

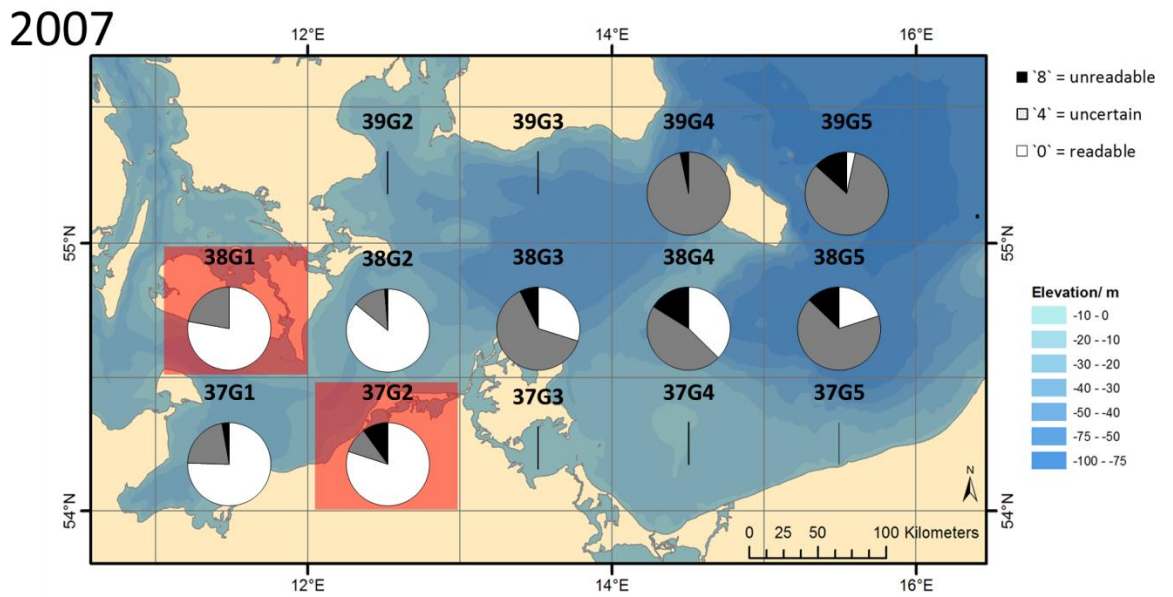
**Supplementary material**

**Use of otolith quality flags to assess distributional dynamics in Baltic cod stocks**

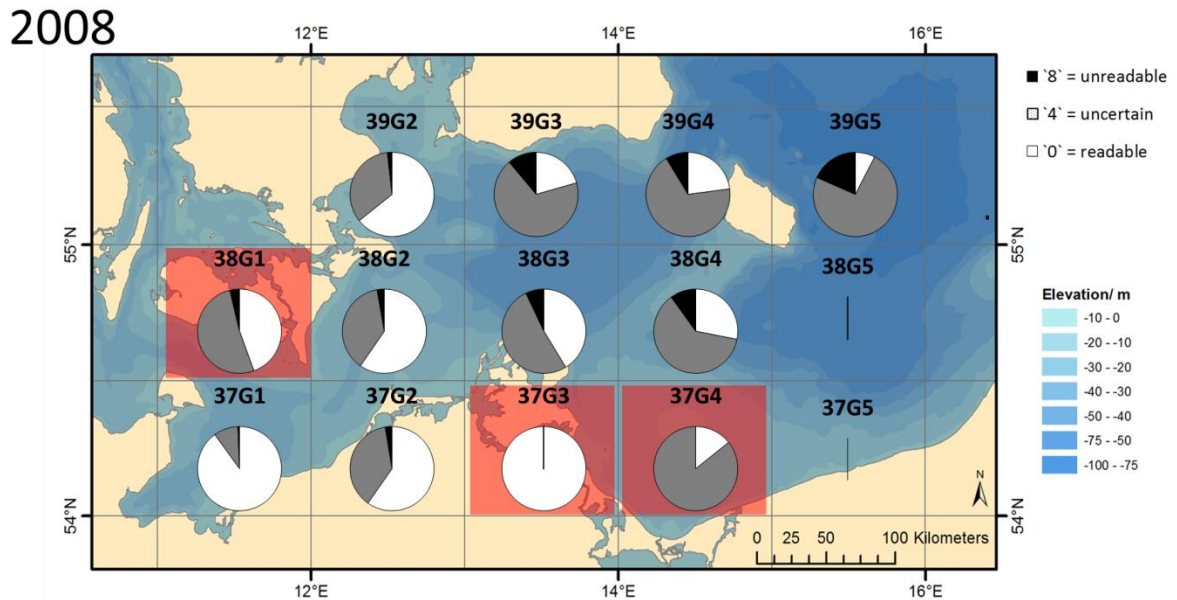
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Source of elevation data:BSH  
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**Fig. S1.** Proportion of three quality flag categories (white: 'readable'; grey: 'uncertain'; black: 'unreadable') per year and quarter (Q) assigned to cod otoliths collected between 2007 and 2013 from SD22, SD24 and SD25. Sample sizes are given for each subdivision by quarter.

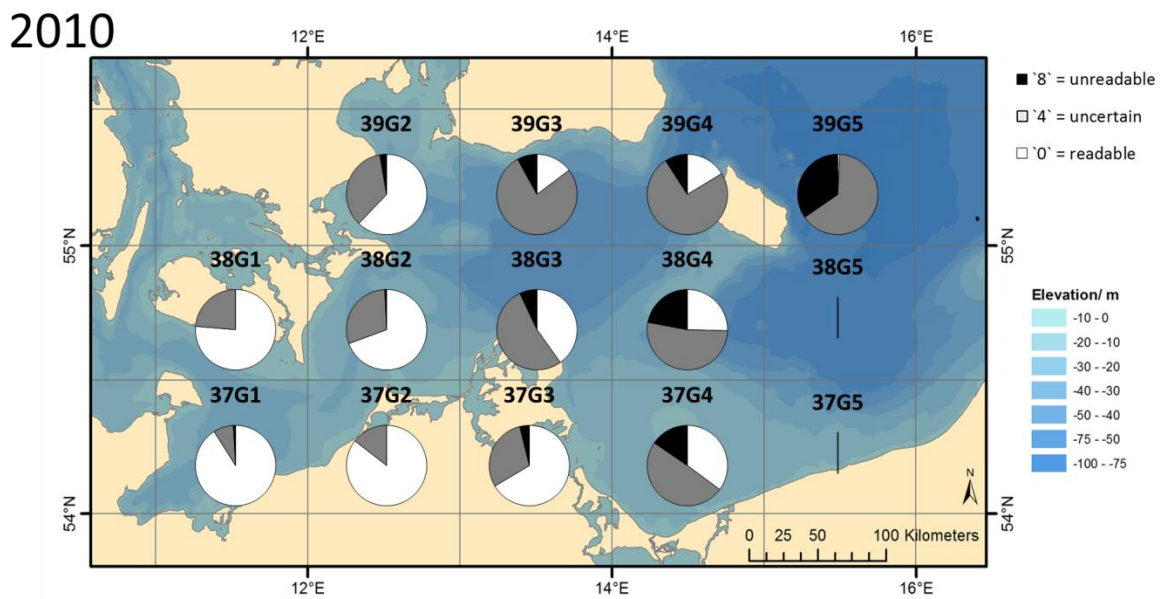
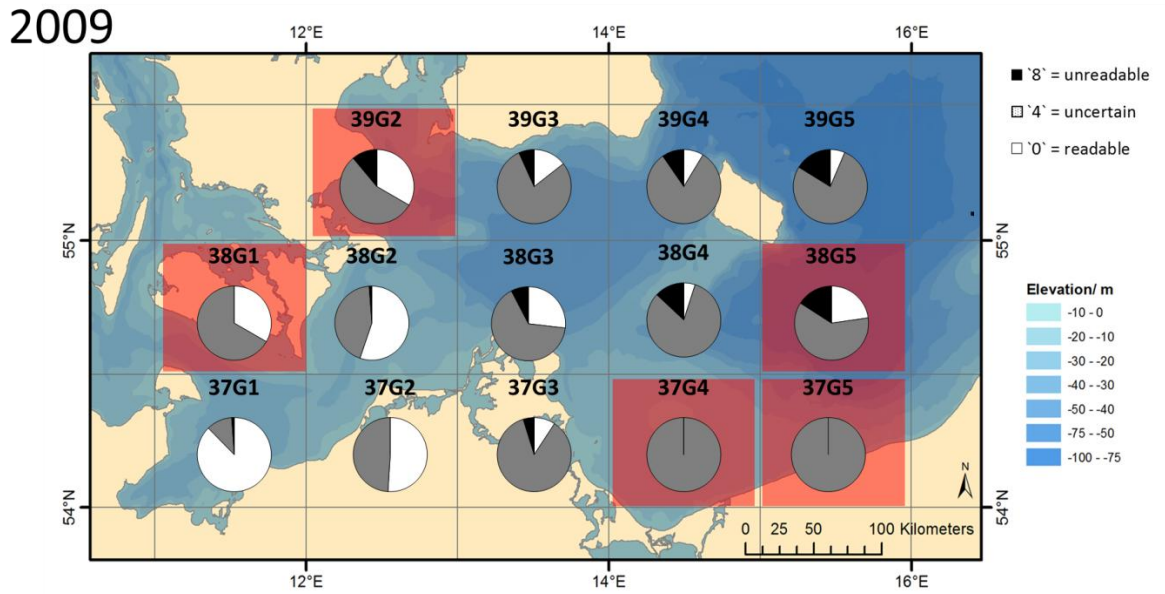
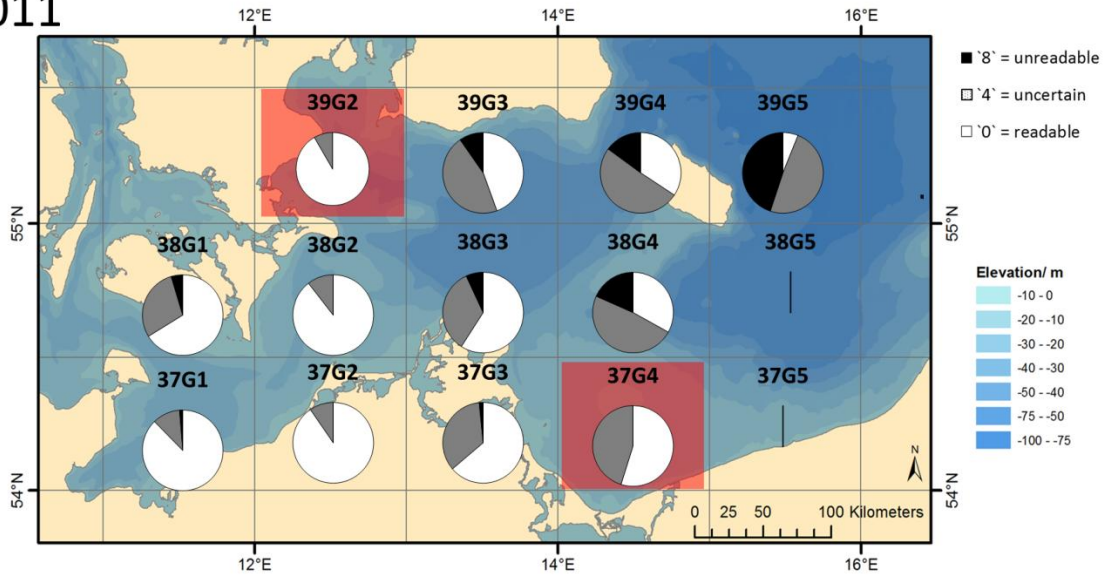


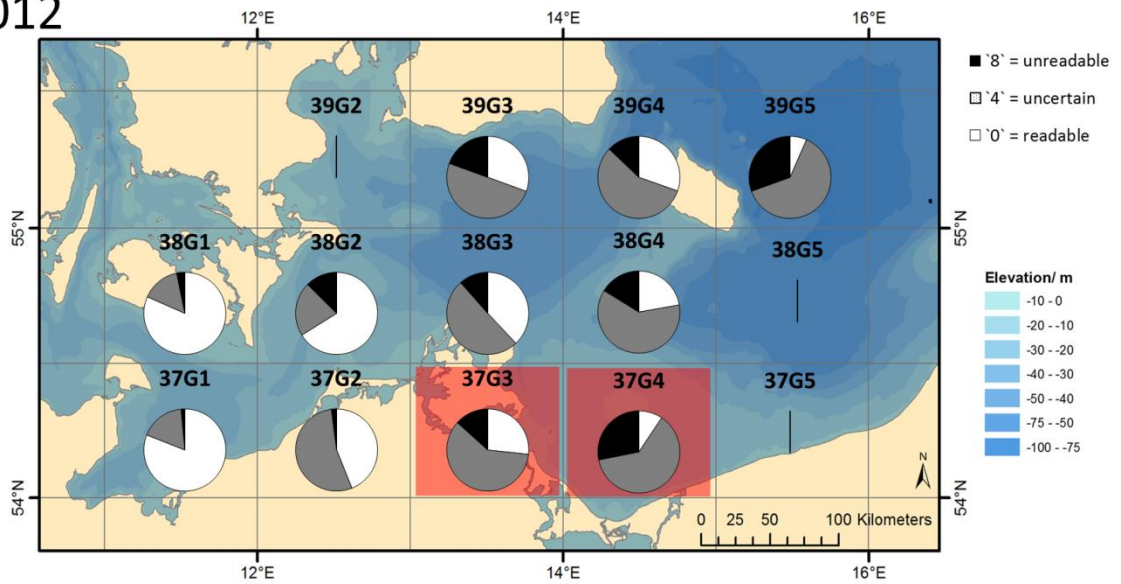
Fig. S1. (Cont.)

2011



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2012



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Fig. S1. (Cont.)

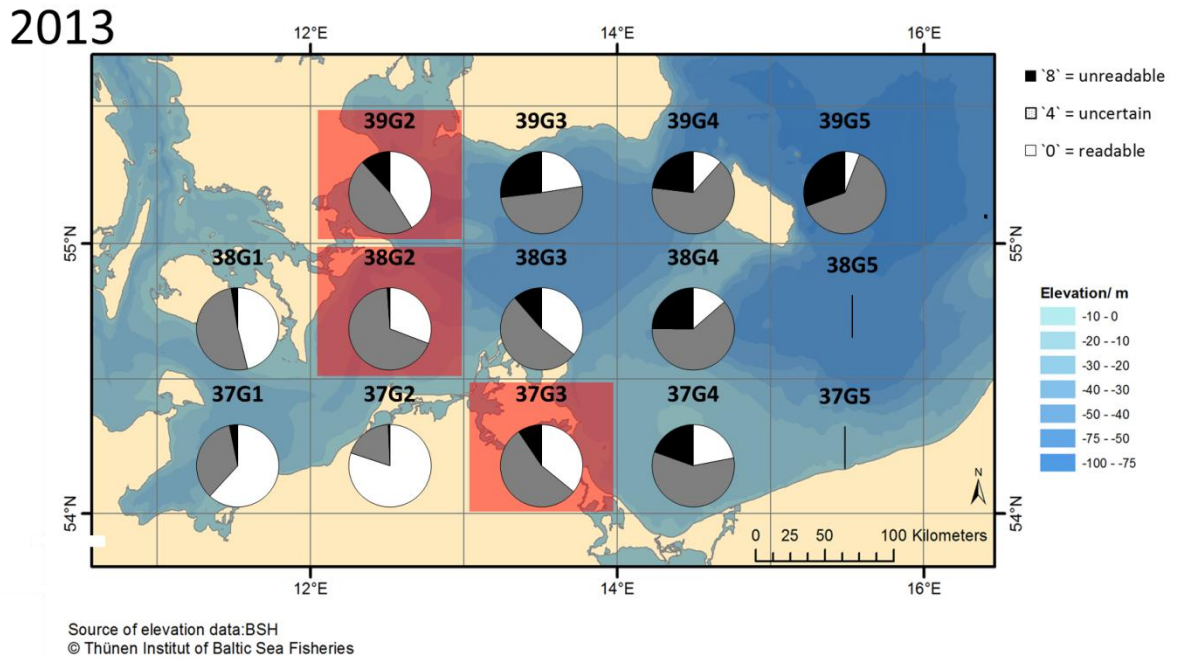
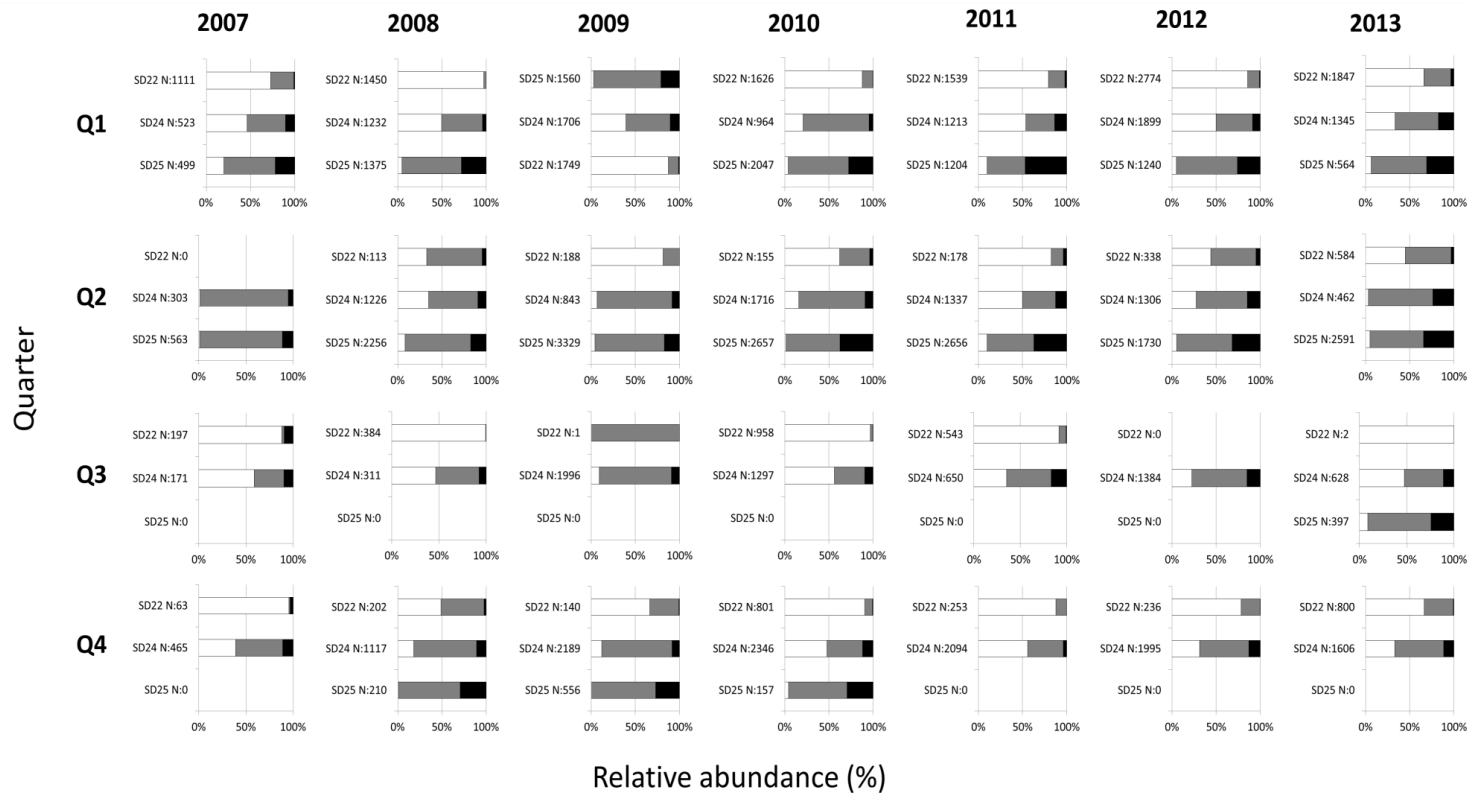


Fig. S1. (Cont.)



**Fig. S2.** Relative abundance of 3 quality flag categories (white, ‘readable’; grey, ‘uncertain’; black, ‘unreadable’) assigned to cod otoliths collected between 2007 and 2013 from specific rectangles in SD22, SD24 and SD25. Red background indicates low reliability of rectangles with <50 otoliths per year.

**Table S1. Results of SIMPER analyses of the influence on dissimilarity in quality flag proportions between Year, SD, rectangle, sex and length groups**

## SIMPER

Similarity Percentages - species contributions

Two-Way Analysis

*Data worksheet*

Data type: Abundance

Sample selection: All

Variable selection: All

*Parameters*

Resemblance: S17 Bray Curtis similarity

Cut off for low contributions: 90.00%

*Examines YEAR groups*

*(across all SD groups)*

*Groups 2007 & 2008*

Average dissimilarity = 32.65

	Group 2007		Group 2008			
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
0	11.36	15.27	14.19	1.13	43.48	43.48
4	12.67	18.18	13.63	1.93	41.76	85.24
8	5.6	7.87	4.82	1.43	14.76	100.00

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Groups 2007 & 2009

Average dissimilarity = 36.84

	Group 2007		Group 2009			
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	12.67	27.05	18.8	2.2	51.04	51.04
0	11.36	14.36	11.4	1.07	30.96	82
8	5.6	10.85	6.63	1.83	18	100.00

Groups 2008 & 2009

Average dissimilarity = 27.02

	Group 2008		Group 2009			
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
0	15.27	14.36	11.55	0.93	42.74	42.74
4	18.18	27.05	11.11	1.26	41.12	83.86
8	7.87	10.85	4.36	1.29	16.14	100.00

Groups 2007 & 2010

Average dissimilarity = 36.82

	Group 2007		Group 2010			
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
0	11.36	19.44	15.42	1.12	41.88	41.88
4	12.67	21.56	15.25	2.32	41.42	83.3
8	5.6	10.79	6.15	1.16	16.7	100.00

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*Groups 2008 & 2010*

Average dissimilarity = 26.82

	Group 2008	Group 2010				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
0	15.27	19.44	13.39	1.01	49.94	49.94
4	18.18	21.56	8.74	1.02	32.59	82.53
8	7.87	10.79	4.69	0.89	17.47	100.00

*Groups 2009 & 2010*

Average dissimilarity = 25.04

	Group 2009	Group 2010				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
0	14.36	19.44	11.87	0.97	47.39	47.39
4	27.05	21.56	8.51	1.04	34.01	81.4
8	10.85	10.79	4.66	1.06	18.6	100.00

*Groups 2007 & 2011*

Average dissimilarity = 34.39

	Group 2007	Group 2011				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
0	11.36	20.96	15.96	1.51	46.39	46.39
4	12.67	18.31	10.7	1.67	31.1	77.49
8	5.6	11.78	7.74	1.53	22.51	100.00

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*Groups 2008 & 2011*

Average dissimilarity = 26.14

	Group 2008	Group 2011				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
0	15.27	20.96	13.22	1.19	50.57	50.57
4	18.18	18.31	7.83	1.52	29.95	80.52
8	7.87	11.78	5.09	1.06	19.48	100.00

*Groups 2009 & 2011*

Average dissimilarity = 24.45

	Group 2009	Group 2011				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
0	14.36	20.96	11.94	1.18	48.86	48.86
4	27.05	18.31	8.79	1.43	35.96	84.82
8	10.85	11.78	3.71	0.95	15.18	100.00

*Groups 2010 & 2011*

Average dissimilarity = 22.75

	Group 2010	Group 2011				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
0	19.44	20.96	11.79	1.18	51.83	51.83
4	21.56	18.31	7.11	1.24	31.23	83.06
8	10.79	11.78	3.85	0.77	16.94	100.00

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*Groups 2007 & 2012*

Average dissimilarity = 37.76

	Group 2007		Group 2012			
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	12.67	24.41	15.82	2.44	41.9	41.90
0	11.36	20.5	14.21	1.24	37.62	79.52
8	5.6	12.19	7.73	1.87	20.48	100.00

*Groups 2008 & 2012*

Average dissimilarity = 25.59

	Group 2008		Group 2012			
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
0	15.27	20.5	11.87	0.98	46.4	46.40
4	18.18	24.41	8.66	1.18	33.84	80.24
8	7.87	12.19	5.06	1.34	19.76	100.00

*Groups 2009 & 2012*

Average dissimilarity = 20.14

	Group 2009		Group 2012			
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
0	14.36	20.5	10.24	0.9	50.87	50.87
4	27.05	24.41	6.88	1.36	34.17	85.04
8	10.85	12.19	3.01	1	14.96	100.00

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*Groups 2010 & 2012*

Average dissimilarity = 21.80

	Group 2010	Group 2012				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
0	19.44	20.5	11.22	1.05	51.45	51.45
4	21.56	24.41	6.55	1.07	30.03	81.48
8	10.79	12.19	4.04	1	18.52	100.00

*Groups 2011 & 2012*

Average dissimilarity = 20.02

	Group 2011	Group 2012				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
0	20.96	20.5	9.8	0.94	48.92	48.92
4	18.31	24.41	7.39	1.57	36.9	85.82
8	11.78	12.19	2.84	1.12	14.18	100.00

*Groups 2007 & 2013*

Average dissimilarity = 31.71

	Group 2007	Group 2013				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	12.67	22.2	12.81	1.26	40.4	40.4
0	11.36	16.29	12.23	1.42	38.58	78.98
8	5.6	11.58	6.66	1.37	21.02	100.00

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*Groups 2008 & 2013*

Average dissimilarity = 28.24

	Group 2008	Group 2013				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	18.18	22.2	12.02	1.65	42.56	42.56
0	15.27	16.29	10.65	1.19	37.71	80.27
8	7.87	11.58	5.57	1.37	19.73	100.00

*Groups 2009 & 2013*

Average dissimilarity = 26.96

	Group 2009	Group 2013				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	27.05	22.2	12.79	1.57	47.43	47.43
0	14.36	16.29	9.68	1.23	35.91	83.34
8	10.85	11.58	4.49	1.22	16.66	100.00

*Groups 2010 & 2013*

Average dissimilarity = 25.52

	Group 2010	Group 2013				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	21.56	22.2	10.97	1.52	42.99	42.99
0	19.44	16.29	9.33	1.2	36.55	79.54
8	10.79	11.58	5.22	0.97	20.46	100.00

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*Groups 2011 & 2013*

Average dissimilarity = 23.60

	Group 2011	Group 2013				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
0	20.96	16.29	9.85	1.24	41.73	41.73
4	18.31	22.2	9.22	1.3	39.07	80.79
8	11.78	11.58	4.53	0.97	19.21	100.00

*Groups 2012 & 2013*

Average dissimilarity = 21.79

	Group 2012	Group 2013				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
0	20.5	16.29	9.39	1.08	43.1	43.1
4	24.41	22.2	8.38	1.48	38.43	81.53
8	12.19	11.58	4.02	1.21	18.47	100.00

*Examines SD groups*

*(across all YEAR groups)*

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*Groups 22 & 24*

Average dissimilarity = 40.30

	Group 22	Group 24				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	9.95	24.8	18.34	1.72	45.52	45.52
0	21.72	18.72	12.59	1.49	31.26	76.78
8	2.77	11.02	9.36	2.25	23.22	100.00

*Groups 22 & 25*

Average dissimilarity = 55.67

	Group 22	Group 25				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	9.95	28.51	21.22	1.67	38.11	38.11
8	2.77	18.47	17.52	2.45	31.48	69.59
0	21.72	7.74	16.93	1.27	30.41	100.00

*Groups 24 & 25*

Average dissimilarity = 27.98

	Group 24	Group 25				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
0	18.72	7.74	11.11	1.52	39.69	39.69
4	24.8	28.51	9.46	1.25	33.79	73.48
8	11.02	18.47	7.42	1.57	26.52	100.00

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Examines RECTANGLE groups

(across all YEAR groups)

Groups 37G1 & 38G1

Average dissimilarity = 47.26

	Group 37G1	Group 38G1				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
0	18.78	6.78	28.62	1.6	60.55	60.55
4	8.26	4.87	13.32	1.46	28.18	88.74
8	2.48	0.8	5.32	1.45	11.26	100.00

Groups 37G1 & 37G2

Average dissimilarity = 41.06

	Group 37G1	Group 37G2				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
0	18.78	7.73	25.94	1.43	63.18	63.18
4	8.26	5.19	10.28	1.19	25.03	88.21
8	2.48	0.6	4.84	1.41	11.79	100.00



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Groups 38G1 & 37G2

Average dissimilarity = 34.63

	Group 38G1	Group 37G2				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
0	6.78	7.73	17.88	1.5	51.62	51.62
4	4.87	5.19	13.34	1.84	38.53	90.15

Groups 37G1 & 37G3

Average dissimilarity = 43.80

	Group 37G1	Group 37G3				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
0	18.78	6.71	25.36	1.58	57.91	57.91
4	8.26	7.53	14.2	1.6	32.42	90.32

Groups 38G1 & 37G3

Average dissimilarity = 31.63

	Group 38G1	Group 37G3				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	4.87	7.53	14.95	0.93	47.28	47.28
0	6.78	6.71	10.3	0.89	32.56	79.83
8	0.8	2.25	6.38	1.2	20.17	100.00

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Groups 37G2 & 37G3

Average dissimilarity = 41.98

	Group 37G2	Group 37G3				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	5.19	7.53	19.51	1.87	46.47	46.47
0	7.73	6.71	15.97	1.34	38.04	84.51
8	0.6	2.25	6.5	1.49	15.49	100.00

Groups 37G1 & 37G4

Average dissimilarity = 48.23

	Group 37G1	Group 37G4				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
0	18.78	4.74	31.27	2.22	64.83	64.83
4	8.26	6.4	11.79	1.89	24.44	89.27
8	2.48	3.48	5.18	2.11	10.73	100.00

Groups 38G1 & 37G4

Average dissimilarity = 41.09

	Group 38G1	Group 37G4				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
0	6.78	4.74	18.19	1.3	44.28	44.28
8	0.8	3.48	11.66	3.3	28.37	72.65
4	4.87	6.4	11.24	1.17	27.35	100.00

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Groups 37G2 & 37G4

Average dissimilarity = 42.23

	Group 37G2	Group 37G4				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
0	7.73	4.74	17.72	1.53	41.97	41.97
4	5.19	6.40	15.26	1.48	36.13	78.10
8	0.60	3.48	9.25	1.48	21.90	100.00

Groups 37G3 & 37G4

Average dissimilarity = 22.21

	Group 37G3	Group 37G4				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
0	6.71	4.74	9.51	1.07	42.8	42.80
4	7.53	6.40	6.74	1.53	30.33	73.12
8	2.25	3.48	5.97	1.78	26.88	100.00

Groups 37G1 & 38G2

Average dissimilarity = 44.01

	Group 37G1	Group 38G2				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
0	18.78	6.10	28.93	1.70	65.74	65.74
4	8.26	4.38	10.10	1.27	22.94	88.68
8	2.48	0.77	4.98	1.39	11.32	100.00

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Groups 38G1 & 38G2

Average dissimilarity = 36.51

	Group 38G1	Group 38G2				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
0	6.78	6.10	19.45	2.24	53.26	53.26
4	4.87	4.38	12.40	1.37	33.95	87.21
8	0.80	0.77	4.67	1.13	12.79	100.00

Groups 37G2 & 38G2

Average dissimilarity = 27.08

	Group 37G2	Group 38G2				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
0	7.73	6.1	13.78	1.11	50.88	50.88
4	5.19	4.38	10.16	1.02	37.53	88.41
8	0.6	0.77	3.14	0.83	11.59	100.00

Groups 37G3 & 38G2

Average dissimilarity = 40.07

	Group 37G3	Group 38G2				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
0	6.71	6.1	17.33	1.79	43.25	43.25
4	7.53	4.38	14.9	1.95	37.19	80.44
8	2.25	0.77	7.84	2.5	19.56	100.00

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Groups 37G4 & 38G2

Average dissimilarity = 36.48

	Group 37G4	Group 38G2				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
0	4.74	6.1	13.81	1.36	37.84	37.84
8	3.48	0.77	11.92	2.36	32.67	70.51
4	6.4	4.38	10.76	1.55	29.49	100.00

Groups 37G1 & 38G3

Average dissimilarity = 39.28

	Group 37G1	Group 38G3				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
0	18.78	13.57	16.93	1.29	43.1	43.1
4	8.26	16.83	15.33	1.54	39.02	82.12
8	2.48	6.79	7.02	1.61	17.88	100.00

Groups 38G1 & 38G3

Average dissimilarity = 56.16

	Group 38G1	Group 38G3				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	4.87	16.83	25.88	2.04	46.08	46.08
0	6.78	13.57	17.46	1.7	31.1	77.17
8	0.8	6.79	12.82	2.63	22.83	100.00

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Groups 37G2 & 38G3

Average dissimilarity = 53.77

	Group 37G2	Group 38G3				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	5.19	16.83	24.02	2.33	44.66	44.66
0	7.73	13.57	16.76	1.62	31.17	75.83
8	0.6	6.79	12.99	2.65	24.17	100.00

Groups 37G3 & 38G3

Average dissimilarity = 48.38

	Group 37G3	Group 38G3				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	7.53	16.83	20.24	1.58	41.83	41.83
0	6.71	13.57	17.94	1.9	37.08	78.9
8	2.25	6.79	10.21	2.01	21.1	100.00

Groups 37G4 & 38G3

Average dissimilarity = 49.27

	Group 37G4	Group 38G3				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
0	4.74	13.57	20.48	1.78	41.58	41.58
4	6.4	16.83	19.2	1.99	38.98	80.55
8	3.48	6.79	9.58	1.83	19.45	100.00

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Groups 38G2 & 38G3

Average dissimilarity = 55.64

	Group 38G2	Group 38G3				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	4.38	16.83	25.12	3.32	45.15	45.15
0	6.1	13.57	17.87	1.68	32.12	77.27
8	0.77	6.79	12.64	2.4	22.73	100.00

Groups 37G1 & 38G4

Average dissimilarity = 43.43

	Group 37G1	Group 38G4				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
0	18.78	6.43	22.73	1.48	52.33	52.33
4	8.26	12.25	12.75	1.38	29.36	81.69
8	2.48	6.4	7.95	1.43	18.31	100.00

Groups 38G1 & 38G4

Average dissimilarity = 49.88

	Group 38G1	Group 38G4				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	4.87	12.25	23.5	1.81	47.12	47.12
8	0.8	6.4	15.85	2.64	31.79	78.9
0	6.78	6.43	10.52	1.01	21.1	100.00

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Groups 37G2 & 38G4

Average dissimilarity = 48.43

	Group 37G2	Group 38G4				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	5.19	12.25	21.83	1.86	45.08	45.08
8	0.6	6.4	15.89	2.43	32.8	77.88
0	7.73	6.43	10.71	1.14	22.12	100.00

Groups 37G3 & 38G4

Average dissimilarity = 41.98

	Group 37G3	Group 38G4				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	7.53	12.25	19.26	1.4	45.88	45.88
8	2.25	6.4	12.67	2.05	30.18	76.06
0	6.71	6.43	10.05	1.05	23.94	100.00

Groups 37G4 & 38G4

Average dissimilarity = 38.11

	Group 37G4	Group 38G4				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	6.4	12.25	15.78	1.66	41.4	41.4
8	3.48	6.4	11.51	1.79	30.21	71.61
0	4.74	6.43	10.82	1.27	28.39	100.00

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Groups 38G2 & 38G4

Average dissimilarity = 46.63

	Group 38G2	Group 38G4				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	4.38	12.25	20.43	2.15	43.82	43.82
8	0.77	6.4	15.53	2.23	33.3	77.12
0	6.1	6.43	10.67	1.22	22.88	100.00

Groups 38G3 & 38G4

Average dissimilarity = 30.66

	Group 38G3	Group 38G4				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
0	13.57	6.43	14.05	1.5	45.82	45.82
4	16.83	12.25	11.84	1.44	38.62	84.43
8	6.79	6.4	4.77	1.17	15.57	100.00

Groups 37G1 & 38G5

Average dissimilarity = 53.40

	Group 37G1	Group 38G5				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
0	18.78	4.7	22.65	1.59	42.41	42.41
4	8.26	16.29	18.26	1.77	34.19	76.6
8	2.48	9.35	12.5	1.89	23.4	100.00

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Groups 38G1 & 38G5

Average dissimilarity = 57.58

	Group 38G1	Group 38G5				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	4.87	16.29	27.18	1.85	47.22	47.22
8	0.8	9.35	20.35	3.99	35.34	82.55
0	6.78	4.7	10.04	1.17	17.45	100.00

Groups 37G2 & 38G5

Average dissimilarity = 59.40

	Group 37G2	Group 38G5				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	5.19	16.29	27.36	2.19	46.07	46.07
8	0.6	9.35	20.82	3.13	35.06	81.13
0	7.73	4.7	11.21	1.3	18.87	100.00

Groups 37G3 & 38G5

Average dissimilarity = 46.86

	Group 37G3	Group 38G5				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	7.53	16.29	22.36	1.52	47.72	47.72
8	2.25	9.35	15.59	2.2	33.27	80.99
0	6.71	4.7	8.91	1.24	19.01	100.00

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Groups 37G4 & 38G5

Average dissimilarity = 41.46

	Group 37G4	Group 38G5				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	6.4	16.29	19.33	1.66	46.62	46.62
8	3.48	9.35	14.52	1.54	35.02	81.64
0	4.74	4.7	7.61	1.36	18.36	100.00

Groups 38G2 & 38G5

Average dissimilarity = 56.75

	Group 38G2	Group 38G5				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	4.38	16.29	26.68	2.67	47.01	47.01
8	0.77	9.35	20.27	2.72	35.72	82.73
0	6.1	4.7	9.8	1.33	17.27	100.00

Groups 38G3 & 38G5

Average dissimilarity = 32.72

	Group 38G3	Group 38G5				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
0	13.57	4.7	14.12	1.63	43.14	43.14
4	16.83	16.29	11.59	1.21	35.42	78.56
8	6.79	9.35	7.02	1.21	21.44	100.00

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Groups 38G4 & 38G5

Average dissimilarity = 29.78

	Group 38G4	Group 38G5				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	12.25	16.29	13.84	1.41	46.48	46.48
8	6.4	9.35	8.53	1.61	28.66	75.14
0	6.43	4.7	7.4	1.19	24.86	100.00

Groups 37G1 & 39G2

Average dissimilarity = 55.27

	Group 37G1	Group 39G2				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
0	18.78	3.5	37.34	2.02	67.57	67.57
4	8.26	2.85	13.87	1.67	25.1	92.67

Groups 38G1 & 39G2

Average dissimilarity = 24.77

	Group 38G1	Group 39G2				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
0	6.78	3.5	11.16	0.79	45.06	45.06
4	4.87	2.85	8.03	1.29	32.42	77.48
8	0.8	0.88	5.58	1.51	22.52	100.00

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Groups 37G2 & 39G2

Average dissimilarity = 32.90

	Group 37G2	Group 39G2				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
0	7.73	3.5	16.95	1.26	51.5	51.5
4	5.19	2.85	11.06	2.77	33.63	85.13
8	0.6	0.88	4.89	1.44	14.87	100.00

Groups 37G3 & 39G2

Average dissimilarity = 41.96

	Group 37G3	Group 39G2				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	7.53	2.85	21.03	1.17	50.12	50.12
0	6.71	3.5	13.92	0.99	33.17	83.3
8	2.25	0.88	7.01	2.58	16.7	100.00

Groups 37G4 & 39G2

Average dissimilarity = 47.06

	Group 37G4	Group 39G2				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	6.4	2.85	22.12	8.76	47	47
8	3.48	0.88	12.88	3.76	27.38	74.38
0	4.74	3.5	12.06	1.7	25.62	100.00

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Groups 38G2 & 39G2

Average dissimilarity = 31.06

	Group 38G2	Group 39G2				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
0	6.1	3.5	14.54	1.76	46.82	46.82
4	4.38	2.85	11.87	1.33	38.22	85.05
8	0.77	0.88	4.64	1.54	14.95	100.00

Groups 38G3 & 39G2

Average dissimilarity = 62.09

	Group 38G3	Group 39G2				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	16.83	2.85	30.58	3.08	49.25	49.25
0	13.57	3.5	19.96	1.77	32.15	81.4
8	6.79	0.88	11.55	2.48	18.6	100.00

Groups 38G4 & 39G2

Average dissimilarity = 53.03

	Group 38G4	Group 39G2				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	12.25	2.85	29.25	3.54	55.16	55.16
8	6.4	0.88	15.03	3.31	28.34	83.5
0	6.43	3.5	8.75	1.26	16.5	100.00

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Groups 38G5 & 39G2

Average dissimilarity = 62.77

	Group 38G5	Group 39G2				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	16.29	2.85	35.41	3.72	56.41	56.41
8	9.35	0.88	21.52	3.97	34.28	90.69

Groups 37G1 & 39G3

Average dissimilarity = 41.96

	Group 37G1	Group 39G3				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
0	18.78	5.97	24.2	1.65	57.68	57.68
4	8.26	10.29	12.42	1.5	29.61	87.29
8	2.48	4.45	5.33	1.32	12.71	100.00

Groups 38G1 & 39G3

Average dissimilarity = 46.95

	Group 38G1	Group 39G3				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	4.87	10.29	21.41	1.89	45.6	45.6
0	6.78	5.97	13.72	1.57	29.22	74.81
8	0.8	4.45	11.82	1.93	25.19	100.00

Groups 37G2 & 39G3

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Average dissimilarity = 41.28

Group 37G2 Group 39G3

Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	5.19	10.29	19.41	1.87	47.02	47.02
8	0.6	4.45	11.55	2.19	27.98	75
0	7.73	5.97	10.32	1.39	25	100.00

Groups 37G3 & 39G3

Average dissimilarity = 35.06

Group 37G3 Group 39G3

Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	7.53	10.29	15.81	1.39	45.1	45.1
0	6.71	5.97	11.1	1.32	31.65	76.75
8	2.25	4.45	8.15	1.52	23.25	100.00

Groups 37G4 & 39G3

Average dissimilarity = 31.80

Group 37G4 Group 39G3

Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	6.4	10.29	13.64	2.48	42.88	42.88
0	4.74	5.97	10.45	1.7	32.87	75.76
8	3.48	4.45	7.71	1.87	24.24	100.00

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Groups 38G2 & 39G3

Average dissimilarity = 39.09

	Group 38G2	Group 39G3				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	4.38	10.29	18.41	1.9	47.09	47.09
8	0.77	4.45	11.4	1.84	29.15	76.24
0	6.1	5.97	9.29	1.48	23.76	100.00

Groups 38G3 & 39G3

Average dissimilarity = 37.21

	Group 38G3	Group 39G3				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
0	13.57	5.97	15.65	1.89	42.07	42.07
4	16.83	10.29	15.42	1.93	41.43	83.51
8	6.79	4.45	6.14	1.73	16.49	100.00

Groups 38G4 & 39G3

Average dissimilarity = 27.45

	Group 38G4	Group 39G3				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	12.25	10.29	12.62	1.36	45.96	45.96
0	6.43	5.97	7.82	1.52	28.48	74.45
8	6.4	4.45	7.02	1.46	25.55	100.00

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Groups 38G5 & 39G3

Average dissimilarity = 33.96

	Group 38G5	Group 39G3				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	16.29	10.29	16.77	1.57	49.38	49.38
8	9.35	4.45	10.54	1.53	31.03	80.41
0	4.7	5.97	6.65	1.33	19.59	100.00

Groups 39G2 & 39G3

Average dissimilarity = 49.92

	Group 39G2	Group 39G3				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	2.85	10.29	29.22	2.51	58.52	58.52
8	0.88	4.45	11.48	2.34	23	81.52
0	3.5	5.97	9.23	2.01	18.48	100.00

Groups 37G1 & 39G4

Average dissimilarity = 48.54

	Group 37G1	Group 39G4				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
0	18.78	3.45	32.71	2.13	67.38	67.38
4	8.26	7.28	10.88	1.31	22.41	89.79
8	2.48	3.49	4.95	1.28	10.21	100.00

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Groups 38G1 & 39G4

Average dissimilarity = 43.32

	Group 38G1	Group 39G4				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
0	6.78	3.45	16.78	1.55	38.74	38.74
4	4.87	7.28	14.67	1.59	33.88	72.62
8	0.8	3.49	11.86	1.88	27.38	100.00

Groups 37G2 & 39G4

Average dissimilarity = 45.72

	Group 37G2	Group 39G4				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
0	7.73	3.45	18.56	1.45	40.6	40.6
4	5.19	7.28	16.07	1.52	35.16	75.75
8	0.6	3.49	11.08	1.66	24.25	100.00

Groups 37G3 & 39G4

Average dissimilarity = 35.33

	Group 37G3	Group 39G4				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
0	6.71	3.45	13.93	1.36	39.44	39.44
4	7.53	7.28	13.55	1.43	38.36	77.79
8	2.25	3.49	7.85	1.62	22.21	100.00

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Groups 37G4 & 39G4

Average dissimilarity = 28.51

	Group 37G4	Group 39G4				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
0	4.74	3.45	11.07	1.72	38.82	38.82
4	6.4	7.28	10.05	1.37	35.26	74.08
8	3.48	3.49	7.39	1.44	25.92	100.00

Groups 38G2 & 39G4

Average dissimilarity = 39.49

	Group 38G2	Group 39G4				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
0	6.1	3.45	14.89	1.49	37.71	37.71
4	4.38	7.28	13.2	1.49	33.42	71.13
8	0.77	3.49	11.4	1.69	28.87	100.00

Groups 38G3 & 39G4

Average dissimilarity = 47.30

	Group 38G3	Group 39G4				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
0	13.57	3.45	20.23	2.05	42.76	42.76
4	16.83	7.28	19.18	1.98	40.55	83.3
8	6.79	3.49	7.9	1.69	16.7	100.00

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Groups 38G4 & 39G4

Average dissimilarity = 33.24

	Group 38G4	Group 39G4				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	12.25	7.28	14.79	1.36	44.5	44.5
0	6.43	3.45	10.22	1.41	30.76	75.26
8	6.4	3.49	8.22	1.34	24.74	100.00

Groups 38G5 & 39G4

Average dissimilarity = 41.35

	Group 38G5	Group 39G4				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	16.29	7.28	20.28	1.84	49.05	49.05
8	9.35	3.49	13.93	2.17	33.69	82.74
0	4.7	3.45	7.14	1.35	17.26	100.00

Groups 39G2 & 39G4

Average dissimilarity = 42.96

	Group 39G2	Group 39G4				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	2.85	7.28	21.97	2.9	51.14	51.14
8	0.88	3.49	10.53	2.02	24.52	75.66
0	3.5	3.45	10.46	1.99	24.34	100.00

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Groups 39G3 & 39G4

Average dissimilarity = 29.59

	Group 39G3	Group 39G4				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	10.29	7.28	14.61	1.79	49.38	49.38
0	5.97	3.45	9.28	1.39	31.36	80.75
8	4.45	3.49	5.7	1.31	19.25	100.00

Groups 37G1 & 39G5

Average dissimilarity = 55.76

	Group 37G1	Group 39G5				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
0	18.78	5.12	21.13	1.65	37.9	37.9
4	8.26	18.69	19.61	1.83	35.17	73.07
8	2.48	12.22	15.02	1.75	26.93	100.00

Groups 38G1 & 39G5

Average dissimilarity = 61.38

	Group 38G1	Group 39G5				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	4.87	18.69	28.72	2.34	46.79	46.79
8	0.8	12.22	22.18	4.87	36.13	82.92
0	6.78	5.12	10.48	1.55	17.08	100.00

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Groups 37G2 & 39G5

Average dissimilarity = 59.63

	Group 37G2	Group 39G5				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	5.19	18.69	27.44	2.09	46.01	46.01
8	0.6	12.22	24.04	2.71	40.31	86.33
0	7.73	5.12	8.15	1.08	13.67	100.00

Groups 37G3 & 39G5

Average dissimilarity = 50.28

	Group 37G3	Group 39G5				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	7.53	18.69	23.37	1.67	46.49	46.49
8	2.25	12.22	19.63	2.93	39.04	85.53
0	6.71	5.12	7.28	1.24	14.47	100.00

Groups 37G4 & 39G5

Average dissimilarity = 46.00

	Group 37G4	Group 39G5				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	6.4	18.69	20.95	1.74	45.54	45.54
8	3.48	12.22	19.33	1.74	42.02	87.56
0	4.74	5.12	5.72	1.61	12.44	100.00

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Groups 38G2 & 39G5

Average dissimilarity = 60.59

	Group 38G2	Group 39G5				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	4.38	18.69	28.38	2.73	46.85	46.85
8	0.77	12.22	24.27	2.71	40.06	86.91
0	6.1	5.12	7.93	1.1	13.09	100.00

Groups 38G3 & 39G5

Average dissimilarity = 34.48

	Group 38G3	Group 39G5				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
0	13.57	5.12	12.71	1.48	36.85	36.85
4	16.83	18.69	12.49	1.57	36.22	73.06
8	6.79	12.22	9.29	1.39	26.94	100.00

Groups 38G4 & 39G5

Average dissimilarity = 31.09

	Group 38G4	Group 39G5				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	12.25	18.69	14.18	1.45	45.62	45.62
8	6.4	12.22	10.35	1.47	33.3	78.92
0	6.43	5.12	6.55	1.1	21.08	100.00

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Groups 38G5 & 39G5

Average dissimilarity = 26.54

	Group 38G5	Group 39G5				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	16.29	18.69	13.35	1.34	50.29	50.29
8	9.35	12.22	7.53	1.22	28.37	78.67
0	4.7	5.12	5.66	1.22	21.33	100.00

Groups 39G2 & 39G5

Average dissimilarity = 65.83

	Group 39G2	Group 39G5				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	2.85	18.69	36.21	3.56	55.01	55.01
8	0.88	12.22	23.95	4.19	36.38	91.39

Groups 39G3 & 39G5

Average dissimilarity = 37.06

	Group 39G3	Group 39G5				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	10.29	18.69	17.23	1.44	46.48	46.48
8	4.45	12.22	14.92	1.73	40.26	86.74
0	5.97	5.12	4.92	1.64	13.26	100.00

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*Groups 39G4 & 39G5*

Average dissimilarity = 44.86

	Group 39G4	Group 39G5				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	7.28	18.69	21.49	1.71	47.92	47.92
8	3.49	12.22	16.77	2.02	37.39	85.31
0	3.45	5.12	6.59	1.34	14.69	100.00

*Examines SEX groups*

*(across all YEAR groups)*

*Groups 1 & 2*

Average dissimilarity = 39.07

	Group 1	Group 2				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	8	7.9	15.56	1.42	39.82	39.82
0	5.79	6.04	14.15	1.16	36.21	76.03
8	3.79	3.5	9.37	1.3	23.97	100.00

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*Examines SEX groups*

*(across all RECTANGLE groups)*

*Groups 1 & 2*

Average dissimilarity = 28.76

	Group 1	Group 2				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	8	7.9	11.55	1.27	40.17	40.17
0	5.79	6.04	11.03	1.16	38.36	78.53
8	3.79	3.5	6.18	1.17	21.47	100.00

*Examines LENGTHCLASS groups*

*(across all YEAR groups)*

*Groups 2 & 1*

Average dissimilarity = 31.81

	Group 2	Group 1				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
0	2.41	2.4	11.17	1.37	35.12	35.12
8	2.55	1	10.83	1.44	34.03	69.15
4	5.25	4.02	9.81	1.39	30.85	100.00

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*Groups 3 & 1*

Average dissimilarity = 45.43

	Group 3	Group 1				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	10.14	4.02	18.51	1.68	40.75	40.75
8	5.07	1	13.74	1.81	30.24	70.98
0	5.85	2.4	13.18	1.29	29.02	100.00

*Groups 2 & 4*

Average dissimilarity = 32.82

	Group 2	Group 4				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	5.25	3.79	12.43	1.45	37.87	37.87
0	2.41	2.56	11.36	1.23	34.62	72.49
8	2.55	1.17	9.03	1.41	27.51	100.00

*Groups 3 & 4*

Average dissimilarity = 47.12

	Group 3	Group 4				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
4	10.14	3.79	21.24	1.74	45.07	45.07
0	5.85	2.56	13.3	1.34	28.23	73.31
8	5.07	1.17	12.58	1.62	26.69	100.00

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*Groups 1 & 4*

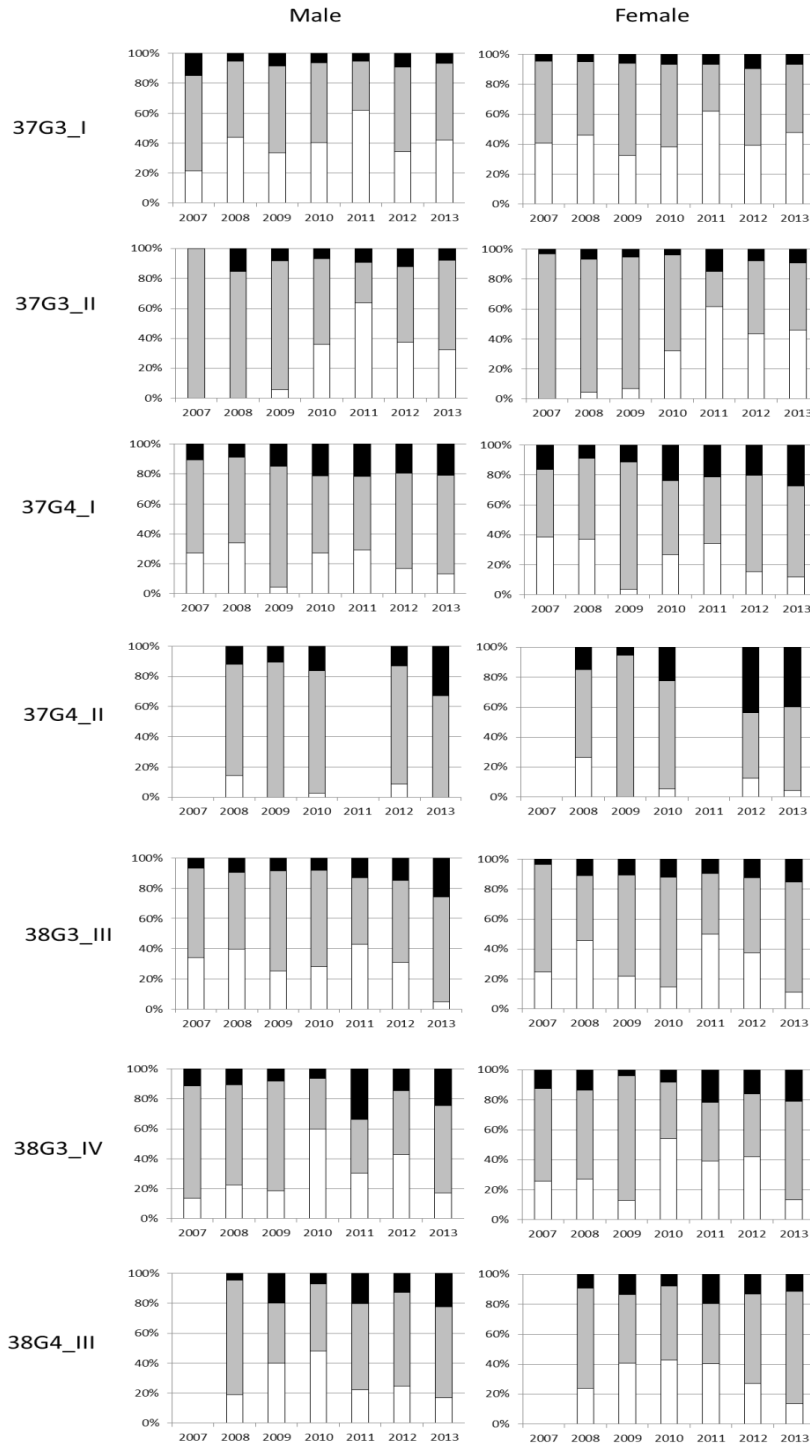
Average dissimilarity = 29.60

	Group 1	Group 4				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
0	2.4	2.56	12.23	1.26	41.3	41.3
4	4.02	3.79	10	1.38	33.79	75.09
8	1	1.17	7.37	1.25	24.91	100.00

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**Table S2. Results of Cox & Stuart trend time analysis by subdivision and rectangle for three quality flag categories**

		QF0	QF4	QF8
Subdivision	Time	P	P	P
SD22	2007–2013	0.5	0.5	0.25
SD24	2007–2013	0.5	0.125	0.125
SD25	2007–2013	0.5	0.125	0.125
		QF0	QF4	QF8
Rectangle	Time	P	P	P
37G1	2007–2013	0.5	0.5	0.75
38G1	2007–2013	0.5	0.5	0.5
37G2	2007–2013	0.5	0.75	0.5
37G3	2009–2013	0.75	0.75	0.25
37G4	2010–2013	0.25	0.25	0.25
38G2	2007–2013	0.5	0.5	0.75
38G3	2007–2013	0.5	0.125	0.125
38G4	2007–2013	0.5	0.75	0.125
38G5	2007–2013	0.5	0.125	0.125
39G2	2008–2011+2013	0.25	0.25	0.75
39G3	2008–2013	0.125	0.125	0.125
39G4	2008–2013	0.125	0.125	0.125
39G5	2007–2013	0.75	0.125	0.125



**Fig. S3.** Relative abundance of three quality flag categories (white: 'readable'; grey: 'uncertain'; black: 'unreadable') per sex (Male, Female) by quarter rectangles assigned to cod otoliths collected between 2007 and 2013 in quarter rectangles of seven rectangles in SD24 and SD25. Quarter rectangles are defined row-wise, starting in the upper left quarter with I and the lower left quarter with III.

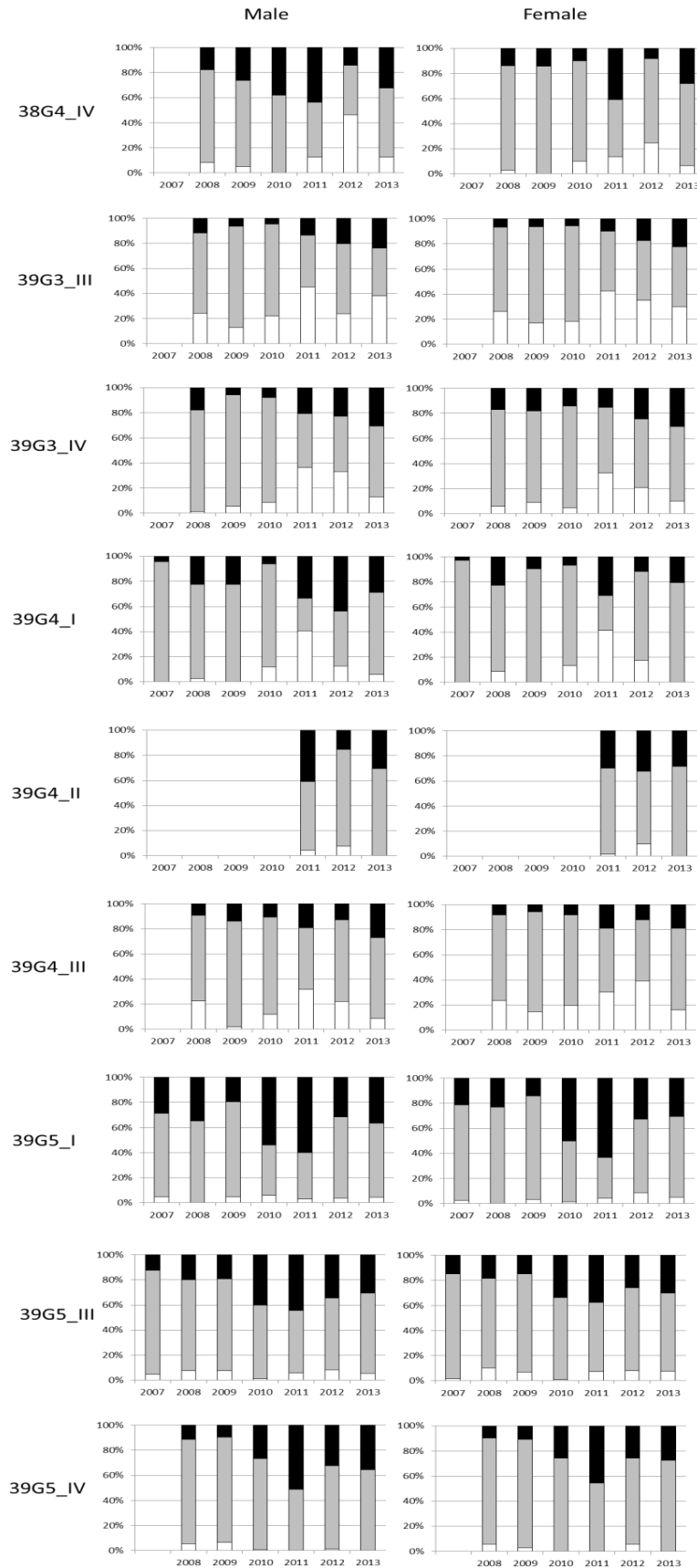
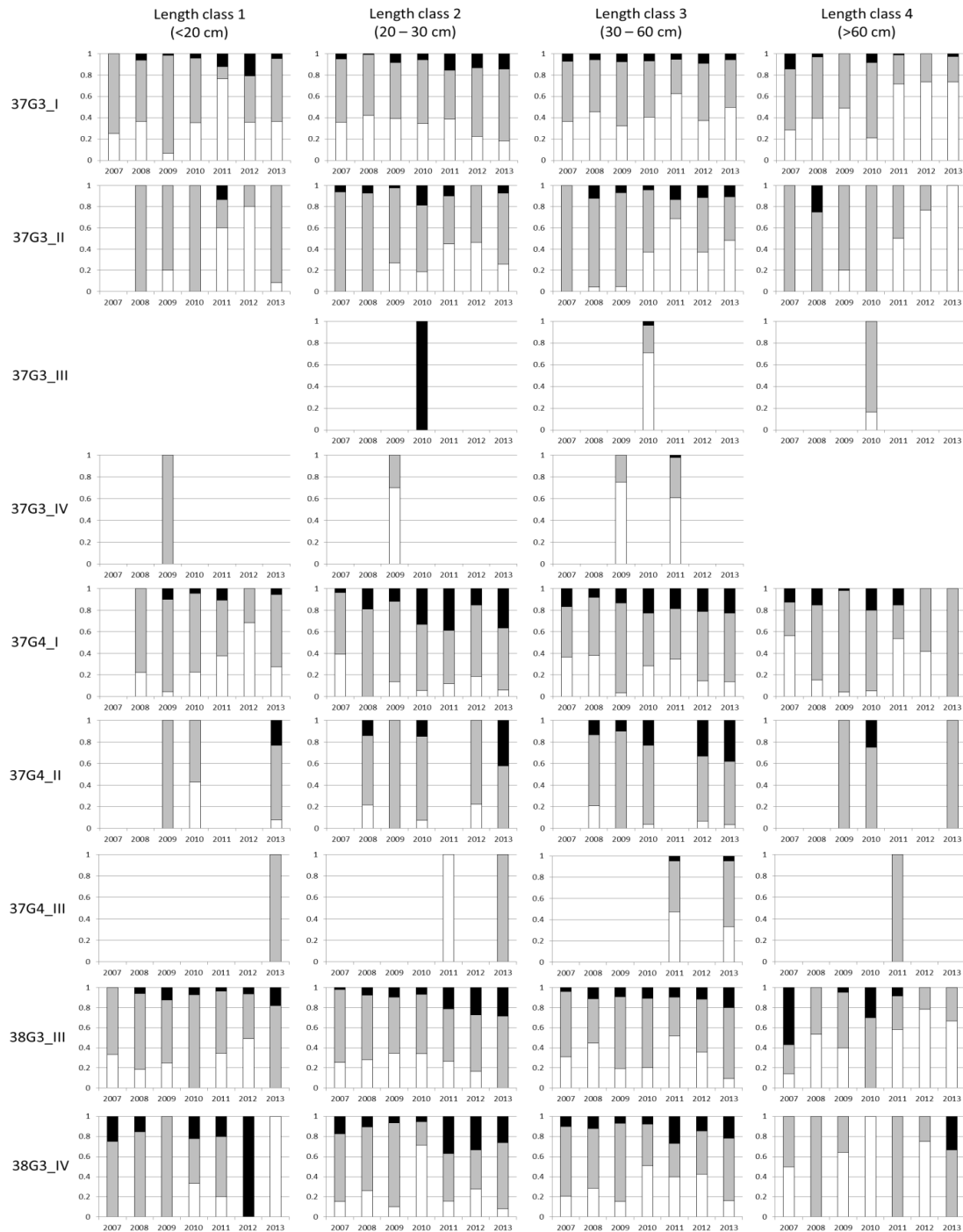


Fig. S3. (Cont.)





**Fig. S4.** Relative abundance of three quality flag categories (white: ‘readable’; grey: ‘uncertain’; black: ‘unreadable’) per length group length class (rounded down to the next centimetre) and quarter-rectangle assigned to cod otolith collected between 2007 and 2013 in quarter rectangles of seven rectangles in SD24 and SD25. Quarter rectangle I is located in the upper left of a rectangle, quarter rectangle II in the upper right, quarter rectangle III in the lower left and quarter rectangle IV in the lower right.

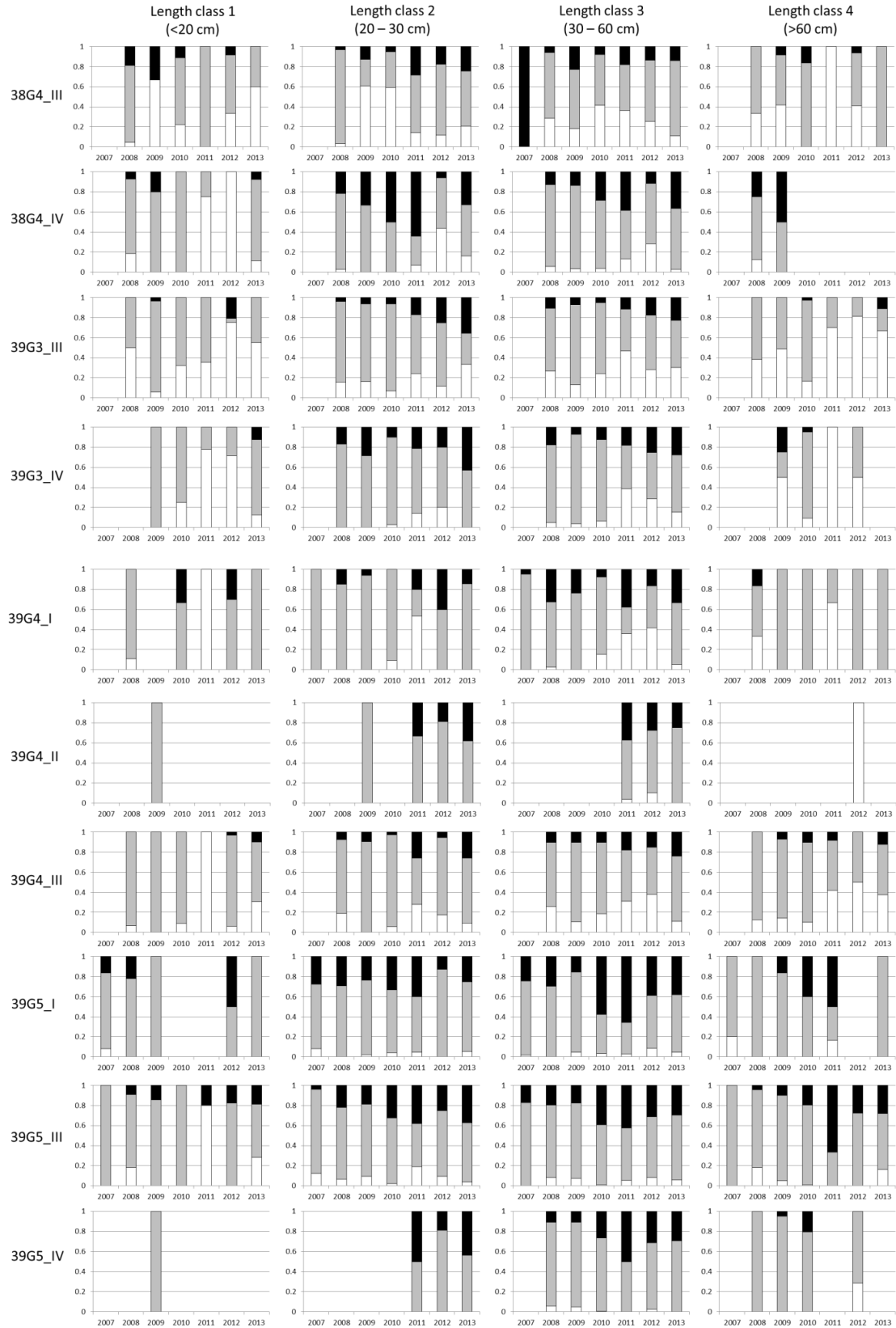


Fig. S4. (Cont.)