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Toktrapport - F/T ”RAMOEN” 07.10-20.10 - 2013

Av Thor Bærhaugen, Arill Engås, Wenche Vigrestad, Melanie Underwood, Jan Tore Øvredal og Asbjørn Aasen

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HAVFORSKNINGSINSTITUTTET
INSTITUTE OF MARINE RESEARCH

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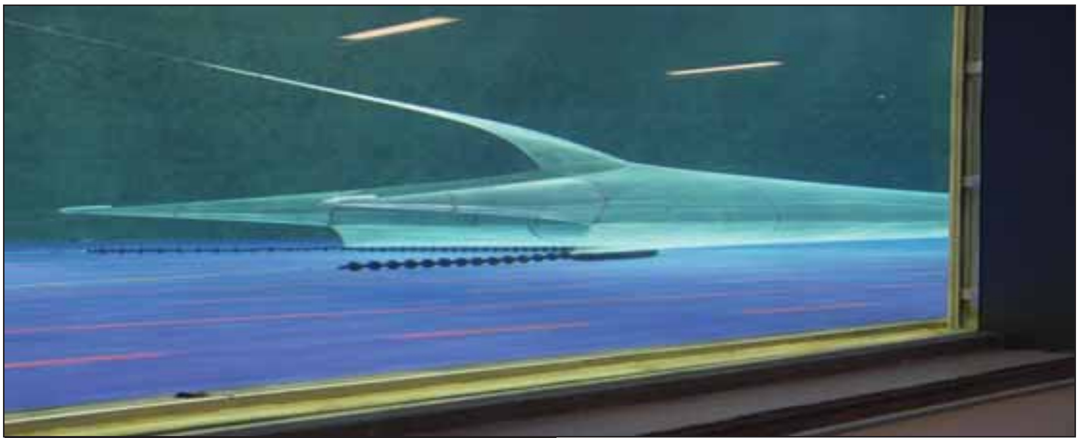

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Innhold

Innledning

Formålet med toktet var å kartlegge fangsteffektiviteten til bunntrål med tråldørene på og av bunnen, testing av trålinstrumentering fra Kongsberg Maritime, Simrad og uttesting av fangstbegrensingssystem i to-panel trål med og uten rist-seksjon.

Utbyttet av toktet ble begrenset fordi det under store deler av toktet ikke ble funnet ansamlinger av torsk og hyse i Barentshavet. Resultatene fra forsøkene er i all hovedsak basert på trålhal gjennomført i Storfjordrenna (nordøst av Bjørnøya).

Kartlegging av fangsteffektiviteten til bunntrål med dørene på og av bunnen

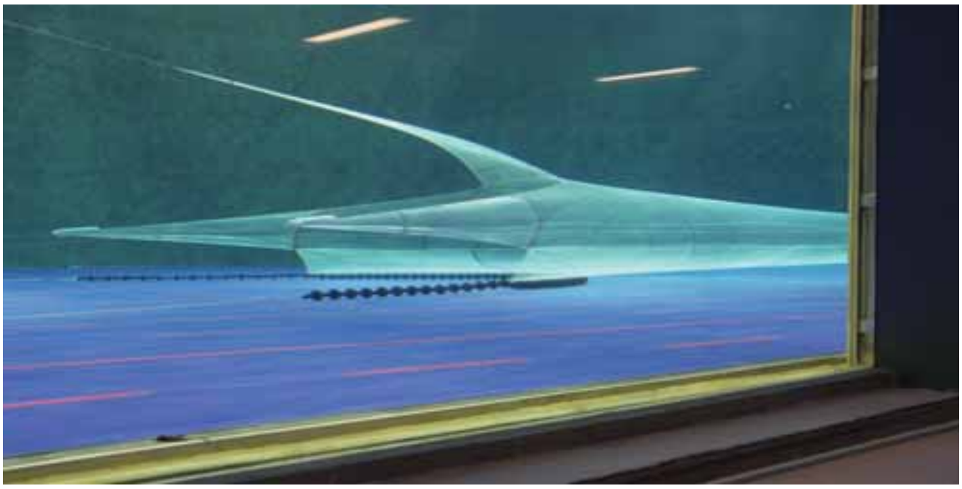
Bakgrunn

CRISP er å utvikle trålkonsept der bunnpåvirkningen blir redusert sammenlignet med dagens bunntrålteknologi. Et av konseptene er å utvikle og teste ut semipelagisk tråling der dører og sveiper ikke berører bunnen. Under forsøk om bord på F/T "Ramoen" i 2012 ble det gjennomført forsøk for å sammenligne fangsteffektiviteten til bunntrål med dørene på bunnen og med dørene ca 10 m over bunnen. Forsøkene som ble gjennomført under tette forekomster av torsk ved Hopen viste at fangstraten var tilnærmet lik for de to riggingene (se Appendix). Forsøkene i 2012 var begrenset i omfang og det var derfor behov for en ytterligere dokumentasjon hvordan rigging med dører på og av bunnen påvirket fangsteffektiviteten.

Gjennomføring, resultat og konklusjon.

Forsøkene ble gjennomført med Egersund 630 høyåpnings trål med framtrekk i taket (Figur 1).

Sammenligningen av fangsteffektiviteten med dører på bunn og dører og sveiper over bunn ble gjennomført tilnærmet tilsvarende som i 2012 (alternerende hal), med unntak av størrelsen på trekantvinge og tråldører. For detaljer om forsøksopplegg, resultater og konklusjon, se Appendix.



Figur 1. Bilde av trålen fra strømningstank (trekantvingen som vist på bildet er tilsvarende som benyttet under 2012 forsøkene).

Testing av trålinstrumentering

Bakgrunn

Under tokt med F/F "Ramoen" i 2012 ble SIMRAD PX multisensorer montert i tråldørene for å måle døravstand, høyde mellom dører og bunn samt helningsvinkler av dørene. Sensorene var helt avgjørende for å kunne posisjonere dørene i en gitt avstand fra bunnen.. Under disse forsøkene ble det også gjennomført forsøk med modifisert SIMRAD EK 15 montert på ulike steder i trålen. Utstyret ga nyttig informasjon blant annet om hvordan fisk fordelte seg i ulike deler av trålen og effekten av ulik rigging av paneler for å skille arter som torsk og hyse. For å høste mer erfaring og eventuelt videreutvikle dette instrumenteringsoppsettet ble forsøkene videreført i 2013

Gjennomføring, resultat og konklusjon

For detaljer om forsøksoppsett, resultat og konklusjon, se Appendix.

Regulering av fangstmengde

Bakgrunn

Fiskeridirektoratet innvilget seks fartøy tillatelse til å benytte fangstbegrensningssystem uten rist i fiske etter torskefisk i Barentshavet i perioden 1. august 2013 – 1.mars 2014. Utformingen av fangstbegrensningssystemet, gummimatte over et utslippshull, var basert på forsøk utført innenfor CRISP i 2012. Forsøkene var utført med fire-panels trål og det var derfor usikkerhet hvordan systemet fungerte med to-panels trål som fiskeflåten benytter.

Tilbakemeldingene fra et fartøy som benyttet systemet i to-panels trål var at gummimatten ikke dekket utslippshullet før trålposen var fylt opp med ønsket fangst (dokumentert med undervanns videoobservasjoner). Observasjonene viste også at fisk forsvant ut gjennom utslippshullet under denne fasen av trålhalet.

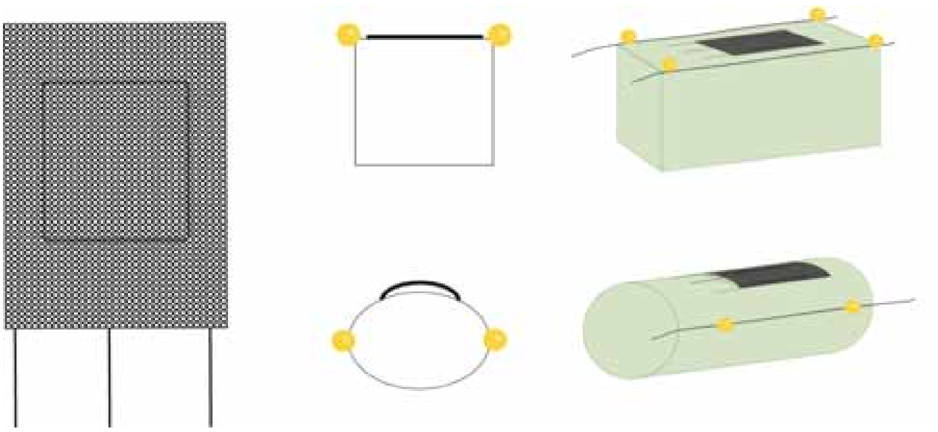
Gjennomføring, resultater og konklusjon.

Det ble gjennomført fire hal med fangstbegrensingssystemet (uten rist seksjon) montert i to-panels forlengelsen i forkant av posen på fartøyets egen bunntrål (Selstad 630). Observasjonene viste at gummimatten ikke dekket utslippshullet (Figur 2).

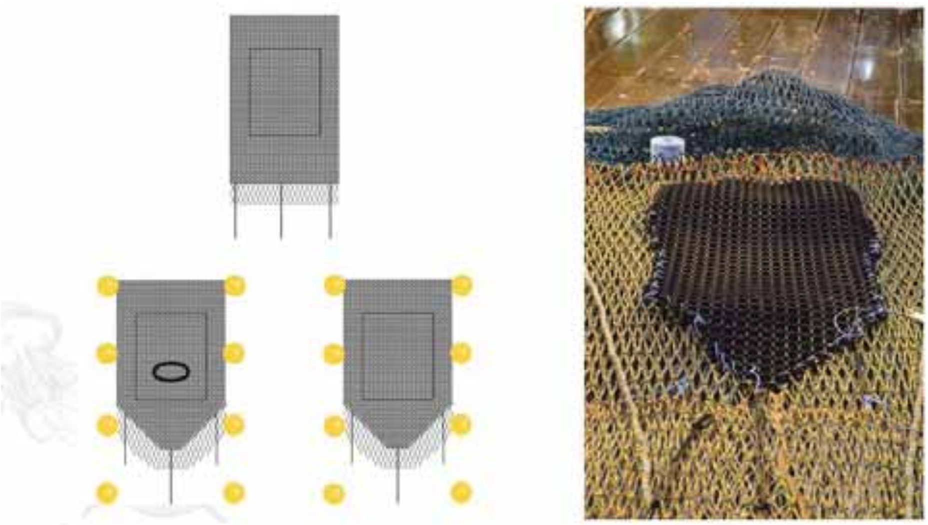
Det antas at årsaken til åpningen mellom utslippshullet og gummimatten skyldes at når overpanelet i topanels seksjon får en konveks form samtidig som maskene lukkes, vil dette også tvinge gummimatten i en konveks form. Siden gummimatten ikke er fleksibel som panelet vil dette tvinge matten opp fra panelet og dermed vil en åpning oppstå mellom matten og panelet (Figur 3).

For å redusere åpningen mellom fiskeutslippet og gummimatten ble det gjennomført forsøk med å skråskjære gummimatten i bakkant samt forsøk med en vekt på ca 1.5 kg på toppen av bakre del av gummimatten (Figur 4). Disse riggingene hadde liten innvirkning for å redusere ”flagringen” og åpningen på matten. Ved å benytte fire stk. fløyt på hver leis ved siden av matten (Figur 4), ble matten stabil og åpningen til utslippshullet ble redusert til et minimum (Figur 5).

Figur 2. Fangst-begrensningssystemet med åpning mellom utslippshullet og gummimatte.



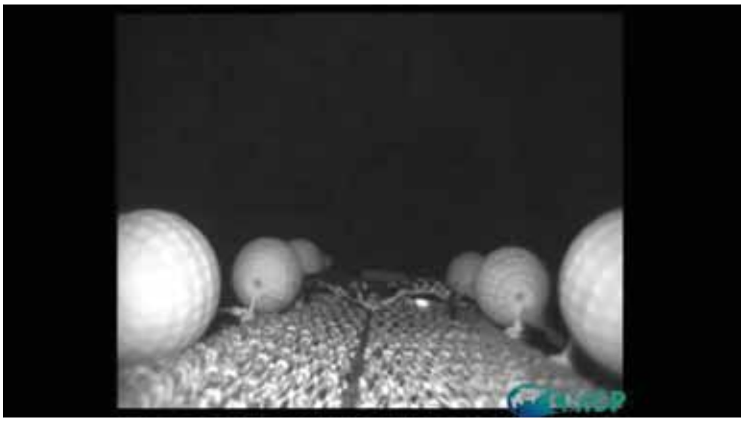
Figur 3. Skjematisk skisse av gummimatte i fire panels og to panels trål.



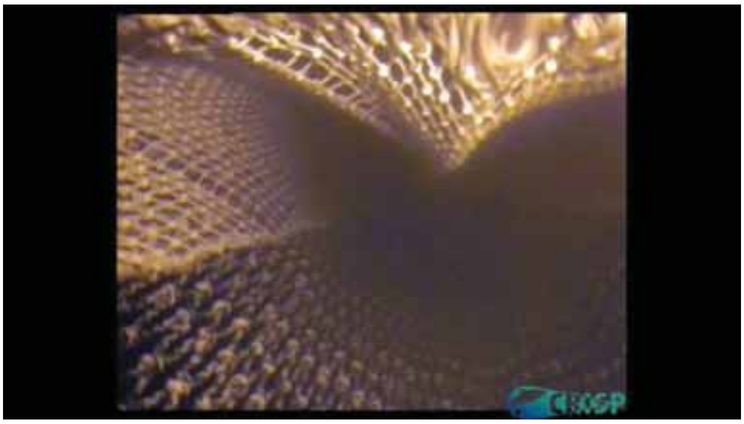
Figur 4. Gummimatte med skråskjæring i bakkant (vestre figur med vekt på toppen av gummimatte).

Lave fangstrater under forsøkene med fangstbegrensingssystemet, samt dårlige observasjonsforhold på bunnen, gjorde det umulig å dokumentere effektiviteten av systemet med de overnevnte riggingene.

Videokameraobservasjoner viste at fiskelåset fungerte som tiltenkt og at det var god åpning for fisk til å passere bak i posen under tråling (Figur 6).



Figur 5. Bilde av gummimatte med kuler på leiser.



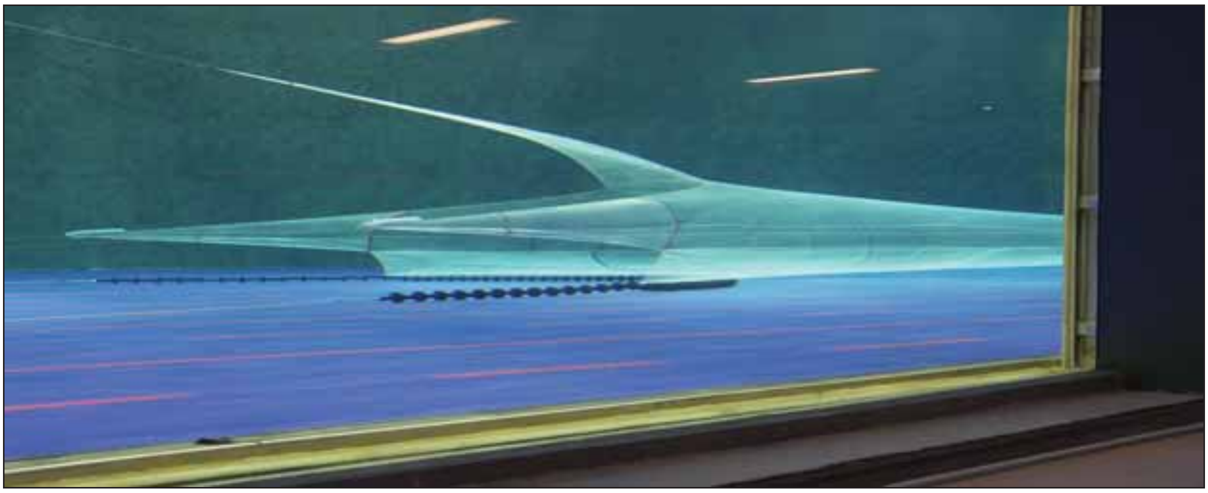
Figur 6. Fiskelåset (kamera pekende bakover mot posen, fiskelåset på toppen av bilde med blyline) under tauing.

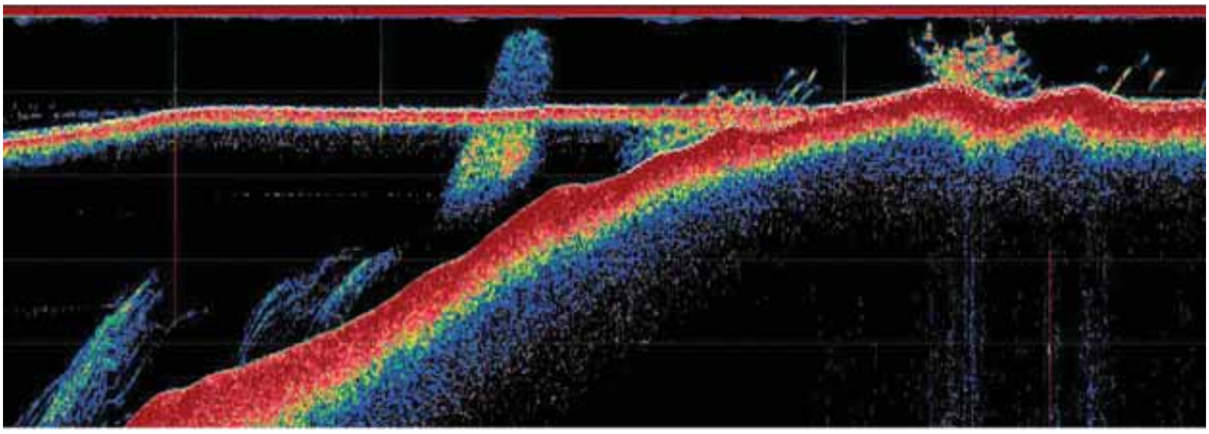
Appendix 1

Herding behaviour of Gadoids in a Semi-pelagic trawl – 2013 Ramoen

Commercial Cruise Summary, October, 2013, Hopenøya

Thor Bærhaugen, Arill Engås, Melanie Underwood, Wenche Vigrestad, Jan Tore Øvredal, Asbjørn Aasen





Background

Demersal trawl doors and sweeps are used to keep the trawl entrance open and herd fish back into the trawl path by a combination of different stimuli, such as, the door warps, door noise, sand clouds, sweeps and bridles. However, with a recent shift towards a more environmentally friendly trawl, investigations have begun exploring semi-pelagic trawls as an alternative gear choice to traditional demersal trawls. The herding stimulus of a semi-pelagic trawl is different to a traditional demersal trawl. For instance, with the doors and part of the sweeps or bridles off the seabed, it is expected to reduce herding stimuli by decreasing noise and sand clouds from the doors which are commonly observed in demersal tow operations. Nonetheless, the doors are still present, and may be used as a stimulus by their vibrations. It is our goal to see if the herding stimulus of a semi-pelagic trawl is efficient to herd cod and Haddock, and therefore a viable method to reduce the seabed impact of the gadoid fishery as seen in the saithe industry. To note the effect of the doors, sweeps and bridles on the herding response of gadoids, a traditional demersal trawl (doors, sweeps and bridles on the seabed - high seabed contact) will be compared to a modified semi-pelagic trawl (doors, sweeps and bridles off the seabed - low seabed contact). With the semi-pelagic trawl, only the trawl footgear is in contact with the seabed.

Objectives

1) Reduce the seabed-contact of bottom trawling without reducing catch of gadoids. Compare catch rates when doors and sweeps are off and on the seabed.
2) Observe the herding behaviour of gadoids throughout the capture process. Quantify fish in the trawl mouth, and calculate the passage rate of fish from the vessel through the trawl.
3) Repeat the experiment conducted in October 2012 on a commercial vessel.

Methodology

To simulate both low and high contact trawling, two different riggings of a high-opening trawl were tested on the commercial vessel Ramoen in October, 2013 (Figure 1). The high-opening trawl has a standard, commercial footgear with 24″ rockhoppers and 8″ spacers. The doors are also of standard, commercial size (Rock doors, 10.5m^2, 4500kg) but have increased from 2012 (Super Shark Injector; 9.5m^2, 4250kg), and are connected to the trawl by 55 m sweeps (32 mm wire diameter) and 70 m bridles (20 mm upper and 32 mm lower wire diameter). The sweeps were connected to the doors with 11 m and a 4.12 m chain (1.12 m longer than in 2012). In the high-contact rigging, all aspects of the trawl (door, sweeps and footgear) were on the seabed. In the low-contact rigging, two 300kg weights were added to the footgear on the wings to keep the footgear in contact with the seabed as well as .5 m chain to the lower bridle. The weights were 7% of the weight of the trawl doors. The doors in the low-contact rigging were flown at an average of 10m above the seabed (7 – 12 m range) and fitted with Simrad PX system to measure the height of each door from the seabed. Door performance was measured using the PX sensors, recording the door spread, tilt and roll.

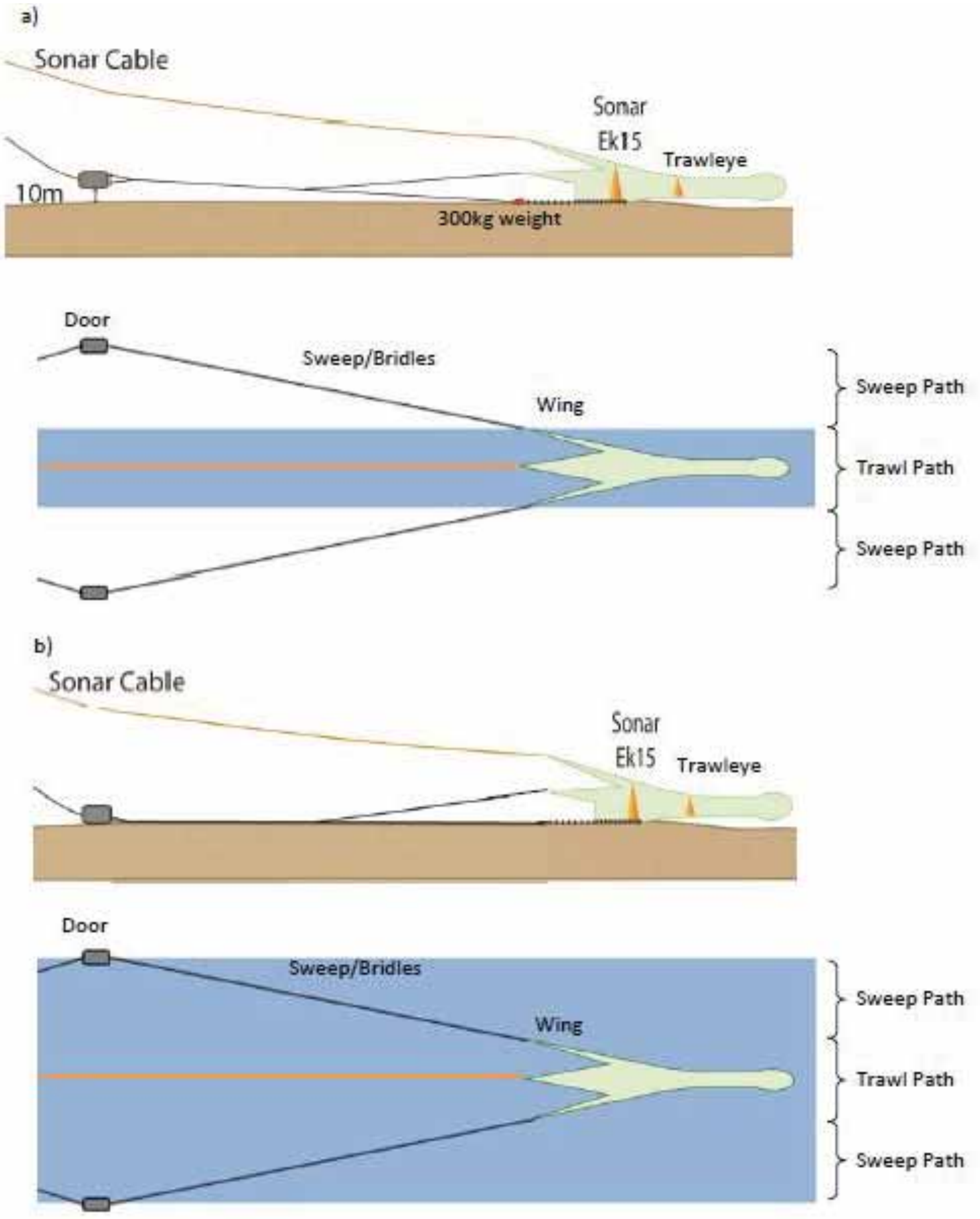


Figure 1. Sketch of the seabed contact between the two different trawling methods; a) low- and b) high- contact trawling. The Trawl path is the area between the wings. The Sweep path is the area between the wings and the doors. The area in blue indicates the amount of seabed in contact with the gear with the low-contact trawling method (a) having ~1/3 as much seabed contact as the high-contact trawling method (b).

Gear performance was measured using both Scammar and Simrad sensors, recording the wing spread, trawl opening height, bottom contact and trawl speed through the water. Temperature and turbidity was measured using a trawl mounted Star Oddi DST tilt tag and underwater cameras respectively. The Star Oddis were also used to record the height from the headline to the Middle wing.

All comparison hauls were alternated and each haul per comparison was towed in the same direction (only altered to avoid the other 20 fishing vessels in the area) with a trawling speed of ~4 kts, the same as the commercial vessels. All computers and time-stamping devices were synchronized prior to the haul. The vessel EK60 recorded the distribution (even or patchy) and the depth of fish prior to interacting with the gear.

An EK15, trawl sonar (digital FS70) and speed sensor was mounted to the middle of the top of the trawl, above the footgear, and a trawleye was mounted in the aft of the trawl at the 155mm/200mm mesh change, to quantify the entrance height and distribution of fish, and the swimming speed of schools from the vessel to the trawl (this assumes that the schools seen in the vessel EK60 are entering the trawl and are the same school as seen in the EK15 and trawleye). Star Oddi DST were placed on the Trawleye and EK15 to measure the tilt and roll of each during the haul.

Biological data was collected every haul. The total weight of all species caught per haul was recorded and the length of 300 randomly selected individuals per species, were measured. Of the 300 individuals randomly selected for cod, 20 individuals were randomly selected at one haul per day for stomach, sex and maturity recordings.

Preliminary Results

In general, the cruise was a success. A total of eight comparisons were completed with tow direction and door height stability a priority (Fig. 2).

Instrumentation and Gear Performance

The bottom contact sensor was placed on the footgear (Fig. 3) and was meant to display ¨0 degrees when on seabed and ¨90 degrees when off seabed. However, it constantly displayed between 35-70 during the time the trawl was in the water and more detail is needed on the accuracy of the values. However, the sonar displayed the trawl consistently on the seabed during the comparisons only leaving the seabed in extremely rough substrate (observed in both hauls of the comparison).

The DST sensors were placed in holders made on board for the EK15and trawleye. The sonar has a built in tilt sensor. Each holder prevented the sensor from moving during the haul and allowed the tilt of the echosounder to be calculated (Fig. 4).

Due to technical issues with the digital sonar, it was decided to use the vessels analogue sonar (FS70) to get the entrance distribution of gadoids. This meant that the EK15 was also not used during the comparisons. This limited the ability to access objective 2.

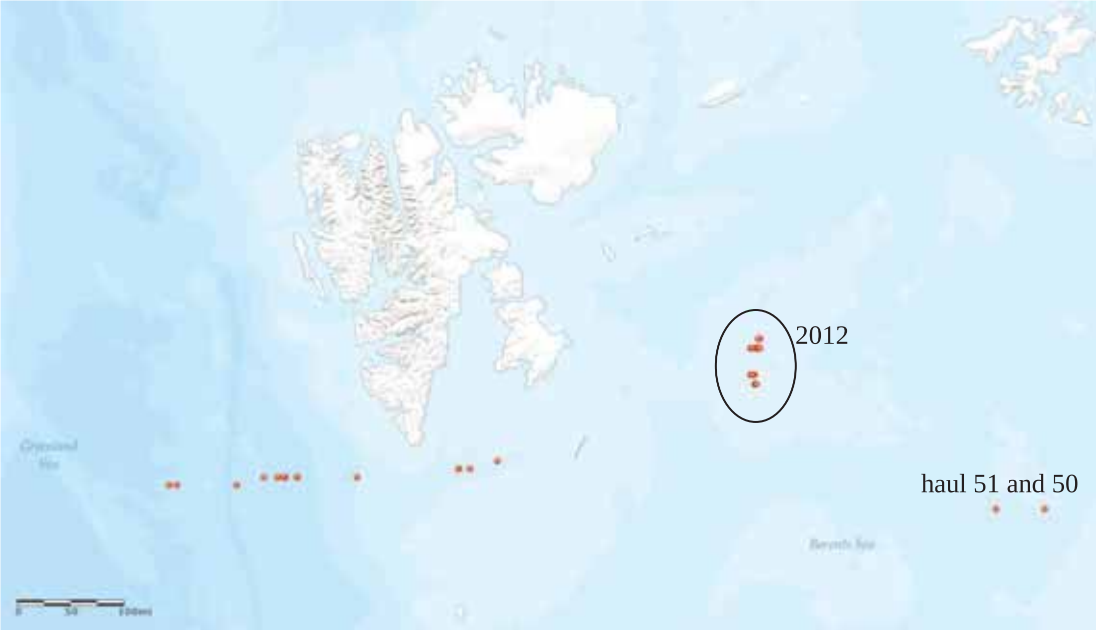


Figure 2. Map of the 2012 and 2013 comparisons. All comparisons made in 2012 are within the black circle.

Figure 3. Bottom contact sensor mounted to the footgear of the trawl.

Figure 4. The DST tilt sensors and holders.

The trawling depth was deeper in 2013 than 2012, with the start depth between 175 to 249 m compared to between 150 – 180 m for 2012. This meant that the average door spread was greater this year with 136 m in the high-contact rigging and 122 m with low-contact rigging compared to 110 and 101 m in 2012, respectively (Table 1). However, the difference in door spread between riggings each year was similar (9 % in 2012 and 11 % in 2013). Door height of the seabed was consistent throughout the comparisons. The trawl opening height was a meter higher in each rigging than last year.

Table 1. Gear performance for each haul during 2012 and 2013.

Haul	Date	Start Latitude	Start Longitude	Start Time (UTC)	Haul Time	Wireout	Average Heading	Speed (knots)	Start Depth (m)	Door Spread (m)	Difference in Door Spreads	Door Height (m)	Wing Spread (m)	Trawl Height (m)
11a*	5/10/2012	77.3	34.2	7:19	2:42	400	NW & SE	4.0	150	98.46	8%	10.93	none	10
12b*	5/10/2012	77.3	34.2	11:18	2:44	450	N & S	4.0	155	107.25		0.00	34.90	10
17b	6/10/2012	77.3	34.3	8:23	1:16	425	NW	4.0	137	105.22		0.00	35.30	9
18a ‡	6/10/2012	77.4	34.2	10:17	1:16	400	SE	4.0	157	95.88	9%	12.84	33.66	10
22a*	7/10/2012	77.4	34.0	9:50	2:40	445	N & SE	4.0	174	102.07	9%	13.57	35.03	
23b*	7/10/2012	77.4	34.1	13:26	2:48	480	NW & N	4.0	180	112.54		0.00	37.60	
34b	9/10/2012	77.7	34.0	7:16	1:22	450	W	4.0	168	108.09		0.00	36.39	9
35a	9/10/2012	77.7	34.1	9:14	1:22	420	NE	4.0	163	99.68	8%	11.41	34.45	10
37b*	9/10/2012	77.8	34.5	15:44	1:01	440	SW - NE	4.0	161	115.32		2.16	37.00	9
38a	9/10/2012	77.8	34.4	17:44	1:00	420	SW	4.0	163	113.50	2%	10.57	35.35	
40a	10/10/2012	77.7	34.4	6:55	0:30	415	NE	4.0	164	101.65	6%	11.34	35.17	9
41b	10/10/2012	77.7	34.3	10:36	0:30	425	NE	4.0	163	108.68		0.00	39.27	9
41b	10/10/2012	77.7	34.3	10:36	0:30	425	NE	4.0	163	108.68		0.00	39.27	9
42a	10/10/2012	77.7	34.4	11:47	0:30	400	NE	4.0	164	102.34	6%	9.75	35.86	
42a	10/10/2012	77.7	34.4	11:47	0:30	400	NE	4.0	164	102.34	13%	9.75	35.86	
43b ‡	10/10/2012	77.7	34.5	13:08	0:37	460	S	4.0	161	116.96		0.00	38.75	
24a	14/10/2013	76.2	21.0	8:42	1:23	505	54	4.0	196	122.00	10%	9.00	38.00	10
25b	14/10/2013	76.2	21.0	11:07	1:23	579	57	4.0	188	136.00		0.00	41.20	9
26b*	14/10/2013	76.3	21.2	13:25	1:56	635	87*	4.0	212	138.00		0.00	41.60	9
27a*	14/10/2013	76.4	21.2	16:14	1:59	535	70*	3.9	220	123.00	11%	10.00	38.00	11.5
32b	15/10/2013	76.2	19.7	17:58	1:52	625	306-009	3.8	200	136.00		0.00	41.00	9
33a	15/10/2013	76.2	19.7	20:57	1:46	550	302-009	4.0	201	128.00	6%	10.00	39.00	10.5
36a	16/10/2013	76.1	18.8	8:07	1:57	450	89	4.0	183	119.50	11%	9.50	37.50	10
37b	16/10/2013	76.1	18.9	11:14	1:59	530	89	4.2	175	134.50		0.00	41.00	8.5
41b	17/10/2013	76.1	19.7	9:37	1:59	575	60	3.9	188	133.50		0.00	40.90	9.10
42a ‡	17/10/2013	76.2	19.8	12:51	1:59	530	358‡	4.0	197	121.00	9%	10.00	37.80	11
44a	17/10/2013	76.3	19.8	21:22	1:58	575	190	3.8	241	122.00	12%	9.50	none	10.5
45b	18/10/2013	76.3	19.7	0:30	1:59	715	202	3.8	249	139.00		0.00	none	9
47a	18/10/2013	76.2	20.0	8:38	1:28	515	229	4.0	226	119.00	14%	8.50	none	11
48b	18/10/2013	76.2	19.6	11:11	1:28	640		3.7	225	139.00		0.00	none	9
50a	18/10/2013	75.8	17.9	21:26	0:59	475	168	4.0	184	118.00	13%	9.00	none	11
51b	18/10/2013	75.8	17.8	23:07	1:00	590	172	3.8	189	135.00		0.00	none	9

a 10m over seabed (low-contact rigging)
b on seabed (high-contact rigging)
* turned during haul
‡ different towing directions

Catch Comparison

The density of gadoids was lower this cruise than in 2012 and displayed an even distribution throughout the water column (i.e., no large groups of fish were observed). Catch rates were also lower with minimum catches of less than a ton (2013, table 2). On average, the low-contact trawl caught approximately 30% less cod per hour than the standard high-contact trawl. Since flatfish are herded by the sweeps, it was assumed that the number of flatfish would be higher when trawling with the high-contact rigging, however, there was no consistency with the flatfish catches. Generally, the catches were similar between low- and high- contact trawling.

Table 2. Catch comparison for each haul in 2012 and 2013

Haul	Date	Start Latitude	Start Longitude	Start Time (UTC)	COD Average LENGTH	COD Fangst per hour (Kg)	COD Difference in catch	Total Fangst Torsk (Kg)	Total Fangst Hyse (Kg)	Total Fangst Blåkveite	Total Fangst Gapeflyndre (Kg)
11a*	5/10/2012	77.3	34.2	7:19	71.2	2509	36%	6774	88.6		91.0
12b*	5/10/2012	77.3	34.2	11:18	69.5	3928		10562	173.3		98.3
17b	6/10/2012	77.3	34.3	8:23	68.7	5128		6495	118.2		49.3
18a ‡	6/10/2012	77.4	34.2	10:17	67.2	4257	17%	5392	95.6		40.9
22a*	7/10/2012	77.4	34.0	9:50	69.8	1467	35%	3912	170.3		106.5
23b*	7/10/2012	77.4	34.1	13:26	71.4	2243		6280	171.0		257.2
34b	9/10/2012	77.7	34.0	7:16	66.0	2219		3033	30.6		45.8
35a	9/10/2012	77.7	34.1	9:14	68.2	2348	-6%	3209	15.1		39.1
37b*	9/10/2012	77.8	34.5	15:44	69.0	7442		7566	64.7		31.1
38a	9/10/2012	77.8	34.4	17:44	71.6	8062	-8%	8062	17.7		23.9
40a	10/10/2012	77.7	34.4	6:55	68.4	20472	-395%	10236	11.4		24.4
41b	10/10/2012	77.7	34.3	10:36	67.5	4138		2069	17.7		39.9
41b	10/10/2012	77.7	34.3	10:36	67.5	4138		2069	17.7		39.9
42a	10/10/2012	77.7	34.4	11:47	68.4	12664	-206%	6332	66.2		40.5
42a	10/10/2012	77.7	34.4	11:47	68.4	12664	-54%	6332	66.2		40.5
43b ‡	10/10/2012	77.7	34.5	13:08	66.6	8199		5056	54.1		57.5

Haul	Date	Start Latitude	Start Longitude	Start Time (UTC)	COD Average LENGTH	COD Fangst per hour (Kg)	COD Difference in catch	Total Fangst Torsk (Kg)	Total Fangst Hyse (Kg)	Total Fangst Blåkveite	Total Fangst Gapeflyndre (Kg)
24a	14/10/2013	76.2	21.0	8:42	74.1	1718	-108%	2377	27.7	5.3	26.3
25b	14/10/2013	76.2	21.0	11:07	72.7	828		1139	5.9	1.4	39.6
26b*	14/10/2013	76.3	21.2	13:25	78.4	2036		3936		4.7	144.7
27a*	14/10/2013	76.4	21.2	16:14	74.5	467	77%	926	1.6	248.7	128.4
32b	15/10/2013	76.2	19.7	17:58	70.9	4494		8389	1.5	33.3	19.5
33a	15/10/2013	76.2	19.7	20:57	72.5	3190	29%	5636		5.8	13.3
36a	16/10/2013	76.1	18.8	8:07	74.1	2607	52%	5084	22.4	1.0	62.4
37b	16/10/2013	76.1	18.9	11:14	75.5	5395		10701	18.9	0.0	126.8
41b	17/10/2013	76.1	19.7	9:37	70.4	2913		5777	43.5	0.0	53.7
42a ‡	17/10/2013	76.2	19.8	12:51	74.2	2514	14%	4986	2.2	18.93	45.2
44a	17/10/2013	76.3	19.8	21:22	69.7	1186	20%	2332		204.47	46.44
45b	18/10/2013	76.3	19.7	0:30	72.2	1479		2934	2.005	91.27	42.35
47a	18/10/2013	76.2	20.0	8:38	71.7	1325	24%	1944	3.64	24.77	88.39
48b	18/10/2013	76.2	19.6	11:11	70.8	1747		2562	2.325	18.62	25.7
50a	18/10/2013	75.8	17.9	21:26	68.5	647	16%	636	9.81	3.8	16.88
51b	18/10/2013	75.8	17.8	23:07	68.0	772		772	11.765	0.0	30.62

a 10m over seabed (low-contact rigging)
b on seabed (high-contact rigging)
* turned during haul
‡ different towing directions

Gadoid Behaviour
As mentioned above, only the analogue sonar was used during the comparisons, limiting the behavioural observations to the entrance distribution and general notes. The entrance distribution will be analysed post-cruise. Last year, there seemed to be a difference in the entrance distribution of low- and high- contact trawling and will be interesting to see if this difference continued this year. However, it was noted that the distribution of capelin was not as dense as last year and since the majority of fish were eating capelin, this could explain the lack of schooling seen.

Preliminary Conclusions

Reduce the seabed-contact of bottom trawling without reducing catch of gadoids

When comparing different riggings in high densities with large schools, it is easy to 'hit or miss' schools which can add variance to the catch data (i.e., catch a large school and hide the true efficiency of the rigging). However, when the distribution is even with lower densities, this variance is lowered. It is believed that the difference in catch rates between comparisons from this year are more consistent because of the lower density. It is now concluded that the low-rigging trawl does catch less cod than the high-contact trawl even when you take into account the difference in the door spread.

The design of this study was to have as much difference in low- and high- contact rigging as possible. However, future studies on understanding the exact area of catch loss are needed (i.e., are fish being lost close to the doors or close to the trawl). Since round fish are known to avoid the doors in a fountain affect. The sweeps near the doors may not herd fish as much as the sweeps near the trawl and therefore may not be the best indicator of difference between riggings. Increasing the sweep contact near the trawl may increase the catch rate of cod. This could be tested by moving the weights from the end of the footgear to further out on the sweeps or by lowering the door height (e.g., fly the doors are 5 m instead of 10 m off the seabed). Both methods would increase the seabed contact of the trawl, however, would still be lower than the seabed contact of the current commercial trawl (i.e., ¨50 % reduction, instead of ¨60 %). Therefore, we need more information to meet the first objective to reduce the seabed-contact of bottom trawling without reducing the catch of gadoids.

Observe the herding behaviour of gadoids throughout the capture process
More information is needed on the swimming speeds, entrance distribution and the herding behaviour in front of the trawl opening. We are able to observe the entrance behaviour (in the process of working the data up) and the swimming speed with the technology we currently have, however, there is a need to design a method to observe fish just in front of the trawl and the use of a side-scanner, mounted to the sonar cable may be an option.