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**Scientific Monitoring Plan for the Baie ny Carrickey Closed Area:
Scientific Trial (November 2013 – October 2016)**

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1. Background

Baie ny Carrickey is an area (of approximately 8.7 km²) off the south coast of the Isle of Man that has been closed to fishing for scallops and queen scallops by any means since 1st November 2012. Exploitation of commercially important crustaceans (*Homarus gammarus* and *Cancer pagurus*) continues in the area under commercial licence to seven members of the Baie ny Carrickey Crustacean Fishery Management Association (BNCCFMA) with a total maximum limit of 650 commercial pots (reduced to 440 pots from 1st December 2014), as well as the continuation of potting under a recreational licence by hobby potters. Following consultation the Department of Environment, Forestry and Agriculture (DEFA) have sanctioned the commencement of a three year scientific trial to take place within the Closed Area from November 1st 2013 to monitor the impacts of these effort restrictions and other management measures on the crustacean stocks within the area.

2. Aims

Aim 1: To maintain the ecological integrity of the area. Ecological integrity refers to the health of an ecosystem.

Aim 2: To maintain and enhance commercial fisheries resources, primarily crustaceans, within the Closed Area and promote their sustainable use.

3. Objectives:

Objective 1: Maintenance and Enhancement of crustacean populations:

- Limit and quantify commercial fishing effort
- Increase yield per recruit and egg production per recruit
- Assess the status (density, size, sex ratio, egg production) of lobster and crab stocks
- Assess the size-at-onset of maturity for crab and lobster to assess validity of current Minimum and Maximum landing sizes.
- Determine immigration and emigration/spill-over of commercial crustacean species into and out of the Closed Area

Objective 2: Determine habitat distribution and use within the Closed Area

- Produce a habitat map
- Assess the abundance and distribution of crustaceans in different habitats
- Assess the recruitment and habitat use of juvenile brown crab
- Assess species composition and biodiversity within the area (including scallops)

Objective 3: Provide Future management options:

- Analyse data collected during the three year trial
- Produce a report on the outcomes of the trial
- Provide scientific recommendations for continued management options

4. Proposed Scientific Changes

Increased MLS of crustaceans (Objective 2):

The Minimum Landing Size (MLS) inside the Baie ny Carrickey Closed Area (BNC-CA) is 88 mm for lobster and 135 mm for crab resulting in a step of 1 mm and 5 mm respectively across the BNC-CA boundary. For the validity of the scientific trial, and the likelihood of detecting significant changes within the three year period, an increase in MLS of lobsters to 90 mm is proposed. Increasing MLS reduces fishing mortality by increasing the size at first harvest. It also provides predicted increases in yield per recruit in addition to egg production per recruit that accrue relatively quickly (CEFAS, 2005). Thus although newly undersized lobsters will be discarded and thus fewer lobsters initially retained, within two years they will all have moulted and long-term benefits will accrue (CEFAS, 2005). Based on data collected on size distribution data of lobsters sampled at sea on commercial vessels in the sub-areas L12 and K12 in March, July, November and December 2012, it is estimated that a 9 % decrease in landings would accompany an increase in MLS from 88 mm to 90 mm (Figure 1). Collating seasonal length-structure data will assist in the assessment of the efficiency of minimum size-limits. This data will then be analysed to assess the impact of the increased MLS on the mean size of lobsters and crabs caught within BNCRA both temporally (i.e. between 2014 Vs. 2015 Vs. 2016) and spatially (i.e. when compared to control areas MLS 87 mm Vs. MLS 90 mm).

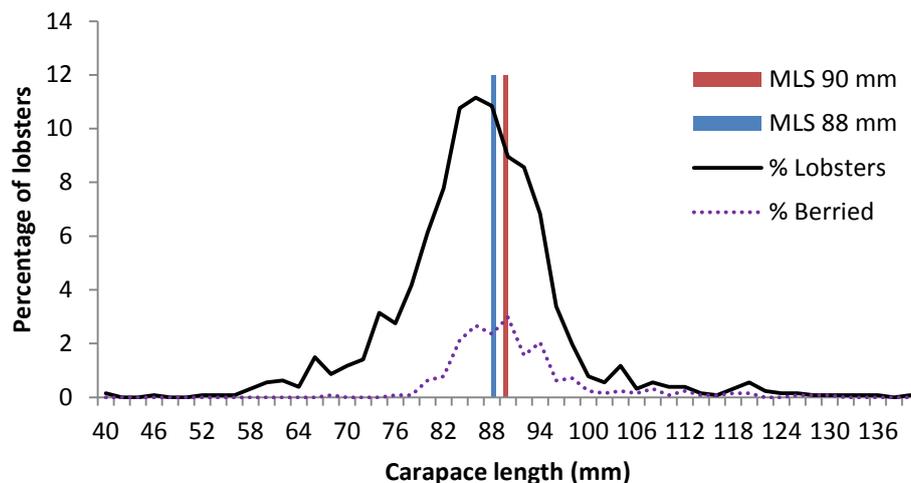


Figure 1: The size distribution of lobsters sampled at sea on commercial vessels by Bangor University during March - December 2012. Current MLS of 88 mm and the proposed increased MLS of 90 mm are shown.

Control areas:

The requirement for replicate control sites (sites outside of BNCRA) is acknowledged to assess the validity of the results from this 3-year scientific trial. Control sites will be selected in consultation with the BNCCFMA in accordance with a set of pre-established key requirements.

5. Proposed Mandatory Methods:

Towed video array with static photographs (Objective 1):

An understanding of the relationships between exploited species and the habitats that support them is critical to effective fisheries management. Information on habitat distribution will be gathered onboard the primary vessels of the BNCCFMA. In conjunction with Bangor University scientists this will involve the use of a cost-effective and low-impact towed sledge carrying a high definition video sensor and a static camera capable of taking pictures at 9 second intervals across a set of predefined transect points. Spatially explicit habitat data will be quantified from the static photographs obtained during these transects and a map of benthic habitats will be created. In addition to mapping habitats a range of other spatially specific environmental data (e.g. salinity, water temperature and depth) will also be recorded.

Logbook sheets for data collection (Objective 2 & 3):

For the new monitoring scheme monthly data will be collected across all 11 scientific data zones (Figure 2). Initially this data will be collated manually in log sheet form, however to aid with ease and consistency of data collection, a trial using video camera systems will be undertaken. In addition GPS recorders can be supplied by Bangor University that will automatically record the time and location of the boat during the sampling event.

Monthly data will be collected across all 11 scientific data zones (Figure 2). Records of all catch from **5 standard commercial shellfish pots** (with escape gaps); **5 scientific shellfish pots** (without escape gaps) and **1 prawn pot** will be required from each primary commercial vessel that fishes within the BNC-CA and will include information on:

- Area fished (Zone 1 -11)
- Location of pot (GPS)
- Soak time (hrs)
- Pot type (Scientific/Standard/Prawn)
- No., Size, Sex, Condition & Retention of all caught lobsters and crab
- Bycatch data

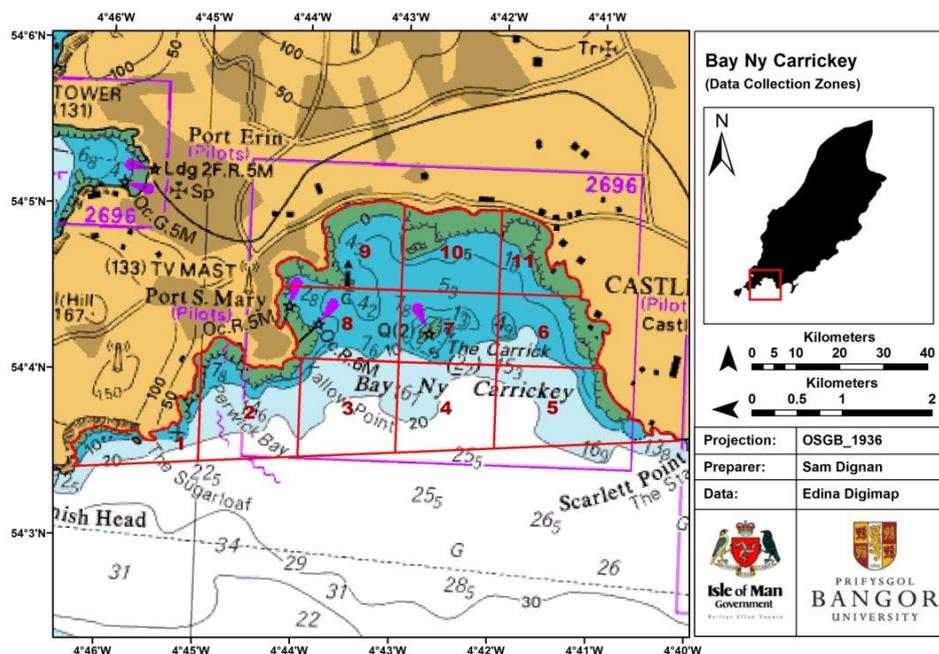


Figure 2: The Baie ny Carrickey Closed Area. Scientific data collection zones 1-11 are displayed

6. Proposed Additional Methods

Tag-mark-recapture study (Objective 2):

A tag-mark-recapture study can be undertaken to assess the movement and habitat use of crustaceans. Closed Areas, which effectively rebuild biomass of exploited species within their boundaries, are expected to benefit local fisheries through biomass spill-over and export of eggs and larvae. There is a perception that 87 mm lobsters or 134 mm crabs returned to the sea within the BNCRA may move outside the boundary limit where they can be caught immediately and landed. Tag-recapture experiments allow estimation of the amount of spill-over from the Closed Area harvested by the adjacent commercial fishery. As well as providing information on movement of recaptured individuals, information on abundance, growth and moult rate can also be collected.

Baited Remote Underwater Video (BRUV) (Objective 1):

BRUV sampling is a non-destructive technique commonly used to sample fish populations, often with respect to Closed Areas. Fish and mobile invertebrates can be sampled in the area using this system which comprises a high definition video sensor mounted on a static frame with fresh bait held within a cage positioned one metre in front of the camera. The frame is deployed on the sea floor and allowed to settle, before a 15 min video will be recorded for analysis. Relative abundance of mobile animals can be assessed by counting the maximum number of individuals of each species within each one-minute slice of video, and averaged to give a mean Max N for each species (e.g. Stevens, in press).

Surveys for juvenile crab (Objective 2):

A Masters student project will be offered to Bangor University students to investigate the distribution and habitat use of juvenile brown crab. The project will involve a series of intertidal shore surveys and subtidal potting surveys for juvenile crab. This project will endeavour to combine these two sampling methods to test ecological theories about habitat use by this species.

7. References

CEFAS (2005). Stock conservation benefits of various lobster management measures. URL: <http://webarchive.nationalarchives.gov.uk/20130123162956/http://www.defra.gov.uk/marine/pdf/fisheries/cefas-lobsteradvice.pdf>. Last accessed: 18th October 2013.

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