

Effects on community structure and food webs

Three of the most important fish populations in Region I – herring, cod, and capelin – have all undergone changes in the recent decades, due in part to overfishing of the top predators with very strong effects on fish community structure and the food web (Daan *et al.*, 2005; ICES, 2008a). With these fish linked to one another through their population dynamics (Anon., 2006), the overfishing of one or the other has repercussions for all. Years with good recruitment of herring and cod have typically resulted in poor capelin recruitment and, subsequently, a weak capelin stock size. In recent years the stock size of capelin off Iceland has decreased from about 2000 Kt in 1996/97 to about 1000 Kt in 2006/07 (Anon., 2007). Herring were very abundant in the early 1960s, collapsed, and have then increased since 1970 to a historical high level in the last decade (ICES, 2008a). This inverse relationship between abundance of capelin and herring is well documented as the young herring are predators on capelin larvae. The reduced stock size of capelin has resulted in a *ICES Advice 2008, Book 1* 15 lower food availability of capelin for feeding by the Icelandic cod stock and thus a poorer condition of cod since 2003 (Anon., 2006; ICES, 2008a). It appears that cod do not readily substitute herring for capelin in their diets. There is also evidence that a change in the distribution of capelin, resulting in less overlap with cod, may lead to a marked detrimental impact on cod growth.

In Region V overfishing has led to major changes in demersal deep-sea fish communities due to the loss of their larger predators and corresponding ecological functions (ICES, 2008b). In addition to catching target species, deep-water fisheries bycatch unwanted species that are either too small or unpalatable. Discarding rates are often high (in the order of 50%); in the roundnose grenadier fishery the bulk of the discarded catch consists of smoothheads (Alepocephalidae) because of their high abundance (Allain *et al.*, 2003).

Ecosystem-wide effects of overfishing of the large predatory fish species and discarding of large numbers of immature fish has had an indirect effect on the trophic structure in much of the OSPAR region. Absolute numbers of small fish belonging to all species and of demersal species with a low maximum length have steadily and significantly increased over large parts of the North Sea (Region II) during the last 30 years while the abundance of large fish has decreased (Daan *et al.*, 2005). In the Celtic Seas (Region III) discarding levels differ between the different fleets but can be as high as two thirds of the total catch, with increasing trends in recent years (Borges *et al.*, 2005; ICES, 2008a). There is general agreement that the size structure of the fish community has also changed significantly; a decrease in the relative abundance of large piscivorous fishes such as cod and hake coincides with an increase in smaller pelagic species, which feed at a lower trophic level (Pinnegar *et al.*, 2003). Zooplankton abundance has declined in the region in recent years and the overall substantial decline in *Calanus* abundance, which is currently below the long-term mean (ICES, 2008a), may have longer term consequences given the fish community shift towards smaller pelagic species feeding on zooplankton.

Some evidence suggests that the decline in *Calanus* may be due to increased feeding pressure of these smaller fish and hence be an indirect effect of fishing; however, climate change factors are also implicated (ICES, 2008a). In the Bay of Biscay (Region IV), the mixed species fishery has increased its level of discards to the highest yet reported.

In the Cantabrian Sea (Region IV), the mean trophic level of the demersal and benthic fisheries declined prior to 1993 and the fish communities are now largely dominated by lower trophic level planktivorous fish (blue whiting, horse mackerel) (ICES, 2008a).

Fisheries have a considerable influence on the distribution of seabirds at sea due to the supply of discard that are used as food for scavenging species. Studies of offshore seabirds in the Gulf of Cadiz, Galicia, and the Cantabrian Sea (Region IV) report a strong correlation between the spatial distribution of the scavengers and that of the demersal trawl fleet (Valeiras *et al.*, 2007). Provision of discards to the environment by trawling fleets has impacted seabird communities directly through food subsidies and indirectly through the food web. In the North Sea (Region II) over the past decade, 12 out of 28 seabird species in the North Sea showed an increasing trend. Now that total discarding rates are expected to fall with declining effort and possible regulation, discards may be a less accessible food supply for seabirds (Parsons *et al.*, in press).

↪ *Go to full ICES assessment on impact of fisheries on the marine environment of the OSPAR maritime area (ICES Advice 2008, Book 1, section 1.5.5.9)*