

In this review:

- A. Recent articles – no abstract
- B. Recent publications available online
- C. Recent articles with abstracts

O/A denotes an open access article or journal

A. Recent articles – no abstract

Kathiresan, K. Globally threatened mangrove species in India. *Current Science* 98(12): 1551, 2010. O/A

B. Recent publications available online

Arctic Biodiversity Trends 2010 – Selected indicators of change. CAFF International Secretariat, Akureyri, Iceland. May 2010. 121pp.

Available at: <http://www.arcticbiodiversity.is/index.php/en/downloads>

Notes: This report is based on twenty-two indicators and provides a snapshot of the trends being observed in Arctic biodiversity. The indicators show that the Arctic has changed dramatically during recent decades and that unique Arctic habitats for flora and fauna, including sea ice, tundra, thermokarst ponds and lakes, and permafrost peatlands are disappearing. Some species of importance to Arctic people or species of global attention are declining. And while climate change is emerging as the most far reaching and significant stressor on Arctic biodiversity, contaminants, habitat fragmentation, industrial development, and unsustainable hunting continue to have impacts. Furthermore, complex interactions between climate change and other factors have the potential to magnify impacts on biodiversity.

Committee on Environment and Natural Resources. 2010. *Scientific Assessment of Hypoxia in U.S. Coastal Waters*. Interagency Working Group on Harmful Algal Blooms, Hypoxia, and Human Health of the Joint Subcommittee on Ocean Science and Technology. Washington, DC. 154pp.

Available at: <http://www.whitehouse.gov/administration/eop/ostp/nstc/oceans>

Notes: This report assesses the increasing prevalence of low-oxygen “dead zones” in U.S. coastal waters and notes that incidents of hypoxia—a condition in which oxygen levels drop so low that fish and other animals are stressed or killed—have increased nearly 30-fold since 1960. Incidents of hypoxia were documented in nearly 50 percent of the 647 waterways assessed. The report finds that Federal research programs are addressing many aspects of the problem of hypoxia, and coordination among the relevant governmental entities is increasing. As a result, some areas are now in better condition than they were a few decades ago. But overall, management efforts to stem the tide of hypoxia have not made significant headway, the report concludes, in part due to increased development and population growth in coastal watersheds.

This report focuses on the science that forms the basis for improving knowledge of the causes, impacts, and solutions for hypoxia in U.S. coastal ecosystems. Areas covered include:

- the legislative background;
- the current status of hypoxia in U.S. coastal waters, the spectrum of causal factors contributing to hypoxia, and the ecological and economic consequences of hypoxia;
- status and accomplishments of current Federal monitoring, assessment, and research activities related to hypoxia, including research on coastal ecosystems and their watersheds that provides the basis for effective management actions;
- directions for future science activities and opportunities to increase effectiveness and cost-efficiency through coordination of programs across Federal agencies;
- Federal government hypoxia or hypoxia-related research;
- case studies that feature coastal ecosystems across the United States affected by hypoxia; and
- details on U.S. coastal systems affected by hypoxia.

C. Recent articles with abstracts

Beger, M., Grantham, H.S., Pressey, R.L., Wilson, K.A., Peterson, E.L., Dorfman, D., Mumby, P.J., Lourival, R., Brumbaugh, D.R., and Possingham, H.P. **Conservation planning for connectivity across marine, freshwater, and terrestrial realms.** *Biological Conservation* 143(3): 565-575, 2010.

Notes: Conservation plans are usually developed for regions that encompass only one environmental realm (terrestrial, freshwater or marine) because of logistical, institutional and political constraints. This is inadequate because these realms often interact through processes that form, utilize and maintain interfaces or connections, which are essential for the persistence of some species and ecosystem functions. We present a conceptual framework for systematic conservation prioritization that explicitly accounts for the connectivity between the terrestrial, marine, and freshwater realms. We propose a classification of this connectivity that encompasses: (1) narrow interfaces, such as riparian strips; (2) broad interfaces, such as estuaries; (3) constrained connections, such as corridors of native vegetation used by amphibians to move between natal ponds and adult habitat; and (4) diffuse connections, such as the movements of animals between breeding and feeding habitats. We use this taxonomy of inter-realm connectivity to describe existing and new spatial conservation prioritization techniques that aim to promote the persistence of processes that operate between realms.

Levy, J.K. and Gopalakrishnan, C. **Promoting ecological sustainability and community resilience in the US Gulf Coast after the 2010 *Deepwater Horizon* oil spill.** *Journal of Natural Resources Policy Research* 2(3): 297-315, 2010.

Notes: On 20 April 2010, the 5000-foot-deep Macondo Mississippi Canyon Block 252 (MC252) well erupted after a blowout caused a catastrophic explosion and fire aboard the BP PLC-leased **Deepwater Horizon** offshore oil drilling platform (owned by Transocean Ltd.) about 40 miles (64km) southeast of the Louisiana coast. The 2010 **Deepwater Horizon** Gulf Coast oil spill now imperils ecologically sensitive lands, affects the livelihoods of thousands of workers, and threatens a way of life that has been passed down for generations. An oil spill management Decision Support System (DSS) architecture is put forth that integrates the latest advances in MCDA and geomatics engineering in order to cope with the worst environmental disaster in US history. It is shown that policy-makers should improve the sustainability and resilience of Gulf Coast ecosystems and communities so that they are healthier and more robust than before the oil spill. Policy recommendations with respect to the 2010 **Deepwater Horizon** spill are put forth. We discuss how to best assist disrupted businesses, rehabilitate polluted ecosystems, and improve regulatory oversight of the oil and gas industry in order to prevent future oil spill disasters.

Webb, A.P. and Kench, P.S. **The dynamic response of reef islands to sea-level rise: Evidence from multi-decadal analysis of island change in the Central Pacific.** *Global and Planetary Change* 72(3): 234-246, 2010.

Notes: Low-lying atoll islands are widely perceived to erode in response to measured and future sea-level rise. Using historical aerial photography and satellite images this study presents the first quantitative analysis of physical changes in 27 atoll islands in the central Pacific over a 19 to 61 yr period. This period of analysis corresponds with instrumental records that show a rate of sea-level rise of 2.0mm yr⁻¹ in the Pacific. Results show that 86% of islands remained stable (43%) or increased in area (43%) over the timeframe of analysis. Largest decadal rates of increase in island area range between 0.1 to 5.6 ha. Only 14% of study islands exhibited a net reduction in island area. Despite small net changes in area, islands exhibited larger gross changes. This was expressed as changes in the planform configuration and position of islands on reef platforms. Modes of island change included: ocean shoreline displacement toward the lagoon; lagoon shoreline progradation; and, extension of the ends of elongate islands. Collectively these adjustments represent net lagoonward migration of islands in 65% of cases. Results contradict existing paradigms of island response and have significant implications for the consideration of island stability under ongoing sea-level rise in the central Pacific. First, islands are geomorphologically persistent features on atoll reef platforms and can increase in island area despite sea-level change. Second, islands are dynamic landforms that undergo a range of physical adjustments in responses to changing boundary conditions, of which sea level is just one factor. Third, erosion of island shorelines must be reconsidered in the context of physical adjustments of the entire island shoreline as erosion may be balanced by progradation on other sectors of shorelines. Results indicate that the style and magnitude of geomorphic change will vary between islands. Therefore, island nations must place a high priority on resolving the precise styles and rates of change that will occur over the next century and reconsider the implications for adaptation.

Irish, J.L., Frey, A.E., Rosati, J.D., Olivera, F., Dunkin, L.M., Kaihatu, J.M., Ferreira, C.M., and Edge, B.L. **Potential implications of global warming and barrier island degradation on future hurricane inundation, property damages, and population impacted.** *Ocean and Coastal Management* 53(10): 645-657, 2010.

Notes: Hurricane flooding is a leading natural threat to coastal communities. Recent evidence of sea level rise coupled with potential future global warming indicate that sea level rise will accelerate and hurricanes may intensify over the coming decades. In regions fronted by barrier islands, the protective capacity of these islands may diminish as they are degraded by rising sea level. Here we present a hydrodynamic and geospatial analysis of the relative role of barrier island degradation on potential future hurricane flooding. For the City of Corpus Christi, Texas, USA, hurricane flooding is projected to rise between 20% and 70% by the 2030s, resulting in an increase in property damages and impacted population. These findings indicate that adaptive management strategies should be developed and adopted for mitigating loss of natural barrier islands when these islands act as protective features for populated bayside communities. Finally, this study illustrates a method for applying models to forecast future storm protection benefits of barrier island restoration projects.

Howes, N.C., FitzGerald, D.M., Hughes, Z.J., Georgiou, I.Y., Kulp, M.A., Miner, M.D., Smith, J.M., and Barras, J.A. **Hurricane-induced failure of low salinity wetlands.** *Proceedings of the National Academy of Sciences [USA]* 107(32): 14014-14019, 2010. [O/A](#)

Notes: During the 2005 hurricane season, the storm surge and wave field associated with Hurricanes Katrina and Rita eroded 527 km² of wetlands within the Louisiana coastal plain. Low salinity wetlands were preferentially eroded, while higher salinity wetlands remained robust and largely unchanged. Here we highlight geotechnical differences between the soil profiles of high and low salinity regimes, which are controlled by vegetation and result in differential erosion. In low salinity wetlands, a weak zone (shear strength 500-1450 Pa) was observed ~30 cm below the marsh surface, coinciding with the base of rooting. High salinity wetlands had no such zone (shear strengths >4500 Pa) and contained deeper rooting. Storm waves during Hurricane Katrina produced shear stresses between 425-3600 Pa, sufficient to cause widespread erosion of the low salinity wetlands. Vegetation in low salinity marshes is subject to shallower rooting and is susceptible to erosion during large magnitude storms; these conditions may be exacerbated by low inorganic sediment content and high nutrient inputs. The dramatic difference in resiliency of fresh versus more saline marshes suggests that the introduction of freshwater to marshes as part of restoration efforts may therefore weaken existing wetlands rendering them vulnerable to hurricanes.

Allison, M.A. and Meselhe, E.A. **The use of large water and sediment diversions in the lower Mississippi River (Louisiana) for coastal restoration.** *Journal of Hydrology* 387(3-4): 346-360, 2010.

Notes: This study examines the use of large sediment and water diversions in the lower Mississippi River (e.g., South Louisiana) as a tool for coastal restoration. Herein we provide a review, new analysis and synthesis of existing work, much of it previously only available in government reports, and integrate our recent research on the topic. We outline critical knowledge gaps that need to be addressed by the time that construction begins on any future large diversions. The focus of this study is on "river side" issues and the policy considerations that arise from them. The study includes a quantitative examination of the sediment budget of the Lower Mississippi River as a region of potential diversion construction in South Louisiana, due to its critical control on any future management plans that include large diversions. We conclude that development of a coordinated system of diversions and other restoration strategies for land-building will require parceling this sediment budget out between individual projects. However, this is only possible if the input function and its variability is well understood. It is clear that numerical simulations are the only way to adequately predict the combined effects of multiple diversions and other restoration projects, such as dredge-fed pipelines, on the river channel for navigation, flood control and sediment regime. Numerical models also provide the only way to properly examine diversion structures to maximize their sediment capture and minimize any negative impacts. The status of these models and their application to lower Mississippi River channel hydrodynamics and sediment transport is examined herein.

Zhou, X. and Cai, L. **Coastal and marine environmental issues in the Pearl River Delta region, China.** *International Journal of Environmental Studies* 67(2): 137-145, 2010.

Notes: The Pearl River Delta (PRD) region has become the most prosperous region in China. Unfortunately, this rapidly growing economy has incurred high environmental cost. Our paper explores land-based pollution input increases, eutrophication, mangrove deforestation, oceanic fisheries depletion, marine biodiversity loss and more frequent occurrences of red tides. Long periods of monitoring data on benthic organisms have confirmed environmental deterioration in Shenzhen Bay. A system of government perceived to be inappropriate, the inefficient functioning of marine institutions and the public's low awareness of environmental sensitivity are together responsible for the current environmental degradation. This paper proposes reconciling the goals of economic development and environmental protection to evaluate the government's performance, setting up a comprehensive agency in the PRD, increasing investment in ecological improvement, and making a more concerted effort to stimulate public awareness on environmental deterioration.

Eriksson, B.K., van der Heide, T., van de Koppel, J., Piersma, T., Van der Veer, H.W., and Olf, H. **Major changes in the ecology of the Wadden Sea: Human impacts, ecosystem engineering and sediment dynamics.** *Ecosystems* 13(5): 752-764, 2010.

Notes: Shallow soft-sediment systems are mostly dominated by species that, by strongly affecting sediment dynamics, modify their local environment. Such ecosystem engineering species can have either sediment-stabilizing or sediment-destabilizing effects on tidal flats. They interplay with abiotic forcing conditions (wind, tide, nutrient inputs) in driving the community structure and generating spatial heterogeneity, determining the composition of different communities of associated species, and thereby affecting the channelling of energy through different compartments in the food web. This suggests that, depending on local species composition, tidal flats may have conspicuously different geomorphology and biological functions under similar external conditions. Here we use a historical reconstruction of benthic production in the Wadden Sea to construct a framework for the relationships between human impacts, ecosystem engineering and sediment dynamics. We propose that increased sediment disturbances by human exploitation interfere with biological controls of sediment dynamics, and thereby have shifted the dominant compartments of both primary and secondary production in the Wadden Sea, transforming the intertidal from an internally regulated and spatially heterogeneous, to an externally regulated and spatially homogenous system. This framework contributes to the general understanding of the interaction between biological and environmental control of ecosystem functioning, and suggests a general framework for predicting effects of human impacts on soft-bottom ecosystems

Lotze, H.K. **Historical reconstruction of human-induced changes in U.S. estuaries.** *Oceanography and Marine Biology: An Annual Review* 48: 265-336, 2010.

Notes: Estuaries are vital ecosystems that have sustained human and marine life since earliest times. Yet, no other part of the ocean has been so fundamentally shaped by human activities. Understanding the magnitude, drivers and consequences of past changes is essential to determine current trends and realistic management goals. This review provides a detailed account of human induced changes in Massachusetts, Delaware, Chesapeake, Galveston and San Francisco Bays and Pamlico Sound. Native Americans have lived off these estuaries for millennia, yet left few signs of local resource depletion. European colonisation, commercialisation and industrialisation dramatically depleted and degraded valuable species, habitats and water quality. Exploitation and habitat loss were the main factors depleting 95% of valued species, with 35% being rare and 3% extirpated. Twentieth century conservation efforts enabled 10% of species to recover. Such profound changes in species diversity have altered the structure and functions of estuarine ecosystems as well as their services for human well-being. Thus, undesirable health risks and societal costs have increased over past decades. Protecting and restoring the diversity and vitality of estuaries will enhance their resilience towards current and future disturbances, yet require better governance of these often neglected ecosystems. Their documented historical richness and essential role for marine life and people may increase the necessary awareness and appreciation.

Pulido, C. and Borum, J. **Eelgrass (*Zostera marina*) tolerance to anoxia.** *Journal of Experimental Marine Biology and Ecology* 385(1-2): 8-13, 2010.

Notes: The tolerance of eelgrass (*Zostera marina* L.) to anoxia was assessed experimentally to evaluate the potential role of short-term anoxia on eelgrass performance. Eelgrass ramets (terminal leaf bundles with rhizomes and roots) were submerged in anoxic seawater for variable periods of time (0.5 to 48 h) at three temperatures (20, 25 and 30 °C) in darkness. Photosynthetic efficiency (Fv/Fm), leaf growth and shoot mortality were assessed as response parameters. Photosynthetic efficiency and leaf growth of ramets exposed to anoxia were closely coupled and declined with both increasing exposure time and temperature. At 20 °C, negative effects of anoxia occurred after 12 h (Fv/Fm) and 24 h (leaf growth). Shoot mortality appeared after 24 h. The negative impacts of anoxia on photosynthesis and growth increased markedly with increasing temperature. At 30 °C, Fv/Fm declined after 1 h, leaf growth after 2 h and no plants survived 8 h of anoxia. The results show that eelgrass is surprisingly intolerant to anoxia and support the hypotheses that anoxia may induce sudden eelgrass die-off and that high temperature strengthens the negative impact of anoxia. The study documents that anoxia in itself may have strong negative impacts on eelgrass performance within ecologically relevant time scales.

Marbà, N. and Duarte, C.M. **Mediterranean warming triggers seagrass (*Posidonia oceanica*) shoot mortality.** *Global Change Biology* 16(8): 2366-2375, 2010.

Notes: Rapid warming of the Mediterranean Sea threatens marine biodiversity, particularly key ecosystems already stressed by other impacts such as *Posidonia oceanica* meadows. A 6-year monitoring of seawater temperature and annual *P. oceanica* shoot demography at Cabrera Archipelago National Park (Balearic Islands, Western Mediterranean) allowed us to determine if warming influenced shoot mortality and recruitment rates of seagrasses growing in relative pristine environments. The average annual maximum temperature for 2002-2006 was 1 °C above temperatures recorded in 1988-1999 (26.6 °C), two heat waves impacted the region (with seawater warming up to 28.83 °C in 2003 and to 28.54 °C in 2006) and the cumulative temperature anomaly, above the 1988-1999 mean annual maximum temperature, during the growing season (i.e. degree-days) ranged between 0 °C in 2002 and 70 °C in 2003. Median annual *P. oceanica* shoot mortality rates varied from 0.067 year⁻¹ in 2002 to 0.123 year⁻¹ in 2003, and exceeded recruitment rates in all stations and years except in shallow stations for year 2004. Interannual fluctuations in shoot recruitment were independent of seawater warming ($P > 0.05$). *P. oceanica* meadows experienced a decline throughout the study period at an average rate of -0.050 ± 0.020 year⁻¹. Interannual variability in *P. oceanica* shoot mortality was coupled ($R_2 > 0.40$) to seawater warming variability and increasing water depth: shoot mortality rates increased by 0.022 year⁻¹ (i.e. an additional 2% year⁻¹) for each additional degree of annual maximum temperature and by 0.001 year⁻¹ (i.e. 0.1% year⁻¹) for each accumulated degree water temperature remained above 26.6 °C during the growing season. These results demonstrate that *P. oceanica* meadows are highly vulnerable to warming, which can induce steep declines in shoot abundance as well indicating that climate change poses a significant threat to this important habitat.

Yanagisawa, H., Koshimura, S., Miyagi, T., and Imamura, F. **Tsunami damage reduction performance of a mangrove forest in Banda Aceh, Indonesia inferred from field data and a numerical model.** *Journal of Geophysical Research* 115(6): art. C06032, 2010.

Notes: Since the 26 December 2004 Indian Ocean tsunami, the role of mangrove forests as natural defenses protecting coastal communities from tsunami disaster has been highlighted. However, some mangrove forests were destroyed by that tsunami. They are expected to have lost their protective functions. In this study, we develop a fragility function to assess the mangrove trees' vulnerability, expressed as the damage probability of mangrove trees, based on field surveys and numerical modeling of the 2004 Indian Ocean tsunami in Banda Aceh, Indonesia. Based on the fragility function, we reconstruct a numerical model of tsunami inundation including the performance of mangrove forests in terms of reducing tsunami damage. The model reveals that a 10 year old mangrove forest in a 500 m wide area can reduce a tsunami's hydrodynamic force by approximately 70% for an incident wave of 3.0 m inundation depth and a wave period of 40 min at the shoreline. The model also shows, for a tsunami inundation depth of greater than 4 m, that a 10 year old mangrove forest would be mostly destroyed and that it would lose its force reduction capacity. Moreover, approximately 80% of a 30 year old mangrove forest would survive a 5 m tsunami and absorb 50% of the tsunami's hydrodynamic force.

Manna, S., Chaudhuri, K., Bhattacharyya, S., and Bhattacharyya, M. **Dynamics of Sundarban estuarine ecosystem: eutrophication induced threat to mangroves.** *Saline Systems* 6: art. 8, 2010. [O/A](#)

Notes: Background Sundarbans is the largest chunk of mangrove forest and only tiger mangrove land in the world. Compared to the rich species diversity and uniqueness, very few studies have so far been conducted here, mainly due to its inaccessibility. This study explores water quality, density of biomass, species diversity, phytoplankton abundance and bacterial population of a tidal creek in Sunderban estuary during the post and pre monsoon period of 2008-09. **Results** Phytoplankton community was observed to be dominated by diatoms (Bacillariophyceae) followed by Pyrrophyceae (dinoflagellates) and Chlorophyceae. A total of 46 taxa belonging to 6 groups were recorded. Other algal groups were Cyanophyceae, Euglenophyceae and Chrysophyceae. Species diversity was highest in summer (March) and lowest in winter season (November) in all the sample stations indicating its close correlation with ambient temperature. Species evenness was fairly high in all five stations throughout the study period. Present study indicated that dissolved oxygen, nutrients and turbidity are the limiting factors for the phytoplankton biomass. The estuary was in eutrophic condition (chlorophyll-a ≥ 10 ug/L) in winter. During the month of May phytoplankton biomass declined and at high salinity level (21.2 PSU) new phytoplankton species take over, which are definitely better resilient to the high saline environment. Bio-indicator species like *Polykrikos schwartzii*, *Dinophysis norvegica* and *Prorocentrum concavum* points to moderately polluted water quality of the estuary. **Conclusion** Eutrophication as well as presence of toxic dinoflagellates and Cyanophyceae in the tidal creek of Sundarban estuary definitely revealed the deteriorated status of the water quality. The structure and function of the mangrove food web is unique, driven by both marine and terrestrial components. But little attention has been paid so far to the adaptive responses of mangrove biota to the various disturbances, and now our work unfolds the fact that marine status of Sundarban estuary is highly threatened which in turn will affect the ecology of the mangrove. This study indicates that ecosystem dynamics of the world heritage site Sundarban may facilitate bioinvasion putting a question mark on the sustainability of mangroves.

Sandilyan, S., Thiyagesan, K., Nagarajan, R., and Vencatesan, J. **Salinity rise in Indian mangroves – a looming danger for coastal biodiversity.** *Current Science* 98(6): 754-756, 2010. [O/A](#)

Notes: India has a long coastal line of over 7500 km supporting vast habitats such as lagoons, backwaters, estuaries, coral reefs and mangrove swamps. Among them, the mangrove ecosystem commands the highest importance because of its biological productivity and specialized diversity. After coral reefs, mangrove forests have the highest productivity among the coastal wetlands. With regard to biodiversity, mangroves support a unique group of fungi, microbes, plants and higher animal species including several species of migratory water birds. Such unique wetlands are in peril due to increasing salinity in recent times especially after the tsunami of 2004. It is time to control the increasing salinity, failing which the Indian subcontinent stands to lose its unique coastal biodiversity which, in turn, might affect the marine food web of the entire tropical region.

Guimarães, A.S., Travassos, P., Souza, P.W.M.E.F., Gonçalves, F.D., and Costa, F. **Impact of aquaculture on mangrove areas in the northern Pernambuco Coast (Brazil) using remote sensing and geographic information system.** *Aquaculture Research* 41(6): 828-838, 2010.

Notes: The conversion of mangrove areas into shrimp farming ponds has been indicated as the main activity responsible for the reduction in the area of this ecosystem along the northeastern coast of Brazil. The present study was conducted using remote sensing methods and a geographical information system with the aim of quantifying the participation of this activity in the reduction of the mangrove areas along the northern coast of the State of Pernambuco (northeast, Brazil), where shrimp farming has been implanted in last recent years. From 1973 to 2005, there was reduction of about 2,052 ha of mangrove, 197 ha of which were converted into shrimp ponds. Thus, the real contribution of shrimp farming to this reduction was just 9.6% of the total area. Other anthropogenic activities, such as agriculture, urban expansion and tourism, contributed greatly to the reduction in the mangrove areas along the northern coast of the State of Pernambuco.

Sweetman, A.K., Middelburg, J.J., Berle, A.M., Bernardino, A.F., Schander, C., Demopoulos, A.W.J., and Smith, C.R. **Impacts of exotic mangrove forests and mangrove deforestation on carbon remineralization and ecosystem functioning in marine sediments.** *Biogeosciences* 7(7): 2129-2145, 2010. O/A

Notes: To evaluate how mangrove invasion and removal can modify short-term benthic carbon cycling and ecosystem functioning, we used stable-isotopically labeled algae as a deliberate tracer to quantify benthic respiration and C-flow over 48 h through macrofauna and bacteria in sediments collected from (1) an invasive mangrove forest, (2) deforested mangrove sites 2 and 6 years after removal of above-sediment mangrove biomass, and (3) two mangrove-free control sites in the Hawaiian coastal zone. Sediment oxygen consumption (SOC) rates averaged over each 48 h investigation were significantly greater in the mangrove and mangrove removal site experiments than in controls and were significantly correlated with total benthic (macrofauna and bacteria) biomass and sedimentary mangrove biomass (SMB). Bacteria dominated short-term C-processing of added microalgal-C and benthic biomass in sediments from the invasive mangrove forest habitat and in the 6-yr removal site. In contrast, macrofauna were the most important agents in the short-term processing of microalgal-C in sediments from the 2-yr mangrove removal site and control sites. However, mean faunal abundance and C-uptake rates in sediments from both removal sites were significantly higher than in control cores, which collectively suggest that community structure and short-term C-cycling dynamics of sediments in habitats where mangroves have been cleared can remain fundamentally different from un-invaded mudflat sediments for at least 6-yrs following above-sediment mangrove removal. In summary, invasion by mangroves can lead to dramatic shifts in benthic ecosystem function, with sediment metabolism, benthic community structure and short-term C-remineralization dynamics being affected for years following invader removal.

Everard, M., Jones, L., and Watts, B. **Have we neglected the societal importance of sand dunes? An ecosystem services perspective.** *Aquatic Conservation: Marine and Freshwater Ecosystems* 20(4): 476-487, 2010.

Notes: 1. Coastal sand dunes are widespread worldwide, including around the coasts of the British Isles and Europe, providing a wide range of functions some of which are recognized for their socio-economic benefits. 2. In some localities, their contribution to coastal defence and to tourism and regional character have been acknowledged in local plans, but this is far from ubiquitous. 3. A rapid assessment was undertaken of the range of ecosystem services provided by coastal sand dune systems, using the Millennium Ecosystem Assessment ecosystem services classification augmented with habitat- and locally-appropriate additions. 4. Sand dunes were shown to provide a wide range of provisioning, regulatory, cultural and supporting services, many of which remain substantially overlooked. 5. Although the importance of coastal sand dune for a diversity of characteristic and often rare organisms from a variety of taxa has been addressed, many of the broader ecosystem services that these habitats provide to society have been overlooked. This suggests that coastal sand dune systems are neglected ecosystems of significant and often under-appreciated societal value.

Berke, S.K. **Functional groups of ecosystem engineers: A proposed classification with comments on current issues.** *Integrative and Comparative Biology* 50(2): 147-157, 2010.

Notes: Ecologists have long known that certain organisms fundamentally modify, create, or define habitats by altering the habitat's physical properties. In the past 15 years, these processes have been formally defined as "ecosystem engineering", reflecting a growing consensus that environmental structuring by organisms represents a fundamental class of ecological interactions occurring in most, if not all, ecosystems. Yet, the precise definition and scope of ecosystem engineering remains debated, as one should expect given the complexity, enormity, and variability of ecological systems. Here I briefly comment on a few specific current points of contention in the ecosystem engineering concept. I then suggest that ecosystem engineering can be profitably subdivided into four narrower functional categories reflecting four broad mechanisms by which ecosystem engineering occurs: structural engineers, bioturbators, chemical engineers, and light engineers. Finally, I suggest some conceptual model frameworks that could apply broadly within these functional groups.

Thomsen, M.S., Wernberg, T., Altieri, A., Tuya, F., Gulbransen, D., McGlathery, K.J., Holmer, M., and Silliman, B.R. **Habitat cascades: The conceptual context and global relevance of facilitation cascades via habitat formation and modification.** *Integrative and Comparative Biology* 50(2): 158-175, 2010.

Notes: The importance of positive interactions is increasingly acknowledged in contemporary ecology. Most research has focused on direct positive effects of one species on another. However, there is recent evidence that indirect positive effects in the form of facilitation cascades can also structure species abundances and biodiversity. Here we conceptualize a specific type of facilitation cascade—the habitat cascade. The habitat cascade is defined as indirect positive effects on focal organisms mediated by successive facilitation in the form of biogenic formation or modification of habitat. Based on a literature review, we demonstrate that habitat cascades are a general phenomenon that enhances species abundance and diversity in forests, salt marshes, seagrass meadows, and seaweed beds. Habitat cascades are characterized by a hierarchy of facilitative interactions in which a basal habitat former (typically a large primary producer, e.g., a tree) creates living space for an intermediate habitat former (e.g., an epiphyte) that in turn creates living space for the focal organisms (e.g., spiders, beetles, and mites). We then present new data on a habitat cascade common to soft-bottom estuaries in which a relatively small invertebrate provides basal habitat for larger intermediate seaweeds that, in turn, generate habitat for focal invertebrates and epiphytes. We propose that indirect positive effects on focal organisms will be strongest when the intermediate habitat former is larger and different in form and function from the basal habitat former. We also discuss how humans create, modify, and destroy habitat cascades via global habitat destruction, climatic change, over-harvesting, pollution, or transfer of invasive species. Finally, we outline future directions for research that will lead to a better understanding of habitat cascades.

Breitburg, D.L., Crump, B.C., Dabiri, J.O., and Gallegos, C.L. **Ecosystem engineers in the pelagic realm: Alteration of habitat by species ranging from microbes to jellyfish.** *Integrative and Comparative Biology* 50(2): 188-200, 2010.

Notes: Ecosystem engineers are species that alter the physical environment in ways that create new habitat or change the suitability of existing habitats for themselves or other organisms. In marine systems, much of the focus has been on species such as corals, oysters, and macrophytes that add physical structure to the environment, but organisms ranging from microbes to jellyfish and finfish that reside in the water column of oceans, estuaries, and coastal seas alter the chemical and physical environment both within the water column and on the benthos. By causing hypoxia, changing light regimes, and influencing physical mixing, these organisms may have as strong an effect as species that fall more clearly within the classical category of ecosystem engineer. In addition, planktonic species, such as jellyfish, may indirectly alter the physical environment through predator-mediated landscape structure. By creating spatial patterns of habitats that vary in their rates of mortality due to predation, planktonic predators may control spatial patterns and abundances of species that are the direct creators or modifiers of physical habitat.

Callaway, R., Desroy, N., Dubois, S.F., Fournier, J., Frost, M., Godet, L., Hendrick, V.J., and Rabaut, M. **Ephemeral bio-engineers or reef-building polychaetes: How stable are aggregations of the tube worm *Lanice conchilega* (Pallas, 1766)?** *Integrative and Comparative Biology* 50(2): 237-250, 2010.

Notes: Dense aggregations of tube-worms can stabilize sediments and generate oases for benthic communities that are different and often more diverse and abundant than those of the surroundings. If these features are to qualify as biogenic reefs under nature-conservation legislation such as the EC Habitats Directive, a level of stability and longevity is desirable aside from physical and biological attributes. *Lanice conchilega* (Pallas, 1766) is widely distributed around the European coast and aggregations of this tube-dwelling polychaete are known to have a positive effect on the biodiversity of associated species in inter- and sub-tidal areas. This increases the value of *L. conchilega*-rich habitats for higher trophic levels such as birds and fish. However, *L. conchilega* is currently not recognized as a reef builder primarily due to uncertainty about the stability of their aggregations. We carried out three studies on different spatial and temporal scales to explore a number of properties relating to stability: (1) Individual aggregations of *L. conchilega* of ~1 m² were monitored for up to 1 year, (2) records of *L. conchilega* from a 258-ha area over a 35-year period were analyzed, (3) the recovery of a population of *L. conchilega* subjected to disturbances by cultivation of Manila clams (*Ruditapes philippinarum*) was followed over 3 years. The studies provided evidence about the longevity of *L. conchilega* aggregations, their resistance to disturbance, their resilience in recovering from negative impact and their large-scale persistence. The results showed that populations of *L. conchilega* were prone to considerable fluctuation and the stability of aggregations depended on environmental factors and on recruitment. The tube-worms proved to be susceptible to disturbance by cultivation of Manila clams but demonstrated the potential to recover from that impact. The long-term monitoring of a large *L. conchilega* population in the Bay of Mont Saint Michel (France) indicated that aggregations can persist over many decades with a constant, densely populated core area and an expanding and contracting more thinly populated fringe zone. The stability of aggregations of *L. conchilega* and the structures they form do not unequivocally fit the currently accepted definition of a reef. However, given *L. conchilega*'s accepted reef-like potential to influence diversity and abundance in benthic communities, we suggest clarifying and expanding the definition of reefs so that species with records of significant persistence in particular areas and which otherwise meet expectations of reefs are included within the definition.

Polidoro, B.A. et al. **The loss of species: Mangrove extinction risk and geographic areas of global concern.** *PLoS ONE* 5(4): art. e10095, 2010. [O/A](#)

Notes: Mangrove species are uniquely adapted to tropical and subtropical coasts, and although relatively low in number of species, mangrove forests provide at least US \$1.6 billion each year in ecosystem services and support coastal livelihoods worldwide. Globally, mangrove areas are declining rapidly as they are cleared for coastal development and aquaculture and logged for timber and fuel production. Little is known about the effects of mangrove area loss on individual mangrove species and local or regional populations. To address this gap, species-specific information on global distribution, population status, life history traits, and major threats were compiled for each of the 70 known species of mangroves. Each species' probability of extinction was assessed under the Categories and Criteria of the IUCN Red List of Threatened Species. Eleven of the 70 mangrove species (16%) are at elevated threat of extinction. Particular areas of geographical concern include the Atlantic and Pacific coasts of Central America, where as many as 40% of mangroves species present are threatened with extinction. Across the globe, mangrove species found primarily in the high intertidal and upstream estuarine zones, which often have specific freshwater requirements and patchy distributions, are the most threatened because they are often the first cleared for development of aquaculture and agriculture. The loss of mangrove species will have devastating economic and environmental consequences for coastal communities, especially in those areas with low mangrove diversity and high mangrove area or species loss. Several species at high risk of extinction may disappear well before the next decade if existing protective measures are not enforced.

Perkol-Finkel, S. and Airoldi, L. **Loss and recovery potential of marine habitats: An experimental study of factors maintaining resilience in subtidal algal forests at the Adriatic Sea.** *PLoS ONE* 5(5): art. e10791, 2010. [O/A](#)

Notes: Background Predicting and abating the loss of natural habitats present a huge challenge in science, conservation and management. Algal forests are globally threatened by loss and severe recruitment failure, but our understanding of resilience in these systems and its potential disruption by anthropogenic factors lags well behind other habitats. We tested hypotheses regarding triggers for decline and recovery potential in subtidal forests of canopy-forming algae of the genus *Cystoseira*.

Methodology/Principal Findings By using a combination of historical data, and quantitative **in situ** observations of natural recruitment patterns we suggest that recent declines of forests along the coasts of the north Adriatic Sea were triggered by increasing cumulative impacts of natural- and human-induced habitat instability along with several extreme storm events. Clearing and transplantation experiments subsequently demonstrated that at such advanced stages of ecosystem degradation, increased substratum stability would be essential but not sufficient to reverse the loss, and that for recovery to occur removal of the new dominant space occupiers (i.e., opportunistic species including turf algae and mussels) would be required. Lack of surrounding adult canopies did not seem to impair the potential for assisted recovery, suggesting that in these systems recovery could be actively enhanced even following severe depletions. **Conclusions/Significance** We demonstrate that sudden habitat loss can be facilitated by long term changes in the biotic and abiotic conditions in the system, that erode the ability of natural ecosystems to absorb and recover from multiple stressors of natural and human origin. Moreover, we demonstrate that the mere restoration of environmental conditions preceding a loss, if possible, may be insufficient for ecosystem restoration, and is scarcely cost-effective. We conclude that the loss of complex marine habitats in human-dominated landscapes could be mitigated with appropriate consideration and management of incremental habitat changes and of attributes facilitating system recovery.

Webb, T.J., Vanden Berghe, E., and O'Dor, R. **Biodiversity's big wet secret: The global distribution of marine biological records reveals chronic under-exploration of the deep pelagic ocean.** *PLoS ONE* 5(8): art. e10223, 2010. O/A

Notes: Background Understanding the distribution of marine biodiversity is a crucial first step towards the effective and sustainable management of marine ecosystems. Recent efforts to collate location records from marine surveys enable us to assemble a global picture of recorded marine biodiversity. They also effectively highlight gaps in our knowledge of particular marine regions. In particular, the deep pelagic ocean – the largest biome on Earth – is chronically under-represented in global databases of marine biodiversity. **Methodology/Principal Findings** We use data from the Ocean Biogeographic Information System to plot the position in the water column of ca 7 million records of marine species occurrences. Records from relatively shallow waters dominate this global picture of recorded marine biodiversity. In addition, standardising the number of records from regions of the ocean differing in depth reveals that regardless of ocean depth, most records come either from surface waters or the sea bed. Midwater biodiversity is drastically under-represented. **Conclusions/Significance** The deep pelagic ocean is the largest habitat by volume on Earth, yet it remains biodiversity's big wet secret, as it is hugely under-represented in global databases of marine biological records. Given both its value in the provision of a range of ecosystem services, and its vulnerability to threats including overfishing and climate change, there is a pressing need to increase our knowledge of Earth's largest ecosystem.

Coll, M. et al. **The biodiversity of the Mediterranean Sea: Estimates, patterns, and threats.** *PLoS ONE* 5(8): art. e11842, 2010. O/A

Notes: The Mediterranean Sea is a marine biodiversity hot spot. Here we combined an extensive literature analysis with expert opinions to update publicly available estimates of major taxa in this marine ecosystem and to revise and update several species lists. We also assessed overall spatial and temporal patterns of species diversity and identified major changes and threats. Our results listed approximately 17,000 marine species occurring in the Mediterranean Sea. However, our estimates of marine diversity are still incomplete as yet-undescribed species will be added in the future. Diversity for microbes is substantially underestimated, and the deep-sea areas and portions of the southern and eastern region are still poorly known. In addition, the invasion of alien species is a crucial factor that will continue to change the biodiversity of the Mediterranean, mainly in its eastern basin that can spread rapidly northwards and westwards due to the warming of the Mediterranean Sea. Spatial patterns showed a general decrease in biodiversity from northwestern to southeastern regions following a gradient of production, with some exceptions and caution due to gaps in our knowledge of the biota along the southern and eastern rims. Biodiversity was also generally higher in coastal areas and continental shelves, and decreases with depth. Temporal trends indicated that overexploitation and habitat loss have been the main human drivers of historical changes in biodiversity. At present, habitat loss and degradation, followed by fishing impacts, pollution, climate change, eutrophication, and the establishment of alien species are the most important threats and affect the greatest number of taxonomic groups. All these impacts are expected to grow in importance in the future, especially climate change and habitat degradation. The spatial identification of hot spots highlighted the ecological importance of most of the western Mediterranean shelves (and in particular, the Strait of Gibraltar

and the adjacent Alboran Sea), western African coast, the Adriatic, and the Aegean Sea, which show high concentrations of endangered, threatened, or vulnerable species. The Levantine Basin, severely impacted by the invasion of species, is endangered as well.

Fautin, D. et al. **An overview of marine biodiversity in United States waters.** *PLoS ONE* 5(8): art. e11914, 2010. [O/A](#)

Notes: Marine biodiversity of the United States (U.S.) is extensively documented, but data assembled by the United States National Committee for the Census of Marine Life demonstrate that even the most complete taxonomic inventories are based on records scattered in space and time. The best-known taxa are those of commercial importance. Body size is directly correlated with knowledge of a species, and knowledge also diminishes with distance from shore and depth. Measures of biodiversity other than species diversity, such as ecosystem and genetic diversity, are poorly documented. Threats to marine biodiversity in the U.S. are the same as those for most of the world: overexploitation of living resources; reduced water quality; coastal development; shipping; invasive species; rising temperature and concentrations of carbon dioxide in the surface ocean, and other changes that may be consequences of global change, including shifting currents; increased number and size of hypoxic or anoxic areas; and increased number and duration of harmful algal blooms. More information must be obtained through field and laboratory research and monitoring that involve innovative sampling techniques (such as genetics and acoustics), but data that already exist must be made accessible. And all data must have a temporal component so trends can be identified. As data are compiled, techniques must be developed to make certain that scales are compatible, to combine and reconcile data collected for various purposes with disparate gear, and to automate taxonomic changes. Information on biotic and abiotic elements of the environment must be interactively linked. Impediments to assembling existing data and collecting new data on marine biodiversity include logistical problems as well as shortages in finances and taxonomic expertise.

Benn, A.R., Weaver, P.P., Billet, D.S.M., van den Hove, S., Murdock, A.P., Doneghan, G.B., and Le Bas, T. **Human activities on the deep seafloor in the North East Atlantic: An assessment of spatial extent.** *PLoS ONE* 5(9): art. e12730, 2010. [O/A](#)

Notes: Background Environmental impacts of human activities on the deep seafloor are of increasing concern. While activities within waters shallower than 200 m have been the focus of previous assessments of anthropogenic impacts, no study has quantified the extent of individual activities or determined the relative severity of each type of impact in the deep sea. **Methodology** The OSPAR maritime area of the North East Atlantic was chosen for the study because it is considered to be one of the most heavily impacted by human activities. In addition, it was assumed data would be accessible and comprehensive. Using the available data we map and estimate the spatial extent of five major human activities in the North East Atlantic that impact the deep seafloor: submarine communication cables, marine scientific research, oil and gas industry, bottom trawling and the historical dumping of radioactive waste, munitions and chemical weapons. It was not possible to map military activities. The extent of each activity has been quantified for a single year, 2005. **Principal Findings** Human activities on the deep seafloor of the OSPAR area of the North Atlantic are significant but their footprints vary. Some activities have an immediate impact after which seafloor communities could re-establish, while others can continue to make an impact for many years and the impact could extend far beyond the physical disturbance. The spatial extent of waste disposal, telecommunication cables, the hydrocarbon industry and marine research activities is relatively small. The extent of bottom trawling is very significant and, even on the lowest possible estimates, is an order of magnitude greater than the total extent of all the other activities. **Conclusions/Significance** To meet future ecosystem-based management and governance objectives for the deep sea significant improvements are required in data collection and availability as well as a greater awareness of the relative impact of each human activity.
