# Temperature and day length related seasonal movement of seahorses at South Beach in Studland Bay in Dorset.

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**The temperatures and connected seasonal movement of British Seahorses is little understood and all work so far, has been conducted by The Seahorse Trust through the British Seahorse Survey and its sub project the Studland Seahorse Tagging Project.**

**At South Beach in Studland Bay, Dorset there is a seasonal population that is reliant on the seagrass meadow for feeding and breeding during the warmer months of the year.**

**It has been observed over the years that the seahorses move in and out of the bay depending on the yearly, seasonal temperature but this probably does not tell the whole story and day length could and probably does play an important role in the cycle; whether this is with food cycles and/or seagrass growths rates.**

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## Introduction

The British Isles are home to two species of seahorse, the Spiny (*Hippocampus guttulatus)* known as the Spiny in the UK and Malta and in other parts of Europe but is also known as the Long Snouted, and the Short Snouted (*Hippocampus hippocampus*) which both range from the northern most Shetland Isles down (predominantly) the western coastline. This includes around the Irish coastline, down to and along the south coast, across to the eastern seaboard, and up into southern Norfolk. They have also been found down the east coast of Scotland, in many of the estuaries and out into the North Sea, onto the Dogger Bank. It is possible their range continues all the way down the east coast but a lack of confirmed data (although there is a lot of anecdotal evidence) stops us completing this picture, further study is needed.

The main reason for the population to be more pronounced in the western region is the influence of the Gulf Stream which provides warmer, plankton rich waters, ideal food for the

plankton and small crustacea that the Seahorse; adult and fry are dependent upon and also for the seasonal growth of the seagrass meadows, favoured by the Spiny Seahorses.

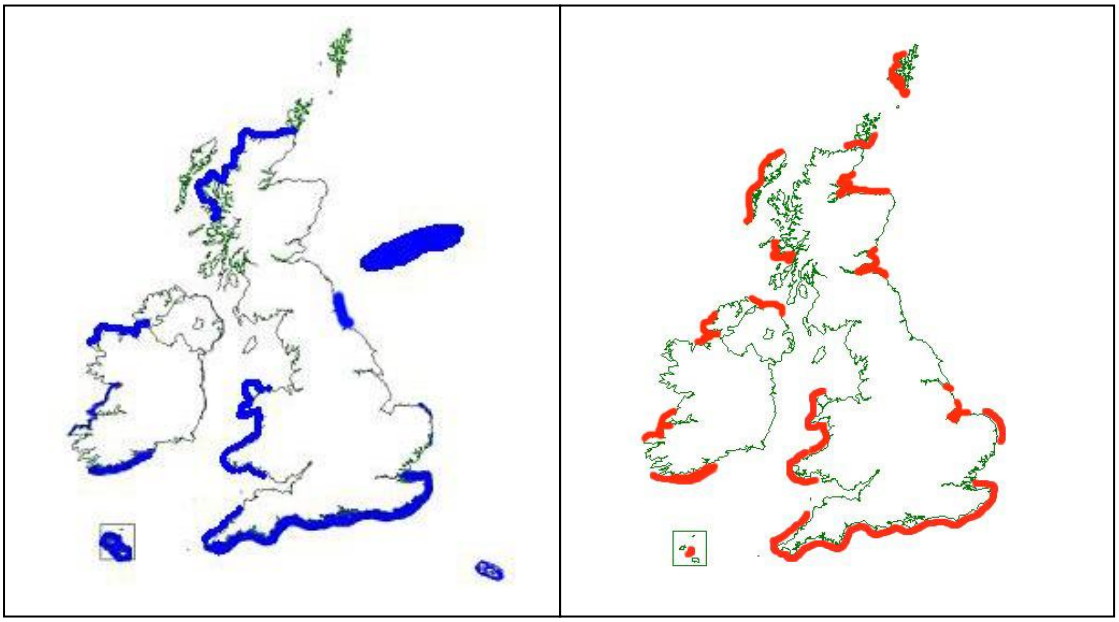

**Fig 1 Distribution of the Short Snouted Seahorse. (*Hippocampus hippocampus*)**

**Fig 2 Distribution of the Spiny Seahorse *Seahorse.* (*Hippocampus guttulatus*)**

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**Photo 1: Short Snouted Seahorse (*Hippocampus hippocampus*)**

**Photo 2: Spiny Seahorse (*Hippocampus guttulatus*)**

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## Gulf Stream

The Gulf Stream is a relatively warm water 'river' of water that starts in the Gulf of Mexico and heads north east across the Atlantic; it then moves predominantly up the west coast of the British Isles and Ireland and up into and then west back across the north of the Atlantic, where the waters of the Atlantic meet the cold, nutrient rich Artic and then down the east coast of Canada and America. As it moves down from the Artic, it takes with it rich cooler waters down to the Gulf of Mexico, providing

all the nutrients and elements to make the Gulf of Mexico one of the most important marine areas in the Atlantic.

It must not be underestimated the influence this warming current of water has on the British Isles and Ireland. Without it, we would have short hot summers and long, cold snowy winters, the same as in northern, North America and Canada, with which we share the same line of latitude. The Gulf Stream gives us our maritime climate but it also gives us more than that, in the form of the varied number of species native to our shores and the vast variety of life, terrestrial and maritime that we have.

As the Gulf Stream hits our westerly shores it warms the shallow seas and brings with it necessary nutrients to provide a myriad of creatures and to feed a wide variety of animals in the food chain; starting with the building blocks of life, plankton.

**Map 1: The blue lines show the direction and influence of the Gulf Stream. As the current moves into the North Sea, over the top of Scotland and through the English Channel it weakens and cools.** **Illustration courtesy of DEFRA**

## Plankton cycle

The plankton, zoo (animal) and phyto (plant) kick-starts a food chain that is dependent on temperature (from the Gulf Stream) and day length (due to changing seasons) but sustains a myriad of creatures from other plankton to shrimp, jellyfish, seahorses and up to Basking Sharks. Along the way, the food it feeds is food for other creatures, so for example the huge Leatherback Turtle found in British waters feed on Barrel Jellyfish which in turn feed on plankton.

The plankton cycle, booms and busts with rising and falling temperatures and longer and shorter day lengths and the cycle of plankton directly affects the life cycle of others species that are reliant on it.

During the cooler, shorter days of winter there is little plankton around but as the day length gets longer, this warms the seas of the British Isles, this warming starts the growth in phyto (Plant) plankton creating large algal blooms that can be seen from space. The abundance of phyto plankton allows the herbivorous, plant eating plankton to have sufficient food to grow and propagate into ever increasing numbers which are only kept in check by the coinciding increase of Zoo plankton; carnivores that feed on the herbivorous plankton. It is a fine balance that is easily disrupted.

As each type of plankton increase, it is kept from dominating the seas by the next group down or up. When the phyto plankton is depleted, there is little food for the herbivores to feed on and with that and the reduction in their numbers from carnivorous plankton, their numbers are reduced. Without the herbivores to eat the zoo-plankton, numbers drop, this goes on until the phyto plankton numbers build again and the whole cycle restarts. The plankton cycle during the warmers months tend to peak each month around the full moon; this peak at full moon coincides with the highest and lowest tides, which help to distribute the plankton much more widely.

Other species take advantage of this peak in plankton numbers by timing their reproduction to maximum numbers of plankton in combination with the best tidal movements to distribute their

young. Seahorses are a perfect example of this and the adults and fry (young) are perfectly aligned to reproduce, grow and distribute according to lunar, plankton, seasonal, yearly and day length cycles. The processes occurring in shallow water whilst the seahorses are migrating inshore include the increase in plankton, which in turn feeds the smaller crustacea such as Mysis Shrimp, so that by the time the seahorses arrive in the shallow water there is a good supply of food for them to increase body weight, improving their condition for breeding.

## Study site

South Beach at Studland Bay in Dorset is situated on the south coast of England and is a sheltered East facing bay protected by chalk cliffs. The east facing nature of the bay and height of the cliffs provides the perfect conditions for the seagrass (*Zostera marina*) meadow to grow, which is home to the Spiny Seahorse (*Hippocampus guttulatus*), the larger of the two British species of seahorse. The Spiny Seahorse is the seahorse species most likely to be found in seagrass in the UK. However on the edge between the seagrass and the cliffs on the South side of South Beach, a single pair of Short Snouted Seahorses (*Hippocampus hippocampus*) was found in 2008, the only recorded incidence of this species at Studland.


**Map 2: South Beach, Studland Bay, East Dorset**

**Courtesy of Google Earth**

The Seahorse Trust has been studying this site since late 2008 as part of the Studland Bay Seahorse Tagging Project (SBSTP) under license (Licence Number: L/2012/00096/1) from the Marine Management Organisation (MMO). It has now amassed data on the seasonal arrival and departure of the seahorses from 2008 until the end of 2012. Research will continue into 2013 and far beyond.

## Data collection and storage

All data collected during the period of the Studland Bay Seahorse Tagging Project (SBSTP) is entered into the National Seahorse Database (NSD) which is the repository for seahorse sightings throughout the UK and Ireland. There are in excess of 750 confirmed sightings held on the database, some dating back to the 1800's and any sighting recorded in the British Seahorse Survey (BSS) and the SBSTP are recorded into the NSD. The Seahorse Trust (SHT) which runs and manages the database has set up and also runs the National Maltese Seahorse Database (NMSD). We also note and record other sightings throughout Europe and the rest of the world.

The NSD and the British Seahorse Survey is internationally recognised as the most comprehensive and longest running seahorse database and survey of there kind in the world and is used by a wide variety of individuals and organisations throughout the world, access to the data is on a request only basis.

## Sightings listed from 2008 to late 2012

The number of seahorses seen since the second half of 2008 until the end of 2012 dropped considerably from 58 individuals (we know some of these are repeat sightings, which suggests there were approximately 40 individuals) down to 7 individuals in 2012. There could be a number of reasons for this but it is thought that the dominant reason is the fragmentation of the seagrass habitat as reviewed by a recent publication. This is called A guide to assessing and managing anthropogenic impact on marine angiosperm habitat (NECR111) by Drs Jackson and Collins found on the Natural England website.

[ http://publications.naturalengland.org.uk/publication/3665058]

During this period there were long, colder, stormy winters but it is not thought that this is highly significant because there were seahorse sightings occurring in other regions. These included the neighbouring sites of Poole Harbour and Swanage Bay, if they were occurring elsewhere there had to be another factor influencing them at Studland Bay. The most obvious conclusion based on ongoing research is the fragmentation of the habitat which could lead to a break down in food chains and suitable areas to set up territories. It could also affect the migration of the seahorses that need covered areas to cross as they move through the seagrass bed.

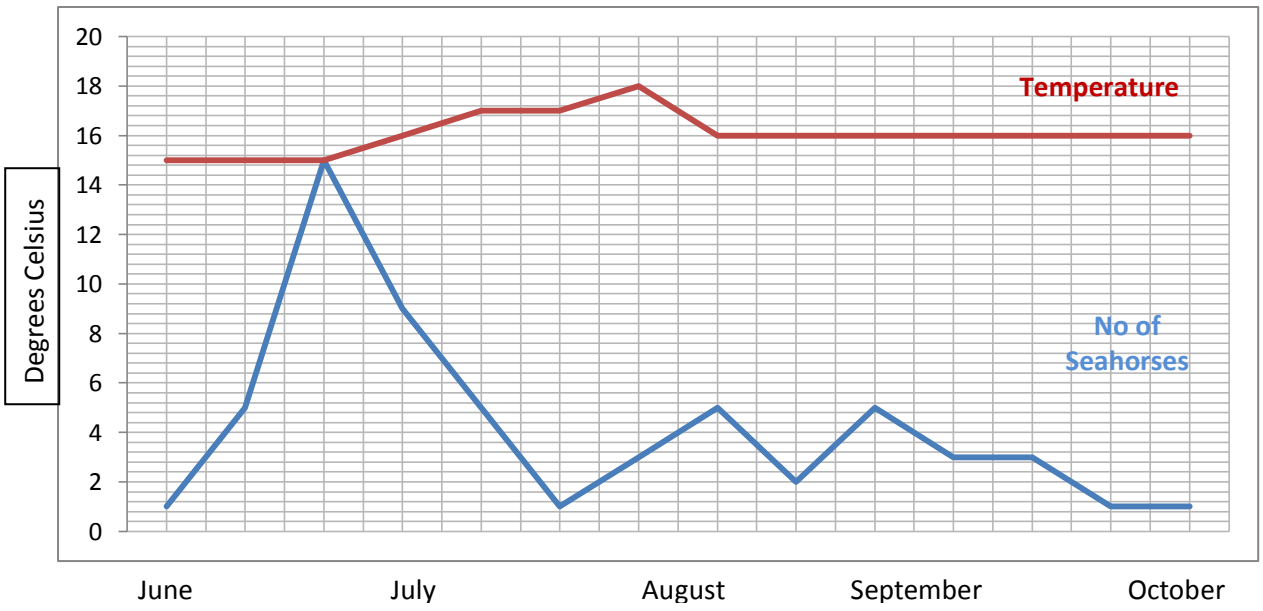
## Yearly temperature variation/seahorse sightings

Throughout the study period of the SBSTP we have recorded the movement of the seahorses into and out of the bay and there is a direct correlation with sea temperature

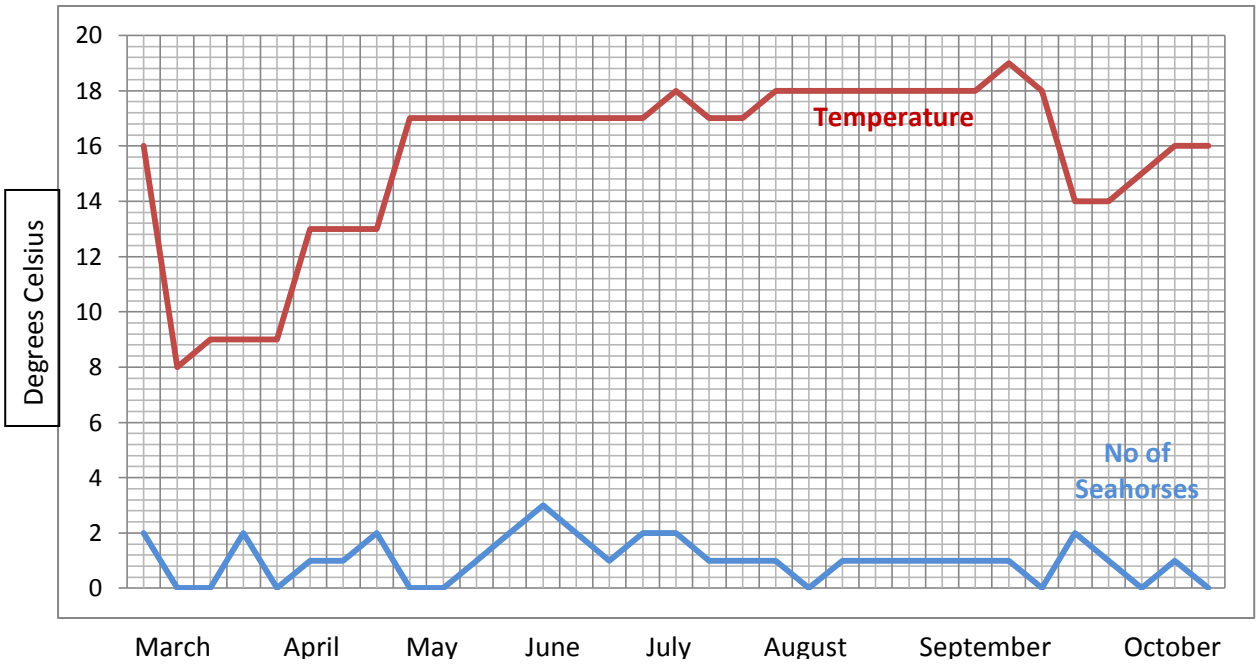
when the first sightings of the season occur. It is strongly thought that temperature is not the only parameter in effect here and that day length; bringing with it increased amounts of food and longer growth in the seagrass fronds is equally important.
It has been recorded since 2008 at Studland Bay that it is rare to see seahorses before the temperature has risen to 9 degrees. They tend to leave the bay regardless of temperature when the autumn storms break and it becomes too dangerous for them to be in shallow water. Occasionally we see seahorses washed up when the first storms hit in the autumn or at the start of the season when the weather has warmed the sea. Unseasonal storms hit, which catches the seahorses out in the shallows.
At the beginning of the season as the seasonal temperature increases the seahorses migrate back across the seagrass meadow into shallow waters from the deeper Swash Channel which sits to the East of Studland Bay. The migration is a slow process and the lengthening day is possibly the stimulus for this process to start. This coincides with the seahorses coming into the shallow water when the water temperature has reached 9 degrees or above.

Seahorses usually appear by late April to early May depending on the sea temperature and go into deeper water by mid-October at the latest. Although the number of survey dives drop in the winter due to the weather, there has never been a confirmed recorded sighting of a seahorse in Studland Bay between mid to late October and to late April to early May the following year.

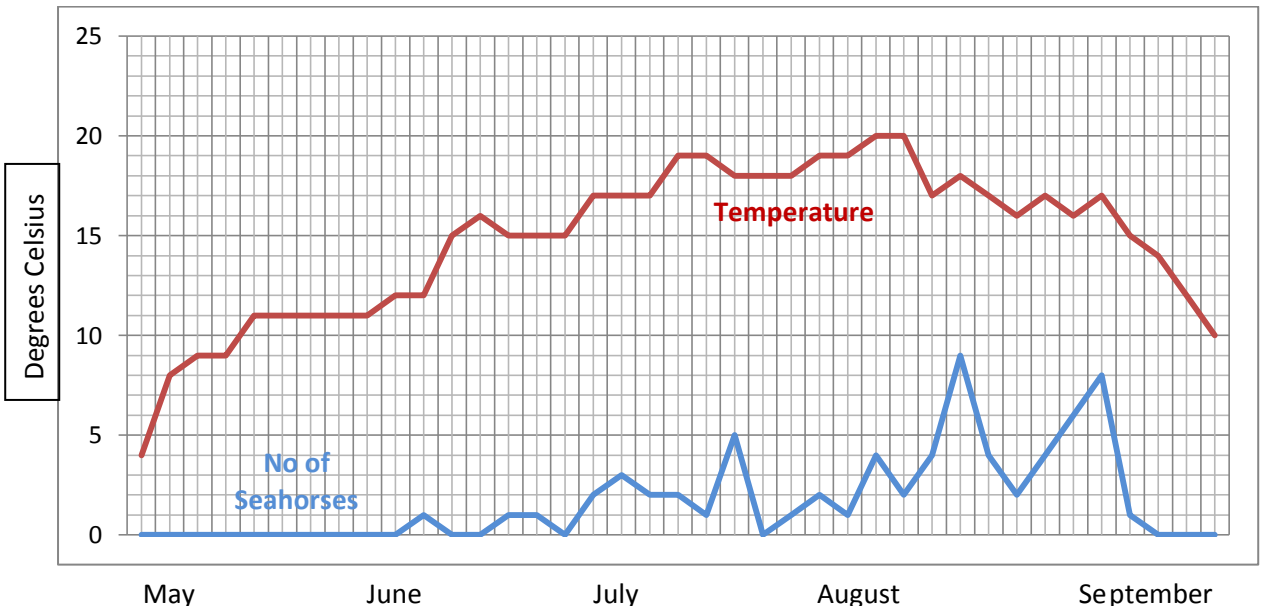
The graphs below show the years 2008 through to 2012, charting the temperature and seahorses sightings in Studland Bay. The earliest sighting was in late April and the latest sighting was in October. It is worth noting the sightings for 2008 were only for the second half of the year when the sea temperature was already at 15 degrees.



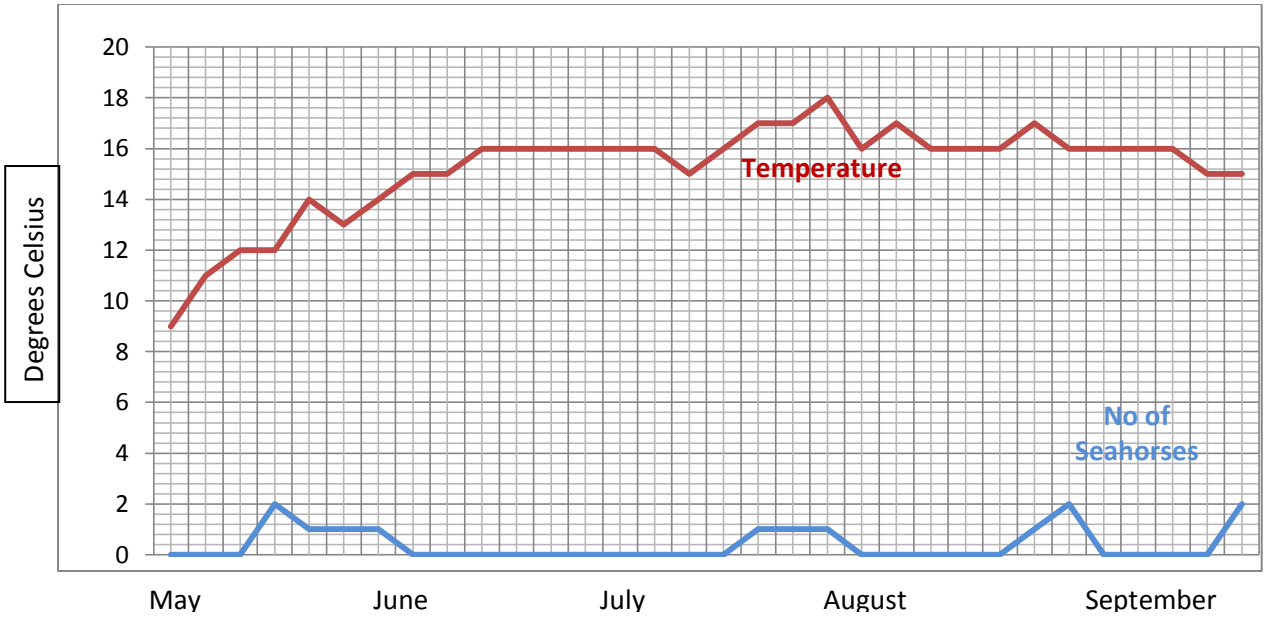

**Graph 1: Temperature/seahorse records for the second half of 2008 until October**



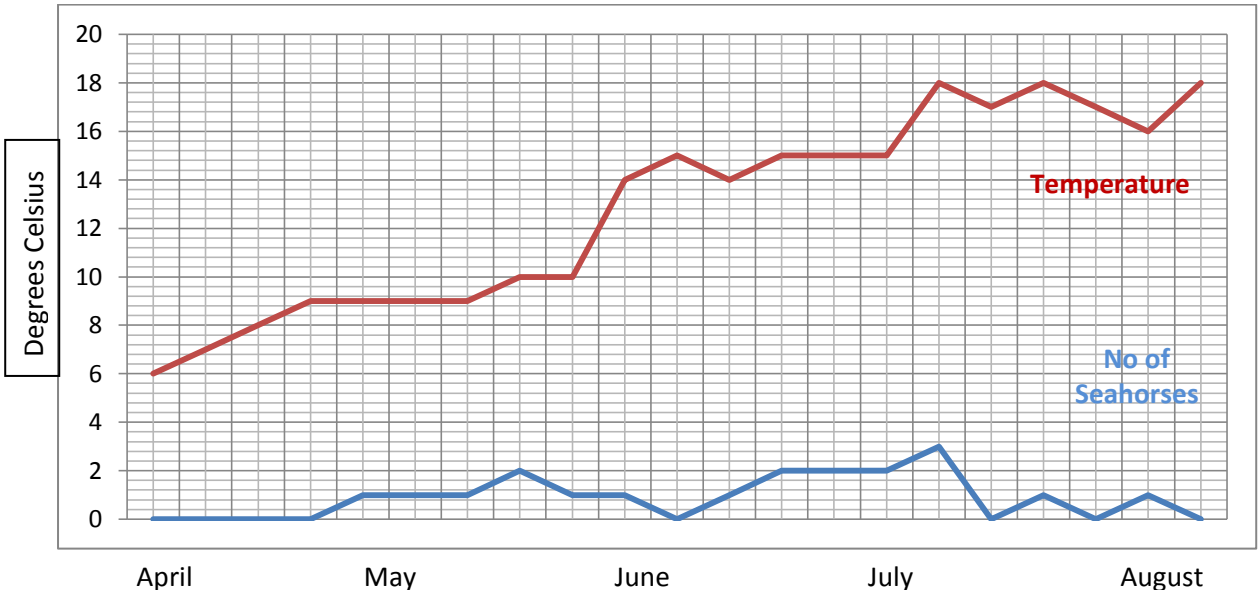

**Graph 2: Temperature/seahorse records for 2009 from the end of March until October**



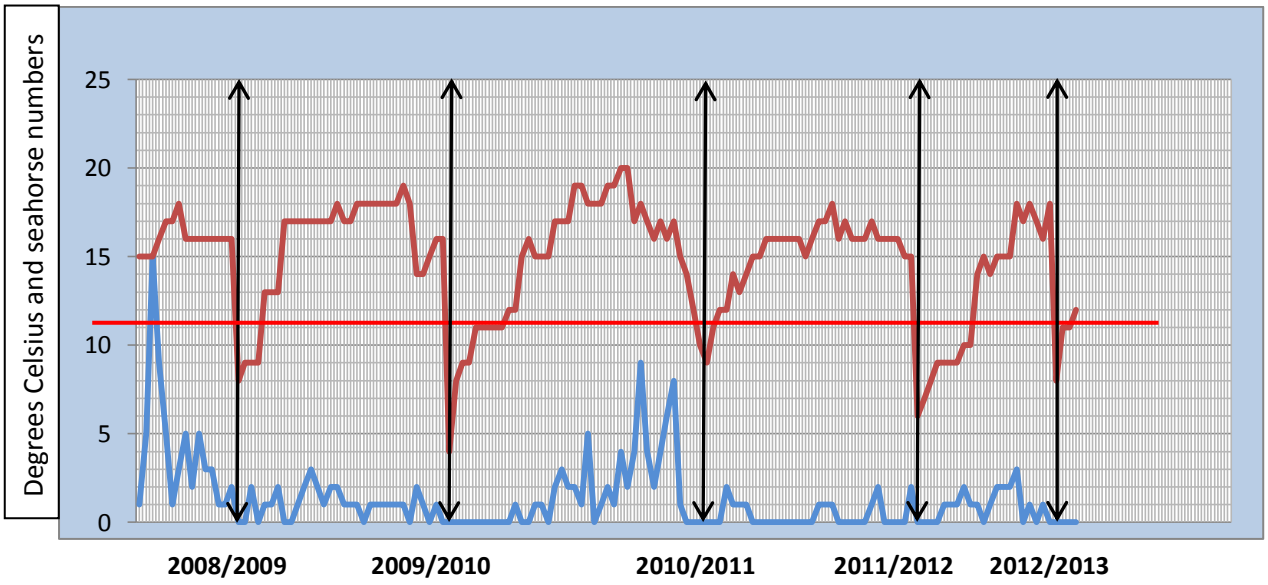

**Graph 3: Temperature/seahorse records for 2010 from May to September**



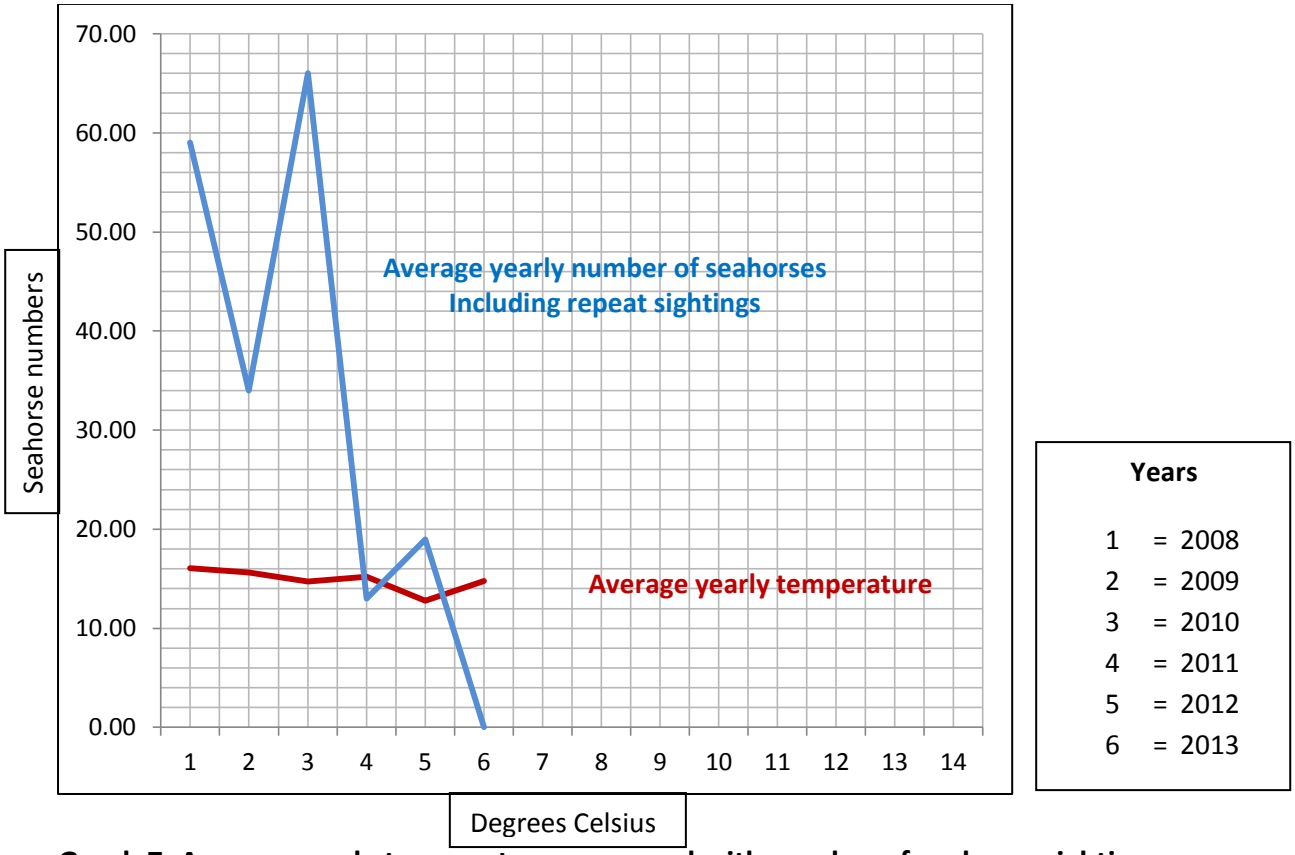

**Graph 4: Temperature/seahorse records for 2011 from May until September**



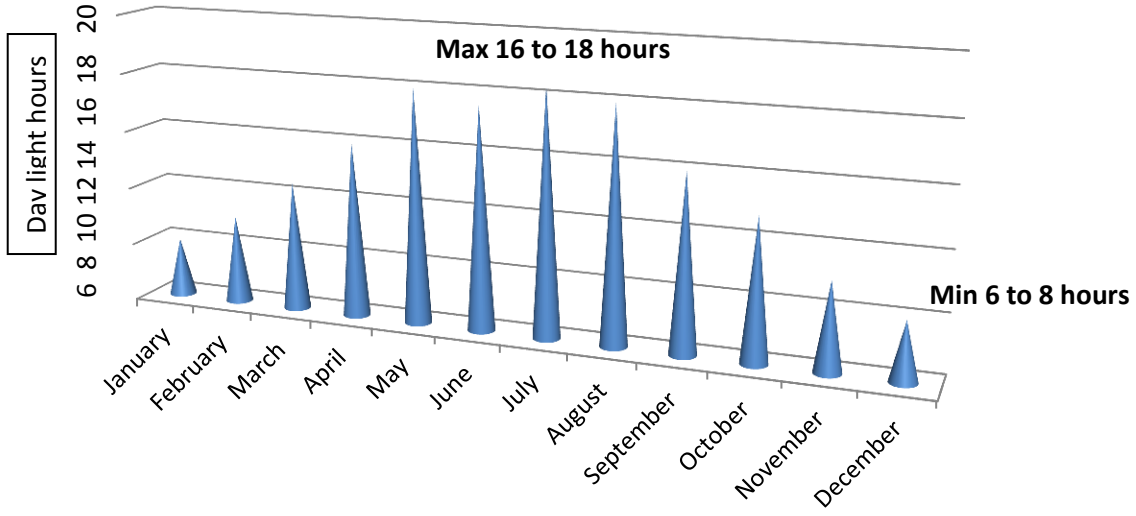

**Graph 5: Temperature/seahorse records for 2012 from April until August**




**Graph 6: Temperature / seahorse records from the second half of 2008 until early 2013**




**Graph 7: Average yearly temperature compared with number of seahorse sightings**




**Graph 8: Average day length for a year in the UK**

## Yearly temperature variation effect on algal growth

As the day length increases and temperature rises, photosynthesis takes place in the seagrass, increasing growth in the fronds. As the plants receive more sun light this will increase the growth rate causing a spurt of growth in early season. This slows down as mid-season approaches and stops just after mid-season.

**Photo 3: Early season growth of seagrass**

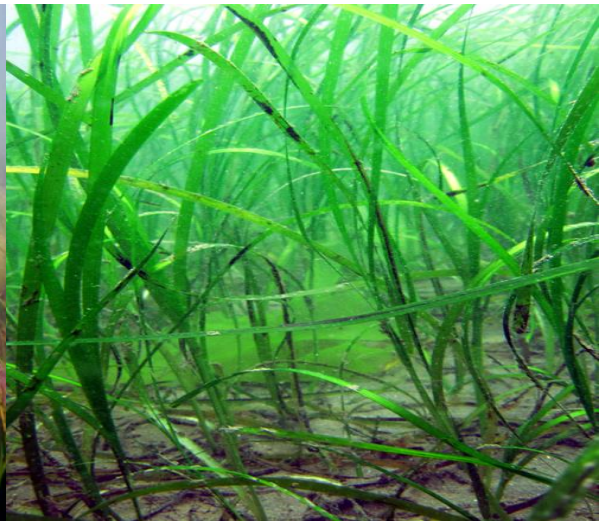


**Photo 4: Mid season growth of Seagrass**

**[Copyright, The Seahorse Trust]**

The migration inshore of the seahorses coincides with this growth spurt and by the time the seahorses arrive there is sufficient length on the seagrass fronds to create an overhang which the seahorses prefer to hide under. By hiding under the fronds they shelter from predators and benefit from the reduced light levels. Their cryptic nature and body design allows them to be camouflaged in this dimly lit, dense habitat; Spiny seahorses prefer not to be out in the open.

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**Photo 5: Spiny Seahorses are found at the bottom of seagrass fronds, protected from predators and from the harmful effects of bright light. Seagrass acts like am umbrella, diffusing sunlight.**

**[Copyright, The Seahorse Trust]**

## Conclusion

The Gulf Stream creates and effects the United Kingdom's maritime climate and it influences the ecology and biology of the plants and animals that occur here, non more so than the life cycle of seahorses which are reliant on plankton, temperature and day length to govern their way of life.

Our maritime climate, caused by the influence of the Gulf Stream provides a unique set of circumstances, giving the UK and Ireland a diverse range of species and habitats. These are all based on the plankton life cycle. This allows us to have species such as Leatherback Turtles, Basking Sharks and two species of seahorse; both of which are influenced by temperature and day length throughout the year.

The two seahorse species resident in the British Isles appear to have preferences for different types of habitat, with the Spiny favouring seagrass and the Short Snout just about everywhere else. Both species migrate to deep water in the winter, (both having been recorded as far down as 80 plus metres), however during the summer they differ in their depth requirements due to the preference in habitat type. Spiny Seahorses appear to prefer the shallow growing seagrass and the Short Snouted use various types of habitat and are more often than not found from 10 metres downwards but there is no fixed rule to this and they can both be found in differing circumstances.

Throughout the period of the survey at South Beach in Studland Bay, Dorset, it is mainly the Spiny that has been studied and we have seen a dramatic crash in numbers since 2008. This coincides with the fragmentation of the seagrass habitat as reported by Drs Jackson and Collins.
With the colder, longer winters for the last 5 to 8 years something more than cold is affecting the numbers of seahorses because we are still getting sightings in close. Neighbouring areas such as Swanage and Poole show the evidence is pointing to the fact that fragmentation of the habitat is the reason.

Temperature is a major contributing factor to the movement and migration of seahorses but it is not the only one. Day length appears an equally important role, not just in the movement inshore but also the movement offshore into deeper, safer water.
The Seahorse seasonal migration is not just related to sea temperatures, lunar cycles and day length but many other factors such as the seagrass growth and the plankton cycle. It is important when looking at seahorse ecology to look at all the contributing and cyclic factors, not just for one season but yearly and over many years.
All the processes occur in tandem, initially stimulated by an increase in day length and the increased seasonal warming of the seas but subsequently by food availability for adults and fry alike.

Habitat is crucial to this life cycle and a fragmented habitat will affect the food and breeding and ultimately the migration habits of seahorses.
It is crucial to protect whole habitats to ensure species such as seahorses can complete their life cycles and when looking at the protected habitat it should not just be the obvious one such as the seagrass but their overwintering sites and neighbouring areas as well.

## Figures, graphs and pictures

**Figures**

Fig 1: Distribution of the Short Snouted Seahorse. (*Hippocampus hippocampus*)
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Fig 2: Distribution of the Spiny Seahorse. (*Hippocampus guttulatus*)
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**Photographs**

Photo 1: Short Snouted Seahorse (Hippocampus hippocampus) [credit Neil Garrick-Maidment]

Photo 2: Spiny Seahorse (Hippocampus guttulatus) [credit Neil Garrick-Maidment]

Photo 3: Early season growth of seagrass

Photo 4: Mid season growth of Seagrass

Photo 5: Seahorses are found at the bottom of seagrass fronds, protected from predators and from the harmful effects of bright light.

**Graphs**



**Maps**



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