STAR REPORT for Spiny Dogfish During the Mop-up Panel

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Executive Summary

The Groundfish subcommittee met virtually using the Ring online meeting platform from September 29 and 30, 2021 to review 1) rebuilding analyses and other analyses potentially informing management of California copper and quillback rockfish, 2) the spiny dogfish assessment, and 3) management delineations for copper rockfish, quillback rockfish, and vermilion and sunset rockfishes. While comments during the meeting on other issues before the Groundfish Subcommittee were welcomed, it was Spiny dogfish for which this reviewer's comments and report were asked to be directed.

The dogfish issue centered around the availability of dogfish to the fishery-independent trawl survey. The most current assessment of dogfish, earlier this year, highlighted that q was not well informed by other data in the model, and had a large range. Compounding this issue, the model was very sensitive to q, resulting in large differences in stock size, and suggesting a problem with the base model's resolution of population scale. Because of this, the Groundfish Subcommittee of the Science and Statistical Committee (SSC), requested a further examination of fishery-independent catchability in light of fishery-dependent evidence which suggested a lower q and thus higher stock size.

Discussion at the meeting was proceeded by a response presentation by the STAT, as well as other preliminary analyses presented during the public comment period. A noted hindrance to the discussion was that the STATs presentation was preliminary, while the additional presentations during the public comment period were both preliminary and not available prior to the start of the meeting.

After discussion, it appears that there is at least good quantitative evidence that the catchability estimated in the dogfish assessment earlier this year was an overestimate, suggesting a more pessimistic stock size than the true population. However, there is much uncertainty on this issue. One important uncertainty centered around comparability between fishery-dependent and independent estimates of catchability, stock structure, and validity of the methods used during the meeting. Despite the uncertainty, the evidence was compelling enough such that the range of uncertainty was reduced at low stock sizes as it is likely that the population is more abundant what initially estimated. Overall probabilities within this large range of q and resulting stock sizes could not be determined.

While the best, and indeed the only, scientific information was used to define the range of uncertainty for setting ABC, this issue warrants further examination during the next peer-reviewed assessment. A number of recommendations were made, including those to address the issue directly in a three-stage process, as well as recommendations on the Mop-up meeting itself and how it might better fit into the STAR Panel process.

Background

Introduction

The Groundfish subcommittee met virtually using the Ring online meeting platform from September 29 and 30, 2021 to review 1) rebuilding analyses and other analyses potentially informing management of California copper and quillback rockfish, 2) the spiny dogfish assessment, and 3) management delineations for copper rockfish, quillback rockfish, and vermilion and sunset rockfishes (rebuilding analyses and management delineations findings are described in Appendix 3 of this report).

This meeting, and thus this report, was and is substantially different than previous STAR Panel meetings in several ways. First, this was not a formal review panel, where the merits of an assessment approach or analysis were examined for scientific rigor. Rather this was a subcommittee meeting of the Science and Statistical Committee (SSC) where outstanding issues from this year's assessments were resolved. Recommendations from this meeting would be brought before the full SSC at a later date for their consideration before final actions are taken.

As reiterated in the "Description of the Individual Reviewer's Role" section below, the role of the Center for Independent Experts (CIE) reviewer was to evaluate and comment on only Spiny Dogfish during this meeting, rather than on all of the material presented. To that end, while background information will be provided on rebuilding analyses and other analyses potentially informing management of California copper and quillback rockfish and stock and management delineations for copper rockfish, quillback rockfish, and vermilion and sunset rockfishes, only brief comments and no recommendations will be made to towards those issues. One exception is made however for the stock delineation issue for copper rockfish.

It should be noted that this author served as a reviewer for all of the STAR Panels that had CIE involvement this year, including Spiny dogfish and Dover sole, Lingcod, and Sunset/Vermillion snapper. California copper and quillback rockfish assessments were not conducted with this reviewer's input. Further, the issue of stock and management delineations for vermilion and sunset rockfishes, particularly how to partition quota by area for these species, was outside the scope of the STAR Panel review earlier this year.

Terms of reference (TORs) and report writing guidance were not provided prior to this review. As such the format and TORs used in this report are from previous review reports conducted this year by this reviewer. Because Spiny dogfish is the focus of the report, background information and a summary for the other issues is provided in Appendix 3.

Spiny Dogfish

During the Council's June 2021 meeting a request was passed through the Groundfish Subcommittee of the SSC to reexamine the catchability coefficient estimated during the assessment for Spiny dogfish.

To provide some background on this issue, Spiny dogfish were recently reviewed this year during the first STAR Panel (May 3 to May 7, 2021). This reviewer served on that STAR Panel and was therefore familiar with the issues. During this process, the Panel noted that catchability was not well informed (see Figure 1) but that model results were highly sensitive to it (See Figure 2). Overall, the model tended to set catchability near the prior. From Figure 1 it can be seen that a large range of catchability is possible, with the model showing no real preference for solutions below 1.9 log-likelihood units. Because of this lack of preference, the sensitivity of the model's output across the range of catchability, and suggestions that the models prior might be an overestimate of catchability resulting in an underestimate of stock size, the GFSC (Groundfish Subcommittee) requested further analysis as outlined below.

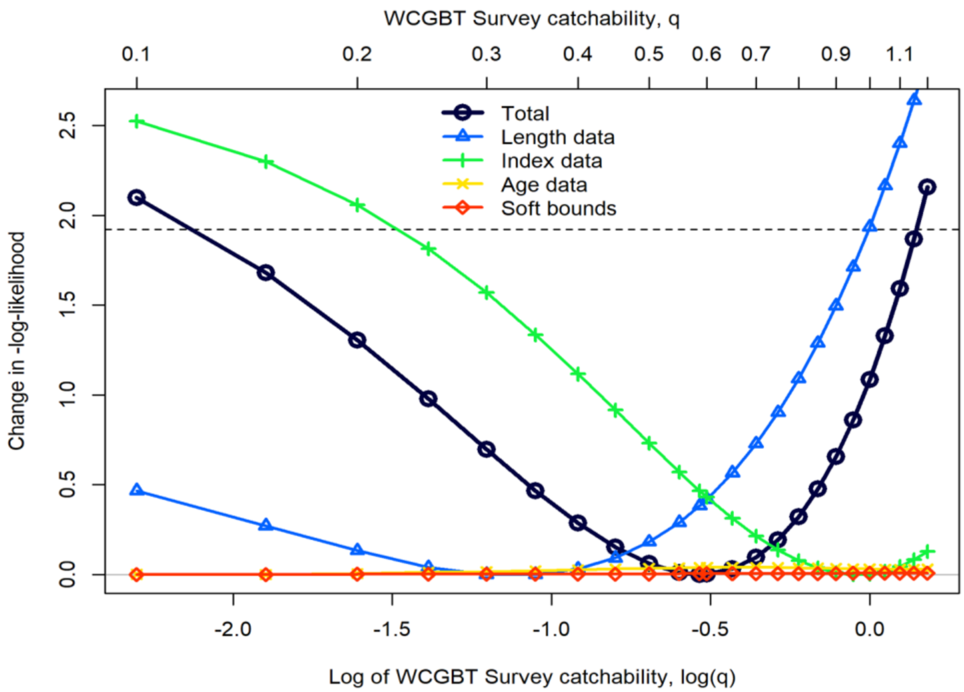

Figure 1: Spiny dogfish catchability across log-likelihood. Note values below the dashed line are not different statically from each other.

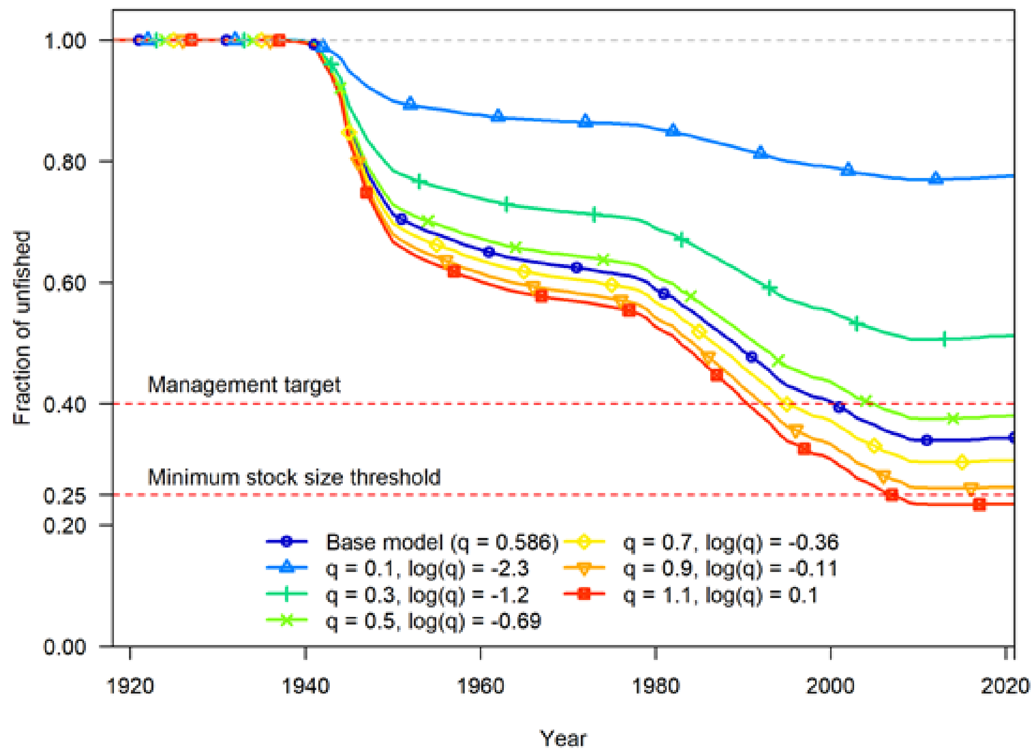

Figure 2: Depletion by year across several different assumptions on catchability.

Request: *The GFSC suggests that an analysis of the seasonality of bycatch rates of spiny dogfish from WCGOP and other available data sources (e.g., ASHOP, Pikitch et al. bycatch study) should be conducted to evaluate whether the data indicate a strong seasonal availability of spiny dogfish as bycatch to fisheries. A reasonable way to do this would be to examine haul-specific catch rates in a General Linear Model (GLM) or delta-GLM (depending on the frequency of occurrence of dogfish in a given dataset), with the primary factor of interest being month (or some other seasonal variable, such as Julian day bins, two month periods, etc. as appropriate given the data) as a factor, along with appropriate covariates that were determined by the analyst. These might include year, depth, latitude/state or region, vessel size or power, gear type, stated fishing strategy, or comparable information. Alternatively, it may be feasible to explore the use of modeling frameworks such as VAST or 'sdmTMB' (see https://pbs-assess.github.io/sdmTMB/index.html) to develop this analysis. It may also be appropriate to do separate analyses by region (e.g., Washington coast, Oregon coast, northern California coast), in addition, depending on data availability, in order to facilitate interpretation of model results. As with any such model, an exploration of available information and relevant covariates will require some exploratory work, but GLMs and delta-GLMs are standard tools for any assessment analyst and the precise approach should be at the analyst's discretion*.

Rationale: *The results should provide an indication, albeit imperfect as there will certainly be challenges associated with developing a conclusive result from these data sources, of the relative differences in catch rates of dogfish by fisheries participants. This alone should provide some insights to the SSC and to the PFMC (who made the formal request) with respect to how encounter and catch rates in the fisheries themselves appear to change seasonally, and thus the extent to which the model-estimated q was* *consistent with seasonal fluxes in catch rates. For example, if catch rates were on average 10x greater between November and March than those between April and October, then a survey estimated q greater than 0.5 for a survey that exclusively takes place between April and October may be a questionable model result. In such a scenario, there may be the potential to develop a weakly informative "upper bound" prior for catchability based on the ratio of bycatch rates during the months during which the survey takes place relative to the months in which spiny dogfish are likely to be more abundant. This request does not include an explicit request to develop such a prior, but rather will provide the SSC with a basis for considering whether such an approach might be feasible and worthwhile in light of the limited time remaining in this stock assessment cycle.*

The STAT examined the issue of Spiny dogfish not being available to the trawl survey during certain portions of the year as requested. A memo documenting their findings, as well as their conclusions, was presented. Additional analyses were presented by Mr. Niles and supplementary analysis to the STAT's presentation was provided by Mr. Wallace. However, both Mr. Niles and Mr. Wallace's contributions could not be fully examined due to those not being available prior to the meeting. Further examination and conclusions on Spiny dogfish are under the Terms of References, below.

Description of the Individual Reviewer's Role

Unlike other panels conducted this year, the Mop-up Panel was not a peer review STAR Panel, but rather a meeting of the Groundfish Subcommittee to examine issues to multiple assessments conducted over the Summer. This reviewer's role was to read all provided materials on the 2021 Mop-up assessment with particular reference to Spiny dogfish. While comments during the meeting on other issues before the Groundfish Subcommittee were welcome, it was Spiny dogfish for which this reviewer's comments and report were asked to be directed.

Summary of Findings

1. Become familiar with the draft stock assessment documents, data inputs, and analytical models along with other pertinent information (e.g., previous assessments and STAR panel report when available) prior to review panel meeting.

Because of the nature of this meeting, this reviewer reexamined the presentations, notes, and documentation provided during the initial STAR Panel meeting on Spiny dogfish earlier this year.

During the Spiny dogfish portion of the meeting, only the memo entitled "Spiny d Summary analysis" presented by the STAT was provided prior to the meeting. During the meeting, two other analyses, "Commercial fishery CPUE considerations" by Mr. Wallace and "GAM and random forest models of dogfish bottom trawl catches" by Mr. Niles were provided during the public comment section and the discussion portion of the meeting. Because the latter two were not made available prior to the meeting they could not be fully examined. Additionally, the documents provided were not actual publications, but informal write-ups of various analyses.

<u>Recommendation:</u> That all analyses be made available to the group at least a week prior to the Mop-up Panel meeting. Additionally, the documents should be more formal working papers using a similar format as any other STAR Panel working draft document. It is understandable why this may have not been the case for this meeting, given the short lead-up time. But having a more formal process might make a review of this type of material easier in the future.

2. Discuss the technical merits and deficiencies of the input data and analytical methods during the open review panel meeting.

In some respects, this TOR doesn't wholly apply. Data used for these analyses were not "new" but rather a re-analysis of data presented during the Spiny dogfish STAR Panel.

All three analyses had very similar approaches, utilized the same data, and generally provided the same results, though the conclusions did vary. The STAT's analysis utilized a GLM approach, while the analysis by Corey Niles (WDFW) used random forest and a GAM approach. The work done by Mr. Niles filtered the fishery-dependent CPUE data to exclude trips that landed dogfish, in an effort to remove trips that could be targeting dogfish. While the STAT's document concluded that there was some evidence of potentially increasing availability, that evidence was too uncertain to inform a change in the catchability. Mr. Niles during his presentation suggested the opposite, that there was evidence to support at least a qualitative increase in catchability.

All analyses appeared to be conducted appropriately. The filtering in Mr. Niles' analysis solved a major issue for this reviewer, that vessels targeting dogfish will always have higher CPUE than a fishery-independent survey. The differing conclusions by the STAT and Niles could be attributed to interpretation rather than any large difference in the results. Based on this rather sparse documentation there didn't appear to be any deficiencies in the analysis provided.

3. Evaluate model assumptions, estimates, and major sources of uncertainty.

As stated previously estimates from both analyses presented did not have major differences in their results. Both Mr. Niles and the STAT's (with supplementary information provided by Mr. Wallace) indicated that CPUE of Spiny dogfish in the northern regions during late Fall/early winter were high in the trawl fishery when the survey was not present. Meanwhile, CPUE differences between survey and fishery in the southern areas or at other times in the year were not very different. This implies that the seasonality of the trawl survey results in that survey missing a large portion of the Spiny dogfish biomass, and further results in erroneously low estimates of population size. Given that the most current dogfish model derives much of its information on population-scale from this survey, and the fact that that catchability is not well informed by other sources of data in the model could lead one to conclude that the most current model (peer-reviewed this past year) underestimates Spiny dogfish abundance.

There are multiple difficulties with the assumptions for both STAT and Mr. Niles's approach to this subject. The assumption of increased fishery-dependent CPUE as a metric for availability to a fishery-independent survey is problematic. Changes in fisherman behavior or even management changes could result in those same differences observed. Even filtering for those trips which did not land Spiny dogfish (in an attempt to remove targeted trips) could still result in potential biases. The act of fishing itself may contribute to the observed differences in the CPUE between fishery-independent and dependent data sources, regardless of target stock. Behavioral changes by the fishermen in the northern area during late Fall/early Winter could also explain these differences. Additionally, given that the area in question is adjacent to the Canadian waters (Figure 3), it cannot be ruled out that the dogfish potentially missed by the survey, are not dogfish from US stock reviewed by the STAR earlier this year. As outlined in this reviewer's Spiny dogfish report to CIE, stock structure and the degree of intermixing with the adjacent Canadian stock is a major source of uncertainty. In short, it is difficult to assume that this fishery-dependent catch rates reflect an overestimate in a fishery-independent q, resulting in a model's underestimate of populations size when the potentially "missed" fish may not be from the US stock.

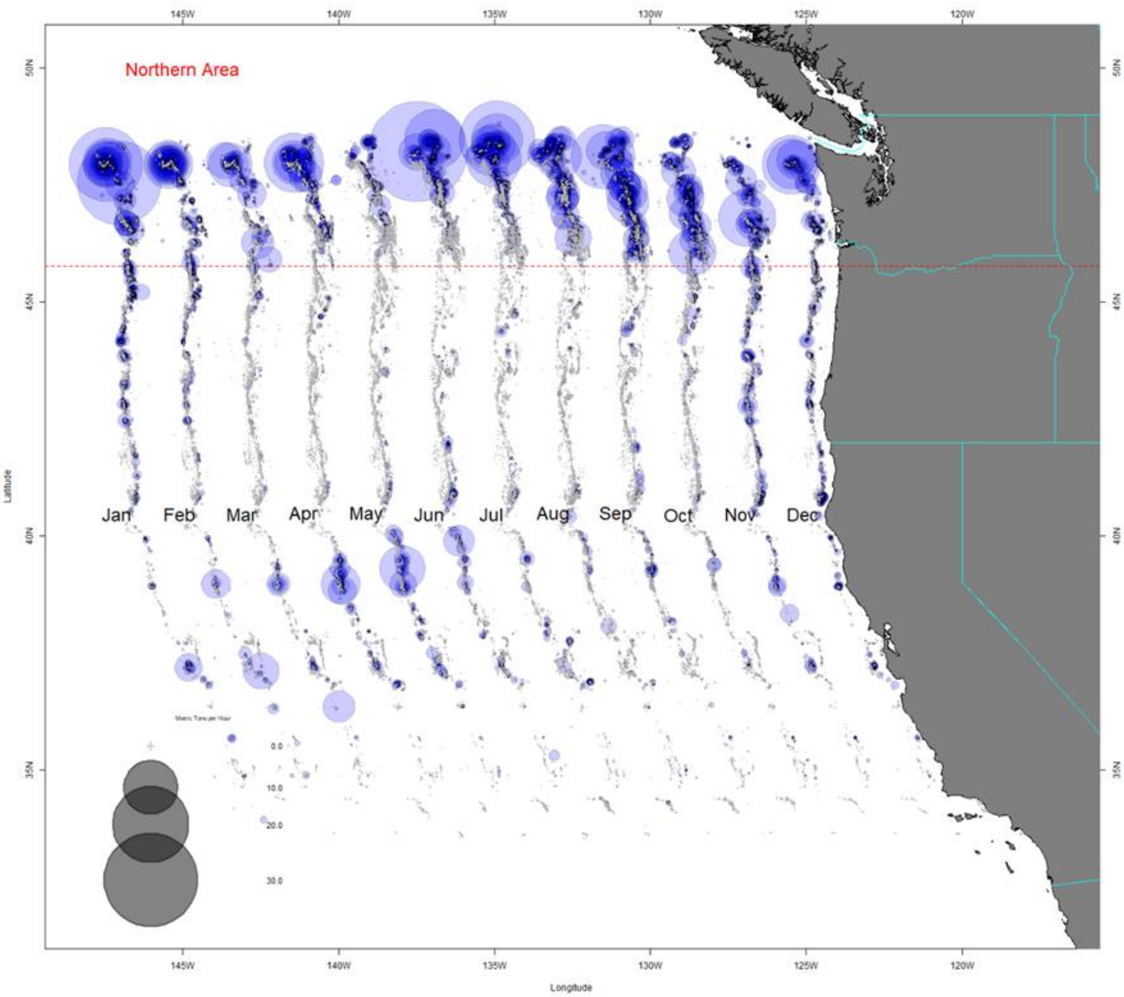

Figure 3: Map of the catch rates for the bottom trawl fishery by month 2002 -2019.

That said, the results on the analyses give at least qualitative information that 1) this is an issue that needs fuller exploration in the next benchmark, and 2) that there is at least some probability that the current model for Spiny dogfish underestimates stock size given the high produced by the model.

4. Provide constructive suggestions for current improvements if technical deficiencies or major sources of uncertainty are identified.

Unfortunately, there was little time during this short meeting to make many suggestions. Additionally, some of the analyses were not available prior to the start of the meeting, which further happened suggestions. That said, The STAT for Spiny dogfish provided alternative runs using the proposed q=0.43 derived from the Pacific Ocean Perch precedent, including some diagnostics. These were at the request of this reviewer, as well as others. Given that many of these were run during the STAR Panel review earlier this year, it was not surprising that changing q did little to change the diagnostics. Other than this request, no further suggestions were possible given the shortness of time.

It was requested however that the decision table from the 2021 Dogfish assessment be redone (Table 1). The new range of uncertainty would place the 2021 model estimated catchability as the low state of nature (q=0.586), a new middle state of nature (q=0.43) based on a precedent used for the 2017 Pacific Ocean Perch assessment, and a high state of nature, based on upper bound of the 2021 model (q=0.3). This effectively narrows the range of uncertainty by dropping the lowest state of nature in the 2021 model and adding a middle value of (q=0.43), despite there being more uncertainty. This in turn changed the projection table also found in the 2021 peer-reviewed assessment, if the central state of nature is selected.

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

It is this reviewer's opinion that the most recent estimate of Spiny dogfish abundance and fishing mortality, as described in the amended stock assessment report earlier this year (Gertseva, et al. 2021), represents the most scientifically defensible point estimate currently available for management and decision-making. That said, there was compelling, if preliminary and less rigorously presented, qualitative evidence that the fishery-independent q for Spiny dogfish was overestimated, resulting in an underestimate of the population size.

As outlined elsewhere, the range of possible fishery-independent q's is quite large. Further, the current model as configured is highly sensitive to q, resulting in a large possible range of stock size, and relative depletion. Because further analysis presented after the STAR Panel meeting suggested at least a qualitative expectation that there was an overestimate of q in the base model, the consensus at the Mop-up meeting was to drop the highest q in the decision table, while retaining the lower estimates. Effectively decreasing the uncertainty range to include more optimistic stock sizes. A fuller examination of the materials proved was not possible, given the lateness in which some of the analyses were made available and the preliminary nature of those that were on time.

There appears to be at least some qualitative evidence that q is lower than estimated in the base model presented to the STAR Panel earlier this year. However, though the possible range of stock sizes is narrowed, there remain many uncertainties in both the presented analyses, as well as in the base model itself, that excludes the ability to say where in this range the true q actually lies; even qualitatively. As such it is equally probable that q could be from 0.3 to 0.586 resulting in an estimated depletion ranging from 0.344 to 0.51, which has dramatic management implications. So, while the science used is the best available information, and is in fact the only information available, caution is recommended and precautionary management is advised.

6. When possible, provide specific suggestions for future improvements in any relevant aspects of data collection and treatment, modeling approaches, and technical issues, differentiating between the short-term and longer-term time frame.

Recommendations have been made throughout the document on other issues. Here it is important to document the specific recommendations for dogfish and the issue of availability to the trawl survey. This is a very difficult issue. That said it is important to highlight a path forward for dogfish in what may be a three-step process.

Recommendation 1: A fuller more rigorous examination on the relationship between the fishery-dependent and independent data should be undertaken for presentation during the next peer review. Many of the analyses presented were preliminary and did not have a full write-up of methods. The confounding of availability and selectivity needs to be addressed more quantitatively and formally. Additionally, further work on the standardization of the fishery-dependent CPUE should be undertaken.

Recommendation 2: Conduct a fishery-independent survey in the northern part of the US stock area concurrent with the fishery-dependent activity. Such a study, while difficult and expensive, can be used to examine the issue of availability and the potential for the underestimation of stock size by directly comparing fishery-dependent and independent CPUE in the same area and season examined during this meeting.

Recommendation 3: Use microchemical, morphometric, or tagging studies, to examine the origin of the dogfish in the northern stock area during this season. As stated elsewhere, an increase in availability in this region could be the result of dogfish from neighboring Canada moving into the area, rather than an underestimation of the trawl survey. Knowing the stock origin of the dogfish captured could be important for this issue.

Concurrent with these recommendations two others might be useful.

Recommendation: Examine the issue of scale in the current dogfish model, with particular reference to potential data sources that may help define the scale of the dogfish population. As outlined elsewhere, the scale in the current dogfish model is not well resolved. Other data sources, such as a fishery-dependent CPUE, or other sources could be instrumental in reducing the flatness of the q likelihood profile; essentially giving more information to the model to help resolve scale. This would allow the model itself to help inform what a possible q is for the trawl survey.

Recommendation: Examine the feasibility of working with Canada on stock structure and assessment. In particular, explore the possibility that there is migration/immigration between the two jurisdictions, as well as the potential for a transboundary assessment; or at least a sharing of data. As suggested in this reviewer's STAR Panel report for dogfish earlier this year, the potential for transboundary issues is quite high for dogfish in this area. As such a more meaningful working relationship, sharing of data, or even co-occurring assessments could be worthwhile in helping to resolve this issue of availability, as well as improving overall assessment performance in the future.

It is acknowledged that the level of expense and resources needed to fully address this issue may not be feasible given the low value of the fishery. This is likely to not be an issue that is easily resolved without considerable effort. That said, work on this issue for dogfish could be helpful for other stocks in the area which have the same or similar issues.

7. Provide a brief description of panel review proceedings highlighting pertinent discussions, issues, effectiveness, and recommendations.

For the purposes of this TOR, only the issue of Spiny dogfish was examined. For other items discussed please see the background section.

During the Council's June 2021 meeting a request was passed through the Groundfish Subcommittee of the SSC to reexamine the catchability coefficient estimated during the assessment for Spiny dogfish.

Request: *The GFSC suggests that an analysis of the seasonality of bycatch rates of spiny dogfish from WCGOP and other available data sources (e.g., ASHOP, Pikitch et al. bycatch study) should be conducted to evaluate whether the data indicate a strong seasonal availability of spiny dogfish as bycatch to fisheries. A reasonable way to do this would be to examine haul-specific catch rates in a General Linear Model (GLM) or delta-GLM (depending on the frequency of occurrence of dogfish in a given dataset), with the primary factor of interest being month (or some other seasonal variable, such as Julian day bins, two month periods, etc. as appropriate given the data) as a factor, along with appropriate covariates that were determined by the analyst. These might include year, depth, latitude/state or region, vessel size or power, gear type, stated fishing strategy, or comparable information. Alternatively, it may be feasible to explore the use of modeling frameworks such as VAST or 'sdmTMB' (see https://pbs-assess.github.io/sdmTMB/index.html) to develop this analysis. It may also be appropriate to do separate analyses by region (e.g., Washington coast, Oregon coast, northern California coast), in addition, depending on data availability, in order to facilitate interpretation of model results. As with any such model, an exploration of available information and relevant covariates will require some exploratory work, but GLMs and delta-GLMs are standard tools for any assessment analyst and the precise approach should be at the analyst's discretion.*

Rationale: *The results should provide an indication, albeit imperfect as there will certainly be challenges associated with developing a conclusive result from these data sources, of the relative differences in catch rates of dogfish by fisheries participants. This alone should provide some insights to the SSC and to the PFMC (who made the formal request) with respect to how encounter and catch rates in the fisheries themselves appear to change seasonally, and thus the extent to which the model-estimated q was consistent with seasonal fluxes in catch rates. For example, if catch rates were on average 10x greater between November and March than those between April and October, then a survey estimated q greater than 0.5 for a survey that exclusively takes place between April and October may be a questionable model result. In such a scenario, there may be the potential to develop a weakly informative "upper bound" prior for catchability based on the ratio of bycatch rates during the months during which the survey takes place relative to the months in which spiny dogfish are likely to be more abundant. This request does not include an explicit request to develop such a prior, but rather will provide the SSC with a basis for considering whether such an approach might be feasible and worthwhile in light of the limited time remaining in this stock assessment cycle.*

The STAT examined the issue of Spiny dogfish not being available to the trawl survey during certain portions of the year as requested. To do so they used Generalized Linear Models (GLMs) fit to trawl bycatch rates of spiny dogfish from the fishery-dependent sources. This revealed that higher average catch rates for November-February were likely, during a time when the fishery-dependent trawl survey was not in operation.

This suggests that catchability used in the assessment, based on the trawl survey, was an underestimate resulting in lower stock sizes. The additional analysis presented to the group by John Wallace, which was not made available prior to the meeting, seemingly indicated a similar, if more pronounced, outcome. Despite this, the STAT indicated that while this new analysis was suggestive, it was not definitive evidence that the survey q estimated in the assessment was overestimated.

During discussions, Corey Niles (WDFW) presented a supplementary analysis during public comment which fit random forest and GAM models to spiny dogfish CPUE using similar predictors as the STAT but used hurdle models that account for the presence-absence and positive CPUE components of the data. These analyses showed higher catch rates in non-survey months and demonstrated skewness and complex spatial patterns in the fishery-dependent bycatch data. Due to the lateness in which they were received, neither of the analyses of John Wallace and Corey Niles could be examined fully.

After much discussion, the group indicated that the seasonal pattern in relative CPUE observed in the GLM, random forest, and GAM approaches suggest that seasonal migration of dogfish is a component of survey catchability that was not accounted for in the assessment and suggests that the estimate of q from the assessment was likely too high. However, given the uncertainty and the inability to fully explore these analyses given their lateness, the group couldn't come to a consensus on how much of an overestimate there was in the base model.

This left the difficult task of what to do about this conclusion moving forward. On one extreme, the assessment could have been rejected, while on the other the assessment could be accepted without change. Rejecting the assessment outright would 1) go against the recommendation of the STAR Panel, 2) would result in a reversion to the previous 2017 assessment which would 3) not recognize the additional data and improved modeling in the current assessment, including the updated fecundity relationship, separate from the considerations of seasonal migration and distribution discussed.

Neither of these two extremes seemed workable to the group. As such, an alternative to modifying the decision table to reflect the qualitative knowledge that catchability is likely higher than estimated in the base model (Table 1) was suggested. In effect, the new range of uncertainty would place the 2021 model estimated catchability as the low state of nature (q=0.586), a new middle state of nature (q=0.43) based on a precedent used for the 2017 Pacific Ocean Perch assessment, and a high state of nature, based on upper bound of the 2021 model (q=0.3). This effectively narrows the range of uncertainty by dropping the lowest state of nature in the 2021 model and adding a middle value of (q=0.43), despite there being more uncertainty.

This discussion highlights a recommendation made earlier this year by this reviewer

Recommendation: Allow for alternatives when a proposed model may not be appropriate for management use but is better than the most recent peer-reviewed model. For dogfish, the only alternative to changing the decision table was to have dogfish advice revert to the 2017 peer-reviewed assessment. This was untenable, as there had been vast improvements in the model since 2017. Finding an alternative to this issue is recommended. Whether that be a short-term “Plan B” like is used in the

Northeast US coupled with an expedited re-review the following year, some process mechanism is needed to address instances where the models are improvements, but still may have large uncertainties.

Table 1: The new decision table includes the new high, middle, and low states of nature as provided by the STAT during the Mop-up meeting.

			Low state (old base): q =0.586		Middle state: q =0.43		High state: q =0.3	
Management decision	Year	Catch (mt)	Spawning output	Depletion	Spawning output	Depletion	Spawning output	Depletion
Full ACL for 2021 and 2022 catches; P*0.4 with 65% of ACL from old base model taken after that	2021	1,621	9,895	0.344	13,613	0.418	20,067	0.513
	2022	1,585	9,876	0.343	13,604	0.418	20,068	0.513
	2023	655	9,854	0.342	13,591	0.417	20,066	0.513
	2024	635	9,868	0.343	13,614	0.418	20,100	0.514
	2025	616	9,879	0.343	13,634	0.419	20,130	0.515
	2026	598	9,888	0.344	13,652	0.419	20,158	0.515
	2027	581	9,893	0.344	13,666	0.420	20,182	0.516
	2028	565	9,896	0.344	13,677	0.420	20,202	0.516
	2029	549	9,895	0.344	13,684	0.420	20,219	0.517
	2030	535	9,892	0.344	13,688	0.420	20,232	0.517
	2031	520	9,885	0.343	13,689	0.420	20,241	0.517
	2032	507	9,875	0.343	13,686	0.420	20,246	0.518
Full ACL for 2021 and 2022 catches; P*0.4 with 100% of ACL from old base model taken after that	2021	1,621	9,895	0.344	13,613	0.418	20,067	0.513
	2022	1,585	9,876	0.343	13,604	0.418	20,068	0.513
	2023	1,001	9,854	0.342	13,591	0.417	20,066	0.513
	2024	970	9,859	0.343	13,595	0.417	20,092	0.514
	2025	941	9,861	0.343	13,596	0.417	20,114	0.514
	2026	913	9,860	0.343	13,594	0.417	20,132	0.515
	2027	887	9,855	0.342	13,588	0.417	20,147	0.515
	2028	862	9,847	0.342	13,579	0.417	20,157	0.515
	2029	839	9,834	0.342	13,566	0.417	20,162	0.515
	2030	816	9,817	0.341	13,550	0.416	20,164	0.516
	2031	794	9,797	0.340	13,530	0.415	20,160	0.515
	2032	774	9,773	0.340	13,506	0.415	20,152	0.515
Full ACL for 2021 and 2022 catches; P*0.4 with full ACL from new middle state (q = 0.43) after that	2021	1,621	9,895	0.344	13,613	0.418	20,067	0.513
	2022	1,585	9,876	0.343	13,604	0.418	20,068	0.513
	2023	1,456	9,854	0.342	13,591	0.417	20,066	0.513
	2024	1,407	9,839	0.342	13,586	0.417	20,072	0.513
	2025	1,361	9,821	0.341	13,578	0.417	20,074	0.513
	2026	1,318	9,798	0.340	13,565	0.416	20,072	0.513
	2027	1,278	9,771	0.340	13,548	0.416	20,066	0.513
	2028	1,240	9,740	0.338	13,526	0.415	20,055	0.513
	2029	1,204	9,705	0.337	13,500	0.414	20,039	0.512
	2030	1,170	9,664	0.336	13,470	0.414	20,018	0.512
	2031	1,138	9,620	0.334	13,434	0.412	19,993	0.511
	2032	1,108	9,571	0.333	13,394	0.411	19,962	0.510

The group discussed at length whether probabilities could be assigned to these apparent states of nature. Generally, these are assigned with the middle value being the highest probably (q=0.43 at 0.5) while the two extremes (q= 0.3 and 0.586) are assigned to lower probabilities (0.25). Given the qualitative nature of the information presented, as well as the abundance of uncertainty, the group recommended not assigning weights. Effectively each of these states was considered equally plausible.

The group also indicated that this alteration of the Spiny dogfish decision table was only a temporary fix. A full assessment for Spiny dogfish should be conducted as soon as possible, considering the need to allow time to conduct the research necessary to better inform that next assessment. This research should include a full analysis of catchability as well as a full examination of the potential for fishery-dependent sampling to inform survey catchability and availability. Additionally, a full vetting of the trawl survey as representative of Spiny dogfish abundance should be conducted during the next assessment. On a longer, time-scale exploration of a transboundary assessment or other collaboration with DFO Canada was recommended.

Closing Thoughts and a Further Recommendation

This reviewer would like to thank the STAT for an excellent and informative presentation. Additionally, the others who presented at this meeting should also be recognized for their engaging presentations as their work on this difficult issue for Spiny dogfish. The other GFSC members were particularly helpful and provided much food-for-thought for this reviewer

This was a markedly different meeting than the other STAR Panels that were convened over this past Summer. While the desire for a Mop-up meeting to review difficulties encountered during the Panel meetings is admirable, this meeting seemed to miss the purpose of a Mop-up meeting, in this reviewer's opinion. A Mop-up meeting, at least in this reviewer's mind, seems best suited to examining issues of failed or nearly failed assessments where the STAR Panel meeting simply did not have time to fully investigate modeling or data issues. In this case, this meeting was mostly convened to examine questions/requests made by the Groundfish Subcommittee to the STAT prior to recommending an ABC. In essence, it seemed to be more of a "catch-all" meeting dedicated to stocks that were not on the STAR Panel's list, examination of methods to distribute quota, as well as questions posed to the STAT on dogfish catchability. Additionally, the role of a CIE reviewer at this meeting was not well defined. As such this reviewer would like to make a final recommendation.

Recommendation: That the use of the Mop-up meeting as part of the STAR Panel process be examined in more detail. Specifically, the goals and objectives of such a meeting, the role of CIE reviewers, and the products that are expected. One suggestion would be to make this a formal STAR meeting, where issues brought up during the review of the various assessment could be addressed by STATs and the reviewers, outside of the Groundfish Subcommittee process. Such a process would also require the STAR panels to formally forward candidate assessment to the Mop-up Panel with clear explanations of outstanding issues and related rectifying measures to be taken. Thereupon the Mop-up Panel could determine if those measured improved the model performance

Overall, it was an enjoyable meeting, with very good discussions and a lot of very thoughtful comments from all parties involved.

APPENDICES

Appendix 1: Bibliography of materials provided for review and literature cited

Dogfish

Gertseva, V. Taylor, I.G., Wallace, J.R., Matson, S.E. 2021. Status of the Pacific Spiny Dogfish shark resource off the continental U.S. Pacific Coast in 2021. Pacific Fishery Management Council, Portland, OR. Available from http://www.pcouncil.org/groundfish/stock-assessments.

Gertseva, V., Wallace, J., and Taylor, I. 2021. Additional NWFSC analyses for spiny dogfish. Memo and presentation to the Groundfish Subcommittee to the Science and Statistical Committee Mop-up meeting. Pacific Fisheries Management Council, Portland, Oregon.

Niles, C. GAM and random forest models of dogfish bottom trawl catches: offered for SSC Groundfish Subcommittee Sep 29-30 meeting. 2021 Pacific Fisheries Management Council, Portland, Oregon.

Wallace, J. Commercial fishery CPUE considerations: Supplementary Information. 2021. Memo and presentation to the Groundfish Subcommittee to the Science and Statistical Committee Mop-up meeting. Pacific Fisheries Management Council, Portland, Oregon.

Other materials

Langseth, B.J., C.R. Wetzel. 2021. DRAFT Rebuilding analysis for quillback rockfish (*Sebastes maliger*) in U.S. waters off the coast of California based on the 2021 stock assessment. Pacific Fisheries Management Council, Portland, Oregon. 38 p.

Langseth, B.J. 2021. Quillback rockfish: Updated growth analysis based on new otolith reads for California. Pacific Fisheries Management Council, Portland, Oregon.

Wetzel, C.R. 2021. Evaluating available information to determine stock management delineation for copper rockfish (*Sebastes caurinus*) off the U.S. West Coast. Pacific Fishery Management Council, Portland, Oregon. 12 p.

Wetzel, C.R. 2021. Evaluating new otoliths reads to evaluate growth of copper rockfish (*Sebastes caurinus*) off the U.S. West Coast. Pacific Fishery Management Council, Portland, Oregon. 15p.

Appendix 2: Panel Membership or other pertinent information from the panel review meeting.

Participants

Review Panel Members Present

Dr. John Budrick, California Department of Fish and Wildlife, San Carlos, CA
Dr. Fabio Caltabellotta, Oregon State University, Corvallis, OR
Dr. Matt Cieri, Center for Independent Experts
Dr. John Field, National Marine Fisheries Service Southwest Fisheries Science Center, Santa Cruz, CA
Dr. Melissa Haltuch, National Marine Fisheries Service Northwest Fisheries Science Center, Seattle, WA
Dr. Owen Hamel, National Marine Fisheries Service Northwest Fisheries Science Center, Seattle, WA
Dr. Kristin Marshall, National Marine Fisheries Service Northwest Fisheries Science Center, Seattle, WA
Dr. André Punt, University of Washington, Seattle, WA (Chair for this meeting)
Dr. Jason Schaffler, Muckleshoot Tribe, Auburn, WA
Dr. Tien-Shui Tsou, Washington Department of Fish and Wildlife, Olympia, WA
Dr. Will White, Oregon State University, Corvallis, OR

Stock Assessment Teams Present

Dr. E.J. Dick; Vermilion and Sunset Rockfishes; National Marine Fisheries Service Southwest Fisheries Science Center, Santa Cruz, CA
Dr. Brian Langseth; Copper Rockfish and Quillback Rockfish; National Marine Fisheries Service Northwest Fisheries Science Center, Seattle, WA
Dr. Melissa Monk; Vermilion and Sunset Rockfishes; National Marine Fisheries Service Southwest Fisheries Science Center, Santa Cruz, CA
Dr. Ian Taylor; Spiny Dogfish; National Marine Fisheries Service Northwest Fisheries Science Center, Seattle, WA
Mr. John Wallace; Spiny Dogfish; National Marine Fisheries Service Northwest Fisheries Science Center, Seattle, WA
Dr. Chantel Wetzel; Copper Rockfish and Quillback Rockfish; National Marine Fisheries Service Northwest Fisheries Science Center, Seattle, WA

Other Attendees

Mr. Russell Barabe, California Department of Fish and Wildlife, San Diego, CA
Mr. George Bradshaw, F/V Susan, Crescent City, CA
Ms. Susan Chambers, West Coast Seafood Processors Association, GAP, Charleston, OR
Dr. Jason Cope, National Marine Fisheries Service Northwest Fisheries Science Center, Seattle, WA
Mr. John DeVore, Pacific Fishery Management Council, Portland, OR
Ms. Jaime Diamond, Stardust Sportfishing, Santa Barbara, CA
Mr. Ben Enticknap, Oceana, Portland, OR
Mr. Ken Franke, Sportfishing Association of California, San Diego, CA
Mr. Tom Hafer, Morro Bay Commercial Fishermen's Organization, Morro Bay, CA
Mr. Don Hansen, Dana Wharf Sportfishing, Dana Point, CA
Ms. Heather Hall, Washington Department of Fish and Wildlife, Pacific Fishery Management Council, Olympia, WA
Ms. Gretchen Hanshew, National Marine Fisheries Service West Coast Region, Seattle, WA

Dr. Jim Hastie, National Marine Fisheries Service Northwest Fisheries Science Center, Seattle, WA
Mr. Christian Heath, Oregon Department of Fish and Wildlife, Newport, OR
Mr. Brian Hooper, National Marine Fisheries Service West Coast Region, Seattle, WA
Mr. Harrison Ibach, GAP, McKinleyville, CA
Mr. Bob Ingles, Golden Gate Fisherman's Association, GAP, Half Moon Bay, CA
Mr. Bill James, Salem, OR
Mr. Will Jasper, Makah Tribe, Neah Bay, WA
Mr. Galeeb Kachra, National Marine Fisheries Service West Coast Region, Seattle, WA
Ms. Keeley Kent, National Marine Fisheries Service West Coast Region, Seattle, WA
Mr. Kris Kleinschmidt, Pacific Fishery Management Council, Portland, OR
Ms. Traci Larinto, California Department of Fish and Wildlife, GMT, West Sacramento, CA
Mr. Dan Lee
Ms. Mel Mandrup, California Department of Fish and Wildlife, GMT, West Sacramento, CA
Ms. Heather Mann, Midwater Trawlers Cooperative, Newport, OR
Mr. Tom Marking, GAP, McKinleyville, CA
Dr. Steve Martell, Sea State Inc., Seattle, WA
Ms. Lynn Mattes, Oregon Department of Fish and Wildlife, GMT, Newport, OR
Mr. Merit McCrea, Sportfishing Association of California, GAP, Santa Barbara, CA
Mr. Pete McHugh, California Department of Fish and Wildlife, GMT, Santa Rosa, CA
Mr. Corey Niles, Washington Department of Fish and Wildlife, Pacific Fishery Management Council, Olympia, WA
Mr. Mike Okoniewski, Pacific Seafoods, CPSAS, Woodland, WA
Mr. James Phillips, California Department of Fish and Wildlife, Santa Rosa, CA
Mr. Todd Phillips, Pacific Fishery Management Council, Portland, OR
Ms. Katie Pierson, Oregon Department of Fish and Wildlife, GMT, Newport, OR
Mr. Dan Platt, Salmon Trollers Marketing Association, GAP, Fort Bragg, CA
Mr. Rick Powers, Golden Gate Fisherman's Association, GAP, Bodega Bay, CA
Mr. Gerry Richter, B & G Seafoods, Inc., GAP, Santa Barbara, CA
Ms. Whitney Roberts, Washington Department of Fish and Wildlife, GMT, Olympia, WA
Dr. Will Satterthwaite, National Marine Fisheries Service Southwest Fisheries Science Center, SSC, Santa Cruz, CA
Ms. Maggie Sommer, Oregon Department of Fish and Wildlife, Pacific Fishery Management Council, Newport, OR
Dr. Andi Stephens, National Marine Fisheries Service Northwest Fisheries Science Center, Newport, OR
Mr. Daniel Studt, National Marine Fisheries Service West Coast Region, GMT, Long Beach, CA
Mr. Nick Tharp, El Tiburon Sportfishing, Santa Barbara, CA
Mr. Dan Waldeck, Pacific Whiting Conservation Cooperative, GAP, Portland, OR
Ms. Marci Yaremko, California Department of Fish and Wildlife, San Diego, CA
Mr. Louis Zimm, Sportfishing Association of California, San Diego, CA

Groundfish Subcommittee of the Scientific and Statistical Committee

Pacific Fishery Management Council
Via Webinar
September 29-30, 2021
Scientific and Statistical (SSC) subcommittee meetings are open to the public, and public comments will be taken at the discretion of the Chairs. Committee member work assignments are noted in parentheses at the end of each agenda item. The first name listed is the discussion leader/chair and the second, the rapporteur. Times on this agenda are subject to change once the meeting begins. Please refer to the Meeting Notice on the Pacific Fishery Management Council's webpage for more information and detailed instructions on joining the meeting.

Wednesday, September 29, 2021 – 1:00 PM

A. Welcome and Introductions

1. Roll Call, Introductions, Announcements, etc. Andre Punt, Chair
2. Virtual Meeting Logistics John DeVore

B. Review of the Spiny Dogfish Assessment

1. Presentation of Requested Analyses Ian Taylor and John Wallace
2. Subcommittee Discussion and Requests to STAT, if any

(1:15 p.m.; **Punt, Marshall**)
BREAK (2:15 – 2:30 p.m.)

C. Data-Moderate Stock Assessments

1. Definition of Substantial Change Andre Punt/ Will Satterthwaite
2. Copper Rockfish Age Data and Sensitivity Test Chantel Wetzel
3. Quillback Rockfish Age Data and Sensitivity Test Brian Langseth
4. Subcommittee Discussion

(2:30 p.m.; **Punt, Field**)

D. Data-Moderate Rebuilding Analyses

1. Copper Rockfish Chantel Wetzel
2. Quillback Rockfish Brian Langseth
3. Subcommittee Discussion and Requests to STATs

(4:30 p.m.; **Punt, Caltabellotta**)
PUBLIC COMMENT PERIOD
5:30 p.m. (or immediately following Agenda Item D)
Public comments are accepted at this time.

A. Groundfish Subcommittee Administrative Matters

3. Draft and Review Subcommittee Report (Summary of Key Points)

(5:30 p.m.)

Thursday, September 30, 2021 – 8:30 AM

A. Welcome and Introductions

4. Roll Call, Announcements, etc. Andre Punt, Chair
5. Brief Summary of Recommendations and Review of Today's Agenda

B. Review of the Spiny Dogfish Assessment, Continued if Needed

3. Spiny Dogfish Presentation and Responses to Requests Ian Taylor and John Wallace
4. Subcommittee Discussion and Recommendations

(8:45 a.m.; **Punt, Marshall**)

D. Data-Moderate Rebuilding Analyses, Continued if Needed

4. Copper Rockfish Presentation and Responses to Requests Chantel Wetzel
5. Quillback Rockfish Presentation and Responses to Requests Brian Langseth
6. Subcommittee Discussion and Recommendations

(9:45 a.m.; **Punt, Caltabellotta**)

BREAK (10:45 – 11:00 a.m.)

E. Area Apportionments

1. Summary of Past Approaches John DeVore
2. Copper Rockfish Chantel Wetzel
3. Quillback Rockfish Brian Langseth
4. Vermillion and Sunset Rockfishes Melissa Monk
5. Presentation of Requested Analyses
6. Subcommittee Recommendations

(11:00 a.m.; **Punt, White**)

PUBLIC COMMENT PERIOD

12:30 p.m. (or immediately following Agenda Item E)

Public comments are accepted at this time

A. Groundfish Subcommittee Administrative Matters

6. Draft and Review Subcommittee Report (Summary of Key Points)

(12:30 p.m.)

ADJOURN

PFMC 09/23/21

Appendix 3: Rebuilding analyses and other analyses potentially informing management of California copper and quillback rockfish, and management delineations for copper rockfish, quillback rockfish, and vermilion and sunset rockfishes

California Copper and Quillback Rockfish Rebuilding

The STAT presented the rebuilding analysis of Copper rockfish south of Point Conception based on the TORs for the Groundfish Rebuilding Analysis using Rebuilder software version 3.12h. This analysis assumed the recommended removals for 2021 and 2022 of 90.8 and 88.9 metric tons, respectively. A suite of rebuilding strategies was examined, including 1) setting all harvest to zero (F=0), and determining the rebuilding timeline without fishing (TMIN); 2) applying a range of SPR values between 0.55 and 0.75; 3) applying Annual Catch Limits (ACLs) based on the 40:10 control rule; 4) applying the Acceptable Biological Catch (ABC) control rule with time-varying sigma; and 5) looking at SPR harvest rates that are estimated to lead to rebuilding at TMID, TMAX and the years between them.

Uncertainty was examined using the assumption that recruitment was stochastic into the future with sigmaR = 0.6, which was similar to the estimated recruitment deviations for Northern California. Reference points were calculated from the base model. Projections started in 2023 and estimated a minimum rebuilding time of ten years, ending in 2033.

Because the stock can rebuild in ten years, the maximum time allowed under current policy to rebuild this stock is likewise ten years. As such most of the strategies considered were not practical, as many of those examined did not achieve this rebuilding with a greater than 50% probability within that time frame. Indeed, only those values with SPR higher than or equal to 0.935 were considered permissible. As such SPR values of 0.94, 0.95, and 0.96 were analyzed and forwarded to the full SSC for consideration. This represents a fairly sizable reduction in the overall catch for this stock if it is managed as a single unit. Previously this stock had supported a 90 mt removal, while the median rebuilding strategy would have removals set at 2 mt and being slowly increased to 4.64 mt by the end of the rebuilding period. Some members of the Groundfish subcommittee expressed concern that a ten-year rebuilding strategy was arbitrary.

This reviewer indicates that this analysis was performed correctly but has no substantial opinion on the efficacy of a ten-year rebuilding for this stock. While experience suggests that this can, and often is, relatively arbitrary, the need for defined rebuilding goals is an important part of fishery management overall. That said, while perhaps not useful in this circumstance the ten-year rebuilding “rule” is codified in both policy and law.

The rebuilding analysis for quillback rockfish used similar methods to the one used for copper rockfish. The data-moderate assessment for this stock off of California found that it was 14% below its Minimum Stock Size Threshold (MSST). Like Copper rockfish, the analysis used the Terms of Reference for the Groundfish Rebuilding Analysis and used the Rebuilder software version 3.12h.

Alternatives examined included: 1) strategies that are specified in the TOR (e.g., setting all harvest to zero, F=0); 2) strategies that are specified in the TOR, but require an SPR or catches that would result in an SPR < 0.5 (not done); and 3) additional strategies that include a range of SPR values between 0.5 and 0.9. The strategies in category 2 above include two options, one generating Annual Catch Limit (ACL) contributions for the current year of around 5.86 metric tons, and another one applying SPR harvest rates that are estimated to lead to rebuilding by TMAX from the current cycle.

The projections assumed full utilization of the quota and included starting values based on the states of nature around natural mortality as done for the data-moderate assessment. The runs included recruitment deviations with a sigmaR of 0.6 and reference points were as calculated from the base run from that assessment.

The rebuilding plan was set to start in 2023, with an estimated minimum time for the rebuilding of 17 years (TMIN= 2040), and a mean generation time of 26 years, which resulted in a TMAX of 2066. Alternative target years were not explicitly presented in the current analysis, though the various SPR runs provide a range of expected rebuilding years.

The STAT ran an additional rebuilding sensitivity based on a request received after the assessment was completed earlier this year. This run set recreational and commercial selectivities blocked at 2001 in the assessment model, with asymptotic selectivity in the early time period and dome-shaped selectivity in the latter period. The goal was to capture the changes in the availability of fish of differing size classes before and after severe depth restrictions (20-30 fm) were put in place where the bulk of the biomass of quillback rockfish is found. Overall, this run was similar to the base model in results. While the sensitivity run had a slightly higher spawning output which resulted in a slightly lower minimum time to rebuild, this sensitivity run indicated a longer generation time, which balanced it. This resulted in the same maximum rebuilding time for both base and sensitivity models. That said there was a 10-20 increase in the amount of catch that could be generated if using the sensitivity model during interim rebuilding strategies. Due to this fact, the subcommittee requested that this information be included in the report to the SSC.

This reviewer notes that this analysis was performed correctly but has no other substantial opinion. As stated previously the rebuilding of copper and quillback were outside the purview of this reviewer.

Stock and Management Delineations for Copper, Quillback, and Vermilion and Sunset Rockfishes

Copper rockfish are assessed as two separate units, one north and one south of Point Conception. Despite this, there is weak or mixed evidence for genetic differentiation between northern and southern California. Adult migration also has mixed evidence for two separate units but is overall dwarfed by the size of larval dispersal. This led to discussions about whether to treat both units as one combined to two separate units for quota setting. After that lengthy discussion, the GFSC recommended combining the two units for stock status determination as well as quota setting. However, it was recommended that the removals be allocated among the stock areas in line with the estimated stock size in each area.

Copper rockfish was not part of the overall tasks for this reviewer, and so familiarity with the assessment and the issues brought up during that review were limited. As such, this reviewer's opinion could be off base. That said, it is odd to conduct two separate assessments, combine them for stock status determination, then determine an acceptable removal level, which is then portioned by area based on the relative abundance in each area. The is that is both a convoluted process and may not be fully recognized within unit depletion as effectively as other methods. While management and assessment scales can differ, it is important to acknowledge that and provide a meaningful rationale for that type of approach. Precedent, based on other assessments such as the 2009 and 2019 Cabezon, may be used with caution. Such precedents may not be the best available information and may not be best practices. As such a recommendation is suggested.

<u>Recommendation</u>**: Combining units of assessment for status and quota determination should be examined in detail through either simulation or, less optimally, literature review to determine when it may be appropriate.** This appears to be an issue in many assessments for stocks in this region. A board simulation study in cases where the adult is more mobile, vs stocks which have most of the connectedness by larval transport, might offer some insights as well as possible pitfalls of this issue.

This issue of delineation was similar for quillback rockfish. Assessment units were defined based on the Oregon-CA border given data availability, though there are questions as to if a more appropriate line might be slightly to the south (40º 10' N) based on recreational and commercial catches from 2005-2020. After discussion, it was recommended that that the Terms of Reference for this stock be updated to address this issue in a future assessment, that estimates of stock status for coast-wide as well as by assessment area be made available by the next Council meeting, but that the issue would remain unresolved until more stock structure information could be provided.

Vermilion & Sunset Rockfishes were also discussed in terms of delineation for stock and management purposes. A habitat proxy was developed using bathymetry from the California Seafloor Mapping Program. It also used the fishery-dependent CPUE (Catch per Unit Effort) estimate and habitat availability to estimate a proxy for the proportion of biomass in each region, but this was only available north of Point Conception. The group supported the use of habitat estimates to help partition the units, but overall recommended that the issue be tabled until evidence related to stock structure, similar to that provided for copper rockfish, as well as estimates of stock status at the assessment area, state and coastwide level were available; likely at the next Council meeting.

Given that quillback, sunset, and vermilion rockfish issues were tabled, this reviewer had no opinion on these discussions. Additionally, the issue of stock delineation was not the subject of this reviewer's work during this meeting.