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**Preliminary report on an Iceland/Greenland survey as part of the coordinated ecosystem survey in the Norwegian Sea and adjacent waters with R/V Árni Friðriksson 11 July-12 August 2014**

**Cruise report:** Survey number A6-2014 (Arni Fridriksson)

**Period:**

Arni Fridriksson; 11 July - 12 August

**Area:** Icelandic and East-Greenland.EEZ.

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Guest: Hauke Bietz, biologist from Germany

**Main objective:** To study the abundance, spatial and temporal distribution and feeding ecology of the Northeast Atlantic mackerel, Norwegian spring-spawning herring, blue whiting and other pelagic species in relation to hydrographic conditions, plankton and other prey communities.

**Material and Methods.**

**Calibration of echo sounder transducers**

The echo sounder transducers of R/V Arni Fridriksson were calibrated according to standard hydro-acoustic procedure for the operating frequencies of 18, 38, 120 and 200 kHz (Foote, 1987).

### **Cruise tracks**

In general a predetermined survey lines with a preselected pelagic trawl stations, hydrography stations and plankton stations were followed. This predetermined plan was modified somewhat according to the distribution of mackerel and time constraint. The cruising speed was generally between 10.5 – 11.5 knots. The survey started at north Iceland and progressed clockwise around Iceland and into Greenland waters.

### **Biological sampling**

Trawling was done with a standardized sampling trawl ( Mulpelt 832) specially designed for this type of survey. The trawl opening was on average approx. 32 meters and the spread between trawl doors 112-115 meters using 350 m warp length. A kite was used to keep the headline at the surface and two floats on the wing ends. Towing speed was generally 4.8-5.2 knots and towing time was always set at 30 min. The catch was sorted and weighed at each station and biological sampling was done according to the table below.

	Species	number
Length measurements	Mackerel	50
	Herring	150
	Blue whiting	50
	Other species.	50
Weight, sex and maturity stage	Mackerel	50
	Herring	50*
	Blue whiting	50
	Other species.	0
Otoliths/scales	Mackerel	50
	Herring	50
	Blue whiting	50
	Other species.	0
Stomach sampling	Mackerel	10
	Herring	10
	Blue whiting	10
	Other species.	0

\*Icelandic summer spawning herring. Additional sampling of 50 hearts at each station for studies of *Ichthyophonus* sp. Infestation.

**Lump suckers:** Sample otoliths from 1 male and 1 female at each station and measure length, weigh whole weight, gutted weight and weight of gonads and liver, determine maturity. In addition up to 20 lump suckers are measured and sexed at each station.

Salmon were caught at 2 stations and were labelled and stored immediately in a freezer for later examination.

Eight DNA samples of 400 mackerels were collected and frozen. Stomachs from 10 mackerel, 10 herring and 10 blue whiting were collected at each station where possible and frozen for later analyses of the contents. A total of 117 trawl stations were worked.

### **Hydrography**

Hydrographic stations were worked on the transect at the same position as the trawl stations down to 500 m using SEABIRD CTD sensor with a water bottle.rosette. A total of 117 CTD stations were worked.

### **Plankton sampling**

Zooplankton sampling was performed at 108 stations, usually immediately prior to a trawl station. A WP-2 net with a 180 µm mesh size was used and towed at 0.5 m/sec. At each station two hauls from 50-0 m were taken and one from 200-0 m. Samples were treated according to working standards described in “Cruise report from the coordinated ecosystem survey with M/V “Libas” and M/V “Brennholm”, M/V Finnur Fridur and R/V “Arni Fridriksson” in the Norwegian Sea and surrounding waters, 9 July-20 August 2010”.

### **Acoustics**

#### **Sonars**

Kaijo Denki survey sonar and high frequency sonar were run throughout the survey.

#### **Echo sounders**

Continuous data logging and raw data recording from 18, 38, 120 and 200 kHz drop keel mounted Simrad EK60 echo sounder were done down to 500 m depth. The quantitative acoustic analyses and NASC species analyses were done with the software program Large Scale Survey System (LSSS).

### **Results**

#### **Hydrography**

An interpretation of hydrographic data will be done later at a post cruise meeting in the Faroes 13-18 August 2014 in a common report of scientists of the participating countries (Faeroes, Greenland, Iceland and Norway).

#### **Plankton**

The samples were preserved frozen and in formaldehyde for later analyses at the Marine Research Institute. Preliminary interpretation of zooplankton data will be done at the post cruise meeting.

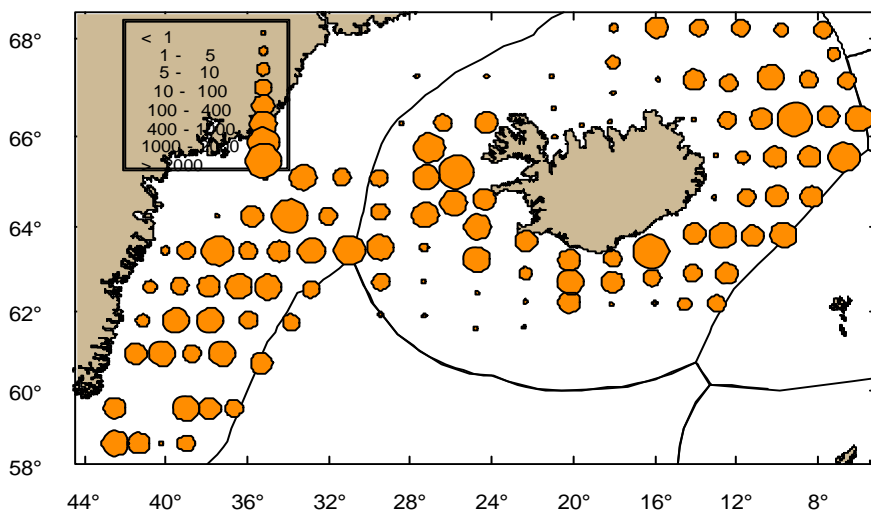
#### **Biomass estimations of target species**

As this is a joint international survey and Iceland covers only part of the surveyed area no total biomass estimates from both acoustic and trawl data are possible at this time. A preliminary index estimate (biomass) based on trawl data for mackerel indicate a similar or a little lower biomass in 2014 than the estimate in the record years of 2012 and 2013 for the Icelandic area (around 1.5 million tonnes). This was the second time that the survey was extended into Greenland waters. A preliminary estimate for that area was about 1 million tonnes. Preliminary acoustic estimate of Norwegian spring spawning herring in Icelandic waters was over 3.4 million tonnes. The biomass of the NSSH for the Icelandic area alone was estimated for the first time in 2013 and the estimate then was about 4.4 million tonnes

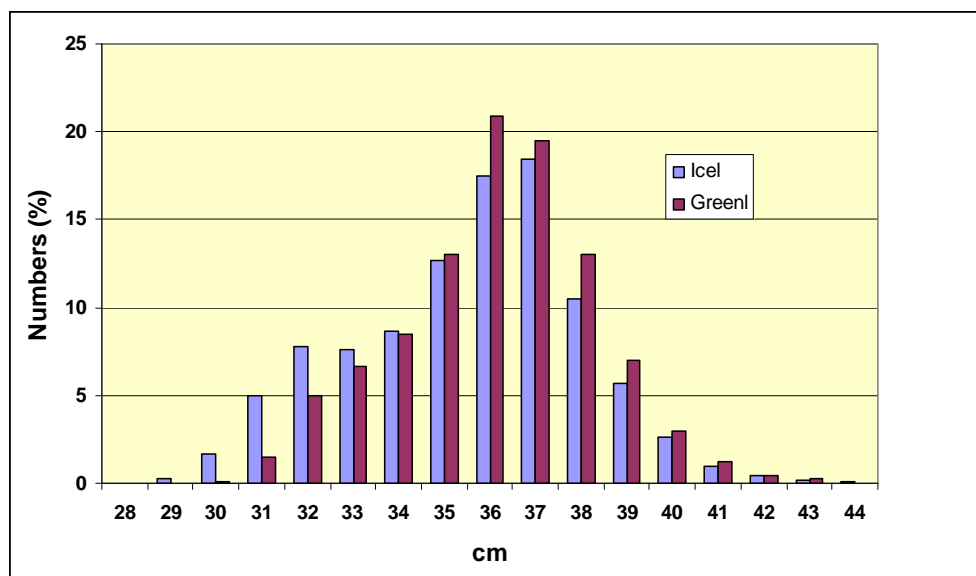
#### **Spatial and length distribution of mackerel**

Mackerel was caught in the majority of tows except for areas off Northwest-, and western North-Iceland and deep off Southwest-Iceland. In Figure 1 is shown the surveyed area, the tows and the catch and distribution of mackerel. The mackerel distribution in the Icelandic area is similar to that observed in previous years although it extended further north off Northeast-Iceland where the zero line of distribution was

not reached. The highest trawl catches were to the east- southeast and west of Iceland as has been the trend the last three years, whereas the largest catches were taken south-east of Iceland in 2010. In 2013 some surveying was done in Greenland waters to the west of Iceland where considerable amounts of mackerel were recorded. During this survey the surveyed area in Greenland waters was extended to the west and south as can be seen in figure 1. The survey there extended as far south as 58°30' N and 42°30'W where the zero line of distribution was not reached. In Figure 2 is shown the total length distribution of mackerel in all tows in Icelandic and Greenland waters. The length distribution was from 28-44 cm with the most common length frequencies 34-38 cm (68%). The mean length of mackerel in the Icelandic area was 35.6 cm and in the Greenland area the mean length was 36.1 cm. The length distribution was from 28-44 cm with the most common length frequencies 34-38 cm (68%). In Figure 4 is shown the mean length in all tows with mackerel.

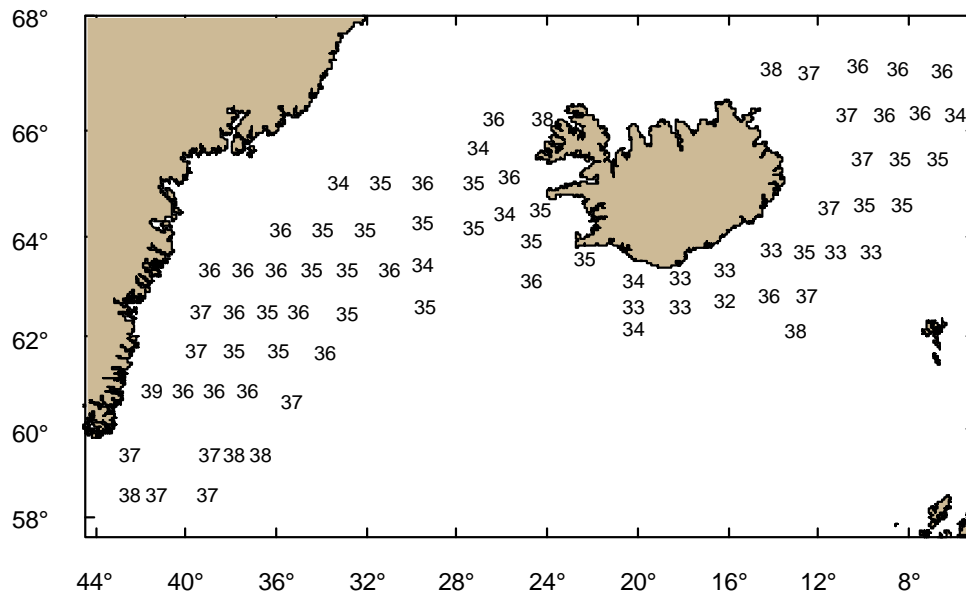


**Figure 1.** Catch (kg/nm) of mackerel in July-August 2014.



**Figure 3. Length distribution of mackerel**

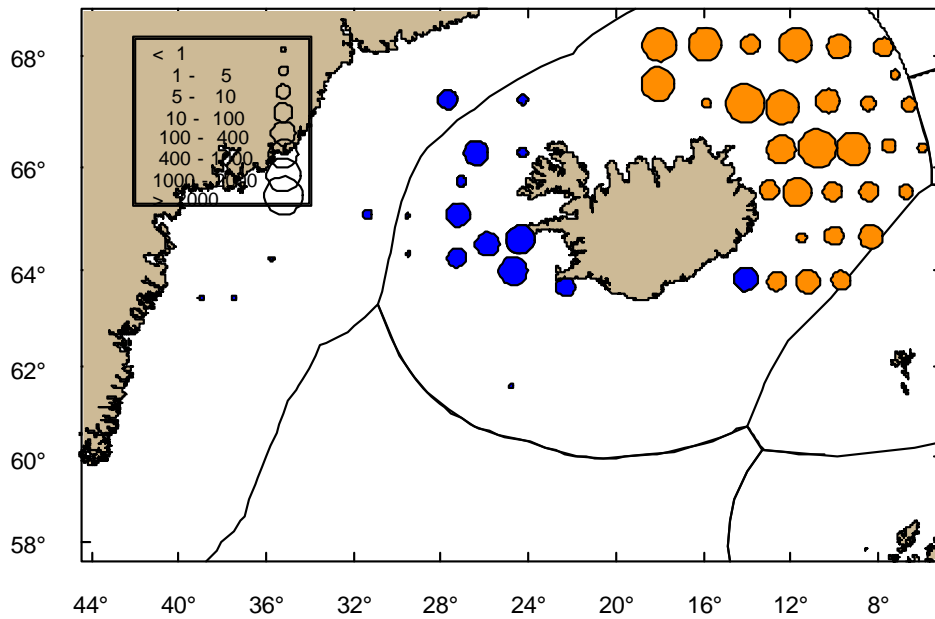
In general the largest mackerel has the longest migration and are found furthest to the west and south west and off Northeast Iceland. The smallest mackerel was on the other hand found off the south coast of Iceland



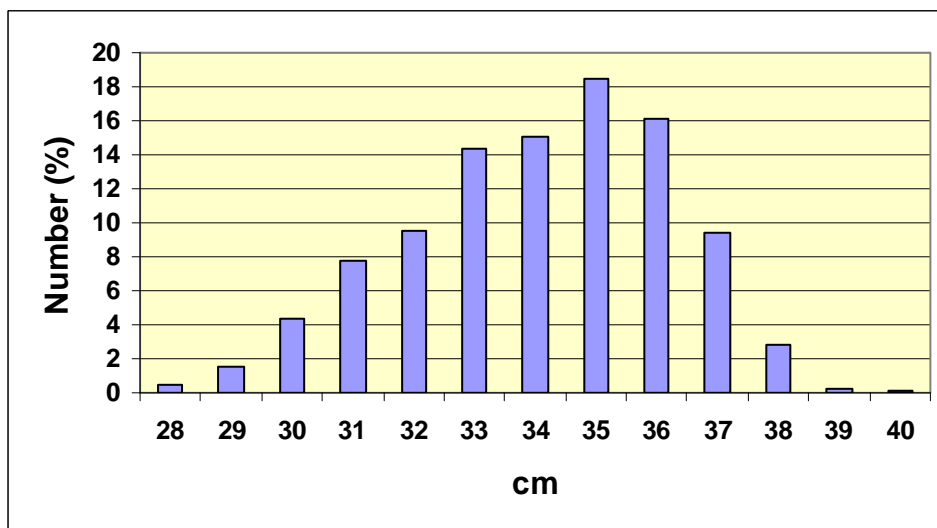
**Figure 3. Mean length of mackerel in trawl catches.**

**Length and spatial distribution of herring**

In figure 4 is shown the distribution of the Icelandic summer spawning herring (ISSH) and the Norwegian spring spawning herring (NSSH) and the catch per nm towed. The ISH is mainly distributed to the west of Iceland mostly over the shelf whereas the NSSH has more oceanic distribution off southeast, east and the northeast Iceland. It is of interest that a few specimens of mature pre-spawning ISSH were observed in the Greenland area. No mixing of the species was observed.



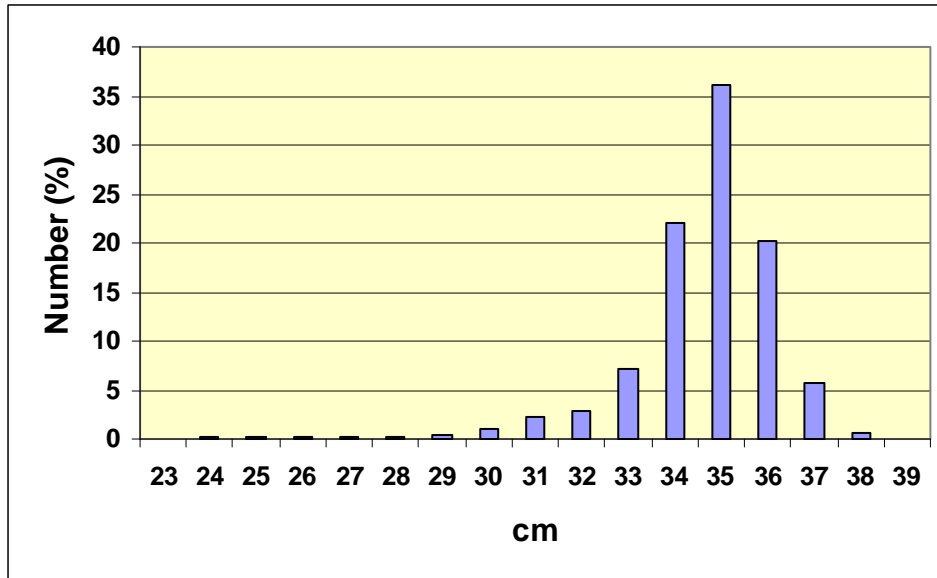
**Figure 4.** Distribution of ISSH (blue circles) and NSSH (orange circles) and catch in kg/nm towed.



**Figure 5.** Total length distribution of ISSH

The length range of the ISSH was from 20 – 40 cm. In Figure 5 is shown the length distribution of the ISSH. As seen from the length frequencies the greatest numbers ranged in length from 33-36 cm.

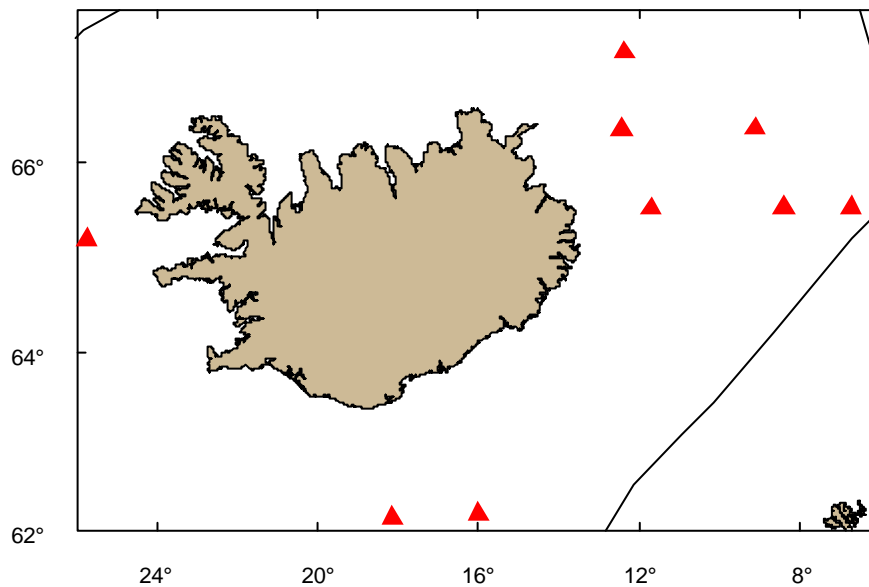
The length distribution of the NSSH is shown in Figure 7. The length ranged from 23-39 cm. The most common length frequencies were from 34-36 cm.



**Figure 6.** Total length distribution of NSSH

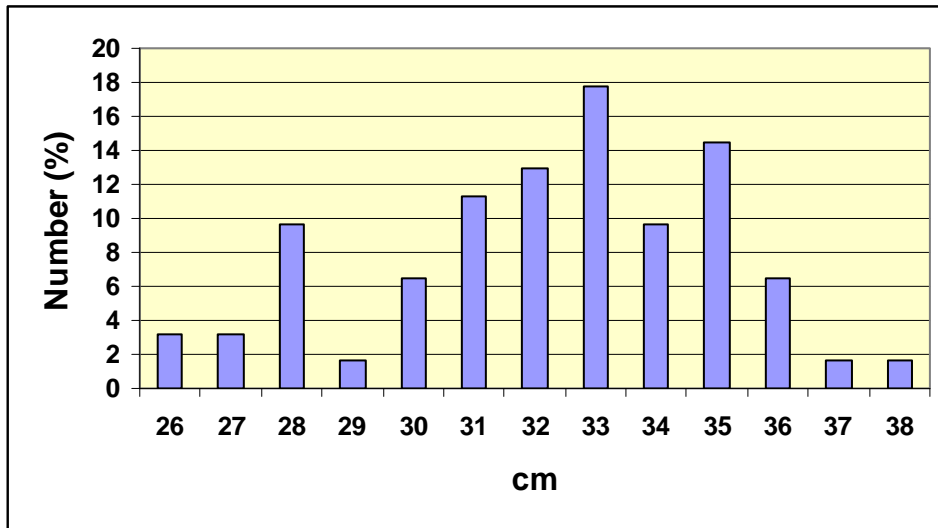
**Length and spatial distribution of blue whiting**

In figure 8 is shown the distribution of blue whiting. The distribution of blue whiting was very restricted in the Icelandic area as measured by the trawl catches. The blue whiting is usually staying in deeper waters than herring and especially mackerel and only surface tows were worked. This affects the distribution as represented in the tows. The distribution as measured by acoustic methods will be analysed at a later time.



**Figure 7.** Distribution of blue whiting. Red triangles show tows with catch

The blue whiting caught in the survey ranged from 26-38 cm with the most common lengths 28 and 31-35 cm.



**Figure 8.** Total length distribution of blue whiting

### **Other species**

Eighteen other fish species were caught in the survey. The most common of which were, lump suckers, capelin, sand eels and lantern fishes.

Two salmon were caught in positions 68°11' N and 18°02' W and 63°47' N and 12°40' W, 56 and 55 cm long respectively.