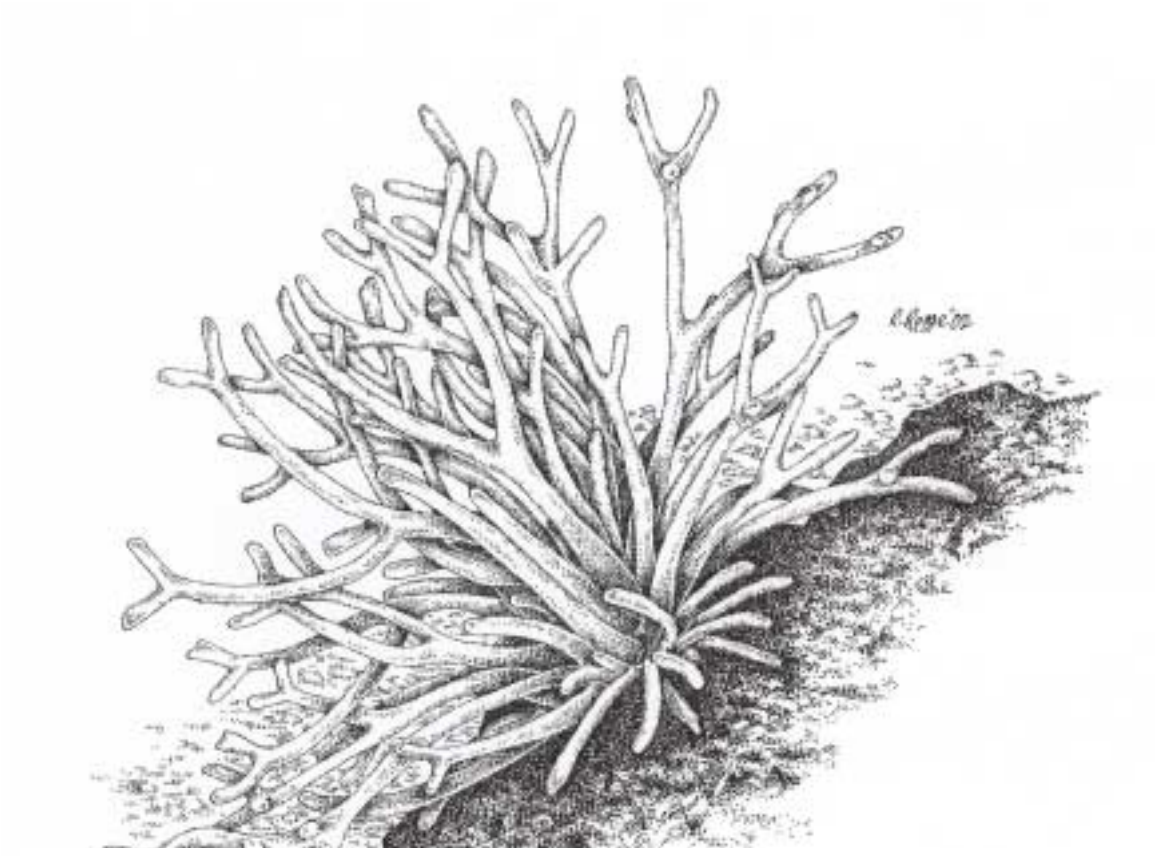
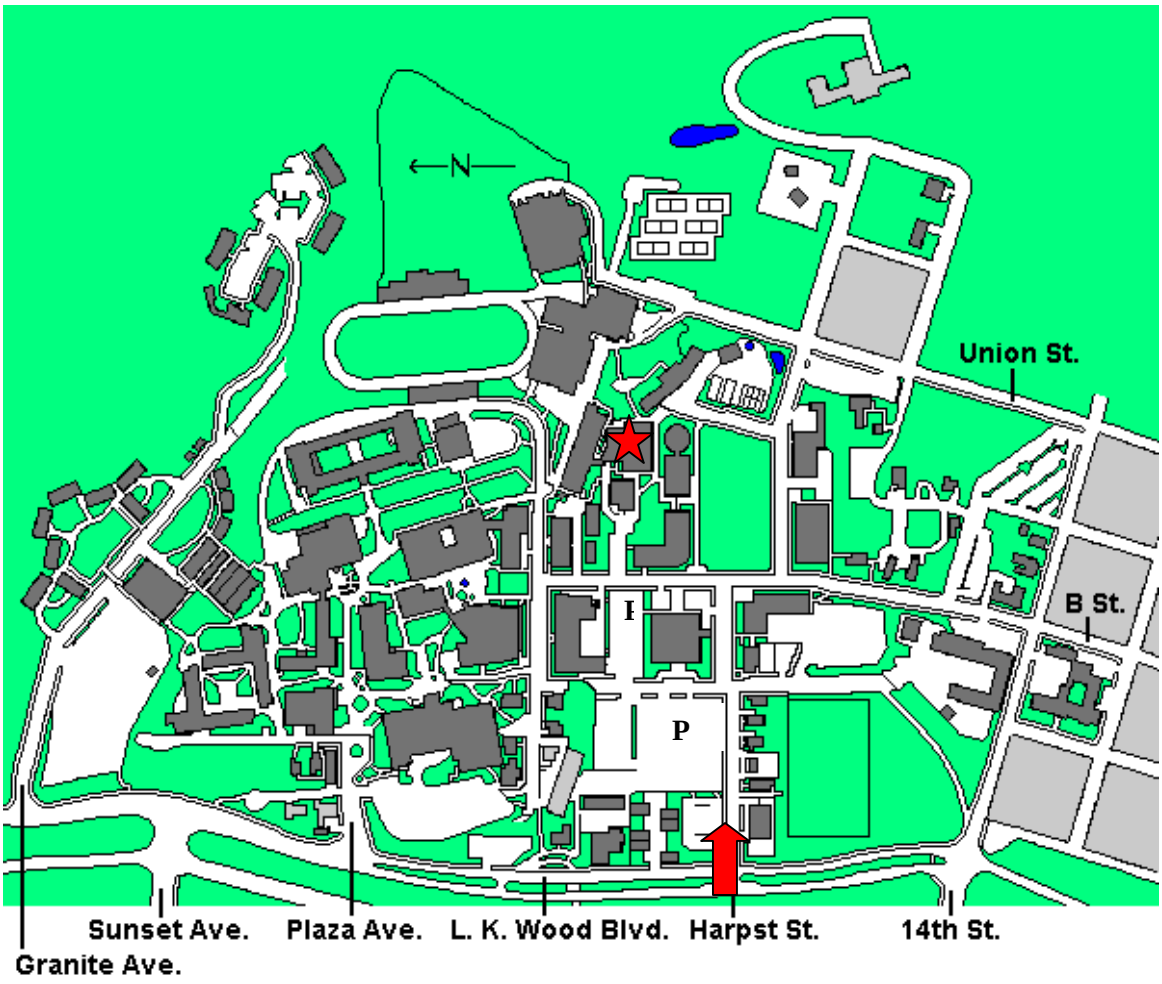
16th Northwest Algal Symposium



Humboldt State University,
May, 22 - 24 2002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SCHEDULE

WEDNESDAY, MAY 22ND

5:00 – 7:30PM. Decompression Session: Northcoast Inn, Crystal Willow Room. An assortment of imported cheeses, crackers, seasonal fruit, meats and vegetables will be available, as well as a no host bar.

THURSDAY, MAY 23RD

8:25 HSU campus, Science B, Rm. 135 (Follow the NWAS signs)

8:25 – 8:30 Frank Shaughnessy. Opening remarks.

8:30 – 8:45 Robert Waaland, Edward Duffield and Cortney Jensen. Recirculating culture for the Turkish Towel Seaweed, *Chondracanthus exasperatus*.

8:45 – 9:00 Luis Barahona and Gregory Rorrer. Production and isolation of a novel cyclic halogenated monoterpene from *in vitro* plantlet cultures of the red alga *Ochtodes secundiramea*.

9:00 – 9:15 Brian Bartkowiak and Grant Mitman. Algal stimulation of the Berkeley Pit Lake system.

9:15 – 9:30 Daniela Bocioaga and Grant Mitman. Metal uptake kinetics of *Chromulina freiburgensis* Dofl from the Berkeley Pit Lake.

9:45 – 10:00 Charles Williams and Robert Waaland. Episode III: Attack of the cyanobacteria clones.

10:00 – 10:30 **Break,** Lobby & Greenhouse

10:30 – 10:45 S. Frisch and Steven Murray. The diversity and availability of *Caulerpa* species found in retail aquarium outlets in southern California, USA.

10:45 – 11:00 Carol Thornber, Brian Kinlan, Michael Graham, and John Stachowicz. Population biology of the invasive kelp *Undaria pinnatifida* along the California coast.

11:00 – 11:15 Tawnya Peterson and David Crawford. Effect of zinc and iron addition on phytoplankton assemblage in a high nutrient low chlorophyll region.

11:15 – 11:30 Roly Russel. Biological diversity and ecosystem functioning in a New Zealand algal assemblage.

11:30 – 11:45 Gisela Fritz, Frank Shaughnessy and Tim Mulligan. The floral recovery of a restored coastal wetland: Kunz Marsh, South Slough, Coos Bay, OR.

11:45 – 1:00 **Lunch,** Founders Hall, Green & Gold Room

1:00 – 3:00 **Poster Session**, Science D hallway

3:00 – 3:30 **Break,** Lobby & Greenhouse

3:30 – 3:45 Leonard Dyck. Spore production in *Mazzaella splendens* at Brockton Point, Vancouver, B.C., Canada.

3:45 – 4:00 Sarah Henkel and Steven Murray. Morphological variation and patterns of reproduction and recruitment in lower intertidal populations of the kelp *Egregia menziesii* (Turner) Areschoug.

4:15 – 4:30 Robert DeWreede, Sophie Boizard and Russell Markel. Disturbance and recovery in a *Hedophyllum* community.

4:30 – 4:45 Lorena Wisehart, Susan Elliot and Frank Shaughnessy. Testing and redefining patterns of rocky intertidal community organization in Humboldt Bay, CA.

4:45 – 5:00 Kristen Kusic, Alison Kendall, Erin Maloney, Megan Williams, Pete Raimondi, Dave Lohse, Carol Blanchette, et al. Spatially explicit grid surveys of temperate rocky reef communities: "How do physical and biological factors effect community structure?"

7:00 - **Banquet:** Northcoast Inn, Crystal Willow Room.

FRIDAY, MAY 24TH

8:30 – 8:45 Sandra Lindstrom. What can seaweeds tell us about coastal refugia during the last ice age?

8:45 – 9:00 Paul Gabrielson, Jeffrey Hughey and Max Hommersand. A previously unrecognized species of *Mazzaella* (Gigartinales, Rhodophyta) in Alaska.

9:00 – 9:15 Max Hommersand, Lawrence Liao, Frederico Gurgel and Susan Fredericq. The correct name for the plant known as *Gracilariopsis lemaneiformis* from Pacific North America.

9:15 ~ 9:35 Thomas Widdowson. Demonstration of database: "Marine macrophytes of the Northeast Pacific".

9:35 ~ 10:00 Brian Oates and Sandra Lindstrom. Demonstration of a web-based key for the identification of marine chlorophytes.

10:30 – 11:30 Business Meeting. All participants are welcome.

11:30 THE 16TH NWAS IS ADJOURNED.

SATURDAY, MAY 25

Field trip led by Frank Shaughnessy and others. Low tide: 06:00 (-1.0'). The destination for the intertidal trip will be based upon the interests of those attending.

PAPER ABSTRACTS (In the order presented)

Waaland, J. Robert, Edward W. Duffield and Cortney T. Jensen. Department of Botany, University of Washington. **RECIRCULATING CULTURE FOR THE TURKISH TOWEL SEAWEED, *CHONDRACANTHUS EXASPERATUS*.**

The red alga *Chondracanthus exasperatus* is a source of the phycocolloid carrageenan as well as an ingredient referred to as "intralamellar gel" in a recently developed cosmetic formula (U.S. Patent 6,136,329). The high value of the cosmetic product has sparked renewed interest in cultivation of this species. Previous cultivation methods for this species include open water culture on nets and immersed cultivation in tanks supplied with flow-through pumped seawater. The installation of a high capacity seawater supply, pumping and drain system is a major cost for flow through systems. Recirculating or re-use seawater systems that minimize seawater turnover may offer significant cost savings over single-pass, flow through seawater systems. In this research several options for minimizing seawater use have been tested: 1) recirculating batch culture in which nutrient replenished (carbon dioxide and mineral nutrients) natural or artificial seawater is used with minimal turnover and spray culture in which plants are suspended in air saturated with nutrient replenished natural or artificial seawater medium, 2) small volume (<2 L), single-plant bioreactors and 3) larger multi-plant, 20, 80 and 320 L (sea water volume) immersion and spray systems have been developed and tested. Results from these systems will be presented. Research supported by Washington Sea Grant, Washington Biotechnology Center and Söliv International Corporation.

Barahona, Luis F., and Rorrer, Gregory L. Department of Chemical Engineering, Oregon State University. **PRODUCTION AND ISOLATION OF A NOVEL CYCLIC HALOGENATED MONOTERPENE FROM *IN VITRO* PLANTLET CULTURES OF THE RED ALGA *OCHTODES SECUNDIRAMEA*.**

The tropical marine red alga *Ochtodes secundiramea* produces both cyclic and acyclic halogenated monoterpenes as a chemical defense against herbivory. Some of these compounds may have biomedicinal potential. The objective of this present work was to produce and isolate cyclic halogenated monoterpenes from *in vitro* microplantlets of *O. secundiramea* recently developed in our laboratory. Microplantlet suspension cultures were grown up in a two-liter stirred tank photobioreactor in seawater-ESS nutrient medium to obtain nearly 10 grams of dry cell mass. The cell biomass was extracted with the dichloromethane (DCM). Lipophilic compounds in the DCM extract were fractionated on a silica column under elution with ether. This fraction was then profiled by high-performance liquid chromatography (HPLC) with an ODS column under 9:1 v/v acetonitrile/water isocratic elution. Eluted peaks representing a purified compound were collected and analyzed by gas chromatography - mass spectrometry. By these methods, only one cyclic halogenated monoterpene was putatively found, 6-bromo-1,2,8-trichloro-3,4-ochtodene. This compound is not found in field collected *Ochtodes* plants, but is found in a related red alga within Rhizophyllidaceae, *Portieria hornemannii*. From this data, a biosynthetic route to 6-bromo-1,2,8-trichloro-3,4-ochtodene from its precursor, the monoterpene myrcene, was proposed.

Bartkowiak, Brian and Grant Gregory Mitman. Department of Biology, Montana Tech of The University of Montana. **ALGAL STIMULATION OF THE BERKELEY PIT LAKE SYSTEM.**

This study was conducted to evaluate four species of algae (*Chromulina freiburgensis* Dofl., *Chlorella ellipsoidea* Gerneck, *Chlorella vulgaris* Beijerinck, and *Chamydomonas acidophila* Negoro) isolated from an acid pit lake for their bioremediative potential. The Berkeley Pit Lake system, located in Butte, Montana, is an abandoned open-pit mine. As a result of acid rock drainage the water in this pit is very acidic and contains high concentrations of dissolved metals. First, optimal nutrient levels for each species of algae were determined. Levels of nutrients tested include: 5, 10, 15 mg-N/L, and 0, 3, 6 mg-P/L. The experiment was conducted with sterile filtered Berkeley Pit water. Next, each species of algae were grown under optimal nutrient levels and dissolved metal removal potentials were examined, using Inductively Coupled Plasma-Atomic Emission Spectrometry (ICP-AES). In addition, field sampling was preformed to gain a better understanding of the microbial community within the pit. Finally, field parameters including, light, temperature, dissolved oxygen, specific conductivity, redox potential, and turbidity were examined to determine the actual conditions for microbial growth within the Berkeley pit.

Bocioaga, Daniela and Mitman,Grant. Department of Biology, Montana Tech of the University of Montana.
METAL UPTAKE KINETICS OF *CHROMULINA FREIBURGENSIS* DOFL FROM THE BERKELEY PIT LAKE.

Bioremediation is one of the methods considered for cleaning abandoned mine sites, since most of the time it is less costly and environmentally friendly. The Berkeley Pit is one of these mine sites, with a very low pH (2.7) and high concentration of heavy metals. *Chromulina freiburgensis* is one of the six species of algae found in this pit lake. This study is an approach to gain a better understanding of the behavior of this species of algae regarding metal uptake. Previous studies on the potential of these algae to sorb metals have shown tendencies to reduce metal concentration in the aqueous solution of Berkeley Pit water over a short time period. After the algae were introduced into the solution a decrease of the metal uptake over time occurred. This is probably due to adsorption occurring immediately and quickly followed by a release of a fraction of the metals adsorbed ,while absorption occurs later and seems to be a slower process. In previous studies *Chromulina freiburgensis* has shown to have the best capacity to sorb metals of the five species of algae studied for the Berkeley Pit (*Chromulina freiburgensis* Dofl.,*Chlorella vulgaris* Beijerinck,*Chlorella ellipsoidea* Gernek *Chlamydomonas acidophila* Negoro and *Euglena mutabilis* Schmitz). Furthermore, the ability of *C.freiburgensis*, to remove heavy metals from aqueous solutions as a function of time will be studied. *C. freiburgensis* was grown to a concentration of $1.68*10^8$ cells/ml, in a Modified Acid Medium solution, of pH=2.7. 1.0 ml containing approximately $1.6 *10^8$ cell per ml were added to 100 ml of Berkeley Pit water. Samples for ICP (Inductively Coupled Plasma) metal analyses were taken before the algae were added, one hour after the algal cells were added, and then at 6, 12, 24 and 48 hours. The control was represented by Berkeley Pit water. Metal concentration at these time intervals were analyzed as a function of time to show the trend of metal uptake activity of *C. freiburgensis* over 48 hours.

Williams, Charles R. and Waaland, J. Robert. Department of Botany, University of Washington. **EPISODE III: ATTACK OF THE CYANOBACTERIA CLONES.**

Anabaena samples from Pacific Northwest lakes were examined for regional diversity and to determine their phylogenetic relationships within the genus *Anabaena*. Direct filament PCR was used to obtain DNA sequence from the gene subunits cpc*B* and cpc*A* with intergenic spacer, and the rpo*C1* gene subunit. The distribution of planktonic *Anabaena* in eight lowland Puget Sound lakes from late spring through early fall appeared limited to 4 genotype clusters representing 6 morphotypes. One *Anabaena flos-aquae* genotype was found exclusively in the late fall/winter through early spring and was responsible for toxic blooms (anatoxin *a*). An identical morphotype from the same lake exhibited a significantly different genotype and life history (summer and early fall dominant). Trichome habit, cell, heterocyst and akinete shape and size were shown to be poor characters for distinguishing strains but were useful features in distinguishing *Anabaena circinalis* from *Anabaena flos-aquae* in the Pacific Northwest.

Frisch, S.M. and Murray, S.N. Department of Biological Science, California State University, Fullerton. **THE DIVERSITY AND AVAILABILITY OF *CAULERPA* SPECIES FOUND IN RETAIL AQUARIUM OUTLETS IN SOUTHERN CALIFORNIA, USA.**

Biological invasions are recognized as a serious threat to marine biodiversity. In June 2000 invasive populations of *Caulerpa taxifolia* were found in southern California's coastal waters. The southern California inoculation of *C. taxifolia* is believed to have resulted from the release of aquarium specimens. Besides *C. taxifolia*, other species of *Caulerpa* being sold for aquarium use may have the potential to invade temperate waters. As a first step towards making this determination, the availability (% frequency) of *Caulerpa* species being sold in southern California for aquarium use was ascertained. Fifty retail saltwater aquarium stores were visited in southern California between November 2000 and August 2001. Sixteen *Caulerpa* taxa were identified from the retail aquarium outlets. *Caulerpa* species were sold in 52% of these stores. *Caulerpa taxifolia*, "Mediterranean form", was offered for sale in 10% of the visited stores; *C. serrulata* var. *hummii* (18%), *C. racemosa* (14%), and *C. racemosa* var. *lamourouxii* (14%) were the most commonly sold species. These data indicate that the aquarium industry is bringing into the region other species of *Caulerpa* besides *C. taxifolia*. Some of these species may also have the potential to invade temperate waters.

Thornber, Carol S., Brian Kinlan, Michael Graham and John Stachowicz. Center for Population Biology, University of California, Davis, and Department of Ecology, Evolution, and Marine Biology, University of California, Santa Barbara. **POPULATION BIOLOGY OF THE INVASIVE KELP *UNDARIA PINNATIFIDA* ALONG THE CALIFORNIA COAST.**

The invasive kelp *Undaria pinnatifida* has recently become established at several locations in California coastal waters. *Undaria* is native to Japan, but in recent decades it has spread to numerous other coastal areas worldwide. The population biology of *Undaria* varies greatly among locations, and it is unknown what effects *Undaria* will have upon California's native marine communities. We tracked the timing and magnitude of *Undaria* recruitment, growth, and subsequent reproductive onset, in the Santa Barbara, California harbor, following the discovery of a dense, reproductive population there in April 2001. From July to September 2001, there was limited recruitment of new *Undaria* sporophytes. Although these individuals did mature and reproduce, they were much smaller than the spring 2001 cohort. A much larger recruitment pulse was observed during January-February 2002, followed by rapid growth of individuals. This recruitment pulse is correlated with a drop in ocean temperature, and ongoing laboratory culture experiments are exploring the effects of different water temperatures on the growth of microscopic stages of *Undaria*. This research provides insight into the potential for *Undaria's* spread and growth into previously unoccupied habitats along the California coast, as well as information for the timing of subsequent eradication efforts.

[1]Peterson, Tawnya D. and [2]David W. Crawford. [1]Department of Earth and Ocean Sciences, University of British Columbia, Vancouver, B.C., Canada; [2]School of Ocean and Earth Science, Southampton Oceanography Centre, Southampton U.K. **EFFECT OF ZINC AND IRON ADDITION ON PHYTOPLANKTON ASSEMBLAGE IN A HIGH NUTRIENT LOW CHLOROPHYLL REGION.**

In High Nutrient Low Chlorophyll regions of the world's oceans, addition of iron leads to a dramatic increase in photosynthetic biomass and primary productivity. Many other trace metals are both required for growth by primary producers and are present in low concentrations at Ocean Station P (50^{o}N, 145^{o}W), including iron and zinc. Based on results from incubation experiments we suggest that trace additions of iron alone, zinc alone, and a combination of iron and zinc together lead to differences in species assemblage. Fe-amendments produced a community dominated by large diatoms, small diatoms, and nanoflagellates. Addition of zinc alone resulted in a decrease in the number of coccolithophores and small diatoms relative to controls, with no change observed for nanoflagellates and large diatoms. When Fe and Zn were added together, growth of coccolithophores was higher than when either metal was added alone, but lower than controls. Cell abundances of small diatoms, large diatoms, and nanoflagellates were higher than controls but lower than in the Fe treatment. These results suggest that zinc may be toxic to phytoplankton at OSP, and that iron may mitigate these negative effects. The degree of growth suppression appears to be taxon-specific.

Russell, Roly. Department of Zoology, Oregon State University. **BIOLOGICAL DIVERSITY AND ECOSYSTEM FUNCTIONING IN A NEW ZEALAND ALGAL ASSEMBLAGE.**

Although it is accepted that humans are dramatically altering global biological diversity, we do not yet have a good grasp on how these changes influence ecosystem level processes. Recently, there have been a number of research projects demonstrating patterns between species richness and various ecosystem processes. My work attempts to illuminate some of the mechanisms underlying this relationship between diversity and ecosystem functioning, using a suite of intertidal macroalgal species from southern New Zealand. Using oxygen production as a proxy for carbon fixation, my results demonstrate that even after accounting for 'sampling effects' there is evidence that species richness – a diversity effect – remains significant for both the magnitude and stability of this ecosystem process. Increases in species richness not only tend to increase oxygen productivity of this algal assemblage, but also cause an increase in the stability of this ecosystem process.

Gisela B. Fritz[1], Frank J. Shaugnessy[2], and Tim J. Mulligan[3]. [1]Stillwater Sciences, Arcata, CA., [2]Dept. of Biol. Sciences, Humboldt State University, [3]Dept. of Fisheries Biology, Humboldt State University, Arcata, CA. **THE FLORAL RECOVERY OF A RESTORED COASTAL WETLAND: KUNZ MARSH, SOUTH SLOUGH, COOS BAY, OR.**

Improved understanding of the importance of estuarine wetlands to the function of coastal ecosystems has lead to increased restoration efforts of degraded wetlands. The South Slough National Estuarine Research Reserve (SSNERR) in Coos Bay, Oregon, has taken active steps to restore previously diked tidal wetlands. In addition, they have established monitoring programs that focus on the faunal and floral recovery of restored sites within

Kunz Marsh. The overall objective of the present study was to determine the degree of community recovery in restored salt marsh sites relative to control sites. Vascular plants and diatoms fish were sampled in spring, summer, and fall of 1998 and 1999. Vegetation cover decreased from high to low elevations, was higher in control than restored sites, and increased between 1998 and 1999. Diatom abundances showed seasonality in most sites and were higher in the restored than the control sites. In general, community recovery, occurred more quickly in the higher restored sites. This may be due to the aggressive restoration method used, as well as successional processes that are known to occur more rapidly in the high marsh.

Dyck, Leonard J. Department of Botany, University of British Columbia. **SPORE PRODUCTION IN *MAZZAELLA SPLENDENS* AT BROCKTON POINT, VANCOUVER, B.C., CANADA.**

Production of carpospores precedes tetraspore production in this *Mazzaella splendens* population. There is some temporal overlap, with maximum carpospore production from August to October and maximum tetraspore production in November and December. Onset of spore production coincides with a fall population density decline. No more than 50 % of available gametophytes are cystocarpic at any time of year, while the winter tetrasporophyte population becomes 90 - 95% fertile. Two cohorts of blades, one tagged in June and the other in November, show no significant survival cost associated with spore production. With heavily pigmented photosynthetic haploid and diploid spores, an energetic cost of reproduction also appears unlikely. In spite of this, spore production is seasonally constrained and does not utilize the time of maximum blade density to maximize spore production. The observed pattern suggests optimization of spore production in response to some selective pressure, but if as Bell (1984, Evolution 38: 314 - 326) claims, reproductive cost is a necessary condition for the optimization of life histories, the source of that cost is not immediately apparent.

Henkel, Sarah K. and Murray, Steven N. Department of Biological Science, California State University, Fullerton. **MORPHOLOGICAL VARIATION AND PATTERNS OF REPRODUCTION AND RECRUITMENT IN LOWER INTERTIDAL POPULATIONS OF THE KELP *EGREGIA MENZIESII* (TURNER) ARESCHOUG.**

Egregia menziesii is an important habitat-structuring component of shallow, benthic communities throughout California. Morphological variation in this species is high, particularly in the lateral blades. Fertile sporophylls are believed to be produced throughout the year; however, spatial and temporal patterns of thallus morphology and sporophyte reproduction have not been fully investigated in southern California. We studied lower intertidal populations of *E. menziesii* at three sites. Growing axes (n = 9) were collected monthly to quantify sporophyll production and the frequencies of different lateral types. Band transects were surveyed quarterly to determine temporal patterns of sporophyte recruitment. Sporophylls were found throughout the year, but showed a strong peak in winter. Sporophyte recruitment began in February and peaked in June, suggesting a gametophyte period of ~6 months. Lateral morphology varied in a consistent pattern related to axis length; most thalli initially developed spatulate blades and then produced filiform laterals. Thalli subjected to intense grazing pressure had shorter axes dominated by spatulate blades, while those growing under low grazing pressure exhibited longer branches, densely covered with filiform laterals. Observed changes in the frequencies of morphologically variable lateral blades along *E. menziesii* axes hypothetically affect productivity, susceptibility to grazing, and drag in this kelp.

DeWreede, R.E., Boizard, S. and Markel, R. Department of Botany, The University of British Columbia. **DISTURBANCE AND RECOVERY IN A *HEDOPHYLLUM* COMMUNITY.**

Hedophyllum sessile is a common - and biomass dominant - kelp in many low intertidal west coast habitats. Success of juvenile *H. sessile* (measured as abundance) is influenced positively by the presence of some understory species, particularly articulated coralline algae. We have manipulated *H. sessile* canopy density, *H. sessile* spore availability, and herbivore (the chiton *Katharina tunicata*) density to examine their impact on the abundance of different understory species and, in turn, on *H. sessile* juveniles. The experimental manipulations done reflect natural disturbances in the *H. sessile* community, and their measured impact reflects community recovery. Among our results are the following: 1. Juvenile *H. sessile* was most abundant in control quadrats throughout the experimental period. 2. Removal of *H. sessile* canopy, and a reduction in density of *K. tunicata*, resulted in changed relative abundance of *H. sessile* juveniles on different substrata. 3. Addition of *H. sessile* spores to canopy removal plots initially increased juvenile sporophyte density. 4. Wave exposed sites had consistently higher density of juvenile and adult *H. sessile* than did wave sheltered sites. Small scale (0.25 x 0.25 cm) disturbances as imposed here result in changed pathways of community reestablishment, but do not prevent community recovery.

Lorena M. Wisehart, Susan M. Elliot & Frank J. Shaughnessy. Department of Biological Sciences, Humboldt State University. **TESTING AND REDEFINING PATTERNS OF ROCKY INTERTIDAL COMMUNITY ORGANIZATION IN HUMBOLDT BAY, CA.**

The Ricketts model of rocky intertidal community organization in the Pacific Northwest predicts four distinct zones dominated by particular taxa. The highest zone, zone one, should contain cyanobacteria, and filamentous algae, whereas zone two should be dominated by barnacles, zone three by mussels, and the lowest zone, zone four, by kelps, red algae, and *Phyllospadix*. The degree to which this model accurately describes the northern California coastline is unknown. Our objectives were to test the hypothesis that four distinct zones exist in the rocky intertidal of Humboldt Bay, California, and to determine whether the numerically dominant taxa in each zone agree with predictions made by the Ricketts model. Algal and invertebrate taxa were converted into functional groups that were randomly sampled within four intertidal elevations every February since 1999. Ordination of functional groups followed by the multiple response permutation procedure confirmed the presence of four significantly different zones. The dominant taxa we found in each zone were not always those predicted by the Rickets model. Although zone one contained the predicted groups, and zone two had many barnacles, zones three and four lacked mussels and kelps, and were instead characterized by cartilaginous, filamentous, and foliose terete groups.

Kusic, Kristen[1], Alison Kendall[1], Erin Maloney[1], Megan Williams[1], Pete Raimondi[1], Dave Lohse[1], Carol Blanchette[2], et al. [1] UCSC, [2]UCSB. **SPATIALLY EXPLICIT GRID SURVEYS OF TEMPERATE ROCKY REEF COMMUNITIES: "HOW DO PHYSICAL AND BIOLOGICAL FACTORS EFFECT COMMUNITY STRUCTURE?"**

Through the use of spatially explicit grid surveys we are characterizing the structure of rocky reef intertidal communities over an unprecedented geographical scale. Currently, our sites range from northern Oregon to San Diego County, California and include six of the Channel Islands. Species composition and abundance are sampled at each of our 60 (current) sites. The same protocols and the same sampling team are used at all sites ensuring compatibility of data. In addition to biological data, specific tidal elevations are gathered. Hence we are able to produce detailed and spatially explicit topographic and biological maps at each site. This will allow evaluation of the importance of physical complexity to biological communities. Initial analyses have revealed striking patterns of abundance and diversity across large and small spatial scales.

Lindstrom, Sandra C. Department of Botany, University of British Columbia. **WHAT CAN SEAWEEDS TELL US ABOUT COASTAL REFUGIA DURING THE LAST ICE AGE?**

In contrast to the Atlantic coast of North America, the Pacific coast is relatively rich in marine species. Both areas were affected by Pleistocene glaciations, but the diverse marine flora and fauna within the glacial boundary of the North Pacific suggests that extinctions were not as significant there as they were in the northwest Atlantic. A major question arising from this observation is whether species survived within the glaciated area during glaciation or have colonized from outside the glacial boundary. Seaweeds provide excellent exemplars for such studies because of their essentially linear distribution and limited dispersability. Although colonization from outside the glacial boundary has undoubtedly occurred, a growing body of evidence suggests that at least some and possibly many species of seaweeds survived within the area of the coast thought to have been completely covered by ice during the most recent (Wisconsin) glaciation. In addition to species richness within the glacial boundary, other present-day evidence for coastal refugia include the occurrence of endemics well within the glaciated area, distributions of genotypes that require the existence of coastal refugia to explain them, and concordant patterns of seaweed disjunctions, both disjunctions of species with southern affinities well within the glacial boundary and disjunctions of species with northern affinities scattered along the glaciated coastline.

Gabrielson, Paul W., Hughey, Jeffery R. & Hommersand, Max H. **A PREVIOUSLY UNRECOGNIZED SPECIES OF *MAZZAELLA* (GIGARTINALES, RHODOPHYTA) IN ALASKA.**

Anatomical and molecular evidence has revealed in Alaska a previously unrecognized, widely distributed and morphologically highly variable species of Mazzaella. This taxon had been subsumed mainly under the name *Mazzaella heterocarpa*. ITS and rbcL gene sequences indicate that this taxon is distinct from the other four species of *Mazzaella* in Alaska with which it might be confused, namely, *M. oregona*, *M. phyllocarpa*, *M. parksii* and *M. splendens*. A distinguishing feature of cystocarps of this species is the production of numerous terminal tubular cells that extend from gonimoblasts to inner cortical cells that

surround the cystocarp. An available name for this taxon is *Iridophycus parvula* (Kjellman) Setchell *et* Gardner, based on *Iridaea laminarioides* var. *parvula* Kjellman from the Commander Islands. ITS1 sequences of type material, of more recently collected topotype material and of material from the Aleutian Islands, the Alaskan Peninsula and Southeast Alaska indicate that this species is widespread in Alaska. The distributions of this and other species of *Mazzaella* in Alaska and adjacent areas will be discussed.

Hommersand, Max H., Department of Biology, University of North Carolina; Liao, Lawrence M., Department of biology, University of San Carlos, Cebu, Philippines; Gurgel, Frederico D., Inst. de Biologia, Universidade Federal do Rio de Janeiro, Brazil; & Fredericq, S., Department of Biology, University of Louisiana at Lafayette.
THE CORRECT NAME FOR THE PLANT KNOWN AS GRACILARIOPSIS LEMANEIFORMIS FROM PACIFIC NORTH AMERICA.

The genus *Gracilariopsis* Dawson 1949 was established upon *Gracilaria sjoestedtii* Kylin 1928, a common species that ranges from British Columbia to central Pacific Baja California. Ever since Abbott reduced *Gracilaria sjoestedtii* to synonymy under *Gracilaria lemaneiformis* in 1983 the epithet "*lemaneiformis*" has been applied to similar *Gracilaria* and *Gracilariopsis* species around the world. We have shown that *G. lemaneiformis* is probably restricted to Peru and neighboring parts of Chile and that other entities referred to by that name are probably distinct, including the one from Pacific North America. The North American plant possesses large, distinctive cystocarps and is clearly separated from other species of *Gracilariopsis* in an *rbcL* phylogeny. A search for the earliest available name for the North American plant revealed that Abbott 1983 had typified a collection by C.L. Anderson from Santa Cruz, California, originally published as *Cordylecladia andersonii* Grunow in Piccone 1886, that corresponds to our species. Accordingly, the correct name becomes *Gracilariopsis andersonii*. The morphological and molecular evidence supporting this conclusion will be discussed.

Widdowson. Thomas B. Victoria, B.C., Canada. **DEMONSTRATION OF DATABASE: "MARINE MACROPHYTES OF THE NORTHEAST PACIFIC".** This is a relational database, using Microsoft *Access.* It is designed to accompany the 2000 edition of the UBC *Keys.* It contains approximately 69418 records, derived from information in the UBC herbarium and site specific ecological information in the literature. Data can be retrieved by taxon, locality, or ecology; either grouped or in the original form.

POSTER ABSTRACTS (Alphabetical by first author)

Barahona, Luis F., and Rorrer, Gregory L. Department of Chemical Engineering, Oregon State University.
SHOOT PROLIFERATION OF *OCHTODES SECUNDIRAMEA* MICROPLANTLETS.

Microplantlets derived from cell and tissue cultures of *Ochtodes secundiramea* and other red algae of terete thallus morphology exhibit growth at the apical meristem. The development and proliferation of *O. secundiramea* microplantlets were followed by light microscopy in non-agitated and bubble-agitated liquid suspension culture. To study the patterns of shoot initiation, microplantlet thallus tissues were first cut down into linear non-branched pieces of 2 mm length. New shoots proliferated in a symmetric, fractal array from both the cut and uncut faces of the explant. Shoot branching occurred primarily at the apical meristem. Microplantlets in non-agitated culture were lightly branched, whereas microplantlets in bubble-aerated culture were highly branched. In bubble-agitated culture, microplantlets ultimately developed into a dense ball of intricately branched shoot tissues of nearly 20 mm in diameter, with all major shoots emanating from center of the microplantlet. From these results, the hydrodynamics of the cultivation process may have a significant impact on microplantlet growth morphology. Specifically, it appears that bubble aeration of the liquid medium induces a tumbling pattern of the microplantlets that in turn stimulates a symmetric branching of the shoot tips. This hydrodynamically induced growth morphology promotes high-density biomass production.

Deshais, August M., Brian Rush, and Frank J. Shaughnessy. Department of Biological Sciences, Humboldt State University. **EFFECTS OF ARTIFICIAL FERTILIZER AND BRANT DROPPINGS ON THE GROWTH OF EELGRASS (*ZOSTERA MARINA* L.) AND ITS EPIPHYTES: A PRELIMINARY STUDY**.

Seagrasses can be nutrient limited and the degree to which this is the case for Eelgrass and its algal epiphytes in Humboldt Bay, CA is unknown. Objectives of the present study were to determine if Eelgrass and its epiphytes were nutrient limited, and to determine if these primary producers responded differently to artificial fertilization versus Brant droppings. The study ran for four weeks during Spring 2002 and, in addition to a control treatment, there were ammonium chloride on sediment, ammonium chloride in water, and Brant droppings treatments. Fertilization of any kind had no significant effect on Eelgrass leaf growth, below or above ground biomass, or on the number of short or long shoots. However, both the ammonium chloride and Brant droppings treatments had greater numbers of short shoots and the lack of a significant treatment effect was probably due to low statistical power. Epiphyte abundance actually decreased over time in all treatments, due to one storm event, and the ammonium on sediment treatment showed the least epiphyte loss, and coincidentally, the lowest numbers of the herbivore *Phyllaplysia taylori*. A better replicated experiment with the manipulation of *P. taylori* could result in bottom-up and top-down effects on both primary producers.

McBride, Susan. UC Sea Grant, Eureka, CA, Jeff Robinson, Humboldt Bay Harbor, Recreation and Conservation District, Eureka, CA, John Mello, Calif. Dept. of Fish and Game, Eureka, CA, Vicki Frey, Calif. Dept. of Fish and Game, Eureka, CA*, Neil Kalson, Calif. Dept. of Fish and Game, Eureka, CA. **HUMBOLDT BAY EELGRASS, *ZOSTERA MARINA*, PLANT DENSITY, PLANT LENGTH AND BIOMASS.**

Eelgrass population dynamics were studied in Humboldt Bay, California during summer 2001. Plant density (number of plants/m^2), plant length (mm), and biomass (kg wet weight/m^2) were measured at 15 sites in the north and central part of Humboldt Bay. Digitized aerial photographs were used to define Z. marina beds and determine their area in acres. A sample consists of three 100-m transect with plant material collected from six random 0.1m^2 quadrants along each transect. All plants were counted and recorded as flowering or non-flowering. Plant density ranged from 23 to 200 plants/ m^2. Mean sample site plant length was between 430 to 925 mm. Biomass fell into two broad categories, 0.40 and 0.80 kg/ m^2. Elevation appeared to have the strongest influence on biomass and plant density. The lower biomass values were found at sites with uneven terrain or a narrow band of *Z. marina*. In general plant length and plant density followed the same pattern as biomass.

McComb, Melinda C. Trinidad, California. **THE IMPACTS OF INTERTIDAL WILDCRAFTING OF MARINE ALAGE**.

Current law in California permits unlimited takes, with no seasons, quotas, size limit or mandated cutting techniques for commercial wildcrafters of marine algae in the intertidal zone. The lack of codified cutting techniques negatively impacts the ability of the algae to regrow, and the lack of seasonal limitations also

negatively impacts annual algae, such as *Postelsia*. There is also a significant "incidental take" of animal life with the seaweed. As wildcrafting becomes more economically viable due to increased local demand and internet marketing, the Dept. of Fish and Game Marine Life Protection Map review during 2002 is an opportune time to comment on the need for greater protection of these common resources by requesting mandated cutting techniques and protection of reproductive phases by limiting cutting to post reproductive seasons.

Milbrandt, Eric C. Oregon Institute of Marine Biology, University of Oregon. **BACTERIA COMMUNITY CHARACTERIZATION AND PROFILE (DGGE) PATTERNS IN RESTORED AND NATURAL COASTAL WETLAND SEDIMENTS, SOUTH SLOUGH, OR, USA.**

Molecular methods and data reduction techniques were used to describe sediment 16S rDNA Bacteria communities in a restoration site and three reference sites. We found that sampling location in the estuary was more important in determining composition of bacteria communities than sampling location within a site. Within each site, community profiles were compared along a perceived environmental gradient; the presence or absence of *Vaucheria longicaulis* mats. The reference sites showed a unique bacteria community associated with algal mats. The development of a unique mat associated community has not yet occurred in the restoration site. The interaction between algal mats and bacteria may be caused by a physical or biochemical feature of the mat. The presence of a unique community could serve as a benchmark for evaluating restoration success. Picked, reamplified bands from DGGE were unsuccessful in determining community members, therefore, two clone libraries were constructed. Differences in community composition in DGGE profiles were observed in clone libraries from restoration and reference sites. Clone identities suggest a functional difference between restored and reference, and could serve as a reference for future research and monitoring.

Rueter, John G. and Houston, Wm. Michael. Environmental Sciences Program, Portland State University. **EXTENDING THE C-S-R FUNCTIONAL MORPHOLOGY FRAMEWORK TO INCLUDE PHYSIOLOGY AND REGULATION.**

Our recent work has focused on extending the Species Diversity Theory Characterization of Reynolds in an attempt to include parameters of photophysiology and different types of regulatory responses. The photosynthetic parameters of alpha, Pmax, beta, steady-state respiration and post-illumination respiration were collected on seven species. In addition the temperature sensitivity of these species was studied. These physiological parameters were used to address tradeoffs that these species might make in their ecological strategies, for example the sensitivity to photoinibition at high light compared to the loss to respiration at low light. Several similar tradeoffs were explored. The efficiency of regulation is also important in variable environments. The efficiency of regulation was modeled as the potential growth lost during the time it takes for cells to optimize to a change in light. Several strategies were compared including set composition (i.e. no optimization), optimization with uniform allocation to different cellular components, allocation with different weights, and maintaining physiological diversity. These simulations help describe the conditions in which physiological optimization strategies are not competitive. For example, in large step functions of light, a set strategy can sometimes beat a regulatory scheme that tries to optimize to the changed condition. Similarly, in some fluctuating conditions, a population that contains cells that are optimized to several different light levels, but don't adapt in response to changes in light, can beat optimization strategies. These regulation strategies are mapped onto the C-S-R framework. The combination of physiological parameters and adaptation strategies are used to help understand the different effects of stresses and disturbances to phytoplankton communities.

Shaughnessy, Frank J. Department of Biological Sciences, Humboldt State University. **THE 1997 KURE OIL SPILL IN HUMBOLDT BAY: DID CLEANING ACCELERATE INTERTIDAL COMMUNITY RECOVERY?**

On 11/97 the MV Kure spilled 5,000 gallons of bunker fuel oil in Humboldt Bay, CA. The more heavily oiled intertidal riprap areas were cleaned with high temperature and pressure water. The immediate objective of the present study is to determine if cleaning accelerated the rate of community recovery. Oiled and cleaned sites, oiled and uncleaned sites, and unoiled sites have been seasonally sampled since the spill. Unoiled sites show seasonal pulses of limpets, low cover values of filaments, ulvoids and barnacles, and high but seasonal covers of cartilaginous algae like *Mastocarpus.* Cleaned sites started with high covers of filaments, sheets, and barnacles, but with the arrival of limpets, these pioneering organisms decreased in abundance whereas cartilaginous cover increased. However, the cover of *Fucus*, an alga that is rare in Humboldt Bay, has steadily been increasing at one of the cleaned sites. At uncleaned sites, limpets were slower to recruit, filaments and ulvoids have persisted, and cartilaginous cover is generally low. Cleaning may have accelerated the rate of

early community recovery, but high cover of *Fucus* suggests that cleaning may result in an atypical community, or that site-specific covariates are more important in affecting the direction of recovery.

Tiffany, Mary A. Department of Biology and Center for Inland Waters, San Diego State University. **VALVE MORPHOGENESIS IN THE MARINE ARAPHID DIATOM GENUS *TABULARIA*.**

Two *Tabularia* species were studied with scanning electron microscopy. The valve of *Tabularia investiens*, epiphytic upon *Ceramium* sp. from the littoral off San Diego California, begins with a wide sternum and widely spaced areolae. The apical pore field produces mucilage for connection to the host and develops early in valve formation. The rimoportula also forms early and is produced from an areolae close to the apex. Three to five thin outgrowths are produced from either side of each areola, fusing to form crossbars. The final step in morphogenesis is the production of cribra as outgrowths from the crossbars that more-or-less fully fill in the cribra. *Tabularia parva*, epiphytic on *Chaetomorpha linum* from the saline Salton Sea, differs in that the areolae are more closely spaced and the sternum is narrower. The progression of cribrum development also differs. Crossbars are produced but after completion, biseriate striae form as the spaces between the crossbars divide in two. These biseriate striae persist in mature valves, seen most easily from the interior. The early appearance and location of the rimoportula in this genus and in the araphid genus *Gephyria* argue against the prevailing theory that the raphe evolved from the elongation of a rimoportula.

Wood, Michelle[1], Scott Pegau[2], Helmut Maske[3], Chuck Trees[4], Jim Mueller[4,] and W.K.W. Li[5], [1]Ecology and Evolution, University of Oregon, Eugene, Oregon 97403; [2]COAS, Oregon State University, Corvallis, Oregon; [3]CICESE/Ecología, Ensenada, B.C., Mexico; [4]CHORS, San Diego State University, [5]Bedford Institute of Oceanography, Dartmouth, N.S., Canada. **ASSOCIATION OF A LOW-PHYCOUROBILIN CONTAINING PHYCOERYTHRIN WITH UPWELLING-INFLUENCED WATERS IN THE GULF OF CALIFORNIA.**

Phycoerythrin (PE) is the predominant light harvesting pigment of *Synechococcus*, a ubiquitous picocyanobacterial group. The pigment is highly fluorescent in vivo, $_{EmMax}$~560-570 nm and harvests green and blue-green wavelengths with varying efficiency depending on the chromophore composition of the form of phycoerythrin being synthesized. Most oceanic forms of *Synechococcus* are thought to produce a PE composed of higher concentrations of the blue-light absorbing chromophore, phycourobilin (PUB, $_{AbsMax}$~495nm), than the green-light absorbing chromophore, phycoerythrobilin (PEB, , $_{AbsMax}$ ~550nm). Recent studies in the Arabian Sea have shown that spectral forms of PE characterized by a relatively low PUB:PEB ratio dominate the PE fluorescence signature in upwelling-influenced waters, even when these waters are transported far offshore. In this study we examine a range of water mass types in the Gulf of California to test the hypothesis that these low PUB PEs are typically associated with Case I waters, under conditions of increased productivity when the attenuation of blue light is greater than that of green light. We also evaluate the data for the degree of correlation between parameters of the PE fluorescence signature and other optical parameters of surface water that would influence the interpretation of remotely sensed data on ocean color.

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