Recolonisation by decapod crustaceans following dumping of dredge spoil

Cefas

S. R . J. Lovewell, M. T. Smith and J. T. Addison
The Centre for Environment, Fisheries & Aquaculture Science, Lowestoft
email: s.r.j.lovewell@cefas.co.uk http://www.cefas.co.uk

Background

There is a significant pot fishery for the European lobster *Homarus gammarus* around the Roughs Tower, off the East coast of England (Figure 1).

Improvements to the shipping channel for Felixstowe and Harwich required the dredging and disposal of an estimated 17.5Mm³ of material. A licence to use the Roughs Tower spoil ground was issued by Defra following studies by CEFAS and Hydraulics Research and discussion with interested parties. One licence condition was that a retaining clay bund would be deposited along the spoil ground's western edge.

Dredging work was completed in 2000. Beneficial use was made of sand, gravel and rock but around 14Mm³ of stiff clay was disposed of at Roughs Tower. Some heavy stone was redeposited along the outside of the clay bund to reinforce it and provide the basis for good lobster habitat. To assist with stabilisation of the clay and enhance habitat potential, gravel was spread over part of the spoil ground (Figure 2).

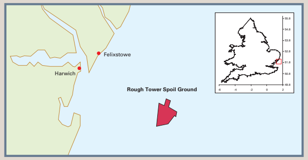

Figure 1. Harwich and Felixstowe on the East Coast of England and the Roughs Tower Spoil Ground

Figure 2. Spreading gravel over the Roughs Tower Spoil Ground

Monitoring

To provide insight into recovery at Roughs Tower, Harwich Haven Authority (HHA) financed a pot survey. Seven groups of five prawn pots were set and hauled periodically by a local fisherman. Six groups were sited on the spoil ground and the seventh was a control on nearby lobster ground (Figure 3). Pots were hauled weekly from 12 July 2001 to 25 August 2002 and then monthly until October 2003. On hauling, total contents and sizes of lobsters from each group of pots were recorded and evidence of accumulation of clay or sand noted.

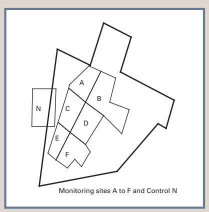

Figure 3. Sampling sites at Roughs Tower Spoil Ground

Results

Decapod species recorded were European lobster *(Homarus gammarus)*, edible crab *(Cancer pagurus)*, green crab *(Carcinus maenas)*, velvet swimming crab *(Necora puber)*, spider crab (not identified to species), hermit crab *(Pagurus sp.)*, swimming crab *(Liocarcinus sp.)*, brown shrimp *(Crangon crangon)*, pink shrimp *(Pandalus montagui)* and common prawn *(Palaemon serratus)*.

Species abundance

- Seasonal and spatial variations in abundance were apparent from visual inspection of the data (Figure 4).
- Lobsters were most abundant at the control site. Within the spoil ground lobsters were most abundant at the two sites closest to the control and were least abundant at sites most distant from the control.
- Green crabs, swimming crabs, hermit crabs and pink shrimps were least abundant at the control site, but were periodically abundant in different parts of the spoil ground, possibly reflecting ground type and/or the influence of tidal flow that has a NE to SW axis (Anon. 2002).
- In the first year green crabs and hermit crabs were very abundant at some sites, but abundance declined over the next 3 years. Abundance of other species varied without obvious spatial trends.
- Seasonality of capture was quite consistent. Lobsters, velvet swimming crabs and hermit crabs were generally caught late summer through to early winter. Green crabs, prawns and swimming crabs were generally caught during the summer or early autumn. Pink shrimps were most frequently taken in the winter. Edible crabs did not show any seasonal pattern of availability.

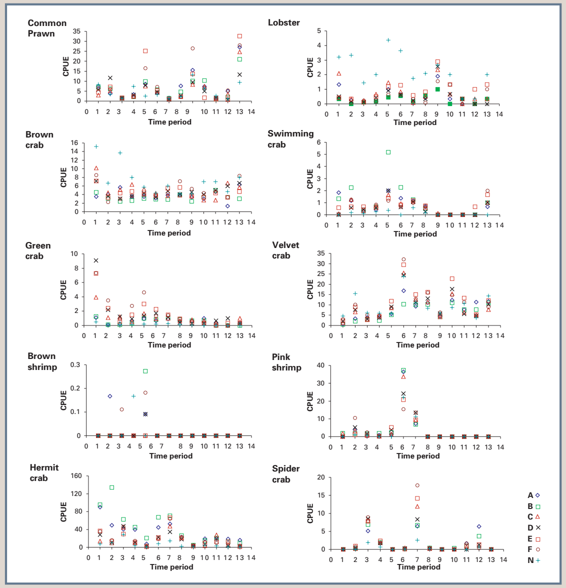

Figure 4. Abundance of decapod species by quarterly time period and site

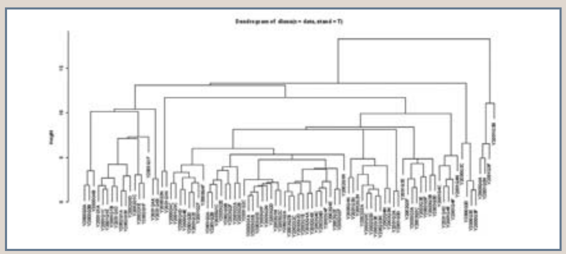

Figure 5. Dendrogram of cluster analysis for decapod abundance by year, quarter and site

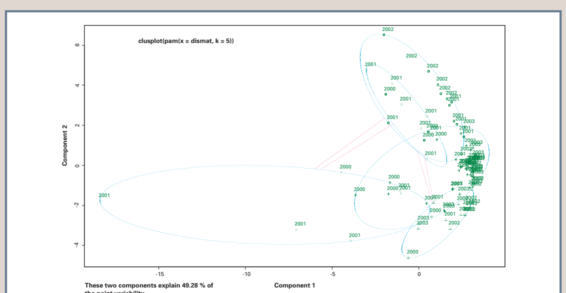

Figure 6. Clusplot of cluster analysis for decapod abundance by year, quarter and site (labelled by year only)

Cluster analysis

Average quarterly abundances were analysed using the open source software R (R Development Core Team, 2005) cluster analysis package (Kaufman and Rousseeuw, 1990). Abundance in time and space by species was used to try and identify the key features of some clusters. The following generalisations regarding dendrogram clusters (Figure 5) are suggested:

1. Sites B and F in quarter 3 and N in quarter 2, 2001 and site A in quarter 4, 2000 characterised by the presence of brown shrimp.
2. A cluster containing sites C, D, E and F in quarter 3, 2000, with high abundances of edible and green crabs.
3. A larger cluster within which sub-structure was apparent: e.g. smaller groups of sites A and B in quarter 4, 2001, where abundances of pink shrimp and hermit crabs were very high; sites A and B in quarter 3, and site B in quarter 4, 2000 with high abundance of hermit and swimming crabs.
4. All 2003 samples fell into a large cluster below a height of around 9, which also contains many 2002 samples. A clusplot (Figure 6) shows 2003 samples are clustered relatively tightly towards the right hand side of the plot. By contrast 2000 and 2001 samples were much more widely scattered. This suggests more variation in species composition initially.

Lobster size distribution

Annual (July to June) length frequency distributions of lobsters for the control site and combined spoil ground sites (Figure 7) were similar between sites and years. Kolmogorov Smirnov tests indicated no significant difference between the control and spoil ground in any year and no difference between years with the exception of year 3 for the control site which differed significantly from both year 1 and year 2.

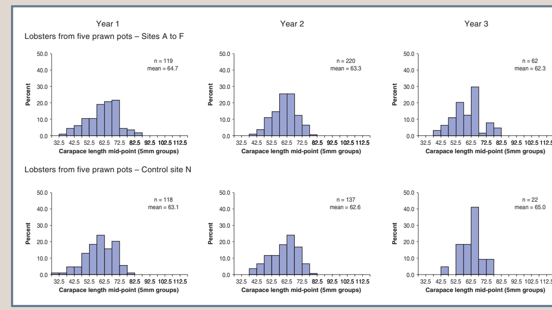

Figure 7. Annual length distributions of lobsters for control and combined spoil ground sites

Accumulation of sediment

No association of clay with pots was found at the control site, while within the spoil ground it declined progressively in years 2 and 3. Siltation of pots with sand was more prevalent at sites A and B in years 1 to 3 but reduced in general from year one to three. Siltation was thought slightly greater during spring.

Conclusions

- This study provided insights into aspects of colonisation of a majorly impacted habitat.
- Significant captures of mobile macro benthos including commercial decapod species were taken within the spoil ground.
- Catch rates of lobsters were generally highest at the control site, but in latter years were similar at some sites in the spoil ground.
- The size of lobsters captured implied that they were moving into the spoil ground.
- Initially species composition varied widely between season and site. Later there was less variation as periodic high abundances of opportunistic species became less frequent. However Rees et al. (2002) found no evidence of proliferation of opportunistic species in the sediment fauna which they suggested was due to the relatively inert nature of capital material disposed of at the site

References

Anon., 2002. Southern North Sea Sediment Transport Study Phase 2. Report EX 4562. HR Wallingford, CEFAS/UEA, Posford Haskoning and B. D'Olier.

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