Can Pitch & Roll DST distinguish between pelagic and demersal behaviour of adult Greenland halibut?


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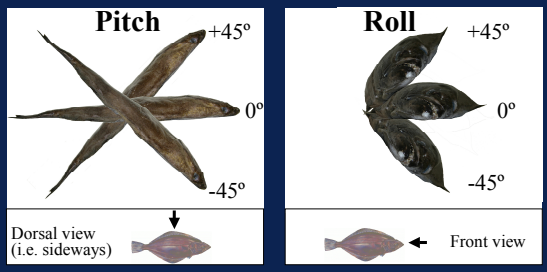
Previous studies have shown that adult Greenland halibut may commonly occur several hundred meters above the bottom. Survey indices based on bottom trawls may therefore be biased. Our long-term goal is to quantify this bias.

Without a swimbladder, the species is virtually invisible to echo sounders. Here we investigate if swimming behaviour, as recorded by Pitch & Roll Data Storage Tags, may be used to estimate the time spent in the pelagic environment.

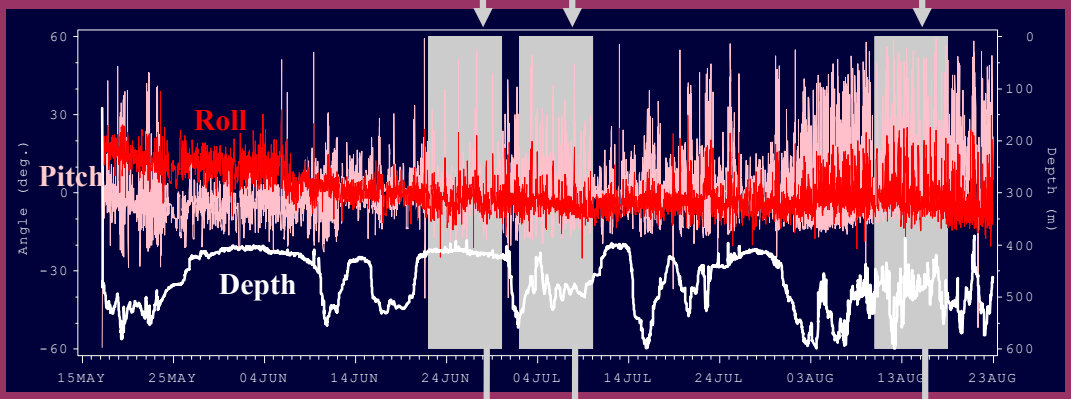


Greenland halibut (*Reinhardtius hippoglossoides*)

- Deep-water flatfish
- Pigmentation on both sides
- Left eye on top of the dorsal ridge
- Equally muscular on both sides
- Both scientists and fishermen have therefore speculated if the species may adopt a vertical swimming position (i.e. Roll=90°).

Three typical sequences

Each lasting one week



A typical example of Pitch & Roll DST recordings from Greenland halibut released and recaptured at the continental edge north of Norway. The data shown are from a 78 cm female in 2006. Data were recorded each 15 minutes.

Angular spectrum

The shape of the angular spectrum may indicate if the fish is closely associated with the bottom or is continuously swimming.

When the fish is close to the bottom and frequently resting on it, we would expect a symmetrical spectrum with central tendency close to zero. Since the bottom acts as refuge, steep descents are also expected.

When the fish is swimming pelagically the usual flatfish swimming behaviour predicts steep ascents and gentle gliding descents. Without a bottom to rest on, horizontal pitch should be rear. Without the bottom surface to generate thrust against, body flexing may be more fierce.

On bottom ?

Constant depth

48% of the time of all recaptures

Along bottom ?

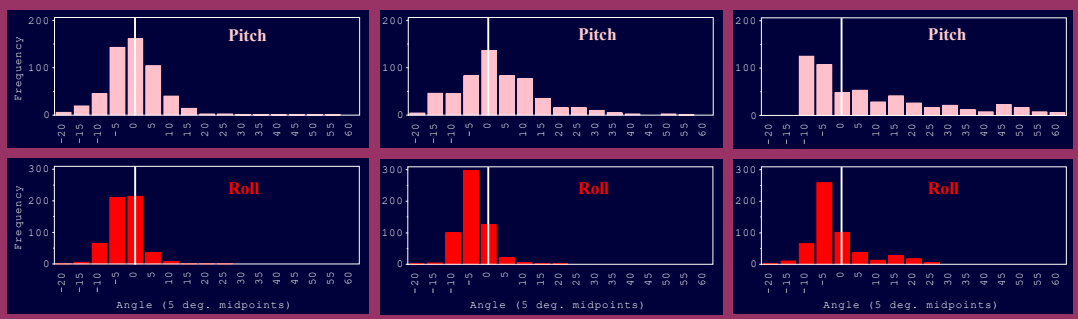
Diurnal or other slow changes in depth

32% of the time of all recaptures

Pelagic ?

High frequency changes in depth

20% of the time of all recaptures



Pitch and roll spectrum with strong central tendency around zero

The fish is often resting on the sea floor and shows some steep descents.

Diurnal activity rhythms may be seen in pitch and roll, even though they may not appear in the depth and temperature recordings.

Pitch spectrum with central tendency around zero

The fish is often resting on the sea floor and shows both steep descents and ascents.

The depth varies typically with a one-day period. The fish seems to be swimming up and down the slope, along the bottom.

Pitch spectrum with no central tendency

The fish is seldom or never resting on the sea floor and it lacks the steep descents.

The fish is probably either swimming upwards or gliding slowly downwards, in accordance with expected pelagic behaviour.

They swim horizontally, like other flatfishes

From 11 recovered Pitch and Roll DSTs, there were no indication of sustained swimming in a vertical position. Even during the first descents after release, the mean roll angle was less than 30°.

CONCLUSIONS AND FURTHER WORK

- **Pitch & Roll DSTs may distinguish activity periods that are not apparent from the usual depth-temperature trajectories.**
- **It seems plausible that Pitch & Roll DSTs may help distinguish between periods of pelagic swimming and more bottom oriented behaviour.**
- **In addition to the field experiments, controlled tank experiments are needed to establish the relationships between pitch and roll, angle of movement, and whether or not the fish is swimming close to the bottom.**

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