



NOAA FISHERIES

Northwest Fisheries Science Center

F. Summary of Assessment Accomplishments

Accomplishments Relative to NMFS Mandates

The Northwest and Southwest Fisheries Science Centers have been leaders in producing stock assessments and providing scientific guidance for Pacific coast groundfish to the PFMC and the West Coast Region, or management arm of NMFS. In the early years of the Council's groundfish FMP, limited staffing and data collection forced assessment activity to focus on a few species that were the most important to west coast fisheries. The passage of the Sustainable Fisheries Act of 1996 created two new explicit mandates that were previously implicit in the MFCMA's original charge of sustainable management: namely, preventing overfishing and rebuilding overfished fisheries.

These new mandates led to the identification of considerable challenges facing Pacific coast groundfish management, and eventually to additional resources with which to address those challenges. Prior to the SFA, the PFMC had not established Minimum Stock Size Thresholds or spawning biomass targets for groundfish. In 1998, the PFMC revised its harvest policy to satisfy requirements of the SFA by adopting Amendment 11 to the Pacific coast groundfish FMP which identified the MSY as a constant fishing mortality rate and limit not to be exceeded; established the use of proxy MSY exploitation rates as $F_{40\%}$ for rockfish and $F_{35\%}$ for other species when previously set at $F_{20\%}$ for all groundfish stocks; set a schedule for reducing fishing mortality at low stock size (40-10 policy); and identified the overfished/rebuilding threshold as 25% of unfished biomass (B_{unfished}).

As assessments began to focus on the status of stocks, relative to their unfished levels, it became clear by 2001 that several stocks were in need of rebuilding. As data to support assessments accumulated, it also became clear that many west coast species were less-productive than in the North Pacific, and also too unproductive to support continued harvest at rates of identified by prior research, such as Clark, as sustainable.

In response to the new scientific information, a series of workshops were held to evaluate the Council's harvest policy. Based on guidance from west coast NMFS scientists and members of its SSC, the PFMC adopted a more conservative harvest-rate policy, particularly for rockfish ($F_{50\%}$). This policy, in conjunction with data, assessment, and management uncertainties did not guaranteed that subsequent assessments do not occasionally find that historical harvests since 2000 have been higher than the intended rates. The Council, to its credit, has been steadfastly committed to constraining catches to amounts consistent with its policies and SSC recommendations, throughout its history. As a result, there have been remarkably few instances since 2000 where estimates of total annual catch have exceeded amounts that were specified as the equivalents of current Overfishing Levels (OFLs) in any given year. Throughout this challenging transitional period, the Council has benefited not only from the wise leadership of its members, but from the many devoted NMFS assessment scientists who have helped guide their decisions from positions on the SSC and GMT.

The challenge of rebuilding stocks brought with it the need for new tools to help with understanding rebuilding trade-offs. The University of Washington's Dr. Andre Punt, through support provided by the NWFSC, developed (and has refined over the years) a tool for projecting assessment results forward across rebuilding timeframes, capturing important summary information including rebuilding uncertainty. Analyses by west coast assessment scientists using this tool have guided the Council to set rebuilding harvest caps that have rebuilt 3 of the 10 species which have needed rebuilding plans, to date. Another three stocks are expected to be identified as rebuilt during the 2015 assessments. Since 2002, only one stock has been newly identified as overfished, and it is considered the most likely to be rebuilt in 2015. In addition to assessment support, the NWFSC has provided extensive analytical support to the PFMC, in its effort to constrain fisheries to desired rebuilding mortality levels.

Long before the Magnuson Act's revision in 2006, all of the species in the PFMC groundfish FMP were included in some individual or assemblage category which was capped by the equivalent of today's OFLs. However, for many species included in assemblages, these limits had been based on simplistic averages of historical catch levels in the late-1980s and early-1990s. Scientists at the SWFSC pioneered improved methods of deriving safe harvest levels, based only on catch data and other assumptions, in part based on species vulnerability. Analyses conducted in 2009-10 led to a vastly improved scientific basis for specifying OFLs for these species from 2011 on. In response to new harvest guidance from Congress and NMFS, following the 2006 reauthorization, scientists from both centers collaborated to produce an award-winning meta-analysis to determine the amount of uncertainty about current stock size, across assessed stocks. This analysis has been used by the Council as the basis for determining the size of the scientific uncertainty buffer by which the OFL is reduced, in calculating the ABC, which serves as the effect cap on harvests.

Extensive development and simulation testing of alternative, data-moderate assessment methods by NMFS scientists represents the latest methodological advances in the region's ability to better meet its assessment challenges. The motivation to explore these methods has been to seek a middle ground between the best possible assessment, with the high costs of developing and reviewing a benchmark assessment, and a data-poor assessment that includes only catch data and provides no information about stock status. Collaborative research, development, and testing by scientists at both Centers produced eight accepted, data-moderate assessments in 2013, including six for species that had not previously been assessed. Most importantly, these new assessments meet agency standards for adequacy.

The west coast fishery stock assessment community, and NMFS's in particular, have made tremendous strides over the last 15 years. Despite severe reductions in state fishery agency budgets, the number of adequate groundfish assessments that are less than 5 years old has risen from 15, in 2003, to 31 in 2013. A total of 15 species have received first-ever benchmark assessments since 2005 (inclusive). In 2004, groundfish in the Pacific region lagged 10 percentage points behind the national attainment of 50% of its possible FSSI points. By 2013, west coast groundfish had achieved nearly 73% of its maximum score, and exceeded the national average of 69%.

Ecosystem Considerations

The NWFSC and SWFSC collaboratively produce both the California Current Integrated Ecosystem Assessment as well as the Annual state of the California current ecosystem report that are used by the PFMC. Stock assessment authors contribute to both of the above documents. While the IEA provides extensive documentation of ecosystem indicators and processes, this large document is distilled down into the more concise and annually updated ecosystem report reviewed annually by the PFMC. Assessment authors have also directly contributed to the development and acceptance of the Fishery Ecosystem Plan and Research and Data Needs documents by the PFMC. Relevant PFMC documents to which assessment authors have contributed are provided below.

All groundfish stock assessments fulfill PFMC terms of reference that require a summary of relevant physical, environmental, and ecosystem issues for each assessed fish stock, as well as detailed discussion and documentation of any ecosystem factors used in evaluating alternative assessment models. In general, assessment ecosystem sections represent summaries of ecological influences and issues from the scientific literature. As time permits assessment authors consult with NWFSC and SWFSC ecosystem assessment scientists.

Examples of integrating ecosystem considerations directly into stock assessments or assessment-related research include 1) a sablefish-sea surface height recruitment relationship, 2) environmental drivers of Pacific hake distribution, and 3) analysis of data from the annual May–June mid-water trawl survey for juvenile rockfish. Additionally, a large number of relevant research projects are presented in the power point for this topic area. These include projects funded by the NMFS Fisheries and the Environment (FATE) program, and strong research partnerships with university faculty and students.

Research suggests that sablefish recruitment is driven by feeding conditions during the pelagic life stages, and that these feeding conditions can be indexed by sea level. The relationship between feeding conditions, sea level, and sablefish recruitment has been under investigation since the early 2000s and has been considered in the stock assessment since 2005. The most recent, 2011, stock assessment, found that the use of the environmental index has not had a large effect on model results, and as a result this model run is presented as a model sensitivity in the stock assessment. The small effect of the SSH recruitment index on the sablefish stock assessment is due to consistent signals from fishery and survey data regarding year-class strengths. Additionally, because sablefish are observed by the annual trawl survey as 1- and 2-year-olds, the index is of less use for stock projection purposes than would be the case for species that are selected by the survey at older ages.

Annual changes in the distribution of Pacific hake are driven by environmental conditions in the California Current, thus impacting the availability of hake to the fishery. This issue has been addressed by incorporating time varying selectivity, via a random walk modeled as yearly deviations from the base selectivity, into the 2014 Pacific hake stock assessment. Support for this change to the stock assessment was the result of a MSE, which indicated that incorporating time-varying fishery selectivity reduced the risk of the biomass falling below critical reference points.

The SWFSC conducts an annual May–June mid-water trawl survey for juvenile rockfish with the goal of providing pre-recruit indices of abundance for use in groundfish stock assessments. Analyses of the standardized anomalies of recruitment indices for the ten most frequently encountered rockfish species in the survey suggest that interannual fluctuations of all 10 species are strongly coherent but highly variable. Sea level anomalies in the months preceding the survey are well correlated with reproductive success. In particular, equatorward anomalies in the alongshore flow field following the spawning season are associated with elevated survival and poleward anomalies with poor survival.