

Cruise report

Irish Beam trawl Ecosystem Survey 2016



Hans Gerritsen, Fisheries Ecosystems Advisory Services,

Marine Institute, Rinville, Oranmore

Galway, Ireland, H91R673



Clár Chistí Eorpacha Struchtúrtha
agus Infheistíochta na hÉireann
2014–2020

Cómhainithe ag Rialtas na hÉireann
agus ag an Aontas Eorpach



Department of
**Agriculture,
Food and the Marine**
An Roinn
**Talmhaíochta,
Bia agus Mara**



EUROPEAN MARITIME
AND FISHERIES FUND

Contents

Introduction	3
Methods.....	3
Stratification.....	3
Station selection	3
Fishing operations.....	3
Wetlab protocol	4
Data collection and storage	6
Estimation	6
Results.....	6
Cruise narrative.....	6
Downtime, damage.....	7
Summary statistics	7
Figures.....	9
References	14
List of survey staff	15
Appendix 1 – Gear specifications.....	16

Introduction

The first annual Irish Beam trawl Ecosystem (IBES) took place from 6-16th March 2016 on RV *Celtic Explorer* in the western Celtic sea.

The main objective of the survey is to connect the Irish Anglerfish and Megrim Survey (IAMS) to the UK beam trawl surveys in the Celtic Sea, English Channel and Irish Sea, with the purpose of providing a swept-area biomass estimate for anglerfish (*Lophius piscatorius* and *L. budegassa*) in area VII.

Secondary objectives are to collect data on the distribution and relative abundance of commercially exploited species as well as invertebrates and by-catch species, particularly vulnerable and indicator species. The survey also collects maturity and other biological information for commercial fish species in the western Celtic Sea.

The IBES survey is coordinated with the CEFAS Q1 South-west Ecosystem Survey (Q1SWECOS) and uses the same gear and methods.

Methods

Stratification

An ecosystem-based spatial stratification for the Celtic Sea and western Channel was developed by WGMSFDEMO (2015). These strata are used by IBES as well as Q1SWECOS which covers the area as far west as stratum G (Figure 1). The IBES was designed to cover strata Ia, Ib, IV and A as well as stratum G to allow a comparison between the IBES and Q1SWECOS.

Station selection

Each stratum is divided into 15 hexagons. Random hexagons are selected sequentially in each stratum. Inside each hexagon a random station position is then selected. The sequence in which the station is selected will be considered the priority of the station; so if the target number of stations in a stratum was 5, then only the first 5 randomly selected stations would be sampled. If, during the survey, it becomes clear that the targets will not be met (e.g. due to bad weather) then the stations with the highest sequence numbers will be dropped first. For example in a stratum with 5 stations, only the first 4 will be sampled (where feasible).

The target number of stations in each of the strata is given in Table 1. A tow track was picked to go through the randomly selected points. Where it was impossible to do so (e.g. underwater cables, passive gear, unsuitable bottom) it was attempted to find a tow track that came within 1nm of the selected point. Because this is the first time this area is surveyed using a beam trawl, there was little information to optimise the sampling design and the target number of stations in each stratum was chosen to be proportional to the stratum area.

Four to six weeks prior to the departure a Marine Notice was issued (www.dttas.ie) to advise seafarers and fishermen about the proposed work. This document included a brief description of the survey methods and objectives including a list and map location of the proposed stations.

Fishing operations

Two steel 4m beam trawls are towed directly from the warps off the stern of the vessel. The beam trawls are similar to those used by the fishing industry and identical to those used by the CEFAS Q1

South-west Ecosystem Survey (Q1SWECOS). The trawls are fitted with a chain mat and single flip-up rope and 80mm mesh size in the cod-end. The starboard trawl was fitted with a 40mm cod-end liner. Further gear specifications are given in Appendix 1.

The gear was trawled at 4kn over a distance of 2nm (approx. 30min). The warp to depth ratio was 3/1. On very soft or hard ground the warp may be shortened a bit to make the gear lighter on the bottom. No trawl sensors are used; the fishing master judges from the speed of the vessel when the gear is on the bottom.

The gear was inspected on daily basis by suspending it from the A-frame. The gear was checked for any missing linker chains, worn fly meshes (which tie the net to the fishing line), the shape (too slack or tight) of the chain mat, footrope, fishing line and flip-up as well as any other damage.

Fishing took place between 07:00h and 19:00h. On future surveys 24h operations could be considered but this would require some additional scientific staff.

Wetlab protocol

The catches from the (starboard) trawl with the 40mm liner are sorted first. All fish and invertebrate species are sorted and weighed. All fish and squid species as well as *Nephrops* and *Cancer pagurus* were measured and biological data are collected for the species listed in the table below. The catches from the (port) trawl without the liner are treated in the same way except for the invertebrate species, are were only weighed if they do not occur in the catches from the first trawl.

	Species ¹	Sex ²	Sex/Mat/Wt ³	Age ⁴	GuttedWt ⁵
Aged demersal species	COD	U	1pcm	1pcm	-
	HAD	U	1p2cm	1p2cm	-
	LIN	U	1pcm	1pcm	-
	MEG	F/M	<38cm: 1p2cm ≥38cm: all	<38cm: 1p2cm ≥38cm: all	-
	MON	U	<15cm: 1p5cm 15-17: 1p2cm 18-27cm: 1pcm ≥28cm: all	<15cm: 1p5cm 15-17: 1p2cm 18-27cm: 1pcm ≥28cm: all	<15cm: 1p5cm 15-17: 1p2cm 18-27cm: 1pcm ≥28cm: all
	WAF	U	all	all	all
	PLE	F/M	1pcm	1pcm	-
	POK	U	1pcm	1pcm	-
	POL	U	1pcm	1pcm	-
	SOL	F/M	1pcm	1pcm	-
WHG	U	1p2cm	1p2cm	-	
Biological teleo	BLL	F/M	1pcm	-	-
	HKE	U	1pcm	-	-
	JOD	U	1pcm	-	-
	LBI	F/M	1pcm	-	-
	LEM	F/M	1pcm	-	-
	TUR	F/M	1pcm	-	-
	WIT	F/M	1pcm	-	-
Bio elasmobranch	BLR	F/M	1pcm	-	-
	CUR	F/M	1pcm	-	-
	DGS	F/M	1pcm	-	-
	DFL	F/M	1pcm	-	-
	DII	F/M	1pcm	-	-
	SDR	F/M	1pcm	-	-
	THR	F/M	1pcm	-	-

¹ 3-letter MAFF species code

² Length sample sorted by sex (F/M) or both sexes combined (U)

³ Sampling targets for sex, maturity and live weight of individual fish (number of fish per size class per station)

⁴ Sampling targets for collecting age structures (otoliths/illicia)

⁵ Sampling targets for gutted weight

Data collection and storage

Station positions, heading and bottom depth were recorded at the moment the gear settled on the bottom and when the gear was hauled back. Tide and wind direction and speed, barometric pressure, heave, pitch and roll were recorded at the mid-point in the tow. Bottom depth and GPS position are also recorded in a SQL database at intervals of approximately 1 per second.

Catch weights, length frequency distributions and biological data were captured using the CEFAS Electronic Data Capture (EDC) system and stored into local Access '97 databases before being imported into a central SQL database. The CEFAS software FSS (Fishing Survey System) was used to enter station data and import catch data.

Estimation

The capture probability for a fish in tow i in stratum s , (p_{is}) is given as:

$$p_{is} = \frac{v_i I_s}{A_s}$$

v_i is the swept area of tow i in stratum s .

I_s is the number of tows in stratum s .

A_s is the surface area of stratum s .

The estimated number of fish (\hat{N}) or biomass (B) in the survey area is then:

$$\hat{N} = \sum_{i \in I} \frac{n_i}{p_{lis}} \quad \hat{B} = \sum_{i \in I} \frac{n_i w_i}{p_{lis}}$$

n_i is the catch numbers-at-length in tow i

w_i is the mean weight-at-length, obtained from the length-weight relationship for the whole survey.

Because this estimate is based on the assumption that catchability is 100%, it can be treated as a lower bound of the actual abundance.

Results

Cruise narrative

A total of 45 valid tows were completed (out of a possible 51), as well as 2 additional tows (these had not been randomly selected but were sampled opportunistically). There were no foul hauls or gear damage. The weather was good for most of the survey.

Date (2016)	Comment
Sun 06 Mar	All scientific staff were on board for 17:00
Mon 07 Mar	Sailed at 01:30, arrived at the first station in Dingle Bay at 14:00. Completed 3 valid tows. Good weather.
Tue 08 Mar	Completed 5 valid tows, heading inshore for shelter. This leaves the two stations in stratum Ia isolated (>50nm from the nearest remaining station) so it was decided to drop this stratum from the survey.
Wed 09 Mar	Staying inshore to avoid weather. Completed 4 valid and 2 additional tows (these

were not planned but selected ad-hoc).

Thu 10 Mar	Completed 6 stations. Weather good.
Fri 11 Mar	Completed 6 stations. Weather good.
Sat 12 Mar	Completed 6 stations. Weather good.
Sun 13 Mar	Completed 5 stations. Weather good.
Mon 14 Mar	Completed 5 stations. Wind increasing to around 20kn
Tue 15 Mar	Completed 5 stations.
Wed 16 Mar	Docked in Cork at 08:00. Scientific and fishing gear demobilised.

Downtime, damage

Weather downtime	None
Technical downtime	None
Gear damage	None

Summary statistics

Target and achieved number of stations per stratum

Stratum name	Target	Achieved	Area (km²)	Swept area (km²)	Swept area (%)
Stratum A	5	4	6832	0.1782	0.0026%
Stratum_la	2	0	2502	0	0
Stratum_lb	16	14	20065	0.4246	0.0021%
Stratum_IV	14	13	17970	0.3901	0.0022%
Stratum G	14	14	17309	0.4251	0.0025%
Total	51	45	64675	1.4180	0.0026%

Catch rates of target species

Species	CatchNum	CatchNumHr	CatchWtKgHr
Megrim	3467	144.0	11.28
Black bellied angler	907	37.7	9.89
Four-spot megrim	474	19.7	1.01
White-bellied angler	230	9.6	9.25

Catch rates of the top 10 species (by number); 57 species of fish were caught.

Species	CatchNum	CatchNumHr	CatchWtKgHr
Megrim	3467	144.0	11.28
Norway pout	942	39.1	0.38
Black bellied angler	907	37.7	9.89
Boarfish	851	35.3	1.61
Grey gurnard	534	22.2	1.56
Four-spot megrim	474	19.7	1.01
Witch	441	18.3	1.18
Plaice	417	17.3	1.56
Poor cod	343	14.2	0.43
Common dragonet	330	13.7	0.53

Catch weights of the top 10 invertebrates (by occurrence); 96 species and genera of invertebrates were caught.

Species	CatchWtKg	NumHauls
<i>Ophiura ophiura</i>	4.754	44
<i>Astropecten irregularis</i>	5.620	42
<i>Eledone cirrhosa</i>	49.511	40
<i>Actinauge richardi</i>	49.774	36
<i>Solenocera membranacea</i>	1.011	36
<i>Stichastrella rosea</i>	5.612	36
<i>Porania pulvillus</i>	3.558	34
<i>Hyalinoecia tubicola</i>	0.785	32
<i>Pagurus prideaux</i>	8.428	32
<i>Macropipus tuberculatus</i>	1.074	31

Number of biological samples taken.

	Species¹	Sex²	Sex/Mat	Age
Aged demersal species	COD	U	2	2
	HAD	U	85	85
	LIN	U	2	2
	MEG	F/M	873	873
	MON	U	225	225
	WAF	U	463	463
	PLE	F/M	130	130
	POK	U	0	0
	POL	U	1	1
	SOL	F/M	87	87
Biological teleo	WHG	U	52	52
	BLL	F/M	3	
	HKE	U	201	
	JOD	U	11	
	LBI	F/M	126	
	LEM	F/M	32	
	TUR	F/M	0	
Bio elasmu	WIT	F/M	152	
	BLR	F/M	1	
	CUR	F/M	33	
	DGS	F/M	0	
	DFL	F/M	17	
	DII	F/M	1	
	SDR	F/M	7	
THR	F/M	1		

Figures

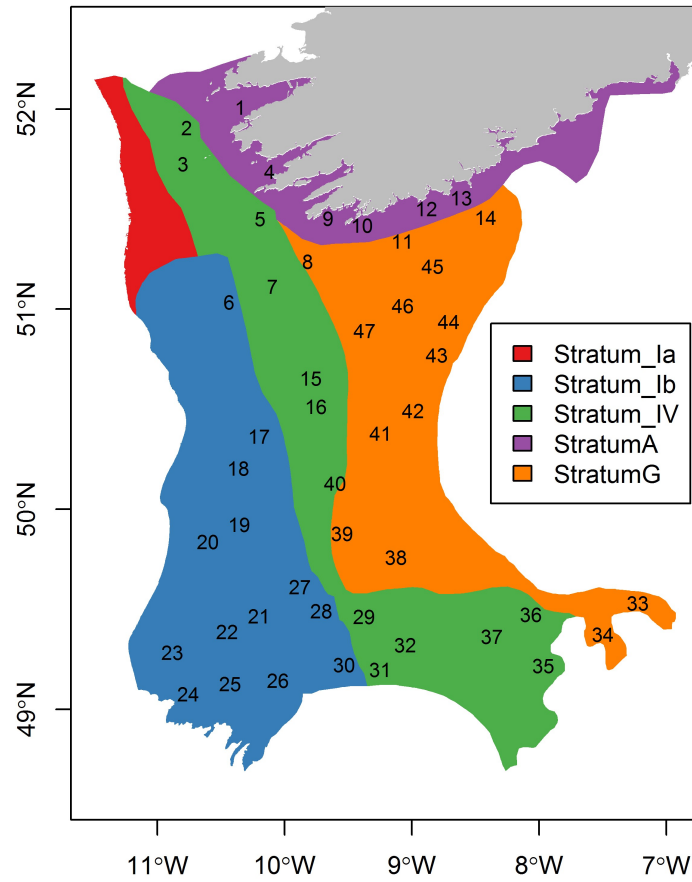


Figure 1. Valid tow positions, the numbers refer to the haul number.

Species Composition
Pelagic species and large gadoids omitted

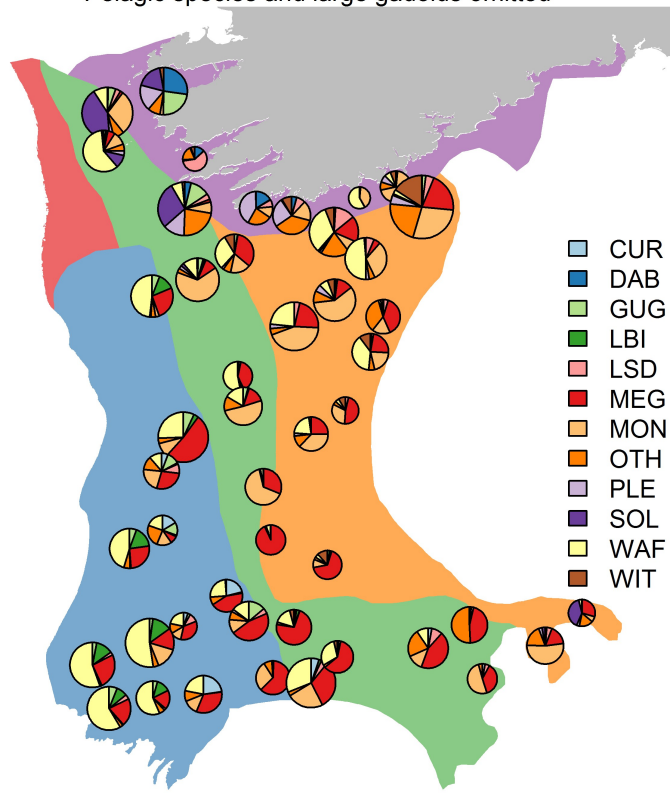


Figure 2. Fish species composition of the catches. The size of the pies is proportional to the catch weight per km² swept area. Pelagic species and gadoids were removed.

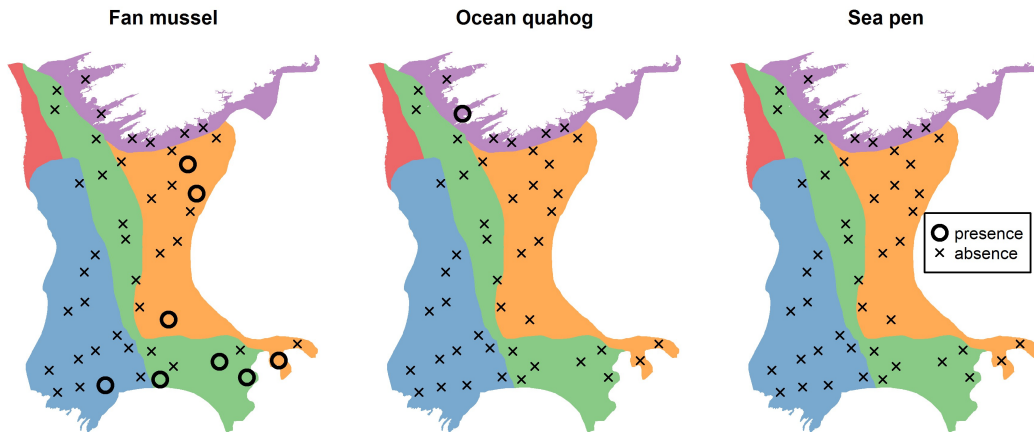


Figure 3. Presence/absence of vulnerable and sentinel species.

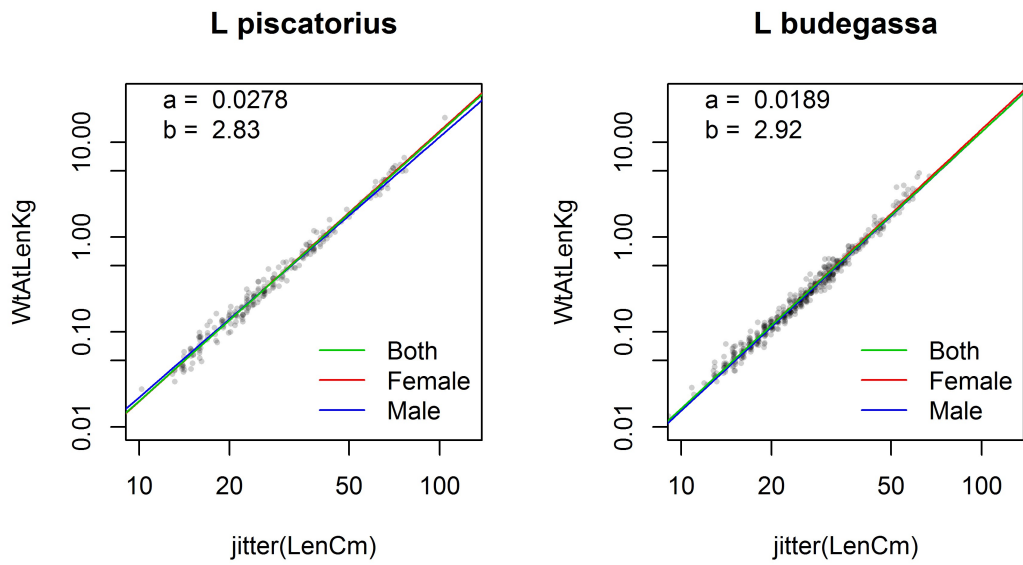


Figure 4. Length-weight parameters for *L. piscatorius* and *L. budegassa*.

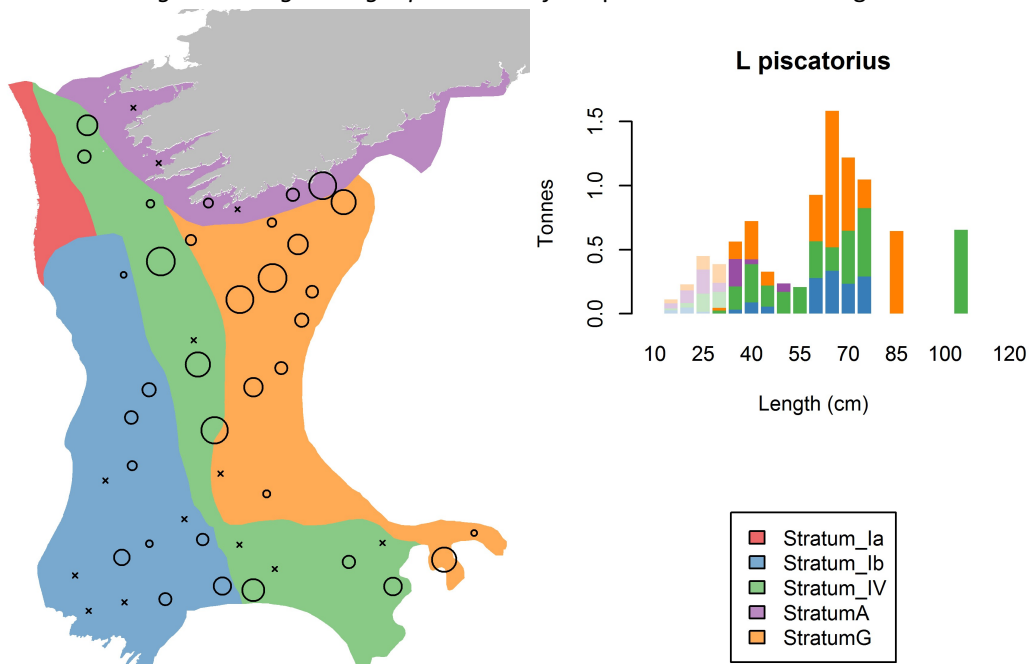


Figure 5. Bubble size is proportional to the biomass of *L. piscatorius* per swept area at each sampling station (left; >500g fish only) and biomass per size class and stratum (right; fish <500g in pale shades).

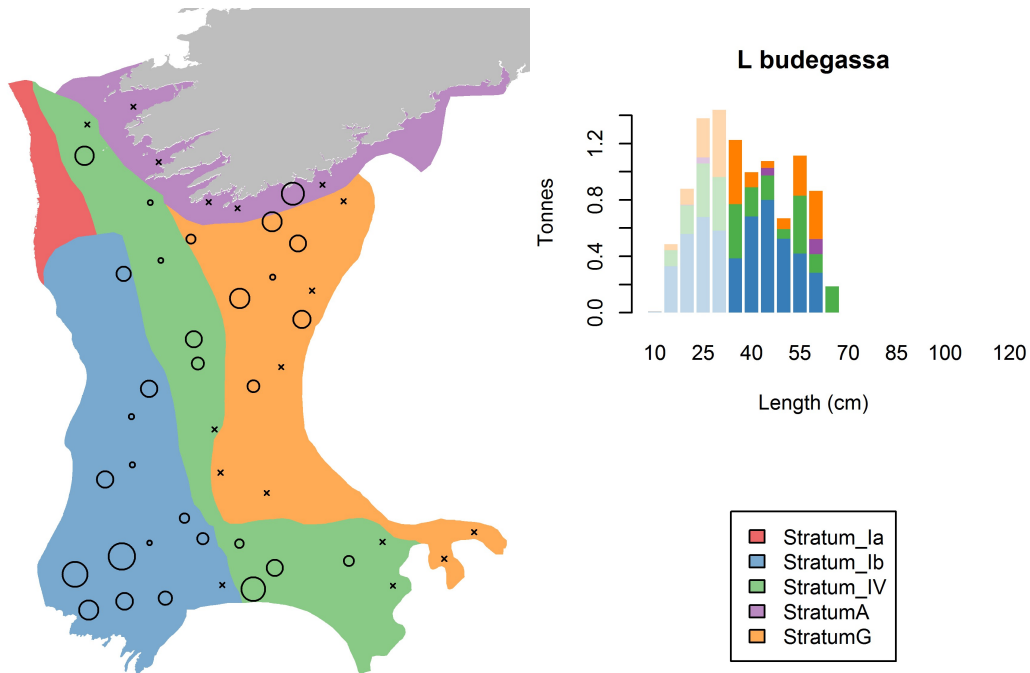


Figure 6. Bubble size is proportional to the biomass of *L. budegassa* per swept area at each sampling station (left; >500g fish only) and biomass per size class and stratum (right; fish <500g in pale shades).

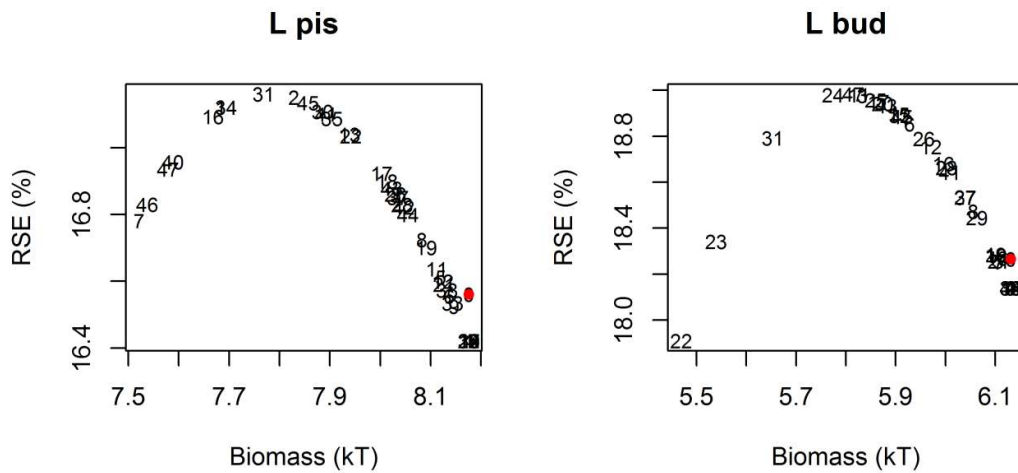


Figure 7. Influence that each tow had on the final biomass estimate (excluding fish <500g). Estimates were obtained by sequentially removing each of the tows from the analysis. The left figure shows that without haul 7 or 46 the biomass estimate of *L. piscatorius* would have been considerably lower.

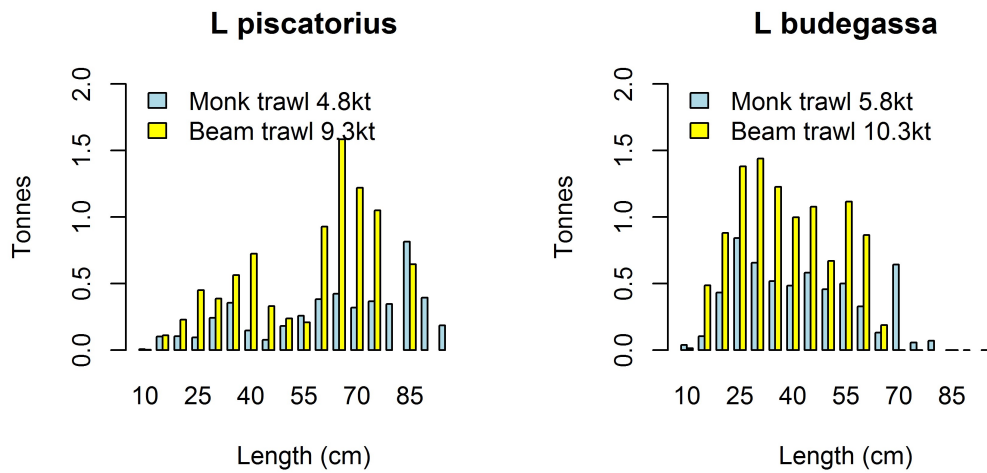


Figure 8. Comparison between the biomass estimates-at-length of the beam trawl and Irish Anglerfish and Megrim Survey (IAMS) 2016 in the area where the two overlapped. The AIMS survey took place in January and used a commercial anglerfish trawl.

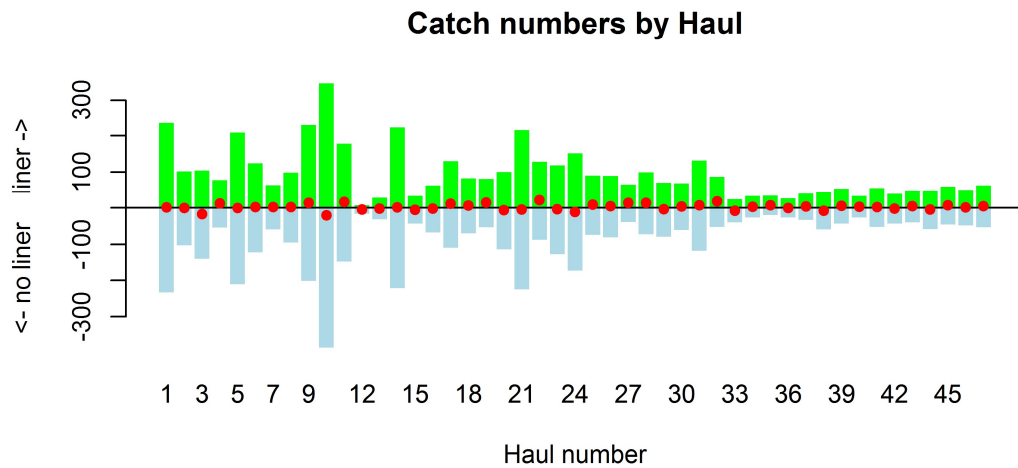


Figure 9a. Comparison between the catch numbers in the trawl with the liner (green) and without the liner (blue). The red dots signify the difference between the two trawls.

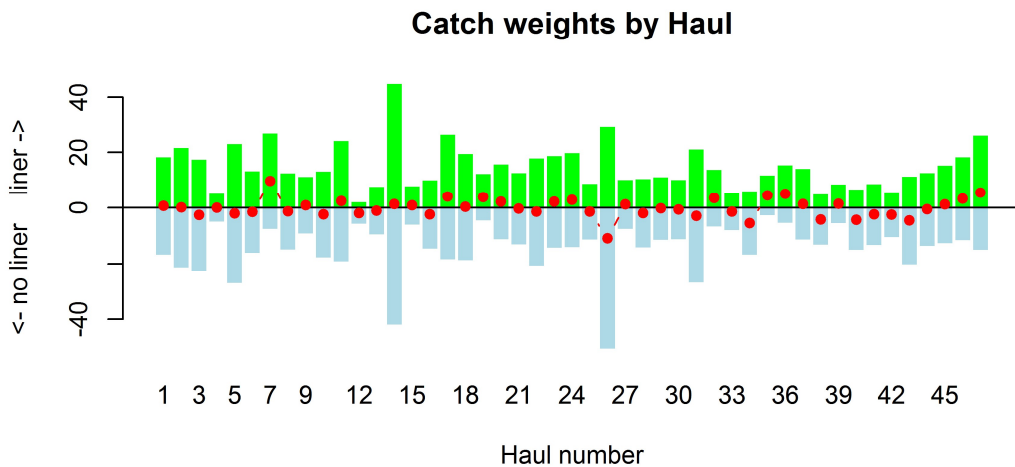


Figure 9b. Comparison between the catch weights in the trawl with the liner (green) and without the liner (blue). The red dots signify the difference between the two trawls.

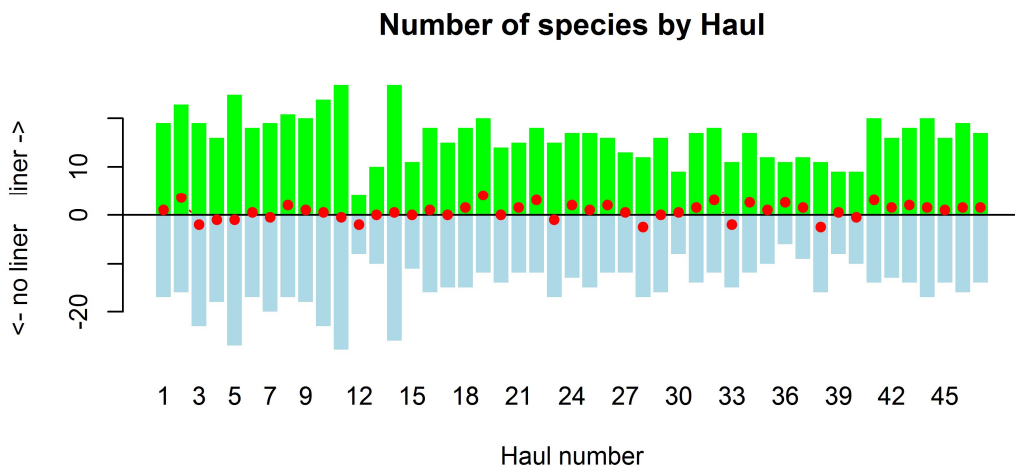


Figure 9c. Comparison between number of fish species in the trawl with the liner (green) and without the liner (blue). The red dots signify the difference between the two trawls.

References

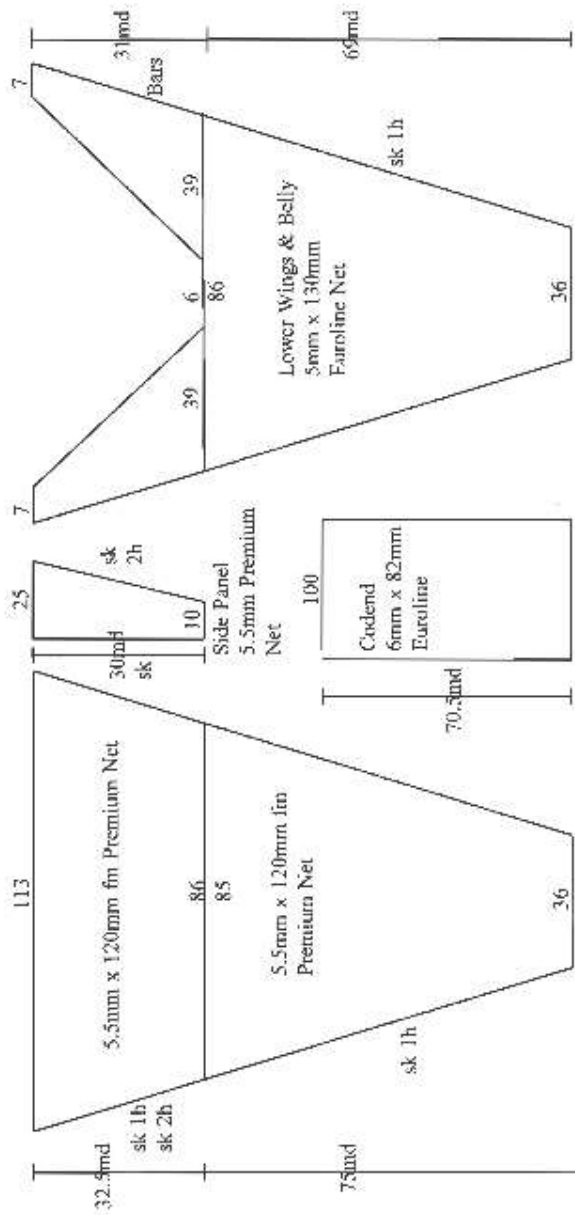
ICES. 2015. Interim Report of the Working Group to Demonstrate a Celtic Seas wide approach to the application of fisheries related science to the implementation of the Marine Strategy Framework Directive (WGMSFDemo), 28-30 April 2015, Dublin, Ire-land. ICES CM 2015\SSGIEA:12. 32 pp.

List of survey staff

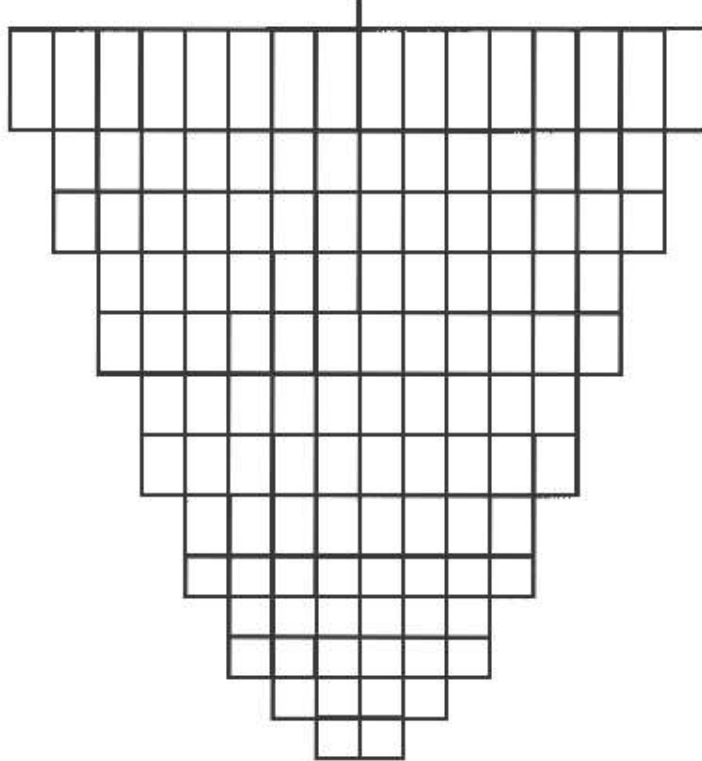
Name	Organisation	Role
Caoimhe O'Brien-Moran	Unaffiliated	Wetlab Assistant
Dermot Fee	Marine Institute	Wetlab Deckmaster
Ger Dougal	Survey Contractor	Technical Consultant
Hans Gerritsen	Marine Institute	Scientist In Charge
Louise Healy	Marine Institute	Wetlab Assistant
Robert Bunn	Marine Institute	Wetlab Deckmaster
Sharon Sugrue	Survey Contractor	Wetlab Assistant
Sinéad O'Brien	Marine Institute	Wetlab Assistant
Sven Kupschus	CEFAS	Scientific Consultant
Tobi Rapp	Marine Institute	Wetlab Assistant

Appendix 1 – Gear specifications

CEFAS 4MTR BEAM TRAWL

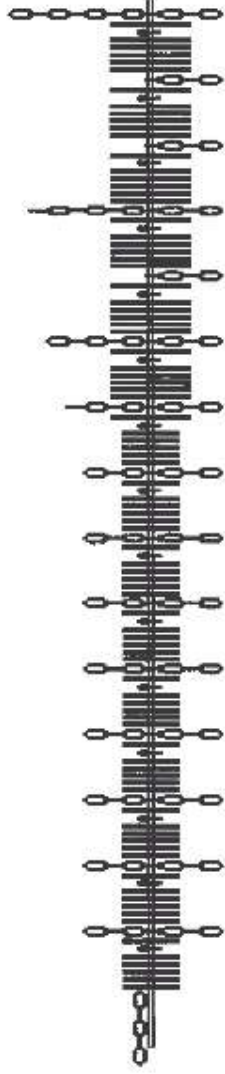


4MTR BEAM TRAWL STONE MATT



1ST DOWN CHAINS 13MM G80 12 LINKS
MATT IN 19MM CHAIN
MADE UP OF 3 & 5 LINK CHAIN
3/4 X 3/4 HT DUMPY SHACKLES

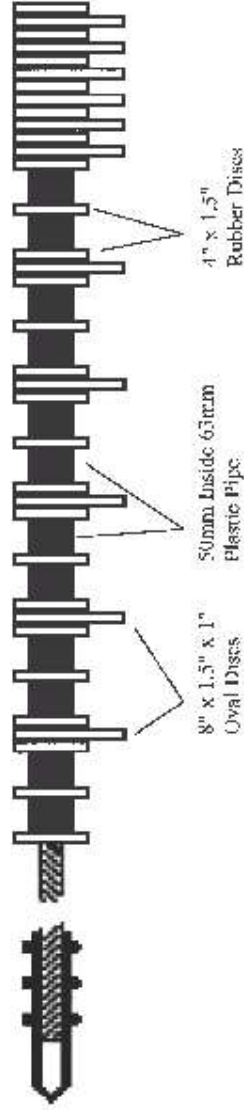
CEFAS 4MTR BEAM TRAWL FOOTROPE



Overall Length 11,000mm
Spacings Between Bulldogs 350mm

Materials Used
Centre Wire 26mm PIR Wire
Bulldogs 26mm
Shackles 3/4 x 3/4 HT Dumpy
Stirrup Chains 19mm Chain
Flip Up Links 9.5mm LL Chain
Rubber Discs 8" x 1 3/8" & 6" x 1 3/8"

CEFAS ATLAS & RUBBER FISHING LINES

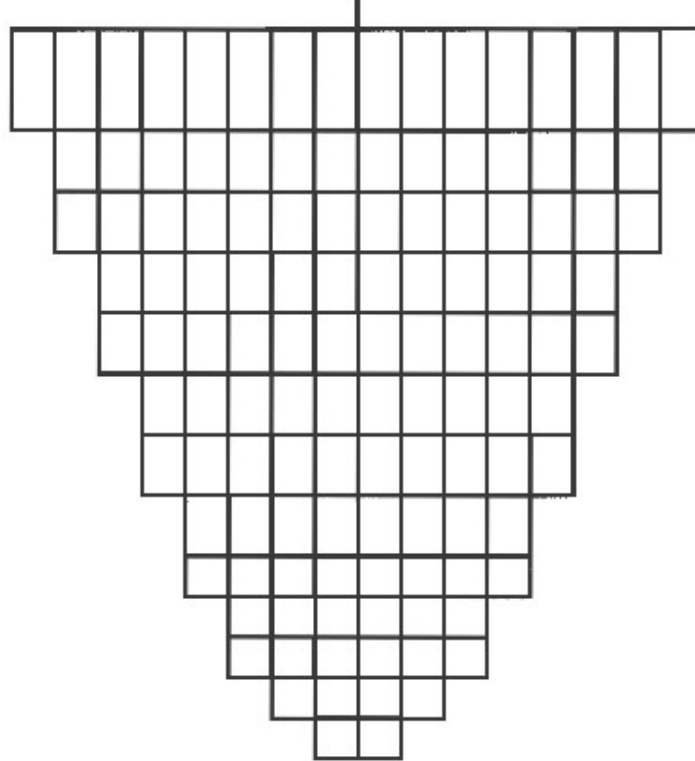


Overall Length Back Of Eyes 11.460m
Bottom 300mm 6 Mesh
31 Drop Mesh @ 180mm

Materials Used

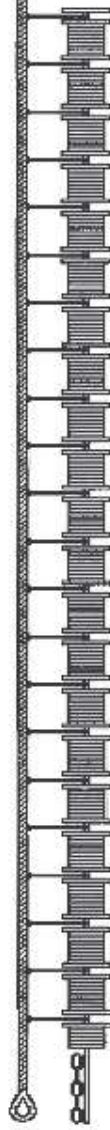
Centre Rope 32mm Atlas Rope
Drop Mesh Rubber Discs 8" x 1.5" x 1" Oval
Spacer Rubber Discs 4" x 1.5"
Plastic Pipe 50mm Inside 63mm

4MTR BEAM TRAWL STONE MATT



1ST DOWN CHAINS 13MM GR0 12 LINKS
MATT IN 19MM CHAIN
MADE UP OF 3 & 5 LINK CHAIN
3/4 X 3/4 HT DUMPY SHACKLES

CEFAS SINGLE ROW FLIP UP



Overall Length 10.20mtr
200mm Spacings

Materials Used

Bottom Rope 16mm 6 x 7 Wire
3.5" x 3/4" Rubber Discs
2" x 3/4" Rubber discs
Upright Ropes
14mm 4 Strand Poly Rope
Covered With 1" Plastic Pipe
Top Rope 32mm Polysteel