Solent and South Downs: Fish monitoring report 2023

Results of all fish monitoring carried out in 2023.

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We can't do this alone. We work as part of the Defra group (Department for Environment, Food & Rural Affairs), with the rest of government, local councils, businesses, civil society groups and local communities to create a better place for people and wildlife.

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Foreword

Every year, fisheries staff in Solent & South Downs Area complete a wide range of fish population monitoring activities, including electric fishing surveys for salmonids, coarse fish, eels and lamprey, operating three salmon counters, estuarine fish surveys and using a variety of underwater video techniques.

We consider it important to make the results of this work available to everyone with an interest in the fisheries and species we are monitoring, so we produce and circulate comprehensive annual Area reports. Fish monitoring reports were produced annually between 2008 and 2020, with the scope of the 2020 report being reduced by coronavirus working restrictions that year. Full reports were not produced in 2021 or 2022 due to a combination of coronavirus restrictions and reduced staffing, but much of the survey data from those years is included in this report.

Highlights of our 2023 monitoring programme and report include: an in-depth assessment of wild brown trout populations on the River Meon, eel index monitoring on the Itchen, coarse fish surveys on the Sussex Ouse and Western Rother, the full suite of water company sponsored fish monitoring across the Test and Itchen catchments, Test and Itchen salmon stock assessments and the first complete monitoring programme on the Adur estuary and Southampton Water since 2018.

River Meon at Northfields.

Executive summary

We carried out a total of 92 fish surveys across Solent and South Downs area in 2023. This is a summary of the key results:

- A total of 835 fish of 17 species were caught across eight sites on the **Ouse**. 501 individuals (12 species), were of angling interest, the remainder being minor species (minnow, bullhead, stone loach, brook lamprey & 3 spined stickleback). The number of species present increased at six of the eight sites and estimated density (abundance) increased at five of the eight survey sites, when compared with each site's previous survey. At Isfield Gate on the River Uck, we assessed the fish population shortly before the installation of a new fish pass at a flow control structure a short distance downstream; we recorded significantly fewer fish than in 2019 and will now schedule post-installation surveys to assess the effect of the pass on the fish community.

- 297 fish of 14 species were caught across five sites on the **Western Rother** as part of the Principal Coarse Fisheries (PCF) programme. 215 (10 species) of these were of angling interest. Brown trout (resident & sea trout) was the most numerous of the key species (22 caught) and had the highest estimated biomass. However, trout abundance appears to have an overall declining trend. Dace and roach abundance decreased despite increased temperatures, suggesting temperatures have either exceeded the optimal threshold for survival and recruitment, or that other pressures are having a greater negative influence on populations. The fish status of both waterbodies associated with the Western Rother were classified as 'Poor' under the Water Framework Directive (WFD) assessment in 2022.

- 1,542 individual fish of 12 species were caught on the **Meon** for the Principal Brown Trout (PBT) survey programme, 1,055 of which were minor species. 325 wild brown trout were caught across the 13 sites. Brown trout density had increased at both temporal sites (Mislingford & upstream of Silver Springs) since the last survey in 2021, however, some sites experienced substantial decreases in brown trout abundance compared with the last in-depth assessment in 2017. Length frequency distributions showed fewer older adult brown trout. Catch data indicated a decline in eel abundance, with catch numbers just under 32% of the abundance recorded in 2011 and less than 50% of the abundance recorded in 2017.

- The numbers of returning adult salmon recorded on our **Test and Itchen** salmon counters in 2023 were far below each rivers' Conservation Limit, leading to a stock assessment classification of **"At Risk"** and a forecast that they will remain in this category in five years' time. Salmon parr abundance per unit area on the Test and Itchen was at approximately the recent average level, and slightly higher on the Itchen than the Test, despite there being far fewer spawning adults on the Itchen in 2022. This discrepancy has been noted in previous years and suggests that parr survival is poorer on the Test.

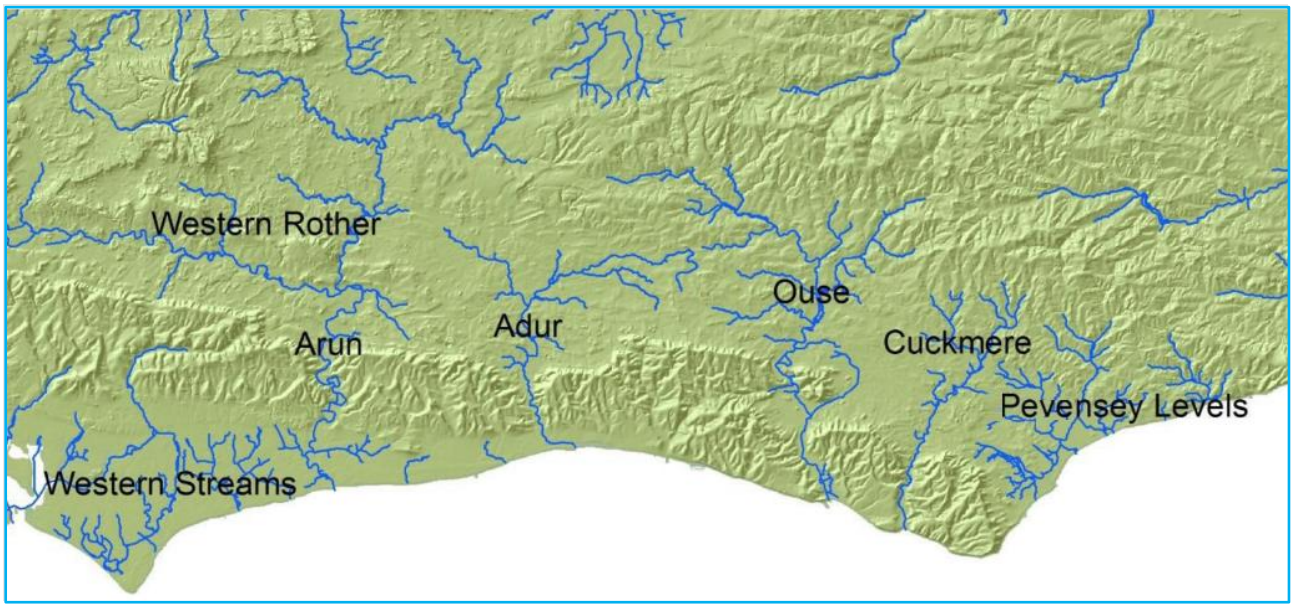
- Eleven fish species and 1,178 individual fish were caught in the **Adur** estuary (below average μ= 2310.3) in the 2023 Transitional and Coastal (TraC) survey programme. 227 juvenile sea bass were caught (above the autumn mean μ=170.7), plus three larger specimens ranging between 156-202 mm. Common goby dominated the catch overall. Sprat and lesser sand eel were absent, but were recorded in autumn 2018. Dover sole was recorded for the first time since spring 2018 and solenette for the first time since autumn 2017.

- 21 fish species were caught (above average μ=18.5) in the **Southampton Water** 2023 TRaC surveys, but overall catch size (n=4,216) was below average (μ=5,306.86). Species such as Baillon's wrasse, flounder and greater pipefish were caught for the first time in several years.

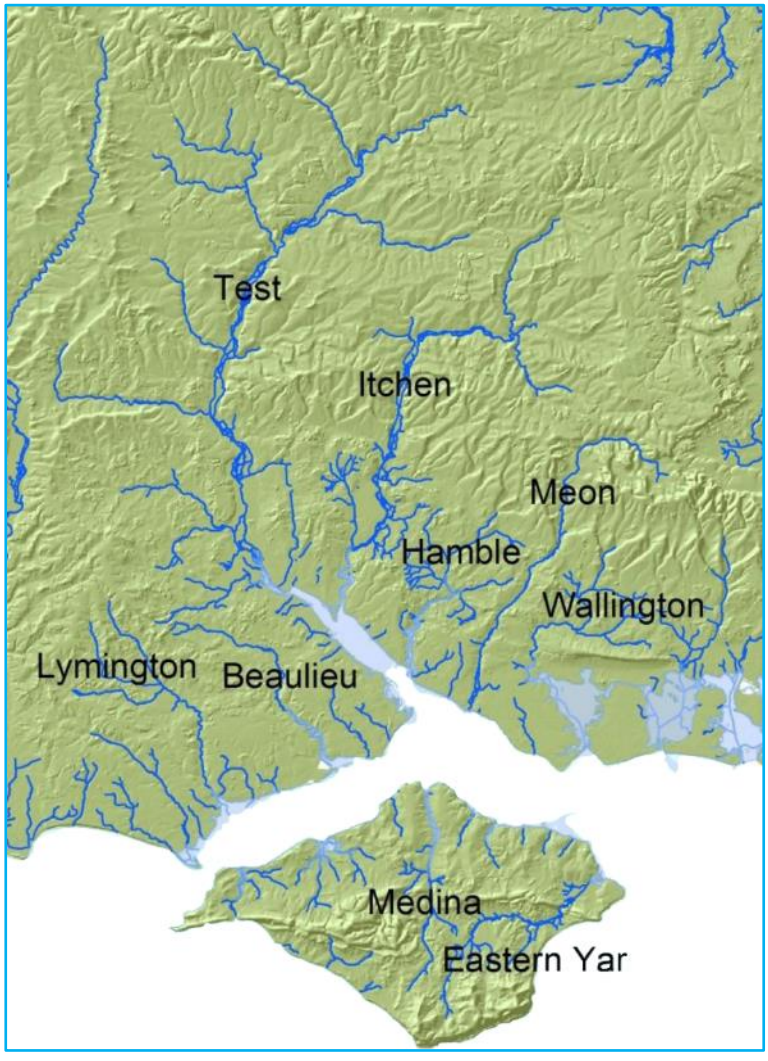
- 15 species and 411 individual fish were caught, the majority being sand goby, during the Hythe Pier Coastal Survey Vessel (CSV) otter trawl (autumn 2023). The highlight of the catch was a 2-year-old male spiny seahorse. Total catch increased from the previous survey in 2019.

Rivers of Solent and South Downs

South Downs:



Solent:



Contents

Temperature and rainfall

Climatic conditions have a major influence on fish populations in both freshwater, estuarine and marine environments. Rainfall dictates flow and temperature affects the rate of fish growth and multiple aspects of water quality, particularly dissolved oxygen.

Monitoring of temperature (Met Office's Central England Temperature dataset) and rainfall (Environment Agency rain gauge at Romsey) has continued in 2023. The data for the 2023 year covers a 15-month period, (October 2022 – December 2023); previous winter conditions are influential to fish populations the following summer and thus, our survey results. For example, mild, low flow winters are preferential for juvenile coarse fish, which can be affected by wash-out in flood flows. However, cooler winters with ample flow are ideal for migratory Atlantic salmon and sea trout entering the rivers to spawn, as well as subsequent salmonid egg incubation.

Mean monthly temperatures from October 2022 to December 2023 were relatively consistent with the 22-year average. However, the mean was exceeded slightly during five periods over the 15-month period totalling approximately 7-8 months of above average temperatures (Figure TR1). December 2022 and July-August 2023 saw below average temperatures. Mean monthly temperatures never exceeded the maximum temperatures or fell below the minimum temperatures. Nevertheless, despite a relatively cool summer, spring and autumn 2023 temperatures were above average, potentially resulting in sub-optimal conditions for salmon and sea trout egg development and spawning.

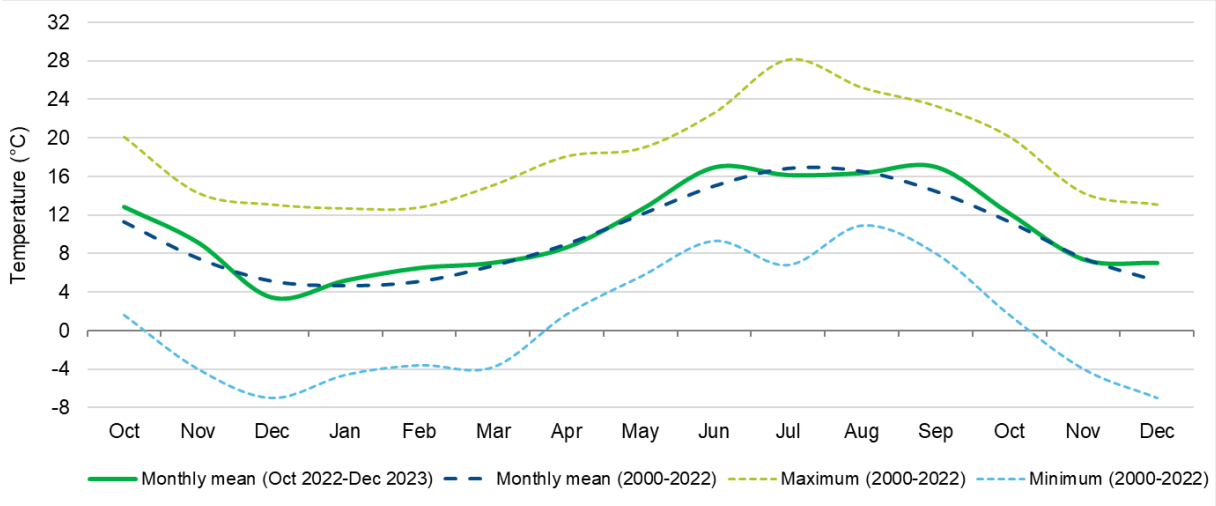


Figure TR1. Monthly mean temperatures (°C; October 2022 to December 2023) and monthly mean, maximum and minimum temperatures (2000 to 2022).

While temperatures this year followed a relatively average trend, total rainfall was much more unpredictable (Figure TR2). Excluding a very dry February (reaching minimum total rainfall values) and a relatively dry May-June period, total rainfall remained above the 22-year mean for the rest of the 15-month period. In July 2023, total rainfall exceeded the maximum total rainfall recorded between 2000 and 2022. This high rainfall resulted in high groundwater and river levels throughout winter 2023 and 2024, which is likely to have affected juvenile coarse fish survival and potential damage to completed salmonid redds. Another result of high autumn and

winter flows is that salmon and sea trout tend to migrate further upstream to find optimal depth and velocity conditions for spawning.

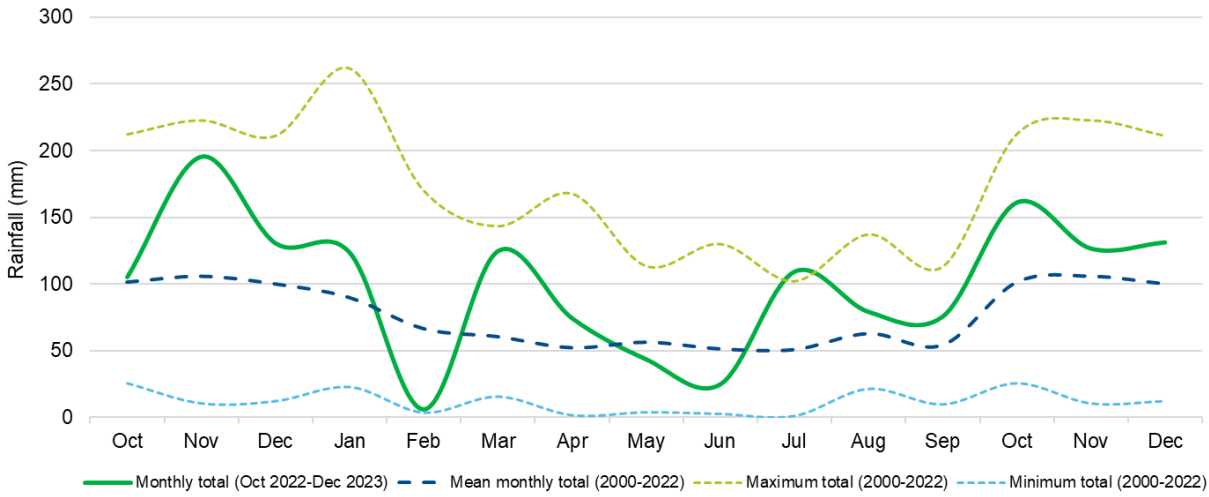


Figure TR2. Monthly rainfall totals, October 2022 to December 2023 and monthly rainfall totals (mm) from 2000 to 2022.

February freeze at Compton on the River Test.

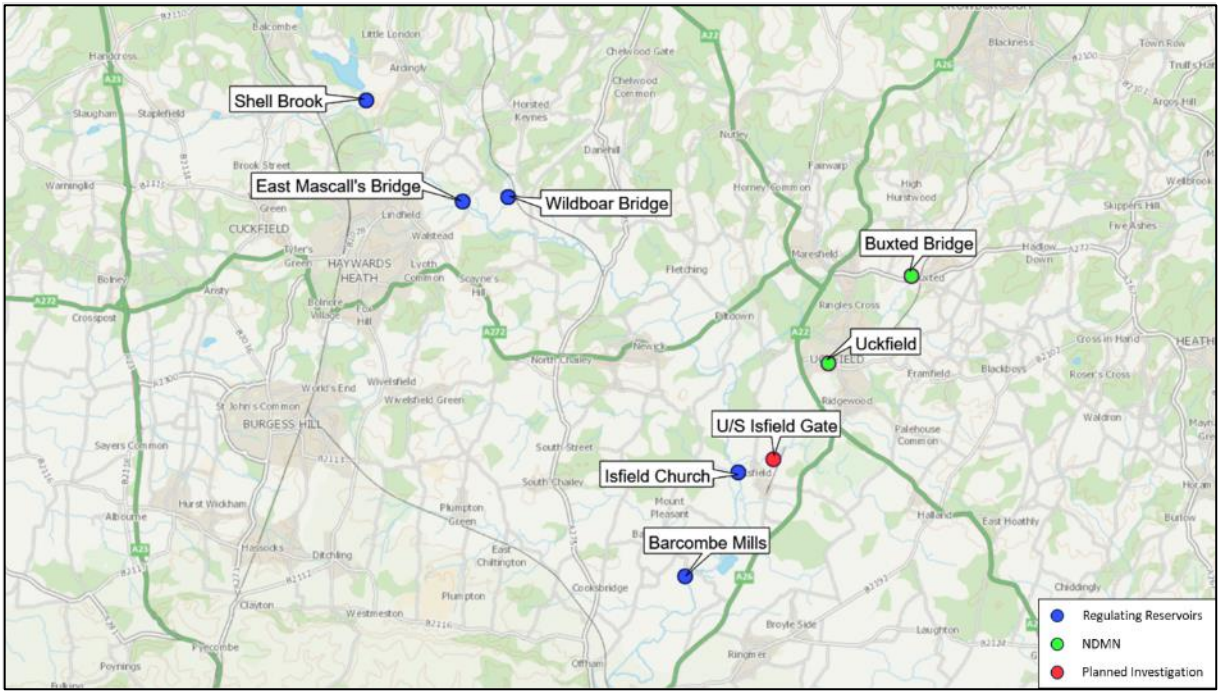
1. East Sussex

1.1. Sussex Ouse

Eight fish population surveys were completed on the Sussex Ouse in 2023. Five of these were Regulating Reservoirs surveys (designed to assess fish populations on streams affected by the presence of major reservoirs); two sites served as part of the National Drought Monitoring Network (NDMN) and one was a local investigation.

The NDMN and Regulating Reservoirs programmes are nationwide programmes, but the surveys provide valuable data for local fisheries and ecology. U/S of Isfield Gate was surveyed as a Planned Investigation to assess the impact of the installation of a fish passage easement on a weir.

Map Ouse 1 shows the locations of each survey site and sets out the site purpose in 2023. Please note that some of these sites have additional purposes (e.g. Eel Index, Principal Coarse Fishery, Principal Brown Trout), but were not scheduled for those purposes this year.



Map Ouse 1: Sussex Ouse survey sites, 2023.

These surveys were completed using the three run, catch-depletion method, allowing abundance and density estimates for each fish species to be calculated from total catch numbers at each site. Minor species of least angling interest were excluded (i.e. brook lamprey, bullhead, minnow, three-spined stickleback and stone loach). Figure Ouse 1 summarises the estimated abundance and species composition at each site surveyed in the River Ouse in 2023.

A wide range of species was found across the River Ouse sites, with dominant species varying between location (Figure Ouse 1). Brown trout were observed at Shell Brook (n=1), Wildboar Bridge (n=9), East Mascall's Bridge (n=11), Barcombe Mills (n=2), U/S Isfield Gate (n=1) and Buxted Bridge (n=66). Estimated population density increased at five of the eight sites (Shell Brook, Wildboar Bridge, Isfield Church, Barcome MIlls and Buxted Bridge) compared with the previous survey year at that site. In 2023, the fish community at Shell Brook had the greatest abundance of fish (Figure Ouse 1), whilst Uckfield and U/S of Isfield Gate were the most species diverse. Dace were observed at all sites.

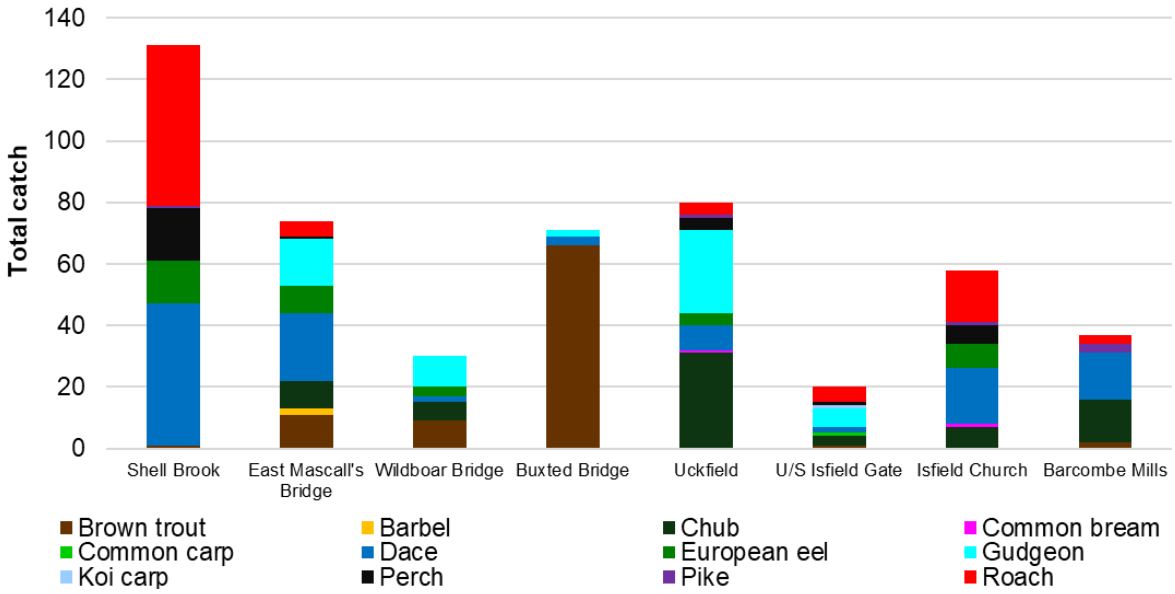


Figure Ouse 1. Estimated species abundance per site, Ouse, 2023.

Regulating Reservoirs

Figure Ouse 2 shows an increase in fish population density at Shell Brook between 2021 and 2023, most notably dace and roach. There was a decrease in European eel and pike densities, however, perch saw the biggest decrease. Chub, tench and common bream were also absent in the 2023 survey. One wild brown trout was caught in 2023, which is an improvement since the last survey in 2021.

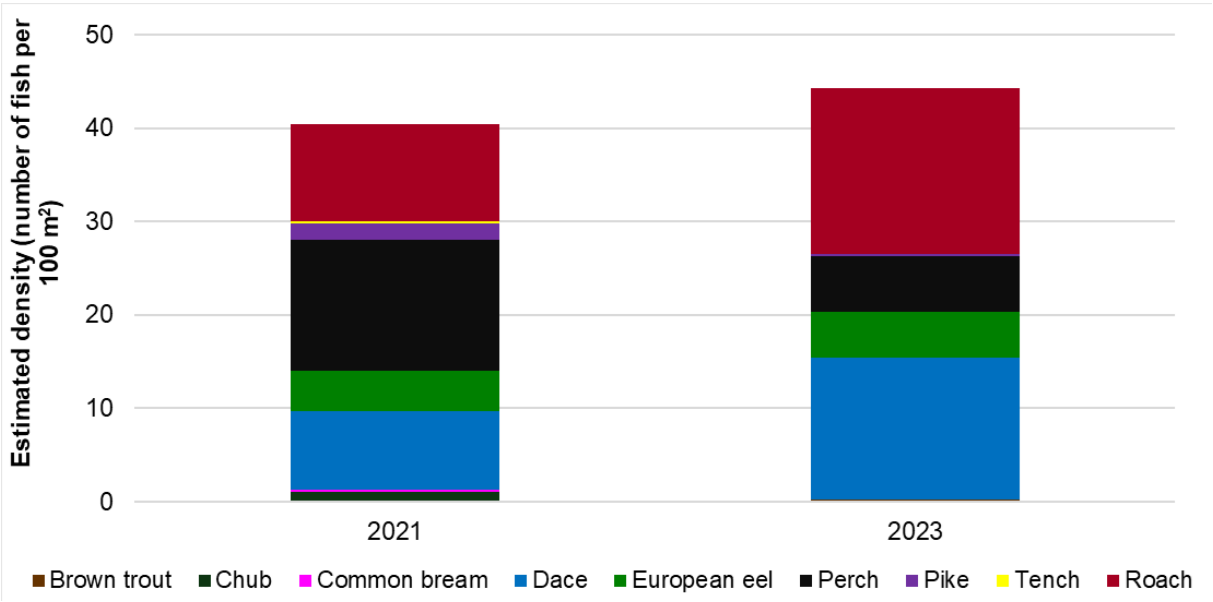


Figure Ouse 2. Estimated density of key fish species at Shell Brook in 2021 and 2023.

Wild brown trout density increased in 2023 since the previous survey in 2017 at Wildboar Bridge (Figure Ouse 3), however, numbers were at their third lowest value since 2009. Since the inaugural survey in 2009, gudgeon has been recorded in 2009 and 2023; the highest density of gudgeon was recorded in 2023. A decrease in the density of European eel and dace was noted in 2023. After an absence in the catch since 2011, chub were recorded in 2023.

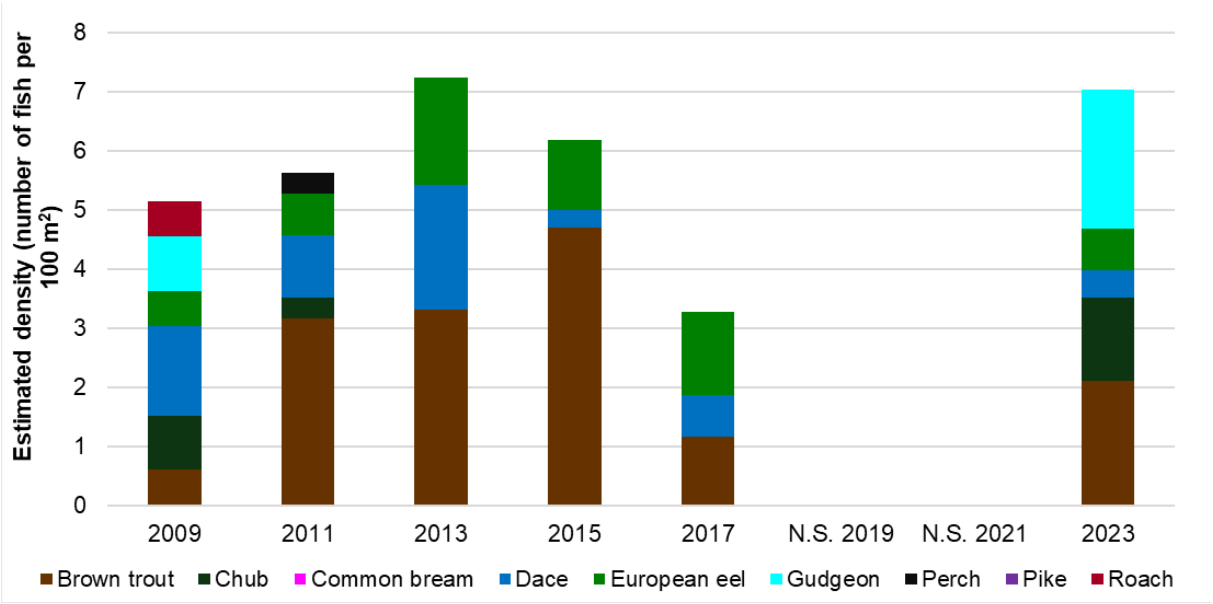


Figure Ouse 3. Estimated density of key fish species at Wildboar Bridge, 2001 – 2023 (N.S. = no survey).

Fish population density was at its lowest since 2013 at East Mascall's Bridge (Figure Ouse 4), however there have been few surveys since then. Dace, European eel, perch and roach all saw a decrease in density since the last survey in 2017. In contrast, barbel were recorded for the first time since 2013 and wild brown trout density was the highest recorded since surveys began in 2001.

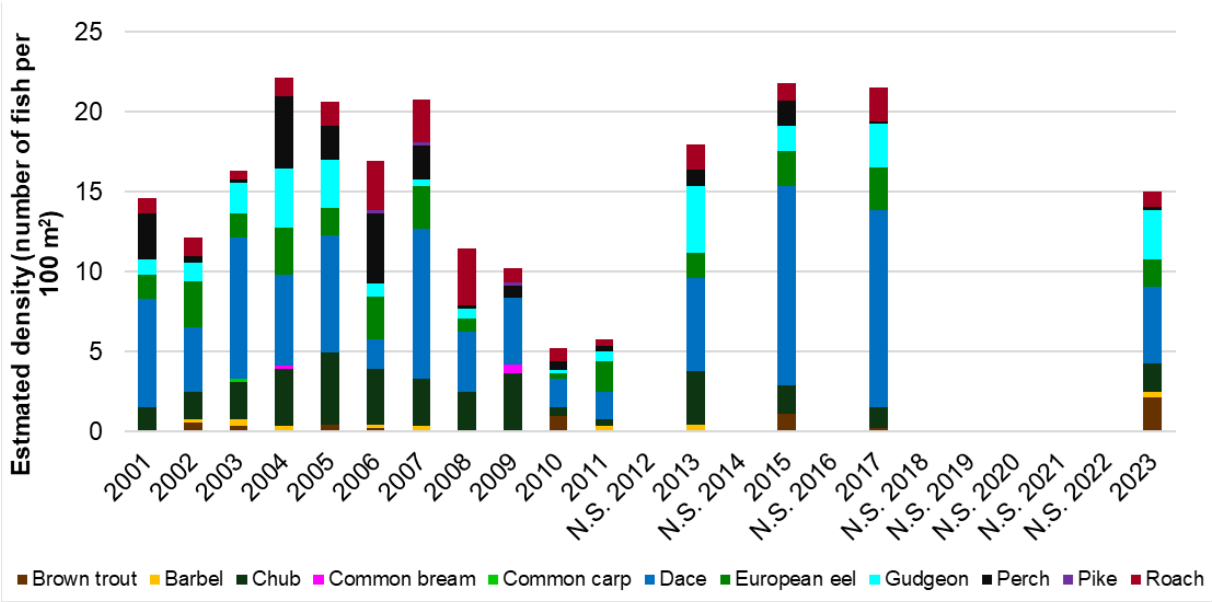


Figure Ouse 4. Estimated density of key fish species at East Mascall's Bridge, 2001-2023 (N.S. = no survey).

There was an increase in overall population density at Isfield Church between 2009 and 2023 (Figure Ouse 5), but it was still less than half of that of 2007. Common bream was recorded for the first since surveys began in 2003, chub for the first time since 2007 and perch and pike for the first time since 2009. Wild brown trout, gudgeon, mirror carp and rudd were absent in the 2023 survey.

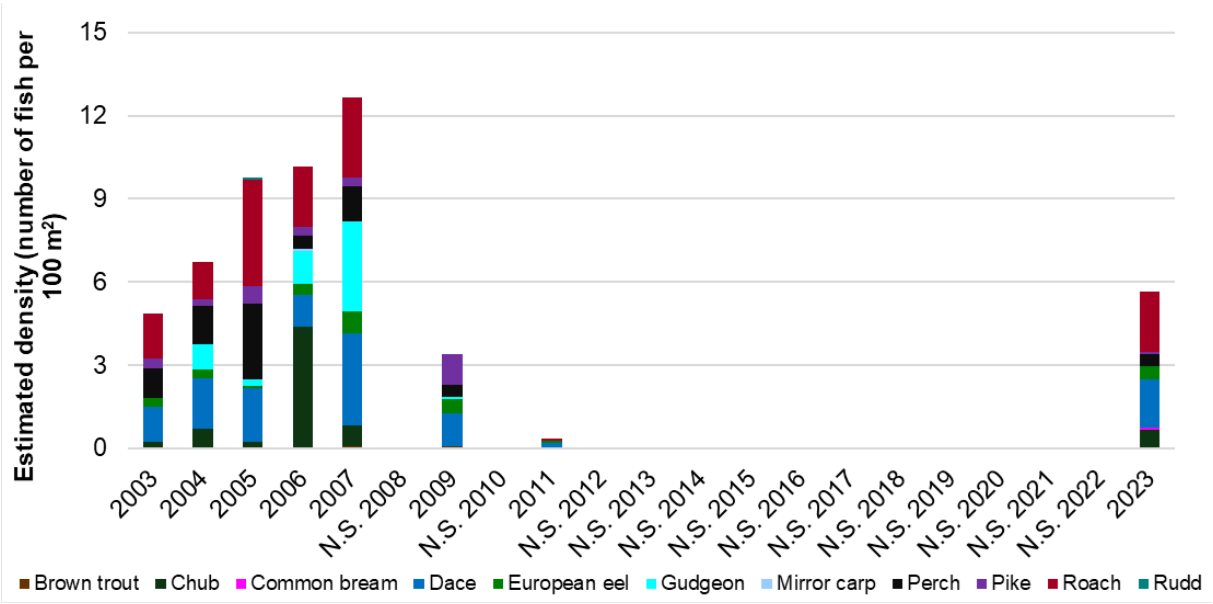


Figure Ouse 5. Estimated density of key fish species at Isfield Church, 2003-2023 (N.S. = no survey).

Despite population density being less than half of that seen 20 years ago at Barcome Mills (Figure Ouse 6), it has more than doubled since the last survey in 2007. Chub and dace have seen a substantial increase in density and wild brown trout have returned. Pike density has more than halved since 2007.

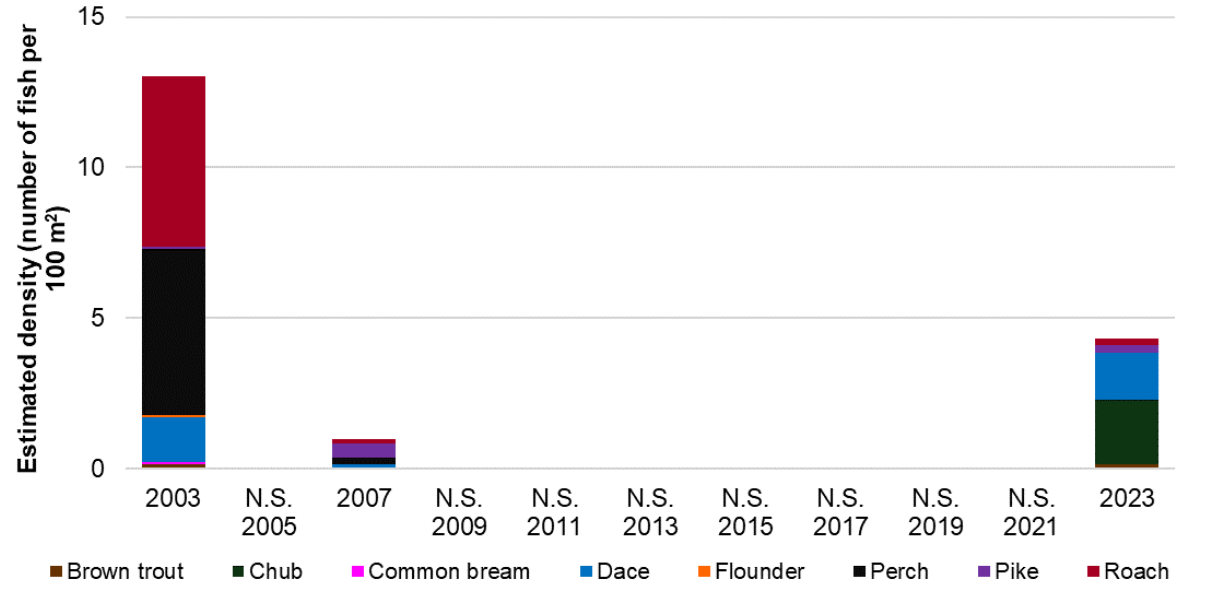


Figure Ouse 6. Estimated density of key fish species at Barcombe Mills in 2003, 2007 and 2023 (N.S. = no survey).

Planned Investigation (coarse)

"U/S of Isfield Gate" on the River Uck was surveyed *before* the installation of a new fish pass at an obstructive flow control structure a short distance downstream. A new brush pass was developed with Southampton University, featuring clusters of brushes fitted to the face of the gauging weir to create the right flow and velocity conditions for upstream fish passage (Photograph Ouse 1). The surveys assessed the size and composition of the fish population prior to the installation of the pass; future surveys will assess if the pass has improved connectivity through assessment of the fish community.

Photograph Ouse 1. The recently installed (Oct-Nov 2023) fish pass on the weir downstream of the survey site.

Figure Ouse 7 shows the estimated density of key fish species at Upstream Isfield gate in 2019 and 2023. Minor species are excluded. The new fish pass was installed to replace a previous structure that had dried out, following the removal of a redundant obstructive gate which subsequently lowered the impounded level. It is likely that the reduced fish density in 2023 is a result of fish being unable to pass the weir upstream to the survey site.

In 2023, fish population density has decreased to less than one fifth of that seen in 2019 (Figure Ouse 7). European eel, mirror carp, perch and tench were absent from the survey in 2023, although dace and koi carp were recorded for the first time. It is possible that the carp species found in the river had escaped from nearby lake fisheries. The lack of eel and perch and the decrease in density of other coarse fish species may be related to drought conditions experienced in summer 2022.

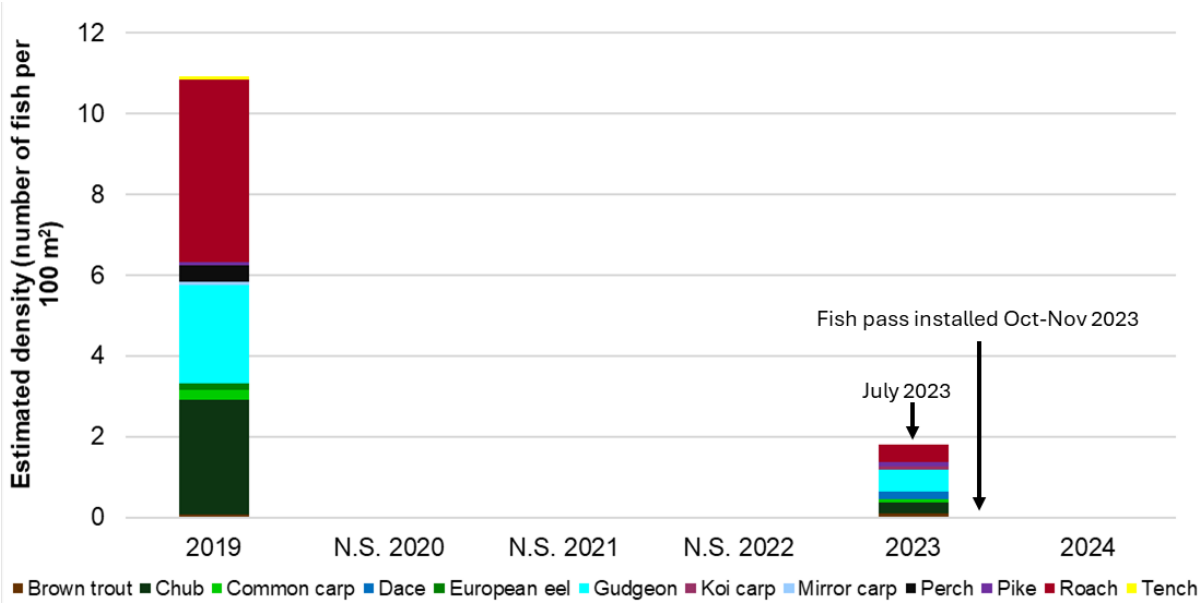


Figure Ouse 7. Estimated density of key fish species Upstream of Isfield Gate in 2019 and 2023 (N.S. = no survey).

National Drought Monitoring Network (NDMN)

At Buxted Bridge (Figure Ouse 8), chub were absent in 2023 when compared with the last survey in 2018, roach and perch have not returned since 2015, and species diversity declined by 50% since 2011. Brown trout dominated the site in 2023, with the highest density since surveys began in 2009. Dace and gudgeon were observed for the first time since 2015. Since 2015, there is an increasing trend in overall density of the fish community and a shift towards rheophilic (flow-loving) species; it is considered improvements to flow have resulted in this trend, and the increased density of wild brown trout recorded.

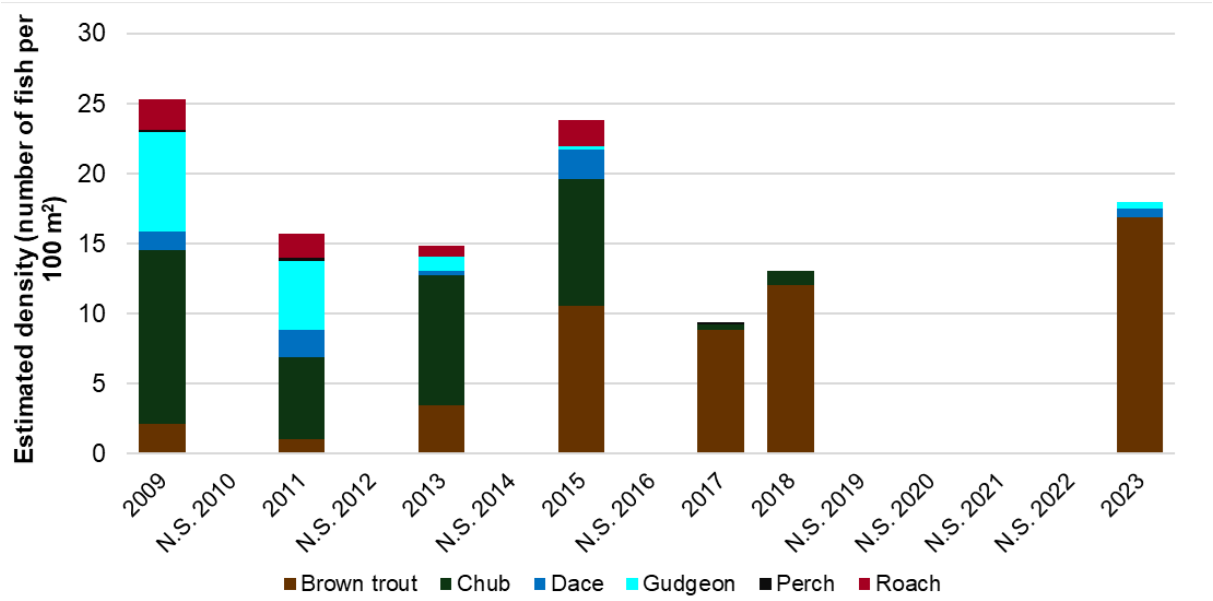


Figure Ouse 8. Estimated density of key fish species at Buxted Bridge, 2009 - 2023 (N.S. = no survey).

Uckfield (Figure Ouse 9) saw its second-lowest estimated fish population density since 2009, less than half of the density estimated in 2021. Brown trout were absent in 2023 and dace, European eel and gudgeon decreased in estimated density. However, common bream, perch and roach were observed for the first time at this site since 2017. Estimated density of chub increased since the previous survey in 2021.

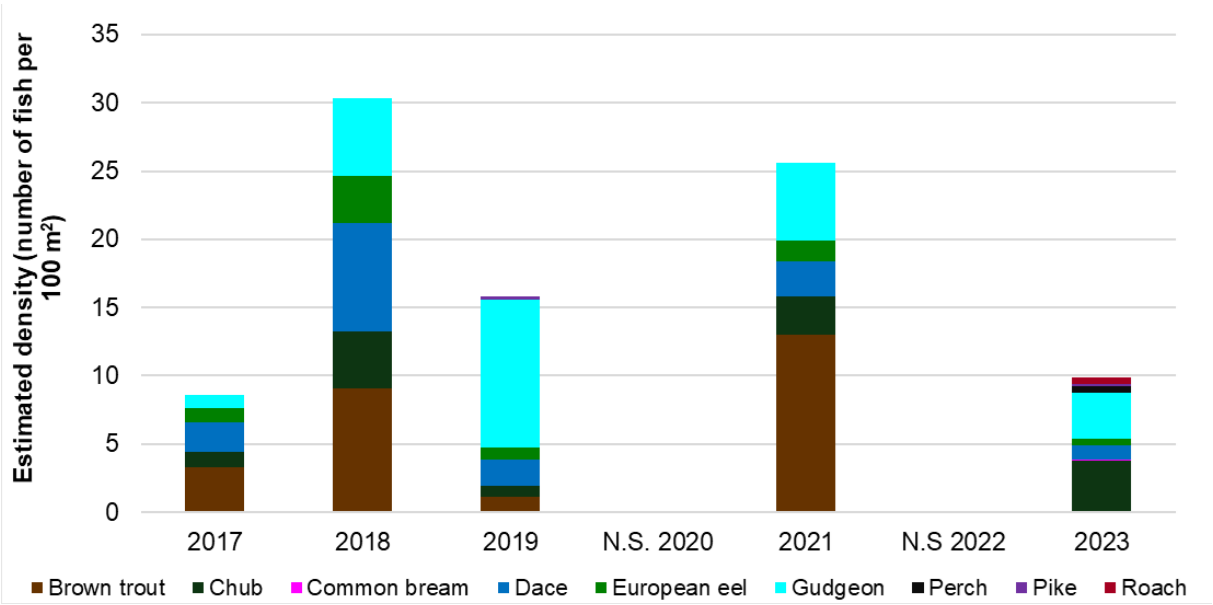


Figure Ouse 9. Estimated density of key fish species at Uckfield, 2009 - 2023 (N.S. = no survey).

Brown / sea trout, Barcome Mills, Ouse, 2023.

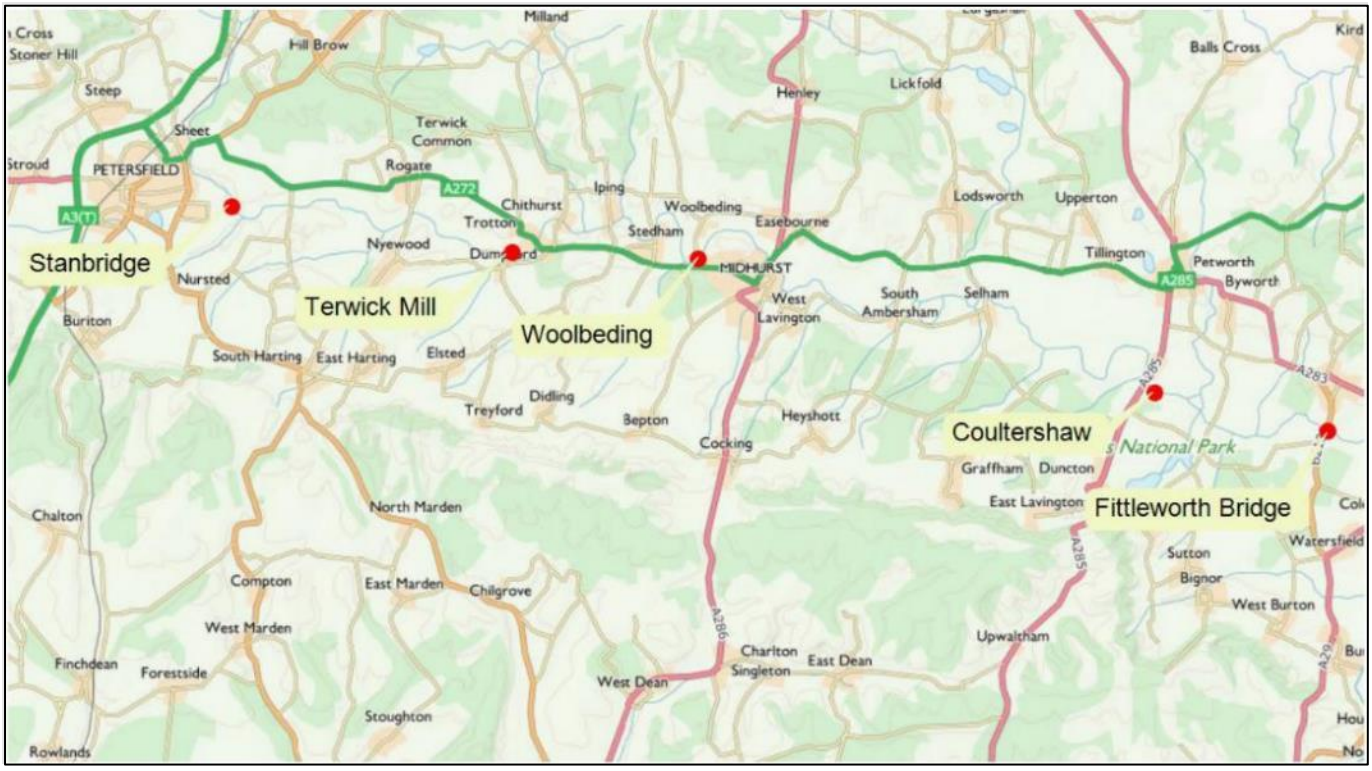
A Sussex stone loach

2. West Sussex

2.1. Western Rother

Five sites on the Western Rother, between Petersfield and Fittleworth, were surveyed by electric fishing in July 2023 to assess fish communities and inform management of the Principal Coarse Fishery.

A three-run catch-depletion method was used, allowing density and biomass estimates to be calculated. Map Western Rother 1 shows the site locations.



Map Western Rother 1: Western Rother Principal Coarse Fishery survey sites, between Petersfield and Fittleworth (flow is from West to East).

Survey results

Table Western Rother 1 shows population density estimates (number of fish per 100 m^2) and size ranges for the key fish species recorded during the surveys. Minor species (minnow, bullhead, stone loach and brook lamprey) were also caught but are not included in the table. Species diversity has decreased, with 10 major species and four minor species being recorded, compared with 11 major species and five minor species in the 2019 and 2022 surveys.

Table Western Rother 1: Population density estimates (number of fish per 100 m^2) and size range (min – max, mm) for key species.

Fish species	Measure	Stanbridge	Terwick Mill	Woolbeding	Coultershaw	Fittleworth Bridge
Brown Trout	Density	2.4	0.6	0.2	0.1	
	Size range	150 - 305	146 - 379	418 - 581	570	
Chub	Density		0.2		0.1	0.2
	Size range		301 - 326		147	128 - 150
Dace	Density		1.1	0.1		
	Size range		125 - 198	204		
European eel	Density		1.0			0.3
	Size range		120 - 590			260 - 460
Grayling	Density		0.2			
	Size range		169 - 260			
Gudgeon	Density		0.5	0.3		
	Size range		115- 141	108 - 135		
Perch	Density		0.7	0.1	0.3	
	Size range		155 - 387	147	136 - 343	
Pike	Density		0.2	0.1	0.1	0.6
	Size range		342 - 387	651	535	92 - 122
Roach	Density			0.1	0.2	0.1
	Size range			65	72 - 73	84
Tench	Density		0.1			
	Size range		112			

Mean estimated density of key species has varied through the years, decreasing in 2023 since 2022 (Figure Western Rother 1). Mean estimated density has remained relatively consistent in terms of distribution between sites, however, most appear to have experienced a decrease over time. Coultershaw, especially, has seen a substantial decrease in mean estimated density since 2006. When observing *total* estimated density, Terwick Mill has a greater density than Standbridge, however, it also has the greatest diversity of key species.

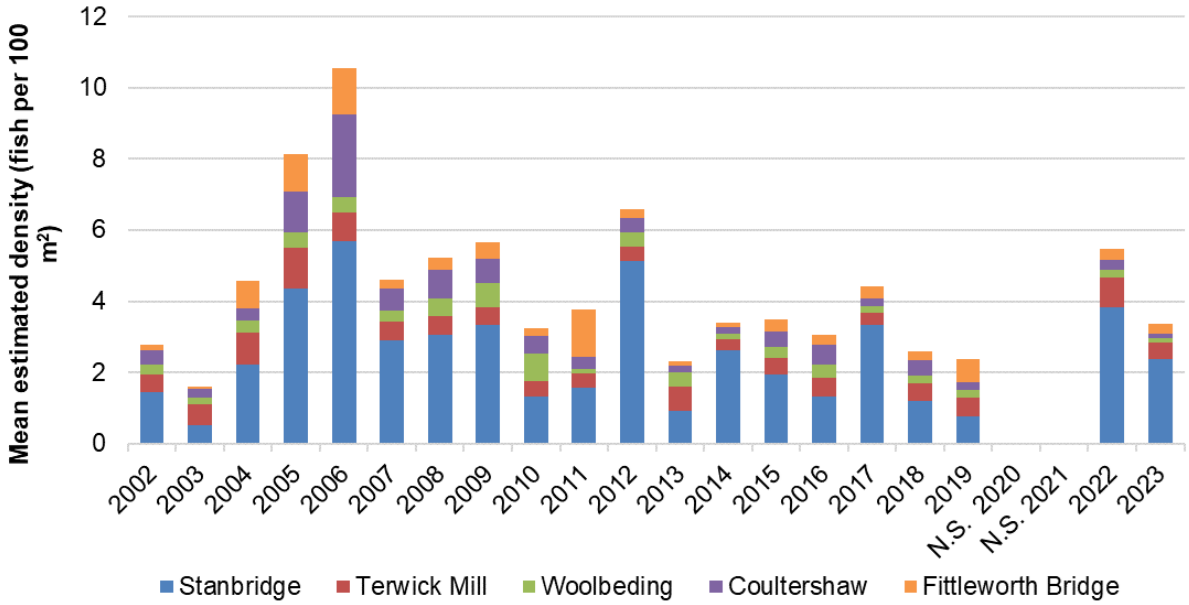


Figure Western Rother 1. Mean population density estimates (number of fish per 100 m²) of key species across all survey sites, 2002 – 2023 (N.S. = no survey, due to COVID-19 regulations).

Figures Western Rother 2 and 3 show fish population density and biomass estimates, respectively, for the major fish species recorded during the surveys. There is a distinct change in species composition from the headwaters downstream, with brown trout dominant at Stanbridge (furthest upstream site monitored) and other coarse fish more prevalent downstream; this trend was also identified in 2019 and 2022 (Figures Western Rother 2 and 3). Terwick Mill was the most species diverse and densely populated site, with nine major species recorded in 2023. Three-spined stickleback were observed for the first time in 2022 at Terwick Mill, and tench for the first time in 2023.

Densities dropped to below 2019 values at all sites, except Stanbridge.

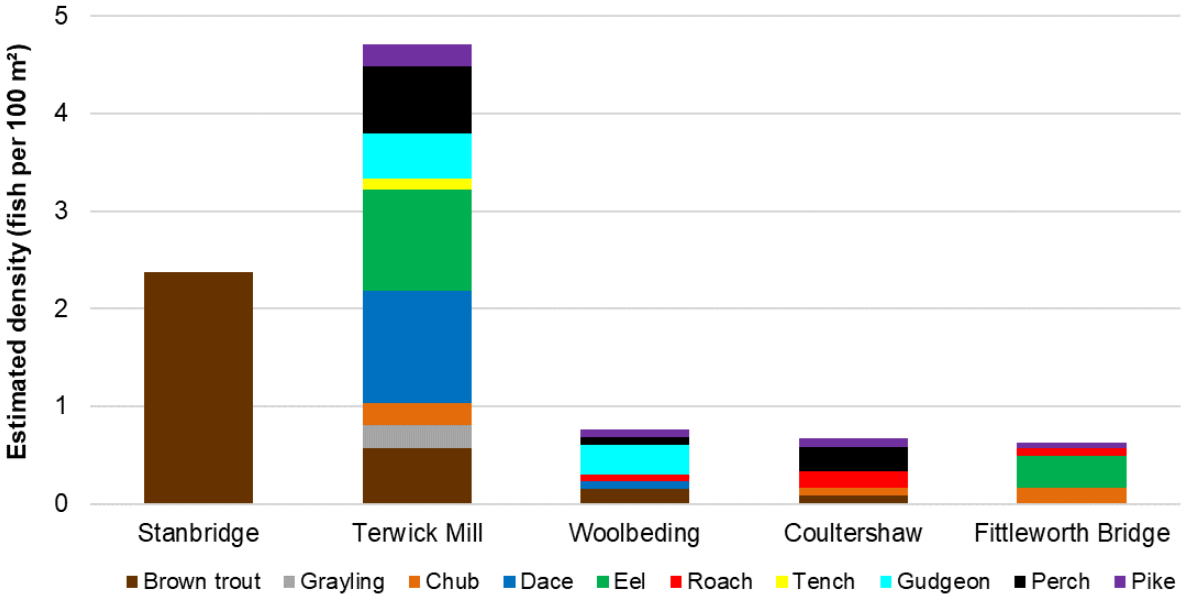


Figure Western Rother 2. Population density estimates of key species (number of fish per 100 m²) across all survey sites.

Woolbeding and Coultershaw brown trout and pike numbers were low, but because of their larger size, they dominate the total biomass at these sites compared with smaller species such as dace and roach.

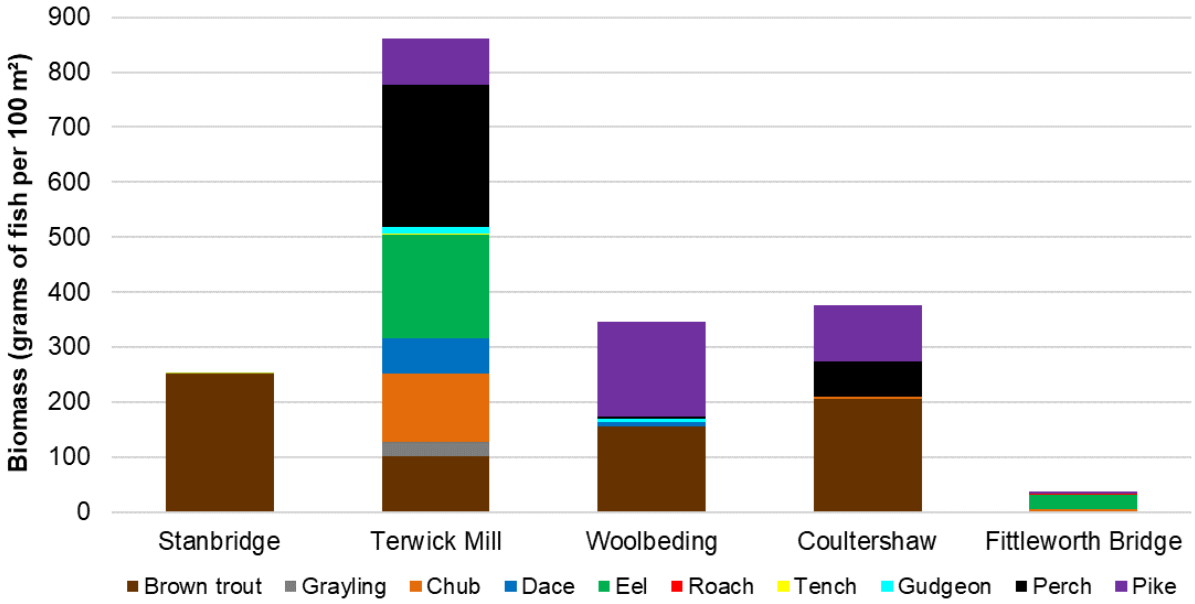


Figure Western Rother 3. Population biomass estimates (grams of fish per 100 m^2) across all survey sites.

Upstream, the river is steeper, faster flowing and less silty. As the sites progress downstream, channel gradient decreases and the degree of channel engineering and impoundment increases. Habitat is an important factor in shaping the biological communities of a river system, and these habitat changes identified in the River Rother are considered to be influencing species distribution (Figures Western Rother 2 and 3).

Stanbridge, the furthest upstream site, has experienced a successive decline of brown trout since 2006 (Figure Western Rother 4). Despite the increased density in 2022 from 2019, the absence of data from 2020 and 2021 inhibits the understanding of any increasing population trends. Although 2023 data indicates an increase in estimated density of brown trout since 2018, 2023 data indicates a slight decrease compared to 2022.

Terwick Mill survey site

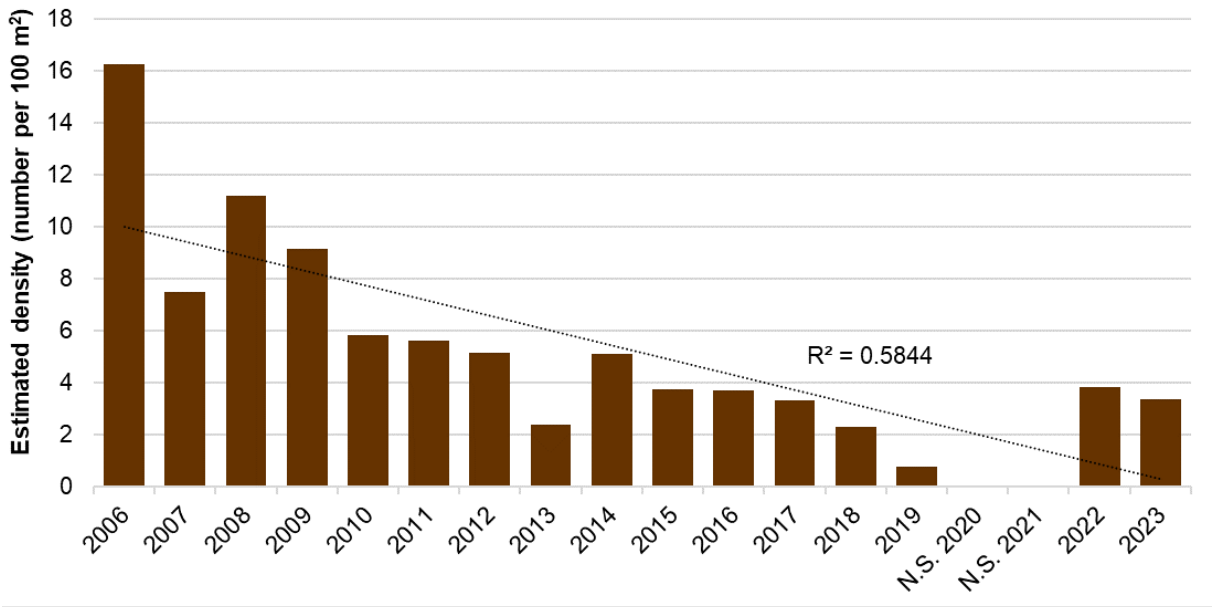


Figure Western Rother 4. Estimated density of brown trout at Stanbridge between 2006 and 2023. No surveys (N.S.) were undertaken in 2020 and 2021 due to the COVID-19 pandemic.

Brown trout are the dominant species here and influences on the population are more likely to come from environmental or climatic pressures rather than competition with other species. Hence why Standridge is the focus here. The trend towards increasing peak and seasonal summer air temperatures since 2007 (Figure Western Rother 5) is of significant importance to temperature-sensitive species, such as brown trout and grayling.

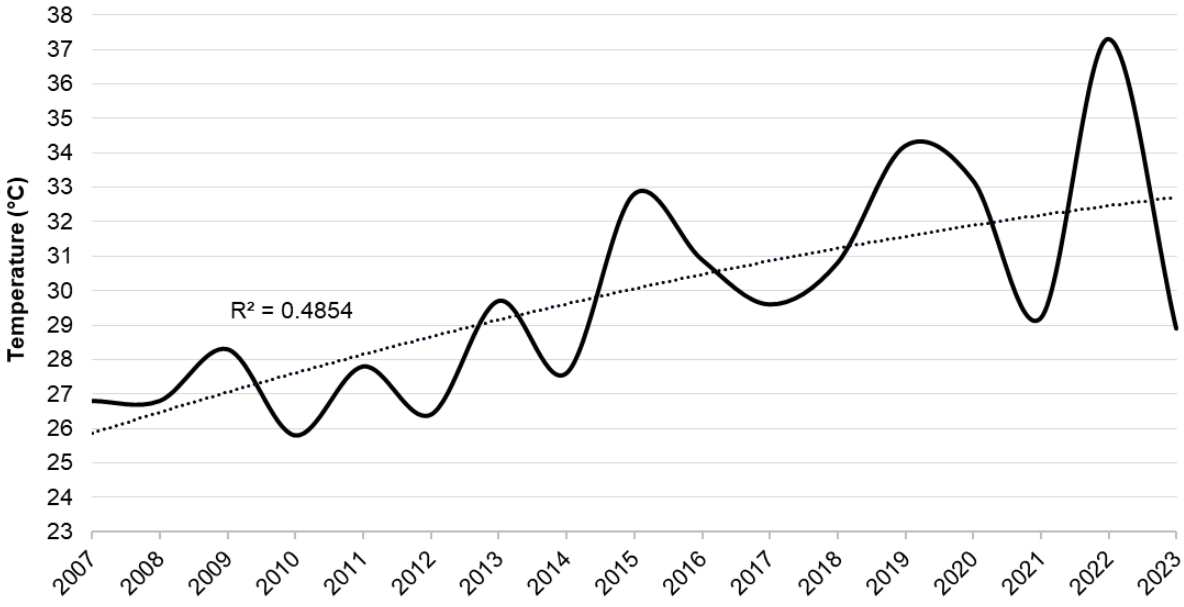


Figure Western Rother 5. Annual maximum temperatures (CET), 2007-2023.

The negative correlations between their respective densities (brown trout = -0.45 and grayling = -0.72) and the daily maximum and seasonal maximum temperatures (Figure Western Rother 6), demonstrate this relationship and emphasise the negative impact of increasing temperatures on local salmonid populations.

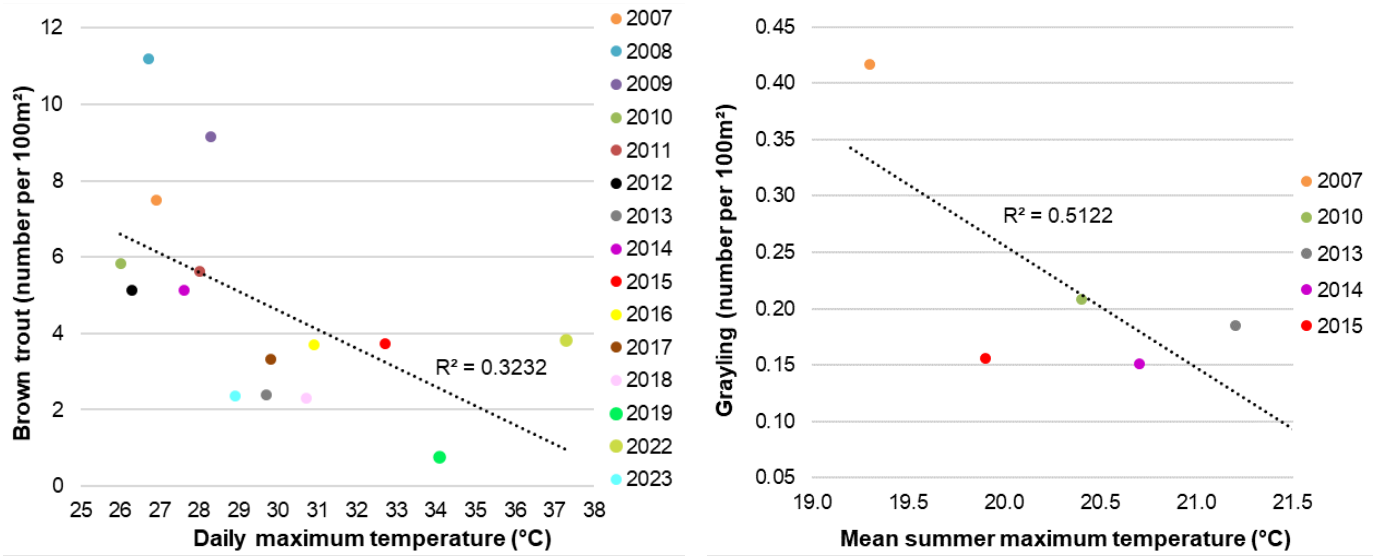


Figure Western Rother 6: Estimated density of brown trout (left) and grayling (right) at Stanbridge and the daily maximum temperature, 2007-2023.

WFD Classification

The River Rother has consistently failed the Water Framework Directive Classification at Moderate or below (Table Western Rother 2), suggesting observed fish communities are different to what they should be when compared to a river with no anthropogenic stress. The primary issues are siltation, impoundment and historic channel modification, in combination with warming climatic conditions. Nevertheless, as demonstrated by the survey results, the Western Rother fish community continues to offer a diverse range of species for anglers to target.

Table Western Rother 2. Water Framework Directive water bodies on the Western Rother and their classification status.

Water body ID	Waterbody name	Sites	Fish status 2016	Fish status 2019	Fish status 2022
B107041012840	Western Rother upstream of Petersfield	Stanbridge	Moderate	Poor	Poor
GB107041012810	Western Rother	Terwick Mill Coultershaw Fittleworth Bridge	Moderate	Moderate	Poor

Planned actions

The focus of habitat improvements in the Western Rother is to increase river connectivity. Recently completed and current improvement works on the catchment include:

- Leconfield Estate have made improvements to floodplain connectivity near Petworth, to improve habitats in the floodplain and reduce sediment loading.
- Fencing reaches between Shopham and Fittleworth, to improve the riparian zone, reduce cattle poaching and sediment input.
- Investigation of sediment transport at Stedham Mill to inform the possible removal of automated flood gates and improve passage/connectivity.

Planned improvement works on the catchment include:

- Structure removal on the Cowdray estate.
- Fish easement on gauging weirs at Iping and Halfway Bridge.

Sea trout

Juvenile pike, Fittleworth Bridge

Juvenile Grayling

Perch

Fittleworth Bridge

3. Hampshire

3.1. Meon

This report provides a summary of results from 2023 fish population surveys on the River Meon between Drayton, to the west of Petersfield, and Titchfield, near Fareham. The surveys were carried out to assess the health of the river and enable management of our principal fisheries.

2023 Meon surveys. Left: The survey site at St Clair's Farm. Top right: The upper stop net at Exton. Bottom right: Measuring the fork length of a chub at Upper Rookesbury.

Site locations

The Meon is classed as a Wild Brown Trout River and fish population monitoring is conducted at specific sites from the headwaters near Drayton, to Titchfield, close to the tidal limit. Two sites are surveyed once every two years, while eleven other sites are surveyed once every six years; the biennial sites indicate changes in brown trout abundance over time, while the six-yearly sites indicate changes in geographical distribution of trout over a longer timeframe. Map Meon 1 shows the locations of the 13 sites surveyed on the Meon in June and July 2023.

Map Meon 1. Site locations of the fish surveys undertaken in 2023 on the river Meon. The red markers indicate the 11 spatial sites, and the black markers the two temporal sites.

Survey results

Table Meon 1 shows population densities as the actual number of fish captured per 100 m² and the size ranges for the fish species recorded during the surveys. Minor species (minnow, bullhead, stone loach and brook lamprey) were caught, but are not included.

Table Meon 1. Population densities (fish per 100 m²) and size ranges (min – max, mm) for key species recorded during the surveys.

	Measure	Riplington	Moorhen	Exton	Meonstoke	St Clair's Farm	Holywell	Mislingford Beat
Brown trout	Density	0.61	3.83	3.21	4.42	5.00	2.60	13.51
	Size range	346	86-275	73-273	73-251	72-342	98-370	70-245
Chub	Density						1.22	0.70
	Size range						289-464	320-425
Eel	Density		0.26	0.77	1.56	1.54	1.22	0.70
	Size range		620	200-430	330-610	250-640	330-590	300-450

	Measure	Upper Rookesbury	Northfields	Wickham Gardens	U/S Silver Springs	Titchfield Mill	Titchfield Canal
Salmon	Density				0.58	1.75	
	Size range				68-71	68-95	
Brown trout	Density	10.18	4.3	1.89	3.11	9.83	0.56
	Size range	64-310	66-238	68-250	58-385	52-290	184-238
Chub	Density	0.71	0.14	0.37	3.50	2.46	1.68
	Size range	300-390	389	92-440	148-340	160-290	54-168
Dace	Density				0.39	2.46	
	Size range				220-230	136-200	
Eel	Density	1.79	1.25	1.51	0.97	3.51	2.52
	Size range	220-450	190-470	170-520	150-280	120-350	140-360
Grayling	Density				0.2		
	Size range				345		
Roach	Density						1.96
	Size range						70-165

Sites were surveyed using single-run electric fishing, which is ideal for completing many surveys in a short space of time. Actual catch sizes allow minimum population abundance and density estimates to be derived, for comparison between sites and years. There is a distinct change in species composition and abundance from the headwaters at Riplington downstream to Titchfield Canal, with the most species rich sites in the lower reaches (Figure Meon 1). Brown trout dominated most sites except for Wickham Gardens, U/S Silver Springs and Titchfield Canal.

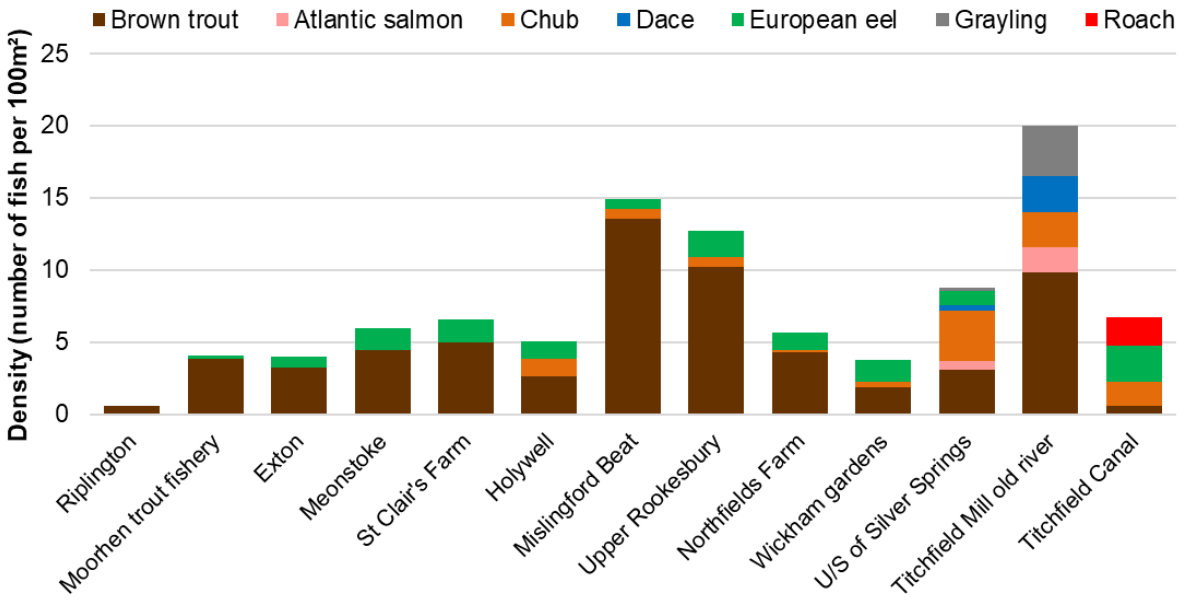


Figure Meon 1. Population densities (fish per 100 m^2), excluding minor species, across all survey sites, River Meon, 2023.

Mislingford Beat and U/S Silver Springs are temporal sites surveyed biennially, to assess brown trout populations over time. Brown trout numbers have fluctuated since 2007 but increased at both sites since the previous survey in 2021. Furthermore, Atlantic salmon were recorded at U/S Silver Springs for the first time since 2019, albeit in low numbers.

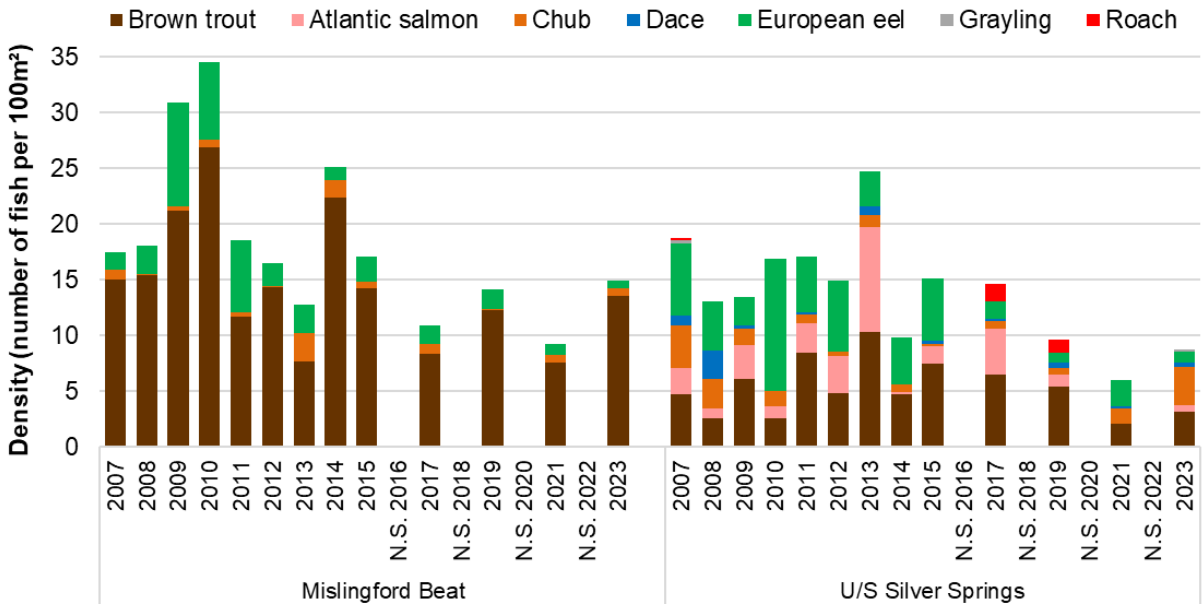


Figure Meon 2. Fish population densities (actual number of fish per 100 m^2) at the temporal monitoring sites alongside the trendline for brown trout, River Meon, 2007 – 2023 (N.S. = no survey).

All 13 sites were surveyed together in 2011, 2017 and 2023. The minimum, median and maximum total abundances of wild brown trout across all sites, as well as the interquartile range are presented in Figure Meon 3. There was a decrease in maximum brown trout abundance at all sites between 2011 and 2023 and a slight decrease in the minimum abundance, indicating a downward shift in overall abundance. Most of the 2023 site abundance values are within a much narrower range than previous years. Furthermore, 75% of the 2023 site abundance values fell below the median of 2011 site abundance values. Wild brown trout abundances naturally fluctuate, however fewer wild brown trout were caught in 2023 (n=325) than in 2017 (n=385) and 2011 (n=538), demonstrating a continued decrease over time.

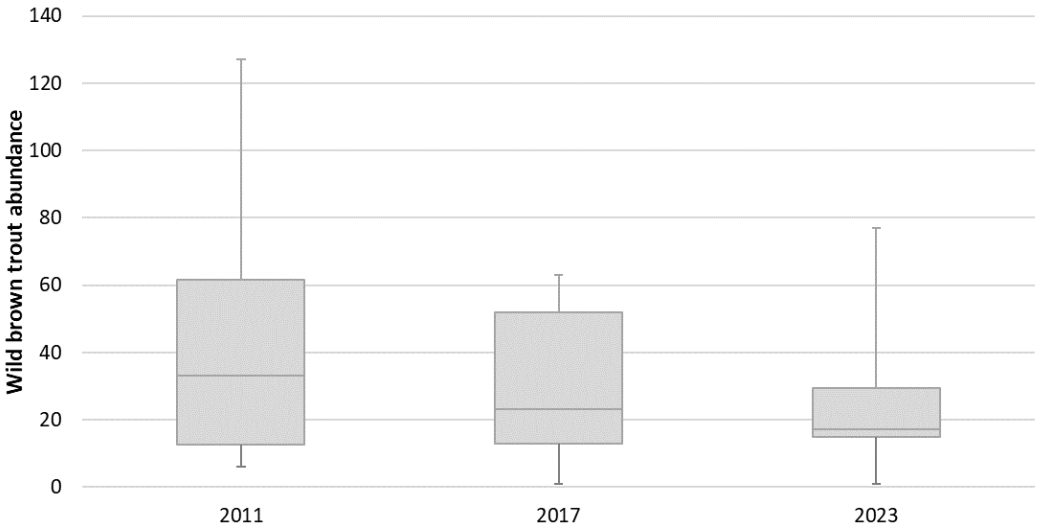


Figure Meon 3. Total recorded abundance of wild brown trout across all sites in 2011, 2017 and 2023.

Wild brown trout were caught at all 13 sites in 2023, and in previous years (2011, 2017; Figure Meon 4). Trout numbers were higher than previous surveys at Moorhen Trout Fishery, Upper Rookesbury and Northfields Farm in 2023. Trout numbers increased at Mislingford Beat in 2023, from 2017. Nevertheless, trout catches have continued to decrease at all other sites (except Meonstoke where catch numbers remained the same), with the largest decrease seen at Exton.

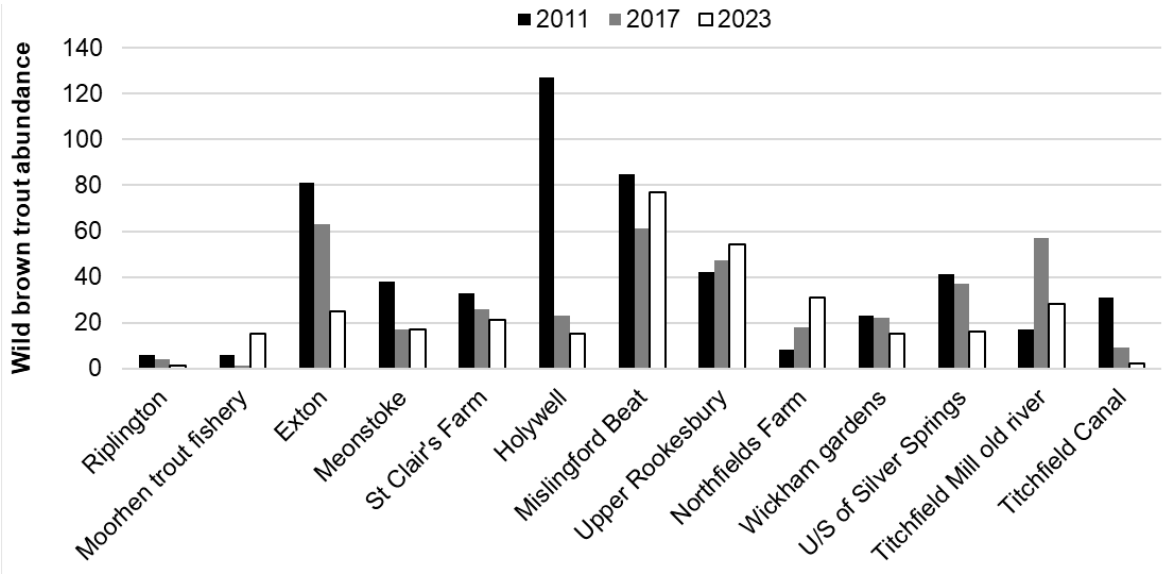
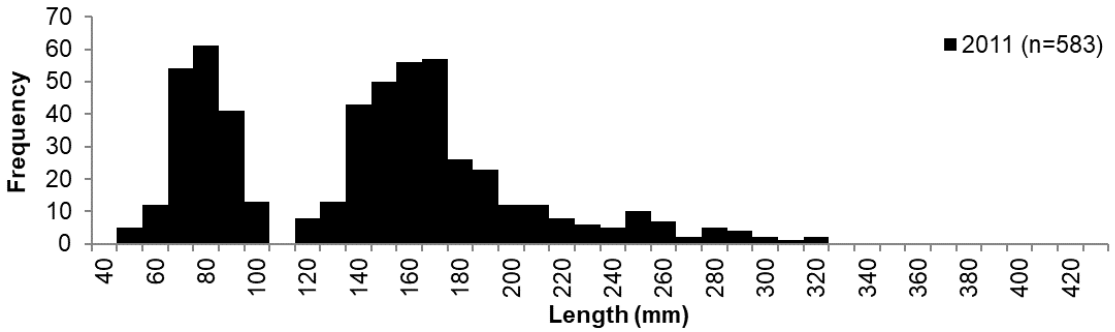


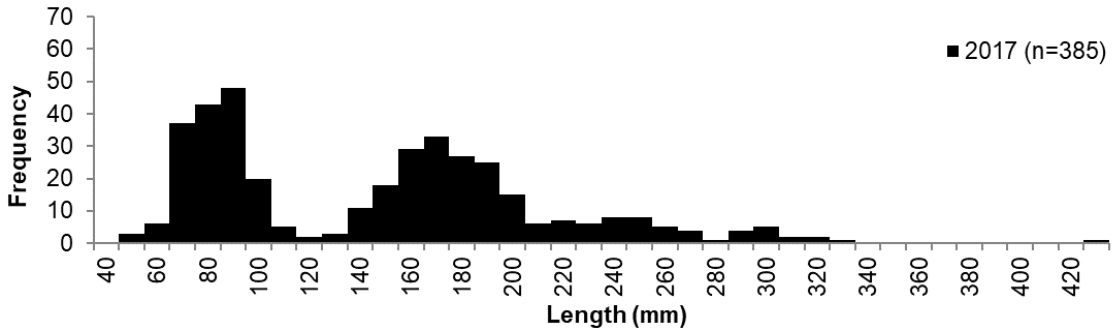
Figure Meon 4. Total number of wild brown trout caught in 2011, 2017 and 2023 at each site surveyed.

Figure Meon 5a to 5c are length-frequency histograms depicting the year classes of wild brown trout caught across all survey sites on the Meon in 2011, 2017 and 2023, respectively. The distinct separation between peaks depicts the end of one age class and the start of another. The brown trout population on the Meon predominantly consists of 0+ (young of the year) and 1+ (fish in their second year), with progressively fewer older year classes.

5a.



5b.



5c.

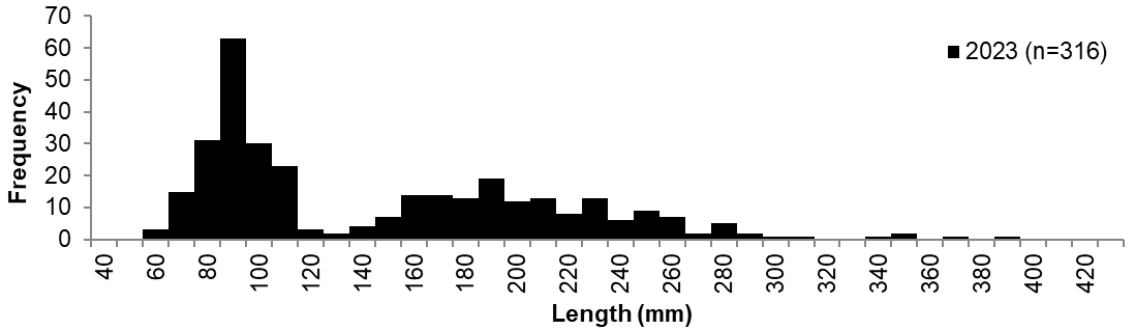
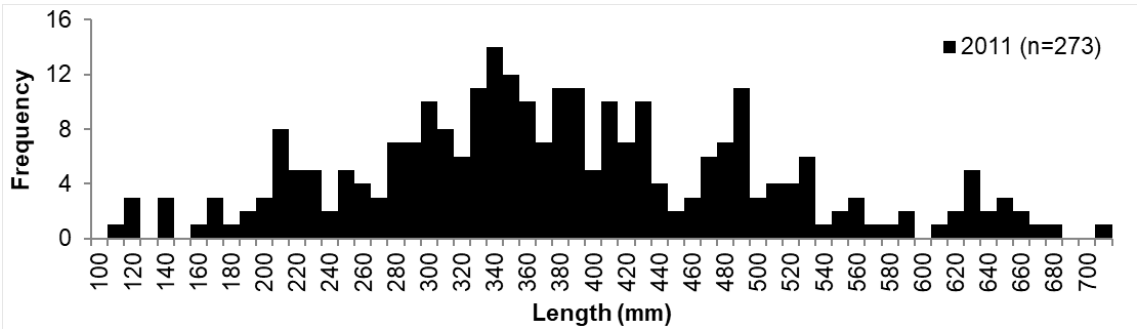


Figure Meon 5. Wild brown trout lengths (mm) caught in the Meon, in 2011 (5a; n = 583), 2017 (5b; n = 385) and 2023 (5c; n = 316). 'n' refers to the number of fish caught.

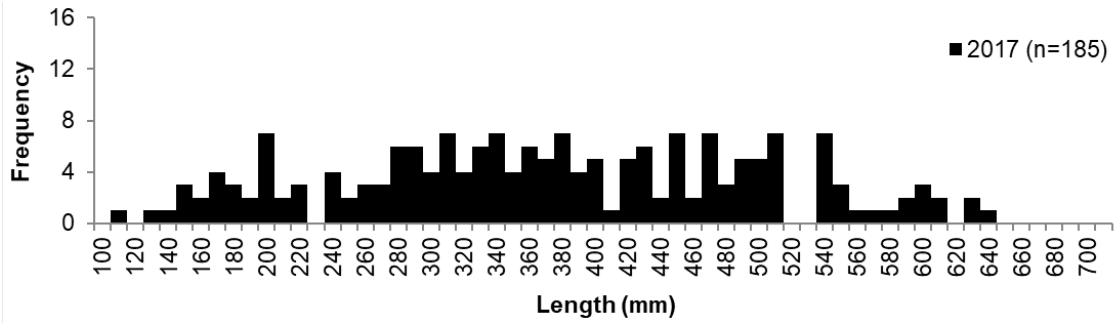
The Meon typically includes a high proportion of migratory trout (sea trout) in its breeding stock and thus, produces high numbers of juveniles annually. Sea trout use the nutrition they accumulate in the marine environment to grow large and produce far higher numbers of eggs than smaller, non-migratory trout would. This increased egg deposition results in the abundant juvenile year classes apparent in the length frequency chart, but also in the small numbers of adults because these are present in the sea or in the deeper parts of the lower river reaches at the time of the surveys. By comparing length frequency distributions of the three survey years, it is evident that whilst the age class pattern remains relatively consistent, the abundance of brown trout has declined, especially larger individuals.

Figure Meon 6a to 6c present length-frequency distributions of the European eels caught across all survey sites in the Meon in 2011, 2017 and 2023, respectively. The length of European eel caught in the Meon is variable (Figure Meon 6), ranging from approximately 110 mm to 720 mm since 2011.This size range probably includes eels from approximately one to 15 years old. In 2011, there was a peak in frequency centred around lengths of 340 mm, however, in 2017 and 2023 length frequency was more evenly dispersed within the historical range. Comparison between years highlights the alarming decrease in recorded eel catches over time.

6a.



6b.



6c.

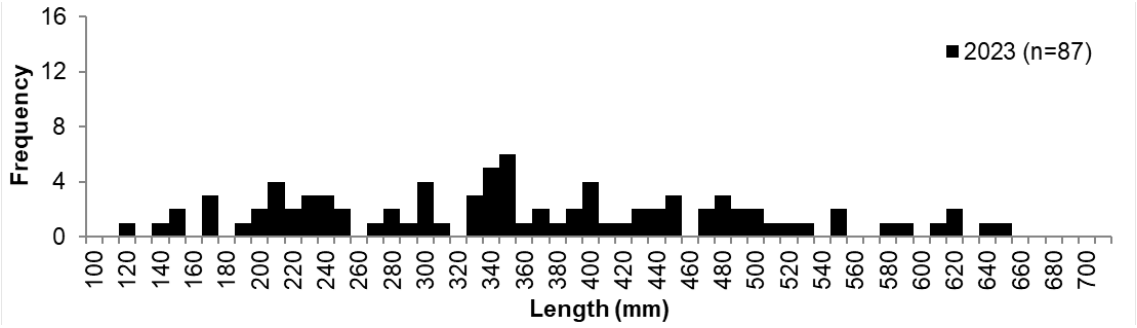


Figure Meon 6. European eel lengths (mm) from all sites in the Meon in 2011 (6a; n = 273), 2017 (6b; n = 185) and 2023 (6c; n = 87). 'n' refers to the number of fish caught.

WFD Classification

Three sites surveyed as part of the Environment Agency monitoring programme are used in WFD classification. The most recent WFD classification of fish status is provided in Table Meon 2. These classifications are based on the most recent surveys prior to the classification in 2022, not the 2023 data. This water body has since deteriorated to 'Moderate', which is an indication of poor fish population health status and considered a 'Fail' in terms of the WFD classification objectives.

Table Meon 2. Water Framework Directive waterbodies with classification status in the Meon catchment.

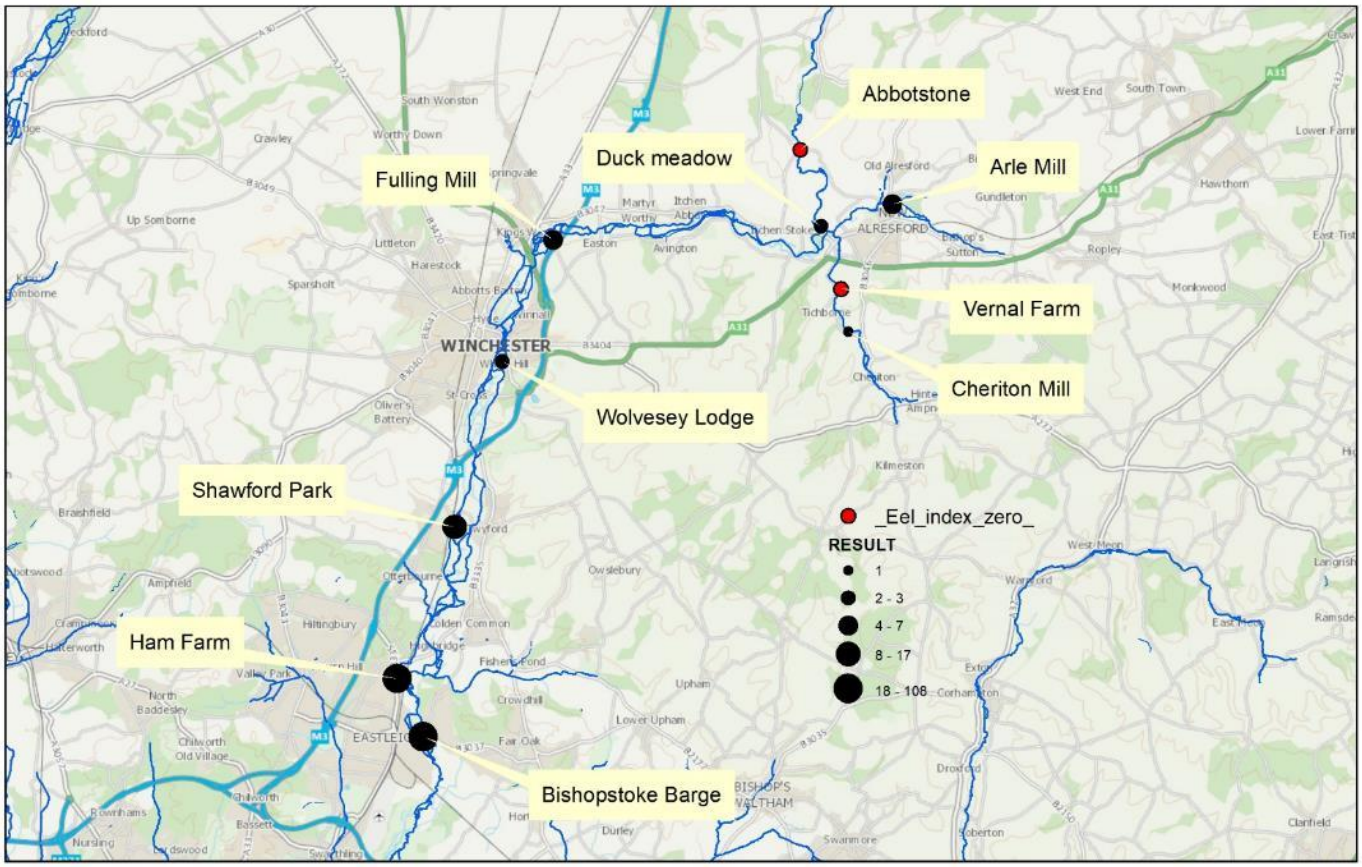
Water body ID	Sites in water body	Fish status 2016	Fish status 2019	Fish status 2022
GB107042016640	Moorhen trout fishery U/S Silver Springs Mislingford Beat	Moderate	Good	Moderate

3.2. Test and Itchen

Itchen: Eel Index monitoring

River Itchen Eel Index monitoring has been carried out since 2009 and consists of surveys at ten sites, spread throughout the catchment, sampled every two years. The Sussex Ouse is also an Eel Index River but is not sampled in the same years as the Itchen, in order to distribute the workload evenly. The Coronavirus pandemic disrupted the Itchen programme, resulting in only upper catchment sites being sampled in 2021, with lower catchment sites (which contain the vast majority of eels) being completed in 2022.

Map 1 shows the ten Itchen Eel Index survey sites, with the black markers sized according to the 2023 population estimate; red markers indicate the two sites where no eels were captured.



Map Eel Index 1: Eel index survey site locations and 2023 population estimates.

The graphs below show the eel population estimates at each site in each survey year, with Figure Eel Index 1 showing the lower catchment sites (by far the most prolific) and Figure Eel Index 2, the upper catchment sites.

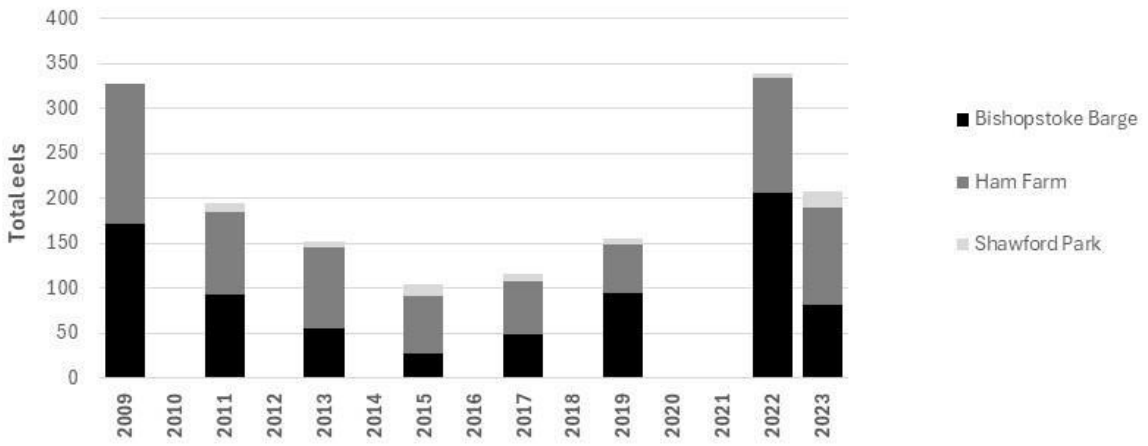


Figure Eel Index 1: Lower Itchen eel survey site population estimates

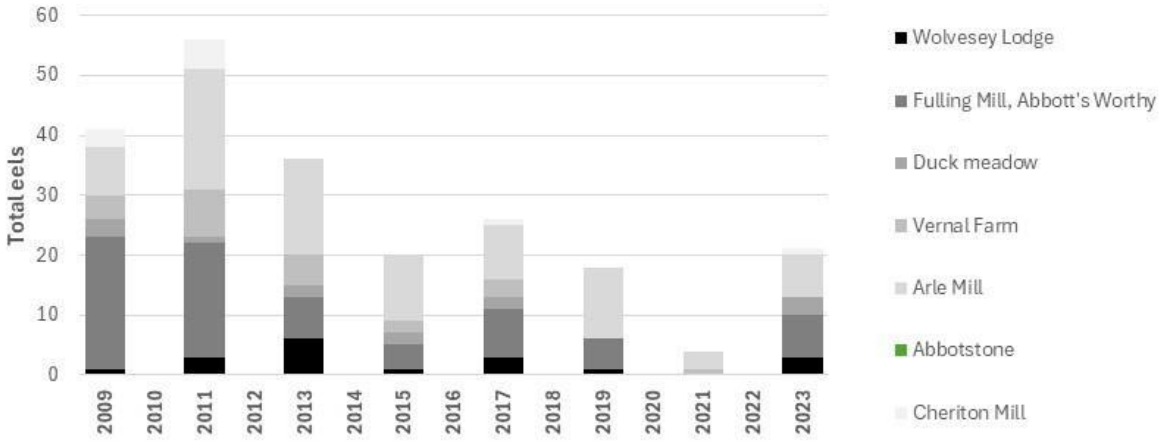


Figure Eel Index 2: Upper Itchen eel survey site catches

Silver eel from Twyford, River Itchen 2023.

The series of graphs below indicates the numbers of eels in each length category in every Eel Index survey year. By comparing the shape in each successive figure, overall varying abundance over time and the changes in relative abundance of younger and older eels can be seen. Note that surveys are not strictly in the scheduled biennial sequence in recent years, because of disruption caused by the Covid pandemic.

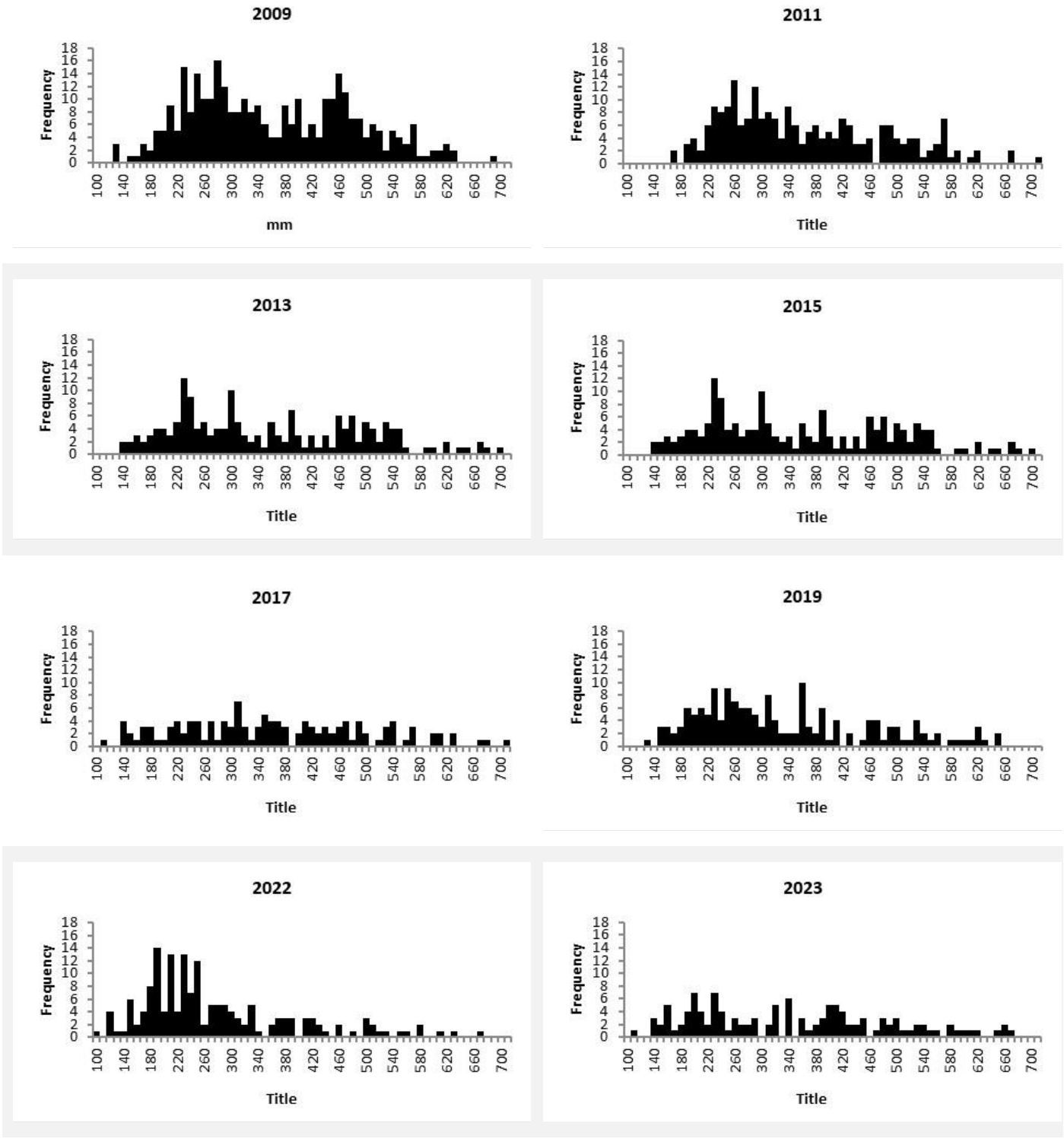


Figure Eel Index 3: Eel length-frequency histograms, 2009-2023

Discussion

Throughout its range, the Europe eel had declined drastically well before this survey programme commenced, so the start point in 2009 represents an already extremely depleted population. Figures Eel Index 1 and 2 show that eel abundance on the Itchen continued to decline for the next decade, to the extent that they were very scarce in the upper reaches. None at all have been recorded in surveys at Abbotstone on the Candover Brook throughout the survey period. Eel catches at the two sites closest to the sea, Bishopstoke Barge and Ham Farm, were much improved in 2022 but less good in 2023. In the upper reaches, eel numbers were slightly improved in 2023 but the species remains extremely scarce, with just over twenty individuals caught across seven 100m survey sites.

Figure Eel Index 3 shows that between 2009 and 2023, the Itchen eel population has decreased significantly in all length categories, suggesting a loss of mid-aged and older eels from the river in combination with a lack of immigrating elvers to replace them. Loss of older eels may be the result of increased rates of emigration from the river but may also be driven by increased in-river mortality. Survey data in 2019 and 2022 indicated slight improvements in juvenile eel numbers, but these are not apparent in the 2023 data.

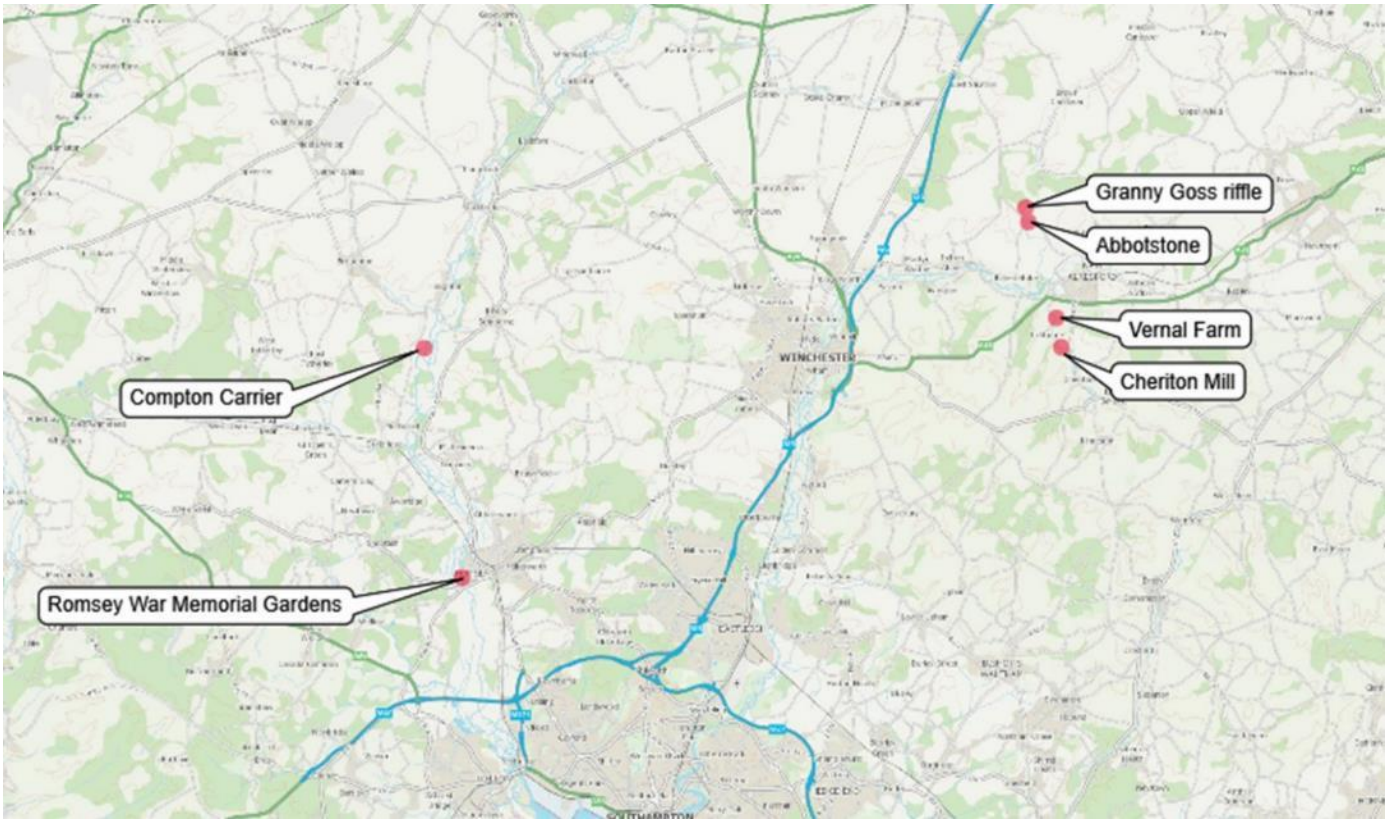
Eels are keystone species, fulfilling important roles as both predators, scavengers and prey and their scarcity or absence has important knock-on effects in terms of chalkstream food webs. They are the preferred prey item for a range of large predators and are themselves particularly effective consumers of juvenile signal crayfish and diseased fish.

An adult eel heading downstream through the Itchen salmon counter in October 2023

Test and Itchen: Principal Brown Trout and National Drought Monitoring

We have a network of six annual fish population survey sites on the Test and Itchen, designed to track the effects of varying river flows. Four of these are in the headwaters of the Itchen and two are on small carriers in the middle reaches of the Test. These six sites belong to the National Drought Monitoring Network, but two of them, Abbotstone on the Candover Brook and Vernal Farm on the Cheriton stream, are also our official monitoring sites for the upper Itchen Principal Brown Trout Fishery. These six surveys have the same methods and aims, so they are reported together, which gives a greater spatial assessment of trout populations in the chalk catchments.

The wild brown trout fishery of the three upper Itchen tributaries combined, the Candover Brook, River Arle and Cheriton stream (also known as the Tichborne stream or upper Itchen) are of particular interest and value, as they form the first fishery designated a “Wild Fishery Protection Zone”, under the terms (Policy 29) of the EA’s National Trout and Grayling Fisheries strategy, (published in 2003). This means that the EA and the fishery managers agree that the integrity of the wild trout stocks and their habitat is to be preserved by not stocking trout.



Map WBT 1: Test & Itchen drought monitoring and wild brown trout surveys, 2023.

Figure WBT1 below compares the estimated densities (number per 100m^2) of the fish species caught (excluding minor species) for the six drought monitoring sites surveyed on the Test and Itchen in 2023.

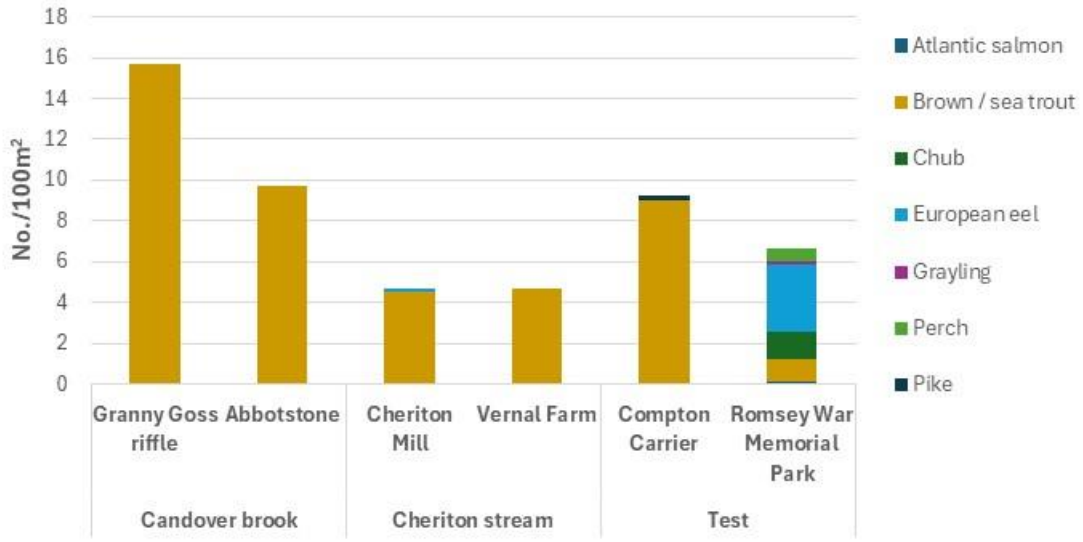


Figure WBT1: Wild brown trout densities at Test & Itchen NDMN / wild trout sites, 2023.

Our survey sites at Abbotstone and Vernal Farm have been monitored frequently but somewhat intermittently since 2001. Figure WBT2 below shows estimated wild brown trout numbers at both sites in each survey year. Absent columns represent non-survey years, except for Abbotstone in 2006, when a survey was completed but no trout were caught. The graph also shows annual average April-September flow (Borough Bridge gauging station).

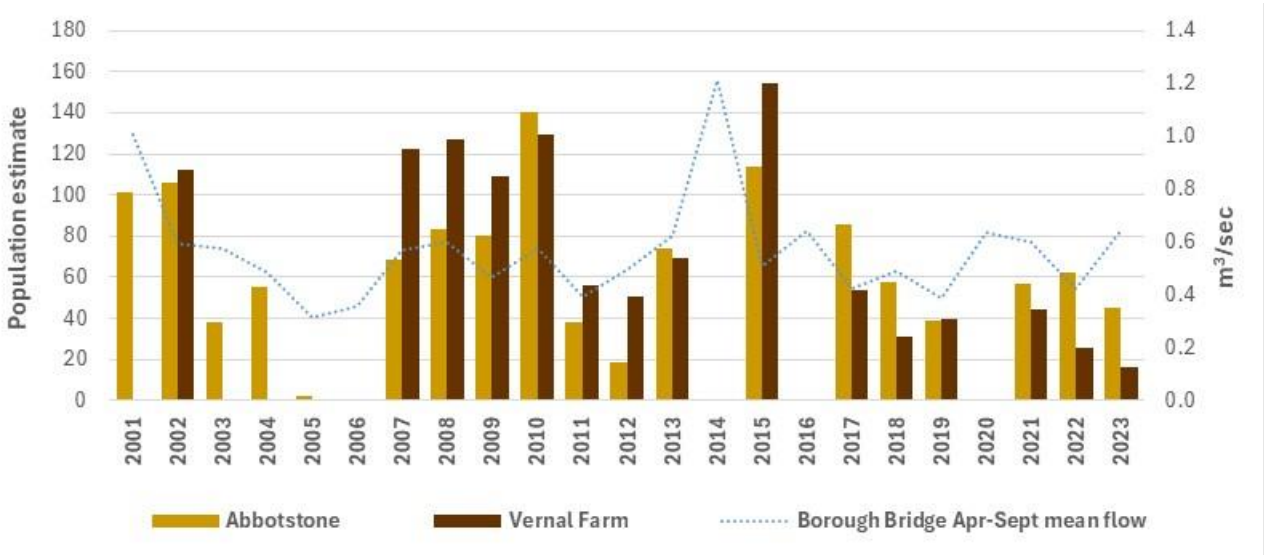


Figure WBT2: Abbotstone & Vernal Farm wild brown trout estimated number & mean summer flow, 2001-2023.

Similarly, Compton Carrier and Romsey Memorial Gardens have been surveyed intermittently over the same period. For the first few years of this period juvenile Atlantic salmon were an important component of the catch, so here we present individual graphs (Figures WBT3 & 4) for each of these sites, showing Atlantic salmon and brown trout population estimates.

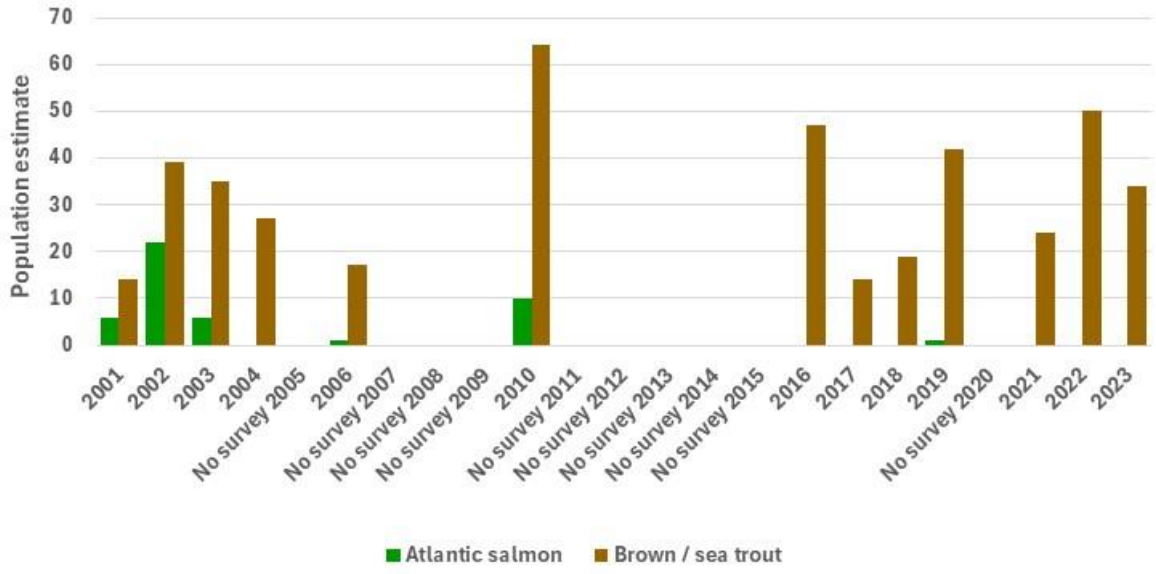


Figure WBT3: Compton Carrier Atlantic salmon & wild brown trout estimated number, 2001-2023.

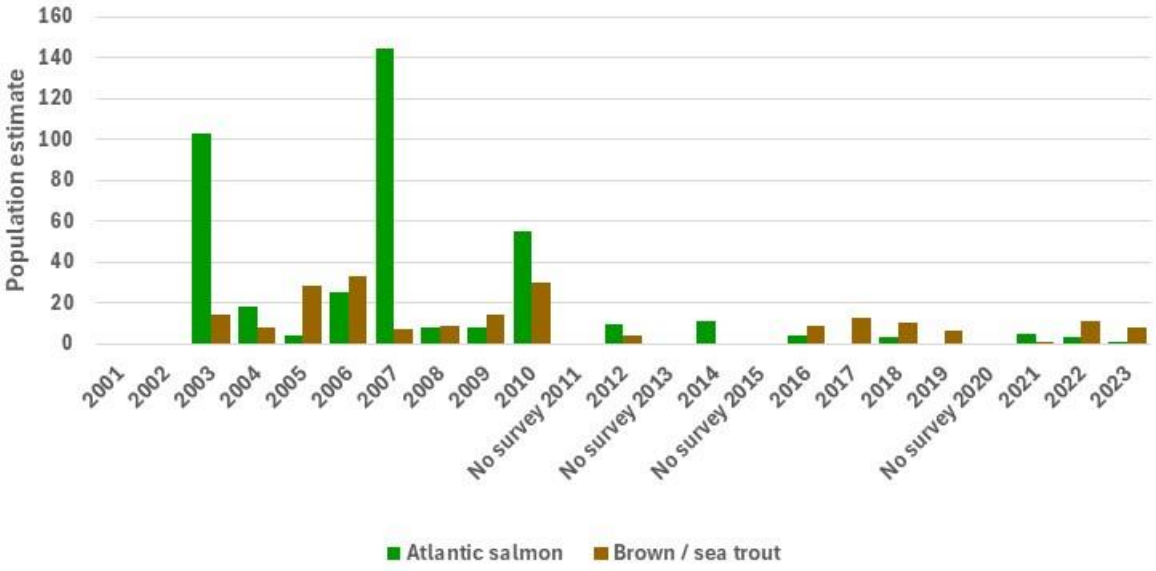


Figure WBT4: Romsey War Memorial Gardens Atlantic salmon & wild brown trout estimated number 2001-2023.

Discussion:

Wild brown trout are typically prolific in the upper Itchen headwaters and these streams can be enormously productive. Figure WBT1 shows that the fish communities of the four upper Itchen survey sites and Compton Carrier on the Test were dominated by wild brown trout in 2023. The Romsey War Memorial site had a lower abundance of wild trout but a more diverse fish community overall – this and its higher abundance of eels reflect the site's position relatively far downstream in the catchment.

Figure WBT2 compares wild brown trout abundance at Abbotstone and Vernal Farm over a 22-year period and shows average summer flow (April-September) at Borough Bridge gauging station on the Candover Brook. In simple terms, trout abundance is positively correlated with average summer flow at both sites, but, not surprisingly, our data analysis makes it clear that the situation is more complex than this. Trout abundance is sensitive to prevailing flow at different times of year, because of the influences these have on various key

life-stages, such as upstream migration, spawning success, egg incubation, juvenile growth and recruitment to adulthood. In addition, as with other types of fish community, the sequence of prevailing flow conditions over several years is also important, as it has a cumulative effect on abundance.

Physical habitat in the upper Itchen streams is crucial to wild trout abundance but is easily damaged by poor management or neglect. During the period covered in Figure WBT2, a great deal of habitat improvement was completed on both streams, primarily in the early 2000's. The survey data suggests generally low trout abundance since 2015, with a declining trend up to the most recent surveys. One important consideration is to assess the current habitat condition and whether or not any deterioration has taken place over recent years.

Figures WBT3 and 4 indicate the gradual decline in salmon parr abundance at our Compton Carrier and Romsey War Memorial Gardens survey sites over the past two decades. Brown trout abundance at Compton Carrier has been consistently high since annual monitoring was reinstated in 2016, around which time habitat improvements were made, improving the site's resilience to varying weather – it's notable that trout abundance was unaffected by the drought of 2022. In contrast, brown trout abundance at Romsey War Memorial Gardens has been consistently lower in the second half of the period, despite there having been very little physical change at the site over the entire sampling period – it's not clear what the cause of this change has been, but it may be linked to increasing water temperatures in the lower river in recent years.

Survey at Compton Carrier

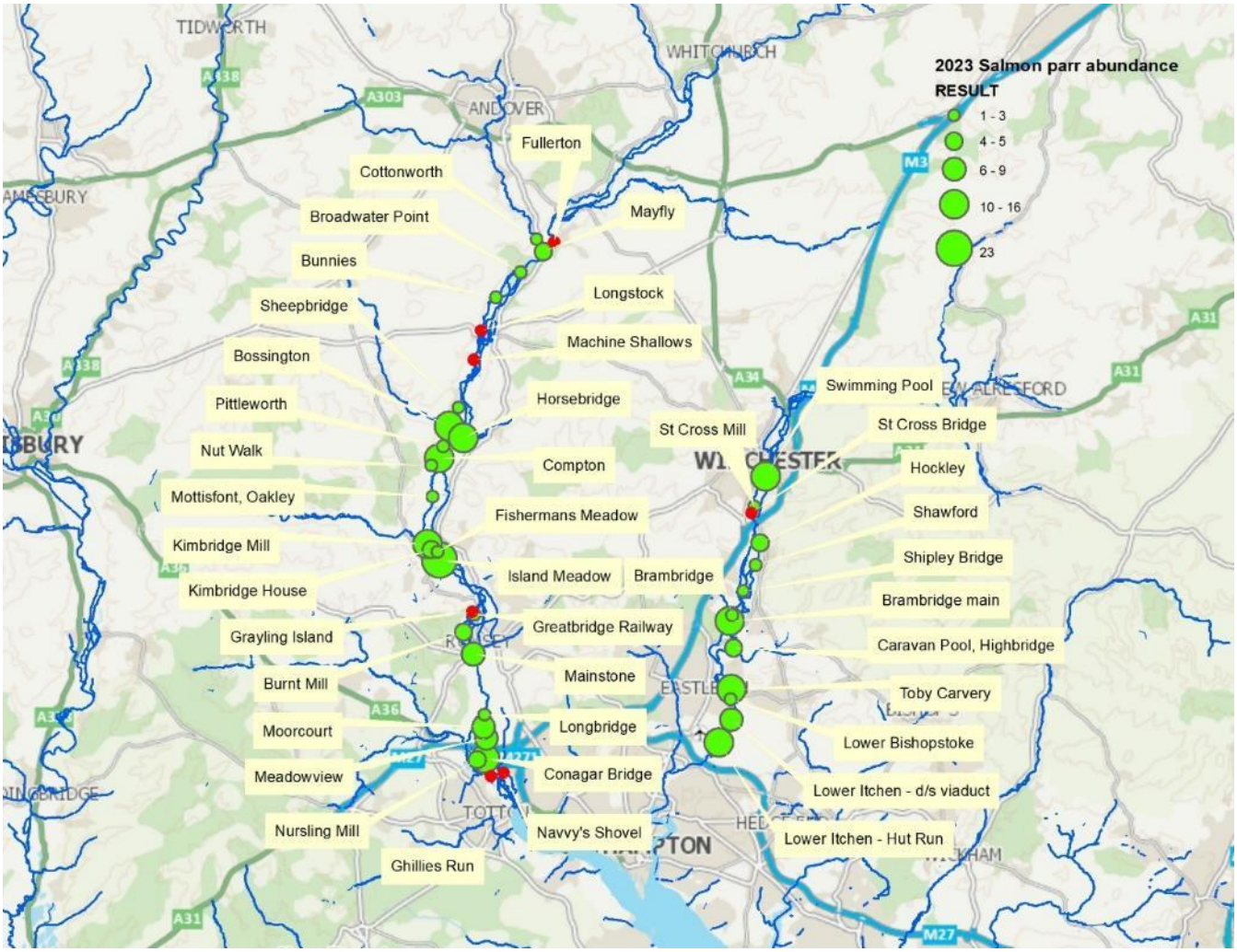
Compton Carrier juvenile brown trout

Survey at Vernal Farm

Test and Itchen combined Water Company Drought Monitoring

Salmon parr surveys:

Since 2018, we've completed an extensive programme of annual salmon parr surveys on both rivers; each one involves exactly 5 minutes of backpack electric fishing through good quality parr habitat (fast flow, gravel substrate, <50cm deep, abundant *Ranunculus*), typically sampling around 75m in length, by around 1.5 metres width. The map below shows the survey site locations, with green markers sized according to the number of salmon parr caught at each site. Red markers indicate that no salmon were caught.



Map DM1: Test and Itchen salmon parr survey results, 2023.

Figure DM1 compares average salmon parr numbers per site over the six years of this monitoring programme.

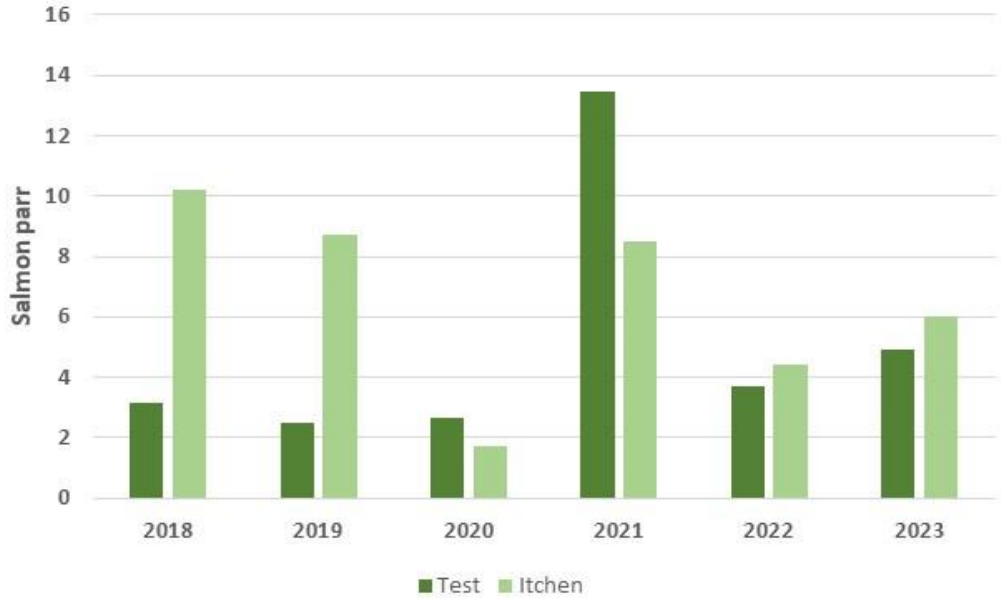
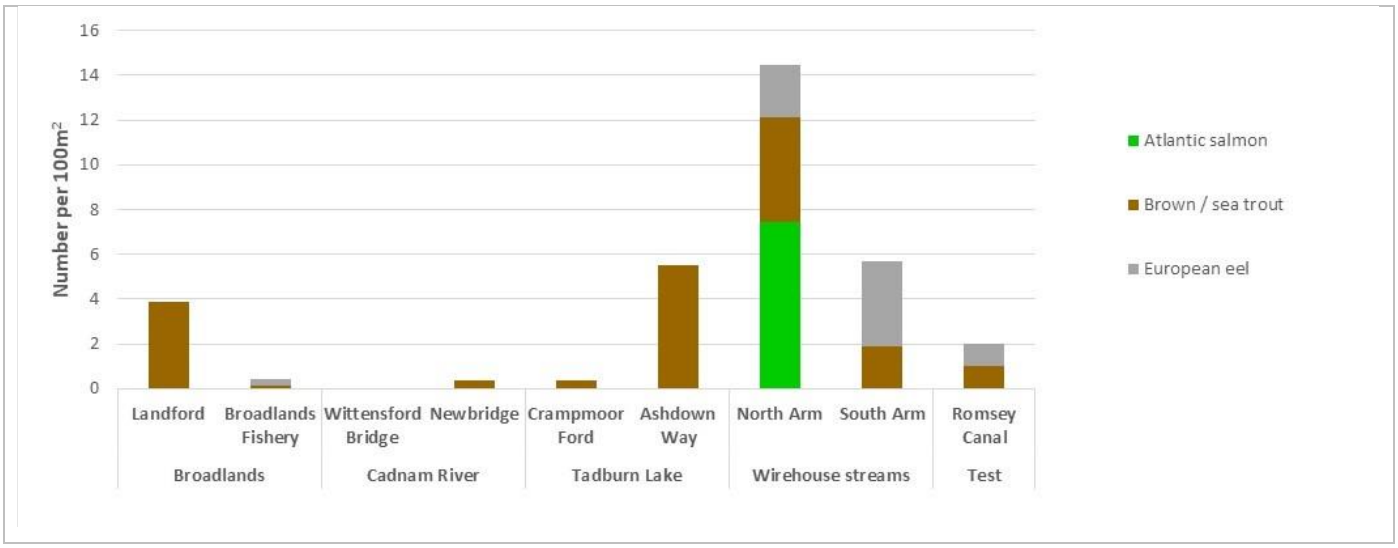
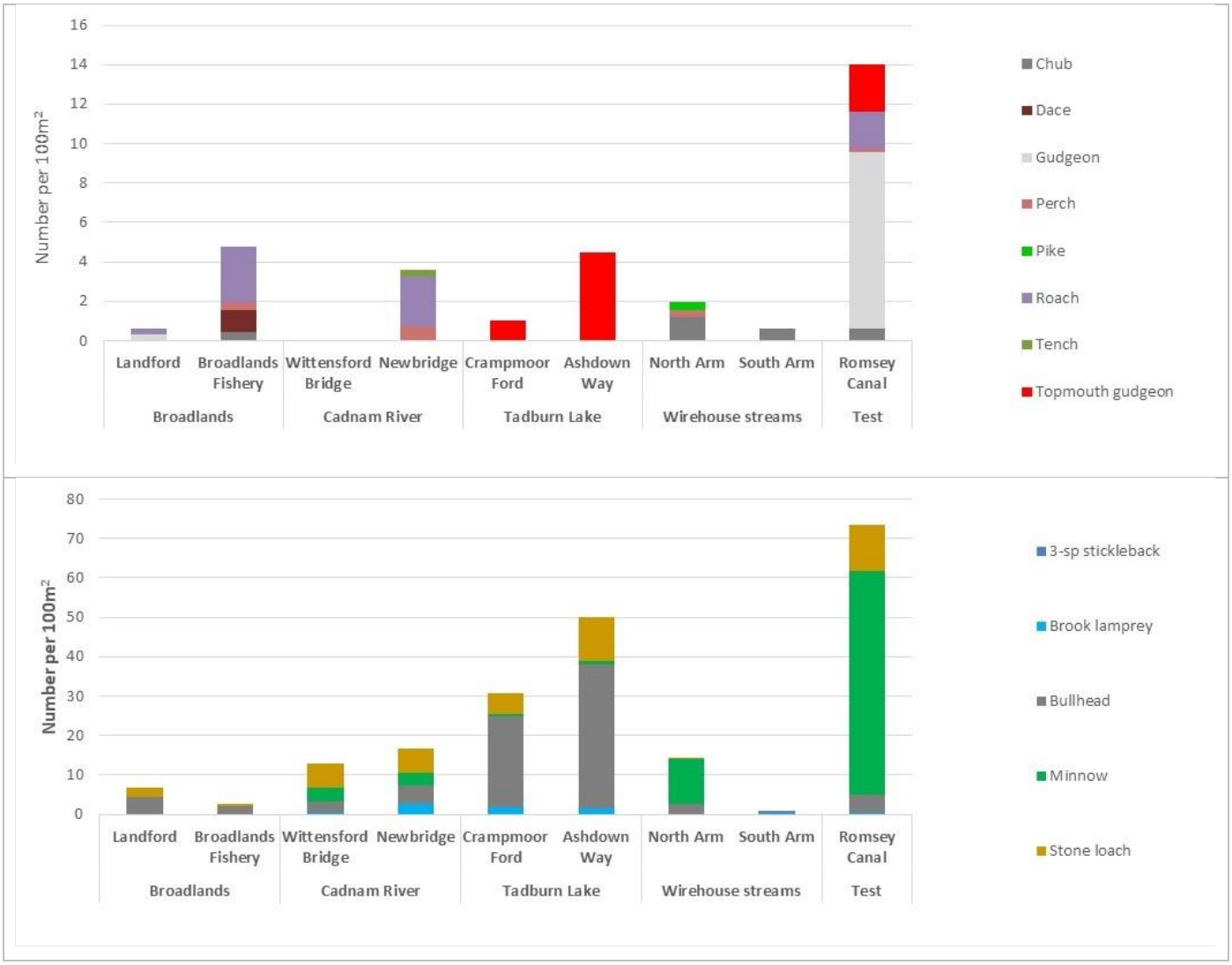


Figure DM1: Average salmon parr survey catches per year (2018-2023).

Single run surveys:

In addition to the salmon parr surveys, we conduct a series of standard, single run electric fishing surveys at nine locations on Test tributaries and carriers. The aim of this part of the programme is to assess the fish community in general, but with a particular focus on brown / sea trout and eels. Figures DM2-4 below show the number of fish per 100 m^2 at each site for migratory species (salmonids and eels), coarse fish and minor species.





Figures DM 2-4: Migratory (top), coarse (middle) and minor (bottom) fish species composition and density at single run survey sites in the Test catchment, 2023.

Juvenile lamprey monitoring

At every annual salmon parr survey, we also complete a juvenile lamprey survey – this is done by electric fishing for exactly two minutes within a one square metre quadrat (a plastic frame with mesh sides), placed on a silty area close to the riverbank. These areas are where juvenile lampreys – known as ammocoetes – spend the first few years of their lives before maturing and leaving the silt.

Lampreys are jawless, cartilaginous fishes. Their evolutionary lineage connects their present form to a time that predates the development of bony skeletons and separate jawbones in fish. There are three species of lamprey in the UK: brook, river and sea lamprey, with brook and river being very closely related and difficult to distinguish from one another when in the juvenile form. The lifecycles of river and sea lamprey differ greatly from that of brook lamprey: upon maturation (which involves considerable physical transformation in all three species), river and sea lamprey migrate to sea and parasitise large fish until they reach maturity, at which point they are far larger than brook lamprey (sea lamprey 50-100cm; river lamprey 25-40cm; brook lamprey 12-15cm). They then enter whichever river is suitable and available (not necessarily their river of birth) where they then spawn and die. Brook lamprey can be thought of as living a similar lifecycle but skipping the entire marine phase; they mature in freshwater, but instead of migrating to sea, they spawn in spring and die, never having fed as adults. Despite never leaving the river, it's remarkable that brook lamprey develop some of the physical attributes required for marine, parasitic life; a ring of teeth, silver colouration, large eyes and more prominent fins.

No adult river lamprey have been recorded in the Test or Itchen in fish surveys, on the fish counters or during spawning surveys, so we presume that river lamprey are absent, or at least extremely scarce in these rivers. Sea lamprey have been observed (and filmed) spawning in the Test and Itchen in recent years, but very infrequently. By contrast, brook lamprey are very widespread throughout both catchments. Our lamprey monitoring programme was originally intended to focus on sea lamprey, and a small number of juvenile sea lamprey have been recorded. However, it is now clear that sea lamprey are very scarce and that brook lamprey are ubiquitous.

Figure DM5 below shows the average lamprey catch per quadrat in each survey year, with error bars indicating the annual maximums and minimums. A small number of zero catches are recorded every year.

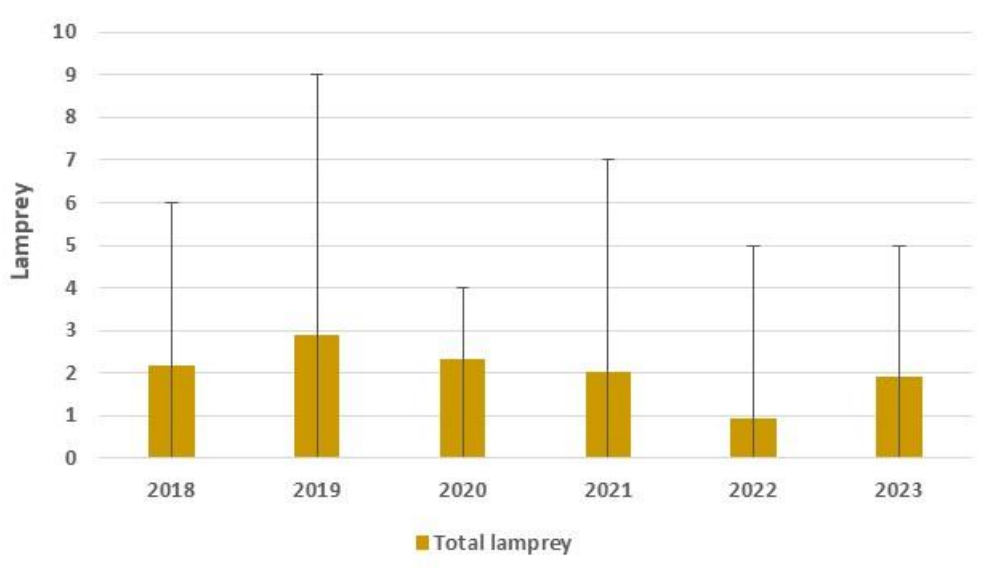


Figure DM5: Annual average, maximum & minimum lamprey catches per quadrat.

Figure DM5 indicates that average brook lamprey abundance per survey site has been reasonably consistent at between 1 and 3 individuals since 2018. The year of lowest abundance was 2022, during which both rivers experienced very low flows and exceptionally high temperatures; the Test was officially in drought and the Itchen experienced well below average flow. When conducting lamprey quadrat surveys, the impacts of low flows on the physical habitat of the juvenile lamprey is evident; in 2022, areas of previously excellent quality habitat were dry or devoid of silt, and the overall area of suitable habitat was much diminished.

Juvenile lamprey survey quadrat (above)

Adult & juvenile brook lamprey

Table DM1 below sets out the limited number of confirmed observations of sea lamprey since 2018.

Table DM1: Summary of 2018-2023 sea lamprey records.

	Ammocoetes in surveys	EA spawning surveys	Keeper reports
2018	*1 in Wirehouse north single-run survey.*	-	*3 x redds Lower Test; pair seen spawning.* *Post-spawning adult in Testwood Pool, late June.* *1 x redd Lower Itchen.*
2019	*1 at Mansbridge*	-	-
2020	-	-	*Dying adult in Testwood Pool, early July (natural occurrence).*
2021	-	*Group of 4 spawning at Lower Itchen.*	*Same group reported.*
2022	-	-	*Dying adult in Testwood Pool, early July (natural occurrence).*
2023	-	-	-

Pair of sea lamprey seen spawning on the Lower Test in June 2018

Dying adult sea lamprey in Testwood Pool, 2018

Baited Remote Underwater Video

Baited Remote Underwater Video (BRUV) is a technique most often used for marine fish monitoring but well suited for rivers where electric fishing or netting are not appropriate. A small camera is mounted to a frame, pointing at a bait container. The frame is lowered to the riverbed so that the camera films at ninety degrees to the flow and the gear is left in place for thirty minutes. We then review the footage, list all the species present and then record the greatest number of each species visible in a single frame; this value is known as NMAX. This technique provides a record of the majority of fish species present and an indication of their relative abundance. It also often reveals useful information about fish behaviour. The shortcoming of the technique is that it's biased towards diurnal, shoaling, species that are attracted to the selected bait. It's not effective at attracting and recording species that are nocturnal, territorial, or not attracted to the selected bait – for example, juvenile salmonids, eel, pike and grey mullet tend to be seen passing in the background, rather than feeding confidently.

Table BRUV1 lists the species recorded in the eight BRUV surveys competed in 2023 and gives the NMAX for each.

Table BRUV1: 2023 species observed and NMAX.

NMAX table:	**Site**							
Species	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**
Atlantic salmon (adult & parr)	1	2	3	1	1	2	0	0
Carp	0	0	0	0	1	0	0	0
Chub	1	0	1	3	3	0	0	0
Common bream	4	2	3	0	4	0	1	0
Dace	4	9	0	13	3	2	0	0
European eel	0	1	0	0	0	0	0	0
Grayling	1	0	0	1	0	1	5	1
Minnow	0	0	0	0	0	27	0	0
Perch	2	3	4	2	1	0	0	2
Pike	0	1	0	0	0	0	0	0
Roach	2	4	1	3	0	0	0	0
Sea bass	0	0	0	1	0	0	0	0
Wild brown trout / sea trout	0	0	0	0	0	0	2	1
Stocked brown trout	1	2	3	2	0	0	4	2
Species observed	8	8	6	8	6	4	8	4

Below is a selection of images taken from various 2023 BRUV surveys:

Dace

Common bream

Stocked / farmed brown trout

Perch

Wild sea trout

Perch & dace, with an adult Atlantic salmon in background.

In 2023, a prominent feature of the BRUV survey results was the abundance of stocked / farmed trout at all but two sites. Our footage showed that, not only were these stocked trout particularly numerous, but that they were also notably aggressive feeders compared to other species. Many examples of stocked trout biting and chasing other fish were recorded, demonstrating the disruptive effects that stocking can have on the normal behaviour of wild fish; the prevalent response of wild fish to the presence of stocked trout was to avoid the area. The first photo below shows a typical stocked trout feeding at the bait container. The other three show incidents of stocked trout attacking and biting other trout (stocked and wild) during 2023 BRUV surveys. These observations emphasise the need for careful management of stocking, particularly the size and abundance of stocked trout, in rivers containing high conservation value species. Based on these observations, we conducted further BRUV surveys at a reach on the middle Test containing a high abundance of stocked trout (displaced from upstream fisheries) and recorded the same aggressive behaviour; frequent biting, chasing and avoidance by wild fish.

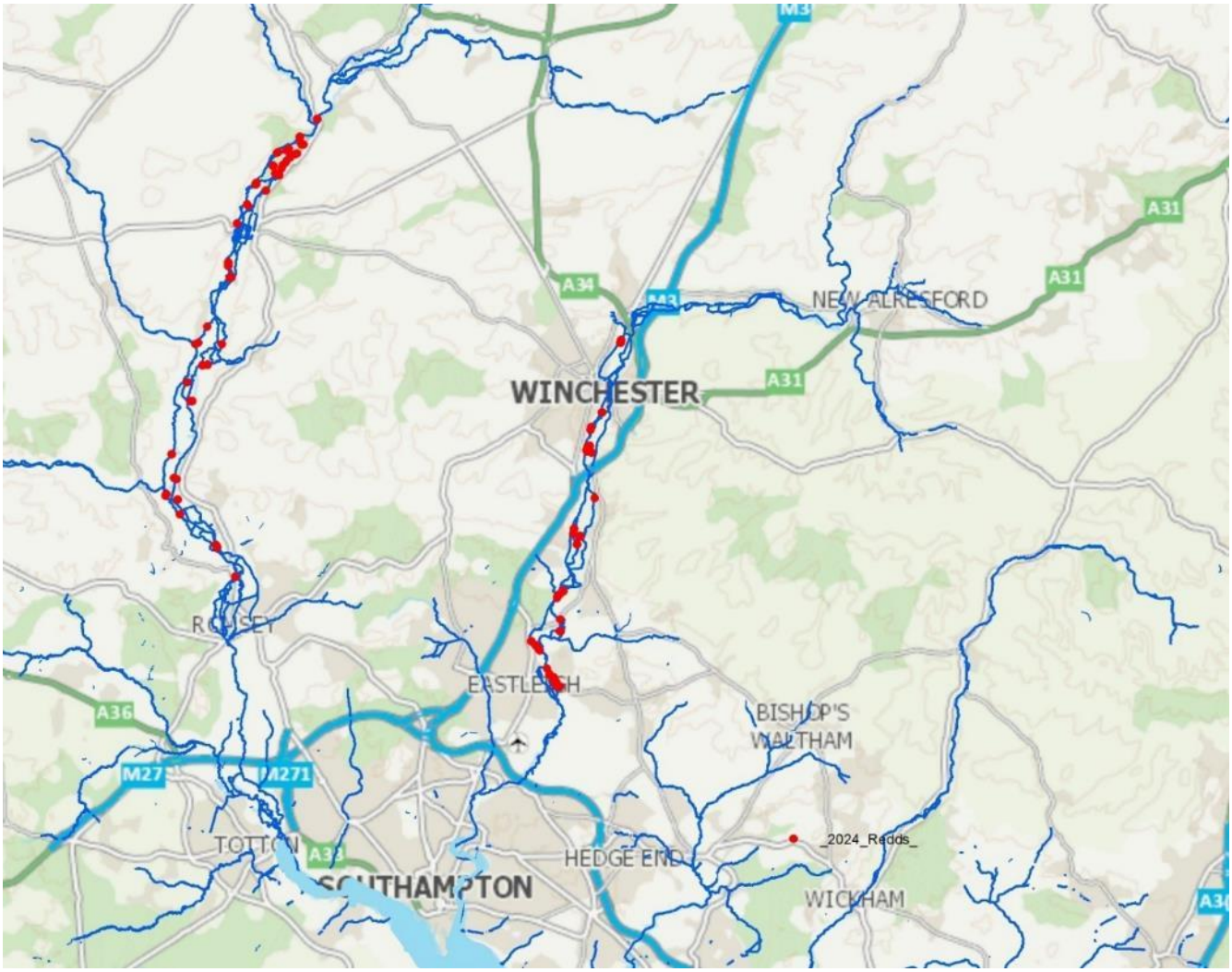
Above left: stocked brown trout in intertidal reach of lower Test

Above right, below left & below right: stocked brown trout attacking competitors for food.

Redd mapping

In combination with parr surveys and salmon counting, redd mapping is a crucial component of our overall Atlantic salmon monitoring effort. Redd mapping involves walking extensive stretches of the Test and Itchen, locating and noting the presence of large salmonid redds. With some very large sea trout and small salmon present amongst the spawners each year, it's impossible to distinguish between salmon and sea trout redds with complete certainty. However, the size and shape of each redd and sometimes the presence of the spawning fish give a reliable indication of the species. There is another important factor, which is that it's not always possible to determine which redds are complete and contain eggs, as hens often dig several areas before selecting the most suitable and releasing eggs. However, even considering these uncertainties redd mapping is a very effective tool for recording the geographical distribution of spawning activity from year to year, which can then be compared with parr abundance and varying climatic conditions over time.

Map RM1 shows the locations of salmon redds observed in winter 2023/24.



Map RM1: Salmon redd locations, winter 2023/24.

This is a selection of photos of typical salmon redds recorded in winter 2023/34:

Lower River Dun, Kimbridge

Mayfly Carrier, Timsbury

Kimbridge

Greatbridge, Romsey

Test and Itchen salmon counters.

We operate three electronic salmon counters; Nursling Mill on the Great Test, Conegar on the Little River Test and Gaters Mill on the Itchen. All three use a combination of electrical resistance monitoring and video camera arrays (above and below water) to detect and identify fish and their direction of travel as they pass through.

The three Test & Itchen salmon counters: Nursling on the Great Test (right); Conegar on the Little River Test (bottom right) and Gaters on the Itchen (below).

Figure SC1 shows the numbers of returning adult salmon estimated to have survived to spawning (the “spawning stock”) annually for the period 1990-2023. The dashed lines indicate the *approximate* Conservation Limits for each river (approximate, because CL is calculated on the basis of eggs produced, rather than number of adults).

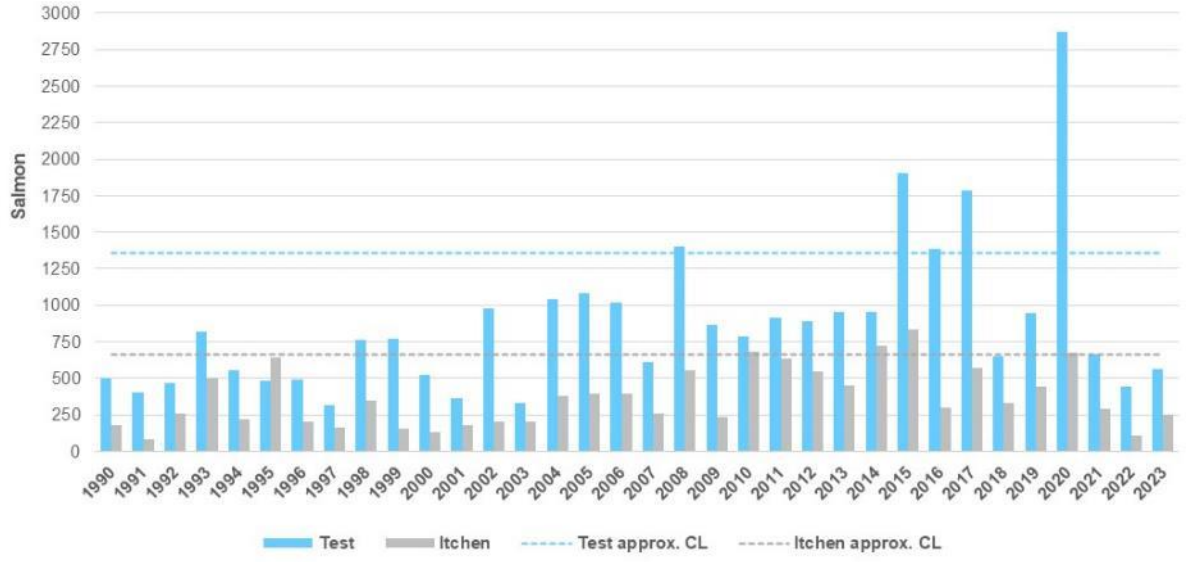


Figure SC1: Test & Itchen Atlantic salmon spawning stock Estimate, 1990-2023

Discussion

The numbers of returning salmon on both rivers were only slightly better than in 2022 but still very far below the respective Conservation Limits. This is of acute concern, because in contrast with 2022, flows remained at or above average throughout summer and there was an expectation of a strong grilse run originating from the exceptionally high number of spawning adults in winter 2020/2021 (Figure SC1).

Both rivers are now formally classified as *"At Risk",* under the national Principal Salmon River classification scheme; both are forecast to remain in this category for the next five years. It has been widely acknowledged by everyone with an interest in chalk stream Atlantic salmon that if populations are to recover, then urgent action is essential within the river and estuary environments to take pressure off salmon at all life stages. The ultimate goal is for more adults to survive and spawn, more smolts to be produced, and for both to be in optimal physical condition. In the simplest terms, the estuary must become a more amenable place for returning adults and emigrating smolts and the river must become a far more productive place for eggs, parr and smolts

In the past two years, detailed monitoring of water quality in the Test and Itchen estuaries has highlighted that water temperature during hot summer weather and under certain tidal conditions, is a major pressure on returning adult salmon attempting to return to freshwater. Unfortunately, salmon do not tend to swim from the estuary into the river in one, simple journey; their urge and ability to do so are hampered by poor water quality, especially elevated temperatures, depleted dissolved oxygen and the presence of pollutants. Continuous monitoring on the upper Test estuary indicates that poor water quality is primarily driven by hot weather and low river flow, so the imperative is to protect flows as far as possible. Some sources of contamination are known, particularly in the form of urban and industrial runoff.

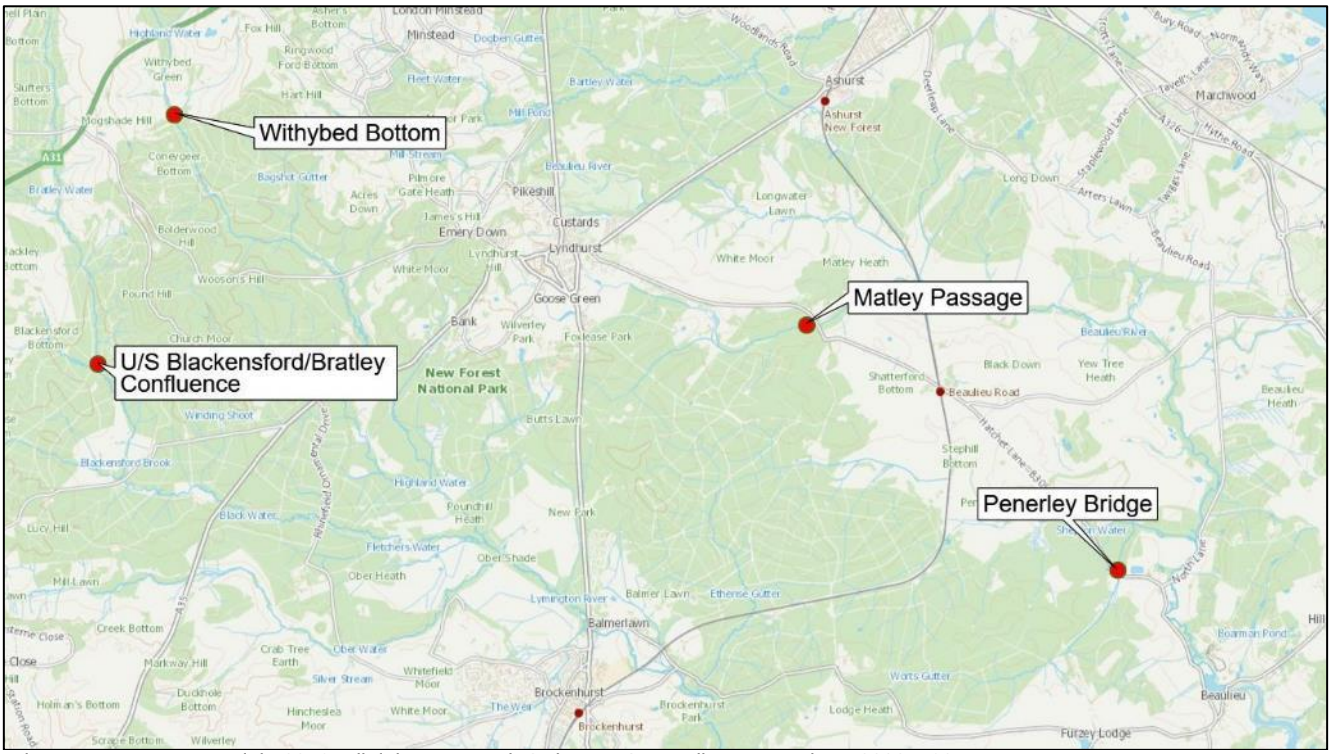
Low flow and hot weather are also of critical importance in the upper Itchen estuary, but our investigations suggest that there is another specific and significant pressure on water quality, which is the continuous stream of effluent from the major Sewage Treatment Works (STW) at Portswood. Analysis of effluent quality and estuarine water quality in the vicinity of the works in 2023 provide strong evidence that the discharge affects dissolved oxygen and ammonia to an extent likely to impact the behaviour and welfare of returning adult salmon, particularly in combination with hot weather and low river flow.

Increased smolt production in each river is dependent on high levels of egg deposition, good egg survival and, in particular, good parr growth and survival. Other than egg deposition, which is largely dependent on the number of returning adults, parr survival and growth are primarily dependent on habitat quality, water quality and the degree of competition and predation, all of which can be managed within the catchment, providing realistic scope for measures to support the recovery of Test and Itchen salmon.

Multi sea winter salmon at Gaters (above) and Nursling (below) fish counters in mid-June.

3.3. New Forest

Across the New Forest, four Principal Brown Trout surveys were completed in 2023: two on the river Lymington and two on the Beaulieu River. These four sites are surveyed biennially and a wide range of additional sites on both rivers are surveyed every six years, next scheduled for 2025.



Map New Forest 1. Withybed Bottom and Upstream of Blackensford (Bratley confluence) on the Lymington. Matley Passage and Penerley Bridge on the Beaulieu.

Fish population surveys were conducted on the Lymington and Beaulieu Rivers with the primary aim of monitoring the abundance and spatial distribution of juvenile wild brown trout, a sizeable proportion of which are destined to become smolts and migrate to sea as sea trout, returning to the rivers each autumn to spawn. The surveys also provide us with valuable information on other species, particularly eels, coarse fish (e.g. roach, chub and pike) and the "minor" fish species: brook lamprey, bullhead, minnow, stone loach and three-spined stickleback.

Total catch size was greater at Withybed Bottom than at U/S Blackensford on the Lymington River, however, there were more species present at the latter site. Matley passage had a greater catch size and was more species diverse than Penerley Bridge on the Beaulieu River. Overall, total catch size was greater in the Lymington River than in the Beaulieu (Figure New Forest 1).

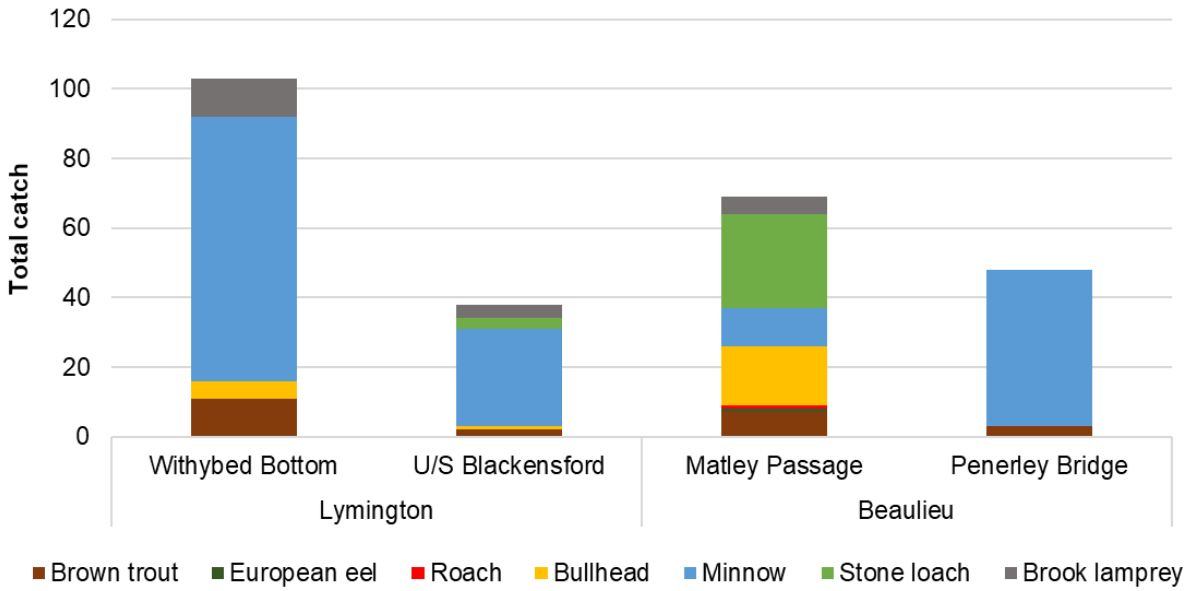


Figure New Forest 1. Total catches of each species from the surveys on the Lymington and the Beaulieu in the New Forest, 2023.

The range of trout lengths observed in the Lymington River was more limited than on the Beaulieu, as indicated by the whiskers on the box plot below (Figure New Forest 2). The age classes depicted in Figure New Forest 3 suggest that all individuals caught on the Lymington River fell into the age class '0+' (young of the year), with few or potentially no adults present at these sites. Whereas some of the individuals caught in the Beaulieu were evidently larger and thus, older. As the vast majority of spawning adults on both rivers are sea trout, this is entirely natural.

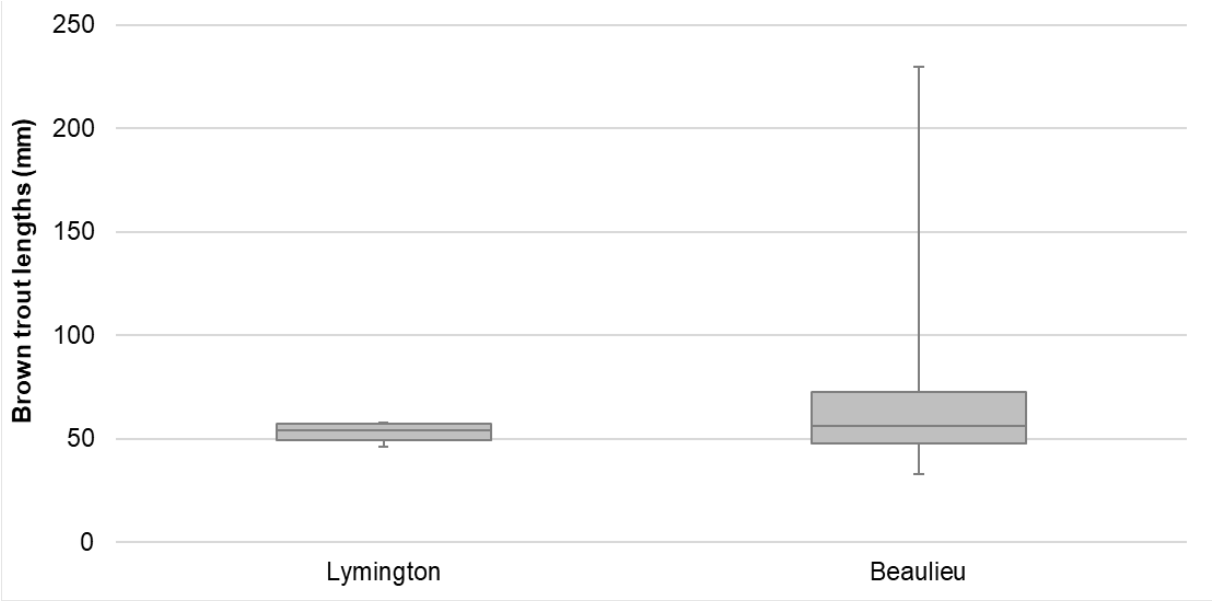


Figure New Forest 2. The minimum, median and maximum values of brown trout lengths on the Lymington and Beaulieu Rivers.

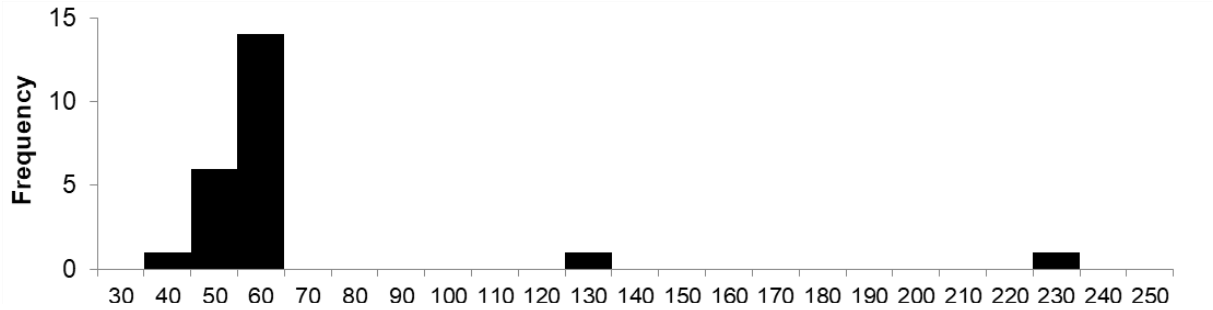


Figure New Forest 3. Length-frequency histogram of brown trout lengths in the New Forest, 2023.

Catches at all sites have fluctuated over the years (Figures New Forest 4 and 5). However, the trendlines in indicate a downward trend in the number of wild brown trout caught during these surveys since 2011.

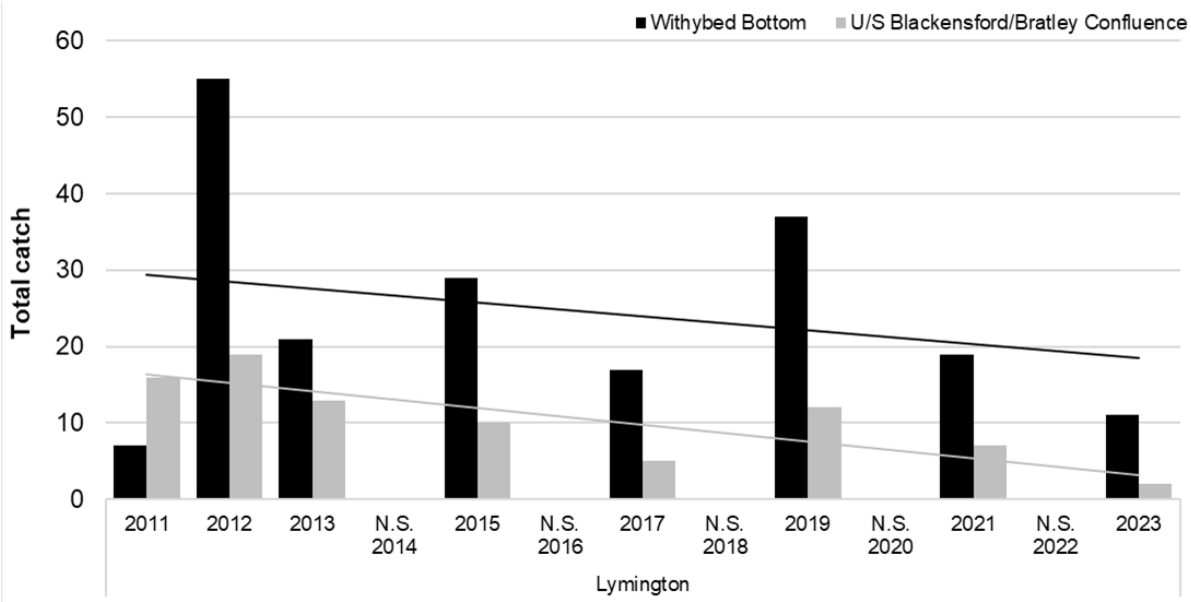


Figure New Forest 4. Brown trout catches at Withybed Bottom (black) and U/S Blackensford (grey) on the Lymington River, 2011-2023 (N.S. = no survey). Linear trendlines are shown for both sites (N.S. = no survey).

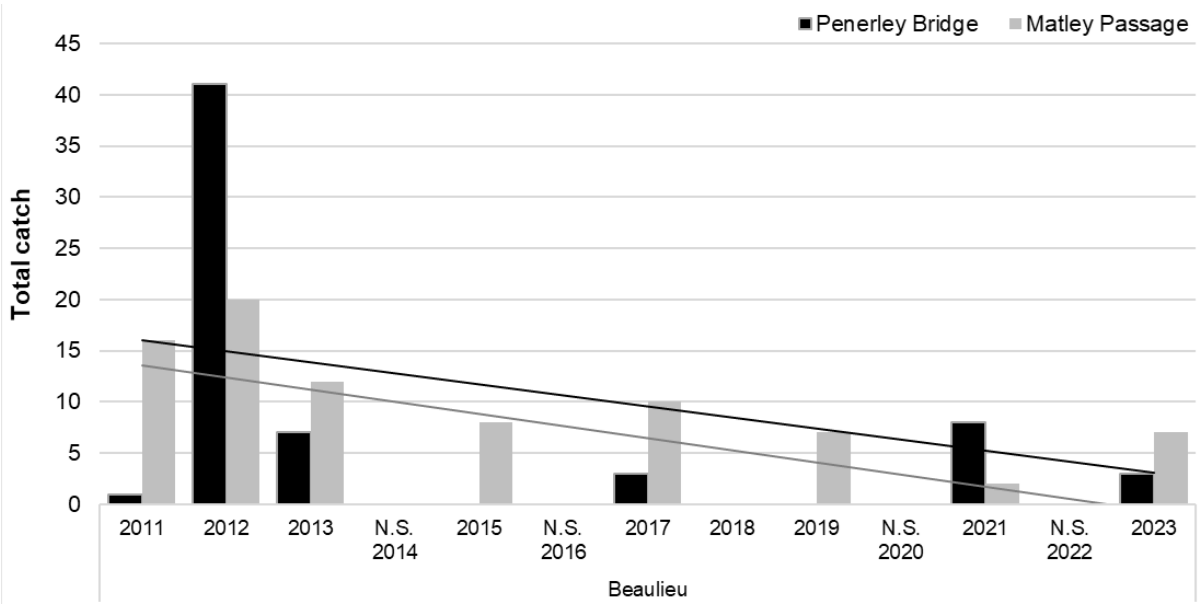


Figure New Forest 5. Brown trout catches at Penerley Bridge (black) and Matley Passage (grey) on the Beaulieu, 2011-2023 (N.S. = no survey). Linear trendlines are shown for both sites (N.S. = no survey).

Summary

A range of species were caught across the New Forest (Figure New Forest 1), with Matley Passage being the most diverse and Penerley Bridge being the least. Withybed Bottom was the most productive site, with high abundances of minnow. Twenty-three brown trout were caught across the four sites in the New Forest in 2023. The individual sites surveyed all saw a decline in brown trout numbers compared with the previous year of surveys (Figures New Forest 4 and 5), except for Matley Passage in which trout numbers tripled.

There was little variation in brown trout lengths across all sites on the Lymington River (Figure New Forest 2), most of the brown trout caught across these sites were young of the year, with only two individuals being at least a year old based on length (Figure New Forest 3).

A downward trend in brown trout catches is evident at all four sites from the trendlines in Figures New Forest 4 and 5; the New Forest streams are particularly vulnerable to drought and heat, as they are small, rain fed, and situated in the central south coast, one of the warmest parts of the country. Although the majority of both rivers flows through woodland, extensive reaches pass through open lawns that are highly exposed to the sun and experience extremely high water temperatures in summer. Cooling takes some time and distance, so these hot areas have a strong effect on downstream reaches. The distinct upward trend in maximum summer temperatures in recent years appears to have impacted juvenile trout survival and adult sea trout migration success.

Both rivers receive frequent discharges of dilute, untreated sewage effluent (predominantly during wet weather) from Combined Sewer Overflows (CSO's) at local wastewater treatment works - the impacts of discharged effluents are far greater under elevated temperatures due to increased fish oxygen demand (higher metabolism), the reduced oxygen carrying capacity of warmer water and increased rates of biological oxygen demand from organic contaminants. However, it is the Beaulieu River that is under the most severe pressure because a major CSO is located close to its source, meaning that almost the entire main stem of the river is contaminated when discharges occur; this is an extremely undesirable situation for a such a sensitive and highly designated river and the priority fish species it supports.

Estuarine fish monitoring

The Transitional and Coastal (TraC) fish monitoring programme uses a multi-method survey approach, which allows us to monitor the presence and diversity of estuarine fish species over time.

3.4. Adur Estuary

In Autumn 2023, the Adur Estuary Transitional and Coastal (TraC) fish monitoring programme included routine beach seine (45 m) and beam trawl (1.5 x 200 m) surveys at three sites displayed in Map Adur 1. There are no suitable locations for fyke nets in the Adur Estuary. These sites were last surveyed in autumn 2018.

Map Adur 1. Fish monitoring sites, River Adur Estuary, 2023. Salinity at Ladywell Stream was 2.62 ppt (LW), 33.26 ppt (HW) at Old Toll Bridge and 34.43 ppt at Kingston beach (HW).

Common goby dominated the catch in 2023 and was the most abundant species at Ladywell Stream and Old Toll Bridge (Figure Adur 1). Sand smelt was the dominant species at Kingston beach. 'Grey mullet sp.' refers to grey mullet that were too small to speciate in the field (typically less than 5 cm long).

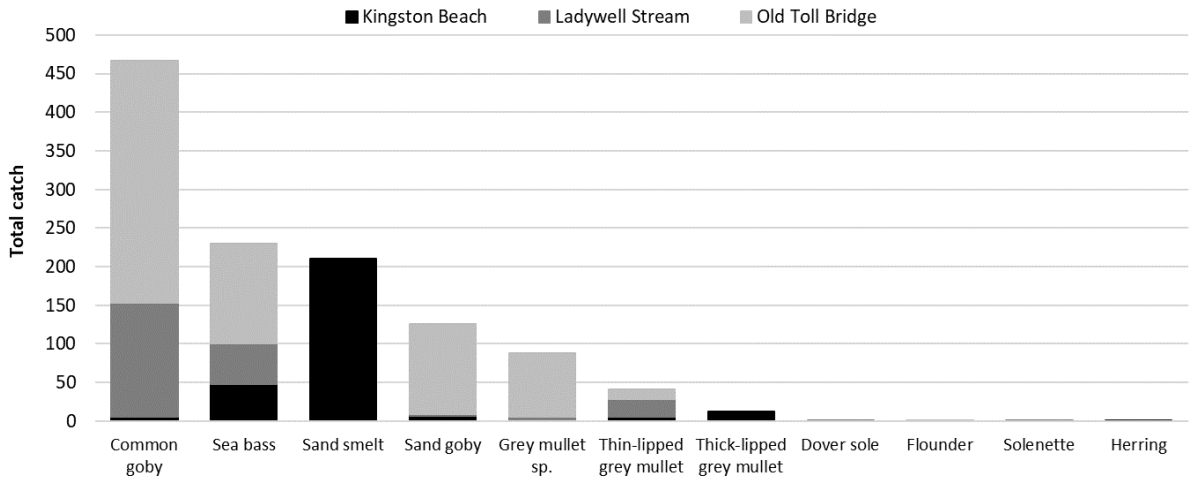


Figure Adur 1. Total catch for seine netting and beam trawling in the Adur Estuary, autumn 2023.

No surveys took place between 2019 and 2022 due to COVID-19 regulations and resource availability. There were exceptionally high catches in 2016 and 2017, when compared with other survey years (Figure Adur 2). Although the catch size in 2023 is significantly lower than in 2016 and 2017, it is relatively consistent with other survey years and has increased since the previous survey in 2018.

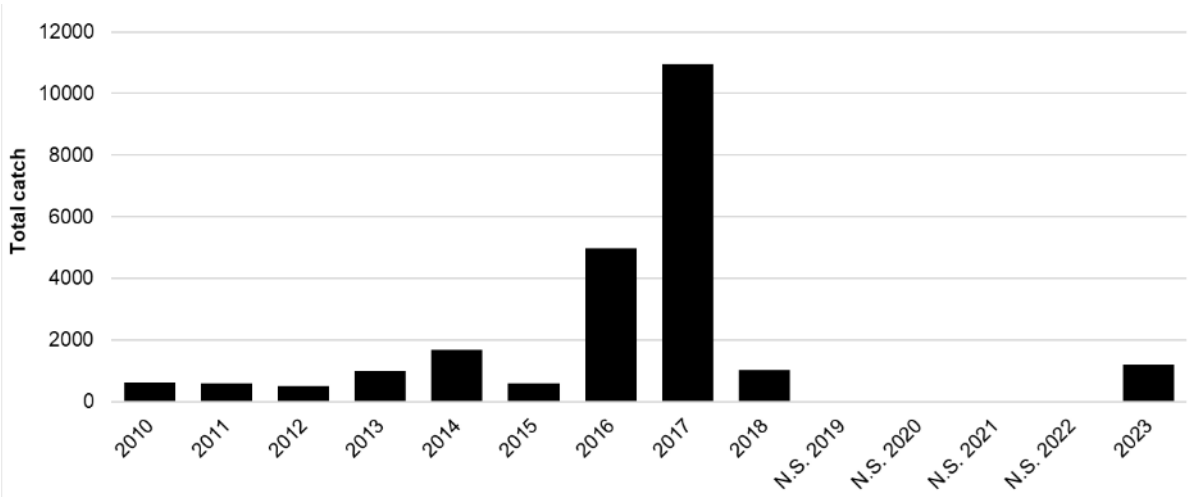


Figure Adur 2. Total catch for seine netting and beam trawling in the Adur Estuary, autumn 2010-2023 (N.S. = no survey).

Figure Adur 3 shows the number of juvenile bass caught during autumn surveys (2010-2023) and mean summer sea surface temperatures (calculated from CET mean monthly temperatures from May to September). The R^2 metric for the regression line in Figure Adur 4 is greater than 0.5, indicating that variation within the juvenile bass catch data is somewhat determined by its relationship with summer sea surface temperatures, and thus suggesting a significant positive relationship between the two variables. Correlation analysis indicates a strong positive relationship (r = 0.75) between mean summer sea surface temperature and the number of juvenile sea bass caught during our autumn surveys.

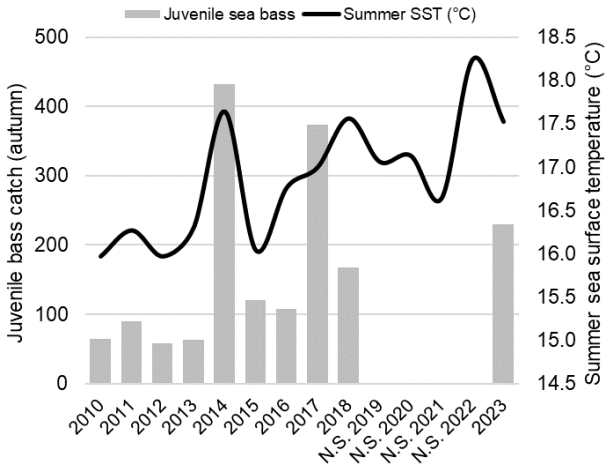


Figure Adur 3. Autumn juvenile bass catches between 2010 and 2023 and mean summer sea surface temperatures (N.S. = no survey).

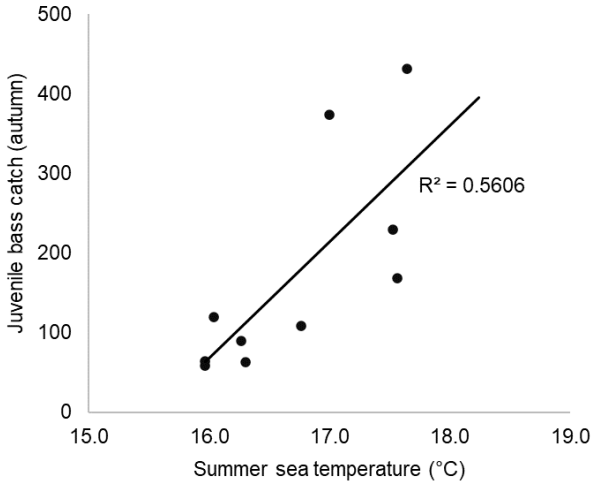
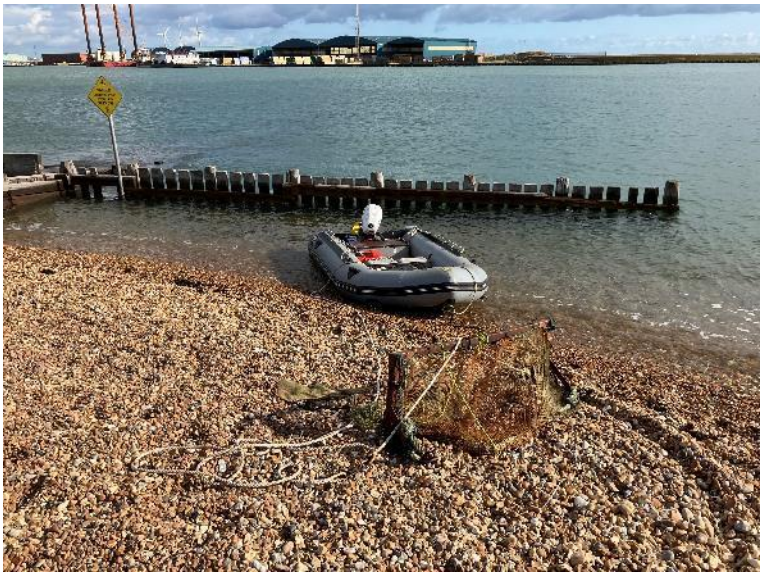


Figure Adur 4. Correlation between autumn juvenile bass catches between 2010 and 2023 and mean summer sea surface temperatures

Discussion

The number of species caught was below average in 2023 compared with previous years. Catch size was greatest at Old Toll Bridge (Figure Adur 1). Total catch size was also below average, however the mean is influenced by the exceptionally large catches in 2016 and 2017 (Figure Adur 2). The catch was dominated by common gobies, followed by sea bass, sand smelt and sand gobies respectively.

Juvenile sea bass numbers were above average (μ=170.7). The strong correlation between mean summer sea surface temperatures and juvenile bass catches suggests that this larger catch could be due to the warm summer sea surface temperatures (Figure Adur 4). Nevertheless, bass numbers were not as high as previous years with similar mean summer sea surface temperatures (Figure Adur 3; 2014 and 2017), suggesting other pressures could be influencing the population.



Survey boat & beam trawl, Kingston beach

Left: Kingston Beach; Top right: sea bass; Bottom right: the sole solenette of the Adur Estuary surveys.

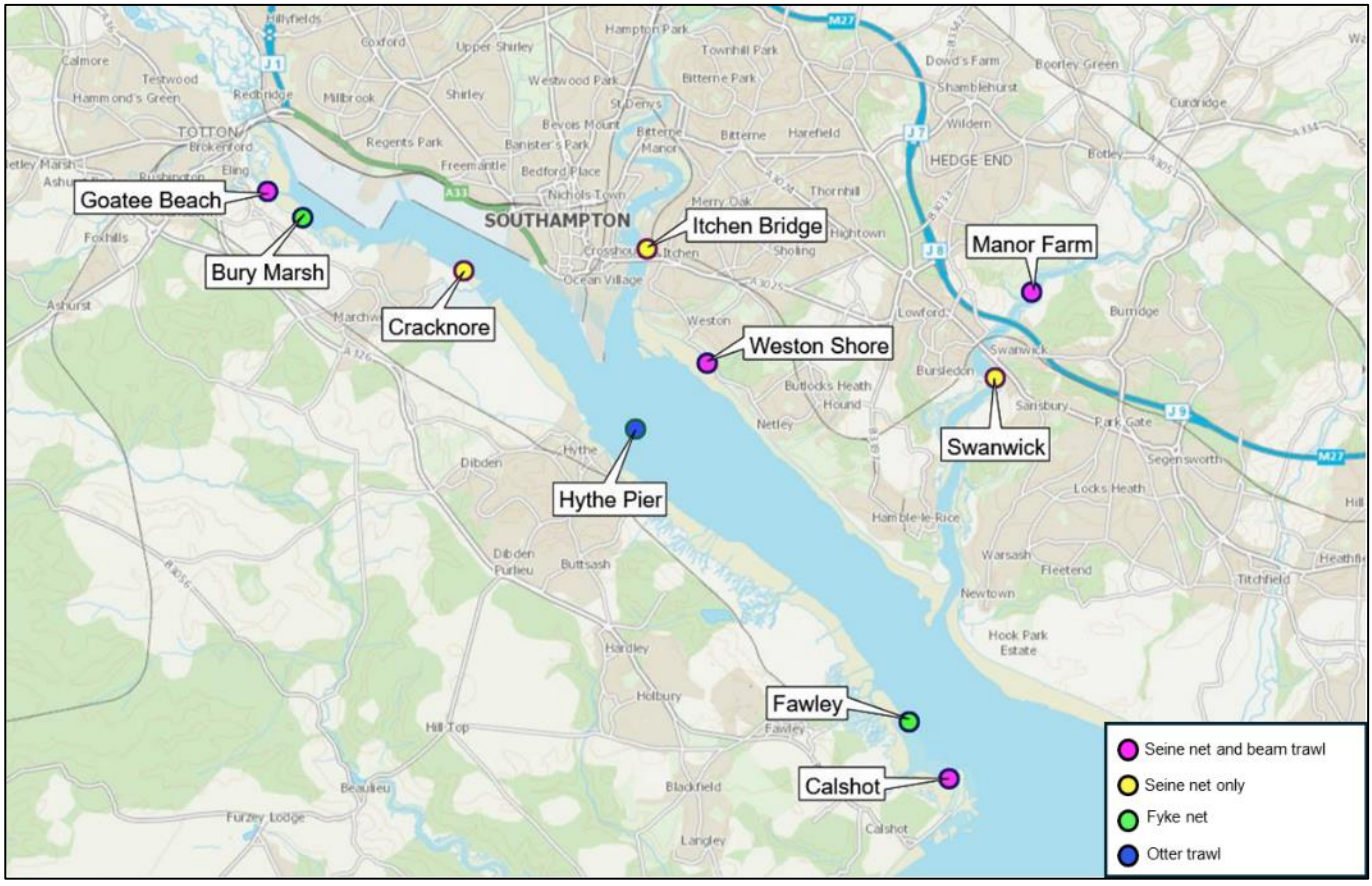
Top left: Adult flounder; Bottom left: hauling in the seine net at Ladywell Stream; Right: juvenile sea bass.

3.5. Southampton Water

In 2023, the Southampton Water Transitional and Coastal (TraC) fish monitoring programme included routine beach seine and beam trawl surveys at four sites, beach seine only surveys at three sites (where beam trawling would be hazardous) and 24-hour fyke net surveys at a further two sites. No surveys took place during autumn 2019, 2020 and 2022 due to COVID-19 and resource availability.

All sites were surveyed in autumn 2023. An otter trawl was also conducted via a coastal survey vessel (CSV) at Hythe Pier. This multi-method approach was used because different fish species and age cohorts within a species inhabit different areas of the water column and bed, and different methods are appropriate for sampling different habitats. Thus, use of several complimentary sampling techniques can enhance the accuracy of fish assemblage assessments.

Map Soton Water 1 shows the TraC monitoring sites in Southampton Water, coloured according to the types of survey conducted at each location.



Map Soton Water 1: Estuarine fish monitoring sites, Southampton Water, 2023.

Routine Beach seine netting, beam trawling and Fyke netting results and discussion:

Total catch size (n=4216) in 2023 was below the long-term average (μ=5306.86), however, was it greater than the previous autumn surveys in 2021 (Figure Soton Water 1).

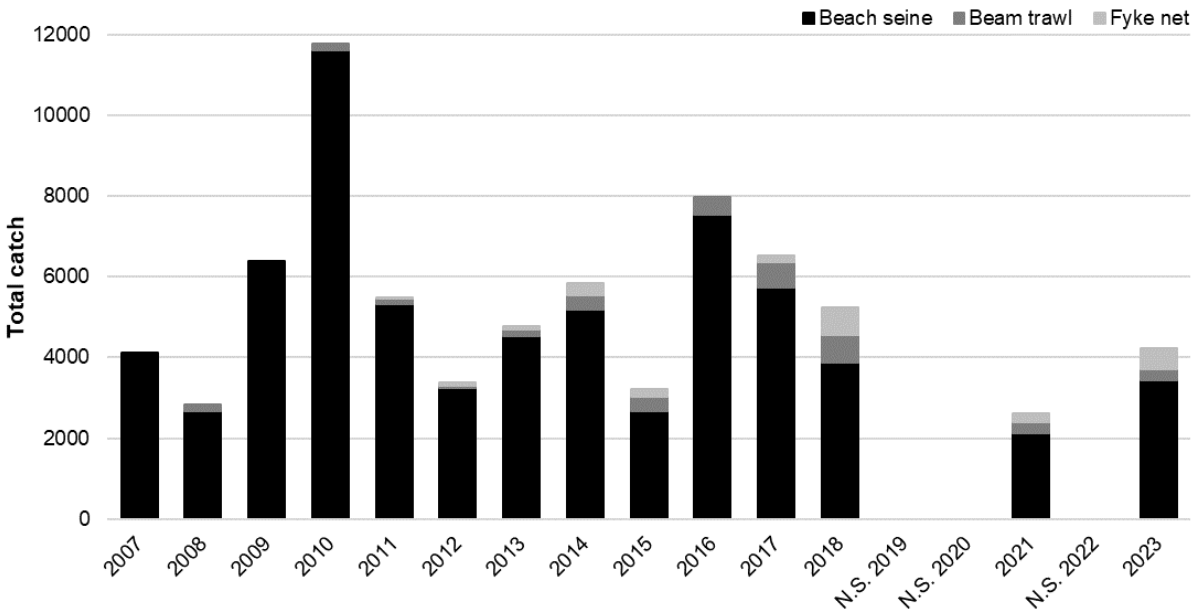


Figure Soton Water 1. Total number of fish caught in autumn surveys (all sites) between 2007 and 2023 (N.S. = no survey).

The number of species caught (n=21) exceeded the mean for all survey years (μ=18.5). Sea bass dominated the catch with exceptionally high numbers (Figure Soton Water 2), the highest of any surveys in previous years. Baillon's wrasses were present for the first time since 2017, as were flounder and greater pipefish for the first time since 2019.

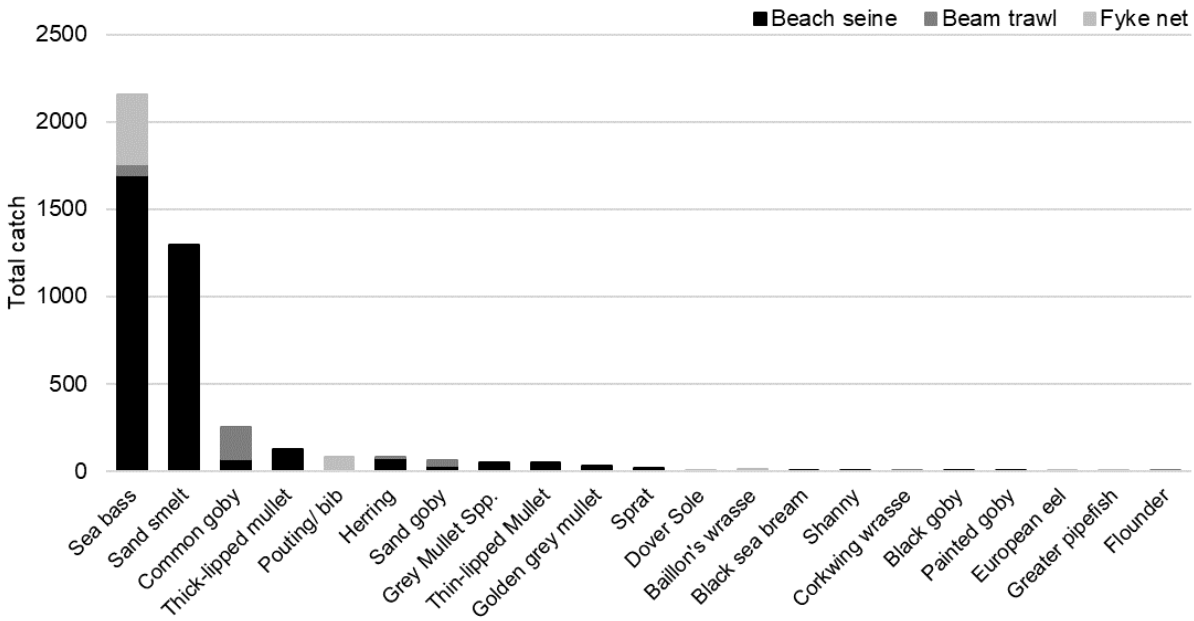


Figure Soton Water 2. Total number of fish caught across all sites in Southampton Water during autumn, 2023.

Figures Soton Water 3 and 4 both display total catch at each site; figure 3 identifies the species present and figure 4 shows the number of individuals caught by each survey method at each site. Manor Farm was the most productive of the multi-method sites, Swanwick was the most productive of the seine only sites and Fawley was the most productive of the two fyke net sites (Figure Soton Water 4). Calshot was the most species diverse site (Figure Soton Water 3).

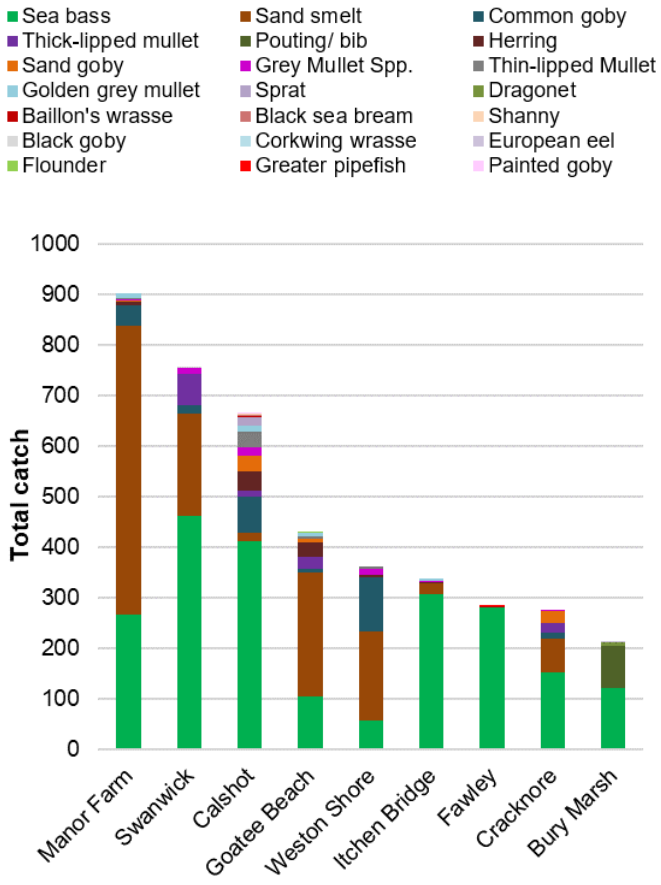


Figure Soton Water 3. Species composition of the catch at each site in autumn, 2023.

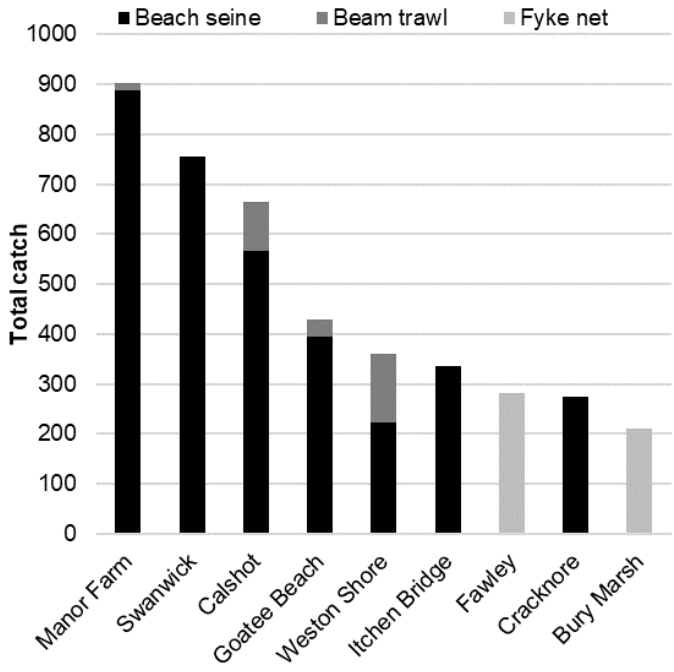


Figure Soton Water 4. Number of individuals caught by each survey method at each site in autumn, 2023.

A notable observation was the number of Pacific oysters that had colonised hard substrate at Cracknore Hard (pictured below). There was considerably more than seen in previous years, making it extremely difficult to set and haul the beach seine net. Increasing sea surface temperatures and an abundance of suitable hard substrate could be contributing factors.

Top left: Gathering the lead line at Weston Shore; Top right: Corkwing wrasse vs. Baillon's wrasse at Calshot; Bottom left: Greater pipefish; Bottom right: Cracknore Hard was densely populated with Pacific oysters.

Top left: Iridescent green eyes of a dover sole; Top right: Fyke nets set at Bury Marsh; Bottom left: Sorting the catch at Manor Farm; Bottom right: Pouting/bib caught in the fyke nets at Bury Marsh.

Top left: Golden grey mullet and thick-lipped grey mullet (top right) at Goatee Beach; Bottom left: Invasive Pacific oysters and sponges collected in the beam trawl at Manor Farm; Bottom right: Juvenile Sea bass at Swanwick.

Hythe Pier CSV otter trawl results and discussion:

Occurring annually since 2009 (excluding 2020 to 2022 due to COVID-19 regulations), the otter trawl is conducted at Hythe Pier via a coastal survey vessel (CSV). The highlight of the survey was catching an adult male spiny seahorse (long-snouted seahorse; *Hippocampus guttulatus;* Figure Soton Water 5). The Seahorse Trust estimated it to be approximately two years old from its size and shape. Southampton University have been collating records and monitoring numbers since the first seahorse find in 2007. 2019's specimen was the first confirmed adult spiny seahorse in Southampton Water.

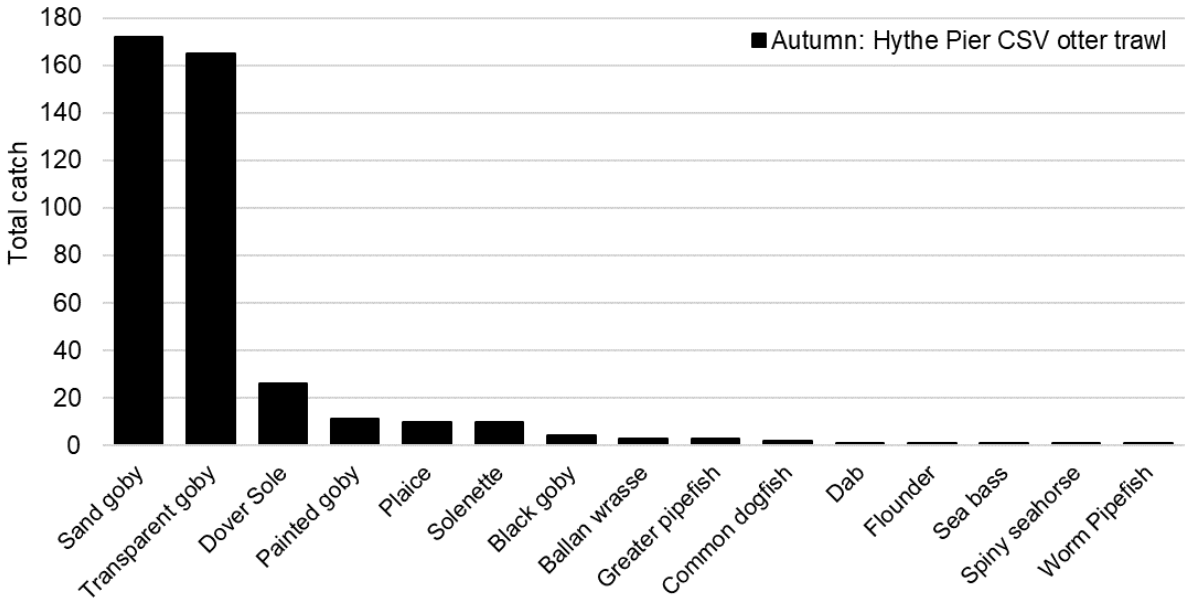


Figure Soton Water 5. Total number of fish caught during the CSV otter trawl at Hythe Pier, autumn 2023.

Three greater pipefish and one worm pipefish were also caught, and common dogfish were present again after being caught for the first time in 2019. Furthermore, dab was present for the first time since 2016. Transparent goby and painted goby were present for the first time since 2017, although common goby was absent despite being caught most years. The total number of species caught increased from 2019's survey, as did the total catch size. Nevertheless, many previously commonly caught species were absent this year including common goby, corkwing wrasse and dragonet.

Figure Soton Water 6 shows the total number of fish caught during each autumn trawl alongside the average summer sea surface temperature (2009 – 2023). The average sea surface temperature is calculated by taking an average of the mean monthly sea surface temperatures between May and September, as recorded at the Hayling Island data buoy.

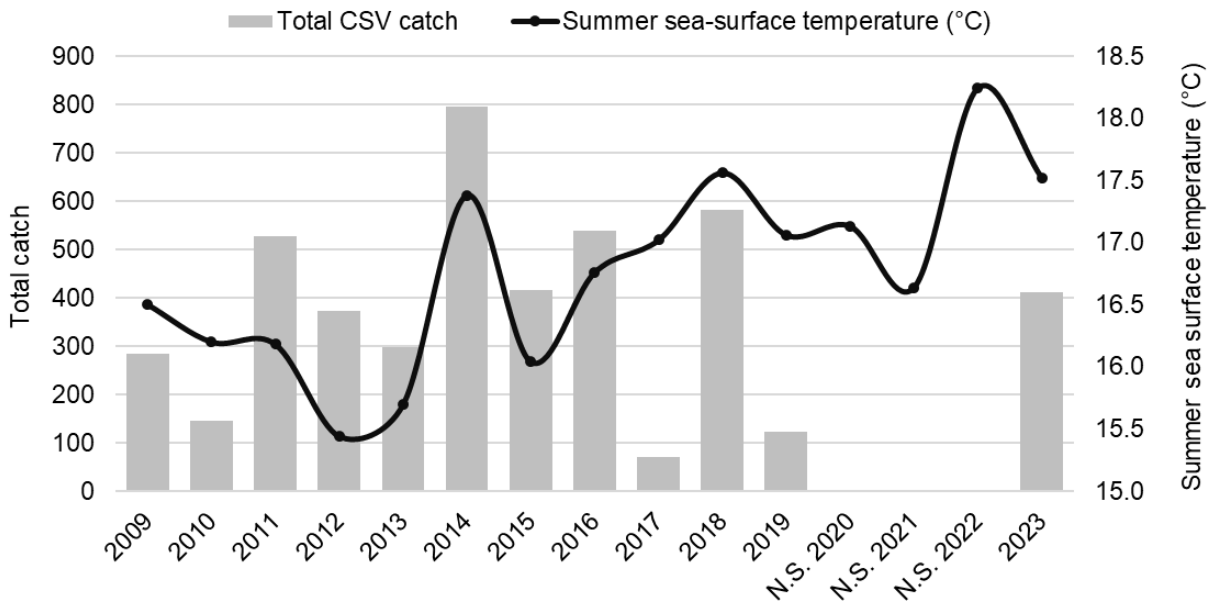
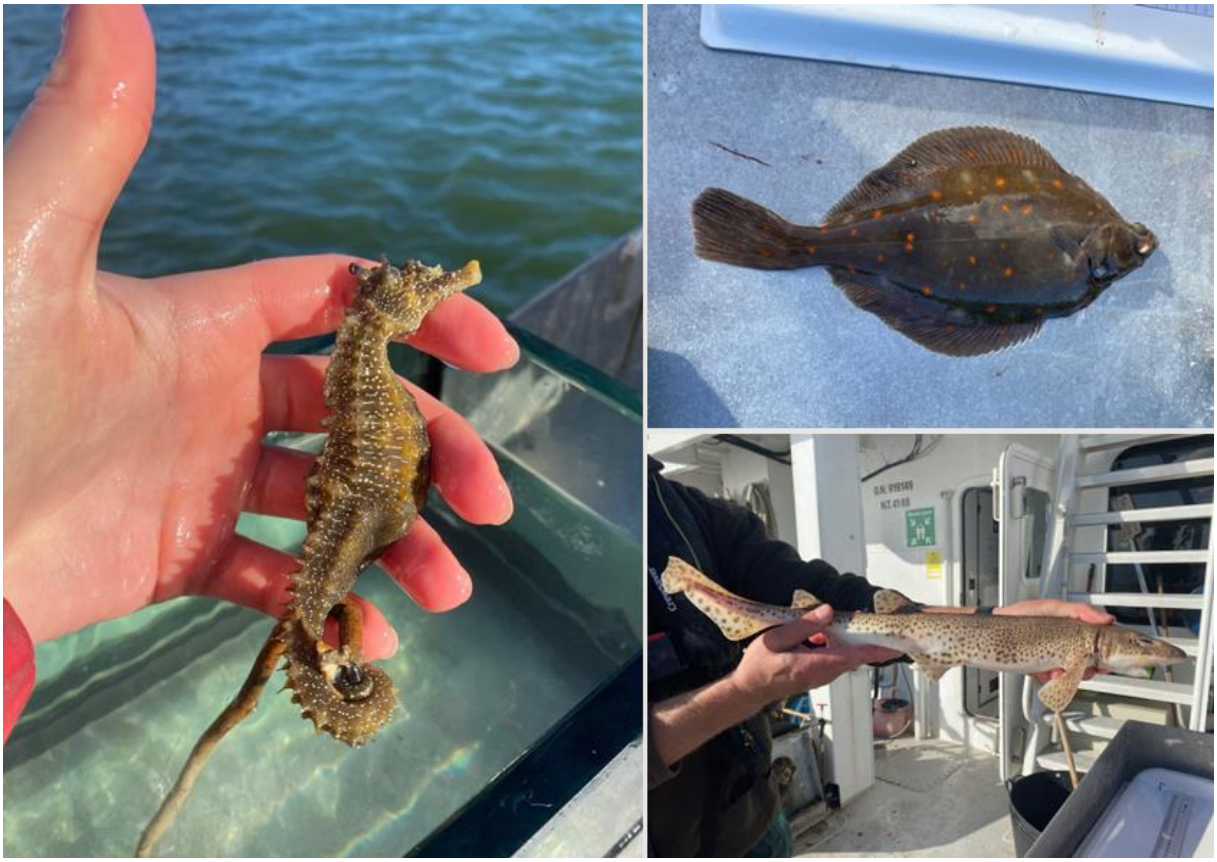


Figure Soton Water 6. Total CSV catch and summer sea surface temperature 2009 – 2023 (N.S. = no survey).

Total catch has, until recent years, positively correlated with the average summer sea surface temperature, however in both 2017 and 2019, the numbers of fish caught have not responded to the warm seas. Although this year's total catch is substantially larger than 2017 and 2019, it is not as large as expected given the summer's sea surface temperatures (Figure Soton Water 6). Potential explanations include too much commercial removal, or the survey area may have recently been dredged (a regular occurrence in the Solent). The CSV trawl takes place close to, if not within, the maintenance dredge area.

Left: Common dogfish (lesser-spotted dogfish, small-spotted catshark); Top right: Baillon's wrasse; Bottom right: Bobtail squid.

Top left: Greater pipefish; Bottom left: releasing the cod end of the otter trawl; Right: Common dogfish.



Left: Adult male spiny seahorse; Top right: Plaice; Bottom right: Common dogfish.

Top left: Dover sole; Bottom left: worm pipefish; Right: Setting the otter trawl.

Looking forward

In 2024, fish monitoring across the SSD Area is scheduled to include:

- Principal coarse fish surveys on the: Western Rother, Adur, Wallington, Hamble, Ouse and Cuckmere.
- General coarse fishery surveys: Eastern Yar (Isle of Wight).
- Two temporal Wild Brown Trout sites on the Ouse
- Eel Index monitoring on the Ouse.
- Annual National Drought Monitoring Network surveys: Test, Itchen and Ouse.
- 7th year of Water Company Drought Monitoring on the Test and Itchen.
- Salmon counters and annual redd mapping
- Autumn TrAC surveys in the Adur Estuary and Southampton Water.

Acknowledgements

As always, we would like to express our gratitude to the landowners, fishing clubs, river keepers, farmers and land agents who kindly allowed us access on to their rivers in 2023 and in many cases provided valuable local knowledge and advice. The collection of this essential fish population data would not be possible without your support and assistance, so thank you.