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Viewpoint

More bang for your monitoring bucks: Detection and reporting of non-indigenous species

P. Whomersley [a,*], J.M. Murray [a], P. McIlwaine [a], D. Stephens [a], P.D. Stebbing [b]

[a] Centre for Environment, Fisheries and Aquaculture Science (Cefas), Pakefield Road, Lowestoft, Suffolk NR33 0HT, UK
[b] Centre for Environment, Fisheries and Aquaculture Science (Cefas), Barrack Road, The Nothe, Weymouth, Dorset DT4 8UB, UK

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ABSTRACT

'Collect once, use often' is a frequently cited principle in both national and international efforts to promote the collection, archiving and sharing of marine monitoring data. Since the implementation of the Marine Conservation Zone (MCZ) evidence collection programme, 67 recommended MCZ sites have been visited and a suite of marine data collected. Here we present how this dataset was utilised outside of the MCZ programme to identify occurrences of non-indigenous species (NIS) around the UK coast. One hundred and thirty-five aquatic species from the Non-native Species Information Portal (NNSIP) register were used to produce a standard list of NIS against which, infauna and epifaunal data records from the MCZ project were compared. A total of 20 NIS were identified across 42 of the 67 sites surveyed. This study demonstrates that with sufficient coordination and management data collected for other purposes can be easily utilised to address additional policy requirements.

1. Introduction

The phrase 'collect once, use often' is a frequently cited principle in both national and international efforts to promote the collection, archiving and sharing of marine monitoring data (Defra's Evidence Investment Strategy, 2011). Specifically, Defra's current network evidence strategy it is stated that existing data should be utilised before further work is commissioned and methods for handling and exploiting new large data sources, or combining existing data sets to answer new questions should be explored (Defra, 2014a,b). However, in reality are these principals really being considered when new programmes of work are in their preparatory stages or even when a programme of work is actually commissioned? There are currently several key policy's relating to the marine realm that are driving the collection, analysis, reporting and storage of large amounts of marine data in the UK. These include the Marine and Coastal Access Act (MCAA), the Marine Strategy Framework Directive (MSFD), the Water Frame Work Directive (WFD) and the Birds and Habitats Directive (BHD). Each of these acts/directives require the collection of data to enable an assessment on the status of the ecosystem which can encompass a multitude of parameters ranging from the condition of features, benthic biodiversity through to quantities of marine litter. Due to the ever diminishing resource available to address questions posed by current and evolving policy, it has become imperative that the 'collect once, use often' approach is fully implemented.

The introduction of the MCAA in 2009 enabled the creation of new type of Marine Protected Area (MPA), called a Marine Conservation Zone (MCZ). The main aim of establishing an ecologically coherent network of Marine Protected Areas (MPAs), incorporating MCZs was to facilitate the protection of a range of nationally important marine species, habitats and geology in English inshore and English and Welsh offshore waters (Marine and Coastal Access Act, 2009). Following the identification of 127 recommended MCZs (rMCZ) by four regional project groups, the UK government initiated a number of measures aimed at improving the evidence base, one of which took the form of a dedicated survey programme, implemented and coordinated by the Centre for Environment Fisheries and Aquaculture Science (Cefas), to collect and interpret new survey data at selected priority rMCZ sites. Since its initiation, 67 rMCZ have been visited (as of October 2014) and a suite of robust and standardised marine data including; acoustic surveys, seabed imagery and infaunal grab samples have been gathered. Although this dataset has been collated to support the designation of MCZ sites, it harbours huge potential to address other key questions where additional resources for a dedicated programme are not available.

Concurrent with the evidence collection programme to support MCZs in England, there is a requirement under the Marine Strategy Framework Directive (2008/56/EC) (MSFD) for member states to establish and implement coordinated monitoring programmes for

* Corresponding author.
E-mail address: Paul.Whomersley@cefas.co.uk (P. Whomersley).

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the ongoing assessment of the environmental status of our marine waters in relation to human pressures. In a step towards fulfilling this requirement, the Marine Strategy Part Two: UK Marine Monitoring Programmes document was released in July 2014 detailing the UK's current marine monitoring programmes which support the targets and indicators set out in the Marine Strategy Part One. In this viewpoint paper, we demonstrate how the MCZ evidence collection programme can be used to support additional monitoring options required under MSFD, specifically in relation to Descriptor 2 non-indigenous species (NIS) and also suggest the development of a framework aimed at coordinating and standardising the recording and reporting of NIS.

2. The case study: non-indigenous species

Non-indigenous species are defined as a non-native animals or plants that have the ability to spread causing damage to the environment, the economy, our health and the way we live (GB non-native species secretariat, 2014). The introduction of non-indigenous species is considered to be one of the greatest threats to biodiversity after climate change and habitat loss and destruction (Charlton, 1999; Bax et al., 2003; GB non-native species secretariat, 2014; Nunes et al., 2014; Ojaveer et al., 2014). Non-indigenous species have the potential to out-compete and displace native species therefore having a negative effect on ecosystem functions and services (Shiganova, 1998; Shiganova and Bulgakova, 2000; Grosholz et al., 2000) as well as having potentially detrimental effects on marine infrastructure (piers and pipelines) and marine based industries such as shipping and offshore exploration (Eno, 1996). Early intervention is considered the most effective approach to reducing the impact of NIS but this requires the ability to detect their occurrence (Bogich et al., 2008).

As numerous human mediated activities can lead to the introduction of NIS, marine policy and management responses must consider a diverse range of human activities (Bax et al., 2003; Williams and Grosholz, 2008). The UK is proposing to take a risk based approach to managing pathways and vectors of introduction of marine NIS (Defra, 2014). Therefore, there is a need for robust surveillance monitoring in order to determine a baseline against which the effectiveness of pathway management strategies can be determined. Routine national and regional statutory monitoring programmes that have a biological sampling component have been highlighted as having the potential, with some modification, to provide a method of detecting NIS occurrences, abundance and distribution (Ojaveer et al., 2014). In this paper we detail an approach to demonstrate how data collected for one purpose i.e. MCZ habitat verification can be further developed to deliver additional aims using the occurrences of NIS as an example.

3. Approach

3.1. Identification of a relevant non-indigenous species list

The Non-native Species Information Portal (NNSIP) (hosted on the Non-native Species Secretariat website) provides a central repository for distribution data and information regarding NIS in Britain. One hundred and thirty-five aquatic species from the NNSIP register were used to produce a standard list of marine NIS relevant to the UK against which, infauna and epifaunal data records from the MCZ project could be compared.

3.2. MCZ data availability

Since the implementation of the MCZ data and evidence gathering programme at the end of 2011, 67 rMCZ sites have been visited. A suite of marine data have been collected at these sites including multibeam echosounder backscatter and bathymetry, sidescan sonar, seabed imagery and grab samples for infauna and particle size analysis (PSA). Not all of the sites surveyed required the collection of the full suite of data and therefore the complement of data collected was site specific.

Of the 67 MCZ sites visited, seabed imagery was collected at 58 sites resulting in a total of 2848 individual video tows with an associated presence/absence epifaunal species matrix. Infauna (species abundance and biomass) and PSA (half Phi distribution), collected using a 0.1 m^2 Hamon grab, was available from 59 of the MCZ sites surveyed, resulting in a total of 2614 individual sampling stations. Sediment data and substrate information was used to classify the stations according to Modified Folk (Long, 2006), European Nature Information System (EUNIS habitat classification, 2007) classes and Broadscale habitats (Marine Conservation Zone Project. Ecological Network Guidance, 2010).

3.3. MCZ data standards and protocols

A major strength of the current MCZ dataset are the robust protocols employed during data collection, processing and analysis. All data for the programme are collected, processed and quality assured following standard operating procedures and laboratory practises. The elutriation, extraction, identification, enumeration and biomassing of faunal samples is carried out following the National Marine Biological Analytical Quality Control (NMBAQC) Processing Requirement Protocol (PRP) (Worsfold et al., 2010). All fauna are identified to the lowest taxonomic level possible, with species names conforming to the Marine Species of the British Isles and Adjacent Seas (MSBIAS) list which is a subset of the species on the World Register of Marine Species (WoRMS). If a new species is found, it is added to the MSBIAS list and updated via the website (The UK Marine Environmental Data and Information Network, 2011).

Table 1
List of NIS species present and their percentage occurrence in 67 rMCZ or MCZ sites which had survey data from the MCZ data and evidence gathering programme. All species were identified from infaunal grab samples * denotes species which were identified from both infaunal grab samples and epifaunal video samples.

Species	Common name	% Occurrence in rMCZ or MCZ sites surveyed
Mya arenaria	Sand-gaper	7
*Crepidula fornicata**	Slipper limpet	16
Elminius modestus	Barnacle	3
Ensis americanus	American jack knife clam	2
Goniadella gracilis	Polychaete worm	33
Monocorophium acherusicum	Slender-tube amphipod	6
Hydroides ezoensis	A tube worm	3
Eusarsiella zostericola	Ostracod	5
Metavermilia multicristata	A tube worm	6
*Styela clava**	Leathery sea squirt	6
Hydroides elegans	Polychaete worm	3
Limnoria quadripunctata	Wood-boring gribble	2
Crassostrea gigas	Pacific oyster	2
Ammothea hilgendorfi	A sea spider	2
Calyptraea chinensis	Chinamans hat	2
Tricellaria inopinata	Bryozoan	2
Molgula manhattensis	Sea grape	3
Vermiliopsis striaticeps	A tube worm	3
Filogranula calyculata	A tube worm	2
Grandidierella japonica	Amphipod	2