



At Sea Simulation of the Landing Obligation on Irish Vessels

Report to the Discard Implementation Group

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1. Introduction

The 2013 reform of the EU Common Fisheries Policy came into force in January 2014¹ and included a Landing Obligation (LO) whereby the discarding of quota species is prohibited. This policy will be introduced gradually starting with pelagic fisheries in 2015, extending to demersal fisheries in 2016 with the objective that all fisheries will be included by 2019. The LO will require catches of quota managed species to be landed except in cases where high post catch survival can be demonstrated. Furthermore a limited amount, or 'de minimis', level of discarding will continue if selectivity cannot be improved or if on-board handling and storage becomes prohibitive. De minimis discard levels will be set at 7% of catch for first 2 years, 6% in years 3 and 4 and 5% for subsequent years. Up until now the management of EU fisheries has been restricted to regulation of landings, whereas under the LO these fisheries will now be managed by catch regulation. The switch from landings to catch regulation represents a major change for the management of EU fisheries and has major implications for the fleets that depend on them. The LO will introduce a number of challenges to the Irish fleet particularly in the demersal mixed fisheries fleet segment. Key challenges will include requirements to land undersize quota species, cessation of fishing activity once the quota for the first individual TAC species is exhausted (choking) and costs associated with handling and disposal of catches which cannot be sold for human consumption.

¹ Regulation (EU) No 1380/2013 of the European Parliament and of the Council of 11 December 2013 on the Common Fisheries Policy, amending Council Regulations (EC) No 1954/2003 and (EC) No 1224/2009 and repealing Council Regulations (EC) No 2371/2002 and (EC) No 639/2004 and Council Decision 2004/585/EC.

Previous work on the impacts of the LO has been restricted to desktop study (Poseidon, 2013) or focussed broadly on a wide range of potential issues such as enforcement, and on board handling and markets for fish which cannot be sold for human consumption (Catchpole et al., 2014). Much of the knowledge acquired from these UK studies can be applied to the Irish Fishing Industry and the benefits of revisiting the topics covered are likely to be limited. This study aimed to carry out a detailed at sea simulation of the impacts of the LO at operational level with a particular focus on the impacts of choke species. A wide range of potential scenarios exist in relation to provisions currently outlined under the LO element of the CFP. While one example of a quota uplift scenario has been provided for demonstration purposes, apart from an economic comparison of business as usual and LO scenarios, we have refrained from further analysis of potential scenarios. Such an analysis would be better suited to a broader assessment of the range of measures that can be used to mitigate impacts of the LO.

2. Methods

Two vessels were chartered to undertake the trial in the Celtic Sea: Vessel 1, a 24 m quad-rig trawler targeting *Nephrops*; Vessel 2, a 25 m single-rig demersal trawler targeting mixed whitefish species. Vessels were required to retain and land all catches of demersal species specified in Article 15.1.C(ii) of EU regulation 1380/2013, namely cod, haddock, whiting, saithe, Norway lobster, hake, common sole and plaice. Vessels fished their standard monthly quota allocation as normal, but were required not to discard the species listed above. Fishing was permitted to continue until the quota for the target stock(s) had been

taken or where any by-catch quota allocations had been exhausted, provided a quota allocation for the target stock(s) remained. Catches of all other TAC species were fully documented during the trials, but discarding of undersize and over quota catches was permitted. This provided full information on the catch retained and facilitated detailed economic assessment of documented fishing activities under the LO scenario.

The study was split into two phases: Phase 1, commenced in October 2014, where vessels were expected to operate under LO conditions; Phase 2, commenced in November 2014, where skippers were requested to choose from a range of existing technical measures and/or adjust their fishing behaviour and tactics, and challenged to reduce the levels of unwanted catch as much as practically possible.

For both phases of the study, vessels fished using their own monthly quota allocation and any additional landings (over quota) were counted against an additional scientific quota. Regular updates on the amount of scientific quota available were provided to vessels. Where insufficient scientific quota was available to cover over quota landings, documented discarding was permitted if required. Any fish caught in excess of the vessels monthly allocation was sold by the vessel and discounted against the total charter cost. This approach prevented targeting of over quota fish, was considered to be closest to normal fishing operations and resulted in optimal simulation of the actual impacts of the LO.

2.1 Analysis

Total catches were separated by species, size grade and condition e.g. large gutted, and weighed to the nearest kg at haul level. Sampling of catches in this manner permitted allocation of detailed price information

obtained from vessel sales notes and accurate economic analysis of landing scenarios. Representative length frequency samples were also obtained at haul level for all fish species. As part of the LO, minimum landing size will be replaced with 'minimum conservation reference size' (MCRS) to take account of the obligation to land all catches regardless of size. For the purposes of this study, catches by species were categorised into above or equal to (\geq MCRS) and below MCRS ($<$ MCRS). Catches of \geq and $<$ MCRS quota species which exceeded the monthly quota allocation for a given month were defined as 'choke' species. Cumulative catches of key species were assessed over time to identify at which point during monthly fishing operations 'choking' occurred and a vessel would, under the LO, be required to cease fishing operations, return to port and land their catches. Catches were standardised in relation to the number of hauls carried out by each vessel in each month to facilitate effective comparison of catch rates between project phases and vessels. Proportions of \geq MCRS and $<$ MCRS catches of key fish species were compared across months to assess potential impacts of measures taken by vessel skippers to reduce the impact of the LO in Phase 2.

Technical measures adopted during Phase 2 consisted primarily of employment of a 300 mm square mesh panel (SMP) deployed 9 to 12 m from the cod-line on board Vessel 1, and behavioural or tactical changes for Vessel 2: Vessel 1 employed the 300 mm SMP on all four trawls of the quad-rig for 38 of the 56 hauls conducted in November. Vessel 1 also utilised a coverless trawl and larger cod-end mesh sizes on one or more of the four trawls for some hauls. However, sampling was not conducted at individual trawl level so it was not possible to examine in detail the effects of these devices. Vessel 2 primarily avoided

areas where high quantities of juvenile fish were likely to be encountered and also employed a 90 mm instead of an 80 mm mesh cod-end when targeting whiting during November.

Length frequency data on the main fish species caught during the trial were examined to assess whether technical or tactical changes adopted in Phase 2 of the study affected the size distribution of catches. These data were raised to trip level and standardised by effort (number of hauls) across vessel and month to permit effective comparisons of length frequency distributions (LFD) between months. However, major temporal differences, and potential differences in the size distribution and quantities of fish species on the ground, precluded quantitative comparisons of LFDs between the two periods.

Detailed operational economic information was received for one trip undertaken during the trial from each vessel. This information was used to derive costs per day at sea which were subsequently applied to all trips during the trials. Detailed cost information provided by trial vessels was categorised in the

following manner: Variable Costs – fuel for steaming and fishing days, food, ice and transport for \geq and $<$ MCRS landings, port fees, ship maintenance and net mending; Fixed Costs – duties, levies and insurance; Capital Costs. Neither vessel provided capital costs so the average annual capital cost for a polyvalent vessel over 18m in length was obtained from DCF figures and applied. This provided an approximate indication of the typical capital costs, such as vessel repayments, expected to be incurred by vessels in a similar size class to study vessels. This information was used to carry out a detailed economic comparison of ‘business as usual’ (BAU) and LO fishing scenarios. Catch values in the case of BAU consisted of all \geq MCRS fish that did not exceed monthly quota limits. The value of catches under the LO scenario consisted of the value of all fish up until the first choke occurred. Plaice and sole were excluded from catch values while a nominal value of €200 per tonne was assigned to $<$ MCRS fish based on sales notes received for such fish when sold either for fish meal or bait.

3. Results

Table 1. Trip details

| Vessel | Month | Trip | Start Date | End Date | Days at sea | Days fished | Hauls |
|----------|----------|---------|------------|------------|-------------|-------------|-------|
| 1 | October | 1 | 02/10/2014 | 06/10/2014 | 5 | 4 | 9 |
| | | 2 | 13/10/2014 | 23/10/2014 | 11 | 9 | 16 |
| | | 3 | 27/10/2014 | 31/10/2014 | 5 | 4 | 11 |
| | Subtotal | | | | 21 | 17 | 36 |
| | November | 3 | 01/11/2014 | 06/11/2014 | 6 | 4 | 9 |
| | | 4 | 11/11/2014 | 12/11/2014 | 11 | 9 | 29 |
| | | 5 | 25/11/2014 | 30/11/2014 | 6 | 5 | 18 |
| | Subtotal | | | | 23 | 18 | 56 |
| | 2 | October | 1 | 11/10/2014 | 17/10/2014 | 7 | 5 |
| 2 | | | 17/10/2014 | 22/10/2014 | 6 | 6 | 14 |
| 3 | | | 23/10/2014 | 29/10/2014 | 7 | 6 | 15 |
| Subtotal | | | | 20 | 17 | 41 | |
| November | | 4 | 04/11/2014 | 09/11/2014 | 6 | 6 | 18 |
| | | 5 | 10/11/2014 | 13/11/2014 | 4 | 3 | 7 |
| | | 6 | 13/11/2014 | 16/11/2014 | 4 | 3 | 5 |
| Subtotal | | | | 14 | 12 | 30 | |
| Total | | | | 78 | 64 | 163 | |

Fishing operations occurred from 02/10/14 to 29/11/14. Over this period 11 sea trips and 163 valid hauls were conducted (Table 1). Although Vessel 1 spent a similar number of days at sea in the two months, the number of hauls carried out increased from 36 in October to 56 in November. In contrast, Vessel 2 had less fishing effort in the second month of the study with 30 hauls completed

in November compared with 41 in October. Vessel 1 operated in a relatively restricted geographic area on the Smalls fishing ground in the Eastern Celtic Sea for the duration of the study. Vessel 2 fished over a wide area in the Celtic Sea in October but carried out the majority of fishing effort (17 hauls) on the Smalls fishing ground in November (Figure 1).

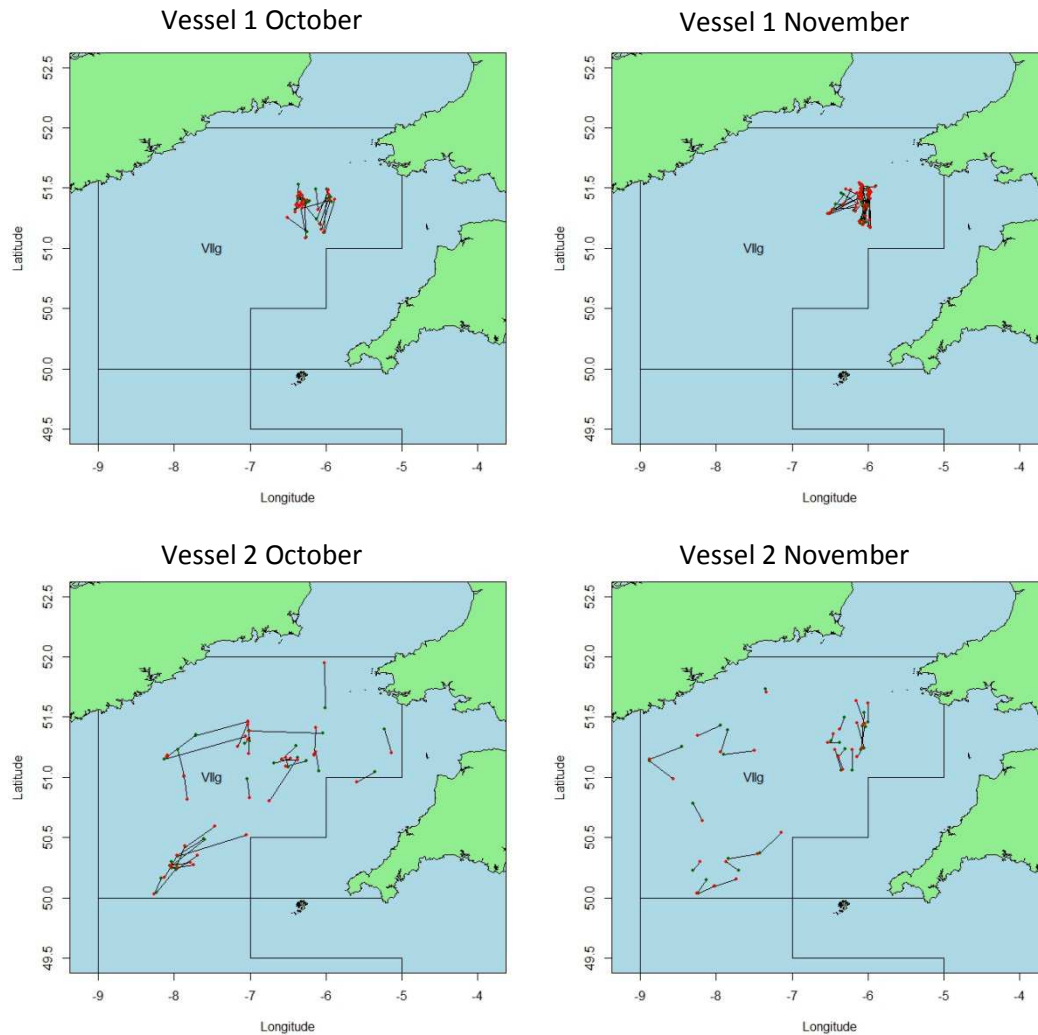


Figure 1: Haul positions of the trial vessels during Phase 1 (October) and Phase 2 (November)

3.1 Choke species

Details of choke species encountered during the trial are outlined in Table 2. Plaice and black sole chokes occurred early on in fishing operations due to zero monthly quota available for these species. It is likely that measures will be adopted under the LO to deal with such low catch allowances. For the purposes of this study we focus on species with larger quota allowances which are more likely to significantly affect fishing operations under the LO. Vessel 1 choked on haddock in both months whereas Vessel 2 choked on haddock, whiting and cod in October, and haddock in November.

Cumulative catches of key choke species over time are outlined in Figure 2. Vessel 1 choked on haddock after 14 days fished and 27 hauls

in October, and after 15 days fished and 41 hauls in November. Vessel 1 was also relatively close to choking on whiting towards the end of fishing operations in October with 11.09 t out of a monthly quota of 12 t retained. Substantial reductions in catches of whiting in November greatly reduced the risk of Vessel 1 choking on whiting in that month. Vessel 2 choked on haddock after 8 days, cod after 12 days and whiting after 16 days out of a total of 17 days fished in October. In November, Vessel 2 choked on haddock on the 7th out of a total of 12 days fished in that month. The number of hauls achieved by Vessel 2 before choking occurred was 17 and 19 in October and November respectively. Substantial reductions in cod catches, well below the monthly quota of 2.5 t were achieved by Vessel 2 in November. Although a

slight reduction in whiting catches was achieved by this vessel in November, choking would have occurred in relation to this species if the monthly quota had not increased from 12 t in October to 15 t in November. Based on STECF figures, an additional 1.6 t of haddock was added to the quota of 2.5 t as an example of a potential quota uplift which might mitigate the impact of the LO on Vessel 2. An increase in haddock quota to 4.1 t resulted in an increase of fishing effort by one day or four hauls in October and just one extra haul in November.

3.2 Catch comparison between the two phases

Standardised catches of cod haddock and whiting by Vessel 1 were reduced by at least 50% in November compared with October. Little difference in the proportions of < MCRS fish retained in total catches were, however, observed for these species on this vessel (Table 3). These figures are supported in standardised length frequency charts where reductions in total catches but little difference in the overall shape of LFDs are evident (Figure 3). Apart from a substantial reduction in cod, negligible differences in standardised catches of whitefish species occurred between November and October for Vessel 2. However, substantial reductions in proportional catches of < MCRS haddock and whiting were observed for this vessel. The retention rate of < MCRS whiting was reduced from ~ 34 % in October to ~ 12 % in November, corresponding to an effective reduction in retention rates of ~ 66 % for < MCRS whiting. The reduction in retention rates for haddock was lower at ~ 35 %. These

findings are again supported in Figure 3 where clear shifts to the left and smaller lengths are evident in LFDs for haddock and whiting in November.

Table 2. Details of landings and choke species (highlighted in red)

| Vessel | Month | Species | Total catch (t) | Monthly Quota (t) | Δ (t) |
|--------|-------|-----------------|-----------------|-------------------|--------|
| 1 | Oct | Haddock | 3.93 | 2.50 | -1.43 |
| | | Plaice | 0.2 kg | 0.00 | -0.2kg |
| | | Angler | 1.16 | 2.00 | 0.84 |
| | | Whiting | 11.09 | 12.00 | 0.91 |
| | | Cod | 1.49 | 3.00 | 1.51 |
| | | Ling | 0.23 | 2.00 | 1.77 |
| | | <i>Nephrops</i> | 3.77 | 12.00 | 8.23 |
| | | Megrim | 0.60 | 20.00 | 19.40 |
| 1 | Nov | Haddock | 2.89 | 2.50 | -0.39 |
| | | Plaice | 0.06 | 0.00 | -0.06 |
| | | Black Sole | 4kg | 0.00 | -4kg |
| | | Cod | 1.12 | 3.00 | 1.88 |
| | | Ling | 0.10 | 3.00 | 2.90 |
| | | <i>Nephrops</i> | 10.51 | 14.00 | 3.49 |
| | | Angler | 1.46 | 6.00 | 4.54 |
| | | Whiting | 6.32 | 15.00 | 8.68 |
| 2 | Oct | Hake | 0.10 | 18.00 | 17.90 |
| | | Megrim | 0.55 | 20.00 | 19.45 |
| | | Haddock | 10.71 | 2.50 | -8.21 |
| | | Whiting | 16.31 | 12.00 | -4.31 |
| | | Cod | 5.09 | 3.00 | -2.09 |
| | | Plaice | 0.43 | 0.00 | -0.43 |
| | | Angler | 0.76 | 2.00 | 1.24 |
| | | Ling | 0.36 | 2.00 | 1.64 |
| 2 | Nov | Pollack | 1.00 | 7.00 | 6.00 |
| | | Hake | 3.25 | 12.00 | 8.75 |
| | | Megrim | 0.78 | 20.00 | 19.22 |
| | | Blonde ray | 0.08 | 30.00 | 29.92 |
| | | Thornback Ray | 0.03 | 30.00 | 29.97 |
| | | Haddock | 7.53 | 2.50 | -5.03 |
| | | Plaice | 0.25 | 0.00 | -0.25 |
| | | Black Sole | 4kg | 0.00 | -4kg |
| 2 | Nov | Whiting | 13.66 | 15.00 | 1.34 |
| | | Cod | 1.13 | 3.00 | 1.87 |
| | | Ling | 0.07 | 3.00 | 2.93 |
| | | Angler | 0.69 | 6.00 | 5.31 |
| | | Pollack | 0.12 | 10.00 | 9.88 |
| | | Hake | 1.13 | 18.00 | 16.87 |
| | | Megrim | 0.65 | 20.00 | 19.35 |

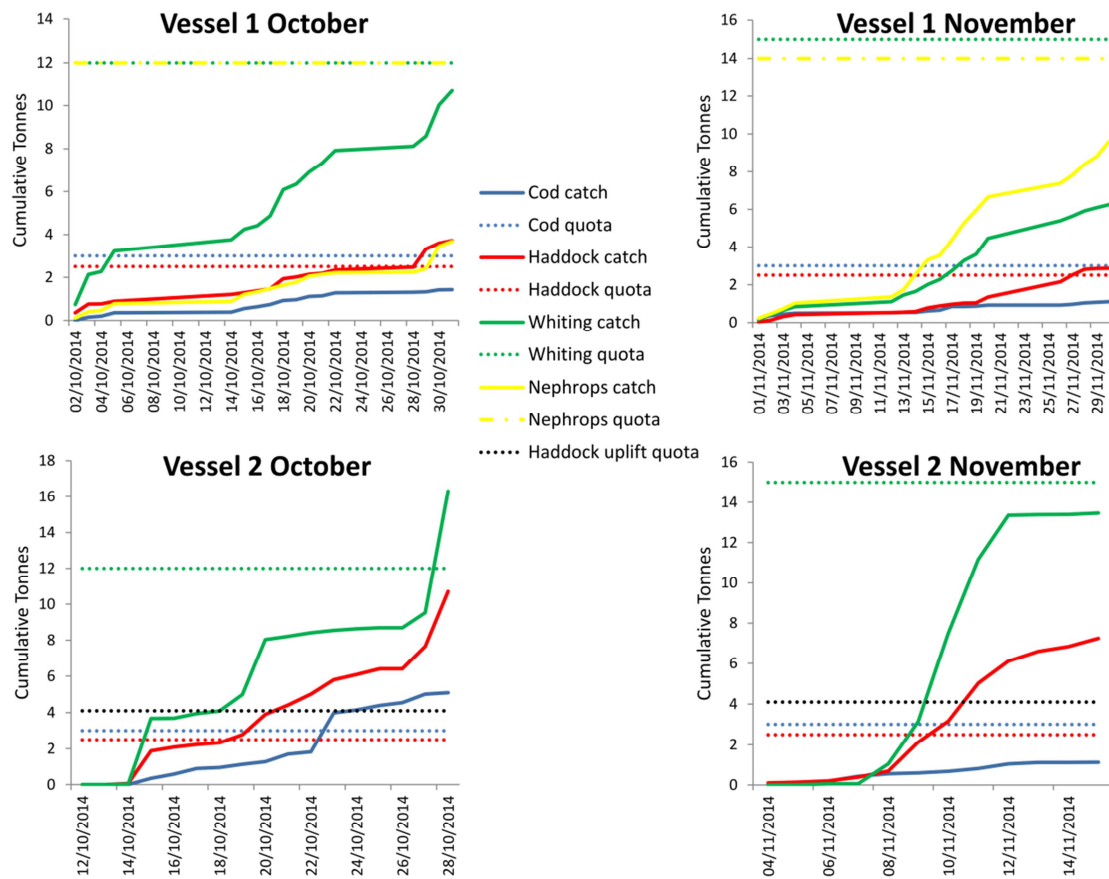


Figure 2. Cumulative catches of key choke and target species in relation to time and available quotas

3.3 Economics

Details of economic results under BAU and LO scenarios are outlined in Table 4 and Figure 4. Vessel 1 operated at a loss under BAU during October due to relatively low catch rates of the target species *Nephrops* (Figure 3). Consequently, a premature cessation of fishing activity had little impact on profitability that month. Vessel 1 made a profit of €23,183 in November under BAU due to increased catches of *Nephrops* (Figure 3). The reduction in fishing effort due to the haddock choke resulted in a reduction in profits to €6,373 under the LO in November. Profitability for Vessel 2 dropped from €6,827 under BAU to -€6,654 under the LO in

October. This was caused by a substantial reduction in fishing effort due to the first choke on haddock. In addition the value of retained catches was reduced as low value < MCRS fish formed a substantial component of retained catches under the LO scenario. Breakeven was roughly achieved by Vessel 2 in November under both the BAU and LO scenarios. Vessel 2 finished fishing early on 16 November due to lack of quota for haddock and whiting. Cod quota was still available but, according to the vessel owner, it would have been uneconomic to solely target cod. Aside from these issues, profitability under the BAU scenario dropped in November as indicated by a drop in catch value haul¹ compared to October.

Table 3. Quantities of key species above and below minimum conservation reference size (MCRS) retained during the two phases of the trial, October and November

| Vessel | Species | October | | | | | November | | | | |
|--------|---------|------------------------------|-----------------|------------|------------|--------------------------|------------------------------|-----------------|------------|------------|--------------------------|
| | | Catch haul ⁻¹ (t) | Total catch (t) | ≥ MCRS (t) | < MCRS (t) | ∝ Total catch < MCRS (%) | Catch haul ⁻¹ (t) | Total catch (t) | ≥ MCRS (t) | < MCRS (t) | ∝ Total catch < MCRS (%) |
| 1 | Cod | 0.04 | 1.49 | 1.31 | 0.18 | 12.13 | 0.02 | 1.12 | 0.83 | 0.29 | 25.86 |
| | Haddock | 0.11 | 3.93 | 1.14 | 2.80 | 71.06 | 0.05 | 2.89 | 0.70 | 2.19 | 75.75 |
| | Whiting | 0.31 | 11.09 | 3.91 | 7.18 | 64.74 | 0.11 | 6.32 | 2.33 | 3.99 | 63.16 |
| 2 | Cod | 0.12 | 5.09 | 4.85 | 0.24 | 4.72 | 0.04 | 1.13 | 1.04 | 0.09 | 7.71 |
| | Haddock | 0.26 | 10.71 | 4.96 | 5.75 | 53.65 | 0.25 | 7.53 | 4.86 | 2.67 | 35.45 |
| | Whiting | 0.40 | 16.31 | 10.82 | 5.49 | 33.67 | 0.46 | 13.66 | 12.03 | 1.63 | 11.97 |

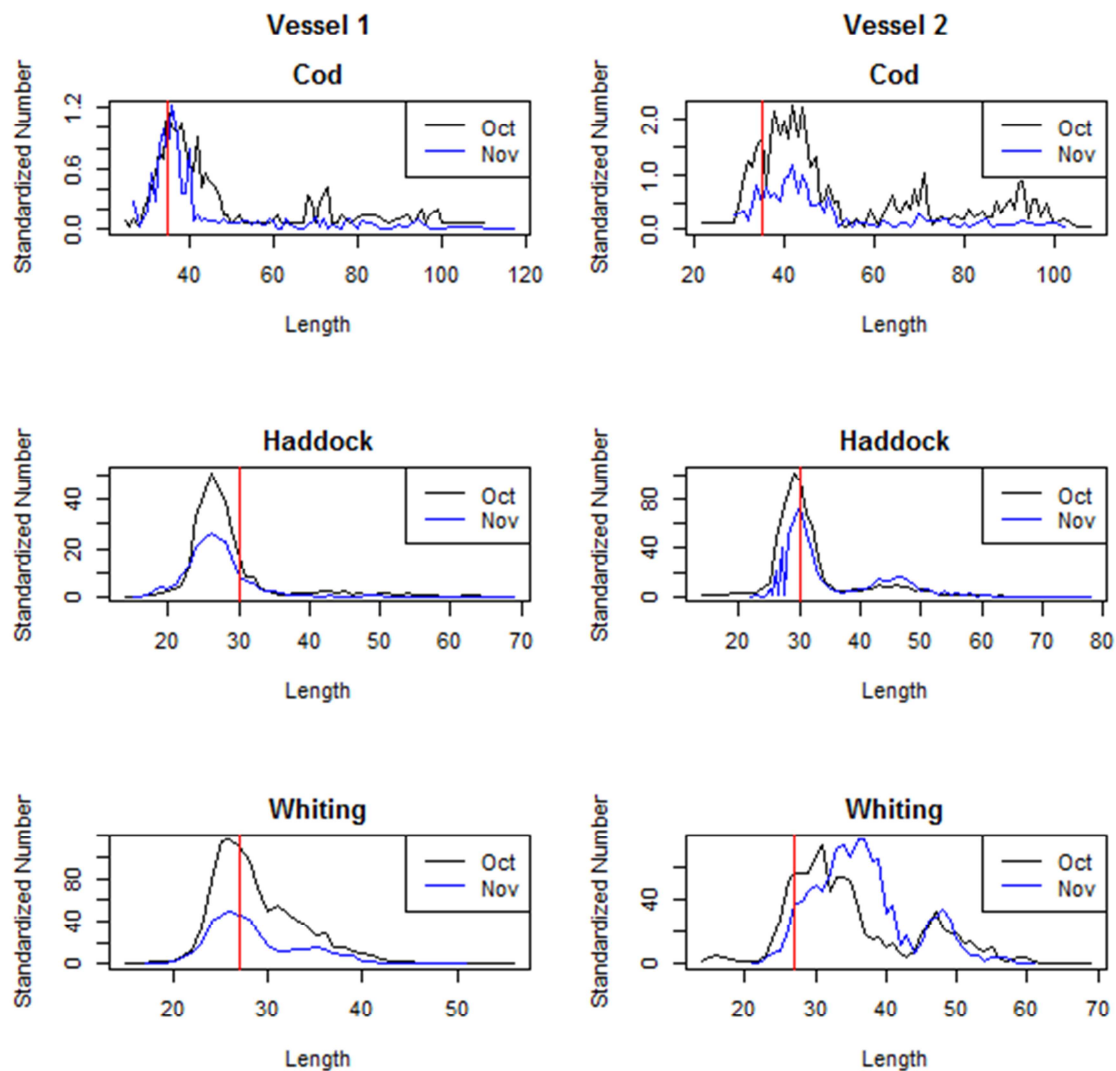


Figure 3. Standardised length frequencies of cod, haddock and whiting catches per vessel in October and November. The red line indicates minimum conservation reference size.

4. Discussion

Haddock was the principal choke species encountered by both vessels in both months primarily due to a relatively limited monthly quota allowance for this species. The impact on fishing effort on Vessel 2, the mixed demersal whitefish trawler, was the greatest with fishing activity curtailed after just 8 and 7 days fished in October and November respectively under the LO scenario. The current mismatch in available quota of haddock (2.5 t) and whiting (e.g. 15 t November) is problematic. Some species based selection of cod is possible but haddock and whiting generally behave the same way in the trawl, generally precluding the use of technical devices to select one species over the other (Catchpole and Revill, 2008). Instead, as was attempted in this study, tactical changes in fishing behaviour are more likely to provide solutions to this issue at an operational level in mixed whitefish demersal fisheries.

Vessel 2 did manage to achieve substantial reductions in < MCRS fish in Phase 2 of the project. However, the reductions were almost twice as high for whiting, the high quota species, compared with haddock, the low quota species, and the vessel ending up choking at roughly the same time on haddock in both study Phases. Also, attempts to avoid juvenile fish may have been a major factor contributing to reduced profitability under the BAU scenario for Phase 2 in November. This demonstrates that tactical changes are unlikely to provide a comprehensive strategy for mitigating impacts of the LO in this fishery. Alternative quota management strategies which assist in reducing the mismatch in quotas available to vessels engaged in this mixed whitefish demersal fishery are likely to offer potential in this regard and should be explored.

Focusing on catches alone, the LO seems to have had less of an impact on Vessel 1, the *Nephrops* trawler, as choking occurred much later in the month for both phases of the project

for this vessel. Furthermore, employment of a 300 mm SMP in the majority of hauls was likely a key factor in achieving reductions in catches of key fish species and extending effort by ~ 50% before choking occurred in November (41 hauls) compared to October (27 hauls). However, economic analysis demonstrated that Vessel 1 suffered major reductions in profitability under the LO scenario. Fishing operations conducted by Vessel 1 in October were of little use in determining the economic impacts of the LO as the vessel was operating at an economic loss and would likely have changed fishing grounds if not engaged in this study. Fishing operations and economic conditions experienced by Vessel 1 in November were likely more typical of normal conditions due to higher catch rates of *Nephrops*, substantially higher catch values haul⁻¹ and increased profitability under the BAU scenario. However, although major improvements were achieved, Vessel 1 still suffered major losses in profits due to the LO in November. Little difference in catch values haul⁻¹ were observed between LO and BAU scenarios so this reduction in profitability was caused by a reduction in fishing effort from 56 to 41 hauls due to the LO.

It is interesting to note that although Vessels 1 and 2 largely operated on the same fishing ground in November, catch rates per haul were roughly 50 % lower for cod, 80 % lower for haddock and 76 % lower for whiting on board Vessel 1 compared to Vessel 2 (Table 3). These differences in catch rates are likely due to a lower catch rates of whitefish species in quad-rigs trawls, particularly when a 300 mm SMP selectivity device is employed (Revill et al., 2009; BIM, 2014b).

Table 4. Detailed Economics for Business As Usual (BAU) and Landing Obligation (LO) scenarios

| Vessel | Month | Scenario | Catch (t) | Catch value (€) | Days at sea (No.) | Hauls (No.) | Catch value haul ⁻¹ (€) | Variable cost (€) | Fixed cost (€) | Capital cost (€) | Total Cost (€) | Profit (€) |
|--------|-------|----------|-----------|-----------------|-------------------|-------------|------------------------------------|-------------------|----------------|------------------|----------------|------------|
| 1 | Oct | BAU | 13.04 | 48,408 | 21 | 36 | 1,345 | 61,230 | 5,670 | 7,244 | 74,144 | -25,736 |
| | | LO | 17.00 | 35,288 | 17 | 27 | 1,307 | 49,567 | 4,590 | 7,244 | 61,401 | -26,113 |
| | Nov | BAU | 16.89 | 103,699 | 23 | 56 | 1,852 | 67,061 | 6,210 | 7,244 | 80,515 | 23,183 |
| | | LO | 18.93 | 77,331 | 20 | 41 | 1,886 | 58,314 | 5,400 | 7,244 | 70,958 | 6,373 |
| 2 | Oct | BAU | 23.92 | 66,754 | 20 | 41 | 1,628 | 49,826 | 2,857 | 7,244 | 59,927 | 6,827 |
| | | LO | 11.70 | 26,559 | 10 | 17 | 1,562 | 24,540 | 1,429 | 7,244 | 33,213 | -6,654 |
| | Nov | BAU | 18.47 | 44,548 | 14 | 30 | 1,485 | 35,400 | 2,000 | 7,244 | 44,644 | -96 |
| | | LO | 13.86 | 26,865 | 7 | 19 | 1,414 | 17,700 | 1,000 | 7,244 | 25,944 | 921 |

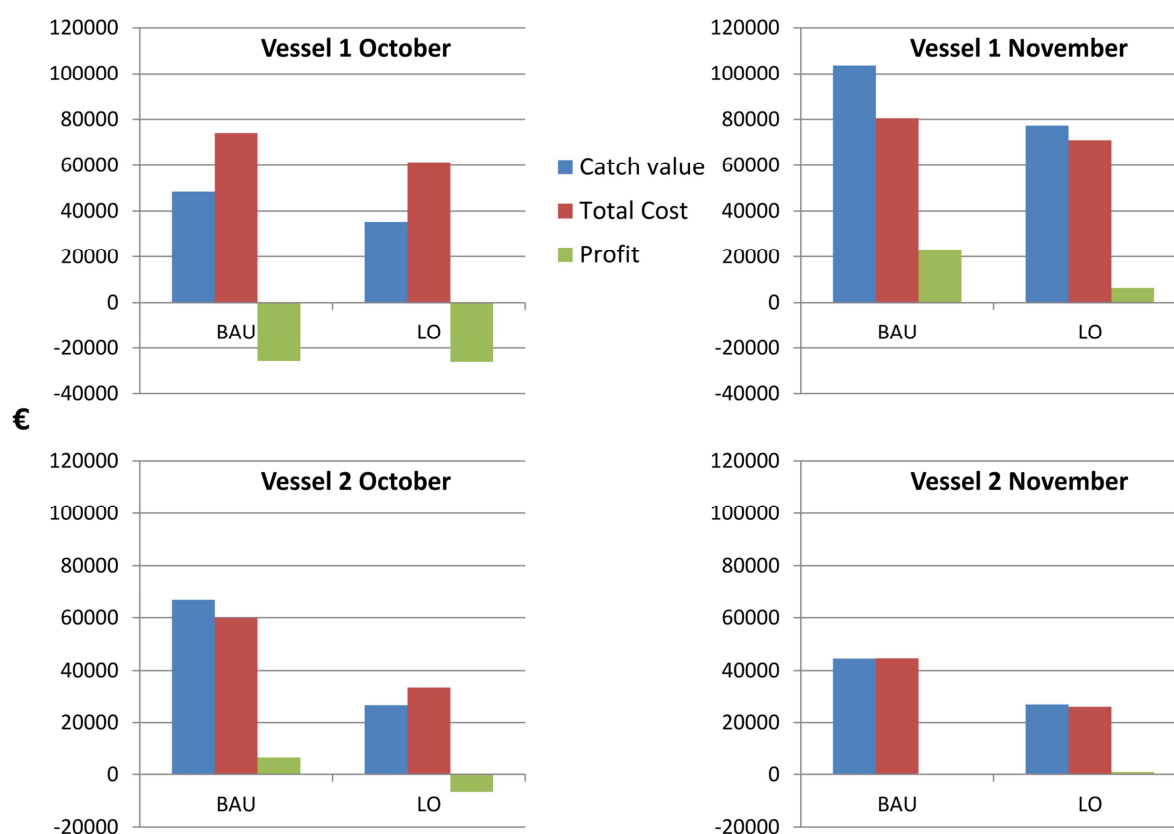


Figure 4. Summary economic results for trial vessels under Business As Usual (BAU) and Landing Obligation (LO) scenarios

Results of the latter and current studies demonstrate that technical solutions can partially assist in mitigating the impacts of the LO in relation to whiting catches on board *Nephrops* trawlers. However, the scope for mitigation through technical measures is likely to be more limited in other situations. For example, while a whiting quota of 15 t was available in the Celtic Sea in November 2014,

a quota of just 1 tonne was available in the Irish Sea during the same period (DAFM, 2014). Average whiting discard rates (whiting discards/whiting catches) in Irish sea demersal trawl fisheries were 88 % from 2010 to 2012 (CEFAS, 2014). These figures suggest that whiting chokes would have a much greater impact on Irish trawlers operating in the Irish Sea. A study on the impacts of the LO on the

UK *Nephrops* trawl fleet operating in the Irish Sea predicted a total of around 10 days fishing for the entire *Nephrops* fleet before the annual whiting quota would be exhausted. The study which also assessed potential economic implications of the LO on North Sea whitefish and *Nephrops* fleets, concluded that improvements in gear selectivity would essentially form just one of a suite of measures required to maintain fleet viability. Additional measures include increased quota access through uplifts, trades and swaps; research on survivability; de minimus; and changes in MCRS (Poseidon, 2013). The relatively small benefit of additional haddock quota, outlined as a potential quota uplift scenario in the current study, further demonstrates that no single measure is likely to produce a comprehensive solution.

The current and previous studies conducted to date (Poseidon, 2013; Catchpole et al., 2014), highlight the importance of assessing the potential impacts of the LO in a range of fisheries conducted at different times of the year, whether through at sea simulation trials or desk top studies. While the current study primarily specifically addresses operational issues in relation to particular fisheries, a comprehensive assessment of all measures which have potential to mitigate economic impacts of the LO on Irish vessels is required.

5. References

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