Llywodraeth Cymru
Welsh Government

Welsh Government Consultation Evidence Review

Sustainable Management of the Welsh Whelk Fishery

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Introduction

The common whelk, *Buccinum undatum*, is the most abundant gastropod mollusc inhabiting the North Atlantic (Kideys *et al*., 1993). It is a large edible mollusc and a carnivorous predator. It can scavenge in water depths between 3 - 600m (Haig *et al*., 2015) and has very acute chemical sensory abilities enabling it to detect carrion within 111 - 585m^2 (Himmelman, 1988). It is this acute sensory ability which enables whelks to be commercially exploited in baited pots.

Fisheries Background

The whelk fisheries are one of the largest fisheries in Wales, grossing £3.6 million in 2014 (MMO Official Landing Statistics).

Global fishing effort for whelks has seen a dramatic rise in the last 10-15 years (Fig. 1).

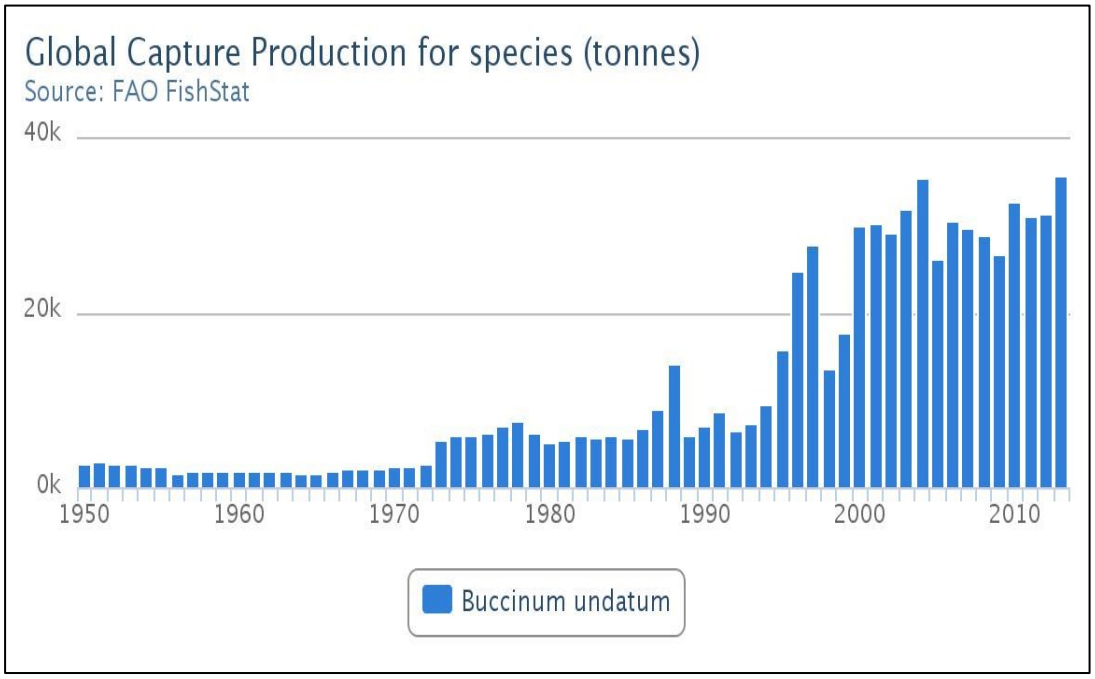

Figure 1. FAO Global Whelk Landings , *Buccinium undatum*, from 1950 – 2013 (Website 1)

Global markets have expanded and are dominated by Korea and China, with demand and price increasing (Fahy *et al*., 2000, Shelmerdine *et al*., 2006). Fishing effort within the UK has also increased due to displacement of effort from whitefish and trap fisheries. Whelks are now ranked 5th to 6th in a list of the most valuable shellfish with the total first sale landings in England and Wales of £7-9 million p.a over the last 5 years (Cefas, 2011).

The whelk fishery in Wales has seen, on average, an increase in vessels, both Welsh and non-Welsh registered, targeting the species over the last 5 years (Figs. 2 and 3).

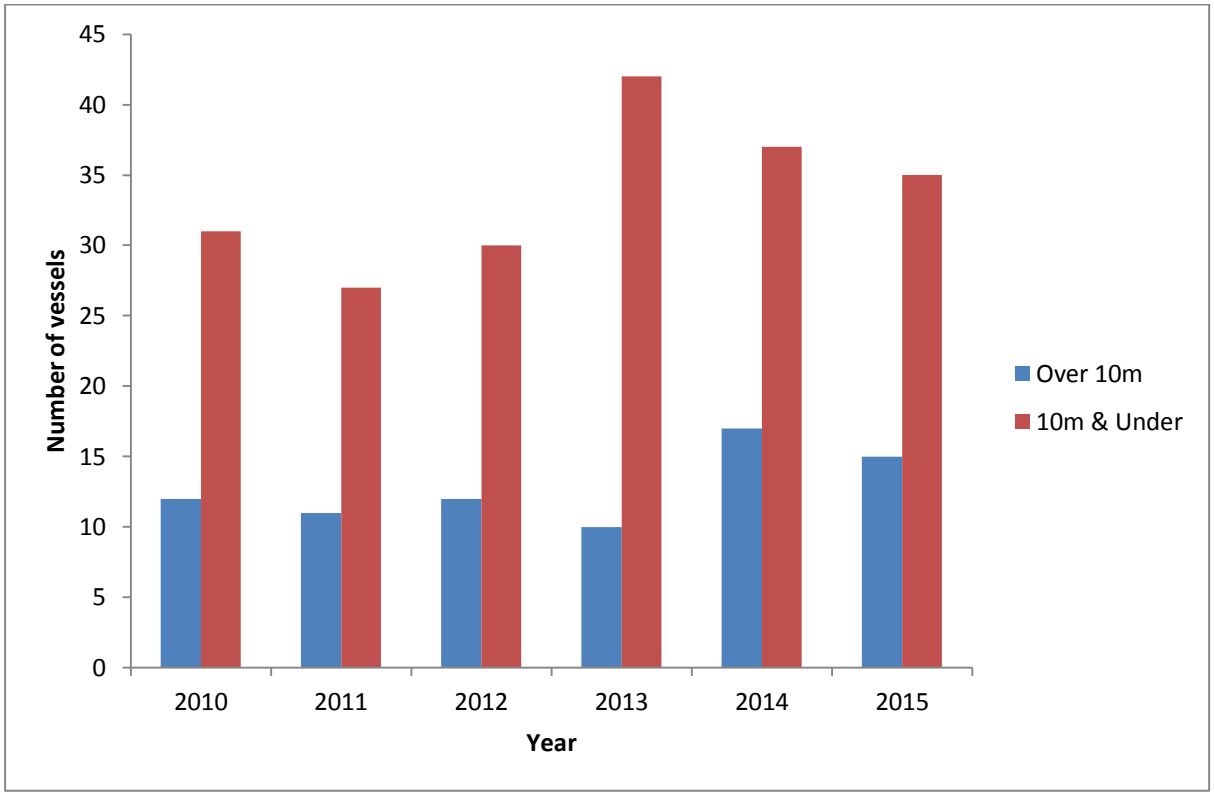

Figure 2. Number of Welsh Vessels Targeting Whelks in Wales (MMO Official Landing Statistics)

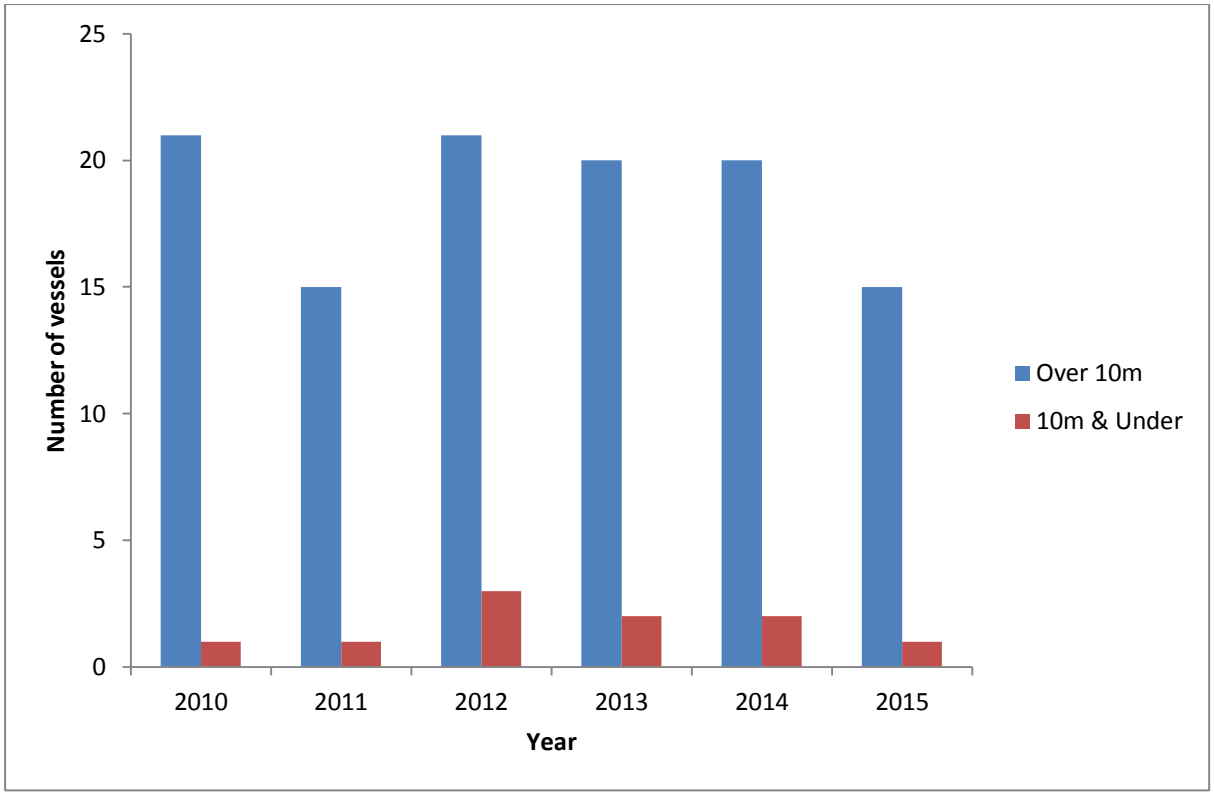

Figure 3. Number of Non Welsh Vessels Targeting Whelks in Wales (MMO Official Landing Statistics)

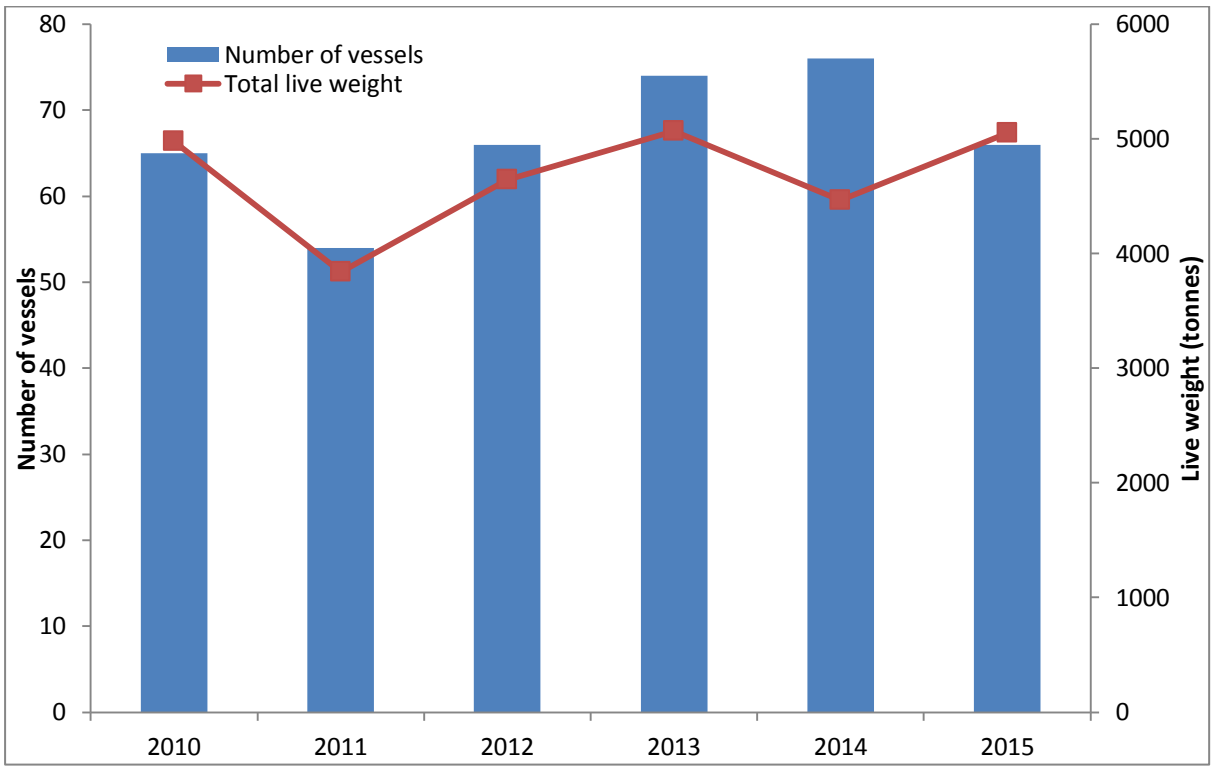

Figure 4. Combined Number of Vessels and Total Landings of Whelks in Wales 2010-2014 (MMO Official Statistics)

The total combined number of vessels targeting the species and the tonnes (live weight) landed are shown in Figure 4.

Figure 4 is subjective and must be interpreted with caution. The data does not include any information about the level of fishing i.e. the amount of fishing gear used. A standardised approach used by fisheries managers to monitor the abundance of the target species is the catch per unit effort (CPUE). With respect to the whelk fishery, this will be the weight of whelks caught per pot. Changes in the CPUE can signify changes in stock levels.

In the absence of a long term data set and the ability to conduct an accurate stock assessment, CPUE can be used to set a baseline. If catch rates fall below this baseline they are considered unsustainable. There is limited CPUE information for the Welsh whelk fishery (see 'Current Status of Welsh Whelk Stocks').

There is currently very limited management of whelks at both national and EU level. There is an EU Minimum Conservation Reference Size (MCRS) of 45 mm, however the species is not subject to any management under the EU Common Fisheries Policy (CFP).

Due to the national importance of whelks Welsh Government have a statutory EU obligation under the Marine Strategy Framework Directive to ensure that sufficient management is in place to ensure the species achieves Good Environmental Status (GES) by 2020. Additionally, Welsh Government also has statutory duties pertaining to the Well–being of Future Generations Act (2015).

As regional whelk populations come under increasing fishing pressure there is a need for managers to ensure effective management strategies are in place. Management strategies must be based on a robust evidence base, which considers and evaluates all available sources of evidence to produce well thought out management options.

Biology and Ecology of Whelk (*Buccinium undatum*)

Understanding the life history of the species is imperative to enable effective management. Whelks have a k-selected life history, this is characterised by late stage maturation and low fecundity. Whelks are single sexed and reproduce by internal fertilisation. They encase their eggs in protective cases which are attached to the sea bottom. There is no free-living larval stage which limits dispersal to other grounds. All of these characteristics make whelks vulnerable to over exploitation and if regional populations are overfished the ability for the population to recover is very low and protracted. Life history traits make whelk populations vulnerable to recruitment overfishing (the rate of fishing above which the recruitment to the exploitable stock becomes significantly reduced). This is characterized by a greatly reduced spawning stock, a decreasing proportion of older fish in the catch, and generally very low recruitment year after year. If this poor recruitment is prolonged and combined with poor environmental conditions this may lead to stock collapse (Website 4). In the mid 1970's the *Buccinum undatum* fishery collapsed in the Dutch Wadden Sea due to overfishing (Cadee *et al*., 1995).

The size of sexual maturity and the genetic structure of whelk populations has been shown to vary over small spatial scales (Lawler, 2014; Weetman *et al*., 2006; McIntyre *et al*., 2015).

Lawler (2014) investigated size of first sexual maturity in ten important fisheries in England. Size of maturity varied between 44.8 mm and 46.4 mm shell length (female and male respectively) for a site in the Solent (Portsmouth) and 77.8 mm and 76.2mm (female and male respectively) for a site in the North Sea, with other sites varying in between. Lawler (2014) discussed reasons as to why this variation may occur, including water temperature, and also gave reference that season may introduce sampling bias. Lawler (2014) stated that other studies have described local variations in whelk populations and that these marked regional differences are accepted by scientists and managers.

There have been three studies investigating the size of maturity of *Buccinum undatum* in Welsh Waters. Ellis (1997) investigated size of first maturity in whelk

samples from Carmarthen Bay (South Wales) and found that female whelks matured between 75-78mm shell length, with males maturing at around 75mm.

Edmonds and Masefield (2015) also investigated size of maturity in whelks from Carmarthen Bay and found that females mature around 71-78 mm shell length, no estimates of male size of first maturity were determined. However, the size does closely tie in with McIntyre *et al*., (2015) who found that whelks fished from an area near Lundy Island matured at 75.5 mm. Edmonds and Masefield (2015) found that whelks in an area off North Wales matured between 80-94 mm and 75-90 mm for males and females respectively. The study concluded that size of maturity among Welsh Whelks cannot be considered as less than 76.1 mm.

Haig *et al*. (2015) found marked differences in whelk size of maturity and length frequency distribution between sites around Wales that were within close proximity to each other (8-10 miles) (For details of maturity assessment please see Haig *et al*., 2015; Edmonds and Masefield, 2015).

The size of sexual maturity in the Haig *et al*. (2015) study ranged from 57 mm to 75 mm total shell length in males and 58 – 76 mm in females. The study did not find any difference in the proportion of mature male and female whelks between sample sites, but found that season did cause variation. This may be related to spawning season with an increase in gonad somatic index (GSI), the weight of the gonad tissues expressed as a percentage of the total weight. Both Haig *et al*. (2015) and Edmonds and Masefield (2015) found that GSI or relative gonad weight (RGW) in females was greatest in autumn months (October-November), which corresponds with the pre-egg laying season. The marked decrease in GSI observed by Haig *et al*. (2015) in winter corresponds with fishermen's observations of eggs appearing on whelk fishing gear, and washed up on shorelines. This indicates that egg laying occurs a few months after the peak in gonad activity. Haig *et al*. (2015) also found an increase in GSI in the spring for both sexes from each location, however, this was not as pronounced as the increase in Autumn. This could potentially coincide with an increase in feeding in the whelks after the winter lull and subsequent development of the gonad tissue. Fahy *et al*. (2000) found a similar pattern in GSI in whelks from the south-west Irish Sea where gonads were heaviest in autumn and lightest at the end

of winter. Valentinsson (2002) also found a defined reproductive cycle in *Buccinum undatum* in Swedish waters with a single major egg laying period in autumn. This was also the case in the study by Heude-Berthelin *et al.* (2011) who found that whelks in west Cotentin (Channel), France, laid eggs between October and December.

Understanding the reproductive cycle of a species is essential when considering management options for closed fishing seasons to protect spawning stock biomass, and to increase the reproductive potential of the stock.

Genetic Structure of Welsh Whelks

The genetic diversity of whelks in Welsh Waters was investigated by McKeown and Shaw (2016). This study used a combination of nuclear microsatellites and mtDNA markers. As both marker types have different inheritance/mutation properties their combination can be highly informative. Genetic analysis was performed on the same samples included in the size at maturity study of (Haig *et al*. 2015) to allow direct comparison between genetic and morphometric (biological) patterns.

The study found that throughout Wales there is considerable recruitment heterogeneity (same genetic structure), which in turn increases the susceptibility of populations/stocks to local collapse. McKeown and Shaw (2016) also found that at the regional level around Wales levels of genetic variation (as measured by haplotype diversity) were significantly lower than other UK samples. This is prominent around the Llyn Peninsula where the samples studied have very little genetic variation which indicates a local bottleneck event. This is where the population size has been reduced to such an extent that a large amount of genetic variation is lost. The recruitment heterogeneity and low level of genetic variation may decrease the resilience of Welsh populations to events such as disease, pollution and climate change.

When relating this information to the regional differences in size at first sexual maturity found in the Haig *et al*. (2015) study it is highly probable that these

differences are related to environmental factors. This has important considerations for management strategies and balancing the biological and economic stability of the whelk fishery.

Current Status of Welsh Whelk Stocks

The exact status of the whelk populations in Welsh waters has not been determined by means of a detailed analytical stock assessment. However, detailed assessments of length data coupled with an increase in effort into the fishery and lack of a sustainable management plan present worrying signals with respect to the long term biological and economic sustainability of the stock. The preliminary catch per unit effort (CPUE) data exemplifies this.

Welsh Government have undertaken a pilot study with Succorfish M2M that investigated the efficiency of whelk fishers being able to use inshore vessel monitoring systems (IVMS) together with a mobile phone app (called catch app) to provide detailed reporting on their catches. The pilot study involved five vessels around Wales and proved that this means of real-time electronic recording of catch data is very effective.

The preliminary results revealed that the median (mid-point) CPUE for the vessels appears to just above 1 kg per pot per day soak, while the average is 0.82 kg per pot per day soak. Poor weather is the main cause of the mean being lower than the median as it affects fishing patterns and unintentionally increases the soak time and consequently reduces the CPUE value. The data shows a reduction in CPUE during July, August and September and this is supported by the fact that most of the vessels switched from whelks to other species for this time period (Rossiter, 2016).

This is very much a preliminary data set and data will continue to be collected added to the baseline data. However, the CPUE level is considered low compared to what has been considered a CPUE baseline indicative of a biologically sustainable fishery.

Shrives *et al*. (2015) assessed the populations of whelks around Jersey (Channel Islands) as catches were reported to be declining since 2004, with suggestions that existing management measures may not be effective.

This study reports eight years of annual monitoring of whelk catches from 2003 to 2011, and analysis of Jersey commercial whelk fishermen's logbook returns from 2007 to 2011 for changes in effort and catch. The results showed a decline in average catch per unit effort (CPUE) of 36.7 % from 3.3 kg per pot to 2.09 kg per pot.

Since 2007, reported landings per unit effort for whelks, also dropped from 2.12 kg per pot to 1.75 kg per pot. Whilst a decline in catch rates of whelks greater than 44 mm shell length was reported earlier, this study also found catch rates for smaller whelks (<44 mm shell length) had declined by 54.5% from 0.44 kg per pot to 0.2 kg per pot, suggesting the start of possible recruitment overfishing (Shrives *et al*., 2015).

Shrives et al. (2015) indicated that previous work by Morel and Bossy (2004) had found a CPUE of 3 kg per pot was considered good and comparable with CPUE levels from France and Sweden (Morel and Bossy, 2004). This figure may be utilised as a guideline for a sustainable fishery, however, CPUE can not be used to asses a fishery in isolation, but in conjunction with other biological parameters, namely recruitment and the number of adult whelks present in the stock (spawning stock biomass).

Conclusion

The data and evidence reviewed in this document highlight the urgent requirement for a sustainable management plan for Welsh whelks. The current management measure of a pan EU MCRS of 45 mm is not protecting the spawning stock in Wales and as such the stock is in danger of recruitment overfishing. Additionally, there is no protection for whelks throughout their reproductive season which will exemplify the effect of recruitment overfishing.

The preliminary CPUE baselines in Wales are below what may be considered commercially sustainable and with an increase in effort and further displacement into the fishery, the long term sustainability of the Welsh whelk fishery is in serious jeopardy if sustainable measures are not introduced.

This evidence will underpin a public consultation on sustainable management measures for the Welsh whelk fishery.

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