

GROUND FISH MANAGEMENT TEAM REPORT ON ADDITIONAL METHODS THAT  
MAY BE USED TO EVALUATE ALTERNATIVES FOR STOCK COMPLEX  
REORGANIZATION

**Overview**

The Groundfish Management Team (GMT) presented descriptions of methods intended for evaluation of alternatives for stock complex reorganization at the June 2013 Pacific Fishery Management Council (PFMC) Meeting under [Agenda Item F.8.b, GMT Report, June 2013](#). That report suggested that the new methods were meant to supplement, not replace, other methods and analyses shown in an April Council Report (i.e., [Agenda Item D.3.a, Attachment 1, April 2013](#)). Methods provided in that April report, as well as those described in a June Council Report (i.e., [Agenda Item F.8.a, Attachment 1, June 2013](#)) were considered and applied by the GMT during the June meeting to evaluate alternatives to reconfigure the slope rockfish and “other fish” complexes ([Agenda Item F.8.b, Supplemental GMT Report 2, June 2013](#)).

Some of the primary methods used by the GMT for the June 2013 analysis were described in detail under [Agenda Item F.8.b, GMT Report, June 2013](#). Those methods were:

- Spatial Analysis (haul/set level, or 25 fathom x 1° lat. blocks, depending on data source)
- Species Co-occurrence Tables (haul/set level)
- C-scores Derived from the Co-occurrence Tables (haul/set level)
- Cluster Analysis (haul/set level)
- Description of a Survey developed by the GMT to acquire information from Port Biologists and State Fishery Managers

The Scientific and Statistical Committee (SSC) provided comment on these methods under [Agenda Item F.8.b, Supplemental SSC Report, June 2013](#). Their guidance included:

- Analyses should be made using only catch-based (e.g., observer) data
- Cluster analysis should not be used to identify co-occurrence
- Co-occurrence tables should be based on probability of co-occurrence (as was done in June) as well as catch weight or catch per unit of effort (CPUE)

In addition, the SSC reiterated its recommendation from the April meeting that metrics should include the ratio of total cumulative catch to total cumulative overfishing limit (OFL) “and the mean difference between total catch and total component OFL” ([Agenda Item F.8.b, Supplemental SSC Report, June 2013](#)).

The purpose of this document is to provide a summary of methods that the GMT plans to apply for evaluation of alternatives for stock complex reorganization. Those methods already presented and reviewed by the SSC will only briefly be mentioned herein (see above). Only new methods for which the GMT seeks SSC review will be described in detail.

## **Previous or Updated Analyses and Methods (SSC reviewed)**

Methods and analyses that the SSC had previously reviewed and recommended for use to evaluate stock complex reorganization can be found at [ftp://ftp.pcouncil.org/pub/Stock\\_Complex\\_Materials/](ftp://ftp.pcouncil.org/pub/Stock_Complex_Materials/). These methods include spatial analysis, C-scores, and tables of co-occurrence, and were fully described under [Agenda Item F.8.b, GMT Report, June 2013](#). Figures and tables will be uploaded to this FTP site prior to publication of the September 2013 briefing book; these analyses will be based on West Coast Groundfish Observer Program (WCGOP) data (groundfish trawl and non-trawl), CPUE metrics (i.e., spatial analysis), or encounters ( i.e., C-scores and tables of co-occurrence). The GMT plans to upload tables of co-occurrence based on catch levels or CPUE just prior to or at the September Council meeting. All analyses will be completed for species within the current:

- Slope rockfish complex
- Shelf rockfish complex
- “Other fish” complex
- “Other flatfish” complex

## **Additional Analyses for SSC Review**

The GMT intends to provide analyses and recommendations for restructuring stock complexes at this September Council meeting. Although most analyses and data sets used by the GMT have been reviewed by the SSC (see above), three analyses remain for SSC review. Those are provided or referenced in this section. The GMT notes that although the underlying data (e.g., WCGOP) or underlying methods such a Productivity and Susceptibility Analysis (Cope et al., 2011) have been reviewed by the SSC, our application of those sources for evaluation of stock complexes has not been reviewed.

### *Application of PSA Scores*

The Productivity and Susceptibility Analysis (PSA) will be applied by the GMT to (a) identify species that are “in the fishery” and (b) provide an independent estimate species susceptibility to overfishing (especially those that have no status determination criteria). The GMT provided a separate report in the briefing book on PSA scores and its application for identifying species that are “in the fishery” (Groundfish Management Team Report on the Classification of Stocks in the Groundfish Fishery Management Plan; Agenda Item G.8.b, GMT Report 2, September 2013). It is expected that the SSC will provide comments on that report, where Susceptibility (S) scores were re-weighted to eliminate the contribution of management-related attributes (e.g., rockfish conservation areas; RCAs). We note that for the purpose of evaluating alternatives for stock complex reconfiguration, the GMT intends to use original PSA scores shown by Cope et al. (2011) with the exception of individual species adjustments shown in Agenda Item G.8.b, GMT Report 2, September 2013 for longspine thornyhead and dusky rockfish. More detailed discussions on interpretation of PSA scores can be found in the GMT “in the fishery” document (Agenda Item G.8.b, GMT Report 2, September 2013).

### *Port Sampling Surveys*

The GMT provided a report in the briefing book that describes results of state groundfish sampling surveys (Groundfish Management Team Report on Port Sampling Surveys; Agenda Item G.8.b, GMT Report 3, September 2013). Surveys developed by the GMT were taken by state sampling program managers and supervisors, and by state agency port biologists and samplers during June, 2013. The intent of these surveys was to evaluate potential impacts of stock complex reorganization to state groundfish sampling programs.

### *Risk Analysis*

Tables 1-4 were developed to evaluate the risk of overfishing. Although some of this information had already been applied for the preliminary analyses shown in [Agenda Item F.8.b, Supplemental GMT Report 2, June 2013](#), the information has been updated and additional metrics have been developed.

Species shown in Tables 1-4 are provided only as an example of our intended process. Complete tables will be developed for the September Council meeting that will include **all species** which are currently members of slope rockfish, shelf rockfish, other fish, and other flatfish complexes. Species or species groups that are not currently in the FMP may be added to this analysis, depending on results shown by the GMT's "in the fishery" analysis (Agenda Item G.8.b, GMT Report 2, September 2013).

Annual Catch Apportioned By Management Area: Catch estimates from 2004-2011 were compiled for the commercial, Tribal, recreational and research sectors (Table 1). Estimates from 2004-2010 were the result of a summation of mortality data provided from WCGOP for commercial sectors, recreational data provided by Washington and Oregon state sampling programs, recreational data taken from the Recreational Fisheries Information Network (RecFIN) by California, and research catch provided by the National Marine Fisheries Service (NMFS) Northwest Region. For 2011, estimates for each species were taken directly from the 2011 total mortality report for all sources of mortality (Bellman et al., 2012). For our initial analysis, rockfish complexes were stratified by management area (i.e., north and south of 40°10' N latitude).

A detailed description of sources of commercial and recreational catch estimates were provided in our "in the fishery" analysis (see Agenda Item G.8.b, GMT Report 2, September 2013). Note that data were filtered for the "in the fishery" analysis. Data filtering was not performed for this risk analysis.

The example in Table 1 shows catch by recreational, commercial, Tribal, and research sectors for three species from the minor slope rockfish complex (north). Recent (2009-2011) and longer-term averages (2004-2011) are also provided.

**Table 1. Estimated annual catch for aurora, bank, and blackgill rockfishes (north of 40°10' N latitude) from 2004 through 2011. Mean catches for 2009-2011 and for 2004-2011 are shown for comparison. Data were obtained from WCGOP (commercial and Tribal catch), NMFS Northwest Region (research catch), and state GMT representatives (recreational catch).**

Minor Slope Rockfish North (subgroup)											
Component Stock	Catch (mt) by Year or Range of Years									Mean 2009-2011	Mean 2004-2011
	2004	2005	2006	2007	2008	2009	2010	2011			
Aurora (north)	30.1	12.1	14.0	34.4	37.4	52.2	36.6	20.7	36.5	29.7	
Bank (north)	3.6	1.4	1.1	2.0	1.3	1.0	0.5	0.7	0.8	1.4	
Blackgill (north)	6.4	3.8	5.1	7.0	9.7	6.4	12.3	4.6	7.8	6.9	

Metrics to Evaluate Risk of Overfishing: Various metrics may be used to evaluate the risk of overfishing. Metrics that the GMT may use to evaluate this risk are shown in Table 2 for aurora, bank, and blackgill rockfishes (north of 40°10' N latitude). These species are provided as examples only. The full suite of species being considered for complex reorganization will be included in the risk analysis that will be presented at the September Council meeting.

The PSA vulnerability scores and associated “vulnerability” to being overfished (= PSA relative value) are shown in Table 2. Cope et al. (2011) assigned ranks to these scores as follows: Major concern ( $V \geq 2.2$ ), High concern ( $2.0 \leq V < 2.2$ ), Medium concern ( $1.8 \leq V < 2.0$ ), and Low concern ( $V < 1.8$ ). For the examples shown in Table 2, all vulnerabilities would be ranked as High. Note that in one case, the PSA vulnerability score was very close to Medium. The GMT does not plan to create additional levels of vulnerability. However, the actual PSA vulnerability score should be acknowledged for those “borderline” cases.

The GMT understands that other metrics may be more suitable than PSA for evaluating the risk of overfishing. It may be better to emphasize those metrics recommended by the SSC to evaluate this risk, such as the ratio of annual catch relative to the OFL (see below). The GMT will provide more comment on the use of PSA analysis for evaluating risk of overfishing at the September Council meeting.

Catch as a percent of the component Allowable Biological Catch (ABC) and as a percent of the component OFL is shown for catches over three periods: 2011, 2009-2011, and 2004-2011. In all cases, the average annual catch was divided by the 2013 component OFL or the 2013 component ABC. The most recent component OFL or component ABC was selected as the denominator to emulate the most recent stock status.

The percent of years that catch may have exceeded the 2013 component ABC or 2013 component OFL is shown for 2004-2011. We provide catch for a period of 8 years. For aurora rockfish north of 40°10' N latitude, Table 2 shows that the component OFL was exceeded 75 percent of the time from 2004-2011. In other words, the 2013 component OFL for aurora rockfish (north) would have been exceeded in 6 out of 8 years.

The GMT points out that aurora rockfish and other stocks have been recently assessed and the resulting OFL and ABC values should replace those used in the analysis described above, which is based on OFLs derived from data-poor methods. Comparisons with new projected OFLs for species such as aurora rockfish will be completed at the September meeting and included in the GMT's supplemental statement. The most current projected OFLs should be evaluated before concern is expressed regarding “apparent overages” based on data-poor methods since our understanding of stock status, the stocks overfishing limit, and potential overfishing will be supplanted by new assessment results.

The last column of Table 2 represents the percent contribution of this management area OFL (i.e., north or south) to the coastwide OFL. At the June Council meeting, the SSC and the GMT discussed the significance of this proportion when considering a management response (see [Agenda Item F.8.b, Supplemental SSC Report, June 2013](#) and [Agenda Item F.8.b, Supplemental GMT Report 2, June 2013](#)). In this example, the contribution of the OFL for aurora rockfish (north) represents 37 percent of the coastwide OFL. The OFL for bank rockfish (north) and blackgill rockfish (north) account for only 3 percent of the coastwide OFL for both species. Given that the regional OFL reflects the relative expected biomass in region, if a very low proportion of the total biomass resides in the region in question, the Council may want to weigh whether an overage poses a risk to the health and productivity of the stock as a whole when considering taking management action to address an overage (i.e. blackgill rockfish).

Shaded cells in the table represent metrics that may suggest high risk of overfishing. However, since the management lines may not be of biological importance, and many of these component OFLs are shown north and south of 40°10' N latitude (i.e., for rockfish complexes), the GMT will also provide coastwide risk analyses for all species that contain “shaded” cells within one or more management areas (i.e., north or south of 40°10' N latitude). Examples of our planned coastwide-risk analysis are shown in Table 3 and Table 4.

**Table 2. Metrics that may be used to evaluate the risk of overfishing for aurora, bank, and blackgill rockfishes (north of 40°10' N latitude. Metrics include (1) PSA score and PSA relative value (Cope et al., 2011), (2) average annual catch (2011, 2009-2011, and 2004-2011) as a percent of the 2013 ABC and the 2013 OFL, (3) percent of years (N = 8 years) that catch would have exceeded the 2013 OFL or the 2013 ABC, and (4) percent contribution of the management-unit OFL (i.e., north or south of 40°10' N latitude) OFL to the coastwide OFL. Shaded areas represent potential areas of concern (i.e., higher risk of overfishing).**

Minor Slope Rockfish North (subgroup)

Species	PSA Score	PSA Relative Value	2013 OFL	2013 ABC	Catch as Percent of ABC 2011	Catch as Percent of ABC 2009-2011	Catch as Percent of ABC 2004-2011	Percent of Years Over ABC 2004-2011	Catch as Percent of OFL 2011	Catch as Percent of OFL 2009-2011	Catch as Percent of OFL 2004-2011	Percent of Years Over OFL 2004-2011	Percent Contribution to the Coastwide OFL
Aurora (north)	2.1	High	15.4	12.8	161%	285%	232%	88%	134%	237%	193%	75%	37%
Bank (north)	2.02	High	17.2	14.4	5%	5%	10%	0%	4%	4%	8%	0%	3%
Blackgill (north)	2.08	High	4.7	3.9	119%	199%	177%	88%	99%	165%	147%	75%	3%

Table 3 provides catch estimates only for aurora and blackgill rockfishes (coastwide). Bank rockfish would be dropped from further analysis of risk because annual catch from 2004-2011 never exceeded the 2013 OFL or 2013 ABC (north or south of 40°10' N latitude). Hence, our full analysis will only provide coastwide catch tables for those species that “seemed” at risk at either north or south of 40°10' N latitude to evaluate whether the combined coastwide OFL has also been exceeded.

Note that for bank rockfish, the PSA analysis suggests a high risk of overfishing, whereas our ratio analysis (i.e., catch:OFL) suggests that under current management, it is at low risk of overfishing. The appropriate use or weighting procedure of these metrics to evaluate risk of overfishing will be discussed extensively by the GMT prior to making recommendations.

**Table 3. Estimated annual catch for aurora, bank, and blackgill rockfishes (coastwide) from 2004 through 2011. Mean catches for 2009-2011 and for 2004-2011 are shown for comparison. Data were obtained from WCGOP (commercial and Tribal catch), NMFS Northwest Region (research catch), and state GMT representatives (recreational catch).**

Stock	Year							
	2004	2005	2006	2007	2008	2009	2010	2011
Aurora (coastwide)	83.6	53.8	59.2	64.0	48.7	68.3	41.1	27.2
Blackgill (coastwide)	159.4	92.2	100.5	55.2	84.3	142.3	164.8	154.9

Metrics that may be used to evaluate the risk of overfishing will be provided on a coast wide level for those species that seemed at risk of overfishing within one or both management areas. An example of this is provided in Table 4. Descriptions of the column headers are the same as shown for Table 2 (see above).

**Table 4. Metrics that may be used to evaluate the risk of overfishing for aurora, bank, and blackgill rockfishes (north of 40°10' N latitude). Metrics include (1) PSA score and PSA relative value (Cope et al., 2011). (2) average annual catch (2011, 2009-2011, and 2004-2011) as a percent of the 2013 ABC and the 2013 OFL, (3) percent of years (N = 8 years) that catch would have exceeded the 2013 OFL or the 2013 ABC, and (4) percent contribution of the management-unit OFL (i.e., north or south of 40° 10' N latitude) to the coastwide OFL. Shaded areas represent potential areas of concern (i.e., higher risk of overfishing).**

Metrics to Evaluate Risk of Overfishing (Coastwide)												
Species	PSA Score	PSA Relative Value	2013 OFL	2013 ABC	Catch as Percent of ABC 2011	Catch as Percent of ABC 2009-2011	Catch as Percent of ABC 2004-2011	Percent of Years Over ABC 2004-2011	Catch as Percent of OFL 2011	Catch as Percent of OFL 2009-2011	Catch as Percent of OFL 2004-2011	Percent of Years Over OFL 2004-2011
Aurora (coastwide)	2.1	High	41.5	34.5	80%	132%	162%	88%	67%	110%	134%	75%
Blackgill (coastwide)	2.08	High	134.7	122.6	126%	126%	97%	50%	115%	114%	88%	50%

One metric that the SSC requested but not yet provided is “the mean difference between total catch and the total OFL”. This metric will be provided prior to or at the September Council meeting.

## **Summary**

In this report, the GMT provided some new approaches or analyses for (a) evaluating species that should be “in or out” of the fishery (Agenda Item G.8.b, GMT Report 2, September 2013), (b) assessing costs of stock complex reorganization at the state level through surveys provided to state managers and state port biologists (Agenda Item G.8.b, GMT Report 2, September 2013), and (c) evaluating the risk of overfishing (this document). The GMT plans to present these analyses to the SSC at the Council meeting and expects feedback and recommendations from the SSC on the three reports. We will incorporate the SSCs recommendations when developing final GMT analyses for the September Council meeting.

## **References**

- Bellman, M.A., A.W. Al-Humaidhi, J. Jannot, and J. Majewski. 2012. Estimated discard and catch of groundfish species in the 2011 U.S. west coast fisheries. West Coast Groundfish Observer Program. National Marine Fisheries Service, NWFSC, 2725 Montlake Blvd E., Seattle, WA 98112.
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