Spatial variability in condition, growth and diet of juvenile plaice (*Pleuronectes platessa*) at sandy beach nursery grounds on the south west coast of Ireland.

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Introduction

Characterization of suitable habitat for settlement of juvenile flatfish is important for the management of nursery areas. Food availability is one important determinant of habitat quality that can affect condition and growth, and thus survival, of flatfish (Gibson, 1994).

Temporal variation in plaice diet (Amara et al., 2001) and trophic niche overlap between different flatfish species (Beyst et al., 1999; Cabral et al., 2002) has been widely studied whereas levels of intraspecific variation in plaice diet at small spatial scales are relatively unknown.

This study investigates how diet, growth and condition of juvenile plaice vary over small spatial scales. It also serves as a pilot study to assess the importance of scale for characterizing habitat quality for flatfish over a larger scale.

Methods

Juvenile plaice were collected from 3 beaches and from 3 replicate hauls on each beach using a beach seine on 3 consecutive days in September 2007 (Fig. 1 & 2).

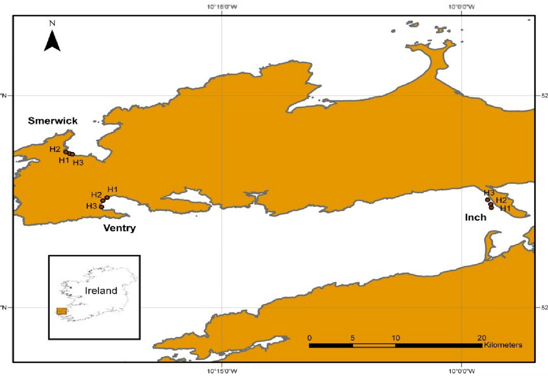

Fig. 1: Beach seine locations and position of 3 hauls (H1-H3) per beach.

Fig. 2: Beach seine used to sample flatfish.

Fig. 3: Gut content analysis

6 Plaice of 7-9 cm were randomly selected per haul and kept frozen until analysis:

- Length, weight and morphological characteristics were measured and Fulton's condition factor was calculated.
- Otolith microstructure analysis was used to assess recent daily growth rates.
- Gut content analyses of the total 54 juvenile plaice were carried out (Fig. 3).

Results

SPATIAL VARIATION IN GROWTH

- Fulton's K condition Index and mean otolith Increment width over the last 5 days (Fig. 4) were significantly higher for fish from Inch compared to fish from Ventry (p=0.0037 and p=0.0029, respectively; Two-way nested ANOVA with Tukey pairwise comparisons). There was no difference between hauls for either variable (p>0.05).

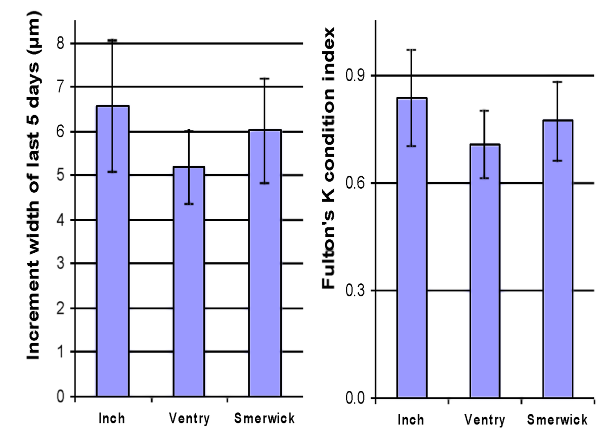

Fig. 4: Averages of growth measures per beach.

- Mouth gape was not correlated with fish length but showed higher values for Smerwick (4.05mm±0.12) compared to Inch (3.41mm±0.08) and Ventry (3.42mm±0.14) (p<0.001 and p=0.001 respectively; Two-way nested ANOVA with Tukey pairwise comparisons).

- ANCOVA with fish length included as a covariate showed that otolith size was significantly correlated with fish length (p<0.001) and that fish from Ventry had larger otoliths at a given length compared to fish from Inch (p=0.002, Fig.5 & 6). This reflects slower growth of plaice in Ventry compared to those in Inch on a longer term.

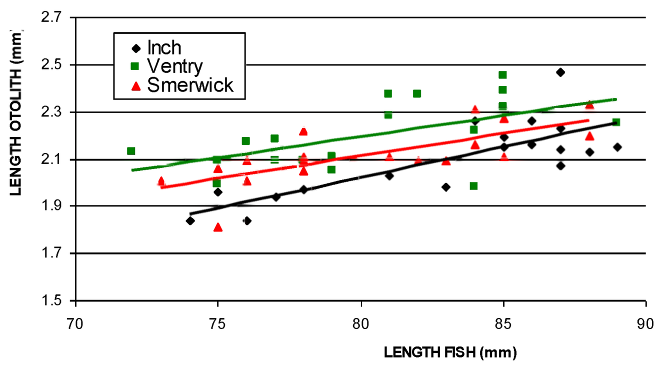

Fig. 5: Average Otolith length and Fish length ratio per beach.

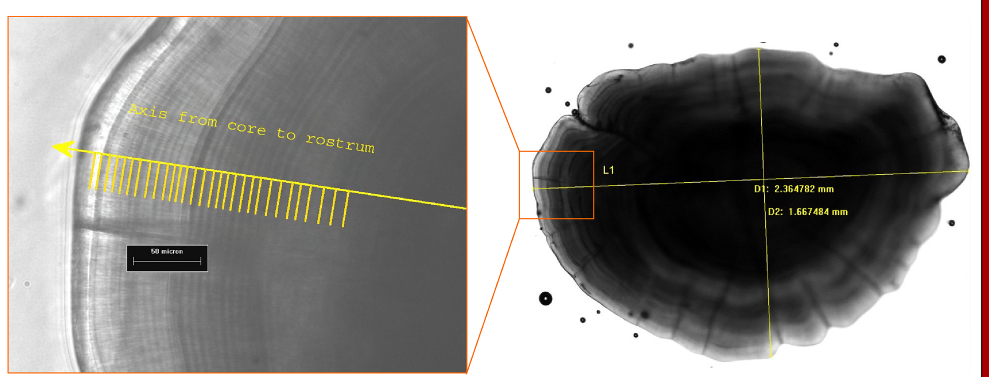

Fig. 6: Otolith daily increment width during the last 30 days.

Results

SPATIAL VARIATION IN DIET

- A Principal Component Analysis (PCA) characterized the 3 different beaches which were distinguished based on prey assemblages (Fig. 7) and prey descriptors (Table 1).

Inch is characterized by high abundances of Amphipods, Mysids and Cumacea; species rarely abundant at other beaches.

Smerwick is characterized by a high abundance of predominantly one prey item; siphons of bivalves.

Ventry reveals a high prey diversity but very low abundances of prey (Table 1 & Fig. 7).

However, gut composition also varied over smaller spatial scales (Fig. 8).

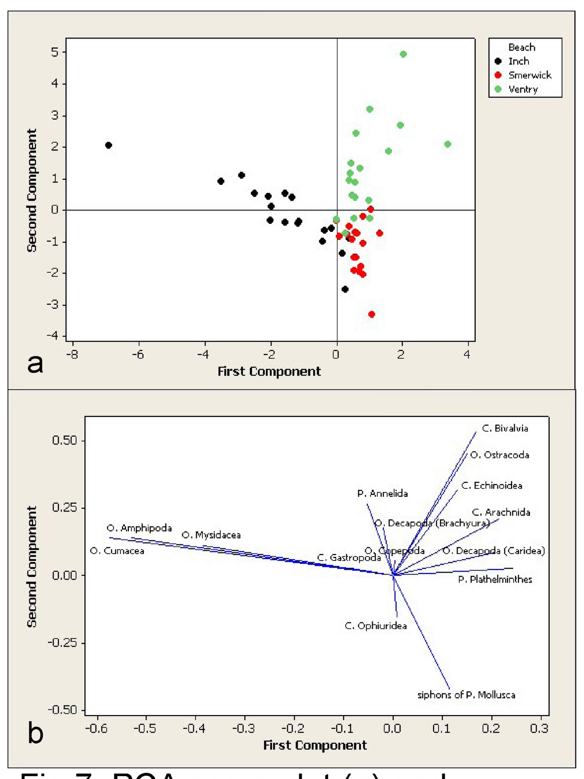

Fig.7: PCA score plot (a) and loading plot (b) based on PCA of relative measures of prey groups in juvenile plaice, individually indicated by dots in (a).

- ANOVA revealed significant variation in the diversity and volume of prey items between replicate hauls within beaches (Table 1)

	Beach Differences	Haul Differences
Tot. Prey Taxa	1.63 ns	4.37 **
Tot. Prey Abundance	9.87 ***	1.67 ns
Shannon-Wiener Prey Index	2.88 ns	4.05 **
% Stomach Fulness	0.40 ns	4.09 **

Table 1: Results of Two-Way nested ANOVA performed on diet descriptors, with F-value and levels of significance; ns, not significant; ** p<0.01; *** p<0.001

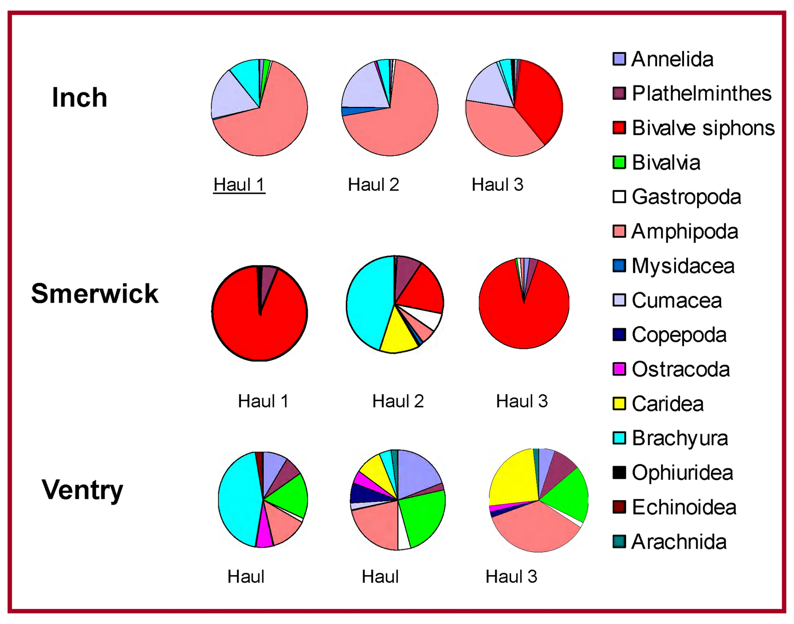

Fig. 8: Pie charts showing the taxonomic breakdown of prey items in the guts of juvenile plaice across replicate hauls on three beaches.

Conclusions

- Condition and growth of juvenile plaice varied over a spatial scale of several km's. This may reflect differences in habitat quality (diet or environmental conditions) between beaches. Further investigation is needed to determine the cause of the variability.
- Mouth gape varied significantly and considerably between beaches. This may reflect spatial variation in feeding behaviours, although further work is needed to confirm this.
- The composition and quantity of juvenile plaice gut contents varied over a small spatial scale (meters).
- Variation in composition of plaice diet was also observed over larger spatial scales (km's).
- The results highlight the importance of considering small scale variation when attempting to link broad scale habitat types to feeding, growth and condition of juvenile flatfish.

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