Appendix 3

Hawaii

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Summary

None of the five BMUS species for which SPR values can be calculated have 2002 SPR values below the 20% critical theshold that defines recruitment overfishing under the FMP. Estimates range from a low of 26% for onaga to a high of 45% 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 recorded to date for 2002 are lower than the 2001 landings (a 5.6% decrease). CPUE for the MHI was down (7.7%) in 2002 (179 lb/trip) from 2001 (194 lb/trip). 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 and ehu stocks are severely depleted on a local basis as the MHI SPR values for these species are at or below 20% (5% and 20% for onaga and opakapaka, 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). Hapuupuu SPR values calculated for the MHI are 26% for 2002 and SPR is 24% for both ehu and uku in the MHI.

Bottomfish resources in the NWHI remain relatively healthy. 2002 CPUE on a per trip basis increased 20.8% from 2001 in the Mau Zone and dropped 12.2% in the Hoomalu zone. On a per day basis CPUE values are up 54.8% in the Mau zone and down 24.1% 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 2002. 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 2002 SPR for Colahan Seamount was 0.2%, 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	**810348**	**274**	**$3,354**	**$4.43**	**538**	**33**
1987	**783569**	**237**	**$3,648**	**$4.88**	**535**	**25**
1988	**1164492**	**329**	**$4,828**	**$4.36**	**572**	**37**
1989	**1006142**	**361**	**$4,296**	**$4.57**	**537**	**40**
1990	**645802**	**245**	**$2,910**	**$4.88**	**501**	**27**
1991	**547800**	**202**	**$2,074**	**$4.06**	**469**	**24**
1992	**587471**	**228**	**$2,130**	**$3.93**	**407**	**25**
1993	**347960**	**213**	**$1,722**	**$4.04**	**403**	**24**
1994	**457956**	**217**	**$1,963**	**$4.00**	**423**	**24**
1995	**439625**	**193**	**$1,946**	**$3.73**	**400**	**22**
1996	**439867**	**125**	**$1,680**	**$4.13**	**487**	**21**
1997	**512554**	**176**	**$1,664**	**$3.55**	**502**	**20**
1998	**478802**	**130**	**$1,594**	**$3.65**	**498**	**20**
1999	**455131**	**209**	**$1,448**	**$3.57**	**483**	**25**
2000	**496989**	**187**	**$1,678**	**$3.75**	**495**	**21**
2001	**366997**	**194**	**$1,279**	**$3.70**	**404**	**20**
2002	**361774**	**179**	**$1,364**	**$4.04**	**386**	**20**
Ave.	**582546**	**218**	**$2,328**	**$4.07**	**473**	**25**
s.d.	**232027**	**61**	**$1,079**	**$0.42**	**58**	**6**

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**	**4463**	**$433,060**	**$3.67**	**5**	**91**
1990	**249000**	**3435**	**$816,720**	**$3.28**	**14**	**77**
1991	**103000**	**1199**	**$364,620**	**$3.54**	**14**	**42**
1992	**71000**	**1273**	**$242,820**	**$3.42**	**8**	**38**
1993	**98000**	**1321**	**$299,880**	**$3.06**	**8**	**36**
1994	**160000**	**1573**	**$524,800**	**$3.28**	**12**	**68**
1995	**166000**	**1635**	**$498,000**	**$3.00**	**10**	**45**
1996	**135000**	**1543**	**$440,100**	**$3.26**	**13**	**53**
1997	**105000**	**1976**	**$375,900**	**$3.58**	**9**	**61**
1998	**66000**	**1689**	**$192,060**	**$2.91**	**7**	**42**
1999	**54000**	**1808**	**$178,740**	**$3.31**	**7**	**51**
2000	**49000**	**1053**	**$169,540**	**$3.46**	**6**	**42**
2001	**50000**	**916**	**$141,000**	**$2.82**	**6**	**36**
2002	**108000**	**1416**	**$334,800**	**$3.10**	**5**	**45**
Ave.	**109429**	**1914**	**$358,003**	**$3.26**	**9**	**50**
s.d.	**55315**	**920**	**$181,880**	**$0.26**	**3**	**16**

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**	**5481**	**$616,400**	**$3.35**	**5**	**70**
1990	**173000**	**5403**	**$563,980**	**$3.26**	**5**	**64**
1991	**283000**	**5871**	**$894,280**	**$3.16**	**4**	**82**
1992	**353000**	**9464**	**$1,193,140**	**$3.38**	**5**	**98**
1993	**287000**	**8412**	**$961,450**	**$3.35**	**4**	**109**
1994	**283000**	**6903**	**$973,520**	**$3.44**	**5**	**64**
1995	**202000**	**6130**	**$636,300**	**$3.15**	**5**	**73**
1996	**176000**	**6216**	**$607,200**	**$3.45**	**3**	**78**
1997	**241000**	**6351**	**$785,660**	**$3.26**	**6**	**65**
1998	**266000**	**5315**	**$819,280**	**$3.08**	**7**	**66**
1999	**269000**	**5611**	**$968,400**	**$3.60**	**6**	**62**
2000	**213000**	**5909**	**$813,660**	**$3.82**	**5**	**62**
2001	**236000**	**5757**	**$750,480**	**$3.18**	**5**	**64**
2002	**120000**	**4638**	**$423,600**	**$3.53**	**4**	**59**
Ave.	**234714**	**6215**	**$786,239**	**$3.36**	**5**	**75**
s.d.	**60836**	**1327**	**$204,490**	**$0.20**	**2**	**17**

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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 7 vessels participating in 1998; 7 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.

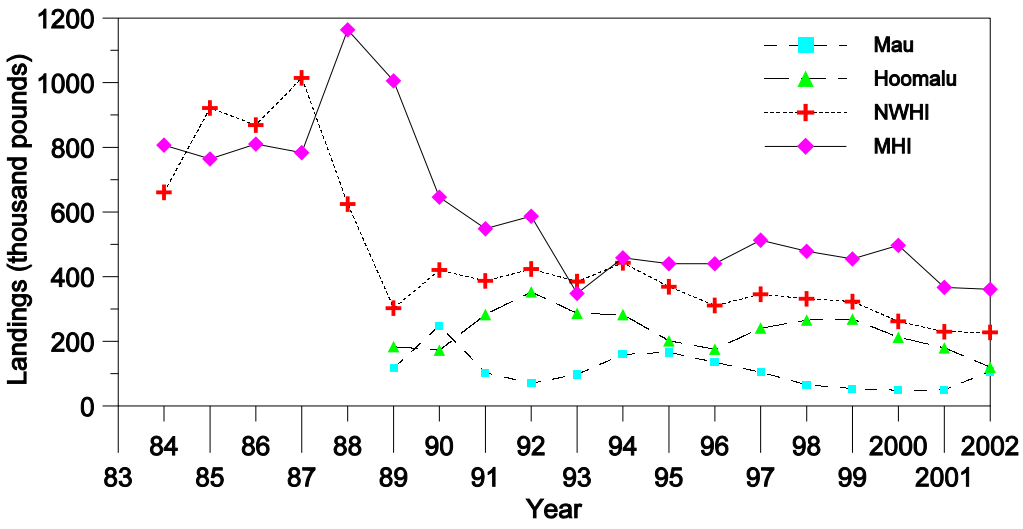
Catch and revenue data for bottomfish have been collected by the State of Hawaii Division of Aquatic Resources (HDAR) since 1948 in the form of a report submitted by commercial fishermen. No data is collected for recreational or subsistence fishermen, but their catch is estimated to be about equal to 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 recommends the Council support and participate in the State of Hawaii's effort to review and assess effectiveness of the Main Hawaiian Island bottomfish area closures.

2) The BPT recommends that the NMFS re-evalute MSY and standardized cpue and effort estimates for the Hawaiian archipelago.

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



	BMUS 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]	133	176	309	440
1997[1]	105	241	346	513
1998[1]	66	266	332	479
1999[2]	54	269	323	455
2000	49	213	262	497
2001	50	236	286	367
2002[3]	**108**	**120**	**228**	**361**
mean	109.29	234.71	468.95	603.79
s.d.	55.25	60.84	235.24	227.89

[1] NWHI data from combination NMFS and HDAR
[2] Data from HDAR
[3] MHI data not complete.

Source: Data are from HDAR. Data are only those from BMUS. Landings and values presented represent fishes that were sold. Pelagic and miscellaneous species data were not included.

Calculation & Adjustment: The 2002 data set are complete as of March 2004. The data are from the HDAR integrated data set which provides the most complete data set dealing with the effort and landings of the NWHI fishing fleet.

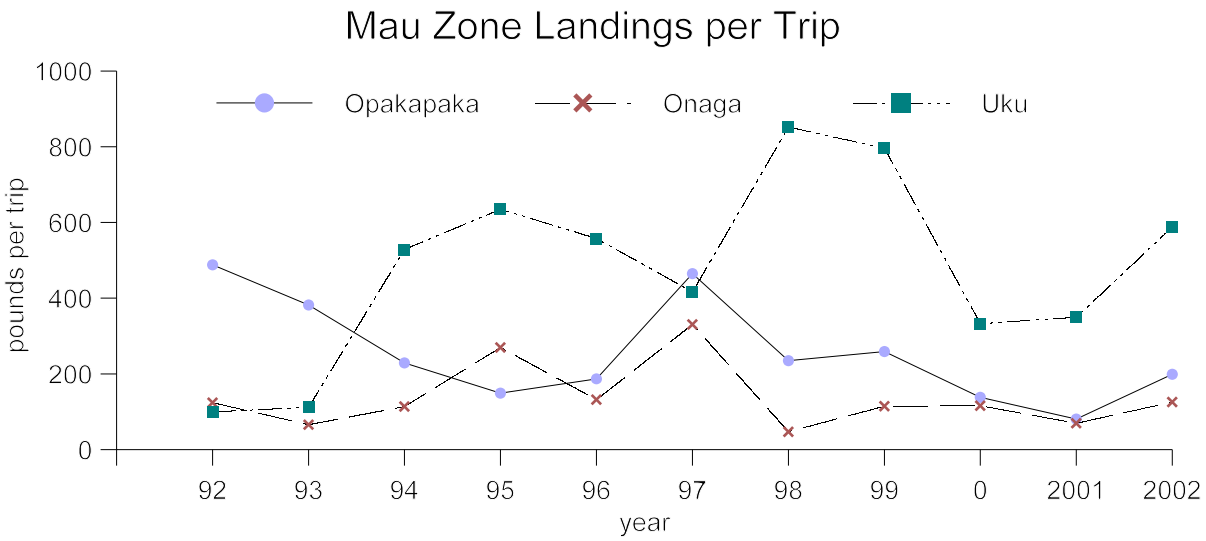
Data in this report are only from those trips that were directed at bottomfish species or in which bottomfish gear was used (zero catch trips or efforts were included). Trolling only trips that resulted in BMUS being caught were included. Trolling only trips to the NWHI that were not targeting BMUS are not included.

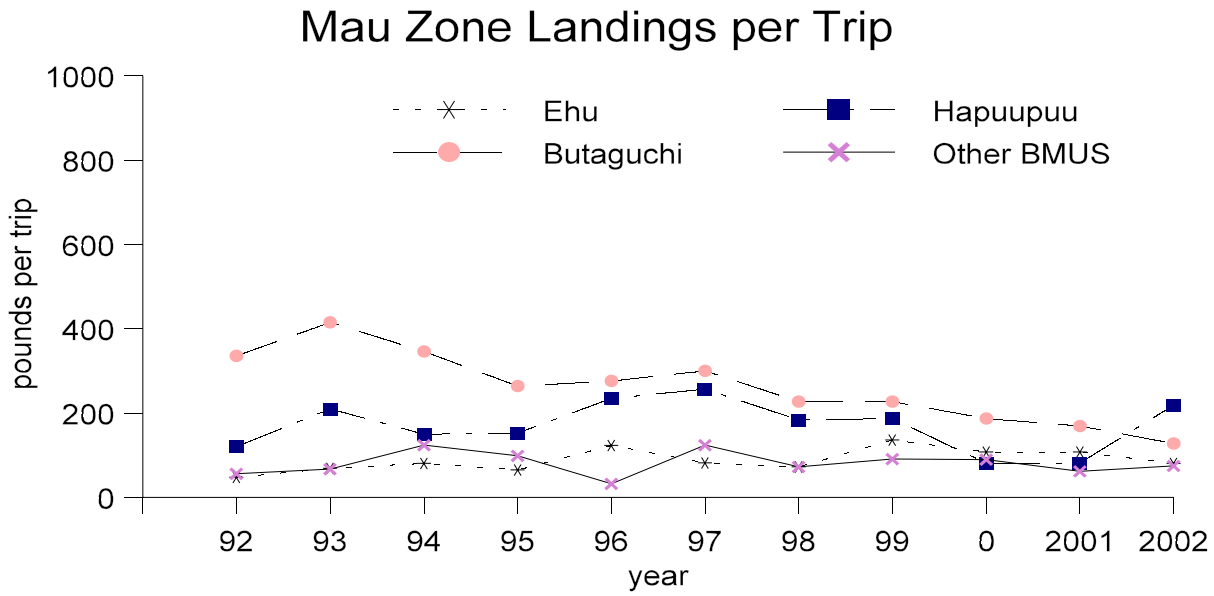
Comments & Interpretation: The ex-vessel sales of BMUS in 2002 clearly show the substantial effects of a change in fishing strategy or to participation(or lack of participation) in the fishery. The overall vessel sales reports indicate that the total NWHI BMUS landings were substantially lower in 2002. A single vessel dropped out of each management zone with varying effects on the overall zone landings(fig. 5).

Although the Mau zone lost a vessel there were some vessels that did increase their targeting of bottomfish which ran counter to their usual pelagic species/mixed species targeting strategy. The BMUS landings in the Mau zone increased by 116% while the number of trips increased by 21(38%).

The Hoomalu zone lost a single participating vessel and the effects of that loss of a highliner was realized in the BMUS landings dropping by 49% while the number of trips fell by 15(36%).

Figure 2a. Northwestern Hawaiian Islands Mau Zone BMUS species composition of landings per trip, by weight.





NWHI BMUS average pounds sold per trip by species, Mau Zone

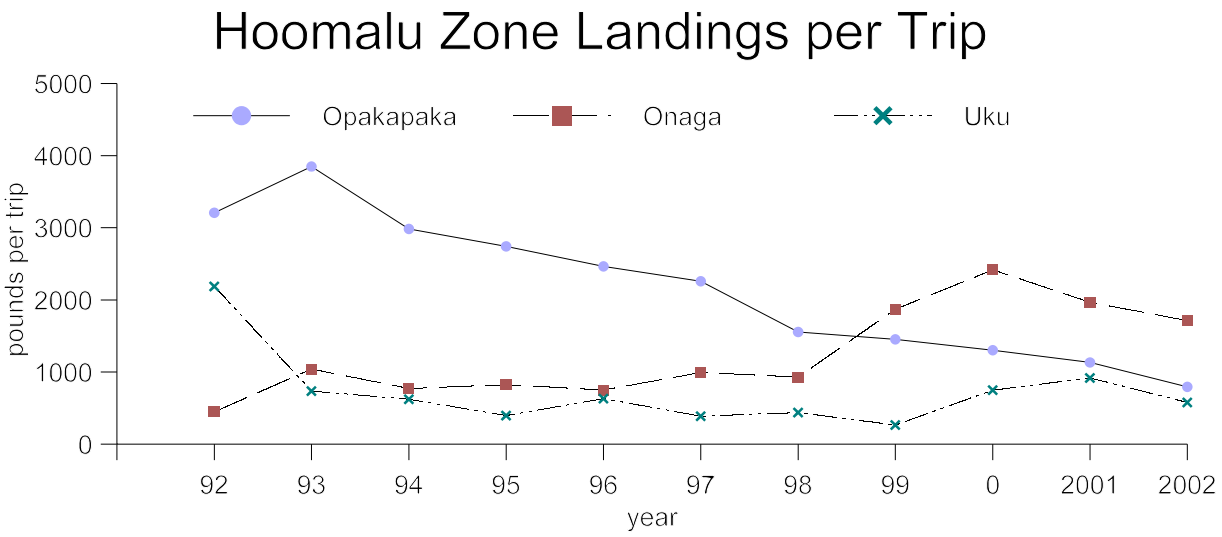
Species	1992[1]	1993[1]	1994[1]	1995[1]	1996[2]	1997[2]	1998[2]	1999[2]	2000[2]	2001[2,3]	2002[2]
Opakapaka	488	382	229	149	187	465	235	259	138	80	199
Onaga	124	66	114	270	132	331	47	115	116	70	126
Ehu	48	69	81	65	123	82	72	136	108	109	81
Uku	100	112	529	635	558	417	852	796	333	343	588
Hapuupuu	121	210	150	153	235	257	184	187	81	81	219
Butaguchi	336	415	346	264	276	300	227	227	187	171	128
Other BMUS	56	67	124	99	32	124	72	91	90	62	75
Total per trip	1273	1321	1573	1635	1543	1976	1689	1811	1053	916	1416

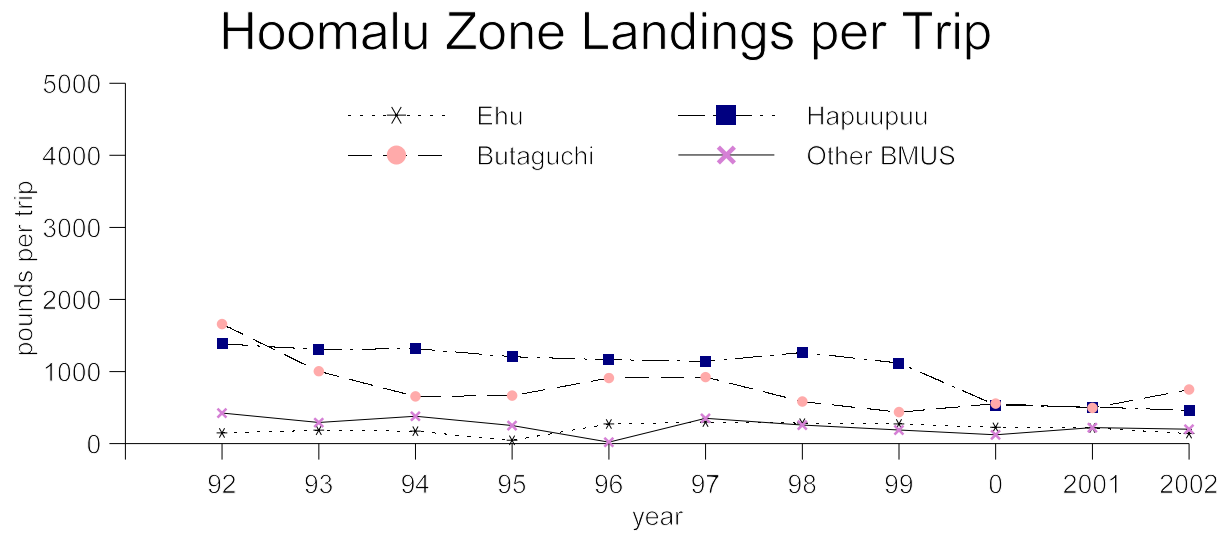
[1] Data from combination of NMFS and HDAR data sets.

[2] Data from HDAR data set.

[3] 2001 data are a combination of HDAR data sets.

Figure 2b. Northwestern Hawaiian Islands Hoomalu Zone BMUS species composition of landings per trip, by weight.





NWHI BMUS average pounds sold per trip by species, Hoomalu Zone

Species	1992[1]	1993[1]	1994[1]	1995[1]	1996[2]	1997[2]	1998[2]	1999[2]	2000[2]	2001[2,3]	2002[2,4]
Opakapaka	3208	3849	2984	2741	2426	2258	1556	1454	1304	1530	793
Onaga	450	1042	771	825	752	993	931	1872	2417	1680	1716
Ehu	148	185	172	47	272	298	285	273	225	187	139
Uku	2187	736	623	397	632	387	438	266	750	970	578
Hapuupuu	1386	1305	1318	1206	1166	1141	1266	1119	535	645	463
Butaguchi	1660	1004	655	665	909	923	583	439	556	549	750
Other BMUS	425	291	380	249	21	351	256	188	122	196	199
Total per trip	9464	8412	6903	6130	6216	6351	5315	5611	5909	5757	4638

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

[2] Data from HDAR data set.

[3] 2001 data are a combination of HDAR data sets.

[4] Preliminary data for 2002 are nearly complete.

Source: The data are from HDAR. Data are only those from BMUS. Landings presented represent fishes that were sold. Pelagic species data were not included.

Calculation & Adjustment: The BMUS data were totaled by zone and divided by the number of trips to each zone. The 2002 data set are complete as of March 2004. The data are from the HDAR integrated data set which provides the most complete data set dealing with the effort and landings of the NWHI fishing fleet. Data in this report are only from those trips that were directed at bottomfish species or in which bottomfish gear was used (zero catch trips or efforts were included). Trolling only trips to the NWHI that were not targeting BMUS are not included. Trolling only trips that resulted in BMUS being caught were included.

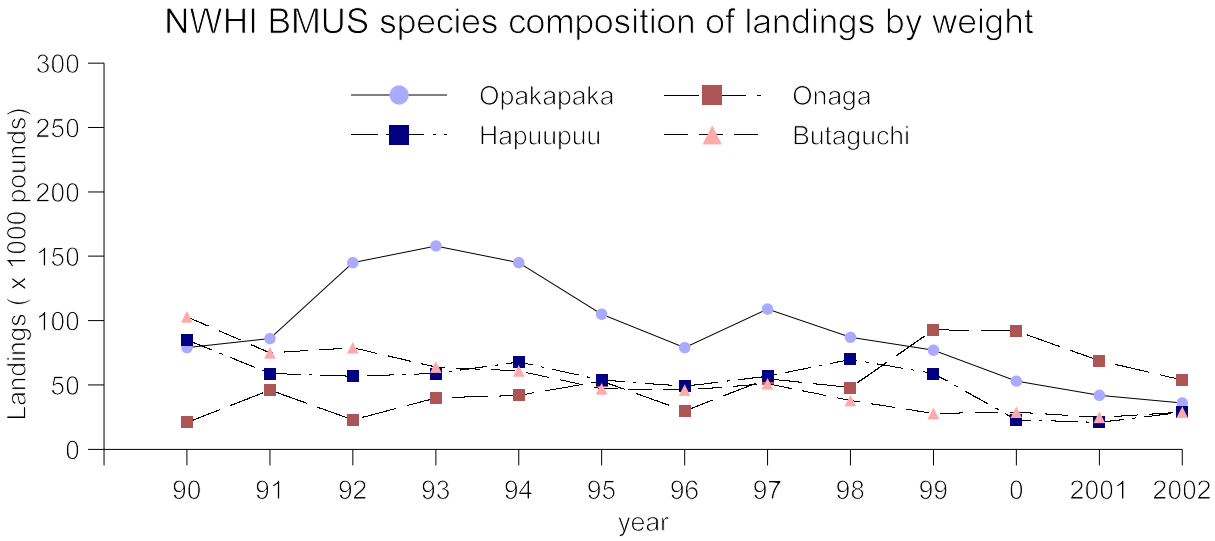
Comments & Interpretations: The Mau zone average landing per trip has increased by 54% over last year. One vessel quit the fishery in 2002. Average pounds per trip of BMUS species has added 500 pounds per trip over last year. Most of the major BMUS landings increased substantially. Only ehu and butaguchi landings categories decreased. Trip lengths varied by vessel and trip strategy/target. Most of the trips incorporated some trolling activity.

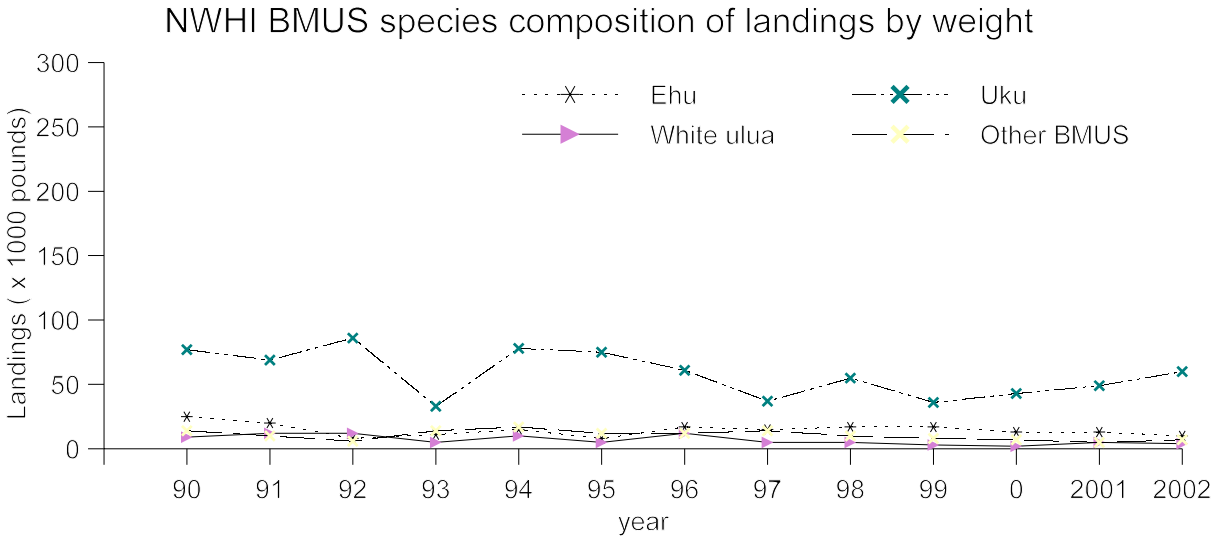
In looking at the Mau zone data table the per trip catches of onaga and opakapaka have risen in 2002. This was mainly due to a more concerted effort to target and catch bottomfish this year by a few of the Mau zone participants. Normally the multipurpose vessels based on Kauai focus on pelagics for most of the year. Bottomfish are usually targeted during the winter season when they are more abundant. The Oahu component of the fleet is more focused on full time bottomfishing. They divide their time between bottomfishing the Mau zone and the MHI.

The Hoomalu zone BMUS landing per trip in 2002 fell 19%. The Hoomalu zone fleet size was reduced by 1 vessel in 2002. The reduction in effort and associated landings of a single vessel in this fishery which had only 5 participants has had a large impact on overall landings (figure

1). Up until 2002 the Hoomalu zone fleet had very stable participation and landings for the last 7-8 years.

Figure 3. NWHI BMUS species composition of landings by weight





Data table for Figure 3 (in thousands of pounds)

Species	1990	1991[1]	1992[1]	1993[1]	1994[1]	1995[1]	1996[2]	1997[2]	1998[2]	1999[2]	2000[2]	2001[2,3]	2002[2,4]
Opakapaka	79	86	145	158	145	105	79	109	87	77	53	67	36
Onaga	21	46	23	40	42	53	30	55	48	93	92	73	54
Ehu	25	20	8	11	15	8	17	15	17	17	13	14	10
Hapuupuu	85	59	57	59	68	54	49	57	70	59	23	31	29
Butaguchi	103	75	79	64	61	47	46	51	38	28	29	32	29
Uku	77	69	86	33	78	75	62	37	55	36	43	59	60
White ulua	9	12	12	5	10	5	13	5	5	3	2	6	4
Other BMUS	14	10	6	14	17	12	12	14	10	8	7	6	7

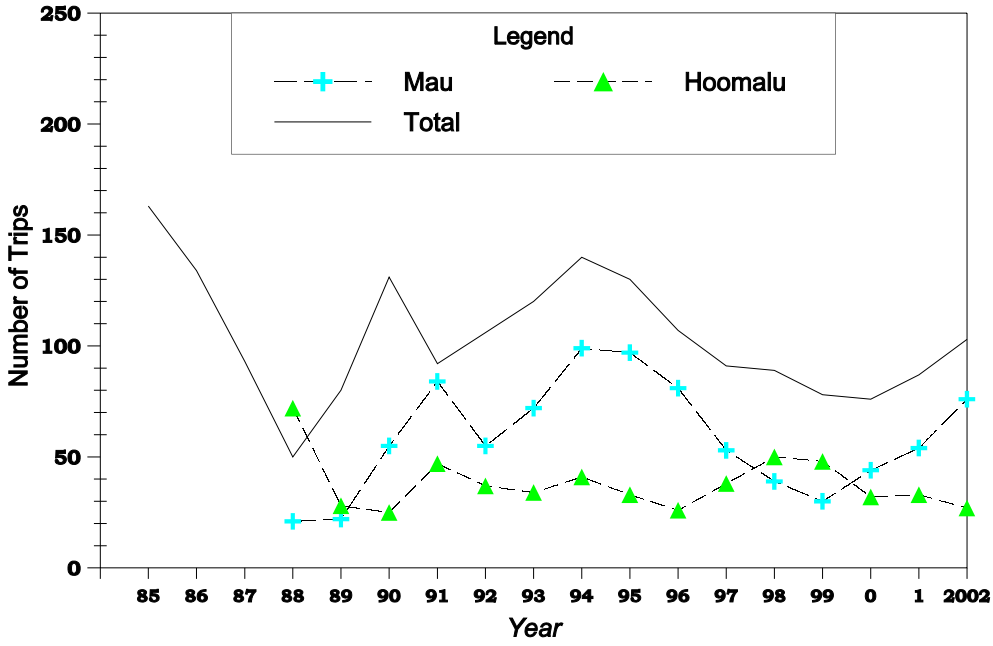
[1] Data from a combination of NMFS and HDAR data.
[2] Data from HDAR data set.
[3] 2001 data are a combination of HDAR data sets.
[4] Preliminary data for 2002 are nearly complete.

Source: Data for 1996-2002 is 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. Landings presented represent fishes that were sold.

Calculation & Adjustment: The 2002 data set are complete as of March 2004. The data are from the HDAR integrated data set which provides the most complete data set dealing with the effort and landings of the NWHI fishing fleet. Data in this report are only from those trips that were directed at bottomfish species or in which bottomfish gear was used (zero catch trips or efforts were included). Trolling only trips to the NWHI that were not targeting BMUS are not included. Trolling only trips that resulted in BMUS being caught were included.

Comments & Interpretation: Overall BMUS landings are down for 2002. Most of the landings of BMUS decreased. Opakapaka landings showed the largest decline. Of the major species only uku, hapuupuu, and butaguchi had landings similar to those of last year. It is interesting to note that although the landings for some BMUS species remained stable in the context of the whole fishery the source of the landings has flip flopped with the normally strong Hoomalu zone landings, which were down this year due to the loss of a highliner vessel, being replaced by the increase in the Mau zone participation and strategy which resulted in increased BMUS landings from their zone.

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



	Trips		
Year	**Mau**	**Hoomalu**	**Total**
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
1998[2]	39	50	89
1999[2]	30	48	78
2000[2]	47	36	83
2001[2,3]	55	41	87
2002[2,4]	**76**	**26**	**102**
mean	59.07	38.80	106.44
s.d.	25.20	12.23	30.37

[1] Based on combined NMFS and HDAR data.
[2] Based on HDAR data.
[3] 2001 data are a combination of HDAR data sets.

[4] Preliminary data for 2002 are nearly complete.

Source: The 2002 data set are complete as of March 2004. The data are from the HDAR integrated data set which provides the most complete data set dealing with the effort and landings of the NWHI fishing fleet. Data in this report are only from those trips that were directed at bottomfish species or in which bottomfish gear was used (zero catch trips or efforts were included). Trolling only trips to the NWHI that were not targeting BMUS are not included. Trolling only trips that resulted in BMUS being caught were included.

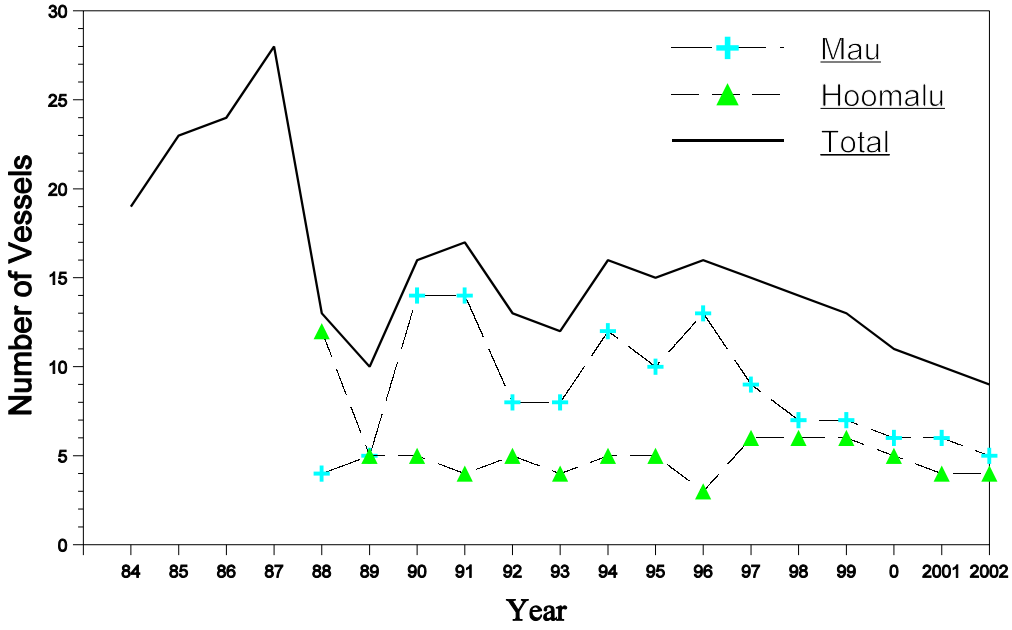
Data for 1996-2000 was from HDAR. Data for 1991-1995 are from a combination of HDAR and NMFS market monitoring program and the HDAR fast-track data system. Data from 1986-1990 are NMFS estimates. The trips were totaled by management area fished.

Calculation & Adjustment: Trips were counted from the HDAR integrated data set.

Comments & Interpretation: Trip numbers fluctuated this year after 1 vessel from each zone left the fishery. There was a 38% increase(21 trips) in Mau zone trips despite losing a vessel that had participated on a part-time level. One vessel limited itself to the 5 minimum required trips to maintain its permit. The Mau zone trip count varies as each operator makes the fishing strategy decision that suits their operation.

The loss of a vessel in the Hoomalu zone resulted in a 36% decrease(15 trips) in trips. All of the vessels in the Hoomalu zone made less trips than in 2001. Only one vessel made the minimum number of trips to maintain its permit. There were also non-fishing factors involved in the decision by some vessel owners to cut back on the number of bottomfishing trips to the NWHI(boat maintenance and family commitments).

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



	Boats		
Year	**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
1998[2]	7	6	13
1999[3]	**7**	6	13
2000[3]	6	5	11
2001[3]	6	5	11
2002[3,4]	**5**	**4**	**9**
mean	8.53	5.33	15.47
s.d.	3.36	2.02	5.00

[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.
[4] Preliminary data for 2002 are nearly complete.

Source: The 2002 data set are complete as of March 2004. The data are from the HDAR integrated data set which provides the most complete data set dealing with the effort and landings of the NWHI fishing fleet. Data in this report are only from those trips that were directed at bottomfish species or in which bottomfish gear was used (zero catch trips or efforts were included). Trolling only trips to the NWHI that were not targeting BMUS are not included. Trolling only trips that resulted in BMUS being caught were included.

Data for 1996-2000 was 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 number of active participating vessels were totaled by year and management zone.

Comments & Interpretation: There was a loss of 2 vessels in the overall NWHI fleet. One vessel from each zone dropped out of the fishery. The number of active vessels during the previous 2 years had been identical. The Hoomalu zone has lost a highliner type vessel while the Mau zone has lost a part-time vessel.

Table 1. Mau Zone Bycatch by Species, 2002

R = # released, S = # sold, % bycatch within species={R/(R+S)}*100
% bycatch within species groups=(R/R+S by species group)*100
% bycatch per total catch=(R/total R+S)*100

Pelagic MUS	# released 2002	total # sold 2002	% bycatch by species 2002	# released 2001	% bycatch by species 2001
Shark (unidentified)	57	0	100 %	55	100 %
Tiger shark (G. cuvieri)	3	0	100 %	1	100 %

Bottomfish MUS	# released 2002	total # sold 2002	% bycatch by species 2002	# released 2001	% bycatch by species 2001
Ehu (E. carbunculus)	2	2070	<1 %	8	< 1 %
Hapuupuu(E. quernus)	12	1254	1%	0	0 %
Butaguchi (P. dentex)	184	641	22 %	10	1 %
Black Ulua (C. lugubris)	2	81	2 %	0	0 %
Kahala (Seriola spp.)	226	0	100 %	653	100 %

Miscellaneous species	# released 2002	total # sold 2002	% bycatch by species 2002	# released 2001	% bycatch by species 2001
Omilu (C. melampygus)	20	193	9 %	30	38 %
Barracuda	1	9	10 %	0	0 %

Table 2. Hoomalu Zone Bycatch by Species, 2002

R = # released, S = # sold, % bycatch within species={R/(R+S)}*100
% bycatch within species groups=(R/R+S by species group)*100
% bycatch per total catch=(R/total R+S)*100

Pelagic MUS	# released 2002	total # sold 2002	% bycatch by species 2002	# released 2001	% bycatch by species 2001
Shark (unidentified)	8	0	100 %	34	100 %
Tiger shark (G. cuvieri)	4	0	100 %	3	100 %
Bottomfish MUS	# released 2002	total # sold 2002	% bycatch by species 2002	# released 2001	% bycatch by species 2001
Opakapaka (P. filamentosus)	1	2206	<1 %	1	<1 %
Kalekale (P. sieboldii)	439	474	48 %	264	24 %
Butaguchi (P. dentex)	303	1248	20 %	767	32 %
White Ulua (C. ignobilis)	221	128	63 %	532	70 %
Kahala (Seriola spp.)	1610	0	100 %	3360	100 %
Miscellaneous species	# released 2002	total # sold 2002	% bycatch by species 2002	# released 2001	% bycatch by species 2001
Omilu (C. melampygus)	43	0	100 %	41	82 %

Source: The 2002 bycatch data were from HDAR's integrated data set which combines the NWHI daily logs and the sales report. The bycatch data are recorded on the daily logs and are filled in on a daily basis by the fishermen while at sea. The species that are listed here are only those that were identified on the daily logs that were released therefore it is not a complete list of all species caught or sold.

Calculation & Adjustment: The bycatch percentage was calculated by dividing the number of released fish by the sum of the number of sold fish plus the number of released. The number of sold fish does not equal the total catch but does represent a verifiable number of fishes taken. The numbers of fish that are retained but not sold, ie. eaten or given away, is believed to be very few compared to the total number sold. The release category does not specify whether the fish was released alive or released dead.

The data consists of the reported releases from all of the daily log sheets for NWHI fishing trips that were submitted. All fishing trips (including main Hawaiian island areas or other areas) made

by the permitted fishing vessels are reported to the State under this reporting system. Only the information on trips made to the NWHI which landed bottomfish management unit species, regardless of gear type or fishing method, were included in the data set. Nearly 100% of the NWHI fishing trips were accounted for by the HDAR reporting system. There were no adjustments made for data from any missing or unreported trips.

Comments & Interpretation: The identification of the species and number of fishes that were released indicates that the majority of the released fish would fall into the category of economic or regulatory discards. Since the State of Hawaii instituted regulations to control the practice of shark finning by requiring that the entire carcass be brought to shore along with the fins the NWHI bottomfishermen have been releasing all of the sharks that they have caught. Previous to the implementation of the new shark carcass retention regulation a small percentage of the sharks were retained by a few vessels due to the high value of their fins. Although the value of the shark fins are high the income generated could not offset the costs of lost and damaged equipment and the loss of catch that can be directly attributed to sharks. The percentage of live verses dead releases under the present regulations are not known. Sharks constitute the major regulatory discard for this fishery.

The economic discards are mainly constituted of species which have low or in some cases no commercial value. Bottomfish management unit species as well as pelagic management unit species and miscellaneous other species are released. Releases are generally prompted by product shelf-life concerns(due to trip length), low value, or concern for future resources(release of small fish). The fishermen are making an effort to minimize some economic liability by live releasing “low value” fish early in the trip and retaining them later during the trip to obtain the maximum value.

Conservation or stock related releases are another component of the release strategy employed by the fishermen. The NWHI fishermen have been live releasing a low number of small sized high value BMUS species such as onaga, opakapaka, ehu, and uku. Large numbers of various commercially low valued species(ie., butaguchi, kalekale, and white ulua) are also released live in an effort to reduce/minimize any waste of fishery resources.

Releases of fishes by management area presents patterns that reflect the fisheremen’s strategy for maximizing their profits. In the Mau zone where the trip lengths and distances to markets are short and hold space is not a limiting factor most of the fish caught are retained for sale regardless of their short shelf-life or low-value. The Hoomalu zone presents more of a challenge to the fishermen to try to maximize their profitability on these long trips. The maximizing of hold space and the ice capacity make this a tricky balancing act. Hold space is primarily reserved for high valued species. The shelf-life concerns for various species are addressed by releasing the species early on in the trip and retaining them during the latter stages of the trip to maximize the returns on the fresher product. This strategy lessens waste(by live releases) and maximizes economic profits(fresher product) while conserving the limited bottomfish resources. Additionally the fresher appearance of the fish put up for sale usually increases the price paid and enhances the reputation of the fisherman as being quality conscious and bringing in a top quality product.

Tha largest component of the releases is that of kahala, *Seriola* spp. The kahala was once a very important commercial species but due to the presence of ciguatoxin in a percentage of fish it has not been sold for many years due to liability concerns. It is thought that since kahala are caught in such large numbers while fishing for the targeted species their population represent competition for food and habitat resources. The large kahala are also known to feed on the valuable bottomfish species, often stealing them off the hooks and thus contributing to the inefficiencies of the fishing operations as well. The fishermen release the majority of kahala that they catch although they may from time to time use them as bait or chum. The releases can be either live or dead depending on the preference of the captain. The percentage of live releases to dead releases are not known. With the start of the NWHI bottomfish observer program in 2003/04 information on the discard rates and disposition of the discards will be collected.

Many of the NWHI captains voluntarily participate in the State of Hawaii's ulua tagging study and routinely tag many kahala and other jacks. Recent recapture results from the tagging study showed a kahala that was tagged on the SW side of St. Rogatien Bank in 2000 was recaptured in 2004 on "The Grounds" off of Keahole Point, Kailua-Kona on the island of Hawaii. The kahala had traveled at least 678 "straight line" miles and grew approximately 4 inches while at liberty for 3 years and 7 months.

Figure 6. MHI species composition of landings by weight

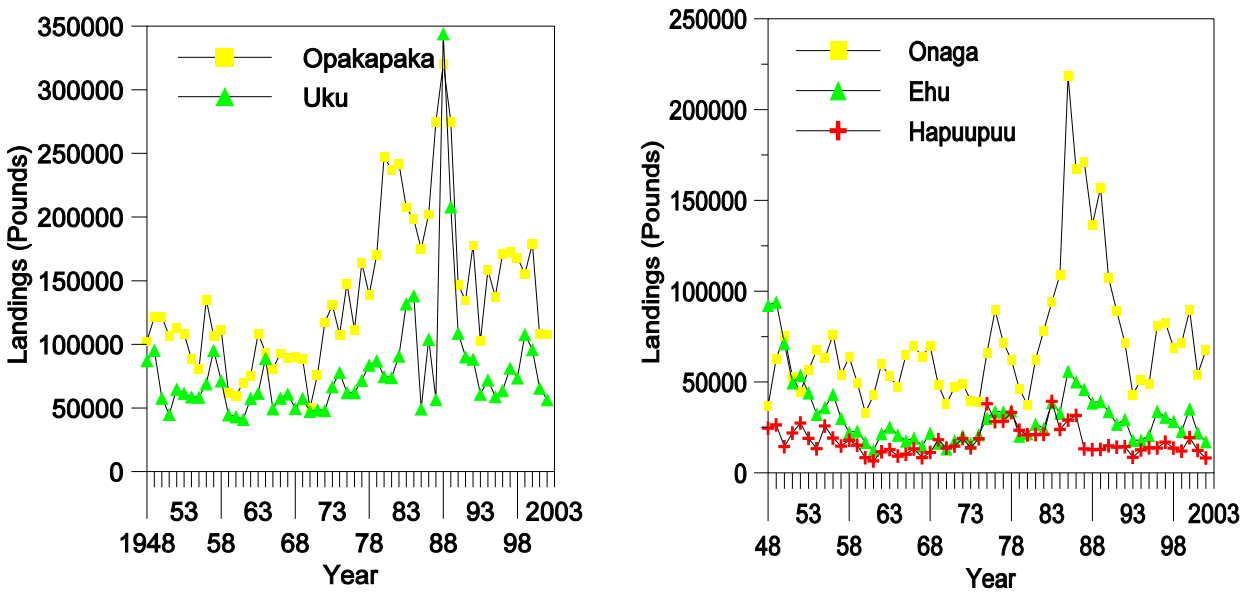


Figure 8

Interpretation: Most species show declining trends from the mid- and late-eighties to 1993 then peaking in the late 90's and falling to current lower levels. The prevailing interannual pattern in landings is episodic versus predictably periodic or constant. 2002 landings for all species are preliminary as they are based on catch reports submitted to date. Data from earlier years is essentially complete. Landings for all species were highest in the mid 1980s. Landings of ehu and hapuupuu are well below the long-term average, approximating lows of the early 1960's.

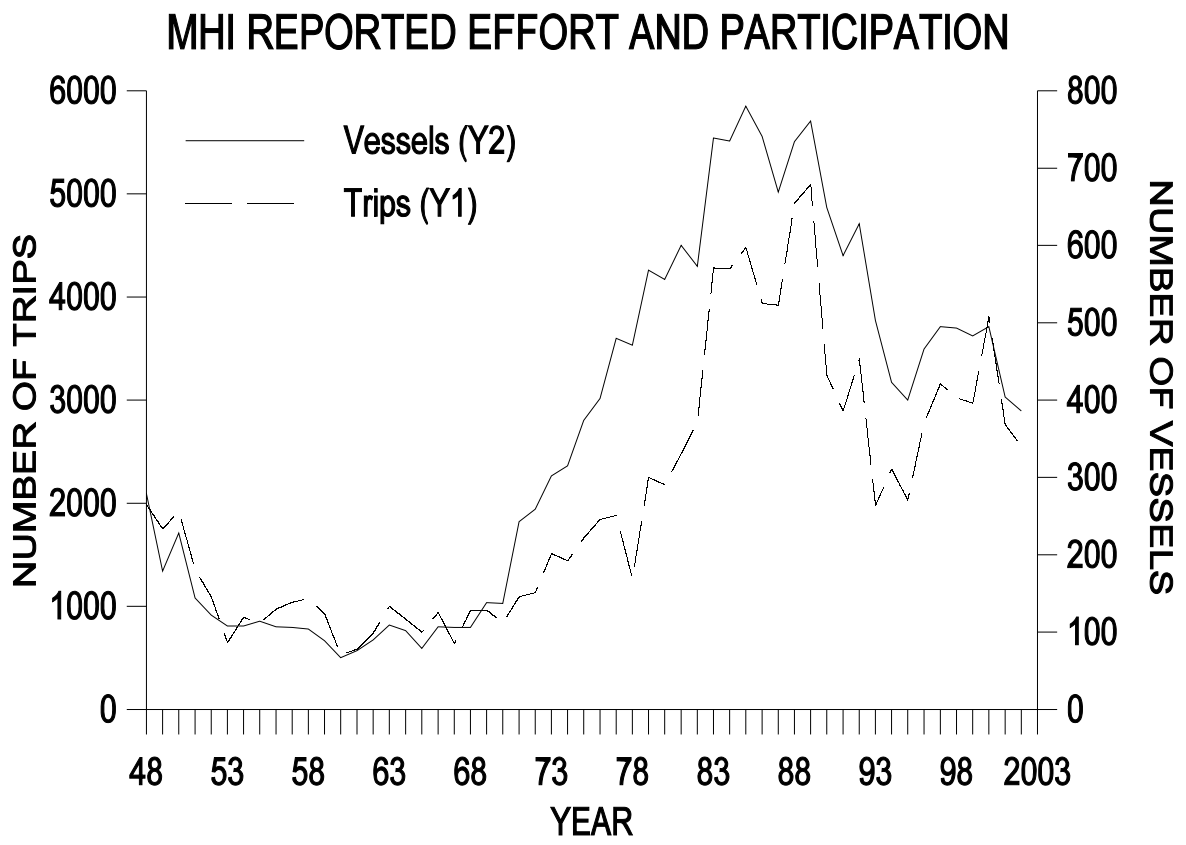
Source: Total commercial landings by species are from HDAR commercial catch report data for the MHI with no screening by gear. 2001 values have been updated from last year's report with an essentially complete data set for that year. 2002 values are preliminary estimates of annual landings based on landings reported to date and should increase for all species by an unknown amount with further reporting.

Comments: Landings presented here are commercial reported landings only and do not include any expansion for recreational landings.

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	172308	82874	30778	81367	16984
1998	167918	69077	28417	73724	13610
1999	155300	71749	23009	107826	12080
2000	179172	89431	35368	96012	19420
2001	108089	54232	22160	65634	12431
2002	**107681**	**67489**	**17204**	**56549**	**8244**
mean	138544	72096	31528	78736	17905
s.d.	59437	36650	17103	46059	7612

Figure 7. MHI reported effort and participation



Interpretation: Preliminary 2002 values for effort and participation are based on reports received to date and not expanded for any late reporting. Participation indicated to date suggest a sharp decline in participation and effort from 2000. These values are apt to increase with more complete reporting, but are not apt to reach 2000 levels.

Landings and CPUE for bottomfish trips are tabulated in the following table. These figures differ from those presented in Figure 1 (landings) and Figure 14 (CPUE). Those presented here are screened for bottomfish trips only (as defined below). In Figure 1 landings are for bottomfish species caught on all gears without screening criteria and in Figure 14 data are further screened by area fished and landings of individual fishers to reflect the effective fishing effort required to "standardize" CPUE. Landings and CPUE for 2002 are above the 2001 values even though the data set is preliminary with late reports still outstanding. The values are, however, below the long-term average, and the CPUE value is the third lowest on record.

Source: HDAR commercial catch report data.

Calculation & Adjustment: MHI commercial bottomfish trip and vessel values are obtained from the HDAR commercial fisher's 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 1994-1999 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.

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	2780	253887	91.33
97	495	3158	288107	91.23
98	493	3023	268607	88.85
99	483	2970	261148	87.92
2000	495	3810	310817	81.58
2001	404	2761	215575	78.08
2002	**386**	**2556**	**221359**	**86.60**
mean	299	2049	293370	178.01
s.d.	179	1246	111293	76.16

Figure 8a. Hawaii bottomfish landings, revenues, inflation-adjusted revenues, 1970-present.

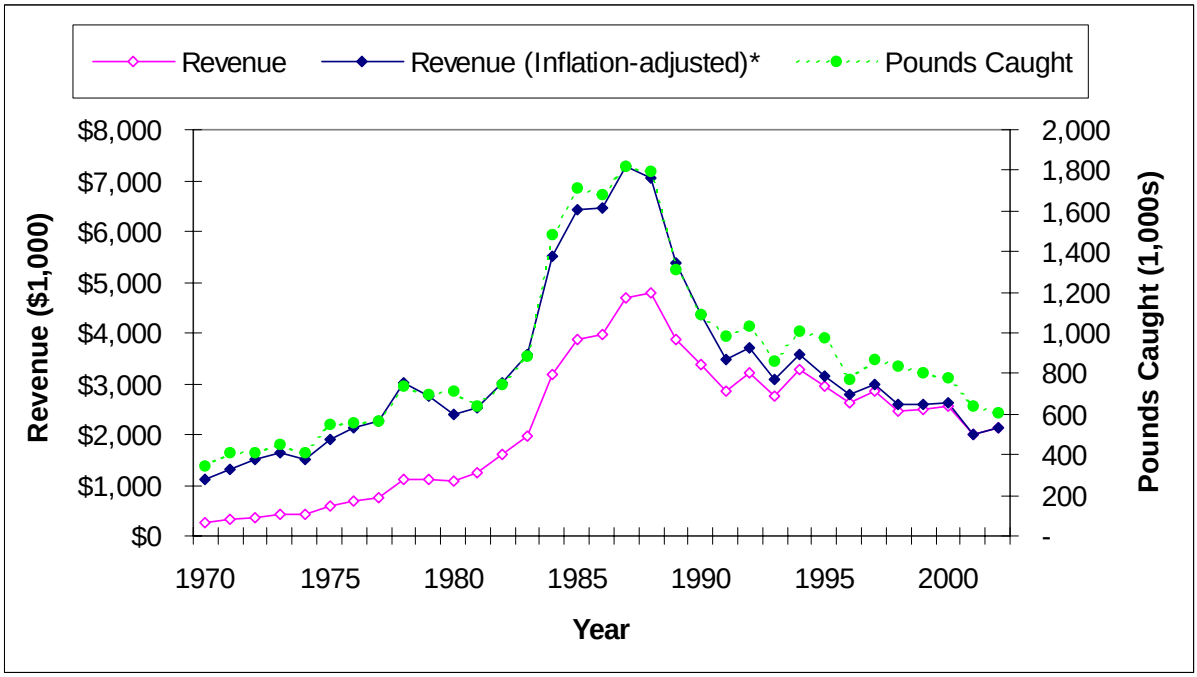
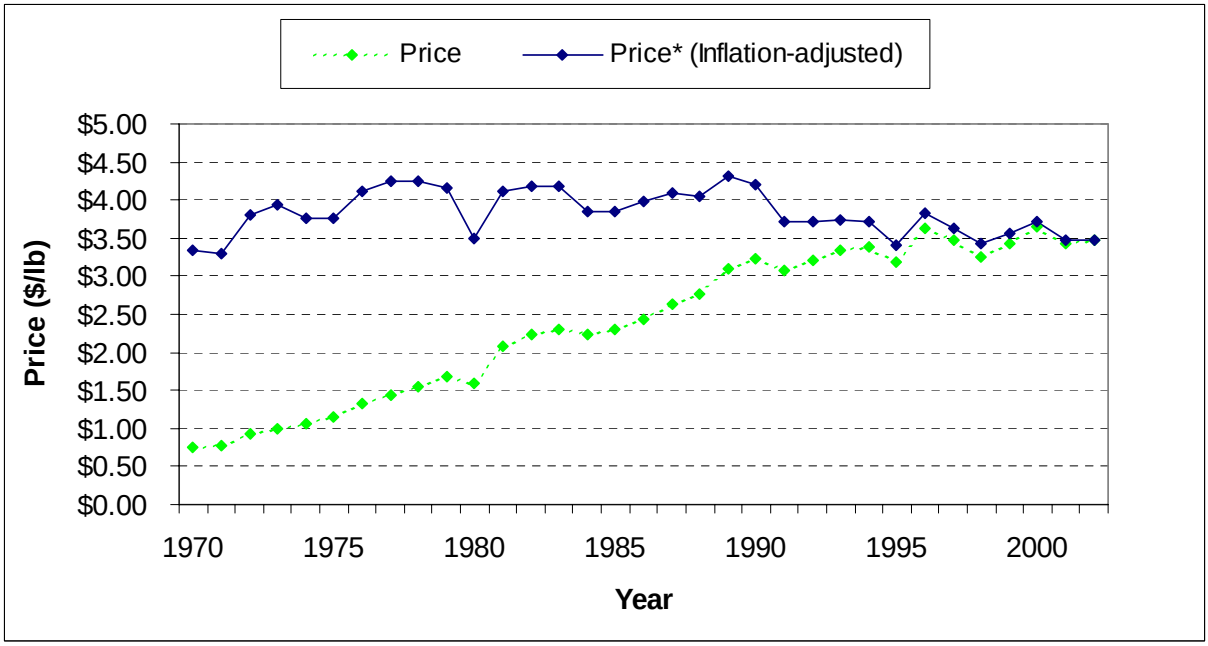


Figure 8b. Hawaii bottomfish price and inflation-adjusted price, 1970-present



Interpretation: After twenty years of growth, Hawaii bottomfish landings and *real* (inflation-adjusted) revenue peaked in 1987 and then declined by 67% and 70%, respectively, in the fifteen years since then. Much of this decline was caused by reductions in fishing participation (vessels and trips) due to limited entry and to a weak market for fresh bottomfish in the 1990s.

In 2002, landings continued to decline. However, the revenue increased due to the fish price increased by 3 cents from the previous year.

There is a slightly declining trend from 1991 to 2001 for inflation-adjusted ex-vessel bottomfish prices. Based on its movement, the price trend can be divided into three periods, 1970-1976, 1977-1990, and 1991-2002. Bottomfish price (inflation-adjusted) increased substantially during 1970-1976, from $3.33 to $4.11 per pound. It stabilized around $4.00 during the period of 1977-1990 (except a drop in 1985), then declined gradually from $4.21 per pound in 1990 to $3.47 in 2002. Previous economic research (mid-1980s) showed a strong inverse relationship between monthly and weekly price and landings, but this relationship appears weaker in the 1990s, perhaps due to increased imports of bottomfish from Pacific island nations. The supply-demand relationship in the Hawaii bottomfish market will be discussed later in the report.

Of particular importance in interpreting bottomfish price trends, which strongly influence the economic performance of bottomfish vessels, is the increasing presence of imported bottomfish (snappers) in the Hawaii market. According to U.S. Customs data for the Port of Honolulu, 715,000 pounds of snapper were imported in CY 2002 worth $1.92 million ($2.68 per pound). This amounts exceeded domestic supply and thus was a significant factor in ex-vessel prices. Tonga and Australia were the largest sources of fresh snapper, with Fiji and New Zealand also being major sources.

Data: "Landings" refer to Pounds Caught (vs. Pounds Sold). Revenue is ex-vessel.

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 although there may be problems of under-reporting during the latter part of that period[1]. NMFS estimates from shoreside monitoring are used for NWHI landings from 1984 - 1990. Data from 1991 - 1997 use a combination of HDAR figures and NMFS adjustments, while data for 1998 - 2001 are solely from HDAR data. For 2002, data from HDAR reports are used for NWHI for the entry year, but for MHI only from January to September, due to the form changes in HDAR catch reports.

[1] The likelihood of that under-reporting is shown by the "jump" in NWHI landings when the Western Pacific Regional Fishery Management Council (and subsequently in 1987 NMFS) shoreside monitoring program began in 1984, with 38,000 pounds reported landed by the State in 1983 and 661,000 pounds reported landed by the Council in 1984. NWHI reported NWHI landings to HDAR in 1984 were 224,000 pounds.

HDAR Dealer reports are used for MHI for the last three months (October to December in 2002).

Revenue* represents nominal revenue adjusted for inflation by the Honolulu Consumer Price Index (HCPI), 1983-84 baseline; prices* are adjusted for inflation to the current year.

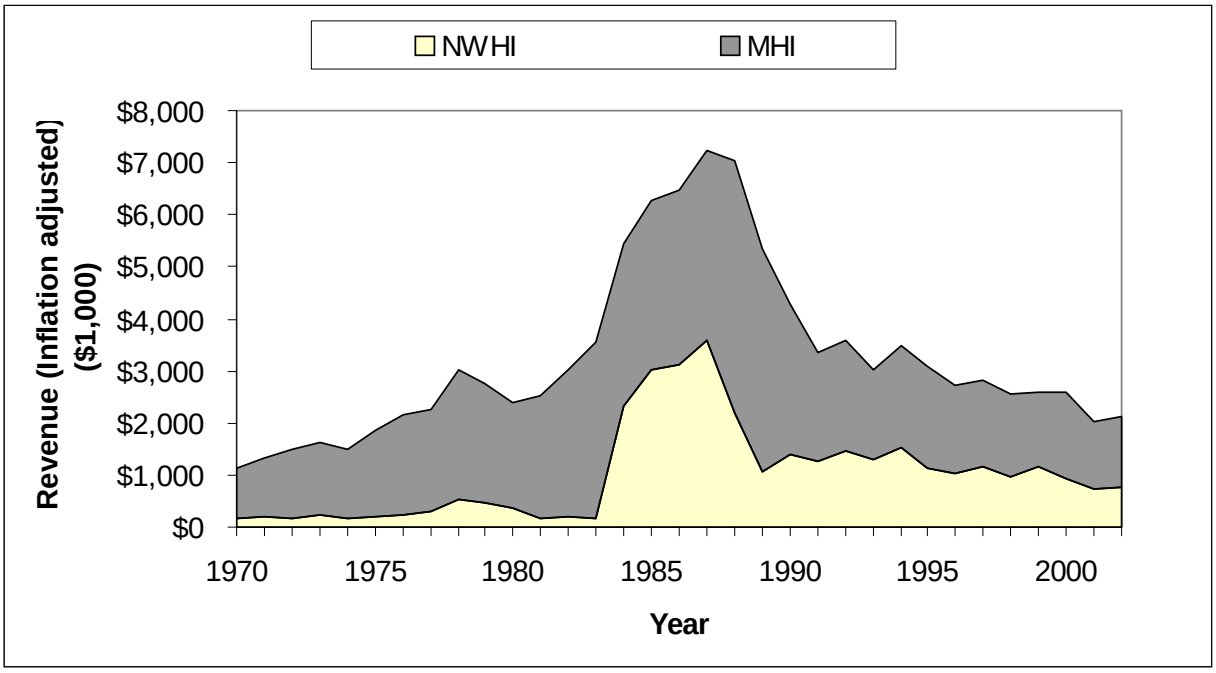
Data source: Data imported from b8702xnb.xls (3/12/04)

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

	Pounds Caught All Areas (1,000s)	Revenue All Areas ($1,000)	Revenue* (Inflation-adjusted)	Price[2] Per Pound Sold	Price * (Inflation-adjusted)	HCPI
1970	344	$253	$1,115	$0.76	$3.33	40.9
1971	410	$312	$1,321	$0.78	$3.31	42.6
1972	407	$366	$1,500	$0.93	$3.81	44.0
1973	454	$418	$1,642	$1.00	$3.93	45.9
1974	413	$421	$1,494	$1.06	$3.77	50.8
1975	549	$584	$1,897	$1.16	$3.77	55.5
1976	558	$693	$2,143	$1.33	$4.10	58.3
1977	562	$764	$2,251	$1.44	$4.23	61.2
1978	740	$1,100	$3,010	$1.55	$4.24	65.9
1979	698	$1,123	$2,766	$1.69	$4.17	73.2
1980	713	$1,082	$2,382	$1.59	$3.51	81.9
1981	643	$1,262	$2,514	$2.07	$4.12	90.5
1982	750	$1,600	$3,005	$2.23	$4.19	96.0
1983	887	$1,976	$3,570	$2.31	$4.18	99.8
1984	1,481	$3,192	$5,518	$2.23	$3.85	104.3
1985	1,717	$3,853	$6,438	$2.31	$3.85	107.9
1986	1,682	$3,958	$6,470	$2.43	$3.97	110.3
1987	1,819	$4,687	$7,291	$2.63	$4.09	115.9
1988	1,794	$4,796	$7,042	$2.76	$4.06	122.8
1989	1,314	$3,867	$5,376	$3.10	$4.31	129.7
1990	1,094	$3,371	$4,376	$3.24	$4.21	138.9
1991	984	$2,864	$3,468	$3.07	$3.72	148.9
1992	1,043	$3,199	$3,700	$3.21	$3.71	155.9
1993	862	$2,749	$3,084	$3.33	$3.74	160.7
1994	1,011	$3,277	$3,587	$3.39	$3.71	164.7
1995	972	$2,949	$3,157	$3.19	$3.42	168.4
1996	768	$2,636	$2,779	$3.62	$3.82	171.0
1997	872	$2,855	$2,989	$3.47	$3.63	172.2
1998	834	$2,470	$2,595	$3.26	$3.43	171.6
1999	801	$2,496	$2,595	$3.43	$3.57	173.4
2000	781	$2,550	$2,608	$3.64	$3.72	176.3
2001p	643	$1,993	$2,014	$3.44	$3.48	178.4
2002p	**607**	**$2,124**	**$2,124**	**$3.47**	**$3.47**	**180.3**
Average	885	$2,177	$3,267	$2.40	$3.83	113.9
Standard Deviation	407	$1,316	$1,649	$0.95	$0.29	48.3

[2] Price calculated on Pounds Sold (not shown in the table) and Revenue, not Pounds Caught.

Figure 9. Hawaii bottomfish landings, and revenue* by area (NWHI vs. MHI), 1970 - 2002.
(*Inflation adjusted)



Interpretation*: The variation of Hawaii bottomfish revenue (inflation-adjusted) over time mainly resulted from the changes of the NWHI bottomfish revenue. NWHI bottomfish revenue grew dramatically in the mid-1980s, due to the increase of landings in the same period, and then tailed off. Inflation-adjusted revenue in 2002 is only 20% that in 1987 (the peak).

Inflation-adjusted revenue from main Hawaiian Islands bottomfish grew steadily through the 1970s and 1980s as both *real* prices and total landings increased substantially. Beginning in 1988, total landings began to decline, falling almost 60% in the subsequent decade.

Revenue from MHI was always greater than the revenue from NWHI. Before mid-1980s, MHI bottomfish revenue made up over 80% of the total Hawaii bottomfish revenue. The proportion declined due to a dramatic increase of NWHI bottomfish landings in the mid-1980s, and the MHI revenue was about 50% of the total during the period of 1985 to 1987. Since then, revenues of both areas declined, but revenue from MHI was still at a level above the NWHI, at 64% of the total in 2002.

These changes in total landings are related to both catch rates and participation. More interpretation can be gleaned from discussion in detailed tables and figures in this report.

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 from 1997 to 2001. For 2002, data from HDAR reports are used for NWHI for the entry year, but for MHI only from January to September, due to the form changes in HDAR catch reports. HDAR Dealer reports are used for MHI for the last three months (October to December in 2002).

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 b8702xnb.xls (3/12/04)

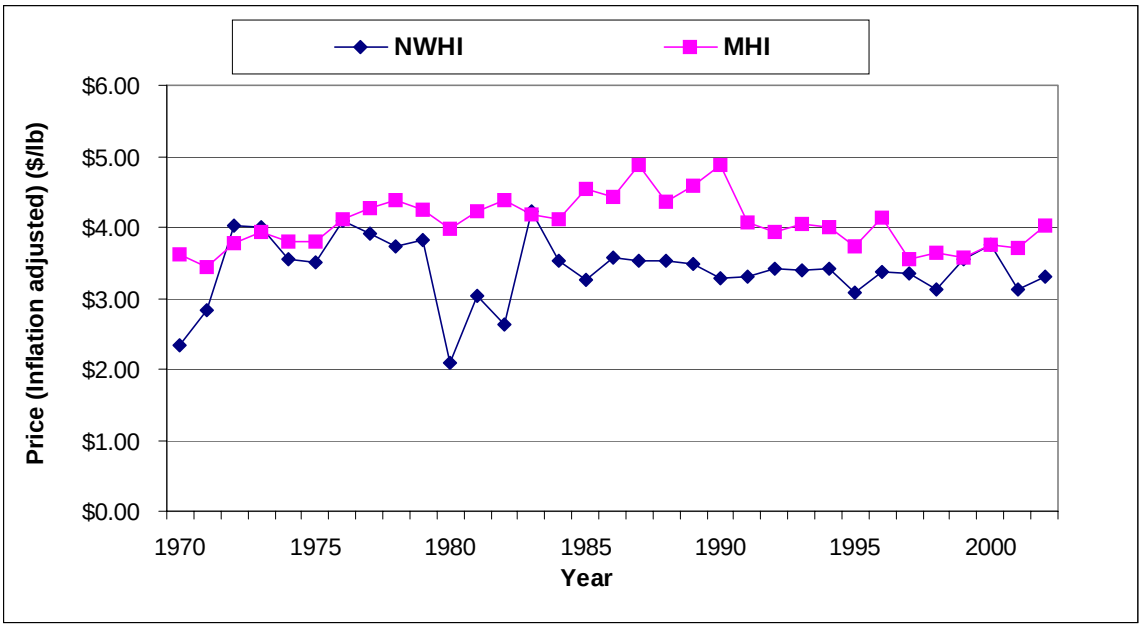
NWHI bottomfish landings, revenue, and price by source, 1970 - present.
(* Inflation-adjusted.)

	NWHI Pounds Caught	NWHI Revenue	NWHI Revenue*	NWHI Aggregate	NWHI Aggregate Price *	HCPI
		Nominal Values	(Inflation-adjusted)	Nominal Price	(Inflation-adjusted)	
1970	74	$39	$172	$0.53	$2.34	40.9
1971	75	$50	$212	$0.67	$2.84	42.6
1972	43	$42	$172	$0.98	$4.02	44.0
1973	62	$63	$247	$1.02	$4.01	45.9
1974	49	$49	$174	$1.00	$3.55	50.8
1975	59	$64	$208	$1.08	$3.51	55.5
1976	59	$78	$241	$1.32	$4.08	58.3
1977	83	$104	$306	$1.33	$3.92	61.2
1978	143	$194	$531	$1.36	$3.72	65.9
1979	118	$183	$451	$1.55	$3.82	73.2
1980	172	$163	$359	$0.95	$2.09	81.9
1981	52	$79	$157	$1.52	$3.03	90.5
1982	77	$108	$203	$1.40	$2.63	96.0
1983	38	$89	$161	$2.34	$4.23	99.8
1984	661	$1,350	$2,334	$2.04	$3.53	104.3
1985	922	$1,800	$3,008	$1.95	$3.26	107.9
1986	869	$1,900	$3,106	$2.19	$3.58	110.3
1987	1015	$2,300	$3,578	$2.27	$3.53	115.9
1988	625	$1,500	$2,202	$2.40	$3.52	122.8
1989	303	$756	$1,051	$2.50	$3.48	129.7
1990	423	$1,066	$1,384	$2.52	$3.27	138.9
1991	387	$1,053	$1,275	$2.72	$3.29	148.9
1992	424	$1,255	$1,451	$2.96	$3.42	155.9
1993	385	$1,164	$1,306	$3.02	$3.39	160.7
1994	443	$1,382	$1,513	$3.12	$3.42	164.7
1995	369	$1,060	$1,135	$2.87	$3.07	168.4
1996	309	$989	$1,043	$3.20	$3.37	171.0
1997	346	$1,106	$1,158	$3.20	$3.35	172.2
1998	329	$924	$971	$2.97	$3.12	171.6
1999	341	$1,102	$1,146	$3.42	$3.56	173.4
2000	270	$902	$922	$3.68	$3.76	176.3
2001p	251	$725	$733	$3.10	$3.13	178.4
2002p	**243**	**$759**	**$759**	**$3.13**	**$3.13**	**180.3**
Average	306	$739	$1,028	$2.10	$3.40	111.8
Standard Deviation	265	$645	$921	$0.90	$0.47	47.6

NWHI bottomfish landings, revenue, and price by source, 1970 - 2002.
(* Inflation-adjusted.)

	MHI Pounds Caught	MHI Revenue	MHI Revenue* (Inflation-adjusted)	MHI Aggregate Price	MHI Aggregate Price * (Inflation - adjusted)	HCPI
1970	270	$214	$943	$0.82	$3.61	40.9
1971	335	$262	$1,109	$0.81	$3.43	42.6
1972	364	$324	$1,328	$0.92	$3.77	44.0
1973	392	$355	$1,394	$1.00	$3.93	45.9
1974	364	$372	$1,320	$1.07	$3.80	50.8
1975	485	$513	$1,667	$1.17	$3.80	55.5
1976	499	$615	$1,902	$1.33	$4.11	58.3
1977	479	$660	$1,944	$1.45	$4.27	61.2
1978	597	$906	$2,479	$1.60	$4.38	65.9
1979	580	$940	$2,315	$1.72	$4.24	73.2
1980	541	$919	$2,023	$1.81	$3.98	81.9
1981	591	$1,183	$2,357	$2.12	$4.22	90.5
1982	673	$1,492	$2,802	$2.33	$4.38	96.0
1983	847	$1,882	$3,400	$2.31	$4.17	99.8
1984	803	$1,797	$3,106	$2.38	$4.11	104.3
1985	765	$1,954	$3,265	$2.72	$4.55	107.9
1986	811	$2,052	$3,354	$2.71	$4.43	110.3
1987	785	$2,345	$3,648	$3.14	$4.88	115.9
1988	1,166	$3,288	$4,828	$2.97	$4.36	122.8
1989	1,007	$3,090	$4,296	$3.29	$4.57	129.7
1990	651	$2,242	$2,910	$3.76	$4.88	138.9
1991	562	$1,713	$2,074	$3.35	$4.06	148.9
1992	588	$1,842	$2,130	$3.40	$3.93	155.9
1993	462	$1,535	$1,722	$3.60	$4.04	160.7
1994	536	$1,793	$1,963	$3.65	$4.00	164.7
1995	570	$1,818	$1,946	$3.48	$3.73	168.4
1996	442	$1,593	$1,680	$3.92	$4.13	171.0
1997	519	$1,589	$1,664	$3.39	$3.55	172.2
1998	496	$1,517	$1,594	$3.47	$3.65	171.6
1999	460	$1,393	$1,448	$3.43	$3.57	173.4
2000	509	$1,641	$1,678	$3.67	$3.75	176.3
2001p	391	$1,266	$1,279	$3.66	$3.70	178.4
2002p	**363**	**$1,364**	**$1,364**	**$4.04**	**$4.04**	**180.3**
Average	588	$1,407	$2,287	$2.44	$4.08	107.4
Standard Deviation	197	$787	$934	$1.02	$0.37	45.9

Figure 10. Hawaii bottomfish ex-vessel prices* by area (NWHI vs. MHI, 1987 - 2002. (* Inflation-adjusted.)



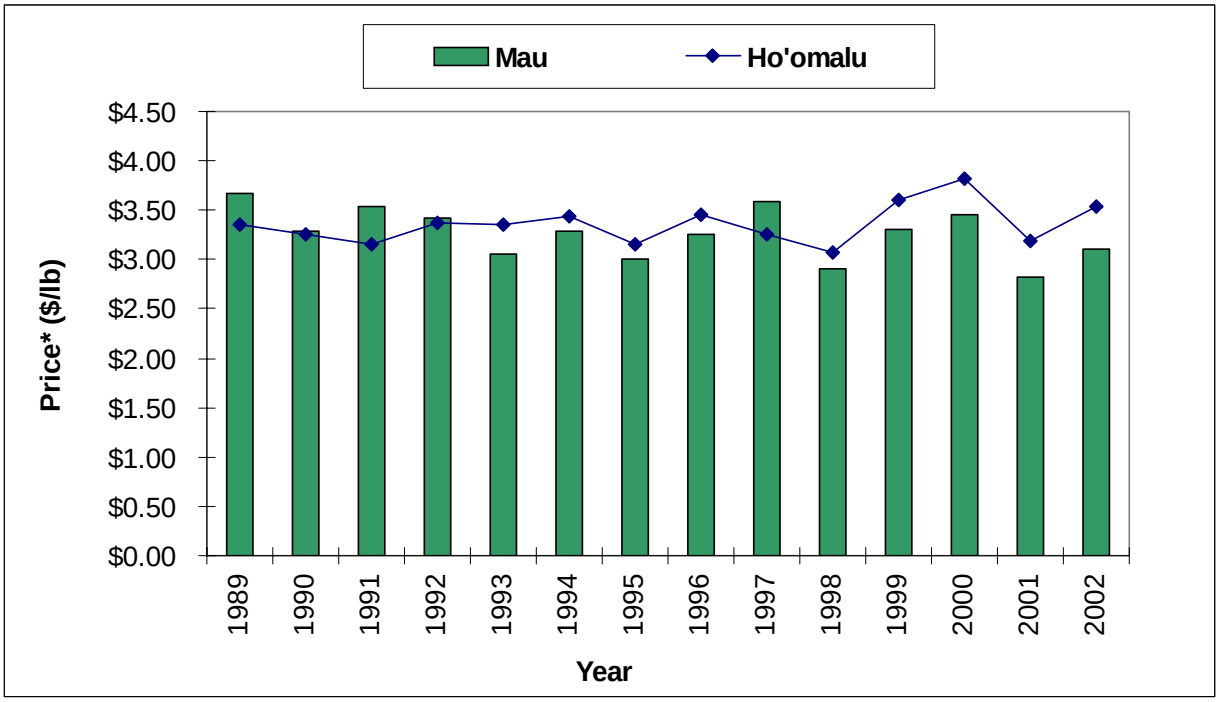
Interpretation*: Historically, bottomfish caught in the main Hawaiian Islands tended to have higher aggregate prices, reflecting both species composition and greater freshness. However, the MHI price declined in general in 1990s, while NWHI price was relatively steady during the same period. This relative lowering of the MHI bottomfish prices may have reflected the softness of the upscale part of the Hawaii market. As a result, it brought the prices to a similar range in 1999, and slightly converge in 2000 as NWHI price was $3.76 and MHI was $3.75.

In 2001, the prices from both areas drops, but to a greater degree for bottomfish caught in the Northwestern Hawaiian Islands. In 2002, the prices from both areas increased slightly. Again, the MHI price was higher than NWHI again in these two years.

Onaga and opakapaka comprise the largest valued landings in each area for most years (ignoring the highly fluctuating landings of uku); NWHI ex-vessel prices were $4.53 and $4.79 per pound respectively in CY 2002 while MHI were $5.89 and $5.01, respectively. However, the NWHI landings are comprised of a higher percentage of these higher priced species compared to the MHI, so the difference in price for individual species by area is ironed out by the different species compositions between the two areas.

Data: See Figure 9.

Figure 11. Hawaii Bottomfish (BMUS) Ex-vessel Prices* by NWHI zone, 1989 - 2002 (* Inflation-adjusted).



Interpretation*: Mau and Ho'omalu zone aggregate bottomfish prices (not accounting for differences in species composition) have been roughly the same in aggregate over time but diverged rather substantially in recent years, with the Ho'omalu receiving the highest aggregate prices. In inflation-adjusted terms, Mau zone prices have not changed substantial over the past ten years but Ho'omalu zone aggregate prices are 15 - 20% higher than in the late 1980s and early 1990s. The prices of the two zones moved down in 2001 and up 2002, with the Ho'omalu still receiving the highest.

However, on an individual species basis, Mau zone prices exceed those for the Ho'omalu zone, which might be expected since there is a shorter running time from the Mau zone to markets on Oahu and Kauai. Onaga and opakapaka are respectively $5.10 and $4.83 per pound, ex-vessel, from the Mau zone, while from the Ho'omalu zone the prices are $4.41 and $4.78. These two species composed only 23% of the bottomfish cought from the Mau zone, while 54% from the Ho'omalu zone.

Hawaii Bottomfish Ex-vessel Prices* by NWHI zone, 1989 - present.
(*Inflation-adjusted to current year base)

	Nominal Price per Pound		Inflation-adjusted Price		
Year	**Mau**	**Ho'omalu**	**Mau**	**Ho'omalu**	**HCPI**
1989	$2.64	$2.41	$3.67	$3.35	129.70
1990	$2.53	$2.51	$3.28	$3.26	138.90
1991	$2.92	$2.61	$3.54	$3.16	148.90
1992	$2.96	$2.92	$3.42	$3.38	155.90
1993	$2.73	$2.99	$3.06	$3.35	160.70
1994	$3.00	$3.14	$3.28	$3.44	164.70
1995	$2.80	$2.94	$3.00	$3.15	168.40
1996	$3.09	$3.27	$3.26	$3.45	171.00
1997	$3.42	$3.11	$3.58	$3.26	172.20
1998	$2.77	$2.93	$2.91	$3.08	171.6
1999	$3.18	$3.46	$3.31	$3.60	173.4
2000	$3.38	$3.74	$3.46	$3.82	176.3
2001p	$2.79	$3.15	$2.82	$3.18	178.4
2002p	**$3.10**	**$3.53**	**$3.10**	**$3.53**	**180.3**
Average	$2.95	$3.05	$3.26	$3.36	163.6
Standard Deviation	$0.26	$0.38	$0.26	$0.20	**15.2**

Data: Data from HDAR reports are used for NWHI for both years. Inflation-adjusted values are to current year base HCPI (Honolulu Consumer Price Index).

Data source: nwhi02kek.xls (3/12/04)

Hawaii bottomfish species landings and prices, all areas combined, 2001 & 2002.[3]

	2001		2002	
	Pounds	**Revenue**	**Pounds**	**Revenue**
Butaguchi	31,228	49,224	32,271	49,597
Ehu	37,503	126,843	27,704	106,580
Hapuupuu	37,437	133,846	38,044	149,244
Onaga	128,414	569,700	124,389	675,353
Opakapaka	156,416	653,372	145,881	681,039
Uku	117,280	266,732	116,798	273,855
Ulua	7,862	10,198	9,506	10,880
Other BMUS	92,963	124,466	80,095	128,345
Other Bottomfish	33,518	59,056	31,886	49,385
Total Bottomfish	642,621	1,993,437	606,574	2,124,279
	Average Ex-vessel Price per Pound			
	2001		2002	
Butaguchi	$1.73		$1.62	
Ehu	$3.69		$4.01	
Hapuupuu	$3.78		$4.04	
Onaga	$4.67		$5.29	
Opakapaka	$4.41		$4.88	
Uku	$2.43		$2.44	
Ulua	$1.48		$1.54	
Other BMUS	$1.82		$1.97	
Other Bottomfish	$2.20		$2.22	
Total Bottomfish	$3.43		$3.74	

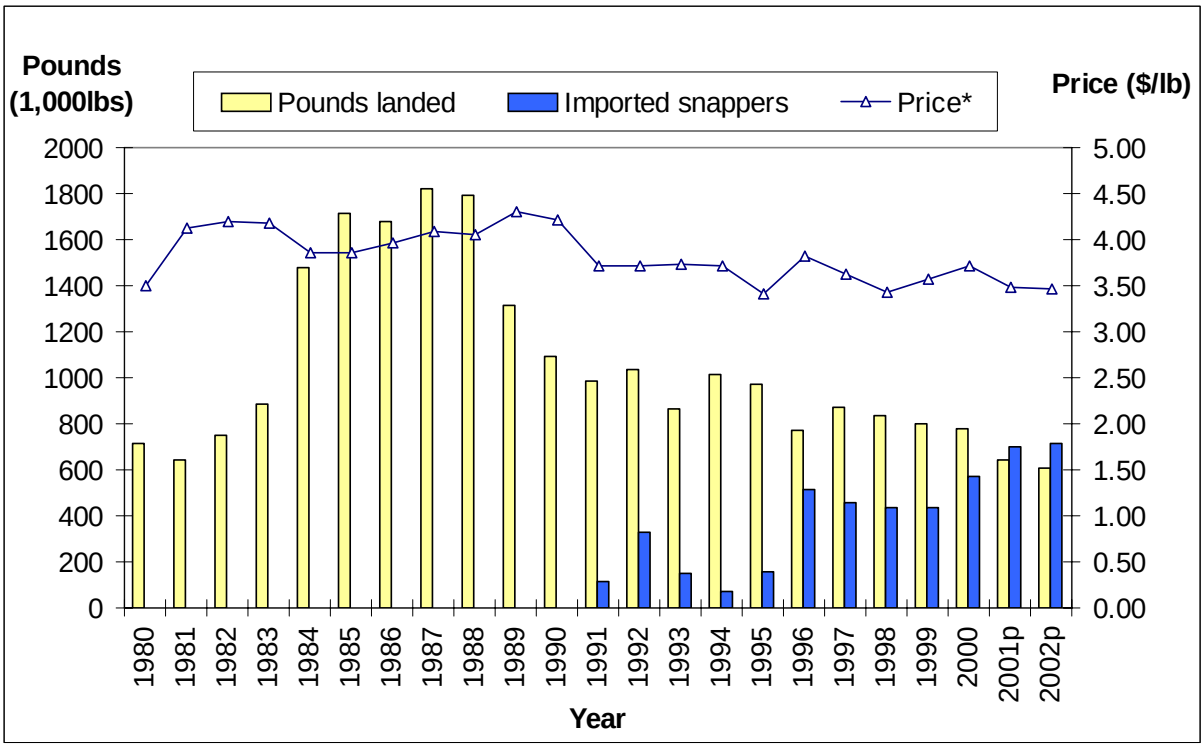
[3] Small differences may exist between species totals and area totals due to rounding.

Interpretation: Species prices show the significance of species composition in aggregate statistics since prices vary from $5.29 per pound, ex-vessel, for onaga to $1.57 for ulua. The generally higher species prices in 2002 probably reflect the improved economic climate in Hawaii and the resulting increased demand for fresh seafood.

Data & Data Sources: NMFS estimates from shoreside monitoring are used for NWHI landings from 1984-96. HDAR landings are again used for NWHI landings from 1997-2001. For 2002, data from HDAR reports are used for NWHI for the entry year, but for MHI only from January to September, due to the form changes in HDAR catch reports. HDAR Dealer reports are used for MHI for the last three months (October to December in 2002).

Data imported from: b8702xnb.xls (3/12/04)

Figure 12. Hawaii bottomfish demand (annual, inflation-adjusted ex-vessel price* and supplies (domestic landings and imported fresh snappers), 1980 - present.)

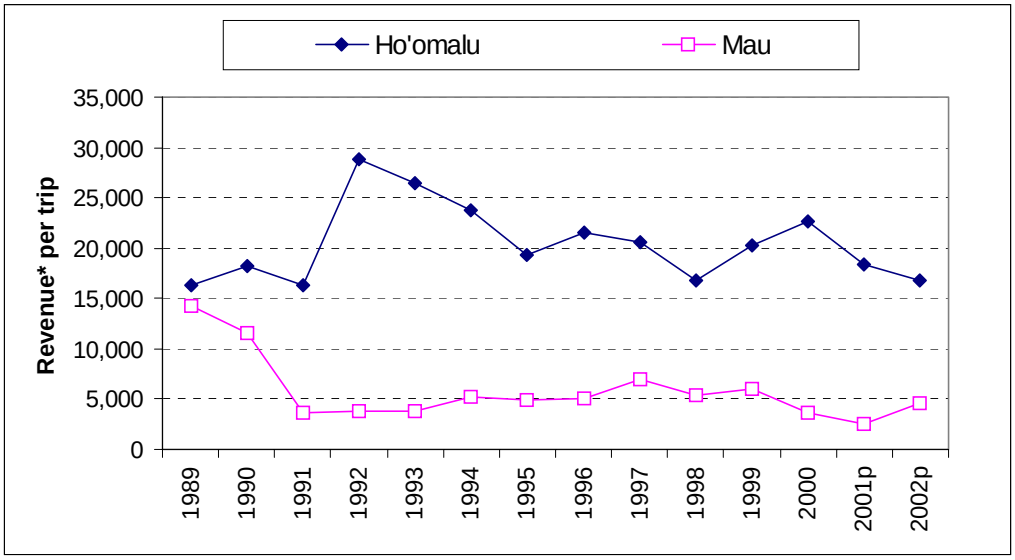


Interpretation*: Economic research in the mid-1980s showed a considerable (negative) relationship between weekly bottomfish landings and ex-vessel price. However this relationship is not shown for the annual data. As shown by this and the earlier figure, despite a considerable decrease in total landings since 1987, inflation-adjusted ex-vessel price has been slightly declined over the past decade. The impact of imports may be significant. Based on the U.S. Census statistics, fresh bottomfish, mainly snappers, have been imported to Hawaii market since 1991 and the imported volume has increased substantially. In resent years, 2001 and 2002, the imported fresh snappers supplied more than half of the local market and the average price of imported snappers were around $2.70 per pound, one dollar lower than the local bottomfish price.

Data: See Figure 9 for domestic landings and price data. Imported snapper information is based on the data recorded by U.S. Census Bureau, maintained by NMFS market news, http://www.st.nmfs.gov/st1/market_news/ . The import data are available in the web site since 1989. Since the imported fish snappers did not appeared in the data until 1991, it is not sure that the imported fresh snappers were zero or information was not available prior to 1989.

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

Figure 13. 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. When the limited entry provisions began to take effect in the Ho'omalu zone in 1989-91, revenue rose dramatically but has subsequently declined to slightly more than its average for the period. Revenue (inflation-adjusted) in the Mau zone initially fell (as the limited entry vessels could no longer fish in the Mau zone, only smaller boats remained in the Mau zone). After that initial drop, however, revenue per trip in the Mau zone rose for several years, but has subsequently declined from 1997 to 2001. In 2002, revenue per trip for the vessels fishing in Ho'omalu declined, while it increased in Mau zone. The limited entry program, which was implemented in Mau zone since 2001, may has improved the economic performance for the vessels that has a permit to fish in Mau zon.

Additional trip revenue to bottomfish vessel, in some cases a substantial proportion, comes from non-bottomfish landings outside the bottomfish grounds of the NWHI. Thus additional revenue was not included in this graph.

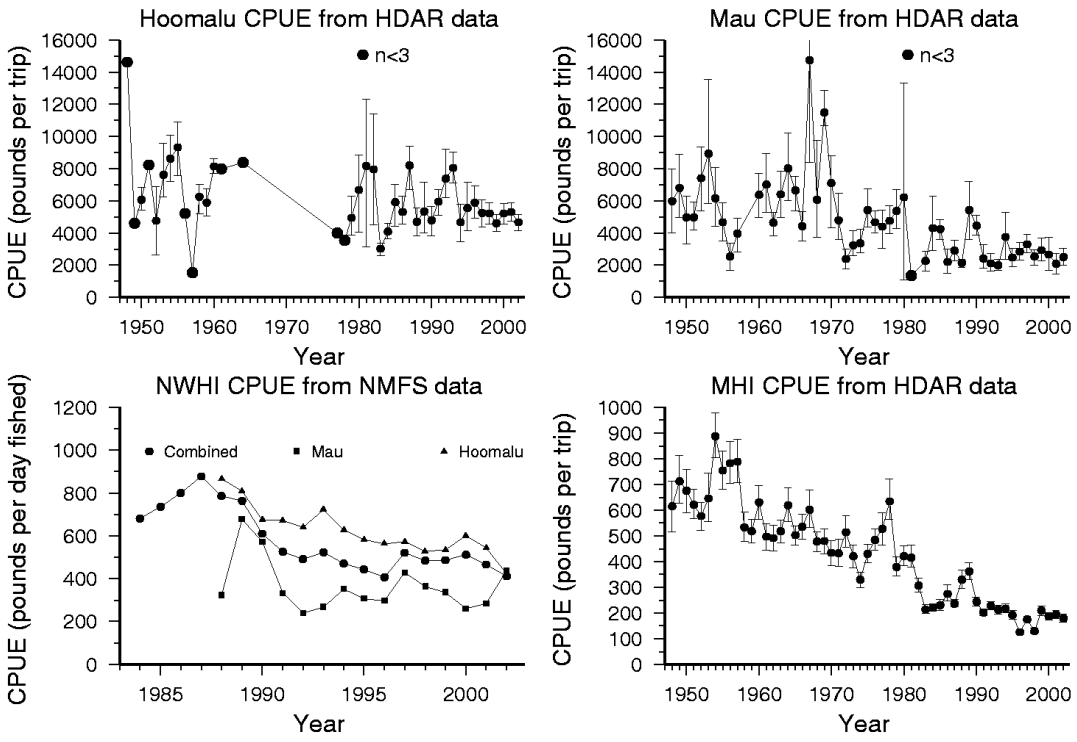
NWHI bottomfish inflation-adjusted fleet-wide revenue* and revenue* per trip by zone, 1989 - present.

	Ho'omalu Zone			Mau Zone		
Year	Trips	Revenue per trip	Revenue* per Trip	Trips	Revenue per trip	Revenue* per trips
1989	28	11,788	16,387	22	10,211	14,195
1990	25	14,015	18,387	55	8,904	11,558
1991	47	13,514	16,364	84	2,981	3,610
1992	37	24,989	28,900	55	3,273	3,785
1993	34	23,527	26,397	72	3,327	3,733
1994	41	21,706	23,762	99	4,746	5,196
1995	33	18,021	19,294	97	4,584	4,908
1996	26	20,387	21,496	81	4,757	5,016
1997	38	19,736	20,664	53	6,702	7,017
1998	50	16,006	16,817	39	5,130	5,390
1999	48	19,480	20,255	30	5,832	6,064
2000	32	22,174	22,677	44	3,639	3,722
2001p	41	18,146	18,339	55	2,564	2,591
2002p	**26**	**16,746**	**16,746**	**76**	**4,576**	**4,576**
Average	36	18,588	20,463	62	5,088	5,812
Standard Deviation	8.0	3,890.5	3,863.5	23.9	2,219.1	3,238.8

Data: Data are compiled from NMFS shoreside market monitoring for 1984-95 and then combined with HDAR data for 1996 and 1997. Since 1998, data is compiled from HDAR figures. Revenue is adjusted for inflation to the current base year by the Honolulu consumer price index.

Data Source: Imported from nwhikek02.xls (3/16/04)

Figure 14-a. CPUE for Hawaiian bottomfish



Interpretation: Decreases in MHI CPUE to about 30% of early CPUE values (mean of the first 5 years recorded) signify a strong yellow light condition for the fishery in this area. In the Mau zone CPUE has dropped from earliest values to 41% and 102% for trip based and daily based CPUE respectively, a borderline condition when viewed on a per trip basis, but extremely high when viewed on a per day basis. For the Hoomalu zone these values are 61% and 56 % respectively, a healthy condition.

Comments: The MHI CPUE value for 2002 is about 8% lower than the 2001 value, but remains above the 1996-1998 values. The 1999 increase in MHI CPUE was due primarily to a large increase in uku, and to a lesser degree onaga, catches and catch rates. This high in CPUE is similar to that of the late 1980s which was due to increased uku catch rates alone and may not indicate an increase in abundance of other species in either case. With the exception of lower values in 1996 and 1998, MHI catch rates have remained relatively stable since 1991.

In the Mau zone, trip CPUE increased from the 2001 value to about 41% of early values. On a catch per day basis, the Mau 2001 CPUE increased markedly to 102% of earliest values. Although the 2002 values for both increased over 2001 levels the two values do give a somewhat conflicting indication of resource abundance. Comparatively low values on a per trip basis may

be due, in part, to the recent loss of highliner vessels from the fleet. Daily CPUE values are a better indication of abundance and show a marked increase over last year. This increase may be due to changes in targeting with fishers spending more effort on BMUS vs pelagic resources.

In the Hoomalu Zone CPUE values dropped from 2001 values on both a daily and trip basis. This declined may be due, in part, to the loss of a highliner vessel in 2002.

The trip CPUE values are used for NWHI SPR calculations because they form a longer time series of data and may better estimate virgin fishery catch rates. There are no correction factors for possible changes in trip duration or fleet composition or behavior.

Source: MHI CPUE is based on HDAR C-3 catch report data from commercial fishermen. Two NWHI CPUE's are presented. Trip based CPUE is derived from HDAR C-3 catch report data from the earlier years and more recently from HDAR trip sales reports. Daily CPUE is currently derived from HDAR daily catch logs. In earlier years, HDAR data was combined with the NMFS vessel interview program catch data to obtain appropriate data and full coverage.

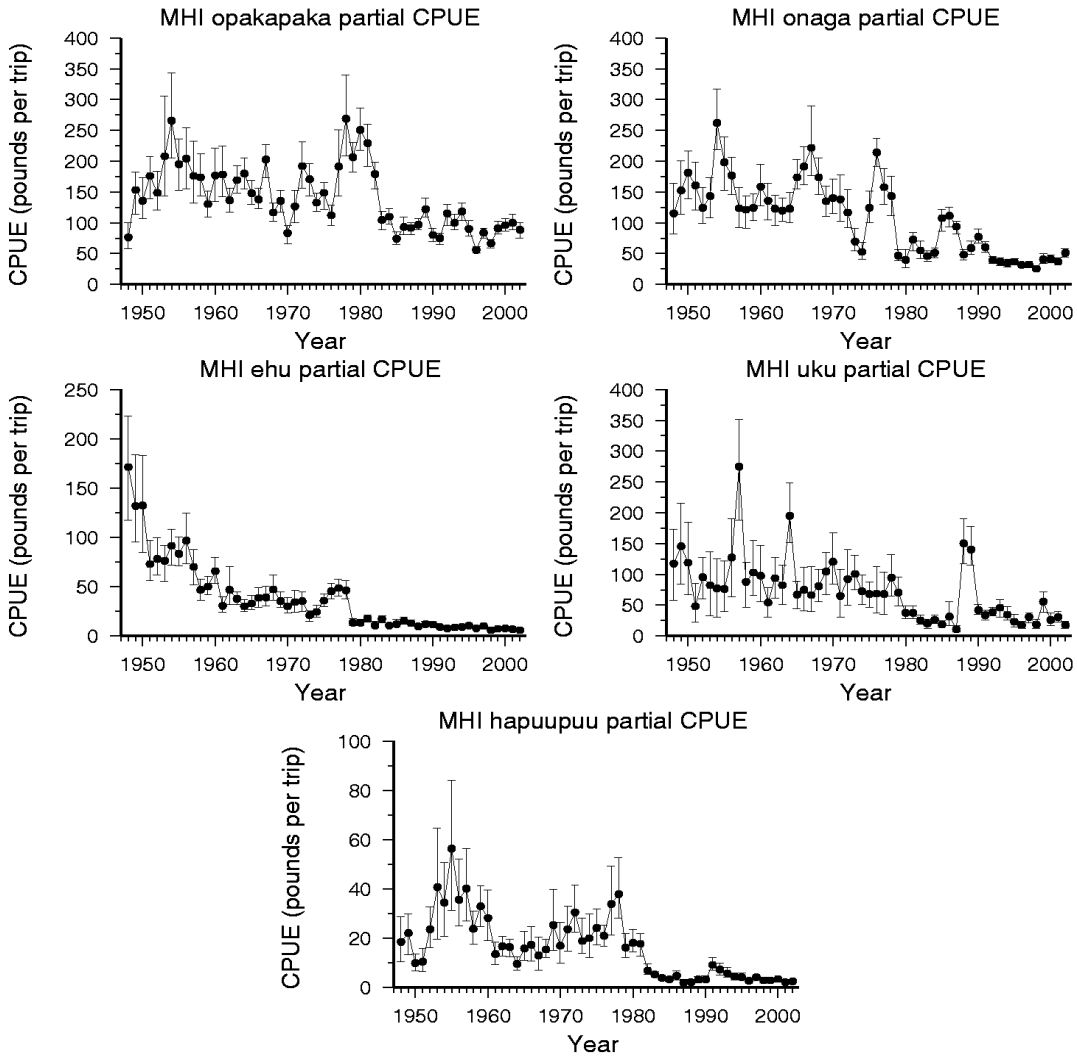
Calculation & Adjustment: MHI trips were screened to only include trips from the areas of Maui, Lanai, Molokai, and Penguin Banks that had at least 90% of the catch by weight in bottomfish. Additionally, some MHI small boats were excluded based on minimum annual landings criteria to correct for temporal 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 trip 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 14-a data summaries:

	Pounds/Trip		
Year	**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
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	125	2823	5870
1997	176	3294	5234
1998	130	2518	5198
1999	209	2926	4605
2000	187	2654	5212
2001	194	2066	5300
2002	**179**	**2496**	**4651**
mean	428	4703	6135
s.d	195	2510	2199

	NMFS NWHI CPUE (lb/day)		
Year	**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
1998	364	527	484
1999	337	534	486
2000	260	601	513
2001	283	543	467
2002	**438**	**412**	**425**
mean	365.27	623.13	585.79
s.d.	121.02	114.89	141.07

Figure 14-b. Partial CPUE for MHI bottomfish



	MHI Partial CPUE (lb/trip)				
Year	**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	56	31	8	18	3
1997	84	32	10	30	4
1998	66	25	6	19	3
1999	91	41	7	55	3
2000	96	41	8	26	3
2001	100	36	7	30	2
2002	**88**	**51**	**6**	**17**	**2**
mean	141.27	106.69	37.78	72.65	16.09
s.d	52.57	59.16	35.93	48.94	12.65

Interpretation: Reduction of species-specific CPUE for species presented here, with the exception of opakapaka, to less than half of their early values would suggest a yellow light situation for all of these species. 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 2002 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.

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

Calculation & Adjustment: The same subset of HDAR data as used in Fig. 14-A is used here, but the weight of each species is tabulated separately rather than in aggregate. The same denominator value used in Fig. 14-A is used here (# trips fished), i.e. summing these five partial CPUE's (and remaining BMUS CPUE's) will approximate the Fig. 14-A estimates. 95% non-parametric confidence intervals were calculated by bootstrapping.

Figure 14-c. Partial targeted CPUE for MHI bottomfish

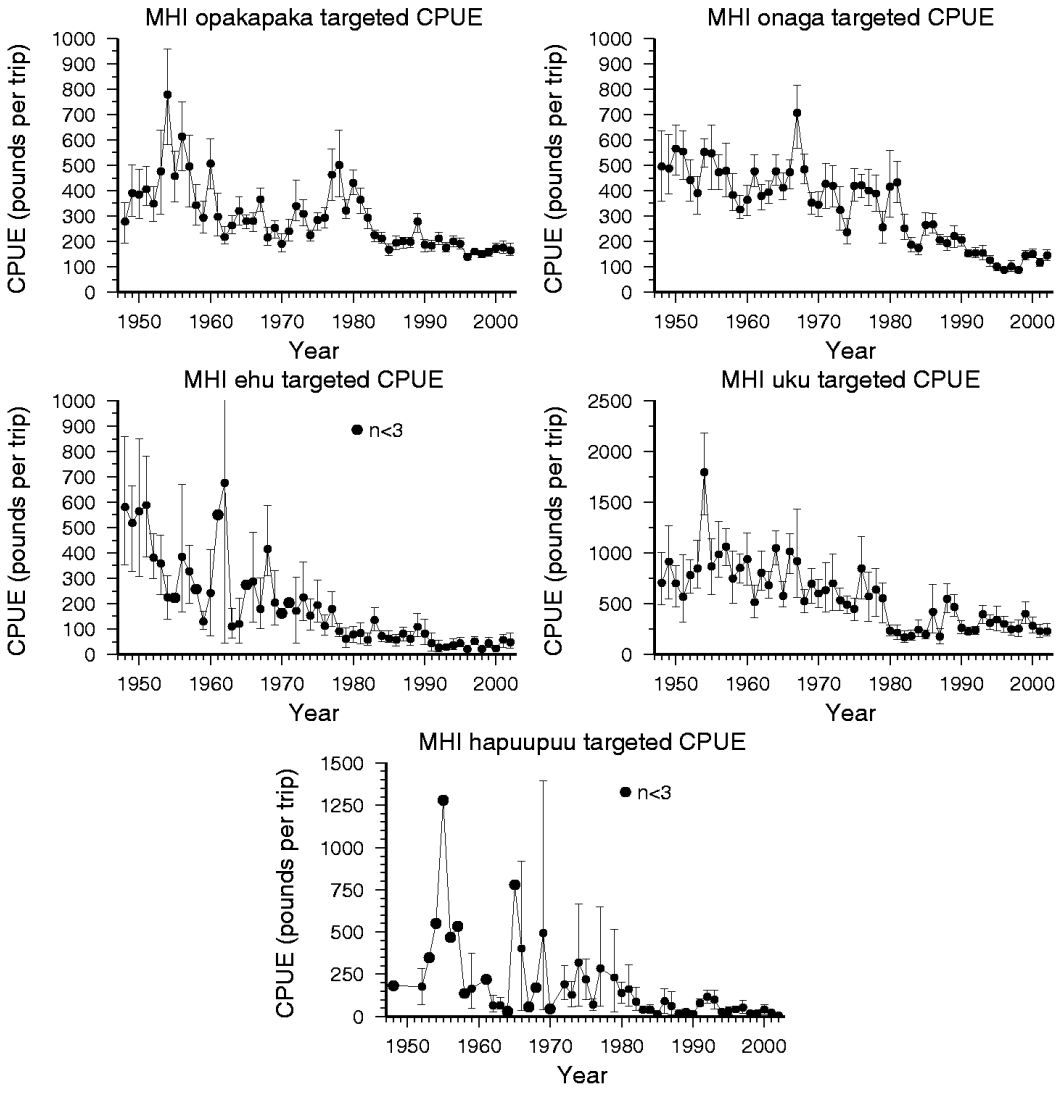


Figure 14-c data summary:

	MHI Targeted CPUE (lb/Trip)			
Year	**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	138	88	21	300
1997	161	101	52	250
1998	148	87	21	251
1999	158	145	44	398
2000	174	150	23	282
2001	176	116	58	228
2002	**164**	**144**	**47**	**230**
mean	295.67	330.53	190.45	565.36
s.d.	129.29	152.74	171.86	315.83

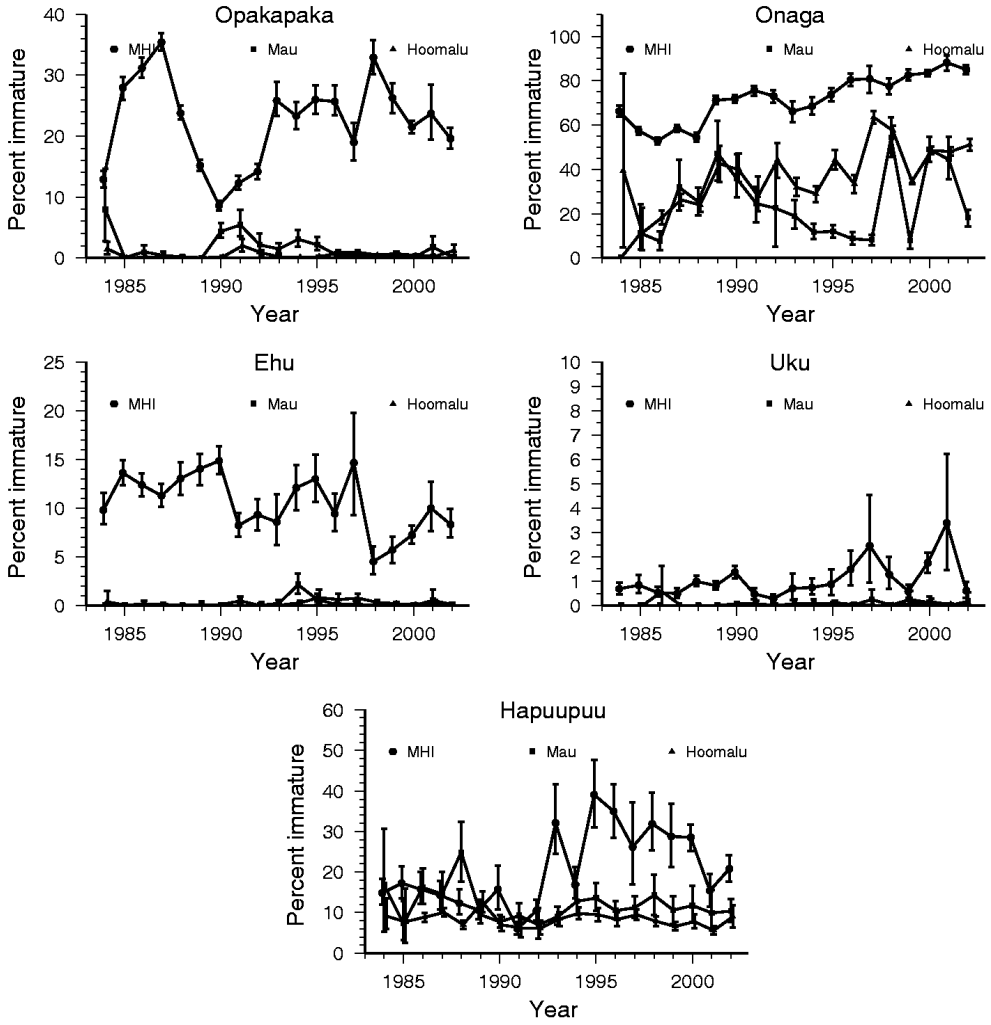
Interpretation: Comparison of 2002 CPUE values with the first 5 years available (1948-52) indicate that all four species for which sufficient data is available have CPUE values less than or equal to 50% of original values. These values represent a yellow light or borderline condition for these four species in the MHI, with the ehu stocks being the most stressed.

Comments: As in Fig. 14-B, there are apparent declines when comparing recent years with values earlier in the time series. The decline is least apparent in opakapaka (45% of original values) and most apparent for ehu (9% of original values). The level of screening done here severely reduces the size of the sample, and this may contribute to some of the observed variability, particularly for ehu where there are fewer targeted trips. Values for hapuupuu are graphed but not put in the table due to the extremely small numbers of targeted trips in most years making the values unreliable.

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

Calculation & Adjustment: The data used in Fig. 14-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 15. Percent immature in Hawaiian bottomfish catch



Interpretation: MHI onaga catch has the highest percentage of immature fish, and is the only one consistently over 50%. In 2002 the MHI onaga landings comprised of 85% immature fish, signifying a yellow light condition for this species in this zone. This is, however, a slight improvement over 2001 (88%). In the NWHI zones onaga showed high % immature values for 1997 and 1998 in the Hoomalu zone and 1998 in the Mau zone. 2002 values for the Hoomalu zone is just above 50% whereas that for the Mau zone dropped to 18%. All other MHI and NWHI values are in the healthy range for percentage of immature fish in the catch.

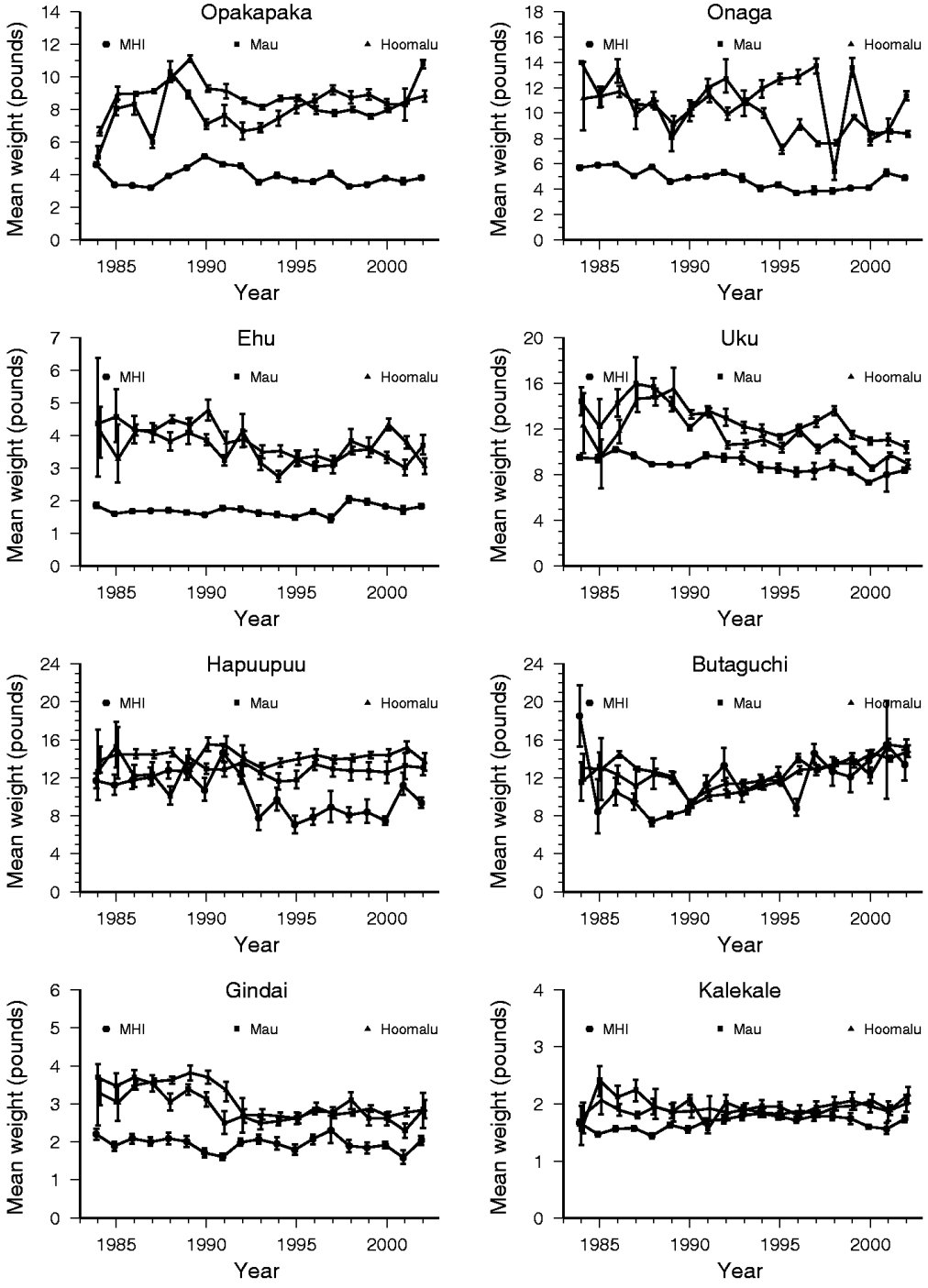
Comments: MHI catch is comprised of more immature fish than NWHI catch for all species.

In all areas onaga values are the highest on average. 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) and a sharp rise in 1998. MHI hapuupuu percent immature declined from a peak in 1995 to moderate levels in 1997-2002.

Source: Prior to 2000 fish size data is derived from auction lot statistics obtained at the Honolulu UFA auction by HDAR, NMFS and WPRFMC personnel. Data for 2000 through the present is from dealer sales records. 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 16. Mean weight of Hawaiian bottomfish



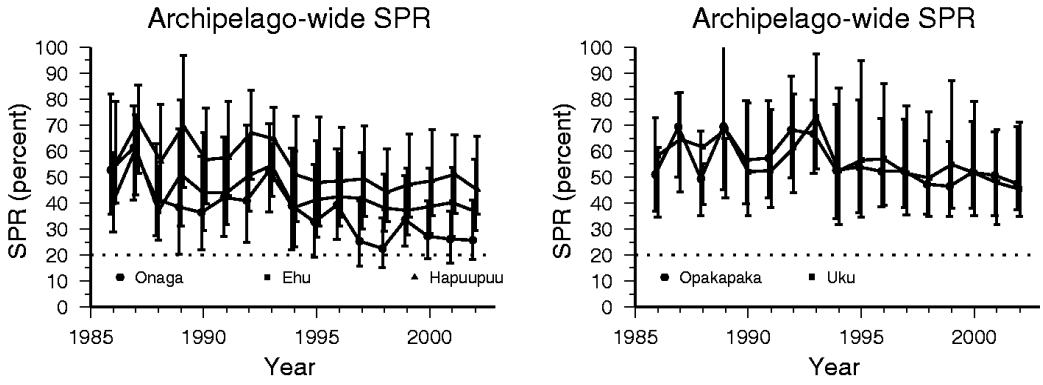
Interpretation: MHI mean weights are considerable lower than NWHI weights indicating considerable stress on these resources. No noticable trends can be seen in NWHI mean weights, indicating relative health in these zones. Low mean weights were first recorded for MHI hapuupuu in 1993 and remained low through 2000, but show a sharp increase in 2001 followed by a slight decrease in 2002. The small number of fish upon which the annual estimates are based may bias the results for this species. Both onaga and opakapaka showed an increase in mean weight in the Mau zone.

Comments: Mean weights of fish in the NWHI catch appear generally stable over time, with the notable exception of the onaga mean weight, where recent declines can be seen for the Hoomalu zone. The 1998 Mau onaga value is the lowest on record showing a sharp decline from earlier values with a return to normal levels in 1999 then another drop in 2000 and increases in 2001 and 2002. MHI values have been remarkably stable for most species over the time series available. The two most important changes in 2002 are the sharp increases in mean size of the Mau zone onaga and opakapaka.

Source: Prior year's fish size data was derived from auction lot statistics obtained at the Honolulu UFA auction by HDAR, NMFS, and WPRFMC personnel; 2000 data is from HDAR dealer reports.

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 17. 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	43	49	39	52	57
1997	42	49	25	52	51
1998	38	44	22	47	50
1999	37	47	34	46	55
2000	39	49	27	52	52
2001	40	51	26	51	48
2002	**37**	**45**	**26**	**47**	**45**
mean	43.41	54.82	37.47	55.35	56.35
s.d.	6.91	8.71	10.89	7.98	7.42

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 2002 value at 26%. This low value for onaga is due to the consistently poor condition of the resources in the MHI. Now that the state management plan for the MHI bottomfish has been implemented, it is likely that the condition of onaga resources in this area will improve and the archipelago-wide SPR value will increase over time. In fact, the onaga SPR values for the last four years are all above the 1998 low of 22%.

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. The values for the second half of the nearly 20 year time series are lower than those of the first half, but the only species showing current signs of concern is the onaga for which the lower bound dips below the 20% critical threshold value. The management measures implemented 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 commercial catch records integrated with NMFS interview data in some cases. Also important is the size frequency data obtained from market sampling by HDAR and NMFS and dealer reports. 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 18, 18a, 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 18. Spawning potential ratio (SPR) for MHI bottomfish

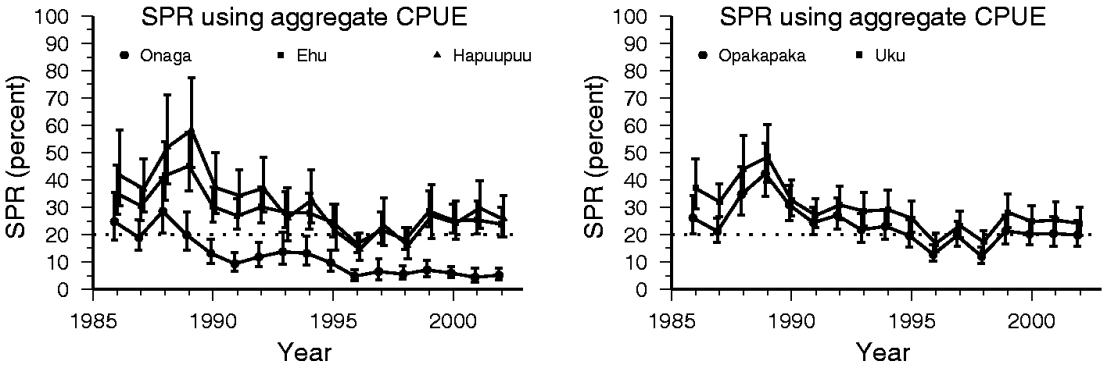


Figure 18 data summary:

			SPR (%)		
Year	**Ehu**	**Hapuupuu**	**Onaga**	**Opakapaka**	**Uku**
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	16	15	6	13	23
1997	22	23	6	20	23
1998	18	16	6	12	17
1999	29	27	7	21	28
2000	25	24	6	20	25
2001	25	30	4	20	25
2002	**24**	**26**	**5**	**20**	**24**
mean	28.18	31.65	12.00	23.35	29.47
s.d.	7.43	11.63	7.38	7.37	7.76

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 and catch rates. 2002 SPR values show improvements over low values for the major BMUS species, other than onaga, in 1997 with the exception of onaga which shows an all time low for 2001. The improvement is largely due to an increase in aggregate CPUE over the low 1997 value. The 2002 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 2002 MHI SPR.

Comments: Current SPR estimates for onaga in the MHI is below the twenty percent critical threshold level indicating localized resource depletion. Onaga remains below 20% for the 13

years in a row.

Source: SPR is estimated from the Honolulu UFA auction size frequency data collected by HDAR, NMFS, and WPRFMC personnel; CPUE estimates from 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. 14-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

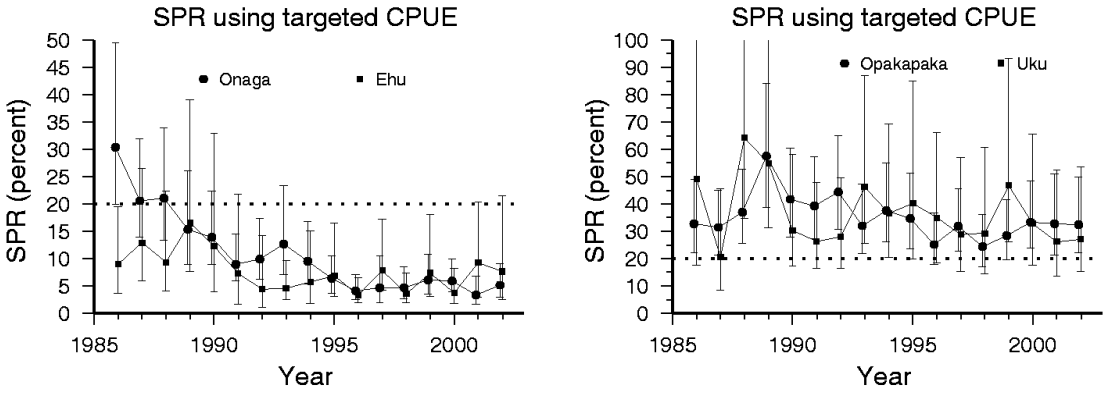


Figure 19a data summary:

	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	25.10	4.12	3.36	34.96
1997	31.85	4.63	7.85	28.81
1998	24.30	4.68	3.53	29.28
1999	28.40	6.12	7.36	46.74
2000	33.33	5.94	3.72	32.76
2001	**30.29**	**3.07**	**11.10**	**27.27**
mean	35.08	11.07	7.86	37.26
s.d.	8.12	7.60	3.83	11.96

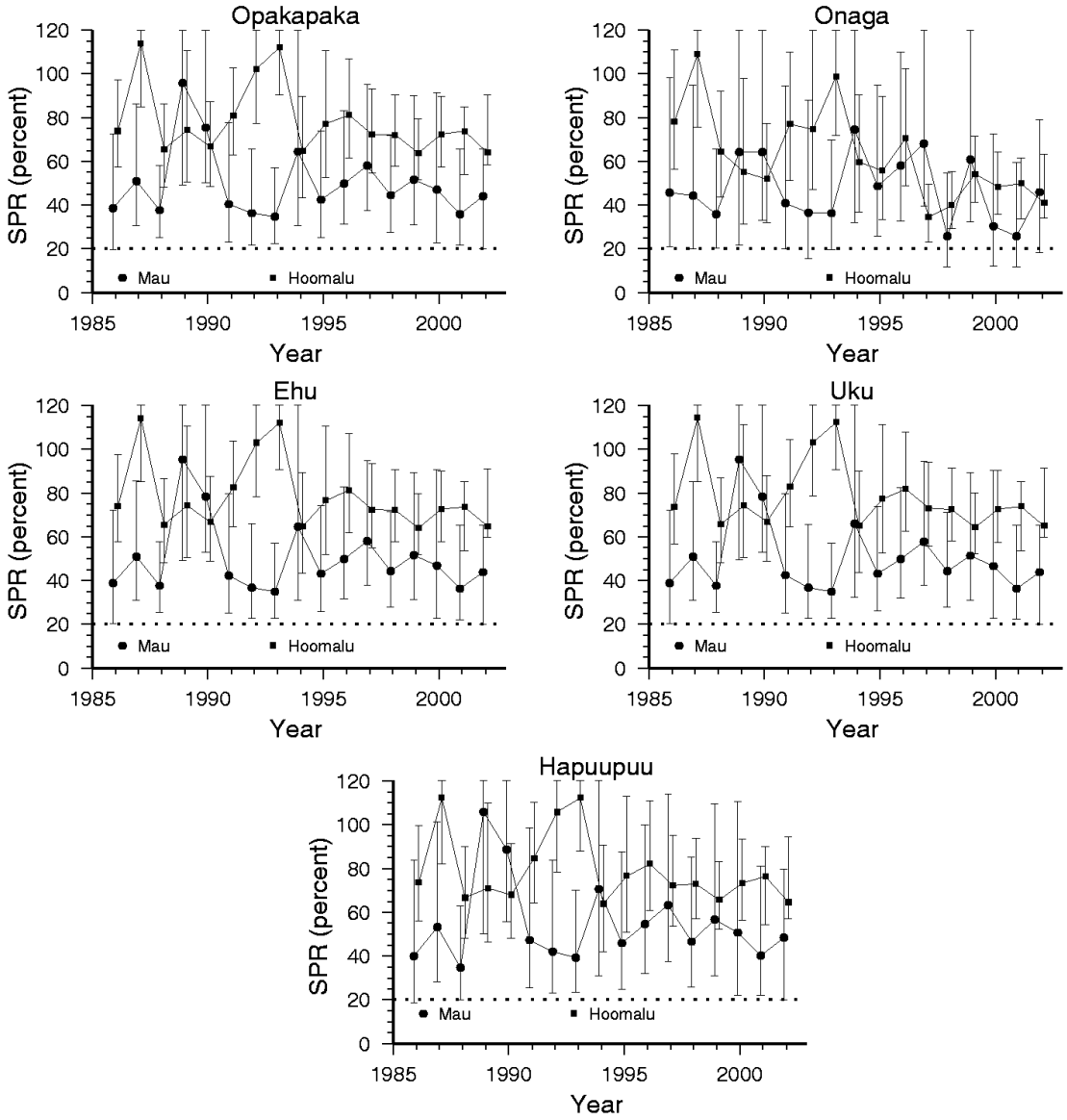
Interpretation: We feel that SPR values obtained here may better represent the condition of the MHI resources in regards to localized depletion than those found in the previous section. Ehu and onaga stocks are clearly stressed and well below the 20% SPR threshold, with ehu below the 20% level for the duration of our data and onaga on a continuing downward trend with values below 20% for the last13 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: Targeted SPR values are available for only four of the BMUS species present in the MHI. As expected onaga and ehu values are below the 20% critical level and have been for many years. Opakapaka SPR values are higher using targeted CPUE compared to using aggregate CPUE. It should be noted that values reported here do not take into consideration any improvements to the stock resulting from State of Hawaii MPAs. If data were obtained on abundance and size of fish within the reserves, then estimates of CPUE, mean size, percent immature in the catch, and ultimately SPR could be made.

Source: SPR values are estimated using dealer reports; 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 was 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 for most species. 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	63	68	58	58
1998	44	47	26	44	44
1999	52	57	61	52	51
2000	47	51	30	47	47
2001	36	40	26	36	36
2002	**44**	**48**	**46**	**44**	**44**
mean	50.24	54.65	47.41	49.88	50.24
s.d.	16.11	18.76	15.21	16.04	16.16
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	71	81	81
1997	72	72	35	72	73
1998	72	73	40	72	73
1999	64	66	54	64	64
2000	73	73	48	72	73
2001	74	76	50	74	74
2002	**65**	**65**	**41**	**64**	**65**
mean	78.59	79.00	62.65	78.29	78.71
s.d.	15.91	15.87	20.25	15.87	15.86

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 years, and onaga SPR estimates tend to be slightly lower than those for most other species in most years. Notable increases in 1999 onaga SPR values for the Mau and Hoomalu zones are due to decreases in the percent of immature onaga in the catches of these zones in that year.

Source: SPR estimated from Dealer reports or Honolulu auction size frequency data collected by NMFS personnel, and CPUE estimates from 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).

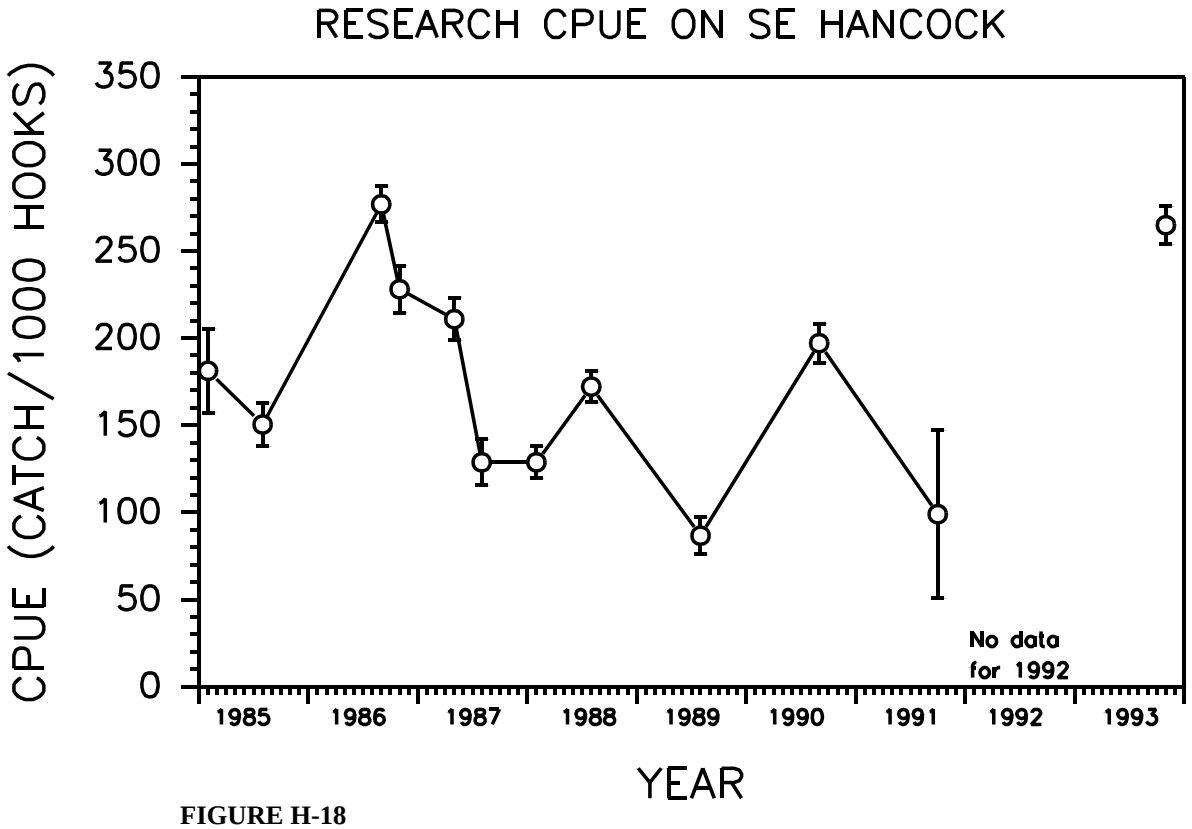


FIGURE H-18

DATA SOURCE:

Figure H-18 presents CPUE based on research longline catches at Southeast (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 assessment 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.

INTERPRETATION:

The fluctuations in CPUE shown in Figure H-18 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 succeeding years, the armorhead population as a whole would decline both in numbers (natural mortality) and in biomass (natural mortality and declining fatness index of survivors). 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.

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)
1998	(unknown)
1999	(unknown)
2000	(unknown)
2001	(unknown)
2002	(unknown)

ARMORHEAD SPAWNING POTENTIAL RATIO

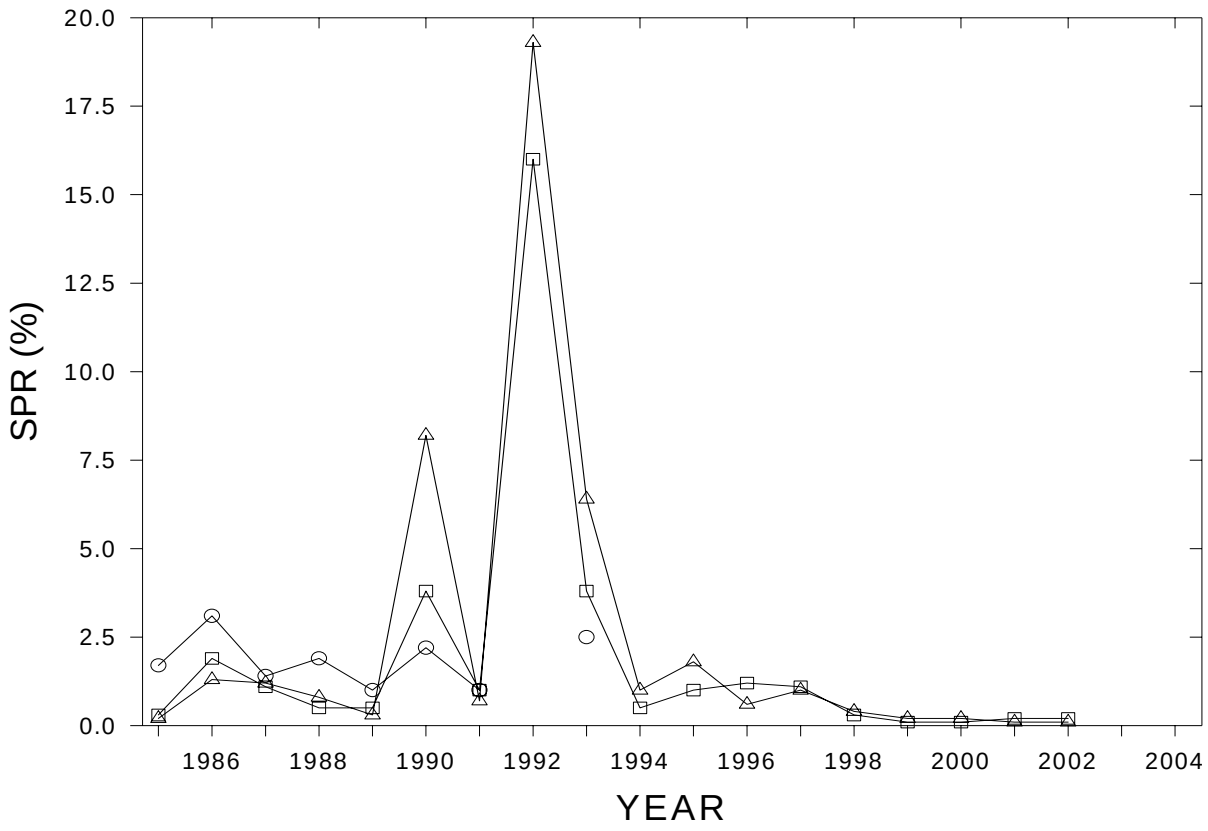


FIGURE H-19

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:

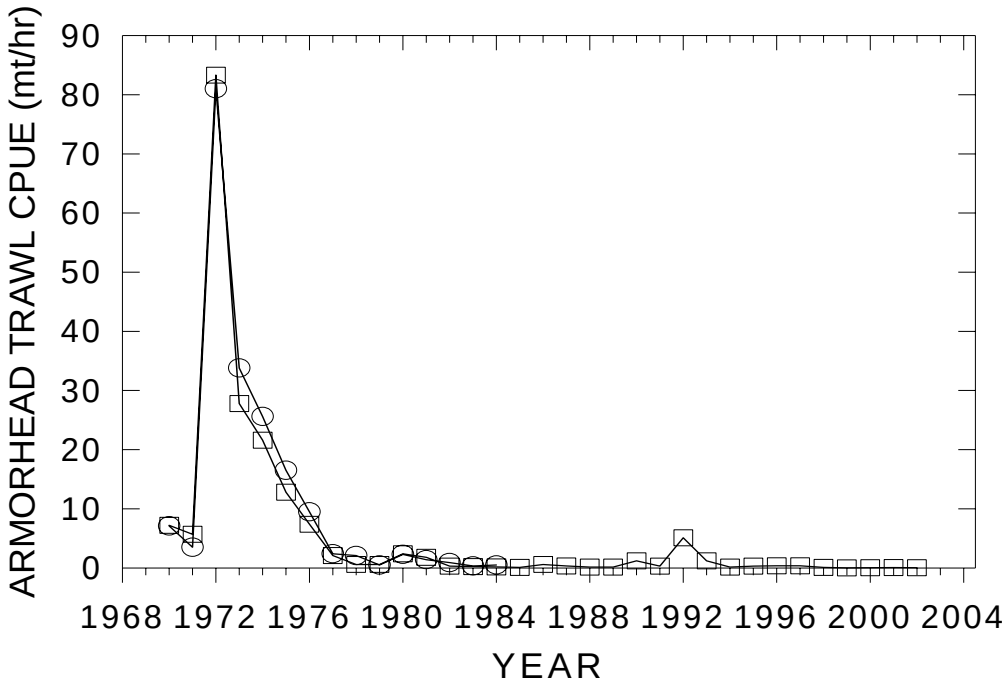


FIGURE H-20

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. Biomass estimates are based on 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 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.

INTERPRETATION:

Seamounts outside the U.S. EEZ represent some 91% of the historical trawl fishery in term of fishing grounds and overall catch and lie in international waters under no fishery management control. The most current SPR estimate for aromorhead within the region outside the U.S. EEZ is 1.0%; based on the most current (1997) available catch and effort statistics from the Japan North Pacific trawl fishery. The 1996 SPR of 0.4% in last year's report was incorrect; the correct value (0.6%) however was only slightly higher. These low SPR values for the last two years of data indicate 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 and continued low levels since then. This continuation of low stock levels outside the U.S. EEZ is interpreted to be a result of the intensive fishing effort on the high 1992 recruitment pulse coupled with little subsequent recruitment during 1993-1997 to compensate for losses due to fishing and natural mortality. Based on previous trends, catch levels are expected to remain low in unless offset by a large recruitment event.

Based on age estimates of a 2-2.5 year pelagic phase prior to seamount recruitment (Humphreys 2000), 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 one of 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 conducted a research survey of pelagic stage armorhead in open ocean waters of the North Pacific during November 1998. The major objective was to tag-and-release pelagic specimens from various locations distant from the seamounts in hopes of later obtaining seamount re-captures and movement data. Unfortunately, no pelagic stages of armorhead were encountered during this cruise.

Four the previous four years, NMFS had been unable to obtain more recent data (1998 to present) from the Japan seamount trawl fleet. The fisheries agency that had been providing us data was no longer authorized to disseminate this data to our laboratory. However, this agency has just this year been able to forge an inter-government (within Japan) agreement that has now

allowed the resumption of this data flow to NMFS.

MANAGEMENT ISSUES:

Effective September 1, 1998, the fishing moratorium on seamount groundfish at the Hancock Seamounts was extended for a third 6-year period until August 31, 2004. Based on current sustained low SPR values both at Colahan Seamount and at all SE-NHR seamounts outside the U.S. EEZ, it was inferred that the status of the Hancock Seamounts armorhead resource was similarly depressed. The intent of the moratorium is to provide continued long-term protection (which is absent elsewhere within the much larger seamount habitat of the SE-NHR) to enhance the possibility of armorhead and other seamount groundfish resources to re-build via recruitment.

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	0.6
1997	NA	1.1	1.0
1998	NA	0.3	0.4
1999	NA	0.1	0.2
2000	NA	0.1	0.2
2001	NA	0.2	0.1
2002	NA	0.2	0.1