

## 7.1.5 Anticipated Impacts of the Proposed Management Measures – Environmental Consequences

### 7.1.5.1 Biological Impact Analysis

The following sections describe the expected biological impacts for each management measure described in Section 3.0. Most of the analysis is focused on the primary management measures that will have the greatest effect on mortality reduction: qualification criteria (Section 3.1.2), days-at-sea allocations and trip limits (Sections 3.3 and 3.6.1), and minimum size limits (Section 3.5.1). The synergistic effects of the individual management measures are described in the Rationale for Adoption of the Preferred Alternative (Section 7.1.2.2.1). Options for management measures included in the preferred alternative are discussed within Section 7.1.5. The biological impacts of management measures included only in the non-preferred alternatives are discussed in Section 7.1.5.1.2.

The impacts of non-preferred alternative management measures are based on analyses conducted for the DSEIS, using 1994 and 1995 data. It was impossible to update the analyses of the non-preferred alternatives using 1995 and 1996 data (the same as the preferred alternative impact analysis) in the short time-frame available to develop the Final FMP and supporting documentation. It is not believed that changes in the fishery during 1996 would have significantly altered the conclusions reached in the DSEIS. Portions of those analyses are given in Section 7.1.4.4, but more detail can be found in the DSEIS.

The primary biological impact of the proposed measure is to reduce fishing mortality for monkfish. It is unclear whether the overall impact on ecosystem productivity is enhanced by rebuilding stock biomass, since monkfish are tertiary predators and feed on many commercially-important species. There are insufficient data to parameterize the trophic relationships between monkfish and other species, enabling an optimization of stock abundance that considers the abundance of other species. Optimum yield, therefore, is independently defined for monkfish. The overfishing definition that complies with the Magnuson-Stevens requirements and meets the new National Standard guidelines requires that fishing mortality not exceed  $F_{\text{threshold}}$ , a proxy reference point for FMSY. Biomass will therefore be above  $B_{\text{MSY}}$  for the majority of time and conditions, once rebuilding has occurred.

Secondary biological impacts include reduced habitat alteration and reduced bycatch from the proposed restrictions on fishing activity. The FMP proposes to greatly reduce fishing mortality on monkfish through effort reduction by limited access vessels. Other synergistic management actions on fisheries (multispecies, sea scallops, summer flounder) that have a monkfish bycatch will also reduce habitat alteration. These secondary impacts are described on Section 7.1.5.2.6.

#### 7.1.5.1.1 Preferred alternative

##### 7.1.5.1.1.1 *Total allowable catch targets*

The total allowable catch (TAC) targets will allow more rapid management response to inaccurate projections of impacts and to changing conditions. Setting target TACs will allow the Councils to take management action, without conducting a time-consuming full assessment, when the fishery catches significantly exceed (or fall below) the anticipated amount. This provision will have an unquantifiable impact on mortality, monkfish stock biomass, and catches of other species. The benefits of using a target TAC should be positive since more rapid management action should aid in achieving optimum yield from the fishery.

#### 7.1.5.1.1.2 *Limited entry qualification criteria*

Limited entry is necessary to insure that other input restrictions have the intended effect on fishing mortality. Without limiting the number of vessels, total days-at-sea allocations would be too high and the directed fishery trip limits would not hold landings at desired levels. The target TACs would be exceeded and the plan would not stop overfishing.

It is not clear if limiting the number of vessels in the monkfish fishery will have a positive or negative effect on habitat alternation or bycatch of monkfish and other species. It is possible that vessels that do not qualify (e.g. vessels that began targeting monkfish after the control date) will target other species. The Fishery Impact Statement (Section 6.0) suggests that many of these vessels will target multispecies or sea scallops if they have a limited access permit for one of those fisheries. If they do not have a limited access day-at-sea multispecies or sea scallop permit, the analysis in the Fisheries Impact Statement indicates that vessels that use trawls are likely to target summer flounder, squid, whiting, and dogfish to the extent that current and future regulations allow. Vessels that do not qualify for a limited access monkfish permit and use gillnets are likely to target dogfish, skates, and coastal migratory species of finfish (e.g. bluefish, croaker, spot, and weakfish).

The following information discusses the number of vessels that qualify, their characteristics, and their landings history during the four-year qualification period, February 28, 1991 to February 27, 1995. The number and size of vessels that qualify with different criteria options are discussed. For the preferred alternative, the analysis compares the landings and economic dependence of vessels that qualify and do not qualify for limited access. Section 7.1.7 provides more details about the distribution and social impacts of the proposed qualification criteria.

On one hand, more qualifying vessels would exceed the biological objectives and mortality goals. On the other hand not qualifying enough vessels would cause increased discarding, due to catches where monkfish was an unavoidable component of total landings. The preferred alternative strikes a balance between these two competing factors.

#### **Preferred option**

The preferred qualification option will allow a significant majority of vessels with high monkfish landings to qualify. The preferred alternative qualification criteria are described in Section 3.1.2. Some of these vessels qualify due to large volumes of landings that occur while the vessel is targeting other species, consistent with the proposed management measures that require existing days-at-sea vessels to use a multispecies or scallop day-at-sea to land monkfish that exceed the bycatch allowances. It is anticipated that many will use their monkfish days to accommodate higher incidental catch of monkfish when it occurs. The proposed criteria will therefore reduce discards while limiting the amount of time that a vessel may target monkfish, within or outside its current allocation of days-at-sea.

Although the preferred alternative qualification criteria are less conservative than non-preferred alternative 3a and 3b, the preferred alternative is still considerably more conservative than the non-preferred alternative 3, taken to public hearings in January 1997 as the preferred alternative. Since all vessels with multispecies day-at-sea permits would have automatically qualified for monkfish limited access, non-preferred alternative 3 would have automatically qualified 1,172 vessels for monkfish limited access<sup>25</sup>.

The preferred qualification criteria will automatically qualify 600 vessels for monkfish limited access, 298 eligible for the higher trip limit while using mobile gear (Table 89). Based on NMFS weighout data from the four-year qualification period, there would be 32 (3+4+25) category A permits, 33 (2+10+21) category B permits, 266 (136+102+28) category C permits, and 269 (250+2+17) category D permits. Sixty-five (65) vessels would therefore

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<sup>25</sup> The number of qualifying vessels for non-preferred alternative 3 is slightly different from the estimates taken to public hearings in January 1997 and included in the PDT analysis (PDT Document 1). Since that time, qualification data have been updated to include the exact four-year qualification period, instead of the 1991-1994 calendar years. The number and identity of the vessels in the buyout program have also changed.

be classified as monkfish-only and would receive up to 40 days-at-sea each year to target monkfish. Six of the 65 vessels have summer flounder permits and probably qualify for monkfish limited access due to their incidental landings of monkfish. Five-hundred and thirty-five (535) days-at-sea vessels would qualify for monkfish limited access and could target monkfish during up to 40 of the vessel's multispecies or scallop days-at-sea.

This qualification option qualifies more vessels than either non-preferred alternative 3a or 3b, presented below. Compared to non-preferred alternative 3a, the preferred alternative will qualify more scallop vessels with day-at-sea permits and more monkfish-only (category A and B) vessels. This option will therefore reduce discarding caused by the bycatch trip limits that would apply to scallop vessels that do not qualify for monkfish limited access. Fewer vessels that rely on monkfish landings would be displaced from the monkfish fishery.

**Table 89. Preferred alternative qualification criteria.** Number of vessels that qualify for monkfish limited access by permits currently held by the vessels. Data are from 1,815 vessels that landed at least one pound of monkfish during the qualification period and have not been removed from the fleet by the multispecies buyout program.

Permits currently held by vessel	Will not automatically qualify	Qualifies for low trip limit	Qualifies for high trip limit	Total vessels permitted in 1997
Multispecies DAS	537	250	136	923
Scallop DAS	112	2	102	216
Combination	10	17	28	55
Summer Flounder	58	2	3	63
Other	140	10	4	154
No NERO permit	358	21	25	404
All vessels	1215	302	298	1815

When classified by size of vessel, the vessels that qualify for monkfish limited access appear to have a similar distribution to all vessels that landed monkfish during the four-year qualification period (Table 90). The qualifying vessels tend to be underrepresented in the smaller vessel categories (e.g. less than 30 GRT, possibly because these vessels do not land as much monkfish per year as do the larger vessels. The smaller vessels rely on monkfish landings as much as the larger vessels, when the percent of revenue derived from monkfish landings is summarized by vessel size. These vessels could however continue targeting monkfish under the daily bycatch allowance for day-at-sea vessels. Three-hundred and forty-four (344) of the 617 vessels less than 30 GRT have multispecies permits.

The majority of non-qualifying vessels is under 50 GRT and they fail to qualify with the more liberal criterion, 7,500 pounds tail-weight. Only 10% of the non-qualifiers are between 51 and 99 GRT, potentially missing the 7,500 pounds tail-weight criterion because of vessel size alone. Only 45 of the 172 vessels in this size range have between 7,500 and 50,000 pounds tail-weight during the four-year qualification period. Other choices of a vessel size qualification threshold will have greater proportions of vessels that fall into this situation.

Since monkfish landings during the qualification period is a function of vessel size (Table 91), the vessels that qualify with 50,000 pounds tail-weight (category A and C) tend to be larger vessels, over 100 GRT. This result is compatible with the Councils' management philosophy, giving higher directed fishery trip limits to larger offshore vessels using trawls to target monkfish.

**Table 90. Preferred alternative qualification criteria.** Vessel size by gross registered tonnage (GRT) recorded on the 1997 vessel permit. Only non-buyout vessels that do not have a 1997 vessel permit or that had no monkfish landings during the qualification period are excluded. There were 1,871 vessels that had at least one pound of monkfish landings during the qualification period, but 56 have been removed from the fleet due to the multispecies buyout program. The qualification criteria are given in Section 3.1.2.

GRT on 1997 vessel permit	Will not automatically qualify	Qualifies for low trip limit	Qualifies for high trip limit	Total vessels permitted in 1997
0	41			41
10	187	16	3	206
20	243	43	8	294
30	146	41	6	193
40	68	31	7	106
50	68	26	3	97
60	29	18	6	53
70	40	8	9	57
80	34	11	5	50
90	24	8	9	41
100	78	12	15	105
110	14	9	8	31
120	42	16	24	82
130	34	19	18	71
140	28	12	23	63
150	45	10	19	74
160	18	2	27	47
170	22	9	25	56
180	10	6	19	35
190	15	2	23	40
200	17	2	38	57
220	9			9
240	1		1	2
250			1	1
260		1		1
300			1	1
310	1			1
370	1			1
<b>Grand Total</b>	1215	302	298	1815

The preferred alternative criteria would qualify for monkfish limited access vessels that landed nearly 90 percent of the monkfish during the four-year qualification period (Table 91). A large proportion of those landings came from vessels that would automatically qualify for category A and C limited access permits. There do not

appear to be any vessel categories that landed a large fraction of monkfish landings, but fail to qualify for monkfish limited access.

**Table 91. Preferred alternative qualification criteria.** Monkfish landings (pounds, live weight) during the four-year qualification period by vessel size by gross registered tonnage (GRT) recorded on the 1997 vessel permit. Only non-buyout vessels that do not have a 1997 vessel permit or that had no monkfish landings during the qualification period are excluded. There were 1,871 vessels that had at least one pound of monkfish landings during the qualification period, but 56 have been removed from the fleet due to the multispecies buyout program. The qualification criteria are given in Section 3.1.2.

<b>GRT on 1997 vessel permit</b>	<b>Will not automatically qualify</b>	<b>Qualifies for low trip limit</b>	<b>Qualifies for high trip limit</b>	<b>Total vessels permitted in 1997</b>
<b>0</b>	106,615			106,615
<b>10</b>	564,217	808,183	912,186	2,284,586
<b>20</b>	1,079,315	2,816,079	2,252,888	6,148,282
<b>30</b>	805,790	2,813,884	2,193,641	5,813,315
<b>40</b>	470,119	1,839,964	2,816,194	5,126,278
<b>50</b>	503,455	2,145,388	1,220,975	3,869,818
<b>60</b>	327,834	1,538,735	1,795,054	3,661,623
<b>70</b>	372,445	659,490	3,808,538	4,840,473
<b>80</b>	369,017	745,625	1,055,825	2,170,466
<b>90</b>	372,476	635,522	2,556,389	3,564,388
<b>100</b>	991,234	938,167	6,298,450	8,227,850
<b>110</b>	757,412	645,104	3,477,187	4,879,704
<b>120</b>	1,874,089	1,168,912	8,224,318	11,267,319
<b>130</b>	1,844,746	1,620,176	5,428,564	8,893,485
<b>140</b>	1,445,353	902,153	6,792,279	9,139,785
<b>150</b>	1,258,254	1,045,426	8,574,958	10,878,638
<b>160</b>	615,088	166,387	11,994,965	12,776,440
<b>170</b>	884,605	912,035	12,712,567	14,509,208
<b>180</b>	632,656	636,325	10,145,623	11,414,604
<b>190</b>	584,064	256,473	11,137,940	11,978,477
<b>200</b>	764,012	291,110	16,178,355	17,233,477
<b>220</b>	79,092			79,092
<b>240</b>	110,543		244,950	355,492
<b>250</b>			1,007,240	1,007,240
<b>260</b>		64,488		64,488
<b>300</b>			1,046,232	1,046,232
<b>310</b>	16,909			16,909
<b>370</b>	7,204			7,204
<b>Grand Total</b>	16,836,544	22,649,624	121,875,319	161,361,488

On the other hand, a higher proportion of days absent and trips tend to be taken by vessels that do not qualify for monkfish limited access, indicating that the proposed qualification criteria are truly selecting vessels that are targeting monkfish instead of just the more actively fished vessels. During the four-year qualification period, vessels were at sea for over 300,000 days absent when they landed one or more pounds of monkfish during a fishing trip (Table 92). Nearly vessels that will not qualify for monkfish limited access generated nearly one-third of the fishing effort during trips landing at least one pound of monkfish. About the same fraction of trips were taken by non-qualifying vessels (Table 93).

Trip length was longer for vessels that will be eligible for the higher directed fishery trip limit. Vessels that will qualify for category A or C permits had trips that averaged 6.1 days absent. Trip length was only 2.4 days absent per trip for vessels that will qualify for category B or D permits. Trip length also appears to be highly correlated with vessel size. Trip length for 50 GRT vessels was 2.6 days absent during the qualification period and increases for larger vessels: 3.5 days absent for 100 GRT vessels, 6.0 days absent for 150 GRT vessels, and 8.4 days absent for 200 GRT vessels.

**Table 92. Preferred alternative qualification criteria.** Total number of days absent for trips with at least one pound of landings during the qualification period, excluding the 56 vessels that have been removed from the fleet by the multispecies buyout program.

<b>GRT on 1997 vessel permit</b>	<b>Will not automatically qualify</b>	<b>Qualifies for low trip limit</b>	<b>Qualifies for high trip limit</b>	<b>Total vessels permitted in 1997</b>
0	357			357
10	6,273	2,084	569	8,926
20	13,110	8,131	2,070	23,311
30	9,629	8,712	1,285	19,626
40	6,175	6,079	1,859	14,113
50	5,780	6,773	1,358	13,911
60	2,023	3,413	2,422	7,858
70	2,910	2,013	4,624	9,547
80	2,454	2,455	2,110	7,019
90	1,774	1,615	3,579	6,968
100	5,531	2,451	6,435	14,417
110	2,904	1,765	3,973	8,642
120	7,538	2,414	10,194	20,146
130	7,859	2,993	6,588	17,440
140	5,687	1,791	10,442	17,920
150	6,024	1,938	8,681	16,643
160	2,156	682	15,070	17,908
170	3,340	1,808	15,415	20,563
180	2,274	545	9,929	12,748
190	2,003	491	14,714	17,208
200	2,741	842	22,905	26,488
220	687			687
240	413		581	994
250			235	235
260		197		197
300			421	421
310	119			119
370	80			80
<b>Grand Total</b>	<b>99,841</b>	<b>59,192</b>	<b>145,459</b>	<b>304,492</b>

**Table 93. Preferred alternative qualification criteria.** Total number of trips with at least one pound of landings during the qualification period, excluding the 56 vessels that have been removed from the fleet by the multispecies buyout program.

<b>GRT on 1997 vessel permit</b>	<b>Will not automatically qualify</b>	<b>Qualifies for low trip limit</b>	<b>Qualifies for high trip limit</b>	<b>Total vessels permitted in 1997</b>
0	698			698
10	4,703	1,125	324	6,152
20	5,109	4,869	863	10,841
30	4,146	4,333	485	8,964
40	2,950	2,555	602	6,107
50	2,593	2,487	302	5,382
60	866	1,377	629	2,872
70	1,150	922	858	2,930
80	767	1,447	466	2,680
90	612	452	618	1,682
100	1,401	930	1,777	4,108
110	439	571	809	1,819
120	1,101	642	1,973	3,716
130	842	923	1,185	2,950
140	689	871	1,426	2,986
150	723	425	1,609	2,757
160	381	92	2,368	2,841
170	475	307	1,843	2,625
180	209	171	1,272	1,652
190	203	127	1,818	2,148
200	325	225	2,610	3,160
220	70			70
240	39		52	91
250			39	39
260		18		18
300			52	52
310	15			15
370	19			19
<b>Grand Total</b>	<b>30,525</b>	<b>24,869</b>	<b>23,980</b>	<b>79,374</b>

## Non-preferred options

Fewer vessels would qualify for monkfish limited access, because the qualification criteria options (Sections 7.1.4.2.2 and 7.1.4.2.3) are more conservative. These options became less attractive as the Councils considered more restrictive bycatch allowances for non-qualifying vessels. In response, the Councils relaxed the qualification criteria after the second round of public hearings in January 1998 to avoid causing excessive discarding by vessels that landed monkfish as a component of their targeted catch, but failed to qualify for monkfish limited access.

For the non-preferred alternative 3a, 506 vessels would qualify for monkfish limited access (Table 94). The same multispecies days-at-sea vessels would qualify, but there would be fewer scallop vessels and monkfish-only vessels that would qualify for monkfish limited access. With this qualification option, there would be 48 monkfish-only permits and 458 monkfish limited access permits held by multispecies and scallop vessels.

**Table 94. Non-preferred alternative 3a.** Number of vessels that qualify for monkfish limited access by permits currently held by the vessels. Data are from 1,815 vessels that landed at least one pound of monkfish during the qualification period and have not been removed from the fleet by the multispecies buyout program.

Permits currently held by vessel	Will not automatically qualify	Automatically qualifies	Total vessels permitted in 1997
Multispecies DAS	537	386	923
Scallop DAS	189	27	216
Combination	10	45	55
Summer Flounder	60	3	63
Other	142	12	154
No NERO permit	371	33	404
All vessels	1309	506	1815

Classified by vessel size, fewer large vessels would qualify for monkfish limited access (Table 95), since vessels with scallop day-at-sea permits tend to be larger than vessels with other types of permits. The same vessels that qualify with the preferred alternative would qualify with option 3a, since both use a 7,500 pounds tail-weight threshold for these vessels.

Table 95. **Non-preferred alternative 3a.** Vessel size by gross registered tonnage (GRT) recorded on the 1997 vessel permit. Only non-buyout vessels that do not have a 1997 vessel permit or that had no monkfish landings during the qualification period are excluded. There were 1,871 vessels that had at least one pound of monkfish landings during the qualification period, but 56 have been removed from the fleet due to the multispecies buyout program. The qualification criteria are given in Section 7.1.4.2.2.

GRT on 1997 vessel permit	Will not automatically qualify	Automatically qualifies	Total vessels permitted in 1997
0	41		41
10	187	19	206
20	243	51	294
30	146	47	193
40	68	38	106
50	68	29	97
60	29	24	53
70	40	17	57
80	37	13	50
90	26	15	41
100	80	25	105
110	17	14	31
120	51	31	82
130	37	34	71
140	37	26	63
150	52	22	74
160	29	18	47
170	31	25	56
180	16	19	35
190	25	15	40
200	36	21	57
220	9		9
240	2		2
250		1	1
260		1	1
300		1	1
310	1		1
370	1		1
<b>Grand Total</b>	<b>1309</b>	<b>506</b>	<b>1815</b>

For the non-preferred alternative 3b, only 455 vessels would qualify for monkfish limited access (Table 96) even though it would qualify more monkfish only vessels than qualification option 3a. With this qualification option, there would be 65 monkfish-only permits and 390 monkfish limited access permits held by multispecies and scallop vessels.

**Table 96. Non-preferred alternative 3b.** Number of vessels that qualify for monkfish limited access by permits currently held by the vessels. Data are from 1,815 vessels that landed at least one pound of monkfish during the qualification period and have not been removed from the fleet by the multispecies buyout program.

<b>Permits currently held by vessel</b>	<b>Will not automatically qualify</b>	<b>Automatically qualifies</b>	<b>Total vessels permitted in 1997</b>
Multispecies DAS	666	257	923
Scallop DAS	112	104	216
Combination	26	29	55
Summer Flounder	58	5	63
Other	140	14	154
No NERO permit	358	46	404
All vessels	1360	455	1815

Classified by vessel size, fewer intermediate-size (60-110 GRT) vessels would qualify for monkfish limited access (Table 97). The under-representation of intermediate-size vessels occurs because the monkfish-only (tending to be smaller) and the scallop day-at-sea (tending to be larger) vessels have lower thresholds compared to their historic landings than do the intermediate-size multispecies vessels. For this qualification option, the vessels less than 50 GRT that qualify with the preferred alternative would also qualify with option 3b, since both use a 7,500 pounds tail-weight threshold for these vessels.

**Table 97. Non-preferred alternative 3b.** Vessel size by gross registered tonnage (GRT) recorded on the 1997 vessel permit. Only non-buyout vessels that do not have a 1997 vessel permit or that had no monkfish landings during the qualification period are excluded. There were 1,871 vessels that had at least one pound of monkfish landings during the qualification period, but 56 have been removed from the fleet due to the multispecies buyout program. The qualification criteria are given in Section 7.1.4.2.3.

<b>GRT on 1997 vessel permit</b>	<b>Will not automatically qualify</b>	<b>Automatic qualify</b>	<b>Total vessels permitted in 1997</b>
0	41		41
10	187	19	206
20	243	51	294
30	146	47	193
40	68	38	106
50	68	29	97
60	47	6	53
70	48	9	57
80	45	5	50
90	32	9	41
100	90	15	105
110	23	8	31
120	58	24	82
130	53	18	71
140	40	23	63
150	55	19	74
160	20	27	47
170	31	25	56
180	16	19	35
190	17	23	40
200	19	38	57
220	9		9
240	1	1	2
250		1	1
260	1		1
300		1	1
310	1		1
370	1		1
<b>Grand Total</b>	<b>1360</b>	<b>455</b>	<b>1815</b>

### **Vessels in the monkfish fishery that fail to qualify for limited access**

Many vessels in North Carolina began targeting monkfish after the control date. Nearly all of these vessels will fail to qualify for monkfish limited access because before the control date they accumulated insufficient history to qualify for limited access. According to NC records, many vessels began targeting monkfish during March 1995 and landings per trip increased to over 1,000 pounds, immediately after the publication of the control date. Some monkfish landings occurred during the spring of 1994, but came from New England vessels that were displaced southward by the Multispecies FMP Amendment 4 regulations. Some NC vessels that entered the monkfish fishery early also participated during 1994, but it is not clear if any of these vessels had sufficient landings history prior to the control date to qualify for monkfish limited access. Landings in 1995 and 1996 by vessels using gillnets increased, with about 20 to 30 vessels landing 2,500 pounds of monkfish per trip.

Some vessels may revert back to fishing for other species that they targeted before 1995, e.g. weakfish, bluefish, king whiting, and croaker. Others may try their hand at the newly developed bluefin tuna fishery, provided that permits are available for new entrants or they already have a permit. Some others may buy another vessel that qualifies for monkfish limited access and transfer the permits to the current NC vessel, provided that the transfer does not violate the upgrade restrictions of the FMP.

The former choices (i.e. targeting other species) will promote mortality reduction for monkfish, but may increase mortality on other species. Most of the non-qualifying vessels that are in the monkfish fishery use gillnets to target monkfish, so changes in habitat alteration and bycatch of other fish species is expected to be negligible. The use of sink gillnets is thought to cause very little habitat alteration and fish bycatch in gillnets is low. Bycatch of marine mammals and endangered species is higher in gillnets than in other gears, so any effort reduction away from the use of gillnets could have a positive impact.

#### *7.1.5.1.1.3 Day-at-sea allocations and trip limits*

Restrictions on total fishing effort when limited access vessels may target monkfish and trip limits, controlling bycatch and directed fishing effort, will be two of the primary management measures controlling fishing mortality. The preferred alternative and non-preferred alternative 3a and 3b have similar expected mortality reductions. The amount of anticipated discards is significantly lower, however, for the preferred alternative.

The expected mortality reductions are a little less than the FMP's mortality reduction objectives. For the preferred alternative, the anticipated mortality reductions are 50 percent in the Northern Fishery Management Area and 65 percent in the Southern Fishery Management Area. This result compares to the 68 percent and the 78 percent mortality reduction objectives, respectively. These results, however, only include three components (limited entry, days-at-sea restrictions, and trip limits). On these factors alone, the plan is expected to achieve 74 and 83 percent of the mortality reductions needed in the Northern and Southern Fishery Management Areas, respectively. The anticipated impacts of size limits and gear restrictions are described in Sections 7.1.5.1.1.6 and 7.1.5.1.1.7.

### **Sources of uncertainty**

Although the PDT made some assumptions about when discards would occur, there was no attempt to forecast changes in fishing behavior that are anticipated from monkfish management. No assumptions were made that vessels in other fisheries would all land the applicable bycatch trip limits or that the limited access vessels would use all of the days-at-sea allotted to them. Had the PDT made these assumptions, the expected landings would considerably exceed those associated with the mortality

objectives, possibly exceeding observed landings during 1995 and 1996. Observed landings and days absent on trips targeting monkfish are less than the expected landings if all vessels fish at the proposed limits. This outcome supports the Councils' assertion that not all monkfish limited access vessels will take advantage of the opportunity to use monkfish days to target monkfish, while discarding excess bycatch during the vessel's remaining fishing time in other fisheries.

One of the large uncertainties is how and when multispecies and scallop vessels will use monkfish days to target monkfish. The PDT's made no assumptions about shifts in fishing effort, other than the status quo use of days would continue. If a qualifying vessel used fewer than 40 days to target monkfish (without landing large-mesh groundfish or scallops), the analysis assumes that the vessel would use the monkfish days to target monkfish if the vessel also had sufficient unused multispecies or scallop days to utilize for this purpose. Alternatively, if unused multispecies or scallop days during 1996 (after applying the day-at-sea reductions for the 1998 and 1999 fishing years) were insufficient to absorb the monkfish effort or the vessel targeted solely monkfish during more than 40 days absent, the PDT analysis assumed that the vessel would no longer be able to make those directed monkfish trips. The vessel would be more likely forgo targeting monkfish instead of shifting fishing effort from groundfish or scallops. Some examples are given in Table 93 to clarify these assumptions.

If multispecies vessels use the monkfish days primarily to enable the vessel to land monkfish as a component of their normal groundfish catch, then the realized mortality reduction might be greater than analyzed here. This is one of the main reasons that the year 2 measures only take effect as 'defaults' if the year 1 management program exceeds the TACs and there is insufficient mortality reduction to meet the year 1-3 objectives. On the other hand, if the multispecies vessels reserve their monkfish days to target only monkfish, discarding unavoidable monkfish bycatch while targeting groundfish during a multispecies day-at-sea, then monkfish mortality could remain high. If this effort shift occurs, however, mortality on regulated groundfish would decline, because the multispecies vessels with fleet day-at-sea allocations would only have 48 days remaining to target groundfish. Because of the cost associated with losing a multispecies day-at-sea to target solely monkfish, the Councils believe that this type of effort shift is unlikely.

Similarly, the Councils anticipate that only a small fraction of scallop vessels will convert gear and vessel equipment to use trawls or sink gillnets to target monkfish during a scallop day-at-sea. If more scallopers than anticipated shift fishing effort toward monkfish, then monkfish mortality could remain above the mortality objectives, but scallop mortality would correspondingly decline if the scallop vessel gave up an active scallop day-at-sea. If this effort shift occurs, monkfish mortality could exceed the objectives, but habitat damage due to heavy scallop dredges would be reduced. Scallopers also have the option of using a gillnet to target monkfish. The Council believes it will be highly unlikely for a scallop dredge vessel to convert to using sink gillnets to capture monkfish. Few scallopers have experience using gillnet gear and it is probably uneconomical to use a large scallop vessel to use gillnets, given the restrictions on the number of nets a gillnet vessel may use.

Although the least costly alternative for these vessels to target monkfish may be to use large-mesh beam trawls, there is a high cost of relinquishing a valuable scallop day, especially since additional scallop day-at-sea reductions are planned. Since scallop vessels have a history of targeting monkfish with dredges during a scallop day-at-sea, the analysis also made the assumption that a scalloper would only switch to another gear to target monkfish if the monkfish revenue was more than 50 percent of the total revenue for the trip.

Another source of uncertainty is fishing behavioral changes when vessels would be forced to discard monkfish if they did not relocate and avoid monkfish. The PDT needed to make some

assumptions about the likelihood that a vessel would continue fishing and discard or move to other areas. These assumptions are explained below and in PDT Document 2 (Appendix II). If discards are higher than anticipated, the realized mortality rate will exceed the mortality objectives, unless other factors compensate. On the other hand, a greater effort by fishermen or management to reduce discards will have a beneficial effect on monkfish mortality. It is unclear how this fishing behavior will effect other species, because it is unknown how much the monkfish rules will change fishing behavior or where the vessels would relocate to target other species.

**Table 93.** Assumptions about the use of monkfish day-at-sea with various levels of unused multispecies or scallop day-at-sea allocations.

Vessel type	Situation	Days absent on trips targeting only monkfish	Days-at-sea when monkfish revenue exceeds multispecies or scallop revenue	Unused multispecies or scallop days-at-sea	Expected monkfish days-at-sea to be used to target only monkfish
Multispecies Fleet or individual Or Scallop Full-time, part-time, or occasional	Monkfish days absent exceed unused multispecies or scallop days	25	0	10	10
Multispecies Fleet or individual Or Scallop Full-time, part-time, or occasional	Unused days exceed monkfish days absent	25	0	60	25
Multispecies Fleet or individual Or Scallop Full-time, part-time, or occasional	Monkfish days absent exceed the proposed allocation of monkfish days	60	0	70	40
Multispecies Fleet or individual	Monkfish days will be used for a mixed-species trip	25	40	15	0
Scallop Full-time, part-time, or occasional	Effort shift from scallops to monkfish is cost effective.	25	40	10	40
Monkfish-only	Must use a monkfish day to target monkfish	25	0	0	25
Monkfish-only	Monkfish days absent exceed proposed allocation of monkfish days	60	0	0	40

## Methods

The analysis of impacts was conducted in two parts and the combined result was evaluated by comparing the predicted landings and discards if the rules were in place during 1995 and 1996 vs. the observed landings by selected trips. Some landings were not considered in this analysis, primarily because they were from combined trips from multiple vessels. Despite this censoring of the data, about 200,000 trips were used to analyze the expected fishing mortality reduction. These trips accounted for

24,000 mt of the 26,000 mt of known monkfish landings. The change in predicted landings under the proposed rules vs. the observed landings during 1995-1996 is equivalent to the anticipated fishing mortality reduction. This assumption is true as long as the management measures have the same impact on the unanalyzed portion of the fishery and exploitable stock biomass remains at 1995-1996 levels.

The anticipated fishing mortality reductions are compared below to the mortality reduction objectives to evaluate the preferred and non-preferred alternatives 3a and 3b. The expected mortality reductions associated with non-preferred alternatives taken to public hearings in January 1997 are described in Sections 7.1.4.4.1 and 7.1.4.4.2.

The Council anticipated the effects of the preferred and non-preferred alternatives by applying the proposed rules to trips during 1995 and 1996. The PDT developed two separate models to analysis the effects of day-at-sea and trip limit restrictions on vessels that would qualify for monkfish limited access and vessels that would not qualify, respectively. The qualifying vessels would have up to 40 monkfish days (with or without directed fishery trip limits) to exceed the bycatch allowances, either on trips where monkfish was a component of a mixed catch or on trips targeting only monkfish. The latter group would have no monkfish days and could only land monkfish up to the applicable bycatch allowance. Some examples are given in Table 93 to clarify this procedure.

To develop a realistic model, the PDT made certain assumptions about fishing effort shifts (described above) and discarding. Discarding mortality was calculated when monkfish landings exceeded the proposed trip limits and when the proportion of the trip's revenue from monkfish landings was less than 50 percent. Otherwise the analysis assumed that the revenue loss would be sufficient inducement for the fishermen to change behavior and avoid monkfish, focusing on areas or gears that captured another target species better and also captured less monkfish. The analysis also assumed the same discard mortality rates that the Council adopted to evaluate the effects of a minimum size limit (Table 99 and Table 100). More details about the PDT's analytical methods are given in PDT Document 2 (Appendix II).

## **Results**

In the **Northern Fishery Management Area**, day-at-sea restrictions and trip limits are expected to produce a 25 percent reduction in mortality during the first year of FMP implementation (Table 94) and a 33 percent reduction in year 2. Total landings decrease from 10,687 mt under the status quo, to 7,718 and 6,891 mt in years 1 and 2, respectively. The reduction in year 1 would be caused by the limits on available days (vessels would no longer be able to target monkfish outside of multispecies days) and due to the effect of the bycatch trip limit. The analysis suggests, however, that discards would only be about five to eight percent of the catch. Discards by days-at-sea vessels are low because many vessels that target monkfish qualify for limited access and would not have a trip limit on any of their multispecies days. Most of the reduction between years 1 and 2 reflect decreases in available scallop day-at-sea. Some vessels in the 1995-1996 weighout data fished for scallops and monkfish on the northern and western sides of Georges Bank, open to fishing during a scallop day-at-sea.

In the fourth fishing year when only retention monkfish bycatch would be allowed and all vessels on a multispecies day-at-sea would have a 300 pounds tail-weight per day-at-sea, or 25 percent of the total weight of fish onboard limit, the calculated mortality reduction is 50 percent. Landings would decline from 10,687 mt under the status quo to only 3,374 mt with the preferred alternative. Discards, however, are expected to increase to over 2,000 mt, or about 40% of the total catch. The Council believes that this discard level is overstated, especially if the new closed areas are effective for reducing monkfish

mortality, groundfish recovery makes fishing for monkfish less attractive, or vessels change fishing behavior more than predicted by the model.

The expected mortality reductions in the **Southern Fishery Management Area** are greater than in the northern area. The day-at-sea restrictions and the more restrictive bycatch limits, coupled with planned reductions in scallop day-at-sea through the 1999 fishing year, are calculated to reduce mortality by 32 percent in year 1 (Table 95). The preferred alternative, without directed fishery trip limits, is estimated to fall significantly short of the mortality goals for 1999 to 2002 (years 1-3). Additional mortality reductions in year 2 are anticipated, when the scallop day-at-sea are slated to be 120 days and the directed fishery trip limits become effective. In year 2, the day-at-sea restrictions and trip limits are estimated to produce a 59 percent reduction in fishing mortality. Landings for the analyzed trips are calculated to decline from 13,414 mt under the status quo to 8,672 mt in year 1 and 6,444 mt in years 2 and 3. Increased discards caused by the regulations are anticipated to be about 420 mt, or five to six percent of the total catch.

In the fourth fishing year when limited access vessels would receive no monkfish days-at-sea allocations and only bycatch levels could be landed, the estimated mortality reduction is 65 percent. Landings are expected to decline to 3,578 mt, while discards increase to 1,184 mt, or about 25 percent of the total catch.

### **Comparisons with non-preferred alternatives 3a and 3b**

The alternatives are expected to give roughly equivalent results, with regard to monkfish mortality reduction when the Council proposes to end overfishing by May 1, 2002. In the Northern Fishery Management Area (Table 94), the estimated mortality reductions range from 50 to 51 percent for the three alternatives. In the Southern Fishery Management Area (Table 95), the estimated mortality reductions are 64 to 65 percent for all three alternatives. These estimated effects compare with the mortality reduction objectives of 68 and 78 percent, respectively. While all the alternatives appear to fall somewhat short of the overfishing definition thresholds, there are many behavioral responses that the PDT could not analyze would effect the mortality rates actually realized by the management program. Some of these responses (for example fishermen using fewer days-at-sea to target monkfish or moving away from concentrations of small monkfish) would have beneficial effects. Other responses may increase fishing mortality, or could cause shifts in fishing activity between the two management areas. Estimated discard mortality is also roughly the same for all alternatives, except for non-preferred alternative 3b in the Northern Fishery Management Area, where discard mortality is somewhat less and landings would be somewhat higher.

The preferred and two non-preferred alternatives have different effects in the first two years, however. In year 1, non-preferred alternative 3b is estimated to achieve greater reductions in fishing mortality [35% in the northern area (Table 94) and 39% in the southern area (Table 95)], than the other two alternatives. More vessels qualify with non-preferred alternative 3a than with non-preferred alternative 3b. The preferred alternative has the most vessels that qualify for monkfish limited access, but the directed fishery trip limits do not become effective until halfway through year 2.

In the northern area during years 2 and 3 (implementation after 18 months in the final alternative), the preferred alternative and the non-preferred alternative 3b are estimated to have

about the same effect on mortality reduction, 33 percent vs. 37 percent, respectively (Table 94). Both fall about 20 percent short of the 55 percent mortality reduction objective. Non-preferred alternative 3a is expected to produce the least mortality reduction, only a 30 percent reduction relative to the status quo. In the southern area during years 2 and 3 (Table 95), the preferred alternative is the most conservative of the three options and is expected to achieve a 49 percent reduction in fishing mortality, compared to a 59 percent objective.

More details for each of the alternatives, by permit type, gear, and qualification status, are given PDT Document 2 (Appendix II). Examination of the estimated effects on landings and discard mortality could reveal how the proposed rules could effect individual sectors of the monkfish fishery. Further description would, however, require much more discussion than provided in this summary of results.



**Table 94.** Northern Fishery Management Area: Summary of estimated landings and discards after applying the proposed qualification criteria, days-at-sea limits, and trip limits. These results are compared with the total 1995-196 landings for vessels in each category to estimate monkfish mortality reduction.

	Vessel classification	Mortality reduction objective	Preferred Alternative			Non-Preferred Alternative 3a			Non-Preferred Alternative 3b		
			Expected landings (mt)	Expected discards (mt)	1995-1996 Landings (mt)	Expected landings (mt)	Expected discards (mt)	1995-1996 Landings (mt)	Expected landings (mt)	Expected discards (mt)	1995-1996 Landings (mt)
Year 1	DAS Qualifiers		6,492	53	7,991	6,035	34	7,341	5,337	50	6,532
	DAS Non-qualifiers		706	49	1,599	1,437	139	2,913	1,571	388	4,742
	Monkfish-only		416	115	708	282	44	425	416	115	708
	Bycatch fisheries		104	33	389	169	172	950	104	33	389
	Total		7,718	250	10,687	7,923	389	11,629	7,428	586	12,371
	Percent reduction	<b>55%</b>	<b>25%</b>			<b>29%</b>			<b>35%</b>		
Year 2	DAS Qualifiers		5,781	49	7,991	5,930	32	7,341	5,173	45	6,532
	DAS Non-qualifiers		697	49	1,599	1,372	133	2,913	1,516	416	4,742
	Monkfish-only		309	115	708	282	44	425	416	115	708
	Bycatch fisheries		104	33	389	169	168	950	104	33	389
	Total		6,891	246	10,687	7,753	377	11,629	7,209	609	12,371
	Percent reduction	<b>55%</b>	<b>33%</b>			<b>30%</b>			<b>37%</b>		
Year 4	DAS Qualifiers		2,546	1,663	7,991	2,177	1,609	7,341	2,882	868	6,496
	DAS Non-qualifiers		656	68	1,599	1,212	195	2,913	1,481	425	4,742
	Monkfish-only		68	243	708	32	111	425	68	243	708
	Bycatch fisheries		104	33	389	168	165	950	104	33	389
	Total		3,374	2,007	10,687	3,589	2,080	11,629	4,535	1,569	12,335
	Percent reduction	<b>68%</b>	<b>50%</b>			<b>51%</b>			<b>51%</b>		

**Table 95.** Southern Fishery Management Area: Summary of estimated landings and discards after applying the proposed qualification criteria, days-at-sea limits, and trip limits. These results are compared with the total 1995-196 landings for vessels in each category to estimate monkfish mortality reduction.

	Vessel classification	Mortality reduction objective	Preferred Alternative			Non-Preferred Alternative 3a			Non-Preferred Alternative 3b		
			Expected landings (mt)	Expected discards (mt)	1995-1996 Landings (mt)	Expected landings (mt)	Expected discards (mt)	1995-1996 Landings (mt)	Expected landings (mt)	Expected discards (mt)	1995-1996 Landings (mt)
Year 1	DAS Qualifiers		6,391	48	7,853	5,393	21	6,569	5,368	30	6,588
	DAS Non-qualifiers		1,104	212	3,200	2,720	259	5,753	1,400	643	5,505
	Monkfish-only		1,091	105	1,426	902	73	1,152	1,023	105	1,352
	Bycatch fisheries		86	60	935	98	172	1,341	86	60	935
	Total		8,672	425	13,414	9,113	525	14,815	7,877	838	14,380
	Percent reduction	<b>59%</b>	<b>32%</b>			<b>35%</b>			<b>39%</b>		
Year 2	DAS Qualifiers		4,903	44	7,853	5,258	19	6,569	5,117	27	6,588
	DAS Non-qualifiers		1,046	210	3,200	2,540	254	5,753	1,400	641	5,505
	Monkfish-only		409	105	1,426	902	73	1,152	1,023	105	1,352
	Bycatch fisheries		86	60	935	97	163	1,341	86	60	935
	Total		6,444	419	13,414	8,797	509	14,815	7,626	833	14,380
	Percent reduction	<b>59%</b>	<b>49%</b>			<b>37%</b>			<b>41%</b>		
Year 4	DAS Qualifiers		2,432	712	7,853	1,642	645	6,569	2,558	343	6,588
	DAS Non-qualifiers		955	233	3,200	2,226	343	5,753	1,235	666	5,505
	Monkfish-only		104	180	1,426	69	128	1,152	103	179	1,352
	Bycatch fisheries		85	59	935	97	154	1,341	85	59	935
	Total		3,576	1,184	13,414	4,034	1,270	14,815	3,981	1,247	14,380
	Percent reduction	<b>78%</b>	<b>65%</b>			<b>64%</b>			<b>64%</b>		

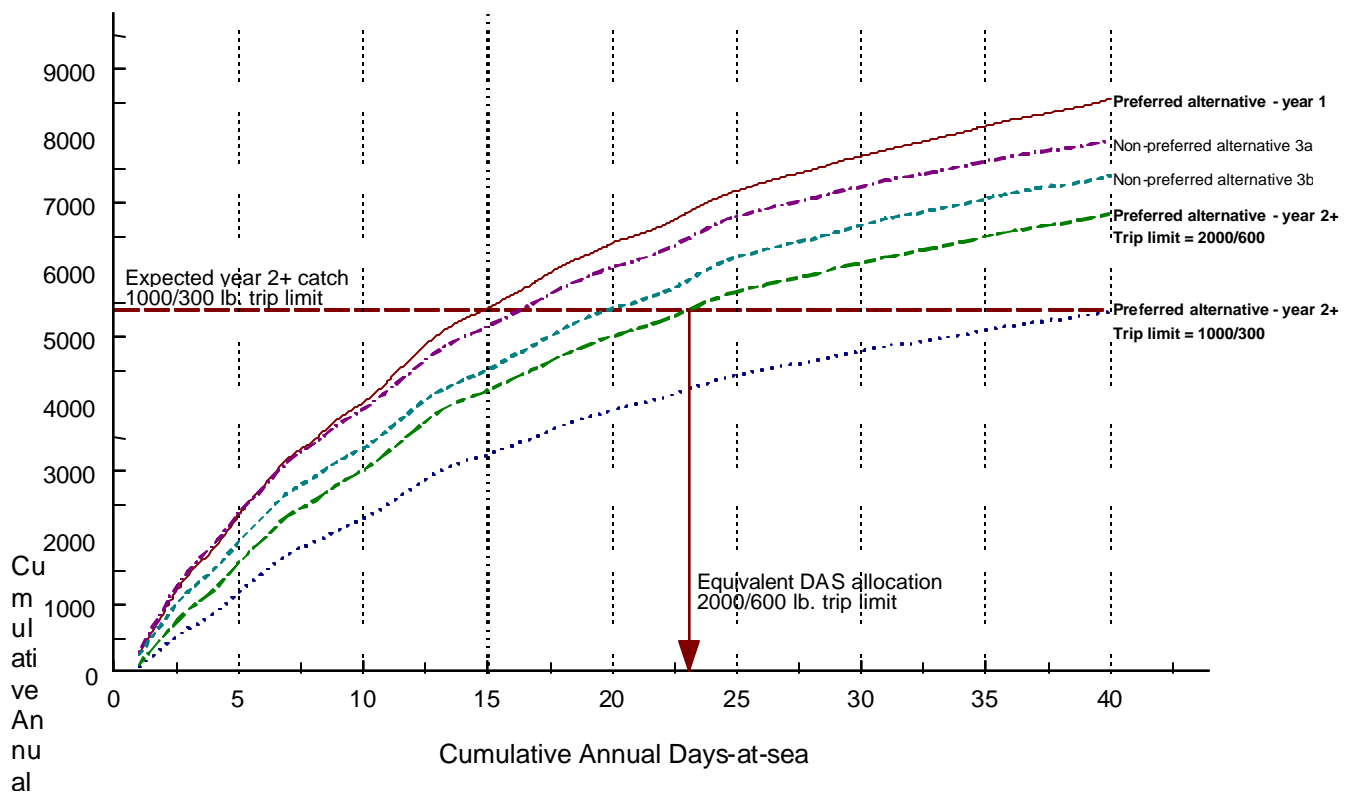
#### *7.1.5.1.1.4 Day-at-sea options*

Days-at-sea allocations will restrict the amount of time that monkfish limited access can target monkfish and therefore reduce fishing mortality. Various allocations of days-at-sea were examined to determine their impact on expected landings by the directed fishery for monkfish. No discards were assumed, because the Council expects that limited access vessels will not be able to target monkfish with the proposed bycatch limits.

Lower days-at-sea allocations, rather than using directed fishery trip limits to achieve the same mortality reduction, could reduce cost and habitat alteration by reducing fishing time. The Council believes, however, that day-at-sea allocations that are less than 40 days per year would not be economically viable for many vessels. A short season would not cover fixed operating costs to participate in even a seasonal fishery, if the gear and equipment could not be use in another fishery.

With a 40 day-at-sea annual allocation of days, the preferred alternative is anticipated to produce 8,564 mt of monkfish landings in year 1 from the directed fishery and 5,403 mt in year 2. Another 5,826 mt of monkfish would be landed in year 1 by qualifying vessels while they were targeting other fish and not on a monkfish day-at-sea. Since no monkfish days-at-sea are anticipated for year 4, the landings from the directed fishery are anticipated to be zero.

Below 40 days, expected landings decline at a faster rate as the days-at-sea allocation approaches zero (Figure 25). This result occurs because a greater number of vessels become affected by the lower allocation of days. Total landings from the directed fishery (including multispecies and scallop vessels on a monkfish day-at-sea) would be 50 percent of projected landings for the preferred alternative, by reducing the allocation to 11 days. To achieve an equivalent mortality reduction as that expected from a (year 2) trip limit of 300 pounds for vessels using fixed gear and 1,000 pounds tail-weight for vessels using mobile gear, the annual day-at-sea allocation would have to be 15 days (Figure 25).



**Figure 25.** Cumulative estimated landings vs. monkfish days-at-sea allocation options with preferred and non-preferred alternative qualification criteria and trip limits. The data include trips for all vessels that qualify for monkfish limited access and the vessel would have to use a monkfish day-at-sea, had the rules applied during the 1995-1996 fishing year.

#### 7.1.5.1.1.5 Trip limit options

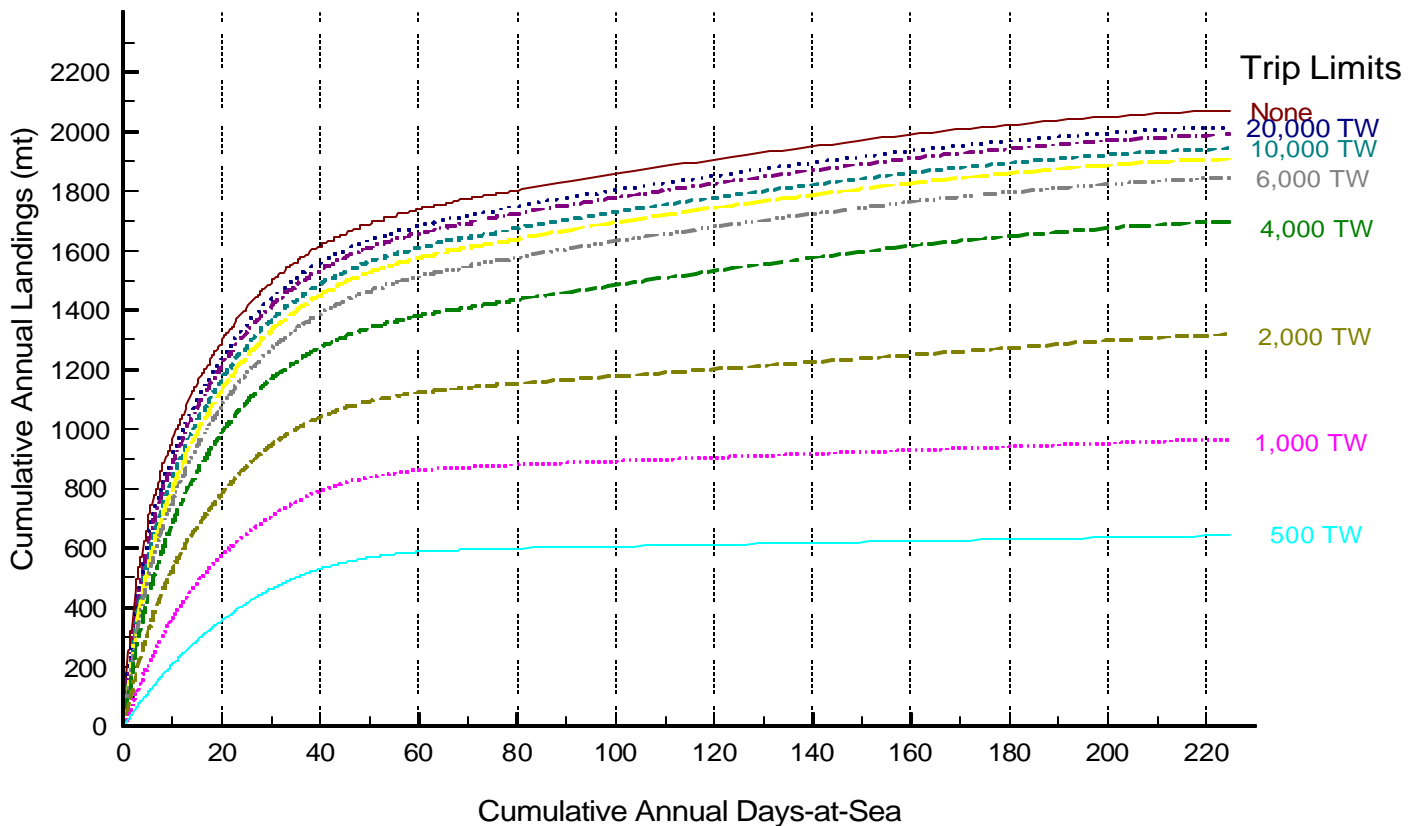
##### 7.1.5.1.1.5.1 Directed fishery limits

The Councils also evaluated other combinations of days-at-sea allocations and trip limits, besides the ones chosen for years 2 and 3. These trip limit/day-at-sea options ranged from no trip limit to 500 pounds tail-weight per trip and from zero to 220 days (Figure 26). In general, reductions in landings and mortality were non-significant with trip limits over 6,000 pounds tail-weight per trip and over 40 days, because few monkfish limited access vessels have fishing activity that exceed these amounts<sup>26</sup>.

<sup>26</sup> The amount of days absent during 1995-1996 by monkfish-only vessels may be underestimated because these vessels were not required to report landings to NMFS. Some vessels landed monkfish at dealers that did not report landings. It is also unclear how days absent for gillnet vessels (many vessels that target monkfish use gillnets) were calculated. Fishing time will be counted differently under the day-at-sea program and may deviate from the anticipated effectiveness of the days-at-sea program to limit fishing mortality.

The Councils later revised the directed fishery trip limits, so they would be applied on a daily basis, rather than per trip. This change allows vessels greater flexibility to fish different lengths of time, but cannot be directly evaluated against the results in Figure 26. The Councils considered two daily trip limit options. In one option, vessels on a monkfish day-at-sea would be able to land 300 pounds tail-weight per day-at-sea while using fixed gear or 1,000 pounds tail-weight per trip while using mobile gear, both limits in the Southern Fishery Management Area. In the Northern Fishery Management Area, there are not directed fishery trip limits planned. In the other analyzed option, vessels in the Southern Fishery Management Area would be able to land 600 pounds tail-weight per day-at-sea while using fixed gear or 2,000 pounds tail-weight per day-at-sea while using mobile gear.

The higher of the two trip limit options would produce 6,860 mt of monkfish landings, 50 percent higher than the more conservative trip limit option. To achieve the same fishing mortality reduction with the more liberal trip limit option, only 23 days could be allocated to the monkfish limited access vessels. The preferred alternative allows some monkfish limited access vessels to fish with a 1,500 pounds tail-weight per day-at-sea limit while using mobile gear. According to the NMFS data, 298 of the 600 monkfish limited access vessels would qualify to fish at the higher limit (Table 89). How many will fish with the higher trip limit is unknown, but 136 of the 298 permit category A or C vessels have multispecies permits and usually fish with mobile gear. The expected landings of the preferred alternative is therefore between the options in Figure 26 labeled "Preferred alternative, Trip limit = 1000/300" and the one labeled "Preferred alternative, Trip limit = 2000/600), probably closer to the more conservative option.



**Figure 26.** Expected landings for monkfish limited access vessels without multispecies or scallop day-at-sea permits for various day-at-sea and trip limit options. Rules were applied to the trips taken during 1995-1996 by vessels that would qualify for monkfish limited access under the preferred alternative.

#### 7.1.5.1.1.5.2 Bycatch limits – Preferred alternative

The purpose of the monkfish trip limits is to discourage increases in fishing effort by vessels that currently have an incidental catch of monkfish. Without trip limits, there is no way to distinguish limited access vessels from those that do not qualify, but usually catch monkfish while targeting other species. For many fisheries, the usual bycatch of an incidental species is low and possession is prohibited or the trip limit is set at very low levels. A local example of this sea scallops, where fishing vessels without limited access permits can only retain up to 40 pounds of shucked scallops.

Fishermen using many types of gears over a wide area, on the other hand, catch monkfish as a bycatch. The proposed trip limits are compromise between unacceptably low limits that would cause fishermen to discard monkfish and excessively high limits that could allow many vessels to target monkfish.

The proposed limits have been chosen such that a very small proportion of trips targeting other species would have to discard monkfish or relocate to land the monkfish that are caught. The basis for choosing these limits was the PDT recommendation to adopt trip limits that were at the 95 percentile of trips by non-qualifying vessels in other fisheries (PDT Document 1, Appendix I). These limits and the distribution of landings per trip when vessels target other species is examined in more detail below.

Although a reduction in bycatch is anticipated, most of it will be realized through planned changes in multispecies and scallop days-at-sea. Between the 1995-1996 base period and the 1999 fishing year, multispecies fleet days will have dropped from 139 to 88. Similarly, scallop days will have fallen from 164 days in the 1995-1996 base period to 142 days in 1999 and 120 days in 2000. These two fisheries have significant volumes of monkfish bycatch and the planned decreases in allowable fishing effort will have a large, beneficial impact on monkfish mortality reduction.

Under the preferred alternative, the Council expects landings from monkfish bycatch to decline, with minor increases in discard mortality. Although the PDT analysis did not count discards when applying the proposed rules to trips by non-qualifying vessels when monkfish revenue was more than 50 percent of the trip revenue, only the top 5 percent of the trips (sorted by total monkfish landings) would be forced to discard monkfish. It is very likely that these large-volume trips, with trip limits appropriate for fisheries targeting other species, would try to avoid these large volumes of monkfish, if they cannot be landed.

The expected landings for the preferred alternative is calculated to decline from 1,988 under the status quo to 810 mt in year 1, 801 mt in year 2, and 760 mt in year 4 in the Northern Fishery Management Area (Table 94). The Council expects minor increases in monkfish discards<sup>27</sup> compared to the status quo. When vessels target other species, discards due to the preferred alternative rules would rise by 82 mt, 82 mt, and 101 mt, respectively. In the Southern Fishery Management Area (Table 95), landings are expected to decline from 4,135 mt under the status quo to 1,190 mt in year 1, 1,132 mt in year 2, and 1,040 mt in year 4. Minor increases in discards are anticipated, rising by 272 mt, 270 mt, 292 mt compared to the status quo, respectively.

The change in landings for non-preferred alternatives 3a and 3b are about the same as for the preferred alternative, but discards are higher. Bycatch trip limits are slightly different for non-preferred alternatives 3a and 3b, because the Council modified the preferred alternative trip limits after the second round of public hearings. Also qualification criteria are different with the non-preferred alternatives, so the number and fishing characteristics for vessels that do not qualify for monkfish limited access is different. Year 1 landings for non-preferred alternatives 3a

<sup>27</sup> Discards are already a significant fraction of the catch, due to unmarketability or state regulation. See Section ? for more details.

and 3b in the Northern Fishery Management Area are expected to be 1,606 and 1,675 mt, respectively. Year 1 landings for non-preferred alternatives 3a and 3b in the Southern Fishery Management Area are expected to be 2,818 and 1,486 mt, respectively. These expected landings are considerably higher than the non-preferred alternative for all analyzed years, because fewer vessels would qualify for monkfish limited access.

Discards for the non-preferred alternatives in year 1 are expected to increase by 311 and 421, respectively in the Northern Fishery Management Area and 431 and 703 mt, respectively in the Southern Fishery Management Area. The anticipated discards are therefore 155 to 380 percent higher than the preferred alternative in the Northern Fishery Management Area and 160 to 260 percent higher than the preferred alternative in the Southern Fishery Management Area. Table 94 and Table 95 show similar results for years 2 and 4. Very little of the anticipated discards are mitigated by declines in discards by (fewer) vessels that qualify for monkfish limited access in the non-preferred alternatives.

The basis for the bycatch trip limit options was the 95th percentile of observed trips by non-qualifying vessels during 1994 and 1995. The PDT analyzed and presented these data to the Councils in PDT Document 1 (Appendix I). While developing the preferred and non-preferred alternatives, the Councils aggregated and modified the proposed trip limits, based on public comments, industry advice, and their knowledge of the fisheries.

In the Northern Fishery Management Area (Table 97), the preferred alternative daily trip limit for vessels using groundfish trawls is nearly double the 99th percentile for the landings of tails, while the preferred alternative trip limit for vessels using groundfish gillnets is 1.5 times the 99th percentile of observed 1994-1995 trips. The preferred alternative trip limit for scallop vessels using dredges is consistent with the 99th percentile of observed trips. Few vessels fish for summer flounder in the Northern Fishery Management Area. The proposed limit for vessels using small mesh is about ½ of the 95th percentile of observed trips.

In the Southern Fishery Management Area (Table 97), the preferred alternative daily trip limit for vessels using groundfish trawls is less than the 95th percentile for observed trips and ½ of the 95th percentile for vessels using gillnets. The proposed trip limit for vessels using scallop dredges, on the other hand, are 1.5 times the 99th percentile of observed trips. The proposed trip limit is consistent with the 99th percentile of observed trips for vessels using scallop trawls, although the estimate of trip length is less certain. For non-qualifying vessels using trawls to target summer flounder, the proposed 5 percent limit is consistent with the 95th percentile of observed trips. For vessels using small mesh in the Southern Fishery Management Area, the proposed limit is only 1/3<sup>rd</sup> of the 95th percentile of observed trips.

In general, the preferred alternative trip limits for monkfish bycatch tend to be less conservative than the 95th percentiles. This is consistent with the Councils' agenda to limit the ability of non-qualifying vessels to target monkfish, while minimizing discard mortality. For vessels using small mesh, on the other hand, the proposed limit tends to be more conservative than the 95th percentile. The Councils want to be more conservative for vessels using small mesh, because they are more likely to catch very small (also unmarketable and fast-growing) monkfish. Even if the vessels had a market for these small fish, landings of monkfish less than 11-inches tail-length would be prohibited. More details are given in Section 7.1.5.1.1.5.3 about the distribution of landings per trip and per day-at-sea during 1991-1993 (reporting of days absent was transferred to a separate reporting system that is difficult to match with landings).

**Table 96.** Distribution of monkfish landings as bycatch in fisheries that target other species in the Multispecies Regulated Mesh Area, 1994-1995. Only trips by vessels that would not qualify for monkfish limited access for non-preferred alternative 3 were included in the PDT analysis. Source: PDT Document 1 – September 26, 1997. Source: PDT Document 1 (Appendix I), average trip lengths from 1995 vessel trip reports.

Gear	Preferred alternative trip limit <sup>28</sup> for non-qualifying vessels in the NFMA	Average trip duration	Landings of whole fish per trip (lbs.)		Percent of total weight of fish onboard		Landings of monkfish tails per trip (lbs.)		Percent of total weight of fish onboard		Average landings of monkfish tails per day absent (lbs.)	
		Days	95 <sup>th</sup> percentile	99 <sup>th</sup> percentile	95 <sup>th</sup> percentile	99 <sup>th</sup> percentile	95 <sup>th</sup> percentile	99 <sup>th</sup> percentile	95 <sup>th</sup> percentile	99 <sup>th</sup> percentile	95 <sup>th</sup> percentile	99 <sup>th</sup> percentile
Groundfish trawl	300 pounds/DAS	7	1,992	3,984	20%	30%	600	1,200	6%	9%	150	300
Groundfish gillnet	300 pounds/DAS	1	332	664	10%	20%	100	200	3%	6%	100	200
Scallop dredge	300 pounds/DAS	15	9,960	13,280	13%	17%	3,000	4,000	4%	5%	215	285
Scallop trawl	300 pounds/DAS	No data	3,320	4,648	13%	13%	1,000	1,400	4%	4%	90	125
Summer flounder trawl	5% of total weight of fish onboard	Not analyzed	650	2,026	19%	41%	196	610	6%	13%	-	-
Other gear	50 pounds/trip	Not analyzed	398	830	7%	13%	120	250	2%	4%	-	-

<sup>28</sup> Pounds tail-weight. To calculate the whole-weight equivalent, multiply the trip limit for tails by 3.32. When expressed as the percent of total weight of fish onboard, the 5 percent limit would apply to the possession or landings of whole fish or tails.

**Table 97.** Distribution of monkfish landings as bycatch in fisheries that target other species in the Mid-Atlantic Regulated Mesh Area, 1994-1995. Only trips by vessels that would not qualify for monkfish limited access for non-preferred alternative 3 were included in the PDT analysis. Source: PDT Document 1 – September 26, 1997. Source: PDT Document 1 (Appendix I), average trip lengths from 1995 vessel trip reports.

Gear	Preferred alternative trip limit <sup>29</sup> for non-qualifying vessels in the SFMA	Average trip duration	Landings of whole fish per trip (lbs.)		Percent of total weight of fish onboard		Landings of monkfish tails per trip (lbs.)		Percent of total weight of fish onboard		Average landings of monkfish tails per day absent (lbs.)	
		Days	95 <sup>th</sup> percentile	99 <sup>th</sup> percentile	95 <sup>th</sup> percentile	99 <sup>th</sup> percentile	95 <sup>th</sup> percentile	99 <sup>th</sup> percentile	95 <sup>th</sup> percentile	99 <sup>th</sup> percentile	95 <sup>th</sup> percentile	99 <sup>th</sup> percentile
Groundfish trawl	50 pounds/DAS	9	1,992	2,988	20%	27%	600	900	6%	8%	150	225
Groundfish gillnet	50 pounds/DAS	1	332	332	3%	7%	100	100	1%	2%	100	100
Scallop dredge	300 pounds/DAS	11	5,312	7,304	13%	20%	1,600	2,200	4%	6%	115	155
Scallop trawl	300 pounds/DAS	6	2,324	5,976	10%	17%	700	1,800	3%	5%	65	165
Summer flounder trawl	5% of total weight of fish onboard	Not analyzed	680	1,295	18%	21%	205	390	5%	6%	-	-
Other gear	50 pounds/trip	Not analyzed	498	1,328	7%	10%	150	400	2%	3%	-	-

<sup>29</sup> Pounds tail-weight. To calculate the whole-weight equivalent, multiply the trip limit for tails by 3.32. When expressed as the percent of total weight of fish onboard, the 5 percent limit would apply to the possession or landings of whole fish or tails.

#### 7.1.5.1.1.5.3 Bycatch limits – Non-preferred alternatives 1, 2, and 4

Potential problems with unacceptably high discarding are precisely why the Councils considered, but rejected non-preferred alternative 2. This alternative was an initial attempt to counter the argument that the proposed trip limits for non-preferred alternative 1 were too low and would cause unacceptable discarding of monkfish. Ninety-five percent of all trips, regardless of the degree of targeting monkfish, would be able to land the entire catch without discarding. On the other hand, the high trip limits for non-preferred alternative 2 (including a 3,500 pound tail-weight possession limit for multispecies trawl vessels) were proposed at levels that would allow many vessels to target monkfish under a trip limit. The Councils believed that vessels targeting a species should not be restrained by a trip limit that would force them to return to port or continue fishing and high-grade their catch to retain more valuable sized fish or their livers.

The initial proposed trip limits, for each gear that commonly captures monkfish in the northern and southern areas were based on trips that had a small portion of the total revenue coming from monkfish landings. Rounded off to the nearest 100 pounds, ninety-nine percent of trips where monkfish landings comprised less than 16 percent of total revenue would be able to land its entire catch of monkfish without discarding. A much larger proportion of total monkfish landings occurred on trips where monkfish landings exceeded the proposed trip limits, but these trips were ones where fishermen targeted monkfish. Presumably, many of these vessels would qualify for monkfish limited access and these trips would occur during monkfish days-at-sea or while the directed monkfish fishery is open under the quotas. If a vessel that made these trips does not qualify, it is very unlikely that it would make the trip anyway and discard, since most of the trip's revenue originally came from monkfish landings. It is impossible to accurately predict how many of these trips with high monkfish landings would continue and begin discarding monkfish. Estimating changes in fishing behavior requires detailed knowledge of the fixed and variable costs of each vessel, as well as the motives of the fishermen. There is simply not enough data to make this estimate possible for the wide variety of vessels and fisheries that land monkfish.

The three management alternatives (including non-preferred alternative 3) have similar trip limits for fisheries with monkfish bycatch, but have slight differences that reflect the management strategy of each alternative. In certain cases, the Councils also combined trip limits across areas or types of gear to make the proposed management program more uniform and thus improve compliance and enforceability. In all cases, the proposal is based on weighout data for individual trips and reflects the normal landings of monkfish that are peculiar to a given area, gear type, and fishery. Scallop dredges, for example, take longer trips and fish in areas prone to monkfish bycatch than do vessels in other fisheries. Their trip limits are therefore considerably higher than those proposed by the Councils for other vessels. The proposed limits for each alternative and the proportion of trips and landings that would be impacted are explained in more detail below.

##### *7.1.5.1.1.5.3.1 Groundfish trawl limits*

###### **Northern area**

In the northern area, the 1,000 pound trip limit for Alternative 1 would affect 94 percent of trips that derive more than 25 percent of their total revenue from groundfish while using trawl gear (Figure 27, upper panels). About 92 percent of groundfish trips would be affected in the southern area (Figure 28, upper panels). Landings on the trips that had monkfish landings exceeding the 1,000 pound limit accounted for 50 percent of the total landings of monkfish in the northern area and 38 percent in the southern area. Most trips with landings that exceed the proposed limits target monkfish, although

groundfish still contributed more than 25 percent of total revenue. Some of the vessels making the trips with high landings of monkfish would qualify for limited access and could target monkfish. Others may move to areas with less monkfish and more of their target species if they cannot otherwise land these high volumes of monkfish.

Monkfish limits per day-at-sea are possible for this fishery, because the time away from port is monitored via a mandatory call-in system. Vessels that do not call-in cannot retain any of the 10 regulated large-mesh species and are not reflected in the weighout files with trips having at least 25 percent of the total revenue from monkfish.

The proposed 200 pounds per day-at-sea limit for alternatives 1 and 4 would have similar impacts to trip limits on the number of affected trips and on monkfish landings. In the northern area, about 93 percent of all trips in this category would be able to land their customary bycatch of monkfish (Figure 27, lower panels). Because of the few number of trips with large volumes of monkfish, monkfish landings in this fishery would be reduced by 42 percent, assuming that vessels with landings less than the trip limit do not increase fishing for monkfish.

### **Southern area**

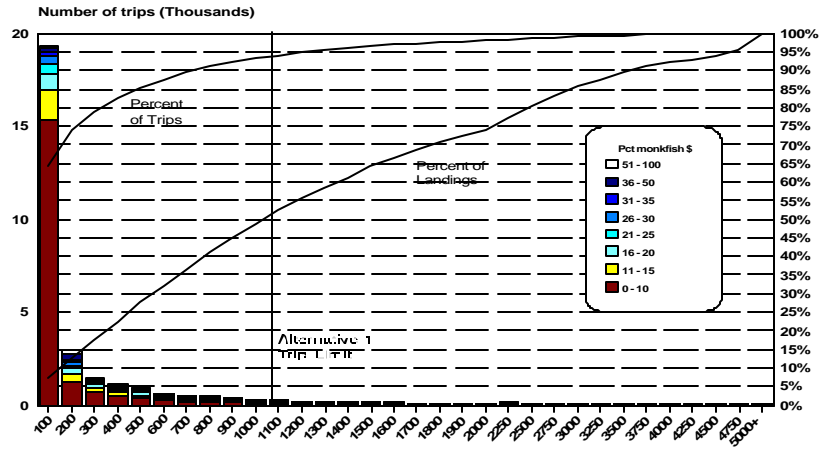
In the southern area (Figure 28, lower panel), the 200 pound/DAS trip limit would not affect 94 percent of all trips in this category, but could reduce monkfish landings by as much as 47 percent. Due to the high percent of revenue derived from monkfish when their landings exceed the proposed trip limit, it does not mean that these landings would be discarded. Some trips will occur within the limited access program while on other trips, the trip limit would force changes in fishing behavior because fishermen could not land the majority of their monkfish catches. Some trips may not occur at all because of the bycatch trip limit.

The trip limits also affect mainly large vessels. Nearly all vessels that are smaller than ton class 31 (less than 150 GRT) land less than 200 pounds per trip (Figure 27 and Figure 28, right panels). They would be unaffected by a 1,000 pound trip limit. This distribution of monkfish landings by vessel size occurs because the smaller vessels tend to take shorter trips, often day-trips. They also tend to have smaller fish holds.

Limits per day-at-sea also has similar impacts on vessels of various sizes. Nearly all vessels smaller than ton class 31 have monkfish landings that do not exceed the 200 pound/DAS proposed limit. In the northern area, there are some trips by ton class 24 and 25 vessels that would be impacted by the daily limit.

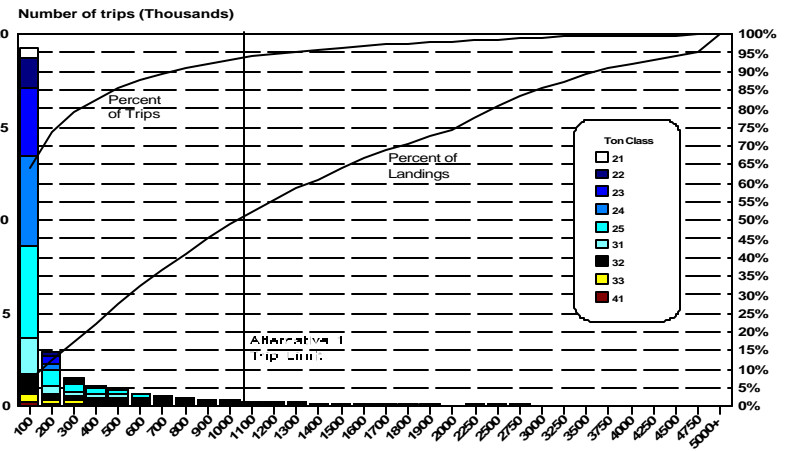
Non-preferred alternative 3 proposes no trip limits for this fishery category, because all vessels that can target groundfish would automatically qualify for monkfish limited access.

### Landings by Percent Monkfish Revenue

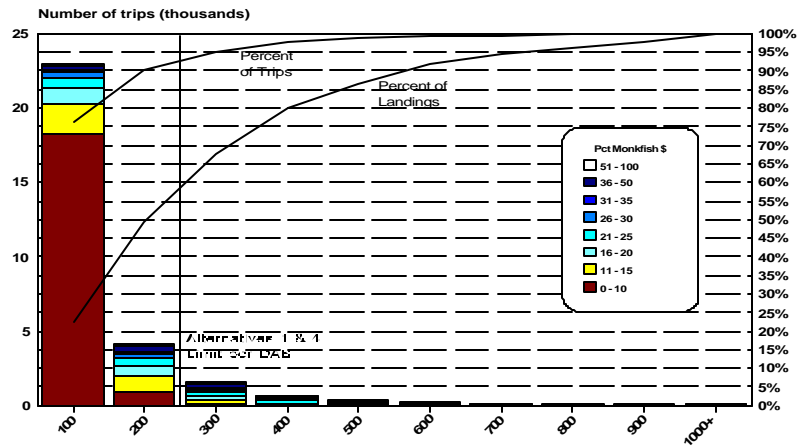


Landings per trip, lbs. tail weight

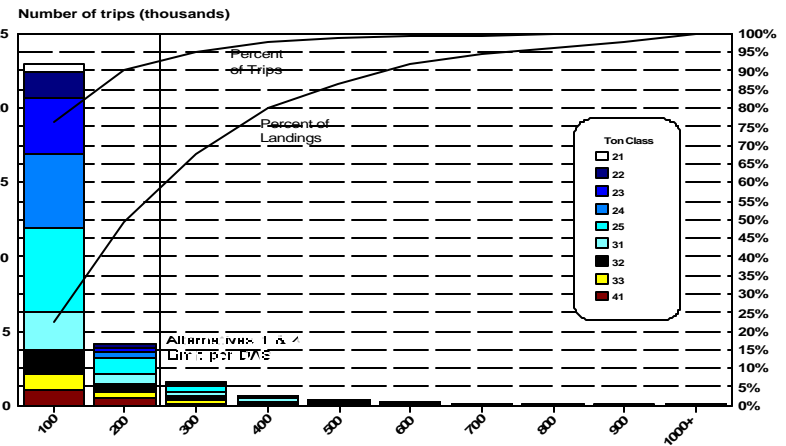
### Landings by Vessel Ton Class



Landings per trip, lbs. tail weight



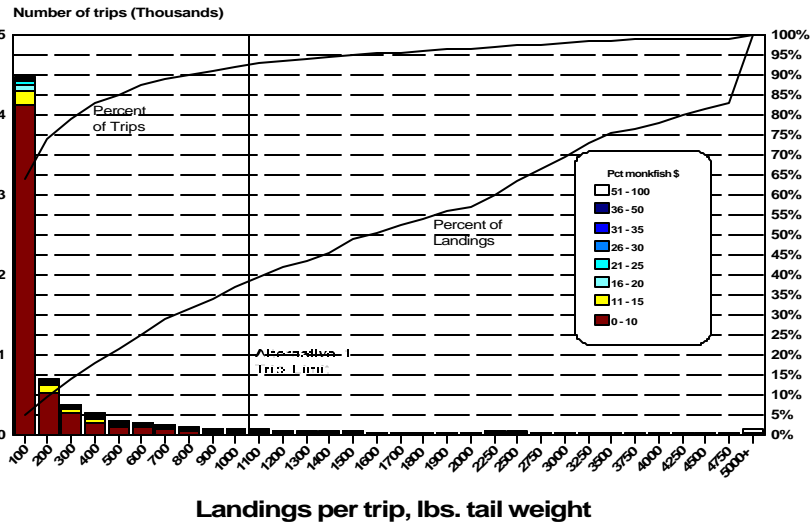
Landings per Day at Sea, lbs. tail weight



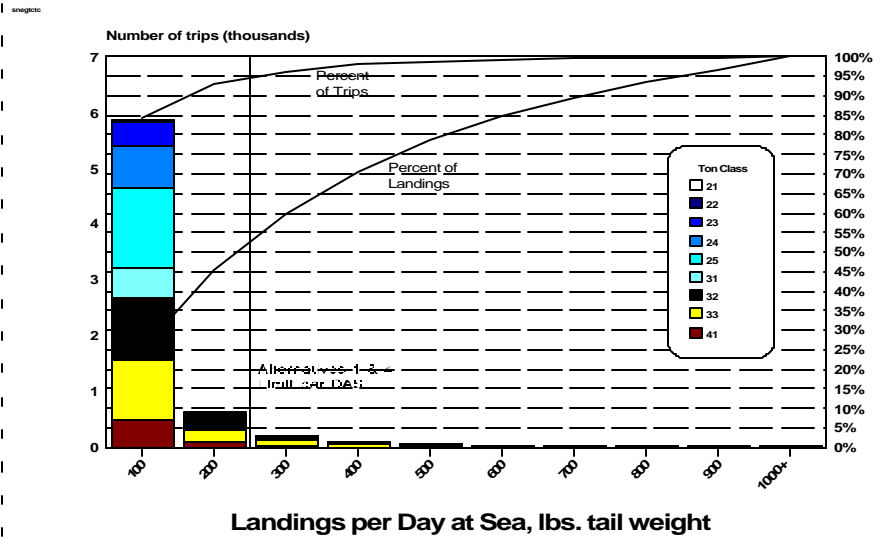
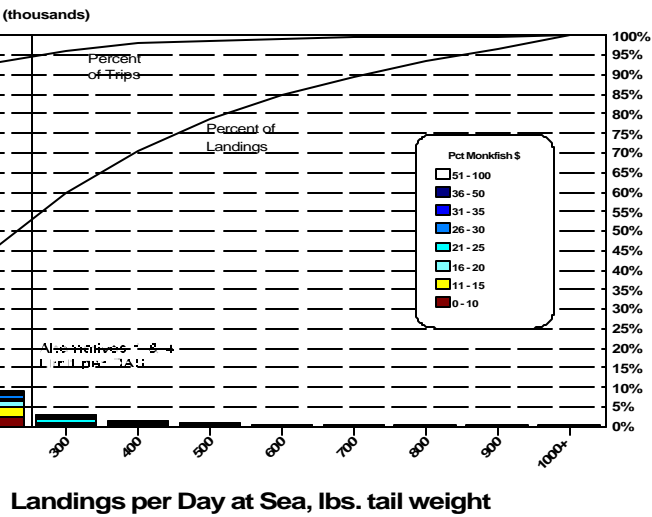
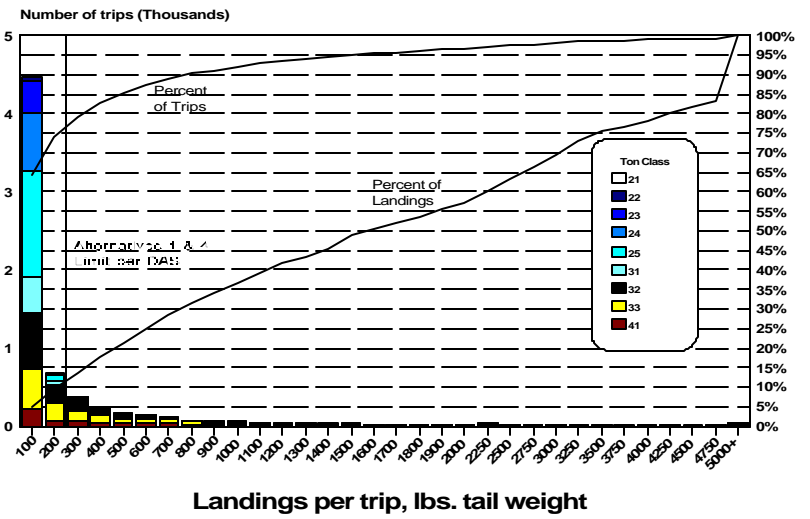
Landings per Day at Sea, lbs. tail weight

**Figure 27.** Distribution of trips grouped by monkfish landings per trip (upper) and per day-at-sea (lower) for trawl vessels targeting large-mesh groundfish in the Northern Fishery Management Area, 1991-1993. The plots on the left show the distribution of trips by the percent of a trip's value from monkfish landings. The plots on the right show the distribution of trips by vessel size.

### Landings by Percent Monkfish Revenue



### Landings by Vessel Ton Class



**Figure 28.** Distribution of trips grouped by monkfish landings per trip (upper) and per day-at-sea (lower) for trawl vessels targeting large-mesh groundfish in the Southern Fishery Management Area, 1991-1993. The plots on the left show the distribution of trips by the percent of a trip's value from monkfish landings. The plots on the right show the distribution of trips by vessel size

#### 7.1.5.1.1.5.3.2 *Groundfish gillnets*

##### **Northern and southern area**

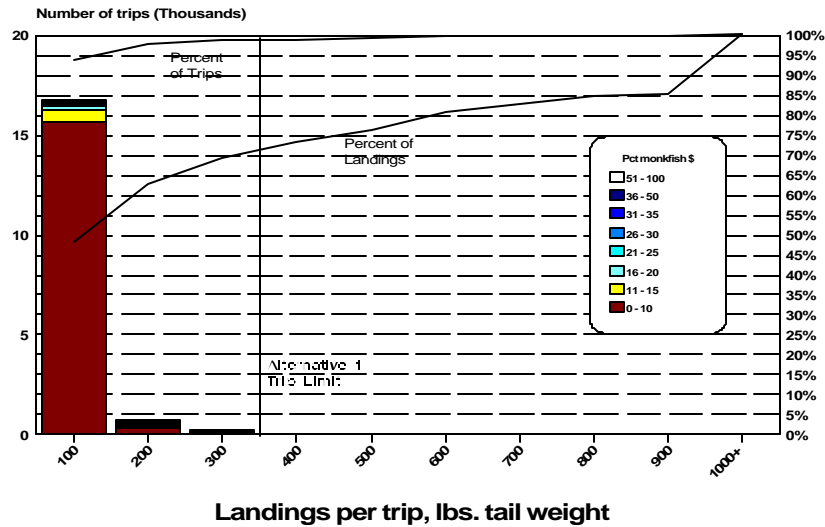
Very few trips by fishermen using gillnets to target groundfish would be impacted by the proposed trip limits. In the northern area (Figure 29, upper panel), only two percent of all trips in this category would be affected by the proposed 300 pounds tail-weight trip limit. Nearly all trips with low proportions of monkfish revenue have monkfish landings that are less than 200 pounds per trip. The remaining trips with monkfish landings above the trip limit would have to discard the excess monkfish, but the fishing effort on these trips is likely to occur under the limited access program or it will probably change so that monkfish bycatch is reduced.

Also, the trips by small vessels (< 150 GRT) in this category have monkfish landings that less than the proposed trip limit. On the other hand, there are a few trips (< two percent) that have higher amounts of monkfish landings, many that partially target monkfish. As a result, the 300-pound trip limit for the northern area would reduce monkfish landings by groundfish gillnet vessels by 29 percent.

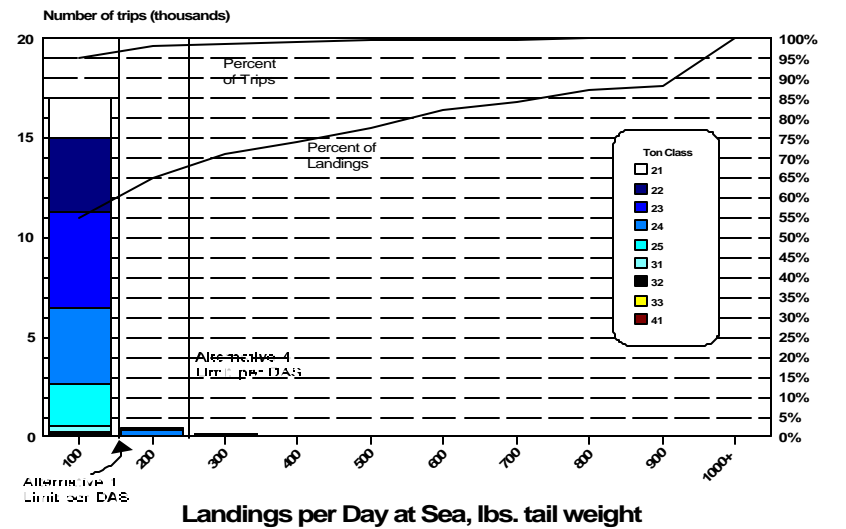
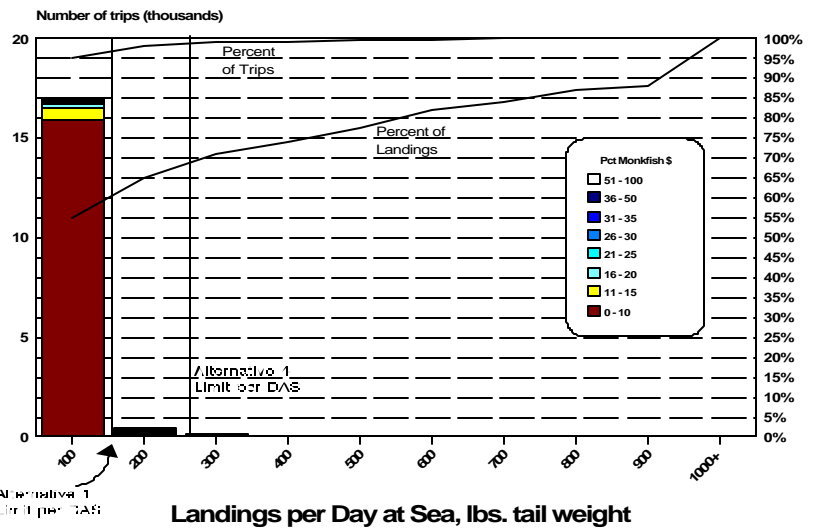
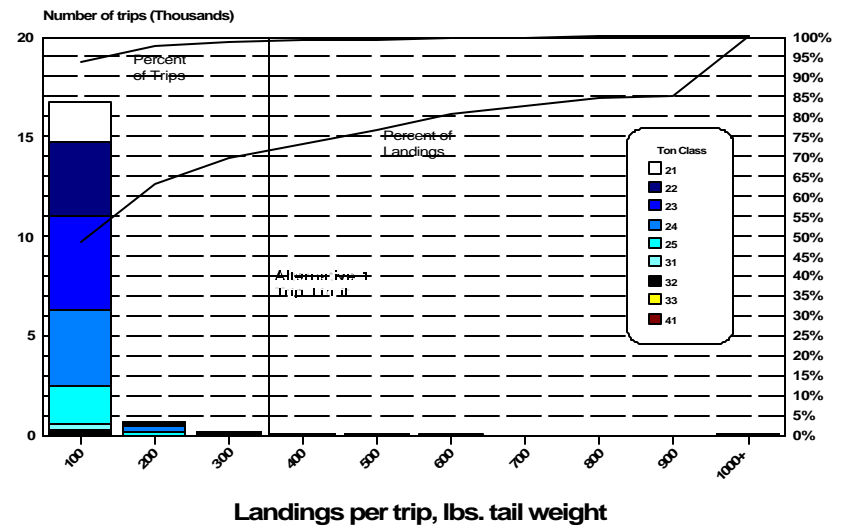
The landings per day-at-sea limit for the northern area would also affect few trips (Figure 29, lower panel). Non-preferred alternative 1 proposes a 100 pound/DAS limit, which would affect only four percent of all trips in this category, but could reduce monkfish landings by as much as 40 percent. Few if any trips that have monkfish revenue below 10 percent of total trip revenue would be affected. Most trips with monkfish landings higher than larger vessels make the non-preferred alternative 1 trip limit. Which limit applies, per trip or per day-at-sea, depends on whichever limit is more. These estimates of each factor, therefore, overestimate the proportion of trips that would be affected.

The monkfish landings per day-at-sea limit for non-preferred alternative 4 would affect fewer vessels than non-preferred alternative 1, because the 200 pound/DAS limit is higher. Only two percent of all trips would be affected, but landings could be reduced as much as 32 percent. Alternative 3 proposes no trip limits for this fishery category, because all vessels that can target groundfish would automatically qualify for monkfish limited access.

## Landings by Percent Monkfish Revenue

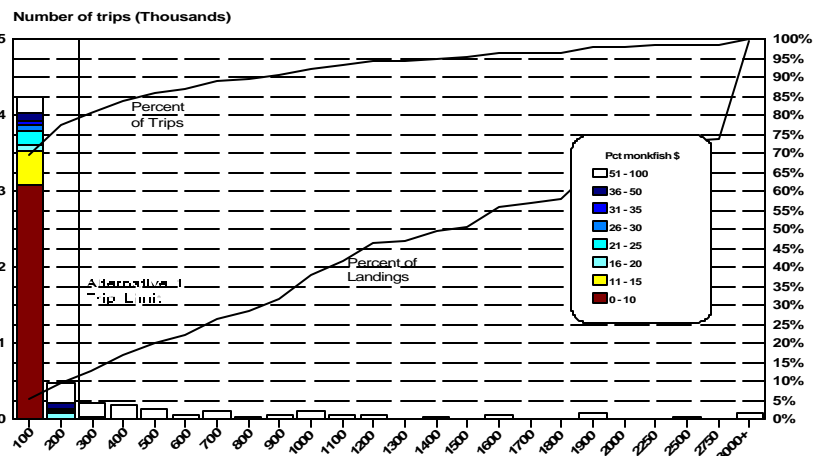


## Landings by Vessel Ton Class



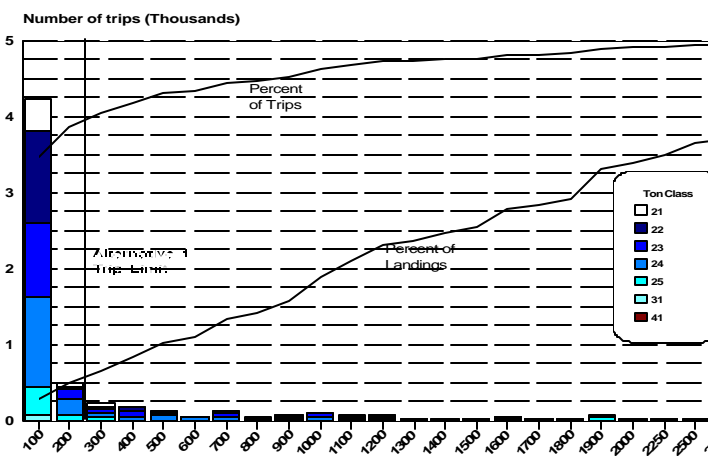
**Figure 29.** Distribution of trips grouped by monkfish landings per trip (upper) and per day-at-sea (lower) for gillnet vessels targeting large-mesh groundfish in the Northern Fishery Management Area, 1991-1993. The plots on the left show the distribution of trips by the percent of a trip's value from monkfish landings. The plots on the right show the distribution of trips by vessel size

### Landings by Percent Monkfish Revenue

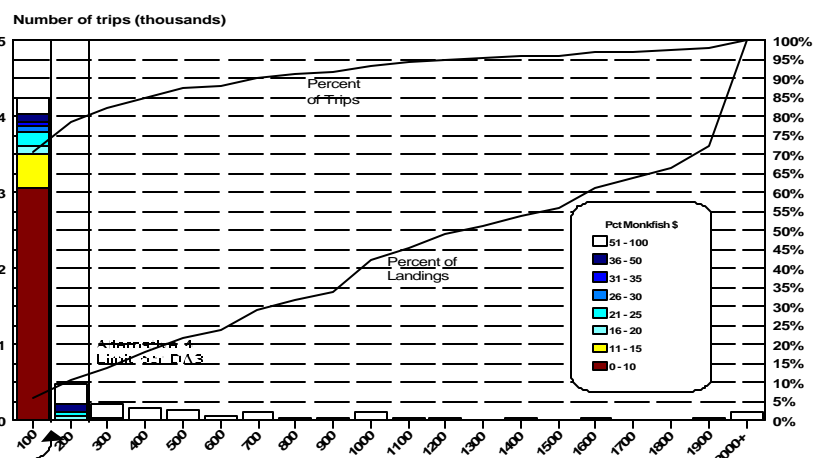


Landings per trip, lbs. tail weight

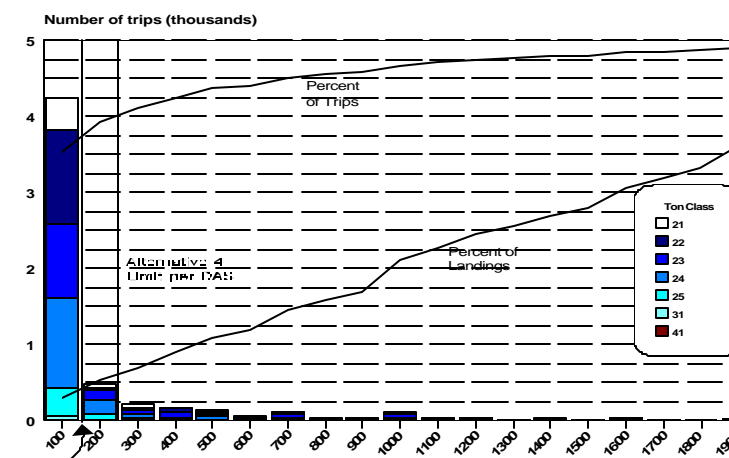
### Landings by Vessel Ton Class



Landings per trip, lbs. tail weight



Landings per Day at Sea, lbs. tail weight



Landings per Day at Sea, lbs. tail weight

**Figure 30.** Distribution of trips grouped by monkfish landings per trip (upper) and per day-at-sea (lower) for gillnet vessels targeting large-mesh groundfish in the Southern Fishery Management Area, 1991-1993. The plots on the left show the distribution of trips by the percent of a trip's value from monkfish landings. The plots on the right show the distribution of trips by vessel size

#### 7.1.5.1.1.5.3.3 Summer flounder trawl

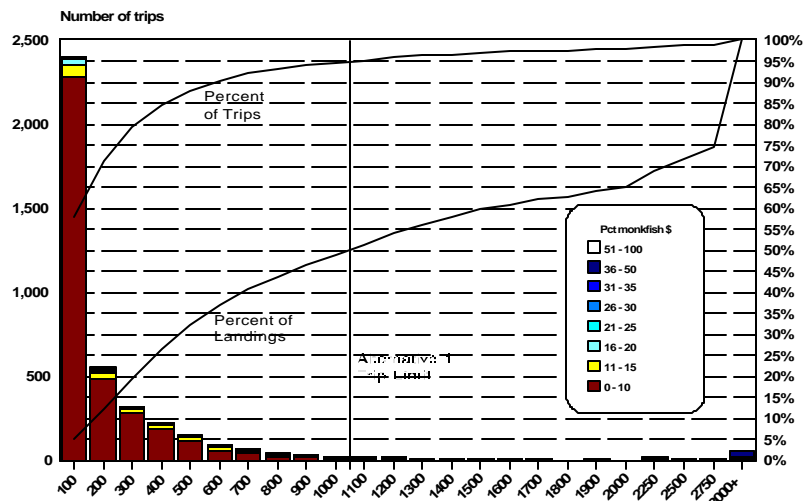
Few trips, but a substantial fraction of monkfish landings, would be affected by the proposed 1,000 pounds tail-weight and 10 percent of the total weight of fish on board limits. The summer flounder trawl fishery occurs almost exclusively in the southern area. Landings of monkfish as a bycatch on trips that derive more than 25 percent of the total revenue from summer flounder are sometimes very high when they exceed these limits. Most of the trips with landings that exceed the proposed limits derive less than 30 percent of the total revenue from monkfish. How frequently the proposed limits will induce changes in fishing behavior depends on the amount of overlap in the distribution of monkfish and summer flounder when these vessels target the latter.

Recent changes to management will significantly reduce the quotas to meet the biological targets under the Summer Flounder FMP. If the fisheries close earlier due to the reduced quotas, the monkfish bycatch associated with this fishery will similarly decline.

A trip limit of 1,000-pounds tail-weight or 50 percent of the total weight of fish onboard is proposed for non-preferred alternative 1. The 50 percent possession limit will have no effect on trips in this category (Figure 31, lower panel). It will almost never be less than the 1,000-pound trip limit. The 1,000-pound trip limit will affect the landings of monkfish on about six percent of trips in this category (Figure 31, upper panel). Because of the high volume of monkfish landings when the amount of a trip is more than the proposed limit, total landings of monkfish bycatch could be reduced as much as 50 percent. It is difficult to estimate how frequently the trip limit would alter fishing behavior to avoid catching monkfish. Some trips, especially when the monkfish bycatch exceeds 3,000 pounds tail-weight, derive more than 30 percent of the trip's revenue from monkfish. Some of the vessels with these high-volume trips could qualify for monkfish limited access. If they do not qualify, however, they would probably seek other areas to fish to target more on summer flounder and less on monkfish.

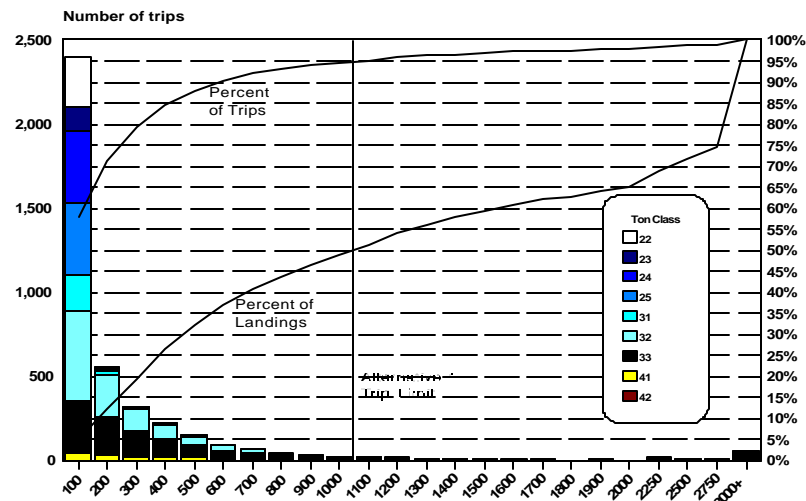
Like Alternative 1 trip limits, a 10 percent possession limit would affect few trips, but a substantial fraction of monkfish landings in this fishery category. Alternatives 3 and 4 propose a proportional possession limit of 10 percent of the total weight of fish onboard. This limit would affect only about seven percent of the total trips targeting summer flounder (Figure 31, lower panel), but could decrease monkfish bycatch by as much as 47 percent. By definition, the amount of a trip's revenue from monkfish increases as a proportion of the total when monkfish landings exceed 10 percent. Some partial targeting of monkfish may be occurring when monkfish landings exceed 10 percent and the limit may affect fishing behavior in some cases. How frequently the 10 percent possession limit will alter fishing behavior and decrease monkfish catch is difficult to predict.

## Landings by Percent Monkfish Revenue

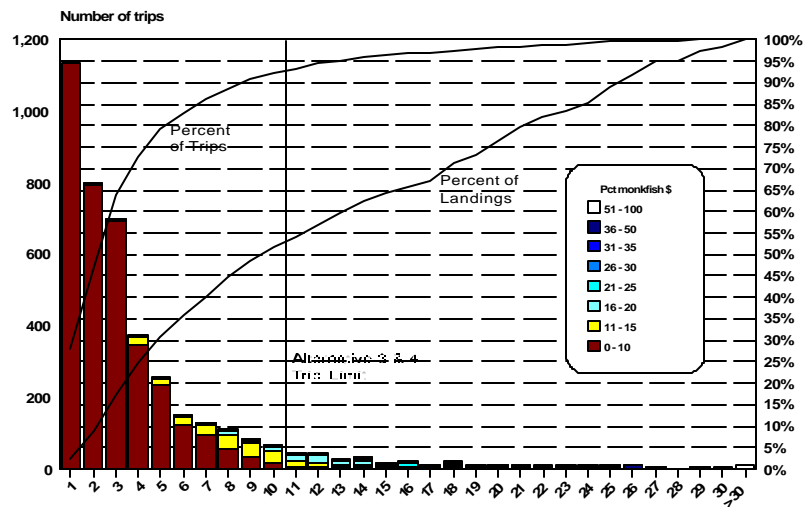


Landings per trip, lbs. tail weight

## Landings by Vessel Ton Class



Landings per trip, lbs. tail weight



Percent monkfish landings by weight

**Figure 31.** Distribution of trips grouped by monkfish landings per trip (upper) and per day-at-sea (lower) for gillnet vessels targeting summer flounder in the Southern Fishery Management Area, 1991-1993. The plots on the left show the distribution of trips by the percent of a trip's value from monkfish landings. The plots on the right show the distribution of trips by vessel size

#### *7.1.5.1.1.5.3.4 Small mesh trawl fisheries*

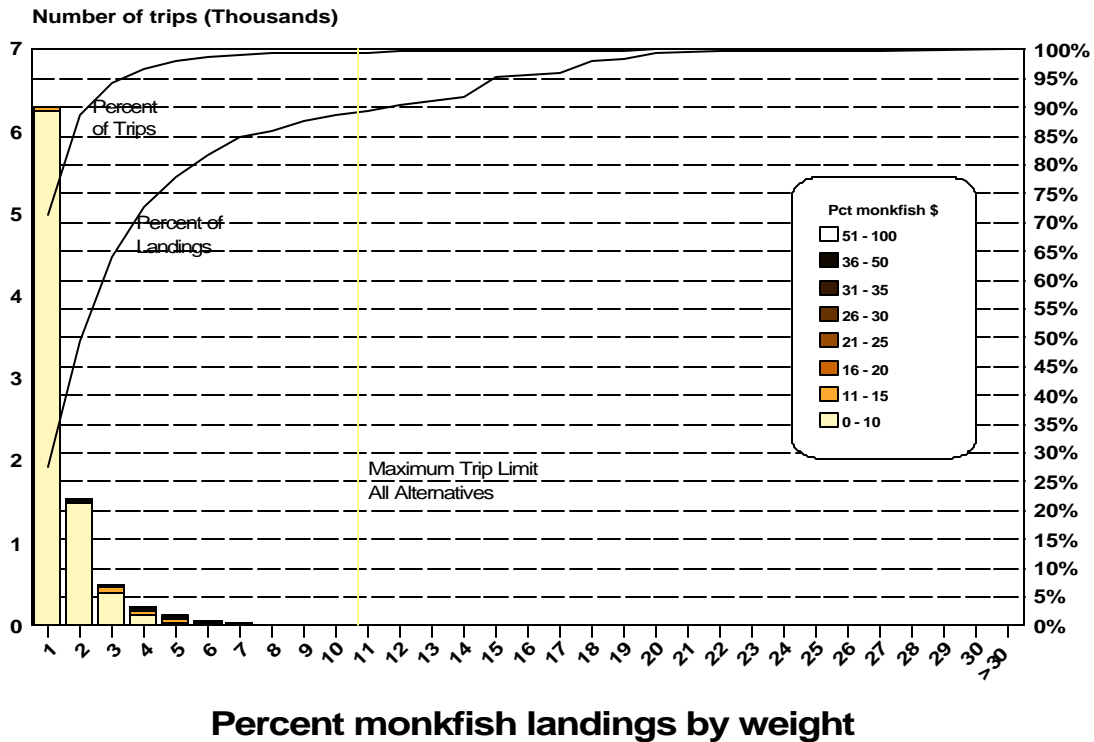
At the most liberal limit (10 percent of the total weight of fish onboard), the monkfish possession limits for fisheries that target other species with small mesh (less than 6 inches in the New England regulated mesh area and 5 1/2 inches in the Mid-Atlantic regulated mesh area) would affect very few trips. The bycatch of monkfish on these trips would not decrease and could increase, especially if landing live fish as a bycatch became even more lucrative.

#### **Northern area**

In the northern area (Figure 32), a 10 percent limit would have affected an extremely small fraction of the 5,000 trips during 1991-1993 that were evaluated. Vessels in the small mesh fishery in the northern area target shrimp, whiting, and dogfish. Monkfish landings would decrease only about two percent and could increase. If the criteria for selecting trip limits in other fisheries are applied to small mesh fisheries, the possession limit could be as low as four percent. Unlike other fisheries, however, the percent of revenue from monkfish is very low. A low possession limit is unlikely to affect fishing behavior and reduce catches of monkfish.

#### **Southern area**

A similar pattern of landing monkfish as a bycatch in small mesh fisheries occurs in the southern area (Figure 32). A very small fraction of total trips would be affected by a 10 percent possession limit, but when the fraction of monkfish landings is higher than 10 percent there are significant amounts of monkfish landed. Unlike the northern area, a 10 percent possession limit in the southern area could reduce monkfish landings by about 12 percent. These landings, however, make up a small fraction of the total revenue and the possession limit is unlikely to change fishing behavior and reduce monkfish catch. If the criteria for selecting trip limits in other fisheries are applied to small mesh fisheries, the possession limit could be as low as six percent.



**Figure 32.** Distribution of trips grouped by monkfish landings per trip (upper) and per day-at-sea (lower) **for gillnet vessels targeting squid, whiting, and scup in the Southern Fishery Management Area, 1991-1993.**

#### 11.6.5.5 Scallop dredge

The majority of monkfish bycatch from scalloping occurs in the southern area, so the following discussion focuses on that area. The monkfish bycatch that comes from the northern area mainly arises from scalloping on the northern edge of Georges Bank, in statistical areas 522 and 561. Both these statistical areas fall within the northern fishery management area (Figure ), but the southern area trips limits for non-preferred alternative 1 would apply to scallop dredges fishing there. For non-preferred alternatives 3 and 4, the scallop trip limits is the same in the northern and southern areas. The following discussion of the impacts of the proposed trip limits, therefore, focuses on the catches in the southern area only.

#### Southern area

The proposed trip or possession limits for scallop dredge vessels are generally much higher than those for other fisheries. Scallop vessels often land large amounts of monkfish per trip, due to the usual practice of making long trips (average DAS about 15 days) and their frequent bycatch of monkfish in scallop areas. These vessels, furthermore, have low reliance on monkfish revenue owing to the higher unit value of scallop meats.

The 4,000 pound trip limit for non-preferred alternative 1 would affect about eight percent of all trips during 1991-1993 that targeted scallops<sup>30</sup> (Figure 33, upper plots). Monkfish landings, on the other hand, could be reduced as much as 35 percent of current levels because the trips that land larger amounts of monkfish contribute to a disproportionate share of total landings. The majority of monkfish landings by scallopers that exceed the proposed limit are made on trips where monkfish contributes to a large fraction of the trip's value, even though the percent of the trip's revenue from scallop landings is at least 25 percent. For trips where monkfish contribute to less than 15 percent of the trip's value, only about one percent of them had landings that were higher than the non-preferred alternative 1 trip limit. Most vessels in the scallop fleet are large, falling into ton classes 33 and 41 (greater than 105 GRT).

Only five percent of all trips by scallop dredge vessels would be affected by the 5,000 pound non-preferred alternative 3 trip limit. Monkfish landings by scallop dredge vessels could decline as much as 25 percent of current landings in this category. The TAL allocation for the limited access fishery would be accordingly lower than under non-preferred alternative 1, increasing the potential for additional days-at-sea reductions if the target landings are exceeded. Fishermen could land more monkfish on their scallop trips, however, making it less likely they would have to change their fishing practices or discard the excess monkfish.

The non-preferred alternatives 1 and 3 possession limit of 400 pounds (tail weight) per day-at-sea is also not expected to affect a large number of dredge trips that target scallops. Only five percent of all trips in the southern area during 1991-1993 had monkfish landings that exceeded the proposed limit. Simply on the basis of this possession limit, the landings of monkfish bycatch is expected to decrease by 25 percent (Figure 33, lower plots). Very few trips where monkfish contributed to more than 15 percent of a trip's value had landings above the 400 pound per day-at-sea limit.

The possession limits for non-preferred alternative 1 are somewhat more liberal than those for non-preferred alternative 3, although individually the limits for non-preferred alternative 3 are the more liberal of the two options. Discards of monkfish could be higher under the limits for non-preferred alternative 3, especially on long trips that are common in the scallop fishery. Because of the way the limits would be applied, the proportion of affected trips would be less than 5 percent for non-preferred alternative 1 (4,000 pounds per trip or 400 pounds per day-at-sea, whichever is more) and about five percent of all trips for non-preferred alternative 3 (5,000 pounds per trip or 400 pounds per day-at-sea). Non-preferred alternatives 1 and 3 differ in the way they treat the possession limit per trip versus the possession limit per day-at-sea. The possession limit for non-preferred alternative 1 would be whichever is more. This means that a scallop dredge vessel on a 6-day trip could retain up to 4,000 pounds of tails, while a scalloper on a fifteen-day trip could retain up to 6,000 pounds of tails. Under non-preferred alternative 3, these same scallopers could only retain 2,400 and 5,000 pounds of tails, respectively.

The proposed possession limit for non-preferred alternative 4 is much more conservative. Although it only has a limit per day-at-sea, it is half of the one proposed by non-preferred alternatives 1 and 4 and may cause unacceptable discarding. About 16 percent of trips targeting sea scallops during 1991-1993 had monkfish landings that exceeded the 200 pound per day-at-sea limit (Figure 33, lower plots). Landings from monkfish bycatch could be reduced as much as 48 percent, but catches are unlikely to be reduced as much. About 20 percent of trips where monkfish accounted for 15 percent or less of total revenue had monkfish landings that exceeded the proposed non-preferred alternative 4 limit. It is very unlikely that scallopers on these trips would change their fishing behavior because they were not able to land their monkfish bycatch. The trips with low monkfish revenue that would exceed the non-preferred alternative 4 possession limit account for slightly more than 15 percent of total monkfish bycatch by scallopers, or eight percent of total landings in the southern area.

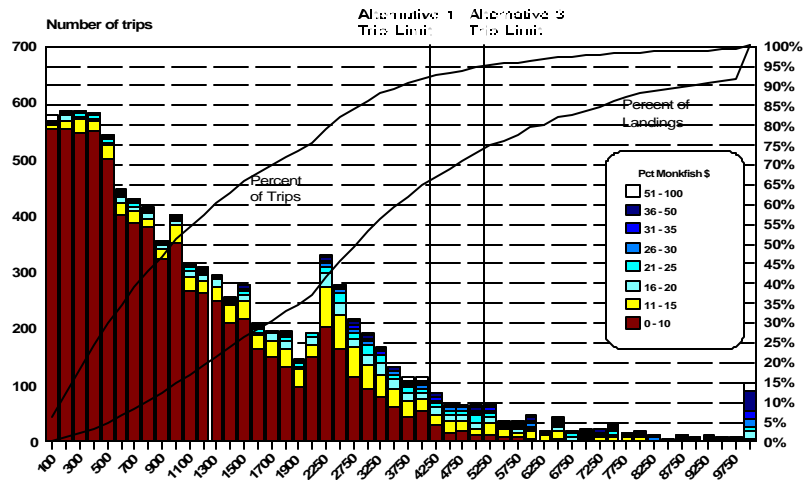
Discarding is not expected to be excessively high because the proposed trip limit is higher than customary bycatch levels and scallopers that rely on the high levels of monkfish landings will change their fishing practices. Some of the scallopers with a history of landing large amounts of monkfish will furthermore qualify for monkfish limited access. When monkfish revenue is a high fraction of the total trip value, the scallopers are probably targeting monkfish during some portion or their entire trip. If these

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<sup>30</sup> when scallop revenue exceeded 25 percent of the total value of a fishing trip.  
Monkfish FEIS - 254 -

vessels cannot land these large amounts of monkfish, it is likely that they will change their fishing practices. There are several options for scallopers that find large amounts of monkfish: a) move to other areas where scallops are abundant, but monkfish are not as prevalent, b) make shorter trips, or c) discard the excess monkfish. It is difficult to quantify how frequently the scallopers will discard monkfish, because it will depend on a variety of unpredictable factors. The Council believes that discarding will not be a frequent problem in the scallop fishery, because fishermen that rely on incidental catch for a significant fraction of revenue are likely to fish elsewhere when they cannot land a valuable component of their catch.

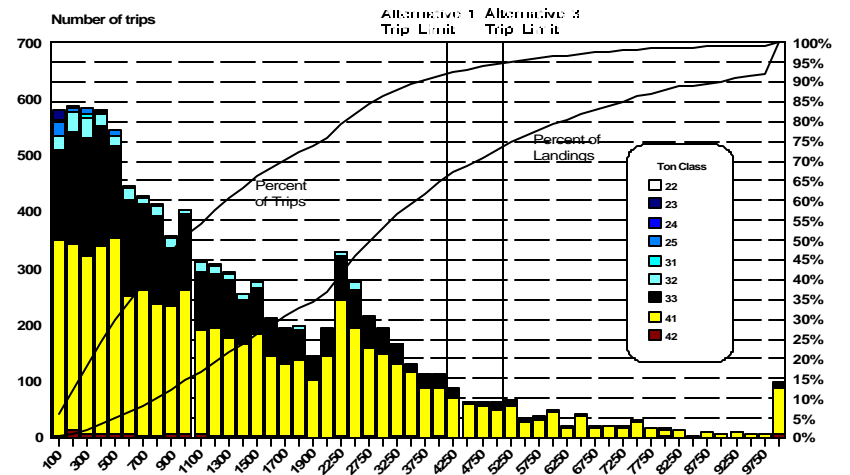
## Landings by Percent Monkfish Revenue



Landings per trip, lbs. tail weight

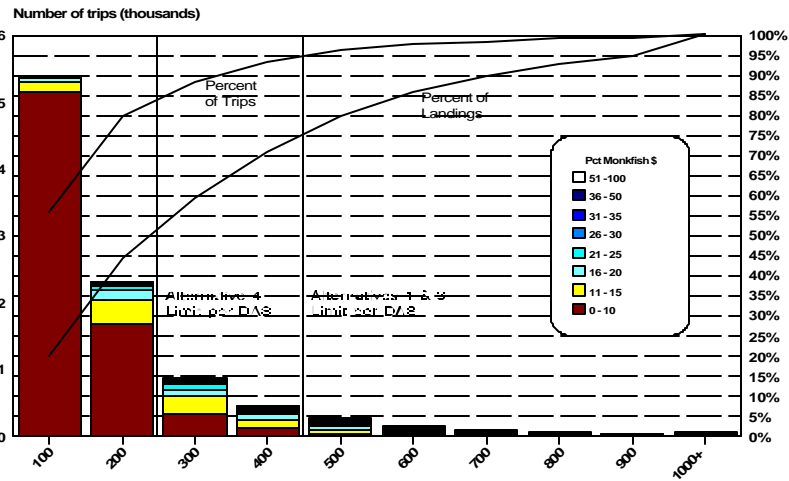
SNEDRCP

## Landings by Vessel Ton Class



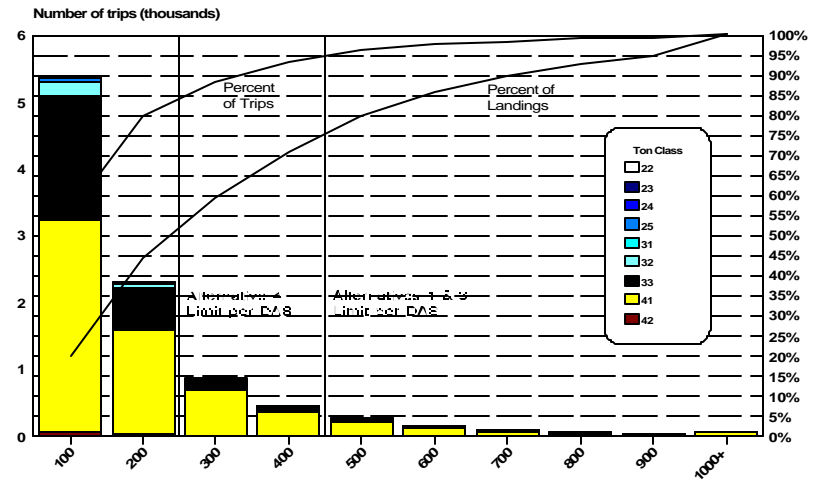
Landings per trip, lbs. tail weight

SNEDRCP



Landings per day at sea, lbs. tail weight

SNEDRCPA



Landings per day at sea, lbs. tail weight

SNEDRCPA

**Figure 33.** Distribution of trips grouped by monkfish landings per trip (upper) and per day-at-sea (lower) **for dredge vessels targeting scallops in the Southern Fishery Management Area**, 1991-1993. The plots on the left show the distribution of trips by the percent of a trip's value from monkfish landings. The plots on the right show the distribution of trips by vessel size

**Limits defined by other geographical divisions**

The Councils discussed a broad range of monkfish trip or possession limits for vessels using scallop dredges. Trip or possession limits that differ over smaller geographical regions was ultimately discarded by the Councils as a viable alternative because the differences were not great enough to justify the possible lower compliance and the higher enforcement costs. The proposed limits vary somewhat among the alternatives because the normal monkfish by-catch by scallopers varies with season and latitude. In some areas, the 200 pound per day-at-sea limit for non-preferred alternative 4 is not too conservative (i.e. it affects a small proportion of scallop trips) and in other areas the 5,000 pound per trip limit for non-preferred alternative 3 is not too liberal (i.e. some trips where monkfish account for a small proportion of a trip's value have monkfish landings that approach the proposed trip limit).

After taking comment at scoping meetings, the scallop dredge landings of monkfish were analyzed at a finer level of detail to recommend suitable monkfish possession limits for smaller geographical regions. The Council initially recommended the following monkfish limits for scallop dredge vessels, based on the same criteria that was used to develop the original recommendations for two management areas:

**Table 98.** Non-preferred trip limit options for scallop day-at-sea vessels.

<i>Gear</i>	<i>Target species</i>	<i>Proposed trip limit</i>
<i>Scallop dredges and trawls (with limited access permit and fishing under days-at-sea)</i>	Gulf of Maine	1,600 pounds (tail weight) per trip or 200 pounds (tail weight) per day-at-sea, whichever is more
	Georges Bank	5,000 pounds (tail weight) per trip or 400 pounds (tail weight) per day-at-sea, whichever is more
	Southern New England and the New York bight	3,000 pounds (tail weight) per trip or 300 pounds (tail weight) per day-at-sea, whichever is more
	Mid-Atlantic	3,000 pounds (tail weight) per trip or 200 pounds (tail weight) per day-at-sea, whichever is more

Managing monkfish bycatch in a greater number of areas in a fishery with vessels that frequently fish over a broad geographical range poses many problems. One problem is that the different trip limits may increase fishing effort in areas with higher trip limits. The added travel time may be more than offset by the increased value of the monkfish bycatch. Although the practice of optimizing the value of the catch relative to the variable costs of fishing is common, a trip limit may increase the normal shifts in fishing effort. Obviously, more restrictive trip limits would increase this effect if the area-specific limits differ. And since the vessels may primarily be targeting scallops, localized increases in fishing effort to also target monkfish would have a detrimental impact on scallops as well.

A second problem from having different trip limits for a large number of areas is the possibility of decreased compliance and more difficult enforcement. Vessels would need to be held to the lowest trip limit in any of the areas that they fished to make the trip limits effective. Thus continuous monitoring of fishing activity is necessary. Fortunately vessel-monitoring systems (VMS) would greatly improve compliance and reduce enforcement costs. Without a VMS system in place, different trip limits by area would be unenforceable.

Transiting areas that have lower monkfish bycatch trip limits still presents a problem, however. Under the days-at-sea monitoring program, the system may not be able to distinguish whether a vessel is in fact fishing or transiting an area. Perhaps rules could be established that no more than a given number of hourly reports within an

area would be a presumption that a vessel was fishing. It would be difficult and complicated however to make allowances for vessels that were broken-down or anchored to let bad weather pass under such a monitoring system.

#### *7.1.5.1.1.6 Minimum size limits*

The primary reason to implement a minimum size limit for monkfish is to achieve FMP objective 3, preventing increased fishing on immature fish. The monkfish size selection by nets with different mesh size is unknown, but may have a beneficial effect on size selection. The body shape of monkfish, however, prevents even large changes in minimum mesh size from substantially improving monkfish selectivity. Unless there is a significant shift in fishing behavior to avoid immature fish, there is therefore little rationale for implementing a size limit that is larger than current cull practices. The Council believes that this potential shift in fishing behavior is more likely in the Southern Fishery Management Area than in the Northern Fishery Management Area. A minimum size that is consistent with current cull practices will prevent increased fishing pressure on immature monkfish, while minimizing regulatory discards.

##### **7.1.5.1.1.6.1 Preferred alternative**

Some mortality reduction will be realized through survival of discarded monkfish. Although the direct gains in yield from survivors are unlikely to outweigh the yield loss from discard mortality (Section 7.1.5.1.1.6.3), some mortality reduction is expected from surviving discards, nonetheless. With an 11-inch minimum size in both areas during year 1, the expected mortality reduction is four percent. If the 14-inch minimum size becomes effective May 1, 2000, the expected mortality reduction is seven percent. These estimates do not take into account any changes in fishing behavior induced by a minimum size regulation.

In the Northern Fishery Management Area, the fraction of discarded catch surviving with an 11-inch minimum tail length (17-inch total length) is four percent (Table 99). The proportion of total landings under the proposed minimum size is 16 percent for trawls, 14 percent for dredges, and 2 percent for gillnets. The fraction of discarded catch surviving is calculated by multiplying the percent of landings (estimated by number from 1995-1996 sea sampling data) by the discard survival rate, or  $0.16 \times 0.3 = 0.048$  in this case. The total fraction of catch surviving in each area was calculated as the landings-weighted average of the fractions surviving for each gear type. Although the highest discard survival is for gillnets (60%), a higher proportion (16%) of the trawl catch is less than the minimum size. In the Northern Fishery Management Area, the greatest mortality reduction that can be expected from the minimum size is in the trawl fishery.

In the Southern Fishery Management Area (Table 99), the largest fraction of the catch below the proposed minimum size is for scallop dredges. Dredge vessels only land 15 percent of the total in the southern area, however. The aggregate reduction in mortality in the Southern Fishery Management Area is only three percent when weighed by landings by gear. Only 1 percent of the number of monkfish caught by gillnets are under the proposed 11-inch minimum size.

Greater mortality reduction is expected when the 14-inch minimum size becomes effective in the Southern Fishery Management Area (Table 100). The fraction of the catch surviving discards from trawls increases from 4 percent with an 11-inch minimum size (Table 99) to 18 percent with a 14-inch minimum size (Table 100). The greater mortality reduction occurs mainly because the fraction of the trawl catch under the minimum size is 61 percent. Most of the trawl-caught monkfish in the southern area, however, comes from the directed fishery. It is much more likely that these vessels will adapt to the higher size limit by avoiding small fish or by using more size-selective gear.

The fraction of discarded catch surviving from dredges also increases from 6 to 13 percent, but it is less likely that scallop vessels will be able to avoid small monkfish. New technology for using finfish excluder devices in scallop dredges could effectively reduce unwanted discards of small monkfish.

The fraction of discarded catch surviving from gillnets increases from one percent with an 11-inch minimum size to nine percent with a 14-inch minimum size. Not only does the fraction of catch under the larger size limit higher, but also the discard mortality rate is lower, allowing more discarded monkfish to survive. This issue is discussed in more detail below.

The percent of landed number below the size limit is analogous to a mesh selection pattern, but includes fishery culling practices. If the every vessel culled monkfish with exactly the same size, the Councils could set a minimum size that would produce no discards. Knife-edge size selection is unfortunately the exception and a size limit that produces an acceptably low level of discards is unavoidable while preventing vessels from targeting small monkfish.

A higher size limit that was near the median of landings would force fishermen to discard half of the monkfish they caught. This option is unattractive unless discard survival is high or the size limit would induce significant changes in fishing behavior. Changes in fishing behavior, discussed in more detail below, include moving to avoid small fish when they are encountered or using gear that is more size selective for monkfish while maintaining efficiency for catching target species.

Although increased compliance costs for a larger size limit in the Southern Fishery Management Area are expected, the Council is proposing administration that reduces administrative and enforcement costs. The 30-day declaration only applies to vessels fishing in the Northern Fishery Management Area with the smaller size limit. Vessels can declare that they will fish exclusively in the northern area for 30 to 365 days, but this declaration is optional. Vessels could continue fishing in the northern area without declaring their intention if they land only monkfish tails that are larger than 11 inches.

**Table 99. Preferred alternative size limit prior to May 1, 2000.** Estimated mortality reduction from the survivors of discarded monkfish due to an 11-inch minimum tail length in all areas.

Gear	Total Landings (mt)		Percent of Total		Percent of landed number below size limit		Discard mortality rate		Fraction of catch surviving		
	North	South	North	South	North - 11"	South - 11"	North	South	North	South	
Fish Trawl	10,672	4,290	63%	48%	16%	12%	70%	70%	5%	4%	
Scallop Dredge	3,768	1,356	22%	15%	14%	29%	80%	80%	3%	6%	
Gillnet	2,537	3,138	15%	35%	2%	1%	40%	40%	1%	1%	
Other	48	144	0%	2%	0%	0%	70%	70%	0%	0%	
<b>Total</b>	<b>17,026</b>	<b>8,928</b>						<b>Mortality reduction:</b>		<b>4%</b>	<b>3%</b>
									<b>All areas:</b>		<b>4%</b>

**Table 100. Preferred alternative size limit for after May 1, 2000.** Estimated mortality reduction from the survivors of discarded monkfish due to an 11-inch minimum tail length in the Northern Fishery Management Area and a 14-inch minimum tail length in the Southern Fishery Management Area.

Gear	Total Landings (mt)		Percent of Total		Percent of landed number below size limit		Discard mortality rate		Fraction of catch surviving		
	North	South	North	South	North - 11"	South - 14"	North	South	North	South	
Fish Trawl	10,672	4,290	63%	48%	16%	61%	70%	70%	5%	18%	
Scallop Dredge	3,768	1,356	22%	15%	14%	65%	80%	80%	3%	13%	
Gillnet	2,537	3,138	15%	35%	2%	15%	40%	40%	1%	9%	
Other	48	144	0%	2%	0%	0%	70%	70%	0%	0%	
<b>Total</b>	<b>17,026</b>	<b>8,928</b>						<b>Mortality reduction:</b>		<b>4%</b>	<b>14%</b>
									<b>All areas:</b>		<b>7%</b>

#### 7.1.5.1.1.6.2 Non-preferred options

The Councils considered applying minimum size limits by gear or gear and area. Lower mortality reduction than the year 2 preferred alternative is expected when the 14-inch minimum size applies only to vessels that use fixed gear. The primary fixed gear that has significant monkfish catches is sink gillnet. Mortality reduction is expected to increase from 4 percent for the preferred alternative to 6 percent in the Northern Fishery Management Area with this option (Table 101). Mortality reduction is only six percent in the Southern Fishery Management Area, however, due to the lower fraction of the catch under the non-preferred 11-inch size limit option for mobile gear. On one hand, the lower fraction of the catch reduces discards of unavoidable catches of small monkfish. On the other, it reduces the incentive for trawl vessels to avoid catching small monkfish. The aggregate mortality reduction for both areas is six percent for non-preferred option 1 (Table 101).

Another option that the Councils considered was to implement a 14-inch minimum size for all vessels except those using mobile gear in the Northern Fishery Management Area (Table 102). The rationale for a smaller size limit for mobile gear in the north is because of the inability for groundfish trawl vessels to avoid small monkfish in the northern area. Also the Council believes, but has no supporting data, to suspect that small monkfish in trawls fare better in the Southern Fishery Management Area than in the northern area. The Southern Fishery Management Area has less mud and rocks that are detrimental to monkfish survival when captured by trawl nets. The mortality reduction in the northern area is that same as expected for non-preferred option 1 above. In the southern area, the expected mortality reduction is the same as expected for the year 2 preferred alternative measures. Combined, the aggregate mortality reduction is expected to be the highest at nine percent.

The reason the Councils rejected these non-preferred options was due to increased enforcement costs. With a size limit that differs by gear, enforcement would have to observe the boat using its fishing gear to make a case for violating the 14-inch minimum size. Vessels could also take advantage of a potential loophole by using a trawl for part of the fishing trip that otherwise caught monkfish with gillnets. If the size limit differs by gear and area, the enforcement problem is doubled and compliance costs would be higher. Enforcement would have to prove vessels did not fish in the northern area or use mobile gear to prosecute a violation of the 14-inch size limit in the southern area. To relieve the enforcement burden, vessels would have to declare into a fishing area, increasing compliance costs.

**Table 101. Non-preferred option 1.** Estimated mortality reduction from the survivors of discarded monkfish due to an 11-inch minimum tail length in for vessels using mobile gear and a 14-inch minimum tail length for vessels using fixed gear.

Gear	Total Landings (mt)		Percent of Total		Percent of landed number below size limit				Discard mortality rate		Fraction of catch surviving	
	North	South	North	South	North - 11"	North - 14"	South - 11"	South - 14"	North	South	North	South
Fish Trawl	10,672	4,290	63%	48%	16%		12%		70%	70%	5%	4%
Scallop Dredge	3,768	1,356	22%	15%	14%		29%		80%	80%	3%	6%
Gillnet	2,537	3,138	15%	35%		26%		15%	40%	40%	16%	9%
Other	48	144	0%	2%		0%		0%	70%	70%	0%	0%
Total	17,026	8,928							<b>Mortality reduction:</b>		<b>6%</b>	<b>6%</b>
										<b>All areas:</b>		<b>6%</b>

**Table 102. Non-preferred option 2.** Estimated mortality reduction from the survivors of discarded monkfish due to an 11-inch minimum tail length in for vessels using mobile gear in the Northern Fishery Management Area and a 14-inch minimum tail length for all other vessels.

Gear	Total Landings (mt)		Percent of Total		Percent of landed number below size limit				Discard mortality rate		Fraction of catch surviving	
	North	South	North	South	North - 11"	North - 14"	South - 11"	South - 14"	North	South	North	South
Fish Trawl	10,672	4,290	63%	48%	16%			61%	70%	70%	5%	18%
Scallop Dredge	3,768	1,356	22%	15%	14%			65%	80%	80%	3%	13%
Gillnet	2,537	3,138	15%	35%		26%		15%	40%	40%	16%	9%
Other	48	144	0%	2%		0%		0%	70%	70%	0%	0%
Total	17,026	8,928							<b>Mortality reduction:</b>		<b>6%</b>	<b>14%</b>
										<b>All areas:</b>		<b>9%</b>