Vision

The Eastern Inshore Fisheries and Conservation Authority will lead, champion and manage a sustainable marine environment and inshore fisheries, by successfully securing the right balance between social, environmental and economic benefits to ensure healthy seas, sustainable fisheries and a viable industry

Whelk Technical Summary Report – Review of whelk permit conditions

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Background:

Buccinum undatum, better known as the common whelk, is a commercially important marine gastropod species fished in coastal waters of the UK and Northern Europe (Hollyman et al., 2018). In 2015, the UK landings of *B. undatum* by UK vessels totalled 20,900 tonnes with a value at first sale of £18.7 million (MMO, 2016). The demand from Asian markets has driven national whelk landings up significantly, with whelk making the top 20 species by value landed into the UK and abroad by UK vessels in 2017 (MMO landings figures 2017). This means that the fishery has substantial value, which in turn has increased the level of fishing effort on a local and national scale. Sustainability within the whelk fishery has become a major concern because of over-exploitation and increased landings due to the expansion of export markets to East Asian countries (Hollyman et al., 2018).

The only national management measure applicable to whelk is a minimum landing size (MLS), which is widely considered to be smaller than needed for effective conservation of stocks. There is no total allowable catch or quota. The national MLS is 45mm, to allow an individual enough time to reproduce at least once, but studies have suggested that this length is too small to offer stock protection and size of maturity (SOM) can vary over small spatial scales (McIntyre et al., 2015).

Overfishing is thought to be a threat to the development of whelk fisheries (Nicholson & Evans 1997) because of their slow development to sexual maturity (2–5 years) and slow development of eggs (Cadee et al., 1995). Also, their absence of a planktonic larval stage means their capacity to recolonise depleted areas is limited. Anecdotally, whelk fisheries in Eastern IFCA's district have historically shown a cyclical 'boom-bust' trend with high fishing intensity (likely driven by market demand and good prices) leading to over-fishing and depletion of stocks.

Whelk landings have been increasing within Eastern IFCA's district since 2010. In 2014 there was the largest increase in the number of vessels engaged in the fishery in Eastern IFCAs district since 2010, landings did not increase upon the 2013 figures, which indicated that catch per unit effort may have been decreasing and that the species was possibly being over-fished (Authority meeting paper 28 January 2015).

In 2015, a decision was made to introduce an emergency byelaw aimed at managing the whelk fisheries operating within the Eastern IFCA district. The raised intensity in fishing effort and increase in landings raised concerns over how sustainable this fishery was, leading to a suite of measures being introduced to protect stocks, encourage more sustainable practices and collect more information on this relatively understudied species.

The emergency byelaw introduced a 55mm shell length MLS, within the Eastern IFCA district, as a restriction to protect individuals being removed from the population that have not yet had the opportunity to spawn. As with most species, populations can only maintain their biomass through the recruitment of juveniles and MLS is set to protect those pre-spawning juveniles. SOM is defined as the size at which 50% of the whelk population is sexually mature. Eastern IFCA committed to undertake a study with a view to determine accurate estimations of SOM to inform a review of the MLS.

In 2016, Eastern IFCA put into effect a Whelk Permit Byelaw to replace the Whelk Fisheries Emergency Byelaw. The byelaw required fishers to obtain a whelk permit and fish within certain conditions. These conditions included a prohibition on the use of any fishing gear except ‘whelk pots’ when fishing for whelk. Whelk gear must be marked with tags issued by Eastern IFCA and strings of pots must be marked with buoys to be clearly visible at the end of a string of pots. On the buoy the whelk permit number must be visible, as well as port letters and numbers (if using a registered vessel) and must be set so they always remain afloat.

To prevent further increases in effort, Eastern IFCA also introduced both a commercial and recreational pot limitation. For commercial fishers, the byelaw caps effort at 500 pots per vessel, while for recreational fishers, it is capped at 5 pots. No limit on the number of permits was issued however, instead maintaining the fishery as one for fishers to diversify into. The byelaw does include a mechanism to limit permit numbers, but it was not considered necessary at the time (Authority meeting paper 29 April 2015).

Fishers were restricted from using edible brown crab for bait, set out in Eastern IFCA Byelaw 5: Prohibition on use of edible crab (*Cancer pagurus*) for bait. Catch returns forms were also issued by Eastern IFCA to permit holders to fill out each month whether they had been fishing or not. These management measures were put in place to prevent detrimental impacts to the whelk fisheries throughout the district.

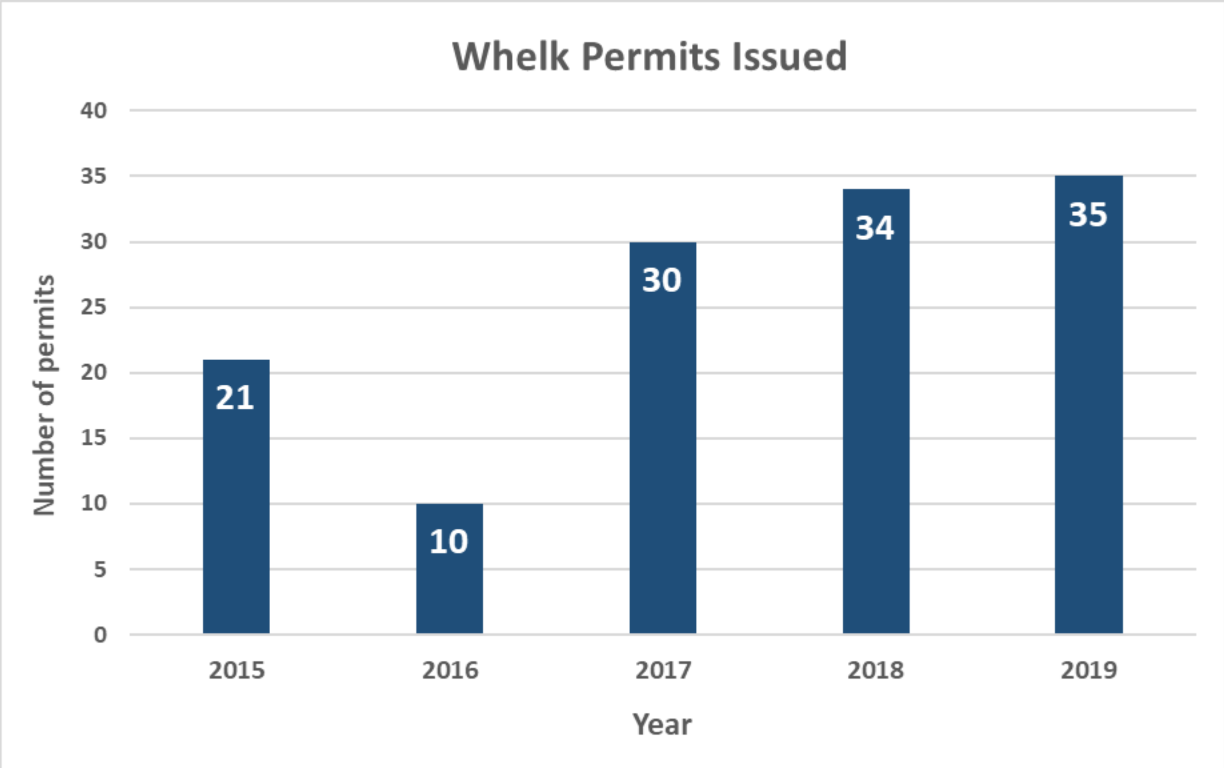

Figure 1: Total number of whelk permits issued in the EIFCA district from 2015–2019.

Report:

The purpose of this report is to reflect on current measures and assess whether these are adequate to ensure the fishery is sustainable. This includes consideration specifically of fishing effort, landings and whether the MLS is appropriate to ensure whelks being fished have had the opportunity to reach maturity.

1. Size of Maturity (SOM)

1.1. Whelk Biology

Whelks have life histories which make them particularly vulnerable to overfishing. In addition, there is likely to be variation in key biological characteristics between fisheries across the geographical range of Eastern IFCA's district.

Size/age at sexual maturity **–** The size or age at which whelk reach sexual maturity (i.e. spawning age) is thought to vary greatly even over relatively small spatial scales (Fahy et al., 1995; Fahy et al., 2000). A Cefas report in 2014 found growth rates and size at age vary greatly throughout the UK (Lawler, 2014). There is a general consensus that the current minimum landing size (45mm) is below the spawning size of most whelk stocks in the UK (Lawler, 2014) and Europe (Fahy et al., 2000).

Removing pre-spawning individuals can have a dramatic detrimental effect on stock sustainability particularly when the MLS is far below the size of maturity. A limited evidence base suggests that the size of maturity for the Southern North Sea is around 77mm (Lawler, 2014). The age of maturity ranges from 3 to 8 years.

Low mobility **–** Tagging studies have revealed that adult whelks are relatively sedentary. In addition, larval development is known to occur within the eggs and as such, larval stages do not disperse as in many other species (such as mussels and cockles). As a result of this limited mobility, individuals removed through fishing mortality have to be replaced by recruitment within the local stock.

Whelks have been found to form 'stocklets' with distinct biological characteristics including, for example, size and age of maturity. There are likely to be several distinct 'stocklets' throughout the Eastern IFCA district.

1.2. The SOM Project

The whelk SOM project has been in operation since 2016, during which period over 5,000 individuals have been collected and sampled from The Wash, the North Norfolk Coast and the Suffolk Coast. Data collection is ongoing as part of the project, with samples being collected and analysed from 4 areas within the district; The Wash, Sea Palling, Lowestoft and Southwold. These are regularly fished areas and areas where fishers agreed to collect samples to facilitate the EIFCA project.

This report assesses the data from 10/07/2015 to 18/04/2019. It should be noted that data collected from Southwold, unlike from the other three sites, was taken from riddled catch (45mm) and collected from just outside the 6nm limit but still provides important information to include within this report.

The table below shows the number of samples retained for each sample area and the number of whelks within those samples.

Table 1: EIFCA SOM project data 2015–2019 EIFCA SOM project data 2015–2019.

Sample area	No. of samples	No. of males	No. of females
Lowestoft	6	659	674
The Wash	5	719	780
Sea Palling	5	732	859
Southwold	1	260	265

To calculate SOM, samples within each area were collected throughout the year, aiming to account for spatial and seasonal variation, providing a robust, repeatable study. A number of parameters were recorded including shell height, minimum shell width, maximum shell width, total weight, shell weight, sex and whether the whelk was mature or not. A female whelk was classified as mature if there was a clear differentiation in colour between the gonad and digestive tissue and/or if the whorl contained yellow eggs, whilst those with no visible differentiation were classified as immature. In the males, sex was determined by the presence of a penis and its length, and, like the females, maturity was classified by observing the differentiation of the digestive whorl (Haig, J. A; Pantin, J.R., Salomonsen, H, Murray, L. G. & Kaiser, M.J., 2015).

1.3. Minimum Landings Size (MLS)

Ideally, whelk MLS should be based upon the size at which 50% of a population reaches maturity (known as L50). This is quite a common way of setting the MLS for a fishery. In principle, the aim is for an individual to breed at least once before being removed from a population, L50 allows half of the population to have reached maturity and had the opportunity to breed, while enabling the fishery to remain financially viable. However, 50% of the population are still immature at L50 even though they may be above the minimum landing size, and this problem worsens further as SOM has proven to vary greatly between populations (Haig et al., 2015; Hollyman, 2017).

It should be noted that whelks breed only once per year and so if fished before they have reproduced, they may be of size and be mature, but may not have contributed to the sustainability of the species. Eastern IFCA set an MLS of 55mm for all whelks landed in the district, together with a byelaw requirement for a 24mm riddle and 24mm escape holes with the objective of sustaining the viability of the fishery.

Around the UK other regulators have put several forms of management measures in place; Devon and Severn IFCA are to increase MLS to 65mm from November 2020, Jersey have a 75mm MLS and Northumberland IFCA have a flexible byelaw in draft for potting to have a 55mm MLS coming into force for a year with an increase to 65mm in its second year increasing further to 75mm in its third year.

Whelk are considered to have a limited dispersal capability due to internal fertilization. When a female lays a mass of eggs they are attached to a hard substrate like rocks or other solid structure, and the eggs develop directly into juveniles with no planktonic dispersal stage. This results in more discrete populations (Pálsson et al., 2014). Studies on microsatellite variation of the common whelk in the British Isles showed differentiation over short distances, as well as across the Atlantic between Europe and Newfoundland (Weetman et al., 2006; Mariani, Pejnenburg & Weetman, 2012). This has led to the formation of discrete stocks or ‘stocklets’ who are vulnerable to over exploitation (Fahy et al., 2000). Studies have shown that stocklets have clear genetic and morphometric differences (e.g. Weetman et al., 2006; Shelmerdine et al., 2007;

Magnúsdóttir, 2010), including SOM, which can vary greatly between sites (Haig et al., 2015; McIntyre et al., 2015; Shrives et al., 2015).

Eastern IFCA currently has no data regarding the location, extent or size of the whelk stocks or stocklets within its district. However, the SOM project data proves an indication of variation in maturity sizes around the coast, which could indicate the presence of different stocklets.

1.4. SOM results and advice on MLS

Ogive curves showing the accumulative size of maturity were used to determine the L50 SOM for the sampled whelk populations. Because the samples are a sub-sample of the wild population, the variation of SOM within the samples was determined in order to calculate upper and lower threshold limits within which the SOM of the wild population has a 95% probability of being. These results are shown in table 2.

Table 2: Size of maturity confidence limits, EIFCA SOM project data 2015 - 2019.

SOM	Sea Palling		Lowestoft		Wash		Southwold	
	M	F	M	F	M	F	M	F
50% SOM	59.18	62.57	53.5	56.98	54.76	54.59	50.3	48.8
Confidence Level(95.0%)	0.48	0.48	0.37	0.37	0.58	0.58	0.29	0.29
Upper Limit	59.66	63.05	53.87	57.35	55.34	55.17	50.59	49.09
Lower Limit	58.70	62.09	53.13	56.61	54.18	54.01	50.01	48.51

Whelk samples from The Wash had a mean L50 SOM of 54.76mm for males and 54.59mm for females, which is close in size to the 55mm MLS. The 95% confidence limits indicate the SOM of the wild population in The Wash will lie between 54–55.5mm, suggesting that the current minimum landing size is appropriate for this area from the perspective of stock sustainability.

While the data found male whelks from Lowestoft had an average size of maturity smaller than the MLS, female whelks from this area had a L50 SOM between 56.5–57.5mm. To provide adequate sustainability to these, the MLS off the Lowestoft coast (areas 9 and 10 in Fig 10) should be increased to 57mm.

At Southwold the L50 SOM was found to be well below the 55mm MLS (48.8mm for females and 50.3mm for males). This seems to substantiate claims made by local fishermen that whelk are smaller for a given age in the Southwold area, and who had raised concerns in 2015 that the 55mm minimum size implemented by Eastern IFCA would impact them disproportionately. While the number of individual whelks sampled from Southwold were sufficient to produce relatively narrow 95% confidence intervals of 50.01–50.59mm for males and 48.51–49.09mm for females, unlike the other areas in which the study was conducted, where multiple samples were tested to account for spatial and seasonal variation, these individuals all came from a single sample of riddled whelks taken from outside of the district. This reduces the robustness of the conclusion, which would indicate the MLS in this area could be reduced to 50.5mm. Whilst the fishing activity is currently relatively small in these areas (areas 11 and 12, fig. 10), a reduction in the minimum size could result in effort being greatly increased, particularly given that several fishers are known to fish just outside of the district (beyond 6 nm) to avoid the higher minimum landing size therein. From a stock perspective, having a minimum size above the SOM is beneficial however, this indicates a risk in relation to industry viability.

The study identified the L50 SOM of whelk at Sea Palling is significantly higher than the current minimum landing size. To sustainably protect female whelk at Sea Palling the MLS would need to be raised to 63mm.

In conclusion, the current minimum size of 55mm is appropriate for The Wash (as a robust dataset indicates this is at or around the SOM) and for Southwold (given that the data set was insufficient to draw a firm conclusion and, therefore, the risk associated with reducing it is considered too high). With regards to Lowestoft, a suggested potential increase in minimum size by 2mm would be appropriate to reduce the risk associated with stock sustainability as a result of the removal of pre-spawning individuals. A suggested potential increase within areas 9 and 10 to at least 57mm would be sufficient to reduce this risk. At Sea Palling, where the sampling identified an L50 SOM well above the minimum size, this report suggests that the MLS would need to be increased to 63mm to adequately protect the female whelk. These increases to the minimum size in localised areas are suggestions that would reduce the risk associated with the removal of pre-spawning individuals from the fishery. However, this report recognises the difficulty of balancing the currently acceptable MLS in The Wash, with the areas where there is a suggested increase, without significantly limiting the fisheries in these areas.

While robust datasets have been provided for The Wash, Lowestoft and Sea Palling areas, it is recommended that further sampling is conducted in the Southwold area in order to provide enough samples to account for localised spatial and seasonal variations that may occur. In order to provide a robust dataset for this area, the sampling regime must enable the collection of adequate numbers of whelks from several sampling occasions, particularly between November and January, when whelks are thought to be spawning.

2. Landings

2.1. Landings data

Holders of a Whelk Permit are required to complete returns forms issued by Eastern IFCA, each month, including when no fishing has occurred. Eastern IFCA has fishing activity data for the whelk fishery dating back to 2015 when the whelk permitting scheme came into force. The fishing activity data provides an indication of the effort on the fishery over time. Landings Per Unit Effort (LPUE), which is commonly used in fisheries as an indication of how dense the stock is on the ground, can be calculated from this data and used to show whether the stock is stable or under growing pressure.

The data in Table 3 shows that between 2015 and 2019, landings have been steadily increasing, except for 2017 where landings dipped slightly. The total pots hauled, Figure 2, also reflects this increase.

Table 2: EIFCA sum of pots hauls, soak time days, haul days and whelk landed, landings data 2015–2020. * Figures for 2020 are provisional and relevant up to 31/01/2020.

Year	Sum of Pots Hauled	Sum of Soak time days	Sum of Pot haul days	Sum of Whelk Landed (kg)
2015	16,833	274	44,601	36,277
2016	177,809	1,431	437,751	398,761

2017	115,810	1,568	327,662	295,824
2018	181,574	1,445	449,130	490,373
2019	329,324	1,911	787,723	917,218
2020*	26,562	162	65,238	68,234
Total	847,912	6,790	2,112,105	2,206,686

Table 3: EIFCA average of pots hauls, soak time days, haul days and whelk landed, landings data 2015–2020. * Figures for 2020 are provisional and relevant up to 31/01/2020.

Year	Average of Pots Hauled	Average of Soak time days	Average of Pot haul days	Average of Whelk Landings (kg)
2015	193	3.1	513	417
2016	323	2.6	796	725
2017	225	3.0	636	574
2018	334	2.7	827	903
2019	418	2.4	1,000	1,164
2020*	409	2.5	1,004	1,050
Total	333	2.7	829	866

The standard way to show LPUE is to divide the total landings by the total number of pots hauled. Pot hauls are not the only component of effort, however, because the length of soak time will also influence the total number of whelks landed. Soak times can, therefore, be added into the equation in order to represent “effort” as number of pots hauled multiplied by soak time to create a figure for pot-haul-days.

The average soak time according to the returns data is displayed in Table 4 and Figure 4, showing that soak times are reasonably consistent between 2.5 to 3 days. When pot haul days was used to measure effort (Figure 5), the overall trends are visually similar to those in Figure 2, in which total pots hauled was used as the measure of effort. In the case of this fishery, therefore, the similarities between these two methods of calculating effort result in outputs with little difference. This can be seen in the similarities between Figure 6, showing landings/pot hauls, and Figure 7, showing landings/pot haul days. In both cases, there is a steady increase through the years.

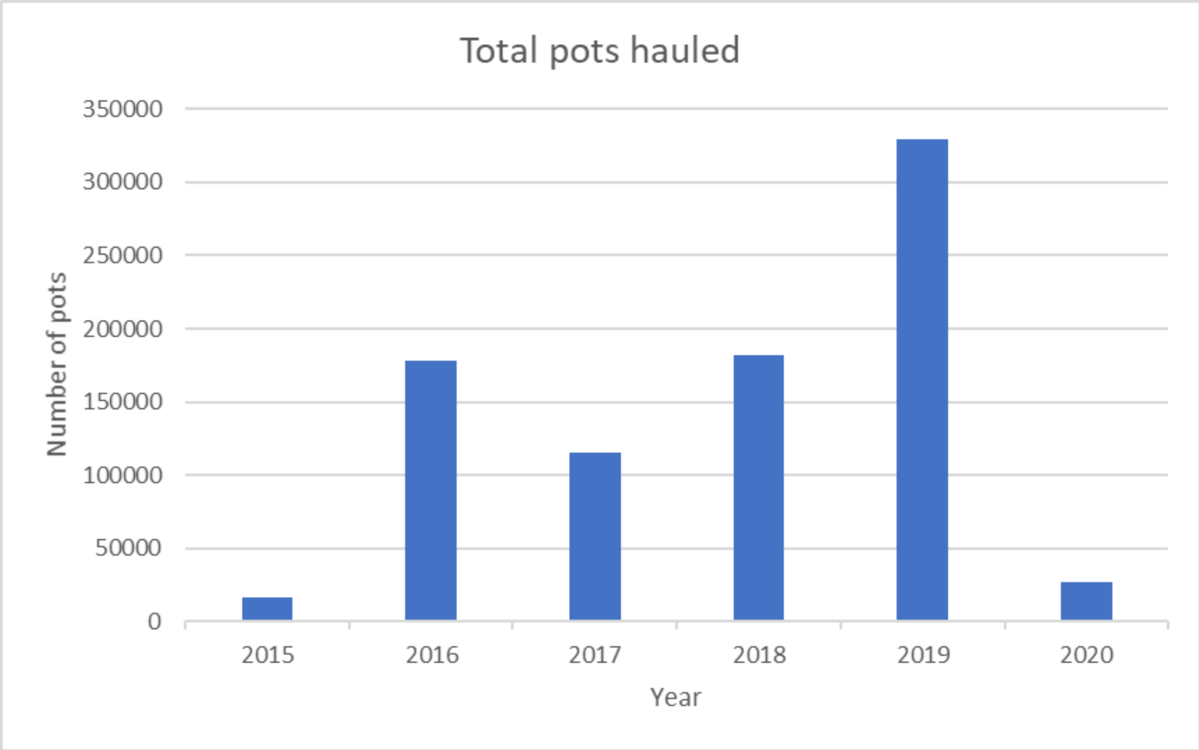

Figure 2: Total pots hauled, EIFCA landings data 2015–2020.

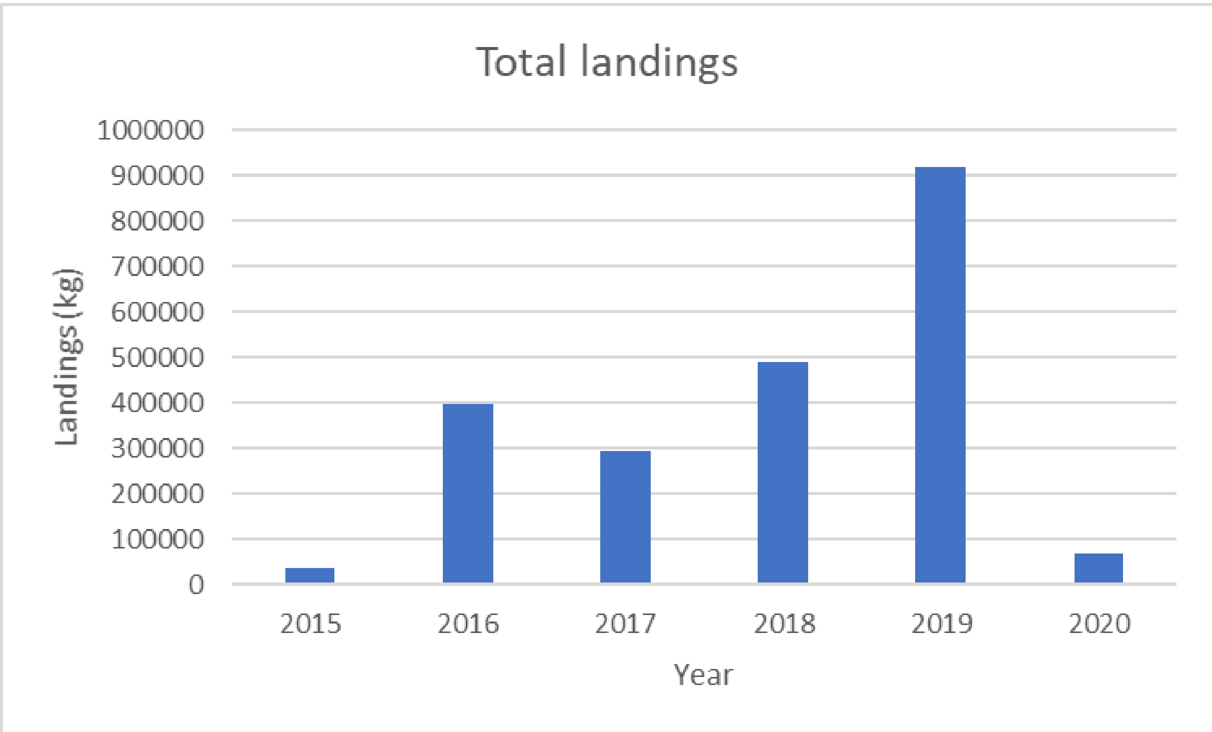

Figure 3: Total landings, EIFCA landings data 2015–2020.

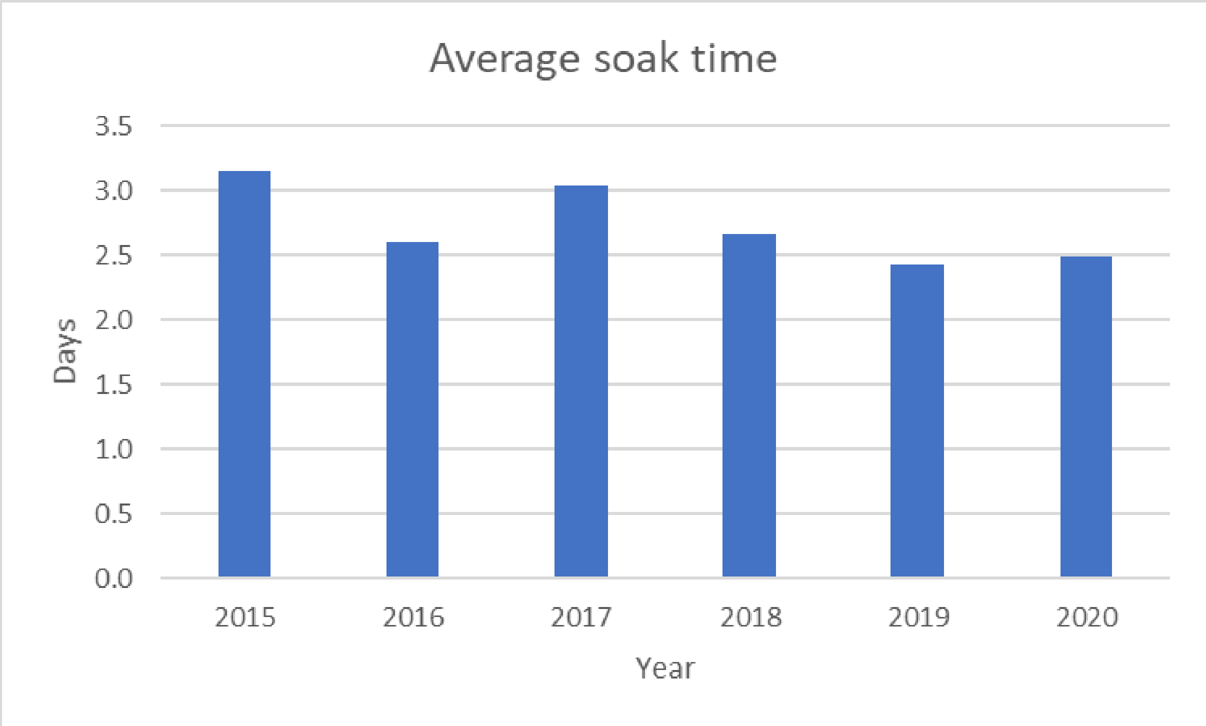

Figure 4: Average soak time, EIFCA landings data 2015–2020.

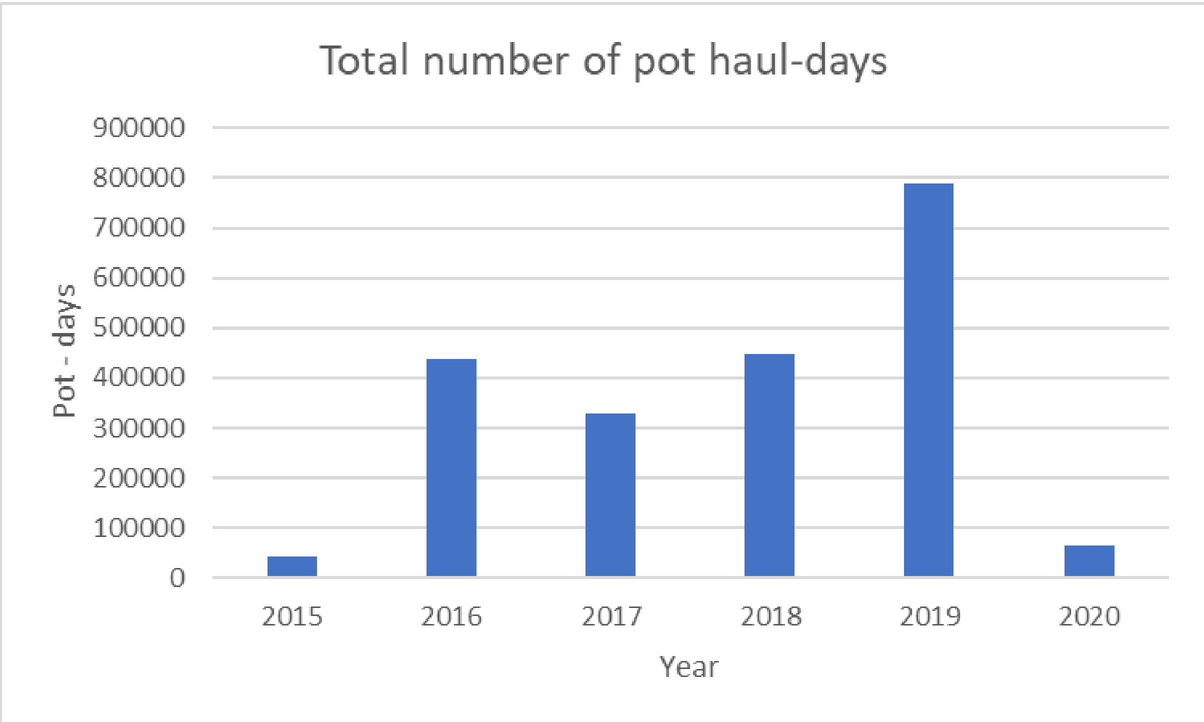

Figure 5: Total number of pot haul days, EIFCA landings data 2015–2020.

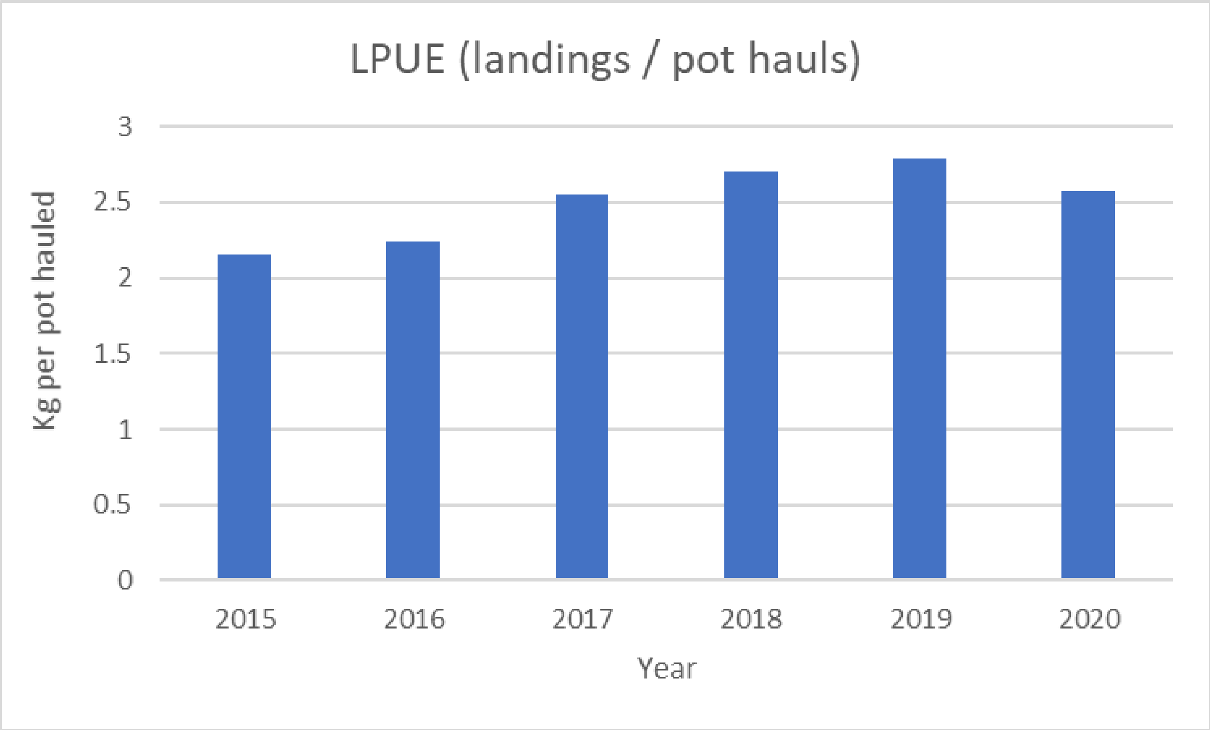

Figure 6: Landings per unit effort (Total landings / pots hauled). EIFCA Landings Data 2015–2020.

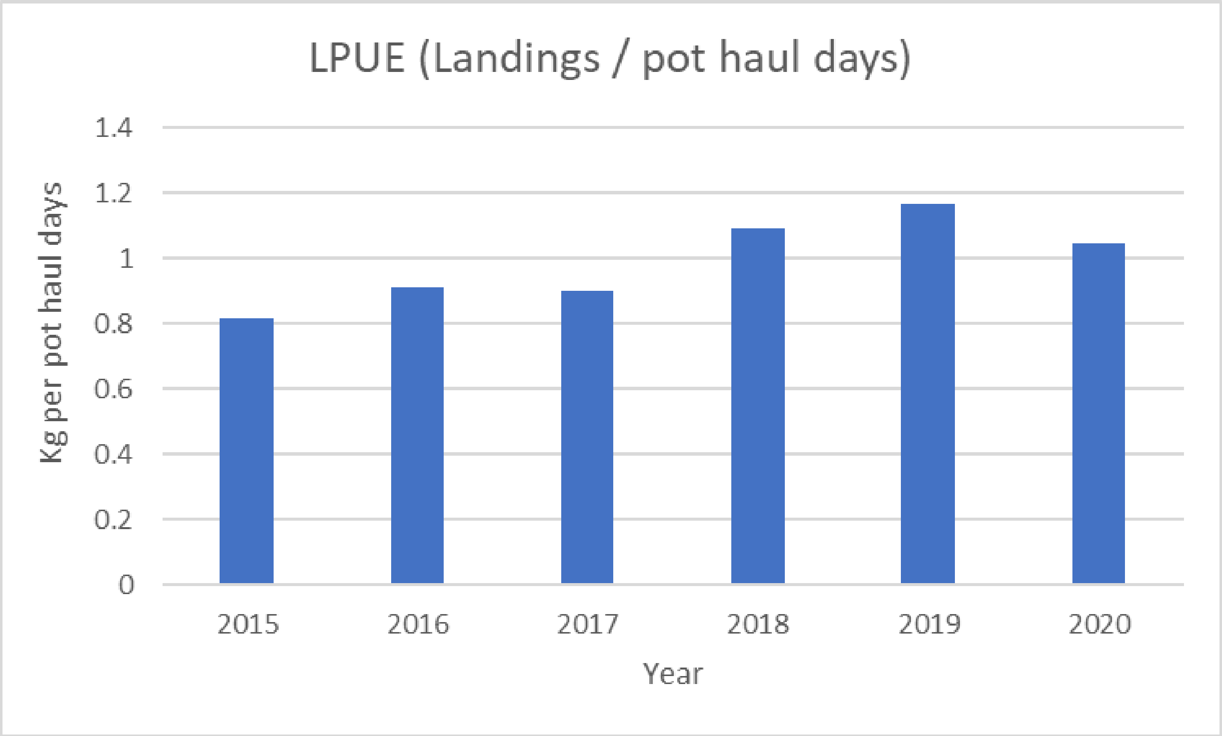

Figure 7: Landings per unit effort (Total landings / pots haul days). EIFCA Landings Data 2015–2020.

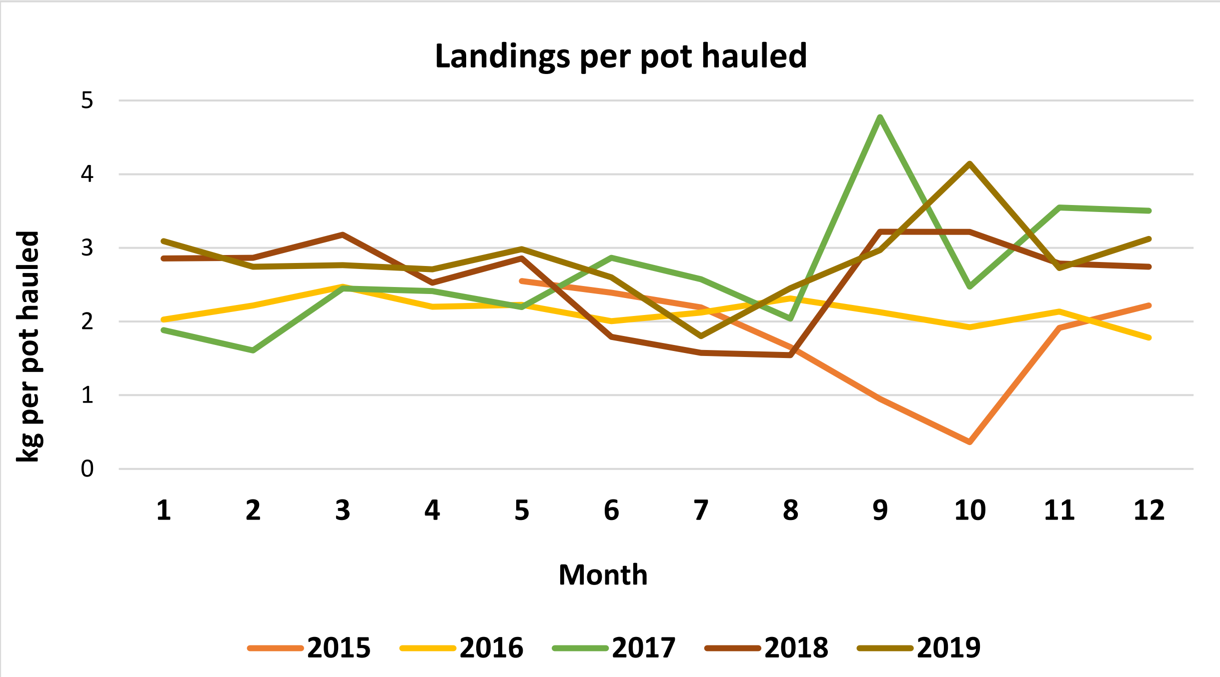

Figure 8: Landed weight per pot hauled per year, EIFCA Landings Data 2015–2019

LPUE was also broken down to review the data on a monthly (Figure 8) and quarterly (Figure 9) basis. In the line chart (Figure 8), each coloured line corresponds to a specific year and they are overlaid to depict the trends in the fishery throughout the year, on a month by month basis. We can see the points at which over the course of the year the landings per pots hauled peaked and fell. The quarterly chart, Figure 9, gives a better insight into patterns of effort in the fishery throughout quarters of the year. It also helps to detect trends in the fishery per quarter and gives us a good picture as to when in the year effort peaks.

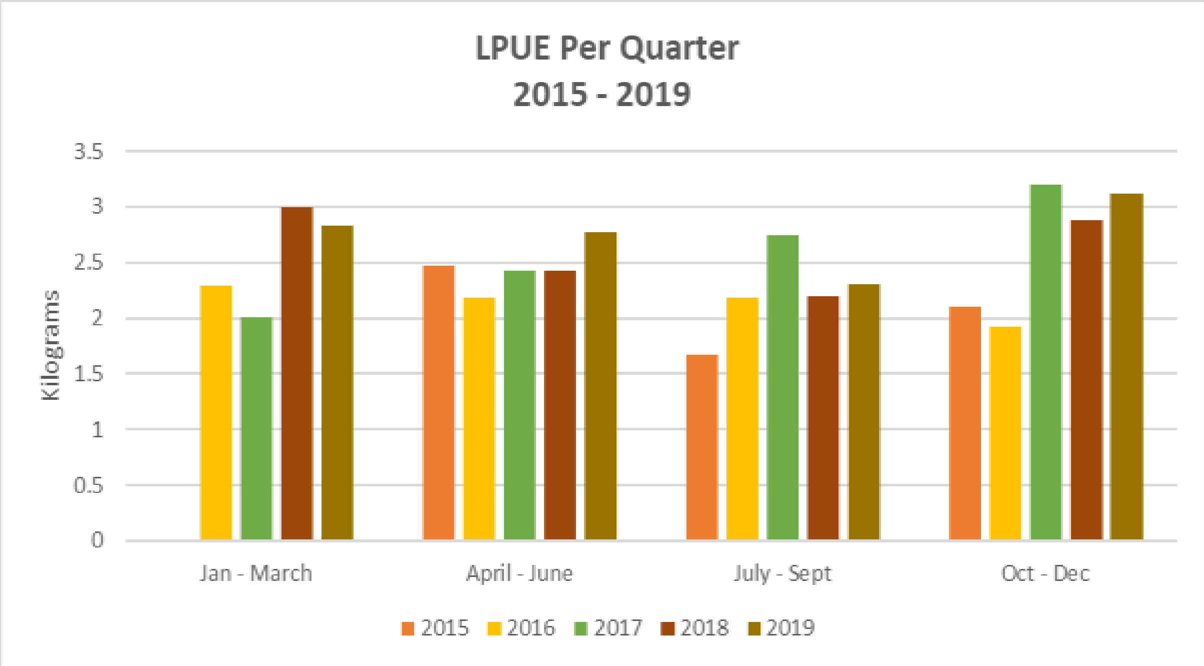

Figure 9: LPUE per Quarter, EIFCA Landings Data 2015–2019

It is clear from reviewing the effort and landings data that both the amount of effort and landings have increased significantly between 2015 and 2019, with effort almost doubling between 2016 and 2019 (Figure 5).

LPUE is commonly used as a proxy to indicate the health of stocks over time. Figures 6 and 7 both show the LPUE for this fishery has slowly increased between 2015 and 2019, with a slight decline in 2020. While the decline in 2020 could be an indication that the LPUE is responding to declining stock levels, it should be noted that the 2020 figures are based on a partial dataset covering just the first quarter. As figures 8 and 9 show average catch rates are lower during the first quarter than later quarters, it is thought this dip is an artefact caused by the sampling period rather than a response to declining stocks.

Irrespective of the stability shown in LPUE, the rapid increase in effort and landings is a cause of concern as the low mobility of whelk makes them vulnerable to over-fishing and slow to recover. Further, while LPUE provides a good proxy for the health of populations over time, there is a lag between when the stocks begin to decline and when it is detected in declining LPUE metrics. While this makes it a good tool for showing how stocks have responded to fishing pressures over time, it is not an ideal tool for predicting when stocks may be at the point of being over-fished. Further, if the fishers have improved their catch rates since 2015 by improving their fishing techniques or familiarising themselves with the best fishing grounds, as is often the case in new fisheries, this would influence the LPUE data and could mask any declines in stock that would otherwise be detected in the LPUE data.

2.2. Spatial distribution of the fishery

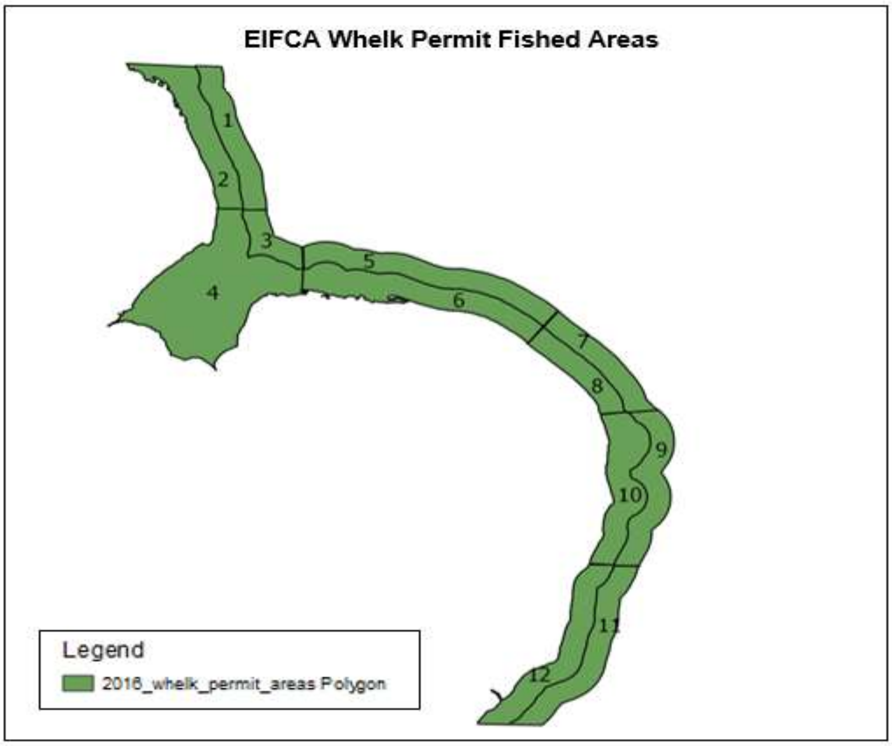

Figure 10: EIFCA district whelk fished areas, EIFCA whelk returns forms

Figure 10 shows the management areas for the whelk fishery within the district. It is known that the fishing effort for whelk is not distributed evenly throughout these areas. Concerns that fishing levels could have reached unsustainable levels in some of the more heavily fished parts of the district prompted further spatial analysis of the data.

Figure 11 below, shows the percentage of landings returns that were received from each area between 2015 and 2020. This clearly shows that far more returns were received from areas 4 (The Wash) and 6 (North Norfolk inshore) than anywhere else in the district, with 56% of the returns coming from those two.

This pattern is also reflected in figure 12, which shows the fishing effort directed at each area, in terms of number of pot hauls. Interestingly, this shows the effort directed into areas 4 and 6 accounts for 72% of the total effort conducted throughout the district. This means that vessels targeting these two areas are either deploying more pots than those fishing elsewhere or are turning them over faster.

Figure 13 shows the landings follow a similar pattern to effort through the district, with 75% of the landings being harvested from areas 4 and 6.

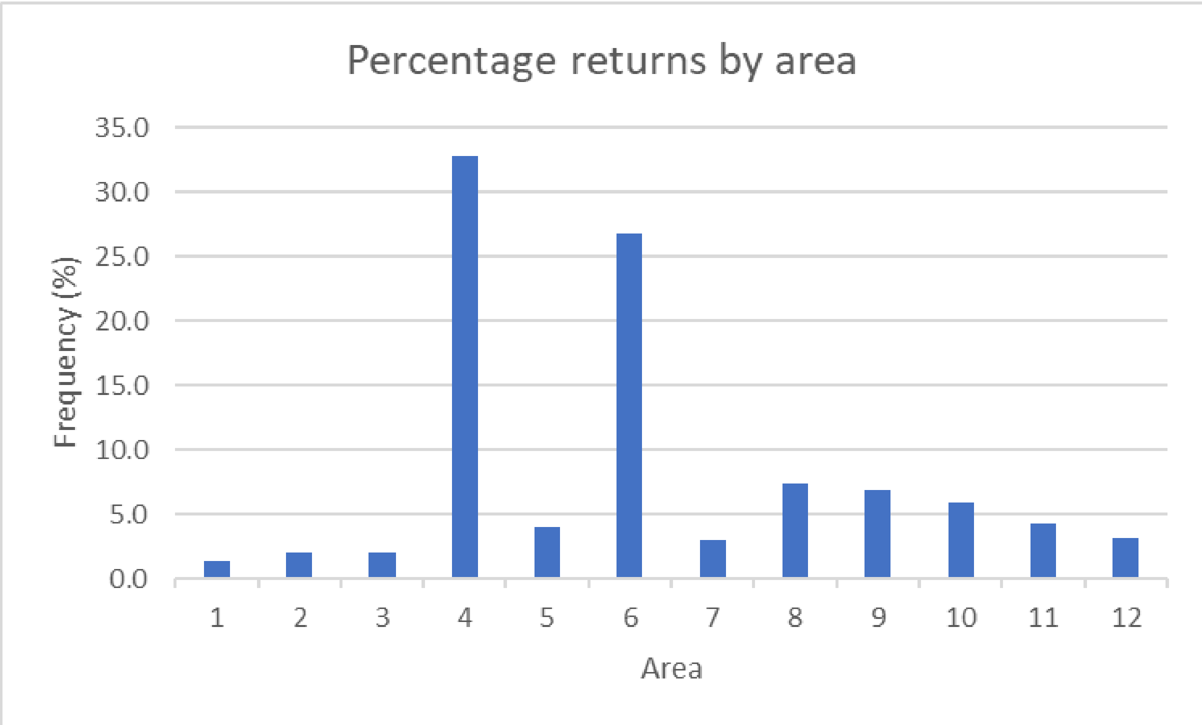

Figure 11: Percentage of the whelk landings returns by area (2015–2020)

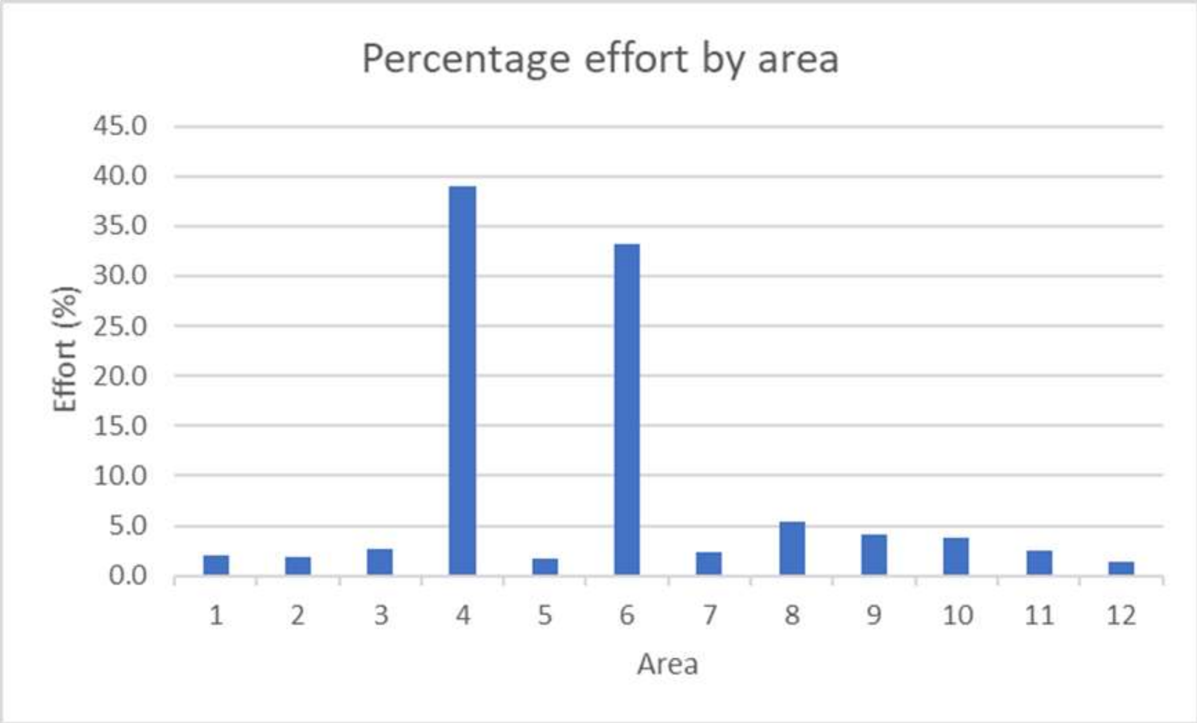

Figure 12: Percentage effort (pot hauls) occurring in each area (2015–2020)

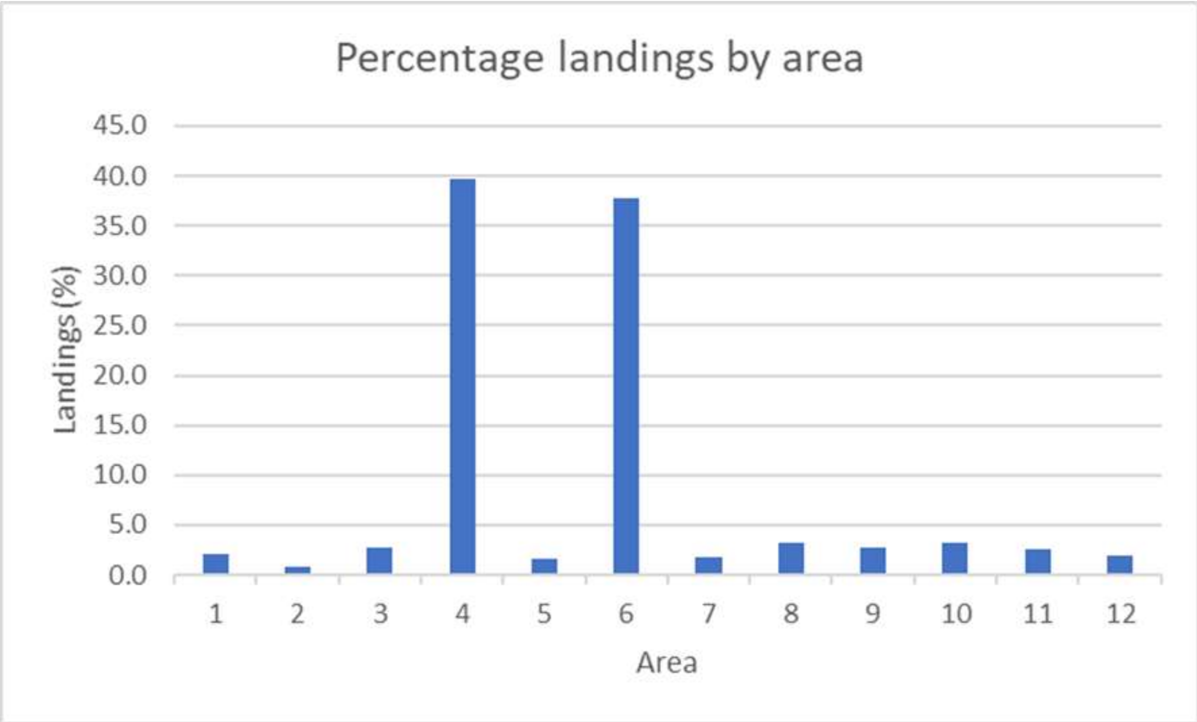

Figure 13: Percentage landings harvested from each area (2015–2020) (note—figures for 2020 are based on a partial data set)

Because of the disparate fishing effort being directed at areas 4 and 6, further analysis was conducted for those areas. Table 5 and figure 14 show the Landings Per Unit Effort (LPUE) between 2015–2020 for Area 4 with 95% confidence limits applied.

Table 5: LPUE for Area 4 with 95% confidence limits.

Area 4	2015	2016	2017	2018	2019	2020
Mean	1.54	2.50	2.79	2.79	3.11	2.55
Confidence Level(95.0%)	0.84	0.14	0.27	0.32	0.52	0.33
Upper limit	2.38	2.64	3.07	3.11	3.63	2.88
Lower Limit	0.70	2.36	2.52	2.47	2.59	2.22

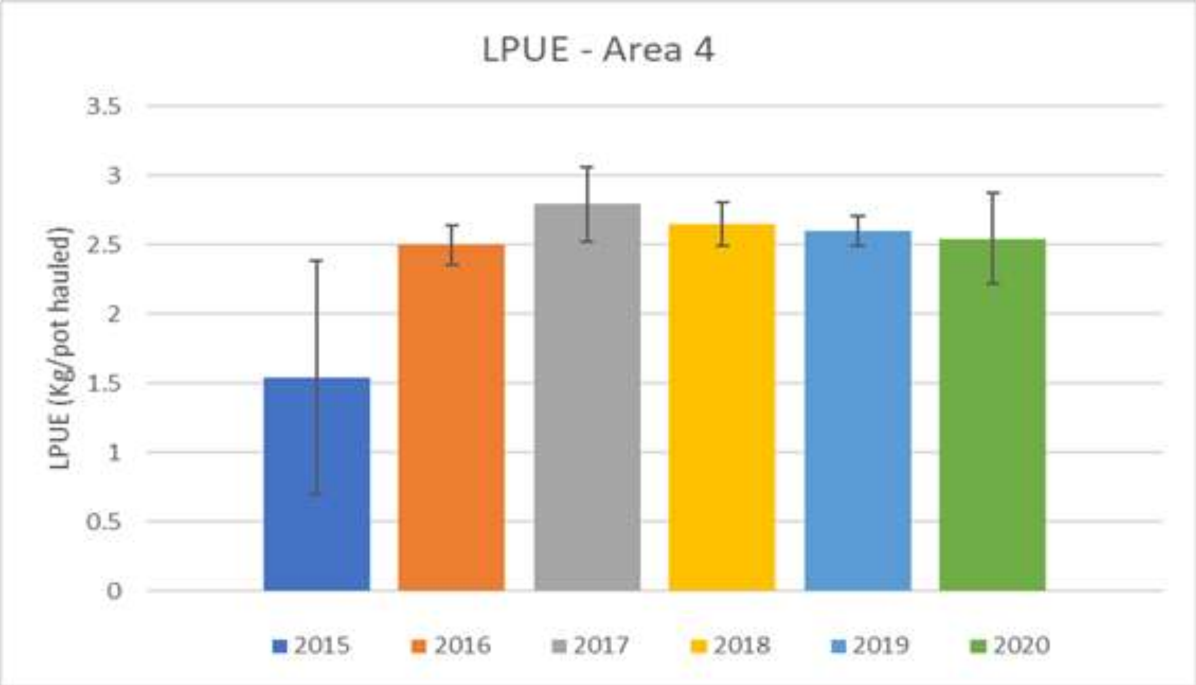

Figure 14: LPUE with 95% error limits, Area 4 for the period (2015–2020) (note—figures for 2020 are based on a partial data set).

While figure 6—which showed the LPUE for the whole district—was still increasing, the mean LPUEs shown in table 5 and figure 14 for Area 4, indicate that the LPUE peaked in 2017 and has subsequently been declining. This would suggest the fishing effort passed sustainable levels in 2017 and has resulted in a declining LPUE since. When the 95% confidence limits are considered, however, to reflect variations in the individual LPUEs within the dataset, overlapping error margins mean this is not as clear cut as the mean values alone suggest. Where these margins overlap, statistically, there isn't a significant difference in the data. Looking at the data in table 5 there is a slight overlap between the 2015 and 2016 margins, and a definite gap between 2015 and 2017, but everything from 2016 through to 2020 overlaps. When 95% confidence limits are applied, therefore, the only statistically significant change between 2015 and 2020 has been an increase in LPUE between 2015 and 2017 onwards. Table 6 and figure 15 show a similar analysis for Area 6.

Table 6: LPUE for Area 6 with 95% confidence limits.

Area 6	2015	2016	2017	2018	2019	2020
Mean	2.08	2.46	2.67	3.26	3.44	3.21
Confidence Level(95.0%)	0.36	0.27	0.21	0.40	0.18	0.29
Upper limit	2.44	2.72	2.88	3.66	3.62	3.50
Lower Limit	1.72	2.19	2.46	2.86	3.27	2.92

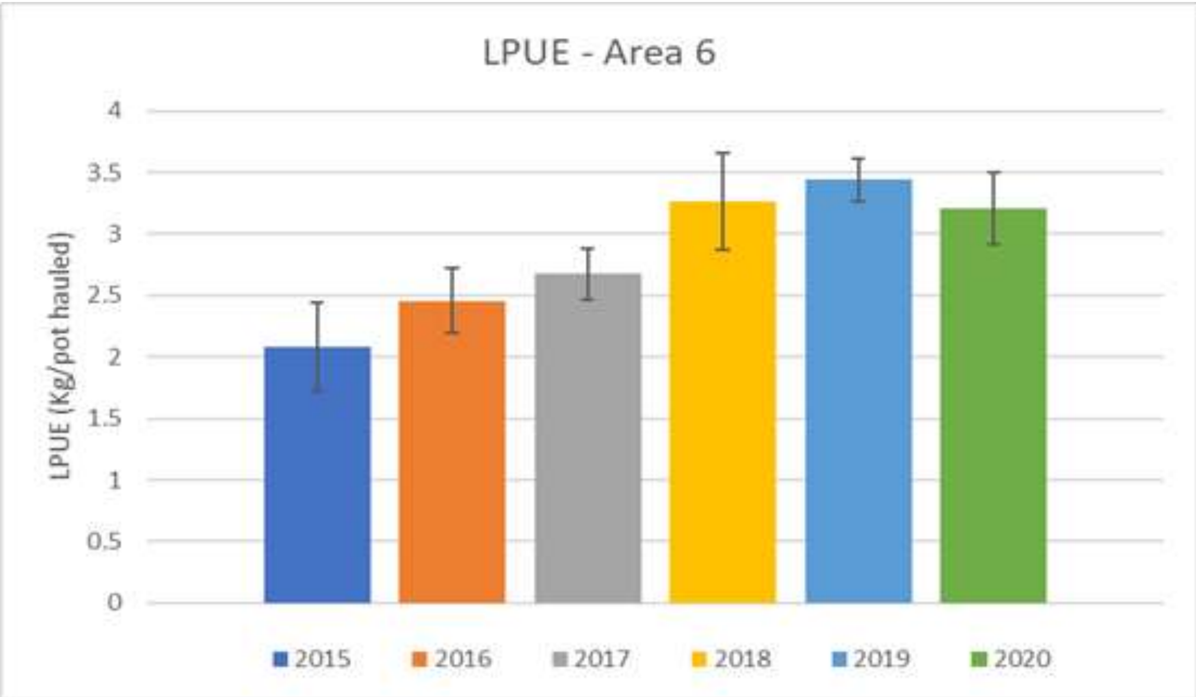

Figure 15: Landings per unit effort for Area 6 for the period (2015–2020) (note—figures for 2020 are based on a partial data set).

Unlike Area 4, where the mean LPUE values peaked in 2017, the mean LPUE values for Area 6 have continued to increase until a dip in 2020 (the latter possibly due to an incomplete data series for 2020). When the 95% error margins are applied to the means, there are overlapping margins between some years in this area, but there are sufficient gaps to indicate with 95% confidence that the LPUEs have increased between 2015 and 2017 and again between 2017 and 2019.

Figure 16 shows the effort, in terms of pot hauls, conducted in Area 4 in the period 2015-2020. This shows that barring a sharp dip in 2017 (thought to be the result of an exceptional cockle fishery in The Wash), the effort has rapidly increased. As the LPUE figures were still rising in 2016 but declining in 2018, the tipping point of sustainability would seem to be between the levels of effort directed at the fishery at those two points. This would indicate a sustainable level of potting would lie between the 75,765 pot hauls conducted in 2016 and the 93,105 conducted in 2018. To prevent further deterioration of the stocks, therefore, this report suggests the possible solution that effort should be capped between these two figures until the impact of the interaction can be seen in future LPUE figures.

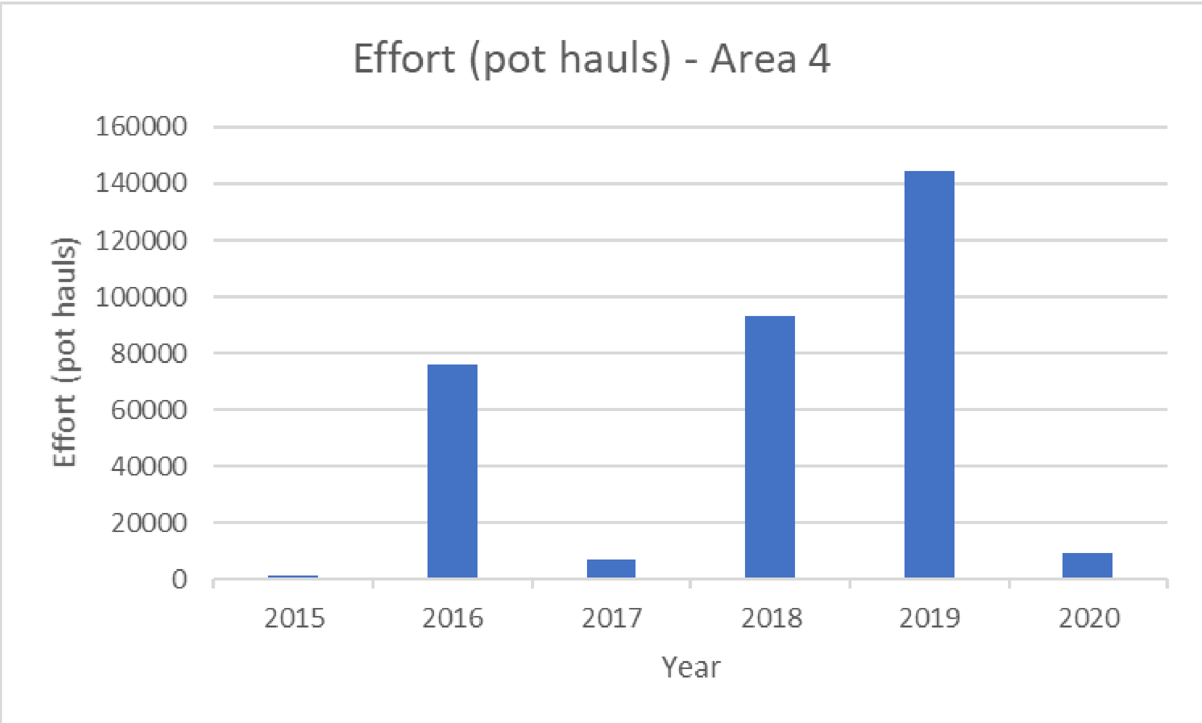

Figure 16: Effort (pot hauls) targeted at area 4 between 2015 and 2020

While the LPUE for Area 6 was still rising in 2019, figure 17 shows effort increased significantly there, too, in 2019. Knowing the limitations of LPUE as a predictive tool for determining when over-fishing might occur, and taking into account the low mobility and slow recoverability of whelk that make them vulnerable to over-fishing, it would be prudent to also consider capping effort in this area, too, until future stability in LPUE can be demonstrated. This would also minimise the impacts of any displacement activity that may be directed to Area 6 as a result of any potential capped effort in Area 4.

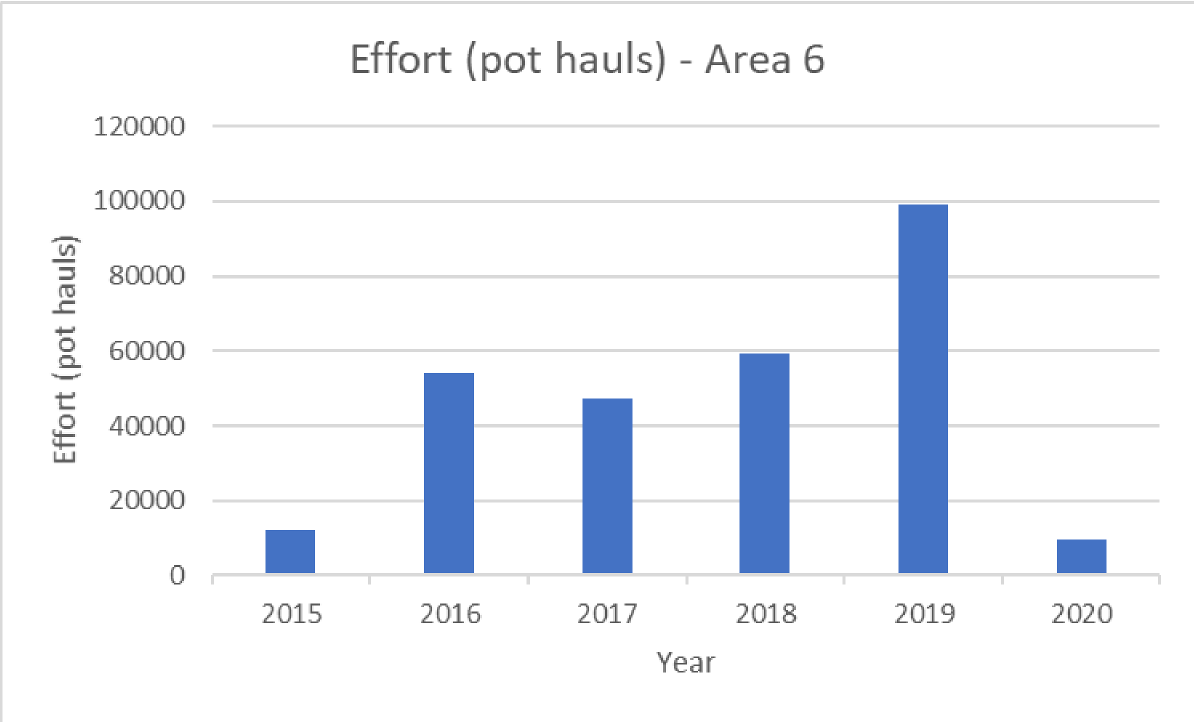

Figure 17: Effort (pot hauls) targeted at area 6 between 2015 and 2020.

The level of effort and LPUE in other areas does not indicate concerns at this time however, there is the potential for this to change if management measures are introduced as suggested above, as vessels now engaged in fishing in The Wash particularly are displaced. It is recommended that an annual stock assessment model is developed, following the above methodology, which will monitor regional LPUEs and the effects of any effort limitations.

3. Summary

Due to their low mobility and absence of a planktonic larval dispersal phase, whelks are vulnerable to over-fishing, frequently leading to “boom and bust” situations in unmanaged fisheries. The importance of the local fishery has increased significantly in recent years, so the collapse of this fishery would have severe economic impacts on the local fishing industry, as well as being detrimental to the marine ecosystem. Such a collapse would place a heavier reliance on other shellfish species such as the cockle, mussel, shrimp, crab and lobster fisheries, all of which are currently facing their own pressures.

SOM is crucially important in informing an appropriate minimum size and data from Sea Palling, Lowestoft and Southwold indicate that the minimum size currently in place is less than the size of maturity. Whilst there is sufficient data to draw robust conclusions in The Wash, Lowestoft and Sea Palling areas, this is not the case in Southwold. It is recommended that further sampling is conducted in this area to improve the available dataset spatially and temporally.

The current rapid rise in potting effort directed at the whelk fishery, particularly in areas 4 and 6, have led to concern about the sustainability of this fishery. As the LPUE figures suggest the whelk stocks in Area 4 may already declining, this report indicates that current levels of activity are too high and that a more sustainable level would be that seen between 2016 and 2018. It is likely that the sustainable level of fishing effort in Area 6 is at or around current levels. Understanding the limitations of using LPUE to predict the point at which over-fishing may occur, this report suggests that any cap on effort in area 4 is similarly implemented in Area 6 to the current level of effort.

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