Release Mortality Workshop SMART Tool Results

Lee Benaka and Leah Sharpe
NOAA Fisheries Office of Science and Technology
Silver Spring, Maryland

Background

In July 2014, NOAA Fisheries published a technical memorandum on release mortality in fisheries (Benaka et al. 2014). Release mortality generally is used to describe ostensibly live animals of varying condition at capture that subsequently die when released. "Release mortality" will be used throughout this summary, although it is referred to in the literature by other descriptors such as delayed, discard, fatigue, hooking, and post-release.

The 2014 technical memorandum described research projects addressing release mortality that were funded by NOAA Fisheries from 1999 to 2013. The report also described several important data gaps in understanding and methodology used to determine release mortality. In addition, the technical memorandum identified criteria that could help scientists and managers prioritize species for release mortality research efforts.

When this technical memorandum was published, NOAA Fisheries announced that it would develop—in partnership with fishing communities, industry, scientists, and managers—an Action Plan to guide agency science, improve estimates of release mortality, and better incorporate release mortality estimates into stock assessments. NOAA Fisheries staff charged with developing the Action Plan decided to utilize a simple multi-attribute rating technique (SMART) tool. This tool could use the criteria identified in the technical memorandum to prioritize species for which improved release mortality estimates would significantly alter fishing opportunities or practices.

NOAA Fisheries identified a Steering Committee charged with organizing an April 2015 workshop involving state researchers and managers, academics, Regional Fishery Management Council staff and members, and industry representatives (see Appendix 1). The workshop participants helped the Steering Committee to explore prioritization options for important U.S. fish species that might be in need of improved release mortality rate estimates (e.g., species with very low or high assumed mortality rates supported by only a single study, few data, and/or myriad assumptions, or species subject to "no-retention" management policies). Workshop participants focused especially on instances where improved estimates of release mortality rates would likely directly affect the results of a stock assessment and/or fishing opportunities or practices.

The SMART Tool

The SMART tool is designed to be an objective, repeatable, and fairly quick assessment of the need for improved release mortality estimates for certain species. The tool first applies a "management sensitivity filter" to each species, which asks experts to evaluate the extent to which a new release mortality estimate likely would significantly alter fishing opportunities or practices. If experts determined that a new release mortality estimate could significantly alter

fishing opportunities or practices, then the species should be evaluated with the SMART tool. If not, then the species should not be evaluated.

The SMART tool, which was used by Steering Committee members prior to the 2015 workshop, included five criteria:

1. Restricted or rare
2. Vulnerability
3. Economic impact
4. Political sensitivity and stakeholder engagement
5. Discard ratio

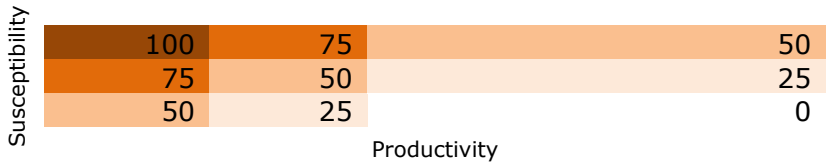
The following sections describe how each of these criteria was scored.

Restricted or Rare

The restricted or rare criterion was a binary option that asked simply whether the species was considered to be restricted or rare. If the answer to the question was "yes" for either restricted or rare, then the criterion received a score of 100. If the answer was "no" to both questions, then the criterion received a score of 0. The Steering Committee defined "restricted" to mean that the species was commonly considered to be a limiting or "choke" species in relation to other target species in a mixed-species fishery. The Steering Committee defined "rare" to mean that the species was listed as threatened or endangered under the Endangered Species Act.

Vulnerability

The vulnerability criterion was a quantitative approach based on stock status and /or productivity and susceptibility indices. If a species stock status is unknown, or if the stock assessment results are uncertain, then experts should utilize the productivity-susceptibility analysis (PSA) tool developed by NOAA Fisheries (http://nft.nefsc.noaa.gov/PSA.html). The PSA tool should result in categorization of a species productivity and susceptibility as low, medium, or high. Based on those categories, the species would receive scores based on the matrix shown below:



If the species in question has a related stock assessment, and that stock assessment addresses uncertainty, then SMART tool users should assign the following scores for this criterion, based on the stock status in the assessment:

- Overfishing and overfished = 100
- Overfishing and not overfished (substantial uncertainty) = 70
- Not overfishing but overfished (substantial uncertainty) = 70
- Overfishing but not overfished (little uncertainty) = 50
- Not overfishing but overfished (little uncertainty) = 50
- Not overfishing and not overfished = 0

In addition, if the species in question has suffered a decline in status (i.e., moved from not overfished to overfished, and/or not undergoing overfishing to undergoing overfishing) from 2004 to 2014, then the assessors should add a 10-point bonus to the score. This bonus score was designed to highlight variability and susceptibility in a species stock status.

Economic Impact

The economic impact criterion asked experts to consider the impacts of a hypothetical situation in which uncertainty about release mortality led to the unexpected closure of a fishery or fisheries. The following types of impacts received various scores:

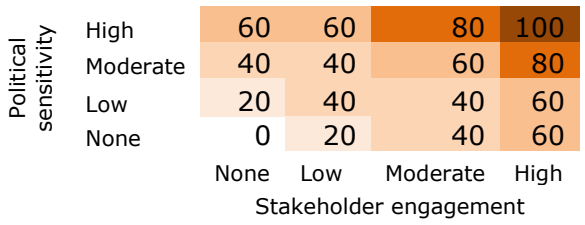
- The regional economy would suffer significant and immediately measurable economic consequences (e.g., impact could lead to a request for a fishery disaster declaration) = 100
- The regional economy would suffer some measurable economic consequences = 60
- The regional economy would suffer minor economic consequences = 20
- The regional economy would suffer no measureable economic consequences = 0

Political Sensitivity and Stakeholder Engagement

This criterion utilized a matrix approach that could result in a range of scores from 0 to 100, based on level of political sensitivity and stakeholder engagement. Experts were asked to categorize sensitivity and engagement related to the species in question as high, moderate, or low.

High sensitivity/engagement could be characterized by lawsuits involving the species, efforts to certify/ecolabel the species, or large involvement of stakeholders including anglers/fishermen in cooperative release mortality research. Moderate sensitivity/engagement could be characterized by infrequent or no lawsuits, moderate levels of public comment on rulemaking, some discussion of certification/ecolabeling for the species, and some angler/fishermen involvement in cooperative research. Low sensitivity/engagement could by characterized by either low levels of public comment on rulemaking or low levels of angler/fishermen involvement in cooperative research.

Based on those categories, the species would receive scores based on the matrix shown below:



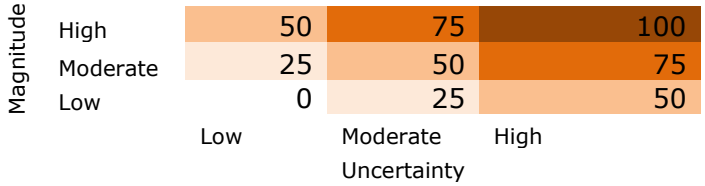
Discard Ratio

This criterion also utilized a matrix approach that could result in a range of scores from 0 to 100, based on the magnitude of the discard estimate (e.g., high, medium, low) and the uncertainty in the discard estimate (e.g., high, medium, low). For magnitude of the discard rate, if ratio of discards to landings was unknown or more than 1.5 times landings, experts were asked to assign

a score of "high." If discards were between 0.5 and 1.5 times landings, experts were asked to assign a score of "moderate." If discards were less than 0.5 times landings, experts were asked to assign a score of "low."

For uncertainty, if the coefficient of variation (CV) of the discard estimate was unknown or above 50%, experts were asked to assign a score of high. If the CV of the discard estimate was from 30% to 50%, experts were asked to assign a score of medium. If the CV of the discard estimate was less than 30%, experts were asked to assign a score of low.

Based on those categories, the species would receive scores based on the matrix shown below:



Each of the criteria received a weight that reflected the importance of the criterion in relation to the other criteria. The weights, which can be easily adjusted within the SMART tool, were as follows for the analyses conducted prior to and during the expert workshop:

1. Restricted or rare = 20
2. Vulnerability = 100
3. Economic impact = 100
4. Political sensitivity and stakeholder engagement = 20
5. Discard ratio = 60

Species Evaluated with the SMART Tool

Prior to the April 21-22 2015 workshop, the Acting Director of the Office of Technology sent an email message to Regional Fishery Management Council and Marine Fisheries Commission Executive Directors, as well as the Division Chief for Atlantic HMS, asking for lists of the top-10 species under their jurisdiction that would benefit from improved release mortality rates. Steering Committee members and workshop participants participated in a series of conference calls prior to the workshop to evaluate the top-10 species using the SMART tool. Table 1 lists the species submitted for consideration.

<u>New England Fishery Management Council (NEFMC) Species Results</u>

The experts who evaluated the NEFMC species used the management sensitivity filter to rule out an evaluation of Atlantic herring and river herring. The experts felt that the Atlantic herring discard rate was very low, and that it would be difficult to design a study to identify an improved release mortality rate estimate for this species. The experts felt that more information was needed regarding the magnitude of river herring discards before a new release mortality rate would have a significant impact on management. The experts also decided to evaluate the skate complex as separate species. Figure 1 shows the scores for these species.

Workshop participants felt that some of the higher scores for the NEFMC species reflected the species position as a choke species that constrains other fisheries (e.g., flounder species).

Vulnerability also influenced high scores for some of the species, especially windowpane flounder and thorny skate. For the two species that scored the highest (windowpane flounder and Atlantic halibut), the NEFMC cited an unknown release mortality rate and the fact that the annual catch limit for these species could constrain other fisheries. Workshop participants suggested some additional species for consideration by the SMART tool, including Atlantic cod (especially as encountered lobster fisheries), haddock, pollock, wolfish, and cusk (especially as released through the use of recreational gear).

Mid-Atlantic Fishery Management Council (MAFMC) Species Results

The experts who evaluated the MAFMC species used the management sensitivity filter to rule out an evaluation of several species, including the six species submitted by the MAFMC that were not identified as species of concern (i.e., Atlantic mackerel, tilefish, surfclam, ocean quahog, Loligo, and Illex). In addition, the experts decided not to evaluate spiny dogfish, at least initially, because numerous studies already have focused on this species. In addition, the experts decided not to evaluate summer flounder because that species also has been the subject of many recreational fishery studies. Summer flounder may warrant SMART tool evaluation if commercial fishery release mortality estimates could possibly change substantially in response to additional research. Figure 2 shows the scores for these species.

Table 1. Species submitted for consideration by the Regional Fishery Management Councils, the Atlantic States Marine Fisheries Commission, and expert opinion in the case of the West Coast (the Pacific Fishery Management Council was unable to provide a species list due to schedule conflicts). Species with an asterisk were considered but not evaluated by workshop participants. Atlantic HMS have not yet been evaluated with the SMART tool.

NEFMC	MAFMC	ASMFC	SAFMC	GFMC	West Coast	NPFMC	WPFMC	Atlantic HMS
Georges Bank winter flounder	Butterfish	Black sea bass	Red snapper	Red snapper	Black rockfish	Pacific halibut	Main Hawaiian Islands Deep-7 bottomfish species	Loggerhead sea turtle
Windowpane flounder	Scup	Scup	Gag grouper	Gag grouper	Blue rockfish	Bering Sea red, blue, golden king crab	Bigeye tuna	Leatherback sea turtle
Atlantic halibut	Black sea bass	Spanish mackerel	Vermillion snapper	Vermillion snapper	Bocaccio	Bering Sea Tanner crab	Striped marlin	Dusky shark
Northern red hake	Bluefish	Bluefish	Warsaw grouper	Greater amberjack	Brown rockfish	Bering Sea Bairdi crab	Oceanic whitetip shark	Sandbar shark
Silver hake	Spiny dogfish*	Black drum	Speckled hind	Goliath grouper	Copper rockfish	Longnose skate	Silky shark	Porbeagle shark
Southern New England winter flounder	Summer flounder*	Atlantic sturgeon	Gray triggerfish	Gray triggerfish	Cowcod	Big skate	Blue shark	Scalloped hammerhead shark
Gulf of Maine winter flounder	Atlantic mackerel*	Shad*	Red porgy	Mutton snapper	Canary rockfish	Alaska skate	Bigeye thresher shark	Common thresher shark
Northeast skate complex	Tilefish*	Red drum*	Red grouper	Red grouper	Quillback rockfish	Sleeper shark	Shortfin mako shark	Yellowfin tuna
Ocean pout	Surf clam*	Spotted seatrout*	Scamp grouper	Scamp grouper	Vermillion / sunset rockfish	Spiny dogfish	Blue marlin	Blacktip shark
Atlantic herring*	Ocean quahog*	Weakfish*	Black sea bass	Yellowtail snapper	Yelloweye rockfish	Yelloweye rockfish	South Pacific albacore	Blacknose shark
River herring*	Loligo*	Summer flounder*	Snowy grouper	King mackerel	Sablefish (fixed gear)	Shortraker rockfish		
	Illex*	Tautog*	Blueline tilefish		Sablefish (trawl gear)	Rougheye rockfish		
		Striped bass*			Lingcod	Sablefish		
					Spiny dogfish			
					Skates (big and longnose)			

Figure 1. SMART Tool Scores for NEFMC Species

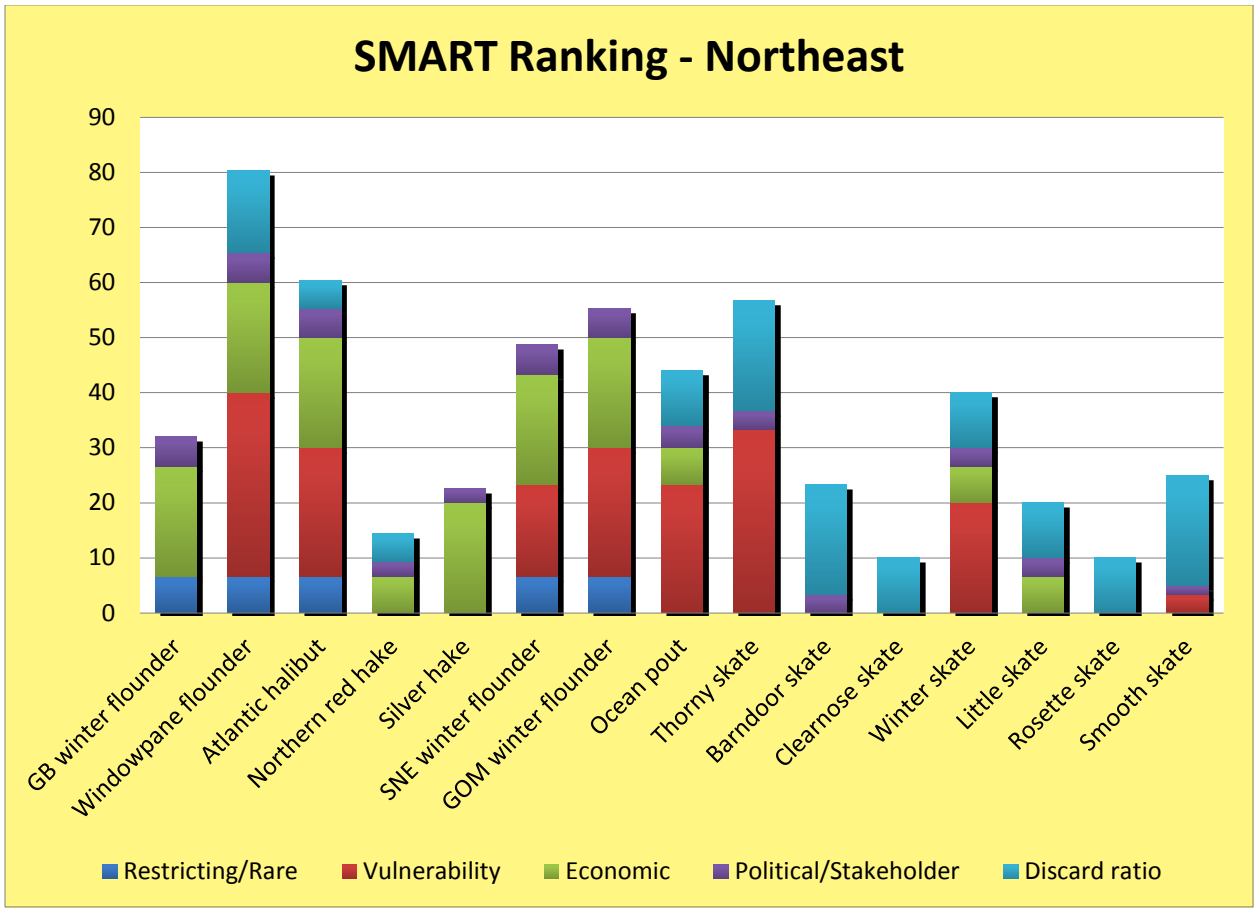
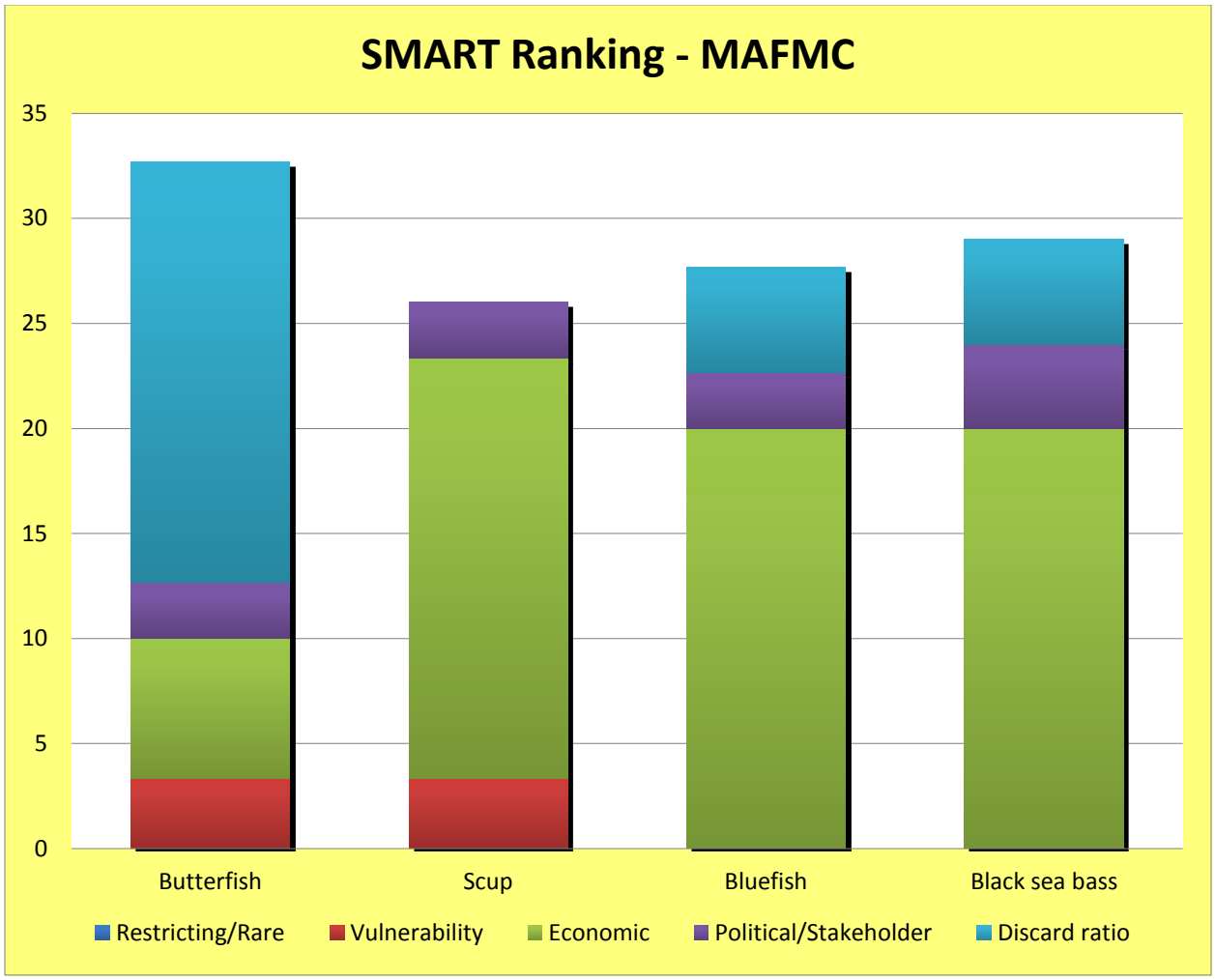


Figure 2. SMART Tool Scores for MAFMC Species



Economic impact scores were major drivers for the MAFMC species scores, with the exception of butterfish, whose score was driven by the discard ratio criterion. None of the species were considered to be restricting or rare, and the species scored low in terms of vulnerability and political sensitivity/stakeholder interest.

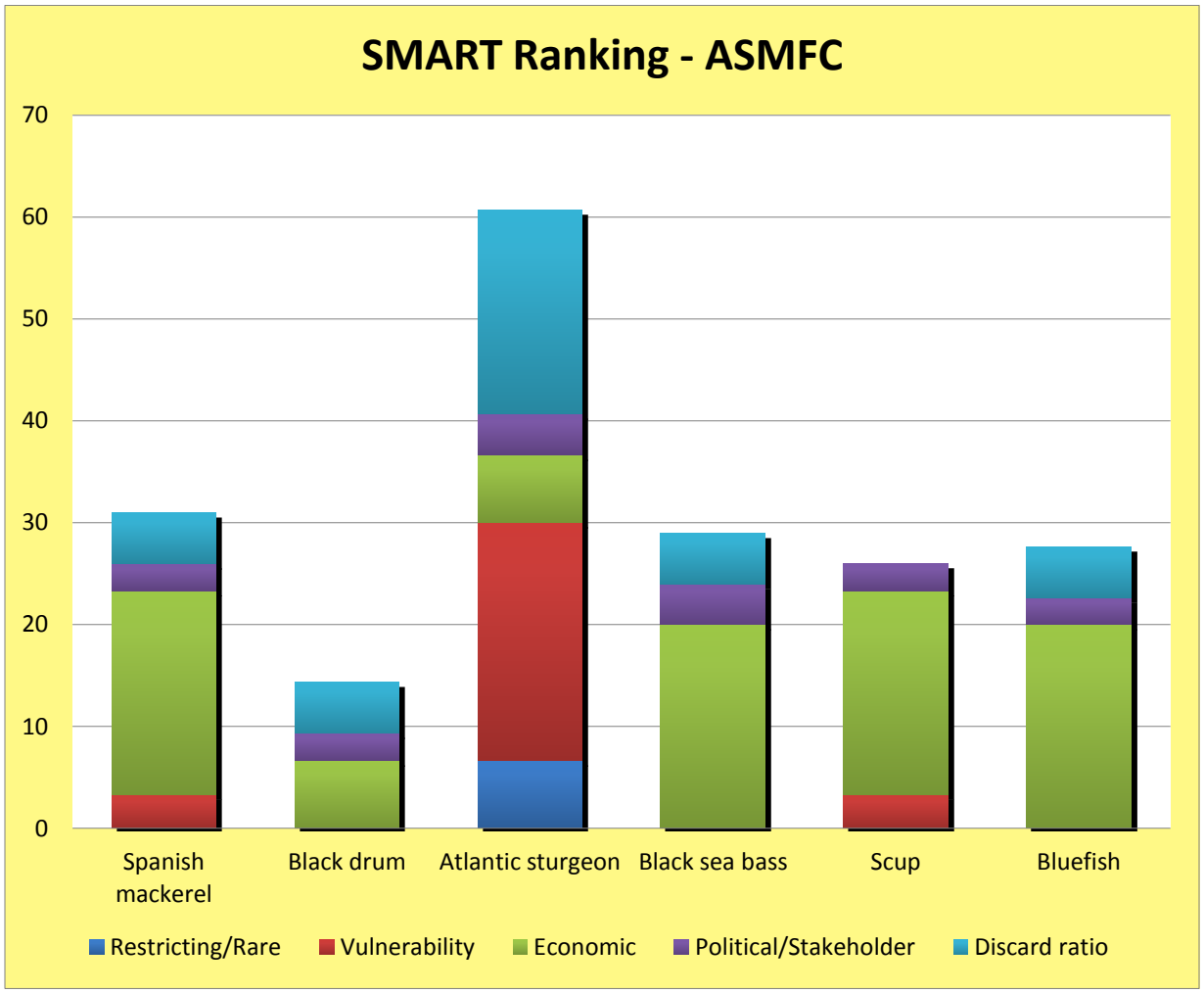
The MAFMC included some comments on the species it suggested for evaluation. For butterfish, the MAFMC commented, "Discards are a large part of catch (sometimes greater than 50%); discard mortality assumed=100%.... Most probably do die either immediately or indirectly, so I wouldn't think this would be a high priority for research on this topic."

Atlantic States Marine Fisheries Commission (ASMFC) Species Results

The experts who evaluated the MAFMC species used the management sensitivity filter to rule out an evaluation of several species. These species (shad, red drum, spotted seatrout, weakfish, summer flounder, tautog, and striped bass) were identified by the ASMFC as species that have been the subject of multiple release mortality studies, and or species whose release mortality rates are not debated in assessment processes.

Figure 3 shows the scores for the six ASMFC-suggested species that were evaluated. Atlantic sturgeon received an overall score that was twice that of the next highest-scoring group of species. This high score was due to the vulnerability and discard ratio criterion scores assigned to Atlantic sturgeon. In addition, according to ASMFC comments, the release mortality rate used for Spanish mackerel, the second highest-scoring species, is based on a couple of studies, although release mortality rates identified in those studies were highly variable (10-35%).

Figure 3. SMART Tool Scores for ASMFC Species

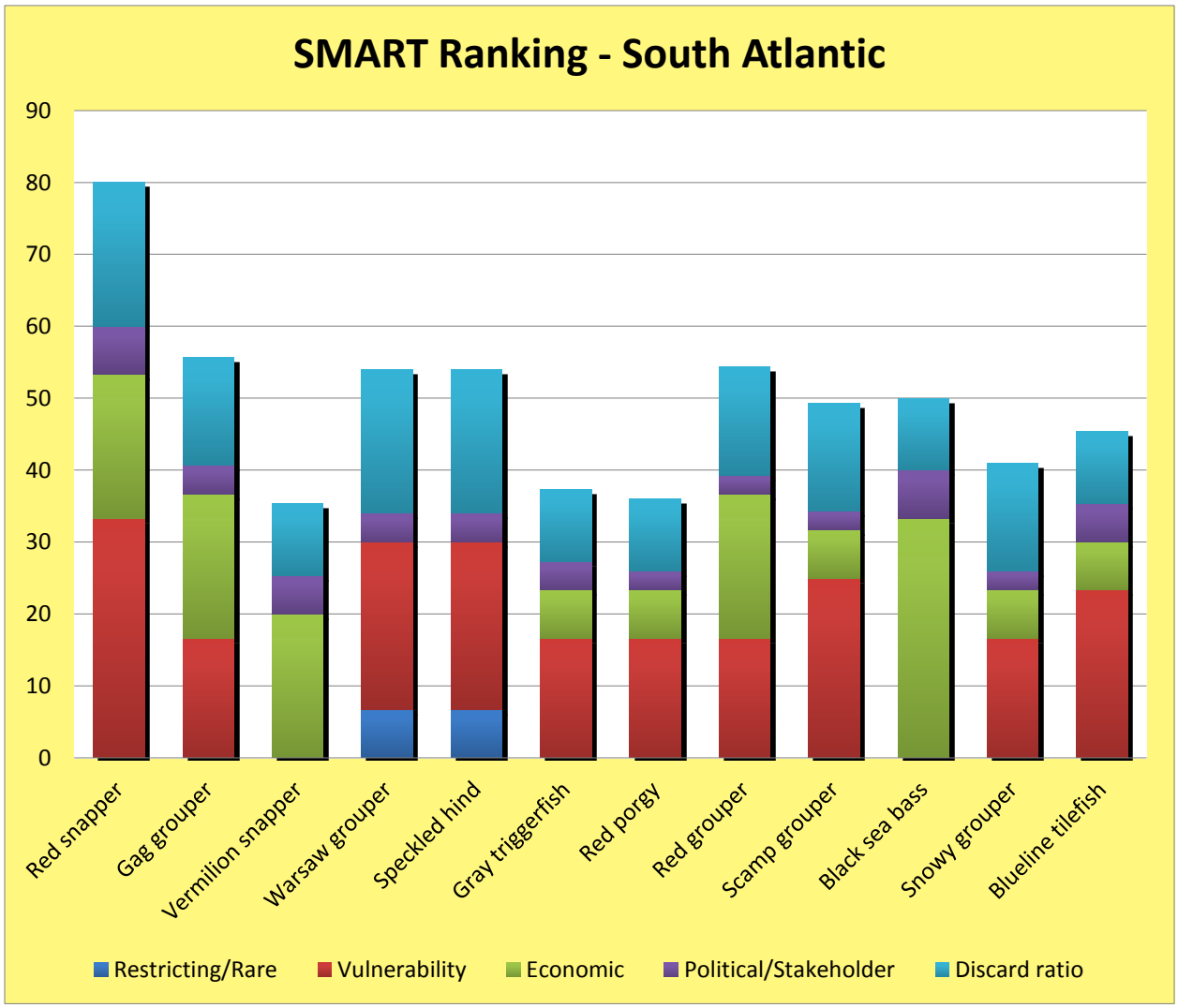


South Atlantic Fishery Management Council (SAFMC) Species Results

Experts evaluated all 12 species that were suggested by the SAFMC. Figure 4 shows the results for these species. Although red snapper received the highest score due to its stock status and high discard quantities, the experts felt that Warsaw grouper and speckled hind should have received the highest scores due in part to the fact that retention of these species is not allowed, as well as stock status. However, these two species received lower scores because no directed fishery for these species has existed for a few decades, which impacted the species points under

the economic criterion. The experts also commented that a release mortality study focusing on Warsaw grouper and speckled hind would be difficult because the species are rarely encountered. This challenge led workshop participants to suggest that the Action Plan should focus on complexes of species that are caught by a certain gear type, e.g., hook-and-line.

Figure 4. SMART Tool Scores for SAFMC Species



Gulf of Mexico Fishery Management Council (GFMC) Species Results

Experts evaluated all 11 species that were suggested by the GFMC. Figure 5 shows the results for these species. The experts were surprised to see that red snapper received the highest scores because that species has been studied so extensively. This surprising result led to some discussion of the possible need for an additional SMART tool criterion that would evaluate the extent to which release mortality has been studied for a species. In addition, the experts commented that if red snapper had been separated into recreational and commercial sectors, then the recreational sector may not have been evaluated due to the management sensitivity filter. Workshop participants felt it would be worthwhile to consider separation of certain species into recreational and commercial sectors for SMART tool evaluation purposes.

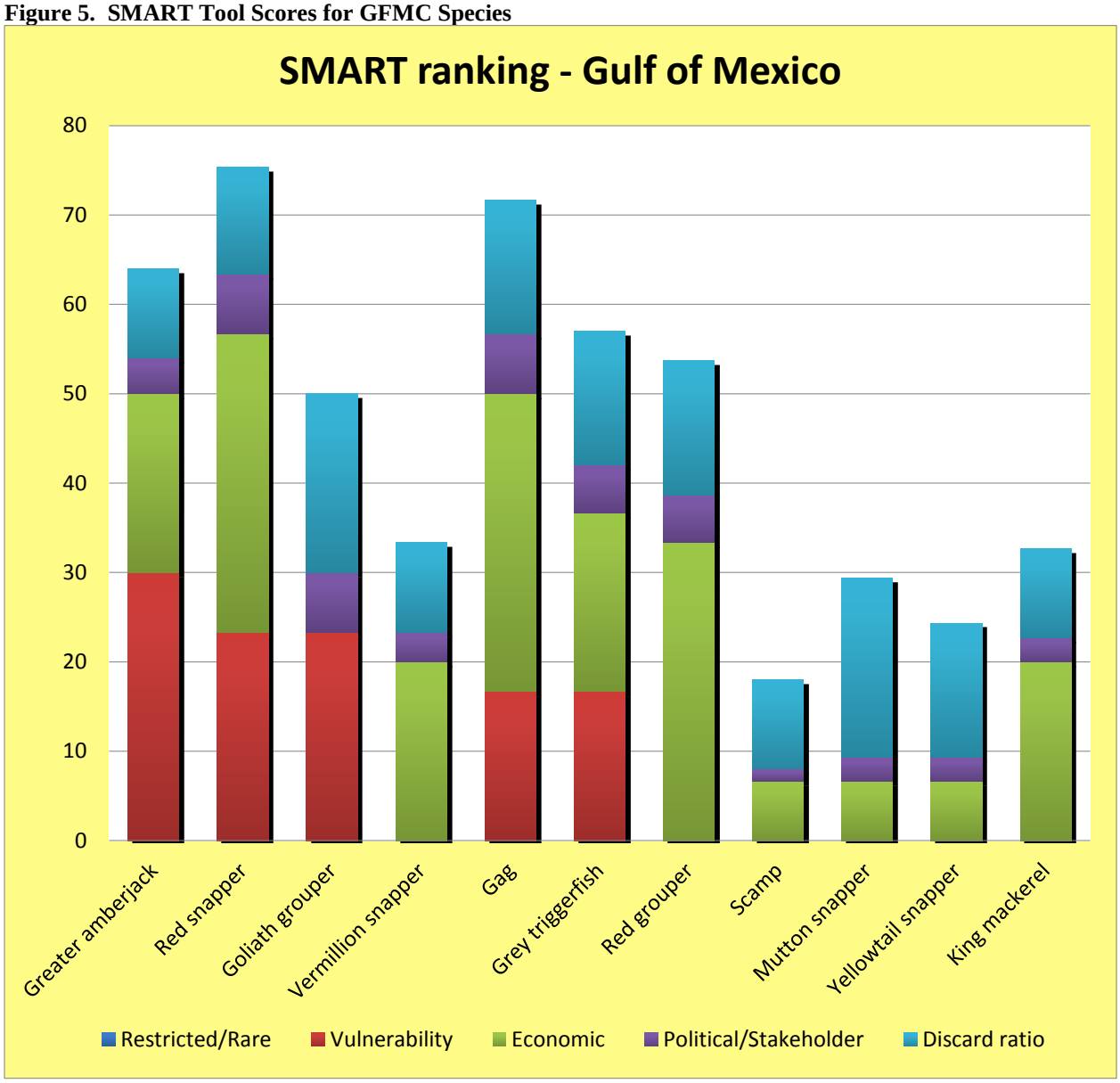
West Coast Species Results

Because the timing of the top-10 species request conflicted with a meeting of the Pacific Fishery Management Council (PFMC), the PFMC was unable to provide a list of species. Instead, experts invited to the workshop, as well as Steering Committee members, identified a list of 15 species to be evaluated with the SMART tool. Figure 6 shows the results for these species.

Workshop attendees commented that some of the West Coast species have important regional differences due to distribution. For example, cowcod, which received a high score, is found mostly off Southern California. Sector differences (i.e., commercial versus recreational) also was cited as important by the workshop attendees. Similar differences might occur for nearshore fisheries as opposed to offshore fisheries for the same species. Workshop attendees also concluded that highly migratory species were underrepresented in the West Coast SMART tool analysis due to a lack of input from experts familiar with those species.

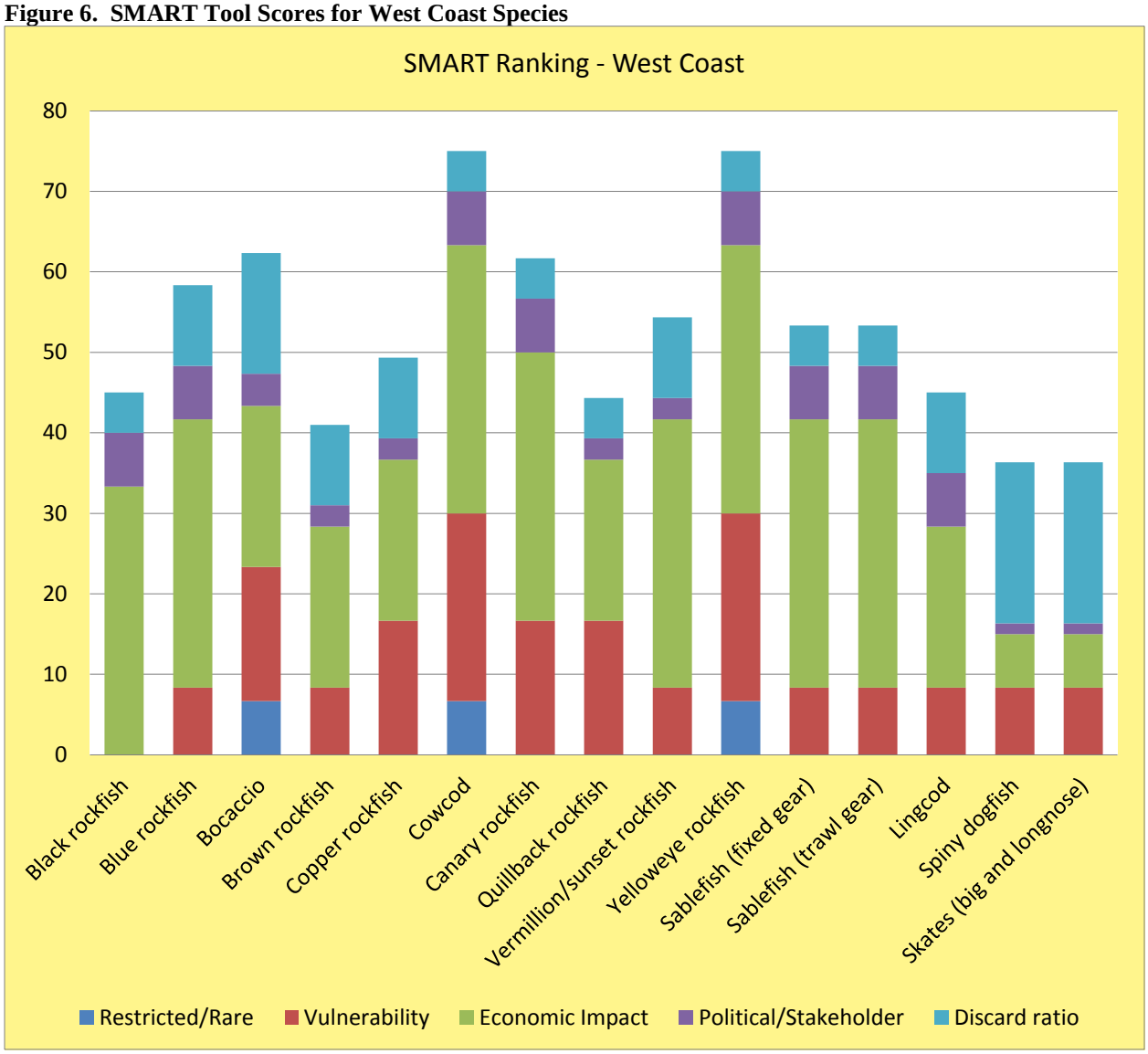
Although all Regional Fishery Management Councils may want to revisit these SMART tool analyses using a more complete set of species and expert opinion, it will be especially important for the PFMC to spend some time with the SMART tool as it was unable to fully engage with the analytical process that occurred prior to the workshop.

Figure 5. SMART Tool Scores for GFMC Species



.

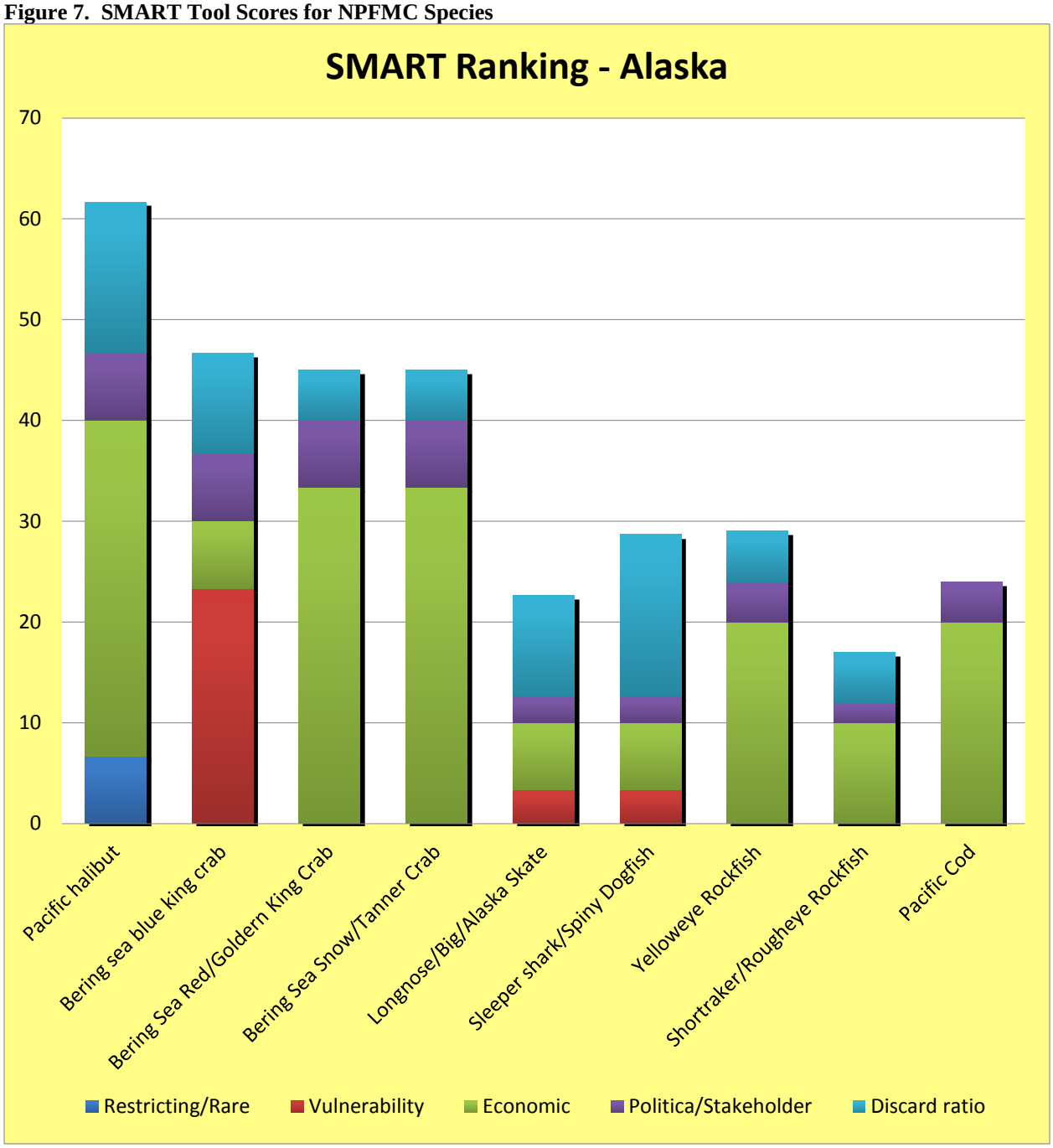
Figure 6. SMART Tool Scores for West Coast Species



North Pacific Fishery Management Council (NPFMC) Species Results

Experts evaluated all 13 species or species groups that were suggested by the NPFMC. However, the experts combined some of the species for evaluation purposes, and they evaluated an additional species, Pacific cod. The experts added Pacific cod because quotas for Pacific cod are limited, which leads to additional discards when limits are close to being met, even though it is a valuable commercial species. Figure 7 shows the results for these species. Pacific halibut scored highest due to its economic value, its discard ratio, and its ability to limit groundfish trawl fisheries. Workshop participants felt that skates could receive a higher score as a restricting species if more were known about their biology and release mortality rates. Workshop participants also felt that rockfish species may have been scored too low in terms of the restricting criterion. In addition, participants felt that it is important to note when species are managed under multiple jurisdictions, for example, Pacific halibut and some highly migratory species.

Figure 7. SMART Tool Scores for NPFMC Species



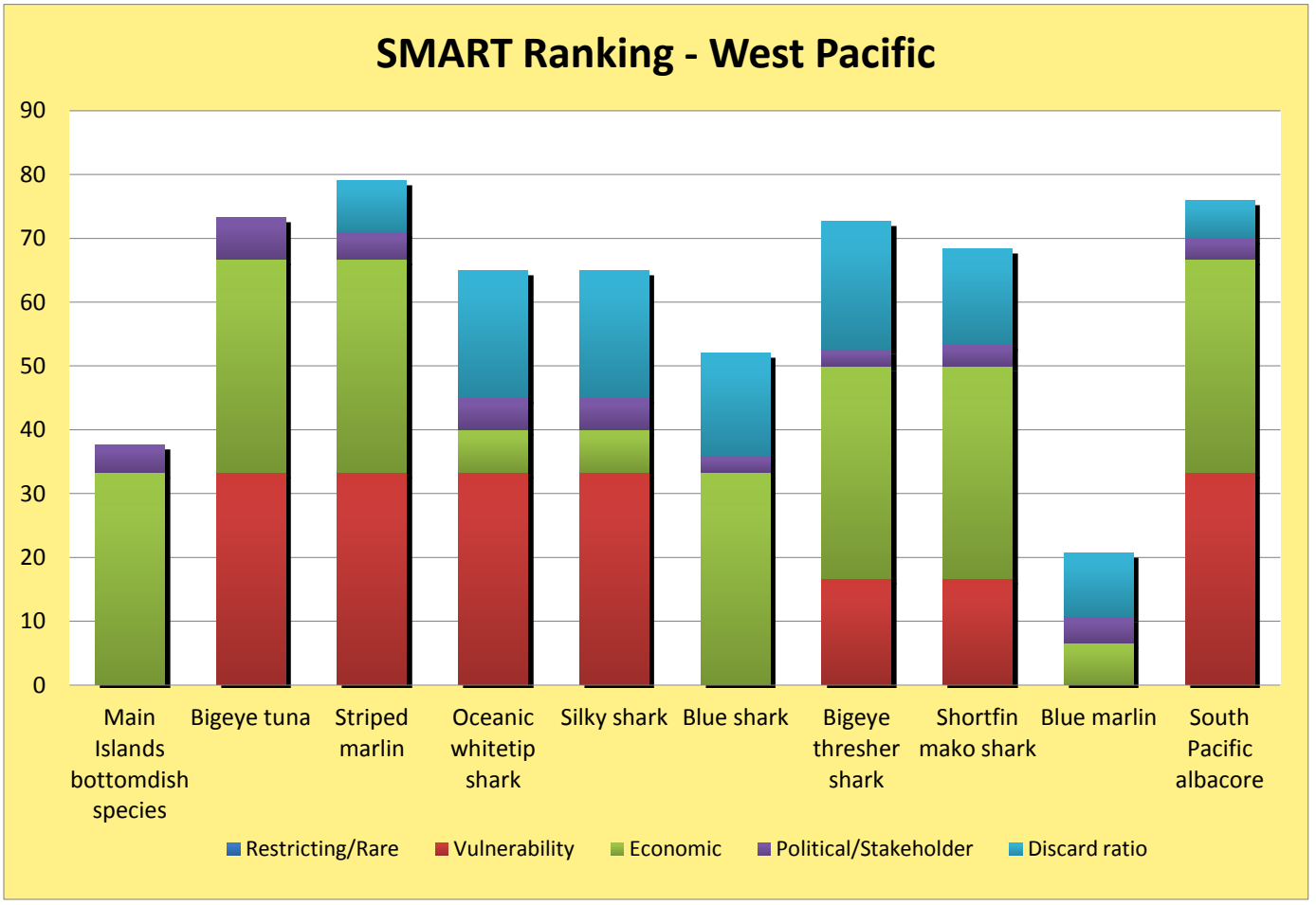
Western Pacific Fishery Management Council (WPFMC) Species Results

Experts evaluated all 10 species or species groups that were suggested by the WPFMC. Figure 8 shows the results for these species. Several species, including some tunas and sharks, received high scores due to the economic and vulnerability criteria receiving high scores. This scoring inspired some discussion at the workshop regarding the need to ensure there is a consistent understanding of the criteria definitions by various parties from different parts of the country who use the SMART tools. When it submitted its list of top species, the WPFMC commented that release mortality rates for small cetaceans such as false killer whales and pilot whales, as

well as other protected species such as sea turtles and albatrosses, are of high interest to the Council.

Workshop attendees expressed some confusion over why particular species were submitted for evaluation, and why some species were not. It appears that the species submitted by the WPFMC were chosen due to a combination of factors including population status, stock assessment results, and conservation and management measures that include a no-retention policy. Subsequent use of the SMART tool by Councils should involve a wider variety of experts and species than were possible for the limited time and participants allowed for the 2015 workshop. In the case of Western Pacific species, additional SMART tool evaluations might include species for which managers have little release mortality information, such as louvar or oilfish.

Figure 8. SMART Tool Scores for WPFMC Species



Atlantic Highly Migratory Species (HMS) Results

Results for Atlantic HMS species are not available because the Steering Committee did not receive the list of species in time to conduct a SMART tool evaluation prior to the workshop. A meeting of experts will be scheduled soon to analyze the 10 species. The HMS list of species includes loggerhead and leatherback turtles. This Action Plan was designed to focus on fish

species, but the Steering Committee may try to analyze the sea turtle species to see whether the SMART tool can work for sea turtles. The other species suggested by the Atlantic HMS Management Division are mostly highly overfished shark species with an identified need for improved discard mortality estimates.

General Thoughts on the SMART Tool

Workshop participants generally found the SMART tool to be useful in figuring out which species should be prioritized for release mortality research. However, participants did have some ideas to improve the tool.

One possible improvement would be to make the vulnerability criterion more nuanced. For example, this criterion could award additional points if a species is making good progress with its rebuilding plan. Without such nuances, a stock that is declining steadily toward an overfished status would score higher than a stock that is overfished but rebuilding nicely. In addition, progress in ending overfishing might make this criterion less-meaningful if most species evaluated are no longer undergoing overfishing.

As was mentioned above, the SMART tool might be improved by introducing a new criterion that provides a score based on how much data on release mortality is available for a species. This score could be based on a simple scheme of low, medium, or high levels of data being available. Another criterion, or perhaps a related criterion, could try to capture the complexity of the fishery related to the fish species. For example, does the fishery involve multiple sectors, multiple jurisdictions, and/or multiple gears?

The discard ratio criterion could be more meaningful if it included information about whether the estimates are derived from observer data as opposed to self-reported data. Workshop participants also felt that the scoring matrix used for the PSA option under the vulnerability criterion should more closely reflect the scoring system used in the actual PSA tool. Species with rich data sets and for which detailed analytic assessments exist could further elaborate the discard mortality criterion by detailing the proportion of fishing mortality composed of discard mortality. This additional metric would help inform managers about the relative importance of discard mortality.

Workshop participants strongly felt that the SMART tool should be refined a bit and then utilized by a wider group of regional stakeholders, including Regional Fishery Management Council Scientific and Statistical Committees, in order to apply a wider range of expertise of expertise to the SMART tool analysis, as well as evaluate additional species and help identify additional data gaps. A wider group of regional stakeholders also could explore ways to adapt the SMART tool, for example, to use it to evaluate individual species, species complexes, sectors, or even gear types, or revise the weighting scheme to more accurate reflect regional concerns.

Appendix 1. Steering Committee and Workshop Attendees

Steering Committee
Lee Benaka, Leah Sharpe—NOAA Fisheries Office of Science and Technology
Brian Linton—NOAA Fisheries Northeast Fisheries Science Center
Matthew Campbell—NOAA Fisheries Southeast Fisheries Science Center
John Hyde—NOAA Fisheries Southwest Fisheries Science Center
E.J. Dick—NOAA Fisheries Southwest Fisheries Science Center
Jason Cope—NOAA Fisheries Northwest Fisheries Science Center
Chris Lunsford—NOAA Fisheries Alaska Fisheries Science Center
Scott Baker—North Carolina Sea Grant
Bruce Leaman—International Pacific Halibut Commission

Workshop Attendees
Bill Hoffman—Massachusetts Department of Marine Fisheries
Michael Musyl—Pelagic Research Group, LLC (Honolulu)
John Mandelman—New England Aquarium
Andrew Loftus—Andrew Loftus Consulting (Annapolis, MD)
Heather Reed—Washington Department of Fish and Wildlife
Theresa Tsou—Washington Department of Fish and Wildlife
Beverly Sauls—Florida Fish and Wildlife Commission
Chip Collier—South Atlantic Fishery Management Council
Greg Stunz—Texas A&M University
Scott Meyer—Alaska Department of Fish and Game
Melanie Hutchinson— Joint Institute for Marine and Atmospheric Research, University of Hawaii
Bruce Leaman—International Pacific Halibut Commission
Craig Rose—FishNext Research (Seattle)
John Gauvin—Alaska Seafood Cooperative (Seattle)

References

Benaka, L. R., L. Sharpe, L. Anderson, K. Brennan, J. E. Budrick, C. Lunsford, E. Meredith, M. S. Mohr, and C. Villafana. 2014. Fisheries Release Mortality: Identifying, Prioritizing, and Resolving Data Gaps. U.S. Dept. of Commer., NOAA. NOAA Technical Memorandum NMFSF/SPO-142.