Salmon & Trout Association

Fighting for the future of game angling

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Briefing Paper

The Importance of Intertidal Habitat to Fish

Intertidal habitat of mudflat and saltmarsh typically forms in areas with sufficient shelter from wave energy, e.g. inlets and estuaries. Initially, pioneer halophytic plants (plants adapted to living in salty conditions) stabilise and bind the mudflat sediments and reduce the water velocity through their stem network, aiding a succession to saltmarsh vegetation.

Estuaries are highly dynamic systems with continual larvae/ juvenile fish immigration and emigration from fluvial and marine habitats. They are also very vulnerable systems affected by both the quality and quantity of fresh and marine water they receive.

It is estimated that 85% of British estuaries have lost individually up to 80% of their intertidal area through anthropogenic land claim, for reasons such as agriculture, port developments, harbours, industry and housing (Atrill *et al.*, 1999).This loss of intertidal habitat is also being exacerbated by sea-level rise in a phenomenon known as coastal squeeze; when habitat on the seaward side is lost through sea-level rise, because hard sea-line defences prevent the marshes' compensatory inland encroachment. It is estimated this currently results in the loss of 2% of English saltmarshes every year (Dixon *et al.*, 1998).

Value of Intertidal habitat

Intertidal habitats have long been recognised as key feeding and roosting grounds for birds, and as possessing a wide range of key functions, including nutrient and carbon storage, and as providing primary flood defence, by attenuating wind wave height and tidal amplitude. Unpublished work from an Interreg ComCoast PhD project has also recently found intertidal areas are important in removing atmospheric particulate matter, in particular PM_{10}, meaning under the right conditions they can improve air quality (ComCoast, 2007).

The importance of these areas for fish however, has only recently been documented in the UK, despite an extensive body of work on the issue in North America. Elliott and Taylor (1989) reported that intertidal habitats in the Forth Estuary were nearly twice as productive as their subtidal equivalents. Nixon (1980) produced evidence that commercial landing of estuarine dependent species correlated with marsh area available to them in the area.

A recent study, in collaboration with Environment Agency (EA), of intertidal habitat in the Thames Estuary, confirmed fish species, in particular juvenile bass (*Dicentrarchus labrax*) actively favoured saltmarsh habitat in their first summer, as it provided high foraging profitability and predator avoidance. The study also found that fish species utilising intertidal saltmarsh varied with the changes in fluvial flow, demonstrating that both marine estuarine dependent and freshwater species could make opportunistic use of this intertidal resource (Gray, 2007).

Estuaries and their intertidal habitat also support critical life stages of migrating fish, by providing refugia, rich foraging, and a suitable environment for Atlantic salmon (*Salmo salar*) parr to undergo smoltification. Evidence from the River Frome has shown early autumn movements into tidal habitats in 19.1% of the total 0+ parr year class (Pinder, *et al.*, 2006). This sizeable proportion of parr relocating downstream highlights the importance of the estuary as an over-wintering habitat. The use of estuarine habitats by distinct cohorts of autumn parr migrates (Cunjak *et al.*, 1989) and remnant individuals from the previous year's smolt run (Power and Shooner, 1966), has also been found in Canadian estuaries. Research from Hutching (1986)

even found despite the lower initial quantities, over-wintering estuarine parr dominated the total output for system in Newfoundland, Canada, due to the enhanced growth and survival rates associated with the estuarine habitat.

Intertidal habitats within estuaries are continuations of our river habitats, they're conservation should be viewed as an important step in re-establishing the river corridor for migrating species. In the UK these migratory fish include Habitat Directive protected species such as the twaite shad (*Alosa alosa*), sea lamprey (*Petromyzon marinus*), river lamprey (*Lampetra fluviatilis*) and Atlantic salmon.

Despite the obvious value of intertidal habitats, little work has been done to economically quantify their value, although Costanza *et al.*, (1997) estimated estuaries as one of the most expensive global habitats to recreate, due to the large amount of functions they perform both naturally and for humans, and valued them accordingly at $22,832 per hectare per year.

Protection

Saltmarshes are now designated as UK Biodiversity Action Plan (BAP) habitat and form part of Defra's High Level Target Habitat Series. This has resulted in initiatives requiring no further net loss of saltmarsh habitat, and a growing appreciation for protecting the UK coastlines with soft-engineering methods such as managed realignments.

The Habitats Directive supplies a statutory requirement to obtain compensatory habitat if the proposed development can be shown to have a deleterious impact on the site. However, this protection only occurs in Natura 2000 designated sites e.g. SSSI and SACs.

Protection is also set to change with the introduction of the Water Framework Directive (WFD), which requires that all Member States must achieve 'good ecological status/potential' in all freshwater, transitional and coastal water-bodies by the end of 2015. This is the first time transitional waterbodies (estuaries) have been included within required monitoring programmes. Under these new guidelines, the preservation and restoration of intertidal habitats within estuaries could be required to obtain 'good ecological status/potential'. The high association of fish with the habitats shown in recent EA studies could be developed as an argument under WFD to protect all extant saltmarsh as a necessary element within existing good ecological status/potential.

Effect of Removing Intertidal Habitat

Evidence from the Humber Estuary shows the removal of intertidal saltmarsh and mudflat markedly reduces the carbon and nutrient trapping capacity of the estuary (Andrews *et al.*, 2000). With the UK now required to implement large-scale decreases in nutrient inputs reaching the North Sea under the OSPAR Convention, and EC Nitrates from Agricultural Directive (91/676/EEC), this in itself has huge monetary value. Global pressure to reduce carbon footprints also highlights the need to value and assess the carbon storage abilities of intertidal areas within coastal management schemes (Andrews *et al.*, 2006).

In terms of fisheries benefits, each part of the intertidal habitat within estuaries could indirectly contribute to commercial offshore fisheries through increased recruitment (Tinch, 2003) and directly contribute to recreational fisheries (Bell, 1997). Therefore, removing these nursery habitats could significantly affect juvenile recruitment.

The Future

Instead of destroying these intertidal habitats, their importance as nursery and feeding grounds for fish suggests we should be considering their further protection and restoration, such as making them candidates for Marine Protected Areas (MPA). The MPA network should be working to help safeguard different stages of commercial/recreational fish's life history, helping achieve maximum recruitment through nursery protection, which can only help fisheries in the future.

Conclusion

The protection of intertidal habitats is a vital step in improving local commercial and recreational fisheries, through increased juvenile recruitment and production.
Intertidal habitats have the ability to achieve a range of ecosystem functions from increasing biodiversity to improving air quality, carbon storage and flood defence simultaneously. These issues are all extremely important and topical, and it therefore seems illogical that all these natural functions of intertidal habitat should be lost to harvest one resource, tidal energy.

Andrews, J.E., Samways, G., Dennis, P.F. and Maher, B.A. (2000). Origin, abundance and storage of organic carbon and sulphur in the Holocene Humber Estuary: emphasizing human impact on storage channels. In: Shennan, I. and Andrews, J. (Eds). *Holocene Land-Ocean Interaction and Environmental Change around the North Sea.* Geographical Society of London, Special Publications, London 144: 145-170.

Atrill, M.J., Bilton, D.T., Rowden, A.A., Rundle, S.D. and Thomas, R.M. (1999). The impact of encroachment and bankside development on the habitat complexity and supralittoral invertebrate communities of the Thames Estuary foreshore. *Aquatic Conservation- Marine and Freshwater Ecosystems* **9**: 237-247.

Bell, F.W. (1997). The economic valuation of saltwater marsh supporting marine recreational fishing in the South-eastern United States. *Ecological Economics* **21**: 243-254.

ComCoast. (2007). Project updates. [Online]. Available from: http://www.comcoast.org [Assessed 7th December 2007].

Cunjak, R.A., Chadwick, E.M.P. and Shears, M. (1989). Downstream movements and estuarine resident by Atlantic salmon parr (*Salmo salar*, L). *Canadian Journal of Fisheries and Aquatic Sciences* **46**: 1466-1471.

Dixon, A.M., Leggett, D.J. and Weight, R.C. (1998). Habitat creation opportunities for landward coastal re-alignment Essex case studies. *Journal of Chartered Institute of Water and Environmental Management* **12**: 107-111.

Elliott, M. and Taylor, C.JL. (1989). *The Structure and Functioning of an Estuarine/marine Fish Community in the Forth estuary, Scotland.* Proceedings of the 21st European Marine Biology Symposium, Gdansk, September 1986. Gadansk: Polish Academy of Sciences, Institute of Oceanology: 227-240.

Gray, J. and the Environment Agency. (2007). Fish Utilisation of restored intertidal habitat in a tidal backwater of the Thames Estuary. (Unpublished).

Nixon, S.W. (1980). Between coastal marshes and coastal waters- a review of twenty years of speculation and research on the role of saltmarsh in estuarine productivity and water chemistry. In: Hamilton, P. and MacDonald, K.B. (Eds). *Estuarine and Wetland Processes.* Plenum, New York.

Pinder, A.C., Riley, W.D., Ibbotson, A.T. and Beaumount, W.R.C. (2006). Evidence for an autumn downstream migration and the subsequent estuarine residence of 0+ year juvenile Atlantic salmon *Salmo salar* L., in England. *Journal of Fish Biology* **71**: 260-264.

Power, G .and Shooner, G. (1966). Juvenile salmon in the estuary and lower Nabisipi River and some results of tagging. *Journal of Fisheries Research Board of Canada* **23**: 947-961.

Tinch, R. (2003). Managed Re-alignment, Intertidal Zones and Offshore Fishery Production. In: Ledoux, L. (Eds). *Proceedings of a workshop organised for the Environment Agency by Environmental Future Ltd. And CSERGE.* UK.

Janina Gray
Research and Policy Manager