table 1. Cruise and specific sampling dates of five subtidal sites off Redwood National and State Parks, Humboldt and Del Norte Counties, CA, 25 June 2005 to 15 July 2007. RC = Redwood Creek; GBB = Gold Bluffs Beach; FKC = False Klamath Cove; DC = Damnation Creek; EB = Enderts Beach. n/a = site not sampled.

Month	RC	GBB	FKC	DC	EB
Jun 2005	n/a n/a	06-25-05 06-26-05	06-25-05 06-26-05	n/a n/a	06-25-05 06-26-05
Jul 2005	n/a 07-31-05	07-30-05 07-31-05	07-30-05 07-31-05	n/a 07-31-05	07-30-05 07-31-05
Sep 2005	n/a 09-18-05	09-17-05 09-18-05	09-17-05 09-18-05	09-17-05 09-18-05	09-17-05 09-18-05
Jan 2006	n/a 01-22-06	01-21-06 01-22-06	01-21-06 01-22-06	01-21-06 01-22-06	01-21-06 n/a
May 2006	05-06-06 05-07-06	05-06-06 05-07-06	05-06-06 05-07-06	n/a 05-07-06	05-06-06 n/a
Jun 2006	06-24-06 06-25-06	06-24-06 06-25-06	06-24-06 06-25-06	n/a 06-25-06	06-24-06 n/a
Dec 2006	12-02-06 12-03-06	12-02-06 12-03-06	12-02-06 12-03-06	12-02-06 12-03-06	12-02-06 12-03-06
Mar 2007	03-30-07 03-31-07	03-30-07 n/a	03-30-07 03-31-07	03-30-07 03-31-07	03-30-07 03-31-07
Jul 2007	07-14-07 07-15-07	07-14-07 n/a	07-14-07 07-15-07	07-14-07 07-15-07	07-14-07 n/a

Table 2. Site location/description of the five subtidal sites sampled off Redwood National and State Parks, Humboldt and Del Norte Counties, CA, 25 June 2005 to 15 July 2007. RC = Redwood Creek; GBB = Gold Bluffs Beach; FKC = False Klamath Cove; DC = Damnation Creek; EB = Enderts Beach.

	RC	GBB	FKC	DC	EB
GPS	W 124° 06' 34"	W 124° 05' 80"	W 124° 07' 61"	W 124° 08' 65"	W 124° 09' 46"
(WGS 84)	N 41° 17' 42"	N 41° 22' 10"	N 41° 35' 40"	N 41° 37' 40"	N 41° 42' 59"
Substrate	rocky reef	sandy	sandy	rocky reef	sandy
Depth range (m)	13 – 15	12 – 18	25 – 31	15 – 35	11 – 17
Distance from shoreline (nm)	0.27	0.40	0.76	0.82	0.36
Sampling method	hook and line	trawl	trawl	hook and line	trawl

Table 3. Sea surface temperature, salinity, and dissolved oxygen (D.O.) measured at five subtidal sites off Redwood National and State Parks, Humboldt and Del Norte Counties, CA, 25 June 2005 to 15 July 2007. Temperatures taken from 25 June 2005 to 25 June 2006 were measured to 0.1 °C using a Fisher Scientific traceable thermometer. Salinity was measured to the nearest whole ppt using a Reichet refractometer. Water quality parameters taken after 25 June 2006 were measured to two places using a YSI 600XL multi-parameter data sonde. °C = degrees Celsius; ppt = parts per thousand; ppm = parts per million; n/a = data not collected.

Station	Date	Temperature (°C)	Salinity (ppt)	D.O. (ppm)
Redwood Creek	07 / 31 / 05	14.5	30	n/a
	09 / 18 / 05	14.0	31	n/a
	01 / 22 / 06	11.0	22	n/a
	05 / 06 / 06	10.7	32	n/a
	05 / 07 / 06	10.5	30	n/a
	06 / 24 / 06	12.3	32	n/a
	06 / 25 / 06	14.9	30	n/a
	12 / 02 / 06	11.93	32.47	8.61
	12 / 03 / 06	11.25	26.53	9.84
	03 / 30 / 07	9.37	30.39	9.85
	03 / 31 / 07	10.23	24.20	7.85
	07 / 14 / 07	12.96	33.82	10.53
	07 / 15 / 07	16.42	33.57	11.00
Gold Bluffs Beach	06 / 25 / 05	11.6	n/a	n/a
	06 / 26 / 05	14.0	30	n/a
	07 / 30 / 05	15.0	31	n/a
	09 / 17 / 05	14.0	30	n/a

Table 3. CONTINUED.

Station	Date	Temperature (°C)	Salinity (ppt)	D.O. (ppm)
Gold Bluffs Beach Cont.	09 / 18 / 05	14.0	33	n/a
	01 / 21 / 06	11.0	27	n/a
	01 / 22 / 06	10.0	22	n/a
	05 / 06 / 06	11.5	30	n/a
	05 / 07 / 06	10.0	30	n/a
	06 / 24 / 06	13.5	32	n/a
	06 / 25 / 06	15.3	30	n/a
	12 / 02 / 06	11.81	32.63	8.52
	12 / 03 / 06	12.03	32.74	8.13
	03 / 30 / 07	9.98	33.08	9.21
	07 / 14 / 07	14.73	33.77	10.84
False Klamath Cove	06 / 25 / 05	12.7	n/a	n/a
	06 / 26 / 05	14.4	21	n/a
	07 / 30 / 05	15.5	31	n/a
	07 / 31 / 05	16.0	26	n/a
	09 / 17 / 05	14.5	30	n/a
	09 / 18 / 05	14.0	25	n/a
	01 / 21 / 06	12.0	24	n/a
	01 / 22 / 06	9.0	17	n/a

Table 3. CONTINUED.

Station	Date	Temperature (°C)	Salinity (ppt)	D.O. (ppm)
False Klamath Cove Cont.	05 / 06 / 06	11.6	25	n/a
	05 / 07 / 06	10.3	20	n/a
	06 / 24 / 06	13.0	28	n/a
	06 / 25 / 06	13.9	30	n/a
	12 / 02 / 06	11.00	30.43	9.53
	12 / 03 / 06	10.64	30.07	9.52
	03 / 30 / 07	9.69	27.18	9.30
	03 / 31 / 07	9.66	23.90	8.27
	07 / 14 / 07	14.93	31.87	11.90
	07 / 15 / 07	14.00	31.37	10.06
Damnation Creek	07 / 31 / 05	16.0	24	n/a
	09 / 17 / 05	15.0	27	n/a
	09 / 18 / 05	14.0	28	n/a
	01 / 21 / 06	10.0	20	n/a
	01 / 22 / 06	10.0	22	n/a
	05 / 07 / 06	10.1	28	n/a
	06 / 25 / 06	12.7	26	n/a
	12 / 02 / 06	11.01	30.82	9.57
	12 / 03 / 06	10.79	31.04	9.50

Table 3. CONTINUED.

Station	Date	Temperature (°C)	Salinity (ppt)	D.O. (ppm)
Damnation Creek Cont.	03 / 30 / 07	9.93	28.72	9.64
	03 / 31 / 07	9.95	27.44	9.41
	07 / 14 / 07	14.71	32.45	12.34
	07 / 15 / 07	14.59	31.72	11.49
Enderts Beach	06 / 25 / 05	13.8	n/a	n/a
	06 / 26 / 05	13.8	25	n/a
	07 / 30 / 05	16.5	29	n/a
	07 / 31 / 05	16.0	29	n/a
	09 / 17 / 05	15.0	28	n/a
	09 / 18 / 05	14.5	29	n/a
	01 / 21 / 06	10.0	20	n/a
	05 / 06 / 06	11.0	28	n/a
	06 / 24 / 06	15.3	25	n/a
	12 / 03 / 06	10.84	30.83	9.13
	03 / 30 / 07	10.58	28.43	8.42
	03 / 31 / 07	10.36	26.98	6.33
	07 / 14 / 07	13.81	32.92	13.50

Table 4. Fish species collected at five subtidal sites off Redwood National and State Parks, Humboldt and Del Norte Counties, CA, 25 June 2005 to 15 July 2007.
X = species collected; blank = not collected.

Family, Scientific name (Common name)	Gold Bluffs Beach	False Klamath Cove	Enderts Beach	Dannation Creek	Redwood Creek
Squalidae					
<i>Squalus acanthias</i> (spiny dogfish)	X	X	X		
Myliobatidae					
<i>Myliobatis californica</i> (bat ray)		X	X		
Rajidae					
<i>Raja binoculata</i> (big skate)	X	X	X		
Clupeidae					
<i>Alosa sapidissima</i> (American shad)	X	X	X		
<i>Clupea harengus</i> (Pacific herring)	X	X	X		
<i>Sardinops sagax</i> (Pacific sardine)		X	X		
Engraulidae					
<i>Engraulis mordax</i> (Northern anchovy)	X	X	X		
Salmonidae					
<i>Oncorhynchus kisutch</i> (coho salmon)		X			
Osmeridae					
<i>Allosmerus elongatus</i> (whitebait smelt)	X	X	X		
<i>Hypomesus pretiosus</i> (surf smelt)	X	X	X		
<i>Spirinchus starksi</i> (night smelt)	X	X	X		
<i>S. thaleichthys</i> (longfin smelt)	X	X			
Osmeridae species (unidentified)	X	X	X		

Table 4. CONTINUED.

Family, Scientific name (Common name)	Gold Bluffs Beach	False Klamath Cove	Enderts Beach	Damnation Creek	Redwood Creek
Batrachoididae					
<i>Porichthys notatus</i> (plainfin midshipman)		X			
Gadidae					
<i>Microgadus proximus</i> (Pacific tomcod)	X	X	X		
Scorpaenidae					
<i>Sebastes caurinus</i> (copper rockfish)				X	
<i>S. flavidus</i> (yellowtail rockfish)				X	
<i>S. maliger</i> (quillback rockfish)				X	
<i>S. miniatus</i> (vermillion rockfish)				X	
<i>S. melanops</i> (black rockfish)	X	X		X	X
<i>S. mystinus</i> (blue rockfish)				X	
<i>S. nebulosus</i> (China rockfish)				X	
<i>S. pinniger</i> (canary rockfish)				X	
Scorpaenidae species (unidentified)		X			
Hexagrammidae					
<i>Hexagrammos decagrammus</i> (kelp greenling)				X	X
<i>Ophiodon elongatus</i> (lingcod)		X	X	X	X

Table 4. CONTINUED.

Family, Scientific name (Common name)	Gold Bluffs Beach	False Klamath Cove	Enderts Beach	Damnation Creek	Redwood Creek
Cottidae					
<i>Artedius fenestralis</i> (padded sculpin)		X			
<i>Enophrys bison</i> (buffalo sculpin)	X		X		
<i>Leptocottus armatus</i> (staghorn sculpin)	X	X			
<i>Scorpaenichthys marmoratus</i> (cabezon)			X	X	X
Agonidae					
<i>Ocella verrucosa</i> (warty poacher)	X	X	X		
<i>Stellerina xyosterna</i> (pricklebreast poacher)	X	X	X		
Liparidae					
<i>Liparis pulchellus</i> (showy snailfish)	X	X	X		
Sciaenidae					
<i>Genyonemus lineatus</i> (white croaker)	X	X			
Embiotocidae					
<i>Amphistichus rhodoterus</i> (redtail surfperch)		X			
<i>Cymatogaster aggregata</i> (shiner surfperch)		X			
<i>Hyperprosopon anale</i> (spotfin surfperch)	X	X	X		
Pholididae					
<i>Pholis ornate</i> (saddleback gunnel)		X			

Table 4. CONTINUED.

Family, Scientific name (Common name)	Gold Bluffs Beach	False Klamath Cove	Enderts Beach	Dannation Creek	Redwood Creek
Stromateidae					
<i>Peprilus simillimus</i> (Pacific butterflyfish)		X	X		
Bothidae					
<i>Citharichthys sordidus</i> (Pacific sanddab)	X	X	X		
<i>C. stigmaeus</i> (speckled sanddab)	X	X	X		
Pleuronectidae					
<i>Isopsetta isolepis</i> (butter sole)	X	X	X		
<i>Microstomus pacificus</i> (dover sole)		X			
<i>Parophrys vetulus</i> (English sole)	X	X	X		
<i>Platichthys stellatus</i> (starry flounder)	X	X	X		
<i>Pleuronichthys decurrens</i> (curlfin turbot)		X			
<i>Psettichthys melanostictus</i> (sand sole)	X	X	X		
Pleuronectidae species (unidentified)		X			
Molidae					
<i>Mola mola</i> (common mola)					X
No. of families	14	20	16	3	4
No. of species	25	38	26	11	5

Table 5. Relative abundance of the 12 most common fish species collected at five subtidal sites off Redwood National and State Parks, Humboldt and Del Norte Counties, CA, 25 June 2005 to 15 July 2007.

Scientific name (Common name)	No. Caught	% of Total	Rank
<i>Squalus acanthias</i> (spiny dogfish)	161	1.00	8
<i>Engraulis mordax</i> (Northern anchovy)	3,341	20.86	2
<i>Allosmerus elongatus</i> (whitebait smelt)	984	6.14	4
<i>Spirinchus starksi</i> (night smelt)	7,005	43.71	1
Osmeridae spp. (unidentified)	2,350	14.67	3
<i>Microgadus proximus</i> (Pacific tomcod)	291	1.82	7
<i>Sebastes melanops</i> (black rockfish)	596	3.72	5
<i>Sebastes mystinus</i> (blue rockfish)	94	0.59	11
<i>Stellerina xyosterna</i> (pricklebreast poacher)	337	2.10	6
<i>Citharichthys stigmaeus</i> (speckled sanddab)	78	0.49	12
<i>Isopsetta isolepis</i> (butter sole)	103	0.64	10
<i>Parophrys vetulus</i> (English sole)	161	1.00	8
Totals	15,501	96.76	
Total fish caught (all species)	16,020		

Table 6. Overall abundances and lengths of fish species collected by trawling at three, sandy bottom subtidal sites off Redwood National and State Parks, Humboldt and Del Norte Counties, CA, 25 June 2005 to 15 July 2007. GBB = Gold Bluffs Beach; FKC = False Klamath Cove; EB = Enderts Beach; TL = total length; mm = millimeters. Mean ($\bar{X}$) lengths were determined by measuring 25 random individuals per species per trawl tow when numbers exceeded 25.

Species	GBB			FKC			EB		
	total length (mm)			total length (mm)			total length (mm)		
	No.	$\bar{X}$	(range)	No.	$\bar{X}$	(range)	No.	$\bar{X}$	(range)
<i>Squalus acanthias</i>	15	282.8	(218-345)	140	300.3	(129-370)	6	302.3	(267-343)
<i>Myliobatis californica</i>				1	135.0		4	805.8	(648-930)
<i>Raja binoculata</i>	13	207.3	(40-480)	16	211.6	(132-541)	4	387.8	(319-495)
<i>Alosa sapidissima</i>	3	108.0	(93-116)	3	175.0	(118-271)	1	125.0	
<i>Clupea harengus</i>	1	183.0		1	182.0		4	139.8	(121-163)
<i>Sardinops sagax</i>				1	101.0		1	81.0	
<i>Engraulis mordax</i>	627	87.8	(11-163)	1,959	102.7	(11-173)	755	118.8	(48-172)
<i>Oncorhynchus kisutch</i>				1	685.0				
Osmeridae spp. (unidentified)	524	64.0	(46-85)	341	64.4	(39-80)	1,483	60.6	(40-85)
<i>Allosmerus elongatus</i>	209	109.3	(86-143)	709	110.0	(72-160)	66	103.1	(65-145)
<i>Hypomesus pretiosus</i>	24	132.0	(63-164)	9	100.6	(68-136)	11	138.4	(78-177)
<i>Spirinchus starksi</i>	2,492	94.5	(58-217)	3,011	104.9	(24-190)	1,507	99.1	(50-142)
<i>S. thaleichthys</i>	1	128.0		3	136.7	(132-145)			
<i>Porichthys notatus</i>				1	77.0				
<i>Microgadus proximus</i>	18	139.1	(101-203)	240	149.2	(65-201)	33	153.2	(134-198)
<i>S. melanops</i>	3	444.3	(416-467)	7	422.1	(201-500)			

Table 6. CONTINUED.

Species	GBB		FKC		EB	
	No.	$\bar{X}$ (range)	No.	$\bar{X}$ (range)	No.	$\bar{X}$ (range)
Scorpaenidae spp. (unidentified)	1	35.0				
<i>Ophiodon elongatus</i>	1	161.0	1		1	740.0
<i>Artedius fenestralis</i>	28	80.7 (50-122)				
<i>Enophrys bison</i>	1	50.0			1	55.0
<i>Leptocottus armatus</i>	3	176.7 (162-201)	4	210.4 (120-244)		
<i>Scorpaenichthys marmoratus</i>					1	73.0
<i>Occella verrucosa</i>	1	70.0	3	70.7 (65-77)	2	86.0 (79-93)
<i>Stellerina xyosterna</i>	25	82.3 (52-127)	300	85.0 (46-185)	12	115.4 (66-156)
<i>Liparis pulchellus</i>	19	92.6 (55-154)	48	92.6 (55-154)	4	127.8 (80-183)
<i>Genyonemus lineatus</i>	5	162.8 (79-255)	2	125.5 (115-136)		
<i>Amphistichus rhodoterus</i>			2	338.5 (267-410)		
<i>Cymatogaster aggregata</i>			1	136.0		
<i>Hyperprosopon anale</i>	2	109.5 (89-130)	15	115.2 (103-410)	45	97.6 (52-159)
<i>Pholis ornata</i>			1	124.0		
<i>Peprilus simillimus</i>			1	107.0	2	131.5 (127-136)
<i>Citharichthys sordidus</i>	9	105.1 (65-119)	10	147.0 (57-278)	7	111.7 (101-120)
<i>C. stigmaeus</i>	13	92.3 (67-120)	16	79.1 (59-115)	49	80.4 (51-120)

Table 6. CONTINUED.

Species	GBB			FKC			EB		
	No.	$\bar{X}$	(range)	No.	$\bar{X}$	(range)	No.	$\bar{X}$	(range)
Plueronectidae spp. (unidentified)				6	98.8	(29-228)			
<i>Isopsetta isolepis</i>	4	130.5	(50-222)	72	161.5	(39-288)	27	97.7	(51-265)
<i>Microstomus pacificus</i>				1	93.0				
<i>Parophrys vetulus</i>	5	298.8	(138-380)	118	132.4	(48-360)	38	81.4	(57-207)
<i>Platichthys stellatus</i>	5	292.6	(129-459)	3	386.7	(346-419)	1	333.0	
<i>Plueronichthys decurrens</i>				1	47.0				
<i>Psettichthys melanostictus</i>	11	177.1	(54-440)	1	118.0		18	179.3	(53-480)
Total fish caught	4,033			7,077			4,083		

Table 7. Overall abundances and lengths of fish species collected by hook and line at two, rocky reef subtidal sites off Redwood National and State Parks, Humboldt and Del Norte Counties, CA, 25 June 2005 to 15 July 2007. RC = Redwood Creek; DC = Damnation Creek; mm = millimeters. All individuals collected by hook and line were measured to determine mean ($\bar{X}$) lengths.

Species	RC			DC		
	No.	total length (mm)		No.	total length (mm)	
		$\bar{X}$	(range)		$\bar{X}$	(range)
<i>Sebastes caurinus</i>				4	446.0	(414-470)
<i>S. flavidus</i>				4	255.3	(171-310)
<i>S. maliger</i>				49	412.6	(340-480)
<i>S. miniatus</i>				1	427.0	(195-543)
<i>S. melanops</i>	397	418.4	(204-560)	189	380.3	(195-543)
<i>S. mystinus</i>				94	295.7	(180-406)
<i>S. nebulosus</i>				1	480.0	
<i>S. pinniger</i>				6	287.5	(245-360)
<i>Hexagrammos decagrammus</i>	2	293.0	(270-316)	15	320.1	(237-372)
<i>Ophiodon elongatus</i>	7	610.4	(376-770)	47	671.4	(462-1010)
<i>Scorpaenichthys marmoratus</i>	2	375.0	(320-430)	8	542.4	(484-634)
<i>Mola mola</i>	1	472.0				
Total fish caught	409			418		

Table 8. Number of species and total number of fish caught per date and location at five subtidal sites off Redwood National and State Parks, Humboldt and Del Norte Counties, CA, 25 June 2005 to 15 July 2007. RC = Redwood Creek; GBB = Gold Bluffs Creek; FKC = False Klamath Cove; DC = Damnation Creek; EB = Enderts Beach.

Month	Date	Location	No. species	No. fish caught
Jun 2005	06 – 25 – 05	GBB	8	27
	06 – 26 – 05	GBB	9	28
	06 – 25 – 05	FKC	12	139
	06 – 26 – 05	FKC	8	153
	06 – 25 – 05	EB	9	54
	06 – 26 – 05	EB	11	56
Jul 2005	07 – 30 – 05	GBB	3	54
	07 – 30 – 05	FKC	11	341
	07 – 31 – 05	FKC	16	495
	07 – 30 – 05	EB	8	261
	07 – 31 – 05	EB	8	114
	07 – 31 – 05	DC	7	32
	07 – 31 – 05	RC	2	97
Sep 2005	09 – 17 – 05	GBB	7	49
	09 – 18 – 05	GBB	2	17
	09 – 17 – 05	FKC	8	84
	09 – 18 – 05	FKC	6	69
	09 – 17 – 05	DC	6	25

Table 8. CONTINUED

Month	Date	Location	No. species	No. fish caught
Sep 2005 Cont.	09 - 18 - 05	DC	5	13
	09 - 17 - 05	EB	6	34
	09 - 18 - 05	EB	6	89
	09 - 18 - 05	RC	4	105
Jan 2006	01 - 21 - 06	GBB	9	250
	01 - 22 - 06	GBB	14	570
	01 - 21 - 06	FKC	12	350
	01 - 22 - 06	FKC	14	185
	01 - 21 - 06	DC	1	1
	01 - 22 - 06	DC	2	13
	01 - 21 - 06	EB	8	45
	01 - 22 - 06	RC	0	0
	05 - 06 - 06	RC	3	70
	05 - 07 - 06	RC	1	26
May 2006	05 - 06 - 06	GBB	8	308
	05 - 07 - 06	GBB	4	528
	05 - 06 - 06	FKC	9	1,088
	05 - 07 - 06	FKC	7	749
	05 - 06 - 06	EB	8	155
	05 - 07 - 06	DC	2	5

Table 8. CONTINUED

Month	Date	Location	No. species	No. fish caught
Jun 2006	06-24-06	RC	1	9
	06-25-06	RC	1	2
	06-24-06	GBB	9	1,533
	06-25-06	GBB	2	9
	06-24-06	FKC	8	536
	06-25-06	FKC	10	430
	06-24-06	EB	9	1,159
	06-25-06	DC	9	52
Jul 2006	12-02-06	RC	1	3
	12-03-06	RC	0	0
	12-02-06	GBB	6	518
	12-03-06	GBB	3	50
	12-02-06	FKC	9	1,022
	12-03-06	FKC	11	893
	12-02-06	DC	6	78
	12-03-06	DC	5	52
	12-02-06	EB	7	661
	12-03-06	EB	14	869
Mar 2006	03-30-07	RC	2	4
	03-31-07	RC	0	0

Table 8. CONTINUED

Month	Date	Location	No. species	No. fish caught
Mar 2006 Cont.	03 - 30 - 07	GBB	5	18
	03 - 30 - 07	FKC	8	377
	03 - 31 - 07	FKC	6	56
	03 - 30 - 07	DC	8	27
	03 - 31 - 07	DC	5	22
	03 - 30 - 07	EB	4	244
	03 - 31 - 07	EB	8	275
Jul 2006	07 - 14 - 07	RC	2	61
	07 - 15 - 07	RC	1	32
	07 - 14 - 07	GBB	6	74
	07 - 14 - 07	FKC	5	63
	07 - 15 - 07	FKC	4	47
	07 - 14 - 07	DC	4	39
	07 - 15 - 07	DC	7	59
	07 - 14 - 07	EB	3	67

Table 9. Relative abundance of the 12 most common fish species collected, by season, at five subtidal sites off Redwood National and State Parks, Humboldt and Del Norte Counties, CA, 25 June 2005 to 15 July 2007.

Scientific name (Common name)	Relative Seasonal Abundance				Overall Abundance	
	spring	summer	fall	winter	No. caught	Rank
<i>Squalus acanthias</i> (spiny dogfish)	0	0	150	11	161	1.00
<i>Engraulis mordax</i> (Northern anchovy)	1,852	281	1,144	64	3,341	20.86
<i>Allosmerus elongatus</i> (whitebait smelt)	4	969	1	10	984	6.14
<i>Spirinchus starksi</i> (night smelt)	1,443	2,995	1,639	928	7,005	43.71
Osmeridae spp. (unidentified)	476	950	900	24	2,350	14.67
<i>Microgadus proximus</i> (Pacific tomcod)	21	238	0	32	291	1.82
<i>Sebastes melanops</i> (black rockfish)	130	425	24	17	596	3.72
<i>Sebastes mystinus</i> (blue rockfish)	1	9	84	0	94	0.59
<i>Stellerina xyosterna</i> (pricklebreast poacher)	29	48	8	252	337	2.10
<i>Citharichthys stigmaeus</i> (speckled sanddab)	1	70	1	6	78	0.49
<i>Isopsetta isolepis</i> (butter sole)	8	84	9	2	103	0.64
<i>Parophrys vetulus</i> (English sole)	2	94	55	10	161	1.00
Totals	3,967	6,163	4,015	1,356	15,501	96.76
Total fish caught (all species)	4,037	6,489	4,084	1,410	16,020	

Table 10. Relative abundances and lengths of the 12 most abundant fish species collected at five subtidal sites off Redwood National and State Parks, Humboldt and Del Norte Counties, CA, 25 June 2005 to 15 July 2007. GBB = Gold Bluffs Beach; FKC = False Klamath Cove; EB = Enderis Beach; TL = total length; mm = millimeters.

Scientific name (Common name)	Relative Seasonal Abundances											
	spring			summer			fall			winter		
	TL (mm)			TL (mm)			TL (mm)			TL (mm)		
	No.	$\bar{X}$	(range)	No.	$\bar{X}$	(range)	No.	$\bar{X}$	(range)	No.	$\bar{X}$	(range)
<i>Squalus acanthias</i> (spiny dogfish)	0			0			150	300.4	(129-370)	11	276.5	(218-345)
<i>Engraulis mordax</i> (Northern anchovy)	1,852	93.0	(63-149)	281	89.1	(11-150)	1,144	126.5	(90-173)	64	75.6	(70-96)
<i>Allosmerus elongatus</i> (whitebait smelt)	4	137.5	(125-149)	969	108.2	(65-160)	1	149.0		10	126.7	(105-145)
<i>Spirinchus starksi</i> (night smelt)	1,443	98.5	(24-150)	2,995	100.2	(50-143)	1,639	103.5	(65-147)	928	104.4	(53-217)
Osmeridae spp. (unidentified)	476	60.4	(47-85)	950	57.1	(46-76)	900	68.0	(40-85)	24	51.8	(39-68)
<i>Microgadus proximus</i> (Pacific tomcod)	21	150.3	(124-175)	238	152.3	(65-201)	0			32	132.5	(98-203)
<i>Sebastes melanops</i> (black rockfish)	130	411.4	(289-540)	425	407.1	(195-560)	24	391.54	(300-500)	17	376.6	(273-494)
<i>Sebastes mystinus</i> (blue rockfish)	1	372.0		9	297.6	(183-400)	84	294.8	(180-406)	0		
<i>Stellerina xyosterna</i> (pricklebreast poacher)	29	114.2	(81-159)	48	100.2	(49-185)	8	100.6	(59-152)	252	73.6	(46-156)
<i>Citharichthys stigmaeus</i> (speckled sanddab)	1	98.0		70	81.4	(51-120)	1	83.0		6	89.0	(59-110)
										78	82.2	(51-120)

Table 10. CONTINUED

Scientific name (Common name)	Relative Seasonal Abundances											
	spring			summer			fall			winter		
	No.	$\bar{X}$	TL (mm) (range)	No.	$\bar{X}$	TL (mm) (range)	No.	$\bar{X}$	TL (mm) (range)	No.	$\bar{X}$	TL (mm) (range)
<i>Isopsetta isolepis</i> (butter sole)	8	109.1	(55-222)	84	153.3	(39-288)	9	80.1	(51-265)	2	146.0	(120-172)
<i>Parophrys vetulus</i> (English sole)	2	222.0	(84-360)	94	152.6	(57-380)	55	71.4	(49-104)	10	193.0	(59-357)
Totals	3,967			6,163			4,015			1,356		
Total fish caught (all species)	4,037			6,489			4,084			1,410		

Table 11. Annual abundances and $\bar{X}$ lengths (TL mm) of fish species collected by hook and line sampling at Redwood Creek and Damnation Creek off Redwood National and State Parks, Humboldt and Del Norte Counties, 25 June 2005 to 15 July 2007.

Scientific name	Redwood Creek				Damnation Creek			
	<u>2005</u>		<u>2006</u>		<u>2005</u>		<u>2006</u>	
	No.	$\bar{X}$	No.	$\bar{X}$	No.	$\bar{X}$	No.	$\bar{X}$
<i>Sebastes caurinus</i>							2	427.0
<i>S. flavidus</i>					1	301.0	1	239.0
<i>S. maliger</i>					4	388.5	22	413.5
<i>S. miniatus</i>								
<i>S. melanops</i>	195	422.4	107	419.4	44	367.3	51	371.9
<i>S. mystinus</i>					3	256.0	86	296.0
<i>S. nebulosus</i>					1	480.0		
<i>S. pinniger</i>					2	307.5	3	261.0
<i>Hexagrammos decagrammus</i>			2	293.0	3	320.0	7	324.7
<i>Ophiodon elongates</i>	5	604.0	1	630.0	7	653.6	27	671.6
<i>Scorpaenichthys marmoratus</i>	1	320.0						
<i>Mola mola</i>	1	472.0			4	548.8	3	544.7
Total fish caught	202		110		69		202	
			97				147	

Table 12. Abundances and sex ratios of juvenile dungeness crab, *Cancer magister*, collected by trawling at three, sandy bottom subtidal sites off Redwood National and State Parks, Humboldt and Del Norte Counties, CA, 25 June 2005 to 15 July 2007. Effort = number of trawls. GBB = Gold Bluffs Beach; FKC = False Klamath Cove; EB = Enderis Beach; n/a = data not collected.

Date	GBB			FKC			EB		
	No.	Sex Ratio (male:female)	Effort	No.	Sex Ratio (male:female)	Effort	No.	Sex Ratio (male:female)	Effort
June 2005	13	0.86:1.17	4	143	0.68:1.47	4	42	1:0.62	4
July 2005	9	1:0.05	2	118	1:0.87	4	238	1:0.76	4
Sept 2005	9	1:0.08	4	195	0.93:1.07	4	27	0.80:1.25	4
Jan 2006	147	1:0.16	4	68	0.06:16.00	4	4	1:1	2
May 2006	26	1:0.36	4	17	0.55:1.83	4	4	0.33:3.00	2
June 2006	48	1:0.33	4	13	1:0.86	4	15	1:0.15	2
Dec 2006	101	1:0.40	3	4,263	0.93:1.07	4	520	1:0.20	4
Mar 2007	23	1:0.35	2	789	n/a	4	1,018	n/a	4
July 2007	20	1:0.54	2	59	0.69:1.46	4	27	n/a	2
Overall Totals	396	1:0.32	29	5,665	0.90:1.11	36	1,895	1:0.36	28



Figure 1. Stations sampled in subtidal waters off Redwood National and State Parks, Humboldt and Del Norte Counties, CA. Sampled 25 June 2005 to 15 July 2007. Redwood Creek, W 124° 06' 33", N 41° 17' 44"; Gold Bluffs Beach, W 124° 06' 04", N 41° 21' 80"; False Klamath Cove, W 124° 06' 97", N 41° 34' 59"; Damnation Creek, W 124° 08' 64", N 41° 37' 41"; Enderls Beach, W 124° 09' 59", N 41° 42' 33".

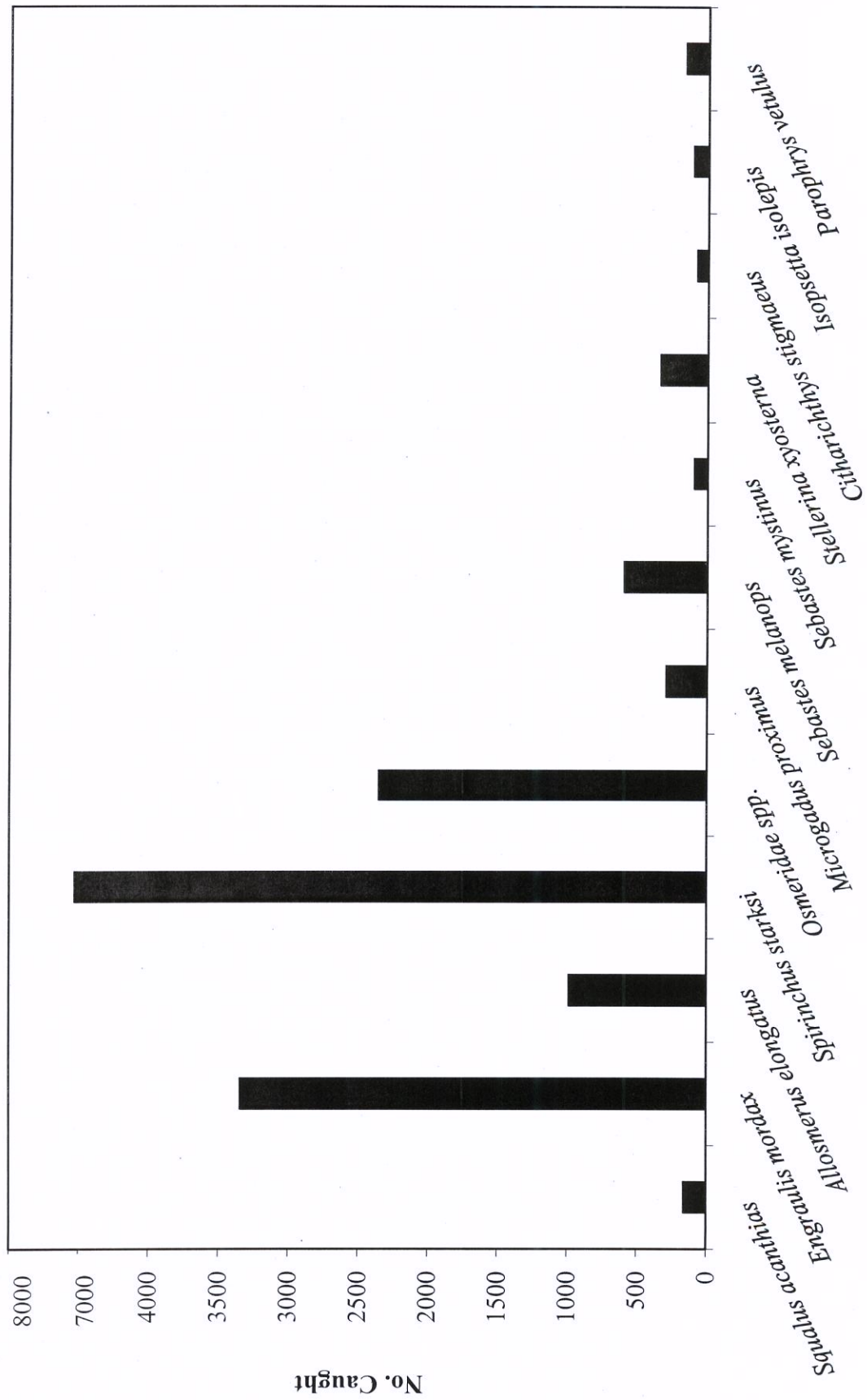


Figure 2. Twelve most abundant fish species collected at five subtidal sites off Redwood National and State Parks, Humboldt and Del Norte Counties, CA, 25 June 2005 to 15 July 2007.

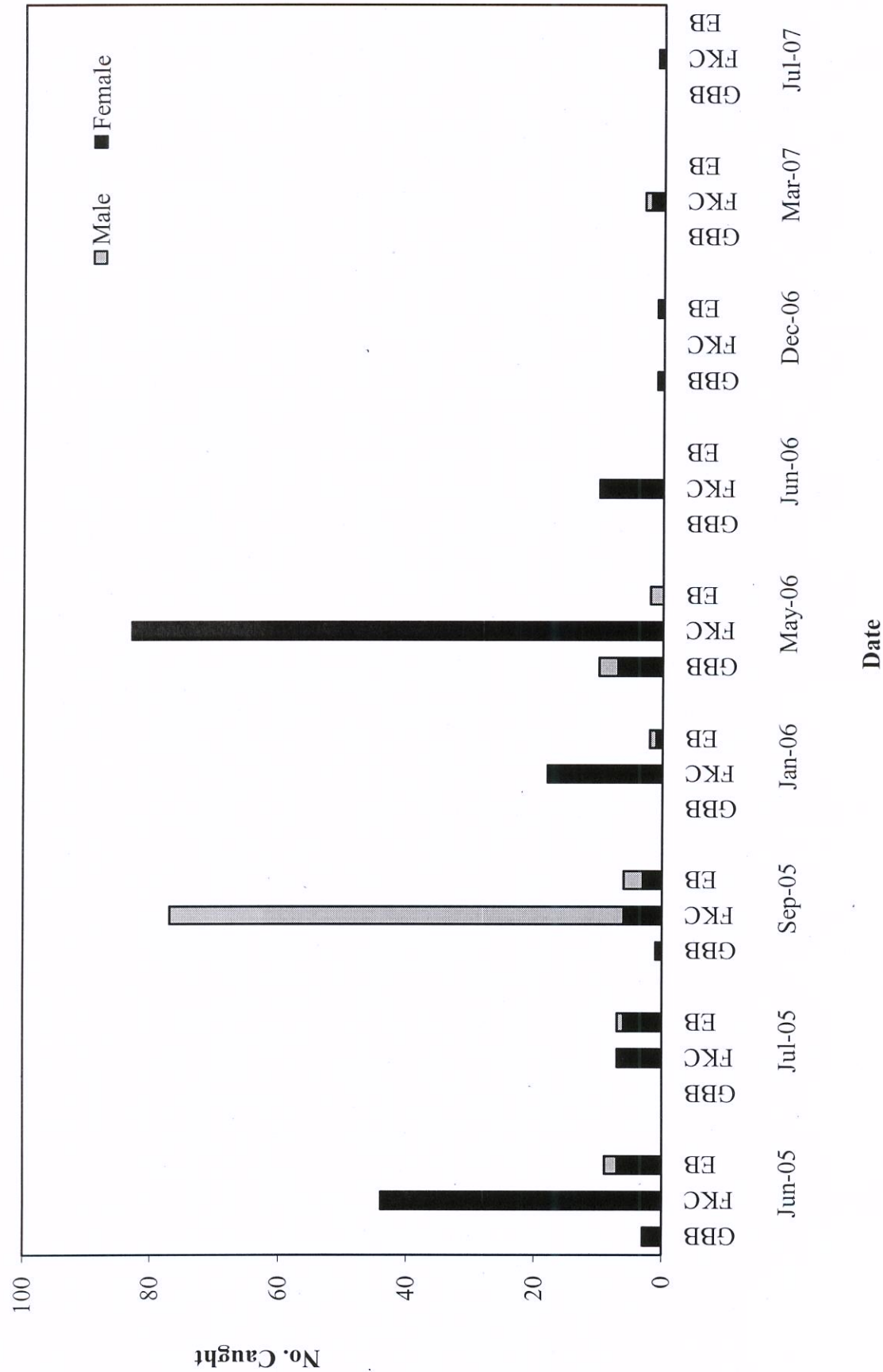
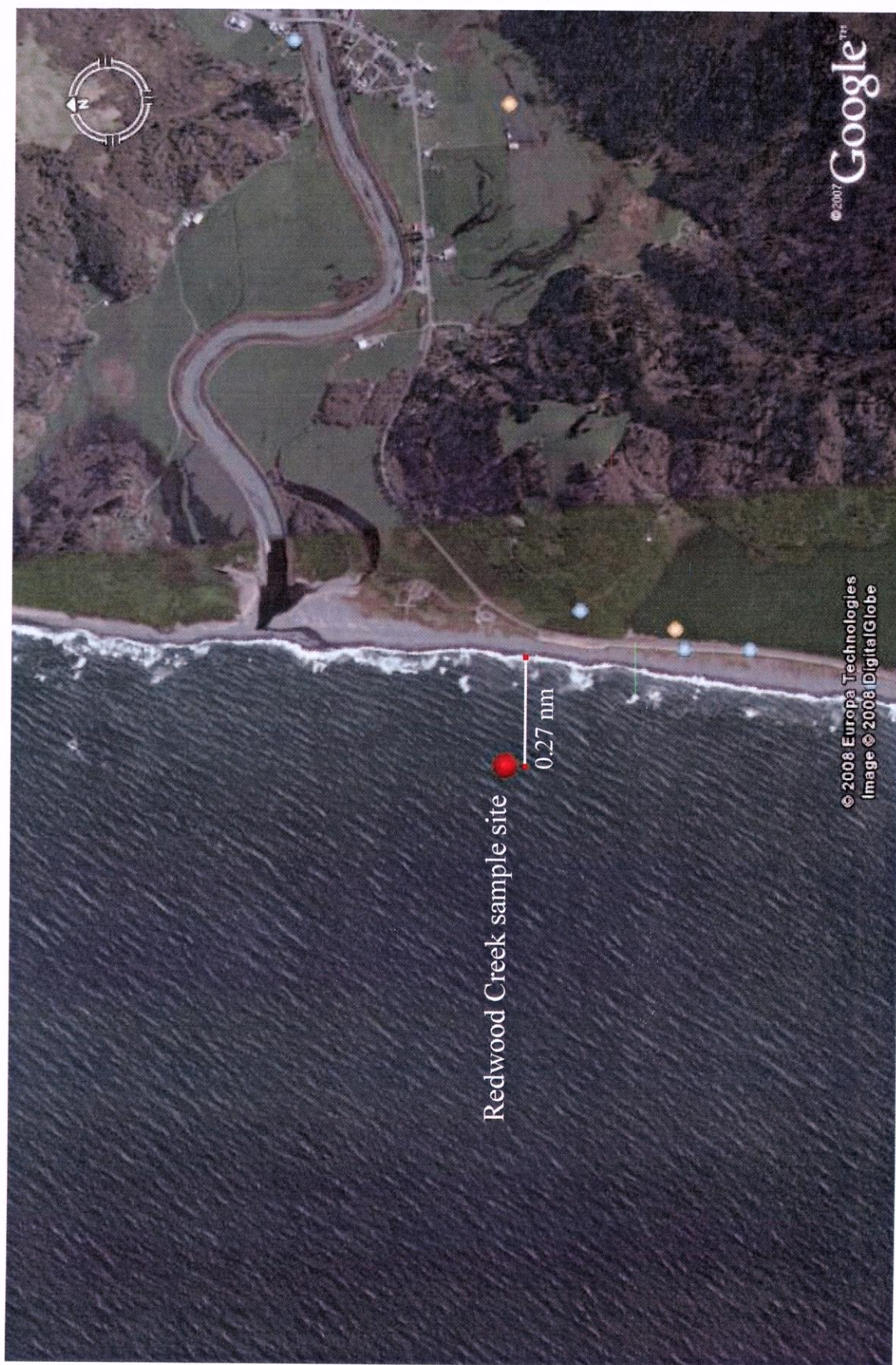


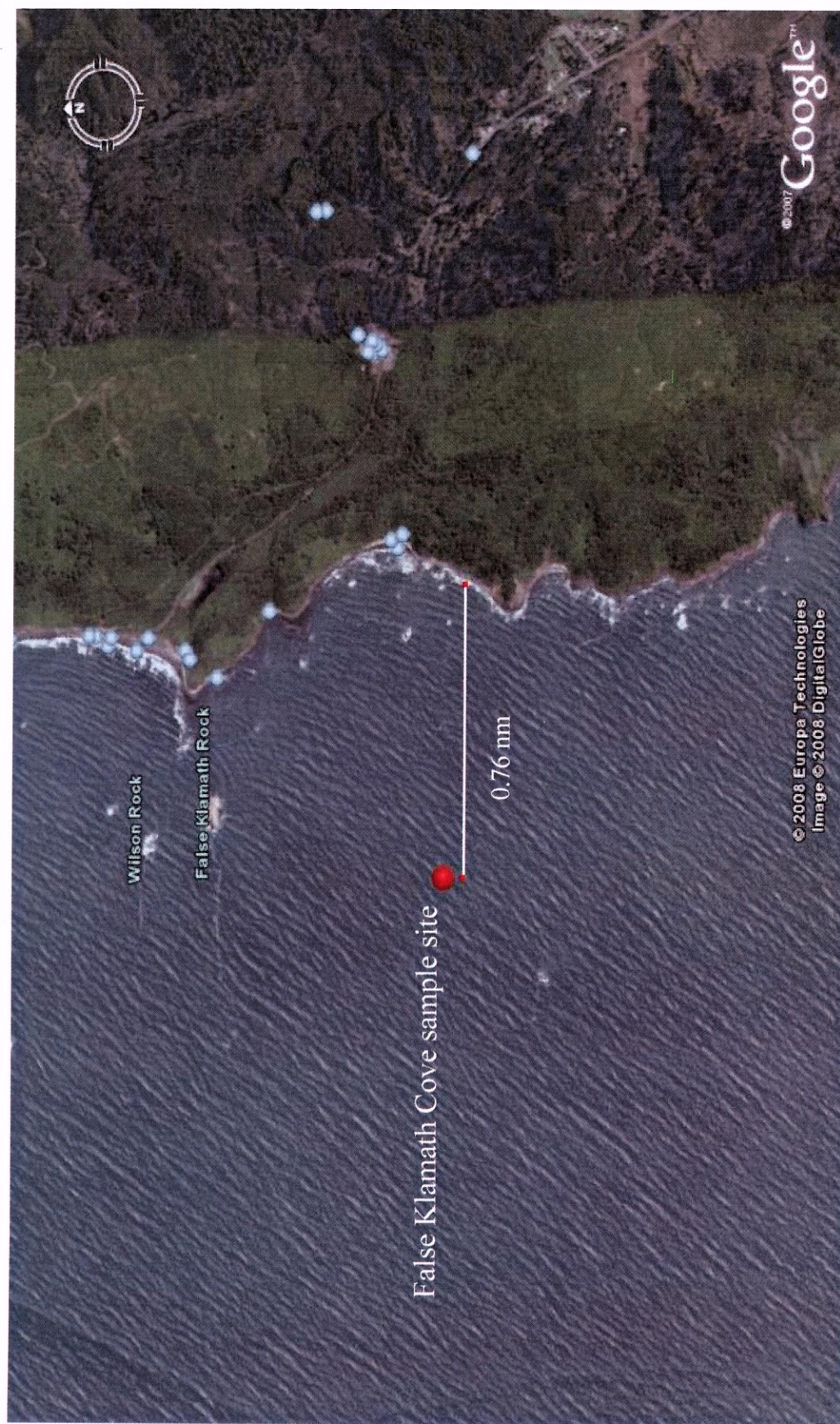
Figure 3. Abundances and sex ratios of adult dungeness crab, *Cancer magister*, collected by trawling at three, sandy bottom subtidal sites off Redwood National and State Parks, Humboldt and Del Norte Counties, CA, 25 June 2005 to 15 July 2007. GBB = Gold Bluffs Beach; FKC = False Klamath Cove; EB = Enderb's Beach.



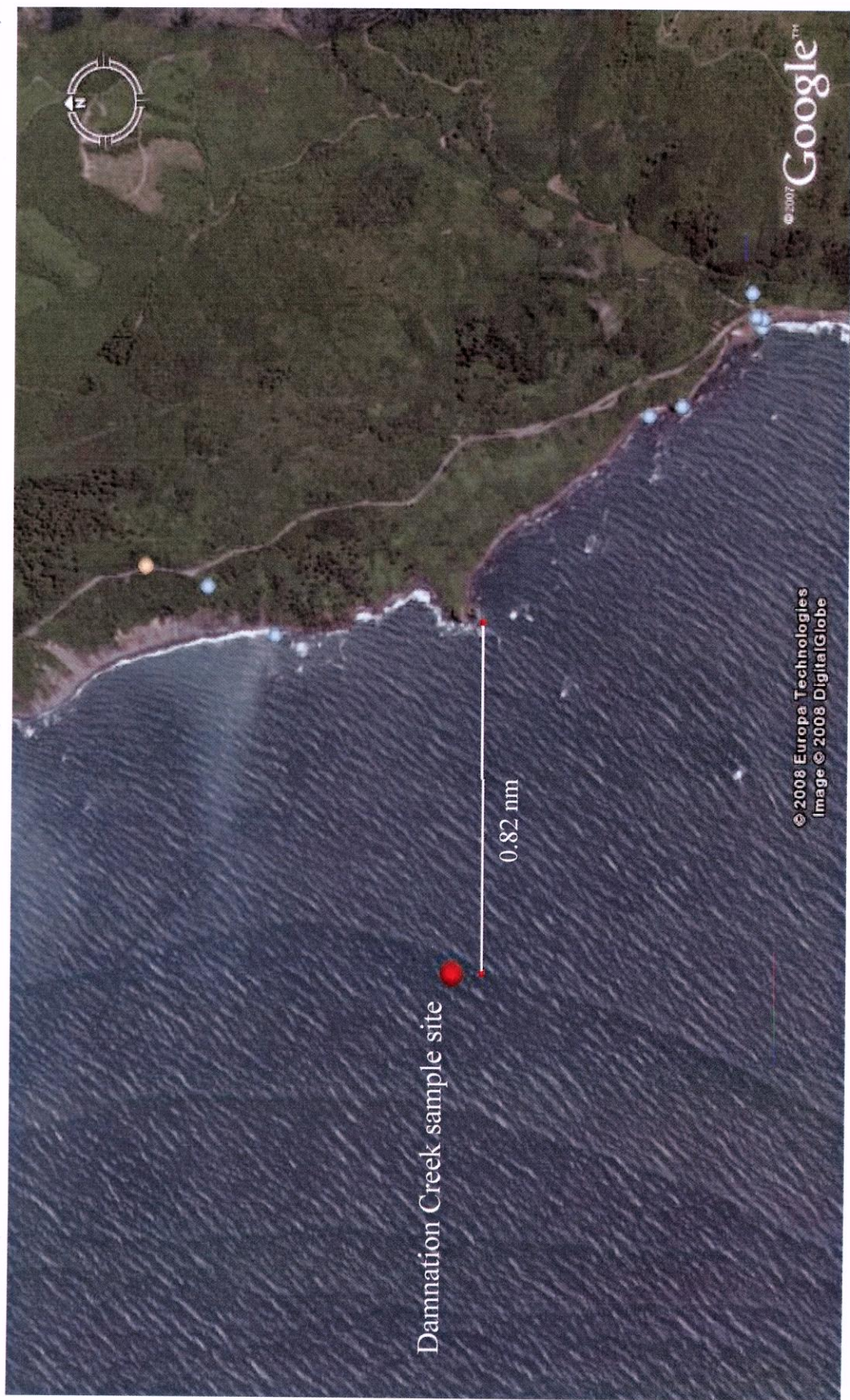
Appendix 1. Redwood Creek subtidal site off Redwood National and State Parks, Humboldt County, CA. Sampled 31 July 2005 to 15 July 2007. nm = nautical mile. GPS = N 41° 17' 42", W 124° 06' 34".



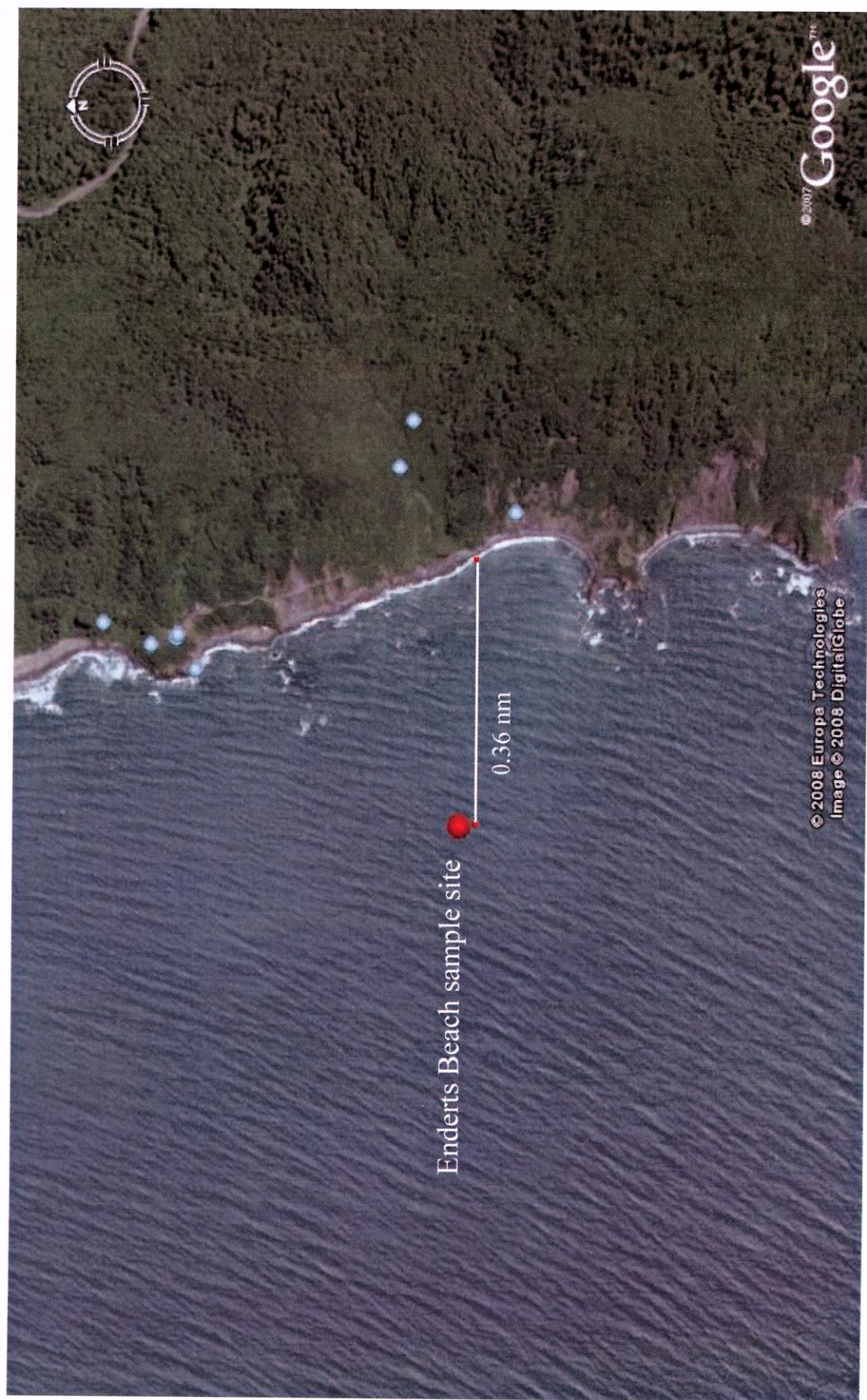
Appendix 2. Gold Bluffs Beach subtidal site off Redwood National and State Parks, Humboldt County, CA. Sampled 25 June 2005 to 15 July 2007. nm = nautical mile. GPS = N 41° 22' 10", W 124° 05' 80".



Appendix 3. False Klamath Cove subtidal site off Redwood National and State Parks, Del Norte County, CA. Sampled 25 June 2005 to 15 July 2007. nm = nautical mile. GPS = N 41° 35' 40", W 124° 07' 61".



Appendix 4. Damnation Creek subtidal site off Redwood National and State Parks, Del Norte County, CA. Sampled 31 July 2005 to 15 July 2007. nm = nautical mile. GPS = N 41° 37' 40", W 124° 08' 65".



Appendix 5. Enderts Beach subtidal site off Redwood National and State Parks, Del Norte County, CA. Sampled 25 June 2005 to 15 July 2007. nm = nautical mile. GPS = N 41° 42' 59", W 124° 09' 46".