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Research article

Evaluating adaptive co-management as conservation conflict resolution: Learning from seals and salmon

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ABSTRACT

By linking iterative learning and knowledge generation with power-sharing, adaptive co-management (ACM) provides a potential solution to resolving complex social-ecological problems. In this paper we evaluate ACM as a mechanism for resolving conservation conflict using a case study in Scotland, where seal and salmon fishery stakeholders have opposing and entrenched objectives. ACM emerged in 2002, successfully resolving this long-standing conflict. Applying evaluation approaches from the literature, in 2011 we interviewed stakeholders to characterise the evolution of ACM, and factors associated with its success over 10 years. In common with other ACM cases, triggers for the process were shifts in slow variables controlling the system (seal and salmon abundance, public perceptions of seal shooting), and exogenous shocks (changes in legal mandates, a seal disease outbreak). Also typical of ACM, three phases of evolution were evident: emerging local leadership preparing the system for change, a policy window of opportunity, and stakeholder partnerships building the resilience of the system. Parameters maintaining ACM were legal mechanisms and structures, legal power held by government, and the willingness of all stakeholders to reach a compromise and experiment with an alternative governance approach. Results highlighted the critical role of government power and support in resolving conservation conflict, which may constrain the extent of local stakeholder-driven ACM. The evaluation also demonstrated how, following perceived success, the trajectory of ACM has shifted to a 'stakeholder apathy' phase, with declining leadership, knowledge exchange, stakeholder engagement, and system resilience. We discuss remedial actions required to revive the process, and the importance of long term government resourcing and alternative financing schemes for successful conflict resolution. Based on the results we present a generic indicator framework and participatory method for the longitudinal evaluation of ACM applied to conservation conflict resolution.

1. Introduction

Adaptive co-management (ACM) is a novel form of environmental governance that can enhance social-ecological systems' resilience and adaptability to uncertainty and change (Armitage et al., 2009; Plummer et al., 2012). In contrast to conventional, centralised 'command-and-control' approaches, it combines the iterative learning, knowledge generation and problem-solving of

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adaptive management with the stakeholder power-sharing and conflict resolution of co-management (Olsson et al., 2004a; Folke et al., 2005; Armitage et al., 2007; Fabricius and Currie, 2015). Folke et al. (2002, p. 8) broadly define ACM as "a process by which institutional arrangements and ecological knowledge are tested and revised in a dynamic, ongoing, self-organized process of trial-and-error", which is known to evolve through stages (Olsson et al., 2004b; Berkes et al., 2007; Plummer and Baird, 2013).

One context where the utility of ACM has not been assessed is conservation conflict (Butler, 2011), which occurs when conservation interests wish to protect wildlife species that impact the livelihoods of others (Redpath et al., 2013). Examples include predation of livestock (e.g. Butler, 2000, Butler et al., 2014) or game (e.g. Graham et al., 2005; White et al., 2009) by protected predators, and retaliatory killing by the affected stakeholders. These conflicts are often intractable because actors' worldviews and values are polarised and have become entrenched (Young et al., 2010). Eliminating conflict permanently is unlikely, but reducing the negative impacts on species and stakeholders by finding compromises is sometimes feasible (Colyvan and Regan, 2011). Designing mechanisms that can achieve sustained conflict resolution is an evolving field of research (Dickman, 2010; Redpath et al., 2013). Early evidence suggests that keys to success are ongoing collaborative decision-making processes which involve all stakeholders equitably (Young et al., 2013a), trial innovative ideas, and include evaluation to provide learning (Walkerden, 2005; Redpath et al., 2013).

To understand the value of ACM for conservation conflict resolution requires systematic evaluation of case studies. Plummer and Armitage (2007) proposed a generic framework to evaluate ACM interventions based on outcome parameters. Armitage et al. (2009) also suggested 10 pre-conditions that must exist for successful ACM to be maintained. These approaches illustrate the necessity for measuring progress towards intended outcomes, plus assessing whether the outcomes have created pre-conditions for the collaborative process to continue (Innes and Booher, 1999; Berkes et al., 2007). While some methods have been designed to monitor components of ACM (e.g. Cundill and Fabricius, 2010; Smedstad and Gosnell, 2013; Fabricius and Currie, 2015), none have explicitly integrated the parameters developed by Plummer and Armitage (2007) and Armitage et al. (2009), nor calibrated them against successful ACM interventions (Plummer et al., 2012).

In this paper we investigate the characteristics of successful ACM in the context of a conservation conflict. We use a case study in Scotland, the Moray Firth Seal Management Plan (MFSMP), which was launched in 2005 as a pilot initiative to balance conflicting stakeholder interests in seal conservation and salmon fisheries (Butler et al., 2008). Following its perceived success, the model is being scaled-out through national legislation (The Scottish Government, 2014).

We had three research goals. First, we aimed to understand the evolution of ACM in the context of conservation conflict, and the factors that triggered the process. Second, we sought to identify the factors associated with the MFSMP's success in terms of Plummer and Armitage (2007) and Armitage et al.'s (2009) ACM parameter frameworks by calibrating them against the attainment of the MFSMP's objectives. Third, we aimed to develop and test a participatory method to integrate and implement the frameworks for the longitudinal evaluation of ACM. Informed by the results we present a generic indicator framework for evaluating pre-conditions and outcomes of ACM applied to conservation conflict resolution.

2. Study area

2.1. The Moray Firth and seal-salmon fishery conflict

The Moray Firth is a 5230 km^2 marine embayment in northeast Scotland (Fig. 1). Eighteen major rivers flow into the Firth which have historically supported an annual run of up to 270,000 adult Atlantic salmon (*Salmo salar*) (Fig. 2). At the time of the MFSMP's development there were 20 coastal salmon netting stations plus more than 100 in-river rod fisheries, managed by 12 statutory District Salmon Fishery Boards (DSFBs). Angling tourism is of high economic importance to the Moray Firth (Butler et al., 2009). The region is also a nationally important site for marine mammals. In the 1990s up to 1500 harbour seals (*Phoca vitulina*) were resident in the Firth, plus 900 grey seals (*Halichoerus grypus*) which are part of a larger North Sea population (Butler et al., 2008). Together with bottlenose dolphins (*Tursiops truncatus*), these species supported a small but expanding marine wildlife tourism industry (Hoyt, 2001).

Throughout Scotland marine survival rates of salmon declined from the mid-1980s to the early 2000s due to a number of pressures including climatic changes in their North Atlantic feeding grounds (Jonsson and Jonsson, 2004). This resulted in periods of low abundance in 1991–1992 and 1996–2003. Spring-running subpopulations declined most markedly (Butler et al., 2008). Harbour seal numbers also declined steeply over this period (Fig. 2).

There has been a long history of conflict between salmon fisheries and seals in Scotland. Seals prey on fish migrating into river estuaries and around coastal netting stations, interfering with fishing and reducing the numbers available for capture, resulting in demands from fishery stakeholders for seal culling (Moore, 2003). In the Moray Firth the economic impacts are small, but in 2005 the majority of fishery stakeholders still believed that seal culling was necessary (Butler et al., 2011). Fishermen and scientists' perceptions of the extent of seal predation on salmon are polarised (e.g. Graesser, 1991; Scottish Salmon Strategy Task Force, 1997; Middlemas et al., 2003, 2006).

Historically, under national legislation it has been legal for fishery managers to shoot seals to protect fisheries. Outside closed seasons covering pupping periods, when managers must apply to the government for licenses to kill seals, shooting was unrestricted and unreported. In the 1990s opposition to shooting from animal welfare groups intensified (e.g. Advocates for Animals, 2002), and the wildlife tourism industry was also promoting seal conservation (Young, 1998). The decline in salmon abundance during the 1990s prompted Moray Firth fisheries to intensify shooting, with up to 425 seals shot annually (Butler et al., 2008). Thompson et al. (2007) concluded that this could have caused the decline in harbour seals observed in 1992–2003 (Fig. 2).

2.2. The Moray Firth seal management plan

In 1992 the UK government adopted the European Union Habitats Directive, which aims to secure the favourable conservation status of listed species through the designation of Special Areas of Conservation (SACs). Atlantic salmon, harbour and grey seals are listed, and in 1999 salmon were included in SACs covering six Moray Firth rivers. In 2000 harbour seals were included in the Dornoch Firth SAC (Fig. 1). The designations presented an unprecedented challenge for seal and salmon management, because they imposed new statutory responsibilities on the government and DSFBs to ensure the favourable condition of the seal and salmon SACs, yet the protection of one species potentially impinged upon the status of the other. The situation was exacerbated in 2002 when an outbreak of Phocine Distemper Virus in Europe prompted the