

Appendix A. Estimation of Bering sea Tanner crab OFL using F35% and estimated fishery selectivities.

The calculation of the OFL in this appendix follows the SSC recommended method from their June 2008 meeting. The SSC recommended using fishery selectivities, which at the time were taken from the EA on OFL definitions, due to the lack of recent data on fishery selectivities. The Fmsy proxy was recommended as F35%/M which was estimated as 2.1 \*M from the analysis presented in June 2008. The same method is used here, except that new fishery selectivity curves are estimated from the most recent year of fishery data and F35% is calculated given the new selectivity curves. The Fmsy proxy for the control rule is,

$$\text{Fmsy proxy} = \text{gamma} * M$$

$$\text{Gamma} = \text{F35\%/M}$$

Therefore,

$$\text{Fmsy proxy} = (\text{F35\%/M}) * M = \text{F35\%}$$

So the use of F35% as the Fmsy proxy in the control rule is equivalent to using gamma, where gamma is estimated as F35%/M. This value of F35% is used with the estimated fishery selectivities as recommended by the SSC to estimate the OFL. This gamma is specific to the F35% and fishery selectivities estimated here and cannot be used without those fishery selectivities, for example in a simple multiplication on M and mature male biomass to estimate the total catch OFL.

The observer data from the 2006/7 and the 2007/8 fishery seasons were not available for analysis in June 2008, , so the fishery selectivities used in the EA for the new OFL definitions were used in the June SSC presentation. However, the last two years of fishery data indicate a change in selectivity and an increase in the discarding in the directed Tanner crab fishery. Discard and retained selectivities were estimated using the length frequency of the observed catch from the 2007/8 season as well as the ratio of discarded to retained numbers of crab (Figure A-1 and Table A-2) and the predicted catch length frequency and numbers (discard and retained) using the 2007 survey abundance by length projected forward to the time of the fishery. The discard fishery selectivities were used along with trawl selectivities to estimate bycatch in the snow crab and trawl fisheries (Figure A-2). F35% was then determined base on the estimated fishery selectivities and the OFL calculated. Two fishery selectivity scenarios were estimated, one with retained selectivity at 1.0 for the 140-145 mm length bin and then dropping to 0.5 for larger sizes (Figure A-1 and Table A-2), and scenario 2 were retained selectivity was 1.0 for all crab > 140mm (Figure A-4 and Table A-2). The scenario with retained selectivity at 1.0 for all crab larger than 140mm did not fit the length frequency of the catch as well and also did not fit the ratio of discard to retained numbers as well as the scenario with retained selectivity at 0.5 at > 145mm (Figures A-3 and A-5).

The discard fishery selectivities were estimated differently for each scenario to fit the total length frequency and the ratio of retained and discarded numbers in the 2007/8 fishery using the 2007 survey length frequency projected forward. The current Tanner crab fishery may not be targeting specifically on Tanner crab, which results in the drop in selectivity at larger sizes fitting the fishery data better than selectivity of 1.0 at larger sizes.

The 2008 survey abundance by length was projected forward to estimate catch and MMB using F35% and the estimated fishery selectivities (Table A-1). The total catch OFL for scenario 1 (0.5 selectivity size>145mm) was 16.1 million lbs with a retained directed fishery catch of 5.27 million lbs. The total catch OFL for scenario 2 (1.0 selectivity size>140mm) was 15.67 million lbs with a retained directed fishery catch of 5.21 million lbs. The total catch OFL with F=M was 15.37 million lbs with a retained directed fishery catch of 4.71 million lbs.

Table A-1. Catch OFL (million lbs) using F35% and 2008 survey numbers by length and mature biomass at mating. Ratio of numbers of discard to retained was 4.09 in the 2007/8 fishery. Scenario 1 ratio in the fitting was 4.37, for the selectivity = 1.0 ratio was 5.05.

	Scenario 1	Scenario 2
	retained sel >145mm =0.5	retained sel >140 mm = 1.0
directed legal catch	5.62	5.57
Retained directed legal catch	5.27	5.21
directed discard	7.13	6.75
nondirected discard (snow crab fishery and trawl)	3.35	3.36
total catch OFL	16.10	15.67
MMB	106.03	106.47
Bref	178.2	178.2
MMB/Bref %	59.49	59.75
Directed F35%	0.585	0.411
Directed control rule F 2008/9	0.322	0.227
F snow crab fishery	0.105	0.09

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Table A-2. Estimated retained and discard selectivity. Discard selectivity estimated as a logistic function with slope 0.17 and size at 50% selected 120 mm from 95 mm to 135 mm. Value at 135-140 mm fixed at 0.5, and discard selectivity 0 after 140 mm. Values of retained selectivity set at 1 and 140-145 mm other values (0.5) estimated to fit the length frequency of the catch and the split in catch between retained and discarded.

Width (mm)	Scenario 1		Scenario 2	
	retained sel	discard sel	retained sel	discard sel
97.5	0	0.014064	0	0.032295
102.5	0	0.032295	0	0.072426
107.5	0	0.072426	0	0.154465
112.5	0	0.154465	0	0.299433
117.5	0	0.299433	0	0.5
122.5	0	0.5	0	0.700567
127.5	0	0.700567	0	0.845535
132.5	0	0.845535	0	1
137.5	0.5	0.5	0.5	0.5
142.5	1	0	1	0
147.5	0.5	0	1	0
152.5	0.5	0	1	0
157.5	0.5	0	1	0
162.5	0.5	0	1	0
167.5	0.5	0	1	0
172.5	0.5	0	1	0
177.5	0.5	0	1	0

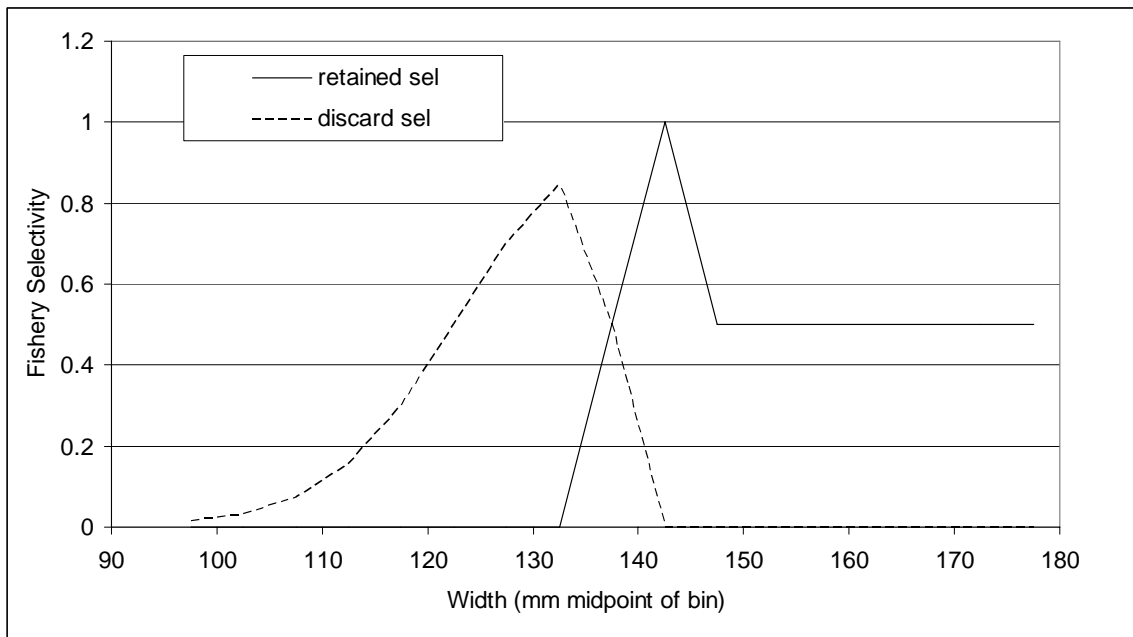


Figure A-1. Retained and discard directed Tanner fishery selectivities estimated for the 2007/8 fishery (before discard mortality is applied).

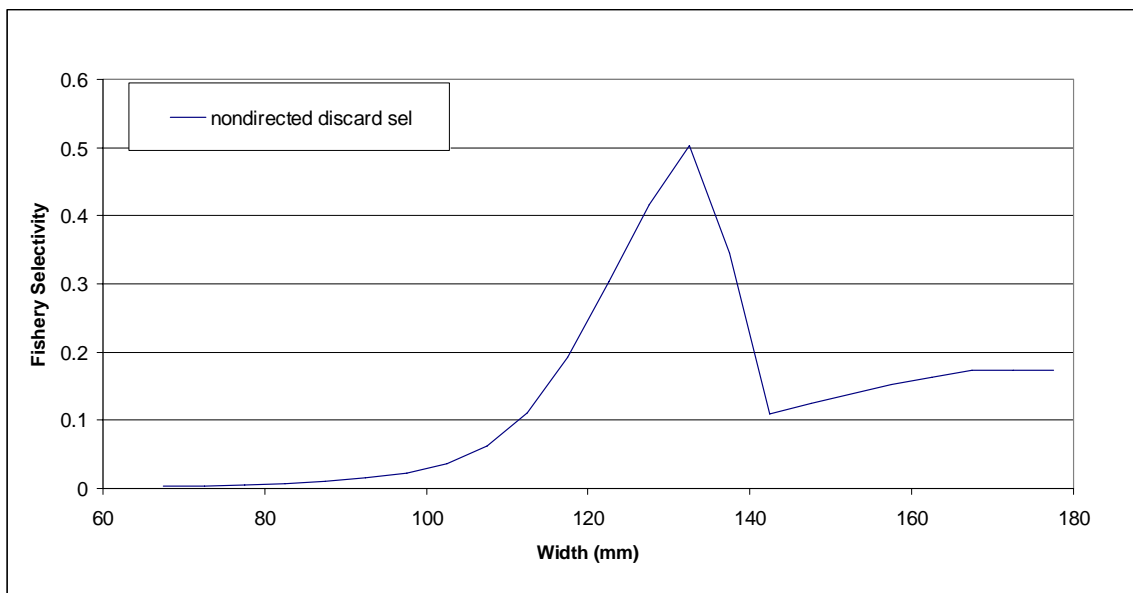


Figure A-2. Nondirected discard fishery selectivities with 50% mortality in the snow crab fishery and 80% mortality from trawl fisheries. The directed Tanner crab discard selectivity was used for snow crab fishery discards. Selectivity for the trawl discard is from the EA on overfishing analysis.

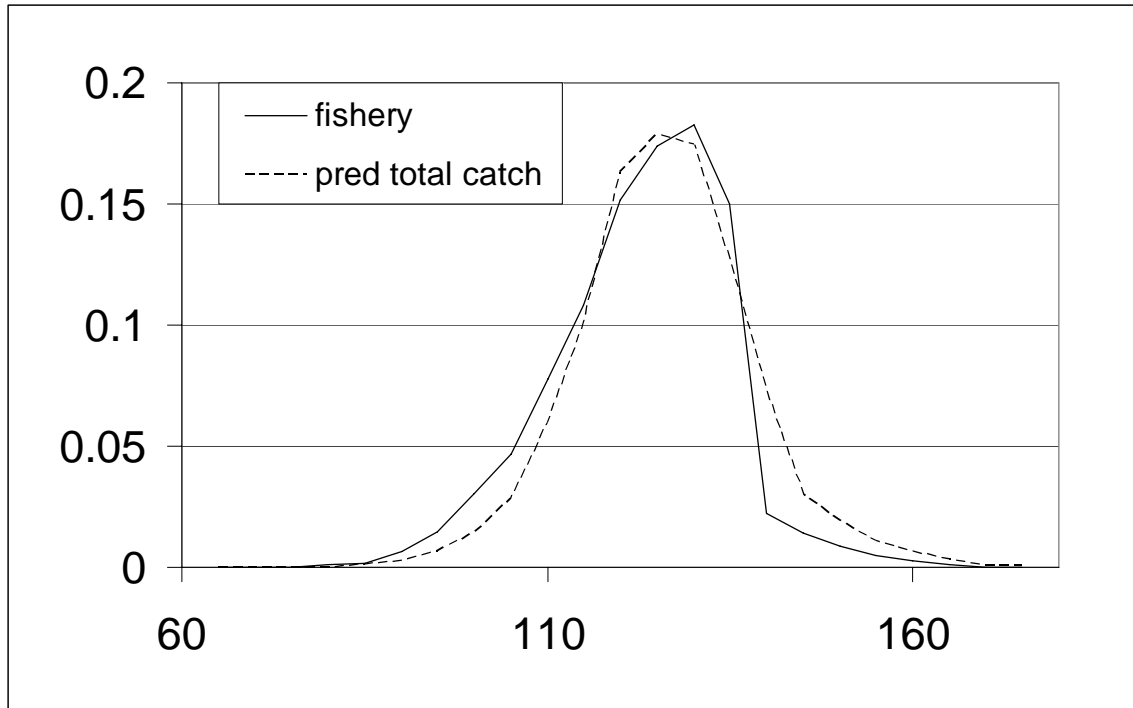


Figure A-3. Length frequency of total directed Tanner fishery catch (fishery) and predicted total directed Tanner fishery catch with estimated discard and retained fishery selectivities (Figure 1) using the 2007 survey data and 2007/8 fishery observer data.

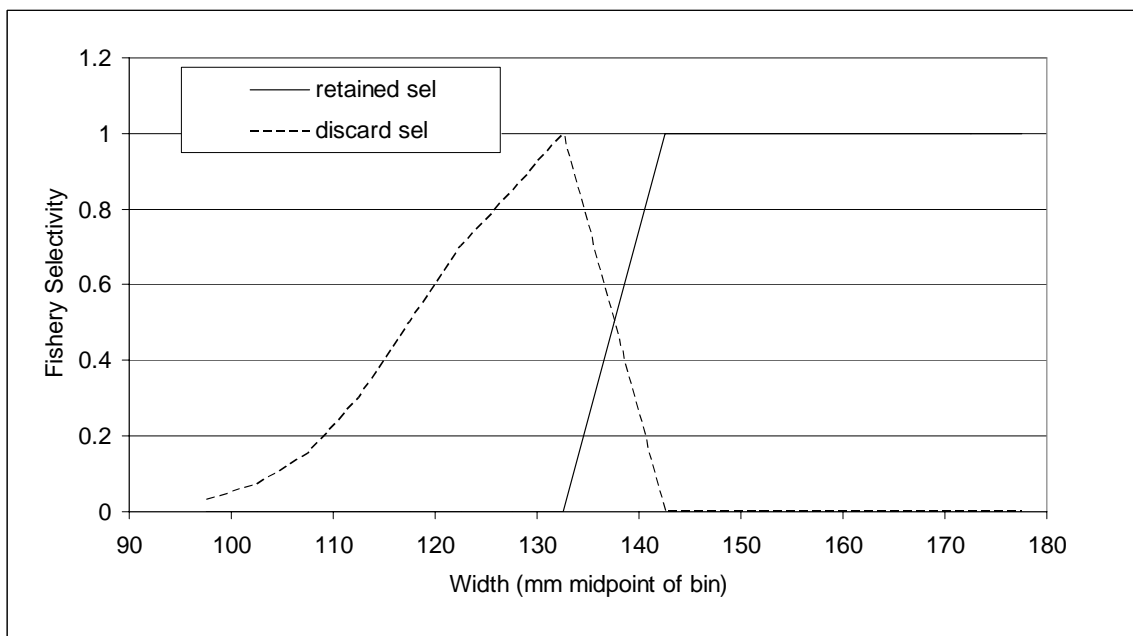


Figure A-4. Retained and discard directed Tanner fishery selectivities estimated for the 2007/8 fishery (before discard mortality is applied), with retained selectivity of crab >140mm fixed at 1.0.

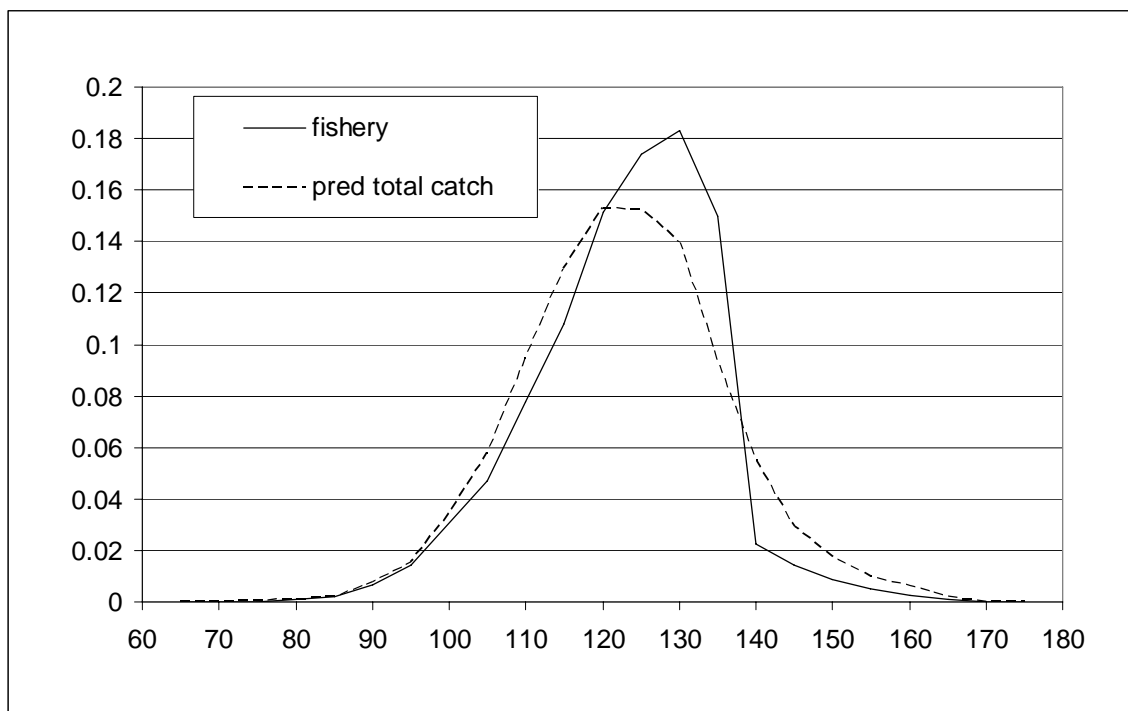


Figure A-5. Fit to total catch length frequency using retained selectivity at 1.0.