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Knowledge of Dead Discards Needed for Making Choices about Fish

Imagine you are at the fishmonger’s and you are thinking about buying a sole. It's a relatively expensive fish, but according to the Dutch Fish Bureau, it's the "steak of the sea." Moreover, it seems you can enjoy this flatfish with a clear conscience. Although the estimated sole stock has nearly halved since the advent of large-scale beam trawling in the North Sea, it remains above safe levels (ICES, 2024).

Less known to consumers and policymakers is that catching sole involves a lot of unwanted bycatch, including starfish, crabs, and undersized fish. These animals are not marketable and are therefore thrown back into the sea. These are the so-called "discards". A significant portion does not survive being caught in the net and the selection process on board.

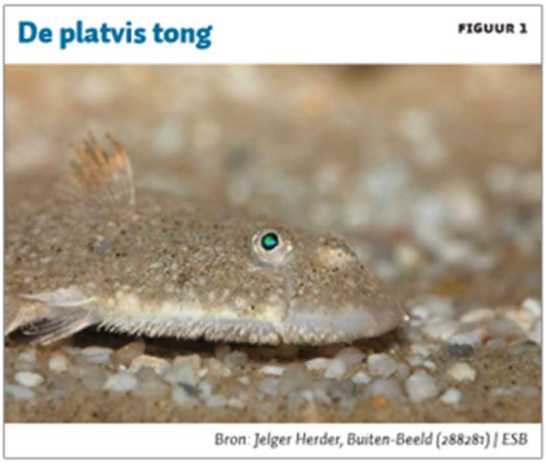
Those who consult the Fish Guide and know how and where a fish was caught can find this out, but fish mongers rarely comply with the obligation to provide information about this (Consumentenbond, 2021). Moreover, three-quarters of fish consumers believe that beam trawling, which is the main cause of this negative impact on seabed life, is already banned, according to the same research by the Consumentenbond.

How serious is this disruption of other marine life by sole fishing? This question is not easy to answer because it concerns an unpriced, external effect of fishing: fishermen have to pay for fuel, crew, and the like, but not for the disruption of the unsold marine life. It's free. Of course, that doesn't mean that other marine life is worthless. Valuation simply takes place outside the market.

When assessing this environmental damage, the fact that the extent of unwanted bycatch is relatively unknown is problematic. To help consumers make a well-informed decision when buying fish and policymakers when regulating fisheries, this article develops a simple measure for this disturbance *in kind*: the number of discarded marine animals that do not survive – or the "dead discards" – per fish sold. This allows the benefit of a sold fish to be compared with the costs of the fish and the disruption of marine life caused by fishing. The measure is illustrated for sole fishing, the main source of income for Dutch fishermen in the North Sea.

Trawling the bottom

Because sole (Figure 1) is often partially buried in the sandy bottom of the North Sea, a fisherman cannot simply reach it. To catch sole, a fisherman must either set a net where the sole will eventually swim into and get stuck or find the sole themselves, startle it, and then scoop it up with a net. The first method, gillnet fishing, is small-scale (De Vos, 2011). The second method, beam trawl or bottom trawl fishing, has been applied on a large scale since the 1960s. The startling of the sole is done with heavy "tickler chains" that plow through the bottom. In addition to marketable sole and other marketable



flatfish such as plaice and turbot, many other non-marketable creatures end up in the net with this form of fishing. This includes bottom dwellers such as sea urchins and starfish, fish that are too young to be sold (Molenaar and Chen, 2018), and fish that are not worth landing, such as dab (Miller and Verkempynck, 2016). Being compressed in a net for up to two hours, the sudden pressure difference when the net is hauled up, and the selection process on board is too much for many of these bycatch.

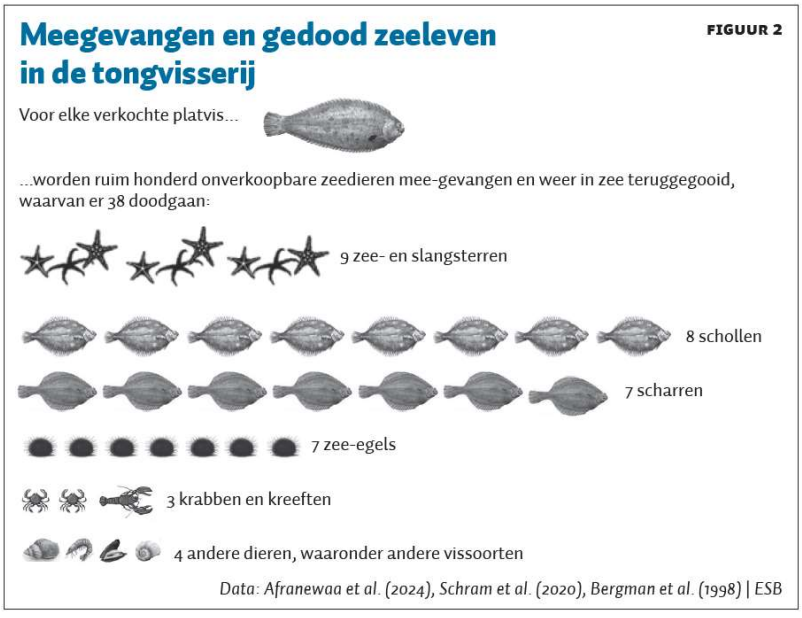
Visualizing dead discards

To give an idea of the unwanted bycatch of sole fishing, we calculate the number of dead animals per fish sold. This is possible thanks to monitoring data collected under the European Fisheries Policy. Since 2009, a number of Dutch fishing vessels have been providing data for this purpose. For sole fishing in 2022, the most recent year for which monitoring data are available, this involved 83 samples of the catch (Afranewaa et al., 2024). In addition to the unwanted bycatch, these data also tell us the amount of desired catch. This includes sole (55 percent in numbers), but also the flatfish plaice (35 percent), turbot (4 percent), dab (6 percent), and brill (1 percent). The other desired catch is negligibly small.

The vast majority of the catch turns out to consist of discards. In terms of numbers, the ratio between the desired catch of flatfish and (dead plus live) discards is 1 to 109. This involves a wide variety of bottom life. The researchers counted more than fifty different fish species and almost ninety other species of marine life. Some species are rare in the discard, such as squid, while others are common, such as starfish. On average, there are 21 fish per flatfish caught, mainly the flatfish plaice and dab (17). In addition, 88 other marine creatures end up in the net per flatfish, mainly starfish and brittle stars (67), sea urchins (14), and crabs and lobsters (6).

The proportion of this discard that does not survive the catch can be deduced from several scientific studies. Most of the data comes from Bergman et al. (1998) and Schram et al. (2020). For some rare species, we rely on the work of Kaiser and Spencer (1995), Mensink et al. (2000), Catchpole et al. (2005), Revill et al. (2005), Suuronen (2005), and Depestele et al. (2014). These show that on average ninety percent of the fish (excluding rays and sharks) do not survive the catch; for other marine life, this is on average over twenty percent.

Based on these studies, it follows that of the 109 discarded marine animals per flatfish caught, an average of 38 die (Figure 2). This are the "dead discards". Per flatfish caught, an average of eighteen fish and twenty other marine animals die from the discard. This includes nine starfish and brittle stars, eight plaice, seven dab, seven sea urchins, three crabs and lobsters, and four other animals. These results are similar to those of a study on this subject from thirty years ago (De Groot and Lindeboom, 1994).



In total, the weekly catch of a trawler involves huge numbers of dead discards. Take a weekly catch of 1,400 kg of sole, 1,250 kg of plaice, and 400 kg of other flatfish. That amounts to a landed catch of approximately 11,000 flatfish. To catch these fish, 1.2 million other marine creatures also ended up in the net, of which 420,000 died.

Due to mesh size fraud, unwanted bycatch is potentially much higher. Many sole fishermen make the mesh of their nets up to half the size legally permitted (Kastoryano and Vollaard, 2023). The fishermen benefit from this because fewer sole of just marketable size, so-called slip sole, escape from the net.

A changed North Sea

The impact of beam trawling on marine life goes beyond the dead discards we have visualized (Hiddink et al., 2017, Pitcher et al., 2022). Bottom life that does not end up on board the fishing vessel also suffers from bottom fishing because it can be mutilated by contact with the beam trawl. For example, many shellfish die in the wake of the beam trawl (Mensink et al., 2000). Animals that manage to escape from the net are also often injured (Wileman et al., 1999).

Moreover, the dead discards per fish sold only show the immediate damage of fishing, not the damage in the longer term. What is now caught in the nets as discards is less diverse and less abundant than during the rise of large-scale beam trawling. This is because bottom fishing changes the ecosystem on the seabed (Den Heijer and Keus, 2001; Rijnsdorp and Lindeboom, 2010). Long-lived and slow-reproducing species such as the common whelk (a sea snail) and the ocean quahog (a shellfish that can live for hundreds of years) are becoming rarer. More opportunistic species such as starfish are doing well. Scavengers, such as crabs, benefit from the dead discards.

Incidentally, sole and plaice seem to benefit from these changes in, among other things, food supply (apart from the dead discards of juvenile sole and plaice that have not yet been able to reproduce) rather than suffer from them. Some even speak of "flatfish fields" on the North Sea (Murk, 2020). However, this depletion of bottom life can increase the vulnerability of the ecosystem, which is also a risk for sole and plaice.

Alternatives

With greater awareness of dead discards, this cost can carry more weight in choices. These can be political choices – political parties differ in their plans for fisheries – but of course also choices as a consumer. If consumers are willing to pay more for fish caught in a different way, with less dead discards, then this external effect is partially internalized. The demand for fish with relatively high dead discards will then decrease. This will incentivize fisheries to reduce this cost.

In addition to not eating fish, consumers can thus look for fish whose catch causes less environmental damage. The proposed measure can also be calculated for fish caught in a different manner. This allows a comparison to be made between methods of fishing. In addition to a good picture of the dead discards, it is of course also important that the fish itself is not overfished. Cod, for example, does not have a large unwanted bycatch according to the Fish Guide, but is in a poor state in the North Sea. There seem to be few fish that do not cause many problems, including North Sea herring.

Meanwhile, the sole fishing industry is looking for adjustments to fishing techniques that reduce dead discards and are beneficial, for example, because of lower fuel consumption or better quality of marketable fish. Reintroduction of the so-called pulse trawl is a frequently heard wish. With this technique, the heavy tickler chains that drag across the seabed are replaced by strings of electrodes that emit electric shocks. This saves a lot of fuel and the flatfish are startled with less bottom disturbance. The unwanted bycatch per fishing trip is smaller, but remains large (ICES, 2020).

However, for the time being, pulse trawling remains prohibited and other technical adjustments also face obstacles (Den Heijer, 2024). This leaves a reduction in fishing intensity as a policy option. This is the most direct and effective way to limit this environmental externality (Heath and Cook, 2015).

Recently, a subsidy for fishermen to stop has contributed to reducing fishing intensity: this has resulted in half of the flatfish trawlers being scrapped (Taal, 2024). Fishing intensity can also be reduced by designating protected areas. On various banks in the North Sea, fifteen percent is now closed to beam trawling. Areas for wind farms are added to this. A more drastic measure is a total ban on this form of fishing, as exists in Norway since 2022 and is in the making in Denmark.

In any case, insights into the environmental damage of beam trawling must be taken into account when making well-informed policy choices regarding the North Sea.

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