PASAS COMMENTS ON MEETING 8 DECEMBER 2017 TO DISCUSS TLSB FISH MODEL PARAMETERS

1. GENERAL

   a. Regrettably we didn't find the meeting helpful. There was a lot of misunderstanding and people seemed to be at cross purposes for much of the time. We were left wondering whether Ted Potter had read the responses by ourselves (including that by Dr Guy Mawle) and NRW (TE) to TLSB's June submission.

   b. We find the draft minutes, which are an attempt to record verbatim what people said rather than summarise their points, almost unintelligible and they fail to capture the points we were trying to make. Rather than try to improve the minutes we propose to restate our position. Perhaps you could take out the comments attributed to us and include the points made in this note.

2. OUR POSITION

   a. We stand by the note which we handed you on the day, which we attach together with the items to which it refers and would ask you to read it in conjunction with this note.

   b. We don't think that this model is capable of reliably predicting the likely impacts on salmon and sea trout and we are disappointed that you and Ted Potter apparently plan to use it for that purpose.

   c. We understand that it might be useful to re-run the model with revised, more realistic, parameters in order to disprove TLSB's predictions but we don't think NRW PS and Cefas should attempt to use it to arrive at revised impact levels and to use those levels to inform WFD etc assessments.

   d. The onus is on TLSB to satisfy you, on a precautionary basis, that any potential impacts are acceptable. If their model is shown to be not fit for that purpose, TLSB have a problem and you can quite reasonably use the results of re-running the model (and the uncertainty about the inclusion / exclusion of other parameters) in support of a refusal of consent.

   e. Why would you want to turn TLSB's problem into your problem by cobbling together some alternative prediction which you then have to defend? You know what happened last time you did that.

3. SOME POINTS ON PARAMETERS

   a. In case you insist on using the model to arrive at alternative impact levels (which we would challenge), we offer some observations as follows.

   b. Population area.

      i. We don't think that the adoption of an arbitrary population area and random distribution of fish over that area is a reasonable way of arriving at likely entrainment levels.

      ii. On the contrary, we think, on the basis of best available information and our reasonably expert opinion, that a realistic worst case is that the configuration of the bay and water flows are likely to concentrate fish in areas where they are particularly susceptible to entrainment. Please see the chart of Swansea Bay and our illustration of likely fish movements.

   c. Hydrodynamic model.

      i. Ted Potter Cefas took the wind out of our sails on the day by saying that the ADZv2 (MCA) model no longer makes use of an underlying hydrodynamic model. We don't think that's right, is it?

ii. The size and shape of the draw zone are determined, are they not, from fish swim speeds and prevailing flows, obtained from the hydrodynamic model? So if there are doubts about the underlying hydrodynamic model, which we have mentioned in previous submissions, they affect the determination of the draw zone.

iii. Not only are there doubts about the underlying model but, as we have said repeatedly:

1). the underlying model is likely to be affected by river spates, which have not been allowed for; and

2). there is still a possibility that the model will be further undermined by major works in the bay to realign the shipping channel for ship safety reasons (which we have argued needs to be addressed as part of this application and not salami-sliced off and addressed as a separate application).

d. Avoidance.

i. There is insufficient evidence on which to base the introduction of 'avoidance behaviour' (or attraction) into the model.

ii. There are concerns with the parameters used for both "Realistic Best-Case" (99%) and "Realistic Worst Case" (28.5%).

1). TLSB have based the 'Realistic Best Case' 99% on avoidance values reported by Amaral et al. (2015) who used fish representative of those likely to encounter marine turbines. The Amaral study was conducted using a single 1.5m diameter turbine which was housed in a specially constructed flume at a research laboratory in Massachusetts. However, Amaral et al. state:-

> " Further investigations examining entrainment avoidance by more species and lengths of fish as well as the probability of escaping entrainment and subsequent injury and mortality in an array of HK turbines are warranted to more fully understand the potential impacts of these turbines on riverine and tidal fishes".

2). As a 'Realistic Best Case' TLSB have also used Hammar et al. (2013) whose study was based on an operational marine turbine 0.7m diameter and 1.5m long sited in a vertical position in a narrow tidal straight off the coast of Mozambique. Hammer et al. made a number of observations in relation to visibility:-

> "All sampling was performed in daylight and during ebb currents……The number of gap passages was positively related to visibility…….. Importantly, this study is confined to effects of the rotor during daylight. At night, fish will have reduced possibility of detecting a rotor by visual senses and collision risk may increase. A reduced reaction distance for fish approaching hydrokinetic turbine rotor blades during the night as compared to the daytime has previously been reported. Fish assemblage composition and spatial distribution of fish differ between night and day, and many of the species in this study are strictly diurnal. Hence studies under dark conditions, and with adapted equipment, should be performed……In particular, the effects of hydrokinetic turbines during low light needs to be addressed".

3). There are questions raised by the authors of both studies relating to light, and the number of turbines used, and both authors call for further studies to be carried out. These studies are therefore inappropriate for use as a basis for a 99% Realistic Best-Case parameter.

4). TLSB used a study by Vowles et al. (2015) "Effects of avoidance behaviour on downstream fish passage through areas of accelerating flow when light and dark"

to obtain the lower parameter for the MCA 'Realistic Worst Case'. The study used a specially constructed flume. The flume was supplied with water from the McNary Dam in Columbia USA. This study assessed the response of downstream moving juvenile Chinook salmon to velocity gradients. No turbine was involved in the study. The study was used to observe migrant juvenile salmon behaviour under two velocity gradients during both dark and light conditions. Vowles commented that "…..the percentage of avoidance responses increased when light. When dark 88% of responses were non-avoidant, compared to 55% when light." It should be noted that the worst-case parameter of 28.5% chosen by TLSB is a daily average between the conditions 'high velocity light' 45% and 'high velocity dark' 12%. This approach does not fairly represent a worst-case scenario. Even if this study is a reasonable guide for the behaviour of adult Atlantic salmon at a tidal barrage, the worst-case is clearly 12%. As noted in our written comments and those by NRW (TE), you should not assume that effective avoidance cues will be present in daylight at the lagoon turbines.

5). Clearly the studies above used by TLSB to demonstrate 'avoidance behaviour' bear little resemblance to the conditions that fish are likely to encounter in Swansea Bay e.g. turbidity, multiple turbines in an array, very high velocities near the turbines. Therefore 'avoidance behaviour' should be discounted and should not be included in the model. Indeed, if salmon preferentially go with the flow as the limited studies indicate that they do, the draw into the turbines could potentially be attractive.

e. Attraction. If you feel that you have to take account of avoidance, we think you should also take account of attraction. Although not at a tidal lagoon, the video here is a very compelling illustration of attraction / failure to avoid:

http://www.fishlegal.net/news.asp?section=1481&sectionTitle=Latest+News+from+Fish+Legal&itemid=3865

Phil Jones