

# Trends and drivers of marine fish landings in Portugal between 1989 and 2014

## SUPPLEMENTARY INFORMATION DOCUMENT

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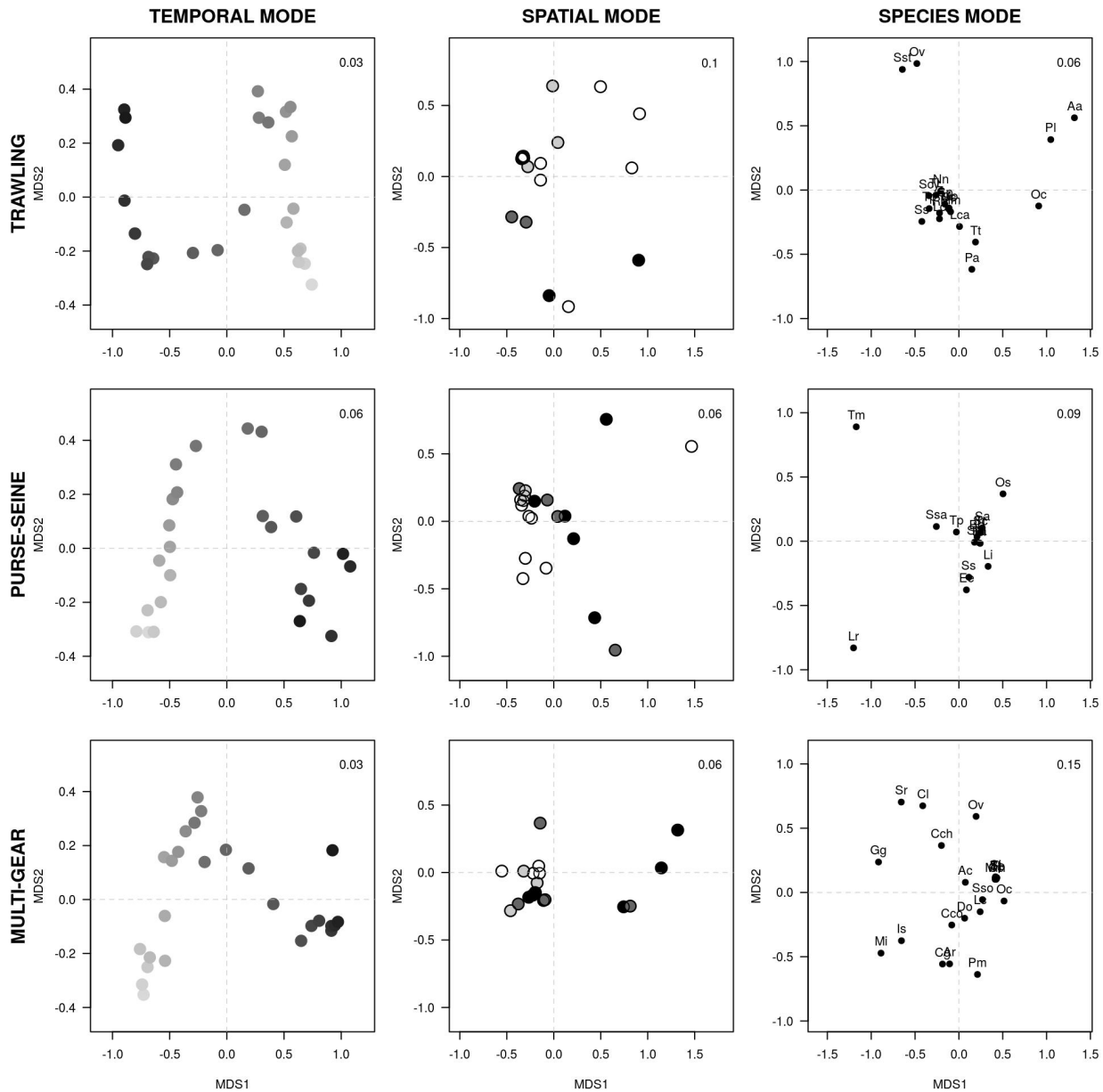
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## Exploratory analysis of the time series

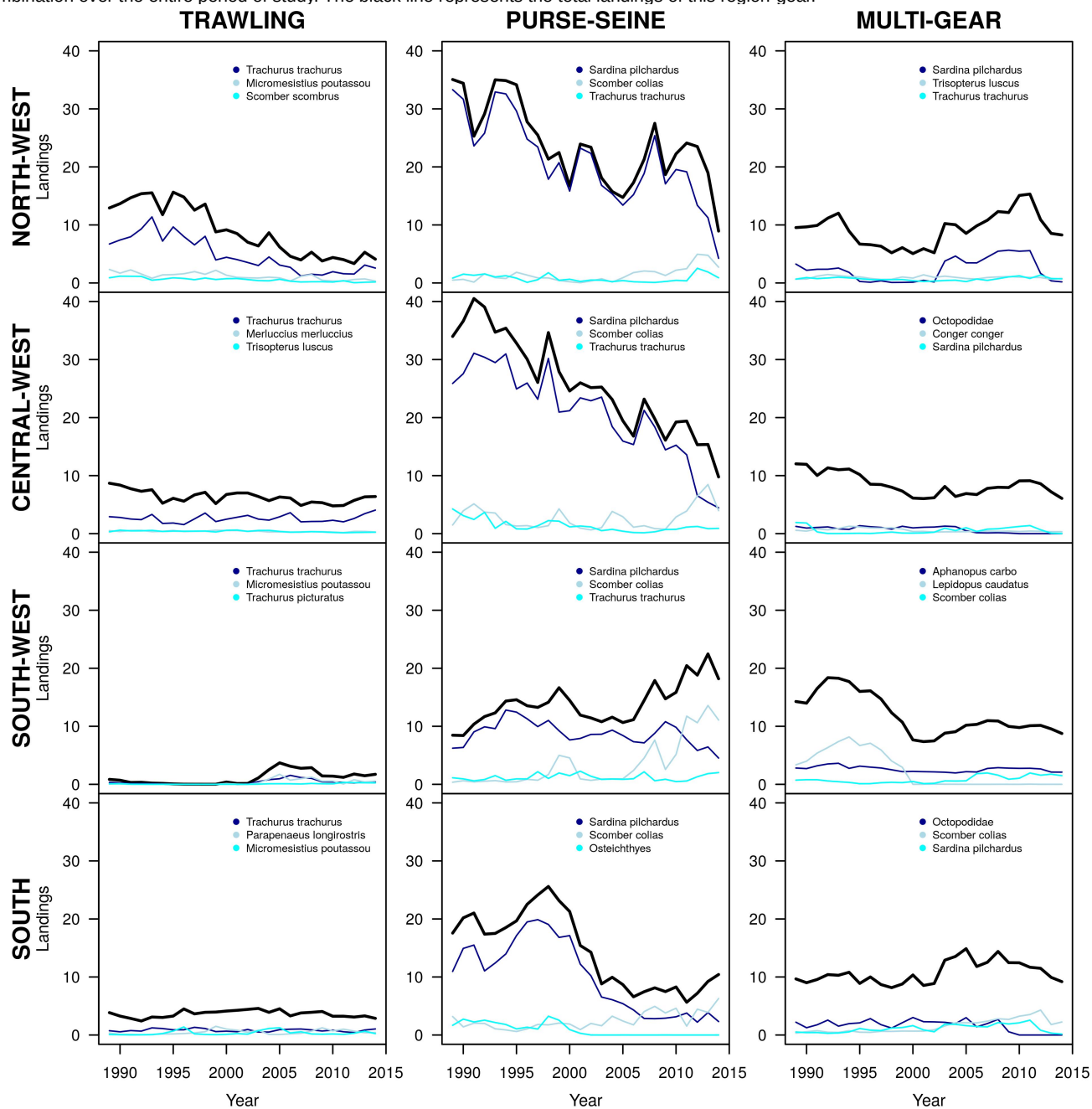
The existence of ordination patterns was found for the different modes considered in the MDS, with stress values below 0.15 in the nine combinations of gear/mode, and below 0.10 in seven of them (Fig. 2). The clearest pattern for the three gears was found in the temporal mode, where years were aligned in chronological order and a change of pattern was observed for the gears in middle of the time series. Ordination patterns in the spatial mode were less clear, but some consistency was still apparent. Thus, ports in the South-west and South regions tended to cluster away from ports in the North-west and Central-west in all fisheries, although homogeneous groups defined by the two axes could not be identified. Regarding the species mode, the Octopodidae family, the common octopus (*Octopus vulgaris*), nursehound (*Scyliorhinus stelaris*) and dog-fishes (*Scyliorhinus* spp.), on one hand, and the Norwegian lobster (*Nephrops norvegicus*), Mediterranean red prawn (*Aristeus antennatus*) and deep-water rose shrimp (*Parapenaeus longirostris*), on the other, clustered away from the remaining species in the case of trawling. The first case comprises species whose landings tended to either increase or decrease along time, whereas the second case includes crustacean species that were more common in southern regions. Regarding purse-seine, the thinlip grey mullet (*Liza ramada*) and the Mediterranean horse mackerel (*Trachurus mediterraneus*), which were registered only during the last few years, were clearly differentiated from the remaining. The multi-gear fishery targets species with a wide variety of life-cycle types depending on the particular gear employed, and therefore clustering patterns are more difficult to interpret.

**Figure SID1.** Plots of the first two axes from multidimensional scaling analyses (MDS1 and MDS2) in the temporal, spatial and species modes, for each of the gear types. Years are coded from light to dark grey along the time series. Regions are coded from dark grey to white from north to south. Species names are coded as: Ac - *Aphanopus carbo*, Aa - *Aristeus antennatus*, Ar - *Auxis rochei*, Bo - *Boops boops*, Cch - *Callista chione*, Cl - *Centrophorus lusitanicus*, Cco - *Centroscymnus coelolepis*, Cg - *Chamelea gallina*, Cc - *Conger conger*, Di - *Diplodus vulgaris*, Do - *Donax* spp., Ee - *Engraulis encrasicolus*, Gg - *Galeorhinus galeus*, Is - *Istiophoridae*, Lc - *Lepidopus caudatus*, Lca - *Lepidotrigla cavillone*, Li - *Lithognathus mormyrus*, Lr - *Liza ramada*, Lo - *Loligo* spp., Mi - *Makaira indica*, Mm - *Merluccius merluccius*, Mp - *Micromesistius poutassou*, Nn - *Nephrops norvegicus*, Oc - *Octopodidae*, Ov - *Octopus vulgaris*, Os - *Osteichthyes*, Pa - *Pagellus acarne*, Pl - *Parapenaeus longirostris*, Pm - *Plectorhinchus mediterraneus*, Ra - *Raja* spp., Ssa - *Sarda sarda*, Sp - *Sardina pilchardus*, Sa - *Sarpa salpa*, Sc - *Scomber colias*, Ss - *Scomber scombrus*, Ssy - *Scyliorhinus* spp., Sst - *Scyliorhinus stellaris*, Sr - *Scymnodon ringens*, Sso - *Spisula solida*, Tp - *Trachurus picturatus*, Tm - *Trachurus mediterraneus*, Tt - *Trachurus trachurus*, Tl - *Trisopterus luscus*.



## Landings evolution of the three most important species per region and gear.

**Figure SID2.** Evolution of the landings ( $10^3$  tonnes) over the period of study of the three most landed species of each region-gear combination over the entire period of study. The black line represents the total landings of this region-gear.



## Sensitivity analysis of the DFA.

In order to test if the selection of the best models shown in Table 2 was influenced by methodological artifacts of the DFA, we performed a sensitivity analysis consisting on evaluating the AICc of the models when exposed to randomized response variables. This method consisted on randomly reordering the time series of the species of interest for each region-gear. The AICc of the selected models to explain the randomized set of time series was recorded over a 100 times iteration procedure. The mean and standard deviation (SD) of each set of AICc values were compared to the AICc of the model of reference shown in Table 2 (Table SDI1).

For every region-gear combination, the AICc of the models explaining the non-randomized response variables (AICc of reference) was lower than the average AICc from the 100 trials process, indicating that the models shown in Table 2 were not selected as a result of a methodological artifact of the DFA.

**Table SDI1.** Results from the sensitivity analysis for the DFA models selected for each region-gear combination. The AICc of the model describing the original response variables (AICc reference) is shown together with the average obtained from the 100 trials evaluating the AICc of the model considering randomized response variables. P represents the probability of obtaining a value of the AICc less than or equal to the true value.

| <b>Gear</b> | <b>Region</b> | <b>Model</b>                             | <b>AICc reference</b> | <b>Average AICc 100x iterations</b> | <b>SD 100x iterations</b> | <b>P</b> |
|-------------|---------------|--|-----------------------|-------------------------------------|---------------------------|----------|
| Trawling    | North-west    | 3 trends + fishing effort                | 1040                  | 1228                                | 26.3                      | <<0.01   |
|             | Central-west  | 3 trends                                 | 1080                  | 1239                                | 18.8                      | <<0.01   |
|             | South-west    | 3 trends + fishing effort                | 895                   | 1119                                | 35.6                      | <<0.01   |
|             | South         | 3 trends + fishing effort + river winter | 1224                  | 1425                                | 26.3                      | <<0.01   |
| Purse-seine | North-west    | 3 trends + fishing effort + EAT spring   | 723                   | 837                                 | 22.9                      | <<0.01   |
|             | Central-west  | 3 trends                                 | 850                   | 968                                 | 20.2                      | <<0.01   |
|             | South-west    | 3 trends                                 | 893                   | 1003                                | 19.4                      | <<0.01   |
|             | South         | 3 trends + fishing effort + river winter | 806                   | 1009                                | 24.7                      | <<0.01   |
| Multi-gear  | North-west    | 3 trends                                 | 1328                  | 1456                                | 18.1                      | <<0.01   |
|             | Central-west  | 3 trends                                 | 1315                  | 1426                                | 17.0                      | <<0.01   |
|             | South-west    | 3 trends + fishing effort                | 1188                  | 1420                                | 36.3                      | <<0.01   |
|             | South         | 2 trends + fishing effort + river winter | 1271                  | 1479                                | 26.5                      | <<0.01   |

## Relationship between species-specific landings per region and gear and the environmental variables.

**Table SID 2.** Summary of the variables related to each species landings captured by trawling in each of the regions considered. This table represents a summary of the results shown in Supplementary Information Files 5 (correlations between trends and variables, in parenthesis) and 6 (correlations between species landings, trends and variables).

| Species                         | North-west   | Central-west  | South-west  | South   |
|---------------------------------|--|---|---|---|
| <i>Aristeus antennatus</i>      |  |   | + Trend 2 (+Fishing effort)                                       | + Trend 2<br>+ Trend 3 (+Fishing effort)<br>+ Fishing effort                  |
| <i>Lepidotriglia cavillone</i>  | + Trend 1 (-Annual AMO)<br>- Trend 2 (+Annual AMO; +Summer EA)<br>- Trend 3 (-Winter NAO; - Summer NAO; +Annual AMO; -Fishing effort)<br>+ Winter NAO<br>- Annual AMO<br>- Summer EA     | + Trend 1 (+Winter NAO; +Summer NAO; -Annual AMO)<br>- Trend 3 (-Winter NAO; +Annual AMO; +Summer EA; -Fishing effort)<br>+ Summer NAO<br>- Annual AMO<br>- Autumn EA<br>+ Fishing effort | + Trend 1 (+Winter NAO; +Summer NAO; -Annual AMO)<br>+ Summer NAO | + Trend 1 (+Winter NAO; - Annual AMO)<br>+ Winter NAO<br>- Annual AMO         |
| <i>Loligo sp.</i>               | + Trend 1 (-Annual AMO)<br>- Trend 3 (-Winter NAO; - Summer NAO; +Annual AMO; -Fishing effort)<br>+ Fishing effort   | + Trend 1 (+Winter NAO; +Summer NAO; -Annual AMO)<br>- Trend 3 (-Winter NAO; +Annual AMO; +Summer EA; -Fishing effort)<br>+ Fishing effort  | + Trend 1 (+Winter NAO; +Summer NAO; -Annual AMO)                 | + Trend 1 (+Winter NAO; - Annual AMO)   |
| <i>Merluccius merluccius</i>    | + Trend 1 (-Annual AMO)<br>- Trend 2 (+Annual AMO; +Summer EA)<br>- Annual AMO   | + Trend 2 (+Fishing effort)<br>+ Fishing effort   | + Trend 2 (+Fishing effort)<br>+ Fishing effort                   | + Trend 2 (+Fishing effort)   |
| <i>Micromesistius poutassou</i> | + Trend 1 (-Annual AMO)<br>- Trend 3 (-Winter NAO; - Summer NAO; +Annual AMO; -Fishing effort)<br>+ Winter NAO<br>+ Summer NAO<br>- Autumn EA  |   | + Trend 2 (+Fishing effort)<br>+ Annual AMO<br>+ Fishing effort   | - Trend 1 (+Winter NAO; - Annual AMO)   |
| <i>Nephrops norvegicus</i>      | + Trend 1 (-Annual AMO)<br>- Trend 2 (+Annual AMO; +Summer EA)<br>- Trend 3 (-Winter NAO; - Summer NAO; +Annual AMO; -Fishing effort)<br>- Annual AMO<br>- Summer EA                     | - Trend 3 (-Winter NAO; +Annual AMO; +Summer EA; -Fishing effort)<br>- Autumn SST inshore<br>- Annual AMO<br>+ Fishing effort   |   |   |
| <i>Octopodidae</i>              | + Trend 1 (-Annual AMO)<br>- Trend 2 (+Annual AMO; +Summer EA)<br>- Trend 3 (-Winter NAO; - Summer NAO; +Annual AMO; -Fishing effort)<br>- Annual AMO<br>- Summer EA<br>+ Fishing effort | - Trend 3 (-Winter NAO; +Annual AMO; +Summer EA; -Fishing effort)<br>- Annual AMO<br>- Summer EA<br>+ Fishing effort  | + Spring NAO  | + Trend 3<br>- Autumn SST inshore<br>+ Winter SST anomaly<br>+ Fishing effort |
| <i>Octopus vulgaris</i>         | + Trend 2 (+Annual AMO; +Summer EA)<br>+ Trend 3 (-Winter NAO; - Summer NAO; +Annual AMO; -Fishing effort)<br>+ Summer EA  | + Trend 3 (-Winter NAO; +Annual AMO; +Summer EA; -Fishing effort)<br>- Fishing effort<br>+ Annual precipitation   | + Trend 2 (+Fishing effort)<br>+ Fishing effort                   | - Trend 3<br>- Fishing effort   |
| <i>Pagellus acarne</i>          |  |   | + Trend 2 (+Fishing effort)<br>+ Fishing effort                   | + Spring river discharge  |
| <i>Parapenaeus longirostris</i> |  |   | + Trend 2 (+Fishing effort)                                       | + Trend 2 (+Fishing effort)   |
| <i>Raja sp.</i>                 | + Trend 1 (-Annual AMO)  | + Trend 1 (+Winter NAO; +Summer NAO; -Annual AMO)<br>+ Trend 2 (+Fishing effort)<br>+ Winter NAO<br>+ Summer NAO<br>- Annual AMO<br>+ Fishing effort                                      | + Trend 2 (+Fishing effort)<br>+ Fishing effort                   | + Winter SST anomaly  |

|                               |   |  |  |   |
|-------------------------------|---|--|--|---|
| <i>Sardina pilchardus</i>     | + Trend 1 (-Annual AMO)<br>- Trend 3 (-Winter NAO; - Summer NAO; +Annual AMO; -Fishing effort)<br>+ Fishing effort  | + Trend 2 (+Fishing effort)  |  | + Trend 1 (+Winter NAO; - Annual AMO)                                       |
| <i>Scomber colias</i>         |   | + Trend 3 (-Winter NAO; +Annual AMO; +Summer EA; -Fishing effort)  | + Fishing effort   |   |
| <i>Scomber scombrus</i>       | + Trend 1 (-Annual AMO)<br>- Trend 2 (+Annual AMO; +Summer EA)<br>- Trend 3 (-Winter NAO; - Summer NAO; +Annual AMO; -Fishing effort)<br>- Annual AMO<br>+ Fishing effort | + Trend 2 (+Fishing effort)  | + Summer SST inshore<br>+ Fishing effort                     |   |
| <i>Scyliorhinus sp.</i>       | + Trend 1 (-Annual AMO)<br>- Trend 3 (-Winter NAO; - Summer NAO; +Annual AMO; -Fishing effort)<br>+ Fishing effort  | + Trend 2 (+Fishing effort)<br>- Trend 3 (-Winter NAO; +Annual AMO; +Summer EA; -Fishing effort)<br>+ Fishing effort | + Trend 3  | + Trend 3 (+Fishing effort)<br>+ Winter river discharge<br>+ Fishing effort |
| <i>Scyliorhinus stellaris</i> | + Trend 3 (-Winter NAO; - Summer NAO; +Annual AMO; -Fishing effort)<br>- Winter NAO<br>- Fishing effort   | - Trend 2 (+Fishing effort)<br>+ Trend 3 (-Winter NAO; +Annual AMO; +Summer EA; -Fishing effort)<br>- Fishing effort | + Trend 2 (+Fishing effort)<br>- Trend 3<br>+ Fishing effort | - Trend 3 (+Fishing effort)<br>- Fishing effort                             |
| <i>Trachurus picturatus</i>   | + Trend 3 (-Winter NAO; - Summer NAO; +Annual AMO; -Fishing effort)<br>- Fishing effort   | - Trend 2 (+Fishing effort)<br>- Fishing effort  | + Trend 2 (+Fishing effort)                                  | - Trend 3 (+Fishing effort)   |
| <i>Trachurus trachurus</i>    | + Trend 1 (-Annual AMO)<br>- Trend 2 (+Annual AMO; +Summer EA)<br>- Trend 3 (-Winter NAO; - Summer NAO; +Annual AMO; -Fishing effort)<br>- Summer EA<br>+ Fishing effort  |  | + Trend 2 (+Fishing effort)<br>+ Fishing effort              |   |
| <i>Trisopterus luscus</i>     |   | + Trend 2 (+Fishing effort)<br>+ Fishing effort  | + Fishing effort   | - Trend 2<br>- Summer EA  |

**Table SID 3.** Summary of the variables related to each species landings captured by purse-seine in each of the regions considered. This table represents a summary of the results shown in Supplementary Information Files 5 (correlations between trends and variables, in parenthesis) and 6 (correlations between species landings, trends and variables).

| Species                        | North-west  | Central-west   | South-west   | South   |
|--------------------------------|---|--|--|---|
| <i>Boops boops</i>             |   | + Trend 2 (+Winter NAO;<br>+Summer NAO; +Fishing effort)<br>+ Winter NAO<br>+ Summer NAO<br>- Annual AMO<br>+ Fishing effort   | + Trend 1  | + Trend 1<br>- Trend 3 (+Summer river<br>discharge; -Fishing effort)<br>+ Fishing effort  |
| <i>Diplodus vulgaris</i>       | + Fishing effort  | - Winter SST inshore   | - Trend 2 (+Winter NAO;<br>+Summer NAO; -Annual AMO; -<br>Autumn EA; +Fishing effort)  | + Trend 2<br>- Annual AMO<br>+ Fishing effort   |
| <i>Engraulis encrasicolus</i>  |   | - Spring EA<br>- Summer EA   | + Trend 3 (-Fishing effort)  |   |
| <i>Lithognathus mormyrus</i>   |   |  | + Trend 2 (+Winter NAO;<br>+Summer NAO; -Annual AMO; -<br>Autumn EA; +Fishing effort)<br>- Trend 3 (-Fishing effort)<br>- Autumn SST inshore<br>+ Summer SST anomaly<br>- Annual AMO<br>+ Fishing effort | + Trend 2<br>- Trend 3 (+Summer river<br>discharge; -Fishing effort)<br>+ Winter NAO<br>- Annual AMO<br>- Summer river discharge<br>+ Fishing effort                  |
| <i>Liza ramada</i>             | - Trend 2<br>+ Trend 3  |  | + Trend 3 (- Fishing effort)   |   |
| <i>Osteichthyes</i>            | + Trend 1 (+Winter NAO;<br>+Fishing effort)<br>+ Fishing effort | + Trend 1 (-Autumn SST inshore; -<br>Annual AMO; +Fishing effort)<br>+ Fishing effort  | + Trend 2 (+Winter NAO;<br>+Summer NAO; -Annual AMO; -<br>Autumn EA; +Fishing effort)<br>+ Winter NAO<br>- Annual AMO  | - Trend 3 (+Summer river<br>discharge; -Fishing effort)<br>- Autumn SST inshore<br>+ Fishing effort   |
| <i>Pagellus acarne</i>         | - Trend 2<br>+ Trend 3  | - Winter EA  |  | + Trend 1<br>- Annual AMO<br>+ Fishing effort   |
| <i>Sarda sarda</i>             |   | + Trend 3 (- Fishing effort)   | + Trend 3 (-Fishing effort)<br>- Fishing effort  | + Spring SST anomaly  |
| <i>Sardina pilchardus</i>      | - Autumn EA<br>+ Fishing effort                                 | + Trend 1 (-Autumn SST inshore; -<br>Annual AMO; +Fishing effort)<br>+ Trend 2 (+Winter NAO;<br>+Summer NAO; +Fishing effort)<br>- Trend 3 (- Fishing effort)<br>- Autumn SST inshore<br>- Annual AMO<br>- Autumn EA<br>+ Fishing effort | - Trend 3 (-Fishing effort)<br>+ Fishing effort  | + Trend 2<br>- Trend 3 (+Summer river<br>discharge; -Fishing effort)<br>+ Winter river discharge<br>+ Fishing effort  |
| <i>Sarpa salpa</i>             | + Trend 3   | - Summer EA  | - Trend 3 (-Fishing effort)<br>+ Fishing effort  | - Trend 3 (+Summer river<br>discharge; -Fishing effort)<br>+ Winter NAO<br>+ Summer NAO<br>- Summer EA<br>- Autumn EA<br>- Summer river discharge<br>- Fishing effort |
| <i>Scomber colias</i>          | - Trend 2<br>+ Trend 3  | + Trend 3 (- Fishing effort)   | + Trend 3 (-Fishing effort)<br>- Fishing effort  | + Trend 3 (+Summer river<br>discharge; -Fishing effort)<br>+ Summer river discharge<br>- Fishing effort   |
| <i>Scomber scombrus</i>        | - Trend 2<br>+ Trend 3  | + Trend 2 (+Winter NAO;<br>+Summer NAO; +Fishing effort)<br>+ Winter NAO   | + Trend 1  | + Trend 1<br>+ Spring river discharge   |
| <i>Trachurus mediterraneus</i> |   | - Trend 1 (-Autumn SST inshore; -<br>Annual AMO; +Fishing effort)<br>+ Trend 3 (- Fishing effort)<br>- Fishing effort  |  |   |
| <i>Trachurus picturatus</i>    | + Trend 3   | + Trend 2 (+Winter NAO;<br>+Summer NAO; +Fishing effort)   | + Trend 3 (-Fishing effort)<br>- Fishing effort  | + Trend 3 (+Summer river<br>discharge; -Fishing effort)   |
| <i>Trachurus trachurus</i>     | + Trend 3   | + Trend 2 (+Winter NAO;<br>+Summer NAO; +Fishing effort)<br>+ Winter NAO<br>+ Fishing effort   |  |   |



**Table SID 4.** Summary of the variables related to each species landings captured by the multigear fishery in each of the regions considered. This table represents a summary of the results shown in Supplementary Information Files 5 (correlations between trends and variables, in parenthesis) and 6 (correlations between species landings, trends and variables).

| Species                             | North-west  | Central-west   | South-west  | South  |
|-------------------------------------|---|--|---|--|
| <i>Aphanopus carbo</i>              | + Trend 3   | + Summer NAO<br>+ Fishing effort   | + Trend 2<br>- Trend 3 (-Summer SST anomaly; +Annual AMO; +Summer EA; -Fishing effort)<br>- Autumn SST inshore<br>- Annual AMO<br>- Spring EA<br>+ Fishing effort | - Trend 1 (+Summer EA; - Fishing effort)<br>- Trend 2<br>+ Fishing effort  |
| <i>Auxis rochei</i>                 |   | + Trend 2 (-Fishing effort)<br>- Summer NAO  |   | + Trend 1 (+Summer EA; - Fishing effort)<br>- Winter NAO<br>+ Annual AMO   |
| <i>Callista chione</i>              |   | + Trend 3 (+Annual AMO)  | - Trend 2   | - Winter NAO   |
| <i>Centrophorus lusitanicus</i>     | - Trend 2 (-Fishing effort)<br>+ Trend 3                            | - Trend 1 (-Annual AMO; - Summer EA; +Fishing effort)<br>+ Trend 2 (-Fishing effort)<br>- Fishing effort                                 | + Trend 1   |  |
| <i>Centroscymnus coelolepis</i>     | + Trend 1 (-Annual AMO)<br>+ Trend 2 (-Fishing effort)<br>- Trend 3 | + Winter NAO<br>+ Summer NAO<br>+ Fishing effort   | - Trend 1<br>- Trend 3 (-Summer SST anomaly; +Annual AMO; +Summer EA; -Fishing effort)  |  |
| <i>Chamalea gallina</i>             |   | + Trend 3 (+Annual AMO)  |   | + Spring EA  |
| <i>Conger conger</i>                | + Trend 1 (-Annual AMO)<br>- Annual AMO                             | + Trend 1 (-Annual AMO; - Summer EA; +Fishing effort)  | - Trend 1<br>- Trend 3 (-Summer SST anomaly; +Annual AMO; +Summer EA; -Fishing effort)<br>+ Fishing effort  | - Trend 1 (+Summer EA; - Fishing effort)<br>+ Trend 2<br>+ Winter SST anomaly<br>+ Fishing effort                                  |
| <i>Donax spp.</i>                   |   | - Winter SST anomaly   | + Trend 1<br>+ Trend 3 (-Summer SST anomaly; +Annual AMO; +Summer EA; -Fishing effort)  |  |
| <i>Galeorhinus galeus</i>           |   |  |   |  |
| <i>Istiophoridae</i>                | - Summer SST inshore  |  |   | + Spring SST inshore<br>+ Winter river discharge<br>+ Autumn river discharge   |
| <i>Lepidopus caudatus</i>           | + Trend 1 (-Annual AMO)   | + Trend 1 (-Annual AMO; - Summer EA; +Fishing effort)  | - Trend 3 (-Summer SST anomaly; +Annual AMO; +Summer EA; -Fishing effort)<br>+ Summer SST anomaly<br>- Annual AMO<br>- Summer EA<br>+ Fishing effort              | - Trend 1 (+Summer EA; - Fishing effort)<br>- Autumn SST inshore<br>- Annual AMO<br>- Summer EA<br>+ Fishing effort                |
| <i>Makaira indica</i>               |   |  |   | + Winter river discharge   |
| <i>Merluccius merluccius</i>        | + Trend 1 (-Annual AMO)   | + Trend 2 (-Fishing effort)  | - Autumn SST inshore  | - Trend 1 (+Summer EA; - Fishing effort)<br>- Autumn SST inshore<br>+ Winter NAO<br>- Summer EA<br>- Autumn EA<br>+ Fishing effort |
| <i>Octopodidae</i>                  | + Trend 2 (-Fishing effort)<br>- Trend 3<br>- Fishing effort        | + Trend 1 (-Annual AMO; - Summer EA; +Fishing effort)<br>- Trend 2 (-Fishing effort)<br>+ Fishing effort                                 | - Trend 1<br>- Trend 3 (-Summer SST anomaly; +Annual AMO; +Summer EA; -Fishing effort)<br>+ Fishing effort  | + Fishing effort   |
| <i>Octopus vulgaris</i>             | + Trend 3   | - Trend 1 (-Annual AMO; - Summer EA; +Fishing effort)<br>+ Trend 2 (-Fishing effort)<br>- Winter NAO<br>+ Annual AMO<br>- Fishing effort | + Trend 1<br>+ Trend 3 (-Summer SST anomaly; +Annual AMO; +Summer EA; -Fishing effort)  | - Fishing effort   |
| <i>Plectorhinchus mediterraneus</i> |   | + Trend 1 (-Annual AMO; - Summer EA; +Fishing effort)<br>- Autumn SST inshore<br>- Annual AMO  |   | + Trend 2  |

|                            |  |  |   |   |
|----------------------------|--|--|---|---|
|                            |  | - Summer EA<br>+ Fishing effort  |   |   |
| <i>Sardina pilchardus</i>  | - Trend 2 (-Fishing effort)<br>+ Fishing effort              |  | + Trend 2   | + Trend 1 (+Summer EA; -<br>Fishing effort)   |
| <i>Scomber colias</i>      | - Trend 2 (-Fishing effort)<br>+ Trend 3<br>+ Fishing effort | - Trend 1 (-Annual AMO; -<br>Summer EA; +Fishing effort)<br>+ Trend 2 (-Fishing effort)<br>+ Trend 3 (+Annual AMO) | + Trend 1<br>+ Trend 3 (-Summer SST<br>anomaly; +Annual AMO;<br>+Summer EA; -Fishing effort)                                    | + Trend 1 (+Summer EA; -<br>Fishing effort)<br>- Summer NAO<br>+ Annual AMO<br>- Fishing effort |
| <i>Scymnodon ringens</i>   | - Trend 2 (-Fishing effort)                                  |  | + Trend 1   |   |
| <i>Spisula solida</i>      |  |  |   | + Trend 2   |
| <i>Trachurus trachurus</i> |  | - Trend 1 (-Annual AMO; -<br>Summer EA; +Fishing effort)<br>+ Trend 2 (-Fishing effort)<br>+ Autumn EA             | + Trend 2   | - Winter SST inshore<br>+ Spring EA   |
| <i>Trisopterus luscus</i>  |  |  | + Trend 2<br>- Trend 3 (-Summer SST<br>anomaly; +Annual AMO;<br>+Summer EA; -Fishing effort)<br>- Autumn EA<br>+ Fishing effort |   |