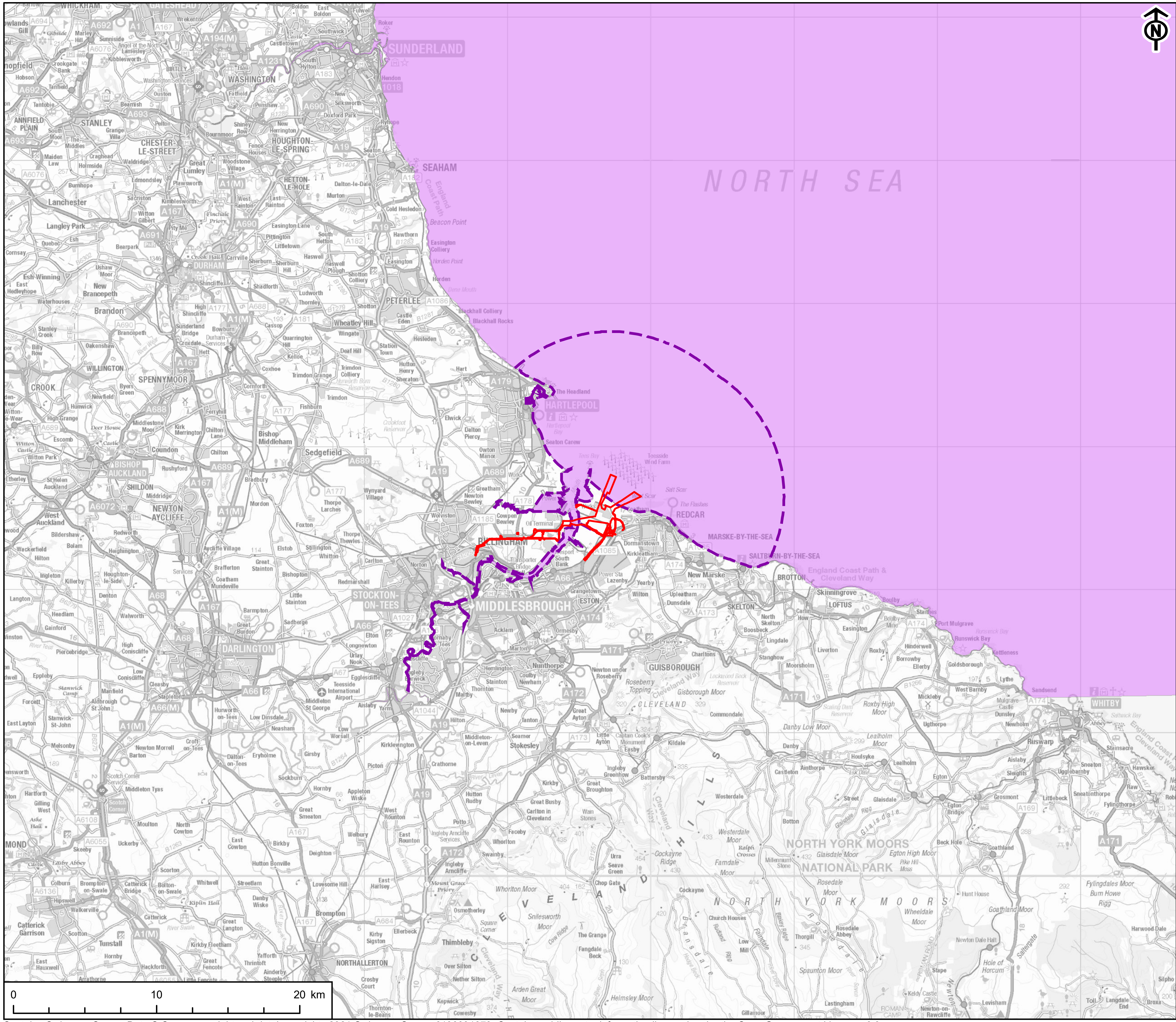
Project Management Initials: RL Designer: LC Checked: AR Approved: RG



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AECOM

PROJECT

NET ZERO TEESSIDE PROJECT

Net Zero Teesside

APPLICANTS

NZT POWER LTD. AND NZNS STORAGE LTD.

KEY

Site Boundary

10km Study Area

Spurdog Nursery Ground (2010)

Low Intensity

TITLE

FIGURE 14B-3f
NURSERY GROUNDS WHICH FALL WITHIN THE STUDY AREA FOR THE PROPOSED DEVELOPMENT: SPURDOG
(ELLIS ET AL., 2012)

REFERENCE

NZT_210511_FEB_14B-3f_v5

SHEET NUMBER: 1 of 1

DATE: 11/05/21

14.4.5 Fish surveys were undertaken in 2010 as part of the Teesside Offshore Wind pre-construction baseline monitoring programme with several sampling locations overlapping with the Study Area for the Proposed Development (Entec UK Limited, 2011). Three fishing techniques were employed, including trawling, gill nets, and potting. A total of 31 fish species were caught, with catches dominated by whiting, whilst plaice, haddock, dab and Atlantic cod were also caught in high abundances. Species such as lemon sole, saithe (*Pollachius virens*) and herring were recorded but in lower abundances. The shellfish catches were dominated by edible crab (*Cancer pagurus*), squid (*Loligo vulgaris*), harbour crab (*Liocarcinus depurator*) and European lobster (*Homarus gammarus*). Of the fish and shellfish species observed, edible crab, European lobster and velvet swimming crab (*Necora puber*), as well as plaice and dab, were mostly captured inshore within the windfarm site. In contrast, species such as cod and *nephrops* were caught offshore, whilst Dover sole and lemon sole were caught inshore during the summer months and offshore in the winter months.

14.4.6 A similar community composition was also observed in nearshore fish and shellfish surveys undertaken in autumn 2012 and spring 2013 to inform the Dogger Bank Teesside A & B export cable corridor ES (Precision Marine Survey Ltd, 2014). The fish surveys utilised the methods of otter trawling, scientific beam trawls and static gear (nets and shellfish pots). The results of these surveys found that, similar to the Teesside Offshore Wind surveys, whiting dominated catches, representing 47% of the total across all sites and surveys. Pouting (*Trisopterus luscus*), haddock, dab, plaice, and grey gurnard (*Eutrigla gurnardus*) were also caught in higher abundances. From the shellfish surveys, edible crab represented the highest proportion of the catch, contributing 48% to the overall total. Hermit crab (*Pagurus bernhardus*), star fish (*Asterias rubens*), whelk (*Buccinum undatum*), velvet swimmer crabs and lobster were also caught in relatively high abundance, representing 19%, 10%, 9%, 7%, and 5% of the total, respectively.

NFPD Fish Counts - Environment Agency

14.4.7 Data from the National Fish Populations Database (NFPD) for the Tees area, as reported by the Environment Agency (2019a; and 2019b), has been analysed and presented below. The NFPD provides a collection of information from fisheries monitoring work on rivers, lakes and transitional and coastal waters (TraC), recorded by the Environment Agency and third parties. The data includes information on fish counts, lengths, age and weight for a variety of marine, diadromous and freshwater fish species in different reaches of the River Tees.

14.4.8 It should be noted that the surveys represent a range of gear types and survey effort, meaning that the comparison of abundances is only indicative. The gear types used as part of the TraC fish surveys include:

- beam trawl – 1.5 m wide;
- beam trawl – 2.4 m wide;
- otter trawl netting; and
- seine netting.

14.4.9 A table summarising temporal and seasonal variations in the type of gear used in each area of the River Tees as part of the TraC fish surveys, can be found in Appendix A. Typically, beam trawling with an aperture of 2.4 m was used from the 1980s to 2004 in both the middle and lower reaches and was the only technique used in the lower reaches across all years. From 2004 onwards, seine netting was used more frequently in the middle and lower reaches, whilst otter trawling was utilised only occasionally. Beam trawls with an aperture of 1.5 m were only used in the lower reaches of the river in all years from 2011.

14.4.10 In addition to the TraC fish surveys, freshwater fish count NFPD surveys were undertaken by the Environment Agency from 1993 to 2019 in the River Tees and associated tributaries. These surveys comprised of the following methodologies:

- electric fishing;
- seine netting; and
- fixed trap fishing.

14.4.11 The information from these surveys has been used as supporting evidence for the abundances and spatial distribution of the diadromous fish species present in the freshwater sections of the River Tees and its adjoining tributaries. As with the TraC surveys, these surveys represent a range of survey methodologies and survey effort, meaning that the comparison of abundances is only indicative.

Estuarine and Marine Fish Species

14.4.12 Table 14B-3 shows the marine fish species recorded across all areas of the River Tees in the most recent 10-year sampling period of the TraC monitoring surveys (2009 – 2018). It should be noted that monitoring spanned 1981 to 2018 but monitoring has focussed on the lower reaches only in the last 10 years and so this data was considered the most geographically and temporally relevant to the assessment of estuarine and marine fish species.

14.4.13 The species which were most prevalent and found across all 10 monitoring years were herring, plaice and sprat. These species contributed 73% to the total number of estuarine or marine fish observed. Lesser sandeel (*Ammodytes tobianus*) and flounder were also found to be prevalent within the Study Area, occurring in nine out of the 10 monitoring years and contributing a further 15% to the total abundance. In addition to the aforementioned species, sand goby and whiting were also prevalent for most of the monitoring period, being recorded in nine of the 10 most recent monitoring years but occurred in comparatively lower abundances (Table 14B-3).

Table 14B-3: Marine fish counts from Environment Agency (2019a) TraC surveys in the River Tees for 2009 to 2018. Data has been reported for a range of survey methods (beam trawl, otter trawl, and seine netting) and effort. Fish species have been presented in order of prevalence (number of years present), followed by total abundance.

Common Name	Latin Name	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Sprat	*Sprattus sprattus*	456	4,741	655	1,639	310	54	7	276	7	51
Herring	*Clupea harengus*	1,647	495	42	378	639	1,619	459	29	10	566
Plaice	*Pleuronectes platessa*	250	12	16	27	330	236	396	246	103	31
Lesser sandeel	*Ammodytes tobianus*		58	933	120	158	114	206	1	373	19
Flounder	*Platichthys flesus*	40	153	471	185	127	10	143	5	21	
Sand goby	*Pomatoschistus minutus*	35	65	15	5	38	11	73	45	54	
Whiting	*Merlangius merlangus*	228	2		2	1	7	17	8	18	14
Dab	*Limanda limanda*	260				10	69	102	189	168	
Common goby	*Pomatoschistus microps*		1	25	4	42	21	57			
Cod	*Gadus morhua*	287			3		5		32	20	
Lesser weever	*Echiichthys vipera*	8		2	1			4	2		
Pogge	*Agonus cataphractus*	13						10	5	16	
Dover sole	*Solea solea*	2				1		1	1		
Corbin's sandeel	*Hyperoplus immaculatus*	69		1	1						
Nillsson's pipefish	*Syngnathus rostellatus*						6	1	2		
Pollack	*Pollachius virens*	441					1				
Long-spined sea scorpion	*Taurulus bubalis*	10							2		
5-bearded rockling	*Ciliata mustela*	3						1			

Common Name	Latin Name	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Greater pipefish	*Syngnathus acus*									1	2
Snake pipefish	*Entelurus aequoreus*	1								1	
Turbot	*Psetta maxima*						1			1	
Viviparous blenny	*Zoarces viviparus*			1		1					
Dragonet	*Callionymus lyra*	4									
Greater sandeel	*Hyperoplus lanceolatus*					3					
Gurnard sp.	*Triglidae*	3									
Lemon Sole	*Microstomus kitt*	2									
Painted goby	*Pomatoschistus pictus*						1				
Sand smelt	*Atherina presbyter*		1								
Sea bass	*Dicentrarchus labrax*	1									
Thornback ray	*Raja clavata*									1	

Source: Environment Agency, 2019a

14.4.14 Of the least prevalent species, dragonet (*Callionymus lyra*), greater sandeel (*Hyperoplus lanceolatus*), gurnard species (*Triglidae*), lemon sole (*Microstomus kitt*), painted goby (*Pomatoschistus pictus*), sand smelt (*Atherina presbyter*), sea bass (*Dicentrarchus labrax*), and thornback ray (*Raja clavata*) were only recorded in one year, with the four latter species only having one individual recorded, each. It is possible that some of these species, such as sea bass, were under-sampled due to the survey techniques utilised, although other species, such as turbot, are less common generally and therefore lower frequency occurrence would be expected.

Diadromous Fish Species

14.4.15 Figure 14B-4 shows the diadromous fish species recorded across all areas of the River Tees for all years (1981 – 2018) reported as part of the TraC monitoring surveys. Data has been presented for all years in order to encompass sampling undertaken in the upper reaches of the River Tees, for which fish abundances were only reported from 1982 to 1996.

14.4.16 European eels are the most prevalent species recorded, having been reported in a total of 16 years, the most recently being in 2008. This species has the highest recorded relative abundance of 178 individuals, including two elvers reported in 2008. Sea trout was the diadromous species most recently recorded, reported to be present in 2015, having first been recorded in 1988. Atlantic salmon has only been recorded in July 1998, with one individual being recorded as part of beam trawl (2.4 m) surveys in the middle reaches of the river. Similarly, river lamprey has been reported on only one occasion in 1992, with three individuals recorded in a beam trawl (2.4 m).

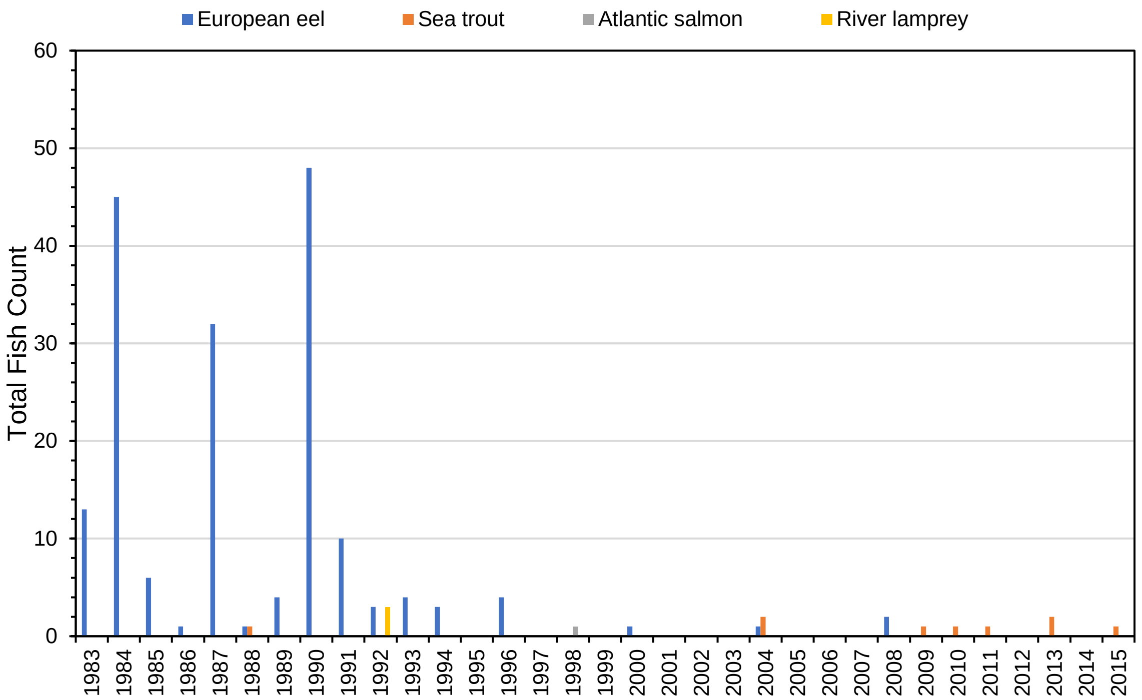

Figure 14B-4: Diadromous fish counts from Environment Agency (2019a) TraC surveys in the River Tees. Data has been reported for a range of survey methods (beam trawl, otter trawl, and seine netting) and effort.

14.4.17 Freshwater fish counts from NFPD Environment Agency surveys recorded the following diadromous species: Atlantic salmon, brown / sea trout, European eel, and lamprey (individuals of lamprey were not identified to species level). Of these species, brown / sea trout was recorded in the greatest abundances, with a total of 18,535 individuals counted from the River Tees and its connected tributaries between 1994 and 2019. Atlantic salmon was the second most abundant, with 11,528 individuals across all sites and sampling years. These species are also the most consistently recorded, being present in all years sampled[1]. A total of 1,385 European eel and 215 lamprey have been recorded to date; both taxa were recorded for the first time in 2001 but have only been consistently recorded from 2011 onwards when sampling at, and in the vicinity of, the Tees Barrage began.

Spatial Variations

14.4.18 Figure 14B-5 shows the locations of the NFPD TraC surveys reported for the River Tees. For the purpose of investigating spatial variations, the River Tees has been divided into three areas: the upper, middle and lower reaches.

14.4.19 The upper reach of the River Tees is defined as the area located upstream of the Tees Barrage, whilst the middle reach falls downstream of the barrage. The lower reaches were defined as the survey locations where sampling was undertaken at the mouth of the River Tees and the adjacent coastal waters.

[1] No survey took place in 2012.

Figure 14B-5: TraC fish count sampling locations (Environment Agency, 2019a).

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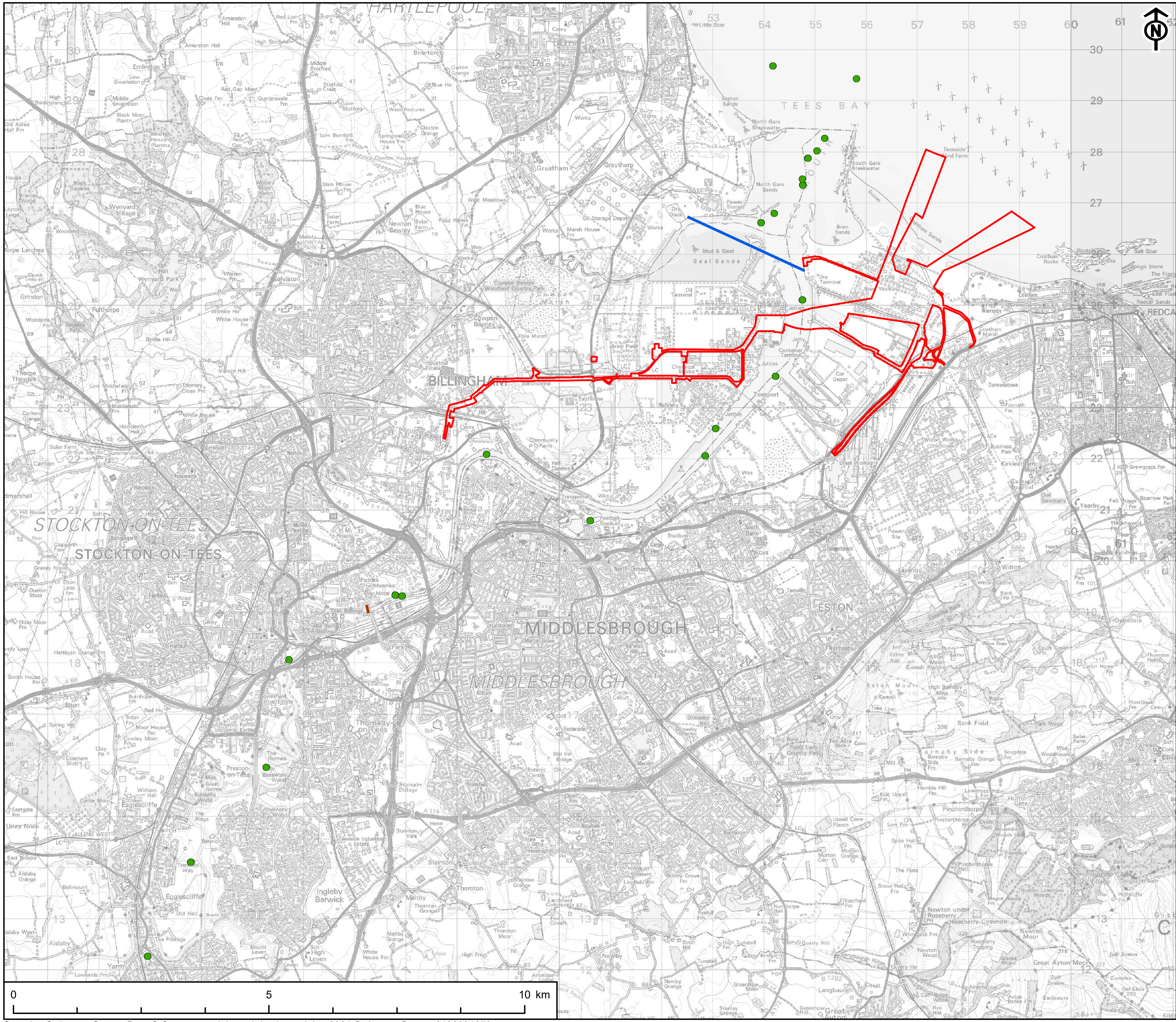

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Net Zero Teesside

APPLICANTS
NZT POWER LTD. AND NZNS STORAGE LTD.

KEY
- Site Boundary
- Tees Barrage
- Tees Mouth
- TRaC Fish Counts

TITLE
FIGURE 14B-5
TRAC FISH COUNT SAMPLING LOCATIONS
(ENVRIONMENT AGENCY 2019)

REFERENCE
NZT_210511_FEB_14B-5_v5

SHEET NUMBER
1 of 1

DATE
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Lower Reaches

14.4.20 The lower reaches of the River Tees have been defined as the area where Environment Agency TraC surveys were undertaken at the mouth of the river and beyond into the coastal waters (see Figure 14B-5). Data for this area has been reported from 1985 to 2018, with beam trawling (2.4 m) representing the majority of surveys undertaken between 1985 and 2009. However, since 2004 seine netting has become the main fishing technique. Seine netting has the highest total catches across years, with 17,324 individuals reported; particularly high abundances were recorded in 2006, 2010, 2012 and 2014 (see Figure 14B-6). This gear type typically captures species which utilise intertidal areas as nursery grounds and therefore, occur in high abundances (e.g. sprat, herring, and lesser sandeel).

14.4.21 Figure 14B-7 shows the proportion of fish reported across all years from TraC surveys in the lower reaches of the River Tees. As expected, the majority of species recorded in this area were marine, with sprat contributing 41% to overall abundance. Herring and lesser sandeel formed the second and third largest proportions representing 15% and 10%, respectively. The following species contributed between 1% and 9% to the total proportion: plaice, dab, whiting, cod, saithe, flounder, pogge (*Agonus cataphractus*) and sandeel species (Ammodytidae). The species listed as other (a full list is included in Appendix B) in Figure 14B-7 collectively contributed 1% to the overall proportion of fish species in the lower reaches of the River Tees.

14.4.22 The only diadromous fish species caught in this area were European eel and sea trout. A single European eel was reported in 2004, whilst two elvers were caught in 2008. Furthermore, a total of three sea trout were recorded with a single individual recorded in each of 2004, 2009 and 2010.

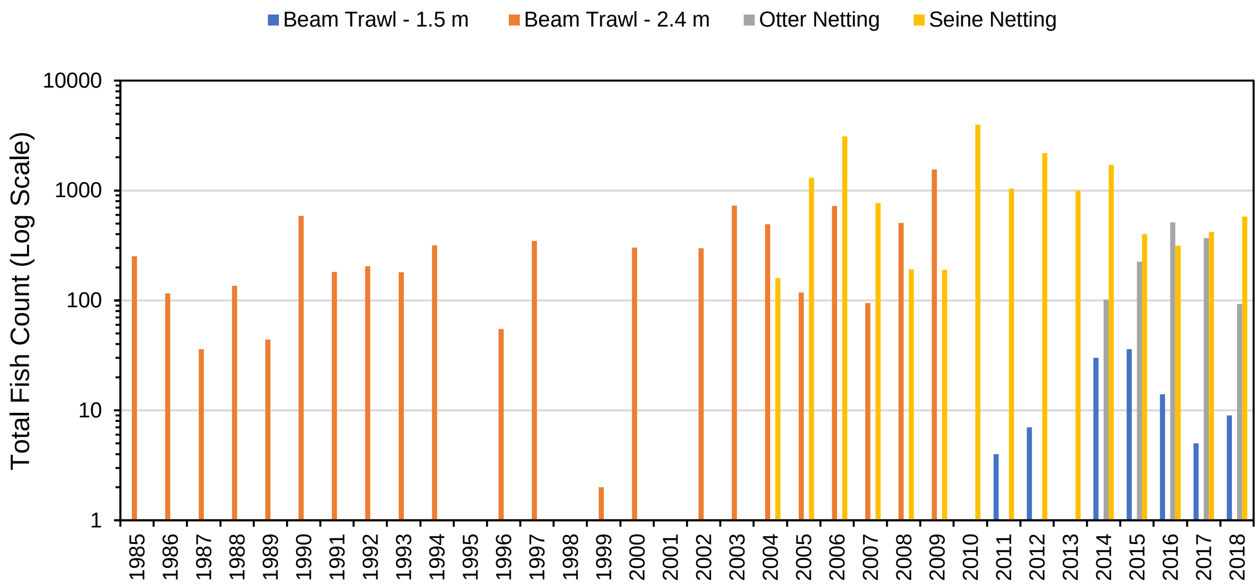


Figure 14B-6: Total fish counts for each gear type used, in Environment Agency (2019a) TraC surveys in the lower reaches of the River Tees.

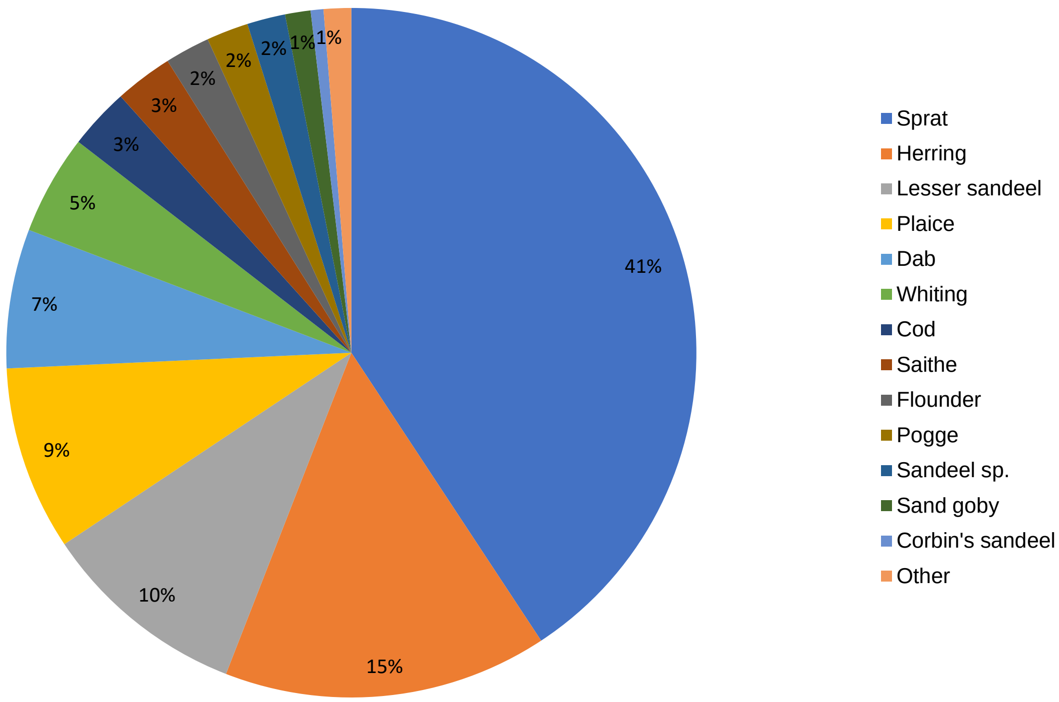


Figure 14B-7: Proportion of fish species from Environment Agency (2019a) TraC surveys in the lower reaches of the River Tees (1985 – 2018). Fish species in the legend have been presented in order of percentage contribution.

Middle Reaches

14.4.23 The middle reaches of the River Tees has been defined as the area upstream of the mouth of the river and downstream of the Tees Barrage (see Figure 14B-5). Data from TraC surveys for this area have been reported from 1981 to 2015 (see Figure 14B-8). Beam trawling (2.4 m) was the main gear type used from 1981 to 2004, with seine netting being the predominant method used from 2004 to 2015. High total fish counts from beam trawls (2.4 m) occurred in 1993, 1994, 2000 and 2002 where sprat, plaice and whiting dominated catches. Counts for seine netting in the middle reaches were highest between 2009 and 2011, which was predominantly due to the presence of herring and sprat in 2009 and 2010, whilst in 2011, sprat, flounder and three-spined stickleback contributed the most to the total abundance.

14.4.24 Sprat, plaice, whiting, and herring contributed the most to the overall abundance, representing 31%, 21%, 13% and 13%, respectively. The species contributing between 9% and 1% were: flounder, three-spined stickleback, dab, sand goby, cod, common goby, and viviparous blenny. The remaining species contributed 2% to the overall fish species proportions in the middle reaches, for a full list see Appendix B.

14.4.25 The majority of fish species recorded in the middle reaches of the River Tees were marine; however, the diadromous species European eel, Atlantic salmon, sea trout, and river lamprey were also found to be present. Of these species, European eel was recorded most frequently with 19 individuals recorded during a total of eight sampling occasions. Five individuals of sea trout were recorded in total, with four of these being present in the past 10 years. Total counts for river lamprey and Atlantic salmon for the entire monitoring period (1981 – 2015), were three and one individuals, respectively.

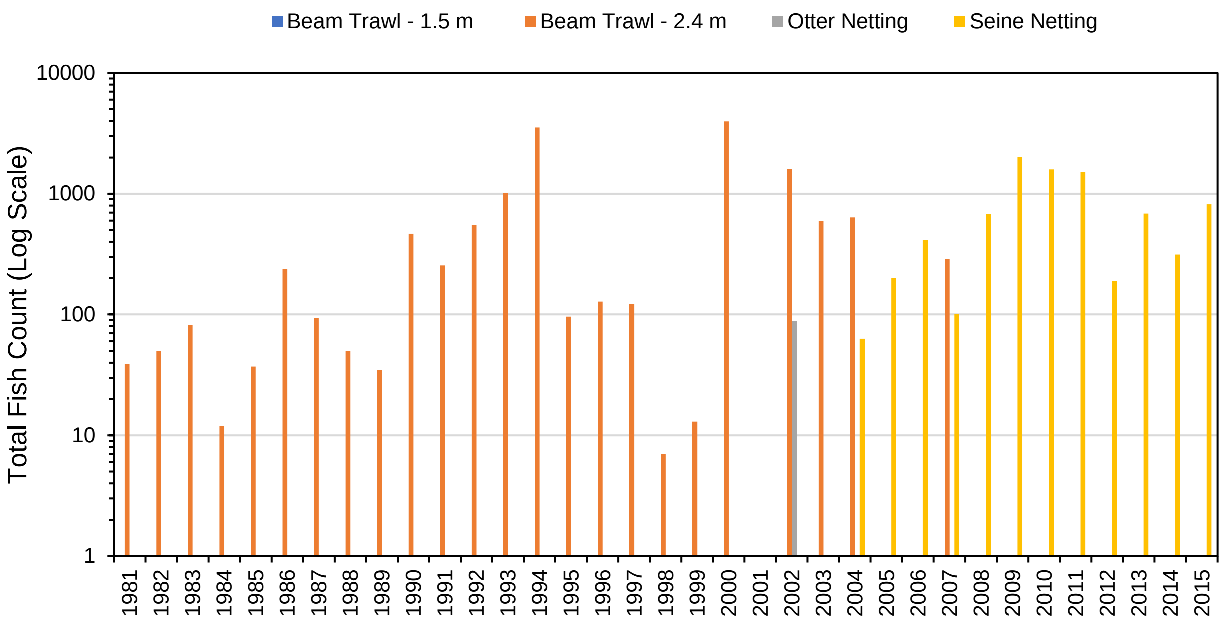


Figure 14B-8: Total fish counts for each gear type used, in Environment Agency (2019a) TraC surveys in the middle reaches of the River Tees.

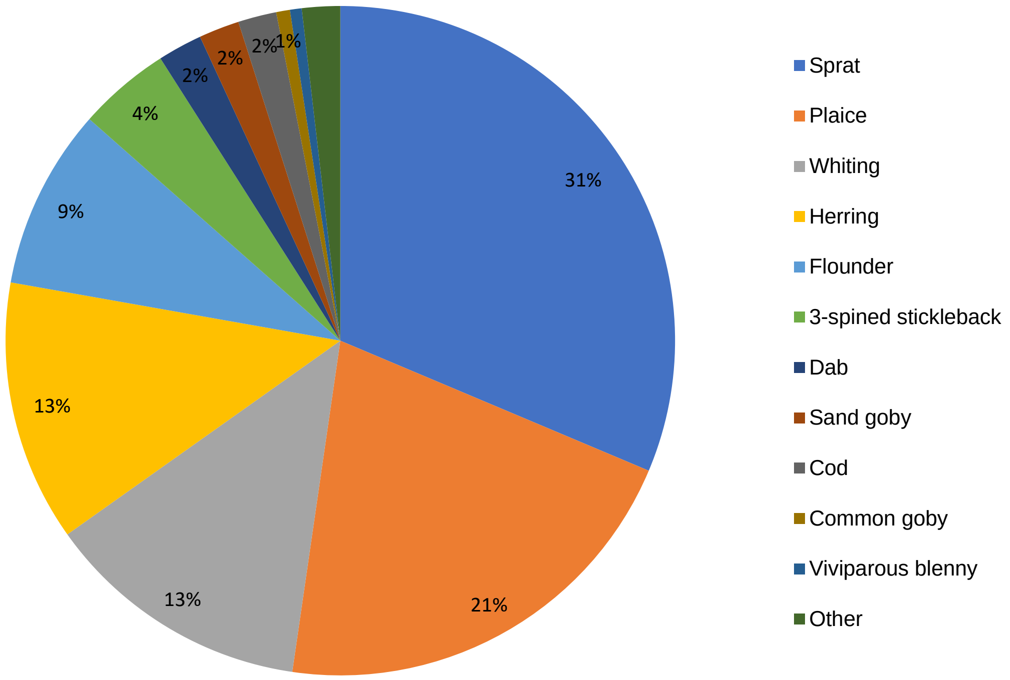


Figure 14B-9: Proportion of fish species from Environment Agency (2019a) TraC surveys in the middle reaches of the River Tees (1981 – 2015). Fish species in the legend have been presented in order of percentage contribution.

Upper Reaches

14.4.26 Of the fish species recorded in the upper reaches, a range of marine, freshwater, and diadromous species were reported. The upper reaches were defined as the survey area undertaken upstream of the Tees Barrage (Figure 14B-5). However, the barrage was only used as an indicative reference point, as the surveys undertaken from 1982 to 1990 in the upper reaches took place prior to the construction of the barrage. All TraC surveys in the upper reaches utilised beam trawl netting (2.4 m). The highest fish counts were recorded in 1987 and 1990, with 641 and 796 fish recorded, respectively (Figure 14B-10). In 1987 the catch was dominated by flounder and in 1990 by dace and gudgeon.

14.4.27 Of the fish species recorded in the upper reaches, flounder and dace contributed the most to the overall abundance of fish species, representing 60% and 20%, respectively (Figure 14B-11). Gudgeon, European eel, roach and sprat, contributed a further 9%, 5%, 3% and 2%, respectively, whilst the remaining species combined contributed less than 1% of the total.

14.4.28 The diadromous fish caught were European eel and sea trout, with a total of 156 individuals of European eel caught from 1983 to 1991. Sea trout were reported in 1988 only, with one individual recorded.

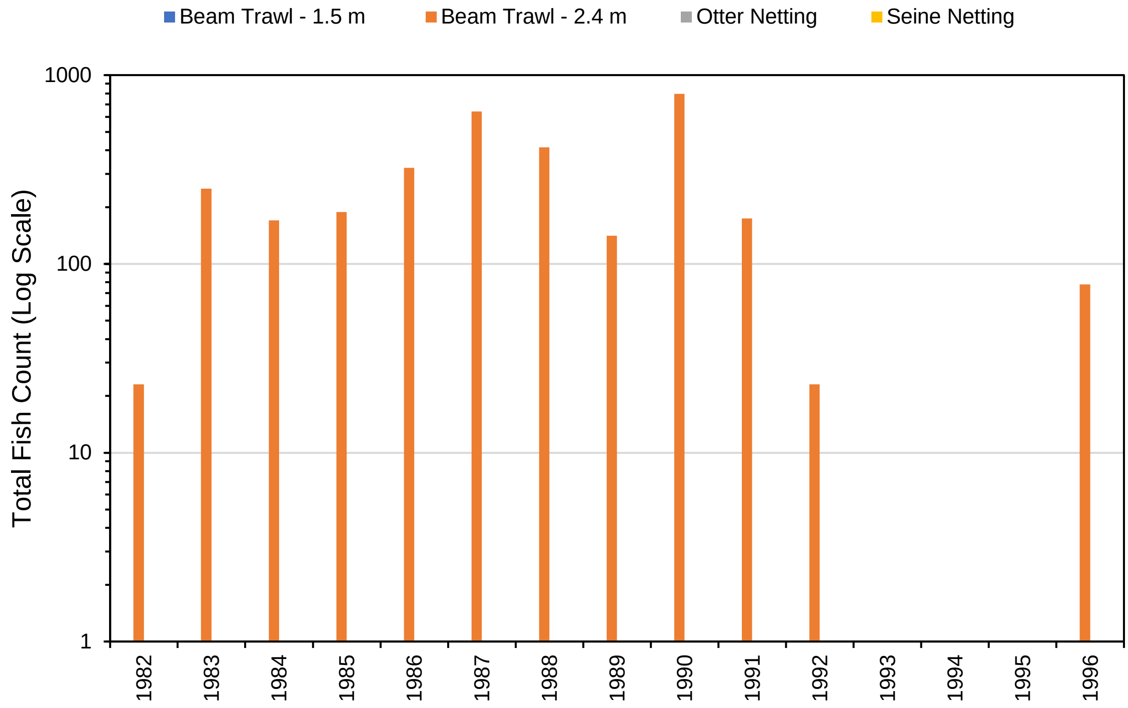


Figure 14B-10: Total fish counts for each gear type used, in Environment Agency (2019a) TraC surveys in the upper reaches of the River Tees.

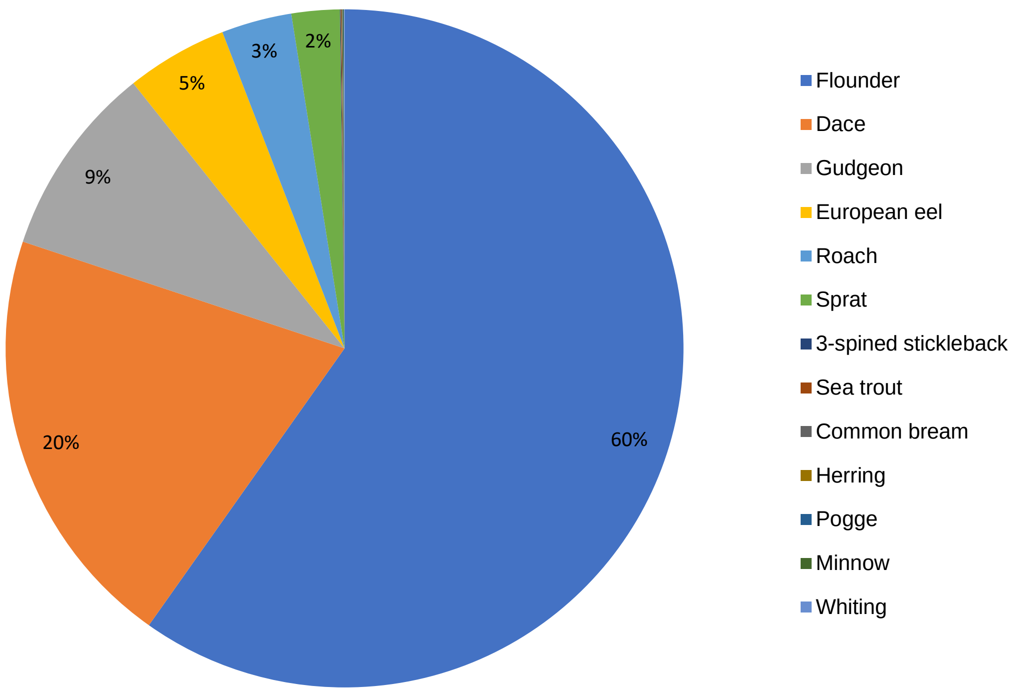


Figure 14B-11: Proportion of fish species from Environment Agency (2019) TraC surveys in the upper reaches of the River Tees (1982 – 1996). Fish species in the legend have been presented in order of percentage contribution.

14.4.29 Additional data from freshwater fish counts from NFPD Environment Agency surveys in the upper reaches of the River Tees and adjoining tributaries, recorded a total of 31,663 individuals of diadromous fish species from 1993 to 2019. Of these, a total of 24,857 individuals were counted from the River Tees and Tees Barrage. Appendix C provides detailed figures showing the spatial distribution of Atlantic salmon, brown / sea trout, European eel and lamprey in the River Tees and connected tributaries.

14.4.30 Lamprey were recorded in the River Tees and River Skerne (a tributary of the River Tees) only and exhibited the smallest spatial distribution of the migratory species identified. The highest abundance of lamprey was recorded near Darlington on the River Tees but they were recorded upstream as far as Staindrop.

14.4.31 European eel had a greater distribution than lamprey, being recorded from the Tees Barrage to as far upstream as Newbiggin. European eel was also recorded on the River Lune and River Skerne, both tributaries of the River Tees. Atlantic salmon had a similar spatial extent to European eel. The highest abundances of this species were found near Eggleston, further upstream than the highest abundances of European eel and lamprey. Atlantic salmon was also recorded on the following River Tees tributaries: Egglestone Beck, Ettersgill Beck, River Lune and River Skerne. Brown / sea trout had the greatest spatial distribution of all diadromous fish species, with the highest concentrations of individuals recorded near Middleton-in-

Teesdale. In addition to the tributaries where Atlantic salmon were recorded, brown / sea trout were also present in Harwood Beck and Hudeshope Beck.

14.5 Commercial Fisheries

14.5.1 Commercial fisheries data provides valuable information on the economic and social importance of fish stocks and whilst recognising its limitations with respect to potential bias in activities and reporting, can also be used to infer the distribution and abundance of commercial species, supplementing the fish and shellfish community baseline.

14.5.2 The commercial fishing activity of relevance to the Study Area comes from the ICES rectangle 38E8, which encompasses the fish and shellfish baseline Study Area for the Proposed Development. Information on commercial fishing activity in this rectangle has been collated from data reported by the MMO (2018a), as part of the iFISH data system which is a UK repository where commercial fisherman (not just from the UK) are required to report administrative data under EU legislation. The data reported as part of this system gives information on the fishing activity by nationality of the vessels in the selected area, the length group of the vessel, the gear type used, the month and year of fishing and the species-specific landing weight (tonnes) and value (pound sterling). This information has been supplemented by recent Automatic Identification System (AIS) data published by the MMO for UK vessels 15m and over (MMO, 2018b) – for further information see Appendix 20B: Navigational Risk Assessment provided in ES Volume III Appendices (Document Ref. 6.4).

14.5.3 Discussions with the NEIFCA have been undertaken, clarifying that all available data sources have been referenced as part of this baseline study (T. Smith, pers. comms., 2021). This discussion highlighted that the resolution for commercial fishing activity, for vessels under 10 m, was limited to the ICES rectangle 38E8. However, comment was provided on fishing activity in the Tees Bay, stating that limited potting and trapping was likely to take place, with very small numbers of local fishing vessels (under 10 m) utilising this area.

Vessel Nationalities

14.5.4 Table 14B-4 gives an indication of the nationality of the vessels fishing in ICES rectangle 38E8 and the landing weight recorded per annum for vessels registered in the United Kingdom (UK)[2]. The highest average landed weight (1,018 tonnes) was made by English vessels. Vessels from Scotland and Ireland had the second and third highest average landed weight with 85 and 39 tonnes, respectively. Welsh vessels have not reported landings from ICES rectangle 38E8 in recent years (2016 and 2017) with low annual landing weights (<10 tonnes) recorded prior to this.

[2] Foreign nationalities are not required to report landings data via iFISH.

Table 14B-4: Nationalities of vessels fishing in the ICES rectangle 38E8 and the weight (tonnes) of their annual landings (tonnes) (2013 – 2017).

Vessel Nationality	Landed weight (tonnes)					
	2013	2014	2015	2016	2017	Average (2013 – 2017)
UK – England	1233.7	1043.3	1082.1	1017.4	711.7	1,017.6
UK – Scotland	183.9	84.5	63.9	54.8	35.2	84.5
UK – Northern Ireland	101.9	57.7	21.6	6.5	9.1	39.3
UK – Wales	-	8.0	0.2	-	-	4.1

Source: MMO, 2018a

Fishing Activity

14.5.5 As shown in Appendix 20B provided in ES Volume III, Document Ref. 6.4, the higher densities of vessels are found within the navigational channel in the estuary (see Figure 20B-1 and Figure 20B-2). Areas to the north east also exhibit higher densities as this region represents the primary routes of commercial vessels leaving Teesport. Directly to the east of the estuary mouth and South Gare, vessel densities are much lower as this area is predominately non-navigable for larger vessels. See Appendix 20B provided in ES Volume III, Document Ref. 6.4, for weekly average vessel density values.

14.5.6 There are 24 vessels of 10 m and under and 2 vessels of 10 m and over that are registered with home port status in Hartlepool (MMO, 2021a; MMO, 2021b). Twenty of the 10 m and under vessels hold active shellfish licences; none of the 10 m and over vessels hold shellfish licences. None of the vessels hold scallop licences.

14.5.7 Discussions with NEIFCA highlighted that local fishing vessels would also be docked at Paddy's Hole, South Gare and along the Redcar Promenade, Coatham (Smith, pers. comms., 2021). Overall, there were 28 vessels of 10 m and under registered with home port status in Redcar, all of which hold shellfish licences but not scallop licences (MMO, 2021a). No vessels 10 m and over were registered with home port status in Redcar (MMO, 2021b).

14.5.8 Figure 14B-12 shows the extent of fishing activity (recorded as landed weight in tonnes) by fishing method in the ICES rectangle 38E8 for the most recent five-year period (2013 to 2017). The fishing methods identified as being used are:

- beam trawling;
- demersal otter trawling and seine netting;
- scallop dredging;
- drift and fixed netting;
- gear using hooks; and
- potting and trapping.

14.5.9 The MMO statistics showed that demersal otter trawling and seine netting were the most prevalent fishing methods operating in the ICES rectangle

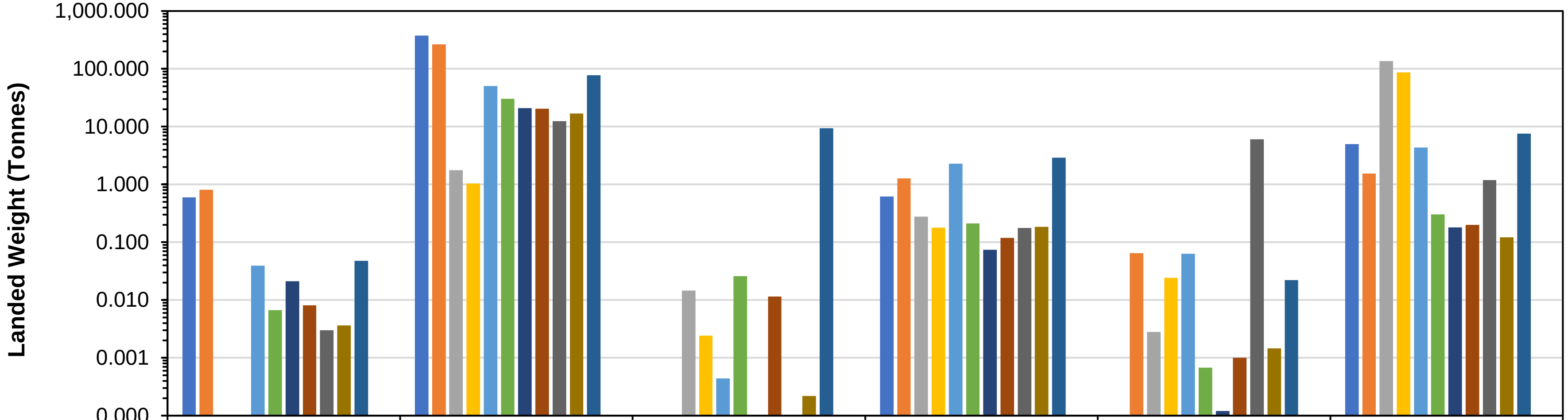
38E8. From 2013 to 2017 a total of 4,369 tonnes of fish and shellfish were landed using these methods. *Nephrops* and whiting were the most targeted species, with an average landed weight of 377 tonnes and 265 tonnes, respectively. Cod, plaice, haddock and lemon sole also represented an important component of total landings by otter trawling and seine netting, representing a combined average weight of 122 tonnes.

14.5.10 The second most common fishing method used within the ICES rectangle 38E8 is potting and trapping with a total landed weight of 1,219 tonnes reported from 2013 to 2017. This method is predominately used to target lobsters and edible crabs, with an average weight of 87 tonnes and 136 tonnes landed between 2013 and 2017, respectively. In addition, but to a lesser extent, velvet swimming crab, *nephrops* and cod contributed to the total landed weight reported for potting and trapping.

14.5.11 Beam trawling, scallop dredging, drift and fixed netting, and gear using hooks, only represented a combined total of 2% of landed weight (tonnes) reported in the MMO statistics for the ICES rectangle 38E8 (2013 – 2017). Scallops comprised 88% of the total landed weight recorded for the scallop dredging fishing method, whilst mackerel dominated the reported fish catch for vessels utilising gear using hooks, representing 97% of the total landed weight. The fish and shellfish species typically targeted by drift and fixed netting were whiting and cod.

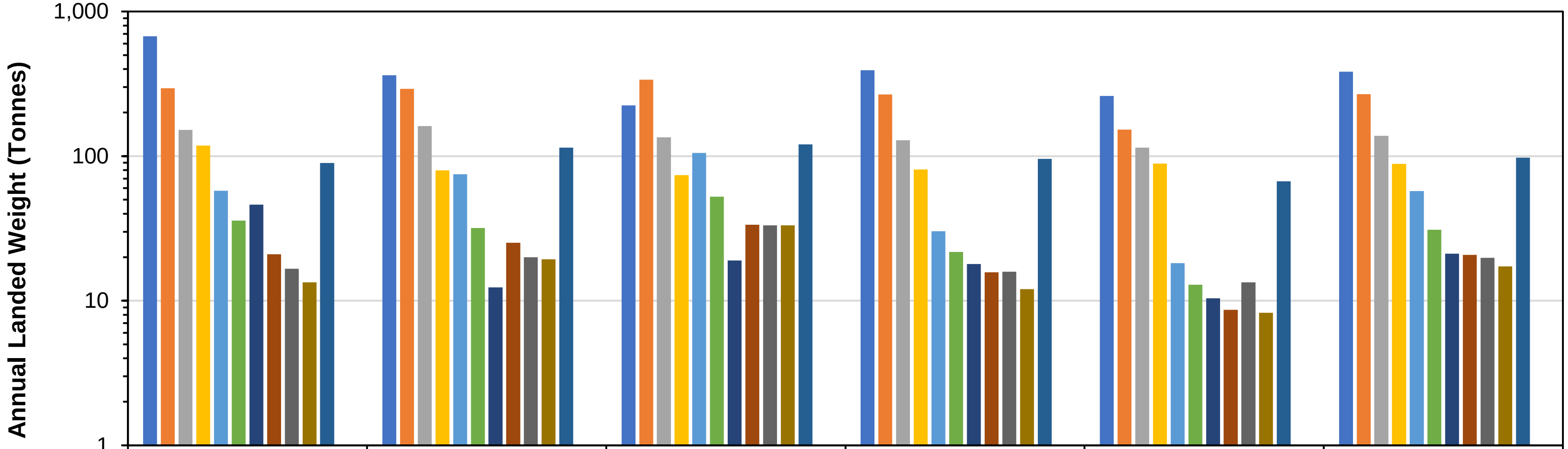
14.5.12 Figure 14B-13 shows the annual variation in the fish and shellfish species landed weights (tonnes) from reported landings data in the ICES rectangle 38E8. In general, the total landed weights per year have remained similar, with a slight overall decline in 2017.

14.5.13 The species composition of the total landed weights across years was dominated by *nephrops*, with an average of 383 tonnes (2013 – 2017). This is with the exception of 2015, where whiting represented the highest total landed weight. In general, abundances were similar between years with only small variations for each species. *Nephrops,* whiting and edible crabs always represented the top three landed weights.



	Beam trawl	Demersal trawl/seine	Dredge	Drift and fixed nets	Gears using hooks	Pots and traps
Nephrops (Norway Lobster)	0.599	376.958	0.000	0.616	0.000	4.999
Whiting	0.806	264.826	0.000	1.266	0.064	1.538
Crabs (C.P.Mixed Sexes)	0.000	1.765	0.015	0.279	0.003	136.081
Lobsters	0.000	1.038	0.002	0.178	0.024	87.203
Cod	0.039	50.525	0.000	2.291	0.063	4.371
Plaice	0.007	30.415	0.026	0.212	0.001	0.304
Haddock	0.021	20.917	0.000	0.074	0.000	0.181
Lemon Sole	0.008	20.467	0.011	0.119	0.001	0.199
Mackerel	0.003	12.407	0.000	0.177	6.054	1.185
Monks or Anglers	0.004	16.943	0.000	0.185	0.001	0.121
Other	0.048	77.553	9.367	2.913	0.022	7.581
Total	1.535	873.812	9.422	8.311	6.234	243.762

Figure 14B-12: Average landed weight (tonnes) (2013 – 2017) recorded in the ICES rectangle 38E8 for each gear category used. Fishing activity data taken from iFISH data system, as reported by the MMO (2018a).



	2013	2014	2015	2016	2017	Average (2013 - 2017)
Nephrops (Norway Lobster)	674.6	362.1	224.5	393.4	261.3	383.2
Whiting	294.0	292.0	337.4	266.4	152.7	268.5
Crabs (C.P.Mixed Sexes)	151.9	161.2	134.7	128.5	114.4	138.1
Lobsters	118.5	79.9	74.0	81.0	88.8	88.4
Cod	57.7	75.0	105.3	30.3	18.2	57.3
Plaice	35.8	31.9	52.5	21.7	12.9	31.0
Haddock	46.2	12.4	19.0	17.9	10.4	21.2
Lemon Sole	20.9	25.2	33.5	15.7	8.6	20.8
Mackerel	16.6	20.0	33.2	15.9	13.4	19.8
Monks or Anglers	13.4	19.3	33.2	12.1	8.3	17.3
Other	89.8	114.3	120.4	95.9	66.9	97.5
Total	1,519	1,193	1,168	1,079	756	1,143

Figure 14B-13: Annual landed weight (tonnes) (2013 – 2017) recorded in the ICES rectangle 38E8. Fishing activity data taken from IFISH data system, as reported by the MMO (2018a).

Vessel Size

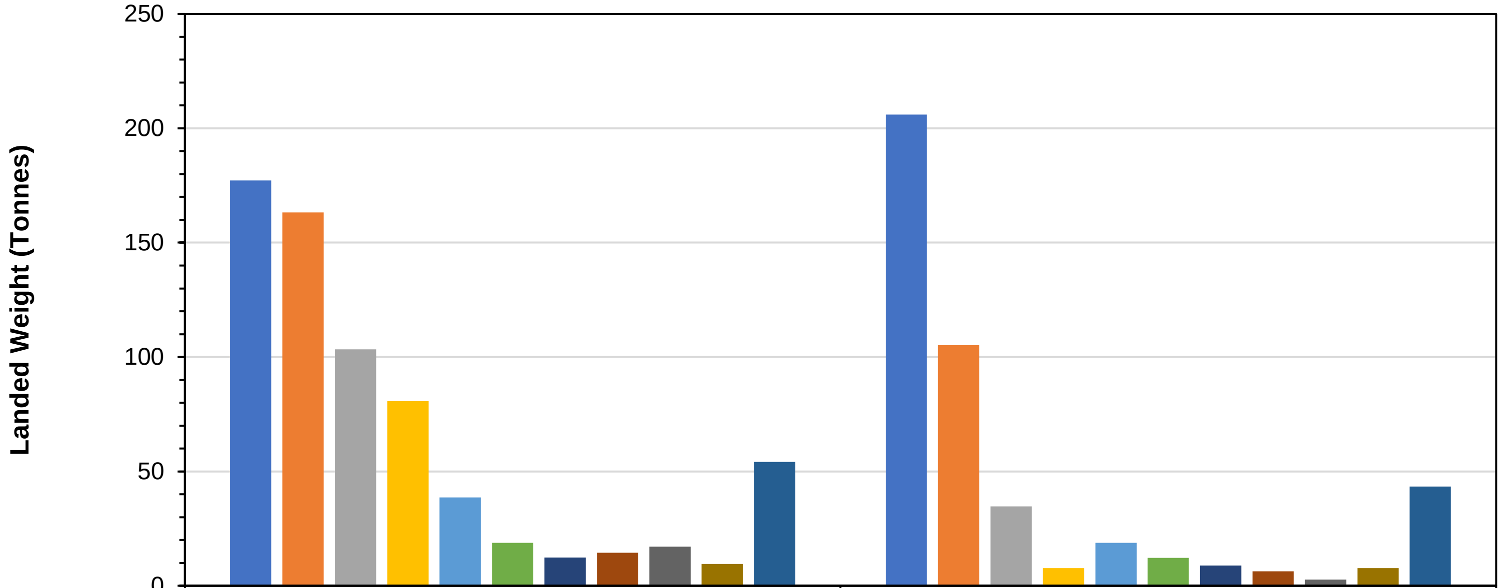
14.5.14 Table 14B-5 shows the differences in annual landed weight (tonnes) between the different vessel sizes that fish in the ICES rectangle 38E8. The vessel sizes reported are 10 m and under, and over 10 m, with similar species contributing to the overall landed weight reported from 2013 to 2017. The average landed weight reported by vessels over 10 m is dominated by *nephrops* and whiting, with an annual average of 206 tonnes and 105 tonnes, respectively. The remaining species such as edible crabs, cod and plaice also contributed to the overall landed weight, but to a lesser extent (31%). For vessels registered as 10 m and under, although the catch was still dominated by *nephrops* and whiting (177 tonnes and 163 tonnes, respectively), other species had a greater contribution to the total landed weight. For example, edible crabs, lobsters and cod contributed 15%, 12%, and 6% to the total landed weights, respectively.

14.5.15 Differences in the composition of catches landed by the two vessel sizes can be accounted for by the different gear types utilised, as shown in Figure 14B-14. For example, the 10 m and under fleet carries out a larger amount of potting and trapping which targets edible crab and lobster. In contrast, the over 10 m fleet carries out more beam trawling and dredging, targeting whiting and scallops. However, demersal trawling and seine netting remains the dominant fishing technique for all vessels and therefore accounts for the overall dominance of *nephrops* and whiting for both sized fleets.

Table 14B-5: Length categories of vessels fishing in the ICES rectangle 38E8 and their average landed weight (tonnes) per year (2013 – 2017) for each gear type used.

Gear Type	10 m and Under	Over 10 m
Beam trawl	0.0	1.5
Demersal trawl/seine netting	475.8	398.0
Dredge	1.0	8.4
Drift and fixed netting	5.7	2.6
Gear using hooks	5.8	0.4
Pots and traps	201.1	42.7

Source: MMO, 2018a



	10m & Under	Over 10m
Nephrops (Norway Lobster)	177.2	206.0
Whiting	163.3	105.2
Crabs (C.P.Mixed Sexes)	103.4	34.8
Lobsters	80.8	7.7
Cod	38.6	18.7
Plaice	18.8	12.1
Haddock	12.4	8.8
Lemon Sole	14.5	6.3
Mackerel	17.1	2.7
Monks or Anglers	9.5	7.7
Other	54.1	43.4

Figure 14B-14: Average landed weight (tonnes) (2013 – 2017) recorded in the ICES rectangle 38E8 for each vessel length category. Fishing activity data taken from IFISH data system, as reported by the MMO (2018a).

14.6 Species-Specific Information

Migratory Species

14.6.1 Diadromous species migrate between bodies of freshwater and seawater during different life phases. Major physiological changes associated with these movements occur in order to adapt to altered salinity and during such periods, sensitivity to environmental stressors increases (Shrimpton, 2012). Many migratory species, such as European eel, are also susceptible to being drawn into water intakes and outfalls as they move through estuaries and rivers (Sheridan *et al.,* 2013). Owing to their conservation importance (see Table 14B-2), it is necessary to understand the migration patterns of the diadromous species known, or likely, to be present within the Study Area.

Salmon and Sea Trout

14.6.2 Historically, the River Tees has been subjected to serious pollution from urbanisation and industrial development, principally in the estuary and lower reaches (Moore and Potter, 2014). Since the latter part of the 20th century it has been a river in recovery, supporting a small but increasing salmon and sea trout in-river rod fishery (Environment Agency, 2009). The salmon population in the Tees has increased in the period 2004 and 2013, though numbers have become more variable. This followed a period of relatively stable abundance seen between 1995, when counts of salmon entering the Tees began, and 2003 (Moore and Potter, 2014).

14.6.3 Salmon are an anadromous[3] migratory species, which during their lifetime utilises both marine and freshwater habitats. Spawning of salmon typically occurs in November or December, in the upper reaches of rivers where females deposit eggs into nests known as 'redds' which are cut into gravelly substrate (Heessen *et al.,* 2015; NASCO, 2012). In the River Tees, the greatest numbers of redds are located upstream of Eggleston, with a relatively high density between Stapleton and Whorlton (Environment Agency, 2009). Once the eggs hatch, the resultant larvae known as 'alevins' remain within the interstitial gravels, utilising nutrients from the yolk sac (Heessen *et al.,* 2015). The larvae then develop into fry which prey on invertebrates, and then a 'parr', a young salmon distinguished by dark rounded patches evenly spaced along its sides. The length of time of the transition between life stages is geographically variable. Typically, the transition from larvae to parr occurs in the first summer in southern streams (Potter and Dare, 2003) or up to a year in upland systems. Following the parr life stage, salmon physically and morphologically change into the next life stage, known as a 'smolt' (McCormick *et al.,* 1998). This is preceding migration to the ocean following one to five years in freshwater. The migration of smolt down-river to the ocean usually occurs from spring to early summer, generally occurring earlier in the season for larger smolt (Thorstad *et al.*, 2012; Heessen *et al.,* 2015). Once salmon have spent another one to five years at sea, the adults then return to their spawning rivers, which in the UK usually peaks in June to August and October to December (Cowx and Fraser, 2003).

[3] Migration from the sea into freshwater for spawning

14.6.4 Brown trout display a broad range of life history traits, including individuals that complete their lifecycle in freshwater, those that predominately inhabit estuarine waters and exhibit full anadromy (Harris *et al*., 2017). Sea trout are therefore anadromous brown trout (*Salmo trutta*), the migratory and non-migratory forms are considered as a single species. Migration of brown trout is known to involve genetic and environmental cues, although the full trigger is not completely understood (Malcolm *et al.,* 2010). Sea trout exhibit a similar life cycle to Atlantic salmon. However, the adult marine stage of sea trout is shortened both spatially and temporally, with some immature smolt, sometimes known as 'whitling', migrating back to freshwater environments after only a very short period of time feeding at sea (usually in the first winter in the ocean), whilst 'maidens' only return to freshwater after a minimum of a year at sea (Gargan *et al.,* 2004). Heessen et al. (2015) has reported that the length of the adult marine stage of sea trout is dependent on the season in which they moved out to sea and is highly variable, ranging from one month to three years. Adult sea trout returning to freshwater to spawn are more likely to stray from natal rivers (Degerman *et al*., 2012; Gauld *et al*., 2013; King *et al*., 2016) as well as spawn over multiple years when compared to salmon. Similar to salmon, spawning usually takes place in autumn or winter, on stone and gravel bottoms (Heessen *et al.,* 2015). Salmonids that migrate downstream towards salt water post spawning, referred to as 'kelts', and return to freshwater to reproduce in subsequent years are likely to have increased fecundity, resulting in larger egg deposits and improved survival of offspring (Reid *et al*., 2012).

14.6.5 In England and Wales there are 80 rivers which regularly support salmon, 64 of which are designated 'principal salmon rivers', as shown in Figure 14B-15Figure 14B-15: Main salmon rivers in England and Wales, denoting those with Salmon Action Plans (*) and those designated as Special Areas of Conservation ($) in which salmon must be maintained or restored to favourable conservation status (CEFAS *et al*., 2019).. The performance of salmon stocks in these rivers is assessed against conservation limits (CL) which are identified by a target number of eggs deposited during spawning to ensure the status of the population remains favourable (CEFAS *et al*., 2019).

14.6.6 The River Tees is included in the list of 'principal salmon rivers' and has its own 'Salmon Action Plan' (Environment Agency, 2009). The River Tees has been subject to historic pollution and is therefore recovering but supports a small rod river fishery although this has declined in recent years (Environment Agency, 2017). The River Tees is not achieving its current CL which has been identified as 14.9 million eggs. Whilst this is expected for a river in the recovery phase, it is projected that in 2021, the Tees will remain at risk of not complying with management objectives for salmon as reported by ICES (Environment Agency, 2018).

14.6.7 Fish monitoring surveys of salmon and sea trout, undertaken by Moore and Potter (2014), were conducted in 2008, 2009 and 2013, using acoustic telemetry to track the movements of fish. In total, 237 fish (199 salmon and 38 sea trout) were tagged with acoustic transmitters and released below the River Tees Barrage, into the lower estuary. Of these fish, 11 individuals passed through the barrage moving mainly over the barrage gates (10 fish) but also utilising the fish pass (one fish). The remaining fish either left the estuary, migrated to adjacent river systems, or were eaten by seals.

14.6.8 The Environment Agency have reported monthly numbers of salmon and sea trout utilising the fish pass at the Tees Barrage since 1995; however, in 2011 the existing fish trap was changed to an electronic fish-counter to employ a non-invasive counting method (Environment Agency, 2013). It must be noted that the counter only monitors the upstream migration of salmon and sea trout through the fish pass and therefore only represents a proportion of the run, with available alternative passage through the main barrage gates, canoe slalom, turbine fish pass and navigation lock (Environment Agency, 2021). Furthermore, to help fish migrate, the Environment Agency and the Canal and River Trust keep the main barrage gates open as much as possible, in doing so reducing the numbers that utilise the fish passage.

14.6.9 The results of the monthly upstream fish count from 2011 to 2020 are presented in Figure 14B-16. In total, 5,563 salmon and sea trout were recorded with higher numbers occurring in June to October. Typically, peak numbers of fish were recorded in either July and August and once in September (2015). Taking an average across all years between 2011 and 2020 the peak value occurred in August (mean = 180.2; std. = 219.5). Particularly high numbers of salmon and sea trout were reported in 2012 (1,661 individuals) and 2013 (1,161 individuals) however, in recent years numbers have declined with lower annual total abundances reported in 2017 (297 individuals), 2018 (217 individuals), 2019 (204 individuals), and 2020 (328 individuals).

14.6.10 Data collected from 1995 to 2011 by the Environment Agency at the Tees Barrage (presented in Figure 14B-17 and Figure 14B-18 (Environment Agency, 2013)), shows that mean counts of upstream migrating salmon at the Tees Barrage, peak in September and October, with mean values reported as 50.8 (std. = 54.6) and 58.6 (std. = 49.4), respectively. In comparison, peak mean sea trout counts were similar, occurring marginally later, in October, with a mean value of 119.4 (std. = 135.5).

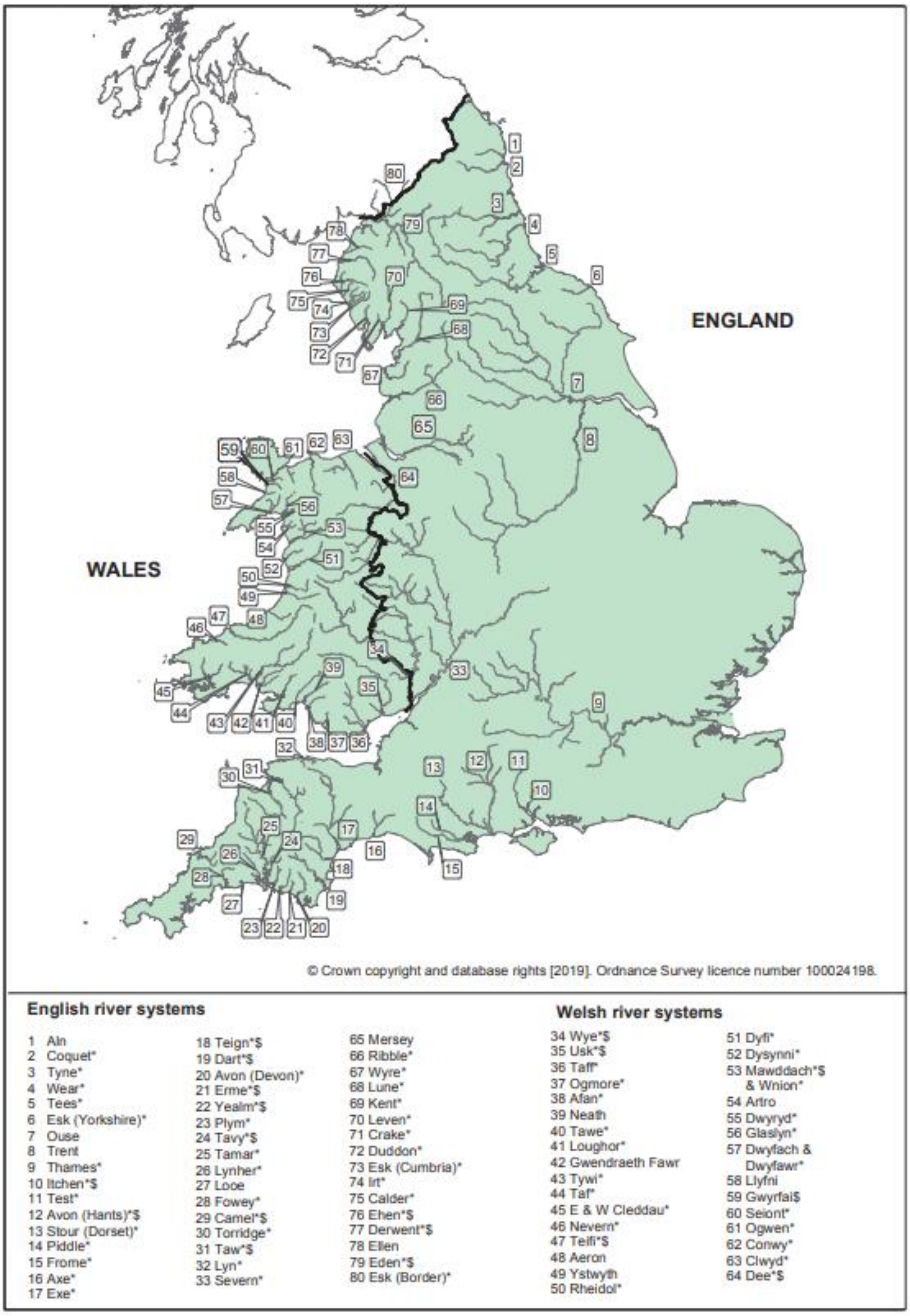


Figure 14B-15: Main salmon rivers in England and Wales, denoting those with Salmon Action Plans (*) and those designated as Special Areas of Conservation ($) in which salmon must be maintained or restored to favourable conservation status (CEFAS *et al*., 2019).

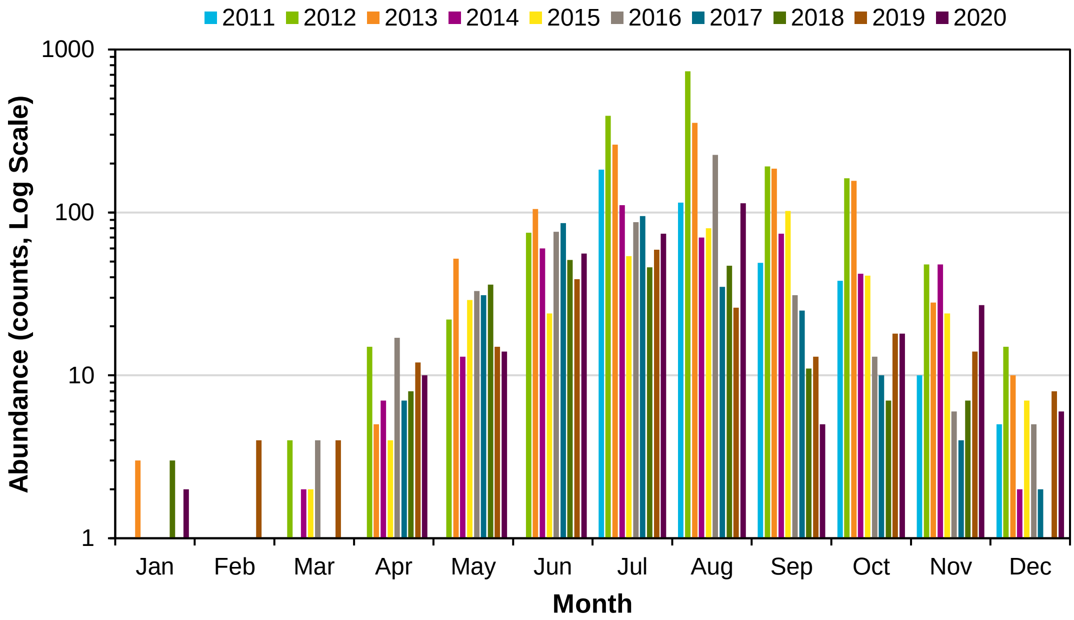


Figure 14B-16: Monthly combined upstream counts for salmon and sea trout from 2011 to 2020 at the Tees Barrage on the lower Tees, reported by the Environment Agency (Environment Agency, 2021). Counter only monitors upstream migration through the fish pass. No data was reported for January to June 2011.

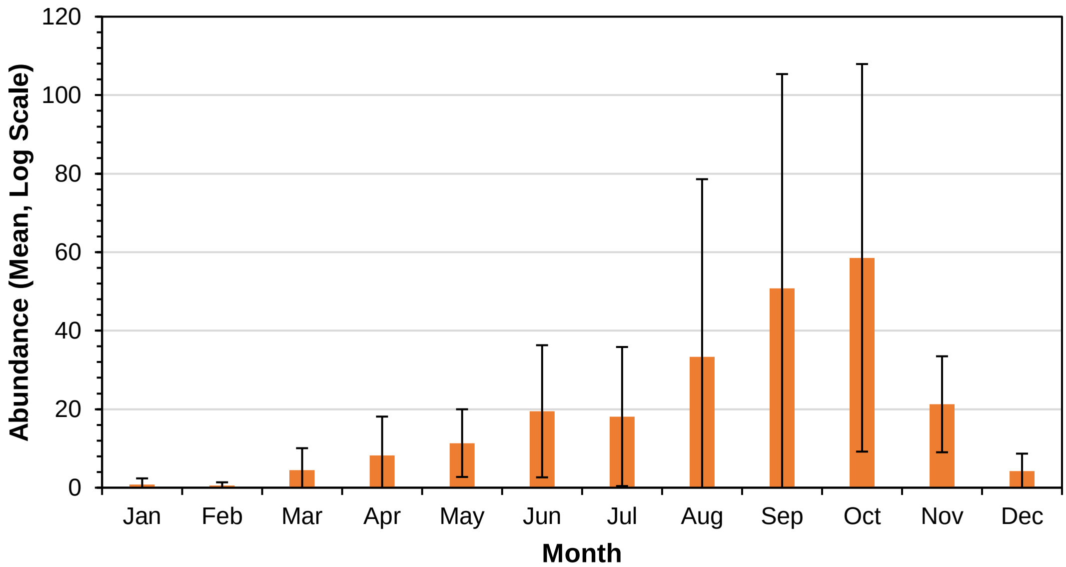


Figure 14B-17: Monthly mean upstream counts for salmon from 1995 to 2011 at the Tees Barrage on the lower Tees, reported by the Environment Agency (Environment Agency, 2013). Fish trap counts only refer to upstream migration through the fish pass. Error bars refer to standard deviation. No data was reported for January to April 1995 and July to December 2011.

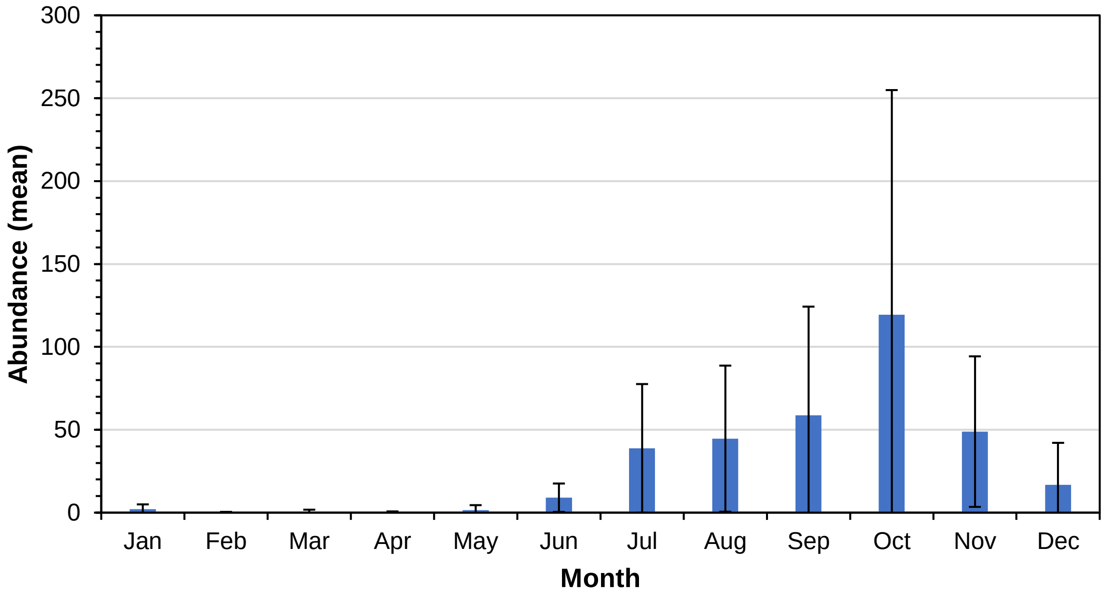


Figure 14B-18: Monthly mean upstream counts for sea trout from 1995 to 2011 at the Tees Barrage on the lower Tees, reported by the Environment Agency (Environment Agency, 2013). Fish trap counts only refer to upstream migration through the fish pass. Error bars refer to standard deviation. No data was reported for January to April 1995 and July to December 2011.

14.6.11 The declared rod catches for salmon and sea trout in the River Tees from 2007 to 2017 are presented in Figure 14B-19, showing that for both species there has been a general decline in overall rod catches in recent years. This is likely due to actions taken by the Environment Agency and Defra to reduce the overall exploitation of salmon and sea trout in England and Wales, such as catch and release measures (such as: restrictions on night fishing; size limits, for trout only; and bag limits, for trout only) (Environment Agency, 2017). Salmon rod catches in this period were highest in 2008 with 267 fish, which declined to 2014 when only 16 fish were declared. There has been a general increase since 2014 to 2017, when 67 salmon were caught. Sea trout in contrast, peaked in 2014, with 114 fish catches declared. Total sea trout rod catches then declined in 2015 where there was a three year low in total catches, ranging from 11 to 13 fish. It must be noted that data from the rod and line fishery does not necessarily reflect abundance as it is not corrected for other variables, such as effort. In addition, some migration occurs outside of the angling season. However, this data is useful for a general indication of historical trends.

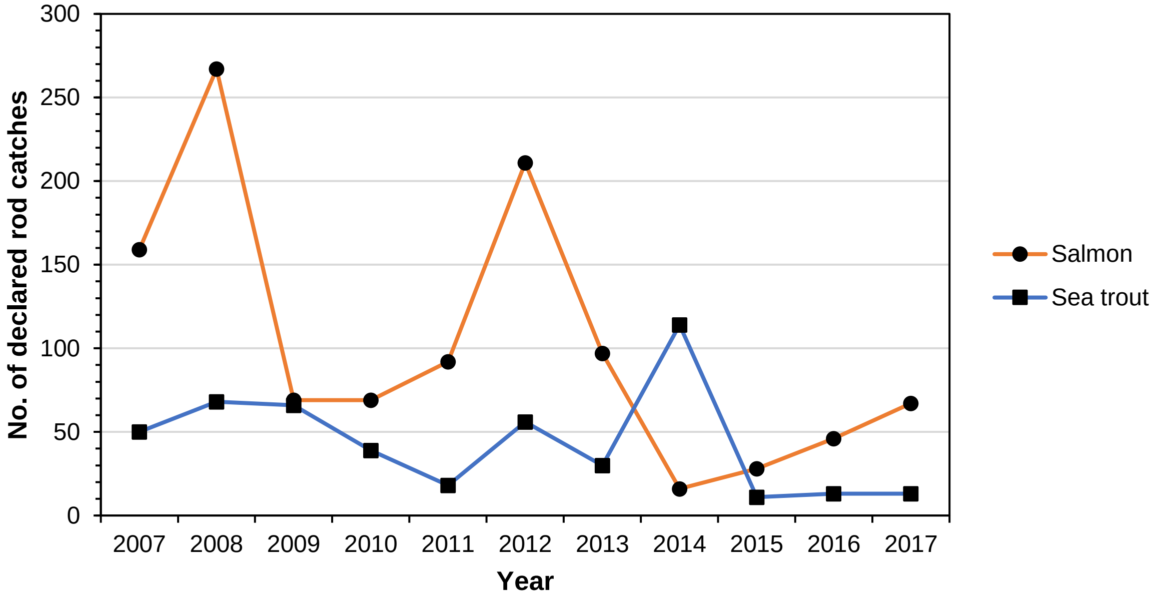


Figure 14B-19: Summary of salmon and sea trout rod catches from the river Tees that were declared from 2007 to 2017, as reported by the Environment Agency (2017).

14.6.12 Only one individual of salmon was recorded in Environment Agency TraC surveys in the River Tees, being captured in 1998 in the middle reaches of the river. Nine individual sea trout were recorded in the TraC surveys, being recorded mainly in the last 10 years (six individuals) in both the lower and middle reaches of the river. One individual was recorded in the upper reaches in 1998. On average sea trout individuals measured 320 mm (n = 8), with the smallest measuring 87 mm (2011), whilst the largest measured 635 mm (2004).

European Eel

14.6.13 European eel is a catadromous migratory species, whose spawning occurs in the Sargasso Sea where the adults subsequently die. The newly hatched larvae, known as leptocephali, are transported to the continental shelf of the North Atlantic by the prevailing currents of the Gulf Stream, where they metamorphose into the life stage of glass eel and subsequently, in freshwater and coastal waters become pigmented ‘elvers’ (Aerestrup *et al.,* 2009; Potter and Dare, 2003). Glass eels travel across shelf seas, using tidal stream transport, rising in the water column when the tide travels inwards, and settling to the bottom as the tide returns seawards (Creutzberg, 1961 McCleave and Kleckner, 1982; cited in Heessen *et al.,* 2015). Eels migrate upstream into freshwater predominately during spring but may continue to do so until early Autumn (Heessen *et al.,* 2015; ICES, 2010). Once within freshwater habitats, eels remain for five to 15 years, transforming into yellow eels and then finally to silver eels when they begin their downstream migration through rivers and estuaries towards spawning grounds, predominately between August and December (Behrmann-Godel and Eckmann, 2003; Tesch, 2003; Chadwick *et al.,* 2007). Spawning occurs mainly in spring (Righton *et al.,* 2016). However, it must be noted that some eels do not migrate into freshwater but instead inhabit estuaries as 'elvers' and yellow eels before returning to spawning grounds.

14.6.14 Throughout England, European eels are present in almost all rivers, although in recent years their numbers have dramatically declined. This has resulted in European eels being listed as 'critically endangered' on the IUCN Red List since 2008. There are multiple reasons for the decline of European eel numbers, including barriers to migration, hydropower turbines, loss of wetland, and the introduction of the parasitic nematode *Anguillicola crassus* (UK BAP, 2012). The River Tees Barrage has the potential to act as a barrier but has built opportunities for the migration of glass eels into its design, although the escapement of adult silver eels around the barrage is unknown.

14.6.15 The current population size and distribution of European eels in the River Tees is unknown. However, European eel have been reported in Environment Agency TraC surveys in the River Tees (see Figure 14B-20), with a total of 178 individuals found in total across all surveys. The majority of European eel were recorded in the upper reaches of the River Tees. Only three individuals of European eel were recorded in TraC surveys in the River Tees, exhibiting a total length of 280 mm (2008), 282 mm (2008), and 625 mm (2004). These fish were all recorded in the lower reaches of the River Tees.

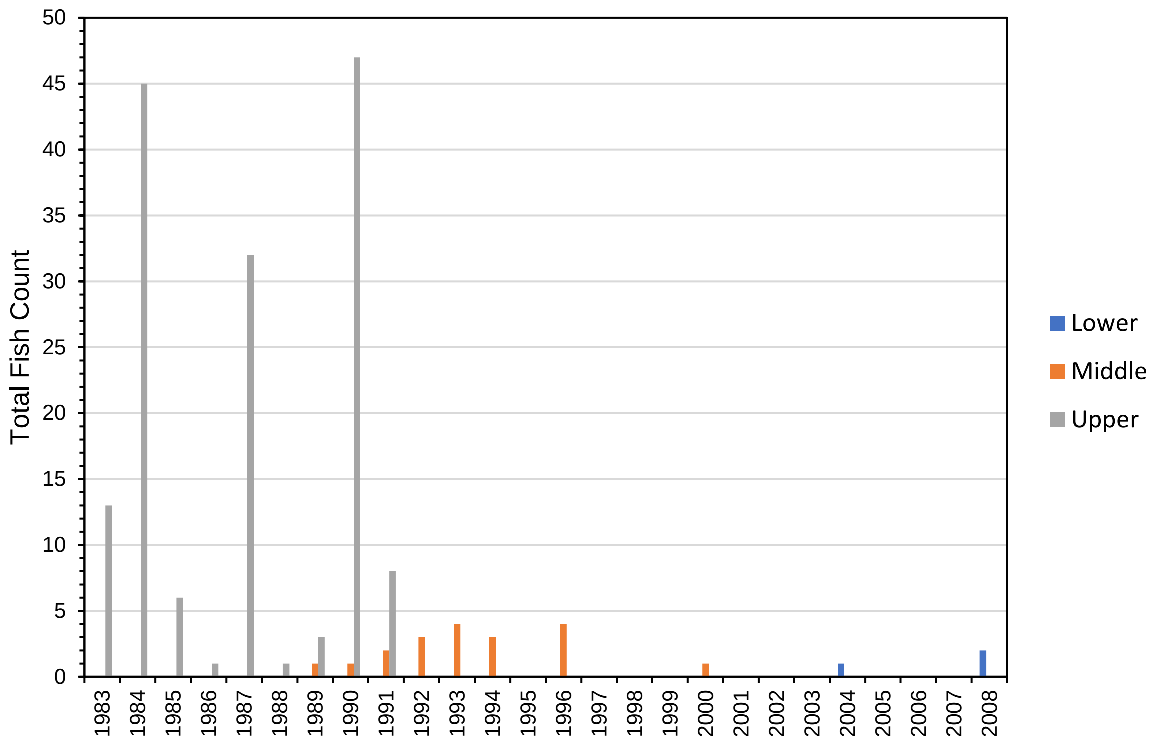


Figure 14B-20: Total fish counts for European eel (*Anguilla anguilla*), in Environment Agency (2019a) TraC surveys in the three reaches of the River Tees.

Sea and River Lamprey

14.6.16 Sea lamprey and river lamprey are both anadromous migratory species. Both species spawn in spring and early summer in freshwater, followed by the ammocoetes life stage (larval phase) which is spent in the silt beds of streams and rivers (Laughton and Burns, 2003). Following spawning, all adult individuals die (Maitland, 2003). In the ammocoetes phase, lamprey feed on organic detritus and can spend several years in this life stage, eventually transforming into the adult life stage in late summer and onwards (Laughton and Burns, 2003). Once an adult, both river and sea lamprey migrate out to sea where they become parasitic, using their suckers to attach onto host fish and feed on their blood (Maitland, 2003). The adults then return to freshwater once they have spent several years in the marine environment (Laughton and Burns, 2003).

14.6.17 Sea lamprey is widely dispersed in the open sea as they are solitary feeders, being rarely found in coastal and estuarine waters (Moore *et al.,* 2003; Heessen *et al.,* 2015). The distribution of sea lamprey is chiefly defined by their host (Waldman *et al.,* 2008) and they are often found at considerable depths in deeper offshore waters (Moore *et al.,* 2003). When returning to freshwater, sea lamprey generally choose larger rivers compared to river lamprey, although they can be found in tributaries of all sizes (Heessen *et al.,* 2015).

14.6.18 Sea lamprey typically feed on the blood of a range of marine mammals and fish, which include, herring, cod, pollack, Atlantic salmon, haddock, shad, and basking sharks (Kelly and King 2001, ter Hofstede *et al*., 2008). In contrast, river lampreys are usually found in coastal water, estuaries and accessible rivers and young river lamprey are often found in large congregations (Maitland *et al.,* 2003). River lamprey feed on a variety of estuarine fish, predominantly herring, sprat and flounder. River lamprey generally spend one to two years in estuaries and in the autumn, between October and December, stop feeding and move upstream (Natural England, 2010). Sea lamprey normally migrate into freshwater in April and May as adults, whilst the migration to sea can vary from river to river, although the metamorphosis of larvae into adults, occurs in July and September (Maitland, 2003).

14.6.19 The UK distribution of river lamprey and sea lamprey, presented in Figure 14B-21, shows that both species have been recorded in the River Tees. River lamprey were also recorded in Environment Agency TraC surveys of the River Tees, with three individuals being recorded in the middle reaches in 1992. Although Figure 14B-21 suggests sea lamprey are present in the River Tees, this species has not been recorded during the Environment Agency TraC surveys to date.

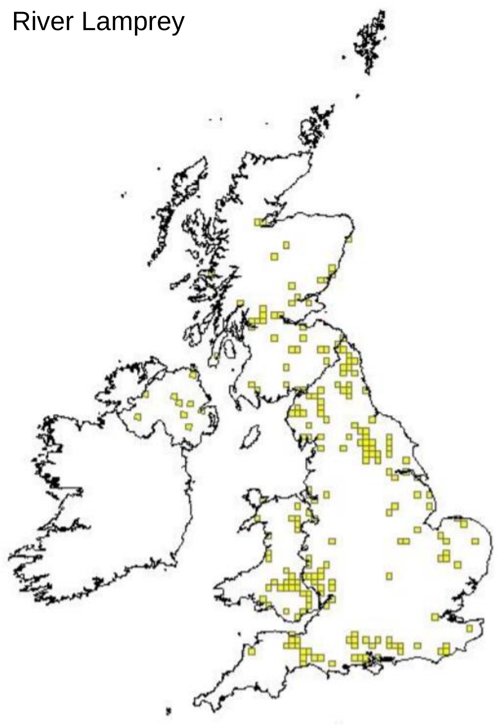


Figure 14B-21: UK Distribution of River Lamprey (left) and Sea Lamprey (right) (JNCC, 2013a and 2013b).

Pelagic Fish Species

Herring

14.6.20 Herring is an important commercial species and represents a significant prey species for many predators, including large gadoids (such as cod), dogfish, sharks, marine mammals and birds (ICES, 2006a). Herring is a pelagic fish and is found mostly in continental shelf areas to depths of 200 m (Whitehead, 1986). Juveniles are generally distributed separately from adults, being found in shallower water, migrating into deeper waters to join the adult stock after two years. In the North Sea 1-group herring are restricted within the 100 m depth contour and are most abundant in the south east, Kattegat and along the British east coast (ICES, 2006a).

14.6.21 Herring exhibits multiple geographically distinct stocks in UK waters (Tappin *et al.,* 2011), with three major populations which are identified with different spawning times. The major population associated with the Study Area is the Banks population which is located in the Central North Sea and off the English coast, with spawning occurring from August to October (Ellis *et al*., 2012). Herring are demersal spawners, which means when spawning occurs, large numbers of eggs are released (~50,000 per female) near the seafloor, which sink and attach to gravel, stones and shell where they form a dense mat. Herring spawning takes place in areas of well-mixed waters in open seas, coastal waters, and embayments (Heessen *et al.,* 2015) Herring are considered to be synchronous single-batch spawners and spawning can occur in episodes which are weeks apart (Heessen *et al.,* 2015; Dempsey and Bamber, 1983). Once developed into juvenile fish, herring aggregate into shoals which migrate into estuaries and shallow waters where they remain for six months to a year (Dipper, 2001). After their first year, herring move offshore, joining the adult populations as they reach maturity (Heessen *et al.,* 2015). The Study Area is recognised by Ellis *et al*. (2012) as being a high intensity nursery ground for herring.

14.6.22 Herring larvae usually consume copepods and other small planktonic organisms (Daan *et al.,* 1985), whilst juveniles will predominantly feed on calanoid copepods (Blaxter and Hunter, 1982) as well as euphausids, hyperiid amphipods, juvenile sandeels, *Oikopleura* spp., and fish eggs (Last, 1989). Larger adult herring consume predominantly copepods as well as small fish, arrow worms, and ctenophores.

14.6.23 The herring fish stock in the North Sea is caught mainly using beam or pelagic trawls (Cotter *et al.,* 2004) and is used for human consumption or constitutes bycatch from industrial fisheries. In the North Sea, Skagerrak and Kattegrat and eastern English Channel, ICES landings data for herring reported 602,328 tonnes in 2018. Herring did not represent one of the main fish species targeted in the ICES rectangle 38E8, with an average landed weight of only 1.2 tonnes for the period 2013 to 2017 (MMO, 2018a). Herring were chiefly caught using the method of demersal trawling and seine netting from vessels of both size categories (10 m and under and over 10 m).

14.6.24 In Environment Agency TraC surveys in the River Tees, herring was recorded in all reaches of the River Tees, although only one individual was recorded in the upper reaches (caught in 1986). Herring were predominantly found in the past 10 years (largely as a consequence of changes to the monitoring programme) and represented the second highest proportions of fish found in the lower reaches and the fourth highest in the middle reaches, contributing 15% and 13% to the total fish composition, respectively.

14.6.25 The population structure of herring in the North Sea, usually comprises two distinct groups from 90 – 190 mm and 190 – 300 mm (ICES, 2006a). The lengths recorded for herring as part of the TraC surveys in the River Tees are shown in Figure 14B-22, which demonstrated a distinct group of individuals from 55 – 65 mm, representing 1-group fish, which is typical in coastal areas and confirms use of the area as a nursery ground. The overall mean length recorded was 67 mm (± std. = 14 mm), with the majority of individuals measuring between 45 mm and 95 mm. The smallest recorded length was 36 mm with one individual recorded in 2013 and one individual recorded in 2004. The largest size capture was an individual measured at 218 mm, which was caught in 2002.

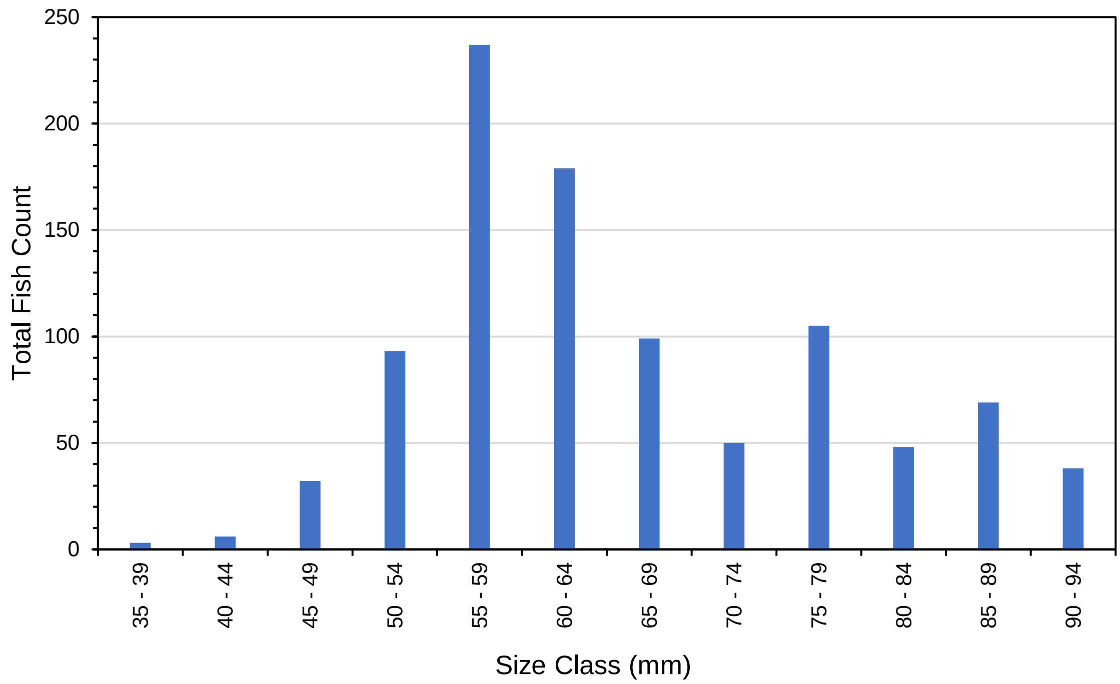


Figure 14B-22: Size classes (mm) (based on total length (mm)) measured for herring (*Clupea harengus*) in Environment Agency (2019a) TraC surveys in the River Tees. Data has been presented for the first 95% of fish counts.

Sprat

14.6.26 Sprat is a short-lived, small-bodied pelagic schooling species that is relatively abundant in shallow waters. Sprat are an important food resource for a number of commercially important predatory fish, seabirds and marine mammals. Sprat themselves primarily feed on copepods, cladocerans, sea-squirts, bivalve larvae, mysids and euphausids (Maes and Ollevier 2002; ICES, 2005).

14.6.27 Spawning of sprat is thought to occur from May to August, peaking in May to June (Coull *et al.,* 1998). Sprat are thought to be intermediate, multiple batch spawners, batches of eggs released repeatedly throughout the spawning period (Heessen *et al.,* 2015; Milligan, 1986). Spawning occurs in coastal waters up to 100 km offshore, and in deep basins (Whitehead, 1986; Nissling *et al.,* 2003). Once released, the eggs and larvae, which are pelagic, move into coastal nursery areas by larval drift (Hinrichsen *et al*., 2005; Nissling *et al*., 2003). Larvae exhibit diel vertical migration in relation to copepod distributions and are most abundant at tidal mixing fronts (Heessen *et al.,* 2015). The Study Area is recognised by Coull *et al*. (1998) as being an important nursery ground for sprat, with spawning grounds located nearby.

14.6.28 Sprat is particularly abundant in shallow areas in the North Sea and is fished commercially, primarily for use in fish meal and as bait (ICES, 2006b). In the central North Sea (ICES Subarea 4b) official landings of sprat in 2018 totalled 179,664 tonnes (ICES, 2019a). However, in the ICES rectangle 38E8, sprat is not an important commercial species, with no reported landed weights of sprat for this area (MMO, 2018a).

14.6.29 In Environment Agency TraC surveys in the River Tees, sprat was recorded in all reaches of the river, with the highest relative abundances being recorded in the lower reaches with 10,593 individuals across all years (1981 – 2018), with a further 7,096 individuals recorded in the middle reaches between 1981 and 2015. In the upper reaches, sprat was recorded in only three years: 1986, 1987, and 1996. In the lower and middle reaches, sprat was recorded as present in all years sampled, excluding 2002, and represented the highest proportions of fish species found, contributing 41% and 31% to the total proportion of fish, respectively.

14.6.30 In the North Sea, landings of sprat are dominated by 0-group, 1-group, and 2-group fish, with lengths ranging from 50 – 100 mm (ICES, 2006b). The lengths recorded for sprat as part of the TraC surveys in the River Tees are shown in Figure 14B-23, with the mean length recorded as 61 mm (± std. = 31 mm), with most individuals measuring between 40 mm and 80 mm. The smallest recorded length was 31 mm (recorded in 2010), whilst the largest size recorded was 136 mm, for which one individual was caught in 2015.

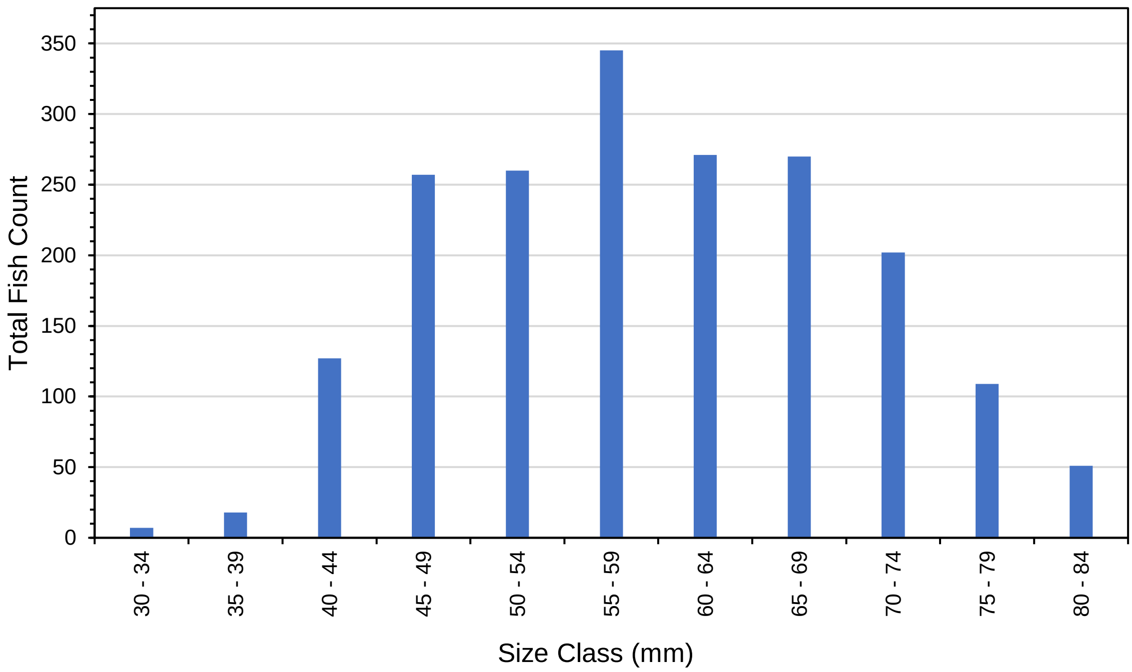


Figure 14B-23: Size classes (mm) (based on total length (mm)) measured for sprat (*Sprattus sprattus*) in Environment Agency (2019a) TraC surveys in the River Tees. Data has been presented for the first 95% of fish counts.

Mackerel

14.6.31 Mackerel is a widely distributed migratory fish in the North Atlantic and is one of the most abundant fish species in this area (ICES, 2011). Mackerel spend their entire life in the pelagic environment and are an important food source for sharks, tuna and dolphins (Tappin *et al.*, 2011). This species is also exploited by commercial fisheries, which in the past has caused the collapse of abundant stocks in the North Sea (ICES, 2006c).

14.6.32 Mackerel in the eastern Atlantic is divided into three spawning components, the North Sea being one of these (ICES, 1999). Mackerel overwinter in deeper waters, which in the North Sea typically occurs in Skagerrak and the north-eastern North Sea (Jansen and Gislason, 2011). They then move closer to the shore in spring when temperatures range between 11°C and 14°C. The main spawning period for mackerel occurs in mid-May to late June, taking place particularly in the central North Sea (Jansen and Gislason, 2011). After this period, mackerel redistribute in the North Sea or migrate into surrounding waters. Mackerel are batch spawners (Murua and Saborido-Rey, 2003), reported as having a fecundity of between 130,00 and 1,100,000 eggs in the North East Atlantic (Macer, 1976). The eggs released are pelagic and predominantly found in the mixed upper layer (typically 0-26 m) (Heessen *et al.,* 2015).

14.6.33 Mackerel feed on zooplankton, in particular large quantities of pelagic crustaceans, and the pelagic larvae and juvenile stages of numerous commercially important fish species (ICES, 2008) which includes smaller fish such as sprat, herring and sandeel (Wheeler, 1978). Feeding patterns of mackerel vary seasonally; during the winter, mackerel spend most of their time on the seabed where they are not active feeders (Heessen *et al.,* 2015).

14.6.34 Mackerel were identified as being an important commercial species in the ICES rectangle 38E8 (see Section 14.5), with average recorded landed weights in this area equating to 20 tonnes per annum (from 2013 – 2017) (MMO, 2018a). They are also of commercial importance for the North Sea (ICES Subarea 4) as a whole, although official landings data of mackerel in the North Sea was unavailable (ICES, 2019b. Only one individual was recorded in the River Tees in Environment Agency TraC surveys, occurring in the lower reaches of the river in 2006 (see NFPD Fish Counts – Environment Agency in section 14.4)).

14.6.35 Mackerel can reach a maximum size of 65 cm, although are rarely found larger than 40 cm (Tappin *et al.,* 2011). The one individual recorded in the River Tees was an adult, measuring 386 mm in total length.

Demersal Fish Species

Cod

14.6.36 Cod is widely distributed throughout the North Sea (Heessen, 1993) and is found in shallow coastal waters to the shelf edge (200 m depth). Juveniles prefer shallow waters where there are a range of habitats such as seagrass beds, gravel, rock, and boulders which provide protection from predators. Cod are omnivorous, but in the North Sea are predominantly piscivorous, feeding on young clupeids, flatfish and gadoids (Daan, 1973). Cod will not only predate but also scavenge for food (Heessen *et al.,* 2015). The typical feeding times for cod are dawn and dusk (Cohen *et al.,* 1990).

14.6.37 From late winter to early spring, adult cod migrate to offshore spawning grounds, typically at depths of 20 m to 100 m in the North Sea (often 200 m elsewhere) (Dipper, 2001). Cod is classified as a determinate multiple spawner (McEvoy and McEvoy, 1992) with experiments reporting between eight and 22 batches spawned per season (Kjesbu *et al.,* 1992). In a single spawning event, females produce between three million and six million eggs (Trippel, 1998), which rise to the surface and drift with ocean currents (Dipper, 2001).

14.6.38 The eggs and larvae of cod remain in the water column, developing into juvenile fish within six months. When individuals reach a size of approximately 7 cm, juveniles move to the seabed where they become demersal, often occurring between July and August (Heessen and Daan, 1994). Juvenile cod then move into coastal nursery areas once the spawning season is over, with young cod often found in estuaries and shallow waters. The Study Area is recognised by Ellis *et al*. (2012) as being a high intensity nursery ground for cod.

14.6.39 Cod was identified as being an important commercial species in the ICES rectangle 38E8 (see Section 14.5), where on average, 57 tonnes of cod were recorded per year as landed from 2013 to 2017, representing 5% of the total landed weight for all species and years in the area (MMO, 2018a). In this area, cod was caught mainly from vessels that were 10 m and under in size, using trawling and seine netting. Overall in the North Sea (ICES Subarea 4), ICES official landings for cod in 2018 were 35,789 tonnes (ICES, 2019c). In Environment Agency TraC surveys in the River Tees, cod was recorded in both the middle and lower reaches of the River Tees but not in the upper reaches. Cod was recorded as present in most years and represented 3% and 2% of the total proportion of fish species found in the lower and middle reaches, respectively.

14.6.40 In the North Sea, the population structure of cod is dominated by individuals aged one (100 – 250 mm) and two years (200 – 400 mm) old (ICES, 2006d). The lengths recorded for cod as part of the TraC surveys in the River Tees are shown in Figure 14B-24,with the mean length recorded as 151 mm (± std. = 48 mm) with the majority of fish being one year of age. The smallest recorded length was 30 mm. The largest size recorded was 504 mm, which was caught in 2009.

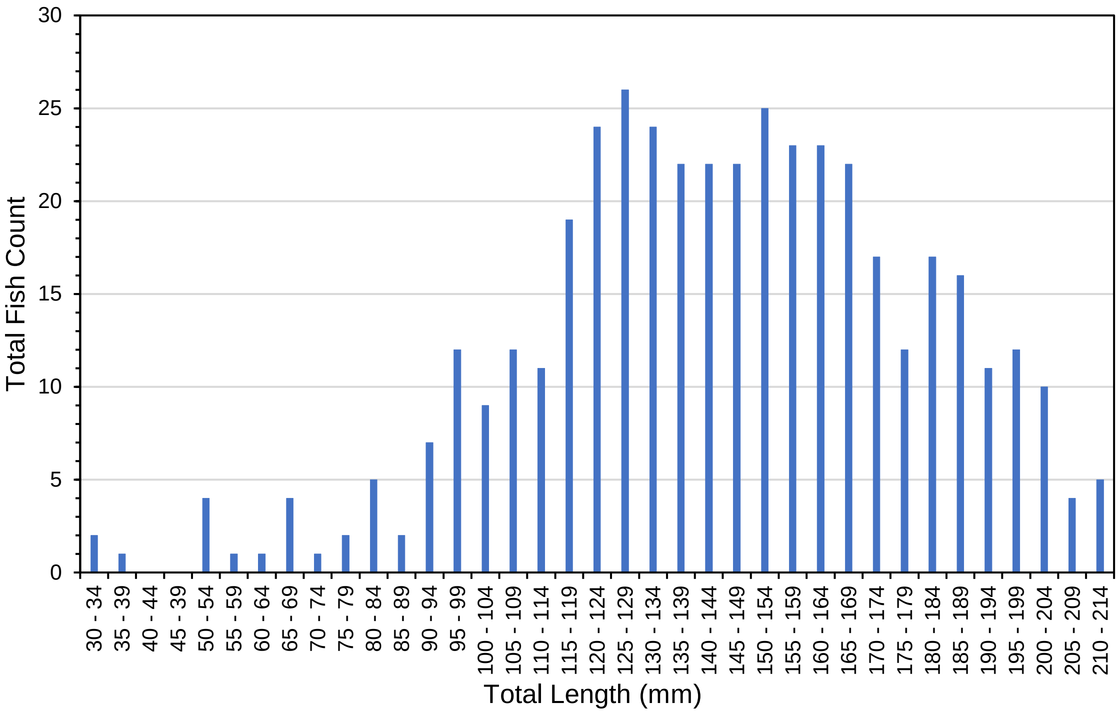


Figure 14B-24: Size classes (mm) (based on total length (mm)) measured for cod (*Gadus morhua*) in Environment Agency (2019a) TraC surveys in the River Tees. Data has been presented for the first 95% of fish counts.

Whiting

14.6.41 Whiting is most abundant in water depths of 30 m to 100 m, but is very common in shallow waters (Wheeler, 1978). Whiting are a bentho-pelagic species, found in association with a variety of substrates including mud, gravel, sandy and rocky areas, (Barnes, 2008). The spatial distribution of whiting, particularly in the northern North Sea, appears to be affected by sea surface temperature (Zheng *et al.,* 2002). Overall, whiting do not make long-distance migrations from their spawning site (Heessen *et al.,* 2015).

14.6.42 Spawning of whiting is mainly triggered by temperature (5 – 10°C is optimal) and takes place from February to June (Coull *et al*., 1998), peaking in spring in shallow waters (Wheeler, 1978). Most whiting spawning occurs in water depths <100 m (Heessen *et al.,* 2015). The Study Area is recognised by Ellis *et al*. (2012) as being a high intensity nursery ground for whiting. Once spawned, whiting grows relatively slower during their first year of life, with large variations in growth rates between individuals (Hislop *et al.,* 1991). Whiting typically reach maturity after two years and often spawn during this year.

14.6.43 A female whiting of 30 cm will produce 400,000 eggs, which compared to other gadoids, demonstrates high relative fecundity (Hislop and Hall, 1974). Whiting release their eggs in many batches over a period which usually lasts up to 14 weeks (Hislop *et al.,* 1991).

14.6.44 Whiting is a common predator of other fish species, feeding predominantly on commercially important species, including its own offspring. Whiting feed near the seabed and in mid water and are an active predator (Heessen *et* *al.,* 2015). When greater than 30 cm, whiting feed almost entirely on fish, including younger age classes of herring, cod and haddock as well as smaller species such as sprat, sandeel, and Norway pout (Hislop *et al.,* 1991). When in the pelagic larvae life stage, whiting feed on the nauplii and copepodite stages of copepods (Last, 1978) whilst juvenile whiting (< 20 cm) feed on crustaceans, including euphausids, mysids and crangonid shrimps.

14.6.45 In the North Sea area, the population structure of whiting is typically dominated by high relative abundances of those aged 1 and 2+ years. This same pattern was recorded in TraC surveys in the River Tees, with two peaks in length frequency illustrated in Figure 14B-25. The two clear size groups comprise a peak from 105 mm to 145 mm and a second but smaller peak at 250 mm to 265 mm. The smallest recorded length for whiting across all surveys was 42 mm, caught in 2012, whilst the largest length was 382 mm, which was recorded in 2008. The mean total length for whiting was 186 mm (± std. = 83 mm).

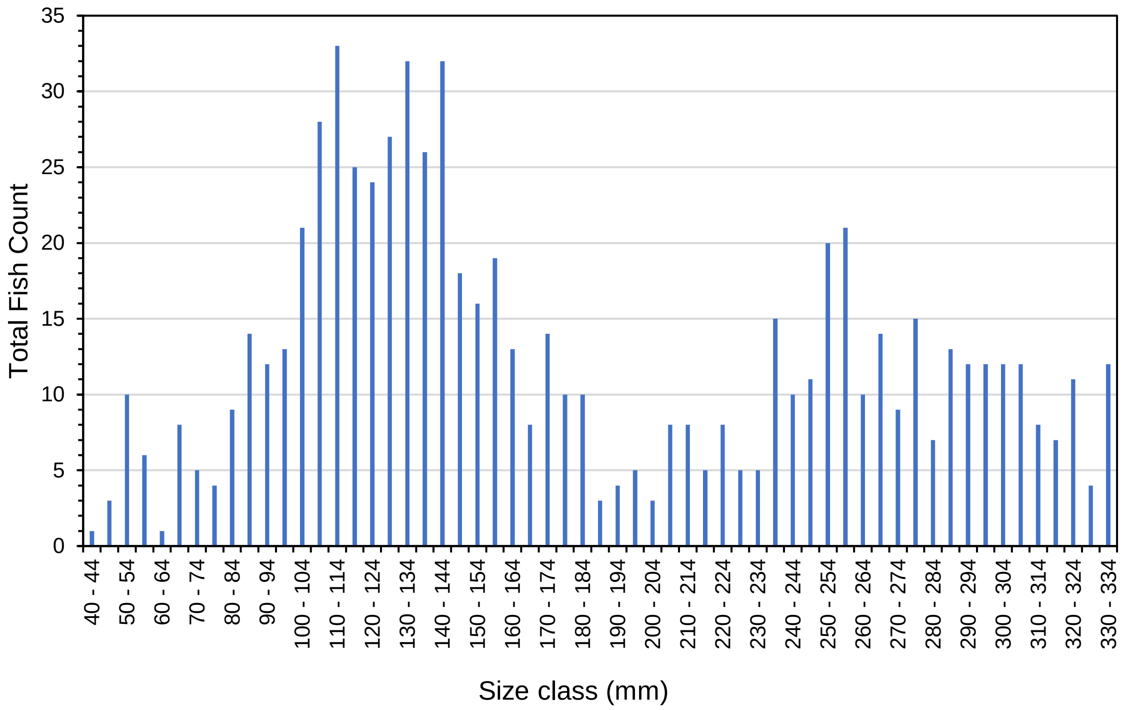


Figure 14B-25: Size classes (mm) (based on total length (mm)) measured for whiting (*Merlangus merlangus*) in Environment Agency (2019a) TraC surveys in the River Tees. Data has been presented for the first 95% of fish counts.

Dover Sole

14.6.46 Dover sole is a southern species whose northern limit is in the North Sea. Sole favours sandy and sandy muddy substrates, which they can bury into, in waters of up to 50 m depth. The spatial distribution of Dover sole varies between life stages, with juveniles favouring coastal nursery grounds whilst older and larger individuals occupying deeper offshore waters (Teal, 2011).

14.6.47 Spawning in the North Sea typically occurs in March to June and peaks in April (Tappin *et al.,* 2011). Spawning takes place inshore, generally in estuaries, where high numbers of eggs are released (up to 500,000 eggs). The eggs then drift into high productivity shallow sandy nursery grounds which provide a good feeding ground for juveniles (Dipper, 2001). Newly hatched larvae, typically 3 mm in length will metamorphose, following which, at a length of 7-10 mm, the larvae will settle to the sea bottom (Heessen *et al.,* 2015). Dover sole will inhabit nursery grounds for up to two years before migrating offshore (Rijnsdorp *et al.,* 1992). The Study Area is not recognised by Ellis *et al*. (2012) or Coull *et al.* (1998) as being a Dover sole nursery ground or spawning area.

14.6.48 Dover sole is a nocturnal feeder spending the day buried in bottom sediment (Kruuk, 1963). Dover sole are olfactorial feeders with multiple sensory organs located on their blind side which aid prey detection. Juveniles and adults typically eat polychaete worms and small echinoderms and small molluscs (Braber and Groot, 1973), whilst pelagic larvae feed on copepod nauplii (Russel, 1976).

14.6.49 Sole is mainly found in the southern and eastern North Sea, south of the line from Flamborough (ICES, 2006e). In summer and autumn this line represents a steep gradient in temperature which divides the North Sea into a cold stratified northern section and a warm mixed southern section where the bottom waters are also warmer (ICES, 1965). Official landings of Dover sole in the North Sea (ICES Subarea 4) for 2018 estimated by ICES was 11,199 tonnes. In the ICES rectangle 38E8, Dover sole represents only a small proportion of the total landed weight from 2013 to 2018, that being 0.8% with an average landed weight (tonnes) per year of 9.5 tonnes (MMO, 2018a). Fishing activity for Dover sole in this ICES rectangle uses predominantly demersal trawls and seine netting by vessels which were typically 10 m and under in length.

14.6.50 In Environment Agency TraC surveys in the River Tees, Dover sole was recorded occasionally in the lower reaches of the river and to a lesser extent in the middle reaches but was never caught in the upper reaches. A total of 19 fish were recorded in these surveys from 1991 to 2016.

14.6.51 In the North Sea, Dover sole that are over 10 years of age are rarely caught, with length distributions dominated by individuals that are one year old (~100 mm) and a second peak at two years old (~200 - 250 mm) (ICES, 2006e). In TraC surveys in the River Tees, the majority of individuals were two years old with the mean total length recorded being 251 mm (± std. = 97 mm). The smallest recorded length of sole was 44 mm (caught in 2013) whilst the largest length was 410 mm (caught in 2002).

Plaice

14.6.52 Plaice are found on all UK coasts, normally located on sandy substrata, as well as gravel and mud, and are frequently observed on sand patches in rocky areas (Tappin *et al.,* 2011).

14.6.53 Female plaice usually mature at four to five years old, whereas males typically become sexually mature at two to three years of ages (Heessen and Rijnsdorp, 1989). Plaice generally spawn between January and April, at depths of between 20 m and 40 m, with up to 500,000 eggs being released. Spawning grounds in the North Sea with high concentrations of egg production include Southern Bight and eastern Channel, whilst further north on the east coast of the UK, spawning is less intense (Ellis *et al.,* 2012).

Coastal and inshore waters of the North Sea however, represent important nursery areas (Kuipers, 1977) although the Study Area is recognised by Ellis *et al*. (2012) as being only a low intensity nursery ground for plaice. Following spawning, plaice reach their peak densities in May, and in June and July older fish tend to migrate offshore, whilst juveniles remain in the intertidal zone until autumn (Kuipers, 1997). The planktonic larvae stage lasts four to six weeks, following which plaice settle on sandy substrates within nursery grounds. Fine sandy sediments allow juveniles to bury themselves and hide from predators (Heessen *et al.,* 2015).

14.6.54 Plaice usually feed during the day although during spawning periods adults do not feed at all (De Clerk and Buseyne, 1989). Adult plaice will often eat polychaete worms and bivalve molluscs, but also feed on small crustaceans, such as amphipods, mysids, and small shrimp (De Clerk and Buseyne, 1989). The diet of plaice larvae usually consists of pelagic tunicates although copepods, algae and bivalve post-larvae are also consumed (Ryland, 1964).

14.6.55 Plaice is an important commercial species in the North Sea, with estimated landings of plaice of 50,783 tonnes being reported by ICES (ICES, 2019d). In the ICES rectangle 38E8, plaice represented 3% of the total landed weight (tonnes) of all fish species caught from 2013 to 2017, with the main fishing technique used being demersal trawling and seine netting (MMO, 2018a). In Environment Agency TraC surveys in the River Tees, plaice was recorded in both the middle and lower reaches of the River Tees but not in the upper reaches. The highest relative abundances were recorded in the middle reaches, with 4,741 fish caught across all surveys (compared to 2,248 individuals in the lower reaches). Plaice was recorded as present in most years and represented 9% and 21% of the total proportion of fish species found in the lower and middle reaches, respectively.

14.6.56 In the North Sea, the typical length frequency distribution is dominated by two peaks, corresponding with age groups 1 (~100 mm) and 2 (~200 – 250 mm), the latter being the more dominant (ICES, 2006f). In the River Tees, the lengths frequency distribution showed only one peak from 40 – 100 mm, the mean length being 79 mm (± std. = 39 mm) (Figure 14B-26). The smallest recorded length was 13 mm, recorded in 2014 whilst the largest size recorded size was 418 mm, which was caught in 2007.

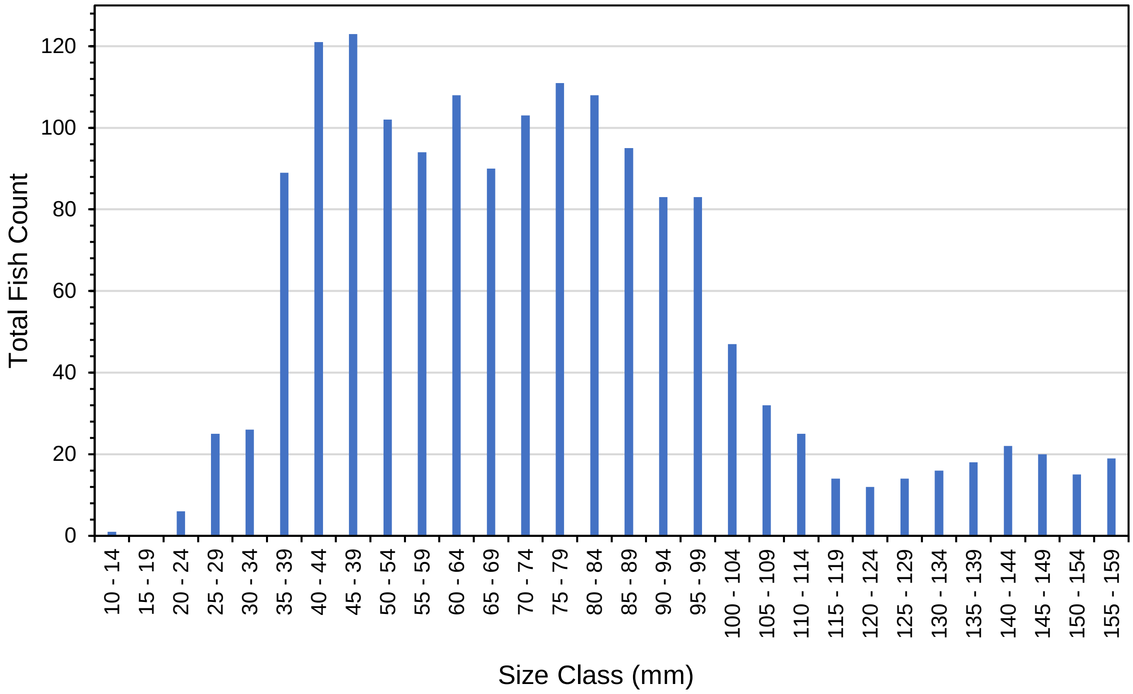


Figure 14B-26: Size classes (mm) (based on total length (mm)) measured for plaice (*Pleuronectes platessa*) in Environment Agency (2019a) TraC surveys in the River Tees. Data has been presented for the first 95% of fish counts.

Sandeel

14.6.57 Five sandeel species occur in the North Sea, including Raitt's sandeel (*Ammodytes marinus*) which is the most common although the lesser sandeel (*Ammodytes tobianus*) and great sandeel (*Hyperoplus lanceolatus*) are also prevalent. Sandeel are an important element of the food chain in the North Atlantic and feed other fish species, sea birds and marine mammals, including cod, herring, salmon, mackerel, grey seal, harbour seal, porpoise and puffins (Dipper, 2001).

14.6.58 Sandeel spend a large proportion of the year buried in the sediment, only emerging into the water column to spawn briefly in winter (November to February), and for an extended feeding period during the spring and summer months (van der Kooij *et al*., 2008).

14.6.59 The distribution of sandeel (referring to all species within the genus *Ammodytes* spp) is highly patchy due to their preference for sandy habitats in well oxygenated waters, favouring coarse sand with fine to medium gravel and a low silt content (Heessen *et al.,* 2015); Holland *et al*., 2005; Greenstreet *et al*., 2010). Populations are also associated with seabed morphological features such as subtidal sandbanks (MarineSpace *et al*., 2013). However, this species is broadly found from inshore waters down to the shallow sublittoral zone (i.e. to 70 m depths).

14.6.60 During spawning, females will release between 4,000 and 20,000 eggs (Tappin *et al.,* 2011), which they deposit within the sandy habitat of the adults as they are demersal spawners (Winslade, 1971). Spawning periods vary depending on the species. Great sandeel spawn from late spring to summer, Raitt's sandeel from November to February, whilst the lesser sandeel may spawn both in spring and autumn (Heessen *et al.,* 2015). Once hatched, the larvae are pelagic, spending their time in the water column (undertaking vertical migrations that are influenced by light) until they develop into juveniles in the winter when they burrow into the sediment (Macer, 1966; Heessen *et al.,* 2015). The Study Area was not recognised by Ellis *et al*. (2012) as being within a nursery ground for sandeel.

14.6.61 Sandeel, which is mainly used for fish meal, supports one of the largest fisheries in this area. In the northern and central North Sea (ICES Divisions 4.a and 4.b) sandeel fisheries have been divided into 'Sandeel Areas', Sandeel Area 4, in the northern and central North Sea (ICES divisions 4.a and 4.b), being associated with the Study Area (ICES, 2019e). Official landings of sandeel in Sandeel Area 4 for 2018 estimated by ICES was 42,526 tonnes. No landings of sandeel from ICES rectangle 38E8 has been reported for 2013 – 2017 (MMO, 2018a).

14.6.62 In Environment Agency TraC surveys in the River Tees, no sandeel were recorded in the upper reaches of the River Tees and only six individuals were present in the middle reaches. The majority of sandeel were found in the lower reaches of the river, being caught using seine netting. Lesser sandeel were the *Ammodytidae* species caught in the highest abundances, whilst Corbin's (*Hyperoplus immaculatus*) and greater sandeel were also recorded. In the past 10 years, the total relative abundance of sandeel was 2,056 individuals. Lesser sandeel in the lower reaches of the River Tees, composed 10% of the total proportion of fish reported from the TraC surveys.

14.6.63 The total lengths of sandeel recorded in TraC surveys in the River Tees is illustrated in Figure 14B-27. The length at maturity for lesser sandeel ranges from 110 - 150 mm. Thus, with mean total length for sandeel of 98 mm (± std. = 18 mm), the majority of fish measured were immature. The smallest recorded length for sandeel across all surveys was 64 mm, caught in 2010, whilst the largest length was 260 mm, which was a lesser sandeel recorded in 2005.

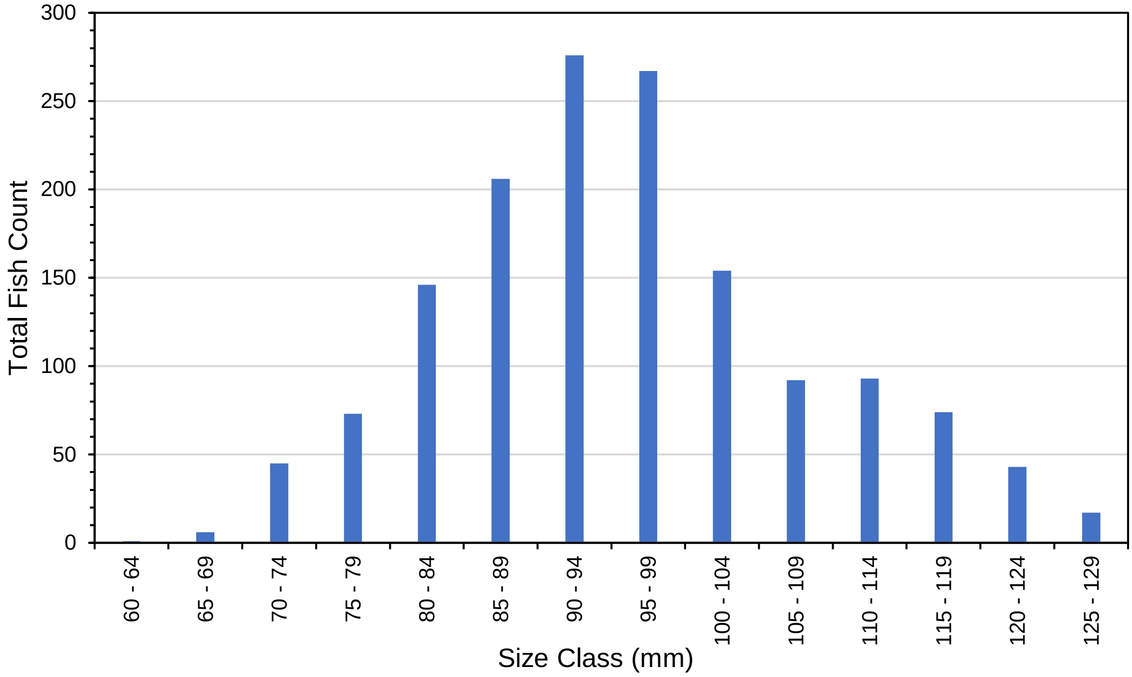


Figure 14B-27: Size classes (mm) (based on total length (mm)) measured for *Ammodytidae* (sandeel species) in Environment Agency (2019a) TraC surveys in the River Tees. Data has been presented for the first 95% of fish counts.

Shellfish

Nephrops

14.6.64 *Nephrops* (Norway lobster) are distributed according to the extent of cohesive muddy sediments, in which they construct their burrows (Howard, 1989). The type of sediment also dictates the structure of the *Nephrops* populations, with areas of sandy mud having higher population densities and smaller sized individuals, whilst fine sediment is characterised by lower densities of larger-bodied individuals. Males can reach up to sizes of 250 mm in length and mature at three years of age (Tappin *et al.,* 2011). Mating of *Nephrops* in the UK occurs in summer after the female has moulted, the eggs being laid on their pleopods in the autumn (Farmer, 1974). The eggs stay on the pleopods for up to 60 days in temperate waters, releasing a pelagic larva, after which the juveniles metamorphose into burrowing post-larvae.

14.6.65 *Nephrops* in the North Sea is targeted mainly by demersal trawlers but are also caught using seine nets and pots (Cotter *et al.,* 2004). In the North Sea, the *Nephrops* fishery has been divided into different functional units by ICES, the unit relating to the Study Area being Farn Deeps in the central North Sea (ICES Division 4.b, Functional Unit 6) (ICES, 2019f). Since April 2016, a range of measures on UK vessels fishing for Norway lobster in Farn Deeps were implemented by the UK in order to reduce fishing mortality on the stock and unsustainable fishing of the stock. The official total landings weight of *Nephrops norvegicus* in Farn Deeps was 1,807 tonnes in 2018.

14.6.66 *Nephrops* represents an important commercial species in the ICES rectangle 38E8, having the highest total landed weight of all fish and shellfish for the area, representing 34% of the total from 2013 to 2017 (MMO, 2018a). An average landed weight of 383 tonnes per annum (2013 – 2017) was recorded for *Nephrops* with demersal trawling and seine netting being the main gear types used to catch this species (representing 98% of the total landed weight). However, pots and traps also contributed (1%) to the overall fishing activity of *Nephrops*, with an average landed weight of 5 tonnes per annum. Landings of *Nephrops* were from vessels that were both 10 m and under and over 10 m in size, those representing over 10 m contributing 54% to the average landed weight (2013 – 2017).

Edible crab

14.6.67 Edible crab in the North Sea is found in waters between 25 m and 300 m, with a preference for bedrock, mixed course grounds, and offshore in muddy sands (Neal and Wilson, 2008). Edible crabs copulate in the spring and summer, the female crabs becoming gravid, carrying their eggs under the abdomen. At this time, females do not feed and remain in pits in the sediment or under the rocks and therefore fishing pressure is unlikely to affect the larval population (Howard, 1982). In the North Sea, brooding females migrate offshore to release the larvae, which once hatched remain in the water column for between 60 and 90 days before settling. Tagging surveys off the coast of Norfolk, have shown that mature females undertake long-distance northerly migrations to the Yorkshire coast, although more recent studies suggested this may be a discrete population of edible crabs (Eaton *et al.,* 2003).

14.6.68 On the coast of England and Wales, edible crabs represent a significant commercial fishery, with the most recent reported landings in 2015 above 14,000 tonnes (ICES, 2016). The fishery in England and Wales is mainly targeted by vessels under 12 m, which utilise pots and operate close to the coast. Average numbers of edible crabs reported from CEFAS (and ICES in parenthesis) samples in the central North Sea from 2014 to 2016 was 3,703 (2,440) (n = 152 (77)) (CEFAS *et al.,* 2017a).

14.6.69 Traditional fisheries of edible crabs are located off Yorkshire and Northumberland and are an important fishery in the ICES rectangle 38E8 (MMO, 2018a). From 2013 to 2017, the annual average recorded landed weight of crab in this area was 269 tonnes, which represents the third highest average landed weight by species in that area (12% of the total landed weight in the rectangle). The annual reported landed weights (2013 – 2017) of edible crab in the ICES rectangle 38E8 have remained similar between years, peaking in 2014 at 135 tonnes. Pots and traps were the main gear types used to catch edible crab, with 99% of the average landed weight being recorded using these methods. Landings of edible crab were also mostly from vessels that were 10 m and under in size, representing 75% of the average landed weight.

Lobsters

14.6.70 European lobster is generally found from the intertidal zone to depths of 60 m. This species exhibits site fidelity although home extents can range between 2 km and 10 km (Bannister *et al*., 1994). Lobsters are solitary animals and inhabit holes and tunnels that they build below rocks and boulders (Wilson, 2008). Females can spawn annually or following a bi-annual pattern, with reproduction taking place during the summer (Atema, 1986). They do not make extensive migrations when berried and hatching takes place in spring and early summer on the same grounds (Pawson, 1995).

14.6.71 Similar to edible crab, European lobster is an important commercial shellfish species caught along the coasts of England and Wales, with the most recent annual landings reported in 2015 being 1,885 tonnes (ICES, 2016). The gear types used to target lobster include pots and traps, predominantly by vessels under 12 m in size. The most productive lobster fishery area is Yorkshire and Humber, where landings represent 44% of the total in 2015, and have increased progressively since 2006 despite fishing effort remaining similar since 2011. Lobster fisheries in England have been divided into six Lobster Fisheries Units (LFU), the Study Area falling within the Yorkshire Humber LFU but also associated with the Northumberland LFU (CEFAS, 2017b). Both LFUs have high levels of exploitation which are above the maximum reference point limit, although this has decreased in recent years (CEFAS, 2017b). Furthermore, fishing pressure is particularly high around the Minimum Landing Size (CEFAS, 2017b).

14.6.72 From 2013 to 2017, the average annual recorded landed weight of lobster in the ICES rectangle 38E8 represented 8% of the total landed weight across the years and equated to 88 tonnes (MMO, 2018a). Pots and traps were the main gear types used to catch lobster, with 99% of the average landed weight being recorded using these methods. Landings of lobster were also mainly from vessels that were 10 m and under in size, representing 91% of the average landed weight.

14.7 Baseline Evolution

14.7.1 Baseline conditions for fisheries and fish ecology can be influenced by a variety of factors including, commercial exploitation, pollution, loss of habitats and food resources due to riverine and coastal development, conservation and management measures, and global warming (i.e. climate change). These factors can not only influence the abundance and distribution of species but also life history processes including growth and reproduction.

14.7.2 Monitoring of fish communities within the Tees Estuary by the Environment Agency has been ongoing since the 1980s (Environment Agency, 2019a; 2021). However, owing to changes in sampling methods, locations and sampling frequency during the monitoring period, it is not possible to reliably identify any long-term trends to inform this assessment of baseline evolution.

14.7.3 Within the Study Area, climate change impacts due to factors such as increasing sea surface levels and warming sea temperatures is considered to be one of the principle ways in which baseline conditions are likely to evolve during the life cycle of the Proposed Development and is therefore considered in further detail below.

14.7.4 Future UK Climate Projections 2018 (UKCP18) from the Met Office for the Stockton-on-Tees area (The Met Office, 2019), based on a 1981 – 2000 baseline[4], uses a range of possible scenarios, classified as Representative Concentration Pathways (RCPs), to inform different future emission trends. RCP 8.5 has been used for the purposes of this assessment as a worst-case scenario.

14.7.5 Based on RCP 8.5, there is a 50% probability that sea levels will have risen 8 cm by 2022 (commencement of construction) and 11 cm by 2026 (commencement of operation). By 2051 (i.e. the end of the Proposed Developments operational lifespan) this may increase further to 26 cm above the 1981 – 2000 baseline.

14.7.6 The direct effect of a relatively small increase in sea level rise within the region of 8 – 11 cm prior to and throughout the construction phase of the Proposed Development is an extension and / or shift in the distribution of intertidal habitats which are used as nursery grounds by several fish species. As there is not predicted to be any significant decline in the availability of functional habitats, effects to fisheries or fish ecology are likely to be limited and not significant.

14.7.7 Sea temperature change projections are more variable and less specific to the Teesside region. Under RCP 8.5 a rise in global sea surface temperatures of 1.5˚C by 2050 is predicted, increasing to a 3.2°C rise by 2100 relative to 1870 – 1899 temperatures. In UK waters, mean annual sea temperatures have risen by 0.8°C since 1870 and have continued to show consistent warming trends since the 1970s onwards (Genner *et al*., 2017). According to Lowe *et al*. (2009), the seas around the UK are projected to be 1.5 – 4 ºC warmer by 2100.

14.7.8 Rapid responses to climate change are likely to be observed for fish species that rely on planktonic food sources owing to climate induced changes to phytoplankton and zooplankton productivity and distribution (Rijnsdorp *et al.,* 2009). Furthermore, species such as mackerel, herring, and sardines (*Sardina* sp.), which are mobile and wide-ranging pelagic species, are expected to have the greatest distributional variations, although changes in the distribution and behaviour of demersal fish have also been reported (Mieszkowska *et al.,* 2009).

14.7.9 It is predicted that the distribution of Lusitanian species (those with an affinity for warm water) in UK waters, such as sand smelt and horse mackerel, will shift further north around the coast due to increasing sea temperatures (Heath *et al.,* 2012). Additionally, the optimal habitat range of boreal species (those with an affinity for cold water), such as cod and herring, is also likely to shift northwards or into deeper waters (Heath *et al.,* 2012).

14.7.10 Species which don't migrate, for instance schooling pelagic species, like the lesser sandeel, are likely to be affected more locally, with potential impacts to abundance (Frederiksen *et al.,* 2006). It is predicted that changes to sea water temperatures may alter the spawning period of certain species, such as whiting, sole, and sprat, who have an energy-income breeding strategy where spawning period is temperature dependent (Heath *et al.*, 2012).

14.7.11 In the short-term (i.e. between the time of writing in 2020 and beginning of construction in Q3 2022), climate change is expected to have a negligible

[4] This baseline has been selected as it provides projections for 20-year time periods (e.g. 2020 – 2039).

impact on fish. However, in the medium-term and long-term (i.e. commencement of operation in 2026 and during the operational lifetime of the Proposed Development, respectively), climate change is expected to have the following impacts:

- Increased frequency and severity of droughts reducing water levels or drying-out of watercourses may impact migratory fish prohibiting access to upstream spawning habitats;
- Increased frequency and severity of flooding leading to the mortality of fish adults, juveniles, and eggs;
- Shift in north-south and onshore-offshore distributions of species due to increasing sea temperatures; and
- Changes in the timing of spawning and other lifecycle characteristics due to increasing sea temperatures.

14.7.12 Overall, it is difficult to say with any certainty the potential magnitude of changes to fisheries and fish ecology within the Study Area prior to and during construction and operation of the Proposed Development. However, it is unlikely that significant changes in baseline conditions would be detectable above natural variability in the short and medium-term but may be observed in the long-term.

14.8 Summary of Findings

14.8.1 The Tees river and estuary is an important water body for the transit of a variety of diadromous fish species which make seasonal migrations between the sea and riverine environments. The species known to migrate through the Study Area include salmon, sea trout, European eel, river lamprey and sea lamprey, all of which have been identified as part of the Tees Valley BAP. The River Tees is particularly important for salmon and sea trout which both regularly use the Tees catchment area. Furthermore, the River Tees is designated as one of 64 ‘principal salmon rivers’ in England and Wales and has its own ‘Salmon Action Plan’.

14.8.2 A range of estuarine and marine fish and shellfish species have been recorded in the Study Area, most notably in the lower reaches of the River Tees. The taxa identified represent a mixed demersal and pelagic fish assemblage which is typical of the central North Sea. The highest abundances were of the species sprat, herring and lesser sandeel, which were caught in the intertidal areas of the lower reaches of the River Tees. Cod, whiting and plaice also represented a high proportion of the estuarine and marine fish caught. Moreover, the Study Area has been identified as located within the nursery grounds of the following species: herring, sprat, cod, whiting, plaice, Nephrops, lemon sole and spurdog. The Proposed Development is also found within the spawning areas of lemon sole and Nephrops. Spawning of sprat takes place from May to August, peaking in May to June, whilst spawning of herring occurs predominantly in late summer (although spawning can happen at different times). It is therefore expected that the highest abundance of juvenile fish in the intertidal will be in summer and early autumn. Mackerel was not identified as being a key risk species, with only one individual having been recorded in the River Tees in Environment Agency TraC surveys.

14.8.3 The key migratory periods for the diadromous fish species utilising the River Tees have been identified, which for salmon migrating as smolt down rivers to oceans, occurs in spring to early summer. The return of salmon as adults arises between June to August and October to December, whilst sea trout have a similar migratory period. The significant migratory periods of European eel take place in spring and continue until early autumn, when eels transition upstream into freshwater, and then returning to spawning grounds between August and December. River lamprey typically migrate into freshwater from October to December and continues to do so through winter into early spring. The river lamprey then migrates back downstream from July to September. Sea lamprey normally migrates into freshwater in April and May as adults, whilst the migration to sea can vary from river to river, although the metamorphosis of larvae into adults following spawning, occurs in July and September.

14.8.4 Taking into consideration climate change predictions prior to and during the construction and operational phase of the Proposed Development, it is anticipated that the fish and shellfish baseline is likely to evolve. However, it is unlikely that significant changes in baseline conditions would be detectable above natural variability.

14.9 References

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Appendix A Temporal variations in the type of gear used during the Environmental TraC surveys

Table A1- 1: Temporal variations in the type of gear used during the Environmental TraC surveys in the lower reaches of the River Tees. From 1985 to 2004 beam trawling (2.4 m) was the only sampling method used.

Sampling Year	Sampling Season (Month)	Seine Netting	Beam Trawling – 1.5 m	Beam Trawling – 2.4 m	Otter Trawling
2004	Autumn (October)	X		X	
2005	Summer (June)	X			
	Autumn (September, October)	X		X	
2006	Summer (July)	X			
	Autumn (October)	X		X	
2007	Spring (May)	X			
	Autumn (September, November)	X		X X	
	Winter (December)				
2008	Summer (June)	X			
	Autumn (October)	X		X	
2009	Summer (June)	X			
	Autumn (October)	X		X	
2010	Summer (June)	X			
	Autumn (September)	X			
2011	Spring (May)	X	X		
	Autumn (September)	X	X		
2012	Spring (May)	X	X		
	Autumn (September)	X	X		
2013	Spring (May)	X			
	Autumn (September)	X	X		
2014	Summer (June)	X	X		
	Autumn (October)				X
2015	Summer (June)	X	X		
	Autumn (September)	X	X		X
2016	Autumn (October, November)	X	X		X
2017	Spring (May)	X	X		
	Autumn (September, November)	X	X		X

Sampling Year	Sampling Season (Month)	Seine Netting	Beam Trawling – 1.5 m	Beam Trawling – 2.4 m	Otter Trawling
2018	Autumn (October)	X	X		X

Table A1- 2: Temporal variations in the type of gear used during the Environmental TraC surveys in the middle reaches of the River Tees. From 1981 to 2002 beam trawling (2.4 m) was the only sampling method used.

Sampling Year	Sampling Season (Month)	Seine Netting	Beam Trawling – 1.5 m	Beam Trawling – 2.4 m	Otter Trawling
2002	Autumn (October)			X	X
2003	Autumn (October)			X	
2004	Autumn (October)	X		X	
2005	Autumn (September)	X			
2006	Autumn (October)	X			
2007	Spring (May)	X			
	Autumn (September, November)	X		X	
	Winter (December)			X	
2008	Summer (June)	X			
	Autumn (October)	X			
2009	Summer (June)	X			
	Autumn (October)	X			
2010	Summer (June)	X			
	Autumn (September)	X			
2011	Spring (May)	X			
	Autumn (September)	X			
2012	Spring (May)	X			
	Autumn (September)	X			
2013	Spring (May)	X			
	Autumn (September)	X			
2014	Summer (June)	X			
2015	Summer (June)	X			
	Autumn (September)	X			

Table A1- 3: Temporal variations in the type of gear used during the Environmental TraC surveys in the upper reaches of the River Tees.

Sampling Year	Sampling Season (Month)	Seine Netting	Beam Trawling – 1.5 m	Beam Trawling – 2.4 m	Otter Trawling
1982	Summer (June)			X	
	Autumn (September)			X	
1983	Spring (March)			X	
	Summer (June)			X	
	Autumn (September)			X	
1984	Spring (April, May)			X	
	Summer (June, July, August)			X	
	Autumn (September)			X	
1985	Spring (April, May)			X	
	Summer (June, July, August)			X	
	Autumn (September)			X	
1986	Autumn (September, November)			X	
1987	Spring (April)			X	
	Summer (June, July)			X	
	Autumn (September, October)			X	
1988	Spring (April)			X	
	Summer (June, August)			X	
	Autumn (October, November)			X	
1989	Spring (May)			X	
	Summer (June)			X	
	Autumn (September)			X	
1990	Winter (February)			X	
	Spring (April, May)			X	
	Summer (July, August)			X	
	Autumn (November)			X	
1991	Winter (January)			X	
	Spring (April, May)			X	
	Summer (July)			X	
	Autumn (September, November)			X	
1992	Winter (February)			X	
	Spring (April)			X	
	Autumn (September)			X	

Sampling Year	Sampling Season (Month)	Seine Netting	Beam Trawling – 1.5 m	Beam Trawling – 2.4 m	Otter Trawling
1996	Winter (February)			X	

Appendix B Full species list and proportions as presented in TraC survey fish species proportion figures

Table B1- 1: Proportion of fish species from Environment Agency (2019a) TraC surveys in the lower reaches of the River Tees (1985 – 2018). Fish species in the legend have been presented in order of percentage contribution.

Fish species	Latin name	Proportion
Sprat	*Sprattus sprattus*	41%
Herring	*Clupea harengus*	15%
Lesser sandeel	*Ammodytes tobianus*	10%
Plaice	*Pleuronectes platessa*	9%
Dab	*Limanda limanda*	7%
Whiting	*Merlangius merlangus*	5%
Cod	*Gadus morhua*	3%
Saithe	*Pollachius virens*	3%
Flounder	*Platichthys flesus*	2%
Pogge	*Agonus cataphractus*	2%
Sandeel spp.	*Ammodytidae*	2%
Sand goby	*Pomatoschistus minutus*	1%
Corbin's sandeel	*Hyperoplus immaculatus*	1%
Lesser weever	*Echiichthys vipera*	<1%
Short-spined sea scorpion	*Myoxocephalus scorpius*	<1%
Long-spined sea scorpion	*Taurulus bubalis*	<1%
Greater sandeel	*Hyperoplus lanceolatus*	<1%
Five-bearded rockling	*Ciliata mustela*	<1%
Dragonet	*Callionymus lyra*	<1%
Dover sole	*Solea solea*	<1%
Snake pipefish	*Entelurus aequoreus*	<1%
Viviparous blenny	*Zoarces viviparus*	<1%
Nilson's pipefish	*Syngnathus rostellatus*	<1%
Three-spined stickleback	*Gasterosteus aculeatus*	<1%

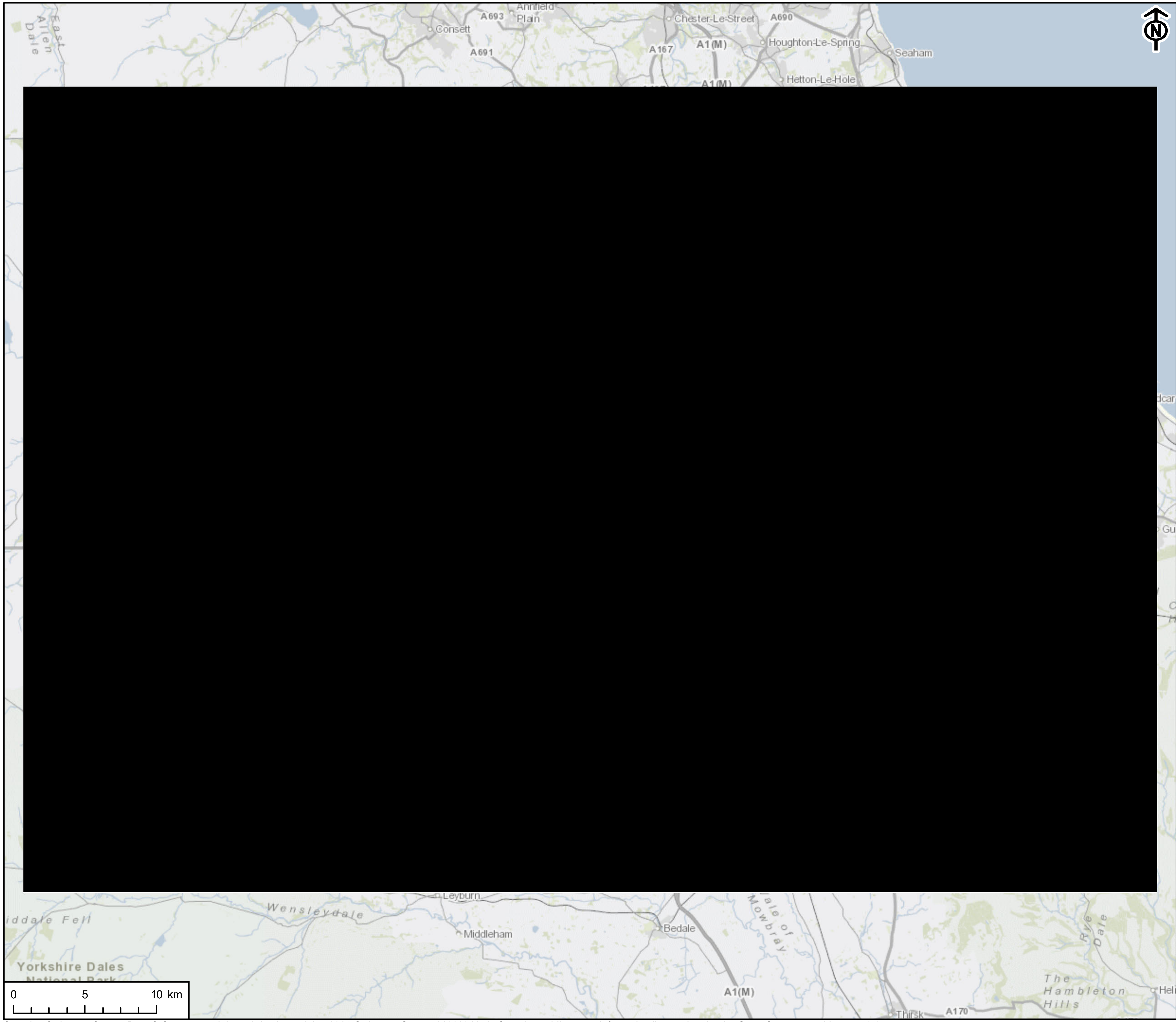
Fish species	Latin name	Proportion
Grey gurnard	*Eutrigla gurnardus*	<1%
Butterfish	*Pholis gunnellus*	<1%
Greater pipefish	*Syngnathus acus*	<1%
Red gurnard	*Aspitrigla cuculus*	<1%
European eel	*Anguilla anguilla*	<1%
Sea trout	*Salmo trutta*	<1%
Gurnard sp.	*Triglidae*	<1%
Lemon sole	*Microstomus kitt*	<1%
Bib	*Trisopterus luscus*	<1%
Sea bass	*Dicentrarchus labrax*	<1%
Sea-snail	*Liparis liparis*	<1%
Turbot	*Psetta maxima*	<1%
Angler fish	*Lophius piscatorius*	<1%
Long rough dab	*Hippoglossoides platessoides*	<1%
Mackerel	*Scomber scombrus*	<1%
Painted goby	*Pomatoschistus pictus*	<1%
Poor cod	*Trisopterus minutus*	<1%
Sand smelt	*Atherina presbyter*	<1%
Thin lipped grey mullet	*Liza ramada*	<1%
Thornback ray	*Raja clavata*	<1%

Table B1- 2: Proportion of fish species from Environment Agency (2019a) TraC surveys in the middle reaches of the River Tees (1981 – 2018). Fish species in the legend have been presented in order of percentage contribution.

Fish species	Latin name	Proportion
Sprat	*Sprattus sprattus*	31%
Plaice	*Pleuronectes platessa*	21%
Whiting	*Merlangius merlangus*	13%
Herring	*Clupea harengus*	13%
Flounder	*Platichthys flesus*	9%
Three-spined stickleback	*Gasterosteus aculeatus*	4%
Dab	*Limanda limanda*	2%

Fish species	Latin name	Proportion
Sand goby	*Pomatoschistus minutus*	2%
Cod	*Gadus morhua*	2%
Common goby	*Pomatoschistus microps*	1%
Viviparous blenny	*Zoarces viviparus*	1%
Long-spined sea scorpion	*Taurulus bubalis*	<1%
Saithe	*Pollachius virens*	<1%
Pogge	*Agonus cataphractus*	<1%
Short-spined sea scorpion	*Myoxocephalus scorpius*	<1%
European eel	*Anguilla anguilla*	<1%
Red gurnard	*Aspitrigla cuculus*	<1%
Butterfish	*Pholis gunnellus*	<1%
Lesser sandeel	*Ammodytes tobianus*	<1%
5-bearded rockling	*Ciliata mustela*	<1%
Dragonet	*Callionymus lyra*	<1%
Sea trout	*Salmo trutta*	<1%
Bib	*Trisopterus luscus*	<1%
Snake pipefish	*Entelurus aequoreus*	<1%
Dover sole	*Solea solea*	<1%
River lamprey	*Lampetra fluviatilis*	<1%
Grey gurnard	*Eutrigla gurnardus*	<1%
Lesser weever	*Echiichthys vipera*	<1%
Pollack	*Pollachius pollachius*	<1%
Roach	*Rutilus rutilus*	<1%
Atlantic salmon	*Salmo salar*	<1%
Common bream	*Abramis brama*	<1%
Dace	*Leuciscus leuciscus*	<1%
Greater pipefish	*Syngnathus acus*	<1%
Haddock	*Melanogrammus aeglefinus*	<1%
Sea-snail	*Liparis liparis*	<1%

Appendix C Freshwater Fish Count NFPD Environment Agency Survey Figures



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Project Management Initials: RL Designer: LC Checked: AR Approved: RG

Scale @ A3 1:250,000

AECOM

PROJECT

NET ZERO TEESSIDE PROJECT

Net Zero Teesside

APPLICANTS

NZT POWER LTD. AND NZNS STORAGE LTD.

KEY

NFPD Fish Count Data - Atlantic Salmon

Total Count

- 1 - 50
- 51 - 100
- 101 - 150
- 151 - 200
- 201 - 250
- 251 - 350

Tees Mouth

Tees Barrage

TITLE

FIGURE 14B-28
NFPD FRESHWATER FISH COUNTS
ATLANTIC SALMON

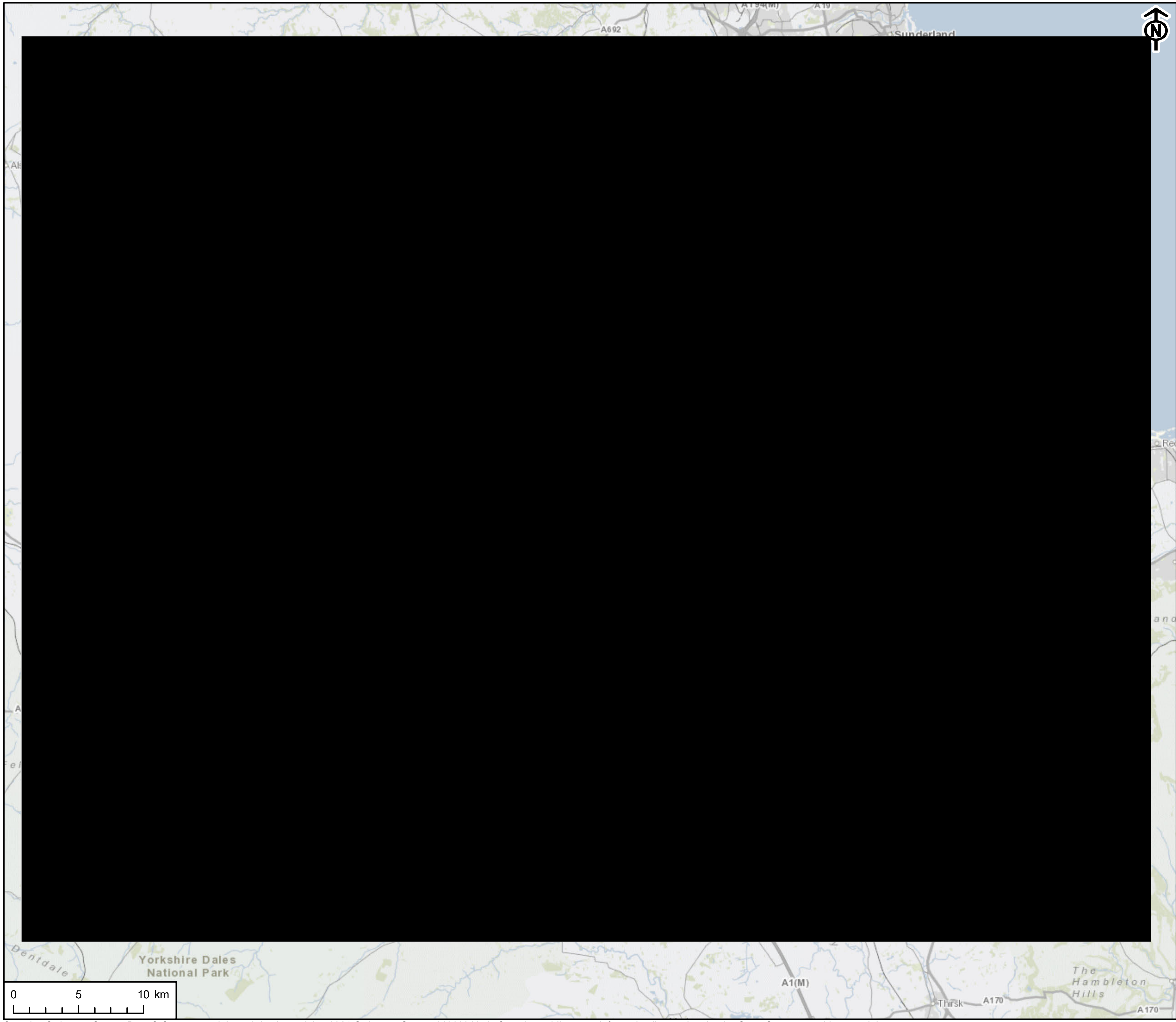
REFERENCE

NZT_210511_FEB_14B-28_v4

SHEET NUMBER: 1 of 1

DATE: 11/05/2021

Project Management Initials: RL Designer: LC Checked: AR Approved: RG



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AECOM

PROJECT

NET ZERO TEESSIDE PROJECT

Net Zero Teesside

APPLICANTS

NZT POWER LTD. AND NZNS STORAGE LTD.

KEY

NFPD Fish Count Data - Brown/Sea Trout

Total Count

- 1 - 50
- 51 - 100
- 101 - 150
- 151 - 200
- 201 - 250

Tees Mouth

Tees Barrage

TITLE

FIGURE 14B-29
NFPD FRESHWATER FISH COUNTS
BROWN/SEA TROUT

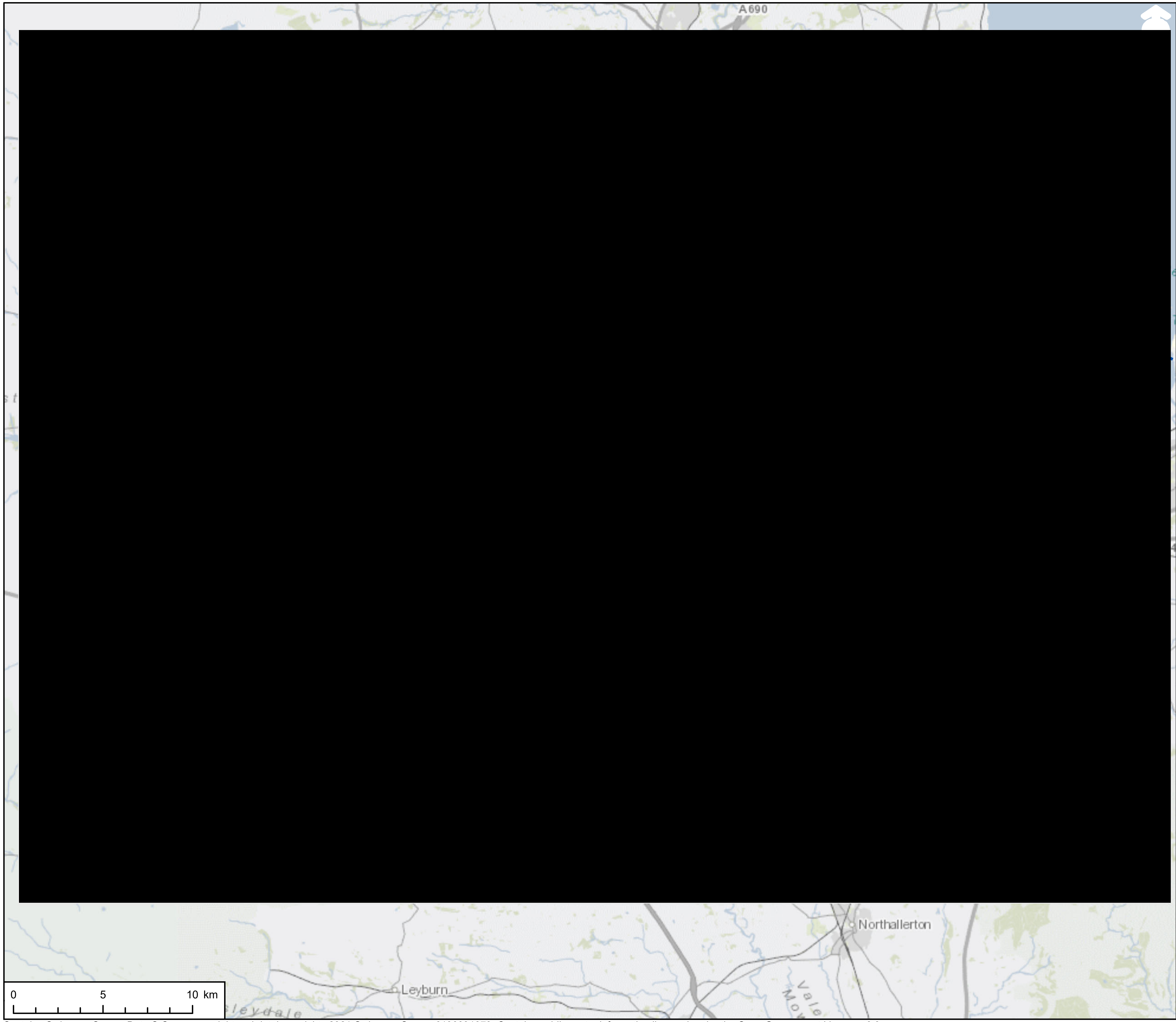
REFERENCE

NZT_210511_FEB_14B-29_v4

SHEET NUMBER: 1 of 1

DATE: 11/05/2021

Project Management Initials: RL Designer: LC Checked: AR Approved: RG



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AECOM

PROJECT

NET ZERO TEESSIDE PROJECT

Net Zero Teesside

APPLICANTS

NZT POWER LTD. AND NZNS STORAGE LTD.

KEY

NFPD Fish Count Data - European Eel

Total Count

- 1 - 50
- 51 - 100
- 101 - 150
- 151 - 200
- 201 - 250

NFPD Fish Count Data - European Eel

Observed Abundance

- 1 - 9
- 10 - 99
- 100 - 999
- 1000 - 9999

- Tees Mouth
- Tees Barrage

TITLE

FIGURE 14B-30
NFPD FRESHWATER FISH COUNTS
EUROPEAN EEL

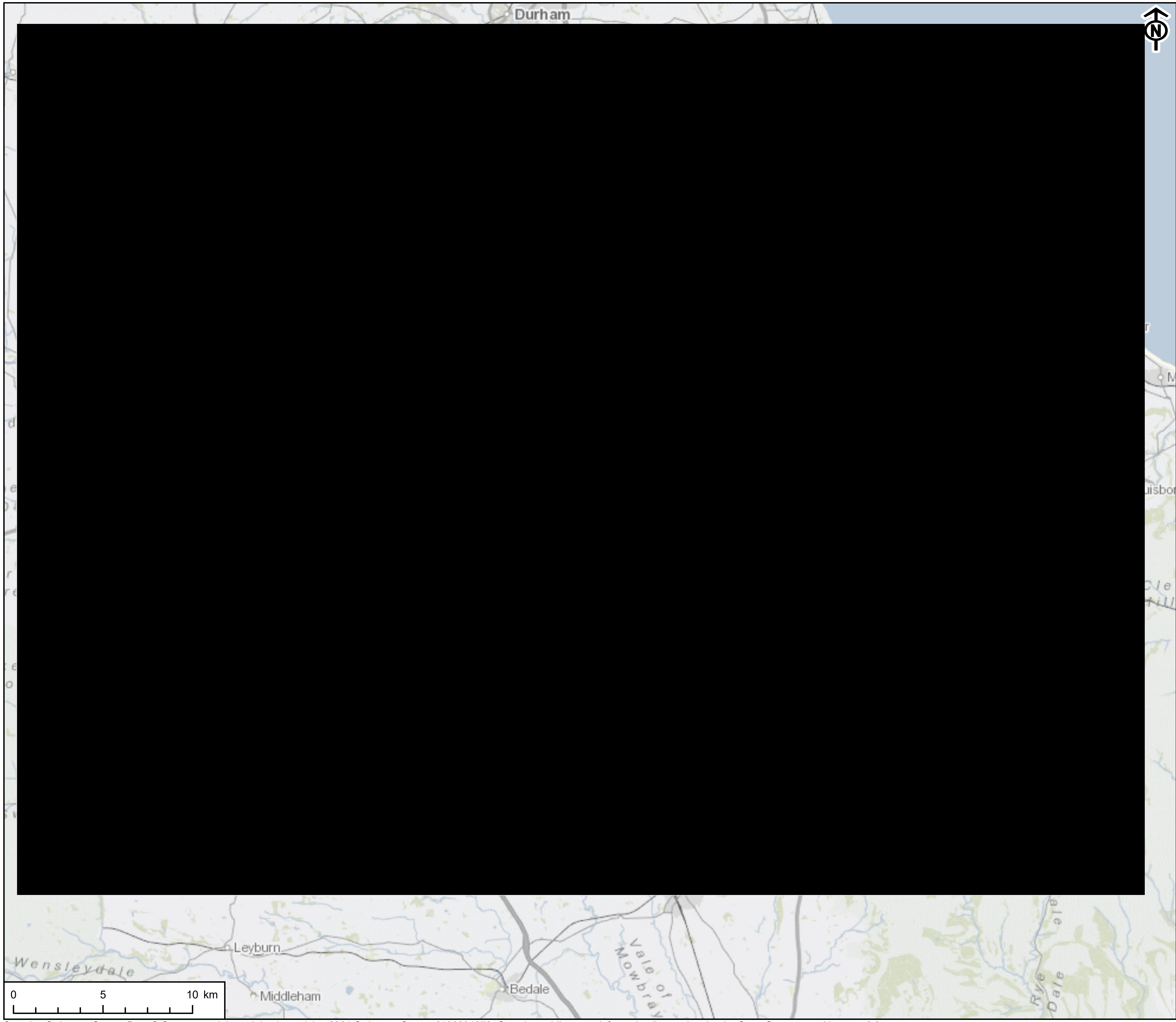
REFERENCE

NZT_210511_FEB_14B-30_v4

SHEET NUMBER: 1 of 1

DATE: 11/05/2021

Project Management Initials: RL Designer: LC Checked: AR Approved: RG



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AECOM

PROJECT

NET ZERO TEESSIDE PROJECT

Net Zero Teesside

APPLICANTS

NZT POWER LTD. AND NZNS STORAGE LTD.

KEY

NFPD Fish Count Data - Lamprey

Total Count

- 1 - 4
- 5 - 8
- 9 - 12
- 13 - 16
- 17 - 20

NFPD Fish Count Data - Lamprey

Observed Abundance

- 1 - 9
- 10 - 99
- 100 - 999
- 1000 - 9999
- Tees Mouth
- Tees Barrage

TITLE

FIGURE 14B-31
NFPD FRESHWATER FISH COUNTS
LAMPREY

REFERENCE

NZT_210511_FEB_14B-31_v4

SHEET NUMBER: 1 of 1

DATE: 11/05/2021