

# Marine Science Review - 222

## Ecosystems and habitats

### In this review:

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

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## A. Recent articles – no abstract available

Halfar, J. and Fujita, R.M. **Danger of deep-sea mining.** *Science* 316(5827): 987, 2007.

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## B. Recent publications available online

UNEP. 2006. *Marine and Coastal Ecosystems and Human Wellbeing: A Synthesis Report Based On the Findings of the Millennium Ecosystem Assessment.* UNEP. 76pp

**Available at:** [http://www.unep.org/dewa/assessments/EcoSystems/water/Marine\\_Coastal\\_Ecosystems.pdf](http://www.unep.org/dewa/assessments/EcoSystems/water/Marine_Coastal_Ecosystems.pdf)

**Notes:** All information contained in this synthesis report is derived from chapters of the Millenium Assessment's four main assessment reports, and the report on *Ecosystems and Human Well-being: A Framework for Assessment*, which sets out the MA's conceptual framework (CF) and the approach and methodology adopted for the global assessment and relevant sub-global assessments.

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EPA Office of Water. 2006. *National Estuary Program Coastal Condition Report.* EPA, Washington, DC. xxi + 445 pp.

**Available at:** <http://www.epa.gov/owow/oceans/nepccr/>

**Notes:** Nationally, 37% of the National Estuary Program (NEP) estuaries are in poor overall condition, 32% are in good condition, and 29% are in fair condition. Regionally, roughly 46% of the Northeast Coast, 46% of the Gulf Coast, 36% of the West Coast, and 23% of the Southeast Coast NEP estuaries are in poor overall condition. The overall condition ratings for the nation's NEP estuaries are based on four primary indices of estuarine condition—a water quality index, sediment quality index, benthic index, and fish tissue contaminants index.

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Springer, Y., Hays, C., Carr, M. and Mackey, M. 2006. *Managing Bull Kelp Forests *Nereocystis luetkeana*: A Synthesis with Recommendations for Future Research.* Lenfest Ocean Program, Washington, DC. 48pp.

**Available at:** [http://www.lenfestocean.org/publications/springer\\_underlying\\_report.pdf](http://www.lenfestocean.org/publications/springer_underlying_report.pdf)

**Notes:** Kelp forests provide important ecosystem and human benefits. In the United States, the commercial demand for kelp from the pharmaceutical and aquaculture industries has increased the extraction pressure on these ecosystems. Although giant

kelp (*Macrocystis* spp.) has historically been the focus of commercial extraction, there is growing interest in harvesting bull kelp (*Nereocystis luetkeana*) as well. This report reviews available information on the ecology of bull kelp and concludes that if the harvest of bull kelp is regulated in the same manner as giant kelp, the result will be unsustainable. Bull kelp extraction is riskier than for the more common giant kelp because the parts of the bull kelp able to reproduce are the same parts that are harvested. Thus, harvesting the bull kelp is like cutting off a flower while harvesting the giant kelp is similar to mowing a lawn because the giant kelp is able to grow from the bottom up. The report includes several suggestions to improve the sustainability of the bull kelp harvest: (1) address extraction methods that can ensure that bull kelp can reproduce effectively; (2) account for the varied ecosystem functions of the species; and (3) coordinate throughout the species' range to ensure that a broad-scale ecosystem approach is used.

## C. Recent articles with abstracts

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Finkl, C.W., Benedet, L., and Campbell, T.J. **Beach nourishment experience in the United States: Status and trends in the 20th century.** *Shore and Beach* 74(2): 8-15, 2006.

**Notes:** Beach erosion is a worldwide problem that is particularly noticeable along developed shorelines that front open-ocean coasts. Engineered response to the coastal erosion problem in the United States features the imposition of hard structures (such as seawalls and groins), and soft structures such as beaches and dunes. Beach nourishment has become the shore protection measure of choice because it is a multipurpose approach that provides economic and environmental advantages to threatened coastal systems. Experience with the procedure in the US over the last century identifies trends towards improved methods of fill placement, better design strategies, and recognition of increased potential of performance associated with larger fill densities. Maintenance volumes (expressed in terms of total volume per unit length per year) for Atlantic, Gulf and Pacific coast nourishment programs decrease from north to south along the Atlantic coast and from Atlantic coasts to Gulf coasts. Planning long-term nourishment requirements requires differentiation of volumetric maintenance needs from initial construction. Of the  $1 \times 10^9$  m<sup>3</sup> (one billion cubic meters) of sediments removed from America's beaches by engineering works and anthropogenic activity in the past century, about  $650 \times 10^6$  m<sup>3</sup> (six-hundred fifty million) have been returned to the beaches. There is thus a sediment deficit that needs to be mitigated over the long term.

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Fraser, C., Hutchings, P., and Williamson, J. **Long-term changes in polychaete assemblages of Botany Bay (NSW, Australia) following a dredging event.** *Marine Pollution Bulletin* 52(9): 997-1010, 2006.

**Notes:** The long-term effects of marine aggregate dredging on near-shore benthic assemblages are still largely unknown, despite a global increase in demand for, and extraction of, marine aggregates. This study assessed the state of recovery of polychaete assemblages in Botany Bay, temperate NSW, Australia, at sites dredged for aggregate material more than 10 years previously. Sedimentary and faunal samples were collected from impact sites in Botany Bay, and from reference sites in nearby Pittwater estuary. This study was based on, and included data from, a study conducted by the Australian Museum at the same sites in the 2 years following cessation of dredging. Abundance, species richness and evenness of polychaetes, as well as overall polychaete assemblage structure, were compared between localities over time.

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Peterson, B., Emmett, R., Goericke, R., Venrick, E., Mantyla, A., Bograd, S.J., Schwing, F.B., Ralston, S., Forney, K.A., Hewitt, R., Lo, N., Watson, W., Barlow, J., Lowry, M., Lavaniegos, B. E., Chavez, F., Sydeman, W.J., Hyrenbach, D., Bradley, R.W., Warzybok, P., Hunter, K., Benson, S., Weise, M., and Harvey, J. **The state of the California current, 2005-2006: Warm in the North, cool in the South.** *California Cooperative Oceanic Fisheries Investigations Reports* 47: 30-74, 2006.

**Notes:** This report summarizes the recent state of the California Current System (CCS), primarily during the period April 2005 through early 2006, and includes observations of ocean conditions made from Washington State south to Baja California. During 2005, the CCS experienced very unusual "ocean weather." For example, off Washington, Oregon and northern California, the start of upwelling was delayed, resulting in anomalously warm sea surface temperatures through the spring and the early summer months. The warming observed in the northern California Current (NCC) in the spring and early summer appeared to be a regional phenomenon, since waters south of approximately 35°N to the California-Mexico border were near

the long-term average, and cooler-than-normal temperatures prevailed off Baja California. The extent of the warming and subsequent ecosystem response was similar to that of a major tropical El Niño event. However, we know from observations made at the equator that equatorial waters were in an El Niño-neutral state. The impacts on the NCC pelagic ecosystem were profound with very low biomass of zooplankton observed in Monterey Bay, the Gulf of the Farallones, and off Oregon, accompanied by unprecedented reproductive failure and mortality in several locally-breeding, seabird species. Recruitment failure was seen in a variety of fishes as well. The proximate cause was a delay in the initiation of the upwelling season in the NCC (which usually begins in April) to a nearly unprecedented start time of late July. Thus, animals that reproduce in spring and in other years would find bountiful food resources, found themselves faced with famine rather than feast. Similarly, marine mammals and birds which migrate to the NCC upwelling region in spring and summer, which would otherwise find a high biomass of energetically-rich zooplankton and small pelagic fish upon which to feed, were equally disappointed. Moreover, 2005 marked the third year of chronically warm conditions in the NCC, a situation which could have led to a general reduction in physiological condition of fish and birds, rendering them less tolerant of adverse ocean conditions in 2005.

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Velegrakis, A.F., Vousdoukas, M.I., Vagenas, A.M., Karambas, Th., Dimou, K., and Zarkadas, Th. **Field observations of waves generated by passing ships: A note.** *Coastal Engineering* 54(4): 369-375, 2007.

**Notes:** This short contribution reports the results of a field study on the nearshore characteristics of waves generated by both conventional and high speed passenger ferries. The field observations took place in the late summer of 2005, at a beach close to the port of Mytilene (Island of Lesbos, Greece), and involved the visual observation of ship waves, using digital video recordings and image processing techniques. The results showed that passage of the fast ferry was associated with a longer, more complex and energetic nearshore event; this event not only did include higher nearshore waves (up to 0.74m) and was organised in different wave packets, but it was also an order of magnitude longer (~ 680s) than the conventional ferry event. Regarding the effects on beach sediment dynamics, the fast ferry waves were estimated to be very efficient in mobilising the nearshore sediments in contrast to those of the conventional ferry. The fast ferry service appears to generate daily prolonged nearshore events, which contain waves with higher energy than those expected from the normal summer wind wave regime of the area; these events also include some high and very steep waves, which can be particularly erosive. Therefore, fast ferry wakes may have considerable impacts on the seasonal beach sediment dynamics/ morpho-dynamics and the nearshore benthic ecology, as well as they may pose significant risks to bathers, affecting the recreational use of the beaches exposed to fast ferry traffic. Finally, the study has shown that satisfactory field observations of the nearshore characteristics of ship-generated (and wind) waves can be obtained using inshore deployments of calibrated poles, digital video cameras and appropriate image processing algorithms.

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Kirwan, M.L. and Murray, A.B. **A coupled geomorphic and ecological model of tidal marsh evolution.** *Proceedings of the National Academy of Sciences [USA]* 104(15): 6118-6122, 2007.

**Notes:** The evolution of tidal marsh platforms and interwoven channel networks cannot be addressed without treating the two-way interactions that link biological and physical processes. We have developed a 3D model of tidal marsh accretion and channel network development that couples physical sediment transport processes with vegetation biomass productivity. Tidal flow tends to cause erosion, whereas vegetation biomass, a function of bed surface depth below high tide, influences the rate of sediment deposition and slope-driven transport processes such as creek bank slumping. With a steady, moderate rise in sea level, the model builds a marsh platform and channel network with accretion rates everywhere equal to the rate of sea-level rise, meaning water depths and biological productivity remain temporally constant. An increase in the rate of sea-level rise, or a reduction in sediment supply, causes marsh-surface depths, biomass productivity, and deposition rates to increase while simultaneously causing the channel network to expand. Vegetation on the marsh platform can promote a metastable equilibrium where the platform maintains elevation relative to a rapidly rising sea level, although disturbance to vegetation could cause irreversible loss of marsh habitat.

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Day, J.W., Boesch, D.F., Clairain, E.J., Kemp, G.P., Laska, S.B., Mitsch, W.J., Orth, K., Mashriqui, H., Reed, D.J., Shabman, L., Simenstad, C.A., Streever, B.J., Twilley, R.R., Watson, C.C., Wells, J.T., and Whigham, D.F. **Restoration of the**

**Mississippi Delta: Lessons from Hurricanes Katrina and Rita.** *Science* 315(5819): 1679-1684, 2007.

**Notes:** Hurricanes Katrina and Rita showed the vulnerability of coastal communities and how human activities that caused deterioration of the Mississippi Deltaic Plain (MDP) exacerbated this vulnerability. The MDP formed by dynamic interactions between river and coast at various temporal and spatial scales, and human activity has reduced these interactions at all scales. Restoration efforts aim to re-establish this dynamic interaction, with emphasis on reconnecting the river to the deltaic plain. Science must guide MDP restoration, which will provide insights into delta restoration elsewhere and generally into coasts facing climate change in times of resource scarcity.

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Pollux, B.J.A., Verberk, W.C.E.P., Dorenbosch, M., de la Moriniere, E.C., Nagelkerken, I., and van der Velde, G. **Habitat selection during settlement of three Caribbean coral reef fishes: Indications for directed settlement to seagrass beds and mangroves.** *Limnology and Oceanography* 52(2): 903-907, 2007.

**Notes:** We studied the settlement patterns of three Caribbean coral reef fishes in three different habitat types: mangroves, seagrass beds, and coral reefs. The settlement patterns of the three species were not random and could best be explained by active habitat selection during settlement. *Acanthurus bahianus* preferentially settled on the shallow reef flat and in adjacent seagrass beds, *Lutjanus apodus* settled exclusively into mangroves, and *Ocyurus chrysurus*, settled into both mangroves and seagrass beds. The settlement patterns of these three species reflect their habitat utilization during later juvenile stages. This study, therefore, suggests that the higher juvenile densities in mangroves and seagrass beds are determined by habitat selection during settlement rather than by post-settlement processes. This habitat selection during settlement is in accordance with the assumed importance of mangroves and seagrass beds as juvenile habitats of coral reef fishes and underlines the pressing need for their conservation.

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Yang, S.L., Zhang, J., and Xu, X.J. **Influence of the Three Gorges Dam on downstream delivery of sediment and its environmental implications, Yangtze River.** *Geophysical Research Letters* 34(10): art. L10401, 2007.

**Notes:** Water and sediment supplies from ungauged areas were calculated and combined with datasets from gauging stations to establish sediment budgets. Using sediment budgets and regression relationships, the influence of the Three Gorges Dam (TGD) on downstream delivery of sediment was quantified. We found that 151 mt/yr (1 mt = 10(6) tons) of sediment has been retained by TGD since it began operation (2003-2005). In response to this, significant erosion has occurred in the downstream riverbed. This erosion did not offset the sediment lost in the reservoir, and the sediment flux into the estuary decreased by 85 mt/yr (31%). This decrease has led to conversion from progradation to recession in the delta front. In combination with other anthropogenic impacts, TGD was expected to decrease the sediment flux into the estuary for centuries, which is of great importance for delta ecosystem and human development.

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Wang, Z.Y., Li, Y.T., and He, Y.P. **Sediment budget of the Yangtze River.** *Water Resources Research* 43(4): art. W04401, 2007.

**Notes:** The sediment budget is a method to study the distribution of sediment in different parts of a river basin. This paper studies the sediment budget of the Yangtze River by analyzing the data on soil erosion, size distributions of sediment deposits, sediment load, and fluvial process. A method to determine the sediment budget for the Yangtze River is proposed in which the total soil erosion from the upstream reaches and tributaries is divided into two parts: sediment load transported to the Yichang station and sediment storage in the tributaries and gullies. Furthermore, the sediment load is divided into three parts: bed material load deposited in the middle and lower reaches for the fluvial process, wash load transported to the estuary, and sediment deposition in Tongting Lake. The sediment transported into the estuary is further divided into two parts: very fine sediment drifting to the ocean and sediment deposition in the estuary for land creation. There is a large sediment demand for (1) the fluvial process to reach the minimum stream power in the middle and lower reaches; (2) sediment mining for building material; and (3) land creation in the estuary. The riverbed profile in the middle and lower reaches is developing toward the equilibrium profile defined by the minimum stream power, but the impoundment of the Three Gorges Reservoir interrupts and modifies this fluvial process. The annual sediment load in the Yangtze River has reduced due to various human activities by about  $100 \times 10(6)$  t in the past 15 years. Thus there is a sediment shortage for land creation in the river mouth.

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Verney, R., Deloffre, J., Brun-Cottan, J.C., and Lafite, R. **The effect of wave-induced turbulence on intertidal mudflats: Impact of boat traffic and wind.** *Continental Shelf Research* 27(5): 594-612, 2007.

**Notes:** Semi-diurnal and fortnightly surveys were carried out to quantify the effects of wind- and navigation-induced high-energy events on bed sediments above intertidal mudflats. The mudflats are located in the upper fluvial part (Oissel mudflat) and at the mouth (Vasiere Nord mudflat) of the macrotidal Seine estuary. Instantaneous flow velocities and mudflat bed elevation were measured at a high frequency and high resolution with an acoustic doppler velocimeter (ADV) and an ALTUS altimeter, respectively. Suspended particulate matter concentrations were estimated by calibrating the ADV acoustic backscattered intensity with bed sediments collected at the study sites. Turbulent bed shear stress values were estimated by the turbulent kinetic energy method, using velocity variances filtered from the wave contribution. Wave shear stress and maximum wave-current shear stress values were calculated with the wave-current interaction (WCI) model, which is based on the bed roughness length, wave orbital velocities and the wave period ( $T_s$ ). In the fluvial part of the estuary, boat passages occurred unevenly during the surveys and were characterized by long waves ( $T_s > 50$  s) induced by the drawdown effect and by short boat-waves ( $T_s < 10$  s). Boat waves generated large bottom shear stress values of  $0.5 \text{ N m}^{-2}$  for 2-5 min periods and, in burst of several seconds, larger bottom shear stress values up to  $1 \text{ N m}^{-2}$ . At the mouth of the estuary, west south-west wind events generated short waves ( $T_s < 10$ s) of  $H_s$  values ranging from 0.1 to 0.3 m. In shallow-water environment (water depth  $< 1.5$  m), these waves produced bottom shear stress values between 1 and  $2 \text{ N m}^{-2}$ . Wave-current shear stress values are one order of magnitude larger than the current-induced shear stress and indicate that navigation and wind are the dominant hydrodynamic forcing parameters above the two mudflats. Bed elevation and SPM concentration time series showed that these high energy events induced erosion processes of up to several centimetres. Critical erosion shear stress ( $T_{ce}$ ) values were determined from the SPM concentration and bed elevation measurements. Rough  $T_{ce}$  values were found above  $0.2 \text{ N m}^{-2}$  for the Oissel mudflat and about  $1 \text{ N m}^{-2}$  for the Vasiere Nord mudflat. These results demonstrate the advantages of combining the measurement of instantaneous velocity and bed elevation to determine in situ the erosion and deposition processes as a function of bottom shear stress variations.

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Oguz, T. and Gilbert, D. **Abrupt transitions of the top-down controlled Black Sea pelagic ecosystem during 1960-2000: Evidence for regime-shifts under strong fishery exploitation and nutrient enrichment modulated by climate-induced variations.** *Deep Sea Research Part I: Oceanographic Research Papers* 54(2): 220-242, 2007.

**Notes:** Functioning of the Black Sea ecosystem has profoundly changed since the early 1970s under cumulative effects of excessive nutrient enrichment, strong cooling/warming, over-exploitation of pelagic fish stocks, and population outbreak of gelatinous carnivores. Applying a set of criteria to the long-term (1960-2000) ecological time-series data, the present study demonstrates that the Black Sea ecosystem was reorganised during this transition phase in different forms of top-down controlled food web structure through successive regime-shifts of distinct ecological properties. The Secchi disc depth, oxic-anoxic interface zone, dissolved oxygen and hydrogen sulphide concentrations also exhibit abrupt transition between their alternate regimes, and indicate tight coupling between the lower trophic food web structure and the biogeochemical pump in terms of regime-shift events. The first shift, in 1973-1974, marks a switch from large predatory fish to small planktivore fish-controlled system, which persisted until 1989 in the form of increasing small pelagic and phytoplankton biomass and decreasing zooplankton biomass. The increase in phytoplankton biomass is further supported by a bottom-up contribution due to the cumulative response to high anthropogenic nutrient load and the concurrent shift of the physical system to the "cold climate regime" following its similar to 20-year persistence in the "warm climate regime". The end of the 1980s signifies the depletion of small planktivores and the transition to a gelatinous carnivore-controlled system. By the end of the 1990s, small planktivore populations take over control of the system again. Concomitantly, their top-down pressure when combined with diminishing anthropogenic nutrient load and more limited nutrient supply into the surface waters due to stabilizing effects of relatively warm winter conditions switched the "high production" regime of phytoplankton to its background "low production" regime. The Black Sea regime-shifts appear to be sporadic events forced by strong transient decadal perturbations, and therefore differ from the multi-decadal scale cyclical events observed in pelagic ocean ecosystems under low-frequency climatic forcing. The Black Sea observations illustrate that eutrophication and extreme fishery exploitation can indeed induce hysteresis in large marine ecosystems, when they can exert sufficiently strong forcing onto the system. They further illustrate the link between the disruption of the top predators, proliferation of new predator stocks, and regime-shift events. Examples of these features have been reported for some aquatic ecosystems, but are extremely limited for large marine ecosystems.

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Smith, T.B., Purcell, J., and Barimo, J.E. **The rocky intertidal biota of the Florida Keys: fifty-two years of change after Stephenson and Stephenson (1950).** *Bulletin of Marine Science* 80(1): 1-19, 2007.

**Notes:** A study of the rocky intertidal environments of the Florida Keys by Stephenson and Stephenson (1950) serves as a valuable baseline of littoral communities prior to extensive development and human population pressures. Five of the study areas originally surveyed in 1947 were resurveyed in 1999 to assess any community changes which may have occurred in the intervening 52 yrs. A more extensive sampling effort in 1999 yielded a greater number of taxa as compared to 1947 (120 vs 78). However, one intertidal zone showed a decrease in taxa richness, not all species recorded in 1947 were seen in 1999, and others had shifts in abundance or zones of occurrence. The gray zone at the high mean water mark may have experienced degradation from the deposition of seagrass, debris, or hydrophobic substances as suggested by a 79% decrease in the species that occurred there, despite an increase in the number of species found in all other zones. Harvesting, pollution, or general habitat degradation may explain the complete absence or reduced abundance of some species, particularly those considered as dominant or characteristic intertidal community members in 1947. Increased nearshore eutrophication and/or changes in grazer communities may explain an apparent upward shift of some macroalgal species and the appearance at more heavily developed sites of algal nutrient indicator species (e.g., *Cladophora*, *Chaetomorpha*, and *Enteromorpha*). Our results are consistent with increasing evidence that disturbances, such as eutrophication, are having a negative effect on rocky intertidal communities of the Florida Keys.

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McKechnie, S. **Biopedturbation by an island ecosystem engineer: burrowing volumes and litter deposition by sooty shearwaters (*Puffinus griseus*).** *New Zealand Journal of Zoology* 33(4): 259-265, 2006.

**Notes:** Seabirds can influence entire island ecosystems through the effects of their burrowing and of their underground deposition of vegetation on biotic and abiotic island processes. This study quantifies the extent of these effects at three sooty shearwater breeding islands in southern New Zealand, with the aim of assessing the importance of this species as an ecosystem engineer. Mean burrow volumes ranged between 158.2 and 528.1 m<sup>3</sup> ha<sup>-1</sup>. Between 18 and 34% of the ground surface was undermined by burrow space on the three islands. This extent of burrowing is comparable to that of fossorial mammals, widely recognised as ecosystem engineers. Mean vegetation inputs (dry weight), transported underground by birds and incorporated into nests, varied between 33 and 96 g m<sup>-2</sup>. The implications of the biopedturbation caused by sooty shearwater burrowing to the extent measured in this study may be profound for some ecosystem processes, and certainly warrants further research.

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Gilman, E., Ellison, J., and Coleman, R. **Assessment of mangrove response to projected relative sea-level rise and recent historical reconstruction of shoreline position.** *Environmental Monitoring and Assessment* 124(1-3): 105-130, 2007.

**Notes:** We predict the decadal change in position of three American Samoa mangroves from analysis of a time series of remotely sensed imagery, a geographic information system, tide gauge data, and projections for change in sea-level relative to the mangrove surface. Accurate predictions of changes to coastal ecosystem boundaries, including in response to projected relative sea-level rise, enable advanced planning to minimize and offset anticipated losses and minimize social disruption and cost of reducing threats to coastal development and human safety. The observed mean landward migration of three mangroves' seaward margins over four decades was 25, 64, and 72 mm a<sup>-1</sup>, 12 to 37 times the observed relative sea-level rise rate. Two of the sites had clear trends in reductions in mangrove area, where there was a highly significant correlation between the change in position of the seaward mangrove margin and change in relative sea-level. Here it can be inferred that the force of sea-level rise relative to the mangrove surface is causing landward migration. Shoreline movement was variable at a third site and not significantly correlated with changing sea-level, where it is likely that forces other than change in relative sea-level are predominant. Currently, 16.5%, 23.4%, and 68.0% of the three mangroves' landward margins are obstructed by coastal development from natural landward migration. The three mangroves could experience as high as a 50.0% reduction in area by the year 2100. A 12% reduction in mangrove area by the year 2100 is possible in the Pacific islands region.

Koch, M.S., Schopmeyer, S., Kyhn-Hansen, C., and Madden, C.J. **Synergistic effects of high temperature and sulfide on tropical seagrass.** *Journal of Experimental Marine Biology and Ecology* 341(1): 91-101, 2007.

**Notes:** To examine the synergism of high temperature and sulfide on two dominant tropical seagrass species, a large-scale mesocosm experiment was conducted in which sulfide accumulation rates (SAR) were increased by adding labile carbon (glucose) to intact seagrass sediment cores across a range of temperatures. During the initial 10 d of the 38 d experiment, porewater SAR in cores increased 2- to 3-fold from 44 and 136  $\mu\text{mol L}^{-1} \text{d}^{-1}$  at 28-29°C to 80 and 308  $\mu\text{mol L}^{-1} \text{d}^{-1}$  at 34-35°C in *Halodule wrightii* and *Thalassia testudinum* cores, respectively. Labile C additions to the sediment resulted in SAR of 443 and 601  $\mu\text{mol L}^{-1} \text{d}^{-1}$  at 28-29°C and 758 to 1,557  $\mu\text{mol L}^{-1} \text{d}^{-1}$  at 34-35°C in *H. wrightii* and *T. testudinum* cores, respectively. Both *T. testudinum* and *H. wrightii* were highly thermal tolerant, demonstrating their tropical affinities and potential to adapt to high temperatures. While plants survived the 38° temperature treatments, there was a clear thermal threshold above 33°C where *T. testudinum* growth declined and leaf quantum efficiencies (Fv/Fm) fell below 0.7. At this threshold temperature, *H. wrightii* maintained shoot densities and leaf quantum efficiencies. Although *H. wrightii* showed a greater tolerance to high temperature, *T. testudinum* had a greater capacity to sustain biomass and short shoots under thermal stress with labile C enrichment, regardless of the fact that sulfide levels in the *T. testudinum* cores were 2 times higher than in the *H. wrightii* cores. Tropical seagrass tolerance to elevated temperatures, predicted in the future with global warming, should be considered in the context of the sediment-plant complex which incorporates the synergism of plant physiological responses and shifts in sulfur biogeochemistry leading to increased plant exposure to sulfides, a known toxin.

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Seaman, W. **Artificial habitats and the restoration of degraded marine ecosystems and fisheries.** *Hydrobiologia* 580: 143-155, 2007.

**Notes:** Artificial habitats in marine ecosystems are employed on a limited basis to restore degraded natural habitats and fisheries, and more extensively for a broader variety of purposes including biological conservation and enhancement as well as social and economic development. Included in the aims of human-made habitats classified as artificial reefs are: Aquaculture/marine ranching; promotion of biodiversity; mitigation of environmental damage; enhancement of recreational scuba diving; eco-tourism development; expansion of recreational fishing; artisanal and commercial fisheries production; protection of benthic habitats against illegal trawling; and research. Structures often are fabricated according to anticipated physical influences or life history requirements of individual species. For example, many of the world's largest reefs have been deployed as part of a national fisheries program in Japan, where large steel and concrete frameworks have been carefully designed to withstand strong ocean currents. In addition, the differing ecological needs of porgy and sea bass for shelter guided the design of the Box Reef in Korea as a device to enhance productivity of marine ranching. The effect of these and other structures on fisheries catch is positive. But caution must be exercised to avoid using reefs simply as fishing devices to heavily exploit species attracted to them. No worldwide database for artificial habitats exists. The challenge to any ecological restoration effort is to define the condition or possibly even the historic baseline to which the system will be restored; in other words, to answer the question: "Restoration to what?" Examples of aquatic ecosystem restoration from Hong Kong (fisheries), the Pacific Ocean (kelp beds), Chesapeake Bay (oysters) and the Atlantic Ocean (coral reefs) are discussed. The degree to which these four situations consider or can approach a baseline is indicated and compared (e.g., four plants per 100 m<sup>2</sup> are proposed in one project). Measurement of performance is a key factor in restoration planning. These situations also are considered for the ecosystem and fishery contexts in which they are conducted. All use ecological data as a basis for physical design of restoration structures. The use of experimental, pilot and modeling practices is indicated. A context for the young field of marine restoration is provided by reviewing major factors in ecosystem degradation, such as high stress on 70% of commercially valuable fishes worldwide. Examples of habitat disruption include an extensive hypoxic/anoxic zone in the Gulf of Mexico and nutrient and contaminant burdens in the North Sea. Principle of ecological restoration are summarized, from planning through to evaluation. Alternate approaches to facilitate ecological recovery include land-use and ecosystem management and determining levels of human population, consumption and pollution.

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Snoussi, M., Kitheka, J., Shaghude, Y., Kane, A., Arthurton, R., LeTissier, M., and Virji, H. **Downstream and coastal impacts of damming and water abstraction in Africa.** *Environmental Management* 39(5): 587-600, 2007.

**Notes:** Anthropogenic factors associated with damming and water abstraction, and the resultant environmental pressures, are reviewed in six African river catchments using records and forecasts of climatic, demographic, and land-use change. Changes in the states of the flow regime through catchment drainage systems to the coastal sea are considered in conjunction with

climate change and other human-induced pressures. The impacts of these changes on downstream and coastal environments and their communities are described in past, present, and future perspectives. Linkages between the issues and the pressures of damming and water abstraction are appraised and scientific, policy, and management responses proposed aimed at remedying existing and perceived future negative impacts. The study proposes that there is a need to integrate catchment and coastal management to account for the whole water flow regime together with its human dimensions. Management priorities relating to the operation of existing damming and abstraction schemes and planning of future schemes include the following: consideration of ways in which water discharges could be adjusted to provide improvements in downstream and coastal environmental and socioeconomic conditions; addressing the problem of sediment trapping impacting on the sustainability of dam reservoirs; and assessment of downstream and coastal impacts of future schemes in the light of climate change forecasts.

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Giulia, C., Davide, C., and Marco, M. **Short-term response of the slow growing seagrass *Posidonia oceanica* to simulated anchor impact.** *Marine Environmental Research* 63(4): 341-349, 2007.

**Notes:** Experimental evaluations about the impact of anchors of small vessels have previously shown that each anchoring can on average damage up to six shoots of *Posidonia oceanica*, removing small amount of biomass and, at the same time, interrupting continuity among shoots. The aim of the paper was to investigate the response of *P. oceanica* to different damage intensity at two levels of substrata compactness. Three treatments were considered: control (no damage); low damage (simulated anchor damage by three strokes of a hoe); and high damage (six strokes). Disturbance was higher where the substratum was highly penetrable and after one year significant variation was observed among treatments for both the number of leaves per shoot and shoot density. Conversely, the number of leaves per shoot by the end of the study was similar among all treatment combinations, suggesting that this was the only phenological feature that recovered, and probably the only result that through clonal integration could be achieved. These data strongly highlighted the role that anchoring might have on the slow growing seagrass *P. oceanica* meadow.

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Weinstein, M.P., Baird, R.C., Conover, D.O., Gross, M., Keulartz, J., Loomis, D.K., Naveh, Z., Peterson, S.B., Reed, D.J., Roe, E., Swanson, R.L., Swart, J.A.A., Teal, J.M., Turner, R.E., and van der Windt, H.J. **Managing coastal resources in the 21st century.** *Frontiers in Ecology and Environment* 5(1): 43-48, 2007.

**Notes:** Coastal ecosystems are increasingly dominated by humans. Consequently, the human dimensions of sustainability science have become an integral part of emerging coastal governance and management practices. But if we are to avoid the harsh lessons of land management, coastal decision makers must recognize that humans are one of the more coastally dependent species in the biosphere. Management responses must therefore confront both the temporal urgency and the very real compromises and sacrifices that will be necessary to achieve a sustainable coastal ecosystem, one that is economically feasible, socially just, and ecologically sound.

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Halpern, B.S., Silliman, B.R., Olden, J.D., Bruno, J.P., and Bertness, M.D. **Incorporating positive interactions in aquatic restoration and conservation.** *Frontiers in Ecology and Environment* 5(3): 153-160, 2007.

**Notes:** The role of positive interactions in structuring biological communities is recognized throughout the field of ecology, but has yet to be well integrated into the restoration and conservation of aquatic systems. Here, we use examples of success in terrestrial restoration to (1) describe how a broader perspective on the scale and nature of positive interactions is necessary if we are to take full advantage of their conservation potential and (2) explain why and when positive interactions should be considered in restoration and conservation of marine, estuarine, and freshwater habitats. Such goals can be accomplished without considering positive interactions, and situations certainly exist in which positive interactions should play a minor role in restoration plans. However, a more explicit recognition of these interactions will make restoration and conservation more successful. In some cases, restoration activities may fail if these interactions are not included.

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Ogburn, D.M., White, I., and McPhee, D.P. **The disappearance of oyster reefs from eastern Australian estuaries - Impact of colonial settlement or mudworm invasion?** *Coastal Management* 35(2-3): 271-287, 2007.

**Notes:** Oysters have been harvested on the east coast of Australia for many thousands of years. Coastal Aboriginal communities used the extensive estuarine oyster resource and may have farmed oysters by establishing shell cultch beds in shallow areas of estuaries. The British colonization of Australia commenced in 1788 and oysters were initially used for food and production of lime. Concerns about unsustainable exploitation led to introduction of legislation that directed the oyster industry to aquaculture in 1884. Translocation of oyster stock for fattening, from New Zealand to Australian east coast estuaries, was encouraged. Here evidence is presented that this activity resulted in "mudworm disease" appearing in oyster farming estuaries on the Australian east coast between 1880 and 1900. The pandemic permanently destroyed natural sub-tidal oyster reefs and forced the oyster industry to adopt avoidance farming techniques including intertidal farming to cope with mudworm.

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Murray, G. **Constructing paradise: The impacts of big tourism in the Mexican coastal zone.** *Coastal Management* 35(2-3): 339-355, 2007.

**Notes:** Although coastal tourism is often looked to as a way of generating foreign revenue, it can also engender a range of social and environmental impacts. From an historical perspective, this article examines the growth of Cancun in the Mexican state of Quintana Roo since the late 1960s. The article documents a range of socioeconomic and environmental impacts associated with the rise of coastal tourism, and suggests that centralized planning and the provision of physical and financial infrastructure does not prevent those impacts. The principal causes of these impacts are also described, including changes in land-usage, population, tourism markets, foreign market penetration and control, an emphasis on short-term economic gain, weak regulatory enforcement, and an overall lack of integration of coastal zone management.

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Milbrandt, E.C., Greenawalt-Boswell, J.M., Sokoloff, P.D., and Bortone, S.A. **Impact and response of southwest Florida mangroves to the 2004 hurricane season.** *Estuaries and Coasts* 29(6A): 979-984, 2006.

**Notes:** Although hurricane disturbance is a natural occurrence in mangrove forests, the effect of widespread human alterations on the resiliency of estuarine habitats is unknown. The resiliency of mangrove forests in southwest Florida to the 2004 hurricane season was evaluated by determining the immediate response of mangroves to a catastrophic hurricane in areas with restricted and unrestricted tidal connections. The landfall of Hurricane Charley, a category 4 storm, left pronounced disturbances to mangrove forests on southwest Florida barrier islands. A significant and negative relationship between canopy loss and distance from the eyewall was observed. While a species-specific response to the hurricane was expected, no significant differences were found among species in the size of severely impacted trees. In the region farthest from the eyewall, increases in canopy density indicated that refoitation and recovery occurred relatively quickly. There were no increases or decreases in canopy density in regions closer to the eyewall where there were complete losses of crown structures. In pre-hurricane surveys, plots located in areas of management concern (i.e., restricted connection) had significantly lower stem diameter at breast height and higher stem densities than plots with unrestricted connection. These differences partially dictated the severity of effect from the hurricane. There were also significantly lower red mangrove (*Rhizophora mangle*) seedling densities in plots with restricted connections. These observations suggest that delays in forest recovery are possible in severely impacted areas if either the delivery of propagules or the production of seedlings is reduced by habitat fragmentation.

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Mallin, M.A. and Corbett, C.A. **How hurricane attributes determine the extent of environmental effects: Multiple hurricanes and different coastal systems.** *Estuaries and Coasts* 29(6A): 1046-1061, 2006.

**Notes:** The most recent spate of hurricanes to strike the United States and Caribbean (1989 to the present) has occurred when many of the affected areas had long-term water quality and biological data collection efforts ongoing, as well as special follow-up studies. These data have allowed researchers to obtain a much clearer picture of how individual characteristics of hurricanes interact with human land use to lead to various types and degrees of environmental effects. Common deleterious water quality effects associated with hurricanes include excessive nutrient loading, algal blooms, elevated biochemical oxygen demand and subsequent hypoxia and anoxia, fish and invertebrate kills, aquatic animal displacements, large scale releases of chemical

pollutants and debris from damaged human structures, exacerbated spread of exotic species and pathogens, and pollution of water with fecal microbial pathogens. These and other effects may or may not occur, or occur to varying degrees, depending upon individual hurricane characteristics including category, point of landfall, wind speed, amount of rainfall, and path after landfall. Landfall in a populous area, a post-landfall trajectory upriver toward a headwater region, passage along a floodplain containing pollution sources (such as wastewater treatment plants, concentrated animal feeding operations, and septic systems), and intensity sufficient to damage power generation will all lead to increased environmental damage. We suggest a number of recommendations for post-hurricane water sampling parameters and techniques, and provide several management-oriented recommendations for better coastal and floodplain land use aimed at lessening the water quality effects of hurricanes.

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Cahoon, D.R. **A review of major storm impacts on coastal wetland elevations.** *Estuaries and Coasts* 29(6A): 889-898, 2006.

**Notes:** Storms have long been recognized as agents of geomorphic change to coastal wetlands. A review of recent data on soil elevation dynamics before and after storms revealed that storms affected wetland elevations by storm surge, high winds, and freshwater flushing of the estuary (inferred). The data also indicate that measures of sediment deposition and erosion can often misrepresent the amount and even direction of elevation change because of storm influences on subsurface processes. Simultaneous influence on both surface and subsurface processes by storms means that soil elevation cannot always be accurately estimated from surface process data alone. Eight processes are identified as potentially influencing soil elevation: sediment deposition, sediment erosion, sediment compaction, soil shrinkage, root decomposition (following tree mortality from high winds), root growth (following flushing with freshwater, inferred), soil swelling, and lateral folding of the marsh root mat. Local wetland conditions (e.g., marsh health, tide height, groundwater level) and the physical characteristics of the storm (e.g., angle of approach, proximity, amount of rain, wind speed, and storm surge height) were apparently important factors determining the storm's effect on soil elevation. Storm effects on elevation were both permanent (on an ecological time scale) and short-lived, but even short-term changes have potentially important ecological consequences. Shallow soil subsidence or expansion caused by a storm must be considered when calculating local rates of relative sea level rise and evaluating storm effects on wetland stability.

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