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Progress Report

American Samoa Bottomfish Assessment Program

by

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SUMMARY

The Office of Marine and Wildlife Resources (OMWR) is conducting a bottomfish assessment program for American Samoa with the cooperation and assistance of the National Marine Fisheries Service (NMFS) Honolulu Laboratory. The purpose of this program is to assess the status of commercially important bottomfish stocks throughout the Territory and to further refine the estimate of maximum sustainable yield (MSY) of deepwater snappers and groupers for American Samoa. The program is also designed to gather basic biological data of selected bottomfish species taken from local waters that may prove useful in the formulation of fishery management plans. The OMWR is primarily responsible for data collection and the collection of otoliths. The NMFS Laboratory has the equipment and personnel capable of making age determinations from the sectioned otoliths and the expertise to analyze the collected fisheries data. Dr. Steven H. Gruber, NMFS Scientist is the principal liaison between the OMWR and the NMFS and is responsible for age and growth data analysis.

OBJECTIVES

Three primary approaches were to be used in the assessment of the status of bottomfish stocks in American Samoa. The first approach involved a simple "paper" approach to the estimation of MSY of the deepwater snapper/grouper/jack complex by determining the amount of 100 fathom habitat existing in the Territory.

The second approach involves the collection of length frequency data and otoliths from a selected group of commercially important foodfishes.

The last approach attempted to reconstruct catch data from a newly discovered, highly productive offshore fishing bank. This fishing location produced excellent catches of deepwater snappers but was depleted of this resource in a very short time. A comparison of relative catch rates of this type can yield important information on the resiliency of the stocks and the condition of the stocks in other fishing locations. A controlled fishing experiment on another unexploited fishing bank was also suggested.

#### PROCEDURES

An estimate of MSY was made based on the length of the 100 fathom isobath in American Samoa waters. The locations of most of the offshore banks surrounding American Samoa have been well known for several years and are crudely represented in the National Ocean Survey Chart Number 83484. The exact location and extent of these banks have been accurately charted during bathymetric cruises of the NMFS/NOAA Research Vessel Townsend Cromwell and documented in the NMFS Southwest Fisheries Center Administrative Report H-86-15. NMFS personnel used these references and a linear tracking device to accurately measure the 100 fathom curve in nautical miles around all islands, banks and pinnacles in the Territory. The result was used with previously estimated figures that represent the kilograms of bottomfish per nautical mile of the 100 fathom isobath (kg/nmi) that can be harvested on an MSY basis.

The collection of otoliths and length frequency data involved the training and active participation of OMWR personnel. The following accomplishments were deemed necessary in order to fulfill these objectives:

1. Agree upon list of target bottomfish species for data collection.
2. Design data collection form and computer data base for data storage.
3. Train data collectors in accurate bottomfish species identification and method of sampling.
4. Solicit cooperation of fishermen and seafood retailers to measure and sort catch.
5. Obtain otoliths.

Target Species List

Past records of the OMWR Offshore Data Collection program were examined to determine the most commonly landed bottomfish species in the Territory. The deepwater Etelis, Pristipomoides and Aphareus rutilans do not contribute heavily to the annual landings of bottomfish in American Samoa but were included on the list due to their high value in the fresh export trade and the regional interest in these species. Two reef fish of the family Acanthuridae were included on the list due to their popularity for local consumption and importance in the local fresh fish market. No groupers (Serranidae), parrotfish (Scaridae) or squirrelfish (Holocentridae) were included on this initial list due to the difficulty in isolating a single species of each family for study and the inability of the data collectors to reliably identify one single species of each family for otolith collection. The following species were selected for the collection of otoliths and length frequency data.

- \* 1. Etelis coruscans
- \* 2. Etelis carbunculus
- 3. Aphareus rutilans
- 4. Pristipomoides filamentosus
- 5. Caranx lugubris
- \* 6. Lutjanus kasmira
- 7. Lutjanus gibbus
- \* 8. Lethrinus rubrioperculatus
- 9. Aprion virescens
- \* 10. Acanthurus lineatus
- \* 11. Ctenochaetus striatus

The species labelled with an asterisk are priority commercial fish species for American Samoa based on social and economic considerations and a special effort was made to obtain data on these particular species.

Forms were designed for the collection of length frequency and otolith data. A computer data base was designed to accept this data for storage and basic analysis.

OMWR fisheries data collectors were carefully trained in the identification of commercially important fishes of Samoa. Special attention was given to species on the Target Species List especially for those species with morphologically similar generics.

Length Frequency Data

Fish were measured at the landing site or at the seafood stall outlets. The fisherman; store; date of catch; catch length and catch location were recorded whenever possible for each lot of sampled fish. The fork lengths of the target species were

measured to the nearest tenth of a centimeter. The importance of taking several small random samples over the entire year was stressed over taking fewer large samples. Five hundred to one thousand length measurements per year per species was the anticipated ideal goal for the program.

#### Otolith Collection

Otoliths were collected from fish taken by OMWR personnel on data collection trips. Hook and line gear and hand spears were used to collect specimens. It was considered extremely important that complete and accurate data accompany all otolith samples. The fish species, fork length, sex, weight(g), date of capture, location and depth of capture were recorded for each otolith sampled specimen. Both otoliths from each sampled fish were cleaned and placed in glass vials filled with freshwater. The requirement for accurate catch data and the dissection of the fish required the collection of otolith sampled fish by OMWR personnel. An attempt was made to collect at least fifty otolith samples per species from as wide a size range as possible. Collected otoliths were sent to the NMFS Laboratory in Honolulu for analysis.

#### Otolith Analysis

The analysis of otoliths to yield age vs length data was conducted by NMFS personnel using a method for the aging of tropical fish developed by Ralston, NMFS (Ralston 1985). The otoliths were dried, mounted in fiberglass resin, sectioned, ground, and mounted on glass microscope slides. The width of daily growth increments are estimated at various points from the otolith focus to the postrostrum. Points along this line are selected in which at least 25 to 30 daily growth increments are clearly visible. The length of these areas are measured and divided by the number of increments to yield the average width of increments within the segment. Several measurements are made and a relationship between otolith growth rate and otolith length is made. The total time required for the otolith to grow to a certain size can then be estimated and otolith lengths are converted to fish length using a regression analysis.

The NMFS Laboratory now is using a digitized, computer linked system to obtain the necessary otolith measurements. This new system has greatly shortened the length of time required to process otoliths for analysis. In practical terms, the measuring of a group of otoliths that used to require three to four weeks can now be accomplished in two or three days with more measurements made per otolith.

## FINDINGS

#### Estimate of MSY

NMFS personnel carefully measured the length of the 100 fathom isobath around American Samoa as it is represented on the previously mentioned nautical charts and bathymetric surveys. The final figure of 143.3 nmi is somewhat smaller than the often quoted figure of 169 nmi measured by earlier investigators (Anon 1985). Table 1 lists the length of the 100 fathom isobath around each island and bank of American Samoa. Current estimates of the MSY of deepwater snappers/groupers and jacks in kg/nmi of the 100 fathom isobath range from 213 to 286 kg/nmi. Using both estimated lengths of the 100 fathom isobath with the highest estimate of MSY (286 kg/nmi) yields a range of 41 to 48 metric tons per year for the estimated MSY of the deepwater bottomfishery in American Samoa. Table 2 lists various estimates of bottomfish productivity with their source and study location.

#### Length Frequency Data

Presently, about 6000 length frequency measurements have been taken by OMWR data collectors. Adequate numbers of measurements have been recorded only for *Lutjanus kasmira*, *Lethrinus rubrioperculatus*, *Acanthurus lineatus* and *Ctenochatus striatus*. This further supports the assumption that the shallow water snapper/emperor complex and inshore coral reef fish are far more important to the Samoan diet than deepwater snappers. No analysis of this data has yet been made. The NMFS scientists plan to incorporate this data with otolith analysis near the end of the study period.

#### Otoliths

Full sets of otoliths from *L. kasmira*, *C. striatus* and *L. rubrioperculatus* have been collected and sent to the NMFS Laboratory for analysis. The otoliths of the *C. striatus* lot have been read and analyzed to yield age vs fork length data Figure 1 (from Ralston, NMFS). This graph lists an estimated fork length of *C. striatus* at year 1, 2 and 3 of 12.8, 17.5 and 20.0 respectively. This data set seems reasonable in light of current information on the species. The otoliths of *L. kasmira* and *L. rubrioperculatus* will be read in the near future and a NMFS Administrative report will be prepared in June 88 detailing the results.

#### Reconstruction of Catch Data

The retrieval of the complete catch data from the newly discovered offshore bank proved impossible. However, it is known that 9000 lbs of bottomfish were exported in 1986 by two vessels composed primarily of *Etelis coruscans* (4254.5 lbs) and *E. carbunculus* (2691 lbs). A comparison of the dates of shipment with the fishermen's records indicate that 86% of this poundage (5949 lbs) was removed from this bank in the first four months of

fishing and the catch rates dropped sharply after this time period.

#### RECOMMENDATIONS

The revised estimate for the MSY of deepwater snappers in American Samoa is based on a decrease in estimated habitat (169 nmi to 143 nmi 100 fathom isobath) and a high productivity estimate of 289 kg of bottomfish/nmi. The estimated MSY of approximately 45 metric tons is probably a high estimate but is still a low figure compared to the commercial landings of Hawaii or the MSY potentials of other Pacific Island nations. The limited habitat for deepwater snappers around American Samoa supports the need for careful management of this resource and the desirability of investigating the possibility of limiting the future entry of larger bottomfish vessels from outside the Territory. Preliminary limited access mechanisms have already been established through the Western Pacific Fishery Management Council.

The qualitative evidence obtained on the rapid depletion of a virgin stock of deepwater snappers on a newly discovered fishing bank further supports the need for future management.

The importance of the shallow water snappers and reef fish to Samoa is well demonstrated by the preliminary findings of this study. This emphasizes the need for future research to concentrate on these areas over deepwater bottomfish assessment.

Otolith collection should continue for the deepwater bottomfish until adequate numbers are obtained for analysis by the NMFS. However, it is recommended that otolith collection efforts should concentrate on Acanthurus lineatus and Lutjanus gibbus both of which have ample length frequency data for analysis. Length frequency measurement effort should concentrate on Ctenochaetus striatus, Lethrinus rubrioperculatus and Lutjanus gibbus. The possibility of adding a grouper (Serranidae), a parrotfish (Scaridae) and a squirrelfish (Holocentridae) to the Target Species List should be investigated in order to learn more about these locally important subsistence and commercial fishes.

#### REFERENCES

- Anon, 1985. Fishery Management Plan for the Bottomfish and Seamount Fisheries of the Western Pacific Region. Western Pacific Fishery Management Council.
- Ralston, Stephen. 1985. A Novel Approach to Aging Tropical Fish. National Marine Fisheries Service, NOAA. South West Fisheries Center. Honolulu Laboratory. 7p.

Table 1. Length of the 100 fathom Isobath in the Waters of American Samoa.

<u>Island or Bank</u>	<u>Length of 100 Fathom Isobath (nmi)</u>
Tutuila I	66.1
Olosega/Ofu	16.9
Tau	19.0
Pinnacles	7.8
Swains	5.7
Rose	6.8
South Bank	11.4
East Bank	0.2
Southeast Bank	1.0
Northeast Bank	8.1
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TOTAL	143.3 nmi

Table 2. Estimates of Deepwater Bottomfish Productivity Based on the Amount of Available Habitat (nmi of 100 fathom isobath) Per Year on a Maximum Sustainable Yield Basis.

<u>Area of Study</u>	<u>Analysis Type</u>	<u>Investigators</u>	<u>Publication</u>	<u>Estimate (kg/nmi)</u>
Taiian Isl	Stock Prod.	Ralston & Polovina 1982	US Fishery Bull. 80(3) 435-448.	272
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Taiiana Isl	Yield/Recr.	Polovina & Ralston 86	US Fishery Bull. 84(4) 759-770.	Basalt (213) Limestone (229) Seamounts (264)
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West Taiian Isl	Ecosystem	Polovina 84	Coral Reefs Vol.3:1-11.	289

FIGURE 1. : Estimated Length (mm) and Age (Yrs) of Ctenochaetus striatus from American Samoa based on Otolith Analysis.  
(Ralston unpublished data, pers. comm.)

