Review of the Telephone Diary Survey of the Tasmanian Recreational Rock Lobster Fishery

Prepared for Tasmanian Association for Recreational Fishing Inc. (TARFish) GPO Box 2198, Hobart, Tasmania, 7001.

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Reviewer:

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Brief Biographical Sketch

Professor Ken Pollock, Fisheries Centre, Murdoch University,

Professor Kenneth Pollock is an expert in developing ways to produce statistical estimates from populations of fish or wildlife. He is a Professor in Quantitative Methods in the Centre for Fish and Fisheries at Murdoch University in Perth, Australia. He obtained his undergraduate degree from Sydney University and his masters and Ph D degrees in Biometrics from Cornell University in Ithaca, New York, USA. He worked for many years at North Carolina State University in Raleigh, North Carolina, USA before coming to Murdoch University.

An expert in quantitative methods for fisheries, wildlife, and conservation biology, Pollock has developed many novel sampling methods including a special mark-recapture sampling design called the Robust Design. He is an elected fellow of the American Statistical Association for his research into sampling animal populations. He has authored and co-authored several books and monographs and over 200 scientific papers in peer reviewed journals.

Pollock has worked extensively on innovative ways to survey recreational anglers and authored and co-authored widely used reference books and on the subject (Pollock et al. 1994, Guthrie et al. 1991). He was a member of an NRC Panel in the US convened to evaluate marine recreational fishing survey designs (NRC 2006). Currently he is investigating ways to improve and validate phone diary and other surveys of recreational anglers.

Brief Executive Summary

1. Census methods using mandatory logbooks or mandatory tagging of all recreationally harvested lobsters are not really practical for the recreational fishery due to the large numbers of participants in the fishery.
2. A probability based sample survey approach is needed and only an off-site telephone diary survey method is likely feasible. This is current practice and no other good options appear to exist at reasonable costs.
3. Ideally the license frame (list of potential survey participants) used should be for the current year but that is not practically possible for a diary survey starting at the beginning of the fishing year. Therefore past year licence holders are contacted and therefore enhancement of the current design by drawing an additional sample of new licence holders that had not had a license the previous year should be considered.
4. Of the original sample of 1030 where contact was attempted 608 of those in the population of interest provided the diary information which is substantial attrition and may lead to some nonresponse bias in the estimates. This survey seems well run in that all parts of the process are documented and refusal rates were quite low. I agree with current practice of not adjusting for nonresponse bias.
5. As the refusal rate is very low currently there is no need to use incentives to keep the response rate high but that may be necessary in the future especially if management restrictions occur.
6. Enhancement of the current telephone diary survey with an onsite-validation survey on one Region over part of the fishing season should be considered. This would be quite costly as there could be the need for a larger sample of telephone diarists in the region as well as the extra costs of the on site survey.
7. The survey was originally designed to estimate numbers of fish. The estimation of weight and then estimation of uncertainty of weight estimation needs much more attention.

8. I do not recommend reducing the frequency of the surveys to less than the current level of every other year. In fact a case could be made that the survey should be run every year.
9. The current survey was designed with the objective of providing state wide estimates of good precision. However, now Regional estimates are becoming more important to management of the fishery. Enhancement by using stratified random sampling by Region and with some increased sample size in each Region is needed. It is not possible to state exactly how much the sample needs to increase with the information available to me currently. I provide concrete suggestions on how to carry out various analyses to arrive at new sample sizes in the more detailed review which follows.

Review

Brief General Introduction

Procedures for estimation recreational fishing harvest and effort differ markedly from those for commercial fisheries because they are made from probability based sample surveys commonly called angler or creel surveys. This is in contrast to commercial fisheries, which typically use mandatory catch reports and are thus obtain a census of the population. Validation of these catch reports using commercial fishing income receipts usually ensures a high level of compliance in reporting harvest. Except possibly for certain recreational-charter boat fisheries, mandatory reporting of recreational effort, harvest and released catch is not feasible (NRC 2006).

The most crucial aspects of designing recreational angler surveys are deciding on appropriate contact methods and appropriate spatial (area) scales for which accurate estimates are needed. Traditionally, angler surveys were usually done at small spatial scales like a lake or small river and used direct onsite methods like access point and roving surveys (Pollock et al. 1994). These surveys allow on site harvest inspection but not released catch that is self-reported. Off-site telephone survey designs to cover much larger spatial scales

have been used in the US and Australia in different forms. Telephone surveys to estimate effort combined with on site access interviews to estimate harvest rate have been used in US marine surveys (Essig and Holliday 1991, NRC 2006). Telephone surveys with fishers contacted repeatedly using a panel diary approach has been used in recent surveys especially in Australia to estimate both harvest and effort (Lyle et al. 2002, Henry and Lyle 2003, Lyle et al. 2005). This is because the larger spatial scales (state or nation) involved make necessary the use of an offsite method despite the fact that all the data is angler self-reported.

In practice, there is always a trade-off between quality of estimates and survey costs that dictates both the feasible methods to use in a survey and the final spatial scale at which precise estimates can be achieved. I now turn to the specifics of my review of the Tasmanian recreational rock lobster fishing survey where these key issues will continually reappear.

Brief Description of Survey

A brief summary of the current telephone diary survey follows (Lyle et al. 2005, Lyle and Tracey 2010). The survey is run every two years with the sampling frame being the previous year's license file. (The sampling frame is a list of potential participants from the population and from which we draw the sample). Contacts in a screening survey are asked if they plan to fish the next year. All the contacts that state they plan to fish are recruited to the diary survey and sent a letter of introduction and a diary by mail. The diary survey phone contact by trained interviewer is roughly once per month for the rest of the year and more frequent if the fisher is avid (i.e. fishes very frequently) to reduce recall bias (that is bias due to memory errors).

Strengths of the approach are its reasonable cost for the large spatial scale covered, relatively high response rates and relatively low response measurement errors.

Some weaknesses or potential weaknesses of the survey are its possible response measurement errors due to all the data being self reported, that the

frame sampled has to be from the previous years fishers rather than the current years fishers, and the growing difficulty of using telephone surveys with the rise in mobile phone use. Another weakness is that the survey was designed to provide statewide estimates and now is increasingly being used to provide regional estimates. These will be considered further as I develop my review.

Crucial Review Points

1. Mandatory Logbooks- Total Effort and Harvest estimates (broken down by sector into Commercial and Recreational) are necessary to the management of the Tasmanian Rock Lobster Fishery. A census based on mandatory logbooks is used to obtain estimates of the Commercial Effort and Harvest. This is practical because of the small number of fishers involved and because verification using catch receipts is feasible. Further substantial penalties exist for inaccurate reporting. However, census methods using mandatory logbooks or mandatory tagging of all recreationally harvested lobsters are not really practical for the recreational fishery. This is due to the large numbers of participants in the fishery (a license file of approximately 21,000) and the difficulty in verifying the recreational logbooks.
2. Probability Sample Survey Approach-There is the need for a probability based sample survey approach and theoretically there are many options for such a design. Possible designs are based on off-site (Telephone, Mail) or onsite (access point, roving) methods. However, the large spatial scale (whole coast of Tasmania and then separate Regions) makes many possible on-site methods too expensive or impractical so that only an off-site telephone survey method is likely feasible. The alternative off-site mail survey method is likely to suffer from high non response rates and serious recall problems and is therefore not feasible. Another off-site method based on internet or email surveys is also impractical.
3. Sampling Frame is Previous Years License File- Ideally the license frame (or list of potential survey participants) used should be for the current year

but that is not practically possible because it is desired that the survey start from the beginning of the fishing season. Enhancement of the current design by drawing an additional sample of new licence holders that had not held a license the previous year should be considered. This is because new licence holders may have different fishing characteristics than previous licence holders

4. Sampled Population- The sampled population is licensed recreational rock lobster fishers. Unlicensed recreational effort and catch is outside of this population and survey and therefore outside the scope of my review.
5. Response Process- The response process is complex as is common in all surveys that are based on a license file list frame. There is also additional complexity due to using the previous years licence holders. I refer to Figures 3 and 4 in the latest report (Lyle and Tracey 2010). For the screening survey there was a loss of 4.4% due to no current telephone number being available and then a further 12% loss due to being non contactable (10%) or refusals to participate (2%). In addition 8.6% were out of scope because they stated they were unlikely to fish the next year. Finally another 6% of the in scope respondents (i.e. those who said they would fish this year) refused to take part in the diary survey. Thus gross sample size reduces from 1030 at the beginning to 741 that actually took up the diary survey. There was further attrition at the diary phase with a 6% drop out rate and also a surprising 13% did not renew their license despite indicating they would in the screening survey. Of the original 1030 where contact was attempted 608 provided the diary information. This survey seems well run in that all parts of the process are documented and refusal rates were quite low. Also it would be very difficult to adjust the estimates for possible non response bias but the fact remains that there is the potential for some non response bias. I wonder if there is any potential to reduce the 10% that are non contactable by changes to the licence process and recording of information as that seems quite high?

6. Response Rate and Incentives- As the refusal rate is very low currently there is no need to use incentives to keep the response rate high but that may be necessary in the future especially if management restrictions occur. Of course the use of incentives is a very complex one which would have to be studied very carefully.
7. Response Errors and Onsite Validation Survey- Telephone diary surveys provide self-reported data that may contain some measurement errors (recall bias due to memory problems, prestige bias due to exaggerations, telescoping where events from outside the survey period are recorded as inside the period and rarely deliberate lies). Further as noted in 5 there is a lot of attrition in the response process. Enhancement with an onsite-validation survey on one area over part of the season should be carefully considered. This would be quite costly as there could be the need for a larger sample of telephone diarists in the region as well as the extra costs of the on site survey. The design details of a possible onsite validation study are not presented here.
8. Weight Estimation- The survey was originally designed to estimate numbers of fish. The estimation of weight and then estimation of the uncertainty in the weight estimation needs more attention. First it is clear that the important length weight relationship used to predict weights from lengths is based on work by Punt and Kennedy (1997) and should be redone as it is based on very old data. Also I would recommend obtaining length data from a random subsample of diarists if practical. There is uncertainty in the precision sense at many stages in the estimation of weight. Some of these involve: imputation of lengths for fish where lengths were not available; prediction of weight for fish from their lengths; and expansion from the sample to the population. Use of a simulation or resampling should enable inclusion of all these sorts of uncertainty into a measure of precision (standard error) but it will take some high level time of the statistician in charge of the survey. In addition uncertainty due to

various biases in the observed lengths and weights should also be considered

9. Other Estimation Issues- As the number of license holders is changing over the fishing year the expansion to obtain population level estimates of catch and effort need to take this into account. This appears to have been handled correctly in the current survey.
10. Frequency of Surveys- I do not recommend reducing the frequency of the surveys to less than the current level of every other year. In fact a case could be made that the survey should be run every year especially if more detailed Regional management occurs in the future.
11. Stratification – I recommend that the survey be changed from a simple random sample of licence holders over the whole state to a stratified random sample based on the regions of residence of the licence holders. A simple random sample is one where each member of the population has equal probability of being chosen. A stratified random sample is one where each stratum (Region) is sampled separately with a fixed sample size in each. Then within the stratum each member of a stratum (Region) has equal probability of being chosen.
12. Sample Size State Level Estimates- The current sample size is adequate for obtaining precise estimates at the state level. The proportional standard error (PSE) which is standard error divided by the estimate and expressed as a % is 7% for total harvest number estimates in Table 2 (Lyle and Tracey 2010). This seems very reasonable as this corresponds to an approximately 95% Confidence Interval of + or – about 14,000 around an estimate of 105,538. The precision of harvest by weight estimates is currently unknown (point 8 above) and will not be quite as precise as for the harvest by numbers estimates but would almost certainly be adequate at the state level.
13. Sample Size Regional Level Estimates- Increased sample size is definitely needed if precise estimates are also required at the level of each region including the ones with a small harvest. I examined Table 3 of Lyle and

Tracey (2010) and converted the confidence intervals for each region to very approximate PSE's with the results 10%, 14%, 18%, 20%, 31%, 21%, 25% and 25% for areas 1-8 respectively. A rather arbitrary guide to precision is to argue that less than 10% PSE indicates a very precise estimate while between 10-20% PSE indicates a reasonable level of precision for an estimate. One possibility would be to increase the sample sizes in each region. It should be kept in mind that to halve all the PSE's above would mean increasing the sample sizes by 4 because the standard error is proportional to the square root of sample size. This is clearly very costly and such an increase is unwarranted because poor precision of regions with small harvest like 5, 7 and 8 is likely not all that important. Another more reasonable approach would be to group the regions into say 3 or 4 groups constituting larger regions in which case the current survey would have a very reasonable level of precision in each of those larger regions.

14. Sample Size-Recommendation- Consider precision of estimates by numbers and by weights for the regions and groups of regions once the precision for weights estimates have been developed. This will require deciding on the groups of regions that make most fisheries management sense. Decide on a reasonable level of precision which could be 10% or perhaps 15% PSE for each group of regions. I suspect that a criterion of this type would necessitate some moderate increase in sample size but I cant provide an exact increase with the information I have available at present.

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