

Cruise Report

**NOAA Ship McArthur II Cruise AR-03-01-NC
(June 1 - 26, 2003)**

EMAP Summer 03 Survey of Ecological Conditions of the Western U.S.
Continental Shelf

August 2003

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NOAA

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION



National Ocean Service

National Centers for Coastal Ocean Science

Center for Coastal Environmental Health and Biomolecular Research

Preface

This cruise report is a summary of field work conducted in near-coastal waters (30-120 m) along a major portion of the U.S. western continental shelf, from the Straits of Juan de Fuca in Washington State to Pt. Conception in California, June 1 - 26, 2003, on NOAA Ship McArthur II AR-03-01-NC. For the present research, representatives of NOAA (including NOS/NCCOS, NOAA's National Marine Sanctuaries Program, and National Marine Fisheries Service), EPA, and partnering west coast states (AL, WA, OR, CA) have combined efforts to carry out a joint survey of ecological condition of aquatic resources in near-coastal waters along the U.S. western continental shelf, using multiple indicators of ecological condition. This study is an expansion of EPA's Environmental Monitoring and Assessment Program (EMAP), which seeks to assess condition of the Nation's environmental resources within a variety of resource categories. A total of one hundred and forty-six (146) stations were successfully sampled during the cruise. The primary focus of the cruise was on the collection of bottom sediment samples for the analysis of benthic macroinfaunal community structure and measurement of concentrations of chemical contaminants in sediments (metals, pesticides, PCBs, PAHs); characterization of general habitat conditions (water depth, dissolved oxygen, conductivity, temperature, chlorophyll A, light transmittance, water-column nutrients, % silt-clay versus sand content of sediment, organic-carbon content of sediment); and collection of selected demersal fish species by hook-n-line to evaluate condition (contaminant body burdens and visual evidence of pathological disorders).

The field work described herein was conducted by scientists and staff from the following organizations:

- NOAA, National Ocean Service, National Centers for Coastal Ocean Science, Center for Coastal Environmental Health and Biomolecular Research, Charleston, SC.
- Environmental Protection Agency, Western Ecology Division, Newport, OR.
- State of Washington, Department of Ecology, Olympia, WA.
- State of Oregon, Department of Environmental Quality, Portland, OR.
- Alaska Department of Environmental Conservation.
- Moss Landing Marine Lab, Moss Landing, CA.
- NOAA, Office of Marine and Aviation Operations, NOAA Ship McARTHUR II.

Funding for this project (to cover supplies, equipment, sample processing, etc.) is provided primarily through the U.S. Environmental Protection Agency, Office of Research and Development. NOAA'S Marine and Aircraft Operations (NMAO) provided the research ship (NOAA Ship McARTHUR II).

Additional copies of this cruise report can be obtained by contacting:

1. NOAA, NOS, National Centers for Coastal Ocean Science, Center for Coastal Environmental Health and Biomolecular Research, 219 Fort Johnson Road, Charleston, South Carolina, 29412, Telephone: 843/762-8511. Attention: Cynthia Cooksey.

1.0 Introduction

Both NOAA and EPA perform a broad range of research and monitoring activities to assess potential effects of human activities on the health of coastal ecosystems and to promote the use of this information in protecting and restoring the Nation's coastal resources. Where possible the two agencies have sought to coordinate related activities, and form partnerships with states and other institutions, to prevent duplications of effort and bring together complementary resources to fulfill common research and management goals. Accordingly, in summer 2003, NOAA, EPA, and partnering west coast states (WA, OR, CA, AL) have combined efforts to conduct a joint survey of ecological condition of aquatic resources in near-coastal waters along the U.S. western continental shelf, using multiple indicators of ecological condition. The study is an expansion of EPA's Environmental Monitoring and Assessment Program (EMAP), which seeks to assess condition of the Nation's environmental resources within a variety of resource categories. The coastal component of EMAP on the west coast of the U.S. began in 1999 with a focus in estuaries. The current survey extends this work to near-coastal shelf waters (30-120 m).

This survey involved the cooperation of numerous organizations. NOAA'S Marine and Aircraft Operations (NMAO) provided the research ship (NOAA Ship McARTHUR II). Funds for the project (to cover supplies, equipment, sample processing, etc.) are provided primarily by the U.S. Environmental Protection Agency, Office of Research and Development. Representatives of the NOAA/National Ocean Service's National Centers for Coastal Ocean Science (NCCOS) and National Marine Sanctuary Program (NMSP) participated on the cruise as members of the scientific staff. The Northwest Fisheries Science Center of NOAA's National Marine Fisheries Service (NMFS) provided field support and analysis of fish pathologies through a cooperative agreement with EPA. State partners included Washington Dept. of Ecology, Oregon Dept. of Environmental Quality, Alaska Department of Environmental Conservation, and the Southern California Water Resources Research Project (SCCWRP). Moss Landing Marine Laboratories (MLML) provided field crews for collection of samples in California waters under contract to SCCWRP.

The environmental condition indicators sampled in this survey include measures of: (1) general habitat condition (depth, salinity, temperature, pH, total suspended solids, sediment characteristics); (2) water quality indicators (chlorophyll a, nutrients); (3) pollutant exposure indicators (dissolved oxygen concentration, sediment contaminants, fish tissue contaminants); and (4) benthic condition indicators (diversity and abundance of benthic infaunal species, fish pathological anomalies). Sampling was conducted at approximately 50 stations each in shelf waters (30-120 m) along the coasts of WA, OR, and CA (total of 150 stations). Note, however, that 146 of these stations, from Straits of Juan de Fuca, WA to Pt. Conception, CA, were sampled on this cruise and the remaining four stations (below Pt. Conception, CA) will be picked up by another cruise as part of the companion "Bight 03" study led by SCCWRP. The Bight 03 study will be assessing condition in the shelf region between Pt. Conception and the Mexican border using similar methods and indicators. Bight 03 data will be integrated with data from the present survey to provide the overall assessment of condition of the continental shelf for California. The present survey also includes an assessment of condition in the five NOAA west-coast National Marine Sanctuaries (Olympic, Cordell Banks, Gulf of Farallones, Monterey Bay, and Channel Islands) as compared to non-sanctuary areas of the shelf.

2.0 Scientific Approach

Sampling activities occurred round-the-clock. At each station, samples were obtained for characterization of: (1) community structure and composition of benthic macroinfauna (> 1.0 mm); (2) concentration of chemical contaminants in sediments (metals, pesticides, PCBs, PAHs); (3) general habitat conditions (water depth, dissolved oxygen, conductivity, temperature, chlorophyll A, light transmittance, water-column nutrients, % silt-clay versus sand content of sediment, organic-carbon content of sediment); and (4) condition of selected demersal fish species caught by hook-n-line (contaminant body burdens and visual evidence of pathological disorders).

Sediment sampling was undertaken using a custom-designed van Veen grab. The sampling device is composed of two 0.1m² samplers, joined together in a L/R frame. The unit is 60 inches high, 42 inches in diameter and weighs 450 pounds with its full complement of (four 50 pound) stainless-steel weights. Sample material will be used for analysis of macroinfaunal communities, concentration of sediment contaminants, % silt-clay, and organic-carbon content. Three grab samples were required at the majority of stations to acquire adequate sediment (approximately 2 liters) for both benthic infauna (1 replicate grab) and chemistry sample processing. A grab sample was deemed successful when the grab unit was >75% full (with no major slumping). The benthic samples were sieved onboard through 1.0-mm (WA, OR) or 0.5mm (CA) screens and preserved in 10% buffered formalin.

A Seabird 9/11 CTD unit, supplied by the NOAA ship McArthur II, was used to acquire profiles of conductivity, temperature, chlorophyll-a concentration, transmissivity, dissolved oxygen, and depth. The unit was also equipped with 12 Niskin bottles to acquire discrete water samples at three designated water depths: 0.5m below sea surface, mid-water column, and 0.5m off seabed. Continuous profiles of conductivity, temperature, dissolved oxygen, chlorophyll (fluorometer), transmissivity, and depth were recorded during the descent and ascent of the unit. Discrete water samples were processed for nutrients, total suspended solids, and chlorophyll.

Hook-and-line fishing methods (up to six fishing rods) were used in an effort to capture bottom fish for inspection of external pathologies and for subsequent analysis of chemical contaminants in tissues of selected species. Any captured fish were identified and inspected for gross external pathologies. Selected species, primarily the Pacific sanddab (*Citharichthys sordidus*), also were preserved for subsequent chemical contaminant body-burden analysis.

3.0 Sampling Logistics and Scientific Parties

Sampling for the EMAP 2003 west-coast shelf survey was conducted on NOAA ship McArthur II, Cruise AR-03-01-NC, June 1-26, 2003. The cruise consisted of three legs: Leg 1 along the Washington coast (Seattle to Astoria, OR, June 1-8); Leg 2 along the Oregon coast (Astoria, OR to Eureka, CA, June 8-16; and Leg 3 along the California coast, from the Oregon border to Pt. Conception (Eureka, CA to Pt. Conception and back to San Francisco, CA, June 18-26). Samples were collected from the deck of the McArthur II around-the-clock. A summary of

scientific parties is given in Table 2. Individual cruise reports for each leg of the cruise are located in Appendix A.

4.0 Preliminary Results

A total of 146 stations from the Straits of Juan de Fuca, WA to Pt. Conception, CA were successfully sampled as part of Cruise AR-03-01-NC (Figure 1, Table 1). Of those 146 stations, 57 occurred within National Marine Sanctuary (NMS) boundaries including 30 in the Olympic Coast NMS, 12 in the Gulf of Farallones NMS, 14 in Monetary Bay NMS, and one in Cordell Bank NMS. All in-situ measurements and records of sampling were recorded on standard field sheets.

Water depths ranged from 29 – 122 m and a variety of bottom types were encountered among the various stations. Along the Pacific coastline of Washington, the seabed was mostly fine sand, with a higher incidence of silt and clay in water depths greater than 60 m. Five stations were unsamplable due to the presence of hard bottom and thus were replaced with reserve sites. Three of these unsamplable stations were in the Straits of Juan de Fuca, which was found to be an unsamplable area overall within the scope of Coastal EMAP operations and objectives. Thus, these three stations were replaced with reserve sites along the Pacific coastline outside the Straits of Juan de Fuca. Along the Oregon coastline, fine sand was also the most common seabed lithology. The sediment collected during the California leg of the cruise was highly variable and included both fine sands and silty sediments. Two targeted stations along the California coastline had to be abandoned due to rocky conditions and replaced with reserve stations.

Collection of targeted flatfish was successful at 48 of 146 sampled stations. Species collected include Pacific sanddab (*Citharichthys sordidus*), speckled sanddab (*Citharichthys stigmaeus*), butter sole (*Isopsetta isolepis*), and dover sole (*Microstomus pacificus*). No fish were collected that exhibited gross evidence of pathological disorders. Fish samples will be analyzed for presence of chemical contaminants.

5.0 Acknowledgements

Funding for this project (to cover supplies, equipment, sample processing, etc.) is provided primarily through the U.S. Environmental Protection Agency, Office of Research and Development.

All members of all three field crews (see Table 2 for lists) are commended for their high level of technical expertise, teamwork and dedication to getting the required sampling completed. Special appreciation also is extended to the officers and crew of the NOAA ship McArthur II for the superb job performed on AR-03-01-NC.

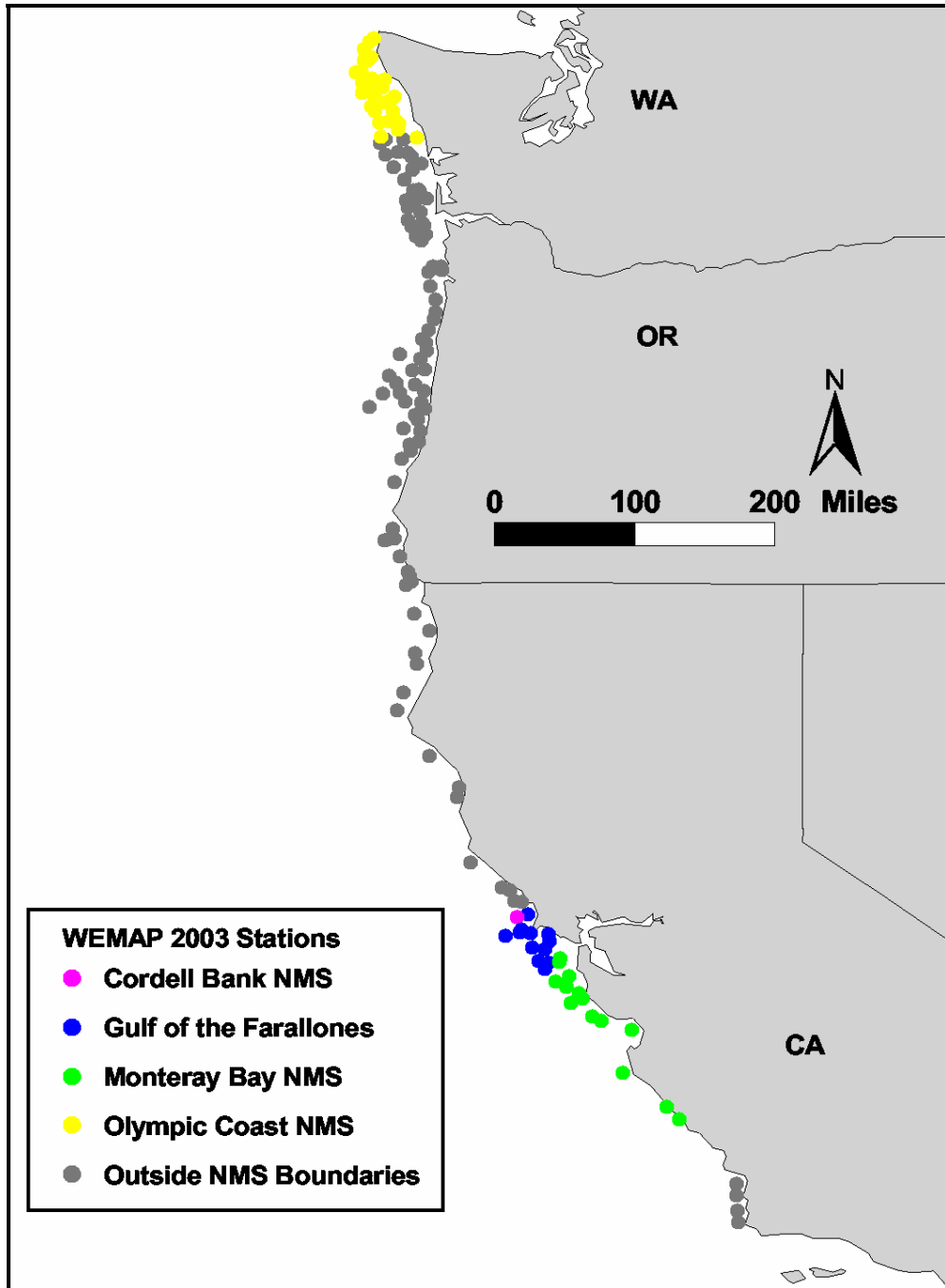


Figure 1. Study area and sampling sites for EMAP 2003 survey of ecological conditions of the western U.S. continental shelf (NOAA Ship McArthur II Cruise AR-03-01-NC).

Table 1. Locations of stations successfully sampled during the EMAP 2003 survey of ecological conditions of the western U.S. continental shelf.

Site ID	State	Sanctuary	Latitude - Decimal Degrees	Longitude - Decimal Degrees
3002	WA	Olympic Coast NMS	47.818267	-124.643973
3006	WA		46.981284	-124.508145
3010	WA	Olympic Coast NMS	47.556611	-124.645791
3014	WA		46.664219	-124.431448
3015	WA	Olympic Coast NMS	47.312937	-124.491338
3018	WA	Olympic Coast NMS	48.043630	-124.886457
3022	WA		47.125615	-124.439118
3023	WA	Olympic Coast NMS	47.327732	-124.711330
3026	WA		47.085254	-124.699983
3030	WA		46.289195	-124.246230
3031	WA	Olympic Coast NMS	48.075192	-124.798558
3034	WA	Olympic Coast NMS	47.914127	-124.909202
3038	WA	Olympic Coast NMS	47.245251	-124.502828
3042	WA	Olympic Coast NMS	48.301223	-124.768879
3046	WA		46.428976	-124.291791
3050	WA	Olympic Coast NMS	47.619889	-124.539575
3054	WA		46.549379	-124.264758
3055	WA	Olympic Coast NMS	47.352209	-124.531579
3058	WA		46.780523	-124.344158
3063	WA	Olympic Coast NMS	47.739239	-124.829064
3066	WA	Olympic Coast NMS	47.778813	-124.752040
3070	WA		46.812694	-124.549307
3074	WA	Olympic Coast NMS	48.252689	-124.813821
3078	WA		46.845432	-124.240101
3079	WA	Olympic Coast NMS	47.462054	-124.755178
3082	WA	Olympic Coast NMS	47.721494	-124.682220
3087	WA	Olympic Coast NMS	47.455371	-124.559719
3090	WA		46.946824	-124.641856
3094	WA		46.527625	-124.262354
3095	WA	Olympic Coast NMS	47.666653	-124.901915
3098	WA	Olympic Coast NMS	47.901079	-124.964785
3102	WA		47.125027	-124.641700
3103	WA	Olympic Coast NMS	47.160642	-124.691686
3110	WA		46.416678	-124.407388
3111	WA	Olympic Coast NMS	48.034647	-124.844826
3114	WA	Olympic Coast NMS	47.620117	-124.754914
3119	WA	Olympic Coast NMS	47.331796	-124.616268
3122	WA		46.932378	-124.357325
3127	WA	Olympic Coast NMS	47.793501	-124.897264
3130	WA	Olympic Coast NMS	47.833364	-124.786493
3138	WA	Olympic Coast NMS	48.174961	-124.879267

Site ID	State	Sanctuary	Latitude - Decimal Degrees	Longitude - Decimal Degrees
3142	WA		46.768866	-124.345054
3143	WA	Olympic Coast NMS	47.508574	-124.796183
3152	WA	Olympic Coast NMS	47.780752	-124.850136
3160	WA	Olympic Coast NMS	47.566698	-124.597913
3180	WA		46.448055	-124.176705
3204	WA	Olympic Coast NMS	47.147620	-124.289437
3208	WA		46.973516	-124.392028
3244	WA		46.336713	-124.392720
3260	WA		46.531452	-124.329729
3003	OR		42.506108	-124.541833
3004	OR		45.957509	-124.242794
3005	OR		44.190514	-124.485548
3009	OR		44.818711	-124.234404
3011	OR		42.013436	-124.351929
3013	OR		44.009688	-124.206969
3017	OR		43.787973	-124.436761
3020	OR		45.660124	-124.110233
3021	OR		44.588694	-124.248927
3025	OR		44.032618	-124.825024
3029	OR		42.119409	-124.398336
3033	OR		43.519339	-124.364318
3036	OR		46.131623	-124.215088
3037	OR		44.458770	-124.344915
3041	OR		45.041504	-124.100382
3045	OR		45.421071	-124.140875
3049	OR		45.266639	-124.087738
3053	OR		44.645315	-124.483138
3057	OR		44.315642	-124.518107
3061	OR		42.302312	-124.474638
3062	OR		46.003450	-124.302694
3065	OR		43.162977	-124.538300
3067	OR		42.497163	-124.620888
3068	OR		46.118992	-124.351716
3069	OR		44.469128	-124.208309
3073	OR		44.923950	-124.161850
3077	OR		43.933335	-124.314492
3081	OR		43.750213	-124.254248
3084	OR		45.621469	-124.011261
3085	OR		44.685148	-124.186426
3089	OR		44.291723	-124.307433
3093	OR		42.076815	-124.372554
3097	OR		43.597514	-124.378839
3100	OR		46.192015	-124.387400
3101	OR		44.385870	-124.598683

Site ID	State	Sanctuary	Latitude - Decimal Degrees	Longitude - Decimal Degrees
3105	OR		44.187407	-124.675946
3109	OR		45.589798	-124.164250
3113	OR		45.135097	-124.082770
3117	OR		44.078171	-124.237625
3121	OR		44.092474	-124.425498
3125	OR		42.624344	-124.568954
3126	OR		46.031822	-124.194271
3129	OR		43.436872	-124.464810
3131	OR		42.484438	-124.652751
3132	OR		46.163754	-124.230948
3133	OR		44.222571	-124.215383
3137	OR		44.779995	-124.192071
3141	OR		43.887535	-124.284110
3145	OR		43.621162	-124.264848
3148	OR		45.654543	-124.022030
3007	CA	Gulf of the Farallones NMS	38.155878	-123.056782
3008	CA	Monterey Bay NMS	37.248410	-122.492510
3012	CA	Monterey Bay NMS	37.650299	-122.705268
3019	CA		39.991533	-124.152511
3024	CA	Gulf of the Farallones NMS	37.598560	-122.823446
3027	CA		38.441274	-123.257062
3028	CA	Gulf of the Farallones NMS	37.944767	-123.144153
3032	CA		34.907021	-120.735225
3035	CA		39.508864	-123.838953
3039	CA		38.314825	-123.204369
3040	CA	Monterey Bay NMS	37.375375	-122.749705
3043	CA		40.727740	-124.439728
3044	CA	Gulf of the Farallones NMS	37.940263	-123.026322
3048	CA		34.588927	-120.717946
3051	CA		41.636723	-124.321329
3052	CA	Gulf of the Farallones NMS	37.910331	-123.307825
3056	CA	Gulf of the Farallones NMS	37.524744	-122.873907
3059	CA		38.464882	-123.347762
3060	CA	Monterey Bay NMS	36.822522	-121.900529
3064	CA	Monterey Bay NMS	35.781312	-121.373013
3071	CA		38.295649	-123.121132
3072	CA	Monterey Bay NMS	37.314571	-122.628403
3075	CA		40.517860	-124.514154
3076	CA	Gulf of the Farallones NMS	37.747275	-122.873096
3083	CA		41.440823	-124.149610
3088	CA	Monterey Bay NMS	37.610439	-122.712917
3091	CA		38.762050	-123.699802
3092	CA	Monterey Bay NMS	36.924242	-122.239064
3096	CA		35.042049	-120.737914

Site ID	State	Sanctuary	Latitude - Decimal Degrees	Longitude - Decimal Degrees
3099	CA		39.624122	-123.825635
3104	CA	Monterey Bay NMS	37.442880	-122.594220
3112	CA		34.724005	-120.728665
3116	CA	Gulf of the Farallones NMS	37.622710	-122.933174
3120	CA	Monterey Bay NMS	36.320137	-122.007249
3123	CA	Gulf of the Farallones NMS	37.925776	-122.834976
3124	CA	Monterey Bay NMS	37.126422	-122.574888
3128	CA	Monterey Bay NMS	35.931036	-121.514803
3135	CA	Cordell Bank NMS	38.126771	-123.180424
3136	CA	Monterey Bay NMS	36.979325	-122.348985
3139	CA		41.969200	-124.407172
3140	CA	Gulf of the Farallones NMS	37.853246	-122.822132
3147	CA		41.184275	-124.311418
3157	CA	Gulf of the Farallones NMS	37.978685	-123.133636
3158	CA	Monterey Bay NMS	37.190103	-122.449691
3194	CA	Gulf of the Farallones NMS	37.772922	-123.010551
3289	CA		41.059053	-124.296699

Table 2. Scientific crew for EMAP 2003 survey of ecological conditions of the western U.S. continental shelf. * - indicates Chief Scientist.

Cruise Leg	Name	Affiliation
Leg 1 – Washington	June 1 – June 7, 2003	
	Sarah Wilson*	WA Dept. of Ecology
	Julia Bos	WA Dept. of Ecology
	Ed Bowlby	Olympic Coast National Marine Sanctuary
	Jon Buzitis	NOAA/National Marine Fisheries Service
	Larry Caton	OR Dept. of Environmental Quality
	Ken Dzinbal	WA Dept. of Ecology
	Steve Hale	Environmental Protection Agency
	Shera Hickman	AK Dept. of Environmental Conservation
	Jeff Hyland	NOAA/National Ocean Service
	Noel Larson	WA Dept. of Ecology
	Valerie Partridge	WA Dept. of Ecology
	Dave Terpening	Environmental Protection Agency
Doc Thompson	Environmental Protection Agency	
Leg 2 – Oregon	June 8 – June 15, 2003	
	Larry Caton*	OR Dept. of Environmental Quality
	Aaron Borisenko	OR Dept. of Environmental Quality
	Greg Coffeen	OR Dept. of Environmental Quality
	Cindy Cooksey	NOAA/National Ocean Service
	Rusty Fairey	Moss Landing Marine Lab
	Won Kim	OR Dept. of Environmental Quality
	Peter Leinenbach	Environmental Protection Agency
	Greg McMurray	OR Dept. of Environmental Quality
	Sarah Miller	OR Dept. of Environmental Quality
	Greg Pettit	OR Dept. of Environmental Quality
	Steve Rumrill	South Slough Estuarine Reserve
	Andy Schaedel	OR Dept. of Environmental Quality
Leg 3 – California	June 18 – June 26, 2003	
	Rusty Fairey*	Moss Landing Marine Lab
	JD Dubick	NOAA/National Ocean Service
	Lorraine Edmond	Environmental Protection Agency
	Laura Gabanski	Environmental Protection Agency
	Matt Huber	Moss Landing Marine Lab
	Tom Kimball	Moss Landing Marine Lab
	Sara Lowe	San Francisco Estuary Institute
	Mark Pranger	Moss Landing Marine Lab
	Bruce Thompson	San Francisco Estuary Institute
	Tamara Vos	Moss Landing Marine Lab
	Susan Wainwright	NOAA Teacher at Sea Program (volunteer)

Appendix A

Individual Cruise Leg Reports:
Washington, Oregon, California

Coastal EMAP 2003 Offshore Sampling Washington State Cruise Report NOAA Ship *McArthur II*

1. Cruise Operations

NOAA Ship *McArthur II* was mobilized at NOAA's Lake Union facility May 28th & 29th 2003. The vessel sailed to begin EMAP cruise operations at 09:00hrs June 1st. She passed through the Lake Union/Puget Sound lock system and transited for five hours to reach the first sample site at the eastern end of the Strait of Juan de Fuca. Sampling operations began at 16:00hrs June 1st.

Three stations in the Strait of Juan de Fuca proved unsamplable under EMAP protocols: stations WA03-3106, WA-03-3146 and WA03-3047 fell in seabed composed of coarse gravel, cobbles and rock fragments. It proved impracticable to collect adequate sediment for chemical analysis at any of these stations and they were abandoned. CTD downtime was experienced throughout this period (telemetry problems), but no vessel/operational downtime occurred as sites were rejected on the basis of grab sampling operations. Acquisition at alternate/reserve stations was not attempted in the Strait of Juan de Fuca for four reasons: the strait has a high energy bottom regime and it was presumed that alternate stations would have similar seabed lithology to the three primary sites; alternate stations fell close to the Traffic Separation Scheme (a safety issue for a vessel operating at night time); alternate stations fell close to in-service submarine cables; at this early stage of the EMAP cruise – with no idea of overall progress rates – it was deemed appropriate that operations progress southwards in a timely fashion.

The vessel proceeded to the first station on the open continental shelf and successful sampling began at 06:00hrs June 2nd. Thirteen stations were sampled on June 2nd, fourteen on June 3rd, thirteen on June 4th and the final ten Washington stations on June 5th. Two stations (WA03-3150 & WA03-3086) were abandoned on June 3rd - the seabed at both sites was composed of coarse gravel/cobbles and it was impossible to obtain adequate sediment. Both stations were replaced effectively with the nearest reserve site (WA03-3204 & WA03-3208 respectively).

In order to acquire the full complement of fifty stations in Washington, three alternate stations were sampled north and northwest of the Columbia River outfall. An area of special interest was designated and the first three alternate stations (in sequential number order) were sampled inside this box. The box was defined by the coastline of Long Beach Peninsula to the east, a northerly latitude of 46°35'N, a southerly latitude of 46°20'N and the 120m isobath at the shelf break to the west. (Alternate stations sampled were WA03-3180, WA03-3244 and WA03-3260).

Grab sampling, CTD and fishing operations proved very successful, with no appreciable equipment downtime logged for any method. The side-scan sonar was deployed once and worked well, but its use proved unsafe because the A-frame's hydraulic power unit (HPU) was not equipped with a heat exchanger. (Note – the side-scan sonar's winch was plumbed into the A-frame's hydraulic system). Hydraulic fluid temperature rose to 280°F and the system began to smoke. The fluid took two hours to cool adequately, during which time the A-frame was non-operational. The side-scan sonar was demobilized in Astoria.

Fishing was successful at twenty-one stations, being notably dependent on water depth. Water depths less than 80m were generally fished quite easily with hook and line; deeper water proved less productive.

Washington's sampling operations were completed at 18:45hrs June 5th, two days ahead of schedule. All parties onboard had previously decided to use this contingency to begin Oregon's sampling. The vessel transited south overnight to a point offshore from Nedonna Beach. The plan was to acquire eleven stations in a northwards direction, back towards Astoria, in preparation for the state/crew change. Sampling of the first Oregon station began at first light June 6th, with completion of the eleventh station at 22:30hrs that same day. The Washington leg of the 2003 Coastal EMAP cruise ended at 11:30hrs June 7th when the vessel came alongside in Astoria for its scheduled crew change.

2. Sample & Station Information

See also *Table 1 – Washington Sample Site Summary Information*

Fifty-five stations were sampled in Washington, with five sites rejected due to hard bottom (coarse sediment, cobbles/rock and inadequate samplable sediment). Sediment for chemical and benthic infauna analyses was acquired at each of the fifty successfully sampled stations. Discrete water samples, for chemical analyses, were acquired at forty-nine stations and at all three EMAP-designated depths (surface, mid-water column and bottom). The fiftieth station, WA03-3042, is missing a sample for the bottom depth. In addition, a bottom water sample was taken at abandoned station WA03-3047 in the Strait of Juan de Fuca.

Conductivity, temperature, depth, transmissivity, chlorophyll-*a* concentration and dissolved oxygen values were acquired during CTD casts at fifty-three stations. (CTD cast data exists for three of the five abandoned stations – WA03-3047, WA03-3146, WA03-3150).

Fish were collected at twenty-one stations, and most stations caught the EMAP-suggested number of five bottom fish for tissue composites. Of the total number of ninety-five fish collected, eighty-eight were Pacific Sand-dab, six were Butter Sole and one was Dover Sole.

Water depths ranged from 29m to 122m. Seabed lithology was mostly fine sand in water depths less than 60m, with a higher incidence of silt and clay in water depths greater than 60m. The occurrence of hard bottom (gravel, cobbles and shell hash) was apparently isolated and unrelated to water depth. In-situ (sediment) porewater salinities generally ranged from 33ppt to 35ppt; five stations had salinities less than 33ppt and only one had salinity greater than 35ppt. Seawater pH ranged from 7.60 to 8.41 and – at all but one station – always decreased with depth.

Abandoned stations:

1. WA03-3106 – hard bottom, Strait of Juan de Fuca
2. WA03-3146 – hard bottom, Strait of Juan de Fuca
3. WA03-3047 – hard bottom, Strait of Juan de Fuca
4. WA03-3150 – hard bottom, open shelf
5. WA03-3086 – hard bottom, open shelf

Replacement stations:

1. WA03-3180 – open shelf, Columbia River area of special interest
2. WA03-3244 – open shelf, Columbia River area of special interest
3. WA03-3260 – open shelf, Columbia River area of special interest
4. WA03-3204 – open shelf
5. WA03-3208 – open shelf

Table 1 – Washington Sample Site Summary Information

	EMAP Station ID	Sed Chem	Infauna	CTD Cast	Discrete Water Samples	Fish	# Fish	Water Depth (m)	Sed Lithol	Comments
1	WA03-3002	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			32	fS	
2	WA03-3006	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	5	73	si Cl	Pacific Sand-dab. Replicate for sediment chemistry - REP3
3	WA03-3010	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	5	60	fS	Pacific Sand-dab
4	WA03-3014	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			88	cl S	
5	WA03-3015	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1	47	S	Pacific Sand-dab
6	WA03-3018	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	5	60	fS	Pacific Sand-dab
7	WA03-3022	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			54	S	
8	WA03-3023	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			116	si Cl	
9	WA03-3026	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			104	si Cl	
10	WA03-3030	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			61	s Si	
11	WA03-3031	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	5	31	fS	Pacific Sand-dab. Replicate for sediment chemistry - REP1
12	WA03-3034	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	3	90	fS	Pacific Sand-dab
13	WA03-3038	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			54	S	
14	WA03-3042	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	5	32	fS	Pacific Sand-dab. No discrete water sample for bottom depth
15	WA03-3046	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1	61	fS	Pacific Sand-dab
16	WA03-3047			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			56	Mixed	Station abandoned - hard bottom. Discrete water sample for bottom depth only
17	WA03-3050	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	10	30	fS	5 Pacific Sand-dab, 5 Butter Sole
18	WA03-3054	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			56	Cl	
19	WA03-3055	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	5	52	fS	Pacific Sand-dab
20	WA03-3058	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			59	S	
21	WA03-3063	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			91	fS	

	EMAP Station ID	Sed Chem	Infauna	CTD Cast	Discrete Water Samples	Fish	# Fish	Water Depth (m)	Sed Lithol	Comments
22	WA03-3066	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			64	fS	
23	WA03-3070	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			96	si S	
24	WA03-3074	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	5	31	S	Pacific Sand-dab
25	WA03-3078	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	3	39	si S	Pacific Sand-dab
26	WA03-3079	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			108	si Cl	Replicate for sediment chemistry - REP2
27	WA03-3082	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			53	fS	
28	WA03-3086							61	G	Station abandoned - hard bottom
29	WA03-3087	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	5	44	sG	Pacific Sand-dab
30	WA03-3090	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			102	si Cl	
31	WA03-3094	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	2	54	fS	Pacific Sand-dab
32	WA03-3095	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			120	fS	
33	WA03-3098	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			106	Mixed	
34	WA03-3102	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			88	si cl S	
35	WA03-3103	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			103	si Cl	
36	WA03-3106							122	G, cobbles	Station abandoned - hard bottom
37	WA03-3110	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			97	s si Cl	
38	WA03-3111	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	5	47	fS	Pacific Sand-dab
39	WA03-3114	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			84	fS	
40	WA03-3119	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			81	si fS	
41	WA03-3122	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	5	48	cS	Pacific Sand-dab
42	WA03-3127	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			103	Mixed	
43	WA03-3130	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			67	fS	
44	WA03-3138	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	5	54	fS	Pacific Sand-dab
45	WA03-3142	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			60	S	
46	WA03-3143	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			113	si Cl	

	EMAP Station ID	Sed Chem	Infauna	CTD Cast	Discrete Water Samples	Fish	# Fish	Water Depth (m)	Sed Lithol	Comments
47	WA03-3146			<input checked="" type="checkbox"/>				82	cobbles	Station abandoned - hard bottom
48	WA03-3150			<input checked="" type="checkbox"/>				41	G, Ro	Station abandoned - hard bottom
49	WA03-3152	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			93	Mixed	
50	WA03-3160	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	6	45	fS	5 Pacific Sand-dab, 1 Butter Sole
51	WA03-3180	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	5	29	fS	Pacific Sand-dab
52	WA03-3204	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			98	S	
53	WA03-3208	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	5	50	S	Pacific Sand-dab
54	WA03-3244	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			109	si S	
55	WA03-3260	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	4	72	s si Cl	3 Pacific Sand-dab, 1 Dover Sole

Coastal EMAP 2003 Offshore Sampling Oregon State Cruise Report

NOAA Ship *McArthur II*

1. Cruise Operations

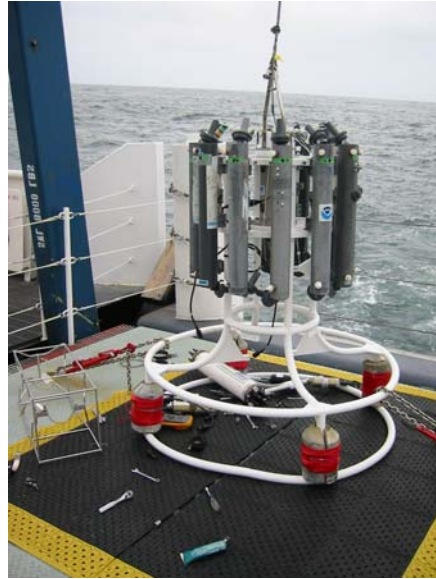
The NOAA Ship *McArthur II* completed its first leg of the Coastal EMAP 2003 Offshore Survey 1 day early and therefore docked around 11:30am on June 7th 2003 in Astoria, Oregon. This was due to the intense efforts from the Washington crew, all of whom have our gratitude for picking up eleven of our sampling stations. The scientific crew for the second leg, which consisted of scientists from Oregon DEQ, EPA, NOAA, California MLML, and OIMB, began mobilizing for the second leg June 8th.



Chief Scientist Larry Caton introducing OR's crew to the McArthur II.

The vessel set sail June 8th at 17:00 hrs. She took approximately 3 hours to reach the first station, OR03-3045 off of Cape Meares.

Upon reaching our first station we immediately had problems with the CTD. There was no communication between the CTD and the operator's computer in the 'Tree house'. In an effort to avoid getting behind schedule chief scientist, Larry Caton, decided that we would proceed with taking sediment grabs from the next three sites until the CTD could be fixed (OR03-3045, OR03-3049, OR03-3113). Repairs were finished by 10:00 hrs on June 9th. We then returned to the three stations that had only sediment samples collected and proceeded to conduct our water and fish tissue sampling. Once finished we returned to normal operations without further delay.



Following NOAA's required cruise safety protocols C.O. Craig Bailey conducted an abandon ship drill the afternoon of June 9th.

The drill went smoothly and we all learned the difficulties of donning our survival suits, although we still manage to have a good time.



The initial CTD problem was the only equipment failure experience during leg 2 of this cruise. Once the scientific crew became familiarized with the work, ship operations, and the ship's crew we quickly made up any time that we had lost while the CTD was down. Between June 8th, 22:30 hrs and June 14th, 02:30 hrs we sampled all 50 of Oregon's primary stations. On average the grab and CTD operations took approximately 45 minutes per site. We tried to dedicate approximately another 30-45 minutes to fishing depending on our fishing success and the site conditions. Usually we would leave station sooner than the 2 hour allotted time. This along with good weather put us

significantly ahead of schedule towards the end of the cruise, so as agreed we picked up 6 of California's stations down to station CA03-3075. We arrived in Eureka on June 15th in the late morning, one day early.



2. Sample & Station Information

See also *Table 1 – Oregon Sample Site Summary Information*

Oregon sampled all of its 50 primary stations. Sediment and water samples were collected at every station except at Station OR03-3025 where we were unable to collect an Infauna sample due to a semi-rocky substrate. Station depths ranged from 47 – 122 meters with the most common seabed lithology being fine sand. Conductivity, temperature, depth, transmissivity, chlorophyll-a concentration and dissolved oxygen measurements were acquired with the Seabird 911 (actual parameter results are pending the analysis of the Seabird files). Seawater pH measurements were collected from the water grab samples, it ranged from 7.2 – 8.5 decreasing with depth.

At 35 of our stations we failed to collect any fish tissue samples. Fishing was often difficult especially at night, in high currents, and at deep sites. Of the 15 stations with fish, 7 had



composites of 5 or more fish, and only 1 station had 2 target species. The primary species caught was the Pacific Sanddab. Secondary species included Butter Sole and Speckled Sanddab. These species were mostly caught at stations with sandy sediment composition at a depth less than 100 meters. We found that we had little success at sites with muddy sediment composition and we

usually only caught rock fish at our sites with a rocky sediment composition.

Although hook and line fishing did have some success we should have attempted trawling at most of our sites. We had the extra time and it would have produced more fish, a greater diversity of target species, and a larger range of age classes.

TABLE 1 – Oregon Sampling Summary

Station ID #	Station Name	Sample Date	Sediment - Chemistry	Sediment - Infauna	Water - Discrete	Water - Profile	Tissue - Chemistry	Comments
OR03-3003	Pacific Ocean 7.1 NM NW of Rogue river mouth	06/13/03	X	X	X	X	X	
OR03-3004	Pacific Ocean 13.3 NM SW of Seaside	06/06/03	X	X	X	X		
OR03-3005	Pacific Ocean 17.1 NM SW of Cape Perpetua	06/11/03	X	X	X	X		
OR03-3009	Pacific Ocean 7.1 NM W of Cape Foulweather	06/10/03	X	X	X	X		
OR03-3011	Pacific Ocean 5.4 NM S of Cape Ferrello	06/14/03	X	X	X	X		
OR03-3013	Pacific Ocean 2.8 NM SW of Siuslaw RiXer	06/12/03	X	X	X	X	X	
OR03-3017	Pacific Ocean 11.4 NM SW of Tahkenitch creek mouth	06/11/03	X	X	X	X		
OR03-3020	Pacific Ocean 8.1 NM SW of Cape Falcon	06/06/03	X	X	X	X		
OR03-3021	Pacific Ocean 8.9 NM SW of Yaquina Head	06/09/03	X	X	X	X	X	
OR03-3025	Pacific Ocean 30.5 NM SW of Heceta Head	06/11/03	X		X	X	X	No Infauna sample, only enough for chemistry.
OR03-3029	Pacific Ocean 2.2 NM W of Cape Ferrello	06/13/03	X	X	X	X		
OR03-3033	Pacific Ocean 6.1 NM SW of Tenmile creek mouth	06/12/03	X	X	X	X		

OR03-3036	Pacific Ocean 10.4 NM SW of Clatsop Spit	06/06/03	X	X	X	X		
OR03-3037	Pacific Ocean 11.8 NM W of Waldport	06/10/03	X	X	X	X	X	
OR03-3041	Pacific Ocean 3.6 NM SW of Cascade Head	06/09/03	X	X	X	X	X	
OR03-3045	Pacific Ocean 7.9 NM SW of Netarts	06/09/03	X	X	X	X		
OR03-3049	Pacific Ocean 5.3 NM SW of Cape Lookout	06/09/03	X	X	X	X	X	
OR03-3053	Pacific Ocean 17.2 NM SW of Yaquina Head	06/10/03	X	X	X	X		
OR03-3057	Pacific Ocean 17.4 NM W of Cape Perpetua	06/10/03	X	X	X	X		
OR03-3061	Pacific Ocean 2.2 NM SW of Cape Sebastian	06/13/03	X	X	X	X		
OR03-3062	Pacific Ocean 15.4 NM W of Seaside	06/06/03	X	X	X	X		
OR03-3065	Pacific Ocean 10.3 NM S of Cape Arago	06/12/03	X	X	X	X		
OR03-3067	Pacific Ocean 9.6 NM W of Rouge river mouth	06/13/03	X	X	X	X		
OR03-3068	Pacific Ocean 15.4 NM SW of Clatsop Spit	06/06/03	X	X	X	X		
OR03-3069	Pacific Ocean 6.3 NM W of Waldport	06/09/03	X	X	X	X		
OR03-3073	Pacific Ocean 5.9 NM SW of Lincoln city	06/09/03	X	X	X	X		
OR03-3077	Pacific Ocean 7.6 NM W of Siltcoos river mouth	06/12/03	X	X	X	X		

OR03-3081	Pacific Ocean 5.4 NM NW of Umpqua river mouth	06/12/03	X	X	X	X		
OR03-3084	Pacific Ocean 2.6 NM W of Rockaway beach	06/06/03	X	X	X	X		
OR03-3085	Pacific Ocean 4.5 NM W of Yaquina Head	06/10/03	X	X	X	X	X	
OR03-3089	Pacific Ocean 8.4 NM W of Cape Perpetua	06/11/03	X	X	X	X		
OR03-3093	Pacific Ocean 1.8 NM S of Cape Ferrelo	06/13/03	X	X	X	X		
OR03-3097	Pacific Ocean 8.4 NM SW of Umpqua river mouth	06/12/03	X	X	X	X		
OR03-3100	Pacific Ocean 15.1 NM SW of Clatsop Spit	06/06/03	X	X	X	X		
OR03-3101	Pacific Ocean 21.5 NM W of Cape Perpetua	06/10/03	X	X	X	X		
OR03-3105	Pacific Ocean 24.9 NM SW of Cape Perpetua	06/11/03	X	X	X	X	X	
OR03-3109	Pacific Ocean 9 NM SW of Rockaway beach	06/06/03	X	X	X	X		
OR03-3113	Pacific Ocean 6.5 NM SW of Cape Kiwanda	06/09/03	X	X	X	X	X	
OR03-3117	Pacific Ocean 5.7 NM SW of Hecta Head	06/11/03	X	X	X	X	X	
OR03-3121	Pacific Ocean 12.9 NM SW of Heceta Head	06/11/03	X	X	X	X	X	
OR03-3125	Pacific Ocean 6.9 NM S of Port Orford	06/13/03	X	X	X	X		
OR03-3126	Pacific Ocean 11.1 NM W of Seaside	06/06/03	X	X	X	X		

OR03-3129	Pacific Ocean 8.3 NM NW of Cape Arago	06/12/03	X	X	X	X		
OR03-3131	Pacific Ocean 10.5 NM W of Rogue river mouth	06/13/03	X	X	X	X	X	
OR03-3132	Pacific Ocean 9.5 NM SW of Clatsop Spit	06/06/03	X	X	X	X		
OR03-3133	Pacific Ocean 6.1 NM SW of Cape Perpetua	06/11/03	X	X	X	X	X	
OR03-3137	Pacific Ocean 4.9 NM W of Cape Foulweather	06/10/03	X	X	X	X		
OR03-3141	Pacific Ocean 5.5 NM W of Siltcoos river mouth	06/12/03	X	X	X	X	X	
OR03-3145	Pacific Ocean 3.6 NM SW of Umpqua river mouth	06/12/03	X	X	X	X		
OR03-3148	Pacific Ocean 6.6 NM S of Cape Falcon	06/06/03	X	X	X	X		



Leg 2- Oregon Crew (from left to right, & top to bottom): Steve Rumrill (OIMB), Won Kim (DEQ), Greg Pettit (DEQ), Larry Caton (DEQ), Andy Schaedel (DEQ), C.O. Craig Bailey (NOAA), Cindy Cooksey (NOAA), Rusty Fairey (CA MLML), Lt. Alison M? (NOAA), Lt. Paulene Riberts (NOAA), Mike Crumley (NOAA), Peter Leinenbach (EPA), Gregory Coffeen (DEQ), Greg McMurray (DEQ), Sarah Miller (DEQ), Aaron Borisenko (DEQ).

2003 Western EMAP Offshore Cruise Report - California – June 14th – June 26th, 2003

The following report describes sampling activities aboard the 225-ft research vessel RV McArthur II on the third and final leg of the EMAP west coast offshore survey. The first sampling leg extended along the coast of Washington, the second sampling leg extended the coast of Oregon, and the third leg extended along the coast of California from the Oregon border to Pt. Conception. Sampling was designed to collect samples from fifty stations in each state, for a survey total of 150 stations. Sampling included the collection of water column profiles of conductivity (salinity), temperature and depth (CTD) using a SEABIRD profiler, additionally outfitted with instruments for fluorescence, dissolved oxygen and transmittance. Grab water samples were collected from three discrete depths using a Niskin bottle array combined with the CTD frame. Sediment samples were collected using a Young modified Van Veen sediment grab with paired 0.1m² surface area samples to maximum of 14 cm. Two successful deployments of the grab were required to sample infaunal organisms from one 0.1m² sample and three 0.1m² samples for the upper 2cm of sediment for chemical analysis. Fish tissues were collected where possible at stations using hook and line. Duplicate samples of CTD casts, water, sediment and infauna were collected at three stations for laboratory QA purposes and water samples were collected for dissolved oxygen, salinity and temperature at every sixth station for CTD QA purposes.

June 14th – The McArthur II entered northern California waters at 02:00 with a science crew from Oregon aboard and the chief scientist (Rusty Fairey) from California. Sampling in Oregon had just been completed, ahead of schedule, so California sampling was initiated. Sampling protocols for Oregon and California were very similar so only minor training of the Oregon crew was needed prior to sampling. This training occurred between the final Oregon station and initial California station. Six California stations were successfully sampled on June 14th (3139, 3051, 3083, 3147, 3289, 3043). All stations sampled were primary target stations except 3289. Station 3107 could not be sampled because heavy seas and shallow rocky conditions made the station unsafe to sample. Reserve station 3289 was instead sampled as the replacement for 3107. CTD casts, water samples, sediment chemistry samples and infaunal samples were collected at all six stations. Water samples were collected for dissolved oxygen at the first station (3139) for CTD QA purposes. Duplicate samples of CTD casts, water, sediment and infauna were collected at Station 3043 for laboratory QA purposes. Hook and line fishing was only marginally successful at one station (3083) where one Pacific sanddab was caught. Fishing was not attempted at stations after dark because of poor success rate previously experienced in Oregon and Washington.

June 15th – One station (3075) was successfully sampled for CTD casts, water samples, sediment chemistry samples and infaunal samples on June 15th. Hook and line fishing was not attempted at night at this station. Water samples were collected for dissolved oxygen, salinity and temperature at the this station (3075) for CTD QA purposes. After completion of this station, the RV McArthur transited north to Humboldt Bay for a port call in Eureka. The ship docked around 10:00.

June 15th – June 17th – In port- offloading Oregon sampling crew, supplies and samples and onloading California sampling crew and supplies. The California sampling crew was: Rusty Fairey – Chief Scientist (MLML), Mark Pranger (MLML), Tamara Vos (MLML), Tom Kimball (MLML), Matt Huber (MLML), Bruce Thompson (SFEI), Sara Lowe (SFEI), JD Dubick (NOAA), Lorraine Edmond (EPA), Laura Gabanski (EPA), and Susan Wainwright (NOAA Teacher at Sea).

June 18th – Departed Humboldt Bay @ 10:00 AM and proceeded several hours south of Humboldt Bay. Training in sampling techniques and protocols was given to the California crew by the chief scientist while transiting to the first sampling station. Fire drills and abandon ship drills were also conducted for the ship's crew and scientific crew during the transit. At the first station deteriorating weather conditions were observed, but sampling began at 16:21. During the day, three stations were successfully sampled (3019, 3099, 3035) for CTD casts, water samples, sediment chemistry samples and infaunal samples. Hook and line fishing was not attempted due to high winds and heavy sea conditions. Water samples were collected for dissolved oxygen, salinity and temperature at the first station (3019) for CTD QA purposes.

June 19th – Sampling continued through the morning and day. Four stations were successfully sampled (3091, 3059, 3027, 3039) for CTD casts, water samples, sediment chemistry samples and infaunal samples. Hook and line fishing was not attempted due to high winds and heavy sea conditions. Water samples were collected for dissolved oxygen, salinity and temperature at the first station (3039) for CTD QA purposes. Upon arrival at station 3071, high seas (12-15ft) and heavy (steady 40+knots, with gusts to 65 knots) made sampling operations unsafe, so the area was abandoned. The ship then steamed south several hours looking for more favorable weather conditions. Sampling was attempted south of the Farallone Islands late that night at station 3040 but sea and wind conditions still made deployment and retrieval of the CTD was very challenging for the crew, so no further operations were attempted. Only the data from the CTD casts was retained. The decision was made to steam farther south in search of better weather.

June 20th – The ship steamed south during the early morning hours and reached Monterey Bay at first light. Weather conditions had improved so the ship steamed toward station 3092, west of Santa Cruz. Unfortunately we received an emergency call for one of the crewmembers relating that his mother had a stroke and his presence was needed at home. The ship steamed to Santa Cruz and deployed a zodiac to deliver the crewmember to shore. A member of the MLML team onshore picked up the crewmember and delivered him to the airport in San Jose for a flight home. The ship then returned to station 3092 and began sampling operations. Sampling continued through the morning and day. Five stations were successfully sampled (3092, 3136, 3124, 3072, 3040) for CTD casts, water samples, sediment chemistry samples and infaunal samples. Hook and line fishing was attempted at stations 3092, 3136, 3124 during daylight hours with limited success. No fishing was attempted after dark at stations 3072 and 3040. Duplicate samples of CTD casts, water, sediment and infauna were collected at Station 3092 for laboratory QA purposes.

June 21st – Sampling continued through the early morning and day. Three stations were successfully sampled (3056, 3116, 3194) for CTD casts, water samples, sediment chemistry

samples and infaunal samples. Hook and line fishing was not attempted when dark at stations 3056 and 3116. Hook and line fishing was successful at 3194 with two composites of flatfish collected. Station 3194 was a reserve station sampled to replace primary station 3108. CTD casts and water samples were collected at 3108, but six unsuccessful sediment grabs throughout the surrounding area proved the area too rocky to obtain sediment. Station 3108 was therefore abandoned but the CTD cast information and water samples were retained. After completion of station 3194, the ship proceeded to station 3052, but once on site weather conditions had deteriorated (12 ft seas and 50 knot winds) so sampling was not attempted. The chief scientist made the decision to abandon the area and proceed south of Monterey Bay and continue sampling southward toward Point Conception.

June 22nd –Weather conditions improved south of Monterey Bay so sampling began early in the morning and continued through the day. The initial station attempted (3120) was too deep (>120 m) at the nominal position so the area within 2km of nominal was surveyed for depths within the sample frame (30-120m). No appropriate depths were located so the station was abandoned and the ship proceeded to Reserve station 3166. CTD cast and water samples were successfully completed, but seven unsuccessful sediment grabs throughout the surrounding area proved the area too rocky to obtain sediment. Station 3166 was therefore abandoned but the CTD cast information and water samples were retained. Six stations (3128, 3064, 3096, 3032, 3112, 3048) were subsequently sampled successfully for CTD casts, water samples, sediment chemistry samples and infaunal samples. Hook and line fishing was successful at three stations (3128, 3064, 3096) with one composite of flatfish collected at each of the three. Hook and line fishing was attempted at 3032 when dark but was unsuccessful, so fishing was not attempted while dark at stations 3112 and 3048. Water samples were collected for dissolved oxygen, salinity and temperature at station 3064 for CTD QA purposes. After completion of station 3048, the decision was made to steam back to the Monterey Bay area and then begin sampling northward toward the Farallone Islands.

June 23rd - Shortly after the ship began steaming north, a major failure of the ship's electrical systems shut down all power to engines and the ship. The ship remained dead in the water for approximately ½ hour before backup systems were operational. The ship then steamed north at half speed to Port San Luis for repairs, arriving at 0800. Investigation of the problem indicated that screens filtering the ship's seawater cooling system had become clogged with an abundance of krill and had stopped the flow of cooling water. This had led to the power generation system overheating and completely shutting down. Repairs consisted of disassembling forward and aft filter systems, cleaning the screens and reassembling the filter systems. Repairs were successfully completed at 1600 and the ship began steaming north toward Monterey Bay and continued steaming north throughout the night against moderate seas.

June 24th - Seas and winds began calming during the early morning hours and continued to improve throughout the day. Sampling began in Monterey Bay and continued north along the San Mateo coastline. Six stations were successfully sampled (3210, 3060, 3158, 3008, 3104, 3088) for CTD casts, water samples, sediment chemistry samples and infaunal samples. Hook and line fishing was attempted at four stations with composites of flatfish being collected at three of the four stations attempted (3060, 3158, 3104). Hook and line fishing was not attempted at 3210 due to water depth or at 3088 due to darkness. Water samples were collected for dissolved

oxygen, salinity and temperature at station 3060 for CTD QA purposes. Concern over an anomalously high reading for bottom water oxygen concentration during the Winkler titration resulting from a sampling error led to repeating the dissolved oxygen measures at the subsequent station (3158). Dissolved oxygen concentrations at 3158 agreed well with CTD measurements so no further CTD QA was performed at that time. Upon completion of sampling at 3210, just south of San Francisco Bay, the decision was made to take advantage of improving weather conditions and steam north to sample stations around Tomales Bay and the Farallone Islands. The northernmost unsampled station was reached at 02:30 the following morning.

June 25th – Weather conditions continued to improve throughout the day. By late afternoon, seas and winds were calm, so sampling progressed rapidly. Sampling began north of Tomales Bay at 02:30 and continued southward. Eleven stations were successfully sampled (3071, 3007, 3135, 3157, 3052, 3028, 3044, 3123, 3140, 3076, 3024) for CTD casts, water samples, sediment chemistry samples and infaunal samples. Water samples were collected for dissolved oxygen, salinity and temperature at stations 3007 and 3123 for CTD QA purposes. Duplicate samples of CTD casts, water, sediment and infauna were collected at Station 3044 for laboratory QA purposes. Hook and line fishing was attempted at all six stations that were occupied during daylight hours. Composites of flatfish were collected at only two of the six stations attempted (3052, 3044). A single flatfish was collected at station 3157. Hook and line fishing was not attempted at the remaining five stations due to darkness during the early morning and late evening hours.

June 26th – Weather conditions continued fair throughout the day. Sampling of the final station (3012) began shortly after midnight and was concluded at 02:30. The station was successfully sampled for CTD casts, water samples, sediment chemistry samples and infaunal samples. Water samples were collected for dissolved oxygen, salinity and temperature at stations 3012 for CTD QA purposes. Hook and line fishing was not attempted due to darkness. Upon conclusion of sampling, the ship steamed 12 miles offshore for sewage disposal and then returned to port in San Francisco. The ship was berthed by 0930. Offloading of gear, samples and crew was completed by 1530.

Leg 3 Summaries:

Forty-six stations were successfully sampled in California waters between June 14th and June 26th as part of the 2003 Western EMAP Offshore Cruise. Forty-four were primary target stations and two were reserve stations. The reserve stations were sampled as replacements for two primary stations that proved to be too rocky to successfully sample for sediments. All forty-six stations were successfully sampled for CTD casts, water samples, sediment chemistry samples and infaunal samples (see attached spreadsheet). Field duplicate samples were collected at three stations and water samples for CTD QA were collected at twelve stations. Collection of targeted flatfish was only successful at twelve of the forty-six stations, being notably dependent on sea state, water depth and available sunlight. Water depths greater than 80m and fishing during the dark hours proved less productive for flatfish. High winds and seas physically hindered the scientific crew's ability to keep fishing gear on the bottom at many stations. Sediment grabs, CTD casts and water sampling operations proved very successful, with no appreciable equipment

downtime logged for any method. No injuries of crew or loss of equipment occurred during the cruise.