Small Pelagic Fish:
New Frontiers in Science and Sustainable Management

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Purse-seine fishery in Portugal:

no sardine, no future?

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IPMA

Portuguese Acoustic Surveys

- Acoustic surveys began in August 1982.
- Data series has a series of changes/interruptions. Nowadays, Iberia collaboration (Portugal and Spain) to assess the Atlanto-Iberian sardine stock.
- Main objective - abundance estimation, numbers and biomass per length and age for sardine inhabiting Portuguese shelf.
- Since 1999, anchovy abundance has also been obtained.

Acoustic Vessels: on top, Portuguese RV Noruega and bottom, Spanish RV Miguel Oliver.

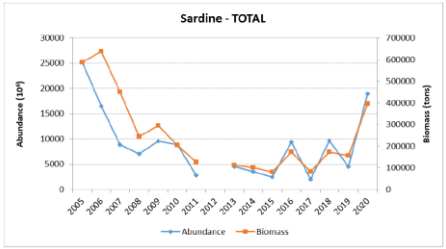
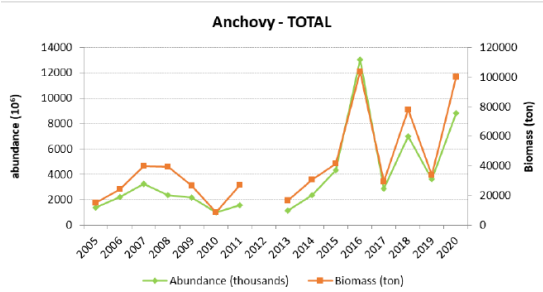


Figure 7 – Sardine abundance and biomass trend in PELAGO surveys since 2005.



Souce: ICES. 2021. Working Group on Acoustic and Egg Surveys for small pelagic fish in NE Atlantic (WGACEGG; outputs from 2020 meeting). ICES Scientific Reports. 3:76. 706 pp.

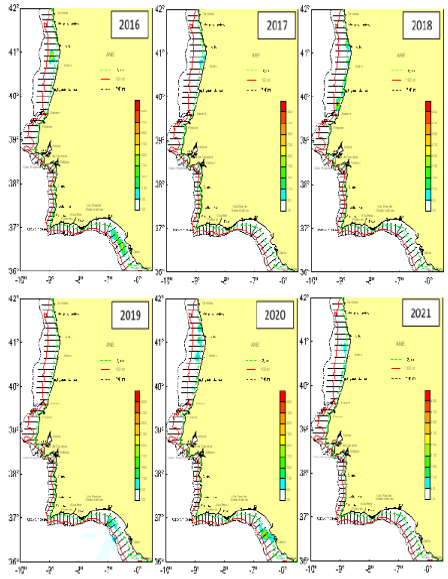


Figure 4 – Acoustic density (NASC, $m^2.nm^{-2}$) of anchovy in PELAGO survey series from 2016 to 2021.

Source: ICES. 2022. Working Group on Southern Horse Mackerel, Anchovy and Sardine (WGHANSA). Draft report. ICES Scientific Reports. 4:51. 354 pp. http://doi.org/10.17895/ices.pub.19982720

Do surveys cover all SPF stock story?

"Eight hours and still not a bird to be seen..."

Portuguese purse-seine fishery

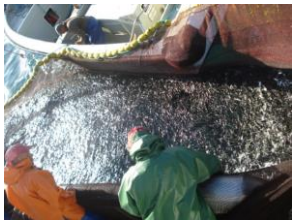
Target species: Sardine (*Sardina pilchardus*)

Purse-seine also targets other pelagic fish:

- Chub-mackerel (*Scomber colias*)
- European anchovy (*Engraulis encrasicolus*)
- Scads (*Trachurus trachurus*, *T. picturatus*, *T. mediterraneus*)

In 2020, purse-seine landings:

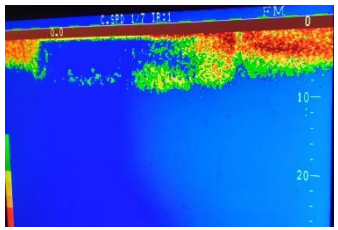
- 46.4 % in weight
- 21 % in value in the first sale (DGRM, 2021)

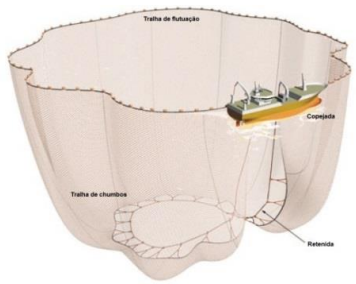


Portuguese purse-seine fishery

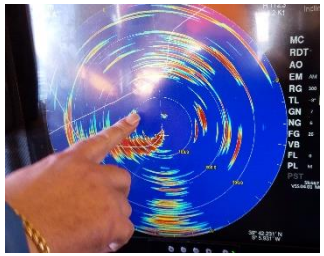
Portuguese Fleet ≈ 149 vessels
85 with LOA(length overall ≥ 16 m
12 000 trips per year

Daily trips and close to shore
Fishing grounds near the landings ports
1 to 4 species in catch (in average)

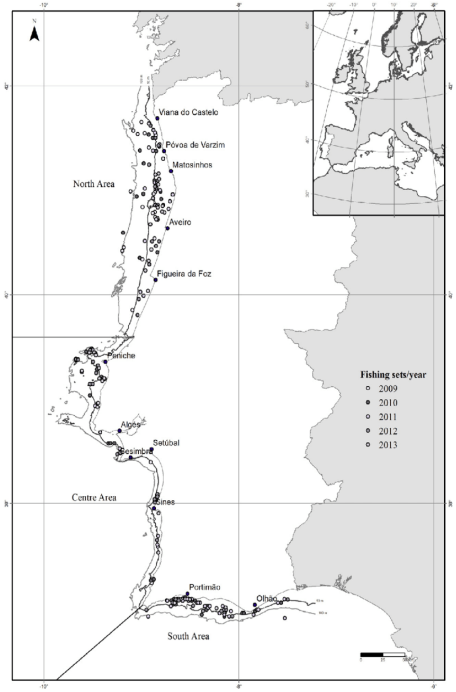


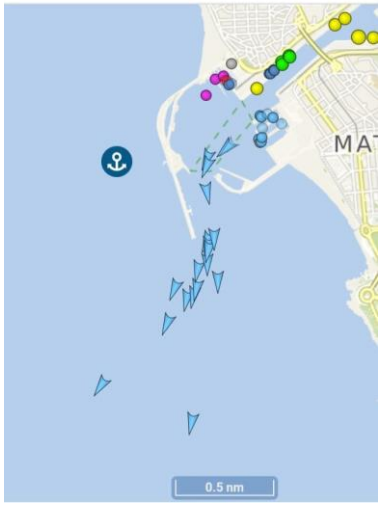


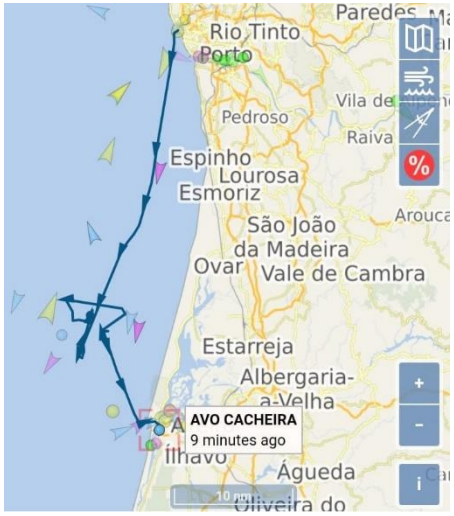
Adaptad from Galbraith *et al*., 2004



Feijó *et al*., 2018







Objectives

This work aims to:

- analyze changes in fleet behavior due to the reduction of annual and daily quotas for sardine in the period 2005-2020
- assess the impact of reduction of quotas for sardines on annual landing dynamics of pelagic species
- identify preferential ports for the target species
- discuss how this information can improve the assessment of pelagic species

Methods

Daily landings (2005-2020) for all relevant purse seiner vessels, aggregated to fishing trips;

- For each vessel:
  - Preferred ports/region for landing;
  - Loa segment:
    - DFC segment – [0-10[, [10-12[, [12-18[, [18-24[, [24-40[m
    - 2 size segments – small vessel = *tuca* (Loa <=16m) and big vessels = *traineira* (Loa >16m)

- For each fishing trip at daily, month and year levels:
  - Quantity landed of each species (kg);
  - Value of each species (Total revenue - euros and mean price - euros/kg)
  - ICES subdivision (27.9.a.c.n. = NW, 27.9.a.c.s. = SW, 27.9.a.s.a. = South);

- Metrics considered:
  - Fleet selected by importance of pelagic species in total landings - cutoff/ elbow rule
  - Targeted species in each trip;
  - Shifts in preferential landing ports/regions;

- Analyses:
  - Landing and time series (R shinny app)
  - Correlation plots (correlation matrix, confidence interval)
  - Variance (ANOVA)
  - Landings standardized with fleet characteristics

- Acoustic Biomass
  - yearly landings and abundance ratio for sardine and anchovy by area

Results: small pelagic landings

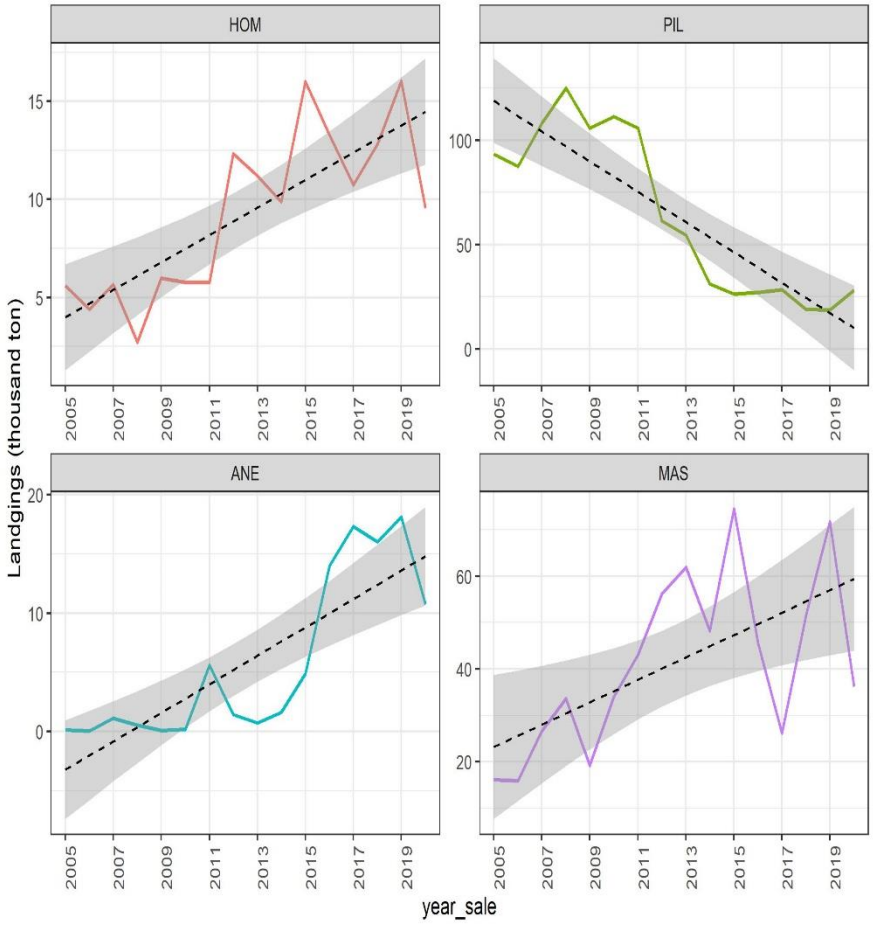
For the period 2005-2020:

- Target species: Sardine
- Chub-mackerel became the most landed species
- Horse-mackerel increase landings
- Anchovy had a large increase since 2016 and mainly in NW

Sardine fishery was restricted, mainly since 2010 as a result of low stock abundance.

Since 2012, Portugal and Spain adopted management rules for sardines such as:

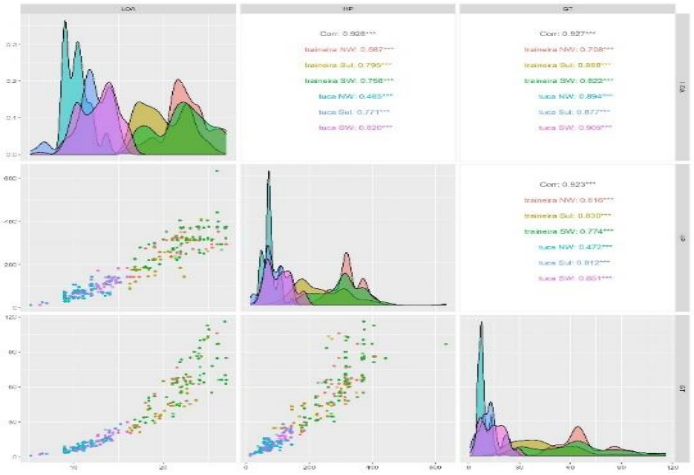
- reduction of annual quotas
- daily quotas for vessel by LOA
- long periods without fishing

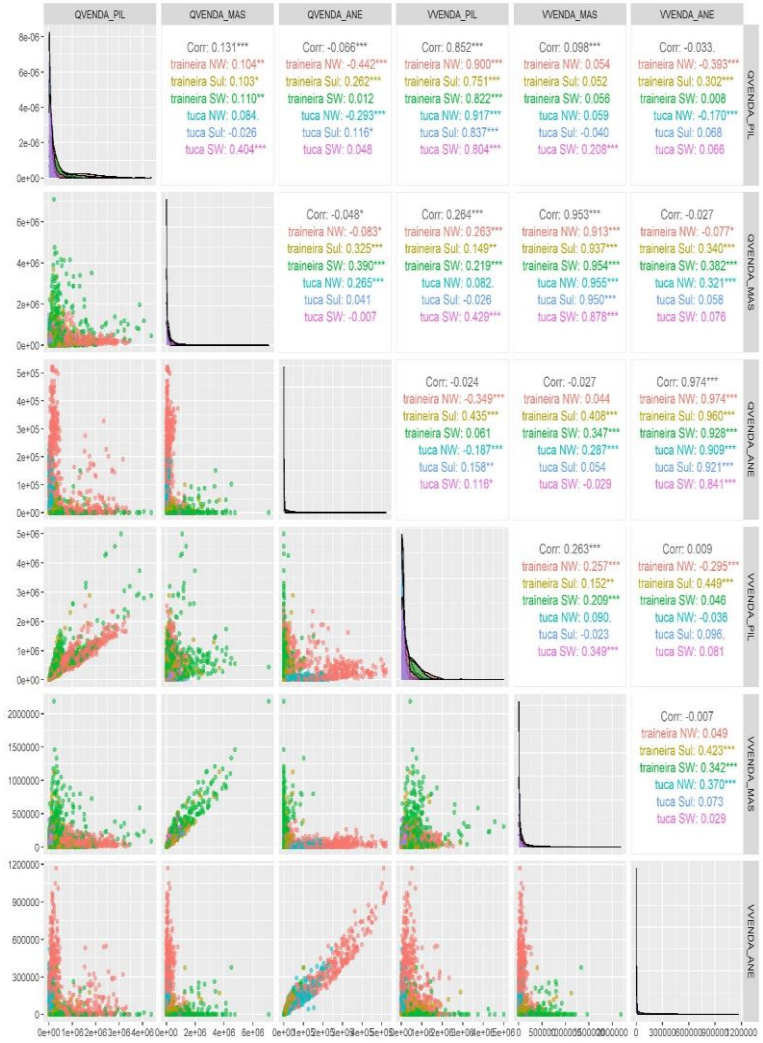


For more information about landings…
My poster and see Shiny app!

Results: small pelagic landings

- Significant positive correlations:
- sardine, chub-mackerel & total landings
- mean prices of sardine & chub-mackerel
- Significant negative correlations:
- anchovy and total landings
- mean prices of sardine, anchovy & all other species





Vessel characteristics (LOA, HP, GT) are very highly correlated and significant differences across region.
Important due sardine regulation is applied by Loa size.

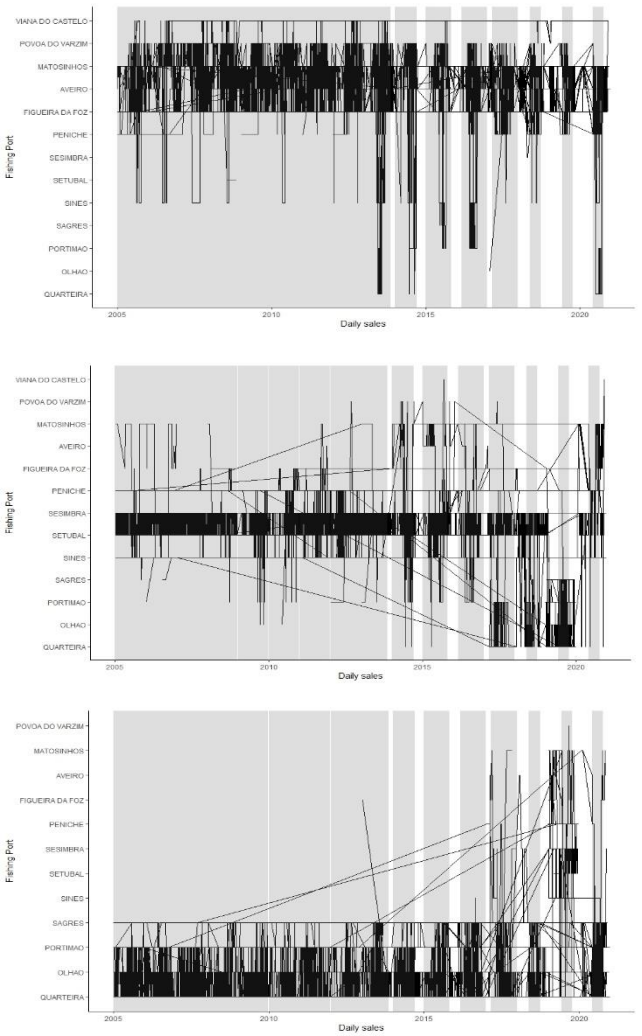
Results: changes in fleet behavior

For the period 2005-2020:

- Area operation: very near of main Port and divided in 3 areas – NW, SW, South
- Until 2013, sardine could be landed all year long with some restrictions (fishery closure). Bands: sardine open fishery - grey, closed fishery – white.
- Daily quotas for sardine (since 2013) and anchovy (since 2018)

With these changes (see figures), some vessels:

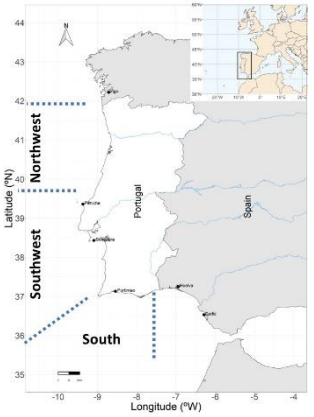
- went to new fishing grounds inside their favorite area
- went to other areas where fish (sardine/other species) are available, or fish have higher revenue (SW and South)
- time spent in new ports/areas variable by year and since 2015



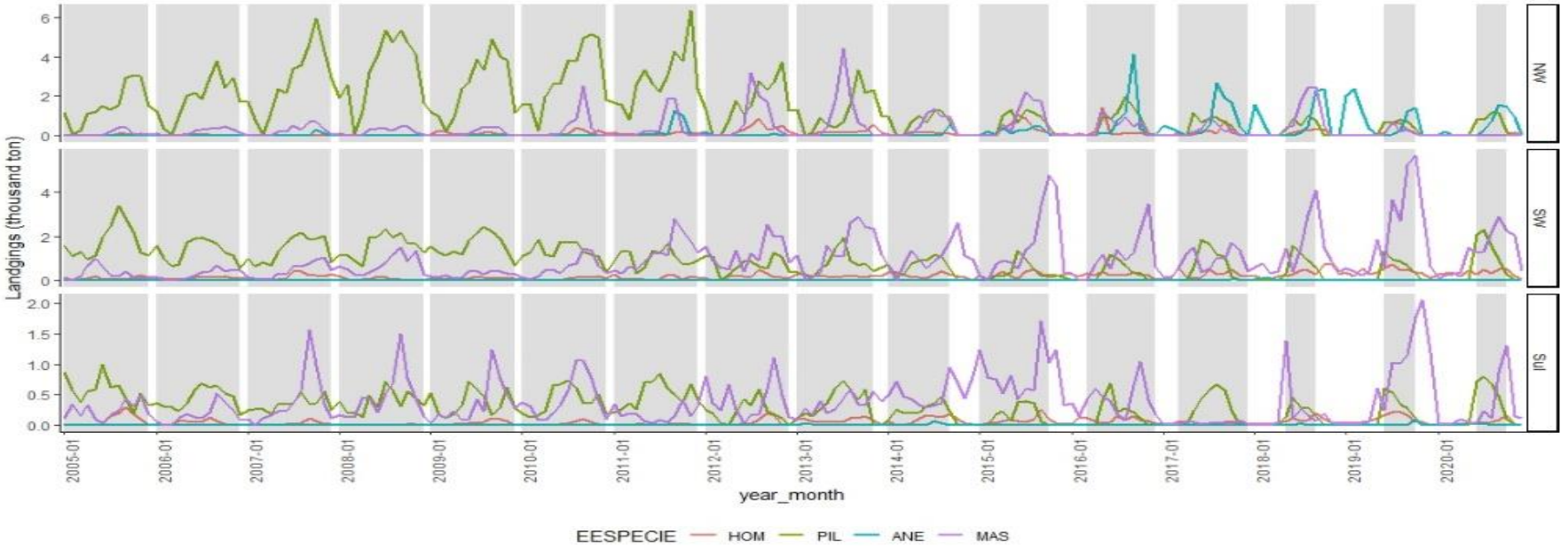
Results: impact of reduction of quotas

Annual landing dynamics of pelagic species have change!

No sardine, no future? Not true!



- Target species change: chub-mackerel (new markets, more value and became most landed species)
- Anchovy landings increase in NW Portugal since 2016
- Horse mackerel landings also increase



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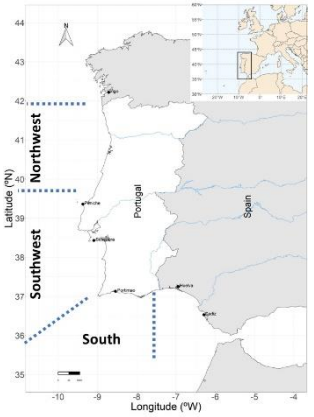

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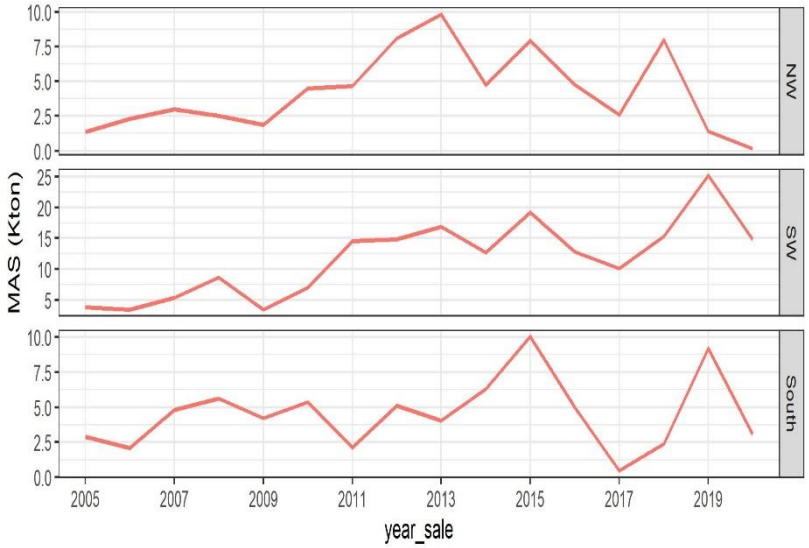
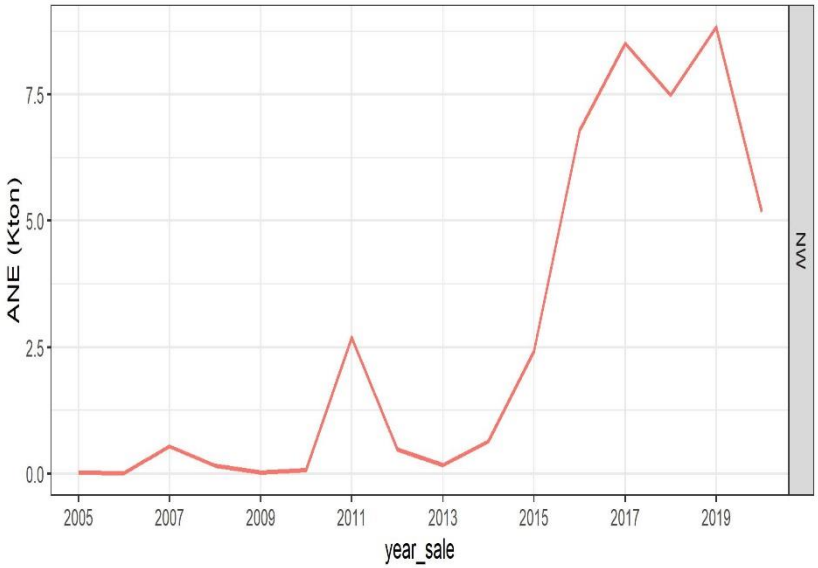


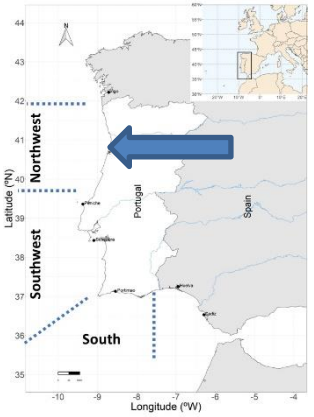


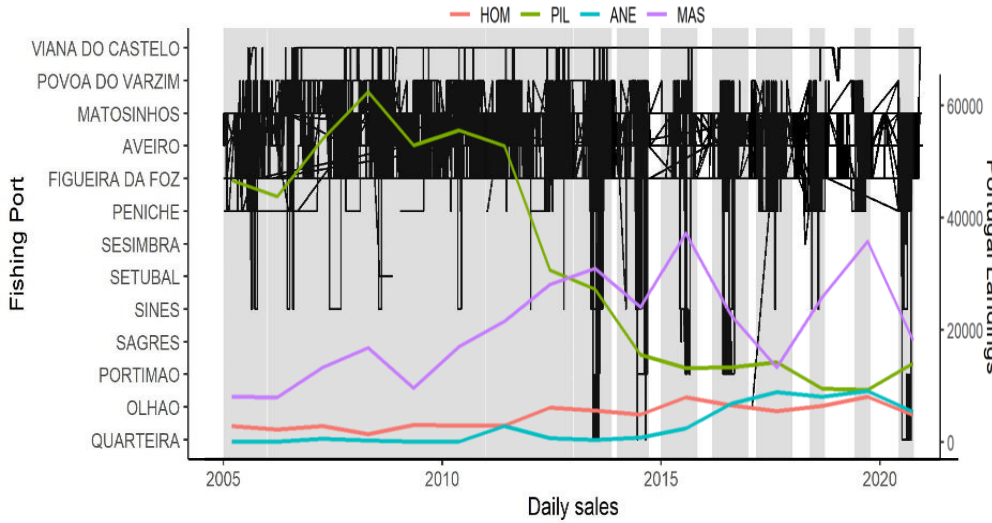
Results: preferential ports for target species

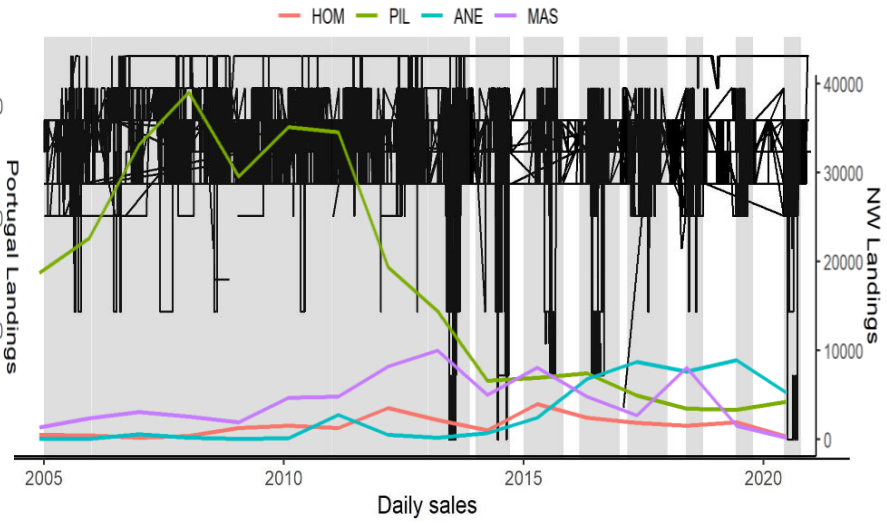
Preferential Ports: >=51% activity in fishing area in each year

NW fleet:

- went fishing in south areas (SW and South) in 2015-2016, in early sardine “ban” period. Searching for better price markets for sardines.
- went fishing NW area anchovy (2016-2020). High value species, become alternative for fishing without stopping work in begging of year (3-4 months at least).



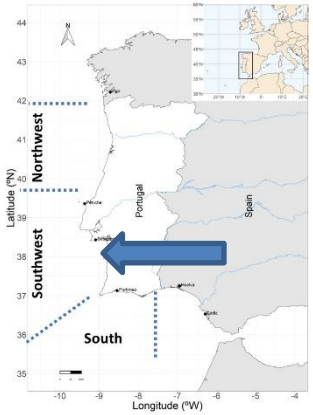


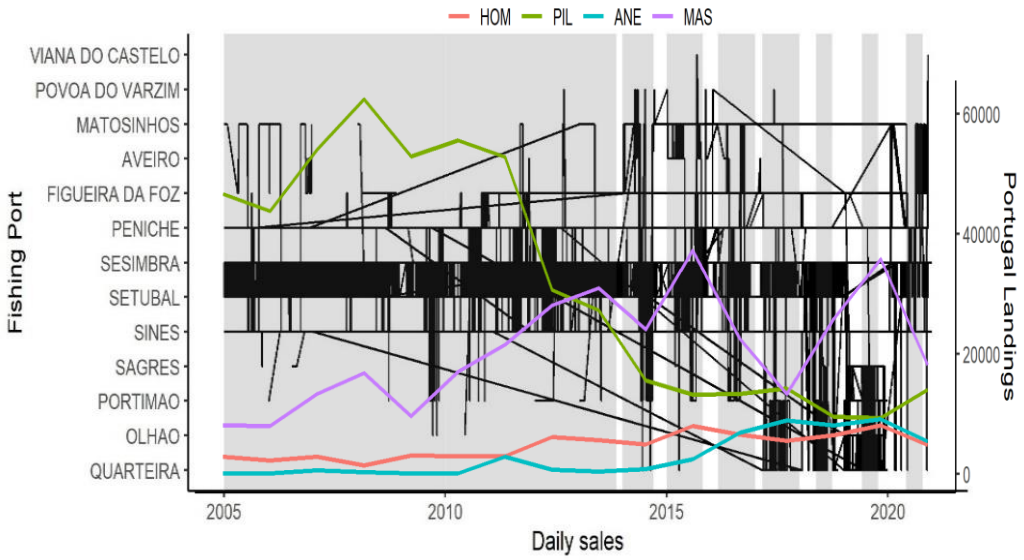


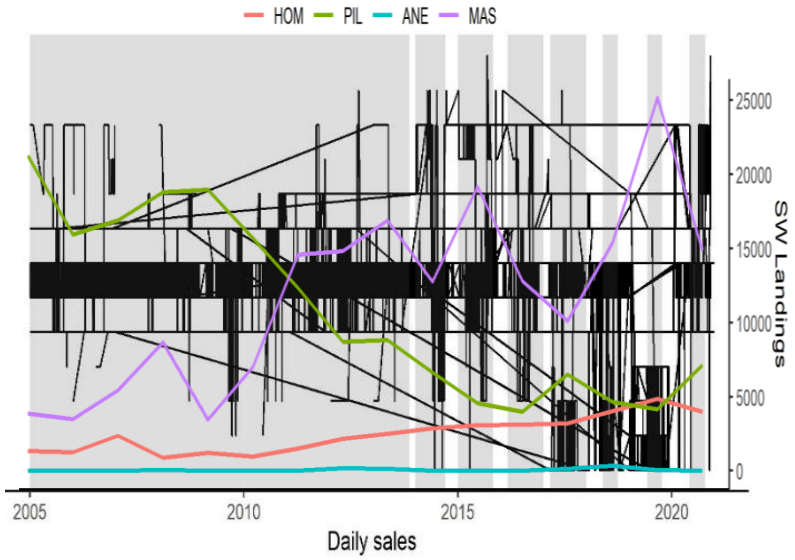
Results: preferential ports for target species

SW vessels

- went fishing south area (Algarve) after 2017 in search of more valuable sardines and chub-mackerel (freezing factory opened in Lagos)
- went fishing NW area anchovy (2019-2020). High value species, become alternative for fishing without stopping work in the beginning of year (3-4 months at least).



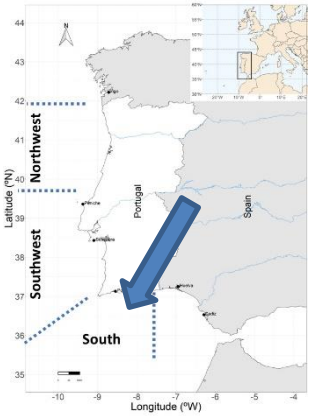


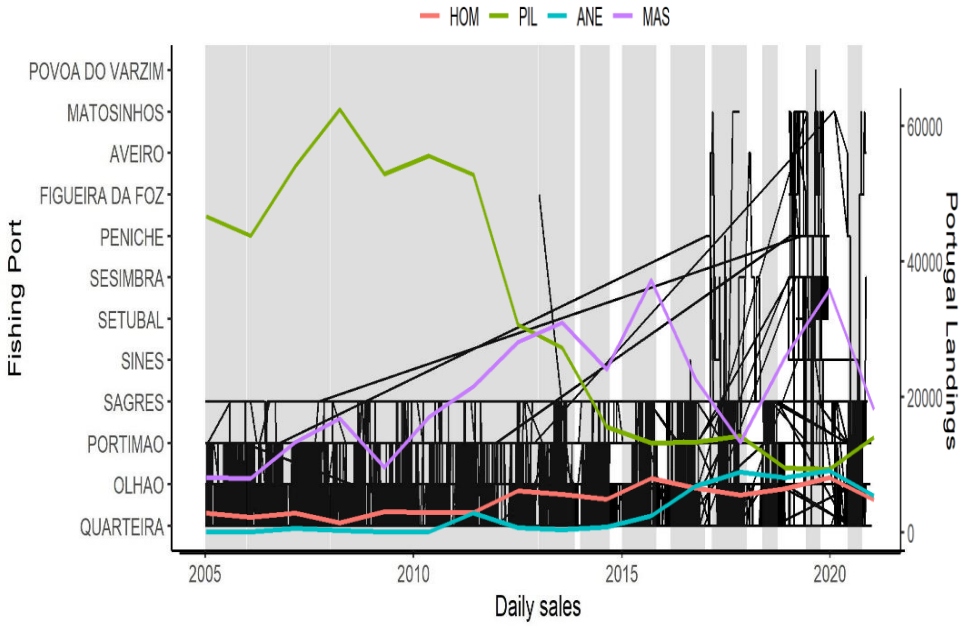


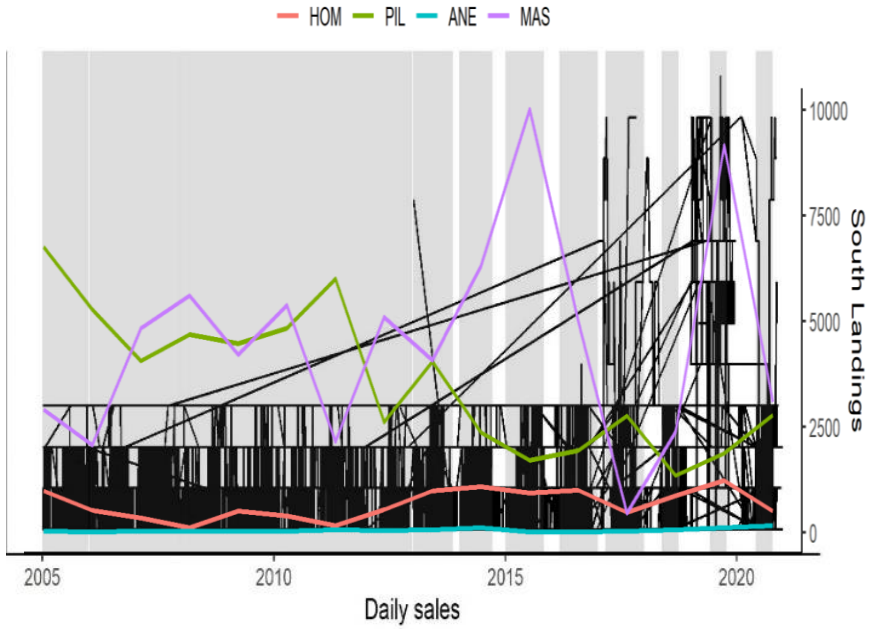
Results: preferential ports for target species

South fleet:

- vessels kept very close to home. Change ports along Algarve.
- went fishing SW area (mainly Sesimbra) when chub-mackerel catches in Algarve decreased (destiny: tuna farms + freezing factory).
- went fishing NW area anchovy for very short periods.



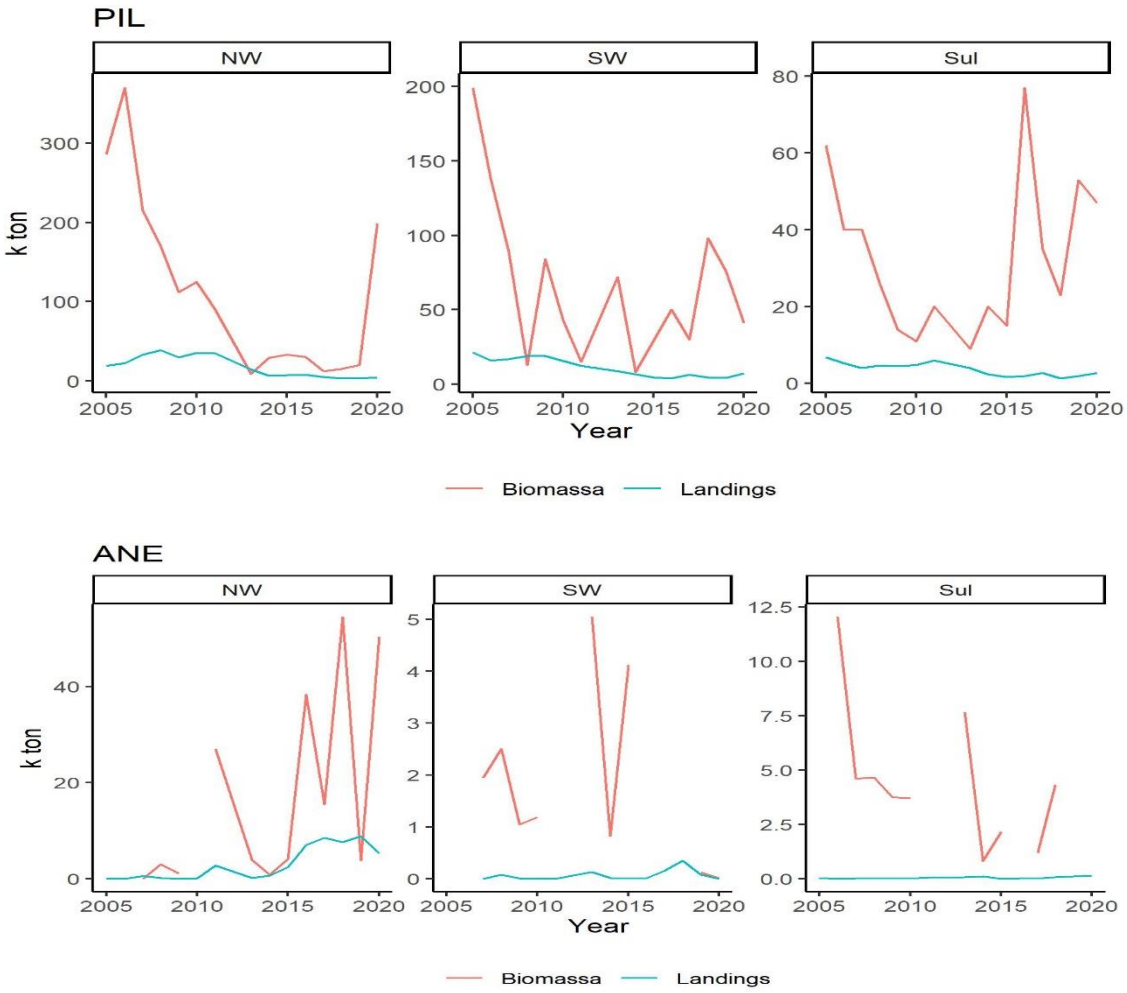




Results: improve assessment species?

Surveys produce fisheries-independent information on the biomass and distribution of species at a given time of year.

Landings reflect something quite different and can complement information on stock dynamics and can contribute to a better understanding of interregional seasonal distribution.

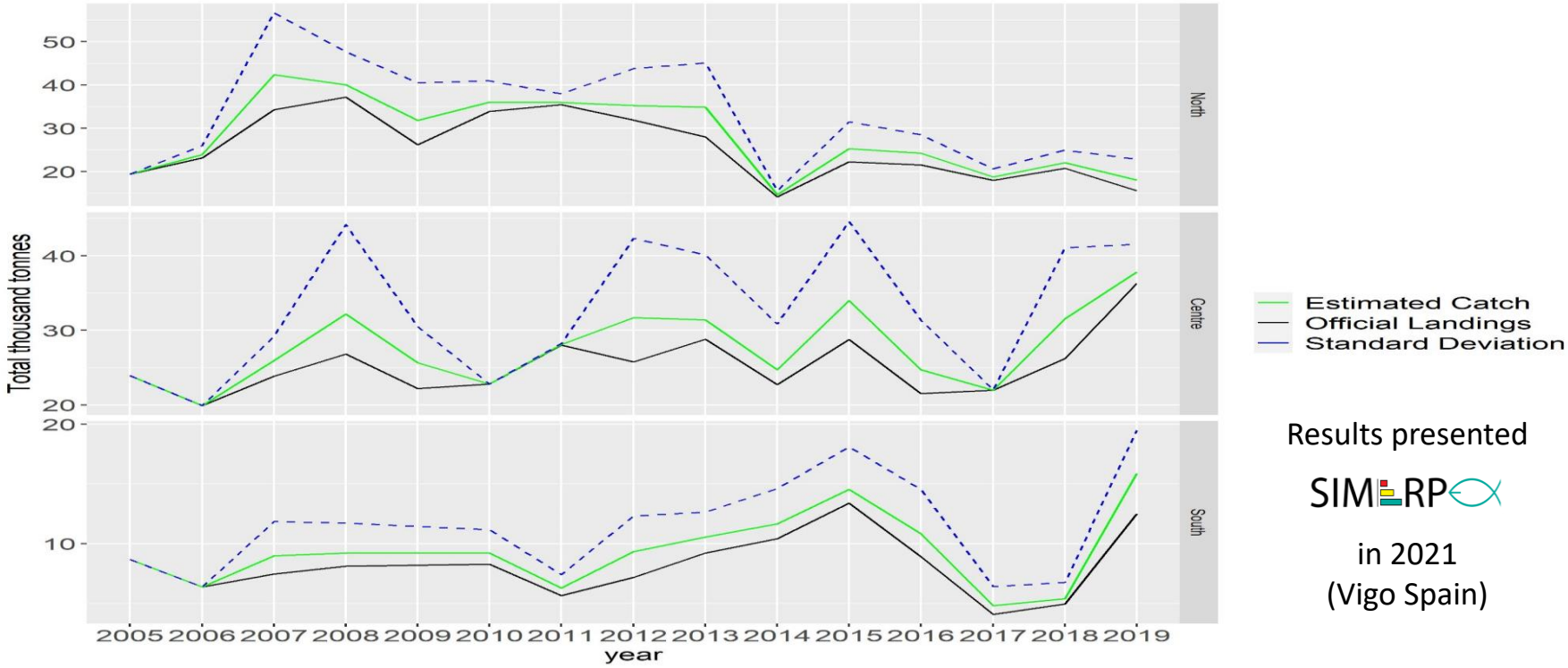


Biomass estimates and landings by area

And landings aren't all the story …

Total catch (all species) vs slipping:

- North: decreases since 2007 until today, with exception of 2013 and 2019.
- Centre: more slipping in 2009 and 2012,
  discards of mackerel, blue jack mackerel and bogue - 2014
- South: mackerel and horse mackerel 2012 and 2019.

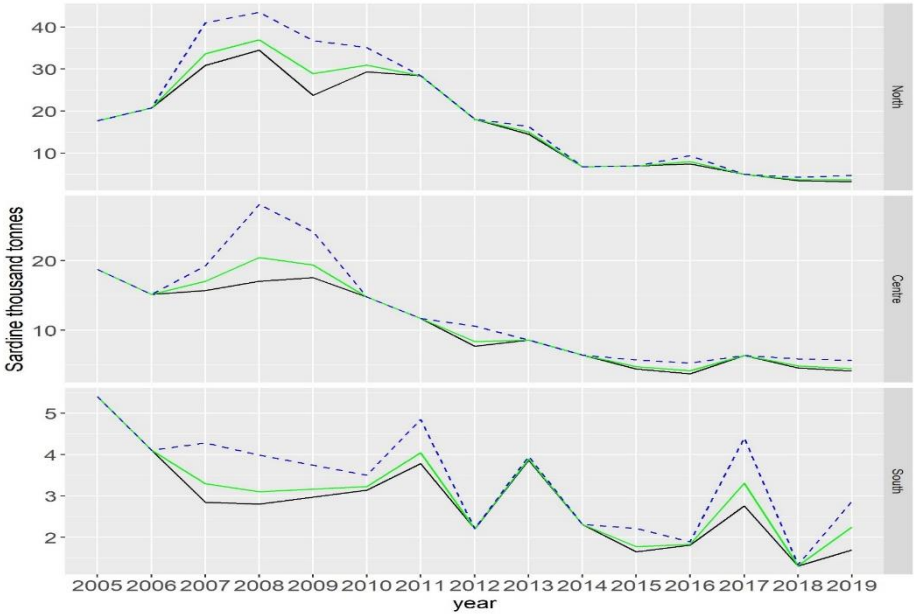


Results presented

SIMRP

in 2021
(Vigo Spain)

And landings aren't all the story …

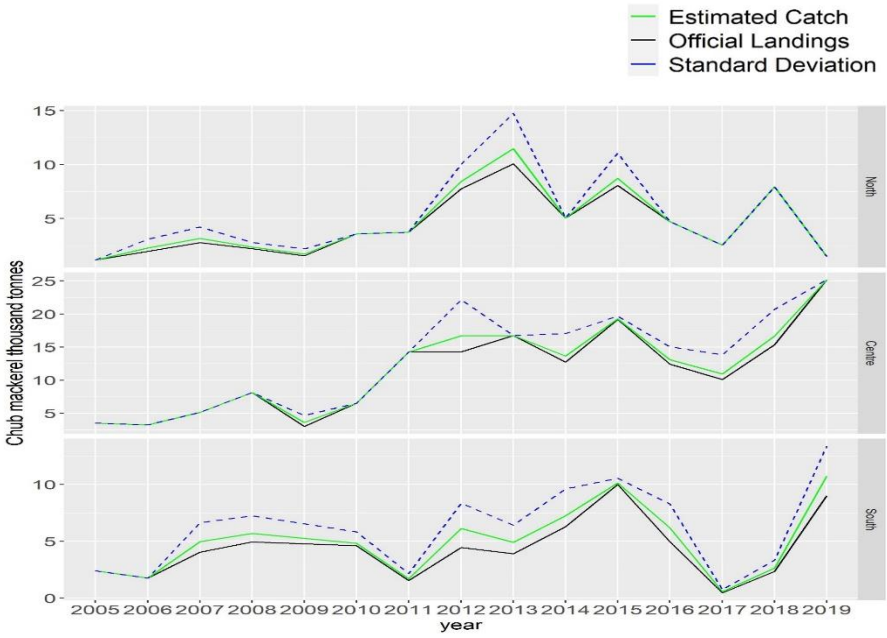


Sardine vs slipping:

- North: decreases since 2010 until today, with exception of 2016 and 2018-2019 (mainly to "sardine ban").
- Centre: occasional and increases after "sardine ban" in 2015, 2018-2019.
- South, 2019 is slipping year.

Chub mackerel vs slipping:

- North: slipping occurs between 2006-2009, 2012-2013 and 2015.
- Centre: occasional or don't occur.
- South: larger variability. The market always accept this species, so behavior is not explained with "sardine ban".



Some Conclusions

In Portugal, the purse-seine is a very important fishery:

- target species is sardine (much appreciated by Portuguese people)
- great socio-economic value dependent on this fishery (canning industry)

Reduction of sardine quota, daily limits and long periods of sardine capture "ban"

=

- Target species change: chub-mackerel and more recently, anchovy in the North
- Increase of market value of other small pelagic
- Even higher market value of sardine
- Changes in fleets dynamics and target species along time and space levels
- For the same revenue, fishing effort have changed over time and space levels

To improve stock assessment, a more detailed look at all the available data is important: surveys, landings, captures by onboard observation and fishing inquiries. Intensify the dialogue with fishermen to take advantage of the information they collect all year round!

There's future in purse-seine fishery targeting other species,
even when sardine collapses!

Acknowledgments

- Project SARDINHA2020 - *Abordagem Ecossistémica para a gestão da pesca da sardinha* (Mar2020)
- Project PNAB/DCF - European Commission's Data Collection Framework
- Foundation for Science and Technology (Portuguese funds) through projects UIDB/04326/2020, UIDB/00013/2020, UIDP/00013/2020 and PTDC/MATSTA/28243/2017
- MARE has support of national funds from FCT – Foundation for Science and Technology through strategic project UIDB/04292/2020 and project LA/P/0069/2020 granted to the Associate Laboratory ARNET.
- Diana Feijó had financial support by PICES in participation on this symposium
- *Direção-Geral de Recursos Naturais, Segurança e Serviços Marítimos* (DGRM) for providing the data on purse-seine daily landings
- Ana Moreno and Pedro Amorim for biomass data from Portuguese surveys
- National Producer Organizations, Skippers and crews of many purse-seiners for helping to collect more and better information about purse-seine fishery in Portugal

Thank you for your attention!
Muito obrigada!

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