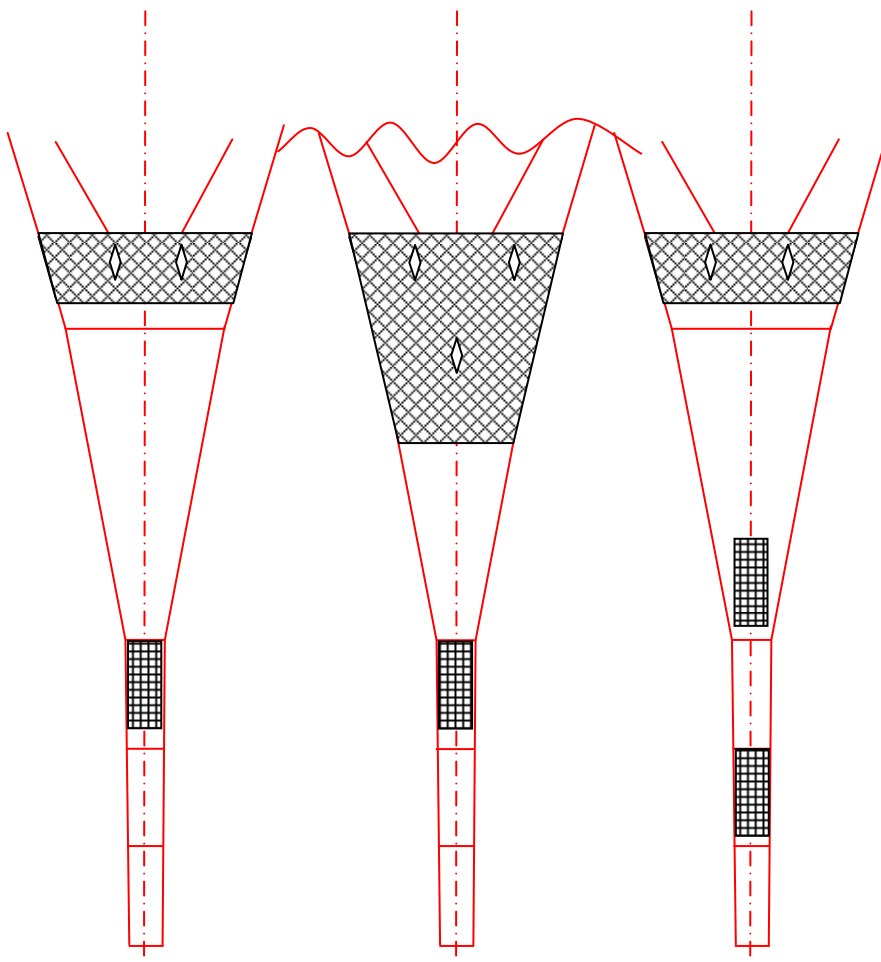


TECHNICAL CONSERVATION TRIALS IN THE NORTHERN IRELAND *NEPHROPS* FISHERY

FINAL REPORT 2007

Not to be cited without prior reference to ANIFPO and AFBI



TECHNICAL CONSERVATION TRIALS IN THE NORTHERN IRELAND *NEPHROPS* FISHERY

February 2007

Funding

This project was conceived by the Anglo- North Irish Fish Producers Organisation Ltd (ANIFPO), was supported by AFBI and DARD, and co-funded by the Northern Ireland Building Sustainable Prosperity (BSP) programme. The BSP and in particular the Financial Instrument for Fisheries Guidance (FIFG) scheme aims to contribute to achieving a sustainable balance between fishery resources and their exploitation. It also seeks to strengthen the competitiveness of the sector and the development of areas dependent upon it.

Management

A steering group of representatives from ANIFPO, AFBI, SEAFISH, net makers and an independent gear technologist manage the project.

Project Steering Group

Alan McCulla	Chief Executive ANIFPO
Brian Annett	MFV Bounteous
Hubert Annett	MFV Albacore
Stanley Hanna	MFV Fairwind
Malachy Polland	MFV Immanuel V
David Zych	MV Olive Branch
Terry Cunningham	TC Nets
Jim Hamilton	James Hamilton Trawl Net Manufacturers
Ken Arkley	SEAFISH, Hull (Senior Gear Technologist)
Paddy Campbell	DARD Policy Division
Dr Richard Briggs	AFBI Scientist, Aquatic Systems Branch
Pieter-Jan Schön	AFBI Scientist, Aquatic Systems Branch
Michelle Allen	AFBI Biometrician
Enda O’Callaghan	AFBI Observer, Aquatic Systems Branch
Greg Foster	AFBI Observer, Aquatic Systems Branch
Dr Norman Graham	IMR, Bergen, Norway (Independent Advisor)

Introduction

In 1991, the Northern Ireland *Nephrops* fleet operating in the Irish Sea consisted of more than 200 trawlers of over 10 m length with a engine powers of 200-500 hp. The vessels used single net otter trawls of low headline height (< 1.5 m) and the same mesh size throughout (70 mm). The minimum mesh size was increased to 70 mm in the mid-80s, and for single net

otter trawls is the optimum mesh size for Irish Sea *Nephrops* (Briggs, *et al.*, 1999). A revised package of EC Fisheries Technical Conservation measures came into force on 1 January 2000. This new legislation incorporated a system of "mesh size ranges" for each of which has been identified a list of target species. In effect, nets in the 70-79 mm mesh size range must have at least 35% of the list of target species which include *Nephrops* and the 80-99 mm mesh size range requires at least 30% of the list of target species which also includes *Nephrops* (Conger Eel, Gurnard, Mackerel and Herring also make up this list). Following a series of studies in the 80's and 90's (Briggs, 1992) a square mesh panel (SMP) of 80 mm became mandatory for 70-79 mm nets in the Irish Sea. Further studies involving commercial vessels subsequently provided optimum positioning data for the SMP (Armstrong *et al.*, 1998). Vessels using twin-rig gear in the Irish Sea require a mesh size of at least 80mm (but no SMP is required for meshes of 80mm and above). Other *Nephrops* conservation measures in the Irish Sea are a minimum landing size of 20mm carapace length (= 37 mm tail length and 70 mm total length).

Over the seven-year period from 1992 to 1998, there were 6 decommissioning rounds in Northern Ireland. These removed 56 vessels from the fleet traditionally associated with *Nephrops* fishing, leaving a fleet of 174 vessels at the end of December 1998. Further fleet reductions left 108 vessels >10m in 2005 capable of fishing for *Nephrops* of which roughly 50 work twin trawls for part of the year. Single trawl vessels normally do 1-2 day trips of 3-4 hour tows while twin-trawl vessels stay at sea for 3-5 days and do tows of 4-12 hours duration. Landings are into the three traditional Northern Ireland ports of Kilkeel, Ardglass and Portavogie. Historically, *Nephrops* were landed into Northern Ireland as tails only and sold to supply the lucrative 'scampi' industry for consumption at home and abroad. The scampi industry requires a sustained supply of small *Nephrops*, which are usually homogenised and coated in breadcrumbs to produce the popular product. In the last 15-20 years, however, the trend has been towards landing whole large *Nephrops* for the export market. Although the valuable *Nephrops* fishery represents around 50 % (£7.5 million) of the combined first sale value of all the Northern Ireland sea fisheries, the mixed nature of the grounds fished (Briggs, 1985) means there is an important by-catch component for a range of species. Of these haddock and cod now rank as the most important. Although historically whiting was within the top 3 commercial species, it no longer ranks within the top 20 species in economic importance. High discard mortality of whiting has always been a feature of the Irish Sea *Nephrops* fishery (Watson, 1973; Watson and Parsons, 1974 and Briggs, 1985) and

despite the introduction of a range of technical measures it is still the most discarded commercial species (Anon., 2002 and 2004).

The perceived high levels of discards of juvenile cod and whiting are particularly problematic in light of the Irish Sea Cod Recovery Plan (initiated in 2000) and the poor status of the whiting stock. The challenge is to reduce the discards of juvenile fish and harvest them in a sustainable fashion while at the same time maximising the value of the catch for fishermen. The discard problem has been recognised by the fishing industry and in an attempt to address this the Anglo-North Irish Fish Producers Organisation Ltd (ANIFPO) conceived a project considering improved gear selectivity. The aim of the project was to examine the effectiveness of recently introduced technical conservation measures, while investigating if these measures can be improved upon by reducing unwanted by-catch in commercial *Nephrops* trawls. These measures were originally proposed by the industry in 2000 and introduced from 1 January 2001 as part of the Irish Sea Cod Recovery Programme, in an attempt to reduce discard levels in the *Nephrops* fishery. Trials on the effectiveness of these measures were never performed and are the subject of this study, in order to address concern about discards without loss of marketable fish.

This is a collaborative project between a sector of the Northern Ireland fishing industry (ANIFPO), AFBI scientists, DARD and independent gear technologists from SEAFISH and IMR. All parties were involved in the design of the project and data were collected collaboratively between the fishermen and AFBI scientist.

Methods

Gear tested

It was agreed that standard regulated gear of a type commonly used in the Irish Sea be used as a control during the comparative fishing trials ie trawls of 80 mm mesh for twin-rigs and 70 mm mesh for single-rig vessels. The gears to be used during the study were as detailed in Figure 1 and summarized below:

- *Control*: Standard 70mm/80mm prawn trawl with 160mm X 15 mesh cover and existing 3 metre X 90mm Square Mesh Panel (SMP).
- *Option 1*: 70mm/80mm standard prawn trawl with 160mm X 50 mesh cover and standard 3 metre X 90mm SMP.

- *Option 2:* standard 70mm/80mm prawn trawl with 160mm X 15 mesh cover and standard 3 metre X 90mm SMP, with a second 3 metre X 100mm SMP to be inserted as per Danish experiments (9-12m from the codline).

Vessel Selection

As the project was designed to involve ANIFPO affiliated fishermen from all three Northern Ireland ports of Portavogie, Ardglass and Kilkeel tenders were sought from fishermen with a view to chartering vessels to perform the investigations. Five vessels were selected as detailed in Table 1 and comprised of one Twin-rig, two single-rig vessels between 12 & 20 metres and two single-rig vessels under 12 metres and is representative of the Northern Ireland. A range of vessel sizes was also selected because technical conservation measures perform differently with different sized vessels (Briggs et al., 1999). It was agreed that the twin-rig vessel would provide a useful tool for direct comparison of gear performance between two nets. However, as these vessels tend to be of higher power compared to the majority of *Nephrops* trawlers in the fleet it was important that trials were performed with medium and small single-rig vessels. Chartering two vessels in each of these size categories enabled parallel hauls over similar grounds to be performed.

Table 1: Vessels used for the gear trials

PLN	Name	Homeport	GT	Overall Length (m)	Power MCEP	Beam (m)	Normal Gear
N942	BOUNTEOUS	KILKEEL	88	19.8	172.0	6.1	TR
N303	ALBACORE	KILKEEL	56	16.8	205.2	5.5	SR
N19	OLIVE BRANCH	ARDGLASS	71	18.6	171.0	6.0	SR
N78	IMMANUEL V	KILKEEL	10	9.6	105.0	4.2	SR
B918	FAIR WIND	KILKEEL	19	9.9	74.0	4.1	SR

SR=Single-rig TR = Twin-rig

Experimental design and sampling procedures

Overall 127 comparative tows (254 hauls) were made between the control gear and the two experimental gears over the period 15th August until 4th November 2005 as detailed in Table 2. The areas fished were within the Irish Sea (Area VIIa) and nearby areas (VIa). This was determined by weather conditions and was restricted to those places where a suitable mixed species catch could be obtained. Tows were of similar duration to those performed commercially, i.e., twin-rig 4-12 hours and single-rig 3-4 hours. Hauls were conducted in a straight tow (as much as practically possible) and if at all possible either into or with the tidal direction.

Table 2: Comparative tows made during the study

Vessel Name	Method	Options	Comparisons	Tows Completed
BOUNTEOUS	Twin-rig	Contr/Opt 1	25	50
		Opt 1/Opt 2	16	32
ALBACORE & OLIVE BRANCH	Single-rig	Contr/Opt 1	44	88
IMMANUEL V & FAIRWIND	Single-rig	Contr/Opt 1	42	84
Totals			127	254

(a) Twin-rig comparisons

The catch from each of the two nets (i.e., experimental and control) were kept separate on hauling and emptied as quickly as possible to minimise surface washout from the second cod-end. Where possible the second cod-end was wound onto the net drum so that the cod-end was clear of the water while the first one was being emptied. The crew as under normal commercial fishing practices sorted the catch.

(b) Single-rig comparisons

The parallel haul method was used, where two vessels, one with the control the other with the test trawl, tow side by side. The distance between the two vessels as small as practically possible and fishing patterns followed commercial conditions. Skippers of the two vessels performing parallel tows selected areas where both vessels could tow in a straight, parallel direction. It was also important that both vessels fished in similar water depths. Depth and position was recorded at the start and end of each tow. Skippers agreed on a standard start and end time for each tow, i.e., when the gear had settled on the bottom and when the winches were engaged for hauling. Start and stop times were carefully recorded. Gears were swapped each 24hr period and a note made of the gear variant towed by each vessel. Checks were made on both trawls, experimental and control (twin-rig and single rigs) for comparability including cod-end mesh sizes/twine diameters, number of meshes round, etc. Gear geometry was also monitored during trials for example door spreads, wing-end spreads, headline heights, towing speeds, etc. Observations on gear performance with the variations under test such as the presence of ‘stickers’ in escape panels were noted as these can often provide useful indication of fish behaviour and effectiveness of the device under test.

Sampling methods

The crew according to normal commercial practice sorted the catch. Retained fish from the bulk catch were separated and placed into boxes and baskets. Marketable *Nephrops* were sorted into large animals to be landed whole and smaller animals to be tailed. The number of baskets in each *Nephrops* component was counted. After the catch had been sorted by species the AFBI observers and crew measured the length frequencies of fish to the nearest cm below. As many fish were measured as practically possible. If there was a large catch of similar sized fish and time was short, a sub-sample was measured and a raising factor applied. Total catch weights were estimated by volume (basket count) by species for each haul and each net. Remaining discard catch of fish and *Nephrops* were separated into baskets or boxes to provide an estimate of total discards for each tow. Any rubbish was also placed in baskets and quantified.

Data Collation and Analysis

The data collected from all 254 hauls were collated through a software-logging package developed by AFBI Biometrics Division. Length frequency data for landed and discarded components of the catch were combined and raised to the total catch per hour of each species by haul. This enabled the catch rate at length by gear type to be compared. Initial analysis has been performed on the main commercial species with particular attention to cod, haddock and whiting, as these are the main species for which an improved selectivity is sought. The mean catch rates (number of fish per hour) in 1cm size categories and the relative size composition have been generated for these species from each comparison. The mean proportions $P(l)$ of total catch retained were plotted against length:

$$P(l) = C_{Opt 1} / [C_{Opt 1} + C_{Control}]$$

Where $C_{Opt 1}$ and $C_{Control}$ are the numbers caught per hour in gear types Option 1 and the Control (Standard gear). Variability in $P(l)$ was examined over each series of hauls and the deviation in mean $P(l)$ from 0.5 was noted. A value of $P(l) = 0.5$ for example indicates no difference in the catch of the two nets being compared. This format for summarizing the data was adopted for the species caught during each comparison.

RESULTS

A summary of catch rates of cod haddock and whiting is presented in Table 3.

Table 3: Mean catch numbers of cod, haddock and whiting caught above and below mls for different gear configurations per hour of fishing

Species	Fish length (cm)	Number of fish caught per hour s fishing							
		Bounteous Twin- comparisons				SR Over 12m		SR Under 12m	
		Opt 1	Cont	Opt 1	Opt 2	Opt 1	Cont	Opt 1	Cont
Cod	<35	4.41	5.48	0.53	0.20	5.20	4.68	7.30	5.23
	>35	0.76	0.62	0.12	0.16	0.04	0.02	0.00	0.00
Haddock	<30	79.90	70.20	0.24	0.16	200.12	216.94	158.75	159.19
	>30	3.50	4.40	0.14	0.20	0.07	0.14	0.03	0.01
Whiting	<27	80.77	110.60	143.24	156.46	332.60	381.37	325.05	314.06
	>27	2.66	4.90	1.41	2.48	0.72	0.44	0.08	0.06

Twin-Rig Comparisons: MFV Bounteous

Trials were completed in Irish Sea and west of Scotland waters as indicated in Figure 2

Option 1 v Control (standard configuration) – 25 valid comparisons

COD: (Figures 3a-c). The data indicate a similar catch rate and size selection by both gears.

There was no significant difference in the proportion [$P(l)$] of cod retained (Figure 3c).

HADDOCK: (Figures 4a-c). Catches were virtually identical by the two gears with $P(l)$ values hovering around 0.5.

WHITING: (Figures 5a-c). The size composition of fish caught in the two nets was similar, though Option 1 seemed to release more large fish. This is marked by a reduction in $P(l)$ for fish over 18cm. There was no discernable difference in catches of very small fish of length 7-17cm.

Option 1 v Option 2 – 16 valid comparisons

COD: (Figures 6a-c). Cod catches in the trial were too low (< 1 fish per hr) for any valid analysis to be performed.

HADDOCK: (Figures 7a-c). Very similar catch rates and size composition, though proportion retained by Option 2 tended to be higher, suggesting that a very slightly higher proportion of larger fish (length 23-36cm) were escaping from the Option 1 configuration.

WHITING: (Figures 8a-c). No discernable difference in selectivity with a hint of larger fish (16-30) escaping from the Option 2 configuration.

Single-Rig (over 12m) Comparisons: MFV Albacore and MFV Olive Branch

Trials were completed in Irish Sea as indicated in Figure 9

Option 1 v Control (standard configuration) - 44 valid comparisons

COD: (Figures 10a-c). Very small catches (<5 fish per hr) with little difference between gear types used in the trials.

HADDOCK: (Figures 11a-c). No difference in catches could be detected between gear types.

WHITING: (Figures 12a-c). Very similar catches with slightly fewer whiting over 15 cm in the Option 1 gear.

Single-Rig (under 12m) Comparisons: MFV Immanuel and MFV Fairwind

Trials were completed in Irish Sea as indicated in Figure 13

Option 1 v Control (standard configuration) - 42 valid comparisons

COD: (Figures 14a-c). Less than cod per hour with no discernable difference in catches between the two gear types.

HADDOCK: (Figures 15a-c). No apparent difference in selectivity.

WHITING: (Figures 16a-c). Similar length compositions

CONCLUSIONS AND DISCUSSION

- The data should be examined and discussed by the Steering Group.
- The results suggest that neither Option 1 nor Option 2 gear configurations affect catches of cod, haddock or whiting. Cod catches were too low (< 7 fish per hr) for a meaningful analysis.

- Similar data are available for all commercial and non-commercial species caught
- *Nephrops* catches were similar in each experiment and the amounts caught are available
- Once the Steering Group have identified priorities further statistical analysis can proceed.

REFERENCES

- Anon., 2002. Monitoring of discarding and retention by trawl fisheries in western waters and the Irish Sea in relation to stock assessment and technical measures. *Final Report of EU (DGXIV) contract Ref 98/095*.
- Anon., 2004. Quantities of whiting discarded from UK *Nephrops* vessels in the Irish Sea. *Joint paper by CEFAS and AFBI resulting from the Fisheries Science (FSP) initiative* 14pp.
- Armstrong, M. J., Briggs, R.P., Rihan, D., 1998. A study of optimum positioning of square mesh escape panels in Irish Sea *Nephrops* trawls. *Fisheries Research*, 34, 179-189.
- Briggs, R. P., 1985. Catch composition in the Northern Ireland *Nephrops* fishery. *Fisheries Research*, 3, 47-60.
- Briggs, R. P., 1992. An assessment of nets with a square mesh panel as a whiting conservation tool in the Irish Sea *Nephrops* fishery. *Fisheries Research*, 13, 133-152.
- Briggs, R.P., Armstrong, M. J., Rihan, D., 1999. Optimum mesh size in the Irish Sea *Nephrops* fishery: An experimental approach. *Fisheries Research* 40, 43-53.
- Watson, P. S., 1973. The Northern Ireland fishery for the Norway Lobster *Nephrops norvegicus* (L.) 1962-1972. *DANI Fisheries Research Leaflet* No. 6, 17pp.
- Watson, P. S. and Parsons, J., 1974. The by-catch of whiting in the Northern Ireland fishery of *Nephrops norvegicus* (L.). *ICES CM* 1974/F:29, 14pp.

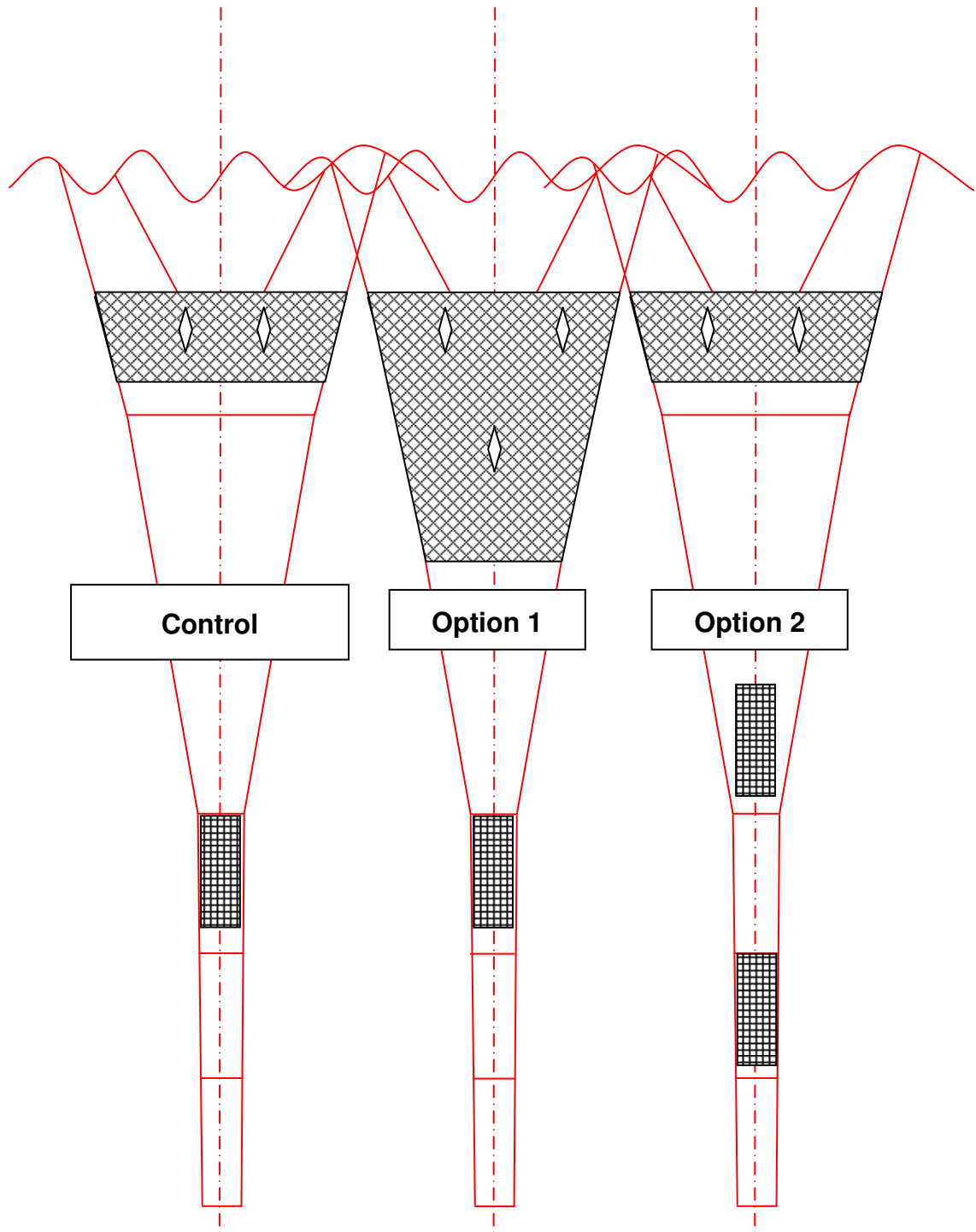


Figure 1: Gear designs used in trials.

Control: Existing 70mm/80mm prawn trawl with 160mm X 15 mesh cover and existing 3 metre X 90mm Square Mesh Panel (SMP).

Option 1: 70mm/80mm prawn trawl with 160mm X 50 mesh cover and existing 3 meter X 90mm SMP.

Option 2: Existing 70mm/80mm prawn trawl with 160mm X 15 mesh cover and existing 3 metre X 90mm SMP, with a second 3 metre X 100mm SMP to be inserted as per Danish experiments (9-12m from the cod line).

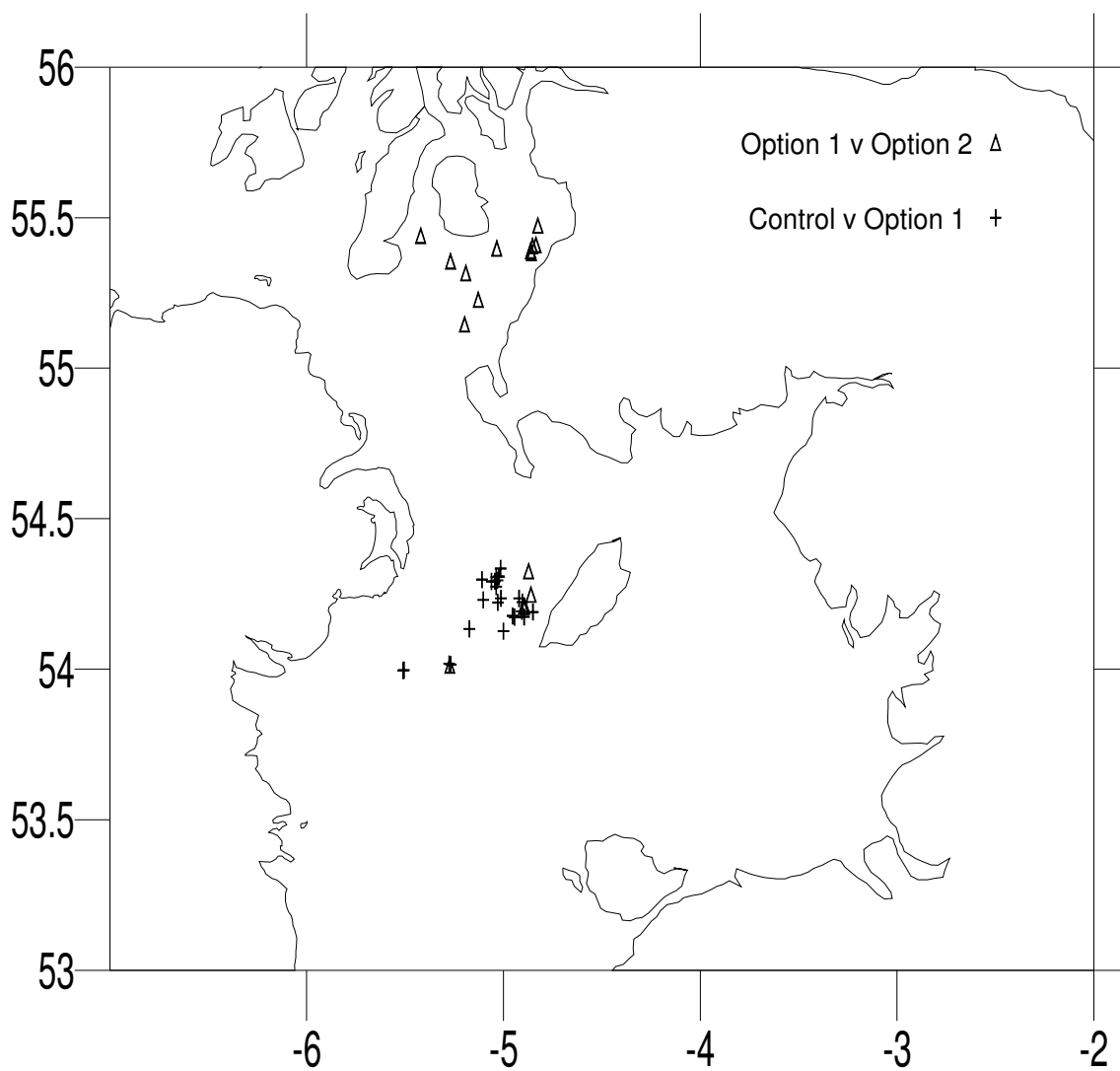


Figure 2: Position of hauls made by MFV Bounteous (twin-rig) to compare (a) Option 1 and Control gear (b) Option 1 and Option 2 gear configurations as explained in Figure 1

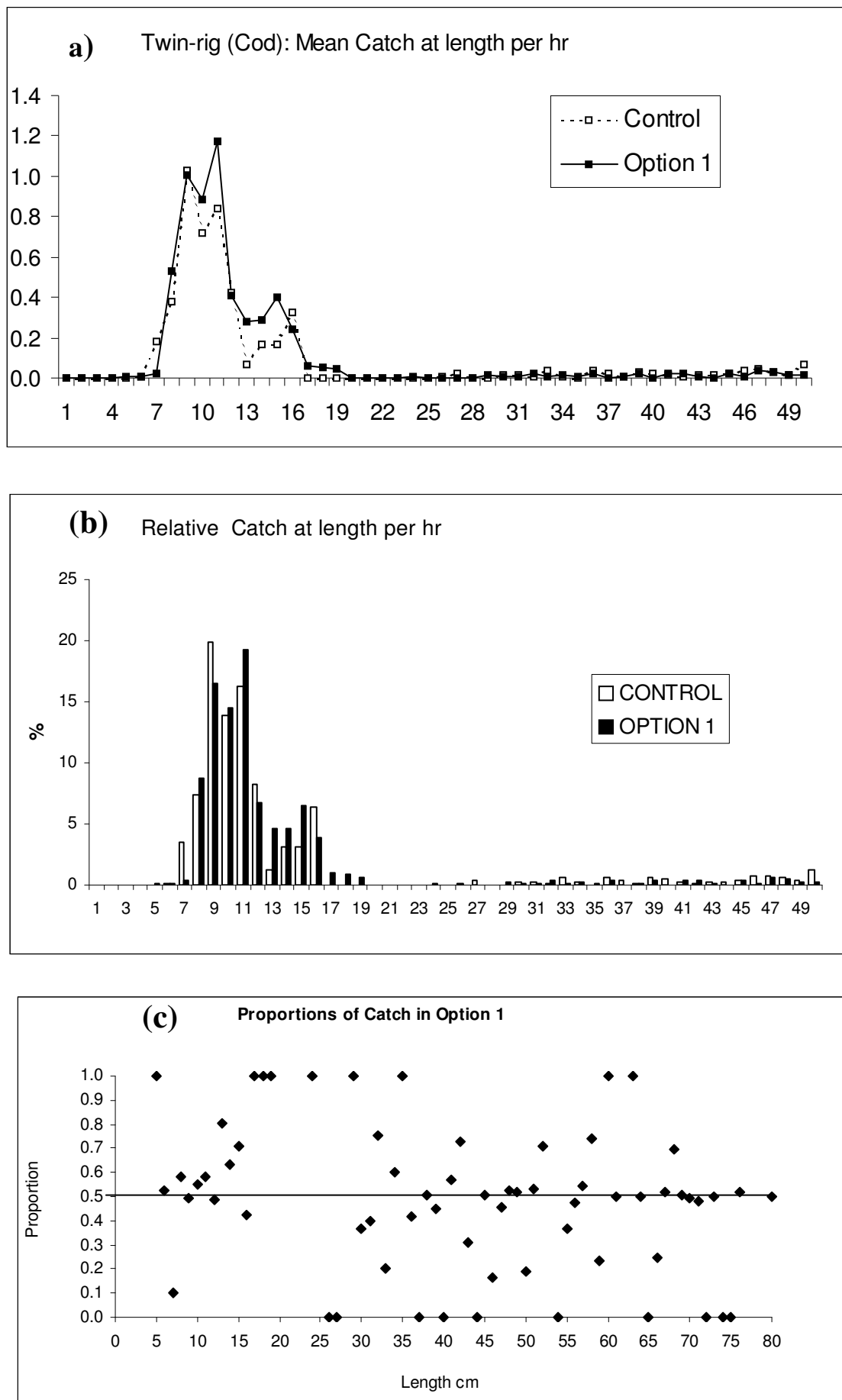


Figure 3: Cod catches during twin-rig comparisons performed by *MFV Bounteous* using Option 1 and Control gear (a) Mean catch at length per hour (b) Relative size composition (c) Proportion (*Pl*) of catch retained by gear Option 1

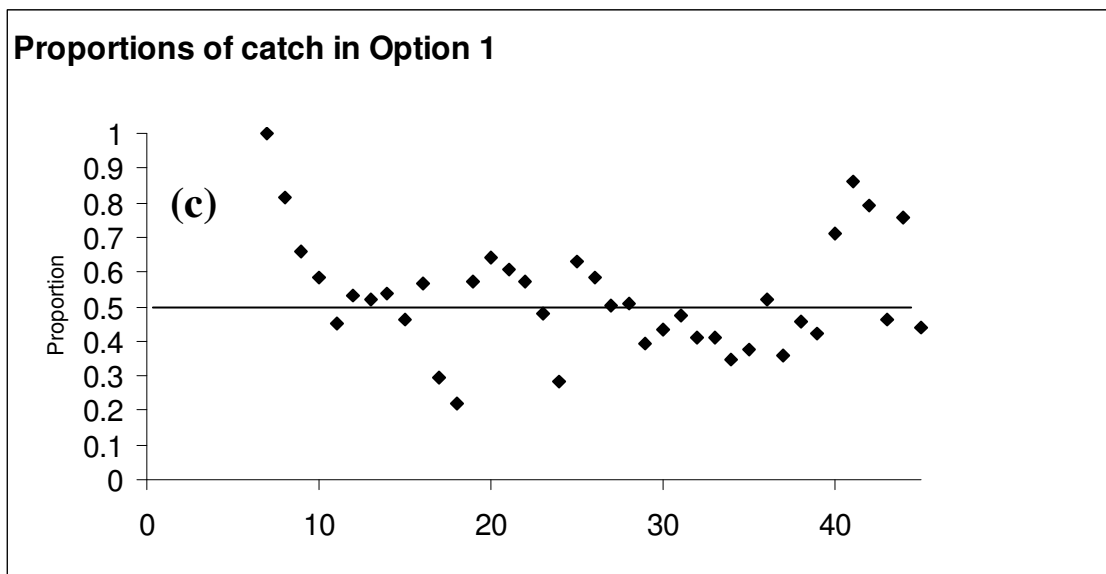
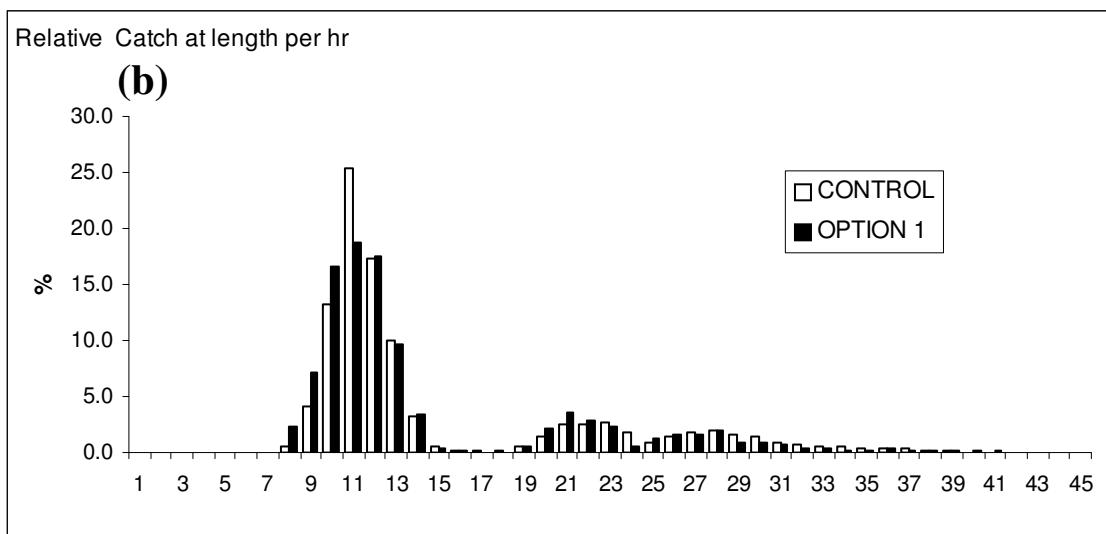
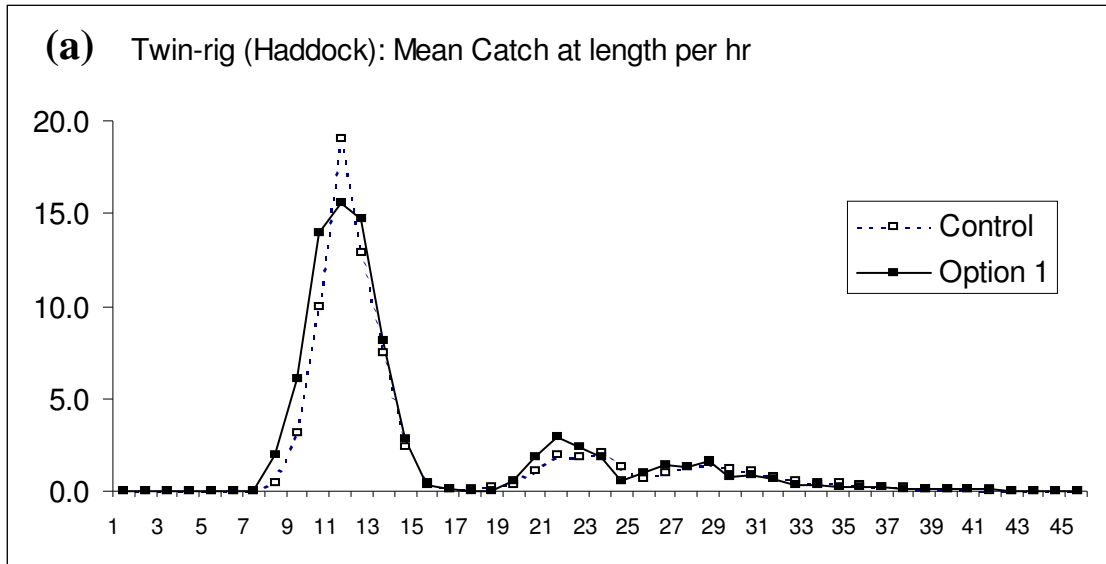


Figure 4: Haddock catches during twin-rig comparisons performed by *MFV Bounteous* using Option 1 and Control gear (a) Mean catch at length per hour (b) Relative size composition (c) Proportion (*Pl*) of catch retained by gear Option 1

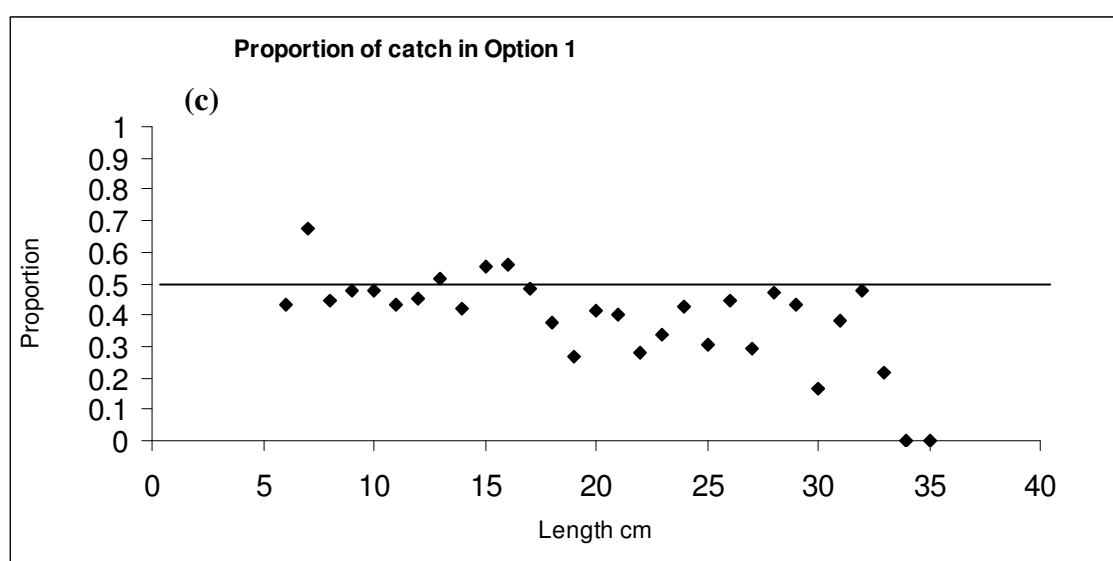
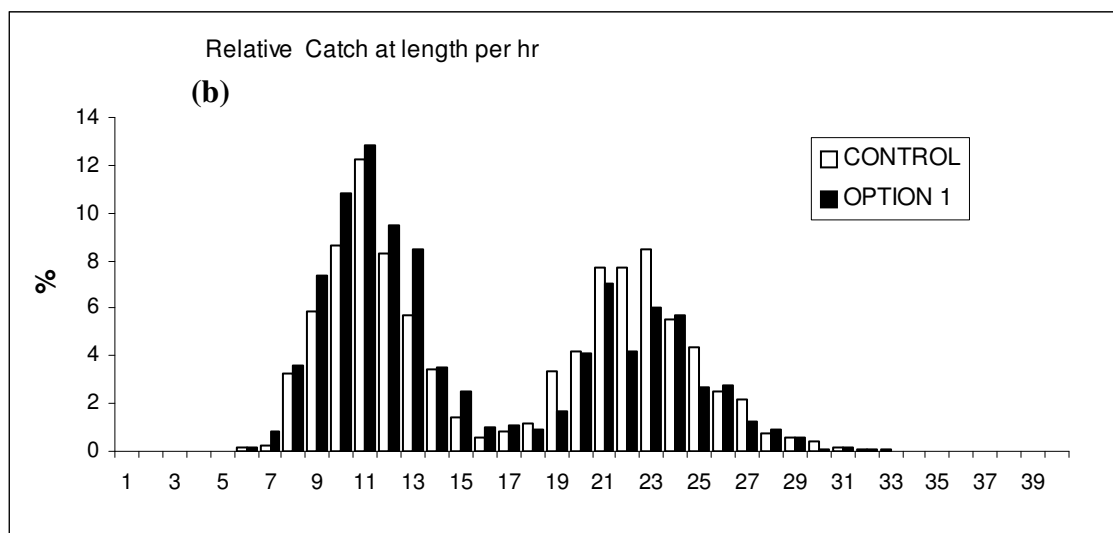
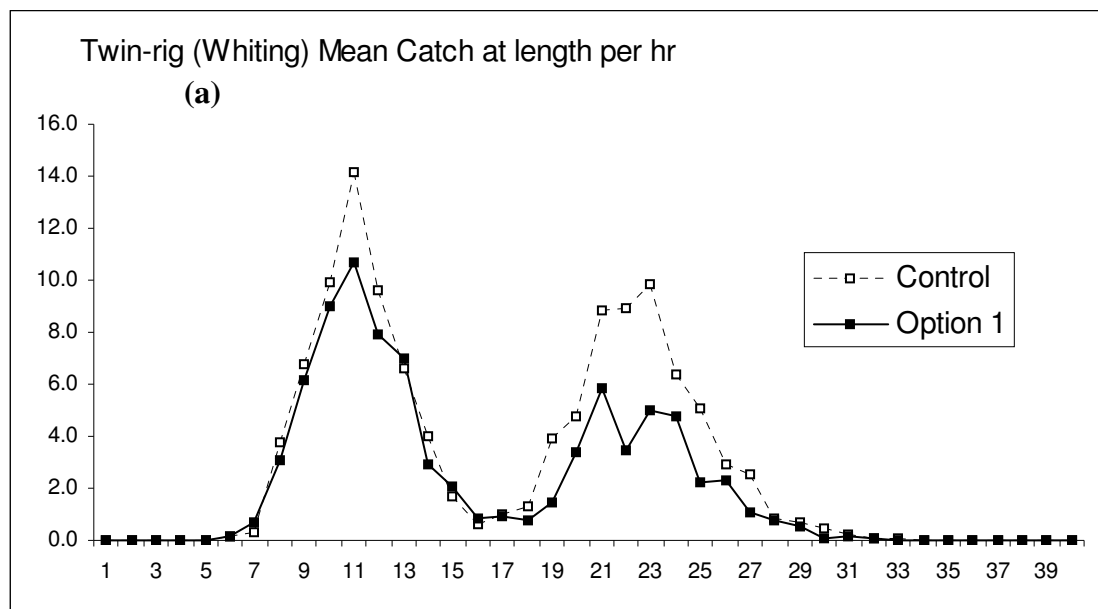


Figure 5: Whiting catches during twin-rig comparisons performed by *MFV Bounteous* using Option 1 and Control gear (a) Mean catch at length per hour (b) Relative size composition (c) Proportion (*Pl*) of catch retained by gear Option 1.

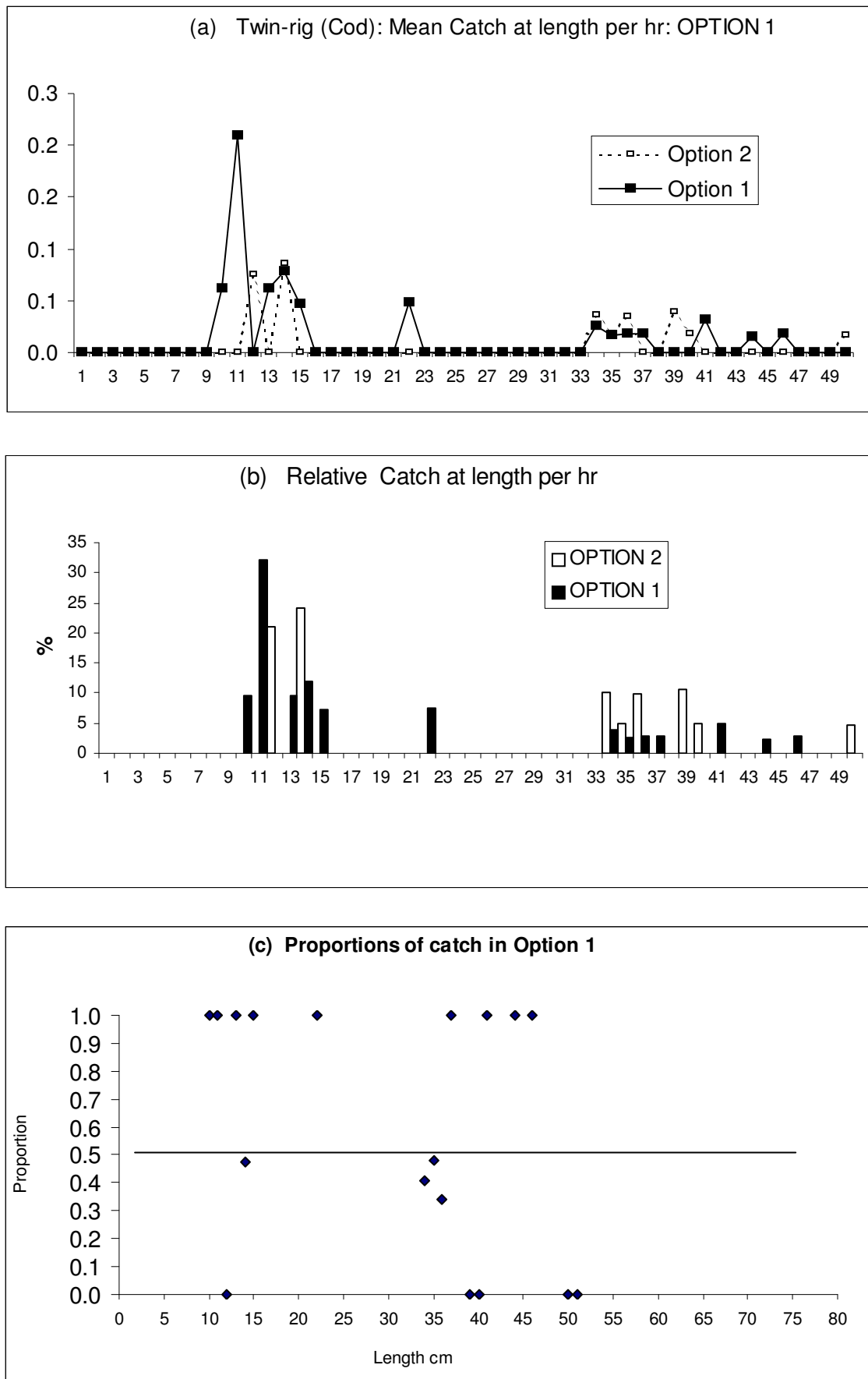


Figure 6: Cod catches during twin-rig comparisons performed by *MFV Bounteous* using Option 1 and Option 2 (a) Mean catch at length per hour (b) Relative size composition (c) Proportion (*Pl*) of catch retained by gear Option 1.

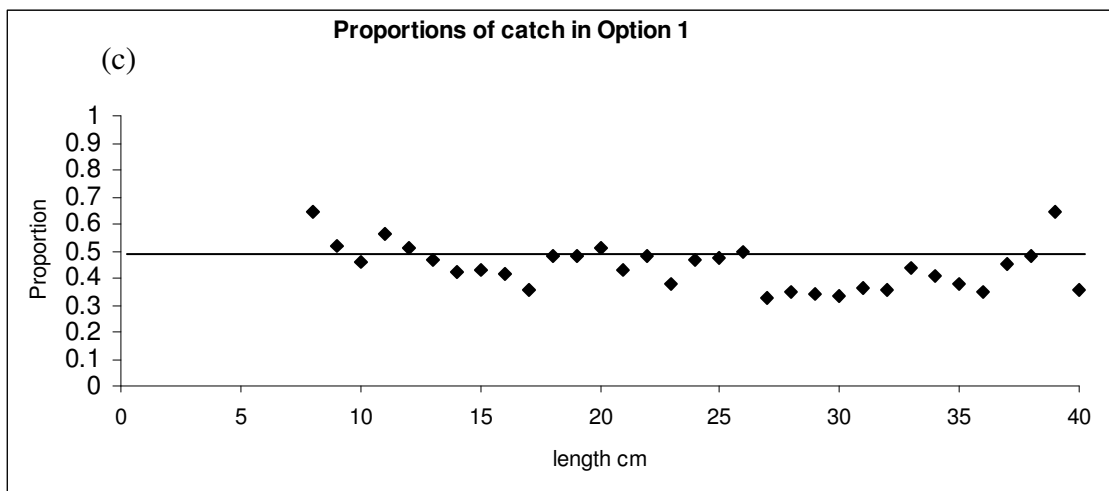
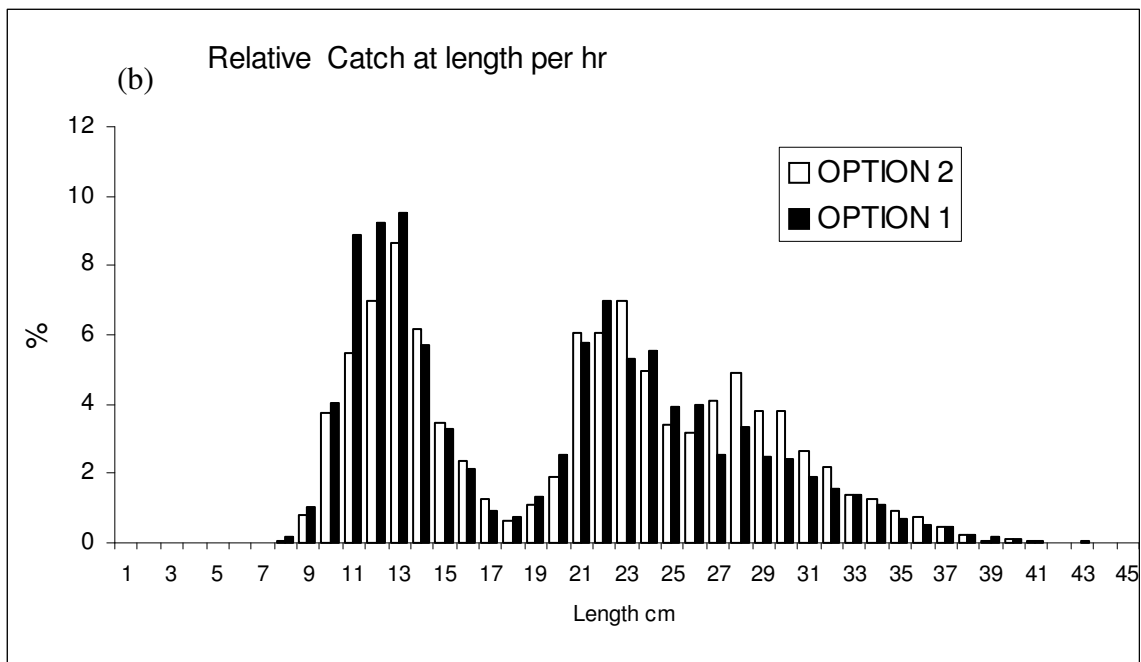
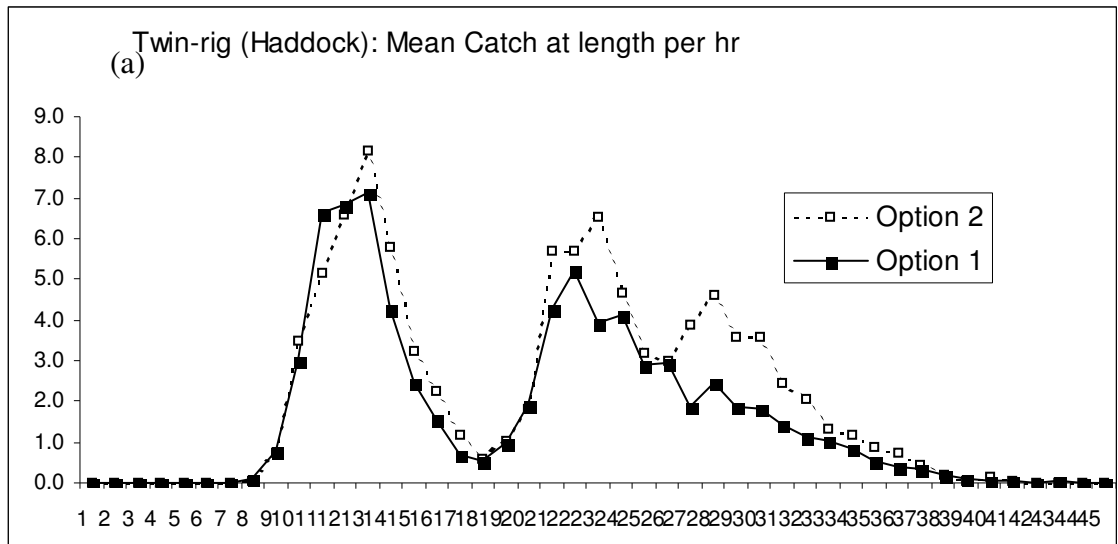


Figure 7: Haddock catches during twin-rig comparisons performed by *MFV Bounteous* using Option 1 and Option 2 (a) Mean catch at length per hour (b) Relative size composition (c) Proportion (P_l) of catch retained by gear Option 1.

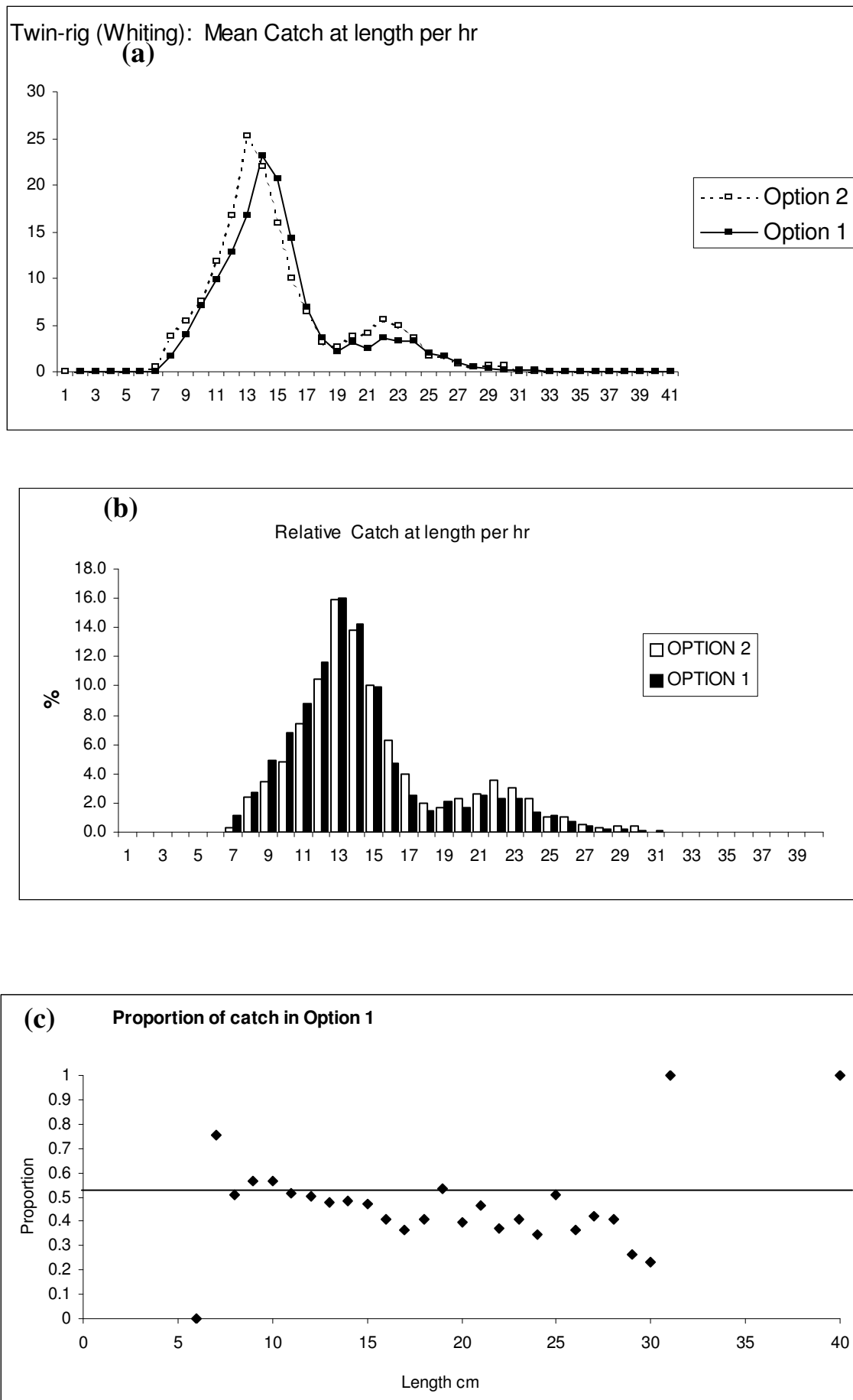


Figure 8: Whiting catches during twin-rig comparisons performed by *MFV Bounteous* using Option 1 and Option 2 (a) Mean catch at length per hour (b) Relative size composition (c) Proportion (*PI*) of catch retained by gear Option 1.

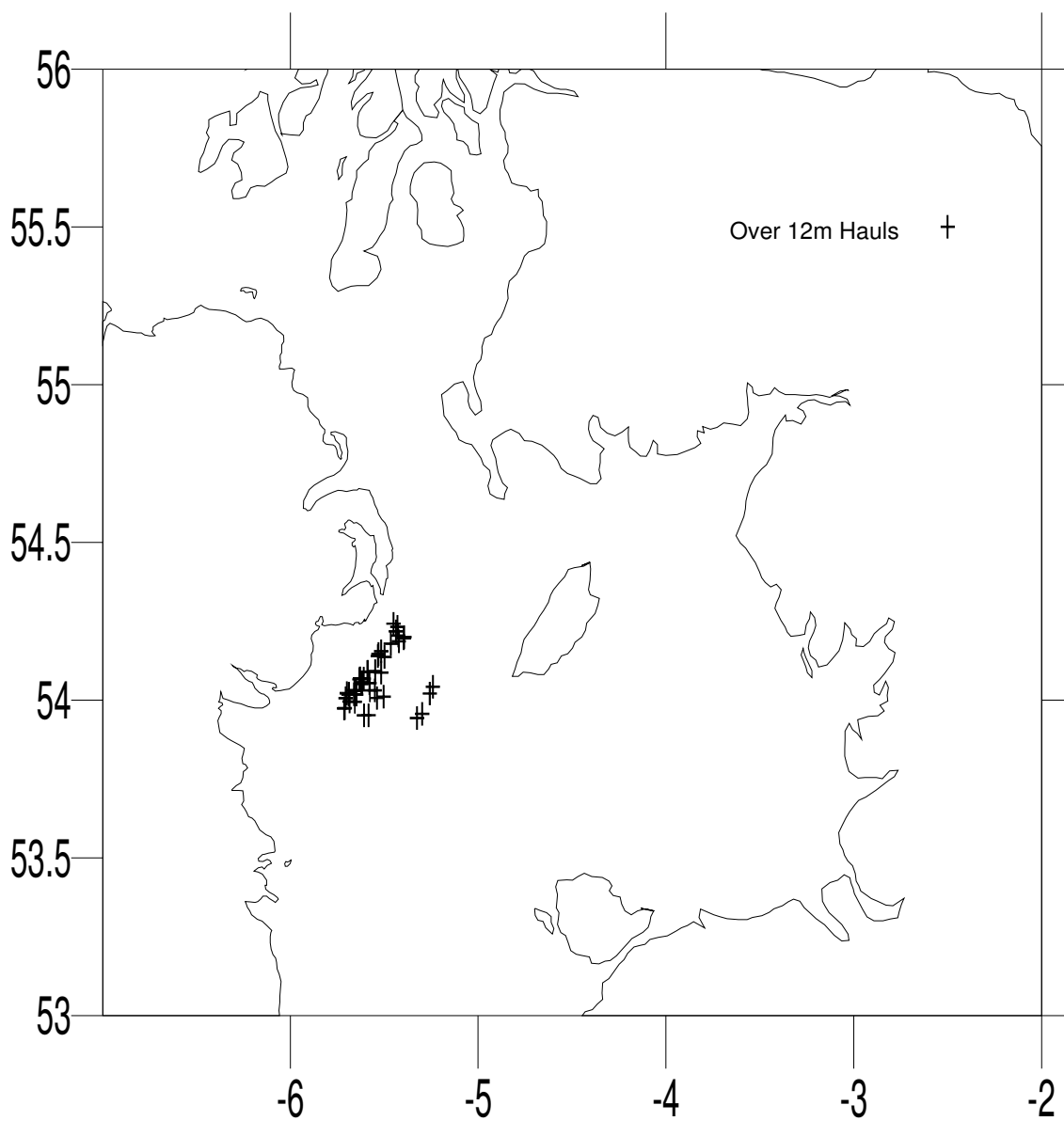


Figure 9: Position of hauls made by MFV Albacore & Olive Branch (single-rigs) to compare Option 1 and Control gear configurations as explained in Figure 1

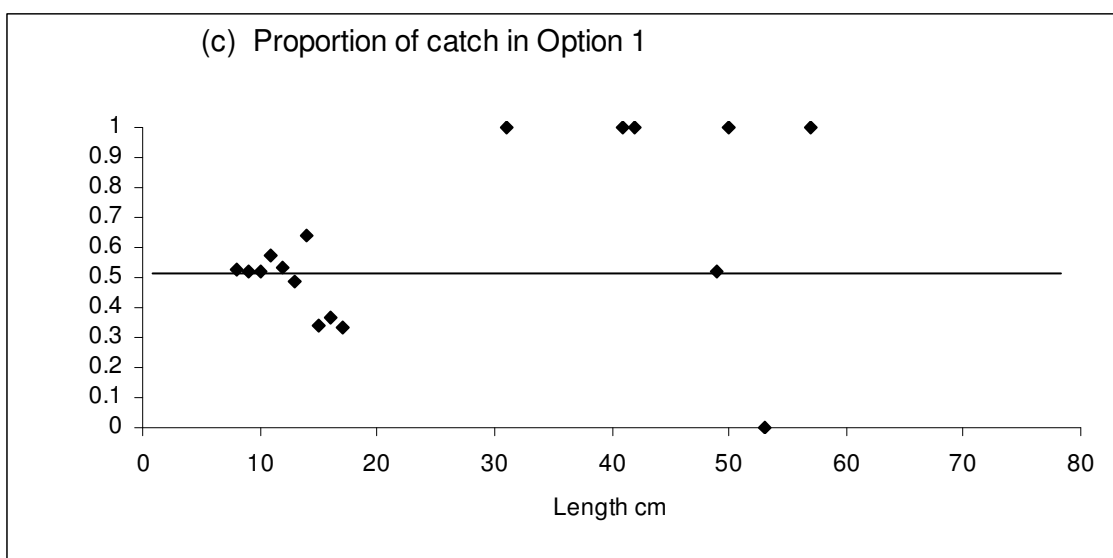
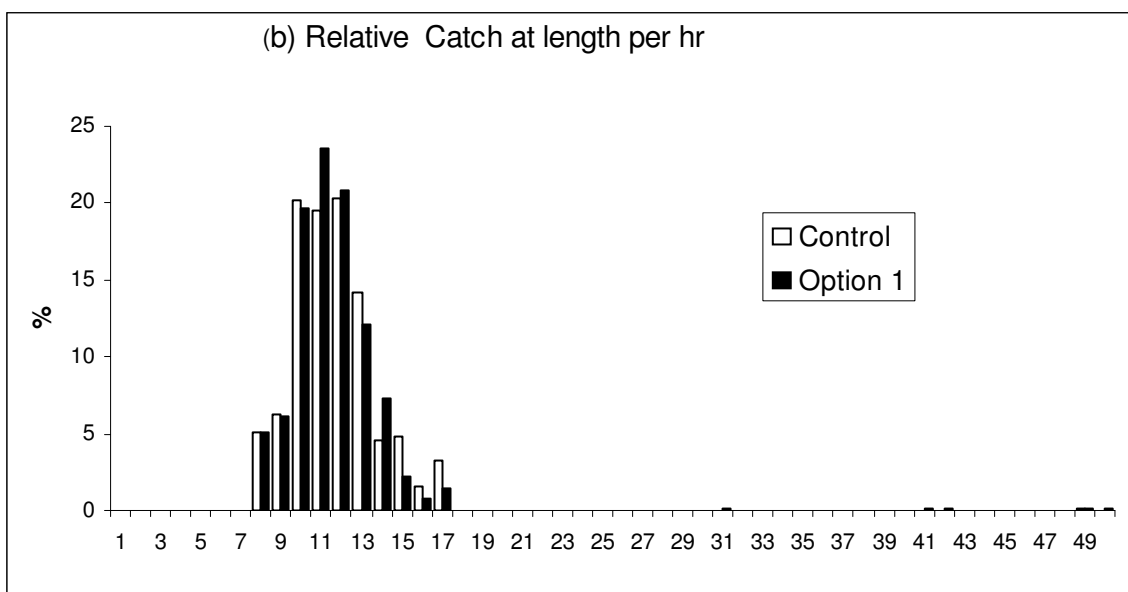
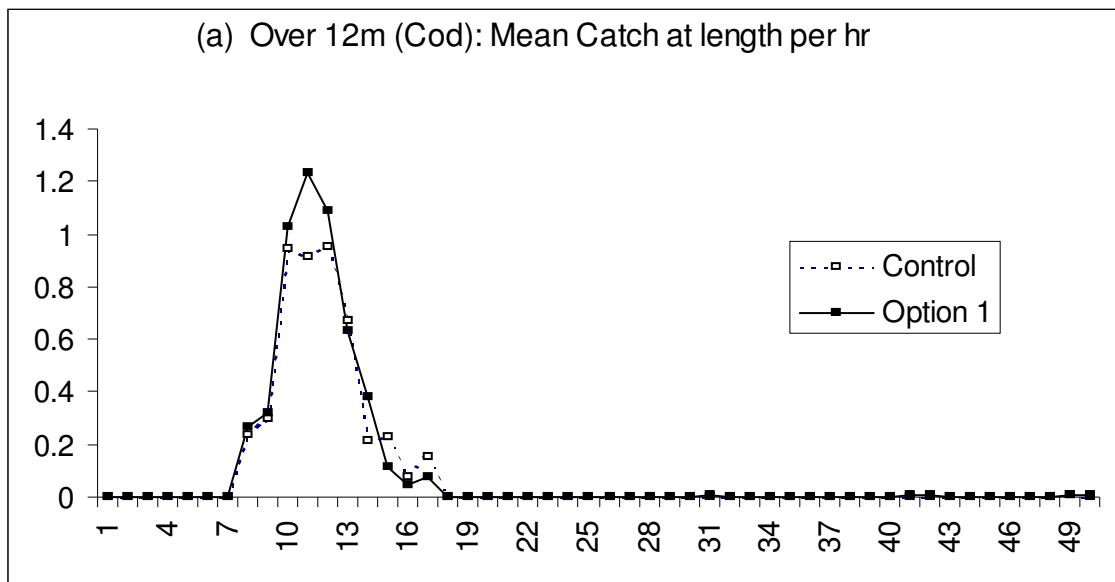


Figure 10: Cod catches during single-rig parallel haul comparisons performed by *MFV Albacore & Olive Branch* using Option 1 and Control gears (a) Mean catch at length per hour (b) Relative size composition (c) Proportion (*Pl*) of catch retained by gear Option 1.

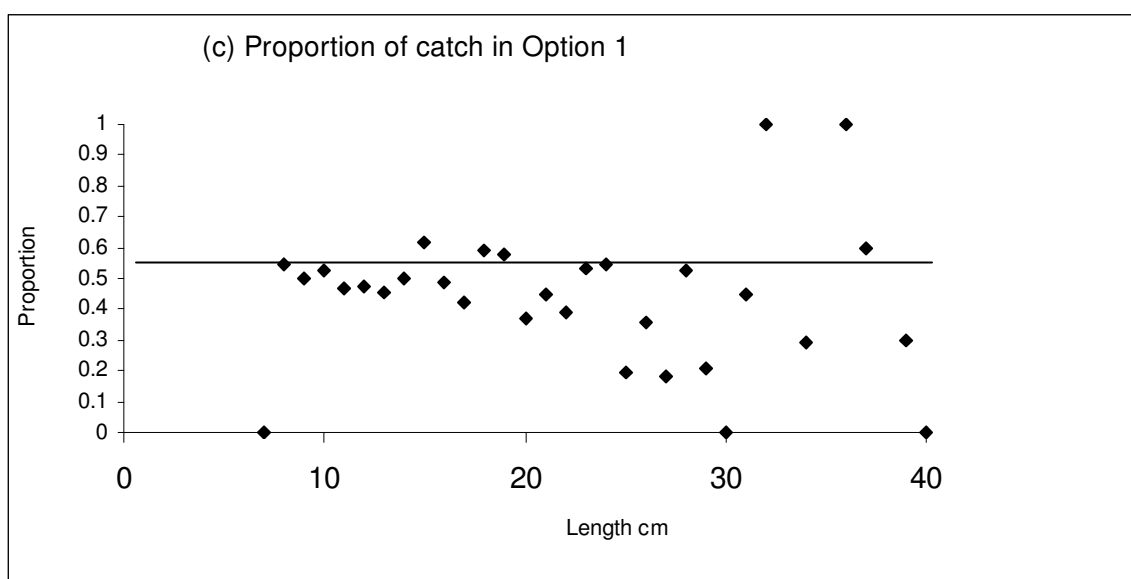
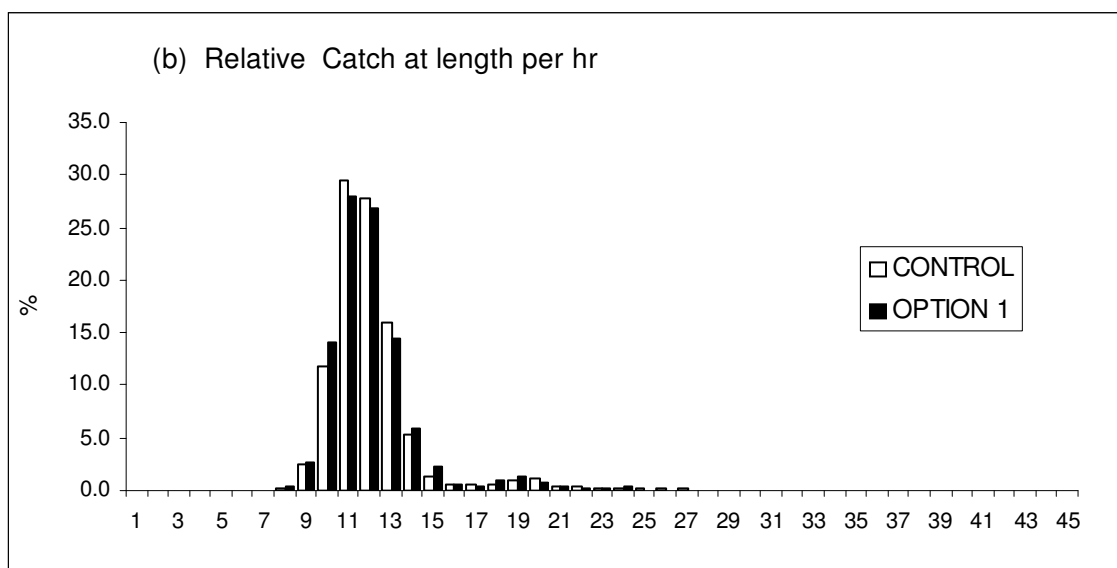
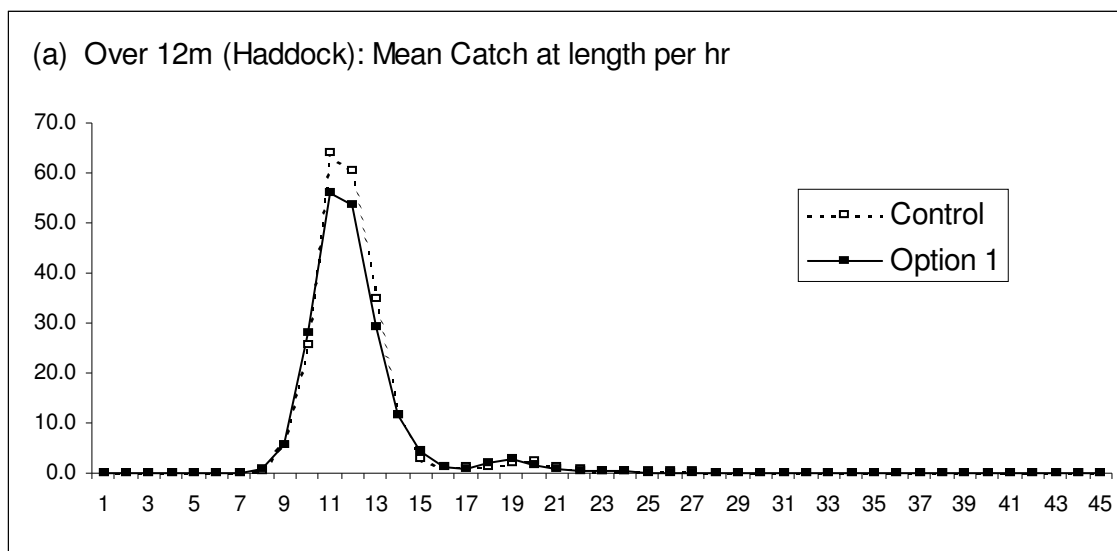


Figure 11: Haddock catches during single-rig parallel haul comparisons performed by *MFV Albacore & Olive Branch* using Option 1 and Control gears (a) Mean catch at length per hour (b) Relative size composition (c) Proportion (*Pl*) of catch retained by gear Option 1.

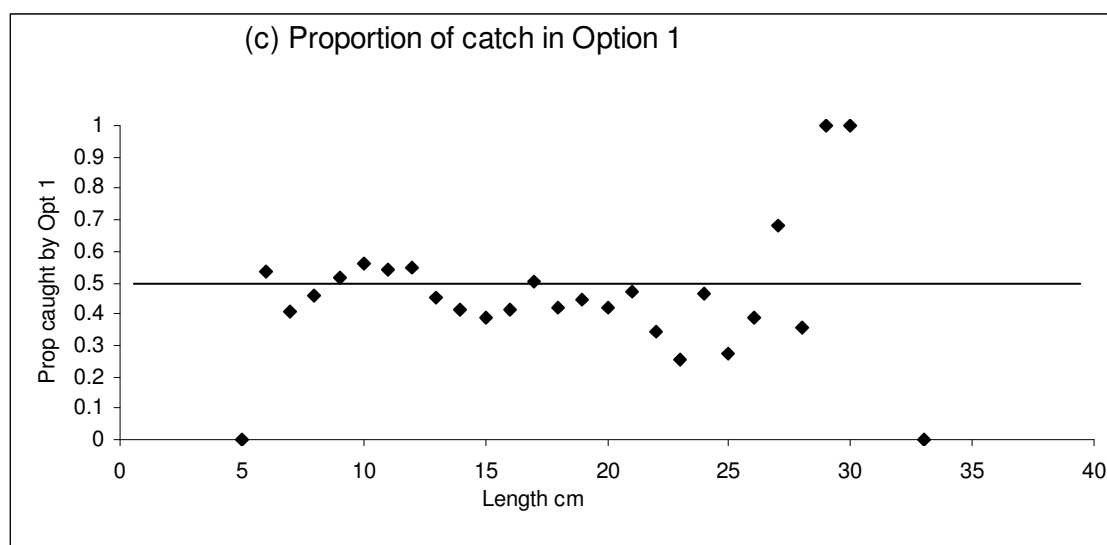
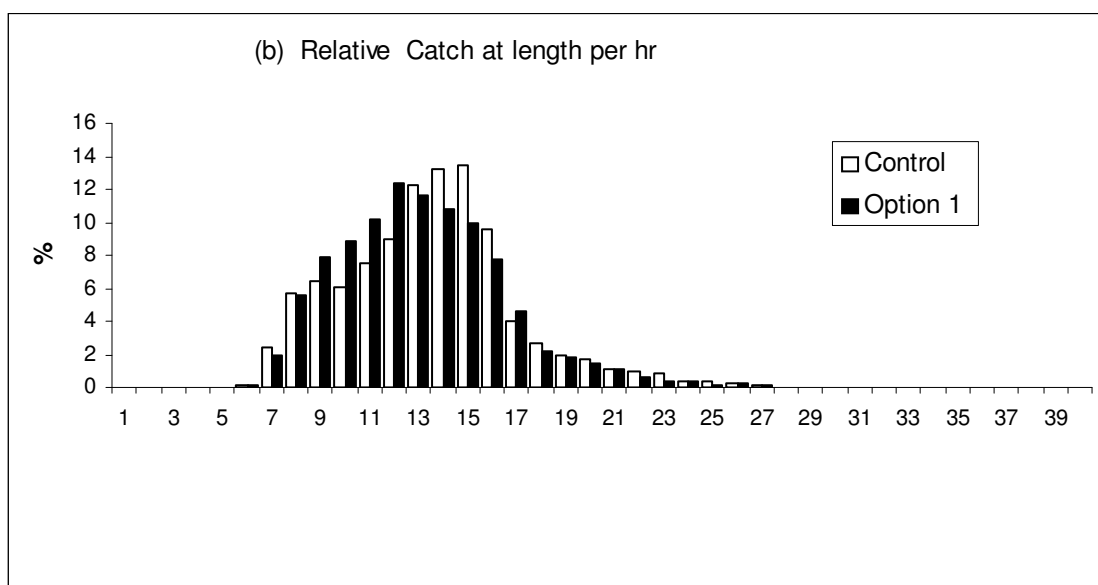
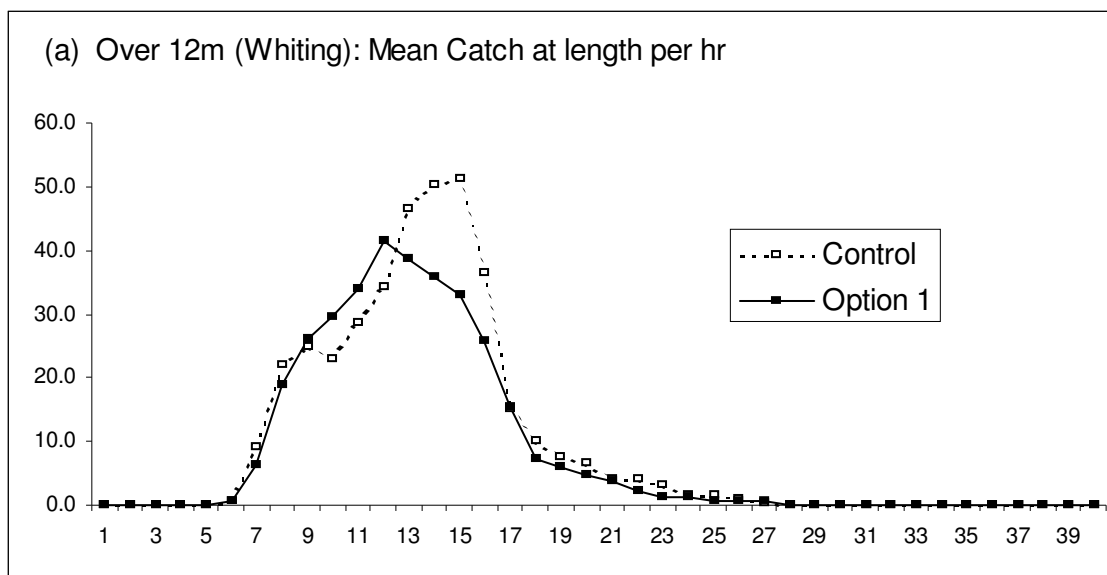
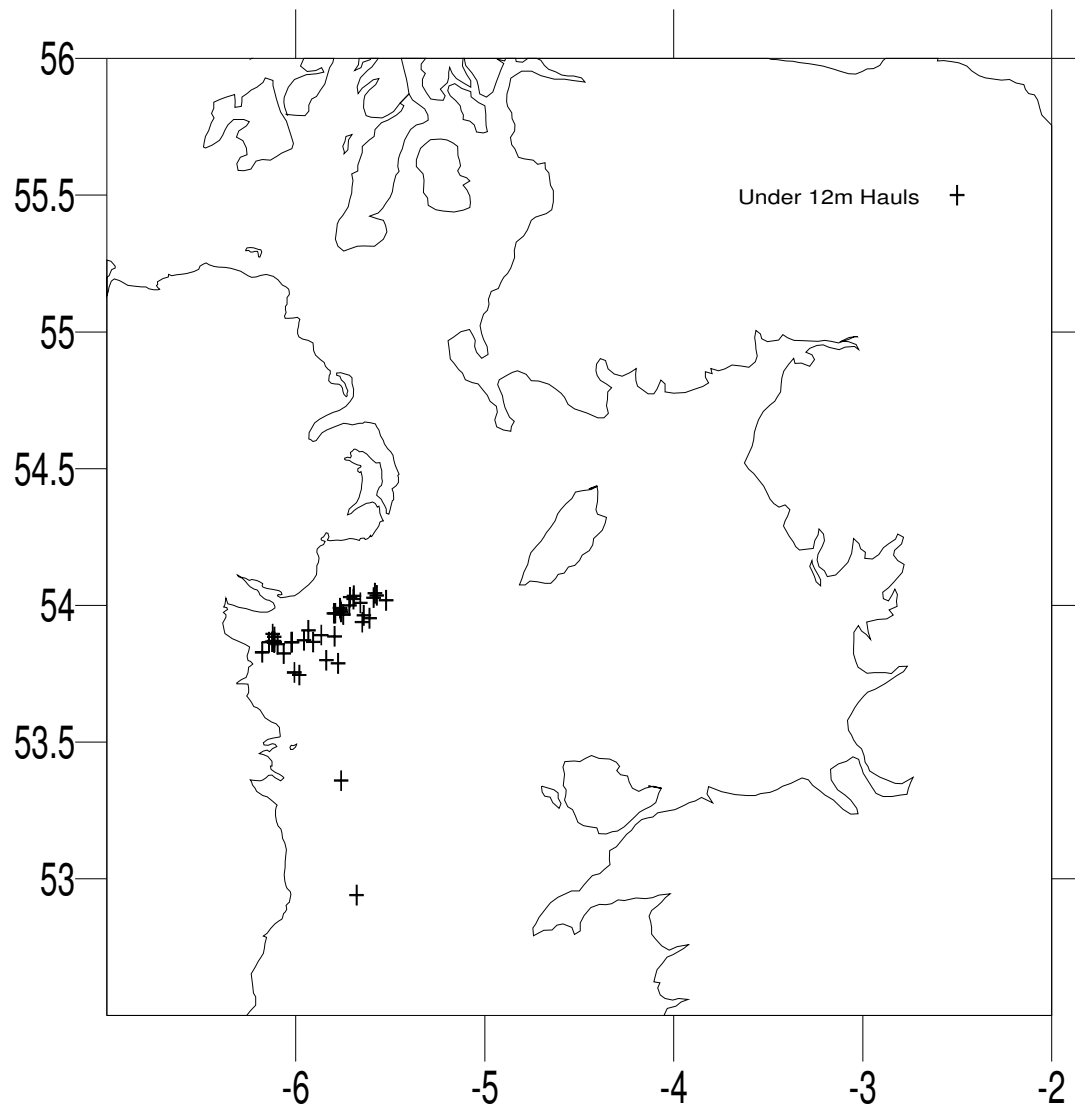


Figure 12: Whiting catches during single-rig parallel haul comparisons performed by *MFV Albacore* & *Olive Branch* using Option 1 and Control gears (a) Mean catch at length per hour (b) Relative size composition (c) Proportion (*Pl*) of catch retained by gear Option 1.



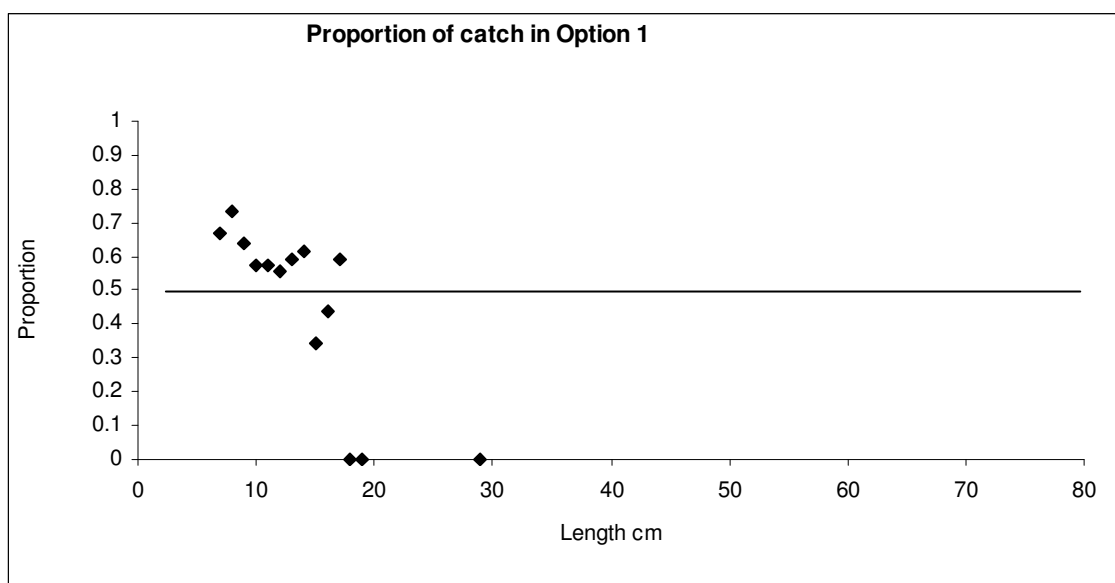
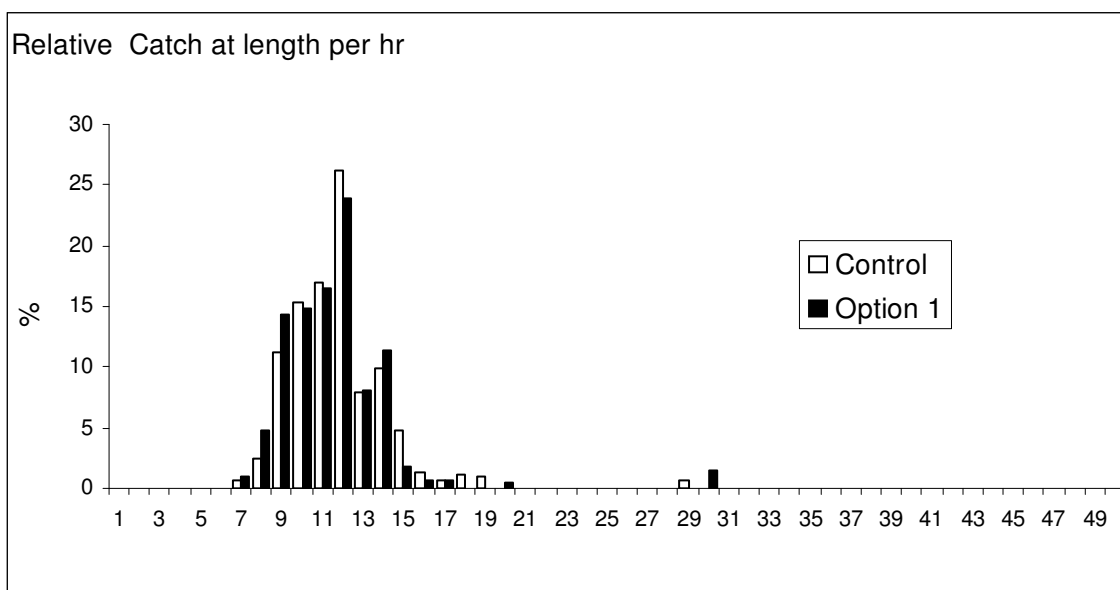
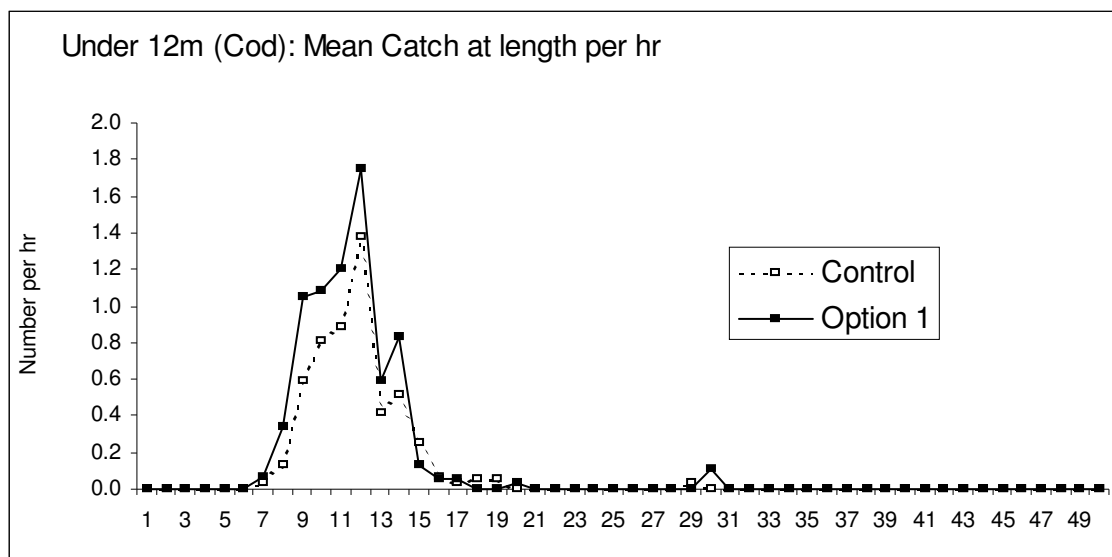


Figure 14: Cod catches during single-rig parallel haul comparisons performed by *MFV Immanuel & Fairwind* using Option 1 and Control gears (a) Mean catch at length per hour (b) Relative size composition (c) Proportion (*PI*) of catch retained by gear Option 1.

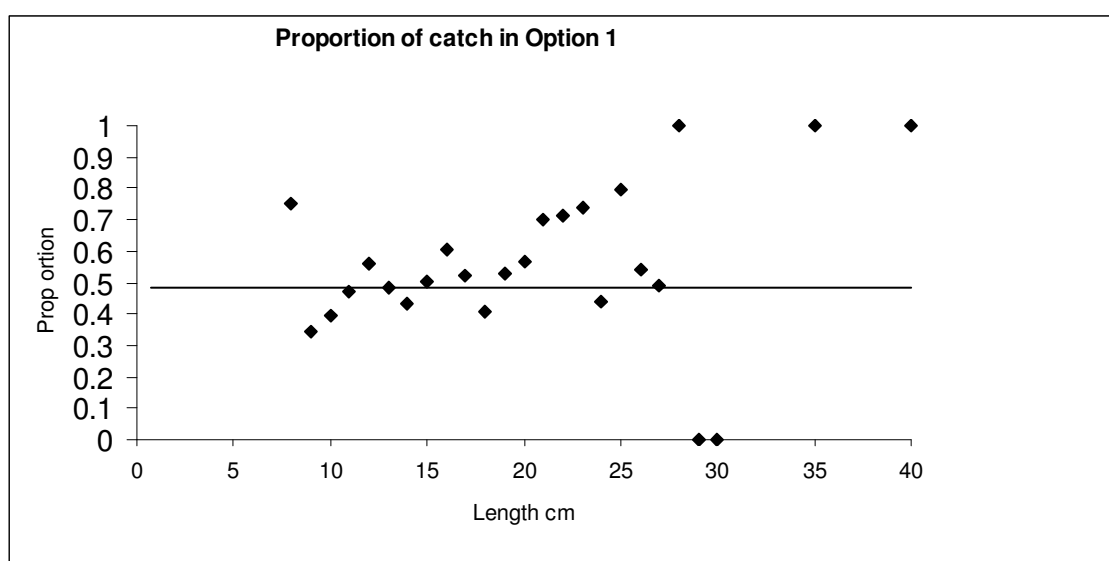
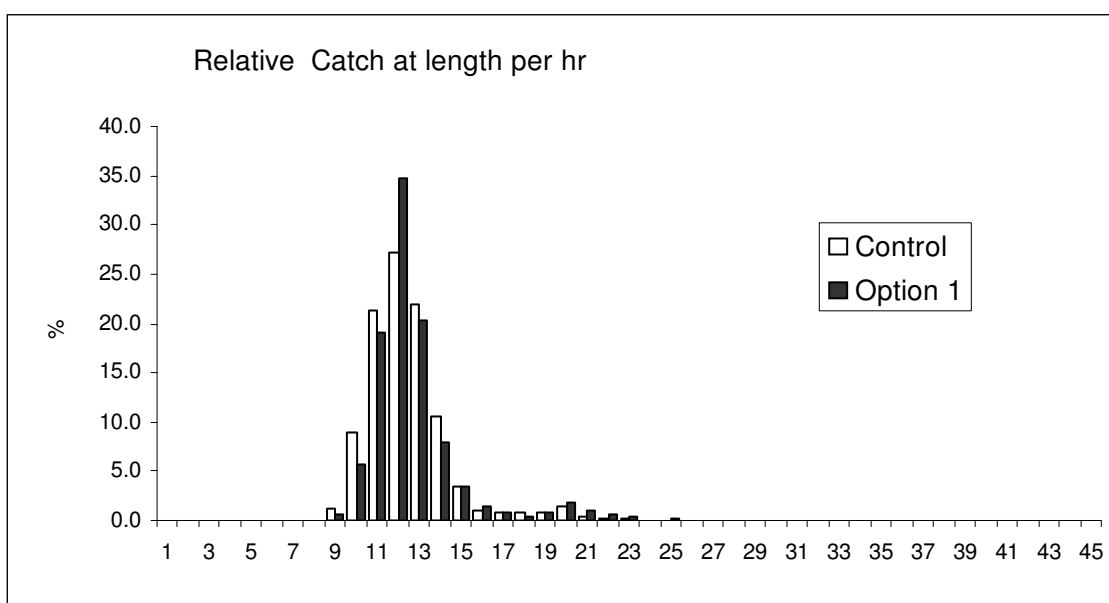
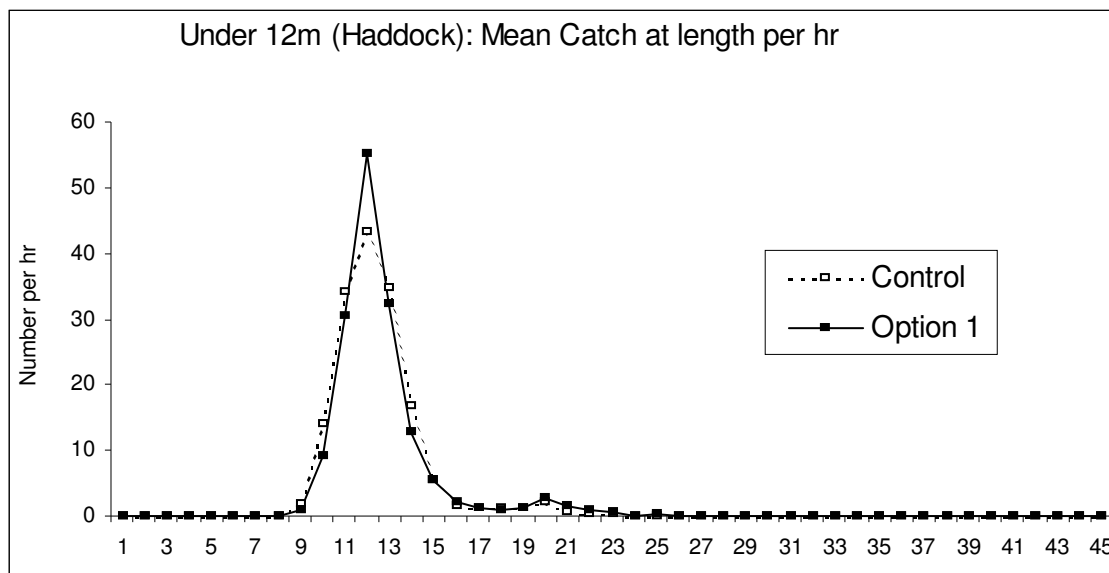


Figure 15: Haddock catches during single-rig parallel haul comparisons performed by *MFV Immanuel & Fairwind* using Option 1 and Control gears (a) Mean catch at length per hour (b) Relative size composition (c) Proportion (*PI*) of catch retained by gear Option 1.

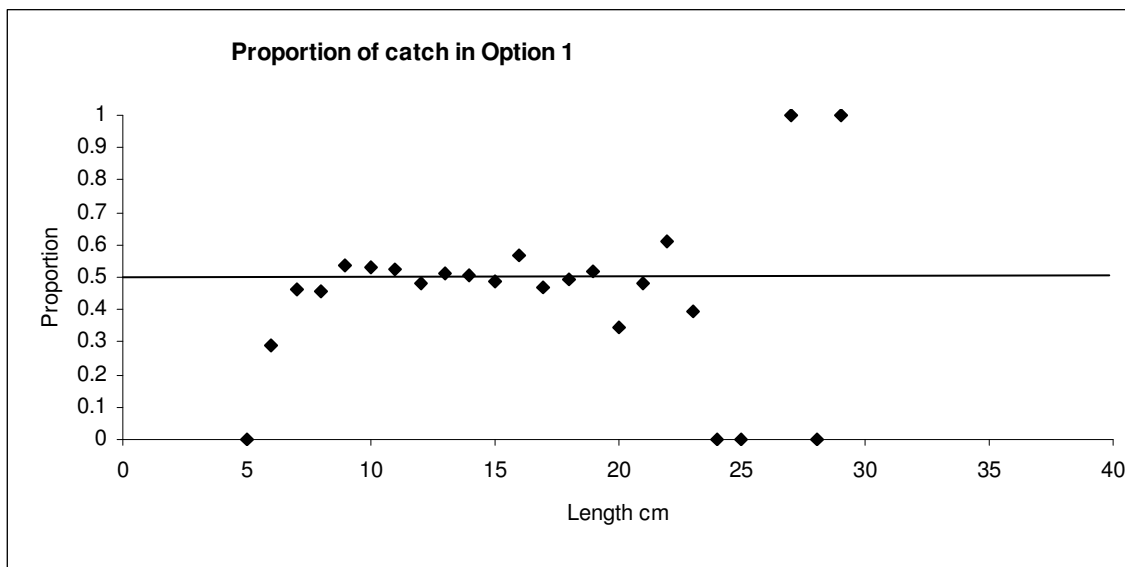
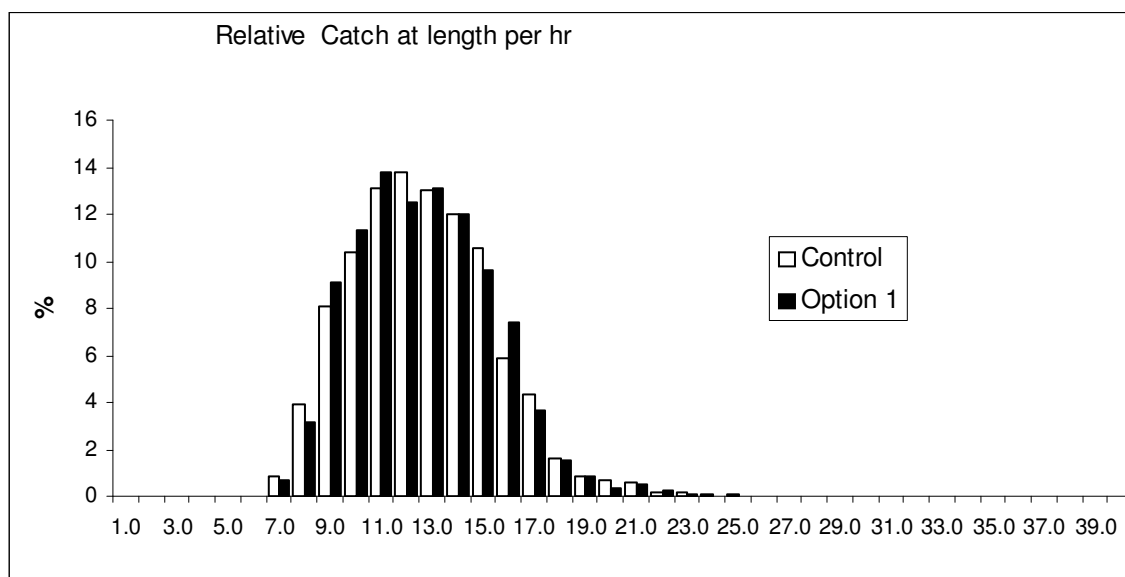
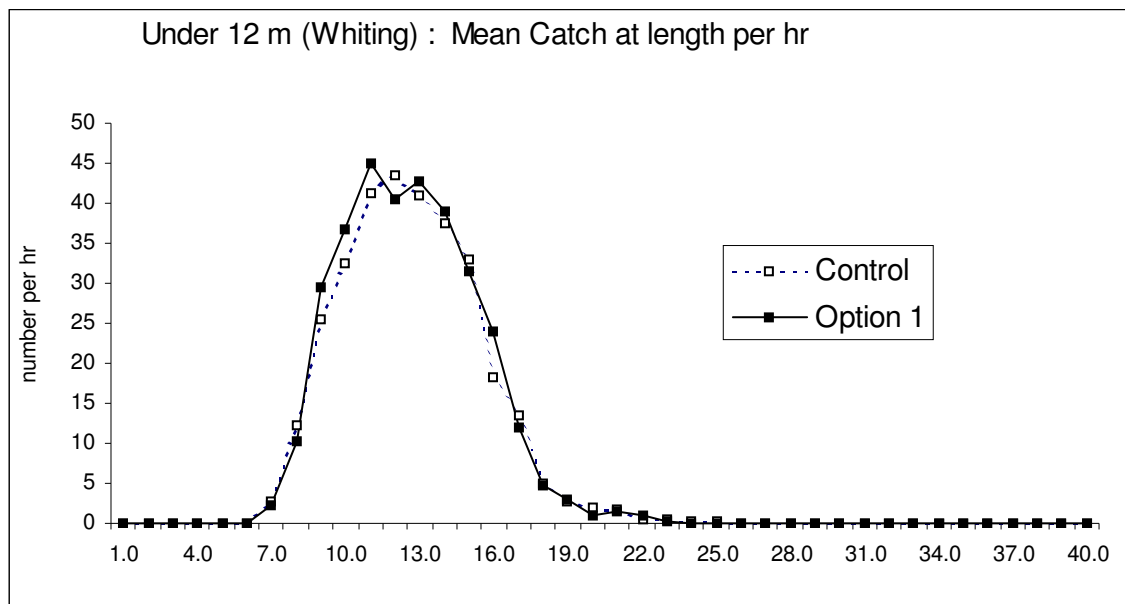


Figure 16: Whiting catches during single-rig parallel haul comparisons performed by *MFV Immanuel & Fairwind* using Option 1 and Control gears (a) Mean catch at length per hour (b) Relative size composition (c) Proportion (*Pl*) of catch retained by gear Option 1.