



Beadnell Bay Transitional and Coastal Waters Surveys

March 2016 – February 2017



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Abstract

The purpose of this report is to assess the state of Transitional and Coastal Waters (TrAC) fish species in Beadnell Bay to evaluate the importance of the site for juvenile fish. Beach seine nets were deployed at 3 locations along the shore, all fish were identified to species level and total length was measured for a sub-sample of each species.

A total of 16 fish species were identified. The most common species were Lesser Sandeel (*Ammodytes tobianus*), Sprat (*Sprattus sprattus*), Atlantic Herring (*Clupea harengus*), and Flounder (*Pleuronectes flesus*). Mean length was below size at maturity values obtained for several species (including herring, sprat and sandeel) suggesting a high number of juveniles occurring at the site.

This report is intended to provide baseline information relating to which species and life stages of fish occur at Beadnell Bay, in order to inform future management of the site.

Introduction

The North Sea is one of the most productive shallow seas in the world (Monaghan, 1992). Shallow-water coastal habitats are highly productive due to factors such as shallow depths, seasonally warm temperatures and nutrients derived from river runoff and are therefore suitable nursery habitats for several commercially important fish species (Stevenson *et al.*, 2014). The abundance of small fish in shallow waters is encouraged due to enhanced survivorship and growth (Gillanders *et al.*, 2003) and a lower risk of predation (Manderson *et al.*, 2004). Small and Juvenile fish are an important dietary component for many commercially important fish and seabirds (Monaghan, 1992). Shallow water habitats are vulnerable to degradation due to human activities because of their proximity to the coast (Stevenson *et al.*, 2014).

Marine protected areas are used to protect vulnerable habitats and species (JNCC, 2015). Section 154 of the Marine and Coastal Access Act outlines the responsibilities of Inshore Fisheries and Conservation Authorities pertaining to the protection of Marine Conservation Zones (MCZs). In 2015, Northumberland IFCA conducted a series of surveys at Druridge Bay and discovered a high number of juvenile fish occur at the site. In order to determine if the presence of juvenile fish is unique to Druridge Bay, Northumberland IFCA commissioned a series of surveys at Beadnell Bay. This report aims to provide an initial assessment of the fish species occurring in Beadnell Bay to provide baseline data and inform future management of the site.

Methods

A series of TrAC (Transitional and Coastal Monitoring) fish surveys were conducted at Beadnell Bay. The surveys were carried out on a monthly basis (subject to sea conditions) between March 2016 and February 2017 by NIFCA officers, members and volunteers from Newcastle University, the Environment Agency, Northumberland Wildlife Trust and the National Trust.

Study Site

Beadnell Bay is a 3.2km sandy bay, located between the small coastal villages of Beadnell and Newton-by-the-Sea in Northumberland (Figure 1). Beadnell Bay is a large shallow inlet and bay and is therefore one of the designated features of the Berwickshire and North Northumberland Coast Special Area of Conservation (BNNC SAC). The study site also falls within the Northumbria Coast Special Protection Area (SPA) and the Northumberland Shore Site of Special Scientific Interest (SSSI) due its importance for a variety of bird species, including Arctic and little terns which breed at the site during the summer.

Survey methods

Data relating to the fish species present in Beadnell Bay were collected using a beach seine net at three locations along the shore (Figure 1). The surveys were conducted monthly (weather permitting) on a falling tide (ebb) to ensure for beach access for the duration of the survey.

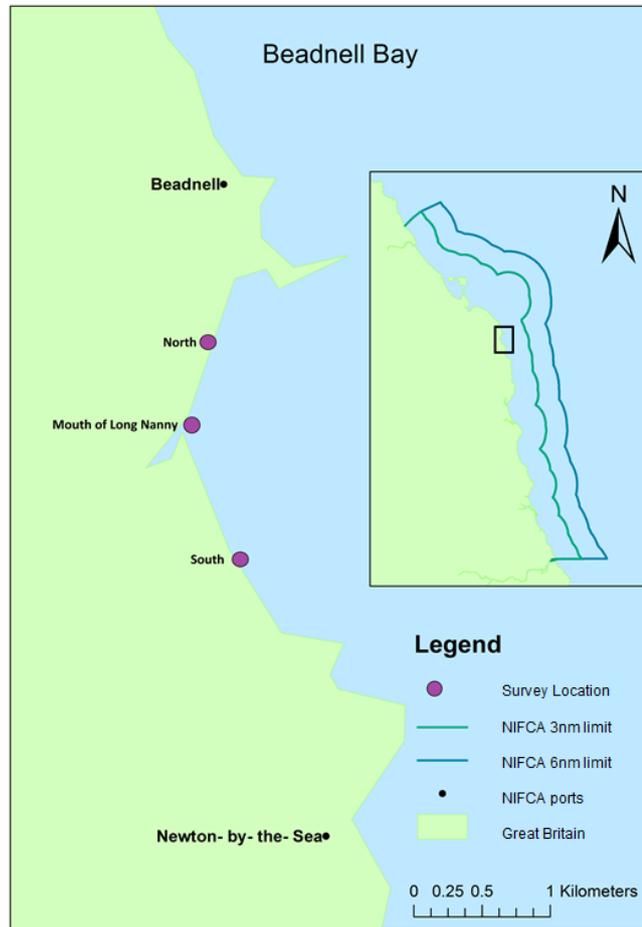


Figure 1. Map of Beadnell Bay, showing the location of the survey sites along the shore.



NIFCA officers and volunteers pulling the seine net into the shore.

An estuary survey seine net 43m in length and 4m in depth (210/12 with 6.5mm and 14mm mesh size), complete with lead weights on the footrope and floats on the head rope was deployed from the Authority RIB Bravo 1. The first tow line was fastened ashore and the net was set out in a wide arc returning to the beach (FAO, 2013). The headrope (with floats) was on the surface, the footrope was in permanent contact with the bottom and the seine acted as a barrier which prevents the fish escaping from the area enclosed by the net (FAO, 2013). The seine net was then pulled ashore by a number of individuals (Environment Agency. 2011) with the ground rope reaching the beach first, herding the fish towards the shore and into the net (FAO. 2013).



NIFCA officers measuring the catch.

The species caught were then removed from the net and placed into buckets of seawater. Fish species were identified using the Environment Agency 2009 manual “Key to the marine and freshwater fishes of Britain and Ireland” and measured to the nearest millimetre using a fish measuring board.

Results

Comparison of the Survey Sites.

The survey site at the mouth of the long Nanny River yielded the highest overall catch of 1311 individual fish during the course of the survey, compared to 551 and 606 fish for the Northern and Southern survey sites respectively. A more diverse range of species were recorded for the Mouth of the Long Nanny River and the Northern site each with 12 species recorded whereas only 8 species were recorded at the southern site.

Species Caught and Presence of Juveniles

A total of 16 fish species were identified during the course of the study. Tables 1 and 2 provide details of the species caught and data pertaining to mean length (mm). Table 1 also includes size at maturity values for the commercially important species caught.

Table 1. Total catch, mean length and size at maturity for the commercially important species caught during the Beadnell Bay surveys. Pink cells indicate where mean length was smaller than size at maturity for that species.

Species	Total no. caught	Mean Length (mm)	Size at maturity (mm)	References
Sprat (<i>Sprattus sprattus</i>)	533	84.54	130	Environment Agency (2009);
Atlantic Herring (<i>Clupea harengus</i>)	487	83.40	175	Ellis <i>et al.</i> (2012); ICES (2009)
Lesser Sandeel (<i>Ammodytes tobianus</i>)	1196	123.65	130	Ellis <i>et al.</i> (2012); ICES (2009)
Greater Sandeel (<i>Hyperoplus lanceolatus</i>)	67	107.66	130	Ellis <i>et al.</i> (2012); ICES (2009)
Sea Trout (<i>Salmo trutta</i>)	2	489.00	360-410	MCS (2011)
Cod (<i>Gadus morhua</i>)	1	65.00	700	MSEP (2014)
Pollack (<i>Pollachius pollachius</i>)	1	129.00	580 (males) 625 (females)	Cargnelli <i>et al.</i> , (1999)
Sea Bass (<i>Dicentrarchus labrax</i>)	1	495.00	460	Angling Trust (2014)
Flounder (<i>Pleuronectes flesus</i>)	141	106.10	300	MSEP (2014)
Turbot (<i>Scophthalmus maxima</i>)	7	79.00	340-400 (females) 400-450 (males)	Caputo <i>et al.</i> , (2001)
Golden Grey Mullet (<i>Liza aurata</i>)	1	184.00	280	Angling Trust (2014)

Table 2. Total catch and mean length for the non-commercially important species caught during the Beadnell Bay surveys.

Species	Total no. caught	Mean Length (mm)
Sand Goby (<i>Pomatoschistus minutus</i>)	4	58.00
Lesser Weever (<i>Echiichthys vipera</i>)	7	71.29
Pipefish (unidentified)	2	130.00
15-Spined Stickleback (<i>Spinachia spinachia</i>)	13	99.46
Sea Snail (<i>Liparis liparis</i>)	1	69.00

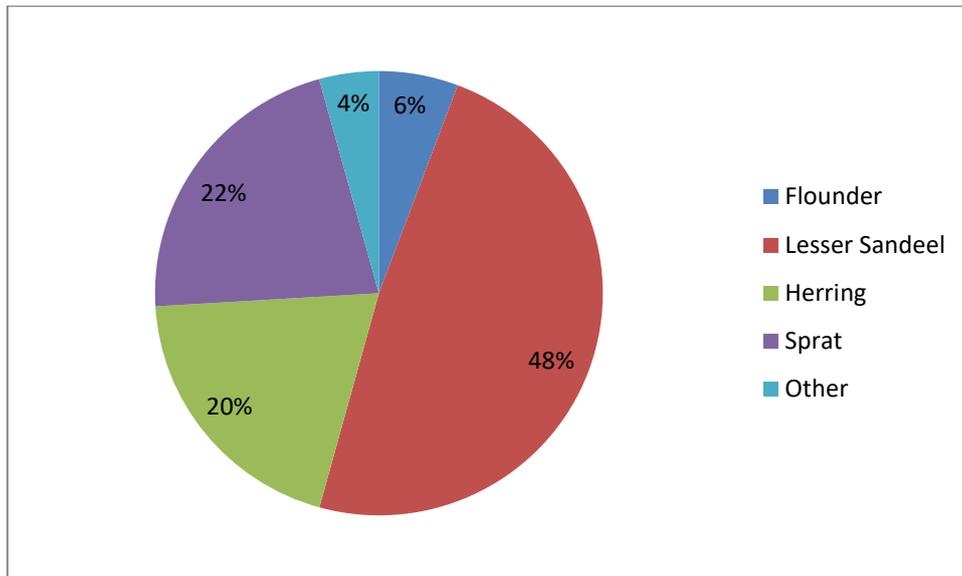


Figure 2. Four most abundant species as a proportion of total catch.

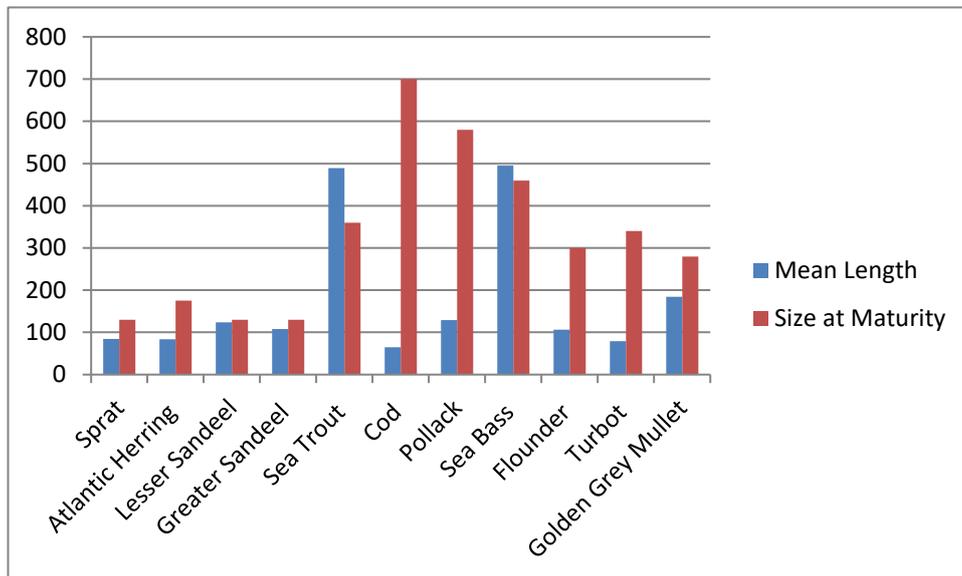


Figure 3: Mean length of commercially important catch in relation to estimated size at maturity of the species.

Seasonality

The highest number of fish caught during any survey was in September (1349 fish, Figure 4), this was also the most diverse month with 11 species recorded (Figure 5). Although there is no apparent relationship between month and number of species, there appears to be a seasonal trend associated with fish abundance, with number of fish caught greater in the summer.

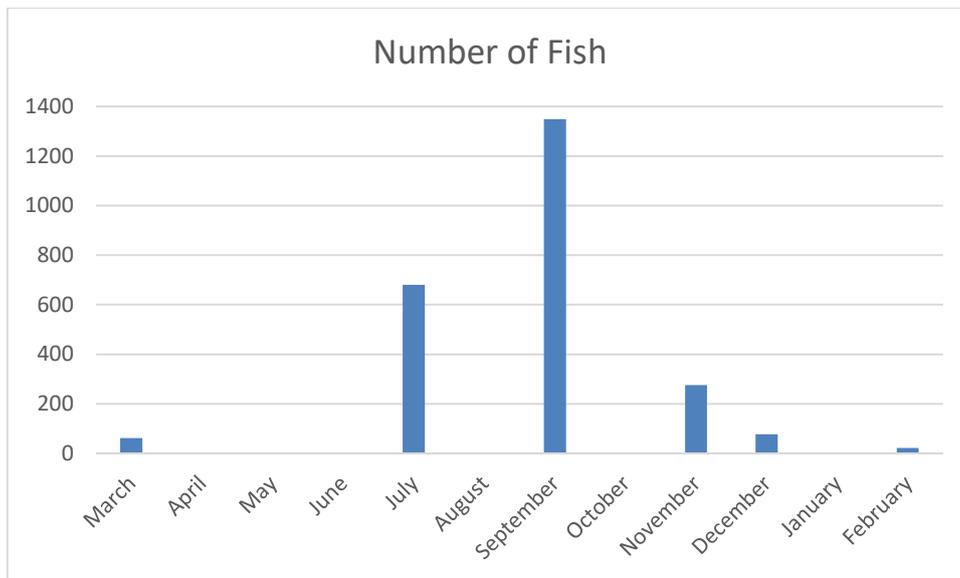


Figure 4. Number of fish caught per month.

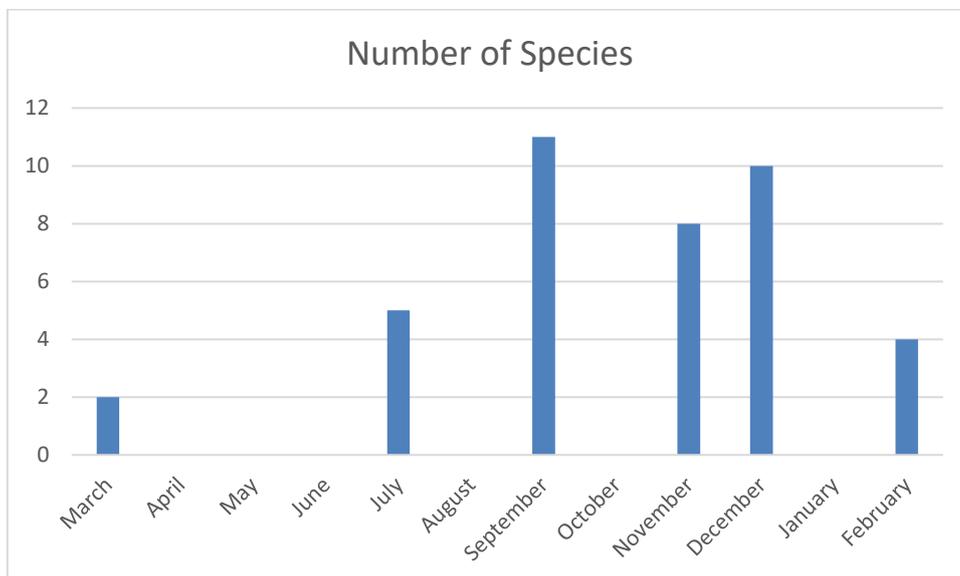


Figure 5. Number of species caught per month.

Discussion

Comparison of the Survey Sites.

The freshwaters of the Long Nanny river and the saline waters of the coastal North Sea meet at the mouth (estuary) of the Long Nanny river. Estuaries are dynamic environments (James *et al.*, 2007) and organisms living here have to tolerate factors such as changing salinity. Despite this many species spawn, develop and grow in these areas (Hossain *et al.*, 2012). Therefore, it is unsurprising that both the highest overall catch and greatest species diversity were recorded at the site at the mouth of the Long Nanny river.

Species Caught and Presence of Juveniles

Beach seine nets are highly unselective, catching a high diversity of fish species (Hillman, 2011), therefore it is assumed that the catch is representative of the species present at the time of each survey. Of the 16 species caught the four most abundant (lesser sandeels, sprat, herring,



Golden Grey Mullet

and flounder) as well as turbot and sea bass will be discussed in more detail. One Golden Grey Mullet (*Liza aurata*) a species which has not been recorded on previous NIFCA surveys was also caught during the Beadnell Bay surveys.

Mean length was below the corresponding Size at Maturity for the commercially important species listed in Figure 1 (with the exception of Sea Bass and Sea Trout), suggesting a) a high proportion of the individuals caught were juveniles, b) Beadnell Bay is an important site for juvenile fish. It is important to note that the size at maturity values obtained (Table 1) are approximations and may not be accurate for Beadnell Bay. Size at maturity values are not available for the species in Table 2.

Lesser Sandeel (*Ammodytes tobianus*)

Lesser sandeels are extremely common in sandy bays in northern Europe at depths down to ca. 30m (Maitland and Herdson, 2009). A total of 1196 lesser sandeels were identified between March and February.



Sandeels are an important dietary component for other commercially important fish species as well as many seabird species (Cefas, 2001). A decline in sandeel abundance in the Shetlands has been linked to declines in seabird populations such as Kittiwakes and Arctic terns (Monaghan, 1992) and been linked to poor breeding success in Atlantic puffins (Wanless *et al.*, 2005). In Beadnell Bay and the surrounding coastal waters little terns forage on lesser sandeels (Bridge *et al.* 2014), it is therefore important that we monitor the status of sandeels in the region to assist with future management of the little tern.

Sprat (*Sprattus sprattus*)

Sprat is both ecologically and commercially important throughout Europe (Mittermayer, 2007). Sprat is a small pelagic fish which is very abundant in northern European particularly in inshore coastal waters. 533 sprat were caught at Beadnell Bay between March and February. Juvenile sprat often occurs in estuaries and areas of shallow water (Maitland and Herdson, 2009). The sprat typically occurs at depths of 10-50m in the summer and at deeper depths in the winter, this trait may explain why catches were lower between November and April.

Atlantic Herring (*Clupea harengus*)

487 Juvenile Atlantic herring were caught during the 2015 surveys. Herring was previously an extremely abundant fish off northern Europe, however due to high levels of exploitation it is not as abundant or economically valuable as it once was (Maitland and Herdson, 2009).

The mean length for Atlantic herring during this study was 83.4mm, which is below the size at maturity for the species (Table 1), suggesting a high proportion of juveniles in the catch. Juvenile herring are particularly common in shallow inshore areas where they form large schools (Maitland and Herdson, 2009). Schooling behaviour is established at 50-55mm as a method of reducing vulnerability to predation (Gallego and Heath, 1994).

Turbot (*Scophthalmus maxima*)

Seven turbot were caught during the Beadnell Bay surveys in 2016-17. The North Sea stock is depleted and the north east of England is close to the northern range of the species (Maitland and Herdson, 2009), both factors are potential explanations for the low

number of turbot caught during the study. Turbot occurs in sandy inshore areas down to depths of 80m and are active predators feeding on species such as sandeels, herring and sprat (Maitland and Herdson, 2009), all of which appear to be abundant at the study site. Mean size of turbot was below the size of maturity for the species, therefore there is evidence to suggest the site is used by juvenile turbot. Further research is needed to determine if Beadnell Bay is an important nursery ground for the species as juvenile turbot were also caught at Druridge Bay it is possible that sandy bays along the whole coast of Northumberland are important for the species.



Turbot (left) & Flounder (right)

Sea Bass (*Dicentrarchus labrax*)

One sea bass was caught during the Beadnell Bay surveys. Although sea bass is relatively common around the UK, similar to turbot, it is close to its northern limits of its range off the north east coast of England and breeding success is limited (Maitland and Herdson, 2009), which potentially explains the results. Sea bass is an actively swimming species which occur in inshore waters, with young often entering estuaries. Sea bass feeds on species such as sandeels, herring and sprat (Maitland and Herdson, 2009), all of which appear to be abundant at the study site.



Seabass

Seasonality

Populations of small fish species increase throughout summer reaching a maximum in August corresponding with the availability of resources (Thorman and Wiederholm, 1983). The highest number of fish caught during any of the Beadnell Bay surveys was in September (1349 fish, Figure 4). No survey was conducted in August or October therefore we cannot be sure exactly when the peak in fish abundance occurred.

Future Study

The high proportion of small fish observed in the study requires further investigation to determine whether Beadnell Bay is an important nursery ground or whether many coastal areas in North East England also sustain large numbers of small fish.

Conclusions

The purpose of this report is to assess the state of Transitional and Coastal Waters (TrAC) fish species in Beadnell Bay to evaluate the importance of the site for juvenile fish. This study has provided an initial assessment of what fish species occur in Beadnell Bay, with 16 species

identified and a significant proportion of the fish caught were juveniles. Whilst the results here indicate that there is a high proportion of juvenile fish at the site, further research is needed to determine whether or not Beadnell Bay (and Druridge Bay) is an important nursery ground.

Acknowledgements

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