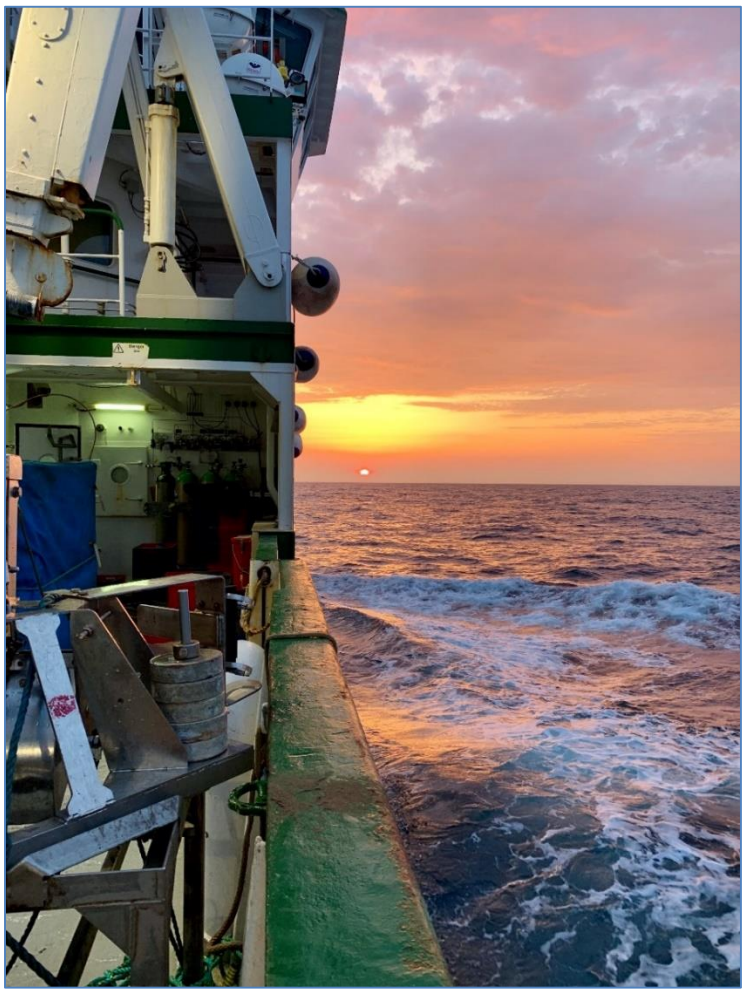
Cruise report
Irish Anglerfish & Megrim Survey 2019



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Contents

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Introduction

The 2019 Irish Anglerfish and Megrim Survey (IAMS) took place from 1-25th March (area 7bcjk) and 16-25th April 2019 (area 6a) on RV *Celtic Explorer*.

The main objective of the survey is to obtain biomass and abundance indices for anglerfish (*Lophius piscatorius* and *L. budegassa*) and megrim (*Lepidorhombus whiffiagonis* and *L. boscii*) in areas 6a (south of 58°N) and 7 (west of 8°W).

Secondary objectives are to collect data on the distribution, relative abundance and biology of other commercially exploited species.

This year, additional sampling took place in deep water (up to 1,500m) in order to monitor the recovery of exploited deep-water species following the decline of the deep-water fisheries in Irish waters.

The IAMS survey is coordinated with the Scottish Anglerfish and Megrim Survey (SIAMISS) and uses the same gear and fishing practices.

Methods

Stratification

The stratification is based on the following considerations:

- Depth: 0-200m; 200-500m; and 500-1,000m
- Clearly defined fishing grounds (from VMS-logbook data: Gerritsen and Lordan, 2011; Gerritsen *et al*., 2012) were identified as separate strata; an area with high fishing intensity surrounded by low fishing intensity signify that the bottom type and ecology on the fishing ground is different from that of the surrounding area. Examples include the Porcupine, Aran and Labadie *Nephrops* grounds, the Stanton Banks and Stags grounds.
- Catch rates of the target species (anglerfish and megrim) from VMS-logbook data as well as IBTS and previous Anglerfish and Megrim surveys were also taken into account in determining the boundaries of the strata.
- Rocky bottom types are excluded from the survey area which implies an assumption that the densities of the target species are zero in those areas.
- Regions 6a and 7 are treated separately because they comprise different assessment and TAC areas.
- In addition to the main survey strata, additional deep water transects were added for in deepwater areas 4 and 5 (north of the Porcupine and west of Donegal).

The density of sampling stations in each stratum was either low, medium (twice the low density) or high (four times the low density). These station densities were assigned to each stratum so that the number of stations in each stratum would be roughly proportional to the expected standard deviation of the biomass estimate in the stratum.

Three small strata with expected low abundance of the target species (Aran and Porcupine *Nephrops* grounds and the area of coarse sediment on the Porcupine Bank) were combined into a single stratum (VII_Shelf_L) for estimation purposes, despite the differences in depth and bottom type.

The strata are shown in Figure 1 and summary statistics are provided in

Table 2. The naming of the strata reflects the region (VIa or VII), area (continental shelf or slope) and density of stations (Low, Medium, High).

Station selection

Sampling stations were selected at random in the following way:

1. Add a 30nm buffer around the survey area (to avoid edge effects)
2. Select 10,000 random points within the (buffered) survey area
3. Identify the pair of points that are closest to each other (nearest neighbour)
4. Remove the point of this pair that is closest to its second-nearest neighbour
5. Repeat steps 3. and 4. until only one point remains
6. Rank the stations in each stratum based on the order in which they were removed – giving stations removed last the highest priority – this ensures that regardless of how many stations are selected in a stratum, they will always be distributed approximately evenly (but randomly) in space

After selecting the random points, suitable tow tracks are identified that go through the random point. Where it was impossible to do so (owing to underwater cables, unsuitable bottom etc.) it was attempted to find a tow track that came within 1nm of the selected point.

The target number of stations is 40 in area 6a and 65 in area 7bcjk. This means that stations with priority number 1-40 and 1-65 respectively will be selected to be trawled. In practice some of the high priority stations may to be dropped (in cases where it was impossible to achieve a valid tow) and replaced by the 'spare' stations with priority numbers >40 and >65 respectively. In addition to the regular sampling strata there were also two 'deep water' transects included in 2019 for the first time. These transects were each composed of 5 stations extending from 500-1,500m using the methodology of previous Marine Institute deep water surveys that were carried out between 2005-2009 (O'Hea *et al*., 2009).

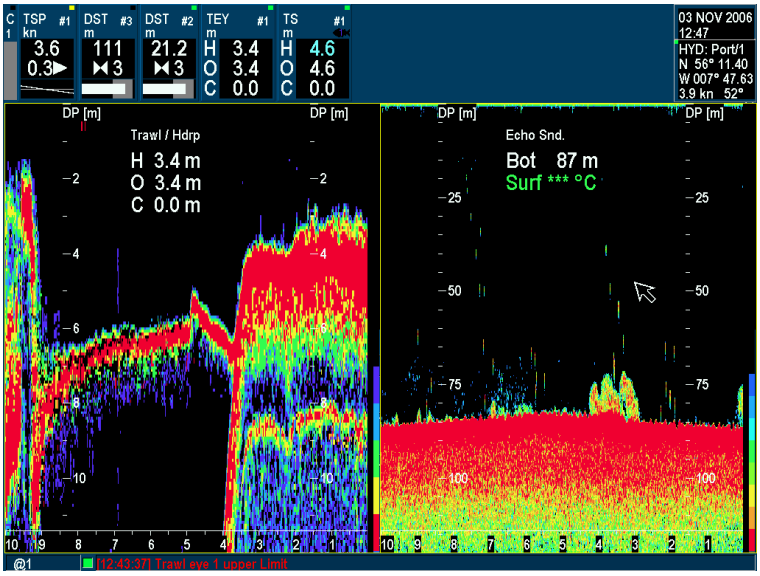
Four to six weeks prior to the departure a Marine Notice was issued (www.dttas.ie) to advise seafarers and fishermen about the survey. This document included a brief description of the survey methods and objectives including a list and map location of the proposed stations.

Fishing operations

The trawl is based on a standard commercial otter trawl used in the anglerfish fishery and is described in detail in Reid *et al*. (2007). The mesh size varies from 200mm in the wings gradually reducing to 100mm in the cod-end. The ground gear is fitted with 16'' rock hopper disks and a 19mm tickler chain is mounted between the wings, rigged to run ahead of the ground gear. The trawl doors were 5.45m^2 Thyboron Type 16 straight oval doors.

The gear was trawled at 3kn for one hour at each station. The warp to depth ratio was 3:1 for depths up to 200m, and 2:1 plus 200m in deeper water.

Door spread, wing spread, headline height and bottom contact were monitored using Scanmar and Marport trawl sensors (distance sensors in the doors and wing-ends, headline sensor and a trawl-eye sensor positioned on the top sheet directly over the footrope).



Screengrab of Scanmar display showing trawl geometry, water depth and fish marks.

Wet lab protocol

All fish and invertebrate species were sorted and weighed. Biological data were collected for the species listed in the table below. Occurrence of the following vulnerable or sentinel invertebrate species was noted if present: corals, sea pen, fan mussel and ocean quahog.

Priority	Task
1	If you are under extreme pressure sort and sample anglerfish and megrim only. For monkfish, record the gutted weight in the 'serial number' box; collect otoliths as well as illica. Inform SIC so they can flag the station with validity code 'T' (target species only)
2	Sort and weigh all fish and squid species, *Nephrops* and rubbish. Record the total weight of benthos as a comment. Sort benthos only for indicator species (see table below) record weights. Take picture or preserve sample if unsure about ID and record as comment.
3	Measure fish species listed in table below.
4	Take biological samples for the demersal listed in the table below.

If you can't complete all the work, drop tasks in reverse order as listed above.
Never record sample weights for a few species; record all or just anglerfish and megrim).
On invalid hauls you can still collect biological data.

	Species	Sort by sex	OTO box	Catch weight	Can you subsample	Bio target	Live weight	Sex	Mat	Age	Gutted weight
Aged demersal species	COD	U	100-149	yes	yes	1pcm	yes	yes	yes	yes	**yes**
	HAD	U	150-249	yes	yes	100%	yes	yes	yes	yes	no
	LIN	U	250-299	yes	yes	1pcm	yes	yes	yes	yes	no
	MEG	F/M	300-364 / 365-399	yes	**Prefer'bly not**	1pcm	yes	yes	yes	yes	no
	MON*	U	400-499	yes	**never**	100%	yes	yes	yes	yes	**Yes**
	WAF*	U	500-599	yes	**never**	100%	yes	yes	yes	yes	**Yes**
	PLE	F/M	600-649 / 650-699	yes	yes	1pcm	yes	yes	yes	yes	no
	POK	U	700-749	yes	yes	1pcm	yes	yes	yes	yes	no
	POL	U	750-799	yes	yes	1pcm	yes	yes	yes	yes	no
	SOL	F/M	800-849 / 850-899	yes	yes	1pcm	yes	yes	yes	yes	no
	WHG	U	900-989	yes	yes	100%	yes	yes	yes	yes	no
Biological teleo	BLL	F/M	wkstn	yes	yes	1pcm	yes	yes	yes	no	no
	HKE	U	wkstn	yes	yes	1pcm	yes	yes	yes	no	no
	JOD	U	wkstn	yes	yes	1pcm	yes	yes	yes	no	no
	LBI	F/M	990-999	yes	yes	1pcm	yes	yes	yes	no	no
	LEM	F/M	wkstn	yes	yes	1pcm	yes	yes	yes	no	no
	TUR	F/M	wkstn	yes	yes	1pcm	yes	yes	yes	no	no
	WIT	F/M	wkstn	yes	yes	1pcm	yes	yes	yes	no	no
Bio elasmo	BLR	F/M	wkstn	yes	yes	1pcm	yes	yes	yes**	no	no
	CUR	F/M	wkstn	yes	yes	1pcm	yes	yes	yes**	no	no
	DGS	F/M	wkstn	yes	yes	1pcm	yes	yes	yes**	no	no
	DFL	F/M	wkstn	yes	yes	1pcm	yes	yes	yes**	no	no
	DII	F/M	wkstn	yes	yes	1pcm	yes	yes	yes**	no	no
	SDR	F/M	wkstn	yes	yes	1pcm	yes	yes	yes**	no	no
	THR	F/M	wkstn	yes	yes	1pcm	yes	yes	yes**	no	no
Others	NEP	U	-	yes	nemesys	nemesys	nemesys	nemesys		no	no
	Most other demersal fish species***			yes	Yes	Measured-only, no need to sort by sex					
	All pelagic fish species, squid; common demersals ***			yes	No length or biological samples						
	Invertebrates: Corals, sea fans, sea pens, fan mussels, Arctica islandica			Count & weight. If unsure about ID, take pic or freeze with haul label. For coral and A. islandica include comment on whether dead or alive							
	Other invertebrates			Total weight in comment field							
	Rubbish			As IGFS							
	CTD			As IGFS							

Key	
Sex	F/M: record catch weight by sex (flatfish and elasmobranchs); U: do not sort by sex.
wkstn	use workstaton number when prompted for otolith box
subsample	these species can be subsampled for length and biological data, if necessary
1pcm	biological sampling target of one fish per cm size class (otolith target 1)
100%	biological sampling target set per length group, i.e. targets vary by size class (otolith target 100%)
*	• Monk <20cm that are not clearly black should be id'd using dorsal fin ray counts: WAF 9-10; MON 11-12 • Cut illicia to around 1cm so they fit flat in the otolith box and clean them so they don't stick to the tissue • When taking gutted weight, also remove the liver
**	Only determine the maturity of female elasmobranchs if they are already dead, otherwise record as stage 9.
***	Do measure: • All deep water species • Large gadoids like ling, blue link, tusk • All elasmobranchs except LSD • Any demersal species that is not very common Don't measure: • Any pelagic fish (including boarfish, blue-mouth, argentines) • Squid, octopus etc. • LSD (no need to record weight by sex either) • Any flatfish not listed in the biological sampling table above • Common demersal species of no or limited commercial value like gurnards, pout, poor cod, dragonets

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 lifts off on haul-back. Tide and wind direction and speed, barometric pressure, heave, pitch and roll were recorded at the mid-point in the tow. The median values of the door spread, wing spread and headline height were recorded at the end of the tow. The CEFAS software FSS (Fishing Survey System) was used to enter station data and import catch data. These data are stored in a SQL database (FSS_SURVEY) on a local server.

The gear sensor data as well as bottom depth and GPS position were also recorded in a SQL database (FSS_NMEA) at intervals of approximately one 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 the central SQL database (FSS_SURVEY).

Estimation

Catchability corrections for the two anglerfish species were applied following the methods described by the ICES working group WKAGME (2009). The equations were re-written to express the estimates in terms of capture probabilities (see also Yuan, 2012).

Footrope selectivity at length l, ($\hat{e}_{1l}$) was estimated using a 3-parameter logistic model:

$$\hat{e}_{1l} = \frac{1}{1 + \exp(-\beta_0 - \beta_1(l - \beta_2))}$$

$\beta_0 = 0.82257, \beta_1 = 0.11386$ and $\beta_2 = 35.5$

A herding coefficient ($\hat{h} = 0.017$) was applied to estimate herding in the area between the doors and wings (sweeps). The herding selectivity ($\hat{e}_{2li}$) was estimated as follows:

$$\hat{e}_{2li} = \frac{v_{1i} + \hat{h}v_{2i}}{v_{1i} + v_{2i}}$$

v_{1i} is the area swept by the footrope on tow i.
v_{2i} is the area covered by the sweeps on tow i.

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

$$p_{lis} = \hat{e}_{1l}\,\hat{e}_{2li}\frac{(v_{1i} + v_{2i})\,I_s}{A_s}$$

I_s is the number of hauls in stratum s.
A_s is the surface area of stratum s.

For megrim, no catchability correction is applied, so the capture probability is simply:

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

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

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

n_l is the catch numbers-at-length in tow i
w_l is the mean weight-at-length, obtained from the length-weight relationship for the whole survey.

Changes in gear, protocols or estimation

During the 2016 survey:

- The tickler chain was fitted with a weak link that broke regularly. It was replaced with a G13 connector (not-so-weak link) at the end of the first leg.

Before the 2017 survey:

- The tickler chain was shortened so it is now well ahead of the footrope (approx. 3m) last year it was about 1.5-2m ahead of the footrope).
- The doors were modified by fitting a new top-end in order to increase their surface area from 5.25m^2 to approx. 5.45m^2 resulting in an additional 6% spreading power (estimated by supplier). This resulted in 4-5m extra door spread.
- The head rope was replaced and the floats were tidied up (tied on tighter and more regularly spaced). This resulted in an additional 60cm headline height, on average.
- The netting at the tips of the wings was replaced with stronger netting to avoid damage when it is pulled onto the drum on top of the floats.
- This was the first year a CTD was mounted on one of the trawl doors.

During the 2017 survey:

- The codend was replaced after the area 7 part of the survey was completed (legs 1 and 2) but before the 6a part of the survey took place.

Before the 2018 survey:

- 1.2m length of chain added to the headline bridles. This chain was part of the design of the gear but was omitted from the gear plans. Fitting the chains resulted in an increase in the headline height of round 75cm and an increase in door spread of around 5m compared to 2017. There were no indications that fitting the chains changed the bottom contact or the amount of digging-in of the ground gear.

Before the 2019 survey:

- Additional deep water transects (500-1,500m) were added to survey protocols (3 additional days have been added to legs 1 and 2 to facilitate this work).
- In the middle of the Porcupine Bank there is some very soft ground. This may cause the gear to dig in (the door sensors getting unstable are observed), reduce the warp to lift the gear a bit more. If this doesn't work, increase the speed a bit, e.g. up to 3.4-3.5 knots. (Soft ground can be quite dangerous if trawl belly fills up with mud!).
- The duration of leg 3 (6a) has been reduced due to over-sampling relative to the Scottish effort; the target has been reduced from 50 to 40 stations.
- In case of extreme work pressure, there is an option to only process target species (MON, WAF, MEG; no catch weights or samples for other species). These stations will be flagged with validity code 'T' (This did not occur during IAMS 2019).
- There has been some inconsistency in recording the end of the tow in the past. Some SiCs recorded the end of the tow as the time when the gear is being hauled back, others as the time the gear lifts off the ground. It will be necessary to analyse the sensor data and apply corrections to the historic data in terms of tow length. From 2019 onwards, the end of the tow is being recorded as the time at lift-off.

Results

Cruise summary

A total of 129 valid tows were completed (out of a target of 115), including 9 additional deep water tows (Table 1). There were 4 invalid hauls although there was no major damage to gear. Summary statistics by stratum for four main target species are provided in Table 2

Table 2. Weather conditions were poor for legs 1 and 2 but very good for leg 3 (see Appendix 2: Cruise narrative for details).

Downtime (Weather, technical and/or gear damage)

Date	Hours downtime	Reason
01-02/03/2019	24	Bad weather/technical problems etc.
09-10/03/2019	11.5	Decision to slow steam from Haul 34 after completion at midnight to review weather at next position after dawn. Fishing resumed c.11:30am.
11-12/03/2019	36	Bad weather.
17/03/2019	7	Bad weather.
21/03/2019	2	Link broken in cross conveyer belt.
22/03/2019	5	Weather worse than forecast.
23/03/2019	9	Damage to net.
16/04/2019	2	Cross conveyor belt broke.
22/04/2019	1	Small tear in port wing (<0.5m).

Summary statistics

Table 1: Target and achieved stations by stratum

Stratum	Target	Valid	Invalid
DeepArea4	5	5	0
DeepArea5	5	4	0
VIa_Shelf_L	14	19	0
VIa_Shelf_M	7	9	0
VIa_Slope_H	10	13	1
VIa_Slope_M	9	9	1
VII_Porc_L	4	4	0
VII_Shelf_H	16	17	0
VII_Shelf_L	7	6	1
VII_Shelf_M	5	5	0
VII_Slope_H	22	25	0
VII_Slope_L	2	4	1
VII_Slope_M	9	9	0
Total	115	129	4

Table 2: Summary statistics by stratum. Stratum area is given in Km², 'Num hauls' is the is the number of valid hauls in each stratum and 'Swept Area' is the total area swept between the doors in each stratum (in Km²), catch numbers ('Catch Num') are given for *L. piscatorius* (MON), *L. budegassa* (WAF), *L. whiffiagonis* (MEG) and *L. whiffiagonis* (LBI).

Stratum	Stratum Area	Num Hauls	Swept Area	CatchNum Mon	CatchNum Waf	CatchNum Meg	CatchNum Lbi
VIa_Shelf_L	37,003	19	9.2	231	38	119	0
VIa_Shelf_M	4,746	9	4.2	187	36	49	0
VIa_Slope_H	3,114	13	7.2	246	72	511	24
VIa_Slope_M	3,044	9	4.8	150	0	122	5
VII_Shelf_H	50,764	17	8.7	43	157	158	40
VII_Shelf_L	42,034	14	8.0	146	49	128	155
VII_Shelf_M	14,621	5	2.5	25	46	49	3
VII_Slope_H	35,768	25	13.5	170	163	297	110
VII_Slope_M	29,406	9	5.7	95	2	31	20

Abundance and Biomass estimates

Estimated numbers and biomass for the survey area are given in Table 3. Note that it is likely that the selectivity correction does not account for all the fish encountered by the gear; therefore these estimates should not be treated as absolute.

Table 3: Estimated numbers (millions; NumMln) and biomass (kT; BiomKT) in the survey area, with CV (relative standard error) and 95% confidence intervals (low:CiLo and high:CiHi). Only fish >500g live weight (approximately 32cm) were included in the estimate.

	VIa MON	VII MON	VIa WAF	VII WAF
NumMln	7.056	10.214	1.202	10.777
NumCV	17.703	26.517	26.320	17.935
NumCIlo	4.608	4.906	0.582	6.988
NumCIlo	9.504	15.522	1.822	14.565
BiomKT	5.466	21.502	0.976	8.658
BiomCV	13.134	7.855	32.700	11.461
BiomCIlo	4.059	18.192	0.351	6.713
BiomCIlo	6.873	24.813	1.602	10.603

Gear and fishing details

Figure 2 gives details of fishing net geometry of valid tows: distance towed, depth / warp length, warp length / door spread and door spread / wing spread. These show expected distributions and ranges.

Catch

The length-weight relationship for *L. piscatorius* and *L. budegessa* caught over the course of the survey followed expected relationships (Figure 3). Figure 4 and Figure 5 summarise the catch distribution across the survey area, and by areas (VIa and VII) of *L. piscatorius* and *L. budegessa* respectively. *L. piscatorius* tended to show higher densities in the VIa Slope and VIa High strata, and lower densities in the VII Shelf High and VIa Shelf Low strata. *L. budegessa* showed highest densities on VII Shelf High

and VIa Slope High, and lowest on VIa Slope Medium and VII Porcupine Low and were absent on VII Slope Low and VII Slope Medium strata.

Figure 6 shows that the relative influence each of the stations had on the final density estimate was generally equitable (i.e. no single tow had a disproportionally large influence on the biomass estimates).

The trends in catch weights per swept area (Kg/Km^2) for anglerfish (*L*. *piscatorius*, *L*. *budegassa*) and megrim (*L*. *whiffiagonis*) from IAMS 2016 to 2019 are shown in Figure 7. For the anglerfish, the footrope and sweep selectivity were estimated as outlined in the Methods section. For megrim, no selectivity figures are available; 100% footrope selectivity was assumed and 0% sweep selectivity. Both species of anglerfish recorded the highest catch rates in 2017 for both assessment areas (6a and 7). Catch rates for anglerfish declined and levelled off after reaching this peak. Catch rates for megrim possibly show a declining trend. However, note that for all species the variability between years is within the uncertainty bounds, so there is no strong evidence of a trend.

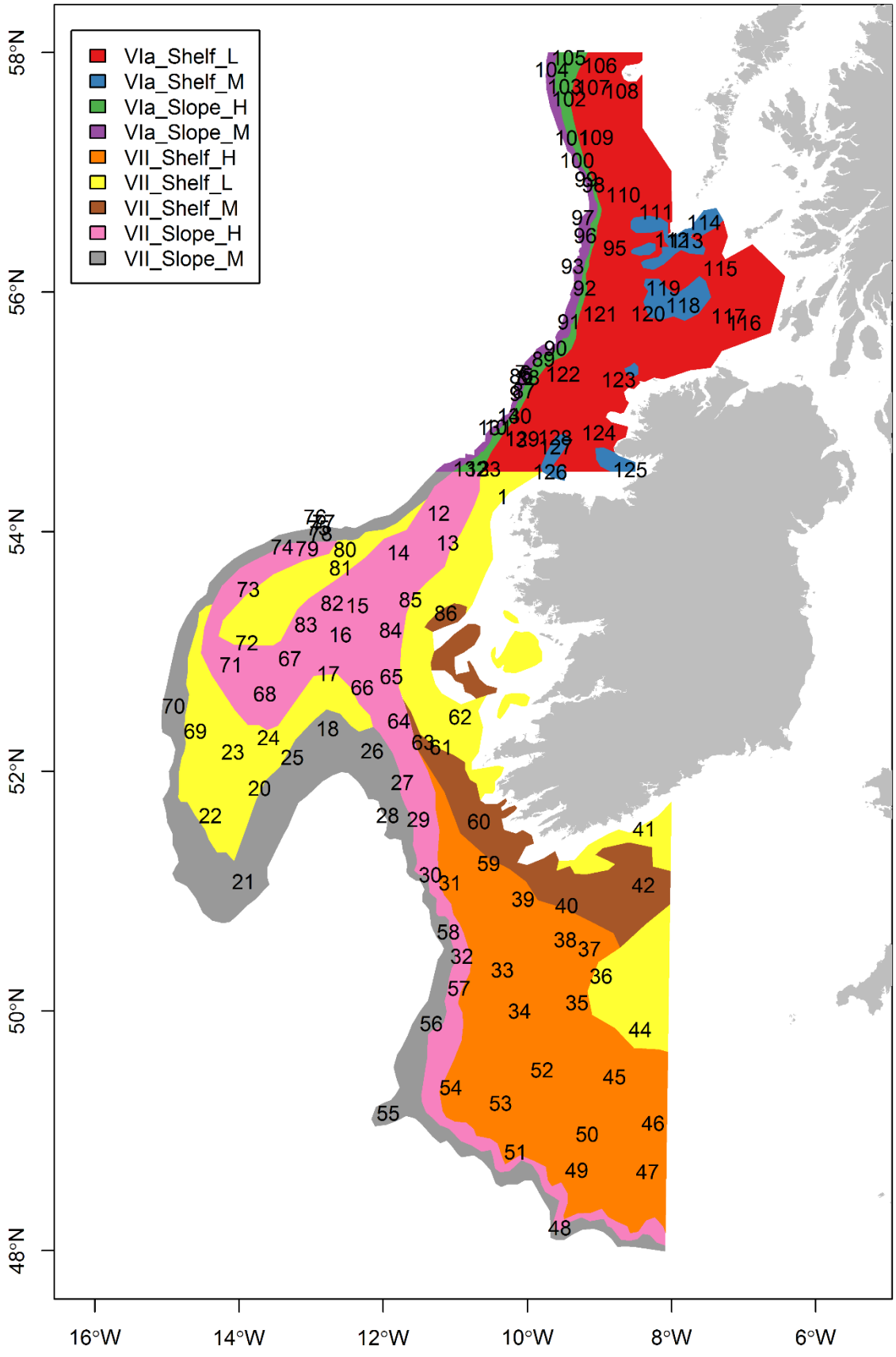


Figure 1*: Valid tow positions, the numbers refer to the haul number.*

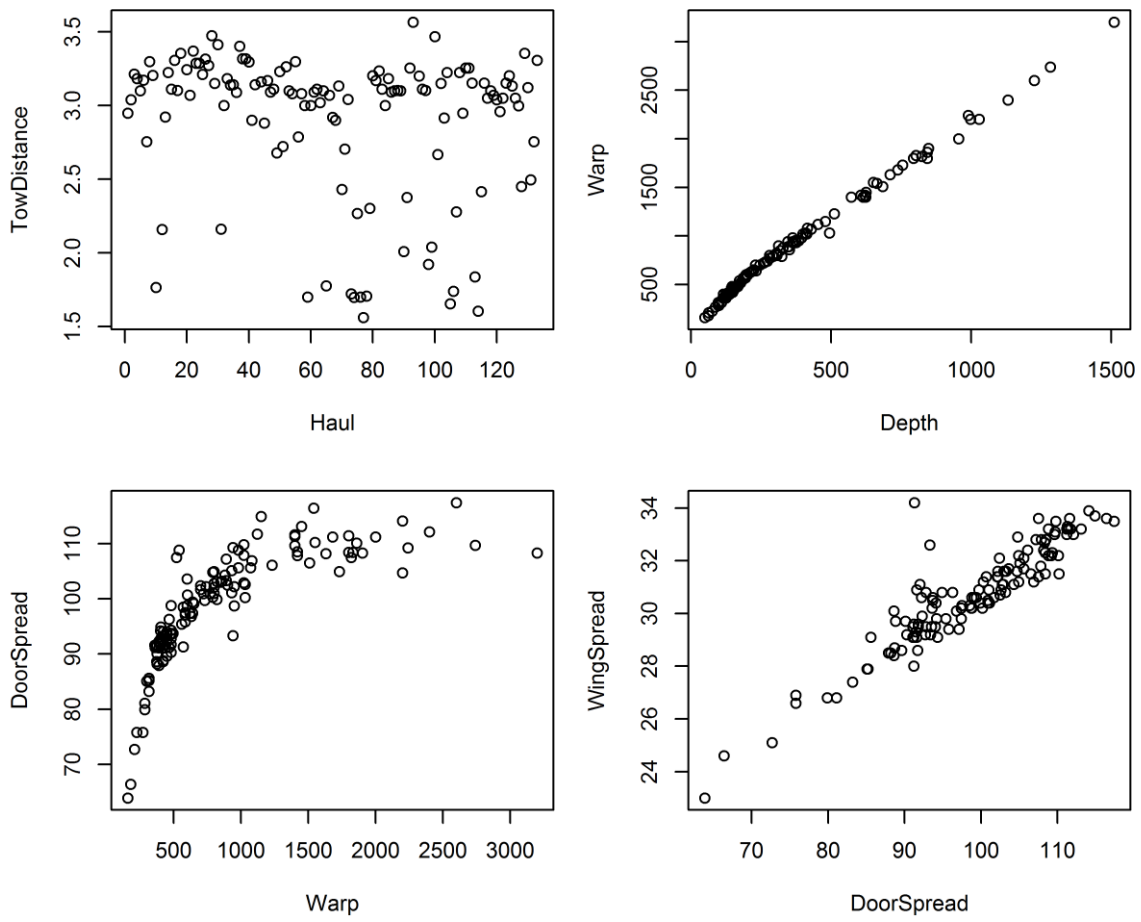


Figure 2: Gear parameters for the valid hauls. Haul is the haul number; tow distance in nautical miles; warp, depth door spread and wing spread in meters

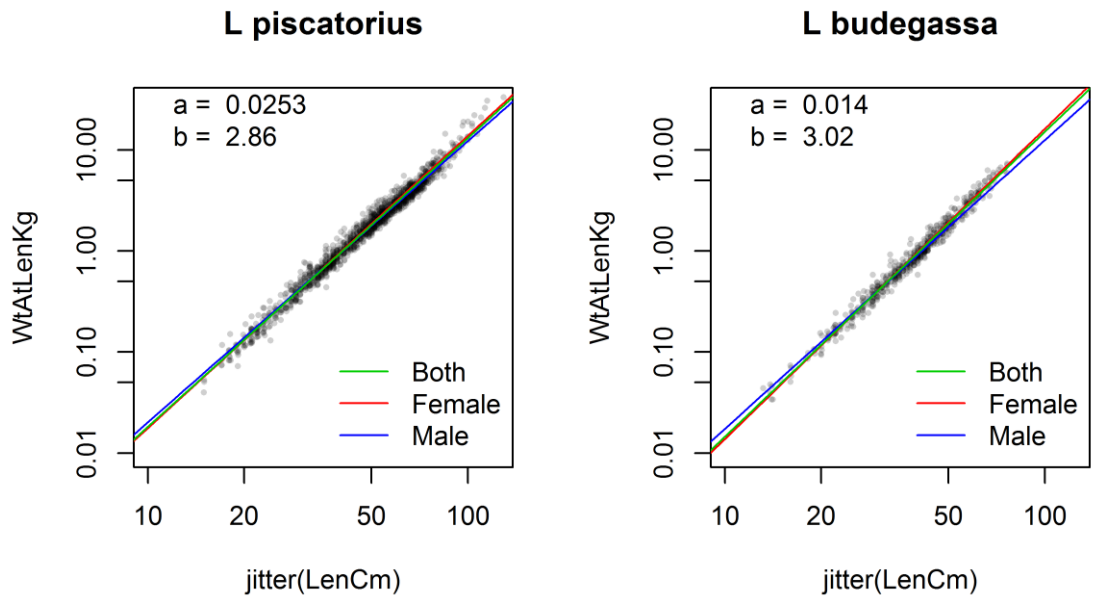


Figure 3: *Length-weight parameters. Total length in cm and live weight in kg. Note the log scale.*

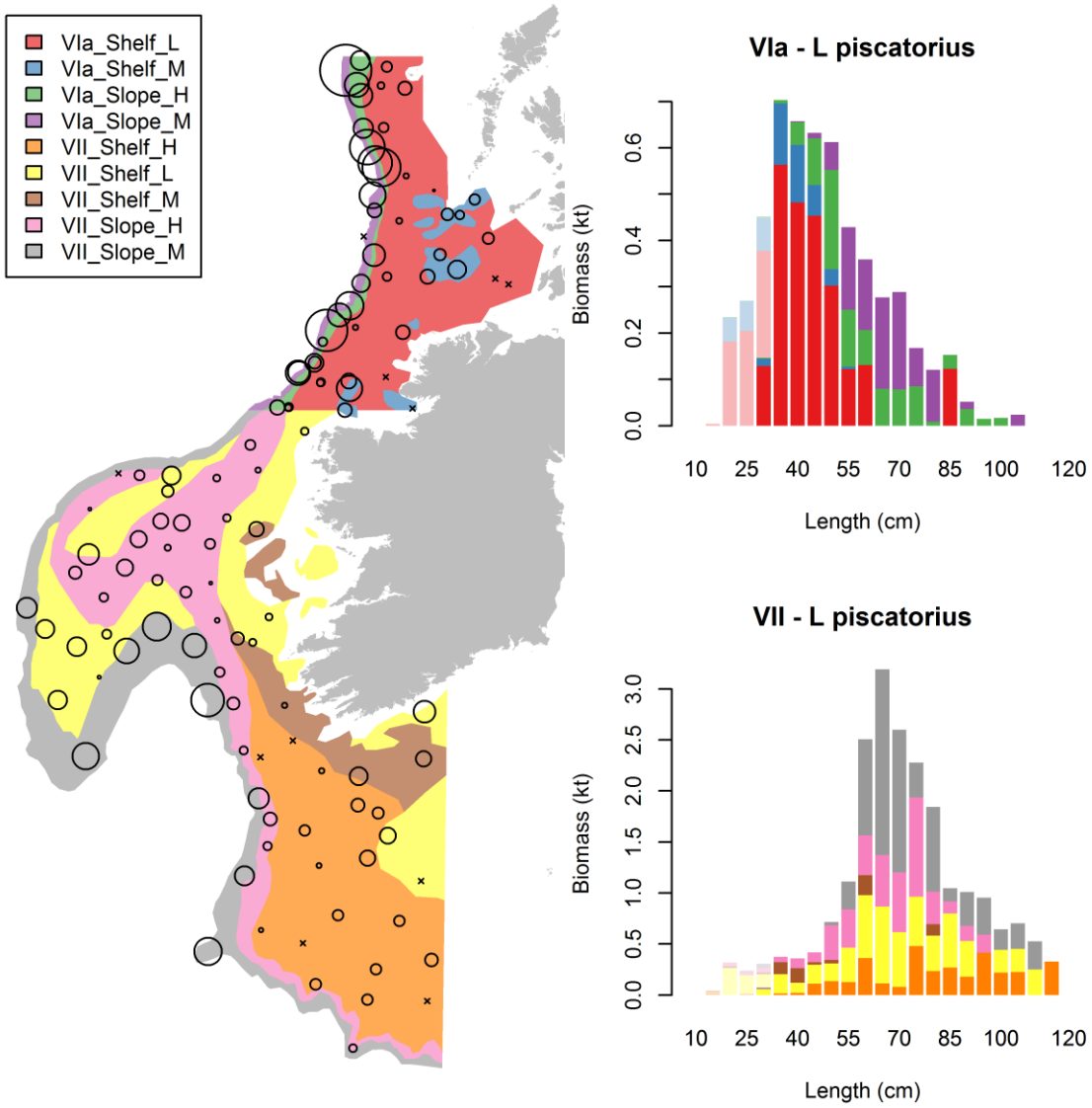


Figure 4: ***Bubble size is proportional to the biomass of*** **L. piscatorius** ***per swept area at each sampling station (left; >500g fish only) and biomass per size class and stratum (right; fish <500g in pale shades).***

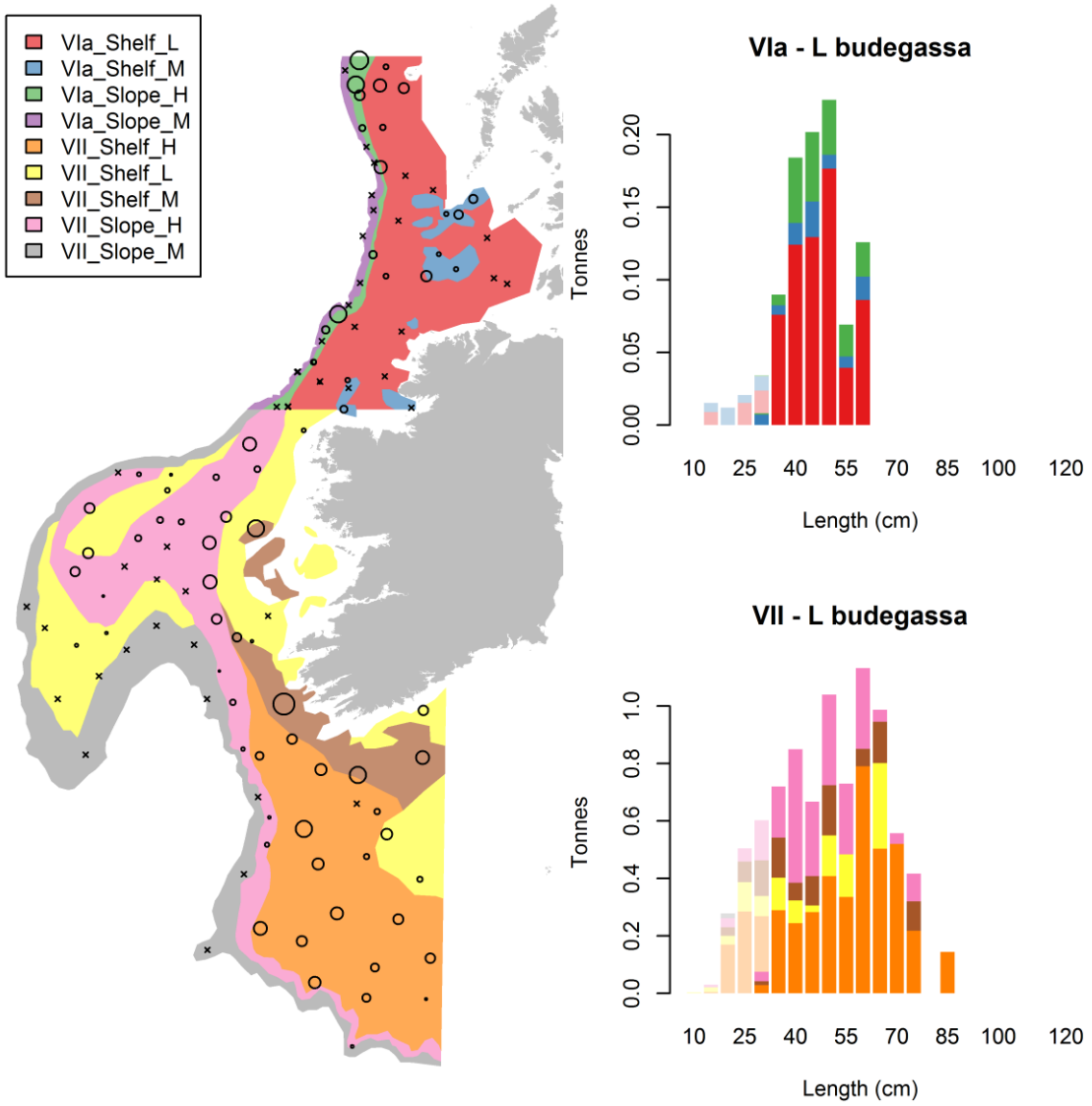


Figure 5: ***Bubble size is proportional to the biomass of*** **L. budegassa** ***per swept area at each sampling station (left; >500g fish only) and biomass per size class and stratum (right; fish <500g in pale shades).***

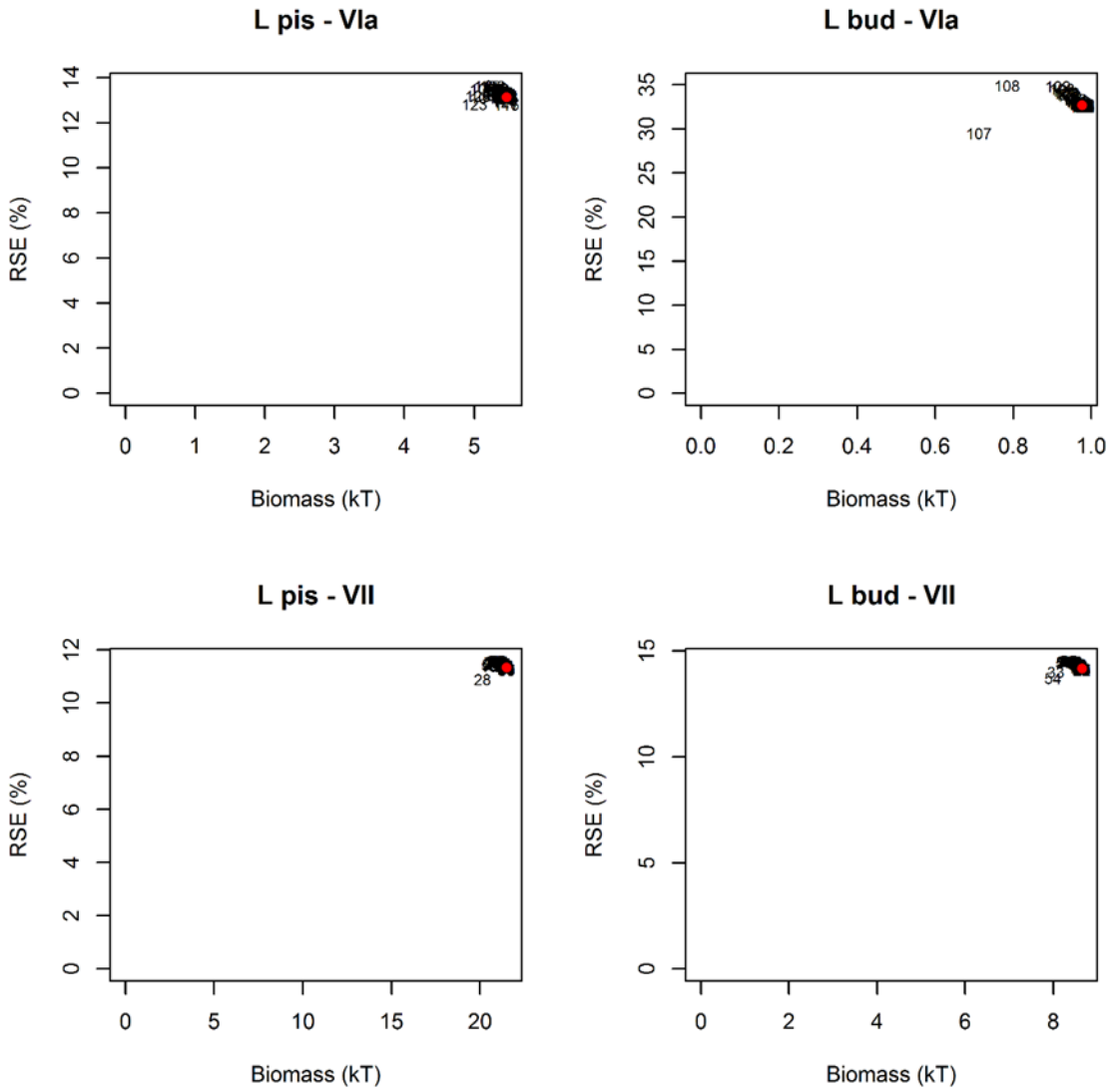


Figure 6: Influence that each tow had on the final biomass estimate. ***Estimates were obtained by sequentially removing each of the tows from the analysis. The red dot indicates the final estimate (with all the valid tows included). For*** **L. piscatorius** ***in subareas VIa station 123 was most influential while in subarea VII station 28 was most influential; for*** **L. budegassa** ***in subarea VIa, stations 107 and 108 were particularly influential (without either of these stations the biomass estimate would have been considerably lower). For*** **L. budegassa** ***in subarea VII, station 54 and 33 were most influential.***

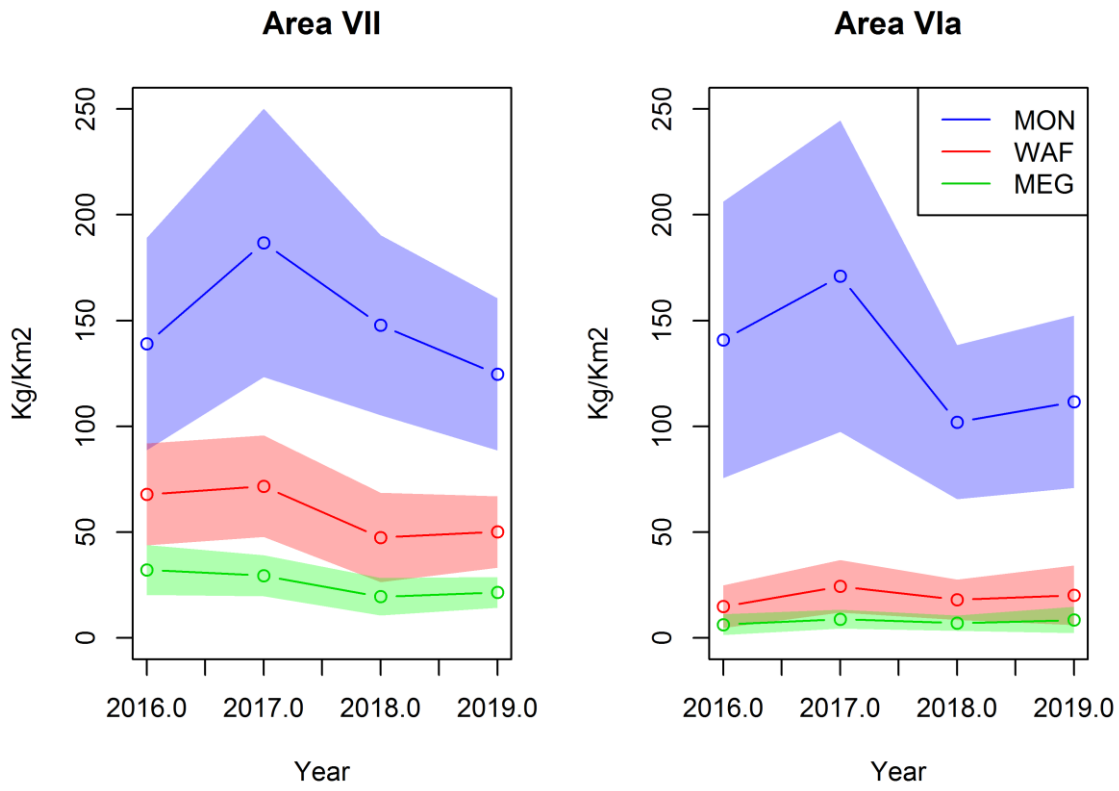


Figure 7: *Trends in catch weights per swept area for white anglerfish (MON); black anglerfish (WAF) and megrim (MEG).*

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Appendix 1: List of survey staff

Name	Organisation	Role	Dates
Artur Opanowski	Survey Contractor	Wetlab Scientist	13-25/3/2019
Dave Stokes	Marine Institute	Scientist In Charge	1-13/03/2019
Debbie Walsh	Smart Sea School	Wetlab Scientist	16-25/4/2019
Deirdre Lynch	Marine Institute	Wetlab Scientist	1-13/03/2019
Edel Sheerin	Smart Sea School (NUIG)	Wetlab Scientist	1-13/03/2019
Emma White	Marine Institute	Wetlab Scientist	16-25/4/2019
Eoghan Kelly	Marine Institute	Scientist In Charge	16-25/4/2019
Frankie McDaid	Survey Contractor	Wetlab Scientist	1-13/03/2019
Gráinne Ryan	Marine Institute	Deckmaster	13-25/3/2019
Gráinne Ryan	Marine Institute	Deckmaster	16-25/4/2019
Grant Course	Survey Contractor	Wetlab Scientist	1-13/03/2019
John Enright	Marine Institute	Wetlab Scientist	13-25/3/2019
John Power	Survey Contractor	Wetlab Scientist	1-13/03/2019
Jonathan White	Marine Institute	Scientist In Charge	13-25/3/2019
Karl Bentley	Survey Contractor	Wetlab Scientist	13-25/3/2019
Kevin McGookin	Smart Sea School (NUIG)	Wetlab Scientist	1-13/03/2019
Leigh Barnwall	NUIG	Wetlab Scientist	13-25/3/2019
Leigh Barnwall	NUIG	Wetlab Scientist	16-25/4/2019
Luke Batts	GMIT	Wetlab Scientist	1-13/03/2019
Macdara Ó Cuaig	Marine Institute	Scientist In Charge	1-13/03/2019
Mairead Sullivan	Marine Institute	Deckmaster	16-25/4/2019
Mark Desmond	Smart Sea School (UCC)	Wetlab Scientist	13-25/3/2019
Michael Petroni	Smart Sea School (NUIG)	Wetlab Scientist	13-25/3/2019
Mikel Aristegui Ezquibela	Marine Institute	Wetlab Scientist	13-25/3/2019
Milaja Nykänen	UCC	Wetlab Scientist	13-25/3/2019
Orla Hanniffy	Marine Institute	Wetlab Scientist	16-25/4/2019
Paul Bouch	Marine Institute	Scientist In Charge	16-25/4/2019
Robert Bunn	Marine Institute	Deckmaster	1-13/03/2019
Ross Fitzgerald	Marine Institute	Deckmaster	13-25/3/2019
Ross O'Neill	Marine Institute	Wetlab Scientist	16-25/4/2019
Sara-Jane Moore	Marine Institute	Scientist In Charge	13-25/3/2019
Sofia Viotti	Smart Sea School (Uni. La Laguna)	Wetlab Scientist	16-25/4/2019
Tobi Rapp	Marine Institute	Deckmaster	1-13/03/2019
Turloch Smith	Marine Institute	Wetlab Scientist	1-13/03/2019
Usna Keating	Survey Contractor	Wetlab Scientist	16-25/4/2019
Yves Reecht	Marine Institute	Wetlab Scientist	16-25/4/2019

Appendix 2: Cruise narrative

Date	Comments
Thu 28 Feb	Fishing gear mobilised
Fri 01 Mar	Scientists on board 16:00, delayed departure by 24hrs due to forecast of 8-9m swell west of Aran's until mid-morning Sunday.
Sat 02 Mar	Pilot aboard 01:30, depart c.01:30
Sun 03 Mar	Slow transit in heavy weather, North Sound 08:00. Haul_1: First station 51 (VII_Shelf_L), 11nmi west of Belmullet. 17:00. Shot the net but decided not to tow here as the ground looks very uneven on approach (note that in hind-sight the tow was probably ok). Steamed north to a safer tow 3.75 miles away (station 22). Haul_2: Shooting away at station 39 which has a half a tow of FID 2997 at the same location. Haul_3 station number 39 (VIa Slope L). Wing sensor acting up; might need to swap.
Mon 04 Mar	Hauls 3-4 valid, Haul 5 is first of the Deepwater tows. Did first sediment grab. Haul_6 Deepwater tow. No problems. Haul_7 Deepwater tow. A long time to shoot the wire! Net seemed to stick a bit in the mud but other than that no bother. Sensors working ok for most of the tow. Haul_8 Deepwater tow. Big bulk & new species. Wing sensor did not like deep water! Haul_9 Deepwater tow. Big bulk, a lot of species to ID. Wing sensor out again. Trawl sounder charging so not available for this tow.
Tues 05 Mar	Haul_10 Deepwater tow shortened due to the work involved with previous tows A lot of bulk overnight in deepwater (2-3 lifts per tow). Moving shallower and south back towards 7b, leaving 1 deepwater station not done. Struggling with bulk and spp. ID. Came fast on Haul 11, towed backwards 0.6nmi during recovery, but all fine bar a few holes. Ground flat, but headline was bouncing with a small catch at the start, including doors. Flagged as Invalid. Haul_12 ArcGis crashed, will reboot after this tow. A sign of fish going back into the net so tow cut short to prevent overload. Haul_13 ArcGis restarted post reboot all good again. No life on the sounder until latter half of the tow, decided to keep towing for full 60 mins. Mackerel but not too much bulk in the net. Haul_14 All good, altered course a little towards the end of the tow to avoid a mark on the Sodena. Haul_15 All good but catch only 50kg!
Weds 06 Mar	Worked from north to south today on eastern side of Porcupine. Poor fishing all day, couple of boxes for 1hr tows. Weather turned very cold and brisk. Sea state is workable, although increasingly marginal by late evening. Haul_18 All good but wing sensors on Marport coming and going. Haul 19 Significant red marks on the TEY so hauled back on after 12min, but not much catch retained. All other hauls valid.
Thu 07 Mar	Forecast showing significant swell coming in for Saturday and especially Tuesday so amending cruise plan to head east after next 2 stations on southern Porcupine. That will finish this area and leave us working towards SW shelf edge and Celtic Sea with cruise break in Cork. Significant distance (30-40 nmi) between stations today and sea conditions building so progress is slow. Haul_20 All sensors worked fine good tow. Long steam to Haul 21. Haul_22 Winch alarm went off a few times as the net was sticking in the mud. Picked up the speed to lighten the net and everything worked fine. Haul_23 Winch alarm went off at around 14mins as the net was sticking in the mud, looks like door fell over for a while. We picked up the speed to lighten the net and everything worked fine.

Fri 08 Mar	Haul_24 Attempted this tow last night but called it short as we were marking fish and the wind was hitting 40 kn. So as we were going past it we decided to do it again tonight. Haul_25 Net very slow to settle all sensors working perfect. Haul_26 Had to move Haul_27 (Stn 26) to the west due to fishing vessel on the original tow track. Haul_28 Net very slow to settle here in 800m we eased the boat back to 2.5 kn and that helped. Nice ground here and Scanmar sensors worked fine but the Marport trawl sensor was not firing despite getting the wing and door readings. Hydraulic trouble on hauling the net to the drum so haul back delayed. Sediment sample taken after this station. 51D 35.812 N and 11D 56.690 W.
Sat 09 Mar	Haul_29 All good except the Marport Trawl Explorer is not working. The screen is telling us the battery is at 0%. Weather gusty in the morning, up to 40 kn during Haul_30. Very slack, 1-2 boxes. A lot marks in Haul_31 so hauled at 40 min. Small catch with a lot of mackerel in the meshes, obviously passing through! Some Scad and few boxes of good hake. Took a sediment sample after the haul. Haul_33 Trawl sounder coming and going will have to take off to charge. All other sensors fine. Haul_34 Weather freshening all the time 30-35 kn for the wind with a big swell.
Sun 10 Mar	Slow start and poor catch (58Kg) at Haul 35. Picked up a bit at Haul 36 with 50Kg haddock and 50Kg monkfish (185Kg total catch). Poor weather over night, hove to.
Mon 11 Mar	Weather settled well from late morning until after lunch. Wind and sea building again so planning to dock Cork late evening. Fishing until late afternoon.
Leg 2	**Crew Change Wednesday 12th March**
Wed 13 Mar	Frist tow in the evening: Haul No. 41; Station 22. Issues with winch slowed operations. Poor weather forecast for the coming 4 to 5 days
Thu 14 Mar	Haul No. 42; Station 50. Haul No. 43; Station 34. Weather still poor
Fri 15 Mar	Haul No. 44; Station 4. Haul No. 45; Station 53. Haul No. 46; Station 56. Haul No. 47; Station 32.
Sat 16 Mar	Haul No. 48; Station 11. Arrived on station for haul 49 (Station 44) around 9am. Weather deteriorating, held position waiting improvements. Shot around 5:30pm. Haul No. 49; Station 44. Haul No. 50; Station 28.
Sun 17 Mar	Haul No. 51; Station 19. 5am. Laid up – high wind & wave height. CTD downloaded. Haul No. 52; Station 16. 2pm. Door sensors changed today. Haul No. 53; Station 48. Slack haul.
Mon 18 Mar	Weather good, Haul No. 54; Station 7. 00:21hrs. Haul No. 54; Station 7. 06:00hrs. 820m depth. Station 41 planned. On arrival ~ 10 Spanish boats. Mikel called on the radio in Spanish. Lots fishing with gear in the water, decision taken to move on to station 54. If gillnetters knew in advance they could have moved gear. Possibly send marine notice to CTB co-op to transfer that information to Spanish buyers. New trawl sounder was put on for Haul 56. Grab carried out after Haul 57 (Station 75).
Tues 19 Mar	Haul 58 (Station 74), grab carried out. Haul 59 cut short at 30 minutes owing to apparent large marks of mackerel, which proved so in the net ~ 2.6 t mackerel. Grab sample taken, Haul 59, Station 65. Haul 60 – fine. Grab sample taken, Haul 60, Station 6. Trawl sounder taken off and change for old one. Battery lasted ~2 days. Station 42 (planned Haul No. 61) was found to be poor, hard, looking ground – this station could have been attempted, but given the delays earlier in the leg, the decision

	was taken to drop this station in favour of a station previously towed in IAMS2017 to the northwest, to safeguard against damage to the gear. This station was fished successfully. Haul 62 (Station 63) carried out – good ground.
Wed 20 Mar	Haul 63 (Station 21). Haul 64 (Station 55) – Grab collected. Haul 68 - door sensors changed, fully charge trawl sounder. CTD Taken off and data downloaded. Trawl eye changed on a daily basis as not showing full complement of lights.
Thurs 21 Mar	After Haul No.70, cross conveyer from the hopper feed, across the back of the wet lab, broke a link. Plan to fix by taking a couple of links out of the lower conveyer. Down time expected of ~ 2 hrs. Fixed successfully by C.E. Engineers. Replacement belts may be required.
Fri 22 Mar	Stations 17 & 33 skipped due to worsening weather and time restrictions, heading for station 46, arriving at ~ 7:30. Haul 73 (Stn 46) hauled at 30 mins owing to strong marks and poor weather conditions (concerns about safety getting a large haul onto the deck) resulting haul was not large, strong marks were possibly small whiting that went through the mesh. Station 39, Haul 74 @ 20 mins speed dropped slightly and doors and wings came in by around 25%. Speed returned but doors and wings did not correct. Called at 30 minutes and hauled. Longline found wrapped around warp just before net. No damage. Haul 75-deep 5-1,000m-big catch of black scabbard Haul 76-deep 5-1,500m-no trawl eye reading as depth is 1,200m - 30mins tow
Sat 23 Mar	Haul 77-deep 5-1,250m Haul 77 – Haul commenced at 1:30am. Damage to net noted when on deck. No indication during tow, haul taken as valid. Damage to net estimated at ~ 9hrs to mend. Net mended and ready to continue fishing at 7:30am Haul 78 Haul 79 Haul 80-grab sample taken Haul 81-grab sample taken. This was a new tow to complete the 'VII_Porc_L' stratum where tows were missed out due to bad weather.
Sun 24 Mar	Haul 82-grab attempted but no sample so moved on to next haul. Old fishing gear brought up on top part of doubles chain. Grab taken after Haul 52. Grab taken after Haul 84. Grab taken after Haul 85 and 86.
Mon 25 Mar	Galway Docks for 07:00.

Leg 3	**Break between legs 2 and 3**
Tuesday 16th April	Departed Killybegs at 14:00UTC; Deployed weather buoy at 21:00UTC; First station (#27) shot at 22:26UTC; Cross conveyor broke during sorting.
Wednesday 17th April	Shot away station #23 at 00:30UTC but no sensor data transmitted. On re-hauling it was discovered that the doors had crossed. Reshot at 02:00UTC. Haul 90 was shot at 08:29UTC. After 25 minutes, connection to the doors sensors was lost, and the wing spread decreased slightly. After a few minutes this corrected itself. A similar event occurred at around 40 minutes, probably due to the rough ground, it was decided to cut the tow short. Prime 33 (Haul 91) was hauled early due to proximity of a fishing vessel with gear in the water, and not responding over the radio. Upon hauling there was a small rip in the starboard wing of the net. The haul was considered valid. Prime 11 (Haul 92) had large pelagic catch of mackerel, horse mackerel, boarfish and blue mouth. Prime 12 (Haul 93) was almost 1,000m and contained large bulk of deep water species. Prime 44 (Haul 94) contained large bulk of Spurdog. Haul was flagged as invalid because only a subsample of the catch could be sorted.
Thursday 18th April	Prime 3 (Haul 96) – began 03:58UTC – no issues. Used the northern part of the line.

	Prime 29 (Haul 97) – Gear on bottom at 06:50UTC. No issues. Decided against doing station 46 due to the proximity of the previous tow and the low confidence in the track. Prime 32 (Haul 98) – Gear on bottom at 10:11UTC. Lot of fish on the sounder so hauled early. Prime 21 (Haul 99) – Gear on bottom at 12:39 UTC. Start of line very uneven seabed, so used later part of line. Snagged at about 35 minutes so hauled early to check for damage, but gear was fine. Lot of mud on the doors though. No issues with Prime Stations 24, 15, 6 or 2.
Friday 19th April	Prime 50 (Haul 104) – Gear on bottom at 02:00UTC. No issues. Prime 37 (Haul 105) – Gear on bottom at 04:390UTC. Lot of marks on sounder, so hauled early. Reasonable numbers of mackerel and boarfish Prime 31 (Haul 106) – Gear on bottom at 07:30UTC. Hard and uneven sea bed and lots of marks so hauled early. Prime 42 (Haul 107) – Gear on bottom at 09:39UTC. High density of marks, so hauled after 45. Prime 19 (Haul 108) – Gear on bottom at 12:18UTC. No issues. CTD removed from door and downloaded. Prime 1 (Haul 109) – Gear on bottom at 16:58UTC. No issues. Prime 28 (Haul110) – Gear on bottom at 21:31UTC.
Saturday 20th April	Prime 34 (Haul111) – Gear on bottom at 00:32UTC. Prime 47 – (Haul 112) – Additional station in the stratum, just in case one of the priority stations has to be skipped later. Prime 14 (Haul 113) – Lot of fish on sounder so hauled early. Performed day grab after the trawl (Grab 1). Prime 35 (Haul 114) – No trawl eye reading so impossible to detect fish or what was happening in the trawl. Skipper noted unusual tension on starboard cable so hauled early to prevent damage. Prime 22 (Haul 115) – Huge numbers of marks on both the trawl eye and the sounder. Hauled after 45 minutes. Prime 36 (Haul 116) – Shallow station (<50m). Wing sensors not working. Prime 10 (Haul 117) – Shallow station (<60m).
Sunday 21st April	Prime 18 (Haul 118) – No issues. Prime 9 (Haul 119) – No issues. Prime 26, 8, 48 and 13 – No issues.
Monday 22nd April	Prime 35 (Haul 124) – Lot of noise from the sensors, but partially due to shallow station, weather and speed. Small tear in port wing (<0.5m) Prime 30 (Haul 125) – No issues. Prime 4 (Haul 126) – Wing sensor was not giving great signal. Otherwise no issues. Prime 43 (Haul 127) – No issues. Prime 45 (Haul 128) – Hauled after 45mins due to fish marks on sounder. Prime 5 Redo (Haul 129) – No issues. (This station had been done on leg 1 but better to do it again so all stations in area 6 are done in the same period).
Tuesday 23rd April	Prime 40 (Redo) (Haul 130) – 02:17UTC – No issues. Prime 16 (Redo) (Haul 131) – 07:45UTC. Extended well beyond planned track, so hauled early due to terrain uncertainty and skipper's advice. Prime 49 (Haul 132) – Lot of mackerel on sounder so hauled after 50 minutes Prime 39 Redo (Haul 133) – No issues.
Wednesday 24 April	Return to Galway 20:30 tide.

Appendix 3: Additional Sampling

Request	Details	Requested by	Target	Number collected
Nephrops	Nemesis catch sampling	Jennifer Doyle (MI)	All	1290
Litter	Litter log per tow	OSPAR	All	129 stations
CTD on trawl door	Mini CTD	DCF (MI)	All	129 stations
CTD transects	Main CTD	Kieran Lyons (MI)	One per leg if possible	2 transects off NW Coast
Grab samples	Sub sample from Day grab	Fabio Sacchetti (MI)	Opportunistic	30
Elasmobranch Tagging	Tag & record elasmobranchs	Macdara O'Cuaig (MI)	Opportunistic	13
Genetics Horse Mackerel	Stock ID Project	Edward Farrell (UCD)	5-10 individuals	10
Seafest demo fish	Bag and tag deep water fish	Gráinne Ní Chonchuir (MI)	6 large bags	6 large bags
Monkfish Stomach samples	Bag and tag stomachs	Conor Dolan (AFBINI)	All	WAF 231 MON 212
Cephalopods	Complete biological sampling	Annemarie Power (NUIG)	All	2,366 individuals
Cuckoo Ray Genetics	All Cuckoo Rays >550mm	Milaja Nykänen (NUIG)	20 per haul maximum	129 samples

Appendix 4: Summary of station location, gear geometry and catch

Note: Valid stations only.

LonDegW and LatDegW are the mid-point positions of each haul; Depth mtr is the average depth of the haul; dist nm is the tow distance in nautical miles; Door and Wing mtr are the median door and wing spread. Mon/Waf num/kg are the catch numbers and weights of *L. piscatorius* and *L. budegassa*. Mon/Waf kg/km2 are the catch weights per swept area and Mon/Waf tons are the contribution that each station makes to the total biomass estimate in the survey area.

Haul	Stratum	LonDeg W	LatDeg N	Depth mtr	Dist nm	Door mtr	Wing mtr	Mon Num	Waf Num	Mon Kg	Waf Kg	Mon $KgKm^{-2}$	Waf $KgKm^{-2}$	Mon Tons	Waf Tons
1	VII_Shelf_L	-10.345	54.293	125.0	2.9	91.2	28	50	2	12.2	1.3	2.6	0.8	566	35
2	VIa_Shelf_L	-10.603	54.532	196.5	3.0	100.7	31.4	11	0	10.6	0.0	3.2	0.0	147	0
3	VIa_Shelf_L	-10.083	54.770	116.0	3.2	91.8	29.5	34	1	12.0	1.7	2.4	0.5	254	18
4	VIa_Slope_H	-10.177	54.972	280.0	3.2	104.9	32.2	4	2	16.5	1.9	6.6	1.0	21	3
5	DeepArea4	-9.998	55.306	511.5	3.1	106.1	32.4	67	2	239.2	2.6	NA	NA	NA	NA
6	DeepArea4	-10.026	55.330	711.0	3.2	108.2	32.4	36	0	135.1	0.0	NA	NA	NA	NA
7	DeepArea4	-10.092	55.333	990.0	2.8	109.2	32.2	1	0	6.3	0.0	NA	NA	NA	NA
8	DeepArea4	-10.172	55.302	1225.5	3.3	117.4	NA	0	0	0.0	0.0	NA	NA	NA	NA
9	DeepArea4	-10.166	55.158	1131.5	3.2	112.1	33	4	0	14.5	0.0	NA	NA	NA	NA
10	VIa_Slope_M	-10.440	54.876	803.0	1.8	108.4	31.5	5	0	19.6	0.0	19.6	0.0	60	0
12	VII_Slope_H	-11.235	54.158	307.0	2.2	102.1	31.4	4	19	13.5	20.9	4.5	7.6	161	279
13	VII_Slope_H	-11.109	53.910	202.0	2.9	98.8	30.2	7	9	5.9	6.4	1.4	1.6	63	74
14	VII_Slope_H	-11.790	53.830	318.5	3.2	103	31.6	7	7	10.8	6.3	2.2	1.4	95	62
15	VII_Slope_H	-12.362	53.387	349.5	3.1	103.3	31.6	15	2	45.6	7.0	11.4	1.4	427	56
16	VII_Slope_H	-12.595	53.143	376.0	3.3	105.1	31.9	2	0	9.8	0.0	1.8	0.0	65	0
17	VII_Slope_H	-12.762	52.819	453.5	3.1	111.7	33.2	9	0	22.5	0.0	4.8	0.0	172	0
18	VII_Slope_M	-12.771	52.359	625.0	3.4	113.1	33.2	14	0	60.3	0.0	33.8	0.0	993	0
20	VII_Shelf_L	-13.716	51.860	479.0	3.2	114.9	33.7	1	0	1.7	0.0	0.6	0.0	27	0
21	VII_Slope_M	-13.937	51.082	624.0	3.1	111.3	33.3	11	0	62.8	0.0	30.4	0.0	894	0
22	VII_Shelf_L	-14.398	51.633	413.0	3.4	107.9	32.8	8	0	41.3	0.0	15.1	0.0	634	0
23	VII_Shelf_L	-14.084	52.164	346.0	3.3	107.2	32.8	11	1	41.0	1.6	15.5	0.6	670	24
24	VII_Shelf_L	-13.590	52.284	394.5	3.3	108.8	32.2	3	1	10.5	0.9	3.8	0.4	160	17

25	VII_Slope_M	-13.262	52.120	606.0	3.2	108.5	32.8	8	0	53.1	0.0	26.7	0.0	784	0
26	VII_Slope_M	-12.152	52.171	663.5	3.3	116.4	33.6	11	0	41.7	0.0	24.1	0.0	709	0
27	VII_Slope_H	-11.735	51.911	415.5	3.3	106.9	31.2	7	1	26.5	1.0	4.4	0.2	156	8
28	VII_Slope_M	-11.939	51.634	847.5	3.5	108.3	32.7	21	0	89.9	0.0	46.1	0.0	1354	0
29	VII_Slope_H	-11.513	51.600	328.0	3.2	104.3	31.1	11	4	30.4	7.3	6.7	1.6	239	56
30	VII_Slope_H	-11.348	51.138	246.0	3.4	101.7	30.6	4	4	15.1	2.7	3.0	0.7	109	28
31	VII_Shelf_H	-11.071	51.070	186.5	2.2	98.5	30.3	0	6	0.0	5.8	0.0	2.9	0	175
32	VII_Slope_H	-10.910	50.457	352.0	3.0	103.2	30.8	6	4	35.3	2.4	7.9	0.5	281	29
33	VII_Shelf_H	-10.346	50.345	153.0	3.2	92.2	30.6	7	15	18.8	37.9	5.0	11.8	259	597
34	VII_Shelf_H	-10.108	50.000	145.5	3.1	93.4	29.2	3	13	4.5	20.4	1.1	5.7	74	356
35	VII_Shelf_H	-9.312	50.071	127.0	3.1	90.1	29.7	2	2	49.9	5.6	10.4	1.4	529	78
36	VII_Shelf_L	-8.979	50.292	137.5	3.1	94.2	29.8	5	14	35.5	13.5	11.3	5.4	476	306
37	VII_Shelf_H	-9.139	50.519	126.5	3.4	91.5	29.3	4	9	19.6	5.3	5.7	1.6	289	126
38	VII_Shelf_H	-9.473	50.597	132.5	3.3	92.3	29.9	6	1	26.6	0.2	7.5	0.0	382	7
39	VII_Shelf_H	-10.062	50.935	NA	3.3	91.1	29.1	3	10	3.6	20.4	1.4	5.6	71	313
40	VII_Shelf_M	-9.453	50.882	121.0	3.3	88.6	30.1	3	2	14.9	11.9	14.1	11.8	206	173
41	VII_Shelf_L	-8.376	51.520	87.5	2.9	75.8	26.9	15	4	53.3	8.2	20.4	4.2	886	182
42	VII_Shelf_M	-8.388	51.053	108.5	3.1	85.6	29.1	4	8	8.5	7.4	10.5	7.6	154	159
44	VII_Shelf_L	-8.433	49.846	133.5	3.2	94.9	30.8	0	16	0.0	4.7	0.0	1.4	0	156
45	VII_Shelf_H	-8.792	49.450	150.5	2.9	93.5	29.5	2	4	15.8	11.6	5.1	4.4	259	225
46	VII_Shelf_H	-8.258	49.063	143.5	3.2	91.1	29.5	2	2	21.9	12.6	7.2	4.3	366	220
47	VII_Shelf_H	-8.333	48.659	158.5	3.1	93.6	30.2	0	1	0.0	0.9	0.0	0.4	0	18
48	VII_Slope_H	-9.548	48.190	312.5	3.1	102.5	30.7	4	1	12.5	1.8	2.7	0.5	103	17
49	VII_Shelf_H	-9.316	48.672	171.0	2.7	93.7	30.6	3	4	14.2	8.9	5.2	2.9	263	167
50	VII_Shelf_H	-9.172	48.974	160.5	3.2	93.7	30.5	2	3	20.2	10.8	5.1	3.1	259	166
51	VII_Shelf_H	-10.164	48.824	159.0	2.7	92.8	29.5	4	17	16.6	18.7	5.4	6.0	288	411
52	VII_Shelf_H	-9.798	49.508	152.5	3.3	94	29.5	3	10	18.8	22.0	5.2	6.8	262	377
53	VII_Shelf_H	-10.373	49.231	130.0	3.1	87.9	28.5	0	13	0.0	14.4	0.0	4.9	0	316
54	VII_Shelf_H	-11.063	49.361	188.5	3.1	95.4	29.8	1	41	3.2	31.7	0.9	7.6	46	666

55	VII_Slope_M	-11.931	49.147	843.5	3.3	110.1	32.2	9	0	59.0	0.0	32.0	0.0	942	0
56	VII_Slope_M	-11.332	49.897	621.0	2.8	107.8	31.8	5	0	24.9	0.0	16.2	0.0	476	0
57	VII_Slope_H	-10.950	50.189	221.0	3.1	97.4	30.2	2	20	15.6	7.2	3.2	0.9	114	104
58	VII_Slope_M	-11.097	50.662	494.5	3.0	102.6	30.9	10	2	30.1	0.2	18.1	0.0	569	16
59	VII_Shelf_H	-10.538	51.234	158.5	1.7	91.7	28.6	1	6	0.0	6.3	0.0	4.2	10	238
60	VII_Shelf_M	-10.673	51.583	144.0	3.0	88.7	28.7	1	8	0.7	15.4	1.3	19.4	20	284
61	VII_Shelf_L	-11.197	52.204	142.0	3.1	88.8	29.7	5	2	5.6	0.7	2.3	0.4	120	20
62	VII_Shelf_L	-10.933	52.456	125.0	3.1	88.2	28.5	4	0	4.8	0.0	2.2	0.0	101	0
63	VII_Shelf_M	-11.444	52.244	167.5	3.0	90.3	29.2	6	4	4.2	3.2	7.2	3.5	105	63
64	VII_Slope_H	-11.779	52.422	215.5	3.1	96.8	30.1	2	14	5.2	18.3	1.0	4.3	36	163
65	VII_Slope_H	-11.885	52.793	192.5	1.8	95.8	29.4	1	14	0.9	19.5	0.5	8.0	16	306
66	VII_Slope_H	-12.291	52.701	372.0	3.1	102.2	31.4	7	0	24.5	0.0	5.5	0.0	201	0
67	VII_Slope_H	-13.294	52.944	265.0	2.9	99.7	30.9	15	0	48.1	0.0	11.7	0.0	429	0
68	VII_Slope_H	-13.643	52.650	293.0	2.9	104.8	32.9	8	1	15.6	1.3	3.6	0.3	136	10
69	VII_Shelf_L	-14.607	52.337	409.0	3.1	102.9	31.1	10	0	36.5	0.0	14.6	0.0	616	0
70	VII_Slope_M	-14.906	52.547	738.5	2.4	111.2	33	6	0	24.2	0.0	17.4	0.0	513	0
71	VII_Slope_H	-14.110	52.894	225.0	2.7	99.1	30.6	9	8	28.5	13.2	7.0	4.0	252	162
72	VII_Shelf_L	-13.893	53.075	193.5	3.0	97.5	30.3	14	4	44.4	13.1	18.4	4.7	797	197
73	VII_Slope_H	-13.870	53.522	259.0	1.7	100.9	30.4	3	5	1.3	9.6	0.5	4.5	33	160
74	VII_Slope_H	-13.401	53.876	409.5	1.7	100.2	30.2	0	0	0.0	0.0	0.0	0.0	0	0
75	DeepArea5	-12.902	54.034	998.0	2.3	104.7	31.6	0	0	0.0	0.0	NA	NA	NA	NA
76	DeepArea5	-12.944	54.126	1510.0	1.7	108.3	32.7	0	0	0.0	0.0	NA	NA	NA	NA
77	DeepArea5	-12.825	54.084	1282.5	1.6	109.7	33.1	0	0	0.0	0.0	NA	NA	NA	NA
78	DeepArea5	-12.865	53.988	755.0	1.7	104.9	31.2	10	0	74.2	0.0	NA	NA	NA	NA
79	VII_Slope_H	-13.054	53.860	362.5	2.3	101.1	30.4	5	1	13.9	2.5	4.5	0.8	167	29
80	VII_Shelf_L	-12.531	53.855	385.0	3.2	98.7	30.2	11	3	32.5	1.1	14.3	0.3	614	33
81	VII_Shelf_L	-12.588	53.700	304.5	3.2	99.9	30.4	9	2	15.0	3.3	5.9	1.1	276	56
82	VII_Slope_H	-12.710	53.404	306.5	3.2	103.1	31.6	12	2	47.0	7.9	9.8	1.6	360	57
83	VII_Slope_H	-13.073	53.227	280.5	3.1	100.9	30.5	16	2	46.9	6.5	11.9	1.8	433	64

84	VII_Slope_H	-11.898	53.180	208.0	3.0	97.4	29.8	8	23	17.9	26.9	4.5	7.3	161	275
85	VII_Slope_H	-11.623	53.435	197.0	3.2	97.1	29.4	6	22	13.5	21.0	2.7	4.8	95	208
86	VII_Shelf_M	-11.131	53.323	148.0	3.1	89.6	28.6	11	24	7.6	12.5	9.7	11.5	177	334
87	VIa_Slope_H	-10.047	55.179	399.0	3.1	109.8	33.5	3	0	8.7	0.0	3.4	0.0	11	0
88	VIa_Slope_H	-9.988	55.290	429.5	3.1	105.6	31.7	45	5	176.2	4.3	74.0	2.7	230	8
89	VIa_Slope_H	-9.776	55.443	364.5	3.1	93.3	32.6	19	18	55.2	27.4	23.3	12.3	73	38
90	VIa_Slope_M	-9.608	55.535	684.5	2.0	106.5	31.5	13	0	35.3	0.0	32.9	0.0	100	0
91	VIa_Slope_M	-9.420	55.755	651.0	2.4	110.2	31.5	5	0	16.8	0.0	13.8	0.0	42	0
92	VIa_Slope_H	-9.206	56.036	230.0	NA	102.4	32.1	26	7	51.5	5.1	NA	NA	NA	NA
93	VIa_Slope_H	-9.374	56.220	1029.0	3.6	114.1	33.9	0	0	0.0	0.0	0.0	0.0	0	0
95	VIa_Shelf_L	-8.789	56.371	139.0	3.2	94.1	30.4	8	0	6.4	0.0	1.6	0.0	83	0
96	VIa_Slope_M	-9.197	56.476	794.5	0.0	111.4	33.2	4	0	18.2	0.0	NA	NA	NA	NA
97	VIa_Slope_M	-9.227	56.625	506.0	3.1	111.2	33.2	11	0	49.6	0.0	29.7	0.0	90	0
98	VIa_Slope_H	-9.082	56.900	324.0	1.9	100.3	31.2	49	6	101.5	8.7	62.3	7.0	194	22
99	VIa_Slope_M	-9.186	56.945	843.5	2.0	108.4	32.3	14	0	57.3	0.0	48.9	0.0	149	0
100	VIa_Slope_M	-9.313	57.102	572.5	3.5	111.6	33.6	37	0	104.5	0.0	52.1	0.0	159	0
101	VIa_Slope_H	-9.382	57.290	363.0	2.7	105.6	32.1	14	3	34.6	3.4	16.4	1.8	51	6
102	VIa_Slope_H	-9.423	57.609	232.5	3.2	99.4	30.6	27	6	55.7	10.9	23.7	4.4	77	14
103	VIa_Slope_H	-9.485	57.718	305.5	2.9	102.8	31.1	25	12	54.7	26.6	25.5	12.0	80	37
104	VIa_Slope_M	-9.666	57.862	614.5	3.2	109.6	33	53	0	207.3	0.0	111.6	0.0	340	0
105	VIa_Slope_H	-9.427	57.960	306.0	1.7	101	30.9	9	11	21.3	18.1	16.0	13.8	50	43
106	VIa_Shelf_L	-8.995	57.895	144.0	1.7	96.3	30.8	7	3	8.6	1.8	4.7	1.3	202	52
107	VIa_Shelf_L	-9.090	57.712	149.5	2.3	91.2	29.6	7	10	4.1	16.3	2.1	6.9	94	264
108	VIa_Shelf_L	-8.698	57.682	154.5	3.2	98.8	30.6	26	13	27.9	16.2	8.2	4.7	343	192
109	VIa_Shelf_L	-9.046	57.296	143.5	2.9	91.2	29.1	9	4	13.1	4.3	4.2	1.4	162	62
110	VIa_Shelf_L	-8.673	56.817	125.0	3.3	92.8	30.8	4	0	3.9	0.0	1.3	0.0	50	0
111	VIa_Shelf_L	-8.217	56.674	134.5	3.3	91.8	29.6	5	0	1.3	0.0	0.2	0.0	32	0
112	VIa_Shelf_M	-7.998	56.437	177.0	3.2	107.5	33.6	14	3	14.4	2.4	6.4	0.9	38	7
113	VIa_Shelf_M	-7.800	56.433	173.5	1.8	108.8	33.2	3	4	3.0	3.3	3.4	3.4	16	20

114	VIa_Shelf_M	-7.553	56.586	194.5	1.6	91.3	34.2	3	2	4.7	3.7	5.0	3.4	24	18
115	VIa_Shelf_L	-7.328	56.200	97.0	2.4	83.2	27.4	14	0	12.8	0.0	5.8	0.0	282	0
116	VIa_Shelf_L	-6.997	55.746	50.0	3.2	63.9	NA	0	0	0.0	0.0	NA	NA	NA	NA
117	VIa_Shelf_L	-7.215	55.802	62.6	3.1	66.4	24.6	0	0	0.0	0.0	0.0	0.0	0	0
118	VIa_Shelf_M	-7.842	55.892	148.5	3.1	88.6	28.4	30	8	19.4	2.0	13.8	0.9	89	13
119	VIa_Shelf_M	-8.120	56.037	154.5	3.1	92.7	29.2	22	4	11.0	1.2	6.1	0.8	53	7
120	VIa_Shelf_M	-8.327	55.823	147.0	3.0	94.3	29.1	27	11	16.7	10.1	9.2	5.0	71	34
121	VIa_Shelf_L	-8.992	55.822	136.0	3.0	91.6	30.9	8	4	9.6	3.2	3.4	1.3	127	46
122	VIa_Shelf_L	-9.508	55.320	124.5	3.1	92	31.1	6	0	3.7	0.0	1.3	0.0	59	0
123	VIa_Shelf_L	-8.735	55.273	97.8	3.2	85.1	27.9	44	0	27.6	0.0	8.4	0.0	461	0
124	VIa_Shelf_L	-9.010	54.830	75.2	3.2	75.8	26.6	3	0	0.5	0.0	0.0	0.0	19	0
125	VIa_Shelf_M	-8.576	54.519	63.4	0.0	72.7	25.1	15	0	3.0	0.0	NA	NA	NA	NA
126	VIa_Shelf_M	-9.684	54.502	97.3	3.1	81.1	26.8	25	3	13.2	2.6	8.3	2.4	69	11
127	VIa_Shelf_M	-9.607	54.714	100.3	3.0	79.9	26.8	48	1	35.3	0.5	27.7	0.0	164	3
128	VIa_Shelf_L	-9.619	54.790	101.2	2.5	85.2	27.9	27	2	20.5	2.0	10.1	1.0	408	39
129	VIa_Shelf_L	-10.078	54.777	115.0	3.4	91.6	29.1	12	1	10.9	0.2	3.1	0.0	138	7
130	VIa_Slope_H	-10.181	54.969	272.0	3.1	102.2	31.6	18	2	33.4	2.6	14.0	1.3	44	4
131	VIa_Slope_M	-10.454	54.871	824.0	2.5	107.5	31.4	8	0	37.5	0.0	26.2	0.0	80	0
132	VIa_Slope_H	-10.790	54.528	345.5	2.8	106.4	29.5	7	0	21.4	0.0	10.5	0.0	33	0
133	VIa_Shelf_L	-10.608	54.526	197.5	3.3	103.6	31.7	6	0	8.5	0.0	2.0	0.0	85	0