

In this review:

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A. Recent articles – no abstract available

Rajbanshi, R. and Pederson, J. **Competition among invading ascidians and a native mussel.** *Journal of Experimental Marine Biology and Ecology* 342(1): 163-165, 2007.

Valentine, P.C., Collie, J.S., Reid, R.N., Asch, R.G., Guida, V.G., and Blackwood, D.S. **The occurrence of the colonial ascidian *Didemnum* sp on Georges Bank gravel habitat - Ecological observations and potential effects on groundfish and scallop fisheries.** *Journal of Experimental Marine Biology and Ecology* 342(1): 179-181, 2007.

Snyder, D.B. and Burgess, G.H. **The Indo-Pacific red lionfish, *Pterois volitans* (Pisces: Scorpaenidae), new to Bahamian ichthyofauna.** *Coral Reefs* 26(1): 175, 2007.

B. Recent articles with abstracts

Lambert, A.M., Winiarski, K., and Casagrande, R.A. **Distribution and impact of exotic gall flies (*Lipara* sp.) on native and exotic *Phragmites australis*.** *Aquatic Botany* 86(2): 163-170, 2007.

Notes: Two exotic gall fly species infest stems of native and exotic *Phragmites australis* (Cav.) Trin. ex Steudel in northeastern North America. In this study, we determined the distribution of *Lipara similis* Schiner and *L. rufitarsis* Loew in native and exotic *P. australis* in Rhode Island. We also studied the within-stand distributions of each fly species and their effects on flowering of native and exotic *P. australis*. We collected stems from populations throughout southern Rhode Island and measured stem length and diameter, and percent flowering. Stems were then dissected to determine *Lipara* infestation. *L. similis* and *L. rufitarsis* were found throughout Rhode Island infesting both native and exotic *P. australis*, but their presence and abundance varied among sites. Within stands, *L. similis* infests the taller, thicker interior stems and *L. rufitarsis* infests the shorter, thinner exterior stems. *Lipara similis* reduces stem length by 6%; *L. rufitarsis* infestation reduces stem length by 37%. The flowering rate of uninfested stems is significantly lower in native *P. australis* stems than in exotic stems. Both *Lipara* species prevent infested stems from flowering. In adjacent stands of native and exotic *P. australis*, *L. rufitarsis* infests significantly more native stems than exotic stems, possibly further reducing the reproductive potential of the native plants relative to the exotic. *Lipara* species may play a role in facilitating the displacement of native *P. australis* by the exotic genotype.

Jackson, D.B. **Factors affecting the abundance of introduced hedgehogs (*Erinaceus europaeus*) to the Hebridean island of South Uist in the absence of natural predators and implications for nesting birds.** *Journal of Zoology* 271(2): 210-217, 2007.

Notes: Introduced hedgehogs *Erinaceus europaeus* are a known threat to ground-nesting birds on many islands. Spring hedgehog density and sex ratio were measured over a 5-year period at four plots on the 315 km² Hebridean island of South Uist. The mean instantaneous density on the sandy-soiled machair plots (31.8 hedgehogs km⁻², SE 2.95) was over twice that on the

peaty-soiled blackland plots (15.4 hedgehogs km⁻², SE 3.46), a difference reflecting the amount of preferred foraging habitat (mainly pasture). Plot population densities fluctuated approximately in unison. Year-to-year density changes were strongly correlated with temperature in the preceding winter and previous year's spring/summer, indicating that warmer conditions promote both survival and breeding success. The mean spring sex ratio of sub-adults (animals born in the previous calendar year) was not significantly different from 1M:1F. However, the 1.8M:1F ratio observed for adults was significantly male biased, probably a result of female mortality associated with rearing young. The study estimates that in an average year the South Uist hedgehog population numbers *c.* 2750 (95% confidence limit \pm 800) adults and sub-adults and these produce around 3000 young. Compared with the native range, hedgehog densities on South Uist are shown to be unusually high, probably because their natural predators are absent. High hedgehog densities have led directly to high rates of egg predation of ground-nesting shorebirds and subsequent declines in bird populations. The results suggest that over the past 20 years egg losses have become more severe and control of hedgehogs more difficult because climate warming has resulted in generally more favourable conditions for hedgehogs on the islands.

Lambert, A.M. and Casagrande, R.A. **Distribution of native and exotic *Phragmites australis* in Rhode Island.** *Northeastern Naturalist* 13(4): 551-560, 2006.

Notes: Exotic populations of *Phragmites australis* (common reed) are now present in southern New England wetland habitats where native populations were once abundant. We surveyed Rhode Island to determine the distribution of native and exotic *P. australis*, and used this information to build a publicly accessible Geographic Information System (GIS) database. All *P. australis* populations sampled on the mainland were exotic. We only found native populations growing throughout a network of tidal marshes and ponds on Block Island, and several of these populations are being overrun by expanding exotic populations. The GIS database from this survey can be expanded to other regions, and can be used for the conservation of the native subspecies and for ensuring that control efforts target only exotic populations.

Garcia, M.E., Trigo, J.E., Pascual, S., Gonzalez, A.F., Rocha, F., and Guerra, A. ***Xenostrobus securis* (Lamarck, 1819) (Mollusca: Bivalvia): first report of an introduced species in Galician waters.** *Aquaculture International* 15(1): 19-24, 2007.

Notes: The presence of the non-indigenous species, the black-pygmy mussel *Xenostrobus securis*, is reported here for the first time in an intense shellfish farming area off Galicia (NW Spain). Very high concentrations of this mytilid bivalve have colonized estuarine waters located at the inner part of the Ria de Vigo. The invasive role of *X. securis* is discussed in the context of the wide ecological tolerance of the species and the recent finding of settlements of this species on numerous colonies of the economically-important blue mussel *Mytilus galloprovincialis*. The mode of introduction of the black-pygmy mussel is also discussed in relation to human management activities.

Brusati, E.D. and Grosholz, E.D. **Effect of native and invasive cordgrass on *Macoma petalum* density, growth, and isotopic signatures.** *Estuarine, Coastal and Shelf Science* 71(3-4): 517-522, 2007.

Notes: Ecosystem engineers can influence community and ecosystem dynamics by controlling resources, modifying the flow of energy or biomass, or changing physical characteristics of the habitat. Invasive hybrid cordgrass (*Spartina alterniflora* x *Spartina foliosa*) is an ecosystem engineer in salt marshes in San Francisco Bay, California, U.S.A. That raises intertidal elevations and may be either increasing C₄ plant carbon input into food webs or tying up carbon in a form that is not usable by consumers. A manipulative experiment compared abundance, growth, and stable isotope (δ C¹³ and δ N¹⁵) composition of the clam *Macoma petalum* (= *M. balthica*) among native marsh, hybrid *Spartina*, and mudflats in central San Francisco Bay. We found higher densities (individuals m⁻²) of *M. petalum* on mudflats compared to either native or hybrid *Spartina* ($p < 0.001$). *Macoma petalum* shell growth was significantly greater in mudflats than in either vegetation type in 2002 ($p = 0.005$) but not 2003. Differences in shell growth between native and hybrid *Spartina* were not significant. Stable isotope results showed differences between habitats in δ C¹³ but not δ N¹⁵. Carbon signatures of *M. petalum* placed in *Spartina* were much more depleted than the isotopic signature of *Spartina*. Neither native nor hybrid *Spartina* appears to be a significant carbon source for *M. petalum* in San Francisco Bay, and we found no evidence that hybrid *Spartina* contributes carbon to *M. petalum* beyond what is provided by *S. foliosa*, despite the hybrid's much greater biomass. Our results show that loss of mudflat habitat, rather than increased input of C₄ carbon, is the greatest effect of the invasion of hybrid *Spartina* on *M. petalum*.

Caldow, R.W.G., Stillman, R.A., le V. dit Durell, S.E.A., West, A.D., McGrorty, S., Goss-Custard, J.D., Wood, P.J., and Humphreys, J. **Benefits to shorebirds from invasion of a non-native shellfish.** *Proceedings of the Royal Society B* 274(1616): 1449-1455, 2007.

Notes: Introductions of non-native species are seen as major threats to ecosystem function and biodiversity. However, invasions of aquatic habitats by non-native species are known to benefit generalist consumers that exhibit dietary switches and prey upon the exotic species in addition to or in preference to native ones. There is, however, little knowledge concerning the population-level implications of such dietary changes. Here, we show that the introduction of the Manila clam *Tapes philippinarum* into European coastal waters has presented the Eurasian oystercatcher *Haematopus ostralegus ostralegus* with a new food resource and resulted in a previously unknown predator-prey interaction between these species. We demonstrate, with an individuals-based simulation model, that the presence of this non-native shellfish, even at the current low density, has reduced the predicted over-winter mortality of oystercatchers at one recently invaded site. Further increases in clam population density are predicted to have even more pronounced effects on the density dependence of oystercatcher over-winter mortality. These results suggest that if the Manila clam were to spread around European coastal waters, a process which is likely to be facilitated by global warming, this could have considerable benefits for many shellfish-eating shorebird populations.

D'Archino, R. and Nelson, W.A. **Marine brown algae introduced to New Zealand waters: first record of *Asperococcus ensiformis* (Phaeophyta, Ectocarpales, Chordariaceae).** *New Zealand Journal of Marine and Freshwater Research* 40(4): 599-604, 2006.

Notes: The brown alga *Asperococcus ensiformis* is recorded from New Zealand waters for the first time. This species is regarded as an introduced species as is the closely related species *A. bullosus*, which was first reported to occur in New Zealand in 1957. Although *A. ensiformis* appears to be flattened and ribbon-like when examined in transverse section it can be seen to be hollow at the margins. It can be distinguished from similar native species and from *A. bullosus* by a combination of anatomical and morphological characters.

Strauss, S.Y., Lau, J.A., and Carroll, S.P. **Evolutionary responses of natives to introduced species: what do introductions tell us about natural communities?** *Ecology Letters* 9(3): 357-374, 2006.

Notes: Biological invasions dramatically affect the distribution, abundance and reproduction of many native species. Because of these ecological effects, exotic species can also influence the evolution of natives exposed to novel interactions with invaders. Evolutionary changes in natives in response to selection from exotics are usually overlooked, yet common responses include altered anti-predator defenses, changes in the spectrum of resources and habitats used, and other adaptations that allow native populations to persist in invaded areas. Whether a native population is capable of responding evolutionarily to selection from invaders will depend on the demographic impact of the invader, the genetic architecture and genetic variability of the native population and potentially the history of previous invasions. In some cases, natives will fail to evolve or otherwise adapt, and local or global extinction will result. In other cases, adaptive change in natives may diminish impacts of invaders and potentially promote coexistence between invaders and natives. Here, we review the evidence for evolutionary responses of native species to novel community members. We also discuss how the effects of introduced species may differ from those caused by natural range expansions of native species. Notably, introduced species may come from remote biotas with no previous evolutionary history with the native community. In addition, the rate of addition of introduced species into communities is much greater than all but the most extreme cases of historical biotic exchange. Understanding the evolutionary component of exotic/native species interactions is critical to recognizing the long-term impacts of biological invasions, and to understanding the role of evolutionary processes in the assembly and dynamics of natural communities.

Colnar, A.M. and Landis, W.G. **Conceptual model development for invasive species and a regional risk assessment case study: The European green crab, *Carcinus maenas*, at Cherry Point, Washington, USA.** *Human and Ecological Risk*

Notes: The goal of this article was to generate a method of regional scale ecological risk assessment using an adaptation Relative Risk Model (RRM). As a case study we performed a quantitative, regional risk assessment of an invasive species, the European green crab (*Carcinus maenas*) at Cherry Point, Washington, USA. The conceptual model was modified from the RRM and incorporates the structure of the hierarchical patch dynamic paradigm. The ranks and filters were integrated to determine the relative contribution of each source of *C. maenas* to risk as well as the risk to selected biological endpoints, habitats and sub-regions for two source scenarios: (1) current conditions (2004) and (2) future conditions during an El Niño year. The results suggest that the habitat and endpoint with the greatest risk are the eelgrass habitat and the juvenile Dungeness crab, respectively. The Cherry Point subregion was identified as the area having the most risk in the first source scenario, while the Lummi Bay sub-region is most at risk during an El Niño event. The risk of impacts is substantially higher for all endpoints, habitats and sub-regions when El Niño-driven current dispersal is considered. The methodology applied in this case study can be modified and applied to determine the risk of introduction and impacts of other invasive species to the Strait of Georgia, Puget Sound, and other coastal areas.

David, M., Gollasch, S., Cabrini, M., Perkovic, M., Bosnjak, D., and Virgilio, D. **Results from the first ballast water sampling study in the Mediterranean Sea - the Port of Koper study.** *Marine Pollution Bulletin* 54(1): 53-65, 2007.

Notes: The ongoing transfer of harmful organisms by shipping, especially via ballast water transport, may result in a change of biodiversity, alteration of ecosystems, negative impacts on human health and economic loss. Species introductions which cause irreversible consequences to receiving environments and economies call for particular attention. One critical issue is a need to evaluate the quantities and processes of species introductions. Consequently ballast water was sampled on 15 ships calling at the Port of Koper, Slovenia. This was the first ballast water sampling study in the Mediterranean Sea. This paper summarises the sampling results. Samples were analysed for all types of aquatic organisms including bacteria. The results may be considered as background information for an initial risk assessment of future species introductions - an important tool for the implementation of ballast water management measures.

van Aarde, R.J. and Jackson, T.P. **Food, reproduction and survival in mice on sub-Antarctic Marion Island.** *Polar Biology* 30(4): 503-511, 2007.

Notes: The house mouse *Mus musculus* is the most widespread introduced mammal on sub-Antarctic islands, where it may alter ecosystem function. Ambient temperature and food availability affect reproduction and survival for mice. It is unclear how these factors influence mouse demography in the sub-Antarctic, and we tested the influence of food experimentally on Marion Island. Using food supplementation trials, we did not alter reproduction or overwinter survival. Alternatively, we argue ongoing climatic change on Marion could increase mouse densities through summer, while increased winter survival may reduce population growth rates the following summer through density dependence. The overall influence of these opposing forces depends on their relative strengths but may limit changes in mouse numbers with ongoing changes in climate in the sub-Antarctic.

Rooney, T.P., Olden, J.D., Leach, M.K., and Rogers, D.A. **Biotic homogenization and conservation prioritization.** *Biological Conservation* 134(3): 447-450, 2007.

Notes: Quantitative studies of biotic homogenization can provide useful insights into conservation problems when used appropriately, but can be dangerously misleading when they are not. By separating the concept of biotic homogenization at the global scale from the study of biotic homogenization at spatially- and temporally-explicit scales, researchers can avoid many of the subtle pitfalls inherent in homogenization studies.

de Rivera, C.E., Hitchcock, N.G., Teck, S.J., Steves, B.P., Hines, A.H., and Ruiz, G.M. **Larval development rate predicts range expansion of an introduced crab.** *Marine Biology* 150(6): 1275-1288, 2007.

Notes: Introduced populations can cause ecological and economic damage and are difficult to eradicate once they have established. It is therefore important to be able to predict both where species may become established and their capacity to spread within recipient regions. Here, we use a new method to assess potential for intraregional spread of a marine crab introduced to North America, *Carcinus maenas*. We determined survivorship and development rates throughout a range of temperatures in the laboratory for *C. maenas* larvae from non-native populations on the Atlantic and Pacific coasts of North America. The larvae exhibited narrower physiological tolerances than adults, and no lab-cultured larvae completed larval development below 10.0°C or above 22.5°C. Survivorship peaked at intermediate water temperatures of 12.5-20.0°C, and development time decreased with increasing temperatures within this range. Based upon these laboratory development rates, we used nearshore sea-surface temperature data from both coasts of North America to predict development times required for larvae at different months and sites. Taken together, survivorship and development data indicate that *C. maenas* has the capacity to continue its northward spread and establish populations at numerous additional sites in North America. Moreover, decadal temperature data at two Alaskan sites predicted little variability in development duration across years, suggesting that development duration predictions are robust to interannual water temperature differences.

Gonzalez-Ortegon, E., Cuesta, J.A., and Schubart, C.D. **First report of the oriental shrimp *Palaemon macrodactylus* Rathbun, 1902 (Decapoda, Caridea, Palaemonidae) from German waters.** *Helgoland Marine Research* 61(1): 67-69, 2007.

Notes: The native East Asian shrimp *Palaemon macrodactylus* has become a common inhabitant of estuaries along the Pacific coast of North America. More recently (documented since 1999), the species has also been colonising European waters and has been reported from Spain, England, Belgium and the Netherlands. In this study, we present a chronology of the reported introductions of this species and provide the first detailed report of its occurrence in German waters. *P. macrodactylus* was found in the Geeste river mouth (Weser Estuary) as well as in Hooksiel, north of Wilhelmshaven between 2004 and 2005. We assume its presence in other estuarine habitats of the North Sea and predict its introduction into the Baltic Sea.

Briggs, J.C. **Marine biogeography and ecology: invasions and introductions.** *Journal of Biogeography* 34(2): 193-198, 2007.

Notes: Although biogeography and ecology had previously been considered distinct disciplines, this outlook began to change in the early 1990s. Several people expressed interest in creating a link that would help ecologists become more aware of external influences on communities and help biogeographers realize that distribution patterns had their genesis at the community level. They proposed an interdisciplinary approach called macroecology. This concept has been aided by the advent of phylogeography, for a better knowledge of genetic relationships has had great interdisciplinary value. Two areas of research that should obviously benefit from a macroecological approach are: (1) the question of local vs. regional diversity and (2) the question of whether invader species pose a threat to biodiversity. The two questions are related, because both deal with the vulnerability of ecosystems to penetration by invading species. Biogeographers, who have studied the broad oceanic patterns of dispersal and colonization, tend to regard isolated communities as being open to invasion from areas with greater biodiversity. It became evident that many wide-ranging species were produced in centres of origin, and that the location of communities with respect to such centres had a direct effect on the level of species diversity. Ecologists, in earlier years, thought that a community could become saturated with species and would thereafter be self-sustaining. But recent research has shown that saturation is probably never achieved and that the assembly of communities and their maintenance is more or less dependent on the invasion of species from elsewhere. The study of invasions that take place in coastal areas, usually the result of ship traffic and/or aquaculture imports, has special importance due to numerous opinions expressed by scientists and policy-makers that such invasions are a major threat to biodiversity. However, none of the studies so far conducted has identified the extinction of a single, native marine species due to the influence of an exotic invader. Furthermore, fossil evidence of historical invasions does not indicate that invasive species have caused native extinctions or reductions in biodiversity.

Arenas, F., Bishop, J.D.D., Carlton, J.T., Dyrinda, P.J., Farnham, W.F., Gonzalez, D.J., Jacobs, M.W., Lambert, C., Lambert, G., Nielsen, S.E., Pederson, J.A., Porter, J.S., Ward, S., and Wood, C.A. **Alien species and other notable records from a**

rapid assessment survey of marinas on the south coast of England. *Journal of the Marine Biological Association of the United Kingdom* 86(6): 1329-1337, 2006.

Notes: In September 2004, a rapid assessment survey for non-native species was conducted at 12 harbours along the south coast of England from East Sussex to Cornwall, focusing on communities of algae and invertebrates colonizing floating pontoons in marinas. Over 80 taxa each of algae and invertebrates were recorded, including 20 recognized non-native species. The southern hemisphere solitary ascidian *Corella eumyota* was recorded in the UK for the first time and was present at three sites. The colonial ascidian *Botrylloides violaceus* was also recorded as new to the UK, but was very widespread and has probably been present for a number of years but misidentified as the native congener *B. leachi*, which was infrequent. Other ascidians included *Styela clava*, introduced at Plymouth in the early 1950s, which was recorded at all locations visited, and *Perophora japonica*, which was found only at the Plymouth locality where it first occurred in the UK in 1999. The diverse algal flora included nine alien species previously recorded in the British Isles. Range extensions and population increases were noted for the kelp *Undaria pinnatifida* and the bryozoan *Tricellaria inopinata*, both first recorded in UK waters during the 1990s. The widespread occurrence of another non-native bryozoan, *Bugula neritina*, appears significant, since in earlier times this was known in UK waters predominantly from artificially heated docks. The results of this survey indicate that dock pontoon systems in southern England are significant reservoirs of non-native species dispersed by vessels and other means. The proliferation of these structures is therefore of conservation importance. The new UK records highlight the need for periodic monitoring of ports for non-native species.

Wright, J.T., McKenzie, L.A., and Gribben, P.E. **A decline in the abundance and condition of a native bivalve associated with *Caulerpa taxifolia* invasion.** *Marine and Freshwater Research* 58(3): 263-272, 2007.

Notes: *Caulerpa taxifolia* is a fast-spreading invasive seaweed that threatens biodiversity in temperate Australian estuaries. To date, little is known about its effects on infauna. In the present study, we describe variation in demographic and life-history traits of the abundant infaunal bivalve, *Anadara trapezia*, in *C. taxifolia* and uninvaded habitats (seagrass and unvegetated sediments) at multiple sites across three estuaries in south-eastern New South Wales. Densities of *A. trapezia* were always lower in *C. taxifolia* than on unvegetated sediment, and lower in *C. taxifolia* than in seagrass at three out of four sites where they were compared. Dry tissue weight of *A. trapezia* was also lower in *C. taxifolia* than on unvegetated sediment at most sites, but was only lower in *C. taxifolia* than in seagrass at one of four sites. Populations were dominated by larger individuals (> 45mm length), but smaller individuals (35 - 45mm length) were more common in *C. taxifolia* and seagrass. *A. trapezia* shell weight and morphology was variable and appeared weakly affected by invasion. Generally, our findings are consistent with the hypothesis that *A. trapezia* is negatively affected by *C. taxifolia*. However, *C. taxifolia* invasion appears complex and, at some places, its effects may not differ from those of native seagrass. There is a need for manipulative studies to understand the mechanisms underlying the effects of *C. taxifolia* on infauna.

Lambert, G. **The nonindigenous ascidian *Molgula ficus* in California.** *Cahiers de biologie marine* 48(1): 95-102, 2007.

Notes: The nonindigenous ascidian *Molgula ficus* was first observed in southern California in October 1994. It was incorrectly identified as the native *M. verrucifera* in Lambert & Lambert (1998) and thus was not included in Lambert & Lambert (2003) or Cohen et al. (2005), two papers on nonindigenous species in southern California. *M. ficus* is probably native to the west Pacific, most likely Australia, the location of the type specimen; it has been reported also from Hong Kong, Gulf of Siam, and Singapore. The first published east Pacific record is Chile, 1997. It is abundant and widespread on manmade structures in bays and harbors from San Diego to Los Angeles; the northernmost record in southern California is Port Hueneme. It was first recorded in San Francisco Bay in October 2005.

Ricciardi, A. and Cohen, J. **The invasiveness of an introduced species does not predict its impact.** *Biological Invasions* 9(3): 309-315, 2007.

Notes: Inconsistent use of terminology plagues the study and management of biological invasions. The term "invasive" has been used to describe *inter alia* (1) any introduced non-indigenous species; (2) introduced species that spread rapidly in a new region; and (3) introduced species that have harmful environmental impacts, particularly on native species. The second

definition in various forms is more commonly used by ecologists, while the third definition is pervasive in policy papers and legislation. We tested the relationship between the invasiveness of an introduced species and its impact on native biodiversity. We quantified a species' invasiveness by both its rate of establishment and its rate of spread, while its impact was assigned a categorical ranking based on the documented effects of the invader on native species populations. We found no correlations between these variables for introduced plants, mammals, fishes, invertebrates, amphibians and reptiles, suggesting that the mechanisms of invasion and impact are not strongly linked. Our results support the view that the term "invasive" should not be used to connote negative environmental impact.

Ricciardi, A. **Are modern biological invasions an unprecedented form of global change?** *Conservation Biology* 21(2): 329-336, 2007.

Notes: The uniqueness of the current, global mass invasion by nonindigenous species has been challenged recently by researchers who argue that modern rates and consequences of nonindigenous species establishment are comparable to episodes in the geological past. Although there is a fossil record of species invasions occurring in waves after geographic barriers had been lifted, such episodic events differ markedly from human-assisted invasions in spatial and temporal scales and in the number and diversity of organisms involved in long-distance dispersal. Today, every region of the planet is simultaneously affected and modern rates of invasion are several orders of magnitude higher than prehistoric rates. In terms of its rate and geographical extent, its potential for synergistic disruption and the scope of its evolutionary consequences, the current mass invasion event is without precedent and should be regarded as a unique form of global change. Prehistoric examples of biotic interchanges are nonetheless instructive and can increase our understanding of species-area effects, evolutionary effects, biotic resistance to invasion, and the impacts of novel functional groups introduced to naive biotas. Nevertheless, they provide only limited insight into the synergistic effects of invasions and other environmental stressors, the effect of frequent introductions of large numbers of propagules, and global homogenization, all of which characterize the current mass invasion event.

Rochette, R., Doyle, S.P., and Edgell, T.C. **Interaction between an invasive decapod and a native gastropod: predator foraging tactics and prey architectural defenses.** *Marine Ecology Progress Series* 330: 179-188, 2007.

Notes: The shell architecture of the intertidal snail *Littorina obtusata* (L.) is thought to have undergone an adaptive transition in response to invasion of the Gulf of Maine, NW Atlantic, by the European green crab *Carcinus maenas* (L.). In order to investigate the hypothesis that this morphological transition affects snail fitness, we conducted predation experiments with snail populations showing morphological differences that are hypothesized to have been caused by, and affect resilience to, green crab predation. Our results are consistent with the adaptive-transition hypothesis, but they reveal more varied predator foraging tactics and prey defensive attributes than previously considered. Crabs killed smaller and less heavily-armored snails by breaking their shell, but killed larger and more heavily-armored individuals using a fairly complex 'shell-entry' tactic, which we refer to as 'winkling'. The snail population which suffered lower mortality from green crab predation apparently obtained protection from crushing by having a thicker, more massive shell, and from winkling by having a smaller aperture. Our study provides evidence that the morphological transition undergone by *L. obtusata* following the green crab's invasion of the NW Atlantic is adaptive, and raises new questions regarding the phenotypic basis of this recent ecological interaction.

Miller, A.W., Ruiz, G.M., Minton, M.S., and Ambrose, R.F. **Differentiating successful and failed molluscan invaders in estuarine ecosystems.** *Marine Ecology Progress Series* 332: 41-51, 2007.

Notes: Despite mounting evidence of invasive species' impacts on the environment and society, our ability to predict invasion establishment, spread, and impact are inadequate. Efforts to explain and predict invasion outcomes have been limited primarily to terrestrial and freshwater ecosystems. Invasions are also common in coastal marine ecosystems, yet to date predictive marine invasion models are absent. Here we present a model based on biological attributes associated with invasion success (establishment) of marine molluscs that compares successful and failed invasions from a group of 93 species introduced to San Francisco Bay (SFB) in association with commercial oyster transfers from eastern North America (ca. 1869 to 1940). A multiple logistic regression model correctly classified 83% of successful and 80% of failed invaders according to their source region abundance at the time of oyster transfers, tolerance of low salinity, and developmental mode. We tested the

generality of the SFB invasion model by applying it to 3 coastal locations (2 in North America and 1 in Europe) that received oyster transfers from the same source and during the same time as SFB. The model correctly predicted 100, 75, and 86 % of successful invaders in these locations, indicating that abundance, environmental tolerance (ability to withstand low salinity), and developmental mode not only explain patterns of invasion success in SFB, but more importantly, predict invasion success in geographically disparate marine ecosystems. Finally, we demonstrate that the proportion of marine molluscs that succeeded in the latter stages of invasion (i.e. that establish self-sustaining populations, spread and become pests) is much greater than has been previously predicted or shown for other animals and plants.

O'Doherty, D.C. and Sherwood, A.R. **Genetic population structure of the Hawaiian alien invasive seaweed *Acanthophora spicifera* (Rhodophyta) as revealed by DNA sequencing and ISSR analyses.** *Pacific Science* 61(2): 223-233, 2007.

Notes: *Acanthophora spicifera* (Vahl) Borgesen is the most widespread and invasive alien macroalga on coral reefs throughout the main Hawaiian Islands. This alga disperses from harbors and ports to coral reefs throughout the state, producing high quantities of biomass that affect a wide range of reef flora and fauna. Population samples of *A. spicifera* from across the main Hawaiian Islands were collected and compared through two kinds of analyses: DNA sequencing (based on a variable region of the nuclear large subunit ribosomal RNA gene, and the mitochondrial cox 2-3 spacer region) and fragment techniques (Inter-Simple Sequence Repeats [ISSRs]). DNA sequencing revealed no variation for the two markers, even when collections from other areas of the Pacific and Australia were included. In contrast, ISSR analyses revealed highly structured Hawaiian populations of *A. spicifera* with a substantial range of both within- and among-population variation, with individual plants forming discrete clusters corresponding to geographic locality.

Paulay, G. ***Metopograpsus oceanicus* (Crustacea: Brachyura) in Hawai'i and Guam: Another recent invasive?** *Pacific Science* 61(2): 295-300, 2007.

Notes: The grapsid crab *Metopograpsus oceanicus* (Jacquinot, 1852) is recorded from the Hawaiian Islands for the first time; it appears to be established at least in Kane'ohe Bay on O'ahu. I review the ecology of the species in Oceania and argue that it was introduced both to the Hawaiian Islands and Guam, likely by shipping traffic. A brief review of *Metopograpsus* in the Hawaiian Islands is also presented.

Altman, S. and Whitlatch, R.B. **Effects of small-scale disturbance on invasion success in marine communities.** *Journal of Experimental Marine Biology and Ecology* 342(1): 15-29, 2007.

Notes: Introductions of non-indigenous species have resulted in many ecological problems including the reduction of biodiversity, decline of commercially important species and alteration of ecosystems. The link between disturbance and invasion potential has rarely been studied in the marine environment where dominance hierarchies, dynamics of larval supply, and resource acquisition may differ greatly from terrestrial systems. In this study, hard substrate marine communities in Long Island Sound, USA were used to assess the effect of disturbance on resident species and recent invaders, ascidian growth form (i.e. colonial and solitary growth form), and the dominant species-specific responses within the community. Community age was an additional factor considered through manipulation of 5-wk old assemblages and 1-yr old assemblages. Disturbance treatments, exposing primary substrate, were characterized by frequency (single, biweekly, monthly) and magnitude (20%, 48%, 80%) of disturbance. In communities of different ages, disturbance frequency had a significant positive effect on space occupation of recent invaders and a significant negative effect on resident species. In the 5-wk community, magnitude of disturbance also had a significant effect. Disturbance also had a significant effect on ascidian growth form; colonial species occupied more primary space than controls in response to increased disturbance frequency and magnitude. In contrast, solitary species occupied significantly less space than controls. Species-specific responses were similar regardless of community age. The non-native colonial ascidian *Diplosoma listerianum* responded positively to increased disturbance frequency and magnitude, and occupied more primary space in treatments than in controls. The resident solitary ascidian *Molgula manhattensis* responded negatively to increased disturbance frequency and magnitude, and occupied less primary space in treatments than in controls. Small-scale biological disturbances, by creating space, may facilitate the success of invasive species and colonial organisms in the development of subtidal hard substrate communities.

Osman, R.W. and Whitlatch, R.B. **Variation in the ability of *Didemnum* sp to invade established communities.** *Journal of Experimental Marine Biology and Ecology* 342(1): 40-53, 2007.

Notes: Over the past 30 years southern New England, USA has been invaded by several species of ascidians, including *Botrylloides violaceus*, *Diplosoma listerianum*, *Styela clava*, and *Asciidiella aspersa*. These species have become dominant in coastal embayments and marinas but are usually absent from more open water coastal areas. A colonial ascidian, *Didemnum* sp. has invaded southern New England during the past 10 years and we first observed this species in eastern Long Island Sound in 2000. It has become the dominant at several field sites while remaining in low abundance at others. We conducted an experiment at two places, a protected marina and an open coast site, to examine its ability to compete with the established fouling community. Small colonies of *Didemnum* were transplanted onto panels with communities that varied in age from one to four weeks old and these treatments along with controls with only *Didemnum* were exposed at both sites. In most treatments *Didemnum* became a dominant species in the communities at both sites but it reached higher abundances at the open coast site. Potential causes of the observed differences are predation on other species of ascidians at the open coast site reducing recruitment of these species and competition, lower tolerance for elevated temperatures at the marina site, or other environmental parameters that might affect growth rates.

Dijkstra, J., Harris, L.G., and Westerman, E. **Distribution and long-term temporal patterns of four invasive colonial ascidians in the Gulf of Maine.** *Journal of Experimental Marine Biology and Ecology* 342(1): 61-68, 2007.

Notes: Invasive ascidians are a growing concern for ecologists and natural resource managers, yet few studies have documented their short- and long-term temporal patterns of abundance. This study focuses on the invasion of the Gulf of Maine by the colonial ascidians *Botryllus schlosseri*, *Botrylloides violaceus*, *Diplosoma listerianum* and *Didemnum* sp. A. We examined the time of arrival and potential vectors for these four invasive ascidians using survey data (collected from 1969 onwards) and literature documentation. We also compared the dominance and seasonal patterns of abundance of these species using data from two identical panel studies; one conducted from 1979 to 1980, the other from 2003 to 2005. *Didemnum* and *Botrylloides* were most likely first introduced into the Damariscotta River, Maine in the early 1970's through oyster aquaculture while *Botryllus* and *Diplosoma* were probably transported by commercial and recreational vessels. The overall abundance of colonial ascidians has increased since 1979 and 1980. *Botryllus* was the only invasive colonial ascidian present during the 1979 to 1980 study and accounted for an average of 6.16% cover on panels. From 2003 to 2005, the more recently arrived colonial ascidians *Botrylloides* and *Didemnum* accounted for 7.38% and 2.08% cover respectively, while *Botryllus* covered only 1.16%. Our results reveal a shift in seasonal abundance between 1979 to 1980 and 2003 to 2004. In 1979 and 1980, colonial ascidians had the highest percent cover in fall and winter while in 2003 and 2005 they had highest percent cover in summer and fall. Seasonal patterns of space occupation by colonial ascidians were correlated with seasonal changes in seawater temperature.

Bullard, S.G., Lambert, G., Carman, M.R., Byrnes, J., Whitlatch, R.B., Ruiz, G., Miller, R.J., Harris, L., Valentine, P.C., Collie, J.S., Pederson, J., McNaught, D.C., Cohen, A.N., Asch, R.G., Dijkstra, J., and Heinonen, K. **The colonial ascidian *Didemnum* sp A: Current distribution, basic biology and potential threat to marine communities of the northeast and west coasts of North America.** *Journal of Experimental Marine Biology and Ecology* 342(1): 99-108, 2007.

Notes: *Didemnum* sp. A is a colonial ascidian with rapidly expanding populations on the east and west coasts of North America. The origin of *Didemnum* sp. A is unknown. Populations were first observed on the northeast coast of the U.S. in the late 1980s and on the west coast during the 1990s. It is currently undergoing a massive population explosion and is now a dominant member of many subtidal communities on both coasts. To determine *Didemnum* sp. A's current distribution, we conducted surveys from Maine to Virginia on the east coast and from British Columbia to southern California on the west coast of the U.S. between 1998 and 2005. In nearshore locations *Didemnum* sp. A currently ranges from Eastport, Maine to Shinnecock Bay, New York on the east coast. On the west coast it has been recorded from Humboldt Bay to Port San Luis in California, several sites in Puget Sound, Washington, including a heavily fouled mussel culture facility, and several sites in southwestern British Columbia on and adjacent to oyster and mussel farms. The species also occurs at deeper subtidal sites (up to 81 m) off New England, including Georges, Stellwagen and Tillies Banks. On Georges Bank numerous sites within a 230 km² area are 50-90% covered by *Didemnum* sp. A; large colonies cement the pebble gravel into nearly solid mats that may

smother infaunal organisms. These observations suggest that *Didemnum* sp. A has the potential to alter marine communities and affect economically important activities such as fishing and aquaculture.

Gittenberger, A. **Recent population expansions of non-native ascidians in The Netherlands.** *Journal of Experimental Marine Biology and Ecology* 342(1): 122-126, 2007.

Notes: Over the last 50 yrs seven non-native ascidians have settled in The Netherlands, concentrated in the two periods 1974-1977 and 1991-2004 (i.e., *Styela clava*, *Aplidium glabrum*, *Diplosoma listerianum*, *Didemnum* sp., *Botrylloides violaceus*, *Molgula complanata* and *Peraphora japonica*). The year of the introduction of *B. violaceus* remains a matter of dispute because many of the *Botrylloides* specimens that are recorded in western Europe, have been identified as the closely resembling species *B. leachi*. Only *Didemnum* sp. has become a true invasive species and has become a threat to native ecosystems, especially in the province of Zeeland, by its ability to overgrow virtually all hard substrata present. This includes rocks, stones, sand, algae and almost all sessile marine animals. The sudden population expansion of the didemnid from 1996 onward, coincided with the cold winter of 1995/1996, which caused decreased population sizes of many marine animals. The resulting increase in the availability of suitable substrates for settlement and the strong decrease of grazing sea urchins, may have triggered the population expansion. Studying its population dynamics, the optimal growing temperature for *Didemnum* sp. appears to be 14-18°C. Virtually all colonies die when the water temperature gets colder than 5°C. Colonies growing on live marine animals seem to be more resistant to the cold, than those growing on rocks, stones and plants. Two potential predators of the didemnid have also been recorded in Dutch waters: the gastropods *Trivia arctica* and *Lamellaria* sp.