



Catch, effort and fishing practices in a recreational gillnet fishery: Assessing the impacts and response to management change

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ABSTRACT

Gillnets are typically considered to be a commercial fishing gear yet their use by recreational fishers is permitted in several developed countries, often with few if any restrictions on the total number of users. Despite this there have been very few attempts to assess the impacts of recreational gillnet fisheries both in terms of harvest and implications for bycatch. Recreational gillnetting has a long history in Tasmania, Australia, and over the past two decades the fishery has been the focus of a number of management measures to improve fishing practices. In this study, the fishing activity of recreational gillnet license-holders was monitored for 12-months using a telephone-diary based panel survey. Catch, effort and fishing practices were compared with previous recreational fishing surveys and the commercial fishery. During 2010 an estimated 6600 recreational license-holders used gillnets, accounting for 25,712 (95%CI 22,142–28,901) net-days of effort and a total catch of 173,922 (95%CI 147,165–202,950) marine organisms, 35.5% of which were discarded. The recreational fishery is comprised of two main sub-fisheries, a mixed reef-fish fishery and a fishery for marine farm escapees. Four species, three representing key target species and one primarily a bycatch species, accounted for just over half of the total gillnet catch by number. The harvested component of the recreational gillnet catch was comparable to or exceeded commercial landings for the key species, highlighting the importance of taking account of the recreational fishery in stock assessments and species management. Despite an increase in the number of gillnet license-holders, recreational gillnet effort in Tasmania has halved since the late 1990s. This decline in effort appears to be linked to the greater regulation of fishing practices as well as reduced availability of two key target species, one of which has been classified as over-fished. Although recreational fishing practices have improved, the impacts on target and non-target species, including the incidental capture of seabirds and survival of bycatch, remain issues for concern.

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1. Introduction

Hook and line fishing, known as angling, typically characterizes and dominates recreational fisheries (Arlinghaus et al., 2007). Recreational fishers do, however, use a range of other gears such as set-lines, traps, spears, and nets to target fish (Arlinghaus and Cooke, 2005). Nets include seine, fyke and gillnets, fishing gear that is more often associated with commercial fishing operations. Unlike angling where non-consumptive motivations, including the practice of catch and release, are important (Fedler and Ditton, 1986; Sutton and Ditton, 2001; Arlinghaus et al., 2007), the primary, if not sole, motivation for using gillnets is to catch fish for harvest, whether for consumption or bait collection. Recreational gillnet use

is permitted in several European countries (Pawson et al., 2008), some U.S. states (including North Carolina, South Carolina, Virginia and Alabama) and New Zealand (Dawson and Slooten, 2005). While restrictions surrounding gillnet use vary markedly between jurisdictions, very limited information is available for these fisheries (Moore, 1980; FGFI, 2007; Sparrevohn and Storr-Paulsen, 2012; Wynne-Jones et al., 2014).

In most Australian states the recreational use of gillnets is prohibited or very restricted. Tasmania is an exception and gillnets are used to target a diverse range of coastal finfish species, many of which are typically difficult to catch using angling methods. Gillnetting commenced soon after European settlement (Harries and Croome, 1989), with both commercial and recreational sectors active. Following the introduction of restrictions in the 1890s, mainly relating to minimum mesh size and some no-netting areas, regulations governing the recreational use of gillnets remained virtually unchanged for about a century (Harries and Croome, 1989).

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Licensing of recreational gillnets was first implemented in 1995 at which time individuals were permitted to register up to two 50 m 'graball' nets (mesh size of 100–140 mm) and one 50 m 'mullet' net (60–70 mm mesh size). In 2002 the number of permissible graball nets was reduced to one per person and the maximum length for a mullet net reduced to 25 m. License numbers rose steadily from about 5800 in 1995/96, when almost 8900 gillnets were registered, to almost 9500 in 2008/09, at which time there were 10,250 registered nets. Since then license numbers have declined, with over 8100 license-holders and 8900 registered nets in 2012/13. During 2012/13 an estimated 83,000 Tasmanians participated in some form of recreational fishing in saltwater (Lyle et al., 2014), implying that almost 10% of marine recreational fishers held a recreational gillnet license.

Even though recreational fishers have restrictions on the amount of gear and quantities of fish they are permitted to take, the sheer number of participants means that the sector can have significant impacts not only in terms of harvest (Coleman et al., 2004; Arlinghaus and Cooke, 2005) but also as a consequence of variable and potentially poor fishing practices. During the past decade there has been a succession of management changes in Tasmania intended to improve recreational gillnet fishing practices and reduce wastage. In 1998 gillnets were required to be marked, using different combinations of surface buoys, to indicate whether they were deployed as a day or overnight set. This measure was implemented to address a common practice of leaving recreational gillnets unchecked for excessively long periods, often up to 24 h or greater (Lyle, 2000). In 2004 overnight netting was prohibited in all areas apart from Macquarie Harbor (Western Tasmania) (Fig. 1). Maximum soak times were introduced in 2009, mandating that gillnets could only be set for a maximum of two hours in areas designated as Shark Refuge Areas or a maximum of six hours in other waters (apart from those where overnight netting was still permitted) before being checked and cleared of catch.

Despite these management changes, there has been growing community concern about the impacts of gillnetting on target and non-target species, including calls for a total ban on recreational gillnet usage. There is, therefore, a need to better understand how recent management initiatives have influenced netting practices, and to assess the impacts of both commercial and recreational sectors on target and non-target species. The only previous detailed assessment of the recreational gillnet fishery was undertaken in the late 1990s (Lyle, 2000), prior to the implementation of management changes relating to night netting. At the time recreational gillnet catches were similar to or higher than commercial catches for several key species (Lyle, 2000). Presently there is limited information to assess the effectiveness of management changes in terms of reducing bycatch and wastage. The current study was developed against this background with two main objectives, the first to assess recreational gillnet catch and effort and the second is to describe current gillnet fishing practices in the context of recent management changes and varying availability of key species.

2. Materials and methods

2.1. Survey design

The survey involved a two-stage process; an initial screening interview to collect profiling information and then a panel survey in which fishing activity was monitored in detail over a twelve month period. The recreational licensing database provided the sampling frame from which a stratified random sample of license-holders (primary sampling unit) was selected. Stratification was based on matching the license-holder's place of residence with res-

idential strata (statistical divisions) used by the Australian Bureau of Statistics. Sampling intensity was increased for north-western Tasmania (Mersey–Lyell statistical division, Pink, 2011) as a strategy to increase precision in estimates of fishing activities in the sparsely populated north-west and west coasts.

Screening interviews were conducted by telephone during November and December 2009 and respondents were asked about the number of days fished using gillnets during the previous 12 months and their likelihood to renew their gillnet license during 2010. Respondents who already held a license for the 2009/10 season (November 2009–October 2010) or indicated an intention to renew their license were deemed eligible for inclusion in the panel survey and were invited to participate in a follow-up 'diary' survey. Those who agreed were mailed a simple fishing diary and a letter of introduction. Diarists were contacted by telephone shortly afterwards to have reporting requirements explained and to arrange follow-up interviews. Diarists were contacted regularly by telephone throughout the diary period (January–December 2010) and details of any gillnet fishing activity since they were last contacted was recorded by survey interviewers. The frequency of the contact was tailored to the needs and behavior (level of fishing activity) of individual respondents, although in most instances diarists were contacted at least once a month, reducing recall bias associated with any non-diarised data. This approach also negated the need for respondents to return their diary cards at the end of the survey period. This respondent-centric management approach has proven very effective in producing high response rates and maintaining data quality and completeness (Lyle et al., 2002).

Information recorded for each gillnet fishing event included date, location, type of net used (graball or mullet net), species targeted (up to two), set and haul times, number of times the net was checked, and catch composition by numbers retained and discarded. Two separate events were recorded if both types of gillnet (graball and mullet net) were used on a given day. The reason or reasons for discarding catch was recorded by species for each fishing event. Particular care was taken to ensure that respondents reported fishing activity and catches that related only to gillnets licensed to them. Five fishing regions were defined for the analysis of fishing activity; D'Entrecasteaux Channel (DEC), South-east, East, North and West coasts (Fig. 1). Although the difference between set and haul times represents a measure of effort (net-hours), the accuracy of reported times was variable (not always diarised). An alternative measure of effort, the number of separate days on which license-holders fished with their registered gillnet(s) (regardless of set duration or number of times the net was retrieved) was adopted as the measure of effort for analysis. Overnight sets were treated as representing a single net-day. Catch rates were determined as the number of fish caught on each given net-day.

2.2. Data analysis

The license status for each diarist was established by reference to the license database and stratum expansion factors were calculated as the size of the licensed population divided by the number of licensed diarists. However, since the number of persons licensed at a given point in time changed throughout the year, both the sample (i.e., number of licensed diarists) and total number of licensed fishers (i.e., licensed population) changed during the enumeration period. In order to account for this dynamic, the number of license-holders registered and the number of diarists licensed at the end of each month provided the basis for calculating expansion factors that were applied to fishing activity for that month.

Furthermore, recognising that there is turnover in licensing between years, where not all fishers renew their licenses and others who were unlicensed in the preceding season (either novices

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