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Temporal Trends in Condition, Gonado Somatic Index and Maturity Stages of Atlantic Cod (Gadus morhua) from Northern Placentia Bay (Subdivision 3Ps), Newfoundland, during 1998

By

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Abstract

The maturity stage, condition and gonado-somatic index of cod sampled at four sites in northern Placentia Bay were monitored from March to December 1998. A histological procedure was used to determine whether the visual classification of female cod in spawning stage could be improved. The duration and timing of spawning at each site was determined. Among females, spawning fish were present from March to August with a peak spawning period from May to August. The males had two peak spawning times. One during April and one from the end of June to early August. Females had a peak spawning time spreading over two month while males' largest peak spawning period spread only over one month. During the spawning period, the condition of males and females were similar among the sites, ranging between 0.7 and 0.8. Their gonado somatic index reached a peak by the end of June and then decreased until the end of August. This supported the maturity stage data that spawning fish could be found until late August. When comparing the visual to the histological procedure used to classify the gonads, the visual procedure underestimated the percentage of spawning females by up to 29%.

Résumé

Le stade de maturité, la condition et l'indice gonado-somatique de morues prélevées en quatre sites de la partie nord de la baie Placentia ont fait l'objet d'un suivi de mars à décembre 1998. Un protocole histologique a été utilisé pour déterminer la possibilité d'améliorer le classement visuel des femelles au stade du frai. La durée et le moment du frai ont été déterminés à chaque site. Les femelles aptes à frayer étaient présentes de mars à août, la période de frai maximum se situant entre mai et août. Deux périodes de frai maximum ont été notées pour les mâles, l'une en avril et l'autre de la fin de juin au début d'août. La période de frai maximum des femelles s'étendait sur deux mois tandis que la plus longue période correspondante chez les mâles ne durait qu'un mois. Pendant la période de frai, la condition des mâles et des femelles était semblable d'un site à l'autre et le facteur variait entre 0,7 et 0,8. L'indice gonado-somatique atteignait un maximum à la fin de juin pour ensuite décroître jusqu'à la fin d'août. Cela confirme les données sur le stade de maturité qui indiquaient que des poissons en état de frayer étaient présents jusqu'à la fin d'août. La comparaison des protocoles visuel et histologique appliqués au classement des gonades montre que le protocole visuel sous-estime le pourcentage de femelles en état de frayer d'une valeur pouvant atteindre 29 %.

Introduction

Reports of Atlantic cod (*Gadus morhua*) in spawning condition in Placentia Bay, Newfoundland , are not new (Hutchings et al. 1993, Ripley 1994; Brattey and Morgan 1996, Lawson et al. 1998). However, most of this data is not based on seasonal sampling, consequently, the duration and timing of spawning can not be determined from such data (Lilly, 1996). In the Newfoundland region, cod maturities are based on visual examinations of the gonads. As cod are batch spawners, their accurate classification into maturity categories (Templeman et al. 1978) is visually difficult and could be improved by the use of histological analyses on gonads. The first objective of this study is to determine whether the classification of fish in spawning stage could be improved through histological procedures.

The second objective is to describe the seasonal trends in maturity, condition, and gonado-somatic index of cod sampled in northern Placentia Bay during 1998.

Materials and Methods

Biological sampling

Five local fishermen involved in the DFO Sentinel Program of Placentia Bay were interviewed in February 1998. From this information, four different sampling sites were chosen in the north of the bay (Fig.1): two sites on the west side of the bay (W1 and W2); one in the north (N) and one in the east (E). These sites were chosen to maximize the chances of having some fish at each date for the entire year. Thirty fish/site were sampled every two weeks from March to December 1998. The fish were collected using gillnets of each 91.5m long and 3m wide, with 13.8cm (5.5-in) mesh. Only fish which standard length greater than 50cm were examined.

Variables recorded included stage of maturity, round weight (g), gutted weight (g) gonad weight (g) and standard length (cm). These variables were recorded on each fishing day to avoid any misclassification in maturity stage determination of frozen fish. The reproductive stage of cod was assessed using two different methods. The first involved a visual description of the gonad following the criteria of Templeman et al. (1978), and Morrison (1990). The fish were classified into three stages (ripening, spawning, spent). The description for <u>female</u> stages was: <u>Ripening/Maturing</u>: eggs opaque and visible to naked eye, blood vessel well visible on a white background. The cod being a multiple-batch spawner (McEvoy and McEvoy, 1992) this stage was carefully watched for an eventual translucent egg leftover in the middle of opaque eggs, from a previous spawning. <u>Spawning</u>: presence of translucent (hydrated) eggs in the ovaries. Given that the eggs formation is rapid and occurs 1-2 days in advance of spawning and that the number of hyaline (hydrated) oocytes present in the ovary varies in a cyclic manner, the eggs will normally be released within 3 days of hydration (Kjesbu,

1988). Consequently, the presence of hyaline oocytes shows that the specimen spawns or will spawn in the near future. These finding justify the designation "spawning" for this stage. Spent: ovaries whitish-gray or bluish-gray, shrunken, soft and flabby with whitish cast. Residual eggs often present. For males, the classification categories of gonads were: Ripening/Maturing: color of testes ranging from gray or pink to white; translucent on the edges; little or no sperm in the efferent ducts. Spawning: testes and efferent ducts completely opaque and white with milt present. Spent: testes thin, gray or pink and milt not evident. The second method used to classify the gonads was a histological procedure. A small part of the gonad was immediately fixed in "Bouin's fixating" (25% of Picric Acid; 75% of Strong Formalin and 5% of Acetic Acid (37%)). In the laboratory, pieces of 0.5 cm thick were than embedded in paraffin based on conventional histological processing, and 7 µm sections of tissue were stained with Harris hematoxyline and eosine-floxine. The histological procedure was applied only to females which visual classification was uncertain.

Data analysis

For each date, the difference among proportions of spawning females obtained through histological procedures versus proportions of spawning females obtained through visual procedures was calculated. Calculation of the 95% confidence intervals for the differences among the two proportions was tried but aborted due to small sample sizes.

The relative abundance of cod in each maturity stage among site was compared using a oneway ANOVA (General Linear Model) through the SAS software. This test was applied to determine if the maturity stage were significantly different among sites and dates.

The condition of each fish was expressed using Fulton's condition factor ((W/L^3) *100); where W is gutted weight (kg) and L is standard length (cm). The Gonado Somatic Index (GSI) was expressed using the same formula but with the weight of the gonad (kg) instead of the gutted weight. For each date between May and December, an average Fulton's condition factor and GSI were calculated with their corresponding 95% confidence intervals.

Results and Discussion

The comparison of females' spawning percentages obtained through visual and histological procedures for the four sites are presented in Fig. 2, and data is shown in Table 1. A condensed version of the four sites is showed in Fig. 3. The percentage of spawning females obtained through histological procedures (PSFH) was never less than the percentage of spawning females obtained through visual procedures (PSFV).

Macroscopic misclassification matches with the peak spawning period for all four sites. When looking at the graphs obtained for the four sites together (Fig. 3 and 4), the difference between PSFH and PSFV is at his highest from the end of May to early June. This time corresponds to the first releases of eggs, when most of the eggs present have not yet been hydrated and released. The largest difference between the two percentages was of 29% and the minimum was of 1%.

The proportion of maturity stages of female and male cod sampled in the four sites are shown in Fig. 5 to 8. The data is presented in Table 2. The sampling started in the third week of March for two of the four sites and by this time, spawning female were already present. Their proportion seemed to stay relatively stable (1/3) during the next two months, after which they started to increase significantly. The east and the north sites showed a peak spawning period beginning by mid May (Fig. 8 and 7). The female cod collected in the west sites showed a two weeks delay for their peak spawning time. For the end of the peak spawning season a similar trend was observed: the females sampled on the east side of the bay showed first a decline in spawning (mid July). Then followed the cod sampled in the north (end of July), and the one from the west sites (mid August). Due to movements of the fish, one can not conclude that the females which start their peak spawning time first, also stop their peak spawning time first, as these graphs suggest. However all four sites presented a female peak spawning season spreading over approximately two month. When looking at the maturity stages for males, all three sites where early sampling took place, had a similar trend of two spawning periods separated by a maturing period (Fig. 5,6,7). The east site, where the sample collection started only in May, showed also this distinctive maturing period (Fig. 8). The first spawning time presented a peak of spawning males in early April for all sites. For the second spawning period, the west sites and the north site had a peak of spawning from the end of June to the end of July. The east site however, had its peak spawning time stretching until early August. Compared to the females, the males show a shorter time of peak spawning which spread approximately over one month. These results of male maturity stages were not checked through histological methods.
The statistical analysis results of maturity stage variability among sites and date are presented in Table 3. The proportion of ripening, spawning and spent female or male cod is significantly different among dates. On the other hand, the proportion of different maturity stages is not significantly different among the four sites. This result implies that a consistant and regular sample of fish at only one randomly chosen site would be representative of the cod's reproductive time cycle in the north of the bay.

Fulton's condition factors for the females and males collected in the four sites are shown in Fig. 9,10 and Table 4. During the spawning period, the condition of males and females were similar among sites with a range between 0.7 and 0.8. Through the following two months their condition increased to reach a peak of 0.85 in mid October. By the end of the year, their condition declined again to a stage of 0.8.

Gonado Somatic Indexes (GSI) for the cod sampled from May to December are presented in Fig. 11,12 and Table 5. In May the GSI of both males and females decreased to a limit of 0.04. During the next three weeks the female cod had their GSI

multiplied by three in all four sites while the males saw their GSI multiplied by 1.5. After the end of June, males and females had a GSI which declined until the end of August. These results support the maturity stage data that female cod started their peak spawning time by the end of May and that both females and males were still spawning in the month of August.

It has to be notified that the cod proportion observed in this study does not take into account the variability of fish abundance during the year.

Acknowledgements

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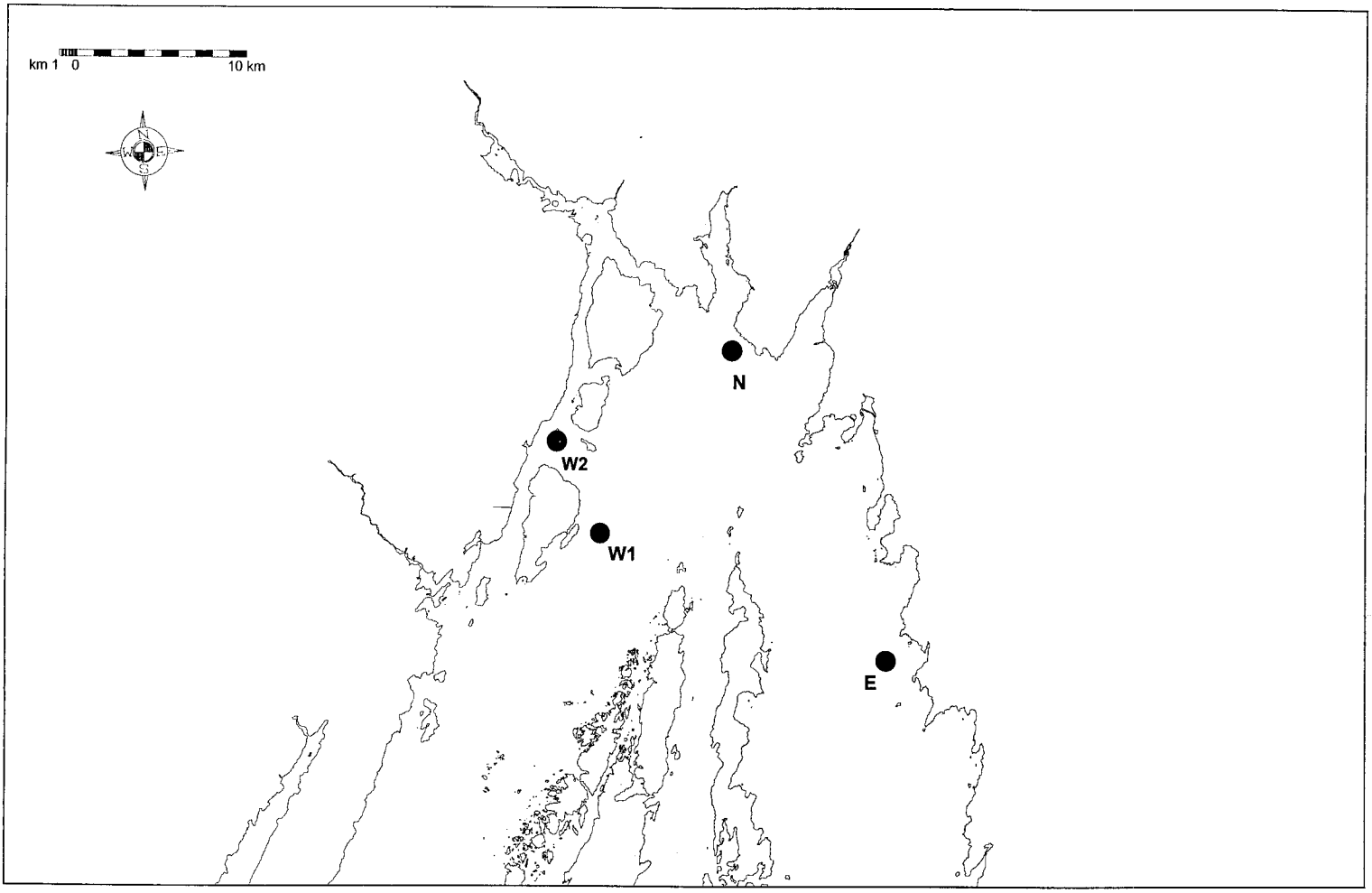
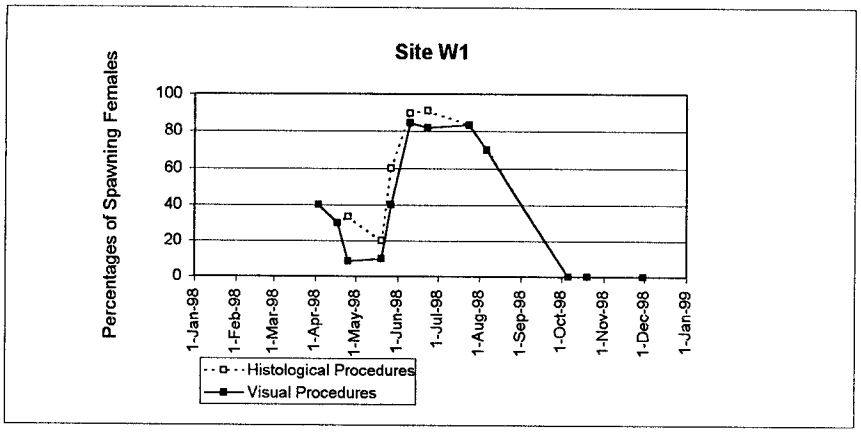
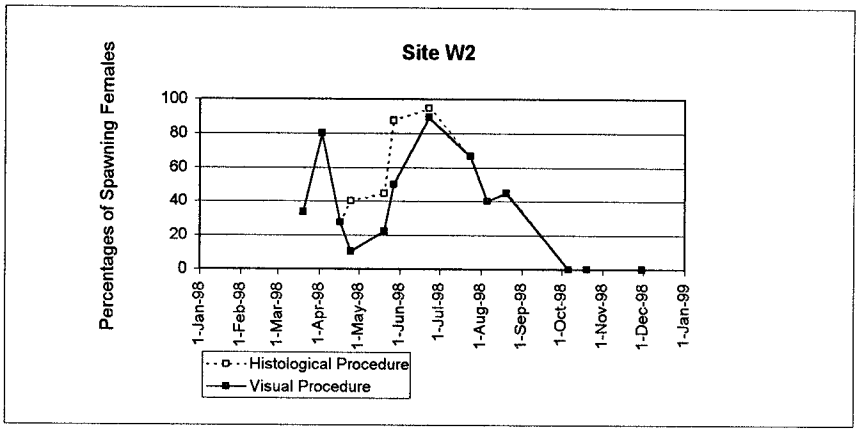
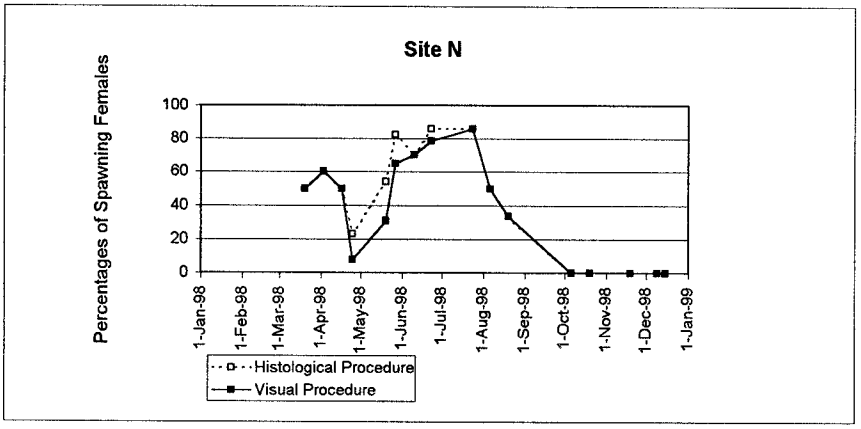


Figure 1. Four sites chosen in northern Placentia Bay, Subdivision 3Ps, Newfoundland.







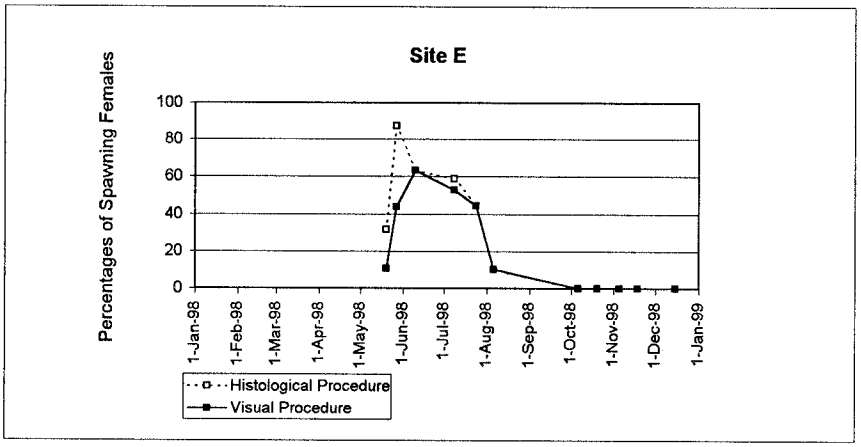


Fig. 2. Comparison of spawning female percentages obtained through visual and histological procedures for the four sites during 1998.

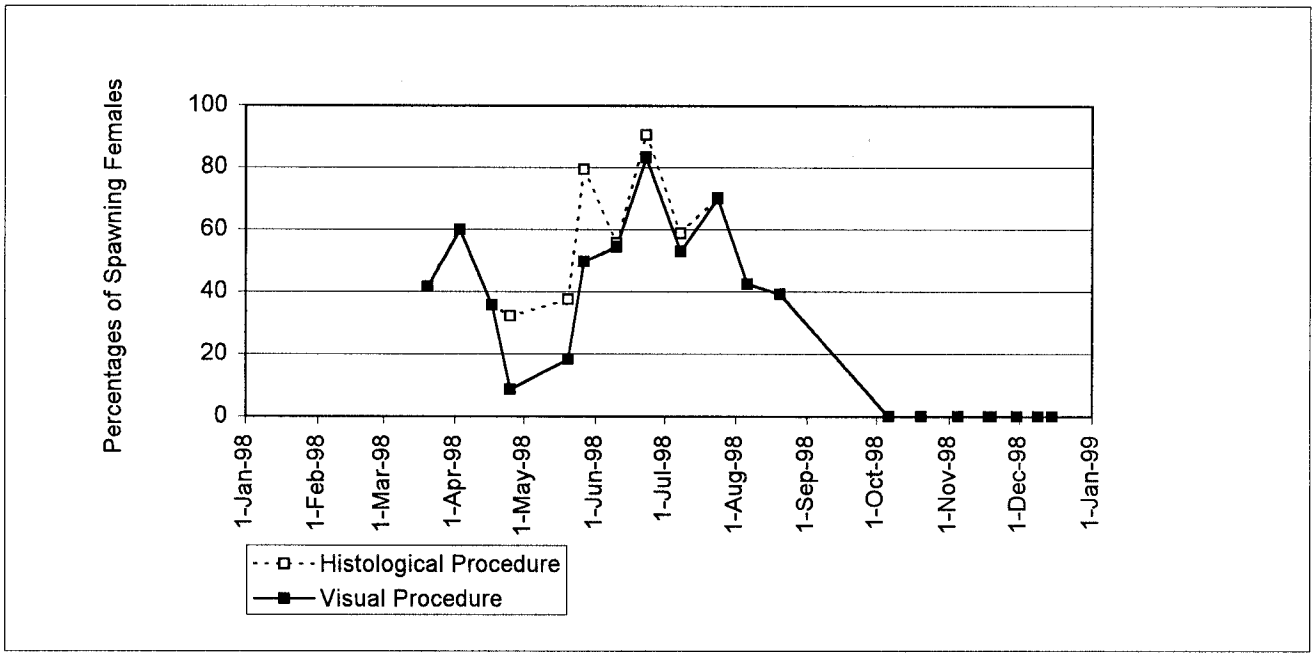


Fig. 3. Comparison of spawning female percentages obtained through visual and histological procedures for the four sites during 1998.

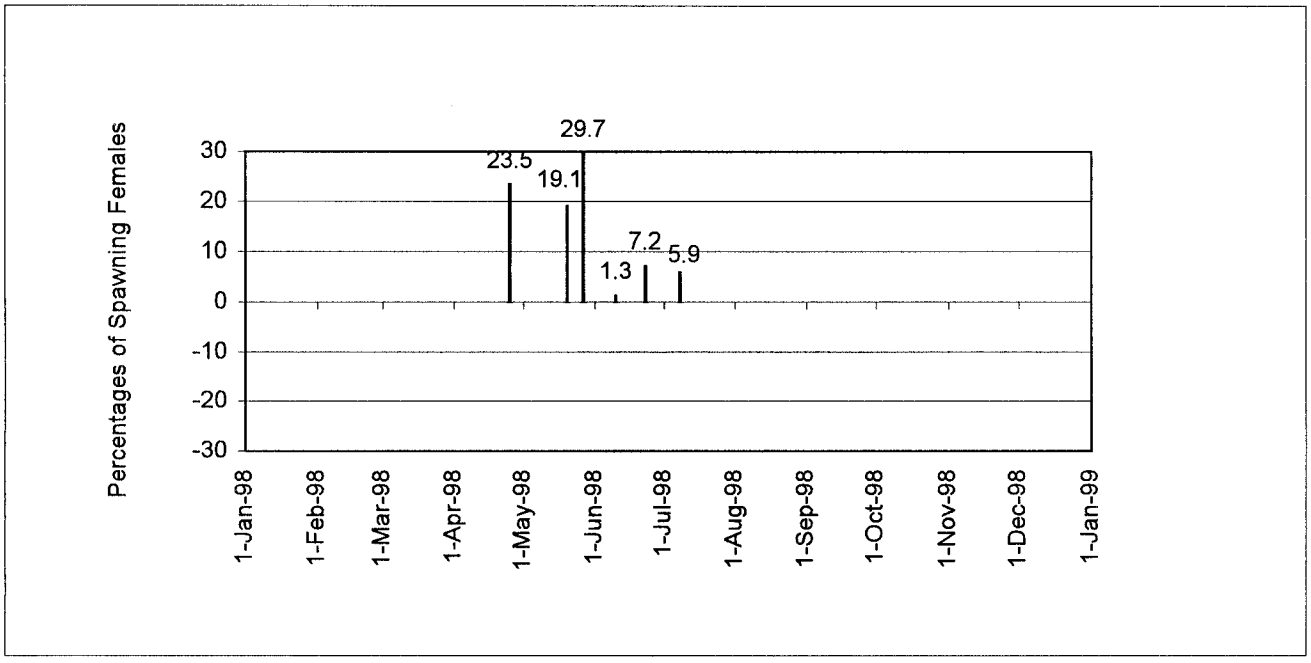


Fig. 4. Percentage difference between the spawning females obtained through histological procedure and the spawning females obtained through visual procedures for the four sites during 1998.

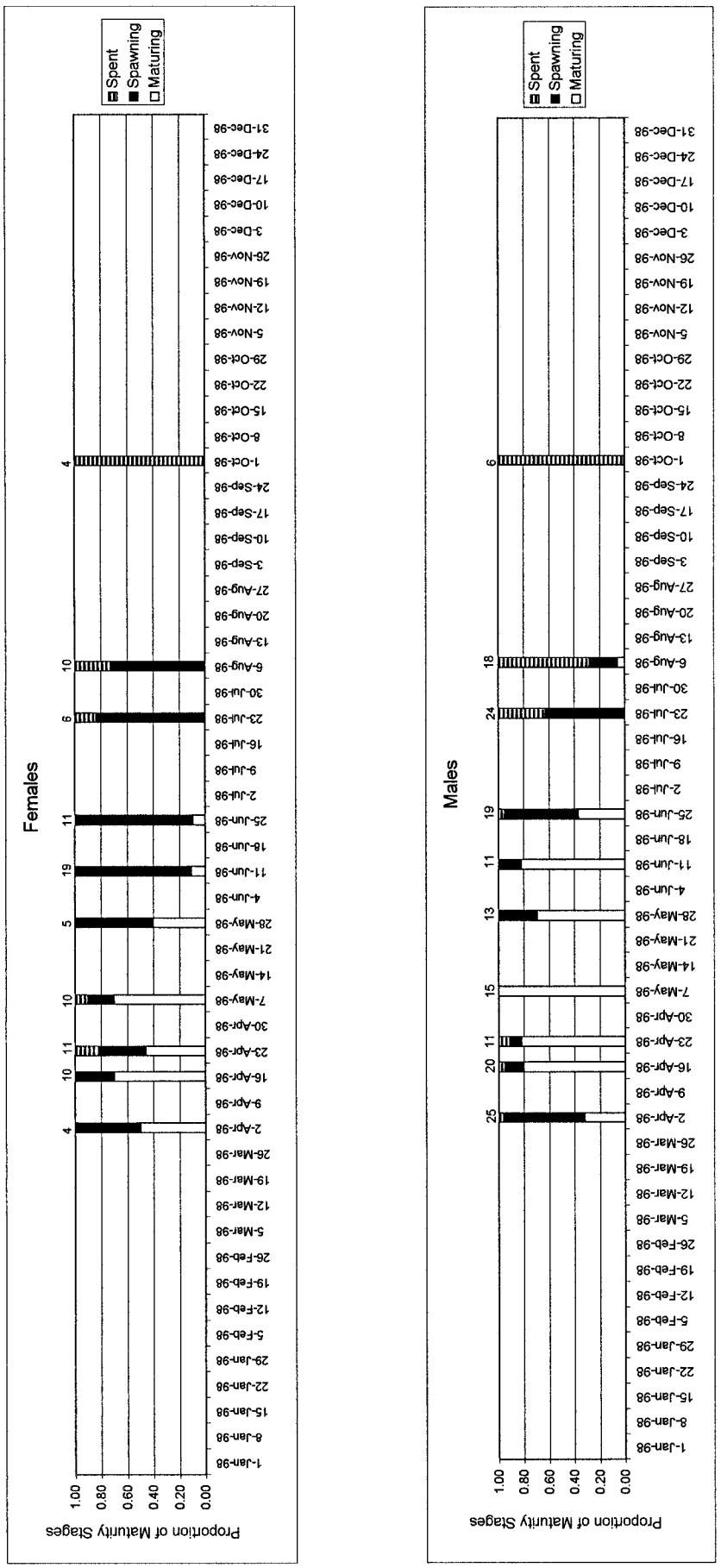


Fig. 5. Maturity stages of cod sampled at site W1 during 1998. The numbers on top of each bar represent the sample size.

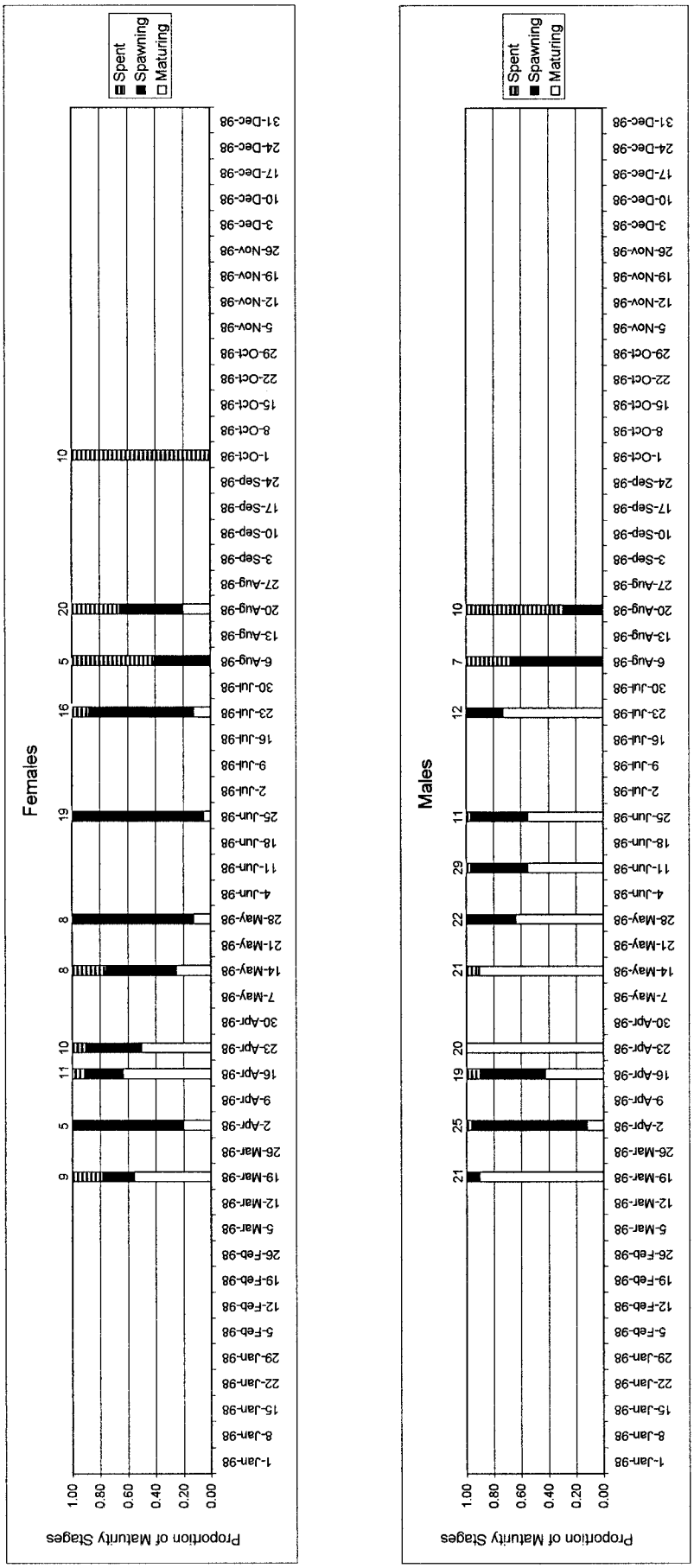


Fig. 6. Maturity stages of cod sampled at site W2 during 1998. The numbers on top of each bar represent the sample size.

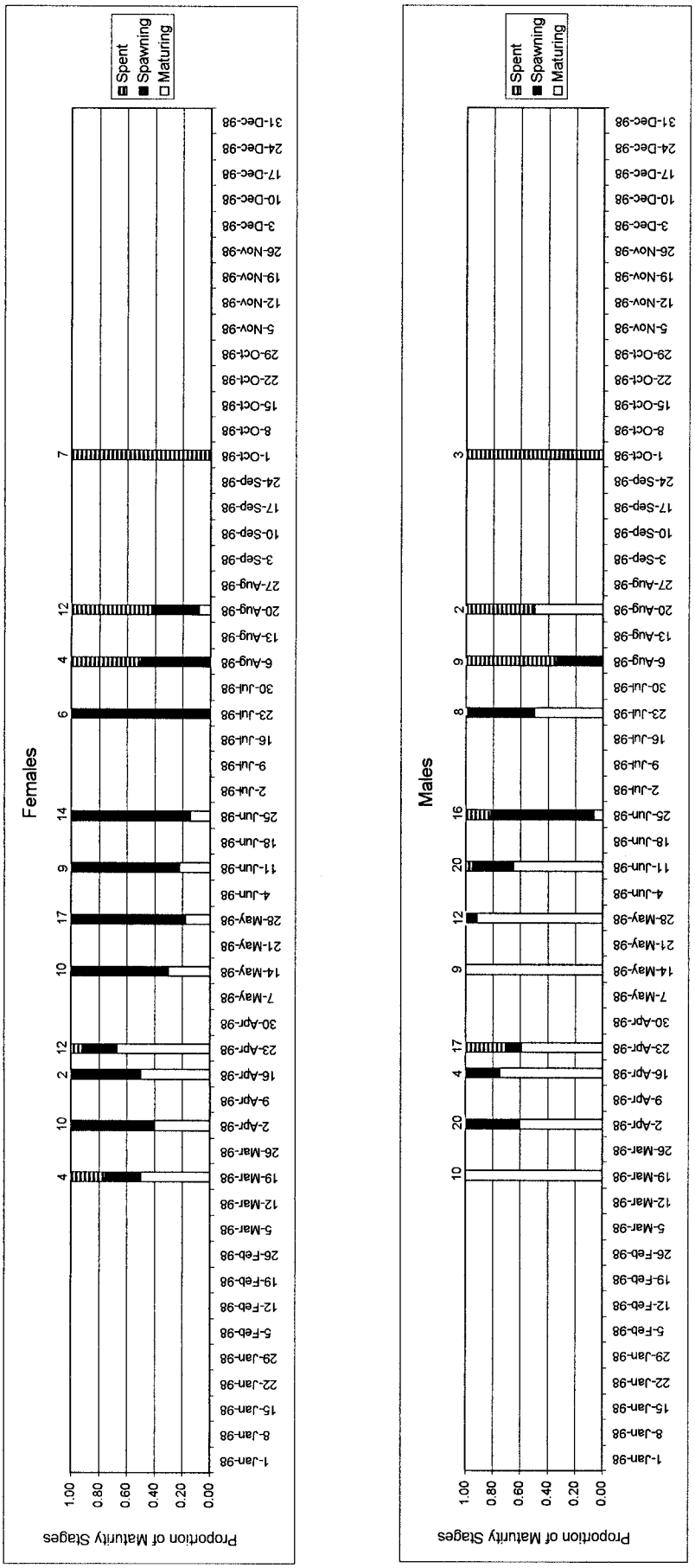


Fig. 7. Maturity stages of cod sampled at site N during 1998. The numbers on top of each bar represent the sample size.

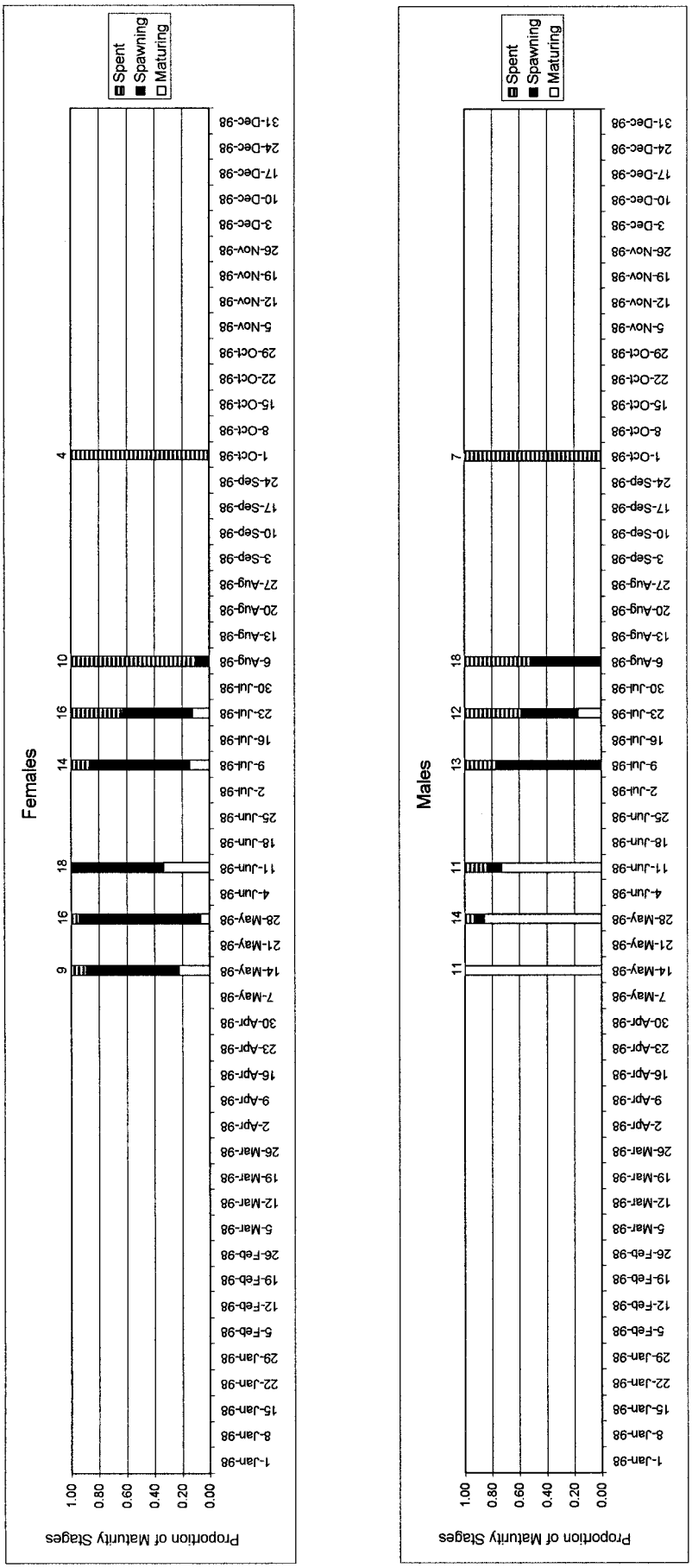


Fig. 8. Maturity stages of cod sampled at site E during 1998. The numbers on top of each bar represent the sample size.

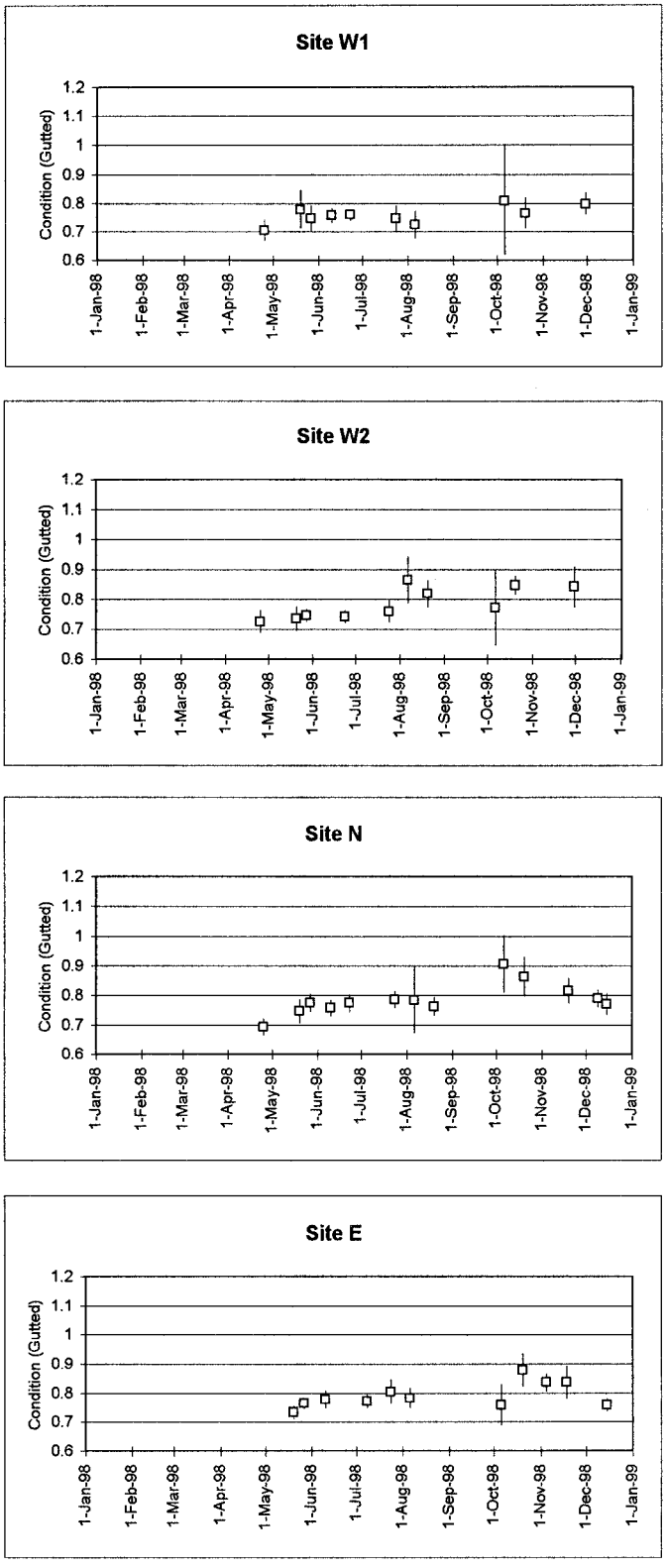


Fig. 9. Fulton's condition factor (gutted) for the female cod sampled at the four sites during 1998. Error bars are upper and lower 95% confidence intervals.

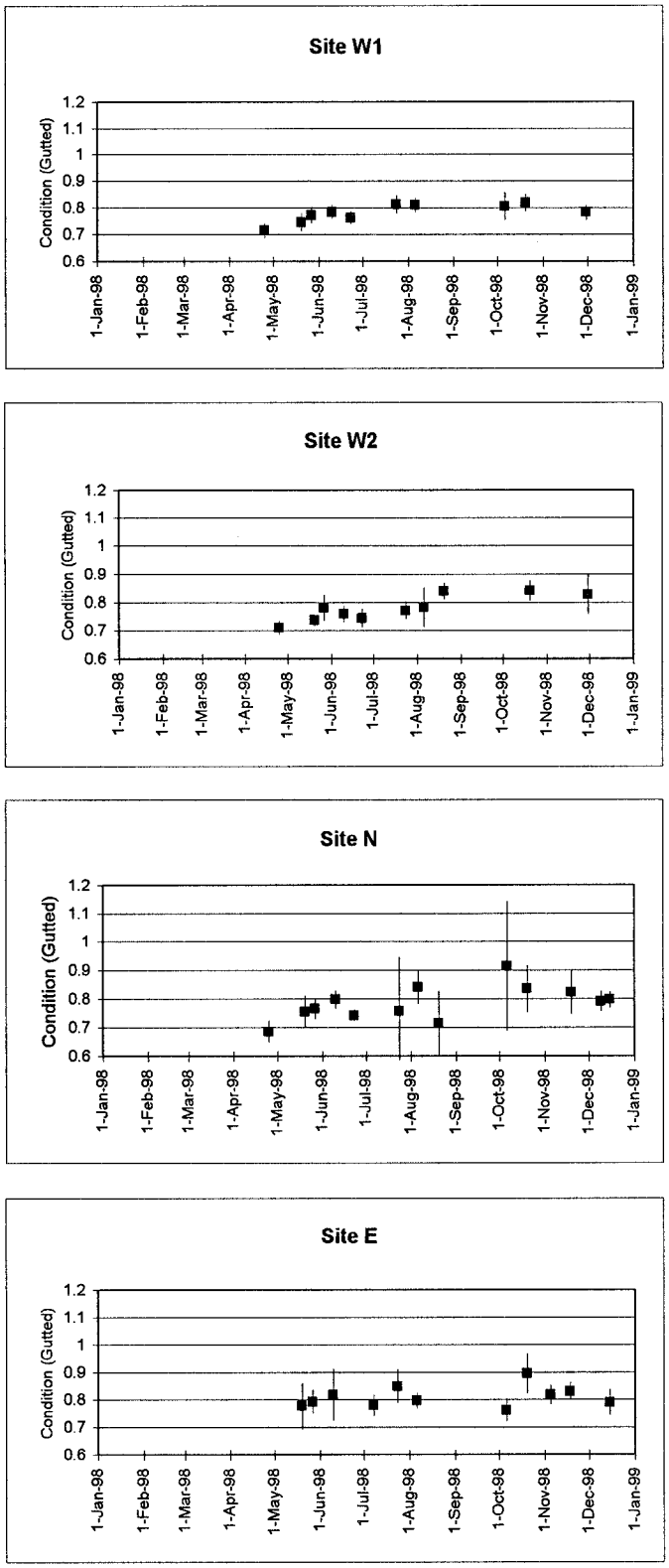


Fig. 10. Fulton's condition factor (gutted) for the male cod sampled at the four sites during 1998. Error bars are upper and lower 95% confidence intervals.

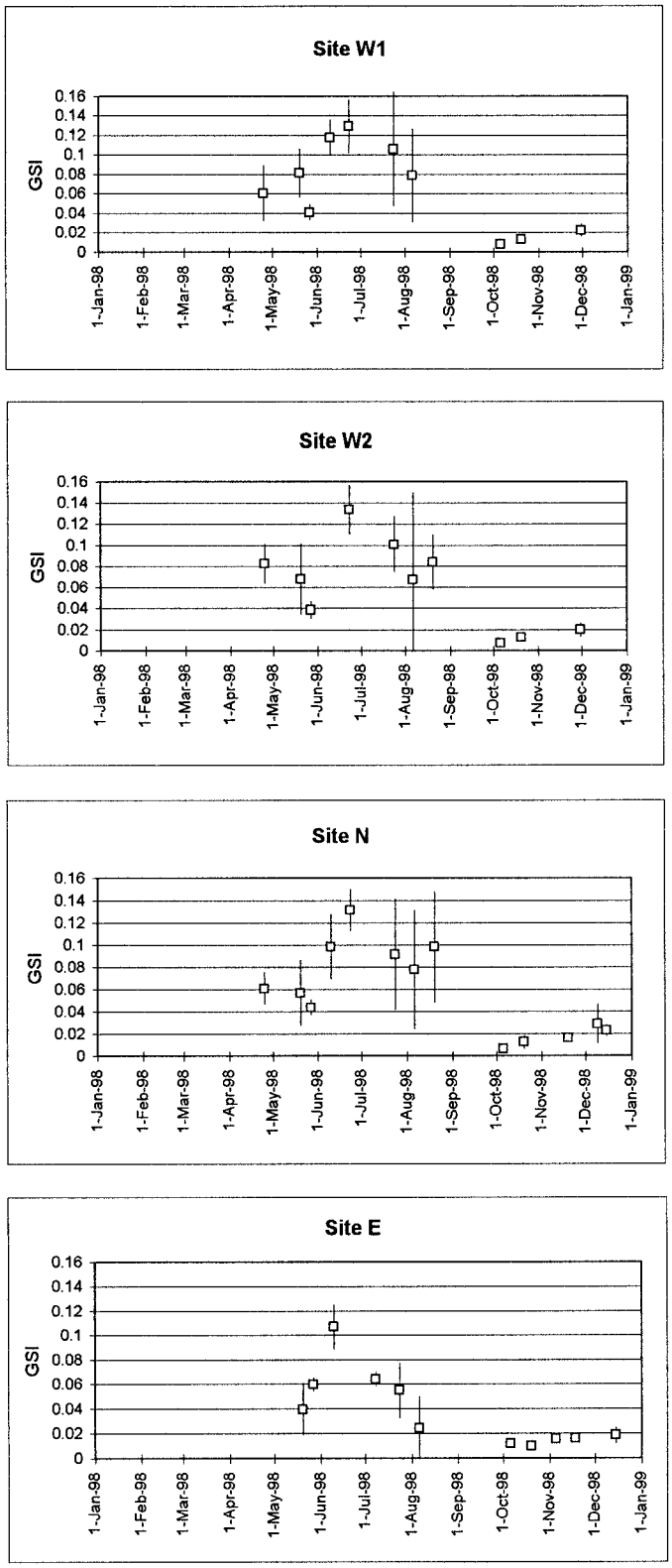


Fig. 11. Gonado Somatic Index (GSI) for the female cod sampled at the four sites during 1998. Error bars are upper and lower 95% confidence intervals.

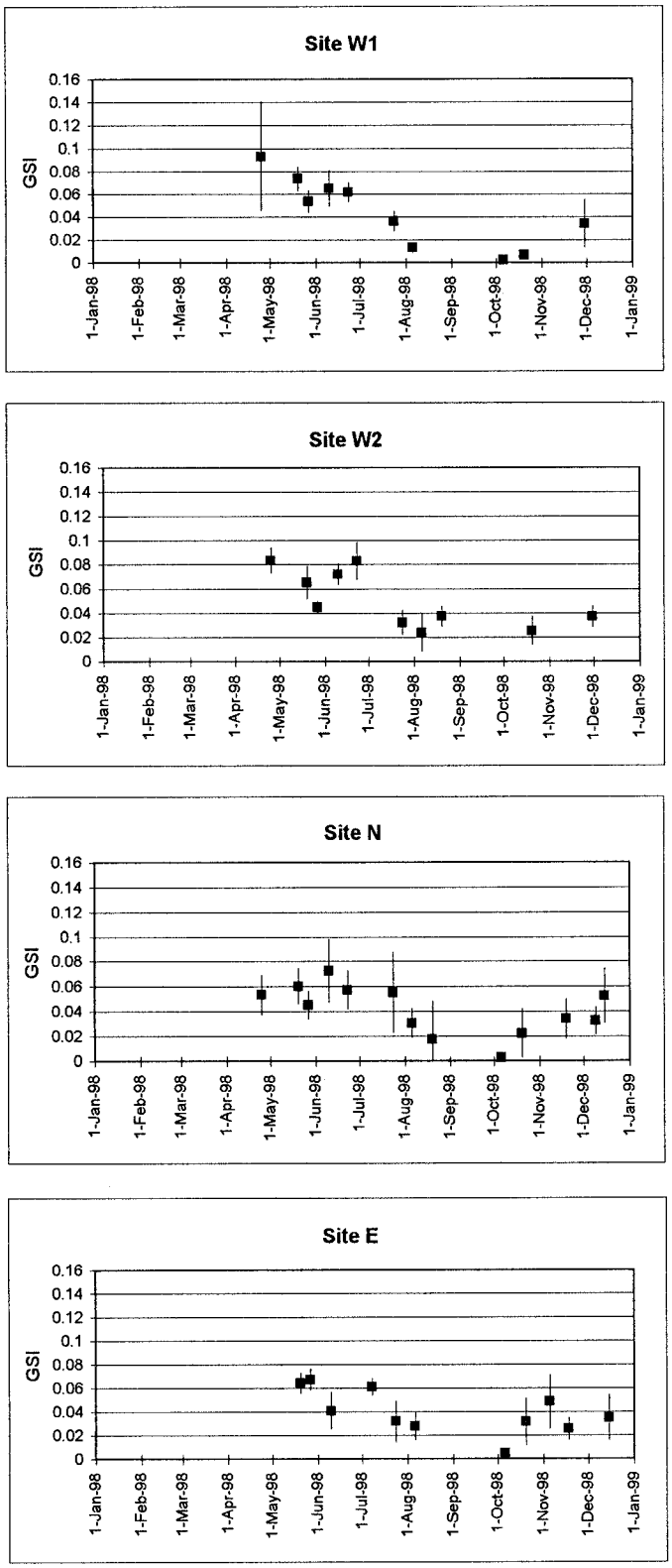


Fig. 12. Gonado Somatic Index (GSI) for the male cod sampled at the four sites during 1998. Error bars are upper and lower 95% confidence intervals.

Table 1. Detail of the Number of Female Spawning Stages Obtained through Histological and Visual Procedures for the Four Sites during 1998.

			Histological procedures				Visual procedures			
Site	Date	N	Imature	Maturing	Spawning	Spent	Imature	Maturing	Spawning	Spent
W1	3-Apr	5	1	2	2	0	1	2	2	0
	17-Apr	10	0	7	3	0	0	7	3	0
	25-Apr	12	1	5	4	2	2	8	1	1
	20-May	10	0	7	2	1	0	8	1	1
	27-May	5	0	2	3	0	0	3	2	0
	10-Jun	19	0	2	17	0	0	3	16	0
	23-Jun	11	0	1	10	0	0	2	9	0
	24-Jul	6	0	0	5	1	0	0	5	1
	6-Aug	10	0	0	7	3	0	0	7	3
	6-Oct	4	0	0	0	4	0	0	0	4
	20-Oct	12	0	0	0	12	0	0	0	12
	30-Nov	16	0	7	0	9	0	7	0	9
W2	20-Mar	9	0	4	3	2	0	4	3	2
	3-Apr	5	0	1	4	0	0	1	4	0
	17-Apr	11	0	7	3	1	0	7	3	1
	25-Apr	10	0	5	4	1	0	8	1	1
	20-May	9	1	2	4	2	0	4	2	3
	27-May	8	0	1	7	0	0	4	4	0
	10-Jun	1	0	1	0	0	0	1	0	0
	23-Jun	19	0	1	18	0	0	2	17	0
	24-Jul	18	2	2	12	2	0	2	12	4
	6-Aug	5	0	0	2	3	0	0	2	3
	20-Aug	20	0	4	9	7	1	4	9	6
	6-Oct	10	0	0	0	10	0	0	0	10
	20-Oct	18	0	0	0	18	0	0	0	18
	30-Nov	11	0	3	0	8	0	3	0	8
N	20-Mar	4	0	1	2	1	0	1	2	1
	3-Apr	10	0	4	6	0	0	4	6	0
	17-Apr	4	0	2	2	0	0	2	2	0
	25-Apr	13	1	8	3	1	1	10	1	1
	20-May	13	3	3	7	0	0	6	4	3
	27-May	17	0	3	14	0	0	6	11	0
	10-Jun	10	1	2	7	0	1	2	7	0
	23-Jun	14	0	2	12	0	0	3	11	0
	24-Jul	7	1	0	6	0	1	0	6	0
	6-Aug	4	0	0	2	2	0	0	2	2
	20-Aug	12	0	1	4	7	0	1	4	7
	6-Oct	7	0	0	0	7	0	0	0	7
	20-Oct	8	0	0	0	8	0	0	0	8
	19-Nov	16	0	4	0	12	0	4	0	12
	9-Dec	15	0	4	0	11	0	1	0	14
	15-Dec	13	0	0	0	13	0	0	0	13
E	20-May	19	9	3	6	1	0	16	2	1
	27-May	16	0	1	14	1	0	8	7	1
	10-Jun	19	1	6	12	0	1	6	12	0
	8-Jul	17	3	2	10	2	0	3	9	5
	24-Jul	18	2	2	8	6	0	2	8	8
	6-Aug	10	0	0	1	9	0	0	1	9
	6-Oct	4	0	0	0	4	0	0	0	4
	20-Oct	16	0	0	0	16	0	0	0	16
	5-Nov	15	0	1	0	14	0	1	0	14
	18-Nov	18	0	3	0	15	0	3	0	15
	15-Dec	16	0	4	0	12	0	4	0	12

Table 3. Results of the maturity stage proportions variability among sites and dates (ANOVA, GLM)

Y = proportion of maturing females X = site and date

Source	DF	Type III SS	Mean Square	F Value	Pr > F
SITE	3	0.0288761	0.0096254	0.22	0.8823
DATE	6	1.1979692	0.1996615	4.53	0.0072
SITE*DATE	15	0.4596777	0.0306452	0.69	0.7570

Y = proportion of spawning females X = site and date

Source	DF	Type III SS	Mean Square	F Value	Pr > F
SITE	3	0.1407504	0.0469168	0.69	0.5706
DATE	6	1.7866192	0.2977699	4.39	0.0083
SITE*DATE	15	0.5088567	0.0339238	0.50	0.9065

Y = proportion of spent females X = site and date

Source	DF	Type III SS	Mean Square	F Value	Pr > F
SITE	3	0.0721388	0.0240463	3.31	0.0471
DATE	6	3.7543454	0.6257242	86.08	0.0001
SITE*DATE	15	0.1888786	0.0125919	1.73	0.1432

Y = proportion of maturing males X = site and date

Source	DF	Type III SS	Mean Square	F Value	Pr > F
SITE	3	0.0410550	0.0136850	0.14	0.9317
DATE	6	3.3271347	0.5545225	5.86	0.0022
SITE*DATE	14	0.5451840	0.0389417	0.41	0.9489

Y = proportion of spawning males X = site and date

Source	DF	Type III SS	Mean Square	F Value	Pr > F
SITE	3	0.0199878	0.0066626	0.10	0.9576
DATE	6	1.0660530	0.1776755	2.72	0.0511
SITE*DATE	14	0.3084976	0.0220355	0.34	0.9763

Y = proportion of spent males X = site and date

Source	DF	Type III SS	Mean Square	F Value	Pr > F
SITE	3	0.0249446	0.0083149	0.44	0.7283
DATE	6	2.9439788	0.4906631	25.90	0.0001
SITE*DATE	14	0.1706459	0.0121890	0.64	0.7937

Table 2. Details of 41 Samples Collected in the Four Sites during 1998 for the Determination of Maturity Stages.

	Female numbers					Male numbers				
Site	Date	N	Maturing	Spawning	Spent	Date	N	Maturing	Spawning	Spent
W1	3-Apr	4	2	2	0	3-Apr	25	8	16	1
	17-Apr	10	7	3	0	17-Apr	20	16	3	1
	25-Apr	11	5	4	2	25-Apr	11	9	1	1
	20-May	10	7	2	1	20-May	15	15	0	0
	27-May	5	2	3	0	27-May	13	9	4	0
	10-Jun	19	2	17	0	10-Jun	11	9	2	0
	23-Jun	11	1	10	0	23-Jun	19	7	11	1
	24-Jul	6	0	5	1	24-Jul	24	0	15	9
	6-Aug	10	0	7	3	6-Aug	18	1	4	13
	6-Oct	4	0	0	4	6-Oct	6	0	0	6
W2	20-Mar	9	4	3	2	20-Mar	21	19	2	0
	3-Apr	5	1	4	0	3-Apr	25	3	21	1
	17-Apr	11	7	3	1	17-Apr	19	8	9	2
	25-Apr	10	5	4	1	25-Apr	20	20	0	0
	20-May	8	2	4	2	20-May	21	19	0	2
	27-May	8	1	7	0	27-May	22	14	8	0
	10-Jun	1	1	0	0	10-Jun	29	16	12	1
	23-Jun	19	1	18	0	23-Jun	11	8	3	0
	24-Jul	16	2	12	2	24-Jul	12	0	8	4
	6-Aug	5	0	2	3	6-Aug	7	0	2	5
	20-Aug	20	4	9	7	20-Aug	10	9	0	1
	6-Oct	10	0	0	10					
N	20-Mar	4	1	2	1	20-Mar	10	10	0	0
	3-Apr	10	4	6	0	3-Apr	20	12	8	0
	17-Apr	4	2	2	0	17-Apr	6	4	2	0
	25-Apr	12	8	3	1	25-Apr	17	10	2	5
	20-May	10	3	7	0	20-May	9	9	0	0
	27-May	17	3	14	0	27-May	12	11	1	0
	10-Jun	9	2	7	0	10-Jun	20	13	6	1
	23-Jun	14	2	12	0	23-Jun	16	1	12	3
	24-Jul	6	0	6	0	24-Jul	8	4	4	0
	6-Aug	4	0	2	2	6-Aug	9	0	3	6
	20-Aug	12	1	4	7	20-Aug	2	1	0	1
	6-Oct	7	0	0	7	6-Oct	3	0	0	3
E	20-May	10	3	6	1	20-May	11	11	0	0
	27-May	16	1	14	1	27-May	14	12	1	1
	10-Jun	18	6	12	0	10-Jun	11	8	1	2
	8-Jul	14	2	10	2	8-Jul	13	0	10	3
	24-Jul	16	2	8	6	24-Jul	12	2	5	5
	6-Aug	10	0	1	9	6-Aug	18	0	9	9
	6-Oct	4	0	0	4	6-Oct	7	0	0	7

Table 4. Average Fulton's Gutted Condition Factors (FCF) with their 95% Confidence Interval for the Cod Sampled in the Four Sites During 1998.

Females					Males				
		95% Confidence interval					95% Confidence interval		
Site	Date	Uper Limit	Lower Limit	FCF	Site	Date	Uper Limit	Lower Limit	FCF
W1	25-Apr	0.741	0.668	0.704	W1	25-Apr	0.741	0.687	0.714
	20-May	0.845	0.711	0.778		20-May	0.778	0.710	0.744
	27-May	0.792	0.698	0.745		27-May	0.803	0.741	0.772
	10-Jun	0.783	0.731	0.757		10-Jun	0.808	0.758	0.783
	23-Jun	0.780	0.737	0.758		23-Jun	0.784	0.738	0.761
	24-Jul	0.793	0.700	0.746		24-Jul	0.846	0.777	0.812
	6-Aug	0.772	0.676	0.724		6-Aug	0.836	0.783	0.809
	6-Oct	1.000	0.617	0.809		6-Oct	0.858	0.753	0.805
	20-Oct	0.819	0.710	0.765		20-Oct	0.850	0.785	0.817
	30-Nov	0.836	0.758	0.797		30-Nov	0.808	0.755	0.781
W2	25-Apr	0.762	0.688	0.725	W2	25-Apr	0.734	0.683	0.708
	20-May	0.775	0.695	0.735		20-May	0.754	0.716	0.735
	27-May	0.766	0.725	0.746		27-May	0.824	0.733	0.779
	23-Jun	0.762	0.720	0.741		10-Jun	0.788	0.728	0.758
	24-Jul	0.795	0.722	0.758		23-Jun	0.776	0.711	0.743
	6-Aug	0.943	0.785	0.864		24-Jul	0.801	0.740	0.771
	20-Aug	0.864	0.774	0.819		6-Aug	0.852	0.712	0.782
	6-Oct	0.898	0.644	0.771		20-Aug	0.868	0.808	0.838
	20-Oct	0.879	0.814	0.846		20-Oct	0.875	0.804	0.839
	30-Nov	0.909	0.773	0.841		30-Nov	0.897	0.756	0.827
N	25-Apr	0.721	0.664	0.693	N	25-Apr	0.723	0.649	0.686
	20-May	0.786	0.706	0.746		20-May	0.808	0.702	0.755
	27-May	0.805	0.745	0.775		27-May	0.801	0.731	0.766
	10-Jun	0.784	0.730	0.757		10-Jun	0.829	0.766	0.798
	23-Jun	0.804	0.743	0.774		23-Jun	0.763	0.722	0.742
	24-Jul	0.816	0.757	0.786		24-Jul	0.946	0.568	0.757
	6-Aug	0.897	0.671	0.784		6-Aug	0.898	0.781	0.840
	20-Aug	0.794	0.732	0.763		20-Aug	0.826	0.601	0.714
	6-Oct	1.003	0.809	0.906		6-Oct	1.142	0.686	0.914
	20-Oct	0.931	0.797	0.864		20-Oct	0.916	0.753	0.835
	19-Nov	0.860	0.770	0.815		19-Nov	0.899	0.745	0.822
	9-Dec	0.820	0.759	0.789		9-Dec	0.826	0.756	0.791
	15-Dec	0.807	0.735	0.771		15-Dec	0.824	0.768	0.796
E	20-May	0.757	0.709	0.733	E	20-May	0.858	0.694	0.776
	27-May	0.782	0.745	0.763		27-May	0.835	0.750	0.792
	10-Jun	0.809	0.747	0.778		10-Jun	0.910	0.724	0.817
	8-Jul	0.795	0.746	0.770		8-Jul	0.817	0.741	0.779
	24-Jul	0.847	0.761	0.804		24-Jul	0.909	0.786	0.848
	6-Aug	0.816	0.747	0.782		6-Aug	0.824	0.767	0.796
	6-Oct	0.829	0.688	0.758		6-Oct	0.802	0.720	0.761
	20-Oct	0.936	0.821	0.878		20-Oct	0.967	0.823	0.895
	5-Nov	0.868	0.803	0.835		5-Nov	0.852	0.782	0.817
	18-Nov	0.894	0.779	0.836		18-Nov	0.861	0.799	0.830
	15-Dec	0.779	0.736	0.758		15-Dec	0.835	0.743	0.789

Table 5. Average Gonado Somatic Indexes (GSI) with their 95% Confidence Interval for the Cod Sampled in the Four Sites During 1998.

Females					Males				
		95% Confidence interval					95% Confidence interval		
Site	Date	Uper Limit	Lower Limit	GSI	Site	Date	Uper Limit	Lower Limit	GSI
W1	25-Apr	0.089	0.032	0.060	W1	25-Apr	0.140	0.045	0.093
	20-May	0.106	0.056	0.081		20-May	0.085	0.063	0.074
	27-May	0.049	0.033	0.041		27-May	0.064	0.044	0.054
	10-Jun	0.136	0.099	0.117		10-Jun	0.081	0.049	0.065
	23-Jun	0.156	0.102	0.129		23-Jun	0.071	0.053	0.062
	24-Jul	0.165	0.047	0.106		24-Jul	0.045	0.027	0.036
	6-Aug	0.126	0.031	0.079		6-Aug	0.018	0.008	0.013
	6-Oct	0.010	0.005	0.008		6-Oct	0.003	0.001	0.002
	20-Oct	0.017	0.009	0.013		20-Oct	0.009	0.004	0.007
	30-Nov	0.030	0.015	0.023		30-Nov	0.055	0.013	0.034
W2	25-Apr	0.101	0.064	0.082	W2	25-Apr	0.094	0.073	0.083
	20-May	0.102	0.034	0.068		20-May	0.079	0.051	0.065
	27-May	0.047	0.030	0.039		27-May	0.050	0.039	0.044
	23-Jun	0.157	0.110	0.133		10-Jun	0.081	0.063	0.072
	24-Jul	0.127	0.074	0.100		23-Jun	0.099	0.067	0.083
	6-Aug	0.150	-0.015	0.067		24-Jul	0.043	0.022	0.032
	20-Aug	0.110	0.058	0.084		6-Aug	0.039	0.008	0.023
	6-Oct	0.009	0.006	0.007		20-Aug	0.046	0.029	0.037
	20-Oct	0.016	0.010	0.013		20-Oct	0.037	0.013	0.025
	30-Nov	0.027	0.013	0.020		30-Nov	0.046	0.028	0.037
N	25-Apr	0.075	0.046	0.061	N	25-Apr	0.069	0.037	0.053
	20-May	0.086	0.027	0.057		20-May	0.075	0.046	0.060
	27-May	0.051	0.036	0.044		27-May	0.057	0.033	0.045
	10-Jun	0.128	0.069	0.099		10-Jun	0.098	0.047	0.073
	23-Jun	0.150	0.113	0.132		23-Jun	0.073	0.042	0.057
	24-Jul	0.142	0.041	0.091		24-Jul	0.088	0.023	0.055
	6-Aug	0.131	0.024	0.077		6-Aug	0.043	0.018	0.030
	20-Aug	0.148	0.048	0.098		20-Aug	0.049	-0.014	0.017
	6-Oct	0.009	0.004	0.006		6-Oct	0.004	0.001	0.002
	20-Oct	0.018	0.007	0.013		20-Oct	0.042	0.003	0.022
	19-Nov	0.020	0.013	0.016		19-Nov	0.050	0.017	0.034
	9-Dec	0.047	0.011	0.029		9-Dec	0.044	0.021	0.032
	15-Dec	0.028	0.018	0.023		15-Dec	0.074	0.030	0.052
E	20-May	0.061	0.019	0.040	E	20-May	0.073	0.055	0.064
	27-May	0.065	0.054	0.060		27-May	0.077	0.058	0.067
	10-Jun	0.125	0.088	0.107		10-Jun	0.057	0.025	0.041
	8-Jul	0.070	0.058	0.064		8-Jul	0.069	0.054	0.061
	24-Jul	0.077	0.032	0.055		24-Jul	0.049	0.014	0.032
	6-Aug	0.050	-0.001	0.024		6-Aug	0.039	0.016	0.027
	6-Oct	0.016	0.008	0.012		6-Oct	0.007	0.002	0.005
	20-Oct	0.012	0.008	0.010		20-Oct	0.051	0.011	0.031
	5-Nov	0.019	0.012	0.015		5-Nov	0.072	0.025	0.048
	18-Nov	0.020	0.013	0.016		18-Nov	0.035	0.015	0.025
	15-Dec	0.025	0.012	0.018		15-Dec	0.055	0.015	0.035