

**Report on the  
Stock Assessment Review (STAR) Panel for Pacific Ocean Perch and Petrale Sole**

Prepared for:  
The Center for Independent Experts

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## **EXECUTIVE SUMMARY**

*The CIE independent report shall be prefaced with an Executive Summary providing a concise summary of the findings and recommendations, and specify whether the science reviewed is the best scientific information available.*

The Stock Assessment Review (STAR) Panel for Pacific Ocean Perch (POP) and petrale sole took place at the Hotel Deca, 4505 NE 45<sup>th</sup> St, Seattle, from 20<sup>th</sup> to 24<sup>th</sup> June 2011. The review was hosted by NWFSC. The meeting was of necessity fluid due to the difficulty of presenting extensive materials and responding to multiple requests against a rigid schedule. The difficulty was caused by the large amount of ground to be covered in arguably too short a time, placing pressure both on STAT Team members and reviewers. Nevertheless, for both petrale sole and POP, the Panel reached a point where agreement was reached on what would constitute base case runs and sensitivity tests, and what would go in to decision tables. Given time available, the final base case runs using MCMC and sensitivity tests still needed to be run after the Panel meeting ended, and the final decision tables prepared.

The assessment models for both petrale sole and POP are complex, fitting to multiple indices, extensive composition data, and catch data. Both assessments effectively estimate productivity parameters using composition data from recent periods (and, to a lesser extent, indices) and back calculate virgin biomass by application of the productivity estimates and taking account of removals. The estimates of virgin biomass thus rely both on composition data (and, to a lesser extent, indices) and catch histories. Estimates of depletion of importance to management are relative to estimates of virgin biomass and are thus similarly influenced by data.

Given the importance of data, most notably composition data which receive high weighting, and catch histories, it is essential that these data sets are of the highest quality. The review process was such that it was not possible to look in depth at all issues related to data collection, processing and analysis. There remains a need to look in detail at all catch reconstructions and discard estimates and also to evaluate carefully composition data to determine correlations and appropriate weighting. Survey indices and CPUE for POP were not extensively reviewed but all seemed to be appropriate. A major issue for petrale sole is the use of CPUE data; considerable progress has been made on this issue in recent years and a CPUE was fit in the model; it will be necessary to elaborate and develop this work as management changes take place.

The assessments of POP and petrale sole were implemented using Stock Synthesis 3. Stock Synthesis has been extensively used and the main software and extensions have been validated and documented. Nevertheless, there were questions raised about the POP implementation relative to the previous (non SS3) assessment which raise technical issues that need to be resolved. During STAR 2, all model runs were to MPD stage only. Tuning of model runs followed standard procedures with multiple passes to refine index and composition weights. Full MCMC runs for both stocks have been conducted only on the candidate base cases brought to the meeting and there do not appear to be any problems with convergence; none are therefore expected with the Panel-defined base case MCMC runs, but this is not guaranteed.

The models for both POP and petrale sole are complex and the likelihood surfaces are quite flat, at least in the dimension of key productivity parameters. Exploration of the surfaces was reasonably thorough and uncertainty seems to be well depicted. The models and methods used are fairly standard and I see no major causes for concern. A number of suggestions and recommendations are made.

## **BACKGROUND**

### **Petrale Sole**

Petrale sole (*Eopsetta jordani*) is a right-eyed flounder distributed from the Gulf of Alaska to Baja California. It inhabits soft bottoms in depths ranging from 0 to 550 meters. The lifespan of Petrale sole is of the order of thirty years, reaching maturity at 5-8 years. The assessment region for petrale sole considered in this review covers the US west coast ranging from Point Conception, through Oregon to the USA-Canada border. Although there are likely linkages with petrale sole in British Columbia, these are assumed to be negligible.

Petrale sole were first reported in California fisheries in 1876 and in Oregon in 1884. The fishery developed during the 1930s but increased markedly during the war years, reaching a peak of 3,500 to 4,000 tonnes per year. Catches fell steadily from the early 1950s. From 1981 to present, the annual catches have varied between about 1,200 and 2,800 tonnes per year. From the beginning of the fishery and through the war years, catches occurred almost exclusively between March and October (the summer season) at which time the stock is dispersed over the continental shelf. After the war, there was a steady decline in both the amount and the proportion of catches during the summer months. At the same time, catches between November and February (the winter season) increased steadily; during winter, the fishery targets spawning aggregations. Since the mid-1980s, catch volumes during the winter and summer seasons have been comparable.

Petrale sole was last assessed in 2009. At that time, the point estimate for depletion of the spawning biomass at the start of 2009 was 11.6%, having declined from an estimated 16.4% in 2005. The estimate of fishing mortality rate in 2008 was 0.29. At the time of the last assessment reference points for petrale sole were based on a  $B_{msy}$  proxy of 40% virgin spawning biomass. At the time of assessment, the stock would have been characterized as overfished and subject to overfishing. However, subsequent to the assessment, the PFMC adopted new reference points for flatfish; a stock is now considered overfished when it is below 12.5% of virgin spawning biomass, and recovered when it reaches 25% of virgin spawning biomass. Against the revised reference points, the stock was classified in 2010 as overfished. It is unclear if it would have been classified as subject to overfishing.

### **Pacific Ocean Perch (POP)**

Pacific Ocean Perch (*Sebastes alutus*) (POP) is a rockfish with a lifespan of the order of 100 years and relatively early maturity at 5-9 years. It is most abundant in the Gulf of Alaska but distributed also off the coasts of Washington and Oregon. The assessment region for POP considered in this review covers only the Columbia and Vancouver INPFC areas ranging from southern Oregon to the USA-Canada border. Although there are linkages with POP in British Columbia these are assumed to be negligible in the assessment.

POP in the assessment area was subject to removals of 5,000 to 20,000 tonnes during the mid-1960's, primarily by foreign vessels. Fishing by foreign vessels ended in 1977. Between 1969 and 1994 removals were of the order of 1,100 to 2,200 tonnes per year. By 1995, management measures reduced landings to below 900 tonnes, with subsequent landings falling steadily to between 60 and 150 metric tons per year from 2002 to 2010. Since 2002, the total catch, including discards, is estimated to be between 80 and 180 tonnes.

POP was last assessed in 2009. At that time, the point estimate for depletion of the spawning biomass at the start of 2009 was 28.6% and the estimate of fishing mortality rate  $F$  was 0.006. For West Coast rockfish, a stock is considered overfished when it is below 25% of virgin spawning biomass, and recovered when it reaches 40% of virgin spawning biomass. Overfishing for POP is considered to be occurring when  $F$  is above  $F_{msy}$  (estimated as 0.0406 in the 2009 assessment base model). Based on the 2009 assessment, POP on the West Coast was therefore characterized as recovering, and overfishing not to be occurring.

## REVIEW PROCESS

**ToR 7** *Provide a brief description on panel review proceedings highlighting pertinent discussions, issues, effectiveness, and recommendations*

The Stock Assessment Review (STAR) Panel for Pacific Ocean Perch (POP) and petrale Sole took place at the Hotel Deca, 4505 NE 45<sup>th</sup> St, Seattle, from 20<sup>th</sup> to 24<sup>th</sup> June 2011. The review was hosted by NWFSC.

Participants in the review are listed in Appendix 3. The STAR Panel comprised a PFMC SSC appointed Chair (Conser), a NWFSC appointed reviewer (Ianelli, AFSC) and two CIE reviewers (Chen and Stokes). The rapporteurs (Ianelli and Stokes) for the STAR Panel reports, were notified in advance. The STAR Panel was tasked with providing separate reports for POP and petrale Sole. Notification of the meeting and dissemination of papers followed closely the schedule laid out in the CIE Statement of Work (see Appendix 2). Materials were provided in advance *via* a dedicated ftp server (see Appendix 1). Overall, administration of the review was sound.

The Terms of Reference (ToR) for the review are given in Appendix 2, Annex 2. Often, reviews including CIE experts focus on a particular phase of the stock assessment process – either the data inputs or the assessment *per se*, and often deal only with a single stock. The ToR set for the STAR 2 review (and other STAR meetings) is very wide, spanning for each of petrale sole and POP, data quality (including collection and analysis) and the stock assessment. Given the scope of the ToR and review meeting, it was not possible to devote as much time as would be desirable to every issue area.

The meeting followed the general outline of the draft agenda (Appendix 2, Annex 3) but of necessity was fluid due to the impossibility of presenting extensive materials and responding to multiple requests against a rigid schedule. The impossibility was caused by the large amount of ground to be covered in arguably too short a time, placing pressure both on STAT Team members and reviewers. Daily meetings generally started at 8am and continued to around 7pm. There was no time within the meetings for Panel-only discussion or for real time report drafting and stock taking of notes. Preparation of the two Panel reports relied on two Panel members (one for each stock) taking extensive notes in real time, a difficult task when also attempting to pay full attention to and participate in fast moving technical discussions and to deal inter-changeably with two separate assessments with no breaks between.

The STAR process involves the STAR Panel working with Advisors and the STAT Team, not just to review data and assessments, but also to agree to final decision tables. For both petrale sole and POP, the Panel reached a point where agreement was reached on what would constitute base case runs and sensitivity tests, and what would go into decision tables. Given time available, however, the final base case runs using MCMC and sensitivity tests still needed to be run after the Panel meeting ended, and the decision tables prepared. From time to time, in any stock assessment process, unfinished business is unavoidable, especially given the time required for MCMC runs. In my view, however, it is not entirely satisfactory for a review to sign off when there is still substantial work to be finalized. It is always possible that final assessment tuning or convergence problems could lead to a need to rethink advice.

The two STAT Teams both drew members from the NWFSC and University of Washington. Panel advisors included representatives from the PFMC, the Groundfish Management team (GMT), and Groundfish Advisory Panel (GAP). Other participants included NWFSC and AFSC staff as well as fishing industry. I am not aware of any problems with notification of the meetings and interpret from the presence of stakeholder representatives, and lack of complaint, that notification was appropriate. All participants were able to participate throughout the meeting and opportunity was explicitly and regularly given for input. Many “other participants” contributed usefully to discussion and I believe that all were provided appropriate opportunity for involvement both during the Panel meeting and during extra-mural discussions.

## **REVIEWER’S ROLE IN THE REVIEW ACTIVITIES**

The role of the reviewer is set out in the CIE Statement of Work, Attachment A, attached here in Appendix 2, Attachment A. Both CIE reviewers are tasked with producing an independent report to the CIE. The reviewers were additionally tasked with contributing to Panel Reports for each of POP and petrale Sole.

In addition to *becom(ing) familiar with the draft stock assessments(s) and background materials (ToR 1)*, I (Stokes) participated in all discussions, acted as rapporteur for petrale sole, and wrote (most of) the petrale sole draft Panel Report during the meeting. The draft, along with that for

POP, was left with the Chair at close on 24<sup>th</sup> June for further work. At the time of writing this (CIE) report, the Panel Reports have yet to be finalized.

## SUMMARY OF FINDINGS BY STOCK

**ToR 2** *Comment on the quality of data used in the assessments including data collection and processing.*

### **Petrale Sole**

**Stock structure:** Based on a limited consideration of Canadian data and assessment results during STAR 2, it appears that the Canadian and US petrale sole stock(s) are likely linked. While it would be desirable to consider joint assessment, this is generally not essential to inform effective management. Given the management and assessment history, it is reasonable to maintain US-only assessments to inform management. The one caveat in this is that if the Canadian and US stock(s) are tightly linked and if recruitment to US stock(s) is primarily a function of the Canadian stock component(s) (which appear to comprise older fish) then the presumed stock recruit relationship or parameter estimation may not be appropriate.

**Natural Mortality:** Natural mortality is estimated for males and females separately in the stock assessments with priors derived from unpublished meta-analyses by Hamel. Extensive discussion took place during STAR 2 and a presentation was made by Hamel (see file *Mprior.ppt* on the ftp server) which explained background theory and alternative methods of estimation as well as derivation of the priors used for petrale sole and other stock assessments to be reviewed during the 2011 STAR Panels. The proposed priors (plotted on request for the candidate base case) are well justified, with medians in line with estimates made using standard methods.

**Steepness:** Concerns about high steepness estimates were expressed by STAR 2009. The prior used for the 2011 assessment is that derived by Myers et al (1999) for *pleuronectids*. This is appropriate. (Note that in general for west coast assessments, steepness priors provided by Dorn (AFSC) are used; see POP below.)

**Length/Age/Growth:** Growth is estimated in the stock assessment separately for males and females. Data on length and age and age vs length are available variously from commercial fisheries and surveys. Given the large amount of composition data in the assessment (and its high weighting) the quality of these data is important, both for estimating productivity parameters but especially if the stock is estimated to be at or below the MSST, when estimates of recent year-classes are likely to impact projections and management decisions. It was noted in the 2009 assessment, and by the 2009 STAR Panel, that age data from the early periods of the fishery are limited and that age validation and studies of ageing bias were needed. In response, work has since been undertaken on both age validation and ageing bias and error. Age validation work using radiocarbon methods was reported by the STAT Team and, on request, a draft manuscript by Haltuch *et al.* was made available on the ftp server. Ageing error comparing across

laboratories and reading methods was estimated and used in the assessment. This represents a major step forward from 2009.

**Maturity:** There is little information on maturity but the assessment uses the most recent information available (from 2002). The 2009 SAFE Report (provided on the ftp server) notes that information is sparse in space and time and changes may have occurred over time, though no details are provided to support this assertion and it was not followed up as a major issue in 2011 during STAR 2. In general, use of the most recent information is reasonable. If major changes have occurred in life history traits (or other biological/ecological aspects), then implications for reference points would need to be considered. The use of “virgin biomass” based reference points, especially when estimating virgin biomass in the 19<sup>th</sup> Century, is potentially misleading.

**Surveys:** Fishery independent indices are available from triennial surveys conducted between 1980 and 2004 and from annual surveys conducted by the NWFSC between 1999 and 2008. However, the timing of the triennial surveys effectively splits the series in two, leading to a 5-point index spanning 1980 to 1992 and a separate 4-point series from 1995 to 2004 (with a questionable high point in 2004). For each of the triennial series relative biomass indices are calculated and length (but not age) frequency data are available. For the NWFSC surveys, the 1999-2002 surveys did not include shallower waters and did not fish consistently in southern areas. The NWFSC relative biomass indices are therefore calculated only for the period 2003-2008, together with length and age frequency data, and conditional age-length frequencies. All surveys show similar catch rate distributions with depth. All are summer surveys. Surveys are post-stratified and delta-GLMMs fit to derive indices. From the limited presentations during STAR 2, the indices appear to be sound and constitute important assessment inputs.

It was noted in 2009 that the catchability of the NWFSC was very high. A video study in 2009 suggested that flatfish are herded and this may contribute to the high catchability value for petrale sole.

**CPUE:** CPUE indices were not used as input to the 2009 assessment. At the time, there were some concerns that further consideration of CPUE was warranted and that the signal in CPUE could provide useful information to the new assessment. The 2009 STAR Panel suggested that this be done. The STAT Team made significant progress investigating CPUE for use in the 2011 assessment and suggested for the candidate assessment (presented at the beginning of the STAR 2 review meeting) that summer CPUE by state is used in the base case run. During the STAR 2 review, a number of requests were made to investigate data filtering and spatial coverage of CPUE data and consideration was given to management changes over time that could have affected CPUE interpretation. The STAR Panel rejected the use of summer CPUE principally on the grounds of management changes and difficulty of accepting CPUE as a single index through time (despite the filtering and model fitting). I agree with this. The Panel also, however, explored with the STAT Team and advisors the potential use of the winter CPUE series. Unlike summer fisheries, winter fisheries have not been subject to management changes through time that might affect interpretability as a single series. Initially, however, use of winter CPUE had been

dismissed by the STAT Team because they were from fisheries at a time of year when petrale sole aggregate, leading to concerns that the stock could be “hyper-stable”, possibly expanding in range as abundance increased. On inspection, the three standardized CPUE indices (by state) all display considerable range and continuous, rather than abrupt, changes. Examination of requested plots of unfiltered, spatial catch rate data suggests that effort was stable and not expanding spatially (though it could be temporally within seasons) in response to abundance changes. The Panel decided that winter CPUE might be used as indices of abundance, though also suggested using a power relationship (see below) when fitting. I agree that the use of winter CPUE is reasonable but I am less comfortable about imposing a power relationship which is in effect a method of down weighting the index in an arbitrary fashion. For the 2011 assessment it is reasonable to fit to winter CPUE by state, but in the future it would be desirable to consider combining Washington and Oregon catch and CPUE data sets within the assessment (see below).

During the review meeting it was mentioned more than once that new catch shares would likely render future CPUE useless as potential indices of abundance. I do not necessarily share this view. The utility of CPUE in the future will depend on data collection and analyses and the ability to capture statistically any changes in behaviour that might occur – CPUE may or may not prove to be useful. From discussion during the review meeting, it did appear that the changing management regime would likely have less impact on fishing practices (and therefore CPUE utility) in the winter fishery.

Removals: Total removals (landings and discards) are important, especially when virgin biomass based reference point are used. The petrale sole assessment is fairly standard in that productivity parameters are estimated using a complex model and fitting procedure for a period relatively late in the fishing history, and then those parameters are applied in a simple accounting exercise, taking account of withdrawals (removals) over a prolonged period to estimate initial capital (virgin biomass) *circa* 1880. Any uncertainty in removals can therefore be a major source of uncertainty in estimates of depletion (as a ratio of current to virgin biomass). In the case of petrale sole, removals can be broken down into landings by domestic and foreign fleets, and discards. No information on foreign fleet removals was presented. This seems to be an oversight and it would be useful for completeness to quantify, if possible, or at least to provide anecdotal information on, possible foreign vessel catches. There have clearly been difficulties in reconstructing state catches and those for Washington are still outstanding. Oregon reconstructions are now available but it is unclear whether the reconstruction methods or outputs have been reviewed; no report was made available to the STAR 2 Panel. Given various comments about the likely utility of combining Washington and Oregon catches and CPUE it would be good if the Oregon reconstructions could be reviewed and the Washington reconstructions completed prior to the next stock assessment. At the moment, however, the assessment can only proceed on the basis of available data. Given that major uncertainties are due to fitting of productivity parameters (see below) and treatment of CPUE, use of currently available information on catches by state is appropriate.

Discard fractions and composition data exists from WCGOP observers, by state, for summer and winter fisheries, from 2002 onwards; these are fit in the stock assessment. Some historic data also exist from 1985-1987 which are used to provide a discard rate for earlier years. The historic data have previously been used to estimate a discard rate of 8.8% per year. Analyses presented during STAR 2 suggested this should be modified to 2.9%. It was agreed that any final assessment runs would use the figure of 2.9% and possibly use the 8.8% in sensitivity tests. Given the data available, this seems appropriate.

## **POP**

Stock structure: Based on a limited consideration of Canadian data and assessment results during STAR 2, it appears that the Canadian and US POP stock(s) are likely linked. While it would be desirable to consider joint assessment, this is generally not essential to inform management. Given the management and assessment history, it is reasonable to maintain US-only assessments to inform management. The one caveat in this is that if the Canadian and US stock(s) are tightly linked and if recruitment to US stock(s) is primarily a function of the Canadian stock component(s) then the presumed stock recruit relationship or parameter estimation may not be appropriate.

Natural Mortality: Natural mortality is estimated for males and females separately in the stock assessments with priors derived from unpublished meta-analyses by Hamel. Extensive discussion took place during STAR 2 and a presentation was made by Hamel (see file *Mprior.ppt* on the ftp server) which explained background theory and alternative methods of estimation as well as derivation of the priors used for POP and other stock assessments to be reviewed during the 2011 STAR Panels. The proposed priors are well justified, with medians in line with estimates made using standard methods.

Steepness: For west coast assessments, steepness priors provided by Dorn (AFSC) are used in most cases. The priors are updates from Dorn (2009) and are not published. During the STAR 2 review meeting a brief explanation was given and a spreadsheet provided to show calculations. The prior was plotted on request, compared to that used in 2009. In 2009, a uniform prior was used. The new prior spans 0.2-1.0 and is very highly skewed to the right.

Length/Age/Growth: Growth is estimated in the stock assessment separately for males and females. Data on length and age and age vs length are available variously from commercial fisheries and surveys. Given the large amount of composition data in the assessment (and its high weighting; especially for surveys for which data are expanded by tow) the quality of these data is important, both for estimating productivity parameters but especially if the stock is estimated to be at or below the MSST when estimates of recent year-classes are likely to impact projections and management decisions. During the STAR 2 review it was noticed that the NWFSC age-length data for 2004 seemed to be incorrect. It was not possible to correct data for use in final

assessment runs so the data were omitted. While not a major problem, the data should clearly be checked and corrected for future use.

**Maturity:** For POP, reference points are based on spawning output as opposed to the more standard spawning biomass. This is because of presumed complexity in the relationships between maturity, fecundity and survival and the possibility of the need to account for age-structure effects in stock status and rebuild definitions. There is little information, however, to justify this added complexity. Maturity used in the assessment is based on 2000 STAR Panel recommendations and length-weight information is from 1977-89 only. It is not clear that this added complexity is necessary, especially as any variations in output will be compensated for when estimating steepness. If spawning output is to be used, then it would be nice to see more detailed justification and explanation of why it might be preferable to using spawning biomass (a modeling exercise), as well as more direct information on the biological quantities of relevance and how they may vary through time or with stock size/structure.

**Surveys:** Six sets of fishery independent indices are available: dedicated POP surveys in 1979 and 1985; triennial surveys conducted between 1980 and 2004, split from 1995 to create two series; AFSC slope surveys between 1996 and 2001; and annual surveys conducted by the NWFSC between 1999 and 2008, split bases on POP size at depth to create separate strata. Survey age and length data were expanded by tow (as opposed to trip for fishery composition data). This could lead to over-weighting of survey composition data in the assessment if there are correlations between tows; the issue was not considered in the limited time available. From the limited presentations during STAR 2, the indices appear to be sound.

**CPUE:** CPUE from 1955 to 1973 were used in the previous assessment and are used again in 2011. The indices derive from a 1977 analysis. In the 2011 assessment, the indices were used with an arbitrary doubling of the CV compared to previous assessments. There was no time during the review to reconsider the CPUE. Given the low influence of the indices, this is probably not a problem.

**Removals:** Total removals (landings and discards) are important, especially when virgin biomass based reference point are used. The POP assessment is fairly standard in that productivity parameters are estimated using a complex model and fitting procedure for a period relatively late in the fishing history and then those parameters are applied in a simple accounting exercise, taking account of removals (withdrawals) over a prolonged period to estimate initial capital (virgin biomass). Any uncertainty in removals can therefore be a major source of uncertainty in estimates of depletion (as a ratio of current to virgin biomass). In the case of POP, removals can be broken down in-to landings by domestic and foreign fleets and discards. The foreign landings are particularly important for POP assessment as they spiked dramatically in the 1960s and will have an impact on estimation of virgin biomass and hence estimates of depletion. A new reconstruction of catches has been used for the 2011 assessment. The new series starts in 1940 as opposed to 1956 and adds a considerable quantum of catch (in the order of 11,000 tonnes). The new series also adds catch through the 1970s (perhaps a few thousand tonnes in total).

Comparing assessment runs (slide 88 of *POP\_Presentation\_STAR062111\_model\_results.ppt* on the ftp server) suggests the new catch series leads to a substantial decrease in estimated depletion. As for other catch reconstructions it would be sensible to review fully those used for POP. At the moment, the assessment can only proceed on the basis of available data. Given that major uncertainties are due to fitting of productivity parameters (see below), use of currently available information on catches by state is appropriate.

Discard fractions and composition data exists from WCGOP observers, by state, for summer and winter fisheries, from 2002 onwards; these are used to calculate discard rates used in the model (close to 16% from 2002-2007 and 36% thereafter). Some historic data also exist from the 1980s which are used to provide a discard rate for earlier years. The historic data have previously been used to estimate a discard rate of 16% per year. However, the analysis was based on widow rockfish catch data. Analyses suggested during STAR 2 and based on POP catch data suggested this should be modified. The final discard rates used in the assessment are 5% from 1982-1988 and 10% from 1989-1994. Given the data available this seems appropriate.

**ToR 3** *Evaluate and comment on analytic methodologies.*

### **Petrale Sole**

The assessment model fit assumes a distinct US west coast-wide stock of petrale sole and uses catch data by sex and season. The catch history starts in 1876. Catches and compositions are provided by state and season and observer data and compositions are provided from 2002 onwards, as well as a single discard rate estimate for 1985-87. Discard ratios and compositions are fit in the model. The model estimates separate asymptotic selectivity for separate fleets (state and season) in the periods 1876 to 1972, 1973-1982, 1983-1992 and 2003-2008. Growth is estimated in the model (by sex) as are natural mortality (by sex, with male mortality as an offset to estimated female mortality) and stock-recruit steepness (a Beverton-Holt stock recruitment relationship is assumed). Informative priors derived from meta-analyses are provided for natural mortality and steepness. Surveys fit are the NWFSC and two Triennial series. The model also fits to winter standardized CPUE indices by state assuming a non-linear relationship to coast-wide (not state) abundance. Age and length data and conditional age-at-length compositions from the NWFSC are fit with agency specific ageing for given fleets.

The assessment of petrale sole was implemented using Stock Synthesis 3 (SS3; v3.21e). Stock Synthesis has been extensively used and the main software and extensions have been validated and documented.

The model was explored using SS3. During STAR 2, all model runs were to MPD only. Tuning of model runs followed standard procedures with multiple passes to refine index and composition weights. A full MCMC has been conducted on the candidate base case and there do not appear to be any problems with convergence; none are expected with the Panel-defined base case MCMC, but this is not guaranteed.

The model is complex and the likelihood surface is quite flat, at least in the dimension of key productivity parameters. Exploration of the surface was reasonably thorough and uncertainty (see below) seems to be well depicted.

The model and methods used are fairly standard and I see no major causes for concern.

## **POP**

The assessment model fit assumes a distinct US west coast-wide stock of POP and uses catch data separated by sex. The catch history starts in 1940. Catches and compositions are provided by state and observer data and compositions are provided from 2002 onwards, as well as a single discard rate estimate from the 1980s. Discard ratios are estimated externally while compositions are fit in the model. The model estimates separate length-based selectivity for separate fleets (state). Growth is estimated in the model (by sex) as are natural mortality (by sex, with male mortality as an offset to estimated female mortality) and stock-recruit steepness (a Beverton-Holt stock recruitment relationship is assumed). Informative priors derived from meta-analyses are provided for natural mortality and steepness. Six survey series fit: an early POP survey, early and late Triennial series, an AFSC slope survey and two, depth stratified series from the NWFSC. The model also fits to CPUE from the period 1955-1973. Age and length data (but not conditional age-at-length compositions) are fit in the model.

The assessment of POP was implemented using Stock Synthesis 3 (SS3; v3.21d). Stock Synthesis has been extensively used and the main software and extensions have been validated and documented. The implementation in SS3 was new in 2011. The new implementation was tested with settings and data as closely as possible mimicking the previous assessment (the so called “bridge analysis” or “crossover” run). Results of the bridge analysis are somewhat perplexing. Looking only at the derived parameters (of interest to management), the SS3 crossover run resulted in a 2008 depletion estimate of 21.5% compared to the old model estimate of 27.3% (a proportional difference of -21.5%). Test runs during STAR 2 suggest some of this difference could be explained by the different selectivity parameterization, but the issue of explaining the difference was not fully explored or resolved due to lack of time and the need to progress the current assessment.

The model was explored using SS3. During STAR 2, all model runs were to MPD only. Tuning of model runs followed standard procedures with multiple passes to refine index and composition weights. A full MCMC has been conducted on the candidate base case and there do not appear to be any major problems with convergence; none are expected with the defined base case MCMC but this is not guaranteed.

The model is complex and the likelihood surface is both flat and complex making model selection difficult. Exploration of the surface was reasonably thorough and uncertainty (see

below) seems to be well depicted around the base case (though the issue of technical implementation relative to the old model remains).

The model and methods used are fairly standard and I see no major causes for concern except for the remaining need to resolve the differences between old and new models that could be due to subtle differences in optimization phasing or SS3 settings. For credible assessment there is a need for quantities of management interest not to be dependent on technical minutiae and for any effects to be understood.

**ToR 4** *Evaluate model assumptions, estimates, and major sources of uncertainty and provide constructive suggestions for improvements if technical deficiencies or additional major sources of uncertainty are identified.*

## **General**

Both petrale sole and POP assessments combine extensive length and age composition data and a number of survey and CPUE indices. The indices are typically short and the surveys in particular are representative of relatively recent periods in the history of the fisheries. The CPUE data used for petrale cover a usefully long period, though recent period. The CPUE for POP cover a usefully earlier period in the history of the fishery. My sense overall is that the various indices are given relatively little weight compared to the extensive composition data. Considering arguments in Francis (in press) it would be worthwhile to consider carefully the various composition data to determine the degree of correlation (and hence true information content and effective sample size) for each dataset. The composition data are used extensively to fit complex models and estimate highly correlated productivity parameters (especially natural mortality and steepness); it may be that the approach is trying to do too much and that simpler assessment methods could be used for both petrale sole and POP.

## **Petrale Sole**

The model assumes a single, distinct US west coast stock with no linkage to petrale sole beyond US waters. This is clearly simplification. As noted above, it is unlikely to be a major problem for assessment and management purposes unless linkages are such to render the stock-recruit assumptions (structural form and parameterization) invalid. Given the sensitivity of the assessment to the steepness parameter of the Beverton-Holt relationship (as exposed in the final sensitivity tests and decision tables; below) this is potentially problematic. Investigation of the issue would require access to US and Canadian fishery and biological data and would require simulation modeling (management strategy evaluation).

It is unclear what assumptions are made with respect to reconstructions of historical landings. Certainly, the quantum of removals has a large effect on estimates of virgin biomass and hence

depletion. At a minimum it would be useful to formally review catch reconstructions to provide confidence in their validity.

The model uses substantial data sources, fitting to survey and fishery-dependent indices and length and age composition data, with priors and externally calculated parameters, to estimate a range of parameters and derived parameters of interest to management. The fits to composition data are poor, especially to lengths and particularly for discard data. Consideration of age composition fits by state suggests potential utility in combining data for Washington and Oregon. Attempts to improve fits by fitting a joint selectivity for Washington and Oregon, by forcing a constant standard deviation on length at age (the initial runs estimated increasing standard deviation at length), by truncating compositions with multiple zeros in the tails (“dynamic binning”), or by changing the “robustification” constant applied in SS3 to deal with zeros, were well investigated but did not generally improve fits. Fits to indices are reasonable, especially in final runs with tuned input standard errors, although the catch history and implied biomass decline through the 1980s is at odds with the trend in the early Triennial survey series. Fits to winter CPUE are good, especially when a power function is included. Despite the complexity of fitting productivity parameters using composition data, a major uncertainty in the assessment remains in those parameters, with little variation in the likelihood over a wide range of natural mortality (about one likelihood unit for natural mortality ranging from 0.12 to 0.2).

The final STAR 2 Panel decision is to use a base case in which winter CPUE is included and a power function fit, and with steepness and natural mortality both estimated, and to characterize uncertainty by removing winter CPUE or fitted assuming linearity. The base case MPD run has a depletion estimate of 18%. Omitting CPUE leads to an estimate of less than 14% while including CPUE and assuming a linear relationship with abundance leads to an estimate of close to 40%. The latter fit also leads to a very high estimate of natural mortality and low estimate of steepness and seems implausible. Overall, the base case and uncertainty envelope reasonably capture the current and possible future variations in depletion under alternate catch forecasts. Retrospective fits suggest strong patterns in estimates of steepness and natural mortality, with steepness initially over-estimated and natural mortality under-estimated.

Overall, while the modeling exercise has been careful and thoughtful, final characterization of petrale sole is difficult as key parameters are poorly estimated. As noted above, much of the complication arises from attempting to fit complex models to extensive composition data. Consideration of simpler models to characterize status could help to build confidence in the outputs from complex models. The use of Management Strategy evaluation (MSE) to investigate the efficacy of simpler models in informing management might also be worthwhile. If complex models are to be used, then it is essential that the component data are fully appraised. Equally, it is important that technical issues of fitting are fully explored. In the case of petrale sole issues related to treatment of composition data are clearly of relevance (dynamic binning and robustification). At a minimum, how these work in SS3 and their effect on assessments needs to be understood generally and case specifically. More usefully, it might be appropriate to consider adoption of alternative error forms to deal with zeros in data.

## POP

The model assumes a single, distinct US west coast stock with no linkage to POP beyond US waters. This is clearly a simplification. As noted above, it is unlikely to be a major problem for assessment and management purposes unless linkages are such to render the stock-recruit assumptions (structural form and parameterization) invalid. Given the sensitivity of the assessment to the steepness parameter of the Beverton-Holt relationship (as exposed in the final sensitivity tests and decision tables; below) this is potentially problematic. Investigation of the issue would require access to US and Canadian fishery and biological data and would require simulation modeling (ideally management strategy evaluation).

The model assumes natural mortality is constant for males and females. The separate mortality by sex is in fact little different and given the relationship between natural mortality and other parameters (steepness, growth-related, etc) the separation seems unnecessary. For a long-lived species such as POP there is also likely large variation in natural mortality at age which would far outweigh the minor differences by sex. Given the use of spawning output as opposed to spawning biomass, an exploration of age-related natural mortality and the implications of using it might be warranted.

It is unclear what assumptions are made with respect to estimates of historical landings. Certainly, the quantum of removals has a large effect on estimates of virgin biomass and hence depletion. At a minimum it would be useful formally to review catch reconstructions to provide confidence in their validity.

The model uses substantial data sources, fitting to survey and fishery-dependent indices and length and age composition data, with priors and externally calculated parameters, to estimate a range of parameters and derived parameters of interest to management. The fits to composition data are acceptable if unspectacular. Fits to indices are similarly acceptable though indices show little variation and have large CVs, and have relatively little impact on estimates of depletion. The trends in the early CPUE series are fit well, again recognizing the high CV, with the biomass trajectory a clear consequence of the removals history. Despite the complexity of fitting productivity parameters using composition data, the major uncertainty in the assessment remains in those parameters. The likelihood surface the model explores is apparently convoluted but with little variation over which to optimize. The final STAR 2 Panel decision is to use a base case with fixed growth parameters (estimated in an earlier model run) and steepness and natural mortality estimated (0.45 and ~0.048 respectively), and to characterize uncertainty by varying steepness around a fixed value of 0.45 with natural mortality held constant at 0.05. The final sensitivity runs (and decision table) use steepness values fixed at 0.35 and 0.55, calculated to approximate the 25<sup>th</sup> and 75<sup>th</sup> percentiles of the base case posterior on steepness. The final decision table thus has three runs (at steepness values of 0.35, 0.45 and 0.55) each with low, medium and high catch scenarios (representing the future catches under each steepness value run if fishing mortality were set to the rebuilding SPR rate estimated in that run). Overall, the base

case and uncertainty envelope reasonably capture the current and possible future variations in depletion under alternate catch forecasts.

That uncertainty is reasonably captured, however, is dependent on validation of the base case assessment and explaining why it is substantially different to the previous assessment implementation when parameterized similarly and fitting to the same data. Understanding the reasons for the discrepancy will require a careful and systematic review of the implementation. If the differences are due to technical aspects of fitting and coding, this will be cause for concern. However, it should be noted that even if the differences cannot be explained, at least in the initial bridge model comparison, the differences in depletion estimates were less than those seen in the sensitivity tests with steepness varying from 0.35, through 0.45 to 0.55.

*ToR 5 Determine whether the science reviewed is considered to be the best scientific information available.*

### **Petrale Sole**

In my opinion, the STAT Team initially, and in conjunction with the STAR Panel and advisors, has comprehensively reviewed the available information on petrale sole and has conducted thorough analyses to provide estimates of management-related quantities. Uncertainties in inputs and estimates of interest have been adequately explored and, overall, I am confident that the resulting assessments and decision tables represent the best scientific information available.

### **POP**

In my opinion, the STAT Team initially, and in conjunction with the STAR Panel and advisors, has comprehensively reviewed the available information on POP and has conducted thorough analyses to provide estimates of management-related quantities. Uncertainties in inputs and estimates of interest have been adequately explored and, overall, I am confident that the resulting assessments and decision tables represent the best scientific information available.

*ToR 6 Provide specific suggestions for future improvement in any relevant aspects of data collection and treatment, modeling approaches and technical issues.*

### **Petrale Sole**

1. The issue of linkages between US and Canadian petrale sole remains an issue worthy of consideration. In particular, it would be useful to explore how stock linkages could affect recruitment assumptions and whether the assumed Beverton-Holt stock recruitment function and parameter estimation is appropriate. This is difficult work potentially requiring trans-boundary cooperation and substantial review of data and analyses. It is

**suggested** that the most fruitful way forward would be to explore assessment and management effects of plausible (data based) hypotheses about stock structure and mixing. Management Strategy Evaluation (MSE) could be used to identify analyses or research to refine hypotheses or to develop new assessment (and perhaps management) approaches. Such work is time consuming and costly. The suggestion is made as a general consideration of petrale sole and takes no account of wider research planning priorities.

2. It is suggested that the characterization of depletion and uncertainty could likely be achieved fitting much simpler models and assuming productivity parameters from first principles and/or meta-analyses. The depletion estimates are effectively driven by the productivity estimates/assumption and by the single series of catch removals. If a complex model is to be the approach of choice, then it is **suggested** that the age and length composition data as presented should be re-evaluated to ensure the best possible basis for estimation of productivity parameters.
3. It is unclear if catch history reconstructions have been formally reviewed. It is **suggested** that there is a need formally to do so and to identify an accepted, definitive catch history and agreed sensitivity series. Similarly, discard estimates from the WCGOP should be reviewed (similar to catch reconstructions), and be made available to the assessment process. Virgin biomass and hence depletion estimates, and future management, largely depends on these figures and their importance cannot be underestimated.
  - It is **recommended** that consideration be given to combining Washington and Oregon fleets in future assessments either within a US west coast-wide model or within a wider trans-boundary assessment (see 1).
  - Further consideration of incorporating CPUE in the assessment is warranted, especially given changes in management.
  - It is **recommended** that alternative means of fitting composition data are investigated, including tail compression fitting options (dynamic binning), use of additive constants to deal with zeros, and alternative error structures that are robust to zeros, etc.

## POP

4. There is a need to understand the detailed reasons why the new SS3 implementation of the POP assessment does not correspond to the previous assessment. It is **recommended** to carry out a careful and systematic analysis of the coding, technical optimization choices, and data treatments in order to build confidence in the new model.
5. The issue of linkages between US and Canadian POP remains an issue worthy of consideration. In particular, it would be useful to explore how stock linkages could affect recruitment assumptions and whether the assumed Beverton-Holt stock recruitment function and parameter estimation is appropriate. This is difficult work potentially requiring trans-boundary cooperation and substantial review of data and analyses. It is **suggested** that the most fruitful way forward would be to explore assessment and management effects of plausible (data based) hypotheses about stock structure and

mixing. Management Strategy Evaluation (MSE) could be used to identify analyses or research to refine hypotheses or to develop new assessment (and perhaps management) approaches. Such work is time consuming and costly. The suggestion is made as a general consideration of POP and takes no account of wider research planning priorities.

6. It is suggested that the characterization of depletion and uncertainty could likely be achieved fitting much simpler models and assuming productivity parameters from first principles and/or meta-analyses. The depletion estimates are effectively driven by the productivity estimates/assumption and by the single series of catch removals. If a complex model is to be the approach of choice, then it is **suggested** that the age and length composition data as presented should be re-evaluated to ensure the best possible basis for estimation of productivity parameters.
7. It is unclear if catch history reconstructions have been formally reviewed. It is **suggested** that there is a need formally to do so and to identify an accepted, definitive catch history and agreed sensitivity series. Virgin biomass, and hence depletion estimates, and future management, largely depends on these figures and their importance cannot be underestimated.

## CONCLUSIONS AND RECOMMENDATIONS

Because of the wide scope (two stocks, consideration of both data collection and analysis, and stock assessment) and lack of review time, it is highly likely that misinterpretation of some materials, presentations or discussions has been made. This is the fault of the reviewer, not of the many excellent STAT Team scientists who gave good presentations and made the review an enjoyable experience – to them, many thanks. The NWFSC is in the enviable position of having many excellent scientists doing good work and providing sterling support to the PFMC.

The STAR Panel system is well established and I am reluctant to criticize it on the basis of one meeting. My view may change over the course of the 2011 Panel meetings. My initial view is that reviewing two entire stock assessments and all data inputs in one week, using the same Panel, is too frenetic. There is insufficient time to do justice to the substantial efforts of the STAT Teams and to review in detail all necessary aspects

Although the review was arguably too wide in scope to do full justice to both petrale sole and POP assessments and ancillary data inputs, and there remains a need to review in detail some of the assessment inputs, notably removals histories, the final, agreed assessments, explorations of uncertainty, and emergent management advice, represent the best scientific information available at this time.

Specific recommendations and suggestions are highlighted in **bold, red** in the preceding sections. I distinguish between recommendations as necessary activities and suggestions as

desirable ones, recognizing that research planning and prioritization requires consideration of multiple factors and applies to many stocks, fisheries and other factors.

## **APPENDIX 1**

### **BIBLIOGRAPHY**

Prior to the Workshop, extensive materials were provided *via* a dedicated, anonymous ftp server ([ftp.pcouncil.org/pub/GF\\_STAR\\_2\\_2011\\_POP\\_PetraleSole](ftp.pcouncil.org/pub/GF_STAR_2_2011_POP_PetraleSole)). The materials were extensive and relevant to all terms of reference in varying degrees.

During the workshop multiple presentations were given, and additional materials were provided on request, including further background documents and presentations as well as responses to Panel requests. All files were made available using the dedicated server which was accessed using hotel guest Wi-Fi throughout the meeting. The access was generally adequate. Directory listings are not provided here as the server is anonymous (and therefore publicly available).

### **OTHER REFERENCES**

Myers, R. A., K. G. Bowen, and n. J. Barrowman. 1999. Maximum reproductive rate of fish at low population sizes. *Canadian Journal of Fisheries and Aquatic Sciences* **56**:2404-2419.

R.I.C. C. Francis (In Press) Data weighting in statistical fisheries stock assessment models. *Canadian Journal of Fisheries and Aquatic Sciences* xx:xx-xx.

## **APPENDIX 2**

### **Attachment A: Statement of Work for Dr. Kevin Stokes**

#### **External Independent Peer Review by the Center for Independent Experts**

##### **Stock Assessment Review (STAR) Panel for Pacific Ocean Perch and Petrale Sole**

**Scope of Work and CIE Process:** The National Marine Fisheries Service's (NMFS) Office of Science and Technology coordinates and manages a contract providing external expertise through the Center for Independent Experts (CIE) to conduct independent peer reviews of NMFS scientific projects. The Statement of Work (SoW) described herein was established by the NMFS Project Contact and Contracting Officer's Technical Representative (COTR), and reviewed by CIE for compliance with their policy for providing independent expertise that can provide impartial and independent peer review without conflicts of interest. CIE reviewers are selected by the CIE Steering Committee and CIE Coordination Team to conduct the independent peer review of NMFS science in compliance the predetermined Terms of Reference (ToRs) of the peer review. Each CIE reviewer is contracted to deliver an independent peer review report to be approved by the CIE Steering Committee and the report is to be formatted with content requirements as specified in **Annex 1**. This SoW describes the work tasks and deliverables of the CIE reviewer for conducting an independent peer review of the following NMFS project. Further information on the CIE process can be obtained from [www.ciereviews.org](http://www.ciereviews.org).

**Project Description:** Both Pacific ocean perch and Petrale sole are rebuilding species and are being considered for benchmark assessments in the upcoming assessment cycle. A benchmark assessment for Petrale sole is necessary to address unresolved data and modeling issues, as well as to explore the development of commercial CPUE indices. The last benchmark assessment for Pacific ocean perch was conducted in 2003 and has been updated during each assessment cycle. It is the only species with an individual ABC whose recent assessments have not been conducted using Stock Synthesis. The Terms of Reference (ToRs) of the peer review are attached in **Annex 2**. The tentative agenda of the panel review meeting is attached in **Annex 3**.

**Requirements for CIE Reviewers:** Two CIE reviewers shall conduct an impartial and independent peer review in accordance with the SoW and ToRs herein. One of the CIE reviewers will participate in all STAR panels held in 2011, except for the than Pacific hake, to provide a level of consistency between the STAR panels. Reviewers should have expertise in fish population dynamics, with experience in the integrated analysis modeling approach, using age-and size-structured models, use of MCMC to develop confidence intervals, and use of Generalized Linear Models in stock assessment models. Each CIE reviewer's duties shall not exceed a maximum of 14 days to complete all work tasks of the peer review described herein.

**Location of Peer Review:** Each CIE reviewer shall conduct an independent peer review during the panel review meeting scheduled in Seattle, Washington during the dates of 20-24 June 2011.

**Statement of Tasks:** Each CIE reviewers shall complete the following tasks in accordance with the SoW and Schedule of Milestones and Deliverables herein.

**Prior to the Peer Review:** Upon completion of the CIE reviewer selection by the CIE Steering Committee, the CIE shall provide the CIE reviewer information (full name, title, affiliation, country, address, email) to the COTR, who forwards this information to the NMFS Project Contact no later the date specified in the Schedule of Milestones and Deliverables. The CIE is responsible for providing the SoW and ToRs to the CIE reviewers. The NMFS Project Contact is responsible for providing the CIE reviewers with the background documents, reports, foreign national security clearance, and other information concerning pertinent meeting arrangements. The NMFS Project Contact is also responsible for providing the Chair a copy of the SoW in advance of the panel review meeting. Any changes to the SoW or ToRs must be made through the COTR prior to the commencement of the peer review.

Foreign National Security Clearance: When CIE reviewers participate during a panel review meeting at a government facility, the NMFS Project Contact is responsible for obtaining the Foreign National Security Clearance approval for CIE reviewers who are non-US citizens. For this reason, the CIE reviewers shall provide requested information (e.g., first and last name, contact information, gender, birth date, passport number, country of passport, travel dates, country of citizenship, country of current residence, and home country) to the NMFS Project Contact for the purpose of their security clearance, and this information shall be submitted at least 30 days before the peer review in accordance with the NOAA Deemed Export Technology Control Program NAO 207-12 regulations available at the Deemed Exports NAO website: <http://deemedexports.noaa.gov/sponsor.html>.

Pre-review Background Documents: Two weeks before the peer review, the NMFS Project Contact will send (by electronic mail or make available at an FTP site) to the CIE reviewers the necessary background information and reports for the peer review. In the case where the documents need to be mailed, the NMFS Project Contact will consult with the CIE Lead Coordinator on where to send documents. CIE reviewers are responsible only for the pre-review documents that are delivered to the reviewer in accordance to the SoW scheduled deadlines specified herein. The CIE reviewers shall read all documents in preparation for the peer review.

Documents to be provided to the CIE reviewers prior to the STAR Panel meeting include:

- The current draft stock assessment reports;
- Previous stock assessments and STAR Panel reports for Pacific ocean perch and Petrale sole;
- The Pacific Fishery Management Council's Scientific and Statistical Committee's Terms of Reference for Stock Assessments and STAR Panel Reviews;
- Stock Synthesis (SS) Documentation
- Additional supporting documents as available.
- An electronic copy of the data, the parameters, and the model used for the assessments (if requested by reviewer).

Panel Review Meeting: Each CIE reviewer shall conduct the independent peer review in accordance with the SoW and ToRs, and shall not serve in any other role unless specified herein. **Modifications to the SoW and ToRs can not be made during the peer review, and any SoW or ToRs modifications prior to the peer review shall be approved by the COTR and CIE Lead Coordinator.** Each CIE reviewer shall actively participate in a professional and respectful manner as a member of the meeting review panel, and their peer review tasks shall be focused on the ToRs as specified herein. The NMFS Project Contact is responsible for any facility arrangements (e.g., conference room for panel review meetings or teleconference arrangements). The NMFS Project Contact is responsible for ensuring that the Chair understands the contractual role of the CIE reviewers as specified herein. The CIE Lead Coordinator can contact the Project Contact to confirm any peer review arrangements, including the meeting facility arrangements.

Contract Deliverables - Independent CIE Peer Review Reports: Each CIE reviewer shall complete an independent peer review report in accordance with the SoW. Each CIE reviewer shall complete the independent peer review according to required format and content as described in Annex 1. Each CIE reviewer shall complete the independent peer review addressing each ToR as described in Annex 2.

Other Tasks – Contribution to Summary Report: Each CIE reviewer may assist the Chair of the panel review meeting with contributions to the Summary Report, based on the terms of reference of the review. Each CIE reviewer is not required to reach a consensus, and should provide a brief summary of the reviewer's views on the summary of findings and conclusions reached by the review panel in accordance with the ToRs.

**Specific Tasks for CIE Reviewers:** The following chronological list of tasks shall be completed by each CIE reviewer in a timely manner as specified in the **Schedule of Milestones and Deliverables**.

- 1) Conduct necessary pre-review preparations, including the review of background material and reports provided by the NMFS Project Contact in advance of the peer review.
- 2) Participate during the panel review meeting tentatively in Seattle, Washington during the tentative dates of 21-23 June 2011.
- 3) In Seattle, Washington during the tentative dates of 20-24 June 2011 as specified herein, and conduct an independent peer review in accordance with the ToRs (**Annex 2**).
- 4) No later than 7 July 2011, each CIE reviewer shall submit an independent peer review report addressed to the “Center for Independent Experts,” and sent to Mr. Manoj Shrivani, CIE Lead Coordinator, via email to [shivlanim@bellsouth.net](mailto:shivlanim@bellsouth.net), and to Dr. David Die, CIE Regional Coordinator, via email to [ddie@rsmas.miami.edu](mailto:ddie@rsmas.miami.edu). Each CIE report shall be written using the format and content requirements specified in Annex 1, and address each ToR in **Annex 2**.

**Schedule of Milestones and Deliverables:** CIE shall complete the tasks and deliverables described in this SoW in accordance with the following schedule.

|                        |   |
|------------------------|---|
| 17 May 2011            | CIE sends reviewer contact information to the COTR, who then sends this to the NMFS Project Contact                     |
| 7 June 2011            | NMFS Project Contact sends the CIE Reviewers the pre-review documents   |
| <b>20-24 June 2011</b> | Each reviewer participates and conducts an independent peer review during the panel review meeting                      |
| 7 July 2011            | CIE reviewers submit draft CIE independent peer review reports to the CIE Lead Coordinator and CIE Regional Coordinator |
| 21 July 2011           | CIE submits CIE independent peer review reports to the COTR   |
| 28 July 2011           | The COTR distributes the final CIE reports to the NMFS Project Contact and regional Center Director                     |

**Modifications to the Statement of Work:** Requests to modify this SoW must be approved by the Contracting Officer at least 15 working days prior to making any permanent substitutions. The Contracting Officer will notify the COTR within 10 working days after receipt of all required information of the decision on substitutions. The COTR can approve changes to the milestone dates, list of pre-review documents, and ToRs within the SoW as long as the role and ability of the CIE reviewers to complete the deliverable in accordance with the SoW is not adversely impacted. The SoW and ToRs shall not be changed once the peer review has begun.

**Acceptance of Deliverables:** Upon review and acceptance of the CIE independent peer review reports by the CIE Lead Coordinator, Regional Coordinator, and Steering Committee, these reports shall be sent to the COTR for final approval as contract deliverables based on compliance with the SoW and ToRs. As specified in the Schedule of Milestones and Deliverables, the CIE shall send via e-mail the contract deliverables (CIE independent peer review reports) to the COTR (William Michaels, via [William.Michaels@noaa.gov](mailto:William.Michaels@noaa.gov)).

**Applicable Performance Standards:** The contract is successfully completed when the COTR provides final approval of the contract deliverables. The acceptance of the contract deliverables shall be based on three performance standards:

- (1) each CIE report shall be completed with the format and content in accordance with **Annex 1**,
- (2) each CIE report shall address each ToR as specified in **Annex 2**,
- (3) the CIE reports shall be delivered in a timely manner as specified in the schedule of milestones and deliverables.

**Distribution of Approved Deliverables:** Upon acceptance by the COTR, the CIE Lead Coordinator shall send via e-mail the final CIE reports in \*.PDF format to the COTR. The COTR will distribute the CIE reports to the NMFS Project Contact and Center Director.

**Support Personnel:**

William Michaels, Program Manager, COTR  
 NMFS Office of Science and Technology

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**Key Personnel:**

NMFS Project Contact:

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Michelle McClure  
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[Michelle.McClure@noaa.gov](mailto:Michelle.McClure@noaa.gov)

## **Annex 1: Format and Contents of CIE Independent Peer Review Report**

1. The CIE independent report shall be prefaced with an Executive Summary providing a concise summary of the findings and recommendations, and specify whether the science reviewed is the best scientific information available.
2. The main body of the reviewer report shall consist of a Background, Description of the Individual Reviewer's Role in the Review Activities, Summary of Findings for each ToR in which the weaknesses and strengths are described, and Conclusions and Recommendations in accordance with the ToRs.
  - a. Reviewers should describe in their own words the review activities completed during the panel review meeting, including providing a brief summary of findings, of the science, conclusions, and recommendations.
  - b. Reviewers should discuss their independent views on each ToR even if these were consistent with those of other panelists, and especially where there were divergent views.
  - c. Reviewers should elaborate on any points raised in the Summary Report that they feel might require further clarification.
  - d. Reviewers shall provide a critique of the NMFS review process, including suggestions for improvements of both process and products.
  - e. The CIE independent report shall be a stand-alone document for others to understand the weaknesses and strengths of the science reviewed, regardless of whether or not they read the summary report. The CIE independent report shall be an independent peer review of each ToRs, and shall not simply repeat the contents of the summary report.
3. The reviewer report shall include the following appendices:
  - Appendix 1: Bibliography of materials provided for review
  - Appendix 2: A copy of the CIE Statement of Work
  - Appendix 3: Panel Membership or other pertinent information from the panel review meeting.

## **Annex 2: Terms of Reference for the Peer Review**

### **Stock Assessment Review (STAR) Panel for Pacific Ocean Perch and Petrale Sole**

1. Become familiar with the draft stock assessment and background materials.
2. Comment on the quality of data used in the assessments including data collection and processing.
3. Evaluate and comment on analytic methodologies.
4. Evaluate model assumptions, estimates, and major sources of uncertainty and provide constructive suggestions for improvements if technical deficiencies or additional major sources of uncertainty are identified.
5. Determine whether the science reviewed is considered to be the best scientific information available.
6. Provide specific suggestions for future improvement in any relevant aspects of data collection and treatment, modeling approaches and technical issues.
7. Provide a brief description on panel review proceedings highlighting pertinent discussions, issues, effectiveness, and recommendations

**Annex 3: Tentative Agenda**

*Final Agenda to be provided two weeks prior to the meeting with draft assessments and background materials.*

**Stock Assessment Review (STAR) Panel for  
Pacific Ocean Perch and Petrale Sole**

June 20-24, 2011  
Hotel Decca  
4507 Brooklyn Avenue NE  
Seattle, WA 98105

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**Monday, June 20, 2011**

- 9:00 a.m. Welcome and Introductions  
9:15 a.m. Review the Draft Agenda and Discussion of Meeting Format (Panel Chair)  
- Review Terms of Reference for Assessment and Review Panel  
- Assignment of reporting duties  
- Discuss and agree to format for the final assessment document  
9:45 a.m. Stock Assessment Team (STAT-1) Presentation of Species 1 (Authors)  
- Overview of Data and Stock Synthesis Modeling  
12:30 p.m. Lunch (On Your Own)  
1:30 p.m. Q&A session with the STAT-1 & Panel discussion  
3:30 p.m. Coffee Break  
3:45 p.m. Panel develops request for additional model runs / analyses for STAT 1  
4:30 p.m. Panel provides written requests for additional model runs / analyses to STAT 1  
5:00 p.m. Adjourn for day.

**Tuesday, June 21, 2011**

- 9:00 a.m. Stock Assessment Team (STAT-2) Presentation of Species 2 (Authors)  
- Overview of Data and Stock Synthesis Modeling  
12:00 p.m. Lunch (On Your Own)  
1:30 p.m. Q&A session with the STAT-2 & Panel discussion  
3:00 p.m. Coffee Break  
3:15 p.m. Panel develops request for additional model runs / analyses for STAT 2  
4:00 p.m. Panel provides written requests for additional model runs / analyses to STAT 2  
4:30 p.m. Panel check in with STAT-1 if needed  
5:00 p.m. Adjourn for day.

**Stock Assessment Review (STAR) Panel for  
Pacific Ocean Perch and Petrale Sole**

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**Wednesday, June 22, 2011**

- 9:00 a.m. STAT-1 Presentation of first set of model runs for Species 1  
- Q&A session with the STAT-1 & Panel discussion  
- Panel develops written request for second round of model runs / analyses for STAT 1  
12:00 p.m. Lunch (On Your Own)  
1:30 p.m. STAT-2 Presentation of first set of model runs for Species 2  
- Q&A session with the STAT-2 & Panel discussion  
- Panel develops written request for second round of model runs / analyses for STAT 2

3:30 p.m. Coffee Break  
3:45 p.m. Continue Panel discussion with STAT-2  
5:00 p.m. Adjourn for day.

**Thursday, June 23, 2011**

9:00 a.m. STAT-1 Presentation of Second Set of Model Runs for Species 1  
- Q&A session with the STAT-1 & Panel discussion  
- Identification of preferred model and elements for the decision table.  
- Panel develops third list of model runs for decision table and begins drafting STAR report.  
12:00 p.m. Lunch (On Your Own)  
1:00 p.m. STAT-2 Presentation of Second Set of Model Runs for Species 2  
- Q&A session with the STAT-2 & Panel discussion  
- Identification of preferred model and elements for the decision table.  
- Panel develops third list of model runs for decision table and begins drafting STAR report.  
3:30 p.m. Coffee Break  
3:45 p.m. Panel discussion or report drafting continues  
5:00 p.m. Adjourn for day.

**Friday, June 24, 2011**

9:00 a.m. Consideration of remaining issues  
- Review decision tables for Species 1 and Species 2  
11:00 a.m. Panel agrees to process for completing final STAR report by Council's September meeting  
Briefing Book deadline  
5:00 p.m. Review Panel Adjourn.

## **APPENDIX 3**

### **PERTINENT INFORMATION FROM THE REVIEW**

#### **1) Participants List**

##### **Reviewers:**

Yong Chen, Center for Independent Experts

James Ianelli, Alaska Fisheries Science Center

Kevin Stokes, Center for Independent Experts

Ray Conser (Chair), Scientific and Statistical Committee (SSC) representative

##### **Advisors:**

John DeVore, Pacific Fishery Management Council (PFMC) representative

Dan Erickson, Groundfish Management Team (GMT) representative

Pete Leipzig, Groundfish Advisory Subpanel (GAP) representative

##### **STAT Team Members present:**

Melissa Haltuch, Northwest Fisheries Science Center

Kevin See, University of Washington

Allan Hicks, Northwest Fisheries Science Center

##### **Others:**