

Short communication

Comparison of long-term trends in growth of sole and plaice populations

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Millner, R., Flatman, S., Rijnsdorp, A. D., Beek, F. A. van, De Clerck, R., Damm, U., Tetard, A., and Forest, A. 1996. Comparison of long-term trends in growth of sole and plaice populations. – ICES Journal of Marine Science, 53: 1196–1198.

Trends in growth of sole and plaice stocks were examined from ICES areas IV, VII and VIII for periods of 10–20 years. Within each area, there were significant differences between plaice and sole in the trends in catch weight-at-age. Plaice showed a general decline in weight in most stocks compared with more variable trends in sole. The changes in growth were thought to be related to both environmental factors and fishing pressure.

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Key words: sole, plaice, growth, density-dependence.

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Introduction

Sole and plaice show overlapping distributions in sea areas around the British Isles. Comparison of populations for differences both within and between areas may provide a means of assessing the importance of density-dependent and independent factors affecting growth.

A total of 11 plaice and sole stocks were examined to see whether there are consistent species or area trends in growth (Table 1). Each species within an ICES management area was considered as a separate stock for this analysis. Catch weight-at-age for stocks in ICES Areas IV, VII, and VIII were taken from published data in ICES Working Group reports. Trends in weight-at-age were examined and analysis of variance used to examine area, year, and age effects.

Results

A preliminary analysis showed that for each stock, trends in mean weight-at-age were similar over ages 4–8. Therefore, to simplify the analysis, an average

Table 1. List of the unit stocks by species and ICES Subdivisions used in the analysis.

Sole	IV, VIIa, VIIId, VIIe, VIIIf+g, VIII
Plaice	IV, VIIa, VIIId, VIIe, VIIIf+g

Table 2. Results of the generalized additive model fitted to Species, Area, and Year.

Source	df	SSq	MS	F
Model	49.6	4.19	0.084	101.0
Year	4.6	0.42	0.093	111.7
Area Year	5	0.55	0.110	131.5
Area Species+Year	5	0.51	0.102	122.2
Species Year	1	2.64	2.636	3151.0
Species Area+Year	1	2.60	2.597	3104.4
Species × Area Year	39	0.62	0.016	18.9
Residual	203.4	0.17	0.0008	

mean weight for these ages was used. Most stocks showed strong trends in growth over time (Fig. 1).

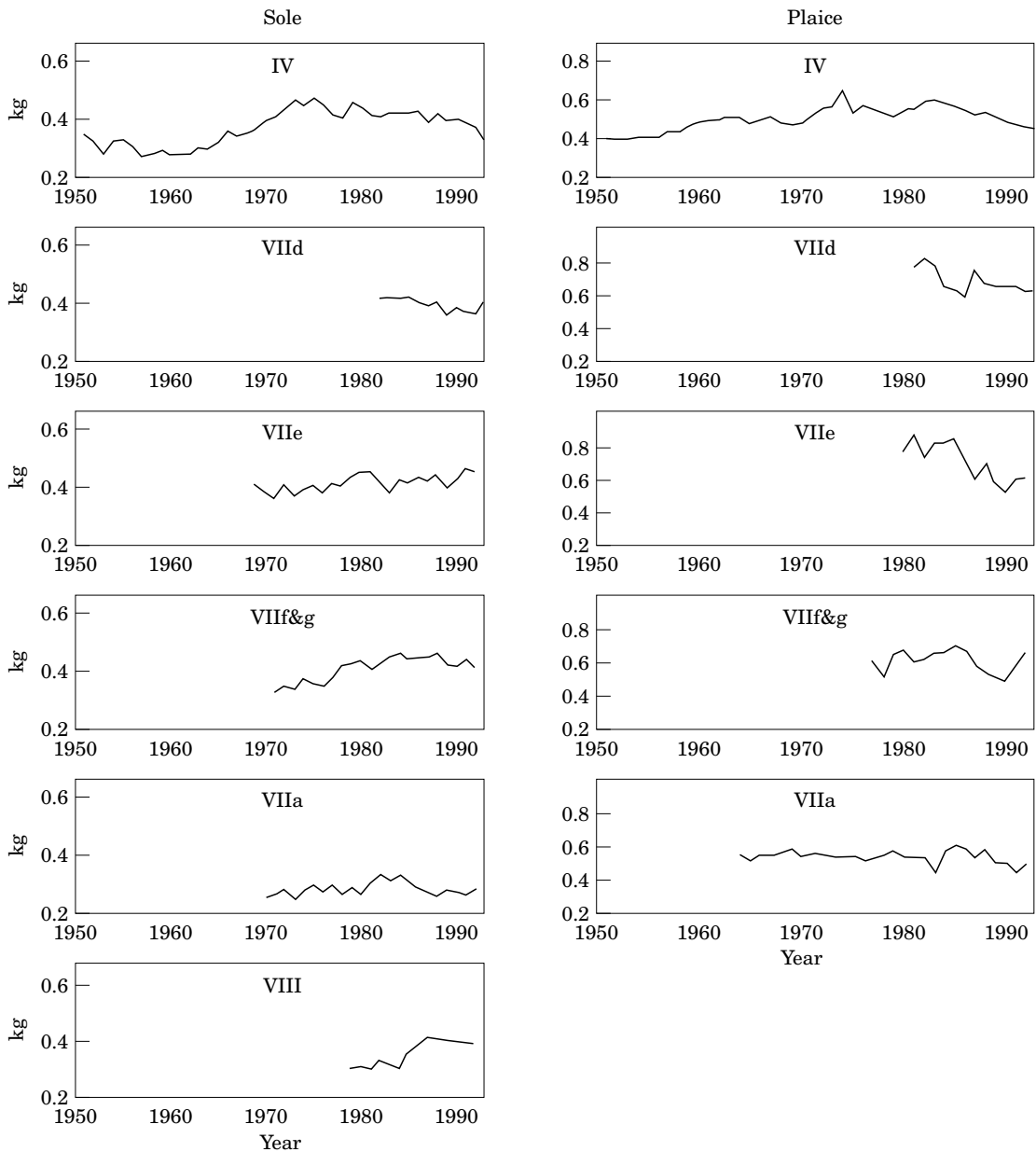


Figure 1. Trends in catch weight-at-age of sole and plaice for the mean of ages 4–8 by area.

In area IV, catch weight-at-age increased in plaice and sole in the 1960s and both species show a decline in more recent years. In the case of plaice, the decline in weight appears to have been both steeper and to have occurred over a longer period than for sole. A decrease in weight has occurred in all plaice stocks since the mid-1980s and, with the exception of VIIf+g, all stocks have been at or close to an historical minimum weight in recent years (1990–1992). In contrast, weight-at-age of sole in recent years has been lower

than in the mid-1980s in only three stocks (IV, VIIId, and VIIa).

Comparison of species trends within each region was made using a generalized additive model (Hastie and Tibshirani, 1990) fitted to Species, Area, and Year, with the Year effect modelled using a LOESS smoother and stock defined as a species/area combination. The analysis of variance is given in Table 2. There were significant differences in the species trends both between and within each area.

Conclusion

These results indicate that in most areas sole and plaice do not show similar trends in weight-at-age over time. If fishing pressure was mainly responsible for the changes in growth, it might have been expected that both species would show similar trends within each region. In plaice, the general decline in weight towards an historical minimum in all areas suggests there may be some overriding environmental signal which has affected all stocks in addition to any local factors such as fishing pressure and eutrophication (Rijnsdorp and van Leeuwen, 1994).

But in sole the changes appear to be more area-specific and it is not clear whether density-dependent and/or independent factors are more important.

References

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