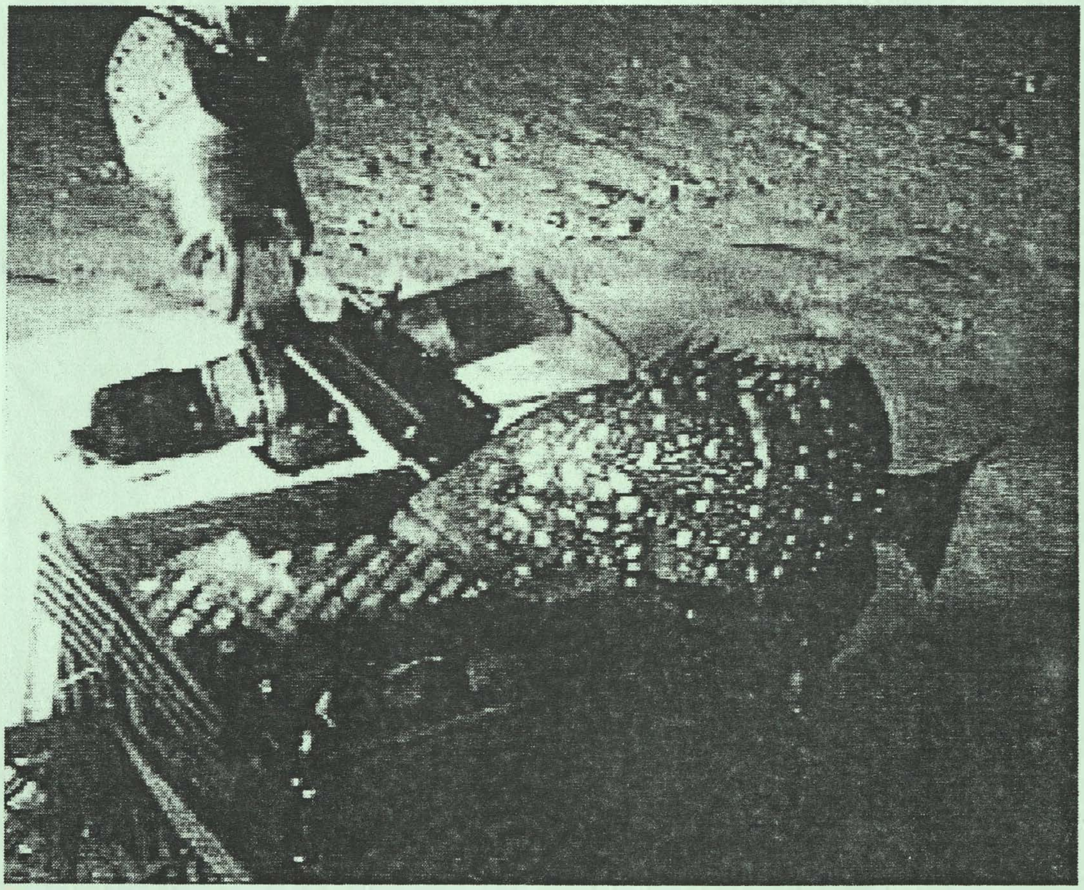
Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region

1997 Annual Report



October 1998

Western Pacific Regional
Fishery Management Council
1164 Bishop Street, Suite 1400,
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Cover photo: Hapuupuu (*Epinephelus quernus*) at 450 ft off Haleiwa, Oahu, Hawaii, taken from the *Pisces V* submersible while bottom sampling. (Photo courtesy of Dr. Chris Kelley)

A report of the Western Pacific Regional Fishery Management Council pursuant to National Oceanic and Atmospheric Administration Award No. NA87FC0006

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1997 Annual Report

October 1998

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for the

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Bottomfish and Seamount Groundfish Fisheries of the Western Pacific

1997 Annual Report

1.0 INTRODUCTION

The 1997 annual report provides a set of descriptors and indicators of the bottomfish fisheries from American Samoa, Guam, Hawaii and the Northern Mariana Islands. The descriptors are designed to document recent trends in landings, effort, participation, revenue and prices. Should management action be recommended, descriptor information will aid in assessing potential impacts of the action on fishery participants. The indicators are quantifiable and measurable tools used to identify signs of stress in the stocks or the fishery. Based on changes over time in indicator levels, the Bottomfish Plan Team (BPT) may identify "yellow light" situations (i.e., where stress is first detected) and recommend that either management action or additional study be undertaken or "red light" situations where immediate management action is needed.

The annual report is organized as follows: The introduction section defines and briefly explains the descriptors and indicators. The next section briefly summarizes time trends in descriptor and indicator levels, through the current year, and recommends any areas of concern for each island area. Reports from each island area are appended. The introduction describes the history and present characteristics of the fishery. Results of the current year's descriptors and indicators are presented in detail, in relation to past temporal trends. Figures are supported with information on source of the data, methods of calculation, and data interpretation. Table 1 summarizes 1997 bottomfish statistics for the region. The appended report from each area includes a summary, which addresses progress made on the previous year's recommendations, and lists new recommendations. Finally, additional appendices contain information on NMFS 1997 administrative and enforcement activities, habitat conditions, protected species interactions, and 1997 BPT membership.

Table 2 lists scientific, common English and local/indigenous names for bottomfish management unit species (BMUS) for each area (American Samoa, Guam/Northern Marianas, and Hawaii).

1.1 Definition of Descriptors

The fishery descriptors are defined as follows:

1.1.1 Landings information

Time series information on aggregate catch for each island area shows recent trends in total bottomfish harvest. For American Samoa and Guam, estimates of both the commercial landings and the total landings (combined commercial, recreational and subsistence) are available. For

Table 1. Regional Summary of 1997 Bottomfish Species

	AS	GU	NMI	Hawaii All	Hawaii MHI	Hawaii Mau	Hawaii Hoomalu
BMUS Landings (lb)	24,226	29,243	50,851	863,000	403,000	105,000	241,000
Revenue ($)	56,842	27,929*4	168,890	2,761,000	1,609,000	note 3	note 3
No. Of Boats	26	354	67	---	368	9	6
No. Of Trips	205	7,604	373	---	2,528	53	38
CPUE	15.2lb/hr	4.0lb/hr	136 lb/trip	---	146 lb/trip	2,528 lb/trip	5,234 lb/trip
SPR	0.50	---	---	0.25-0.53	note 1	note 2	note 2

Notes:

1) Species with Spawning Potential Ratio near or below threshold level of 0.20, indicating localized subarea depletion: MHI onaga ("targeted" SPR = 0.035); MHI ehu ("targeted" SPR = 0.070); MHI hapuupuu ("best/worst" SPR = 0.19)
2) Healthy (SPR > 0.20) for all species (Mau Zone=0.62, Hoomalu Zone=0.65)
3) Revenue for NWHI zones combined was $1,152,000
4) Revenue based on commercial landing of 9,342 pounds

Table 2. Bottomfish Management Unit Species (BMUS) Names
(Absence of an indigenous name implies no local name established or area is not within the species' geographic range.)

Scientific	English Common	American Samoa	Guam/ CNMI	Hawaii
Bottomfish:				
Aphareus rutilans	red snapper/silvermouth	palu-gutusiliva	maraap tatoong	lehi
Aprion virescens	gray snapper/jobfish	asoama	tosan	uku
Caranx ignobilis	giant trevally/jack	sapoanae	tarakito	white ulua/pau'u
C. lugubris	black trevally/jack	tafauli	trankiton attilong	black ulua
Epinephelus fasciatus	blacktip gouper	fausi	gadao matai	
E. quernus	sea bass			hapu'upuu
Etelis carbunculus	red snapper	palu-malau	guihan boninas	ehu
E. coruscans	red snapper	palu-loa	onaga	onaga
Lethrinus amboinensis	ambon emperor	filoa-gutumumu	mafuti/lililok	
L. rubrioperculatus	redgill emperor	filoa-pa'o'omumu	mafuti tatdong	
Lutjanus kasmira	blueline snapper	savane	sas/funai	ta'ape
Pristipomoides auricilla	yellowtail snapper	palu-i'usama	guihan boninas	yellowtail kalekale
P. filamentosus	pink snapper	palu-'ena'ena	guihan boninas	opakapaka
P. flavipinnis	yelloweye snapper	palu-sina	guihan boninas	yelloweye opakapaka
P. seiboldi	pink snapper		guihan boninas	kalekale
P. zonatus	snapper	palu-sega	guihan boninas/gindai	gindai
Pseudocaranx dentex	thicklip trevally		terakito	butaguchi/pig ulua
Seriola dumerili	amberjack		guihan tatdong	kahala
Variola louti	lunartail grouper	papa	bueli	
Seamount Groundfish:				
Beryx splendens	alfonsin			kinmedai (Japanese)
Hyperoglyphe japonica	ratfish/butterfish			medai (Jap.)
Pseudopentaceros richardsoni	armorhead			kusakari tsubodai (Jap.)

Hawaii and the Northern Marianas, landings information represents only the commercial harvest.

In Hawaii, changes in species catch composition are provided for the Main Hawaiian Islands (MHI) and the Northwestern Hawaiian Islands (NWHI). Statistical tests for consistency in catch composition over time and between areas are included. Where possible, descriptor information has been presented for each NWHI management zone: Hoomalu and Mau. For 1997, pounds landed by species are presented in tabular form for each area except Hawaii. For Hawaii, NWHI BMUS landings by species are provided for 1986 through 1997.

1.1.2 Effort information

Effort is measured in number of trips for Hawaii and the Northern Marianas, and in both hours fished and trips taken for American Samoa and Guam.

1.1.3 Participation information

Estimates of the number of vessels making bottomfish landings are provided for all areas.

1.1.4 Economic information

Time trends in economic performance are characterized by plots of total ex-vessel revenue, aggregate average price levels, and for Hawaii, price trends over time for major species. In time-series of prices and revenues, it is appropriate to adjust value for the rate of inflation so that values throughout the time period are comparable (based on a consistent purchasing power for the dollar). Both the unadjusted and adjusted aggregate average price and aggregate revenues are plotted to clarify the relative change over time.

1.2 Definition of Indicators

Indicators were developed as tools for identifying signs of stress in the stocks or the fishery which deserve further investigation and/or a management response. Analyses consider how the indicators change over time. Indicators for Hawaii include 95% confidence intervals. To the degree possible, similar variance estimates are expected from the other areas in future annual reports. The indicators are defined as follows:

1.2.1 Aggregate Catch-Per-Unit-Effort

If the current year's aggregate catch-per-unit-effort (CPUE) is less than 50% of the average aggregate CPUE for the first three years of available data, there may be cause for concern. CPUE information is available for all areas; research CPUE is available for SE Hancock Seamount for all years since 1985, except in 1992 and 1994-1997.

1.2.2 Mean Fish Size

If there has been a significant reduction in mean fish size for a species over time, the stock may be stressed by the fishery. Mean size information is provided for nine species in Hawaii. No mean size information was available at this time for American Samoa, Guam or the Northern Marianas.

1.2.3 Percent Immature

If over 50% of the catch for a species is below the size of first maturity, the stock may be stressed by the fishery. Information for this indicator by species is available only from Hawaii.

1.2.4 Spawning Potential Ratio

The spawning potential ratio (SPR) is the ratio of the spawning stock biomass per recruit, at the current level of fishing, to the spawning stock biomass per recruit that would occur in the absence of fishing. According to the overfishing definition contained in the Bottomfish FMP (Amendment 3, 1990), if SPR is less than or equal to 0.20, recruitment overfishing has occurred (i.e., spawners have been reduced to 20%, or less, of their unexploited stock level). Data to calculate SPR were not available from Guam or the Northern Marianas. An estimate of the "worst case" SPR was calculated for American Samoa's bottomfish complex using Dory Project data to estimate the virgin population CPUE and information on percent of immature fish from Hawaii. In Hawaii, SPR was calculated for five major species in the Hoomalu and Mau Zones, of the NWHI, and the MHI; some SPR values changed slightly from previous year's reports due to improvement in the calculations. SPR for armorhead was calculated annually since 1985, except for 1992 and 1994-1997.

1.2.5 Economic Indicators

Revenue per trip plots are presented for all areas except the MHI. A more valuable indicator for the commercial fisheries, which may be available in the future, would be net revenue (ex-vessel revenue minus costs per trip). Net revenue is available only from the Hoomalu Zone and Mau Zone in Hawaii.

2.0 AREA SUMMARIES

2.1 American Samoa

2.1.1 Descriptors

Bottomfish landings, which declined from 1988 to 1992, rose slightly in 1993 and dramatically in 1994. The decline was attributed to the following: the three hurricanes that struck the territory (in 1987, 1990 and 1991), the departure of several highliners from the fishery, the shift in importance from bottomfishing to trolling, and the substitution of imported fish from Western Samoa and Tonga. The significantly greater 1994 total landings, when compared to the previous years, occurred primarily due to improved catch recording, an increase in effort by highline vessels, and a high fish demand for government and cultural events. The 1997 total landing dropped 43% from the 1996 landings.

Fishing effort, measured by the number of trips, dropped 28% in 1997. The decrease in effort was due to fishermen seeking other more stable and lucrative lines or work. The total number of boats remained about the same at 26.

The average price per pound increased in 1997 by 11% to $2.15. This increase is consistent with a general trend since 1991. Inflation-adjusted values have experienced fluctuations no greater than 11% from 1985-1994, with the 1994 average price near the high end of the range. Prices of locally caught fish were kept low due to the large amount of imports.

2.1.2 Indicators

CPUE (pounds per hour), though relatively stable (at about 10 lb/hr) in the early 1990s, increased in 1996, then stabilized in 1997 at 15 lb/hr, indicating a healthy fishery. The proxy "worst case" SPR was 0.50 in 1997, indicating that recruitment overfishing has not occurred. Size and maturity data were collected from key species, but insufficient sample sizes were available for a more realistic SPR estimate. Bottomfish revenue per trip (as opposed to total revenue) decreased 12% in 1997.

2.1.3 Recommendations

DMWR should identify funds for the continued collection of appropriate data to improve the estimate of SPR for the bottomfish complex (as no progress was made on this recommendation over the past year).

2.2 Guam

2.2.1 Descriptors

The fairly large fluctuations over time in bottomfish landings in Guam appear to be due more to entry and exit patterns of fishermen, rather than changes in fish stocks. The number of highliners fishing in the area doubled from 1993 to 1994, increasing the total commercial BMUS harvest and revenue by nearly 300% during that year. In 1997, the total BMUS landings decreased by 46%, primarily due to poor weather and few fishermen concentrating on deep water bottomfish. The total commercial BMUS harvest increased 42% from 1996, due to a highliner fishing a remote bank.

The increase in total BMUS in 1996 is due primarily to an increase in recreational and subsistence-type boats participating in the fishery. The 1995 total number of boat hours and trips increased nearly 175% due to the recreational and subsistence-type boats and the calm seas throughout most of 1995, which allowed many of them to participate in bottomfishing more often than usual. The general increasing trend began in 1986. The slight declines in boat hours and trips in 1996 and 1997 may have been the result of the almost complete absence of highliners participating in the fishery in the last two years.

The adjusted average price for bottomfish has not shown consistent marketing trends. This is believed to have resulted from the seasonal supply of pelagic fish and difficulties in developing a consistent market for locally caught fish. In addition, imported fish from other islands around the region have contributed to the continued marketing problem for local fishermen. The 1997 inflation-adjusted average bottomfish price of $2.99 is up slightly from 1996 ($2.06) but still low. This may explain why local highliners were almost completely absent from the bottomfish fishery in recent years.

2.2.2 Indicators

In 1997, the CPUE dropped slightly from 1996 to 4.0 lb per hour. Based on an aggregate catch-per-unit-effort average of 6.9 lb/hr for the first three years of data collection on Guam, the 1997 figure may suggest cause for concern. However, it is important to note that CPUE is affected considerably by the predominance of recreational and subsistence-type effort that targets the less productive shallow-water complex of bottomfish.

The adjusted average revenue per trip does not appear to show any long-term trend or cause for concern. The substantial increases in both actual and inflation adjusted revenue per trip occurring in 1994 are best explained by the success of the highliner vessels. The 1995 increase in revenue for all species landed verses the decrease in revenue for bottomfish only, indicated that on average, most commercial fishermen continue to make more money from their trolling efforts than from bottomfishing. The 1996-97 values are representative of the long-term mean.

2.2.3 Recommendations

Status of 1996 recommendations:

Action taken on the recommendation to continue working with the WPacFIN program coordinator to develop and implement a customized computer software program that will update, standardize and reprocess Guam's creel survey data is ongoing. Included in this effort is the assignment and training of staff to input and process the DAWR creel survey database from 1980 to present, which addresses the related recommendations.

A pilot research project was undertaken in October, 1997, in response to the recommendations for a baseline catch and biological survey of the red-gill emperor, *Lethrinus* *rubrioperculatus*, to establish virgin-stock CPUE, mean fish size, percent immature and SPR for this important shallowwater species.

1997 recommendations:

1) Efforts should continue to develop the database computer program that will provide DAWR with the capability of integrating the offshore survey expansion data with the inshore expansion data, and additionally produce statistics of confidence, a compilation of biological data, and a complete species composition analysis according to Plan Team requirements. Upon completion of the computer program, designated DAWR staff should be trained to use the new software to reprocess creel survey data from 1980 to present. Training should also be provided to teach staff how to interface with NMFS/WPacFIN software. Such training would facilitate additional support from NMFS/WPacFIN in the processing and analysis of fisheries data if necessary.

2) The need to complete a baseline biological survey of the red-gill emperor, *Lethrinus rubrioperculatus*, remains as the single most important data deficiency for the Marianas shallowwater bottomfish resource. With funding from the WPacFIN program and technical assistance from the National Marine Fisheries Service, DAWR should continue with proposed plans to conduct research cruises to Bank A to collect virgin-stock data from a rarely-fished bank, and to Galvez Bank to collect comparative data from a regularly-fished bank. In light of the fact that several commercial bottomfishing trips to Bank A were recorded in 1997, it is further recommended that the study be completed as early as possible.

3) With funding from the WPacFIN program and technical assistance from the National Marine Fisheries Service, DAWR should establish mean fish size, percent immature and SPR indicators for Guam's deep and shallowwater bottomfish complexes.

2.3 Hawaii

2.3.1 Descriptors

Main Hawaiian Islands: Only commercial data are available for both the MHI and NWHI fisheries, even though the MHI recreational/subsistence catch is estimated to be about equal that of commercial landings. In 1988, there was a dramatic increase in MHI bottomfish landings due to a bonanza uku (gray snapper) harvest. Since that time there has been a steady decline in total landings, which stabilized from 1990-1992. Landings in 1994 went up 32% over 1993 (which was the lowest recorded annual value), then rose slightly in 1995. Landings continued to decrease in 1997 to 403,000 pounds, which represents about a 8% drop from 1996. Effort also declined while still higher than the long-term mean.

Total ex-vessel revenue from the MHI has shown a general decline from 1988-1997 with the inflation adjusted revenue of the MHI fishery being the lowest since 1974, and less than one third of what is was in 1988.

NWHI Mau Zone: Mau Zone 1997 landings have decreased 33% from 1996. The total number of boats decreased from 13 to 9, while the number of trips decreasing by 35%. However, bottomfish landings per trip increased by 44%.

NWHI Hoomalu Zone: Hoomalu Zone 1997 landings increased 37% from 1996. The number of boats that fished doubled to 6 and number of trips increased by 46%. In addition, bottomfish landings per trip increased by 2% based on NMFS CPUE.

Available revenue data are not separated by zone. Overall NWHI inflation-adjusted revenue has been relatively stable since 1990. Inflation-adjusted average bottomfish price appears to be relatively stable in recent years.

2.3.2 Indicators

Hawaii Archipelago-wide:

Archipelago-wide SPR estimates are the best method available to assess the Hawaii bottomfish resources and should be the only values used to evaluate overfishing. Evidence from larval drift simulation and preliminary genetic work point to single archipelago-wide stocks with substantial larval transfer between zones (generally from the more healthy northwestern zones toward the more depleted MHI zone).

SPR values for the five major BMUS species in 1997 are all above the 20% critical threshold level, that defines recruitment overfishing under the FMP, when viewed on an archipelago-wide basis. Of these species, onaga is usually the lowest with the 1997 value at only 25%. Implementation of the state's management plan should help improve the condition of onaga in the MHI and increase the archipelago-wide SPR.

SPR values are also presented on a management zone basis (MHI, Mau Zone, Hoomalu Zone) for the purpose of determining locally depleted resources.

MHI: CPUE in 1997 continue to decreased to its lowest level on record at 146 lb/trip. Recent CPUE values are less than one-forth the early (baseline 1948-50) values, signifying local depletion in the MHI. The decline is most apparent in ehu, with a recent CPUE of only about 7% that of the initial years of the fishery. The increase in the late 1980s MHI CPUE was primarily due to a large increase in uku catches, and may not indicate an increase in abundance in other species. Most of the more commercially important species in the MHI have had relatively stable mean weights since 1984. Hapuupuu's mean weight dropped sharply in 1993 and has continued to be low. While sample size is low, size of hapuupuu may have declined in the MHI.

For the fifth year 95% confidence intervals were constructed based on "best" and "worst" case bounds of SPR components (CPUE and percent immature). For the third year SPR values were calculated using both aggregate CPUE, as in previous years, and targeted CPUE which gives a more accurate picture for individual species. All of the five major species for which the

SPR indicator was calculated using aggregate CPUE in 1997 had values below the 0.20 "critical" level: onaga (0.19), opakapaka (0.16), uku (0.19), hapuupuu (0.19), and ehu (0.18). The use of targeted CPUE showed a different picture for the four species where targeted trips are available. Here, onaga and ehu SPRs are much worse than indicated using aggregate CPUE (SPR = 0.035 and 0.069, respectively), whereas SPR values for opakapaka and uku are much higher than previously indicated (SPR = 0.27 and 0.312, respectively). Onaga's SPR has now been below 0.20 for the past 9 years and ehu for the last 12 years (using targeted CPUE). Hapuupuu has now dropped below 20% at 0.19, following two year just above the border, and must also be considered stressed in the MHI.

NWHI Mau Zone: The NMFS CPUE data are only available for the NWHI fishery as a whole since 1984 and by zone since 1988. The NWHI (combined Mau and Hoomalu Zones) NMFS CPUE steadily decreased from 1987 to 1992, rose in 1993, and then declined from 1994-96. In 1997, CPUE returned to the 1993-94 level of 521 lb/day. The Mau Zone NMFS CPUE had been steadily decreasing since 1989, but increased in 1993 and 1994. In 1997, NMFS CPUE rose 49% to 429 lb/day. The Mau Zone HDAR CPUE increased 18% from 1996, returning in 1997 to just over 50% of the initial years. Non-parametric 95% confidence intervals were calculated for HDAR CPUEs by the "bootstrapping" method. Mean weights of fish in the Mau Zone continue to exhibit year to year fluctuations, but are generally at much higher values than MHI mean weights. The percent of immature fish in the 1997 Mau Zone catch was still safely under 50% for all species evaluated.

SPR values in the Mau Zone have been decreasing since 1990 (mirroring the pattern in the HDAR CPUE) but experienced a surprising rise in 1994, then returned to lower levels in 1995, followed by increase in 1996-97. All values are presently above 0.58, well above the critical level of 0.20. SPR values are higher in the NWHI than the MHI because most of the catch is mature fish. SPR values in both NWHI zones have never fallen below 0.35.

NWHI Hoomalu Zone: The Hoomalu Zone NMFS CPUE has been on a downward trend from 1988 to 1996, but increased slightly in 1997. The Hoomalu Zone HDAR CPUE followed an increasing trend, but dropped sharply in 1994 for unclear reasons and rose by 20% in 1995 and remained similar in 1996-97. The 1997 5,234 lb/trip was 62% of the average of the first three years (8,440 lb/trip, 1948-50). Mean weights of fish in the Hoomalu Zone continued to exhibit year to year fluctuations, but are still at much higher values than MHI mean weights. The percent of immature fish in the 1996 catch was still safely under 50% for all species evaluated, except for onaga, which may be an anomaly of limited size data.

The SPR values in the Hoomalu Zone increased in 1995, with four of the five measured species showing values of 0.72, while onaga had an SPR value of 0.35 (possible anomaly).

Seamount Groundfish (Armorhead): No fishing has been allowed on the armorhead stocks of the SE Hancock Seamount since the moratorium began in August, 1986. The 1993 CPUE, calculated from research longline catches, was more than double that of the last assessment (in

1991) and nearly as high as the highest CPUE recorded since surveying began in 1985. No research cruise occurred since 1993, and future research assessment cruises are unlikely.

No SPR values were available in 1997 as no research was undertaken. In 1993, SPR within the EEZ (SE Hancock Seamount) was above 0.02, the highest since 1986, but still far below (10% of) the threshold level for recruitment overfishing of 0.20. About 99% of the known armorhead seamount habitat occurs outside the U.S. EEZ, an area which had 0.06 SPR in 1993. During February and March 1997, an oceanic and larval armorhead survey over the seamounts outside the U.S. EEZ was conducted onboard the R/V Kaiyo Maru by the National Research Institute of Far Seas Fisheries Laboratory in Shimizu, Japan. Armorhead larvae were collected from surface waters around all seamounts except for Koko Seamount.

2.3.3 Recommendations

1) The BPT reiterates its concerne regarding the status of MHI onaga, ehu, and hapuupuu. The Team commends DLNR, and Walter Ikehara in particular, for their hard work and persistence in developing a comprehensive state plan to manage MHI bottomfish (which became law in June 1998). The Team recommends that the Council continue to support the state plan. (Same as last year)

2) Again, the BPT continues to strongly encourage the State to proceed expeditiously with computerization of the fish and seafood dealer reporting system and integrate this with the fishermen's commercial catch reporting system. (Same as last year)

3) The BPT encourages NMFS and the State to increase the level of bottomfish catch monitoring of the Honolulu auction and expand this sampling to major dealers on all other main Hawaiian Islands. (Same as last year)

4) The BPT recommends that the archipelago-wide SPR for bottomfish species included in this report be used to determine the overfished status of BMUS, rather than any of the SPR values given by fishing zone, MHI, Mau, or Hoomalu. Considering the direction of initial genetic results and the simulated larval distribution studies, it is most likely that there are single archipelago-wide stocks of each species and that SPR values for smaller areas indicate local depletion, not overfishing of the stock. However, local depletion is not a good practice and management measures should be taken to correct the situation. In the MHI the state management plan is a large step in the correct direction and noticeable improvement should be forthcoming.

5) The BPT recommends that the Council request that the Secretary of Commerce remove onaga, ehu and hapuupuu from the "overfished" category based on the healthy archipelago-wide SPR values presented in this report.

2.4 Northern Mariana Islands

2.4.1 Descriptors

Data are available only on the commercial fishery. The declining trend in landings and revenues, which occurred from 1988-91, was reversed by a growth trend which began in 1992. In 1997, bottomfish landings remained high at 50,851 lb, and exceeded the 1994 landings by 149%, due primarily to the growth of the local bottomfishing industry, particularly from new ventures operating full time. The number of vessels fishing remained high and stable at 67. The 1994 increase was in vessels of all sizes, including large (50 ft plus) vessels. The number of trips decreased 16% in 1997, which included regularly scheduled long trips to the northern islands, where bottomfish are more abundant.

The average adjusted price per pound received for bottomfish has been stable the past 3 years, at $3.32 in 1997. The total 1997 ex-vessel revenue remained high at $168,890. The increase is attributed to expanded bottomfish operations.

2.4.2 Indicators

The average bottomfish catch per trip continued its 6-year increasing trend to 136 lb/trip in 1997. The average catch per trip is subject to significant biases (e.g., changes in trip length and relative amounts of bottomfishing compared to trolling). It may be possible to improve this measure of CPUE by using only those trips which landed bottomfish species exclusively. While such a calculation may be sensitive to other biases due to small sample size, it should be investigated in the future. This indicator does not suggest the need for any management action.

Although bottomfish effort and landings are increasing, revenue obtained from bottomfish sales remain effectively stable. The average revenue per bottomfish trip in 1997 increased 14% for bottomfish species and 5% for all species, continuing a 7-year trend. All species inflation adjusted revenue, which had been declinig since 1988, appears to have not stabilized at this point. Bottomfish fishermen often troll to and from the bottomfishing site, thus acquiring a mixed catch after spending the day "bottomfishing".

2.4.3 Recommendations

1) Establish an ongoing bottomfish monitoring program to provide needed data for the commercial bottomfish fishery, contingent upon the Council identifying funds to implement and maintain the program, with assistance from NMFS/WPacFIN. (Same as last year)

2) Establish baseline (virgin stock) parameters (CPUE, percent immature) for the Guam/Northern Marianas deep-water bottomfish complex (e.g., survey on grouper, snapper) utilizing data collected during Resource Assessment Investigation of the Marianas Archipelago (RAIOMA) cruises (1981-1984), the current fishing in the Northern Islands and sampling aboard DFW research vessel to help calculate SPR, with assistance from NMFS. (Same as last year)

3) Establish baseline (virgin stock) parameters (CPUE, percent immature) for the Guam/Northern Marianas shallow-water bottomfish complex (e.g. red-gilled emperor) by sampling program aboard DFW research vessel to help calculate SPR, with assistance from NMFS. (Same as last year)

4) With assistance from NMFS/WPacFIN, software should be developed and implemented to separate fishery statistics for the main islands fishery and from the Northen Islands fishery with separate descriptions and statistics reported in the annual report module. (Same as last year)

2.5 Region-Wide Recommendations

1) Concur with the need to continue the recent progress, made through NMFS assistance, to establish baseline parameters for virgin shallow- and deep-water stocks in the NMI.

2) For NMFS to develop methodology for the collection and analysis of appropriate data (for biological stock parameters) and assist the island areas, while acknowledging the recent progress made in Guam.

3) Expand the BMUS list to include generic level designations to include all species (to the lowest taxa reported) of the following major families of shallow-water bottomfish: Lethrinids, Lutjanids, Carangids and Serranids.

4) Concur with the island-area specific recommendations in the annual report (as detailed in the above summary).

Appendix 1

American Samoa

CONTENTS

Summary

During 1997, a total of 26 local boats landed an estimated 28,000 pounds of bottomfish in the territory. Revenue for the domestic commercial fishery this year was estimated around $57,000, with all the catch being sold locally.

The fishery was relatively bigger between 1982 and 1986 than in recent years (Fig. 1). This observation reflects a trend in the loss of skilled and full-time commercial fishermen from the fishery, depletion of newly discovered banks (mainly the 2% Bank), the shift of preference from bottomfishing to trolling and, recently, the diversion of effort by the commercial bottomfish fishermen to do longlining. The December 1991 hurricane contributed to the 1992 decrease in landings (Fig. 1) and the second lowest number of trips ever recorded (Fig. 3). Compared to the 1982-1986 period, the past three years' landings, effort and subsequently revenues were notably less. This is mainly due to the highliners diverting their efforts towards the more profitable longlining method.

The CPUE in 1997 (15.2 lb/hr) was greater than the estimated baseline CPUE (14.8 lb/hr) indicating no signs of stress in this fishery. The proxy "estimate of the worst case" SPR of 0.5 (refer to the analysis in Fig. 7) indicated that recruitment overfishing is not occurring in this fishery. Current data do not indicate any serious problems with American Samoa's bottomfish fisheries.

The following annual summaries, dating back to 1982, provide a history of American Samoa's bottomfish fishery.

Historical Annual Statistics					
Years	Total Landings (lb) all Bottomfish	CPUE (Lb/trip.hr)	Inflation adjusted Revenues($)	Bottomfish $/Lb	Number of Boats
1982	64,942	8.5	173,359	1.83	27
1983	126,327	10.0	407,123	2.15	38
1984	94,104	10.7	247,872	1.80	48
1985	104,675	8.1	208,138	1.38	47
1986	98,361	9.6	206,112	1.48	34
1987	30,640	12.5	63,476	1.54	20
1988	64,530	19.7	131,615	1.61	26
1989	48,137	15.3	71,557	1.51	29
1990	15,445	10.2	27,261	1.66	19
1991	17,917	10.0	33,178	1.81	20
1992	13,715	10.5	29,700	2.01	14
1993	17,098	11.4	31,521	1.81	23
1994	39,533	13.1	84,388	2.03	21
1995	30,503	16.5	58,425	1.88	25
1996	39,501	17.5	74,503	1.93	26
1997	27,538	15.2	56,842	2.15	26
Averages	52060.4	12.43	119067	1.786	27.7
St.Deviation	36120.9	3.45	104589.2	0.238	9.65

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Introduction

Bottomfishing from canoes by the natives of the American Samoa islands has been a subsistence traditional practice in the distant past. But it was not until the early 1970s that the bottomfish fishery developed into a commercial venture utilizing motorized boats. A government subsidized program, called the Dory Project, was initiated in 1972 to develop the offshore fisheries into a commercial venture, and resulted in an abrupt increase in the fishing fleet and total landings. In 1982 a fisheries development project aimed at exporting high-priced deep-water snappers to the Hawaii fish auction caused another notable increase in both bottomfish landings and revenue. Between 1982 and 1988, the bottomfish fishery comprised as much as 50% of the total commercial catch. Since 1988 the nature of American Samoa's fisheries has changed dramatically with a shift in importance from bottomfish fishing towards trolling.

During the early 1980s data were collected from the bottomfish fishery by interviewing only commercial vessels. In the current Offshore Creel Survey on Tutuila that started in October 1985, commercial, subsistence and recreational domestic boats landing catch in five designated areas were interviewed and their catches examined. For two weekdays and one weekend day per week, DMWR data collectors sampled offshore fishermen between 0500 and 2100 hours. Two DMWR samplers based on Tau and Ofu collect fisheries data from the Manu'a Islands fleet.

Boat-based fishing in Tutuila and Manu'a used to be just trolling and/or bottomfishing. In the past three years, record longline landings (mainly by the Alia commercial fishermen) were recorded. The bottomfish fishery of American Samoa is typically commercial overnight jigging using skipjack as bait, on 28-32 foot aluminum Alias. Bottomfish imported mainly from the neighboring independent state of Western Samoa has assisted in satisfying the high demand for fresh fish that cannot be supplied by the small local commercial fleet. The adverse effects of three hurricanes that struck American Samoa in 1987, 1990 and 1991 can be seen in some of the trends in the fishery as depicted by the data in this report.

Recommendations

Status of the 1996 recommendation:

DMWR did not act on last year's recommendation to continue collecting the appropriate data to obtain a more realistic SPR estimate for American Samoa's bottomfish complex, but hopes this will be completed soon.

Table 1. American Samoa 1997 Estimated Total Bottomfish Landings

Species	Pounds
Redgill Emperor	1,295
Longnose Emperor	265
Orangespot Emperor	170
Emperors (misc)	3,252
Tomato Grouper	247
Spotted Grouper	4
Peacock Grouper	5
Lunartail Grouper	1,216
Blacktip Grouper	35
Striped grouper	8
Grouper (misc)	660
Bluelined Snapper	3,977
Blacktail Snapper	5
Kusakar's Snapper	16
Stone's Snapper	138
Flagtail grouper	44
Onespot Snapper	106
Yelloweye Opakapaka	1,343
Gindai	506
Gray Jobfish	2,271
Onaga	2,697
Ehu	1,558
Humpback Snapper	1,608
Twinspot/red Snapper	365
Hawaiian opakapaka	58
Lehi	1,957
Trevally-C.caeruleop	9
Oilfish	50
Bottomfish (assorted)	179
Amberjack	63
Black Jack	2,016
Bigeye trevally	258
Whitemouth trevally	13
Giant trevally	10
Jacks (misc)	1,131
Total Bottomfish	**27,538**
Total BMUS	**24,226**

Interpretation: The appearance of new species in recent years was due to the improved identification of various species by DMWR samplers. These species were occasionally present in landings from previous years, but were not identified at the species level. Current data on species composition of bottomfish landed do not indicate any important changes.

Source: DMWR Offshore Creel Survey database

Calculation: Catches are weighed by species either at landing sites or during the selling of fish to dealers. Data on landings sold to stores on non-sampling days and a few trips missed by samplers on sampling days are accounted for in a separate Data Collection System - the Invoice Purchase System. The above analysis is from the Offshore Creel Survey data only. Analyses of American Samoa's bottomfish data are for the whole complex, not just for BMUS.

Table 2. American Samoa 1997 Estimated Average Price of Bottomfish Species

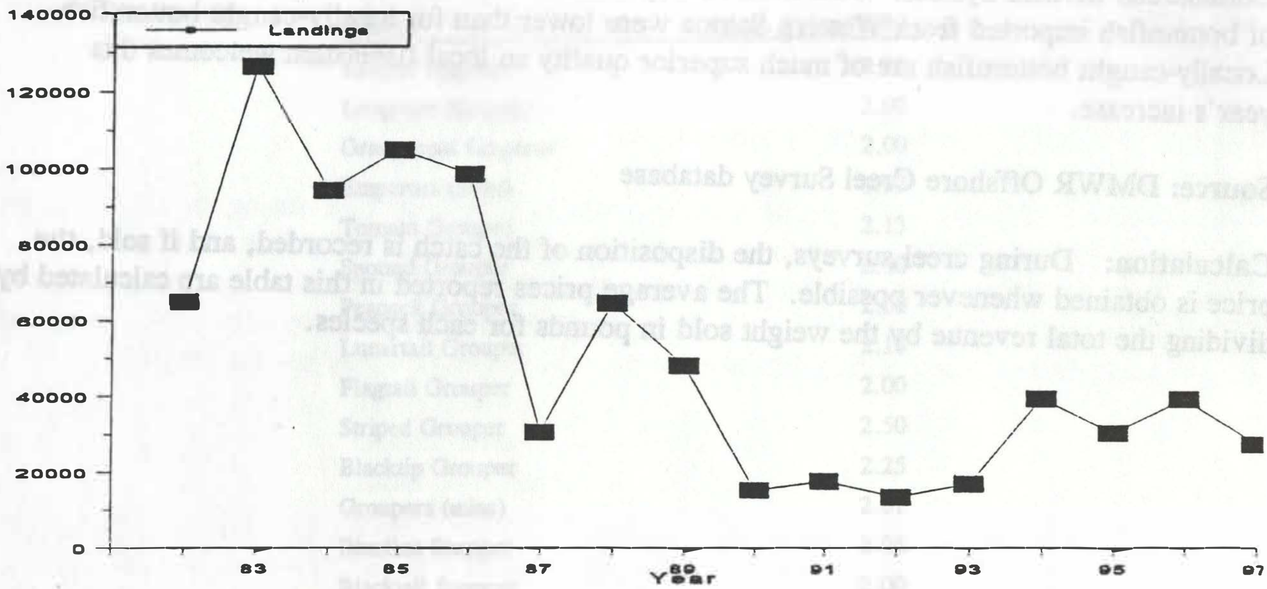
Species	Ave. Price ($/lb)
Redgill Emperor	2.25
Longnose Emperor	2.00
Orangespot Emperor	2.00
Emperors (misc)	1.97
Tomato Grouper	2.13
Spotted Grouper	2.00
Peacock Grouper	2.00
Lunartail Grouper	2.16
Flagtail Grouper	2.00
Striped Grouper	2.50
Blacktip Grouper	2.25
Groupers (misc)	2.01
Blueline Snapper	2.06
Blacktail Snapper	2.00
Kusakar's Snapper	2.00
Stone's Snapper	1.81
Onespot Snapper	2.11
Yellow Opakapaka	2.02
Gindai	2.75
Gray Jobfish	2.21
Onaga	2.49
Ehu	2.28
Humpback Snapper	2.15
Twinspot/red Snapper	2.25
Hawaiian Opakapaka	3.00
Lehi	2.12
Bigeye Trevally	1.93
Bottomfish (assorted)	2.00
Whitemouth Trevally	1.90
Giant Trevally	1.50
Trevally(C.caeruluop)	2.00
Amberjack	2.00
Black Jack	2.18
Jacks (misc)	2.02
Total Bottomfish	**2.15**
Total BMUS	**2.16**

Interpretation: There appears to be no profound changes in the prices of individual species in the past five years. DMWR keeps track of imported bottomfish through a separate Commercial Invoice System. Data from that system reveals that since 1992, the average price of bottomfish imported from Western Samoa were lower than for locally-caught bottomfish. Locally-caught bottomfish are of much superior quality so local fishermen welcomes this year's increase.

Source: DMWR Offshore Creel Survey database

Calculation: During creel surveys, the disposition of the catch is recorded, and if sold, the price is obtained whenever possible. The average prices reported in this table are calculated by dividing the total revenue by the weight sold in pounds for each species.

Figure 1. American Samoa bottomfish landings



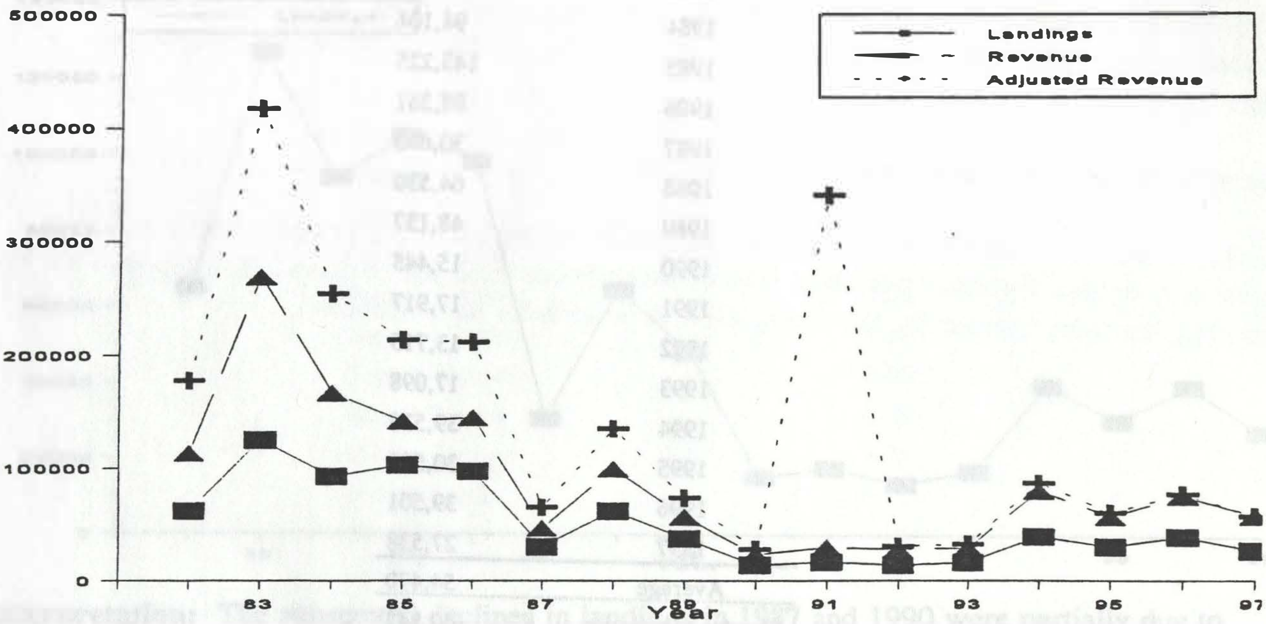
Interpretation: The substantial declines in landings in 1987 and 1990 were partially due to vessel losses caused by two hurricanes. Boat repairs were delayed as fishermen repaired or rebuilt their houses. In terms of total landings, the bottomfish fishery is much smaller in recent years than it was any time between 1982 and 1986, a period when there was a relatively large fleet and fishermen were attracted to the then profitable bottomfish export program. The increase in 1994 was due primarily to improved sampling on Tutuila and increased efforts by the Tutuila highliners. Furthermore, the Manua landings more than tripled due to social/cultural events during that year. This year, with no additional boats participating and a decrease in bottomfish effort, the landings dropped.

Source: DMWR Offshore Creel Survey database

Calculation: Bottomfish landings for 1982-84 are calculated by adjusting the sampled Tutuila data by the calculated annual percent coverage of the fleet, and then adding the similarly adjusted Manu'a landings. The 1986-present landings are from the creel survey expanded species composition files (*SPC) which contain the annual estimated total landings by species for Tutuila, and then adding the adjusted Manu'a landings. Calculating statistics for 1985 is more complicated because the sampling program changed from commercial fleet sampling only to creel sampling on October 1, 1985.

Year	Landings (lb)
1982	64,942
1983	126,327
1984	94,104
1985	143,225
1986	98,361
1987	30,640
1988	64,530
1989	48,137
1990	15,445
1991	17,917
1992	13,715
1993	17,098
1994	39,533
1995	30,503
1996	39,501
1997	27,538
Average	54,470
Standard Deviation	40,842

Figure 2. American Samoa annual estimated commercial bottomfish landings.



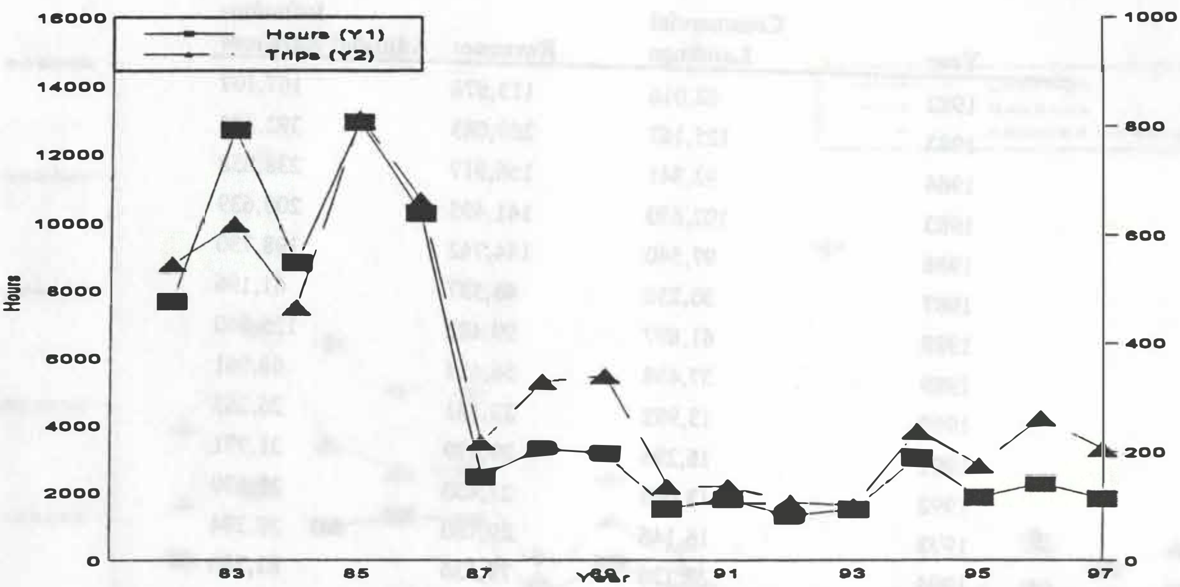
Interpretation: Commercial landings mirror the total fishery's declining catches in recent years. Relative to total landings, commercial landings decreased even more substantially in 1989, because the percent of the catch sold by bottomfish fishermen dropped from an average of about 97% in 1982-88 to 78% in 1989. The peak in 1983 portrays the high prices of deep-water snappers exported to Hawaii, while the trough in 1987 can be attributed to effects of the 1987 hurricane. The December 1991 hurricane contributed largely to the decreased landings and subsequently a decrease in revenues in 1992. Unfavorable weather continued through May 1992 hindering commercial bottomfish trips. Increased efforts in 1994 produced a notable increase in revenues and no major changes in commercial landings were recorded since then.

Source: DMWR Offshore Creel Survey database

Calculation: A relatively complex set of algorithms are used to estimate the commercial landings from estimates of total landings created by the creel survey data expansion system. In short, the percent sold by fishing method is calculated monthly and multiplied by the percent species composition by month, then multiplied by the estimated total landings for that method and month. For 1982-85 sampling was conducted on the commercial fleet only (which included nearly all the fishing boats), whereas since 1985 creel sampling has covered all boats (commercial and recreational). Analysis of creel data for 1986-87 indicates that over 98% of the landed bottomfish were being sold. Therefore, it is believed to be valid to compare commercial data for years prior to 1986 to creel survey totals for years since 1986.

Year	Commercial Landings	Revenues	Inflation-Adjusted Revenues
1982	62,016	113,678	167,107
1983	125,167	269,083	392,323
1984	92,841	166,917	238,858
1985	102,670	141,495	200,639
1986	97,540	144,742	198,730
1987	30,236	46,537	61,196
1988	61,897	99,482	126,840
1989	37,438	56,433	68,961
1990	13,992	23,161	26,265
1991	16,296	29,439	31,971
1992	13,663	27,450	28,630
1993	16,146	29,160	30,384
1994	39,126	79,536	81,286
1995	30,010	56,340	56,340
1996	38,537	74,503	74,503
1997	26,393	56,842	56,842
Average	50,248	88,425	115,055
Standard Deviation	36,017	66,128	101,144

Figure 3. American Samoa annual estimated bottomfish hours and trips



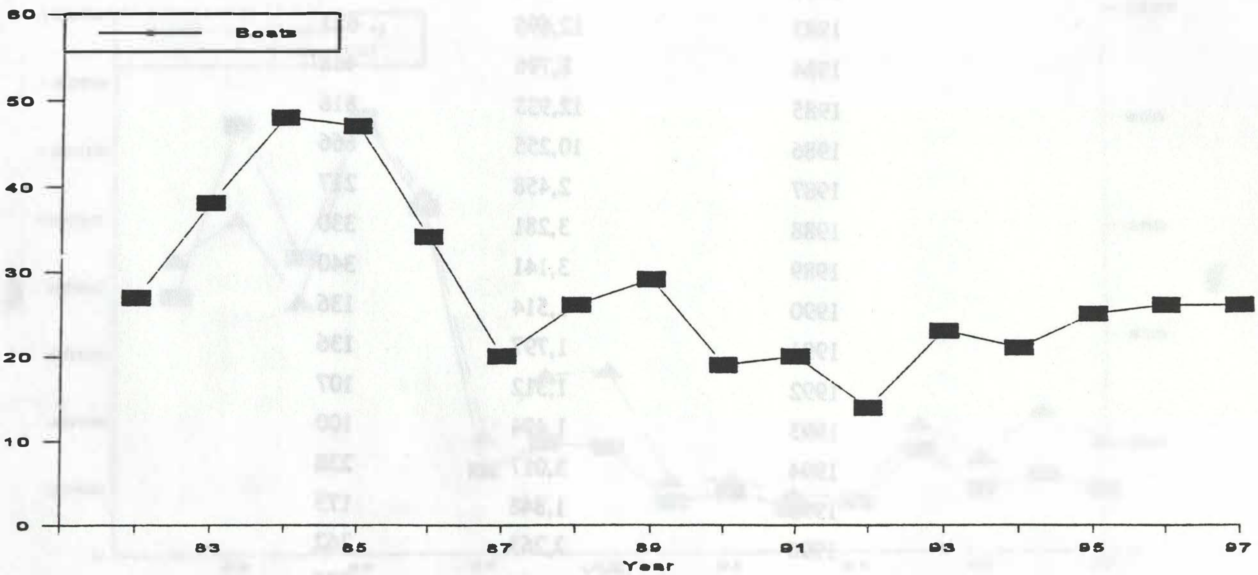
Interpretation: The sharp decline in the bottomfish landings since 1986, noted in Fig. 1 is mirrored in this figure by a sharp decline in the level of effort expended in that fishery. Rather than indicating a problem with the resource, this decline depicts an actual trend of commercial boat owners and fishermen seeking other more lucrative and stable lines of work. The noticeable increase in effort last year is primarily due to improved sampling, increased effort by the Tutuila highliners and the significant (about tripled) increase in effort by the Manua fleet. The bottomfish highliners diverted part of the effort to do longlining efforts in 1994 and contributed to the decrease in bottomfish trips and effort. The 1994-1996 estimated efforts were greater than those for the 1990-93 period due to the highliners increased efforts, with some boat owners employing teams (usually 2-3 fishermen) in continuous shifts during good weather. This year, the number of trips dropped with no additional bottomfish boats entering the fisheries as the local fleet continued to increase its effort and participation in longlining.

Source: DMWR Offshore Creel Survey database

Calculation: The annual estimated effort (hours) spent bottomfish fishing is calculated by dividing the annual estimated total bottomfish catch by the average CPUE (pounds per hour) from trips doing only bottomfish fishing. The annual estimated number of trips is calculated by dividing the estimated annual hours by the average length of a bottomfish fishing trip. The average length of a bottomfish fishing trip (not shown) is calculated by using only trips which exclusively bottomfished and for which the trip length was recorded. The total hours fished from those trips is then divided by the number of trips. Recorded hours are trip hours.

Year	Hours	Trips
1982	7,671	548
1983	12,695	621
1984	8,796	468
1985	12,933	816
1986	10,255	666
1987	2,458	217
1988	3,281	330
1989	3,141	340
1990	1,514	136
1991	1,797	136
1992	1,312	107
1993	1,494	100
1994	3,017	238
1995	1,848	175
1996	2,263	262
1997	1,809	205
Average	4,768	335
Standard Deviation	4,189	223

Figure 4. American Samoa annual estimated number of boats landing bottomfish



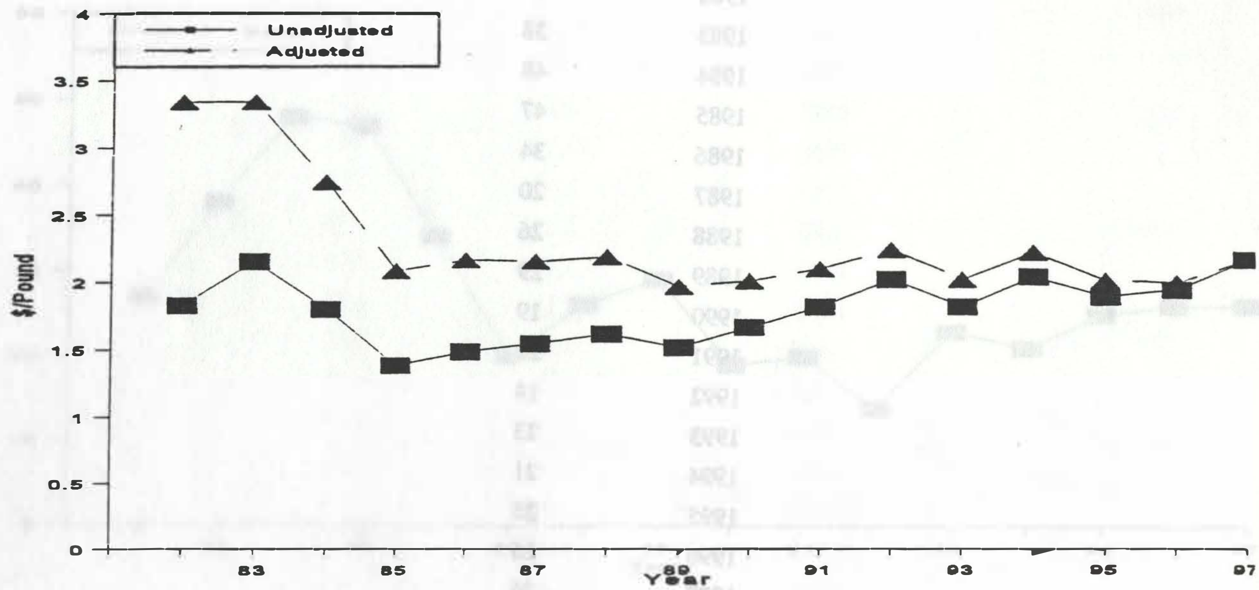
Interpretation: Again, the decline in the fishery since 1985-86 is noted by a decline in the number of boats participating in it. The 1987 hurricane caused the loss of the whole Manu'a fleet, plus some of the Tutuila fleet. Several boats which contributed to the 1989 bottomfish annual landings did not land any bottomfish in 1990, due to much needed repairs and their participation in non-bottomfish chartered trips. About 90% of the domestic fishing fleet was affected by the December 1991 hurricane, hence the decline in 1992. The increase in 1993 is due mainly to the re-entry to the fishery of a few vessels after repairs, trips by two 14-foot vessels that did not bottomfish in 1992, and the entry of one new alia into the sampling area. A few new Alias were bought from Western Samoa and entered the fishery in the 1995 and 1996. There was no net increase in the number of boats that participated in this fishery this year.

Source: DMWR Offshore Creel Survey database

Calculation: The annual estimate of the number of boats in the bottomfish fishery is obtained from the data base by counting the unique boats sampled during the year which landed any bottomfish species.

Year	Boats
1982	27
1983	38
1984	48
1985	47
1986	34
1987	20
1988	26
1989	29
1990	19
1991	20
1992	14
1993	23
1994	21
1995	25
1996	26
1997	26
Average	28
Standard Deviation	10

Figure 5. American Samoa average price of bottomfish



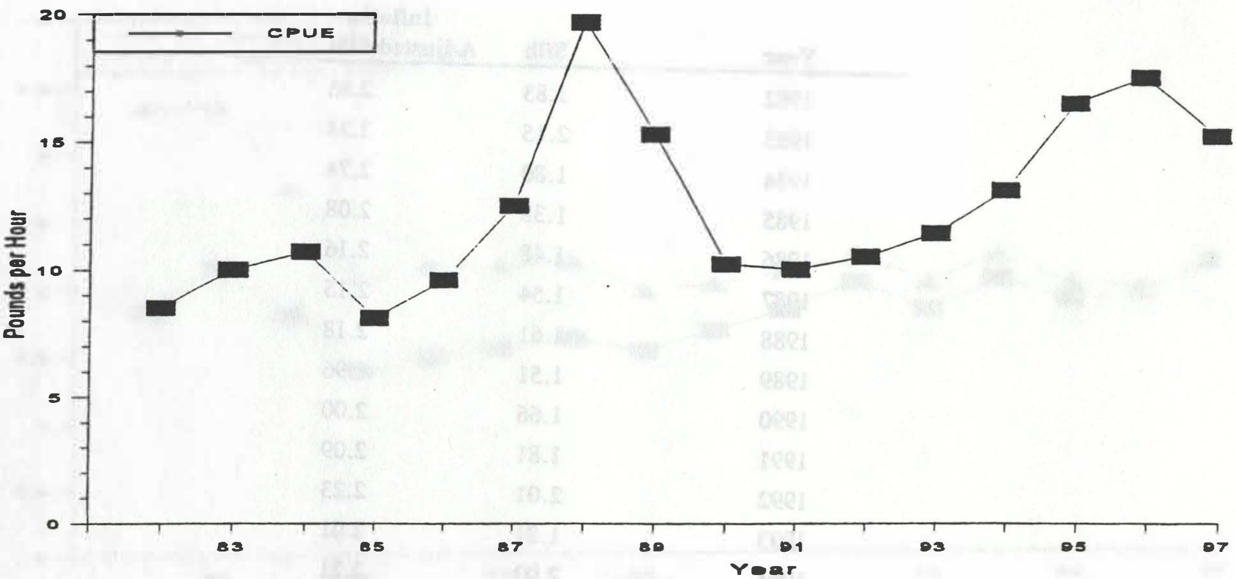
Interpretation: Prices were generally higher between 1982 and 1984 during the exportation of high-priced deepwater snappers to Hawaii. After this period, inflation-adjusted local prices have generally been stable. Prices of locally-caught bottomfish are generally higher than imported fish, and could have been even higher had the local markets not been flooded by imported fish, which are generally of lower quality. The only imported bottomfish in 1994 were from Western Samoa and these were sold at an average price of $1.67/lb. Imported bottomfish (mainly from Western Samoa) have always helped in meeting the demand for bottomfish. Average prices have generally been stable in the past three years.

Source: DMWR Offshore Creel Survey database

Calculation: The average price of all bottomfish species combined is calculated by dividing total bottomfish revenue by total sold weight. The inflation adjusted price is calculated by multiplying the unadjusted annual average price by the annually calculated consumer price index (CPI) for American Samoa using the current year as the base. The local Department of Commerce re-based its CPI calculation for the 4th. Quarter of this year but DMWR continued to use the same base and estimation that has been used for these Plan Team reports in the past.

Year	$/lb	Inflation-Adjusted $/lb
1982	1.83	2.86
1983	2.15	3.34
1984	1.80	2.74
1985	1.38	2.08
1986	1.48	2.16
1987	1.54	2.15
1988	1.61	2.18
1989	1.51	1.96
1990	1.66	2.00
1991	1.81	2.09
1992	2.01	2.23
1993	1.81	2.01
1994	2.03	2.21
1995	1.88	2.00
1996	1.93	1.98
1997	2.15	2.15
Average	1.79	2.26
Standard Deviation	0.24	0.39

Figure 6. American Samoa annual bottomfish CPUE



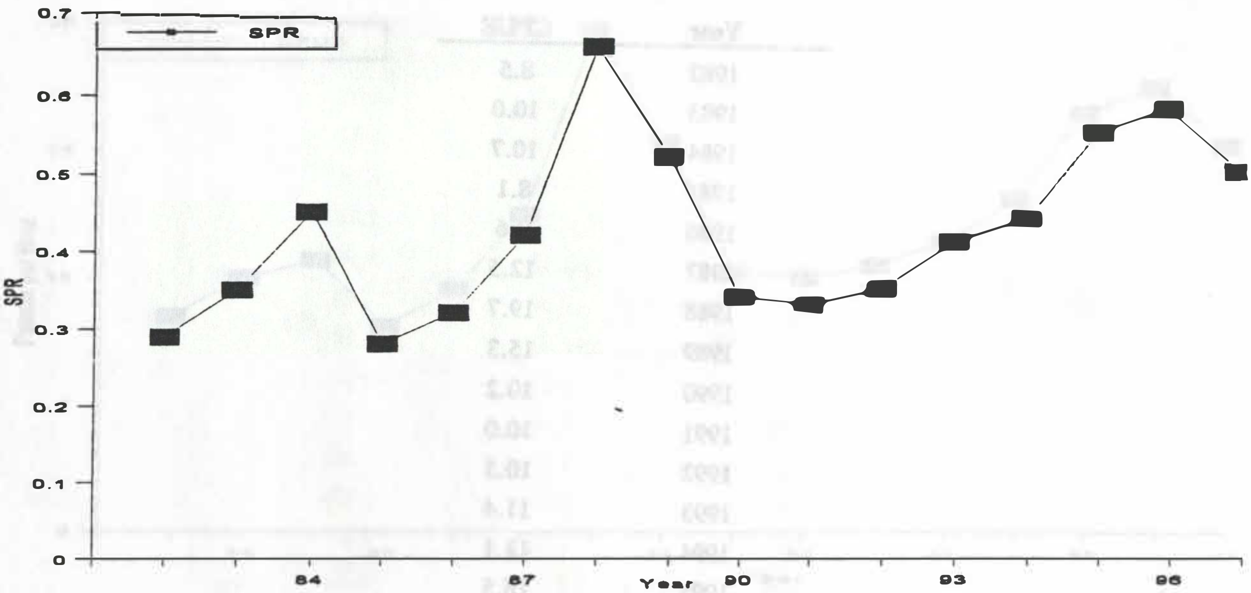
Interpretation: The initial high CPUE in 1983 and 1984 occurred during the intense fishing of some new fishing grounds for deepwater snappers exported to the more lucrative Hawaii auction. A relatively high number of boats and local commercial fishermen participated in the fishery during this period. The drop in 1985 and 1986 might be expected following the ardent harvesting of the limited fishing grounds. Reasons for the CPUE peak in 1988-89 are unknown. The decline in CPUE from 1989 to 1991 can be partially attributed to a combination of some new, inexperienced fishermen entering the fishery and the exit of experienced and full-time commercial fishermen. CPUE has essentially remained stable during 1990 to 1992, and has increased since then. Bottomfishing techniques and gear have generally remained the same in the past years with the Alias being the highliners since the early '70s. The 1995-1996 high CPUE estimates (and most probably the 1988-89 CPUE increase) can be attributed mainly to improved sampling and not necessarily related to the status of the stocks. This years CPUE of 15.2 lb/trip.hrs is higher than the estimated virgin CPUE of 14.8 indicating no cause for concern.

Source: DMWR Offshore Creel Survey database

Calculation: CPUE (pounds per trip.hours) is calculated using only trips in which only bottomfish method was used and trip hours was recorded. The average is calculated by using each CPUE from each trip as an observation and dividing by the number of trips.

Year	CPUE
1982	8.5
1983	10.0
1984	10.7
1985	8.1
1986	9.6
1987	12.5
1988	19.7
1989	15.3
1990	10.2
1991	10.0
1992	10.5
1993	11.4
1994	13.1
1995	16.5
1996	17.5
1997	15.2
Average	12.8
Standard Deviation	3.6

Figure 7. American Samoa annual estimated spawning potential ratio for bottomfish complex



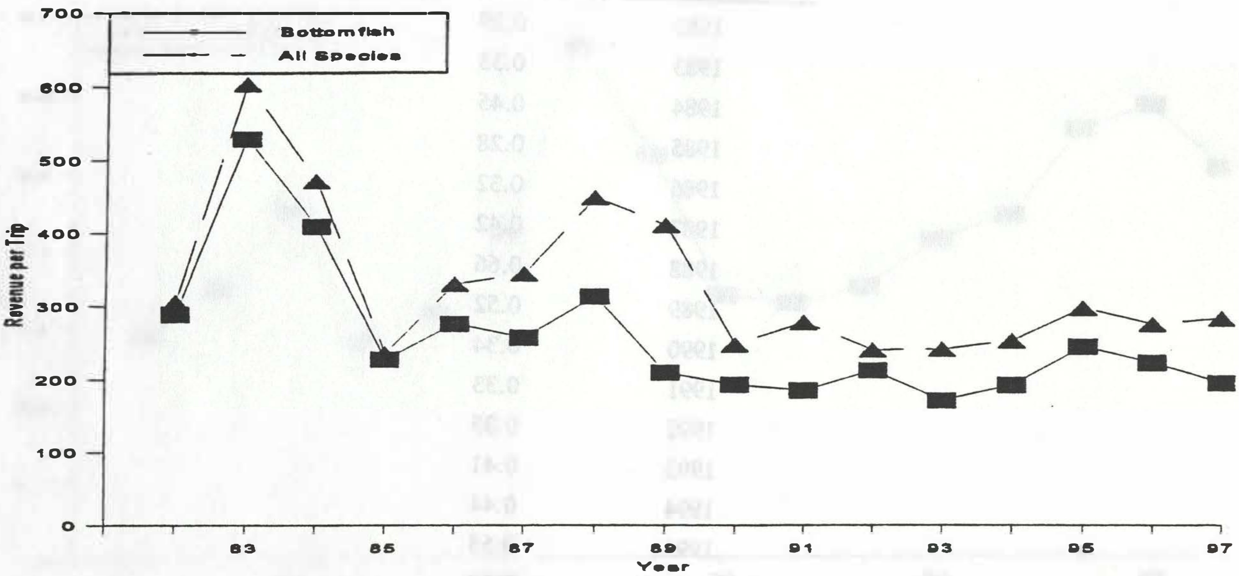
Interpretation: The proxy "worst case" SPR for 1997 was 0.50, substantially above the 0.20 critical level. According to this indicator, the bottomfish complex of American Samoa is not considered to be recruitment overfished. This year's SPR estimate **[refer to Calculations below]** decreased with this year's decrease in CPUE.

Source: DMWR Offshore Creel Survey database

Calculation: The spawning potential ratio is calculated by dividing the current year's CPUE by the virgin population CPUE, and then multiplying by the ratio of the current percent mature to the virgin population percent mature fish in the catch. To estimate SPR for American Samoa, the "Dory" project mean CPUE (refer to 1990 annual report page 20, Table 3) was used to estimate virgin population CPUE (14.8 lb/hr). Since size and maturity data available for bottomfish in American Samoa are insufficient, the ratio of percent mature in the local catch was estimated by substituting with the average (% mature) of the 5 species which have the lowest SPR in Hawaii (in 1991). In this manner a "worst case" SPR was calculated to provide what should be a very conservative estimate of SPR for the American Samoa bottomfish complex.

Year	SPR
1982	0.29
1983	0.35
1984	0.45
1985	0.28
1986	0.32
1987	0.42
1988	0.66
1989	0.52
1990	0.34
1991	0.33
1992	0.35
1993	0.41
1994	0.44
1995	0.55
1996	0.58
1997	0.50
Average	0.42
Standard Deviation	0.11

Figure 8. American Samoa average inflation-adjusted revenue per trip landing bottomfish



Interpretation: No notable changes in revenues since 1990. The distance between these two lines reflects the relative importance of bottomfish species in the total catch whenever any bottomfish are landed. The prominent importance of bottomfish between 1982 and 1985 occurred during the targeting of deepwater snappers for export. Bottomfish fishing was also the more profitable method of fishing during that period. The relative importance of bottomfish has generally been declining since 1985 as most of the full-time commercial fishermen quit the fisheries. The supply of locally caught bottomfish has been supplemented by bottomfish imported from Western Samoa. A slight decrease in adjusted revenues for bottomfish trips was experienced this year by the same number of fishermen doing bottomfish last year.

Source: DMWR Offshore Creel Survey database

Calculation: The average revenue per trip for all species is calculated by summing the revenue of all sales for any trip which landed any bottomfish species, and dividing by the number of trips. The average bottomfish revenue per trip is calculated from those same trips by summing the sales of only bottomfish species and dividing by the number of trips. Figure 8 plots the inflation adjusted bottomfish and all species revenues per trip for the period 1982-1997.

Year	Bottomfish $/Trip		All Species $/Trip	
	Unadjusted	Adjusted	Unadjusted	Adjusted
1982	185	289	196	306
1983	341	529	388	603
1984	269	409	309	471
1985	151	228	157	236
1986	189	276	226	330
1987	184	257	246	344
1988	231	313	331	448
1989	162	210	315	410
1990	161	194	205	248
1991	161	186	240	278
1992	192	213	217	241
1993	155	172	218	242
1994	178	193	233	253
1995	230	245	279	297
1996	217	223	268	275
1997	196	196	283	283
Average	200	258	257	329
Standard Deviation	50	94	59	104

Appendix 2

Guam

CONTENTS

Introduction

Guam has two distinct bottomfish fisheries which can be separated by depth and species. The shallow-water complex (<500 feet) makes up a larger portion of the total bottomfish harvest and is comprised of an assemblage of reef-dwelling snappers, groupers and jacks of the genera *Lutjanus, Lethrinus, Aprion, Epinephelus, Variola, Cephalopholis* and *Caranx*. The deep-water complex (>500 feet) consists primarily of snappers and groupers of the genera ***Pristipomoides,*** *Etelis, Aphareus, Epinephelus,* and *Cephalopholis*.

Bottomfishing on Guam is a combination small-scale commercial and subsistence fishery. This fishery is also highly seasonal in that most bottomfishing effort occurs during the summer months when sea conditions are generally much calmer. The majority of the participants are part-time recreational and subsistence fishermen who operate vessels less than 25 feet in length, primarily target the shallow-water bottomfish complex, combine some trolling effort to supplement bottomfishing effort, and seldom sell their catch commercially.

Historically, notable fluctuations in Guam's annual BMUS harvests have been caused by the respective entry and exit of highliner vessels. These highliner vessels tend to be greater than 25 feet in length and their effort is usually concentrated on the deep-water bottomfish complex.

Adding to Guam's bottomfishing effort in recent years is the charter fishing component which now includes boats making multiple two to four-hour bottomfishing trips daily. The types of vessels making such trips range from the more typical trolling charter boat involving 3-6 patrons who opt to bottomfish instead, to the larger bottomfishing-only "head-boat" vessels accommodating as many as 30 patrons per trip.

Centrally located on the western leeward coast, the Agana Boat Basin serves as the island's primary small-boat launch site to fishing areas off the central and northern leeward coast, as well as the northern banks. Situated to the south, the Merizo Pier, Umatac Boat Ramp and Agat Marina serve as access points to the southern shores and banks. The Agat Marina in particular, located between the Agana Boat Basin and the Merizo Pier, provides boats trailered from the northern and central portions of the island a closer and more convenient launch site to the southern fishing grounds. Plans to construct three additional boat ramps at presently undeveloped eastern windward launch sites are currently being considered. If completed, the new boat launches are expected to lead to a significant increase in bottomfishing effort on the eastern side of the island.

The demand for both deep- and shallow-water bottomfish continues to exceed the locally-caught supply. Although Guam's deep-water bottomfish fishery has limited economic importance, especially during the absence of highliner vessels, the cultural value of its shallow-water complex remains high due to the popularity of this assemblage of fish as food items. Some of the demand for both complexes of bottomfish is offset with imports from other islands throughout Micronesia.

Summary

The Guam offshore survey expansion system now utilizes a database format to expand the survey data, but still does not include complemental statistics of confidence or biological data such as mean species lengths. However, the implementation of an offshore creel survey at the Merizo Pier in 1991 and the Agat Marina in 1994, as well as recent revisions of algorithms to expand the offshore survey data, has increased the confidence in the expansion results. Species composition is limited to BMUS and a few other species of major importance.

DAWR is working with the WPacFIN program coordinator to complete and implement a database computer program that will provide DAWR with the capability of integrating the offshore survey expansion data with the inshore survey expansion data, and additionally produce statistics of confidence, a compilation of biological data, and a complete species composition analysis. DAWR further intends to purchase additional computer software and hardware that will facilitate prompt production of annual reports utilizing standardized wordprocessing, spreadsheet and graphics software.

In October, 1997, staff from the NMFS Honolulu Laboratory, WPacFIN program and DAWR conducted an exploratory fishing research trip to "Bank A" located approximately 117 miles west of Guam. Funded by WPacFIN, the objective of the pilot study was to determine if this rarely-fished bank contained a virgin-stock population of the shallow-water complex of bottomfish characterized by an abundance of the red-gill emperor fish, *Lethrinus rubrioperculatus*. The conclusion of the study was that further research of Bank A could serve to address the 1992-1997 recommendations by the Bottomfish Plan Team to complete a baseline biological survey of the *L rubrioperculatus*. Plans are thus being made to conduct additional research cruises to Bank A to collect virgin-stock shallow-water bottomfish data. For comparative purposes, an equal number of similar research cruises will also be made to a bank closer to the island, such as Galvez Bank approximately 15 miles southwest of Guam, whose shallow-water bottomfish stocks have been subjected to higher levels of fishing pressure over the years.

Analysis of the expanded 1997 bottomfish fishery data indicates that Guam's aggregate CPUE per boat trip for all bottomfishing methods, including deep- and shallow-water complexes in both territorial and federal waters, has declined from last year's 4.60 pounds per hour to 4.04 pounds per hour. At this level no management action is required for Guam's BMUS stocks in federal waters. However, because this CPUE level is just above 50% of the initial average CPUE of the fishery, there may soon be cause for concern. It may be possible that management measures will need to be considered, particularly at the State level, to help stem any further decline of Guam's bottomfish stocks.

Historical Annual Statistics

Year	Total bottomfish landings (lbs)	CPUE (lbs/trip hr)	Inflation-adjusted revenues ($)	Inflation-adjusted price/lb ($)	Number of boats
80	37,399	5.9	40,001	4.26	24
81	63,654	7.6	53,874	5.15	75
82	63,442	7.2	35,160	5.31	49
83	53,404	5.1	174,606	4.81	48
84	56,998	7.7	98,432	4.89	79
85	94,318	7.4	122,141	4.51	63
86	30,368	5.8	48,900	4.26	39
87	35,033	5.6	51,789	4.10	96
88	52,791	5.0	61,797	3.91	107
89	53,272	5.2	88,649	4.56	110
90	45,374	5.6	80,822	4.39	116
91	51,329	5.4	45,260	4.20	173
92	50,099	5.5	39,969	3.86	173
93	78,355	4.8	36,803	3.63	271
94	83,367	6.7	112,480	3.72	268
95	108,741	3.2	44,861	3.35	422
96	137,790	4.6	17,702	2.69	400
97	125,801	4.0	28,070	2.99	354
Average	67,863	5.7	65,629	4.14	159
Std. deviation	30,945	1.2	40,113	0.70	129

Recommendations

Status of 1996 recommendations:

Action taken on recommendation 1a to continue working with the WPacFIN program coordinator to develop and implement a customized computer software program that will update, standardize and reprocess Guam's creel survey data remains ongoing. Included in this effort is the assignment and training of staff to input and process the DAWR creel survey database from 1980 to present, which addresses recommendations 1b and 1c.

A pilot research project was undertaken in October, 1997, in response to recommendations 2 and 3 calling for a baseline catch and biological survey of the red-gill emperor, *Lethrinus rubrioperculatus*, to establish virgin-stock CPUE, mean fish size, percent immature and SPR for this important shallow water species.

1997 Recommendations:

1) Efforts should continue to develop the database computer program that will provide DAWR with the capability of integrating the offshore survey expansion data with the inshore expansion data, and additionally produce statistics of confidence, a compilation of biological data, and a complete species composition analysis according to Plan Team requirements. Upon completion of the computer program, designated DAWR staff should be trained to use the new software to reprocess creel survey data from 1980 to present. Training should also be provided to teach staff how to interface with NMFS/WPacFIN software. Such training would facilitate additional support from NMFS/WPacFIN in the processing and analysis of fisheries data if necessary.

2) The need to complete a baseline biological survey of the red-gill emperor, *Lethrinus rubrioperculatus*, remains as the single most important data deficiency for the Marianas shallow-water bottomfish resource. With funding from the WPacFIN program and technical assistance from the National Marine Fisheries Service, DAWR should continue with proposed plans to conduct research cruises to Bank A to collect virgin-stock data from a rarely-fished bank, and to Galvez Bank to collect comparative data from a regularly-fished bank. In light of the fact that several commercial bottomfishing trips to Bank A were recorded in 1997, it is further recommended that the study be completed as early as possible.

3) With funding from the WPacFIN program and technical assistance from the National Marine Fisheries Service, DAWR should establish mean fish size, percent immature and SPR indicators for Guam's deep- and shallow-water bottomfish complexes.

Tables

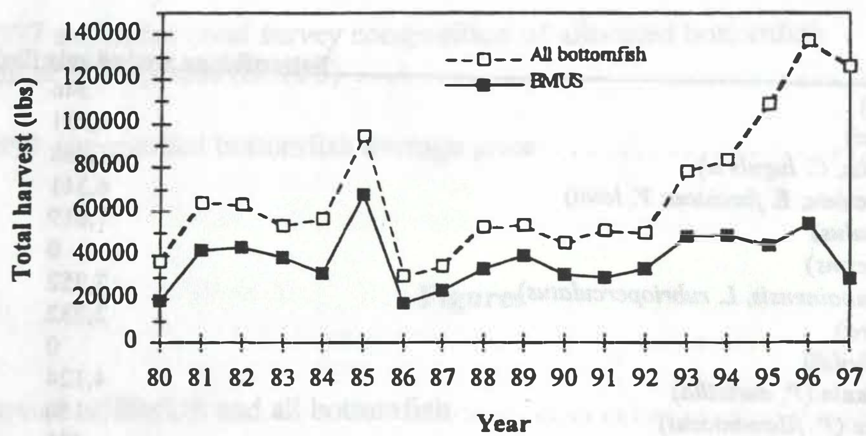
Figures

Table 1. Guam 1997 expanded creel survey composition of bottomfish management unit species (BMUS)

Species	Bottomfishing method only (lbs)
Lehi (*A. rutilans*)	346
Uku (*A. virescens*)	2,831
Jacks (*C. ignobilis, C. lugubris*)	1,968
Groupers (*C. urodeta, E. fasciatus, V. louti*)	6,341
Ehu (*E. carbunculus*)	1,019
Onaga (*E. coruscans*)	0
Emperors (*L. amboinensis, L. rubrioperculatus*)	7,252
Taape (*L. kasmira*)	2,732
Kalekale (*P. seiboldi*)	0
Yellowtail Kalekale (*P. auricilla*)	4,124
Pink Opakapaka (*P. filamentosus*)	150
Yelloweye Opakapaka (*P. flavipinnis*)	481
Gindai (*P. zonatus, P. argyrogrammicus**)	1,220
Amberjack (*S. dumerili*)	779
Total	**29,243**

*non-BMUS species

Figure 1. Guam harvest of BMUS and all bottomfish



Interpretations: Annual fluctuations in BMUS landings on Guam are usually due to highliner fishermen entering or leaving the fishery during a given year. For example, the 1985 peak followed by the apparent crash in 1986 of BMUS harvests were the result of a few highliner fishermen who fished in 1985 and then left the fishery the following year.

Prior to 1993, the "all bottomfish" totals were typically only slightly higher than the BMUS totals and were usually driven by highliner activity. In the last five years however, there have been disproportionate increases in the "all bottomfish" category over that of the BMUS category. Improved data collection and adjustments of expansion algorithms, brought about in large part by the establishment of offshore catch surveys at the Merizo Pier (1991) and Agat Marina (1994) ports, document the fact that the majority of the bottomfishing effort is currently being made by recreational/subsistence and charter fishermen harvesting a higher proportion of non-BMUS fish within territorial waters.

The 9% decrease in the "all bottomfish" category in 1997 may have been caused by the elimination of the bigeye scad, *Selar crumenopthalmus*, as part of the bottomfish catch in the 1997 expansion. The inclusion of this fish in previous bottomfish expansions, especially during a bumper harvest year such as 1996, likely had the effect of inflating bottomfish catch totals. There is also the possibility that the 1997 decline signals the beginning of a potential crisis for Guam's shallow-water bottomfish stocks, especially in light of a concomitant decline in CPUE.

The 46% decrease in the BMUS harvest in 1997 is due to the few number of fishermen concentrating on the deep-water bottomfish fishery. In general, Guam fishermen usually make more money from their trolling efforts than from their bottomfishing efforts.

Source: The DAWR offshore creel survey data as expanded by computer-based algorithms by method of fishing. All unidentified catch was allocated to species categories based on the species percentage of the total catch.

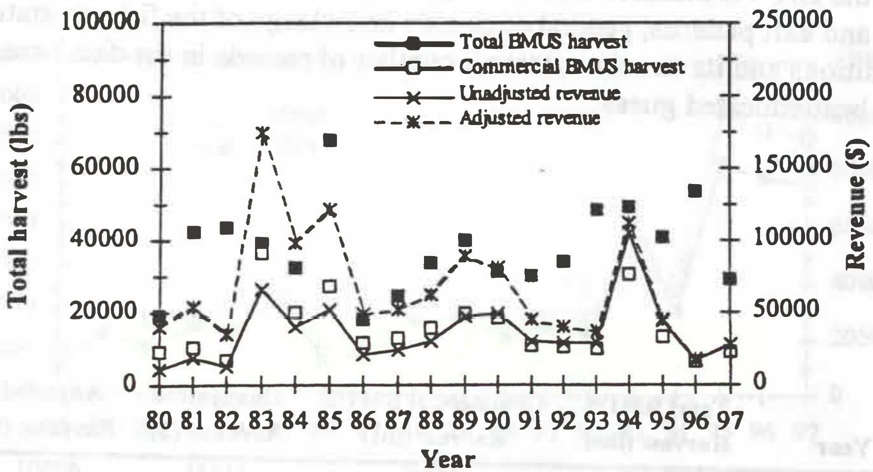
Calculations: The estimated total landings of the bottomfish species are selected from the expanded creel survey species composition files. However, the expanded estimates of catch by species must include at least a portion of the catch identified only by generic species codes categories. These generic categories (e.g. "mixed shallow bottomfish") also include some non-BMUS bottomfish according to the FMP definition (e.g. squirrelfish).

Year	Total Bottomfish Harvest (lbs)	Total BMUS Harvest (lbs)
1980	37399	19253
1981	63654	42517
1982	63442	43428
1983	53404	39193
1984	56998	32232
1985	94318	68141
1986	30368	17969
1987	35033	24288
1988	52791	33724
1989	53272	39814
1990	45374	31295
1991	51329	29962
1992	50099	34057
1993	78355	48494
1994	83367	49169
1995	108741	44135
1996	137790	54122
1997	125801	29243
Average	67863	37835
Std. deviation	30945	12577

Table 2. Guam 1997 commercial bottomfish average price

Species	Average $/lb
Miscellaneous Bottomfish	3.01
Grouper	2.72
Jacks	2.52
Lehi	4.17
Uku	2.65
Ehu	3.98
Onaga	5.36
Opakapaka	3.95
Kalekale	3.55
Gindai	3.99
Emperor	2.90
Amberjack	2.31
All Bottomfish Species	2.99

Figure 2. Total and commercial BMUS harvest, and revenue



Interpretations: Guam's highliner fishermen have generally been responsible for the peaks in commercial BMUs landings, as was the case in 1983, 1985 and in 1994. For example, the nearly 300% increase in 1994 of the commercial BMUS harvest and revenue over the previous year's figure, is the result of highliner vessels entering (or reentering) into the fishery during that year. The 39% reduction in BMUS harvest and 56% decline in commercial harvest for 1995 are best explained by the absence or reduced effort of about six highliners who combined, have landed an average of 18% of the total BMUS harvests between 1992 and 1996, and 68% of the unexpanded commercial landings for the same period. Harvest records for these six highliners indicate a 45% reduction in 1995 of their total bottomfish harvest, dropping from 13,349 pounds in 1994, down to 6,023 pounds in 1995. This decline in highliner landings accounts for about two-thirds of the 1995 reduction in commercial BMUS harvest.

The 1996 peak and 1997 46% decline in total BMUS harvest is believed to have been influenced more by weather conditions than any other factor: there were more calm water days in 1996 than in 1997.

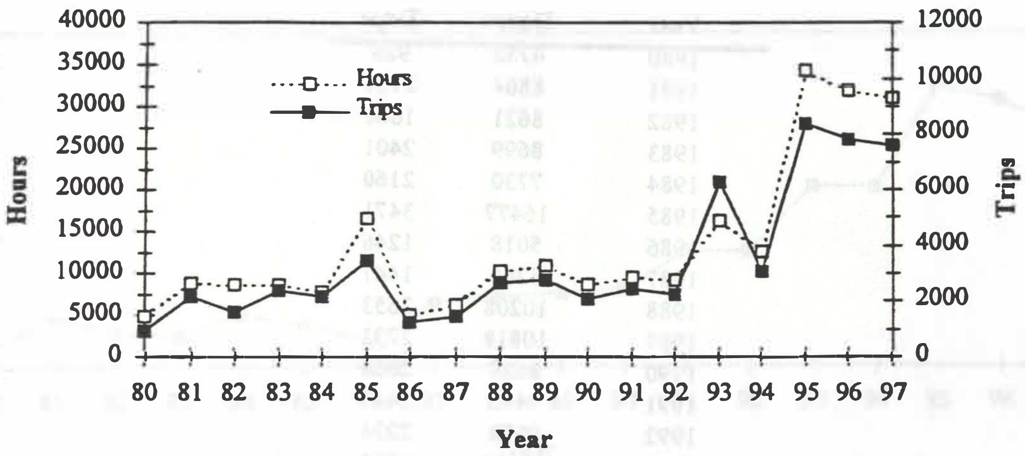
In 1996, commercial BMUS harvest and adjusted revenue dropped to its lowest point ever, owing in large part to the almost complete absence of highliner activity in the fishery. The slight increase in 1997 is attributed to one highliner fisherman who made several recorded trips to the rarely-fished "Bank A" located approximately 117 miles west of Guam.

Source: The estimated total landings are from the DAWR creel survey system, and the commercial data are from the WPacFIN-originated commercial landings system.

Calculations: The total commercial bottomfish landings and revenue for each year were calculated by summing the weight and value fields in the commercial landings data base and then multiplying by an estimated percent coverage expansion factor. This annual expansion factor was subjectively created and includes an analysis of the "disposition of catch" data available from the DAWR offshore creel survey, an evaluation of the fishermen in the fishery and their entry and exit patterns, general dock-side knowledge of the fishery, status of marketing conditions and its structure, overall number of records in the data base, and a measure of the best-educated guess.

Year	Total BMUS Harvest (lbs)	Commercial BMUS Harvest (lbs)	Unadjusted Revenue ($)	Adjusted Revenue ($)
1980	19253	9381	11458	40001
1981	42517	10459	18590	53874
1982	43428	6617	12753	35160
1983	39193	36281	65543	174606
1984	32232	20115	40176	98432
1985	68141	27064	51777	122141
1986	17969	11482	21289	48900
1987	24288	12639	23551	51789
1988	33724	15792	29568	61797
1989	39814	19442	47029	88649
1990	31295	18390	48983	80822
1991	29962	10773	30234	45260
1992	34057	10344	29410	39969
1993	48494	10125	29348	36803
1994	49169	30237	104827	112480
1995	40924	13381	44024	44861
1996	53572	6578	17492	17702
1997	29243	9342	27929	27929
Average	37626	15469	36332	65621
Std. deviation	12463	8380	22513	40121

Figure 3. Estimated boat hours and trips



Interpretations: The slight declines in boat hours and trips in 1996 and 1997 may have been the result of the almost complete absence of highliners participating in the fishery in the last two years. The almost three-fold increases in 1995 are largely the result of the nearly 60% increase in the number of boats, primarily recreational and subsistence, entering into the fishery that year, and a higher number of calm days throughout the year which enabled many of them to bottomfish more often than usual. The increase in boat trips and hours may have also been due to the establishment of the Agat Marina survey in 1994 which served to improve the estimation of the number of recreational/subsistence and charter boats bottomfishing out of this port, and the opening of boat slips at the marina that same year which enabled bottomfish charter boats to operate regularly out of this port. Interestingly, the charter boat component of the bottomfish fishery in 1996 accounted for 23% of the total number of bottomfishing trips, and 13% of the hours fished. Furthermore, the Agat Marina creel survey almost always includes several charter bottomfishing vessels making multiple trips on each survey day.

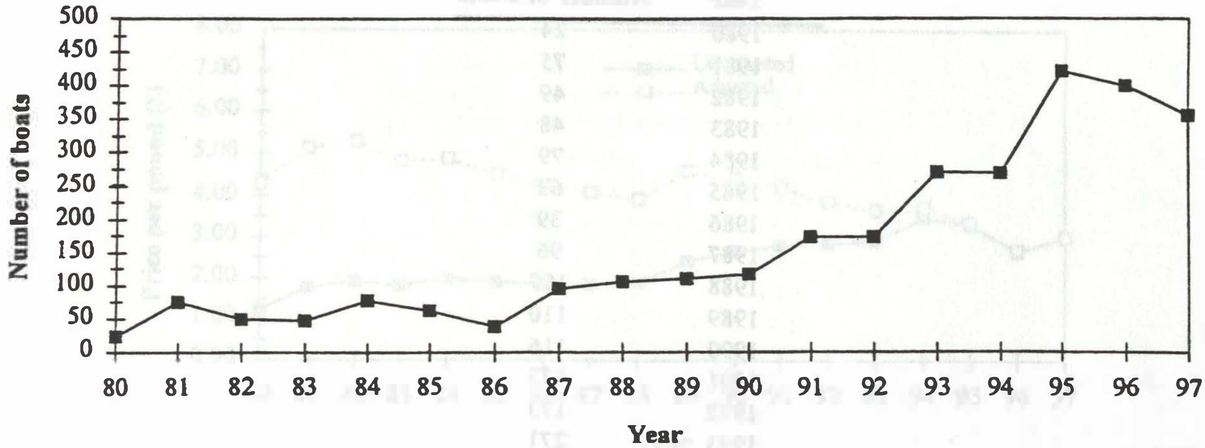
The extended periods of unusually calm seas throughout 1993 resulted in more boats bottomfishing more often and for longer periods, which best accounts for the spike in boat hours and trips recorded for that year. The apparent 1994 declines represent a return to normal weather and fishing conditions, but are still indicative of an increasing trend in the total number of boat trips and boat hours since 1986. The succession of typhoons and inclement weather that hit Guam between 1990 and 1992 may have suppressed the expected trend of a steady increase in the number of boat trips and boat hours during that period.

Source: The DAWR creel survey data for bottomfishing methods.

Calculations: The estimated number of boat trips and boat hours for bottomfishing methods are derived directly from the creel survey expansion algorithms.

Year	Hours	Trips
1980	4752	929
1981	8804	2150
1982	8621	1606
1983	8699	2401
1984	7730	2160
1985	16477	3471
1986	5018	1246
1987	6264	1447
1988	10208	2653
1989	10818	2732
1990	8628	2060
1991	9440	2444
1992	9072	2234
1993	16238	6265
1994	12512	3056
1995	34233	8399
1996	31874	7790
1997	31118	7604
Average	13361	3369
Std. deviation	9317	2391

Figure 4. Guam bottomfish fishery participation



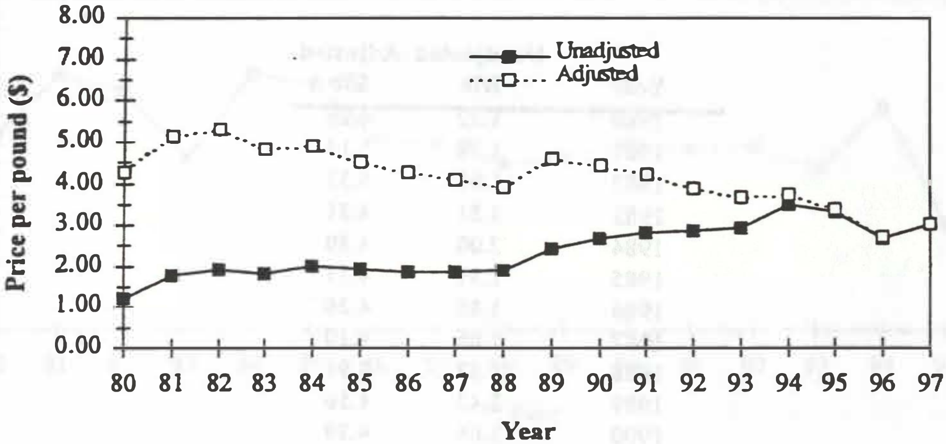
Interpretations: Over the last several years the number of boats participating in this fishery has increased steadily and continues to grow. The approximately 57% increase between 1992 and 1994 is believed to be the result of an improvement in the sampling effort with the inclusion of the Merizo Pier as a survey site in 1991, and a healthy economy that made it possible for more residents to afford boats. Another 57% increase occurred in 1995 due to another improvement in sampling effort with the inclusion of the Agat Marina as an offshore creel survey site in October, 1994. In general, most of the newcomers in the last five years are believed to be recreational and subsistence-type vessels who bottomfish only part-time and primarily target the shallow-water bottomfish complex.

Source: DAWR offshore creel survey boat log data from Agana Boat Basin, Agat Marina and Merizo Pier boat launch sites. The data was converted and processed using the WPacFIN-generated boat estimator model.

Calculations: The 1997 figure was obtained by first running the above-mentioned model 1,000 times using a randomly selected order of the days sampled at all three ports combined, then eliminating the upper and lower 25 estimates to rid the model of occasional outlier estimates; and finally calculating the mean and standard deviation for the remaining 950 estimates. The removal the outliers conducted in the second step lowered the original estimated number of boats after the model was run 1,000 times by about 1%, but more importantly, reduced the standard deviation by approximately 20%. Previous year's estimates were calculated using a similar conservative threshold C/E model which was run a minimum of 15 times per year.

Year	Number of Boats
1980	24
1981	75
1982	49
1983	48
1984	79
1985	63
1986	39
1987	96
1988	107
1989	110
1990	116
1991	173
1992	173
1993	271
1994	268
1995	422
1996	400
1997	354
Average	159
Std. deviation	129

Figure 5. Average bottomfish prices



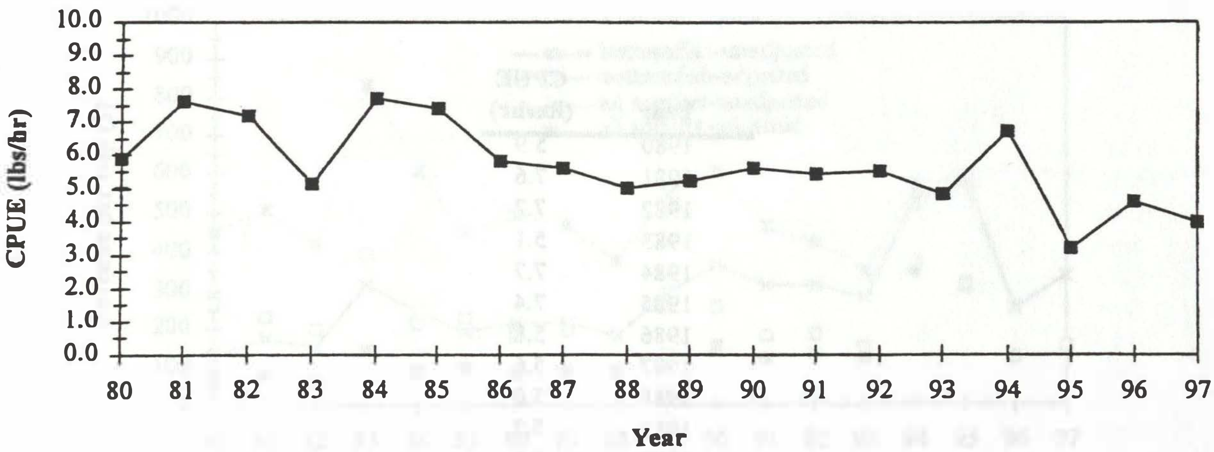
Interpretations: The adjusted average price for bottomfish has decreased only slightly over the years. This is believed to be the result a consistent supply of reasonably-priced fish and competition among vendors. In addition, imported fish from other islands around the region effectively discourage local vendors from increasing the price of locally-caught bottomfish. The 1996 inflation-adjusted average bottomfish price of $2.66 is the lowest ever recorded and may explain why local highliners were almost completely absent from the fishery in the last couple of years. The average price increased slightly in 1997 to $2.99 per pound.

Source: The commercial landings data from the major wholesalers.

Calculations: The average price of all bottomfish species combined is calculated by dividing the total bottomfish revenue by the sold weight. The inflation adjustment is made by using the Consumer Price Index (CPI) for Guam and establishing the 1997 figure as the base from which to calculate expansion factors for all previous years (e.g. divide the 1997 CPI by the CPI for any given year), and then multiplying the unadjusted average price by this factor to obtain the adjusted average price for the given year. A new "market basket" was created by the Department of Commerce in 1997 which resulted in the CPI figure being reset this year.

Year	Unadjusted $/lb	Adjusted $/lb
1980	1.22	4.26
1981	1.78	5.15
1982	1.93	5.31
1983	1.81	4.81
1984	2.00	4.89
1985	1.91	4.51
1986	1.85	4.26
1987	1.86	4.10
1988	1.87	3.91
1989	2.42	4.56
1990	2.66	4.39
1991	2.81	4.20
1992	2.84	3.86
1993	2.90	3.63
1994	3.47	3.72
1995	3.29	3.35
1996	2.66	2.69
1997	2.99	2.99
Average	2.35	4.14
Std. deviation	0.62	0.70

Figure 6. Guam Bottomfish CPUE



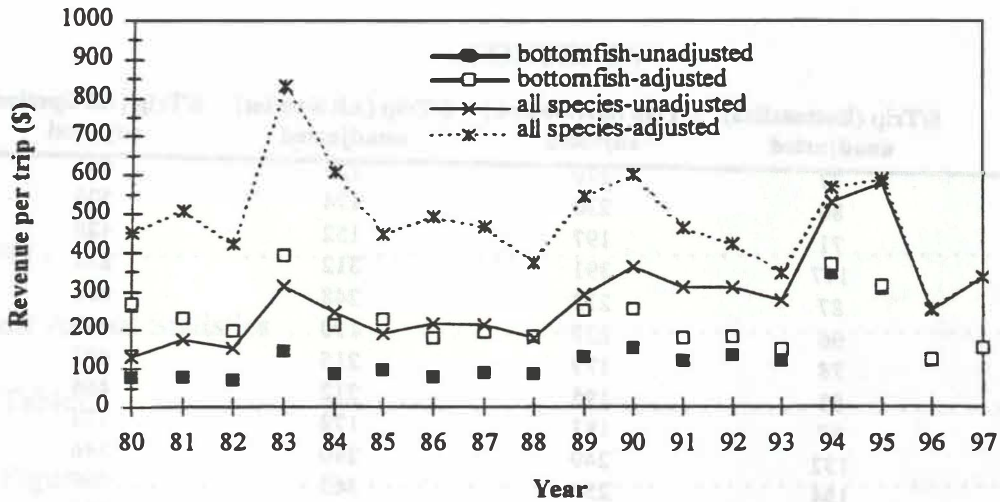
Interpretations: Historically, the annual CPUE has fluctuated around 5 to 8 pounds per hour and has up until the last four years remained fairly stable. In 1995 the CPUE fell to an all-time low of 3.2 pounds per hour, owing in large part to an increasing number of recreational and subsistence-type vessels continuing to enter into the fishery; most of which target the less-productive shallow-water complex of bottomfish. This 1995 CPUE figure was less than half of the aggregate CPUE average of 6.9 pounds per hour for the first three years of data collection on Guam, indicating cause for concern. In 1996 however, the CPUE improved to 4.6 pounds per hour, thereby canceling this indicator of fishery stress. The CPUE decreased to 4.0 pounds per hour in 1997.

Source: The DAWR creel survey data for the bottom fishing method.

Calculations: The yearly catch-per-unit-effort (CPUE) is calculated by using the year-end survey totals and dividing the total weight of bottomfish landed by the total number of hours spent bottomfishing.

Year	CPUE (lbs/hr)
1980	5.9
1981	7.6
1982	7.2
1983	5.1
1984	7.7
1985	7.4
1986	5.8
1987	5.6
1988	5.0
1989	5.2
1990	5.6
1991	5.4
1992	5.5
1993	4.8
1994	6.7
1995	3.2
1996	4.6
1997	4.0
Average	5.7
Std. deviation	1.2

Figure 7. Guam average revenue per trip



Interpretations: The inflation-adjusted average revenue per trip for both the "bottomfish" and "all species" categories fell dramatically in 1996 and was likely due to fewer highliners participating in the fishery. Furthermore, some of the more experienced fishermen who use to sell their catch to vendors participating in the DAWR commercial receipt book program, may have chosen instead to market their catch on their own, or sold their catch to vendors who were not part of the commercial receipt book program. The increase in the amount of imported bottomfish from around Micronesia (Belau, Chuuk, Pohnpei, etc.) that began sometime around 1991 with the addition of frequent airline routes to Guam, may explain the slight decrease in revenues between 1991 and 1993. The substantial increases in the inflation-adjusted average revenue per trip in 1994 are best explained by the success of a few highliner vessels during that year. The 1995 increase in revenue for the "all species" category and the decrease in revenue for the "bottomfish" category, indicates that most commercial fishermen on average continue to make more money from their trolling efforts than from bottomfishing.

Source: The commercial landings data from major wholesalers.

Calculations: The average revenue per trip for all species is calculated by summing the revenue of all species sold for any trip which landed bottomfish species, and dividing by the number of trips. The average bottomfish revenue per trips is calculated from those same trips by summing the sales of only bottomfish species and dividing by the number of trips.

Year	$/Trip (Bottomfish) unadjusted	$/Trip (Bottomfish) adjusted	$/Trip (All Species) unadjusted	$/Trip (All Species) adjusted
1980	77	270	129	451
1981	80	230	174	506
1982	71	197	152	420
1983	147	391	312	831
1984	87	213	248	608
1985	96	227	190	448
1986	78	179	215	493
1987	88	195	212	466
1988	87	183	178	373
1989	132	249	290	546
1990	154	254	363	599
1991	120	179	308	462
1992	134	183	311	423
1993	118	148	277	347
1994	346	371	528	567
1995	307	313	578	589
1996	121	123	250	253
1997	152	152	337	337
Average	133	225	281	484
Std. deviation	76	73	120	130

<u>Appendix 3</u>

Hawaii

CONTENTS

Summary

None of the five BMUS species for which SPR values can be calculated have 1997 SPR values below the 20% critical theshold that defines recruitment overfishing under the FMP. Estimates range from a low of 25% for onaga to a high of 53% for uku when viewed on an archipelago-wide basis. Implementation of the state bottomfish management plan (which became law in June 1998) should bring an improvement to the locally depleted status of ehu and onaga in the MHI and thereby increase the archipelago-wide SPR estimates for these species.

The MHI bottomfish fishery, though showing signs of stress, has remained relatively stable over the last few years. Landings decreased in 1997 as compared to 1996 as did effort resulting in the lowest CPUE on record for the MHI. Stocks of many of the BMUS species in this zone show clear signs of stress. Each of the BMUS species evaluated has a yellow light condition due to a drop in CPUE below 50% of original values. In addition, onaga, ehu, and hapuupuu stocks are severely depleted on a local basis as the MHI SPR values for these species are at or below 20% (4%, 7%, and 19% for onaga,ehu,and hapuupuu, respectively). These SPR levels are below the critical theshold that would signify recruitment overfishing if present on a stock-wide basis and demand immediate action (state bottomfish management measures, when implemented, should meet this need).

Bottomfish resources in the NWHI remain relatively healthy. CPUE on a per trip basis is 55% of the original level in the Mau Zone (up 17% from the 1996 level) and 68% in the Hoomalu zone. On a per day basis CPUE values are up 44% in the Mau zone and 2% in the Hoomalu. Analysis of SPR and percent immature in the catch show no localized depletion problems to date for any BMUS species in either zone.

Armorhead stocks outside of the US EEZ experienced a short pulse in recruitment in 1992 which did not carry over into 1993. The 1993 SPR values at Southeast Hancock Seamount are the highest recorded since 1986, but at 2.5%, they still indicate a collapsed fishery. Data for Hancock Seamount has not been available since 1994, but is available for areas outside of the US EEZ for years through 1996 (1997 values are not yet available). SPR values obtained at Colahan Seamount have been shown to correlate well with values from Hancock Seamount and can be used as a proxy value. The 1996 SPR for Colahan Seamount was 1.2%, indicating a collapsed fishery.

Historical Annual Statistics
Main Hawaiian Islands

Year	Total Landings (lbs)	CPUE (lbs/trip)	Inflation Adjusted Revenue	Price per Pound	Number of Vessels	SPR Average
1986	810000	274	$3,175,000	NA	538	33
1987	784000	237	$3,454,000	$4.40	535	25
1988	1164000	329	$4,571,000	$3.91	572	37
1989	1006000	361	$4,141,000	$4.11	537	40
1990	646000	245	$2,811,000	$4.31	501	27
1991	548000	202	$1,981,000	$3.52	469	24
1992	587000	228	$2,034,000	$3.46	407	25
1993	462000	213	$1,644,000	$3.55	403	24
1994	536000	217	$1,873,000	$3.44	423	24
1995	440000	193	$1,848,000	$3.26	400	22
1996	440000	172	$1,540,000	$3.66	466	21
1997	403000	146	NA	NA	368	18
Ave.	652167	235	$2,642,909	$3.76	468	27
s.d.	242406	62	$1,057,299	$0.40	68	7

Historical Annual Statistics Mau Zone						
Year	Total Landings (lbs)	CPUE (lbs/trip)	Inflation Adjusted Revenue	Price per Pound	Number of Vessels	SPR Average
1986	NA	2206	NA	NA	NA	41
1987	NA	2889	NA	NA	NA	50
1988	NA	2136	NA	NA	4	37
1989	118000	5412	$418,000	$3.53	5	91
1990	249000	4454	$791,000	$3.17	14	77
1991	103000	2413	$348,000	$3.37	14	42
1992	71000	2092	$232,000	$3.26	8	38
1993	98000	1992	$287,000	$2.92	8	36
1994	160000	3748	$501,000	$3.12	12	68
1995	166000	2460	$474,000	$2.86	10	45
1996	135000	2823	$417,000	$3.09	13	53
1997	105000	3324	NA	NA	9	62
Ave.	133889	2996	$433,500	$3.17	10	53
s.d.	52736	1066	$170,667	$0.22	4	18

Historical Annual Statistics
Hoomalu Zone

Year	Total Landings (lbs)	CPUE (lbs/trip)	Inflation Adjusted Revenue	Price per Pound	Number of Vessels	SPR Average
1986	NA	5301	NA	NA	NA	75
1987	NA	8187	NA	NA	NA	113
1988	NA	4702	NA	NA	12	66
1989	184000	5328	$594,000	$3.22	5	70
1990	173000	4793	$545,000	$3.14	5	64
1991	283000	5928	$854,000	$3.02	4	82
1992	353000	7388	$1,138,000	$3.22	5	98
1993	287000	8040	$920,000	$3.20	4	109
1994	283000	4651	$929,000	$3.28	5	64
1995	202000	5544	$606,000	$3.00	5	73
1996	176000	5870	$576,000	$3.27	3	78
1997	241000	5234	NA	NA	6	65
Ave.	242444	5914	$770,250	$3.17	5	80
s.d.	63036	1261	$219,217	$0.11	2	17

Tables

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Figures

Figures (cont.)

Introduction

The commercial bottomfish stocks in the Hawaiian Islands are divided into two fisheries: seamount groundfish and deep-slope bottomfish. The seamount fishery targets alfonsin, *Beryx* spp., and armorhead, *Pseudopentaceros wheeleri.* The only area in the US EEZ for this fishery is Southeast Hancock Seamount located 1,400 nm northwest of Honolulu. This trawl fishery was started by the Russians and Japanese in the late 1960s and large catches were made for about 10 years until they caused a crash in the fishery. This fishery has never been domestically harvested. A moratorium on fishing within the US EEZ began in 1986 and continues through the present as no substantial recovery in the fishery has been observed.

The deep-slope bottomfish fishery in Hawaii concentrates on species of eteline snappers, carangids, and a single species of grouper concentrated at depths of 30-150 fathoms. These fish have been fished on a subsistence basis since ancient times and commercially for at least 90 years. The deep-slope fishing grounds within the US EEZ are divided into three management zones. The inhabited main Hawaiian Islands (MHI) support numerous subsistence, recreational, and commercial fishermen with considerable overlap by category. The uninhabited Northwestern Hawaiian Islands (NWHI) are divided into the Mau Zone, closer to the MHI, and the Hoomalu Zone. Fishing in these zones is conducted solely by commercial fishermen and requires federal licensing for such activities. The Hoomalu Zone is a limited entry zone with 6 vessels participating in 1997; 9 vessels fished the Mau Zone in the same year.

Vessel size varies considerably with larger fully commercial vessels (30 ft in length and over) conducting trips of about 10 days, and smaller vessels (<30 ft) generally restricted to the MHI and trips of 1-3 days. Most vessels in this fishery are fully outfitted with electronic navigation and fish-finding equipment, as well as with electric or hydraulic line-hauling equipment. The catch is sold fresh in the round for local consumption.

Catch and revenue data for bottomfish have been collected by the State of Hawaii Division of Aquatic Resources (HDAR) since 1948 in the form of a report submitted by commercial fishermen. No data is collected for recreational or subsistence fishermen, but their catch is estimated to be about equal to the commercial catch in the MHI. Data obtained from a market monitoring program and data from fishermen interviews are combined with the HDAR data set for most of the analysis presented in this report.

Recommendations

1) The BPT reiterates its concerned regarding the condition of MHI onaga, ehu, and hapuupuu. The Team commends DLNR, and Walter Ikehara in particular, for their hard work and persistence in developing a comprehensive state plan to manage MHI bottomfish. The Team recommends that the Council continue to support the state plan.

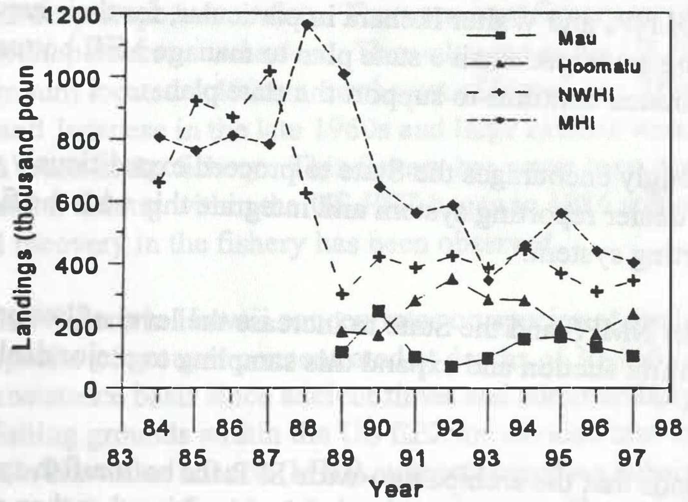
2) Again, the BPT strongly encourages the State to proceed expeditiously with computerization of the fish and seafood dealer reporting system and integrate this with the fishermen's commercial catch reporting system.

3) The BPT encourages NMFS and the State to increase the level of bottomfish catch monitoring of the Honolulu auction and expand this sampling to major dealers on all other main Hawaiian Islands.

4) The BPT recommends that the archipelago-wide SPR for bottomfish species included in this report be used to determine the overfished status of the species rather than any of the SPR values given by fishing zone, MHI, Mau, or Hoomalu. Considering the direction of initial genetic results and the simulated larval distribution studies, the Team believes that there are single archipelago-wide stocks of each species and that SPR values for smaller areas indicate local depletion, not overfishing of the stock. We realize that local depletion is not a good practice and that management measures should be taken to correct the situation, but feel that in the case of the MHI, that the state management plan is a large step in the correct direction and that noticable improvement will be forthcoming.

5) The BPT recommends that the Council request that the Secretary remove onaga, ehu and hapuupuu from the "overfished" category based on the archipelago-wide SPR values presented in this report.

Figure 1. Hawaii's bottomfish landings from the NWHI and MHI



	Landings (1000 lb)			
Year	Mau	Hoomalu	Total NWHI	MHI[2]
1984	NA	NA	661	807
1985	NA	NA	922	763
1986	NA	NA	869	810
1987	NA	NA	1015	783
1988	NA	NA	625	1164
1989	118	184	303	1006
1990	249	173	421	646
1991[1]	103	283	387	548
1992[1]	71	353	424	587
1993[1]	98	287	385	348
1994[1]	160	283	443	458
1995[1]	166	202	369	440
1996[1]	135	176	311	440
1997[1]	105	241	346	403[3]
mean	133.89	242.44	534.36	657.36
s.d.	52.74	63.04	241.97	242.19

[1] NWHI data from combination NMFS and HDAR

[2] Data from HDAR

[3] Preliminary data expanded for full year estimate

Source: Data are primarily from HDAR and supplemented with data from NMFS market monitoring program. Data are only those from BMUS and other bottomfish species. Pelagic species data were not included.

Calculation & Adjustment: The HDAR integrated data set was supplemented with a very limited amount of NMFS market monitoring data. The HDAR integrated data set captures the Kauai-based (Mau zone) segment of the NWHI fishing fleet which was previously difficult to monitor. Use of the data sets in combination provides good coverage of the acitvities of the NWHI bottomfish fleet. It also provides opportunities for the cross-checking of trip and landing information.

Data in this report are only from those trips that were directed at bottomfish species or in which bottomfish gear was used. Trolling only trips to the NWHI are not included.

Data for the MHI landings are from the HDAR C3 commercial catch report only. They are not screened by gear or other factors and not expanded to include any estimate of recreational or subsistance catch.

Comments & Interpretation: NWHI landings data shows an overall increase over 1996. The increase was mainly due to the Hoomalu zone activity. Although Hoomalu landings (Fig. 2) remained nearly stable on a per trip basis the number of participants (Fig. 5) and trips (Fig. 4) did increase. The Mau zone landings on a per trip basis showed a minimal increase but had a large decrease in number of trips taken and of participating vessels.

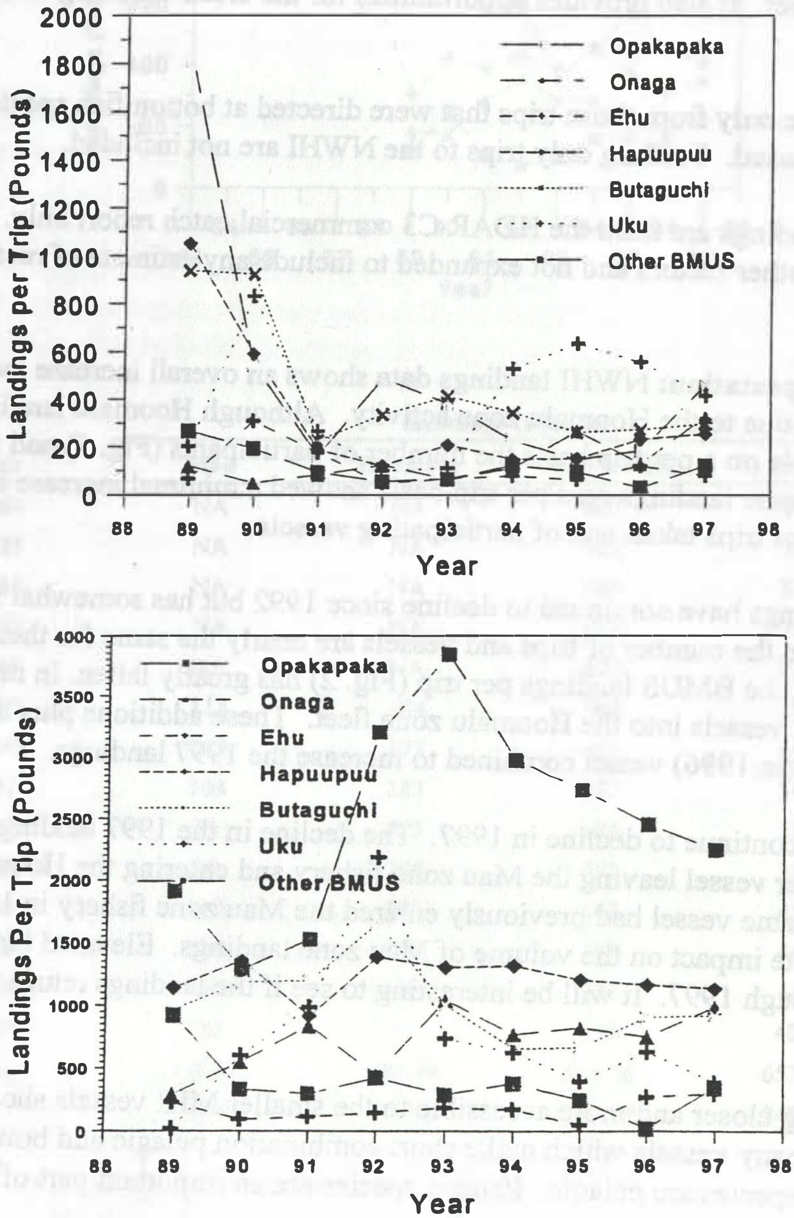
Hoomalu zone landings have continued to decline since 1992 but has somewhat rebounded in 1997. In comparison the number of trips and vessels are nearly the same for these two years (1992 and 1997) but the BMUS landings per trip (Fig. 2) has greatly fallen. In mid-1997 there was an addition of 2 vessels into the Hoomalu zone fleet. These additions plus the participation of a previously idle (in 1996) vessel combined to increase the 1997 landings.

Mau zone landings continue to decline in 1997. The decline in the 1997 landings is partially related to a highliner vessel leaving the Mau zone fishery and entering the Hoomalu zone fishery late in 1997. This same vessel had previously entered the Mau zone fishery in 1994 whereupon it made an immediate impact on the volume of Mau zone landings. Elevated landings in the Mau zone continued through 1997. It will be interesting to see if the landings return to 1993 levels in 1998.

The Mau zone being closer and more accessible to the smaller MHI vessels shows its versatility and varied use by many vessels which make short combination pelagic and bottomfish trips in which the targeted species are pelagic. Pelagic species are an important part of the landings for many vessels.

Main Hawaiian Island landings are based on about 10 months data and expanded out to estimate a total annual landings. The 1997 value continues a downward trend in total landings with only 1993 at a lower value. 1997 also showed declines in CPUE and effort for the MHI indicating declining bottomfish resources and fishermen leaving the fishery (either stopping fishing or participating in other more attractive fisheries, e.g., trolling or longlining).

Figure 2. Northwestern Hawaiian Islands BMUS species composition of landings per trip, by weight, for the Mau and Hoomalu Zones



NWHI BMUS average pounds per trip by species, Mau Zone

Species	1989	1990	1991[1]	1992[1]	1993[1]	1994[1]	1995[1]	1996[2]	1997[2]
Opakapaka	1820	541	163	488	382	229	149	187	465
Onaga	120	49	83	124	66	114	270	132	331
Ehu	65	309	176	48	69	81	65	123	82
Hapuupuu	1050	590	189	121	210	150	153	235	257
Butaguchi	938	923	228	336	415	346	264	276	300
Uku	202	830	266	100	112	529	635	558	417
Other BMUS	268	193	94	56	67	124	99	32	124
Total per trip	4463	3435	1199	1273	1321	1573	1635	1543	1976

[1] Data from combination of NMFS and HDAR data sets.
[2] Data from HDAR data set.

NWHI BMUS average pounds per trip by species, Hoomalu Zone

Species	1989	1990	1991[1]	1992[1]	1993[1]	1994[1]	1995[1]	1996[2]	1997[2]
Opakapaka	1910	1284	1530	3208	3849	2984	2741	2426	2258
Onaga	293	550	837	450	1042	771	825	752	993
Ehu	231	94	113	148	185	172	47	272	298
Hapuupuu	1138	1357	913	1386	1305	1318	1206	1166	1141
Butaguchi	969	1185	1196	1660	1004	655	665	909	923
Uku	20	600	985	2187	736	623	397	632	387
Other BMUS	920	333	297	425	291	380	249	21	351
Total per trip	5481	5403	5871	9464	8412	6903	6130	6216	6351

[1] Data from combination of NMFS and HDAR data sets.
[2] Data from HDAR data set.

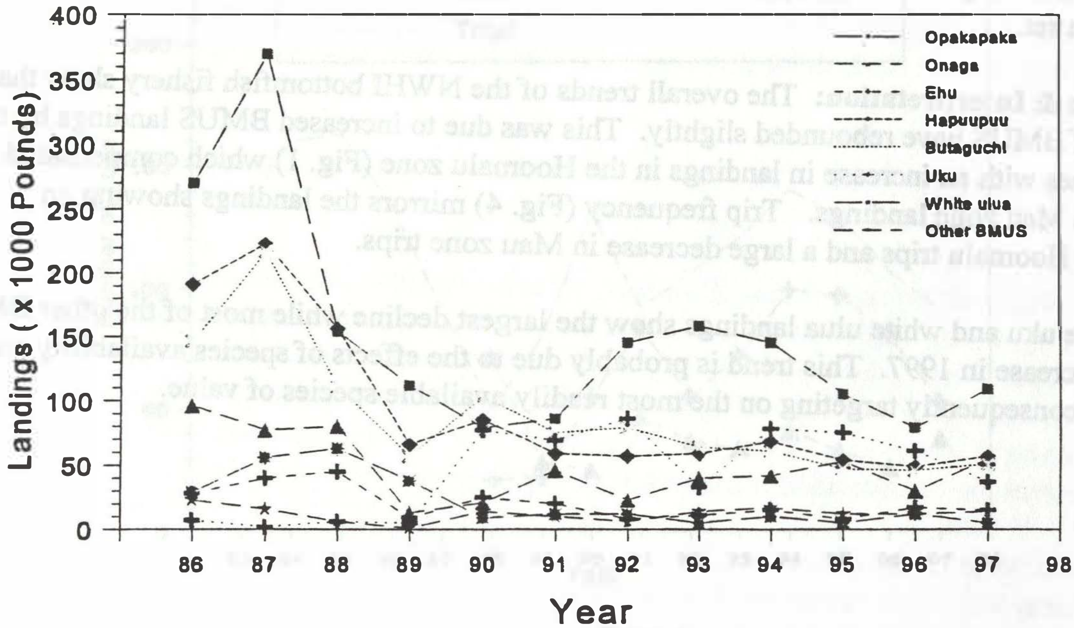
Source: The 1997 data are primarily from HDAR and supplemented with data from NMFS market monitoring program. Data are only those from BMUS and other bottomfish species. Pelagic species data were not included.

Calculation & Adjustment: The HDAR integrated data set was supplemented with a very limited amount of NMFS market monitoring data. The BMUS data were totaled by zone and divided by the number of trips to each zone.

Comments & Interpretations: Mau zone BMUS landings per trip has increased in 1997. Mau zone per trip landings of BMUS species has risen to its highest levels in 7 years. Onaga and opakapaka landings have risen to new highs. The 1995 high level of onaga landings have been surpassed while opakapaka landings have also climbed to levels not seen since 1992. The decrease in the 1996 onaga landings (fishermen avoidance) due to a physiological "tuna burn like" condition of many of the larger (>20 pounds) onaga seems to have subsided. Ehu and uku landings have had a decrease due to the targeting on onaga and opakapaka.

Hoomalu zone per trip landings have increased slightly in 1997. The cyclical landings exhibited by uku have taken the largest loss in volume. The largest gain in volume was in the Other BMUS category. There were 6 vessels that fished in the Hoomalu zone in 1996. Two of the vessels were new entrants who made their entry mid-year with another vessel fishing on a part-time basis. Although there were changes to the structure of the fleet the BMUS catch per trip has remained nearly the same for the last 3 years.

Figure 3. NWHI BMUS species composition of landings by weight



Data table for Figure 3 (in thousands of pounds)

Species	1987	1988	1989	1990	1991[1]	1992[1]	1993[1]	1994[1]	1995[1]	1996[2]	1997[2]
Opakapaka	370	154	112	79	86	145	158	145	105	79	109
Onaga	77	80	13	21	46	23	40	42	53	30	55
Ehu	40	45	9	25	20	8	11	15	8	17	15
Hapuupuu	223	156	66	85	59	57	59	68	54	49	57
Butaguchi	217	111	57	103	75	79	64	61	47	46	51
Uku	2	6	5	77	69	86	33	78	75	61	37
White ulua	56	63	38	9	12	12	5	10	5	12	5
Other BMUS	16	6	1	14	10	6	14	17	12	12	14

[1] Data from a combination of NMFS and HDAR data.
[2] Data from HDAR data set.

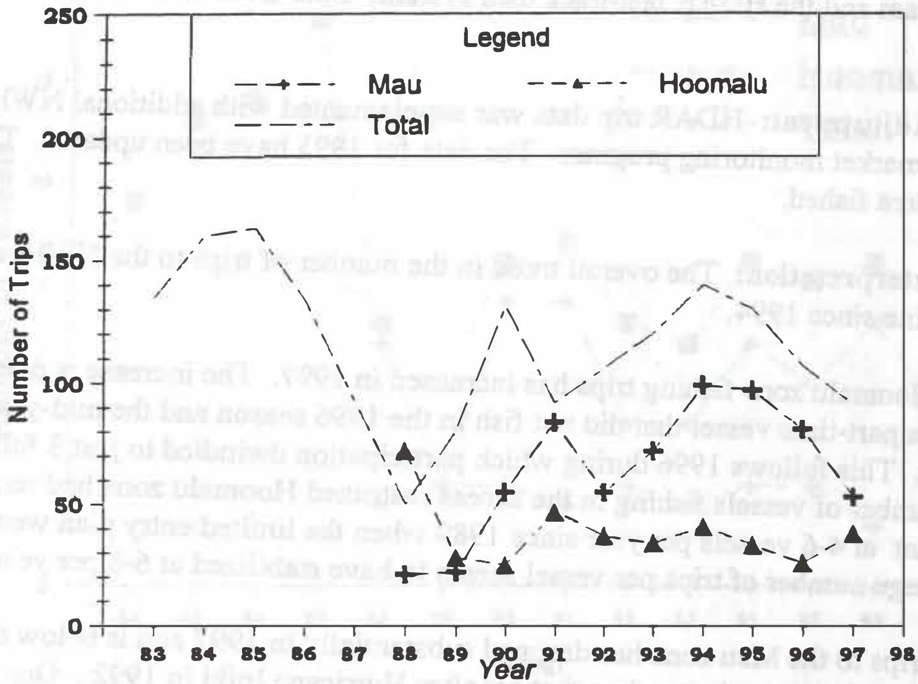
Source: Data for 1997 is mainly from the HDAR integrated data set. Data for 1991-1995 are from a combination of HDAR and NMFS market monitoring program. Data from 1987-1990 are expanded NMFS estimates.

Calculation & Adjustment: HDAR data was supplemented with little additional data from the NMFS data set.

Comments & Interpretation: The overall trends of the NWHI bottomfish fishery show that landings of BMUS have rebounded slightly. This was due to increased BMUS landings by trip in both zones with an increase in landings in the Hoomalu zone (Fig. 1) which compensated for a decrease in Mau zone landings. Trip frequency (Fig. 4) mirrors the landings showing an increase in Hoomalu trips and a large decrease in Mau zone trips.

Overall, the uku and white ulua landings show the largest decline while most of the other BMUS show an increase in 1997. This trend is probably due to the effects of species availability and the fishermen consequently targeting on the most readily available species of value.

Figure 4. Number of trips made by NWHI bottomfish fleet, Mau and Hoomalu Zones



	Trips		
Year	**Mau**	**Hoomalu**	**Total**
1984	NA	NA	135
1985	NA	NA	160
1986	NA	NA	163
1987	NA	NA	134
1988	21	72	93
1989	22	28	50
1990	55	25	80
1991[1]	84	47	131
1992[1]	55	37	92
1993[1]	72	34	106
1994[1]	99	41	140
1995[1]	97	33	130
1996[2]	81	26	107
1997[2]	53	38	91
mean	63.90	38.10	115.14
s.d.	27.81	13.75	32.08

[1] Based on combined NMFS and HDAR data.
[2] Based on HDAR data.

Source: Data for 1997 was primarily from HDAR supplemented with NMFS data on an as needed basis. Data for 1991-1995 are from a combination of HDAR and NMFS market monitoring program and the HDAR fast-track data system. Data from 1986-1990 are NMFS estimates.

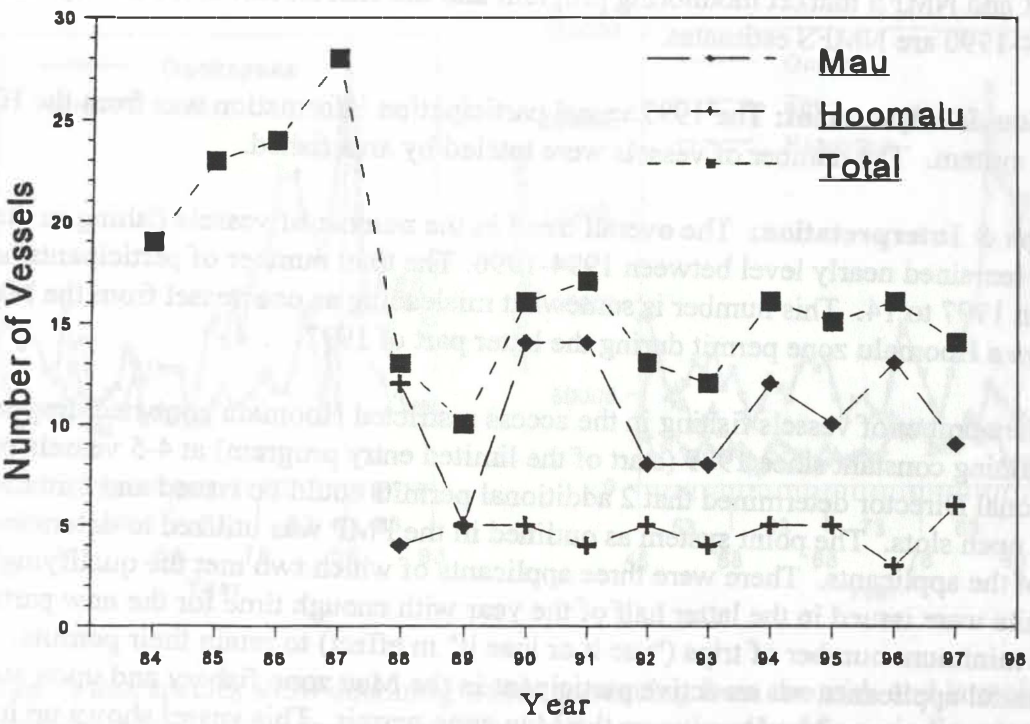
Calculation & Adjustment: HDAR trip data was supplemented with additional NWHI trips from the NMFS market monitoring program. The data for 1995 have been updated. The trips were totaled by area fished.

Comments & Interpretation: The overall trend in the number of trips to the NWHI areas has been one of decline since 1994.

The number of Hoomalu zone fishing trips has increased in 1997. The increase is due to participation by a part-time vessel that did not fish in the 1996 season and the mid-year addition of 2 new vessels. This follows 1996 during which participation dwindled to just 3 full time vessels. The number of vessels fishing in the access restricted Hoomalu zone had remained relatively constant at 4-6 vessels per year since 1989 when the limited entry plan went into effect. The average number of trips per vessel seems to have stabilized at 6-8 per year.

The number of trips to the Mau zone has dropped substantially in 1997 and is below those of the 1990-1996 seasons. It is even lower than that set after Hurricane Iniki in 1992 . One of the contributing factors to this decline may not be one of the bottomfish stock depletion or low prices but one of species availability. In 1997 Kauai experienced an excellent run of yellowfin tuna which probably affected the fishing strategies of many of the Kauai based NWHI fishermen. Historically many Kauai fishermen target the large tunas during the summer months and forgo bottomfishing altogether during this time of the year. Consequently they may not be forced to fish the distant Mau zone during the rough seas of winter.

Figure 5. Number of vessels in the NWHI bottomfish fleet, Mau and Hoomalu Zones



Year	Boats Mau	Hoomalu	Total[2]
1984	NA	NA	19
1985	NA	NA	23
1986	NA	NA	24
1987	NA	NA	28
1988	4	12	13
1989	5	5	10
1990	14	5	16
1991[1]	14	4	17
1992[1]	8	5	13
1993[1]	8	4	12
1994[1]	12	5	16
1995[1]	10	5	15
1996[3]	13	3	16
1997[3]	9	6	15
mean	9.70	5.40	16.93
s.d.	3.56	2.46	5.01

[1] Based on a combination NMFS and HDAR data set.
[2] Total may not match sum of areas due to vessel participation in multiple areas.
[3] Based on HDAR data.

Source: Data for 1997 was primarily from HDAR. Data for 1991-1995 are from a combination of HDAR and NMFS market monitoring program and the HDAR fast-track data system. Data from 1984-1990 are NMFS estimates.

Calculation & Adjustment: The 1997 vessel participation information was from the HDAR fast-track system. The number of vessels were totaled by area fished.

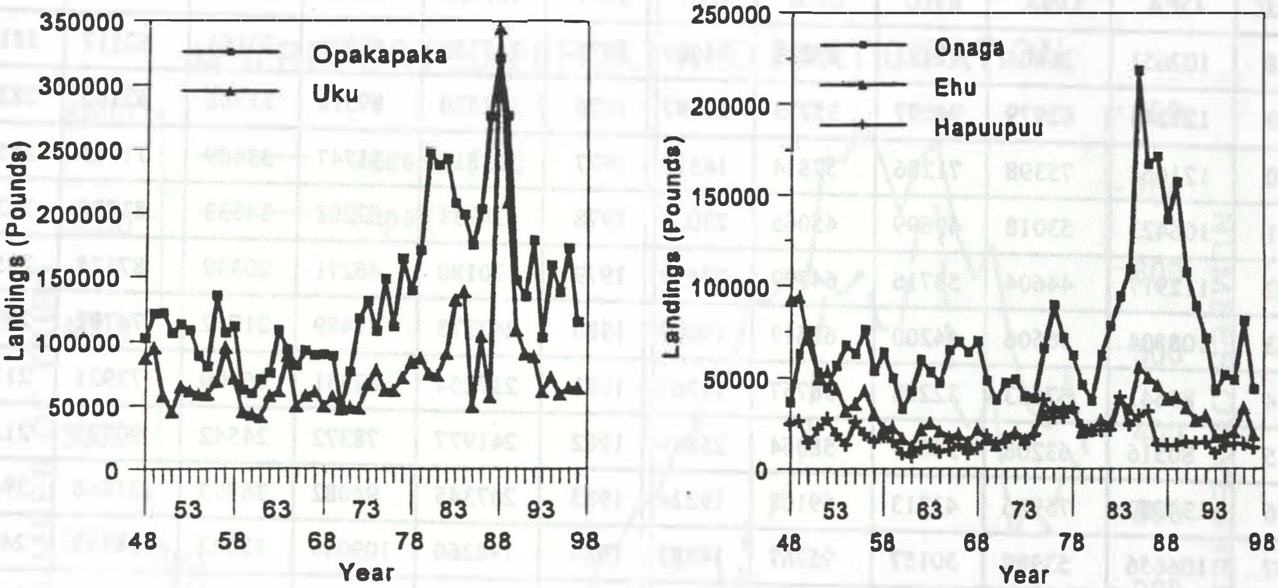
Comments & Interpretation: The overall trend in the number of vessels fishing in the NWHI areas had remained nearly level between 1994-1996. The total number of participants has dropped in 1997 to 14. This number is somewhat misleading as one vessel from the Mau zone did receive a Hoomalu zone permit during the latter part of 1997.

In 1996 the number of vessels fishing in the access restricted Hoomalu zone had dropped to 3 after remaining constant since 1989 (start of the limited entry program) at 4-5 vessels per year. The Regional Director determined that 2 additional permits could be issued and initiated actions to fill the open slots. The point system as outlined in the FMP was utilized to determine the ranking of the applicants. There were three applicants of which two met the qualifying criteria. The permits were issued in the latter half of the year with enough time for the new participants to make the minimum number of trips ("use it or lose it" in effect) to retain their permits. One of the successful applicants was an active participant in the Mau zone fishery and upon receiving the Hoomalu zone permit had to give up the Mau zone permit. This vessel shows up in both the Mau and Hoomalu zone vessel numbers above.

The Mau zone has always been the more dynamic zone in terms of vessel participation. The open access designation was an original feature of the NWHI Bottomfish FMP to allow vessels to accumulate the experience needed to operate in the farther reaches of the NWHI. Thus owners and operators of smaller vessels from the MHI could gain valuable experience and decide if they would like to eventually fish the upper limited access zone.

In 1996 due to fishermen's concerns for the economic situation of the Mau zone fishery the Mau Zone Task Force was formed to address the problem and suggest possible solutions. The Task Force has moved in the direction of a limited entry fishery much like the Hoomalu zone. The 1997 moratorium on additional **new** participants has essentially capped the fleet until new regulations are put in place in 1998. The moratorium itself has reduced the number of vessels from 13 in 1996 to 9 in 1997.

Figure 6. MHI species composition of landings by weight



Interpretation: Most species show declining trends continuing from the mid- and late-eighties. The prevailing interannual pattern in landings is episodic versus predictably periodic or constant. 1997 landings of ehu and onaga are well below their long-term average landings, whereas landings for the other species presented are only slightly below their long-term averages.

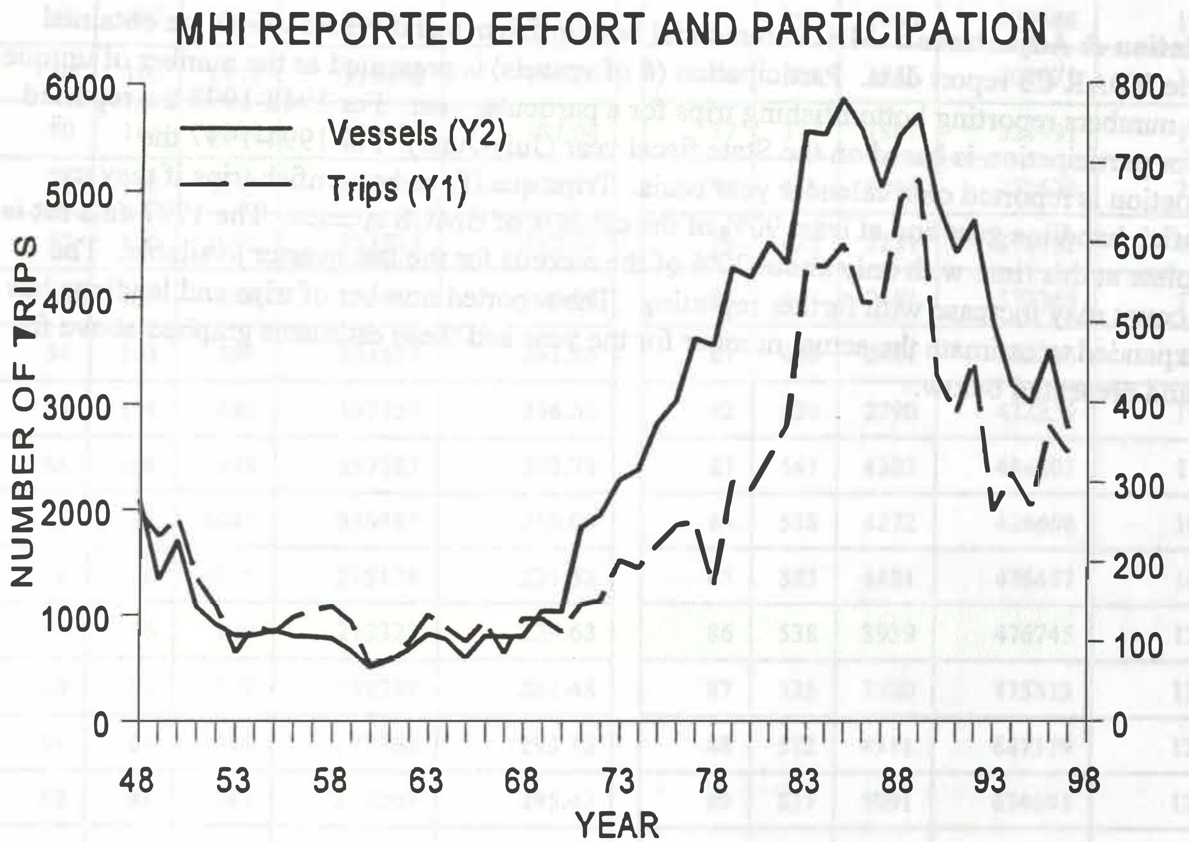
Source: Total commercial landings by species are from HDAR commercial catch report data for the MHI with no screening by gear. 1997 values are estimates of annual landings expanded from partial year reporting.

Comments: Landings presented here are commercial reported landings only and do not include any expansion for recreational landings. The values for 1997 are preliminary estimates based on incomplete 4th quarter reporting.

MHI Landings by Species

YEAR	OPA	ONA	EHU	UKU	HAP
1948	102651	36804	92323	87235	24609
1949	121243	62979	94097	95273	26397
1950	121664	75398	71286	57814	14514
1951	106423	53018	49699	45065	22000
1952	112917	44604	53716	64799	27499
1953	108504	56506	44200	61619	19009
1954	88641	67583	32278	58767	13367
1955	80516	63208	36017	58564	25849
1956	134980	75986	43313	69108	19224
1957	106656	53988	30157	95267	14782
1958	111131	63774	22309	71321	18033
1959	62043	49745	23107	44705	15294
1960	59405	33158	16950	43186	8418
1961	70083	42701	12370	41134	6642
1962	75492	59788	21742	57568	11663
1963	108505	53225	25267	61601	12865
1964	93618	47325	20914	89156	9321
1965	81039	65040	17605	49485	10297
1966	92815	69634	19342	57849	13277
1967	89364	64022	14899	60970	8480
1968	89908	69922	21984	49677	11287
1969	88621	48454	16483	57542	18300
1970	49655	37894	13364	47443	13651
1971	76388	47250	17626	48710	14746
1972	117367	49213	20347	48077	18994
1973	130785	39811	16336	66875	13878
1974	107828	38883	21015	77939	18874
1975	147755	66029	30155	62117	38140
1976	111520	89518	33788	62165	28214
1977	163813	71747	33689	71915	28540
1978	138931	62208	34333	83798	33271
1979	170180	46271	20339	87128	23538
1980	247378	37489	21712	74782	20962
1981	237254	62351	26900	73921	21178
1982	241977	78372	24542	90793	21263
1983	207345	94082	38793	131860	39447
1984	198260	109046	33022	138313	24019
1985	174746	218552	56039	49264	29055
1986	202467	167112	50259	104047	31626
1987	274929	171416	46018	56753	13232
1988	320601	136641	38547	344128	12838
1989	275167	156952	39393	208171	12954
1990	146861	107514	33848	108840	14934
1991	134326	88978	26902	90272	14216
1992	178014	71715	29461	88474	14454
1993	102514	43141	17981	60910	8593
1994	158276	51502	18000	72133	12712
1995	137473	48948	20689	59036	13819
1996	171428	80953	33925	63792	13723
1997	114452	43820	19039	63678	11506
mean	136878	71485	31922	78261	18270
s.d.	61511	38478	17816	48007	7804

Figure 7. MHI reported effort and participation



Interpretation: Reported effort and participation dropped from 1996 values and are both higher than their long-term means, but much lower than their peaks of the mid 80's. Effort dropped only 9% from the 1996 level, whereas participation dropped 21%. Some of the discrepancy may be due to late reporting by specific license holders as the number of trips conducted in 1997 was estimated by expansion to correct for missing reports in the last quarter, but the number of vessels participating was not similarly expanded since most vessels fish (and report) throughout the year, not just in the last quarter. It is also possible that as fishers leave the fishery, those who fish infrequently quit sooner causing a more rapid decline in participation compared to effort.

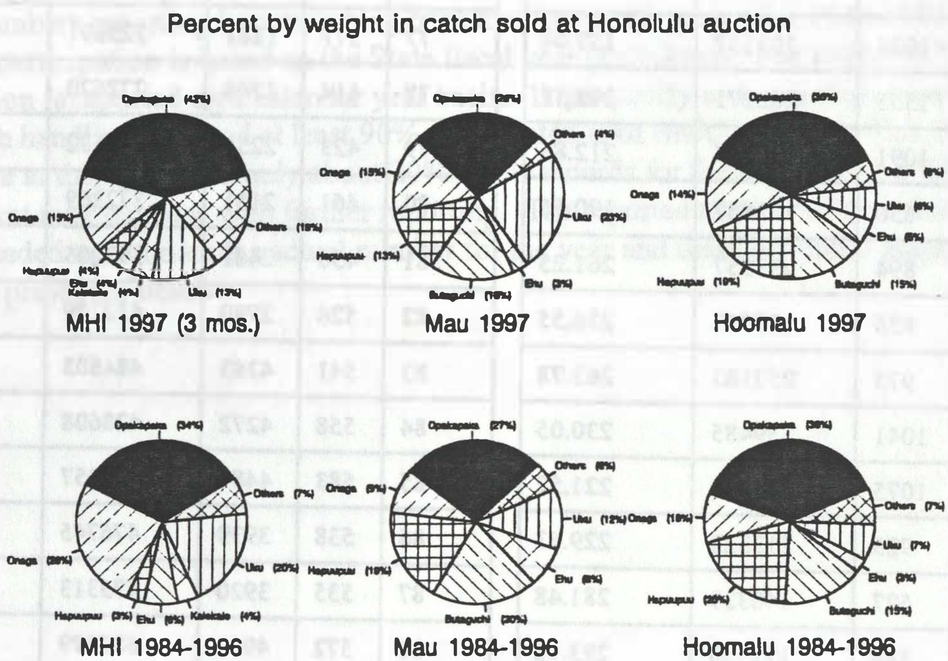
Landings and CPUE for bottomfish trips are tabulated in the following table. These figures differ from those presented in Figure 1 (landings) and Figure 15 (CPUE). Those presented here are screened for bottomfish trips only (as defined below). In Figure 1 landings are for all gears without screening criteria and in Figure 15 data are further screened by area fished and landings of individual fishers to reflect the effective fishing effort required to "standardize" CPUE. 1997 values for each are below their long-term averages, with that for CPUE being by far the lowest on record. It is always a bad sign when landings and CPUE both drop, indicative of resource depletion.

Source: HDAR commercial catch report data.

Calculation & Adjustment: MHI commercial bottomfish trip and vessel values are obtained from the HDAR C3 report data. Participation (# of vessels) is presented as the number of unique license numbers reporting bottomfishing trips for a particular year. For 1948-1993 the reported value for participation is based on the State fiscal year (July-June). For 1994-1997 the participation is reported on a calendar year basis. Trips qualify as bottomfish trips if they use bottomfish handline gear and at least 90% of the catch is of BMUS species. The 1997 data set is incomplete at this time with only about 20% of the records for the last quarter available. The vessel count may increase with further reporting. The reported number of trips and landings has been expanded to estimate the actual number for the year and these estimates graphed above for effort and presented below.

Yr	# Ves	# Trip	Tot.Lbs	Lbs/Trip
48	207	1987	323858	162.99
49	196	1751	338406	193.26
50	164	1924	302137	157.04
51	126	1355	282271	208.32
52	110	1091	232235	212.86
53	106	650	123867	190.56
54	103	894	233557	261.25
55	108	836	197757	236.55
56	106	975	257183	263.78
57	102	1041	239485	230.05
58	96	1075	238138	221.52
59	76	929	213322	229.63
60	69	527	148339	281.48
61	65	586	171768	293.12
62	98	742	219203	295.42
63	110	1001	290690	290.40
64	87	876	297039	339.09
65	85	750	237624	316.83
66	97	940	274293	291.80
67	99	641	236588	369.09
68	116	959	252305	263.09
69	130	964	232754	241.45
70	219	841	169792	201.89
71	198	1093	173001	158.28
72	185	1135	194967	171.78
73	238	1511	246341	163.03
74	241	1442	218750	151.70
75	295	1664	322986	194.10
76	306	1845	301071	163.18
77	377	1881	323991	172.24
78	414	1268	272620	215.00
79	423	2251	316132	140.44
80	461	2181	372369	170.73
81	430	2481	392205	158.08
82	526	2790	432259	154.93
83	541	4283	484603	113.15
84	558	4272	428608	100.33
85	583	4481	476457	106.33
86	538	3939	476745	121.03
87	535	3920	475313	121.25
88	572	4911	687379	139.97
89	537	5091	634691	124.67
90	501	3242	338401	104.38
91	469	2895	285046	98.46
92	407	3401	329024	96.74
93	403	1977	199023	100.67
94	423	2333	226436	97.06
95	400	2031	194828	95.93
96	466	NA	253887	91.33
97	368	NA	226306	89.49
mean	281	1939	295921	187.31
s.d.	178	1250	116040	73.60

Figure 8. Current year and historical catch composition by weight in sold catch.

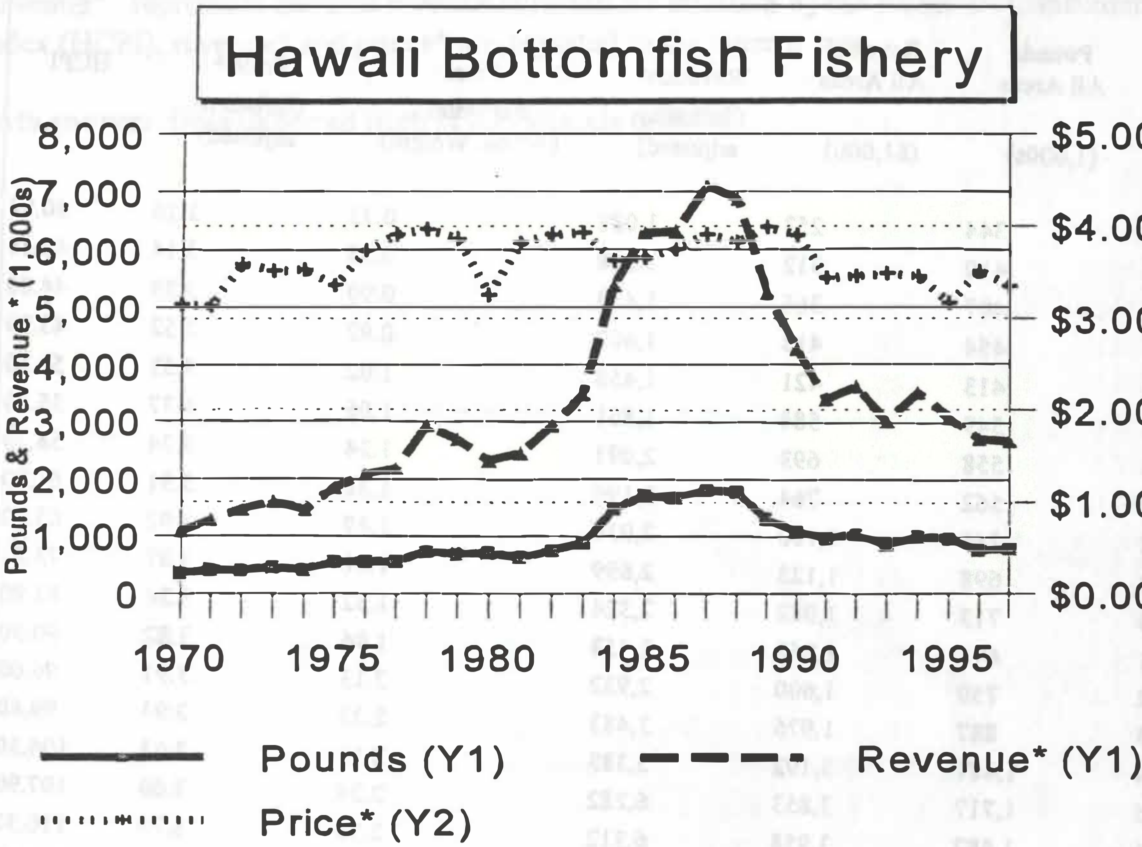


Interpretation: The 1997 pattern closely resembles the historical pattern for all zones. In 1996 the Mau zone showed opakapaka to be a smaller component of the catch than historically whereas uku was a much larger component. In 1997 both species returned to more "normal" levels.

Source: Catch composition estimated from Honolulu auction data.

Comments: Reflects only auction-sold fish, and does not include fish that are kept, given away, or sold at other locations. "Others" in the MHI include butaguchi, gindai, white ulua, lehi, and taape. "Others" in the NWHI include kalekale, gindai, white ulua, lehi, and taape.

Figure 9. Hawaii bottomfish landings, revenues, prices, 1970-97. (* Inflation-adjusted.)



Interpretation: The data show that *real* (inflation-adjusted) revenue peaked in 1987 and has declined by over 50% since then. The mid- to late- 1980s were also the peak of inflation-adjusted aggregate average prices. Previous economic research (mid-1980s) showed a considerable relationship between price and landings, but this relationship appears weaker in the 1990s, perhaps due to increased imports of bottomfish from Pacific island nations. Changes in area and species composition may also be changing the aggregate price (discussed later in the report).

Hawaii bottomfish landings, revenue, and price, 1970-present. (* Inflation-adjusted.)

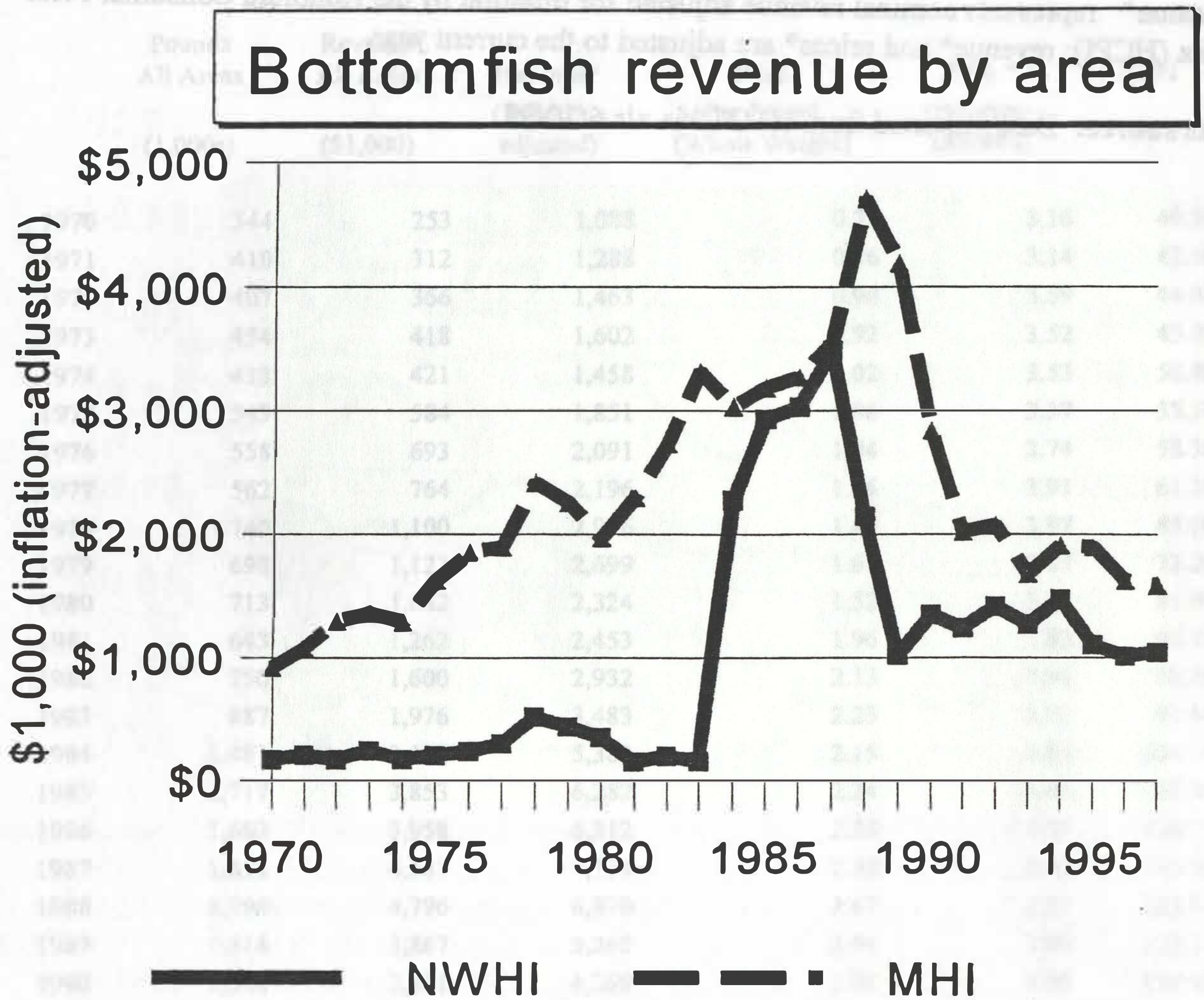
	Pounds All Areas (1,000s)	Revenue All Areas ($1,000)	Revenue* (Inflation-adjusted)	Price Per Pound (Whole Weight)	Price * (Inflation-adjusted)	HCPI
1970	344	253	1,088	0.73	3.16	40.90
1971	410	312	1,288	0.76	3.14	42.60
1972	407	366	1,463	0.90	3.59	44.00
1973	454	418	1,602	0.92	3.52	45.90
1974	413	421	1,458	1.02	3.53	50.80
1975	549	584	1,851	1.06	3.37	55.50
1976	558	693	2,091	1.24	3.74	58.30
1977	562	764	2,196	1.36	3.91	61.20
1978	740	1,100	2,936	1.49	3.97	65.90
1979	698	1,123	2,699	1.61	3.87	73.20
1980	713	1,082	2,324	1.52	3.26	81.90
1981	643	1,262	2,453	1.96	3.82	90.50
1982	750	1,600	2,932	2.13	3.91	96.00
1983	887	1,976	3,483	2.23	3.93	99.80
1984	1,481	3,192	5,383	2.15	3.63	104.30
1985	1,717	3,853	6,282	2.24	3.66	107.90
1986	1,682	3,958	6,312	2.35	3.75	110.30
1987	1,818	4,687	7,114	2.58	3.91	115.90
1988	1,794	4,796	6,870	2.67	3.83	122.80
1989	1,314	3,867	5,245	2.94	3.99	129.70
1990	1,094	3,371	4,269	3.08	3.90	138.90
1991	984	2,864	3,383	2.91	3.44	148.90
1992	1,043	3,199	3,610	3.07	3.46	155.90
1993	862	2,749	3,009	3.19	3.49	160.70
1994	1,011	3,277	3,500	3.24	3.46	164.70
1995	972	2,954	3,086	3.04	3.17	168.40
1996	768	2,634	2,692	3.43	3.51	172.10
1997	863	2,761	2,761	3.20	3.20	175.90

Data: Hawaii Division of Aquatic Resources (HDAR) commercial catch reports are used for all the main Hawaiian Islands (MHI) landings and revenue; HDAR reports are also used for Northwestern Hawaiian Islands (NWHI) landings from 1970-83. NMFS estimates from shoreside monitoring are used for NWHI landings from 1984-96. HDAR landings are again used for NWHI landings in 1997.

Revenue* represents nominal revenue adjusted for inflation by the Honolulu Consumer Price Index (HCPI); revenue* and prices* are adjusted to the current year.

Data source: Data imported from HTOT96a.xls 6/30/98

Figure 10. Hawaii bottomfish landings, revenue, and price by source, 1970-present. (* Inflation adjusted.)



Inpterpretation: Inflation-adjusted revenue from main Hawaiian Islands bottomfish landings grew steadily through the 1970s and 1980s as both *real* prices and total landings increased substantially. Beginning in 1990, total landings began to decline, falling almost 60% in the decade, while inflation-adjusted prices have also declined substantially (perhaps due to the sustained recession of the Hawaii economy). NWHI bottomfish landings grew dramatically in the mid-1980s and then tailed off, stabilizing in the 1990s at a level just below the main Hawaiian Islands. NWHI landings peaked in 1987 and have fallen 70% since then.

Hawaii bottomfish landings, revenue, and price by source, 1970-present. (* Inflation-adjusted.)

	NWHI Pounds	NWHI Revenue	Revenue* (Inflation-adjusted)	Price	Price * (Inflation-adjusted)
1970	74	39	168	0.53	2.27
1971	75	50	206	0.67	2.75
1972	43	42	168	0.98	3.90
1973	62	63	241	1.02	3.89
1974	49	49	170	1.00	3.46
1975	59	64	203	1.08	3.44
1976	59	78	235	1.32	3.99
1977	83	104	299	1.25	3.60
1978	143	194	518	1.36	3.62
1979	118	183	440	1.55	3.73
1980	172	163	350	0.95	2.04
1981	52	79	154	1.52	2.95
1982	77	108	198	1.40	2.57
1983	38	89	157	2.34	4.13
1984	661	1350	2,277	2.04	3.44
1985	922	1800	2,934	1.95	3.18
1986	869	1900	3,030	2.19	3.49
1987	1,015	2300	3,491	2.27	3.44
1988	625	1500	2,149	2.40	3.44
1989	303	756	1,025	2.50	3.38
1990	423	1066	1,350	2.52	3.19
1991	387	1053	1,244	2.72	3.21
1992	424	1255	1,416	2.96	3.34
1993	385	1164	1,274	3.02	3.31
1994	443	1382	1,476	3.12	3.33
1995	369	1060	1,107	2.87	3.00
1996	311	993	1,015	3.19	3.26
1997	380	1152	1,152	3.03	3.03

Data Source:	NWHI Bottomfish	Data Imported from HTOT96a.xls	
	NMFS estimates		6/30/98
	HDAR: 1970-1984		

	MHI Pounds	MHI Revenue	Revenue* (Inflation-adjusted)	Price	Price * (Inflation-adjusted)
1970	270	214	ERR	0.79	??
1971	335	262	1,082	0.78	3.23
1972	364	324	1,295	0.89	3.55
1973	392	355	1,360	0.90	3.47
1974	364	372	1,288	1.02	3.54
1975	485	513	1,626	1.06	3.35
1976	499	615	1,856	1.23	3.72
1977	479	660	1,897	1.38	3.96
1978	597	906	2,418	1.52	4.05
1979	580	940	2,259	1.62	3.90
1980	541	919	1,974	1.70	3.65
1981	591	1,183	2,299	2.00	3.89
1982	673	1,492	2,734	2.22	4.06
1983	847	1,882	3,317	2.22	3.92
1984	803	1,797	3,031	2.24	3.77
1985	765	1,954	3,185	2.55	4.16
1986	811	2,052	3,272	2.53	4.04
1987	785	2,345	3,559	2.99	4.54
1988	1,166	3,288	4,709	2.82	4.04
1989	1,007	3,090	4,191	3.07	4.16
1990	651	2,242	2,839	3.44	4.36
1991	562	1,713	2,024	3.05	3.60
1992	588	1,842	2,078	3.14	3.54
1993	462	1,535	1,681	3.32	3.64
1994	536	1,793	1,915	3.34	3.57
1995	570	1,818	1,899	3.19	3.33
1996	442	1,593	1,628	3.60	3.68
1997	475	1,589	1,589	3.35	3.35

NWHI Bottomfish — Data Imported from HTOT96a.xls

NMFS estimates — 6/30/98

HDAR: 1970-1984

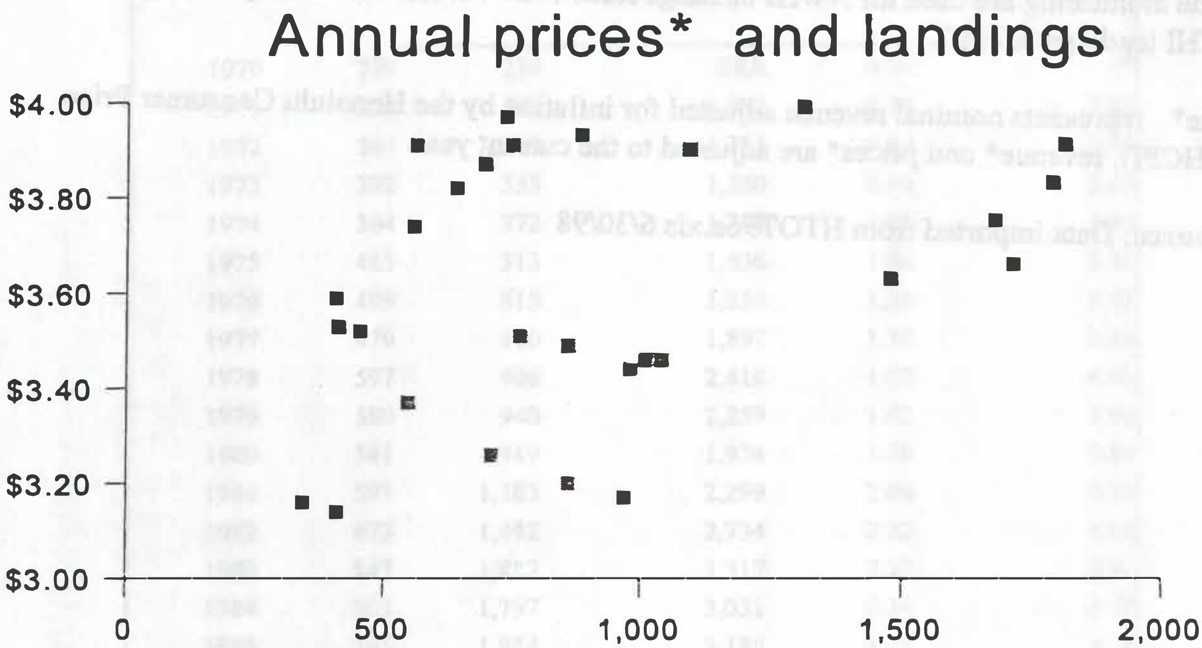
Data: Hawaii Division of Aquatic Resources (HDAR) commercial catch reports are used for all

Data: Hawaii Division of Aquatic Resources (HDAR) commercial catch reports are used for all the main Hawaiian Islands (MHI) landings and revenue; HDAR reports are also used for Northwestern Hawaiian Islands (NWHI) landings from 1970-83. NMFS estimates from shoreside monitoring are used for NWHI landings from 1984-96. HDAR landings are again used for NWHI landings in 1997.

Revenue* represents nominal revenue adjusted for inflation by the Honolulu Consumer Price Index (HCPI); revenue* and prices* are adjusted to the current year.

Data source: Data imported from HTOT96a.xls 6/30/98

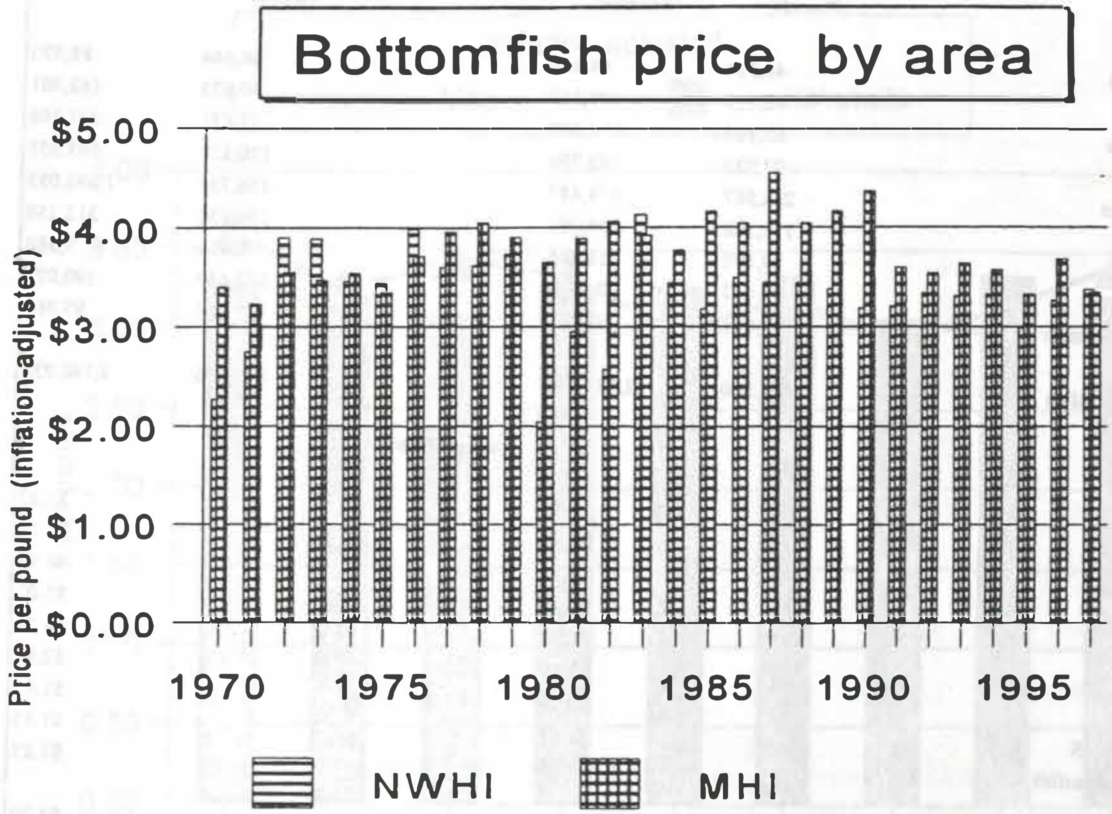
Figure 11. Hawaii bottomfish market (annual, inflation-adjusted ex-vessel price* and total domestic landings, 1970-97.)



Interpretation: Economic research in the mid-1980s showed a considerable (negative) relationship between weekly bottomfish landings and ex-vessel price. However this relationship is not shown for annual data. As shown by this and the earlier figure, despite a considerable decrease in total landings, ex-vessel price has been quite stable over the past 30 years.

Data: See table.

Figure 12. Hawaii bottomfish ex-vessel prices by source, 1987-present. (Price* adjusted for inflation.)



Interpretation: Historically, bottomfish caught in the main Hawaiian Islands have tended to have higher aggregate prices, reflecting both species composition and greater freshness. However, in the past five years, the prices have converged. This appears to reflect a relative lowering of the MHI bottomfish prices, perhaps reflecting the softness of the upscale part of the Hawaii market.

Table 1. Hawaii bottomfish species landings and prices, 1996 & 1997.[1]

	1996 Pounds	1996 Revenue	1997 Pounds	1997 Revenue
Butaguchi	49,304	94,401	64,644	88,576
Ehu	46,215	179,347	40,673	142,801
Hapuupuu	65,167	216,688	77,471	227,386
Onaga	97,525	582,796	120,138	603,355
Opakapaka	226,567	974,487	256,737	1,092,053
Uku	115,286	304,951	109,151	312,258
Ulua	19,198	11,406	8,916	9,366
Other BMUS	96,647	174,515	132,457	190,073
Other Bottomfish	49,651	97,195	51,389	95,067
Total Bottomfish	765,560	2,635,786	861,576	2,760,935
			Average Price	
Butaguchi		$1.91		$1.37
Ehu		$3.88		$3.51
Hapuupuu		$3.33		$2.94
Onaga		$5.98		$5.02
Opakapaka		$4.30		$4.25
Uku		$2.65		$2.86
Ulua		$0.59		$1.05
Other BMUS		$1.81		$1.43
Other Bottomfish		$1.96		$1.85
Total Bottomfish		$3.44		$3.20

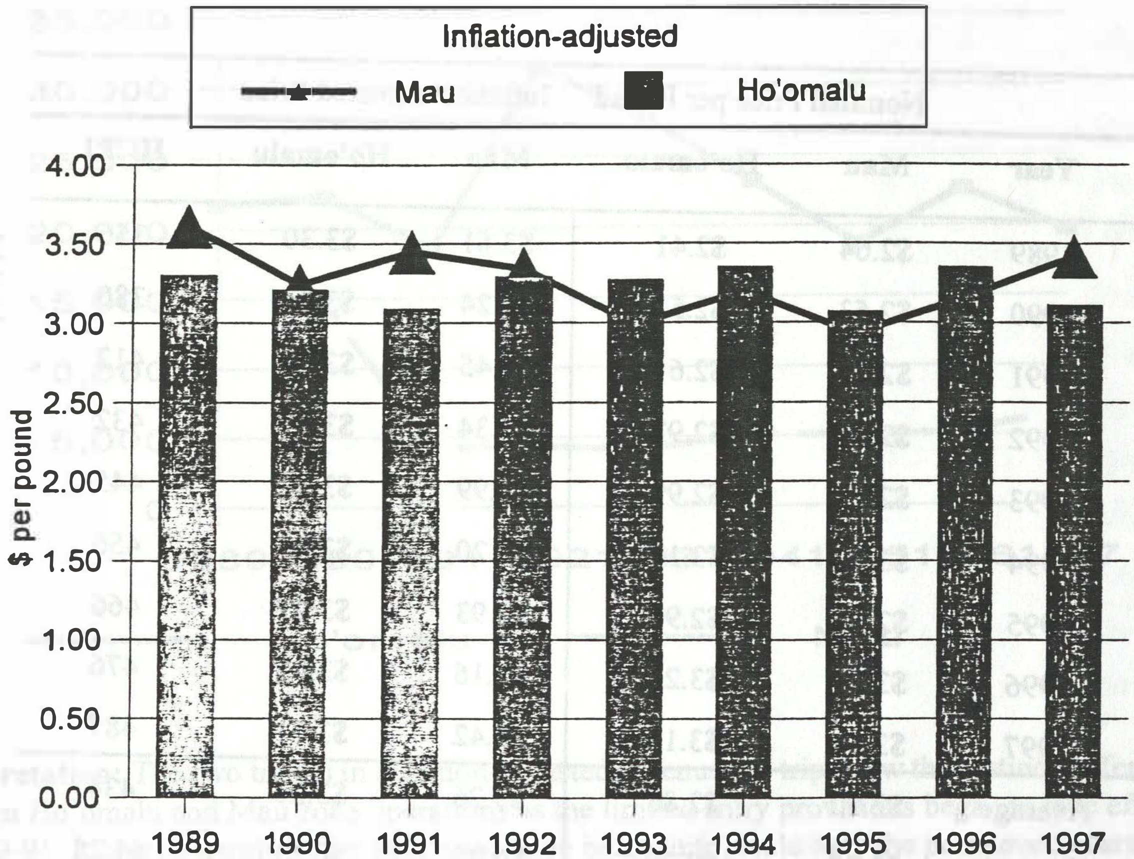
Data Source:
B8796N.xls
\nmfs
July 2, 1998

Data & Data Sources: Similar to previous tables – a combination of HDAR figures and NMFS estimates. Revenue and prices not adjusted for inflation.

Interpretation: Species prices show the significance of species composition in aggregate statistics, although there were no dramatic changes in species composition from 1996 to 1997. The decline in aggreage and individual prices between the two years is consistent with previous economic research suggesting a negative relationship between landings and prices.

[1] Small differences may exist between species totals and area totals due to rounding.

Figure 13. Hawaii Bottomfish Ex-vessel Prices by NWHI zone, 1989-present. (Inflation-adjusted prices to 1997 base.)



Interpretation: Because of the substantial increase in Mau zone prices in 1997 (delineated by the line in the chart), bottomfish prices for the two zones have become effectively the same over time. The 1997 price is as one would generally expect, i.e., landings from the Mau zone come from shorter trips. However there may be species composition effects as well (e.g., more high-valued species caught in the Mau zone in 1997 than in recent years).

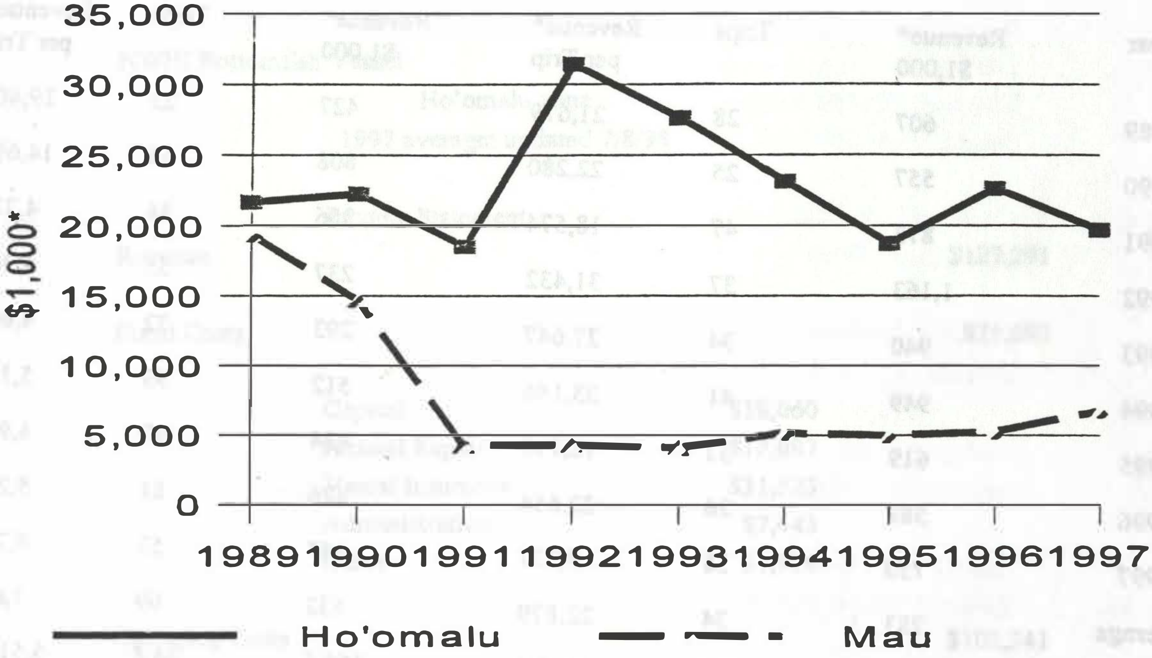
Hawaii Bottomfish Ex-vessel Prices by NWHI zone, 1989-present.
(Inflation-adjusted prices to 1997 base)

	Nominal Price per Pound		Inflation-adjusted Price		
Year	**Mau**	**Ho'omalu**	**Mau**	**Ho'omalu**	**HCPI**
1989	$2.64	$2.41	$3.61	$3.30	356
1990	$2.53	$2.51	$3.24	$3.21	380
1991	$2.92	$2.61	$3.45	$3.09	412
1992	$2.96	$2.92	$3.34	$3.29	432
1993	$2.73	$2.99	$2.99	$3.27	445
1994	$3.00	$3.14	$3.20	$3.35	456
1995	$2.80	$2.94	$2.93	$3.07	466
1996	$3.09	$3.27	$3.16	$3.35	476
1997	$3.42	$3.11	$3.42	$3.11	487
Average	$2.90	$2.88	$3.26	$3.23	434
Standard Deviation	$0.27	$0.30	$0.22	$0.11	44.25

Data: NWHI prices are compiled from NMFS market monitoring. Inflation-adjusted values are to 1997 base.

Data source: nwhi98a.xls (10/7/98)

Figure 14. NWHI bottomfish inflation-adjusted revenue* per trip by zone, 1989-present.



Interpretation: The two trends in inflation-adjusted revenue per trip show the distinct difference between Ho'omalu and Mau zone operations as the limited entry provisions began to take effect in 1989-91. Revenue trends in the Mau zone have been quite stable over the past seven years. The Ho'omalu zone has shown more variability but appears to have stabilized in the past three years.

NWHI bottomfish inflation-adjusted revenue* per trip by zone, 1989-present.

	Ho'omalu Zone			Mau Zone		
Year	Revenue* $1,000	Trips	Revenue* per Trip	Revenue* $1,000	Trips	Revenue* per Trip
1989	607	28	21,679	427	22	19,409
1990	557	25	22,280	808	55	14,691
1991	873	47	18,574	356	84	4,238
1992	1,163	37	31,432	237	55	4,309
1993	940	34	27,647	293	72	4,069
1994	949	41	23,146	512	99	5,172
1995	619	33	18,758	484	97	4,990
1996	589	26	22,654	426	81	5,259
1997	750	38	19,737	357	53	6,736
Average	783	34	22,879	433	69	7,653
Standard Deviation	209.9	7.3	4,230.9	165.6	24.8	5,514.1

Data: Data are compiled from NMFS shoreside market monitoring for 1984-95 and then combined with HDAR data for 1996 and 1997. Revenue is adjusted for inflation to the current base year by the Honolulu consumer price index. D

Table 2. Ho'omalu zone bottomfish vessel, income statement, 1997.

NWHI Bottomfish Vessel

Ho'omalu zone

1997 average: updated 7/8/98

	Income Statement		
Revenue			$127,291
Fixed Costs			$71,693
	Capital	$18,060	
	Annual Repair	$12,697	
	Vessel Insurance	$31,523	
	Administrative	$7,443	
	Other	$1,970	
Operating Costs			$102,341
	Fuel & Oil	$11,164	
	Ice	$2,627	
	Bait	$5,911	
	Handling	$12,700	
	Provisions	$7,990	
	Gear and Supplies	$9,413	
	Other (trip basis)	$10,836	
	Crew's income	$26,100	
	Captain's income	$15,600	
Total Cost			$174,034
Net Revenue			$-46,743

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\econ\data
09-Jul-98

Vessel Operating Characteristics			
	Investment	$233,300	
	Trips	6.33	
	Trip Days: Total & Trip	148	23.4
	Fishing Days: Total & Trip	70	11.05
	Catch per Day (Lbs): Total	593	
	Bottomfish : Other	575	19
	Total Catch (Whole lbs)	41,530	
	Bottomfish : Other	40,223	1,307
	Price per Pound	$3.07	
	Bottomfish : Other	$3.11	$1.80
	Unallocated trip days	155	
	Rate of increase: Net Rev	0.00%	$(46,743)
	HCPI (1993 base)	1.09	
	Fixed Cost rate	1.00	
nwhb97h1.xls		NWHI Bottomfish Vessel	
\econ\data		Ho'omalu zone	
09-Jul-98	-		

Interpretation: The average[2] Ho'omalu zone bottomfish fishing vessel failed to cover its total costs through bottomfishing operations in 1997, as in previous years. There was a positive return on operations; presumably other fishing activities had to be employed to cover fixed costs.

Data: Cost-earnings information was compiled by Hamilton in 1994, and updated to account for inflation and to reflect current operating characteristics.

2 Recalling that in every *average*, some vessels do better, some not as well.

Table 3. Mau zone bottomfish vessel, income statement, 1997.

		NWHI Bottomfish Vessel Mau Zone 1997 Average: updated 7/8/98	
	Income Statement		
Revenue			$52,218
Fixed Costs			13,159
	Capital	4,049	
	Annual Repair	4,789	
	Vessel Insurance	2,803	
	Administrative	1,518	
	Other	0	
Operating Costs			43,391
	Fuel & Oil	4,159	
	Ice	1,095	
	Bait	1,532	
	Handling	5,200	
	Provisions	1,751	
	Gear and Supplies	2,408	
	Other (trip basis)	2,846	
	Crew's income	10,000	
	Captain's income	14,400	
Total Cost			56,550
Net Revenue			$(4,332)

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\econ\data
08Jul98

Vessel Operating Characteristics		
Investment	$153,236	
Trips	6.24	
Trip Days: Total & Trip	54	8.60
Fishing Days: Total & Trip	29	4.60
Catch per Day (Lbs): Total	595	
Bottomfish : Other	429	166
Catch per Trip: Total	2,739	
Bottomfish : Other	1,976	763
Total Catch (Whole lbs)	17,076	
Bottomfish : Other	12,321	4,755
Price per Pound	$3.06	
Bottomfish : Other	$3.41	$2.15
Unallocated trip days	250	
Change in CPUE : Net Rev	0.00%	(4,332)

Interpretation: Mau zone vessels also failed to cover their costs in 1997, although less of their total operations are (on average) reliant on bottomfish fishing. A more substantial analysis was conducted for the proposed limited entry schema.

Table 4. NWHI "optimality" scenarios for NWHI bottomfish vessels, 1997.

NWHI Bottomfish MSY economic analysis

1997 operating basis
(updated: 7/8/98)

		NWHI Combined	Mau	Ho'omalu
Pounds				

Maximum Sustainable Yield (MSY)		586,490	131,210	455,290
	% MSY by zone	100.0%	22.4%	77.6%
1997 actual		346,095	104,730	241,365
	% MSY by zone	100.0%	30.3%	69.7%

Catch & operating levels	Combined NWHI	Mau	Ho'omalu
1997 actual	14	8.5	5.5
Current year cpue	22	11	11
MSY cpue	20	9	10
MSY cpue @ FTE	9	2	6
Breakeven cpue @ FTE	8	3	5

NWHI Combined* -- based on unweighted average vessel characteristics

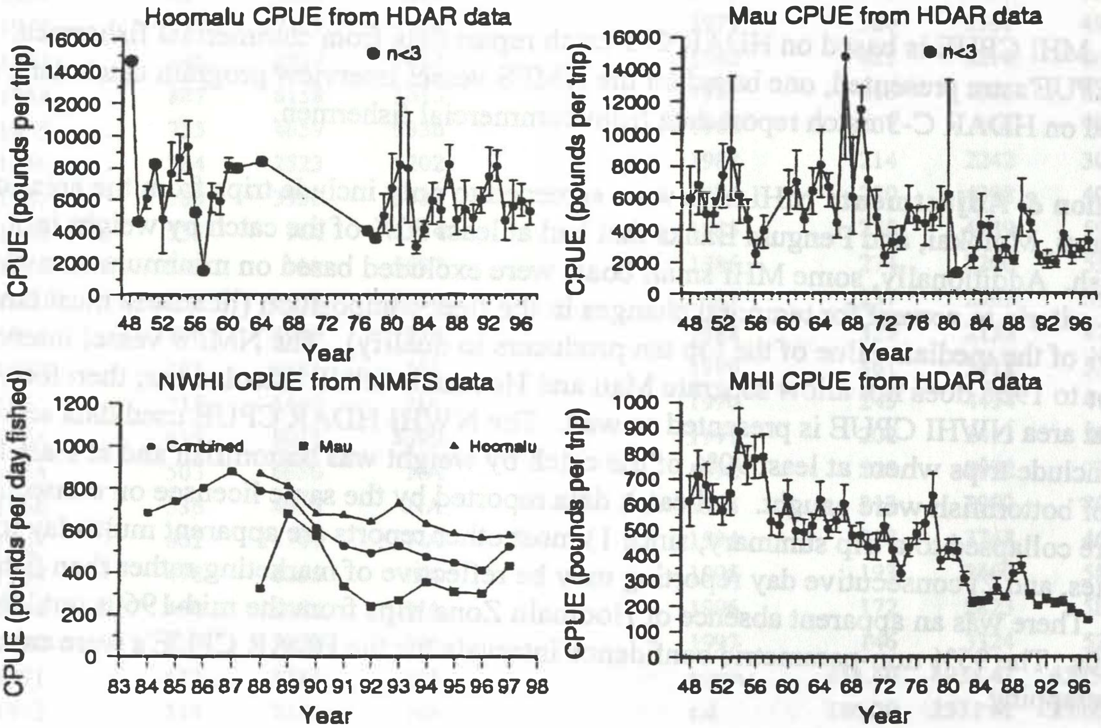
	Bottomfish catch per vessel (pounds)		
	NWHI Combined	Mau	Ho'omalu
Current year cpue	26,272	12,321	40,223
MSY cpue	29,490	14,601	44,380
MSY cpue @ FTE	66,640	56,200	77,081
Breakeven cpue @ FTE	74,083	51,268	96,898

Interpretation: This table presents current results using the methodology of the Ho'omalu zone limited entry amendment to determine the "optimal" number of vessels for each zone in the Northwestern Hawaiian Islands. Three optimality criteria are utilized: 1) assuming vessels achieve the MSY catch rate; 2) assuming that vessels operate at FTE levels (full-year operations); and 3) assuming that vessels break-even on average.

The "optimality" methodology divides the MSY level of total catch for each zone (131,210 pounds for the Mau zone and 455,290 for the Ho'omalu zone) by the annual catch per vessel under the three criteria. This determines the "optimal" number of vessels.

Under the Limited Entry criteria for the Ho'omalu zone, the "optimal" number of vessels is 5-6, the current number.

Figure 15-a. CPUE for Hawaiian bottomfish



Interpretation: Decreases in MHI CPUE to about 20% of early CPUE values signify a strong yellow light condition for the fishery in this area. The increase in the late 1980s MHI CPUE was due primarily to a large increase in uku catches alone and may not indicate an increase in abundance of other species. Rapid decreases in CPUE from the 1989-90 highs may be a return to the prevailing slow decline. The reasons for differing trends in CPUE values for the Hoomalu Zone with differing data sources are unclear, though they could be due to shorter trips with higher CPUE on a per day basis or a change in fleet composition with the new entrants.

Comments: 1997 values for CPUE using the HDAR data set are well below their long-term averages for all three fishing zones with that for the MHI being only about 32% of that average.

There is a long-term decreasing trend in MHI CPUE, with current values approximately 20% that of the initial estimate. The 1997 MHI CPUE value is, by far, the lowest value on record. MHI trips are generally one day in length, so CPUE values presented here reflect catch per day as well as catch per trip.

The NMFS vessel interview NWHI CPUE for 1997 for the Mau Zone is considerably higher than the 1996 value (44%) whereas the value has increased only slightly for the Hoomalu Zone(2%). The 1997 HDAR CPUE values (CPUE/trip) show an increase of 18% for the Mau zone and a decrease of 11% for the Hoomalu zone. The HDAR CPUE is used for NWHI SPR calculations because it is a longer time series and may better estimate virgin fishery catch rates. There are no correction factors for possible changes in trip duration or fleet composition.

Source: MHI CPUE is based on HDAR C-3 catch report data from commercial fishermen. Two NWHI CPUE's are presented, one based on the NMFS vessel interview program catch data, and one based on HDAR C-3 catch report data from commercial fishermen.

Calculation & Adjustment: MHI trips were screened to only include trips from the areas of Maui, Lanai, Molokai, and Penguin Banks that had at least 90% of the catch by weight in bottomfish. Additionally, some MHI small boats were excluded based on minimum annual landings criteria to correct for temporal changes in the fleet composition (licensees must land at least 30% of the median value of the top ten producers to qualify). The NMFS vessel interview data prior to 1988 does not allow separate Mau and Hoomalu CPUE calculations; therefore, the combined area NWHI CPUE is presented as well. The NWHI HDAR CPUE used data screened to only include trips where at least 90% of the catch by weight was bottomfish and at least 1000 pounds of bottomfish were caught. All catch data reported by the same licensee on consecutive days were collapsed to a trip summary, since 1) most other reports are apparent multi-day trip summaries, and 2) consecutive day reporting may be reflective of marketing rather than fishing activity. There was an apparent absence of Hoomalu Zone trips from the mid-1960s until the late-1970s. The 95% non-parametric confidence intervals for the HDAR CPUE's were calculated by bootstrapping.

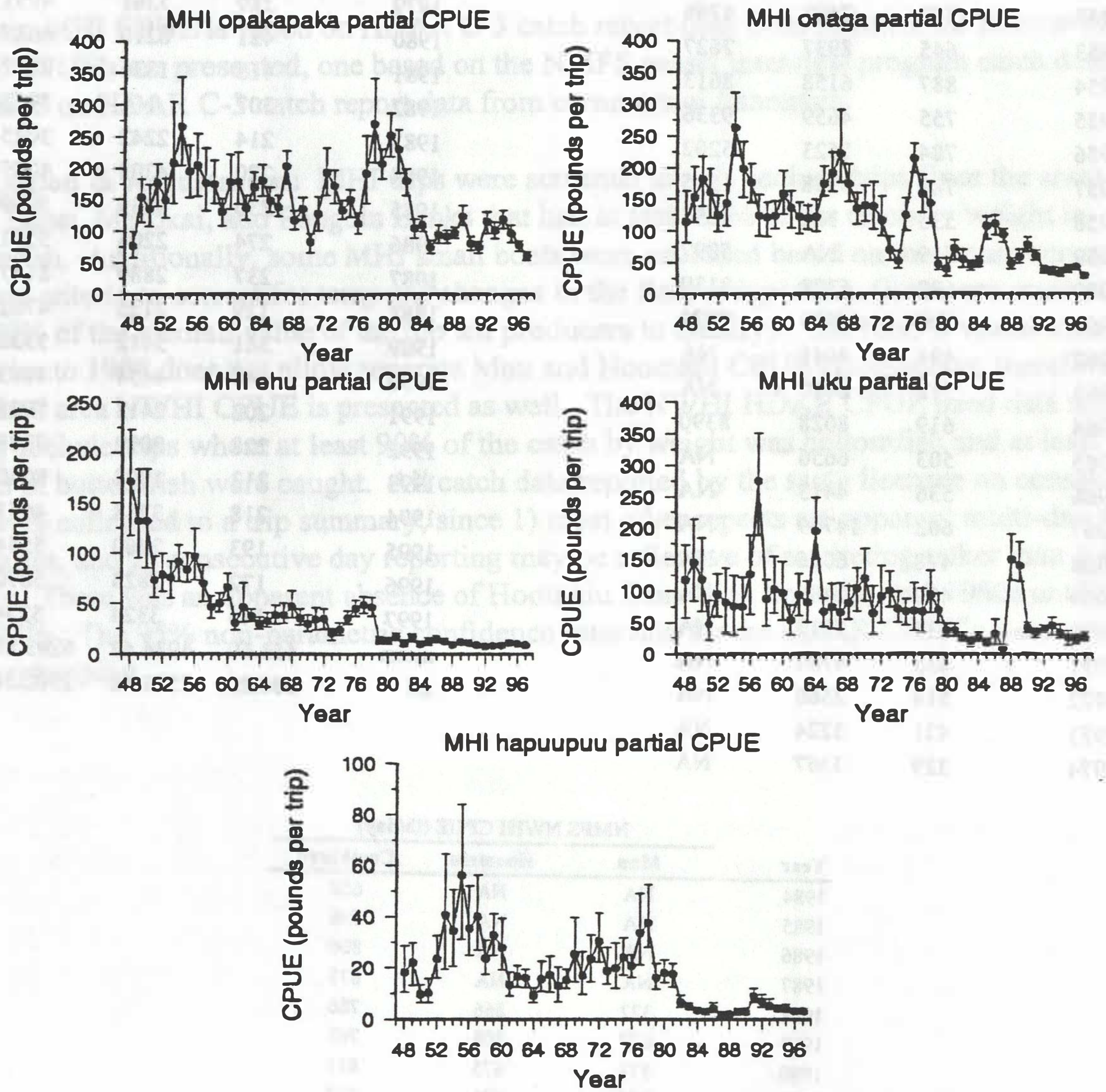
Figure 15-a data summaries:

Year	Pounds/Trip MHI	Mau	Hoomalu
1948	614	5968	14635
1949	713	6799	4614
1950	677	4966	6072
1951	621	4980	8228
1952	577	7407	4766
1953	645	8937	7627
1954	887	6158	8613
1955	755	4659	9336
1956	784	2523	5202
1957	789	3958	1535
1958	533	NA	6254
1959	519	NA	5897
1960	630	6379	8139
1961	496	6999	7978
1962	491	4641	NA
1963	518	6410	NA
1964	619	8028	8390
1965	503	6656	NA
1966	536	4413	NA
1967	602	14749	NA
1968	478	6055	NA
1969	480	11484	NA
1970	433	7111	NA
1971	433	4784	NA
1972	514	2386	NA
1973	421	3224	NA
1974	329	3367	NA

Year	Pounds/Trip MHI	Mau	Hoomalu
1975	430	5439	NA
1976	485	4653	NA
1977	527	4387	4000
1978	635	4753	3550
1979	380	5361	4951
1980	421	6210	6687
1981	416	1336	8167
1982	307	NA	7953
1983	214	2242	3025
1984	220	4308	4085
1985	230	4239	5909
1986	274	2206	5301
1987	237	2889	8187
1988	329	2136	4702
1989	361	5412	5328
1990	245	4454	4793
1991	202	2413	5928
1992	228	2092	7388
1993	213	1992	8040
1994	218	3748	4651
1995	193	2460	5544
1996	172	2823	5870
1997	146	3324	5234
mean	453.60	4934.43	6293.86
s.d	186.29	2531.12	2302.30

Year	NMFS NWHI CPUE (lb/day) Mau	Hoomalu	Combined
1984	NA	NA	682
1985	NA	NA	736
1986	NA	NA	800
1987	NA	NA	877
1988	322	866	786
1989	677	808	763
1990	573	675	611
1991	333	671	525
1992	239	639	491
1993	267	723	523
1994	353	629	526
1995	306	582	442
1996	298	563	407
1997	429	574	521
mean	379.70	673.00	625.36
s.d.	141.03	100.70	144.31

Figure 15-b. Partial CPUE for MHI bottomfish



Year	MHI Partial CPUE (lb/trip) OPA	ONA	EHU	UKU	HAP
1948	77	115	172	117	18
1949	153	153	132	146	22
1950	135	182	132	119	10
1951	176	161	73	48	11
1952	149	124	78	95	24
1953	208	144	76	82	41
1954	266	262	91	77	35
1955	195	198	83	76	56
1956	204	177	97	127	36
1957	176	124	70	275	40
1958	174	121	47	88	24
1959	130	124	50	103	33
1960	177	158	66	97	28
1961	178	136	31	54	13
1962	136	123	47	94	17
1963	169	120	38	82	16
1964	180	122	30	195	9
1965	148	174	33	67	16
1966	138	191	38	75	17
1967	203	222	39	66	13
1968	116	174	47	81	15
1969	135	135	35	104	25
1970	83	140	30	120	17
1971	127	138	34	65	24
1972	192	116	35	92	31
1973	171	70	21	101	19
1974	132	52	24	72	20
1975	149	124	36	68	24
1976	112	214	45	69	21
1977	191	158	49	67	34
1978	269	143	46	94	38
1979	207	47	13	70	16
1980	251	40	13	37	18
1981	229	72	18	37	18
1982	179	55	11	25	7
1983	104	46	17	20	5
1984	109	51	10	26	4
1985	74	107	12	18	3
1986	93	111	15	31	5
1987	91	93	13	10	2
1988	97	48	9	150	2
1989	122	59	12	140	3
1990	80	77	12	42	3
1991	75	60	9	34	9
1992	115	39	8	39	7
1993	100	37	9	46	6
1994	118	34	9	34	4
1995	96	40	11	26	5
1996	77	43	10	24	3
1997	60	29	9	27	3
mean	146.52	113.66	40.90	77.04	17.42
s.d	52.15	57.49	36.24	49.02	12.51

Interpretation: Reduction of species-specific CPUE for species presented here to less than half of their early values would suggest a yellow light situation for all of these species, especially ehu and onaga. Caution must be used in this interpretation because factors such as targeting of effort to specific species is not taken into account (see next section for targeted effort).

Comments: All CPUE time series remain highly variable. All 1997 partial CPUE values are well below their long-term averages. There are apparent declines in most species when comparing several years of recent values with values earlier in the time series. The decline is least apparent in opakapaka and most apparent in ehu. MHI trips are usually of one day duration.

Source: The partial CPUE for the MHI is based on HDAR C-3 catch report data from commercial fishermen.

Calculation & Adjustment: The same subset of HDAR data as used in Fig. 15-A is used here, but the weight of each species is tabulated separately rather than in aggregate. The same denominator value used in Fig. 15-A is used here (# trips fished), i.e. summing these five partial CPUE's (and remaining BMUS CPUE's) will approximate the Fig. 15-A estimates. 95% non-parametric confidence intervals were calculated by bootstrapping.

Figure 15-c. Partial targeted CPUE for MHI bottomfish

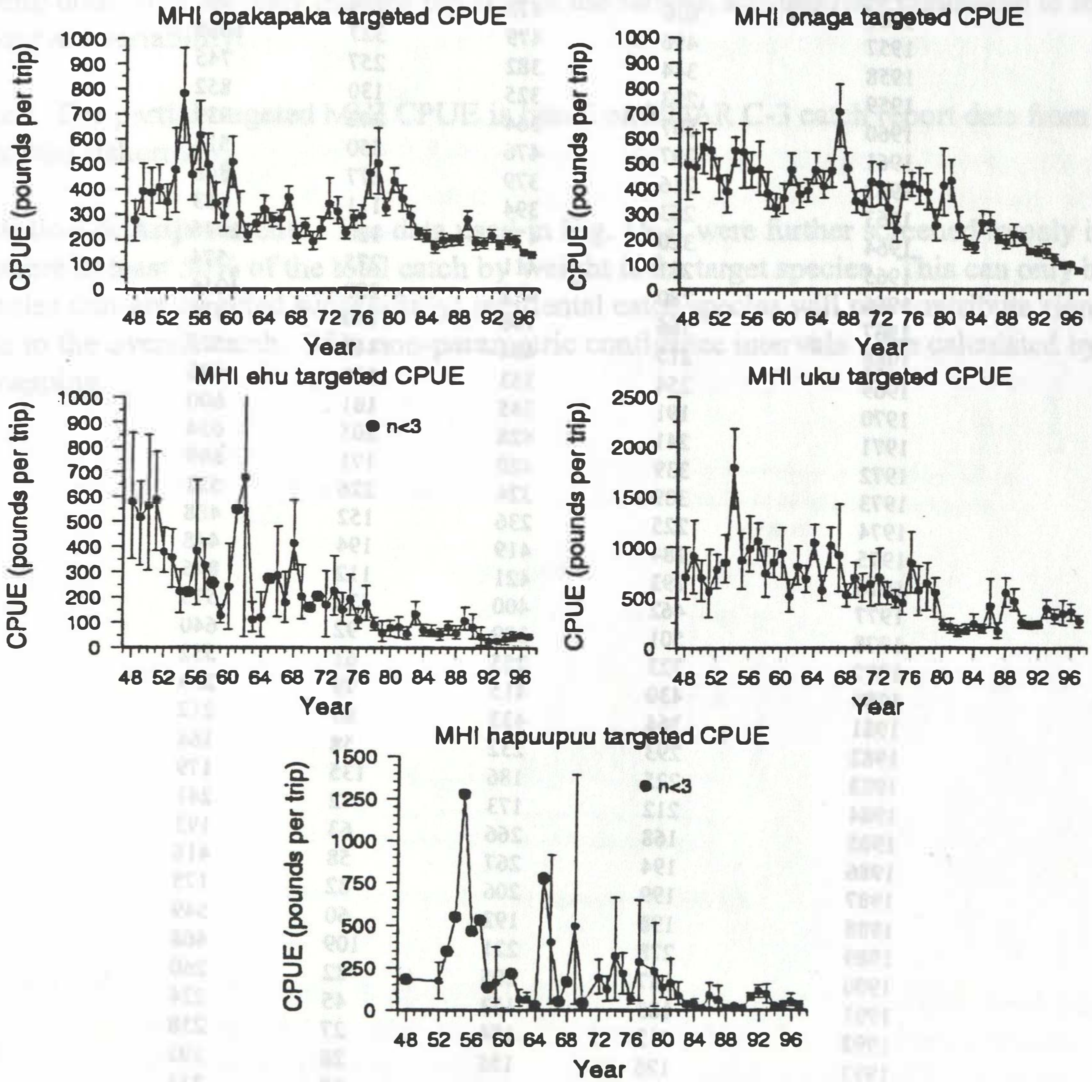


Figure 15-c data summary:

Year	MHI Targeted CPUE (lb/Trip)			
	Opakapaka	Onaga	Ehu	Uku
1948	277	496	581	705
1949	391	488	517	913
1950	385	566	564	701
1951	406	554	589	567
1952	348	442	380	779
1953	476	390	358	850
1954	779	552	224	1796
1955	458	547	222	869
1956	613	473	384	988
1957	496	479	327	1061
1958	344	382	257	745
1959	293	325	130	852
1960	507	364	242	939
1961	297	476	550	514
1962	216	379	677	806
1963	263	394	111	683
1964	320	475	120	1046
1965	281	411	275	574
1966	280	472	288	1014
1967	366	706	180	919
1968	215	484	415	525
1969	254	353	203	696
1970	191	345	161	600
1971	241	428	205	634
1972	339	420	171	699
1973	309	324	226	531
1974	225	236	152	488
1975	284	419	194	448
1976	293	421	112	846
1977	462	400	178	573
1978	501	389	92	640
1979	323	255	61	552
1980	430	415	79	235
1981	364	433	83	212
1982	293	252	58	164
1983	225	186	135	179
1984	212	173	72	241
1985	168	266	63	193
1986	194	267	58	418
1987	199	206	82	175
1988	198	192	60	549
1989	278	221	109	468
1990	187	205	82	260
1991	183	153	45	224
1992	212	154	27	238
1993	176	155	28	393
1994	200	125	37	311
1995	191	100	45	343
1996	147	103	51	363
1997	136	76	46	270
mean	308.52	350.54	206.12	595.78
s.d.	15734.52	145.53	172.54	315.10

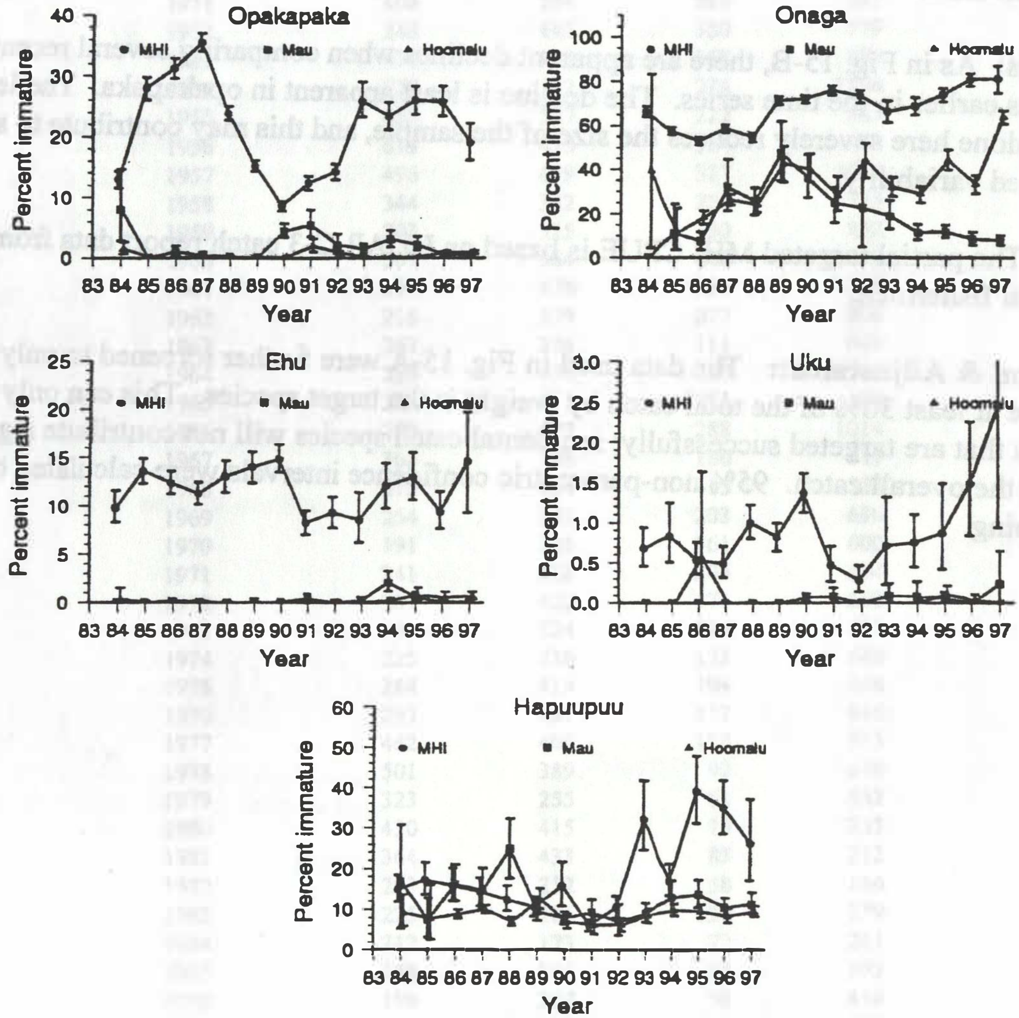
Interpretation: Comparison of CPUE values of the last 10 years (1988-97) with the first 10 years available (1948-57) indicate that all four species for which sufficient data is available have CPUE values less than 50% of original values (and their long-term averages, as well). Opakapaka CPUE values are at 41% of original, onaga at 30%, ehu at 13% and uku at 37%. These values represent a yellow light condition for these four species, with the ehu stocks being the most stressed.

Comments: As in Fig. 15-B, there are apparent declines when comparing several recent years with values earlier in the time series. The decline is least apparent in opakapaka. The level of screening done here severely reduces the size of the sample, and this may contribute to some of the observed variability.

Source: The partial targeted MHI CPUE is based on HDAR C-3 catch report data from commercial fishermen.

Calculation & Adjustment: The data used in Fig. 15-A were further screened to only include trips where at least 50% of the total catch by weight is the target species. This can only be done for species that are targeted successfully; incidental catch species will not contribute significantly enough to the overall catch. 95% non-parametric confidence intervals were calculated by bootstrapping.

Figure 16. Percent immature in Hawaiian bottomfish catch



All MHI estimates from 3 mos. data only

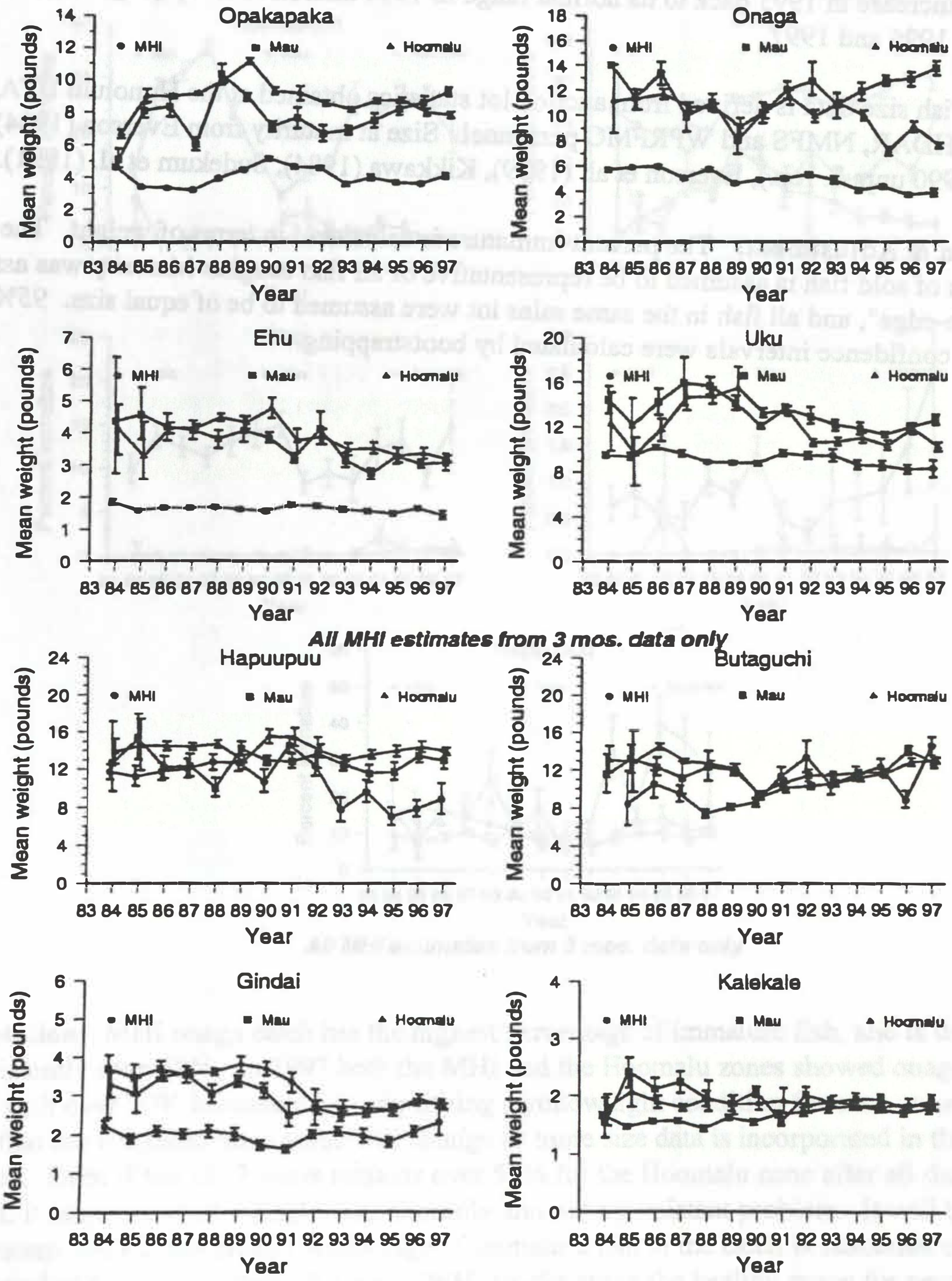
Interpretation: MHI onaga catch has the highest percentage of immature fish, and is the only one consistently over 50%. In 1997 both the MHI and the Hoomalu zones showed onaga landings with over 50% immature fish, signifying a yellow light condition for each zone. It is possible that the Hoomalu zone value will change as more size data is incorporated in the calculation. Even if the 1997 value remains over 50% for the Hoomalu zone after all data is processed, it may represent a single year anomoly and not a persistant problem. It will become a major concern, only if the greater percentage of immature fish in the catch is sustained over a longer period of time. All other MHI and NWHI stocks are in the healthy range for percentage of immature fish in the catch.

Comments: MHI catch is comprised of more immature fish than NWHI catch. In all areas onaga values are among the highest. Percent immature for uku are the lowest (i.e. healthiest) values in all zones. Among the other species, MHI opakapaka experienced periods of relatively high values (peaking in the years 1985-87). MHI hapuupuu percent immature declined from a significant increase in 1993 back to its normal range in 1994 then rised sharply again in 1995 and declined in 1996 and 1997.

Source: Fish size data is derived from auction lot statistics obtained at the Honolulu UFA auction by HDAR, NMFS and WPRFMC personnel. Size at maturity from Everson (1984), Everson (1990 unpub. rep.), Everson et al. (1989), Kikkawa (1984), Sudekum et al. (1991).

Calculation & Adjustment: The percent immature is calculated in terms of weight. The size distribution of sold fish is assumed to be representative of all fish caught. Maturity was assumed to be "knife-edge", and all fish in the same sales lot were assumed to be of equal size. 95% non-parametric confidence intervals were calculated by bootstrapping.

Figure 17. Mean weight of Hawaiian bottomfish



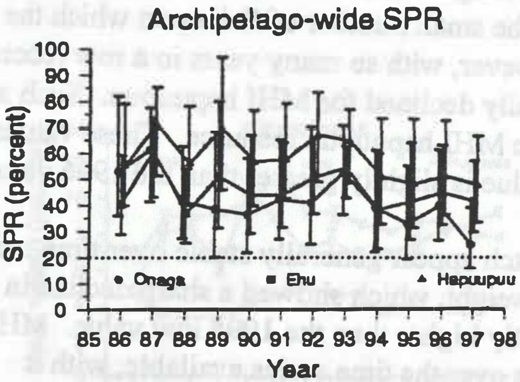
Interpretation: MHI mean weights are considerable lower than NWHI weights indicating considerable stress on these resources. No noticable trends can be seen in NWHI mean weights, indicating relative health in these zones. Low mean weights were first recorded for hapuupuu in 1993 and have remained low through the present. The small number of fish upon which the annual estimates are based may bias the result. However, with so many years in a row recording low mean weights, it is likely that fish size has actually declined for MHI hapuupuu. Such a decline in mean size indicates increased stress on the MHI hapuupuu resource. These values do not exhibit a continuing decline, in fact, the 1997 value is slightly greater than the 1996 value.

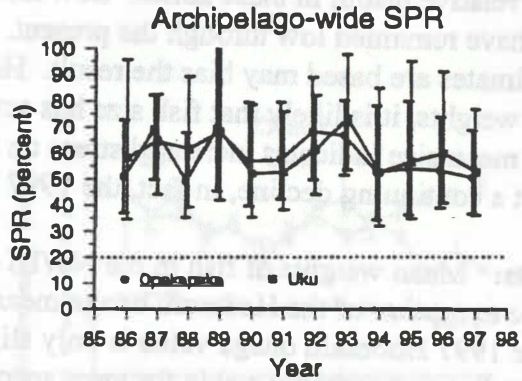
Comments: Mean weights of fish in the NWHI catch appear generally stable over time, with the notable exception of the Hoomalu onaga mean weight, which showed a sharp decline in 1995. The 1997 Hoomalu onaga value is only slightly higher than the 1995 low value. MHI values have been remarkably stable for most species over the time series available, with continuously decreasing sizes found only in the MHI onaga and this decline is very gradual. MHI hapuupuu mean weight has fluctuated to a greater extent over the last four years with very low mean weights recorded for 1993, 1995, 1996 and 1997.

Source: Fish size data is derived from auction lot statistics obtained at the Honolulu UFA auction by HDAR, NMFS, and WPRFMC personnel.

Calculation & Adjustment: The size distribution of sold fish is assumed to be representative of all fish caught. All fish in the same sales lot were assumed to be of equal size.

Figure 18. Archipelago-wide Spawning potential ratio (SPR)





Archipelago-wide SPR:

	SPR (%)				
Year	**Ehu**	**Hapuupuu**	**Onaga**	**Opakapaka**	**Uku**
1986	41	55	53	51	58
1987	61	71	61	69	65
1988	37	56	42	49	62
1989	51	70	38	69	68
1990	44	57	36	57	52
1991	44	58	42	57	53
1992	51	67	41	68	61
1993	54	65	53	67	73
1994	38	51	39	53	52
1995	41	48	33	54	56
1996	45	51	40	53	60
1997	41	48	25	50	53
mean	45.67	58.08	41.92	58.08	59.42
s.d.	7.18	8.28	9.72	7.89	6.78

Interpretation: SPR values for the five major BMUS species are all above the 20% critical threshold level when viewed on an archipelago-wide basis. Of these species, onaga usually has the lowest value with the 1997 value at only 25%. This low value for onaga is due to the continually worsening condition of the resources in the MHI and the greater than normal percentage of immature fish in the landings from the Hoomalu zone. When the state management plan for the MHI bottomfish is implemented, it is likely that the condition of onaga resources in the area will improve and the archipelago-wide SPR value will increase.

The archipelago-wide SPR estimates are the best method available to assess the Hawaii bottomfish resources and should be the only values used to evaluate overfishing. SPR values are also presented in this document on a management zone basis for the purpose of determining locally depleted resources. It is the best policy to have all zones in a healthy condition and actions should continue to be implemented to assure the achievement of this goal. For the purpose of determining an overfished resource, however, the archipelago-wide condition is what should be measured. Evidence from larval drift simulation and preliminary genetic work point to as single archipelago-wide stock with substantial larval transfer between zones (generally from the more healthy northwestern zones toward the more depleted MHI zone).

Comments: SPR values for all species fluctuate annually and have wide error bars. There are no particularly obvious trends in SPR values over the 12 year period of data. The only species showing current signs of concern is the onaga for which the lower bound is below the 20% critical threshold value (the 1997 lower bound value is 16%). The management measures proposed by the state for the MHI should bring improvement of the MHI onaga resource over a period of a few years. Any improvements to the MHI resources will contribute to improvement of the archipelago-wide condition as well.

Source: Data used in calculating archipelago-wide SPR is derived largely from HDAR C3 commercial catch records integrated with NMFS interview data. Also important is the size frequency data obtained from market sampling by HDAR and NMFS. The final component is the weighting factor for each management zone, which is based on the percentage of total 100 fathom contour contained in each zone.

Calculation & Adjustment: Calculations use similar methodology as presented in Somerton and Kobayashi (1990) for dynamic SPR. Preweighted SPR values (point estimates and upper and lower bounds) are from the area specific estimates found in the following section (Figure 19, 19a, b, and c). NWHI estimates are calculated using area specific maturity estimates and partial CPUE values (where area specific landings of each species are divided by the total effort expended in the management zone). For the MHI, hapuupuu SPR estimates are calculated similarly to those for NWHI fish. For the remaining MHI species, however, targeted trips are identified and the landings and effort for these targeted trips only are used to calculate CPUE for these species. Weighting factors are applied to point estimate and upper and lower bounds for each species and management zone. Archipelago-wide values are derived by adding the zone specific components. The weighting factors are: MHI = 0.447, Mau zone = 0.124, Hoomalu zone = 0.429.

Figure 19. Spawning potential ratio (SPR) for MHI bottomfish

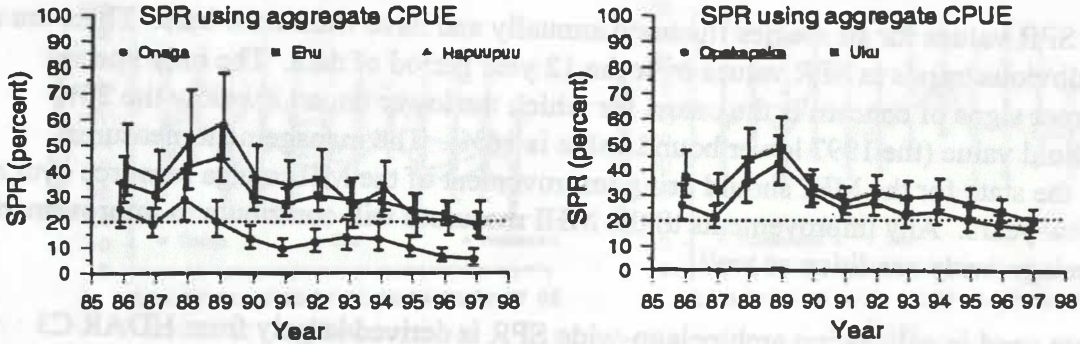


Figure 19 data summary:

Year	Ehu	Hapuupuu	Onaga	Opakapaka	Uku
	SPR (%)				
1986	35	42	25	26	37
1987	31	37	19	21	32
1988	42	52	29	35	44
1989	45	58	20	42	48
1990	30	37	13	31	33
1991	27	34	9	24	27
1992	30	37	12	27	31
1993	28	26	14	22	29
1994	28	33	13	23	29
1995	24	21	10	20	26
1996	23	20	6	18	23
1997	18	19	5	16	19
mean	30.08	34.67	14.58	25.42	31.50
s.d.	7.63	12.21	7.35	7.46	8.27

Interpretation: The peak SPR values observed in 1988-1989 for all species were largely a response to increases in aggregate CPUE due to increased uku landings. 1997 SPR values indicate critical localized depletion for all five major BMUS species, largely due to low 1997 aggregate CPUE. The 1997 value presented here for MHI hapuupuu is the best estimate of MHI SPR available, because we cannot calculate an SPR for this species using targeted CPUE. For the remaining species, the next section (Figure 19-A) gives the best estimation of 1997 MHI SPR.

Comments: Current SPR estimates for all five major BMUS species in the MHI are below the twenty percent critical threshold level indicating localized resource depletion. Onaga remains below 20% for the eighth year in a row. SPR values for other species have recently dropped slightly below this threshold level, entering the critical zone. The sharp drop in hapuupuu SPR in 1995 is due to a combination of factors including a lower aggregate CPUE in 1995 and a marked rise in the percentage of immature individuals in the catch mirrored by a drop in mean weight.

The 1996 and 1997 hapuupuu values are similar to the 1995 values for these measures.

Source: SPR estimated from the Honolulu UFA auction size frequency data collected by HDAR, NMFS, and WPRFMC personnel; CPUE estimates from C-3 form data reported to HDAR by commercial fishermen. Additional information for opakapaka obtained from size frequency data of fish caught from the R/V Townsend Cromwell.

Calculation & Adjustment: Calculations use similar methodology as presented in Somerton and Kobayashi (1990) for dynamic SPR. Virgin CPUE estimate is 1948-1952 mean; current CPUE estimate is a single year estimate. CPUE is of aggregate bottomfish from the areas of Maui, Lanai, Molokai, and Penguin Banks (see Fig. 15-A for more details). Virgin catch size composition is estimated from the 1986-1988 NWHI catch data, and current catch size composition is estimated from single year MHI catch data. All SPR values may have changed slightly from previous year's reports due to more complete reporting and improvements in the calculations. The 90.25% non-parametric confidence intervals were constructed based on "best" and "worst" case bounds of SPR components (CPUE and percent immature).

Figure 19-a. Spawning potential ratio (SPR) for MHI bottomfish using targeted CPUE

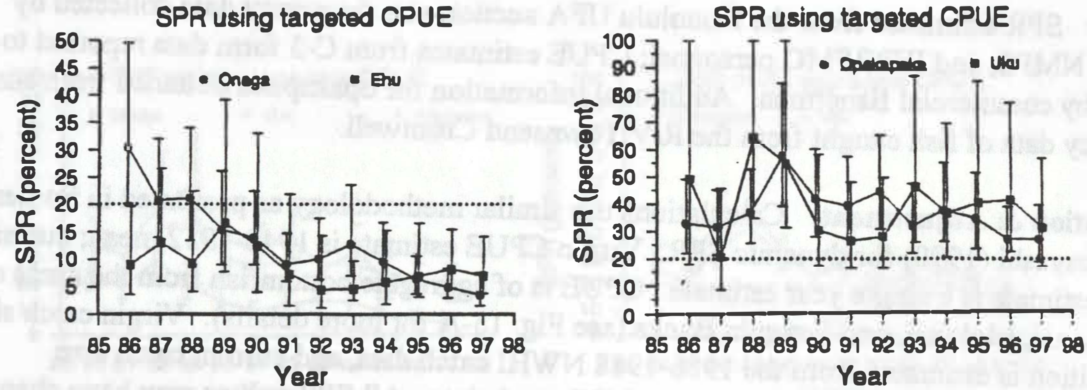


Figure 19a data summary:

	SPR (%)			
Year	Opakapaka	Onaga	Ehu	Uku
1986	32.71	30.37	8.99	49.11
1987	31.43	20.60	12.91	20.57
1988	36.88	21.03	9.30	64.24
1989	57.60	15.31	16.54	54.86
1990	41.73	13.86	12.32	30.29
1991	39.18	8.99	7.23	26.37
1992	44.41	9.95	4.37	28.01
1993	31.93	12.65	4.56	46.13
1994	37.48	9.49	5.76	36.51
1995	34.59	6.34	6.85	40.17
1996	26.96	4.81	8.16	41.15
1997	26.96	3.50	6.92	31.17
mean	36.82	13.08	8.66	39.05
s.d.	8.47	7.80	3.65	12.83

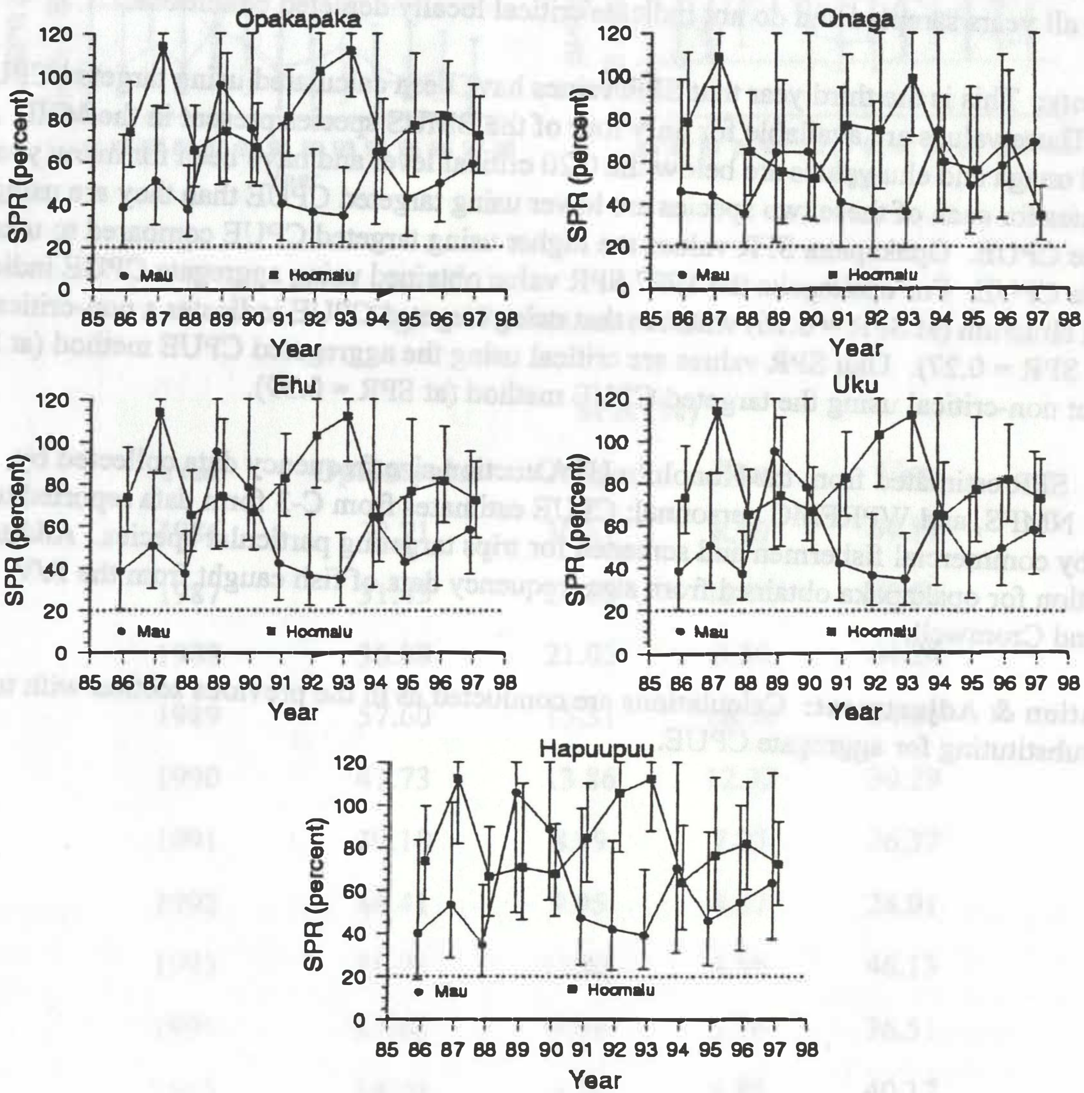
Interpretation: We feel that SPR values obtained here may better represent the condition of the MHI resources in regards to localized depletion than those found in the previous section. Ehu and onaga stocks are clearly stressed and well below the 20% SPR threshold, with ehu below the 20% level for the duration of our data and onaga on a continuing downward trend with values below 20% for the last 9 years. Of particular concern is the continued decline in onaga SPR values; ehu values, though low, have not changed much over the years. Contrary to the results obtained in the previous section, opakapaka and uku SPR levels have remained above the 20% mark for all years sampled and do not indicate critical locally depleted conditions.

Comments: This is the third year that SPR values have been calculated using targeted CPUE values. These values are available for only four of the BMUS species present in the MHI. As expected onaga and ehu values are below the 0.20 critical level and have been for many years. SPR values for each of these two species are lower using targeted CPUE than they are using aggregate CPUE. Opakapaka SPR values are higher using targeted CPUE compared to using aggregate CPUE. For opakapaka the 1997 SPR value obtained using aggregate CPUE indicates a critical situation (at SPR = 0.16) whereas that using targeted CPUE indicates a non-critical level (at SPR = 0.27). Uku SPR values are critical using the aggregated CPUE method (at SPR = 0.19), but non-critical using the targeted CPUE method (at SPR = 0.39).

Source: SPR estimated from the Honolulu UFA auction size frequency data collected by HDAR, NMFS, and WPRFMC personnel; CPUE estimates from C-3 form data reported to HDAR by commercial fishermen and screened for trips targeting particular species. Additional information for opakapaka obtained from size frequency data of fish caught from the R/V Townsend Cromwell.

Calculation & Adjustment: Calculations are conducted as in the previous section with targeted CPUE substituting for aggregate CPUE.

Figure 19-b. Spawning potential ratio (SPR) for NWHI bottomfish



Interpretation: The correlation of SPR values among species is due the high dependence of SPR on the CPUE component, given that the maturity component is nearly negligible. All species utilize the same aggregate bottomfish CPUE component. The maturity component is small relative to MHI SPR calculations because 1) the NWHI catch is primarily mature fish, and 2) the current catch size composition is relatively unchanged from the best estimate of the virgin catch size composition.

Figure 19b data summary:

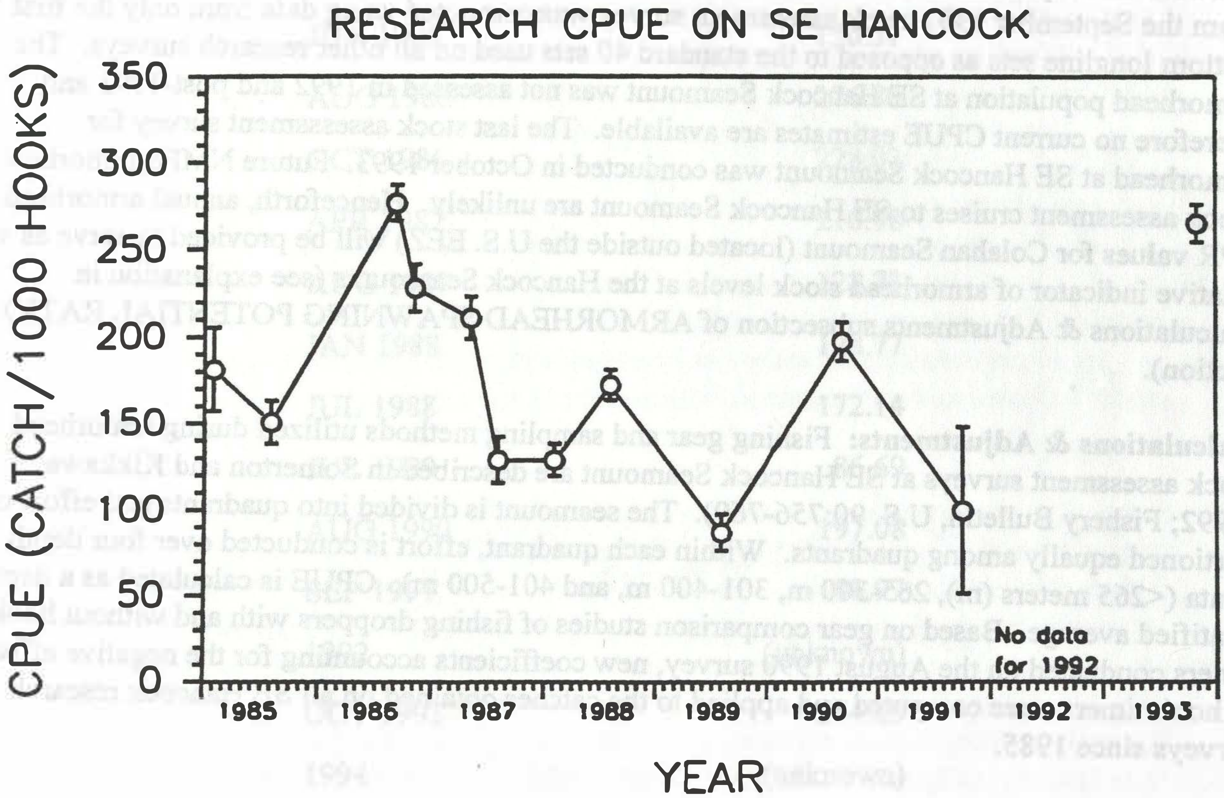
SPR (%)					
Mau Zone					
Year	**Ehu**	**Hapuupuu**	**Onaga**	**Opakapaka**	**Uku**
1986	39	40	46	39	39
1987	51	53	44	51	51
1988	38	35	36	38	38
1989	95	106	64	96	95
1990	78	89	64	75	78
1991	42	47	41	40	42
1992	37	42	36	36	37
1993	35	39	36	35	35
1994	65	71	75	64	66
1995	43	46	49	43	43
1996	50	55	58	50	50
1997	58	64	69	59	58
mean	52.58	57.25	51.50	52.17	52.67
s.d.	18.56	21.81	13.94	18.58	18.63
Hoomalu Zone					
1986	74	74	78	74	74
1987	114	112	109	114	114
1988	66	67	65	66	66
1989	74	71	55	74	74
1990	67	68	52	67	67
1991	83	85	77	81	83
1992	103	106	75	102	103
1993	112	112	99	112	112
1994	65	64	60	65	65
1995	77	77	56	77	77
1996	81	82	67	81	81
1997	72	72	35	72	73
mean	82.33	82.50	69.00	82.08	82.42
s.d.	17.55	17.68	20.43	17.45	17.50

Comments: Current SPR estimates for all five species in both zones are above the 20% critical threshold level indicating healthy resources on a local scale, though lower confidence limits often are near or slightly below this level. Mau Zone SPR estimates tend to be lower than Hoomalu Zone SPR estimates for most species, and onaga SPR estimates tend to be slightly lower than those for most other species.

Source: SPR estimated from Honolulu auction size frequency data collected by NMFS personnel, and CPUE estimates from C-3 form data reported to HDAR by commercial fishermen.

Calculation & Adjustment: Calculations use same methodology as presented in Somerton and Kobayashi (1990) for dynamic SPR. Virgin CPUE estimate is 1948-52 mean; current CPUE estimate is a single year estimate. CPUE is of aggregate bottomfish calculated separately for Mau and Hoomalu Zones. Virgin catch size composition is estimated from the 1986-88 NWHI catch data, and current catch size composition is estimated from single year catch data. All SPR values changed slightly from previous year's reports due to improvements in the calculations. 90.25% non-parametric confidence intervals were constructed based on "best" and "worst" case bounds of SPR components (CPUE and percent immature).

Figure 20. Armorhead Stock Assessment



Interpretation: The fluctuations in CPUE shown in the above figure are apparently the result of episodic recruitment followed by high natural mortality. These peaks in CPUE correspond to years (1986 and 1990) where an appreciable proportion (at least one-third) of the armorhead population consisted of fat individuals (fatness index $\geq$0.26) considered new recruits to the seamount population. Fatness index is defined as body depth divided by fork length. Subsequent to recruitment individuals cease somatic growth and over the course of 3-4 years, survivors decline in fatness index and weight. Without subsequent recruitment to the population in suceeding years, the armorhead population as a whole would decline both in numbers (natural mortality) and in biomass (declining fatness index). The high 1993 CPUE is unusual, however, since fat individuals (new recruits) account for <15% of the 1993 population while leaner individuals (<0.23 in fatness index) form the bulk of the population. These results apparently indicate that the 1993 population is primarily derived from recruitment which occurred either in late 1991 or during 1992. Previous work indicates that little if any annual recruitment to SE Hancock Seamount occurs after the summer months (Humphreys et al. 1993; Fishery Bulletin, U.S. 91:455-463). Since the 1991 stock assessment survey coincided with the end of the summer season, the increase in CPUE at SE Hancock for 1993 is most likely due to good recruitment during 1992. The sharp increase in the 1992 CPUE among seamounts outside the U.S. EEZ implies that a high recruitment occurred (across all seamounts) in 1992.

Data Source: Figure 20 presents CPUE based on research longline catches at SE Hancock Seamount by NMFS, Honolulu personnel aboard NOAA ship R/V Townsend Cromwell. Vertical bars represent the 95% confidence intervals about the mean CPUE. The CPUE derived from the September 1991 stock assessment survey was computed using data from only the first 5 bottom longline sets as opposed to the standard 40 sets used on all other research surveys. The armorhead population at SE Hancock Seamount was not assessed in 1992 and post-1993 and therefore no current CPUE estimates are available. The last stock assesssment survey for armorhead at SE Hancock Seamount was conducted in October 1993. Future NMFS armorhead stock assessment cruises to SE Hancock Seamount are unlikely. Henceforth, annual armorhead SPR values for Colahan Seamount (located outside the U.S. EEZ) will be provided to serve as a relative indicator of armorhead stock levels at the Hancock Seamounts (see explanation in Calculations & Adjustments subsection of ARMORHEAD SPAWNING POTENTIAL RATIO section).

Calculations & Adjustments: Fishing gear and sampling methods utilized during armorhead stock assessment surveys at SE Hancock Seamount are described in Somerton and Kikkawa (1992; Fishery Bulletin, U.S. 90:756-769). The seamount is divided into quadrants and effort is portioned equally among quadrants. Within each quadrant, effort is conducted over four depth strata (<265 meters (m), 265-300 m, 301-400 m, and 401-500 m). CPUE is calculated as a depth stratified average. Based on gear comparison studies of fishing droppers with and without hook timers conducted on the August 1990 survey, new coefficients accounting for the negative effects of hook timers were computed and applied to the catches obtained on all SE Hancock research surveys since 1985.

TABULATED VALUES:

MONTH/YEAR	ARMORHEAD CPUE
JAN 1985	181.28
JUN 1985	150.51
AUG 1986	276.80
OCT 1986	228.03
APR 1987	210.98
AUG 1987	128.73
JAN 1988	128.77
JUL 1988	172.14
JUL 1989	86.69
AUG 1990	197.08
SEP 1991	98.97
1992	(unknown)
OCT 1993	264.85
1994	(unknown)
1995	(unknown)
1996	(unknown)
1997	(unknown)

Figure 21. Armorhead Spawning Potential Ratio

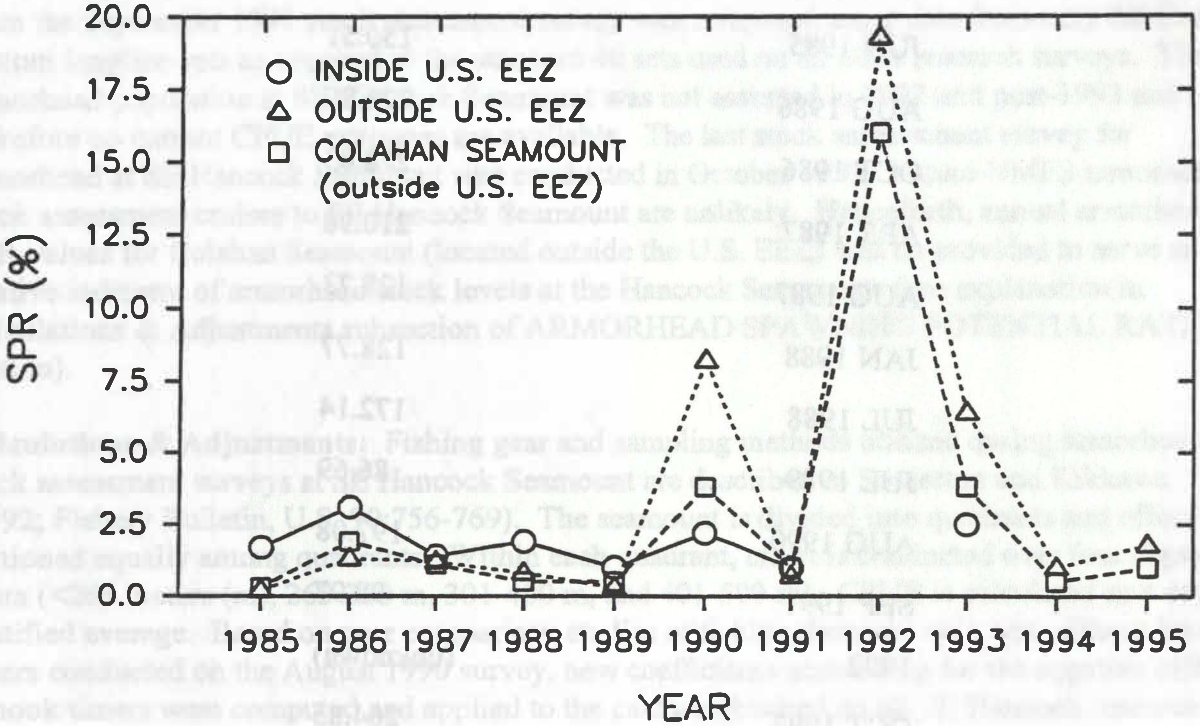
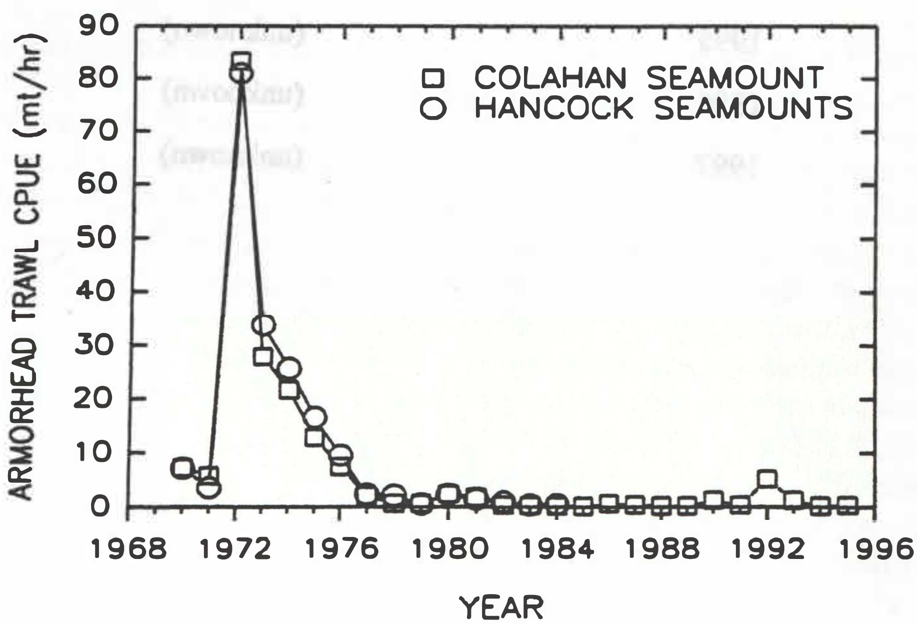


Figure 22. CPUE for Hancock and Colahan Seamounts



Interpretation: SPR within the region outside of the U.S. EEZ, which historically (Japan trawl fleet during the 1969-1981 period) contributed 91% of the total catch of armorhead, is 0.4%; based on the most current (1996) available catch and effort statistics from the Japan North Pacific trawl fishery. This indicates a continued depression in stock levels since the dramatic increase of SPR levels outside the U.S. EEZ in 1992 and the equally dramatic decline since then. This continued decline outside the U.S. EEZ is interpreted to be a result of sustained intensive effort on the high 1992 recruitment stock coupled with little subsequent recruitment during 1993-1996 to compensate for losses do to fishing and natural mortality. Based on previous trends, catch levels are expected to remain low in 1997 unless offset by a large recruitment event.

Based on current estimates of a 2-2.5 year pelagic phase prior to seamount recruitment, the 1992 recruitment would have originated from the 1989-1990 winter spawning season. If this is correct, then the large 1992 recruitment originated from a parental stock which in 1989 had the lowest SPR values both inside and outside the U.S. EEZ (see table next page). This would appear to support the notion that dramatic increases in armorhead abundance across the seamounts are episodic and the product of environmental factors rather than simply a stock-recruitment relationship.

During February-March 1997, an oceanographic and larval armorhead survey over the seamounts outside the U.S. EEZ was conducted onboard the R/V Kaiyo Maru by the National Research Institute of Far Seas Fisheries Laboratory in Shimizu, Japan. Initial plans were to include research trawl hauls over Colahan Seamount, however, the ship was no longer equipped to conduct bottom trawl operations. Armorhead larvae were collected from surface waters around the Milwaukee Seamounts group, Colahan and C-H Seamount, but were absent from Koko Seamount. This same vessel is currently scheduled to conduct a survey of pelagic stages of armorhead away from the SE-NHR seamounts in November 1998. One of the objectives will be to tag-and-release pelagic specimens from various locations away from the seamounts to later determine from seamount re-captures which specific seamounts these individuals settled on.

Management Issues: The current 6-year fishing moratorium at the Hancock Seamounts expired August 31, 1998. Based on the low SPR values through 1996 both at Colahan Seamount and at all seamounts collectively outside the U.S. EEZ, it is inferred that the status of the Hancock Seamounts armorhead stock is similarly depressed and well under the 20% SPR level. This necessitates a continued protection of the resource within the U.S. EEZ and it was recommended that the moratorium be extended for at least another 6 years. This recommendation was implemented.

Data Source: SPR values for seamounts outside the U.S. EEZ are based on reported catch and effort data from the Japanese trawler fleet and values for seamounts within the U.S. EEZ (Hancock Seamounts) are based on research longline CPUE in addition to the trawl CPUE. However, with the cessation of research longline cruises to the Hancock Seamounts, SPR values for Colahan Seamount (comparable in size and located closest to the Hancocks among seamounts outside the U.S. EEZ) are being provided now and in the future as an indicator of stock levels at the Hancock Seamounts. SPR values for Colahan Seamount are also based on reported catch and effort data at that seamount by the Japanese trawler fleet.

Calculations & Adjustments: SPR values outside the U.S. EEZ are computed as the current year CPUE divided by the average CPUE during the first three years of the fishery (1970-1972). SPR values inside the U.S. EEZ are computed as the estimated biomass on SE Hancock Seamount divided by the 1970-1972 average biomass. Biomasses are estimated using procedures described in Somerton and Kikkawa (1992). The SPR values for Colahan Seamount are computed as the current year CPUE divided by the average CPUE during the first three years of the fishery (1970-1972) at Colahan Seamount (Figure H-19). Fishery catch and effort data by seamount by month for seamounts outside the the U.S. EEZ have been provided annually since 1980 by colleagues at the National Research Institute for Far Seas Fisheries in Shimizu, Japan.

The decision to use SPR values for Colahan Seamount (instead of the overall outside U.S. EEZ values) as an indicator of armorhead stock conditions inside the U.S. EEZ (i.e., Hancock Seamounts) is based on the greater similarities between these seamounts. Aside from Colahan Seamount, the seamounts fished for armorhead outside the U.S. EEZ are Milwaukee Seamounts and Koko Seamount. These latter seamounts have summit areas of 67 and 564 nm^2 and average summit depths of 190 and 170 fm, respectively, while Colahan and the Hancock Seamounts have much smaller summit areas (about 1.4 nm^2) and shallower summit depths (141-150 fm). Fishing effort by the Japan trawl fleet has historically been different at these two types of seamounts. Koko and Milwaukee Seamounts have always received the majority (about two-thirds) of the annual total trawling effort and were typically fished intensively over a sustained period of time. However, the fishing effort at Colahan and the Hancock Seamounts was applied in pulses since catch levels could not be sustained for more than several days without a "cooling off" period. These similarities plus the historical close coincidence between Colahan and Hancock Seamounts in temporal profiles of armorhead CPUE from the Japan trawl fleet (Figure H-20) indicate that SPR values for Colahan Seamount should provide the best future indicator of armorhead stock levels at the Hancock Seamounts.

TABULATED VALUES:

ARMORHEAD SPR (%)

YEAR	INSIDE US EEZ	COLAHAN	OUTSIDE US EEZ
1985	1.7	0.3	0.2
1986	3.1	1.9	1.3
1987	1.4	1.1	1.2
1988	1.9	0.5	0.8
1989	1.0	0.5	0.3
1990	2.2	3.8	8.2
1991	1.0	1.0	0.7
1992	NA	16.0	19.3
1993	2.5	3.8	6.4
1994	NA	0.5	1.0
1995	NA	1.0	1.8
1996	NA	1.2	0.4
1997	NA	NA	NA

Appendix 4

Commonwealth of the Northern Mariana Islands

CONTENTS

Introduction

The Northern Mariana Islands (NMI) bottomfish fishery occurs primarily around the islands and banks from Rota Island to Zealandia Bank north of Sarigan. However, this discussion will be limited to the catches landed on Saipan which is by far the largest market. The fishery will be characterized by data collected through the Commercial Purchase Data Base which indirectly records actual landings by recording all local fish sales to commercial establishments. This data collection system is dependent upon first-level purchasers of local fresh fish to accurately record all fish purchases by species categories on specially designed invoices. Division of Fish and Wildlife (DFW) staff routinely collect and distribute invoice books to 70 participating local fish purchasers; which include practically all fish markets, stores, restaurants, hotels, government agencies and roadside vendors (fish-mobiles). Although this data collection system has been in operation since the mid-1970s, only data collected since 1983 are considered accurate enough to be comparable for most aspects of the fishery.

The NMI's bottomfish fishery still consists primarily of small-scale local boats engaged in commercial and subsistence fishing, but in recent years larger vessels (35'-50') have entered the fishery. The bottomfish fishery is broken down into two categories; deep (>500 ft) and shallow (100-500ft) water fishing. The deep water fishery is primarily commercial, targeting snappers and groupers. The snappers targeted include the Eteline and Pristipomoides complexes, whereas the Eight-banded grouper (*Epinephelus octofasciatus*) is exclusively targeted. The shallow water fishery, which targets the Red-gilled emperor (*Lethrinus rubrioperculatus*), is mostly commercial but also includes subsistence fishermen. Hand lines, home fabricated hand reels and electric reels are the common gear used for small-scale fishing operations, whereas electric reels and hydraulics are the common gear used for the larger operations in this fishery. Historically, some trips have lasted for more than a day, but currently, however, effort is defined and calculated on a daily trip basis. Fishing trips are generally restricted to daylight hours, with all vessels returning before or soon after sunset, unless fishing in the Northern Islands. In terms of participation the bottomfish fleet consists primarily of vessels less than 24 feet in length which are usually limited to a 25-mile radius from Saipan. The larger commercial vessels that are able to fish extended trips and which focus their effort from Esmeralda Bank to Zealandia Bank, have landed the majority of the bottomfish reported through the purchase receipt form. In 1997, two commercial ventures fished during the entire year in the Northern Islands of the NMI. One company targeted mostly onaga (*Etelis coruscans*) and the Eight-banded grouper, while the other shifted focus to the Red-gilled emperor. Both of these companies utilized only one vessel. Toward the end of 1997 a third company entered the fishery, fishing one vessel 55 feet long.

Bottomfish fishing requires more technical skill than pelagic trolling, including knowledge of the location of specific bathymetric features. Presently, bottomfish fishing can still be described as "hit or miss" for most of the smaller size (14-25 ft.) vessels. Without fathometers and even nautical charts, the majority of fisherman utilizing smaller vessels often rely on land features for guidance to a fishing area. This type of fishing is inefficient and usually results in a lower CPUE in comparison with pelagic trolling. Larger sized (25 ft. and above) vessels typically utilize Global Positioning System (G.P.S.), fathometers and electric reels, resulting in a far more efficient operation.

Summary

Through documentation of increased landings, it is apparent that bottomfish fishing activity in the NMI has increased from its decline six years ago. In 1997, bottomfish landings remained steady from 1996, decreasing by 4%, and exceeding the 1994 landings by over 149%. Domestic US, joint-venture, and foreign vessels are still inquiring about full-time bottomfish fishing throughout much of the NMI. The impact to the commercial market is still unclear despite a fish market assessment study that was conducted in 1994, but only recently completed in late 1996. This study did not correspond with the significant increase in the Northern Islands bottomfish harvest.

The number of commercial bottomfish fishing ventures active in the Northern Islands increased by one vessel in 1997, with a third company entering the fishery in Decemeber 1997. Commercial trips have been sampled on a monthly basis.

Revenues and prices will probably continue to increase with renewed fishing interest, larger financial investment, and increased utilization of modern electronics and equipment. Deep-water snappers still command the best prices. Fishermen utilizing larger vessels will have greater access to these deep-water resources, especially in the Northern Islands of the NMI. Subsequently, the market demand should continue to increase as long as the supply of these fish increases with consistent quality. This industry could continue to expand with potential support by a training program in bottomfishing that addresses the following; proper fish handling, use of fathometers, nautical charts, modern electronic equipment such as GPS, fish finders, electric reels, plus anchoring techniques and marketing.

With the potential expansion of biological data collection from the bottomfish fishery, as well as DFW fishing surveys, an assessment should be completed for the bottomfish stocks surrounding Saipan. After identifying the extent of resource utilization, additional data collecting could be used to help determine comprehensive management strategies. Continued sampling of vessels fishing bottomfish plus actual fishing by DFW in the Northern Islands of the NMI would provide comparable estimates of CPUE.

Recommendations

1) Establish an ongoing bottomfish monitoring program to provide needed data for the commercial bottomfish fishery, contingent upon the Council identifying funds to implement and maintian the program, with assiatance from NMFS/WPacFIN.

2) Establish baseline (virgin stock) parameters (CPUE, percent immature) for the Guam/Northern Marianas deep-water bottomfish complex (e.g., survey on grouper, snapper) utilizing data collected during Resource Assessment Investigation of the Marianas Archipelago (RAIOMA) cruises (1981-1984), the current fishing in the Northern Islands and sampling aboard DFW research vessel to help calculate SPR, with assistance from NMFS.

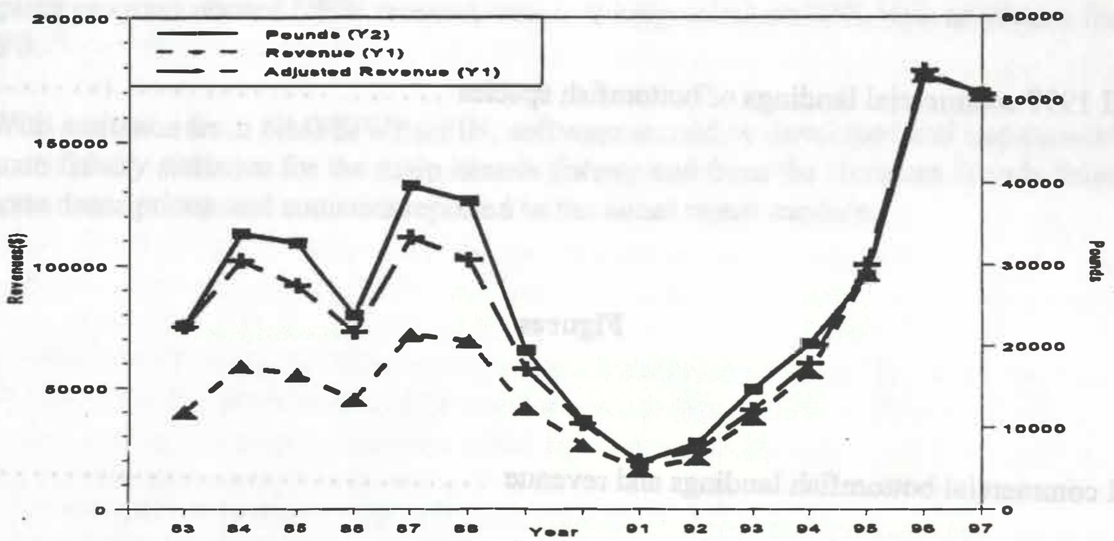
3) Establish baseline (virgin stock) parameters (CPUE, percent immature) for the Guam/Northern Marianas shallow-water bottomfish complex (e.g. red-gilled emperor) by sampling program aboard DFW research vessel to help calculate SPR, with assistance from NMFS.

4) With assitance from NMFS/WPacFIN, software should be developed and implemented to separate fishery statistics for the main islands fishery and from the Norhtern Islands fishery with separate descriptions and statistics reported in the anual report module.

Tables

Figures

Figure 1. NMI commercial bottomfish landings and revenue.



Interpretation: Landings, revenues and adjusted revenues for 1997 have remained relatively constant from 1996, although the average from each category has increased from 1996. This is attributed to the continued bottomfish effort concentrated in the Northern Islands.

Calculation: Landings in pounds are from a simple data base summation of reported purchases of all bottomfish species combined. Revenue in dollars is from the same type of data base summation of the value field. The inflation adjustment is made using the Consumer Price Index (CPI) and establishing the 1996 CPI figure as the basis by which calculations of previous years' prices are made.

Year	Pounds	Unadjusted Revenue	Inflation-Adjusted Revenue
1983	22,683	40,003	75,206
1984	33,924	59,005	102,079
1985	32,780	55,396	91,957
1986	23,929	45,079	73,028
1987	39,772	71,868	111,395
1988	37,850	69,052	102,197
1989	19,550	41,379	57,517
1990	10,903	26,323	35,010
1991	5,693	16,118	19,825
1992	8,148	21,032	23,976
1993	14,769	37,310	40,668
1994	20,363	56,405	59,789
1995	28,744	96,100	99,944
1996	52,967	176,707	178,474
1997	**50,851**	**168,890**	**168,890**
Average	26,862	65,378	82,664
Standard Deviation	14,525	48,305	47,295

Table 1. NMI 1997 commercial landings of bottomfish species

Species	Landings (lb)	Revenue ($)	Ave. Price ($/lb)
Unidentified Bottomfish	3189	8941	2.80
Jacks	2758	8719	3.21
Gindai	657	2082	3.17
Grouper	7269	21479	2.95
Onaga	13290	56722	4.27
Opakapaka	2224	7201	3.24
Lehi	1100	4708	4.28
Emperor	20355	58899	2.89
Subtotal	**50851**	**168751**	**3.32**

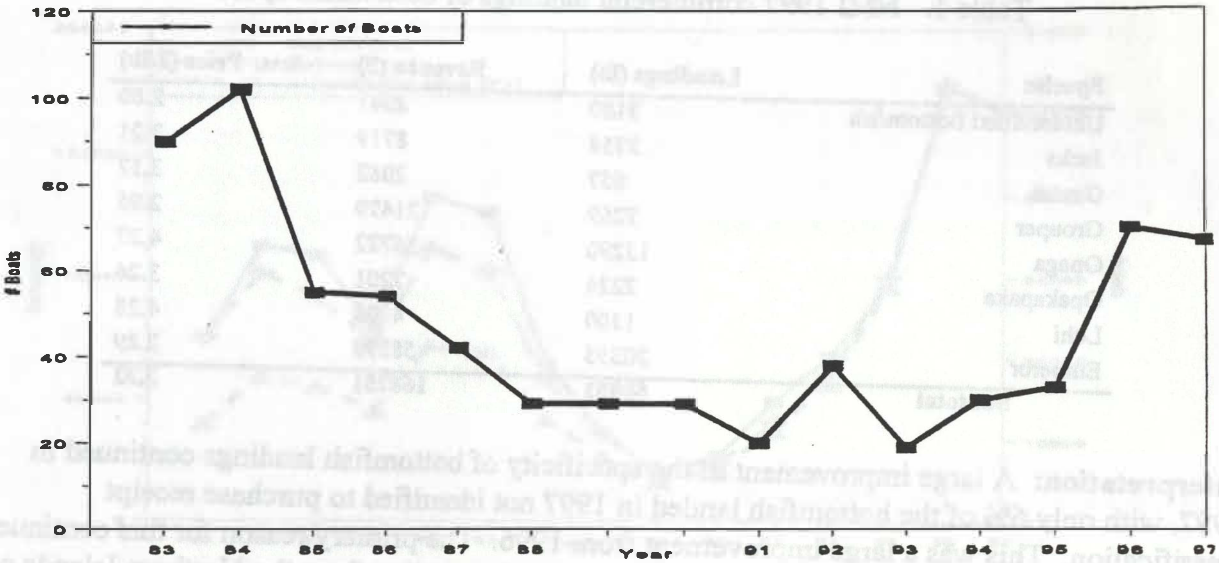
Interpretation: A large improvement in the specificity of bottomfish landings continued in 1997, with only 6% of the bottomfish landed in 1997 not identified to purchase receipt classification. This was a large improvement from 1996. The primary reason for this continued to be the accurate reporting of the commercial ventures harvesting from the Northern Islands of the NMI. The most notable change from 1996 was the 112% increase in landings of the Red-gilled emperor, from 9,592 to 20,355 pounds. This was due to this species becoming an increased target for the two Northern Islands commercial ventures, as well as a target of incerased fishing pressure from smaller (25-30 foot) vessels harvesting around the island of Farallon de Mendinilla. The 'jacks' category also increased as a result of the increased landings of the Black Jack (*Caranx lugubris*), taken in the same depth range as the Red-gilled emperor. Both the Eigth-banded grouper and the Onaga remained relatively stable from 1996, with Lehi (*Aphareus rutilans*) landings decreaseing over 56%.

Because the two commercial ventures fishing in the Northern Islands targeted either the deeper Onaga and Eight-banded grouper, or the shallower Red-gilled emperor, landings of the Pristipomoides complex decreased markedly fom 1996.

Onaga continued to command the highest price per pound, followed by the Lehi. All bottomfish prices increased, except for Gindai.

Calculation: Annual summaries for each species from invoice data sheets.

Figure 2. Number of Fishermen (boats) making bottomfish landings



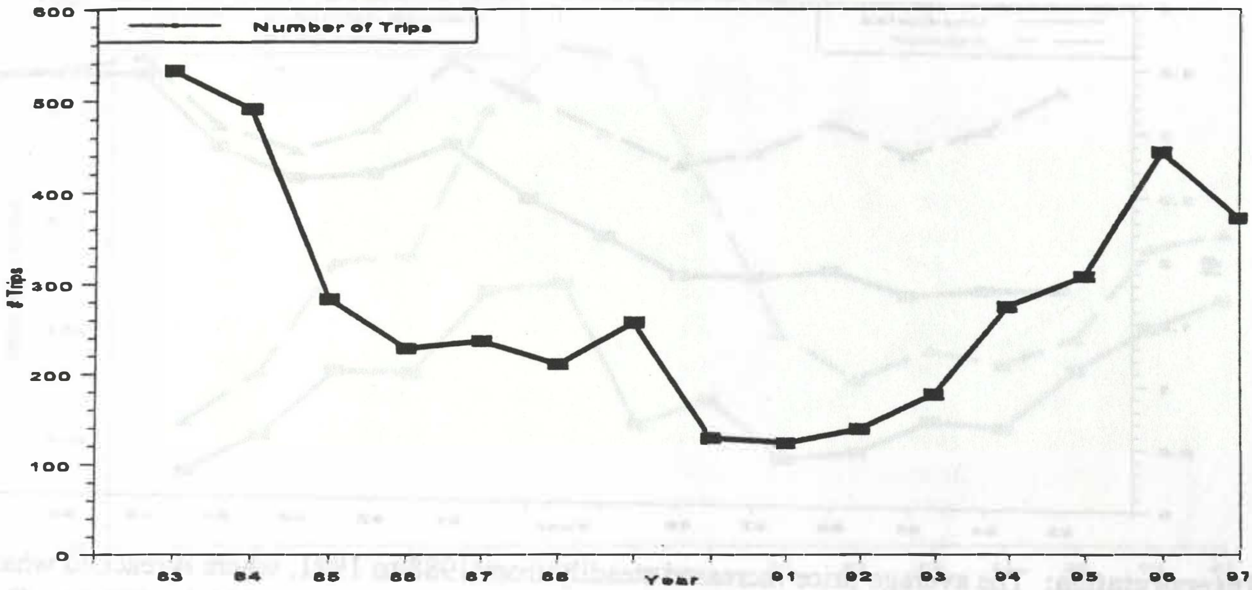
Interpretation: As with the number of trips (Fig. 3), the number of boats or fishermen making commercial landings of any bottomfish species declined from 1984 to 1988, stabilized between 1988-90, slightly increased during 1992, decreased again in 1993, then increased during 1994 and 1995, and increased 100% in 1996. The number of vessels making bottomfish trips decreased slightly from 1996.

More smaller vessels are landing 'mixed' trips over past years. That is smaller vessels are both trolling and Bottom fishing on a single trip.

Calculation: The fisherman or boats selling the catch is identified on the "trip ticket" invoices used by purchasers. The plot shows the number of unique fishermen making any landings of bottomfish within a given year.

Year	Boats
1983	90
1984	102
1985	55
1986	54
1987	42
1988	29
1989	29
1990	29
1991	20
1992	38
1993	20
1994	32
1995	33
1996	70
1997	67
Average	47
Standard Deviation	25

Figure 3. Number of NMI bottomfish trips

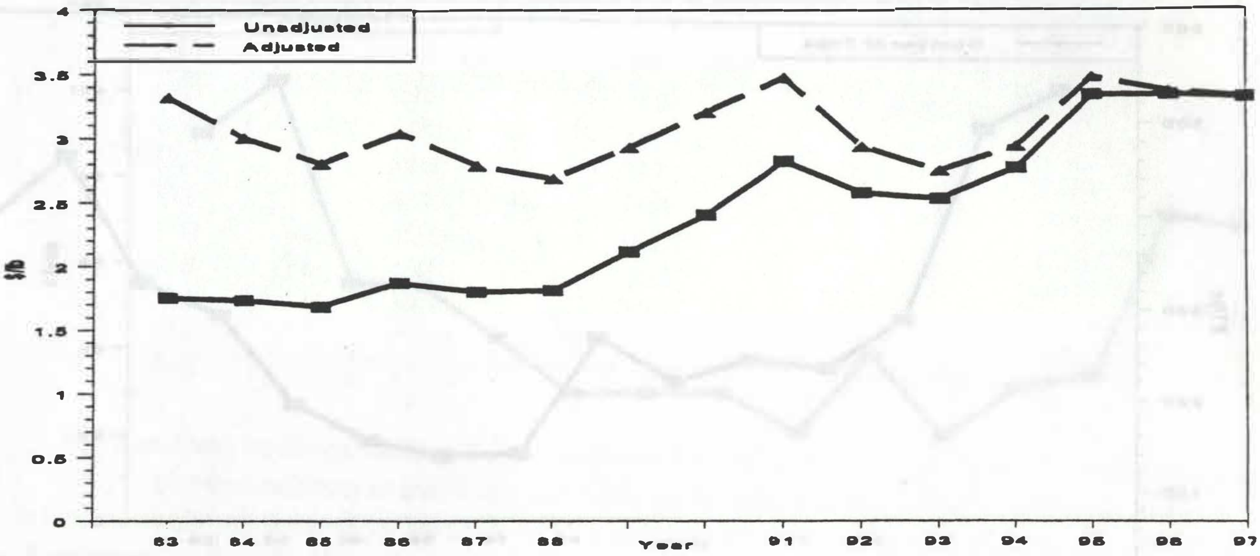


Interpretation: The number of bottomfish trips decreased 16% from 1996. This corresponds with the number of vessels making bottomfish trips, and the decrease in the number of fishing trips by the commercial ventures to the Northern Islands.

Calculation: The number of trips which resulted in landing any bottomfish are tallied by adding each recorded fisherman's trip on a given day. The assumptions are that each fisherman lands only once in a given day, and that he sells all of his catch on that day. Most trips last a single day, but it is also known that the occurrence of longer fishing trips is increasing.

Year	Trips
1983	533
1984	492
1985	283
1986	229
1987	237
1988	211
1989	257
1990	129
1991	124
1992	140
1993	178
1994	275
1995	309
1996	446
1997	373
Average	281
Standard Deviation	129

Figure 4. NMI average price of bottomfish

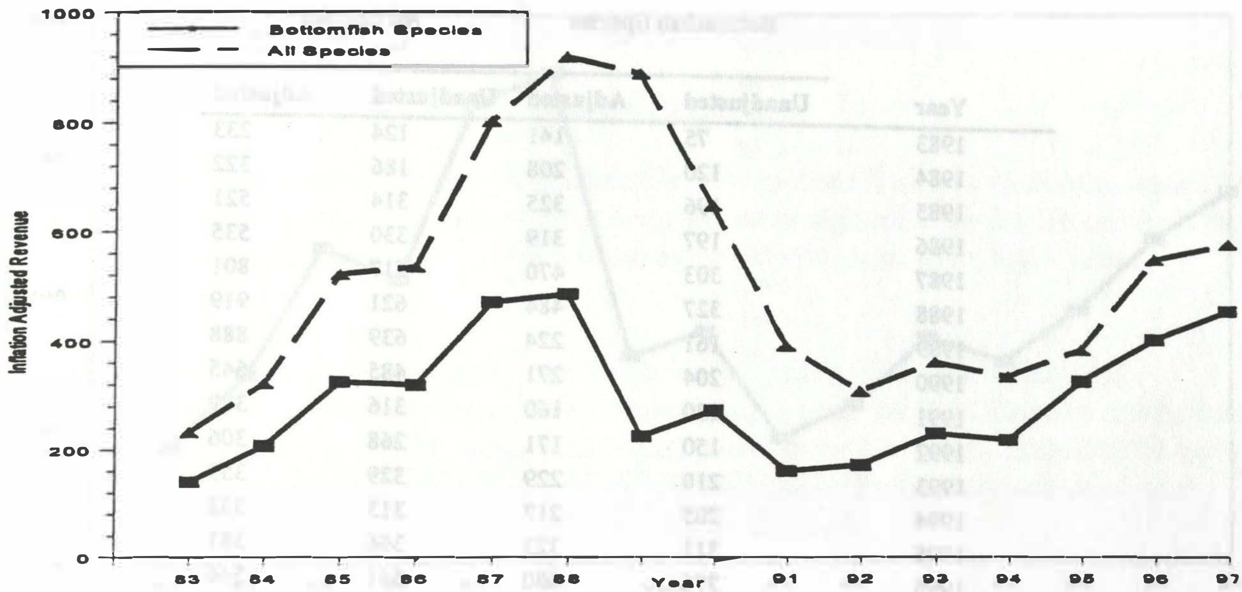


Interpretation: The average price increased steadily from 1988 to 1991, where it reached what was once a record high of $2.83. In 1995 the price increased to a new record high of $3.34. This price remained constant in 1996, but decreased slightly in 1997. This decrease was relatively insignificant. Re-sold catches are not included in this report.

Calculation: The average price of the bottomfish complex is calculated by dividing the total revenue by the total landings. The inflation adjustment is made using the Consumer Price Index (CPI) and establishing the 1995 CPI figure as the basis by which calculations of previous years' prices are made. The CPIs for 1983-87 were not available from the appropriate NMI agency and were, therefore, estimated by using Guam's annual inflation rate to proportionately adjust the 1988 NMI CPI.

Year	Unadjusted $/lb	Adjusted $/lb
1983	1.76	3.32
1984	1.74	3.01
1985	1.69	2.81
1986	1.88	3.05
1987	1.81	2.80
1988	1.82	2.70
1989	2.12	2.94
1990	2.41	3.21
1991	2.83	3.48
1992	2.58	2.94
1993	2.53	2.75
1994	2.77	2.94
1995	3.34	3.48
1996	3.34	3.37
1997	**3.32**	**3.32**
Average	2.40	3.07
Standard deviation	0.62	0.27

Figure 5. NMI average inflation adjusted revenue per trip landing bottomfish



Interpretation: Inflation adjusted bottomfish revenue in 1997 increased over 1996, continuing a trend begun in 1995. The all species inflation adjusted revenue increased significantly from 1995. Unadjusted revenues for both bottomfish and all species increased from 1995. The bottomfish fishery has always been a small proportion of the total fisheries, but it appears that bottomfish are comprising a relatively higher percentage of the trip revenue on trips where bottomfish were caught.

Calculation: Only trips which landed bottomfish are included in these calculations. "Bottomfish $/Trip" is the total revenue of the bottomfish sold from a trip, and "All Species $/Trip" is the total trip revenue of all species combined (e.g. any pelagic and reef fish which were sold). The inflation adjustment is made using the Consumer Price Index (CPI) and establishing the 1995 CPI figure as the basis by which calculations of previous years' prices are made. The CPIs for 1983-87 were not available from the appropriate NMI agency and were, therefore, estimated by using Guam's annual inflation rate to proportionately adjust the 1988 NMI CPI.

	Bottomfish Species		All Species	
Year	Unadjusted	Adjusted	Unadjusted	Adjusted
1983	75	141	124	233
1984	120	208	186	322
1985	196	325	314	521
1986	197	319	330	535
1987	303	470	517	801
1988	327	484	621	919
1989	161	224	639	888
1990	204	271	485	645
1991	130	160	316	389
1992	150	171	268	306
1993	210	229	329	359
1994	205	217	313	332
1995	311	323	366	381
1996	396	400	541	546
1997	452	452	574	574
Average	229	293	395	517
Standard Deviation	107	115	158	217

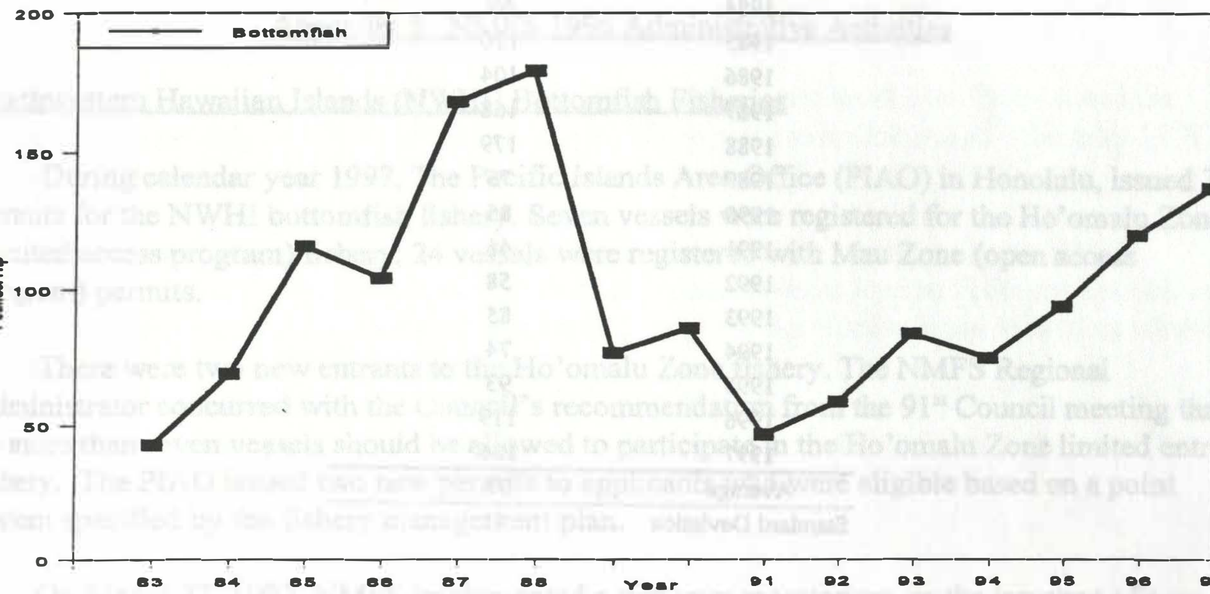


Figure 6. NMI bottomfish catch in average pounds per trip

Interpretation: The average pounds per trip of bottomfish increased 14% over 1996, and 46% over 1995. The substantial increase since 1995 can be attributed to the expanding Northern Islands fishery, which will continue to expand in the near future.

Calculation: The average catch per trip is calculated by dividing the total weight of all bottomfish landings by the number of trips which landed bottomfish, regardless of the amount of bottomfish landed on any given trip. Although the average catch per trip is not a very good measure of CPUE, because it is subject to significant biases (e.g. changes in trip length and relative amounts of Bottom fishing compared to trolling), it is the only measure readily possible from the commercial landings system. It may be possible to improve this measure of CPUE by using only those trips which landed bottomfish exclusively, but that has not yet been done. It is believed that the sample size resulting from this exercise would be extremely small and subject to other biases. It should, however, be investigated in the future.

Year	Pounds per Trip
1983	43
1984	69
1985	116
1986	104
1987	168
1988	179
1989	76
1990	85
1991	46
1992	58
1993	85
1994	74
1995	93
1996	119
1997	136
Average	97
Standard Deviation	41

Appendix 5. NMFS 1996 Administrative Activities

Northwestern Hawaiian Islands (NWHI) Bottomfish Fisheries

During calendar year 1997, The Pacific Islands Area Office (PIAO) in Honolulu, issued 31 permits for the NWHI bottomfish fishery. Seven vessels were registered for the Ho'omalu Zone (limited access program) fishery; 24 vessels were registered with Mau Zone (open access program) permits.

There were two new entrants to the Ho'omalu Zone fishery. The NMFS Regional Administrator concurred with the Council's recommendation from the 91st Council meeting that no more than seven vessels should be allowed to participate in the Ho'omalu Zone limited entry fishery. The PIAO issued two new permits to applicants who were eligible based on a point system specified by the fishery management plan.

On March 27, 1997, NMFS implemented a two-year moratorium on the issuance of new permits for the Mau Zone in an effort to stabilize the fishery while the Council was developing a limited access program for the area. PIAO renewed 21 Mau Zone permits and issued 3 new permits prior to the March 27 moratorium cut-off date.

Ho'omalu Zone (limited access) vessels:

1. Deborah Ann
2. Fortuna
3. Kalmi Kai (new)
4. Kealailani (new)
5. Laysan
6. Nesika (replacement)
7. Windwalker

Mau Zone (open access) vessels:

1. Aikane 49
2. Boomerang
3. Dasher II
4. Daystarr
5. Double D
6. Hoku (new)
7. Honua-Oe
8. Imua
9. Iwalani
10. Jamie Elizabeth
11. Jenine
12. Kai Pali
13. Lei Alana
14. Leo Marie
15. Lisa I
16. Mana Loa
17. Manu Aloha O'Ke Kai
18. Na Alii Kai (new)
19. Pomaikai
20. Pursuit
21. Ruthles (new)
22. Shaman II
23. Shanatu
24. Wahine Kapaloa

Appendix 6. NMFS 1997 Enforcement Activities

The following report is a combined effort of the U.S. Coast Guard 14th District and the NMFS Southwest Region Office of Enforcement. The report covers the period 1 January 1997 through 31 December 1997.

There were no significant MSFCMA law enforcement cases relating to bottomfish/ seamount groundfish fisheries that were prosecuted by the National Marine Fisheries Service or Coast Guard in 1997. One bottomfish vessel was boarded in the Northwestern Hawaiian Islands and had only minor non-fishing violations.

The Coast Guard continues to conduct surveillance of the Hancock Seamount area. The Coast Guard utilizes C-130 aircraft and cutters to patrol the Northwest Hawaiian Islands/Hancock Seamount.

Appendix 7. Protected Species and Habitat

Protected Species

There were no requests for Protected Species Workshops required to validate permits for the Ho'omalu and Mau Zones in 1997.

There were few complaints or informal reports from the bottomfish community regarding the loss of catch to Hawaiian monk seals and bottlenose dolphins during fishing in the Northwestern Hawaiian Islands (NWHI). The National Marine Fisheries Service (NMFS) received no reports of hookings or entanglements in this fishery during 1997 from vessels fishing in the Mau Zone or Ho'omalu Zone.

As in 1996, no observers were placed on bottomfish vessels operating in the NWHI in 1997 with all observer effort continuing to be directed to the Hawaii-based longline fishery and NWHI crustacean fishery.

Habitat

Under the Bottomfish FMP, regulations were implemented to prohibit the use of bottom trawls, bottom-set nets, explosives and poisons for harvesting bottomfish. This has served to greatly reduce the potential for bottomfish habitat degradation. To our knowledge, there have been no violations of these regulations in 1997.

As reported in earlier annual reports, there are several activities occurring, or reportedly occurring, in the EEZ that may potentially alter bottomfish habitat. These include: 1) anchor damage by vessels attempting to maintain position over productive bottomfish habitat, and 2) habitat damage from heavy weights and line entanglements during normal hook-and-line bottomfish operations.

Appendix 8. 1997 Bottomfish Plan Team Members

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Appendix 9. Glossary

TERM	DEFINITION
Alia	Samoan fishing catamaran, about 30 feet long, constructed of aluminum or wood with fiberglass. Used for various fisheries including trolling, longline, and bottomfishing
AP	Advisory Panel. Appointed industry/government/educational representatives functioning in an advisory capacity to the Council.
Armorhead	Groundfish found on the SE Hancock Seamount in the Northwestern Hawaiian Islands
AS or American Samoa	Includes the islands of Tutuila, Manua, Rose and Swains Atolls.
ASDPW	Department of Public Works, American Samoa. Also, DPW.
BARB	Bottomfish Advisory Review Board
BMUS	Bottomfish Management Unit Species, include deep and shallow water bottomfish species
BPT or PT	Bottomfish Plan Team. Advisory body to the Council composed of scientists and fishermen who monitor and manage the fisheries under the jurisdiction of the Bottomfish and Seamount Groundfish FMP.
Bycatch	Fish caught in a fishery but discarded or released, except in a recreational fisheries catch and release program.
Commercial	Commercial fishing, where the catch is intended to be sold, bartered, or traded.
CNMI or Commonwealth of the Northern Mariana Islands	Also, Northern Mariana Islands, Northern Marianas, and NMI. Includes the islands of Saipan, Tinian, Rota, and many others in the Marianas Archipelago.
CPUE	Catch-Per-Unit-Effort. A standard fisheries index usually expressed as numbers of fish caught per unit of gear per unit of time, eg., number of fish per hook per line-hour or number of fish per 1,000 hooks. The term catch rate is sometimes used when data are insufficiently detailed to calculate an accurate CPUE.
DAWR	Division of Aquatic & Wildlife Resources, Territory of Guam.
DBEDT	Department of Business, Economic Development & Tourism, State of Hawaii.

DFW	Division of Fish & Wildlife, Northern Mariana Islands.
DLNR	Department of Land & Natural Resources, State of Hawaii. Parent agency for Division of Aquatic Resources (HDAR).
DMWR	Department of Marine & Wildlife Resources, American Samoa. Also, MWR.
EEZ	Exclusive Economic Zone, refers to the sovereign waters of a nation, recognized internationally under the United Nations Convention on the Law of the Sea as extending out 200 nautical miles from shore. Within the U.S., the EEZ typically is between three and 200 nautical miles from shore.
ESA	Endangered Species Act. An Act of Congress passed in 1966 that establishes a federal program to protect species of animals whose survival is threatened by habitat destruction, overutilization, disease etc.
FAD	Fish Aggregating Device; a raft or pontoon, usually tethered, and under which, pelagic fish will concentrate.
FDCC	Fishery Data Coordinating Committee, WPRFMC.
FFA	Forum Fisheries Agency. An agency of the South Pacific Forum, which comprises the independent island states of the South Pacific, Australia and New Zealand. The FFA formed to negotiated access agreements between FFA member countries and distant water fishing nations such as Japan and the USA.
FMP	Fishery Management Plan.
GU or Guam	A U.S. territory in the Marianas Archipelago. South of and adjacent to the Commonwealth of Northern Marianas Islands.
HI or Hawaii	U.S. state. See MHI, NWHI. Composed of the islands, atolls and reefs of the Hawaiian Archipelago from Hawai'i to Kure Atoll, except Midway Islands. Capitol - Honolulu.
HDAR	Hawaii Division of Aquatic Resources. Also, DAR.
Hoomalu Zone	Bottomfish management area located in the northwestern Hawaiian Islands, includes area from French Frigate Shoals to Kure, including Hancock seamount.
Incidental Catch	Fish caught that are retained in whole or part, though not necessarily the targeted species. Examples include monchong, opah and sharks.
Interaction	Catch of protected species, which is required to be released. Examples: Hawaiian monk seals, marine turtles and albatrosses.

Mau Zone	Bottomfish management area located north of Kauai created as a qualifying zone to the larger, northern Hoomalu zone.
MFCMA	Magnuson Fishery Conservation and Management Act of 1976. Also, Magnuson-Stevens Fishery Conservation and Management Act of 1996. Sustainable Fisheries Act.
MHI	Main Hawaiian Islands (comprising the islands of Hawai'i, Mau'i, Lana'i, Moloka'i, Kaho'olawe, O'ahu, Kauai', Ni'ihau and Ka'ula).
MSY	Maximum Sustainable Yield.
NMFS	National Marine Fisheries Service, National Oceanic and Atmospheric Administration, Department of Commerce. Also NOAA Fisheries.
NOAA	National Oceanic and Atmospheric Administration, Department of Commerce.
NWHI	Northwestern Hawaiian Islands. All islands in the Hawaiian Archipelago, other than the Main Hawaiian Islands (MHI).
OY	Optimum Yield.
PAO	Pacific Area Office, National Marine Fisheries Service. Also, NMFS/PAO.
Protected	Refers to species which are protected by federal legislation such as the Endangered Species Act, Marine Mammal Protection Act, and Migratory Bird Treaty Act. Examples: monk seals, marine turtles, dolphins.
Recreational	Recreational fishing for sport or pleasure, where the catch is not sold, bartered or traded.
SAFE	Stock Assessment and Fishery Evaluation, NMFS.
Secretary	When capitalized and used in reference to fisheries within the U.S. EEZs, it refers to the U. S. Secretary of Commerce.
SPC	South Pacific Commission. A technical assistance organization comprising the independent states of South Pacific Ocean, dependant territories and the metropolitan countries of Australia, New Zealand, USA and France.
SPR	Spawning Potential Ratio. A term for a method to measure the effects of fishing pressure on a stock by expressing the spawning potential of the fished biomass as a percentage of the unfished virgin biomass. Stocks are deemed to be overfished when the SPR<20%.
SSC	Scientific & Statistical Committee, an advisory body to the Council

Trolling Fishing by towing lines with lures or live-bait from a moving vessel.

USCG U.S. Coast Guard, 14th District, Department of Transportation.

USFWS U.S. Fish & Wildlife Service, Department of Interior. Also, FWS.

VMS Vessel Monitoring System. A satellite based system for locating and tracking fishing vessels. Fishing vessels carry a transponder which can be located by overhead satellites. Two-way communication is also possible via most VMS systems.

WPacFIN Western Pacific Fishery Information Network, NMFS.

WPRFMC Also, the Council. Western Pacific Regional Fishery Management Council. One of eight nationwide fishery management bodies created by the Magnuson Fisheries Conservation and Management Act pf 1976 to develop and manage domestic fisheries in the U.S. EEZ. Composed of American Samoa, Guam, Hawaii, and Commonwealth of Northern Mariana Islands.

Appendix 10. New Magnuson-Stevens Act data reporting requirements

Introduction

The 1996 reauthorization of the Magnuson-Stevens Fishery Conservation and Management Act (M-S Act) requires that all FMPs contain provisions regarding bycatch, fishing sectors, essential fish habitat (EFH), fishing communities and overfishing. The Council completed and submitted a comprehensive amendment, "Magnuson-Stevens Act Definitions and Provisions", in September 1998 to address these requirements for all four of its FMPs, including Amendment 6 to the Bottomfish and Groundfish FMP. While the amendment is currently undergoing the review process, two provisions that require annual reporting are presented here in preliminary form: bycatch and fishing sectors. Bycatch was addressed in the M-S Act through the addition of National Standard 9, which states: "conservation and management measures shall to the extend practicable- a) minimize bycatch, and b) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch. "Establishing a standardized reporting methodology to assess the amount and type of bycatch occurring in the fishery" is also required. Regarding fishing sectors, FMPs must "include a description of the commercial, recreational and charter fishing sectors which participate in the fishery and, to the extent practicable, quantify trends in landings of the managed fishery resource by the commercial, recreational and charter fishing sectors". This includes "information regarding the type and quantity of fishing gear used, catch by species in numbers of fish or weight thereof, areas in which fishing was engaged in, time of fishing, number of hauls, and the estimated processing capacity of, and the actual processing capacity utilized by, U.S. fish processors".

The FMP was reviewed to determine compliance with the new M-S Act requirements and identify any modifications that may be necessary. A review of the data collection systems with sregard to bottomfish bycatch and fishing sectors is reported here. The Plan Team will review, expand and improve this synopsis each year in the annual report, to the extent practicable.

Gear Types

In Hawaii commercial and recreational bottomfish fishing are conducted with handlines that are set and hauled on electric-, hydraulic- or hand-powered reels. Vessels are usually equipped with depth sounders, fish echo sounders and satellite navigational devices. Two separately managed bottomfish fisheries occur in Hawaii. In the NWHI all participants fish commercially on a full- or part-time basis while in the MHI fishery there are also recreational fishermen. Available data suggest that the magnitude of the effort in the MHI fishery has been declining since the late 1980s. In American Samoa bottomfishing is conducted from small skiffs and *alia* catamarans equipped with handlines and hand-powered reels. As in Hawaii, this method is relatively selective, targeting a mix of snappers, groupers, jacks and emperors. In the EEZ around Guam and the Northern Mariana Islands deep-water bottomfish fishing is conducted mainly by commercial vessels equipped with electric-powered reels. Shallow-water BMUS are also caught on seamounts using rod and reel.

Bottomfish Data Reporting Systems

In Hawaii fishermen who hold a commercial marine license are required to complete a HDAR Fish Catch Report. The form requires fishermen to report the type of fishing gear used (e.g., deep-sea handline, trolling, etc.), area fished, number and weight of each species caught and the weight sold.

Commercial fishermen participating in the Federally regulated NWHI bottomfish fishery are required to complete the HDAR NWHI Bottomfish Trip Daily Log. The daily log contains provisions for reporting the gear used, number of lines, number of hooks, number and weight of various bottomfish and non-bottomfish species kept, number released, number damaged or stolen by marine mammals and sharks, area fished, length of trip, specific effort information and weather conditions. Sales information is reported on the HDAR NWHI Bottomfish Trip Sales Report. Additional commercial landings information on both the MHI and NWHI bottomfish fisheries is collected by the NMFS market monitoring program.

No routine reporting system exists for collecting data on the recreational component of the bottomfish fishery in Hawaii. Surveys have been undertaken to estimate the extent of recreational fisheries, but these have been sporadic and limited in scope due to a lack of funds.

In American Samoa the Offshore Survey administered by the DMWR collects information on the number and weight of each species caught during commercial and recreational fishing trips, method of fishing (troll, bottom, etc.), time fished and the area fished. In addition, the survey requests information on the disposition of the catch. DMWR applies a set of algorithms to estimate the commercial landings based on the estimate of total landings and catch disposition information derived from the surveys.

In Guam the Offshore Creel Census administered by the DAWR records the number and weight of each species caught during commercial, charter and recreational fishing trips, method of fishing (e.g., trolling, bottom, etc.), number of gear used, area fished, weather conditions and percentage of the total catch that is kept or sold. The survey also asks fishermen if they participated in charter fishing and if so the number of guests taken. The survey does not specifically request fishermen to provide information on the disposition of fish that are kept. DAWR collects additional data on commercial landings through the voluntary trip ticket receipt program. In Guam total commercial landings data are recorded for sales to major fish stores with invoice receipts submitted to DAWR. Landings are calculated by summing the weight and value fields in the commercial landings database and then multiplying by an estimated percent coverage expansion factor. This annual expansion factor is based on an analysis of "disposition of catch" data from the creel survey, vessel entry and exit patterns, general dock-side knowledge of the fishery, status of market conditions and overall number of records in the data base.

In the Northern Mariana Islands data on commercial landings are collected by the DFW from the Commercial Sales Data, or "trip ticket," form, which records local fish sales to commercial establishments. Landings, species composition, revenue and the number of fishermen or boats selling catch are estimated from information provided on the forms. Until the creel survey program was discontinued in 1996, the Offshore Creel Census and Inshore Creel Census administered by DFW recorded the number and weight of each species caught during commercial and recreational fishing trips, fishing method used, number of gear used, area fished, weather conditions and percentage of the total catch that is kept or sold. However, this data were never used due to problems with quality and completeness.

The present annual report summarizes information collected on the bottomfish fisheries in Hawaii, American Samoa, Guam and Northern Mariana Islands. For Hawaii, this information includes landings by species, fishing effort (number of vessels and trips), average price, revenue, annual catch per unit effort and the estimated spawning potential ratio by species. Information from American Samoa includes total weight of bottomfish landed (differentiated by species), weight of bottomfish sold, fishing effort (number of hours and trips), catch rates, average price, revenue and the estimated spawning potential ratio for the bottomfish complex. Information from Guam includes total weight of bottomfish landed (differentiated by species), weight of bottomfish sold, fishing effort (number of hours, trips and boats), average price, revenue and annual CPUE. Information from the Northern Mariana Islands includes estimated landings, species composition, revenue and the number of fishermen or boats selling catch.

Information collected by HDAR Fish Catch Reports on the weight and composition of the unsold portion of the catch is summarized in "Fishery Statistics of the Western Pacific", which is published annually by NMFS.

Bycatch

The combination of information collected from NMFS research cruises and the various catch reporting systems that comprise the Western Pacific Fishery Information Network (WPacFIN) is sufficient to estimate with some confidence the amount and type of bycatch. Although the current focus of catch reporting systems is on monitoring the volume and disposition of landed target species, detailed discard information on target catches is reported by certain vessel types, such as the Northwestern Hawaiian Islands (NWHI) bottomfish vessels. Modification of survey methodologies or catch report forms may enhance the ability of existing catch reporting systems to monitor discards for other gear types. However, it will continue to be important to supplement bycatch information collected by catch reporting systems with bycatch data gathered from observer programs or research cruises conducted by NMFS or other agencies. Modified creel surveys or catch reporting forms will require field testing to determine if additional information on the amount and type of bycatch in the bottomfish fishery can be collected without imposing an excessive reporting burden on fishermen.

With regard to the requirement to minimize bycatch and bycatch mortality, variations of hook and line are the predominant gear used for bottomfish fishing, which tends to be fairly selective. The amount of bycatch can be further reduced by developing and promoting greater utilization of fish that are generally discarded. Gear types currently used in the bottomfish fishery already minimize bycatch mortality, to the extent practicable.

In all areas bottomfish are caught on gear that is relatively selective, targeting the snapper/grouper/emperor complex on outer reef slopes and seamounts. However, the ability to target particular species varies widely depending on the skill of each captain. Experienced bottomfish fishermen have the capability to catch desired species with little bycatch or incidental catch. However, it is impossible to completely avoid non-target species.

Table 1 presents HDAR logbook data on the number of fish kept, discarded and damaged during 1997. Releases and damaged fish might reasonably be designated bycatch; these amounted to only 8% of the total catch of NWHI handline-caught bottomfish. No details were provided about the numbers of fish stolen, as these are usually grouped in the 'damaged' category by fishermen. Sharks, oilfish, snake mackerel, pufferfish and moray eels are typical bycatch species, discarded because they are normally not considered food fish. In contrast, ulua (Caringidae) and kahala are discarded despite being palatable (Kasaoka 1990). Butaguchi are discarded because of their short shelf-life and low market value. Kahala was a component of commercial and recreational landings, but are now seldom retained as they have been implicated in incidents of ciguatera. In Hawaii a recent increase in the market demand for shark fins has meant that more sharks are being "finned" (the practice of cutting off a shark's fins and returning the remainder of the fish to the sea) and fewer are being discarded as bycatch.

Data collected during NMFS research cruises in Hawaii indicate that species generally regarded as bycatch represent about 19% of the total catch (Figure 1.a).

Fishery independent data collected during surveys in American Samoa in 1978 and 1988 by the SPC suggest that the catch of non-target species amounts to less than 1% of the total catch and consists mainly of snake mackerel (*Promethichthys prometheus*). Information gathered during the NMFS Resource Assessment and Investigation of the Mariana Archipelago (RAIOMA) project suggest that in Guam and the Northern Mariana Islands pufferfish, gurnards, beardfish and sharks are the main bycatch species (Figure 1.b). Total potential bycatch comprises only about 1% of the total catch.

Figure 1a. Research cruise estimates of composition of bottomfish catches in the Hawaiian Islands (percent of total number) (Source: NMFS Honolulu Laboratory)

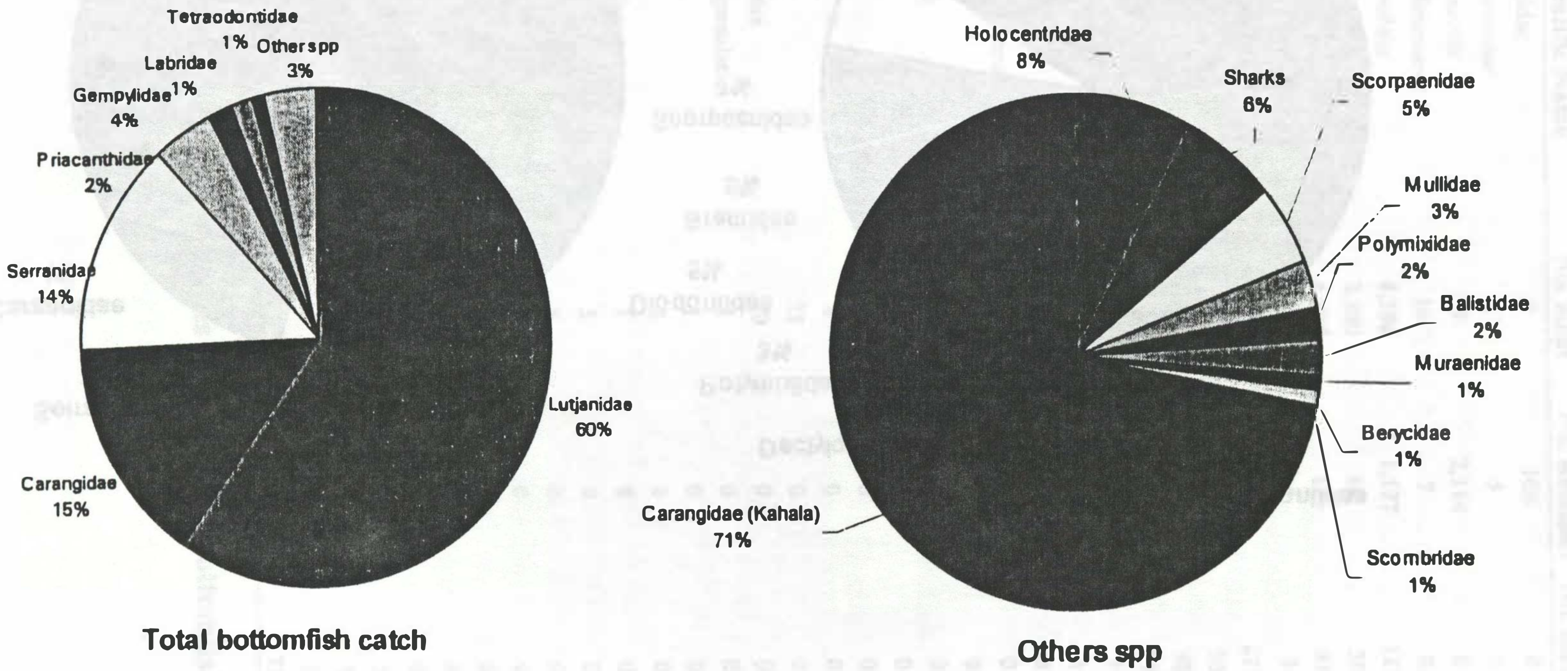
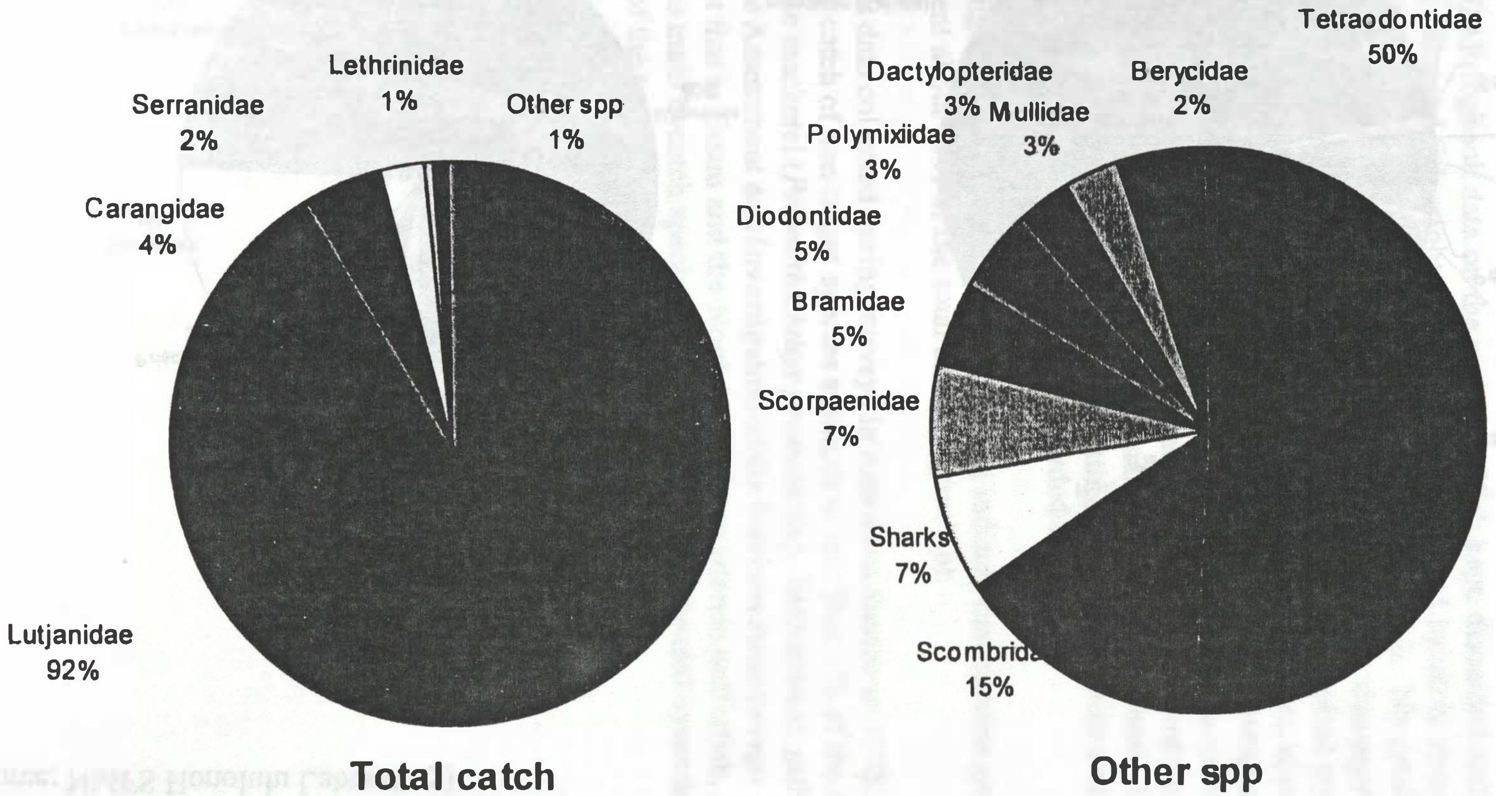


Figure 1b. Research cruise estimates of composition of bottomfish catches in the Nothern Marianas Islands (percent of total number) (Source: NMFS RAIOMA project, 1982-1984)



Hawaiian Name	Scientific Name	No. Kept	No. Released	No. Damaged
Misc. shark,	Carcharhinidae	0	166	0
Tiger shark	*Galeocerdo cuvier*	0	5	0
Kahala	*Seriola dumerilli*	25	2,114	6
Ahi	*Thunnus alabacares*	16	7	0
Ulua butaguchi	*Caranx ignobilis*	4,396	1,177	121
Uku	*Aprion virescens*	3,500	16	50
Hapuupuu	*Epinephelus quernus*	4,586	17	97
Kalekale	*Pristopomoides auricilla*	6,312	12	7
Opakapaka	*Pristipomoides filamentosus*	16,554	2	213
Ehu, ulaula	*Etelis carbunculus*	6,070	0	98
Gindai	*Pristipomoides zonatus*	2,133	0	98
Onaga	*Aprion virescens*	8,207	0	37
Ulua	Carangidae	231	0	7
Lehi	*Aphareus rutilans*	123	0	2
Kawakawa	*Euthynnus affinis*	29	0	0
Mahimahi	*Coryphaena hippurus*	16	0	0
Omilu	Carangidae	49	0	0
Misc. ulua/papio	Carangidae	1	0	0
Weke ula,		11	0	0
Aawa	Labridae	9	0	0
Aweoweo		4	0	0
Wahanui		23	0	0
Kaku	Sphyraenidae	10	0	0
Kamano	Elegatis bipnnulatis	3	0	0
Kumu	Mullidae .	1	0	0
Mu		2	0	0
Nohu,	Scorpaenidae	1	0	0
Ulua kagami	Carangidae	5	0	0
Opelu	Decapterus spp	5	0	0
Taape	Lutjanus kasmira	24	0	0
Pomfret	Bramidae	17	0	0
Ulua dobe	Carangidae	2	0	0
Ulua gunkan	Carangidae	46	0	0
Ulua papa	Carangidae	224	0	0
Hogo	Scorpaenidae	193	0	0
Others		4	0	0
Total		52,832	3,516	736

Table 1. Logbook estimates of disposition of catches in the NWHI bottomfish fishery, 1997 (Source: NMFS Honolulu Laboratory)

Fishing Sectors (commercial, recreational, charter)

The bottomfish annual report includes data on total weight of fish landed by species, weight of fish sold, fishing effort, average price, revenue and annual catch per unit effort (CPUE). Most of this information is collected for both the commercial and charter sectors in all four island areas except for the Northern Mariana Islands, where the fishery data collection system has been significantly reduced. There is no charter fishing at present in American Samoa. Information on the size and composition of recreational catches of bottomfish species in Hawaii is not collected by any ongoing data collection program and charter catch is not distinguished from commercial landings. Furthermore, no recreational fishing surveys have been recently conducted in the Pacific Island Areas to supplement information collected by current creel surveys. Currently, the unsold portion of reported catches is considered to be the recreational catch. This situation could be improved through marine recreational fishing surveys to more accurately quantify landings in the recreational sector, and by reestablishing the creel survey program in the NMI.

Commercial and Recreational Fishing

As noted in the FMP, throughout the western Pacific region there are few fishermen who specialize in harvesting bottomfish. Most fishermen shift from fishery to fishery in response to weather conditions, seasonal abundance or fluctuations in price. Furthermore, most of the vessel operators are part-time commercial fishermen and may combine commercial, recreational or subsistence effort in a single fishing trip.

The most reliable data for Hawaii come from a creel survey conducted on Oahu by NMFS in 1990–91 and indicate that 66% of the bottomfish landed were not sold and thus can be considered the recreational catch. For American Samoa and Guam information in this annual report can be used to estimate the recreational catch. Reported landings are sub-divided into sold and unsold components. Because of the prevalence of fishermen who combine commercial and recreational effort, the unsold percentage of landings is used as a proxy for the recreational component of the fishery. In American Samoa 1985–1996 creel survey data indicate that the unsold—or recreational—catch fluctuates between 14% and 1% with an overall average of 4%. In Guam 1980–1996 creel survey suggests that 60% of landed bottomfish are caught for recreation.

Charter Fishing

Charter vessels in Hawaii and American Samoa do not typically fish for bottomfish. In recent years, some charter vessels in Guam and the NMI have started targeting bottomfish. The vessels range from typical trolling charter vessels involving three to six patrons who opt to fish for bottomfish, to larger bottomfish-fishing-only party boats accommodating up to 30 persons. At present, Guam DAWR is refining the algorithms used to estimate the amount and composition of the charter component of bottomfish landings. Table 2 and Figure 2 summarize this data for 1996 and 1997. Several of the dozen or so charter vessels in Northern Mariana Islands have also started targeting bottomfish in the last few years. Landings from these boats are recorded if the catch is sold, and reported on the Commercial Sales Data form. Catch and effort information on charter trips is not reported separately in this annual report.

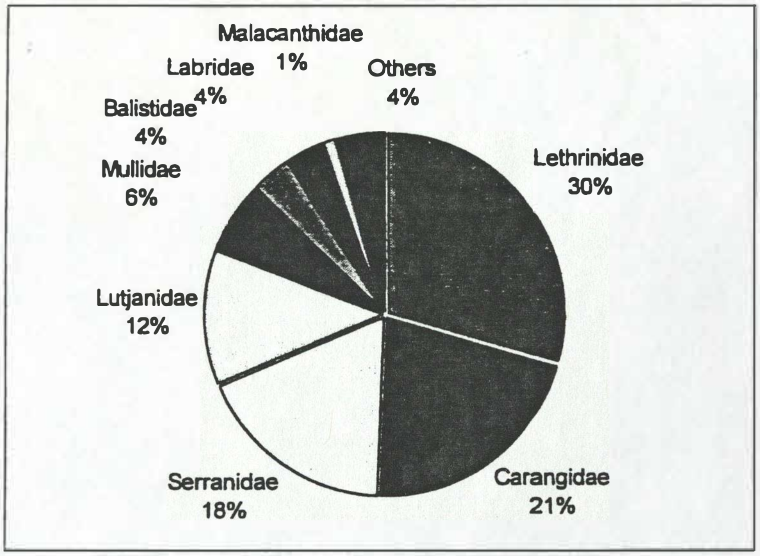


Figure 2. Composition of charter bottomfish catch in Guam, 1996-1997 (percent of total number) (Source WPacFIN)

	Year	
	1996	**1997**
Total trips	1716	1803
Total catch	9907	10138
Total hours	4300	4001
Total no. persons	24044	24443
Person-hrs	60427	53871
Gear-hrs	47660	38674
CPUE (lb/trip	5.77	5.62
CPUE (lb/hr)	203	2.53
CPUE (lb/gr-hr)	0.21	0.26

Table 2. Guam charter bottomfish catch, effort and CPUE, 1996-1997 (Source: WPacFIN)