WESTERN PACIFIC REGIONAL FISHERY MANAGEMENT COUNCIL

Social, Economic, Ecological, and Management (SEEM) Working Group Meeting for Coral Reef Fisheries in Hawaii, Samoa, and Marianas Archipelagos

February 26-28, 2014
1:00 pm – 5:00 pm
Council Conference Room

DRAFT REPORT

Report Highlights

- Chair welcomed members and asked for introductions.
- Council staff provided background and described Working Group purpose.
- The Working Group discussed fishery attributes that facilitate the use of ACLs in policy and management and the need to consider SEEM factors when setting these catch limits.
- In all island areas (three archipelagos; four political jurisdictions), the current level of observed catch of each coral reef stock is generally far below the stock's assumed biomass (note: this is not the case for the MHI bottomfish fishery, which is managed under a separate management plan.)
- The Working Group decided to use SEEM factors for the NMI that were recently developed by researchers at the NMFS Pacific Islands Fisheries Science Center as a starting point to consider factors important to the other three jurisdictions.
- The Working Group decided to comprehensively describe and score all SEEM factors, but to use only the ecological and management uncertainly factor scores to reduce from ABC, since the Council cannot use the results of a SEEM analysis to increase an ACL.
- Outcome: Based on ecological and management uncertainty considerations, the SEEM Working Group determined that reductions from coral reef MUS ABC in American Samoa, Hawaii, and the Marianas archipelagos of 5%, 5%, and 3% respectively may be warranted.

Full Report

The Council's Coral Reef Fisheries SEEM Working Group met from February 26th – 28th, 2014 at the Council office in Honolulu to examine social, economic, ecological, and management uncertainty factors inherent in coral reef fisheries in American Samoa, Guam, Hawaii, and the Northern Mariana Islands.

Council Vice-Chair, Edwin Ebisui welcomed the Working Group members and opened the meeting with introductions.

Following introductions, Council staff provided a summary of the history of ACL management and the basis for conducting a SEEM analysis on the Region's coral reef fisheries. The Council now uses a catch-MSY model, augmented by Marlowe Sabater and Pierre Klieber to account for biomass, to specify ACLs for the Region's coral reef MUS and as such most of those fisheries are now considered Tier 3 stocks. Because of this change, the Council requested staff to convene a SEEM Working Group to examine SEEM factors for coral reef fisheries in the three island areas.
Staff also provided the Working Group with an overview of the Main Hawaiian Islands bottom fish fishery SEEM analysis, including process and scoring determinations, that was conducted in 2011. Staff recommended that the Working Group consider a similar process for the current analysis, since it has been accepted by the Council and NMFS, but that improvements to the process could be discussed and considered for future SEEM exercises.

The Group discussed the difference between setting ACLs for coral reef fisheries and the MHI bottomfish fishery. In the latter fishery, the ACL is more meaningful, since there is near-real time catch reporting, which enables in-season tracking of catch towards the ACL and ability to close the fishery if the ACL is going to be reached. After considering these differences, the Working Group affirmed the usefulness of conducting a thorough SEEM analysis on regional coral reef fisheries, to guide future SEEM-related research, to highlight the importance of WPacFIN, and to further the ecosystem fishery management approach the Council has undertaken.

Following this discussion, Drs. Cynthia Grace-McCaskey and Leila Sievanen (JIMAR-PIFSC) presented their recent research in the Northern Mariana Islands to determine how fishermen perceived the social and economic importance of reef fisheries, local knowledge of coral reef ecosystems and associated species, and perceptions about various management strategies. The team interviewed 38 fishermen and vendors and worked with Council staff to determine the scope of the research and appropriate questions. A purpose of the research was to provide data into the SEEM analysis for CNMI reef fisheries. Council staff discussed the extent to which this CNMI-specific information applied to regional coral reef fisheries.

Before proceeding to the four SEEM dimensions, the Working Group discussed several topics: fishermen discussing and practicing conservation; income from fishing should include money saved from food fishermen don't have to buy; conflict between ethnic groups; overfishing terminology and perceptions; and village net exceptions in the NMI.

After the presentation, the Group discussed the best way to proceed. It was decided to follow the existing approach and comprehensively describe and score all relevant SEEM factors. Each item will be scored between -2 and +2. This scale was developed by the MHI bottomfish SEEM Working Group. The main benefit of this approach is that it can be used by each member to highlight how important he believes each social and economic factor is and how serious a concern he believes each management uncertainty factor to be. It is also sensitive to the uniqueness of the ecological dimension, where scoring factors tends to be less one-sided (positive or negative) than in the other three dimensions. Finally, since each ecological and management uncertainty factor can only be given a maximum of -2, there is less potential for one or two items to result in large reductions.

Like the MHI bottom fish SEEM group, the current working group decided that a net positive score across the S and E factors will equal no reduction. The reduction would thus come from the scores of the items in the ecological and management uncertainty factors. The Group also decided to use the NMI study factors as starting factors when discussing the other three jurisdictions. Finally, the Working Group decided to score all SEEM factors for all jurisdictions at the end.

Before proceeding to the four SEEM dimensions, the Group discussed several topics: fishermen discussing and practicing conservation; income from fishing should include money saved from food fishermen don't have to buy; conflict between ethnic groups; overfishing terminology and perceptions; and village net exceptions in the NMI.

Mariana Archipelago

Social Dimension Factors

The Group discussed the importance of understanding the cultural importance around sharing catch and post harvest distribution (fish flow) as well as the various effort triggers, since some of this information was not captured in the PIFSC study interviews. From the social attributes found in the PIFSC study, the Working Group decided to lump "food security" with "diet" and unpack "social identity" and "pride."

The final list of social factors the Working Group selected was:

Allows traditional practices and values to continue
Is an important part of Marianas food security and healthier diet
Reef fishing as part of social identity status
Provides fish important for culturally important events e.g. fiestas, funerals, parties
Is a highly skilled and well-respected practice and occupation
Sense of pride and accomplishment in producing food and cultural benefit to others

Economic Dimension Factors

Most discussion of economic factors centered on the notion that money associated with coral reef fishing in the NMI stayed local, as some interviewees claimed. It was pointed out that while some revenue might stay in the Commonwealth, some of it is remitted and that much of the gear and equipment is purchased off island. The second issue that was discussed was the relative importance of subsistence fishing in reducing an individual's or household's grocery bills.

The final list of economic factors the Working Group selected was:

Supports the local economy
Supplements income of those with part-time jobs or low wages
Is an important source of income and jobs (i.e. primary and secondary)
Acts as an economic "safety net"
Supports extractive tourism/service industries
Supports non extractive value (aesthetic and existence value)
House hold expenses are reduced by subsistence fishing

Ecological Factor Items

Coral reefs provide buffer from large scale perturbation
Uncertainty of ecosystem dynamics (trophic interactions; life history; impacts of climate changes)
Non-fishing factors that affects fish stocks and habitat (pollution, run-off, development)
De-facto MPAs provide additional protection for reef stocks

Management Uncertainty Dimension Factors

Level of education, outreach and enforcement
Management effectiveness (local-federal linkages; real-time accountability measure)
Availability of reliable fishery information (catch, effort, life history, real-time monitoring, late reporting, mis-reporting, under reporting)
Data collection improvement efforts (mandatory reporting in CNMI)
Other management systems may provide additional protection of reef stocks (monuments, sanctuaries, military closed areas)

<u>American Samoa</u>

Social Dimension Factors

The Working Group discussed some of the important cultural differences around fish and fishing in AS. Notably, that there are prescribed ways in which fish are distributed throughout the chief system. The Group also discussed the importance of communal fishing activities, such as for palolo and atulai, and the fact that there tends to be more village control of local fisheries resources than in other areas.

The final list of social factors the Working Group selected was:

Allows traditional practices and values to continue
Is an important part of Am. Samoa food security and healthier diet
Reef fishing as part of social identity status
Provides fish important for culturally important events (e.g. Fa'lavalave, to‘ona‘i funerals, weddings, Chiefly investitures)
Is a highly skilled and well-respected practice and occupation Tautai?
Sense of pride and accomplishment in producing food and cultural benefit to others

Economic Dimension Factors

Members generally agreed that reef fish are not currently an important part of the local economy, but recognized that new fish markets are opening soon and that reef fishing is always there in the event of an economic downturn. In fact, it is not clear what will happen as federal money following the tsunami is phased out.

The final list of economic factors the Working Group selected was:

Supports the local economy
Supplements income of those with part-time jobs or low wages
Is an important source of income and jobs (i.e. primary and secondary)
Acts as an economic “safety net”
Supports extractive tourism/service industries
Supports non extractive value (aesthetic and existence value)
House hold expenses are reduced by subsistence fishing

Ecological Dimension Factors

American Samoa has some unique attributes relevant to ecological factors for ACL consideration. The islands are fairly small and high and receive a lot of annual rainfall, often in intense bouts. When this happens, people tend to stay out of the nearshore water because of pollution and reduced visibility. Members also discussed the ecological implications of management areas, such as community based fishery management sites.

The final list of ecological factors the Working Group selected was:

Coral reefs provide buffer from large scale perturbation
Uncertainty of ecosystem dynamics (trophic interactions; life history; impacts of climatological changes)
Non-fishing factors that affects fish stocks and habitat (pollution, run-off, development); frequency of high rain events and unfavorable weather and climatological conditions keeps people out of the water
Dominance of Community Based FMAs in most villages
Large biomass potential due to under-utilized stocks (due to changes in the social and economic status)

Management Uncertainty Dimension Factors

The Working Group discussed the data uncertainty problem in American Samoa. Improvements have been made, but there continue to no real time tracking of catch and no mechanism or process to close the coral reef fishery should the ACL be reached. There also is limited local capacity to conduct regular government enforcement of fishery regulations.

The final list of management uncertainty factors the Working Group selected was:

Management effectiveness (local-federal coordinated management regime; real-time accountability measure)
Availability of reliable fishery information (catch, effort, life history, real-time monitoring, late reporting, mis-reporting, under reporting)
Timeliness of QA/QC input and output in catch and effort data which would affect the ability to conduct near-real-time monitoring of catch
Data collection improvement efforts (mandatory reporting in Am Samoa; improvement through efforts)
Other management systems may provide additional protection of reef stocks (monuments sanctuaries, CFMP closed areas)

Hawaii

Social Dimension Factors

The cultural context of the reef fishery in Hawaii is more fragmented than in the other archipelagos, owing mostly to demography. However, there are still parts of the islands where coral reef fishing retains its cultural connotations and subsistence importance. Reef fish are also connected to the wider social fabric through events and ceremonies such as luaus, parties and weddings.

The final list of social factors the Working Group selected was:

Allows a variety of cultural, ethnic and Hawaiian traditional practices and values to continue
Is an important part of Hawaii food security and healthier diet
Reef fishing as part of social identity and status (clubs built around these fisheries)
Provides fish important for culturally important events e.g. first birthday luau, weddings, graduations, holidays etc.
Is a highly skilled and well-respected practice and occupation
Sense of pride and accomplishment in producing food and cultural benefit to others
Practice of customary exchange and fish flow to the community is still tied to the contemporary social fabric

Economic Dimension Factors

Members agreed that direct revenue from reef fish sales is not large. However, the sales of fishing gear and other fishing related provisions is likely an economic benefit to each of the islands. In addition, the important tourism component of the economy in some ways depends upon the availability of reef fish (divers, etc.).

The final list of economic factors the Working Group selected was:

Supports the local economy (including the fishing supply chain, fish markets and support network related to fishing)
Supplements income of those with part-time jobs or low wages
Is a source of income and jobs (i.e. primary and secondary)
Acts as an economic “safety net”
Supports extractive tourism/service industries
Supports non extractive value (aesthetic and existence value)
Money stays in the local economy (local manufacturing of fishing gear and supplies)
House hold expenses are reduced by subsistence fishing

Ecological Dimension Factors

The comparatively large size of the Hawaiian Islands makes for additional ecological factors to consider. For example, unlike the other two archipelagos, the Working Group felt that invasive marine species are important to consider. Also, the scale of development and issues like injection wells were discussed.

The final list of ecological factors the Working Group selected was:

Coral reefs provide buffer from large scale perturbation
Uncertainty of ecosystem dynamics (trophic interactions; life history; impacts of climate changes)
Potential effects of fishing interaction with protected species (prey competition)
Non-fishing factors that affects fish stocks and habitat (pollution, run-off, development, injection wells, ecological alteration, physical habitat degradation)
Effects of invasive species on ecological functions and stability
Ecological effects of ciguatera "scare"
De-facto MPAs and MLCDs provide additional protection for reef stocks

Management Uncertainty Dimension Factors

Hawaii management uncertainty items largely mirror the other two areas. The state does benefit from more staff and financial resources, but the islands are larger, which stretch those resources thin. As a result, enforcement is challenging. Also though the State is in the process of improving data collection, reef fish catch and effort statistics can be unreliable, especially for non-commercial participants.

The final list of management uncertainty factors the Working Group selected was:

Level of education, outreach and enforcement
Management effectiveness (local-federal linkages; real-time accountability measure)
Availability of reliable fishery information (commercial catch, effort, life history, real-time monitoring, late reporting, mis-reporting, under reporting)
Data collection improvement efforts (improvements in online reporting); revision of HMRFS
Availability of reliable fishery information (non-commercial catch and effort information is unknown, life history, real-time monitoring, late reporting, mis-reporting, under reporting)
Other management systems may provide additional protection of reef stocks (monuments, State MPAs, military closed areas, community based management areas)

Scoring and Final Scores

The Working Group discussed scoring and factor wording prior to voting, to ensure that all members were approaching the exercise the same way. Members generally agreed that the lack of socially-derived data specific to SEEM scoring for each archipelago was not ideal and discussed the need to conduct research into SEEM factors and the importance of each of those items to members of the fishery. However, most members felt fairly comfortable in making a determination, given that estimated catch is well below the estimated available biomass.

Appendix A contains the scores for each item in each SEEM factor for each archipelago. The table below contains the averaged scores for each factor for each archipelago and the corresponding percentage reduction from ABC recommended by the SEEM Working Group[1].

Archipelago	Social	Economic	Ecological	Management	% Reduction from ABC
American Samoa	7	6	2	-5	-5
Hawaii	9	8	-1.4	-3.2	-5
Marianas	9	8	0	-3	-3

Following the factor scoring, the Working Group discussed the issue that despite the fact that there is less management uncertainty surrounding MHI bottomfish management than the Region's coral reef fisheries, the management uncertainty scores in this SEEM analysis were less than those produced by the MHI bottomfish fishery SEEM Working Group in 2011. The Group came to three conclusions: 1) Membership of the two SEEM working groups differed, and this will produce different results, 2) the biomass-to-fishing effort ratio is much different for coral reef fisheries than for the MHI bottomfish fishery and it is likely that members were taking this into account when scoring, and 3) this working group worded some factors, especially ones in the ecological and management uncertainty dimensions, more neutrally.

[1] Again, positive scores in the social and economic dimensions are zeroed out because the Council cannot increase an ACL based on SEEM analysis.

Appendix A. SEEM scores

AMERICAN SAMOA	Mem#1	Mem#2	Mem#3	Mem#4	Mem#5	Mem#6	Mem#7	Mem#8	Mem#9
Social n=6	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**
Allows traditional practices and values to continue	2	1	2	2	2	1	2	1	2
Is an important part of Am. Samoa food security and fishery development	1	1	0	1	1	1	1	0	2
Reef fishing as part of social identity status e.g. tautai	1	1	1	1	1	1	2	0	2
Provides fish important for culturally important events e.g. fa'a lave lave, funerals, weddings etc.	2	2	2	2	2	2	2	0	2
Is a highly skilled and well-respected practice and occupation	1	1	1	1	2	0	2	0	0
Sense of pride and accomplishment in producing food and cultural benefit to others	1	1	1	2	2	0	1	0	1
SUM	8	7	7	9	10	5	10	1	9

	Mem#1	Mem#2	Mem#3	Mem#4	Mem#5	Mem#6	Mem#7	Mem#8	Mem#9
Economic n=7	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**
Supports the local economy through fishery development	1	1	0	0	0	0	1	0	2
Supplements income of those with part-time jobs or low wages	0	2	0	1	0	1	2	0	2
Is an potential source of income and jobs (i.e. primary and secondary)	1	1	1	0	1	0	1	0	2
Acts as a potential economic "safety net"	0	2	1	2	1	1	1	1	2
Supports extractive tourism/service industries	0	1	1	0	0	0	1	0	0
Supports non extractive value (aesthetic and existence value)	0	0	1	1	0	2	1	0	0

House hold expenses are potentially reduced by subsistence fishing	1	1	1	2	1	2	2	0	2
SUM	3	8	5	6	3	6	9	1	10

	Mem#1	Mem#2	Mem#3	Mem#4	Mem#5	Mem#6	Mem#7	Mem#8	Mem#9
Ecological n=5	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**
Coral reefs provide buffer from large scale perturbation	-1	0	1	0	2	-1	1	2	-1
Uncertainty of ecosystem dynamics (trophic interactions; life history; impacts of climatological changes)	-1	-1	-1	-1	-2	0	-1	-2	-1
Non-fishing factors that affects fish stocks and habitat (pollution, run-off, development); frequency of high rain events and unfavorable weather and climatological conditions keeps people out of the water	0	1	-1	-1	-1	0	0	-2	0
Dominance of Community Based FMAs in most villages	0	1	1	2	2	2	2	2	0
Large biomass potential due to under-utilized stocks (due to changes in the social and economic status)	1	1	2	1	2	2	2	2	0
SUM	-1	2	2	1	3	3	4	2	-2

	Mem#1	Mem#2	Mem#3	Mem#4	Mem#5	Mem#6	Mem#7	Mem#8	Mem#9
Management n=6	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**
Level of education, outreach and enforcement	-1	-1	-1	-1	-1	0	-1	-1	0
Management effectiveness (local-federal coordinated management regime; real-time accountability measure)	-2	-2	-2	0	-2	0	-2	-1	-1
Availability of reliable fishery information (catch, effort, life history, real-time monitoring, late reporting, mis-reporting, under reporting)	-2	-2	-2	-1	-2	-1	-2	-2	-1
Timeliness of QA/QC input and output in catch and effort data which would affect the ability to conduct near-real-time monitoring of catch	-2	-2	-1	-1	-2	-1	-2	-2	-1
Data collection improvement efforts (mandatory reporting in Am Samoa; improvement through efforts)	1	-1	-2	0	0	1	-1	-1	0
Other management systems may provide additional protection of reef stocks (monuments sanctuaries, CFMP closed areas)	2	1	1	-1	2	2	1	1	0
SUM	-4	-7	-7	-4	-5	1	-7	-6	-3

HAWAII	Mem#1	Mem#2	Mem#3	Mem#4	Mem#5	Mem#6	Mem#7	Mem#8	Mem#9
Social n=7	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**
Allows a variety of cultural, ethnic and Hawaiian traditional practices and values to continue	2	2	2	2	2	1	2	1	1
Is an important part of Hawaii food security and healthier diet	2	1	2	2	2	0	2	1	0
Reef fishing as part of social identity and status (clubs built around these fisheries)	2	2	1	2	1	1	2	1	0
Provides fish important for culturally important events e.g. first birthday luau, weddings, graduations, holidays etc.	2	1	1	2	2	1	2	1	0
Is a highly skilled and well-respected practice and occupation	1	1	1	2	1	1	2	1	0
Sense of pride and accomplishment in producing food and cultural benefit to others	1	1	1	2	2	1	1	1	1
Practice of customary exchange and fish flow to the community is still tied to the contemporary social fabric	1	1	2	2	1	1	2	1	1
SUM	11	9	10	14	11	6	13	7	3

	Mem#1	Mem#2	Mem#3	Mem#4	Mem#5	Mem#6	Mem#7	Mem#8	Mem#9
Economic n=8	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**
Supports the local economy (including the fishing supply chain, fish markets and support network related to fishing)	1	2	2	1	2	0	2	1	1
Supplements income of those with part-time jobs or low wages	1	1	1	1	1	1	2	1	0
Is a source of income and jobs (i.e. primary and secondary)	1	2	0	0	0	1	2	1	0
Acts as an economic “safety net”	0	1	0	2	0	2	1	1	0
Supports extractive tourism/service industries	1	2	1	1	1	-1	2	1	1

Supports non extractive value (aesthetic and existence value)	1	-2	2	2	1	0	2	1	-2
Money stays in the local economy (local manufacturing of fishing gear and supplies)	1	1	1	1	2	1	1	1	1
House hold expenses are reduced by subsistence fishing	1	1	0	2	1	1	2	1	1
SUM	7	8	7	10	8	5	14	8	2

	Mem#1	Mem#2	Mem#3	Mem#4	Mem#5	Mem#6	Mem#7	Mem#8	Mem#9
Ecological n=7	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**
Coral reefs provide buffer from large scale perturbation	-1	0	0	0	2	-1	1	2	-1
Uncertainty of ecosystem dynamics (trophic interactions; life history; impacts of climatological changes)	-1	-1	-1	-1	-2	0	-1	-1	-1
Potential effects of fishing interaction with protected species (prey competition)	0	-1	1	0	-1	0	-1	-1	0
Non-fishing factors that affects fish stocks and habitat (pollution, run-off, development, injection well, ecological alteration, physical habitat degradation)	0	1	1	-2	-2	-1	-1	-2	-2
Effects of invasive species in ecological functions and stability	0	0	0	0	-1	-1	-1	-1	-1
Ecological effects of ciguatera “scare”	0	0	1	0	0	1	1	-1	0
De-facto MPAs provide additional protection for reef stocks	0	0	1	1	1	1	2	1	1
SUM	-2	-1	3	-2	-3	-1	0	-3	-4

	Mem#1	Mem#2	Mem#3	Mem#4	Mem#5	Mem#6	Mem#7	Mem#8	Mem#9
Management n=6	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**
Level of education, outreach and enforcement	-1	0	-2	-1	-1	1	-1	-1	0
Management effectiveness (local-federal linkages; real-time accountability measure)	-2	-1	-2	0	-2	-1	-2	-1	0
Availability of reliable fishery information (commercial catch, effort, life history, real-time monitoring, late reporting, mis-reporting, under reporting)	-1	-1	-2	0	1	-1	-1	0	-1
Data collection improvement efforts (improvements in online reporting); revision of HMRFS	1	0	-2	0	1	0	-2	-1	0
Availability of reliable fishery information (non-commercial catch and effort information is unknown life history, real-time monitoring, late reporting, mis-reporting, under reporting)	-1	-1	-2	-1	-2	-1	-1	-2	-1
Other management systems may provide additional protection of reef stocks (monuments, State MPAs, military closed areas, community based management areas)	2	0	1	1	2	1	1	1	0
SUM	-2	-3	-9	-1	-1	-1	-6	-4	-2

MARIANAS	Mem#1	Mem#2	Mem#3	Mem#4	Mem#5	Mem#6	Mem#7	Mem#8	Mem#9
Social n=6	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**
Allows traditional practices and values to continue	2	1	2	2	2	2	2	2	2
Is an important part of Marianas food security and healthier diet	2	2	2	2	2	1	2	0	2
Reef fishing as part of social identity status	2	1	1	1	1	2	1	1	2
Provides fish important for culturally important events e.g. fiestas, funerals, parties	2	2	2	2	2	1	2	2	2
Is a highly skilled and well-respected practice and occupation	2	2	1	1	1	1	2	0	0
Sense of pride and accomplishment in producing food and cultural benefit to others	2	2	1	1	2	1	1	1	1
SUM	12	10	9	9	10	8	10	6	9

	Mem#1	Mem#2	Mem#3	Mem#4	Mem#5	Mem#6	Mem#7	Mem#8	Mem#9
Economic n=7	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**
Supports the local economy	1	2	1	1	2	0	1	1	1
Supplements income of those with part-time jobs or low wages	2	2	2	1	2	1	2	1	1
Is an important source of income and jobs (i.e. primary and secondary)	2	1	1	1	2	0	1	1	1
Acts as an economic “safety net”	2	2	1	2	2	2	2	2	2
Supports extractive tourism/service industries	1	0	0	1	1	-1	2	0	1
Supports non extractive value (aesthetic and existence value)	1	0	-1	1	1	2	1	1	-1
House hold expenses are reduced by subsistence fishing	2	1	1	2	1	1	2	1	1
SUM	11	8	5	9	11	5	11	7	6

	Mem#1	Mem#2	Mem#3	Mem#4	Mem#5	Mem#6	Mem#7	Mem#8	Mem#9
Ecological n=4	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**
Coral reefs provide buffer from large scale perturbation	-1	1	-1	0	2	-1	1	2	-1
Uncertainty of ecosystem dynamics (trophic interactions; life history; impacts of climatological changes)	-1	-1	-1	-1	-2	0	-1	-2	-1
Non-fishing factors that affects fish stocks and habitat (pollution, run-off, development)	0	1	1	0	2	1	-1	-2	-1
De-facto MPAs provide additional protection for reef stocks	1	1	1	-1	2	2	1	1	-1
SUM	-1	2	0	-2	4	2	0	-1	-4

	Mem#1	Mem#2	Mem#3	Mem#4	Mem#5	Mem#6	Mem#7	Mem#8	Mem#9
Management n=5	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**	**SCORE**
Level of education, outreach and enforcement	-1	-2	0	0	0	0	-1	-1	0
Management effectiveness (local-federal linkages; real-time accountability measure)	-2	-2	-1	0	-2	-2	-2	-2	-1
Availability of reliable fishery information (catch, effort, life history, real-time monitoring, late reporting, mis-reporting, under reporting)	-2	-2	-2	0	0	-1	-2	-2	-1
Data collection improvement efforts (mandatory reporting in CNMI; improvement through efforts)	1	-1	-2	0	0	0	-1	-1	0
Other management systems may provide additional protection of reef stocks (monuments sanctuaries, military closed areas)	2	1	2	-1	2	1	-1	1	0
SUM	-2	-6	-3	-1	0	-2	-7	-5	-2