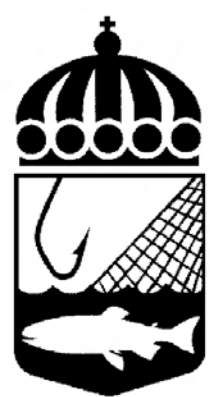


DISCORDANCE BETWEEN HISTOLOGICAL AND VISUAL INSPECTION AND EVALUATION OF ALTERNATIVE CRITERIA IN MATURITY JUDGMENT OF COD (*Gadus morhua*)



F.Vitale, H. Svedäng and M. Cardinale
National Board of Fisheries, Institute of Marine Research, Lysekil, SWEDEN

AIMS

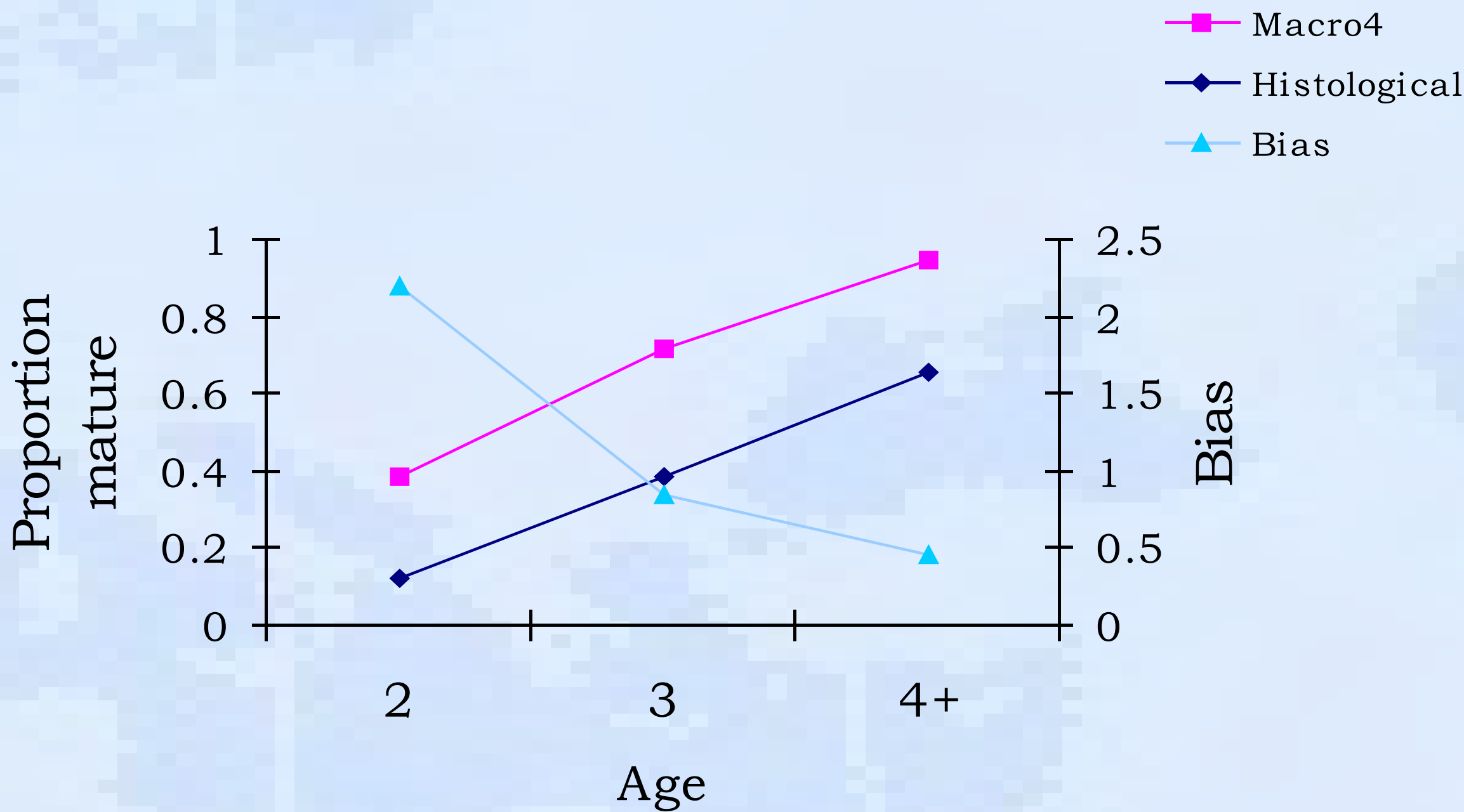
- 1 To compare the maturity stages based on the histological and visual inspection
- 2 To investigate some morphological parameters and their usefulness in the determination of maturity stage
- 3 To study the effect of macroscopic bias on the historical Spawning Stock Biomass (SSB) estimates

CONCLUSIONS

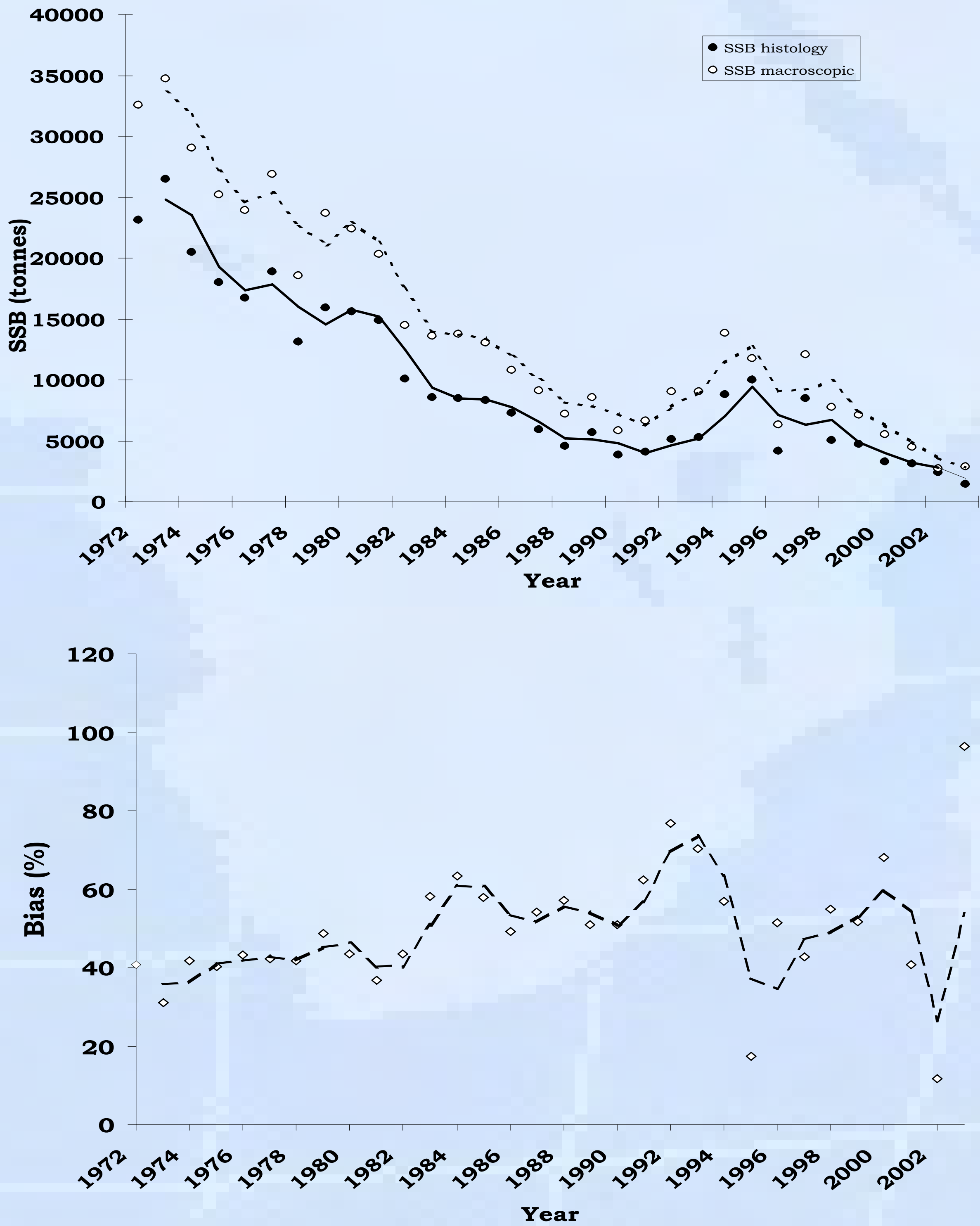
- 1 The comparison between histological and macroscopic analysis showed significant inconsistencies. The macroscopic maturity scale largely overestimated the proportion of mature individuals in the three age classes considered.
- 2 The misclassification rates are higher in tree-models including macroscopic maturity. GSI, HIS and CF might be used as alternative criteria to recognize individuals building up the yolk reserve, in order to increase the precision of maturity evaluation when histological analysis is missing.
- 3 The SSB bias increased with decreasing SSB, in association with the proportion of older mature individauls. Moreover, when SSB is very low and compressed in age classes 3 and 4 an increased variability of SSB bias is observed. The risk is an unpredictable and possible large error in estimating

RESULTS

1 Comparison macroscopical & microscopical inspections



3 Effect of the bias on the historical SSB estimates



MATERIALS & METHODS

- 518 individuals from the Sound and Kattegat, collected monthly from September 2002 until May 2003
- Total Lenght (TL), Total Weight (TW), Gonad (GW) & Liver (LW) Weight
- Histological & Visual Inspection of gonads
- Data analyses: Comparison Macroscopical/Histological maturity judgment
Classification rates of alternative variables. Use of Tree-Model
Revision of the historical Spawning Stock Biomass estimates

2 Classification rates of alternative variables. Tree-model

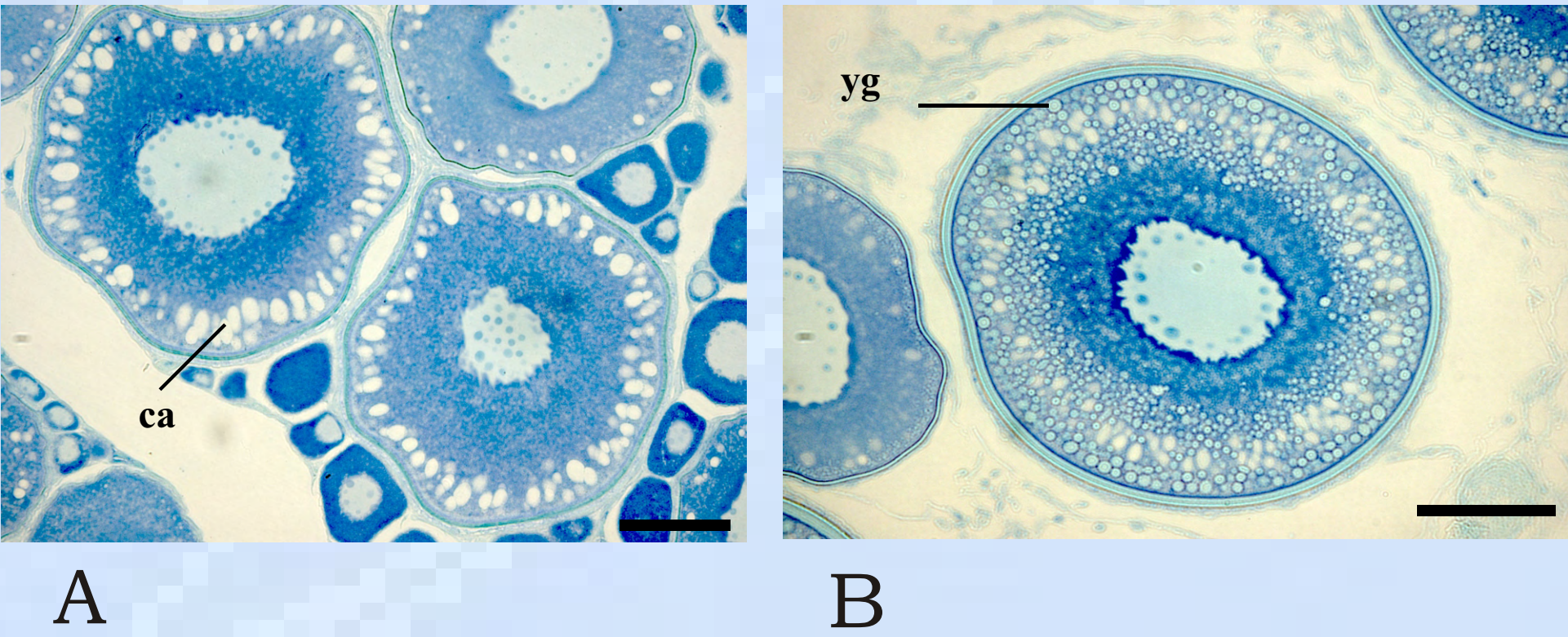
Models	Variables used
Complex Model (CM)	: TL, Area, Month, Age, Macroscopic Mat.
Simple Model (SM)	: TL, Area, Month, Macroscopic Mat.
Complex Without Macroscopic Maturity (CWM)	: TL, Month, Age, GSI, HIS, CF
Simple Without Macroscopic Maturity (SWM)	: Age, GSI, HIS
All	: TL, Area, Month, Age, Macroscopic Mat., GSI, HIS, CF

Age	CM	SM	CWM	SWM	All
2	5.9	10.2	2.0	3.9	2.0
3	20.7	20.1	7.9	14.0	12.8
4+	15.3	20.4	4.1	11.2	6.1
Total	12.4	15.3	4.3	8.5	6.2

Nodes	50	8	27	6	26
Misclassification rates (%)					

BACKGROUND

Cod stock in the Kattegat has experienced a sharp decline in abundance during the last two decades due to intensive exploitation(Cardinale & Svedäng, 2004). One of the important parameter to assess fish stock status relies on an estimation of the proportion of spawning fish (SSB) within age classes. At present, assessment of cod stocks within ICES framework relies on a 4-stages macroscopic scale to estimate the proportion of mature individuals within each age class. However, there is large concern about the consistency of macroscopic gonadal evaluation, as it is difficult to discriminate between non-maturing and maturing fish by visual inspection, especially at the pre-spawning phase. On the other hand, histology has proved to have greater reliability than traditional macroscopic evaluation. The histology of cod ovaries from the Sound and Kattegat has been studied in Vitale *et al* (2004). In the picture below, it is shown the crucial step in the developmental process, i.e. the passage from *endogenous* to *exogenous vitellogenesis*. As a matter of fact, only fish that have attained *exogenous vitellogenesis* can be considered as being reproductively active in the forthcoming breeding season.



Transverse sections of ovaries showing oocytes at two different stages. (A) Endogenous vitellogenesis (B)Exogenous vitellogenesis. ca: cortical alveolus; yg: yolk granule. Scale bar 25 µm. Toluidine blue staining.

REFERENCES

Cardinale, M. & Svedäng, H. (2004). Modelling recruitment and abundance of Atlantic cod, *Gadus morhua*, in the Kattegat - Eastern Skagerrak (North Sea): evidence of severe depletion due to a prolonged period of high fishing pressure, Fisheries Research, in press.

F. Vitale, M. Cardinale and H. Svedäng (2004). Evaluation of the temporal development of the ovaries in cod (*Gadus morhua*) from the Sound and Kattegat. Journal of Fish Biology, submitted.