Consultant's Report: Review of Washington's Puget Sound Sampling Program

F. Jay Breidt* and Jean D. Opsomer†
Colorado State University

Virginia Lesser‡
Oregon State University

February 7, 2011

1 Introduction

During the two-day meeting in Montesano, Washington, on November 8–9, 2010, we met with Washington Department of Fish and Wildlife (WDFW) staff to discuss WDFW's Ocean Sampling Program and its Puget Sound Sampling Program (abbreviated as PSSP in what follows). In this document, we will provide our initial reaction to the design and estimation procedures for the PSSP.

The PSSP collects large amounts of information on the characteristics of both catch and effort in Puget Sound, in a very challenging survey environment (as further detailed below). Data collection is done by several complementary surveys with designs of varying complexity, and those design features are currently not explicitly accounted for in estimation. While the resulting estimates of catch volume and characteristics certainly appear reasonable, the fact that they do not reflect the sampling design makes it difficult to fully justify them statistically, potentially making WDFW vulnerable to criticism about its estimates. An associated problem is that the

*jbreidt@stat.colostate.edu.
†jopsomer@stat.colostate.edu.
‡lesser@science.oregonstate.edu.

measures of precision such as confidence intervals and coefficients of variation are almost surely too optimistic.

The components of the PSSP form an excellent basis from which to start designing a survey program that is more statistically justifiable. Doing so will definitely require a more in-depth look at the PSSP, but we will provide some initial ideas in that direction later in this document.

2 A Challenging Survey Environment

Estimating characteristics of the catch and, to a lesser extent, the fishing effort in Puget Sound is clearly extremely challenging. Even a somewhat cursory list illustrates the range and magnitude of the problems faced by the PSSP:

- Unlike in the case of the OSP, access to Puget Sound is not restricted to a small number of ports. Instead, fishing boats can depart from a large number of ports of varying sizes, and a possibly large amount of shore fishing takes place as well. Not all of this angling activity is captured well in the PSSP. For example, a substantial fraction of the ports are not available for sampling (private ramps/marinas), and shore sampling is rare or non-existent. This leads to concerns about potential bias, since fishing behavior is likely to vary by public versus private and boat modes versus shore modes.

- Fishing behavior appears to display a component of "flash fishing" (a term we made up for lack of a better one), with heavy fishing activity concentrated in a specific place for a short time in a way that is difficult to predict ahead of time.

- WDFW is required to sample a large fraction ($> 20\%$) of the salmon catch, which limits the overall flexibility of the sampling program.

- Puget Sound fisheries are surveyed by three different entities (WDFW, Canadian fisheries agencies, US tribal agencies), making estimation of overall catch and effort characteristics for the region more difficult.

3 Some Highlights of the Current Approach

The PSSP is an intensive survey program and has many good features, which clearly reflect the fact that WDFW is committed to producing high quality and reliable estimates of the total catch and its characteristics in Puget Sound, at fine spatial and temporal scales. During our meeting in November, we noted the following:

- The core of the PSSP consists of the intercept surveys at public boat ramps, which are conducted year-round ("baseline sampling") and augmented with more intense sampling during the peak seasons ("intensive creel surveys"). This gives good temporal resolution throughout the year and captures a large fraction of the fishing activity.

- Interviewing for the two types of intercept surveys uses a uniform data collection method, allowing the data to be readily combined. Interviewing covers all or most of the fishing day and includes counting of all anglers/boats, resulting in high quality information at the site level.

- The intercept surveys are complemented by two additional data sources related to catch: the on-water surveys and the test fishing program. The on-water surveys make it possible to estimate the fraction of fishing activity that occurs from out-of-frame launch sites. This is an important element of the overall estimation procedure for what appears to be an unavoidable undercoverage issue. The test fishing program provides insights into some of the detailed characteristics of the catch, which is valuable as an external validation for the intercept survey data.

- Washington has an on-going licensing program, which provides a frame for a telephone survey to estimate fishing effort. This makes it possible to conduct a much more efficient and cost-effective survey of anglers than a random-digit dialing survey.

- We noted with appreciation the current efforts to interpret, re-code, and document the estimation methodology. This is extremely important for producing a system that can be continuously updated and improved over time, even with changes in staffing.

4 Some Issues

The following is a list of the major issues we identified related to the PSSP.

- The current intercept surveys (baseline and intensive creel) are clearly set up to cover most of the fishing activity, with an emphasis on sites and times with higher fishing pressure. It appears that significant components of the overall design are informal, with sampling supervisors making the assignments based on local knowledge and occasionally adjusting them "on the fly" when fishing activity is known to congregate in certain areas. Allowing this level of independence to sampling supervisors has the advantage of flexibility and makes it possible to maximize the number of interviews ("headhunting"), but lack of an overall formal sampling design opens the door for criticisms of subjectivity. It also makes the system heavily reliant on the experience and expertise of the sampling supervisors, which is not easily transferred to future WDFW staff unless it can be converted into formal protocols.

- In addition to the issues associated with subjectivity in site selection, a key problem with the lack of a formal sampling design is that it is difficult to create sampling weights that account for the fact that some sites are selected more often than others and to estimate the true sampling variability of the estimators. The lack of weighting can result in bias in the estimates, and the lack of recognition of the fact that the observations are clustered by site-day means that the estimated measures of precision (CV, confidence intervals) are too optimistic.

- There are clearly issues with undercoverage in the current intercept surveys. The issue of private boat ramps and marinas is something that is unlikely to be fixed, and the on-water intercepts seem like a good way to estimate (at least) the fraction of fishing activity launched from those inaccessible sites. The current intercept surveys seem to completely miss shore fishing, which might be a significant issue unless it is a trivial fraction of the total catch. It is possible that shore fishing targets a different mix of species, so that using a "ratio-ing" solution might not work in this case.

- The PSSP appears to have some components that are more closely related to convenience sampling. This includes the ability of sampling

supervisors to send interviewers to fishing sites that are "hot" because of short-term presence of large numbers of fish, and the Voluntary Trip Reports (VTR) card program. The former can most likely be formalized and incorporated in an overall intercept survey sampling design (see below). But because the latter is completely voluntary and lacks any controls on response quality, it cannot be viewed as a survey data source and hence should not be combined with the intercept data in making overall estimates of the catch characteristics.

- The effort estimates are based on a telephone survey of licensed anglers. There are some issues associated with this frame, including the fact that some licenses can be obtained from boat captains and are not available for sampling, the telephone number information is incomplete on the other licenses, and not all anglers are licensed.

5 Suggestions for Possible Improvements

The following are some suggestions for improvements to the PSSP. These are based on our initial understanding of the features of the PSSP. Of course, these suggestions would need to be investigated carefully to determine their statistical efficiency, logistical feasibility, and cost effectiveness.

- The baseline and intensive creel surveys already use a frame of access sites and partly apply a formal procedure to select sampling site-days, using the Murthy two-per-stratum PPS design. Extending the sampling design so that all or most (see the next point) of the interview assignments are determined by a formal mechanism would put the program on a much stronger statistical footing. Such a design could use some of features of the new MRIP design currently being field-tested in North Carolina, including assigning fishing pressures to sites and periodically updating them, and combining multiple low-pressure sites into "super-sites" for the purpose of making interviewing assignments. The key component of the sampling design would continue to be spatial and temporal stratification with PPS by pressure within the strata. Note that sampling supervisors' experience and expertise are ideally used in the construction of strata and pressure matrices, as an example of the kind of formal protocols noted under "Issues" above.

- If it is desired to continue allowing sampling supervisors to deploy interviewers to areas with very high short-term fishing activity, there are a number of ways to incorporate such a feature in a formal sampling design. One way is to update the fishing pressures prior to drawing samples to reflect the new information, so that samples are drawn in light of the most recent information and will contain a larger number of the newly more "interesting" sites. Another way is to hold back a fraction of the total assignments when drawing the samples, and then deploy them as needed to "hot spots." If the latter is done, then these assignments do not follow the overall design, and the way to incorporate those data into the overall sample is to make them "self-representing." An example of this in a different context might be a sample of companies, in which a few very large ones are thought to be so important that they must be part of the sample and are drawn with certainty. These companies become self-representing, which means they receive a weight of one.

- The license-based frame provides a cost-effective way to collect the data used for estimating fishing effort. However, like almost all such frames, it suffers from undercoverage, and it might be useful to investigate a dual frame approach, in which the license frame sample is supplemented by a general-population sample. The latter can either be used to make combined estimates across both frames, or can be used to determine the adequacy of the license frame. A separate issue concerns the fact that some people might have licenses but their contact information is either not available for sampling or is incomplete. Dual frame approaches typically cannot correct for this type of problem, so that efforts should be undertaken to ensure that the contact information is available for license holders.

- Because the ultimate goal of the PSSP is to estimate characteristics of the catch of anglers in Puget Sound, it seems important to coordinate data collection and estimation procedures across the different agencies responsible for Puget Sound fisheries (WDFW, Canadian fishery authorities, tribal fishing authorities). Of course, this point is broader than the PSSP and might not be something that WDFW has any control over.

Survey Review Final Status
Marine Recreational Information Program

Provider Name: **Cory Niles**
Survey: **Washington Puget Sound Sampling Program (PSSP)**
Date of Review: **2/7/11**
Date of Final Response: **5/13/11**

Provider Instructions: Read the review and provide feedback if desired. Feedback includes accuracy, usefulness, and potential to implement recommendations. Comments on the review process are also welcome.

1. Accept final report: ☒ Yes ☐ No

2. Submitted MRIP proposal(s) in response to review: ☒ Yes ☐ No

3. Formal Feedback Provided: ☐ Yes ☒ No

   3a. Type of formal feedback provided: ☐ Corrections ☐ Comments

   3b. Corrections incorporated in final report: ☐ Yes ☐ No

   3c. Comments attached: ☐ Yes ☐ No

Notes:
We would again like to thank MRIP for supporting this review. As you will see, we have found the comments very helpful and are already moving to implement certain recommendations.

WDFW Comments on:

Consultant's Report: Preliminary Review of Washington's Puget Sound Sampling Program (dated 2/7/11)

We very much appreciated the opportunity to work with the MRIP consultants during the review of Washington Department of Fish and Wildlife's (WDFW) Puget Sound Sampling Program, conducted November 8-9 in Montesano, Washington. After thoroughly reviewing the MRIP consultants' document titled "*Consultant's Report: Preliminary Review of Washington's Puget Sound Sampling Program*" (dated February 7, 2011), we at WDFW are in full agreement with the consultants' analysis of our sampling program, issues raised, and recommendations made for possible improvements. We do not see any flaws in the review or misunderstandings of program, and we do not anticipate asking for revisions or re-visitation of any major issues.

The WDFW Puget Sound Sampling Unit (PSSU) is eager to address several of the MRIP consultants' recommendations for improving the intercept survey in particular, as exemplified in our submission of a proposal for MRIP funds that was submitted in late January 2011 (project concept attached). Specifically, our proposal focuses on work we can start immediately to improve the scientific rigor of the Baseline Sampling design. The consultants recommended incorporating a formalized site selection approach for the Baseline design that is scientifically defensible and repeatable rather than the current approach based on the sampling supervisors' discretion; i.e., a randomized, formalized probability-proportional-to-size (PPS) approach designed for selecting Baseline sampling sites, similar to the approach PSSU currently uses for selecting Intensive sampling sites. Also, the consultants recommended refining PSSU's database structure to enable distinguishing Baseline versus Intensive records in the recreational fishery database. In addition, they recommended adding a field to the recreational database that would contain the probability value (site "size measure") used for selecting Baseline and Intensive sampling sites. These probabilities would then be incorporated into subsequent catch estimation steps in our computer program. Each of these deliverables would be accomplished as part of fulfilling the objectives of our recently-submitted MRIP proposal.

Once again, we thank MRIP/NOAA and the expert consultants who worked with us for the objective, helpful reviews, clear communications, sharing of knowledge and expertise, and recommendations offered for our Puget Sound Sampling Program. We intend to carry forward with continued improvements to our sampling program in the years to come.