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Status Determination Criteria Component Team for Revising Territorial BMUS Lists
A subgroup of the Archipelagic Fishery Ecosystem Plan Team

Draft Report

Status Determination Criteria Component Team Members: Felipe Carvalho (PIFSC), Marc Nadon (PIFSC), Rob Ahrens (PIFSC), Domingo Ochavillo (American Samoa DMWR), Marlowe Sabater (PIFSC), Brett Schumacher (PIRO), Thomas Remington (Lynker, Council Contractor) and Matthew Seeley (Council Staff).

Introduction to Status Determination Criteria

Magnuson-Stevens Fishery Conservation and Management Act (MSA) National Standards 1 (50 CFR § 600.310 (e)(2)(i)) defines both “overfishing” and “overfished” as states that jeopardizes the capacity of a fishery to produce the maximum sustainable yield (MSY) on a continuing basis. Status determination criteria (SDC) are the measurable and objective factors used to determine if overfishing has occurred, or if the stock or stock complex is overfished (50 CFR 600.310(e)(2)(i)(A)). Overfishing occurs whenever a stock or stock complex is subjected to a level of fishing mortality or total catch that jeopardizes the capacity of a stock or stock complex to produce MSY on a continuing basis, measured using maximum fishing mortality threshold (MFMT), overfishing limit (OFL), or suitable proxies. “Overfished” is a stock or stock complex state where biomass has declined below MSST (minimum stock size threshold) or suitable proxy. MFMT, OFL, and MSST reference points can be established if stock demographic,productivity, and fishery characteristics are known. This is usually achieved through an analysis of historical data using an assessment model. When these characteristics cannot be determined, assumptions are made and proxy reference points are used in place of MFMT, OFL, and MSST.

Bottomfish fisheries in the territories are currently data limited, making the use of proxies the most suitable approach for establishing SDC. The suitability of these proxies depends on how closely a chosen stock or stock complex’s characteristics are to the underlying stock and fishery characteristics used to derive the proxies.

Current SDC in the American Samoa and Mariana Archipelago Fishery Ecosystem Plans

Overfishing criteria and control rules are specified and applied to individual species within a multi-species stock whenever possible. When this is not possible, they are based on an indicator species for a multi-species stock. It is important to recognize that individual species would be affected differently based on this type of control rule, and it is important that for any given species, fishing mortality does not currently exceed a level that would result in excessive depletion of that species. No indicator species are used for the bottomfish multi-species stock complexes. Instead, the control rules are applied to each stock complex as a whole.

The MSY control rule is used as the MFMT. The MFMT and MSST are specified based on the recommendations of Restrepo et al. (1998) and both are dependent on the natural mortality rate (M). The value of M used to determine the reference point values is not specified in this section. The latest estimate published annually in the stock assessment and fishery evaluation (SAFE) report is used, and the value is occasionally re-estimated using the best available information. The range of M among species within a stock complex is taken into consideration when estimating and choosing the M to be used for the purpose of computing the reference point values.

In addition to the thresholds MFMT and MSST, a warning reference point, B_{FLAG}, is specified at some point above the MSST to provide a trigger for consideration of management action prior to B reaching the threshold. MFMT, MSST, and B_{FLAG} are specified as indicated in Table 1.

Table 1. Overfishing threshold specifications for the BMUS in CNMI.

MFMT	MSST	B_{FLAG}
$F(B) = \frac{F_{MSY} B}{c\, B_{MSY}}$ for $B \le c\, B_{MSY}$ $F(B) = F_{MSY}$ for $B > c\, B_{MSY}$	$c\, B_{MSY}$	B_{MSY}
where $c = \max(1\text{-}M, 0.5)$		

Standardized values of fishing effort (E) and catch-per-unit effort (CPUE) are used as proxies for fishing mortality (F) and biomass (B), respectively, so E_{MSY}, $CPUE_{MSY}$, and $CPUE_{FLAG}$ are used as proxies for F_{MSY}, B_{MSY}, and B_{FLAG}, respectively.

In cases where reliable estimates of $CPUE_{MSY}$ and E_{MSY} are not available, they would be estimated from catch and effort times series, standardized for all identifiable biases. $CPUE_{MSY}$ would be calculated as half of a multi-year average reference CPUE, called $CPUE_{REF}$. The multi-year reference window would be objectively positioned in time to maximize the value of $CPUE_{REF}$. E_{MSY} would be calculated using the same approach or, following Restrepo et al. (1998), by setting E_{MSY} equal to E_{AVE}, where E_{AVE} represents the long-term average effort prior to declines in CPUE. When multiple estimates are available, the more precautionary is used.

Application of the Rate-Based SDC to Data Limited Fisheries

Implementing regulations of the MSA described the features of MSY and the SDC (50 CFR 600.310(e)). The MSY is defined as the largest long-term average catch or yield that can be taken from a stock or stock complex under prevailing ecological, environmental conditions and fishery technological characteristics (e.g., gear selectivity), and the distribution of catch among fleets (50 CFR 600.310(e)(1)(i)(A)).

All Fishery Management Management Plans (FMPs), inclusive of the Western Pacific Regional Fishery Management Council's (Council) Fishery Ecosystem Plans (FEPs) require specification of SDC and overfishing and overfished determinations (50 CFR 600.310(e)(2)(ii)). National Standard 1 guidelines also state that "when data are not available to specify SDCs based on MSY or MSY proxies, alternative types of SDCs that promote sustainability of the stock or stock complex can be used.” Moreover, if alternative types of SDCs are used, the regional council should explain how the approach will promote sustainability of the stock or stock complex on a long term basis. A council should consider a process that allows SDCs to be updated quickly to reflect the best scientific information available. This section describes the proposed alternative type of SDC that could be used for data limited stocks.

The MSY and other components of the SDC all require the determination of an underlying stock-specific production function. This is usually accomplished, at a minimum, within a stock assessment framework using an index of abundance, typically derived from fishery dependent information including CPUE and total catch. For data limited fisheries, the estimates of CPUE and catch have high variability due to the nature of data collection in the fishery. The limited quantity and quality of fishery-dependent information sets into questionthe reliability and representativeness of these data,particularly when determining the status of the stock based on MSY.

National Standard 1 also provides flexibility in the application of annual catch limits (ACL) for data limited stocks (50 CFR 600.310(h)(2)). Data limited stocks are stocks for which data are not available either to set reference points based on MSY or MSY proxies, or manage to the reference points based on MSY or MSY proxies. The Technical Guidance on this provision was developed by NMFS and provides recommendations for the development of alternative status determination criteria (Macpherson et al. 2022). The Technical Guidance provides direction on the application of a rate-based approach, which this report describes in detail.

Rate-Based Status Determination Criteria

The calculation and evaluation of reference points for stock status determination depends upon the types of data that are available, the length of time series, and the history of fishing. Much of the previous technical guidance on implementing the provisions of National Standard 1 (Restrepo et al. 1998) was tailored to age-structured assessments. More recently, methods have been developed for application to a wide range of possible scenarios. Some methods lead to the direct estimation of the reference points and others rely on proxy estimates based on other stocks with similar characteristics. The classical method of estimating MSY reference points when sufficient data are available involves estimating (or assuming) a stock recruit curve. If it is not possible to derive a stock recruit relationship or no information is available to estimate one, proxy reference points should be considered based on spawning potential ratio (SPR) calculations. The use of proxies makes specific assumptions about the relative strength of compensatory mechanisms in a stock. If age or length data does not exist, then MSY may be estimated using a surplus production (i.e., biomass dynamics) model (e.g., JABBA; Winker et al. 2018).

Data (e.g., quality, quantity and coverage) and resource (e.g., time, money and technical capacity) limitations present significant challenges to using certain SDC to interpret stocks status. To address these challenges, there has been a proliferation of data limited methods (DLM) to address the spectrum of data limited situations, with no single approach applicable in all situations. The goal of these DLM is deriving a metric that can be compared to SDC to indicate stock status and/or be associated with catch advice.

In recent years, the most commonly used DLM are those that utilize size composition. Such methods employ a snapshot or time series of biological composition (e.g., relative numbers at length) and life history characteristics to estimate the fishing rate that produced the observed composition. Size composition methods are based on the concept of catch curve analysis. Catch curve analysis measures the total mortality rate, Z, using the age composition of the catch. With life history information, it is possible to calculate the expected proportion of fish at one age surviving to the next age if only natural mortality (M) were occurring. However, the catch curve concept can be applied to size composition data with the use of a growth curve with the use of a growth curve. These types of data limited length-based methods have been established in several assessment software packages (e.g., length-based SPR, Hordyk et al. 2015), including for the Main Hawaiian Islands reef fish stocks (Nadon 2016).

The proposed action to revise the territorial BMUS lists would not impact provisions of the MSA or National Standard guidelines that require SDC be established for all federally-managed stocks and stock complexes. The proposed action would require that SDC be revisited in consideration of the addition of more deep-water species and removal of shallow-water species from the BMUS lists, and the Status Determination Component Team recommends that new SDC be established for territorial BMUS that would allow for stock status determination to be made based on rate-based (i.e., length-based) analytical approaches.

Reference Point for Overfishing Determination

The overfishing SDC (i.e., the MFMT) for composition-based DLM are the same as presented for dynamic age-based assessments. Both are based on the selected %SPR proxy for that stock or collection of stocks in an FMP. The SDC units can be in terms of %SPR itself (e.g., SPR45%) or in terms of the F that would produce that SPR level. It is preferable to keep the SDC in terms of %SPR, which allows the associated F to be updated as life history information is improved as a result of new assessments. The overfishing status determination can then be made with no special modifications associated with it being derived from a DLM.

Reference Point for Overfished Determination

Previously, NMFS did not support the use of SPR-based measurements in the application of SDC to make an “overfished” determination. However, the 2022 version of the National Standard 1 guidelines version of the National Standard 1 guidelines recognizes the need for SDC SDC alternatives when conventional approaches cannot be applied, including the consideration of rate-based alternatives to ACLs. As length composition data directly relate to the degree to which the relative abundance of older fish has been reduced below a reference level, these data would be sufficient to develop an alternative MSST. If the current stock and fishery have been relatively stable for at least a generation time, then the recently obtained measure of SPR has probably been the SPR for several years. So, such an SPR would be both a measure of the recent F that created this stock condition and a measure of the current condition of the stock relative to an unfished stock. The MSST can be translated into units of SPR to enable comparisons to the current measure of SPR. If the stock’s current SPR has fallen below this rate-based MSST, then there is a very high probability that it is overfished. The suitability of the SPR-MSST translation depends upon the characteristics of the stock being assessed relative to the characteristics of the example stocks used in the construction of the SPR-MSST relationship. Ultimately, the suitability of the SPR-MSST relationship would depend on the strength of the compensatory mechanism of the stock in question.

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