Preliminary observations of the behaviour of sea bass (*Dicentrarchus labrax*) during migration

Cefas

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Introduction

The distribution of European sea bass (*Dicentrarchus labrax*) changes seasonally as they migrate between feeding and spawning grounds, yet their behaviour during migrations is unknown. We used miniature electronic data storage tags (DSTs) that record depth and temperature to identify characteristic behaviours of sea bass at a fine temporal scale during migrations from and to spawning grounds within the North Sea and English Channel.

Method

A total of 89 sea bass (>36cm) were tagged in the North Sea and English Channel between November 2005 and October 2006. Bass were anaesthetised with 2-phenoxy-ethanol (0.5ml^{-1}) before tagging either internally with a G5 tag (Cefas Technology Limited www.cefastechnology.co.uk) or externally with a LTD1400 (Lotek marine technologies www.lotek.com). Tags were programmed to record temperature and depth every 10 minutes.
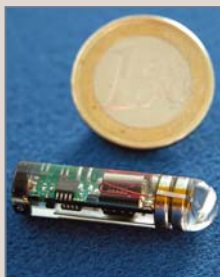
Above: G5 tag
Above right: Tagged sea bass

Results

To date 10 bass (11%) have been recaptured, of which four were at liberty between 55 – 79 days and migrated more than 100km (Figure 1). The six remaining bass were recaptured within 55 days and showed only limited dispersal from release sites (up to 89km).

Figure 1: Release and recapture positions of tagged bass. Release positions shown by white crosses and recapture positions shown by black circles.
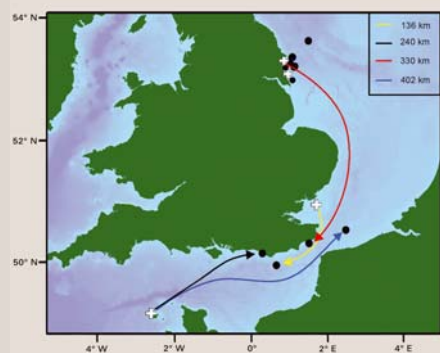
During their time at liberty, bass spent the majority of their time at shallow depths. We identified three distinct daily behaviour patterns (Figure 2; Table 1) that could be distinguished numerically on the basis of comparisons between the minimum depth, depth range and an index of activity calculated as the standard deviation of depth divided by mean depth. The most common behaviour pattern was '**mid-water**', during which bass resided well below the sea surface and made frequent ascents and descents (mean depth of 27m ± 6.8 m). The second most common behaviour pattern was '**diving**', during which bass undertook many large return dives (up to 70 m) to and from very shallow water, often just below the sea surface. The final behaviour type we identified was '**inshore**', during which bass remained in very shallow water (2 m ± 0.9 m) and during which depth changes often closely resembled the rise and fall of the tide.
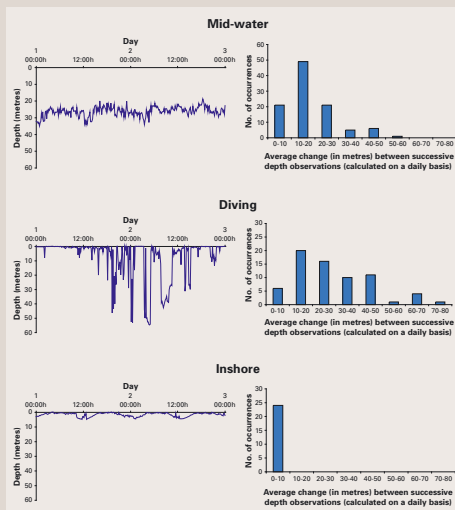

Figure 2: Behaviour patterns exhibited by bass. Left- Example depth data for each type. Right- Frequency distribution of the average change between successive depth observations (calculated on a daily basis) for each behaviour type in the full dataset.

Table 1: Criteria used to classify daily behavioural patterns. Behaviour patterns were first identified by eye, and summary statistics extracted (see text). The percentage agreement between visual classifications and numerical classifications is shown in the final column.

Behaviour pattern	Minimum depth	Depth range	Activity	Occurrence (days)	Success of numerical classification (%)
Inshore	< 3m	< 7m	< 0.55	24	83
Mid-water	> 3m	> 7m	< 0.55	96	93
Diving	< 3m	> 7m	> 0.55	76	81

The highly similar patterns of vetical movement of two bass tagged and released together off Guernsey provide evidence of shoaling for the first two weeks at liberty (Figure 3a) after which they appear to have separated (Figure 3b). One of the bass was caught three weeks later, over 400km from its release location, the other was caught four weeks later, 240km from release. Whilst they were shoaling, both fish occupied shallower water during the night than during the day (Figure 3a).
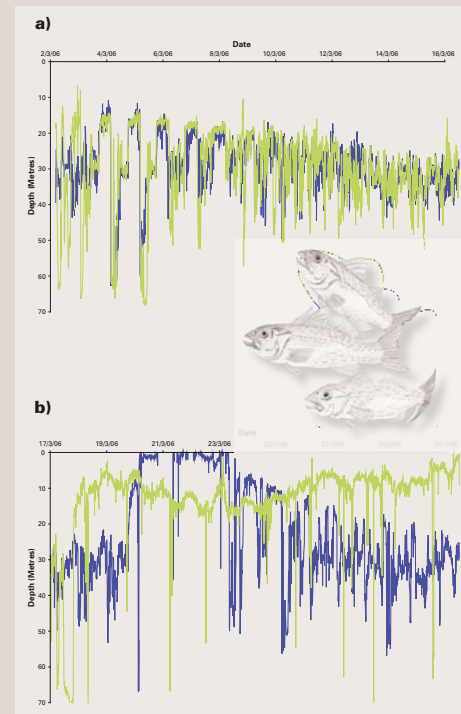

Figure 3a and 3b: Vertical depth movements of two sea bass released off Guernsey depicting (a) the first two weeks of their liberty, when their depths were closely matched (r = 0.43) and (b) the second two weeks of their liberty, when their depths were no longer significantly related (r = 0.19).

Conclusions

In summary, our study is the first application of electronic tags to investigate the behaviour of sea bass. Our results show that, overall, bass prefer to occupy the upper layers of the water column, but that behaviour (as evidenced by depth changes and depth selection) can change dramatically as bass migrate between spawning and feeding grounds. The recapture data are consistent with previous studies that suggest bass migrate annually between the North Sea and western English Channel.

Suggested further reading

Pawson, M. G., Pickett, G. D., Leballeur, J., Brown, M. & Fritsch, M. 2007. Migrations, fishery interactions and management units of sea bass (*Dicentrarchus labrax*) in Northwest Europe. **ICES** Journal of Marine Science, 64: 332–345.

Pawson, M.G., Kelly, D. F. & Pickett, G. D. 1987. The distribution and migrations of bass *Dicentrarchus labrax* L. in waters around England and Wales as shown by tagging. Journal of the Marine Biological Association of the UK, 67: 183-217.

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