

Palos Verdes Peninsula, Portuguese Bend

PHOTO: SARAH WOODARD



The Notes and Abstracts section contains summaries of research and policy submitted to *Urban Coast*, as well as abstracts from current literature. In this section *Urban Coast* brings together innovative environmental research, technical studies, BMP or LID implementation, and policy developments to keep our readers abreast of the latest developments in urban coastal research and policy. We welcome suggestions for abstracts to include in this section as well as submittals. By submitting to *Urban Coast*, you will be reaching our stakeholders and decision makers, keeping them apprised of the latest thinking about environmental issues and solutions, and helping practitioners to share knowledge of how the vast array of techniques and tools available are being applied in urban coastal regions. Please direct correspondence to sbergquist@santamonicabay.org and swoodard@waterboards.ca.gov.

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Scaling Up to Networks of Marine Protected Areas in the Philippines: Biophysical, Legal, Institutional, and Social Considerations. Lowry, G.K., A.T. White, and P. Christie. 2009. *Coastal Management*. 37(3&4):274-290.

Abstract

The growing number of marine protected areas (MPAs) globally represents an increasing interest in marine conservation and fisheries management and the potential of planned and managed MPA networks as a way of strengthening local management. This study documents the development of MPA networks in the Philippines and identifies critical success factors and issues. Methods were field observation by participation in MPA and fisheries management projects and focused interviews that gathered opinions and observations of primary MPA network stakeholders in the central Visayas region. Findings show that an MPA network is defined through social and ecological criteria. From a social perspective, a network is comprised of people and organizations that manage component MPAs, benefit from the network, and promote the network's viability through shared administrative responsibility and information. To qualify as part of an ecological network, individual MPAs must interact ecologically (e.g., source or sink of larvae and propagating organisms, protection for habitat, and threatened or endangered species) to enhance

fisheries and biodiversity conservation. The study found that while social and ecological criteria are shaping MPA networks through science-based planning, integrated management, and coordination, there exist numerous institutional issues related to scaling up to networks from single MPAs. Issues pertain to: limiting access to resources, boundary delineation, monitoring compliance, finding common goals and identity, and conflict resolution. Factors correlated with management success included common institutional processes and legal support, improved understanding of benefits from a network and improved habitat conditions and fishery yields associated with MPAs.

Practicing Coastal Adaptation to Climate Change: Lessons from Integrated Coastal Management. Tobey, James, P. Rubinoff, D. Robadue Jr., G. Ricci, R. Volk, J. Furlow, and G. Anderson. 2010. *Coastal Management*. 38(3):317-335.

Abstract

The challenges faced in adapting to climate change present themselves with increasing urgency. Nowhere will these challenges be greater than in the developing world where often weak institutions and governance systems struggle to deal with mounting pressures from population growth, inadequate infrastructure, and diminishing or already

depleted natural resources. This article synthesizes the many global climate change and other anthropogenic threats to coastal ecosystems and draws on lessons and good practices from global experience in integrated coastal management (ICM) that can be transferred to coastal adaptation to these challenges. The case is made that the process and best practices of ICM are not radically changed by applying a climate lens. For the most part, the good practices of planning and implementation coastal management measures apply equally to climate change as they do to other coastal issues. However, there are some new and important considerations that enter into planning and decision-making with respect to climate change. These considerations include the need for an even greater emphasis on nature-based coastal protection strategies and measures, more pronounced issues of uncertainty in decision-making, the need for a longer planning horizon, and the importance of including in the decision-making equation opportunities to mitigate the sources of climate change with adaptation measures.

The Challenge of Threatened and Endangered Species Management in Coastal Areas. LeDee, Olivia E., K.C. Nelson, and F. J. Cuthbert. 2010. *Coastal Management*. 38(4):337-353.

Abstract

A substantial proportion of U.S. federally listed species inhabit a small fraction of the nation's land mass, the coastal zone. Historically, management in this region has been conflict-ridden among diverse parties interested in natural resource extraction, land use, and conservation. This tension persists today, albeit in a more contemporary form: public access demand versus ecosystem conservation. The focus of this study is the influence of this tension on local-level management of federally threatened and endangered species. We surveyed managers of 43 locations of ecological importance for a threatened shorebird, the Piping Plover (*Charadrius melodus*). Reflecting the federal mandate to accommodate both public access and ecosystem conservation, we detected a shift in mission from sole-purpose initiatives (e.g., public access or ecosystem conservation) to a multiple-use mission (i.e., resource-based recreation). Public access and ecosystem conservation were the primary management goals at surveyed sites, 97 and 93%, respectively. Accessible public recreation is common at most locations; however, active management for listed species is rare. Ultimately, local land managers are accountable for managing coastal sites for dual use, thus the tension; however, coastal management activities have yet to resolve the conflict between concurrent management of public access and ecological requirements of listed species.

Land Changes and Conflicts Coordination in Coastal Urbanization: A Case Study of the Shandong Peninsula in China. Xu, Xuegong, H. Peng, Q. Xu, H. Xiao, and G. Benoit. 2009. *Coastal Management*. 37(1):54-69.

Abstract

The coastal zone is an interaction region between land and ocean and an interface of geosphere, hydrosphere,

atmosphere, and biosphere, as well as greatly affected by human activities. Driven by economic activities and increased population, urbanization is rapidly developing in coastal zones, and a series of land resource and environmental conflicts have occurred, especially in developing countries at times of economic transition. This article reports a case study of the Shandong Peninsula of East China. We analyze the land-use practices and land cover changes of six cities over a timeframe of nearly a decade. We then review the management conflict issues. The most commonly encountered conflicts fall into three categories: those between expanding constructed land and decreased cultivated land; those between land resource utilization and conservation; and those between increasing demand for land and degrading land quality. All in all, they reflect the fundamental conflicts between short-term economic development gains and long-term food security and ecosystem sustainability. This article puts forward an institutional approach to coordinate these conflicts so as to realize integrated and coordinated coastal management

Sea-level Rise Research and Dialogue in North Carolina: Creating Windows for Policy Change. Poulter, Benjamin, R.L. Feldman, M.M. Brinson, B.P. Horton, M.K. Orbach, S.H. Pearsall, E. Reyes, S.R. Riggs, and J.C. Whitehead. 2009. *Ocean & Coastal Management* 52(3-4):147-153.

Abstract

Coastal areas are among the world's most vulnerable landscapes to impacts related to climate change, including inundation from sea-level rise (SLR), increased exposure to shoreline erosion, and greater frequency and intensity of storms. The status of research on the physical, ecological, and socio-economic effects of vulnerability to SLR and progress toward planning for its consequences varies from region to region worldwide. Here, we synthesize the results of three decades of SLR research and the development of coastal management policies in North Carolina, USA. We identify the major factors responsible for opening new policy 'windows' that address SLR, including how stakeholders have developed an increased understanding of the risks, the extent of public dialogue about potential response strategies, and advances in political receptivity to policy change. Research and policy progress in North Carolina continue to provide a model for other regions to help guide and evaluate the development of coastal policies.

The Convergence of Integrated Coastal Zone Management and the Ecosystems Approach. Forst, Mark F. 2009. *Ocean & Coastal Management*. 52(6):294-306.

Abstract

The primary role of the Integrated Coastal Zone Management model was to arbitrate conflicts between stakeholders in a living and natural resource environment characterized by a common property and open access doctrine. A chronology of events describes how the development and acceptance of an ecosystems approach policy began to converge and coincide with the spread and development of Integrated Coastal Zone Management. Those organizations that gave representation

to the conservation ethic became internationally recognized as surrogate natural resource 'users', the interests of which possessed commonality with all stakeholder interests in general. The tenants of conservation policy were therefore largely employed to decide the merits of disputes over ocean and coastal resources. In the 1990s, scientists created a forum to debate, better define, and institutionalize a sound basis for ecosystem management theory and practice. Protocols were developed that embedded science in living and natural resources planning and management. These protocols were shaped and adopted to serve an evermore contemporary Integrated Coastal Zone Management model. Improvements in methodology include the use of adaptive management, ecological modeling and monitoring, appropriate temporal and spatial scales, salient indicators, and stakeholder participation. This contemporary approach is dependent upon recognizing the benefits inherent in utilizing instruments capable of managing resources on a holistic level. Bioregional planning and zoning accommodate the successful management of resources on this level. It is a direct outcome of the convergence of Integrated Coastal Zone Management and the ecosystems approach. Bioregional zoning schemes are capable of traversing the private property and common property doctrines that define the respective terrestrial and aquatic environments of the coastal zone. A comparative case study of the Great Barrier Reef Marine Park and the Belize Marine Protected Area Program is included as an annex, the analysis of which is predicated upon the principles espoused in the literature.

Integrated and Interdisciplinary Scientific Approach to Coastal Management. Tintoré, Joaquín, R. Medina, L. Gómez-Pujol, A. Orfila, and G. Vizoso. 2009. *Ocean & Coastal Management*. 52(10): 493-505

Abstract

Coastal zones and beach management practices, regulatory decisions, and land use planning activities along coastal zones have historically been made with insufficient information concerning the dynamic coastal environment. In this study we address and integrate an interdisciplinary scientific approach to Coastal Management in a scenario where lack of this information has resulted in the alteration of the natural dune system of the beach of Cala Millor (Mallorca, Balearic Islands, Spain), and also in the perception of the beach retreat and in a parallel way, a risk for the tourism resources. In this work the detailed studies on beach morphodynamics have been developed as a basis for integrating proper beach management, beach natural dynamics and local users and economic agent interests. From this point of view a set of solutions are considered as the basis for a management policy that links beach science and beach use as a tourism resort resource.

Sustainable Coastal Resources Management: Principles and Practice. Turner, R.K., W.N. Adger, S. Crooks, I. Lorenzoni, and L. Ledoux. 2009. *Natural Resources Forum*. 23(4):275-286.

Abstract

Coastal zones are currently experiencing intense and sustained environmental pressures from a range of driving

forces. Responsible agencies around the globe are seeking ways of better managing the causes and consequences of the environmental change process in coastal areas. This article discusses the basic principles underpinning a more integrated approach to coastal management, as well as the obstacles to its implementation in both developed and developing countries. The fulfilment of the goal of sustainable utilisation of coastal resources via integrated management is likely to prove to be difficult. Any successful strategy will have to encompass all the elements of management from planning and design through financing and implementation. An interdisciplinary analytical and operational approach is also required, combined with a more flexible and participatory institutional structure and emphasis to account for multiple stakeholders and resource demands. As historical and institutional perspectives as well as socio-economic and cultural contexts are also important, two case studies (based on UK and Vietnamese experiences) are presented in order to identify arguments and examine these aspects in more detail.

Integrated Coastal Management: A Comparative Analysis of Four UK Initiatives. Stojanovic, T.A. and R.C. Ballinger. 2008. *Applied Geography*. 29(1):49-62.

Abstract

The effectiveness of institutional arrangements and policies for governance has become a key question within the sustainability paradigm, not least in coastal areas which have unique issues and jurisdictions across the land-sea interface. In the UK, approximately 60 non-statutory coastal management initiatives have been established at the local/regional level since the 1990s, based on a variety of programmes and projects. Proposals for a UK Marine Bill have raised questions about the role of non-statutory initiatives in the system of governance. The traditional sectoral approach to management and planning is being modified due to the pressure of increased human activities, but doubts exist about what effective contribution local and regional partnerships can make. The paper reports extensive examples of Integrated Coastal Management initiatives engaging institutions and society to produce outputs which have transformed management, promoting long-term, collaborative, participatory and ecologically sustainable approaches. The paper concludes that there are demonstrable benefits in taking a partnership approach to coastal management at a local level, yet these forms of planning and management are not widely accepted or embedded within the current system of governance.

Balancing Science and Society through Establishing Indicators for Integrated Coastal Zone Management in the Balearic Islands. Diedrich, A., J. Tintoré, and F. Navinés. 2010. *Marine Policy*. 34(4):772-781.

Abstract

This paper explores the process by which indicators may be developed as tools for communicating science to decision-makers using the participatory approach demonstrated by the Balearic Indicators Project. This initiative reflects a series of compromises considered necessary to achieve the objective of generating an indicator system that is

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scientifically viable, comparative internationally yet locally relevant, and to facilitate its implementation. The article highlights questions regarding the utility of science for addressing current global issues related to sustainability and why science often fails to promote change at the societal level.

The Role of Research Networks for Science-policy Collaboration in Coastal Areas. Stojanovic, T.A., I. Ball, R.C. Ballinger, G. Lymbery, and W. Dodds. 2009. *Marine Policy*. 33(6):901-911.

Abstract

This paper reviews the approach taken by several UK coastal partnerships in developing research strategies and programmes. It reports on the status of these research initiatives and describes how the co-ordination and communication of scientific research have been approached through active partnerships with universities and the wider research community. Results of semi-structured interviews are followed by in-depth case studies of research networks on the Sefton Coast (focusing on coastal morphology) and the Severn Estuary (focusing on coastal change and climate change impacts). The results reveal the constraints and opportunities that exist in bringing together a variety of knowledge holders in the coastal zone. The paper identifies key elements of these initiatives and highlights lessons that can be applied to the development of other research initiatives in order to achieve science supported, ecosystem-based management.

Practice Versus Policy-led Coastal Defence Management. O'Connor, M.C., G. Lymbery, J.A.G. Cooper, J. Gault, and J. McKenna. 2009. *Marine Policy*. 33(6):923-929.

Abstract

Throughout northwest European coastal countries risks associated with coastal erosion are significant but spatially and temporally variable. The level of this risk is largely dependent on the extent of development within the coastal zones and a variety of approaches have been adopted for its management. The decision-making process for responding to erosion risk depends to a large extent on national policy. Coastal protection policy in northwest European countries varies in terms of the level of centralisation and formality of arrangements. In this paper the practical outworking of the informal practice-based system of Ireland, where there is no national policy framework, is compared with the policy-led system of England and Wales where formal national guidelines exist. Using case studies, the strengths and weaknesses of both the bottom-up and top-down approaches are assessed. The findings reveal strengths and weaknesses in both existing types of approach.

Successful Integrated Coastal Zone Management (ICZM) Program Model of a Developing Country (Xiamen, China) – Implementation in Bangladesh Perspective. Islam, Kazi Shakila, X. Xue, and M.M. Rahman. 2009. *Journal of Wetland Ecology*. 2(1&2):34-40.

Abstract

This paper represents the overall current situation of two Integrated Coastal Zone Management (ICZM) programs- one is as a successful model like Xiamen ICZM program in China and another is as a developing project like ICZM program in Bangladesh. The paper begins with an attempt to track the evolution of policies and their implementation on coastal zone management with particular reference from both the countries. It then discusses the coastal management and livelihood issues that predicate the different socio-economic and environmental situation between the two countries. The paper then goes on to discuss how the institutional management and policy initiatives of Xiamen ICZM have dealt with in the perspective of Bangladesh. There is a brief consideration of the progress of the management for ICZM of Bangladesh and how this project might be more effective and beneficial for Bangladesh.

Geographic Information Systems Applied to Integrated Coastal Zone Management. Rodríguez, I., I. Montoya, M.J. Sánchez, and F. Carreño. 2009. *Geomorphology*. 107(1-2):100-105.

Abstract

The littoral is the area where marine and terrestrial processes superpose and interact. Limits of their respective actions are imprecise, as processes which are characteristic of each of these environments do overlap. This particular characteristic makes the littoral zone complex and vulnerable to human activity, which in many cases, causes irretrievable damage to the natural equilibrium. Integrated Coastal Zone Management (ICZM) promotes sustainable coastal development by adapting the use of natural resources in a way that avoids serious damage to the natural environment. This requires an integrated and organized action of all institutions that are involved in coastal development. Geographic Information Systems (GIS) besides being a useful tool for drawing maps on different scales and projections constitutes an excellent instrument for data analysis and integration due to its ability to identify spatial connections between different information layers. In this way, it is possible to build models for geomorphological evolution and predict changes in the coastal areas. In order to illustrate this, three examples of GIS applications are presented, which are currently being developed in different areas of the Spanish littoral, coastal hazards, shoreline evolution and coastal sand dune evolution, respectively.

Nature Conservation for Future Sustainable Shorelines: Lessons from Seeking to Involve the Public. Milligan, Jessica, T. O'Riordan, S.A. Nicholson-Cole, and A.R. Watkinson. 2009. *Land Use Policy*. 26(2):203-213.

Abstract

The soft coastline of eastern England is dynamic, with much of it subject to the risk of erosion or flooding. A number of internationally important coastal nature conservation sites are under threat. This paper explores the character and reasoning behind changing coastal management policies and governance practices in England. It reveals how Natural England is tackling these changes, notably with regard to establishing

reconstituted nature conservation sites and re-designed coastlines. Such an approach requires the close involvement of policy leaders, agency officers, local maritime authorities and local residents. This paper explains how participatory processes play a critical role in the design of new coastlines that are ecologically and geomorphologically sustainable yet enable local communities to survive and flourish. A case study involving a visioning exercise at Winterton-on-Sea in Norfolk, UK, highlights the many practical difficulties around planning for the uncertain future of internationally important nature conservation sites, and local economies and communities. Future moves toward sustainable coastal alignments will have to involve a wide mix of public and civic bodies, as well as local communities, and will be underpinned by risk-based planning and well-researched adaptation and relocation arrangements.

Multiscale Analysis of Restoration Priorities for Marine Shoreline Planning. Diefenderfer, Heida L., K.L. Sobocinski, R.M. Thom, C.W. May, A.B. Borde, S.L. Southard, J. Vavrinec, and N.K. Sather. 2009. *Environmental Management*. 44(4):712-731.

Abstract

Planners are being called on to prioritize marine shorelines for conservation status and restoration action. This study documents an approach to determining the management strategy most likely to succeed based on current conditions at local and landscape scales. The conceptual framework based in restoration ecology pairs appropriate restoration strategies with sites based on the likelihood of producing long-term resilience given the condition of ecosystem structures and processes at three scales: the shorezone unit (site), the drift cell reach (nearshore marine landscape), and the watershed (terrestrial landscape). The analysis is structured by a conceptual ecosystem model that identifies anthropogenic impacts on targeted ecosystem functions. A scoring system, weighted by geomorphic class, is applied to available spatial data for indicators of stress and function using geographic information systems. This planning tool augments other approaches to prioritizing restoration, including historical conditions and change analysis and ecosystem valuation.

Managing Coastal Area Resources by Stated Choice Experiments. Liu, Xin and K.W. Wirtz. 2009. *Estuarine, Coastal, and Shelf Science*. 86(3):512-517.

Abstract

In many coastal regions, oil spills can be considered as one of the most important and certainly the most noticeable forms of marine pollution. Efficient contingency management responding to oil spills on waters, which aims at minimizing pollution effects on coastal resources, turns out to be critically important. Such a decision making highly depends on the importance attributed to different coastal economic and ecological resources. Economic uses can, in principal, be addressed by standard measures such as value added. However, there is a missing of market in the real world for natural goods. Coastal resources such as waters and beach cannot be directly measured in money terms, which increases the risk of being neglected in a decision making process. This

paper evaluates these natural goods of coastal environment in a hypothetical market by employing stated choice experiments. Oil spill management practice in German North Sea is used as an example. Results from a pilot survey show that during a combat process, beach and eider ducks are of key concerns for households. An environmental friendly combat option has to be a minor cost for households. Moreover, households with less children, higher monthly income and a membership of environmental organization are more likely to state that they are willing to pay for combat option to prevent coastal resources from an oil pollution. Despite that choice experiments require knowledge of designing questionnaire and statistical skills to deal with discrete choices and conducting a survey is time consumed, the results have important implications for oil spill contingency management. Overall, such a stated preference method can offer useful information for decision makers to consider coastal resources into a decision making process and can further contribute to finding a cost-effective oil preventive measure, also has a wide application potential in the field of Integrated Coastal Zone Management (ICZM).

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A Comparative Study of Macrobenthic Community from Harbours Along the Central West Coast of India. Ingole, B., S. Sivadas, M. Nanajkar, S. Sautya, and A. Nag. 2009. *Environmental Monitoring and Assessment*. 154(1-4):135-146.

Abstract

Harbours are heavily stressed coastal habitats characterised by high concentration of contaminant and low diversity of benthic community. The west coast of India harbours most of the major harbours compared to the east coast. Very few studies have compared the macrobenthic community between different Indian harbours. The present study was therefore conducted in three important harbour (Ratnagiri, Goa, Karwar) along the central west coast of India. The paper discusses the health status of the three harbours diagnosed using various biotic indices. Sediment samples were collected using van Veen grab (0.11 m²) on board CRV Sagar Sukti. A total of 55 macrobenthic taxa were identified and were numerically dominated by polychaete. Biomass was high (0.14–145.7 g m⁻²) and was made largely by echinurans (>80%). Overall, polychaete dominated the macrobenthic diversity. Opportunistic *P.pinnata*, *Notomastus sp.* and *Mediomastus sp.*, dominated the macrobenthic community responding to the increased in the harbour. Biotic indices (Polychaete:Amphipod ratio, ABC curve and geometric class abundance) and the dominance of opportunistic species indicate that, the three harbours are under stress from anthropogenic activities.

Marine Debris Contamination along Undeveloped Tropical Beaches from Northeast Brazil. Santos, Isaac R., A.C. Friedrich, and J.A. Ivar do Sul. 2009. *Environmental Monitoring and Assessment*. 148(1-4):455-462.

Abstract

We hypothesize that floating debris leaving polluted coastal bays accumulate on nearby pristine beaches. We examined

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composition, quantities, and distribution of marine debris along ~ 150 km of relatively undeveloped, tropical beaches in Costa do Dendê (Bahia, Brazil). The study site is located south of Salvador City, the largest urban settlement from NE Brazil. Strong spatial variations were observed. Plastics accounted for 76% of the sampled items, followed by styrofoam (14%). Small plastic fragments resultant from the breakdown of larger items are ubiquitous all over the area. Because the dominant littoral drift in Bahia is southward, average beach debris densities (9.1 items/m) along Costa do Dendê were threefold higher than densities previously observed north of Salvador City. River-dominated and stable beaches had higher debris quantities than unstable, erosional beaches. Areas immediately south of the major regional embayments (Camamu and Todos os Santos) were the preferential accumulation sites, indicating that rivers draining populous areas are the major source of debris to the study site. Our results provide baseline information for future assessments. Management actions should focus on input prevention at the hydrographic basin level rather than on cleaning services on beaches.

Anthropogenic Impacts on Heavy Metal Concentrations in the Coastal Sediments of Dumai, Indonesia. Amin, Bintal, A. Ismail, A. Arshad, C.K. Yap, and M.S. Kamarudin. 2009. *Environmental Monitoring and Assessment*. 148(1-4): 291-305.

Abstract

Concentrations of Cd, Cu, Pb, Zn, Ni and Fe were determined in the surface sediments to investigate the distributions, concentrations and the pollution status of heavy metals in Dumai coastal waters. Sediment samples from 23 stations, representing 5 different site groups of eastern, central and western Dumai and southern and northern Rupa Island, were collected in May 2005. The results showed that heavy metal concentrations (in µg/g dry weight; Fe in %) were 0.88 (0.46–1.89); 6.08 (1.61–13.84); 32.34 (14.63–84.90); 53.89 (31.49–87.11); 11.48 (7.26–19.97) and 3.01 (2.10–3.92) for Cd, Cu, Pb, Zn, Ni and Fe, respectively. Generally, metal concentrations in the coastal sediments near Dumai city center (eastern and central Dumai) which have more anthropogenic activities were higher than those at other stations. Average concentration of Cd in the eastern Dumai was slightly higher than effective range low (ERL) but still below effective range medium (ERM) value established by Long et al. (*Environmental Management* 19(1):81–97, 1995; *Environmental Toxicology Chemistry* 17(4):714–727, 1997). All other metals were still below ERL and ERM. Calculated enrichment factor (EF), especially for Cd and Pb, and the Pollution load index (PLI) value in the eastern Dumai were also higher than other sites. Cd showed higher EF when compared to other metals. Geo-accumulation indices (I_{geo}) in most of the stations (all site groups) were categorized as class 1 (unpolluted to moderately polluted environment) and only Cd in Cargo Port was in class 2 (moderately polluted). Heavy metal concentrations found in the present study were comparable to other regions of the world and based on the calculated indices it can be classified as unpolluted to moderately polluted coastal environment.

Power Analysis for Biomarkers in Mussels for Use in Coastal Pollution Monitoring. Fang, J.K.H., R.S.S. Wu, C.K.M. Yip, and P.K.S. Shin. 2009. *Marine Pollution Bulletin*. 58(8):1152-1158.

Abstract

Data from literature on neutral red retention time (NRRT) in lysosomes, micronucleus (MN) frequency and condition index (CI) in mussel *Mytilus*, especially *Mytilus edulis* and *Mytilus galloprovincialis*, were re-analyzed to ascertain their statistical power in detecting a minimum 20% spatial/temporal change in field studies. Results showed that CI largely displayed higher statistical power (>90%) than lysosomal NRRT and MN frequency (<50%), suggesting that data from the latter two biomarkers may lead to erroneous conclusions if sample size is inadequate. Samples of green-lipped mussel *Perna viridis* were also analyzed in Hong Kong. To achieve statistically valid power, the optimal sample sizes for monitoring lysosomal NRRT, MN frequency, CI and gonosomatic index (GSI) were determined as 34, 90, 16 and 29, respectively. Natural variability of lysosomal NRRT and MN frequency was significantly greater than CI and/or GSI in mussels, rejecting the general belief in the greater variability of higher-tiered hierarchical biomarkers.

Temporal Variation of Chlorophyll a Concentration in the Coastal Waters Affected by the Hebei Spirit Oil Spill in the West Sea of Korea. Lee, Chung Il, M.C. Kim, and H. C. Kim. 2009. *Marine Pollution Bulletin*. 58(4):496-502.

Abstract

Time series changes in chlorophyll a concentration before and after the Hebei Spirit oil spill that occurred in December 2007 were analyzed using NCEP wind and SeaWiFS/MODIS ocean color data. Prevailing southwesterly winds and northeast/southwestward tidal currents pushed the oil towards Korea's West Sea coast of Taean. After the oil spill, daily chlorophyll a concentration decreased about 45–50% compared to the normal condition before the oil spill, and this decrease continued for about two weeks. Monthly mean chlorophyll a concentration in December 2007 was lower compared to the average value for the same month between 1998 and 2007, but, in October and November 2007 before the spill and in January–February 2008 after the spill, the concentration value was higher than average for the same period between 1998 and 2007.

Detection of Spatial Fluctuations of Non-point Source Fecal Pollution in Coral Reef Surrounding Waters in Southwestern Puerto Rico using PCR-based Assays. Bonkosky, M., E.A. Hernández-Delgado, B. Sandoz, I.E. Robledo, J. Norat-Ramírez, and H. Mattei. 2009. *Marine Pollution Bulletin*. 58(1):45-54.

Abstract

Human fecal contamination of coral reefs is a major cause of concern. Conventional methods used to monitor microbial water quality cannot be used to discriminate between different fecal pollution sources. Fecal coliforms, enterococci, and human-specific *Bacteroides* (HF183, HF134), general *Bacteroides*

Prevotella (GB32), and *Clostridium coccooides* group (CP) 16S rDNA PCR assays were used to test for the presence of non-point source fecal contamination across the southwestern Puerto Rico shelf. Inshore waters were highly turbid, consistently receiving fecal pollution from variable sources, and showing the highest frequency of positive molecular marker signals. Signals were also detected at offshore waters in compliance with existing microbiological quality regulations. Phylogenetic analysis showed that most isolates were of human fecal origin. The geographic extent of non-point source fecal pollution was large and impacted extensive coral reef systems. This could have deleterious long-term impacts on public health, local fisheries and in tourism potential if not adequately addressed.

Impact of Petroleum Pollution on Aquatic Coastal Ecosystems in Brazil. Da Silva, Eduardo Mendes, M.C. Peso-Aguiar, M.D.F.T. Navarr, and C.D.B.E.A. Chastinet. 2009. *Environmental Toxicology and Chemistry*. 16(1):112-118.

Abstract

Although oil activities generate numerous forms of environmental impact on biological communities, studies of these impacts on Brazilian coastal ecosystems are rare. Results of tests for the content of oil in sediments and organisms indicate a substantially high rate of degradation. Results for uptake of polycyclic aromatic hydrocarbons in bivalves suggested the recent occurrence of oil spills and that these organisms differed in their capabilities to bioconcentrate oil. The mangrove community has suffered constant inputs of oil and has responded with increased numbers of aerial roots, generation of malformed leaves and fruits by plants, and a decrease in litter production. Studies of the impact of oil on rocky shore communities and the toxicity of oil and its by-products to marine organisms have confirmed the results reported in the literature. Presently most of the available studies deal with the macroscopic effects of oil on organisms and have indicated that the nature of oil, climate characteristics, the physical environment, and the structure of the community influence the symptoms of oil contamination in organisms of coastal waters. Longterm studies should be carried out to assess changes in community structure, sublethal effects in populations, and the resilience of contaminated ecosystems.

Predicting Toxicity in Marine Sediments with Numerical Sediment Quality Guidelines.

Long, Edward R., L.J. Field, and D.D. MacDonald. 2009. *Environmental Toxicology and Chemistry*. 17(4):714-727.

Abstract

Matching synoptically collected chemical and laboratory bioassay data ($n = 1,068$) were compiled from analyses of surficial sediment samples collected during 1990 to 1993 to evaluate the predictive ability of sediment quality guidelines (SQGs), specifically, effects range - low (ERL), effects range - median (ERM), threshold effects level (TEL), and probable effects level (PEL) values. Data were acquired from surveys of sediment quality performed in estuaries along the Atlantic, Pacific, and Gulf of Mexico coasts. Samples were classified as either nontoxic ($p > 0.05$ relative to controls), marginally toxic ($p < 0.05$ only), or highly toxic ($p < 0.05$ and response greater

than minimum significant difference relative to controls). This analysis indicated that, when not exceeded, the ERLs and TELs were highly predictive of nontoxicity. The percentages of samples that were highly toxic generally increased with increasing numbers of guidelines (particularly the ERMs and PELs) that were exceeded. Also, the incidence of toxicity increased with increases in concentrations of mixtures of chemicals normalized to (divided by) the SQGs. The ERMs and PELs indicated high predictive ability in samples in which many substances exceeded these concentrations. Suggestions are provided on the uses of these estimates of the predictive ability of sediment guidelines.

Identifying Major Pesticides Affecting Bivalve Species Exposed to Agricultural Pollution Using Multi-biomarker and Multivariate Methods. Damásio, Joana, A. Navarro-Ortega, R. Tauler, S. Lacorte, D. Barceló, A.M.V.M. Soares, M.A. López, M.C. Riva, and C. Barata. 2009. *Ecotoxicology*. 19(6):1084-94.

Abstract

The aim of this investigation was to identify major pesticides that may cause detrimental effects in bivalve species affected by agricultural pollution. Investigations were carried out using freshwater clams (*Corbicula fluminea*) transplanted in the main drainage channels that collect the effluents coming from agriculture fields in the Ebro Delta (NE Spain) during the main growing season of rice (from May to August). Environmental hazards were assessed by measuring simultaneous up to 46 contaminant levels and 9 biomarker responses. Measured biological responses showed marked differences across sites and months. Antioxidant and esterase enzyme responses were in most cases inhibited. Lipid peroxidation levels increased steadily from May in upstream stations to August in drainage channels. Principal Component (PCA) and Partial Least Squares to Latent Structure regression (PLS) analyses allowed the identification of endosulfan, propanil, and phenylureas as being the chemical contaminants causing the most adverse effects in the studied species.

Coastal Zone Mapping For Oil Spill Emergency Management. Assilzadeh, H., Y. Gao, and J.K. Levy. 2009. *Sea Technology*. 50(9):33-38.

Abstract

The Canadian coastal and marine environments contain many sensitive species, habitats and resources that could be severely affected by oil pollution. Accordingly, protection of the marine environment from oil spills is a high priority for Canada. Since it is not always possible to prevent these spills, it is important to address their consequences. In order to combat pollution from marine oil spills successfully, Canada must have an effective response strategy. A successful operation to combat a marine oil spill depends on a rapid response, from the time the oil spill is reported until it has been fully combated. The use of modeling, spatial analysis and a near-real-time system can assist decision makers in making better informed judgments that will affect the governance and management of the ocean environment during an oil spill.

Monitoring

Monitoring

Monitoring the Effects of Temperature Variability and Fishing Pressure on Fish Populations at Rocky Point, Palos Verdes. Muñoz, Chelsea E., M.L. Hansler, D.L. Hanson, J. P. Williams and D.J. Pondella, II. 2010. Vantuna Research Group at Occidental College.

Project Summary

The Vantuna Research Group at Occidental College has been performing diver transects of fish at Rocky Point, Palos Verdes since 1974. This extensive database allows us to see the effects of large scale, long-term oceanographic phenomena, changes in fishing regulations, and assess the health of one of the largest kelp forest communities in Santa Monica Bay. An examination of the abundance and age of commercially and recreationally important species over the last 35 years shows significant changes in the community structure in relation to specific oceanographic events and changes in fishing regulations. These observations can show us what to expect as the next regime shift looms and areas like Rocky Point remain unprotected from recreational and commercial fishing pressure.

The Pacific Decadal Oscillation (PDO) regime shift of the late 1970's resulted in warmer waters along the Eastern Pacific coastline and an increase in ambient temperature. In particular, blue rockfish (*Sebastes mystinus*) and the olive rockfish (*S. serranoides*) showed a distinct drop in numbers after the PDO shift of 1977. This may be attributed to their affinity for cold-water environments of deeper waters and more northern latitudes. The regime shift also caused an increase in sightings of fish with warm-water affinities such as the California sheephead (*Semicossyphus pulcher*). Sheephead appear to be a strong indicator species for this reef as, their density correlates with the temperature fluctuations caused by the El Niño/Southern Oscillation events and Pacific Decadal Oscillation. The increase in abundance in the late 1970s and early 1980s is highly correlated with the shift to a PDO warm phase. Their subsequent decline in numbers was most likely due to increased commercial fishing pressure during the 1980's. Once stricter size and bag limit regulations were imposed in 1999, the size and density of sheephead increased within six years. Unlike the California sheephead, fishing regulations for kelp bass (*Paralabrax clathratus*) have remained unaltered since the 1950s. Following the peak in abundance during the early 1980's, kelp bass decreased in size and number, suggesting heavy fishing pressure.

The nearshore gillnet ban that was enacted in 1994 has previously been shown to increase the number of large, predatory fishes that are not typically seen during diver surveys. One of those species, the giant seabass (*Stereolepis gigas*) had not been seen on a transect since the beginning of the study, but has been seen with regularity since. Other fish species included in this study are likely to have benefited for the ban as well, but most were never

targeted and appeared in gillnets only as bycatch. The potential increase in abundance for these species is likely negated by other fishing pressures and habitat degradation.

Given the continuation of current trends, and without further protection in the form of slot limits, bag limits, and general protection of the reef community, the average size and number of commercially and recreationally important species at Rocky Point will continue to decline.

Rain Barrel Usage in Los Angeles. Chang, Johanna and M. Hanna. 2010. Los Angeles Department of Water and Power.

Project Summary

A simple spreadsheet model was developed to understand the water conservation benefits of rain barrels in Los Angeles. Input data include precipitation, rain barrel capacity, tributary roof area, number of days following a rain event before the rain barrel is used, and the number of gallons used per rain barrel per day. Using actual precipitation data from 1938 to present, a 60-gallon rain barrel, and a tributary roof area of 600 square feet, while assuming that the rain barrel will not be used for seven days following a rain event and that 10 gallons per day will be used, a rain barrel could potentially be filled and emptied seven times per year, on average. Seven fills in a 60-gallon rain barrel equates to 420 gallons of water. Interestingly, the year type (wet or dry) had little effect on this value. In wet years the rain barrel overflows. Conversely in dry years the rain barrels caught much of the rain, there just was not much to catch. The model is very sensitive to rain barrel size and tributary roof area, especially when both variables were adjusted in concert.

Results of this modeling effort were applied to projected water rates from the Metropolitan Water District of Southern California (MWD). Beginning on January 1, 2010 MWD rates for Tier II treated water will be \$810.00 per acre-foot (approx. 326,000 gallons). Assuming the life of a rain barrel is 30 years and that water rates will increase at 5% per year, the overall water supply benefit for a rain barrel equates to close to \$70.00. Unfortunately the additional benefits of water quality and flood protection are not included in this analysis, however it is presumed that the overall benefits in terms of dollars would be much greater if those were calculated and included.

Spatial and Temporal Modeling of Beach Use: A Case Study of East Anglia, UK. Coombes, E.G., A.P. Jones, I.J. Bateman, J.A. Tratalos, J.A. Gill, D.A. Showler, A.R. Watkinson, and W.J. Sutherland. 2009. Coastal Management. 37(1):94-115.

Abstract

As tourists are sensitive to weather conditions and changes to the environments they visit, it is likely that climate change will affect coastal recreation in the future. To understand these impacts, it is first important to quantify how visitor numbers are associated with beach characteristics and weather patterns. Using the East Anglian coastline, UK, as a case study, information on the spatial distribution of visitors recorded

from aircraft flights is combined with beach characteristic data in a Geographical Information System. In addition, surveys are undertaken at two beaches to assess temporal variations in visitation. The study finds a diverse range of characteristics are associated with visitor numbers. These findings are evaluated alongside the anticipated effects of climate change and management policies. Although it is predicted that warmer weather will increase visitor numbers overall, sea-level rise may reduce numbers at wide sandy beaches, which are currently most preferred by tourists.

Accelerating Loss of Seagrasses Across the Globe Threatens Coastal Ecosystems. Waycott, Michelle, C.M. Duarte, T.J.B. Carruthers, R.J. Orth, W.C. Dennison, S. Olyarnik, A. Calladine, J.W. Fourqurean, K.L. Heck, Jr., A.R. Hughes, G.A. Kendrick, W.J. Kenworthy, F.T. Short, and S.L. Williams. 2009. Proceedings of the National Academy of Sciences of the United States of America. 106(30):12377-12381.

Abstract

Coastal ecosystems and the services they provide are adversely affected by a wide variety of human activities. In particular, seagrass meadows are negatively affected by impacts accruing from the billion or more people who live within 50 km of them. Seagrass meadows provide important ecosystem services, including an estimated \$1.9 trillion per year in the form of nutrient cycling; an order of magnitude enhancement of coral reef fish productivity; a habitat for thousands of fish, bird, and invertebrate species; and a major food source for endangered dugong, manatee, and green turtle. Although individual impacts from coastal development, degraded water quality, and climate change have been documented, there has been no quantitative global assessment of seagrass loss until now. Our comprehensive global assessment of 215 studies found that seagrasses have been disappearing at a rate of 110 km² yr⁻¹ since 1980 and that 29% of the known areal extent has disappeared since seagrass areas were initially recorded in 1879. Furthermore, rates of decline have accelerated from a median of 0.9% yr⁻¹ before 1940 to 7% yr⁻¹ since 1990. Seagrass loss rates are comparable to those reported for mangroves, coral reefs, and tropical rainforests and place seagrass meadows among the most threatened ecosystems on earth.

An Integrated Approach to Assess Broad-scale Condition of Coastal Wetlands—The Gulf of Mexico Coastal Wetlands Pilot Survey. Nestlerode, Janet A., V.D. Engle, P. Bourgeois, P.T. Heitmuller, J.M. Macauley, and Y.C. Allen. 2009. Environmental Monitoring and Assessment. 150(1-4):21-29.

Abstract

The Environmental Protection Agency (EPA) and U.S. Geological Survey (USGS) initiated a two-year regional pilot survey in 2007 to develop, test, and validate tools and approaches to assess the condition of northern Gulf of Mexico (GOM) coastal wetlands. Sampling sites

were selected from estuarine and palustrine wetland areas with herbaceous, forested, and shrub/scrub habitats delineated by the US Fish and Wildlife Service National Wetlands Inventory Status and Trends (NWI S&T) program and contained within northern GOM coastal watersheds. A multi-level, stepwise, iterative survey approach is being applied to multiple wetland classes at 100 probabilistically-selected coastal wetlands sites. Tier 1 provides information at the landscape scale about habitat inventory, land use, and environmental stressors associated with the watershed in which each wetland site is located. Tier 2, a rapid assessment conducted through a combination of office and field work, is based on best professional judgment and on-site evidence. Tier 3, an intensive site assessment, involves on-site collection of vegetation, water, and sediment samples to establish an integrated understanding of current wetland condition and validate methods and findings from Tiers 1 and 2. The results from this survey, along with other similar regional pilots from the Mid-Atlantic, West Coast, and Great Lakes Regions will contribute to a design and implementation approach for the National Wetlands Condition Assessment to be conducted by EPA's Office of Water in 2011.

Monitoring the Changing Position of Coastlines Using Aerial and Satellite Image Data: An Example from the Eastern Coast of Trabzon, Turkey. Sesli, Faik Ahmet, F. Karsli, I. Colkesen, and N. Akyol. 2009. Environmental Monitoring and Assessment. 153(1-4):391-403.

Abstract

Coastline mapping and coastline change detection are critical issues for safe navigation, coastal resource management, coastal environmental protection, and sustainable coastal development and planning. Changes in the shape of coastline may fundamentally affect the environment of the coastal zone. This may be caused by natural processes and/or human activities. Over the past 30 years, the coastal sites in Turkey have been under an intensive restraint associated with a population press due to the internal and external touristic demand. In addition, urbanization on the filled up areas, settlements, and the highways constructed to overcome the traffic problems and the other applications in the coastal region clearly confirm an intensive restraint. Aerial photos with medium spatial resolution and high resolution satellite imagery are ideal data sources for mapping coastal land use and monitoring their changes for a large area. This study introduces an efficient method to monitor coastline and coastal land use changes using time series aerial photos (1973 and 2002) and satellite imagery (2005) covering the same geographical area. Results show the effectiveness of the use of digital photogrammetry and remote sensing data on monitoring large area of coastal land use status. This study also showed that over 161 ha areas were filled up in the research area and along the coastal land 12.2 ha of coastal erosion is determined for the period of 1973 to 2005. Consequently, monitoring of coastal land use is thus necessary for coastal area planning in order to protecting the coastal areas from climate changes and other coastal processes.

Monitoring

Application of a Remote Sensing Technique to the Study of Coastal Dunes. Delgado-Fernandez, Irene, R. Davidson-Arnott, and J. Ollerhead. 2009. *Journal of Coastal Research*. 25(5):1160-1167.

Abstract

This paper reports on a remote sensing station specifically designed to investigate eolian processes at a beach–dune system. The monitoring station is located at Greenwich Dunes, Prince Edward Island National Park, Prince Edward Island (Canada), and it is the second, improved generation of a previous system using continuous video and photographs. The setup consists of three digital single-lens reflex cameras, a two-dimensional sonic anemometer, two safires, erosion–deposition pins, and an array of batteries and solar panels. The cameras run on a timer that takes pictures every hour. The images are rectified and analyzed using a combination of ArcMap 9.2 and PCI Geomatica software, which permits the generation of moisture maps, vegetation, ice and snow cover, shoreline position, and erosion–deposition processes. The two-dimensional sonic provides continuous wind speed and direction, and the saltation probes record the intensity of transport events. The result is a large geodatabase of a time series of factors affecting eolian processes at the beach at a variety of temporal and spatial scales. This geodatabase can be queried, and it is a valuable tool for studying the frequency and magnitude of events delivering sediment from the beach to the dune and thus for improving our knowledge of sediment transport at coastal areas. Although the remote sensing station was initially conceived as a tool to measure subaerial processes, a full year of measurements shows large potential for the system to provide information on processes at the nearshore environment and ice dynamics.

Mapping Ecosystem Functions to the Valuation of Ecosystem Services: Implications of Species–habitat Associations for Coastal Land-use Decisions. Sanchirico, James N. and P. Mumby. 2009. *Theoretical Ecology*. 2(2):67-77.

Abstract

Habitats and the ecosystem services they provide are part of the world's portfolio of natural capital assets. Like many components of this portfolio, it is difficult to assess the full economic value of these services, which tends to over-emphasize the value of extractive activities such as coastal development. Building on recent ecological studies of species–habitat linkages, we use a bioeconomic model to value multiple types of habitats as natural capital, using mangroves, sea grass, and coral reefs as our model system. We show how key ecological variables and processes, including obligate and facultative behaviors map into habitat values and how the valuation of these ecological processes can inform decisions regarding coastal development (habitat clearing). Our stylized modeling framework also provides a clear and concise road map for researchers interested in understanding how to make the link between ecosystem function, ecosystem service, and conservation policy decisions. Our findings also highlight the importance of additional ecological research into how species utilize habitats and that this research is not just important for

ecological science, but it can and will influence ecosystem service values that, in turn, will impact coastal land-use decisions. While refining valuation methods is not necessarily going to lead to more rational coastal land-use decisions, it will improve our understanding on the ecological–economic mechanisms that contribute to the value of our natural capital assets.

Threats to Sandy Beach Ecosystems: A Review. Defeo, Omar, A. McLachlan, D.S. Schoeman, T.A. Schlacher, J. Dugan, A. Jones, M. Lastra, and F. Scapini. 2009. *Estuarine, Coastal, and Shelf Science*. 81(1):1-12.

Abstract

We provide a brief synopsis of the unique physical and ecological attributes of sandy beach ecosystems and review the main anthropogenic pressures acting on the world's single largest type of open shoreline. Threats to beaches arise from a range of stressors which span a spectrum of impact scales from localised effects (e.g. trampling) to a truly global reach (e.g. sea-level rise). These pressures act at multiple temporal and spatial scales, translating into ecological impacts that are manifested across several dimensions in time and space so that today almost every beach on every coastline is threatened by human activities. Press disturbances (whatever the impact source involved) are becoming increasingly common, operating on time scales of years to decades. However, long-term data sets that describe either the natural dynamics of beach systems or the human impacts on beaches are scarce and fragmentary. A top priority is to implement long-term field experiments and monitoring programmes that quantify the dynamics of key ecological attributes on sandy beaches. Because of the inertia associated with global climate change and human population growth, no realistic management scenario will alleviate these threats in the short term. The immediate priority is to avoid further development of coastal areas likely to be directly impacted by retreating shorelines. There is also scope for improvement in experimental design to better distinguish natural variability from anthropogenic impacts. Sea-level rise and other effects of global warming are expected to intensify other anthropogenic pressures, and could cause unprecedented ecological impacts. The definition of the relevant scales of analysis, which will vary according to the magnitude of the impact and the organisational level under analysis, and the recognition of a physical–biological coupling at different scales, should be included in approaches to quantify impacts. Zoning strategies and marine reserves, which have not been widely implemented in sandy beaches, could be a key tool for biodiversity conservation and should also facilitate spillover effects into adjacent beach habitats. Setback and zoning strategies need to be enforced through legislation, and all relevant stakeholders should be included in the design, implementation and institutionalisation of these initiatives. New perspectives for rational management of sandy beaches require paradigm shifts, by including not only basic ecosystem principles, but also incentives for effective governance and sharing of management roles between government and local stakeholders.

Mapping and Monitoring Intertidal Benthic Habitats: A Review of Techniques and a Proposal for a New Visual Methodology for the European Coasts. Godet, Laurent, J. Fournier, N. Toupoint, and F. Olivier. 2009. *Progress in Physical Geography*. 33(3):378-402.

Abstract

Mapping seafloors is a fundamental step for managing and preserving coastal zones. Moreover, in a context of current global environmental changes, new methods allowing long-term monitoring are increasingly required. Various methods have been used to map seafloors, primarily benthic macrofauna and sediment sampling along regular grids or transects, and remote sensing methods. These methods map very different things, do not have the same accuracy levels, and have different costs in time and money. Furthermore, such methods often require the competencies of highly skilled scientists and exclude non-specialists otherwise best placed to perform them. In this paper, we test a method based on Direct Field Observations ('DFO method'), which can be used by non-specialists, and assess if it is sufficient for mapping and monitoring intertidal habitats. We further compare this method with other conventional ones. The results show that such a simple method is relatively rapid and inexpensive given the results obtained. Moreover, it is particularly suitable for highly fragmented intertidal landscapes where other methods are often very limited. In consequence, in areas such as the European coasts, it can be used by non-specialists, such as protected-area managers, and because it is an inexpensive and quick method long-term monitoring is also possible.

Application of a Remote Sensing Technique to the Study of Coastal Dunes. Delgado-Fernandez, Irene, R. Davidson-Arnott, and J. Ollerhead. 2009. *Journal of Coastal Research*. 25(5):1160-1167.

Abstract

This paper reports on a remote sensing station specifically designed to investigate eolian processes at a beach-dune system. The monitoring station is located at Greenwich Dunes, Prince Edward Island National Park, Prince Edward Island (Canada), and it is the second, improved generation of a previous system using continuous video and photographs. The setup consists of three digital single-lens reflex cameras, a two-dimensional sonic anemometer, two safires, erosion-deposition pins, and an array of batteries and solar panels. The cameras run on a timer that takes pictures every hour. The images are rectified and analyzed using a combination of ArcMap 9.2 and PCI Geomatica software, which permits the generation of moisture maps, vegetation, ice and snow cover, shoreline position, and erosion-deposition processes. The two-dimensional sonic provides continuous wind speed and direction, and the saltation probes record the intensity of transport events. The result is a large geodatabase of a time series

of factors affecting eolian processes at the beach at a variety of temporal and spatial scales. This geodatabase can be queried, and it is a valuable tool for studying the frequency and magnitude of events delivering sediment from the beach to the dune and thus for improving our knowledge of sediment transport at coastal areas. Although the remote sensing station was initially conceived as a tool to measure subaerial processes, a full year of measurements shows large potential for the system to provide information on processes at the nearshore environment and ice dynamics

Restoration

Eelgrass (Zostera marina L.) in the Chesapeake Bay Region of Mid-Atlantic Coast of the USA: Challenges in Conservation and Restoration. Orth, Robert J., S.R. Marion, K.A. Moore, and D. J. Wilcox. 2010. *Estuaries and Coasts*. 33(1):139-150.

Abstract

Decreases in seagrass abundance reported from numerous locations around the world suggest that seagrass are facing a global crisis. Declining water quality has been identified as the leading cause for most losses. Increased public awareness is leading to expanded efforts for conservation and restoration. Here, we report on abundance patterns and environmental issues facing eelgrass (*Zostera marina*), the dominant seagrass species in the Chesapeake Bay region in the mid-Atlantic coast of the USA, and describe efforts to promote its protection and restoration. Eelgrass beds in Chesapeake Bay and Chincoteague Bay, which had started to recover from earlier diebacks, have shown a downward trend in the last 5–10 years, while eelgrass beds in the Virginia coastal bays have substantially increased in abundance during this same time period. Declining water quality appears to be the primary reason for the decreased abundance, but a recent baywide dieback in 2005 was associated with higher than usual summer water temperatures along with poor water clarity. The success of eelgrass in the Virginia coastal bays has been attributed, in part, to slightly cooler water due to their proximity to the Atlantic Ocean. A number of policies and regulations have been adopted in this region since 1983 aimed at protecting and restoring both habitat and water quality. Eelgrass abundance is now one of the criteria for assessing attainment of water clarity goals in this region. Numerous transplant projects have been aimed at restoring eelgrass but most have not succeeded beyond 1 to 2 years. A notable exception is the large-scale restoration effort in the Virginia coastal bays, where seeds distributed beginning in 2001 has initiated an expanding recovery process. Our research on eelgrass abundance patterns in the Chesapeake Bay region and the processes contributing to these patterns have provided a scientific background for management strategies for the protection and restoration of eelgrass and insights into the causes of success and failure of restoration efforts that may have applications to other seagrass systems.

Restoration

Return to Neverland: Shifting Baselines Affect Eutrophication Restoration Targets. Carlos M. Duarte, D. J. Conley, J. Carstensen, and M. Sánchez-Camacho. 2009. *Estuaries and Coasts*. 32(1):29-36.

Abstract

The implicit assumption of many scientific and regulatory frameworks that ecosystems impacted by human pressures may be reverted to their original condition by suppressing the pressure was tested using coastal eutrophication. The response to nutrient abatement of four thoroughly studied coastal ecosystems that received increased nutrient inputs between the 1970s and the 1980s showed that the trajectories of these ecosystems were not directly reversible. All four ecosystems displayed convoluted trajectories that failed to return to the reference status upon nutrient reduction. This failure is proposed to result from the broad changes in environmental conditions, all affecting ecosystem dynamics, that occurred over the 30 years spanning from the onset of eutrophication to the reduction of nutrient levels. Understanding ecosystem response to multiple shifting baselines is essential to set reliable targets for restoration efforts.

Reforming Watershed Restoration: Science in Need of Application and Applications in Need of Science. Palmer, Margaret A. 2009. *Estuaries and Coasts*. 32(1):1-17.

Abstract

Coastal and inland waters are continuing to decline in many parts of the world despite major efforts made to restore them. This is due in part to the inadequate role that ecological science has played in shaping restoration efforts. A significant amount of fundamental ecological knowledge dealing with issues such as system dynamics, state changes, context-dependency of ecological response, and diversity is both under-used by managers and practitioners and under-developed by ecologists for use in real-world applications. Some of the science that is being 'used' has not been adequately tested. Thus, restoration ecology as a science and ecological restoration as a practice are in need of reform. I identify five ways in which our ecological knowledge should be influencing restoration to a far greater extent than at present including a need to: shift the focus to restoration of process and identification of the limiting factors instead of structures and single species, add ecological insurance to all projects, identify a probabilistic range of possible outcomes instead of a reference condition, expand the spatial scale of efforts, and apply hierarchical approaches to prioritization. Prominent examples of restoration methods or approaches that are commonly used despite little evidence to support their efficacy are highlighted such as the use of only structural enhancements to restore biodiversity. There are also major gaps in scientific knowledge that are of immediate need to policy makers, managers, and restoration practitioners including: predictive frameworks to guide the restoration of ecological processes, identification of social-ecological feedbacks that constrain ecosystem recovery and data to support decisions of where and how to implement restoration projects to achieve the largest gains. I encourage ecologists to respond to the demand for their scientific input so that restoration can shift from an engineering-driven process to

a more sustainable enterprise that fully integrates ecological processes and social science methods.

*Potential of Restoration and Phytoremediation with *Juncus roemerianus* for Diesel-contaminated Coastal Wetlands.* Lin, Qianxin and I.A. Mendelssohn. 2009. *Ecological Engineering*. 35(1):85-91.

Abstract

Oil spills may considerably damage sensitive coastal wetlands. In this study, the tolerance limits of a dominant coastal salt marsh plant, *Juncus roemerianus*, to diesel oil and its phytoremediation effectiveness in wetland environments were investigated in the greenhouse. *J. roemerianus* was transplanted into salt marsh sediment contaminated with diesel fuel at concentrations of 0, 20, 40, 80, 160, 320, and 640 mg diesel g⁻¹ dry sediment. Plant stem density, shoot height, aboveground biomass and belowground biomass were detrimentally impacted at high oil dosages even 1 year after transplantation. Tolerance limits were estimated between 160 and 320 mg g⁻¹ based on various plant variables. Importantly, *J. roemerianus* enhanced oil degradation; at the 40 mg/g diesel dosage, concentrations of residual total petroleum hydrocarbons (TPH) in the sediment planted with *J. roemerianus* were significantly lower than those of unplanted sediments 1 year after treatment initiation. Furthermore, concentrations of total targeted polycyclic aromatic hydrocarbons (PAHs) and n-alkanes in the *J. roemerianus* planted treatment were, respectively, about 3% and 15% of the unplanted treatment. Concentration reduction in all categories of hydrocarbons suggested that *J. roemerianus* effectively phytoremediated the diesel-contaminated wetlands.

Hydrodynamic and Ecological Assessment of Nearshore Restoration: A Modeling Study. Zhaoqing Yang, K.L. Sobocinski, D. Heatwole, T. Khangaonkar, R. Thom, and R. Fuller. 2010. *Ecological Modeling*. 221(7):1043-1053.

Abstract

Along the Pacific Northwest coast, much of the estuarine habitat has been lost over the last century to agricultural land use, residential and commercial development, and transportation corridors. As a result, many of the ecological processes and functions have been disrupted. To protect and improve these coastal habitats that are vital to aquatic species, many projects are currently underway to restore estuarine and coastal ecosystems through dike breaches, setbacks, and removals. Understanding site-specific information on physical processes is critical for improving the success of such restoration actions. In this study, a three-dimensional hydrodynamic model was developed to simulate estuarine processes in the Stillaguamish River estuary, where restoration of a 160-acre parcel through dike setback has been proposed. The model was calibrated to observed tide, current, and salinity data for existing conditions and applied to simulate the hydrodynamic responses to two restoration alternatives. Model results were then combined with biophysical data to predict habitat responses within the restoration footprint. Results showed that the proposed dike removal would result in desired tidal flushing and conditions that would support four habitat types on the restoration

footprint. At the estuary scale, restoration would substantially increase the proportion of area flushed with freshwater (<5 ppt) at flood tide. Potential implications of predicted changes in salinity and flow dynamics are discussed relative to the distribution of tidal marsh habitat.

Drowning of the Mississippi Delta Due to Insufficient Sediment Supply and Global Sea-level Rise. Blum, Michael D. and H.H. Roberts. 2009. *Nature Geoscience*. 2:488-491.

Abstract

Over the past few centuries, 25% of the deltaic wetlands associated with the Mississippi Delta have been lost to the ocean. Plans to protect and restore the coast call for diversions of the Mississippi River, and its associated sediment, to sustain and build new land. However, the sediment load of the Mississippi River has been reduced by 50% through dam construction in the Mississippi Basin, which could affect the effectiveness of diversion plans. Here we calculate the amount of sediment stored on the delta plain for the past 12,000 years, and find that mean storage rates necessary to construct the flood plain and delta over this period exceed modern Mississippi River sediment loads. We estimate that, in the absence of sediment input, an additional 10,000–13,500 km² will be submerged by the year 2100 owing to subsidence and sea-level rise. Sustaining existing delta surface area would require 18–24 billion tons of sediment, which is significantly more than can be drawn from the Mississippi River in its current state. We conclude that significant drowning is inevitable, even if sediment loads are restored, because sea level is now rising at least three times faster than during delta-plain construction.

Wetlands and Global Climate Change: The Role of Wetland Restoration in a Changing World. Erwin, Kevin L. 2009. *Wetlands Ecology and Management*. 17(1):71-84.

Abstract

Global climate change is recognized as a threat to species survival and the health of natural systems. Scientists worldwide are looking at the ecological and hydrological impacts resulting from climate change. Climate change will make future efforts to restore and manage wetlands more complex. Wetland systems are vulnerable to changes in quantity and quality of their water supply, and it is expected that climate change will have a pronounced effect on wetlands through alterations in hydrological regimes with great global variability. Wetland habitat responses to climate change and the implications for restoration will be realized differently on a regional and mega-watershed level, making it important to recognize that specific restoration and management plans will require examination by habitat. Floodplains, mangroves, seagrasses, saltmarshes, arctic wetlands, peatlands, freshwater marshes and forests are very diverse habitats, with different stressors and hence different management and restoration techniques are needed. The Sundarban (Bangladesh and India), Mekong river delta (Vietnam), and southern Ontario (Canada) are examples of major wetland complexes where the effects of climate change are evolving in different ways. Thus, successful long term restoration and management of these systems will hinge on how we choose

to respond to the effects of climate change. How will we choose priorities for restoration and research? Will enough water be available to rehabilitate currently damaged, water-starved wetland ecosystems? This is a policy paper originally produced at the request of the Ramsar Convention on Wetlands and incorporates opinion, interpretation and scientific-based arguments.

Restoration of Dredged Canals in Wetlands: A Comparison of Methods. Baustian, Joseph J., R.E. Turner, N.F. Walters, and D.P. Muth. 2009. *Wetlands Ecology and Management*. 17(5):445-453.

Abstract

A comparison of two methods for restoring dredged canals to wetlands was examined at the Jean Lafitte National Historical Park and Preserve's Barataria Preserve Unit near New Orleans, LA. Both northern and southern canals had the remnant dredged spoil material returned to the canal, but the southern canal had additional sediment pumped in from a nearby lake. The water depth in the southern canal shallowed significantly from 1.2 to 0.4 m following backfilling and sediment addition, while the depth of the northern canal (which received no additional sediment) remained unchanged following backfilling. Neither site had complete soil restoration, but the former spoil areas of the northern canal showed greater restoration than the southern canal. The vegetation on the former spoil areas of the northern canal closely resembled that of the reference marsh, while the former spoil areas of the southern canal had species indicative of spoil banks and other elevated areas. After 3 years wetland vegetation was established on approximately 65% of the former spoil areas at both sites and 20–25% of the open water areas. Sediment addition to the southern canal raised costs by a factor of eight times compared to that of the northern canal. The results of this study document the restoration potential of both methods, but also show that backfilling without supplemental sediment additions can restore abandoned canals at a fraction of the cost of other methods.

Evaluating Wildlife Response to Coastal Dune Habitat Restoration in San Francisco, California. Russell, Will, J. Shulzitski, and A. Setty. 2009. *Ecological Restoration*. 27(4):439-448.

Abstract

The vast dune system that once dominated the entire western half of the San Francisco peninsula in California has been reduced to a few fragments that conserve locally threatened plant and animal species. We measured the effects of ongoing restoration efforts on wildlife abundance and diversity on one of the largest of these fragments, Fort Funston in the Golden Gate National Recreation Area. Efforts included removal of non-native species, active restoration of native dune vegetation, and restricted visitor use. We collected data regarding the composition and abundance of vegetation, birds, and ground-dwelling vertebrates on four treatments including an actively restored area with restricted visitor use, an unrestored area where visitor use had been restricted for ten years, an unrestored area where visitor use had been restricted for two years, and an unrestored

Restoration

area with unrestricted visitor use. Results indicated that the diversity and abundance of wildlife species, as well as the richness and cover of native plant species, were greater in the restored area than in all other sampled areas. Restricted visitor use alone had only modest positive effects on the abundance and diversity of wildlife and the richness and cover of native plant species.

Soil Recovery after Removal of the N₂-fixing Invasive Acacia longifolia: Consequences for Ecosystem Restoration. Marchante, Elizabete, A. Kjøller, S. Struwe, and H. Freitas. 2009. *Biological Invasions*. 11(4):813-823.

Abstract

Invasion by *Acacia longifolia* alters soil characteristics and processes. The present study was conducted to determine if the changes in soil C and N pools and processes induced by *A. longifolia* persist after its removal, at the São Jacinto Dunes Nature Reserve (Portugal). Some areas had been invaded for a long time (>20 years) and others more recently (<10 years). For each type of invasion, (i.e., long-invaded and recently invaded), three treatments were used: (1) *A. longifolia* left intact; (2) *A. longifolia* was removed; and (3) both *A. longifolia* and litter layer were removed. Soil samples were collected once a year for four and half years and analysed for chemical and microbial properties. In general, microbial parameters responded faster than C and N pools. In long-invaded areas, two and half years after removal of plants and litter, basal respiration and microbial biomass had already decreased >30%, -glucosaminidase activity (N mineralization index) >60% and potential nitrification >95%. Removal of plants and litter resulted in a >35% decrease in C and N content after four and half years. In recently invaded areas, -glucosaminidase activity and potential nitrification showed a marked decrease (>54% and >95%, respectively) after removal of both *A. longifolia* and litter. Our results suggest that after removal of an N₂-fixing invasive tree that changes ecosystem-level processes, it takes several years before soil nutrients and processes return to pre-invasion levels, but this legacy slowly diminish, suggesting that the susceptibility of native areas to (re)invasion is a function of the time elapsed since removal. Removal of the N-rich litter layer facilitates ecosystem recovery.

Assessing the Residual Effects of Carpobrotus edulis Invasion, Implications for Restoration. Conser, Christiana and E.F. Connor. 2009. *Biological Invasions*. 11(2):349-358.

Abstract

We examined whether the residual effects on soil caused by the invasion of *Carpobrotus edulis*, common iceplant, would inhibit the reestablishment of a native plant species. *Carpobrotus edulis* interacts both directly by suppressing the growth and establishment of other plants and indirectly by altering soil chemistry. We tested whether the residual effects of *C. edulis* resulted in lowered germination, survival, growth, and reproduction of *Gilia millefoliata*, a rare dune annual. We compared *G. millefoliata* planted in plots previously occupied by *C. edulis* to *G. millefoliata* planted in plots that previously had native vegetation.

Each plot received three treatments: seed, transplant, and unplanted, and were censused every three weeks until senescence. *Carpobrotus edulis* had strong negative effects on the germination, survival, growth, and reproduction of *G. millefoliata*. *C. edulis* lowers soil pH and increases organic content due to the recalcitrance of tissue to decomposition, which may have evolved as a mechanism to facilitate recolonization and invasion.

Can Soil Seed Banks Contribute to the Restoration of Dune Slacks under Conservation Management? Plassmann, Katharina, N. Brown, M.L.M. Jones, and G. Edwards-Jones. 2009. *Applied Vegetation Science*. 12(2):199-210.

Abstract

Questions: Does the soil seed bank resemble the former early successional stages of a dune slack system more than the established later successional vegetation? Does it have the potential to contribute to the conservation of a highly endangered habitat?

Location: Dune slacks at Newborough Warren, UK.

Methods: The composition of the soil seed bank in two depth layers was determined using the seedling emergence method between March 2004 and April 2005. Long-term monitoring data on the floristic composition of the established vegetation were obtained from the national conservation agency, and additional monitoring was undertaken in 2003. Floristic composition, seed weights, seed longevity of component species and Ellenberg indicator values were used to compare the seed bank and established vegetation.

Results: The soil seed bank was diverse and contained typical dune slack species, species of early successional stages and species of conservation interest. A comparison between the composition of the seed bank and historical data on the composition of the established vegetation showed that the seed bank reflects earlier successional stages more closely than the current aboveground vegetation. This study increases the scarce information currently available on the seed bank ecology of several species, including two orchid species.

Conclusions: The soil seed bank can be expected to contribute to vegetation change after disturbance. Stimulation of germination from the seed bank through management may contribute to the conservation of both characteristic and threatened species typical of dune slacks.