VI. IMPACT ASSESSMENT

VI.A. **Methods employed in impact assessment**

The evaluation of the impacts of the effort limitation alternatives employed a spreadsheet simulation model developed using logbook data to estimate resulting changes in location and magnitude of harvests.

VI.A.1 Development of spreadsheet simulation model.

The spreadsheet simulator was based on activity patterns during a 12-month period from October 1991 through September 1992. This period was chosen because, at the time the model was being developed, it included the most recent year's worth of information, for a time during which regulations were relatively constant. Catch and effort information from the federal logbook program was computed for three vessel size (length) categories: small (55 ft or less), medium (56 ft to 74 ft) and large (75 ft or greater). While it was recognized that vessel length may be an overly simplistic way to classify the fleet, these size categories were chosen because discussions with industry representatives indicated that, in general, each category represented different fishing capabilities and strategies. Small vessels are basically coastal vessels that are dependent on seasonally changing island-associated schools of yellowfin and bigeye tuna. Medium-sized boats can travel farther in search of available resources, including swordfish, when that resource moves closer to Hawaii during part of the year. Large vessels have a wider range of fishing opportunities and target swordfish heavily.

Information on fishing location, fishing effort, species and CPUE by vessel size category for the 12 month period was extracted from the federal logbook data base and used to construct the spreadsheet model. Total catch for selected species groups and species by area of fishing was then calculated using the estimated fleet by vessel size categories under various scenarios as input into the model.

The use of this simulation tool to evaluate the implication of various alternative permit transfer and vessel replacement rules is based on two assumptions: (1) the average CPUE values for a given size category vessel do not change with a change in number of active vessels, and (2) fishing strategies and activity patterns are assumed to be identical as those during the chosen 12-month period. That is, the model is static in that it is based on average fishing effort and species catch rates by area and by vessel category. Only the number of vessels by size category (the input to the model) is variable. The spreadsheet simulator does not have a category for vessels larger than those active during the moratorium. If, under this alternative, significantly larger vessels with different activity patterns (e.g., a large freezer-longliner) obtained a limited entry permit, then anticipated impacts could be greater. However, it was not possible to quantify such impacts at this time.

VI.A.2 -- Predicting changes in fleet size and composition under various scenarios.

The next step in the assessment process was to predict expected active fleet size and composition (proportion of small, medium and large vessels) which might occur under each regulatory alternative. The impact assessment developed for the draft amendment focused on four alternatives, all of which were ultimately rejected. However, the impacts of the proposed limited entry program are expected to fall within the range of these four alternatives.

The following predicted active fleet configurations were used to assess the impacts of the proposed limited entry program and five rejected alternatives:

For the continued moratorium alternative, the predicted fleet was based on the results of a Transferability Assessment Working Group meeting held on 12 November 1992. The longline industry members of the working group felt that if current regulations continued the active fleet would be expected to decline, especially the small boat segment. A number of the vessels in this size category were negatively impacted by the MHI area closures. Without the opportunity to upgrade fishing operations, marginal vessels were expected to leave the fishery. Industry representatives familiar with the medium-size vessels also predicted some decline in the active vessel if their ability to restructure corporations (to bring in new capital) is restricted by the one-time-only transfer rule. The one-time-only transfer rule also limits the number of potential buyers of marginal operations. If the new buyer is not successful, he or she does not have the option of reselling the permit with the vessel. The Working Group predicted a slight increase in the large vessels, based on several currently inactive swordfish vessels becoming active in the near future. The Working Group predicted that, under the continued moratorium, attrition in the active fleet would continue and a total active fleet of 106 vessels (15 small, 48 medium and 43 large) would result. This compares to an active fleet of 123 vessels (23 small, 60 medium and 40 large) in 1992.

For the limited entry alternative without restrictions (the original preferred alternative), the Working Group did not did not believe that all permits would become active, even with no restrictions on permit transfers or upgrading of vessel harvesting capacity. Scenario A represents their prediction that about 136 vessels would be active (16 small boats and 60 each of medium and large vessels). This scenario did not provide information on the maximum possible impact of this alternative. Therefore, a second scenario (B) with a maximum of 166 active vessels was also used with the spreadsheet simulator. For this scenario, the number of active small longliners (23) was assumed to remain the same as in 1992, but the remainder of the inactive vessels (43 in 1992) were allocated proportionally between the medium vessels (i.e., 86 medium vessels and 57 large vessels).

To assess the impacts of the dual permit alternative, the analysts assumed that the 166 "A" permits, eligible to fish either inside or outside the EEZ, would be active, as well as an additional 100 "B" permits (fishing outside the EEZ and landing in Hawaii). A level of additional effort of one hundred additional vessels was chosen because it equalled the increase in fleet size observed between the five-year period (1987-1991) before the moratorium took effect. These additional 100 vessels were divided among the medium (60) and large (40) categories. No additional small vessels were assumed since all fishing was required to take place outside the EEZ. Therefore, the total active fleet under the dual permit option was 266 vessels (23 small, 146 medium and 97 large vessels).

To analyze the impacts of allowing the current moratorium to lapse without any new effort limitation regulations in place, a tripling of the current active fleet was assumed for the open access alternative. Since the area closures would remain in effect, the number of small vessels was predicted to remain the same as in 1992 (23) while the active medium and large vessels would increase proportionally (208 and 138 vessels, respectively).

The limited entry program with a "harvesting capacity cap" alternative would have restricted fleet-wide harvesting capacity to the maximum allowed during the moratorium. Predicting the active fleet under this alternative is difficult because the rules for determining fleet-wide harvesting capacity and for allocating and transferring individual vessel harvesting capacity units were never developed. However, initial discussions focused on restricting vessel characteristics. Therefore, the size distribution of vessels associated with legal permits, i.e., 41 small, 71 medium, and 54 large vessels, was assumed to represent the active fleet for this alternative.

The limited entry program proposed under Amendment 7, differs from the Council's original preferred alternative in that the proposed limited entry program restricts vessel upgrades and permit transfers to the length of the longest vessel active in the fishery (93 feet to date). The active fleet was assumed to be the maximum which can be allowed (166 vessels), in the same size distribution as described under the no harvesting capacity restriction alternative, since the simulator model itself is limited to activity patterns of vessels no greater than the longest vessel active during the moratorium. That is, it was implicitly assumed that no owners would upgrade to a larger vessel than had been active in the moratorium.

Among the elements that can be manipulated to carry out a limited entry program, are the number of limited entry permits, the transferability of permits, the upgradeability of fishing capacity by the permit holders, and the differential application of limited entry to separate sectors of the fleet or in different areas. Before the Council narrowed its choice of alternatives, the preparers of Amendment 7 also ran the simulation model for active fleets predicted under 25 possible combinations of these elements. The results of this analysis are presented in Appendix 6.

VI.A.3 -- Estimating Predicted Changes in Longline Harvests

The actual 1992 active fleet, by size category, and estimates of active fleet size and composition under the proposed limited entry program and rejected alternatives, were then entered into the spreadsheet simulator and changes in expected harvest of pelagic species calculated. These results are summarized in Tables VI-1 and VI-2.

VI.B Predicted Fishery Impacts of Effort Limitation Alternatives

Each alternative is assessed with respect to expected changes in fishing effort, catch and revenue, and probable impacts on the stock-wide status and local availability. Table VI-3 summarizes the relative risks of each alternative with respect to potential problems of under-development, catch competition, market competition over-utilization and over-capitalization. A ranking of 1 indicates the lowest relative risk while a ranking of 5 represents the highest.

VI.B.1 Proposed Limited Entry Program

VI.B.1.a Expected Changes in Fishing Effort

The proposed limited entry program provides that limited entry permits will be issued to moratorium permit holders who either land longline caught fish at some time during the moratorium or meet certain exemption criteria. Since the moratorium does not expire until April 1994, the exact number of vessels that will qualify for permits and be active in the fishery is not known. However, the maximum number of longline boats that may be allowed to fish under Amendment 7 would be no more than the number of permits issued during the moratorium (166 to date). This number was used to estimate the impacts of the proposed limited entry program. A 32% increase in the total annual hooks was predicted. More effort would be expended both inside and outside the MHI EEZ, with the increase outside the EEZ being proportionately greater.

VI.B.1.b. Expected changes in catch and revenue

Landings of all species were expected to increase. Increases of 37% for all species and all areas was predicted. The largest estimated increase was for swordfish (41%). The increase was proportionately greater outside the EEZ (29%) than inside the MHI EEZ (9%). Total longline fleet revenue was estimated to increase from $43.7 million in 1992 to $60 million, assuming all permits are actively fished.

Table VI-1. **Active longline fleet used for each alternative to estimate changes in total effort (1,000 hooks) and catches (1,000lb).**

Vessels				
Management Alternative	Small (<56 ft)	Medium (56-74 ft)	Large (> 74 ft)	Total
Current (1992)[1]	23	60	40	123
Amendment 7 Limited Entry Program	23	86	57	166[2]
Harvesting Capacity Cap	41	71	54	166
LE w/out harvesting capacity restrictions[3]	16	60	60	136[4]
	23	86	57	166[5]
Current Moratorium	15	48	43	106
Dual Permits	23	146	97	266
Open Access	23	208	138	369

Estimated Total Effort Under Each Scenario (1,000 hooks)		
Management Alternative	Effort (1,000 hooks)	Percent Change
Current (1992)	11,700	
Amendment 7 Limited Entry Program	15,400	+32%
Harvesting Capacity Cap	16,300[6]	+39%
LE w/out harvesting capacity restrictions	12,600[2]	+7%
	15,400[3]	+32%
Current Moratorium	9,900	-15%
Dual Permits	23,500	+101%
Open Access	33,000	+182%

Estimated Total Catch and Percent Change from Current Situation				
Management Alternative	All Areas (1,000 lb)		MHI EEZ only (1,000 lb)	
Current (1992)	20,100		4,600	
Amendment 7 Limited Entry Program	27,500	+37%	6,000	+30%
Harvesting Capacity Cap	27,000	+34%	6,600	+44%
LE w/out harvesting capacity restrictions	23,900[2]	+19%	4,500	-2%
	27,500[3]	+37%	6,000	+30%
Dual Permits	46,800	+133%	6,000	+30%
Open Access	62,600	+211%	12,200	+165%

[1] Actual fleet active in 1992. Fleet information entered into simulator model to get simulated 1992 catch and effort. Simulated results closely approximated actual 1992 catch and effort information.

[2] Assumes all vessels active. Represents a maximum expected impact. If all permits not active, impacts would be less.

[3] Spreadsheet simulator based on activity of active vessels. If permit obtained for a significantly larger vessel with a different fishing pattern (e.g., a large freezer-longliner), then expected impacts might be greater under this alternative than estimated.

[4] Assumes Working Group active fleet prediction (136).

[5] Assumes maximum number of permits allowed will be active (166).

[6] Indicates the number of hooks predicted if all vessels permitted under the moratorium actively fished. The increase in effort is greater than the LE with no harvesting capacity restrictions because assumes same size distribution as under the moratorium. Therefore, there would be more small vessels than under the no restriction alternative. In 1992, small vessels deployed 116,001 hooks/vessel compared to 88,167 hooks/vessel and 92,353 for medium and large vessels, respectively.

Table VI-2. Impact of management options expressed as percent change from current landings.

MANAGEMENT OPTION	A PERMITS	TRANSFER-ABILITY	UP-GRADE	B PERMIT	ACTIVE PERMITS A/B S/M/L	CAPTURE LOCATION	MARLINS %	SWORD-FISH %	TUNA %
Amendment 7 limited entry	Yes	Yes, with restrictions[1]	Restricted[2]	No	166[3]/-- 23/86/57	Total[4] In[5]/Out[6]	28 25/33	41 39/58	32 25/37
Harvesting Capacity Cap	Yes	Yes, with restrictions	Restricted	No	166/-- 41/71/54	Total In/ Out	42 46/38	31 28/31	39 45/35
LE w/o harvesting capacity restrictions	Yes	Yes	Yes	No	136[7]/-- 16/60/60	Total In/Out	1 -812	27 9/29	8 -8/17
	Yes	Yes	Yes	No	166[8]/-- 23/86/57	Total In/Out	28 25/33	41 39/58	32 25/37
Continued Moratorium	Yes	No	No	No	106/-- 15/48/43	Total In/Out	-18 -23/-13	-5 -15/-4	-15 -23/-10
Dual Permits	Yes	Yes	Yes	Yes	166/100 23/146/97	Total In/Out	76 25/143	156 39/169	105 25/156
Open Access	Open	Open	Open	Open	369 23/208/138	Total In/Out	162 141/190	234 223/235	184 140/208

[1] Permits can only be transferred for use with vessels no longer than the length of the longest vessel active during the moratorium (93 feet to date).

[2] Vessels can be upgraded only to the length of the longest vessel active during the moratorium.

[3] Assumes that all current permit holders are eligible for new limited entry permit and all permits are active. If some permits inactive, then anticipated impacts would be less.

[4] Percent change from 1992 levels, for all areas combined.

[5] Percent change inside main Hawaiian island EEZ.

[6] Percent change outside the EEZ.

[7] Based on Working Group's prediction of 136 active vessels.

[8] Assumes all 166 permits issued are active. Spreadsheet simulator based on activity patterns of current vessels. If permit obtained for a significantly larger vessel with a different fishing pattern (e.g., large freezer-longliner), then expected impacts might be greater under this alternative than estimated.

Table VI-3. Relative risk[1] of under-development, catch competition, over-utilization, and over-capitalization caused by four alternatives.

Management Alternative	Under-Development	Catch Competition	Market Competition	Over-Utilization	Over-Capitalization
Amendment 7 Limited Entry Program	4	2	2	2	2
LE with Harvesting Capacity Cap	4	3	3	2	1
LE with Unrestricted Transfers/Upgrades	A[2]: 4 B: 4	A: 1 B: 2	A: 1 B: 2	A: 2 B: 2	A: 2 B: 2
Continued Moratorium	5	1	1	1	1
Dual Permits	2	3	3	4	4
Open Access	1	5	5	5	5

[1] Calculation of risks (ranked 1 to 5, with 1 lowest) was as follows: Under-development: % change in total tuna and swordfish catch; catch competition: 2 * % change in total tuna and marlin catch inside EEZ + % changes in tuna and marlin catches outside EEZ; market competition: 2 % changes in tuna catch inside EEZ + % changes in tuna catches outside EEZ; and over-utilization: % change in total swordfish and marlin catches; over-capitalization, based on catches: 2 * % change in tuna catch within the EEZ + % change in tuna catch outside the EEZ + 3 * change in total swordfish catch, or based on boats: 3 * A permit large boats + 2.5 * A permit medium + 0.5 * A permit small + 2* B permit large + 1.5 * B permit medium

[2] Based on Working Group estimate of 136 active vessels.

[3] Assumes all permits active (166 vessels).

VI.B.1.c. Probable stock impacts

The predicted levels of increased landings are more likely to have a measurable impact on swordfish than on tuna or other billfish species. Since landings are projected to increase, the relative likelihood of over-utilization must also increase. However, the relative risk of over-utilization for the proposed limited entry was low (risk factor 2) compared to the open access alternative (risk factor 5) or most of the rejected alternatives with a variable number of allowable permits (Appendix 6, Table 6-3). The projected increases in landing of tuna and marlin might technically increase the relative risk of over-utilization, but the impact on the stocks is not likely to be measurable or contribute significantly to over-utilization because the US proportion of the catch would still be 10% or less.

VI.B.1.d. Impacts on the locally available segment of the stocks

The potential for catch competition relative to current conditions would be expected to stay about the same. The relative likelihood of catch competition is a risk factor of 2. Thus, the risk of catch competition for the proposed limited entry program is low to moderate, compared to the range of risks for the entire set of alternatives considered by the Council.

VI.B.2. Limited entry with "harvesting capacity" cap

VI.B.2.a Expected Changes in Fishing Effort

This alternative would have the same eligibility criteria for obtaining a permit as the proposed limited entry program.. Therefore, an active fleet of 166 vessels was used to estimate impacts. A 39% increase in the total annual hooks was predicted. The increase in hooks deployed would be proportionately greater inside the MHI EEZ than outside, because there would be a larger number of small vessels that set more hooks fishing for tuna than larger vessels set fishing for swordfish..

VI.B.2.b. Expected changes in catch and revenue

Overall landings of all species from all areas would be expected to increase by 37%. For all areas, swordfish was predicted to increase by 31%, other billfish (marlins) by 42% and tunas by 39%. The largest increase in marlin catch was expected to occur within the MHI EEZ (46%), compared to 38% outside the EEZ. Total longline fleet ex-vessel revenue was estimated to increase from $43.7 million in 1992 to $58.7 million.

VI.B.2.c. Probable stock impacts

The predicted stock impacts under this alternative were the same as discussed for the proposed limited entry program.

VI.B.2.d. Impacts on the locally available segment of the stocks

The potential for catch competition relative to current conditions would be expected to increase under this alternative. The relative likelihood of catch competition is moderate (risk factor of 3) compared to the range of risks for the entire set of alternatives which were considered by the Council (Appendix 6, Table 6-3).

VI.B.3. Limited entry with no restrictions on permit transfers or vessel upgrades

VI.B.3.a Expected changes in fishing effort.

The maximum number of longline boats allowed to fish under this alternative would be 166, with the number of active vessel set at 136 and 166 for scenarios A and B to estimate the impact of the alternative. Under these scenarios, increases of 7% and 32% in the total annual hooks deployed was predicted. Under scenario A, 7% less effort was predicted to be expended within the MHI EEZ, commensurate with the decline in the number of active small boats compared to the "current situation". Under scenario B, more effort would be expended both inside and outside the MHI EEZ, with the increase outside the EEZ being proportionately greater.

VI.B.3.b Expected changes in catches and revenue

Landings of all species were expected to increase. Increases of 19% and 37% for all species and all areas were predicted for scenarios A and B, respectively. For both scenarios, the largest estimated increase was for swordfish (27% for scenario A, 41% for scenario B). For scenario A, the largest increase in swordfish catch occurred outside the MHI EEZ (29%) compared to 9% inside. For scenario B, a 58% increase in swordfish catch outside the EEZ was predicted, compared to 39% increase inside. Total longline fleet revenue was estimated to increase form $43.7 million in 1992 to $60 million for scenario B, (maximum number of active vessels).

VI.B.3.c. Probable stock impacts.

The predicted stock impacts under this alternative were the same as discussed for the proposed limited entry program.

VI.B.3.d. Impacts on the locally available segment of the stocks.

The potential for catch competition relative to current conditions would be expected to stay about the same under scenario A and increase for scenario B. The relative likelihood of catch competition are 1 and 2 for scenarios A and B, respectively. Thus, the risk of catch competition for this alternative ranges from low (for the fleet size predicted by Working Group) to moderate in the most extreme case, compared to the range of risks for the entire set of alternatives considered by the Council.

VI.B.4 -- Continued Moratorium Alternative

VI.B.4.a Expected Changes in Fishing Effort

If the moratorium continued in its present form, with no adjustments to permit transferability, the number of active vessels fishing would be expected to continue to decline by 14%, from 123 to 106 vessels. The annual number of hooks deployed is expected to decrease by 15%. Attrition is expected to cause a reduction in the number and proportion of small and medium sized vessels (from 23 to 15, and from 60 to 48, respectively) due to area closures and to the inability of these vessels to efficiently and safely fish distant grounds. Under this alternative, a permit holder cannot transfer the permit to a larger vessel with greater harvesting capacity. However, there is currently no restriction on modifying the original vessel in a way which would increase harvesting capacity. Only large vessels would be expected to increase proportionally from 39 to 43. The Working Group projected there would be such a small increase in large vessels because of the restriction on replacing vessels with increased harvesting capacity and allowing only one permit transfer. With this mixture of vessel size-classes, the proportion of vessels fishing offshore for swordfish and bigeye tuna would be expected to increase. Winter inshore bigeye tuna grounds would still be actively fished.

VI.B.4.b. Expected changes in catches and revenue

If the present moratorium continued, landings of all species and species categories would decline further from the current level. Landings of swordfish would remain the highest compared to other species, but would decline 5% overall (15% inside the MHI EEZ and 4% outside). Landings of marlins would be expected to decline 18% overall (23% within the MHI EEZ and 13% outside). Blue marlin catches would be expected to decline more than striped marlin catches because the large vessels target on swordfish and bigeye tuna in the winter when striped marlin are available and blue marlin are not. Total tuna landings would be expected to decline 15% overall and 23% within the MHI EEZ and 10% outside. Both yellowfin and bigeye landings would decline, but bigeye landings would decrease more than yellowfin both inshore and offshore. The species composition of the total catches would be expected to be: swordfish (25%), bigeye tuna (13%), yellowfin tuna (3%), and blue marlin (2%), and other species (45%). No significant changes would be expected in the average size of species landed. Bycatches would be expected to decline proportionally to total catches, thus blue shark bycatch and incidental takes of albatross and turtles in the swordfish fishery would decline the least. Total longline fleet revenue would decrease to $39 million from $43.7 million in 1992.

VI.B.4.c. Probable stock impacts

Given the size of the domestic fishery, the effect on the stocks would probably not be measurable. With the decline in fishing effort and landings by the Hawaii fleet, the

status of the stocks should improve if foreign mortality remains the same. The relative likelihood of over-utilization is the lowest among the alternatives considered (Table VI-3), but the risk of under-development is the greatest. For example, catch rates should go up, but probably not enough to be measured. Technically, the risk of over-utilization (growth overfishing) or recruitment overfishing would decline for all species. Since the decline in swordfish landings is expected to be small (5%), the domestic fishery would remain at or near its highest level of development and still comprise a significant portion of the total fishery on the species in the North Pacific. If it remains near the highest harvest levels, which would occur if other fisheries do not expand, then MSY will remain poorly estimated.

VI.B.4.d. Impacts on the locally-available segment of the stocks

With decreasing effort and catch, particularly within the EEZ of the main Hawaiian Islands, gear conflict would be expected to decrease. In addition, various aspects of fishery interaction (e.g. catch competition and market competition) should decline. Under this alternative, the likelihood of catch competition is the smallest.

VI.B.5 The Dual Permit Alternative

VI.B.5.a. Expected changes in fishing effort

Inside the EEZ, vessel participation would be expected to increase similar to the limited entry without harvesting capacity restrictions alternative, but outside the EEZ the model assumes that 100 additional vessels would participate for a total of 266 vessels (116% increase from 119). No small vessels were projected to enter the fishery outside the EEZ, and the number of medium and large vessels would increase 60 and 40, respectively. With the addition of these 100 vessels, allowed to fish only outside the EEZ, even more fishing effort would be distributed outside the EEZ than at present.

VI.B.5.b. Expected changes in catches and revenue

Landings resulting from fishing outside the EEZ would be expected to increase substantially, while landings from inside would be the same as without B permits (Table VI-1 and VI-2). Swordfish landings would increase 156% overall (169% outside the MHI EEZ, and 39% inside). Thus, the proportion of swordfish in the catch would increase substantially, and unless other swordfish fisheries in the central and eastern Pacific increased proportionally, the Hawaii fishery would almost certainly become the largest in the area. Tunas harvested outside the MHI would increase 156% while an overall increase of 105% would be expected (since predicted landings within the Main Hawaiian Islands EEZ would be the same as under the Council's preferred alternative). Landings of marlins would increase the least, but overall landings and landings outside the EEZ would be substantial (76 to 143%). Estimated total longline fleet revenue would be $102 million compared to $43.7 million in 1992.

VI.B.5.c. Probable stock impacts

The relative risk of under-utilizing the stocks under the dual permit alternative has a value of 2, compared to 1 for open access and 5 for the continued moratorium. That is, it has a relatively low risk of under-utilization. The relative risk of over-utilization of the resources is ranked at 4 compared to 1 for the continued moratorium and 5 for open access. Thus, the risk of over-utilization is relatively high. These high landings of swordfish will probably have a measurable impact on the stock. The relative risk of over-utilizing swordfish would be second highest among the alternatives (four times higher than for the continued moratorium). Whether the increased landings would cause MSY to be exceeded or (recruitment) overfishing to occur is unknown. The most recent assessment of the Atlantic fishery found swordfish to be more resilient to fishing pressure than previously believed. However, the need for effort limitation would be increased with the projected increases in fishing effort. While the increased landings of tunas and marlins would be sizeable, and the relative risk of over-exploitation is second highest, it is still not likely that the local fishery would significantly contribute to over-utilization or overfishing of the stocks. With an increase in the domestic share of the stock-wide harvest, however, catch rates might be expected to decline.

VI.B.5.d. Impacts on the locally-available segment of the stocks

The expected landings from within the EEZ for the dual permit option is the same as under the Council's preferred alternative. Therefore, catch competition effects due to fishing within the EEZ would be expected to be the same. However, catch competition might increase due to the substantial increases in fishing outside the EEZ by vessels holding B class permits. Thus, an overall relative risk of catch competition was estimated to be 3 (i.e., about a middle ranking).

VI.B.6. Under the Open Access Alternative

VI.B.6.a. Expected changes in fishing effort

The number of participating vessels was arbitrarily set at 369 by tripling the number active in 1992. The small vessels active remained the same while the medium vessels increased by about 245%. Effort would increase significantly both inside and outside the EEZ. A 182% increase in number of hooks deployed annually would be predicted.

VI.B.6.b. Expected changes in catches and revenue.

The landings from all species and species categories would be expected to increase considerably: swordfish 234%, tunas 184%, and marlins 162%. Proportionately swordfish would become even more dominant in the landings, and marlin would become less important. Bycatch would also be expected to increase considerably

from current levels, particularly in association with the swordfish fishery (more blue sharks, albatrosses and, turtles would be caught). The area closures in the Northwestern Hawaiian Islands would be expected to continue to preclude interaction with Hawaiian monk seals. Estimated total longline fleet revenue would be $136 million.

VI.B.6.c. Probable stock impacts

Under open access, the large increase in swordfish landings (234%), would be expected to produce a significant impact on the stocks. The probability of exceeding MSY and overfishing the stock would be at least 5 times greater than for the most conservative alternative. Even though the risk of recruitment overfishing would be greater (as with any increase in effort), it cannot be determined if it would be imminent. With the predicted large landings of tuna and marlins (much greater than under any limited entry alternative), the Hawaii fishery would no longer be an inconsequential part of the Pacific fishery. Impacts on the status of tuna and marlin stocks would most likely be measurable, including contributing to the continued over-utilization of blue marlin (unless catches by other foreign fisheries declined comparably to US increases).

VI.B.6.d. Impacts on locally-available segment of the stocks

With the open access alternative, the Hawaii fishery would increase its relative take of the total Pacific harvest. Hawaii fishermen would increasingly experience a decline in catch rates due to their own fishing, leading to catch competition. Catch competition between the longline fishery and the troll and handline fisheries would presumably increase, since the fishing power of a troll or handline boat is less than a longline vessel. Large increases in harvest from inside the EEZ suggests that fish would be removed faster than could be replaced through recruitment and immigration. This may result in local overfishing and catch competition. Of all alternatives, the relative risk of catch competition is greatest for open access.

VI.C Economic and Social Impacts of Effort Limitation Alternatives

The purpose of this section is to assist in understanding the relative economic consequences of alternative limited entry management actions by providing a qualitative evaluation of the limited entry alternatives identified in this amendment. Because of limitations on available information concerning the potential physical effects of the preferred action (and its alternatives) on fishing vessel performance and shoreside operations, a defensible quantitative approach is not possible.

The alternative management actions which were reviewed in the draft amendment contained three main components: 1) limits on entry into the Hawaii longline fishery, 2) various options for transferability of longline permits options, and (3) rules on vessel

upgrading. These measures were evaluated in terms of four theoretical longline fleet configurations.

As described previously, the four longline fisheries management alternatives which were discussed in the draft amendment were:

- Continued moratorium

  This alternative reduces the number of active longline fishing vessels by maintaining the current program of limited entry and restrictive permit transferability and upgrading rules.

- Limited entry without harvesting capacity restrictions

  This alternative fixes the number longline vessel permits at 166 but allows unlimited transferability of permits and upgrading of vessel capabilities.

- Dual permits

  This alternative allows for growth in the number of longline permits by allowing unrestricted permit transferability and upgrading for longliners with current permits and by allowing 100 additional permits for longliners to fish only outside the EEZ.

- Open access

  This alternative is designed to approximate the greatest range of open access possibilities, although it is not know whether this range would be reached or exceeded. The open access alternative assumes a fleet of 369, triple that of the current active fleet. This is designed to approximate a fleet which might become based in Hawaii if no effort limitation regulations are continued.

These alternatives specified a range of fleet size options to be analyzed. The proposed limited entry program differs from these in that it limits vessel upgrades to the size of the longest vessel active during the moratorium. As described earlier, the spreadsheet simulator was based on fishing patterns of active vessels. The impacts associated with the limited entry with no harvesting capacity restrictions alternative did not assume any vessels larger than the longest vessel active during the moratorium. Therefore, under the assumed active fleet, the economic impact of the new scenario is fundamentally the same as was estimated in the draft amendment for the limited entry without harvesting capacity restrictions alternative (previous preferred alternative). In this final amendment, this alternative has been replaced with the proposed limited entry program.

VI.C.1 Overview of Impact Assessment methodology

Table VI-4 presents the catch levels and estimated gross revenues used for the impact assessment. Also included is the estimated catch and revenue levels under the proposed limited entry program. The methodology behind the impact assessment is to identify some key causal relationships between the number of active longliners and their associated catch levels (as identified above), as well as potential economic effects. Figure VI-1 outlines this methodology.

The following section discusses each of seven key economic impact categories in some detail. However, it is important to realize that in many cases the relative quantification of the causal relationships is largely conjectural. Their basic parameters should be probed for resiliency before too much weight is placed on the projected impacts.

Two central effects considered important by the trollers and handliners are catch competition and market competition. In neither case is the causal relationship confidently modeled in a quantitative sense. However, using "worst case" scenarios, expanding longliner access may have a substantial cost to these types of vessels in both the catch and market competition impacts. It is important to realize that the scale of these effects must be considered subjective until more is known about the physical and economic relationships involved in these competing fisheries.[1]

Finally, the economic costs of the risk of over-fishing swordfish are also projected, although there is essentially no biological information on which to base the risk projections except for the experience of the Atlantic swordfish fishery.[2]

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[1] Although these effects would be "additive" in a qualitative sense, the extent of this additivity is not know quantitatively. This is particularly true since the strongest quantitative relationships between catch and catch rate, and landings and sales price, are within the troll/handline segment of the pelagic fishery.

[2] Presumably these effects would also be additive, but they are not evaluated due to the lack of quantitative information (including simulation).

Table VI-4. Estimated Catch and Gross Revenue under Effort Limitation Alternatives

Current Situation	Catch (1,000 lb)		Gross Revenue ($1,000)	
	All Areas	MHI	All Areas	MHI
Longline	20,100	4,600	$43,700	$10,000
Troll/Handline	5,000	5,000	$7,700	$7,700
Management Alternative	**Longline Catch (1,000lb)**		**Longline Gross Revenue ($1,000)**	
	All Areas	MHI	All Areas	MHI
Amendment 7 Limited Entry	27,500	6,000	$60,000	$13,000
Continued Moratorium	18,000	3,700	$39,000	$8,000
LE without Harvesting Capacity Restrictions[1]	27,500	6,000	$60,000	$13,000
Dual Permits	46,800	6,000	$102,000	$13,000
Open Access	62,600	12,200	$136,000	$26,500

The spreadsheet simulator assumes no vessel greater than those active during the moratorium. Therefore, if a significantly larger vessel with a different activity pattern (e.g., a larger freezer-longliner), were to become active under this scenario, then impacts might be greater than those described.

Figure VI-1: Causal relationships in the impact assessment

Regulatory alternative ====>

Estimated number and location of longline fishing vessels

====> Predicted change in total longline catch and catch composition

====> Estimated physical change in related activities

(for example, troll/handline catch rates)

====> Estimated economic costs or benefits (change in income) of individual effects

(for example, change in troll/handline operator incomes)

====> Fleet segment change in economic values

(for example, change in total troll/handline fleet income)

=====> Relative ranking of regulatory alternatives

VI.C.2. Potential economic and social effects

Regulatory impact analysis usually presumes a long-term perspective where costs are allocated over time, and discounted appropriately. However, conducting such analysis, accounting for both time and sensitivity of the results to variation in parameters, would imply that the estimates in this section have greater confidence than they do. These estimates should be viewed purely as indicative of the scale of impacts possible under the moratorium and as a source for discussing and evaluating qualitatively the impact of the proposed measures.

There are a number of potential economic effects which might be caused by the proposed limited entry alternatives, and their effects may vary in the short- and long-term by the extent to which fishing vessels excluded from the Hawaii longline fishery can find alternatives. Seven types of fishing vessels are potentially affected by these management measures (Table VI-5). The number of all fishing vessels which might be excluded from the fishery cannot be computed, but identification of the types of potentially-excluded fishing vessels may make evaluation of the potential impact of limited entry alternatives easier.

The potential economic effect of the longline moratorium is discussed below with as much quantitative "simulation" as possible. However, it must be stressed that these "simulations" are not based on a current statistical data base.

A central issue in the initial moratorium was whether non-grandfathered longline vessels would be excluded just from the EEZ, (i.e., the dual permit option), or whether they would be excluded from operating from Hawaii entirely. This issue is integrally linked to the enforceability of such area restrictions and is not addressed in this analysis per se. (However dual permits are considered throughout the analysis).

The following are seven possible effects of various limited entry alternatives:

1. Income of longline fishing vessels.
2. Catch rates (catch per unit effort).
3. Gear conflicts.
4. Market competition.
5. Seafood market volume and income.
6. Shoreside provisioning and infrastructure.
7. Risk of over-fishing.

Table VI-5. Types of fishing vessels potentially affected by longline limited entry (number in parenthesis is a *rough estimate* of the number of vessels in each category)

1. Included Hawaii longline fishing vessels (currently permitted under moratorium) (166)

2. Excluded Hawaii longline fishing vessels (excluded by original moratorium) (20)

3. Hawaii trollers and handline fishing vessels, full-time equivalent number (475 commercial, of which 75 are full-time charter boats, and 200 frequently active recreational fishing boats).[3]

4. Excluded Hawaii fishing vessels (e.g., small-scale vessels which might have outfitted for short-set longliners, bottomfish, lobster, and albacore fishing vessels which might have outfitted for longline fishing) (25)[4]

5. Excluded US mainland longline fishing vessels (50)[5]

6. Excluded US mainland non-longline fishing vessels (number unknown)

7. Potential fishing vessels, i.e., those subject to investment (number unknown)

---

[3] The number of commercial troll/handline vessels is estimated by dividing estimated total landings for 1990 by average catch per vessel from the cost earnings statement which used current average catch per trip, and the full-time equivalent number of trips per year.

[4] Excluded Hawaii non-longline vessels are calculated as 5% of the small boat fleet.

[5] Excluded mainland longline vessels are calculated as 10% of Atlantic longline permit holders.

The following discusses each of these effects in detail. Figures VI-2 through VI-8 outline each effect. The basic framework for the analysis is a cost-earnings approach to modeling the economic returns to individual vessels, amplified by the number of vessels in each fleet segment (Pooley 1991).

The cost-earnings statements used in the impact assessment are derived from spreadsheet models following the basic methodology outlined in Clarke and Pooley (1988). These cost-earning statements are summarized in Tables VI-6 and VI-7.

Basically, the cost-earnings statements consist of two components: the income statement which summarizes annualized fixed and operating costs, and the operating characteristics which present basic information on vessel operating rates, e.g., number of days fishing, percentage of revenue used to calculate handling costs, etc. The operating characteristics section also summarizes some components from the income statement. The longline cost-earnings statement is based on the cost of operations of a Class II NWHI lobster fishing vessel (Clarke and Pooley 1988), modified to adjust some cost categories and to calculate revenue based on longline fishing characteristics and updated to 1992 price levels. The troll/handline cost-earnings statement is based on several research studies of trolling and handline fishing vessels in Hawaii, with the basic methodology outlined in Pooley (1986).

Longline catch (234,000 lb) is calculated as number of fishing days (134) times catch per day (1,747 lb). Catch per day is calculated as the number of hooks per day (1,015) time CPUE (1.34 lb per hook). Troll/handline catch (23,465) is calculated as number of trips per year (150) times catch per day (156.43 lb of pelagic species).

Capital costs (for both longline and troll/handline) is calculated as an amortized rate of investment at the capital factor rate (11.03%). The annul repair costs are calculated as a maximum of actual average costs and an annual depreciation of investment, at a 6.67% rate. Handling costs area calculated as a percentage of total revenue, as identified in the operating characteristics sections of Tables VI-6 and VI-7. Labor income is the sum of crew share plus captain's bonus

The inflation factor updates costs prices from 1990 to 1992 price levels using the 1990 and 1992 Honolulu consumer price index (HCPI). The inflation factors differ between the longline and troll/handline cases because of different base years for the analysis.

The impact assessment analysis examines both the gross (ex-vessel) revenue of the affected vessels and their total income, which is calculated as the sum of the net revenue (profit) and labor share. In most cost-benefit analyses, the change in net revenue is considered to be the most appropriate means of comparing costs and benefits, but gross revenue is presented here because it is well known to the fishing public. Total income is used instead of net revenue to reflect the supplemental income effect in an economy that is not at full employment.

Figure VI-2. Loss of income for excluded longline fishing vessels

Continued moratorium ===> lost fishing opportunities

for a variable number of currently permitted but inactive longliners

&

for 100 mainland longliners

==========

Continued moratorium ===> cost of moving vessels back to mainland US fisheries

for a variable number of currently permitted but inactive longliners

==========

Amendment 7 Limited Entry Program ===> lost fishing opportunities

for 100 mainland longliners

Figure VI-3 Change in catch rates (catch per unit effort)

Main Hawaiian Islands EEZ effect only

Continued moratorium ===>

decline in MHI longline catch levels

{impact of permit transferability restrictions}

===> potential increase in troll/handline catch rates

===> potential increase in catch rates for remaining longliners

==========

Amendment 7 limited entry program, dual permits and open access ===>

increase in MHI longline catch levels

===> potential decrease in troll/handline catch rates

===> potential decrease in catch rates for current longliners

Figure VI-4. Reduced gear conflicts

Amendment 7 limited entry program, dual permits and open access ===>

increased MHI longline fishing activity

===> potential increase in interference with troll/handline fishing activity

Swordfish dual permit options ===>

increase swordfish activity in limited areas

====> potential increase in **intra**-longline gear conflicts

****

Figure VI-5. Market competition

Continued moratorium ===>

Continued reduction in longline tuna fishing effort

===> Potential reduction in competition with troll/handline tuna

===> Potentially higher tuna prices to troll/handline vessels operators

Amendment 7 limited entry program, dual permits and open access ===>

===> Potential increase in competition with troll/handline tuna

===> Potentially lower tuna prices to troll/handline vessel operators

Figure VI-6. Hawaii seafood volume

Continued moratorium ===>

Continued reduction in longline tuna fishing effort

===> Potential reduction in availability of high-value tuna for local consumption and export

===> Decreased income for local wholesalers

===> Increased fresh tuna prices for local consumers

Amendment 7 limited entry program, dual permits and open access ===>

===> Likely increase in availability of high-value tuna for local consumption and export

===> Increased income for local wholesalers

===> Continued increase in swordfish landings

===> Increased income and employment for local wholesalers and brokers

Figure VI-7. Shoreside provisioning

Volume of services

Continued moratorium ===>

Reduction in fleet size

===> Reduction in volume of

--- fleet repair {shipyard, etc.}

--- provisioning {fuel and oil, ice, supplies, etc.}

===> Potential decrease in waiting time for some services

{for example, annual haul-out}

===> Potential increase in some costs to all segments of pelagic fleet

{for example, loss of ice machine or increased charge due to sub-optimal operating levels}

Amendment 7 limited entry program, dual permits and open access ===>

Increased fleet size

===> Increased volume of fleet repair and provisioning

===> Potential delays in obtaining some services {for example, annual haul-out}

Figure VI-7: Shoreside provisioning (continued)

Dockside logistics

Continued moratorium ===>

Reduction in fleet size

====> reduced off-loading & re-supply problems dockside

Amendment 7 limited entry program, flexible permits and open access ===>

Increase in fleet size

====> off-loading & re-supply problems dockside

--- too many boats for existing harbors

{evaluated as increased time spent loading and off-loading per trip}

Figure V-8: Risk of Overfishing

Swordfish

Continued moratorium ===>

No increase in risk

Amendment 7 limited entry program, dual permits and open access ===>

Potential risk of over-fishing
{Hawaii landings large percentage of total Pacific-wide catch}

===> lost income to existing and new longliners

===> possible shift of fishing into tuna

===> potential impact on MHI EEZ fisheries

==========

Tuna and other pelagics

{Hawaii landings are small percentage of Pacific-wide total, thus limited or no risk of Hawaii fishery leading to over-fishing for these species}

Table VI-6: Hawaii longline cost-earnings statement (updated to 1992) average, annualized, full-year operations

Income Statement	Mid-sized Hawaii Longliner[6]	
Revenue		$519,000
Fixed Costs		$206,400
Capital	$75,800	
Annual Repair	$24,500	
Vessel Insurance	$47,400	
Administrative	$26,700	
Other	$32,000	
Operating Costs		$364,493
Fuel & Oil	$54,300	
Bait	$64,200	
Ice	$23,700	
Handling	$38,793	
Provisions	$19,100	
Gear and Supplies	$39,600	
Other	$6,600	
Crew income	$109,100	
Captain's Bonus	$9,100	
Total Cost		$570,893
Net Revenue		$- 51,893

Operating Characteristics (next page)

[6] Costs of operations for a longline vessel was modeled using a Class II NWHI lobster vessel as a prototype (Clarke and Pooley 1988)

Table VI-6(cont). Updated to 1992 costs and operations, 1987-90 hypothetical, annualized (full-time operations)

Operating Characteristics (Weighted average)

Investment			$500,000
Trips	15		
Catch per day	1,747		
Trip Days	224		
Fishing Days	134		
Turn-around days	90		
Shipyard, etc	51		
Total Days	365		
Shared Operating Costs			$246,293
Crew share	40.0	%	
Crew	6.00		
Labor income			$188,200
Total income			$66,307
Return on Investment	-10.38	%	
Handling rate	7.47	%	
Revenue			$519,000
Product Price per pound	$2.23		
Total Catch	234,000		
Total Hooks	135,439		
Capital factor	11.03	%	
Depreciation factor	6.67	%	
Inflation factor (1992 to 1990)	1.19		

Table VI-7: Hawaii small-scale troll/handline cost-earnings statement
Updated to 1992 costs and operations.
Annualized (full-time operations) 1987-1990 hypothetical

Income Statement	Small-scale troll-handline	
Revenue		$39,378
Fixed Costs		$18,000
Capital	$9,600	
Annual Repair	$3,900	
Vessel Insurance	$2,900	
Administrative	$1,600	
Other	0	
Operating Costs		$32,228
Fuel & Oil	$10,100	
Bait	$3,600	
Ice	$2,800	
Handling	$3,938	
Provisions	$2,200	
Supplies	$5,300	
Other	0	
Crew income	$3,432	
Owner-operator income	$858	
Total Cost		$ 50,228
Net Revenue		$ -10,850

Operating Characteristics (next page)

Table VI-7 (cont). Operating Characteristics (Weighted average)

Investment			$58,143
Trips	150		
Catch per day	156.43		
Trip Days	150		
Fishing Days	150		
Turn-around Days	150		
Total Days	300		
Shared Operating Costs			$27,938
Gross revenue (ex-vessel)			$39,378
Crew share	30.0	%	
Crew	2.00		
Labor income			$ 4,290
Total income			$-6,560
Return on Investment	-18.66	%	
Handling rate	10.00	%	
Revenue			$39,378
Product Price per pound	$1.68		
Total Catch (lb)	23,465		
Capital factor	11.03	%	
Depreciation factor	6.67	%	
Inflation factor	1.50		
Fuel price factor	1.28		

As discussed previously although the results in this section are calculated *quantitatively*, the overall assessment of the effects should be *qualitative* because of the weakness of the information on which these effects are being analyzed.[7]

VI.C.2.a. Income of longline fishing vessels.

There are two types of costs and benefits likely to accrue to the longline segment of the Hawaii pelagic fishery due to the proposed regulatory alternatives: increased income (or at least augmented income) to longline vessels included in the Hawaii fishery, and lost income to the longline vessels excluded from the Hawaii fishery. The increment in longline industry revenue in the four regulatory alternatives can be calculated from Table VI-4, but the existing economic analysis of the profitability of individual longline fishing vessel suggests that the average Hawaii longliner is failing to make an economic profit, although it is covering operating costs (Table VI-6). It is likely that loosening permit transferability or upgrading restrictions would reduce the average costs of operations for Hawaii longline vessels, either as permit holders invest in improvements to existing longline vessels or as inefficient operations sell their permits to more efficient operators and leave the fishery. Unfortunately, too little is known about the range of operating economics of the whole Hawaii longline fleet to make estimates of these improvements. The collection of such information is part of the research needs identified in Appendix 2.

In terms of the loss of income for excluded Hawaii longliners, at the time of the initial moratorium, the impact assessment argued that the 30 *excluded* longline vessels already resident in Hawaii would incur substantial relocation costs if the moratorium were implemented. Those are now sunk costs and should not be considered in this amendment. However there are also 43 inactive, but permitted, longline vessels in Hawaii. These vessels may be inactive because of the permit transferability restrictions involved in the current moratorium or because of other factors. If the moratorium is extended, they would then incur relocation costs to other fisheries (along the same lines as argued in the impact assessment for the current moratorium). These costs amount to approximately $75,000 per vessel on a one-time basis.

It is still the case that fishing vessels in Hawaii and from the mainland US were entering the Hawaii longline fishery at dramatic rates in the late 1980s before the moratorium. As mentioned earlier, it is assumed that there would be as many as 200 additional longline vessels in the fishery without a moratorium or limited entry.

In the open access alternative, these vessels will be able to join the Hawaii longline fleet and generate incomes in Hawaii. With the Amendment 7 limited entry program or a continued moratorium, they will not be allowed to enter the Hawaii fishery, but they will be able to continue in whatever fishery they are currently in. East and Gulf

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[7] The calculations used to make the individual estimates are contained in a Supercalc 5.0 spreadsheet, RIR3z.cal (10 October 93) maintained by Sam Pooley, Honolulu Laboratory.

Coast longliners may have been entering the Hawaii fishery because of better fishing conditions in Hawaii, and the exclusion of these vessels would mean they have lost an opportunity for income. However, a simple comparison of average catch rates for Atlantic coast yellowfin longliners (Prager and Browder 1992) with Hawaii tuna longline catch rates (Dollar 1992) suggests that the differences in catch rates are not the only reason longliners came to Hawaii. Therefore, no opportunity costs are estimated for this analysis.

VI.C.2.b. Catch rates (CPUE).

As pointed out in the original impact assessment (Pooley, unpubl.) and in other parts of this amendment, no statistically valid relationship between catch rates and expanded longline catch and catch rates in the longline fishery or other fisheries has been identified. Similarly, there is no evidence of catch competition within the longline fishery, although experience in the Atlantic suggests that substantial increases in fishing effort may diminish longline catch rates (or size of fish) in the long-run (Berkeley 1989). The impact of increased longline catch on the catch rates of the originally permitted longline vessels, using the methodology discussed below for the longline and troll/handline catch competition analysis (extension of Pooley and Yoshimoto 1991), is positive but statistically insignificant (i.e., increasing longline catch leads to increasing longline catch rates)[8]. Therefore for this impact assessment, the impact of increasing the size of the longline fleet through the restricted entry or open access alternatives is judged to be zero.

Pooley and Yoshimoto (1991) examined the available information on catch competition between the longline and troll/handline fleets using a four-year sample of monthly landings from the two fleets. Extending that analysis for the initial and for the current RIR, no statistically-valid relationship could be found between longline catch and troll/handline catch rates[9]. The statistically-insignificant relationship indicated that a 100% increase in MHI longline tuna catch per month would lead to a 5.6% decrease in troll/handline catch rates. For example, increasing MHI longline tuna landing by 100,000lb (a 50% increase over the sample period) would reduce Oahu total catch per trip by 4.4. pounds (from a sample average of 155.6 lb). A stronger relationship may exist, but it may be shielded by natural variability in the pelagics fisheries and by the short time-series of detailed information available for the Hawaii analysis.

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[8] The impact is statistically insignificant, with the coefficient on the trips variable being positive; presumably an unexamined influence, such as changes in the composition of the longline fleet during the three year period or unidentified seasonal and annual variability in the catchability of pelagics, "explains" this anomaly.

[9] The "strongest" relationship was between Oahu troll catch per trip (CPT) and longline tuna catch, but only 5/10 of 1 percent of the total variation in Oahu CPT was "explained" statistically. The t-statistic is insignificant at the 90% confidence level. (S. Pooley, NMFS Honolulu Laboratory, personal communication, 1993).

The potential impact of an extended moratorium or a limited entry program on catch rates for the remaining longline and troll/handline fishing vessels depends on both the potential number of excluded longliners and where the excluded longliners would have fished. The three basic scenarios in this amendment and the two major alternative locations in which they could fish (inside and outside the main Hawaiian islands EEZ) would mean different effects of the amendment. For the purposes of this section, it will be assumed that only changes in longline catch inside the MHI EEZ might affect troll and handline catch rates, and the distribution of fishing effort will parallel that identified in the Longline Permit Transferability Workshop. The chance that an alternative distribution of fishing effort (i.e., substantially more fishing within the MHI EEZ) might occur is considered under the risk of over-fishing swordfish stocks.

Table VI-8 indicates the simulated relationship (using the relationship described above) between longline tuna landings and Oahu troll/handline catch under the four alternatives.

Under the continued moratorium alternative there would be continued attrition in the fleet, with total longline tuna catch declining by 15% overall, and 23.5% in the MHI EEZ (compared to the current situation). The loss to the longline fleet was considered in the previous section. The benefit to the troll and handline fleet would accrue from increased catch rates due to less catch competition. The troll/handline catch rate would be 158.3 lb/trip (compared to 156.4 in the simulated current situation), with an increase in annual income (net revenue and labor share) per vessel of $417 and an increase in annual ex-vessel revenue of $463 per vessel[10].

The Amendment 7 limited entry program would involve a 25% increase in tuna landings from the MHI EEZ. The decreased troll/handline catch rate would be 154.4 pounds per trip, with a decrease in annual income (net revenue and labor share) per vessel of $451 and a decrease in annual ex-vessel revenue of $501 per vessel.

The dual permits and open access alternative would have similar, but proportionally larger, effects. These are summarized in Table VI-9.

The impact on recreational fishing is unpredictable because no clear relationship has been established between catch rates and the recreational experience. However, Meyer (1987) has shown the hedonic value of recreational fishing to be substantial in Hawaii. For this impact assessment, the potential cost to recreational fishing is considered roughly equivalent to the impact on the small-scale commercial troll/handline impact just evaluated. However, particular effects may exist for some recreational segments, e.g., the Kailua-Kona charterboats and their patrons fish for blue marlin.

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[10] Recalling the definitions of gross revenue and total income discussed earlier.

Table VI-8. Simulated Relationship[11] Between Monthly MHI Longline Tuna Catch and Oahu Troll/handline Catch Per Trip

Scenario	Estimated Monthly MHI Longline Catch (Pounds)	Projected Troll/handline Catch Per Trip (CPT)	
		CPT (lb)	% Change
Current Situation	179,500	156.4	
Continued Moratorium	137,583	158.3	1.2%
Amendment 7 Limited Entry Program	224,667	154.4	-1.3%
Dual Permits	224,667	154.4	-1.3%
Open Access	438,000	145.1	-7.3%

Table VI-9 Change in annual gross (ex-vessel) revenue and total income per vessel for full-time commercial troll/handline fishing boats due to changes in MHI longline tuna catch. ((+) represents increase while (-) represents a decrease)

	Gross Revenue	Total Income
Continued moratorium	+ 463	+ 417
Amendment 7 limited entry program	-501	- 451
Dual Permits	- 501	- 451
Open access	- 2,865	- 2,578

[11] Oahu Total CPT = Constant +/- B * longline tuna catch, where the constant equals 164.325 and B equals -0.000044.

VI.C.2.c. Gear conflict.

The passage of Amendment 5 eliminated most, if not all, of the gear conflicts between longline and troll/handline fishing vessels. The open access alternative, by potentially tripling the longline fleet size, might lead to gear conflicts either amongst longliners themselves or even with some troll/handline vessels (if more longliners chose to fish near the MHI area closures). There is no quantitative information on the impact of these gear conflicts on trollers and handliners, or between longliners. However, for purposes of evaluation, it is assumed that one day of fishing per commercial troll/handline vessel affected would be lost every month due to gear conflicts in the case of open access (with a potential tripling of the total active longline fleet operating in the EEZ). The cost per troll/handline vessel in recovery of lost fishing time is about $3,150 in gross revenue and $343 in net income per year. However, since the overwhelming majority of small-boat fishermen fish within 20 miles of shore and longliners are prohibited from fishing within 75-50 miles from shore most of the year, few troll/handline fishermen would be expected to be impacted. The greatest risk of increased gear conflict would be due to undetected illegal fishing. No impact is estimated for the growth in the active longline fleet other alternatives since the fleet allowed to fish inside the MHI would be fixed at 166 vessels or less.

Other permit combinations, (such as dual permits with relatively open access for "B" permits) might cause conflict on the swordfish grounds whenever swordfish are not abundant. This is evaluated as losing one day per month to such gear conflicts[12]. This amounts to $4,300 per vessel in lost income per year.

VI.C.2.d. Market competition

Many local commercial trollers and handliners believe there has been a substantial reduction in their market price due to increased longline catches. This effect is not clearly identifiable using annual data for 1980-92. Furthermore, there is a strong argument by people in the Hawaii seafood market sector that the market segments served by the longline and troll/handline vessels are substantially different. However, changes in species composition and intra-monthly factors may be masking the impact.[13] Nonetheless, since most of the increased longline catch has been exported to the mainland USA and to Japan, it is not surprising that evidence of a price effect is not easily determined. Study of this issue was proposed as part of the three-year research plan of the Pelagic Plan Team (Appendix 2).

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[12] Calculated as adding 0.8 at-sea days per trip.

[13] For example, Pooley (1987) found a strong weekly effect in bottomfish landings and prices where a monthly and annual effect was minimal.

In preparing the previous impact assessment, Pooley (unpubl.) found a small (although still statistically insignificant) effect for all species combined (instead of just yellowfin tuna): an 18% decrease in fishing effort and catch by the longline vessels excluded by the moratorium could increase market price by 1% for troller and handliners. The impact of such competition on Hawaii's pelagic fish consumers is unknown.

Under the Amendment 7 limited entry program, troll handline prices would decrease 1.7% due to increases in overall longline landings. Under the Dual permits alternative, troll/handline prices would decrease by 1.7%. Under the Open Access (tripled active fleet) alternative, troll/handline prices would decreased by 9.2% The losses in annual total income (labor share plus net revenue) per year for commercial troll/handline boats are identified below.

	Annual loss in Total Income per commercial troll/handline vessel
Amendment 7 Limited Entry Program	$1,123
Dual Permits	$1,123
Open Access	$2,169

The impact on consumers, in terms of availability of fresh fish and higher prices, is unpredictable because a) retail mark-ups are not known, b) substantial volumes of the longline caught fish are "exported" to markets (i.e., the US east coast) where there is sufficient competition to make the impact of the Hawaii component uncertain, and c) imported fresh pelagic fish seems to be increasingly available on a world scale.

Thunberg and Seale (1992) developed an empirical model of swordfish demand and supply on the east coast of the US. Their research timeframe (1984-1990 monthly data, 1978-1990 quarterly data) pre-dated the development of the Hawaii swordfish fishery, but does contain some useful information on the swordfish market. Thunberg and Seale found that the price elasticity of demand for swordfish was -0.85, meaning that a 1% increase in the swordfish prices would decrease consumer demand by 0.85%. Furthermore, there was a strong seasonal effect, with demand for swordfish being strongest from July through December. Finally, the price flexibility of supply was found to be -0.93, meaning that a 1% increase in supply would decrease price received by 0.93%. This suggests that further development of the Hawaii swordfish fishery would have to be tempered by the impact of competition with the Atlantic fishery.

VI.C.2.e. Seafood market volume and revenue

The greatest change in Hawaii seafood market volume and revenue since the initial moratorium has been a change in the species and gear composition of pelagic landings. In particular, the availability of high-value yellowfin and bigeye tuna has declined.[14] The Continued Moratorium would be expected to continue this trend, with tuna landings diminishing by 15% and total landings by 10%. This would reduce income to the seafood market sector (wholesalers, retailers, brokers, etc.) by reducing their volume (adding to per unit fixed costs) and by reducing labor income for handling and processing pelagic product[15].

The seafood market revenue and income impacts are summarized below:

	Annual Gross Revenue -- Seafood markets[16]	
	$million	
	Tuna	Total
Current Situation	30	54
Continued Moratorium	25	49
Amendment 7 Limited Entry Program	40	74
Dual Permits	62	125
Open Access	85	167

[14] Longline landings of bigeye and yellowfin tuna decreased by 12% from 1990 to 1992. Inflation-adjusted longline revenue, excluding swordfish, peaked in 1989 at $25.3 million (1992 $), falling to $20.5 million in 1992. Bigeye tuna revenue, however, has remained essentially stable from 1989 to the present.

[15] Although the final value added through the wholesaling, processing, and retailing process is not clearly known, value-added is calculated as 20% of the ex-vessel revenue for this analysis. Cooper and Pooley (1983) found wholesale mark-up on fresh product in the Hawaii market as 9% on volume, and Higuchi and Pooley (1985) found retail mark-up as 10% on volume. Value-added income is estimated at 10% of the total mark-up. This is a purely hypothetical figure.

[16] Estimated as 20% more than ex-vessel gross revenue.

	Annual Mark-up Income -- Seafood markets[17]	
	Tuna ($1000)	Total ($1000)
Current Situation	500	900
Continued Moratorium	400	800
Amendment 7 Limited Entry Program	660	1,200
Dual Permits	1,000	2,100
Open Access	1,400	2,800

VI.C.2.f. Shoreside provisioning and infrastructure

The same kind of impacts would be felt on shoreside provisioning (supplying fuel and oil, equipment, bait, provisions, etc., as well as shipyard services). If we view this as the annual cost of repairs and operating expenses for a longline fishing vessel, then various Hawaii suppliers would lose income for every longline vessel excluded form the fishery[18]. The estimated value-added income for each scenario is presented below[19]:

$1,000 in value-added income to Hawaii suppliers[20]

Current situation	326
Continued moratorium	273
Amendment 7 Limited Entry Program	430
Dual permits	669
Open access	924

[17] Estimated as 10% of mark-up.

[18] Whether there would be an increment of income to Hawaii trollers and handliners is not known.

[19] Figures were estimated using percentages of gross revenue for the longline fleet.

[20] Based on a 10% supplier income on 25% value-added.

In addition, Honolulu has limited dock space. Queuing problems already exist, in terms of waiting for space along the wharf. An increased longline fishing fleet would exacerbate these problems, perhaps reducing the number of fishing days available to a vessel over a year. If we assume that one-half day would be lost per trip, due to queuing in the absence of a complete moratorium, thus reducing the number of trips per year, then the annual loss per vessel in lost fishing time would be $9,000 per year in lost net income.

VI.C.2.g. Risk of overfishing

One reason for the initial moratorium was a conservation concern related to the main species landed by the rapidly growing longline fishery. Of the various species taken in Hawaii's longline fishery, only landings of swordfish are a significant percent of the Pacific-wide stocks. There is no way to estimate either the risk of overfishing or its economic cost at this time. The level of risk is probably a function of the number of longline vessels in the fishery. Under the Continued moratorium alternative, only the 1% probability of over-fishing is considered likely. Under the Amendment 7 limited entry program, a 5% probability is evaluated, and under the Dual permit and Open access alternatives, 10%. In this case "over-fishing" is considered to be the collapse of swordfish availability, so that its catch rate is zero.

The economic cost will be evaluated as the relocation cost incurred by the Hawaii pelagic fishery of a shift of half the swordfish fleet back to mainland US fisheries and the cost to the remaining Hawaii fleet of a zero catch rate for swordfish. The cost of shifting into mainland US fisheries by swordfish longliners choosing to give up the western Pacific is evaluated as equivalent to the costs identified for the excluded longliners (effect #1): $ 75,000 per vessel, one-time sunk cost.[21] The effect of shifting half of Hawaii's longline swordfish fishing effort into Hawaii's longline tuna fisheries is a per vessel annual loss of $15,000 in net revenue and $27,000 in total income (including labor share) should the swordfish fishery collapse.[22]

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[21] This cost is pro rated across 10 years in the estimation of fleet-wide impacts using a present value calculation of 10% discount rate.

[22] These costs are also evaluated on a 10-year basis and discounted in present value terms.

VI.C.3. Fleet- and industry-wide impacts

The following section provides a qualitative ranking of the management options. This section applies estimates of per vessel costs or benefits (as discussed in the previous section) to estimates of total fleet size (Table VI-5) and independent industry-wide estimates (e.g., market impacts). The relative impacts of the four alternatives (continued moratorium, limited entry with unrestricted transfers/upgrades, dual permits and open access) evaluated across the seven possible economics effects, are displayed in Table VI-10. The impacts are presented qualitatively to indicate which types of effects are likely to have the greatest and least impact and which types of vessels and segments of the industry are likely to be affected the most and the least.[23] It must be re-emphasized that the quantitative basis for making these qualitative comparisons is extremely weak, but it is the best available information.

Another fleet-wide potential problem is over-capitalization, i.e., more resources are expended than are required to efficiently harvest the available resources. Over-capitalization leads to reduced profitability to individuals as well as decreased benefits to the nation. The relative risks of over-capitalization was calculated using the results of the simulation model (Table VI-3). The Amendment 7 limited entry program had a relatively low risk factor (ranking of 2), second lowest only to the continued moratorium alternative (rank 1). The dual permit alternative had a greater relative risk (ranking of 4), second only to the open access alternative (rank 5).

VI.C.4. Separable issues

There are several other economic and social issues which deserve further discussion:

VI.C.4.a. Transferability of permits

The original moratorium allowed permits to be transferred only once with the sale of the vessel during the three years of the moratorium. Alternatives would be for permits to be freely transferable or not be transferable at all. This issue was addressed several times by the Council during the current moratorium, with no changes being made in the permit transferability rules. As discussed above, the most recent discussion of permit transferability addressed four alternatives, including freely and non-transferable permits, and harvesting capacity upgrading and harvesting upgrade restrictions.

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[23] Although the effects are presented qualitatively to stress their conjectural characteristics, they were actually quantified. The range of effects, except for the increase in longline income due to expansion of the fleet, is form minus $1.0 million to plus $1.2 million. The impact of the alternatives on longline fleet net income ranges from minus $1.2 million to plus $16 million.

Table VI-10. Hawaii Longline Limited Entry Alternatives: Summary of Potential Effects. Relative income gain/loss from management alternatives.

Effect	Continued Moratorium	Limited Entry	Dual Permits	Open Access
1. Longline Vessel Income				
Included Longliners	- - - -	+++++	+++++	+++++
Excluded Longliners	- - -	- -	0	0
2. Catch Competition				
Longliners	0	0	0	0
Troll/handline	0	0	0	- -
3. Gear conflict				
Longliners	0	0	0	0
Troll/handline	0	0	0	-
4. Market Competition				
Longline	0	0	0	0
Troll/handline	++	-	-	- - -
Mainland longline	??	??	??	??
Mainland consumer	??	??	??	??
Hawaii consumers	??	??	??	??
5. Seafood market volume effects				
Hawaii wholesale	- -	++	++++	++++
6. Shoreside provisioning and infrastructure				
Hawaii suppliers	-	++	+++	+++
Longline queuing	0	0	- - -	- - -
7. Risk of overfishing				
Swordfish longliners	0	-	- -	- - -
Remaining longliners	0	-	- -	- -
Troll/handline	0	0	0	-

The economic essence of the transferability issue is whether a permitted longline fishing vessel has an equivalent asset value outside the Hawaii longline fishery. Restricting the transferability of longline permits may have other impacts, such as reducing the fleet size by attrition and redistributing income and wealth, but these impacts are directly related to the asset value issue. A longline fishing vessel is an asset whose income is based on the ability of the vessel to fish productively. Any limitation on the flexibility of vessel use diminishes its value as an asset. With the two main alternative fisheries in Hawaii under limited entry regimes (NWHI lobster and bottomfish), the primary alternatives under a restricted permit transfer system are mainland US fisheries, but many of these fisheries are also under limited entry regimes. Although the first sale of a Hawaii longline fishing vessel under the proposed regulation would not be restricted, the buyer would have to discount the value of the vessel since his/her options for re-sale are limited. The vessel would either have to leave the fishery after a second sale, or the new owner would have to expect that the permit transfer restriction would be lifted at the end of the moratorium.

There is no precise way to evaluate this risk. For discussion purposes, however, the risk might be viewed as equivalent to the difference between the prime interest rate charged by banks to their best commercial customers (10.0%) and the consumer interest rate (18% in Hawaii). The difference, 8%, applied to the value of the average Hawaii longline fishing vessel would be $40,000.

Experience has shown that some 10% of fishing vessels in Hawaii change hands annually. Using a sequential probability, 30% of the current fleet might change hands once, and 3% more than once during the three years of the moratorium. The potential fleet-wide effect of a continued restriction on permit transfer would be $168,000 under a single-transfer proposal, and $1.7 million under a no-transfer alternative, compared to the free transfer alternative.

No evaluation of the effects of restrictions on harvesting capacity is undertaken, since these are essentially equivalent to limiting or increasing fleet size. However, there is a potential safety factor involved in restricting the ability of owners to upgrade their vessels. The economic costs of accidents at sea are clearly secondary to the human costs and are usually "estimated" in litigation. There are currently two cases of NWHI lobster vessels that sank and these may provide some information on the economic cost of the risk associated with vessel safety.

VI.C.4.b Socio-political considerations

Independent of the direct economic effects of the alternative management scenarios, several sociological and political considerations should be discussed which are peculiar to the Hawaii fishery. These considerations have not been evaluated even in a qualitative manner, but their potential effects are highlighted in terms of whether they support the benefits or costs of the management alternatives.

Native Hawaiian rights

The circumstance by which the USA gained control in 1898 of Hawaii, formerly an independent nation, and the current socio-economic status of native Hawaiians, suggest that the effort limitation alternatives should be evaluated in terms of differential impacts on native Hawaiians.

First, the reservation of some longline permits for native Hawaiian fishermen or corporations could be considered as an partial "remedy" for past grievances and the current socio-cultural deprivation. Reservation of permits suggests that the costs of the moratorium alternatives to other groups of longliners would be greater (since fewer permits would be available) or that the benefits to the remaining longline and troll/handline vessels would be less (because more permits in total would be issued), both corresponding to a relatively higher level of benefits for native Hawaiian longline fishermen.

Second, there may be a non-pecuniary impact of continued longline fishing on rural native Hawaiian communities. To the extent that longline fishing diminishes the fishing experiences and subsistence values of ika-shibi and palu-ahi handline fisheries, the impact of the moratorium alternatives on rural native Hawaiians argues for a more liberal approach toward evaluating the costs of expanding longline fishing.

Traditional fishing practices

Independent of the native Hawaiian rights issue is that of traditional fishing practices in Hawaii. Longline fishing was introduced to Hawaii by Japanese immigrants shortly after the turn of the century. For those early Japanese immigrants, fishing was an important alternative source of employment, and a means for developing small businesses. Furthermore, tuna and billfish landed by longline fishing vessels have played a key role in the assimilated Japanese-American culture in Hawaii. Limits on the capability of the ancestors of these immigrants to continue and expand their participation in the longline fishing and seafood marketing have a subtle, but important, socio-political impact in the community. A similar situation pertains to Korean immigrants who became the mainstay of the traditional sampan longline fleet in the late 1970s and in the 1980s. Consideration of these factors suggests a more conservative evaluation of the benefits of the effort limitation alternatives to the extent that the alternatives reduce the ability of these ethnic groups to expand or continue their participation in the longline fishery.

Troll and handline fishing has been part of rural communities in Hawaii for decades, including the role of charterboat and recreational fishing. Consideration of the potential effect of increased longline fishing on these communities suggests a more liberal evaluation of the benefits of the alternatives.

Hawaii fisheries have always been socially heterogeneous, and community-based means of "patrolling" the ocean have been common. The intrusion of large numbers of longline fishing vessels into Hawaiian waters has upset the balance by which large-scale commercial fishing operations and small-scale commercial, subsistence and recreational fishers have been traditionally able to mediate their inter-relationships. Consideration of this effect also suggests a more liberal evaluation of the benefits of the moratorium alternatives.

VI.D. Administrative Impacts

Most of the administrative elements (and their associated costs) now in place under the current three-year moratorium would continue under the proposed amendment, as follows:

VI.D.1. Limited Entry Permits

The Southwest RD would continue to administer the limited entry permit program. By eliminating the dual permit requirement (i.e., a limited entry permit for the Hawaii-based fishery would meet the requirement for a general permit for all other areas under the Council's jurisdiction), there will be no need for an annual renewal of longline permits, and confusion for the fishermen should be reduced.

The elimination of documentation requirements that were required for many in qualifying for initial permits will be a reduction in permit administration. Further, the liberalization of permit transfer rules will reduce the burden of determining if a transfer is permissible and maintaining and reviewing files concerning transfers. There will be no need to determine if ownership of the underlying interest in the vessel had changed. However, the permit process will require more documentation as permits will be transferable apart from the vessels. There will have to be a central register of permit holders, and the register will have to be maintained as closely as the current permit register.

The cost of administering the limited entry permit program varies annually and depends on changes to direct and indirect costs incurred by the Southwest Region. The amount of fee levied by NMFS to administer the program is determined according the established Federal (NOAA, US Department of Commerce guidelines governing cost computation associated with permit product and services provided by the Southwest Region. The guidelines require in the computation direct labor costs of all NMFS personnel involved in the administration of the Western Pacific longline permit program including wages, compensation, cost-of-loving adjustment, supplies and materials, postage, printing etc. and indirect costs such as NOAA support, rent, etc. The initial cost for administering the Hawaii longline limited entry permit program is estimated to be between $40-$50 per application.

VI.D.2. Enforcement

NMFS Enforcement and the US Coast Guard now estimate that about 50% of the total fisheries enforcement effort in the region is directed to the pelagic fisheries, and most of this effort is directed to the longline sector. The total estimated expenditures are $1.5 million, excluding vessel patrols.

VI.D.3. Plan Monitoring and Review

The Council Pelagics Plan Team includes members from all island areas as well as NMFS staff in Honolulu. The Plan Team prepares the annual report required under the FMP and in-season reports, as needed. The Council budget includes funds for travel and staff support for non-NMFS members of the Plan Team. In addition, about one-third to one-half of all Council meetings and associated costs are spent on pelagics-associated issues, including this and future amendments, annual reports, and documentation under the framework procedures to address in- or between-season problems. The estimated annual cost of monitoring the plan is about $300,000 per year for the Council. NMFS scientists and staff also made major contributions to the development of this amendment, and will continue to participate on the Plan Team and prepare reports for the Council, at an estimated cost of $100,000 per year.

The adoption of the framework process should result in some savings in administrative costs. The process focuses the public review function at the Council level and reduces the extent of publication of proposed and final rulemaking in the Federal Register. The magnitude of change cannot be predicted because the number and nature of potential changes through the framework process on an annual basis cannot be predicted. In the past, however, there have been as many as six actions with proposed and final rules in one year; if a single publication could have sufficed for half these cases, there would have been a savings of about 15 pages of Federal Register publications or $5625. More important, however, is that the amount of time between the identification of a problem and the implementation of a solution could be reduced by 45-90 days, depending on the nature of the action and the extent to which it might be delayed in the many steps required to promulgate rules. There is no way to quantify what these savings might mean to the fishermen or the living marine resources involved.

VI.D.4. Reporting Requirements

NMFS receives and processes longline logbooks and provides reports to the Council. The estimated cost of this data processing and reporting function is about $65,000 per year.

VI.E. Vessel Safety

The restrictions on vessel upgrading that were in place during the moratorium have resulted in vessel safety concerns, particularly for small vessels having to fish beyond 50-75 miles because of MHI area closures and vessels which may wish to travel to distant water swordfish grounds. The proposed limited entry program will enhance vessel safety in the longline fishery since it will provide a mechanism for upgrading to the length of the longest vessel active during the moratorium.

VI.F Impact on Protected Species

The available data do not permit a specific determination of the impact the longline fishery will have on protected resources. Observers placed on longline vessels by NMFS have documented takes, but the level of observer coverage has not been sufficient to establish a basis for an estimate of total take that has known confidence limits. Fishermen have reported takes in logbooks, but reporting may be incomplete. Section III.G. provides information on the status of protected resources and reported rates of take of different protected species in the longline fishery.

In the Biological Opinion and Incidental Take Statement (Appendix 3), NMFS provides information concerning the estimated rates of take of turtles in a number of longline fisheries throughout the world. The range of rates of take is extremely broad, and it is not known which (if any) is most representative of the rate that actually occurs in the Hawaii-based longline fishery. It is noted that the May 1991 Biological Opinion estimated turtle takes in the Hawaii longline fishery was based on the rate reported for the Gulf of Mexico longline fishery. However, for the 1993 Biological Opinion, NMFS uses the rate of take observed on longline vessels in the waters around the Hawaiian archipelago. Again, it is not known which of these rates is more representative of the rate actually experienced by the longline fishery, especially now that the some of the areas where takes were observed are now closed to longline fishing. Nonetheless, NMFS based its incidental take limit under the new Incidental Take Statement on a rate of take of 0.061 turtles per 1,000 hooks, with an estimated mortality rate of 0.012 turtles per 1,000 hooks.

The actual level of take of turtles that will occur under the proposed action cannot be predicted with any confidence until additional information is available through the mandatory observer program now being established. The level and rates of take will depend on the amount of fishing effort, its distribution, and possibly seasonal shifts in fishing effort and the vulnerability of turtles to incidental capture. If the rates of take and mortality used in setting the allowable take under the 1993 Biological Opinion are applied to the estimated level of fishing expected to occur under the proposed action, the total turtle take would be 939 turtles, with mortality of 373 turtles. If the rates used in the 1991 Biological Opinion are used, total turtle take would be 277 turtles with mortality of 33 turtles. If the reported rates of take are used, the level of take would be between 28 and 29 turtles.

While it is unknown whether the level of take will exceed the level under current conditions, the number of active vessels may increase for two reasons. First, the eligibility criteria are expected to encourage some inactive vessels to be activated so that, if nothing else, the owner subsequently can have a new limited entry permit for possible sale. Second, the allowance for upgrading is expected to result in some permit holders obtaining new vessels capable of fishing beyond nearshore grounds now closed to longlining, while others may upgrade vessels in order to participate in the swordfish fishery. However, it is unlikely that all vessels will be active, particularly in the short term. Buying a new vessel or enlarging an exisiting vessel requires a substantial financial commitment. In addition, some permit holders are actively involved in alternative fisheries (e.g., the lobster fishery).

Total effort (measured by total hooks deployed) may not increase, even if participation increases. While more vessels may be active, the average hooks per vessel could drop if there is a shift from smaller vessels to larger vessels which generally set fewer hooks per day when fishing for swordfish. In fact, in 1992, the average small vessel set 116,000 hooks compared to 88,200 and 92,400 for the average medium and large vessel, respectively.

Only with the collection of observer data will it be possible to determine the actual total turtle take and rates of take by species and area. The proposed framework procedures are intended to provide the Council and NMFS with the ability to respond rapidly to new information demonstrating a need for action to protect threatened and endangered species. For example, observer data might provide a basis for implementing seasonal closures or gear restrictions to prevent excessive take of sea turtles. The framework procedures would allow rulemaking to deal with such problems rather than requiring an amendment to the FMP.

The take of seabirds would be expected to increase compared with current conditions. There are no data on rates of take other than reported takes (see III.G.). In 1992, a total of 100 birds were reported taken in the fishery at a total fishing effort of about 11.6 million hooks. Using this rate of take, if the longline fishery deploys 16.3 million hooks per year under the proposed action, the take would be 141 birds.

The take of whales, porpoise, and other marine mammals is very rare and would not be expected to increase to a significant level under the proposed action. Records from observers will provide a sound basis for estimating the take (if any) of marine mammals in the longline fishery in the future.

VI.G Impacts on Habitat

The fishery as it will operate under Amendment 7 will not affect the habitat of pelagic species or associated living marine resources. Longline fishing occurs over a very large area of ocean. While there may be a net increase in the total longline effort compared to current conditions, and thus, increased fuel use and associated emissions, the increase in emissions will not pose any habitat risks. No habitat components known to be especially important for feeding or spawning will be affected

by the fishery. There may be an increase in discard of offal from gutting and cleaning fish on board longline vessels, but this also will be spread out over a large area. Longline vessel operators must comply with the Marine Plastic Pollution Research and Control Act and, therefore, are prohibited from discarding plastic light sticks at sea. Marine habitat quality is expected to remain high under the FMP.

VI.H International Implications

A difficult issue in this amendment is the extent to which regulations should be imposed on US fishermen on the high seas. The Magnuson Act provides authority to manage fisheries beyond the EEZ, provided there is some clear linkage to the achievement of optimum yield from the portion of the fishery on the same stocks in the EEZ. In this instance, fishing with longline gear on the high seas for swordfish and tuna clearly has a linkage with fishing in the EEZ for swordfish, tuna, and other large pelagics. Vessels fishing outside the EEZ employ Hawaii residents, buy supplies from Hawaii businesses, and off-load their fish in Hawaii. Their activities are important to the economy of Hawaii. The volume of their landings may affect prices paid for fish landed by vessels fishing within the EEZ. Many vessels that fish outside the EEZ spend some time fishing in the EEZ, as well. Catches made outside the EEZ may affect the status of stocks in the fishery management unit and may affect the catches by vessels fishing in the EEZ.

However, it is not clear that there is a strong basis for regulating US fishing or effort on the high seas. There are no convincing signs that US catches are affecting the stocks, although such impacts could be occurring without detection, due to a lack of data on the status of stocks throughout their range. There also is no clear evidence that catches outside the EEZ are affecting catches inside the EEZ. The impact of longline landings from outside the EEZ on prices received by vessels fishing in the EEZ also is not established. Under these circumstances, it is not clear that anything is gained by controlling access to the waters outside the EEZ. In fact, it is probably to the nation's benefit if the fishery outside the EEZ continues to grow if that can be accomplished without serious harm to fisheries in the EEZ and without adverse impacts on the stocks.

Further, it could be viewed as disadvantageous to US fishery interests if US access to high seas fishing areas were curtailed when there is no similar constraint on foreign fisheries. If there is ever an international agreement to manage overall pelagic species harvests in the Pacific, it would be in the interest of the USA to be in a position to be able to demonstrate a historic interest in a larger share of the fishery than it now has.

On the other hand, events in other areas of the world demonstrate that achievement of international agreement on conservation and sharing of fishery resources almost always comes only after stocks have been reduced. A case in point is the Atlantic swordfish fishery. That fishery grew rapidly for years, but the international community (in this case, the International Convention for the Conservation of Atlantic Tunas) did not take action until presented with overwhelming evidence that the stock had been

significantly reduced, and that conservation measures were urgently needed. Invariably, such reductions cause both severe economic and social pain, as well as political disruption. It would be in every nation's interest to avoid a repetition of this pattern in the Pacific. The Council and NMFS could demonstrate a leadership role by managing US fishing on the high seas in hopes of getting other fishing nations to enter into agreements to exchange fisheries data and coordinate management efforts.

The concern over the impact of longline fishing on turtles also has international implications. Estimates of turtles takes in the Japanese distant water longline fisheries far exceed those estimated for the Hawaii-based fishery. Reductions in overall turtle-longline interactions will require international cooperation.

The limited entry program proposed under Amendment 7 shows concern about the potential for overfishing and protected species interaction, and takes a leadership position in relation to other countries that impose little restraint on their fisheries on the high seas. On the other hand, restrictions on vessel upgrades may limit the ability of Hawaii-based longliners to participate in the distant-water swordfish fishery throughout the Pacific. Still, some increased harvest of swordfish is anticipated under the proposed limited entry program; this will help generate additional information for stock assessments, information that can be shared with other nations in development of agreements concerning the abundance and yield of pelagic stocks throughout their range. The increased US catches can place the USA in a better position in any future negotiations dealing with allocations through international organizations, though less so than would have been possible under the limited entry alternative with no restrictions on harvesting capacity.

VI.I. Impacts of Other Proposed Actions and Alternatives

VI.I.1. Framework Process

Adoption of an improved framework process should simplify the adjustment of conservation and management measures, and reduce the costs of those adjustments to the federal government. Once the process is in place, many future adjustments could be made with a single notice in the Federal Register rather than through proposed rule and comment procedures. The notice process is faster and entails less cost for Federal Register publications. In addition, there is less administrative cost to the Department of Commerce because the authority has already been delegated to NMFS for many of the required actions. Quantifying the cost savings is difficult because it cannot be predicted how many actions will be taken in the future, but it appears likely (based on past actions) that two or more notices and comment rulemakings each year can be eliminated through the framework process.

This will not reduce the costs to the Council, which will continue to be required to have a sufficient basis for proposing that action be undertaken. In fact, there will probably be more pressure on the Council because the framework process essentially places the full burden for determining and justifying the desired action on the Council.

There will continue to be measures that can be implemented only through "notice and comment" procedures, (e.g. initial application of requirements to a new fishery sector), even if such requirements already apply to some other sector and are readily understandable.

Adoption of the framework processes will not result in any biological, economic or social impacts. Each action taken under the framework processes will entail documentation of the analysis of impacts of that action. To the extent appropriate, the Council will need to prepare regulations, regulatory analyses, environmental assessments, or other documents depending on the scope of the action, which framework process (if any) is being used, and the types and magnitude of impacts involved.

VI.I.2. Allowing Non-permitted Vessels Access to Hawaii Ports

Amendment 7 would allow operators of longline vessels that fish exclusively beyond the EEZ to enter ports in Hawaii to reprovision or conduct repairs. Operators of such vessels would not be allowed to off-load their catch in Hawaii. This alternative is not expected to have any significant impact on the Hawaii-based longline fishery, other fisheries, or the stocks. It does provide to US vessel operators the same port privileges that are afforded to foreign longline vessel operators. To the extent any other longline vessels take advantage of this opportunity, there will be some benefits to shoreside suppliers. However, there is no indication that a substantial number of vessels will choose to operate in this manner.

VI.I.3. Modifying the List of Pacific Pelagic Management Unit Species

Amendment 7 proposed to add selected species to the list of management unit species. This will not affect the manner in which the fishery operates or the stocks involved. However, it will ensure that longline vessel operators record and report their catches of all pelagic species that are in the unit. For example, moonfish are valuable species in the catch, but the amount caught, retained, and sold is not known. Data are, therefore, not available for stock assessments or economic analyses of the fishery. This would be corrected by this action.

VI.I.4. Modification of Optimum Yield (OY) Definition

The proposed revisions to the definition recognizes that OY is defined to encompass fishing by all vessels that fish under the FMP, as amended. As currently defined, OY could be construed to be a result of fisheries that occur under management rules that apply only in the EEZ. This amendment clearly considers the Hawaii-based longline fishery for swordfish and other species beyond the EEZ to be part of the management unit. The revised definition of OY recognizes that all US vessels that fish for pelagic management unit species throughout their range can affect the stocks that occur in the EEZ, as well as beyond, or can affect the fishing patterns and the catch rates and success of vessels that operate primarily in the EEZ. By taking this approach, the

FMP will promote the management of all of the fisheries that operate throughout the range of the target species, involved and not look at EEZ fisheries in isolation.

VI.J Unavoidable Adverse Effects

The proposed action is expected to result in some increase in longline fishing activity and, thus, increased fuel use and associated emissions of waste heat, gases, and water. There will be some added wastes from cleaning of fish at sea. Neither of these results is significant. The proposed action also will result in the take of sea turtles and marine birds. While most turtles are released alive, there will be some incidental mortality (see Biological Opinion). At present, there is no known way to avoid such impacts.

VI.K. Short-term Use of Environment Related to Long-term Productivity

The proposed action is expected to result in achievement of the objectives of the FMP and the achievement of OY (a long-term management concept) from the pelagic fisheries based in Hawaii. The long-term productivity of the stocks taken by Hawaii fisheries will be maintained (to the extent practicable). The longline limited entry program contains mechanisms to adjust fishing effort and/or catch as more information becomes available. Restrictions will be imposed if necessary to maintain the stocks or prevent adverse impacts on other fisheries in the EEZ. The proposed action does not involve short-term use of resources at the expense of long-term productivity.

VI.L. Irreversible or Irretrievable Commitment of Resources

As indicated, there will be irreversible increases in the use of fuel if the longline fishery expands. No other irreversible results are expected. If new information demonstrates a need to curtail the longline fishery (or any other fishery) to maintain the productivity of pelagic fish stocks, action can and will be taken by the Council. Similarly, if it becomes necessary to regulate longline fishing to protect marine turtles, seabirds, or other species, such action also can be taken under the framework procedures of the FMP.

VI.M. Mitigation Measures

The proposed action includes periodic FMP plan evaluations and framework procedures so that problems can be rapidly identified and action can be rapidly taken to adjust fishing effort or catch (or both) to ensure of the long-term productivity of the fish stocks subject to fishing under the fishery management plan and to ensure that any protected species are not jeopardized. The complementary observer program which will be established through existing FMP framework procedures will provide up-to-date information on interactions with protected species and on total catch and discards in the longline fishery, which may lead to improved methods to limit bycatch in the longline fishery.