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Synthesis of selection curves for Atlantic cod, Gadus morhua

by

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Introduction

Selection is a major tool in fisheries management although the amount of effort put into studies on this subject has diminished in the last ten to twenty years. One reason for this reduced effort was pointed out by Clay (1979a) as:

> "the inherent variability in mesh selection studies which raises the question of the necessity and value for further studies on species for which much data already exists." This review suggested "the possibility of utilizing past studies ... to produce general selection patterns which may be useful in analyzing the effects of mesh regulations..." when adequate data are not available.

Technique

Figure 1 (after Clay, 1979a) shows the general selection pattern of cod. From the GM regression of these data (TL = 4.35 M -87.62), where TL is total length in mm and M is codend mesh size in mm) the 50% retention points can be estimated for any mesh size. Using the historic data summarized by Holden (1971) the selection range was plotted against the mesh size (Figure 2). The selection range of any mesh size can then be estimated from the GM regression of the ln transformation ($SR = 1.69137 \times 10^{-4} M^{2.7621}$, where SR is the selection range in mm and M is the codend mesh size in mm). Table 1 summarizes the selection parameters for 60, 90, 100, 115, 120, 130, 140, 150, 175, and 200 mm mesh codends.

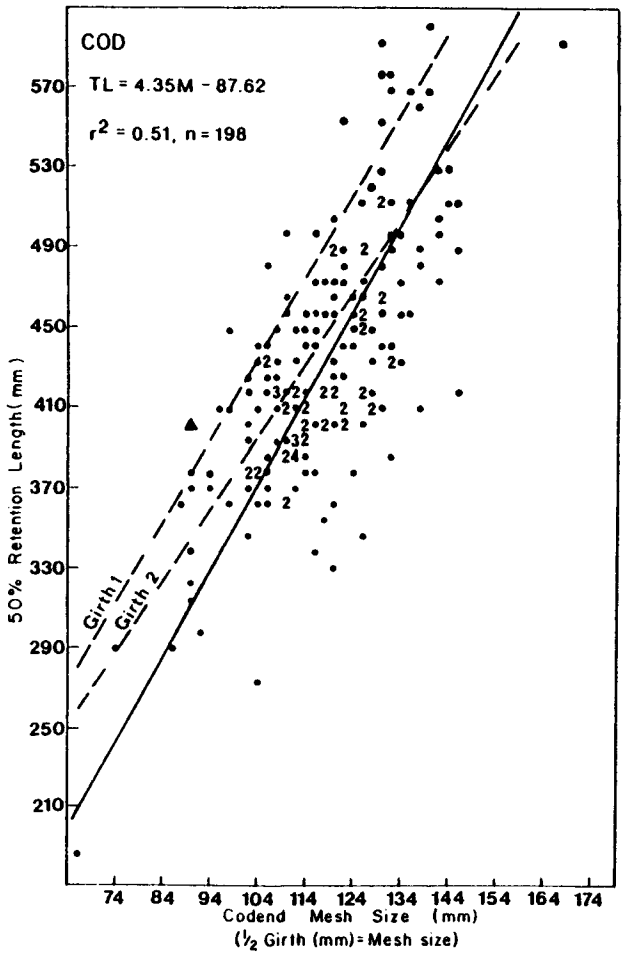

Fig. 1. General selection pattern for cod based on historical mesh selection studies. (Each dot represents a single observation and numbers indicate points with two or more observations; triangles indicate points from the 1977 studies; the dashed line represents the length-girth relationship. The scatter graphs used throughout this paper are computer plots and as such have lower resolution than was found in the original data.)

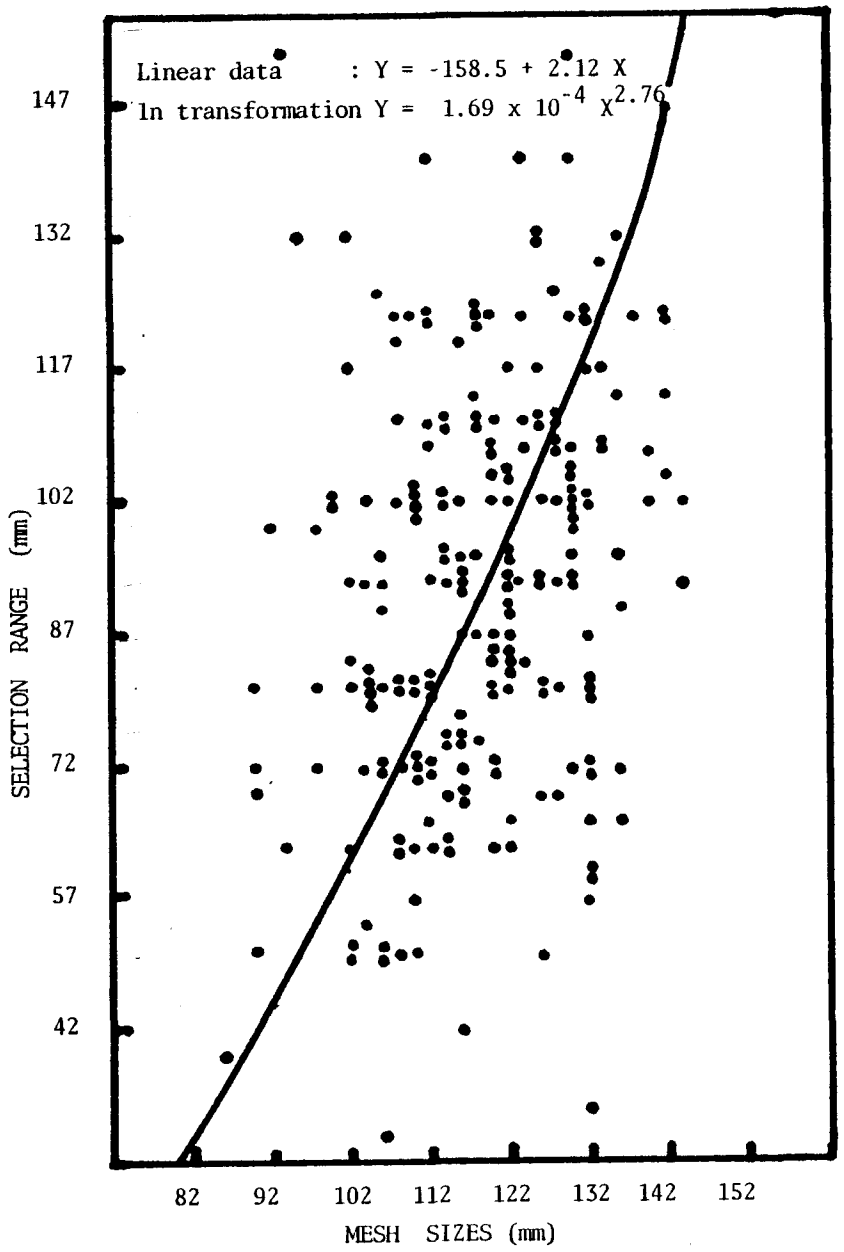

Fig. 2. Computer scatter graph of selection range .vs. mesh size for Atlantic cod (Gadus morhua).

Table 1. Selection parameters for Atlantic cod (Gadus morhua) used in synthesis of ogives.

Mesh Size (mm)	50% Retention Length (mm)	Range (mm)	Selection Factor (rounded)
60 (2 3/8 in)*	173	14	2.9
90 (3 1/2 in)	304	42	3.4
100 (3 11/12 in)	347	57	3.5
115 (4 1/2 in)	413	83	3.6
120 (4 5/8 in)	434	94	3.6
130 (5 1/8 in)	478	117	3.7
140 (5 1/2 in)	521	143	3.7
150 (5 11/12 in)	565	173	3.8
175 (6 4/5 in)	674	265	3.9
200 (7 4/5 in)	782	384	3.9

* Current minimum mesh size for foreign fleets fishing silver hake (Merluccius bilinearis).

A computer simulation [1.] (of a sine transformation) was carried out to produce the selection ogives of Table 2.

References

Clay, J.D. (1979a) Current mesh selection studies on Scotian Shelf in relation to historical selection data. ICNAF Sel. Pap. 5:49-60.

Clay, J.D. (1979b) Synthesis of selection curves for Atlantic redfish, Sebastes, Mentella). ICNAF Res. Doc. 79/VI/113. Serial No. 5478. 7pp. (Mimeo).

Holden, M.J. (ed). (1971) Report of the ICES/ICNAF Working Groups on selectivity analysis. Coop. Res. Rep. ICES, 25:144 p.

1. This program can calculate a synthetic selection ogive for any mesh size for several species (see Clay, 1979a).

Table 2. Selection ogives for Atlantic cod (Gadus morhua) as calculated from a computer simulation based on a sine transformation (after the technique described in Clay,1979b).

TL (cm)	MESH SIZE (mm)									
	60	90	100	115	120	130	140	150	175	200
1	0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0
9	0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0
10	0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0
11	0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0
14	0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0
15	0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0
16	8.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
17	37.5	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
18	73.7	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
19	97.3	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
20	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.0
21	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.0
22	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.1
23	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.2
24	100.0	.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.3
25	100.0	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.5
26	100.0	6.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.7
27	100.0	13.3	.7	0.0	0.0	0.0	0.0	0.0	.0	1.0
28	100.0	22.6	3.0	0.0	0.0	0.0	0.0	0.0	.1	1.2
29	100.0	33.4	6.8	.1	0.0	0.0	0.0	0.0	.2	1.6
30	100.0	45.3	12.1	.8	.2	.0	0.0	0.0	.4	1.9
31	100.0	57.4	18.6	2.3	1.0	.2	.1	.1	.6	2.3
32	100.0	69.1	26.1	4.5	2.4	.8	.4	.3	1.0	2.7
33	100.0	79.7	34.5	7.4	4.4	1.8	1.0	.8	1.4	3.2
34	100.0	88.5	43.3	10.9	6.9	3.1	1.8	1.4	1.9	3.7
35	100.0	95.1	52.4	15.0	10.0	4.8	2.9	2.2	2.5	4.2
36	100.0	98.9	61.4	19.7	13.5	6.9	4.2	3.1	3.1	4.7
37	100.0	100.0	70.0	24.9	17.5	9.3	5.7	4.2	3.8	5.3
38	100.0	100.0	78.0	30.4	21.9	12.0	7.5	5.5	4.6	5.9
39	100.0	100.0	85.0	36.2	26.6	15.0	9.5	6.9	5.5	6.6
40	100.0	100.0	90.9	42.2	31.6	18.3	11.7	8.5	6.4	7.3
41	100.0	100.0	95.4	48.4	36.8	21.8	14.1	10.2	7.3	8.0
42	100.0	100.0	98.4	54.5	42.1	25.6	16.7	12.1	8.4	8.7
43	100.0	100.0	99.9	60.7	47.6	29.5	19.5	14.1	9.5	9.5
44	100.0	100.0	100.0	66.6	53.1	33.6	22.4	16.2	10.7	10.3
45	100.0	100.0	100.0	72.3	58.5	37.8	25.5	18.5	11.9	11.1
46	100.0	100.0	100.0	77.6	63.9	42.2	28.7	20.9	13.2	12.0
47	100.0	100.0	100.0	82.6	69.1	46.5	32.0	23.3	14.5	12.9
48	100.0	100.0	100.0	87.0	74.0	50.9	35.4	25.9	15.9	13.8
49	100.0	100.0	100.0	90.9	78.7	55.3	38.8	28.5	17.3	14.7
50	100.0	100.0	100.0	94.1	83.0	59.7	42.4	31.2	18.8	15.7

Table 2. cont Selection ogives for Atlantic cod (Gadus morhua) as calculated from a computer simulation based on a sine transformation (after the technique described in Clay,1979b).

	MESH SIZE (mm)								
TL (cm)	90	100	115	120	130	140	150	175	200
51	100.0	100.0	96.7	86.9	64.0	45.9	34.0	20.4	16.6
52	100.0	100.0	98.5	90.4	68.1	49.5	36.8	22.0	17.7
53	100.0	100.0	99.6	93.4	72.2	53.1	39.7	23.6	18.7
54	100.0	100.0	100.0	95.9	76.0	56.7	42.6	25.2	19.7
55		100.0	100.0	97.8	79.7	60.2	45.6	26.9	20.8
56		100.0	100.0	99.1	83.1	63.7	48.6	28.7	21.9
57			100.0	99.8	86.3	67.1	51.5	30.4	23.0
58			100.0	100.0	89.2	70.4	54.5	32.2	24.2
59			100.0	100.0	91.7	73.7	57.4	34.1	25.3
60			100.0	100.0	94.0	76.7	60.3	35.9	26.5
61				100.0	95.9	79.7	63.2	37.8	27.7
62				100.0	97.5	82.5	66.1	39.7	28.9
63					98.7	85.2	68.8	41.6	30.1
64					99.5	87.6	71.6	43.5	31.4
65					99.9	89.9	74.2	45.4	32.6
66					100.0	91.9	76.7	47.4	33.9
67					100.0	93.8	79.2	49.3	35.2
68					100.0	95.4	81.6	51.2	36.4
69					100.0	96.8	83.8	53.2	37.7
70					100.0	97.9	85.9	55.1	39.0
71					100.0	98.8	87.9	57.0	40.4
72						99.5	89.8	58.9	41.7
73						99.9	91.5	60.8	43.0
74						100.0	93.1	62.7	44.3
75						100.0	94.5	64.6	45.7
76						100.0	95.8	66.4	47.0
77						100.0	96.9	68.2	48.3
78						100.0	97.9	70.0	49.7
79						100.0	98.6	71.8	51.0
80						100.0	99.2	73.5	52.4
81						100.0	99.7	75.2	53.7
82						100.0	99.9	76.9	55.0
83						100.0	100.0	78.5	56.4
84						100.0	100.0	80.1	57.7
85						100.0	100.0	81.6	59.0
86						100.0	100.0	83.1	60.3
87						100.0	100.0	84.5	61.6
88						100.0	100.0	85.9	62.9
89						100.0	100.0	87.2	64.2
90						100.0	100.0	88.5	65.5
91						100.0	100.0	89.7	66.8
92						100.0	100.0	90.8	68.0
93						100.0	100.0	91.9	69.3
94						100.0	100.0	92.9	70.5
95						100.0	100.0	93.9	71.7
96						100.0	100.0	94.8	72.9
97						100.0	100.0	95.6	74.1
98						100.0	100.0	96.4	75.3
99						100.0	100.0	97.1	76.4
100						100.0	100.0	97.7	77.5