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Actions speak louder than words: Tournament angling as an avenue to promote best practice for pelagic shark fishing

Matthew Heard [a,*], Stephen Sutton [b], Paul Rogers [c], Charlie Huveneers [a]

[a] School of Biological Sciences, Flinders University, Adelaide, Australia
[b] Atlantic Salmon Federation, New Brunswick, Canada
[c] South Australian Research and Development Institute-Aquatic Sciences, Adelaide, Australia

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ABSTRACT

Social research can aid in understanding the behaviour of the general public or stakeholders towards natural resources. In the case of recreational fishing, social research aids in integrating anglers' knowledge and attitudes into management frameworks to increase the likelihood of the uptake of new management regulations. Tournament anglers were surveyed at game fishing competitions throughout New South Wales, Victoria, and South Australia between February 2012 and May 2013 to investigate their general beliefs around sharks and their behaviours when targeting pelagic sharks. Over half (55%) of the anglers interviewed practised catch and release of pelagic sharks. Of those, almost all (98%) asserted that they attempt to release sharks in good condition, but a large percentage of anglers (48%) did not use circle hooks that have been shown to increase post-release survival. Results showing some concordance between angler's beliefs and behaviours when targeting pelagic sharks suggest that anglers are cognisant of the functional role of sharks in the ecosystem and would be open to recommendations ensuring the long-term sustainability of recreational fisheries targeting pelagic sharks.

1. Introduction

Recreational fisheries receive relatively little attention as a potential threat to fish populations compared to commercial fisheries, and the role of the recreational sector in driving stock declines remains largely unknown [1,2]. Recreational catches have been estimated to account for ≈ 12% of total global catches of fish, but recreational catches can also far exceed commercial catches [3,4]. For example, recreational catches from the United States account for 93% of red drum (*Sciaenops ocellatus*) catches in the South Atlantic, and 87% of bocaccio (*Sebastes paucispinus*) from the North-east Pacific [4]. The effect of recreational fishing on fish stocks is difficult to detect due to a lack of quantitative data, however, there is growing evidence that recreational angling can contribute to declines in fish populations, leading to the sustainability of recreational fisheries being increasingly questioned [3–7].

In Australia, estimates of recreational catches range from ≈ 13% [8,9] to 25% [10] of total catches, with recreational catches exceeding commercial catches of some teleost species, e.g. King George whiting (*Sillaginodes punctatus*), mulloway (*Argyrosomus japonicus*), and snapper (*Pagrus auratus*) [11–13]. The most recent National Recreational and Indigenous Fishing Survey in Australia [8] provides estimates of catches for commonly caught teleost species but provides no species-specific information about sharks and rays.

Pelagic sharks have been identified as a group of particular conservation concern because they are susceptible to high levels of mortality as targeted catch and bycatch in high seas fisheries [14]. Reported declines in the northern hemisphere [15,16] and concerns about the population status of several species of pelagic sharks prompted global assessments of the longfin mako (*Isurus paucus*), shortfin mako (*I. oxyrinchus*), porbeagle (*Lamna nasus*) and of three thresher shark species (*Alopias* spp.) as vulnerable on the International Union for the Conservation of Nature Red-list. Subsequent listings of these species under Appendix II of the Convention on the Conservation of Migratory Species of Wild Animals (CMS, of which Australia is a range state) triggered the requirement for legislative protection under the Australian governments Environmental Protection and Biodiversity Conservation (EPBC Act 1999). In addition, the Indian Ocean Tuna Commission (IOTC) passed a resolution to protect all three *Alopias* species in 2010. Following these listings and resolutions the mandatory release of live *Alopias* spp. (IOTC resolution 12/09) and of *I. oxyrinchus, I. paucus*, and *L. nasus* (*EPBC Act 1999*) is required by commercial fisheries within Australian waters. However, the same

* Corresponding author.
E-mail address: matt.heard@flinders.edu.au (M. Heard).

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restrictions are not enforced (IOTC resolution 12/09) or have been directly amended (*EPBC Act amendment part 13*) to allow fishing for these species by recreational and tournament anglers.

In Australian waters, the prohibitions and restrictions on retaining these pelagic shark species by commercial fisheries has led to recreational anglers becoming important stakeholders in the management of *I. oxyrinchus, I. paucus*, *L. nasus,* and *Alopias* spp. stocks. While tournament anglers only make up a small proportion of recreational anglers in Australia (~5%), they tend to fish more frequently and invest more in vessels and gear than non-tournament anglers, therefore representing a disproportionately high percentage of fishing effort [17,18]. Tournament anglers are likely to account for a large proportion of recreational offshore fishing effort and pelagic shark catch as they are equipped to reach offshore areas and have additional incentives to target sharks through points bonuses and trophies during tournaments [8,19]. Catch and release angling is widely practised at game fishing tournaments in Australia with tagging of pelagic sharks playing an integral part of tournament angling [19]. Best practice methods for catch and release fishing (e.g. the use of circle hooks) are promoted by organisations at all levels (e.g. United Nations Food and Agriculture Organisation, International Game Fishing Association, Australian National Sportsfishing Association and the NSW Department of Primary Industries Game Fish Tagging Programme) although, it is unclear what percentage of anglers adopt these methods [20–23].

Recreational fisheries are inherently complex and management must consider the social and economic benefits of recreational fishing along with the effects that fishers have on both fish populations and the environment [24]. Social research can aid understanding the behaviour of the general public or stakeholders towards natural resources [25]. In the case of recreational fishing, social research aims to integrate angler knowledge and attitudes into the management framework and increase the likelihood of the uptake of new management regulations [24,26,27]. There is a large body of evidence showing that individual's beliefs and attitude towards a behaviour will influence their intentions to perform that behaviour see [28]. Few previous studies have compared angler preferences and behavioural intent with their actual behaviour [29,30]. By better understanding angler's beliefs and how they are linked to their behaviours, researchers are able to inform managers on the most appropriate methods to change angler behaviours [29]. Along with the choice to practice catch and release, the gear (e.g. circle or 'J' hooks) and methods that anglers choose to use when targeting pelagic sharks may also have an effect on the survival of line caught released sharks.

This study aims to investigate the beliefs of tournament anglers around sharks and the behaviours of anglers when targeting pelagic sharks. Specifically, the level of catch and release for pelagic sharks was quantified to gain an insight into anglers' fishing practices. Anglers' reasons behind retaining or releasing sharks was examined to better understand what is required to promote catch and release. This study also aimed to explore links between angler behaviours and their beliefs in relation to the value of catching a shark, the value of the existence of sharks to the ecosystem, and the importance of releasing sharks in a good condition. These aims were addressed by measuring the beliefs and behaviours of tournament anglers through surveys at game fishing tournaments in South Australia, Victoria, and New South Wales throughout 2012 and 2013.

2. Methods

Shortfin mako (I. *oxyrinchus*), longfin mako (*I. paucus*), thresher sharks (*Alopias spp.*) and porbeagle (*L. nasus*), henceforth referred to as 'pelagic sharks', were the primary interest of this research due to global conservation concerns relating to these species. The target population for this study was tournament anglers >18 years of age who fish in temperate Australian waters. Surveys were undertaken at game fishing tournaments throughout South Australia, Victoria, and New South Wales. A short 5–10 min questionnaire (Appendix 1) was provided to tournament anglers at boat ramps to collect data on anglers catch of pelagic sharks over the previous 12 months, release practices, gear preference, and beliefs about sharks. An interview based questionnaire was used due to their increased effectiveness at generating responses compared to mail surveys [31]. An opportunistic sampling approach was used as the angling population that we aimed to survey has previously been identified to be a minority of the recreational fishing community particularly hard to reach [32].

2.1. Questionnaire design

Anglers were asked to provide details about their fishing catch and effort targeting pelagic sharks during the previous 12 months. Respondents that had caught or targeted pelagic sharks were provided with the full survey, while those that had not targeted pelagic sharks were only provided with the belief and demographic questions. We surveyed both anglers who targeted pelagic sharks and anglers that did not target pelagic sharks to allow comparisons between the beliefs of these two groups. The population demographics of tournament anglers was assessed, including; age, gender, and education level.

2.2. Dependent variables: Angler behaviours

Respondents were asked questions about their fishing effort (days fished) and catch of pelagic sharks over the previous 12 months. Capture of pelagic sharks is considered to be memorable due to both the rarity and seasonality of these captures and we would therefore expect minimal recall bias and telescoping in estimates over the previous 12 months [33]. Fishers who had fished for, or caught a pelagic shark in the previous 12 months were also asked about the release rate for each species and the reasons for retaining or releasing sharks. We investigated the gear type used by recreational fishers when targeting pelagic sharks by asking them specific questions regarding hook shape and material, and leader material.

2.3. Independent variables: Beliefs about sharks

Respondents' beliefs towards sharks were evaluated through questions asking anglers to rate their level of agreement to a series of statements about catching and releasing sharks. These questions pertain to different aspects of beliefs about sharks and were grouped to measure beliefs on three different domains: (1) importance of releasing sharks in a good condition; (2) value of catching sharks; and (3) conservation of sharks. Broad terms such as 'shark' and 'fish' were used in some survey questions (e.g. I prefer to catch fish than sharks) rather than 'elasmobranch' and 'teleost' to be more easily understood by respondents. Anglers responses to the belief questions were originally asked on a five point Likert scale from strongly agree to strongly disagree. To produce discreet analysis, responses were subsequently collapsed into three categories (agree, neutral and disagree). Belief questions in each of the three domains were grouped and the mean calculated to create an index for each domain. Scores with a value over two represent a positive belief with higher mean scores (>3) indicating strong positive beliefs. Reliability of each question to add to the consistency of each domain was investigated using Cronbach's Alpha.