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Comparison of PFA self-sampling with EU observer data

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Comparison of PFA self-sampling with EU observer data

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Abstract

The pelagic freezer-trawler fleet (PFA) has been carrying out a self-sampling program on the freezer-trawler fleet since 2015, within the northeast Atlantic, West Africa and the South Pacific. The pelagic freezer-trawler fisheries are characterized by a high level of sampling being carried out for commercial purposes. The self-sampling programme expanded on the ongoing sampling programme by standardizing the sampling methodology and the recording formats. During self-sampled trips, the crew member will generally take a random sample of around 20 kg from the catch of each haul (or the majority of hauls), separate them into the different species and measure the length compositions of each of the subsamples. During some of the self-sampled trips, the vessel was also joined by a scientific observer. For those trips the species and length compositions from the scientific observer have been compared to the self-sampling data.

Within the fishery for jack mackerel in the South Pacific, the PFA self-sampling program has been carried out on all trips. The scientific observer program for that fishery is targeted to cover at least 10% of the effort. Over the years 2015-2019 the analysis has shown that around 42% of the catch has been covered by scientific observers. Over these years, 12 trips were covered by both self-sampling and scientific observes.

The overal number of length measurements between the self-sampling and observer trips is comparable, but self-sampling samples fewer fish per trip but more (all) trips while the observer program measures more fish but on fewer trips. Comparisons of the cumulative catch per trip show close correspondence between the two sampling programs, as does the species compositions. Length compositions per sampled trips and hauls are generally comparable.

A comparison of the overall length compositions by year derived from all self-sampled trips or derived from the raised observer trips, demonstrates that the self-sampling covers a wider part of the fishery (season, area) which explains some of the differences between the two data sources. Self-sampling provides a substantial improvement in the coverage of the fishery and thereby a more realistic length composition to be used in the assessment of jack mackerel. The combination of self-sampling and observer trips allows for quality control of both programs while being able to assure a wide coverage of the fishing season.

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1 Introduction

1.1 Self-sampling in the Pelagic freezer-trawler fisheries

The pelagic freezer trawler fishery targets small pelagic species. In the Northeast Atlantic, the most important species are: herring (*Clupea harengus*), blue whiting (*Micromesistius poutassou*), horse mackerel (*Trachurus trachurus*), mackerel (*Scomber scombrus*), greater argentine (*Argentina silus*) and sardine or pilchard (*Sardina pilchardus*). There is also a fishery for sardine (*Sardina pilchardus*) and sardinella (*Sardinella aurita*) in the waters west of Africa and for jack mackerel (*Trachurus murphyi*) in the South Pacific.

The Pelagic Freezer-trawler Association (PFA) is an association that has nine member companies that together operate 17 (in 2020) freezer trawlers in six European countries (www.pelagicfish.eu). The PFA initiated a research and knowledge strategy in 2014 with the aim to "initiate, develop, contribute and sustain knowledge development that is needed for sustainable management and exploitation of fish stocks in all areas where PFA members are active." As part of this ambition a self-sampling program has been initiated that extended and harmonized the already ongoing sampling activities on the vessels for commercial reasons. The extension in the self-sampling programme consists of recording of haul information, recording the species compositions per haul and regularly taking random length-samples from the catch. The self-sampling is carried out by the vessel quality managers on board of the vessels, who have a long experience in assessing the quality of fish, and by the skippers/officers with respect to the haul information. The scientific coordination of the self-sampling programme is carried out by Martin Pastoors (PFA chief science officer) with support of Floor Quirijns (contractor). A self-sampling manual is used to provide instructions to the crews (Pastoors 2018a). Results of the self-sampling program are published in annual reports (Pastoors & Quirijns 2017, 2018, 2019, 2020) and in dedicated reports for species expert groups (e.g. Pastoors 2017a, 2018b)

1.2 Scientific observer program

In the European Union, the collection and management of fisheries data is regulated through the Data Collection Framework (DCF) of the European Commission (EC). The observer program in the South Pacific was initially carried out by Corten Marine Research (CMR). In 2015 this observer program became embedded into the European Data Collection Framework even though the coordination was still carried out by CMR. From 2017 onwards the coordination has been taken over by the National Marine Fisheries Research Institute in Poland. A minimum of 10% of the trips in the South Pacific is to be covered by scientific observers. Scientific observers have a wider objective than the self-sampling program by also focussing on potential bycatch of birds and seamammals or other protected species.

1.3 Aim of this paper

This paper aims to present a comparison of the results of the PFA self-sampling and the EU observer sampling. Direct comparisons are made of trips were self-sampling was carried out while an scientific observer was also carrying the the scientific sampling. In addition there will be comparisons between raising length compositions from all self-sampled trips in comparison with only from observer trips.

2 Material and methods

Data from the PFA self-sampling program has been made available from the PFA database system. Data from the official observer programs could only be released for this analysis after written consent of the vessel-owners because by definition the observer data will not be released in a form that can be attributed to specific vessels. The aim of the analysis was to present a haul-by-haul comparison of observer data and self-sampling data. Given the time available for preparing this paper/presentation, this could only be achieved for the trips in the SPRFMO area in 2015 - 2019. Comparisons will be focussed on catch compositions and length compositions.

3 Results

The European fishery in the South Pacific is targeted as Jack mackerel (*Trachurus murphyi*) and has been carried out by one or two vessels per year. All trips of vessels by PFA members are covered by self-sampling and at least 10% of the effort is covered by observer trips. In 2016 one of the European vessels fishing in the South Pacific did not belong to the PFA membership and was not covered by the self-sampling program.

An overview of the key-characteristics of the self-sampling and scientific observer trips between 2015 and 2019 is shown in Table 3.1. Of the just over 90 000 tonnes of catch during those years, around 38 000 tonnes were covered by the scientific observer programme (~ 42%). The number of length measurements in the self-sampling and the observer program are more or less similar. This means that the self-sampling covers a larger part of the fishery at a more extensive rate, while the observer program targets fewer trips but with higher sampling rate.

Table 3.1: Summary of self-sampling and scientific observer trips in the South Pacific: number of vessel, trips, hauls, catch (tonnes) and number of fish measured

year	nvessels SS	nvessels OBS	ntrips SS	ntrips OBS	nhauls SS	nhauls OBS	catch SS	catch OBS	nlength SS	nlength OBS
2015	2	2	9	3	379	176	28,972	13,935	7,299	18,810
2016	1	1	4	2	169	50	10,284	2,694	6,927	5,594
2017	2	1	10	3	615	183	29,652	7,429	20,829	14,575
2018	1	1	5	2	236	117	10,234	6,012	4,692	9,417
2019	1	1	3	2	162	90	12,114	8,463	7,680	5,435
(all)	.	.	31	12	1,561	616	91,256	38,533	47,427	53,831

A direct comparison of the trips that were both self-sampled and that had a scientific observer on board is shown in table 3.2. Generally, these will give very similar values, except when a trip was not fully covered by an observer as was the case in 2016 for example.

Table 3.2: Summary of trips where both self-sampling and scientific observations was carried out in the South Pacific: number of vessels, trips, hauls, catch (tonnes) and number of fish measured

year	nvessels SS	nvessels OBS	ntrips SS	ntrips OBS	nhauls SS	nhauls OBS	catch SS	catch OBS	nlength SS	nlength OBS
2015	2	2	3	3	167	176	14,112	13,935	2,703	18,810
2016	1	1	2	2	85	50	4,664	2,694	2,702	5,594
2017	1	1	3	3	183	183	7,429	7,429	5,493	14,575
2018	1	1	2	2	117	117	6,015	6,012	2,365	9,417
2019	1	1	2	2	90	90	8,422	8,463	2,991	5,435
(all)	.	.	12	12	642	616	40,642	38,533	16,254	53,831

Cumulative catch per trip

A comparison between the cumulative catches per trip from self-sampling and scientific observers is shown in figure 3.1.There is generally a very close correspondence between the two sampling programs. Where there is a mismatch, this is mostly due to misallocations in haul numbers and haul datetimes (note that haul numbers are not included in the SPRFMO exchange format). A process of manually checking the haul numbers and associated date-times and positions has been carried out but it has not been possible to reallocate all catches accordingly.

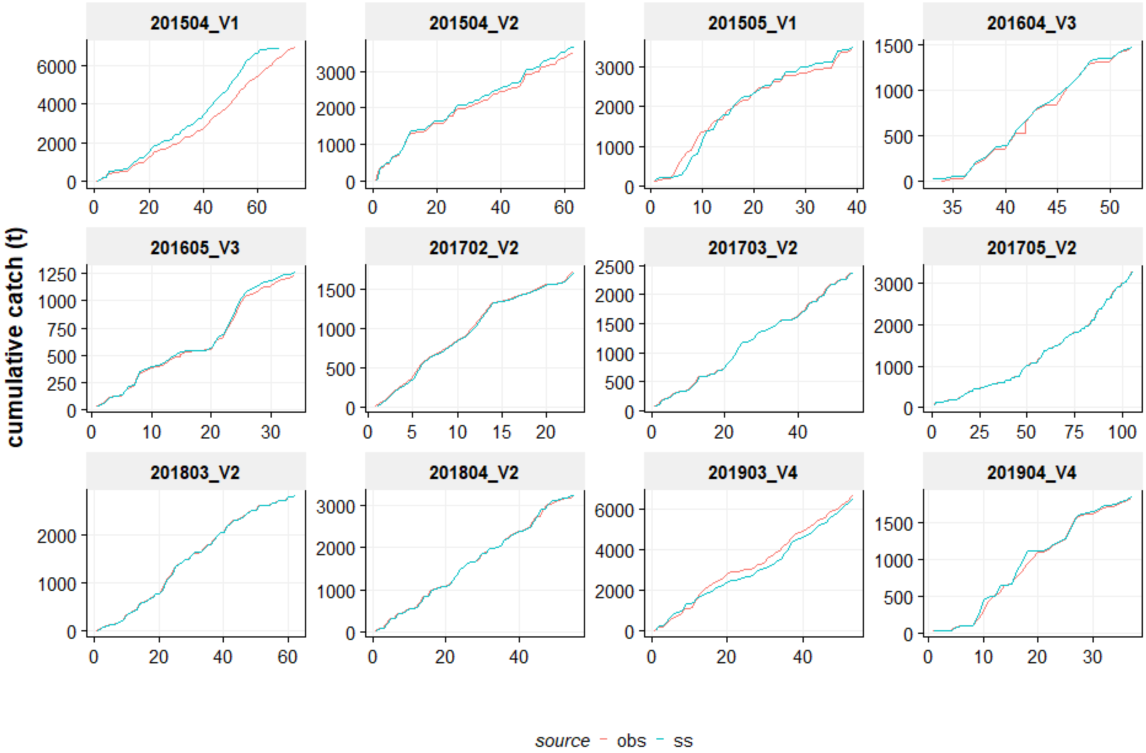

Figure 3.1: Overlap between catch per haul for observer trips (red) and self-sampling trips (bluegreen)

A comparison of the proportion of the total cumulative catch by trip and species for the hauls in common between the self-sampling and the observer program indicated a close correspondence in the estimated proportions for the main species.

Length distributions

The length distributions of Jack mackerel (in proportion at length calculated from raised catch numbers) by trip for the hauls that are in common between the self-sampling and observer program are shown in figure 3.3. There is generally a close correspondence between the length distributions from the self-sampling and the observer program.

The main exception to the good correspondence is trip 201504_V2. This demonstrated a pattern whereby the scientific observer measured relatively less small fish and more larger fish compared to the self-sampling data. Trip 201504_V2 was in fact a special case, because it was closely linked with trip 201505_V1. The two vessels were fishing in the same area and each of the vessels was carrying out the self-sampling program and had a scientific observer on board. This provided a unique opportunity to evaluate the consistency of the self-sampling and the observers on board of the vessels. There were 6 days in which both vessels were fishing on the same dates and close to each other. The comparisons demonstrated that the length compositions of the self-sampling and scientific observer on V1 and the self-sampling on V2 was very consistent but that the scientific observer on V2 had a tendency to sample relatively more larger fish. This has been confirmed afterwards as being due to the sampling method being used by the scientific observer on V2 who created samples by manually picking fish from the conveyor belt instead of taking an appropriate random sample (See: SC6-JM04 for a more in depth comparison of those trips).

The erratic behaviour in the length compositions of the self-sampling trips during 2019 has not been fully investigated yet but will be addressed in future publications.

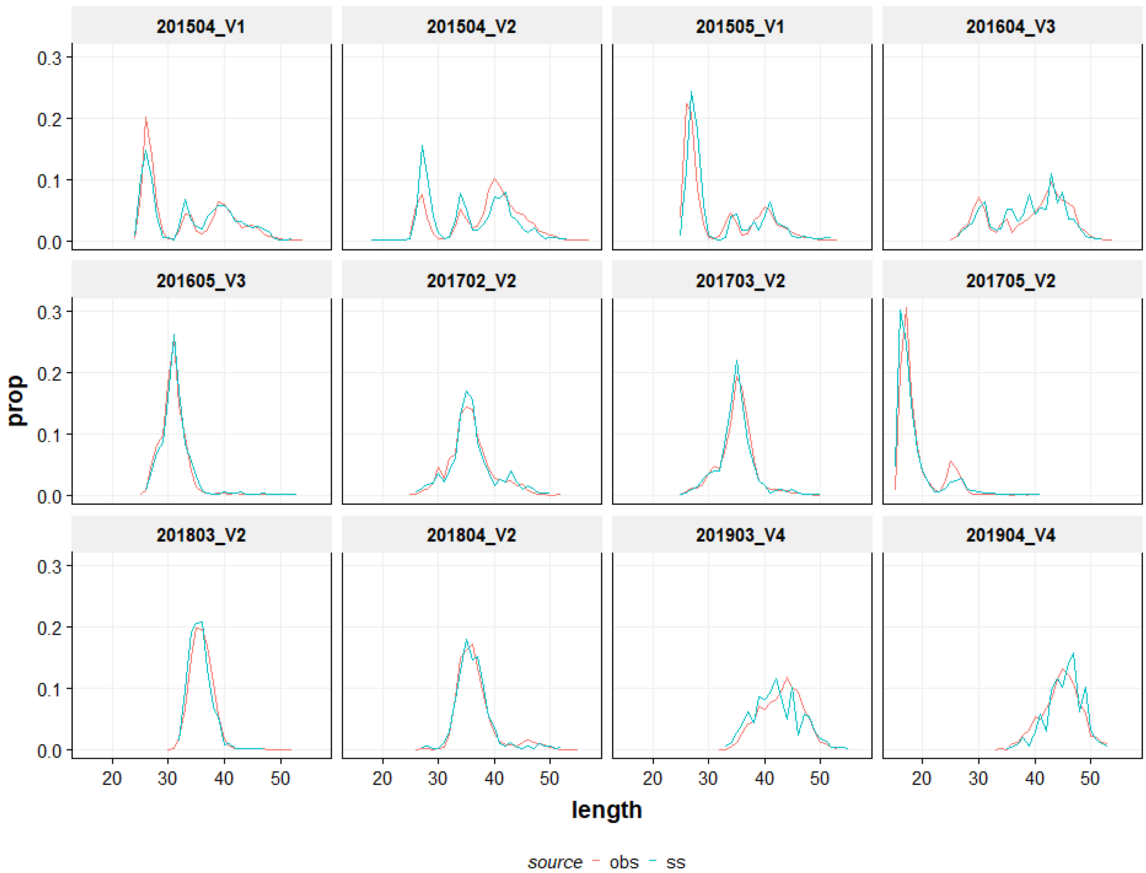

Figure 3.3 Jack mackerel length distributions by trip only for hauls that are in common between self-sampling and observer trips

Comparison of (all) self-sampled trips and observer trips

The scientific observer program aims to cover at least 10% of the fishing effort in the area. In practice, the observer program in the years 2015-2019 has covered around 42% of the total catch by PFA vessels (see table 3.1). However, that still means that a substantial part of the catch has not been covered by the scientific observers (see figure 3.4 for a spatial map of self-sampled hauls versus observed hauls by year and quarter). The self-sampling program, because it covers all trips in the area at a somewhat lower intensity, could be used as a way to expand the results of the observer program to the whole fishing season.

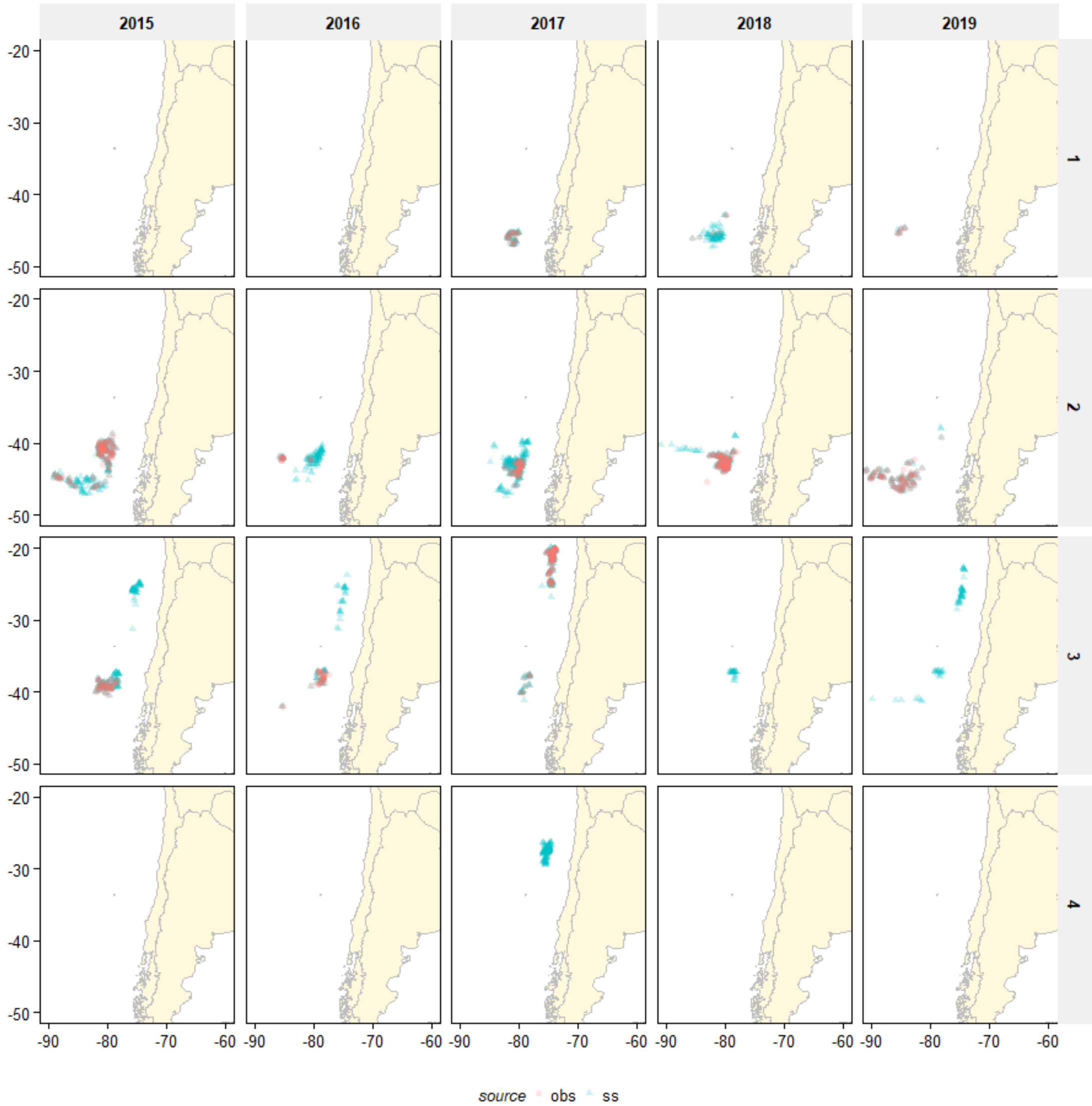

Figure 3.4 mapping of self-sampling hauls (bluegreen) and observer hauls (red) by year and quarter.

Comparison of raised catch number at length (in proportions)

Given that the direct comparison of the observer-trips with the self-sampling data from the same trip yielded very close correspondence, in this section we are exploring the impacts of comparing raised estimates from all self-sampling trips with raised estimated from observed trips only. The raised numbers at length by year are expressed as proportions to make them comparable between years (figure 3.5 all quarters combined; figure 3.6 separately by quarter). Using all the self-sampling trips may give a substantially different length composition compared to only using the observer trips. This effect is almost fully due to specific fisheries (area and/or season) not covered by the observer trips. Thus, the length composition from the self-sampling does provide a more realistic overall length composition that could be used in the assessment of jack mackerel.

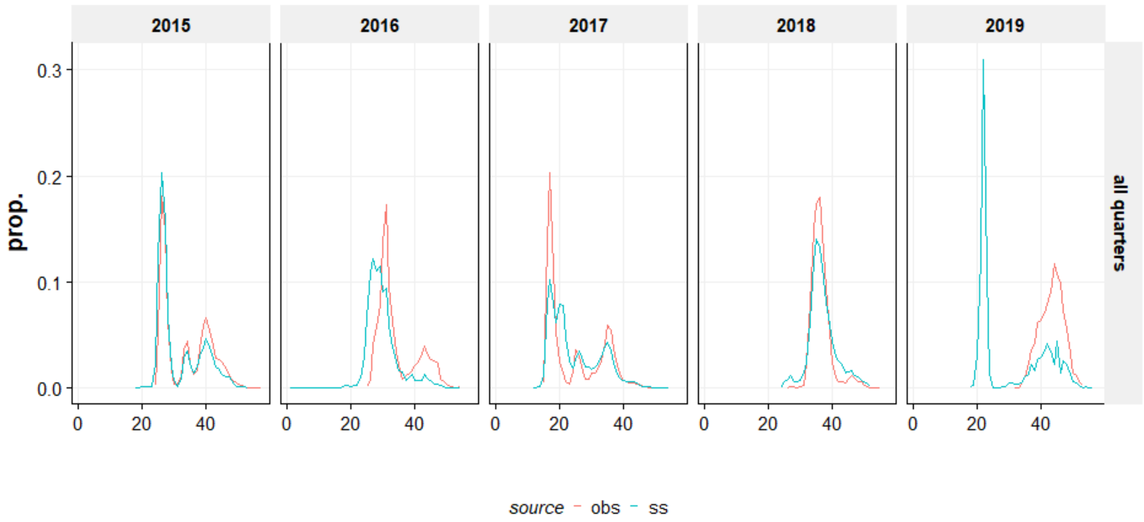

Figure 3.5 Jack mackerel overall relative length distributions from all trips where self-sampling (bluegreen) and observer trips (red) where available.

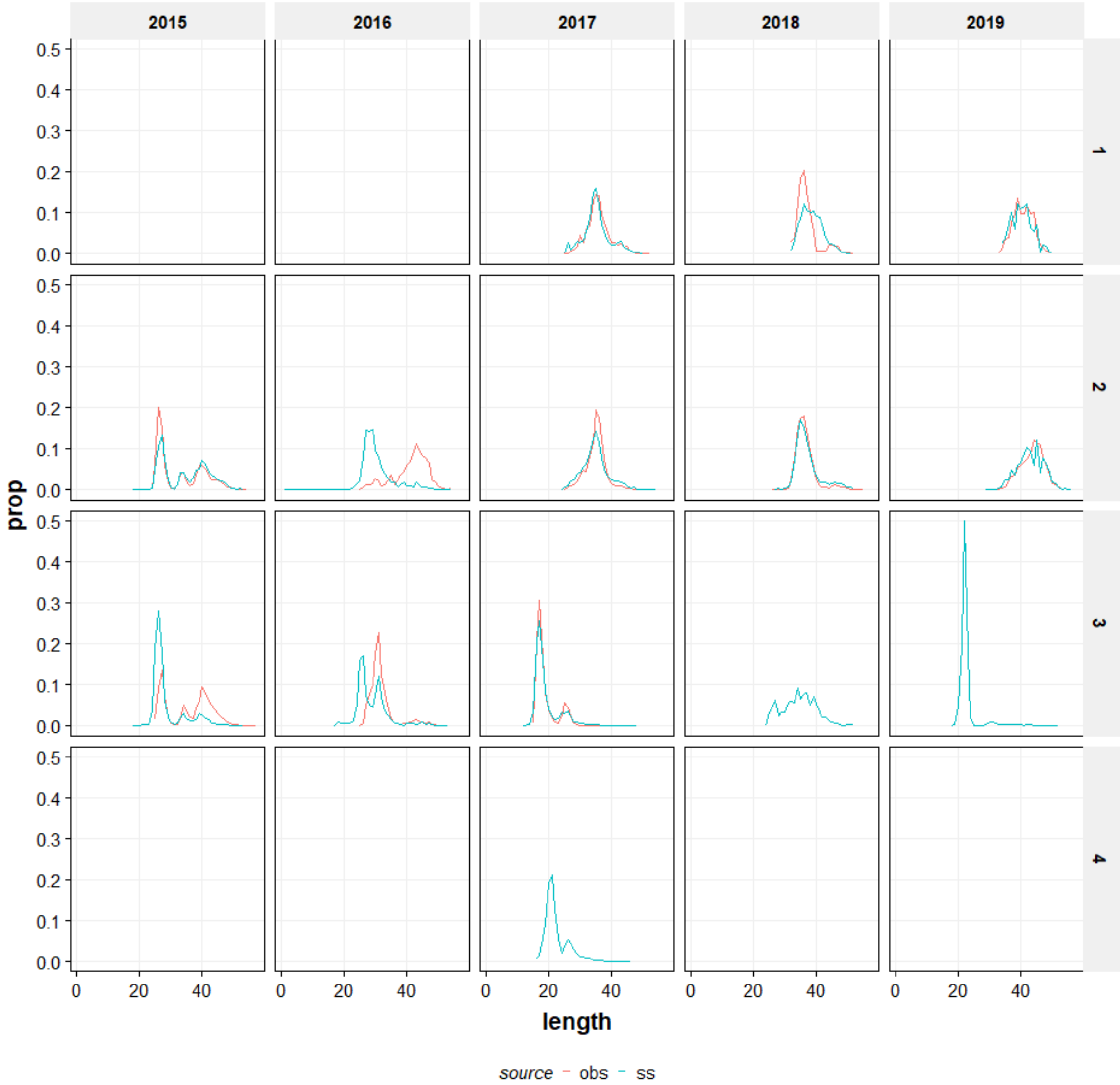

Figure 3.6 Jack mackerel overall relative length distributions by quarter from all trips where self-sampling (bluegreen) and observer trips (red) where available.

4 Discussion

The pelagic freezer-trawler fleet (PFA) has been carrying out a self-sampling program on the freezer-trawler fleet since 2015, within the northeast Atlantic, West Africa and the South Pacific. In the fishery for jack mackerel in the South Pacific, the PFA self-sampling program has been carried out on all trips. The scientific observer program in that for that fishery is targeted to cover at least 10% of the effort. Over the years 2015-2019 the analysis has shown that around 42% of the catch has been covered by scientific observers. Over these years, 12 trips were covered by both self-sampling and scientific observers.

While working with the data from the self-sampling and from the observer trips, we found that there were a large number of small issues with the consistency of the data. This was largely due to three reasons: 1) the absence of vessel, trip and haul identifiers in the SPRFMO observer database, 2) an apparent lack of consistency checking in the database (e.g. haul dates being prior to the shoot dates), difficulties in the time conversions (according to the protocols, time should be reported in UTC, but this has not always been the case in the self-sampling program). Due to these inconsistencies it has not been possible to create an exact one-on-one match between hauls in the self-sampling and observer program, although we could get very close. We recommend to include vessel, trip and haul identifiers in the SPRFMO database. Time-zone has been included in the self-sampling template from 2020 onwards.

The PFA self-sampling program has been initiated in 2015 while the observer program has been carried out for many more years already. Because this was the first time that self-sampling has been applied in this fleet, there was a learning process involved in finding out the best way to measure and record the relevant parameters on board of the vessel. This has also meant that the method of measurement has developed over time which in turn generated challenges for the methods of raising. Initially the sampling was carried out by 'batch' (i.e. a production unit of a certain species and size and quality). By also recording the share of batches within a haul, it has been possible to redistribute the length measurements by batch to length estimates per haul. During the later years of the self-sampling program, this approach has been abandoned, and the sampling was simply carried out by haul. One of the immediate and very important consequences of the comparison between self-sampling and the observer program has been to critically review the data storage and raising methods employed for the self-sampling program. Several (small) errors have been removed from the code because of the comparisons that could be carried out.

The overall number of length measurements between the self-sampling and observer trips is comparable, but self-sampling samples fewer fish per trip but more (all) trips while the observer program measures more fish but on fewer trips. Comparisons of the cumulative catch per trip show close correspondence between the two sampling programs, as does the species compositions. Length compositions per sampled trips and hauls are generally comparable. However, during some trips, differences were observed in the overall length compositions. These differences have previously been investigated (SC6-JM04) and were shown to derive from either problems in the sampling method employed by one of the scientific observers or by the lower number of measurements in the self-sampling program. The erratic behaviour in the length compositions of the self-sampling trips during 2019 has not been fully investigated yet, but will be addressed in future publications.

A comparison of the overall length compositions by year derived from all self-sampled trips or derived from the raised observer trips, demonstrates that the self-sampling covers a wider part of the fishery (season, area) which explains some of the differences between the two data sources. Self-sampling can therefore provide an improvement in the coverage of the fishery and thereby a more realistic length composition to be used in the assessment of jack mackerel, provided that the erratic length-compositions in 2019 can be explained. The combination of self-sampling and observer trips allows for quality control of both programs while being able to assure a wide coverage of the fishing season.

5 Acknowledgements

We would like to acknowledge the crews of the PFA vessels and the scientific observers who have been on board of the vessels. We would like to thank the coordinators of the scientific observer program for allowing access to the observer data for this analysis.

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