Agenda Item H.2
Attachment 1
March 2020

DATA AND ANALYSIS SUPPORTING THE PRIORITIZATION OF SPECIES FOR STOCK ASSESSMENTS IN 2021 AND 2023

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This year represents the third biennial cycle in which the Pacific Fishery Management Council (Council) and its advisors have been presented with an analysis of factors relevant to the prioritization of groundfish species for assessment, using the general framework advanced in the 2015 National Marine Fisheries Service Technical Memorandum, "Prioritizing Fish Stock Assessments".
[https://www.st.nmfs.noaa.gov/Assets/stock/documents/PrioritizingFishStockAssessments_FinalWeb.pdf]

This process was envisioned as a way of synthesizing a broad range of relevant information in a manner that can, over time, provide improved guidance, primarily on which species should be considered for Benchmark (i.e. Full) assessments, or subsequent Updates. The ranking process provides a useful tool for focusing discussion on species where a new assessment may have the greatest impact, but it is not a replacement for the judgment of the Council and its advisors.
An important consideration for selecting any species for assessment is whether the (potentially) available data (e.g. trend and compositional data) are adequate to conduct the desired level of assessment. This aspect of prioritization is not scored in the way other Factors are, and so must be considered independently, at this time. In that regard, the process is likely to help identify important data gaps and/or situations where a data-moderate approach should be undertaken with whatever data are available. It is also the subject of a new Appendix written for this year's package.

The scoring and weighting of Factors in the associated Excel workbook remains a work in progress, particularly as we consider its ability, as currently configured, to provide useful insight into priorities in subsequent cycles, as requested by the Council. The worksheet which will help identify priorities for 2023, given 2021 selections could not be completed by the advanced Briefing Book deadline, but will be available by the March meeting. There may be important considerations that are not encompassed by any of the existing factors, or the methods by which Factor Scores are derived or weighted may be identified as needing improvement. As consideration of priorities for 2021 are considered this spring it will be important to identify any parts of the scoring that could be improved. As aspects of management change, this framework should adapt to reflect the manner in which those changes affect prioritization. For instance, in this year's exercise a new element has been included in the scoring to acknowledge the increases in the buffer between a stock's OFL

(Overfishing level) and its ABC (Acceptable Biological Catch) values that accompany non-selection of species for assessment in the upcoming cycle.

The Excel workbook that accompanies this document begins with an Overview tab, followed by a Summary tab in which the Factor Scores are assembled and multiplied by the base-case weights, resulting in a total score and ranking. Those are followed by a tab for each Factor, which documents the Factor scores and ranks for each species, and a Summary scoring worksheet. The following text provides a description of the content and issues associated with each tab, along with the source of data and information used in scoring each Factor.

Descriptions of Excel workbook Tab contents

Overview

The Overview tab includes a table which lists all of the Factors, the information source(s) and basis for scoring each Factor. The scoring approach or formula, if applicable, is presented to the right of a Factor. As noted above, a Factor Scores the Ecosystem Importance Factor has now been included, and also contributes, as intended, to the determination of assessment frequency. Updated stock trend graphs were not yet available for inclusion in this first workbook of the cycle. Trawl survey data for 2019 are not expected to be available until later in the spring.

Commercial Fishery Importance

The commercial importance score is based on the coastwide ex-vessel revenue generated by commercial landings of groundfish during the period 2014-18. The raw revenue amounts have a very large range (from $1,000 to $129 million), with revenue dropping by one order of magnitude between the top and 5th-highest species and by another order of magnitude from there to the 17th-highest species. Consequently, a transformation is used to compress the distribution and reduce the differences between species. If scores were based strictly on revenue, this Factor's scores would fall from a high of 10 to less than 0.34 at species #8. As in 2018, a 2-stage logarithmic transformation is used to compress and rescale the distribution (to a high score of 10, using the following approach: revenue is exponentiated to the 0.18 power [$Initial_Value_i = Revenue_i)^{(0.18)}$], with a simple multiplicative scalar used to achieve a maximum score of 10 [$Score_i = Initial_Value_i * 10/(Initial_Value_{MAX})$]. Revenue amounts included in this tab's scoring do not include sales of Tribally-caught groundfish. Those are included in the Tribal tab. Since hake is not included in this exercise, sablefish is the top-scoring commercial groundfish, followed by petrale and Dover soles, shortspine thornyhead, and widow rockfish.

Recreational Importance

Recreational landings lack a measure of value that is equivalent to commercial ex-vessel revenue. In the absence of an equivalent metric, these rankings continue to rely on the approach implemented in 2016, in which a “pseudo value” for the recreational landings of each species is calculated by multiplying the 2014-18 landed catch amounts in each state by a set of state-specific relative weights, which serve the same function as prices. These weights were initially developed in cooperation with the state recreational representatives to the GMT in 2016, and were reviewed by members of the GAP in in that year and 2018. The pseudo values are transformed into Factor Scores using the same exponential transformation that is applied to commercial revenues in the previous tab. To the right of the main data section in this tab, the state-specific weights for species are listed in descending order. Further comments/input from the recreational fishing community or state agencies regarding relative value of species among recreational fishery participants of each state are always welcome. The top-scoring recreational species is lingcod, followed by black rockfish, vermillion/sunset rockfish, blue/deacon rockfish and copper rockfish.

Tribal Importance

Because of the importance of west coast groundfish species to NW coastal Tribes, the Subsistence category identified in the NMFS guidance document was expanded to include the value of Tribal fishing for both commercial sale and subsistence (and ceremonial) uses. Commercial revenue from landings by Tribal vessels were obtained from PacFIN concurrently with other commercial data. Those revenues were transformed using the same process described above for commercial and recreational values, except that the maximum for this part of the total score is set to 7. The second part of the score (ranging from 0 to 3), represents the relative value of groundfish species to Tribal subsistence harvesters. These species scores were refined through consultation with Tribal representatives. Further comments/input from the Tribal community regarding subsistence scores are always welcome. The top-scoring species for Tribal importance is sablefish, followed by yellowtail rockfish, Pacific cod, petrale sole, and lingcod.

Constituent Demand and Choke Species

This Factor includes two aspects of species importance that are less easily quantified through formulaic transformation of fisheries data. Constituent Demand is intended to capture elements of fishery importance that are not adequately captured by the scoring for the commercial and recreational fisheries on a coastwide basis. Four elements are currently reflected in the scoring of this component, two of which capture situations in which a species is considerably more important to a segment of the commercial or recreational fishery than is reflected in the coastwide scoring of those Factors. Scoring and ranks for the coast and states or fleets which support these determinations are shown to the right of Column G in this tab. Because there are different numbers of species present in the catch of each state/fleet, all species with zero catch have been assigned a rank of ‘57’, in order to better facilitate comparison. Those are accompanied by additional columns showing the differences between the coastwide and each state's/fleet's values.

Initial evaluation of the significance of differences is indicated by'*' and '#' symbols in Column F, for the commercial and recreational fleets, respectively. The third element (represented by '@') provides an opportunity to elevate scores for "species of concern" to the stakeholders. One example of such concern might be rapid changes in the availability of a species to fishermen in a particular area. The final component (represented by '$') reflects the degree to which the 5-year catch histories (used in scoring the Commercial, Recreational, and Tribal Factors) of species were reduced as a result of rebuilding, or post-rebuilding caution, in the setting of Annual Catch Limits (ACLs). Input from the Council family and public regarding areas of importance or concern relevant to this tab is encouraged. The symbols assigned to Column F have been assigned 1 point each towards the Constituent Demand score, which is shown in Column E.

Choke-species scores are intended to capture the degree to which unavoidable bycatch of a stock acts as a constraint on the catch of other healthy species. The highest component scores for Choke species are assigned to rebuilding species, which this year has been reduced to just yelloweye rockfish. Smaller point values were added to recently-rebuilt stocks whose future value to the fisheries is considerably greater than is reflected by their recent 5-year catch histories, or to other species where concern over the attainment of ACLs (or ACL contributions) may have a similar, if less pronounced effect on harvest of co-occurring species. The overall Factor Score is the sum of the component scores for Choke Stock and Constituent Demand. Yelloweye rockfish has the top score for this Factor, followed by black rockfish and a host of other *Sebastes* stocks.

Rebuilding Status

This Factor provides another means of emphasizing the importance of rebuilding stocks, whose harvest amounts are commonly highly restricted. The highest possible score would be assigned to species that are being managed under rebuilding plans, whose spawning biomass is continuing to decline. The next highest score acknowledges the importance of completing the rebuilding process (stocks projected to rebuild by the next cycle) and permitting the relaxation of constraints that rebuilding has presented. Species with longer anticipated rebuilding times receive lower scores than those with shorter ones. Yelloweye rockfish is the only groundfish species which continues to be managed under a rebuilding plan, and it is assigned a score of 6 for this Factor, reflecting that it is expected to rebuild within 20 years.

Abundance of Stocks, Relative to their Biomass Targets

Holding other factors constant, scheduling an assessment in the upcoming cycle will be a higher priority for a stock whose spawning biomass represents a lower percentage of that in an unfished condition, as estimated in the most recent assessment. Correspondingly, the highest scores for this Factor would be assigned to stocks that are below their Minimum Stock Size Thresholds (MSSTs), i.e. are 'overfished'. Such cases are differentiated in the scoring by whether the spawning biomass trend is decreasing (10), stable (9), or increasing (8). As the ratio of current stock biomass to the unfished level increases, this Factor Score decreases. Where available, the percentage of unfished biomass estimated in the terminal year of the most recent assessment for each species is used as the basis for scoring.

However, most groundfish species have not been assessed in a manner that provides an estimate of relative abundance. For those stocks, the PSA (or Vulnerability) score has been used to assign a Factor Score. For species that lack an assessment-determined population status, those in the most vulnerable group (with PSA scores ≥ 2) are assigned a score of 6, while those in the least vulnerable group (with PSA scores < 1.8) assigned a score of 3, and intermediate species a score of 4. Scoring criteria are described and illustrated in columns G and H. Rather than basing scores for these species solely on Vulnerability scores, it may be useful in the future to also categorize them according to the average attainment of their OFL contributions (to assemblage OFLs) over the past 10 years.

To the right of the scoring criteria, two sets of columns show the stocks ordered by PSA score (with assessment-based depletion levels) and also by depletion level, within each of the three PSA categories used in the analysis. As demonstrated in the last set of columns, it is a tremendous credit to the Council that the most recent assessment for every groundfish species (that has been assessed with an age-structured model) has estimated the spawning potential to exceed the Minimum Stock Size Threshold in the assessment's terminal year, and that the average depletion ratio for even the most vulnerable group of assessed species is estimated to be 50%.

Fishing Mortality, Relative to Overfishing Limits

Analogously to stock status, it will be a higher priority to assess a stock whose fishing mortality represents a larger percentage of its Overfishing Limit (OFL), all other things being equal. The criteria are listed and illustrated in columns K and L of this tab. Fishing mortality estimates developed by the West Coast Fisheries Observer Program were averaged over the 2016-18 period, and then divided by the average OFL (or OFL contribution) for each stock over the same period, to calculate the ratio used to scoring this Factor. Average ABCs and percentages of ABC attainment are also presented for comparison, but are not used in scoring this Factor.

For the group of species that had individual OFLs, Petrale sole had the highest ratio of fishing mortality to OFL over this period, at 91%, followed by black rockfish at 70% and sablefish at 68%. Five species that were retained in the analysis and are managed as part of assemblages had estimated fishing mortalities in excess of their OFL contributions. Three of these had average fishing mortalities of less than 23 mt, with flathead sole at 38 mt and vermillion/sunset rockfish at 345 mt. Other "assemblage" species which attained more than 80% of their OFL contributions were rougheye/blackspotted and redbanded rockfishes. Attainment levels of OFL contributions (where available) for species that were removed from the detailed prioritization analysis are shown at the bottom of this tab.

Ecosystem Importance

Ecosystem importance scores are intended to describe the relative importance of each species to the trophic dynamics of the California Current ecosystem. We based the ecosystem importance scores on an Ecopath model for the California Current ecosystem (Koehn et al. 2016). Importance scores have top-down and a bottom-up components, which are summed. First each species was matched to the corresponding functional group from the Ecopath model, and the proportional contribution of each species to the functional group was calculated using the OFL contributions from the Fishing Mortality tab.

The top-down component represents the importance of each species as a predator of managed or protected species in the California Current ecosystem. We represent this as an index of the proportion of total consumption in the ecosystem that can be attributed to each species. The score is the product of 1) the proportion of the functional group's adult diet consisting of managed or protected species, 2) the functional group's total consumption rate (QB*B defined in Ecopath), 3) the proportion of the functional group that consists of the species (calculated from the OFL percentages). The product is then divided by the summed total consumption of managed or protected species. We then re-scale that proportion using all the functional groups in the Ecopath model (not just groundfish) to range from 0 to 10.

The bottom-up component represents the importance of the species as a prey species to all predators in the ecosystem. We used the proportion of total consumer biomass to represent the contribution of each species. This index has been used by others to describe the importance of forage species to ecosystem dynamics (Smith et al. 2014). This is labeled as the 'Proportion of species available for consumption', in the spreadsheet. We calculated the index value for each species in the prioritization, using biomass from the ecopath model and attributing it to each species using the OFL percentages as we did with the top-down score. Because juvenile life stages of groundfish may be more important prey items than adult, we added apportioned biomass from the four juvenile fish groups in the Ecopath model (juvenile rockfish, juvenile flatfish, juvenile thornyhead, and juvenile roundfish) to each of the relevant species biomasses. The species biomass was divided by the total consumer biomass from the model (all functional groups summed except phytoplankton and detritus). These percentages were then scaled to the ecosystem by dividing by the most abundant consumer functional group and rescaled to range from 0 to 10.

We combined the top-down and bottom-up scores by summing the ecosystem-scaled scores. Last, we re-scaled the summed ecosystem importance score to range between 0 and 10. The top-down scores were higher for the groundfish than the bottom-up scores, which meant that the top-down scores were more influential in determining the total ecosystem importance score.

There were two species that could not be attributed to a functional group from the Koehn et al. model: California scorpionfish, and pacific cod. In the absence of information, we assigned these species the median top down and bottom up scores for all groundfish that were present in the model.

The groundfish top-down scores were much higher than the bottom-up scores, illustrating that in general, the groundfish species are, on balance, more important as predators than prey in California Current ecosystem. For reference, the five highest top-down scores in Ecopath model were calculated for Hake, Dogfish, Sea Lions, Sablefish, and Arrowtooth flounder. The five highest bottom-up scores at the ecosystem-scale were for benthic infauna, euphausiids, mesopelagics, copepods, and epibenthic invertebrates. Hake was ranked 6th for bottom-up scores.

Relevant New Types of Information Available

As new types/sources of useful information or methods become available for a species, the potential value of conducting a new assessment for it increases. The scoring of this Factor has been broken down into four categories. The first category of new information involves the Bayesian prior for the steepness parameter used to inform stock productivity in rockfish assessments, which increased steadily from 2005 through 2011, and has been fairly stable since. The two stocks that received the most points in this category were last assessed in 2009. Smaller point amounts are awarded to previously unassessed rockfish, based on the potential for any future assessments to benefit from the availability of this prior information.

The next two categories are for new sources of trend information and for information, such as length, age, or maturity data or genetic research that help inform stock structure or population dynamics in an assessment. Although these categories are intended to focus on new *sources* of information, some points have been assigned where there are significant amounts of new data from existing sources since the last benchmark or update, as well as to species without major assessments. Points are assigned in the last category where issues/problems identified during the review of prior assessments can now be addressed through the inclusion of newly available data or methods. This Factor includes information from prior assessments, summaries of composition and other data collected from surveys and fisheries, along with review statements by STAR Panels or the SSC.

Assessment Frequency

The original focus of this Factor was to quantify the extent to which a stock is “overdue” for an assessment: has it been more than the target number of years since the last assessment was conducted? Gradually, other considerations which reflect the urgency of conducting a new assessment during the upcoming cycle have been included in the calculation of the final score for this Factor.

The first step in this process involves the calculation of a target assessment frequency for all stocks that have had a benchmark assessment. As described in the NMFS Tech Memo, the mean age of harvested fish serves as the starting point, which is then modified by a regional multiplier. In the case of Pacific coast groundfish, there is more than a 10-fold difference among species in the mean age of fishery catch, so part of the initial adjustment serves to compress the range of the distribution (as with revenue) to a range that is more useful for calculating target frequency.

This transformed mean-age value is then modified, based on each stock's recruitment variability (using the sigma-R value from the last assessment), the overall importance to fisheries (using the weighted sum of Fishery Factor Scores, as shown in columns S-V of the Factor Summary tab), and the ecosystem importance score, as described in the previous section. For each of these variables, a species is assigned a value of 1, 0, or -1, which is added to modified mean catch age. For recruitment variability, species with sigma-R values greater than 0.9 exhibit a high degree of variability, and receive a value of -1. Low variability species (with sigma-R values below 0.3) receive a +1, with others receiving values of zero. For the Fishery and Ecosystem Importance scores, the top-third of each receive a -1, the bottom-third a +1, and the rest zero. The sum of these components appears in Column K, and is rounded to the nearest 2 years in Column L, reflecting the Council's 2-year cycle for assessments. In order to promote turnover of the species appearing in the overall top-15, and acknowledge our capacity limitations for assessment development and review, no species was assigned a target frequency of less than 4 years.

The number of years a stock is "overdue" for assessment is calculated as the difference between the years since the last assessment and the target frequency (with a minimum value of zero). In an effort to better reflect Council selection decisions of the past decade, a value of 2 was subtracted for any stock that was assessed in the previous cycle. This makes it harder, but not impossible for a species to return directly to the top-20. The guidance in the Tech Memo calls for points to be added to a species after it has not been assessed by its target frequency. In order to promote assessing species by the time the target frequency has been reached, points start being added when the target frequency equals the years since the last assessment.

Species that have either never received a benchmark assessment, or those where the SSC has rejected the benchmark (either at the time, or later) are treated differently, since there usually is no existing basis for knowing the mean age of the catch, nor sigma-R. These stocks are assigned an Initial Score of 4 (in column O). Because all of these stocks have both Fishery and Ecosystem Importance modifiers, this initial value is modified by subtracting the sum of these two modifiers. (a negative modifier value shortens the assessment frequency for previously-assessed species, but increases the current importance of assessing a stock which lacks a previous benchmark assessment. For example, a stock in the upper-third of both fishery and ecosystem importance (e.g. Pacific cod) would have its initial score of 4 increased to 6, while one in the bottom-third of both (e.g. flathead sole) would drop to 2.

Several other conditional adjustments are made to initial scores, as shown in Columns Q-T. The first of these adds one point to the species if the prior assessment will be 10 years old by the next assessment year. This element acknowledges the SSC's previously expressed preference for not endorsing model projections beyond a 10-year period. Now, with an uncertainty buffer that increases with time, this addition might need to be revisited. If, at the time of the last assessment, the SSC recommended that an Update was suitable for the next assessment and that assessment will be no more than 6 years old, one point is subtracted in Column R. This is intended to reflect the decreased need for a new assessment to be a benchmark. If a species is at or beyond its target frequency an additional point is added in Column S.

With the Council's adoption of uncertainty buffers that increase with the time since the last assessment, a new element has been incorporated into this Factor to reflect concern over the degree to which upcoming catches are likely to be constrained by planned ABCs. The development of this modifier is documented in the "2022 spex limiting" tab. For each species, the largest of either the 2016-18 average fishing mortality or that in 2018 is compared with the draft ABC (or ABC contribution) for 2022. A maximum of 2 points is assigned as a preliminary score to species for which the larger mortality amount exceeds the draft 2022 ABC. Species in that category with lesser amounts of mortality and others where mortality was more than 75% of the draft ABC receive a preliminary score of one point. Species whose recent mortality represents less than 20% of their draft 2022 ABC (or ABC contribution) are assigned a modifier value of -1. Finally, a positive preliminary modifier for any stock that was assessed in the most recent cycle is set to zero, based on the premise that conducting another assessment in the second consecutive cycle is unlikely to address the degree of constraint posed by the prior assessment (barring important new information). The final modifier from this sheet is included in Column T of the Assessment Frequency sheet. The final Factor Scores are shown in Column U, representing the sums of values in Columns O-T (which are capped at a value of 10).

This Factor is a key element in the ability of the process to elevate species from lower ranks to higher-priority levels in a reasonable, cyclical manner. Further exploration will likely be required to achieve desirable, longer-term performance. What is 'desirable' should be the topic of discussion with Council and its advisors. There are real limits on how many assessments of different levels of complexity and review. Transitioning to an assessment mix which contains a larger share of more-expeditious Update and Data-Moderate assessments may require changes in Terms of Reference that permit more assessment freedom than is currently afforded. The other part of this equation is examining how many assessments of various types the Council family is satisfied with. Given recent experience, future reliance on a benchmark-heavy process will almost certainly result in a reduction in the number of species that have assessments which are better than data-poor and no more than 10 years old.

Factor Summary

All of the Factor Scores are assembled in columns F-O of this tab, with the Base-Model Factor Weights being found in row 7 of those columns. The products of the Factor Scores and Weights are found in columns R-AA, and are summed into a total weighted score in columns C and AC, with the ranks across species in the adjoining columns. The Factor Weights used to scale the importance of each Score are unchanged from the 2018 analysis.

The highest-scoring 10 species in this year's analysis are shown In Table 1. Based on the species selected by the Council for assessment in 2019, the top species projected in 2018 as priorities for 2021 assessment are very similar to this year's top group. With the minor changes in Factor scoring and changes in species mortality, two nearshore species (quillback and treefish rockfishes) rose into the top 10, from having been ranked 13th and 16th, respectively, in 2018. Yelloweye and canary rockfishes dropped out of the top 10 from 2018, but remain at 11th and 16th, respectively in the current analysis.

Table 1. Top-ranked species for assessment in 2021, based on the prioritization analyses conducted in 2020 and 2018.

Rank	2021 Rank in 2020	2021 Rank in 2018
1	Vermilion/Sunset rockfish	Vermilion/Sunset rockfish
2	Black rockfish	Black rockfish
3	Copper rockfish	Sablefish
4	Brown rockfish	Pacific cod
5	Quillback rockfish	Brown rockfish
6	Sablefish	Dover sole
7	Lingcod	Lingcod
8	Dover sole	Copper rockfish
9	Pacific cod	Yelloweye rockfish
10	Treefish rockfish	Canary rockfish

Data availability

The next tab provides an overview of the availability of various types of data with which a benchmark assessment might be conducted. As noted, the summary of available composition data from commercial and recreational sampling has not yet been fully updated. In addition to the data summaries, ranking and assessment information from the Summary tab are carried over to this tab. Half of the top ten are nearshore species, and most of them would present benchmark assessment challenges, due to the limited availability of ages/otoliths and useful CPUE data. In particular, the lack of routine CDFW collection of groundfish age structures from the recreational and nearshore commercial fisheries is discussed further in the Appendix to this document. Copper and brown rockfishes did have sufficient recreational CPUE data to support data-moderate assessments (which included only indices of abundance and catch data) in 2013. Recent levels of fishing mortality for vermillion/sunset, copper, quillback, and treefish rockfishes approach or exceed their draft ABC contributions for 2022.

Three of the top 21 species were last assessed in 2009-11: Dover sole, Pacific spiny dogfish, and splitnose rockfish. Updates are not recommended for any of those assessments. In the past, the SSC has been reticent to recommend the use of model projections beyond 10 years, which has in some cases led to old benchmarks being replaced by data-poor assessments for setting harvest specifications. With the addition of uncertainty buffers that increase with assessment age, evaluation of species choices for 2021 would be aided by having the SSC clarify if and at what point they believe use of projections from an assessment should be discontinued.

2021 Assessment Calendar Possibilities

The following tab in the workbook presents an annotated 2021 assessment planning calendar that identifies potential weeks in which STAR panels can be scheduled. The May-October period is also presented, here, in Table 2. Based on the expected availability of 2020 data and the time needed for model development and documentation, it is unlikely that any full assessments could be reviewed before May. Given the anticipated Briefing Book deadline for the June Council meeting, only the first two weeks in May (highlighted in lavender) are good candidates for reviews that could feed assessments into the June meeting. A STAR Panel the week of May 17 would most likely provide assessments for SSC/Council review in September, along with one week in June and three in July (highlighted in light olive green). If needed, a follow-up Panel could be scheduled the week of September 27.

Table 2. 2021 Calendar highlighting possible STAR Panel weeks

May

Su	Mo	Tu	We	Th	Fr	Sa
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

June

Su	Mo	Tu	We	Th	Fr	Sa
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

July

Su	Mo	Tu	We	Th	Fr	Sa
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

August

Su	Mo	Tu	We	Th	Fr	Sa
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

September

Su	Mo	Tu	We	Th	Fr	Sa
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

October

Su	Mo	Tu	We	Th	Fr	Sa
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

Holidays
Council Meetings
Prospective Briefing Book Deadlines
Possible STAR Panel weeks, for review in June Recommended
Possible STAR Panel weeks, for review in Sept. Recommended
Possible SSC-GSC Pre-Sept. Assessment Review
Week for additional review, if needed

Stock Assessment History

The final tab presents a condensed history of stock assessment activities since 2003.

APPENDIX

California Groundfish Commercial Fishery Sampling Issues

Overview

Accurate and timely data from fisheries catch, including age-composition data, is critical for informing stock assessments, but collection of ageing structures continues to be very sparse from most California commercial groundfish fisheries, and nonexistent from recreational fisheries off the state. With limited exceptions, a lack of age data is likely to lead to a stock assessment being designated as a category 2 (or lower) assessment, reducing future allowable catches from category 1 status, due to greater uncertainty buffers. Under even the most optimistic sampling scenario (of 500 fish per year), the impacts on landings with respect to presumed reduce value of the catch (due to the need to cut fish for otolith extraction and sex determination) is far lower than the potential increase in yield if such data ultimately improve the robustness of the stock assessment to a category 1.

For example, sampling 500 blackgill rockfish per year would reduce the price of ~383 kg per year of (otherwise whole) fish. However, ongoing sacrifice of this magnitude could ultimately lead to over 10.1 mt per year of increased ABC (at long term equilibrium yield levels) if it led to upgrading the blackgill assessment from category 2 to a category1 status. For lingcod, the cost of dropping from a category 1 to a category 2 in the absence of improved age data could reduce the ABC (at equilibrium biomass levels) by 94.5 tons, whereas sampling 500 fish per year would result in impacts (cut and partially devalued fish) of only 1.3 tons per year. In evaluating available data for upcoming assessments of the vermillion/sunset rockfish complex, copper rockfish, and brown rockfish; ageing sample sizes are extremely low for both fishery-dependent and fishery-independent sources. As a result, it is very unlikely that any assessments of these stocks will be determined to be category 1 in the near term. We believe it is important to continue to bring the significance of data shortages to the attention of the Council and stakeholders. Over 2016-18, fishing mortalities for vermillion/sunset and quillback rockfishes exceeded their OFL contributions by 24% and 63%, respectively. If available data do not support even category-2 assessments, opportunities for increasing the size of those OFL contributions will be minimal. If the management response to anticipated overages is to restrict catch of the entire assemblage, to better protect these stocks, the potential losses from not increasing the collection of age samples could rise considerably.

Additional Details

Accurate and timely data on catches, including species composition, size composition (by sex) and age composition of targeted and bycatch species, is critical for informing and developing robust stock assessments. In California, sampling of commercial groundfish fisheries is conducted by the Pacific States Marine Fisheries Commission (PSMFC) in cooperation with the California Department of Fish and Wildlife, and the National Marine Fisheries Service. Currently, sampling of biological data from California fisheries landings relies on <u>voluntary</u> cooperation from processors, in contrast to mandatory sampling requirements that exist in other US West Coast states (in fact 16 of the 19 coastal states have legislation that requires fishermen and processors to comply with port sampling requests for data-collection purposes). This right to refuse samplers access to some or all fish has historically constrained the ability to collect biological data from fisheries landings that are crucial to informing fisheries stock assessments.

Many processors have refused samplers access to landings, or refused permission to cut fish to determine sex or collect otoliths. This issue has been raised in past assessment cycles, and is relevant to consideration stock assessment priorities for the 2021 and future assessment cycles.

While a majority of California processors allow port samplers to sample the species composition and length composition of landings, a large and growing fraction do not allow sampling of biological structures (otoliths or spines for age determination, examination of gonads to determine sex and maturity stage), as this requires cutting the fish and can decrease the value of the fish for market. This decrease in fish value can be substantial, where fish would otherwise be destined for "live-fish" markets. As a result, in some cases, even handling the fish to take lengths is not permitted. The voluntary provision of sampling opportunities has been most limited for processors and/or fishermen who sell their own catch in the Southern California Bight, where essentially no age structures have been collected for rockfish species since the early 1990s.

These challenges presented by minimal California age data have been highlighted in recent assessments of cowcod (in 2019), blackgill rockfish (2011, 2017), sablefish (2019), along with the southern stocks of lingcod (2017) and yellowtail rockfish (2017), for example. As we have seen numerous nearshore stocks rise in recent prioritization analyses, these stocks generally have the least age data with which to develop reliable assessments. The lack of fisheries age and sometimes length data has been particularly constraining for stock assessments of these nearshore species, for which fishery-independent data are essentially non-existent. These issues were highlighted in recent assessments of China rockfish (2015) and gopher/black-and-yellow rockfish (2019), and have also been discussed as impediments to conducting successful benchmark assessments for many of the species under consideration in the 2021 assessment cycle (particularly copper, brown, and quillback rockfishes). Many of the assessments where this issue has been paramount were determined to be category 2. The lack of robust age data, with which to assess growth and characterize fishery removals, has led to greater uncertainty buffers in catch limits for several such species where benchmark assessments were eventually accepted. However, the lack of useful numbers of fish ages can also lead to the rejection of a benchmark assessment, altogether, as was the case for southern yellowtail rockfish in 2017. Management of yellowtail rockfish, which is poorly sampled in the West Coast Groundfish Bottom Trawl Survey, remains subject to category-3 (data-poor) buffers in the southern area, while the northern yellowtail area enjoys a much smaller buffer, thanks to category-1 status.

To illustrate the trade-offs between the "cost" of allowing sampling of age structures to support stock assessments with the benefits with respect to future yields, we developed two simple examples of how many tons of fish a robust age sampling program would impact for blackgill rockfish and lingcod, and how much the allowable catches would increase or decrease with a change in category level (for simplicity, we base this difference on the long-term estimated equilibrium MSY level for each stock). For blackgill rockfish, based on the length compositions from the trawl fishery, the tonnage of fish impacted by sampling 500 fish per year (e.g., cut fish to remove otoliths and make sex determinations, thereby reducing the value of the catch for the whole fish market) would be 383 kg per year. With the important caveat that it would take some time to build a time series sufficient to better inform the assessment with respect to age structure, the increased yield of moving from a category-2 to a category-1 stock (at long term equilibrium yield levels) would be 10.1 metric tons for the first year after an assessment alone: over 26 times more than the amount of impacted fish. [Long-term MSY= 178mt, with P* of

0.45, the cat-1 buffered ABC would be 167.1 mt, while the cat-2 buffered ABC would be 157 mt in year 1.] The magnitude of this tonnage difference would only increase moving farther into the model-projection period.

For lingcod, sampling age and sex information from 500 fish a year would result in partial devaluation of approximately 1.3 tons of fish per year. If the absence of such data led to greater uncertainty and the stock assessment for this area was labeled category 2, (as it was in 2009; in 2015 the assessment for southern lingcod could be described as a "weak" category 1, with the lack of fishery age data in the south highlighted as a key uncertainty and data need), the resulting decrease in long term equilibrium yield would be 94.5 tons, over 72 times the amount of the fish that were devalued by sampling. An example with China rockfish illustrates that these gains diminish for more minor (lower-abundance-level) stocks. Collecting 500 age structures per year would diminish the value of 395 kg of China rockfish, but only increase allowable catches (assuming an improvement from a category-2 to a category-1 assessment) by 1.1 mt in the long-term (equilibrium) MSY level). China rockfish in California waters are also primarily caught in recreational and "live-fish" fisheries, indicating the extent to which this challenge extends well beyond commercial "dead-fish" fisheries. However, it is also worth noting that, for an assessment area the size of California, 500 age structures per year really represents an "upper end" to ideal, robust age sampling for a given assessment (e.g., each of the assessed areas for multi-assessment stocks). In many cases, 50 to 75% of that number, if sampled continuously from year to year, would likely be adequate to support robust assessments for most species.

In evaluating available data for upcoming assessments of the vermillion/sunset rockfish complex, copper rockfish, and brown rockfish; sample sizes range from zero to as many as "dozens" of fish per year for the past several decades for these stocks in California waters, leading to concerns among assessment teams regarding the ability to develop robust models for these data poor populations. While some data are available from samples taken from the California Cooperative Fisheries Research Program (CCFRP), the total numbers are generally well below target levels, and it would be optimal to have at least some age data that was representative of commercial and/or recreational fisheries removals. Despite the fact that age-reading capacity has been declining over the past 8 years, we remain able to prioritize age determination efforts effectively for stocks of particular need (e.g., high-valued or choke species).

There is some optimism that age determination efficiency and capacity can be increased in the future through new technologies, such as the use of Fourier transform near infra-red spectroscopy (FT-NIRS), but fundamental research on this method for groundfish is in its infancy. Therefore the near-term ageing capacity is inadequate to process all collected samples (as it has always been), but that is not a prerequisite for data collection. Even with current constraints on aging, surprises regarding which stocks or species are constraining would be most effectively addressed (e.g. by improving assessments, or conducting higher category assessments) if age data were available to inform models of high priority stocks. In other words, if a category 2 or 3 stock becomes constraining to a complex or fishery, it is unlikely to be a candidate for a category 1 assessment (with consequent increases in likely allowable catches) in the absence of a time series of age data. Such data cannot be collected retroactively. Although it must be recognized that robust age data are not a guarantee that an assessment can rise to a category 1 level, it is more often true that the absence of robust age data from other surveys or sources (and in some cases, even where such data does exist), it is extremely difficult to estimate recruitment variability and population structure robustly without such data (there are a limited number of exceptions for very fast growing stocks with high recruitment variability and turnover rates, such as bocaccio and cabezon). Consequently, these data constraints will continue to lead to increased challenges to assessment and management efforts, even as most stocks continue to recover or to increase well above target levels.

In short term, and potentially longer, the opportunity to make better use of length data in a data-moderate, category-2 assessment could provide another avenue for reducing uncertainty. Research in this area is ongoing, and potentially could be available to contribute to a suite of assessment types used in 2021.