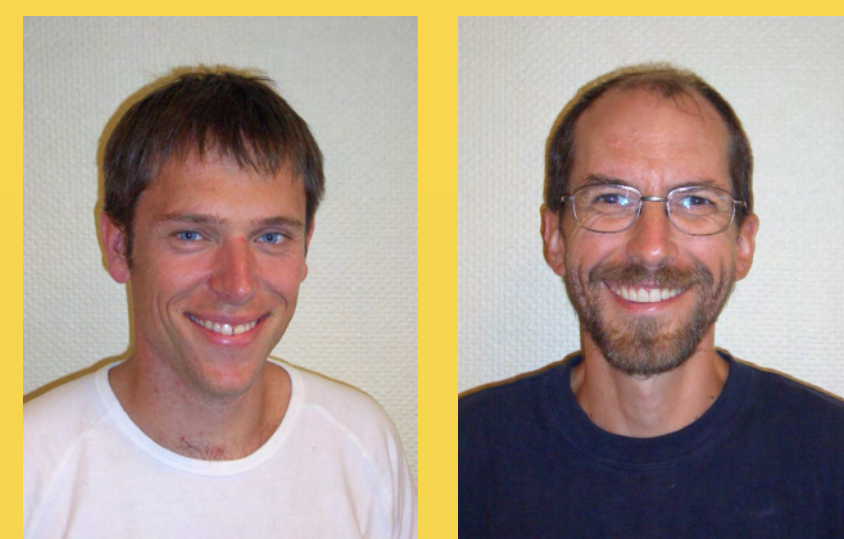


# A vessel specific bias in echo sounder recordings during trawling.



Handegard, Nils Olav<sup>1,2</sup>, Hjellvik, Vidar<sup>1</sup>



N.O. Handegard V. Hjellvik

<sup>1</sup>Institute of Marine Research, Bergen, Norway.  
<sup>2</sup>Department of Mathematics, University of Bergen, Norway

## Significantly higher acoustic density during trawling than before/after for (old) RV "G.O.Sars".

We have analysed acoustic data recorded by RV "Johan Hjort" and (old) RV "G.O.Sars" during the bottom trawl survey in the Barents Sea from 1997 through 2002. The observed acoustic density of demersal fish during trawling was compared to that just before and just after trawling. For RV "G.O.Sars", the echo abundance was on average about 12 % lower before and after trawling than during trawling, and the difference was highly significant and consistent between years. For RV "Johan Hjort" the average difference was about 1%, which was not significant (Figure 1).

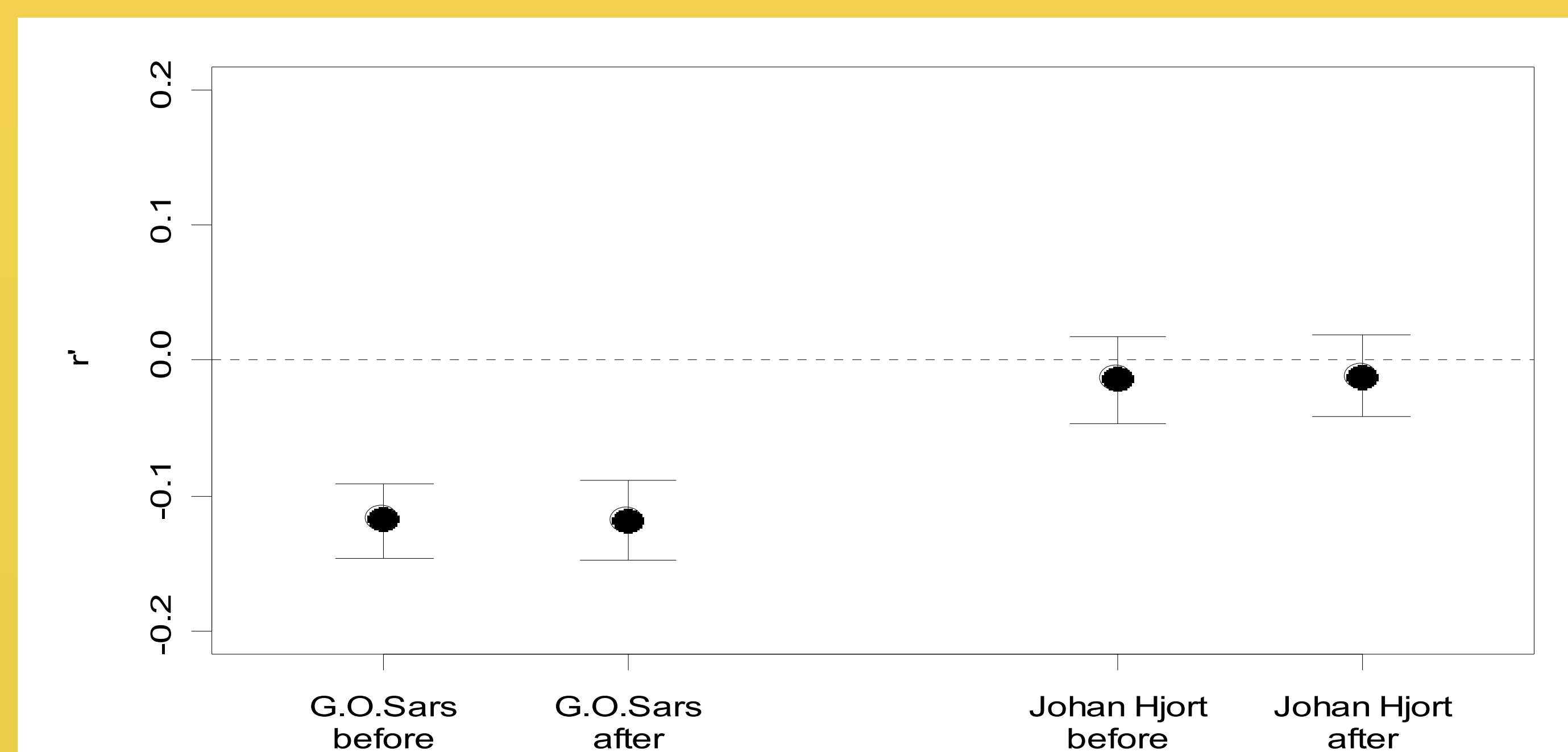
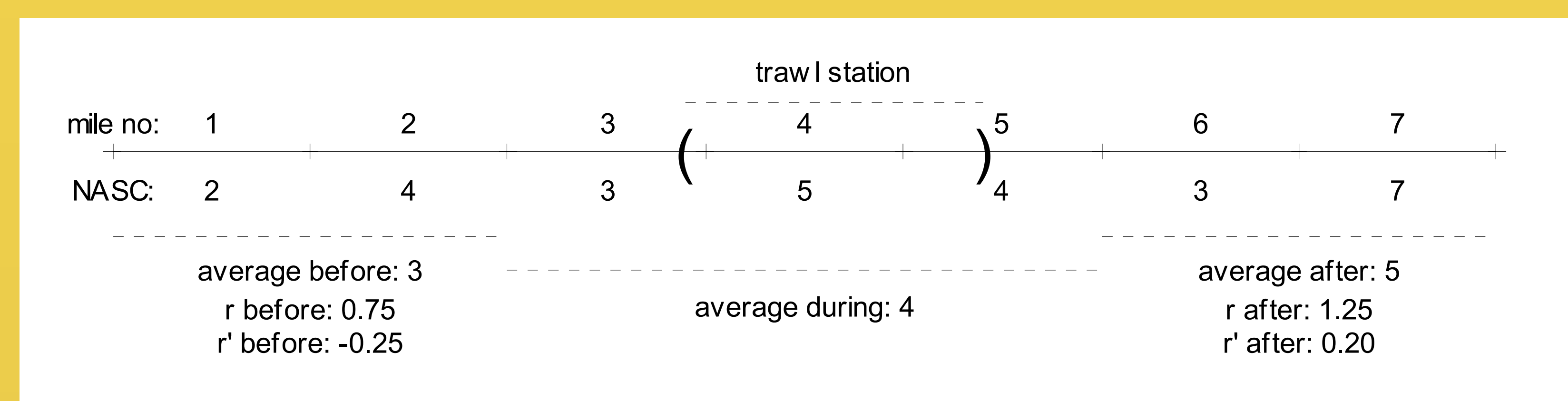


Figure 1. Acoustic density before/after trawling, as compared to during trawling, for (old) RV "G.O.Sars" (n=638) and RV "Johan Hjort" (n=578). All years joined together. Means and bootstrapped 95% confidence intervals for the ratio  $r'$  are given ( $r' = 0$  if the density is the same before/after and during trawling,  $r' = -1$  if the density before/after trawling is zero and  $r' = 1$  if the density during trawling is zero; see to the right for details).

Definition of the ratio  $r'$

$X_D$  = average acoustic density (NASC) during trawling.  
 $X_B$  = average acoustic density the two miles before trawling.  
 $X_A$  = average acoustic density the two miles after trawling.  
 $r_B = X_B/X_D, r_A = X_A/X_D$   
 $r' = r - 1, r \leq 1, r' = 1 - 1/r, r > 1$



## What causes the high acoustic density during trawling for (old) RV "G.O.Sars"?

Experiments investigating individual fish behaviour towards the (old) RV "G.O.Sars" may elucidate this (Figure 2 and 3).

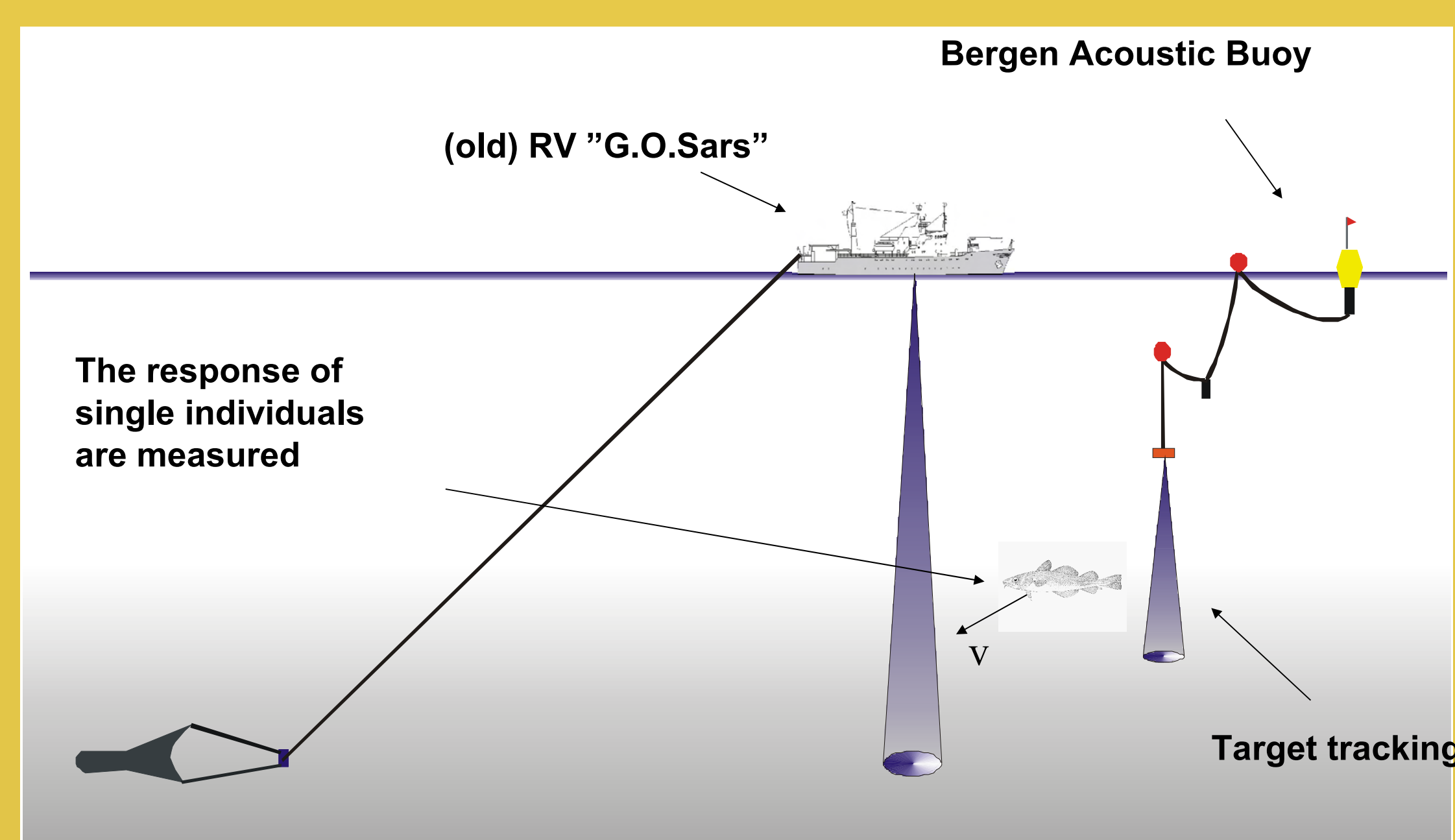


Figure 2. The experimental design for measuring fish behaviour towards an approaching vessel. Single fish are tracked within the echo beam of the buoy.

Fish are swimming towards the vessel track. Is this the cause of the high acoustic density during trawling?

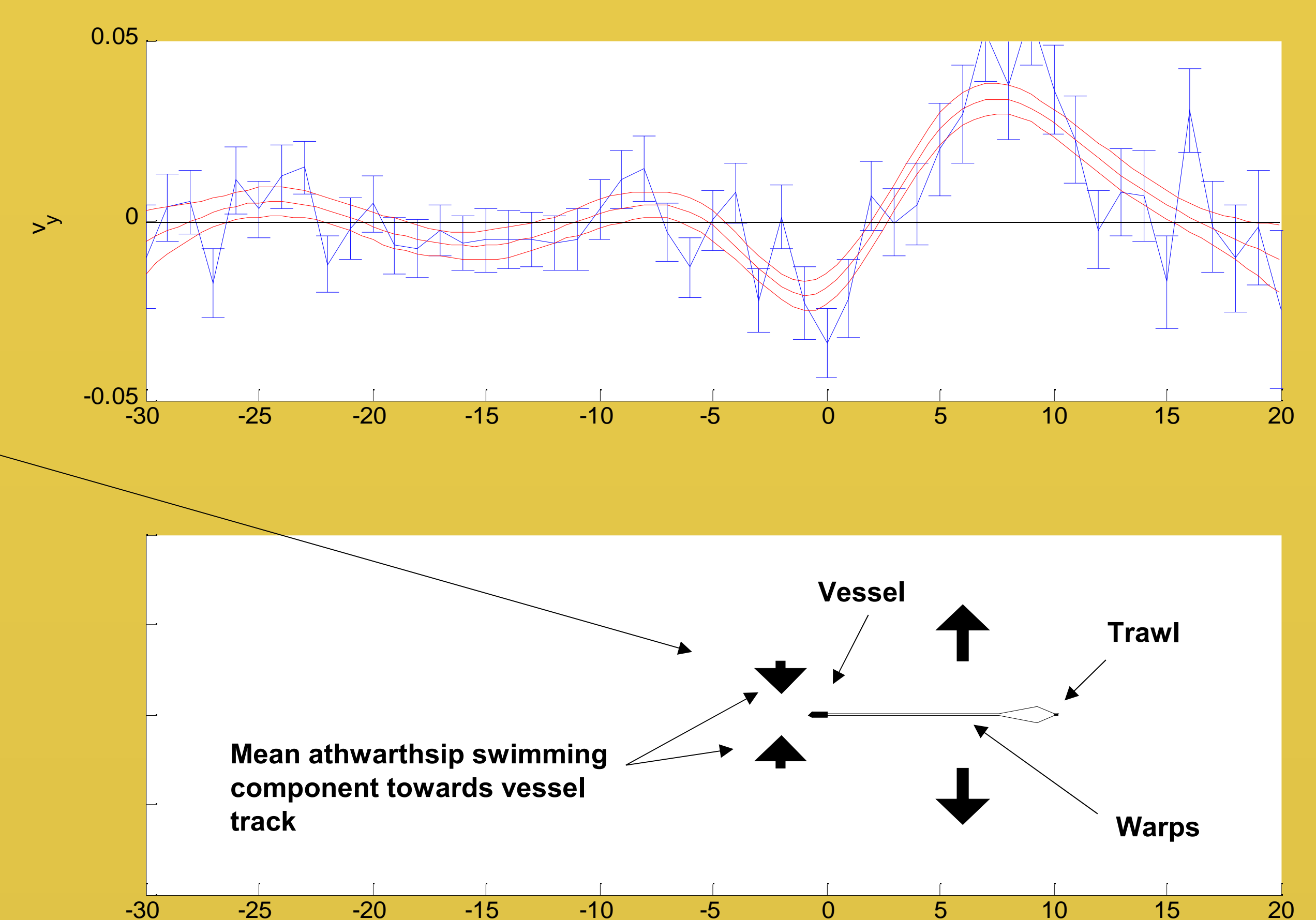


Figure 3. The measured mean athwartship reaction. Positive  $v_y$  is defined as swimming away from the vessel track. The upper panel shows the measured  $v_y$  as a function of time [min] before/after passing of the vessel. The blue bars indicate the mean of  $v_y \pm 2$  standard errors within bins of 1 min, the red curves show a fitted GAM with 95% confidence intervals. The arrows in the lower panel indicate the main athwartship swimming component relative to the vessel and gear.

**We put forward the hypothesis that the high acoustic density during trawling for (old) RV "G.O.Sars" is caused by a vessel specific fish reaction pattern.**