

NOAA Pacific Islands Fisheries Science Center

Pacific Islands Fisheries Science Center response to questions concerning Hawaii's bottomfish and seamount groundfish populations

October 24, 2005

This note provides information in response to the reports we received of meetings between representatives from The Ocean Conservancy (TOC) and the Marine Conservation Biology Institute (MCBI) with Congressional staff (TOC and MCBI, 2005) and the NOAA Administrator (TOC, 2005) (separate meetings) concerning the status of Northwestern Hawaiian Islands (NWHI) bottomfish in the context of NOAA's proposed designation of a sanctuary in the NWHI. We do not take a position on that designation process, but we do want to provide additional information on and clarification to the bottomfish stock assessment issues reported from those meetings.¹

The language from the reports of those meetings is indicated by *italics*. We did not receive the TOC/MCBI paper which was the basis for these meetings, but we did receive copies of the presentations and figures (original and corrected). This note also complements the stock assessment information on the Hawaii bottomfish fisheries at the following website: <http://www.wpcouncil.org/bottomfish.htm> and a separate PIFSC summary of these stocks ("Summary of Hawaii Bottomfish and Seamount Groundfish Stocks," September 20, 2005).

As an introduction, we think it would be useful to describe how bottomfish stocks in the Hawaiian Islands are assessed. Following the established guidelines for implementing the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) National Standard 1 (NMFS, 2005a), bottomfish stocks in the Hawaiian Islands are assessed as a single archipelagic (all areas combined) multispecies stock complex (snappers, groupers, and jacks). A maximum sustainable yield (MSY)-based control rule was developed and applied to the Hawaii bottomfish stock complex as a whole (all areas combined) and two stock status thresholds are determined: maximum fishing mortality threshold (MFMT) and minimum stock size threshold (MSST) (Moffitt and Kobayashi, 2000).

¹ No one from PIFSC participated in either meeting.

NOAA Pacific Islands Fisheries Science Center

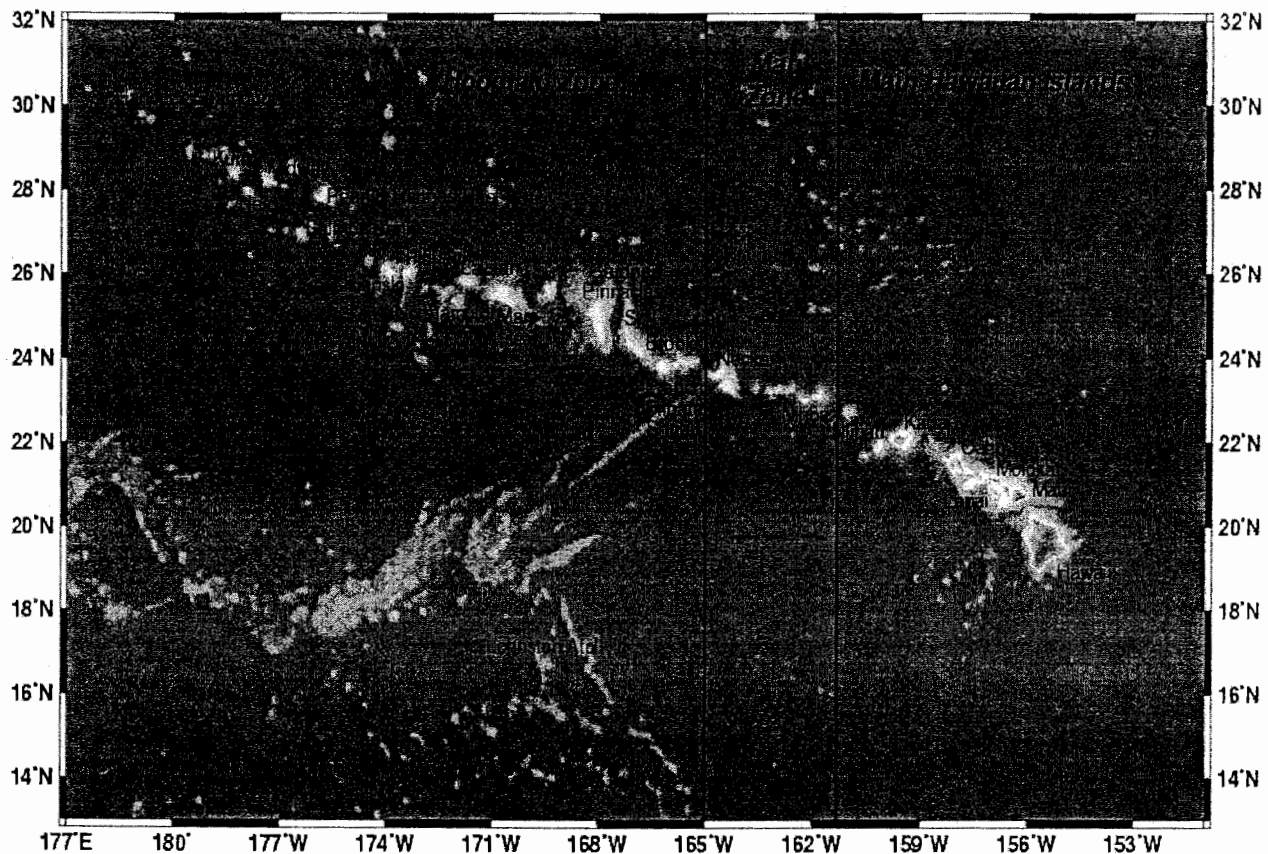
Overfishing would be determined to be occurring if fishing effort applied to the Hawaii bottomfish complex were to exceed the MFMT threshold. The current estimate of MFMT is indeed higher than the established MFMT threshold indicating that overfishing is occurring on the Hawaii bottomfish complex as a whole (archipelagic basis).

The Hawaii bottomfish complex would be considered overfished if the number (or weight) of fish removed by fishing were to exceed the MSST threshold. The current estimate of MSST is lower than the MSST threshold established for the Hawaii bottomfish complex indicating that the Hawaii bottomfish complex is not overfished.

These management measures were adopted by the Western Pacific Fishery Management Council and NMFS in 2003 and applied for the first time in 2004. Prior to 2004, Hawaii bottomfish stock status was evaluated based on a species-specific 20% spawning potential ratio (SPR) threshold (an index of the reproductive capability of the stock).

While the MSFCMA requires the establishment of an MSY-based control rule, application in a multispecies complex setting does not necessarily ensure that the integrity of the complex (the mix of species) will be maintained. To safeguard against changes of species composition within the Hawaii bottomfish complex, species-specific estimates of SPR are also routinely reported as part of the assessment. While Hawaii bottomfish are considered a single stock assessment complex and assessed accordingly, the Hawaiian Archipelago has been divided into three bottomfish fishery management zones: main Hawaiian Islands (MHI) and two zones within the Northwestern Hawaiian Islands: Mau, and Ho'omalau (see map below). To assist managers in decision making, bottomfish stock status criteria (MFMT, MSST, and SPRs) are reported for each zone. These additional measures are intended to minimize the risk of local depletion or that the bottomfish stock complex might become overfished. When necessary, additional conservation and management measures can be allocated to the correct zone based on these management units.

NOAA Pacific Islands Fisheries Science Center



Criticisms from the TOC/MCBI meetings

- 1) *Criticism: Stock assessment for the Mau zone indicates the population has been hovering around the overfished level for years and instead of following MSA regs to establish an MSY or optimal yield, the management target level of fishing is that of overfishing.*

Response: This statement is inaccurate both legally and substantively. First, as stated above, by statute bottomfish stocks in the Hawaiian Islands are assessed as a single archipelagic multispecies stock complex, not as separate stocks in three management zones. Guidelines for implementing the MSFCMA National Standard 1 have been applied to Hawaii bottomfish and additional precautionary measures adopted. The 2004 assessment determined that overfishing on the Hawaii bottomfish complex was occurring on an archipelagic basis as a whole and that fishing mortality was excessive in the MHI. There is no indication of excessive fishing mortality in the Mau zone.

NOAA Pacific Islands Fisheries Science Center

While it is not clear why TOC/MCBI claims that current assessment procedures are not consistent with the MSFCMA National Standard 1, we acknowledge that some preliminary (draft) information provided by the PIFSC to the Western Pacific Fishery Management Council's (WPFMC's) bottomfish plan team earlier in the year. However at its meeting in April 2005 for which the preliminary 2004 Hawaii bottomfish assessment was prepared, this misinformation was addressed and corrected. This information was also given directly to a TOC/MCBI scientist shortly thereafter by one of the PIFSC stock assessment staff. Given the lack of information provided by the TOC/MCBI to support their assertion concerning the status of the Mau zone fishery, it is difficult to be sure precisely what led to their misinterpretations. The assertion (and graphical representation) that stocks in the Mau zone have "been hovering around the overfished level for years" suggests a misunderstanding of the assessment process on their part. An MSY-based control rule was first applied in 2004; therefore it is really inappropriate to apply that rule retrospectively if the point is to suggest that the agency failed to recognize a dangerous condition based on that rule. But more to the point, the Mau zone was not identified by PIFSC as overfished, nor that overfishing was occurring nor that there was excessive fishing mortality in 2004. If the TOC/MCBI is interested in historical trends, an appropriate analysis would be to estimate the current species-specific SPR metric and compare it to historical estimates. This analysis was, in fact, conducted as part of the 2004 assessment (see the 2003 Annual Report) and all SPR estimates were above and remain above the established threshold.

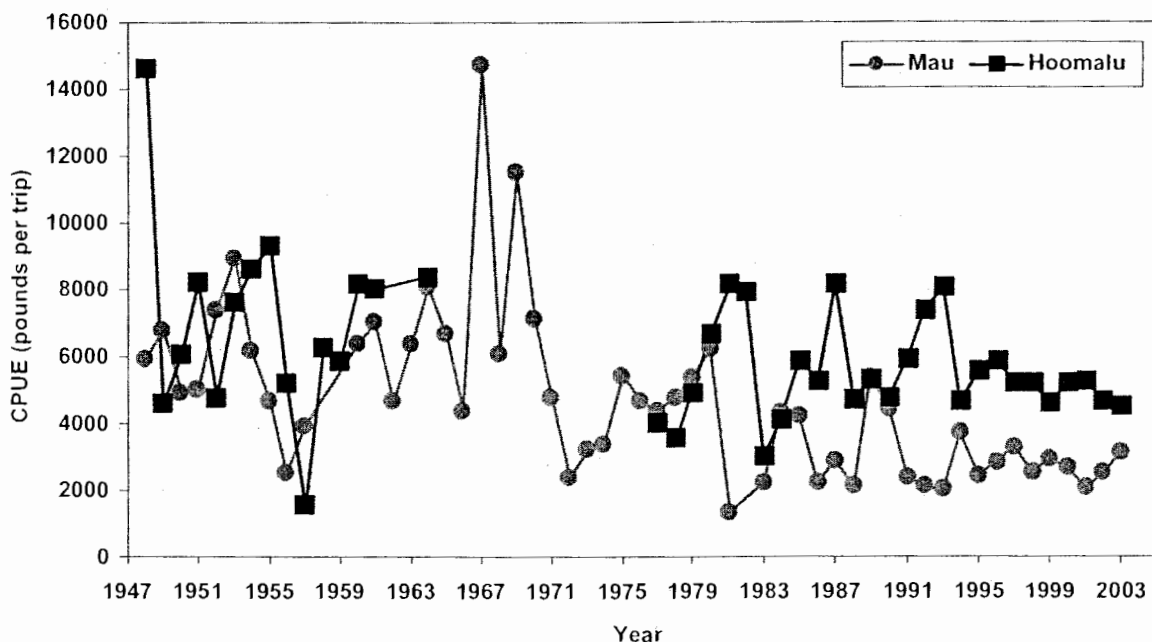
Second, PIFSC scientists noticed that the TOC/MCBI utilized only a selected subset of data which was available to them, ignoring other more comprehensive publically-accessible data such as that available on page 49 (Fig. 14-a) of the most recent available report on the status of these stocks:

<http://www.wpcouncil.org/Bottomfish/Documents/AnnualReports/2003/2003BAR-Appendix3-HI.pdf>

The use of truncated data frequently results in incorrect analyses and interpretations; the TOC/MCBI analysis suffers from this problem. For convenience, the Mau and Ho'omalulu zone catch per unit effort (CPUE) time series are reproduced below. While recent trends in such data are important, it is also important to examine the longer time series such as these, when available, to grasp the larger picture. This is particularly true given the turnover of fishing vessel participation in the Mau zone during this period. These data show a quite stable trend over an almost 50-year period (although we also acknowledge that use of such unstandardized CPUEs does represent some issues in interpretation, which are addressed below). The TOC/MCBI analysis selects only the period since 1988/89, which fails to give the full depiction of historical trends.

NOAA Pacific Islands Fisheries Science Center

NWHI Bottomfish Catch per Unit Effort



In addition, a suite of stock status indicators that were developed and routinely used by PIFSC stock assessment scientists were not used in the TOC/MCBI analysis. Average weight of fish and percent of the primary target species that are immature, two such indicators, have not changed significantly in the 15 years for which data exist. This is not surprising since there are a small number of fishing boats working a small number of fishing days across a tremendous expanse of fishing habitat. Evidence from PIFSC's Coral Reef Ecosystem Division's rapid ecological assessments suggests that the NWHI remains a largely pristine area in the near-shore environment, absent any ecosystem cascades that might be caused by overfishing (except by the recreational fishery for jacks (*ulua*) (Friedlander and DeMartini, 2002)).

We recognize that assessments are difficult when operating in a data poor environment as is the case for Hawaii bottomfish. We also recognize that the estimation of historical baselines and evaluation of their relevance are critical steps in the management process. We acknowledged that uncertainty by implementing additional precautionary measures in the assessment process. Does this mean that localized depletion may not be occurring in some areas? Of course not. In fact, we identify such a problem for the main Hawaiian Islands and we utilize these secondary measures precisely to identify problems (and the source of problems) as early as possible. But this lack of overfished status, nor the lack of evidence of excessive fishing mortality in any fishing area except the main Hawaiian Islands, does not argue for complacency from a fishery

NOAA Pacific Islands Fisheries Science Center

management perspective. Because of the difficulty in handling these assessments we have called on additional expert assistance through a contract with academic researchers to undertake an independent assessment of the Hawaii bottomfish fisheries. We have also implemented an internal process for evaluating the data used in these assessments. It is also important to explore bottomfish biomass indicators both on an archipelagic and a more localized spatial scale to determine whether the kind of oceanic regime shifts which have affected other species in the NWHI, e.g., lobster biomass and monk seal survival, have a short-term, decadal or other temporal time phase effect on bottomfish biomass.

- 2) *Criticism: With everything going on in terms of Sanctuary designation, a biomass assessment has not been done, nor has NMFS collected life history data for bottomfish in the NWHI.*

Response: This is not true. Biomass assessments in the form of dynamic production modeling applied to commercial catch data are routinely updated to provide the best estimates of MSY-based reference points. This material is available in the Bottomfish Annual Report on the WPFMC's website (see WPFMC, 2003). Bottomfish life history data has been collected in the NWHI on a continuing basis for several decades. Baseline life history parameters for commercially important species are therefore well known. There is a whole literature on the subject ranging from early work in the 1980s through the present (see Haight et al., 1993 for an example), and additional life history and genetic information continues to be collected by PIFSC and independent researchers (e.g., the University of Hawaii's Hawaii Institute of Marine Biology).

- 3) *Criticism: TOC asked NMFS and WesPac to pull the NWHI islands out of the Fishery Management Plan for Bottomfish and Seamount Groundfish Fisheries of the Western Pacific as it was being dealt with separately within the Sanctuary designation process.*

Response: This is a management question to which we would defer to the Pacific Islands Regional Office (PIRO) and WPFMC, but we believe the stock assessment information is sufficient to evaluate proposed Sanctuary alternatives against designation criteria.

NOAA Pacific Islands Fisheries Science Center

Additional questions:

1 - Where has all of the coral money gone? Why hasn't better groundfish information been collected?

First a point of clarification might be helpful before fully addressing this question. We refer to the Hawaii fishery targeting snappers, groupers, and jacks (e.g., *opakapaka*, *hapuupuu*, and *ulua*) as "bottomfish" and reserve the term "groundfish" for the seamount fishery on armorhead and alfoncinos (quite different species). The NWHI bottomfish fishery is conducted by small boats using vertical handlines; the seamount groundfish fishery was conducted by large foreign trawlers (vessels that pull large nets across the bottom) on the Emperor seamounts that extend at the far edge of the Hawaiian Islands exclusive economic zone (EEZ) into international waters. The foreign seamount fishery for armorhead within the U.S. EEZ has been closed since 1986 with very little fishing occurring prior to that date following the passage of the MSFCMA in 1976. No domestic fishing ever occurred to our knowledge on these seamounts, although some armorhead and alfoncinos have been occasionally seen in the NWHI.

Second, the coral reef funds support research, mapping, and long-term monitoring programs conducted under NOAA's Coral Reef Conservation Program (CRCP) (a matrix-managed program administered by NOAA's National Ocean Service (NOS)) by the PIFSC Coral Reef Ecosystem Division (CRED). Most of this program's monitoring of fish, corals, other macroinvertebrates, and algae focuses on the shallow coral reef habitats (0-30 m). This has been the focus of NOAA's CRCP nationally and consistent with the delineation of shallow coral reef habitat described above and differentiated from the bottomfish habitat (100 - 250 m), although juvenile bottomfish do inhabit some shallow areas (and are generally not vulnerable to fishing in those locations) and the grey snapper (*uku*) can also be caught in a surface schooling manner at some periods. However, CRED has conducted research in support of bottomfish assessments, including 1) extensive mapping of bottomfish habitats in the NWHI and MHI (the multibeam surveys primarily), 2) towed camera video transects of bottomfish habitats as ground-truthing for multibeam mapping, 3) development of stereo video camera bait stations (BotCam) as a tool for future fishery independent assessments of bottomfish (currently being tested in the Marianas Archipelago), and 4) extensive oceanographic observations throughout the Hawaiian Archipelago (including those related to connectivity which is critical to the delineation of ecosystem zoning). The mapping activities have produced the "Bathymetric atlas of the Northwestern Hawaiian Islands: a document for benthic habitat mapping" in May 2003 and "Bathymetric atlas of the Main Hawaiian Islands: a planning document for Pacific ecosystem assessment and monitoring" in February 2005.

There simply has not been adequate funding over the past five-ten years to conduct stock assessments on all the important species in the western Pacific area. With this in mind, the PIFSC and WPFMC hosted a meeting in 2004 to review bottomfish stock assessment procedures in the central and western Pacific, including Hawaii, and provide recommendations for

NOAA Pacific Islands Fisheries Science Center

advancing bottomfish population modeling and stock assessments (WPFMC, 2004). A suite of sampling and monitoring programs was recommended, forming the basis of proposals submitted to the NMFS Office of Science and Technology. These proposals amounted to approximately \$4 million, of which \$2.5-3 million was designated for insular resources (i.e., bottomfish, crustaceans, etc.) alone. However, these proposals have not yet been funded.

2 - Without good information on bottomfish how do you develop the alternatives within the DEIS?

Response: We believe there is quite good information, as delineated in our separate paper which summarizes the fishery (NMFS, 2005b). Commercial catch and effort data from the bottomfish fishery form the primary basis of our stock assessments. While assessments can be conducted with only these data, additional fishery-independent data would clearly enhance the assessments (but only after a period of ground-truthing which would take several years). When only catch and effort data are available, NMFS stock assessment scientists classify this as a "data poor" situation. Despite the *data poor* situation, indicators of stock status can be estimated to promote and foster effective resource management.

While the situation is considered *data poor*, there are adequate indicators to make science-based decisions. Recall that part of this paucity of the data reflects the small amount of fishing pressure that has been applied to the NWHI over the past three decades (i.e., the small number of fishery-dependent samples we have on which to make such assessments, compared to large-scale commercial fisheries where there may be more fishing effort in one year than in the history of the NWHI bottomfish fishery). While more detailed information on NWHI bottomfish fishing would have been useful in earlier years when NMFS decided to rely on State of Hawaii commercial catch reports for management purposes, i.e., before the State of Hawaii implemented augmented logbooks to include higher resolution data in 1986 (these were developed in conjunction with PIFSC and the WPFMC), that would not have resolved the limitations of the amount of sampling effort represented by the existing fishing fleet. Although experiments with fishery-independent stock assessment methods have been conducted over the years (e.g., the camera bait stations mentioned above and some efforts at acoustics), none has yet proven to be tractable for species which live their adult stages at these depths and in situations as far from scientific operation centers as the NWHI. Nonetheless, PIFSC is using both NOS CRCP and NMFS Stock Assessment Improvement Program funds to continue these experiments.

- ▶ In terms of the draft Environmental Impact Statement (DEIS) and other matters concerning management of the NWHI bottomfish fishery, we defer to PIRO and the WPFMC on this question.

NOAA Pacific Islands Fisheries Science Center

3 - How do you do an FEIS for Western Pacific FMPs without a good stock assessment?

Response: Writers of environmental impact assessments utilize the best information available based in this case on over twenty years of publications documenting research on and monitoring of bottomfish fisheries. The purpose of an EIS is to present the existing information and its limitations as an aid to decision-making. Bottomfish stock assessment procedures in the Pacific Islands region have been independently reviewed and determined to be adequate given the "data poor" situation (WPFMC, 2004). Many of the approaches taken to assess stock status here in Hawaii stem from guidelines crafted for "data poor" situations by NMFS scientists at national Stock Assessment Workshops (NMFS, 1999; Restrepo et al., 1998).

- ▶ As with the previous question, in terms of the Environmental Impact Statements and other matters concerning management of the NWHI bottomfish fishery, we defer to PIRO and the WPFMC on the specifics of those documents.

4 - What is NMFS doing to improve the stock assessment?

Response: Beginning in late 2003 we initiated a multi-pronged effort to enhance our bottomfish stock assessments in conjunction with the WPFMC and subsequently other partners. In January 2004, a Bottomfish Stock Assessment Workshop was held in Honolulu co-sponsored by the WPFMC and PIFSC, bringing together an independent scientific panel of stock assessment experts. The objective of the workshop was to evaluate the existing bottomfish data and stock assessment techniques and make recommendations for future assessments. This panel generated a wide range of recommendations which are currently being implemented. In particular, independent academic stock assessment experts under contract to PIFSC are: 1) evaluating existing bottomfish data collection programs and if necessary providing recommendations to enhance these programs; and 2) advancing population modeling and stock assessment methodologies through the incorporation of spatial structure and ecosystem principles. We expect the review of existing data collection programs and possible recommendations for enhancing the programs to be completed by June 2006. Advancing population models and assessment methodologies is an ongoing task which will commence with the creation of a Pacific Islands Region Insular Ecosystem Working Group in late 2005. This working group is being formed as a result of discussions at the *Ecosystem Science and Management Planning Workshop: Development of Ecosystem-Based Approaches to Marine Resource Management in the Western Pacific Region*, held in April 2005. This workshop provided a forum for discussion on the strengths and weaknesses of existing and potential ecosystem modeling tools.

In the meantime, this year PIFSC scientists have developed algorithms to incorporate improved data into the current stock assessment methodology and will have results in November 2005 to use these new measures in calculating National Standard 1 reference points. This data includes CPUE data at the line-hour level for each NWHI vessel which can be generated from 1997 to the present from new State of Hawaii logbooks.

NOAA Pacific Islands Fisheries Science Center

We have again submitted a proposal to the NMFS Office of Science and Technology as part of the Stock Assessment Improvement Program that would allow us to enhance PIFSC stock assessment capabilities in the Pacific Islands region. As mentioned earlier, this proposal identifies the need for approximately \$2.5-3 million to advance insular (bottomfish, crustaceans, etc.) population modeling and stock assessments. These funds are important to enhancing bottomfish stock assessments, and a major portion would be used to develop independent bottomfish surveys to estimate bottomfish abundance, as well as provide requisite biological samples, through collaborative research initiatives with local fishermen. The PIFSC, PIRO, and WPFMC are also developing a formal stock assessment peer-review process that will also allow for constituent input. This process will not only review the stock assessment methodology and conclusions, but also the data that went into the assessment

TOC/MCBI Figures²

Response: It is difficult to evaluate the statements made by TOC and MCBI without knowing the details behind each analysis. Interpreting charts without access to the underlying numerical data is even more difficult. We are aware they were required to make a major correction in the presentation, but that does not change the gist of their material. Comments on each of the figures follow.

Figure 1 – Fishing Pressure in the Mau Zone: The unit of effort reported is days fished, which is a weak measure of fishing effort since the time spent fishing on a particular day can be quite variable depending on weather, transit time, and general fisher behavior. Additionally, vessels have a variable number of crew and handline reels, making it difficult to compare an hour from a small vessel fishing with one line to a large vessel fishing multiple lines. The use of line-hours (number of lines fished times the number of hours fished) is one way to standardize this mixture of data. Failure to do so results in the dangerous assumption of a blindly rigid relationship between days, hours, and line-hours across the entire fishing fleet for all time. Using days fished can bias estimates of effort, as well as corresponding relative abundance indices (CPUE), when looked over the long term, particularly projecting back to periods prior to the line-hours component of the logbooks. Scientists at the PIFSC have determined this underlying assumption to be incorrect and thus the effort metrics presented are likely upwardly biased which would have incorrectly placed the TOC/MCBI annual estimates into the overfishing zone. Scientists at the PIFSC are in the process of standardizing the effort time series. This source of error was pointed out by PIFSC staff to the TOC scientist involved in their assessment prior to the development of their document.

² The figures under discussion are those in their presentation (The Ocean Conservancy and Marine Conservation Biology Institute, 2005).

NOAA Pacific Islands Fisheries Science Center

Figure 2 – Health of Bottomfish Populations in the Mau Zone: As noted in the introduction: (1) control rule definitions apply to the stock as a whole and not to any one management zone; and (2) the current control rules can only be legitimately applied to years for which data has become available since their approval (approval occurred in July 2004, so the rules were first applied to the completed 2002 data). The area in the TOC/MCBI graph labeled “In Danger of Being Overfished” is not a part of the control rule. In addition, when a fishery is fished at MSY, biomass would be expected to fluctuate above and below the MSY line (the upper line on the TOC/MCBI Figure 2) which is a long-term average.

Catch per day in pounds is used by TOC/MCBI as an index of relative abundance and assumed proportional to stock abundance. There are very few cases in the fisheries literature that would suggest that using commercially-derived CPUE indices is a safe practice as a stand-alone method of stock assessment. In fact, much of the literature warns against the use of commercial CPUE indices even though in data poor situations, they may be the most accessible data. Most common is that these indices are most often hyperstable, that is, catch rate does not decline proportionally with reductions in stock size (Harley et al. 2001). Also common is range contraction of the stock such that the remaining proportions of the stock become concentrated. There are a few exceptions, however, where CPUE indices are hyperdepleted (i.e., catch rates decline faster than the stock size). These typically occur in situations where only a limited fraction of the total population is vulnerable to harvest. Another way that indices could become hyperdepleted is in situations where the highliners have left the industry, and fisheries-dependent data collected from the remaining less efficient fishermen are below the historical average. This latter situation is not very typical in most fisheries but has been occurring in the NWHI where (1) the commercial fishing fleet is very small (< 15 vessels on average), (2) changes in skippers or the loss of even one vessel has had profound effects on the interpretation of catch statistics, and (3) according to anecdotal accounts, the uncertainty caused by the Sanctuary designation process has led to changes in fishing behavior. The temporal pattern of fishery participation (number of vessels ≤ 5) in the Mau Zone is similar to the biomass index suggesting that these indices are hyperdepleted (downwardly biased). Adjusting for this bias, via effort standardization, would likely move the biomass trajectory upward and further into the “Not Overfished” category.

Figure 3 – Status of Bottomfish Populations in the Ho’omalū Zone: The extrapolation of a linear regression on the nonlinear time series of abundance is inappropriate without constraining the analysis by examination of inter-annual and decadal scale processes which may be affecting bottomfish biomass. As a result, the TOC/MCBI regression results are generally misleading. Changes in abundance of a natural population proceed by complex non-linear processes, not simple linear changes as the linear regression is asserting. Furthermore, populations are subject to unpredictable vagaries of oceanography and climate. Therefore the predicted depletion by 2010 is without foundation, particularly in the absence of any evidence of excessive fishing mortality.

NOAA Pacific Islands Fisheries Science Center

Figure 4 – Population Status in the Ho'omalū Zone: It is assumed by TOC/MCBI that species-specific indices of biomass are a measure of abundance, and that biomass, at least for some species, has been declining. How much of a decline was determined by TOC/MCBI assuming the 1992/1993 estimates reflect an appropriate level that the system *must* maintain. The utility of the biomass time series has already been addressed in comments associated with Figure 2. It is important to keep in mind that individual boats can be markedly different from each other in their fishing power. This may be due not only to variation in ability between skippers and fishing practices, but can also be the results of individual preference in which fish to target (targeting is influenced by market factors, interannual abundances of specific species, preferences of individual fishers, and other variables). However, the important point is that with so few boats, the overall fishing power of the fleet can vary markedly as individual boats join or leave the fleet, which greatly influences the biomass time series. The choice of 1992/1993 as a population *benchmark* has no particular foundation in terms of the history the fishery or dynamics of the bottomfish stocks. One could just as easily have chosen an earlier period, 1988-1990, as a benchmark resulting in increasing biomass trajectories.

Figure 5 – Integrity of Bottomfish Populations in the Mau Zone: This figure incorrectly applies the current control rule to past data from the Mau zone only. This is inconsistent with current management of the stock as a single archipelagic-wide stock and inappropriately applies current control rules to the past. The current control rule was adopted in mid-2004 and first applied to 2003 data. The 2003 value is below the MFMT (fishing pressure = 200 days fished per year) and to the right of the MSST biomass index (biomass index = 330) indicating that excessive fishing mortality is not occurring and that the stocks are not locally depleted. The arrow pointing to the lower right corner suggests that “integrity” equates to virgin populations with no fishing mortality. While one *could* define ecosystem integrity as such, we believe this is not useful. Ecosystems can still maintain their ecological integrity (which might be viewed as their integrated viability) while being fished.

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NOAA Pacific Islands Fisheries Science Center

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NOAA Pacific Islands Fisheries Science Center

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