



**Seasearch Pembrokeshire**  
**Crawfish, *Palinurus elephas* Survey 2018**



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**Seasearch South and West Wales**  
**February 2019**



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**Cover image: Kate Lock**

## Summary

Seasearch divers completed 5 days of *Palinurus elephas*, crawfish surveys during 2017 and 2018. A wide range of data can be collected by Seasearch divers and their experience of diving in Pembrokeshire can be usefully used to complete cost-effective surveys.

The surveys were completed at two sites that were identified as suitable habitat for crawfish with regular sightings by divers. The numbers recorded during the survey are very low in contrast to higher numbers recorded by divers during the 1970's and 1980's (Lock, 2011). Crawfish were recorded from early May to October with higher numbers recorded in the late May, July and August surveys.

A healthy number of juvenile animals were found showing that new recruits are entering the population. There were a good range of adult sizes again indicating a good age distribution in the population.

If a Pembrokeshire crawfish regeneration project plan is developed in the future these sites would be suitable locations for it to take place.

## Crynodeb

Cwblhaodd deifwyr Seasearch 5 diwrnod o arolygon cimychiaid coch *Palinurus elephas* yn ystod 2017 a 2018. Gellir casglu ystod eang o ddata gan ddeifwyr Seasearch a gall eu profiad o ddeifio yn Sir Benfro fod yn hynod o ddefnyddiol ar gyfer cwblhau arolygon cost-effeithiol.

Cwblhawyd yr arolygon ar ddau safle a glustnodwyd fel cynefin addas ar gyfer cimychiaid coch gan fod rhai wedi'u gweld yn rheolaidd yno gan ddeifwyr. Mae'r niferoedd a gofnodwyd yn ystod yr arolwg yn isel iawn o'u cyferbynnu â niferoedd uwch a gofnodwyd gan ddeifwyr yn ystod y 1970au a'r 1980au (Lock, 2011). Cafodd cimychiaid coch eu cofnodi o ddechrau mis Mai hyd at fis Hydref gyda niferoedd uwch wedi'u cofnodi yn yr arolygon ar ddiwedd mis Mai, Gorffennaf ac Awst.

Canfuwyd nifer iach o anifeiliaid ifanc a oedd yn dangos bod recriwtiaid newydd yn ymuno â'r boblogaeth. Roedd amrediad da o feintiau oedolion ac roedd hyn eto'n nodi dosbarthiad oedran da yn y boblogaeth.

Pe bai cynllun prosiect adfywio cimychiaid coch Sir Benfro yn cael ei ddatblygu yn y dyfodol, byddai'r safleoedd hyn yn lleoliadau addas ar ei gyfer.

# Seasearch Pembrokeshire Crawfish, *Palinurus elephas* Survey 2018

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# 1. Introduction

## 1.1 Crawfish

*Palinurus elephas*, crawfish also known as crayfish, spiny lobster or rock lobster are marine crustaceans. They are found in the sub-tidal on exposed rocky seabeds where protective holes and crevices are numerous, in depths typically between 5-70m, but can be found to 200m. The post larvae settle during the summer in holes and crevices at 5-20m depth (Diaz et al., 2001), and adults are found usually at the base of rock or boulders over gravel or sandy beds. Juveniles and adults are primarily active at night, they prey on a variety of benthic organisms (Mercer, 1973) including molluscs, sea urchins, and crustaceans (Goni et al., 2001a).



They are an important predator on rocky reefs and are a key component of the 'rocky reef' feature of the Pembrokeshire Marine Special Area of Conservation, PMSAC.

In Europe, their distribution is along the eastern Atlantic from Norway to the Azores and in the Mediterranean. In Britain and Ireland they are found along western coasts from Shetland southwards towards the Isles of Scilly although numbers are currently very low.

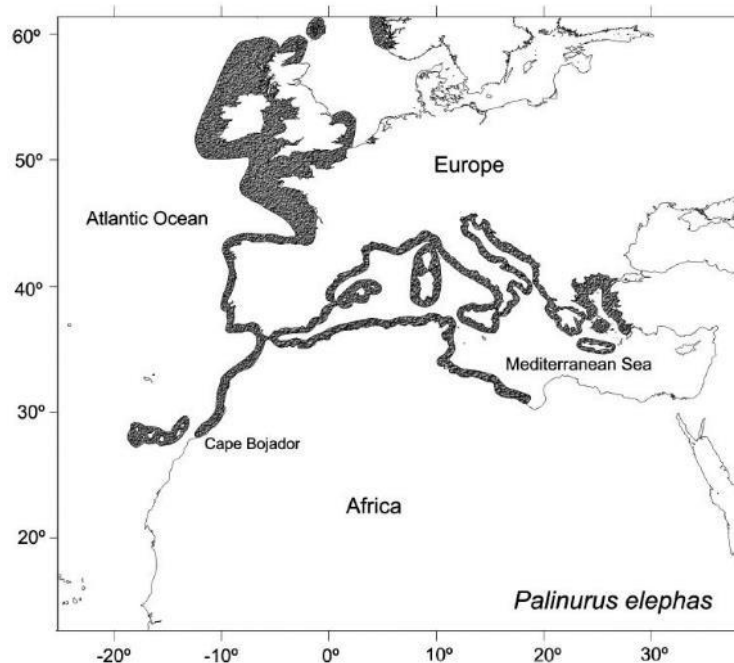


Figure 1. Geographic distribution of *Palinurus elephas* (Holthuis (1991))



## **1.2 Current status in southwest England and Wales**

The widespread decline of the crawfish may be traced back to the period of 1960-1980 depending on the area. The collapse of the crawfish population abundance within the southwest fisheries has been attributed to a change in capture gear from pots and traps to the less selective tangle and trammel nets (Hepper 1977, Goni and Latroutte, 2005, Amengual-Ramils et al., 2016). However, lack of reliable historical catch and effort data allows only a circumstantial cause-and-effect relationship to be identified (Goni & Latroutte, 2005). Scuba diving for crawfish is also identified as a cause of a decline in the crawfish population. A fishery operating out of Pwllheli on the south side of the Llyn Peninsula using divers during the late 1970s led to a rapid decline in numbers in that area, and within 2 years diving for crawfish became economically unviable. A similar diving fishery operated in Pembrokeshire, rapidly reducing crawfish from shallow waters.

There is evidence that the crawfish fishery is now in un-favourable condition in all southwest waters due to stock depletion (Goni and Latroutte, 2005). The decline has resulted in very few targeted fisheries for crawfish remaining in the UK (Whomersley et al., 2018).

In Wales crawfish have been in decline since 1970 as outlined in a CCW report, Leslie and Shelmerdine 2012. The South Wales Sea Fisheries Committee (SWSFC) collected catch and effort data for the crawfish fishery from 1980. Landings were under 2 tonnes per year from 1980 to 1997 except for a peak of 12 tonnes in 1992 (Davies, 1999), which was attributed to 3 boats which targeted an inshore reef where crawfish were carrying out a migration (P. Coates per comm), and the fishery became uneconomic by 1993. The dive fishery landed around 0.4 tonnes in 1980 and 1981 but no commercial dive fishing has been recorded in south Wales since 1986.

Where this species was once taken in a targeted fishery, it is still commercially sought after but is largely caught as a by-catch in multi-species fisheries.

Crawfish is identified as a priority species for the UK Biodiversity Action Plan and is also an important component of the Special Areas of Conservation (SA's) designated for rocky reefs. It was identified by the National Assembly for Wales as one of the species of 'principal importance for the purpose of conserving biodiversity in Wales and was listed on the Natural Environmental Rural Communities (NERC) Act 2006, which has now been superseded by the Environment Act (Wales) Section 7 list of priority species. This requires that steps be taken that are 'reasonably practicable to further the conservation of the living organisms' listed and to 'promote the taking by others of such steps'. At the Marine Biodiversity Restoration and Enhancement task and finish group in 2016 set up by Welsh Government, crawfish were identified as the 4<sup>th</sup> species/habitat in need of suitable projects.

## **1.3 Seasearch Crawfish surveys**

Crawfish have been recorded by Seasearch divers in Pembrokeshire since the project started in 1995. In 2011 Environment Wales funded a Seasearch survey to gather baseline crawfish data at 6 sites in north Pembrokeshire. The aim of the surveys was to record baseline information on the number and size of crawfish at

different sites and to identify habitat preferences to aid any future re-stocking proposals. A total of 44 crawfish were recorded, of which just over half were juveniles. In addition, the survey recorded the abundance of other commercial crustacean species: Edible crab (*Cancer pagurus*), Lobster (*Homarus gammarus*), Spider crab (*Maja brachydactyla*) and Velvet swimming crab (*Necora puber*). The data has been entered into the Seasearch crawfish database and Marine Recorder database and a project report was completed (Jones 2012).

In 2014 Pembrokeshire Biodiversity Partnership funded boat charter to re-survey the sites. Sadly, the weather did not allow this to happen and the divers could not access the sites, instead they completed general Seasearch dives close to Ramsey island to identify further sites for crawfish (Jones, J & Lock, K. 2014).

A repeat of the sites surveyed in 2010 would be ideal, but a combination of both weather and the loss of the dive school in north Pembrokeshire has not allowed this to happen. In 2017 it was decided by Seasearch to visit other sites that had been identified as having crawfish present. Two sites were chosen in close proximity to Milford Haven, thus easily accessible by dive charter boats which would minimize cancellation due to weather. The divers followed the methods established in 2010 (Jones 2012), recording the abundance of both crawfish and commercial crustacean species. A total of 26 crawfish were recorded, including both adult and juveniles, and it was proposed that these sites were set up as a regular crawfish monitoring project.

## **2. Survey Objectives**

- Record numbers and size of crawfish;
- Record numbers of commercial crustacean species;
- Complete habitat descriptions of sites;
- Provide photos/video where possible to aid awareness raising.

## **3. Method**

The survey followed the methods established in 2010 (Jones 2012).

### **3.1 Crawfish search method**

Each pair of divers were dropped onto the reef and a GPS position was taken to establish the start position of their survey. The divers selected a depth on the reef to complete the survey and then moved along the rock face following a depth contour with a band width of 2m (eg. between 18-20m depth). At the end of the dive, before commencing their ascent, divers deployed a delayed surface marker buoy (SMB) to enable the support boat crew to record the end of survey position. Assuming a reasonably constant direction of swim, accurate start and finish positions allowed an estimate of the area surveyed.



### 3.2 Recording

Each time a crawfish was seen the diver noted the depth, the time elapsed on the dive and the size of the animal. Crawfish size is difficult to measure underwater as in most cases they are occupying a crevice, therefore size classes were estimated from the total length (TL) from rostron to telson as follows:



Total Length (rostron to telson)	Estimated carapace length	Size class
Up to 100 mm	Up to 50 mm	Juvenile
100 – 150 mm	50-75 mm	Small adult
150 – 200 mm	75 – 100 mm	Medium adult
200 – 300 mm +	100 – 150 mm	Large adult

The number of European lobster (*Homarus gammarus*), edible crab (*Cancer pagurus*), spiny spider crab (*Maja brachydactyla*) and velvet swimming crab (*Necora puber*) encountered were also recorded in order to make a comparison between the numbers of other commercially fished crustacea with the numbers of crawfish.

### 3.3 Site habitat and species recording

Habitat and species recording were completed on each dive following Seasearch methods, the records were then collated onto a group Seasearch surveyor form for each site on each of the survey days.

### 3.4 Crawfish records at other Pembrokeshire dive sites

A basic crawfish recording sheet was made to encourage general recreational divers to record their sightings. These sheets were provided to the recreational dive charter boats so that data could be collected by their visiting divers. Data included: date, site name, GPS position, depth, substrate, approx. size and recorders name.

## 4. Results

The 2 sites surveyed in 2017 were established as repeat survey sites in 2018. Crawfish is named on the NRW sensitive species list, therefore access to data is restricted and the positions and names of the sites can not be given in this report. In 2017 1 day of diving was completed with 4 dives at site 1 and 5 dives at site 2. In 2018 4 days of diving was completed with 13 dives at site 1 and 19 dives at site 2.

### 4.1 Crawfish data

The 2017 survey was completed in July and the 2018 survey was completed over 4 weekends between the beginning of May and October.

Date	Site 1	Site 2	Total
23/7/17	8	16	24
6/5/18	4	7	13
26/5/18	8	13	21
5/8/18	Not completed	15	15 (Site 2 only)
7/10/18	1	11	13
	21	62	83

Table 1. Crawfish survey data

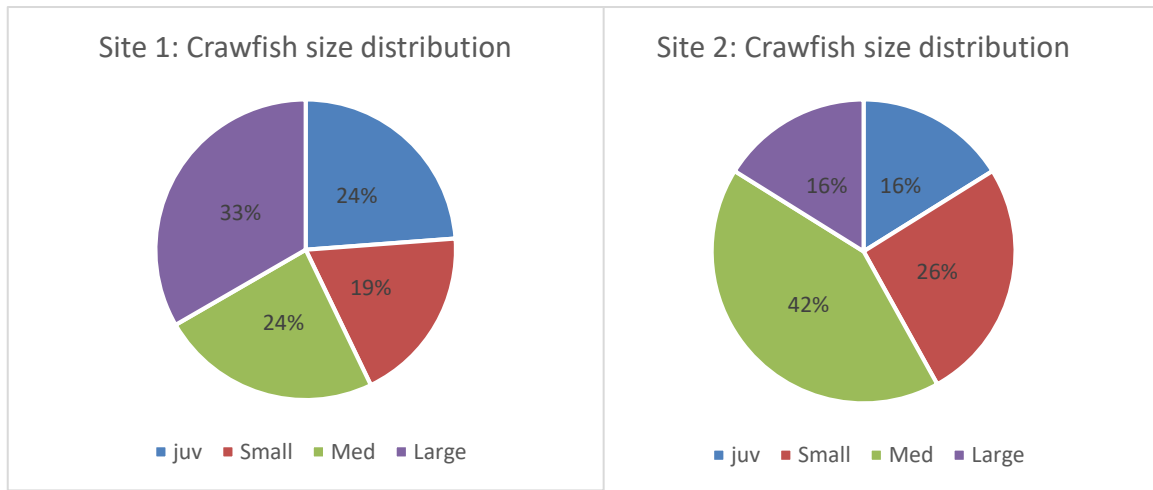
Crawfish were recorded from the beginning of May to October, and the highest numbers were recorded in late May, July and August. A higher number of crawfish were recorded at Site 2, however the total area of search at each site needs to be considered and the crawfish density calculated to provide more accurate comparison (see section 4.3 below).

### 4.2 Crawfish size data

The data from both 2017 and 2018 surveys have been combined for analysis

	Juvenile	Adults	Small adult	Medium adult	Large adult
Site 1	5	16	4	5	7
Site 2	10	52	16	26	10
Total No.	15	68	20	31	17
Percentage	18	82	24	37	21

Table 2. Crawfish size recorded at each site.



Graph 1. Crawfish size distribution recorded at site 1 and site 2.

A range of sizes were recorded at both site 1 and 2. Juveniles made up 18% of the total crawfish found. The percentage of juveniles found at site 1 (24%) was higher than found at site 2 (16%). The adult sizes small (24%), medium (37%) and large (21%) are relatively evenly represented. Variable size distribution was recorded at the 2 sites with the highest percentage being large adults (33%) at site 1 and medium adults (42%) at site 2.

Surveyors were asked to note the dive time elapsed each time they recorded a crawfish. The results were variable, some dives recorded no crawfish, some recorded 2 or 3 animals close together whilst others found them spread out during the dive. The greatest number found in a single dive were 7 animals.

#### 4.3 Crawfish and Crustacean density data

The area of each dive was calculated by measuring the distance between the start and end GPS positions and multiplying with the band width of 2m. The density for each crustacean species could then be calculated per 100 m<sup>2</sup>

	Survey area	Crawfish per 100 m <sup>2</sup>	Lobster per 100 m <sup>2</sup>	Edible crab per 100 m <sup>2</sup>	Spider crab per 100 m <sup>2</sup>	Velvet swimming crab per 100 m <sup>2</sup>
Site 1	4164 m <sup>2</sup>	0.5	0.43	0.9	1.6	4.7
Site 2	7672 m <sup>2</sup>	0.72	0.29	0.4	1.46	3

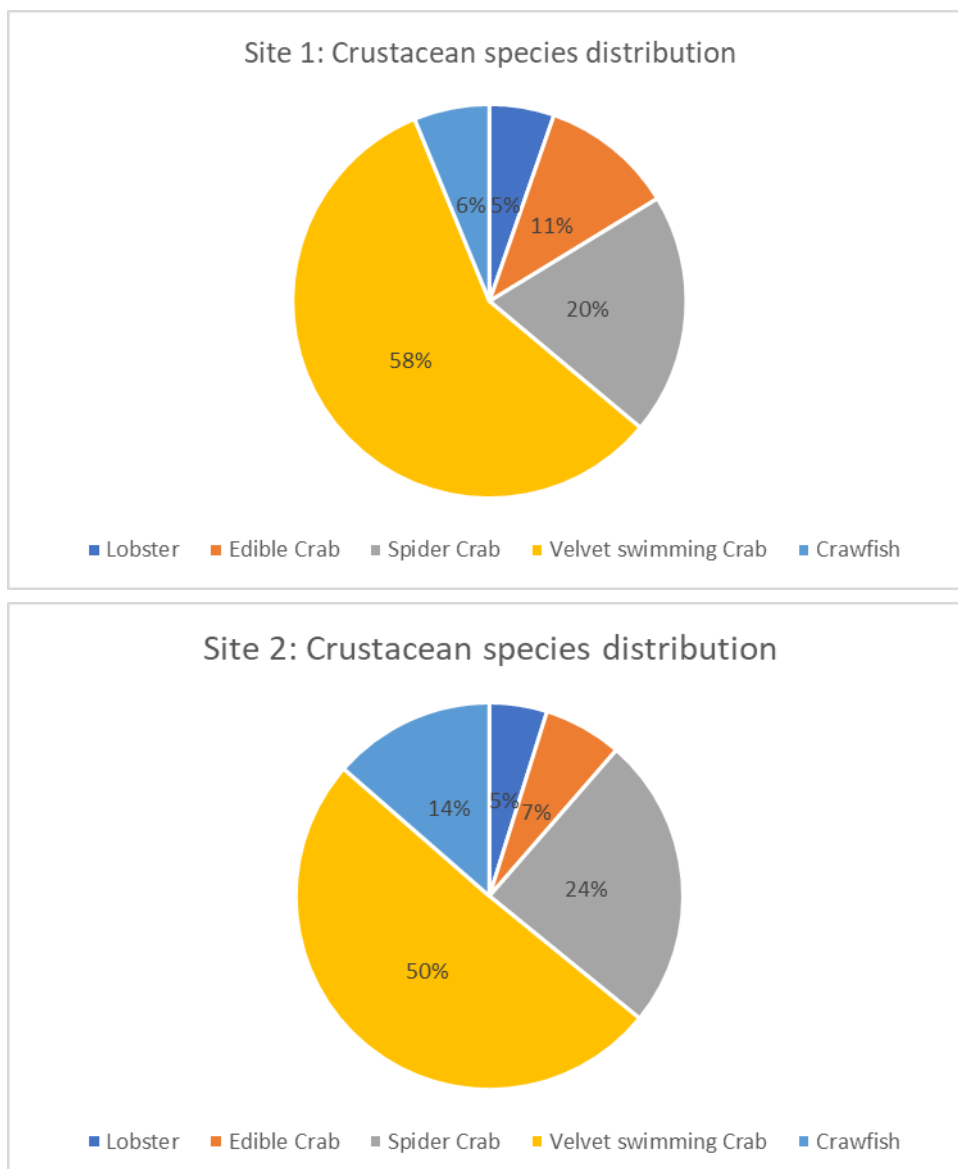
Table 3. Density of crustaceans at each site.

The density of crawfish was slightly higher at Site 2 (0.72 per 100 m<sup>2</sup>) to Site 1 (0.5 per 100m<sup>2</sup>).

The total number of crustacean species recorded for each site are shown in Table 4 and the percentage of crustacean species recorded for each site in Graph 4.

	Crawfish	Lobster	Edible crab	Spider crab	Velvet swimming crab
Site 1	21	18	37	67	195
Site 2	62	22	30	112	231
Total	76	40	67	179	426

Table 4. Total number of crustaceans recorded at each site.



Graph 2. Crustacean species percentage recorded at Site 1 and Site 2.



Velvet swimming crabs were the most frequently recorded crustacean followed by spider crabs at both sites. Crawfish were more frequently found compared to lobster at both sites and at Site 2 more than edible crabs.



Velvet swimming crab, *Necora puber*



Lobster, *Homarus gammarus*



Spiny spider crab, *Maja brachydactyla*



Edible crab, *Cancer pagarus*

#### 4.4 Site habitat and species recording

A Seasearch surveyor form (<http://www.seasearch.org.uk/downloads/survform01-14web.pdf>) was completed for each site on each of the survey weekends. Species and habitat data has been entered into the national database Marine Recorder and the data is available through the National Biodiversity Network Atlas [www.nbnatlas.org](http://www.nbnatlas.org)

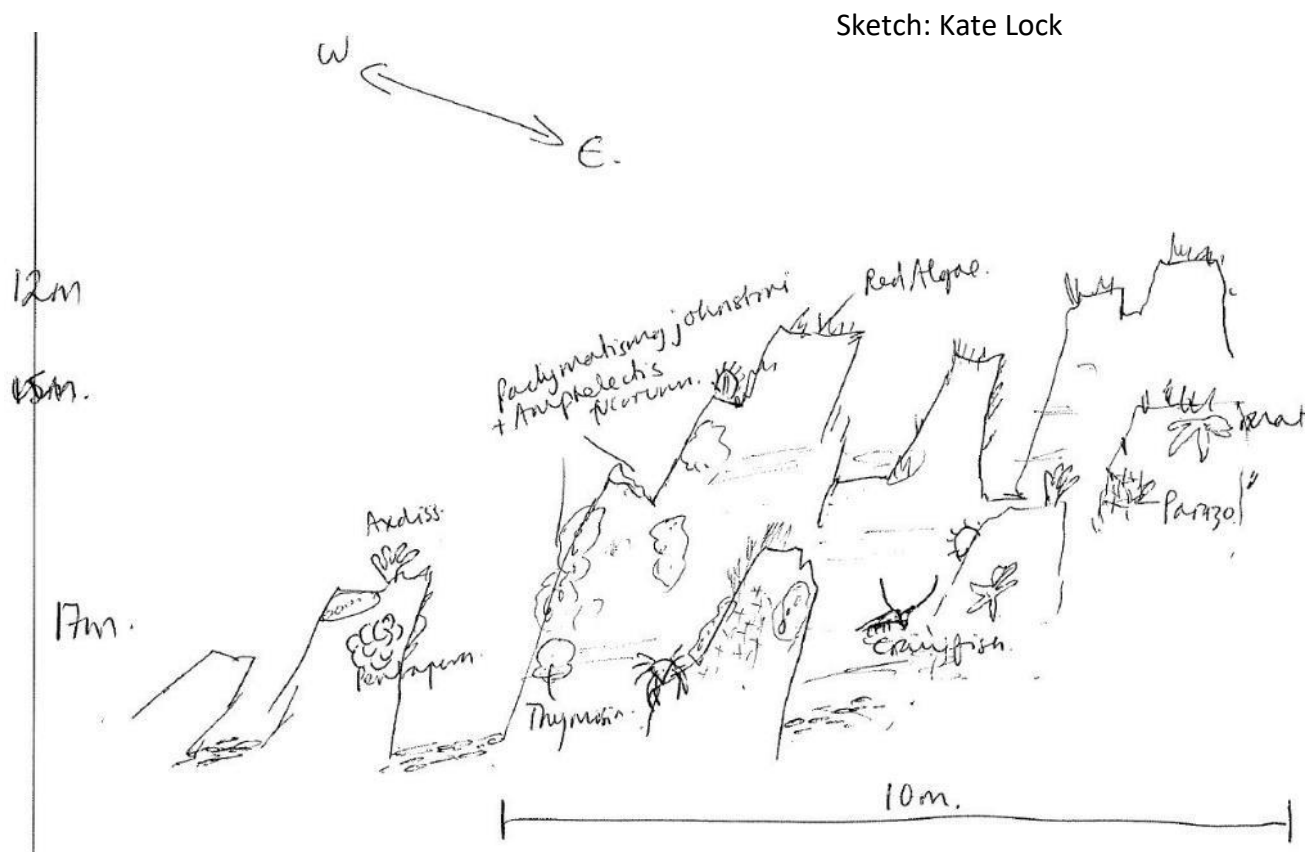
Seasearch surveys record the various types of seabed found in the near-shore zone around the whole of the UK and, as comprehensively as possible, the identity and frequency of the dominant animals and plants living at each survey site. Species frequencies are recorded using established semi-quantitative abundance scales (Hiscock, 1996).

S = Super-abundant, A = Abundant, C = Common, F = Frequent, O = Occasional, R = Rare and NS = Not Seen. Actual numerical frequencies vary with taxonomic group and species. Abundance scores in the text are capitalised to distinguish them from standard grammatical usage, e.g. Common versus common.

Site summaries for site 1 and 2 are as follows.

##### Site 1.

Chart datum depth between 5 to 12m. Red sandstone reef with steep slabs of rocks forming ridges, steep faces between 2-5m in height with small ledges and up to 2m gullies between. In some areas large boulders were found in between the ridges. The following sketch shows the cross-section profile.





Large sponges dominated the reef, elephant hide sponge, *Pachymatisma johnstonia* and shredded carrot sponge, *Amphilectus furcorum* were both Abundant. Sponges species were diverse with 18 species recorded, these included nationally scarce species: *Tethyspira spinosa*, mashed potato sponge, *Thymosia gurnei*, Staghorn sponge, *Axinella dissimilis* and brain sponge *Axinella damicornis*. Bryozoan and ascidian turf carpeted the reef with both *Cellaria spp.* and white claw sea moss, *Crisia sp.* both recorded as Common, club sea squirt, *Aplidium punctum* Frequent and 'Caramel two spot' seasquirt recorded as Abundant.



On the current swept edges of the ridges the oaten pipe hydroid, *Tubularia indivisa* was Common and on one face a large area of the yellow cluster anemone, *Parazoanthus axinellae* was found along with occasional patches of the Indian feather hydroid, *Gymnangium montagui* and a single pink sea fan, *Eunicella verrucosa*.

Ledges and crevices were good hiding places for fish species with butterflyfish, *Pholis gunnellus*, scorpion fish, *Taurulus bubalis* and tompot blenny, *Parablennius gattorugine* and a conger eel, *Conger conger* all being found. The reef was populated with territorial wrasse species: ballan wrasse, *Labrus bergylta*, cuckoo wrasse, *Labrus mixtus*, goldsinny wrasse, *Ctenolabrus rupestris* and corkwing wrasse, *Crenilabrus melops*. The ledges were also popular with crustacean species including squat lobster, *Galathea strigosa* and the sponge crab, *Dromia personata*.



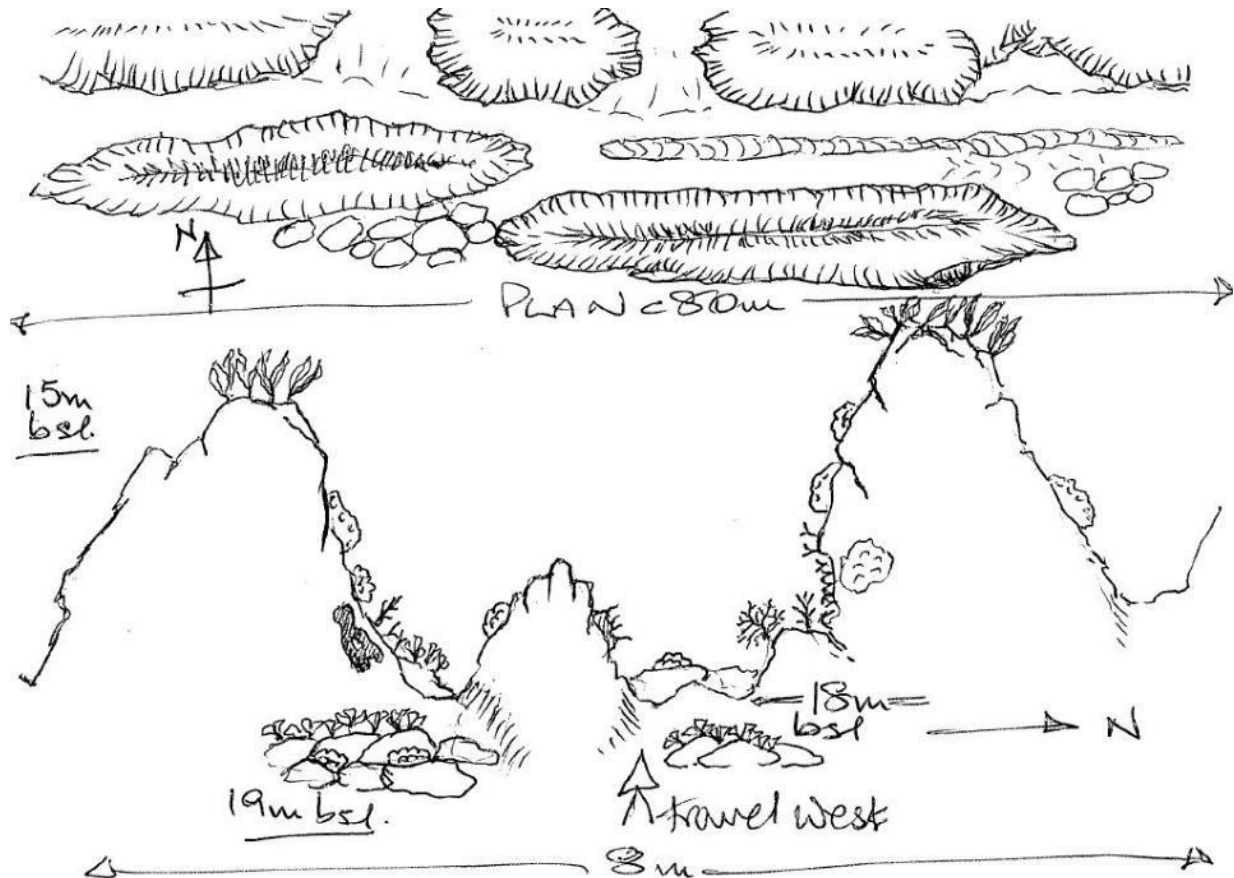
At the base of some ridges large boulders were found, on these were Frequent records of hornwrack, *Flustra foliacea*, potato crisp bryozoan, *Pentapora foliacea* and a smattering of sponge species.



## Site 2

Chart datum depth 5 to 15m. Rugged rocky reef with undulating ridges up to 4m in height and wide gullies between. Ridges running primarily in an east to west direction with smaller cross gullies running north to south. The following sketch shows the plan and cross-section profile.

Sketch: Blaise Bullimore



The rock faces had numerous crevices and fissures where velvet swimming crab, *Necora puber*, squat lobster, *Galathea strigosa*, Tompot blenny, *Parablennius gattorugine* and leopard spotted goby, *Thorogobius ephippiatus* were found.

The rocks were dominated by massive cushion sponges: Boring sponge, *Cliona celata*, Elephants hide sponge, *Pachymatisma johnstonia* and shredded carrot sponge, *Amphilectus furcorum* along with erect sponges: Staghorn sponge, *Axinella dissimilis* and *Stelligera rigida*. Other notable sponges included the brain sponge, *Axinella damicornis*, the prawn cracker sponge, *Axinella infundibuliformis* and the mashed





potato sponge, *Thymosia gurnei*. Hydroid, bryozoan and ascidian turf carpeted the rocks with antenna hydroid, *Nemertesia antennia* Common, branched antenna hydroid, *Nemertesia ramosa* Frequent, club seasquirt, *Aplidium punctum* Abundant and pinhead seasquirt, *Pycnoclavella aurilucens* Common. Bryozoan turf included an abundance of *Cellaria fistulosa* and *Scrupocellaria scruposa*. The pink seafan, *Eunicella verrucosa* was recorded along with large patches of yellow cluster anemone, *Parazoanthus axinellae* and peppercorn anemone, *Isozoanthus sulcatus*. 9 nudibranch species were recorded, notable species were *Aegires punctilucens* and the nationally scarce *Doris sticta*.



Large boulders were found in the gullies and these were dominated by hornwrack, *Flustra foliacea* potato crisp bryozoan, *Pentapora foliacea* and finger bryozoan, *Alcyonidium diaphanum*.

#### 4.5 Crawfish records at other Pembrokeshire dive sites

General crawfish recording forms were collected from the dive charter boats for the 2017 and 2018 seasons. A total of 67 crawfish records were made from 18 different sites in Pembrokeshire. This data has been submitted onto the Seasearch online recording page for crawfish sightings [www.seasearch.org.uk/crawfish.html](http://www.seasearch.org.uk/crawfish.html)

## 5. Discussion

Seasearch divers successfully collected crawfish data and associated habitat and species data at two sites in Pembrokeshire. Strong tidal currents in Pembrokeshire limits diving but with careful planning diving was completed over 5 days involving 22 divers.

### 5.1 Crawfish data

A total of 83 crawfish were recorded on the 5 surveys days. More were recorded at Site 2 (62) than at Site 1 (21), however a larger area was surveyed at Site 2. To allow for a more accurate comparison the density per 100m<sup>2</sup> was calculated. Site 1 (0.5/100m<sup>2</sup>) and site 2 (0.72/100m<sup>2</sup>) densities are comparable to the sites with highest densities recorded on the north Pembrokeshire crawfish survey in 2011 (Site A (0.54/100m<sup>2</sup>) and Site B (0.42/100m<sup>2</sup>) (Jones 2012). These densities are low compared to the high numbers that were regularly recorded by divers in Pembrokeshire during the 1970's and into 1980's (Lock, 2011).

The surveys were completed from May to October, and higher numbers were found at the sites on the end of May, July and August survey days, with fewer numbers recorded in early May and October. The higher number recorded in the summer months is expected as in the Atlantic crawfish undertake a pre-reproductive spring onshore migration and a reverse post-reproductive offshore migration in late autumn (Mercer, 1973). Mating occurs between June and October (Mercer, 1973 and Whomersley et al 2018).

A range of crawfish sizes were recorded at both Site 1 and 2. In this survey the divers measured the total length (rostron to telson) and from this the carapace length was estimated. The total length was selected as it was thought that this would be easier to measure underwater by divers without disturbing the animals. In hindsight it would have been better to take time to make more accurate measurements of the carapace length during the dive as this measurement would allow more accurate comparisons with other research and survey work.

Juveniles made up 18% of the total, showing evidence of new recruits to the population. Crawfish have an estimated average carapace growth rate of 12mm per year (Mercer 1973). The juvenile crawfish seen had a carapace length approx. 50mm making them an estimated 4-5yrs old, whilst the large crawfish were approx. 150mm giving them an estimated age of 12 yrs. Growth studies have shown that the estimated lifespan of crawfish is >15yrs (Follesa et al 2007).

The adults recorded on the survey had a good spread of sizes: small (24%), medium (37%) and large (21%) showing a healthy size range and age distribution of young to mature animals.

This information will provide a base for future monitoring of the crawfish population contributing to evidence on changes in population densities and size structure.

## **5.2 Crustacean density data**

Commercial crustacean species numbers were also recorded which is useful extra data from the survey. The results showed that velvet swimming crabs were the most frequently recorded, matching the results on the 2011 North Pembrokeshire survey (Jones 2012). Crawfish were more frequently found compared to lobster at both sites and at Site 2 more than edible crabs. At both sites observations of lobster pot fishing were made which targets both lobster and edible crabs.

## **5.3 Site habitat and species recording**

Seasearch divers are trained and experienced in completing habitat and species recording. Most of the divers that took part were experienced in completing surveys in Pembrokeshire and have a good knowledge of the local species. Many of the divers were also excellent underwater photographers and were able to provide photographs of the habitat and species found supporting the data recorded. The advantage of this photographic record is the ability to go back and interrogate imagery for further information.

Both Site 1 and 2 are strong current, steep rugged rocky reef sites with lots of crevices, ideal habitat for crawfish (Mercer 1973, Ansell and Robb, 1977). They are relatively easily accessible sites and with careful planning can be used for diving surveys. If a crawfish regeneration project was planned for Pembrokeshire then these would be suitable sites for it to take place. During the 2011 North Pembrokeshire Crawfish survey sites A and B were also identified as suitable sites (Jones 2012) and these can also be considered.

## **6. Conclusions**

The use of Seasearch divers to collect crawfish data was a success and all survey aims were met. A wide range of data can be collected by Seasearch divers and their experience of diving in Pembrokeshire can be usefully used to complete cost-effective surveys.

The two surveyed sites have been identified as suitable habitat for crawfish with regular sightings by divers, but the numbers recorded during the survey are very low in contrast to higher numbers recorded by divers during the 1970's and 1980's (Lock, 2011). Crawfish were recorded from early May to October with higher numbers recorded in the late May, July and August surveys.

A healthy number of juvenile animals were found which is encouraging as it shows new recruits are entering the population. There were a good range of adult sizes again indicating a good age distribution in the population.

The survey methods followed those established in Jones 2012. These worked well on this survey although improvements in measuring carapace length is recommended to allow better comparisons with other studies.

If a regeneration project plan of action for Pembrokeshire occurs in the future these sites would be suitable locations for it to take place.



## 7. Recommendations

1. To use the data to inform:
  - A crawfish local biodiversity action plan;
  - Management of the Pembrokeshire Marine Special Area of Conservation (SAC);
  - Current status of crawfish distribution and abundance in the UK, National Biodiversity Network (NBN atlas);
  - A crawfish regeneration project plan of action for Pembrokeshire.
2. Continue Seasearch crawfish surveys at Site 1 and 2 to monitor the population, completing the surveys between May and October. Repeat the methods used on this survey but make improvements to allow more accurate measurements of the carapace length of the animals.
3. Continue recording crawfish on all Seasearch dives and promote sightings from recreational divers and submitting records to [www.seasearch.org.uk/crawfish.html](http://www.seasearch.org.uk/crawfish.html)

## 8. Acknowledgement

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Photo contributions from: Kate Lock (KL), Matthew Green (ML), Blaise Bullimore (BB), Sarah Bowen (SB).

Heading out at sunrise:  
Matthew Green.





## 9. References

- Amengual-Ramils J F, Vazquez-Archdale, M, Canovas-Perez C & Morales Nin B. (2016) The artisanal fishery on the spiny lobster *Palinurus elephas* in Cabera National Park, Spain: comparative study in traditional and modern traps with trammel nets: *Fish, Res.* 179: 23-32 doi: 10.1016/j.fishres.2016.01.022.
- Ansel A & Robb L. (1977) The spiny lobster *Palinurus elephas* in Scottish waters. *Marine Biology*: 43: 63-70.
- Follesa MC, Cuccu D, Cannas R & Cau A (2007) On the growth of the European spiny lobster, *Palinurus elephas* from Sardinian waters (central Mediterranean Sea). *New Zealand Journal of Marine and Freshwater Research* 2007. Vol 41: 377 – 383.
- Goni et al (2001a) Diet of the spiny lobster *Palinurus elephas* of the marine reserve of Columbretes Islands. *Journal of the Marine Biological Association of the United Kingdom*, 80: 1-3.
- Goni R and Latrouette D (2005) Review of the biology, ecology and fisheries of *Palinurus* spp. species of European waters: *Palinurus elephas* and *Palinurus mauritanicus*. *Cah. Biol. Mar* (2005) 46: 127-142.
- Hepper B T, (1977) The fishery for crawfish *Palinurus elephas* off the coast of Cornwall. *Journal of the Marine Biological Association of the United Kingdom*, 57: 925-941.
- Hiscock, K, ed, 1998. *Marine Nature Conservation review: Benthic marine ecosystems of Great Britain and the north-east Atlantic*. Peterborough, Joint Nature Conservation Committee. (Coasts and seas of the United Kingdom. MNCR Series) ISBN 186107445X
- Hunter E. (1999) Biology of the European spiny lobster, *Palinurus elephas* (Fabricius, 1787) (Decapoda, Palinuridea). *Crustaceana* 72: 545-565.
- Jones, J (2012) Distribution and abundance of *Palinurus elephas* in North Pembrokeshire. Seasearch report, Marine Conservation Society.
- Jones, J & Lock, K (2014) Distribution and abundance of *Palinurus elephas* in Pembrokeshire. Seasearch report, Marine Conservation Society.
- Lock, K (2011) Seasearch Wales Crawfish (*Palinurus elephas*) historical diver records.
- Mercer P (1973). Studies on the spiny lobsters (Crustacea: Decapoda: Palinuridae) of the west coast of Ireland, with particular reference to *Palinurus elephas* Fabricius, 1787. PhD thesis, University College, Galway.
- Whomersley P, Van der Molen J, Holt D, Trundle C, Clark S & Fletcher D (2018) Modeling the Dispersal of Spiny Lobster (*Palinurus elephas*) Larvae: Implications for

Future Fisheries Management and Conservation Measures. *Frontiers in Marine Science* March 2018 Vol 5, Article 58.