

Tracking wild cod in a wild ocean: Investigating the effects of man-made sound on Atlantic cod (*Gadus morhua*)

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The distribution and movement of all marine aquatic life structures the marine ecosystem from deep ocean canyons to the shallower North Sea. Understanding the movement and behaviour of marine animals can provide us with information on the wellbeing of the species as well as a tool to predict how the increasing human activities at sea may influence marine life. However, tracking marine animals like fish, is challenging in a harsh environment like the North Sea. Over the past decade, technological advances in telemetry have transformed our ability to observe aquatic animal behaviour and movement. Smaller sized tags with longer battery life have given us the opportunity to tag smaller animals and track them over a prolonged period of time. Furthermore, acoustic tags including a pressure and acceleration sensor are now available, leading to additional detailed data on fish behaviour and physiology.

Since 2010 Atlantic cod (*Gadus morhua*) have been tagged with acoustic tags in the North Sea. Over the past eight year this has provided us with a rich data set of over 150 tagged cod moving through the area. This telemetry data on cod has given indications of the migration paths these fish follow every year: from coastal zones in winter to more offshore areas in summer. The data has furthermore shown how cod use offshore man-made structures like wind turbines. However, little is known about the effects of sounds that accompany human activities, like pile driving and seismic exploration. The Population Consequences of Acoustic Disturbance on Cod project (PCAD4Cod) looks into the effects of seismic sound on Atlantic cod movement behaviour. This project, funded by the Joint Industry Program (JIP), uses an integrated set of techniques to study the impacts of this high intensity sound on cod. One of the goals of this project is to expose free-ranging cod to a real seismic survey and study the effects. To accomplish this, acoustic telemetry is used to track the movement and behaviour of the cod before, during and after the survey.

The tags can detect both pressure and acceleration which will add detailed information on position and behaviour on top of the detection data. The full seismic survey will take place during the coming field season (2018) and will provide new insights into how man-made seismic noise can affect wild cod movement and behaviour in the North Sea. Here, we will present first results from the field.

Keywords: acoustic telemetry; Atlantic cod; PCAD4Cod; seismic sound; North Sea