These results demonstrate that rays were not restricted to the Thames Estuary, but moved more widely in the southern North Sea, with a seasonal pattern of migration (Figure 3).

Fishery data

British and Dutch commercial landings of rays caught in Div IVc were collected for the years 1999-2001 (Figure 5), corresponding to the period that fishery-independent distribution data were available from the DST tagging study (Figure 3). A small-scale trawl-net fishery targets rays off the south-east coast of England, though they are taken largely as by-catch in a variety of fishing gears including otter trawls and long lines. Landings data did not differentiate between ray species but survey data indicates that up to 95% of rays caught commercially in the southern North Sea are thornbacks (Walker & Heessen 1996). Dutch landings were caught almost entirely by beam trawl.

Seasonal distribution

We used a method of geolocation based on tidal data recorded when rays remained on the sea-bed over a full tidal-cycle (see Hunter et al. 2003) to reconstruct the movements of the fish throughout their liberty period (Figure 2).

Evidence from individual fish suggests that the rays may demonstrate migration route and spawning site fidelity (Figure 4).

British ray landings peaked in spring (Figure 5) while Dutch landings peaked during winter. British landings were taken predominantly within the Thames Estuary, while Dutch landings originated mainly outside the Thames Estuary (Figure 6).

Management options

Simulations of a number of closed area scenarios in IVc were performed to assess the potential catch reduction of thornback rays, based on the fishery-independent 1999-2001 stock density distribution and total landings over the same period (Figure 7).

Permanent closures of individual ICES rectangles are not as effective at reducing ray landings as a seasonal closure of the Thames Estuary in spring or summer (Figure 8). The most effective management scenario in terms of protecting female rays during the spawning season would be to shut the whole Thames Estuary between March and August (Figure 8). Further work is currently under way to consider the effects of spatial and temporal closures on landings by specific gear types, and also to examine how these closures might affect other fisheries.

References


The Centre for Environment, Fisheries and Aquaculture Science (CEFRAS), Lowestoft Laboratory, Pakefield Road, Lowestoft, Suffolk NR33 0HT, UK.

http://www.cefas.co.uk email: e.hunter@cefas.co.uk © Crown Copyright 2004