

## Background

Commercial cultivation of scallops is one of the more recent developments in bivalve mollusc aquaculture in the UK. Selection of appropriate sites is critical for a successful operation.

The aim of this project was to determine the performance and tolerance limits of scallops, especially juveniles, within a range of environmental conditions; in particular, factors that are important for site selection, such as sea water temperature and salinity, food availability and water flow rate.



### Location of field sites

The field sites were selected to give a range of environmental conditions.

Laboratory experiments were carried out at Conwy and Southampton.

## Approach

A combination of field trials and controlled laboratory experiments was carried out to include:

- Growth and survival of seed planted out at 13-15 mm.
- Collection and analysis of water samples for salinity, chlorophyll, and particulate organic content.
- Continuous temperature records at each site.
- A commercial scale planting of 50 mm scallops onto the seabed (at Portland).
- Effect of temperature, ration, flow rate and salinity on growth performance.
- Biological indicators of stress.

## Key findings

### Temperature

King scallops do not grow at all below 6.5°C. Growth rate increases with temperature above this up to the maximum tested value of 23°C. Growth rate at field sites was strongly correlated with temperature.

### Food - Quantity

As temperature increases scallops can consume a bigger food ration. If the ration available is so high that they cannot consume more than 80% of it efficiently then they will not grow any faster than with a lower ration. It seems that sufficient food was available in the water at all field sites for maximum growth in relation to temperature, especially as scallops can filter faster when there is less food available, so as to maintain an adequate ration.

### Food - Quality

The quality of the diet has a strong effect on growth rate. Filtration rate of scallops also varies with the type of algae available, being lower when species with a low nutritional value are present. Scallops are also less efficient at filtering smaller (2-5 µm) algae cells. Food quality is much more difficult to assess from water samples, and may have an influence on performance

### Salinity

An ambient salinity of 28 psu or above is required for successful scallop cultivation. Scallops were usually able to tolerate short exposure (up to 6 hours per day for 3 days) to lower salinity (20 psu) although there was always a short-term reduction in growth rate and sometimes a high mortality at lower temperatures. Salinity at the field sites was always above 30 psu.

### Water flow rate

In nursery experiments, growth and filtration rate were not affected by flow rate up to 105 litres per hour.

### Stress

The metabolic responses, measured as concentrations of selected metabolites, show a bi-stable physiology in which there is a switch in state ('winter/summer') around 10 °C. Other results suggest an optimum temperature range for cultivation of 10-17 °C, in which growth efficiency and condition index are greatest.

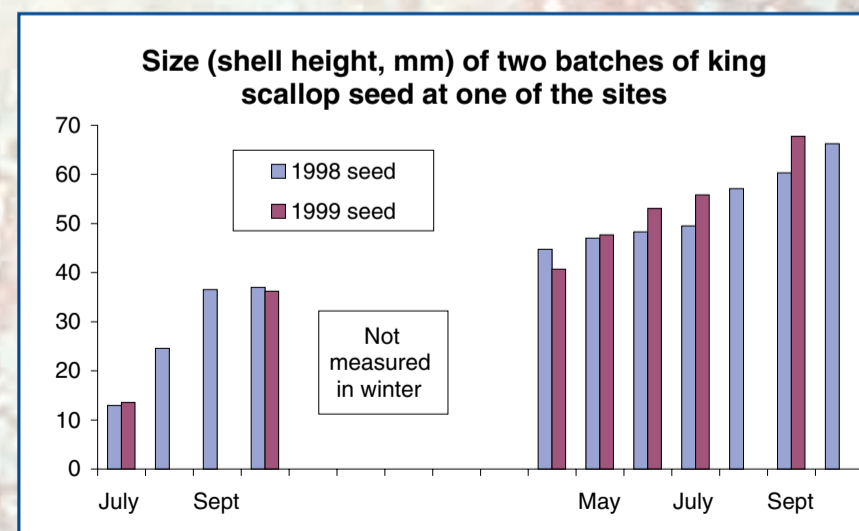
### Costs

Based on seeding 75,000 scallops per year at a density of 5-6 per square metre, with 15% mortality and diver harvest at £1 per scallop, commencing after 3 years, the potential profit is £33,000 (23% of costs). This is also based on equipment purchase within first 3 years, and so profit will be higher based on depreciation costs over several years. Seafish economic modelling of scallop cultivation also suggests that cultivation is potentially viable.



### Pearl nets

Scallops at the three field sites were held in pearl nets initially, then transferred to lantern nets as they grew.



Seed planted out in nets at 10-15 mm will grow, in suspended cultivation, to a size at which they can be put out onto the seabed after 12-14 months. Survival at this stage is excellent (80-100%). Market sized scallops may be harvested after a further 2-3 years.

## Other important criteria

- Mortality increases significantly if the scallops are kept longer than necessary (>60 mm) in lantern nets. They cannot be kept in trays on the bottom.
- Handling to take monthly measurements during the summer had no effect on performance.
- Filtration rates are suppressed at very high food cell concentrations, suggesting that areas with regular dense algae blooms are not suitable.
- Scallops are best cultivated at a depth of water between 15-30 metres.
- Scallops prefer substrates of clean, firm sand, fine gravel or sandy gravel, sometimes with an admixture of mud. They will only survive on fine sediments provided current speeds are reasonably slow.
- Obtaining a Several Order for suitable cultivation sites will give legal protection to stock on the seabed.
- Performance of wild-caught and hatchery-reared seed is similar. A current constraint is a reliable supply of seed.



Field trials in Portland Harbour  
Recovering lantern nets to assess growth of king scallops

## Partners

The Centre for Environment, Fisheries & Aquaculture Science  
University of Southampton Oceanography Department  
Devon Sea Fisheries Committee  
Loch Fyne Seafarms Ltd.  
Quest Holdings, Portland.