

**Report of the Groundfish Historical Catch Reconstruction Workshop**  
Pacific Fishery Management Council  
Sheraton Portland Airport Hotel  
Garden A-B Room  
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**Introduction**

A workshop on Groundfish Historical Catch Reconstructions, which are used in Pacific Fishery Management Council groundfish stock assessments to inform the assessment model regarding unfished stock biomass, was held at the Sheraton Portland Airport Hotel on 1-3 November 2016. The workshop began with a welcome by the meeting chair, Dr. David Sampson (Oregon State University), followed by a round of self-introductions from the workshop attendees. A list of attendees and the meeting agenda<sup>1</sup> are appended to this report. After a brief review of the agenda and assignment of reporting duties, Dr. Sampson presented an overview of the workshop.

**Overview of the Workshop**

Dr. Sampson clarified that the workshop would focus on the years not covered by the Pacific Fishery Information Network (PacFIN) system, which begins its coverage with 1981. However, one presentation would include an overview of the PacFIN system to set the stage for reconstruction efforts. The goal is to better understand the approaches taken by the analysts at the state and Federal agencies to develop the current set of reconstructions of groundfish landings, highlighting the major issues in developing the reconstructions and the associated uncertainties and choices. The workshop would also include presentations of statistical approaches under development for revisiting some of our historical estimates, including efforts to more effectively account for uncertainty. The new statistical approaches were not just for application to historical records but could also be applied to deriving contemporary landings estimates. Finally, the workshop would conclude with an exercise to produce “on the fly” reconstructions of selected species that would be compared to the landed catch estimates used in “published” assessments. The workshop announcement informed participants that the workshop would include an exercise and Dr. Sampson announced the three species selected for the exercise during his overview presentation.

Dr. Sampson reminded the workshop that catch histories and changes in reconstruction estimates can have a substantial impact on assessment results, noting that for the 2009 Canary rockfish update stock assessment, the addition of a fully revised catch history reduced total spawning biomass by an average of 14%. He also noted the wide range of factors that can affect reconstructions. For example, landings data may be derived from multiple sources that may

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<sup>1</sup> The workshop concluded early on Thursday 11/03, at 1pm, due to reports of an impending snowstorm.

overlap in their information content but have information presented in different forms (e.g., the Fisheries Statistics of the United States series includes data by state, while the US / Canada Technical Subcommittee reports include data by management area), different target fisheries may present unique challenges (e.g., fish landed for mink food versus for human consumption), species compositions were rarely reported and must often be assumed, there may be issues with dressed to round weight (or other) conversion factors, and that inconsistencies in spatial boundaries (e.g., PFMC vs state, port of landing vs location of capture) can lead to additional complications when different data series are combined. The availability and resolution of historical data by state also varies widely, leading to questions regarding the level of consistency in reconstruction methods among the different states. There was also considerable discussion regarding the quality of the data and estimates during the PacFIN era, with Dr. Sampson highlighting a study done on data from the late 1990s during a period in which market categories were relatively stable, in which it was demonstrated that most landings estimates were based on borrowed, or at best poorly sampled, species composition estimates. The point was raised that when developing landed catch reconstructions, analysts are typically required to make numerous decisions and rarely have any clear guidance regarding the most appropriate choices for data sources or analytical methods.

### **How PacFIN Derives Estimates of Landings by Species and Areas**

Mr. Niels Leuthold (Pacific States Marine Fisheries Commission, PSMFC) presented an overview of how the PacFIN system derives estimates of landings by species and area for 1981 onwards. PacFIN uses two types of composition proportions: (1) area compositions (in OR and WA only) apportion landed catch to Pacific Marine Fisheries Commission (PMFC) statistical areas (CA uses port area for the catch-area assignment); (2) species compositions (groundfish species only) apportion landed catch by market category (e.g., large rockfish) to the component species. Prior to implementation of the PacFIN system, there was an annual PSMFC data series that was not released until 4-6 months after each year end. The PacFIN program was created in response to the growing need for in-season data to inform industry and management. To facilitate and streamline in-season reporting, the system was based primarily on fish ticket data (rather than trawl logbook data, which are slower to collect and often incomplete) and there were no area adjustments or reporting of trawl effort. Species compositions were applied to market categories, recognizing that many market categories were aggregations of species accepted by the market, based primarily on similarities in appearance and price.

The system of applying species compositions as implemented by PacFIN was also discussed. The states provide PacFIN with the species proportions information that the system uses to apportion market category landings to species. Because the states are generally unable to collect species composition samples from all strata (e.g., year, quarter, gear, area, port), the states develop estimates of the species proportions for PacFIN based on borrowing rules that typically call for borrowing of samples in nearby space or time. The borrowing rules have developed independently in each state. PacFIN typically reports landings as “nominal” if no appropriate species composition samples are available to apportion the landings to species. It was noted that in Oregon, about 50-60% of strata estimates were based on borrowed data during 1987 to 1997, and that this has declined to ~30% by strata in recent years. The estimation system has changed substantially with the implementation of the dedicated access program and the increased requirements for species sorting. It was noted that while there are benefits to splitting out all of

the market categories to the species level, this also leads to a vast increase in need for sampling to verify the purity of the sorting. OR and WA have largely stopped sampling market categories that are assumed to be pure. There was also discussion regarding the unknown rockfish market category (UNRK or URCK), which is typically present in data from older samples and for which there is currently no well-defined practice or means for assigning to the species level, particularly in the early part of the PacFIN era (the 1980s). It was noted that analysts developing catch series for a stock assessment should examine the fraction of the landed catch that PacFIN identifies as being “nominal” in addition to the landings that PacFIN identifies as the species of interest.

### **Historical Reconstruction of Oregon Commercial Rockfish Landings**

Dr. Vlada Gertseva (Northwest Fisheries Science Center, NWFSC) presented a talk entitled “Historical reconstruction of Oregon commercial rockfish landings” based on a recently published reconstruction conducted by ODFW and NWFSC staff (Karnowski et al., 2014). The focus of the reconstruction was on rockfish and flatfish market categories from commercial fisheries; recreational and foreign fisheries were not included in the reconstruction. Dr. Gertseva’s presentation focused on the rockfish reconstructions. The analysis relied on Oregon fish ticket data and fish ticket summaries, but also used summary statistics from US Fish and Wildlife Service and National Marine Fisheries Service publications and other published sources. There were lingering questions of whether some rockfish landings were reported as dressed weights prior to 1941, and it was noted that no non-trawl landings of Pacific ocean perch were reported prior to 1940s. ODFW initiated a sampling program for rockfish species composition data in 1963 and estimates of rockfish landings by species based on these species composition data were reported in Douglas (1998). Although the raw data from the historical species composition samples are unavailable prior to 1976, they are now available from 1976 to the present. It was noted that within some of the market category subsamples, there apparently were some fish that could not be identified or assigned a species code; these “unidentified” or “other” rockfish were combined together at some point and now cannot be disentangled (at least in the pre-1978 time period). To inform the pre-1963 rockfish species composition, the reconstruction applied the 1963-1968 species compositions backwards in time, which in effect assumes that between 1945 and 1963 the fishery was already fishing comparable depth ranges as post-1963, even though it seems likely that the fishery was operating in shallower waters. It was also noted that while the Oregon non-trawl landings of rockfish were modest, sampling was also very modest, such that the earliest available data were 1985-1993 for longline landings and 1995-2001 for troll landings.

### **Ongoing Issues in Oregon’s Historical Commercial Fishery Landings**

Mr. Patrick Mirick (Oregon Department of Fish and Wildlife, ODFW) continued the Oregon theme with a talk entitled “Oregon Commercial: Resolving Ongoing Issues.” Focusing on the impact of changing historical catch estimates to assessment results, he discussed the case of substantial changes in estimates of historical black rockfish catches between the 2007 and 2015 stock assessments. Much of the change was a consequence of a small change in the stock assessment boundary that led to landings in the port of Astoria being included in the Oregon assessment, despite the fact that the footprint of the trawl grounds for the Astoria trawler fleet (based on historical logbook data) spans waters off both states and most catches landed in

Astoria were caught north of the OR / WA border. This led to some discussion of the relative merits of state-based vs. area-based reconstructions, as well as the recognition that catch reconstruction efforts should strive to keep as fine a spatial resolution as possible to maintain options for assessment analysts.

Other ongoing issues discussed relative to catch estimates in the PacFIN era in Oregon included gear classifications for fixed gear catches (some “troll” caught rockfish should have been classified as “longline” caught), some discrepancies in the time series regarding the POP market categories (“POP1” is actually a mix of shelf and slope species), and ongoing challenges associated with dealing with unidentified rockfish (“URCK”) between 1987 and 1999.

### **Quantifying Uncertainty in Commercial Landings**

Mr. Nick Grunloh (University of California Santa Cruz) along with Dr. E.J. Dick and Mr. Don Pearson (Southwest Fisheries Science Center, SWFSC) gave a “tag team” presentation entitled “Improving Catch Estimation Methods in Sparsely Sampled, Mixed Stock Fisheries.” The basic idea of this on-going project is to develop statistical model-based estimates of species compositions and landings by treating the fish ticket data as census data (i.e., known without error due to incomplete sampling), and combining the fish tickets with sampling data of species compositions by strata (year, quarter, port complex) and domain (market category, gear group, live/dead), with ad hoc borrowing of compositions for unsampled strata. Such an approach could replace the current system of borrowing samples and is likely to be more appropriate for dealing with the dramatic increase over the years in the complexity of the data (e.g., an increase in the number of market categories and associated strata) that has not been associated with an increase in sampling effort. A statistical model-based approach would have the advantages of providing a flexible framework for sharing information among strata and for quantifying the associated uncertainty, as well as for exploring whether a model-based approach to sampling might perform better if it had a simpler design (e.g., reducing the number of strata). The approach developed and presented applies a Bayesian hierarchical model to the data that results in a large set of simulated “draws” of species composition distributions that can be summarized to provide point estimates and distributions of landed catch by species and stratum, as well as used directly as a suite of catch stream draws for direct propagation of uncertainty in Bayesian models. The example in the presentation used data from the 1983-1990 time period and showed the potential of the approach for hindcasting historical catches and the associated uncertainty. It should also be possible to use revised species composition estimates from this approach for historical catches in California (pre-1981), when no species composition data are available.

Issues not fully resolved regarding the approach include the use of the beta-binomial distribution to deal with “counts of pounds” data and the associated collapse of the model to the binomial distribution as the overdispersion parameters approach zero. Efforts to investigate the trade-offs associated with sharing data across spatial regions (e.g., across port complexes) suggest the existence of major biogeographic regions but considerable pooling among port groups seems reasonable. In anticipation of potentially adopting model-based estimates for both modern and historical time periods, Don Pearson described the three principle databases currently involved in estimating species composition of California catches (CDFW, PacFIN and CalCOM) and how they are inter-related, and provided some guidance on how data from model-based estimates might be made available (served) to users, given that time blocking for recent time periods could result in continued changes to species composition estimates as new data were integrated into the

model. The basic idea is that PacFIN could be the server for summary data and associated uncertainty estimates, with the raw draw data made available online by query on CalCOM (as the billions of draws that would result would likely be too great to serve in raw form). There was discussion of plausible next steps, which could include continued work to develop an example set of catch and uncertainty estimates, a formal methodology review during the next “off year” cycle, and continued discussions with PacFIN and other states to consider how results from a model-based approach would be formally incorporated and served as data streams in a reasonably consistent manner coastwide (ideally using a standardized approach).

### **California’s Historical Catch Reconstruction**

Dr. John Field (SWFSC) described the historical groundfish catch reconstruction developed by a team of researchers at the Santa Cruz fisheries laboratory and documented in Ralston et al. (2010), plus some additional exploratory work done subsequently. The data available for the historical fisheries in California are more robust than the information available for fisheries in Oregon or Washington. For example, a system of fish tickets for the commercial fisheries has existed in California since 1928, although only summary records are available for the early years. The data record landed catches at the species level for most flatfish and roundfish species but in broad aggregations for rockfish species. The data include spatial designations at the ten-minute block resolution. The data from the 1920s to 1968 were on paper forms and microfiche but were recovered and put in digital form. Summaries of trawl landings at the block level (from trawl logbooks) were subtracted from total block summaries to derive non-trawl landings.

Dr. Field highlighted that the California fishery system underwent numerous changes over time in the number of rockfish market categories reported in the commercial landings. The catch reconstruction apportioned commercial rockfish landings by market category to species based on the assumption that some relatively minor categories were pure (e.g., cowcod, black rockfish) and species compositions for other market categories were based on the species compositions of market categories from the period 1978-1984. There is anecdotal information suggesting that fishing operations shifted to deeper water over time which implies a change in the mix of rockfish species encountered by the fishery and raises concerns about the validity of applying rockfish species compositions from a later period to rockfish landings in earlier periods.

Another issue that Dr. Field identified is that the California catch reconstruction did not account for fish caught north of the CA / OR border by trawlers that landed into ports in California. For the period 1948 and 1968, there were just over 17,000 tons of groundfish (over 75% flatfish, primarily Petrale sole and Dover sole) reported by vessels landing at California ports as being caught off Oregon or Washington.

Dr. Field also described the process used to reconstruct the historical landings by the California recreational fisheries. There is much less information available for the recreational fisheries than for the commercial fisheries. The primary information source was logbook data from the Commercial Party Fishing Vessel (CPFV) fleet which reported daily catches by ten-minute block but did not identify rockfish or flatfish except at those coarse levels. The reported landings were expanded to account for assumed fixed proportions of non-reporting (66% compliance in the north, 80% in the south). A relatively small number of spatial blocks accounted for large proportions of the overall recreational landings. The reconstruction took the approach of applying block-specific species compositions based on species compositions from modern CPFV

sampling programs. The recreational reconstruction accomplished to date was only for landings of rockfish and lingcod for the pre-RecFIN era (e.g., 1980). Landed catches by recreational fishers operating from shore or private skiffs were derived by linear extrapolation based on estimates of shore and skiff landings from a 1965 study, coupled with estimates for the early 1980s from the Marine Recreational Fisheries Statistics Survey program.

### **Spatially Distinct Historical Development of California's Groundfish Fisheries**

Ms. Rebecca Miller described a recently published study (Miller et al. 2014) that developed geographic information system layers based on the 10-minute block summary data that are available for California's commercial fisheries since the 1930s. The study objectives were to explore issues such as whether fishing areas closed in the modern era have experienced exploitation histories that were similar or different from areas that have not been closed and whether spatial catch histories (e.g., movement over time to deeper fishing grounds) could help refine certain unspecified market categories (e.g., skates). The investigators produced maps of the year at which the cumulative catch associated with each 10-minute block reached 50% of the total catch over the period 1935 to 2000 and used a general linear modeling approach to explore the explanatory power of spatial variables such as distance from the closest port, the percent of days with strong winds, and mean depth. The maps illustrate the general phenomenon of a shift from shallow water species in the 1940s to deeper water species in the 1980s and the set of GLMs indicate the importance of depth, distance from port, and the percent of windy days as "explanations" for the temporal changes in the spatial patterns of fishery removals. The study included a similar investigation of spatial changes in the recreational fishery for rockfish based on 10-minute block summary data and came to similar conclusions, that over time the recreational fishery for rockfish has fished deeper habitats, further from port, in increasingly inclement weather, and in more productive waters (higher chlorophyll concentrations).

### **Oregon's Comprehensive Sport Fishery Catch Reconstruction**

Ms. Alison Whitman (ODFW) provided an overview of an Oregon recreational catch reconstruction effort. This is an ongoing project that uses data covering the years 1979 to 2000 based on samples from the recreational fishery, mostly collected from the major ports and mostly during summer months. The primary driver during the early years of this sampling program was to monitor the recreational landings of salmon. The current reconstruction project is working towards producing a comprehensive sport fishery landings reconstruction for Oregon that uses the same approach for all species, rather than the species by species reconstructions that have been done previously. One motivation for the project is to provide an alternative to suspicious landings in reported in the past in the Recreational Fishery Information Network (RecFIN) that were based on questionable estimates of fishing effort (angler days) derived from telephone surveys. Ms. Whitman described a four-step process that will be used to derive the catch reconstruction: expand landings in numbers of fish by category (e.g., "rockfish") for (1) unsampled ports and (2) unsampled time periods; (3) apply species composition proportions to apportion the landings to species; and (4) apply average weights by species to estimate landings in biomass. The final reconstruction product will be landings weights and numbers of fish by species, year, month, port, boat type (charter vs private).

Two datasets are available for developing species compositions, one from ODFW's Ocean Recreational Boat Survey (ORBS) and another from angler surveys conducted by the Marine Recreational Fisheries Statistics Survey program (MRFSS). Although the ORBS dataset contained many more fish observations than the MRFSS dataset (hundreds of thousands versus thousands), there was discussion of whether the ORBS data may have already been expanded. Ms. Whitman illustrated how she might apply regression tree analysis or nonmetric multi-dimensional scaling to develop a strategy for pooling samples to derive species composition estimates for use in the reconstruction.

### **Constructing Historical Commercial Landings of Lingcod and Rockfishes in Washington**

Dr. Theresa Tsou, Mr. Dayv Lowry, and Mr. Phil Weyland, all from the Washington Department of Fish and Wildlife, provided background information on the ongoing Washington historical catch reconstruction effort. There are numerous challenges associated with this reconstruction, particularly the fact that many of the fish that are landed into Washington ports were caught from distant areas such as fishing grounds British Columbia or Alaska. The presentation noted that until 1995 market categories in the Washington landings system were driven by markets. There was no motivation to sort fish to species (or size) unless market prices so dictated. Also, technological developments (e.g., availability of increasingly sophisticated navigational equipment, development of better trawl gear) were often followed by an expansion in the geographic range of fishing. As well, the presentation noted that the WA catch reconstruction will not account for all Tribal landings. >>> *Need to clarify if any Tribal catches will be included.*

The WDFW team of analysts has assembled data from a variety of different Federal and WA State agency sources that have been involved in collecting and reporting fishery statistics, with commercial landings recorded from as early as the 1880s from inland waters (Puget Sound). The data are much more consistently recorded and straightforward to work with from the mid-1940s on. After 1943, WA fish tickets became the primary data source; U.S. Fish Commission reports are the primary data source prior to then. Another problem was sometimes there was at-sea processing and the reported historical landings were for dressed fish, especially for lingcod and flatfish. One assumption made in the reconstruction is that the U.S. Fish Commission reports of landings prior to 1941 were fillet weights, not round weights. There was discussion that a fillet-to-round conversion factor for lingcod of 1.431 is questionable.

The basic steps planned for the reconstruction are to develop data series of the total annual landings into Washington by market category (from Agency reports and WA fish tickets), make catch-area assignments for the landings (Alaska, Canada, Puget Sound, WA outer coast) and gear assignments (e.g., bottom trawl, midwater trawl, set line, troll, pot), and compile species composition samples to apportion landings to species. There is much left to do in completing the WA catch reconstruction. The top priority is to develop reconstructions for the full assessments scheduled for 2017 (e.g., lingcod and rockfish).

During discussions it was noted that during some periods the Washington port sampling program used a different strategy than the other states when conducting species composition sampling. In Washington if the landed catch was from a trip that fished in multiple areas, then landings from that trip would be deliberately avoided. The idea of this approach was to develop species composition samples that were area-specific. There was also discussion of the general need to report species composition data by gear type.

## **Constructing Historical Recreational Catches of Rockfishes off the Washington Coast**

Dr. Jason Cope (NWFSC) provided an overview of reconstructing Washington recreational catches using as an example the reconstruction he was involving in developing for the 2015 black rockfish assessment. For the modern era (from 1990) the reconstruction was based on estimates provided by the WDFW Ocean Sampling Program. For the period 1975 to 1986 there were WDFW sport catch reports. Most of the early years of the reconstruction were based on applying a black rockfish-to-salmon catch ratio to reported landings of salmon. One notable feature of the black rockfish reconstruction was a very abrupt shift between 1980 and 1984 with about a fourfold increase in the landed catch. Dr. Cope noted that black rockfish is a major target species for the WA recreational fishery and is therefore well represented in the available species composition information. It will be a challenge to develop suitable species composition proportions for the other rockfish species.

## **Quantifying Uncertainty in the Historical Catch Reconstruction of Commercial Groundfish Fisheries in Washington**

Ms. Kristin Privitera-Johnson (MS Fisheries student at the University of Washington) provided an overview of the bootstrap resampling approach she intends to use to quantify uncertainty in historical commercial groundfish catches off the Washington coast. She provided an example using some landings data by market category with resampling done at the level of the sampling stratum (year quarter, port group (Westport, Neah Bay, Bellingham), and gear group). There was some discussion as to whether it was more important to mimic the sampling error about the mean for that stratum or whether it was better to mimic more of the uncertainty by resampling across all strata. One error check is to correlate the number of samples in each draw. There should be some consideration for drawing across years, which is dependent on the interannual variability of catches.

In general, there should not be an expectation that the methodologies being investigated to capture catch uncertainty will be ready to implement in 2017 assessments.

## **Lessons Learned from the States' Historical Catch Reconstructions**

Following the presentations there was discussion regarding general lessons that have been learned from the catch reconstructions done independently by the three states. The workshop participants formulated the following list of things-to-do and things-to-avoid-doing when developing catch reconstructions.

*Things to do (when developing catch reconstructions):*

- Document all methodologies used in developing the reconstructions.
- Each state reconstruction should account for all landings into the state, not just the landings of fish that were caught in waters off the state. For example, the California reconstruction does not include fish caught off Oregon or Washington.
- Keep the underlying data at the most granular level possible (e.g., monthly and at the finest available spatial scale).

- Try to account for the evolution of the fishery (e.g., gradual movements of fishing operations to deeper waters).
- Where possible, investigate the sources of variability in the data. Consider using model-based rather than design-based statistical approaches.
- The state fishery agencies should consult with each other regarding how to reconstruct historical catches, resolve issues that might result in inconsistencies, and avoid double-counting.
- Encourage development of a coastwide database of historical catches and reconstruction methods. One approach would be to migrate the states' catch history reconstructions into the PacFIN/RecFIN systems. Any central repository should include the disclaimer that the reconstructions are subject to change.
- Search state agencies files and archives for historical catch data.
- Prioritize digitizing of available historical data series.
- Standardize conversion factors.
- Explore why the U.S. Fish Commission catch estimates were consistently higher than what was reported in Washington State data sources.
- Explore approaches for hindcasting species compositions to fill in data gaps and improve catch reconstructions.
- Conduct a formal methodology review of the statistical model-based approach for generating landings by species (i.e., the approach being develop by Grunloh) when it is more fully developed.
- Communicate historical catch reconstructions to the STATs doing the 2017 assessments.
- Warn the STATs that they should explore whether the unspecified market categories (e.g., POPI, URCK, unidentified flatfish, and unidentified skates) include appreciable quantities of the species they are assessing.

*Things to avoid doing:*

- Don't throw away data.
- Don't lose the codes associated with historical data series.

### **Workshop Exercise**

As a demonstration of the robustness and ease of use of the systems developed by the three states for producing groundfish historical catch reconstructions, the workshop included a half-day activity in which teams from each state were asked to produce historical catch reconstructions for three stocks: Dover sole, lingcod, and darkblotched rockfish. The reconstructions were then compared to the reconstructions used in the most recent corresponding PFMC stock assessments and the discrepancies were examined to identify the causes where possible. Summaries of the results for each state are provided below.

### *California - Dover Sole*

- There were some discrepancies between the workshop reconstruction and what was reported in the last assessment (Hicks and Wetzel, 2011), especially during the early years of the landings series. For years prior to 1948 the 2011 assessment used landings data from the 2005 assessment (Sampson, 2005) rather than from the CalCOM system, which was used for the period 1948-1980. The discrepancies in the early years were apparently due to how the 2005 assessment accounted for incidental catches of Dover sole that were discarded as scrap fish and unreported prior to the late 1940s. The 2005 assessment assumed that “0.2 tons of Dover sole [were landed] for each landed ton of English, petrale, and rex sole”. The workshop reconstruction did not account for these unreported landings of Dover sole.
- During discussion it was noted that “Unspecified sole” were not broken out in the California catch reconstruction.
- The discrepancies highlighted the fact that the existing reconstructions are only for the landed catches and do not account for at-sea discards.

### *California – Lingcod*

- There was almost exact agreement between the two reconstructions, which was to be expected given that the California landings data from the 2009 assessment (Hamel et al., 2009) were taken directly from the California catch reconstruction.
- However, landings prior to 1930 were not available from the workshop reconstruction because block summary data were not available for that period. The 2009 assessment in comparison used data from US Fish and Wildlife Bulletins to fill in landings back to 1928. The California catch reconstruction could be extended back in time if it added data from this source.
- There were some discrepancies (e.g., 1960) that were inexplicable. The database has not changed since the reconstructed catch data were provided for the 2009 assessment.

### *California - Darkblotched Rockfish*

- There were major discrepancies between the workshop reconstruction and the landings data used in the 2015 assessment (Gertseva et al., 2016). The landings in the assessment were about half of what was found in the workshop reconstruction for years prior to 1952; the estimates were nearly equivalent thereafter.
- The workshop participants had no explanation for the discrepancy.

### *Oregon - Dover Sole*

- The workshop reconstruction exactly matched the landings data from the previous assessment (Hicks and Wetzel, 2011).

### *Oregon - Lingcod*

- The reconstruction in the assessment (Hamel et al., 2009) only reported data for Oregon and Washington combined. When this item came up for review the Oregon reconstruction had been completed, but the reconstruction for Washington was still being developed.

### *Oregon - Darkblotched Rockfish*

- The landings series from the assessment (Gertseva et al., 2016) was consistently below the workshop reconstruction due to the workshop accounting for darkblotched rockfish in the URCK and POP1 unspecified rockfish market categories in PacFIN, which were identified and discussed on the first day of the workshop. The development of species composition proportions to apply to these market categories sometimes required pooling data across years or ports from fixed gear landings, due to a dearth of data. Year-specific compositions were used to apportion trawl contributions of unspecified rockfish categories.
- Both the assessment and workshop reconstructions only used landings data and did not attempt to account for at-sea discards.

### *Washington - Dover Sole*

- There were large discrepancies since the 1970s with landings in the assessment (Hicks and Wetzel, 2011) being much higher than the landings in the workshop reconstruction. The greatest differences were during the period 1978 to 1991.
- There were no large landings of unspecified flatfish in Washington that might account for differences.
- The assessment provided no description of the landings data for the 1978 to 1991 period other than that the landings data from 1981 on were downloaded from PacFIN. It is possible the workshop reconstruction used different area composition proportions than PacFIN to account for the catches that occurred off Washington (as opposed to landings caught off Canada or Alaska).

### *Washington - Lingcod*

- There were substantial differences between the workshop reconstruction and the landings used for Oregon and Washington combined in the 2009 assessment (Hamel et al., 2009), especially for the period 1930 to 1970.
- On further review, the vast majority of the landings discrepancies that were observed were due to the inclusion of catches that had actually been from waters off Canada. Apportioning catches from Swiftsure Bank and other fishing grounds that straddle the border is an issue potentially in need of further resolution. The workshop reconstruction assumed that all catches from the straddling grounds were from Canadian waters. The catch history resulting from apportioning these catches to the US versus Canadian areas

is much closer to what was used in the last assessment, suggesting that the assessment authors made the same assumption.

- Geographic information system mapping layers exist for each of the banks identified on fish tickets and may be useful in apportioning catches between the countries.

#### *Washington - Darkblotched Rockfish*

- The workshop reconstruction for darkblotched rockfish was not fully completed at this point in the workshop. However, reconstructed landings that were available for the period 1968 to 1980 were substantially lower compared to the corresponding landings from the assessment (Gertseva et al., 2016).
- The species composition proportions may have differed between the workshop reconstruction and the assessment reconstruction. Further, the unspecified rockfish (UROCK) had not yet been accounted for in workshop reconstruction.

#### **Lessons Learned from the Workshop and Recommendations**

- Most of the discrepancies identified by the workshop exercise were in the Washington catch reconstruction. Readers should appreciate that this reconstruction is a work in progress; additional time is required to fully develop and debug the Washington reconstruction.
- Additional follow up work is needed to evaluate the source(s) of the discrepancies between the workshop reconstructions for darkblotched rockfish and the landings reported in the assessment.
- Digitizing more of the recreational data in California that are currently available only as paper records should be prioritized and funding provided to extend the data series further into the past.
- Some historical landings of fish reported as being for animal food (mink food) may have been waste carcasses rather than whole fish. Analysts developing catch reconstructions should attempt to confirm that landings reported as animal food or scrap-fish have not been double-counted (e.g., once when sold as whole fish, a second time after processing when sold as mink food).
- Research is needed to evaluate the costs and benefits of splitting current market categories to finer and finer levels. At issue is how fishers / fish processors will use the additional categories (e.g., will they be willing and able to fully comply with sorting to species) and whether additional sampling will be required to derive reasonably reliable estimates of the compositions of the additional categories.
- Concerns were expressed regarding the representativeness of the biological samples taken from the landed catch and whether sampling should be proportional to landings for a given trip type. Sampling at the ports is conducted more on an opportunistic basis rather than proportional to the landings. Special problems can arise at locations where the processing plant operator is uncooperative about allowing sampling to occur (e.g., because it interferes with operations of the fillet line). An evaluation of which locations (or vessels) get sampled regularly and which do not might help identify potential problems that could be resolved by

informal communication with the uncooperative processing plant operator or by using more drastic measures.

- An unresolved question for catch reconstructions is what analysts should do when data are unavailable for either the basic landings series or the catch compositions (for species or areas). The Bayesian methods being developed and tested seem a significant improvement over the existing data borrowing procedures, but the approach will not be fully developed nor thoroughly reviewed in time to produce catch reconstructions for the 2017 assessments. Approaches for borrowing data across time periods or spatial regions should consider variability between periods or areas rather than using arbitrary rules. Some analysts have the view that data borrowing should not extend between ports, but model-based approaches could be used to test this supposition. Providing rationale and documentation for the decisions made and alternatives forgone during preparation of a catch reconstruction is an important aspect of the process.
- Sometimes in reconstructions it is necessary to use interpolation to fill in data gaps, but there is no agreed standard procedure. How interpolation is handled is case-specific, depending on the duration being interpolated over and what conditions in the fishery may have changed. There can be shifts in species distributions as well as in where the fisheries operate.

**Recommendation:** During the development of stock assessments there should be a review by state data stewards early in the process of the historical catch reconstructions to ensure that STAT teams are aware of any items that should be considered regarding how to fill in data gaps in landings or species compositions.

- During the workshop there were examples of historical landings being reported as the weights of fillets rather than whole fish.

**Recommendation:** Conversion factors to expand landed weights to whole fish should be standardized for fish that are processed at sea and landed as headed and gutted product, as fillets, or as just livers.

- The historical annotated landings database (HAL) includes the data reported by the Pacific Marine Fisheries Commission (in the so-called PMFC “big book”).

**Recommendation:** A copy of the HAL database should be placed in the PacFIN system.

- **Recommendation:** Copies of state catch reconstructions and contributing databases should be transferred to PacFIN so there is a single repository. A process will need to be established so reconstructions in PacFIN can be updated as the states make revisions to their reconstructions.

- **Recommendation:** The existing California catch reconstruction should be revised to account for unspecified sole.

- Because species compositions on the fishing grounds are generally depth dependent, there is good potential for using fishing depths to improve estimates of species compositions, especially in the context of the historical period for which there were few if any direct samples of species compositions.

**Recommendation:** Model-based methods for hindcasting landings should explore the potential for using trawl logbook data (tow locations and/or tow depths) to inform the

estimates of species proportions that are applied to landings. Trawl logbook data are available back to the 1960s for Oregon, to the 1950s for Washington, and back even further for California.

- Accounting for at-sea discards remains a significant challenge, especially for catch reconstructions. The topic of discards was barely touched on during the current workshop and should be considered as a possible focus of a future workshop. The reasons for discarding probably were market driven in early years and due to regulations (e.g., trip limits) in later years. Thus the magnitude of discards will likely vary through time as a result.

**Recommendation:** Current historical catch reconstructions only account for the landed portion of the catch. The Council should consider sponsoring a workshop to explore methods and data series that could be used to account for at-sea discards in historical catch reconstructions.

## References

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- Sampson, D.B. 2005. The status of Dover Sole off the U.S. West Coast in 2005. Pacific Fishery Management Council.

## **Attendees**

Dr. David Sampson, Oregon State University, Corvallis, OR, Chair  
Dr. John Budrick, California Department of Fish and Wildlife, Belmont, CA  
Mr. Troy Buell, Oregon Department of Fish and Wildlife, Newport, OR  
Dr. Dave Colpo, Pacific States Marine Fisheries Commission, Portland, OR  
Dr. Jason Cope, National Marine Fisheries Service Northwest Fisheries Science Center, Seattle, WA  
Mr. John DeVore, Pacific Fishery Management Council, Portland, OR  
Dr. E.J. Dick, National Marine Fisheries Service Southwest Fisheries Science Center, Santa Cruz, CA  
Dr. John Field, National Marine Fisheries Service Southwest Fisheries Science Center, Santa Cruz, CA  
Mr. Mark Freeman, Oregon Department of Fish and Wildlife, Newport, OR  
Dr. Vladlena Gertseva, National Marine Fisheries Service Northwest Fisheries Science Center, Seattle, WA  
Mr. Nick Grunloh, National Marine Fisheries Service Southwest Fisheries Science Center, Santa Cruz, CA  
Mr. Ed Hibsich, Pacific States Marine Fisheries Commission, Portland, OR  
Mr. Bob Leos, California Department of Fish and Wildlife, Monterey, CA  
Mr. Pete Leipzig, Fishermens Marketing Association, Eureka, CA  
Dr. Niels Leuthold, Pacific States Marine Fisheries Commission, Portland, OR  
Mr. Greg Lippert, Washington Department of Fish and Wildlife, Olympia, WA  
Mr. Dayv Lowry, Washington Department of Fish and Wildlife, Olympia, WA  
Ms. Rebecca Miller, National Marine Fisheries Service Southwest Fisheries Science Center, Santa Cruz, CA  
Mr. Patrick Mirick, Oregon Department of Fish and Wildlife, Newport, OR  
Dr. Melissa Monk, National Marine Fisheries Service Southwest Fisheries Science Center, Santa Cruz, CA  
Mr. Don Pearson, National Marine Fisheries Service Southwest Fisheries Science Center, Santa Cruz, CA  
Ms. Kristin Privitera-Johnson, University of Washington, Seattle, WA  
Mr. Robert Ryznar, Pacific States Marine Fisheries Commission, Portland, OR  
Ms. Lori Steele, West Coast Seafood Processors Association, Portland, OR  
Dr. Tien-Shui Tsou, Washington Department of Fish and Wildlife, Olympia, WA  
Mr. Phil Weyland, Washington Department of Fish and Wildlife, Olympia, WA  
Ms. Alison Whitman, Oregon Department of Fish and Wildlife, Newport, OR

**PROPOSED AGENDA**  
**Groundfish Historical Catch Reconstruction Workshop**

Pacific Fishery Management Council  
Sheraton Portland Airport Hotel  
Garden A-B Room  
8235 NE Airport Way  
Portland, OR 97220  
503-281-2500

**November 1-3, 2016**

TUESDAY, NOVEMBER 1, 2016 – 1 PM

**A. Call to Order**

1. Call to Order and Introductions Dave Sampson
2. Reporting Assignments
3. Review and Approve Agenda  
(1 p.m., 0.33 hours)

**B. Overview of the Workshop and Some of the Likely Issues** David Sampson  
(1:20 p.m., 0.66 hours)

**C. Overview of How PacFIN Derives Estimates of Landings by Species and Area** PSMFC  
(2:00 p.m., 0.5 hours)

**D. Historical Reconstruction of Oregon Commercial Rockfish Landings** Vlada Gertseva  
(2:30 p.m., 1 hour)

**E. Oregon Commercial: Resolving Ongoing Issues** Patrick Mirick  
(3:30 p.m., 1 hour)

**F. Quantifying Uncertainty in Commercial Landings** E.J. Dick, Nick Grunloh, & Don Pearson  
(4:30 p.m., 1 hour)

WEDNESDAY, NOVEMBER 2, 2016 – 8:30 AM

**G. California's Historical Catch Reconstruction** John Field  
(8:30 a.m., 1 hour)

**H. A Spatially Distinct History of the Development of California Groundfish Fisheries** Rebecca Miller  
(9:30 a.m., 1 hour)

**I. Oregon's Comprehensive Sport Reconstruction** Alison Whitman  
(10:30 a.m., 0.5 hours)

**J. Constructing Historical Commercial Landings of Lingcod and Rockfishes in Washington**

Theresa Tsou

(11:00 a.m., 1 hour)

LUNCH (12:00 p.m.-1:00 p.m.)

**K. Constructing Historical Recreational Catches of Rockfishes off the Washington Coast**

Jason Cope

(1:00 p.m., 1 hour)

**L. Historical Catch Reconstruction of Commercial Groundfish Fisheries in Washington: A Look at Quantifying Uncertainty**

Kristin Privitera-Johnson

(2:00 p.m., 1 hour)

BREAK (3:00 p.m.-3:15 p.m.)

**M. Panel Discussion on Historical Catch Reconstruction: Dos and Don't Dos**

(3:15 p.m., 0.75 hours)

**N. Workshop Exercise in Breakout Groups**

(4:00 p.m., 1.5 hours)

*Teams for each state will be asked to produce several on-the-fly historical catch reconstructions. These reconstructions will be compared to reconstructions used in existing PFMC stock assessments.*

*The exercise of constructing several historical catch reconstructions will provide participants with first-hand exposure to some of the issues associated with catch reconstructions. Even with purpose-built software available for querying databases and compiling the information there are likely to be several decision-points requiring human intervention. The published stock assessments will provide results based on decisions by one set of analysts. The workshop exercise will produce results from a different set of analysts. Comparisons of the results will illustrate some of the uncertainty associated with producing catch reconstructions.*

THURSDAY, NOVEMBER 3, 2016 – 8:30 AM

**O. Progress Reports on the State Catch Reconstructions**

(8:30 a.m., 0.5 hours)

**P. Continue Work on the State Catch Reconstructions**

(9:00 a.m., 3 hours)

LUNCH (12:00 p.m.-1:00 p.m.)

**Q. Final Reports on the State Catch Reconstructions**

(1:00 p.m., 1 hour)

**R. Panel Discussion on Lessons Learned from the Workshop Exercise**  
(2:00 p.m., 1 hour)

**S. Elephants in the Room:**

1. What to do When No Sample Data are Available
  2. What to Do About Discards
  3. Other Key Uncertainties in Historic and Current Catch Estimates
- (3:00 p.m., 1 hour)

**T. Develop Workshop Recommendations**  
(4:00 p.m., 1 hour)

ADJOURN