Hoveton Great Broad Restoration Project – alternative options considered:

The following document addresses the potential questions that may arise as to what alternatives to full lake biomanipulation have been considered by the Hoveton Great Broad Restoration Project, namely:

Q1 - Alternative options which could reduce the potential impacts on fish whilst meeting the project objectives

Q 2 - Why you have chosen full lake exclusion above those alternative options identified in any response to question 1

The discussion of these question is inextricably linked as you can't discuss alternative options without making comparisons to the project's plan for full lake biomanipulation. As such we have addressed these questions together in our response below.

Project objectives

To frame our response, we wish to restate the project's objectives, as agreed by Natural England and the Environment Agency, an associated beneficiary, on 10th October 2014 which were:

1. Improve the ecological condition of the Naturally Eutrophic lakes with Magnopotamion or Hydrocharition feature (H3150) within Hoveton Great Broad and Hudson's Bay, moving them into 'Unfavourable Recovering' condition by 2020 (thus contributing to Biodiversity 2020 targets). This will involve:
• Sediment removal from both water-bodies
• Biomanipulation of both lakes to achieve clear-water conditions, leading to an aquatic macrophyte dominated state.

2. Beneficial re-use of sediment to create new areas of fen vegetation corresponding to the previous extent of marginal lake edge habitats, including Calcareous fens with Cladium mariscus habitat (H7210*) and to help restore eroded river banks.

3. Monitor the recovery process and disseminate best practice guidance associated with the restoration techniques to managers of similar habitats both within the SAC and elsewhere in the UK and Europe.

4. Raise awareness of anthropogenic impacts, improve physical and intellectual access and increase appreciation of biodiversity amongst local communities, visitors, land managers and range of other target audiences.

Hoveton Great Broad (HGB) and Hudson's Bay (HB) form part of the Bure Broads and Marshes Site of Special Scientific Interest (SSSI), the Broadland Special Protection Area (SPA), The Broads Special Area of Conservation (SAC) and Broadland Ramsar Site. They also form part of the Bure Marshes National Nature Reserve.

A legacy of high phosphate levels from sewage have resulted in turbid phytoplankton dominated waters on the broads, and resultant low macrophyte diversity and density. As a result of this legacy and siltation, HGB & HB are currently classified as having poor status under the Water Framework Directive and the SSSI status of the broads is unfavourable – no change. Our reassessment of WFD and making use of the latest data form the Environment Agency both suggest that macrophyte levels have worsened since the last WFD indicating that the broads' status is worsening.

Hoveton Great Broad requires further urgent action to reach its conservation objectives.

WFD – Reasons for not achieving good ecological status

The Environment Agency provides reasons for not achieving good status (RNAGS) for each WFD body. (waterbody ID: GB30535977). The entry for Hoveton Great Broad (waterbody ID: GB30535977). indicates the main reason for HGB failing to meet its WFD objectives are diffuse sources, mainly from Agriculture and rural land management. So, how will biomanipulation improve the WFD status of Hoveton Great Broad, and why the focus of the project is not on diffuse sources of pollution from agriculture and urban sources (as per the RNAGS identified by the Environment Agency).

Whilst diffuse pollution from agricultural and urban run-off has played a part in the current WFD status of HGB, it is incorrect to identify it as the main driver for continued poor status. The science does not support the Environment Agency's conclusions, as discussed below, and evidenced in the 'Hoveton Project creating a sustainable future for the Bure system' report submitted to support this application.

The main source of diffuse pollutants in to HGB come from the River Bure. There is little land adjacent to HGB which would provide significant source of diffuse water pollution. Since the 1980's there has been a significant effort to reduce the diffuse pollution in the River Bure through phosphate stripping at sewage treatment works and engagement with farmers to reduce diffuse pollution through agri-environment schemes and the Catchment Sensitive Farming programme

This has delivered significant improvements in water quality in the River Bure, but despite these improvements the condition of HGB continues to deteriorate. Figure 1 shows the reduction in riverine phosphorus over the years. The rivers Bure, Ant and Thurne (but not the broads attached to them) are now generally at high WFD status for phosphorus, reflecting the historic and ongoing efforts to minimise point and diffuse sources of pollution.

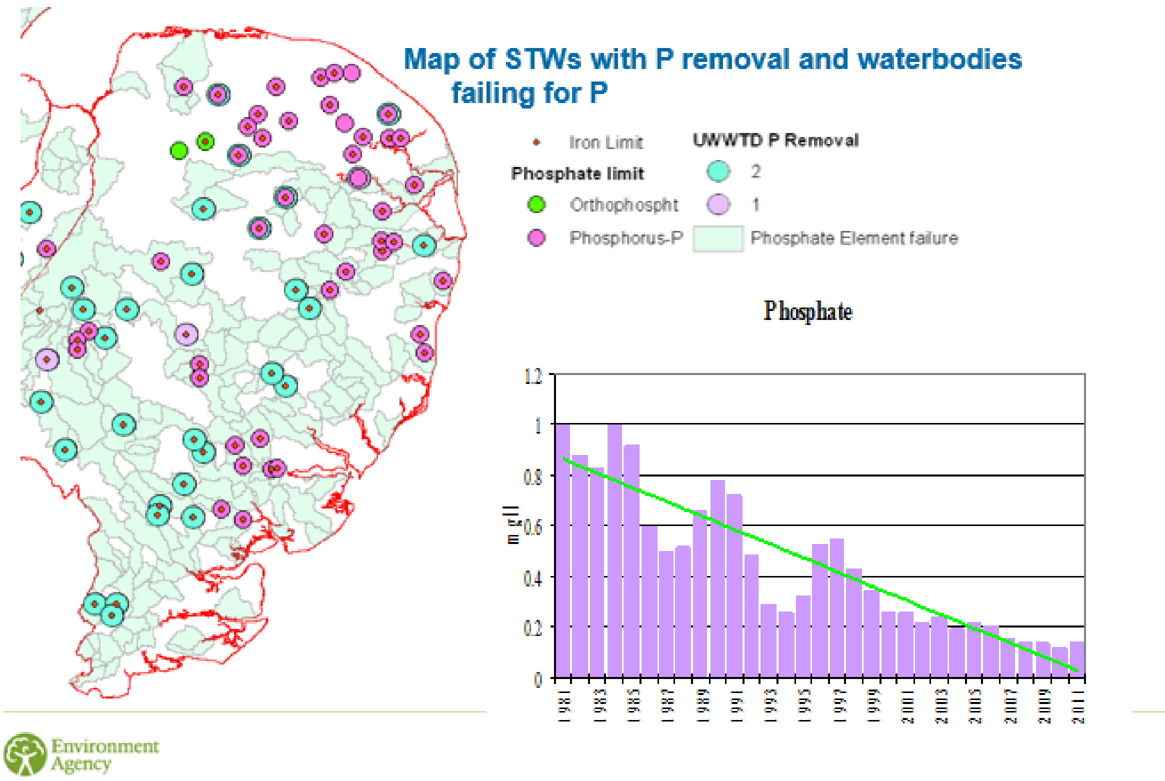

Figure 1. Reduction on phosphorus loading from STWs 1981 to 2011 (EA presentation, date unknown).

It is well known that shallow lakes can exist in two states, both of which are considered stable states (Sheffer et al, 1993). The idea was first proposed in the 1960's (Lewontin, 1969) and described mathematically within ecological communities in the 1970's (May 1977). This means that it is difficult to move from one state to another without certain switching mechanisms being applied. The two states of shallow lakes are:

1. clear-water macrophyte dominated state
2. algal dominated turbid state

Figure 2 below shows that the two states can exist over a wide range of overlapping nutrient concentrations. They are essentially stable owing to ecological feedback mechanisms (food chain relationships such as top down predation that aid grazing on plankton and bottom up relationships such as algae shading light and thus stopping plant growth). These controlling relationships both maintain the current state and prevent it switching to the other state. The effort required to switch between states is dependent on the nutrient status of the lake. The role fish play in maintaining a feedback loop are addressed in the 'Addendum to Hoveton Wetlands Restoration Project Water Framework Directive Assessment (WFDA), January 2020' (submitted with FRAP application) and will not be covered further in this section.

Phosphorus concentrations of <0.03mg/l are required for Hoveton Great Broad, Hudson's Bay, and the other broads to recover naturally (Moss et al. 1996).

The Diffuse Water Pollution Plan (DWPP – still in draft and unpublished) has modelled the current sources of P in the river Bure as shown in figure 3. This shows that the major contributors are Sewage Treatment Works (STWs), livestock, and urban run-off. In order to achieve the target of

0.03mg/l in the Bure the DWPP has modelled that 12 STWs will need further P stripping up to the technical achievable limit, and 100% uptake of P reduction methods across agriculture.

Whilst Anglian Water have committed to delivering their fair share reduction in P by 2030 this would only deliver a P concentration within the River Bure of 0.052mg/l. The Catchment Sensitive Farming review 2006 -2018 shows that since 2006, 34% of the farmed area in England is managed by CSF engaged farmers with an uptake of 59.6% uptake of advised measures. This has seen a modelled decrease of 2.4% for total P in rivers from farm sources within target areas up to January 2018 (EA 2019). It is evident from this data that a 100% of uptake for all agriculture methods on all agricultural land within the Bure catchment is not going to be achieved within the short to medium term. **Therefore P concentrations of <0.03mg/l will not be achieved, and biomanipulation of the fish community is the only option to restore the WFD status of the broads to favourable condition and good ecological status.**

In contrast Phillips et al. 2015 concluded that mean total Phosphorus concentrations of <0.055mg/l are likely to be required to achieve successful biomanipulation. **Therefore the modelled reduction to 0.052mg/l by 2030 (within the life span of the barriers) will be sufficient to see successful biomanipulation and the improvement in WFD status, which would not be achieved by focusing only on diffuse pollution for agricultural and urban sources.**

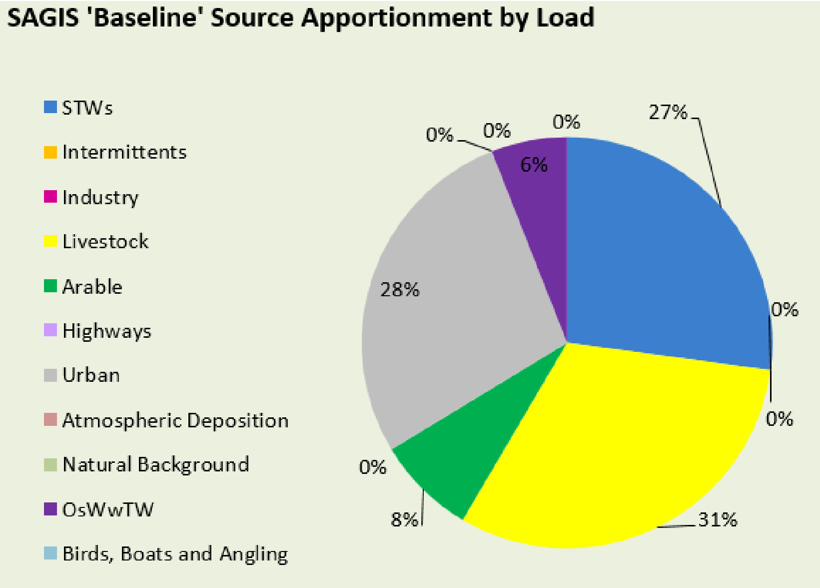

Figure 3. Source appointment of phosphorus within the river Bure catchment.

Whilst continued improvement in water quality is required to aid stable recovery of HGB **we recommend the RNAGS are updated for HGB (waterbody ID: GB30535977) to reflect the scientific evidence and modelling available, and that biomanipulation is added to the required measures to achieve good ecological status of HGB (waterbody ID: GB30535977).**

Can Hoveton Great Broad and Hudson's Bay be restored without biomanipulation?

As discussed in the previous section, a return to a plant dominated state does not necessarily require biomanipulation, for example theoretically if you could get nutrient levels low enough (generally lower than the concentration required to maintain a plant dominated state, so we are talking very low i.e. < 0.03mg/l) you should be able to get the plants back.

At P concentrations above 0.03mg/l two stable states for lakes are possible, algal dominated with few/no macrophytes, or clear water macrophyte dominated. **What biomanipulation enables is that switch between states at higher nutrient levels and Hoveton is in that zone when a switch via biomanipulation is possible. (**Phillips et al. 2015 concluded that mean total Phosphorus concentrations of <0.055mg/l are likely to be required to achieve successful biomanipulation.)

Biomanipulation requires the removal of fish from the system, resulting in increased zooplankton populations, which in turn feed on phytoplankton, reducing turbidity, and providing suitable conditions for macrophtyes to colonise. In particular zooplanktivorous and benthivorous species need to be targeted in this fish removal. Zooplanktivorous species such as roach need to be removed to decrease predation pressure on zooplankton, allowing sufficient predation of the phytoplankton to achieve clear water. Benthivorous species such as bream, cause significant disturbance of the sediment when in high numbers, increasing turbidity and releasing phosphate. They can also uproot macrophytes preventing re-colonisation.

Biomanipulation is a **proven method of lake restoration**, and has been used successfully in the Broads and across Europe. Biomanipulation is required as when a lake suffers from eutrophication as changes in the fish community prevent recovery of the ecosystem even when water quality is improved, as described by the following section from 'Addendum to Hoveton Wetlands Restoration Project Water Framework Directive Assessment (WFDA), January 2020 (submitted to EA to support FRAP application):

'*The **dominance of roach and bream under eutrophic conditions is not just a symptom of eutrophication, these species play a critical role in the food web, which reinforces the turbid, algal dominated state**. In effect, they act as a forward switch, maintain the stability of the algal dominated turbid state and make it harder to switch the lake back to a macrophyte dominated state, even if nutrient concentrations reduce (Bernes et al., 2015, Phillips et al., 2015). Large numbers of small roach significantly alter the zooplankton community in lakes, which reduces their ability to control the phytoplankton through grazing, allowing algal dominated water to persist. Bream also play an important role as benthic feeders re-suspending the sediment, increasing turbidity and uprooting macrophytes. They also promote nutrient release and cycling from the sediment. This also reinforces the algal dominated state (Breukelaar et al., 1994)'*

The present fish assemblage found in Hoveton Broad is what you would expect in a system subject to eutrophication. The literature and the lack of any macrophyte recovery in the broad would suggest that with the current fish assemblage at current levels a clear water macrophyte dominated state will not be achievable. Consequently if the lake is to be restored to a plant dominated state with its associated fish assemblage, **biomanipulation is required.** If this does not occur, **Hoveton Great Broad and Hudson's Bay will remain in a turbid, algal dominated state and NE and the EA not meet our statutory duties under the Conservation of Habitats and Species Regulations 2017 and Water Framework Directive, respectively..**

The evidence is clear, it is not feasible to restore HGB and HB to 'favourable condition' and 'good ecological', and therefore deliver our statutory duties and the project objectives, without biomanipulation.

What alternatives to full lake closure have been considered?

1. Can we use smaller biomanipulation enclosures within Hoveton Great Broad and Hudson's Bay?

Elsewhere on the Broads, such as Ranworth Broad, a number of biomanipulation enclosures have been used to biomanipulate areas within the lake but leaving the rest of the lake open and in original condition. It has been suggested that adopting this approach on HGB and HB would have the benefit of allowing bream to continue spawning in the un-enclosed areas.

Whilst this approach would minimise the impact of bream, it certainly does not meet the objectives of the project or our statutory duties to restore Hoveton Great Broad and Hudson's Bay to 'favourable condition' and 'good ecological status'.

Work on the Broads and elsewhere has shown that whilst biomanipulation of a sufficient magnitude almost inevitably produces clear water, **the difficulty has been maintaining this change**. Key to maintaining this change is the establishment of a diverse and extensive macrophyte assemblage that as a consequence is **stable**. The literature suggest there may be a delay of 2-8 years for macrophytes to recover (Lauridsen *et al*., 2003 & Pot & ter Heerdt, 2014). Experience in the Broads has shown that although clear water is quickly achieved, the time taken for macrophyte establishment is variable, sometimes happening quickly whilst in others taking around 15 years, as in the cases of Pound End and Cockshoot Broad (Phillips *et al*., 2015). This variability is at least in part due to the availability of propagules. Whilst it is hoped that dredging will have exposed the propagule bank in Hoveton Broad, allowing quick macrophyte colonization, it remains a risk that macrophyte colonisation might take longer.

The composition and diversity of the plant assemblage has also been reported as key to the success and stability of lake restoration. More than 10 macrophyte species has been reported as being key to lake stability in the Broads and the presence of submerged macrophytes and charophytes are particularly important (Phillips *et al*., 2015). This has taken 15-20 years in the Broads that have been biomanipulated successfully (Cockshoot and Ormesby Broad).

Whilst enclosures have been shown to deliver clear water and macrophyte recovery in the Broads, indeed enclosures have been trailed in HGB, they need to be maintained indefinitely, or until P concentrations are <0.03mg/l, to maintain clear water. When these enclosures are removed or fail, as observed on the enclosure on HGB, they are inundated by the surrounding turbid water and unfavourable fish assemblage. This results in macrophyte die off and reversion to an algal dominated turbid water state.

In Denmark biomanipulation has repeatedly been attempted as a one off measure (fish being removed from a lake and then no further action being implemented) and as a result in nearly all these attempts the lake has returned to its original condition within 10 years (Søndergaard, 2008). The reasons cited for the failure of these biomanipulation attempts was an **insufficient quantity of fish being removed in the first place or water quality continuing to be an issue.** In such situations despite sufficient fish being removed and short-term improvements in water clarity the fish assemblage returned to its pre-manipulated state and a stable **macrophyte assemblage was not established.** It was concluded that repeated fish removal would be required to obtain long-term effects in the most nutrient rich lakes.

In contrast, by biomanipulating the whole of HGB and HB we will establish a diverse and abundant macrophyte population across a wider area, making it much more stable and able to buffer inputs from the River Bure. By continuing to manage the fish population in HGB and HB throughout the biomanipulation until nutrient inputs from the catchment have declined to suitable levels (<0.055mg/l) increases the likelihood that the macrophyte dominated state **will continue** once the barriers come down. At this point the **fish assemblage will respond to the environment available** and consequently a diverse fish assemblage compatible with the macrophyte dominated state should **naturally be maintained due to the environmental niches available**. The macrophyte assemblage established in Hoveton Broad should then be able to act as **a propagule bank to colonise the wider Bure system** which will have also improved due to water quality improvement works in the catchment.

In addition, by their nature these enclosures are to some extent closed off biospheres not accessible to sections of the ecosystem. The increases in macrophytes and improved habitat within the enclosure will not be accessible to fish for example. This means enclosures are of more limited value to the wider ecology when compared to the whole lake approach. **The approach proposed by the project will maintain hydraulic connectivity to the wider system throughout biomanipulation, and will provide high quality macrophyte dominated habitat when the barriers are removed**.

Finally, it is the statutory duty of the NE and the EA to restore HGB and HB to 'favourable condition' and 'good ecological status'. Using enclosures would leave approximately two thirds of the site un-restored and therefore failing to meet its conservation objectives. The areas within the enclosures which had been restored to a clear water state would also not be meeting their full conservation objectives due to a lack of connectivity to the wider ecological system. Therefore, partial biomanipulation using enclosures cannot be considered to meet the statutory duty of NE, the EA, or the objectives of the project. This would obviously present further issues with our funders and the land owner.

2. Can we exclude Hudsons Bay (HB) from the biomanipulation plan?

This was discussed at length by the Project Steering Group on **20th March 2019**. The Steering Group exists to make decisions and agree project plans. The group consist of colleagues and recognised specialists from Natural England, Environment agency & Stakeholders. The minutes (as recorded below) show that the decision on this point was that Hudson's Bay cannot be excluded from the plan for the following reasons.

- ***Increased fish incursion into Hoveton Great Broad-*** *To ensure a successful bio-manipulation fish removal needs to be conducted repeatedly to keep the removed fish biomass >70%*
  →If HB is opened to additional fish populations, potentially providing spawning habitat for the fish previously found across the entire area of HGB, this is likely to result in a greater density of fish in HB than is currently the case. Having a large density of fish in such close proximity to HGB would mean that in the event of a flood, more fish would be likely to get over the barriers into HGB , this would require an increased frequency of fish removals to maintain the desired biomass reduction of >70% and would result in increased project costs.

- ***Additional costs associated with exclusion****- £400,000 has been allocated for the fish barriers and £ 100,000 for fish removal work.*
  →Designing and building an additional fish barrier of 15-20 meter width to separate HB and HGB would cost circa £70,000 and we would need to find additional funding. In

addition we would need to find resources to fund installing culverts at the top end of HB which would cost circa £100,000. Any saving on removing fish from a smaller area would not equate to the cost of an additional barrier and culverts.

- ***European Designation impacts-*** *Hudsons Bay is a Special Area of Conservation area and bio-manipulation will deliver water quality improvements as required by the The Conservation of Habitats and Species Regulations 2017.*

  →Connecting Hudsons Bay to the wider river system by installing culverts, thus turning Hudsons Bay into an alternative bream spawning area, could cause further ecological deterioration form increased numbers of bream using the area. Before excluding HB a Habitat Regulation Assessment would need to conclude there would be no likely significant effect on the habitat for it to be consented. The burden of proof would be on the project to show that connection of HB to the wider river system would not cause any damage to the Special Area of Conservation, notably macrophytes and water quality. It would also represent a failure of NE and the EA to deliver their statutory duty to restore Hudson's Bay to 'favourable condition' and 'good ecological status'.

- ***The osmosis effect-*** *Current nutrient concentrations limit the ability of macrophytes and a suitable fish assemblage of suitable biomass from establishing. Bio-manipulation will address this via improvements to water quality.*

  →If the water quality in HB decreases as a result of increased fish numbers, or even if it were maintained at current levels, whilst HGB improves, the semi permeable membrane (fish barrier) would allow water of poorer quality to impact upon HGB risking the biomanipulation and the potential to recover to a favourable state.

- ***Likelihood of success increases with area-*** *Literature and Case Studies suggest that the greater the extent of macrophytes that can be established the greater the chances are of achieving a clear-water state. The more diverse the plant assemblage the more stable it becomes. Research shows that bio-manipulation is effective as it provides a situation in which a diverse macrophyte community of suitable extent can establish. The more diverse this community is, the more complex the habitat will be, due to a greater range of micro-habitats. If the area available is larger, there is increased potential for a higher number of micro-habitats to establish, which increases the probability of successful bio-manipulation.*

  →If HB is excluded from bio-manipulation, the area where such micro-habitats can develop is reduced by approximately a third, thus impacting on the projects ability to establish a stable resilient restored habitat capable of buffering inputs from the wider system.

- ***Long term resilience increases with area****-The establishment of a diverse macrophyte cover and associated fish community over the largest possible extent of the broad is critical to the maintenance of a clear-water state after barriers are re-opened.*

  →Long term maintenance of macrophyte cover in the Broad hinges on the fish assemblage not reverting to its previous state (i.e. dominated by benthivores and zooplanktivores) when the barriers are removed. This is achieved by establishing a large habitat to support a diverse piscivore dominated assemblage instead. Maintaining the status quo in Hudsons Bay reduces the habitat available to this improved fish assemblage by a third.

- ***Funder Agreement-****The rationale for the extension of the project to a sixth year has been based on the fact that the project intends to deliver what it set out to.*

  → The option of not applying bio-manipulation to Hudsons Bay has not been discussed with the funders HLF or LIFE. Making such an adjustment to the objectives, would need approval from our funders, which is unlikely, and potentially hold significant financial impact for the project. This would seriously jeopardise our ability to deliver restoration of either lake.

(Project Steering Group Minutes 20th March 2019)

Conclusion

Water quality has now improved to the point where it is possible, using proven biomanipulation methods, to 'kick' the broads into an alternative clear water macrophyte dominated system, as seen at Ormesby Broad, and Cockshoot Broad.

Whole lake biomanipulation, including both HGB and HB, is the only feasible option for creating a stable and diverse habitat which can be reconnected to the wider broads system, and meet our statutory duties to achieve 'favourable condition, and 'good ecological status'. The fish barriers will be in situ, with additional fish removal effort as required, until an abundant and diverse macrophyte community has established (The project currently has planning permission for the barriers to be in situ for a maximum of 10 years, if an extension is required this would require a an application to the Broads Authority and further public consultation). After this period the barriers will be removed reconnecting HGB to the Bure system.

Positive impacts

- Improved ecological condition of HGB and HB – macrophyte recovery, increased biodiversity. Conservation objectives for SSSI, SAC, WFD achieved.
- Projects visitor engagement can show people what good ecological condition looks like on the broads.
- Improved water quality – lower turbidity, lower P levels with HGB and HB from macrophyte growth.
- Long term – Change in the fishery to a more natural and diverse fish community – increase piscavores, rudd, tench. Increase of pike meets Broad's Angling Strategy aims.
- Reduction in bream numbers as a result of biomanipulation could create conditions for clear water in whole upper Bure system (hypothesis of Geoff Phillips and Martin Perrow)
- Successful deliver of LIFE and HLF funded project

Negative impacts

- Loss of important bream spawning habitat for period barriers are in situ, potentially having a large impact on bream populations in the Bure/Thurne/Ant (BTA) fisheries if they do not find alternative spawning areas. Resultant impact on local economy.
- Reduction of HGB fishery during period fish barriers are in place.
- Low levels of fish mortality from electro-fishing etc during fish removal phase of the biomanipulation.

Whilst we acknowledge that there is evidence to suggest HGB and HB are important spawning areas for bream within the BTA fisheries, **we do not believe that temporarily closing of HGB and HB will**

result in a significant impact on these fisheries. Furthermore, we believe such high populations of bream (and roach) are **indicative of the poor ecological condition of the broads**, and the project will help towards delivering a natural more diverse piscavore dominated fishery.

Closing off of HGB and HB will only have an impact on BTA fisheries if those **bream which would normally spawn on HGB and HB fail to find alternative spawning sites** during the 10 years the barriers are in situ. Bream are a very common species across England (and indeed northern Europe), found in a wide variety of waters from ponds and canals to large lakes and slow-to-moderate flowing rivers. This suggests they are able to **spawn successfully in a broad range of environments**. Indeed, we know that locally, bream will attempt to spawn on a wide variety of substrates including lilies, sedge roots and tress roots. It is therefore highly unlikely that within the BTA catchment, HGB offers the only suitable spawning habitat for bream. It is also very unlikely – given that bream have already been recorded covering large distances and wide areas - that **bream would not be able to access such suitable spawning habitat in the fishery**, even if it does not occur local to HGB.

Such a common species is also likely to be adaptable in its habits. It therefore seems reasonable to assume that if bream are denied access to HGB, they will simply spawn elsewhere. In terms of a species' evolutionary fitness, it is not advantageous to show strong spawning site fidelity when other suitable spawning habitat is available and is accessible. **Whilst bream might preferentially choose HGB and HB due to habitat quality and the low disturbance levels, it is likely they will use lower quality habitats if HGB and HB are unavailable.**

While we acknowledge that specific data to support these conclusions is lacking, it should also be noted there is also **no evidence available** to suggest that bream have such high site fidelity that we would see a significant impact on spawning and recruitment. We also lack specific evidence on the proportion of broadland bream using HGB and HB so should be cautious when considering any impact to the wider population. This is however why we are creating a 'Hoveton Fisheries Advisory Group' with ring fenced budget so that it can monitor, in a reasonable and measured way, the management of this unknown.

Restoring HGB to a clear-water plant-dominated state potentially offers significant benefits to a wide range of species. This has **been acknowledged since the start of the project** and includes improved spawning, nursery, shelter and feeding habitat for rudd, tench and pike (see figure 4). The decline of the latter is identified as being of particular concern in the Broads Angling Strategy and it has previously been **acknowledged that restoration of HGB is likely to help deliver a number of the Strategy's aims**, particularly with regard to pike.

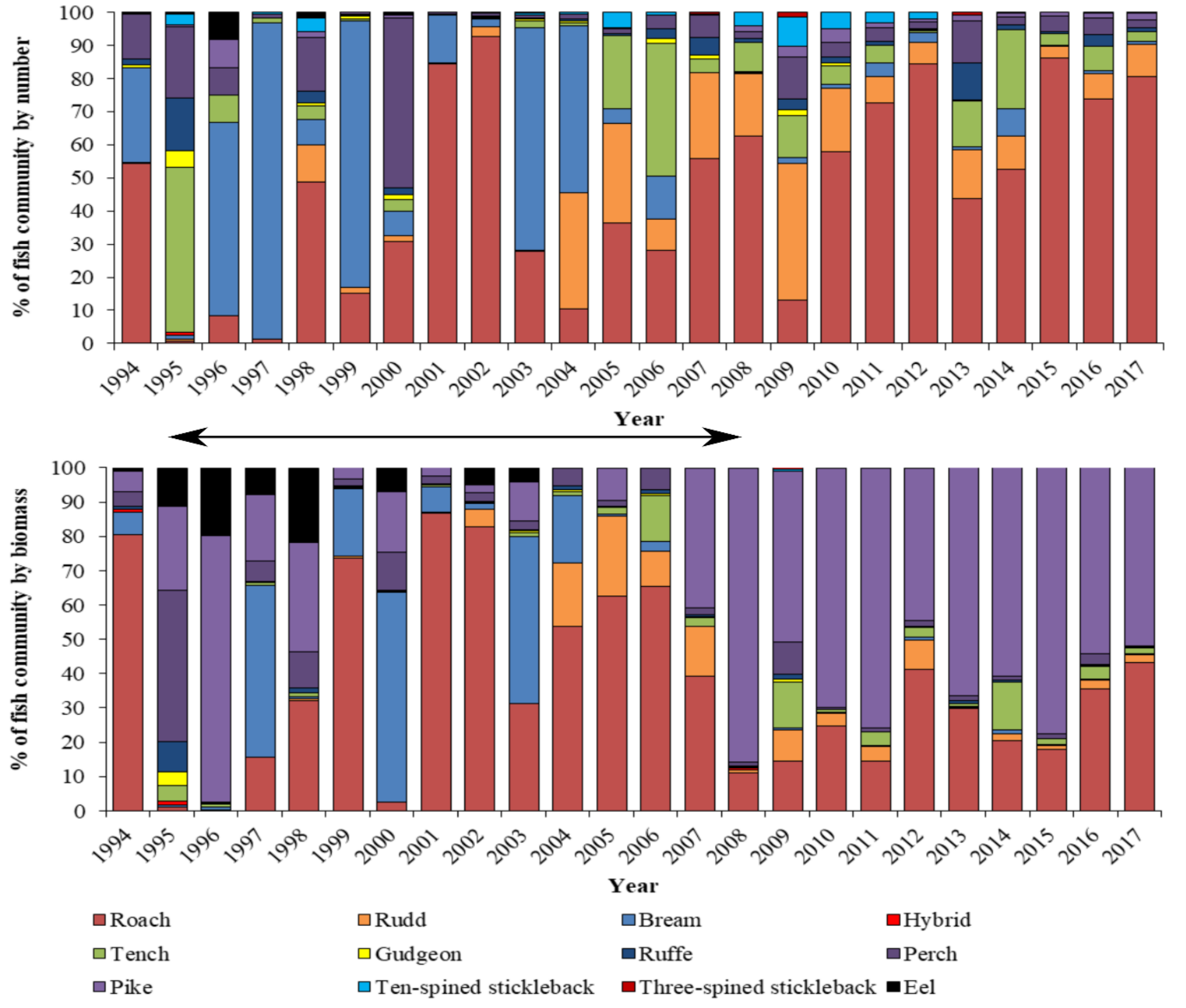

Figure 4: Fish community composition on Ormesby Broad following biomanipulation in 1994/95 to present (from Martin Perrow presentation at NE lakes network meeting)

A reduction in bream numbers is likely to be a natural consequence of restoring the broads system to good ecological condition. **Bream and roach will be found in greater abundance in algal dominated nutrient rich waters than in macrophyte dominated, low nutrient, clear waters**. Whilst this increase in bream abundance under nutrient enriched conditions is a natural response, their **abundance then helps to prevent a return to a macrophyte dominated, clear water state**. In clear waters dominated by macrophytes bream would naturally form a smaller part of the fish community, therefore **a reduction in bream is the inevitable outcome of successful lake restoration**. Consequently it needs to be accepted that improved water and habitat quality in the Broads by necessity goes hand in hand with reduced bream numbers. Sustained **high numbers of bream is incompatible with the clear water macrophyte dominated state, which is the objective for HGB and HB as a SSSI, SAC and WFD water body.** It needs to be acknowledged that in this case it is not possible to have both. Whilst bream will always form a significant part of any broadland fish community, they should not dominate the fishery as currently observed, a reduction in Bream numbers across the system by implementing biomanipulation at HGB actually represents a huge opportunity to restore not only HGB but the wider system.

There is no clear metric against which to measure the ‘condition status’ of the BTA fishery. There appears to be an assumption that the **high numbers of bream and roach is desirable** and should be maintained. It should be noted that the anticipated impact is on bream and a fishery heavily modified by eutrophication. Maintaining the current fish assemblage, by necessity requires the system to be **maintained in a permanently degraded state, placing the worth of an un-natural fishery, typical of a degraded system, above the conservation objectives of the SSSI, SAC, and WFD**, not to mention a diverse fish assemblage. A **changed** fish community with **improved numbers of rudd, tench and pike would also be highly desirable**, and is the likely consequence of biomanipulation as demonstrated by other successful biomanipulations across the Norfolk Broads.

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