# A joint industry-science project to improve selectivity by acoustic species characterisation

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## Background

The EU regulates the catch of mackerel *(Scomber scombrus)* and horse mackerel *(Trachurus trachurus)* by use of quotas. Pelagic freezer-trawlers encounter mixed fish schools towards the end of the mackerel fishing season when their quota for mackerel is nearly depleted but horse mackerel can still be targeted. A good selectivity of the target species is therefore necessary. Improved acoustic species identification can be a valuable tool in reducing bycatch of species for which less quota is left.

## Objective

- Upgrade the echosounder on a pelagic freezer-trawler to 4 operating frequencies (38, 70, 120, and 200 kHz) to collect more information.
- Collect acoustic multifrequency test data during fishing operations targeting mackerel and horse mackerel.
- Develop scientific species identification algorithms based on multi-frequency echosounder data and implement them in a software tool to helps skippers make more objective decisions when targeting mackerel and horse mackerel aggregations.

## Results

The identification algorithm correctly classified 61.4% (mackerel) and 60.6% (horse mackerel) of backscattered sound energy from schools that contained the respective species. Proportions of fish school backscatter that was identified as the wrong species were much lower for both mackerel (14.4%) and horse mackerel (14.0%) schools. There was a significant difference between the proportions of correct and incorrect classification within schools (mackerel: $df$=21, $F$=47.9, $p$<0.001; horse mackerel: $df$=51, $F$=127.9, $p$<0.001) (Figure 1).

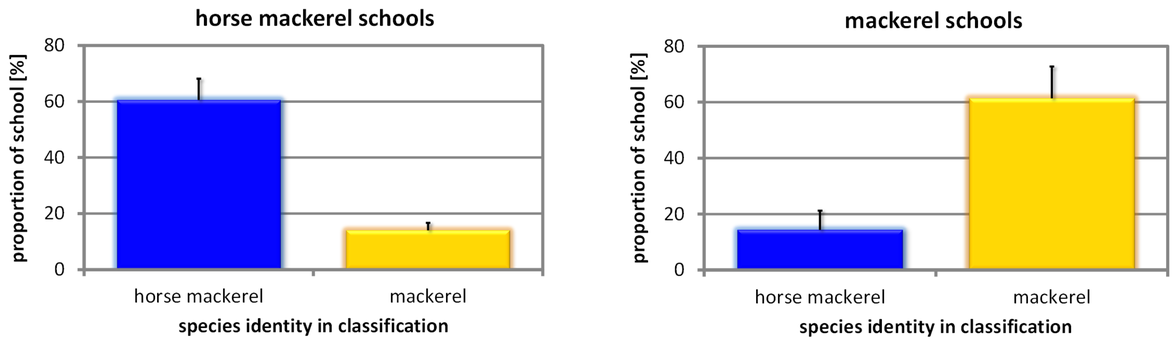


**Figure 1.** Proportions of acoustic backscatter classified as mackerel or horse mackerel in schools containing either of these species, based on automated acoustic species identification.

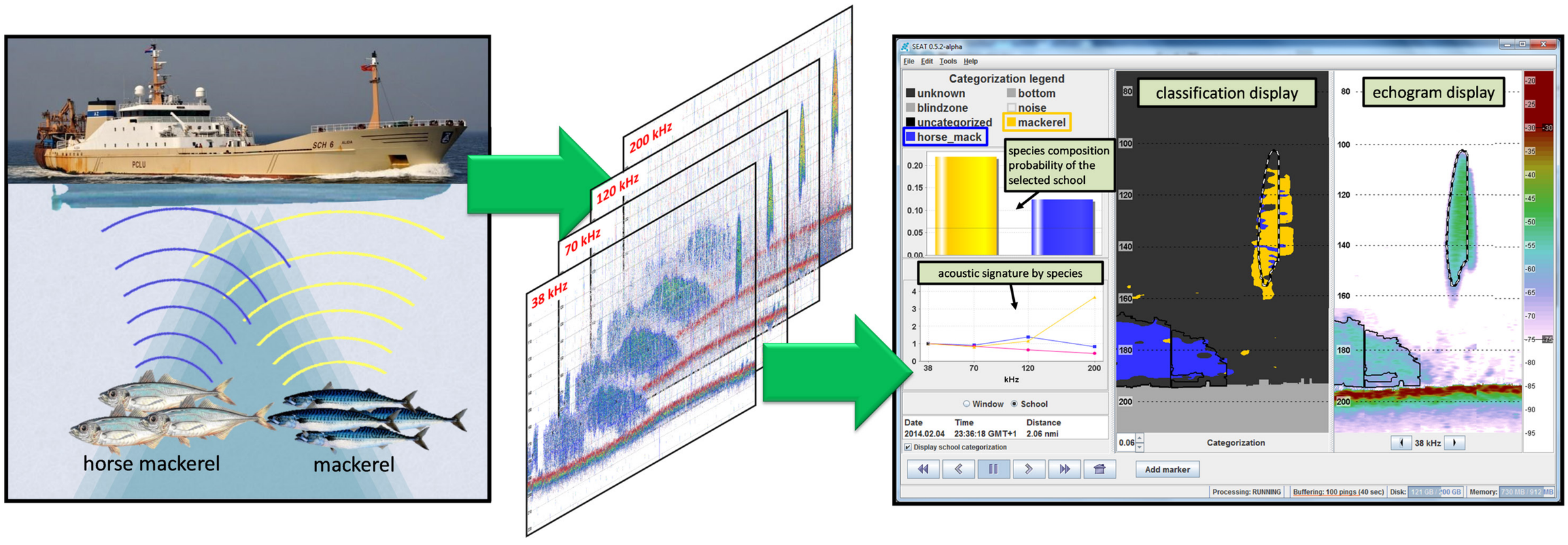


**Figure 2.** Schematic description of the acoustic multifrequency species identification method: The echosounder is used to detect fish (left panel) and collect acoustic data at four different frequencies (middle panel). Data are analysed in real-time and fish schools classified and displayed in a dedicated software (right panel) to help the skipper decide which school to target.

## Methods

The acoustic identification approach makes use of variations in sound reflection properties at different frequencies between the fish species investigated. Fish with swimbladders, like horse mackerel, usually show less variation in sound backscatter at the four frequencies used. Mackerel has no swimbladder and is therefore generally a weak scatterer of sound. However, mackerel reflect sound stronger at higher frequencies (>100 kHz) compared to lower frequencies. This feature is used here in the development of an identification algorithm for automated mackerel and horse mackerel school characterisation (Figure 2).

## Conclusions

- Acoustic distinction between mackerel and horse mackerel based on multifrequency data is theoretically and practically possible, providing skippers with an additional aid to improve fishing selectivity.
- Data quality can sometimes be hampered by noise from other acoustic equipment and machinery running at the same time.
- There is potential to extend the list of species classified with the software to include others, like herring *(Clupea harengus).* The same is also true for boarfish *(Capros aper),* which currently poses a major bycatch problem.

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