

West Coast Sardine Survey – 2010

Response to September 2009 STAR panel Research Recommendations

The following narrative gives a point-by point description of how the 2010 West Coast Sardine Survey intends to address the recommendations of the STAR Panel held at the NOAA / Southwest Fisheries Science Center, La Jolla, California, September 21-25, 2009.

Research Recommendations

The Panel noted that most of the short-term recommendations of the May 2009 Panel had been implemented and identified a number of additional recommendations (not in priority order).

1. Further attempt to quantify (and then account for) the impact of “edge effects” on photographs, including the effect of calculating school weight for an estimate of school area, in which only part of a school is visible in a photograph.

Ryan: Select a set of photographs with multiple sardine schools present from the 2009 survey archives. Work with Tom to design an evaluation of the impact of “edge effects”. Conduct the analysis by analysing the photographs. Repeat analysis with photographs from the 2010 Summer and Fall surveys. Use IMU data from Fall Survey if feasible (see Research Item 4, below).

2. Further attempt to calibrate the scheme used to estimate surface area from photographs. Specifically, calibration experiments should consider objects which do not have a regular shape (e.g., a baseball field was identified as a possible “target”) and explore whether there are “analyst effects” and/or “photograph effects” by analysing existing and future calibration data. (SUMMER/FALL)

Ryan: Select photographs from the 2009 survey calibration tests in the PNW and/or CA, where a baseball diamond (or another irregular shaped object) can be used as a target. Work with Tom to design an evaluation of “analyst effects” and/or “photograph effects”. Conduct the analysis with Photo Analysis Team. Repeat analysis with calibration photographs from the 2010 Summer survey, and photographs provided by Doyle from the Fall Pilot Study.

3. Future research should consider methods that can be used to determine the proportion of sardine schools that are visible from aircraft. Acoustics (e.g., from fishing vessels) was identified as one potential method to achieve this goal.

As part of the Fall Pilot Study, Doyle will design and conduct a study to compare school sightings from aerial photographs with acoustic sampling of the same transects during the collaboration with the CalCOFI cruise in the S. Ca. Bight.

4. Continue to refine the approach used to identify sardine schools in photographs. The use of mosaicing and recording lines on the images were identified as possible areas of investigation.

As part of the Fall Pilot Study, Doyle will be conducting aerial transects using the same camera equipment employed in the 2009 survey – with the addition of a new roll/pitch (IMU) sensor. This roll/pitch data will be used to investigate the feasibility of geo-referencing the survey photographs.

5. Examine the trade-offs associated with different flight heights between area surveyed and the ability to fly transects.

An analysis of sample size requirements (see 2010 EFP Application) showed the value of obtaining more survey area coverage. Additional (and faster) airplanes are planned for the 2010 survey to improve our likelihood of increasing area coverage and also completing replicate transects.

6. Estimate the variation in the perceived size of sardine schools using multiple photographs of the same schools.

As part of the Stage 2 sampling, schools will be photographed before and during the process of conducting the point sets. Multiple photographs of the same school (3 or more) taken prior to the vessel capture of the school will provide data to conduct this analysis. Tom will conduct this analysis using data from the Summer Survey and also using data provide by Doyle from the Fall Pilot Study.

7. Refine the method of variance estimation to account for all sources of uncertainty. Specifically, identify methods (e.g., based on bootstrapping; see Adjunct 2) that can take into account: (a) inter-transect variation in density, (b) uncertainty about the school weight – school area relationship, (c) variation for individual schools about the school weight – school area relationship, and (d) uncertainty arising from attempting to estimate the size of schools.

An analysis of sample size requirements (see 2010 EFP Application) demonstrated the use of a method of variance estimation based on bootstrapping to account for (a) and (b), above. Tom will develop an extension of this approach and will use the data collected in the analyses described in Research Items 2 and 6 (above) to evaluate the additional sources of uncertainty identified in (c) and (d), above.

8. Consider the use of geostatistical methods to estimate sardine abundance and the uncertainty of the estimate, especially if the likelihood of obtaining multiple replicates within a single aerial survey is likely to remain low.

The classical random sampling approach is preferred if logistics permit, however, geostatistical methods may be employed in the future if the 2010 survey again fails to yield multiple replicates.

9. Consider further stratification of the area surveyed during the aerial survey. In particular, consider the benefits of offshore strata. Such strata could have lower coverage, consistent with likely lower density.

We expect increased (coastwide) survey coverage and better transect replication in 2010. The data collected in 2010 should help to better evaluate the potential advantages of refinements in stratification.

10. Consider whether it is possible to use acoustics to calculate the density associated with schools that are too large to be sampled using point sets. Consideration must be given to the impact of vessel avoidance in the analysis of such data.

As part of the Fall Pilot Study, Doyle will evaluate the feasibility of using acoustics to calculate the density of schools that are too large to be sampled using point sets (data permitting).

11. Collect data on environmental conditions from point sets (e.g., using onboard loggers) and explore whether environmental covariates explain some of the variation about the school weight – school area relationship.

We have no plans (at present) to equip fishing vessels with onboard loggers to record environmental data. As part of the Fall Pilot Study, Doyle will be collecting point set data in areas where CalCOFI surveys will be logging environmental variables. It may be possible to begin to explore whether environmental covariates can help to explain some of the variation about the school weight – school area relationship with this pilot data.

12. Refine how photographs are analysed to account for pitch and roll.

As part of the Fall Pilot Study, Doyle will be conducting aerial transects using the same camera equipment employed in the 2009 survey – with the addition of a new roll/pitch sensor. Tom and Doyle will evaluate how the use of this pilot data may be used to improve how photographs are analysed to account for pitch and roll in future surveys.

13. Provide all of the data on which the aerial survey estimate is based (including the original photographs and details regarding school size identification and quantification) to the STAT.

Ryan has compiled (and indexed) all of the 2009 Survey data on which the aerial survey estimate of sardine abundance is based. The data are archived on a 1TB external hard drive. A copy of the 1TB archive has been provided to Dr. Kevin Hill at the SWFSC.

Additional recommendations from the May 2009 STAR Panel:

- Record qualitative information related to processing photographs, and the difficulty in assigning species and calculating school areas.

This is routine procedure for the Photo Analysis Team. Ryan will work to further formalize how this information is collected and reported in the future.

- Observer effects when viewing photographs could be evaluated using double-blind comparisons and similar techniques.

The analyses described in Research Item 2, as well as additional multiple-reader analyses using photographs taken on transects during the Summer Survey and the Fall Pilot Study will be conducted using the double-blind technique.