

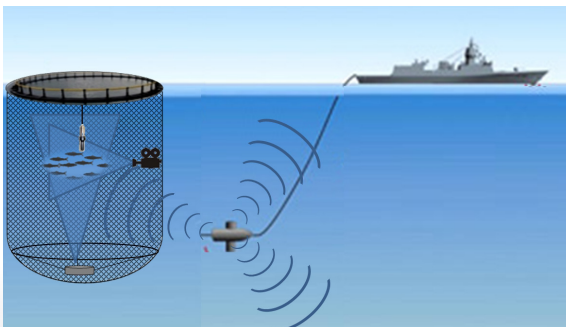
Herring are not frightened by frigate sonar

The large stocks of Norwegian spring-spawning herring do not just feed millions of people, they also provide food for cod, seals, killer whales and sea birds. The Royal Norwegian Navy's new frigates are equipped with powerful sonars, which could potentially disturb the herring. Fortunately, the herring don't seem bothered.

AV KJARTAN MÆSTAD

The characteristic “ping” of military sonars is familiar to anyone who has watched a film involving submarines. By sending sound pulses down into the sea and listening for an echo, it is possible to detect submarines. The same basic technology is used to locate and recognise fish for research purposes.

“When the Norwegian Navy introduced the new Nansen-class frigates in 2005, it equipped them with



Cage set-up: The herring were kept in a deep cage, and their behaviour was monitored by a vertically oriented echo sounder at the bottom of the cage, as well as by a video camera. The sound level in the cage was measured using a hydrophone, which was suspended in the middle of the cage at a depth of 5 metres.

KNM “Fridtjof Nansen”, the frigate used in the experiments.
Photo: FFI

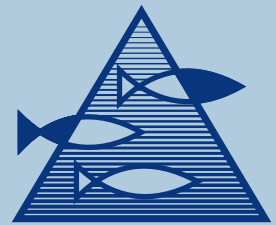
military sonars that are both more powerful and operate at lower frequencies than the ones on the old frigates. The new sonars are audible to various fishes, such as herring and European sprats,” explains Lise Doksaeter Sivle, researcher at the Institute of Marine Research (IMR).

JUMPY HERRING

“In previous studies, herring have been found to react quite strongly to other types of man-made sounds such as the noise of ships and seismic surveys. The extent to which herring react to these stimuli depends on the season and where the herring is in its migratory cycle,” says Doksaeter Sivle.

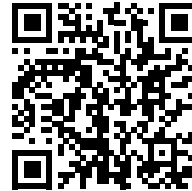
The behavioural responses of herring to naval sonars were tested in a collaboration project between IMR and the Norwegian Defence Research Establishment (FFI). In order to test whether herring react to the sound of the sonars, and if so how, herring were kept in cages at the Institute of Marine Research's aquaculture facility at Austevoll, near Bergen, for eighteen months, to enable testing in all seasons of the year. The possibility of seasonal variation was also studied.





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Watch video of herring that is exposed first to the sonar and then to sound from an outboard motor.

Top row: Both before and after exposure to the sonar, the herring can be seen swimming calmly. Bottom row: The herring can be seen swimming calmly until the outboard motor is started. Then all of the herring swim rapidly and synchronously downwards, which is their typical flight response.

PASSING FRIGATES

On three separate occasions, a frigate passed very close to the cage with its sonar on, to expose the herring to the sound of a military sonar. The three experiments were carried out at different times of year, corresponding to each of the three phases of the herring's annual cycle: feeding, overwintering and spawning. An echo sounder was placed on the bottom of the cage to monitor the herring's vertical movement, a video camera made it possible to study behavioural patterns in greater detail, and a hydrophone measured how loud the sonar was in the cage. The frigate then passed the cage several times, with its sonar both on and off, in order to distinguish between any reactions to the vessel itself and reactions to the sonar.

In addition to the sound of the sonar, the sound of a normal motorboat was used as a positive control. This is a sound to which the herring are known to react strongly.

NO REACTION

“The results of the experiments were quite surprising: the herring showed no reaction at all to the sonar; they continued to school and feed as before. This was true at all times of year. Conversely, when exposed to the sound of a motorboat, the herring responded by fleeing vertically, in spite of the fact that the sound was much less loud than the sound of the sonar,” says Lise.

This shows that the level of sound is not decisive in triggering a flight response, and suggests that the frequency range may be an important factor, as the noise from the motorboat includes components with much lower frequencies than the sonar. A flight response consumes significant amounts of energy, and takes time that could have been spent spawning and feeding, so it should only be used when there is a real threat. The ability to distinguish sound components associated with real danger, such as the sound of a predator, therefore confers a great advantage. This may be why herring only react to some sounds. Perhaps the low frequencies in motorboat noise are associated with the sound of a predator, whereas the sonar does not trigger any such associations.

The experiments, which were carried out using the actual sonars and vessels used by the Norwegian Navy at sound levels very close to operational ones, show that the frigates do not constitute a major risk to the population and distribution of Norwegian spring-spawning herring, or to the herring fisheries. These findings will be used when making guidelines for how the sonars on board the frigates should be operated during exercises in Norwegian waters, in order to minimise the negative impacts on marine life.

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