Chapter 36A. North Atlantic Ocean

Writing team: Jake Rice (Convenor and Co-Lead member), Christos Arvanitidis, Laura Boicenco, Panagiotis Kasapidis, Robin Mahon, Thomas Malone, William Montevecchi, Marta Coll Monton, Fabio Moretzsohn, Patrick Ouellet, Hazel Oxenford, Tim Smith, John Wes Tunnell, Jan Vanaverbeke, Saskia Van Gaever (Co-Lead member)

1. Introduction

The North Atlantic is characterized by relatively wide continental shelves, particularly in its northerly portions, with steep slopes to the abyssal plain[1]. The width of the shelf decreases towards the south, with typical boundary current systems, characterized by strong seasonal upwelling, off the Iberian Peninsula and northwest Africa. Two chains of volcanic islands, the Azores and the Canaries, are located in the east central North Atlantic, and a large number of islands of volcanic origin, many with associated warm water coral reefs, are found in the southwest portion of the North Atlantic. In the far north of the region is the world's largest island, Greenland, primarily of Precambrian origin, whereas Iceland and the Faroe Islands are of more recent volcanic origin. All have rugged coastlines with rich faunas.

The biota of the North Atlantic is strongly influenced by both the warm Gulf Stream flowing north-eastward from the Gulf of Mexico and the Caribbean to northwest Europe, and the cold, fresh Labrador Current flowing south from the Canadian Archipelago and Greenland to the northeast coast of the United States. Major oceanographic and associated biotic regime shifts have been documented in the North Atlantic, but not with the frequency or scale of the North Pacific.

Around the coasts of the North Atlantic are a number of semi-enclosed seas. These seas have distinct oceanographic and bath

this trend, the mean size of copepods decreased as their species diversity increased and SST increased (Beaugrand et al., 2010).

The primary pressures responsible for regime shifts in shelf ecosystems are overfishing and climate-driven changes (hydro-

McQuatters-Gollop et al., 2007). Mean phytoplankton chlorophyll levels peaked in 1989 (Reid et al., 1998), and the new regime (1990 - 2003) maintained 13 per cent and 21 per cent higher chlorophyll concentrations in open and coastal waters, respectively (McQuatters-Gollop et al., 2007). The regime shift was also marked by increases in the abundance and diversity of dinoflagellates relative to diatoms, decreases in the abundance of spp. (e.g.,), increases in diversity and abundance of warm water calanoid copepod species (e.g., of Finland. These species appear to have been introduced via ballast water. The Pacific diatom was transported into the Labrador Sea via the Canadian Arctic Archipelago in the late 1990s. It has since spread south to Georges Bank and further east, south of Iceland. The geographic expansion of this species portends of more trans-Arctic invasions from the Pacific Ocean as climate-driven Arctic ice melt continues.

2010), and the European Network of Excellence MarBEF (2004-2009). MarBEF was highly successful in compiling data on coastal benthos of the North-East Atlantic, and CoML captured many data of the deeper parts of the Atlantic in general.

Within MarBEF, a large database (MacroBen), consisting of more than 460,000 distribution records on the distribution of 7,203 taxa from almost 23,000 stations was compiled (Gage et al., 2004; Vanden Berghe et al., 2009). Data were collected between 1972-2005 in the North-East Atlantic and adjacent semi-

Council, 2001), with the longest-lasting impacts on hard-bodied biogenic structures, such as corals and glass

disrupting native fish communities (Whitfield et al., 2007; Muñoz et al., 2011). Such changes would, in turn, have consequences much wider than the local scale of the impacts, given the important role of coastal systems as nursery habitats (Beck et al., 2001; Persson et al., 2012).

Consequently, even if the overall trends in coastal fish communities cannot be quantified on the scale of the North Atlantic, the impacts of many pressures on these communities have been documented, as have the effects of larger-scale oceanographic and climatic drivers. With the increase in intensity of human activities causing many of these pressures (Sections IV and V) and a background of a changing ocean climate, there is ample justification for attention to the conservation of these systems. The evidence also indicates that appropriate management regimes need to be designed and implemented on local scales, to accommodate local communities and pressures, even if the overarching policies are developed at larger scales (sensu FAO Ecosystem Approach to Fishing (Staples and Funge-Smith, 2009)).

A few studies have reconstructed fish communities and their variation over centuries into the past, albeit usually for just a few selected species and using catch records, sediment layers, or middens for local areas. These studies have consistently shown major changes in the composition of the fish community over the full time series, sometimes in regime-like ways. Likely impacts of overfishing were already evident early in the second half of the previous millennium (Mackenzie et al., 2007; Poulsen et al., 2007), but changes to the fish community associated with warmer and cooler periods of the North Atlantic are documented for the last several centuries (Enghof et al., 2007).

The current status of shelf fish stocks is best evaluated by the assessments done by the major fisheries management authorities around the North Atlantic. When data are sufficient, assessments provide estimates of fishing mortality and biomass, and interpret these relative to sustainability benchmarks. The biomass benchmarks reflecting that a stock is not overfished vary among jurisdictions and often are based on data series that do not extend back to a time when the stocks were unexploited (Lotze and Worm, 2009; Greenstreet et al., 2012). Nevertheless, Table 36A.4 presents the evaluations for most of the major assessment jurisdictions. The general messages are clear: many stocks are overfished and/or experiencing current overfishing, based on their current status relative to their management benchmarks, and the status of a number of other exploited stocks is not known. However, that only reflects part of the picture. For a large fraction of these stocks, the severe overfishing occurred in the 1990s and 2000s, and their status is improving. The improvement is consistently attributed to reductions in fishing effort (ICES and NOAA websites).

Of course the status of exploited stocks is only part of the fish diversity of the North Atlantic shelf systems. Many studies have analysed trends in the properties of fish communities, but these studies have varied greatly in the time intervals used, the parts of the North Atlantic examined, the metrics of community status quantified, and the species included in the metrics. Given that the results of community analyses are scale-dependent (e.g., Gaertner et al., 2007), metrics are often partially redundant but not interchangeable (e.g., Greenstreet et al., 2012), and both fishing pressure and

Bringing together the results of studies that look at how environmental drivers and fisheries have affected North Atlantic fish communities, the key messages include:

The overall picture here indicates that surface-feeders (storm-petrels, gulls, terns) drive the negative NAFO trend, and diving auks (Dovekie , Thick-billed Murre , Common Murre) in Iceland drive the negative ICES trend, with the ICES decrease being six times greater than that reported for NAFO.

Within regional trends considerable variation is observed (Table 36A.6), with different areas exhibiting increasing trends (E Baffin Island, Newfoundland/Labrador, E Canada + US, Faroes) or decreasing trends (W Greenland, Gulf of St. Lawrence, Caribbean, E Greenland, Iceland, Norwegian and North Seas).

The negative trend in the NAFO Region is driven by surface-feeding species (gulls, terns, petrels) that are decreasing in eastern Canada (Cotter et al., 2012) and in the Caribbean (Bradley and Norton, 2009). The decline is also driven by an inferred decreasing trend in a diving planktivore (Dovekie) in Western Greenland based on North American Christmas Bird Counts (BirdLife International, 2014). Otherwise, divers are increasing in all regions, with the exception of the Caribbean, where a small population of Brown Pelicans ( ) is declining (Bradley and Norton, 2009). Decreasing trends in surface-feeders and increasing trends in diving species are associated with fisheries closures in eastern Canada and the concurrent cessation of discards and gill-net removals (Bicknell et al., 2013; Regular et al., 2013). Surface-feeders are vulnerable to sea-surface temperature perturbations (Schreiber and Schreiber, 1984) and long-line fishing (Zydelis et al., 2009). Some ocean regions, notably the Gulf of Mexico, are data-deficient.

The decreasing trend in the ICES Regions is overridden by the uncertain negative Icelandic estimates. Positive trends are reported for the Faroes Island (Denmark)/Western United Kingdom and for the Barents Sea (which is excluded from consideration as it is in the Ar-r ylhe Ar-(t)-4(h 0 4(e) is)(re)--0.001 Tw [(in)-4( )]TJ0.003 Tw 0.10d S8d[(t)6(

TDcre(nd/A1(s)i)6g(l(tre)-1(y)4()6)-11mae Bn. m.9(me)9e4(g)12( )10(n9e)-1(y)(c)4((t)-4(h)6(e))9( )]TJr.9(d

7. Specific areas of the North Atlantic

The predominance of semi-enclosed seas with characteristic biota around the North Atlantic, particularly the more southern and central portions of the region, and the concentration of human pressures around these seas, result in many important trends in biodiversity being observed most clearly at the scale of these seas. Hence this chapter includes brief summaries of the main patterns of and pressures on biodiversity for a number of these regional seas.

The Black Sea is a very deep inland sea with an area of 432,000 km². The thin upper layer of marine water (up to 150 m) supports the unique biological life in the Black Sea ecosystem. The deeper and more dense water layers are saturated with hydrogen sulphide, that over thousands years, accumulated from decaying organic matter in the Black Sea. Due to the unique geomorphological structure and specific hydrochemical conditions, specific organisms, basically on the level of protozoa, bacteria, and some multi-cellular invertebrates inhabit the deep-sea waters. Knowledge about biological forms of life in the deep waters of the Black Sea is very limited. The disturbance of the natural balance between the two layers could trigger irreversible damage to the people and ecosystem of the Black Sea[6].

The recently published evidence raises the number of species, including supra-specific taxa, inhabiting the Black Sea to 5,000 (Gomoiu, 2012).

The distribution diagram of different physiological types of species from the Black Sea fauna shows the coexistence of four categories of species, according to a salinity gradient: (1) marine species, (2) freshwater species, (3) brackish water species, and (4) Ponto-Caspian relic species (Skolka and Gomoiu, 2004). The Black Sea biota consist of 80 per cent of Atlantic-Mediterranean origin species, and 10.4 per cent and 9.6 per cent of species of freshwater and Ponto-Caspian origin, respectively (Shiganova and Ozturk, 2010). The eastern sector is one of the biologically richest regions on Earth and is recognized as a biodiversity hotspot, along with other parts of the Caucasus Biodiversity Hotspot Region (Kazanci et al., 2011).

Genetic studies confirm the recent origin of many Black Sea marine taxa from the Mediterranean. The majority of these taxa most probably entered the Black Sea through the Marmara Sea and the Straits linking the Black Sea and the Marmara Sea after the last glacial maximum, when a connection between the Mediterranean and the Black Sea was re-established (Ryan et al., 1997). For this reason, these Black Sea populations are genetically similar to the Mediterranean ones, although in some cases they have already diverged, implying reduced genetic connectivity (e.g., Durand et al., 2013). There are also cases of Black Sea taxa, such as the copepod , to which the species

---

[6] http://www.blacksea-commission.org/_geography.asp

richness of total, endemic and threatened coastal fish assemblages, as well as their functional and phylogenetic diversity, have been mapped and described as spatially mismatched between regions of the Mediterranean Sea (Mouillot et al., 2011).

The Mediterranean Sea is also diverse in terms of habitats and ecosystem types, due to its unique biogeography (Bianchi et al., 2012). Although empirical data are insufficient to have a full representation of habitat types (Danovaro et al., 2010; Levin et al., in press) and are only fully available for some coastal habitats (Giakoumi et al., 2013), a series of surrogates or modelling techniques are used to characterize marine habitats in the whole Mediterranean basin (Micheli et al., 2013; Martin et al., 2014).

Temporal trends have indicated that overexploitation of some fish and macro-invertebrates and habitat loss have been the main human driver

The Baltic Sea phytoplankton community is a diverse mixture of microscopic algae representing several taxonomic groups, with more than 1,700 species recorded. The species composition of the phytoplankton depends on local nutrients and salinity levels and changes gradually from the southwest to the northeast. Primary production exhibits large seasonal and interannual variability (Helcom, 2002). In the southern and western parts, the spring bloom is dominated by diatoms, and by dinoflagellates in the central and northern parts (Helcom, 2002, 2009a).

Cyanobacteria are a natural component of the phytoplankton community in most parts of the Baltic Sea area. They usually dominate in summer in the coastal and open areas of most sub-basins of the Baltic Sea, with the exception of the Belt Sea and the Kattegat. Cyanobacterial blooms in the Baltic P the Baltic [0(e)3(sn)-4(ty14(c)8(o)2(m)o)12(f -tici22 Tdh(ba)4(

, the whiting , and the saithe ; the main flatfish species are the common dab , the plaice , the long rough dab

associations between the abundance of some small copepod species, the young stages of larger species and feeding by young fish. In the Gulf, all copepods seem to have increased around 2005, but the abundance of the key species has been below average since 2009 (DFO, 2013). Although there are important uncertainties about total biomass and trend, high concentrations of krill (Euphausiids) are found at specific sites and large numbers of blue whales from the Northwest Atlantic population migrate to the Gulf to feed (Gagné et al., 2013). At least 12 species of whales migrate to the Gulf every year, which makes the Gulf (and the EseaaM4(p)-10(e)6.44 0 T4(i)4(s.25 0 Td[(,) 0 Td(,) The Chesapeake Bay estuarine system[7] supports more than 3,000 species of plants and animals (Table 36A.7). A subset of species has been identified as being [8] (Table 36A.8), based on their importance in (1) regulating the flow of carbon through the food web, (2) providing habitat, and/or (3) supporting ecosystem services (Baird and Ulanowicz, 1989; Costanza et al., 1997;

tidal marshes support high species diversity (Heck and Orth, 1980; Orth et al., 1985; Newell, 1988; Chambers et al., 1999; Coen et al., 1999; Jackson et al., 2001; Wyda et al., 2002; USACE, 2009; Philine et al., 2012). During the course of the twentieth century, the spatial extent of these habitats declined significantly: oyster reefs by 92 per cent (USACE, 2009; Wilberg et al., 2011), submerged vascular plants by 65 per cent (Kemp et al., 1983, 2005; Orth and Moore, 1983, 1984) and marshes by 60 per cent.[14]

Sea level rise is expected to result in even greater losses of marshes, putting hundreds of species of fish, invertebrates and birds at risk (Titus and Strange, 2008), and estuarine acidification poses a significant threat to oyster restoration efforts in the Bay (USACE, 2009; Waldbusser et al., 2011; Sanford et al., 2014). Loss of these habitats exacerbates the impacts of overfishing and is one of the main pressures on species richness, often leading to species extirpation (Orth and Moore, 1983, 1984; Ruiz et al., 1993;

pressures, all of the estuaries of the Virginian Province[18] (Hale et al., 2002) are likely to exhibit similar trends in their capacity to support species diversity.

The Caribbean is the most biologically diverse area of the Atlantic Ocean, hosting approximately 10 per cent of the world's coral reefs, including the Mesoamerican Barrier Reef System; extensive coastal mangroves and shallow banks with seagrass communities; as well as sandy beaches, rocky shores and many bays, lagoons and brackish estuaries. The Caribbean also has open-ocean and lesser-known deep-sea environments, and has been listed as a global-scale hotspot of marine biodiversity (Roberts et al., 2002).

The Caribbean Sea receives primarily oligotrophic, high-salinity North Atlantic water from the North Equatorial Current, but it also receives South Atlantic water entrained in North Brazil Current rings which transport water from the Amazon into the Caribbean basin via the Guiana Current (Cowen et al., 2003). The persistent through-flow of the warm Caribbean Current is modulated by a highly complex and variable pattern of mesoscale eddies (Lin et al., 2012) and upwelling along the South American coastline. Two significant South American rivers, the Orinoco and the Magdalena, also discharge directly into the southern Caribbean. The considerable spatial heterogeneity of physical environments and habitats across the Caribbean Sea influences the distribution, population connectivity and biodiversity of marine organisms found there. Several significant barriers to gene flow in Caribbean reef populations have been recognized (Cowen et al., 2006). This has led to relatively high levels of endemism. Miloslavich et al. (2010) estimate a value of 25.6 per cent regional endemism across 21 of 78 marine taxa examined in the Caribbean, with values ranging from 45 per cent for fish, 26 per cent for molluscs and 2 per cent for copepods. They also summarize the diversity, distribution and key threats to marine biota in the Caribbean and conclude that the 12,046 species currently reported is a gross underestimation, considering that the marine biota is far from well known in this area.

Seagrass communities occur throughout the Caribbean and support a high diversity of epiphytic and other species (van Tussenbroek et al., 2010). Seven native seagrass species are known from the region; two (and) are considered to be near-threatened and vulnerable, respectively. A recently introduced species, , is spreading rapidly through the Lesser Antilles (Willette et al., Biologically, the shallow waters of the northern Gulf are warm-temperate (Carolinian areas and are taken only by recreational fishers, sometimes under strict regulations (Tunnell et al., 2007).

The Gulf-wide bottlenose dolphin ( ) is probably the single most recognizable Gulf species by the public, as it is abundant in coastal bays and estuaries, as well as offshore in the northern Gulf (Wursig et al., 2000).

Gulf-wide biodiversity patterns cannot be completely explained, for lack of complete information, although we do know that the Gulf of Mexico exhibits great habitat complexity that probably supports high levels of biodiversity due to both endemic and cosmopolitan species (Rabalais et al., 1999). Linkage to the Caribbean Sea with large-scale circulation provides the southern and eastern Gulf with a distinct Caribbean biota. However, strong regional endemism appears to exist, as demonstrated in large-scale studies across the entire northern Gulf (Rabalais et al., 1999; Harper, 1991; Carney et al., 1993). Eventual analysis of databases from the Biodiversity of the Gulf of Mexico Project on GulfBase will provide considerable insight into the spatial distribution of species. Of the 15,419 species found, 1,511 (10 per cent) are endemic to the Gulf of Mexico and 341 (2 per cent) are non-indigenous (Felder and Camp, 2009). The most diverse taxa include crustaceans (2,579 species), mollusks (2,455), and vertebrates (1,975), and the least diverse include kinorhynchs (2 species), entoprocts (2), priapulids (1), hemichordates (5), and cephalochordates (5). In addition, other taxa are known to exist in the Gulf of Mexico (placozoans, orthonectids, loriciferans, and pogonophorans), but representatives have not yet been identified (Felder and Camp, 2009; Fautin et al., 2010).

A recent ecosystem status report for the Gulf of Mexico, utilizing the DPSER (Drivers, Pressures, States, Ecosystem Services, Responses) conceptual modelling framework, gives a high-level overview of the state of the Gulf (Karnauskas et al., 2013). Major, large-scale climatic drivers include the Atlantic Multidecadal Oscillation, Atlantic Warm Pool, sea surface temperature, Loop Current, and geostrophic transport in the Yucatan Channel and Florida Current. Long-term trends or changes in these drivers in turn cause fluctuations or changes in selected pressures, such as hurricanes or hypoxic zones. Other pressures include contamination by pollution (e.g., mercury, cadmium), oil and gas exploration and production (including major oil spills, such as Ixtoc I in 1979 and Deepwater Horizon in 2010), bacterial water quality problems, and habitat destruction, mainly caused by coastal development. Harmful algal blooms (HABs), such as red tide and brown tide, are well documented in the Gulf, as are some invasive species (Tunnell, 2009; Fautin et al., 2010; Karnauskas et al., 2013).

The recent Deepwater Horizon oil spill prompted a study of the ecosystem services of the Gulf of Mexico by a leadership committee of the United States National Research Council (NRC). This comprehensive report utilizes the ecosystem services approach and frames for the first time the goods and services provided by the Gulf for an economically and ecologically healthy ecosystem (NRC, 2013).

by overfishing in both the Northeast and Northwest Atlantic have shown increasing trends in abundance and recovery of range when unsustainable levels of fishing effort have been reduced (Table 36A.4). Efforts to control pollution and nutrient inputs, driven by the EU Water Framework Directive and the United States Environmental Protection Act, have led to reduction in these pressures and in many cases to the commencement of the recovery of benthic communities (EEA, 2012). Coastal habitat restoration activities have also shown clear benefits in improved environmental quality and biodiversity measures in many coastal areas around the North Atlantic (Pendleton, 2010). All of these improvements have come with at least short-term costs, which are sometimes large, such as displaced or reduced fishing opportunity (see Part IV), the costs of pollution control and nutrient management in coastal areas and watersheds (costs summarized in the chapters of Part V), and the direct costs of habitat restoration, which may run to the millions of dollars for restoration projects of even moderate scale (Diefenderfer et al., 2011; Kroeger and Guennel, 2014).

In summary, the North Atlantic presents examples of both the extent to which unsustainable actions can adversely affect biodiversity and the benefits that can accrue from policies and programmes that are well developed, adequately resourced, and effectively implemented. The best examples of effective policies and programmes have been designed to address the dominant pressures from the twentieth century: overharvesting of living marine resources and pollution and excessive nutrient inputs from coastal and land-based sources. In the twenty-first century, additional pressures are growing, particularly climate change, invasive species (both responding to changing environmental conditions and transported by shipping), and in many areas, particularly at lower latitudes, ocean-based tourism. Lessons learned from dealing successfully with the earlier pressures, if applied proactively, may help safeguard biodiversity from unsustainable impacts, and result in healthy ecosystems producing many ecosystem services of value to the circum-Atlantic human populations.

Table 1. Abundant phytoplankton species of selected taxa (based on abundance and number of genera represented) in coastal and shelf waters of the western North Atlantic
(* produce mucilage and foam, ** potentially toxic species).

Domain	Location	Division	No.	Abundant Species
Coastal & Shelf	Gulf of Maine[19]	Heterokontophyta (Diatoms)	386	spp., spp., spp., , spp., spp., spp., spp., spp.
		Alveolata (Dinoflagellates)	151	spp., spp.**, spp., spp.
		Haptophyta	31	spp.**, spp., , spp., spp.
		Cyanophyta	22	spp.
		Chlorophyta	20	, , sp., spp.
		TOTAL	665	
	Gulf of Maine & N			

			-	

Coastal

		Alveolata (Dinoflagellates)	28	spp

Table 3. Abundant mesozooplankton species for selected taxa (based on abundance, number of genera represented and their importance as indicators of climate-driven changes in hydro-climate) in coastal and shelf regions of the North Atlantic (NE – British Isles, Baltic and North Seas; SE - Bay of Biscay, Iberian coast, west Africa; North – Labrador and Norwegian Seas, Greenland and Iceland; NW – New York Bight, Gulf of Maine, Newfoundland and Scotian Shelves; SW – Caribbean Sea, Gulf of Mexico, South Atlantic Bight).

Location	Taxa	No.	Abundant Species
NE North Atlantic			

NW North Atlantic[1,2,30]	Calanoida	204	spp , , spp. , spp., spp., , spp
	Cyclopoida	-	spp.
	Cladocera	-	spp., spp., spp.
	Thecosomomata	-	spp.
	Copepod Total	261	
SW North Atlantic[2,31]	Calanoida	553	spp., , spp., spp., spp., spp., spp., , , , , , spp., , , spp.
	Cyclopoida		
	Cladocera		sp.
	Thecosomomata		
	Copepod Total	715	

Table 4. Tabulation of conclusions of assessment authorities on stock status. Each authority has its own standards for benchmarking status. Where quantitative reference points are not estimated, a stock was counted as “healthy or cautious” if abundance was reported as average or high, or as increasing if below average. Stocks reported as depleted or low and

Table 5. Tabulation of a number of primary publications documenting status and trends in fish community metrics for areas in the North Atlantic.

A large number of community metrics were used, and have been grouped into several categories: “size” includes metrics of body size; “diversity” includes any of the typical indices of species diversity; “richness” and “evenness” include numbers of species recorded and how numbers were distributed among species; “dominance” includes measures of how much the abundance of the few most common species in a community comprised of all the individuals in the community; “N” includes measures of total abundance

Canary Islands	Diversity nt, richness nt	1990s	Large changes w/o trend in species composition	Uiblein et al. 1996
Baltic and Kattegat	Richness +, N nt	1990 - 2008	Difference in connectance not a factor	Hiddink and Coleby 2012
West of Scotland	Richness -	1997-2008	F stayed high	ter Hofstede et al. 2010
North Sea	Richness+	“	Southern species incursions	“
Celtic Sea	Richness+	“	“	“
Iceland	Richness +, diversity nt	1996-2007	Warming	Steffansdottir et al. 2010
Iceland	Species Composition	1970s-2010s	Warming	Valdimarsson et al. 2012
Dogger Bank	Diversity-, dominance +	1991 - 2010	Warming, and common species increased	Sonnewald and Turkay 2012
NE Shelf	Richness+, Diversity+	1980 - 2008	[redacted]	[redacted]

Medit. and

France, Iberia, Azores	?	?	?

a – not included

Table 7.

Figure 2bis. Bathymetric chart of the Gulf of St. Lawrence in eastern Canada. Cabot Strait in the southeast and the Strait of Belle Isle in the northeast connect the Gulf to th

Figure 3. Changes in species abundance and/or biomass and food web structure and functioning

References

Abdul Malak, D., Livingstone, S.R., Pollard, D., Polidoro, B.A., Cuttelod, A., Bariche, M., Bilecenoglu, M., Carpenter, K.E., Collette, B.B., Francour, P., Goren, M., Kara, M.H., Massutí, E., Papaconstantinou, C., Tunesi, L. (2011). IUCN, vii + 61pp., Gland, Switzerland and Malaga, Spain.

Albaina, A. and Irigoien, X. (2007). Fine scale zooplankton distribution in the Bay of

Alheit, J., Möllmann, C., Dutz, J., Kornilovs, G., Loewe, P., Mohrholz, V., Wasmund, N. (2005). Synchronous ecological regime shifts in the central Baltic and the North Sea in the late 1980s. vol. 62, pp. 1205–1215.

Alvarez-Filip, L., Dulvy, N.K., Gill, J.A., Côté, I.M, Watkinson, A.R. (2009). Flattening of Caribbean coral reefs: region-wide declines in architectural complexity. , vol. 276, No. 1669, pp. 3019–3025. Available from <u>http://rspb.royalsocietypublishing.org/content/early/2009/06/05/rspb.2009.0339.full.pdf+html</u>.

Andersson, A.J., Mackenzie, F.T., Gattuso, J.-P. 2011. Effects of ocean acidification on benthic processes, organisms, and ecosystems. Ocean Acidification. (Gattuso J, Hansson L, Eds.).: xix,326p, Oxford England; New York: Oxford University Press

Anderson, D.M., Glibert, P.M., Burkholder, J.M. (2002). Harmful algal blooms and eutrophication: Nutrient sources, composition, and consequences.

Attrill, M.J., Wright, J., Edwards, M. (2007). Climate related increases in jellyfish frequency suggest a more gelatinous future for the North Sea. vol. 52, No. 1, pp. 480–485.

Audzijonyte, A., Daneliya, M.E., Väinölä, R. (2006). Comparative phylogeography of Ponto-Caspian mysid crustaceans: isolation and exchange among dynamic inland sea basins. vol. 15, No. 10, pp. 2969–2984.

Baird, D., and Ulanowicz, R.E. (1989). The seasonal dynamics of the Chesapeake Bay ecosystem. vol. 59, No. 4, pp. 329–364.

Baird, D., Christian, R.R., Peterson, C.H., Johnson, G.A. (2004). Consequences of hypoxia on estuarine ecosystem function: Energy diversion from consumers to microbes. , vol. 14, No. 3, pp. 805–822.

Bakun, A., and Weeks, S.J. (2006). Adverse feedback sequences in exploited marine systems: are deliberate interruptive actions warranted? vol. 7, No. 4, pp. 316–333.

Barnard, R., Batten, S.D., Beaugrand, G., Buckland, C., Conway, D.V.P., Edwards, M., Finlayson, J., Gregory, L.W., Halliday, N.C., John, A.W.G., Johns, D.G., Johnson, A.D., Jonas, T.D., Lindley, J.A., Nyman, J., Pritchard, P., Reid, P.C., Richardson, A.J., Saxby, R.E., Sidey, J., Smith, M.A., Stevens, D.P., Taylor, C.M., Tranter, P.R.G., Walne, A.W., Wootton, M., Wotton, C.O.M., Wright, J.C. (2004). Continuous plankton records: Plankton atlas of the North Atlantic Ocean (1958–1999). II. Biogeographical charts, , Supplement, pp. 11–75.

Barrio Froján, C.R.S., Cooper, K.M., Bremner, J., Defew, E.C., Wan Hussin, W.M.R., Paterson, D.M. (2011). Assessing the recovery of functional diversity after sustained sediment screening at an aggregate dredging site in the North Sea. , vol. 92, No. 3, pp. 358–366.

Beaugrand, G. (2004). The North Sea regime shift: Evidence, causes, mechanisms and consequences. vol. 60, No. 2–4, pp. 245–262.

Beaugrand, G., Edwards, M., Brander, K., Luczak, C., Ibañez, F. (2008). Causes and projections of abrupt climate-driven ecosystem shifts in the North Atlantic. , vol. 11, No. 11, pp. 1157–1168.

Beaugrand, G., Edwards, M., Legendre, L. (2010). Marine biodiversity, ecosystem functioning, and carbon cycles. , vol. 107, No. 22, pp. 10120–10124.

Beaugrand, G., Luczak, C., Edwards, M. (2009). Rapid biogeographical plankton shifts in the North Atlantic Ocean. , vol. 15, No. 7, pp. 1790–1803.

Beaugrand, G., McQuatters-Gollop, A., Edwards, M., Goberville, E. (2013). Long-term responses of North Atlantic calcifying plankton to climate change. , vol. 3, pp. 263–267.

Bianchi, G., Gislason, H., Graham, K., Hill, L., Jin, X., Koranteng, K., Manickchand-Heileman, S., Payá, I., Sainsbury, K., Sanchez, F., Zwanenburg, K. (2000). Impact of fishing on size composition and diversity of demersal fish communities. , vol. 57, No. 3, pp. 558–571.

Bicknell, A.W.J., Oro, D., Camphuysen, K.C.J., and Voitier, S.C. (2013). Potential consequences of discard reform for seabird communities. , vol. 50, No. 3, pp. 649–658.

BirdLife International (2014). Species factsheet: Little Auk . http://www.birdlife.org. Accessed 07 Sept. 2014.

Birdsong, R.S., Marshall, H.G., Alden, R.W., and Ewing, R.M. (1989). , Final Report, 1987–1988, Old Dominion University Research Foundation, Norfolk, Virginia.

Birdsong, R.S., and Buchanan, C. (1993). Zooplankton, In: The Ecologically Valuable Species Workgroup of the Living Resources Subcommittee, , The Marlyand Development of Natural Resources Tidewater Administration Chesapeake Bay Research and Monitoring Division for the Chesapeake Bay Program, United States, pp. 45–50.

Birnbaum, C. (2006). Online Database of the North European and Baltic Network on Invasive Alien Species, NOBANIS (

(results 6 years post-dredging). , vol. 62, No. 2, pp. 145–162.

Bradley, P.E., and Norton, R.L. (Eds.) (2009).
, University Press of Florida, United States.

Brault, S., Stuart, C.T., Wagstaff, M.C., McClain, C.R., Allen, J.A., Rex, M.A. (2013).
} v š Œ • š] v P ‰- š v š -Œ • } (diversity in deep-sea bivalves of the eastern and western North Atlantic.
, vol. 92, pp. 157–164.

Brown, J.H., Gillooly, J.F., Allen, A.P., Savage, V.M., West, G.B. (2004). Toward a metabolic theory of ecology. vol. 85, 1771–1789.

t, a1g. 1-2 0 Td 35(a0.4c -0.003 c 4Ta2(ri)a(s)2(ia.(A Sp)6T1 9)1(Rial2P-6.1u(c)-7(e)9)-7)4(.)3a(w)16i108((

Calvo, N., Templado, J., Oliverio, M., Machordom, A. (2009). Hidden Mediterranean biodiversity: molecular evidence for a cryptic species complex within the reef building vermetid gastropod (Mollusca: Caenogastropoda). , vol. 96, No. 4, pp. 898–912.

Campbell, N., Neat, F., Burns, F., Kunzlik, P. (2011). Species richness, taxonomic diversity, and taxonomic distinctness of the deep-water demersal fish community on the Northeast Atlantic continental slope (ICES Subdivision VIa). , vol. 68, pp. 365–376.

CARSEA, (2007). Agard, J.B.R., Cropper, A. (eds). Caribbean Sea Ecosystem Assessment (CARSEA), Caribbean Marine Studies, Special Edition, 85pp.

CBD 2014s Report of the North-West Atlantic Regional Workshop To Facilitate the Description of Ecologically Or Biologically Significant Marine Areas. UNEP/CBD/EBSA/WS/2014/2/4; 120 pp.

CBD 2014b Report of the Mediterranean Regional Workshop to Facilitate the Description of Ecologically or Biologically Significant Marine Areas. UNEP/CBD/EBSA/WS/2014/3/4

Chambers, R.M., Havens, K.J., Killeen, S., Berman, M. (2008). Common reed occurrence and adjacent land use along estuarine shoreline in Chesapeake Bay. , vol. 28, No. 4, pp. 1097–1103.

Chambers, R. M., Meyerson, L.A., Saltonstall, K. (1999). Expansion of into tid3.9(e)-1(1(.3a))4bm(n)-db05 Ts1(t o)12(f)N tiA-A ti to ti

Guilhaumon, F., Kesner-Reyes, K., Kitsos, M.

Cowen, R.K., Sponaugle, S., Paris, C.B., Lwiza, K.M.M., Fortuna, J.L., Dorsey, S. (2003). Impact of North Brazil Current rings on local circulation and coral reef recruitment to Barbados, West Indies, In: Goni, G.J., and Rizzoli, P.M. (eds.), . Elsevier, Amsterdam, pp. 443–462.

. Secr. Can. de Consult. Sci. du MPO. Doc. de rech. 2013/086, vi + 181 pp.

DFO (2011). . OHSAR Pub. Ser. Rep. NL Region, No. 0005: vi + 32pp.

Dolan J. R., 2000. Tinitinnid ciliate diversity in the Mediterranean Sea: Longitudinal patterns related to water column structure in late spring-early summer. Aquatic Microbial Ecology 22: 69-78.

Doyle, T., Houghton, J.D.R., Buckley, S.M., Hays, G.C., Davenport, J. (2007). The broad-scale distribution of five jellyfish species across a temperate coastal environment. , vol. 579, No. 1, pp. 29–39.

Drinkwater, K. (2009). Comparison of the response of Atlantic cod ( ) in the high-latitude regions of the North Atlantic during the warm periods of the 1920s–1960s and the 1990s–2000s. , vol. 56, No. 21–22, pp. 2087–2096.

Drinkwater, K.F. (2005). The response of Atlantic cod ( ) to future climate change. ICES 62, 1327–1337.

Duarte, C.M., Borum, J., Short, F.T., Walker, D.I. (2008). Seagrass ecosystems: Their global status and prospects. In: Polunin, N.V.C. (ed.), . Cambridge: Cambridge University Press, pp. 281–306.

Dufour, R., Benoît, H., Castonguay, M., Chassé, J., Devine, L., Galbraith, P., Harvey, M., Larouche, P., Lessard, S., Petrie, B., Savard, L., Savenkoff, C., St-Amand, L., Starr, M. (2010). Canadian Science Advisory Secretariat. Research Document 2010/030.

Dunnet, G.M., Furness, R.W., Tasker, M.L., Becker, P.H. (1990). Seabird ecology in the North Sea. , vol. 26, No. 2–4, pp. 387–425.

Durand, D., Blel, H., Shen, K.N., Koutrakis, E.T., Guinand, B. (2013). Population genetic structure of in the Mediterranean and Black Seas: a single mitochondrial clade and many nuclear barriers. , vol. 474, pp. 243–261.

Durbin, E.G., Campbell, R.G., Casas, M.C., Ohman, M.D., Niehoff, B., Runge, J., Wagner, M. (2003). Interannual variation in phytoplankton blooms and zooplankton productivity and abundance in the Gulf of Maine during winter. , vol. 254, pp. 81–100.

Dutil, J.-D., Miller, R., Nozères, C., Bernier, B., Bernier, D., Gascon, D. (2006). Révision des identifications de poissons faites lors des relevés scientifiques annuels d'évaluation de l'abondance des poissons de fond et de la crevette nordique dans l'estuaire et le nord du golfe du Saint-Laurent. , vol. 2760: x + 87pp.

Dutil, J.-D., Nozères, C., Scallon-Chouinard, P.-M., Van Guelpen, L., Bernier, D., Proulx, S., Miller, R., Savenkoff, C. (2009). Poissons connus et méconnus des fonds marins du Saint-Laurent. , vol. 133, No. 2, pp. 70–82.

Eakin, C.M., Morgan, J.A., Heron, S.F., Smith, T.B., Liu, G., Alvarez-Filip, L., Baca, B., Bartels, E., Bastidas, C., Bouchon, C., Brandt, M., Bruckner, A.W., Bunkley-Williams, L., Cameron, A., Causey, B.D., Chiappone, M., Christensen, Elmgren, R. (1989). Man’s impact on the ecosystem of the Baltic Sea: Energy flows today and at the turn of the century. , vol. 18, pp. 326–332.

Enghoff, I.B., MacKenzie, B.R., Nielsen, E.E. (2007). The Danish fish fauna during the warm Atlantic period (ca. 7000–3900 BCE): Forerunner of future changes? , vol. 87, No. 2–3, pp. 167–180.

Escaravage, V., Herman, P., Merckx, B., Bodarska-Kowalczuk, M., Amouroux, J., Degraer, S., Grémare, A., Heip, C., Hummel, H., Karakassis, I. (2009). Distribution patterns of macrofaunal species diversity in subtidal soft sediments: biodiversity-productivity relationships from the MacroBen database. , vol. 382, pp. 253–264.

FAO (2007). . FAO Forestry Paper 153, 77pp.

FAO (2009). . Rome, 4–8 February and 25–29 August 2008. Available from ftp://ftp.fao.org/docrep/fao/011/i0605t/i0605t00.pdf.

FAO (2013). NEAFC VME fact sheets 2015. Altair. [online]. Rome. Updated 6 February 2015. [Cited 20 April 2015]. http://www.fao.org/fishery/

Fisher, J.A.D., Frank, K.T., Leggett, W.D. (2010). Global variation in marine fish body size and its role in biodiversity–ecosystem functioning. , vol. 405, pp. 1–13.

Fisher, J.A.D., Frank, K.T., Petrie, B., Leggett, W.C., Shackell, N.L. (2008). Temporal dynamics within a contemporary latitudinal diversity gradient. , vol. 11, No. 9, pp. 883–897.

Fock, H.O., Kloppmann, M.H.P, Probst, W.N. (2014). An early footprint of fisheries: Changes for a demersal fish assemblage in the German Bight from 1902–1932 to 1991–2009. , vol. 85, pp. 325–335.

Fogarty, M., Incze, L., Hayhoe, K., Mountain, D., Manning, J. (2008). Potential climate ce(p)-2(.)5(

Fu, F.X., Tatters, A.O., Hutchins, D.A. (2012). Global change and the future of harmful algal blooms in the ocean. , vol. 470, pp. 207–233.

.,S GmbuTw e,SRC., U.ne, KL., 7

(n)-4(d)-4p. Tw 1697 emnet(Tw) dbe (n)-4((a)10 ms).14(e)-1(i(e)-1as126 (o)-2(f61(mari)10.1(n)-4(e)-1 (e)9cC)4 o)

(e)-1(tu)-4(n)6(e)-1((,)1(J.)]TJ0 Tc 0 Tw41.72 0 Td-)Tj0.

Gomoiu, M.-T. (2012). , Available from http://www.ibiol.ro/man/2012/Diaspora/04_Gomoiu_Biodiversitatea%20Marii%20Negre.pdf.

Gomoiu, M.-T., and Skolka, M. (1998).

SOMLIT-Astan time series off Roscoff (Western Channel, France): data collected from 2000 to 2010. , vol. 54, pp. 247–256.

Hale, S.S., Hughes, M.M., Strobel, C.J., Buffum, H.W., Copeland, J.L., Paul, J.F. (2002). Coastal ecological data from the Virginian Biogeographic Province, 1990–1993. , vol. 83, No. 10, p. 2942.

Hallegraeff, G.M. (2010). Ocean climate change, phytoplankton community responses, and harmful algal blooms: a formidable predictive challenge. , vol. 46, No. 2, pp. 220–235.

Hallegraeff, G.M., and Bolch, C.J. (1992). Transport of diatom and dinoflagellate resting spores via ship's ballast water: implications for plankton biogeography and aquaculture. , vol. 14, No. 8, pp. 1067–1084.

Hällfors, G. (2004). Checklist of Baltic Sea phytoplankton species (including some heterotrophic protistan groups). No. 95, Helsinki Commission, Baltic Marine Environment Protection Commssion, 208pp.

Hammill, M. O., den Heyer, C.E. and Bowen, W.D. 2014. Grey Seal Population Trends in Canadian Waters, 1960-2014. DFO Can. Sci. Advis. Sec. Res. Doc. 2014/037. iv + 44 p.

Hammond, T. R., and Ellis, J. R. (2005). Bayesian Assessment of North-east Atlantic Spurdog Using a Stock Production Model, with Prior for Intrinsic Population Growth Rate Set by Demographic Methods. , vol. 35, pp. 299-308

Harding, K. C., and Härkönen, T. J. (1999). Development in the Baltic grey seal ( ) and ringed seal ( ) populations during the 20th century. , vol. 28, pp. 619–627.

Heck, K.L. and Orth, R.J. (1980). Structural components of eelgrass ( ) meadows in the lower Chesapeake Bay-decapod crustacea. , vol. 3, pp. 289–295.

Heck, K.L., Carruthers, T.J.B., Duarte, C.M., Hughes, A.R., Kendrick, G., Orth, R.J., Williams, S.W. (2008). Trophic transfers from seagrass meadows subsidize diverse marine and terrestrial consumers, , vol. 11, pp. 1198–1210.

Heip, C., Duineveld, G., Flach, E., Graf, G., Helder, W., Herman, P., Lavaleye, M., Middelburg, J., Pfannkuche, O., Soetaert, K. (2001). The role of the benthic biota in sedimentary metabolism and sediment-water exchange processes in the Goban Spur area (NE Atlantic). , vol. 48, pp. 3223–3243.

HELCOM (2002). Environment of the Baltic Sea area 1994–1998. No. 82 B., 215pp,, Helsinki, Finland. Available from www.helcom.fi.

HELCOM (2009a). Biodiversity in the Baltic Sea -- “An integrated thematic assessment on biodiversity and nature conservation in the Baltic Sea.” Baltic Sea Environment Proceedings No. 116B. Available from www.helcom.fi.

HELCOM (2009b). Eutrophication in the Baltic Sea – An integrated thematic assessment of the effects of nutrient enrichment and eutrophication in the Baltic Sea region. No. 115 B., p. 152. Available from www.helcom.fi.

HELCOM (2010). Ecosystem Health of the Baltic Sea 2003–2007: HELCOM Initial Holistic Assessment. No. 122. Available from www.helcom.fi.

HELCOM (2013). HELCOM Red List of Baltic Sea species in danger of becoming extinct. Baltic Sea Environment Proceedings 140. Available from www.helcom.fi.

Henderson, P.A., Seaby, R.M.H., Somes, J.R. (2011). Community level response to climate change: The long-term study of the fish and crustacean community of the Bristol Channel. , vol. 400, pp. 78–89.

Hernández-León, S., Gómez, M., Arístegui, J. (2007). Mesozooplankton in the Canary Current System: The coastal–ocean transition zone. , vol. 74, No. 2–3, pp. 397–421.

Hiddink, J., Jennings, S., Kaiser, M., Queirós, A., Duplisea, D., Piet, G. (2006). Cumulative impacts of seabed trawl disturbance on benthic biomass, production, and species richness in different habitats. , vol. 63, pp. 721–736.

Hiddink, J.G., and Coleby, C. (2012). What is the effect of climate change on marine fish biodiversity in an area of low connect736.8736.736.

Hilborn, R., and Litzinger, E. (2009). Causes of decline and potential for recovery of Atlantic cod populations.

Jackson, E.L., Rowden, A.A., Attrill, M.J., Bossey, S.J., Jones, M.B. (2001). The importance of seagrass beds as a habitat for fishery species. , vol. 39, pp. 269–303.

Javidpour, J., Sommer, U., Shiganova, T. (2006). First record of A. Agassiz 1865 in the Baltic Sea. , vol. 1, No. 4, pp. 299–302.

Johannesen, E., Høines, Å.S., Dolgov, A.V., Fossheim, M. (2012). . PLoS ONE 7: e34924. doi:10.1371/journal.pone.0034924.

Johns, D.G., Edwards, M., Batten, S.D. (2001). Arctic boreal plankton species in the Northwest Atlantic, , vol. 58, No. 11, pp. 2121–2124.

Johnson, N.A., Campbell, J.W., Moore, T.S., Rex, M.A., Etter, R.J., McClain, C.R., Dowell, M.D. (2007). The relationship between the standing stock of deep-sea macrobenthos and surface production in the western North Atlantic. , vol. 54, pp. 1350–1360.

Jones, D.O., Yool, A., Wei, C.L., Henson, S.A., Ruhl, H.A., Watson, R.A., Gehlen, M. (2013). Global reductions in seafloor biomass in response to climate change. , vol. 20, No. 6: doi: 10.1111/gcb.12480.

Joos, F., Plattner, G.-K., Stocker, T.F., Marchal, O., Schmittner, A. (1999). Global warming and marine carbon cycle feedbacks on future atmospheric CO2. , vol. 284, pp. 464–467.

Jordán, F. (2001). Seasonal changes in the positional importance of components in the trophic flow network of the Chesapeake Bay. , vol. 27, pp. 289–300.

Jordan, S.J., Lewis, M.A., Harwell, L.M., Goodman, L.R. (2010). Summer fish communities in northern Gulf of Mexico estuaries: Indices of ecological condition. , vol. 10, pp. 504–515.

Jordaan, A. (2010). Fish assemblages spatially structure along a multi-scale wave energy gradient. , vol. 87, pp. 13–24.

Jorde, D.G., Haramis, G.M., Forsell, D.J. (1993). Waterbirds, In The Ecologically Valuable Species Workgroup of the Living Resources Subcommittee, , The Marlyand Development of Natural Resources Tidewater Administration Chesapeake Bay Research and Monitoring Division for the Chesapeake Bay Program, US, pp. 69–76.

Kaiser, M.J., Clarke, K.R., Hinz, H., Austen, M.C.V., Somerfield, P.J., Karakassis, I. (2006). Global analysis of response and recovery of benthic biota to elnsfl0avin,)s.caluabl f

Kroeger, T., and Guannel, G. (2014). Fishery enhancement, coastal protection and water quality services provided by two restored Gulf of Mexico oyster reefs, In: K. Ninan (ed.), Edward Elgar Press, London. In press.

Künitzer, A., Basford, D., Craeymeersch, J.A., Dewarumez, J.M., Dorjes, J.,

( ). , vol. 39, pp. 734–746.

Malone, T.C. (1977). . MESA New York Bight Atlas
DMo YnsegYnseau(A)ani0oay9() Bi2TJi(u0-2(g)11(u0-F]TJ -2h1(nse)92 l4(o)-w066(Y)-r

McKinley, A.C., Miskiewicz, A., Taylor, M.D., Johnston, E.L. (2011). Strong links between metal contamination, habitat modification and estuarine larval fish. , vol. 159, pp. 1499–1509.

McQuatters-Gollop, A., Raitsos, D.E., Edwards, M., Pradhan, Y., Mee, L.D., Lavender, S.J., Attrill, M.J. (2007). A long-term chlorophyll data set reveals regime shift in North Sea phytoplankton biomass unconnected to nutrient trends. , vol. 52, No. 2, pp. 635–648.

Mejri, R., Lo Brutto, S., Hassine, O.K., Arculeo, M. (2009). A study on Miller 1968 (Perciformes, Gobiidae) reveals the Siculo-Tunisian Strait (STS) as a breakpoint to gene flow in the Mediterranean basin. , vol. 53, No. 2, pp. 596–601.

Mendelssohn, I.A., Andersen, G.L., Baltz, D.M., Caffey, A.H., Carman, K.R., Fleeger, J.W., Joye, S.B., Lin, Q., Maltby, E., Overton, E.B., Rozas, L.P. (2012). Oil impacts on coastal wetlands: Implications for the Mississippi River Delta ecosystem after the oil spill. , vol. 62, No. 6, pp. 562–574.

Merino-Virgilio, F. del C., Okolodkov, Y.B., Aguilar-Trujillo, A.C., Herrera-Silvera, J.A.

Mouillot, D., Albouy, C., Guilhaumon, F., Ben Rais Lasram, F., Coll, M., DeVictor, V., Douzery, E., Meynard, C., Pauly, D., Troussellier, M., Velez, L., Watson, R., Mouquet, N. (2011). Protected and threatened components of fish biodiversity in the Mediterranean Sea. , vol. 21, pp. 1044–1050.

Mumby, P.J., Dahlgren, C.P., Harborne, A.R., Kappel, C.V., Micheli, F., Brumbaugh, D.R., Holmes, K.E., Mendes, J.M., Broad, K., Sanchirico, J.

Chesapeake Bay Research and Monitoring Division for the Chesapeake Bay Program, US, pp. 61–64.

Nizinski, M.S. (2003). Annotated checklist of decapod crustaceans of Atlantic coastal and continental shelf waters of the United States. , vol. 116, No. 1, pp. 96–157.

NOAA (2014). Available from http://www.nmfs.noaa.gov/pr/sars/. Accessed 01 May 2014.

Not, F., Zapata, M., Pazos, Y., Campaña, E., Doval, M., Rodríguez, F. (2007). Size-fractionated phytoplankton diversity in the NW Iberian coast: a combination of microscopic, pigment and molecular

. Final Report, U.S.E.P.A., 191pp.

OSAPR 2010. OSPAR Quality Status Report 2010 (including regional assessments). Available at http://qsr2010.ospar.org/en/ch01.html.

Ospina-Alvarez, N., Varela, M., Doval, M.D., Gómez-Gesteira, M., Cervantes-Duarte, R., Prego, R. (2014). Outside the paradigm of upwelling rias in NW Iberian Peninsula:

Perry, A. L., Low, P. J., Ellis, J. R., & Reynolds, J. D. (2005). Climate change and distribution shhifts in marine fishes. science, 308(5730), 1912-1915.

Persson, A., Ljungberg, P., Andersson, M., Götzman, E. and Nilsson, P.A. (2012). Foraging performance of juvenile Atlantic cod Gadus morhua and profitability of coastal habitats. , vol. 456, pp. 245–253.

Philine, S.E., Ermgassen, Z., Spalding, M.D., Blake, B., Coen, L.D., Dumbauld, B., Geiger, S., Grabowski, J.H., Grizzle, R., Luckenbach, M., McGraw, K., Rodney, W., Ruesink, J.L., Powers, S.P., Brumbaugh, R. (2012). Historical ecology with real numbers: past and present extent and biomass of an imperiled estuarine habitat. , vol. 279, No. 1742, pp. 3393–3400. doi:10.1098/rspb.2012.0313.

Piet, G.J., Jansen, H.M., Rochet, M.-J. (2008). Evaluating potential indicators for an ecosystem approach to fishery management in European waters. , vol. 65, pp. 1449–1455.

–

Pyke, C.R., Najjar, R.G., Adams, M.B., Breitburg, D., Kemp, M., Hershner, C., Howarth, R., Mulholland, M., Paolisso, M., Secor, D., Sellner, K., Wardrop, D., Wood, R. (2008). . A Report from the Chesapeake Bay Program Science and Technical Advisory Committee (STAC), Annapolis, MD.

Quintaneiro, C., Monteiro, M., Pastorinho, R., Soares, A.M.V.M., Nogueira, A.J.A., Morgado, F., Guilhermino, L. (2006). Environmental pollution and natural populations: A biomarkers case study from the Iberian Atlantic coast. , vol. 52, No. 11, pp. 1406–1413.

Razouls, C., de Bovée, F., Kouwenberg, J., Desreumaux, N. (2014). , http://copepodes.obs-banyuls.fr/en/index.php.

Record, N.R., Pershing, A.J., Jossi, J.W. (2010). Biodiversity as a dynamic variable in the Gulf of Maine continuous plankton recorder transect. , vol. 32, pp. 1675–1684.

Reeves, R.R., Smith, T., Josephson, E. (2007). Near-annihilation of a species: Right whaling in the North Atlantic, In: Kraus, S.D., and Rolland, R.M. (eds.), Harvard University Press, Cambridge, MA.

Reid, P., de Borges, M., Svendsen, E. (2001). A regime shift in the North Sea circa 1988 linked to changes in the North Sea mackerel fishery. , vol. 50, No. 1–2, pp. 163–171.

Reid, P.C., Johns, D.G., Edwards, M., Starr, M., Poulin, M., Snoeijs, P. (2007). A biological consequence of reducing Arctic ice cover: arrival of the Pacific diatom in the North Atlantic for the first time in 800,000 years. , vol. 13, pp. 1910–1921.

Reid, P.M., Edwards, H.H., Warner, A. (1998). Phytoplankton change in the North Atlantic. , vol. 391, p. 546.

Reilly, S.B., Bannister, J.L., Best, P.B., Brown, M., Brownell Jr., R.L., Butterworth, D.S., Clapham, P.J., Cooke, J., Donovan, G.P., Urbán, J., Zerbini, A.N. (2008). , In: IUCN 2013, . Version 2013.2, www.iucnredlist.org. Downloaded on 01 May 2014.

Reise, K., Gollasch, S., Wolff, W.J. (1999). Introduced marine species of the North Sea coasts. , vol. 52, pp. 219–234.

Reiss, H., Degraer, S., Duineveld, G.C.A, Kröncke, I., Aldridge, J., Craeymeersch, J.A., Eggleton, J.D., Hillewaert, H., Lavaleye, M.S.S., Moll, A., Pohlmann, T., Rachor, E., Robertson, M., Berghe, E.V., Hoey, G.V., Rees, H.L. (2010). Spatial patterns of infauna, epifauna, and demersal fish communities in the North Sea. , vol. 67, No. 2, pp. 278–293.

Regular, P.M., Montevecchi, W.A., Hedd, A., Robertson, G.J., Wilhelm, S.I. (2013). Canadian fishery closures provide a large scale test of gillnet bycatch on seabird

Ría of Pontevedra (NW Spain). , vol. 58, pp. 499–515.

Rogers, C. (2009). Coral bleaching and disease should not be underestimated as causes of Caribbean coral reef decline.

Savard, L. (2013). Canadian Science Advisory Secretariat (CSAS), Research Document 2013/010.

Schofield, P.J. (2010). Update on geographic spread of invasive lionfishes ([Linnaeus, 1758] and [Bennet, 1828]) in the Western North Atlantic Ocean, Caribbean Sea and Gulf of Mexico. , vol. 5 (suppl. 1), S117–S122.

Schreiber, R., and Schreiber, E.A. (1984). Central Pacific Seabirds and the El Niño Southern Ocean Oscillation: 1892-1983 Perspectives. , vol. 225, No. 4663, pp. 713–716.

Schreiber, E.A., and Lee, D.S. (eds.) (2000). . Society of Caribbean Ornithology, Special Publication 1, Ruston, Louisiana, 10pp.

Secor, D.H., Niklitschek, E., Stevenson, J., Gunderson, T., Minkkinnen, S., Richardson, B., Florence, B., Mangold, M., Skjeveland, J., Henderson-Arzapalo, A. (2000). Dispersal and growth of yearling Atlantic sturgeon, Acipenser oxyrinchus released into Chesapeake , vol. 98, No. 4, pp. 800–810.

Sellner, K., and Marshall, H.G. (1993). Phytoplankton, In: The Ecologically Valuable Species Workgroup of the Living Resources Subcommittee,

Whitfield, P.E., Hare, J.A., David, A.W., Harter, S.L., Munoz, R.C., & Addison, C.M. (2007). Abundance estimates of the Indo-Pacific lionfish Pterois volitans/miles complex in the Western North Atlantic. Biological Invasions, 9(1), 53-64.

Wilberg, M.J., Livings, M.E., Barkman, J.S., Morris, B.T., Robinson, J.M. (2011). Overfishing, disease, habitat loss, and potential extirpation of oysters in upper Chesapeake Bay. , vol. 436, pp. 131–144.

Wilkinson, C., and Souter, D. (eds.) (2008). . Global Coral Reef Monitoring Network, and Reef and Rainforest Research Centre, Townsville, Australia, 152pp.

Willette, D.A., Chalifour, J., Dolfi Debrot, A.O., Engel, S., Miller, J., Oxenford, H.A., Short, F.T., Steiner, S.C.C., Védie, F. (2014). Continued expansion of the trans-Atlantic invasive marine angiosperm in the Eastern Caribbean. , vol. 112, pp. 98–102.

Woodland, R.J., Secor, D.H., Fabrizio, M.C., Wilberg, M.J. (2012). Comparing the nursery role of inner continental shelf and estuarine habitats for temperate marine fishes. , vol. 99, pp. 61–73.

Worm, B., Barbier, E.B., Beaumont, N., Duffy, J.E., Folke, C., Halpern, B.S., Jackson, J.B.C., Zydelis, R., Bellebaum, J., Osterblom, H., Vetemaa, M., Schirmeister, B., Stipniece, A., Dagys, M., van Eerden, M., Garthe, S. (2009). Bycatch in gillnet fisheries – An overlooked threat to waterbird populations. , vol. 142, No. 7, pp. 1269–1281.

Also: Centre for Marine Biodiversity (CMB) http://www.marinebiodiversity.ca/cmb.

Extra References for Gulf of Mexico

Literature cited – all references originally provided were NOT listed in manuscript

Briggs, J. C. (1974). . McGraw-Hill, New York. 480 pp.

Brooks, J. M., Fisher, C., Roberts, H., Bernard, B., McDonald, I., Carney, R., Joye, S., Cordes, E., Wolff, G., Goehring, E. (2008). U.S. Dept. of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, Louisiana. OCS Study MMS 2008-009. 332 pp.

Carney, R. S. (1993). . New Orleans, Louisiana: U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Regional Office, New Orleans, Louisiana.

Cordes, E., McGinley, E., Podowski, M.P., Becker, E.L., Lessard-Pilon, S., Viada, S.T., Fisher, C.R. (2008). Coral communities of the deep Gulf of Mexico. , vol. 55, pp. 777–787.

CSA International, Inc. (2007). U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, Louisiana. OCS Study MMS 2007-044. 169 pp. + app.

Darnell, R.M., Defenbaugh, R.E. (1990). Gulf of Mexico: Environmental Overview and History of Environmental Research. , vol. 30, pp. 3-6.

Davis, R.W., Evans, W.E., Würsig, B. (eds.). (2000). . Vol. II. Technical Report. Prepared by Texas A&M University at Galveston and the National Marine Fisheries Service. U.S. Department of the Interior, Geological Survey, Biological Resources Division, USGS/BRD/CR-1999–0006 and Minerals

Management Service, Gulf of Mexico OCS Region, New Orleans, Louisiana, OCS Study MMS 2000–003. 346pp.

Ellis S.L., Incze, L.S., Lawton, P., Ojaveer, H., MacKenzie, B.R., Pitcher, C.R., Shirley, T.C., Eero, M., Tunnell, Jr., J.W., Doherty, P.J., Zeller, B.M. (2011). Four regional marine biodiversity studies: Approaches and contributions to ecosystem-based management. , vol. 6, No. 4: e18997. doi:10.1371/journal.pone.0018997.

Fautin, D., Dalton, P., Incze, L.S., Leong, J.A.C., Pautzke, C., Rosenberg, A., Sandifier, P., Sedberry, G., Tunnell, Jr., J.W., Abbott, I., Brainard, R.E., Brodeur, M., Eldredge, L.G., Feldman, M., Moretzsohn, F., Vroom, P.S., Wainstein, M., Wolff, N. (2010). An overview of marine biodiversity in United States waters. , vol. 5, No. 8: e11914. doi:10.1371/journal.pone.0011914.

Felder, D.L., Camp, D.K. (eds.) (2009). . Vol. 1. Biodiversity. Texas A&M University Press, College Station, Texas. 1393 pp.

Harper, Jr., D.E. (1991). Macrofauna and macroepifauna. In: Brooks, J. M. (ed). . Vol. II. Technical. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region.