

Exploration of Biomass Reference Points for the Bristol Bay Red King Crab Stock

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Bristol bay red king crab mature male biomass at time of mating was estimated for 1969 to 2008 using survey and catch data (Table 1 and Figure 1). Total catch for 1990 to 2007 was taken from Zheng (2008). Total catch for 1969 to 1989 was estimated by adding the retained catch and 11% of retained catch. The average observed discard mortality for male red king crab from 1990 to 2007 was 11% of the retained catch (assuming 20% mortality on discarded pot catch and 80% mortality on groundfish bycatch).

The first fishery cpue data available is from the 1953 Japanese tangle net fishery (Figure 2). Balsiger (1972) standardized the Japanese, Russian and U.S. fishery cpue data to investigate trends in the stock. The cpue data indicate that the stock was at a similar level from 1953 to about 1960 as it was at the high point in 1978. The survey legal male abundance estimates scale in Figure 2 was adjusted by estimating a scaling factor (1.18) using sum of squared differences between the survey estimates and the U.S. pot fishery cpue. The U.S. pot cpue follows the survey estimates fairly well until the recent IFQ period when effort declined and cpue increased. The historical cpue levels indicate that the relatively high biomass levels in the mid to late 1970's were not an anomaly for the Bristol Bay red king crab stock. The stock appears to have experienced two periods of decline in abundance, one in the 1960's and again in the early 1980's.

Three alternative biomass reference points were calculated: 1) pre-collapse years, 1969 to 1980, 2) all years, 1969 to 2008 and 3) post-collapse years, 1985-2008. The biomass reference points were calculated as the average of the MMB at mating for the respective time period. Bref for 1969 to 1980 was 140.1 million lbs, 1969 to 2008 was 90.58 million lbs and for 1985 to 2008 was 59.82 million lbs, (Table 2). The 2008 MMB at mating (taking the TAC 20.3 million lbs plus 11% of the TAC) is 55%, 85% and 129% of the Bref points, respectively.

The Bristol bay red king crab model estimates of 2008 MMB at mating relative to B35% was 127%, very close to the 129% estimated using Bref using survey data for the same time period (1985-2008). While the model estimates of biomass and the survey estimates are not directly comparable, the relative values of Bref for different time periods could be used with the stock assessment model current MMB, F35% and fishery selectivities to

estimate the OFL. For example, B35% (75.1 million lbs model estimate 1985-2007, Zheng 2008) for the pre-collapse era could be estimated by $2.35 * B35\%$ 1985-2007 ($2.35 * 75.1 = 176.5$ million lbs) (Table 2). If all years (1969 to 2008) were used then an estimate of B35% for use with the assessment model to estimate the OFL would be 114.1 million lbs ($1.52 * 75.1$). The alternative B35% values result in stock status below B35%, which would result in a lower fishing mortality from the OFL control rule.

Literature Cited

Balsiger, J. 1972. Standardization of cpue in the Bristol Bay red king crab fishery. INPFC Doc. No. 1514.

Zheng, J. 2008. Bristol Bay red king crab stock assessment. Bering sea and Aleutian Islands Crab SAFE 2008. North Pacific Fishery Management Council, P. O. Box 103136, Anchorage, Ak 99510.

Table 1. Survey mature male biomass, total catch, MMB at mating and exploitation rate using total catch and mature male biomass at time of the fishery.

Survey Year	mature males mill lbs	total catch	MMB at mating	exp rate
1969	139.3	27.5	98.9	0.207
1970	63.4	23.9	34.3	0.394
1971		21.2		
1972	62.0	29.4	28.0	0.495
1973	169.9	30.1	123.7	0.186
1974	241.1	47.4	171.3	0.206
1975	243.9	57.0	164.9	0.244
1976	379.5	71.0	273.1	0.196
1977	469.8	77.7	347.5	0.173
1978	437.4	97.2	300.2	0.233
1979	375.4	119.7	223.8	0.333
1980	290.9	144.1	125.4	0.518
1981	119.0	37.2	71.7	0.327
1982	75.4	3.3	64.3	0.046
1983	37.2	0.0	33.3	0.000
1984	50.9	4.6	41.2	0.096
1985	43.4	4.6	34.5	0.111
1986	69.9	12.6	50.7	0.189
1987	82.9	13.6	61.4	0.172
1988	54.9	8.2	41.4	0.156
1989	95.9	11.4	75.1	0.124
1990	79.1	21.8	50.4	0.288
1991	85.1	18.3	58.9	0.225
1992	48.0	9.5	34.1	0.207
1993	82.7	16.7	58.3	0.211
1994	53.3	0.1	47.6	0.002
1995	53.6	0.1	47.8	0.002
1996	45.6	8.9	32.5	0.203
1997	91.2	9.4	72.8	0.108
1998	96.3	17.0	70.2	0.185
1999	91.5	12.7	70.0	0.145
2000	76.9	9.1	60.2	0.124
2001	48.9	9.5	34.9	0.203
2002	90.4	10.6	70.9	0.123
2003	106.2	17.8	78.3	0.176
2004	113.5	16.1	86.4	0.149
2005	97.4	21.4	67.1	0.230
2006	94.8	16.8	69.1	0.185
2007	114.6	22.8	81.2	0.208
2008	109.9	24.4	75.4	0.233

Table 2. Red king crab Bref using MMB at mating retained catch and 11% of retained added as discard for years when no discard data are available.

Time period		Bref	MMB2008/Bref	Bref/1985-2008Bref	Estimated B35%
all years	1969-2008	90.58	0.85	1.52	114.1
Post-collapse	1985-2008	59.62	1.29	1	75.1
Pre-collapse	1969-1980	140.10	0.55	2.35	176.5

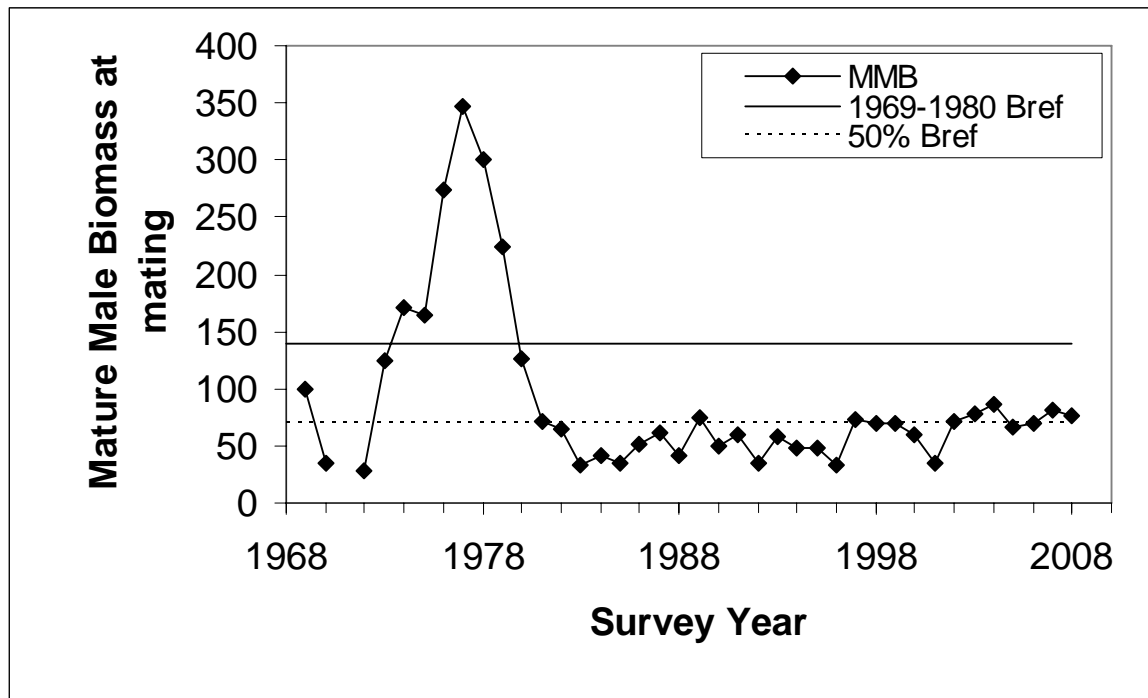


Figure 1. Mature male biomass at mating time from 1968 to 2008. The 1969-1980 time period Bref and 50% of Bref is shown for reference.

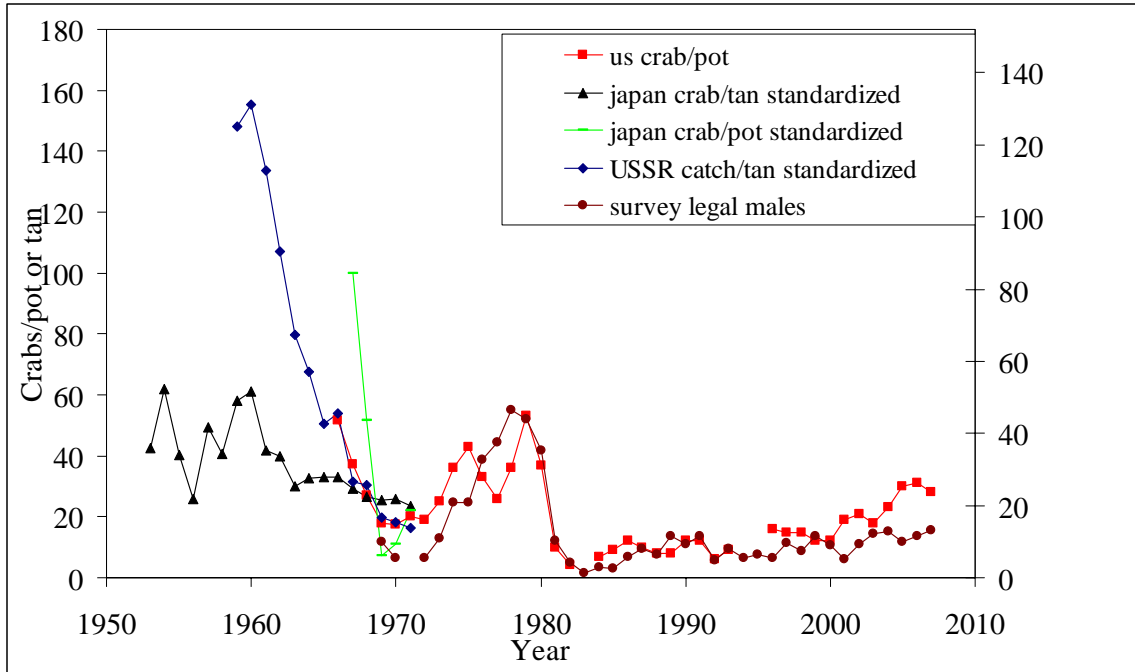


Figure 2. Standardized catch per tan or catch per pot for Bristol bay red king crab U.S., Japanese and Russian fisheries from Balsiger (1972). Survey estimates of abundance of legal male crab from 1968 to 2007.