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Catch and effort from a specialised recreational pelagic sport fishery off eastern Australia

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ABSTRACT

Recreational fisheries are undergoing increasing participation, specialisation and fishing power and contribute significantly to the total catch of several species. The specialised recreational pelagic sport fishery off eastern Australia was studied using a 12-month daytime access point survey. Sport fishing comprised 15% of the fishing trips of the 7243 recreational fishers intercepted, with the majority of fishers being male (90%) and not members of a fishing club (89%). Fishing effort, catch rates and total estimated catch varied temporally, spatially and between fishing club and non-fishing club members. A total of 25 pelagic species were retained or released by fishers and catch rates were very low (0.001–0.047 fish h^{-1}). A generalised additive model incorporating environmental variables provided a useful alternative to traditional direct estimation methods for estimating total annual catch. Estimated sport fishing effort (±S.E.) was 63,802 (±5114) angler hours in 2010. Estimated total catch (±S.E.) for yellowtail kingfish, Spanish mackerel and wahoo ranged between 4.61 (±1.39) and 11.61 (±4.00) t and was equivalent to 27–206% of the 2010 commercial catch for these species. These results demonstrate that the catch from small specialised recreational fisheries can be significant and need to be considered in stock and resource allocation assessments.

1. Introduction

Recreational fishing is undertaken by approximately 11.5% of the global population, who spend billions of dollars annually to participate in this popular social and sporting activity (Aas, 2008; Cooke and Cowx, 2004). Population expansion, particularly surrounding coastal cities, and increases in tourism has led to an overall global rise in recreational fishing participation in recent years (Cooke and Schramm, 2007). Additionally, the increasing affordability of modern fishing equipment (e.g. sonar, electric fishing reels) and efficiency of information exchange between fishers (e.g. internet forums, fishing clubs) has seen a dramatic increase in the fishing power of the recreational sector (Griffiths et al., 2010c; McPhee et al., 2002). As such, the increasing recreational catch in many regions worldwide may have important implications for the sustainability of some species and the broader ecosystem of which they are a part (Arlinghaus and Cooke, 2005; Coleman et al., 2004; Cooke and Cowx, 2004; Post et al., 2002).

Sport fishing can be defined as the targeting of particular species for the excitement of its pursuit and/or capture, rather than for food. In this paper, we define sport fishing as the targeting of pelagic species in offshore waters, which is popular in many regions of the world. Given the technical fishing expertise required and high capital and trip costs associated with sport fishing, it has historically been restricted to more affluent individuals in developed nations (e.g. United States, Europe and Australia) (Ihde et al., 2011; Lowry and Murphy, 2003). However, improved access to many developing nations has driven an increase in sport fishing tourism (e.g. Pacific Island nations) (Whitelaw, 2003). As sport fishing is a highly specialised activity undertaken by a small proportion of the general recreational fishing population, it is rarely specifically incorporated into large-scale survey designs (DFO, 2006; Henry and Lyle, 2003; U.S. Department of the Interior, 2006). Consequently, significant knowledge gaps exist in even the most fundamental aspects of these sport fisheries, such as participation rates, fisher characteristics, effort and catch.

Despite the relatively small size of sport fisheries, their efficiency may contribute to them having a significant impact on populations of target and bycatch species, particularly those that are already exploited by commercial fisheries. Furthermore, as recreational fisheries generally use different techniques than commercial fisheries targeting the same species (e.g. trolling surface lures vs. pelagic longline for striped marlin), the age composition of the catch may also differ. These are important considerations for both stock assessment and ensuring equitable allocation of

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resources between the recreational and commercial sectors. Recent simulations have shown that stock assessment outcomes for individual species can be biased if either recreational data are not included where the age structure of the recreational and commercial catch differ, or if the recreational catch is equivalent to >10% of the commercial catch (Griffiths et al., 2010a).

The eastern coastline of Australia hosts some of the most productive marine sport fishing in the world. The region is composed of complex bathymetry that includes a narrow continental shelf and adjacent deep ocean seamounts to the south, graduating to shallower tropical reef habitats of the Great Barrier Reef to the north. Regional oceanography is temporally dynamic, driven by the warm tropical waters of the East Australian Current (EAC) that seasonally expand into southern sub-tropical and temperate waters (Young et al., 2009). This seasonal biome shift has a marked influence on the distribution of pelagic species such as tunas and billfishes, which are highly prized target species of sport fishers due to their large size, fighting abilities and excellent eating qualities (Kailola et al., 1993; Lowry and Murphy, 2003).

The offshore sport fishery off eastern Australia is a complex multi-species fishery undertaken by less than 1% of the total population (Henry and Lyle, 2003; Lowry and Murphy, 2003). Fishing practices and target species vary spatially and temporally although fishers generally target large pelagic species using rod and reel from large boats suitable for the offshore environment (Lowry et al., 2006; Steffe, 1996). In some areas, the EAC brings warm waters and pelagic fish within close proximity to the coastline, allowing fishers to target species from small vessels and even from the shore (Griffiths, 2012). In addition, fishers generally require specific knowledge, experience and specialised equipment to target, catch and handle large fish, with numerous fishing clubs, fishing tournaments and charter boat operations directly associated with this sport fishery (Pepperell, 2010).

The sport fishery off eastern Australia shares resources with the commercial Commonwealth-managed Eastern Tuna and Billfish Fishery (ETBF), as well as smaller state-managed line and net fisheries. The growing recreational fishing effort towards these shared species in recent years has resulted in conflicts between recreational and commercial sectors over resource allocation of some species, such as striped marlin (Bromhead et al., 2004; Steffe, 1996).

Despite the economic and social importance of recreational fishing in Australia (Henry and Lyle, 2003), researchers and managers are faced with data deficiencies that are similar to many recreational fisheries elsewhere in the world. Specialised fisheries are generally outside the scope of large-scale survey designs (Henry and Lyle, 2003; NSW DPI, 2002; Webley et al., 2009), and there has often been a perception that effort and catch from these relatively small groups is negligible and cost-prohibitive to sample representatively. Although fishing license frames are available for some Australian states, several exemptions exist (e.g. pensioners) and they cannot identify specialised fishers. Due to this lack of a complete list frame of participants, much of the previous research on the sport fishery off eastern Australia has focused on the activities of the more easily accessible components of the fishery, including fishing tournament participants, fishing club members and the charter boat sector (Lowry and Murphy, 2003; Lowry et al., 2006; Park, 2007; Pepperell, 2010). While informative, these studies only represent a small component of the overall sport fishery and significant bias would be introduced if the results of such surveys were extrapolated to represent the total sport fishery (Griffiths et al., 2010b).

The aim of the present study was to undertake a comprehensive investigation of the specialised boat-based offshore sport fishery for pelagic species in eastern Australia using an access point survey (APS). The specific objectives were to: (1) characterise fisher profiles such as target species, fishing methods, frequency of fishing and fishing club membership, (2) examine the effect of environmental parameters (e.g. weather and sea-surface temperature) on fishing effort and catch, (3) estimate the annual effort and catch for the sport fishery using four access points in 2010, and (4) compare annual catches for species shared by recreational and commercial sectors.

2. Materials and methods

2.1. Study area

Four public access points (boat launching ramps) along approximately 200 km of coastline in the vicinity of Brisbane, Queensland, Australia were selected for the APS (Fig. 1). These access points were considered representative of other boat ramps in the region as they encompassed two state government jurisdictions (Queensland and New South Wales), experienced high and low boat traffic, and provided both direct (Mooloolaba and Tweed Heads) and indirect access – via the sheltered waters of Moreton Bay – (Scarborough and Manly) to offshore fishing grounds.

2.2. Survey design

An APS is an on-site prospective survey whereby fishers are intercepted at the completion of a fishing trip (Pollock et al., 1994). This survey method was chosen as it can–with cooperation from fishers – yield high resolution data on fisher characteristics, effort and species-specific catch and size composition. APS can avoid or minimise some of the biases associated with off-site retrospective survey designs, such as recall bias (Pollock et al., 1994).

Stratified random sampling was used, with survey day representing the primary sampling unit (PSU) and each boat intercepted representing the secondary sampling unit (SSU). The survey design was stratified by boat ramp (Mooloolaba, Scarborough, Manly and Tweed Heads), day type (weekday and weekend/public holiday) and month (January–December 2010). Replication of survey days were weighted such that approximately 60% of the sampling effort was allocated to weekends or public holidays to weight in favour of the increased fishing participation at these times following the recommendations of Pollock et al. (1994) and Webley et al. (2009).

Prior to the APS, a pilot study was undertaken to determine peak boat retrieval times to determine the length of a typical fishing day. Preliminary observations of boat traffic were made at each boat ramp on each day type for the entire summer daylight period (approximately 0500–1900 h). This information was used to develop an optimal survey period for the APS that coincided with peak daily boat retrieval times. In addition, survey shift duration was adjusted each month to correspond with seasonal changes in daylight duration.

On each survey day, fishers were intercepted as they retrieved their boat from the water and asked to participate in the survey. As boat was the SSU, one person (usually the owner or skipper) from each boat was interviewed to report on the fishing activity of all people in the boat, although the total number of people in each boat was also recorded. If fishers in a boat had completed some offshore sport fishing (i.e. targeted listed pelagic species) during the survey day and agreed to participate in the survey, they were interviewed. The survey questionnaire collected information on fisher characteristics (e.g. gender, fishing club membership), effort (e.g. target species, fishing methods, duration of fishing) and species-specific catch data (e.g. number and size of fish caught and/or released). Fishing effort in the APS was represented as the number of hours that each angler spent fishing (i.e. angler hours) for pelagic species and was recorded for each specific fishing method used, excluding any time spend travelling or fishing for non-pelagic (i.e. dermersal)