New England Fishery Management Council
50 WATER STREET | NEWBURYPORT, MASSACHUSETTS 01950 | PHONE 978 465 0492 | FAX 978 465 3116
John Pappalardo, *Chairman* | Paul J. Howard, *Executive Director*

MEMORANDUM

DATE: **May 12, 2008**

TO: Skate Oversight Committee and Advisory Panel

FROM: Skate PDT

SUBJECT: **Skate fishery possession limit specification estimates**

The following analysis updates and improves a preliminary PDT analysis of skate possession limits (refer to October 18, 2007 document titled "Amendment 3 possession limit analysis"; http://www.nefmc.org/skates/tech docs/Possession limit model results.pdf), using a cost model to determine which trips in the 2007 vessel trip reports would end trips early when the skate landings reached various possession limits. Trip length, landings, and daily cost are adjusted proportionally to the ratio of the possession limit to the reported skate landings. The model allows other trips to continue fishing and discard excess skates when the revenue from non-skate species exceeds the daily cost of fishing.

The model was used to estimate the wing and whole/bait fishery possession limits that would achieve a target change in landed mortality (net of increasing discards caused by the possession limit) equivalent to the targets identified in the May 12, 2008 draft PDT document titled, "A perspective on skate catch limits", taking into account expected changes in skate mortality caused by area management measures.

The targets are summarized in Table 1. Without time/area closures, the mortality reduction objective is 36.5% for the wing fishery and 31.5% for the whole skate fishery, when the TAL is allocated in the same proportion as 2005-2007 landings. Taking the effects of the proposed time/area closures into account, the target mortality reduction for setting possession limits would be 24.7 and 32.1 percent, respectively. The targets using the 1995-2006 landing proportions to allocate the TAL, are shown on the bottom half of Table 1.

Several improvements to the model were made. Data from 2007 were used to account for recent structural changes in the fishery, which could influence the effects of skate possession limits. The cost model was re-estimated using 2004-2007 data and an additional dummy variable was added to estimate fuel costs, due to the rapidly escalating fuel prices in 2006 and 2007. The update cost equation coefficients estimated by using a general linear model of fuel, ice, food, and miscellaneous costs are shown in Table 2. A composite equation derived from 201 observed trips were applied to the 11,456 trips in the vessel trip reports that had skate landings.

Another improvement made in this analysis was to apply the skate management areas and determine which trips would occur in areas that remained open to skate fishing. This allowed an estimation of possession limits that would be needed to achieve the target landed mortality reduction from trips occurring in open areas only.

The estimated change in skate mortality caused by landings over a wide range of possession limits is shown in Figure 1. The estimated mortality reductions range between 10 and 45 percent. One of the targets is illustrated having a wing possession limit of 2,800 lbs. (6,356 live weight equivalent) and a whole skate possession limit of 6,100 lbs. This target achieves the required landed mortality reduction of 36.5% in the wing fishery landings and 31.5% in the whole skate fishery landings, consistent with mortality objectives without time/area closures and when the fishery allocation is based on the 2005-2007 time period (see Table 3). Possession limits can be estimated for any target mortality reduction using this graph.

Figure 2 shows the estimated increase in discard mortality (expressed as a fraction of total skate landings in 2007) caused by various skate possession limits. The model takes the added discard mortality into account when estimating the change in total mortality caused by imposing a possession limit. The model assumes that 50% of discarded skates survive, contributing to mortality reduction. Dead discards could be as much as 10% of current landings in the bait fishery and 17% of current landings in the wing fishery, at the lowest skate possession limits applied.

Specific outcomes are summarized in Table 2, ones that achieve the target landed mortality objectives, with and without time area closures. If the TAL is allocated in the same proportion as landings occurred during 2005-2007, then a 2,800 lb. wing possession limit and a 6,200 lb. whole skate possession limit would achieve the required reductions, relative to 2007 landings. With the proposed time/area closures, the mortality objective (24.2 percent reduction in the wing fishery; 32% reduction in the whole skate fishery) could be met with a 4,600 lb. wing possession limit and a 6,100 lb. whole skate possession limit, assuming that displaced vessels have the same revenues and costs as vessels fishing in areas that would remain open. If the displaced vessels have the same revenue (from landing all species) and costs as they did when fishing in the proposed time/area closures, then a 4,600 lb. wing possession limit and a 6,100 lb. whole skate possession limit would meet the mortality objectives.

On the other hand, if the Council allocates the TALs in proportion to 1995-2006 landings, the skate possession limits to meet the mortality objectives would be more liberal for the whole skate fishery and the possession limits for the wing fishery would need to be more restrictive. The wing possession limit would need to be 2,100 lbs. (landed weight) without time/area closures and 3,400 lbs. if the proposed time/area closures were implemented. Because of the higher proportion of landings allocated to the whole skate TAL, trip limits between 10,300 and 10,500 would meet the mortality objectives.

Unless the PDT develops a different strategy, the possession limit estimates in Table 3 can be used as specification options in the various alternatives under consideration. This analysis was not used to estimate possession limits if the skate areas 1, 2, 4, and 5 are treated as gear restricted areas, however. Because area 3 would remain open to fishing, the two-bin model estimated that the area closures would cause mortality to increase in both fisheries. Possession limits would need to be lower than those estimated without time/area closures and the PDT may revise the strategy for alternatives including gear restricted areas as a management measure.

Table 1. Estimated landings mortality reduction to meet Amendment 3 targets, with and without time/area closures.

	Whole/wing fishery allocation basis	**Wing fishery**	**Whole/bait fishery**
2007 reported landings (mt)		14,081	4,773
Target (mt)	**2005-2007 proportional**	8,947	3,311
Target change in landed mortality, no closures		-36.5%	-31.5%
Mortality reduction from time/area closures		-11.8%	+0.6%
Target change in landed mortality, with closures		-24.7%	-32.1%
Target (mt)	**1995-2006 proportional**	8,152	4,106
Percent change, no closures		-42.1%	-14.0%
Mortality reduction from time/area closures		-11.8%	+0.6%
Percent change, with closures		-30.3%	-14.6%

Table 2. General linear model coefficient estimates for various daily fishing costs on observed trips targeting skates during 2004-2007.

Fishery	Cost component	Constant	Year	Crew	DA	GRT	Holdcap	HP	N	Multi-R	AIC corrected	F-ratio	p
Trawl wings	Fuel	83.783				3.978		0.487	16	0.582	231.878	3.33	0.068
	Fuel with year	-351.937	181.875			0.257		1.341	16	0.931	210.556	26.123	0.000
	Food	-0.34		33.185	-6.978				17	0.668	167.475	5.644	0.016
	Ice	19.403			8.473		0.000034		15	0.484	161.527	1.838	0.201
	Misc	56.872											
	Combined	**-276.002**	**181.875**	**33.185**	**1.495**	**0.257**	**0.000034**	**1.341**					
	Total	-779.301		261.072	111.168	-6.633	0.002630	0.976	14	0.854	218.715	4.326	0.033
	Total with year	-742.147	151.383	188.219	53.783	-3.58	0.000649	1.224	14	0.953	215.677	11.603	0.002
Trawl whole	Fuel	-430.291				1.444		1.885	89	0.643	1331.769	30.288	0.000
	Fuel with year	-861.011	146.115			1.383		1.9	89	0.702	1321.072	27.517	0.000
	Food	-28.92		35.202	-2.801				75	0.597	794.667	19.953	0.000
	Ice	18.195			5.663		0.000249		55	0.435	585.858	6.08	0.004
	Misc	76.67											
	Combined	**-795.066**	**146.115**	**35.202**	**2.862**	**1.383**	**0.000249**	**1.9**					
	Total	-423.695		33.107	82.767	-1.079	0.001628	1.447	81	0.837	1186.952	35.229	0.000
	Total with year	-1002.929	176.509	111.881	77.817	-1.433	0.001663	1.171	81	0.885	1163.724	44.383	0.000
Gillnet	Fuel	69.427				2.929		0.016	68	0.673	750.861	26.858	0.000
	Fuel with year	14.084	20.518			2.64		0.033	68	0.732	741.862	24.696	0.000
	Food	12.065		5.257	2.019				67	0.261	582.746	2.335	0.105
	Ice	20.982			4.727		-0.000236		49	0.372	416.194	3.7	0.032
	Misc	145.857											
	Combined	**192.988**	**20.518**	**5.257**	**6.746**	**2.64**	**-0.000236**	**0.033**					
	Total	-185.096		155.345	18.833	0.677	-0.000690	-0.28	60	0.375	863.75	1.769	0.135
	Total with year	-217.462	16.425	149.646	19.007	0.379	-0.004820	-0.005	60	0.379	866.193	1.486	0.201

Table 3. Possession limits estimated to achieve target landings mortality reduction, with and without time area closures. "Open areas" is a possession limit estimate that applies only to areas that remain open to fishing, otherwise the possession limit estimate is made using trips from all areas.

Whole/wing fishery allocation basis	Time/area closures	Skate wing fishery			Skate whole/bait fishery	
		Target landings mortality reduction	Possession limit, lbs. wings	Live weight equivalent	Target landings mortality reduction	Possession limit, lbs. live weight
2005-2007 proportional	No	36.5%	2,800	6,356	31.5%	6200
	Yes	24.4%	4,800	10,896	32.0%	6100
	Open areas	24.2%	4,600	10,442	32.0%	6100
1995-2006 proportional	No	41.9%	2,100	4,767	13.8%	10500
	Yes	30.5%	3,700	8,399	14.8%	10200
	Open areas	30.4%	3,400	7,718	14.4%	10300

Figure 1. Estimated skate mortality reduction by skate fishery from applying possession limits (landed weight) to 2007 trips. Discard mortality on skates for trips that continue fishing after the possession limit is met is assumed to be 50%. A 6,200 lb. whole weight possession limit and a 2,800 lb. wing weight possession limit is expected to achieve a 32% and 36.5% mortality reduction, respectively.

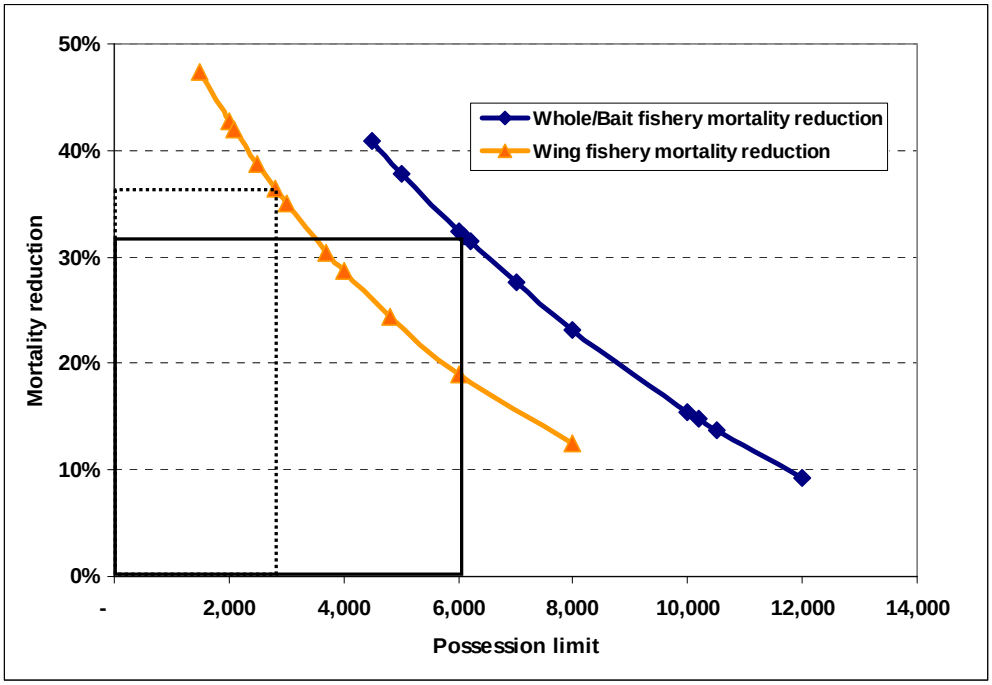

Figure 2. Additional discard mortality caused by skate possession limits, expressed as a fraction of original landings. Discard mortality on skates for trips that continue fishing after the possession limit is met is assumed to be 50%.