

Studland Report 2008 until 2020

Studland Seahorse Project

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Introduction

The Studland Seahorse Survey (SSS) came about due to the chance finding of a seahorse by a local diver; a pregnant male Spiny Seahorse (*Hippocampus guttulatus*) in 2007. It was not realised then, that this sighting would lead to such a long-term project, and all the problems, successes and media coverage this would bring.

Seahorses had been recorded in the area prior to 2008, many times, however it was the significance of this heavily pregnant male, that made the sighting so important. He would have gone on to give birth within 24 to 48 hours after the picture was taken. This was the final piece of a long puzzle that started with the British Seahorse Survey set up in 1994, which is now the World Seahorse Survey. https://www.theseahorsetrust.org/conservation/world-seahorse-survey-2/

In 2008 the Studland Seahorse Project was set up by The Seahorse Trust (<u>www.theseahorsetrust.org</u>) and it has been running ever since, making it the longest running continuous survey, of its kind, in the world.

The survey though would not be possible, if it were not for the support of so many volunteers, and their dedication to go diving week after week, to try and find the seahorses in the bay. Without them, we could not have learnt, and achieved, so much. We would like to publicly acknowledge all their dedication and hard work, thank you.

All of this work is undertaken under license from the Marine Management Organisation (MMO). These wildlife licenses have been shaped and advised upon by the work that The Seahorse Trust has undertaken, which has now become industry standard for this type of research, especially in the UK.

The following report covers the period 2008 to 2020, allowing us to report our findings, developments in survey techniques, failures, and successes in making the site protected.



Picture by Beccy MacDonald-Lofts

British Seahorse Survey

Seahorses have been surrounded by myth and legend for centuries and as a result of this, they have attained an almost mystical presence, wherever they are thought to exist.

These areas are usually thought to be the hotter, tropical regions of the planet, and so it comes as a surprise to many, that the British Isles are indeed home to two species of Seahorse, and they have a wide and varied distribution.

The British Seahorse Survey was set up in 1994 because of an original sighting by underwater videographer Sue Daly in Jersey, and it has been running for 26 years now. Having progressed from a paper exercise, to an active surveying project working with the diving and fishing industries, along with the help of the general public. It is the longest running survey of its kind in the world with well over 2000 sightings in the UK to date. This continuity has been invaluable in understanding the nature and ecology of the Seahorses found around the British Isles and beyond.

The survey is now part of the World Seahorse Survey, also set up and run by The Seahorse Trust, with well over 3,000 sightings recorded on its database. Sightings and access to the database (password protected access only) is through the Trusts website online portal, funded by the Sealife group of aquariums.

All seahorse species are listed under CITES, and protected by the BERN Convention, OSPAR and now here in the UK, for the two native species, the Wildlife and Countryside Act (2008) which was a direct result of the application by, and the work of the British Seahorse Survey run by The Seahorse Trust.

Since the start of the survey, we are now beginning to understand a great deal more about these elusive creatures and their behaviour. It is now understood what happens to them in the winter, where they are breeding, and why we have 2 species. Also, we have information about their own unique traits are that help them to blend in, and live, so perfectly in harmony with their environment.

The survey is a good balance of science, and community based voluntary help. We receive information from a wide range of sources: from divers, fishermen or even walkers on the beach. Everyone can, and does make a valuable contribution, in fact without these people giving up their time and getting in touch with us we would not know so much about British Seahorses.

Here in the UK, adding the Seahorses to the Wildlife and Countryside Act has been a positive move forward, however this protection needs to be fully implemented and at the time of writing this report, unfortunately this is not being done.

British Seahorse species

Spiny Seahorse (Hippocampus guttulatus)

Common names: Spiny Seahorse, (occasionally known in the UK, as the Long Snouted Seahorse)

Distribution: Southern Norfolk, Essex, South Eastern England, along the south coast up around parts of Wales, up the West coast of Scotland to the Shetland Isles and around the all the coasts of Ireland.

There have also been sightings in the Firth of Forth and there is a suggestion they are found all down the east coast of England in suitable habitat.

- Habitat Out of both British Seahorses, the Spiny should really be called the Seagrass Seahorse due to its dependency on seagrass meadows in the warmer months of its life cycle. Although not exclusive to seagrass, it can be found in other weedy areas.
- Description: A big, bony looking seahorse, approximately 17 to 18cm from the top of the coronet to the end of the tail. The largest specimen ever found was found off Poole Harbour in Dorset by a local fisherman and measured 34 cm from the top of the coronet to the end of the tail.

Often, although not exclusively covered in long spines on the top of the head and down the back, which reduce with age.





Picture by Neil Garrick-Maidment

Short Snouted Seahorse (Hippocampus hippocampus)

Common names: Short Snouted Seahorse

Distribution:Essex, Kent and along the south coast of England. All around the
Channel Islands, around parts of Wales, Ireland and Scotland with
reports during 2006 in the North Sea on Dogger Bank.

There have also been a number of records on the River Thames, and other estuaries.

- Habitat The Short Snouted Seahorse is highly versatile in its habitat preferences, and occupies a wide range of habitats from sand and silt, to rocky areas, with or without algae. They are the seahorse species here in the UK which are likely to occupy marinas and have a tolerance for freshwater, which allows them to enter it for short periods of time.
- Description: A stocky, barrel chested, solid looking Seahorse, 15 to 17 cm from the top of the coronet to the end of the tail. Unlike the Spiny Seahorse around the United Kingdom, the Short Snouted Seahorse seldom has spines on its head and back, although in other parts of Europe, they do have them.



Seahorses and migration in the British Isles

Seahorses are a slow-moving fish, with a limited swimming ability; their only form of propulsion is the tiny dorsal fin on the back of their trunk which will 'flutter' between 35 and 70 beats per second. This movement moves down the dorsal fin, from the top to bottom, pushing the Seahorse along, like an outboard motor. When not swimming, the fin will lie at rest against the body, which is a good defence against accidental damage that can occur when amongst algae and rocks. They can damage the delicate membrane of the fin during storms, where they will get bashed around in the surge. The pectoral fins on either side of the head, aid in stability, and appear to help in changing direction, these lie flat against the side of the head when not in use, and like the dorsal fin, flutter at high speed when in use.

Traditionally it was thought that the sightings we had in the British Isles were just 'accidental visitors' that had been washed across the channel from the Continent, or a seasonal migration from across the channel. This appeared to be highly unlikely for a variety of reasons:

Primarily the current in the channel tends to work from west to east or east to west, so most of the seahorses crossing the channel would probably have to raft [that is be attached to an object as it drifts in the current] and would be driven by the current the wrong way. Undoubtedly some would have made their way across the channel, however not in the numbers we have recorded over the years.

Although we do have a couple of sightings of Seahorses in mid channel (Sue Daly personal observation and Ivor Rees; seahorse caught in a scientific trawl) the chances of a small fish, with limited swimming ability, being able to swim across the channel unaided, seemed highly unlikely, and would not explain the numbers (in excess of 2,000 sightings) recorded on the British Seahorse Survey's National Seahorse Database (Now World Seahorse Survey).

We have now discovered, from work conducted by The Seahorse Trust, through the World Seahorse Survey, that some seahorse species migrate, and that even within a species some migrate but many do not. This depends on where they are located, and their exposure to storms in the autumn and winter.

The migration that does occur applies to those seahorses that are found in exposed areas where the seahorses are at great risk of damage from severe winter storms, extreme tidal and weather conditions, such as Studland Bay or the Isle of Wight. In sheltered areas such as Poole Harbour, the River Dart in Devon, Plymouth Sound and the Solent, as well as more sheltered areas such as estuaries around the coastline, the population appears to stay the same area all year around and does not migrate. There would be exceptions to this, and we are sure that migration does take place into and out of these areas. If populations were not 'refreshed' through recruitment, then this could lead to a poor gene pool, or even, over time, development of a sub species. This does not appear to happen, so inter area recruitment is certain to be happening.

Along the south coast there is an east west drift of the major current and so seahorse fry would be mainly moved in a westerly direction as they exit Poole Harbour; the next stop along the coast is Studland Bay. We are certain that some recruitment into Studland Bay comes from Poole Harbour and further east along from Bournemouth and beyond.

There is no data to support seahorses moving from Poole Harbour to Studland Bay, or indeed the reverse, however as seahorses breed. and the pressure on the population builds up, it is crucial for the species to move into other areas, otherwise food would be depleted and there would be a shortage of suitable habitat to live in.

As Poole Harbour reaches capacity, it is realistically assumed, any animals that leave Poole Harbour via the strong tidal currents go out into Poole Bay and some of these animals could even end up in Studland Bay, or the next bay along, Swanage.

It is the same for new bloodlines of seahorses going into Poole Harbour; as the strong tidal currents suck all types of species of fish into Poole Harbour, it could do the same for seahorses (adults and fry).

As animals leave Poole Harbour, they enter Poole Bay. This large bay is fringed by Studland, Swanage, Isle of Wight and Bournemouth, giving it a semi-enclosed aspect, which creates a very gentle circular current in the bay. This is fortuitous for seahorses and other species that spend the initial part of their life cycle in the plankton layer, as it moves them throughout the bay, and so in theory, seahorse fry from Studland and Swanage, could end up in Poole Harbour as the tide is incoming, being taken into the harbour. This is good news for the harbour population of seahorses as it could bring in new bloodlines, refreshing the population.

Temperature does not appear to be the deciding factor as to when the seahorses start to migrate into deeper waters. Looking at the data chapters below it can be seen that when the seahorses migrate into deeper water the temperature is reasonably high at about 15 to 18 degrees. There must be other factors at play, such as storms.

The records of the deeper depths occur from October through to April, which is the time of the worst storms and turbulent seas. This migration to deeper water is in response to the winter storms and looks to be a highly successful survival technique.

The deepest record held for the UK, is off Dartmouth at 45 metres (148 feet) and the coldest record for seahorses in the UK is at 6 degrees, at Studland Bay.

It can be assumed, from the known data, such as observations of pregnant males and mature females in the wild, and recordings of juveniles at various times of the year, that the Seahorses are returning to shallower waters to breed in the increasing warmer months of the year. Depending on the weather this can be from March onwards although this is not a firm rule. European seahorses are known to breed in captivity more frequently during the warmer months,

This coincides with the time of year that plankton bloom (food for seahorse fry) is at its highest. This tends to be from late March or early April, the first and largest of the peaks which go through to the autumn. During this time there are several smaller and medium sized peaks, of varying degrees, mainly during peak lunar cycles.

This is a similar pattern to the corals in the tropics, that coincide their breeding cycles with maximum water movement around the lunar cycle; this allows for better distribution of the eggs.

The earliest recorded sighting of a seahorse at Studland Bay has been late in February, although they are more commonly found from March onwards. The last seahorses spotted in the Bay are usually in October, but this does vary according to the autumn storms.

It is known that seahorses are found in Studland every month from at least March onwards until October.

It is however, very difficult to give a mean average to numbers in the bay, because there is a strong anthropocene influence in the form of thousands of boats during the warmer months of the year. Our observations, supported by the data, clearly show that high numbers of seahorses at the beginning of the year can decline rapidly if the boat numbers build up, creating physical and noise hazards in the bay, which directly affects the seahorses.

Through the work of the survey, we have confirmed a resident breeding population in the British Isles and Ireland, but as described above, there would also be limited recruitment and export from, and to continental Europe. This would most likely be by 'rafting'.

We know from the work being undertaken at Studland and through the British Seahorse Survey in general, that seahorses are indeed a resident, native species in UK waters, and can be presumed to have been for a very long time. They have been recognised as a native species and fully protected under the Wildlife and Countryside Act since 2008, when The Seahorse Trust submitted them, and supporting evidence and data, to get them included under the act.

There is absolutely no evidence at all to suggest that we only have Seahorses in our waters due to global warming, as stated by some scientists. Indeed, it is very misleading

to say this. In the time seahorses have been known to be native, we have gone through warming and cooling of the seas around our shores several times, and there is absolutely no evidence to support this theory.

Site fidelity and populations

There is no doubt that unless they are disturbed, seahorses are site faithful during the warmer, breeding months of the year. With the males, this site fidelity can be a matter of tens of meters and in the females, a great deal more. It takes a great deal of disturbance to move them off site.

Disturbance could be in the form of too many anchors dragging through the seagrass, or lots of engine noise, or possibly other factors. When a group of students were playing volleyball in the area she treated as her territory, one female seahorse was spotted swimming out into the sandy region, away from the seagrass. About an hour or so after they had gone, the female slowly moved back into her site.

However, sadly, most seahorses that suffer abnormal disturbance do not return, and are often not found in the bay again. A good example of this in 2020 is when a group of film makers, under license from the MMO decided to break the normal routine of spending only 5 minutes with a seahorse and ended up spending several hours with them. Within days the seahorses had abandoned the site and were not seen again that breeding season.

Previously, when we used our tagging system of identification, we noted that several individuals returned to Studland in other years, including one female that came back 3 years after first being spotted.

Having said that, we do not think that this is a constant, and is done every year by all of the seahorses. Once the seahorses have moved out into Poole Bay it could be a matter of chance, that they end up coming back into Studland or some other site.

One way of describing a population is to discuss it as a resident population. We use a constant population, in one area, as our description of a resident population. This is not necessarily the same animal's year in and year out, but an area that naturally has a viable breeding population. If it was not for the harmful anthropogenic influences in the bay, it is our considered opinion that seahorses would be resident in Studland every year. The site could easily house a population of a few hundred adults every year.

This population description also applies to areas such as Poole Harbour, the only difference being that some animals will most likely live within the harbour confines for many years at a time.

A constant population under normal natural conditions, constitutes a resident population.

Studland Bay

Studland Bay is found in the south eastern corner of Dorset in England. It is a unique site, protected from strong south westerly storms by the headland known as Old Harry. This shelter from storms, makes it a popular site for visiting boats and a shelter in times of danger for vessels. It is also known as an overnight spot for yachts traversing the south coast of England.

It is a relatively shallow bay, most of it below 3 to 4 metres in depth and is made up of sand and silt, with seagrass in the southern corner of the bay in an area known as South Beach. There are also thin strips and clumps of seagrass running north of this, through Middle and Knowle beaches up to Shell Bay at the entrance to Poole Harbour but this runs in a long thin line due to strong currents and unfavourable conditions.



The seagrass in South Beach protects the cliffs and beach from erosion by waves. However, in recent times, as the seagrass has been eroded, there have been cliff falls, and the beach has dropped in level by almost a metre.

The erosion and fragmentation of the seagrass have been caused by illegal moorings and too many boats anchoring on the site; anywhere up to 400 plus boats in a day, which has resulted in over 120,000 anchoring incidences a



Beach level dropped by almost a metre. Picture by Kim Maidment

year, in an area about the size of 6 football pitches



The seagrass is home to a myriad of species and is a nursery for so many commercial fish species such as Bass. It is also home to 6 legally protected species, protected under the Wildlife and Countryside Act; including the seahorses and Undulate Ray (*Raja undulata*) both of which are known to breed on the site.

Studland Seahorse Project

The Studland Seahorse Project (SSP) is a sub project of the World Seahorse Survey, which at the time of writing has 49 countries on its database and growing every year.

The survey at Studland Bay started in 2008, when a pregnant male Spiny Seahorse was found, and has grown into a nationally and internationally important study of the species and its ecology.

The survey is made up of very willing volunteers from all walks of life and without them we could not have achieved so much. (Thank you to one and all)

All divers require at least 20 logged Uk dives and are to be comfortable diving in very shallow water for long periods of time (up to 3 hours)

Leading on from the sighting of the pregnant seahorse we have dived there every year since 2008 and amassed a lot of data and information about the seahorses in the bay.

The surveys were conducted using SCUBA and we set and devised areas to survey and methods of doing this.

Method(s)

All the survey work undertaken is conducted with a wildlife license from the Marine Management Organisation (MMO) that The Seahorse Trust (TST) has advised and helped to shape. These licenses have been designed to minimise stress and harm to the seahorses and are being refined on a yearly basis. Suggestions by TST are submitted in our End of Year report to MMO to further improve the license for the seahorses and their welfare.

A predetermined route is taken by the divers and this has been decided upon to either look at a new area on the dive site, revisit specific areas or known resident seahorses, to seek new seahorses, or to cover areas within, or outside of the study site. Some areas have been visited before, but need rechecking or sites that have never been visited before.

The routes taken are based on previous work undertaken and are decided upon by the license holder, so that a complete overview of the seahorses, breeding area or new areas is accomplished many times throughout the dive season.

In the survey, we undertake a number of dive patterns, depending how many divers there are, their experience, how much area we need to search, or whether we are seeking a specific seahorse or habitat. Although there are countless ways of surveying, we tend to use three main types. One, the Durrant Transect that was designed specifically for seahorse surveying by The Seahorse Trust.

The three main methods for surveying are: -



Single Transect - ideal for long straight lines or small areas.

Durrant Transect - for large areas using multiple divers



Multiple Transects - ideal for large areas and/or habitat studies.



All 3 main techniques (there are several other, lesser techniques) have been tried and tested for surveying for seahorses and proven to be highly successful.

It is worth noting the Durrant Transect was devised specifically for seahorses by one of our volunteers, Dr Eva Durrant and Trust Director Neil Garrick-Maidment FBNA in 2012 and is based on the formation that a flock of geese make when they are flying together. In this case instead of taking advantage of slipstreams in the air, Dr Durrant and Neil Garrick-Maidment devised it, to take advantage of the diver's actions in front of each diver. When a diver moves forward, a small eddy is created by their fins which opens up the seagrass, exposing the creatures living in, and amongst the seagrass, and is very efficient in exposing seahorses and does not harm them. (Please note this method is copyrighted to The Seahorse Trust ©2012)

Seahorse Identification

We have looked at various types of identification for individual seahorses, from using floy tags around the neck, to fin clipping, but all of them required some form of handling or disturbance to the seahorses, which was not ideal for a species of fish that is very sensitive to stress.

In the end we settled on Head Profiling and this is the method we have used for many years now. It is an ideal technique as it does not require handling and is non-intrusive.

Head profiling

Over the years we have refined the techniques of surveying, as the welfare of the seahorses is paramount. If we were under any suspicion that our methods were harming seahorses, then the project would have been stopped, or the methods would have been stopped and changed.

Originally when the license was issued, we used a tagging method perfected, tried and tested over 8 years. However, slowly, we have moved on from this, to a more efficient system called Head Profiling, which has been devised and perfected by Neil Garrick-Maidment and The Seahorse Trust team.

Head profiling is a crucial tool in identifying individual seahorses. By taking a photograph of either side of the head, it is possible to identify individuals from one dive session to the next, even from one year to the next.



Right side

Left side

When using the profile pictures, we look for clusters of spots or unique markings on each individual seahorse, this then becomes their 'fingerprint'.



Each seahorse has a set of spots (mucous deposits) that are unique to that seahorse, they seldom change over time and so are a reliable method of identifying each seahorse. We look for unique patterns, whether that is a line of spots, a cluster, or a unique formation; anything that can help in the identification of individual animals.

We do not use the spines (cirri) as they are not reliable for long periods of time, as they can be absorbed or grown at will and when identifying seahorses from one year to the next, it is important not to use a method that will cause confusion.

Colour is equally as unreliable as it is can change rapidly and reflects the emotional mood of the animal.

The Head Profiling has proven to be the most reliable method, however we are always endeavouring to improve our techniques, and to refine what we do, and so this system may change over the years, if, or when a new technique is found.

Some seahorses have unique colour patterns or other identifying marks on their body. One female had a small black a square on her body, another had an orange square. These unique marks, alongside, sex and other features, means that we can be extremely accurate in identifying most of the seahorses on the study site, particularly in one season.

Occasionally however we can identify them across seasons. The female below was spotted over 2 years, even though there was a gap of one year in between.



The dark patch on the side of this seahorse helped to identify her, throughout the dive season, and into a second year.

Results and Analysis

During our survey work we have obtained data on sea temperature, depth, location, type of seahorse (species), sex of the seahorse, pregnancy condition (for the males), habitat and any unusual features, pertaining to each individual seahorse.

All of this data allows us to identify individual seahorses over the season we are studying them, and occasionally into following years. It also allows us to work out which seahorses are partnered with which, giving us an accurate idea of breeding cycles and territories.

Divers and volunteer help during the Studland Seahorse Project

The entire British and World Seahorse Survey project would not be possible, but for the incredible help from so many volunteers, which have numbered into the thousands over the years. We would like to offer our heartfelt thanks for all the hard work they have undertaken at their own cost and in their own time to make this project a success.

After receiving our license in 2010 from the Marine Management Organisation (MMO), we formed a core team of highly skilled volunteers, 'agents' (listed on the license under the license holders name). This team has become extremely skilled at finding and locating seahorses, and we are confident that they would see at least 90% to 95% of seahorses that would be found on the site. This gives us a high degree of confidence in the accuracy of seahorse sighting numbers for the site.

The following graph shows numbers of formal volunteers who took part in the Studland Bay project. As can be seen, we have sub divided them into differing skill levels and total hours spent underwater. It is crucial to say, this is actual time underwater and not the time spent getting to the beach and back again.

Year	Volunteers	Hours	Unskilled	Skilled	Professional	
2008	67	125	45	12	9	
2009	172	302	64	46	62	
2010	132	266	39	47	46	
2011	107	151	45	22	39	
2012	64	85	29	12	23	
2013	49	85	15	14	20	
2014	37	55	14	11	12	
2015	25	51	9	9	7	
2016	32	45	6	17	11	
2017	11	23	1	5	5	
2018	15	17	0	8	7	
2019	9	14	0	0	10	
2020	39	63	2	21	16	
TOTALS	759	1281	269	224	267	
Average	58	99	21	17	21	
Volunteer numbers during the period 2009 to 2020						

Seahorse numbers per annum

Throughout the study, seahorse numbers were at a high at the beginning in 2008, and as the graph and tables below show, they declined rapidly over a number of years. There were no seahorses found for 2 years, then one year with a small number (2), followed again by two years with no seahorses.

2010, was an exception to the numbers as we had a large number of sightings reported into us, and our team also saw many repeat sightings. Actual seahorse numbers would have been approximately 40 in this year.

Seahorse sightings per annum				
Year	Number			
2008	59			
2009	45			
2010	66 (40)			
2011	13			
2012	19			
2013	8			
2014	1			
2015	0			
2016	0			
2017	2			
2018	0			
2019	0			
2020	111			
TOTAL	324			

Seahorse sightings, first and last per year				
Last seen				
08				
09				
.0				
11				
12				
13				
14				
17				
20				

It is worth noting that the first date seen does not mean it is the date that the seahorses turned up on the site. For a variety of reasons, such as lack of visibility, poor diving conditions etc, the seahorses had not been seen prior to this date but might have been there.



A big change came in 2020, when a long winter was followed by lockdown, due to COVID-19, which gave the seahorses and seagrass time to recover. It was a very rapid, remarkable recovery, and we identified approximately 46 known seahorses out of 111 sightings during the 2020 dive season. It is worth noting that due to lockdown, we could not access the site before May and so the seahorses may have been there earlier than that. In fact, it is most likely they were there, as the weather conditions had been ideal for several months prior to May.

The unique happenings in 2020 give hope for the future, for what can be achieved now that Studland Bay is a Marine Conservation Zone.

This rapid recovery, although not complete (as the seagrass still showed scarring from anchors) shows what is possible with the correct management of the site. This applies to the seagrass and seahorses as well as the use by people, whether that is by boat, or from the shore, or in the water.

In each of the years there is little difference between sea temperature, so the downward trend of seahorses could not be because of that. The weather overall was similar each year, with long periods of calm water and sunny days. However, the boat numbers tended to increase during this time as more and more people could afford small water-craft, and we noticed the number of boats visiting the site appeared to increase, year on year; sadly, and ironically, probably because of the high level of publicity we were obtaining for the site.

The main reason for the rapid decline of seahorses in 2020 was the sheer number of boats visiting the site (up to 420 on one day) as the British public could not go abroad on holiday, they took holidays here in the UK. This rapid rise in boat traffic, caused noise and chemical pollution and had devastating effects on the seagrass.

2020 was the only year we had to abandon a survey dive on health and safety grounds, due to numbers of boats coming dangerously close to us and creating pollution in the water, that left the divers coughing and choking on the fumes, leading to several days of sore throats.



Seahorse breeding at Studland Bay

Male seahorses are a unique species, in that they get pregnant. The only species in the animal kingdom where a male will have a true pregnancy, not a surrogacy.

After a long winter in the depths, the male and female seahorses will slowly migrate into their summer areas, their 'places of shelter' (as defined by the Wildlife and Countryside Act) to breed.

Seahorses have two places of shelter, one in the depths and one in the shallows. The period of movement between these two, are called migrations.

Arriving on the site the male starts to establish a territory and waits for the females to join him.

As the sea is a vast place, it would be difficult to find mates, especially in seagrass meadows, and so they release pheromones into the water to let the female know where they are.

Seahorses have very effective olfactory senses and so she will sense these pheromones from some distance away from the male and start to make her way towards him.

Once in visual range, the male will display to encourage her interest, he turns side onto the female, erects his dorsal fin, tucks his head into his chest and appear to shimmer by lightening his body colour; they can go from black to white in seconds, but more commonly they just lighten up. On some Spiny Seahorses the abdominal keel goes black and the face will also go dark; all of this is designed to get her interest.

If she is interested, then she will mimic his colour and posture, with the male encircling her, corralling her, often around an object like a piece of seagrass.

Exact synchronisation and mimicking each other's movement, end with the pair rising in the water column with the male turning to face the female. At this point, this is where the seahorse's unique biology comes into play, she has an ovipositor; the equivalent of a male penis, which she inserts into the opening of the male's brood pouch.

The opening is at the very top of the pouch that is attached to the bottom of the abdomen and ventral (front) side of the tail.

Facing each other the ovipositor goes into the male's pouch opening and within a few seconds the female has deposited up to 5 or 7 hundred bright orange eggs. At this point they break away and drop to the seabed.

The female's role is finished for the day and she drifts off, to feed and hide away in the seagrass until the next day.

However, the males' role has just started, as he drops to the seabed, he will wiggle from side to side, self-fertilizing the eggs as they are embedded into the lining of his brood pouch. This lining is very much like the placental lining found in mammals, and indeed it has similar functions, such as providing a blood supply, oxygen, and food to the fry, developing in his pouch.

In the Spiny Seahorse, the eggs take approximately 28 days to develop, whereas the slightly smaller Short Snouted Seahorses it takes approximately 21 days.

Once the male is pregnant, he and the female will reinforce their pair bond by doing a courtship dance every morning. They repeat this stunning mating dance, shimmering and dancing around each other and occasionally they rise in the water together, however as the males' brood pouch is sealed with a plug to allow the fry to develop in an amniotic fluid, she cannot pass over any more eggs.

There is a strange anomaly in female seahorses, in that the female can have eggs prepared in her ovaries ready to pass to the male, eggs in reserve, and eggs in preparation.

Often, even though the female cannot pass eggs across to the male, when he is pregnant, she will spill her eggs out of her ovipositor, during courtship,



down onto the seabed as she is carrying so many internally.

However, nothing in nature is wasted, these eggs are quickly eaten by other fish and crustacean species, giving them a major boost nutritionally.

The Seahorse Trust is starting to think that maybe the female may service more than one male, and this is why, firstly she can produce so many eggs, and secondly why her territory is so much larger than the male.

If she has another male at the other end of her territory, then she can mate with that male as well, and he does not come into conflict with the first male, as he is so far away. This could also mean the second male is also serviced by a second female if her territory overlaps his.

There are other seahorse species that are known to have more than one partner, or that are opportunists, such as the *Hippocampus whiteii* from Australia or the *Hippocampus abdominalis*, also from Australia.

It is early days in this part of the study, and these are just suggestions, but the present line of thought is that the British seahorse's pair with one other partner for a season and then go their separate ways.



At Studland Bay by using facial recognition processes, and identifying the sex of the seahorse, we have become familiar with individual seahorses.

Their state of pregnancy is one of the features we record whilst doing our survey dives and so this gives us a continuous record of how frequently they get pregnant, give birth and get pregnant again.

Some males have been known to be pregnant at least 4 times during the season and could indeed be more. We say this, because by the time we originally find them at the start of the season and then before they leave, there are often times we cannot dive for various reasons (mainly weather) and so the males might get pregnant more times than we observe.

We also know that some males move into deeper water when pregnant. and from records of seahorses caught over the winter and estimates of their age, we can reasonably assume that some individuals would have been born in deeper water during the winter. We also think on occasion that some males are becoming pregnant during the winter in deeper water, which allows for so many other questions.

We do know that males that do not migrate in areas like Poole Harbour, become pregnant during the winter, but this is less frequently than during the summer. This is probably linked to opportunity because of the storms, and also because there is less food in the winter months, and we presume males would need to range wider to search for food.

Transient animals and Short Snouted Seahorses

It is mainly the Spiny Seahorse that is found at Studland Bay, and is indeed the only one of the two British species that breeds there. We do know of a small handful of sightings (approximately 5 since 2008, when repeat sightings are removed) of Short Snouted Seahorses having been seen on the site; they do not stay and are usually only seen once. These are assumed to be transient animals, that do not set up territories within the bay, or do not find suitable habitat to live in.

Being a wide bay with a direct east-west current coming straight into it, transient seahorses of both species can and do end up here. It is assumed they come into the bay and move around looking for suitable habitat to set up territories in, but not all seahorses of both species that come into the bay, stay there.

Individuals are seen and then never seen again during the breeding season. (resident animals are seen numerous times during the season.)

We feel this could be for a variety of reasons, such as the wrong habitat in the case of Short Snouted Seahorses or breeding territories are already occupied. Maybe they could not find a mate and moved onto other areas as in the case of Spiny Seahorses.

Short Snouted Seahorses generally are not found in dense seagrass, and so seagrass meadows like the ones at Studland Bay are not suitable for them.

When they have been seen, it is usually either on the edge of the seagrass, amongst the rocks at the side of the seagrass, or on open sand. Most of the sightings have been of individuals and usually when they are on the move.

The one exception to this was a possible sighting in 2010 of a pair of Short Snouted Seahorses, alongside a Spiny seahorse. Apparently the Short Snouted were doing a mating dance with the Spiny. This record has to be treated with a bit of scepticism, as the source is not very knowledgeable of seahorses and was prone to not be able to interpret seahorse behaviour accurately.

There was a sighting made by a group of Seasearch divers of a pregnant male Short Snouted Seahorse. He was only seen once and looking at the photographic evidence

produced by these divers, he was being chased and they were using bright flash and lights to film him. Had he been wanting to settle in the bay, these actions would have been enough to scare him away and for him to move back out of the bay.



Temperature and seahorses

As can be seen by the yearly graphs below, and the overall yearly average temperature graph, the temperature for the 12 years of the study (during the dive season, mainly, from April through to October) to date, has remained fairly constant, between 13 and 17 degrees. In each year there have been some high temperatures; the highest being 21 degrees, however overall, the yearly average is constant. This consistency is a good indicator that seahorses are not affected by the overall temperature, and so other factors must come into play, to explain the loss of seahorses on the site.



Temperature does not appear to be the deciding factor as to when the seahorses start to migrate into deeper waters. Looking at the graphs, it can be seen that the temperature when the seahorses migrate into deeper water is reasonably high at about 15 to 18 degrees.

The trigger for migration into deeper water for the winter is the seasonal storms, which tend to start late September to early October. As soon as these hit the shallow water of the bay, the seahorse numbers drop rapidly and at Studland Bay the seahorses are usually gone by the end of October.

It has to be noted that in the 12 years of the project to date, there is no evidence for sea temperatures rising due to global warming. This is not to say it is not happening, it is, there is no evidence it is affecting Studland Bay The following graphs show the correlation between temperature (in red) and seahorse sightings (in blue) for each year of the project to date.















































Distribution of seahorses within the study site

Our main study site at Studland Bay is South Beach; in the southern corner of the entire bay, sheltered by the headland known as Old Harry.

We are aware of other seahorse sightings in the greater Studland Bay area and out from Studland into Poole Bay. There are very few sightings in the extended Studland Bay, but they have been found mainly at Middle beach with one or two in Knowle Beach. (we have dived and located them there, as have others)

The reason for this is the seagrass meadow, which is mainly at South Beach and provides for the needs of the Spiny Seahorse (Hippocampus guttulatus), which is the main seahorse species on the site.

Having studied the Spiny Seahorses at Studland Bay for so many years, we are confident in saying that the main area of occupation for the seahorses during their summer place of shelter is within the first 80 to 100 metres of the seagrass, out from the beach.

They are occasionally found out into the open sand, but we feel this is just time spent hunting for food, or if they have been disturbed by a boat or human from their usual territory.

During the summer period they have an average depth of 2 to 3 metres (at mean tidal range) as they are relatively close to shore. This also reflects the very gentle shelving of the bay as it goes out into Poole Bay, before it drops off into Poole Bay itself.

Even though during the summer months the seahorses are inshore, the entire seagrass meadow is vital for migration during the spring and autumn, as cover during these migratory periods and for feeding.



Studland Bay

SOUTH BEACHH STUDLAND BAY

The red line shows the summer, 'place of shelter' of the seahorses.

However, they are found throughout the seagrass meadow during their migration periods, and the whole area is vital to the success of the seahorse colony, as they require hidden areas to migrate through.

The ecology of the seagrass meadows gives the adults and fry ample food types to feed on, due to the shallow water being relatively warm.

This 'warmer water' means that the life cycle of the species that the seahorses feed on, the prey animals, is speeded up and in greater amounts than the same species in slightly cooler, deeper water. andfast Po

Studland Marine Conservation Zone



In 2019 after lobbying for 12 years, Studland Bay finally became a Marine Conservation Zone. It was a long, hard, battle to make this happen as there was a great deal of opposition based on emotion and not on fact.

We, with our partners, submitted our evidence to the consultation process and lobbied ministers as to the international importance of the site and after a formal meeting with Michael Gove MP, the then Environment Minister, it was designated as a Marine Conservation Zone (MCZ).

Within the MCZ marked with red lines above, there are several FOCI (Features of Conservation Interest), such as both seahorse species and the seagrass.

It is a designation of the MCZ status and why it was made one, that these FOCI are to be brought to favourable conditions.

In the case of the seagrass this means a fully functioning and complete seagrass meadows with a full and complete ecosystem.

The seahorses, particularly the main species the Spiny Seahorse, is to be recovered to favourable conditions, where a population is present for the warmer months of the year and a large enough population that is sustainable and balanced with both sexes, adults and juveniles, and a regular breeding population.

In the South Beach area, we estimate that a population of approximately 100 animals should be an initial target number for a viable population each year.

Boat traffic at South Beach in Studland Bay, Dorset

The Seahorse Trust did not set out to collect boat event data, as this was not its prime objective at South Beach, Studland Bay. We were there to study the seahorses on the site. We have though, made some observations during our time studying the site and this section of the report represents these limited observations. Unlike other estimated reports by various groups, they are a true representation of boating events and not an estimate.

The number of boating events anchoring and mooring at South Beach in Studland Bay, Dorset has been the subject of much contention during the life of the project, especially since the area (Studland Bay as a whole), has been designated as a Marine Conservation Zone (MCZ) in 2019

There have been many guesses at boat numbers on the site, and with the exception of a limited study by the ecological survey company, Seastar, nothing else has actually been recorded, except by The Seahorse Trust and Southampton University, during its formal studies on the site.

There are two very good reports by Drs Jackson and Collins listed in the reference section of this report that can be relied upon for accurate information about the seagrass meadows of Studland Bay.

Seastars report on the seagrass and boat numbers has often been quoted as the definitive boat count in the area, but a number of observations by Seahorse Trust staff and volunteers, and members of Natural England (and many others,) have cast doubt on the accuracy of the observations by a team of students who, only occasionally turned up, and when they were there, started at 10 am or 11 am, and usually left by 2 pm or 3pm, giving only the briefest glimpse of what actually occurs in the bay.

Some boats turn up late in the evening, and overnight, before going off early in the morning to sail up or down the coastline. They also turn up in the late afternoon to either spend the evening, eating and drinking in the area (on board, in the local pub or having a barbeque on the beach), some stay for a few hours before leaving and some stay overnight.

The Seastar Report fails to take any of this into account and as such should be dismissed as an incomplete report or at best a snapshot of the middle of the day. It is certainly not safe to rely on it, as the definitive report of boating events in the bay,

Background to data

It is worth noting this section is only a snapshot of events in the bay, for various reasons, but it has been accepted even by the boating groups who were against a MCZ at Studland Bay. In fact, they estimated higher figures than we did.

Where data is quoted, we have found this by the simple process of having several persons present, count the boats, and then an average is derived from the total number put forward by each person. The figures are then divided by the number of people counting to give a mean average.

The data and information contained in this section of the report is from the 11th of April 2010 until the 10th of October 2020. Data prior to this was recorded in the diaries of the author but these have since been accidently discarded, unfortunately without recording the data in them.

It is vitally important to note that most Sundays and Bank Holidays have been avoided for surveying, in the interest of safety to the volunteer divers. With the sheer number of boats on the site, there is a strong possibility of an accident between boats and divers; it is a conscious decision not to dive on these days (there have also been several deliberate attempts to run divers over). It is on Sundays and Bank Holidays, especially when the weather is fine, that the greatest number of boats are around and so this needs to be borne in mind when considering this report.

If the numbers for these days were added to the overall figures, it would not only show very high numbers of boats for these days, but it would also put the overall total up considerably and it would increase the daily average by a very large margin.

We conducted an experiment with 6 volunteers, to see how accurate the estimate of numbers of boats were, compared to the exact number of boats actually present. The results of this informal (non-scientific) experiment were quite a surprise. On the day there were 64 boats present (concluded by actual boat counts and an average gained by dividing counters by the numbers each person counted). Prior to the actual count each person was asked to guess (without counting) the number of boats on the site and an average was derived from each person guess; the average came out at approximately 40; roughly two thirds of the actual number of boats present.

Although this experiment was not scientific, and is accepted as such, it illustrates a point that on average a guess of numbers is a lot lower than actual figures.

Although this chapter is primarily concerned with boat numbers for the South Beach area, the reasons behind all of the studies and research at South Beach is the state of the habitat of the Spiny Seahorses (*Hippocampus guttulatus*), the seagrass.

The image below shows the study area at South Beach in Studland Bay, with red circles on it. Each of these red circles represents damage to the seagrass through anchor or mooring damage, and the whole site has been ground truthed by divers.



All red circles represent holes created by anchor damage or mooring chains in the seagrass, as ground truthed by Seahorse Trust divers and others, such as Southampton University divers under the supervision of Dr Ken Collins. (Courtesy of Google Earth, image 2009) Please note that the blue circle is an area of thin seagrass, but it is caused by fresh- water springs and tidal action in this corner of the bay.

This fragmentation of the seagrass has been illustrated by Dr Collins in his paper, **The impacts of anchoring and mooring in seagrass, Studland Bay, Dorset, UK** and in Drs Jackson and Collins paper, the **MAIA report: A Guide to assessing and managing anthropogenic impact on marine angiosperm habitat (full references below)**, both of which clearly show the effect of the damage which has led to fragmentation of the seagrass meadow.

It is worth noting the Spiny Seahorses (*Hippocampus guttulatus*) are a fully protected species under the Wildlife and Countryside Act (1981 as amended) under schedule 5, section 9 in which the place of shelter of the protected seahorses is also afforded protection. It is also an offence under this act to disturb a species with this level of protection, in its place of shelter. In this case the 'place of shelter' is the seagrass, which is also a legally protected habitat.

Data and boat numbers

Again, it is worth noting in the data collected, there are very few Sundays or Bank Holidays which have the highest level of boat traffic and so the figures below offer a very low average for the total period of time. If Sundays and Bank holidays had been included then it is reasonably expected that the daily average would be considerably higher, possibly up to 120 or more per day during the season. The highest recorded count on the site has been in excess of 420 (2019).

It has been observed that numbers of boats at South Beach can be confusing because boats are coming and going all the time, and so the total numbers of anchoring or mooring events are difficult to ascertain, however observations by Seahorse Trust volunteers (and others) regularly note boats coming and going all day long, and a turnover of total boat numbers, 3 or 4 times in a day, is very feasible, and highly likely.

This snapshot only represents, usually, one day a week, so one seventh of the total number of boats on site in a week. It also needs to be taken into consideration that there are approximately 200 boating days (possibly more) on South Beach per annum, which if you take the average boat numbers per day based on the figures presented, it would account for 19,400 boats per annum (or approximately 25,000 if the higher estimate of numbers includes Sundays and Bank Holidays) since 2008 this would amount to 349,200 mooring or anchoring events, in 18 years. If the higher Sunday and Bank Holiday figures are included this is 450,000 in 18 years.

Please note the average figures were taken by dividing known boat sightings, by the number of days they were observed, and so it was 10709 x 111 giving an average of 98.48 boats per day.

This is a very heavy usage of the site and it is no wonder there is severe damage to the seagrass meadow, with evidence of fragmentation as reported by Drs Jackson and Collins, which could lead to a collapse of the whole eco-system.

All of this, bearing in mind that the seagrass, seahorses and a host of other creatures are protected and the positive benefits of a seagrass meadow as stated by Ben Jones and Dr Unsworth of the Seagrass Project (<u>http://www.project-seagrass.co.uk/</u>). Positive benefits such as a CO2 sink, a diffuser of strong weather, protection against coastal erosion, a nursery for commercially sensitive species and a home to many species such as the seahorses which are legally protected (WCA 2008).

The data collected and estimated, relate to an absolute minimum of boat numbers for the reasons stated above and we estimate numbers to be greatly higher than stated. The highest number of boats counted in one day was in 2020 where 420 were counted with the lowest number being in 0 again in 2020.



As can be seen by the graph below, there has been a real and observable rise in boat numbers since 2010, and after lockdown in 2020 this number is even higher, as more and more people holiday in the UK. As the boat numbers increased in 2020 the number of seahorses declined rapidly.

No	Date	TOTAL	No	Date	TOTAL	No	Date	TOTAL
1	11/04/2010	28	38	06/07/2012	26	75	30/07/2014	150
2	23/04/2010	44	39	14/07/2012	28	76	09/08/2014	192
3	22/05/2010	277	40	20/07/2012	24	77	23/08/2014	216
4	06/06/2010	167	41	27/07/2012	118	78	23/05/2015	108
5	07/08/2010	47	42	03/08/2012	22	79	20/06/2015	55
6	10/08/2010	45	43	10/08/2012	146	80	27/06/2015	122
7	28/08/2010	127	44	25/08/2012	4	81	11/07/2015	125
8	01/09/2010	10	45	01/09/2012	42	82	08/08/2015	291
9	06/09/2010	15	46	08/09/2012	94	83	22/08/2015	343
10	18/09/2010	51	47	04/05/2013	43	84	26/03/2016	33
11	19/09/2010	48	48	21/05/2013	9	85	07/05/2016	77
12	28/09/2010	51	49	01/06/2013	26	86	11/05/2016	88
13	16/04/2010	36	50	19/06/2013	46	87	07/06/2016	16
14	20/04/2010	36	51	22/06/2013	6	88	25/06/2016	42
15	02/06/2010	39	52	29/06/2013	103	89	05/07/2016	43
16	21/06/2010	10	53	06/07/2013	275	90	06/08/2016	175
17	26/07/2011	131	54	18/07/2013	122	91	03/06/2017	104
18	10/11/2011	310	55	20/07/2013	97	92	07/07/2017	141
19	03/08/2011	379	56	27/07/2013	66	93	12/05/2018	6
20	05/08/2011	77	57	31/07/2013	93	94	25/05/2018	7
21	11/08/2011	26	58	10/08/2013	133	95	25/05/2019	290
22	12/08/2011	78	59	17/08/2013	82	96	06/07/2019	236
23	13/08/2011	234	60	24/08/2013	64	97	17/08/2019	5
24	17/08/2011	18	61	31/08/2013	79	98	22/05/2020	4
25	20/08/2011	221	62	07/09/2013	36	99	29/05/2020	22
26	25/08/2011	54	63	12/04/2014	35	100	05/06/2020	1
27	27/08/2011	92	64	19/04/2014	10	101	20/06/2020	18
28	10/09/2011	6	65	10/05/2014	31	102	27/06/2020	0
29	28/09/2011	74	66	24/05/2014	39	103	02/07/2020	16
30	30/09/2011	60	67	26/05/2014	39	104	11/07/2020	450
31	27/02/2012	50	68	14/06/2014	77	105	18/07/2020	345
32	30/2/2012	40	69	22/06/2014	239	106	25/07/2020	110
33	13/04/2012	4	70	23/06/2014	36	107	01/08/2020	278
34	19/05/2012	15	71	05/07/2014	41	108	08/08/2020	228
35	25/05/2012	16	72	07/07/2014	40	109	05/09/2020	24
36	31/05/2012	10	73	12/07/2014	350	110	12/09/2020	98
37	30/06/2012	19	74	26/07/2014	279	111	10/10/2020	5
						TOTALS		
							Dates	10709

Dates with boat numbers (source, The Seahorse Trust)

Anchor damage and other disturbances

Seahorses live in the shallow waters of the oceans. Unfortunately, at Studland this is where mankind spends most of its time destroying the seas and usually the two do not mix.

Habitat destruction can be by a variety of means from dredging to development, from dumping of rubbish, pollution to boating activities.

No matter how the habitat destruction occurs, it is devastating to the environment on land or at sea and can have long term permanent consequences, such as a breakdown in the overall ecology.

Anchor damage

Seagrass roots that are dragged into a ball by anchors, killing the seagrass and destabilising the seabed, leaving a white sand scar devoid of life.

Chain drag (before)

Chain drag on new seagrass, slowly scything it down and making the area just sand.

Chain drag (after)

Chain drag after seagrass has gone, notice the furrows from the chain links. The red line shows where the seagrass mat has been cut through by an anchor, exposing the roots.

By having a sharp edge like this, crabs and other burrowing creatures can get under the edge and stop it from regrowing through the sand/sediment.

Holes in the seagrass meadows from this sort of damage eventually get larger with current and wave action and in an area with lots of them they will join up to form

large anchor scars.

This picture is of a natural edge to a seagrass meadow. The seagrass has grown out into the surrounding sand/sediment and forms a natural flowing edge.

Seagrass forms a rhizome mat under its roots and this seamat stops crabs and other species from digging under the seagrass and it helps the seagrass to hold on, in the most severe of storms.



This picture of South Beach at Studland Bay in the UK was taken on the 21st of July 2008 and shows just a few of the damaged areas caused by the moorings in the bay. Each of the damaged sites have been ground truthed by volunteer divers (main pic. copyright Google)

The same thing has happened in this picture from the Isles of Scilly. It can clearly be seen where each boat's mooring is anchored to the seabed, creating circles as the tide ebbs and flows.

As these two pictures illustrate one of the main problems at Studland Bay is the use of anchors in the seagrass. Apart from seagrass being a poor habitat to anchor in, it also rips out the seagrass. If enough of this happens in one area, it leads to fragmentation of the seagrass, leading to a break- down of the ecology in the seagrass meadow.

Seagrass attached to anchors. This happens hundreds of times a day in the summer, very much like dredging the seabed.

Pollution

Pollution at Studland Bay comes from many sources, such as:

- The large number of boats, either as petrol-based pollution, or manmade sewage directly from the boat users, either directly into the water or by emptying their sewage tanks into the bay (this is illegal but it does happen).
- Run-off from the land from the farming community, although this appears to be in low levels.
- Raw sewage, as has happened several times since 2008. Sewage runs from the toilets behind the beach, which often block and over flow down the steam that flows directly out into South Beach.

As seahorses inhabit inshore coastal waters throughout most of the warmer months of the year and in sheltered areas like Studland Bay, they are susceptible to any form of pollution that impacts these areas, Studland Bay with its high number of visitors is very prone to this.

Water pollution can be caused through direct or indirect discharge of chemicals either into the coastal areas from vessels (small and large), via local rivers and streams or as run-off from the land.

Chemicals such as fertilisers from land run-off can cause rapid changes to the chemistry of the seawater, increasing the concentration of phosphates and nitrates. This increase in nutrients leads to algal blooms that can have very negative impacts upon seagrass habitats and also the species that live there.

Slime Algae can form when there are high levels of chemicals and an excess of sun light.

These two pictures were taken at South Beach in Studland after a sewage leak from the toilets behind the beach. It lasted for weeks and has happened a few times since 2008.

Rubbish

Anywhere you get large groups of humans, sadly you get lots of rubbish and Studland Bay is very prone to this. The rubbish takes many forms, from bottles, plastic, lost items such as sunglasses and boat hooks to used barbeques.

After Bank holidays and Sundays, there is a significant increase in this type of rubbish.

This coil of tyre has been lost from a crab pot

There are endless bottles dumped on the site from boats, we have even had some full bottles of wine found on the site.

Beer and cider cans make up the bulk of rubbish on the site

Crisp packets are also found in large numbers

Small plastic items like ice cream scoops are found in large numbers and potentially could cause a great deal of harm to birds and fish swallowing them.

All these types of rubbish can be avoided by people being responsible, by taking them home or disposing of them in litter bins on land.

Conclusion

Research work has been undertaken at South Beach, in Studland Bay, and the greater Studland Bay area since 2008, when a pregnant male Spiny Seahorse was found on the site. It has been continuous since then and looks set to go on for many more years.

This is the most comprehensive and continuous study of Spiny Seahorses (*Hippocampus guttulatus*) in the world and we hope that it will allow others to better understand the species and its habitat; and crucially its interaction with that habitat and other species, including humans.

It was never intended to be a study to see how boats affected the environment but as time went on, we realised that the boat anchors and the sheer numbers of boats using the site were affecting the seagrass and seahorses. As a result of this we submitted the bay for inclusion under the Marine Conservation Zone scheme; this finally came to fruition in 2019.

We aimed to present, in this report, the facts and data from that study, which has given us a very unique insight into the ecology of the Spiny Seahorse, and how it interacts with its primary habitat, seagrass, and why it is so reliant on that habitat for its survival.

Seagrass meadows are an important site for so many reasons such as CO2 sinks, diffusers of wave action, and they help to protect against coastal erosion. They are nurseries for commercially sensitive fish species such as bass and a home to a wide variety of protected species, such as Undulate Ray, Truncated Anemone, English Oyster and in the case of Studland Bay, the Spiny Seahorses.

One of the most important findings in this study, is that we have proven that seahorses are indigenous to the UK, they are found in every country of the UK.

Being able to track individual seahorses during their time at Studland Bay, we have shown time and again that seahorses are native and indeed breed here in the UK. Although we knew this, we never had that final piece of proof, this project has given that; we have since also proven it on other sites as well.

Migration was also finally proven on this project, even though this had been proposed by the author of this report back in 1994. We only managed to prove it during this project, the longevity of this project, allowed us to do it.

Without a doubt there has been a decline of the species at Studland Bay, due to intense pressure during the life of the project, however the comeback in 2020 due to COVID-19, has taught us so many things. If left alone the seahorses will return in large numbers (46 when we started to dive again) and crucially the seagrass will start to knit itself back together quite quickly. Sadly though, as soon as those anthropocene activities start again, the decline will be rapid.

It was never The Seahorse Trust's intention to collect boat traffic data, and so our data set is small but importantly it is an accurate observation of boat numbers, and can used as a guideline to events on the site.

If a more accurate boat number is required, then a full time, long term study will need to be undertaken on the site.

Studland Bay has quite rightly been designated as a Marine Conservation Zone for a wide variety of reasons, and reports such as Drs Jackson and Collins and work by The Seahorse Trust are vital in understanding this site so management protocols can be put into place.

This does not mean an end to boating activity, but what is does mean is that measures such as Environmentally Friendly Moorings (EFM's or Ecomoorings) should be put in to stop the pressure on the protected seagrass meadow and to allow for regeneration of the seagrass. In turn an increase in seahorse and other protected and non-protected species numbers.

Studland Bay can become a model of marine conservation and human usage with the correct management protocols in place and we hope this report goes some way to helping others understand the pressures on this extremely sensitive site.

A crucial point though, is that this survey and study needs to carry on into the future, to help, with the knowledge gained, to protecting the site. It will also be needed to gather even more knowledge on the species and habitat so that we can make a difference to other sites around the UK and the rest of the world.

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