THE RIVER WENSUM PAST, PRESENT AND FUTURE - A REVIEW BY THE BROAD ANGLING SERVICES GROUP

By

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A Dream of the Future!

INTRODUCTION

1.1 This paper found its genesis in work undertaken by members of the Broads Angling Services Group (BASG) – Wensum Working Group to understand why there has been a marked decline in the River Wensum's Roach population both in size and fish numbers. BASG's initial intention was to conduct a BASG Roach Project influenced by the River Avon's Roach Project to attempt to make improvements to the current situation. In conducting a review of a considerable body of the many papers and studies into the condition and challenges to the River Wensum's ecology, biodiversity and water quality written in the past 10 to 15 years, it became very evident that an angling community of interest could not solve the issues at hand in isolation of the many other stakeholder and interest groups having authority, responsibility and enthusiasm to effect change for the better. It was extremely obvious that there was a need for a concerted and sustained effort to reinvigorate the measures initiated by the River Wensum Restoration Strategy. The Strategy was commissioned in 2009 by Natural England and overseen by a steering group convened by Natural England in partnership with the Environment Agency and the Water Management Alliance.

1.2 The paper provides background with context and history to support the central theme followed by identification of the community of interest and their roles. A catchment perspective is then presented from both a national and local perspective. There is then some discussion of the main perceived threats to the health and demographics of the Roach population, with deliberation of other issues that should be considered before identifying the future steps that should be taken to inform the main elements of a plan that can be taken forward with a River Wensum Roach Recovery Program by the community of interest.

1.3 Notwithstanding the River Wensum Strategy - 2009, the overall status of the ecology of the river with reference to the Wensum WFD is moderate compared to bad in 2009. It is of note that the WFD indicates that some of the river's tributaries remain poor, which must have adverse impact on the river as a whole.

AIM

2. The aim of this paper is to identify the key issues undermining the progress in maximising ecological benefits from the River Wensum Strategy restoration work to make recommendations for a more robust Catchment Based Approach (CaBA) with key stakeholder engagement.

BACKGROUND

3. **Context – The River Wensum. "***The River Wensum is a low gradient chalk river located in Norfolk, England. The river, and a number of adjacent floodplain land parcels, are of national and international importance for wildlife, being designated as*

a Site of Special Scientific Interest (SSSI) and as a Special Area of Conservation (SAC). As a chalk river the Wensum is also recognised as a priority habitat within the UK Biodiversity Action Plan (BAP).

***Typical Upstream Wensum at* Shereford**

3.1 *Past physical modifications to the River Wensum and tributaries have been undertaken to drain adjacent lands to improve their agricultural value, and to provide water storage for milling. These modifications have included extensive dredging which has straightened and over-deepened the channel, significantly impacting on the natural geomorphology and ecology of the river. The 14 redundant mill structures along the course of the River Wensum have significant hydrological impounding effects, with river water backing up behind these structures under a range of flows. This results in sluggish flows and accumulation of sediment in the channel, which, over time, have also contributed to the River Wensum being in unfavourable condition. Former latest condition assessment of the SSSI (Natural England, 2010) found all of the riverine SSSI units to be in 'unfavourable no change' condition. Reasons cited for this condition included poor water quality, excessive siltation and physical modifications. (Reference A)".*

3.2 Action has been taken to address some of these issues in a number of locations, both by Angling stakeholders and the River Wensum Restoration Strategy, but there remains concern that these measures have not had sufficient beneficial effect.

3.3 **History**. Wensum Roach are considered indigenous to the river and were historically prolific, at times reaching very good sizes for the species, (2lbs plus, even 3lbs in some cases), particularly in the second half of the twentieth century. The 1950s and early 60s probably saw the peak of the boom time, which ended around

Hellesdon Mill

1967 when there was an outbreak of *Columnaris*/UDN which devastated the roach population. There was a period after this when a number of survivors and their progeny grew to exceptional sizes, but by about the mid – late eighties both numbers and ultimately sizes of roach in the river had finally dwindled to a fraction of what they once were.

3.4 Environment Agency (formerly AWA and NRA) fish population surveys have been carried out on the Wensum since 1983 and now show a population of Roach, which though possibly declining still is considered viable and sustainable. (There is a caveat here, no-one knows for sure exactly where all juvenile Wensum Roach originate, it is wholly possible that some of them at least are still-water spawned and have found their way into the river during floods or helped by human hand!).

Wensum Roach.

Because these surveys began long after the roach population crashed, they do not take account of the numbers and size of roach in earlier years. We will never actually know the size and extent of the population in those times, other than by guesswork based on anglers catch reports, which invariably show a huge decline in both figures overall in the years since.

3.5 Whilst among anglers at least there is definitely considered to have been a significant drop in numbers of roach, research by the Environment Agency has concluded that the population is not stock-limited, i.e. that there are sufficient roach in the river to breed and sustain a healthy population. Certainly at times there seem to be plenty of roach around to catch in some areas, often up to the six/eight ounce bracket, but they are no longer able to easily reach sizes much more than a pound in weight, let alone 2lb plus, which was formerly the target (and a realistic one) for the Wensum roach angler. The actual number of fish fluctuate, with an apparent downward trend, which may be a key reason why the big fish no longer seem available. It is possible that this might be because they simply don't survive long enough to reach good sizes because of lack of sufficient food, or in the view of many anglers most likely due to over-predation. This may also be an indicator in itself that these fish have entered the river from an adjacent Stillwater and as such do not sustain in the river environment.

3.6 **Community of Interest**. The community of interest in addressing issues investigated by this paper is as follows: The Environment Agency; Natural England; Wensum Working Group, (part of Broads Angling Services Group); Community Interest Groups; landowners with riparian rights; the angling community; community interest groups.

4.0 **An Anecdotal View of The River in Times Gone By.** This section is reproduced by kind consent of its author and taken from:

"Changes in the Wensum ecology in the last 50 years
Russell Francis, 50 years a Wensum Angler and Naturalist"

"I have fished, both coarse and fly, and walked the river since the late 60's. Initially this was in the Lenwade to Hellesdon area but, from the early 80's, throughout the

river mainly from Bintree and all sections down to Norwich. In the mid 1990's I actually walked the entire river from the Tat junction to New Mills in Norwich.

Bintree Mill.

4.1 Generally. *The river is narrower in terms of open water and appears to have a decreased average flow than in the early years. Management of the mill sluices has changed with the privately-owned structures generally being left fully open all year round and the Authority (now EA)-controlled and subject to some form of automatic/semi-automatic regime. Dredging/silt removal has declined to almost nil and likewise the annual weed-cutting operations. Far less tree/shrub removal is carried out than in earlier years. Following periods of heavy rainfall, the river rises very quickly (more so than in the early years) but also drops back in level quickly. In sustained wet spells the levels may remain high, but the heavy sediment loading is normally only apparent for very short periods following the rainfall and the water can be surprising clear despite being bank high. A lot of work has been undertaken to reduce the immediate agricultural run-off and I assume that the initial loading has a higher road/hard surface component these days. In recent years there has been an increased incidence of 'summer' floods, most notably 2007.*

4.2 *Changes in vegetation*. *In the 60's the river macrophyte community was quite diverse throughout the individual sections, i.e. between mill structures. Immediately downstream of the mills Perfoliate Pondweed extended for large distances with occasional beds of Water Crowfoot on the more gravelly, shallow sections. As the river generally slowed Bur-reed became the dominant species with*

yellow waterlily occurring in the deeper, slow section immediately upstream of the mills. Other species included milfoil, arrowhead, starwort, Canadian Pondweed. The situation today is that the Waterlily now often extends much further upstream of the mills into water far shallower than formally.

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Typical Bur-reed Vegetation.

Upstream of this the Bur-reed is by far the most dominant species with a much-reduced area of the perfoliate pondweed present nearer the mills. Other species are much reduced or largely absent. In fact, at times the Bur-reed itself completely disappears for a number of years on some stretches leaving a largely barren 'desert' with no macrophyte cover for large distances.

***4.3 Changes in invertebrates**. One of the wonders of the Wensum in the early years was the diversity and abundance of its insect life. Various species of Baetis,*

Baetis nymph.

Ephemera and caddis were extremely common. Indeed, one could watch the diurnal swarms of the caddis, brown/black silver-horn, over hundreds of yards of the river's length. These however were already beginning to decline, and all caddis species were noted as only at a fraction of their former numbers by the early 80's. A similar situation exists for the mayfly species although Ephemera Danica still appears in varying numbers. (its larvae are silt dwellers!).

Signal Crayfish - a most uninvited interloper.

4.4 Crustaceans etc. *The freshwater shrimp was abundant again in former times, with large numbers found clinging to any submerged material within the river. Certainly, today I have not seen any for many years in the middle to lower reaches despite a great deal of in river work. Native crayfish are now scarce, if not absent from most of the river that I'm familiar with - I last found one 2 years ago. The non-native signal crayfish was of course absent from the river until the mid 1980's. Initial colonisation was in the area downstream of Lenwade. A few years later further colonisation occurred in the Swanton Morley area and now much of the river has a considerable population of these. I cannot comment in depth on mollusc populations although casual observation would indicate that some forms appear to have declined.*

The Effect of Invasive Species on Bank-Side Habitat.

***4.5 ROACH**! That the roach disease severely affected roach populations nationwide is beyond doubt but, as far as the Wensum goes, there seemed no real shortage of roach when, as a relative novice angler, I fished in the late 60's. Certainly in the first half of the 70's catches were stupendous and, contrary to many accounts, fish were of all sizes. A very few of the very large fish did show signs of having recovered from disease but many more were immaculate and were obviously of an age that they had lived through the disease period with no ill effect. However as the decade progressed catches declined although individual large roach were still to be found. The 1980's were very poor generally for the roach and many claimed the influence of the expanding chub population. Now the chub were initially stocked only in the area downstream of Costessey and the next area to hold a population was upstream of Swanton Morley. In between the chub numbers were fairly low for some years as were the roach! In fact in my experience there does not seem to be an immediate effect on roach population due to chub BUT, when, as usually happens, the chub population 'booms' then there seems to be a failure of younger roach for some years. When the chub numbers then stabilise the smaller roach once again gain a foothold.*

***4.6 Cormorants etc**. Cormorants have been blamed for the lack of roach throughout the river and these avian predators have been common in the river valley since the mid 70's. Most birds seem to fly in from the Broads and/or the coast, but in my experience, they feed predominately on the extensive gravel pits within the flood plain. Individual birds are often found hunting on the river but only appear in any numbers when there is large scale freezing of the adjacent still waters. The introduction and subsequent success of the otter from the mid 90's has had a considerable impact upon the fisheries in the Wensum valley. Nowadays the numbers seem to have stabilised here at least and a number of the high value still water fisheries have erected otter proof fencing. I have witnessed otters catching pike, chub, barbel and roach on the river. Again, the biggest losses with respect of roach seem to occur when the female otter, with up to 3 offspring, encounter a large wintering population of roach. This happened in the late 1990's at Lyng mill pools when considerable losses were observed before the remaining roach disappeared elsewhere for the remainder of the winter.*

***4.7 Flooding**. Flooding of the river valley has occurred of course on innumerable occasions and this includes the adjacent IDB drains, dykes and especially the gravel pits. Without any doubt there can be a substantial exchange of fish between these systems especially when the flooding happens outside of the mid-winter period.*

Typical Flooding on The River Wensum at Lyng

High levels during early spring for instance will see roach gathering around the stillwater margins and they actively seek out inlet/outlet flows so it is not surprising that many can and will find their way into the river and indeed fish, especially fry, will equally enter a still water in winter flood conditions. That this has happened on a number of occasions is easily seen by a correlation of increased roach numbers following such events and small dace and chub appearing in the pits.

4.8 *Roach in the future*.

4.8.1 *Whatever their origin, there does seem to be a reasonable population of small to medium size roach present in several sections of the river at present. In order for any of these to reach the sort of size formerly encountered in the early 70's I feel that they need food items in the form of invertebrate larvae, freshwater shrimp and probably molluscs which are sadly lacking throughout the middle and lower river at least. Roach can certainly grow to the sizes we see now with filter feeding of zooplankton and small food items. I do not see predation being the limiting factor and, although the impact of the signal crayfish is a bit of an unknown, the pattern of invertebrate loss does not correlate with the establishment of these aliens. Equally, I do not think that actual spawning of mature fish should be a problem within the river as it is at the moment. The roach is just about the most widespread of freshwater fish, often thriving in what would appear to be far more hostile environments than the river Wensum!*

4.8.2 *The changes in the macrophyte community does, however, reflect deleterious effects of both flow regimes and substrate change, no doubt with consequent adverse effects upon food supply. Many thousands of pounds have been spent over the last 20 years or so improving the diversity of sections of the river bed and allowing the 're-wilding' of the bank side growth. There has been little or no lasting effect of such work on this food supply-chain thus far. In summary, despite the advances made in restricting silts and their associated contaminants from agricultural practices there remains a lot more to be done and of course the residual effects are there, possibly for many years. The recent reports of neonicotinoid levels in the Wensum and Waveney for example are extremely worrying alone even though further restrictions are now being applied as to their use. Add to this the complexity of the make-up of road and hard surface run-off, the contaminates of the modern*

sewage systems and even airborne pollution, I sometimes wonder just how the river manages to produce any life forms at all!!"

4.10 The foregoing view of the Wensum is also reflected in the recollections of a Fakenham River Keeper some 50 years ago:

The River Wensum at Fakenham.

V.S Rose former bailiff to the board 1953-1970:

Notes on the decline of the river and adjoining water meadows during and since the care of the rivers came under the East Suffolk and Norfolk River Board in 1948.

The River Wensum upstream from Denning and Kersley's Mill as far as Sculthorpe Mill, having been drained from its original bed for the purpose of storing and feeding water into the three water mills that existing over a length of approximately 2 miles; namely Mrs Grays Mill at Sculthorpe, the Goggs Mill at Hempton and Denning and Kersley's Mill at Fakenham.
Of the three Mills, only two now remain, no longer used for grinding corn Mrs Grays Mill at Sculthorpe is now a restaurant and Denning and Kersle's has been converted into flats and the Goggs Mill was finally destroyed by the Old E. Suffolk and Norfolk River Board in 1957, quote "in the interest of drainage and agriculture".

The exact date of the diversion is not known no records have come to light and the deeds of Goggs Mill were never found. However, a certain amount of evidence would suggest that it took place during the first 10-20 years of the 18th century. Foden's Map of Norfolk 1797 shows the existence of 3 mills over the length of the water course and although it is obvious that Denning and Kersley's mill has been rebuilt,(the original having been destroyed by fire) both Sculthorpe and Goggs Mills were much older (constructed of red brick and chalk).

The river was apparently moved some 50-70yds south from its natural bed, into an artificial bed, the new course was much wider and deeper than the original and a bed of shingle was laid over the 2 mile stream to assist the river to clean itself. The importance of this will be seen later). Used in conjunction

with the operation of the Mill's sluices, constantly flushed the river 24 hours as the mills worked on a rota basis of 5ft head of water was stored and released on alternate days.

Old photocopies show the river to be in some places 25-30 ft wide and the depth in the pools 12ft deep. Obviously, no river, only 7 miles from its source would ever naturally have been of such proportions. In places on Ox-Bows and bends wooden hoardings were constructed on the N bank to prevent erosion. As the new river was continuously cutting that bank, in an effort to reach its old bed, traces of these hoardings can still be seen on the north bank of the Sculthorpe Fen.

Having diverted the river into a new course, the Landowners were faced with the major problem of drainage, the river now in places higher than the surrounding land. To achieve this a complex system of land drains were constructed, the water from these drains emptied into the river in front of the mills. The old river bed was incorporated in the system and emptied its contents into the front of Goggs Mill.

So it can be seen that irrespective of the Mill's holding of water the drainage system was always working (a similar system existed at Ryburgh and Costessey Mill's). Assisted by a network of smaller drains the land adjacent to the river was kept in perfect condition in respect of drainage. It has been stated that the River Wensum between Sculthorpe Mill and Denning and Kersleys never directly took a drop of water off the land. Such was the effectiveness of the system the land on both the Hempton side and the Sculthorpe Fen, while it was lower than the water course was kept in a good state enabling grazing and hay making to take place at all times.
The water mills gradually ceased to function, although the sluices at Dening and Kersley were operated on occasion, the river was in excellent condition in respect of the quality of its water, good fishing especially for trout, dace and roach was enjoyed by local anglers and holiday makers.

The Wensum Roach were renowned for their size and colour. The weed growth on the chalk and gravel bed was prolific and varied, producing in the spring and early summer hatches of Mayfly, pale olive duns and many other species. Fresh water shrimp, crayfish and minnows all pointed to the purity of the water, Kingfishers and Otters were common on the Sculthorpe Fen.

Under the new River Board Act of 1948, the care and maintenance of the Wensum came under the control of the E Suffolk and Norfolk River Board. In the early 1950s a scheme was introduced the effect of which was to be disastrous for the Wensum.

Very soon after the E Suffolk and Norfolk River Board took control a statement appeared in the local press announcing that they intended to carry out a major drainage programme.
For almost 3 years the dredger carried out the programme as staged, the river above Goggs Mill suffered the worst as the laid gravel was easily removed

and as the dragline required an operational width of 15 ft all shrubs and vegetation was destroyed on the south bank.

After the work was completed in 1967, the character of the river completely changed, it became a deep muddy canal. The attractive bends were mostly gone and the fast gravel and chalk runs were replaced by mud and silt. Every spring the river is to this day covered with a layer of filth. As the sun increases the water temperature, the decaying weed rises from the bed and floats in great rafts downstream.

The otters and the kingfishers have gone and so have the roach and wild brown trout. In June there is no Mayfly hatch from the muddy bottom and with the coming of the nitrate problem the river has been taken over by the worst types of weed and algae.

The worst irony of the whole sorry mess is that the year after the work was completed, the Sculthorpe Fen was flooded, something that before was almost unheard of.... Unless some change in attitude is forthcoming the river will remain almost lifeless.

It is true that stop boards have been introduced at Denning Kersleys Mill during the winter months these boards are lifted to allow surplus water to run off surrounding land lowering the water level some 18". In the spring the boards are lowered and the river again becomes still and dirty. Admittedly in the river in the winter months returns to some degree of normality. I believe it would be better if the stop boards were removed altogether allowing the river to naturally find its own level, failing that they could be operated on a more regular basis thereby partly simulate the previous action of the mills.

Admittedly the river started to deteriorate the day the last mill stopped working. The attitude of the water authority does nothing to help the situation now.

It is too much to hope for the return of the situation that existed before the war, because the water no longer has any commercial value, and as today everything is reckoned in terms of financial gain, not a great deal of effort can be expected. Certainly, it is too much to expect that the river be returned to its natural bed. However, if the shingle gravel bottom could be re-laid, the banks stabilized, the stop boards used properly, and the river be allowed to return to its natural size. Some good may come of the existing mess. I am afraid however that these things will not be done, The Authority will, as foretold by Mr Cotton, continue the programme of dredging every 20-30 years, if only to satisfy public opinion in respect of seeing an open stretch of water. Tragically after all the effort and cost the surrounding land is worse off in appearance and drainage than it ever was. "

So, despite much concern and much action on the River Wensum reading both views of experiences from the river over many years, one might ask what we have achieved and what will we achieve in the future. Clearly, we really need to focus on

the issues and to implement sound, sustainable corrective actions to make improvements.

A CATCHMENT PERSPECTIVE – THE NATIONAL VIEW

5. The following is presented from the Executive Summary from Reference B. The Catchment Based Approach (CaBA) promotes collaborative working at a river catchment scale to realise environmental, social and economic benefits. In early 2017, the CaBA Benefits Working Group designed a monitoring and evaluation assessment process to better understand the benefits arising from CaBA, to determine the general direction of travel of partnerships and to target capacity building.

5.1 **Partnering**. CaBA partnerships are engaging with an increasingly diverse range of stakeholders. Partnerships are actively engaged in delivery and/or are funded by their local water company, whilst other partnerships are actively engaged with local authorities on environmental issues including project delivery, with others liaising with councillors and planners. Some partnerships are actively engaged with trades (excluding farms). At a national level, these businesses include large multi-nationals, airport and port authorities, hotels and others in the leisure sector such as food and drink companies and small local companies. Partnerships also include funding from Local Enterprise Partnerships (LEP) during 2017/18 and other partnerships include at least some form of engagement with a LEP and/or LEP awareness of their work. Across the country's agricultural concerns, almost 6,200 farmers have been engaged during 2017/18 across 92 partnerships.

5.2 **Catchment Management**. These Partnerships continue to take an evidence-led approach to catchment management, drawing upon datasets EA and academia. Partnerships undertook 452 projects during 2017/18 encompassing a wide range of issues. More than 60% of projects included engagement and awareness raising, with 45% addressing education and more than 14,000 volunteers and citizen scientists were deployed. Sixty-five per cent of projects addressed biodiversity and habitat restoration, with 2,835 hectares of new habitat being created. River habitat restoration was undertaken within 53% of projects and 94 barriers to fish migration were mitigated, adding to the more than 200 similar CaBA projects undertaken prior to spring 2017. Invasive non-native flora species were controlled or eradicated along more than 50km of riverbank. Rural and urban diffuse pollution were addressed within 200 (44%) and 72 (16%) projects respectively. The former encompassed a variety of on-farm activities including the development and implementation of nutrient management plans, addressing soil erosion, riparian management including fencing, infrastructure improvements and support to farmers with regard to grants. Flood risk management was an objective of 30% of projects (136) whilst low flows and water scarcity accounted for 14% (64 projects).

5.3 **Socio Economic Benefits**. In addition to environmental outcomes, various social and economic benefits were reported for work undertaken during 2017/18. These included; the provision of training schemes for those living within deprived communities, the development of green space to enhance community health and

wellbeing, improvements to farm business, improved aquatic habitat leading to an increase in angling revenue and, a reduction in economic damage caused by flooding. Moreover, during 2017/18, for every £1 directly invested by Government, CaBA partnerships have raised £6.5 from non- governmental funders including water companies, EU funds including LIFE, Interreg and Horizon2020, waste companies and landfill taxes, and lottery funds. The previous funding ratio was 8:1, however, this was aggregated over the first four years of CaBA and no trend can be inferred. It is likely that considerable year to year variation in the ratio is apparent, but this remains unproven.

5.4 **CaBA Next Steps**. Future Partnerships engagement with stakeholders continues to grow and diversify, including business liaison, facilitated by the CaBA Water Stewardship, Project Manager. Substantial potential exists, however, to expand this engagement further still, particularly with local authorities, Local Enterprise Partnerships (LEPs) and health authorities. It is anticipated that National level activity by the CaBA National Support Group (NSG) should help to facilitate this wider engagement.

5.5 **Delivery**. Environmental delivery by CaBA Partnerships continues to grow, however, **projects addressing Groundwater and Transitional and Coastal Waters remain relatively limited.** The reasons for this need to be understood and, if necessary, targeted support to partnerships provided. Additionally, despite its importance in certain regions of the country, **reporting of water efficiency projects was relatively scarce**, although with evidence of growth in their number over the last year. The 2017/18 reporting reflected an improved reporting of monitoring to capture the environmental benefits arising from delivery. More support to partnerships, is required, however, to help them to undertake and improve the monitoring and evaluation of their projects. The social and economic benefits arising from CaBA projects are key elements of the evaluation process and whilst reporting of these increased during the 2017/18 period, they remain relatively limited. Support to partnerships is required to help them better understand and improve the capture of social and economic benefits.

5.6 **Government 25-year Environment Plan**. CaBA Partnerships can play a key role in the delivery of the Government's 25-year Environment Plan and the NSG is well placed to help drive this process across all areas of policy. Part of this role needs to include guidance to partnerships to help them better understand the language of natural capital, its importance in engaging key stakeholders and, potential to underpin project proposals. All CaBA partnerships are encouraged to have a regularly reviewed Catchment Plan. These plans are made up of several elements, which may be at different levels of development. Partnerships are also encouraged to work with partner organisations to maximise benefits for the water environment.

5.7 **Tackling Farm Management Issues**. The partnerships were asked to give written details about how their projects have tackled farm and land management issues and the outcomes of these interventions. The following gives some examples of responses:

5.7.1 Leaflet encourages farmers to contact the local Catchment Sensitive Farming officer for advice.

5.7.2 Working with horse owners/land managers; installed fencing and moved manure store away from watercourse.

5.7.3 Habitat improvement works including tree planting, willow spiling, INNS removal.

5.7.4 Targeted farm guidance for natural flood management.

5.7.5 Encourage an increasing number of farmers and landowners as part of wide-reaching group.

5.7.6 Collaborate, network, share ideas, raise awareness through farm visits, presentations of key relevant topics etc.

5.7.7 Support and advice to reduce pollution risk, access Countryside Stewardship grants, compliance with NVZ (Nitrate Vulnerable Zone), cross-compliance. Free soil & nutrient analysis service to hep match nutrient inputs to crop requirements.

5.7.8 Management of vehicle tramlines/wheelings.

5.7.9 Information and advice on the use of various pesticides.

5.7.10 Provision of advice to farmers to ensure appropriate management of riparian vegetation to benefit water voles & chalk stream ecology.

Burr Reed - Definitely on the need-to-management-closely List of Riparian Vegetation.

5.7.11 Through tailored farm plans, soil testing and advice, farm management can be altered to reduce environmental risk and improve nutrient efficiency. Extensive work is also undertaken to reduce soil loss erosion and loss.

5.7.12 Educating landowners on best practice and availability of stewardship grants through one-to-one visits giving targeted advice, workshops and newsletters.

Sound Farming Management
of Areas Between Wetland and Rivers
Using Crop Buffering Areas.

5.7.13 Providing tailored advice and developing Farm Clusters.

5.7.14 Soils Manual has enabled upskilling of advisors and delivery of good soils hydrology advice which will have a knock-on benefit to farm management for many years.

5.7.15 The grazing regime on the adjacent field has been altered along with using rare breed cattle more able to cope with wetter ground conditions. Stock density has been reduced to more sustainable levels.

5.7.16 Capital grant scheme to support infrastructure improvements such as bio-beds, wash-down areas, rain water harvesting, riparian fencing etc.

5.7.17 Improvements to bridges and trackways to reduce soil erosion and diffuse pollution.

5.7.18 On-site water management - guttering, rainfall collection and separating clean and dirty water systems.

5.7.19 One-to-one discussions with farmers during walkovers and working up interventions.

5.7.20 Explaining what the catchment issues are to farmers, what we are trying to achieve and how the farmers can help, allowing interventions such as temporary water storage areas, tree planting, riparian fencing etc.

5.7.20 Engaging land owners that own meadows and encouraging more sustainable management

THE CATCHMENT APPROACH - THE RIVER WENSUM VIEW.

6. Whilst there is a strong Catchment structure across the Broads Rivers Management Catchment, little or no focus has been applied at sub-catchment scale to the River Wensum within CaBA. The River Wensum has strong designations and been the focus of a Restoration Strategy, Reference C, led by Natural England and the Environment Agency. In recent years, this initiative seems to have lost its impetus. Many of the interested stakeholder groups now could be considered to work in "silos" in a seemingly haphazard manner in delivering targeted maintenance on the river. There are many stakeholders sharing a passion to restore the River Wensum to as much of its former glory as is feasible given the many constraints applying to river restoration projects. We believe that much more could be achieved if we adopted CaBA principles at the sub-catchment level to reinvigorate the delivery of the key deliverables in the River Wensum Restoration Strategy.

6.1 We propose that all stakeholders should combine their efforts to deliver a co-ordinated approach to deliver measurable and sustained improvements to the River Wensum's journey back to becoming a pristine SSSI and SAC. BASG presented this proposal to the wider catchment partnership at the Broads Rivers Catchment steering group on 14th March 2019, for discussion. The proposal received favourable agreement in principal and some draft proposals on a potential governance structure is contained in appendix 1 for consideration in taking this forward.

Recommendation:

The responsible bodies of the River Wensum adopt the CaBA to managing the ecology of the river by September 2019.

THREATS and ISSUES

7. **Reduced Flows**. Reduced river flow and DWP are both important factors in the deposition of excessive amounts of silt and sand in the river system. This excess, (accepting that there will always be a certain amount of suspended solids as part of the natural processes of a lowland river valley) is attributed to a number of human activities in the environment, such as ploughing up the valley slopes for arable crops (in particular the increase in growing maize for biofuels), the keeping of pigs on the slopes, the reduction of meadowland floodplain buffer zones, the loss of headlands in some arable farming, and also the run-off from roads, towns and industrial developments etc. Suspended material basically drops out of suspension

when the water current velocity slows enough to allow it to do so, typically behind an obstruction in the current but also when there is simply not enough flow to keep it mobile. In a healthy river environment, the gravel riffles will be kept clear of excess silt and sand deposits by the current, when this is not sufficient or there is just too much material in suspension, such deposits will accumulate and clog the gravel, preventing healthy oxygenation which is essential for many life forms, including certain invertebrates and the young of some fish species. Such invertebrates are likely to form a significant part of roach diet at times, and a shortage will have an obvious impact. Of note is that when gravel jetting the riffles sandy top-soils quickly drop out of the fast currents and are deposited immediately downstream, whilst smaller and lighter materials drift away in a cloud of suspension.

7.1 **Diffuse Water Pollution**.

Pristine River Gravel.

7.2. Diffuse water pollution consists of a number of recognised components mostly linked to human activity. Agricultural run-off includes suspended solids (largely the result of soil erosion) and chemicals used as fertilisers, pesticides and herbicides. Accidental spillages of these and diesel fuels is of serious concern. These elements (via road drainage) as well as tar, oils, rubber, plastics etc. come from run offs from towns, industrial sites and road systems. Treated sewage from water authorities, (and untreated sewage under licence released during flood conditions), sceptic tanks and cess pits include chemicals in detergents, contraceptive drugs (endocrine disrupters affecting fertility), statins and other medicines and drugs all of which have detrimental impacts on the water environment and its components.

Poor Farming Practices,
Amongst Other Factors
Lead to Significant Silt Ingress

.

7.3 Silt.

Heavily Silted Gravel

Natural England created a set of wide-reaching standards for Natura 2000 Diffuse Water Pollution Plans (IPENS001). This included the Wensum Special Area of Conservation (SAC). The IPENS is enabling Natural England, the Environment Agency and other key partners to plan what, how, where and when efforts are targeted on Natura 2000 sites and the areas surrounding them. As part of the program, they identified gaps in knowledge and have commissioned a range of projects to help us fill these gaps. The following link refers: River Wensum SSSI - Exemplar Diffuse Water Pollution Plan and Action Plan . A further piece of work was commissioned in 2010 on rural sediment tracing by the EA (see Wensum Rural Sediment Tracing). This major investigation identified a total of 553 locations where sediments could ingress into the River Wensum. 20 of these locations were of significant adverse impact and our recent investigations have found little mitigation has been implemented at these sites. Stopping silt ingress at these sites has to become a major focus for all river improvement schemes in the coming future. Only making such an undertaking will achieve a significant reduction to the level of silt

reaching the river, thus removing the underlying impacts that silt creates. An example of the value of the approach advocated is shown in the outcomes from the Salle Silt trap and the volumes of silt and Phosphate captured as reported by UEA recently (See An Environmental Case Study Silt Traps on the River Wensum)

7.4 **Invertebrates**. Pesticide pollution is impacting on invertebrates. It was widely reported last year that Neonicotinoid Contamination was chronically polluting the river Wensum, with studies showing poor resultant invertebrate levels. https://www.buglife.orguk/news-%26-events/news/heavy-neonicotinoid-insecticide-contamination-damaging-british-rivers).

A recent report issued by Salmon & Trout Conservation also refers to other chemical compounds affecting the river, upstream of Bintree. The Riverfly Partnership scheme does not currently give an end-to-end assessment for the recordings of the levels of invertebrates found along the entire river. See: https://www.salmon-trout.org/wp-content/uploads/2019/03/Chemical-Investigations-on-the-Wensum-watch-list-vs-SPEAR-1.pdf

Recommendation:

The gap between WFD status and findings reported by bug-life in 2018 and S&TC in 2019 be understood and scope for the formation of a potential River-fly Partnership scheme be investigated across the Wensum catchment to gain better understanding.

7.5 Changes to farming practises to facilitate growing maize for biofuel production results in fields that are left without cover-crops for long periods during autumn and winter.

7.6 Further studies by the University of East Anglia, Environment Sciences Team, led by Richard Cooper includes an analysis of water and riverbed sediment sampled across the river Wensum catchment and has demonstrated that Sewage Treatment Works (STW's) significantly impact upon the phosphorus dynamics of a lowland calcareous river system. The following link refers: Riverbed sediments buffer phosphorus concentrations downstream of sewage treatment works across the River Wensum.

Recommendation:

The worst-case single-point source locations of STWs are further analysed to find the potential linkages into the AMP process for future mitigation measure investment.

7.7 **Climate Change.** A review of Summary of Climate Change Risks for the East of England, commissioned by the Department for Environment, Food and Rural Affairs (Defra) to coincide with the publication of the *UK Climate Change Risk Assessment (CCRA) 2012* provides the following assessment which is pertinent to the River Wensum:

7.7.1 Water Scarcity. The East of England region is the driest region in the country. Annual rainfall (600mm average) is only 70 per cent of the national average and less than 20 per cent of the amount that falls in the Lake District. The region already faces significant water challenges, most of the East of England is recorded as being over- abstracted or over-licensed at low flows.

Though water abstraction remains a significant pressure on the river Wensum, Natural England in conjunction with the Environment Agency have set new targets for flows within the SAC. In recent years, this initiative has successfully reduced demand by around 1.32 million cubic metres of water per year from abstraction licence holder quotas. So quite a positive achievement. This work can be studied further in the following link: Managing Water Resources

7.7.2 Sea level Rise. The East of England is a low-lying area with one-fifth of the region below sea level. There is also some of the fastest eroding coastline in Europe in Norfolk and Suffolk. The specific geology of the coastal areas (clay and sandstone) makes them particularly vulnerable to erosion. It is anticipated that the East of England could face dramatic increases in sea level of up to <0.54m by the end of the century assuming the high UKCP09 emissions scenario 6. Shoreline Management Plans (SMPs) are being developed by Coastal Groups, principally made up of local authorities and the Environment Agency. The plans are based not only on the latest available scientific knowledge, but also upon the current legislative and funding arrangements for coastal defence management. In the East of England, these include; Lowestoft Ness to Felixstowe Landguard Point, North Norfolk Shoreline Management Plan, and the Essex and South Suffolk Shoreline Management Plan.

7.7.3 World Famous Biodiversity. The East of England has world famous nature reserves and is rich in biodiversity, landscape and built heritage. For example, The Norfolk and Suffolk Broads is Britain's largest protected wetland and third largest inland waterway. It is home to some of the rarest animals and plants in the UK and provides crucial economic input to the area welcoming over 7 million visitors per year.

7.7.3.1 The major risks are related to water management with flooding being the greatest potential risk. The coastal areas of the East of England are important from an economic and a biodiversity perspective. Farming and tourism are important economic activities and the importance of biodiversity along the coast is recognised, *Cliffs in Hunstanton, Norfolk (Environment Agency)* both nationally and internationally. Coastal erosion and loss of coastal habitat is a well-recognised risk for the Essex are well known areas of coastal erosion. The region contains 122,324 ha of SSSI, covering 7% of the total land area in the region

7.7.3.2 ***In 2009, around 75% of the region's SSSI area met the PSA target and were assessed as being in 'favourable' or 'unfavourable but recovering' condition***. A number of adverse

factors prevent the SSSIs in the East of England being in target condition. Many of the shallow marginal water habitats are in an 'unfavourable' condition due to complex coastal and freshwater issues flood defences and other developments. Much of the 'unfavourable declining' fen, swamp and marsh habitats as well as standing open water and canal habitats are affected by water abstraction and pollution from agriculture.

The Environment Agency suggests that mean monthly river flows between July and November could decrease by 30-80% if temperature rises associated with medium to high climate change scenario assumptions up to 2050 are realised.

7.8 Climate change may well be a factor largely ignored by anglers, but it is likely to be an influence on weather patterns, therefore availability of surface water, also more frequent and severe drought and flood events are likely to be driven by it. This latter will likely lead to or exacerbate erosion of banks, in turn increasing the suspended solid load further leading to yet more build-up of silt etc on the river bed. Climate change could also be a driver in changing wildlife and plant populations. For instance, Little Egrets are now common throughout the Wensum valley, as in much of lowland Britain. This is yet another predator potentially affecting juvenile/small fish survival. (It is apparently possible to "climate-proof" rivers to a certain extent, technically known as bringing in "climate change resilience", by means of tree planting to provide shade and thence cooling, also creation of more complex physical habitats. Source: Jez Wood, Environment Agency).

7.9 <u>Habitat Degradation</u>.

Roach in the Wensum are understood to spawn on the usual known substrates such as *Fontinalis antipyretica*, a water moss, and also submerged willow and alder roots. At this time, we have little firm information (one report from 2017) on present-day roach spawning sites, though some historical sites are coming to light. After hatching, the fry feed off the yolk-sac for a period before becoming free-swimming and moving on to food items such as algae and later zooplankton. It is understood that they need cover such as marginal plant growth, ("soft" margins), instream woody debris and off-river habitats etc to provide refuge from strong flows and predators. Suitable weed growth etc, both for spawning and juvenile survival, appears to be variable, even though the Environment Agency no longer cut the weed bank to bank in the name of flood defence, and also are much less inclined now to grub out riparian vegetation. (Current management recognises the high Fisheries and conservation value of the river, with flood risk management work only carried out where it will result in a reduction in flood risk to people and property. Source: Jez Wood, Environment Agency) A typical case illustrating some of the problems is a side-stream connecting the two weir pools at Lyng. This is actually believed to be the original riverbed, pre-mill construction, and has plenty of gravel, fast flows, and some overhead tree cover and a certain amount of instream and marginal weed growth. Extra gravel was added some years ago by the Environment Agency when the Barbel were known to be spawning here. Unfortunately, the water here still suffers from heavy siltation in the gravels, in spite of the fast flows and our yearly gravel

jetting, and also large sections of its banks are heavily eroded and denuded of vegetation (both instream and riparian) due to erosion exacerbated by colonisation by Himalayan balsam and repeated recent floods. *Ranunculus* weed has been found here at times but is usually absent, as indeed it is from much of the river, despite being listed on the SSSI/SAC citation. This absence is believed to be because *Ranunculus* species need fast flows and clean gravel to flourish, and the Wensum gravels, as stated elsewhere, are increasingly choked with sediment.

7.10 Predation. Predation, some of it arguably unnatural and excessive, is considered by anglers to be a serious factor affecting roach populations in the Wensum. Alien Signal Crayfish are found in great numbers throughout the Wensum in 2018, though population density seems to vary enormously, likely due to habitat preferences. These creatures will predate on anything small enough to be overcome, obviously this will include fish spawn, fry and juveniles, and also water plant life. Given the numbers of Signal Crayfish in the river now, they must take a significant toll of roach spawn and fry, and their respective food sources, and will be impacting on habitat both by burrowing into the banks (causing erosion and associated problems including bank collapse and increased DWP) and eating water plants.

The main culprit of over-predation of adult river Wensum roach is almost certainly the cormorant, now commonly found feeding throughout East Anglian fresh waters. Vast numbers of birds roost in the Norfolk Broads, and will fly considerable distances to feed. The science-based opinion is that they are no longer the saltwater feeding birds driven inland by sea fish shortages, but are in fact the migratory European subspecies, (carbo sinensis) which prefers to feed in freshwater. It is difficult to obtain up to date survey figures for cormorants in inland Britain, as the bodies responsible do not appear to be releasing this information into the public domain. However, it is known that numbers at the roosting site at Ranworth, in the nearby Broads, have increased threefold in recent years, to a current figure of circa 1800 birds in the winter months. Both these predators (Signal Crayfish and cormorants) are considered by anglers to be an additional, unnatural threat, on top of normal, natural predation levels by indigenous species such as pike, perch, kingfishers, herons etc. The Signal Crayfish is officially listed as an invasive alien, in this context anglers at least are definitely considering the "European" cormorant in the same bracket. Otters are now found on the Wensum in some numbers after their controversial re-introduction some years ago. They are certainly known to feed on roach, but whether this is a serious contributor to the decline is open to debate.
A note on predation: whilst for instance American Signal Crayfish, as introduced invasive aliens are unquestionably an unnatural form of predation, there is in theory a question mark over the status of predation by cormorants, which have moved in to feed in inland Britain over recent years. Whatever is driving this – and it could well be human impacts, even if only through climate change perhaps - it is a new threat and if it impacts to an excessive extent on native wild fish populations, which have never evolved to deal with it, we as anglers believe it should be considered unnatural and classed as over-predation.

7.11 Siltation and Floodplain Disconnection. Generally, the instream habitat in the river Wensum consists of a series of "reaches" separated by obsolete mill structures, each with a significant step-like drop, which are very effective barriers to upstream migration of most life forms. This also usually means that the head of

each section will consist of fast water habitat including a mill pool, with flows gradually decreasing towards the impounded area immediately above each mill structure. Typically, as the river upstream nears the mill, it will be more heavily engineered and "perched" above its floodplain. This means that there is little connectivity in many areas with the disconnected floodplain, as most ditches, former tributaries etc will be isolated by the elevated flood/spoil bank, which is also often associated with past dredging activity. Prior to such activity, these erstwhile connections will have provided valuable refuge areas for juvenile fish of all species, both in time of flood and also acting as off-river nursery areas. Typically, shallower than the main river, with reduced or static flows, they would be likely to have had healthy populations of daphnia and zooplankton which could potentially enhance growth rates of fish, which would be able to return to the main river at will. The impounded areas just above each mill structure are also commonly found to effectively act as silt traps, as the water slows dramatically the deeper areas fill up with suspended solids. Whilst some silt is essential for certain species of invertebrate, some of these sections are so heavily affected that there are literally inches of water over several feet of sediment. This obviously does not constitute good chalk-stream habitat! Some sections of the river have little or no bankside tree growth. According to “Taming the Flood”, by Jeremy Purseglove, the presence of bankside trees can increase by up to four times, the total amount of available food in a river, by way of terrestrial insects. In some areas, there is little Large Woody Debris. Where present this naturally disrupts the current, encouraging deposition of suspended solids, in theory helping to keep the main channel clear, and also acts as an instream refuge feature for fish to escape heavy floods and predators.

Sensible Water Management at Bintree Mill
On The Left A Beautiful Wetland –
On The Right Courtesy Google Earth A Drought May Be Just Around The Corner!

7.12 Phosphate Stripping At Sewage Treatment Plants. Helen Beardsleys study of 2012 found possible links between reduced phosphate levels due to stripping on sewage treatment works leading to reduced numbers of zooplankton in the main river, and consequent lower early growth rates of juvenile roach. Ms Beardsley hypothesised that this could be a major factor in a collapse in the ultimate size achieved by adult roach in later life. Whilst Trevor Harrop (Avon Roach Project) has expressed some doubts about this theory, one would at least presume that juvenile roach which find their way into off-river refuge type areas might be able to take advantage of somewhat higher zooplankton levels. This on the assumption that partial disconnection from the main river, coupled with shallow, potentially warmer water might encourage this. (Trevor states that in his experience even heavily "stunted" adult roach populations resume normal growth when presented with an abundant food source.)

7.13 Insufficient Numbers of Adult Roach In The River to Sustain the Population.

Anglers have been claiming for many years that the populations of roach, dace and even chub in the Wensum are low and getting lower. As stated earlier, Environment Agency staff carry out fish population surveys on a yearly basis and the official view based on these is that the population is NOT stock-limited, and that there ARE enough adult roach in the river to sustain a breeding stock. (The very fact that there are roach still there seems to back this view up to a certain extent, however, roach anglers are also interested in quality, based on higher average size, rather than pure numbers, and, as mentioned previously, it is not proven that all Wensum roach were actually spawned in the river). On the Hampshire Avon, the 2005 fishery survey results led the EA and anglers to believe that the entire roach population of the river was under threat, which then resulted in the formation of the Avon Roach Project. Working with local landowners, anglers and other stakeholders, this small group of dedicated people, headed up by two local anglers, Trevor Harrop and Budgie Price, has succeeded in turning around the situation. Intervention in the form of collecting spawn on purpose-designed spawning rafts, transferring it to tanks where it is hatched, tended and then moved to derelict trout stews before being restocked into the river has been combined with a full suite of other measures. These include habitat restoration and maintenance, improved predator controls etc and as a result the Avon now has a healthy population of roach once more. It appears that although we believe we have good reason to be concerned, the roach population in the Wensum has not yet reached such a dire level as on the Avon in 2005. The worry is, with all the threats that Wensum fish now face, that it might be just a matter of time!

Recommendation: Identify the key measures in consultation with the Avon Roach Project to enhance the River Wensum's Roach Population.

7.14 Potential Food Source Deficiency. In considering food sources as a potential regulator of fish size, the Avon Roach project presented the following view:

"An additional issue worth considering is the possibility that a rich food source is missing from the food chain. Any rich or abundant source of fish nourishment may trigger a second and more rapid rate of growth in fish than normally witnessed. This is known to happen with Roach in other rivers from about six years of age (once the

Roach reach a size which enables them to take advantage of this rich food source) – a specific food source is yet to be identified formally but snails could provide a potential source. This might also be highlighted by any lack of 'Black Spot' (Posthodiplostomum and / or Apophallus) with fish being the second intermediate host, the first being aquatic snails. (I believe the fourth intermediate host may be an unknown water bird? TE. - Trevor Harrop, Avon Roach Project".

Black Spot On A Chub- Picture Courtesy Tim Ellis.

Following on from this view, there has been some informal discussion amongst WACA fishery Members regarding the presence or otherwise of 'Black Spot' on Wensum roach. The general consensus appears to show a negative view. However, there have been times in the past when 'black spot' has been heavily present in the river, and some of these occurrences seem to correlate with known influxes of fish from nearby Stillwater fisheries. Russell Francis, a long-time Wensum angler, naturalist and fishery warden is of the opinion that this might be simply because the life-cycle of the parasite may not complete effectively in running water, possibly only doing so in still water. There is of course a degree of interchange between the two water environments, particularly in water movement during floods, also water birds, mammals and even fish migration may be a source of contaminant.

Black Spot on A Roach - Picture Courtesy Josh Fisher.

7.15 Adverse Impact from Other Fish Species. Chub in particular have proliferated throughout the river Wensum in recent years. It has been suggested that this could be impacting on the roach population. This theory has been bandied around for years. Once again, we initially asked the Avon Roach Project's Trevor Harrop for his opinion on this theory. His comments follow:

> *"(Don't listen to everybody. They'll all have a theory.)*
> *Everything has an impact on everything. If you have an over-abundance of chub in a confined space, or trout, grayling, dace, perch… anything, they will impact on the health of a roach population, and each other, but not enough to blame in isolation or to elicit the need to do something about.*
>
> *Our Avon has always had a decent population of chub (many big enough to impact on our roach for many of their early years, right up and beyond spawning age), still has. It's all a numbers game. More eggs = more fry = more juveniles = more adults = more eggs = more fry… see where I'm going with this???*
>
> *If the current population of roach naturally produces ten one year olds each year from the annual spawning, which in turn produce two adults, that is what you have to try to increase regardless of what might be the reason for the low number. If you can make four adults each year, then eight and so on the growth will be slow but exponential. If the surroundings account for a loss of 95% of the annual roach production, simply by making that percentage smaller by increasing the population, however slowly, it will trip the natural balance. Probably just as big a threat to young roach as any fish is the water boatman and great diving beetle and all the other nasty little critters we never consider. Reason is they all tend to spend the summers in the same places in the river. Just sort your roach out and they'll take care of themselves. And don't think too hard and listen to too many people – we didn't but went through exactly the same.* Hope that helps."

Recommendation:

The CaBA Management Team works with stakeholder to agree and initiate an effective plan to provide improved husbandry of the threats and issues to the Wensum's ecology by September 2019.

FUTURE STEPS

8. Proposals. The following steps and considerations should be given in order to formulate a River Wensum Catchment Plan:

8.1 Internal Consultation within WWG 14th April – 30th April 19.

8.2 Wider Consultation with Wensum Stakeholders 24th May – 23rdJune 19.

8.3 Feedback in the creation of recommendations for a future catchment plan 30th June 19.

8.4 Review with the Broads Catchment Partnership 14st July 19.

8.5 Workshop on defining work streams Objectives, Outcomes and Measures 31st July 19.

8.6 Formation of Wensum Steering group and sub group structures 31st Aug 19.

CONCLUSION

9. This paper found its genesis in work undertaken by members of the Broads Angling Services Group (BASG) – Wensum Working Group to understand why there has been a marked decline in the River Wenum's Roach population both in size and fish numbers. BASG's initial intention was to conduct a BASG Roach Project influenced by the River Avon's Roach Project to attempt to make improvements to the current situation. In conducting a review of a considerable body of the many papers and studies into the condition and challenges to the River Wensum's ecology, biodiversity and water quality written in the past 10 to 15 years, it became very evident that an angling community of interest could not solve the issues at hand in isolation of the many other stakeholder and interest groups having authority, responsibility and enthusiasm to effect change for the better. It was extremely obvious that there was a need for a concerted and sustained effort to reinvigorate the measures initiated by the River Wensum Restoration Strategy.

9.1 The River Wensum is a low gradient chalk river located in Norfolk, England. The river, and a number of adjacent floodplain land parcels, are of national and international importance for wildlife, being designated as a Site of Special Scientific Interest (SSSI) and as a Special Area of Conservation (SAC). As a chalk river the Wensum is also recognised as a priority habitat within the UK Biodiversity Action Plan (BAP). Wensum Roach are considered indigenous to the river and were historically prolific, at times reaching very good sizes for the species, (2lbs plus, even 3lbs in some cases), particularly in the second half of the twentieth century. The 1950s and early 60s probably saw the peak of the boom time. Whatever their origin, there does seem to be a reasonable population of small to medium size roach present in several sections of the river at present. In order for any of these to reach the sort of size formerly encountered in the early 70's they need food in the form of invertebrate larvae, freshwater shrimp and probably molluscs which are sadly lacking throughout the middle and lower river at least. Despite much concern and much action on the River Wensum reading both views of experiences from the river over many years detailed in this paper, one might ask what has been achieved and what will be achieve in the future. Clearly, there is an urgent need to focus on the issues and to implement sound, sustainable corrective actions to make improvements.

9.2 As noted in the Executive Summary, Reference B - "The Catchment Based Approach (CaBA) promotes collaborative working at a river catchment scale to realise environmental, social and economic benefits. In early 2017, the CaBA Benefits Working Group designed a monitoring and evaluation assessment process to better understand the benefits arising from CaBA, to determine the general direction of travel of partnerships and to target capacity building. We propose that all stakeholders should combine their efforts to deliver a co-ordinated approach to deliver measurable and sustained improvements to the River Wensum's journey back to becoming a pristine SSSI and SAC. BASG presented this proposal to the wider catchment partnership at the Broads Rivers Catchment steering group on 14th March 2019, for discussion. The proposal received favourable agreement in principal

9.3 There are multitude of threats and issue to achieving, maintaining and sustaining a sound ecology on the river Wensum. This review has identified the

following as chief among those threats: reduced flows; Diffuse Water Pollution; climate change; habitat degradation, including siltation and floodplain disconnection; predation; phosphate stripping at sewage treatment plants; insufficient numbers of adult roach in the river to sustain the population; potential food source deficiency; interspecies competition causing adverse impact between fish species. In the light of the conclusions of this review there is a pressing need to create a Management Team to work and coordinate stakeholder input to agree and initiate an effective plan to provide improved husbandry of the threats and issues to the Wensum's ecology by September 2019 and to resolve the recommendations below.

RECOMMENDATIONS

10. The following recommendations are made:

10.1 The responsible bodies of the River Wensum adopt the CaBA to managing the ecology of the river by September 2019, following completion of the activities listed in section 8.

10.2 The CaBA Management Team works with stakeholder to agree and initiate an effective plan to provide improved husbandry of the threats and issues to the Wensum's ecology by September 2019.

10.3 BASG - Wensum Working Group identify the key measures, in consultation with the Avon Roach Project, to enhance the River Wensum's Roach Population.

10.4 The CaBA Management Team builds an effective plan to address key locations of Silt ingress.

10.5 The BASG - Wensum Working Group appoint a study group to identify in Invertebrate measurement gap between WFD and various other 3rd sector reports to identify and scope the requirement for the introduction of a River Wensum, river-fly catchment-wide monitoring program.

10.6 The CaBA Management Team investigates the worst-case point source locations with potential linkages into the AMP process for future mitigation measure investment.

10.7 To improve the likelihood of delivery of restoration schemes it is important that the CaBA Management team builds effective relationships with River Wensum key stakeholders, including, but not limited to:

References:

A. River Wensum Restoration Strategy Implementation SSSI Unit 47 Tatterford Common to Fakenham Mill, FEASIBILITY & ENVIRONMENTAL SCOPING ASSESSMENT, November 2011.

B. Catchment Based Monitoring Report, CaBA Benefits Assessment Working Group September 2018.

C. River Wensum restoration strategy first published in 26 June 2009.

Documents and papers referred to and reproduced in this paper.

River Restoration Fact Sheets
River Wensum Restoration Strategy Fact Sheet 1
River Wensum Restoration Strategy Fact Sheet 2
River Wensum Restoration Strategy Fact Sheet 3
River Wensum Restoration Strategy Fact Sheet 4
River Wensum Restoration Strategy Fact Sheet 5
River Wensum Restoration Strategy Fact Sheet 6
River Restoration Strategy
Owner Natural England
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http://publications.naturalengland.org.uk/publication/43006

River Wensum SSSI - Exemplar Diffuse Water Pollution Plan and Action Plan
Owner Natural England
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Owner Environment Agency
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Owner Environment Agency
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Neonicotinoids impact on Invertebrates
Owner Bug life
Created by Bub life Dec 2017
https://www.buglife.orguk/news-%26-events/news/heavy-neonicotinoid-insecticide-contamination-damaging-british-rivers

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Created by S&TC Feb 2019

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Instigation into the success of barbel and other coarse fish recruitment
Owner Environment Agency
Created by APEM Mar 2009
http://aterforum.co.uk/index.php/item/download/523_facd006142f2c9c91a7148c0aeb841bf
Investigation into the spawning and recruitment success of barbel
Owner Environment Agency
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Investigation into the abundance and distribution of key barbel habitats
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