

Best Practices II

Task 3.2. Desk study: selectivity curves and economic analysis (short term)

Geert Hoekstra & Katell Hamon.
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WAGENINGEN
UNIVERSITY & RESEARCH



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1. Introduction

This desk study has applied the results from the practical selectivity experiments performed by Wageningen Marine Research (WMR) in the project Best-practices II. In particular the estimated selectivity curves from the experiments were used. Observer trips were carried out with the conventional mesh size of 80 mm and the more selective 90 mm. By using paired observations of 80 and 90mm cod end a catch comparison of both undersized as well as marketable fish (kg per hour), including the percentage loss/reduction, could be made. To obtain a sample of the entire population a cover cod end sampling technique was used, in which the cover consisted of a 40 mm mesh. Observers from WMR collected data on the catches on a haul basis of both meshes (i.e. conventional mesh and selective). Sampling focused on the main target species, sole and plaice (Van der Reijden et al., 2014). Current selectivity curves observed for the sole targeting fleet were compared to the experimentally derived ones for the larger mesh sizes.

Based on the results of the experiments with tested gears, and the resulting catch composition in terms of species and size category, the short-term impact (in costs per fishing day) of the landing obligation on the profitability has been estimated of the fisheries fishing with the current gears (80 mm) and if the fleet were to change to the new gear (90 mm). The costs of operation has been based on the 'Best Practice I' costs (Baarsen, Luchies, Turenhout & Buisman, 2015; Buisman, Van Oostenbrugge & Beukers, 2013).

2. Methodology

- *Calculation of the catch composition by length and market category for the 80mm:*
 - Catch compositions by length of 80mm are calculated for four groups (<300 HP, plaice; <300 HP, sole; >300 HP, plaice; >300 HP, sole) as the proportion of catch at each cm-class in the market categories (see table 5 for the definitions of the market categories)
 - The landings weights are based on data from 2015 for the pulse cutters in 2015 of BedrijvenInformatieNet (Wageningen Economic Research).
 - The landings proportions are calculated as kg per sea day for each category based on the total number of sea days for the pulse cutters with <300 HP and >300 HP in 2015.
 - Prices per market category are based on the average annual prices per market category of the pulse cutters in 2015.
 - Finally, the values per length category are calculated by the price per market category multiplied by the kg per sea day per length size.

- *Calculation of the catch composition by length and market category for the 90mm:*
 - With the selectivity curves for sole and plaice (based on sampling data of WMR) a ratio was calculated to convert the kg per sea day per length category of the 80mm to the 90mm in kg per sea day for each length size.
 - The value per length category has been calculated by the kg per sea day multiplied by the price per market category for each length size.
 - Note the assumption that the selectivity curve for sole and plaice, derived from trips performed by a large >300hp pulse cutter, is also applied to <300hp cutters. In addition only the selectivity curve of trip 2 was used in the analysis. Within trip2 the difference in the actual mesh size between the 80 mm and 90 mm cod ends approximated 10 mm, i.e. 78.8mm and 87.8 mm. Within trip1 the difference between the meshes was lower, i.e. 7.6 mm. Given the smaller difference between the meshes, we assume changes in the economic performance will be smaller when using the selectivity curve of trip 1.
- *Calculation of the bycatch:*
 - The weights and value calculated per sea day has been based on 2015 for the pulse cutters in 2015 of BedrijvenInformatieNet (Wageningen Economic Research).

3. Results

Catch results with two different mesh sizes for small and medium sized pulse cutters (<300 HP).

Figure 1 Catch per sea day by pulse cutter <300 HP.

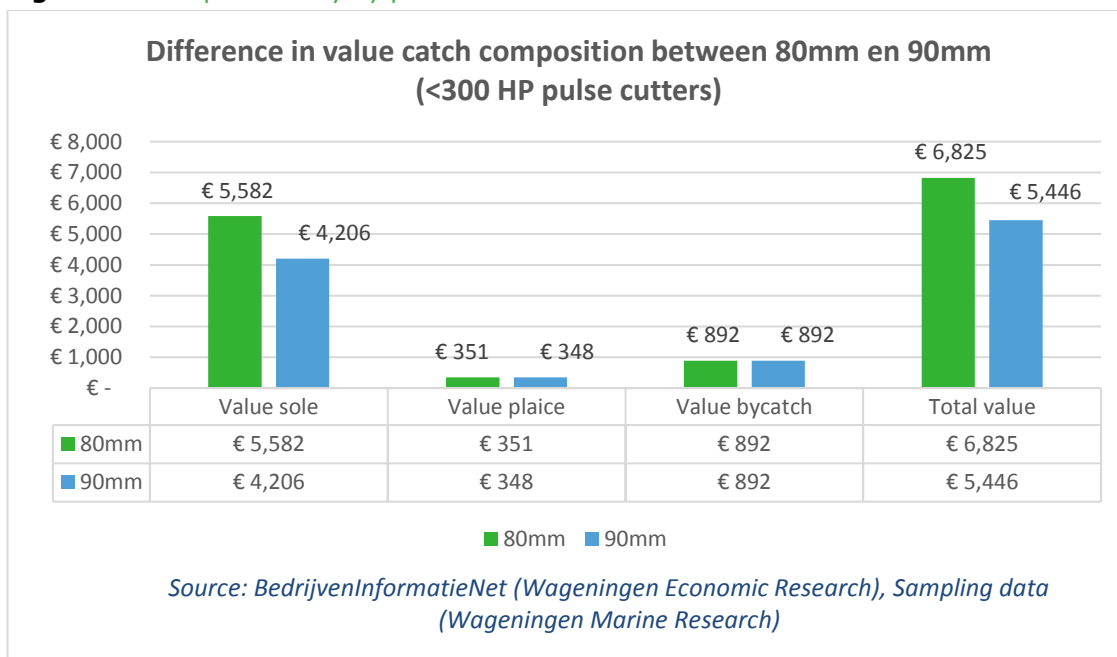


Table 1 Catch composition in weight and value by pulse cutters <300 HP.

Mesh size	80mm per sea day	90mm per sea day	Per cutter annually (80 mm)*	Per cutter annually (90 mm)*
HP class	2	2	2	2
HP	<300	<300	<300	<300
Weight sole**	517	377	82797	60323
Weight plaice**	233	232	37295	37174
Weight bycatch☐	524	524	83867	83867
Value sole	€ 5,582	€ 4,205	€ 893,150	€ 672,883
Value plaice	€ 350	€ 348	€ 56,091	€ 55,731
Value bycatch☐	€ 892	€ 892☐	€ 142,739	€ 142,739
Total value	€ 6,824	€ 5,445	€ 1,091,982	€ 871,353

*Calculated on a mean of 160 sea days annually.

**All the weights (sole, plaice and bycatch) consists of dead/gutted fish for landing.

☐bycatch' includes many fish species but exclude sole and plaice.

☐The 'bycatch' consists of turbot with 4.24% (33.00 kg per sea day) and (European) flounder with 2.78% (267.75 kg per sea day) of the entire catch composition (including sole and plaice) in total value (euro). The other fish species compose on average 1% or less of the total value of the catch.

☐The 'bycatch' has been assumed similar to a fishery using an 80mm mesh size in terms of catch composition in species, length, weight and value (prices).

Table 2 Economic results expected for pulse cutters <300 HP with the landing obligation.

MESH SIZE	80MM PER SEADAY	90MM PER SEADAY	PER CUTTER ANNUALLY (80 MM)*	PER CUTTER ANNUALLY (90 MM)*
TOTAL VALUE LANDINGS	6,824	5,445	1,091,982	871,353
FUEL COST☐	1,068	1,068	170,880	170,880
CREW COST☐	2,162	2,162	345,920	345,920
OTHER COST☐	2,653	2,653	424,480	424,480
DEPRECIATION☐	502	502	80,320	80,320
EXTRA DISCARD COST☐	(3,119 kg)☐	(2,213 kg)☐	(499,040 kg)	(354,080 kg)
- PROCESSING ASHORE☐	951	675	152,160	108,000
- PROCESSING ABOARD ⁴	864	864	138,240	138,240
ECONOMIC RESULT	-1,376	-2,479	-220,018	-396,487

The numbers in table 2 are in € (euro).

*Calculated on a mean of 160 sea days annually.

☐Reference: Baarssen et al, 2015.

☐Calculated with the selectivity curve the discarded sole (kg) decreases with 63% and plaice (kg) with 35% per sea day by each cutter (<300 HP) with the 90 mm mesh size in 2015. The discards of bycatch in weight are approached to be equal to 80 mm mesh size, since there were no sampling data available to determine the selectivity curve. The 3,119 kg is based on the distribution of 29% (market category) landed fish and 71% consists of discards in weight (Baarssen et al., 2015).

☐Cost ashore per kg is €0.305 (Baarssen et al., 2015).

⁴ Cost aboard is based on an estimated extra 2 FTE with cost of €432 per crew member per sea day (Baarssen et al., 2015). Based on the diminished weight of discards (-29%) by 90mm fishing it is assumed that the work load (in time) could decrease. However, from a logical perspective you should decrease by more than 50% weight of discards (and therefore -50% working time) to be

able to save one extra crew member. Since you could not save less than a whole crew member fishing for a whole week aboard. For the situation of 90mm it is assumed from this argument that despite 29% less discards (in weight) still 2 extra crew members are required.

Catch results with two different mesh sizes for large sized pulse cutters (>300 HP).

Figure 2 Catch per sea day by pulse cutter >300 HP.

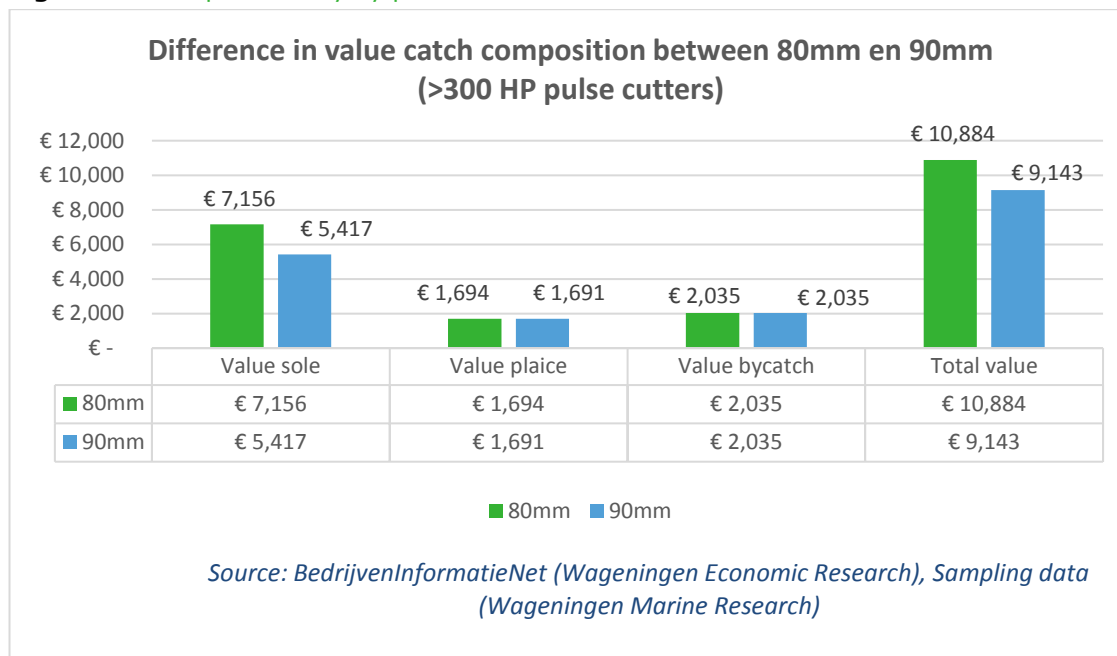


Table 3 Catch composition in weight and value by pulse cutters >300 HP.

Mesh size	80mm per sea day	90mm per sea day	Per cutter annually (80 mm)*	Per cutter annually (90 mm)*
HP class	5	5	5	5
HP	>300	>300	>300	>300
Weight sole**	688	490	130765	93133
Weight plaice**	1179	1165	224069	221514
Weight bycatch [⊠]	559	559	106293	106293
Value sole	€ 7,155	€ 5,417	€ 1,359,578	€ 1,029,289
Value plaice	€ 1,693	€ 1,690	€ 321,850	€ 321,255
Value bycatch [⊠]	€ 2,034	€ 2,034 [⊠]	€ 386,574	€ 386,574
Total value	€ 10,884	€ 9,142	€ 2,068,004	€ 1,737,119

*Calculated on a mean of 190 sea days annually.

**All the weights (sole, plaice and bycatch) consist of dead/gutted fish for landing.

⊠'bycatch' includes many fish species but exclude sole and plaice.

⊠The 'bycatch' consists of turbot with 8.22% (95.6 kg per sea day) and brill with 4.97% (81.5 kg per sea day) of the entire catch composition (including sole and plaice) in total value (euro). The other fish species compose on average 1% or less of the total value of the catch.

⊠The 'bycatch' has been assumed similar to a fishery using an 80mm mesh size in terms of catch composition in species, length, weight and value (prices).

Table 4 Economic results expected for pulse cutters >300 HP with the landing obligation.

MESH SIZE	80MM PER SEADAY	90MM PER SEADAY	PER CUTTER ANNUALLY (80 MM)*	PER CUTTER ANNUALLY (90 MM)*
TOTAL VALUE LANDINGS	10,884	9,142	2,068,004	1,737,119
FUEL COST☐	2,102	2,102	399,380	399,380
CREW COST☐	2,537	2,537	482,030	482,030
OTHER COST☐	2,864	2,864	544,160	544,160
DEPRECIATION☐	500	500	95,000	95,000
EXTRA DISCARD COST	(2,466 kg)☐	(1,806 kg)☐	(468,540 kg)	(343,140 kg)
- PROCESSING ASHORE☐	752	551	142,905	104,658
- PROCESSING ABOARD ⁴	864	864	164,160	164,160
ECONOMIC RESULT	1,265	-276	240,369	-52,269

The numbers in table 4 are in € (euro).

*Calculated on a mean of 190 sea days annually.

☐Reference: Baarssen, J., Luchies, J., Turenhout, M.N. J., Buisman, F.C. (2015).

☐Calculated with the selectivity curve the discarded sole (kg) decreases with 59% and plaice (kg) with 24% per sea day by each cutter (>300 HP) with the 90 mm mesh size in 2015. The discards of bycatch in weight are assumed equal to 80 mm mesh size, since there were no sampling data available to determine the selectivity curve. The 2,466 kg is based on the distribution of 50% market category fish and 50% consists of discards in weight (Baarssen et al., 2015).

☐Cost ashore per kg is €0.305 (Baarssen et al., 2015).

⁴ Cost aboard is based on an estimated extra 2 FTE with cost of €432 per crew member per sea day (Baarssen et al., 2015). Based on the diminished weight of discards (-25%) by 90mm fishing it is assumed that the work load (in time) could decrease. However, from a logical perspective you should decrease by more than 50% weight of discards (and therefore -50% working time) to be able to save one extra crew member. Since you could not save less than a whole crew member fishing for a whole week aboard. For the situation of 90mm it is assumed from this argument that despite 25% less discards (in weight) still 2 extra crew members are required.

4. Discussion

In this desk study the effect has been studied of using two different mesh sizes on a pulse trawl on the selectivity, and ultimately, the economic rentability. By using selectivity curves for both fish species (sole and plaice) and two mesh sizes (80 mm and 90 mm), the selectivity, and finally, the catch composition was calculated. Furthermore, the discards (below Minimum Reference Size, see Table 5) were calculated as well by the selectivity curve for the 90 mm mesh size.

Firstly, for a single pulse cutter with less than 300 HP (Horse Power) fishing with the 80 mm and 90 mm mesh size results into a total value of caught fish per sea day of €6,824 and €5,445 respectively. Based on 160 sea days annually this means €1,091,982 versus €871,353 respectively which is a decrease of 20% by average. This loss of income could be declared by the decrease of 27% marketable sole in weight (value loss of €1,377 per seaday). On the contrary, a decrease of 35% of plaice discards in weight results into less costs for discards processing of €492 per sea day. Finally, fishing with the 90 mm pulse gives despite less plaice discards an even more negative economic result of -€396,487 (-180%) compared to the traditional 80 mm mesh size (-€220,018) with the landing obligation.

Secondly, for a single pulse cutter with more than 300 HP (Horse Power) fishing with the 80 mm and 90 mm mesh size gives the total value of caught fish per sea day of €10,884 and €9,142 respectively. Based on 190 sea days annually this means €2,068,004 versus €1,737,119 for a single large pulse cutter respectively which is a decrease of 16% by average. This loss of income could be declared by the decrease of 29% marketable sole in weight (value loss of €1,738). On the other hand, there is a decrease of 25% of plaice discards in weight (less costs for processing of €309) per sea day. To conclude, despite less plaice discards (-25%) fishing with 90 mm pulse gives an economic result of -€52,269 (-122%) versus the traditional 80 mm mesh size (€240,369).

Finally, for both types of pulse cutters (less and more than 300 HP) there is a loss of income by an larger mesh size of 10 mm. Therefore it could be argued that fishing with 90 mm mesh size for the pulse trawl is from an economic perspective unattractive on short term compared to the traditional 80 mm mesh size.

5. References

Baarsen, J., Luchies, J., Turenhout, M.N.J., Buisman, F.C. (2015). Verkenning economische impact aanlandplicht op Nederlandse kottervloot, Den Haag: Flynth adviseurs en accountants BV & LEI Wageningen UR, 2015, CVO rapport 'Best Practice' 1-12-2015.

Buisman F.C., J.A.E. van Oostenbrugge J.A.E., R. Beukers (2013). Economische effecten van een aanlandplicht voor de Nederlandse visserij. Den Haag: LEI Wageningen UR, (LEI-rapport 2013-062) - p. 48

Van der Reijden, K. J., et al. (2014). Discard self-sampling of Dutch bottom-trawl and seine fisheries in 2013. CVO report: 14.007. Ymuiden: 74.

Table 5 Market category definition for sole and plaice.

Sole		Plaice	
Market category	Lengths	Market category	lengths
1 (Lap)	38 cm +	1	41 cm +
2 (GrootMiddel/GRM)	33-38 cm	2	35-41 cm
3 (KleinMiddel/KLM)	30-33 cm	3	31-35 cm
4 (I)	27-30 cm	4	*27-31 cm
5 (II)	*24-27 cm		

*Minimum Reference Size set by the EU

Table 6 Price per kg market category for sole and plaice (Pulse cutters, 2015).

Sole	<300 HP	>300 HP	Plaice	<300 HP	>300 HP
1 (Lap)	€16.35	€17.10	1	€2.63	€2.63
2 (GrootMiddel/GRM)	€13.17	€13.57	2	€1.79	€1.65
3 (KleinMiddel/KLM)	€11.38	€11.89	3	€1.52	€1.46
4 (I)	€10.10	€10.15	4	€1.31	€1.32
5 (II)	€8.76	€8.49			

Source: *BedrijvenInformatieNet (Wageningen Economic Research)*

*Minimum Reference Size set by the EU

Contact

Wageningen Economic Research Geert Hoekstra
 Postbus 29703 Economic Researcher
 2502 LS Den Haag T +31 (74)84914
www.wur.nl/economic-research E geert.hoekstra@wur.nl