

Marine Science Review - 401

Fish and fisheries

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

Vogel, G. **Europe tries to save its eels.** *Science* 329(5991): 505-507, 2010.

B. Recent articles with abstracts

Eschmeyer, W.N., Fricke, R., Fong, J.D., and Polack, D.A. **Marine fish diversity: history of knowledge and discovery (Pisces).** *Zootaxa* 2525: 19-50, 2010. O/A

Notes: The increase in knowledge of marine fish biodiversity over the last 250 years is assessed. The Catalog of Fishes database (<http://research.calacademy.org/ichthyology/catalog>) on which this study is based, has been maintained for 25 years and includes information on more than 50,000 available species names of fishes, with more than 31,000 of them currently regarded as valid species. New marine species are being described at a rate of about 100-150 per year, with freshwater numbers slightly higher. In addition, over 10,000 generic names are available ones of which 3,118 are deemed valid for marine fishes (as of Feb. 19, 2010). This report concentrates on fishes with at least some stage of their life cycle in the sea. The number of valid marine species, about 16,764 (Feb. 19, 2010), is about equal to that of freshwater fishes (15,170). Valid species of fishes apparently restricted to brackish water number only 108. The sum (32,042) is more than the current total number of 31,362, valid species of fishes because some species occur in more than one habitat. Presented is information on the description of species and genera over historic time, the authors describing taxa, and the deemed validity of described species and genera. We characterize families and also geographic areas where marine fishes are relatively well known and those where much discovery appears to remain. Endemism is also discussed. As examples, the marine fish faunas of the Mediterranean Sea, the Red Sea and the Mascarene Islands are shown to be well known. Little new discovery has been found recently at the family level, and new discoveries of species and genera are mostly limited to certain families and geographic areas and habitats. Specialized collecting techniques are discussed. Overall success rates for valid species discovery through time has only been about 50%, or two species described for each valid one recognized; however this percentage has been improving over time. Because of recent improvements in technology, literature availability, quality of analysis, better communication, and other factors, the current success rate for validity of species is well over 90% (with a small lag time as status is confirmed or rejected by the ichthyological community). Two habitats where most new marine taxa will likely be found are deep-reefs and deep-slopes, areas poorly sampled and studied. Some deep-sea areas, particularly in the Southern Hemisphere and throughout the Indian Ocean and in Indonesia, should reveal many new taxa from increased collecting efforts. Molecular genetic studies are proving valuable in phylogenetic and phylogeographic analyses as well as in species' population analyses, but these relatively new techniques are not uncovering large numbers of new or cryptic taxa. An estimate of marine fish species yet to be sampled and described is about 5,000, or twice the number described in the last 19 years, for a projected total of approximately 21,800 valid marine species of fishes.

Fujii, T., Jamieson, A.J., Solan, M., Bagley, P.M., and Priede, I.G. **A large aggregation of liparids at 7703 meters and a reappraisal of the abundance and diversity of hadal fish.** *BioScience* 60(7): 506-515, 2010. **O/A**

Notes: Few biological studies have investigated the hadal depths within oceanic trenches that plummet from 6000 meters (m) to the full ocean depth of almost 11,000 m. Here we present the deepest known *in situ* observations of fish: a hadal snailfish, *Pseudoliparis amblystomopsis* (Andriashev 1955), from 7703-m deep in the Japan Trench, which was obtained using a baited video lander. The maximum number of fish we observed was unexpectedly higher than trawl catch records of any known hadal fish. We describe changes in fish abundance and associated behaviors over time, including feeding, resting, and swimming. In light of these new observations, we reappraise the occurrence and diversity records of hadal fishes that have been constructed from fragmentary and often misleading information derived from historical explorations and global data sets. This reappraisal suggests that hadal fish diversity may be lower – although some hadal fish species may attain much larger populations – than previously thought.

Slabbekoorn, H., Bouton, N., van Opzeeland, I., Coers, A., ten Cate, C., and Popper, A.N. **A noisy spring: the impact of globally rising underwater sound levels on fish.** *Trends in Ecology and Evolution* 25(7): 419-427, 2010.

Notes: The underwater environment is filled with biotic and abiotic sounds, many of which can be important for the survival and reproduction of fish. Over the last century, human activities in and near the water have increasingly added artificial sounds to this environment. Very loud sounds of relatively short exposure, such as those produced during pile driving, can harm nearby fish. However, more moderate underwater noises of longer duration, such as those produced by vessels, could potentially impact much larger areas, and involve much larger numbers of fish. Here we call attention to the urgent need to study the role of sound in the lives of fish and to develop a better understanding of the ecological impact of anthropogenic noise.

Leschen, A.S. and Correia, S.J. **Mortality in female horseshoe crabs (*Limulus polyphemus*) from biomedical bleeding and handling: implications for fisheries management.** *Marine and Freshwater Behavior and Physiology* 43(2): 135-147, 2010.

Notes: Horseshoe crabs (*Limulus polyphemus*) are bled for biomedical purposes to produce Limulus Amebocyte Lysate (LAL), a valuable material used to detect endotoxins in medical devices and implants. Previous studies generally found mortality from the bleeding process of 5-15% with one study reporting 29% for females; the 15% value is now used for management purposes. However, most of these studies looked only at males, did not mimic handling practices typical of the biomedical facility in Massachusetts, or harvested females after the spawning season when much of the actual biomedical harvest occurs. Female mortality is of particular concern because they have greater importance than males for population dynamics, are preferentially harvested, and are more likely to be physiologically stressed than males because of energy outlay for egg production. We examined the mortality of unbled female horseshoe crabs versus that of crabs bled by the local biomedical company and either returned directly to water, or held overnight as is the current practice. Mortality of control (unbled) crabs was low (3%) and differed significantly ($p < 0.001$) from that of either bled group (22.5% and 29.8% mortality, respectively); the two bled groups did not differ significantly from each other ($p = 0.31$). Mortality rates in bled treatment groups were double those used in current management of the biomedical fishery. The bait and biomedical fisheries are managed differently because biomedical is considered a low-mortality "catch and release" fishery. States and interstate management agencies may want to re-examine policies surrounding biomedical horseshoe crab harvest based on these results.

Faurby, S., King, T.L., Obst, M., Hallerman, E.M., Pertoldi, C., and Funch, P. **Population dynamics of American horseshoe crabs – historic climatic events and recent anthropogenic pressures.** *Molecular Ecology* 19(15): 3088-3100, 2010.

Notes: Populations of the American horseshoe crab, *Limulus polyphemus*, have declined, but neither the causes nor the magnitude are fully understood. In order to evaluate historic demography, variation at 12 microsatellite DNA loci surveyed in 1218 *L. polyphemus* sampled from 28 localities was analysed with Bayesian coalescent-based methods. The analysis showed

strong declines in population sizes throughout the species' distribution except in the geographically isolated southern-most population in Mexico, where a strong increase in population size was inferred. Analyses suggested that demographic changes in the core of the distribution occurred in association with the recolonization after the Ice Age and also by anthropogenic effects, such as the past overharvest of the species for fertilizer or the current use of the animals as bait for American eel (*Anguilla rostrata*) and whelk (*Busycon* spp.) fisheries. This study highlights the importance of considering both climatic changes and anthropogenic effects in efforts to understand population dynamics – a topic which is highly relevant in the ongoing assessments of the effects of climate change and overharvest.

bin Othman, A.S., Goh, G.H.S., and Todd, P.A. **The distribution and status of giant clams (family Tridacnidae) – A short review.** *Raffles Bulletin of Zoology* 58(1): 103-111, 2010. [O/A](#)

Notes: In this review on the distribution, density and status of giant clams (family Tridacnidae) we combine reports derived from primary and grey literature with sighting data provided by Reef Check a non-profit reef-monitoring organisation. Density records from 15 countries typically range from 10^{-3} to 10^{-5} individuals per square meter, however, some populations can achieve numbers in excess of 100 individuals per square meter. *Tridacna maxima* has the most cosmopolitan distribution; almost encompassing the entire geographical range of all the other giant clams species. In contrast, the more recently discovered *T. costata*, *T. rosewateri*, *T. teneroa* and *H. porcellanus* have the most restricted geographical ranges. Reef Check data includes records of (unidentified to species-level) giant clams beyond previously defined geographical boundaries; extending their known occurrence slightly west to near Cape Agulhas, South Africa. Overfishing, habitat loss, pollution, and increases in sea surface temperatures all contribute to decreases in giant clam populations. Restocking efforts provide an opportunity to redress this decline but, without enhanced protection and enforcement, these efforts may be unsuccessful.

Schmalenbach, I. and Franke, H.D. **Potential impact of climate warming on the recruitment of an economically and ecologically important species, the European lobster (*Homarus gammarus*) at Helgoland, North Sea.** *Marine Biology* 157(5): 1127-1135, 2010.

Notes: A laboratory-based study was performed to assess the impact of climate warming on the recruitment of the endangered population of the European lobster (*Homarus gammarus*) at Helgoland (North Sea, German Bight). Egg-bearing females collected in situ just after spawning in late summer were subjected to various seasonal temperature regimes. Regimes with elevated temperatures (mild winters) resulted in a strong seasonal forward shift of larval hatching. Hatching took place at significantly lower temperatures than under regimes with normal winters. Experiments on larval development across a range of constant temperatures showed that no successful larval development occurred at temperatures below 14 °C. Larval survival increased from 9% at 14 °C to 80% at 22 °C, while duration of larval development decreased correspondingly from 26 to 13 days. We hypothesize that an ongoing warming of the North Sea will strongly affect the recruitment success of the Helgoland lobster, mainly resulting from a decoupling of the seasonal peak appearance of larvae from optimal external conditions (temperature, food availability) for larval development.

Coleman, F.C. and Koenig, C.C. **The effects of fishing, climate change, and other anthropogenic disturbances on red grouper and other reef fishes in the Gulf of Mexico.** *Integrative and Comparative Biology* 50(2): 201-212, 2010.

Notes: In this article, we consider the potential effects of anthropogenic disturbances on marine fish species known or suspected to be habitat engineers. The three species of interest inhabit different marine habitats at different life stages, and therefore can have significant influences across the sea floor at broad spatial scales. The primary species include the shallow-water Atlantic goliath grouper (*Epinephelus itajara*), which inhabits mangrove root systems as juveniles, and caves, shipwrecks, and rocky reefs as adults; red grouper (*E. morio*), which excavates habitat throughout its benthic life in Karst regions of the Gulf of Mexico and western Atlantic, from the coast to the shelf-edge; and tilefish (*Lopholatilus chamaeleonticeps*), a species that lives on the continental slope and constructs elaborate, pueblo-esque burrows. The anthropogenic disturbances of greatest interest in the Gulf of Mexico include fishing, hypoxia, red tide, oil and gas exploration, and climatic change. We suggest that

to understand the broader effects of both natural and anthropogenic disturbances on biomass and productivity in these species requires that we first understand the strength of interactions between them and the other species residing within their communities (e.g., predators, prey, commensals, and mutualists).

Scales, H. **Advances in the ecology, biogeography and conservation of seahorses (genus *Hippocampus*)**. *Progress in Physical Geography* 34(5): 443-458, 2010.

Notes: Seahorses (genus *Hippocampus*) form a group of over 30 species of enigmatic and charismatic marine fish that are attracting increasing global concern for their threatened status. Particular issues include the overexploitation of seahorses in target and bycatch fisheries and their utilization for traditional Chinese medicines. Seahorses are also thought to be highly vulnerable to habitat loss and deterioration throughout their circumglobal range in temperate and tropical shallow seas. A suite of unusual biological characteristics, including male pregnancy, has not only stimulated research attention but also contributed to the seahorses' apparently vulnerable nature. Key areas of advancement in recent years, as reviewed here, include the application of genetic tools to confirm the monogamous behaviour of many species both within and between breeding events, to elucidate their challenging taxonomy, to gain insight into their evolution, biogeography and origins, and to identify which species are being traded internationally. Efforts to conserve seahorses have included both 'top-down' and 'bottom-up' approaches, which together have highlighted the need for international regulation of seahorse exploitation and demonstrated that seahorses can stimulate local and regional action in protecting not only seahorses themselves but also a range of threatened habitats in which they live. Updating and extending the global assessment of individual seahorse species on the IUCN Red List of Threatened Species is urgently needed (currently only eight species have been fully assessed), as are a renewed survey of the global seahorse trade and further studies to assess how best to protect seahorses within marine reserves.

Ferretti, F., Worm, B., Britten, G.L., Heithaus, M.R., and Lotze, H.K. **Patterns and ecosystem consequences of shark declines in the ocean**. *Ecology Letters* 13(8): 1055-1071, 2010.

Notes: Whereas many land predators disappeared before their ecological roles were studied, the decline of marine apex predators is still unfolding. Large sharks in particular have experienced rapid declines over the last decades. In this study, we review the documented changes in exploited elasmobranch communities in coastal, demersal, and pelagic habitats, and synthesize the effects of sharks on their prey and wider communities. We show that the high natural diversity and abundance of sharks is vulnerable to even light fishing pressure. The decline of large predatory sharks reduces natural mortality in a range of prey, contributing to changes in abundance, distribution, and behaviour of small elasmobranchs, marine mammals, and sea turtles that have few other predators. Through direct predation and behavioural modifications, top-down effects of sharks have led to cascading changes in some coastal ecosystems. In demersal and pelagic communities, there is increasing evidence of mesopredator release, but cascading effects are more hypothetical. Here, fishing pressure on mesopredators may mask or even reverse some ecosystem effects. In conclusion, large sharks can exert strong top-down forces with the potential to shape marine communities over large spatial and temporal scales. Yet more empirical evidence is needed to test the generality of these effects throughout the ocean.

Simpfendorfer, C.A., Wiley, T.R., and Yeiser, B.G. **Improving conservation planning for an endangered sawfish using data from acoustic telemetry**. *Biological Conservation* 143(6): 1460-1469, 2010.

Notes: Understanding the movement and habitat use patterns of threatened species is essential to effective conservation planning. Modern tracking techniques such as active tracking and passive acoustic monitoring can be useful tools in elucidating this information for aquatic species. To aid in the development of conservation strategies for juvenile critically endangered smalltooth sawfish (*Pristis pectinata*) their fine scale movements and habitat use in southwest Florida were studied using a combination of these techniques. Between 2002 and 2006 a total of 12 individuals were actively tracked for periods of up to 24 h to provide detailed habitat use and movement parameters (distance moved, speed, and linearity). Smaller individuals (<100 cm stretched total length (STL)) had the smallest home ranges, low linearity of movement and had a preference for very shallow mud banks. Juveniles >100 cm STL demonstrated larger home ranges, preference for shallow mud or sand banks, and remained close to mangrove shorelines. Tide was found to be the main factor influencing movement on short time scales.

Sawfish <150 cm STL spend the majority of their time in water <50 cm, while larger juveniles spend most of their time in water 50-100 cm deep. From 2003 to 2007 a total of 22 individuals were fitted with acoustic tags for long-term monitoring. Juveniles >130 cm had high levels of site fidelity for specific nursery areas for periods up to almost 3 months, but the smaller juveniles had relatively short site fidelity to specific locations. The use of a combination of tracking and monitoring techniques provided an expanded range of information by generating both short and long term data on habitat use. The data demonstrated that the conservation of shallow mud and sand banks, and mangrove shorelines will benefit the recovery of these endangered elasmobranchs.

Speed, C.W., Field, I.C., Meekan, M.G., and Bradshaw, C.J.A. **Complexities of coastal shark movements and their implications for management.** *Marine Ecology Progress Series* 408: 275-293, 2010.

Notes: Global declines of shark populations are of concern because of their largely assumed role as moderators of ecosystem function. Without long-term data on movement patterns for many species, it is impossible to infer relative extinction risk, which varies as a function of range, dispersal and habitat specificity and use. The past 50 yr of research on coastal sharks has revealed common movement patterns among species. In the horizontal plane, measured home range size generally increases with body size. We demonstrate meta-analytically the effects of increasing body size and monitoring time on home range size. Changes in the extent of horizontal movement might arise from ontogeny, predator avoidance or environmental tolerances. In the vertical plane, movement patterns include oscillatory vertical displacement, surface swimming, diel vertical migration and swimming at depth. These vertical movements are often attributed to foraging or navigation, but have been quantified less than horizontal patterns. Habitat specificity is often correlated with environmental conditions such as depth, salinity, substratum, and in some cases, prey availability. Site fidelity is common in species that use nursery areas. However, fidelity to mating, pupping, feeding and natal sites has only been observed in a few species. To date, few studies have examined habitat partitioning, although some general patterns have emerged: habitats appear to be subdivided by benthos type, prey availability and depth. The conservation of coastal sharks can be facilitated in some cases by the use of marine protected areas, especially for coastal resident species using specific nursery, reproduction or feeding areas. Partial protected-area closures might be effective during aggregation or migration periods to protect older size classes, but these must be applied with other management strategies such as reduced fishing and size or bag limits to protect individuals throughout different life history phases. More long-term research on habitat use, migration patterns and habitat partitioning is essential for developing successful management initiatives for coastal shark populations.

Ward-Paige, C.A., Mora, C., Lotze, H.K., Pattengill-Semmens, C., McClenachan, L., Arias-Castro, E., and Myers, R.A. **Large-scale absence of sharks on reefs in the greater-Caribbean: A footprint of human pressures.** *PLoS ONE* 5(8): art. e11968, 2010. [O/A](#)

Notes: *Background* In recent decades, large pelagic and coastal shark populations have declined dramatically with increased fishing; however, the status of sharks in other systems such as coral reefs remains largely unassessed despite a long history of exploitation. Here we explore the contemporary distribution and sighting frequency of sharks on reefs in the greater-Caribbean and assess the possible role of human pressures on observed patterns. *Methodology/Principal Findings* We analyzed 76,340 underwater surveys carried out by trained volunteer divers between 1993 and 2008. Surveys were grouped within one km² cells, which allowed us to determine the contemporary geographical distribution and sighting frequency of sharks. Sighting frequency was calculated as the ratio of surveys with sharks to the total number of surveys in each cell. We compared sighting frequency to the number of people in the cell vicinity and used population viability analyses to assess the effects of exploitation on population trends. Sharks, with the exception of nurse sharks occurred mainly in areas with very low human population or strong fishing regulations and marine conservation. Population viability analysis suggests that exploitation alone could explain the large-scale absence; however, this pattern is likely to be exacerbated by additional anthropogenic stressors, such as pollution and habitat degradation, that also correlate with human population. *Conclusions/Significance* Human pressures in coastal zones have lead to the broad-scale absence of sharks on reefs in the greater-Caribbean. Preventing further loss of sharks requires urgent management measures to curb fishing mortality and to mitigate other anthropogenic stressors to protect sites where sharks still exist. The fact that sharks still occur in some densely populated areas where strong fishing regulations are in place indicates the possibility of success and encourages the implementation of conservation measures.

Aarestrup, K., Thorstad, E.B., Koed, A., Svendsen, J.C., Jepsen, N., Pedersen, M.I., and Okland, F. **Survival and progression rates of large European silver eel *Anguilla anguilla* in late freshwater and early marine phases.** *Aquatic Biology* 9(3): 263-270, 2010. O/A

Notes: The population of European silver eel *Anguilla anguilla* has declined tremendously in the last decades. The cause of this decline is unknown, and it is necessary to investigate the migratory behaviour and survival rates of silver eels during the reproductive migration in order to understand if the decline is related to factors acting during that migration. We estimated survival and progression rates of European silver eel migrating in the lower part of the River Gudena and during the first phase of the marine migration in the Randers Fjord in Denmark. Fifty migrating silver eel (total body length: 56 to 84 cm) were captured, and each was equipped with an acoustic transmitter. Their migration was subsequently monitored using an array of automatic listening stations, and progression rate and mortality in the river, inner part of the fjord and outer part of the fjord were estimated. Survival was high in fresh water. However, 60% of eels were lost in the inner and outer fjord, supporting the hypothesis that mortality is large in the early phase of the marine migration and that fishing may be a major cause of mortality of silver eels. There was no indication that the slowest-migrating individuals were more prone to fishing mortality than the faster-migrating individuals. Progression rate increased as the eels proceeded downriver and out of the fjord. The migration was predominantly nocturnal, both in the river and fjord. Based on the available evidence, a considerable increase in eel survival in the river-fjord system will be needed in order to fulfil the goals in the European Union recovery plan for eels.

de Lafontaine, Y., Gagnon, P., and Cote, B. **Abundance and individual size of American eel (*Anguilla rostrata*) in the St. Lawrence River over the past four decades.** *Hydrobiologia* 647(1): 185-198, 2010.

Notes: Changes in abundance indicators and the mean size of American eel (*Anguilla rostrata* LeSueur) in the lower St. Lawrence River (SLR) over the past 40 years were assessed to determine the chronology of the species decline and the possible effect of hydroclimatic factors on that trend. Daily catches at commercial weirs and at an experimental fishery were used to model the long-term trend in silver eel availability. Eel landings started declining in the mid-1980s; whereas the modelled catch-per-unit-effort (CPUE) index shows a monotonic declining trend since the late 1960s. Landings and CPUEs were not strongly correlated, and landings cannot be a valid proxy for silver eel abundance in the SLR. Variations in summer river discharge contributed to interannual fluctuations in CPUE by affecting eel availability to the fishing gears. No relationship was found between CPUE and the North Atlantic Oscillation index of climatic variability. Correlations between hydroclimatic variables lagged by 1-20 years and CPUE indices revealed no measurable effect of riverine hydroclimatic variability on eel recruitment. The average size of silver eels increased by 30% between 1997 and 2007, as a result of poor recruitment during the mid-1980s. Since the onset of the silver eel decline preceded the major decline in recruitment in the mid-1980s, we suggest that the decline in spawning stock size was not due to poor recruitment but rather to large-scale mortality factors associated with high exploitation in upstream Lake Ontario and to construction of hydropower dams in the late 1950s.

de Boer, J., Dao, Q.T., van Leeuwen, S.P.J., Kotterman, M.J.J., and Schobben, J.H.M. **Thirty year monitoring of PCBs, organochlorine pesticides and tetrabromodiphenylether in eel from The Netherlands.** *Environmental Pollution* 158(5): 1228-1236, 2010.

Notes: Because of their excellent properties as a biomonitor, yellow eels (*Anguilla anguilla*) have been used for time-trend monitoring of polychlorinated biphenyls (PCBs), organochlorine pesticides (OCPs) and tetrabrominated diphenylether (tetra-BDE). The program has now lasted for thirty years and has delivered valuable information on trends and spatial differences of these compounds in the delta of the rivers Rhine and Meuse and other Dutch canals, rivers and lakes. Specific local PCB, HCH and dieldrin contaminations were identified. Temporal trends show a slow decrease of PCB concentrations since 1977. Eels from the rivers Rhine and Meuse still exceed present European maximum residue limits for dioxin-like PCBs. Apart from some exceptions, OCP and tetra-BDE concentrations have also decreased, and more than those of PCBs. Fat contents of eel have decreased from an average of 21 to ca. 13%. This decrease in fat contents, coincides with the strong reduction of the European eel stock.

McHugh, B., Poole, R., Corcoran, J., Anninou, P., Boyle, B., Joyce, E., Foley, M.B., and McGovern, E. **The occurrence of persistent chlorinated and brominated organic contaminants in the European eel (*Anguilla anguilla*) in Irish waters.** *Chemosphere* 79(3): 305-313, 2010.

Notes: The European eel (*Anguilla anguilla*) is a relatively high lipid, long lived species capable of living in a variety of brackish, fresh and marine habitats. As such, eels can accumulate organic pollutants and have been incorporated into environmental monitoring programs as a suitable "bioindicator" species for the determination of the levels of organic contaminants within different water bodies. The global eel stock is now in decline and while the cause of the collapse remains unidentified, it is likely to include a combination of anthropogenic mortality in addition to environmental degradation. This study provides valuable data on a range of contaminants (PCDD/Fs, PCBs, OCPs, PBDEs, HBCD, TBBPA and PBBs) and extractable lipid levels in eel muscle tissue collected from five Irish catchments. Extractable lipid levels were lower in the yellow eels compared to those in the silver eels. These levels were similar to those reported elsewhere and it has been posited that a decline in the lipid content in yellow eels may have consequences for the future viability of the stock. With the exception of higher substituted dioxins (especially OCDD), in three samples collected from one catchment (Burrishoole) in the West of Ireland. POP levels in general were determined to be low in eels from Irish waters compared to those in other countries.

Gravato, C., Guimaraes, L., Santos, J., Faria, M., Alves, A., and Guilhermino, L. **Comparative study about the effects of pollution on glass and yellow eels (*Anguilla anguilla*) from the estuaries of Minho, Lima and Douro Rivers (NW Portugal).** *Ecotoxicology and Environmental Safety* 73(4): 524-533, 2010.

Notes: The health status of eels (*Anguilla anguilla*) developing in three estuaries of the NW Portuguese coast with different types and levels of pollution was compared in relation to morphometric parameters, Fulton condition index (F index) and several biomarkers. Relatively to the reference population, glass eels from the Lima estuary had lower weight and length, cholinesterase (ChE) and lactate dehydrogenase (LDH) inhibition, and lower levels of some anti-oxidant parameters, while yellow eels also showed a decreased F index, and increased Na⁺/K⁺-ATPase and lipid peroxidation (LPO) levels. Relatively to the reference population, glass eels from the Douro estuary had increased Na⁺/K⁺-ATPase and glutathione-S-transferase activities and LDH inhibition, while yellow eels also had ChE inhibition and increased LPO. Overall, these results indicate that eels from polluted estuaries showed a poor health status than those from a reference estuary, and that adverse effects become more pronounced after spending several years in polluted estuaries.

Velez-Espino, L.A. and Koops, M.A. **A synthesis of the ecological processes influencing variation in life history and movement patterns of American eel: towards a global assessment.** *Reviews in Fish Biology and Fisheries* 20(2): 163-186, 2010.

Notes: American eel, *Anguilla rostrata*, is a catadromous fish that spawns in the Sargasso Sea and migrates to coastal waters and freshwater systems ranging from Greenland down the Atlantic coast to South America and has been regarded as comprising a panmictic population. American eel is in decline across much of its range. Research and management is primarily conducted at local to regional scales, yielding inconsistent research results and management recommendations that may be inhibited by large-scale processes. We review the research on American eel ecology demonstrating that its variable life history and movement patterns can be explained based on: (1) latitudinal productivity gradients; (2) ideal free habitat selection; (3) conditional evolutionarily stable life history strategies; (4) size at arrival to the coast (correlated with distance from the spawning grounds); and, (5) temperature variance and annual degree-day effects on somatic growth. Using these ecological processes, we outline how local and large-scale effects on American eel dynamics can be integrated in a panmictic (or quasi-panmictic) modelling framework to enable defensible predictions of population responses to anthropogenic and oceanic phenomena. Due to its widespread distribution and existing knowledge gaps, the conservation and management of American eel will require international cooperation.

Jaric, I., Ebenhard, T., and Lenhardt, M. **Population viability analysis of the Danube sturgeon populations in a Vortex simulation model.** *Reviews in Fish Biology and Fisheries* 20(2): 219-237, 2010.

Notes: Populations of six sturgeon species in the Danube River (beluga, Russian sturgeon, stellate sturgeon, sterlet, ship sturgeon and Atlantic sturgeon) have experienced severe decline during the last several decades, mostly due to the unsustainable fishery, river fragmentation and water pollution. Present lack of knowledge on basic sturgeon demography, life history and relative effects of different negative factors is further hindering implementation of efficient policy and management measures. In the present study, population viability analysis in a Vortex simulation model has been conducted in order to assess the state of the six Danube sturgeon species, their future risk of extinction and to determine the most suitable conservation and management measures. Population viability analysis has revealed a large sensitivity of the Danube sturgeon populations to changes in the natural mortality, fecundity, age at maturity and spawning frequency. It was also confirmed that the sturgeons are highly susceptible to even moderate levels of commercial fishery, and that their recovery is a multi-decadal affair. Stocking with adult individuals was shown to produce considerably greater effect on population persistence than stocking with juveniles, but the latter approach is probably still preferable since it avoids many inherent problems of aquaculture cultivation. This study represents the first population viability analysis of the Danube sturgeons.

Campana, S.E., Joyce, W., and Fowler, M. **Subtropical pupping ground for a cold-water shark.** *Canadian Journal of Fisheries and Aquatic Sciences* 67(5): 769-773, 2010.

Notes: Porbeagle sharks (*Lamna nasus*) are large pelagic sharks apparently restricted to the cold temperate waters of the northern and southern hemispheres. Despite considerable knowledge of their biology, their pupping (birthing) grounds have never been identified. Pop-up archival transmission tags applied to 21 sharks off eastern Canada indicated that males and immature sharks of both sexes remained primarily on the continental shelf for periods of up to 348 days after tagging. However, mature female porbeagles migrated up to 2356 km through the winter, at depths down to 1360 m beneath the Gulf Stream, to a subtropical pupping ground in the Sargasso Sea. In addition to this pupping ground being well south of their documented range, the placement of such a key life history stage in international, largely unregulated waters poses problems for the conservation and management of a species that is largely fished in Canadian waters.

Galuardi, B., Royer, F., Golet, W., Logan, J., Neilson, J., and Lutcavage, M. **Complex migration routes of Atlantic bluefin tuna (*Thunnus thynnus*) question current population structure paradigm.** *Canadian Journal of Fisheries and Aquatic Sciences* 67(6): 966-976, 2010.

Notes: Movements of Atlantic bluefin tuna (*Thunnus thynnus*, ABFT) from specific western Atlantic forage grounds are not well described, and the extent of their spawning areas is mainly surmised. In 2005 and 2006, we deployed 41 pop-up satellite archival tags (PSATs) on adult Atlantic bluefin tuna off the coast of Nova Scotia, Canada, and on Georges Bank. During the assumed spawning period, 56% of the tagged ABFT occupied a known spawning area, while 44% were located in distant oceanic regions. Assuming obligate annual spawning, these results are inconsistent with the notion of spawning site fidelity to the Gulf of Mexico. The ocean-wide migrations of adult ABFT tagged on a common forage ground suggest evidence of a metapopulation requiring more spatially explicit management than the current simple two-stock structure.

Perry, A.L., Lunn, K.E., and Vincent, A.C.J. **Fisheries, large-scale trade, and conservation of seahorses in Malaysia and Thailand.** *Aquatic Conservation: Marine and Freshwater Ecosystems* 20(4): 464-475, 2010.

Notes: 1. All seahorse species (genus *Hippocampus*) are listed under CITES Appendix II, requiring that exports of these fishes must be regulated for sustainability. Preliminary trade surveys and anecdotal reports suggested Malaysia and Thailand represented an important source for seahorses used globally in traditional medicine, curios, and aquarium display, but few historic trade or fisheries data are available. Baseline information about pre-CITES catch and trade is essential for managing seahorse fisheries and trade under CITES, and for understanding present-day effects of CITES regulation on the seahorse

trade. 2. In 1998-1999, seahorse fisheries and trade in both countries were assessed by interviewing participants at many levels of the trade and corroborating those surveys with official trade documents. 3. Seahorses were found to be landed primarily as trawl bycatch. Malaysia's catch of 2900 kg year⁻¹ was less than the estimated domestic consumption (5500-6000 kg year⁻¹), whereas Thailand's catch of 6600 kg year⁻¹ apparently far exceeded domestic consumption (~520 kg year⁻¹). 4. Both countries imported seahorses from and exported to other Asian nations. Import statistics from Hong Kong SAR and Taiwan recorded maximum annual trade from Malaysia at 1280 kg year⁻¹. Trade surveys indicated that Thailand exported at least 5000 kg annually (similar to the estimation of catch), but national Customs records reported 10 500 kg year⁻¹ in exports, supported by official import records from Hong Kong SAR and Taiwan which indicated that Thailand was the source of up to 11 400 kg year⁻¹. 5. Fishers and traders in both countries reported decreasing availability of seahorses, raising conservation concerns. These apparent declines, in combination with substantial domestic consumption, point towards the challenges that Malaysia and Thailand face in establishing sustainable levels of exports under CITES.

Graham, N.A.J., Spalding, M.D., and Sheppard, C.R.C. **Reef shark declines in remote atolls highlight the need for multi-faceted conservation action.** *Aquatic Conservation: Marine and Freshwater Ecosystems* 20(5): 543-548, 2010.

Notes: 1. The decline of large-bodied predatory species in the oceans is a concern both from a sustainability perspective and because such species can have important ecological roles. Sharks are particularly vulnerable to fishing as their life histories are characterized by late age at maturity, large body size, and low fecundity. 2. Substantial shark population declines have been documented for a number of coastal and pelagic systems, with high population abundance limited to a few remote locations. The relative abundance and composition of reef shark populations are assessed from 1975 to 2006 at a remote, largely uninhabited, group of atolls in the central Indian Ocean; the Chagos Archipelago. 3. Number of sharks observed per scientific dive declined from a mean of 4.2 in the 1970s to 0.4 in 2006, representing a decline of over 90%. Silvertip sharks displayed an increase in abundance from 1996, whereas blacktip and whitetip reef sharks were rarely encountered in 2006. 4. Poaching in the archipelago, is the most likely cause of these declines, highlighted by a number of illegal vessels containing large numbers of sharks arrested since 1996. The data highlight that shark populations, even in remote, otherwise pristine, marine areas, are vulnerable to distant fishing fleets, and a range of strategies will need to be used in concert for their conservation.

White, W.T. and Kyne, P.M. **The status of chondrichthyan conservation in the Indo-Australasian region.** *Journal of Fish Biology* 76(9): 2090-2117, 2010.

Notes: The status of chondrichthyan (sharks, batoids and chimaeras) conservation in the Indo-Australasian region is examined, and issues relevant to the conservation of this fauna at the subregional level [Australia, Indonesia (excluding West Papua), New Guinea (West Papua and Papua New Guinea), New Caledonia and New Zealand] are discussed. According to the 2009 IUCN Red List of Threatened Species, c. 21% of Indo-Australasian chondrichthyans are classified as threatened (critically endangered, endangered and vulnerable) and c. 40% are of conservation concern (threatened and near threatened). The proportion of threatened species is highest in New Guinea (c. 39%) and Indonesia (c. 35%) and least in New Zealand (c. 11%). In New Guinea, three quarters of the species are of conservation concern; in Indonesia, nearly two thirds are of conservation concern. Within the region, the proportion of threatened batoids (c. 29%) is higher than threatened sharks (c. 17%), while there are no threatened chimaeras. Conservation status is discussed at the order (for sharks), suborder (for batoids) and family level. Issues relating to the conservation status of chondrichthyans vary greatly between each subregion, but they mostly relate to targeted or incidental capture in fisheries. A handful of sharks and batoids are protected within Australian waters, while one species is protected in New Zealand. Both Australia and New Zealand have developed National Plans of Action for the Conservation and Management of Sharks (NPOA-Sharks), but these are lacking elsewhere. Development and implementation of NPOA-Sharks are a priority in order to drive the conservation of the regional fauna. Sustainable fisheries management (including by-catch), confronting the challenge of illegal, unreported and unregulated fishing, species protection where appropriate and marine protected areas (MPA) are all likely to prove vital in ensuring the long-term conservation of Indo-Australasian sharks, batoids and chimaeras.

Chong, V.C., Lee, P.K.Y., and Lau, C.M. **Diversity, extinction risk and conservation of Malaysian fishes.** *Journal of Fish Biology* 76(9): 2009-2066, 2010.

Notes: A total of 1951 species of freshwater and marine fishes belonging to 704 genera and 186 families are recorded in Malaysia. Almost half (48%) are currently threatened to some degree, while nearly one third (27%) mostly from the marine and coral habitats require urgent scientific studies to evaluate their status. Freshwater habitats encompass the highest percentage of threatened fish species (87%) followed by estuarine habitats (66%). Of the 32 species of highly threatened (HT) species, 16 are freshwater and 16 are largely marine-euryhaline species. Fish extinctions in Malaysia are confined to two freshwater species, but both freshwater and marine species are being increasingly threatened by largely habitat loss or modification (76%), overfishing (27%) and by-catch (23%). The most important threat to freshwater fishes is habitat modification and overfishing, while 35 species are threatened due to their endemism. Brackish-water, euryhaline and marine fishes are threatened mainly by overfishing, by-catch and habitat modification. Sedimentation (pollution) additionally threatens coral-reef fishes. The study provides recommendations to governments, fish managers, scientists and stakeholders to address the increasing and unabated extinction risks faced by the Malaysian fish fauna.

Sadovy de Mitcheson, Y., Liu, M., and Suharti, S. **Gonadal development in a giant threatened reef fish, the humphead wrasse *Cheilinus undulatus*, and its relationship to international trade.** *Journal of Fish Biology* 77(3): 706-718, 2010.

Notes: An opportunity arose to obtain humphead wrasse *Cheilinus undulatus* specimens between 2006 and 2009 from Indonesia, the major source and exporting country of this species, making study on its early gonad development possible for the first time. Protogynous hermaphroditism, previously proposed for this species, was confirmed in this study. Based on histological examination of 178 specimens, mainly <500 mm total length (L_T) and ranging from 208 to 1290 mm L_T (119.1 g to 43.0 kg whole body mass), the minimum body sizes for female and male sexual maturation were determined to be 650 and 845 mm L_T , respectively. Primary male development through juvenile sexual differentiation was not detected. A unique blind pouch, with a possible sperm storage function and associated with the testis, was reported for the first time in the Labridae. In Hong Kong retail markets, the global trading centre for this valuable species, live *C. undulatus* on sale for food were dominated by body sizes <500 mm L_T between 1995 and 2009, reflecting an international trade largely focused on juveniles. In consideration of these findings, and given the threatened status of this species, management for *C. undulatus* capture and trade nationally and internationally are discussed with recommendations for ensuring sufficient spawning biomass in exploited populations and for sustainable trade.
