

Full length article

Characterizing information on best practice guidelines for catch-and-release in websites of angling-based non-government organizations in the United States



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ARTICLE INFO

Article history:

Received 31 January 2016

Received in revised form

14 September 2016

Accepted 18 September 2016

Available online 29 September 2016

Keywords:

Catch-and-release

Recreational fishing

Guidelines

Communication

Non-government organizations

ABSTRACT

Recreational catch-and-release angling is an important tool for managing fish stocks. As recreational fishing is often a culturally or community-based activity, many anglers look to local grassroots and other non-government organizations (NGOs) as a source of information regarding their angling practices. For this study we examined the websites of recreational angling NGOs for mention of conservation and availability of best practice guidelines for catch-and-release fishing. Based on combinations of twelve search terms used on the Google search engine between October 2014 and March 2015, we reviewed 183 NGO websites and evaluated the language used in mission statements and website content for mention of conservation, catch-and-release, and any details related to the handling of caught fish. Any posted guidelines for catch-and-release were compared against scientifically evaluated best practices. During the time of our survey, results showed that <9% of recreational fishing NGOs mentioned catch-and-release anywhere within their websites and almost none provided complete, accurate best practice guidelines. For the small number of websites that did mention or promote guidelines for catch-and-release, there was no difference in the frequency of best practices listed among NGOs that focused on fly fishing, conventional gear fishing, or both. NGOs with a large membership shared more best practice guidelines for catch-and-release on their websites. Whether voluntary or mandatory through regulations, if catch-and-release is to be a valuable tool for conservation, our results suggest that there is a need for greater emphasis on encouraging best practices guidelines to be shared across a broad range of angling based NGOs. Knowledge sharing among angling based NGOs could be an effective way to promote best practices guidelines that ultimately help support the sustainability of recreational fisheries.

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1. Introduction

In recreational fisheries it is estimated that as many as 47.1 billion fish are caught worldwide each year, with over 60% being released (Cooke and Cowx, 2004, 2006). Fish are released because it is mandated through regulations or voluntarily based on a growing conservation ethic within the recreational angling community (Arlinghaus et al., 2007). The desired outcome of catch-and-release is that the fish will survive their capture and handling, and subsequently be returned to the water as fit individuals to contribute to the future of the population (Cooke and Suski, 2005). If fitness is greatly reduced or post-release mortality extensive, then the value

of catch-and-release as a conservation tool for recreational fisheries can be compromised (Cooke and Suski, 2005).

Over the past few decades there has been a growing number of scientific studies focused on quantifying the potential impacts of catch-and-release fishing (Cooke et al., 2013). These studies have identified that the capture, handling, and release of fish can result in physical injuries, physiological stress, behavioral impairment, and short-term post-release mortality (reviewed in Muoneke and Childress 1994; Arlinghaus et al., 2007). Some studies have also revealed that catch-and-release can indeed have an impact on individual fitness (e.g., Richard et al., 2012). Based on the suite of potential impacts, general and species-specific guidelines can be used to reduce the negative effects of capture and handling when recreational anglers are interacting with their catch (Cooke and Suski, 2005).

Disseminating accurate best practice guidelines for catch-and-release fishing to the recreational angling community is essential

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for the adoption and effectiveness of this conservation tool (Arlinghaus et al., 2007; Cooke et al., 2013). The recreational angling community is diverse, as are the preferred modes for receiving information on responsible angling techniques, yet the Internet is increasing in popularity as a source of information for recreational anglers (Nguyen et al., 2012). Almost a decade ago, Pelletier et al. (2007) surveyed the websites of state and provincial government agencies in the United States and Canada to assess the presence and accuracy of best practices guidelines. These websites were largely frequented by anglers for the purpose of renewing their fishing licenses, and therefore had a far-reaching audience. They found that there was great variation in the information available in these websites, and that there was a large presence of misinformation about putting catch-and-release into practice (Pelletier et al., 2007). In fact, some posted guidelines for catch-and-release could be deleterious to fish (Pelletier et al., 2007). Although state and provincial government websites have likely evolved since the time of the Pelletier et al. (2007) study to include accurate practice guidelines for catch-and-release fishing, government agencies are likely not the only source of such information for recreational anglers.

Clubs, associations, and grassroots organizations are relatively common within the recreational angling community, and many of these groups have a presence on the Internet. Given the accessibility of these non-government organizations (NGOs) online, their websites could prove to be a source of information for recreational anglers interested in learning about conservation and best practices for handling and releasing fish. However, to date, there has been no assessment as to the conservation messaging in the websites of angling-based NGOs, including the conveyance of guidelines for catch-and-release fishing.

The purpose of our study was to examine the presence and accuracy of best practices guidelines for catch-and-release recreational fishing on websites of angling based NGOs in the United States. Although the Internet is a global network, we limited our search to NGOs based in the United States to avoid issues with language translation and potential cultural differences, yet we did include organizations based in the United States that intentionally intended to have a global reach. We acknowledge that our study was a snapshot in time and that the addition and attrition of angling-based NGO websites may have occurred since the time of our survey. Given the relative ease of changing material presented on websites, we also acknowledge that websites that still persist since our survey could have changed their content. Nevertheless, we hope that our study does reveal important trends in the communication of conservation information emanating from angling-based NGOs, especially information related to catch-and-release fishing.

2. Materials and methods

2.1. Website searches and filtering

Due to the widespread use of the Internet as a means of finding and distributing information, we focused on websites for NGOs as a representation of the information they are openly informing the public. To gather websites, we used the Google search engine between Oct, 2014 and March, 2015. We surveyed the first 100 sites provided by Google for each of twelve search terms. Search terms included combinations of the terms “angler,” “fishing,” and “angling” with “organization,” “organisation,” “club,” and “association.” Websites were only used for the study if they represented NGOs based in the United States, and were directly accessible by one click from the Google results page (i.e., we did not include websites that were embedded as links in other sites). From these 1200 search results, we eliminated websites that: did not represent

grassroots-style groups of anglers, were property- or clubhouse-based, were primarily focused on retail, were members of a larger organization or group that had a broader mandate than fishing, and, did not provide enough information to enable us to conduct the content analysis. We then conducted a second filter of the remaining websites by reviewing their mission statements to determine if the organizations met our criteria. This filtering process left us with the websites used for our detailed analyses.

2.2. Best practices evaluation

The information recorded from each website included a link to the webpage, the nation/state/region that hosts the organization, the organization’s mission statement, whether or not it was based on members, anglers, tournaments, conservation or education, if the NGO was species-specific, and whether or not catch-and-release was mentioned at all on the website. Any content relating to catch-and-release practices, including pictures and diagrams, was reviewed and assessed for accuracy based on 12 criteria compiled using information from scientific studies and review papers (Table 1; Gilmour, 1997; Muoneke and Childress, 1994; Cooke and Suski, 2005; Pelletier et al., 2007; Wilde, 2009; Cooke et al., 2013). For each website that mentioned catch-and-release fishing, the 12 criteria were given a score of ‘0’ if they were not mentioned or incorrectly defined, and a ‘1’ if they were mentioned and adequately explained. Any language that encouraged practicing catch-and-release fishing was also recorded. The evaluation of websites was conducted by the same investigator to ensure consistency in judging criteria, and a random selection of 20 websites were reevaluated at the end of the survey to examine for surveyor drift.

For the websites surveyed, we examined regional patterns since the motivations to convey guidelines for catch-and-release fishing could be linked to social norms related to target species and predominant type/mode of fishing. For this, based on the origin indicated, websites were divided into six categories based on the division of regions by the U.S. Census Bureau: U.S. based with international scope, U.S. (national scale), Midwest (U.S.), Northeast (U.S.), South (U.S.), and West (U.S.). A Chi square test was then used to compare the distribution of NGOs by region. For those websites that did mention best practices for catch-and-release fishing we compared the number of best practices mentioned by the fishing type the NGO promoted (conventional tackle fishing, fly fishing, or both) using a Kruskal-Wallis test. All statistical tests were conducted using JMP Pro 12.1.0 (SAS Institute, Cary, NC, USA) and the level of significance (α) for was 0.05.

3. Results

From the 1200 websites we reviewed, the filtering process identified 183 organizations that fit our NGO-based criteria. Of these 183 organizations, over 57.9% ($n = 106$) mentioned conservation in their websites, and only 8.7% ($n = 16$) mentioned best practices for catch-and-release fishing. Of the 16 sites that referenced best practices for catch-and-release fishing, seven mentioned more than three of the 12 guidelines presented in Table 1. None of the websites mentioned all of the 12 best practices; the greatest number of best practices presented by any NGO was nine presented by the International Federation of Fly Fishers, followed by the International Game Fish Association and Farmington River Angler Association that each listed six of the best practices. The remaining 13 NGO websites included between 1 and 5 of the 12 best practices for catch-and-release fishing used in our survey. For the relatively small number of websites that included any best practices for catch-and-release fishing, there was no difference in the frequency of best practices listed among those NGOs that promoted fly fishing, conventional

Table 1
Best practices guidelines for the catch-and-release of recreationally targeted fishes. Guidelines presented are based on information provided in Muoneke and Childress (1994), Cooke and Suski (2005), Gilmour (1997), Pelletier et al. (2007), Wilde (2009), and Cooke et al. (2013).

Criteria	Correct conveyance of best practice
Wet hands	Fish should only be handled with wet hands to avoid damage to their skin/scales/protective film (Pelletier et al., 2007)
Air exposure	Exposure of any fish to air should be avoided (Cooke and Suski, 2005)
Handling time	The time that a fish is handled should be limited to reduce stress to the fish (Cooke and Suski, 2005)
Hook type	Anglers should use circle hooks rather than J-hooks to minimize damage to the fish's internal organs and internal bleeding, but safest hook type can differ between species (Cooke and Suski, 2005)
Barbed hook	Barbed hooks should be avoided because they are more likely to damage the fish (Cooke and Suski, 2005)
Habitat-related	Any mention of the preservation of the fish's habitat while angling – for example, polluting the water a fish lives in can cause sub-lethal damage (Cooke and Suski, 2005; Cooke et al., 2013)
Temperature	Different species have varying thresholds of temperature tolerance. During times of higher-than-normal water temperatures, duration of fight and handling time should be minimized (Cooke and Suski, 2005)
Barotrauma	Avoid targeting species that are sensitive to pressure changes (Wilde, 2009)
Specialized tools	The use of certain tools can help reduce the negative impacts of landing a fish (e.g., extractor for hook removal) (Muoneke and Childress, 1994)
De-hooking technique	Proper technique differs between species and hook location. When removing a hook from a fish's jaw, it is important to minimize injury to the fish by not using force. When a hook is lodged deep within a fish's body, it is oftentimes better to cut the line, depending on the species (Muoneke and Childress, 1994)
Release technique	Holding a fish properly and fully submerged while moving it forward in an S-shape or figure-8 will allow water to flow over the gills during release and help to ensure that the fish is receiving oxygen (Gilmour, 1997)
Life history specific	Different species have varying levels of vulnerability to the hazards of angling and should be handled according to their individual tolerances to these exposures (Cooke and Suski, 2005)

tackle fishing, or both (Kruskal-Wallis test, $p=0.31$). Of the 12 best practices guidelines for catch-and-release fishing we assessed in our survey, the most commonly mentioned were use of specialized tools to enable release ($n=8$), hook type (single J-style, circle hooks, treble hooks; $n=6$) and barbed vs. non-barbed hooks ($n=6$), while the least common were habitat-related guidelines ($n=1$) and barotrauma ($n=1$).

Of the 183 websites, 39.3% ($n=72$) were based in the southern region of the U.S., however the distribution of the number of NGOs was not significantly different among regions ($\chi^2=21.50$, $p=0.22$; Fig. 1). The western region had proportionally more websites that mentioned best practices for catch-and-release fishing (14.3%), while the south had the least (4.3%). Several NGOs with <10,000 members mentioned a greater number of best practices for catch-and-release than most NGOs with lower membership or that did not have a membership base at all. For example, the International Federation of Fly Fishers (<10,000 members) and the International Game Fish Association (<30,000 members) communicated nine and six catch-and-release guidelines, respectively. Nevertheless, there were exceptions with some smaller, often local and regional organizations also conveying a number of best practices (e.g. Farmington River Angler Association), as well as some NGOs with over 100,000 members (e.g. Trout Unlimited, Coastal Conservation Association) that did not convey any best practices for catch-and-release at the time of this survey (Fig. 2).

4. Discussion

At the time of our survey, very few angling-based NGOs included best practices guidelines for catch-and-release fishing in their websites. Although over half of the angling-based NGOs specifically mentioned conservation in their websites and mission statements, catch-and-release fishing was promoted by very few. This is likely not too surprising because the motivations and ethics among recreational anglers can be very diverse (Arlinghaus et al., 2007), and the low proportion of angling-based NGOs that include best practice guidelines for catch-and-release fishing could just be a reflection of what is commonly practiced in the recreational angling community. Nevertheless, from a conservation perspective, even anglers that do not voluntarily practice catch-and-release fishing do in fact catch-and-release fish when it is mandated by regulations and when non-target species are caught. As such, if the intent of mandatory catch-and-release is to help manage and conserve recreational

fish stocks, then it could be greatly advantageous to encourage all angling-based NGOs to provide their members and followers with information about best practices guidelines for handling and releasing fish.

Of those few NGOs that included information about best practices for catch-and-release on their websites, only a small fraction offered a robust suite of guidelines. The most frequently mentioned best practice focused on the use of specialized tool, such as pliers and hemostats. Such tools can aid in hook removal and reduce handling times for fish prior to release (Muoneke and Childress, 1994). Hook type (J vs. circle) and using barbless hooks were also frequently mentioned, and in the context of reducing gut hooking and handling time. Selection of hook type and removing the barb from hooks has been shown to be an effective way to reduce impacts of catch-and-release on recreationally targeted fish (Cooke et al., 2012). Although air exposure has been shown to increase physiological stress and recover times for caught and released fish (reviewed by Cook et al., 2015), air exposure was only specifically mentioned by two NGOs on their websites. Barotrauma and the use of descending tools only appeared on one website, yet this stressor is relatively common in recreationally targeted fishes that are brought up from depth (Hannah et al., 2014). Although the types of best practices for catch-and-release fishing being communicated by NGOs could be linked to factors such as the type of fish being targeted and the gear type used (e.g., barotrauma being addressed by groups targeting deep dwelling fish using conventional tackle), our results showed no significant differences among groups that promoted fly fishing, conventional tackle fishing, or both. We did find, however, that a higher proportion of angling-based NGOs in the western region of the U.S. provided best practice guidelines for catch-and-release fishing, potentially linked to trout and salmon catch-and-release fisheries in that part of the country. Interestingly though, at the time of our survey and based on our search criteria, the largest trout-based NGO (Trout Unlimited) did not show up as an organization conveying detailed best practice guidelines for catch-and-release fishing on their flagship website.

Size and structure of angling-based NGOs could influence the capacity to research and share conservation guidelines, including best practices for catch-and-release fishing. Our survey revealed that two large, member-based NGOs (International Game Fish Association, and International Federation of Fly Fishers) conveyed a moderate number of best practice guidelines for catch-and-release fishing on their websites. Large organizations that get consider-

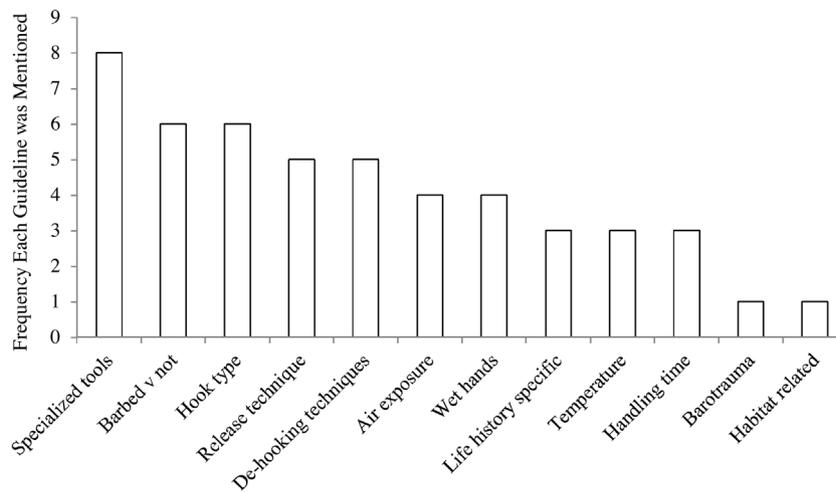


Fig. 1. Frequency of specific best practices guidelines mentioned in websites of angling-based NGOs.

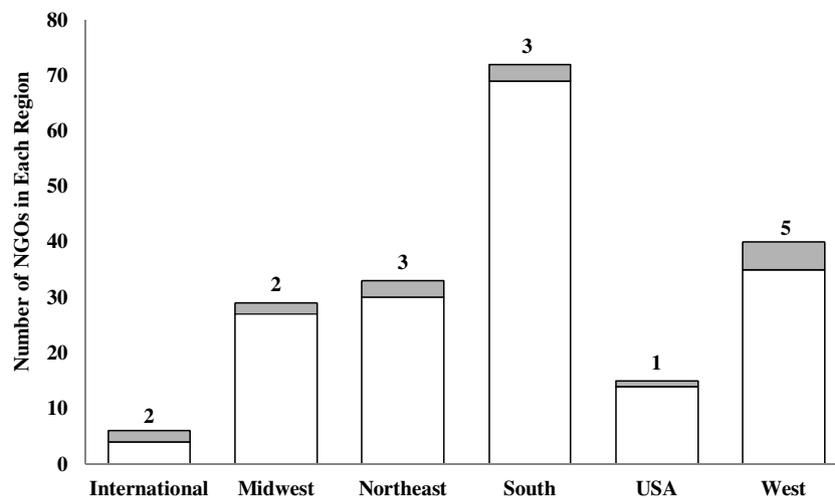


Fig. 2. Total number of NGOs by region. Bars represents the total number of NGOs in each region, with the grey portion of each bar and number representing the portion of NGOs that mentioned best practices guidelines for catch-and-release fishing.

able funding through membership fees, corporate sponsorships, and philanthropic donations potentially have greater capacity (i.e., dedicated staff, often including some with science training) for gathering and sharing conservation related information than smaller, purely volunteer-based, grassroots NGOs. Also, guidelines for catch-and-release fishing developed by the scientific community may not be as accessible to smaller NGOs, because of less access to scientific publications or because their NGOs are not as visible to the scientific community.

More effective channels for communication between scientists and angler-based NGOs are likely needed to help broaden the dissemination of best practices for conservation, including catch-and-release fishing. In the past, scientists were not expected or encouraged to actively engage with stakeholder groups (Wilsdon and Willis, 2004), but rather rely on intermediaries (e.g., journalists, public media offices) to act as the conduits for information sharing. Although these expectations are changing because of a stronger emphasis on ‘broader impacts’ of scientific research, professional expectations related to performance metrics and merit are commonly weighed more heavily on referred scientific journal articles than stakeholder outreach and writing popular media articles (Jensen, 2005). Without direct community engagement, best practices could be misinterpreted or the importance of catch-and-release fishing may not be adequately recognized, even by

segments of the angling community that are mandated to practice catch-and-release (Granek et al., 2008).

Beyond communicating general best practices, it is of equal importance that species-specific guidelines are brought to the attention of anglers (Cooke and Suski, 2005). Species-specific guidelines may be particularly important for NGOs that are focused on a select group of target species and in specific habitats. For instance, techniques to minimize post-release predation might be more relevant for NGOs whose anglers target fishes inhabiting coastal waters with an abundance of sharks and barracuda (e.g., Bonefish & Tarpon Trust, bonefish residing in shallow tropical flats; Danylchuk et al., 2007; Raby et al., 2014). Assisting the leadership of angler-based NGOs in developing a broader understanding of the ‘fundamentals of fish’ while emphasizing that not all fish respond in the same way to capture and handling may, in turn, help these organizations contribute to the consistent and persistent dissemination of best practice guidelines on their websites.

Although angling-based NGOs may compete for website views and membership, websites are also simply communication tools among stakeholder groups that share common interests and goals. Over the last decade, social media (e.g. Facebook, Instagram) has grown rapidly as a way networks of individuals share information, and generally at a faster evolving pace than static websites (except for blogs). As a logical next step to our website survey, assess-

ing angling-based social media forums could provide valuable information about the motivations and conservation best practices adopted by recreational anglers, including catch-and-release fishing. Since the time of our survey, several conservation-based organizations and associated websites have emerged that focus attention on best practices for capture, handling and releasing fish (Keepemwet Fishing, www.keepemwet.org; FishSmart, www.fishsmart.org), potentially hinting at a growing movement related to the communications of scientifically validated guidelines for catch-and-release fishing. Given that recreationally targeted fish are often common pool resources and the health of fish stocks are partially in the hands of recreational anglers themselves, promoting and sharing accurate information on best practices for catch-and-release fishing could play an important role in the sustainability of recreational angling, as well as the maintenance of aquatic ecosystems.

Acknowledgments

Danylchuk is supported by the National Institute of Food & Agriculture, U.S. Department of Agriculture, and the Massachusetts Agricultural Experiment Station and Department of Environmental Conservation.

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