

In this review:

- A. Recent articles - no abstract
- B. Recent articles with abstracts

O/A denotes an open access article or journal

A. Recent articles - no abstract

Pérez-Ruzafa, A., Marcos, C., García-Charton, J.A., and Salas, F. **European marine protected areas (MPAs) as tools for fisheries management and conservation.** *Journal for Nature Conservation* 16(4): 187-192, 2008.

B. Recent articles with abstracts

Spalding, M.D., Fish, L., and Wood, L.J. **Toward representative protection of the world's coasts and oceans - progress, gaps, and opportunities.** *Conservation Letters* 1(5): 217-226, 2008. O/A

Notes: Marine conservation lags behind terrestrial in the establishment of protected areas. This was recognized by the Convention on Biological Diversity, whose members, in 2004, agreed to establish "comprehensive, effectively managed, and ecologically representative" systems of marine protected areas (MPAs) by 2012. Halfway toward this target date, we look at the coverage of the world's 5045 MPAs from a biogeographic perspective. Only 4.09% of continental shelf areas are incorporated within MPAs, although coverage rises to 12.1% in a narrow coastal belt. Approximately half of all marine ecoregions have less than 1% MPA coverage across the shelf, but this is highly variable, and (8%) of ecoregions have >30% protection. Protection is greatest in the tropical realms, while temperate realms remain poorly represented. Given that many sites lack effective management, even these low estimates of coverage are an optimistic measure of the extent of effective marine conservation.

Cudney-Bueno, R., Lavín, M.F., Marinone, S.G., Raimondi, P.T., and Shaw, W.W. **Rapid effects of marine reserves via larval dispersal.** *PLoS ONE* 4(1): art. e4140, 2009. O/A

Notes: Marine reserves have been advocated worldwide as conservation and fishery management tools. It is argued that they can protect ecosystems and also benefit fisheries via density-dependent spillover of adults and enhanced larval dispersal into fishing areas. However, while evidence has shown that marine reserves can meet conservation targets, their effects on fisheries are less understood. In particular, the basic question of if and over what temporal and spatial scales reserves can benefit fished populations via larval dispersal remains unanswered. We tested predictions of a larval transport model for a marine reserve network in the Gulf of California, Mexico, via field oceanography and repeated density counts of recently settled juvenile commercial mollusks before and after reserve establishment. We show that local retention of larvae within a reserve network can take place with enhanced, but spatially-explicit, recruitment to local fisheries. Enhancement occurred rapidly (2 yrs), with up to a three-fold increase in density of juveniles found in fished areas at the downstream edge of the reserve network, but other fishing areas within the network were unaffected. These findings were consistent with our model predictions. Our findings underscore the potential benefits of protecting larval sources and show that enhancement in recruitment can be

manifested rapidly. However, benefits can be markedly variable within a local seascape. Hence, effects of marine reserve networks, positive or negative, may be overlooked when only focusing on overall responses and not considering finer spatially-explicit responses within a reserve network and its adjacent fishing grounds. Our results therefore call for future research on marine reserves that addresses this variability in order to help frame appropriate scenarios for the spatial management scales of interest.

Oikonomou, Z.S. and Dikou, A. **Integrating conservation and development at the National Marine Park of Alonissos, Northern Sporades, Greece: perception and practice.** *Environmental Management* 42(5): 847-866, 2008.

Notes: Available information on the socioeconomic implications of marine protected areas (MPAs) for the socioculturally diverse Mediterranean region is scant. The National Marine Park of Alonissos, Northern Sporades (NMPANS), Greece was established in 1992 as a foundation for the conservation of the endangered Mediterranean monk seal *Monachus monachus*. The evolution of the degree of acceptance of and satisfaction from the NMPANS by involved stakeholder groups (fishermen, tourism operators, hoteliers and owners of rooms to let, governmental bodies, nongovernmental bodies, students, domestic and foreign tourists) were investigated 13 years after its establishment using written questionnaires delivered during personal interviews. The initial positive attitude of local professionals for the NMPANS has eroded due to the unsatisfactory fulfillment of expectations for socioeconomic development. Fishermen expressed dissatisfaction with, mistrust toward, and a reluctance to communicate with the NMPANS's management body. They believe that the fishery areas have decreased in actual geographic area because of the prohibitive measures; fish stocks are declining; compensation for damage to fishery equipment by the Mediterranean monk seal and for the prohibitive measures should be provided; and stricter enforcement of regulations should take place. On the other hand, tourism operators, who organize trips for tourists to the NMPANS, unanimously reported direct economic benefits. Furthermore, there was a disparity in the perception of socioeconomic benefits derived from the NMPANS between governmental bodies and local stakeholders. The governmental bodies and the nongovernmental organization MOm-Hellenic Society for the Study and Protection of the Monk Seal postulated that there had been considerable socioeconomic benefits for the local community of Alonissos due to the establishment of the NMPANS, whereas the local nongovernmental organization Ecological and Cultural Movement of Alonissos claimed benefits were scant. Tourists (domestic and foreign) believe that the NMPANS is not the main attraction to Alonissos Island but is part of a composite, including serenity, aesthetic beauty, and small-scale tourism development, which can turn Alonissos Island into an ideal eco-tourism destination; a common aspiration for both the tourists and the local community by general consensus. The aim of the NMPANS to integrate conservation and development lies in (1) the effectiveness of the NMPANS management body in formulating a strategic management plan that would accommodate stakeholders' interests and aspirations and (2) a national policy of conservation and enhancement of natural resources with consistency and continuity. Quantitative assessment of the socioeconomic effectiveness of the Mediterranean MPAs using a common methodology would facilitate the identification of intraregional variation and better planning for the network of MPAs in the Mediterranean.

Ding, H., Xu, H.G., Wu, J., Le Quesne, W.J.F., Sweeting, C.J., and Polunin, N.V.C. **An overview of spatial management and marine protected areas in the East China Sea.** *Coastal Management* 36(5): 443-457, 2008.

Notes: Marine ecosystems of the East China Sea are rich in biodiversity, with 12,933 species of which approximately 47.7% are endemic. As anthropogenic impacts are intensifying, fishery resources and biodiversity in the East China Sea are under threat from overfishing, habitat loss, pollution, and biological invasions. Marine protected areas (MPAs) and other spatial management measures are believed useful tools to protect and restore biological resources. Seventeen nature reserves, seven special marine reserves, and three fishery resource conservation zones covering a combined area of 102,156 km² have so far been established in the Chinese East China Sea in order to protect fishery resources, biodiversity, and marine landscapes. This article provides a review and inventory of MPAs in the Chinese East China Sea as implemented by the People's Republic of China.

Seytre, C. and Francour, P. **Is the Cape Roux marine protected area (Saint-Raphael, Mediterranean Sea) an efficient tool to sustain artisanal fisheries? First indications from visual censuses and trammel net sampling.** *Aquatic Living Resources* 21(3): 297-305, 2008.

Notes: In recent decades, marine reserves have been established either to protect ecosystem structure and biological diversity or to serve as management tools to counter the overexploitation of fish stocks. The Cape Roux marine protected area (MPA), in the Mediterranean Sea, was established in December 2003 for the management of artisanal fisheries and enhancement of target fish stocks. Monitoring of littoral fish assemblages (0-30 m depth) in this zone began one year after the MPA was set up. The survey was conducted at 6 stations, located inside and outside the MPA, using three methods: underwater visual census (UVC) on transects, UVC using a new fish assemblage survey technique (FAST), and experimental net fishing performed by a fisherman. The FAST indices were derived from visual censuses, performed along a random pathway, scoring species on a presence/absence basis and size on a 2-class basis. Indices were calculated seasonally, by applying "weights" according to species and size. This study presents results obtained between October 2005 and June 2007. In the protected area, the experimental fishing yielded significantly higher abundance and species richness, and the FAST method highlighted a decrease in seasonal fluctuations. These two complementary methods (UVC and experimental fishing) revealed the early changes in fish assemblages in response to protection. The FAST method employed here seems to be relevant for the study of artisanal fishery target fishes, as a low-cost and sensitive UVC method.

Francini-Filho, R.B. and Moura, R.L. **Evidence for spillover of reef fishes from a no-take marine reserve: An evaluation using the before-after control-impact (BACI) approach.** *Fisheries Research* 93(3): 346-356, 2008.

Notes: No-take marine reserves (NTRs) may promote recovery of exploited populations within their boundaries and spillover offshores to adjacent fishing grounds, thus potentially benefiting the local fisheries. Although some studies have measured spillover by examining gradients of fish abundance and body size across reserve boundaries, there are no such studies to date including information from before reserve establishment, thus seriously limiting interpretation of results. We measured reef fish spillover from a NTR (Itacolomis Reef, Eastern Brazil) by estimating biomass and body size across the reserve boundary before (2001) and after (2002-2005) initiation of protection. Replicate sites were sampled inside and outside the reserve, with unprotected sites included in three distance categories from the reserve boundary: 0-400, 400-800 and 800-1200 m. This latter category generally surpasses the scales over which spillover is expected to influence patterns of fish abundance outside reserves (generally <500 m), particularly for relatively sedentary fishes, thus acting as a control for the reserve effect. Habitat measurements were undertaken at the same sites, from 2003 on. Biomass of *Scarus trispinosus*, a major fishery resource and the dominant species in terms of biomass (37.4% of total biomass), was lower inside the reserve area before its establishment. During this same period, no individuals of two primary target species, *Mycteroperca bonaci* and *Sparisoma axillare*, were recorded inside the reserve. Coral cover was consistently lower inside the reserve from 2003 on. Biomass and body size of *M. bonaci*, as well as biomass of *Ocyurus chrysurus*, increased continuously inside the reserve after its establishment, with no similar increases recorded in control sites. Evidences of spillover (i.e. higher biomass inside the reserve and in unprotected sites closer to its boundary) were obtained for *M. bonaci*, *O. chrysurus* and *S. trispinosus*, although this pattern was only marginally significant for *O. chrysurus*. Despite these positive signs, recovery and spillover of *S. trispinosus* were probably inhibited by increased poaching from 2003 on. Our results indicate that the NTR at Itacolomis Reef was established *a priori* on poor quality habitats. Thus, future spatial comparisons between protected and unprotected sites would underestimate changes due to protection. These findings highlight the importance of baseline information and continued monitoring for adequately understanding the effects of NTRs, as well as the need of closer collaboration between natural and social scientists in order to effectively protect high-quality habitats in the long term while accounting for the socio-economic needs of local fishing communities.

Reid-Grant, K. and Bhat, M.G. **Financing marine protected areas in Jamaica: An exploratory study.** *Marine Policy* 33(1): 128-136, 2009.

Notes: The establishment of marine protected areas (MPA) has been a common government response to increasing fishing, tourism and other human activities that lead to decline in coral and marine resources. MPAs often suffer inadequacy of funds and simply become "paper parks". This study makes a case for the feasibility of a self-financing mechanism for MPAs by estimating potential surplus benefit that recreational users may gain from MPAs in Jamaica. These same recreational users in turn, might be willing to pay a small portion of that gain toward the management costs. With the help of a travel cost model and the visitors' willingness to pay (WTP) estimates, we show that the management costs of the park amount to a negligible amount; less than 0.1% of the annual total WTP. Furthermore, using these WTP estimates and the findings from other stakeholders' surveys (hotels, tour operators, etc.), the paper provides insights on user-supported funding policies, such as taxes and fees, which might sustain the operations of MPAs in Jamaica and the broader Caribbean region.

Wallmo, K. and Edwards, S. **Estimating non-market values of marine protected areas: A latent class modeling approach.** *Marine Resource Economics* 23(3): 301-323, 2008.

Notes: The design of marine protected areas (MPAs) generates much discussion among marine scientists. Ecological studies have suggested that protecting 10 to 40% of regional ecosystems is needed to preserve diversity, while public preferences for MPA size have not been modeled. We conduct a choice experiment to estimate the value of protecting species and habitat diversity on the sea floor in areas that vary in size and allowable uses of the water column and apply a latent class specification to accommodate taste parameter heterogeneity. Results identify three latent classes in the sample and suggest that while protecting areas as ecological reserves is utility increasing for most size/use combinations, smaller reserves with liberal use policies produce the largest increases. Our research suggests diminishing marginal utility for MPA sizes that are substantially smaller than ranges often cited, and the distinct latent classes underscore the need to question the assumption of homogeneous preferences when evaluating MPA policy.

Bell, J.J. **Connectivity between island Marine Protected Areas and the mainland.** *Biological Conservation* 141(11): 2807-2820, 2008.

Notes: In addition to protecting important species or ecosystems, ideally Marine Protected Areas (MPAs) should also act as propagule sources and be located where they can receive larval influxes so as to buffer species against local extinctions and allow genetic mixing. There are many examples of island MPAs across the world because of their advantages compared to mainland sites, and although evidence suggests they effectively protect biodiversity and may have localized fisheries benefits, their contribution to larval export and connectivity to mainland areas remains largely unknown; these are important aspects of MPA sustainability and functioning. Here I examined the genetic differentiation between four island MPAs in northern Europe and their respective mainlands, relative to differentiation of populations along the coast at similar spatial scales for two marine invertebrates (*Semibalanus balanoides*, planktonic larvae; *Nucella lapillus*, direct development). These data were used to infer past patterns of larval exchange between populations. Gene flow was restricted at all four locations between the islands and the mainland, compared to gene flow along the coast (for both species) and more distant islands had greater differentiation than those closer to the mainland for *S. balanoides*, but not for *N. lapillus*. My results of genetic analysis suggest that island MPAs may not provide as much larval export or receive as much buffering against local extinctions, compared with mainland populations (for a similar sized protected area). My findings are especially relevant to the creation of MPA networks and in understanding the importance of connectivity in achieving the greatest fisheries benefits and in ensuring inter-MPA linkages. Low levels of larval exchange may limit the success of any protected area and may prevent multiple conservation objectives from being achieved.

Poonian, C.N.S. **The influence of protected area management on the status of coral reefs at Misali Island, Tanzania following the 1998 bleaching event in the western Indian Ocean.** *African Journal of Ecology* 46(4): 471-478, 2008.

Notes: The reefs of Misali Island, Tanzania suffered serious coral mortality as a result of the 1998 coral bleaching event in the western Indian Ocean. Four years after this event, Frontier-Tanzania assessed reef substrate in Misali Island Marine Conservation Area (MIMCA) using scuba surveys. Substrate cover was compared between sites within and outside the nonextraction zone (NEZ) of MIMCA and recovery rates were estimated through reference to previous studies. Coral recovery at Misali Island following the bleaching event has generally been slow, but nonextractive management of MIMCA has enhanced coral recovery within the NEZ. The absence of fishing activities in the NEZ has sustained herbivorous fish populations and thus reduced algal overgrowth; however, outside the NEZ, diving and anchoring activities have caused further coral damage and led to increased levels of debris. Awareness-raising programmes could lessen these problems and the NEZ appeared to be well-placed to capitalize on nonmanageable factors that are thought to mitigate the effects of coral bleaching. In addition, the implementation of flexible zoning schemes could improve recovery rates after future bleaching events.

Ojeda-Martínez, C. *et al.* **A conceptual framework for the integral management of marine protected areas.** *Ocean and Coastal Management* 52(2): 89-101, 2009.

Notes: A general conceptual framework for the management of marine protected areas (MPAs) was developed. The driver-pressure-state-impacts-response (DPSIR) framework was used to determine the elements affecting MPAs. The developed evaluation framework helped to select an appropriate suite of indicators to support an ecosystem approach, an assessment of the MPAs functioning and policy decisions. Gaps derived from the management and policy responses in the MPAs were also outlined. It was concluded that the DPSIR framework can help to simplify the complexity of MPA management. This document is a tool for policy makers, scientists and general public on the relevance of indicators to monitor changes and MPAs management.

Miller, K.J. and Ayre, D.J. **Protection of genetic diversity and maintenance of connectivity among reef corals within Marine Protected Areas.** *Conservation Biology* 22(5): 1245-1254, 2008.

Notes: High-latitude coral reefs (HLRs) are potentially vulnerable marine ecosystems facing well-documented threats to tropical reefs and exposure to suboptimal temperatures and insolation. In addition, because of their geographic isolation, HLRs may have poor or erratic larval connections to tropical reefs and a reduced genetic diversity and capacity to respond to environmental change. On Australia's east coast, a system of marine protected areas (MPAs) has been established with the aim of conserving HLRs in part by providing sources of colonizing larvae. To examine the effectiveness of existing MPAs as networks for dispersal, we compared genetic diversity within and among the HLRs in MPAs and between these HLRs and tropical reefs on the southern Great Barrier Reef (GBR). The 2 coral species best represented on Australian HLRs (the brooding *Pocillopora damicornis* and the broadcast-spawning *Goniastrea australensis*) exhibited sharply contrasting patterns of diversity and connectedness. For *P. damicornis*, the 8-locus genetic and genotypic diversity declined dramatically with increasing latitude ($N_a = 3.6-1.2$, $H_e = 0.3-0.03$, $N_g:N = 0.87-0.06$), although population structure was consistent with recruitment derived largely from sexual reproduction ($G_e:G_e = 1.28-0.55$). Genetic differentiation was high among the HLRs ($F_{ST} [SD] = 0.32 [0.08]$, $p < 0.05$) and between the GBR and the HLRs ($F_{ST} = 0.24 [0.06]$, $p < 0.05$), which indicates these temperate populations are effectively closed. In contrast for *G. australensis*, 9-locus genetic diversity was more consistent across reefs ($N_a = 4.2-3.9$, $H_e = 0.3-0.26$, $N_g:N = 1-0.61$), and there was no differentiation among regions ($F_{ST} = 0.00 [0.004]$, $p > 0.05$), which implies the HLRs and the southern GBR are strongly interconnected. Our results demonstrate that although the current MPAs appear to capture most of the genetic diversity present within the HLR systems for these 2 species, their sharply contrasting patterns of connectivity indicate some taxa, such as *P. damicornis*, will be more vulnerable than others, and this disparity will provide challenges for future management.

Game, E.T., McDonald-Madden, E., Puotinen, M.L., and Possingham, H.P. **Should we protect the strong or the weak? Risk, resilience, and the selection of Marine Protected Areas.** *Conservation Biology* 22(6): 1619-1629, 2008.

Notes: It is thought that recovery of marine habitats from uncontrollable disturbance may be faster in marine reserves than in unprotected habitats. But which marine habitats should be protected, those areas at greatest risk or those at least risk? We first defined this problem mathematically for 2 alternate conservation objectives. We then analytically solved this problem for both objectives and determined under which conditions each of the different protection strategies was optimal. If the conservation objective was to maximize the chance of having at least 1 healthy site, then the best strategy was protection of the site at lowest risk. On the other hand, if the goal was to maximize the expected number of healthy sites, the optimal strategy was more complex. If protected sites were likely to spend a significant amount of time in a degraded state, then it was best to protect low-risk sites. Alternatively, if most areas were generally healthy then, counterintuitively, it was best to protect sites at higher risk. We applied these strategies to a situation of cyclone disturbance of coral reefs on Australia's Great Barrier Reef. With regard to the risk of cyclone disturbance, the optimal reef to protect differed dramatically, depending on the expected speed of reef recovery of both protected and unprotected reefs. An adequate consideration of risk is fundamental to all conservation actions and can indicate surprising routes to conservation success.

Guarderas, A.P., Hacker, S.D., and Lubchenco, J. **Current status of marine protected areas in Latin America and the Caribbean.** *Conservation Biology* 22(6): 1630-1640, 2008.

Notes: Marine protected areas (MPAs), including no-take marine reserves (MRs), play an important role in the conservation of

marine biodiversity. We document the status of MPAs and MRs in Latin America and the Caribbean, where little has been reported on the scope of such protection. Our survey of protected area databases, published and unpublished literature, and Internet searches yielded information from 30 countries and 12 overseas territories. At present more than 700 MPAs have been established, covering more than 300,000 km² or 1.5% of the coastal and shelf waters. We report on the status of 3 categories of protection: MPAs (limited take throughout the area), MRs (no-take throughout the area), and mixed-use (a limited-take MPA that contains an MR). The majority of protected areas in Latin America and the Caribbean are MPAs, which allow some or extensive extractive activities throughout the designated area. These 571 sites cover 51,505 km² or 0.3% of coastal and shelf waters. There are 98 MRs covering 16,862 km² or 0.1% of the coastal and shelf waters. Mixed-use MPAs are the fewest in number (87), but cover the largest area (236,853 km², 1.2%). Across Latin America and the Caribbean, many biogeographic provinces are underrepresented in these protected areas. Large coastal regions remain unprotected, in particular, the southern Pacific and southern Atlantic coasts of South America. Our analysis reveals multiple opportunities to strengthen marine conservation in Latin America and the Caribbean by improving implementation, management, and enforcement of existing MPAs; adding new MPAs and MRs strategically to enhance connectivity and sustainability of existing protection; and establishing new networks of MPAs and MRs or combinations thereof to enhance protection where little currently exists.

Pande, A., MacDiarmid, A.B., Smith, P.J., Davidson, R.J., Cole, R.G., Freeman, D., Kelly, S., and Gardner, J.P.A. **Marine reserves increase the abundance and size of blue cod and rock lobster.** *Marine Ecology Progress Series* 366: 147-158, 2008.

Notes: Size and abundance data were compiled and collated for blue cod *Parapercis colias* and rock lobster *Jasus edwardsii* from New Zealand marine reserve (MR) studies for a meta-analysis to test the null hypotheses that reserve status does not affect the size or abundance of either species. Calculation of meta-analysis effect sizes revealed that significant differences in effect size existed among studies, meaning that the biological response to MR status of both species in terms of their changes in size and/or abundance differed significantly among the MRs. Analysis revealed that blue cod were bigger inside compared with outside MRs in 9 of 10 studies and were more abundant inside MRs in 8 of 11 studies, and that rock lobster were bigger inside the MRs in 12 of 13 studies and more abundant inside the MRs in 11 of 14 studies. These findings indicate that MR protection can result in more and bigger individuals soon after the establishment of the MR (mean of 6.5 yr for blue cod, 8.5 yr for rock lobster) despite small sample sizes of studies (≤ 10 for blue cod, ≤ 14 for rock lobster). Focused comparison tests did not reveal any relationship between rock lobster or blue cod size or abundance and either age or area of MRs. Our results demonstrate that no-take MRs are valuable conservation tools for species such as blue cod and rock lobster (and probably also for other exploited species with similar life history characteristics and habitat requirements) and that statistically detectable conservation benefits are apparent after only a few years of protection.

Goñi, R., Adlerstein, S., Alvarez-Berastegui, D., Forcada, A., Renones, O., Criquet, G., Polti, S., Cadiou, G., Valle, C., Lenfant, P., Bonhomme, P., Pérez-Ruzafa, A., Sánchez-Lizaso, J.L., García-Charton, J.A., Bernard, G., Stelzenmüller, V., and Planes, S. **Spillover from six western Mediterranean marine protected areas: evidence from artisanal fisheries.** *Marine Ecology Progress Series* 366: 159-174, 2008. **O/A**

Notes: This study investigated spillover (biomass export) around 6 marine protected areas (MPAs) in the western Mediterranean based on catch and effort data from artisanal fisheries. The selected MPAs were Cerbere-Banyuls and Carry-le-Rouet in France, and Medes, Cabrera, Tabarca, and Cabo de Palos in Spain. These MPAs had been functional for more than 8 yr and incorporate areas of fisheries closure and restricted use where fishing is limited. We based our study on the hypotheses that, in the presence of biomass export, (1) fishing effort would concentrate close to MPA boundaries, and (2) fishery production, expressed as catch per unit area (CPUA), would be highest near MPA boundaries and decrease with distance. We selected data from 14 'fishing tactics' using gill nets, trammel nets and bottom long-lines targeting sparids, mullids, serranids, scorpaenids and palinurids. We analyzed the spatial distribution of effort, fishery production and revenues per unit area, using generalized additive models (GAMs), and we tested regression slopes of effort density and CPUA with distance to closure boundaries, using generalized linear models (GLMs). GAMs allowed us to recognize habitat discontinuities or 'hot spots' of high production in the vicinity of the MPAs, and to identify the extent of potential spillover effects in order to implement GLMs. We found evidence of effort concentration and high fishery production near fisheries closures for all fishing tactics analyzed and significant negative slopes for most. Revenues generally followed trends similar to CPUA. Significant negative slopes from GLM of effort density and CPUA with distance from fisheries closures were indicative of biomass export where habitats across closure boundaries had some degree of continuity. The spatial extent of spillover was consistent with species

mobility and fisheries efficiency and extended 700 to 2500 m from fishery closure boundaries. Our results suggest that coastal MPAs can be an effective management tool for artisanal fisheries in the region and can be extended to the rest of the western Mediterranean, as the fishing tactics studied are typical of the region.

Lester, S.E. and Halpern, B.S. **Biological responses in marine no-take reserves versus partially protected areas.** *Marine Ecology Progress Series* 367: 49-56, 2008.

Notes: Marine Protected Areas (MPAs) are a common tool for conserving and managing marine and coastal ecosystems. MPAs encompass a range of protection levels, from fully protected no-take reserves to restriction of only particular activities, gear types, user groups, target species, or extraction periods. There is a growing body of scientific evidence supporting the ecological benefits of full reserve protection, but it is more difficult to generalize about the effects of other types of MPAs, in part because they include a range of actual protection levels. However, it is critical to determine whether partial protection and no-take reserves provide similar ecological benefits given potential economic costs of lost fishing grounds in no-take areas, common sociopolitical opposition to full protection, and promotion of partially protected areas as a compromise solution in ocean zoning disputes. Here we synthesize all empirical studies comparing biological measures (biomass, density, species richness, and size of organisms) in no-take marine reserves and adjacent partially protected and unprotected areas across a range of geographic locations worldwide. We demonstrate that while partially protected areas may confer some benefits over open access areas, no-take reserves generally show greater benefits and yield significantly higher densities of organisms within their boundaries relative to partially protected sites nearby.

Fitzsimons, J.A. and Wescott, G. **Getting the measure of Marine Protected Areas: surface area or volume as measures for reserve system auditing?** *Aquatic Conservation: Marine and Freshwater Ecosystems* 18(5): 518-526, 2008.

Notes: 1. Comprehensive classification systems to accurately account for areas managed for biodiversity conservation are an essential component of conservation planning and policy. Traditionally, quantitative targets for reserve system auditing has used a two-dimensional measure of the surface area protected. 2. Marine Protected Areas (MPAs) are three-dimensional systems and where zoning of allowable uses or protection is vertically stratified, measures of surface area at sea level are potentially misleading. 3. Measuring the proportion of the volume of MPAs managed for particular purposes provides a more accurate and transparent measure of the amount of protection or management intent in a single reserve. 4. This paper outlines a number of other emerging policy issues in relation to the zoning, protection and auditing of MPAs in Australia. It will be important to ensure that zoning is clearly and accurately articulated to better inform conservation planning decisions when establishing representative systems of Marine Protected Areas.

Rius, M. and Zabala, M. **Are marine protected areas useful for the recovery of the Mediterranean mussel populations?** *Aquatic Conservation: Marine and Freshwater Ecosystems* 18(5): 527-540, 2008.

Notes: 1. Mussel beds are important intertidal communities in the Mediterranean Sea and have traditionally been exploited by humans. 2. Marine protected areas are management tools for recovering over-fished populations, normally top predator populations, which may in turn undermine prey abundance. Therefore, mussel populations might not recover inside protected areas, as they are affected by increasing fish populations. 3. To study the effects of both human and fish predation on mussels, three locations were selected: the Reserve (R), where all types of exploitation were banned and fish were abundant; the Partial Reserve (PR), where only angling was permitted, and fish abundance was low; and the Non-Reserve (NR), where no protection existed and fish were rare. 4. Data from mussel bed surveys indicate that recruitment is critical to sustain mussel populations, and similar size structures were found at all three locations. However, the overall biomass in the PR was nearly double that in both R and NR, suggesting disturbance of some sort at these latter two sites. 5. A tethering experiment showed that fish predation greatly affected mussels in R, while the analysis of harvester collections from the NR showed that the most harvested size classes were those least abundant in the mussel bed. 6. Both protected and non-protected areas are unable to increase mussel populations due to trophic cascade effects, while partial reserves, where fish populations are exploited and mussels protected, are areas where the Mediterranean mussel populations can recover.

Edgar, G.J., Langhammer, P.F., Allen, G., Brooks, T.M., Brodie, J., Crosse, W., De Silva, N., Fishpool, L.D.C., Foster, M.N., Knox, D.H., Mccosker, J.E., McManus, R., Millar, A.J.K., and Mugo, R. **Key biodiversity areas as globally significant target sites for the conservation of marine biological diversity.** *Aquatic Conservation: Marine and Freshwater Ecosystems* 18(6): 969-983, 2008.

Notes: 1. Recent approaches to the planning of marine protected area (MPA) networks for biodiversity conservation often stress the need for a representative coverage of habitat types while aiming to minimize impacts on resource users. As typified by planning for the Australian South-east Marine Region, this strategy can be manipulated by political processes, with consequent biased siting of MPAs. Networks thus created frequently possess relatively low value for biodiversity conservation, despite significant costs in establishment and maintenance. 2. Such biases can be minimized through application of the data-driven and species-based concept of key biodiversity areas (KBAs). 3. By mapping locations of threatened species and populations that are highly aggregated in time or space, the KBA process allows marine sites of global biodiversity significance to be systematically identified as priority conservation targets. Here, the value of KBAs for marine conservation planning is outlined and guidelines and provisional criteria for their application provided.

Hernandez, J.C., Clemente, S., Sangil, C., and Brito, A. **Actual status of the sea urchin *Diadema aff. antillarum* populations and macroalgal cover in marine protected areas compared to a highly fished area (Canary Islands - eastern Atlantic Ocean).** *Aquatic Conservation: Marine and Freshwater Ecosystems* 18(7): 1091-1108, 2008.

Notes: 1. The aim was to determine the status of subtidal rocky benthic assemblages in three marine protected areas (MPAs) of the Canary Islands: (1) La Graciosa; (2) Mar de Las Calmas; (3) La Palma. Sea urchin (*Diadema aff. antillarum*) populations and non-crustose macroalgal cover were surveyed, and used as an indicator of conservation status in the three MPAs as well as in a highly fished area (HFA-Tenerife Island). 2. Comparing characteristics between each MPA and the HFA, and considering issues of management and design, it was concluded that the three MPAs each have a different conservation status. 'Mar de Las Calmas' marine reserve was found to have the most desirable conservation status, followed by 'La Palma' marine reserve based on sea urchin populations and non-crustose macroalgae assemblages. 3. Conversely, 'La Graciosa' had the highest density of *D. aff. antillarum* and the lowest cover of non-crustose macroalgae out of the three MPAs. Values were comparable to those at the HFA, which shows 'La Graciosa' to have the undesired conservation status. 4. Different spatial distribution patterns of non-crustose macroalgal as well as different algal composition cover were observed between the three MPAs and the HFA. These differences were principally attributed to the intensity of grazing activity of the key herbivore *D. aff. antillarum*. It is suggested that the different study areas correspond to different phase shifts that imply differing resilience of systems that should be taken into a count in future conservation strategies.

García-Charton, J. A. *et al.* **Effectiveness of European Atlanto-Mediterranean MPAs: Do they accomplish the expected effects on populations, communities and ecosystems?** *Journal for Nature Conservation* 16(4): 193-221, 2008.

Notes: The success of MPAs in conserving fishing resources and protecting marine biodiversity relies strongly on how well they meet their planned (or implicit) management goals. From a review of empirical studies aiming at assessing the ecological effects of Mediterranean and Macaronesian MPAs, we conclude that establishing an MPA is successful for (i) increasing the abundance/biomass, (ii) increasing the proportion of larger/older individuals, and (iii) enhancing the fecundity of commercially harvested populations; also, MPAs demonstrated to be effective for (iv) augmenting local fishery yields through biomass exportation from the protected area, and (v) inducing shifts in fish assemblage structure by increasing the dominance of large predator species. However, the attraction for tourism and diving due to ecological benefits of protection can cause damages likely to reverse some of the MPA effects. Other expected effects are more subject to uncertainty, and hence need more research, such as (vi) causing density-dependent changes in life history traits and (vii) protecting the recruitment of commercially important species, (viii) protecting marine biodiversity (including genetic diversity), (ix) causing ecosystem-wide effects such as trophic cascades, and (x) increasing community and ecosystem stability, thus promoting resilience and faster recovery from disturbance. Meta-analysis of data arising from these case studies are used to establish the overall effect of MPAs, and its relationship to MPA features, such as size of no-take area or time since protection. Based on the review and the meta-analyses, specific recommendations are provided for MPA management, regarding the establishment of goals and objectives, site selection, MPA design and zoning, planning, and monitoring. Finally, a series of recommendations for MPA research are offered to drive future research in MPA issues in the Mediterranean and Macaronesia.

Higgins, R.M., Vandeperre, F., Pérez-Ruzafa, A., and Santos, R.S. **Priorities for fisheries in marine protected area design and management: Implications for artisanal-type fisheries as found in southern Europe.** *Journal for Nature Conservation* 16(4): 222-233, 2008.

Notes: Much has been written in recent years regarding the advantages of marine protected areas (MPAs) as conservation tools. The benefits to fisheries have commonly been cited as primary motives in favour of the establishment of MPAs. To date, a good deal has been theorised with regard to the benefit of MPAs to fisheries in their adjacent areas, but there has been little empirical evidence to support or refute hypothetical claims. Considerations for fisheries' benefits are different to those of ecological benefits in several respects. Economically, fishers' livelihoods often depend on the marine reserve being successful. It is not enough to establish that populations of fish are growing due to protection; stocks, as well as individual fish have to be sufficiently large to be catchable by the industry. Furthermore, restrictions in fishable area ought to be compensated for by increases in catches over time. In terms of the biology of the fish themselves, evidence has shown that heavily exploited commercial fish stocks can take much longer to recover from over-exploitation than previously expected. Although there have been several studies that consider the effects of export and spill-over, there have been few that focus on the patterns that these phenomena might have on the surrounding fisheries; many assume that ecological patterns will manifest in the fishery with time. Recently, assessment methods and predictive models have been suggested for fisheries (e.g. Rapfish, Ecopath/Ecosim), some of which have been adapted specifically for MPAs. In this paper we review recent progress in the field of MPA research with particular focus on fisheries assessment. We also identify priorities, and knowledge gaps, for determining and accurately predicting the benefits of MPAs to fishers.

Pérez-Ruzafa, A. *et al.* **Modelling spatial and temporal scales for spill-over and biomass exportation from MPAs and their potential for fisheries enhancement.** *Journal for Nature Conservation* 16(4): 234-255, 2008.

Notes: Marine protected areas (MPAs) are considered as a tool for marine conservation and sustainable fishery resource management. Improvements in fishery yields should take place via the spill-over of individuals from the reserve. In general, it has been demonstrated that MPAs affect the density and biomass of the organisms within them, however, little evidence has been found in order to assess the exportation of individuals across their boundaries. In this study, a simple model involving population growth, harvest, and the diffusion coefficient for individuals was used to explore the effects of protection on populations inside the reserve and the spill-over of individuals to the fished area. The model showed that biological responses inside marine reserves appear to develop quickly, reaching mean levels within a short (1-5 year) time period. Mean population abundance is always higher inside the reserve and highlights the effectiveness of protection, particularly when there is strong fishing pressure outside the reserve. However, reserves smaller than 2000m radius show significantly lower levels of abundance inside than larger sites. Large MPAs (i.e. about 2000m in radius) offer nearly the maximum capacity for recovery (close to 100% of the system carrying capacity) and nearly the maximum flux of individuals per unit boundary length. Very large MPAs (i.e. larger than 6000m in radius) could be a guaranteed means of providing resilience in order to prevent population crises, with the added advantage that the flux of individuals is slightly higher at larger distances from the boundary. However, in practice they provide no further advantage towards increasing the density of individuals or the exportation of biomass, and a network of smaller MPAs could be more beneficial, both from the point of view of conservation and of benefits to fisheries.

Roncin, N. *et al.* **Uses of ecosystem services provided by MPAs: How much do they impact the local economy? A southern Europe perspective.** *Journal for Nature Conservation* 16(4): 256-270, 2008.

Notes: This paper addresses the problem of measuring the local economic impact of marine protected areas (MPAs). It relies on a broad socio-economic field survey covering 12 case studies in southern Europe, and focusing on two major uses of MPA ecosystem services: fishing and scuba-diving. The impact of these uses on the local economic system is expressed in terms of incomes and jobs, and the methodology relies on a distinction between users transforming ecosystem services into commodities, and users consuming ecosystem services for recreational purposes. Assessment results show a variety of situations, from MPAs where commercial fishing is the major economic stake, to MPAs where recreational activities have a dominant economic role. However, available information concerning the number of recreational users and visitors, on one side, and the number and characteristics of commercial fishing boats, on the other side, suggest that the second situation is more representative of the area under study than the former one. Due to the lack of baseline, the question of sorting out the

"reserve effect" from the "site effect" is addressed with the help of survey results concerning perceptions and attitudes of users. As regards divers and diving operators, answers to the survey suggest that the reserve effect plays an important role in the attractiveness of the area. Results are not so clear in the case of fishers, an ambiguity reflecting the uncertainty of the spill-over effects expected from marine reserves on fishing grounds.

Mangi, S.C. and Austen, M.C. **Perceptions of stakeholders towards objectives and zoning of marine-protected areas in southern Europe.** *Journal for Nature Conservation* 16(4): 271-280, 2008.

Notes: The perceptions of stakeholders towards objectives and zoning of marine-protected areas (MPAs) in southern Europe were studied through face-to-face interviews to identify areas of agreement and disagreement. Views were sought about the main objectives of marine protection, ideal zonation of MPAs and the ways to manage stakeholders' competing interests in MPAs. There was good agreement on the objectives of marine protection; conservation and fisheries management scored highly, while research, education and tourism had lower scores. However, there was disagreement on which objective was most important, with most stakeholders listing conservation, while fishers listed fisheries management. Most stakeholders considered MPAs that had been established for longer periods of time to offer more conservation than fisheries benefits. Analysis of the perceptions shows strong preference for having MPAs with different use zonations, including designated areas for recreational fishing, diving and the full protection of species and ecosystems. The results point to a need for increased dialogue between scientists, managers and fishers to improve the disparity in understanding the fisheries benefits of marine protection between these groups.