A Governance Analysis of the Lyme Bay MPA

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Abstract

Marine ecosystems, like much of the natural world, are increasingly under threat from a wide variety of anthropogenic and wider impacts. As these threats increase, there is increasing recognition of the need for Marine Protected Areas, yet many remain as ineffective 'paper parks', and some even increase the damage to the marine habitat they are designed to protect. As a result, attention has turned to the mechanisms of governance of MPAs, and the effectiveness of such structures. The Marine Protected Area Governance framework can be used to analyse MPA governance by moving away from conceptual discussion to focus on key concepts leading to effectiveness. The framework was applied to an MPA in Lyme Bay, UK, the site of a controversial fisheries closure, which has subsequently become a Special Area of Conservation as well the location for an NGO-led project focusing on stakeholder engagement. Twenty-five semi-structured interviews were carried out across a broad range of stakeholders, including regulators, fishermen, wider users, scientists and NGOs, alongside document analysis and participant and nonparticipant observation. Drawing on the results of this analysis, the MPAG framework found a structure with a diversity of incentives, providing for bottom-up stakeholder engagement and awareness coupled with strong top-down legislative structures. Although the fisheries closure and subsequent SAC have provided the main mechanisms for protecting biodiversity, the NGO-led project has provided a complement to the legislative framework and helped to facilitate a mechanism for adaptive co-management. However, the site is predicted to be subject to external pressures from changes in legislation, state resource restrictions and reduced NGO involvement, which will test the resilience of the structure and whether such a diversity of incentives provides resilience to maintain MPA effectiveness.

The content of this document contains 11,872 words.

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Please note that this is an edited, redacted version of the original thesis.

List of abbreviations

AIS	Automatic Identification System
CPR	Common Pool Resource
cSAC	Candidate Special Area of Conservation
Defra	Department for Environment, Food and Rural Affairs
EMFF	European Maritime and Fisheries Fund
EU	European Union
GDP	Gross Domestic Product
IFCA	Inshore Fisheries and Conservation Authority
iVMS	Inshore Vessel Monitoring System
LBFCR	Lyme Bay Fisheries & Conservation Reserve
MCZ	Marine Conservation Zone
MMO	Marine Management Organisation
MPA	Marine Protected Area
MPAG	Marine Protected Area Governance
nm	Nautical miles
RFS	Responsible Fishing Scheme
SAC	Special Area of Conservation
SFC	Sea Fisheries Committee
SI	Statutory Instrument
SPA	Special Protection Area

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Introduction

The world's oceans play a critical role in both supporting human well-being and contributing to the health of the biosphere (Costanza, et al., 1998; Halpern, et al., 2012). There is increasing recognition of the threats to healthy ocean systems, with marine species populations declining by 49% between 1970 and 2012 (UNEP-WCMC, 2016). These threats arise from human activities such as unsustainable fishing, coastal development and pollution, and from wider threats such as climate change (Costanza, et al., 1998; Whitney, et al., 2016). This broad spectrum of impact has altered marine ecosystems and their ability to provide ecosystem benefits, both now and in the future. Marine ecosystems play a role in supporting the seven billion people in the world, almost half of whom live by the coast, and many of whom rely on marine environments for extracting food, making a living, or continuing centuries-old traditions (Halpern, et al., 2012). Therefore the problems facing the oceans include both traditional ocean management issues and broader ecological and social system management issues, meaning there is increasing scrutiny on mechanisms by which marine areas can be protected (Costanza, et al., 1998).

As threats to marine systems increase, there is increasing recognition of the need for marine protected areas (MPAs), defined here as marine areas in which one or more human activities, particularly fishing, are restricted or prohibited. Many treaties have set targets for marine protection, and there have been recent increases in the number of MPAs in attempt to reach the global target for marine protection of 10% of the oceans by 2020, agreed under the Convention on Biological Diversity (Deguignet, et al., 2014). The global percentage of MPAs as a proportion of the marine environment has historically been low, consisting of less than 1% in 1998 (Costanza, et al., 1998), and rising to 3.4% in 2014 (UNEP-WCMC, 2014). Furthermore, these MPAs often fail to achieve their full potential or conservation objectives (Edgar, et al., 2014). Many MPAs remain as 'paper parks', lacking regulation that prevents overfishing or the means to enforce such regulation, and some even increase degradation, through impacts such as the undermining of traditional sustainable management. For this reason, attention has been directed to the governance of MPAs, and the factors leading to successful protection.

The increased attention on MPAs is accompanied by a change in the marine conservation policy landscape, with policy shifts towards more integrated approaches promoting

'stakeholder involvement, robust science and the precautionary principle' (Defra (2007) cited in McVittie & Moran (2010)). Within the UK, the Marine and Coastal Act 2009 is the proposed vehicle for this vision, which includes provisions to designate and manage an ecologically coherent network of MPAs around the UK by 2016 (Figure 1). This has resulted in the designation of fifty Marine Conservation Zones (MCZs), a type of MPA, identified through stakeholder involvement projects, and the establishment of new public bodies to manage marine areas with an increased emphasis on conservation and stakeholder interests (Lowther & Rodwell, 2013).

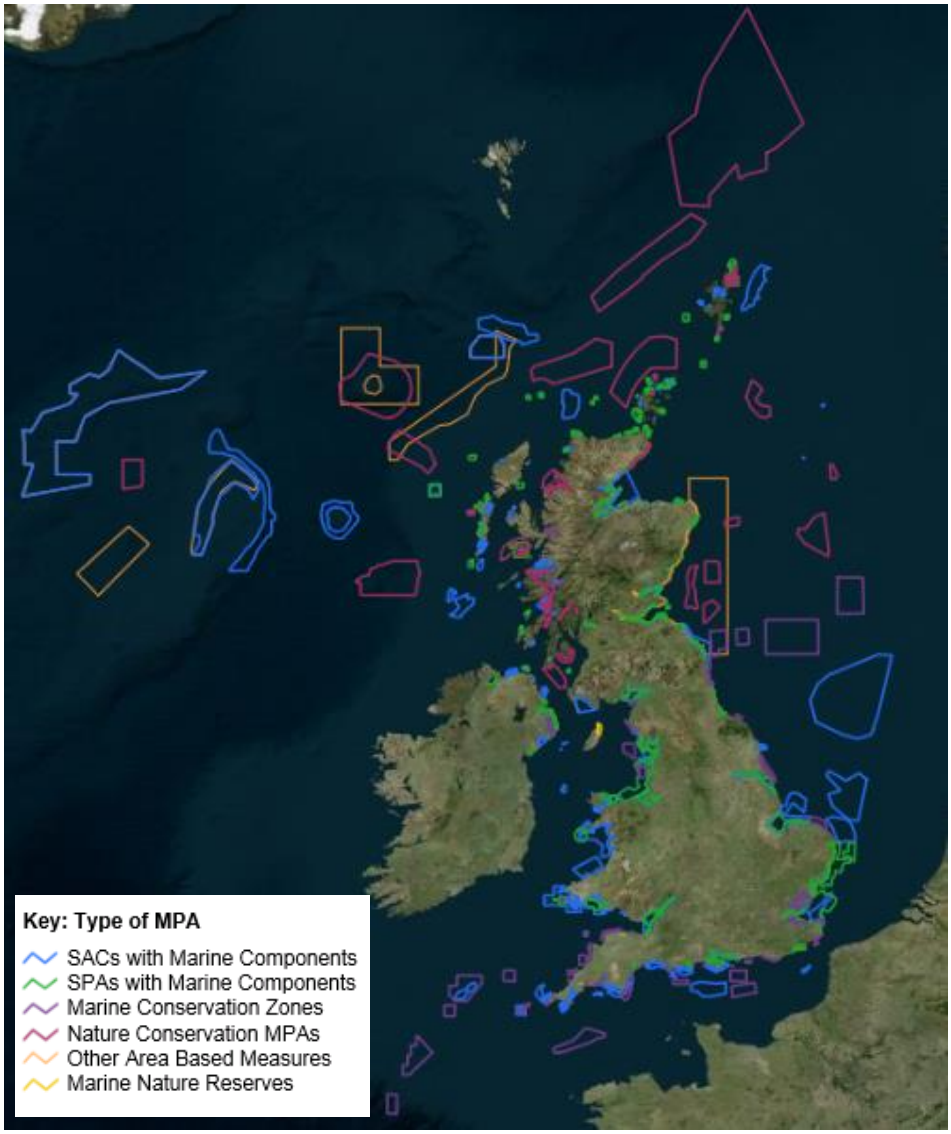

Figure 1: Marine Protected Areas in the UK. Source: JNCC (2016)

This report will focus on the Lyme Bay MPA in South West England, an important marine area for the provision of social and economic benefits as well as marine biodiversity. The

area was the subject of controversy in 2008 when it was subject to a Statutory Instrument (SI) banning bottom-towed fishing gear from a 60nm^2 area, creating a *de facto* MPA, the largest UK MPA at time of its designation (Stevens, et al., 2014). The closure led to widespread academic interest, with significant flaws identified in the stakeholder consultation process (Fleming & Jones, 2012). A larger area of the site subsequently came under EU designation through the Habitats Directive in 2010 as part of the Lyme Bay and Torbay candidate Special Area of Conservation (cSAC). Lyme Bay has therefore attracted considerable attention, both as a case study of conflicting interests of stakeholders (Mangi, et al., 2011), and as a test site for UK and European marine conservation policy (Sheehan, et al., 2013).

The site has received further attention due to the work of an NGO-led stakeholder group, the Lyme Bay Fisheries & Conservation Reserve Working Group. This working group, created and chaired by the Blue Marine Foundation, consists of a broad range of stakeholders, and has received publicity as the first example of self-regulation of the fishing community within the UK, through the use of a voluntary agreement (The Guardian, 2012). Neither voluntary agreements nor the role of NGOs in MPA governance have been assessed in detail in the governance literature. Lyme Bay therefore provides an important case study for UK marine governance and effectiveness, allowing recommendations for the ongoing designation and management of UK MPAs and MCZs.

The research aims of this report are:

- To determine the governance structure of Lyme Bay, in the context of an in-depth review of the governance literature
- To perform an analysis of the Lyme Bay governance and determine effectiveness of the MPA, with an additional focus on the role of NGOs and voluntary agreements
- To provide recommendations, both for the governance of Lyme Bay and the wider landscape of UK marine conservation, on the basis of the findings

Governance literature review

Background to governance

The concept of governance has a range of definitions that have evolved with thinking on the topic, with its origins in the Greek verb 'to steer', and will defined here as 'the steering of human behaviour through combinations of people, market and state incentives in order to meet strategic objectives' (Jones, 2012). Governance can therefore incorporate a wide range of factors, ranging from formal and informal legislation, to funding, to decision making, and to accountability (Dearden, et al., 2005). With evolving meanings of the term there have also been debates on the relative strengths and weaknesses of different governance approaches.

State steer

Hobbes' 17th century work 'Leviathan' argues that the laws of nature do not guide human behaviour towards self-preservation, and that there is a need for a powerful central government (Wolfenden, 2010). Similarly, Hardin's 1968 paper on the 'tragedy of the commons' focused on the role of centralised government property as the only way to provide the necessary steer to protect common-pool resources (CPRs) (Hardin, 1968). This argument centred on the idea that people sharing 'the commons' would eventually deplete these resources, as each person pursues their own best interest in a society that believes in freedom of the commons. This presents a governance school of thought based on state steer: heavily bureaucratic, driven by command-and control based solutions to management of natural resources (Durant, et al., 2004). 'Fortress conservation' is a term associated with strong state control, and the idea that conservation areas must be 'defended' against (local) people, with the designation of National Parks, such as in the USA, a frequently cited example (Buscher, 2016).

Although state steer presents for many an appealing narrative and 'hard certainty', there are many criticisms; research suggests that central governments imposing uniform regulations is often unsuccessful in preventing resource degradation (Ostrom, 1999). A heavy handed central government can lead to games of 'cops and robbers' with authorities and users of CPRs due to imposition of regulations (Ostrom, et al., 1999), and rigid laws can undermine adaptability (Ebbesson, 2010). A particular problem with regards to MPAs is 'paper parks', which lack adequate state enforcement to overcome issues such as resentment from local

users, meaning their designation has little effect (Jones, 2014). MPA decisions are therefore often politically difficult, with resistance from an industry heavily impacted by competition, pollution and decline in stocks (McCay & Jones, 2011).

Self-governance

Criticisms of traditional command-and-control approaches are supported by observations that traditional management of natural resources has been present for millennia (Jones, 2014). Research across the world suggests that local user groups can self-organise to find solutions to commons dilemmas (Ostrom, 1999). Drawing from neo-institutionalist thinking, a backdrop of inequitable fortress conservation has led to a new paradigm, emphasising the role of civil society, and self-governance via empowerment of local people (Durant, et al., 2004). Increased degradation of resources following formal protection or nationalisation is well documented, with state control sometimes less effective than management by those directly affected by changes (Ostrom, 1999). Empowering members of civil society through decision making or partnerships can lead to retention of user knowledge and allow traditional, sustainable means of exploiting nature. This can include measures such as voluntary agreements, as non-enforceable approaches adopted to constrain behaviour which can increase ownership of the measure by users (Whitney, et al., 2016). However, the use of voluntary agreements in governance, particularly of MPAs, has not been covered in detail in the literature.

Ostrom argued for an 'upward spiral' of trust which can help to overcome temptations of short-term self-interest by users (Ostrom, 1998), with users depending on resources for their livelihoods more likely than others to perceive benefits from their own restrictions (Ostrom, et al., 1999). However, these individuals have to share a common consensus of 'how the resource system operates and how their actions affect each other and the resource' for success (Ostrom, et al., 1999). It can also be argued that bottom-up approaches are difficult to integrate with a backdrop of national and international conservation legislation, focused on achievement of objectives and legal obligations, and threats of infraction. Non-compliance and breach of regulations by incoming users can cause a 'downward spiral' with erosion of trust leading to resource degradation. This has been seen in preliminary reviews of the effectiveness of voluntary agreements in MPAs; lack of leverage to discourage non-compliance was found to be the main factor causing failure of voluntary agreements used in

MPAs in developed nations in a review of existing literature (Whitney, et al., 2016). Taking into account these issues, it can be argued that, with many analyses resistant to state steer and focused on the role of people and civil society, the paradigm has swung too far towards the role of bottom-up governance (Jones, et al., 2013).

Co-management

Discussions around top-down vs. bottom-up arguments of governance can be compared to the same arguments by ecologists of the differing weights of top-down impacts (fishing) vs. bottom-up (planktonic productivity) (McCay & Jones, 2011); in reality, both are important and have a role to play. Whilst it is clear that regulation is important, users also have a significant role to play in management, to increase fairness and cooperation. It has been argued therefore that collaborative management (co-management), whereby the advantages of state control are complemented by community involvement in the management process, is a solution to this issue. Co-management can relate to a continuum of arrangements varying from the simple exchange of information to formal partnership between states and users (Carlsson & Berkes, 2005). Such input from users can also enhance adaptive management, whereby management approaches can use polices as hypotheses, with management as a series of experiments from which managers can learn (Carlsson & Berkes, 2005). This type of structure can be facilitated through the use of multiple perspectives, including the knowledge of resource users, to help allow for ecological uncertainty.

In this way, co-management can allow national government to enforce and help to legitimise the input of local users, but it is argued that this can represent another form of state control, by perpetuating the injustices of fortress conservation through a ‘new tyranny’, or by the inclusion of only ‘token’ stakeholder input in order to meet objectives (Ostrom, et al., 1999; Jones & Roberts, 2009). Conversely, it can be argued that too bottom-up an approach can lead to the ‘tyranny of localism’ with governance controlled by local elites (Jones, 2014). In studies of co-management partnerships in fisheries, it appears that both too much and too little user involvement is equally problematic (Jentoft & McCay, 1995).

Governance frameworks

Considering the 'simple' merger of top-down and bottom-up approaches, along with market drivers, as a 'one-size-fits-all' solution to governance, including of MPAs, may present a panacea of the type that Ostrom warned against (Ostrom, 2007). The diversity of governance structures means that a simple framework cannot reflect the complexity seen in reality (Ostrom & Cox, 2010). Co-management may therefore better be viewed as a broad concept, illustrating the challenges of combining top-down and bottom-up approaches, and a loose framework for governance debate (Jones, 2014). Adaptive co-management further illustrates this principle; although a 'learning by doing' nature is seen by some as the key to achieving sustainable governance of the oceans (Costanza, et al., 1998), complex adaptive process can rarely be represented by simple frameworks, although it is tempting to attempt to do so (Ostrom, 1999). Having said this, it is clear that the uncertain and data-poor ocean environment requires adaption in governance (UNEP-WCMC, 2016). Therefore instead of focusing on simple frameworks, we should focus on developing better theories of complex adaptive frameworks, and the factors that influence success (Ostrom, 1999).

Complexity of frameworks is further complicated by involvement of stakeholders other than just users and government, such as NGOs, who may act to support either top-down or bottom-up mechanisms and therefore can be subject to the same support or criticisms of such approaches outlined above (Jones, 2014). NGOs can therefore be actors in government-led, private, NGO-led and self-governed protected areas, and can perform a wide variety of functions from funding, to campaigning, to leadership of users (IUCN, 2013). Although there is no clear analysis of the effectiveness of NGOs in marine conservation, general concerns around the roles of NGOs in conservation are linked to homogenisation of communities of users, and imposition on local users (Cleaver, 2001; Chapin, 2004). However the variety of roles taken and lack of analysis makes comment on the general role of NGOs in MPA governance difficult.

With no 'one best way' to approach protected area governance (Dearden, et al., 2005), co-evolutionary hierarchical governance (Figure 2) presents a loose framework for complex systems incorporating all three forms of governance steer; state steer, civil society steer, and market steer (Jones, 2014). This framework recognises that top-down and bottom-up approaches are not diametrically opposed, and represents a way in which the different steers

can co-evolve, whilst not attempting to represent in detail the full complexity of adaptive systems.

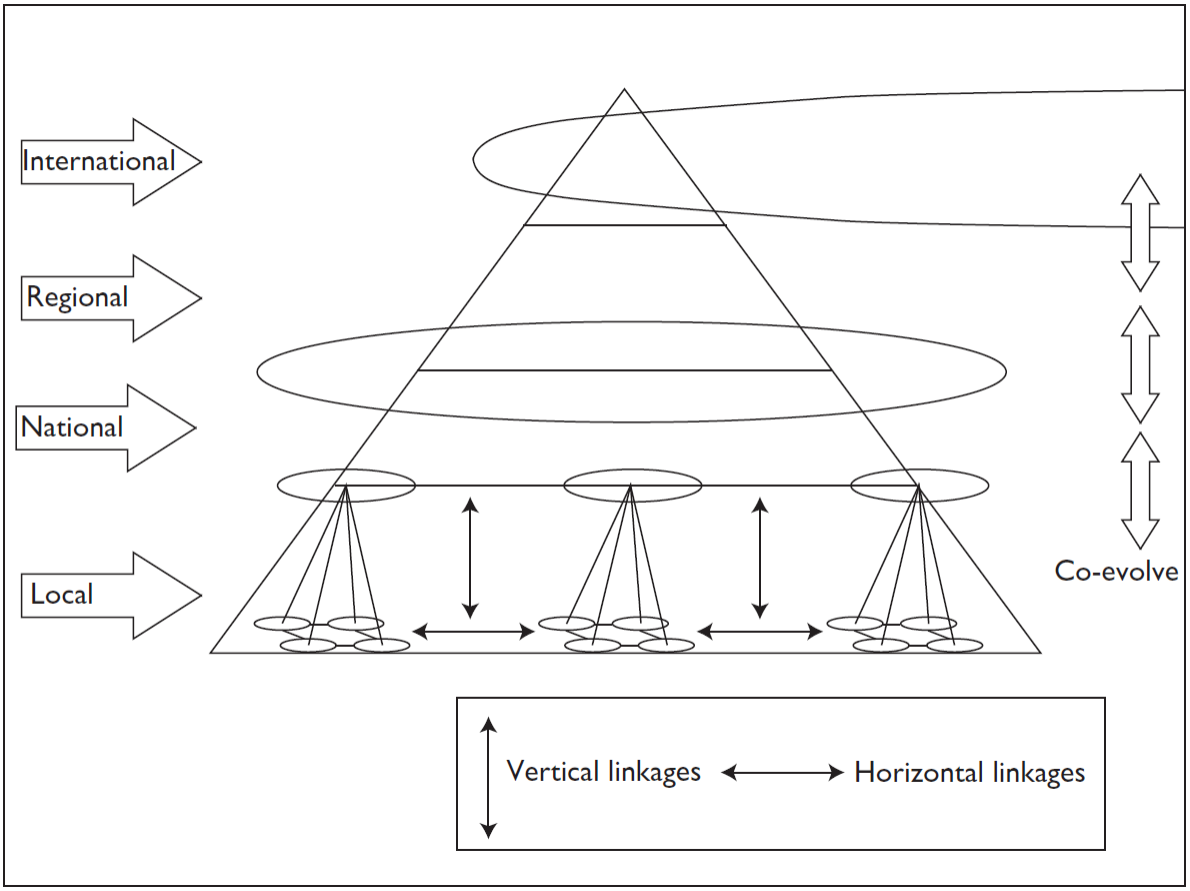

Figure 2: Co-evolutionary hierarchical governance. Source: Jones (2014, p. 75)

Market forces

Throughout discussions of both top-down and bottom-up governance, it is recognised that markets are pervasive drivers, and the examples of market interactions given can differ greatly depending on which 'direction' the steer is coming from. Market or economic incentives are now increasingly discussed, along with terms such as natural capital and ecosystem services (Ulgiati, et al., 2011). These steers can have both positive and negative effects on effectiveness of protected areas. Connecting local users of protected areas to external markets is seen as a way to increase the success of bottom-up conservation, but local economic vested interests can be argued to require stronger top-down controls to ensure protection of biodiversity (Qiu, 2013). Neo-liberalist arguments encourage the removal of policy barriers to economic instruments, and whilst market mechanisms create enthusiasm for

'new tools' with which to manage and finance biodiversity, this 'neo-liberalisation of nature' can face problems of misuse in practice (Penca, 2013). Therefore, while arguments around market forces can mirror discussions of top-down and bottom-up governance, it is now widely accepted that market forces provide an inevitable '3rd pillar' of steer, alongside state control and public interests, and that in reality, all three approaches are important (Jones, 2014).

Marine governance in the UK

Countries with well-developed legal, bureaucratic and political systems, such as the UK, have a tendency to employ government-led governance approaches (Jones, 2012). UK marine governance is therefore set within the context of a complex system of national, regional, European and international codes (McVittie & Moran, 2010), including the UK Marine and Coastal Act 2009. Two new organisations, the Marine Management Organisation (MMO) and the Inshore Fisheries and Conservation Authorities (IFCAs) were created as part of the Marine and Coastal Act, forming part of a new government framework to integrate fisheries and environmental management goals. Formal guidance to IFCAs from Defra is to 'lead, champion and manage a sustainable marine environment and inshore fisheries, by successfully securing the right balance between social, environmental and economic benefits to ensure healthy seas, sustainable fisheries and a viable industry' (Association of IFCA, 2016). Under this remit, the IFCAs are tasked with using byelaws to ensure fishing is compatible with the conservation objectives of inshore SACs (Rodwell, et al., 2014). Conservation advice is provided by Natural England, with the IFCAs ultimately reporting to Defra. The MMO provides guidance and support, and also further contributes to overlapping responsibilities such as enforcement. This structure provides an opportunity to increase co-management partnerships in UK MPA governance through increased social capital and collective learning (Rodwell, et al., 2014).

Emphasis on the designation of an 'ecologically coherent and well-managed network' of MPAs in 25% of English territorial waters by 2016 (Rodríguez-Rodríguez, et al., 2015) has placed emphasis on scaling and connectedness of MPAs, and of stakeholder input in designation. However, an analysis of Channel MPAs in 2015 found that management effectiveness and ecological coherence remained to be assessed, and that MPA designation,

management and monitoring could all benefit from more integrated approaches (Rodríguez-Rodríguez, et al., 2015). Addressing scale challenges in relation to MPA networks has been argued to reduce the scope for self-governance, as each MPA needs to be considered in a wider national or international context (Jones, 2014). This means that understanding of UK marine governance, particularly of the relative importance of state and stakeholder steer, is even more important.

MPAG framework

With governance, including that of MPAs, subject to steer from three different sources, analysis of governance frameworks requires a structure that can adequately incorporate complexity and compare effectiveness across a broad range of case studies. The Marine Protected Area Governance (MPAG) framework (Jones, 2014) allows empirical analysis rather than theoretical discussion, allowing each case study to be considered against its own context and governance challenges. The framework was developed with the support of UNEP, and utilised 20 MPA case studies to deconstruct the complexities of governance by focusing on key concepts, such as governance objectives, effectiveness and the main incentives used to steer human behaviour (Jones, et al., 2011). It has since been used as an overarching metadata analysis, allowing comparison of a wide range of MPA case studies without constraint by any particular theoretical perspective (Jones, et al., 2013). This aids understanding of status and trends of MPAs at a global level, which is essential for increased effectiveness of conservation, but challenging due to the variability between countries (Dearden, et al., 2005). Initial reviews of the framework found that, analogous to ecosystems, diversity of incentives and linkages between them builds resilience of governance systems.

The MPAG framework in this way can allow progression from debates about governance approaches to the development of effective frameworks for UK marine conservation. The MPAG framework is particularly relevant in the case of Lyme Bay as a way of analysing the relative inputs of top-down and bottom-up governance, without any predetermined structure. Despite extensive literature on the area, Lyme Bay has not been analysed through the MPAG framework and can provide an important case study due to NGO involvement and voluntary agreements, against a backdrop of top-down control and stakeholder conflict.

Methodology

In order to analyse the governance of Lyme Bay MPA, a field study was conducted. Qualitative primary research predominantly consisted of semi-structured interviews, with document analysis and participative observation used to allow data triangulation. Interviews were conducted at multiple locations in the Lyme Bay area, over the phone and in London. The MPAG framework provided headings for data coding, and allowed identification of key themes for discussion.

Qualitative primary research

The primary method of qualitative research was through semi-structured interviews, in order to provide the level of detail and privileged information required (Descombe, 2003). The semi-structure method also allowed for flexibility when interviewing a wide range of stakeholders, in order to provide a 'sensitive and people oriented' approach to obtain the range of perspectives required for a rounded governance analysis (Valentine, 2013). Interviews further allowed verification of the validity of data at source (Descombe, 2003).

A total of 25 interviews were conducted, in order to adequately represent key interest groups and to be line with previous research at the site (Fleming & Jones, 2012). A time frame of three weeks was allocated to conduct interviews. Twenty face-to-face interviews were conducted during two weeks of fieldwork in Lyme Bay (Figure 3), and four phone interviews and one face-to-face interview were conducted during one week of fieldwork in London. Field work was aligned with the Lyme Bay Fisheries & Conservation Reserve Working Group (hereafter referred to as 'the working group') meeting which provided an opportunity for participative observation and interviewee recruitment.

Interviewees were selected through purposeful sampling to ensure a breadth of perspectives (Box 1). Initial interview contacts were identified through document analysis as key participants in the MPA, and contacted prior to fieldwork by email to arrange an interview. A research outline document was also circulated to provide details of the study and contact information, both to further allow informed consent of interviewees and transparency of the research, and to contribute to snowballing of interview contacts (Appendix 1). Thirteen interviews were arranged prior to commencement of fieldwork, and snowball sampling and use of gatekeepers was used to further identify the remaining twelve interviewees, with selection subject to the same scrutiny as purposive sampling (Descombe, 2003; Valentine, 2013).

[Figure 3: Removed]

[Box 1: Removed]

Interviews were loosely structured around an interview semi-structure outline (Box 2), which acted as a checklist for topics to be covered. Following the introduction, topics were not necessarily covered in order, allowing the interview to flow and conversation to become more natural. This allowed interviewees to raise their own perspectives, introducing new topics, and allowing a further depth of information to be gained (Valentine, 2013). A mixture of open and closed questions were used to probe topics and clarify points. Efforts were made to hold the interviews face-to-face where possible to allow data to be more detailed and rich (Descombe, 2003). Interviews ranged from 20 minutes to 80 minutes, with interviews recorded. All interviews were one-on-one with the exception of two impromptu joint interviews with members of the same stakeholder group. In addition, the British Sociological Association's Statement of Ethical Practice was consulted for ethical guidelines (British Sociological Association, 2002).

First impressions of the interview were recorded at the first available opportunity after interview. An interview report was sent to each interviewee for confirmation that their views had been captured correctly as in Jones (2008). The interview schedule and interview 'success' were regularly assessed and amendments to technique made for remaining

interviews (Arksey & Knight, 1999). It became clear that covering all sub-topics was over-ambitious in the interview time frame, so they were used as suggested topics rather than checklist items. Funding and leadership were added after observation of the working group meeting. The EU referendum result was announced towards the end of fieldwork, therefore was raised by a number of interviewees when considering future prospects for the MPA, but was not included as a new subtopic in the interview semi-structure due to the uncertainties involved and the changing circumstances mid-way through research.

Box 2: Semi-structure interview outline

Additional materials: Copy of Lyme Bay area map, timeline, research leaflet

- **Introduction**
  Description of project (leaflet, assurance of confidentiality, semi-structure concept, permission to record interview)

- **Tell me from your perspective the story of the Lyme Bay MPA**
  Suggested topics: History of the MPA, from 2008 closure to current day, and future thoughts

- **Governance approach**
  Suggested topics: Leadership (individuals and organisations), legislation, policies and objectives

- **Role of NGOs**
  Suggested topics: The role of NGOs in MPA designation and management

- **Effectiveness of the MPA**
  Suggested topics: Enforcement, management, monitoring, clarity of objectives

- **Further benefits of the MPA**
  (To extent not already covered) Success stories, education, research, sales of Reserve seafood

- **Further challenges impacting conservation**
  (To extent not already covered) Equity, displacement, compliance, incentives needed

- **Future prospects for the MPA**
  Suggested topics: Final chapters, no-take zones, NGO role, strength of MPA in face of future challenges (e.g. economic), use as a blueprint for UK marine conservation, *funding and leadership*

- **Final points**
  Any other points to cover, advice for further interview contacts, contact details for sending interview report

Document analysis

Initial document analysis was conducted prior to the field study through online searches, to identify key contacts, develop interview themes, and identify context data for the MPAG framework. In particular, primary documentation helped to identify opportunities for participative observation and early indications of the governance framework. In addition, documentation was voluntarily provided by some interviewees during the field study. Documents included committee meeting minutes, scientific and project reports, unpublished scientific research, legislative documentation and news articles. Documents were not formally coded and instead were used to corroborate findings and provide further detail, and were considered in light of the positioning of the author (Descombe, 2003).

Participant and nonparticipant observation

Both participant and nonparticipant observation increased the depth of insight of the research (Descombe, 2003). The combination of methods of interviews, document analysis and observation allowed for triangulation of the data, enhancing validity by ensuring consistency of results across methods (Arksey & Knight, 1999). Data was again not formally coded, and was used to verify themes and observations (Descombe, 2003). Participant observation occurred through unplanned conversations and observations, and was recorded through field notes (Cook, 2013). Nonparticipant observation involved observation of the June 2016 working group meeting, and fieldwork was aligned to start on the same day. This allowed the meeting to provide contacts and face-to-face introductions, as well as observing the actions of the working group.

Data analysis

Interviews were transcribed into reports, with headings reflecting semi-structure interview topics and MPAG headings (Appendix 3). Full interview transcripts were not created in order to focus on the relevant data for the MPAG analysis (Crang, 2013). Interview reports were returned to the interviewee to verify content, with a three week ‘no-reply’ period whereby it was assumed that the report was accurate.

Box 3: Outline of the MPAG empirical framework (Jones, 2014). Italics denote categories added during data coding.

- Context, including metrics:
  - Name of MPA
  - Area of MPA
  - Coastline length (where applicable)
  - Per capita Gross Domestic Product (GDP)
  - GDP growth rate
  - Main economic sectors (relative employment and GDP contributions)
  - Unemployment rate
  - State capacity
  - Human Development Index
  - Population below the poverty line
- Objectives of the MPA
- Divers and conflicts
- Governance framework/approach
- Effectiveness
- Incentives employed and needed:
  - Economic
  - Interpretative
  - Knowledge
  - Legal
  - Participative
- How the incentives are combined, relative importance etc.
- Cross cutting themes:
  - Role of leadership
  - Role of non-governmental organisations
  - Equity issues
  - *Role of science*
  - *Voluntary agreement*

Interview reports were grouped into sections depending on content during production (Descombe, 2003). 'Open coding' was then used to note relevant MPAG headings alongside the data, line by line (Box 3) (Crang, 2013). Subsequent reviews of the data allowed further identification of themes and connections, and refinement of analysis (Descombe, 2003; Crang, 2013). The MPAG framework provided a structure for analysis, whilst providing scope for further headings to be added if new themes were identified. Computer programs were not used to avoid errors in interpretation and to allow natural themes to arise during

transcription and analysis (Crang, 2013). Quantitative analyses were not used as the information gained was qualitative rather than representing ‘data’ (Jones, 2008).

Method limitations

During the process of interviewee selection it was warned that a high level of previous study in the area may have created interview fatigue. This was not directly observed, but may have influenced the qualitative data collected. Personal identity of the interviewer may have further impacted the information revealed (Descombe, 2003). Qualitative data is also inherently situational and conditional, and based on a ‘conversation with a purpose’ between the interviewer and interviewee, reducing replicability (Valentine, 2013). Furthermore, although efforts were taken to adopt a neutral stance, analysis can be impacted by personal experience and opinion. An effort was therefore made to interview a wide range of stakeholders with differing viewpoints to develop a well-rounded analysis.

A large volume of information was collected via semi-structured interview, creating difficulties for analysis and meaning that all possible themes relating to governance could not be explored within the time frame (Crang, 2013). The MPAG framework therefore provided a useful tool for the distillation and organisation of themes and ideas. However, some judgement was required on the meaning and significance of data, such as the scientific validity of some of the claims made in interviews (Arksey & Knight, 1999). The number of interviews was therefore limited to 25 despite many further interviewees being available, to allow analysis of adequate detail in the time set aside.

Results and Discussion

Context

Lyme Bay is situated in the English Channel in South West England, sharing its coast between Devon and Dorset. The MPA consists of two overlapping designations; 60nm^2 was designated under the 2008 SI banning bottom-towed gear, and a wider area of 80nm^2 was proposed as part of the 90nm^2 Lyme Bay and Torbay cSAC in 2010 (now a Site of Community Importance (SCI)) (Natural England, 2012). The area analysed by this report will be the combination of the SI closure and the Lyme Bay portion of the Lyme Bay and Torbay SCI, referred to hereafter as the Lyme Bay MPA (Figure 4). The coastline length for the MPA is 40km, starting to the west of Beer and ending off the coast of Abbotsbury. There are a number of adjacent designations to the east of the MPA, including the Chesil and the Fleet SAC, proposed in 1996, and Chesil Beach and Stennis Ledges MCZ, designated in 2013 (Natural England, 2013).

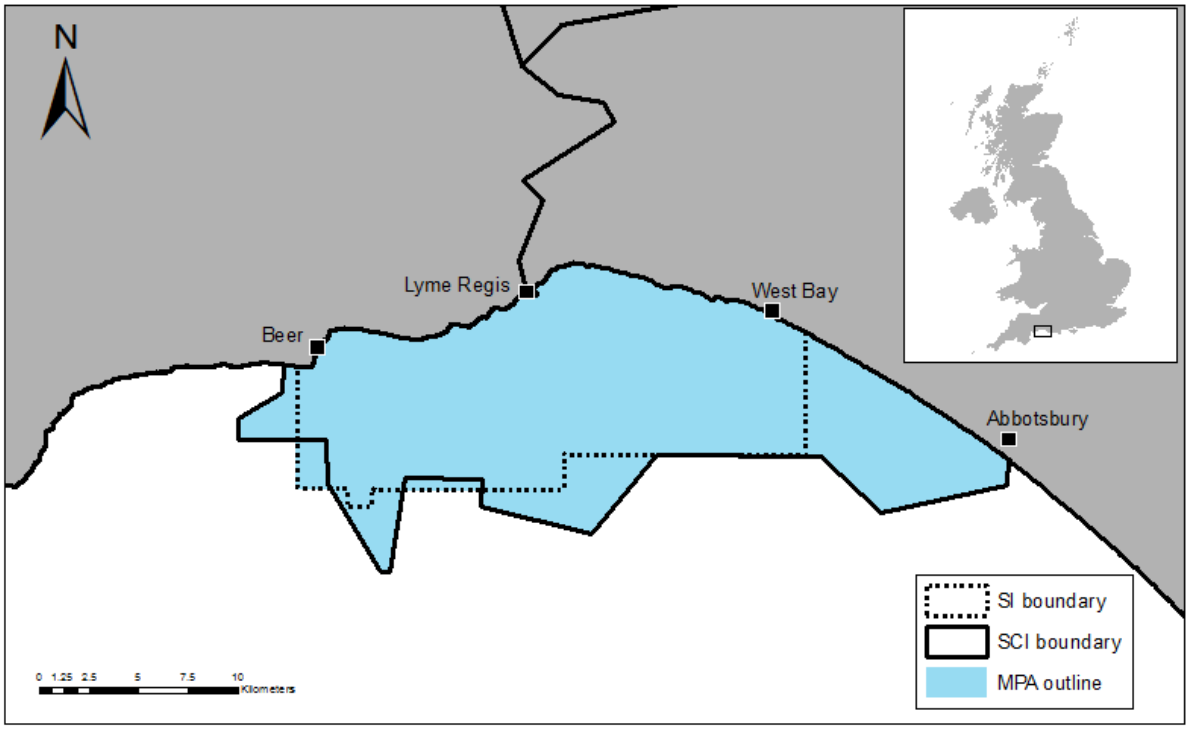

Figure 4: Designations at Lyme Bay comprising the Lyme Bay MPA studied within this report

Devon and Dorset are viewed as traditional English holiday destinations. The Jurassic Coast is one of the most popular tourist destinations in Britain, forming part of the East Devon and

Dorset Areas of Outstanding Natural Beauty (Dorset AONB, 2016) and designated as a World Heritage Site due to its geological and geomorphological features (UNESCO, 2016). The tourist economy is an important income generator in the South West, with visitors associating the area with 'superb beaches and water based activities', indicating the importance of the marine environment (Visit Dorset, 2016). Dorset alone experienced 25.5m day visitors in 2014, generating a total business turnover of £2.5bn, and 13% of all employment (Visit Dorset, 2016), contributing to the South West's low unemployment rate of 4% (UK average 4.9%) (ONS, 2016). In addition, there are a number of coastal fishing towns adjacent to Lyme Bay, and fishing is an important employer, contributing 12% of South West GVA (ONS, 2010). Sea angling clubs and dive charters also contribute significantly to these local economies (Fleming & Jones, 2012).

Box 4: UK Economic Statistics

- GDP per capita: $43,737 in 2015 (£28,614 at 2015 average exchange rate)
- GDP growth rate: 2.85% in 2014
- Unemployment rate: 4.9%
- UK main employment sectors: Wholesale and retail trade, health and social work, and real estate, renting and business activities (also main employment sectors for the South West)
- State capacity: 1.47 (calculation in Appendix 5)
- Human Development Index: 0.907 (14th in the world)
- Population below the poverty line: 15.9%, high in comparison to other EU countries

Sources: ONS (2010; 2015; 2016); The World Bank (2015; 2016); UNDP (2015)

Objectives

Statutory Instrument

The objective of the SI designated in 2008 was to 'prohibit the use of certain damaging fishing practices that have a negative impact on important biodiversity in Lyme Bay' (Defra, 2008). These fishing practices consisted of the use of mobile gear, in particular scallop dredging, which was breaking up the fragile reef habitat and removing sessile fauna (Sheehan, et al., 2013). A history of voluntary agreements between fishermen, environmental groups and regulators broke down after reports of infringements by incoming users who were not party to the agreements (E2; U1; U2). Following an application by Natural England for a Ministerial Stop Order, Defra initiated a full consultation process, with the majority of public responses choosing the option of full closure of the area (Hattam, et al., 2014). This resulted in the closure of 60nm^2 of Lyme Bay to bottom-towed fishing gear, preventing dredging for shellfish and demersal trawling (Hattam, et al., 2014), with the objective of protecting benthic biodiversity by ensuring maintenance of the reef structure and aiding recovery following the damage by bottom-towed fishing gear (Attrill, et al., 2011; Rees, et al., 2013). Although the statutory closure pre-dates the UK Marine and Coastal Access Act 2009, the decision reflects the awareness of the bill's content and change in direction for marine conservation (Fleming & Jones, 2012). The closure therefore represented a significant attempt by the government to implement an MPA to protect marine life (Mangi, et al., 2011), and resulted in the exclusion of mobile gear from a large area encompassing both reef features and interstitial areas (E1; S1).

Site of Community Importance

The Lyme Bay section of the Lyme Bay and Torbay SCI qualifies for the Annex 1 features of reefs, which are of national and international conservation importance due to the presence of species such as pink sea fans (*Eunicella verrucosa*) and the sunset cup coral (*Leptopsammia pruvoti*). Both species are listed for conservation under the Wildlife and Countryside Act, the UK Biodiversity Action Plan, and the IUCN Red List (Mangi, et al., 2011). The site has the legal conservation binding of an SAC, requiring protection of the reef features under which it was proposed, and is only awaiting designation as an SAC by the UK government (R5; JNCC, 2016). The designated reef features cover 14kha (approximately 40nm^2) of the total 90nm^2 Lyme Bay and Torbay SAC (Natural England, 2012). The area was proposed as an SAC due to the presence of extended Annex 1 reef habitat lying outside of the boundary site

of the SI, and therefore requiring protection (Figure 5) (Rees, et al., 2013). Reefs are very variable in the structure and communities they support; the reefs in Lyme Bay are defined under Annex 1 as 'habitats where animal and plant communities develop on rock or stable boulders and cobbles' (Rees, et al., 2013). The site is indicative of offshore reef, and has been identified as a marine biodiversity 'hot spot', possessing particularly high species richness (JNCC, 2016).

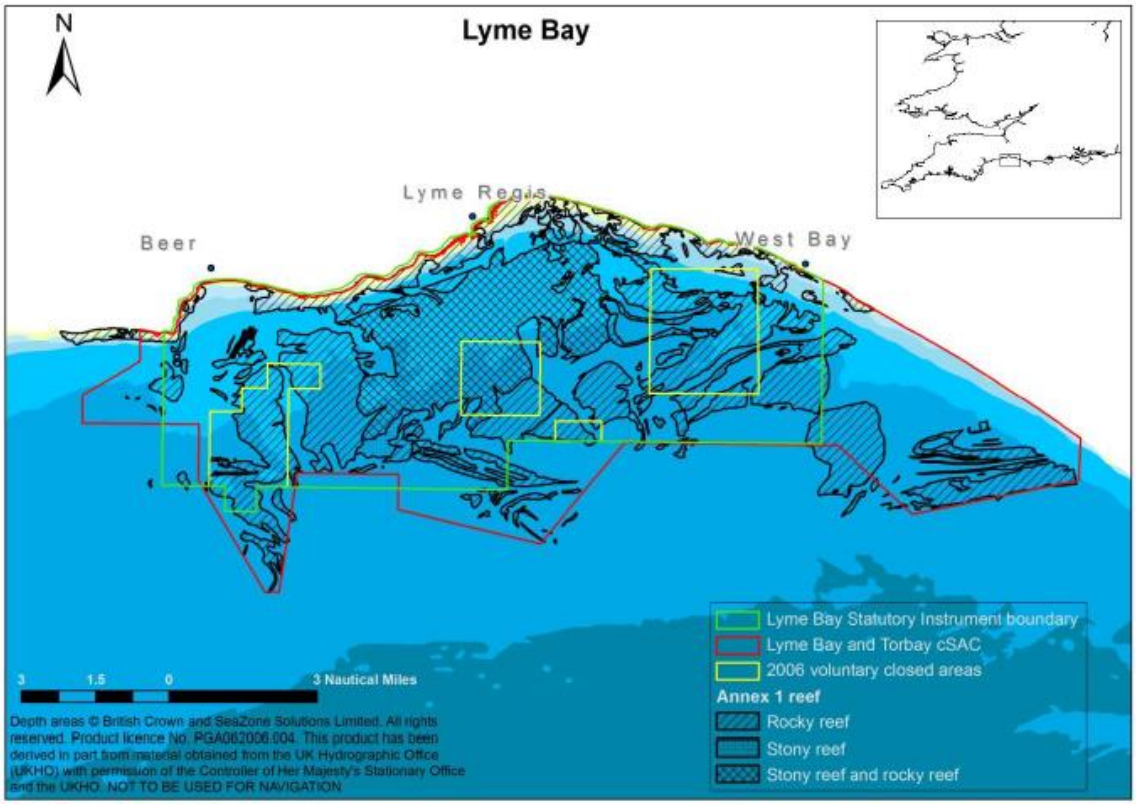

Figure 5: Lyme Bay reef areas, shown with the 2006 voluntary closures, SI closure, and the cSAC (now SCI) designations. Source: Attrill, et al. (2011)

Lyme Bay Fisheries & Conservation Reserve Working Group

Objectives have also been set by the working group, reflecting the group's aim for the site to be managed as a multi-use marine reserve that will benefit fishermen and conservationists alike (Lyme Bay Reserve, 2016). These objectives support wider protection of habitats and communities, socio-economic benefits and best possible fishery management practices. It should be noted that although through this working group the site has been termed the Lyme

Bay Fisheries & Conservation Reserve, this does not reflect a no-take marine reserve (as the term is often used in the literature) as fishing activity still takes place within the area.

The group has agreed to support and promote the following principles:

1. *The socio-economic and cultural importance of the fisheries within the area should be acknowledged and be central to fishery and conservation management which will aim to maximise the socio-economic benefit to local communities and secure their long term sustainability.*
2. *Protected habitats and species will be afforded appropriate protection from disturbance and damage. We recognise that a diverse and healthy marine environment is of paramount importance and that the habitats and communities within the Lyme Bay Fisheries & Conservation Reserve, including the SAC, should be managed to secure their long-term protection.*
3. *Best possible fishery management practices will be developed, promoted and adopted to secure the long-term viability of target species populations.* (Lyme Bay Reserve, 2016)

Drivers and conflicts

Fisheries activities permitted within the Lyme Bay MPA include the use of static gear such as potting and netting, scallop diving, and use of mobile gear (restricted areas only) (Appendix 4). The balance of these activities has the potential to heavily impact achievement of conservation objectives and can be influenced by external drivers (P2; U6; U7; U9). Climate change and natural impacts will play an increasing role in the future, requiring a resilient MPA and adaptive management.

Global seafood demand

Landings have historically varied at Lyme Bay due to complex interactions between market drivers, fishing quota and legislation. Market changes have heavily impacted trends in fishing activity, with similar changes often seen across the country. The increase in market price of the commercially valuable scallop (*Pecten maximum*), coupled with quota pressures on other stocks, caused the consistent increases in dredging activity that prompted the initial closure (E2; E4; U5; U6; U7; Appleby, 2007). The previous economic importance of the scallop market to Lyme is illustrated by reports of c. £3.5m being taken from an area of under 4nm^2 in 2007 (U7). Impacts of the MPA on scallop prices are difficult to discern, although it appears that any increases in price are due to fuel price increases rather than a decrease in dredging effort following the closure (S2). There have been a number of new entrants to scallop diving, suggested to be due to beneficial conditions as a result of the closure, although the exact causes are difficult to identify (U3). As a reef-associated species, scallops have recovered within the MPA since the closure (Sheehan, et al., 2013), and this has contributed to observations of increased catch and quality of hand-dived scallops (U3; U5).

Changes in markets for the common whelk (*Buccinum undatum*) have also driven patterns of activity. Increases in exports to the Far East in the past 15-20 years, linked to high prices (Association of IFCA, 2013) have added pressure to the Lyme Bay fishery. Both mobile and static fishermen have moved over to whelks (S1), with whelks fished predominantly at the western edge of the MPA both by local boats and larger vessels from ports such as Brixham (U6). The increased safety of static gear inside the closed area has contributed to the increase (E4; U2; U3), but even outside of the area, the low cost of whelk gear and bait has allowed significant increases in effort despite gear conflict (U2). Although the majority of the whelk effort occurs outside of the MPA (S1; U3; U4; U6; U8), activity is reported to be up to

thousands of pots (U4; U8), damaging the area subject to such high activity (U8), and contributing to a decrease in landings replicated around the coast (S2; Association of IFCA, 2013). Suggested forthcoming legislation to deal with the issue includes a size of sexual maturity limit, and closed seasons or pot limits (S1; U4).

Changes in technology of fishing techniques were also identified as historic and future impactors on ability to meet conservation objectives, with technological creep allowing increased effort and catch, and undermining MPA effectiveness (R3; U3; U7; Jones, 2014). Quota reductions and revocation of licenses also remain a problem, reducing the diversity of fishing and increasing pressure on non-quota stocks (E2; R4). Monitoring data and recent socio-economic research at the site will aid understanding of trends in response to changing global seafood demand.

Natural impacts

Natural impacts from weather and climate change will increasingly impact conservation objectives, although were less prominent during the research than the impacts of seafood demand. Storms in the winter of 2013/2014 caused reef damage that was picked up by reef monitoring programmes (U4; U7), as well as loss of gear (U3). Storms can further impact management via perception of the level of damage being comparable to use of bottom-towed gear (U1; U7). Increases in biodiversity will increase resilience to future impacts such as climate change (Sheehan, et al., 2013), and future monitoring to differentiate between anthropogenic and natural disturbance is key at Lyme Bay (R3), as at other MPAs.

Governance framework

The Lyme Bay MPA can be categorised as 'government-led' according to the MPAG framework, as it is 'governed primarily by the state under a clear legal framework' (Jones, 2014). This aligns with three other UK MPAs studied under the MPAG framework; the Wash, North East Kent European Marine Site and the Darwin Mounds (Jones, et al., 2011; De Santo, 2013; Roberts & Jones, 2013). In addition to this top-down structure, the role of the Blue Marine Foundation (BLUE) provides a mechanism for local community input under NGO steer.

State governance

State governance at Lyme Bay consists of both the statutory instrument implemented by Defra, and management of inshore fisheries activities by the two local IFCAs (Devon & Severn, and Southern). The IFCAs ultimately report to Defra, with conservation advice provided by Natural England, and MMO guidance and support with overlapping activities such as enforcement (R3; R4; R5). With both the IFCAs and the MMO set up in 2011, their roles have developed alongside changes in governance at Lyme Bay (R1).

Decentralisation allows IFCA judgement on how best to achieve the Habitats Directive Article 6 objectives (R1; Rodwell, et al., 2014). The SAC objectives require a feature-led approach to conservation, which the IFCAs implement via the control of fishing activity through traditional byelaws and permitting byelaws (with regulatory notices recently stopped due to legal concerns) (R3). This allows for a more locally tailored site management, with varied regulations across the MPA (R3), in contrast to the Defra-announced SI, which created a general ban on mobile gear in order to achieve the objectives that have since been formalised through the SCI designation (R1). This local management interacts with the retention of some powers by Defra, such as control over quota (E2; R4).

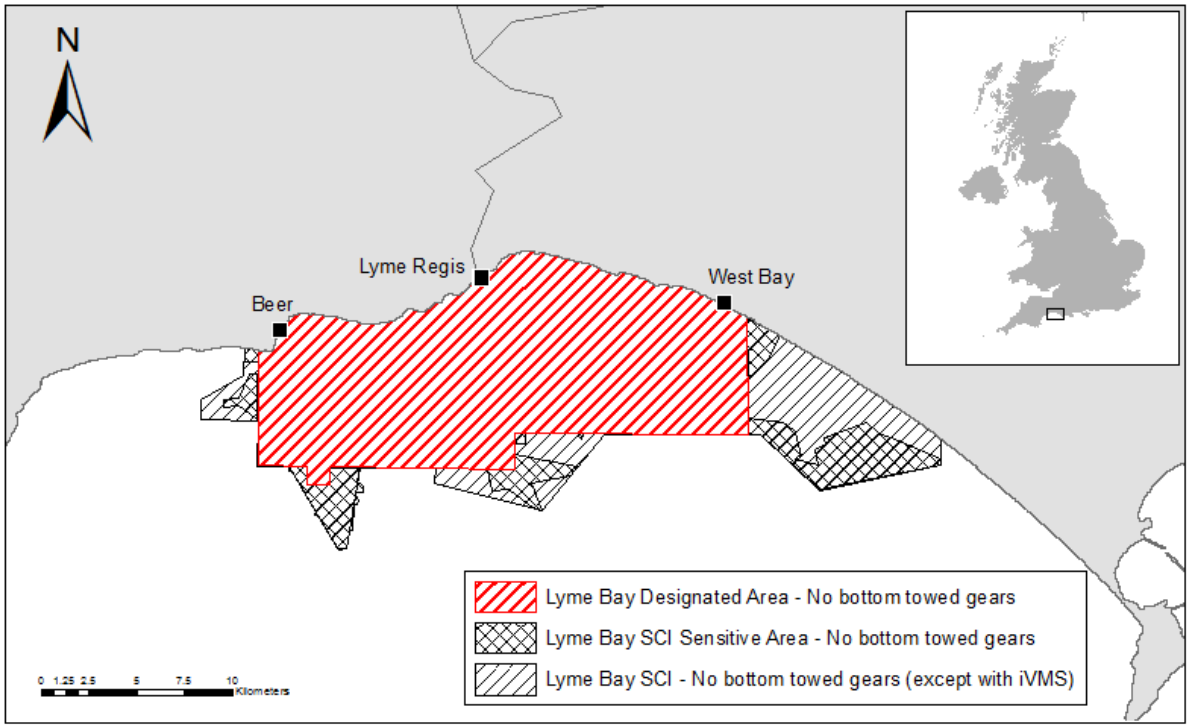

Figure 6: Lyme Bay prohibited fishing areas

The IFCA boundary occurs at the Dorset-Devon boundary, and each half of the MPA is subject to different byelaws and permitting byelaws to achieve the same conservation aims. Implementation of byelaws incorporates a consultation process with affected users (R3; R6), and may also incorporate aspects from discussions at the working group. Key byelaws include the 2014 dredging byelaws that protect the reef habitat by preventing the use of bottom-towed gear in sensitive areas of the MPA, consisting of reef areas and buffer zones (Figure 6). Mobile gear is technically allowed in the remaining small corridors of the SCI, but only with a working satellite-based inshore Vessel Monitoring System (iVMS) (R3; R4). There are currently no legislative restrictions on commercial static gear effort (R3; U3).

At the time of research, consultations were in progress with a view to removing the SI at Lyme Bay, and therefore the general ban on mobile gear (R6; S1; S2). It is currently unclear exactly how this would impact the pattern of prohibited fishing areas, although it would increase reliance on the IFCA byelaw framework for achievement of the SAC objectives, and increase pressure to re-open the site to mobile gear around the reefs (R6). The removal of the SI may reflect the increased state emphasis on stakeholder partnerships for management of

MPAs, and a reduced enthusiasm for the governance structure at Lyme Bay as a 'flagship' site for marine conservation.

Working group

The project of the Blue Marine Foundation at Lyme Bay commenced in 2011 in response to concerns around lack of management post-SI and an 'explosion' in static gear following the closure (E2; U7; Lyme Bay Reserve, 2016). The resultant working group consists of BLUE, fishermen, other MPA users, scientists, IFCAs, MMO, Natural England, private sector companies and any further interested stakeholders. Funding and/or advice is provided from a number of further organisations such as Cefas, Seafish, and the European Maritime and Fisheries Fund (EMFF) (E6). The working group meets every 3 months (previously every 6 weeks) and provides an opportunity for relevant regulators, fishermen and wider stakeholders to discuss management issues of the Lyme Bay MPA, with BLUE as an independent chair (E5; E6; R4). The fishermen in the group are predominantly local static inshore boats and scallop divers, with no involvement of purely mobile fishermen or incoming users, despite attempts to engage these stakeholders (E2; E3; R6).

Under BLUE guidance, the working group has instigated a number of initiatives, including introduction of a Lyme Bay Reserve Seafood brand, installation of chiller units and ice machines into two of the local ports, installation of iVMS to local boats, a schools outreach programme and other awareness raising, and facilitation of a number of scientific studies. Voluntary codes of conduct have been developed for fishermen and anglers, along with a memorandum of understanding signed by wider working group members (U3; U8; U9). The voluntary agreement for fishermen has been signed by 41 boats from the four local ports, and provides a voluntary limit for static fishing effort (Appendix 6) (E2; E6; U3). Although the group is not a direct platform for legislative management, it allows user participation and stakeholder discussion, which may be incorporated into IFCA byelaws or other regulation (R4). At the time of research, the group was in the progress of developing a consultative committee of a narrower subset of members, responsible for providing future steer as the involvement of the Blue Marine Foundation draws to a close.

Incentives

Economic

The Lyme Bay MPA has benefitted from a wide range of NGO, private sector and state funding, both provided directly and facilitated through the BLUE project, ranging from Defra funding for scientific studies, to EMFF funding, to financial and advisory support from the Marks & Spencer Plan A project (E2; E3; E5; P1; P2; R4). This has facilitated an intensive project with regular meetings and substantial investment in infrastructure and research. However, with BLUE's involvement reducing, it is clear that the same level of resource cannot be delivered by already stretched regulators such as IFCAs (R1; R2; R3; R5; R6; U5; Rodwell, et al., 2014). iVMS data sales have been suggested as a mechanism for self-support of working group meetings, although certainty of funding is far from clear (E5; E6; R4; U9). Additional funding restrictions on Natural England and the MMO combined with increased country-wide MPA designation will put further pressure on management, monitoring and enforcement (R4; R5; U9; De Santo, 2013).

The Lyme Bay Reserve Seafood brand is sold to a London-based supplier, and collected 3 times a week from the Lyme Bay ports (U8). Changes in profit for fishermen as a result of using this route to market range from a 25-30% increase to a negligible change, with the main advantage for many being the consistent prices in comparison to other market routes rather than any significant increase in prices (U3; U7; U6; U8). The sale route is only available to those signed up to the voluntary code of conduct and using iVMS, with assurance of ethics further provided by the Responsible Fishing Scheme (RFS) (Lyme Bay Reserve, 2016). Produce must be stored in the working group-provided chillers and ice machines at Axmouth and Beer ports, which allow provision of a higher quality product (U1; U3; U7). Similar infrastructure is in the pipeline for West Bay and Lyme Regis, with delays due to planning issues (U8; E2; E3). However, fishermen may not pursue RFS accreditation without BLUE funding due to costs, and some concern that RFS might represent 'greenwashing' as scallop dredgers are allowed to sign up (U3). The Reserve Seafood brand is divisive with strong support by those whose profits have increased, but lack of interest by those who prefer to maintain their own sales routes (U3; U4; U5; U6; U7), and administrative burden and scalability questioned in terms of the route providing a widespread incentive (U6; P2). No fishermen interviewed suggested that they were 'catching less for more' as a result of the scheme; the focus instead was on profits, and not catch reductions. Instead, the scheme may

encourage buy-in to the working group, thereby facilitating other incentives such as participation.

Interpretative

The working group operates numerous awareness-raising initiatives, including education of local primary school children through a schools outreach programme (U6; U9; R4; E5; E6). Members of the working group lead interactive sessions whereby the concepts of sustainable fishing are communicated to the children, with 30 school visits reaching c. 1,900 children as of July 2016 (E5; E6; U7). An interactive exhibit at the local Seaton Jurassic Centre communicates the work of the Lyme Bay Working Group, detailing the voluntary codes, the concept of minimum catch sizes, and the Responsible Fishing Scheme (Appendix 7). This centre will further act as an education hub for the delivery of half-day sessions for primary school children, communicating the Lyme Bay sustainability concepts and utilising local sites such as the Axmouth harbour (E6). The voluntary angling code has been widely publicised through distribution to sites such as local tackle shops or harbour offices, with copies of the codes and branded stickers used to raise awareness. The working group has also instigated considerable media coverage, through both local and national outlets, complemented by a website and social media presence (E1; E6; U9). These public awareness initiatives help instil a sense of pride in sustainable fishing for local static boats (U3; U8), and may impact any public consultation on lifting of the SI.

IFCA regulations are communicated directly to affected users, and the working group allows a forum for questions and real-time debates between regulators and the group members (R3; R4; R5). This process allows understanding of the purpose of the MPA for fishermen, but is limited to the local inshore, static fishermen that are members of the group (E6; R2). The backdrop of the national drive for MCZ designation has raised the awareness at Lyme Bay throughout the fishing community (R4), and local seafood suppliers also utilise working relationships to relay information between fishermen and the working group (P1). Knowledge of the regulations at Lyme Bay by local users is high, and awareness has dramatically increased reports of infringements to regulators, by fishermen, other users, and members of the public (E2; R4; U6; U9). However, some comment on the degree of complexity of the MPA network, consisting locally of the SI, multiple SACs and MCZs and the Lyme Bay Reserve, with varying terminologies, objectives and regulations (R4; U5).

Knowledge

The original closure decision at Lyme Bay used information collected in partnership with mobile fishermen who were subsequently displaced from the area, raising tensions between NGOs and fishermen (Fleming & Jones, 2012), feelings that are still present (U1; U2; U4). Opportunities for collective learning at the site have greatly improved as the working group allows discussion between scientists, regulators and fishermen, and wider attendees such as the private sector (P1; P2; R4; U7). A PhD study investigating the impact of potting activity in conjunction with BLUE and Plymouth University Marine Institute is referenced as a mechanism by which the static fishermen can be empowered through independent proof that their levels of fishing are sustainable (E2; U7). Fishermen therefore aid the research through use of their vessels for surveys and have voluntarily closed four ½km^2 areas as control sites (E5; U7). However, concern was expressed that future change to the fishing activity allowed within the MPA, such as re-opening to mobile gear, might negate the value of research conducted and 'waste' the time and effort put in (U7). Emphasis by regulators is placed on adaptive management through collective learning, such as the use of the potting study to inform static gear regulation (R2; R3; R5; S1). However, opportunities for collective learning may be impacted by a perceived lack of participation by some regulators in the working group, reducing incentive of fishermen to discuss useful regulation (U7; E5). Nonetheless, at a site with a historic breakdown of social capital through tension and conflict (Hattam, et al., 2014), collective learning has moved in a hugely positive direction (E4; U3; U7; U9).

Numerous scientific studies have greatly increased understanding of the MPA, providing an ecological baseline for future monitoring and adaptive management, and increasing views of legitimacy in the regulatory process (R1; S1). The presence of independent scientific research, including that into socio-economic benefits, is seen by the fishermen as a key benefit of the working group and important for raising awareness amongst the wider fishing community of the benefits of the MPA (U3; U7). However, recovery of the reef is disputed by some, and additional studies are being conducted to be used as evidence for lifting of the SI (U1; U5). Both IFCA and fishermen both expressed a wish for clear consistent conservation advice, particularly with respect to the relative importance of interstitial areas in relation to the protection of reefs by SAC objectives (R3; R6; U1; U3; U7). To this end,

IFCA may submit applications for the re-entry of mobile gear to interstitial areas in order to formally clarify steer from Natural England.

Legal

State governance is predominantly steered through obligations under the EC Habitats Directive, with control over byelaws decentralised to IFCA fisheries management. This mechanism allows an adaptive partnership arrangement specific to the area, with adaptive management a key focus of regulation (E5; R3; R5; S2; U7). However, the SI and IFCA 2014 byelaws provide the primary mechanism for protection of biodiversity by banning mobile gear (E5), and the removal of the SI would increase reliance on byelaws for protection of the site. Control of quota is retained by Defra, and has caused problems by reducing diversity of fishing activity for the small inshore boats (R4).

Infringements have decreased dramatically since the initial closure, in large part due to participative incentives such as peer regulation, and now consist of sporadic breaking of the mobile gear regulations by incoming users of the MPA from larger ports such as Brixham (R1; R2: U3; U4; U5; U7; U8). Enforcement by the IFCAs in conjunction with the MMO has resulted in arrests and prosecutions, with the joint IFCA and MMO prosecution and fining of a visiting boat in 2015 providing a deterrent to other boats (R1; R2; U6; U7; U8; U9). However, prosecutions remain a challenge (R4; U9; Jones, 2012), and MMO/IFCA distance from the MPA, coupled with pressure on resources, means illegal boats may be gone by the time the site is reached (U9). Small coves are difficult to monitor (R4) and discovery of infringements by movement of static gear is only retrospective. However, cross-working between IFCAs and MMO, and additional input by the Navy and Border Force, has allowed a relatively strong presence at Lyme Bay, coupled with strong peer enforcement (R4). Increased IFCA/MMO resource to maintain policing levels and allow even more effective enforcement was noted by many as a possible improvement to the MPA (E5; R1; R2; U3; U5), and a recent MMO recruitment drive will allow more frequent spot checks, increasing frequency to every 2-3 weeks instead of every few months.

Tough penalties are particularly important for visiting boats which are less able to access the local or working group incentives (U1; U2; Jones, 2014). Past prosecutions and fines have dissuaded chance rule-breaking by boats in transit (R4; U7; U8). A management plan for the

site is being developed which will aid cross-jurisdictional coordination, but emphasis on regulation mechanisms still differs between the two organisations, with different focuses on traditional byelaws and permitting byelaws (E2; E5; R3). With clear and consistent legal definitions needed at the site (Fleming & Jones, 2012), it is key that the two bodies agree a consistent coherent direction for conservation, with clear steer from Natural England (E2; E3; E5; R3; R6; U7).

Recent iVMS trials have had mixed success (E2; R3; R4), but working units allow greater clarity and transparency over the locations of boats, and are seen as a key factor for future regulation, particularly if the site were to be re-opened to mobile gear (R4; R6; U1; U5). Data from the units informs statutory management by the IFCAs, and Automatic Identification Systems (AIS) are further required by boats over 10m (E1; R4). Management has historically been hampered by a lack of previous data for inshore vessels, meaning that future monitoring will be hard to compare to previous activity (R5). iVMS will additionally allow targeting of boats of interest rather than relying on spot checks, and mobile apps allow the technology to be accessed by a range of users (R4; R6; U9). However, there are also difficulties with the monitoring of unregistered boats that are outside regulation, who may be illegally selling catch (E5; R4).

Participative

Against the backdrop of stakeholder tension, social capital has greatly increased and has been hugely beneficial for the site. Creating relationships between stakeholder groups has been key to increased compliance, peer enforcement and collective learning. However, these benefits are predominantly limited to local static gear fishermen. Mobile fishermen see little incentive to attend working group meetings for an area they have been displaced from, and incoming users are difficult to reach through such a format (R6; U2). The removal of key conflict at the site through the banning of mobile gear has eased the process of engagement of the remainder of the fishing industry (R3; U1; U2), and now many members describe the group as a rare and excellent example of discussion across vertical and horizontal networks (E2; R2; R4; R5; U7; U9). Voluntary agreements benefit from co-management and adaptive processes through yearly review at the working group (U7), but overall user input is on the lower end of the scale visualised by Jones (2014), with IFCAs ultimately in charge of legislative regulation. However, with incoming boats not party to voluntary agreements, whelk boats continue to

fish far beyond the suggested levels at the western edge of the MPA (R3; U4; U8). A cap of static gear effort was set out in the voluntary agreement signed by 41 boats (Appendix 6), however, this cap was set at the top end or above the levels that that boats were fishing, meaning that the agreement has not directly resulted in any decrease in static gear effort (R3; R5; S1; S2; U1; U4; U6; U7; U8). Instead, it acts to change mindsets and prevent future increases in static catch, although some infringements are still suspected from working group members (R2; R3; R4; S2).

Participation has benefitted from perceived 'resignation' of fishermen to Lyme Bay closures against the backdrop of MCZ designation (S2), and neutral facilitation by an external body, which has been key for BLUE's work (E2; E5; E6; U3). This has implications for the suggestion of IFCAs as the body to manage the working group going forwards, as the main local regulator (E5; U3; U5; U6; U9). Peer enforcement has greatly increased with infringements now reported by fishermen, anglers and members of the public (E2; R4; U6; U9), and it was a local user who reported the visiting illegal dredger, ultimately resulting in prosecution (U6). The working group has also increased the perceived 'voice' and influence of MPA users (E1; E5; E6), and there is significant enthusiasm from users within the group for it to continue (U7; U8; U9).

Incentives weighting and web

With the original MPAG project report discussing 'getting the balance right' between meaningful stakeholder participation and fulfilment of strategic marine biodiversity conservation objectives, focus has moved towards resilience of MPA governance through a diversity of objectives and the linkages between them. At Lyme Bay the strong legal incentives provide the primary mechanism by which objectives are achieved via the protection of reef features (E5; Jones, et al., 2011). However, other categories of incentive help to underpin compliance with these regulations, allowing stakeholder input through collaborative learning, and increased awareness leading to peer enforcement (Figure 7). The main caveat of the web overleaf is the recognised limitations in the majority of the working group-provided incentives due to the limited number of recipients, with difficulties in engaging incoming users and displaced mobile fishermen.

A number of stakeholders commented on the resilience of the Lyme Bay governance structure going forwards, with some pessimistic about resilience to multiple perturbations

such as reduced BLUE involvement, SI removal and lack of state funding (P2; U9). Others were more confident that the current mix of incentives would provide steer into the future, with a small number of predicted infringements by pre-identified individuals easily dealt with by regulators (R4). It is clear that the incentives are not static but dynamic in time; some economic incentives, such as the infrastructure, have been essential for 'buy-in' of fishermen to the working group and now only need maintenance (E5; U3), and existing social capital and linkages may continue into the future even if the current working group structure is changed.

Table 1: Incentives used and needed. A full list of incentives can be found in Appendix 8

	Used	Needed
Economic Market steer	Promoting profitable and sustainable fisheries Promoting green marketing Ensuring sufficient state funding Provision of NGO and private sector funding	 *Improved* state funding *Continued* NGO and private sector funding
Interpretative Supporting market, state and people steer	Raising awareness Promoting recognition of regulations and restrictions Promoting recognition of benefits	
Knowledge Supporting market, state and people steer	Promoting collective learning	
Legal State steer	Hierarchical obligations Capacity for enforcement Penalties for deterrence Clarity concerning jurisdictional limits	Protection from incoming users *Continued* capacity for enforcement *Improved* cross-jurisdictional coordination *Improved* clear and consistent legal definitions
Participative People steer	Establishing collaborative platforms Neutral facilitation Peer enforcement Building social capital Bracing linkages Potential to influence higher institutional levels	 *Continued* neutral facilitation

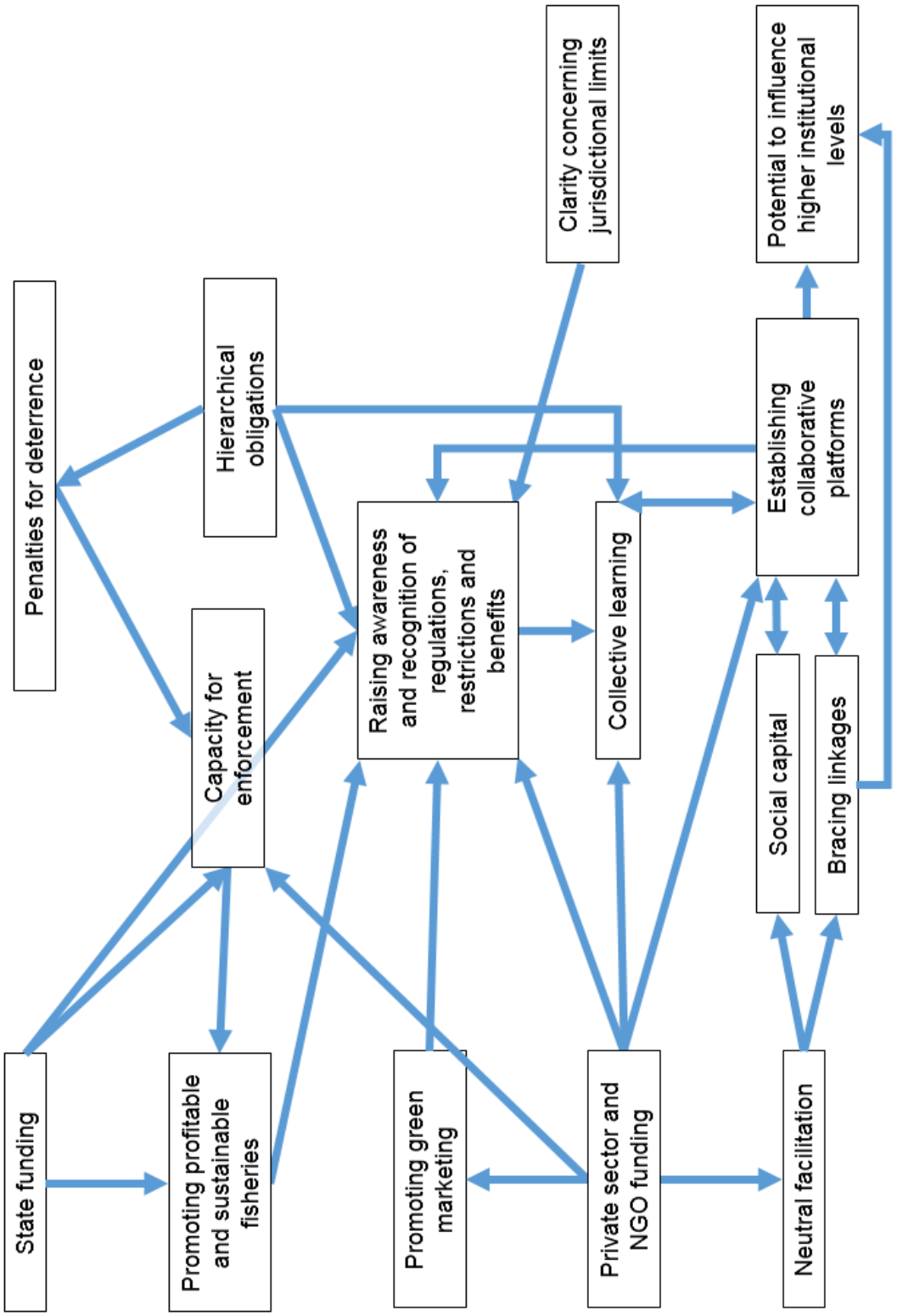

Figure 7: Web illustrating interactions between incentives at Lyme Bay

Governance effectiveness

The MPA is currently judged at around level 3 of the MPAG effectiveness scale, with 'some impacts completely addressed, and some partly addressed', aligning with the three other UK MPAGs studied under the MPAG framework (Jones, et al., 2011; De Santo, 2013; Roberts & Jones, 2013). Effectiveness will be increased following reviews of Habitat Risk Assessments (HRAs) for the remaining fisheries activities, including the use of static gear.

The strong legislative framework at Lyme Bay with regards to bottom-towed gear is supporting the observed recovery of the benthic habitat, thereby addressing the main objectives of the SI and the SAC (E4; Sheehan, et al., 2013). HRAs for this 'red risk' activity conducted by the IFCAs have resulted in the 2014 byelaws that restrict mobile gear from sensitive areas, consisting of reef habitat and buffers (R3; R5). The comprehensive scientific research in the area provides an excellent baseline for monitoring the impacts of bottom-towed gear on meeting fisheries objectives (R1; R2). However, with temperate reef recovery slow (Sheehan, et al., 2013), the relatively recent timeframes of the closure have not allowed sufficient time for the results of such a test closure on the marine environment, particularly on interstitial recovery, to be seen.

A lack of historical effort data for static gear reduces ability to gauge historical trends, and therefore impacts on effectiveness. It has been reported that there has been 'explosion' in static gear since the closure, but different stakeholders give slightly varied reports, and the lack of consistent data makes it difficult to scientifically justify such an such statements (S2; U1; U3; U5; U8; U9). It is agreed that high levels of potting are conducted by incoming users, and some reduction in this effort can be attributed to the area 'not living up to expectations' post-closure (U3). It is clear however that there are still large numbers of whelk pots around the western edge of the MPA, going far above the amount specified in the voluntary code (R3). The impact of these potting levels on the ecosystem was generally not of concern to users, with damage to the seabed by mobile gear more of a concern (U3; U8; U9). The use of static gear is currently classified as an amber risk activity by Natural England, with management measures for amber and green activities required to be in place by the end of 2016. The levels outlined in the voluntary agreement form a generally accepted marker of tolerance by the IFCAs, and increases above this level may trigger a review and potential implementation of restrictions (E2; R5). It is tentatively predicted that no further

management measures will be required for static gear, although the results of the Plymouth University potting study are yet to be formally published, and Natural England currently have little evidence on the impacts of potting on different features. The effectiveness of current measures are reflected in widely noted improvements in the fishery, with catch increases and the observation of a number of new species (E4; P1; U6; U9).

The working group has put in place the majority of actions set out in the original management plan, but achievement of the broad principles is more difficult to quantify in this research, especially through the MPAG effectiveness metric. Socio-economic benefits of the MPA have been identified in the literature with respect to static gear fishermen and the recreation industry (Rees, et al., 2010; Mangi, et al., 2011), and will be addressed in more detail by further recent research facilitated through the working group (S1; S2; U3). Implementing best possible management practices is a similarly broad aim, and is impacted by the levels of potting discussed above and the difficulty of engaging incoming users, and will be benefitted by the outcomes of the potting study.

Cross cutting themes

Role of leadership

Fishermen more invested in the working group can exert influence as leaders of port communities (E5; R4), allowing increased self-organisation (Ostrom, 2009). Leadership of the working group is recognised as a significant time and resource investment (R5; R6), and without a leadership influence going forwards the working group may end (R5; U3; U5). A suggested format is a smaller working group with IFCA leadership and MMO support (E5; U3; U5; U6; U9), although BLUE presence at the site will be reduced for the near future rather than removed to ensure continuation of the project. Leadership will be crucial for coordination of funding through iVMS data and ensuring that compliance is maintained (U5). The research found IFCA leadership as the most often suggested method of organisation of any future working group-type format, but IFCAs may struggle to deliver this on their resources, and prioritise other commitments over the continuation of a working group (R1; R2; R3; R6). . Leadership of a participative group by a regulator may also undermine the incentive of neutral facilitation, and use of an independent chair should be considered going forwards (E5; E6).

Role of NGOs

The role of NGOs within the working group has been largely limited to the role of BLUE, with a low NGO presence as a deliberate choice to ensure maximum participation of fishermen (E6; P2). Originally BLUE were viewed as being 'just another group' who wanted to ban fishing, in the context of past tensions (E5, U7, U8), and have successfully overcome this label to engage with fishermen. Homogenisation of users is a risk of NGO involvement discussed in the literature (Cleaver, 2001), and this has occurred in part due to the participation predominantly by local inshore static boats in the working group. Any accusations of imposition predominantly come from excluded mobile gear fishermen who already felt that the original closure was imposed on them, but also from some static fishermen (U1; U2; U4; U5; U6).

Equity issues

There is some resentment of the inclusion of part-time fishermen in working group, as they are perceived to deserve less of a 'stake' in management of the MPA (U5). Mobile fishermen

who have already been excluded from the MPA further resent the large amount of static gear outside of the MPA area, as well as the perceived 'bias' towards static gear, both in terms of the working group emphasis and the increased national emphasis towards MPAs which are seen as closing huge areas of the coast to mobile gear (U1; U4; U5). With the IFCA role requiring balancing stakeholders as well as managing fisheries for conservation, this can present conflicts in the achievement of objectives (Rodwell, et al., 2014). Equitable treatment of all stakeholders is cited as a key argument by regulators for allowing mobile gear access around the reef areas, but must be carefully balanced with effectiveness of the MPA, which is currently high (Halpern, et al., 2013).

Role of science

The role of science and feature vs. site led approaches arguably produced some of the most varied and diverse opinions of all the research topics. With the feature-led approaches under which the MPA is designated appearing to contrast with the site-led conservation created by the SI, the colonisation of interstitial areas by reef-associated species since the closure raises discussion around the nature of site integrity in relation to conservation objectives (E1; Rees, et al., 2013; Sheehan, et al., 2013). Areas not previously considered as reef can exhibit self-repair and self-renewal, and interactions between reef and non-reef ecosystem elements further require that the site be considered as a whole for ecological and legal purposes (Rees, et al., 2013). Potential SI removal will create pressure for the site to be re-opened around Annex 1 reef features, especially if IFCA submit applications to Natural England to allow dredging in between the reef features. Any re-opening of the site would be stepwise and involve careful monitoring (R6), but stretched IFCA budgets (Rodwell, et al., 2014) may mean such monitoring would be less comprehensive than ideally desired. Further research into interstitial recovery should be conducted to allow adequate legitimate protection under SAC objectives of this site. With use of evidence and the precautionary principle a prominent theme in the designation of MCZs (De Santo, 2016), this site has the potential to feed into wider arguments and debates.

Voluntary agreements

The use of voluntary agreements at Lyme Bay is an important case study, due to previous limited research on their use in MPAs (Whitney, et al., 2016), and a potential increased

government emphasis on stakeholder engagement and the use of voluntary agreements (P2; R2; S2). Although the voluntary agreement at Lyme has not reduced static gear effort, noted benefits include a mechanism to prevent future increases and change mindsets, a tool to control management practices such as bait use which are difficult to enforce, and a 'stepping stone' to legislation, to determine effects and increase before compliance before being adopted as statutory management (E2; R3; R4; S1; U3; Whitney, et al., 2016). There are contrasting opinions on whether the static gear voluntary agreement should be put into legislation, and one suggestion is that it could be adopted as a permitting scheme which would be relatively flexible (E5; U3). The use of voluntary agreements at Lyme has benefited from the relative homogenisation of the users within the working group and the neutral leadership of the Blue Marine Foundation, and should be viewed in the context of the backdrop of strong legislation.

Conclusion

With an increased emphasis in UK marine conservation on stakeholder involvement, and commitments to the designation of an ecologically coherent network of MPAs, understanding governance of UK marine sites and the effectiveness of such structures is essential. Lyme Bay provides an unusual governance structure, with an SI banning mobile gear overlain by a wider SAC designation and subsequent NGO involvement through creation of a working group. The effectiveness of both NGOs and voluntary agreements lacks historical attention in the literature, or empirical study. Analysis of the Lyme Bay governance structure therefore provides a new level of understanding around the role of such interactions at a key test site for UK marine policy.

Analysis of the Lyme Bay MPA through the MPAG framework has found that although a diversity of incentives is present at Lyme, the legal framework has historically been the most important for protection of biodiversity through the reef structures. However, presence of a neutral NGO at the site has facilitated a significant investment of private and NGO funding, a wide range of awareness raising initiatives, development of social capital and a designated forum for collaborative learning. Although this structure has not directly resulted in a reduction in static catch, and only reaches a percentage of fishermen, the incentives provided instead help to change mindsets and achieve compliance with the strong legislative structure, protecting the benthic habitats from the effects of mobile gear and providing the primary mechanism for achievement of the SAC objectives. This has addressed the main impacts on biodiversity, and assessments and management measures for lower risk impacts are expected to be implemented in the near future. Some issues still remain with incoming boats, which are difficult to engage through local and working group-provided incentives, and should be targeted going forward by improved monitoring and informed management. However, effectiveness is generally high (pending the outcome of further Habitat Risk Assessments) due to the banning of mobile gear and the current low infringement rate.

With effectiveness high, recommendations for Lyme Bay turn to the large number of perturbations to the system expected in the near future. With potential upcoming removal of the statutory instrument by government, pressure to re-allow access by mobile gear around the conservation features of interest will increase. As Lyme Bay is currently a test site for such a closure and providing evidence for reef self-renewal outside of areas designated as

Annex 1 reef habitat, it is important that increased monitoring and research is conducted to ensure the SAC objective of protecting reef habitat is adequately defined. Additionally, participative incentives have successfully allowed a format for collaborative learning and enthusiasm for peer enforcement, but with a backdrop of stakeholder conflict and mistrust of NGOs and regulators still within memory, it must be ensured that similar mistakes in stakeholder engagement are not repeated in any further decisions. With potential BLUE exit, a general lack of funding and potential removal of the SI, this could create a gap of leadership, funding and political will to maintain a closed area. These drivers will test the resilience of the MPA and determine whether the current diversity of incentives is sufficient for continued effectiveness.

Autocritique

Further to the limitations of the research methodology described earlier, there are a number of additional caveats within which this research should be viewed. Lyme Bay was originally selected as a site for research due to its unique governance structure and history of stakeholder conflict, which has made for an interesting governance study. However, one of the original objectives of the study was to produce recommendations for the wider background of UK MPA networks and MCZ designation. As the legal structure of Lyme Bay is relatively unique, and selection was largely top-down in contrast to the stakeholder-based selection format of MCZs, it is difficult to provide wider recommendations. Therefore, this report focuses on governance analysis and recommendations for the future of Lyme Bay. The forecast changes in governance at Lyme Bay became apparent during the research process, and made the process of analysing current governance more challenging, as incentives were set within a dynamic structure. Focus on future changes had to be balanced with a more 'moment in time' analysis that the MPAG framework lends itself to.

The research at Lyme Bay raised a number of wider MPA governance concepts, and with a word limit on this report, the temptation to fully explore concepts related to site integrity, the use of voluntary agreements and links to ongoing designation of a UK MPA network had to be balanced with the requirement to cover each section of the MPAG framework in adequate detail. Creating interview reports that adequately represented views without resorting to full interview transcripts was challenging, and in hindsight a more definitive method for transcription would be used. Although there exists a body of literature utilising the MPAG framework, judging relative concepts such as effectiveness was made more difficult with a low level of previous governance experience. Additionally, the complex dynamics present, both ecological and social, mean that it was difficult to distinguish in some cases between MPA effects and wider marine trends. Expansions of the research could include another MPAG review in the near future following the exit of the Blue Marine Foundation, a more detailed analysis of governance by the IFCAs via byelaws, and further research into the concept of feature-led vs. site-led conservation.

Figure references

Figure 1: Picture and key adapted from JNCC (2016)

Figure 2: Diagram taken from Jones (2014, p. 75)

Figure 3: Map created by author

Figure 4: Map created by author, SI and SAC outlines from Attrill, et al. (2011)

Figure 5: Map from Attrill, et al. (2011)

Figure 6: Map created by author, data from the MMO, D&S IFCA and Southern IFCA (2016)

Figure 7: Figure created by author using Jones (2014, p. 186)

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Appendices

Appendix 1 – Research outline

UCL

Lyme Bay Conservation Research Project

Rebecca Singer

I am a master's student at University College London studying Conservation. As part of my degree I am conducting an independent academic research project, exploring roles and perspectives of different organisations as part of the emerging governance and conservation within Lyme Bay.

This research will consist of short, confidential, informal interviews with a range of stakeholders, conducted in London and the Lyme Bay area over June and early July 2016. Interviews can be carried out in person or over Skype/telephone, with all contributions gratefully received.

If you are interested in taking part in this research, have advice on interview contacts or would like to discuss the project, please contact rebecca.singer.15@ucl.ac.uk or 07512262807.

Appendix 2 – Removed

Appendix 3 – Removed

Appendix 4 – Glossary of terms

Mobile gear: Use of gear that is towed in order to fish, including scallop dredging, where a rigid structure is towed on the seabed, and trawling, where nets are towed through the water.

Static gear: Gear that it set to allow fish to swim into it, or attract fish by bait, including the use of pots and nets.

Scallop diving: Collecting scallops by hand from the seabed.

Source: Seafish (2016)

Appendix 5 – Calculation of state capacity

Control of corruption	1.727
Government effectiveness	1.616
Political stability and absence of violence	0.440
Regulatory quality	1.830
Rule of law	1.887
Voice and accountability	1.297
Average	**1.466**

Source: The World Bank (2015)

Appendix 6 – Lyme Bay Working Group Voluntary Code of Conduct

Lyme Bay
Fisheries and
Conservation Reserve

VOLUNTARY CODE OF CONDUCT

- Any registered fishing vessel wishing to fish within the Lyme Bay cSAC will voluntarily fit Inshore Vessel Monitoring Systems (iVMS)
- Undersize fish and shellfish will not be used as bait
- All gear will be clearly marked
- Fishermen will not fish more than 250 crab/lobster pots
- Strings will not exceed a maximum of 10 pots in each
- Escape hatches will be fitted to all parlour pots and soft-eyed creels
- Voluntary V-notching will be carried out at the individual fisherman's discretion
- Fishermen will not fish more than 500 whelk pots
- Strings of whelk pots will not exceed a maximum of 30 in each
- Vessels will not fish a total net length of more than 3200 yards
- Individual nets will not exceed 800 yards
- If significant crustacean bycatch occurs in nets they will be moved to different ground

Appendix 7 – Photographs of the Seaton Jurassic Centre Exhibit

Appendix 8 – Full list of incentives under the MPAG framework

Category	Incentive
Economic	Payments for ecosystem services
	Assigning property rights
	Reducing the leakage of benefits
	Promoting profitable and sustainable fisheries
	Promoting green marketing
	Promoting alternative livelihoods
	Providing compensation
	Re-investing MPA income in local infrastructure
	Ensuring sufficient state funding
	Provision of NGO and private sector funding
Interpretative	Raising awareness
	Promoting recognition of regulations and restrictions
	Promoting recognition of benefits
Knowledge	Promoting collective learning
	Agreeing approaches for addressing uncertainty
	Independent advice and arbitration
Legal	Hierarchical obligations
	Capacity for enforcement
	Penalties for deterrence
	Protection from incoming users
	Attaching conditions to property rights
	Cross-jurisdictional coordination
	Clear and consistent legal definitions
	Clarity concerning jurisdictional limitations
	Legal adjudication platforms
	Transparency, justice and fairness
Participative	Rules for participation
	Establishing collaborative platforms
	Neutral facilitation
	Independent arbitration platforms
	Decentralising responsibilities
	Peer enforcement
	Building social capital
	Bracing linkages
	Building on local customs
	Potential to influence higher institutional levels