

Shellfish News

Number 22, Autumn/Winter 2006



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- Articles, news and comment relating to shellfish farming and harvesting are welcomed and should be sent to the editor. The deadline for the next issue is Friday 6th April 2007.
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THE DISTRIBUTION AND ABUNDANCE OF THE NON-NATIVE PACIFIC OYSTER, *CRASSOSTREA GIGAS*, IN DEVON – A RESULT OF CLIMATE CHANGE?

Gemma Couzens

Background

The Pacific oyster (also known as the Portuguese oyster) was introduced from Portugal in 1926 to the River Blackwater in Essex, but populations disappeared when importations ceased. In 1965, the Pacific oyster, *Crassostrea gigas*, was re-introduced to the UK from North America for commercial aquaculture, after populations of the native oyster, *Ostrea edulis*, declined due to overfishing. Before the Ministry of Agriculture, Fisheries and Food (MAFF) issued a license to allow cultivation of *C.gigas*, the imported individuals were subject to quarantine in order to prevent the introduction of disease and to evaluate their culture potential. It was decided that the likelihood of this species forming viable wild populations from escaped individuals was doubtful due to the cooler climate experienced in the UK, compared to that of Japan, where it originates. The average winter temperature at Pacific oyster sites in Japan is 10°C whereas the average winter temperature at oyster sites in the UK is closer to 5°C. However, while the optimal temperature for growth is estimated to be between 15 and 20°C, it was later discovered that *C.gigas* is capable of growth as low as 6°C. And, with much of the Northern Hemisphere experiencing extended warmer summers and milder winters, it is possible that climate change is facilitating the spread of species previously limited by thermal tolerance.

In 1994, sporadic natural spatfalls of *C.gigas* near sites of cultivation in the Exe, Teign and Dart estuaries in Devon and in the Menai Strait in Gwynedd were reported. Since then, there has been no research on the distribution and abundance of this species in the south west, yet in nearly all areas where cultivation of this species occurs, wild populations have established due to warmer summers and extensive recruitment from local aquaculture sites.

Surveys

Various sites in river estuaries in Devon were visited at low tide and the mid-shore region, dominated by limpets and barnacles, was searched. Oysters were not located in algal

turf or canopy dominated areas. The shore was then searched for 30 minutes for live and dead *C.gigas* individuals and the count recorded. From this search, an abundance scale was used to indicate whether the occurrence of *C.gigas* was abundant, frequent, common, occasional or rare. Further investigation of the site was carried out where *C.gigas* was found to be frequent, common or abundant. Results of the broad-scale survey are shown in Table 1.

This study found substantial populations of the Pacific oyster at sites along the River Yealm, where aquaculture of the species has taken place since its introduction in 1965. The greatest abundance of individuals was observed at Noss Mayo, the most estuarine site and the closest site to the local oyster farm in the Yealm estuary. There was a noticeable decrease in abundance from estuarine sites on the River Yealm to the open coast suggesting that local aquaculture has been a source of recruitment for Pacific oysters in the area. Individuals were also observed in areas around Plymouth (Cawsand, Cremyll and Queen Anne's Battery) even though commercial production of the species has never occurred in the surrounding Tamar and Plym estuaries. Queen Anne's Battery, in the Plym estuary system, was found to support the highest number of individuals of *C.gigas* after Noss Mayo. This site is a marina and therefore there is a limited amount of space for Pacific oysters



Natural settlement of Pacific oysters at Queen Anne's Battery, Plymouth

Table 1: Results of the broad scale survey showing the frequency of abundance during a 30 minute search at each site.

	Location	Grid reference	Abundance scale	No. of oysters in 30 min search
River Avon	Bigbury	SX64802	Occasional	24
	Bantham	SX66143	Rare	1
River Tamar	Cremyll	SX45553	Rare	13
	Cawsand	SX 43450	Occasional	37
River Plym	Queen Anne's Battery	SX48553	Common	379
River Yealm	Noss Mayo	SX53901	Abundant	911
	Between Noss Mayo and Cellar beach	SX53347	Frequent	184
	Cellar beach	SX53071	Frequent	126
River Teign	Shaldon	SX93553	None found	0
	Ness Beach	SX94074	None found	0
River Exe	Great Bull Hill	SX98692	None found	0
	Maer Rocks	SY01804	None found	0

to colonise. The only space available was the structure holding the visitor's pontoon and *C.gigas* appeared to have optimised this space.

As the pelagic phase of *C.gigas* larvae lasts for 18-30 days, it is possible that larvae have been transported to these areas from estuaries such as in the Yealm or open coast sites where the species has become established. Size frequency data collected on Pacific oysters encountered at different sites and estuaries revealed that the most mature individuals were those also found in Noss Mayo. Further along the estuary towards the open coast, the population became more mixed with younger and older individuals. However, at the open coast, the population primarily consisted of juveniles. This was also true for the populations observed near Plymouth (Cremyll and Cawsand).

This reinforces the possibility that the larvae from reproductive individuals at sites along the Yealm estuary may be carried considerable distances away from the parental population and are establishing in new areas. In effect, there seems to be a chain reaction occurring in terms of recruitment and establishment of Pacific oysters in this area. The long running oyster culture in the Yealm estuary seems to have been a source of extensive recruitment

for individuals forming wild populations. Once mature, wild populations have then contributed to the establishment of the species in new areas and the restocking of younger populations further along the estuary.

Despite the Teign and Exe estuaries being sites for *C.gigas* production, no live individuals were found attached to hard substrata away from the shellfish farms. The natural habitat along these estuaries and open coast was found to be unsuitable for *C.gigas* and this has probably prevented the establishment of wild populations in these areas.

Effect of climate change

Since 1990, there has been a 1°C increase in sea surface temperature in the Western English Channel off Plymouth exceeding any changes in temperature recorded for the previous 100 years. In the Dutch Wadden Sea, where the population structure of Pacific oysters has been studied extensively, increases in abundance have always followed years with good recruitment and corresponded with years of extended periods of high summer temperatures. After the high summer temperatures experienced in three consecutive years (2001-2003), it is likely that, as in the Dutch Wadden Sea, oyster abundance in the Devon area increased and the

population expanded. Thus it is apparent that the climate that we have experienced over the past decade may have played a major role in the gradual expansion process of the Pacific oyster. If abundance is now high enough in some areas, recruitment may still be successful even during the cooler summers.

In the Dutch Wadden Sea, *C.gigas* have started to form oyster reefs where by cementing their heavy and thick shells to each other they form dense layers that are more resistant to environmental stress and can alter the natural state of the ecosystem thereby posing a threat to native species. The photographs show an oyster reef that has taken shape in the Yealm estuary between Noss Mayo and Cellar Beach. This is the first oyster reef to be recorded in the UK and there is already evidence of *C.gigas* starting to form zones on other shores. If extensive recruitment and higher temperatures continue to aid the growth and expansion of the Pacific oyster, we may see the formation of an increasing number of oyster reefs causing shifts in native biodiversity and ecosystem functioning, as seen in the Dutch Wadden Sea, due to increased competition for food and space. While conditions remain favourable to *C.gigas*, it has the potential to spread much further than was previously thought.



Crassostrea gigas reef between Noss Mayo and Cellar Beach in summer 2006.