

Appendix 3

**Hawaii**

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## Summary

In 2001, none of the five BMUS species for which SPR values are calculated have values below the 20% critical threshold that defines recruitment overfishing under the FMP. Estimates range from a low of 25% for onaga to a high of 48% for hapuupuu and opakapaka 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 2001 are lower than the revised landings reported for 2000. CPUE for the MHI is up from last year (184 lb/trip vs 187 lb/trip). Stocks of many of the BMUS species in this zone show clear signs of stress. Each of the BMUS species evaluated, with the exception of opakapaka, has a yellow light condition due to a drop in CPUE below 50% of original values. In addition, onaga stocks are severely depleted on a local basis as the MHI SPR values for these species are at or below 20% (4% for onaga). These SPR levels are below the critical threshold 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 24% for 2000 (revised upward from 25% reported last year when calculations were based on incomplete reporting) and 28% for 2001.

Bottomfish resources in the NWHI remain relatively healthy. CPUE on a per trip basis dropped to 13% of the original level in the Mau Zone (down 54% from the 1997 level) and 3% in the Hoomalu zone (essentially the same as the 1998 value). On a per day basis CPUE values are up 9% in the Mau zone and down 10% 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, however, the mean weight of onaga in the Mau zone did drop dramatically in 1998.

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, and data outside the EEZ has been unavailable since 1998. 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 1997 SPR for Colahan Seamount was 1.1%, indicating a collapsed fishery. As a result, data has been unavailable for Colahan Seamount since 1887.

**Historical Annual Statistics  
Main Hawaiian Islands**

<b>Year</b>	<b>Total Landings (lbs)</b>	<b>CPUE (lbs/trip)</b>	<b>Inflation Adjusted Revenue</b>	<b>Price per Pound</b>	<b>Number of Vessels</b>	<b>SPR Average</b>
1986	810348	274	\$2,052,000	\$2.71	538	33
1987	783569	237	\$2,345,000	\$3.14	535	25
1988	1164492	329	\$3,288,000	\$2.97	572	37
1989	1006142	361	\$3,090,000	\$3.29	537	40
1990	645802	245	\$2,242,000	\$3.76	501	27
1991	547800	202	\$1,713,000	\$3.35	469	24
1992	587471	228	\$1,842,000	\$3.40	407	25
1993	347960	213	\$1,535,000	\$3.60	403	24
1994	457956	217	\$1,793,000	\$3.65	423	24
1995	439625	193	\$1,818,000	\$3.48	400	22
1996	439867	125	\$1,593,000	\$3.92	487	21
1997	512554	176	\$1,589,000	\$3.39	502	20
1998	478802	130	\$1,517,000	\$3.47	498	20
1999	455131	209	\$1,393,000	\$3.43	483	25
2000	496989	187	\$1,641,000	\$3.67	495	21
2001	322523	184	\$1,266,000	\$3.66	379	20
<b>Ave.</b>	<b>593564</b>	<b>219</b>	<b>\$1,919,813</b>	<b>\$3.48</b>	<b>477</b>	<b>26</b>
<b>s.d.</b>	<b>235493</b>	<b>62</b>	<b>\$573,174</b>	<b>\$0.24</b>	<b>58</b>	<b>6</b>

<b>Historical Annual Statistics Mau Zone</b>						
<b>Year</b>	<b>Total Landings (lbs)</b>	<b>CPUE (lbs/trip)</b>	<b>Inflation Adjusted Revenue</b>	<b>Price per Pound</b>	<b>Number of Vessels</b>	<b>SPR Average</b>
1986	NA	2206	NA	NA	NA	41
1987	NA	2889	NA	NA	NA	50
1988	NA	2136	NA	NA	4	37
1989	118000	4463	\$309,000	\$3.63	5	91
1990	249000	3435	\$629,000	\$3.25	14	77
1991	103000	1199	\$300,000	\$3.50	14	42
1992	71000	1273	\$206,000	\$3.39	8	38
1993	98000	1321	\$266,000	\$3.03	8	36
1994	160000	1573	\$509,000	\$3.25	12	68
1995	166000	1635	\$471,000	\$2.97	10	45
1996	135000	1543	\$402,000	\$3.22	13	53
1997	105000	1976	\$368,000	\$3.54	9	61
1998	66000	1689	\$208,000	\$2.88	7	42
1999	54000	1808	\$180,000	\$3.27	7	51
2000	49000	1053	\$162,000	\$3.42	6	42
2001	50000	916	\$141,000	\$2.79	6	36
<b>Ave.</b>	<b>109538</b>	<b>1945</b>	<b>\$319,308</b>	<b>\$3.24</b>	<b>9</b>	<b>51</b>
<b>s.d.</b>	<b>57573</b>	<b>941</b>	<b>\$149,612</b>	<b>\$0.26</b>	<b>3</b>	<b>16</b>

<b>Historical Annual Statistics Hoomalu Zone</b>						
<b>Year</b>	<b>Total Landings (lbs)</b>	<b>CPUE (lbs/trip)</b>	<b>Inflation Adjusted Revenue</b>	<b>Price per Pound</b>	<b>Number of Vessels</b>	<b>SPR Average</b>
1986	NA	5301	NA	NA	NA	75
1987	NA	8187	NA	NA	NA	113
1988	NA	4702	NA	NA	12	66
1989	184000	5481	\$454,000	\$3.31	5	70
1990	173000	5403	\$450,000	\$3.22	5	64
1991	283000	5871	\$761,000	\$3.13	4	82
1992	353000	9464	\$1,058,000	\$3.34	5	98
1993	287000	8412	\$888,000	\$3.32	4	109
1994	283000	6903	\$964,000	\$3.40	5	64
1995	202000	6130	\$630,000	\$3.11	5	73
1996	176000	6216	\$553,000	\$3.41	3	78
1997	241000	6351	\$777,000	\$3.22	6	65
1998	266000	5315	\$832,000	\$3.05	7	66
1999	269000	5611	\$962,000	\$3.56	6	62
2000	213000	5909	\$718,000	\$3.78	5	62
2001	236000	5757	\$744,000	\$3.15	5	64
Ave.	243538	6313	\$753,154	\$3.31	6	76
s.d.	53183	1305	\$192,349	\$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 4 vessels participating in 2001; 5 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.

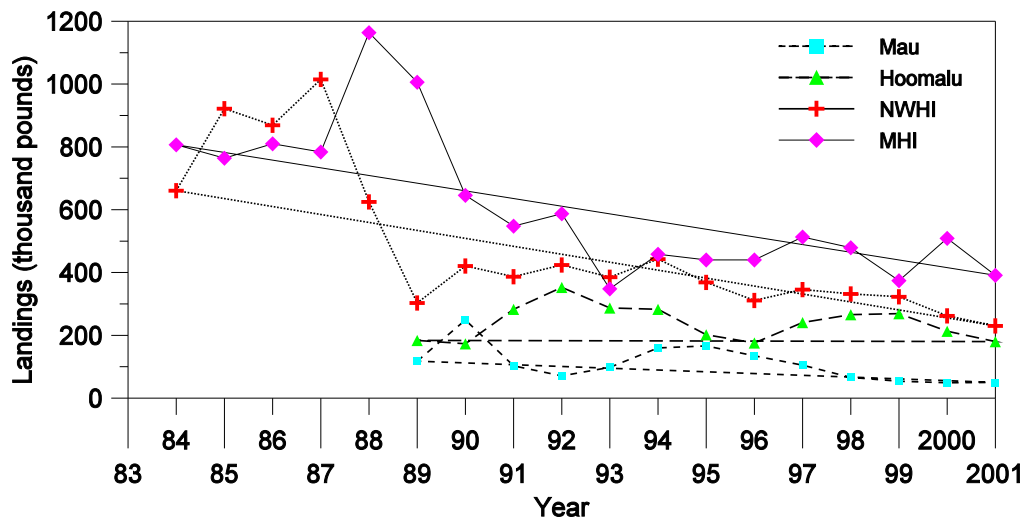
## **Recommendations**

The Plan Team recommends:

The Council should request the State of Hawaii to change the mandatory NWHI daily logbook format to include the disposition of catch, ie. live release or dead release, of the released fish.



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



BMUS Landings (1000 lb)				
Year	Mau	Hoomalu	Total NWHI	MHI <sup>2</sup>
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 <sup>1</sup>	103	283	387	548
1992 <sup>1</sup>	71	353	424	587
1993 <sup>1</sup>	98	287	385	348
1994 <sup>1</sup>	160	283	443	458
1995 <sup>1</sup>	166	202	369	440
1996 <sup>1</sup>	133	176	309	440
1997 <sup>1</sup>	105	241	346	513
1998 <sup>1</sup>	66	266	332	479
1999 <sup>2</sup>	54	269	323	455
2000	49	213	262	509
<b>2001<sup>3</sup></b>	<b>50</b>	<b>236</b>	<b>286</b>	<b>391</b>
mean	109.38	243.54	482.33	619.28
s.d.	57.50	53.18	234.50	224.70

<sup>1</sup> NWHI data from combination NMFS and HDAR

<sup>2</sup> Data from HDAR

<sup>3</sup> MHI data not complete.

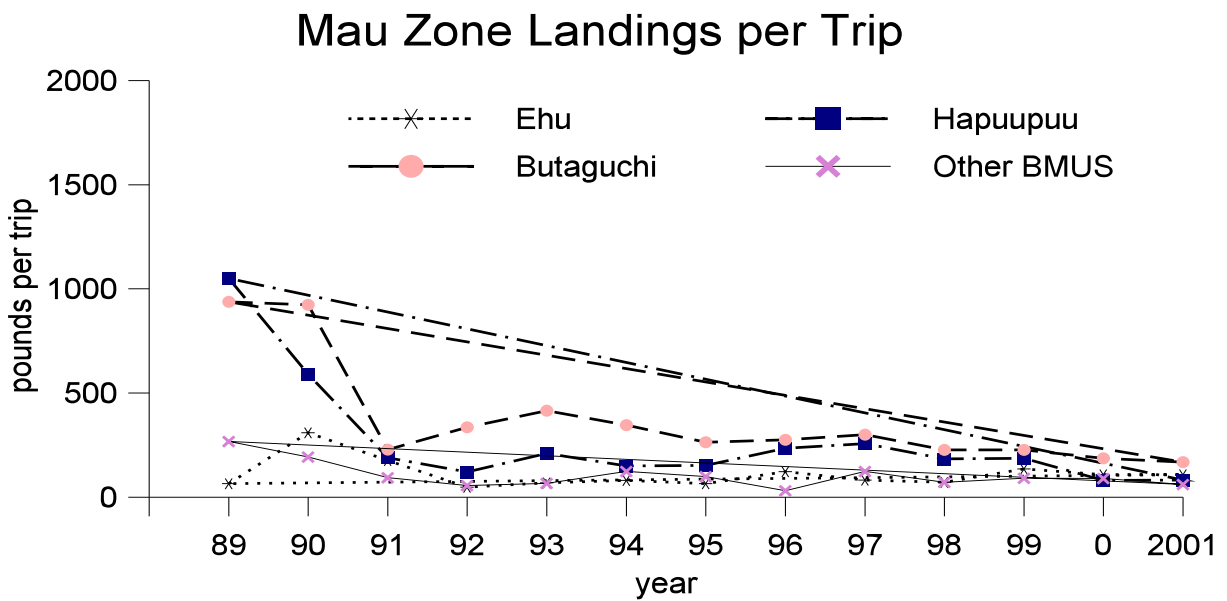
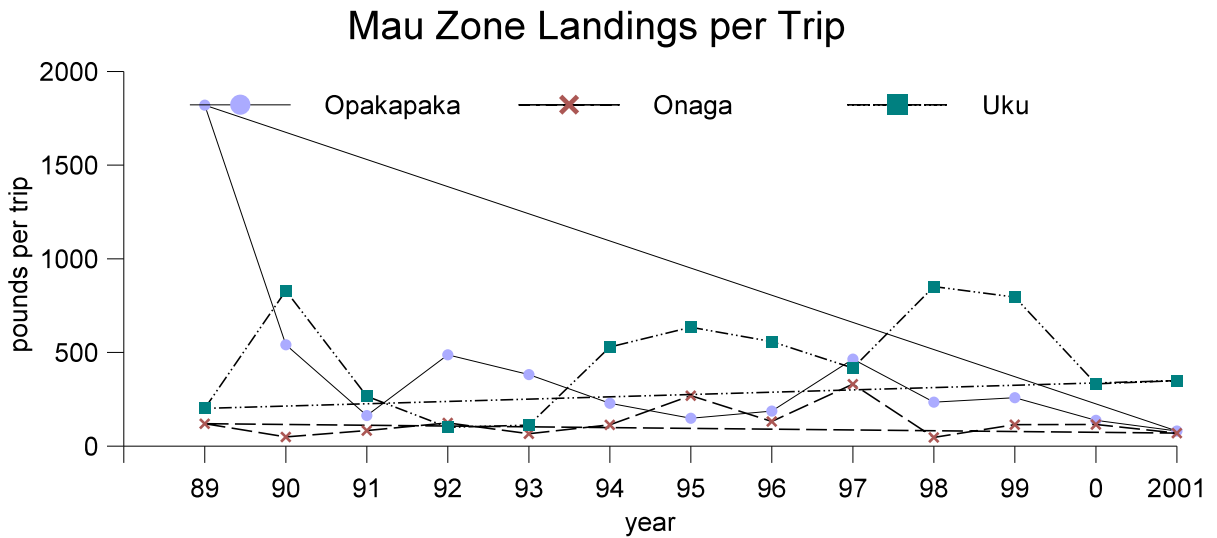
**Source:** Data are from HDAR. Data are only those from BMUS. Pelagic species data were not included.

**Calculation & Adjustment:** The majority of the 2001 data were from the HDAR integrated data set which provides the most complete data set dealing with the effort and landings of the NWHI fishing fleet. Some of the data for 2001 were from the HDAR dealer data reporting system. Other data were from HDAR daily logs and trip sales that were not entered into the system due to protocol/regs on out of State landings. Supplementary collection of data by both HDAR and NMFS at the Honolulu fish auction provides opportunities for the cross-checking of trip and landing information. The detailed information collected at the Honolulu auction is used for other analysis.

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:** The vessel sales reports indicate that the total NWHI BMUS landings were higher than that of last year. Both the Mau and Hoomalu zones increased their landings and sales of BMUS. The NWHI fishing fleet within both zones retained the identical number and vessels as in 2000. The increases were due to an increased number of trips while posting a slight decrease in landings per trip(fig. 2).

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

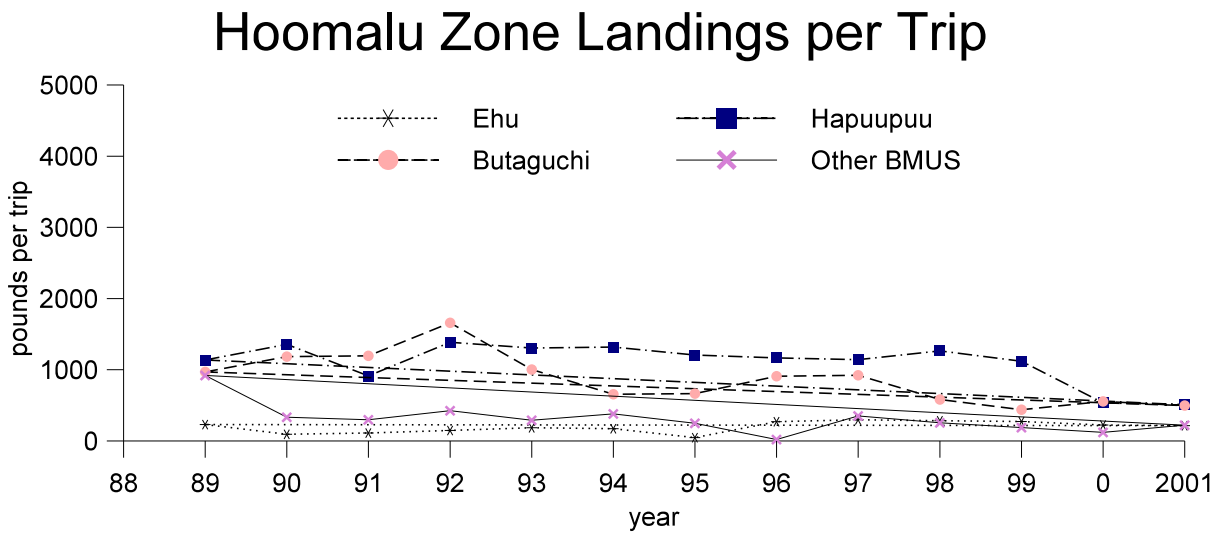
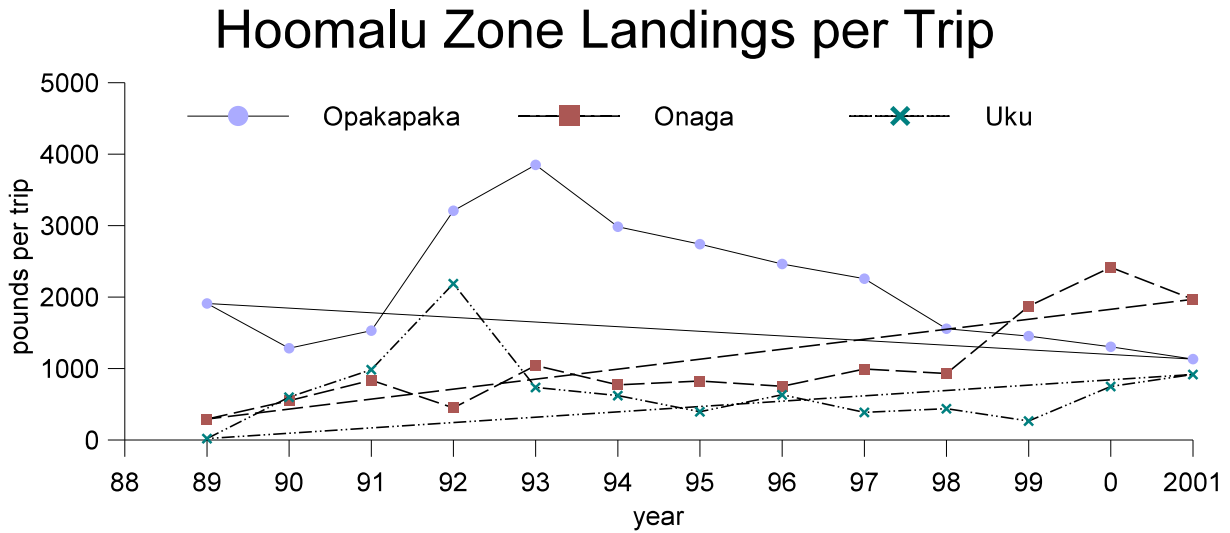
Species	1992 <sup>1</sup>	1993 <sup>1</sup>	1994 <sup>1</sup>	1995 <sup>1</sup>	1996 <sup>2</sup>	1997 <sup>2</sup>	1998 <sup>2</sup>	1999 <sup>2</sup>	2000 <sup>2</sup>	2001 <sup>2,3</sup>
Opakapaka	488	382	229	149	187	465	235	259	138	80
Onaga	124	66	114	270	132	331	47	115	116	70
Ehu	48	69	81	65	123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

<sup>1</sup> Data from combination of NMFS and HDAR data sets.

<sup>2</sup> Data from HDAR data set.

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

<sup>1</sup> Data from combination of NMFS and HDAR data sets.

<sup>2</sup> Data from HDAR data set.

<sup>3</sup> 2001 data are a combination of HDAR data sets.

**Source:** The 2000 data are from HDAR. Data are only those from BMUS. Pelagic species data were not included.

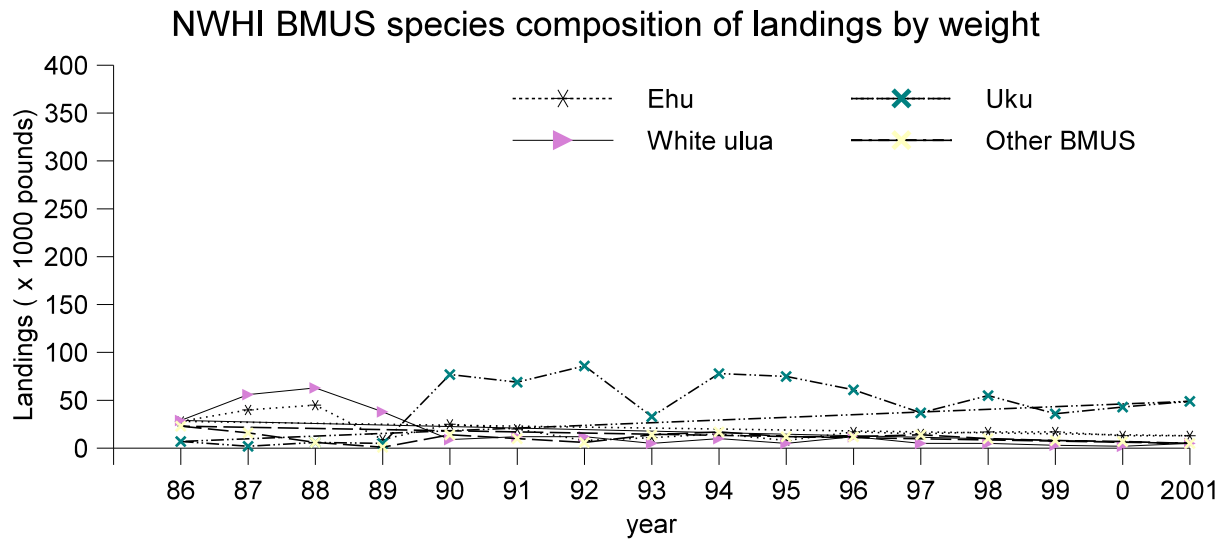
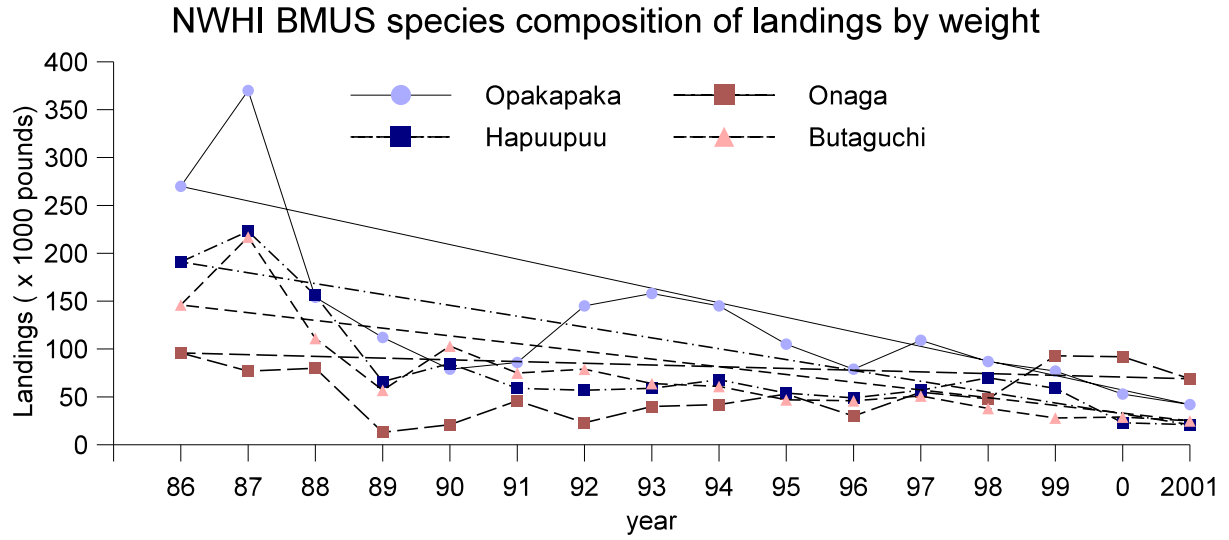
**Calculation & Adjustment:** The BMUS data were totaled by zone and divided by the number of trips to each zone. The majority of the 2001 data were from the HDAR integrated data set which provides the most complete data set dealing with the effort and landings of the NWHI fishing fleet. Some of the data for 2001 were from the HDAR dealer data reporting system. Other supplementary collection of data by both HDAR and NMFS at the Honolulu fish auction provides opportunities for the cross-checking of trip and landing information. The detailed information collected at the Honolulu auction is used for other analysis.

**Comments & Interpretations:** The Mau zone landing per trip decreased by 13% from last year. The Mau zone has had the same 6 vessels fishing for 2 consecutive years. The home ports of these vessels are divided evenly with 3 from Kauai and 3 from Oahu. The vessels based on Kauai have been increasingly targeting pelagic species for most of the year making many short trips that specifically target these seasonally abundant species. The effort by these vessels is characterized by many 2-5 day trips on which 1 day or less is spent on targeting bottomfish species. In looking at the Mau zone data table the per trip catches of onaga and opakapaka have lagged these last 2 years after the exit of one of the full time vessel and the multipurpose vessels driving the targeting away from bottomfish and focusing on pelagics for most of the year. During the winter season when the bottomfish are more abundant they may dedicate some trips wholly to bottomfishing but this appears to be the exception. The Oahu component is more focused on full time bottomfishing. They divide their time between bottomfishing the Mau zone and the MHI.

The Hoomalu zone landing per trip 2001 fell just short of last year by nearly 3%. The Hoomalu zone fleet maintained the same number and identity of vessels from the year 2000. The

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

<sup>1</sup> Data from a combination of NMFS and HDAR data.

<sup>2</sup> Data from HDAR data set.

<sup>3</sup> 2001 data are a combination of HDAR data sets.

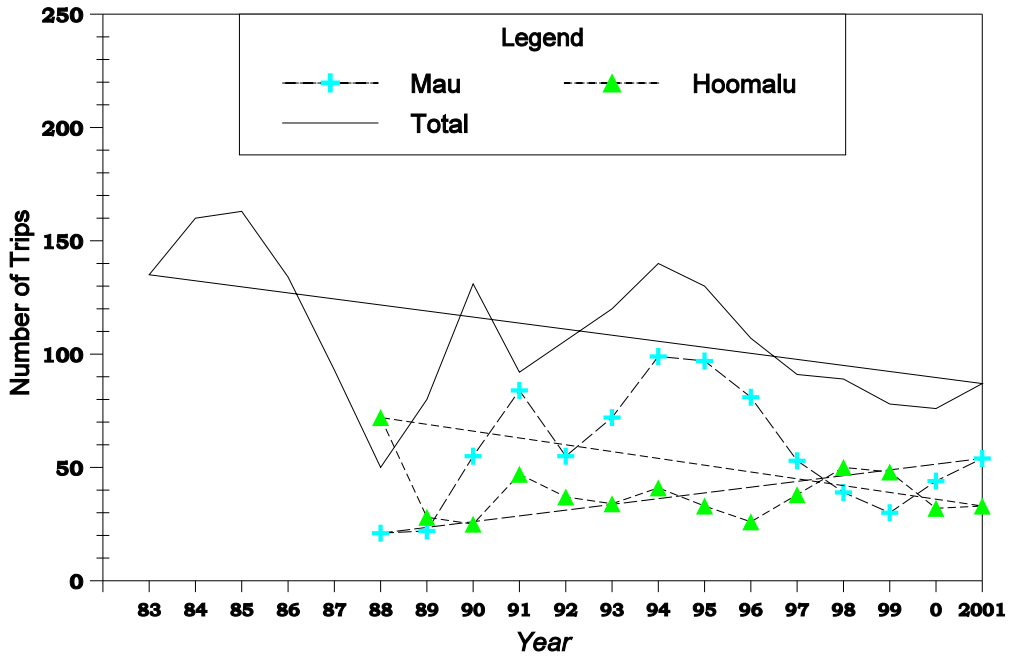
**Source:** Data for 1996-2000 is from the HDAR integrated data set. Data for 1991-1995 are from a combination of HDAR and NMFS market monitoring program. Data from 1987-1990 are expanded NMFS estimates.

**Calculation & Adjustment:** The majority of the 2001 data were from the HDAR integrated data set which provides the most complete data set dealing with the effort and landings of the NWHI fishing fleet. Some of the data for 2001 were from the HDAR dealer data reporting system. Other supplementary collection of data by both HDAR and NMFS at the Honolulu fish auction provides opportunities for the cross-checking of trip and landing information. The detailed information collected at the Honolulu auction is used for other analysis.

**Comments & Interpretation:** Overall landings are up for 2001. The majority of BMUS increased or maintained status quo with the exception of onaga which decreased nearly 21%. Ehu landings which are generally associated with those of the target species onaga (because of habitat/depth similarities) were nearly flat with only a slight increase. Opakapaka, hapuupuu, and butaguchi are likewise associated by habitat and depth requirements. This complex of landings are primarily driven by the targeting of opakapaka. Similarly uku and white ulua catches are related. The uku are targeted and the white ulua are also taken during the operations.



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



Year	Trips		Total
	Mau	Hoomalu	
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 <sup>1</sup>	84	47	131
1992 <sup>1</sup>	55	37	92
1993 <sup>1</sup>	72	34	106
1994 <sup>1</sup>	99	41	140
1995 <sup>1</sup>	97	33	130
1996 <sup>2</sup>	81	26	107
1997 <sup>2</sup>	53	38	91
1998 <sup>2</sup>	39	50	89
1999 <sup>2</sup>	30	48	78
2000 <sup>2</sup>	47	36	83
<b>2001<sup>2,3</sup></b>	<b>55</b>	<b>41</b>	<b>87</b>
mean	57.86	39.71	106.71
s.d.	25.70	12.14	31.29

<sup>1</sup> Based on combined NMFS and HDAR data.

<sup>2</sup> Based on HDAR data.

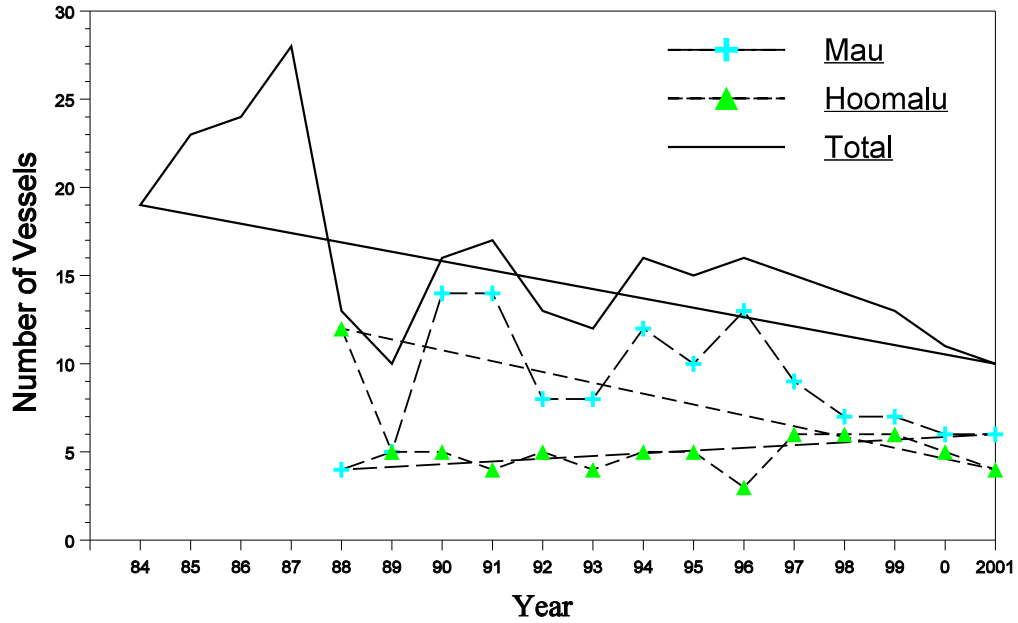
<sup>3</sup> 2001 data are a combination of HDAR data sets.

**Source:** 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 data for 1995 have been updated. The trips were totaled by management area fished. 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.

**Calculation & Adjustment:** The majority of the 2001 data were from the HDAR integrated data set which provides the most complete data set dealing with the effort and landings of the NWHI fishing fleet. Some of the data for 2001 were from the HDAR dealer data reporting system. Other supplementary collection of data by both HDAR and NMFS at the Honolulu fish auction provides opportunities for the cross-checking of trip and landing information. The detailed information collected at the Honolulu auction is used for other analysis.

**Comments & Interpretation:** Although the participant roster remained unchanged from 2000 to 2001 the number of trips made increased in both zones. The increase in the Hoomalu zone was due to 4 of the 5 vessels making more than the minimum number of trips to keep their permit active. In 2000 there were 2 vessels that made the 3 trip minimum. The Mau zone trip count varies as each operator makes the decision of what kind of fishing activity is most will be most successful at any given time. The Honolulu fleet which is mainly composed of full time bottomfish directed vessels did make more trips than in 2000 during which time a couple of vessels experienced equipment and crew problems.

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



Year	Boats		
	Mau	Hoomalu	Total <sup>2</sup>
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 <sup>1</sup>	14	4	17
1992 <sup>1</sup>	8	5	13
1993 <sup>1</sup>	8	4	12
1994 <sup>1</sup>	12	5	16
1995 <sup>1</sup>	10	5	15
1996 <sup>3</sup>	13	3	16
1997 <sup>3</sup>	9	6	15
1998 <sup>2</sup>	7	6	13
1999 <sup>3</sup>	7	6	13
2000 <sup>3</sup>	6	5	11
2001 <sup>3</sup>	6	5	11
mean	8.79	5.43	15.83
s.d.	3.33	2.06	4.89

<sup>1</sup> Based on a combination NMFS and HDAR data set.

<sup>2</sup> Total may not match sum of areas due to vessel participation in multiple areas.

<sup>3</sup> Based on HDAR data.

**Source:** The majority of the 2001 data were from the HDAR integrated data set which provides the most complete data set dealing with the effort and landings of the NWHI fishing fleet. Some of the data for 2001 were from the HDAR dealer data reporting system. Other supplementary collection of data by both HDAR and NMFS at the Honolulu fish auction provides opportunities for the cross-checking of trip and landing information. The detailed information collected at the Honolulu auction is used for other analysis.

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:** The number of active vessels is identical to that of 2000. All of the participating vessels from 2000 did participate in the 2001 fishery.

In 1996 due to fishermen's economic concerns, the Mau Zone Task Force was formed to address the problem and suggest possible solutions. The Task Force moved in the direction of a limited entry fishery much like the Hoomalu zone and the subsequent 1997 moratorium on additional new participants essentially capped the fleet pending new regulations. The moratorium itself had reduced the number of vessels from 13 in 1996 to 9 in 1997 to 7 in 1998. The new limited entry regulations and its initial qualification criteria were put into effect in mid-1999. It allows all qualifying participants initial entry after which a "use it or lose it" criteria would allow the managers to reduce the fleet to its target number. The assumption that the number of initial entrants would be large was unfounded as there was less interest than expected. It was expected that fleet size reduction would occur rapidly as the Mau zone has historically had a large turnover in annual participation. In 2000 the number of active participants decreased by 1 in each zone. The Mau zone has lost a dedicated full-time bottomfish fisherman. The Hoomalu zone has lost a part-time bottomfish fisherman.

Table 1. NWHI 2001 Bycatch by Species

<b>Pelagic MUS</b>	# released	total # sold	% bycatch by species	% bycatch/ total # sold
YF tuna ( <i>T. albacares</i> )	3	1070	<1 %	<1%
BE tuna ( <i>T. obesus</i> )	20	27	43 %	<1%
Kawakawa ( <i>E. affinis</i> )	1	108	1 %	<1%
Striped marlin ( <i>T. audax</i> )	1	3	25 %	<1%
Shark (unidentified)	89	0	100 %	<1%
Tiger shark ( <i>G. cuvieri</i> )	4	0	100 %	<1%
White-tipped shark (unidentified)	1	0	100 %	<1%
 <b>Bottomfish MUS</b>				
# released	total # sold	% bycatch by species	% bycatch/ total # sold	
Onaga ( <i>E. coruscans</i> )	1	8582	<1 %	<1%
Opakapaka ( <i>P. filamentosus</i> )	1	7931	<1 %	<1%
Ehu ( <i>E. carbunculus</i> )	8	3900	<1 %	<1%
Uku ( <i>A. virescens</i> )	3	5538	<1 %	<1%
Kalekale ( <i>P. sieboldii</i> )	265	2026	12 %	<1%
Butaguchi ( <i>P. dentex</i> )	777	2314	25 %	2%
White Ulua ( <i>C. ignobilis</i> )	532	251	68 %	1%
Kahala ( <i>Seriola</i> spp.)	4013	0	100 %	11%
 <b>Miscellaneous species</b>				
# released	total # sold	% bycatch by species	% bycatch/ total # sold	
Omilu ( <i>C. melampygyus</i> )	71	57	55 %	<1%
Papa ulua ( <i>C. orthogrammus</i> )	4	52	7 %	<1%

**Table 2. Mau Zone Bycatch by Species, 2001**R = # released, S = # sold, % bycatch within species= $\{R/(R+S)\} * 100$ % bycatch within species groups= $(R/R+S \text{ by species group}) * 100$ % bycatch per total catch= $(R/\text{total } R+S) * 100$ 

<b>Pelagic MUS</b>	# released	total # sold	% bycatch within species	% bycatch within species groups	% bycatch per total catch
YF tuna ( <i>T. albacares</i> )	0	794	0 %	0 %	0 %
BE tuna ( <i>T. obesus</i> )	20	0	100 %	2 %	< 1%
Kawakawa ( <i>E. affinis</i> )	0	67	0 %	0 %	0 %
Striped marlin ( <i>T. audax</i> )	1	2	33 %	< 1%	< 1%
Shark (unidentified)	55	0	100 %	6 %	< 1%
Tiger shark ( <i>G. cuvieri</i> )	1	0	100 %	< 1%	< 1%
White-tipped shark (unidentified)	1	0	100 %	< 1%	< 1%
<b>Bottomfish MUS</b>	# released	total # sold	% bycatch within species	% bycatch within species groups	% bycatch per total catch
Onaga ( <i>E. coruscans</i> )	1	481	<1 %	<1 %	< 1%
Opakapaka ( <i>P. filamentosus</i> )	0	421	0 %	0 %	0 %
Ehu ( <i>E. carbunculus</i> )	8	1910	<1 %	<1 %	< 1%
Uku ( <i>A. virescens</i> )	0	1541	0 %	0 %	0 %
Kalekale ( <i>P. sieboldii</i> )	1	1207	<1 %	<1 %	< 1%
Butaguchi ( <i>P. dentex</i> )	10	687	1 %	<1 %	< 1%
White Ulua ( <i>C. ignobilis</i> )	0	19	0 %	0 %	0 %
Kahala ( <i>Seriola</i> spp.)	653	0	100 %	9 %	8 %
<b>Miscellaneous species</b>	# released	total # sold	% bycatch within species	% bycatch within species groups	% bycatch per total catch
Omilu ( <i>C. melampygyus</i> )	30	48	38 %	28%	< 1%
Papa ulua ( <i>C. orthogrammus</i> )	0	29	0 %	0 %	0 %

**Table 3. Hoomalu Zone Bycatch by Species, 2001**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

<b>Pelagic MUS</b>	# released	total # sold	% bycatch within species	% bycatch within species groups	% bycatch per total catch
YF tuna ( <i>T. albacares</i> )	3	276	1 %	<1 %	< 1%
BE tuna ( <i>T. obesus</i> )	0	27	0 %	0 %	0 %
Kawakawa ( <i>E. affinis</i> )	1	41	0 %	<1 %	< 1%
Striped marlin ( <i>T. audax</i> )	0	1	0 %	0 %	0 %
Shark (unidentified)	34	0	100 %	<1 %	< 1%
Tiger shark ( <i>G. cuvieri</i> )	3	0	100 %	<1 %	< 1%
White-tipped shark (unidentified)	0	0	0 %	0 %	0 %
<b>Bottomfish MUS</b>	# released	total # sold	% bycatch by species	% bycatch within species groups	% bycatch per total catch
Onaga ( <i>E. coruscans</i> )	0	8101	0 %	0 %	0 %
Opakapaka ( <i>P. filamentosus</i> )	1	7510	<1 %	<1 %	< 1%
Ehu ( <i>E. carbunculus</i> )	0	1990	0 %	0 %	0 %
Uku ( <i>A. virescens</i> )	3	3997	<1 %	<1 %	< 1%
Kalekale ( <i>P. sieboldii</i> )	264	819	24 %	1 %	< 1%
Butaguchi ( <i>P. dentex</i> )	767	1627	32 %	3 %	3 %
White Ulua ( <i>C. ignobilis</i> )	532	232	70 %	2 %	2 %
Kahala ( <i>Seriola</i> spp.)	3360	0	100 %	12 %	11 %
<b>Miscellaneous species</b>	# released	total # sold	% bycatch by species	% bycatch within species groups	% bycatch per total catch
Omilu ( <i>C. melampyrgus</i> )	41	9	82 %	< 1%	< 1%
Papa ulua ( <i>C. orthogrammus</i> )	4	23	15 %	< 1%	< 1%

**Source:** The 2001 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 fishermen'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.

The 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. Many of the NWHI captains voluntarily participate in the State of Hawaii's ulua tagging study and routinely tag many kahala and other jacks.