Quantifying quality assurance in European fisheries biological data collection

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Quality assurance of fisheries data collection is an important topic however since some of the most important fisheries data (for example commercial fisheries data) is confidential it is often not possible to directly evaluate data quality at a European level.
EU countries have a requirement to submit annual reports which describe how they collected the data required under the EU Common Fisheries Policy. One element of this report is a summary of their biological data quality assurance for each of their sampling schemes where they specify general principles, methods and tools that can provide guidance and evidence of their work. Since there is no common framework in use for biological data quality assurance it is hard to compare the information that different countries supply. The aim of this work was to define indicators which would both allow comparison between countries and allow changes to be tracked over time.

It was not possible to evaluate the actual data quality tools, techniques, and manuals that countries are using because: i) not all information is publically available, ii) the information that is available will often be in the native language of the country, and iii) even when the information is publically available in a language that is understood by the authors it would be a difficult, specialised, and time-consuming task to decide whether the techniques were appropriate for the circumstances of the country.
It was therefore decided that the authors would evaluate the existence, availability, recency and pertinence of the quality documentation – with the belief being that this will have a strong correlation with the overall quality of the sampling programme.

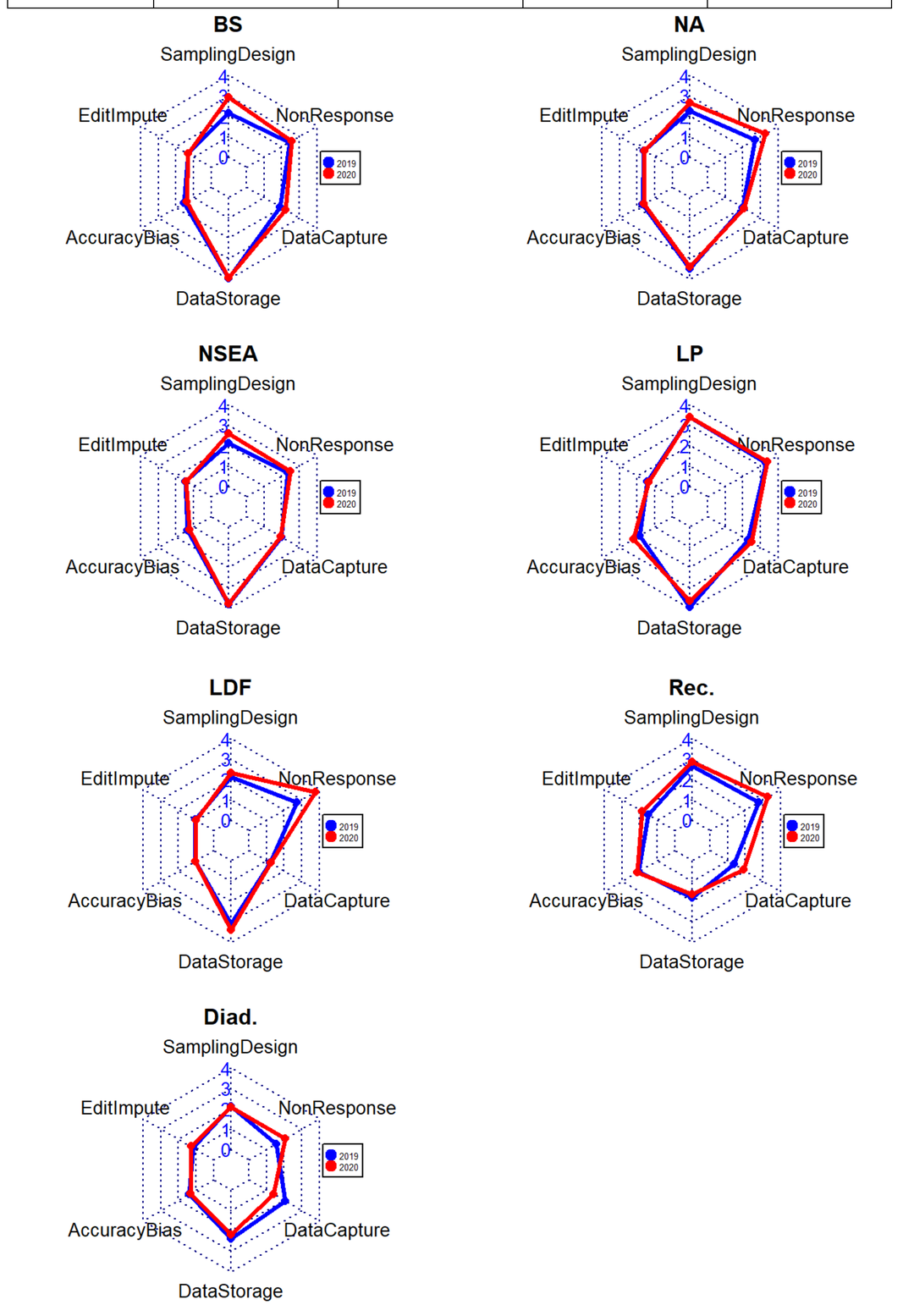
Within the annual report questions are asked on six quality assurance topics: **Sampling Design, Non-responses and Refusals**, **Data Capture**, **Data Storage**, **Accuracy and Bias**, and **Editing and Imputation**. For each of these topics an indicator was defined which had a range from 1 - 4 (with 1 being worst and 4 being the best). Not Applicable (NA) could also be allowed in certain cases.
The overall method used was:
i) the annual reports of each country were collated;
ii) for each row of the biological quality assurance section the indicators were scored from 1 – 4;
iii) each row in the collated reports was evaluated for each country which attends either the North Atlantic, North Sea & Eastern Arctic, or Baltic Sea Regional Coordination Groups (RCG);
iv) the mean of these indicators for different groupings was then calculated. This evaluation process has been performed for 2 years (2019 and 2020) with the intention to continue in the future.

Assessing by region
It was seen that the indicators varied significantly by country (results shown in [1]) - this was because the data for each country can include submissions by different institutes, different regions, and different sampling schemes.
A more consistent picture emerged when means were calculated for different regional groupings. It was seen that the indicators aggregated by EU Regional Coordination Group (RCG) had very similar values – with all showing a characteristic "shield" shape on radar plots. Radar plots are shown for the **Baltic Sea (BS)**, **North Atlantic (NA)**, **North Sea & Eastern Arctic (NSEA)**, and **Long Distance (LDF)** RCGs. The bottom point of the shield was due to the fact that their commercial fisheries data is being uploaded to the Regional Database (RDB) which gives the highest indicator value. The weakest areas are the procedures around **Editing and Imputation**, **Accuracy and Bias,** and **Data Capture**.

Assessing by species groups
Radar plots for the **Large Pelagic (LP)**, **Recreational (Rec.)**, and **Diadromous (Diad.)** groups are shown. The Large Pelagic group had high scores because they were able to refer to internationally coordinated manuals from organisations like ICCAT. They showed a similar weakness to the RCGs discussed above in the areas of **Editing and Imputation**, **Accuracy and Bias**, and **Data Capture**.
The Recreational data does not share the shield-shaped radar plot. Marine recreational data capture is still at the pilot stage in many countries which means many of the quality processes are not at the same maturity as the established commercial fishery sampling schemes.
Although typically data has been collected for longer time-series Diadromous programmes share some characteristics with the Recreational programmes in that there is not a single international database and that data collection is also more heterogeneous than for commercial sea fishery sampling programmes.

Overall assessment
It can be seen that the weakest areas are those around **Accuracy and Bias**, and **Editing and Imputation**. We believe this reflects a general lack of clarity in the data collection community about how to approach these topics. The relatively low value of the indicator for **Data Capture** continues to show that although these checks do exist they are often encoded into local data capture systems and database applications and not documented outside of these systems. The values for **Sampling Design** show that this is often documented, but i) not for all sampling schemes, and ii) when it is documented it is not always clearly following best practice in its documentation. The relatively high values for **Non-Responses** and **Data Storage** shows that the good progress made in these areas has been maintained. There has been little change in the value of the indicators with time. This can be seen as a strength of the method and criteria used to carry on the assessment, since the values have proven to be stable over 2 years. More clear and shared advances for several groups are seen in topics such as **Non-Responses**. This could be due to the relatively straight forward actions needed to improve such elements in contrast with the more difficult mechanisms needed to tackle topics as **Accuracy and Bias**, and **Editing and Imputation**. This seems to show a clear will of countries to make improvements following RCG guidelines and monitoring work, and the need to keep the assessment framework discussed here in place for a longer period.

Indicator	Level 1	Level 2	Level 3	Level 4
Sampling Design	Sampling design not documented	Documented but either (i) not publically available, or (ii) the link to documentation doesn't work, or (iii) the documentation is old	Sampling design is recently documented and publically available	Recently documented and publically available and follows good/best practices
Non-responses and refusals	Non-responses and refusals are not recorded	-	-	Non-responses and refusals are recorded
Data Capture	Quality checks on detailed data are not documented	Checks are documented but either (i) not publically available, or (ii) the link to documentation doesn't work, or (iii) the documentation is old	Quality checks exist and are recently documented and publically available	Checks exist and are available, and either follow good/best practice, or use shared international libraries/tools
Data Storage	Data not in database	Data only available in national database	Data available in national database and international spreadsheets	Data available in national and international databases
Accuracy and bias	Processes to evaluate accuracy and bias are not documented	Processes are documented but are either (i) not publically available, or (ii) the link to documentation doesn't work, or (iii) the documentation is old	Processes to evaluate accuracy and bias exist and are recently documented and publically available	Processes exist and are publically available, and follow good/best practices
Editing and imputation	Editing and imputation processes are not documented	Processes are documented but are either (i) not publically available, or (ii) the link to documentation doesn't work, or (iii) the documentation is old	Editing and imputation processes exist and are recently documented and publically available	Processes exist are documented and publically available, and follow international good/best practice



References

[1]RCG North Atlantic, North Sea & Eastern Arctic and RCG Baltic Reports, 2020, https://datacollection.jrc.ec.europa.eu/docs/rcg

Foras na Mara Marine Institute
Regional Coordination Group North Atlantic North Sea & Eastern Artic
Regional Coordination Group Baltic Sea Region