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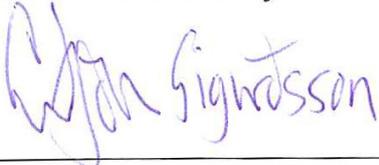
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Ágrip: Stock assessment for plaice (<i>Pleuronectes platessa</i>) and dab (<i>Limanda limanda</i>) in Icelandic waters has historically been limited by lack of recruitment data due to the fact that younger fish are rarely caught in the existing bottom trawl surveys. A new survey with a beam trawl in coastal waters could bridge that gap. The objective of this study was therefore to conduct a pilot study using a standard 4 meter beam trawl at 10-50 meter depth of the west coast of the country. The survey was successful and high densities of plaice and dab were caught, and the vast majority of the fish caught were in the age groups (1-3 year old) that are largely missing from the existing groundfish trawl surveys. The success of this pilot study warrants extension to include flatfish grounds in the south and north of the country		
Lykilorð: Plaice, Dab, Beam trawl, Flatfish Skarkoli, Sandkoli, Bjálkatroll, Flatfiskar		
Undirskrift verkefnisstjóra: 	Undirskrift forstöðumanns sviðs: 	

Abstract

Stock assessment for plaice (*Pleuronectes platessa*) and dab (*Limanda limanda*) in Icelandic waters has historically been limited by lack of recruitment data due to the fact that younger fish are rarely caught in the existing bottom trawl surveys. A new survey with a beam trawl in coastal waters could bridge that gap. The objective of this study was therefore to conduct a pilot study using a standard 4 meter beam trawl at 10-50 meter depth of the west coast of the country. The survey was successful and high densities of plaice and dab were caught, and the vast majority of the fish caught were in the age groups (1-3 year old) that are largely missing from the existing groundfish trawl surveys. The success of this pilot study warrants extension to include flatfish grounds in the south and north of the country.

Introduction

Stock assessment for flatfish in Icelandic waters has historically been limited by lack of data, despite the fact that landed value of the 6 most commonly fished species (plaice, lemon sole, witch, rough dab, and megrim) has been north of €13.000.000 over the last few years. In particular, recruitment data and knowledge about the locations of nursery areas of these species is lacking.

Plaice has historically been the most targeted flatfish in Icelandic coastal waters, with catches exceeding 14.000 tonnes in the 1980s. Overfishing during that period led to lowered catches, and as a result TAC was put in place in 1997, followed by area closures in 2001 to protect the three main spawning grounds for plaice. Despite its importance and value, there is a knowledge gap on the spatial distribution of the species for the first 3 years of their life, or until they start to appear in the fishery and bottom trawl surveys at 3-4 years old. No recruitment index exists, which increases uncertainty in stock assessment and setting of TAC. Similar story can be said about dab, which is rarely caught in the existing bottom trawl surveys. Recruitment indices for lemon sole, witch, rough dab, and megrim can be attained from other surveys as their recruitment occurs in deeper water.

The Marine Research Institute's annual spring survey that was started in 1986 and has over 600 stations around the country does not adequately catch juvenile plaice or dab due to the type of otter trawl used and the fact that it is difficult to deploy in shallow water (100 meters or less) where most of the juveniles of these species are thought to be found. Trials to sample these species in shallow water in 2006 with a modified nephrops trawl with 40 mm shrimp mesh ended in shreds as the gear was ripped easily on the complex bottom, and earlier trials with modified demersal seine ended similarly. Investigation into other gear to sample the juvenile flatfish around Iceland suggests that beam trawl with chain mats would be ideal.

The objective of this study was therefore to conduct a pilot study using a standard 4 meter beam trawl at 10-50 meter depth of the west coast of the country. If this pilot study on the west coast is successful, an expansion to cover the rest of the country is in order.

Methods

Gear

A standard 4 meter beam trawl was bought from Brixham Trawl Makers UK and is the same type of trawl used in the British and Irish beam trawl surveys in the North- and Irish Seas. The trawl has a 4 meter steel beam, with a chain mat and flip up rope. Netting of the trawl has 75 mm mesh, while the cod-end was lined with a 40 mm shrimp mesh.

Vessel and tow information

Shrimp trawler and former research vessel Dröfn RE-035 was leased for the survey, the vessel is 25 meters long, 6.6 meters wide and 185 tons gross weight. The ship's engine is 573 hp. Tow duration was 30 minutes, at 4 nm/h for a total length of 2 nm. In few cases towing was cut short due to issues or high catch of shellfish. We therefore report density of fish as number/nm.

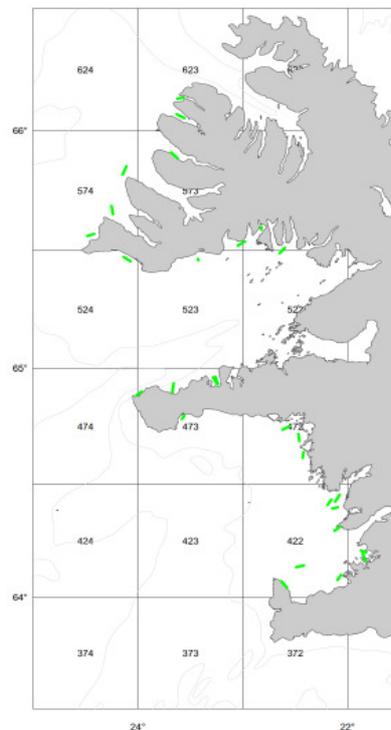


Figure 1. Map showing the location of the 31 tows taken in the survey.

Site selection

Tow sites were selected based on four criteria and were therefore not selected randomly. The first three criteria was that the tow depth had to be less than 50 m, that it had to be close to the shore (within 5 nm) and the bottom had to be sandy according to the ships sonar, but young plaice and dab are thought to prefer shallow sandy bottom close to the shore. The fourth and final criteria was that the tow had to be close (within 10 nm) to areas marked by demersal seine fishermen as areas where juvenile flatfish were found.

Data collection

All fish and crabs that were caught in the trawl were identified on board and the first 100 individuals of each species were measured, total length was taken for fish, and carapace length for crabs. In addition to the fish and crabs, all sea cucumbers, scallops, cyprines, and shrimps counted. If more than 100 individuals were measured of a species, the remaining individuals were counted to speed up processing. Otoliths were taken randomly from 25 individuals of all flatfish species caught (plaice, dab, lemon sole, rough dab, flounder, halibut, and witch). Age of the fish was then estimated from the otoliths using a standardized protocol established within the Icelandic Marine and Freshwater Research Institute.

Results

A total of 26 species of fish were caught in the survey, five species of crabs, in addition to four shrimp species, two shellfish species and one species of sea cucumber. Plaice was the most common fish species, closely followed by dab. Other noteworthy commercially important species are sea cucumbers that were very common, along with scallops, spider crabs, sand shrimp and Atlantic cod (table 1).

Table 1. Numbers of the species found at the 31 stations in the first Icelandic beam trawl survey

Common name	Latin name	Number caught
Plaice	<i>Pleuronectes platessa</i>	2430
Dab	<i>Limanda limanda</i>	2392
Sea cucumber	<i>Cucumaria frondosa</i>	2072
Scallop	<i>Chlamys islandica</i>	517
Spider crab	<i>Hyas araneus</i>	397
Sand shrimp	<i>Crangon crangon</i>	372
Cod	<i>Gadus morhua</i>	316
Raitt's sandeel	<i>Ammodytes marinus</i>	250
Rock crab	<i>Cancer irroratus</i>	247
Lemon sole	<i>Microstomus kitt</i>	193
Swimming crab	<i>Liocarcinus holsatus</i>	189
Pink shrimp	<i>Pandalus montagui</i>	184
Haddock	<i>Melanogrammus aeglefinus</i>	139
Iceland cyprine	<i>Arctica islandica</i>	114
Long rough dab	<i>Hippoglossoides platessoides</i>	114
Whiting	<i>Merlangius merlangus</i>	113
Starry ray, thorny skate	<i>Amblyraja radiata</i>	90
Atlantic wolffish	<i>Anarhichas lupus</i>	75
Bullrout, shorthorn sculpin	<i>Myoxocephalus scorpius</i>	48
Sculptured shrimp	<i>Sclerocrangon boreas</i>	37
Hooknose, pogge	<i>Agonus cataphractus</i>	36
Monkfish	<i>Lophius piscatorius</i>	10
Whelk	<i>Buccinum undatum</i>	10
Flounder	<i>Platichthys flesus</i>	9
Hermit crab	<i>Pagurus spp.</i>	7
Greater sandeel	<i>Hyperoplus lanceolatus</i>	5
Deep water prawn	<i>Pandalus borealis</i>	2
Fourbearded rockling	<i>Rhinonemus cimbricus</i>	2
Halibut	<i>Hippoglossus hippoglossus</i>	2
Lumpfish	<i>Cyclopterus lumpus</i>	2
Moustache sculpin	<i>Triglops murrayi</i>	2
Saithe	<i>Pollachius virens</i>	2
Witch	<i>Glyptocephalus cynoglossus</i>	2
Green crab	<i>Carcinus maenas</i>	1
Herring	<i>Clupea harengus</i>	1
Ling	<i>Molva molva</i>	1
Norwegian topknot	<i>Phrynorhombus norvegicus</i>	1
Seasnail	<i>Liparis liparis</i>	1

The spatial distribution of plaice was not uniform (figure 2). The highest density was observed within Faxaflói, more specifically in Borgarfjörður and Hafursfjörður, but high densities were also observed in one location within Breiðfjörður and in Súgandafjörður, the northernmost fjord that we sampled in.

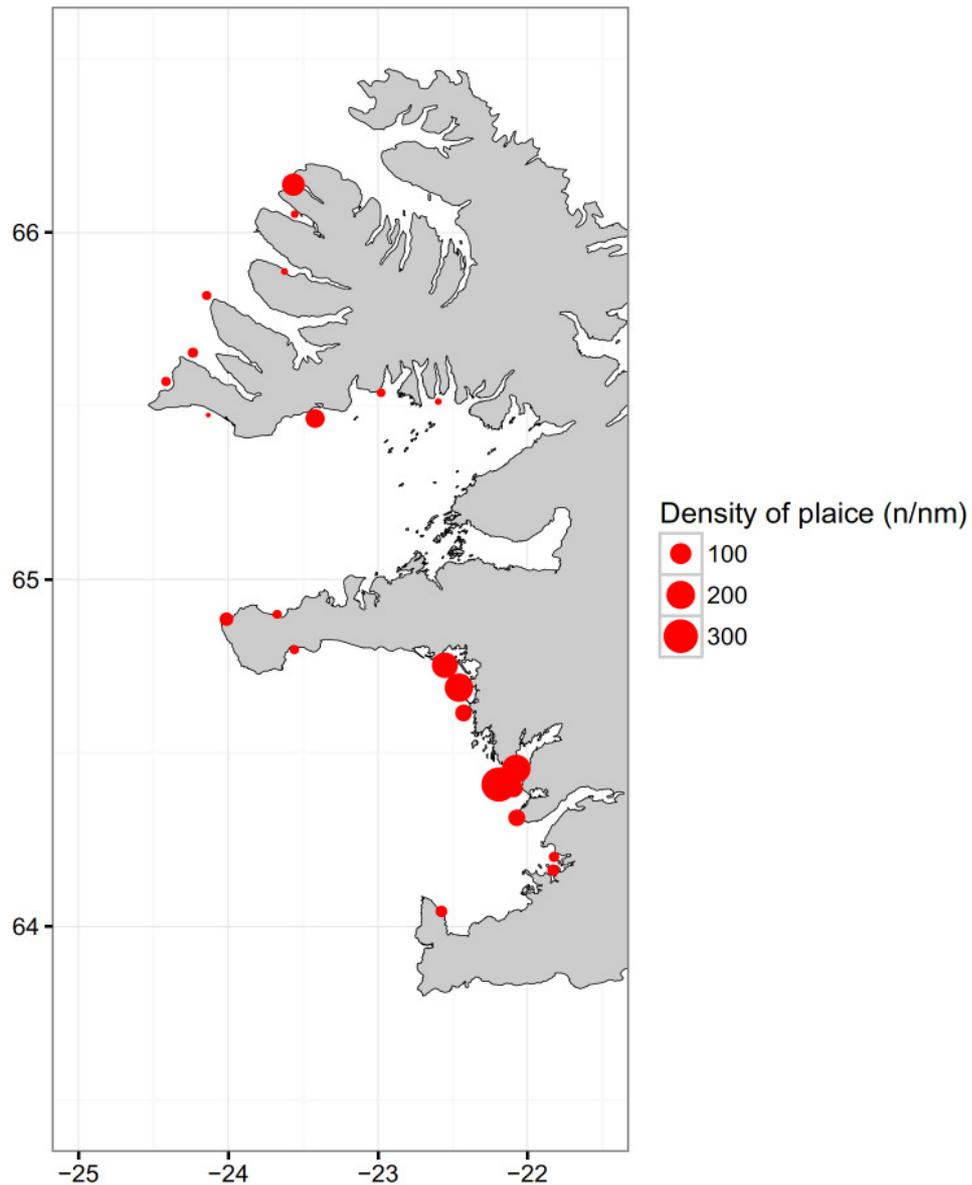


Figure 2. Map showing density (n/nm) of plaice (*Pleuronectes platessa*) at the 31 tow stations taken during the survey.

In comparison to plaice, dab density was lower overall and more uniform spatially. The highest concentrations were within Faxaflói, around the northern point of Reykjanes, and in the two northernmost fjords that we sampled (figure 3).

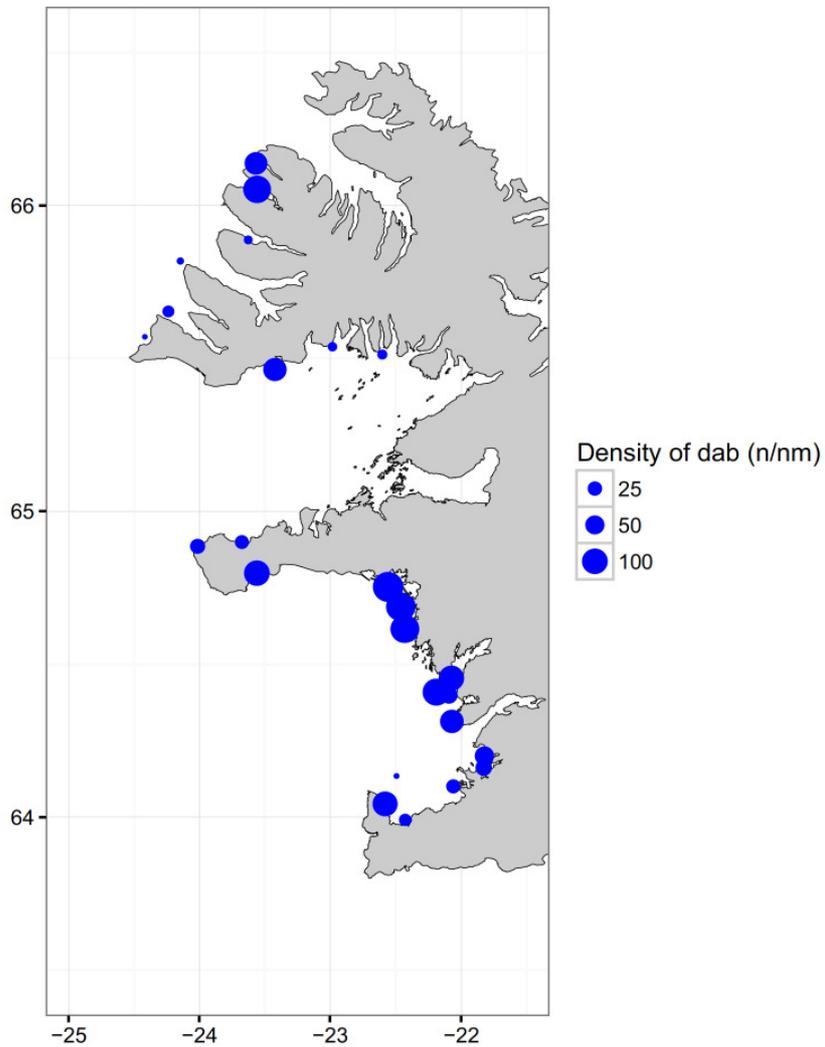


Figure 3. Map showing density (n/nm) of dab (*Limanda limanda*) at the 31 tow stations

Most of the plaice caught was between 1 and 4 years old, while most of the dab was between 1 and 3 years old. Few fish from this year (age 0) were caught suggesting that they move to deeper water later in the year. Very few fish were older than 7 year old and only two plaice were older than 10 year old (figure 4).

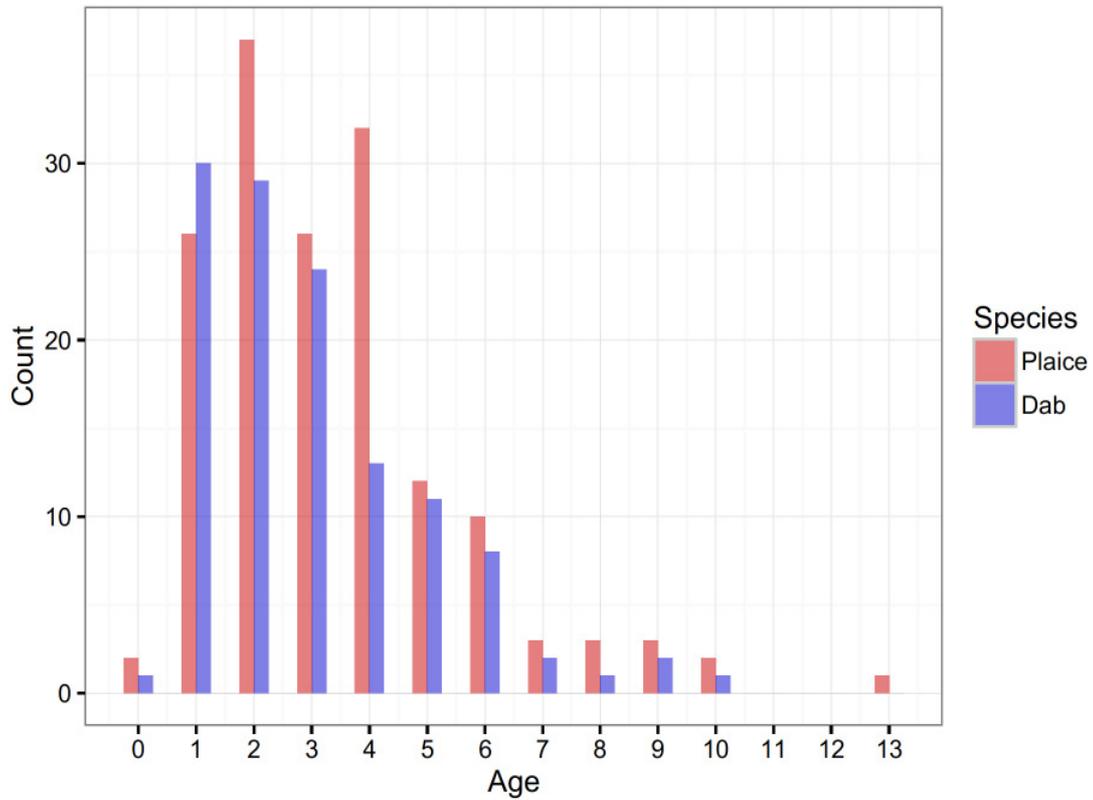


Figure 4. Age distribution of plaice and dab caught in the survey.

Age classes of the younger plaice and dab (0-2 year old) caught in the survey were easily distinguished by size (figure 5). As an example, two year old plaice caught in the survey were all around 20 cm, and easily distinguishable from 1 and 3 year old plaice. After the age of 3, age classes become increasingly harder to distinguish as growth slows down due to the onset of maturity.

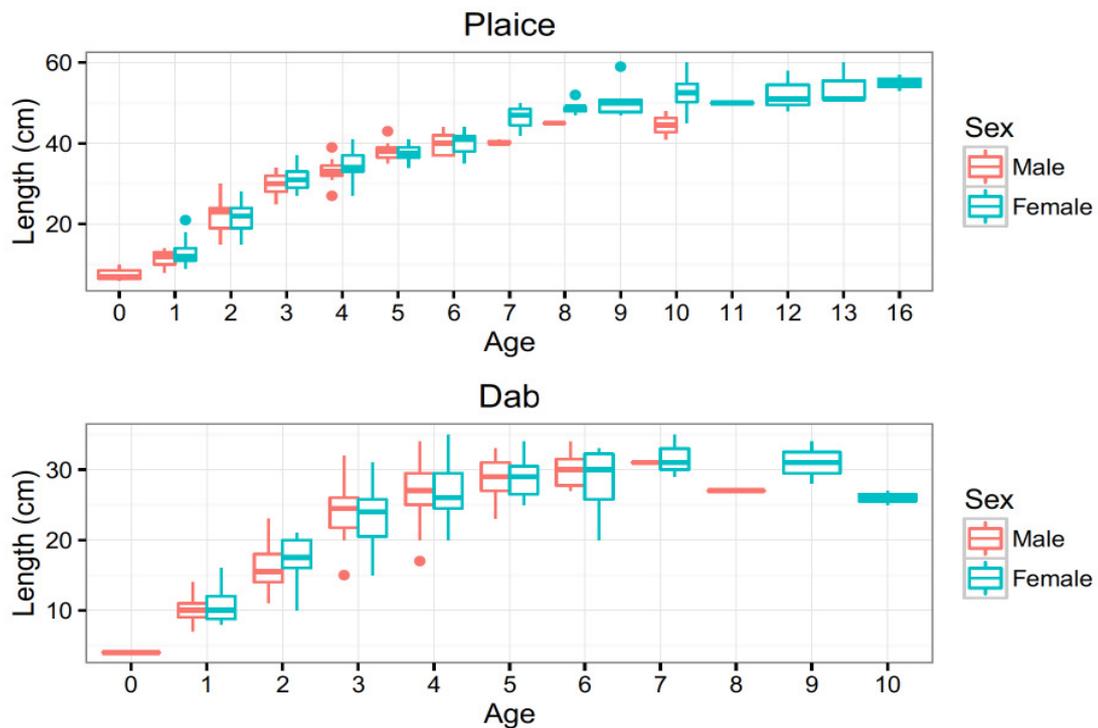


Figure 5. Relationship between age and size of male and female plaice and dab caught in the survey.

Discussion

The survey was successful in catching the target species, plaice and dab, and the vast majority of the fish caught were in the age groups (1-3 year old) that are largely missing from the existing groundfish trawl surveys. This pilot study can therefore be considered successful in the first steps of filling the knowledge gap that has caused issues in stock assessment of those two species. The density of plaice was higher than dab, but more patchy and mostly concentrated within Faxaflói. In addition to those two target species, high density of several other commercially important species were caught, such as the sea cucumber (*Cucumaria frondosa*), juvenile cod (*Gadus morhua*), sand shrimp (*Crangon crangon*) and rock crab (*Cancer irroratus*) (see appendix for density figures).

The success of this pilot survey warrants expansion of the study area to include known flatfish grounds in the south and north of the country so this survey can provide accurate recruitment information for these historically overlooked species.

Appendix

Distribution of sea cucumbers, cod, sand shrimp and rock crab caught in the study.

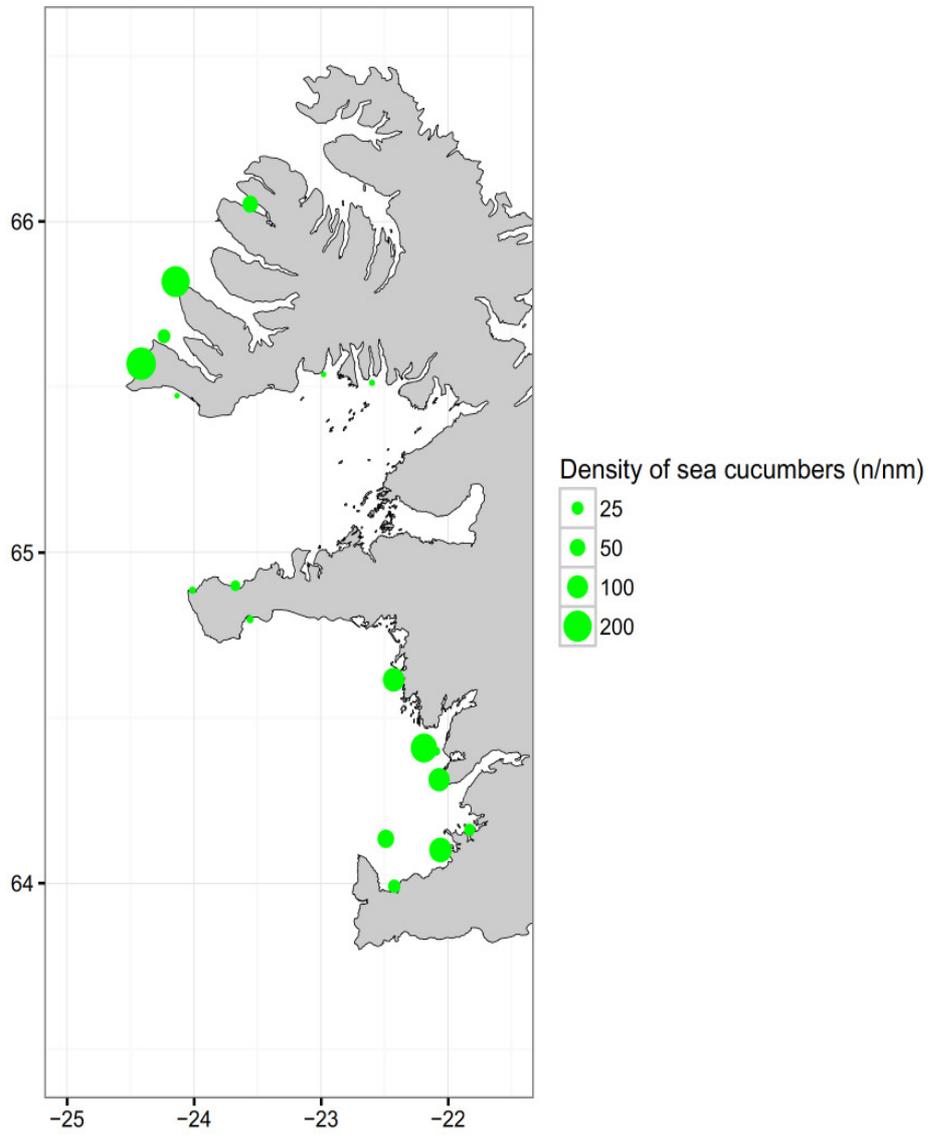


Figure 6. Map showing density (n/nm) of sea cucumber (*Cucumaria frondosa*) at the 31 tow stations taken during the survey.

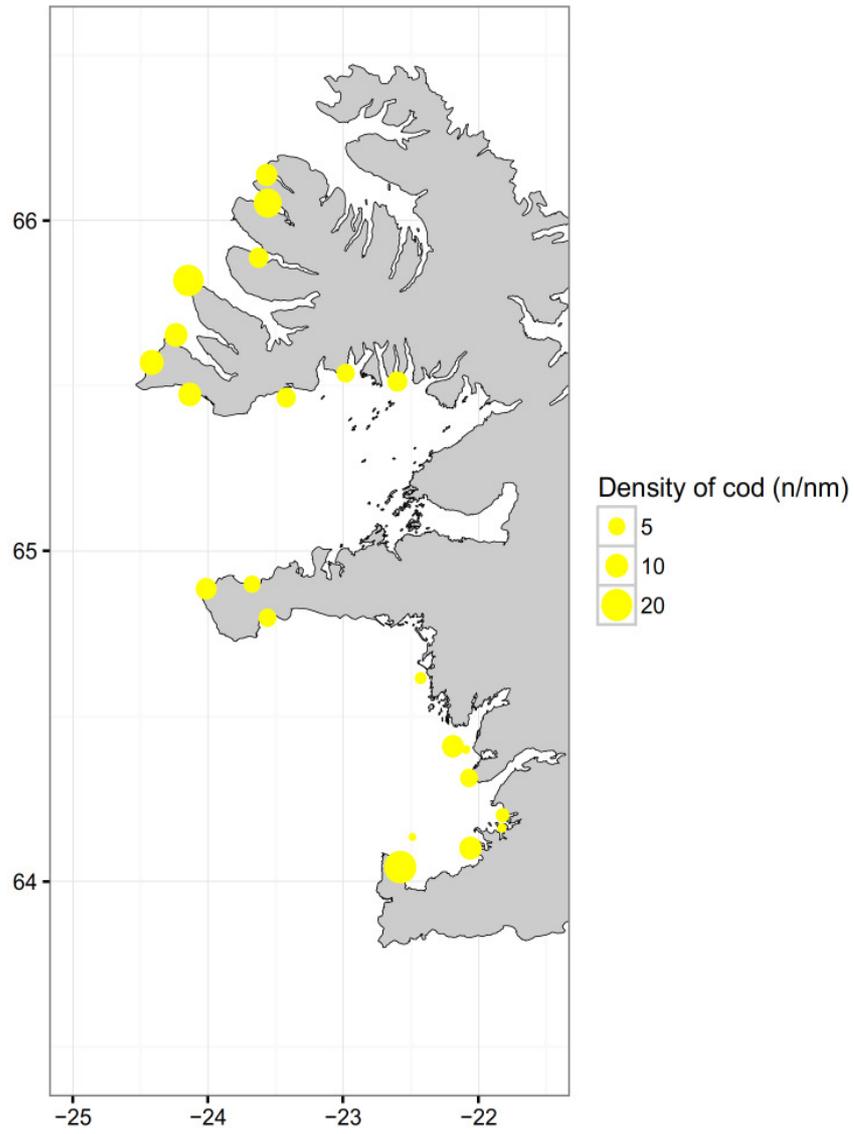


Figure 7. Map showing density (n/nm) of cod (*Gadus morhua*) at the 31 tow stations taken during the survey.

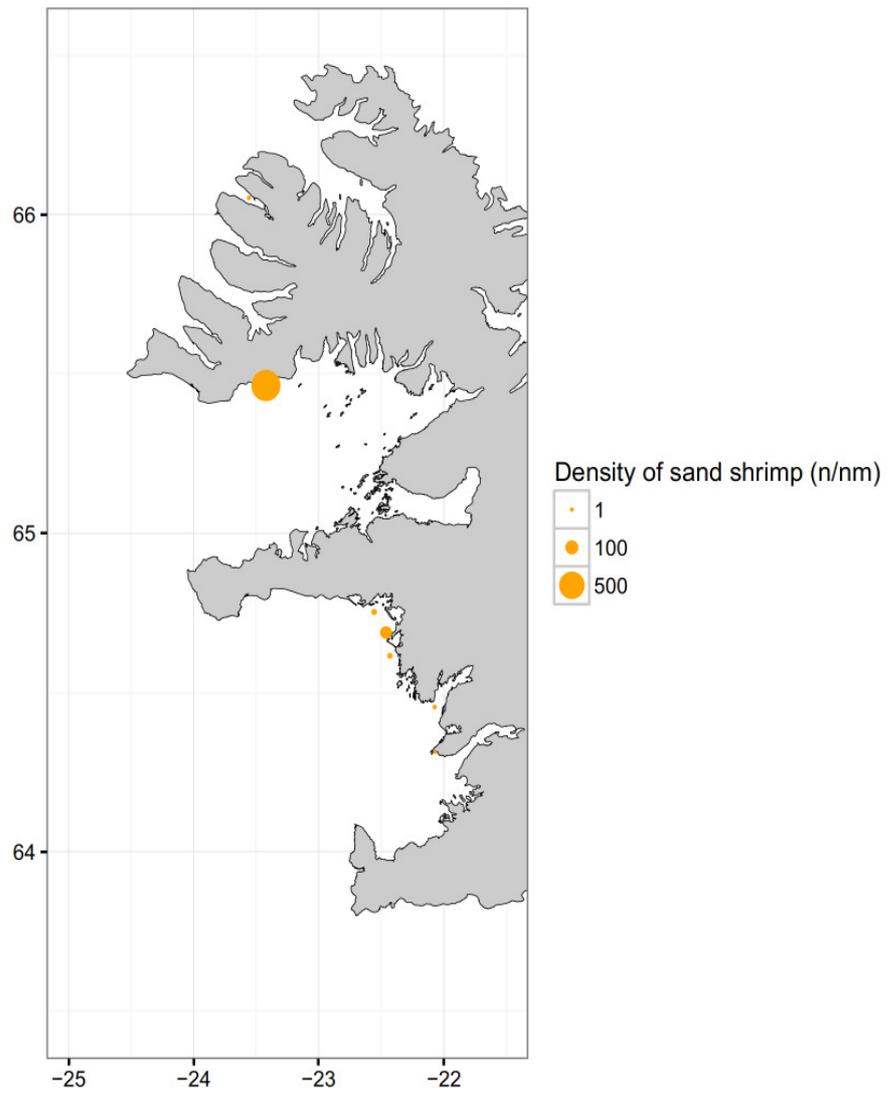


Figure 8. Map showing density (n/nm) of sand shrimp (*Crangon crangon*) at the 31 tow stations taken during the survey.

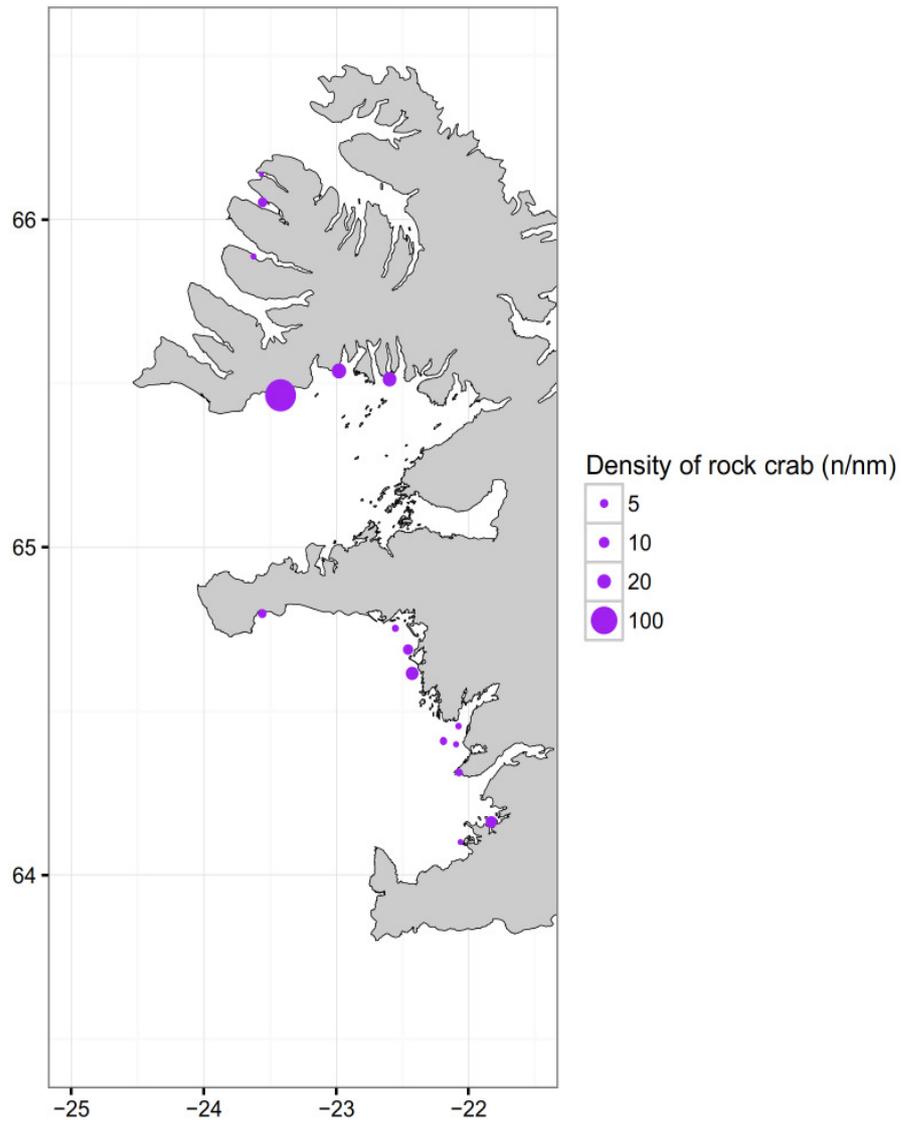


Figure 8. Map showing density (n/nm) of rock crab (*Cancer irroratus*) at the 31 tow stations taken during the survey.



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