Addendum to the 'Live Wrasse Fishery in Devon and Severn IFCA 2018 Research Report'

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1. Introduction

During 2018, data collection continued as part of the fully documented fishery. These data were compared to 2017 and the results were presented to the sub committee in November 2018. Initial analyses indicated a decrease in mean Landings per Unit Effort (LPUE) in 2018 compared to 2017, derived from the fishermen's landing forms which record all catches. This trend was not seen in the Catch per Unit Effort (CPUE), which slightly increased in two months, and was slightly higher overall in 2018 compared to 2017. Given the time constraints of reporting in November 2018 it was not possible to investigate the cause of the disparity between LPUE and CPUE. It was therefore agreed at the sub-committee meeting that further analysis of the data be carried out. Of particular interest was the potential effect of the change in minimum and maximum conservation reference size for corkwing affected LPUE.

2. Methodology

A detailed methodology of the data collection can be found in the research report dated November 2018. All additional analysis contained within this addendum were completed in RStudio version 1.1.456.

In previous analyses Landings Per Unit Effort (LPUE) was calculated from the fishermen's landings forms and included only fish that were within the slot size for each species. Catch Per Unit effort however was calculated from observer surveys and included all fish caught (those within and outside the slot sizes). Differences were apparent in the patterns of CPUE and LPUE between months and it was unclear whether this was caused by differences in the numbers of fish returned in some months or whether the observer surveys from which the CPUE is calculated were not sampling sufficiently to pick up the trends detected in the landings data. CPUE was calculated from the observer surveys using the method described in the high-resolution analysis for 2018, but a new form of LPUE was calculated. The LPUE were calculated from the catch data only (so CPUE minus those fish that were returned. This form of LPUE is referred to as Landings per Unit Effort from catch (LPUE (fc)).

CPUE and LPUE(fc) was calculated for every string fished during the observer surveys, where the total amount of fish caught for each string was divided by the number of pots in that string. This method follows that used in the high resolution CPUE analysis in the November 2018 report.

Spatial fishing effort maps were calculated from landings form data for each month, combining effort of all fishermen. Maps were produced in QGIS v2.14.19. Figure numbers in this addendum follow on from those of the November 2018 report.

3. Results

3.1. Landings Per Unit Effort and Catch Per Unit Effort

CPUE between months and years shows a decrease in median in 2018 compared to 2017 for every month except for August, for which CPUE increased (Figure 32). This plot is calculated in the same way as the high-resolution CPUE data in the original report (Figure

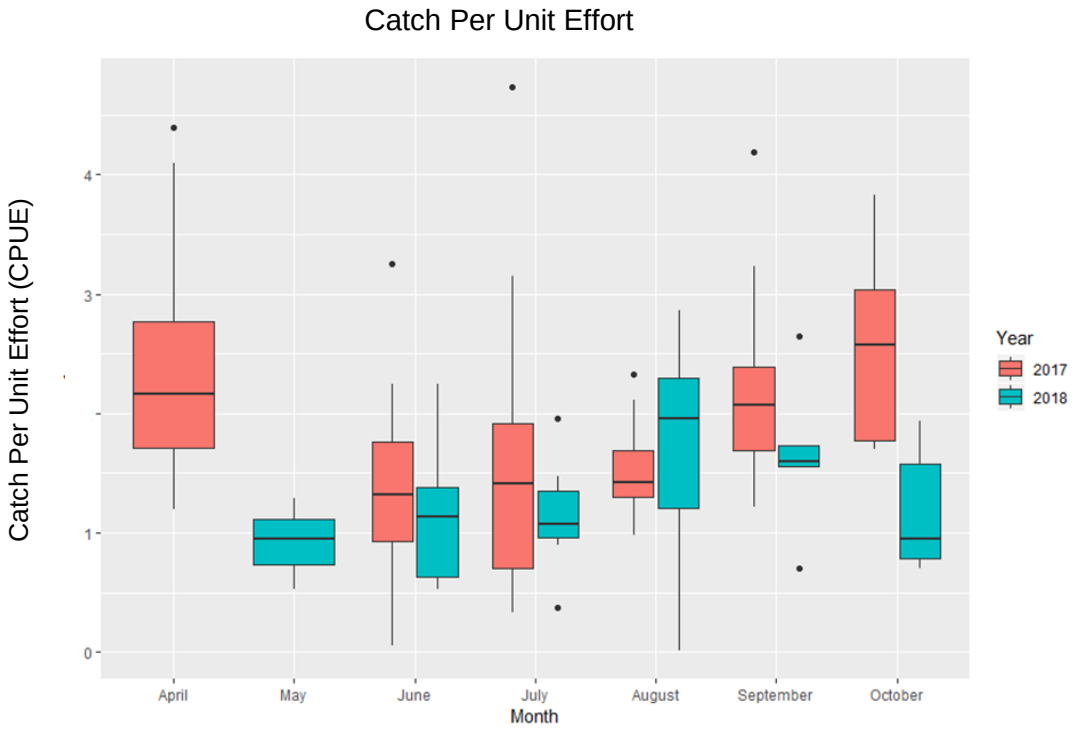

Figure 32. Box and Whisker plot of mean LPUE per month for 2017 and 2018. Showing median (dark line), the lower and upper quartiles (25% and 75%) (the top and bottom of the box) the minimum and maximum values excluding the outliers (the 'whiskers'), and the outliers (circles).

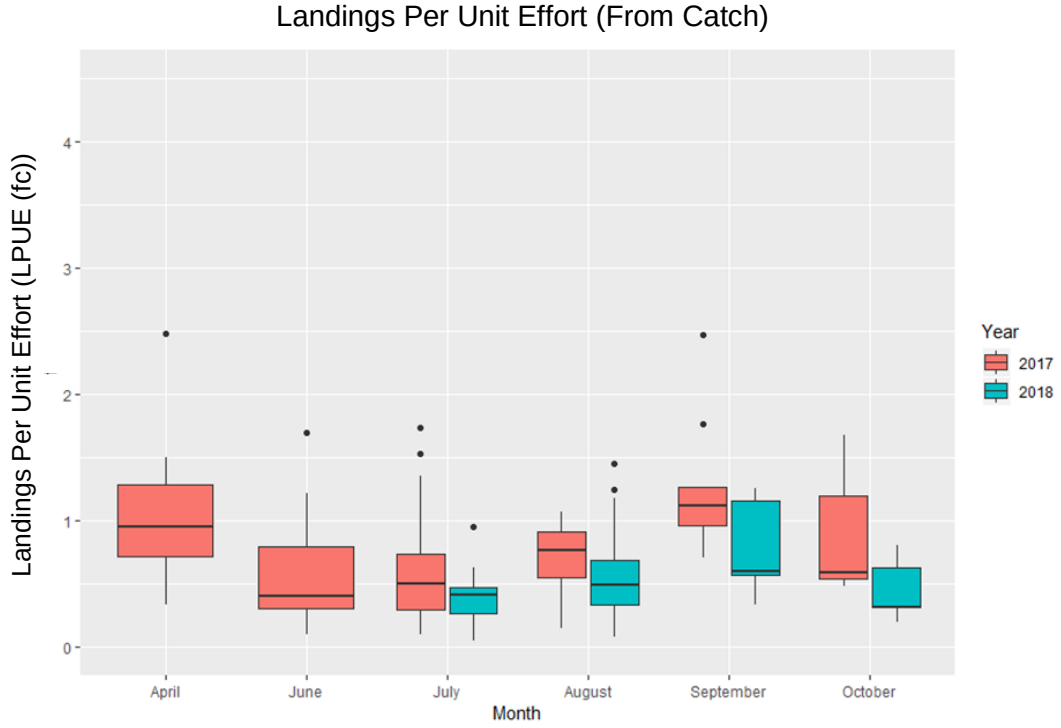

Figure 33. Box and Whisker plot of mean CPUE per month for 2017 and 2018 Taken from the onboard observer surveys, therefore includes all species of wrasse. Showing median (dark line), the lower and upper quartiles (25% and 75%) (the top and bottom of the box) the minimum and maximum values excluding the outliers (the 'whiskers'), and the outliers (circles).

18) in the November 2018 report. This differs slightly from the 'total CPUE', which largely agreed but found an increase in the total CPUE for September 2018 compared to 2017 which is not apparent in the high-resolution analysis. This is likely to be a sampling issue, with few surveys happening in September resulting in unstable results depending on the method of calculation.

In 2018 LPUE (fc) shows an increase from July through to September but monthly values are consistently lower than 2017 (Figure 33). This follows the same trend as total LPUE (Figure 1 from November 2018).

Therefore, regardless of the method of calculation there is an increase in CPUE in August 2018 (and in some cases September 2018) which is not present in the LPUE (from catch). Because the new LPUE(fc) is now derived from the same data source as the CPUE it can be determined that this pattern is caused by higher catch in August 2018, (relative to other months in 2018) not all of which was landable, i.e. the difference in the figures is at least in part because of high return rates in some months, not sampling bias.

3.2. Understanding Return Rates

As indicated in the November 2018 report, from 13 August 2018 onwards, the new potting permit byelaw conditions were implemented which included an amendment to the minimum size for corkwing of 120mm to 140mm and to the maximum size from 230mm to 180mm. It should be noted that there is no ratio for April to June 2018 as the fishery was closed and fishing only took place to allow officers to undertake sampling for comparison to 2017, therefore all catches were returned.

The ratio of all wrasse species returned: kept (including corkwing) varies between months and years but has increased in 2018 compared to 2017 (Figure 34), meaning that a greater proportion of the catch had to be returned in 2018. Some months show instances of above average return ratios. For example, in August 2018 one string resulted in 25 wrasse being returned for every one fish kept (Figure 34). Removing corkwing from the data indicates that there were still higher return ratios for other species of wrasse in 2018 compared to 2017 (Figure 35) with differences between years being most pronounced in August.

The ratio of corkwing returns has markedly increased in 2018 compared to 2017 for July through to October (Figure 36). Again, this is most pronounced in August, especially in terms of the outliers of higher than average value. Median values of return ratios are very different between 2017 and 2018 for corkwing wrasse (Figure 26), something that is not apparent in Figure 34 and 35 for all wrasse, or all wrasse excluding corkwing.

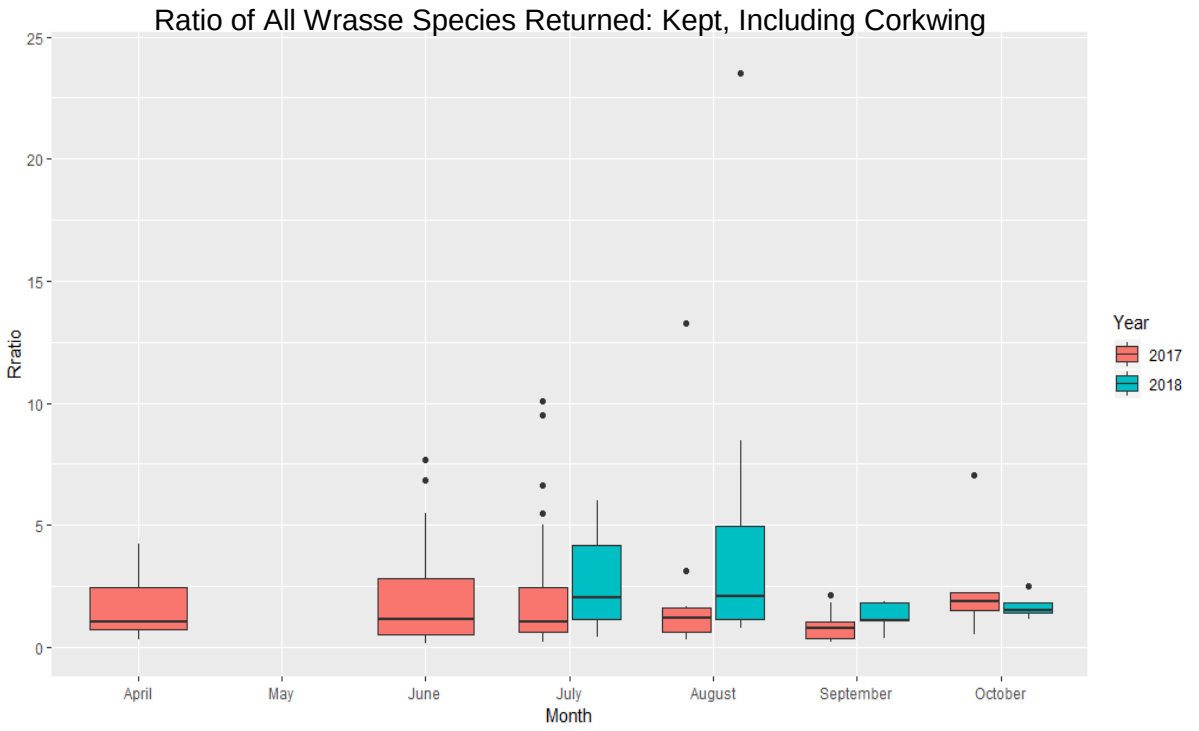

Figure 34. Box and Whisker plot of the amount of wrasse returned as a ratio of the amount kept. Taken from the onboard observer surveys, therefore includes all species of wrasse. Showing median (dark line), the lower and upper quartiles (25% and 75%) (the top and bottom of the box) the minimum and maximum values excluding the outliers (the 'whiskers'), and the outliers (circles).

Figure 35. Box and whisker plot showing the ratio of all wrasse species returned: kept excluding corkwing. Showing median (dark line), the lower and upper quartiles (25% and 75%) (the top and bottom of the box) the minimum and maximum values excluding the outliers (the 'whiskers'), and the outliers (circles).

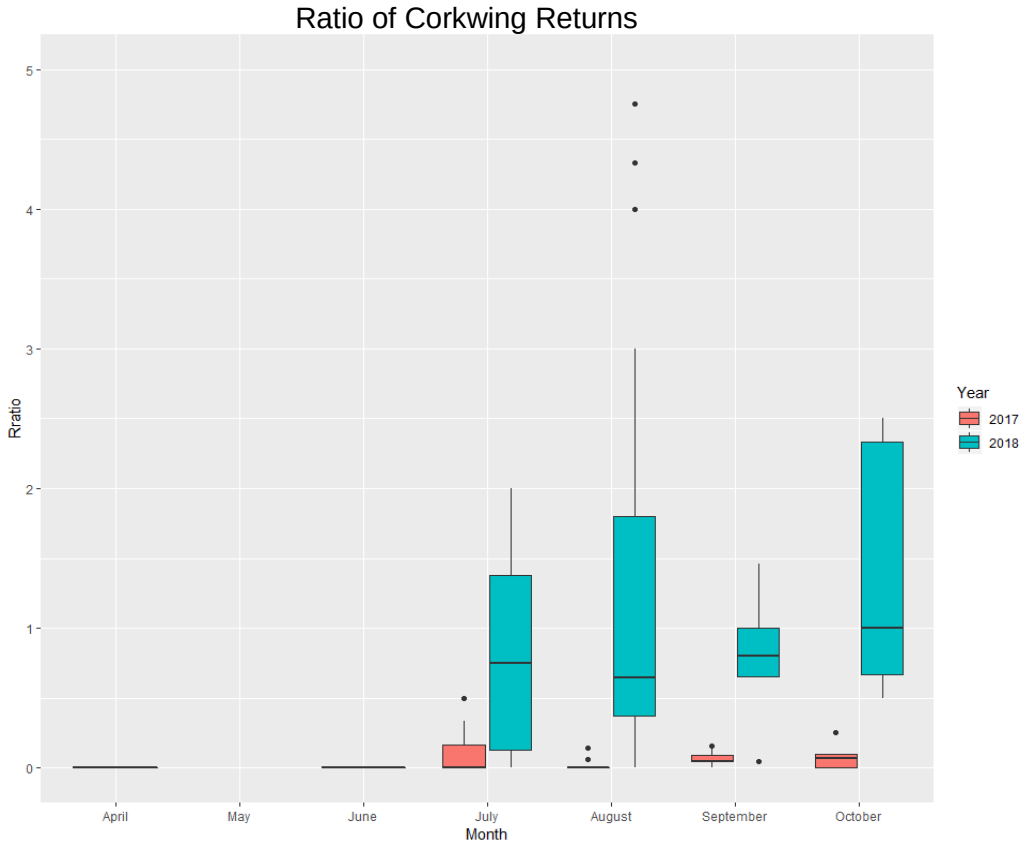

Figure 36. Box and Whisker plot of the amount of corking returned as a ratio of the amount kept. Taken from the onboard observer surveys. Showing median (dark line), the lower and upper quartiles (25% and 75%) (the top and bottom of the box) the minimum and maximum values excluding the outliers (the 'whiskers'), and the outliers (circles).

3.3. Spatial fishing effort

The spatial pattern of fishing effort varies between months during 2018. Fishing effort in July 2018 was concentrated from Fort Bovisand to the Mew Stone, with this area being a hotspot (Figure 7). However, it should be noted that this only represents one fisher out of the four, as this was the only fisher fishing in the District at this time. August 2018 shows an increased fishing effort that is more widespread, highlighting several hotspots within the District (Figure 8) with four boats fishing for wrasse in the District. Fishing effort in September appears to shift more northwards within the sound, with hotspots being identified at Heybrook Bay, Drakes Island and Queens Ground (Figure 9). October only represents the first week and is therefore not representative of the whole fishing fleet or month (figure 10).

4. Discussion

Initial analysis of the data showed a decline in overall 'total' mean LPUE but an increase in the 'total' mean CPUE from 2017 to 2018, with the differences being caused by increased CPUE in August and September. However, the high-resolution data detected a reduction in median CPUE between 2017 and 2018 with reductions in all months except for August. Several explanations were considered but it was agreed that further interrogation of the data was needed to clarify the disparity in the trends seen. It was discussed that the increased Min and decreased Max CRS for corkwing may have resulted in greater returns of this species from early August, therefore affecting LPUE but not CPUE.

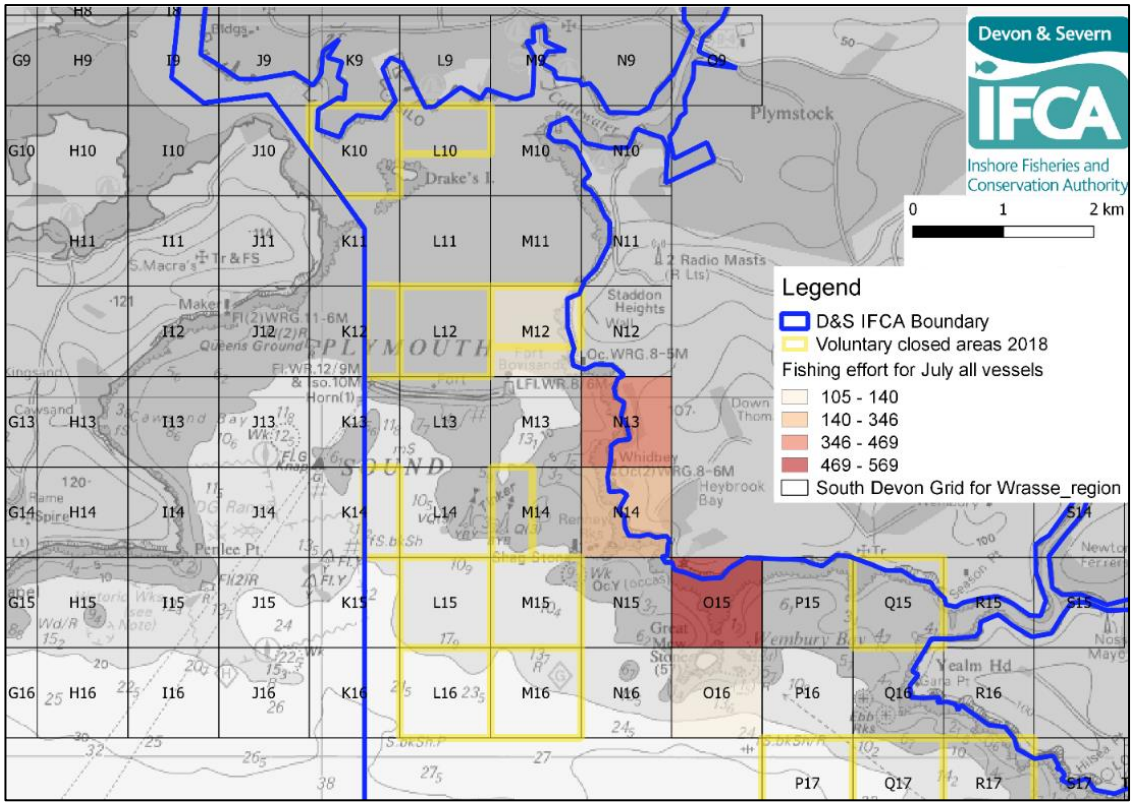

Figure 37. Fishing effort all vessels for July 2018. Showing the amount of pots hauled per grid square.

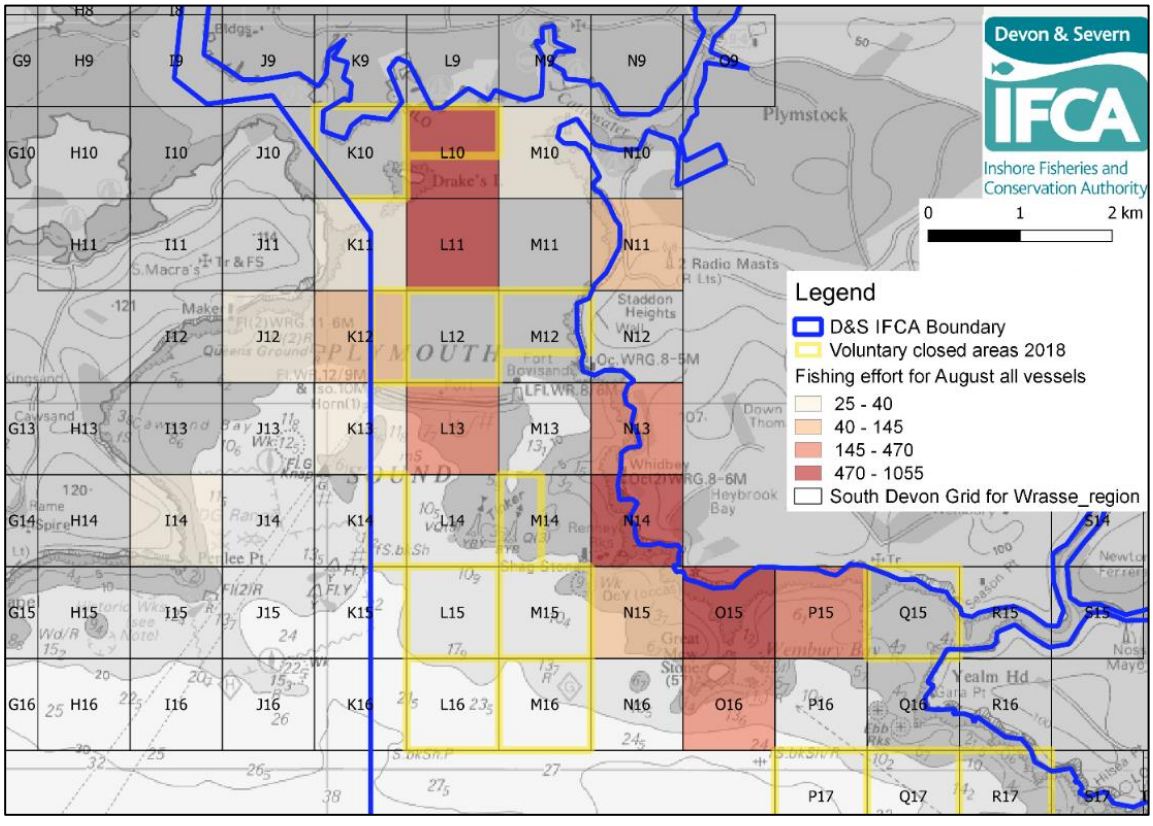

Figure 38. Fishing effort all vessels for August 2018. Showing the amount of pots hauled per grid square.

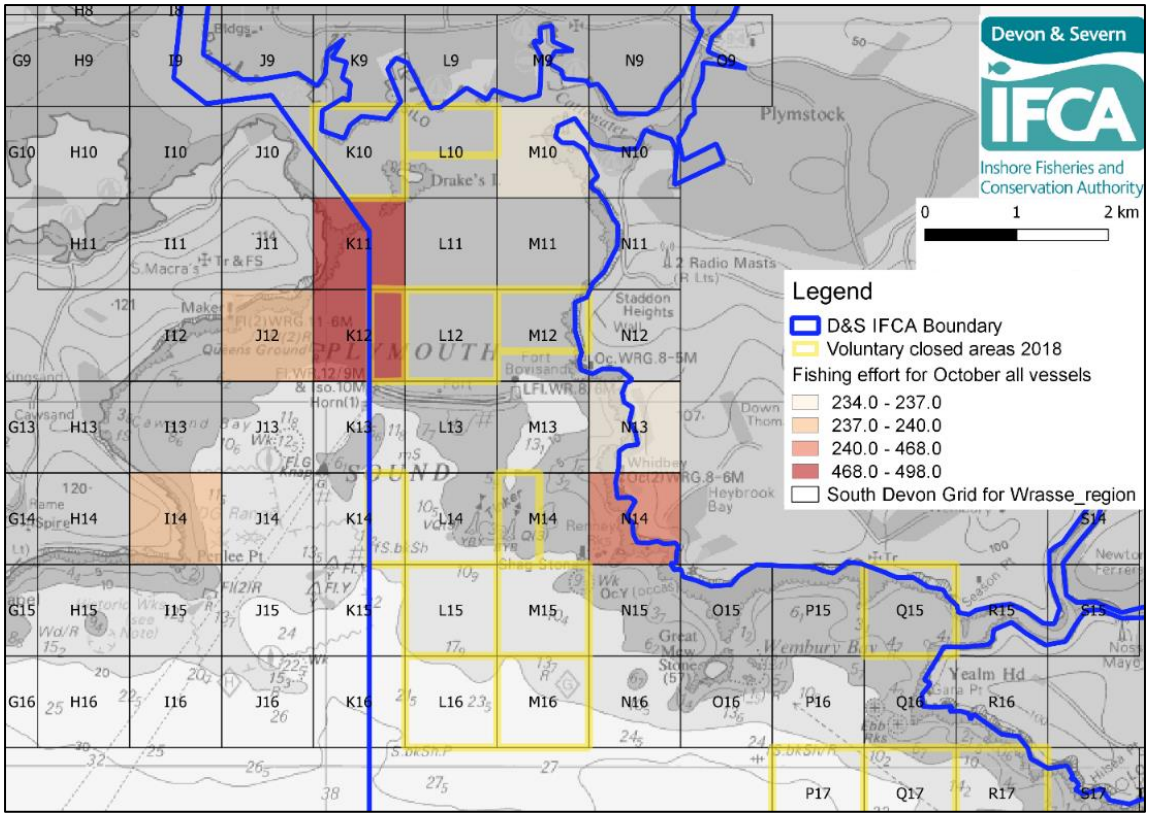

Figure 39. Fishing effort all vessels for September 2018. Showing the amount of pots hauled per grid square.

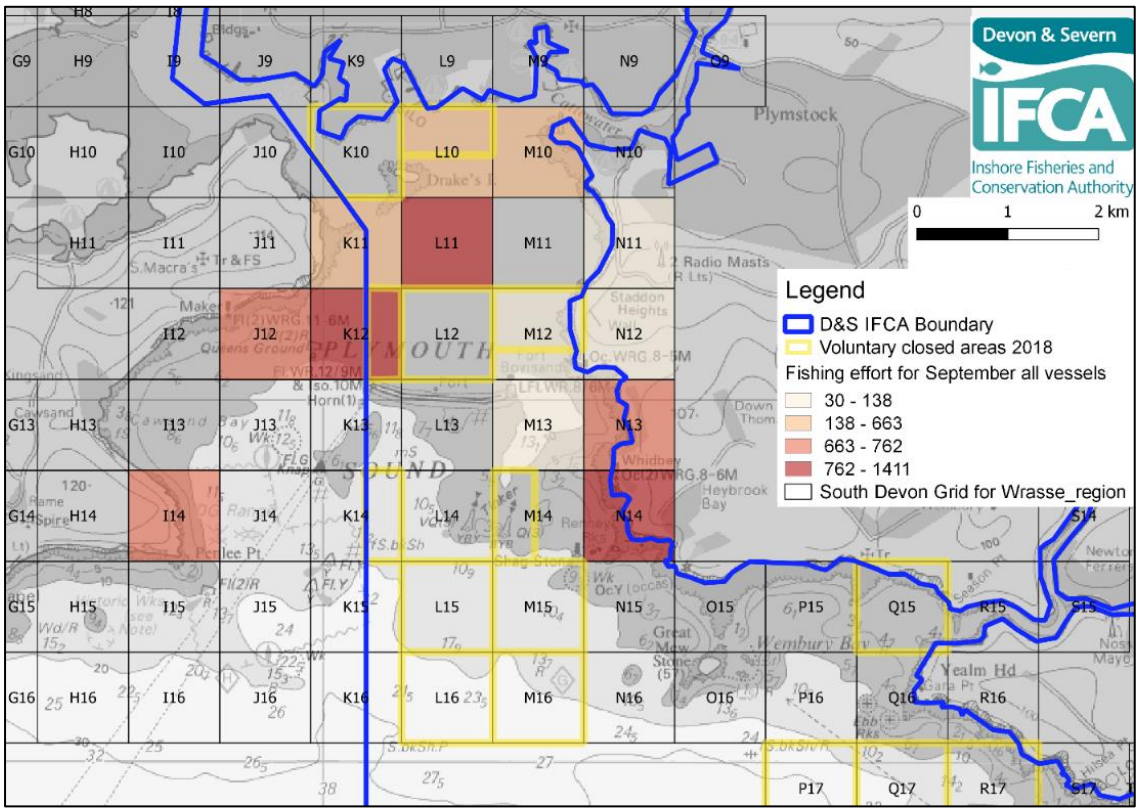

Figure 40. Fishing effort all vessels for October 2018. Showing the amount of pots hauled per grid square.

LPUE derived from the catch data agreed with the LPUE from the total landings, suggesting the difference between CPUE and LPUE was not caused by a sampling bias in the CPUE dataset in 2018.

The increase in return rates in 2018 compared to 2017 suggest that this is at least part of the cause for the difference in the patterns in CPUE and LPUE (in August or August and September depending on the analysis undertaken) between the two years. Whilst the change in slot size for corkwing wrasse may have contributed to this, it is not the only cause and increased return-rates for other species are likely to have contributed to the differences in LPUE and CPUE. Interestingly, higher 2018 return rates for corkwing wrasse compared to 2017 were present in July, prior to the change in slot size. The size frequency graph for corkwing (Figure 24D in the November 2018 report) suggests the majority of returns in July were due to fish being below the minimum size. Returns of corkwing in later months were of both fish below the minimum size and above the maximum size (Figure 24E, November 2018 report). However, for July there was no discrepancy between LPUE and CPUE.

Certainly, the largest increase in return rates between 2017 and 2018 occurred in August. Increases in other months are not as pronounced. Figure 3A in the November 2018 shows that in August goldsinny and rock cook are the two species with the highest CPUE and Figure 35 of this report shows that even when corkwing are excluded, return rates in August have increased in 2018 relative to 2017. This suggests that returns have increased for species such as rock cook and goldsinny. The size frequency histograms (Figure 25 in the November 2018 report) suggest that return rates for these species were high (73% and 71% respectively). This suggests that the higher return rates in 2018 relative to 2017 cannot be attributed to the change in the slot size for corkwing alone.

Changes in spatial fishing effort will also have impacts on catch composition, size distributions and therefore return rates and relationships between CPUE and LPUE. For example, corkwing are a more specialised species and prefer sheltered shallower water within kelp forests. The changes in areas witnessed beween July and October 2018 are partly due to the different number and combination of fishermen fishing at any one time, as well as movements of individual fishermen. Certainly, inter-annual and intra-annual (between and within year) differences in the CPUE for individual species are likely to be caused by the spatial distribution of fishing effort. If fishermen moved to an area with greater numbers of species with higher return rates, this could also influence the relationship between CPUE and LPUE.

5. Conclusions

- When LPUE is derived from the observer data, it follows the same pattern as the LPUE derived from the landings forms, suggesting that it is not a sampling bias influencing differences in observed patterns between CPUE and LPUE between years and month (higher CPUE than LPUE in August and September 2018). The observer surveys were capable of detecting patterns observed in the landings data.
- The differences are instead thought to be caused by an increase in return rates in 2018 compared to 2017 which was especially pronounced in August 2018.
- Although a contributing factor, the change in slot size for corkwing wrasse was not the only cause of increased return rates in 2018 relative to 2017.
- Corkwing return rates increased prior to the change in slot size, and other species are thought to have also had increased return rates.

- The data does not suggest any further changes to the management, other than those agreed in November 2018 are required, nor does it result in any suggestions to changes in data collection.
- Again, the high-resolution data analysis provides a more representative description of the fishery and should be the adopted approach where the data allows.