

Open and shut case

Historical ecologist and BSAC Dive Leader **Ruth Thurstan** is interested in the history of our seabed. In 2010, she led a scientific project to investigate the old oyster fisheries in the muddied waters of the Firth of Forth. Here's what she found

Tony preparing for a coring dive. With stories of low vis and heavy equipment to move, he thought it best to bring his helmet!



Clive, Lee and Roger on the RIB

It was early April and the waters of the Firth of Forth in Scotland were a balmy 6°C. My buddy and I had just surfaced following a 75-minute dive and our boat cover was calling out over the water to check that we were OK. My hands were filled with tape measures, poles and a rather unwieldy video camera rig and my lips were so numb from the cold that I couldn't even spit out my regulator to shout back. As the voices rose in concern, I nodded vigorously back to them, wondering whether my lips, and the rest of me for that matter, would thaw out before my next dive.

I had just completed my first survey in the Firth of Forth, mapping the creatures on the seabed. It was a difficult task in the low visibility and strong current. As I climbed back into the boat, the second buddy pair began their preparations to descend into the darkness to carry out a very different task. They had already lowered a two-metre length of drainpipe and a 25-kilogram post-driver to the seabed and were about to attempt to extract a sediment core for analysis back at the lab. This was difficult in itself, but the fine sediment thrown up by their activities meant that they would be working in near-zero visibility. I spent my time between dives hoping that the volunteer divers wouldn't be put off coming along on the next trip.

Although parts of the Firth of Forth are renowned for wreck diving, much of the southern shore in the mid-part of the firth is not exactly a magnet for divers. Sinking into this tea-coloured world, you are greeted by a muddy, featureless seabed. Today, the only highlights are in areas close inshore, sheltered from the worst of winds, where delicate phosphorescent sea pens, sea squirts and the occasional sea mouse can break the monotony.

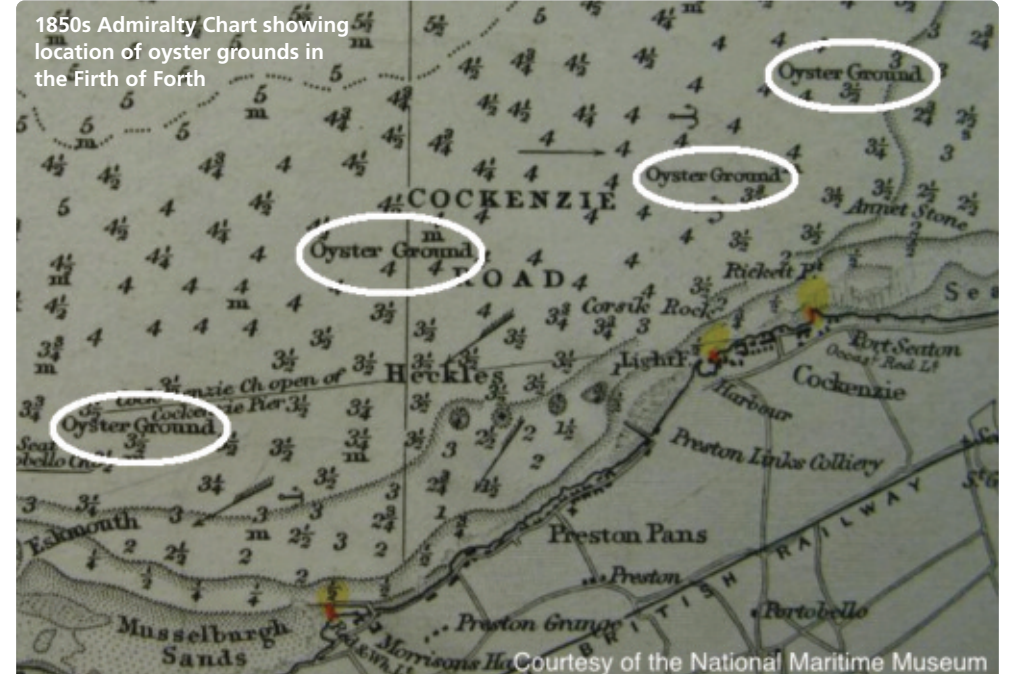
What is hard to believe is that it was not always like this here, or in other places around Britain. Indeed the Forth once housed the most productive oyster fishery in Scotland, exporting millions of shellfish every year. Such intensive exploitation, driven by an insatiable demand from British cities, meant that by the 1890s the oyster beds had been seriously degraded and by the early 20th century the fishery was declared extinct.

Starting the research

In 2010, I began a study into how the firth's underwater habitats had changed during two centuries of intensive human impacts. I started on dry land, in a place intrinsically linked with the sea—the National Maritime Museum at Greenwich. Searching revealed Admiralty charts from the archives indicating the areas of the Forth where oyster beds still existed during the 19th century, and a 115-year old scientific survey provided a picture of the seabed long before cameras were ever taken underwater. Armed with this data and a handful of BSAC volunteers, we began.

Our fieldwork took place off the southern shore of the Firth of Forth, an area tested by swift currents, low visibility and frequent boat traffic. Our aim was to survey the animals and habitats present and compare them to the findings of the survey that had taken place 115 years earlier. We also wanted to extract sediment cores to understand how other species had fared alongside the demise of the oyster.

I had spent months pleading and cajoling the club divers I knew who would help us in exchange for free diving, pie and beer and who wouldn't be put off by the low viz, strong currents and tiring weekends. Surprisingly, I never lacked volunteers and the University of York Sub Aqua Club offered us the use of its RIB if members could come along and help out. After battling difficult slipways and poor underwater conditions on nearly every trip, with several abandoned dives – it's difficult to identify animals on the seabed when you can't see them – we managed to study 11 different sites within the firth. »

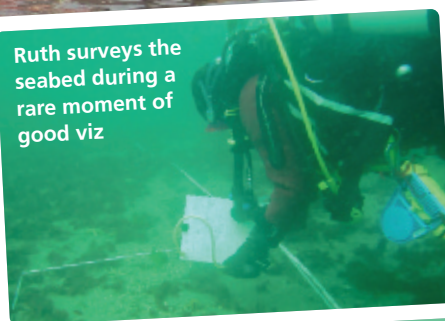


1850s Admiralty Chart showing location of oyster grounds in the Firth of Forth



Launching the YUSAC RIB at Granton, one of the more functional slipways used during the project

Ruth surveys the seabed during a rare moment of good viz



Driving the corer into the seabed took two divers and a lot of effort



Lee securing the base of the core with gaffer tape before it gets hauled to the surface



» The early 19th century fishermen, who launched from Cockenzie and Musselburgh, knew a very different seabed to the one we experienced during our work. They couldn't look beneath the waves, but from the material brought up in their dredges they knew that much of its surface was fused together with a hard crust of shells, laid down by oysters over hundreds of years. These complex habitats also provided shelter and feeding grounds for many other living creatures.

By the 1860s, fishing had spiralled out of control and each small boat was dragging up thousands of oysters a day during the season, yet little was done to prevent the destruction. Scientific surveys documenting the state of the oyster fishery did not take place for another 30 years, by which point it was calculated that on average only seven live oysters remained in every acre of the Forth, far too few to maintain a viable breeding population. So, before the 20th Century had even begun, the Firth of Forth oyster fishery, once the most productive in Scotland, had been doomed to extinction.

When we went looking, 150 years after the peak of the oyster fishery, our sediment cores and surveys revealed that in places where historical records show oysters once occurred in the millions, now almost nothing remains save a few empty shells. When the dredgers took live oysters during the 19th century it seems they also removed the hard shell-based reef that once existed on the seabed. Once this was gone, oysters, together with the

communities that thrived alongside them, could no longer flourish. In addition, the increased quantities of silt in the Forth arising from changes in land use around its shores may also have played a part in the oysters' demise.

In their place, the creatures that prevail now are the burrowing kind – those that live within sand and mud, not on a hard base above it. Only one site of the 11 was any different, and that contained an impressive abundance of horse mussels. The presence of these slow-growing species, themselves highly vulnerable to fishing pressure, was a pleasing sight as it indicates that recovery from fishing could have occurred here. Alternatively, the mussels may have just had a lucky escape from the oyster dredgers and the trawls that came after.

At other survey sites, the time needed to return to previous 'hard-bottomed' conditions will be lengthy, and at some this may not be possible at all, as regeneration relies heavily on the existence of a solid shell structure on which juveniles can settle, together with a breeding population close by to produce the juveniles in the first place.



Lee and Jon making the most of the rare sunshine during a surface interval

The divers

I needed some volunteers to help with the project, and as a former Diving Officer of York University Sub Aqua Club (YUSAC) that seemed a good place to start. YUSAC is closely affiliated with Stingray Divers, a BSAC club also based in York, many of whose members are university alumni and learnt to dive with YUSAC, so I started by asking divers at both clubs for help. Some of the 11 volunteers were also affiliated to other clubs, such as Lancaster University Sub Aqua Club and Oldham Sub Aqua Club.

Because of the type of diving and task loading involved in the work, volunteers had to be Sports Diver or above and experienced in diving in low visibility conditions with strong currents at unknown sites. Volunteers were interested in the work because they were passionate about marine conservation and interested in the science behind it.

The diving

We undertook the research dives over four separate week-ends between April and October. Each trip involved four or five divers. We had our work cut out to dive on slack tides and during periods when the slipways were usable, as most of them dried out for several hours at low tide. The short diving trips meant that everything had to be planned meticulously, in case we missed slack or couldn't retrieve the boat at the end of the day. We also had to time our arrival back at shore to fill cylinders. We got diving gas from Dive Safari in North Berwick and Edinburgh Diving Centre.

The club

YUSAC has been active for more than 20 years and is open exclusively to students and staff of the University of York. Sister club Stingray Divers has been running for 10 years and is open to non-students. For the last 10 years, YUSAC has owned a 5.5m Northcraft RIB, with a 100hp Yamaha engine. YUSAC and its boat are funded by its members, York University Athletics Union and the University of York Annual Fund.

Post-dive extraction of the sediment cores was often a team effort



» A lesson from history

The Firth of Forth is not the only casualty of long-term human impacts. Certainly almost none of the UK's inshore habitats today are in a natural state, and while we divers know that beautiful places still remain, many more are degraded and under threat. Part of this threat comes from a lack of knowledge: despite all our advancements in science and technology, scientific understanding of the state of UK seas is patchy at best.

Many inshore areas have never been dived, either because they are difficult to access or simply because they don't hold much appeal. Even areas that are popular with divers may still be relatively unknown to scientists. In the absence of formal, scientific data collection, efforts to map seabed habitats by volunteer divers through organisations such as Seasearch have become very important, particularly if the information obtained can be coupled with evidence about past environmental states.

While there may never be a way to turn back the clock for Firth of Forth oysters, many other areas containing vulnerable species do have a chance of recovery if we can reduce our impact. The government recently proposed 31 Marine Conservation Zones throughout UK seas, which, although a start, is a poor effort compared to the 127 zones initially advised. Part of the problem is that with such little understanding of past marine environments we have no baseline to aim for – our expectations are simply set too low.

The Firth of Forth is an example of somewhere where we have had an impact for so many decades that we have forgotten just how different things used to be. The few marine reserves that exist in UK waters show that marine life can bounce back startlingly well. Perhaps if we afforded the marine environment the protection it deserves UK divers would come to see some of their favourite sites in completely new ways.

THANKS TO...

The research was carried out by Ruth Thurstan, Julie Hawkins, Lee Raby and Callum Roberts, while Ruth was studying for a PhD in the Environment Department at the University of York. Thanks to the Esmée Fairbairn Foundation for supporting this project. Thanks also to the Greenwich National Maritime Museum, York University Sub-Aqua Club for the use of their boat and the volunteers – BSAC divers Clive Raby, Roger Sturme, Simon Exley, Tony Palmer, Alison Nicholson, Hazel Buckley, Ruth Hart, Andrew Crowe and Jon Bath.

Ruth and Lee are now based in Brisbane where they dive with Brisbane BSAC in the subtropical waters of south-east Queensland.

The research gathered has now been published in the Journal for Nature Conservation. For more details contact Ruth on r.thurstan@uq.edu.au