

In this review:

- A. Recent publications available online
- B. Recent articles with abstracts

O/A denotes an open access article or journal

A. Recent publications available online

Esteban, A. and Crilly, R. 2010. *Fish Dependence: The Increasing Reliance of the EU on Fish from Elsewhere*. New Economics Foundation, London and OCEAN2012, Brussels. 28pp.

Available at: http://www.neweconomics.org/sites/neweconomics.org/files/Fish_dependence.pdf

Notes: EU fish stocks are in an unprecedentedly poor state yet fish consumption throughout Europe remains high. The EU has been able to maintain and expand its levels of consumption by sourcing fish from other countries, both through the catches of its distant-water fleet and imports. This report highlights Europe's increasing reliance on fish products originating from external waters for its fish supplies, and provides pointers towards a more sustainable future for dwindling global fish stocks.

Claesson, S., Rosenberg, A.A., Alexander, K., Cooper, A., Cournane, J., Klein, E., Leavenworth, W., and Magness, K. 2010. *Stellwagen Bank Marine Historical Ecology*. Marine Sanctuaries Conservation Series ONMS-10-02. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Office of National Marine Sanctuaries, Silver Spring, MD. 221 pp.

Available at: http://stellwagen.noaa.gov/library/pdfs/sbnms_mhe_report.pdf

Notes: This report presents the results of a 3-year survey and analysis of historical documents and manuscripts relevant to the marine historical ecology of Stellwagen Bank National Marine Sanctuary (SBNMS). This study of SBNMS history and ecology reinforces the long-term significance of the sanctuary's ecosystems and marine resources to the broader Gulf of Maine system. An assessment of the late 19th- and early 20th-century fisheries of Stellwagen Bank, presented in this report, provides baselines for comparison with current ecosystem conditions. Our historical research revealed significant declines in animal diversity and abundance, as well as major shifts in the species composition of Stellwagen's fisheries. Based on quantitative and qualitative analysis of the historical record, our findings are as follows:

- a) Nearshore and microbank fish populations were significantly deteriorated by ca. 1800.
- b) Top predators in SBNMS, such as halibut and swordfish, were overfished to near extirpation by the late 19th and early 20th centuries.
- c) Steady decline in the trophic level of commercial species began in the early 1900s with the advent of steam-powered bottom trawling.
- d) Composition of catch has shifted over time toward exploitation of lower-level trophic animals.

- e) Diversity of bottom-dwelling species in the western Gulf of Maine appears to have declined significantly from ca. 1900 to 2000.
- f) Maximum annual catch levels of historically-important commercial species in SBNMS have declined by nearly 50% from ca. 1900 to 2000.
- g) Proportional catch ratios of haddock and cod in SBNMS have inverted in the last 100 years from 3:1 to 1:7, signaling resurgence in cod but a precipitous decline in haddock catches.

B. Recent articles with abstracts

Wallace, B.P., Lewison, R.L., McDonald, S.L., McDonald, R.K., Kot, C.Y., Kelez, S., Bjorkland, R.K., Finkbeiner, E.M., Helmbrecht, S., and Crowder, L.B. **Global patterns of marine turtle bycatch.** *Conservation Letters* 3(3): 131-142, 2010. O/A

Notes: Fisheries bycatch is a primary driver of population declines in several species of marine megafauna (e.g., elasmobranchs, mammals, seabirds, turtles). Characterizing the global bycatch seascape using data on bycatch rates across fisheries is essential for highlighting conservation priorities. We compiled a comprehensive database of reported data on marine turtle bycatch in gillnet, longline, and trawl fisheries worldwide from 1990 to 2008. The total reported global marine turtle bycatch was ~85,000 turtles, but due to the small percentage of fishing effort observed and reported (typically <1% of total fleets), and to a global lack of bycatch information from small-scale fisheries, this likely underestimates the true total by at least two orders of magnitude. Our synthesis also highlights an apparently universal pattern across fishing gears and regions where high bycatch rates were associated with low observed effort, which emphasizes the need for strategic bycatch data collection and reporting. This study provides the first global perspective of fisheries bycatch for marine turtles and highlights region-gear combinations that warrant urgent conservation action (e.g., gillnets, longlines, and trawls in the Mediterranean Sea and eastern Pacific Ocean) and region-gear combinations in need of enhanced observation and reporting efforts (e.g., eastern Indian Ocean gillnets, West African trawls).

Alessandro, L. and Antonello, S. **An overview of loggerhead sea turtle (*Caretta caretta*) bycatch and technical mitigation measures in the Mediterranean Sea.** *Reviews in Fish Biology and Fisheries* 20(2): 141-161, 2010.

Notes: This paper reviews the gear parameters responsible for loggerhead sea turtle (*Caretta caretta*) capture and mortality while taking into account the mitigation measures tested in the Mediterranean Sea. Incidental catch is considered as one of the major threats for turtle survival; however, the loggerhead bycatch estimated in different areas seems to be unrealistic, which highlights the need of a method for homogenising the estimates. Drifting longlines and bottom trawls have the greatest impact on Mediterranean turtle populations, respectively in pelagic and demersal phase, while passive nets (gillnets and trammel nets) seem to be responsible for the highest direct mortality, due to drowning. Most of the experiments available for the Mediterranean are focused on drifting longline. The longline parameters, hook shape and size, bait type, setting position and the reaction to sensory stimuli, strongly affect the sea turtle bycatch and mortality. Circle hooks have the potential to reduce turtle mortality only in certain fisheries and areas; larger hooks are less likely to be swallowed by turtles due to physical constraints of the mouth, reducing the mortality rate and the catch of juveniles; branchlines, once ingested, appear to be one of the major causes of sea turtle mortality; squid bait, which consistently catches more turtles than mackerel, and lightsticks, which strongly attract turtles, should be banned, at least in some areas and seasons. On the contrary only two bottom trawl studies are available from the Mediterranean. Turtle excluder devices have been tested with promising results in Turkey and Italy, even if the loss of large fish should be carefully investigated. For set nets no practical solutions are available at this time. The analysis allows the conclusion that technical parameters affecting turtle bycatch and mortality should only be studied one at a time, in order to avoid inconclusive results, studies on post-release mortality should be implemented and finally fishermen cooperation is paramount in reducing turtle bycatch and mortality.

Knip, D.M., Heupel, M.R., and Simpfendorfer, C.A. **Sharks in nearshore environments: models, importance, and consequences.** *Marine Ecology Progress Series* 402: 1-11, 2010. [O/A](#)

Notes: Theoretical models of coastal shark populations have remained largely unchanged since the 1960s despite limitations in applicability to many species. Smaller bodied coastal species are poorly represented by the current models. A new theoretical model is proposed to represent those species that spend most or all of their life within nearshore waters but do not show use of discrete nursery areas. Description of this new model outlines the importance of nearshore areas to these smaller species. While all coastal shark populations are susceptible to environmental and anthropogenic impacts, species that fit the new model are more vulnerable to varying coastal processes, habitat degradation, and fishing pressure than are species that use nearshore areas for only part of their life-span. The dynamic nature of nearshore areas and their proximity to human populations present all sharks that occur in them with a range of advantages and disadvantages. This paper reviews how different species utilise nearshore areas and how they overcome the challenges they face in inhabiting these areas. Improving and expanding theoretical models of coastal shark populations will provide a better understanding of how sharks use nearshore environments and assist in making conservation and management decisions for these regions.

Jacques, P.J. **The social oceanography of top oceanic predators and the decline of sharks: A call for a new field.** *Progress in Oceanography* 86(1-2): 192-203, 2010.

Notes: The decline of top oceanic predators (TOPs), such as great sharks, and worldwide erosion of the marine food web is among the most important functional changes in marine systems. Yet, even though human pressures on sharks are one of the most important factors in the collapse of TOPs, the social science of shark fishing has not kept pace with the biophysical science. Such a gap highlights the need for a marine social science, and this paper uses the case of sharks to illustrate some advances that a coherent marine social science community could bring to science and sustainability, and calls for the development of this new field. Social oceanography is proposed as a "discursive space" that will allow multiple social science and humanities disciplines to holistically study and bring insight to a diverse but essential community. Such a community will not provide answers for the physical sciences, but it will add a new understanding of the contingencies that riddle social behavior that ultimately interact with marine systems. Such a field should reflect the broad and diverse approaches, epistemologies, philosophies of science and foci that are in the human disciplines themselves. Social oceanography would complete the triumvirate of biological and physical oceanography where human systems profoundly impact these other areas. This paper tests the theory that institutional rules are contingent on social priorities and paradigms. I used content analysis of all available (1995-2006) State of the World Fisheries and Aquaculture (SOFIA) reports from the United Nations Food and Agricultural Organization (FAO) to measure the symbolic behavior – i.e., what they say – as an indication of the value of sharks in world fisheries. Similar tests were also performed for marine journals and the Convention on Migratory Species of Wild Animals to corroborate these findings. Then, I present an institutional analysis of all international capacity building and regulatory institutions as they pertain to sharks. We find that sharks are not a high priority compared to other fisheries; and, amongst issue areas, ecological concerns are overshadowed by a paradigm of economism (economic values are demonstrated above all others). Further, sharks have no global binding institutions for conservation, and only new and problematic rules at regional levels. Consequently, human pressures on sharks are partially explained through social marginalization that legitimizes permissive international rules that: (1) have limited scope of authority, (2) provide little-to-no active management of sharks, (3) have important enforcement problems, and (4) are generally not reinforced with National Plans of Action demonstrating a lack of commitment at both national and international scales. Thus, active management of shark populations is nearly non-existent meanwhile pressures on sharks, such as through finning, have increased in the last 20 years and there is strong evidence that many shark species are in decline and may not be able to recover. This paper concludes by arguing that biological oceanography of sharks is fundamentally linked to human dimensions, and, therefore, theories and systematic study of human dimensions in oceanography are crucial to provide more comprehensive understanding of complete social-marine systems.

Salomon, A.K., Gaichas, S.K., Shears, N.T., Smith, J.E., Madin, E.M.P., and Gaines, S.D. **Key features and context-dependence of fishery-induced trophic cascades.** *Conservation Biology* 24(2): 382-394, 2010.

Notes: Trophic cascades triggered by fishing have profound implications for marine ecosystems and the socioeconomic systems that depend on them. With the number of reported cases quickly growing, key features and commonalities have

emerged. Fishery-induced trophic cascades often display differential response times and nonlinear trajectories among trophic levels and can be accompanied by shifts in alternative states. Furthermore, their magnitude appears to be context dependent, varying as a function of species diversity, regional oceanography, local physical disturbance, habitat complexity, and the nature of the fishery itself. To conserve and manage exploited marine ecosystems, there is a pressing need for an improved understanding of the conditions that promote or inhibit the cascading consequences of fishing. Future research should investigate how the trophic effects of fishing interact with other human disturbances, identify strongly interacting species and ecosystem features that confer resilience to exploitation, determine ranges of predator depletion that elicit trophic cascades, pinpoint antecedents that signal ecosystem state shifts, and quantify variation in trophic rates across oceanographic conditions. This information will advance predictive models designed to forecast the trophic effects of fishing and will allow managers to better anticipate and avoid fishery-induced trophic cascades.

Pike, I.H. and Jackson, A. **Fish oil: production and use now and in the future.** *Lipid Technology* 22(3): 59-61, 2010.

Notes: The global production of fish oil is around one million tonnes. This production is expected to be maintained. Rich in long-chain omega-3 fatty acids, especially EPA and DHA, it can supplement diets inadequate in these fatty acids such as those in many Western countries. Farmed fish, especially oily fish such as salmonids fed on fish oil provide an excellent source of these acids. Fish oil can be used directly in a purified form (nutraceuticals) in a wide range of foods. The daily recommended intake of EPA plus DHA of 0.25 to 0.50 g can then be met.

Sethi, S.A., Branch, T.A., and Watson, R. **Global fishery development patterns are driven by profit but not trophic level.** *Proceedings of the National Academy of Sciences [USA]* 107(27): 12163-12167, 2010.

Notes: Successful ocean management needs to consider not only fishing impacts but drivers of harvest. Consolidating post-1950 global catch and economic data, we assess which attributes of fisheries are good indicators for fishery development. Surprisingly, year of development and economic value are not correlated with fishery trophic levels. Instead, patterns emerge of profit-driven fishing for attributes related to costs and revenues. Post-1950 fisheries initially developed on shallow ranging species with large catch, high price, and big body size, and then expanded to less desirable species. Revenues expected from developed fisheries declined 95% from 1951 to 1999, and few high catch or valuable fishing opportunities remain. These results highlight the importance of economic attributes of species as leading indicators for harvest-related impacts in ocean ecosystems.

Neat, F. and Burns, F. **Stable abundance, but changing size structure in grenadier fishes (Macrouridae) over a decade (1998-2008) in which deepwater fisheries became regulated.** *Deep Sea Research Part I: Oceanographic Research Papers* 57(3): 434-440, 2010.

Notes: A ten-year time series (1998-2008) from a trawl survey of the continental slope of the NE Atlantic was analyzed to assess temporal variation in the abundance and length frequency of seven species of deepwater grenadier fish. This period coincided (in 2003) with the regulation of deepwater fisheries in this area. None of the species declined in numbers or biomass over the period, and 2 species significantly increased. This suggests that the declines in abundance of these deepwater species following the onset of fishing in the 1970s may now have stabilized, albeit at much lower levels than the virgin biomass. Although two metrics of body size (mean length and maximum length) did not show any evidence for consistent decrease over time, there were significant changes in the overall length frequency distributions. The species found in shallower depths (500 m) had a greater number of larger individuals in 2008 whereas those found deeper (1500 m) tended to have a greater number of smaller individuals. This suggests the presence of a lagged indirect effect of fishing on species that live beyond the actual depths that fishing takes place.

Wood, C.L., Lafferty, K.D., and Micheli, F. **Fishing out marine parasites? Impacts of fishing on rates of parasitism in the ocean.** *Ecology Letters* 13(6): 761-775, 2010.

Notes: Among anthropogenic effects on the ocean, fishing is one of the most pervasive and extends deepest into the past. Because fishing reduces the density of fish (reducing transmission efficiency of directly transmitted parasites), selectively removes large fish (which tend to carry more parasites than small fish), and reduces food web complexity (reducing transmission efficiency of trophically transmitted parasites), the removal of fish from the world's oceans over the course of hundreds of years may be driving a long-term, global decline in fish parasites. There has been growing recognition in recent years that parasites are a critical part of biodiversity and that their loss could substantially alter ecosystem function. Such a loss may be among the last major ecological effects of industrial fishing to be recognized by scientists.

Hilborn, R. and Stokes, K. **Defining overfished stocks: Have we lost the plot?** *Fisheries* 35(3): 113-120, 2010. **O/A**

Notes: In recent years, there has been increasing emphasis on prevention of overfishing and agencies such as the National Oceanic and Atmospheric Administration now report the proportion of stocks that are overfished as a primary indicator of the agencies' performance. Almost all national and international legislation makes specific reference to maximum sustainable yield (MSY) and most definitions of overfishing are related in some way to achievement of MSY. We show that many of the definitions of overfishing now being adopted by fisheries agencies are increasingly unrelated to achievement of MSY and have become, to a great extent, arbitrary. We argue that overfishing definitions and management targets are generally better based on levels of historical stock size rather than the growing trend to setting targets in relation to theoretical unfished stock sizes.

Iglésias, S.P., Toulhoat, L., and Sellos, D.Y. **Taxonomic confusion and market mislabelling of threatened skates: important consequences for their conservation status.** *Aquatic Conservation: Marine and Freshwater Ecosystems* 20(3): 319-333, 2010.

Notes: 1. The iconic European common skate (*Dipturus batis*) has been described as the first clear case of a fish species brought to the brink of extinction by commercial fishing. Its listing was upgraded to Critically Endangered on the 2006 IUCN Red List of Threatened Species. According to FAO fishery statistics, France is responsible for 60.2% of the 502 tonnes reported as '*D. batis*' in the 2005 world landings. 2. Noticeable phenotypic differences within the species and inconsistencies in published data on its sexual maturation required careful re-examination of its taxonomy. Morphology, genetics, and life history reveal that two distinct species have been erroneously confused since the 1920s under the single scientific name *D. batis*. Here it is argued that they should be resurrected as two valid species. The common skate *D. batis* species-complex is split into two nominal species, the blue skate (provisionally called *D. cf. flossada*) and the flapper skate (*D. cf. intermedia*) with maximum lengths of 143.2 cm and 228.8 cm respectively. 3. This taxonomic confusion puts into question all previously accumulated data based on *D. batis*. Its endangered status highlights the need for an extensive reassessment of population collapses with accurately identified species. In 2006/2007 an extensive survey (4110 skates, 14.081 tonnes by weight) was conducted in the main French ports of the *D. batis* species-complex and relatives (*D. oxyrinchus*, *D. nidarosiensis* and *Rostroraja alba*) that are mixed together in landings under the names '*D. batis*' and '*D. oxyrinchus*'. 4. The survey reveals that official fishery statistics mask species-specific declines, due to the mislabelling of five species under only two landing names. Trends in landings since the 1960s and the life history of these species suggest a dramatic decline and collapse of the spawning stock, preventing the recovery of relict populations. 5. The risk of extinction of these depleted species may be higher than previously assessed and might be unavoidable without immediate and incisive conservation action.

Johnson, J.E. and Welch, D.J. **Marine fisheries management in a changing climate: A review of vulnerability and future options.** *Reviews in Fisheries Science* 18(1): 106-124, 2010.

Notes: Marine capture fisheries are an important source of protein globally, with coastal and oceanic fish providing a rich source of essential fatty acids, vitamins, and minerals. Fisheries also support economies and important social structures in many nations, particularly developing nations. Marine fisheries are under increasing threat from climate change, with climate change now identified as the latest threat to the world's fast declining fish stocks. Marine fisheries will be exposed to increasing

sea surface temperatures, ocean acidification, sea level rise, increasing storm intensity and altered ocean circulation, and rainfall patterns that will affect target species through a range of direct and indirect mechanisms. The sensitivity of fish stocks to these changes will determine the range of potential impacts to life cycles, species distributions, community structure, productivity, connectivity, organism performance, recruitment dynamics, prevalence of invasive species, and access to marine resources by fishers. Many fisheries are already experiencing changes in target species diversity and abundance, species distribution, and habitat area, as well as loss of fishing effort due to intensifying storms. Using a vulnerability assessment framework, we examine the level of vulnerability of marine fisheries to climate change and the factors that will temper vulnerability, such as adaptive capacity. Assessing fisheries vulnerability to climate change is essential to prioritize systems in greatest need of intervention, understand the drivers of vulnerability to identify future research directions, and more importantly, to review current fisheries management with the view to develop management responses that will be effective in securing the future sustainability of marine fisheries.

Svedäng, H., Stal, J., Sterner, T., and Cardinale, M. **Consequences of subpopulation structure on fisheries management: Cod (*Gadus morhua*) in the Kattegat and Oresund (North Sea).** *Reviews in Fisheries Science* 18(2): 139-150, 2010.

Notes: This study shows how cod subpopulations may have been eradicated as a consequence of the use of imperfect models for assessing stock assessment, depleting what was formerly a productive sea. The Kattegat and Oresund (North Sea) were chosen as study objects due to the combination of different exploitation patterns and the possible existence of separate stock units. The scenario was further elaborated by simulating the potential harvest of fishing for different long-run levels of fishing effort as well as stock size. The study clearly indicated that new policy instruments are needed but these instruments need to be carefully fine-tuned to take into account real biological as well as social factors.

Iwata, Y., Ito, K., and Sakurai, Y. **Is commercial harvesting of spawning aggregations sustainable? The reproductive status of the squid *Loligo bleekeri*.** *Fisheries Research* 102(3): 286-290, 2010.

Notes: As marine species that are harvested during spawning aggregation tend to be overfished, sufficient "reproductive escapement" is required to manage such overexploited populations. Because the reproductive value of short-lived organisms changes towards the end of their life span, information is required not only on the total amount harvested but also on the characteristics of the individuals caught. As spawning aggregations of the squid *Loligo bleekeri* are targeted by the commercial fishing industry, we analysed biological data of harvested squid to identify indicators of reproductive status. Females of this species had several sperm resources associated with alternative mating behaviours: in seminal receptacle near the mouth, around the seminal receptacle, and inside the opening of the oviduct, associated with alternative mating behaviours. However, only the mass of sperm on the oviduct was significantly related to oviduct weight (including ovulated eggs): oviduct weight was less when sperm mass was attached to the oviduct than when it was not, indicating that the female had paired with a consort male and had spawned before she was caught. Using this indicator to confirm a recent spawning event, we determined that only 22.9% of females spawned before they were harvested. Our results show that the commercial fishing industry mainly harvests squid that have not spawned and have high reproductive values. Further information on the movement and reproductive behaviour of squid is required to develop a management strategy for the coastal fishing industry that ensure sufficient reproductive escapement.

Stephen, J.A. and Harris, P.J. **Commercial catch composition with discard and immediate release mortality proportions off the southeastern coast of the United States.** *Fisheries Research* 103(1-3): 18-24, 2010.

Notes: The snapper-grouper fishery off the coast of the southeastern United States contains many exploited species that are governed under a multitude of species-specific regulations. Despite ample information on landed commercial catches, there is a critical need to characterize the entire commercial catch to identify catch composition, discard proportion and immediate release mortality proportions. This study recorded the lengths of all fish caught on a commercial snapper-grouper vessel and their subsequent disposition. Over 40 fishing days, the captain captured 55 species, but the majority of the catch (97%) was comprised of just 8 species (vermillion snapper, gray triggerfish, red porgy, black sea bass, tomate, scamp, greater amberjack, and Almaco jack). Discard proportions were low overall, but varied by species, while immediate release mortality proportions

were generally high (>40%). Species with high discard proportions were red porgy (56%), scamp (44%), bank sea bass (46%) and red snapper (42%). Three of these species also had high immediate release mortality proportions red porgy - 82%, scamp - 98%, and red snapper - 93%. Species with both high discard proportions and high immediate release mortality proportions might indicate that current management regulations are not adequately protecting these stocks, as a large number of discarded fish do not survive.

Piet, G.J., van Overzee, H.M.J., and Pastoors, M.A. **The necessity for response indicators in fisheries management.** *ICES Journal of Marine Science* 67(3): 559-566, 2010.

Notes: Results are used from traditional fisheries management to explore two potential response indicators: (i) the extent to which scientific advice is incorporated in decision-making, and (ii) the compliance of industry and the relevant authorities to these decisions. Based on the most comprehensive set of data on the management process of 125 stocks for which ICES provided advice over the period 1987-2006, we explored these response indicators and found that for just 8% of the stocks, the official total allowable catch (TAC) equalled the scientific advice, and that in recent years the official TAC overshoot scientific advice by >50%. Compliance levels appear to be reflected in the percentage of stocks for which landings exceeded the official TAC, decreasing from ~8 to 2%. However, because the TAC appears not to be limiting, compliance may not be the most appropriate indicator. Without transparent decision-making that takes scientific advice into account, or the compliance of industry as reflected by the type of response indicators explored, the effectiveness of new developments in fisheries management, such as the application of an ecosystem approach, will be compromised, as has been the case with conventional fisheries management measures.

de Quevedo, I.A., Cardona, L., de Haro, A., Pubill, E., and Aguilar, A. **Sources of bycatch of loggerhead sea turtles in the western Mediterranean other than drifting longlines.** *ICES Journal of Marine Science* 67(4): 677-685, 2010.

Notes: A survey, including questionnaires to fishers and observers on board fishing vessels, was conducted to assess turtle bycatch in the waters off Catalonia (northeastern Spain), a region inhabited mainly by loggerhead sea turtles (*Caretta caretta*) from the highly endangered eastern Mediterranean rookeries. Observer reports confirmed that the data produced by the interviewees were reliable, so interview results were used to estimate turtle bycatch. The number of turtles caught monthly per vessel was estimated at 0.01 for bottom longlines, 0.02 for trammelnets, 0.07 for bottom trawling, and 1.2 for drifting longlines. From these values, 481 (95% CI: 472-491) turtles were estimated to be taken annually as bycatch by the whole fleet. Bottom trawling and trammelnets were the most widely used fishing gears (33 and 31% of the total 11 237 fishing months), but most turtles were caught either by bottom trawlers (249; 95% CI 83-415) or by drifting longlines (124; 95% CI: 40-199). Ivlev's electivity index revealed that bottom trawler bycatch was higher than expected in areas with a wide continental shelf. Given the heavy turtle mortality associated with bottom trawling and the fact that, in southern Catalonia, the fleet mainly takes turtles from western Mediterranean rookeries, it is suggested that the fishery be regulated through winter fishing restrictions, reducing the number of bottom trawlers working in the area, reducing the time the net is in the water to prevent turtle suffocation, or being obliged to use turtle excluder devices.

Shackell, N.L., Frank, K.T., Fisher, J.A.D., Petrie, B., and Leggett, W.C. **Decline in top predator body size and changing climate alter trophic structure in an oceanic ecosystem.** *Proceedings of the Royal Society of London [B]* 277(1686): 1353-1360, 2010.

Notes: Globally, overfishing large-bodied groundfish populations has resulted in substantial increases in their prey populations. Where it has been examined, the effects of overfishing have cascaded down the food chain. In an intensively fished area on the western Scotian Shelf, Northwest Atlantic, the biomass of prey species increased exponentially (doubling time of 11 years) even though the aggregate biomass of their predators remained stable over 38 years. Concomitant reductions in herbivorous zooplankton and increases in phytoplankton were also evident. This anomalous trophic pattern led us to examine how declines in predator body size (approx. 60% in body mass since the early 1970s) and climatic regime influenced lower trophic levels. The increase in prey biomass was associated primarily with declines in predator body size and secondarily to an increase in stratification. Sea surface temperature and predator biomass had no influence. A regression model explained

65 per cent of prey biomass variability. Trait-mediated effects, namely a reduction in predator size, resulted in a weakening of top predation pressure. Increased stratification may have enhanced growing conditions for prey fish. Size-selective harvesting under changing climatic conditions initiated a trophic restructuring of the food chain, the effects of which may have influenced three trophic levels.

Griffiths, A.M., Sims, D.W., Cotterell, S.P., El Nagar, A., Ellis, J.R., Lynghammar, A., McHugh, M., Neat, F.C., Pade, N.G., Queiroz, N., Serra-Pereira, B., Rapp, T., Wearmouth, V.J., and Genner, M.J. **Molecular markers reveal spatially segregated cryptic species in a critically endangered fish, the common skate (*Dipturus batis*)**. *Proceedings of the Royal Society of London [B]* 277(1687): 1497-1503, 2010.

Notes: Many sharks and skates are particularly vulnerable to overfishing because of their large size, slow growth, late maturity and low fecundity. In Europe dramatic population declines have taken place in common skate (*Dipturus batis* L.), one of the largest demersal fish in regional shelf seas, leading to extirpations from substantial parts of its former range. Here we report the discovery of cryptic species in common skate collected from the northeast Atlantic continental shelf. Data from nuclear microsatellite markers indicated two clearly distinct clades and phylogenetic analysis of mitochondrial DNA sequences demonstrated monophyly of each one of them. Capture locations showed evidence of strong spatial segregation, with one taxon occurring mainly in waters off the southern British Isles and around Rockall, while the other was restricted to more northerly shelf waters. These apparently cryptic species showed overlapping substrate and depth preferences, but distributional limits were closely related to temperature gradients, potentially indicating thermal limits to their distributions. This discovery of hidden diversity within a large, critically endangered marine vertebrate demonstrates how marine biodiversity can be underestimated, even in such a relatively well-studied and heavily exploited region.

Lindegren, M., Möllmann, C., Nielsen, A., Brander, K., MacKenzie, B.R., and Stenseth, N.C. **Ecological forecasting under climate change: the case of Baltic cod**. *Proceedings of the Royal Society of London [B]* 277(1691): 2121-2130, 2010.

Notes: Good decision making for fisheries and marine ecosystems requires a capacity to anticipate the consequences of management under different scenarios of climate change. The necessary ecological forecasting calls for ecosystem-based models capable of integrating multiple drivers across trophic levels and properly including uncertainty. The methodology presented here assesses the combined impacts of climate and fishing on marine food-web dynamics and provides estimates of the confidence envelope of the forecasts. It is applied to cod (*Gadus morhua*) in the Baltic Sea, which is vulnerable to climate-related decline in salinity owing to both direct and indirect effects (i.e. through species interactions) on early-life survival. A stochastic food web-model driven by regional climate scenarios is used to produce quantitative forecasts of cod dynamics in the twenty-first century. The forecasts show how exploitation would have to be adjusted in order to achieve sustainable management under different climate scenarios.

Péron, G., Mittaine, J.-F., and Le Gallic, B. **Where do fish meal and fish oil products come from? An analysis of the conversion ratios in the global fishmeal industry**. *Marine Policy* 34(4): 815-820, 2010.

Notes: As a result of the stagnation of commercial fishery landings, aquaculture activities are expected to increase over the next decades to match the growing demand for marine protein. Overall, it is expected that the aquaculture sector could reduce some of the fishing pressure applied to wild stocks. However, this development is likely to be limited by the availability of key aquaculture inputs, specifically fishmeal and fish oil products (FMFOP). Aquaculture provided 60 % (fish meal) and 80 % (fish oil) of the world total consumption of these products in 2007. FMFOP are generally derived from small pelagic fish species, but can also be derived from other sources. Identifying the origin of FMFOP is crucial to understanding the effects of this new pressure on marine social-ecological systems. Two factors are of particular importance in the reduction sector transforming wild fish into fishmeal or fish oil: the two "conversion ratios" (i.e. the ratio between the quantity of wild fish harvested and the resulting quantity of FMFOP, and the ratio between the quantity of FMFOP and aquaculture production), and the type of raw material used by the reduction sector. Based on trade and production databases from FAO and the International Fishmeal and Fish oil Organisation (IFFO), this paper proposes an approach to identify the origin of FMFOP. It

shows that whereas different countries use different pelagic resources to produce FMFOP, other countries use non-pelagic sources, and some countries use pelagic resources for human consumption.

Cosandey-Godin, A.C. and Worm, B. **Keeping the lead: How to strengthen shark conservation and management policies in Canada.** *Marine Policy* 34(5): 995-1001, 2010.

Notes: Internationally, shark conservation is now being recognized as a major environmental challenge, but management efforts to halt the overexploitation of sharks have lagged behind. This review examines the state of knowledge for shark species in Canadian waters and analyzes the role of existing management and legislation in ensuring shark conservation. Despite Canada's early leadership, the present management framework reveals major shortcomings with regard to legal protection, bycatch and finning regulations. These problems are not unique to Canada but illustrate broader issues pertaining to the global management of endangered fish species. To strengthen the conservation and management of sharks, this paper recommends a set of key policies and management priorities, which exemplify proper precautionary management of endangered shark species in Canada and could serve as a blueprint for improving conservation efforts internationally. A structured approach for grading progress in shark conservation efforts against best practices is also presented and could be used as a goalpost elsewhere.

Williams, G.D., Levin, P.S., and Palsson, W.A. **Rockfish in Puget Sound: An ecological history of exploitation.** *Marine Policy* 34(5): 1010-1020, 2010.

Notes: In Puget Sound, WA (USA), rockfish (*Sebastes* spp.) have significantly declined in abundance, with multiple petitions to list individual species under the Endangered Species Act. In order to better understand the ecological legacy of rockfish fishing to the Puget Sound ecosystem, the local history of rockfish exploitation was reviewed, focusing on the socioeconomic forces and management decisions which influenced the trajectory of landings. Rockfish have always been harvested for human consumption in the region, but over time exploitation patterns have changed from an opportunistic subsistence activity by indigenous peoples, to a year-round target of commercial and recreational interests. Annual commercial and recreational harvests together peaked (almost 400 mt) in the early 1980s as anglers' attitudes changed, gear technology improved, rockfish became more familiar to the market, human population increased, and agency programs promoted fisheries to sustain employment. Rockfishes were generally not managed intensely or with conservation goals in mind until the late 1980s, in part due to scientific shortcomings and a lack of resources. By the time management actions were deemed necessary, the greatest harvest had already occurred. However, the low intrinsic productivity of most rockfish species suggests that the legacy of fishing will remain for years to come. As managers strive to restore the integrity and resilience of Puget Sound, they must realize the significance of historical fishery removals to the ecosystem and use the proper social and economic incentives to drive individual behavior toward these ecosystem goals.

Cullis-Suzuki, S. and Pauly, D. **Failing the high seas: A global evaluation of regional fisheries management organizations.** *Marine Policy* 34(5): 1036-1042, 2010.

Notes: Regional fisheries management organizations (RFMOs) collectively manage the largest distinct area of the world, the high seas, but their effectiveness in conserving the fish stocks therein has been questioned lately, as many stocks have declined. This study quantitatively assesses the effectiveness of the world's 18 RFMOs, based on a two-tiered approach, concentrating first on their performance 'on paper' and secondly, in practice. The former was determined by assessing how well RFMOs scored against 26 criteria that together reflect current RFMO best practices. The latter assessment referenced the current state of the stocks RFMOs manage, through biomass and fishing mortality reference points and biomass trends through time. Results show low performance of RFMOs for both assessments, i.e., average scores of 57% and 49%, respectively. The latter result is emphasized by findings that reflect two-thirds of stocks fished on the high seas and under RFMO management are either depleted or overexploited. Findings also indicate that there is no connection between the two sets of scores, suggesting a disparity between organization intent and action.

Holland, D.S. and Wiersma, J. **Free form property rights for fisheries: The decentralized design of rights-based management through groundfish "sectors" in New England.** *Marine Policy* 34(5): 1076-1081, 2010.

Notes: Harvest cooperatives were implemented in several US fisheries over the last decade during a period when US law prohibited implementation of any new individual fishery quota (IFQ) systems. Harvest cooperatives provided an alternative to individual quotas as a means to end the race for fish and increase fishery profitability. The prohibition on new IFQ systems in the US was lifted, but harvest cooperatives remain a more feasible and perhaps a superior alternative to IFQs for some fisheries. The New England Fishery Management Council is on the verge of implementing a new management system for the groundfish fishery based on harvest cooperatives known as "sectors". This paper describes the New England sector management system and discusses a number of advantages but also some drawbacks relative to IFQs. It argues that a hybrid of the two approaches could have advantages over either.

Pita, C., Pierce, G.J., and Theodossiou, I. **Stakeholders' participation in the fisheries management decision-making process: Fishers' perceptions of participation.** *Marine Policy* 34(5): 1093-1102, 2010.

Notes: Public participation is a key ingredient of good governance and there are many advantages of involving stakeholders in the decision-making process. The European Commission identified the lack of stakeholder involvement as one of the major weaknesses of the Common Fisheries Policy (CFP). As such, the 2002 Reform of the CFP aimed to improve its system of governance by increasing the involvement of stakeholders in decision-making. Over the last decade, Scottish inshore waters have seen an increase in management measures focused on involving fishers, delegating responsibilities and decentralizing management. The present document investigates commercial inshore fishers' perceptions of participation in the decision-making process and attitudes towards a new management regime – the Inshore Fisheries Groups (IFGs) – which aims to increase participation in and decentralization of inshore fisheries management. A survey was conducted, through face-to-face interviews, and ordered logistic and multiple regression models created to identify which characteristics influence fishers' perceptions and attitudes. The present analysis concluded that, 5 years subsequent to the reform of the CFP, the majority of inshore fishers perceive themselves not to be consulted or involved in the decision-making process. However, and despite the fact that fishers are not completely certain of the potential of the IFGs to increase their participation in the management process, they have an overall positive attitude towards their implementation.

Herndon, A., Gallucci, V.F., DeMaster, D., and Burke, W. **The case for an international commission for the conservation and management of sharks (ICCMS).** *Marine Policy* 34(6): 1239-1248, 2010.

Notes: The current rate of shark global exploitation and mortality is arguably so high under current management regimes that unless a renewed initiative is undertaken some species of shark will become effectively extinct. Current efforts to sustainably manage shark mortality are driven primarily by domestic laws in a few countries, big international non-governmental organizations (BINGOs) promoting environmental laws in the countries or regions where they exist, a handful of regional fisheries management organizations (e.g., IATTC and ICCAT), and inter-governmental organizations such as CITES. The absence of enforcement capability is often argued as the critical component in the failure to protect sharks from over-exploitation. The remedy advanced here goes far beyond the need for stepped up enforcement, and calls for the creation of an entirely new international management regime, the International Commission for the Conservation and Management of Sharks (ICCMS). Such an agency could learn from the experiences of management bodies tasked with conservation of species biologically similar to sharks, such as the International Whaling Commission (IWC), to improve its efficacy. Critics have identified many organizational flaws that reduced the IWC's effectiveness during its earliest years. Some of those flaws are examined here and remedies are suggested that an ICCMS could use to create a more effective management regime. The life histories of elasmobranchs and large whales are compared to illustrate their similarities as a biological foundation for the selection of the IWC as a model.

Kronen, M., Vunisea, A., Magron, F., and McArdle, B. **Socio-economic drivers and indicators for artisanal coastal fisheries in Pacific island countries and territories and their use for fisheries management strategies.** *Marine Policy* 34(6): 1135-1143, 2010.

Notes: This is the first regional study of artisanal fisheries in Pacific Island countries and territories that demonstrated that the future of the region's artisanal fishery sector and the livelihood of coastal communities will be highly dependent on alternative subsistence and income sources, which are necessary to reduce fishing pressure to a sustainable level to maintain ecosystem services and food security. The overall objective of this study was to identify socio-economic indicators and drivers to improve the understanding of the dynamics between socio-economic conditions and current exploitation levels of finfish and invertebrates of coastal communities in 17 Pacific Island countries and territories. We showed that exploitation rates and thus possible overexploitation are not solely the consequence of a simple demographic growth process but are in fact a result of the choices people have. Our results confirmed a close relationship between resource exploitation rates and economic development at the national level and the availability of alternative income opportunities at the community level. Multivariate analysis results suggest that communities in countries with somewhat unfavourable conditions and limited access to alternatives and fishing households in communities with overall favourable economic conditions are at highest vulnerability as they have the highest dependence on coastal fisheries resources. Alternative economic opportunities at the national scale and availability of alternative income at the community level vary significantly between cultural groups. Based on our results, the development of management strategies with realistic expectations of ensuring livelihood of coastal communities and sustainable resource use in Pacific Island countries and territories requires a hierarchical and integral approach. Major drivers identified at the regional, cultural and local levels should be used to identify priorities, to assess overall advantages and limitations at the different levels as well as the vulnerability of communities targeted, and to develop strategies accordingly.

Verweij, M.C. and Van Densen, W.L.T. **Differences in causal reasoning about resource dynamics and consequences for the participatory debate on North Sea fisheries.** *Marine Policy* 34(6): 1144-1155, 2010.

Notes: Fishermen, scientists, policy makers, and staff of environmental NGOs (ENGOs) have significantly different understandings of the processes that determine developments in fish stocks. These perception differences hinder the participatory debate on why fish stocks change and which management measures are effective. In this study, differences in causal reasoning about processes between fishermen, policy makers, ENGO-staff, and scientists were examined, regarding four case studies within the management of the fishery on North Sea plaice. First, it appeared that all parties, besides scientists, had difficulty reasoning about long-term effects because of comprehension problems with stock dynamics, and because of short-term economical interests. Second, there were differences in how parties deal with natural variation and interconnectedness of natural and anthropogenic influences. Stock assessment scientists work with single-species models, reducing complexity by using assumptions that rule out variation, in order to inform policy makers about the effect of one isolated management measure. Fishermen on the other hand, relying on information from their daily lives at sea, emphasize complexity and interconnectedness, and the impact of the ever-changing and unpredictable nature. ENGO-staff appeared reluctant to reason about single species and broaden the debate to the ecosystem-level, while emphasizing the effect of man. As a consequence of the diverging perceptions, much time in multi-stakeholder settings is lost on repetitive discussions, mainly on the relative importance of 'nature' versus 'man'. No wonder that policy makers feel lost, and experience processes as very complex. Concluding, to handle these perception differences, there is need for a directive process coordinator, and a more creative informative role for fisheries scientists. Together with all participants, they should map all expectancies and lines of reasoning at the beginning of the debate. This scheme can be relied on during subsequent meetings, in which perceptions can adequately be positioned.

Khalilian, S., Froese, R., Proelß, A., and Requate, T. **Designed for failure: A critique of the Common Fisheries Policy of the European Union.** *Marine Policy* 34(6): 1178-1182, 2010.

Notes: The Common Fisheries Policy (CFP) of the European Union has neither lived up to its aim of enhancing the sustainability of fish stocks nor that of improving the economic competitiveness of the fishing industry. This paper discusses the failure of the CFP from a biological, economical, legal and political perspective.

Horwood, J. **Marine ecosystem management: Fish abundance and size under exploitation.** *Marine Policy* 34(6): 1203-1206, 2010.

Notes: This study is targeted on policy makers and environmental scientists to illustrate the typical historical scale of depletion of our fish stocks, and what current and emerging legislation might mean for fisheries management and the metrics of fish stocks. The population demography of the Bristol Channel sole is described since 1820. Their decline in abundance, and change in length compositions, are modelled. By 2000, the mature stock had been depleted to less than 5% of its original size, and larger sole were rarely caught. The implications of maximum sustainable yield targets, and of good environmental status, are examined.

Phillipson, J. and Symes, D. **Recontextualising inshore fisheries: The changing face of British inshore fisheries management.** *Marine Policy* 34(6): 1207-1214, 2010.

Notes: Inshore fisheries are coming under increasing pressure to account for wider environmental impacts and relations with other users of marine space. However approaches to inshore fisheries management across Britain's devolved governments are becoming even more strikingly divergent. While in England the century old local Sea Fisheries Committees are to be replaced with modernised structures, and in Scotland there are efforts to move to a locally driven management system, in Wales there has been a retreat from local co-management. Not only do the reforms pose ongoing challenges for good governance, not least in the handling of cross-scale interactions and user group participation, but they may also fall short in providing for systematic and full integration of fisheries and marine environmental management.

Swartz, W., Rashid S.U., Watson, R., and Pauly, D. **Sourcing seafood for the three major markets: The EU, Japan and the USA.** *Marine Policy* 34(6): 1366-1373, 2010.

Notes: This paper describes the marine fish and invertebrate consumption in three of the world's major seafood markets (the EU, Japan and the USA) using a series of global maps indicating the likely origin of the seafood consumed by each market. These maps display a high level of dependence by these markets on foreign sources as the serial depletion of local fisheries resources forced the fleets in search for new seafood supplies well beyond their domestic waters. The acquisition of foreign (and high seas) seafood by these markets is conducted through two channels: by dispatching distant water fishing fleets that directly exploit foreign stocks; and by importing catch landed elsewhere by local fleets. The results also demonstrate that each of the three major markets occupies a zone of influence within which it is dominant.
