Emerging frontiers in perceptions research for aquatic conservation

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ABSTRACT

1. Aquatic ecosystems support the livelihoods and food security of millions of people globally, yet face critical challenges from local threats and global pressures.

2. This paper describes how emerging research on perceptions can illuminate potential solutions for aquatic conservation, and seeks to stimulate thinking on how perceptions research can inform sustainable use in aquatic systems.

3. An overview of three emerging research frontiers in perceptions research is presented: (i) perceptions research to assess conservation initiatives and policy; (ii) perceptions research to inform the design of conservation initiatives; (iii) perceptions of the general public and support for aquatic conservation.

INTRODUCTION

Humans are increasingly dependent on aquatic environments for resources, recreation, livelihood security, and as a platform for the exchange of goods in a globalized world. The increasing use of aquatic environments poses a number of challenges, including the formulation of equitable and sound governance mechanisms, biodiversity conservation, and the sustainable use of renewable resources (Halpern et al., 2007). Aquatic environments are affected by multiple anthropogenic stressors, such as overfishing, aquaculture, pollution, climate change, ocean acidification, coastal erosion, habitat loss, and the introduction of invasive species (Naylor et al., 2001; Duarte et al., 2007; Ling et al., 2009; Boon and Raven, 2012). In addition to the above stressors, many freshwater systems find themselves reduced or even exhausted by water abstractions for agriculture, industry and domestic use. Rivers, in particular, are vulnerable to over-exploitation, both because they are the focus of all catchment processes, and because upstream users are often oblivious of their impacts on downstream inhabitants (Nel et al., 2007). Continued degradation of aquatic ecosystems, along with the...
ecosystem services they provide, suggest that new, innovative approaches are needed to scale-up the coverage and effectiveness of initiatives to protect and move closer to the sustainable use of marine and freshwater ecosystems.

As a traditional approach to nature conservation transitions towards one based on stakeholder participation and on the values of nature to human society, the success or failure of marine and freshwater ecosystem conservation goals is increasingly attributed to the degree of support they receive from different stakeholders (Hirst, 1989; Gelcich et al., 2008). For instance, river conservation is dependent on sound management of the entire catchment and therefore relies on effective participation of stakeholders to comply with plans which include explicit conservation visions, targets, and guidelines to ensure the sustainable provisioning of ecosystem services (Nel et al., 2007). Published evidence also suggests marine protected areas which are implemented in a top-down manner (e.g. central government and/or international donor led), with lack of participation and buy-in from local stakeholders are at risk of becoming ‘paper parks’ (McClanahan et al., 2006; Mora et al., 2006; Hind et al., 2010; Lopes et al., 2013).

Researchers and NGOs have promoted a shift towards more inclusive community, user-led and participatory processes for marine and freshwater conservation initiative design and implementation, under the assumption that this would offer better incentives for people to engage and comply (Cinner et al., 2012; Aburto et al., 2016; Walker-Springett et al., 2016). In fact, the whole notion of protected areas (‘fenced off’ and unavailable for development), has been questioned as a conservation initiative, and can be seen: (a) as a failure of holistic environmental protection, since they imply that only these areas are to be conserved, and everywhere else can be exploited; and (b) as an elitist protection policy, reserving desirable conditions only for those with sufficient resources to enjoy them (O’Keeffe, 2013).

To better meet the future challenges associated with aquatic conservation, researchers and practitioners have begun to focus on understanding society's perceptions (i.e. community, stakeholder and general public). Perceptions are defined as ‘a belief or opinion, often held by many people and based on how things seem’ (Cambridge Dictionary, 2016). Perceptions have been considered an umbrella term which includes interests, social values, experiences, interpretation, and evaluation (Jefferson et al., 2015; Bennett, 2016). Although perceptions are not necessarily objective, individuals’ subjective perceptions can become their truths (Munhall, 2008). Thus, considerations of perceptions towards the environment become more important as conservation activity increasingly depends on the actions of interested groups of people (de Groot and de Groot, 2009). In theory, understanding the perceptions of such groups can help predict their likely responses to a new policy or conservation programme before it is implemented (Gelcich et al., 2005), or to understand the responses of different groups to existing policies or conservation initiatives (Bockstael et al., 2016). Accounting for perceptions may help illuminate potential ways of ‘fine tuning’ existing practices and policies, or finding novel solutions to the challenges facing marine and freshwater management and conservation.

This paper seeks to promote perceptions research through providing an overview of three emerging research themes: (1) perceptions research to assess conservation initiatives and policy; (2) perceptions research to inform the design of conservation initiatives; (3) perceptions of the general public and support for aquatic conservation. The overarching goal is to stimulate thinking on how perceptions research can inform sustainability in aquatic systems.

**THEME 1: PERCEPTIONS RESEARCH TO ASSESS CONSERVATION INITIATIVES AND POLICY**

A key lesson from international experience is that aquatic conservation receives its legitimacy from the stakeholders and is successful only if it is able to deliver tangible outcomes (Cinner, 2007; Pinkerton and Leonard, 2008). After a conservation initiative or policy is put in place, perceptions can be useful for assessing its legitimacy and effectiveness (Bennett, 2016; Bockstael et al., 2016). Knowledge
of perceptions can be used to understand acceptability of conservation initiatives by different stakeholders and help identify problems and challenges associated with such programmes or policies (Gelcich et al., 2009). In essence, perceptions are important to understand why stakeholders support or do not support an initiative and to assess what facets of a conservation initiative, be they social impacts, ecological outcomes, governance, or management, are generating or undermining support (Leleu et al., 2012). For instance, how users perceive the performance of marine protected areas has been reported to be influenced by several factors such as social context (Cinner, 2007), type of management (McClanahan et al., 2005), livelihoods (Gelcich et al., 2009) or risk preferences (Gelcich et al., 2007).

There are clear benefits to studying local stakeholder (e.g. fishers, farmers) perceptions of aquatic conservation interventions. Environmental conservation policies have generally assumed that stakeholders will respond homogeneously and deterministically to a given policy. Emerging research in perceptions research is stressing how the response of fishers and farmers to a policy depends on their perceptions, personalities, and livelihoods (Gelcich et al., 2009; Sorice and Donlan, 2015). Hence, the policy response may still be deterministic (if you understand the system well enough), but it will be variable both among groups and between individuals within any group. Understanding this variability is important in predicting the likely success of any given conservation measure (Ite, 1996; Gelcich et al., 2005). For instance, Gelcich et al. (2005) examines perceptions of artisanal fisher participation in a territorial user rights policy in Chile using data collected through rapid rural appraisal techniques, questionnaire surveys, focus group discussions and guided interviews. Results showed that in spite of a high level of community awareness, there are heterogeneous levels of local support. Factors determining support included socio-economic development, the pace of project implementation, livelihood portfolios, the relationship between authorities and communities, and the historical rights of local people to access ecosystem services. These heterogeneous perceptions raise the possibility that, although the new policy or incentive might change fishers’ short-term behaviour, when policy implementation incentives end or in times of crisis, some of these fisher groups are more likely to revert towards less desirable behaviours. In this way, an in-depth study of perceptions can help determine specific causes of lack of support and identify relevant actions, targeted to the specific needs of different users, to ensure long-term support and the success of conservation (Suman et al., 1999; Gelcich et al., 2005).

Newson (1997) gives detailed descriptions of the varying ways that different experts and groups of people perceive the river environment, with their understandings filtered through the perspectives of their disciplinary and experiential knowledge. Making this information explicit can enable the use of this understanding to craft solutions acceptable to the involved parties (Tippett et al., 2005). Determining environmental flows for rivers can accentuate the importance of understanding stakeholders’ perceptions and priorities, particularly in identifying flow-related environmental objectives. Although the assessment process for environmental flows is science based, using hydraulic habitat measures for flow-sensitive indicator species, geomorphological and water quality processes, the choice of specific objectives is not a scientific one, but rather a societal decision, based on the perceived values of the ecological goods and services provided by the river. A recent environmental flow assessment (EFA) for the Kilombera basin of the Rufiji river in Tanzania (McClain et al., 2016) concentrated on a broad-based investigation of stakeholders’ perceptions of the priority goods and services provided by the river. Some 700 direct-use stakeholders (inhabitants of the riparian and floodplain areas) were interviewed about their uses of, and priorities for the river and floodplain, including flood recession farming, fishing, medicinal plants, local crafts and health issues. At a meeting of institutional stakeholders (relevant government ministries, basin officers, NGOs, agriculture and industry) a survey was conducted. The results provided a detailed range of ecosystem services, livelihoods and health issues which are supported by healthy river flows, and could be directly related to the scientific flow indicators (obscure to non-specialists), so that stakeholders could frame and
support the environmental flow process based on their own understanding of the implications for their own specific interests. The likelihood that conservation measures (such as environmental flows) will actually be implemented in the face of competing consumptive demands from agriculture, industry and domestic supply, is highly dependent on broad stakeholder understanding of and buy-in to the importance of the measures, and this is unlikely to be achieved solely by the application of biological scientific analysis.

Research aimed at understanding stakeholders’ perceptions is essential because the management and conservation of ecological systems are inextricably coupled with social systems (Folke et al., 2002). Results from research on perceptions can be incorporated into decision-making processes. Results can inform decision-makers and managers that actions need to be taken to increase the socio-economic benefits or the distribution of benefits associated to a particular conservation intervention (Bennett, 2016). On the other hand, they can be used to assess the degree to which the ecological benefits of conservation measures are being felt or received by stakeholders, establishing the need for modifying existing governance structures (Gelcich et al., 2010). In essence, perceptions research provides a setting for exploring what is desired and what is achievable in a given ecological, social, and political context.

THEME 2: PERCEPTIONS RESEARCH TO INFORM THE DESIGN OF CONSERVATION INITIATIVES

Understanding stakeholders’ perceptions has much to offer to those designing aquatic conservation programmes and policies. Before implementation of a conservation initiative, during the design and planning phase, perceptions can be examined, using qualitative or quantitative methods, to establish baselines, imagine the future social impacts of an initiative, envision what legitimate governance might look like, and determine the acceptability and scalability of management actions. Emerging research in this area helps explain how key conservation programme attributes can be critical in designing effective measures. Information on stakeholder perceptions can aid practitioners to design aquatic conservation programmes in which people’s probability of participation are greater (Gelcich and Donlan, 2015).

The use of perceptions when designing a programme or policy begins by recognizing that the needs and values held by stakeholders may fundamentally differ from those of the conservation programme provider and conservation targets (Gelcich and Donlan, 2015; Sorice and Donlan, 2015). The use of perceptions research at this stage strives to gain an in-depth understanding of the people who will be affected or for whom the programme is hoping to generate value. For example, perceptions research provides in-depth knowledge of a group’s preferences and priorities (Pita et al., 2011), which can serve as a foundation for identifying unarticulated needs of the potential participants. An aquatic conservation programme design process that first understands what is meaningful and appropriate, can then explore how members of different stakeholder groups can be engaged. This knowledge can generate innovative solutions that can improve the overall attractiveness and performance of conservation interventions and avoid conflict (Liedtka, 2011). For example, academics and practitioners are working with small-scale fishers in Chile to design a programme in which fishers create enforced, no-take protected areas within their territorial user rights management zones. Academics are combining focus group and survey methodologies to understand fishers’ preferences for different programme components, such as contract length, perceived benefits, and enforcement requirements (Gelcich and Donlan, 2015; Gelcich et al., 2015).

A challenge to effectively use perceptions research to design collaborative conservation efforts lies in dealing with heterogeneity in stakeholders’ perceptions and values. If not addressed, contrasting uses, worldviews and social conflicts can hamper well-intended participatory approaches. Dealing with different value judgments is a difficult task, partly because they are not evidently positive or negative in themselves, but rather depend on stakeholders’
interests and perceptions (Vanclay, 2002). To deal with this issue and promote stakeholder engagement throughout decision-making processes, academics have developed a series of conceptual frameworks and policy design instruments (Gregory et al., 2012). Participative multi-criteria decision analysis (MCDA) is a family of decision-making protocols aimed at promoting effective stakeholder engagement (Munda, 2004). MCDA evaluates and prioritizes multi-objective management options, giving an analytical framework to consider different perceptions and value judgements in decision making (Estévez and Gelcich, 2015). MCDA has been used in marine (Estévez and Gelcich, 2015) and freshwater (Ananda and Proctor, 2013) ecosystems to make explicit stakeholders' values, perceptions and objectives, and guide trade-offs in decision-making processes. Despite important advances in MCDA, incorporating substantial variation in perceptions which lead to strong trade-offs is an area where research must continue to be developed (Pascoe et al., 2013). Stronger methods to consider uncertainties in the decision analysis process will promote more democratic and participative decision-making.

There are multiple examples of how science and stakeholder values and perceptions have been integrated into designing and setting ecological goals for management in marine and freshwater systems. In Kruger National Park, South Africa, river scientists facilitated discussions among a range of water users outside the park to develop a consensus vision for the ecological health of the park’s river ecosystems. Qualitative stakeholder objectives were translated into quantitative management targets (Rogers and Bestbier, 1997) that now guide water allocation in the river basins.

A particularly striking example of the use of perceptions research has been in the design and initial implementation of environmental flows in the upper Ganges river in India. WWF-India carried out the initial assessment of environmental flows (O’Keeffe et al., 2012), and then presented the report to the Government of Uttar Pradesh (water use in India is governed at the state level), with a request to allow the recommended flows down the river for the six weeks of Kumbh Mela in 2013. Kumbh Mela is a religious ceremony held every 12 years at the confluence of the Ganges and Yamuna rivers, and the 2013 event attracted 89 million pilgrims (Tare et al., 2013) – probably the largest gathering of people in the history of the world. Because the Ganges (the holy mother river of India) is held in such high spiritual regard, the request was agreed, and flows were augmented by between 200 and 300 m$^3$s$^{-1}$ from January to March 2013. Even the farmers whose irrigation water was severely curtailed over Kumbh were in favour of the flow augmentation, feeling proud that they had contributed to the ceremony (Tare et al., 2013). Although many water bodies are assigned spiritual and cultural significance, the Ganges flow provides the first clear example of environmental flows being provided mainly in direct response to such spiritual requirements. These requirements were articulated in a programme of stakeholder interviews, as relating to the positions of steps (ghats) of river-side temples, many of which were built hundreds of years ago, when dry season flows in the river were much less reduced by abstractions (O’Keeffe et al., 2012). Interestingly, the ecological flow requirements, driven by habitat suitability for the endemic river dolphins, matched very well with the spiritual requirements (Lokgariwar et al., 2014). In the context of the Ganges, the spiritual/cultural importance of the river is overt, but most rivers provide a cultural and/or spiritual focus for the communities that live next to them, as well as more concrete goods and services. It is important to understand this focus when planning water allocation and conservation. Even large modern cities are often still centred on their rivers – a boat trip down the Thames, past Hampton Court Palace, Kew Botanical Gardens, Big Ben, the Houses of Parliament, Tower Bridge and the Tower of London, Greenwich observatory, among others is a good example of this.

Research aimed at understanding perceptions to inform the design of conservation initiatives potentially increases the probabilities of a programme or policy fitting the values, cultures, and needs of target participants. In addition, the resulting programme or policy should be considered more legitimate by stakeholders. These factors combine to create conservation programmes or policies that should be better.
adapted to the local context, should provide real value to the users and the community, and ultimately lead to increased levels of participation and programme sustainability.

**THEME 3: PERCEPTIONS OF THE GENERAL PUBLIC AND SUPPORT FOR AQUATIC CONSERVATION**

There is an increasing awareness of the need to engage the general public in aquatic conservation initiatives (House and Fordham, 1997; Poff et al., 2003; Lotze et al., 2011; Gelcich et al., 2014). Research suggests that attempts at communication and engagement of the general public should be sensitive to understanding public perceptions, particularly the ways in which the general public connects with the threats towards aquatic environments and engages in initiatives to promote aquatic conservation. This information is critical to inform both science and policy initiatives towards sustainability (Poff et al., 2003; Carlton and Jacobson, 2013; Chilvers et al., 2014; Gelcich et al., 2014). Research on public perceptions has identified the importance of individuals’ perceptions in determining environmental behaviour (Dunlap and Van Liere, 1978; Hines et al., 1987; Vining and Ebreo, 1992). The public can engage in environmental behaviours such as ecologically friendly consumerism, waste and energy reduction, support for environmental policies, and recycling activities. It is by understanding public perceptions that communication campaigns and conservation policies can be framed in a way that increases the likelihood of engagement by the general public.

As defined in various dictionaries and stated by Novacek (2008) ‘engage’ means ‘to develop meaningful connection with others; to bring into association; or to attract, hold or draw others into some agreed-upon action or service’. Emerging research on public perceptions suggests research should broadly address ‘public engagement’ in terms of the various ways in which people relate to aquatic conservation-related issues (Chilvers et al., 2014). This combines definitions of public engagement as an individual’s state of knowledge, values and behaviour relating to aquatic conservation, with those that emphasize collective forms of public engagement in policymaking, forms of activism, and social innovation (Kasemir et al., 2003; Felt and Wynne, 2007; Wynne, 2007; Chilvers, 2008; Callon et al., 2009; Walker-Springett et al., 2016).

Research on public perceptions can help explain how the general public frames aquatic-related environmental change, including ocean acidification, hypoxia and others (Gelcich et al., 2014). Because public support is key to successful implementation of changes, ignoring public perceptions may well be short-sighted (Spruill, 1997; Poff et al., 2003; Jefferson et al., 2014). Research aimed at understanding how the general public frames different dimensions of complex aquatic impacts can help scientists and policymakers become more knowledgeable about how to trigger and support individual and collective action towards sustainability.

**CONCLUSION**

Understanding stakeholder perceptions is a critical aspect to achieve desirable conservation outcomes. It is a way of recognizing that science must partner with resource managers and other stakeholders in a collaborative process, so that scientific understanding, management strategies, and societal goals are effectively integrated. Conservation scientists need not sacrifice the validity of their advisory and decision-making roles (Poff et al., 2003; Gelcich and Donlan, 2015), but to be effective they must be willing to work with other stakeholders towards common goals in a more democratic process. The use and development of perceptions research is critical to achieve this goal.

The study of perceptions as part of conservation design and intervention assessments is a research frontier which has a great potential to support aquatic conservation initiatives and management, as it contributes to policy coherence and the establishment of a collaborative framework which helps legitimize conservation practices through participation. Research has shown the importance of effectively considering the range of stakeholder perceptions in determining the success of freshwater and marine conservation projects.
Perceptions are an indispensable form of evidence that is useful at all stages of conservation from planning and implementation to ongoing management (Gelcich et al., 2005; Bennett, 2016).

Although the study of public perceptions has much potential to inform approaches for aquatic conservation, translating these concepts from knowledge to action requires on-the-ground engagement with diverse partners to initiate positive change. More participatory management design processes are needed to develop a deeper understanding and social capital necessary for designing and implementing measures based on local stakeholder perceptions. Questions about how one should incorporate variation in perceptions and deal with trade-offs encountered in the multiple value judgments of different stakeholders to inform sound conservation measures remains an important research area which must be tackled.

The three themes highlighted here encompass a set of frontiers emerging from research on perceptions that have potential to improve the sustainability and conservation effectiveness in aquatic environments. However, operationalizing perception research requires careful consideration of how it translates into policy mechanisms and conservation strategies (Kittinger et al., 2013). Promoting and advancing perceptions research is critical in order to maximize its potential in informing on-the-ground action for aquatic conservation and sustainability.

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REFERENCES


