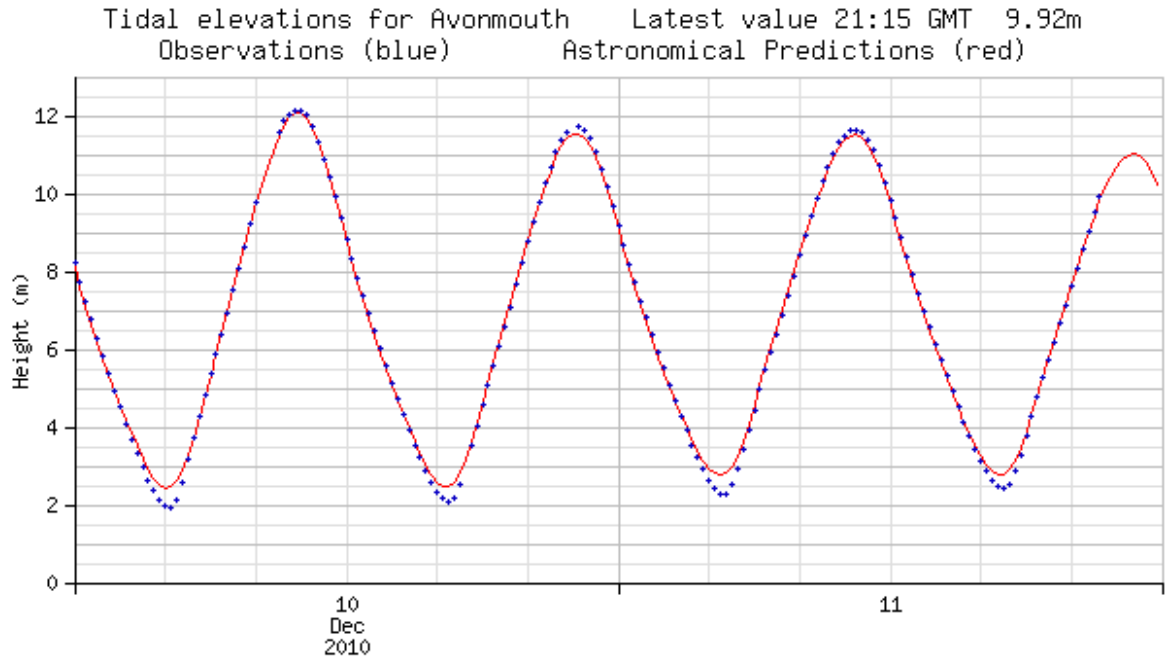
Preliminary results of a study to quantify the number of gated exits on the eastern shore of Severn and Severn Estuary and the likely impact on the migration of glass eels.

There is evidence as early as1850 of systems in place to control flooding and improve drainage on the River Severn. In the 1950's a significant effort was made to upgrade the system of ditches and drains. In the intervening period as technology improved and funds were made available these systems have been upgraded. Some as recently as 2000. It would appear that even the later civil engineering projects little consideration has been given to the provision of the passage for migratory fish.

This study concentrated on a detailed physical examination of the eastern shore of the Severn from the confluence of the Avon at Tewkesbury to the Huntspilll in Somerset. More than 35 confluences and discharges have been examined. As you will see from the photographs the type of discharges range from simple uncontrolled flaps to complex and substantially engineered flood defence systems. The survey is ongoing. There are a further 10 sites that have been identified but not investigated.

The tidal range in the Severn Estuary is between 7 and 15 meters.



The rise and fall of the tide is at a rate of 25mm per minute in the Bristol Channel/Severn estuary with very limited static periods of high and low water. In the some parts of the Severn estuary levels change at rates of 35mm per minute or higher.

Effective glass eel migration (not juvenile migration) is dependant on the conveyor mechanism of the tides.

The independent active migration of juveniles population in the summer is dependent on there being suitable nursery habitat to allow the metamorphosis of a glass eels to juveniles to take place with maximum survival.

Previous studies have shown that where the difference in head is greater than 20 mm between the inner and outerface of submerged door/flap the exit water velocity will exceed the maximum swimming velocity of a glass eel.

Casual observations would suggest that eels as opposed to glass eels are capable of much higher swimming speeds.

My findings are as follows with reference to glass eels.

1) As a general observation the flood defence and tidal protection is continuous and substantial between Tewkesbury and Highbridge. A distance of more than 130 km. Some river systems have been diverted to supply water to various port and navigation authorities negating any access except through the navigation locks. All the outfalls investigated with the exception of the River Twyver were gated. Only one glass eel pass was identified as being present on any of the installations. This was at the Abbey Mill Pitt at Tewkesbury.

2) The suggestion that a "Golden" period exists when significant numbers glass eels can migrate cannot be substantiated in the context of the very rapid rise and fall of the tide in the Severn Estuary. In some circumstances the tide rises so quickly the flood gates can be heard slamming shut. As the tide ebbs, river levels falls rapidly followed by a substantial and significant discharge of the water that has been penned by the incoming tide.

3) In the last 35 years tidal defences have been upgraded and new outfalls that did not previously exist have been established.

4) Many of the swinging flap mechanisms have rubber seals and are also suspended at an angle to guarantee a positive closure. The engineering has been focused on the absolute closure of tidal defences with no concessions to migratory pathways.

5) The water flows through these mechanisms are substantial and rapid. The water pressure heads are greater than 20mm.

6) The water discharge may be above the level of the river breaking migratory pathway.

7) There is often a secondary barrier within the primary flood control barrier that is set to control levels. Stank boards are a challenge, tilting weirs are impassable. Pumped systems are a threat to all life stages.

8) There is no longer a natural conveyor system to assist the passive migration of glass eels as tidal movement has been suppressed by the defence systems.

9) The flood defences have destroyed a substantial part of the inter tidal zone, wetland and nursery areas for glass eels.

10) There is some compensatory increase in suitable nursery habitat for glass eels. However it is not readily accessible.

11) The majority of the primary defence systems are passable to seaward migrating eels.

The probability of passage of the glass eels was based on a previous paper that established the maximum swimming velocity of a glass eel.

The status of habitat was a visual assessment. It did not take into account its relative merit due to area.

Conclusion.

It is accepted that while eels are found behind these defences natural glass eel recruitment through these mechanisms is only possible in very limited and special circumstances. It is likely that the majority of the eel population found above these defences comes form other life stages of migrating eels. It is highly likely that the existing mechanisms for flood defence compromise the passage of glass eels during the period of recruitment.

Migrating eels with reproductive potential are in most circumstances able to traverse over or through these flood defence systems.

However is should be noted that the study deal exclusively with primary barriers at the tidal/freshwater interface. There are inland of these barriers a whole range of barriers, such as weirs and pumping systems that are likely to be significant barriers both to all life stages of migrating eels.

It is a political choice to balance **the restoration of habitat and migratory pathways** against a other least cost recovery measures for the eel. However it is certain without the reinstatement of nursery areas and the establishment of migratory pathways for glass eels the EU target of 40% escapement for reproductive stock will be largely ineffective.

Peter Wood 14th December 2010