

Links Between Environmental Consequences of La Rance and Severn Tidal Power Barrages

La Rance

The Rance Barrage was opened on 26th November 1966 and the final turbine installed on 4th December 1967. In the English-speaking environmentalist community a knowledge gap has developed relating to the ecology of La Rance estuary. It is clear that many in that community were unaware of the huge empirical ecological data base, from appraisal of which it turns out there are many hitherto unknown similarities between La Rance and the Severn.

The main environmental impacts of constructing La Rance barrage are precisely those long and independently predicted for a Severn barrage.

For La Rance, and elsewhere in confined water bodies, there is a "cascade" of dependant attributes - the bathymetry determines the tidal current pattern, which in turn determines the bed sediment distribution and onwards to the invertebrate benthic communities, ie. bed sediment patterns are a "surrogate" (interchangeable) for faunal distribution patterns. The Marine Museum National D'Historie Naturelle was set-up on the banks of La Rance in 1882 and over the years has amassed a huge knowledge base, not all readily accessible. Guidance on best available material has been provided by Professeur Christian Retière, who has been the Director of MNHN for the entire period since the barrage was built. There are detailed and very similar sediment maps for 1889 and 1956, both prior to the start of construction works, as well as either sediment or benthic community maps (indistinguishable) for 1971, 1976, 1982, 1994 and 1995 after the barrage was opened. Supporting this there are salinity and (some) turbidity distribution plots (ie. the physical forcing factors). Prior to construction the dominant bed type was clean sand. The intertidal area has declined from 75% of the total to 50%. Formerly there were a variety of prolific intertidal and one highly impoverished subtidal habitats. Raising mean water level by 2.5m has shifted a variety of intertidal communities into the subtidal category greatly enhancing the species richness and invertebrate abundance of this zone.

There are two main barrage effects, each of which is readily transferable, in prospect, to the Severn. The first is that the reduced hydrodynamic regime has led to fine suspended sediment being deposited on the bed, further widening the species richness and abundance of invertebrates. Muddy sands and sandy muds, which provide hosts for a diagnostic suite of invertebrates, are now widespread. The second is that loss of one third of the intertidal area has been easily compensated for by an increase in its carrying capacity for invertebrates and higher organisms.

This is now higher than elsewhere along the north coast of France, specifically above the Bay of Mont St Michael and Morlaix River mouth. La Rance is the breeding and nursery area for over 30 species of fish and carries a stable population of catadromous fishes (those needing to traverse the barrage - fresh to marine - repeatedly in order to complete their life cycle). La Rance is designated as a RAMSAR site on grounds of its importance for water birds, having particularly well-developed communities of fish eating birds: gulls, guillemots, auks etc.

The bed deposition of mud, coupled with increased intertidal carrying capacity, are what we might term a "Rance Effect", which would occur similarly in the Severn if a barrage is built.

Severn

In beginning to set out a new "way ahead" for future environmental studies in the Severn, should this stage ever be reached, it is already apparent that we now have access to a great deal more environmental data than before, as well as an understanding of what is driving the rapid changes in progress.

Leaving aside the invertebrate and lower communities, and focussing narrowly on birds and fish, these are responding in 180° opposite directions to climate change.

The fish fauna is well known from 1880s and 1930s surveys as well as from catch records and was stable until the 1970s, since which time it has rapidly become more species-rich.

From 25 years worth of monthly sampling on power station cooling water fish screens we know that there are about 82 "indigenous" species and new species are invading the Bristol Channel at a mean rate of 0.83/yr (ie. one every 15 months). This is due to warming of our coastal waters, decreasing salinity and changes in the Index of the North Atlantic Oscillation (a measure of how our weather patterns are manifest). A further 2°C rise in sea water temperature would increase fish species richness in Bridgwater Bay by 10%. This is considered to be inevitable with or without a barrage.

The water bird situation is precisely the reverse. There is already a quirkily British statistic concerning the birds of the Severn. A graph has been compiled of the number of "Water Birds per Giga-Watt Hours" for 8 UK tidal power prospect inlets.

This shows the Severn has the lowest number of "birds affected per unit energy generated" of any UK estuary (axiomatic as high tidal range and low carrying capacity are directly linked) and a 27 fold difference between this and the highest (duddon). There turns out to be bird count data for the Severn going back to the 1970s. Bird numbers have crashed since this time. The Severn has the lowest waterbird carrying capacity of any UK soft sediment coast. There has been a long term decline in the population of dunlin in the Severn (its most abundant bird) from the range 55,000 in the early 1970s to below 14,000 in the late 1990s.

Since this, latter, time, the implementation of the Urban Wastewater Treatment Directive has required organic input (sewage) to be reduced to 10% or less than its former level. Organic abundance drives biological productivity.

The 14,000 value is important, being the number of this species the estuary must support to be "Maintained at a Favourable Conservation Status". Under the terms of the EU SPA designation an area must support more than 1% of a national population to qualify - below 14,000 dunlin the Severn no longer would.

The British Trust for Ornithology, an academic research foundation, report that during recent warmer winters smaller populations of 7 species of common waders

wintered in SW Britain, including the Severn, with dunlin, the smallest species, showing the greatest decline.

Similarly, the Severn has declined from 9th most important UK wetland (1990-91) to 19th (2003-04). Waterbirds showing a preference for milder, more benign, east coast estuaries in the UK are not being replaced by new populations.

Unlike La Rance, the Severn is presently an estuary with turbidities so extremely high that to various degrees they inhibit colonisation by organisms. The water body and subtidal mud deposits are barren, with other subtidal substrates verging on barrenness.

The fauna of the intertidal zone, as explained above, is very severely suppressed.

Should a barrage be built, suspended solids concentration would reduce by a factor of ten permitting prolific colonisation of all these sub-environments. This then would be a specific "Severn Effect". From the above, the "Rance Effect" and the "Severn Effect" would inevitably sum to create a highly biodiverse, prolific community.

The bed would become more muddy and the foreshore increase in its carrying capacity, at least offsetting "area loss".

What are the implications?

1. An increase in biodiversity and faunal abundance is unavoidable in a basin formed by a Severn barrage.
2. There is a rising body of opinion that present international environmental legislation is "unfit for purpose". Various threads, not elaborated here, but in reality one can't sustain legislation to protect an area when its designated fauna has naturally fallen below minimum levels for qualification. Similarly, concerns for the welfare of the planet as a whole shouldn't be constrained by a single special interest group. There are other issues.

R Kirby

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