Fisheries Research 206 (2018) 44–56

Contents lists available at ScienceDirect

Fisheries Research

journal homepage: www.elsevier.com/locate/fishres

Working with, not against recreational anglers: Evaluating a pro-environmental behavioural strategy for improving catch-and-release behaviour

Samantha L. Mannheim[a,*], Amber-Robyn Childs[a], Edward C. Butler[a], Alexander C. Winkler[a], Matthew C. Parkinson[a,b], Matthew W. Farthing[a], Tamzyn Zweig[c], Meaghen McCord[c], Natalia Drobniewska[c], Warren M. Potts[a]

[a] Department of Ichthyology and Fisheries Science, Rhodes University, Grahamstown, South Africa
[b] South African Institute for Aquatic Biodiversity, Grahamstown, South Africa
[c] South African Shark Conservancy, Hermanus, South Africa

ARTICLE INFO

Handled by Guest Editor.

Keywords:
Marine shore-based fisheries
Catch-and-release
Community engagement
Reflex impairment
Air exposure

ABSTRACT

Catch-and-release (C&R) is increasingly popular in recreational fisheries as it is thought to protect target species while still allowing anglers to continue recreational fishing activities. Several studies have highlighted high rates of mortality and many sub-lethal effects which ultimately have a negative impact on fish population viability. With poorly developed handling practices, the fish that are released suffer the consequences of physical and physiological stress and do not always survive, thus making the ethics of catch-and-release fishing questionable. Many studies have contributed to our understanding of the factors that influence the fate of fish released by anglers. Despite this, the few interventions which have relied on the knowledge-attitude-behavioural strategy have had little success in improving angler C&R behaviour. The broader pro-environmental behavioural strategies however hold some potential for improving angler C&R behaviour. To test their potential, we partnered with the South African Rock and Surf Super Pro League (RASSPL Africa), the biggest exclusively C&R competitive shore-based angling league in South Africa. The first two years (2013 and 2014) of the partnership were purely focused on building trust and relationships and making observations on angler behaviour. In 2015, we collected baseline data on angler behaviour and fish health during the RASSPL national fishing competition. This was followed by comparable data collection at the following two national competitions in 2016 and 2017 after the introduction of a combination of pro-environmental behaviour interventions, including rule changes, improving angler knowledge, behavioural modelling, rewards, penalties and feedback to improve C&R behaviour. There was a significant decline in the time taken by an angler to place their fish into a C&R bucket and reduction in total air exposure of the fish during a C&R event. There were also improvements in the health of the fish, with a decline in the blood lactate concentration and mean reflex action mortality predictors (RAMP's) scores for the dominant elasmobranch and teleost species. The findings of this study suggest that pro-environmental strategies hold potential for improving the C&R behaviour of anglers and the health of released fishes. It is suggested that interventions to improve C&R behaviour should aim to develop long-term relationships, and implement a broad range of well communicated strategies based on reliable data and sound rationality.

1. Introduction

Catch-and-release (C&R) angling is an important strategy for managing recreational fisheries worldwide. Catch-and-release can be mandatory in response to fisheries regulations (such as a minimum size or bag limit), or voluntary, where individual anglers or groups adopt it as a conservation practice. With rapidly dwindling global fish populations, the prevalence of C&R is increasing in recreational fisheries (Arlinghaus, 2007; Arlinghaus et al., 2009; Brownscombe et al., 2015; Lennox et al., 2015) with studies estimating that 60% of all fish captured by recreational anglers are released (Cooke and Cowx, 2004; Cooke and Schramm, 2007).

Although C&R (both voluntary and mandatory) aims to conserve fish stocks, its efficacy is dependent on the survival and population

* Corresponding author.
E-mail address: manthamann@gmail.com (S.L. Mannheim).

https://doi.org/10.1016/j.fishres.2018.04.016
Received 15 November 2017; Received in revised form 19 April 2018; Accepted 21 April 2018

viability of the released fishes. Several studies have highlighted high rates of mortality (Bartholomew and Bohnsack, 2005; Cooke and Suski, 2005; Gingerich et al., 2007) and many sub-lethal effects (Cooke and Philipp, 2004; Alós et al., 2017; Brownscombe et al., 2017; Ferter et al., 2017), which ultimately have a negative impact on population viability. Since poor handling practices that are normally associated with high mortality make the ethics of C&R questionable (Arlinghaus, 2007; Arlinghaus et al., 2007; Cook et al., 2015), recent research has focused on improving C&R practices (Delle Palme et al., 2016; Brownscombe et al., 2017; Cooke et al., 2017; Gagne et al., 2017). This body of research has found that effective C&R practices include reduced fish fighting times, limited handling times and reducing air exposure time (Davis, 2010; Raby et al., 2012; Cooke et al., 2013; Cook et al., 2015; Delle Palme et al., 2016; Danylchuk et al., 2017).

Up to now, the general approach for improving C&R behaviour has been the dissemination of best practice guidelines to anglers (Cooke and Suski, 2005; Brownscombe et al., 2015; Brownscombe et al., 2017; Sims and Danylchuk, 2017) under the assumption that improved knowledge would lead to changes in behaviour. Indeed, the simple knowledge – attitude – behaviour models (KABs) presume that the problem is the deficit in public understanding and knowledge of environmental issues (Burgess et al., 1998), when in actual fact, a suite of drivers influence behaviour and these should be considered when attempting to alter behaviour.

Since most environmental degradation can be directly linked to human actions (Schultz, 2011; Gifford, 2014), it is vital to better understand drivers behind poor environmental behaviours, specifically in situations where education alone has not yielded results (Schultz, 2011; Gifford, 2014). Studying behaviour and specifically, pro-environmental behaviour (PEB) has proved to be challenging as there is no simple answer as to what drives decision making, but rather a combination of factors, such as childhood experiences, personality, knowledge and education, perceived control and social norms (Gifford, 2014). These multi-dimensional drivers of behaviour have sparked the interest of many and have resulted in much growth in the field of environmental psychology (Stern, 2000; Gifford, 2014; Larson et al., 2015). The study of human-environment interactions and identifying factors that influence behavioural change have become increasingly valuable as it has become evident that moral, educational, incentive driven and community-based approaches rarely work on their own. Ultimately, the most effective behaviour altering programs generally include a combination of intervention types (Stern, 2000). Here, the traditional models such as the KABs have been replaced by more complex models, such as Kollmuss & Agyeman's model (Kollmuss and Agyeman, 2000) of pro-environmental behaviour, which incorporates human values, norms and external factors that shape, and barriers that prevent changes in behaviour. However, despite the rapid development of our understanding of the factors influencing pro-environmental behaviour, no strategic interventions have been developed to improve C&R behaviour. Delle Palme et al. (2016) conducted the first empirical study that assessed the role of educational workshops on angler behaviour and the biological effects on fish health, and found that such community outreach programs can be effective in terms of immediate behavioural change. However, it is uncertain whether single workshops will facilitate deeper learning on the best practice C&R behaviour and whether it will result in long-term behavioural modification. Indeed, there is little evidence of any long-term improvements in angler C&R behaviour. This is not entirely surprising, as pro-environmental behaviouralists have long recognized that improved education alone, does not necessarily lead to better attitudes and pro-environmental behaviour (Stern, 2000; Kollmuss and Agyeman, 2002).

Steg and Vlek (2009) suggested that interventions to improve environmental behaviour are generally more successful when they are systematically planned, implemented and evaluated. Geller (2002) provided a four-step strategy to improve environmental behaviour that may be appropriate in a C&R context. These include: (1) the careful selection of the behaviours to be changed, (2) the examination of what factors cause these behaviours and their antecedents, (3) the application of interventions to change relevant behaviours and (4) the systematic evaluation of the effects of these interventions on the behaviour.

Proposed interventions for changing environmental behaviour include antecedent and consequence strategies. The sequence of Antecedent → Behaviour → Consequence is known as the three-term contingency model, and is the theoretical basis for many interventions aiming to improve environmental behaviour (Geller, 2002; Bolderdijk et al., 2012). Antecedent strategies take place before the behaviour of interest and include education through the provision of information via presentations and modelling videos (Bolderdijk et al., 2012). Consequence strategies operate on the premise that it is human nature to repeat behaviours that have led to positive outcomes and to reduce behaviours that have resulted in negative outcomes (Bolderdijk et al., 2012). These interventions are implemented after the targeted behaviour and generally aim to either reward or penalize certain behaviours.

To evaluate Geller's (2002) four-step strategy in the context of C&R, we conducted a strategic intervention to improve the behaviour of anglers belonging to the South African Rock and Surf Super Pro League (RASSPL). The league adheres to the mandatory release of all captured fish, and its structures and rules are described in Butler et al. (2017). One of the primary aims of the intervention was to improve the health and survival of fishes released as part of the league's activities. This paper describes the intervention with the RASSPL, assesses its impacts on angler behaviour and on fish health, and discusses the relevance of these findings for changing the C&R behaviour of recreational anglers.

2. Materials and methods

2.1. RASSPL competition format

Fish above the minimum size limit of 500 g for teleosts and 1000 g for elasmobranchs are considered for the competition. Once captured, anglers are required to immediately place them into a C&R bucket (38 × 28 × 27 cm) filled with fresh seawater. Fish are then photographed (in the bucket), unhooked, measured and photographed on a mat. The length of the fish is recorded on the angler's card and a witness is required to sign as confirmation of the catch (Butler et al., 2017). A third photograph, with the angler holding the fish with his back facing the sea is required for teleosts above 1000 g and elasmobranchs over 2000 g as they may qualify for a prize before the fish are returned to the sea.

2.2. The intervention

As anglers in South Africa and in many parts around the world are often sceptical of partnerships with scientists (Arlinghaus, 2007; Arlinghaus et al., 2007; Bower et al., 2017), a group of five members from Rhodes University's Department of Ichthyology and Fisheries Science (DIFS) spent two years (2013–2014) simply participating in the RASSPL league as anglers, immersing ourselves into the league culture and gaining the trust of the recreational anglers. Members of DIFS took part in eight franchise competitions and two Nationals before forming the research group. By the end of 2013, we were asked to assist with the development of a database to simplify the complicated league scoring system, which we used as an opportunity to begin collecting catch and effort data for the league. After the successful implementation of the scoring system, members of the research team were asked to join the governing structure as the scientific advisory team with the goal of assisting in improving fish handling practices. No angling was conducted by the research group during data collection years (2015–2017).

We decided to collect baseline data on the behaviour of anglers and the response of fishes to the C&R event during the April 2015 national competition (see Butler et al., 2017). This information was collected to