OS11I-10 1100h

Ultraviolet Radiation Induced DNA Damage in Marine Viruses Along a Latitudinal Gradient

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Ultraviolet radiation induced DNA damage (cyclobutane pyrimidine dimers, CPDs) in natural marine virus communities was examined along a latitudinal transect from 41 S to 3 N in the southeastern Pacific ocean. Surface waters were collected prior to sunrise each day and placed in UV transparent incubators kept at in situ seawater temperatures. A replicate treatment was prefiltered through a 0.2 um filter to remove microbial host cells. Both treatments were exposed to ambient solar radiation until approximately one hour before sunset. At the end of the day, the virus fraction was collected from each sample by filtration and concentration. DNA damage was determined in each fraction and compared to DNA damage in sunrise samples and DNA dosimeters. The experimental design allowed us to examine DNA damage induction in viruses with and without their host cells and to infer the role of host mediated repair (e.g. photoreactivation). CPDs in dosimeters and integrated solar irradiance are very highly correlated. There was no relationship between latitude (i.e. increasing solar irradiance) and net dimer production in viruses, suggesting that viruses may be relatively insensitive to damage. The presence of host cells resulted in no consistent pattern or change in the CPD induction of virus particles indicating minimal host mediated repair in the natural virus community. The sunrise residual CPD values in the viruses increased latitudinally with increasing irradiance. Low daily induction of damage in virus incubations but a high residual damage indicates that the sunrise damage levels were the result of DNA damage accumulation over numerous days indicating a long residence time for virus particles in surface waters.

OS11I-11 1115h

Viral and Protistian Control of Bacterioplankton Production Over an Oxic to Anoxic Gradient in Chesapeake Bay Water Column

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Over the past decade a number of approaches for estimating virioplankton production and the impact of viral lysis on bacterial mortality have been developed. However, outside of methods development efforts, few studies have examined changes in virioplankton production over environmental gradients. During summer months the mesohaline portion of Chesapeake Bay is highly stratified with cooler, anoxic, and more saline bottom water separated from warmer, oxic, and fresher surface waters. Virioplankton production and nanoflagellate grazing were estimated in water samples from three depths (surface, mid-water, and bottom). Each sample represented a unique portion of the stratified water column. Protists (ciliates and heterotrophic nanoflagellates) were present throughout the water column and numbers of these organisms were only 2.5 fold lower in anoxic bottom water. Interestingly, grazing estimates based on assumed clearance rates were lower than viral-mediated bacterioplankton mortality. Two methods were used to estimate virioplankton production namely, tritated thymidine (TdR) incorporation and fluorescently labeled virus (FLV) tracer approaches. Each method indicated lower viral production in anoxic bottom waters than in surface water. Dark viral decay rates were lower for deep water (ca. 1% h^{-1}) than for surface waters (ca. 4% h^{-1}). Estimates of viral-mediated bacterial mortality from each of the two methods disagreed widely. Using a burst size conversion of 50, the TdR method indicated that between 4 and 8 % h^{-1} of bacterial production was lost to viral lysis, whereas the FLV tracer approach indicated that ca. 160 % h^{-1} of bacterial production was lost to viral lysis in all incubations. The discrepancy between the methods could be due to increased lysogenic viral production during bottle incubations and an inability of the TdR method to detect that portion of viral production which relies on de novo synthesis of nucleic acid. These initial results indicate that viral lysis exceeds grazing as an agent of bacterioplankton mortality in eutrophic, estuarine waters and that controls of bacterial production in estuaries are similar over dramatic environmental gradients.

OS11I-12 1130h

Viral Dynamics in the Permanently Anoxic Cariaco Basin

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Free viral-like particles (VLP) were enumerated in water column (7-1310 m) and sediment trap samples collected during the CARIACO Time Series Program. Vertical distributions of VLP corresponded to those of bacterial abundance and bacterial net production (BNP), with primary maxima consistently in surface waters and secondary maxima near the O_2/H_2S interface. Temporal variations in VLP (0.81 - 631 x 10^8 VLP L^{-1}) correlated with variations in chlorophyll a, primary production, bacterial abundance and BNP in the upper 250 m. In the suboxic zone (250-450 m), VLP abundance covaried with BNP but not bacterial abundance nor chemoautotrophic production. In anoxic waters (> 450 m), temporal variations in VLP abundance were not significantly correlated with any measured variable. Relationships between viruses, hosts and environment appear to vary between these layers.

Vertical fluxes of VLP associated with sedimenting debris varied between 0.39 and 515 x 10^9 VLP m^{-2} d^{-1}, a range similar to bacteria (0.88-331 x 10^9 bac m^{-2} d^{-1}). VLP-to-bacteria ratios (VBR) in sinking pools were very low, varying from 0.01 to 1.21 and averaging 0.60, demonstrating that VLP were not as numerically important in sinking particles as they were in suspended communities where mean VBR were 16 (oxic), 3 (suboxic) and 31 (anoxic). Comparisons of sinking fluxes with suspended VLP pools demonstrate that vertical transport is relatively unimportant in redistributing viruses in the water column. Removal rates by sinking from the oxic, suboxic and anoxic layers averaged 0.11 % mo^{-1}.

OS11I-13 1145h INVITED

Influence of viral lysates on bacterial carbon cycling

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Organic matter released by viral lysis is potentially an important nutrient source for pelagic marine bacteria. Consequently, part of the dissolved organic carbon taken up by bacteria may be used several times in the microbial community before it is respired or transferred to higher trophic levels. A significant fraction of the bacterioplankton production may be based on such recycling of organic matter within the microbial community, and the liberation of viral lysates may, therefore, have a significant impact on the overall carbon cycling in the marine food web. Input of viral lysates may also affect the bacterial population dynamics since the release of cell contents (cytoplasmic and structural material) from viral lysis may influence the substrate conditions, thereby favouring growth of specific bacterial populations. We have studied effects of viral lysis of marine bacteria on bacterial carbon cycling and population dynamics of in two types of experiments: 1)In culture experiments with individual virus-host systems it was verified that viral lysates were potentially very important as substrates for the bacterial populations, and that release of viral lysates may affect bacterial growth and community composition. We also found indications for a close coupling between release and subsequent uptake of lysates. Non-infected bacteria were apparently colonizing infected cells during the latest stage of infection, suggesting that cell contents were leaking out of the cells before the total disruption of the cell. 2) In culture experiments with natural assemblages of bacteria we examined how a removal of most of the natural viral assemblage affected bacterial growth and respiration. The distribution of 3H-thymidine into different size fractions (dissolved fraction, viral fraction, bacterial fraction and respired fraction) was followed over time in batch cultures. The results indicated that bacterial net growth and bacterial growth efficiency were significantly higher in cultures with a reduced abundance of viruses than in control cultures with the natural viral abundance. The data indicated that viral lysis in natural assemblages of bacteria and viruses significantly affected the bacterial carbon cycling by liberating a fraction of the organic matter already taken up by the bacteria, thus stimulating recycling of bacterial carbon and reducing net bacterial production.

OS11J HC: 323 B Monday 0830h

Nutrient Dynamics in Coastal Ecosystems: Linking Physical and Biological Processes I

Presiding: **J Runcie,** Hawaii Institute of Marine Biology**; J Smith,** University of Hawaii Manoa

MON

OS11J-01 0830h INVITED

Evolutionary Perspectives on Nutrient and Water Movement Effects on Estuarine Macroalgae

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Macroalgae of marine origin form 'nuisance' blooms in certain estuaries which are subject to anthropogenic nutrient enrichment. Most of these algae are ephemeral/ruderal strategists with high specific growth rates at resource saturation and relatively short lifespans.Fossils of an alga which is closely related to some extant 'nuisance' bloom algae have been found in 1.2 billion year old rocks. Since there were no terrestrial ecosystems producing major geochemical effects until 0.5 billion years ago, there would have been no biological enhancement of fluxes of algal nutrients into estuaries during this 0.7 billion years. Over the last 0.5 billion years there have been such biologically enhanced fluxes.During the last 0.1 billion years there have also been local inputs of marine-derived nutrients to coastal sites in the form of the faeces and excreta of secondarily marine vertebrates which return to land to breed (pterosaurs, marine birds, pinnipeds). However, 'ornithocoprophilous' algae are not major components of 'nuisance' blooms. At present the flux of nutrients such as N and P through anthropogenically influenced estuaries can greatly exceed the nutrient use by the 'nuisance' algae. Water movements are also important in moving estuarine algae out to sea, and in removing algae which are overwintering in estuarine sediements and which could otherwise initiate blooms at that site in the following spring.

OS11J-02 0850h INVITED

Hydrodynamics and Nutrient Acquisition by Seaweeds

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The productivity of subtidal seaweeds is often considered to be restricted under slow mainstream flows because the development of a thick diffusion boundary layer (DBL) at the thallus surface reduces rates of inorganic nitrogen and carbon uptake compared to fast mainstream flows. Here I review evidence for reduced fluxes of essential nutrients (nitrogen and carbon) to seaweed thalli under slow flows, and discuss the physiological mechanisms by which seaweeds acquire nutrients from sources other than the mainstream flow. Recent work indicates that the time scales of DBL formation for bladed and branched seaweeds in stagnant flows is seconds, measured using O2 microoptodes. For branched seaweed species, properties of the thallus such as morphology and elasticity influence seawater velocities within the thalli, and the scale of turbulence generated. The time scales of DBL formation around seaweeds and their ability to acquire nutrients from a range of sources indicate that the production rates of seaweeds are unlikely to be restricted under natural situations.

OS11J-03 0910h INVITED

Internal Tidal Upwelling on Florida Coral Reefs: Episodic Nutrient Delivery to Deep Benthic Algae

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The relative importance of potential nutrient sources to Florida Keys reefs are not well known, and overall nutrient dynamics for the region are poorly understood. This study examined relationships between high frequency nutrient fluxes associated with internal tidal upwelling and distributions, growth, and tissue chemistry of the common benthic alga *Codium isthmocladum* at Conch Reef in the Upper Florida Keys. During intensive study periods in 2000 and 2001, the impact of semi-diurnal internal tidal bores was measured across sites from 7 to 50 m depth. The arrival of subsurface water in internal bores is marked by rapid drops in temperature of 2 to 8 $^{\circ}$C in 1 to several minutes, increases in upslope flow velocities up to 30 cm s^{-1}, and sharp increases in concentrations of nitrate and phosphate to as high as 2 to 4 μM and 0.1 to 0.3 μM respectively. Instantaneous concentrations and near-bottom fluxes of nitrate and phosphate can be an order of magnitude or more higher during internal bore conditions than during non-bore, ambient conditions. The frequency, duration, and magnitude of nutrient pulses associated with internal bores all increase with increasing depth on the reef slope. Several lines of evidence suggest that nutrient enrichment from deep water has a significant effect on *Codium* at this site. The distribution and mean size of individual algae showed marked increases with increasing depth from 10 to 38 m. A short-term growth experiment showed increased growth at 34 m relative to 22 m. In June 2001 mean *Codium* tissue percent nitrogen increased from 0.65% ($\pm$0.11) at 10 m depth to 0.69% ($\pm$0.12) at 20 m and 1.05% ($\pm$0.11) at 32 m. δ^{15}N values increased from 2.61 ($\pm$0.05) at 10 m to 3.49 ($\pm$0.69) at 20 m and 4.68 ($\pm$0.21) at 32 m suggesting increased utilization of deep water N sources with depth. Seasonal variation in *Codium* N% and δ^{15}N was also observed, and corresponds to variation in internal tidal upwelling. Internal tidal upwelling is widespread on Florida Keys reef slopes, and high frequency nutrient pulses creating highly variable nutrient concentrations are inherent features of nutrient dynamics of this region.

OS11J-04 0930h

Marine macroalgae as bioindicators of elevated nutrients: effects of physical processes on algal physiology.

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Marine macroalgae have been widely used as indicators of the surrounding environment. Marine coastal areas with high levels of human activity are often influenced by elevated nutrient or contaminant loading, altered insolation due to increased sediment loading, or more frequent and intense freshwater events. Knowledge of the extent to which human activity is altering the environment is becoming increasingly important for the maintenance of an acceptable environment. Physiological attributes of macroalgae that reflect changes in these environmental conditions form the basis of most bioindicator studies. These attributes include the elemental composition (C:N:P) of the alga; 13C:12C and 15N:14N ratios; photosynthetic rates; nutrient uptake rates; and the composition and quantity of photosynthetic pigments. However, distinguishing the effects of human activity (urban runoff, sewage disposal) from natural events (changes in seasons, water movement, temperature, rainfall) in terms of algal physiology is problematic.

In this paper I discuss how physical processes influence the physiological responses of marine macroalgae to elevated nutrient loading. I compare the results of two studies that used macroalgae to assess nutrient loading in a) the upper reaches of a temperate estuary subject to sewage discharge, and b) a tropical coastal embayment with considerable oceanic influence. Both environments are subject to anthropogenic nutrients from different sources and are dominated by different hydrodynamic processes. Algal physiological parameters as discussed above are examined in the light of these physical processes.

OS11J-05 0945h

Nutrient Dynamics of the Green Alga Halimeda tuna Along a Depth Gradient at Conch Reef, Florida Keys: Possible Influence of Internal Tides?

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A factorial nutrient enrichment study was conducted to quantify differences in growth and physiology of the common reef alga Halimeda tuna at two depths (20 and 3 m) on Conch Reef, Key Largo, Florida. Previous research conducted at this site has documented the occurrence of periodic internal waves delivering cold water onto deep reefs. We hypothesized that deep populations of benthic algae would be less nutrient limited than shallow populations of the same species as a possible result of these events. Growth of H. tuna was significantly greater at the 20 m site than at the 5 m site. In general, plants at the deeper site were significantly larger than at shallow site and deep plants showed no growth response to enrichment. Shallow enriched plants reached levels of growth that were similar to and not significantly different from deep un-enriched plants. All morphological parameters examined showed similar results. Photosynthetic parameters estimated using PAM florescence showed that these two populations exhibited typical sun-shade characteristics as would be expected from high and low light environments. The nutrient enrichment effects on PAM parameters suggest that both populations were physiologically nutrient limited but again the 5 m population responded more than the 10 m population to enrichment. Tissue nitrogen and phosphorous content were significantly greater for the deep population and both populations showed a significant positive response to enrichment. Results of this study show differential nutrient limitation between two populations of H. tuna along a depth gradient where deep reef plants were more nutrient replete than the shallow. This suggests that natural offshore enrichment events such as upwelling on tropical reefs may be important in driving benthic community production.

OS11J-06 1020h

The Temperature-Nitrate Relationship Along the Baja California Coastline and Giant Kelp Forest Carrying Capacity: Ecosystem Signals of a Physical-Chemical Anomaly?

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Locally intense upwelling events along the California and Baja California coastlines result in highly productive zones inhabited by primary producers such as the giant kelp, Macrocystis pyrifera. Temperature and nutrient concentrations are two important factors affecting giant kelp forest survival. When temperatures rise above 20°C, in general Macrocystis pyrifera plants tend to deteriorate in California. Low nutrient concentrations, often inversely correlated with higher temperatures in these upwelling zones, have been implicated in kelp forest deterioration in California. However, in Baja California, M. pyrifera forests have been shown to thrive in warmer waters in spite of the well-known deleterious effects of high temperatures on giant kelp survival. Analysis of the temperature-nitrate relationship in Baja California shows a similar relationship to that established for California coastal waters: increasing nitrate concentrations with decreasing temperatures. However, in more southern Baja California sites, the relationship becomes shifted to show higher nitrate concentrations in warmer water than would be expected. In California, waters warmer than 15°C rarely show detectable nitrate concentrations, whereas in Baja California detectable nitrate was found at temperatures up to 19°C. We propose that the survival of southern-limit Baja California M. pyrifera kelp forests detected at times in warmer waters, and the higher carrying capacity of southern Baja California sites may be due, in part, to differences in the temperature-nitrate relationship of that region. The reasons for the different relationship between these physical and chemical factors, and the biological processes linked to them, will be discussed.

OS11J-07 1035h

Eutrophication Increases Grazing Pressure of Brown Algae via Increased Performance of the Herbivores

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Plant-herbivore theories predict that the availability of nutrients is reflected in the nutritive value and defensive chemistry of plants. We have experimentally examined the effect of environmentally induced plasticity in algal quality on herbivore fitness and consequently, the capability of the alga to induce herbivore deterrence.

We evaluated the effect of the nutrient enhancement on the quality of Fucus vesiculosus as food for its major herbivore. First, we reared the adults of Idotea baltica on algae grown either on enhanced nutrient or control conditions for the entire intermolt preceding mating and oviposition. The herbivores fed on nutrient-treated algae achieved significantly higher growth rates, consumed more food and laid more and larger eggs than the controls.

Second, we reared the juveniles of I. baltica for five intermolt cycles on filamentous green alga Cladophora glomerata, grown either on enhanced nutrient or control conditions. The juveniles showed similar trend as the adults: animals fed on nutrient-treated alga reached twice the weight in a shorter time compared to those fed on control alga.

Third, we examined the existence of inducible deterrence of F. vesiculosus against I. baltica by simulating herbivory in within-plant and temporal scales. Changes in phlorotannin concentration of the algae and herbivore feeding preference tests suggested that F. vesiculosus has rapidly induced responses to herbivore feeding. However, these responses were not strong and nutrient enhancement did not significantly affect the occurrence of induction.

We suggest that eutrophication may potentially improve quality of the algae for herbivores. This is likely to be reflected in herbivore population dynamics and increased grazing pressure. As a consequence, elevated nutrient levels in the water due to eutrophication may be a cause for diminishing brown algal belts through increased herbivore densities.

OS11J-08 1050h

A Detailed Study of the Nitrogen Isotopic Composition of Organic and Inorganic Nitrogen in a Coral Reef Environment

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Over the past decade there has been a perceived decline in the health of many coral reefs in the Caribbean and in particular in the Florida Keys. One postulated explanation is that a higher nutrient load caused by anthropogenic activity has resulted in the increased growth of algae that competes with the corals for substrate and in some instances, overgrows and kills them. It has also been suggested that the stable isotopes of nitrogen may provide a tracer with which to recognize the impact of anthropogenic nutrients within the coral reefs ecosystem. Several papers have provided data purporting to show this affect on a global scale, as well as within Florida, however, in spite of these published data there remains an absence of basic information on the range of nitrogen isotopes and fractionation in coral reef environments. Such data are vital to interpret the δ^{15}N values of reef organisms and to assess the importance of anthropogenic nitrogen. In order to remedy this situation, we have been conducting a systematic survey of the isotopic composition of organic and inorganic nitrogen in the water column, benthic organisms, and higher trophic organisms in the Florida Keys National Marine Sanctuary. The δ^{15}N of nitrate in the reef waters shows an inverse correlation with concentration, such that positive values relate to low nutrient waters. This is a result of fractionation during the assimilation of nitrate by photosynthetic organisms. This range is consistent with data measured on particulate organic matter (+1 to +5 per mille), corals (+2 to +6), algae (-2 to +10 per mille), and grazing fish (+6 to +8 per mille). Considering these data, it is possible to explain positive δ^{15}N values found in reef organisms by mechanisms other than anthropogenic input.

OS11J-09 1105h

Wind events and Benthic-Pelagic Coupling in Western Florida Bay

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We hypothesized that episodes of wind-induced mixing in Florida Bay (25.07°N, 81.01°W) contributed to biological processes in the water column by suspension of benthic dissolved and particulate materials, including benthic biota. Suspended particulate material, dissolved nutrients (NH_4^+, NO_2^-+NO_3^-, PO_4^{3-}, and SiO_2^{2-}), light, chl *a*, phytoplankton growth and meso and micro-zooplankton grazing were measured daily in Florida Bay from 5-13 March 2001. Initially strong N and NW winds (16 m s^{-1}) gradually diminished during our study. These strong winds resulted in a high degree of particulate material suspension, associated with low light penetration into the water column and enhanced nutrient availability. The highest concentrations of NH_4^+, PO_4^{3-}, and SiO_2^{2-} were observed during the strongest period of mixing, suggestive of a benthic source. Phytoplankton growth rates were light limited during the period of highest SPM concentration. As SPM settled and light transmittance increased, chl *a* concentration and phytoplankton growth increased. Elevated nutrient concentrations quickly diminished. Dilution experiments indicated phytoplankton growth exceeded losses to microzooplankton grazing by significant amounts during this event, with greatest differences during periods of highest SPM concentration. Mesozooplankton did not exert a strong grazing pressure on phytoplankton (<1% reduction in phytoplankton growth rate). Given the regular seasonal passage of northern air masses through Florida Bay during the October-April time period, we conclude that wind-driven suspension events are an integral component of material cycling in this system.

OS11J-10 1120h

Friction, Roughness, Turbulence and Nutrient Uptake by Coral Reefs

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Coral reefs are some of the roughest surfaces encountered in the ocean and maintain this roughness, against the effects of erosion, by their continuous growth processes. Such roughness creates extreme turbulence which is vital to many fundamental biological processes which are of prime importance to the health and ecology of coral reefs. The roughness of coral reefs exists on spatial scales extending from individual polyps (few centimeters) to the larger-scale complex topography of complete reefs (hundreds of meters) and so the conventional nearshore concept of smoothly-varying bathymetry is nowhere applicable to coral reefs. The hydrodynamic 'roughness length' is very large on coral reefs and varies not only with spatial scale but with bottom type, e.g. sand, rubble or living-coral. This paper discusses the important spatial scales for which roughness controls wave-forced currents, turbulence and nutrient uptake. Results are then presented for the variation of frictional stress, turbulent energy dissipation, and nutrient uptake with the height and period of waves on reefs. The paper proceeds to analysis the importance of roughness in controlling water flow across coral reefs, and the associated flushing of their lagoons, and also the dependence of these quantities on the height and period of incoming waves.

URL: http://www.ge.adfa.edu.au/SPECIES

OS11J-11 1135h

Export of Sediment and Nutrients to the Great Barrier Reef from Monsoonal Catchments of NE Queensland

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Monsoonal rivers in NE Queensland drain an average of 70 cu. km of runoff into the Great Barrier Reef (GBR) each year from a catchment of 422,000 sq. km. Most of the GBR catchment was covered by savanna woodland and is now used for cattle grazing. Substantial clearing of vegetation has taken place in some catchments. Intensive cultivation of sugarcane occurs on 4,000 sq. km in wetter portions of the coastal plain. Runoff dynamics are characterised by a high level of inter-annual, seasonal (wet-dry), regional (wet tropics dry tropics) and event-based (tropical cyclone) variability. Most freshwater runoff and export of sediment and nutrients occurs during brief wet-season flood events, which follow cyclones or monsoonal rain depressions. In this variable runoff regime, wet and dry catchments exhibit typologically consistent discharge volume-export relationships for sediment and nutrients (N, P). Dry-catchment rivers have low area-specific runoff rates, but high volume-specific sediment and nutrient loads. Wet-tropical rivers have high area-specific runoff, but lower volume-specific loads. These topological relationships have been used to estimate whole-catchment exports of sediment and nutrients to the GBR that take account of the considerable natural hydrological variability of NE Queensland rivers. Longitudinal sampling of nutrient concentrations within individual rivers indicates that sediment and nutrient exports to the GBR have increased several-fold in the last century as a result of land clearing and floodplain fertiliser applications.

OS11J-12 1150h

The Legacy of Historic Sewer Discharges: Here Today...Gone Tomorrow?

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In the early 1970's, monitoring of Palos Verdes infauna by the Los Angeles County Sanitation Districts (LACSD) revealed distinct effects from wastewater discharge, including low numbers of species diversity, abundance, and biomass in the areas around the outfalls. Since the 1970's, long-term monitoring of the area has allowed documentation of environmental and biotic recovery in response to improving effluent quality. Impacts related to the wastewater discharge were severe during the early years of the surveys, but have dramatically decreased over time. As a result, many adverse alterations to marine habitats have decreased in magnitude or disappeared altogether. Nevertheless, historically deposited contaminated sediments still remain on the shelf and slope. Physical and biological processes are mixing these sediments, and contaminants continue to be bioavailable from both surface and buried sediments. This process allows contaminants that have not been discharged in decades to continue to influence the local fish and invertebrate communities. Options for dealing with this situation will be discussed.

URL: http://www.epa.gov/region09/features/pvshelf/pilot.html

OS11K HC: 315 Monday 0830h

Multidisciplinary Ocean Observations and Observatories I

Presiding: **J Orcutt,** Scripps Institution of Oceanography**; R A Weller,** Woods Hole Oceanographic Institution

OS11K-01 0830h INVITED

Sea Change for the Ocean Planet

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Through development of new platforms, observational technologies, and modeling capabilities, the ocean and earth sciences are on the threshold of a revolution in ability to address fundamentally new scientific questions and to support a much broader community of users of information about the ocean. Specifically, advance in knowledge of the oceans has been severely limited by lack of sustained observations over extended periods and large areas. There is an immediate need for a new approach that effectively links basic research and operational oceanography to provide the data, information, and understanding required for more timely detection, understanding and prediction of change in all aspects of marine and estuarine ecosystems and the resources they support. New approaches are being developed to continuously visualize and assess environmental data that describe physical, biological, chemical, and geological processes operating in the four dimensions of space and time. To achieve expected new scientific insights at previously poorly-explored scales of observation and simultaneously serve national needs for better awareness of ocean processes, the GOOS (Global Ocean Observing System)and DEOS (Dynamics of Earth and Ocean Systems)international initiatives need to develop synergistically and become operational via the National Ocean Partnership Program (NOPP) and Ocean.US as soon as possible. A key premise of this approach is that hypothesis-driven basic research programs and the development of operational oceanography are critically dependent on each other. Basic research to be conducted via the DEOS initiative will be required to develop the full capabilities of the GOOS initiative, and the scales of observation and visualization made possible by use of GOOS, will increase the value and importance of more specifically-scientific inquiries.

URL: http://core.cast.msstate.edu/NOPPpg1.html

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The Coastal Module of The Global Ocean Observing System (Goos): an Assessment of Current Capabilities to Detect Change

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There is an immediate need to develop the coastal module of GOOS that will enable periodic ecosystem assessments and significantly improve the ability of participating nations to achieve the goals of international agreements and conventions for environmental protection, sustainable living marine resources, healthy marine and estuarine ecosystems, and safe and efficient marine operations. It is likely that, in the absence of a sustained observing system for improved ecosystem assessments and prediction of environmental changes and their effects on the environment and people, conflicts between commerce, recreation, development, environmental protection, and the management of living resources will become increasingly contentious and politically charged. The social and economic costs of uninformed decisions will increase accordingly.

Two related topics are addressed in this context. The first is the challenging task of producing scientifically credible quantitative assessments of the status, condition or health of coastal marine and estuarine ecosystems (ecosystem assessments) on regional to global scales. The second is the current capacity to provide the data required to produce such assessments in a routine and repeatable fashion (a purpose of GOOS).

The Program of Action for Sustainable Development (Agenda 21 agreed to at the UNCED conference in1992) calls for the establishment of a global ocean observing system that will enable effective and sustainable management and utilization of the marine environment and its natural resources. Effective and sustainable use of the marine environment and its living resources depends on the capability to routinely and periodically assess and anticipate changes in the status of coastal ecosystems and living resources on national to global scales. Recent attempts to produce such quantitative assessments have not been successful on either national (U.S.) or global scales. The reasons for this state of affairs and the status of the coastal module of GOOS are discussed in this context.

URL: http://www.hpl.umces.edu/cgoos/cgooshome.html

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