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Survey to estimate the national recreational catch of Southern Bluefin Tuna in Australia

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Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES)

Postal address GPO Box 858 Canberra ACT 2601

Switchboard +61 2 6272 2010|

Facsimile +61 2 6272 2001

Email info.abares@agriculture.gov.au

Web agriculture.gov.au/abares/

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Acknowledgements

Survey to estimate the national recreational catch of Southern Bluefin Tuna in Australia

Summary

Australia's national recreational catch of SBT has not been quantified. Acknowledging that good stock management requires consideration of all sources of mortality, Australia has established a formal methodology to estimate mortality of SBT resulting from recreational fishing. This will include a series of on-site and off-site surveys of the SBT recreational catch over the 12-month period 1 December 2018 to 30 November 2019. The survey methods described here have been extensively tested and reviewed and are deemed to be the most cost effective and scientifically robust methods to assess the recreational catch of SBT in Australia. A number of methodological components, including final sampling coverage rates for on-site and off-site surveys, questionnaires and some survey output specifications are still being refined. Potential survey biases have been considered and mitigated where possible, noting that recreational fishing surveys generally necessitate finding a balance between cost and accuracy. It should be acknowledged that such a survey will only provide one data point and recreational catch of SBT in Australia is likely to vary from year to year due to the influence of environmental, oceanographic and other variables.

Introduction

SBT is a valuable commercial fish stock and is also caught by recreational fishers in waters under the jurisdiction of the Australian states of Western Australia, South Australia, Victoria, Tasmania and New South Wales. The species is listed under Australia's *Environment Protection and Biodiversity Act 1999* and is classified as conservation dependent.

In recent years, a number of Australian states have reported survey data on the recreational catch of SBT. These studies have been isolated events and of limited use in estimating a national catch of recreationally-caught SBT. Nonetheless, these surveys, as well as a large and disparate body of anecdotal evidence and numerous 'guesstimates', suggest that Australia's recreational catch of SBT may have increased during the last decade.

The dispersed spatial and temporal nature of recreational fishing generally means that surveying a sample of the recreational fishing population is required. Survey results are then scaled up based on a known population and sample fraction to derive quantitative estimates of catch, effort and other quantities of interest. Recreational fishing surveys for large regional areas are complex and the methods employed need to be tailored to the survey objectives (Lyle et al. 2002; Pollock 2003; Jones and Pollock 2012). In general, recreational fishing survey methods can be on-site (i.e. on the water or at access points), off-site (e.g. phone, mail, diary and computer based) or a combination approach (Jones and Pollock 2012).

On-site methods, such as creel surveys, are generally effective at capturing information relating to niche fisheries by targeting areas (such as boat ramps) known to be used by fishers targeting a particular species. However, the size of the area of interest and temporal variation in catch and effort means on-site methods are likely to be logistically challenging and costly at the scale required to survey recreational catch of SBT in Australia (Jones and Pollock 2012).

Off-site surveys are conducted away from fishing sites and include mail, e-mail, internet and telephone surveys (Jones and Pollock 2012). Generally, off-site surveys are less expensive than large-scale, on-site surveys and information can be obtained from fishers not easily contacted using on-site surveys, such as those fishing from private jetties or returning to moorings. Off-site surveys (telephone and diary based) are suitable for estimating the recreational catch of SBT but are reliant on a suitable sampling frame (e.g. fishing licence database).

The most cost-effective method for estimating the recreational catch of SBT in Australia is different for each State jurisdiction based on the unique characteristics of fishing in each location as well as the sampling frames available. Consequently, the method to survey the

Australian national catch of SBT is based on a combination of survey methods. In situations where a suitable sampling frame is not available for off-site surveys then on-site surveys are the only cost-effective option. On-site sampling for SBT have been designed for locations where SBT are resident for longer periods and effort is concentrated (e.g. Victoria) and locations where SBT fishing activity is diffuse and episodic (e.g. South Australia). Both locations require different sampling intensities to provide robust estimates.

Off-site surveys have been deemed to be the most cost-effective option in Tasmania and New South Wales. Off-site surveys will be based on a 12 phone month diary survey in Tasmania and a recall survey in New South Wales as the SBT season only lasts a few months in that state. The estimates from these approaches will be combined with estimates of recreational harvest from charter boat logbooks and game fishing tournament data to provide a total estimate for each state and for Australia. A size validation survey will also be conducted to verify the off-site component of the survey. It is intended that information on the weights of fish collected will be used to derive a total estimate of recreational fishing mortality in tonnes.

Survey scope

The survey aims to assess the daytime recreational boat catch (retained and released) of SBT in Australia over a 12 month period commencing on 1 December 2018 and finishing 30 November 2019. Diary surveys will be conducted from 1 December 2018 to 30 November 2019. On-site surveys will be run over a 12 month period from December 1 2018, noting that sampling may not be required for a full 12 months and will be scaled to adequately and robustly cover the fishing season between December 1 2018 and 30 November 2019. Total estimated catch will be reported for each state and summed for a national estimate.

Surveys will be conducted in South Australia, Victoria, Tasmania and New South Wales. The estimated catch from Western Australia will be provided via a boat based phone diary survey conducted by the Western Australian Government.

Sampling frame and coverage

A fundamental component of all survey methods is an appropriate sampling frame. A sampling frame refers to the population from which a subset (sample) will be screened and interviewed in order to produce comprehensive sampling coverage with the least bias. The sample must be representative of the target population in order to provide statistically robust population estimates. The frame needs to capture all (or the vast majority of) potential respondents. A frame targeted to the fishery or species of interest will improve efficiency, precision and reduce cost. Developing robust and cost-effective sampling is a key priority for designing off-site and on-site surveys (Arlinghaus et al. 2010; Jones and Pollock 2012). The sampling frame for New South Wales is the one and three year fishing licence database and in Tasmania the MAST recreational boating registration database. These frames have been used in previous recreational fishing surveys.

Table 1. Approach for surveying jurisdictions to obtain a national estimate of recreationally-caught SBT, given the currently available sampling frames, and the indicative sampling coverage

Jurisdiction	Survey type and sampling frame	Indicative sampling coverage*
Western Australia	Off-site using the 'Recreational Fishing from a Boat' licence sampling frame	Based on WA periodic survey
South	On-site	580 days
Victoria	On-site	130 days
Tasmania	Off-site using boat registration sampling frame	Determined via previous surveys
NSW	Off-site using recreational fishing licence frame	Determined through modelling and scenario testing and to be undertaken by external service provider

* Yet to be finalised

Moore et al. (2016) field-tested a survey in South Australia and conducted modelling and scenario testing to determine an appropriate level of sampling coverage. Bootstrap analysis and data simulation modelling were applied to estimate the error associated with catch estimates given different survey intensities at particular locations. This provided an indication of how well the survey designs were likely to perform in localities where fishing activity is more diffuse and episodic. This testing indicated that decreasing sampling coverage below what is currently proposed would increase the level of error around catch estimates. The likely rate of error for the proposed national survey will be (+/- 30 per cent). Increasing the error bands beyond this, by decreasing sampling effort in order to save costs, was shown to limit the usefulness of the survey outcomes.

Overview of recreational fishing survey methods to be used in the Australian national survey of SBT catch

Telephone-diary (off-site) surveys

Telephone-diary surveys are an effective method of assessing recreational fishing catch and effort and are considered more appropriate when the survey area is large (Jones and Pollock 2012). Respondents are contacted by phone and a structured interview is administered to record data on fishing activity. The number and frequency of interviews administered depend on the survey objectives and budget. Telephone surveys generally have high response rates (Henry and Lyle 2003; Lyle et al. 2014; Tracey et al. 2013).

Historically, the publicly available Australian White Pages® directory has been used as a sample frame for telephone-diary surveys. However, its suitability for cost effectively finding SBT fishers in the population is too limited. As a result, the off-site components of the Australian national survey of recreationally-caught SBT will be reliant on licence or registration frames in jurisdictions where these exist. Sampling frames based on recreational fishing licences are particularly effective at targeting respondents because the purchase of a licence indicates an intent to participate, and in the case of specific permits, fish within a targeted fishery. Boat registrations will also provide a more targeted sampling frame, given that recreational SBT fishing is almost exclusively boat based.

General recreational fishing licences are currently only required in Victoria and New South Wales and in both states some exemptions apply. Exemptions are typically given to people under the age of 18, people fishing in private waters, Aboriginal or Torres Strait Islander people

and concession card holders. The impact of the exemptions on the representativeness of a licence database as a sampling frame is not known. The absence of a general recreational fishing licence in other states where SBT are caught means they do not provide a national sampling frame. The intention is to use the New South Wales recreational fishing licence frame in that jurisdiction.

Given that recreational fishing for SBT occurs almost exclusively from boats, a boat-based fishing licence can provide a targeted and appropriate sampling frame. Currently, Western Australia is the only state that applies a boat-based fishing licence. This will be used as the sampling frame for the Western Australian component of the national survey of recreationally-caught SBT (to be undertaken as part of WA's periodic state-based survey).

Tracey et al. (2013) used the Tasmanian vessel registration database as a sampling frame for an off-site survey targeting recreational game fishing, including SBT. This has been determined to be the most effective sampling frame in this jurisdiction.

Access point (on-site) surveys

On-site surveys are routinely used to assess the catch and effort of recreational fishers in Australia (Green et al. 2012; Tracey et al. 2013) and internationally (Dunlop and Mann 2012; Llopart et al. 2012). On-site angler surveys are typically used to assess catch and effort of a particular area or of a type of fishing activity. They are often labour intensive and depending on the number of locations and temporal coverage required can be costly to undertake and complex to roll out over large areas. One advantage is that they allow for the direct counting and measurement of landed fish that can be used to estimate weights (Jones and Pollock 2012).

Access point surveys are conducted at defined access points for the fishery; typically, this is at boat ramps, marinas and public jetties. This captures activity at a central point and allows a census or sample of anglers using these areas (Pollock et al. 1994). This approach works well when anglers are concentrated at focal points. This substantially reduces screening costs and typically provides greater coverage of fishing activity. As the number of access points increase or access becomes more diffuse this approach is less applicable. On-site surveys have been used to estimate SBT catch in Victoria, where there are relatively few access points (Green et al. 2012). A comparison of on-site access point and off-site surveys has been used in Tasmania to sample SBT recreational fishing (Tracey et al. 2013).

Like off-site surveys, on-site surveys rely on having an appropriate sampling design. A spatio-temporal sampling design is used for on-site surveys. The design uses periods of time available for fishing and all access points (or as many as are feasible given the cost) for the fishery. Decisions need to be made regarding the period of time the sampling will be conducted over (e.g. fishing season, calendar year) and what sampling units are appropriate (e.g. entire day or part day, boat or individual angler). Sampling times and locations are usually randomly determined and surveys are conducted according to probabilistic based sampling requirements. This allows for robust estimates of catch and effort with limited sampling bias. The random sample design can be weighted by known strata to increase precision.

Given the large spatial and temporal differences in availability and access to SBT around Australia any on-site surveys of recreational catch will need to be at an appropriate scale to accommodate this variation. The most useful implementation scale is at the state level, with stratification of access points within states. Providing on-site surveys are based on probability based sampling it will be possible to include estimates from on-site surveys to provide a

national estimate based on summing the estimates from each jurisdiction. The current design for on-site surveys in this study use information already obtained as to which boat ramps to survey for SBT fishing. Modelling has been undertaken to assess the most appropriate level of daily sampling coverage.

Analysis and report writing

It is envisaged that data analysis and draft report will be completed by 30 June 2020.

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