Deben Estuary

Citizen Science Fish Survey Programme

Bawdsey Beach and Martlesham Wilds Nature Reserve

July 2024

Institute of Fisheries Management

Plate 1 Seine netting at Bawdsey Beach

Plate 2 Setting the winged fyke at Martlesham Wilds Nature Reserve

All photographs by Richard Verrill (RDA), Gill Colclough & Tanya Ferry (IFM)

Draft Report

Clients River Deben Association, Riverside, Fayrefield Road, Melton, Woodbridge. IP12 1NX

and Andrew Excell, Suffolk Wildlife Trust, Brooke House, Ashbocking, Ipswich. IP6 9JY.

Delivered by : Institute of Fisheries Management

Project Manager: Paul Coulson, Director of Operations

Field Operations Manager and Report Author: Steve Colclough, Chair of the Estuarine & Marine Specialist Section

Institute of Fisheries Management
PO Box 679
Hull
HU5 9AX
United Kingdom

Phone:
Tel: +44 (0) 845 388 7012
(office hrs: Mon-Fri, 9am – 5pm)

Email:
info@ifm.org.uk

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EXECUTIVE SUMMARY

Estuaries are extremely productive environments, playing a crucial part in the life cycle of many fish species, acting as both key marine fish nursery grounds and as vital corridors for migratory species. These are highly dynamic environments, with abrupt changes in oxygen concentration, temperature, turbidity and salinity applying over both the short term and over longer seasonal cycles. The intertidal areas and saltmarsh of the estuarine fringes are vitally important refuge and feeding habitats for fish fry. Saltmarshes exist as a natural component of the estuarine system in the more saline reaches, extending as a band of higher plants on the foreshore between mean high water neap tide level and the mean highwater mark.

The fish communities in estuaries were not well studied in the UK prior to the millennium. The advent of the Water Framework Directive UK regulations in 2003 required an assessment of ecological status of estuaries, including an assessment of the fish life present, for the first time. Even so only one third of UK estuaries have ever been sampled formally to examine the fish life present. The EA has not conducted a full WFD fish survey in the Deben to date. In 2013 & 2014, Eastern IFCA conducted a small fish survey in the estuary at a number of sites using the WFD specification 43m seine net. The author has conducted small scale fish surveys for specific purposes at both Wood bridge in 2007 and Waldringfield in 2016.

The River Deben Association (RDA) are keen to develop a long term citizen science-based fish survey programme in the Deben estuary. Through an initial dialogue with Eastern IFCA, the author (acting through the Institute of Fisheries Management) agreed to deliver an initial survey with staffing support from the RDA. A site at Bawdsey was fished with a 15m seine deployed from the shore on August 16th 2022 (Colclough, 2022).

Since the 2022 survey, the IFM citizen science process has received part funding from Natural England as part of a wider government backed trial to assess how citizen science might assist in delivery of the marine Natural Capital Ecosystem Assessment project. Natural England are cognisant of both the scientific and social benefits arising from citizen science engagement.

The RDA were keen to repeat and extend the survey programme in 2023. Two sites were selected, the original one at Bawdsey plus a further site in the upper reaches at Martlesham Creek. The survey was delivered as before with technical support and equipment from the IFM (Steve Colclough & Tanya Ferry) and staffing by citizen scientists. Active field support was broadened with RDA and Alde/Ore Association members and staff from Suffolk Wildlife Trust, Cefas and Eastern IFCA.

The Bawdsey survey was conducted on September 19th, 2023 and the Martlesham Creek survey on the following day. In 2024, the IFM were invited to repeat the survey process. A new site at Martlesham Wilds Nature Reserve, managed by Suffolk WT, was fished with the same methods as before on 22nd July, 2024. The Bawdsey Beach site was fished on the following day.

This report describes the findings of the 2024 survey and contrasts these with those arising from previous works in 2022 and 2023. Sufficient material from past reports is provided to provide a full background for the new reader. For further information., please consult the 2022 and 2023 survey reports (Colclough, 2022; 2023).

The Deben estuary and its associated saltmarshes form an important nursery ground for a range of marine fish species today and the survey findings continue to demonstrate the functioning of these resources as Essential Fish Habitat.

The Martlesham Wilds NR results are entirely consistent with the type of community found in the upper reaches of estuaries in the Southeast of England and agree with past findings by the author at other sites in the upper and middle reaches of the Deben estuary in past years.

The Bawdsey site data demonstrates how dynamic marine and estuarine fish communities can be. Even though there are significant and predictable seasonal cycles in the behaviour of these species, sampling at similar times of year in the same locations does not necessarily mean that the communities reported are indeed similar. Each survey is no more than a snapshot in time, driven by the specific forcing factors (e.g. salinity, temperature, seasonality etc.) applying at that time. However, the survey results across the period 2022-2024 are still generally consistent with what has been reported from the lower reaches of other estuaries in the Southeast in recent years.

The difference between the communities at Bawdsey and Martlesham Wilds demonstrate how salinity is a prime driver of fish distribution in estuaries and demonstrates the value of maintaining the survey programme at two very different sites at least, in future years.

The surveys conducted as collaborative citizen science exercises since 2022 clearly demonstrate the scientific value of such efforts, helping fill in some of the data gaps where other parties do not have the resources to investigate. Working alongside other bodies, citizen science going forward can prove to be a critical and supportive element in a more holistic understanding of our inshore coastal and estuarine waters, leading to more informed management strategies and wider engagement in management processes.

Both the RDA and Suffolk WT are keen to develop long term fish survey programmes in the estuary. The IFM will continue to support these programmes going forward.

CONTENTS

1. INTRODUCTION

Fish in estuaries

Estuaries provide extremely productive environments, playing a crucial part in the life cycle of many fish species (McHugh, 1967; Haedrich, 1983). They act as key marine fish nursery grounds, as well as vital corridors for migratory species. These are highly dynamic environments, with abrupt changes in oxygen concentration, temperature, turbidity and salinity applying over both the short term and over longer seasonal cycles (Thomas, in Attrill, 1998). This tends to limit the species of fish which survive in these conditions, but those that can do so thrive. (Blaber *et al*, 1989). As a reflection of these challenging conditions, the fish communities associated with estuaries are highly dynamic (Blaber, 1991; Colclough *et al,* 2000 & 2002). Very few species are sedentary, most are moving continually in response to this complex of factors. Migrating fish utilise Selective Tidal Stream Transport (STST) to minimise effort (Colclough *et al,* 2000; Jager, 1999). Those fish which are not actively migrating through the estuary, move passively with the tidal excursion to minimise osmotic stresses. Superimposed on this complex picture are pronounced seasonal rhythms in the movements of the fish species themselves. The sheer dynamic scale of all of these processes together has dictated that until recently, the fish communities of many estuaries across Western Europe have been poorly studied in comparison to their freshwater and marine counterparts. Therefore, the importance of these habitats for fish life is still not fully recognised (Elliott, in Elliott & Hemingway, 2002).

Fish in saltmarshes

Saltmarshes exist as a natural component of the estuarine system in the more saline reaches, extending as a band of higher plants on the foreshore between the mean high water neap tide level and the mean high water mark. The largest remaining expanses of saltmarsh in Britain lie in the greater Thames estuary along the Essex coast and in Suffolk (Waite, in Attrill, 1998). Saltmarshes act as efficient flood defences.

Elliott & Taylor (1989) demonstrated that invertebrate production in intertidal habitats in estuaries is twice as productive compared to subtidal equivalents. Intertidal areas and saltmarshes of the estuarine fringes are vitally important refugia and feeding habitats for fish fry (McLusky *et al*., 1992). For some species, such as sea bass (*Dicentrachus labrax*), saltmarshes may represent the optimal nursery habitat for the early life stages (Laffaille *et al*, 2001). Fish use STST to penetrate into saltmarshes, given this involves minimum energy use. They drift in on the flooding tide on the surface and leave on the ebb near the bed in available drainage channels. This understanding of the importance of saltmarshes as nursery grounds for marine fish species, is well understood in the US (Bell, 1997; Boesch & Turner, 1984; Roundtree & Able, 1992; West & Zedler, 2000) but is very new to Europe (Laffaille *et al*, 2001; Lyndon, 2002; Colclough *et al*, 2005).

Two per cent of English saltmarshes are lost to the sea every year as a consequence of sea level rise (Dixon *et al*, 1998). 80% of the historic saltmarsh habitat has been lost across Europe, with significant but often unrecognised impacts on fisheries (Stamp *et al,* 2022). McLusky *et al* (1992) estimated that land-claim and sea defence works in the Forth estuary over the past 200 years have reduced overall fish production in the estuary by 66%. In the Thames estuary, less than 1% of the original bank form still exists (Colclough *et al,* 2002)

Most fish species are r selected meaning they produce very large numbers of young, with no parental care. Mortality of early life stages is enormous. Historic habitat losses may well have acted to reduce fish populations, just as much as overfishing. The lack of suitable habitat might now be limiting fish production. Green *et al*, (2012) demonstrated that young of the year bass are faithful to the same area of saltmarsh for the whole first summer of life. The bass is a warm water species favoured by rising sea temperatures. More saltmarsh creation might boost bass production significantly in the future through higher survival and growth in the first year.

Saltmarshes can provide a number of other valuable ecosystem services, including nutrient and micro-pollutant removal and carbon sequestration. (Luisetti, 2011; Viera da Silva,2012). Placing all of the currently known functionality of saltmarshes in Water Framework Directive terms, these habitats may prove to be vital components in achieving good ecological status

Saltmarshes are a UK Biodiversity Action Plan habitat and, in England, form part of the Government High Level Target nine habitat series. Government targets see that should be no further net loss of habitat and opportunities for environmental enhancement should be sought. The new Net Gain planning principle strengthens the case for positive action to create new habitat.

Managed realignment has been developed in the UK since the early 1990's as one of a suite of effective flood risk management measures to meet the challenges provided by storm surges and rising sea levels. With appropriate design, they can also provide the other services described above for saltmarshes There have now been more than 40 such treatments in the UK, with sites in the Humber, Greater Thames and Severn estuaries and on a number of coastal locations on the East, South and West coasts.

A lot of information on how saltmarshes function and the ecosystem services they provide, including fish utilisation, has been developed over the last 20 years in the UK, through the study of managed realignment treatments which develop saltmarsh plant communities over a period of years (Colclough *et al*, 2005; Dixon *et al*, 2007; Fonseca, 2009; Fonseca, *et al*, 2011; Yates, 2012; Green *et al*, 2012; Nunn *et al*, 2016; Colclough, 2017; Stamp *et al*, 2022).

Dixon *et al,* (2007) provided a review of the early experiences with design and development of some of the first UK sites (Blackwater and Crouch estuaries). As our knowledge of how sites evolve and how fish utilise these sites over time has grown, we have begun to improve our guidance on future site design. What has become apparent in recent years is that optimal fish production for many species of fish in the intertidal zone is associated with the saltmarsh. Realignment sites will evolve towards saltmarsh functionality over time. Future designs which can more closely mimic the characteristics of a natural marsh will be more successful for fish production over a shorter time period (Burgess *et al*, 2019)

Intertidal habitat creation is also now occurring even in the confines of urban and industrial estuaries. Intensive development in the Thames estuary led to the development of an Encroachment Policy in the early 00's led by the Environment Agency (EA), to resist further encroachment on the grounds of unacceptable impacts on flood risk as well as a range of ecological issues. This policy led to the development through the Thames Estuary Partnership of the Estuary Edges Guidance to encourage no net loss of habitat and the proliferation of artificial marginal habitat features. A second iteration of this guidance in 2018 required assessments of how the early sites had performed. This process included fish surveys on a range of installed features with recommendations provided for future design improvement. (Colclough and Cucknell, 2018). For further information see https://thamesestuarypartnership.org/our-projects/estuary-edges/.

Deben Estuary

The historic loss of intertidal habitats has seen a very large decline in marine fish production over the past 200 years as the nurseries have disappeared. The importance of the resource still available in the Deben and other estuaries on the Essex and Suffolk coasts cannot be understated when set in this context and against the developing impacts of climate change.

The fish communities in estuaries were not well studied in the UK prior to the millennium. The advent of the WFD UK regulations in 2003 required an assessment of ecological status of estuaries, including an assessment of the fish life present, for the first time. The author led the team that developed the estuarine fish sampling protocols for the Environment Agency (EA) to meet the requirements of the new directive. Even so only one third of UK estuaries have ever been sampled formally to examine the fish life present.

In 2007, as a former fisheries scientist in the EA, the author was invited by Simon Read of the River Deben Association (RDA) to conduct a survey of the fish communities present in Sutton Marsh, opposite Woodbridge Tide Mill. The information was used to strengthen the case to appropriate regulators for a timber training barrage to be constructed to protect the marsh from erosion. Simon Read later advised the author that the information gathered on fish utilisation of the marsh helped turn the argument in favour of construction.

The EA have conducted WFD surveys in the Roach & Crouch, Blackwater, Stour/Orwell, Alde/Ore and Blyth over the past 20 years, but never in the Deben. Eastern IFCA employed a WFD compliant large seine net deployed from a vessel in October 2013 at three sites in the estuary. Opposite Waldringfield Golf Club (named the upper site), Ramsholt Arms (middle) and Bawdsey saltmarsh edge (mouth). This programme was repeated in July 2014 as before and a different site near the mouth opposite the Felixstowe Ferry was substituted. The purpose of this two-year programme was to begin a long-term data set. Sadly, that never transpired due to operational constraints.

In 2016, the Water Management Alliance were proposing restoration measures to an area of relict saltmarsh in poor condition at Waldringfield. Restoration included redefinition of the creek system in the marsh using staked hazel hurdle structures. Concern had been expressed by Stephen Thomson (then of the Eastern IFCA) that the structures might hinder fish migration across the marsh during the tidal cycle. Fish which had entered the marsh near the surface on the flood might be stranded behind the structures as they attempted to egress, near the bed, on the ebb tide. The author was engaged by Karen Thomas of the WMA to refine the design of the structures to address this concern. Gaps in the structures were built in at intervals to provide effective drainage channels to encourage fish egrees on the ebb tide. On 16th October 2016, a survey was delivered to assess which fish species were present in the marsh and how they were able to use the gaps provided.

In 2019, Stephen Thomson had suggested to the River Deben Association (RDA) that some form of community based fish survey might be possible. In 2021, the author provided a lecture on behalf of Suffolk Wildlife Trust about the ecology of fish in estuaries and saltmarshes. Subsequently, the author was approached by Richard Verrill of the (RDA) to conduct a fish survey in the estuary. The author agreed to provide the sampling gear and technical support. The RDA agreed to provide volunteer labour. The exercise was viewed as a trial to test the potential for the development of a long-term multi-method multi-site sampling programme in the estuary. A site at Bawdsey (similar to the Eastern IFCA mouth site in 2014) was fished with a 15m seine deployed from the shore on August 16th 2022 (Colclough, 2022).

In 2022, the IFM had been invited by Natural England to deliver their citizen science fish survey programme (with Steve Colclough as technical field lead) as part of a wider Defra led project engaging citizen scientists in marine monitoring (the marine Natural Capital Ecosystem Assessment programme), given both the scientific and social benefits apparent.

Building upon the success of the 2022 survey, an extended River Deben survey programme was planned for 2023 taking in the original site at Bawdsey (now designated as the lower site) plus a new (upper) site at Kyson Point in Martlesham Creek. The surveys took place on September 19th 2023 at Bawdsey and 20th September 2023 in Martlesham Creek. The survey was delivered as before with technical support and equipment from the IFM (Steve Colclough & Tanya Ferry) and staffing by citizen scientists. This year the base was much broader with active field support from members of the RDA and members of the Alde/Ore Association together with staff from Suffolk Wildlife Trust, Cefas and Eastern IFCA.

In 2024, a further survey was conducted on request by both the RDA and the Suffolk Wildlife Trust. On 22nd July, 2024 a survey was conducted in and around a small creek sitting within the new Martlesham Wilds Nature Reserve adjacent to the Deben estuary near Martlesham Creek. Similar methods were employed at the Nature Reserve as were applied in 2023 at Kyson Point. A repeat of the2023 exercise was carried out at Bawdsey beach on 23rd July 2024. Members of the RDA, staff of the WT, staff from Eastern IFCA and several volunteers were engaged in the survey process over the two-day period. As in 2023, the IFM provided all equipment and technical expertise through Steve Colclough and Tanya Ferry. Steve's wife Gill attended as a volunteer and assisted with processing and photography.

This report describes the findings of the 2024 surveys and contrasts these with those arising from previous works. For further information., please consult the 2022 & 2023 survey reports (Colclough, 2022 & 2023).

2. FISH SURVEY METHODOLOGY

As described above, fish movements in estuaries are highly dynamic, with very few species remaining stationary for more than a brief period. These factors dictate that standardisation of the survey process is vital. This is one of the important protocols established for the Transitional and Coastal (TraC) waters fish survey programme to meet requirements of the WFD. Steve Colclough led the team which developed the TraC fish survey programme for the Environment Agency (Coates et al, 2007). No such standard process has ever been designed for the study of fish utilisation of saltmarshes although similar dynamics apply. The methods developed originally here by SC^2 are becoming recognised as best practice. The IFM are developing best practice guidance, a fish identification tool and other technical support for future citizen science surveys under the mNCEA programme for Natural England

The methods employed in such surveys and used again in 2024 on these sites are -

a) *5m winged fyke nets (reducing mesh 10,8,6.5mm) set after low water, facing upstream. Often used in key discharge channel in saltmarshes. The nets are removed after the ebbing tide renders the nets accessible on foot and before the water entirely leaves the net. The nets are fitted with otter guards as an Environment Agency consent condition.*

b) *A 15m seine net (2.7m deep with a 3mm micromesh knotless mesh) is deployed from the shore around slack water at low tide on three occasions.*

c) *A fine mesh (1mm) intertidal scoop net applied opportunistically on a flooding tide as a block net to demonstrate how very young life stages of ever fish species use the first the flood to move up into the marshes.*

For further details on the sampling strategy and rationale see Franco et al, 2022.

Figure 1 Site plan for citizen science fish sampling at Bawdsey, Deben estuary July 23rd 2024

Figure 2 Site plan for citizen science sampling at Martlesham Wilds NR. Deben estuary July 22nd 2024

3. RESULTS

In practice, only the seine net was deployed at Bawdsey (four sweeps), as in 2022 and 2023. Local ground conditions prevent use of the fyke nets here. The full suite of methods was employed in Martlesham Wilds Nature Reserve. Two sweeps of the seine net were made at the mouth of an unnamed small creek drainage to the Deben estuary near the entrance to Martlesham Creek and within the boundaries of the Nature Reserve. Two winged fykes were deployed in this small creek structure. The intertidal push net was deployed on a single occasion within the small creek system. Sampling locations for both sites are shown in Figs 1 & 2.

All fish captured were identified, measured and returned to the water. Identification was aided with a field guide developed by ZSL for citizen science base fish surveys on the Tidal Thames (ZSL, 2021) see - https://www.zsl.org/sites/default/files/media/2021-08/2531%20ZSL%20estuarine%20fish%20web%20guide.pdf.

A summary of the data for Martlesham Wilds and Bawdsey over the two-day period appears in Appendix I. Appendix II presents relevant length frequency distributions for both sites. Appendix III displays site photographs and fish sampling at Martlesham Wilds. Appendix IV displays similar material for Bawdsey. Appendix V displays the most common fish species captured. Appendix VI displays the raw data for v both sites.

4. DISCUSSION

Upper estuary (Martlesham Wilds NR)

At Martlesham Wilds Nature Reserve, the fish community described in July 2024 is essentially similar to that encountered at nearby Kyson Point in September 2023. This is the type of community described by the Environment Agency (S. Colclough, 2007) at Woodbridge and by the same author at Waldringfield in 2016.

Common goby (*Pomatoschistus microps*) were abundant in September 2023 at Kyson Point, but were smaller and less abundant in 2024 at Martlesham Wilds. This is probably a reflection of timing. Common goby spawn on multiple occasions in the spring and early summer in the lower estuary, making small nests in old shells and other cover. During the summer months, the young move upstream into the inner parts of estuaries using Selective Tidal Stream Transport and can tolerate almost freshwater conditions. They descend again as freshwater flows increase and temperatures drop in the late autumn (Fouda and Miller 1981; Henderson, 2014). These fish tend to reach their optimum size (60-70mm) and density in the inner estuary in the early autumn. July is much earlier in that annual growth and migration pattern than September.

Young of the year (0+) bass were abundant in July 2024 yet scare at Kyson Point in September 2023. 0+ bass arrive in waves from multiple offshore spawning sites from June onwards (Sabriye *et al*, 1988). They can penetrate deep into the inner estuary, even close to freshwater conditions, when very young. The dominant position of the bass in the 2024 fish community compared to 2023 is not easily explained. Bass demonstrate a strong preference for accessing saltmarshes at an early stage. In 2024, they were found to be dominant in both the main channel and the creeks. This might simply reflect day to day dynamics as described above, when set against a single survey snapshot in time. It might also reflect wider year on year weather pattern driven impacts. This would require further investigation. Possibly fewer 0+ bass were present in 2023 to access these inner estuarine areas. Certainly, numbers have been high across the south of England in 2024 (Colclough, S. pers. obs.).

Two larger juvenile bass at 1+ were taken with the smaller 0+ fish in the fyke nets. Second year bass tend to penetrate a little less than their 0+ counterparts but are drawn by the abundant small fish available as prey. Older bass hardly ever penetrate far into estuaries.

A low number of the lesser pipefish (*Sygnathus rostellatus*) were taken at Kyson Point in the seine sweeps in September 2023. None were taken in July 2024. Of the six species of pipefish in British coastal waters, the lesser pipefish is the only one which is commonly found in estuaries. Off the Suffolk coast it is most abundant in the winter and spring (Henderson, 2014).

Low numbers of the sand smelt (*Atherina presbyter*) were taken in seine net sweeps and fykes in both years. The sand smelt is another warm water species moving north in response to climate change (Henderson, 2014).

The 0+ grey mullet found in 2023 were identified as thin-lipped grey mullet (Chelon ramada). Positive identification of grey mullets is only practical in the field with specimens over 80mm in length. Thick lipped grey mullet (*Chelon labrosus*) are thick set and display a thick rubbery upper lip. They tend not to penetrate deep into estuaries, avoiding very low salinities. They spawn offshore in the winter and spring (Henderson, 2014). The thin lip and the golden grey (*Chelon aurata*) both spawn offshore in the late summer and early autumn. Both will penetrate deep into estuaries as early young of year fish, moving into brackish and even freshwater conditions. Those specimens taken in 2023 at Kyson Point below 80mm in length and reported as thin lips, might actually have been of either or both species. The population of grey mullets found in 2024 in the fyke nets contained a majority over 80mm and these were positively identified as golden grey. The few smaller ones might have been either or both species. See plates 14 & 15 for photographs of the two species with fish of equivalent size together with some identification characteristics. The golden grey is a more southerly species, now moving north through climate change. Although present for many years as adult summer visitors, spawning activity in the UK has only been recognised in the last few years. (A. Pinder pers. comm). This complex and developing situation is a good example of how subtle changes in our marine environment associated with rising sea temperatures are often going unrecognized.

Lower estuary (Bawdsey Beach)

At Bawdsey, the fish communities described since 2022 have been remarkably consistent. The sampling has been conducted consistently on small spring tides in the hours just before high water. In 2022, the sampling was conducted in mid-August, in 2023 in mid-September and in 2024 in late July, a period spanning some eight weeks.

The distributions of sand goby (*Pomatoschistus minutus*) and common goby overlap, driven by salinity preferences. As described above the common goby moves up the estuary into low salinities in the summer months. The sand goby tends to remain in the lower and middle reaches, preferring higher salinities (Henderson, 2014). As expected, sand goby dominated the community at Bawdsey in 2022 and 2024. However, in 2023 the common goby dominated at Bawdsey. This somewhat anomalous result is difficult to explain. Eastern IFCA reported gobies in abundance at this site in October 2013 (although these were all noted by the family name only (see Colclough, 2022 Appendix III). They did not report any gobies at this site in July 2014. Gobies under 30mm are difficult to identify in the field, so it is possible that some of the smaller gobies captured at this site over the years have been misidentified.

Low numbers of juvenile sand smelt were present in all years. Some of the adult fish (>90mm) were present in 2023 and 2024. Sand smelt were reported as common at this site by Eastern IFCA in October 2013 and July 2014.

Juvenile herring were present in 2023 and 2024. The IFCA took a small shoal of sprat at the Ramsholt Arms in October 2013 and again at Bawdsey in July 2014, but reported no herring. Herring stocks in British waters are divided into a number of different overlapping stocks. The once highly abundant North Sea stocks spawn in the autumn months (Henderson, 2014). The Thames and Blackwater stock is a recognised almost discreet group that spawn in the spring (Wood,1981). The majority are probably 0+ fish arising from a spring spawning. Both sprat and herring will enter the middle reaches of estuaries in the autumn months.

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5. CONCLUSIONS AND RECOMMENDATIONS

The Deben estuary and its associated saltmarshes form an important nursery ground for a range of marine fish species today and the survey findings continue to demonstrate the functioning of these resources as Essential Fish Habitat.

The Martlesham Wilds NR results are entirely consistent with the type of community found in the upper reaches of estuaries in the South East of England and agree with past findings by the author at other sites in the upper and middle reaches of the Deben estuary in past years.

The Bawdsey site data demonstrates how dynamic marine and estuarine fish communities can be. Even though there are significant and predictable seasonal cycles in the behaviour of these species, sampling at similar times of year in the same locations does not necessarily mean that the communities reported are indeed similar. Each survey is no more than a snapshot in time, driven by the specific forcing factors (e.g. salinity, temperature, seasonality etc.) applying at that time. However the survey results across the period 2022-2024 are still generally consistent with what has been reported from the lower reaches of other estuaries in the South East in recent years.

The difference between the communities at Bawdsey and Martlesham Wilds demonstrate how salinity is a prime driver of fish distribution in estuaries and demonstrates the value of maintaining the survey programme at two very different sites at least, in future years.

The surveys conducted as collaborative citizen science exercises since 2022 clearly demonstrate the scientific value of such efforts, helping fill in some of the data gaps where other parties do not have the resources to investigate. Working alongside other bodies, citizen science going forward can prove to be a critical and supportive element in a more holistic understanding of our inshore coastal and estuarine waters, leading to more informed management strategies and wider engagement in management processes.

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Both the RDA and Suffolk WT are keen to develop long term fish survey programmes in the estuary. The IFM will continue to support these programmes going forward.

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Appendix I

Martlesham Wilds Nature Reserve, Deben Estuary Fish survey 22nd July 2024

Site Information and Fish Catches

Low Tide (BST)	High Tide (BST)
06.41	14.02 (3.94m) Martlesham Creek mouth

Two seine net sweeps were conducted on a rising tide across a broken stone and muddy shore at NGR TM27732 46668 adjacent to an unnamed small creek draining out into the Deben estuary, where the fyke netting was to take place. The first sweep was conducted at 11.30am and the second at 11.50am. Temperature and salinity (calibrated refractometer) were measured after the second sweep.

Summary of catches made in the two seine net sweeps. Temperature 21°C Salinity 24ppt.
Figures in parentheses indicate additional fish captured, counted but not measured

Latin Name	Common Name	No. Caught	Length Range mm	Percentage of total catch
Atherina presbyter	**Sand smelt**	**6**	**31-44**	**3**
Dicentrarchus labrax	**Sea bass**	**58(64)**	**32-60**	**73**
Pomatoschistus microps	**Common goby**	**40**	**18-30**	**24**

Common shrimp *Crangon crangon* and estuarine prawn (*Palaemon spp*.) were common in both sweeps.

Two winged fyke nets were set in the creek (TM27790 46656) at locations some 100m apart. One in the main creek (1) and a second in a small secondary creek closer to the mouth (2). The fykes were set before water entered the marsh and recovered on the ebbing tide before the net was fully exposed and fish stranding took place. Fyke 1 was set at 10.50am and recovered at 16.05pm. Fyke 2 was set at 11.00am and recovered at 16.55pm. Temperature and salinity (calibrated refractometer) were measured as the first fyke was withdrawn.

Summary of catches made in the two fyke nets. Temperature 21°C Salinity 30ppt.
Figures in parentheses indicate additional fish captured, counted but not measured.

Latin Name	Common Name	No. Caught	Length Range mm	Percentage of total catch
Chelon aurata	**Golden grey mullet**	**25**	**40-140**	**7**
Dicentrarchus labrax	**Bass**	**41 (509)**	**35-124**	**93**
Pomatoschistus microps	**Common goby**	**1**	**28**	**<1**

The fykes also took several shore crabs, plus a few shrimp and prawn.

Appendix I continued

During the period when the fykes were fishing, a shoal of grey mullet at approximately 100m in length could be clearly seen in the main creek between the two set fykes. A sweep of the intertidal net was made at 12.30pm in this area, sweeping up the channel for 30m into a blind end. Only one of the fish was taken (100mm) identified as a golden grey mullet, similar to those taken in fyke 1. The net also contained 260 small common goby at 20-25mm. This population of small gobies was sampled in the seine sweeps, but not in the fyke nets..

Bawdsey Beach , Deben Estuary Fish survey 23rd July 2024

Site Information and Fish Catches

Low Tide (BST)	High Tide (BST)
07:07am	13.47 pm (3.44m Bawdsey)

Four seine net sweeps were conducted on a rising tide across a fine stone and sand base at NGR TM33090 38190. The seine sweeps were conducted at 10.35am, 11.15am, 11.25am and 11.41am. Temperature and salinity (calibrated refractometer) were measured after the first sweep.

A combined summary of catches from all four seine sweeps. Temperature 19^{o}C Salinity 31ppt.
Figures in parentheses indicate additional fish captured, counted but not measured

Latin Name	Common Name	No. Caught	Length Range mm	Percentage of total catch
Atherina presbyter	**Sand smelt**	**10**	**34-115**	**8**
Chelon ramada	**Thin lipped grey mullet**	**1**	**125**	**<1**
Clupea harengus	**Herring**	**14**	**45-70**	**11**
Dicentrarchus labrax	**Sea bass**	**4**	**19-50**	**3**
Pomatoschistus microps	**Common goby**	**1**	**28**	**<1**
Pomatoschistus minutus	**Sand goby**	**38(59)**	**55-65**	**76**

The sea gooseberry *Pleurobrachia pileus* was taken in three of the four sweeps in low numbers. Several unidentified jellyfish were taken in three of the four sweeps. The European shore crab *Carcinus maenas* was taken in low numbers in two sweeps.

Appendix II

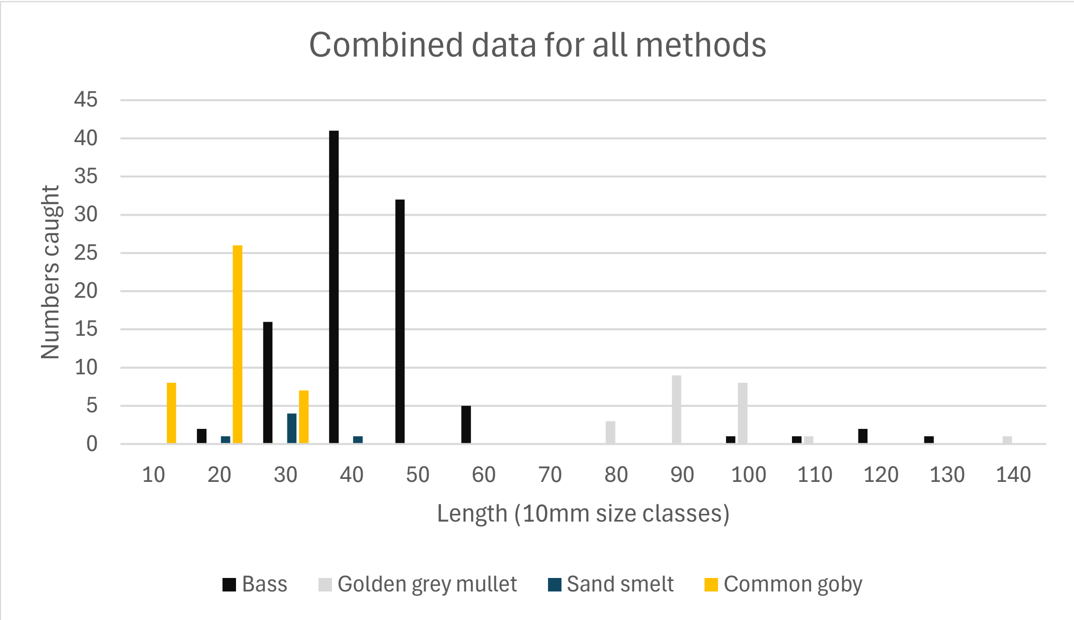
IFM Citizen Science Fish Surveys 2024

Deben Estuary at Martlesham Wilds Nature Reserve July 24th 2024

Length Frequency Distributions

Two winged fykes were set in a small unnamed creek draining to the west bank of the Deben estuary at Martlesham Wilds Nature Reserve (near Hill Farm) at 10.50am and 11.00am. One set in the main creek and the other in a small deep side arm. Both fykes were removed at 17.00pm

Two sweeps of the seine net were made in the main channel of the Deben estuary adjacent to the two fyke nets at 11.30am and 11.50am. One sweep with the push net was made at 12.30pm in the creek below the upper fyke net.



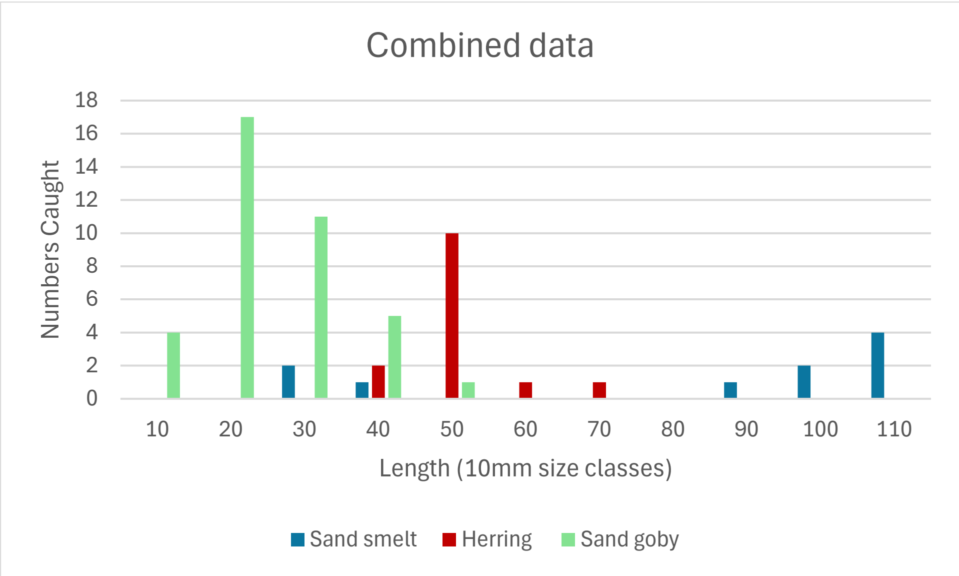
Appendix II continued

IFM Citizen Science Fish Surveys 2024

Deben Estuary at Bawdsey Quay July 23rd 2024

Length Frequency Distributions

Four seine sweeps were made at 10.35am, 11.15am, 11.25am & 11.41am. Data combined into graph below.



Four bass at 19,35, 46 & 50mm, a common goby at 28mm and a thin-lipped grey mullet at 28mm were also captured. Sea gooseberry, *Pleurobrachia pileus*, and shrimps and prawns were also recorded during the seine nets

Appendix III

Site photographs and fish sampling at Martlesham Wilds Nature Reserve 22nd July 2024

Plates 3 & 4 Small unnamed creek draining to the Deben estuary

Plate5 Describing fyke netting and conducting the dynamic risk asssessment l

Appendix III continued

Plate 6 Setting the winged fyke net in saltmarsh creek

Plate 7 Fyke net operating near high water

Plate 8 Intertidal push net

Appendix IV

Seine netting Bawdsey Beach 23rd July 2024

Plate 9 Explaining the seine netting method and running through the task risk assessment

Plate 10 Seine netting close to high water

Appendix V

Some of the species of fish

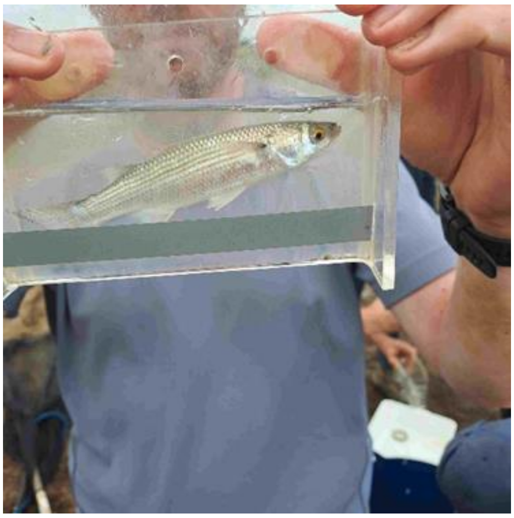
(taken in the perspex viewer and measuring device)

Plate 11 Large sand smelt

Plate 12 Juvenile herring

Appendix V continued

Plate 13 Juvenile bass



Plates 14 & 15 Juvenile thin lipped grey mullet to the left. Juvenile golden grey mullet right

The grey mullet has black spot at the base of the pectoral fin. If that fin is bent forward the tip does not reach the eye. The golden grey mullet has an orange or yellow mark on the operculum. If the pectoral fin is bent forward it reaches beyond the back of the eye.

Appendix VI

Martlesham Wilds 22nd July 2024

Sene netting raw data

Martlesham Wilds Nature Reserve 22nd July 2024 Citizen Science Fish Survey
NGR - TM2773246668
Combined data from 2 seine net sweeps adjacent to the main Deben estuary channel
Temperature and salinity during the first seine sweep 21 degrees C and 24 ppt.
Low water 6.41am, High water 14.02pm Small spring tide rising

Seine sweeps conducted at 11.30am and 11.50am.

Bass			Common Goby		Sand smelt
50	43	115	30	25	
60	48	46	37	22	31
42	52	55	30	20	37
20	45	60	23	25	39
38	43	50	30	23	25
40	50	56	20	20	44
45	32	38	25	21	30
45	55	40	25	14	
50	47	60	25	17	
46	45	50	25	21	
50	55	50	25	22	
55	51	35	25	18	
46	46	36	17	24	
45	40	38	30	17	
52	40	45	32	25	
35	40	45	20	24	
48	40	35	20	23	
30	45	55	28	18	
32	55		32	25	
35	48		18	12	
	n=58		n=40		n=6

plus 64 unmeasured

Total captured = 122

Appendix VI continued

Martlesham Wilds Nature Reserve July 22nd 2024

Fyke net raw data

Martlesham Wilds Nature Reserve 22nd July 2024 Citizen Science Fish Survey
NGR - TM279046656
Two winged fykes set in small unnamed creek adjacent to seine net sweeps
Temperature and salinity just before fyke 1 was removed 21 degrees C and 30 ppt.
Low water 06.41am. High water 14.02pm Small spring tide rising

Fyke 1 set at 10.50am. Recovered at 16.05pm

Bass		Golden grey mullet	
40	47	100	90
45	55	100	86
45	55	100	92
45	130	95	93
100	46	110	140
62	46	100	
50	55	95	
50	54	60	
50	56	100	
50	52	90	
50	45	95	
45	52	40	
35	47	40	
47	35	92	
60	35	91	
55	40	85	
42	40	100	
122	35	100	
52	50	105	
47	45	85	

n=40
plus 304
not measured
total captured =344

n=25

Fyke 2 set at 11.00. Recovered at 16.25pm

Bass	Common goby
124	28

n=1
plus 205
not measured
Totyal captured = 206

n=1

All the grey mullet >79mm were positively identified as *Chelon Aurata*
but the three smaller fish may have been C. ramada

Appendix VI continued

Bawdsey Beach Seine Netting July 23rd 2024

Seine netting raw data

Bawdsey 23rd July 2024 Citizen Science Fish Survey
NGR - TM33093819
Combined data from 4 seine net sweeps at Bawdsey on 23rd July 2024
Temperature and salinity during the first seine sweep 19 degrees C and 31ppt.
Low water 07.07 am, High water 13.47 pm

Seine sweeps conducted at 10.35 am, 11.15am, 11.25am and 11.41am.

Total length in mm

Bass	Sand goby		Common goby	Sand smelt	Herring	Thin lipped grey mullet
35	47	40	28	48	54	125
50	25	22		110	55	
46	52	22		35	70	
19	28	42		110	45	
	41	30		105	47	
	17	27		115	52	
	35	36		95	60	
	37	25		110	57	
	20	30		100	52	
	25	25		34	55	
	36	21			52	
	25	17			54	
	22	28			55	
	30	20			55	
	30	32				
	42	30				
	23	14				
	25					
	18					
	33					
	26					
n=4	n=38 plus 59 fish not measured Total captured =97		n=1	n=10	n=14	n=1