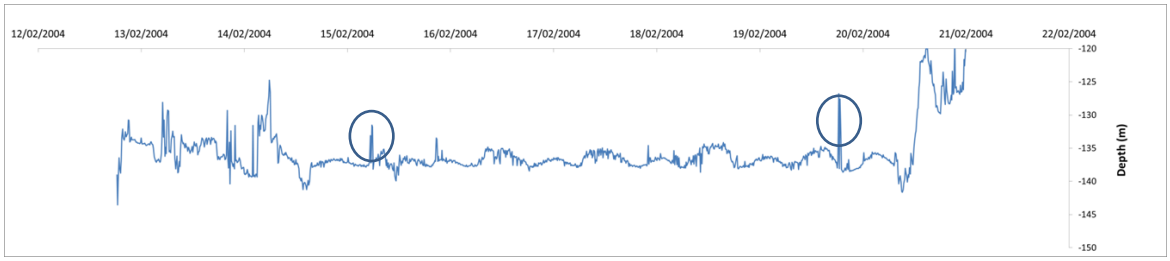
Disturbance of cod spawning areas

Cod mating activity in the north-east Atlantic takes place during the first quarter of the year. Spawning areas are chosen according to suitable substrate type (preferentially coarse sand), with further requirements including high salinity, low temperature (5-7 °C) and low-to-moderate current flow. Given a suitable area, males will identify small territories (known as leks) that they subsequently defend from other males (González-Irusta and Wright 2016, Grabowski et al 2009, Nordeide and Folstad 2000). During mating, males will patrol their leks, using muscles around their swim-bladders to emit characteristic grunting and rumbling sounds. Females will be attracted by this noise, and will visit leks in turn to mate. Some leks are better than others, and a strict male hierarchy develops in which weaker males are relegated to areas that are less suitable (and therefore less attractive to females).

While spawning, cod are extremely vulnerable to fishing activity. They are focussed on mating, and the males are unwilling to leave their hard-won leks, so both sexes are less likely to try and evade oncoming nets. Physical disturbance during mating will disrupt the activity and potentially destroy the lek areas, and cod so disturbed may not return (and therefore may not spawn that year). If the stronger males are caught or disrupted leaving the weaker males, the latter that remain may not be able to attract females. Stressed males are less likely to initiate mating. Noise may also disrupt mating, with females potentially unable to hear mating calls (Slabbekoorn et al 2010).

Most mating takes place on or near the seabed, but a recent study using data storage tags on male cod indicated that males will follow females around 5-10 metres up through the water column to initiate spawning (P. J. Wright pers. comm.: see **Figure 1**). This suggests that any fishing gear which operates within 10 metres of the seabed has the potential to disrupt or prevent cod spawning.

Figure 1. Data storage tag records for a male cod in the northern North Sea during mating activity. Two instances of the male ascending to chase females are circled.



Fishing activity is just one potential reason for the current long period of reduced recruitment, with environmental change and pressure from other species being others. Reducing fishing on spawning cod is likely to improve the amount of eggs produced, and should therefore result in improved recruitment in the following year, but this is difficult to evaluate in advance.

We are therefore unable to quantify the potential improvement in recruitment (and subsequent stock dynamics) that spawning closures in the first quarter should provide, but logic suggests that they should be beneficial.

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