Fisheries & Conservation Science

# English Channel King Scallops

## *Research Summary*

## Environmental impacts (MSC Principle 2)

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## Marine Stewardship Council (MSC) assessment

The MSC assessment process is divided into three key principles that underpin their mission to recognise and reward sustainable fishing practises. A fishery is assessed and given a score for a number of performance indicators under each principle.

| | |
|---|---|
| **MSC Principle 1 – Sustainable Stocks** | A fishery must be conducted in a manner that does not lead to over-fishing or depletion of the exploited populations and for those populations that are depleted the fishery must be conducted in a manner that demonstrably leads to their recovery. |
| **MSC Principle 2 - Environmental Impacts** | Fishing operations should allow for the maintenance of the structure, productivity, function and diversity of the ecosystem (including habitat and associated dependent and ecologically related species) on which the fishery depends. |
| **MSC Principle 3 – Effective Management** | The fishery is subject to an effective management system that respects local, national and international laws and standards and incorporates institutional and operational frameworks that require use of the resource to be responsible and sustainable. |

## Certification requirements

Principle 2 of the MSC assessment criteria states that the fishery should not cause (or pose a risk of) serious or irreversible harm to habitat structure or ecosystem function. There should be knowledge of the impacts of the fishery on the ecosystem and bycatch. The nature, distribution and vulnerability of all main habitat types in the fishery should be known at a level of detail relevant to the scale and intensity of the fishery.

## Background / data requirements

In order to fulfil data requirements for assessment is necessary to: define the full spatial extent of the king scallop (*Pecten maximus*) dredge fishery in the English Channel; assess the habitats and species that are present at the scale of the fishery; and assess the impacts of the fishery on those habitats and species.

Environmental conditions shape the biological communities present on the seabed. The impact of scallop dredges varies depending on habitat type. Scallop dredging can be very damaging in sheltered, biogenic (habitats formed by organisms such as sea grass and coral) and soft sediment environments, but can have very little impact in highly dynamic systems (Sciberras *et al.* 2013). Therefore, it is important to assess the impact of the fishery within the relevant environmental context.

## Action

Vessel monitoring system (VMS) data were used to identify the spatial footprint of the offshore fishery (>6 NM from the coastline) and to calculate a measure of recent scallop fishing intensity (Figure 1). This was calculated as the number of hours scallop fishing that had occurred over the previous 3 years, aggregated at a scale of 0.025 decimal degree grid cells (approx. 5 $km^2$). Scallop dredging activity is concentrated in certain areas of the English Channel, reflecting the optimal habitat for, and highest densities of, scallops.

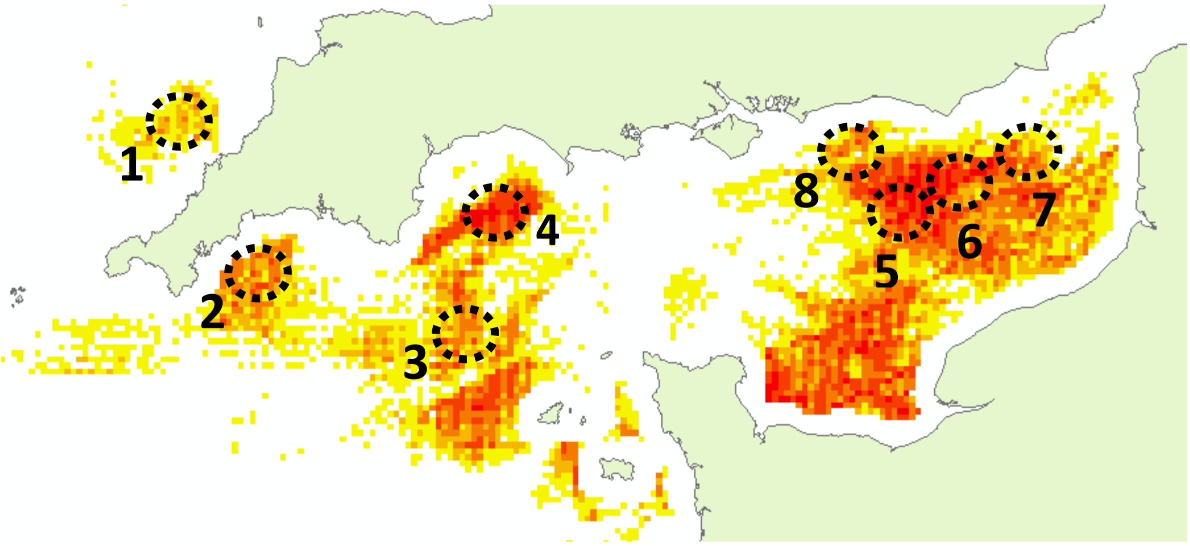


Figure 1: Map of the English Channel. VMS data for scallop vessels is represented by coloured grid cells: yellow = low levels of fishing activity; red = high levels of fishing activity. VMS data was filtered for speeds between 2-4 knots to reflect fishing activity. The locations 1-8 sampled in the present study are indicated by dashed circles. Sampling took place during August and September 2013.

As environmental parameters (e.g. depth, seabed temperature, surface chlorophyll-*a* concentration and substrate) vary across the eastern and western English Channel, sample sites were selected to cover a representative range of environmental conditions that occur at the scale of the fishery. A habitat survey was undertaken at 8 locations across the English Channel (Figure 1). At each of the 8 locations, 5 sample sites were identified within an 8 km radius that covered a range of fishing intensities. The fishing intensities at the sample sites ranged from 2 to 93 hours, over a three year period (October 2010 to September 2013). Due to time and budget limitations the survey was restricted to the English side of the English Channel; however the fishery does extend into the French side, in particular the Baie de Seine in the eastern English Channel.

Species and habitats present at each site were sampled from the *RV Prince Madog* using a beam trawl, scallop dredges and underwater video. Sampling took place during August and September 2013. The mean area of seabed sampled at each site with the beam trawl was 564 $m^2$ and the mean area sampled with the scallop dredges was 4577 $m^2$. The beam trawl was not deployed at site 5 due to the high proportion of large stones at the site. Measures of species abundance, species richness, and species diversity were calculated. The species that characterised the community at each site were assessed and compared among the different sites and across a gradient of fishing intensity. An analysis of biological and life-history traits was also carried out to assess the impact of the fishery on the functional composition of the communities present. Each measure of abundance/diversity was tested for relationships with the level of dredge fishing intensity to assess the impact of the fishery on the biological characteristics of the seabed.

Patterns in physical parameters at each site were also investigated to look for similarities or differences between the sample sites that could influence the habitat and species composition. The scallop fishery in the English Channel exists on areas of sandy gravel, interspersed with pebbles and cobbles. Depth at the sites sampled ranges from 24-78 m; tidal bed shear stress ranges from 0.24 - 1.7 N $m^2$ and mean sea bed temperature ranges from 10-12 °C.

## Results

Within the temporal and spatial pattern of scallop fishing experienced to date, no significant relationships were found between the level of dredge fishing intensity and species richness, diversity, composition or the total number of species. This may be because fishing disturbance has no impact over and above natural physical disturbance within the fishery, or that historic fishing activity could have altered the benthic communities within the area of the scallop fishery to those that are resilient to scallop dredging. The commercial scallop dredge fishery has existed in the English Channel for much of the last century. It is possible that the cyclical pattern of harvesting, whereby areas of the seabed are revisited intermittently, means that disturbance from fishing is holding the ecosystem in a permanently altered state. Hence, it is not possible to detect changes in the habitat across a gradient of recent fishing activity given the current temporal and spatial patterns in the fishery.

The survey did not incorporate any areas of seabed outside the footprint of the fishery, as the aim was to investigate the impacts on seabed that is fished, and whether the degree of fishing intensity has a significant effect on the species and habitats present.

A significant negative relationship occurred between tidal bed shear stress (BSS) (an indicator of natural physical disturbance at the sea bed) and species richness, species diversity and the total number of species. This indicates that within the boundaries of the spatial extent of the commercial scallop dredge fishery, natural disturbance has an over-arching effect on species diversity and composition. When species composition was examined, nine taxa were frequently observed in the samples (Table 1). These species therefore represent the community type typical of scallop fishing grounds in the English Channel. Sites with higher BSS have a significantly different species composition to sites with low BSS. This is attributed to the presence and abundance of some rarer species. Sites with higher BSS have fewer species overall and more species that have biological or life-history traits that are resilient to life in disturbed habitats.

Table 1: Species typical of scallop fishing grounds in the English Channel.

| **Latin name** | **Common name** |
|---|---|
| *Pecten maximus* | King scallop |
| *Aequipecten opercularis* | Queen scallop |
| *Pagurus sp.* | Hermit crab |
| *Psammechinus miliaris* | Green sea urchin |
| *Asterias rubens* | Common starfish |
| *Alcyonium digitatum* | Dead man's fingers |
| *Ciona intestinalis* | Sea squirt |
| *Ophiura / Ophiothrix sp.* | Brittlestars |
| *Inachus / Macropodia sp.* | Spider crabs |

## Management recommendations

Under the MSC assessment criteria, management of a fishery should be based on an understanding and avoidance of vulnerable habitats, understanding of recovery timescales and restriction of overall impact. Methods of achieving this include, demonstrating that recovery can be achieved in areas closed to fishing, or limiting the spatial footprint of the fishery. It is also important to assess the implications of the displacement of fishing activity if areas are closed to fishing.

Within the boundaries of the current English Channel scallop fishery it is not possible to demonstrate that there is an effect of scallop fishing intensity within the current spatial limits of the king scallop dredge fishery (total scallop fishing activity at the sites sampled ranged from 2 to 93 hours over a 3 year period). This indicates that on grounds previously fished, limiting fishing activity will be of little benefit to the ecosystem, whereas prolonged removal of fishing activity may result in benthic communities approaching a recovered state.

The MSC requirements are that fishing activity does not cause irreversible harm to the ecosystem or gross changes in habitat or ecosystem functioning. It is difficult to determine whether the fishery has had this effect due to the lack of relevant historical data at the scale of the fishery. However, as the habitat exists in its current state, the fishery has no significant impact on the species present or on the functional diversity and composition of the communities within the spatial extent of the fishery (see Kaiser & Spence 2002).

To enable recovery for the type of seabed on which the commercial scallop fishery in the English Channel exists, 2-8 years cessation of scallop dredging activity would be required. (Tillin *et al.* 2006, Kaiser *et al.* 2006; Hiddink *et al.* 2006). Tentative evidence of recovery has been demonstrated in an area of Lyme Bay after a 3 year closure to towed mobile fishing gear (Sheehan *et al.* 2013). These changes were manifested as increases in abundance of a habitat forming coral (*Pentapora fascialis*), the tunicate *Phallusia mammilata* and *P. maximus*.

Closed areas can provide benefits to the commercial fishery by enabling an increase in the density of breeding adults (Stokesbury *et al.* 2004), and therefore reproductive output (Kaiser *et al.* 2007). This can enhance areas of the fishery adjacent to a closed area through the spillover of adults and larvae. Also, the recovery of habitat forming species such as *P. fascialis* enhances the complexity of the habitat and provides substrate on which juvenile scallops (spat) can settle, as well as providing protection from predators (Bradshaw *et al.* 2003). Indirect effects of closure (e.g. trophic effects, such as a decline in prey species as the population of target species recovers) take on average 13.1 (± 2.0) years to become evident (Babcock *et al.* 2010).

1. Due to the consequences of scallop dredging on the seabed a future management strategy should retain the fishery within the current spatial extent to negate any damage to grounds that are outside of these boundaries.
2. Limiting the footprint of the fishery over a prolonged period (e.g. 5+ years) would be more beneficial than the current cyclical regime of harvesting to allow recovery of benthic communities to a pre-disturbance state.
3. There is scope for the environmental credentials of the fishery to be improved through development of improved dredge designs which reduce bycatch and reduce the impact on the seabed (Catherall & Kaiser 2014).
4. Negative effects on the seabed could also be offset through the use of voluntary temporal closures for an appropriate period of time.
5. Displacement of the fishing fleet and related impacts must be considered in conjunction with any proposed ground closures.

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