



# School biomass estimates using digital omnidirectional fisheries sonar

Héctor Peña, Egil Ona, Gavin Macaulay, Arne Holmin,  
Sindre Vatnehol and Ole Bernt Gammelsæter

Fiskeleting, fangst og kvalitet: Siste nytt fra forskningsfronten  
15. desember 2015, Clarion hotel Bergen Airport



# Motivation

Omnidirectional fisheries sonar

Detailed inspection

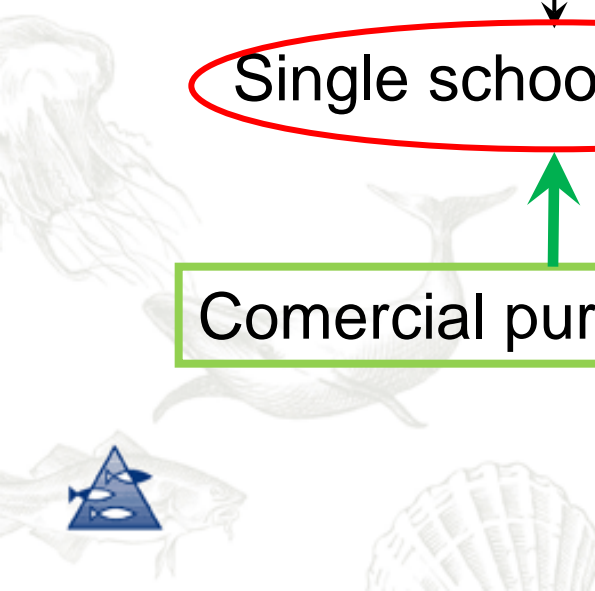
Surveying

Single school biomass

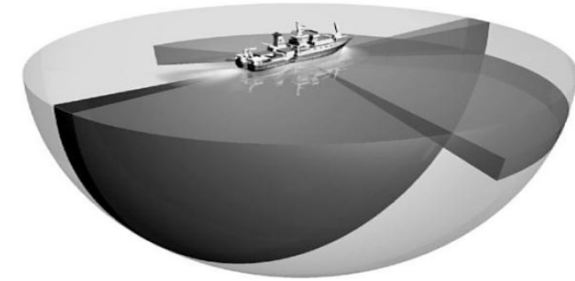
Echo integration

Comercial purse seining

WHO FISH (2012 - 2015)  
CRISP (2011 - 2019)



## Stages of commercial purse seining using omnidirectional fisheries sonars

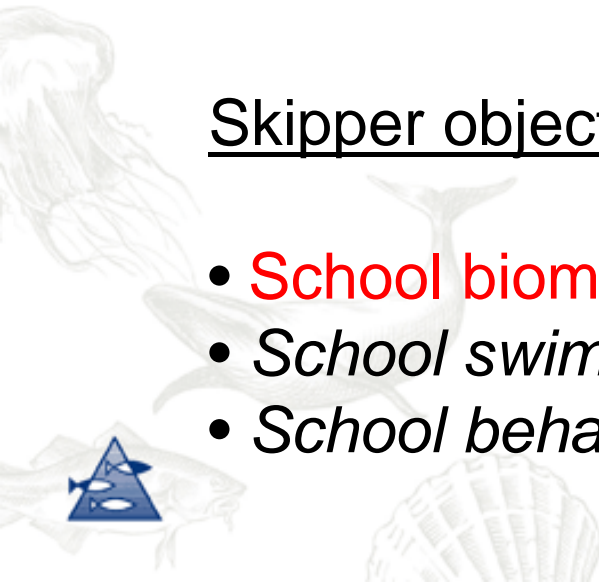


1. Searching (range: 1000 to 3000 m)
2. Preliminary inspection (range: 400 to 600 m)
3. Selection of school candidate
4. Detailed school inspection (range: 150 to 300 m)



### Skipper objectives

- **School biomass**
- *School swimming direction and speed*
- *School behaviour to approaching vessel*



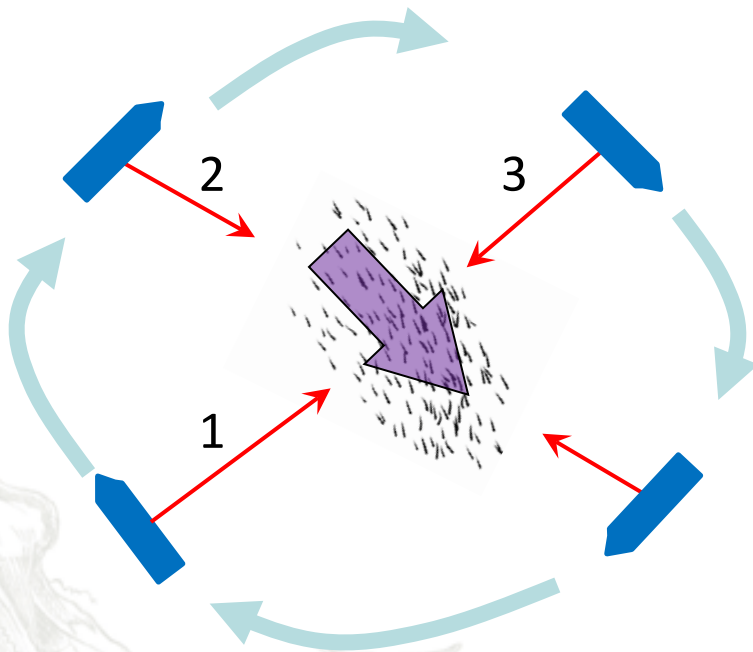


# Detailed school inspection of herring school in North sea November 2013 F/V "Artus"

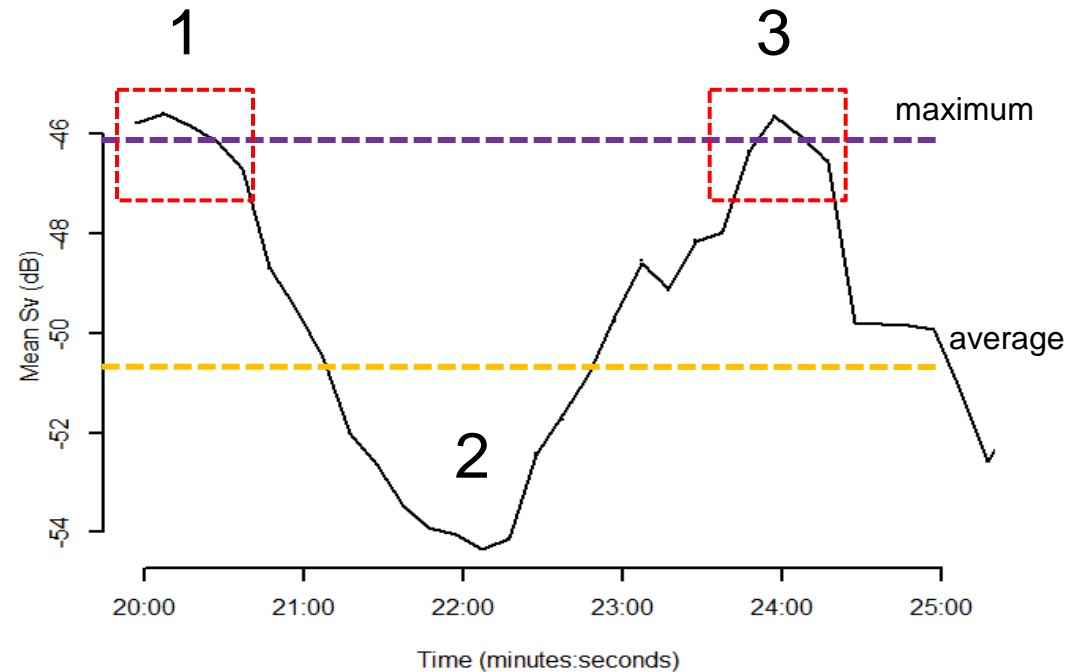
[Inspection.wmv](#)



# Detailed school inspection



Sonar echo strength (Sv) changes during encircling a polarized school



# Biomass calculation

Fish density

School volume

Fish weight

Calibrated  
raw data

Horizontal  
beams



School biomass =

$$\frac{S_v}{\sigma_{bs}}$$

\* school area

\* school height

\* fish weight



Side aspect TS

Vertical beams

Catches

Simrad SX90 and SU90 at 26 and 30 kHz

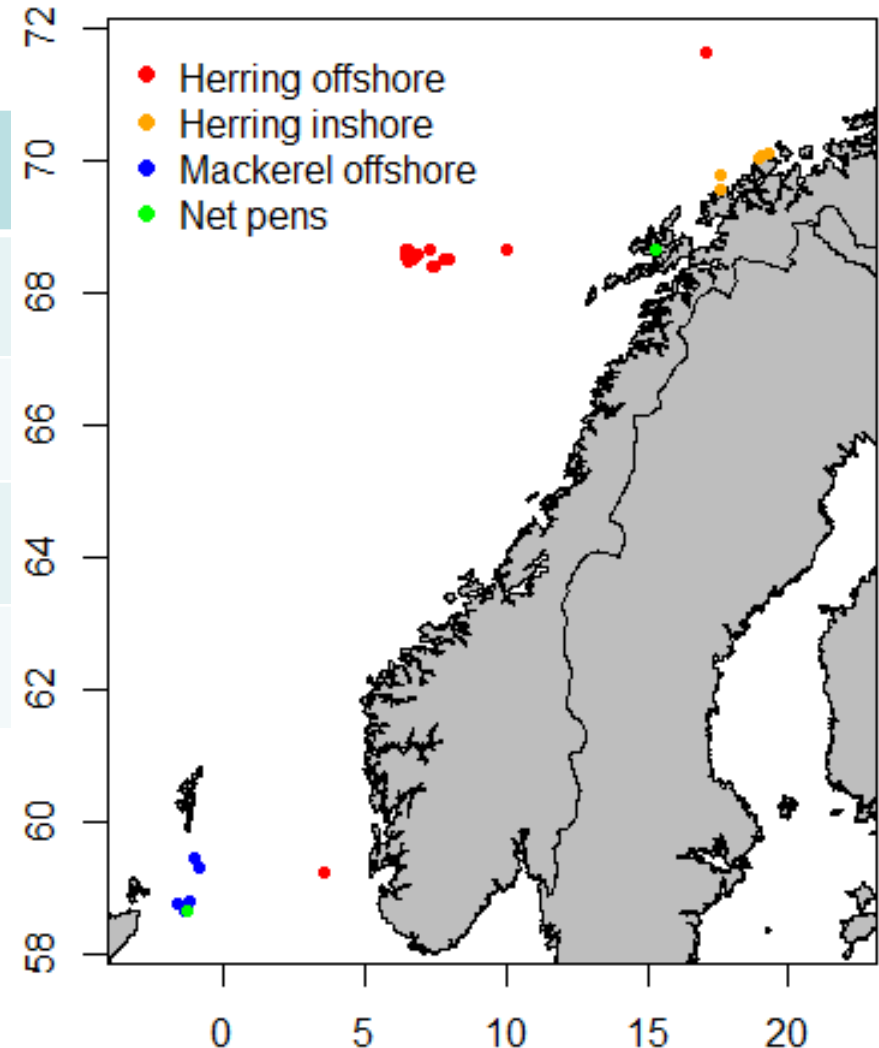


# Results

Vessel	Dates	Ship days	Species	Schools
GO Sars	Nov. 2012	14	Herring	20
GO Sars Artus	Mar. 2013	28	Herring	1
GO Sars Artus	Nov. 2013	28	Herring	7
GO Sars Kings Bay	Oct. 2014	28	Mackerel	6

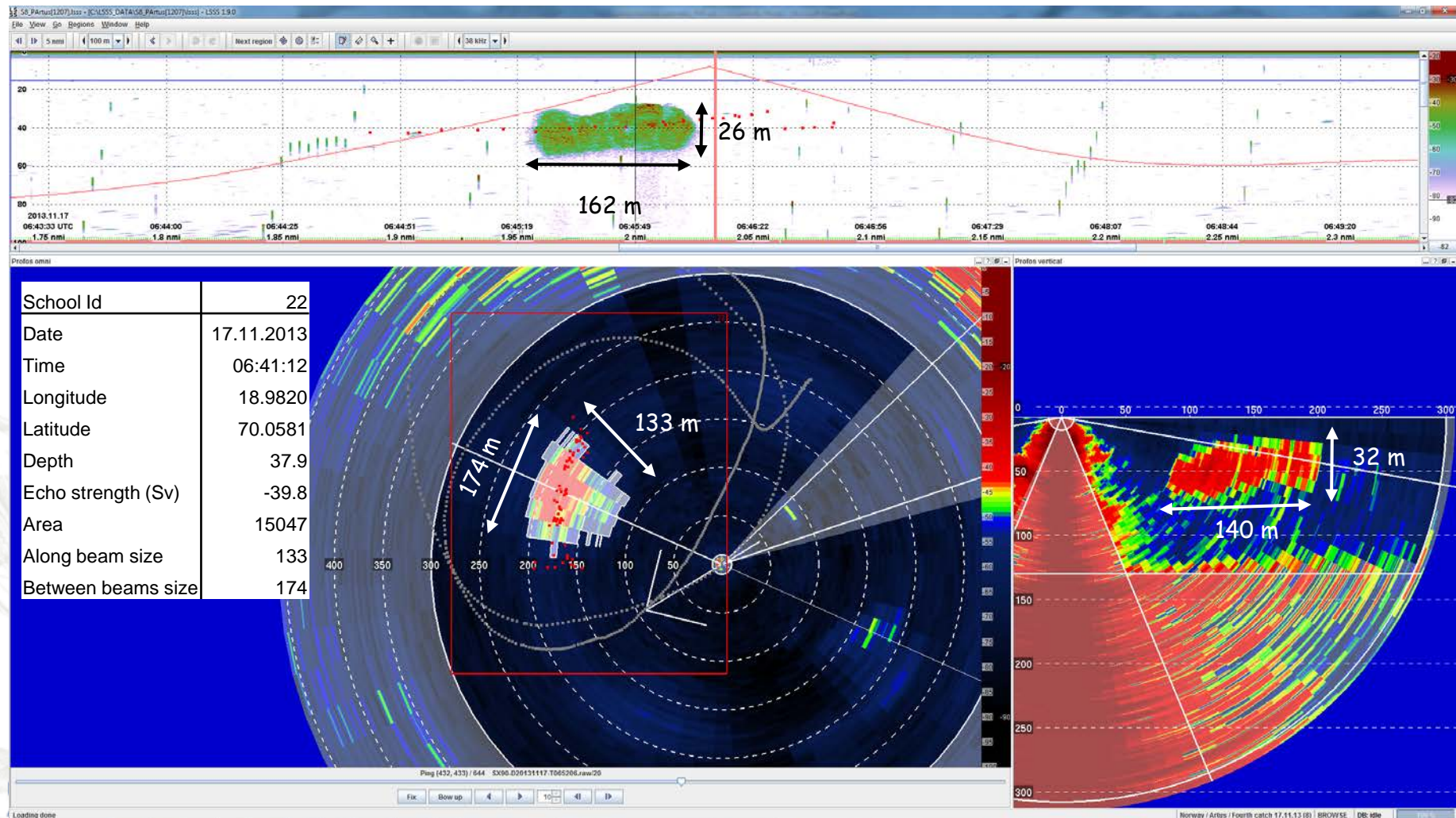
Total of 98 ship days  
34 best quality schools  
9 verified catches

## Schools processed



# Procedure for school growing in post-processing software

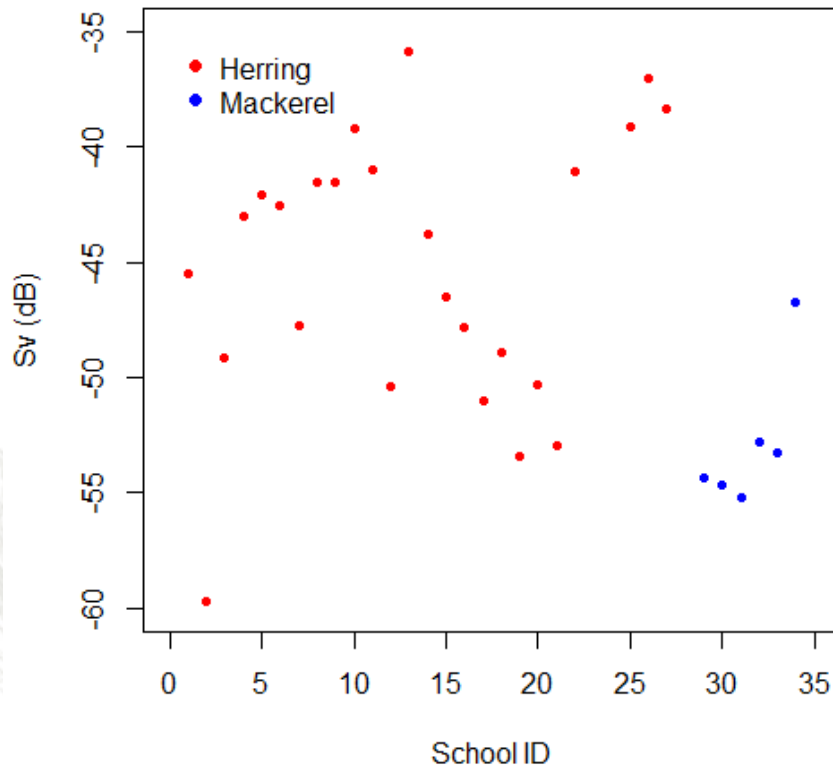
## School growing.wmv



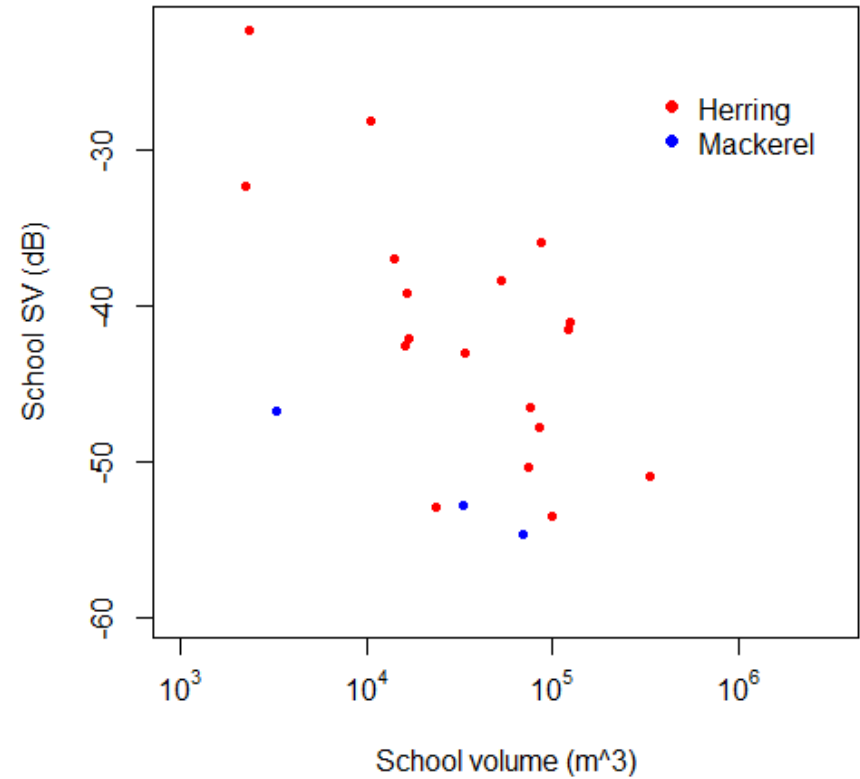


# Results from sonar measurements

Mean echo strength (Sv) from sonar measurements

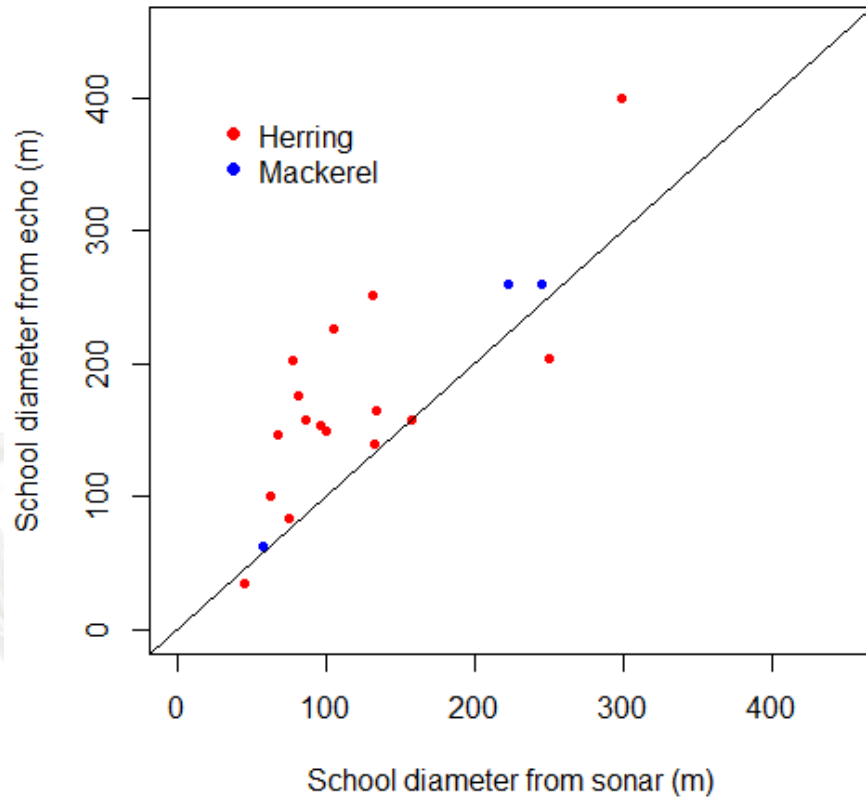


Mean echo strength (Sv) and school volume

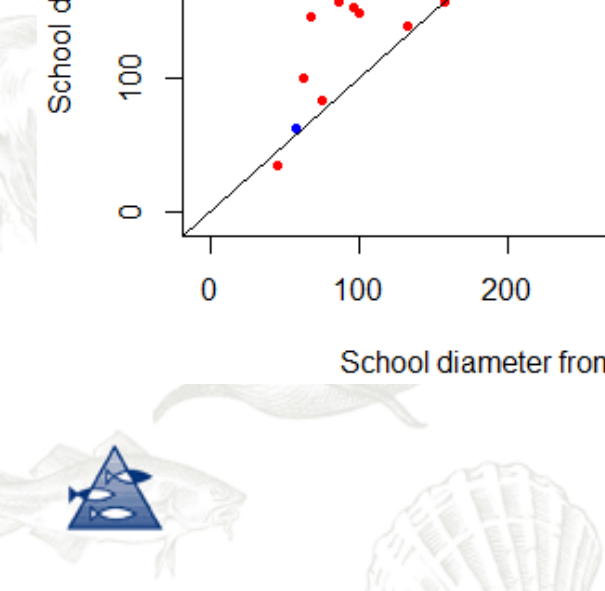
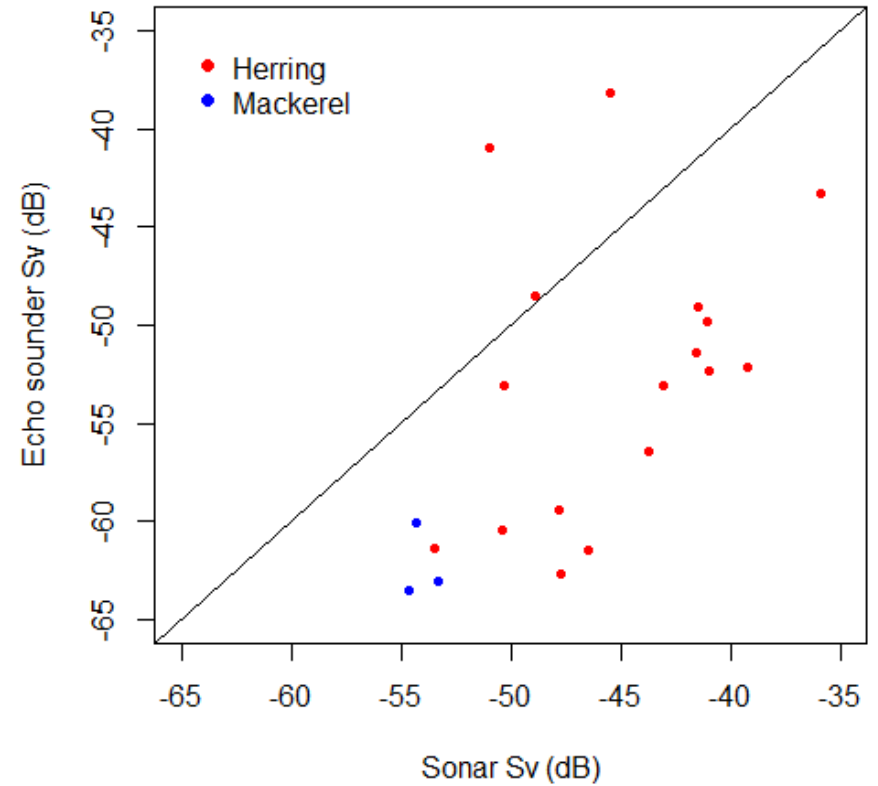


# Sonar and echo sounder measurements

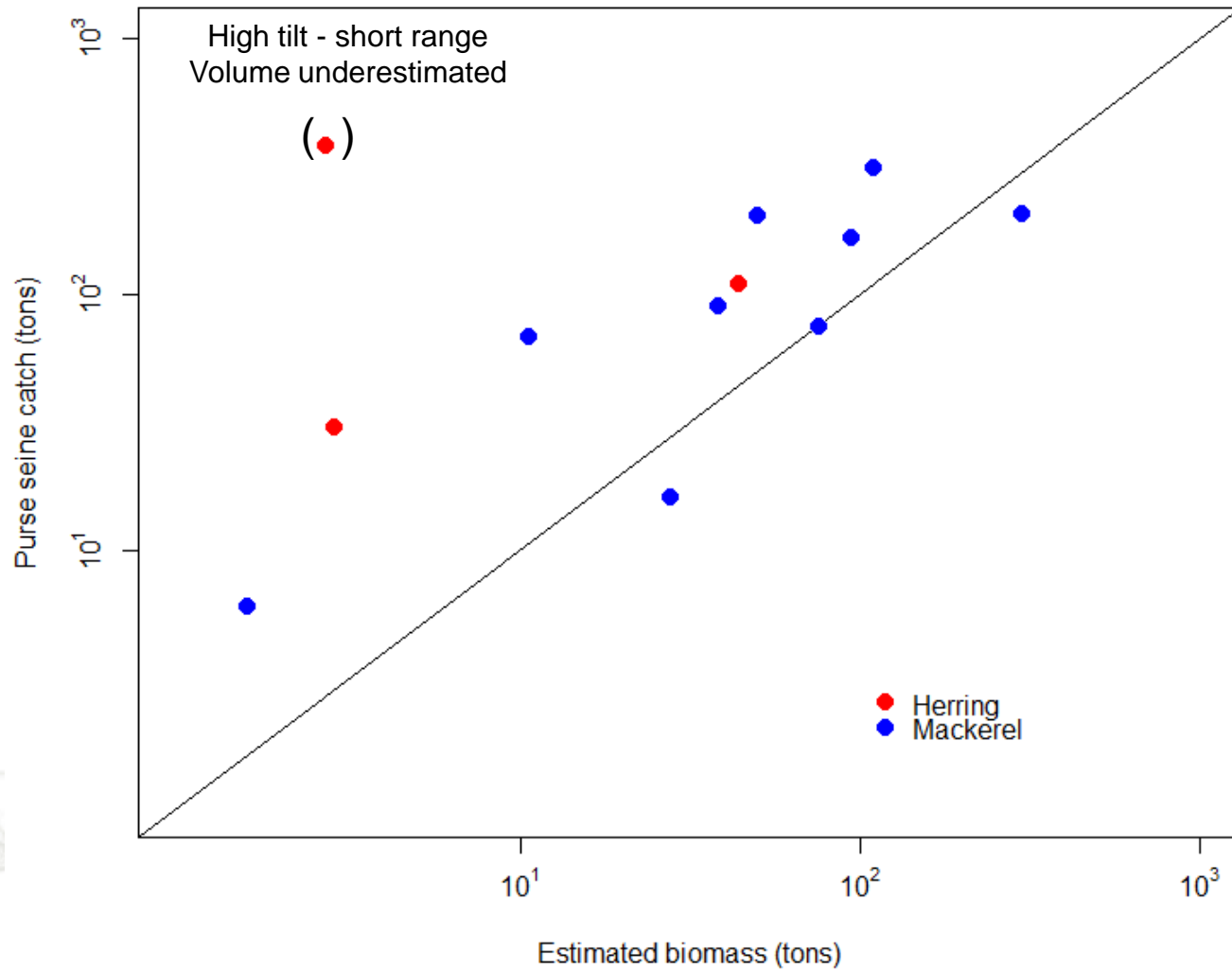
School diameter from echo and sonar



Echo strength from sonar and echo sounder



# Sonar estimated and verified biomass of herring and mackerel



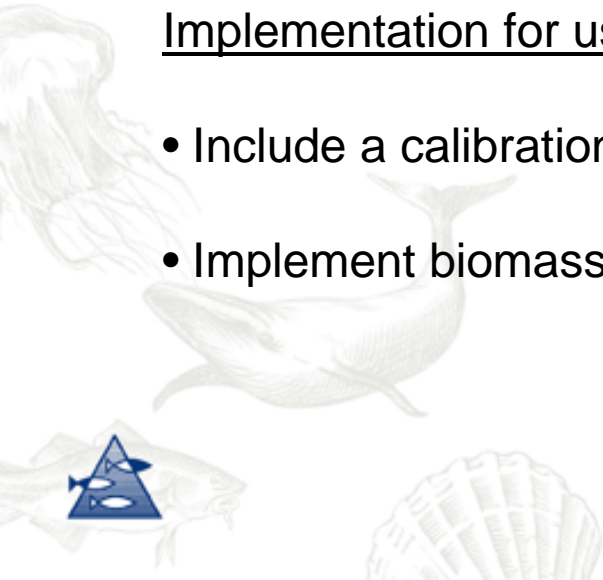
# Future activities

## Improvements in methodology

- Implement improved growing methods in post-processing software
- Calibration in FM mode and vertical beams (done in October 2015)
- Improve side aspect target strength (TS)

## Implementation for use in commercial fishery (2016?)

- Include a calibration facility in sonar software
- Implement biomass equations in sonar software



# Acknowledgements

**WHOFISH** – Whale counting and fish school biomass appraisal by two new omni-directional fisheries sonars. *Norwegian Research council, Proj. No.*

216460  **Forskningrådet**

**CRISP** - Centre for Research-based Innovation in Sustainable fish capture and Processing technology. *Norwegian Research council, Proj. No.*

203477  **Forskningrådet**

And especially to the skippers and crew of:

R/V "GO Sars"



F/V "Artus"



F/V "Kings Bay"

