Opening up about using Closed Areas to Manage Scallop Fisheries

Bryce Stewart, Leigh Howarth, Marija Sciberras, Katherine Yates & Miles Hoskin
Sustainability of Global Scallop Fisheries

UN FAO Fisheries & Aquaculture Department (2013)
The Effect of Fishing on Scallops

Catch per unit effort for scallops

Age composition of scallops
The Effect of Fishing on Scallops
Ecosystem Effects of Scallop Fisheries

Biodiversity

Settlement Habitat
Public Pressure

http://www.youtube.com/watch?v=nkfz5fOPSck
Principles for Improving the Management of Scallop Inshore Fisheries

1. Encourage industry stewardship of the resource (spatial or catch based ownership) – reduce the “race for fish”

2. Allow stocks to recover towards more natural size / age structures – improve yield per recruit & reproductive output

3. Provide spawning refuges – high densities of large individuals

4. Minimise the effects of the fishery on juveniles – improve future yields

5. Reduce by-catch & conflicts with other fisheries

6. Reduce the effect of fisheries on benthic habitats – maintain / recover biodiversity & improve recruitment

Beukers-Stewart & Beukers-Stewart (2009)
Are Closed Areas The Solution?

Georges Bank / NE USA

Figure 36.14. U.S. Georges Bank sea scallop biomass in the groundfish closed areas (dashed line), open areas (dashed-dotted line), and overall (solid line).
Case Study: UK Scallop Fisheries

Great or King scallops
*Pecten maximus*

Queen scallops
*Aequipecten opercularis*

UN FAO Fisheries & Aquaculture Department (2013)
Isle of Man Scallop Fishery

- Scallops dominate fisheries landings into the Isle of Man
- Fishery appears sustainable but is much less productive than in the past
- Dredging for scallops has reduced biodiversity & habitat complexity on the main fishing grounds
- IoM have set up a network of marine protected areas to improve fisheries sustainability
Scallop Recovery in Port Erin Closed Area

Density (1989-2006)

Beukers-Stewart et al. (2005) MEPS
Scallop Recovery in Port Erin Closed Area
Density (2008)

Murray, Hinz & Kaiser (2009)
Scallop Recovery in Port Erin Closed Area

Biomass (2006)

20 TIMES HIGHER!!

• Large scallops ↑
  Egg production (33 x fished area)

• High densities ↑
  Fertilisation

• Combination ↑↑
  Larval production (100 x fished area?)
Fisheries Benefits?

Larval Export?

Spill-over?

Neill & Kaiser 2008

Pascal Dubois
Fisheries Benefits?

Commercial Catch Rates

Conservation Benefits
Closed Area

- Increased biodiversity
- More long-lived and fragile animals
- Increased habitat complexity (upright hydroids, bryozoans etc)
- Feedback to commercial species

Bradshaw et al. (2001; 2003)
Arran No-Take Zone (NTZ)

- Scotland’s first No-take Zone (October 2008)
- Passed by Scottish parliament after years of campaigning by COAST
- Designed to benefit both fisheries and conservation
University of York Research (2010-13)

Howard Wood

Leigh Howarth
Habitat - Photoquadrats

Tim Cross
Last three years - macroalgae within the NTZ was found to contain hundreds of juvenile scallops.
Abundance of scallop settlement was significantly greater inside the reserve

Howarth et al., (2011)
**Over 3 years**

- Scallop density higher in reserve for 3 years year running

- Kings *1.5 times greater* inside reserve

- Queens over *3 times greater* inside reserve

*Error bars represent ±1 SE.*
Scallops older and larger within reserve

Queen scallops

<table>
<thead>
<tr>
<th>Size range (mm)</th>
<th>Reserve</th>
<th>Fishing grounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11-20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21-30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>31-40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>41-50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>51-60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;61</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

King scallops

<table>
<thead>
<tr>
<th>Size range (mm)</th>
<th>Reserve</th>
<th>Fishing grounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>51-60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>61-70</td>
<td></td>
<td></td>
</tr>
<tr>
<td>71-80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>81-100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>101-110</td>
<td></td>
<td></td>
</tr>
<tr>
<td>111-120</td>
<td></td>
<td></td>
</tr>
<tr>
<td>121-130</td>
<td></td>
<td></td>
</tr>
<tr>
<td>131-140</td>
<td></td>
<td></td>
</tr>
<tr>
<td>141-150</td>
<td></td>
<td></td>
</tr>
<tr>
<td>151-160</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;161</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Size composition (%)
# Scallops & Closed Areas in the UK

<table>
<thead>
<tr>
<th>Area</th>
<th>Species</th>
<th>Response</th>
<th>Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arran NTZ</td>
<td><em>P. maximus</em></td>
<td>Moderately higher densities, size and age inside</td>
<td>Variable settlement, moderate fishing pressure outside, some illegal fishing, short duration of protection.</td>
</tr>
<tr>
<td>Arran NTZ</td>
<td><em>A. opercularis</em></td>
<td>Moderately higher densities, size &amp; age inside</td>
<td>As above</td>
</tr>
<tr>
<td>Port Erin CA</td>
<td><em>P. maximus</em></td>
<td>Much higher densities, size and age inside</td>
<td>Regular settlement, high natural densities, high fishing pressure outside, well enforced, long history of protection</td>
</tr>
<tr>
<td>Port Erin CA</td>
<td><em>A. opercularis</em></td>
<td>Higher densities outside</td>
<td>Variable settlement, low natural densities, low fishing pressure.</td>
</tr>
<tr>
<td>Llyn Peninsula SAC</td>
<td><em>P. maximus</em></td>
<td>Higher densities inside</td>
<td>Moderate fishing pressure outside, some illegal fishing, long duration of protection</td>
</tr>
<tr>
<td>Llyn Peninsula SAC</td>
<td><em>A. opercularis</em></td>
<td>Higher densities outside</td>
<td>As above</td>
</tr>
<tr>
<td>Area</td>
<td>Species</td>
<td>Response</td>
<td>Factors</td>
</tr>
<tr>
<td>--------------</td>
<td>--------------</td>
<td>-----------------------------------------------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Cardigan Bay SAC</td>
<td><em>P. maximus</em></td>
<td>Similar densities inside &amp; outside</td>
<td>High natural disturbance, short duration of protection.</td>
</tr>
<tr>
<td>Cardigan Bay SAC</td>
<td><em>A. opercularis</em></td>
<td>Similar densities inside &amp; outside, highly variable</td>
<td>As above</td>
</tr>
<tr>
<td>Skomer MNR</td>
<td><em>P. maximus</em></td>
<td>Higher densities inside</td>
<td>Negligible fishing for scallops outside, long duration of protection</td>
</tr>
<tr>
<td>Skomer MNR</td>
<td><em>A. opercularis</em></td>
<td>Similar densities inside &amp; outside</td>
<td>As above</td>
</tr>
<tr>
<td>Lundy NTZ</td>
<td><em>P. maximus</em></td>
<td>Similar densities and population structure inside &amp; outside</td>
<td>Very low natural densities, low settlement, low fishing pressure outside, some illegal fishing.</td>
</tr>
<tr>
<td>Devon IPA</td>
<td><em>P. maximus</em></td>
<td>Much higher densities, size and age inside</td>
<td>High natural densities, well enforced, long duration of protection</td>
</tr>
</tbody>
</table>
Key Messages... So Far

• Species biology is important
  - permanent closures for long lived species
  - flexible closures for short lived species
• Location is important – you need to understand
  - distribution of suitable habitat
  - larval dispersal and settlement patterns
  - patterns of fishing pressure
• Recovery may be a lengthy process
• Levels of natural disturbance are important
• Enforcement is important
  - industry and stakeholder buy-in is key
Implementation & Management
The Real Challenge
The English Experience

Marine Conservation Zones (MCZs)

127 MCZs recommended – but now only 31 being consulted on
The Northern Ireland Experience

Access priorities of the Northern Ireland Scallop Fleet

Yates (2012)
The Northern Ireland Experience

Areas suggested for protection from dredging

Closed areas suggested for scallop fishery management
Are Closed Areas the Solution?

- Scallop fisheries appear ideally suited to management with networks of closed areas
- **BUT…** effective management outside MPAs is also essential
- A suite of tools are often needed (e.g. minimum sizes, gear modifications, effort restriction, stock enhancement)
- Mapping of benthic habitats, larval dispersal, fishing activity and resources is key to developing effective networks of closed areas
- Closed areas should be set up to benefit both fisheries & conservation wherever possible
- Industry and stakeholder involvement will improve effectiveness and reduce management costs
We All Want Sustainable Seafood
Obrigado!

Science without Borders
http://sciencewithoutborders.international.ac.uk