

Outline of the Danish
fisheries research/fishing industry survey for cod
in the Kattegat 4nd quarter

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Introduction

Since 2003 the cod fishery in Kattegat has been restricted by steadily decreasing quotas due to low abundance of cod estimated from the cod assessment. ICES consider, however, the cod assessment in Kattegat uncertain due to the catch data quality and the analytic assessment has not been accepted by ACFM in recent years. The assessment has shown a discrepancy between the estimated fishing mortality and the reported landings and ICES assumed that the majority of the unallocated mortality was caused by discard, but other factors such as migration, non reported landings and re-allocation of catches also could be part of the problem. Furthermore, the surveys conducted at present in the Kattegat area are not very suited for estimation of cod abundance mainly due to the low coverage and sampling intensity. The abundance estimate in the areas is hence rather uncertain and only shows trends in stock development, and the assessment of the cod stock would, without doubt, benefit significantly from a survey directly aimed at cod. The 5 August 2006 a tender was submitted by Swedish Board of Fisheries, Institute of Marine Research (IMR-SE) in response to the open call for tenders, Reference No FISH/2006/15 Studies and Pilot projects for carrying out the common fisheries policy, Lot No 3: "Evaluation of the pilot effort regime in Kattegat" from Directorate-General for Fisheries and Maritime Affairs.

Both Swedish and Danish scientists and the fishermen's organisations agree that the poor survey quality hampers the assessment of the cod stock in Kattegat and an expert group consisting of people from the fisherman's organisations and scientists has designed an improved survey. The initiative has been taken by the LOT 3 project group and was originally a strictly Swedish project. However, the involvement of Denmark has been considered as an improvement of the project and the survey has been designed in all details in agreement between fishers and scientists from both countries. The survey has been conducted since 2008 with a gap in 2012 and only Swedish vessels participating in 2013. The survey strata has been moderated slightly since 2013 to take into account the closed area very a separate strata has been placed.

The goal

The goal of the Kattegat cod survey is to estimate the abundance, biomass and distribution of cod and to establish a fisheries independent time series of catch and effort series. Furthermore, a recruitment index will be established. The results should be used, together with commercial catch and effort data to strengthen the scientific advice on the cod stock in Kattegat. The survey will also monitor the amount and distribution of cod within the proposed "closed area" in order to analyse the effect of the closure.

Restrictions

The 2 commercial Swedish trawlers participating in the survey conduct the survey without any restrictions in the vessels quota, days at sea regulation and with dispensation from all by-catch regulations. From Denmark the Danish scientific vessel Havfisken is participating.

Survey design

Survey area

The survey area is restricted to the Kattegat area covering from Skagen, to the Tistlarna lighthouse and in south by an south-eastwards line between Ellekilde Hage and Lerbjerg and south-westwards by a line between Gniben og Hassensør on Djursland. Further, the area is restricted by the 20 m depth contour line and the area is split in areas "North" and "South" (Fig. 1).

However, in two fjords Laholmsbugten and Skældervigen fishing at stations shallower than 20 meter will take place and 1 or two stations will be placed in a small area in The Sound "Kilen".

Survey method and stratification

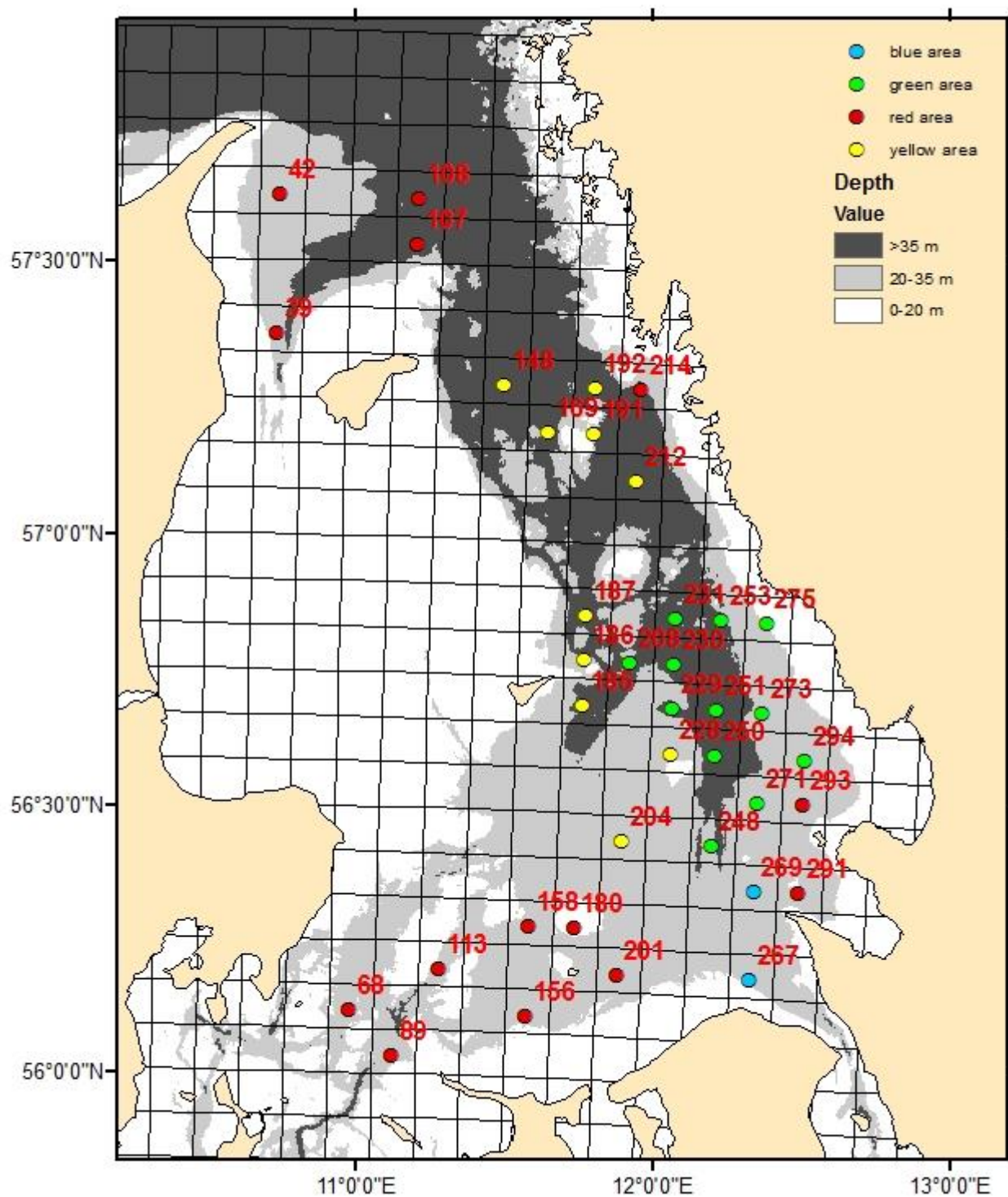
The survey is designed as a random stratified bottom trawl survey. The survey area is since 2013 stratified in four strata: a stratum with high cod density, a stratum with medium density and a stratum with low cod density based on information from the fishers a forth strata has been designate to make sure not stations are placed within the closed area. Each stratum is further subdivided in 5*5 nm squares. Most stations according to the area are allocated to the high density stratum. In the forthcoming years stations will be allocated to the different strata in order to minimize the variance of the estimation of the cod biomass. The survey design allows a post-stratification of the survey area if necessary without losing comparability with previous surveys and hence to take changes in the main focus area into account if the stock distribution is changing between years or the stock is increasing or decreasing.

Station (tow) location

The survey is planed with in average 3.3 trawl hauls per day in 6 days for each of the vessels i.e in total 80 trawl hauls. The hauls are allocated randomly to the 5*5 nm squares and each vessel is allocated 20 different squares. In the high and medium density strata several vessels are allowed to fish in the same square. In the low density stratum only one haul is allowed in each square. Furthermore the low density area is divided in a Southern and Northern area.

Numbers of stations by vessel, stratum and area

Ship	High density	Medium density	Low density (South)	Low density (North)	Closed area	Total
DK Havfisken	12	10	7	7	4	40
SE Tärnan	6	5	7		2	20
SE Cindy	6	5		7	2	20



Stations valid for Havfisker 4Q 2018

	Station	lat	long	DK Havfisker	
1	39 Nord	57.36890	10.73973		1
4	42 Nord	57.61832	10.75163		1
7	63 Nord	57.53295	10.90222	reserv	
11	107 Nord	57.52791	11.21130		1
12	108 Nord	57.61103	11.21635		1
26	172 Nord	57.43585	11.66864	reserv	
28	214 Nord	57.26280	11.96330		1
29	291 Nord	56.33349	12.49026		1
31	293 Nord	56.49957	12.50551		1
37	68 Syd	56.11718	10.98072		1
38	69 Syd	56.20033	10.98501	reserv	
39	89 Syd	56.03156	11.12497		1
44	113 Syd	56.19518	11.28327		1
47	134 Syd	56.10921	11.42712	reserv	
53	156 Syd	56.10620	11.57587		1
55	158 Syd	56.27243	11.58704		1
62	180 Syd	56.26921	11.73640		1
64	201 Syd	56.18273	11.87948		1
74	148	57.27281	11.50321		1
75	169	57.18657	11.65063		1
76	170	57.26966	11.65660	reserv	
80	185	56.68470	11.76648		1
81	186	56.76780	11.77259		1
82	187	56.85089	11.77873		1
86	191	57.18324	11.80365		1
87	192	57.26633	11.80997		1
88	204	56.43200	11.89831		1
93	212	57.09665	11.95002		1
95	225	56.34533	12.04162	reserv	
98	228	56.59455	12.06163		1
102	208	56.76434	11.92389		1
104	229	56.67763	12.06837		1
105	230	56.76070	12.07515		1
106	231	56.84377	12.08196		1
109	248	56.42463	12.19816		1
111	250	56.59075	12.21219		1
112	251	56.67381	12.21926		1
114	253	56.83993	12.23352		1
115	271	56.50372	12.35536		1
117	273	56.66982	12.37012		1
119	275	56.83591	12.38504		1
120	294	56.58261	12.51320		1
125	246	56.25849	12.18428		1
128	268	56.25456	12.33350		1
129	269	56.33762	12.34075		1
130	270	56.42067	12.34803		1

Hoved art

Togtet er målrettet mod dermasale arter I Kattegat og designet specielt mod torsk. Fangsten af alle arter skal dog registreres og afleveres også til bestandsvurdering af rødspætter og jomfruhummer.

Togt periode

Togtet skal foregå I slutningen af November / start December 2018. Der er planlagt 40 stationer samt udtrukket 6 ekstrastationer der kan benyttes hvis en given station ikke kan tages. Der må kun fiskes fra 15 min før solopgang til 15 min efter solnedgang. Deltager på dette års togt er :

Torsk togt	26/11-7/12	12	Aage Thaarup	Skipper
			Søren Grøndby	Styrmand
			Jens Holm	togtleder
			NN Hirtshals	

Ski bog redskab

Skib :

Togtet bliver gennemført med 2 kommercielle svenske skibe og Havfisken. Tidligere blev også den danske del af togtet gennemført med kommercielle skibe.

DK-Vessel 1

Danish participant	Havfisken
Engine (KW):	
Tonnage (BRT):	48
Length (m):	17,5
Door type/size	
Owner	DTU Aqua

Trawler er et kommercielt bund trawl betalt af LOT 3 projectet.

Trawl (see annex): A Swedish TV-trawl 112 ft 24-464

13 pieces of 8'' balls and 16 pieces of 6'' balls.

4 thumps rubber discs at 10 cm

Mesh size in cod end: 70 mm stretch mesh.

Otter boards: 64''-66" "Thyborøn"

Warp: 35 mm .

Mellem liner der benyttes må i 2017 varierer i længden mellem 54 og 154 meter. "Grimdelen" på 27 meter skal bi- beholdes hvilket gives en total længde på mellem 81 og 181 meter. Det er bare vigtigt at notere hvor lang en line der er benyttet.

Trawlet skal løbende tjekkes før og under togtet.

Under fiskeri

Må skipper selv bestemme hvordan fiskeriet skal foregå optimalt (dvs. Den eksakte position, retning wire længde mm). Max. 5 min a trawltiden bør ligge udenfor den planlagte kvadrat.

Træk tid: 60/30 min (træk tid ned til 25 min er accepteret).

Hastighed: Mellem 2.7 kn. Og 3.4 kn over bunden, man bør tilstræbe at holde en jævn fart under et træk.

Træk start: Når trawlet bliver vurderet til at gå stabilt som regel 5-7 min efter wirene er helt ude.

Slut på træk: Når tiden er gået om man begynder at fire ind.

Trawlet distance: fås fra plotter.

Ca.50% af alle træk can blive gennemført med 30 min træk tid. Det er op til skipper at tage stilling til hvilke træk det er men man skal tilstræbe de bliver jævnt fordelt ud over togt området. Det er vigtigt at det fremgår tydeligt hvilke stationer der er gennemført med 30 min træk og hvilke der har 60 min.

Registrering af fiskeriet

Der skal udover besætning deltage 2 videnskabelige medarbejder fra DTU Aqua.

Fangsten oparbejdes tilsvarende som på BITS. Efter hvert træk skal all fangsten oparbejdes og sorteres på art samt vejes til nærmeste 0.1 kg. Alle fisk (undtagen tobis, sild og brislinger) skal måles i cm i total længde. Tobis, sild og brisling i scm. Jomfruhummer måles i mm og det er ikke nødvendigt at kønne dem.

For torsk skal der tages 1 otolith per cm per station

Til genetik er hovedfokus torsk under 25 cm hvor der skal tages 1 prøve per cm per station (same fisk som der tages otolither på). Hvis der fanges meget få torsk vil vi gerne have genetik også på de større torsk.

Der har ikke (endnu) været ønske om yderligere prøver

Kvalitetssikring af data

All data skal før indtastning undersøges for fejl, blandt andet ved længde – vægt plot, at fisk med genetic prøver får dette markeret I fiskeline, stationer ikke ligger på land mm.

Data

Data tastes I Fiskeline og kan overføres til DATRAS

Estimation of stock indices

CPUE kan beregnes som gennemsnitlig fangst I kg eller antal per alder og time.

Biomass and abundance

Da ingen stationer er dybere end 100 meter kan biomasse og abundance beregnes mellem 20 og 100 meter dybde. Togtet er stratificeret i 4 områder med forskellig tæthed af torsk og dækker et område på . 19037.6 km² (Table 1).

Stationerne er på forhånd udvalgt tilfældigt og swept area kan udregnes ved:

Swept area= (estimated trawling speed *1.852)* wing spread * trawling time/60

using the recorded towing speed, wing spread and trawling time and taking the catchability coefficient as 1.0 and the stratum area as weighting factor (Cohran, 1977).

Alle fangster kan standardiseres til fangst per km²

Reporting

The survey results are reported to WGBFAS as a working document. The document includes information about aerial distribution, CPUE, biomass, abundance and length frequencies on cod, sole, plaice and Norwegian lobster together with age distribution of cod.

References

Cochran, W.G. 1977. Sampling Techniques. Third edition. Wiley & Sons.

ICES. 2005. Report of the Workshop on Survey Design and Data Analysis (WKSAD). ICES CM 2005/ B:07, 174 pp.

Wieland, K. and Storr-Paulsen, M. 2006. Effect of tow duration on catch and size composition of Northern shrimp (*Pandalus borealis*) and Greenland halibut (*Reinhardtius hippoglossoides*) in the West Greenland Bottom trawl survey. Fisheries Research 78: 276-285.

Wieland, K., E.M. Fenger Pedersen, H.J. Olesen & J.E. Beyer (2008): Survey results from a Danish collaborative biologist-fishermen project on spatially-explicit management methods (REX) for North Sea cod. Working document, ICES WGNSSK, 7.-13. May 2008.

Fig. 1. Distribution of hauls by type and squares.

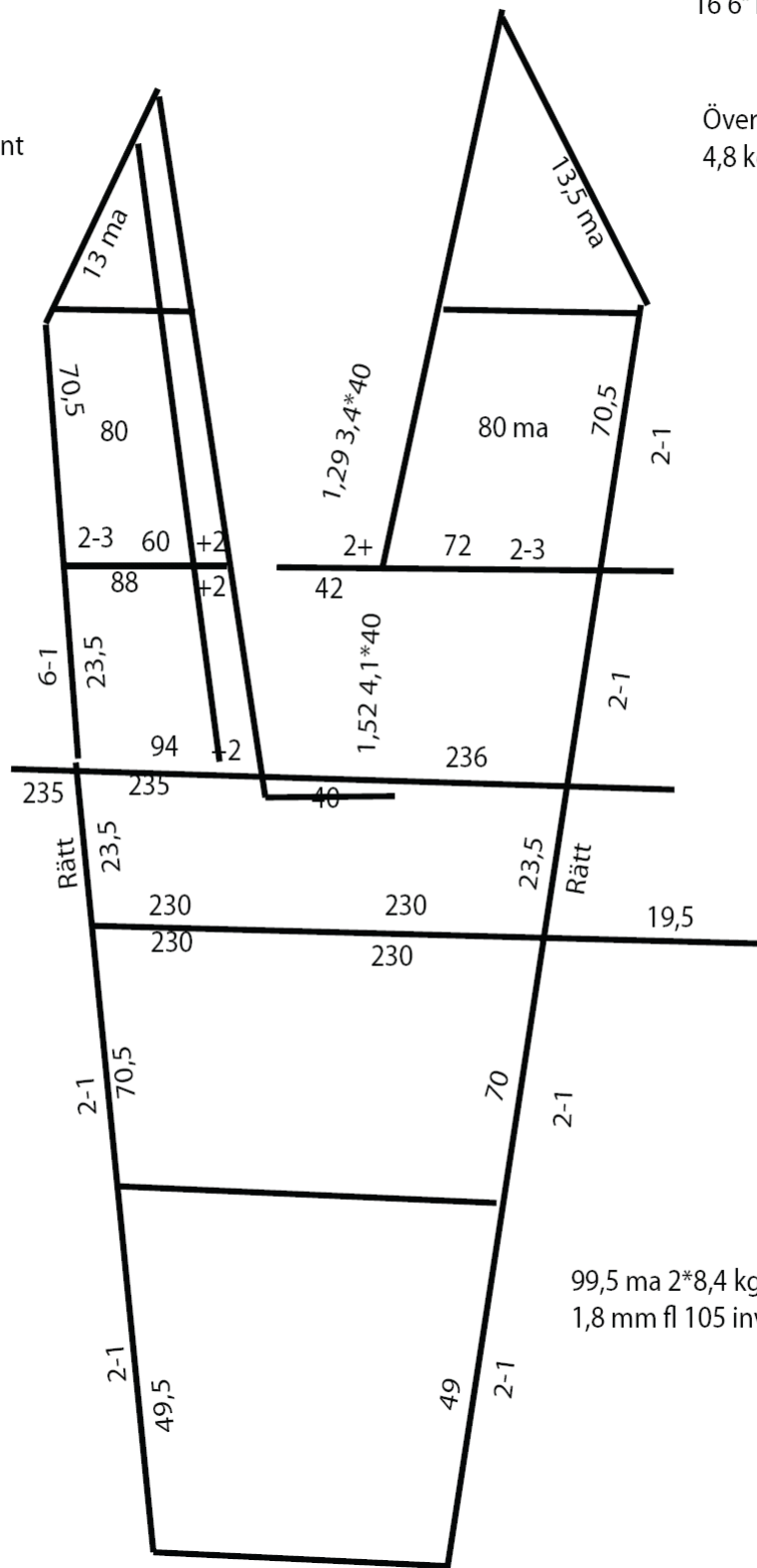
Station	lat	long	SE Cind	SE Tarr	DK Havfisker
39 Nord	57.36890	10.73973			1
40 Nord	57.45204	10.74367			
41 Nord	57.53518	10.74764			
42 Nord	57.61832	10.75163			1
43 Nord	57.70146	10.75565			
62 Nord	57.44981	10.89790			
63 Nord	57.53295	10.90222			reserv
64 Nord	57.61608	10.90656			
85 Nord	57.53052	11.05677		1	
86 Nord	57.61365	11.06147			
107 Nord	57.52791	11.21130			1
108 Nord	57.61103	11.21635			1
125 Nord	57.19266	11.34450			
126 Nord	57.27578	11.34978		1	
127 Nord	57.35889	11.35509			
128 Nord	57.44200	11.36043			
129 Nord	57.52511	11.36580			
146 Nord	57.10660	11.49198			
149 Nord	57.35592	11.50886		1	
150 Nord	57.43902	11.51455			
151 Nord	57.52212	11.52027		1	
166 Nord	56.93727	11.63291			
167 Nord	57.02037	11.63879	reserv		
168 Nord	57.10347	11.64469			
171 Nord	57.35276	11.66261			
172 Nord	57.43585	11.66864			reserv
173 Nord	57.51894	11.67471			
214 Nord	57.26280	11.96330			1
291 Nord	56.33349	12.49026	reserv		1
292 Nord	56.41653	12.49787		1	
293 Nord	56.49957	12.50551			1
313 Nord	56.32919	12.63972		1	
315 Nord	56.49524	12.65563		1	
58 Syd	56.11718	10.98072			1
69 Syd	56.20033	10.98501			reserv
89 Syd	56.03156	11.12497			1
90 Syd	56.11470	11.12955			
91 Syd	56.19785	11.13415			
92 Syd	56.28098	11.13878			
112 Syd	56.11205	11.27835			
113 Syd	56.19518	11.28327			1
114 Syd	56.27831	11.28823	reserv		
115 Syd	56.36144	11.29321			
134 Syd	56.10921	11.42712			reserv
135 Syd	56.19234	11.43237	1		
136 Syd	56.27546	11.43765			
137 Syd	56.35858	11.44295	reserv		
138 Syd	56.44170	11.44828	1		
139 Syd	56.52482	11.45364			
156 Syd	56.10620	11.57587			1
157 Syd	56.18931	11.58144			
158 Syd	56.27243	11.58704			1
159 Syd	56.35554	11.59266			
160 Syd	56.43865	11.59832	1		
161 Syd	56.52176	11.60401			
162 Syd	56.60486	11.60973	1		
178 Syd	56.10301	11.72459			
179 Syd	56.18611	11.73047			
180 Syd	56.26921	11.73640			1
181 Syd	56.35231	11.74235			
201 Syd	56.18273	11.87948			1
202 Syd	56.26582	11.88572	1		
203 Syd	56.34891	11.89200	1		
223 Syd	56.17917	12.02845			
224 Syd	56.26225	12.03502	1		
147	57.18971	11.49758	1	1	
148	57.27281	11.50321		reserv	1
169	57.18657	11.65063			1
170	57.26966	11.65660			reserv
182	56.43541	11.74833			
183	56.51851	11.75435			
184	56.60161	11.76040			
185	56.68470	11.76648	reserv	reserv	1
186	56.76780	11.77259			1
187	56.85089	11.77873			1
188	56.93398	11.78491			
189	57.01707	11.79113	1	1	
190	57.10016	11.79737			
191	57.18324	11.80365	reserv		1
192	57.26633	11.80997			1
204	56.43200	11.89831			1
205	56.51509	11.90465	1		
206	56.59817	11.91103			
210	56.93050	11.93688			
211	57.01358	11.94343			
212	57.09665	11.95002			1
213	57.17973	11.95664			
225	56.34533	12.04162	1		reserv
226	56.42840	12.04825	1	1	
227	56.51148	12.05492		1	
228	56.59455	12.06163		1	1
207	56.68126	11.91744	1		
208	56.76434	11.92389	1		1
209	56.84742	11.93037	1		
229	56.67763	12.06837		1	1
230	56.76070	12.07515			1
231	56.84377	12.08196	1	1	1
232	56.92684	12.08881			
233	57.00990	12.09570			
248	56.42463	12.19816			1
249	56.50769	12.20516			
250	56.59075	12.21219			1
251	56.67381	12.21926			1
252	56.75687	12.22637	1		
253	56.83993	12.23352		1	1
271	56.50372	12.35536		1	1
272	56.58677	12.36272			
273	56.66982	12.37012	1	1	1
274	56.75287	12.37756			
275	56.83591	12.38504		1	1
294	56.58261	12.51320			1
295	56.66564	12.52094			
246	56.25849	12.18428			1
247	56.34156	12.19120			
267	56.17150	12.32630	1	1	
268	56.25456	12.33350			1
269	56.33762	12.34075		1	1
270	56.42067	12.34803			1
289	56.16740	12.47516	1		
290	56.25045	12.48269			

Table 1. Area (km²) 20-120 m depth by depth area.

High density	Medium density	Low density	Closed area	All
21 squares	26 squares	65 squares	8 squares	120 squares
1800.8 km ²	2229.5 km ²	5573.8 km ²	686 km ²	10290 km ²

13 8" Kulor
16 6" Kulor

Överarm
4,8 kg utan kant



Tabel 11. To eksempler på hvordan afstanden mellem skovlene kan beregnes ud fra spilet i wirene.

1. metode

- 1) En pind, skruenøgle, kniv eller hvad man nu har for hånden sættes ind, hvor afstanden mellem wirene lige svarer til længden af genstanden. Fra dette punkt finder man ud af, hvor mange gange dette mål kan ligge langs wiren op til det sted, hvor wirene går sammen.

- 2) Afstanden mellem skovlene fås ved at dele wirelængden med »antallet af mål«.

Eksempel: Fra det sted på wirene, hvor spredningen er 1 skruenøgle, er der 5,5 skruenøgle op til hvor wirene går sammen.

Wirelængde: 150 fv = 274 m.

Afstand mellem skovle: $274 : 5,5 = 50$ m.

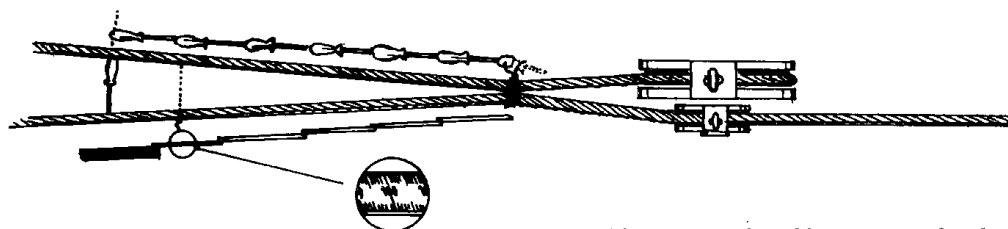


Fig. 33: To metoder til beregning af spilet er her illustreret. Det letter udmålingen, hvis wirene kan samles med et bændsel.

2. metode

- 1) Mål afstanden mellem wirene 1 meter fra, hvor de går sammen.

- 2) Afstanden her ganget med wirelængden giver afstanden mellem skovlene.

Eksempel: Spredningen på 1 meter: 18 cm = 0,18 m

Wirelængde: 150 fv = 274 m

Afstand mellem skovle: $0,18 \times 274 = 49$ m