

2016, 2017, 2018, and 2019 – No Updates or changes

2015 Updates and Changes

Due to budget constraints, Port Camden and Port Frederick were removed as surveyed areas in 2015 and are now considered part of the non-surveyed area for biomass calculations. To estimate regional Tanner crab biomass, the survey area biomass is extrapolated to the non-surveyed areas using an expansion factor. The expansion factor was adjusted in 2015 by removing the average contribution of commercial catch from the two areas removed from the survey during the years used for expansion factor estimation (1980-2000). From 1980 to 2000, an average of 1% of the commercial harvest was from Port Frederick and 4% of the commercial harvest was from Port Camden. Therefore, the previous expansion factor of 71% was reduced to 66%. The current analysis calculates biomass assuming 66% of the biomass is found in the survey areas and 34% in the non-surveyed areas. All graphs and figures reflect these changes.

Additionally, in 2015 the Stephens Passage area was removed from the October Tanner crab survey. In the past, data from the summer red king crab survey and the October Tanner crab survey were combined to assess stock health and estimate biomass in this area. Retrospective analysis of these data showed that the summer red king crab survey adequately allowed for an estimation of biomass in Stephens Passage and that the October survey data could be removed. Long- and short-term trends of stock health were recalculated using ONLY red king crab survey data during the baseline years (1997-2006) and the biomass estimates were also adjusted by a correction factor. This correction factor was calculated by comparing a retrospective analysis from 1997 (when the survey began for Tanner crab) to 2014 (the last year Stephens Passage was surveyed in October). Biomass estimates using only the red king crab survey data were compared to those using both data sets. The difference between these estimates was used to adjust ONLY the red king crab survey data biomass estimates to be comparable to previous years. On average the biomass estimates using ONLY the red king crab survey data were 7% higher than those with both data sets. For 2015 and beyond, the biomass estimate was adjusted down 7% to compare to previous years reported biomass estimates using data from both surveys.

2014 – No Updates or changes

2013 Updates and Changes

In preparation for the 2013 Tanner crab survey the survey areas were stratified based on crab density and depth, modeled on the density stratification currently in place for red king crab survey areas (Clark 2008). Prior to this stratification, simple random sampling had occurred to determine pot placement in the survey areas. The goal of density stratified sampling is to provide more statistically robust estimates of catch per unit effort (CPUE) for use in the CSA model, which in turn will provide additional confidence in our biomass forecasts. Survey sampling from 2013 forward will be performed using these density strata to guide our randomized pot placement. All of the previous year's CPUE calculations and biomass estimates were also re-estimated to accommodate the changes in sampling methods.

A CSA model is performed for each of the survey areas, accurate harvest data in each area is vital to biomass estimation. Harvest, in numbers of crab, is used in the model to scale the survey CPUE to estimate biomass in each area. Inaccurate accounting of harvest can lead to over or under estimation of the biomass. To better match spatial harvest with survey areas, the statistical areas included in harvest calculations for each survey area were reevaluated. The CSA model requires that the harvest input accounts for all harvest on the stock being modeled, prior to this reevaluation some statistical areas adjacent to our survey areas were not included when they should have been. Historic harvests from fish tickets were recalculated using these improved statistical area divisions and used in the 2013 CSA models. The recalculated harvest in these areas changed the magnitude of the biomass estimates in some of the surveyed areas.

The final change in 2013 and future analyses was the graphical representation of legal biomass from the CSA in the area figures. In the past the forecasted biomass for each year was represented here, however this led to inaccuracies in the actual trend in legal biomass (forecasted biomass estimates in each year only include data up to that year). In this document the estimated biomass for each year is based on the current year's model, which includes all data available for each area. Displaying the biomass estimates from the current year's model allows for a more accurate representation of the trends in biomass over time, which more closely follows the historic harvest in most areas.

Harvestable Surplus

Since the 2009/2010 fishing season the Southeast Alaska Tanner crab fishery has been managed using a minimum mature male biomass threshold with a variable season length, in days, determined by a regulatory harvest strategy

reliant on fishing effort and mature male biomass. Even though the fishery is not managed using a GHL, the department continues to determine stock health, establish a biologically appropriate mature male harvest rate, and calculate GHLs to provide a biologically sound benchmark by which actual fishery performance can be evaluated. Based on the analysis of Tanner crab biology and harvest strategies adopted in other regions, region-wide exploitation rate (ER) should not exceed 20% of mature male or 38% of legal male estimated biomass.

Catch-survey modeling of the 2019 fishery and survey data yields a biomass estimate of 5.44 million pounds of mature (greater than 108 mm carapace width) and 3.39 million pounds of legal (greater than 140 mm carapace width) male Tanner crab (Table 1). This is a decrease of 0.73 million pounds of legal male Tanner crab (-17.7%) from the 2018 estimate, predominantly due to legal biomass decreases from the 2018 projections in Stephens Passage, Thomas Bay, Holkham Bay, Seymour Canal, North Juneau, Excursion Inlet, Pybus Bay, Gambier Bay, and Lynn Sisters, but balanced by biomass increases in Icy Strait, Glacier Bay, and Peril Strait. Harvesting at the maximum rate (20% of mature biomass) would equate to a GHL of approximately 1.07 million pounds (Table 1). Harvest above this level will increase the probability of population declines. Incorporating stock health information suggests a regional exploitation rate of 14.4% of the mature male biomass would reduce the likelihood of population decline and may provide higher probability of an increase in biomass (Table 1).

Stock Status

Stock health status is determined by a combination of long- and short-term trends in CPUE. Significance in long-term or short-term trends is defined as a p-value < 0.05. Long-term trends compare the current years mean to the long-term baseline value (generally 1997-2010, or the first ten years for which survey data are available); short-term trends regress the last four years of survey data to determine if a significant increasing or decreasing trend is present. Total score is the sum of scores (+1, 0, -1 for long-term; +.25, 0, -.25 for short-term) for each response variable. Stock health is defined by the total score: < -3.25 = Poor, -3.25 to -1.26 = Below Average, -1.25 to 1.25 = Moderate, 1.26 to 3.25 = Above Average, and > 3.25 = Healthy. Recommended exploitation rates based on stock health are zero percent for “Poor”, 5% for “Below Average”, 10% for “Moderate”, 15% for “Above Average”, and 20% for “Healthy”.

Tanner crab survey areas

Icy Strait, Moderate 10%

The Icy Strait stock score decreased since the 2018 survey to -0.50 but remained at a moderate stock status (Table 2). This change in the population status was due to a decrease in the CPUEs of mature females, but an increase in recruit males (Figures 3a and 3b). Pre-recruit and recruit male CPUEs are not significantly different from their long-term averages, while post-recruit male and mature female CPUEs are significantly below their long-term averages. Both pre-recruit and recruit male CPUE have a significant increasing short-term trend. The percent of females with poor clutch fullness is significantly lower than 10%. Harvest from this area provided an average of 12.0% of the commercial harvest over the baseline years and 3.0% of the harvest during the 2018/2019 fishery (Figure 3a).

Glacier Bay, Above Average 15%

The Glacier Bay stock score decreased from the 2018 survey but remained at above average stock status, with a score of 1.25 (Table 2). Decreased stock health score is primarily due to decrease in mature female (Figures 4a and 4b). All male recruit class CPUEs are not significantly different from their long-term averages, with recruit male CPUE significantly above its long-term average. Recruit male CPUE also has a significant increasing short-term trend. The percent of females with poor clutch fullness is significantly lower than 10%. The population is above baseline levels, with both legal and mature biomass being some of the highest observed. Harvest from this area provided an average of 9.2% of the commercial harvest over the baseline years and 12.7% of the harvest during the 2018/2019 fishery (Figure 4a).

Thomas Bay, Above Average 15%

The Thomas Bay stock score increased substantially from the 2018 survey to a stock status of above average; up to 2.00 from -3.50 in 2018 (Table 2). The CPUEs of all male recruit classes are not significantly different from their baseline values, with pre-recruit male CPUE being significantly above its long-term baseline (Figure 5a and 5b). There are no significant short-term trends for CPUEs. The percent of females with poor clutch fullness is significantly lower than 10%. Thomas Bay commercial harvest provided an average of 4.8% of the regional commercial harvest over the baseline years and 1.3 % of the harvest during the 2018/2019 fishery (Figure 5a).

Holkham Bay, Above Average 15%

The Holkham Bay stock score remained above average, with the same stock health score of 2.00 as 2018 (Table 2). All recruit class CPUEs are at or significantly above their long-term averages, with pre-recruit male CPUE being significantly above its long-term average (Figures 6a and 6b). There are no significant short-term trends in CPUE. The percentage of females with poor clutch fullness is significantly lower than the baseline 10% level. Biomass estimates are generally increasing and are well above their long-term averages. Harvest from this area provided an average of 7.1% of the commercial harvest over the baseline years and 9.5 % of the harvest during the 2018/2019 fishery (Figure 6a).

Port Camden, Not surveyed since 2015

The Port Camden area was removed from the survey in 2015 due to budgetary constraints as well as the low contribution of this area to the overall Tanner crab commercial harvest. Port Camden is now included in the non-surveyed areas; the average contribution of the catch from Port Camden from 1980 to 2000 (catch years used for survey expansion value calculation) was removed from the survey expansion percentage. See comments at the beginning of this document for specific methods. The harvest from this area provided an average of 3.8% of the commercial harvest over the baseline years and the harvest is confidential for the 2018/2019 fishery.

Red king crab survey areas

Stephens Passage, Healthy 20%

The Stephens Passage stock score remained in healthy stock status but had a small decrease from a score of 4.00 in 2018 to 3.50 (Table 3). The score decrease was due to post-recruit CPUE now being at its long-term average instead of significantly above. All recruit class CPUEs are at or significantly above their long-term averages, with both pre-recruit and mature female CPUE being significantly above (Figures 7a and 7b). Recruit and post-recruit male CPUE have significant short-term increasing short-term trends. The percentage of females with poor clutch fullness was significantly less than the 10% threshold. The legal biomass estimate is slightly above the baseline value. The harvest from this area provided an average of 9.5% of the commercial harvest over the baseline years and 11.3 % of the harvest during the 2018/2019 fishery (Figure 7a). Starting in 2015, only survey data from the summer red king crab survey is used to assess the Stephens Passage area. Refer to the assessment updates and changes at the beginning of this document.

Seymour Canal, Moderate 10%

The Seymour Canal stock score fell to moderate, down from above average in 2018. The 2019 score is 1.00 down from 3.00 in 2018 (Table 3). This score decrease was driven by a decrease in recruit male CPUE, which while still above average levels, is not significantly above its average, and by an increase in the percentage of females with poor clutches. All recruit class CPUEs are still at or above their long-term averages, but only pre-recruit male CPUE being significantly above (Figures 8a and 8b). The percentage of females with poor clutch fullness is above the threshold of 10%, indicating an increased amount of females with poor or low clutches. The legal biomass estimate, while down from 2018, is still close at historically high levels and well above the baseline value. The harvest from this area provided an average of 6.3% of the commercial harvest over the baseline years and 15.1 % of the harvest during the 2018/2019 fishery (Figure 8a).

North Juneau, Above Average 15%

The North Juneau stock score decreased since the 2018 survey from a stock health score of 2.50 to 2.00 but remains at above average levels (Table 3). This score decrease is driven by a decrease in post-recruit male CPUE. All recruit class CPUEs are at or above their long-term averages, with only pre-recruit male CPUEs being significantly above (Figures 9a and 9b). There are no significant short-term trends, due to drops in CPUE for mature male recruit classes. The percentage of females with poor clutch fullness is significantly less than 10%. The legal biomass estimate is below the baseline value and slightly decreasing. The harvest from this area provided an average of 7.1% of the commercial harvest over the baseline years and 5.7 % of the harvest during the 2018/2019 fishery (Figure 9a).

Excursion Inlet, Moderate 10%

The Excursion Inlet stock score decreased since the 2018 survey to a stock health of moderate. It is currently scored at -0.25, down from 2.50 in 2018 (Table 3). This change is driven by drops in mature male CPUEs, while all mature male recruit classes are not significantly different from their long-term values, they all decreased from 2018 values, and none are significantly above. Recruit male CPUE has a significant short-term decreasing trend (Figures 10a and 10b). Mature female CPUE is also down from 2018, but still at baseline levels and the percentage of females with poor clutches is at the 10% threshold. The legal biomass estimate is at the baseline value and has an increasing trend. The harvest from this area provided an average of 6.3% of the commercial harvest over the baseline years and 3.5 % of the harvest during the 2018/2019 fishery (Figure 10a).

Pybus Bay, Below Average 5%

The Pybus Bay stock decreased since the 2018 survey to a stock health status of below average. It is currently scored at -2.75, down from -0.75 in 2018 (Table 3). This change is a result of decreases in all male CPUEs, with post-recruit male CPUE falling significantly below its long-term average, while both pre-recruit and recruit CPUE are below baseline levels but not significantly so. There are significant short-term decreasing trends in pre-recruit male, recruit male, and mature female CPUEs (Figures 11a and 11b). The percentage of females with poor clutches was not significantly different from the 10% threshold. The legal biomass estimate is below the baseline value and has a decreasing trend in the last few years. The harvest from this area provided an average of 1.2% of the commercial harvest over the baseline years and 2.0 % of the harvest during the 2018/2019 fishery (Figure 11a).

Gambier Bay, Poor 0%

The Gambier Bay stock score decreased substantially to poor from moderate in 2018. It is currently scored -5.00, down from -1.00 in 2018 (Table 3). This decrease is driven by decreases in all recruit class CPUEs, which are all significantly below their baseline values. There are significant short-term decreasing trends in pre-recruit male, recruit male, post-recruit male and mature female CPUEs (Figures 12a and 12b). The percentage females with poor clutches is not significantly different from the threshold of 10%. The legal biomass estimate is below the baseline value and has a decreasing trend over the last few years. The harvest from this area provided an average of 1.9% of the commercial harvest over the baseline years and 2.0% of the harvest during the 2018/2019 fishery (Figure 12a).

Peril Strait, Moderate 10%

The Peril Strait stock score remained moderate, increasing to 0.00 from -1.25 in 2018 (Table 3). This increased score is driven by increases in pre-recruit and post-recruit CPUEs, with pre-recruit CPUE being significantly above the long-term average. Mature female CPUE is above its long-term average, but not significantly so (Figures 13a and 13b). There are no significant short-term trends. The percentage of females with poor clutches is not significantly different than the 10% threshold. The legal biomass estimate is above its baseline value, with an increase from 2018 levels. The harvest from this area contributed an average of 0.7% of the commercial harvest over the baseline years and 0.03 % of the harvest during the 2018/2019 fishery (Figure 13a).

Lynn Sisters, Above Average 15%

The Lynn Sisters stock remained at above average and the score remained the same, at 2.25, from 2018 (Table 3). While the score remained the same, there was an increase in pre-recruit male CPUE and a decrease in recruit male CPUE, with pre-recruit CPUE being significantly above the long-term average. All recruit class CPUEs are at or significantly above their long-term averages (Figures 14a and 14b). There is a significant increasing short-term trend for post-recruit CPUE. The percentage of females with poor clutch fullness is significantly lower than 10%. The legal biomass estimate is above the baseline value at historically high levels for the area, but down slightly from 2018 values. The harvest from this area provided an average of 0.7% of the commercial harvest over the baseline years and 0.7 % of the harvest during the 2018/2019 fishery (Figure 14a).

Port Frederick, Not surveyed since 2015

The Port Frederick survey area was removed from the survey in 2015 due to its low contribution to the overall Tanner crab catch and department budget constraints. Port Frederick is now included in the non-surveyed areas. The average contribution of catch in Port Frederick from 1980 to 2000 was removed from the survey expansion percentage. See comments at the beginning of this document for more detail. The harvest from this area provided an average of 0.5% of the commercial harvest over the baseline years and 0.60% of the harvest during the 2018/2019 fishery.

Literature Cited

Bishop, G., C.Siddon, and A. Olson. 2013. Southeast Alaska Tanner crab survey and stock health prior to the 2011/2012 season. Regional information report No. 1J13-03. Alaska Department of Fish and Game, Division of Commercial Fisheries.

Clark, J.E. 2008. Restratification of the red king crab stock assessment survey in Southeast Alaska (pp.96). Juneau: Alaska Department of Fish and Game, Division of Commercial Fisheries.

Seber, G. A. F. 2002. The estimation of animal abundance, 2 edition. Blackburn Press, Caldwell, New Jersey. 654 pp.

Zheng, J., and G. H. Kruse. 1999. Evaluation of harvest strategies for Tanner crab stocks that exhibit periodic recruitment. *Journal of Shellfish Research* 18:667-679.

Tables and Figures

Table 1. Results of 2019 catch-survey modeling estimation of legal and mature Tanner crab biomass and guideline harvest level (GHL) calculations using proposed maximum 20% region-wide mature exploitation rates and exploitation rates based upon the current stock health status for each of the 12 survey areas. See matrices below for a more detailed look at the basis of stock status determinations. The expansion factor of 66% (34% for non-surveyed areas) for the total legal and mature male crab biomass was based on the percent of commercial harvest taken from 1980–2000 in surveyed areas. The average harvest and biomass from the first ten years of survey data in each area represents a mean historical baseline (long-term average) of harvest. Both Tanner crab survey (TCS) and red king crab survey (RKCS) areas are presented.

	Survey area	Healthy stock status					Current stock status			1997-2006**	
		Biomass of legal crab	Biomass of mature crab	Mature harvest rate	Legal harvest rate	GHL ^a	Mature harvest rate	Legal harvest rate	GHL ^a	Average catch	Est.mature biomass
TCS	Icy Strait	123,395	230,121	20%	37%	46,024	10%	19%	23,012	160,673	375,023
	Glacier Bay	666,404	970,282	20%	29%	194,056	15%	22%	145,542	118,541	659,423
	Stephens Passage	292,024	453,729	20%	31%	90,746	20%	31%	90,746	128,405	370,280
	Thomas Bay	63,931	171,493	20%	54%	24,294*	15%	40%	24,294*	54,997	182,570
	Holkham Bay	274,275	407,785	20%	30%	81,557	15%	22%	61,168	103,853	204,314
RKCS	Seymour Canal	334,648	551,382	20%	33%	110,276	15%	25%	82,707	89,027	256,921
	North Juneau	149,444	197,918	20%	26%	39,584	15%	20%	29,688	91,575	271,604
	Excursion Inlet	179,686	301,756	20%	34%	60,351	10%	17%	30,176	80,896	279,146
	Pybus Bay	23,022	35,954	20%	31%	7,191	5%	8%	1,798	15,011	55,938
	Gambier Bay	16,049	22,640	20%	28%	4,528	0%	0%	0	27,005	89,805
	Peril Strait	71,383	181,424	20%	51%	27,126*	10%	25%	18,142	10,989	94,317
	Lynn Sisters	43,245	62,997	20%	29%	12,599	15%	22%	9,450	11,220	38,146
	Other Areas	1,152,655	1,848,096			369,619			266,927	459,614	1,482,342
	Total	3,390,161	5,435,577	20%	32%	1,067,951	14.4%	23%	783,650	1,351,806	4,359,829

^a Guideline harvest level (GHL) is 20% of the mature male biomass unless this scenario creates a legal harvest rate that is greater than 38%, if this is the case the GHL is adjusted to be 38% of legal male biomass.

*Adjusted GHL due to >38% of legal biomass.

** Means represent years 1997 to 2006 in most areas, otherwise they represent the first ten years of survey data in the area.

Table 2. Matrix of Tanner crab stock status determination from the 2019 Tanner crab survey. The long-term average is defined as the first 10 years of available data from 1997–2010. Short-term trends are based on individual regression analyses over the past 4 years (including the current year). Total score is the sum of scores (+1, 0, -1 for long-term; +.25, 0, -.25 for short-term) for each response variable. Stock health is defined by the total score: < -3.25 = Poor, -3.25 to -1.26 = Below Average, -1.25 to 1.25 = Moderate, 1.26 to 3.25 = Above Average, and > 3.25 = Healthy.

	Icy Strait		Glacier Bay		Stephens Passage		Thomas Bay		Holkham Bay	
	% of baseline	Score	% of baseline	Score	% of baseline	Score	% of baseline	Score	% of baseline	Score
Large/mature females										
Percent clutch fullness < 25%										
-vs. long-term average	-66	1	-80	1	-72	1	-73	1	-84	1
-short term trend		0		0		0		0		0
- CPUE vs. long-term average	-81	-1	-74	-1	127	1	-1	0	88	0
- CPUE vs. short-term trend		0		0		0		0		0
Prerecruit males										
- CPUE vs. long-term average	-1	0	-21	0	88	1	77	1	96	1
- CPUE short-term trend		0.25		0		0		0		0
Recruit males										
- CPUE vs. long-term average	-40	0	294	1	-12	0	-21	0	66	0
- CPUE short-term trend		0.25		0.25		0.25		0		0
Postrecruit males										
- CPUE vs. long-term average	-96	-1	3	0	1	0	-46	0	15	0
- CPUE short-term trend		0		0		0.25		0		0
2018 Total score		-0.25		2.00		4.00		-3.50		2.00
2018 Stock status		Moderate		Above Average		Healthy		Poor		Above Average
2018 Mature harvest rate		10%		15%		20%		0%		15%
2019 Total score		-0.50		1.25		3.50		2.00		2.00
2019 Stock status		Moderate		Above Average		Healthy		Above Average		Above Average
2019 Mature harvest rate		10%		15%		20%		15%		15%

Table 3. Matrix of Tanner crab stock status determination from the 2019 red king crab survey. The long-term average is defined from 1997–2006. Short-term trends are based on individual regression analyses over the past 4 years (including the current year). Total score is the sum of scores (+1, 0, -1 for long-term; +.25, 0, -.25 for short-term) for each response variable. Stock health is defined by the total score: < -3.25 = Poor, -3.25 to -1.26 = Below Average, -1.25 to 1.25 = Moderate, 1.26 to 3.25 = Above Average, and > 3.25 = Healthy.

	Seymour Canal		North Juneau		Excursion Inlet		Pybus Bay	
	% of Baseline	Score	% of Baseline	Score	% of Baseline	Score	% of Baseline	Score
Large/Mature female percent clutch fullness < 25%	-13	0	-66	1	15	0	57	0
- vs. long-term average		0		0		0		0
- short term trend								
- CPUE vs. long-term average	156	0	44	0	-33	0	-65	-1
- CPUE vs. short-term trend		0		0		0		-0.25
Pre-recruit males								
- CPUE vs. long-term average	183	1	24	1	27	0	-12	0
- CPUE short-term trend		0		0		0		-0.25
Recruit males								
- CPUE vs. long-term average	58	0	-13	0	-22	0	-44	0
- CPUE short-term trend		0		0		-0.25		-0.25
Post-recruit males								
- CPUE vs. long-term average	90	0	8	0	-21	0	-75	-1
- CPUE short-term trend		0		0		0		0
2018 Total score		3.00		2.50		2.50		-0.75
2018 Stock status		Above Average		Above Average		Above Average		Moderate
2018 Mature harvest rate		15%		15%		15%		10%
2019 Total score		1.00		2.00		-0.25		-2.75
2019 Stock status		Moderate		Above Average		Moderate		Below Average
2019 Mature harvest rate		10%		15%		10%		5%

Table 3.–Continued

	Gambier Bay		Peril Strait		Lynn Sisters	
	% of Baseline	Score	% of Baseline	Score	% of Baseline	Score
Large/Mature female percent clutch fullness < 25%	85	0	45	0	-69	1
- vs. long-term average		0		0		0
- short term trend						
- CPUE vs. long-term average	-62	-1	129	0	39	0
- CPUE vs. short-term trend		-0.25		0		0
Pre-recruit males						
- CPUE vs. long-term average	-84	-1	77	1	165	1
- CPUE short-term trend		-0.25		0		0
Recruit males						
- CPUE vs. long-term average	-88	-1	-40	-1	-4	0
- CPUE short-term trend		-0.25		0		0
Post-recruit males						
- CPUE vs. long-term average	-80	-1	76	0	23	0
- CPUE short-term trend		-0.25		0		0.25
2018 Total score		-1.00		-1.25		2.25
2018 Stock status		Moderate		Moderate		Above Average
2018 Mature harvest rate		10%		10%		15%
2019 Total score		-5.00		0.00		2.25
2019 Stock status		Poor		Moderate		Above Average
2019 Mature harvest rate		0%		10%		15%

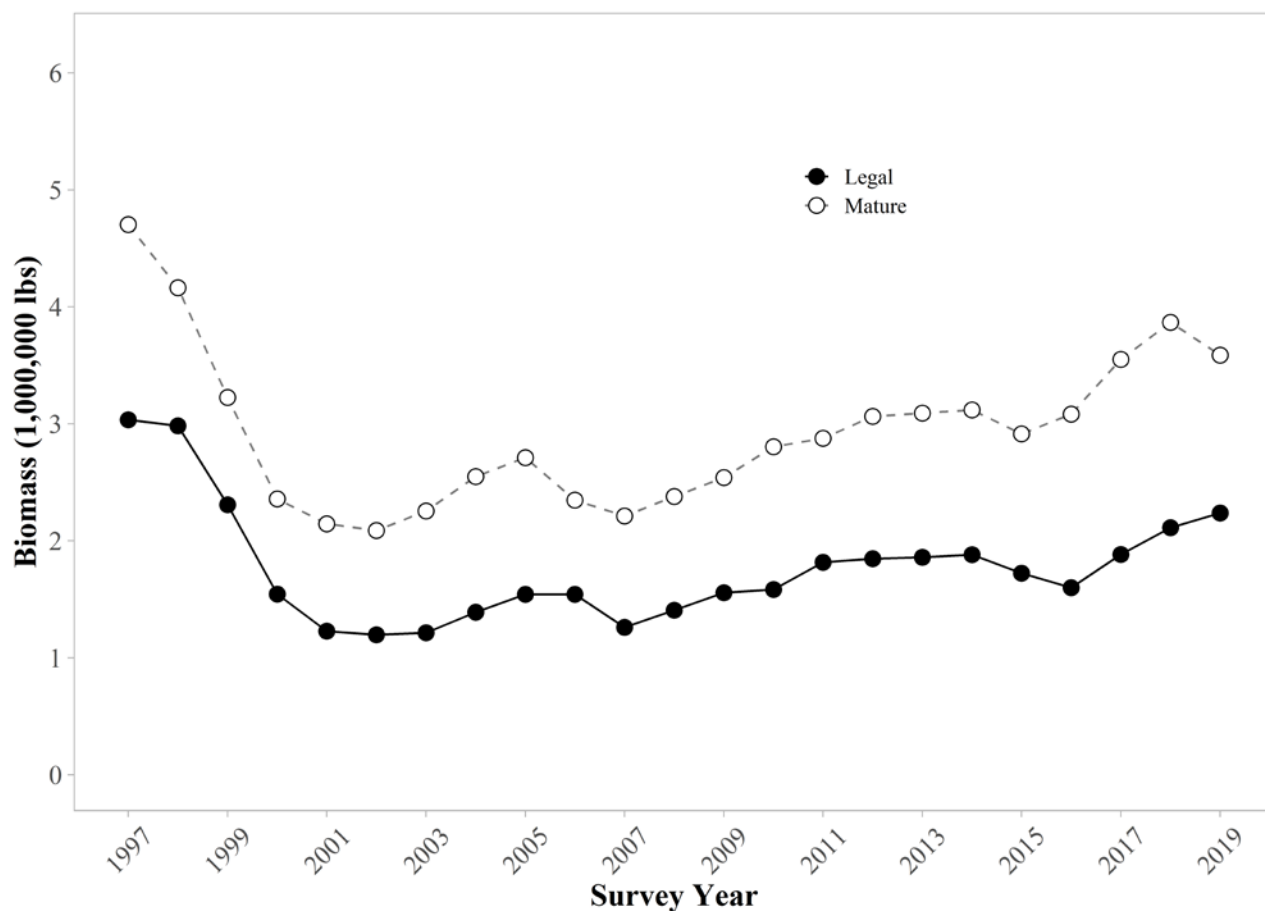


Figure 1. Trends in Tanner crab mature and legal biomass for the surveyed areas estimated from the 2019 catch-survey modeling using the pot survey data for Southeast Alaska. Biomass estimates do NOT include non-surveyed areas (starting in 2015 Port Camden and Port Frederick were removed from the survey areas, they are not included in any biomass estimates here). Prior to 2001 the biomass of areas initially not surveyed (Thomas Bay, Glacier Bay), but added in subsequent years, is as estimated as their average percent contribution to the total surveyed biomass in all subsequent years (first year surveyed until 2018 survey).

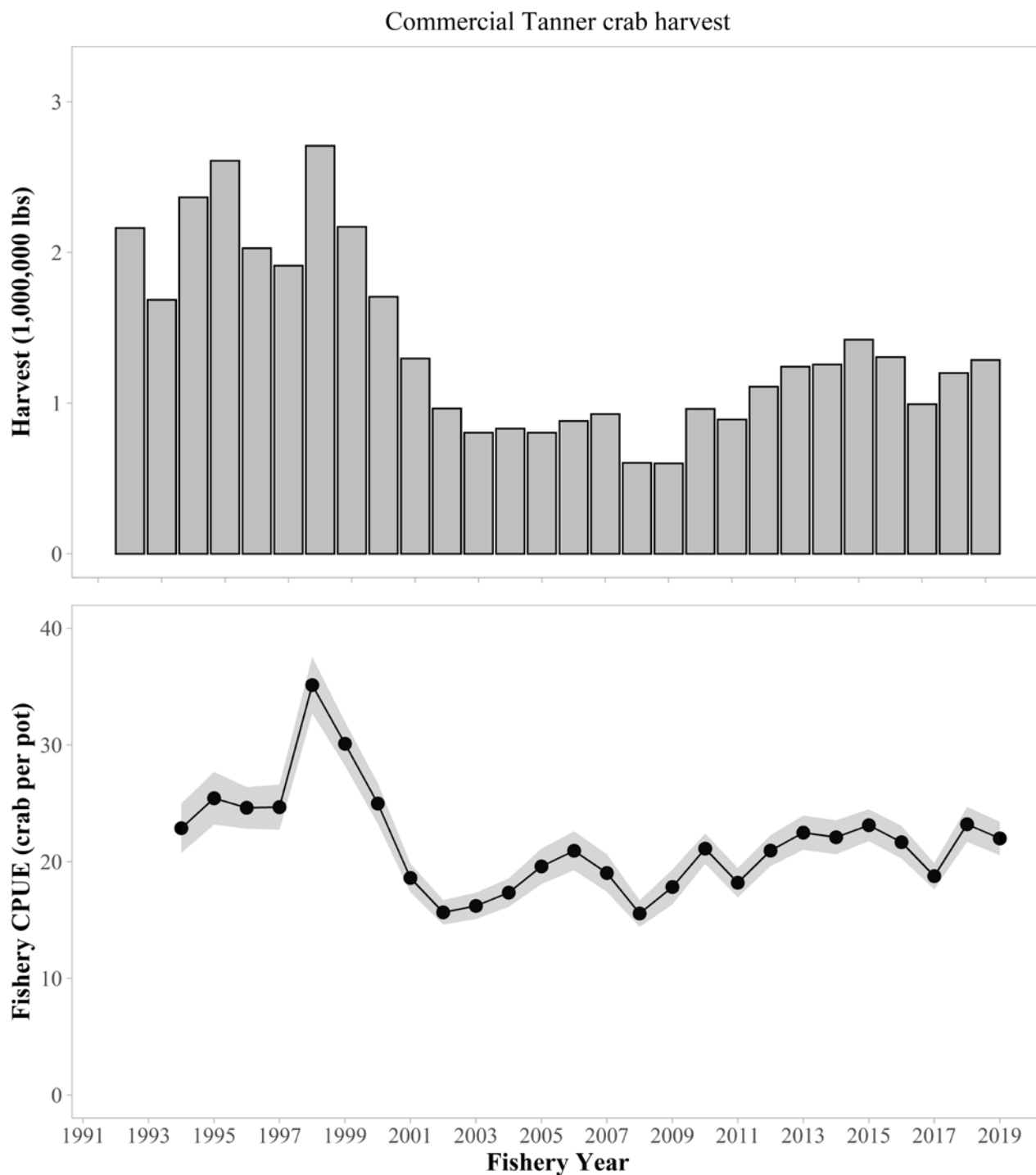


Figure 2. Southeast Alaska commercial Tanner crab harvest and standardized commercial catch-per-unit-effort (CPUE) for 1991/1992 through 2018/2019 seasons. The x axis is represented by fishery year, e.g. 2018/2019 season is 2019 fishery year. CPUE was calculated using logbook data, which began during the 1993/1994 season. Standardized CPUE was calculated by using a similar number of pot lifts for each year, based on the year (2008/2009) with the fewest number of pot lifts (12,521).

Icy Strait

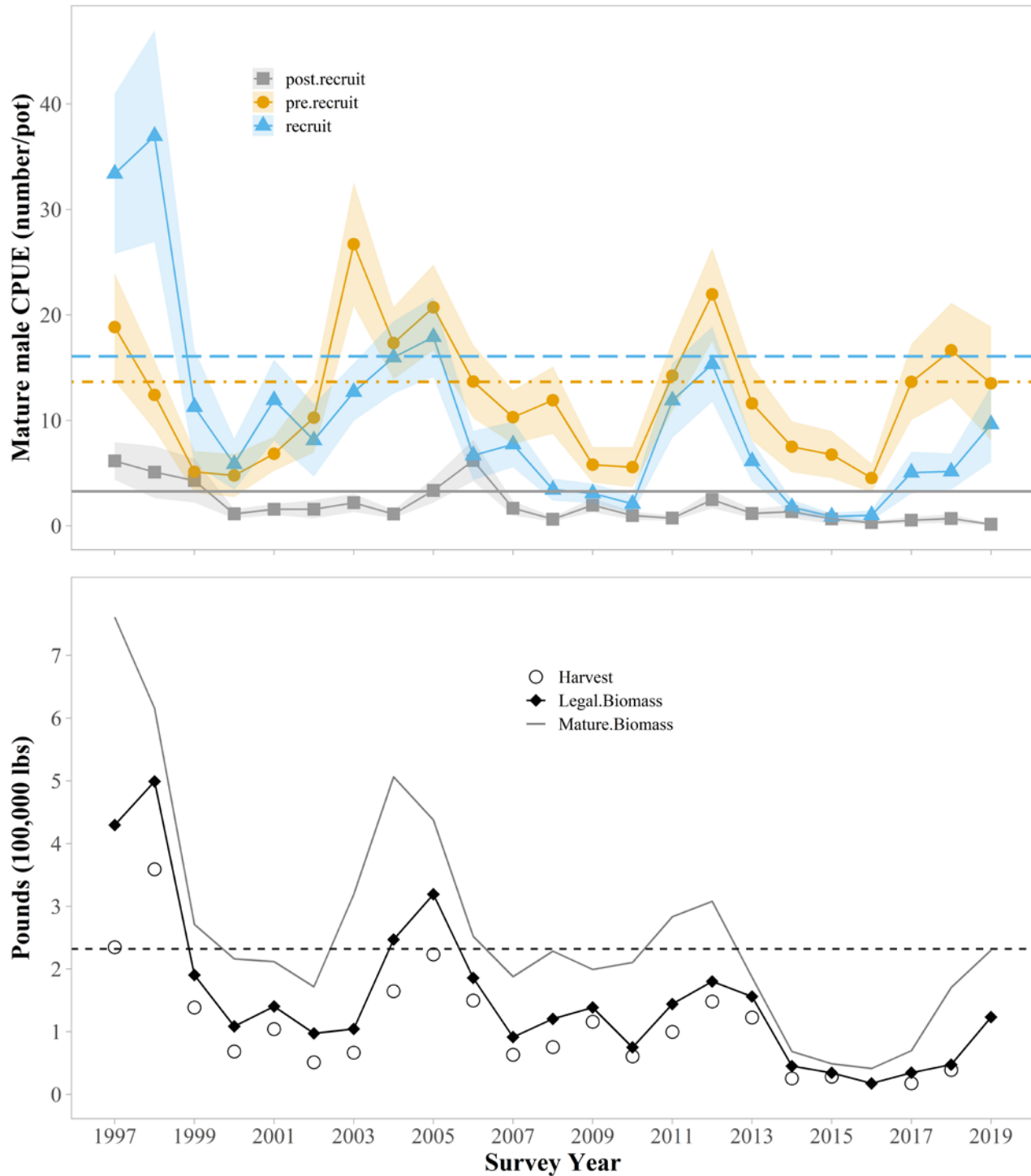


Figure 3a. Icy Strait Tanner crab survey area. Biomass estimates of legal and mature Tanner crab are based on catch-survey analysis methodologies. Commercial harvest is the total pounds harvested in associated and adjacent statistical areas. Reference lines represent long-term benchmark (1997-2006) for pre-recruit male (orange), recruit (blue), and post-recruit (grey) crabs. Reference line for biomass (dashed line) represents the long-term average (1997-2006) for legal biomass (lb). There are significant short-term *increasing* trends for pre-recruit and recruit male CPUE ($p < 0.05$).

Icy Strait - Females

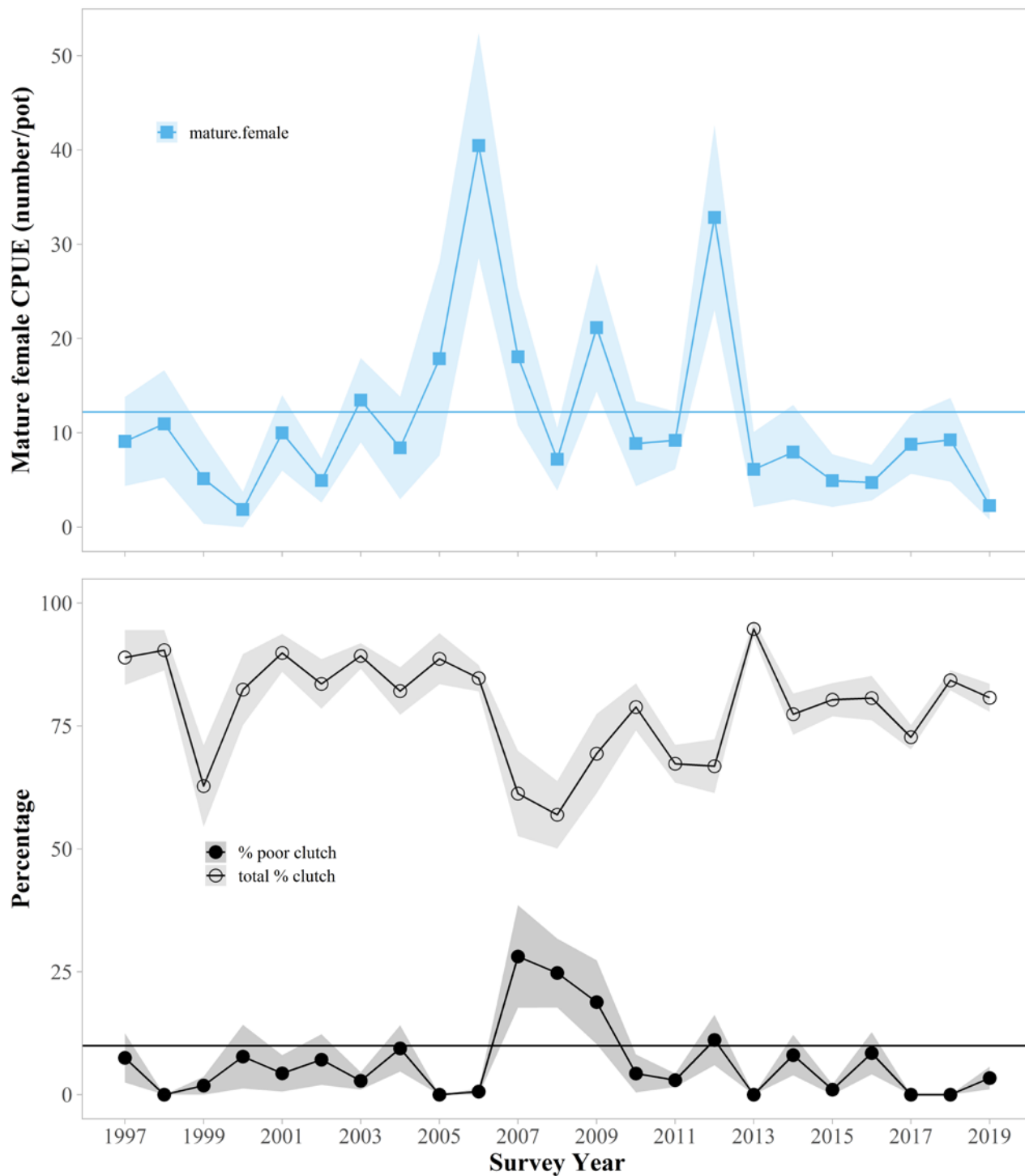


Figure 3b. Female information for Icy Strait Tanner crab survey area. Reference lines represent long-term benchmark (1997-2006) values. There are NO significant short-term trends in either CPUE or the proportion of poor clutches ($p < 0.05$).

Glacier Bay

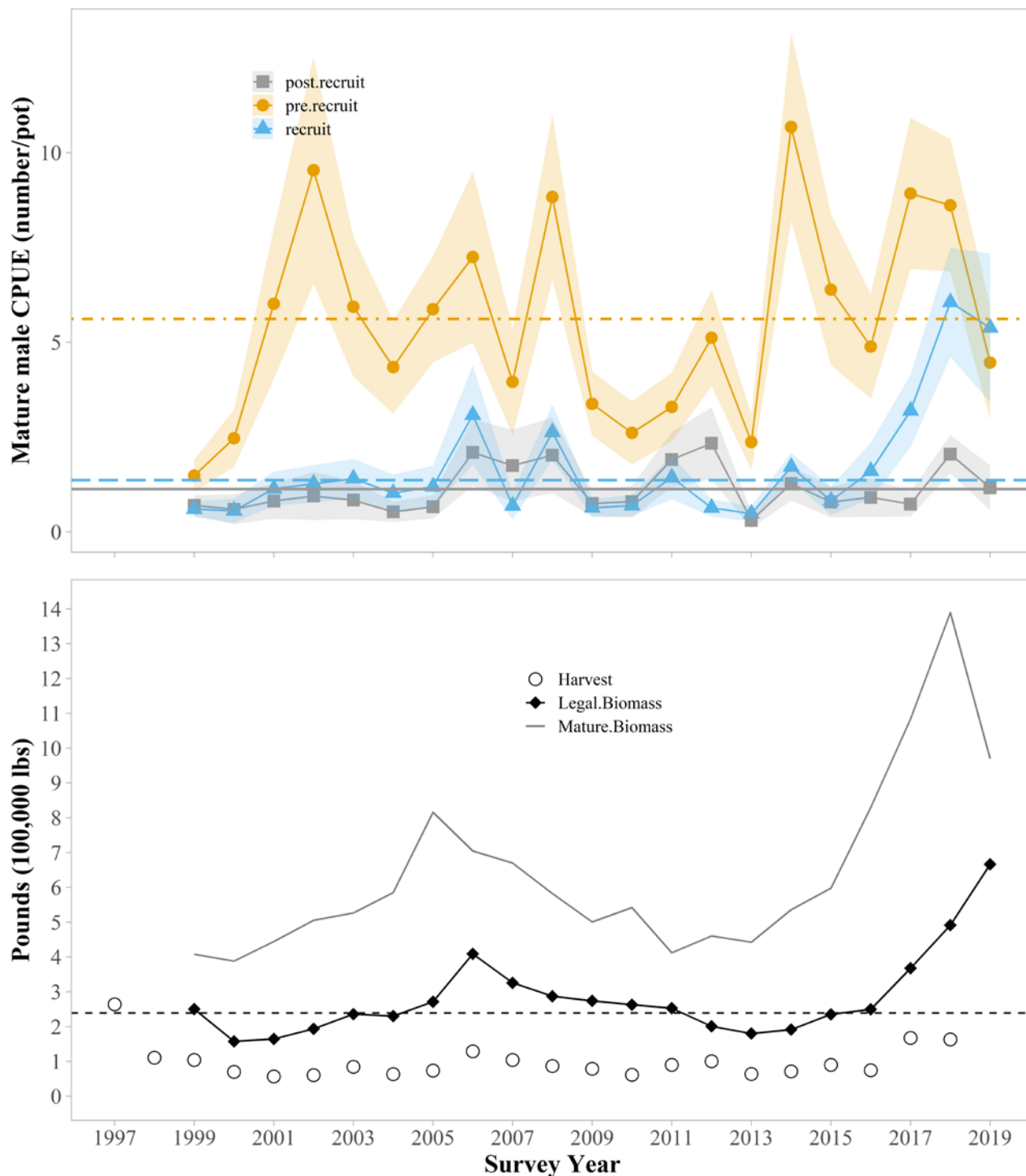


Figure 4a. Glacier Bay Tanner crab survey area. Biomass estimates of legal and mature Tanner crab are based on catch-survey analysis methodologies. Commercial harvest is the total pounds harvested in associated and adjacent statistical areas. Reference lines represent long-term benchmark (1997-2006) pre-recruit male (orange), recruit (blue), and post-recruit (grey) crabs. Reference line for biomass (dashed line) represents the long-term average (1997-2006) for legal biomass (lb). There is a significant short-term *increasing* trend for recruit male CPUE ($p < 0.05$).

Glacier Bay - Females

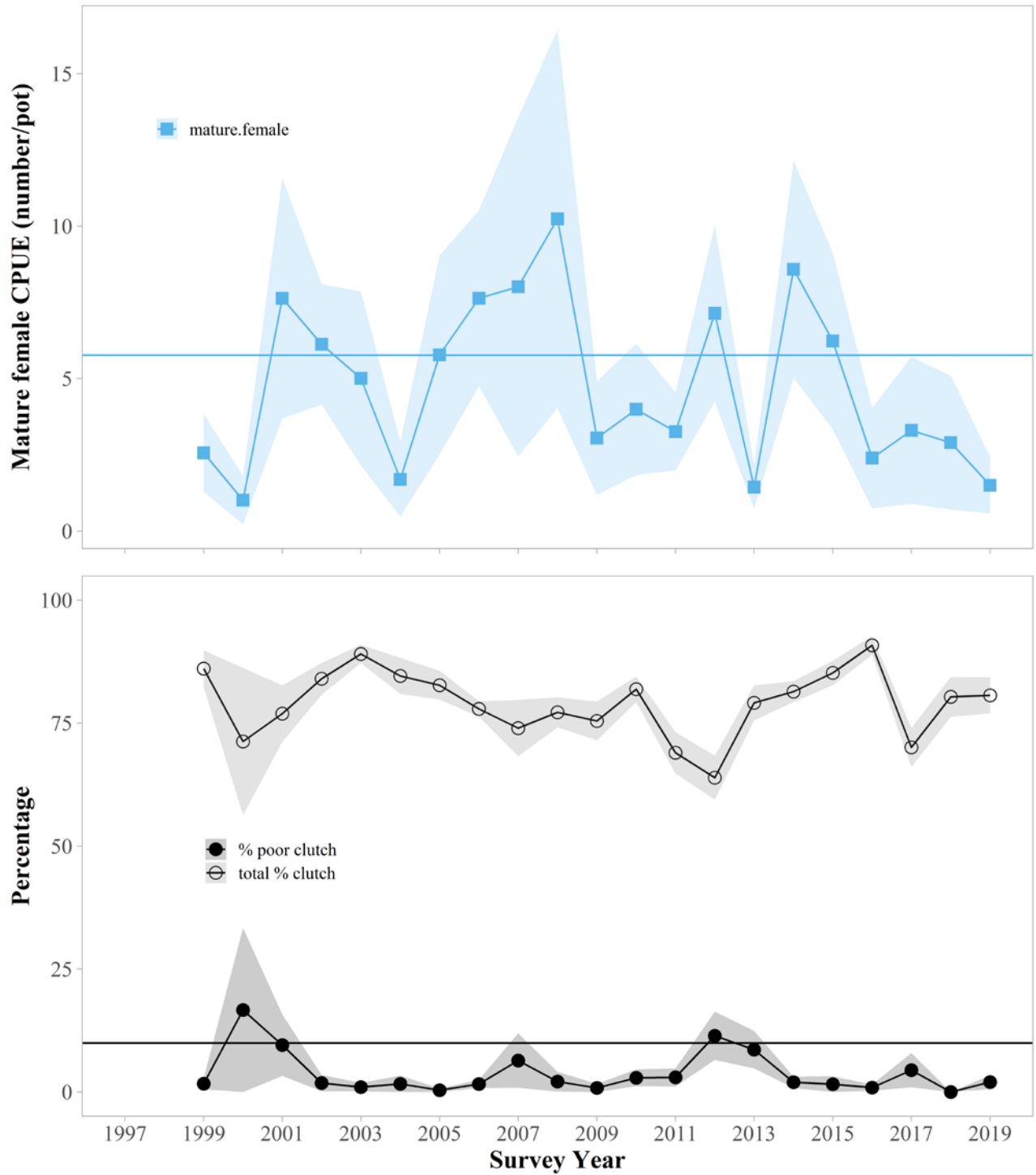


Figure 4b. Female information for Glacier Bay Tanner crab survey area. Reference lines represent long-term benchmark (1997-2006) values. There are NO significant short-term trends in either CPUE or the proportion of poor clutches ($p < 0.05$).

Thomas Bay

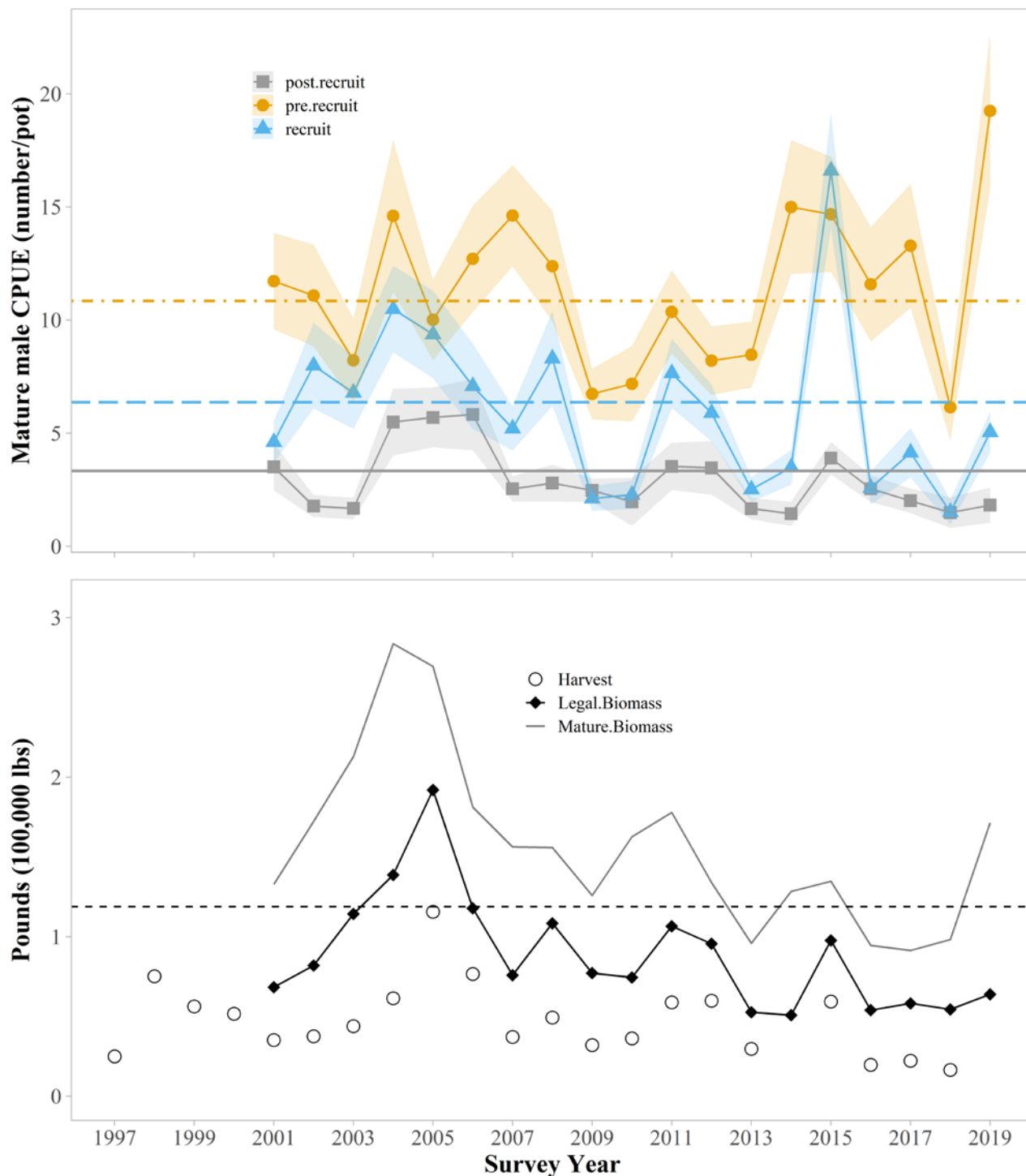


Figure 5a. Thomas Bay Tanner crab survey area. Biomass estimates of legal and mature Tanner crab are based on catch-survey analysis methodologies. Commercial harvest is the total pounds harvested in associated and adjacent statistical areas. Reference lines represent long-term benchmark (1997-2006) for pre-recruit male (orange), recruit (blue), and post-recruit (grey) crabs. Reference line for biomass (dashed line) represents the long-term average (1997-2006) for legal biomass (lb). There are NO significant short-term trends for male CPUEs ($p < 0.05$).

Thomas Bay - Females

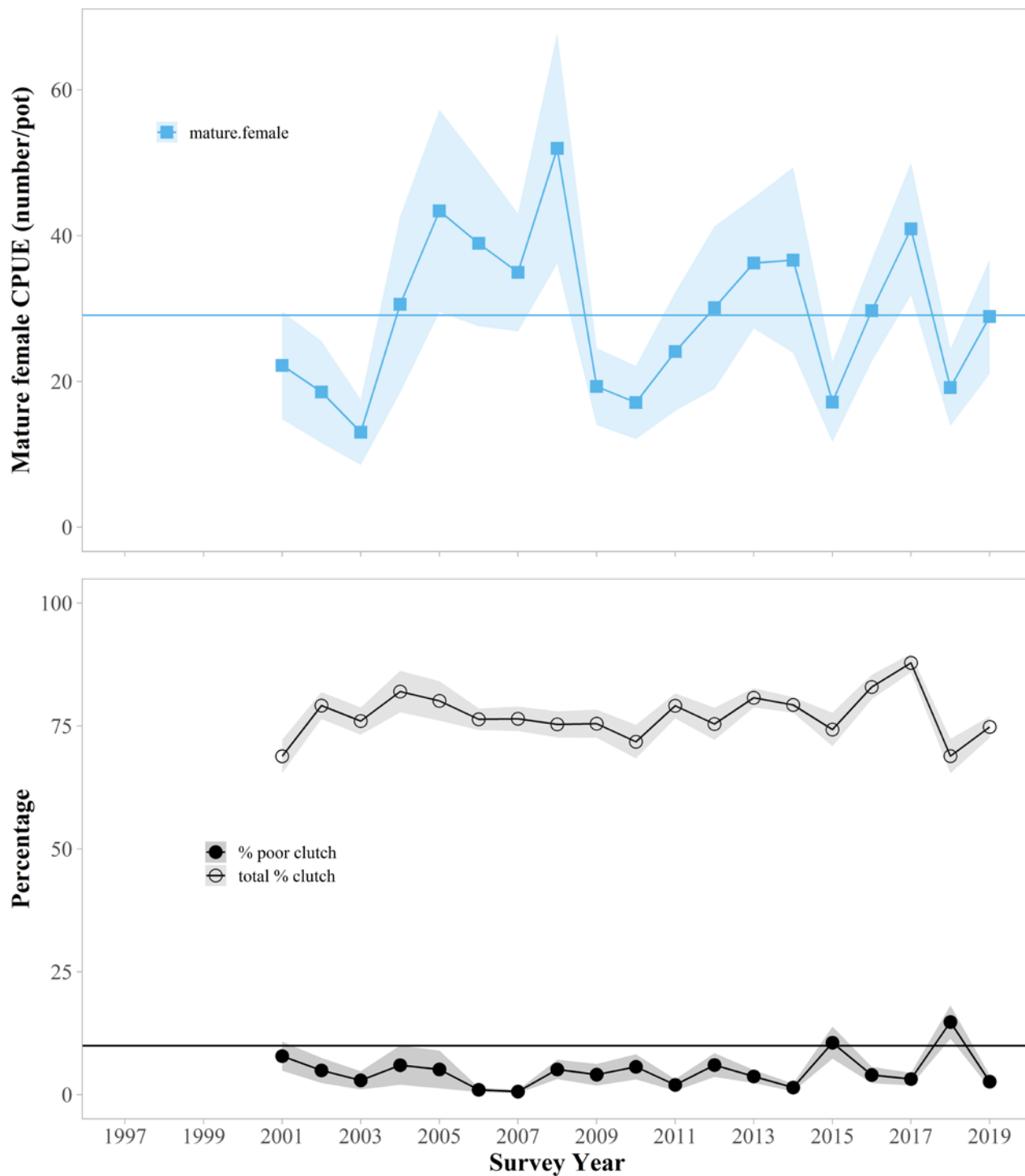


Figure 5b. Female information for Thomas Bay Tanner crab survey area. Reference lines represent long-term benchmark (1997-2006) values. There are NO significant short-term trends in either CPUE or the proportion of poor clutches ($p < 0.05$).

Holkham Bay

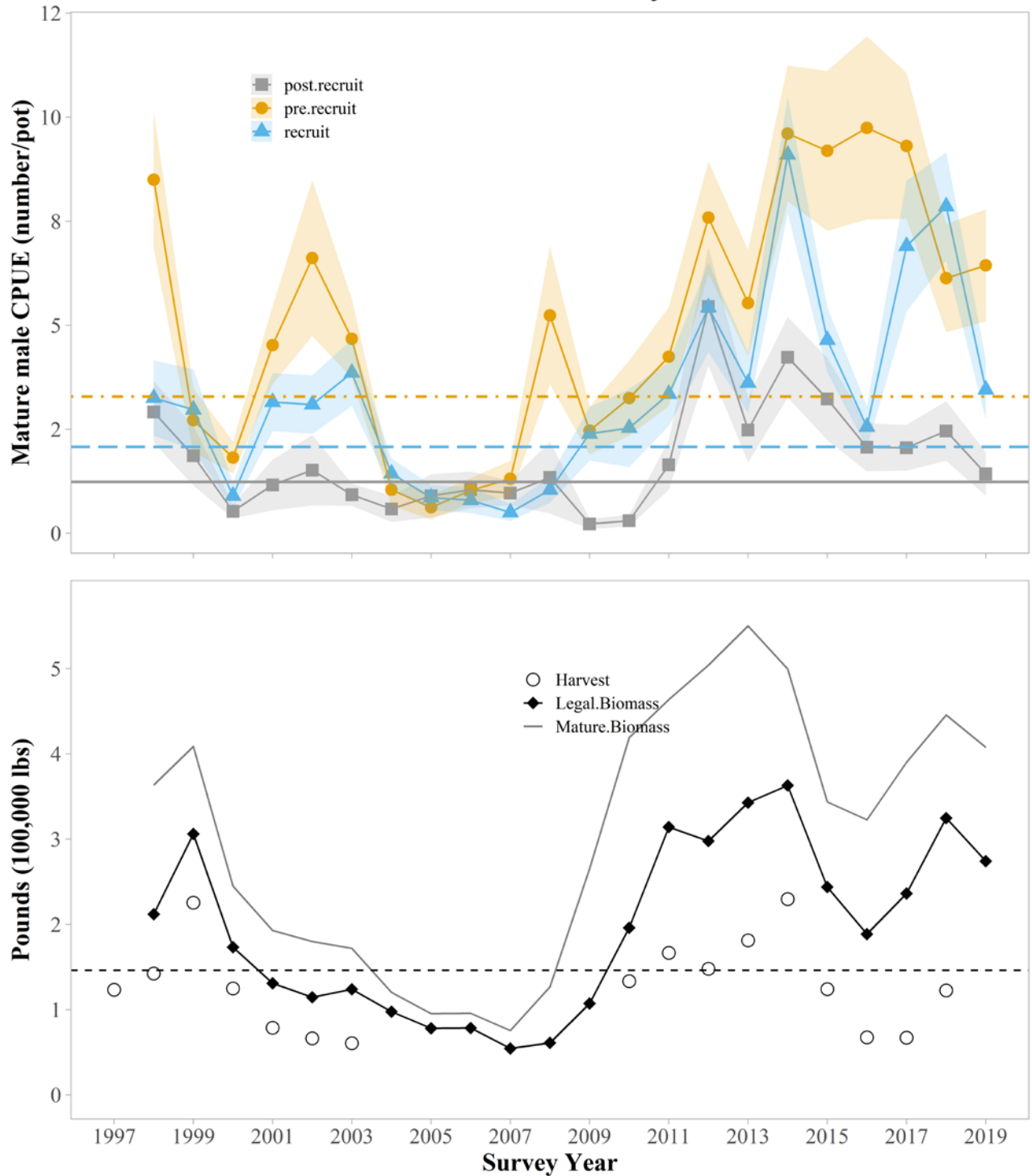


Figure 6a. Holkham Bay Tanner crab survey area. Biomass estimates of legal and mature Tanner crab are based on catch-survey analysis methodologies. Commercial harvest is the total pounds harvested in associated and adjacent statistical areas. Reference lines represent long-term benchmark (1997-2006) for pre-recruit male (orange), recruit (blue), and post-recruit (grey) crabs. Reference line for biomass (dashed line) represents the long-term average (1997-2006) for legal biomass (lb). There are no significant short-term trend for recruit CPUE ($p < 0.05$).

Holkham Bay - Females

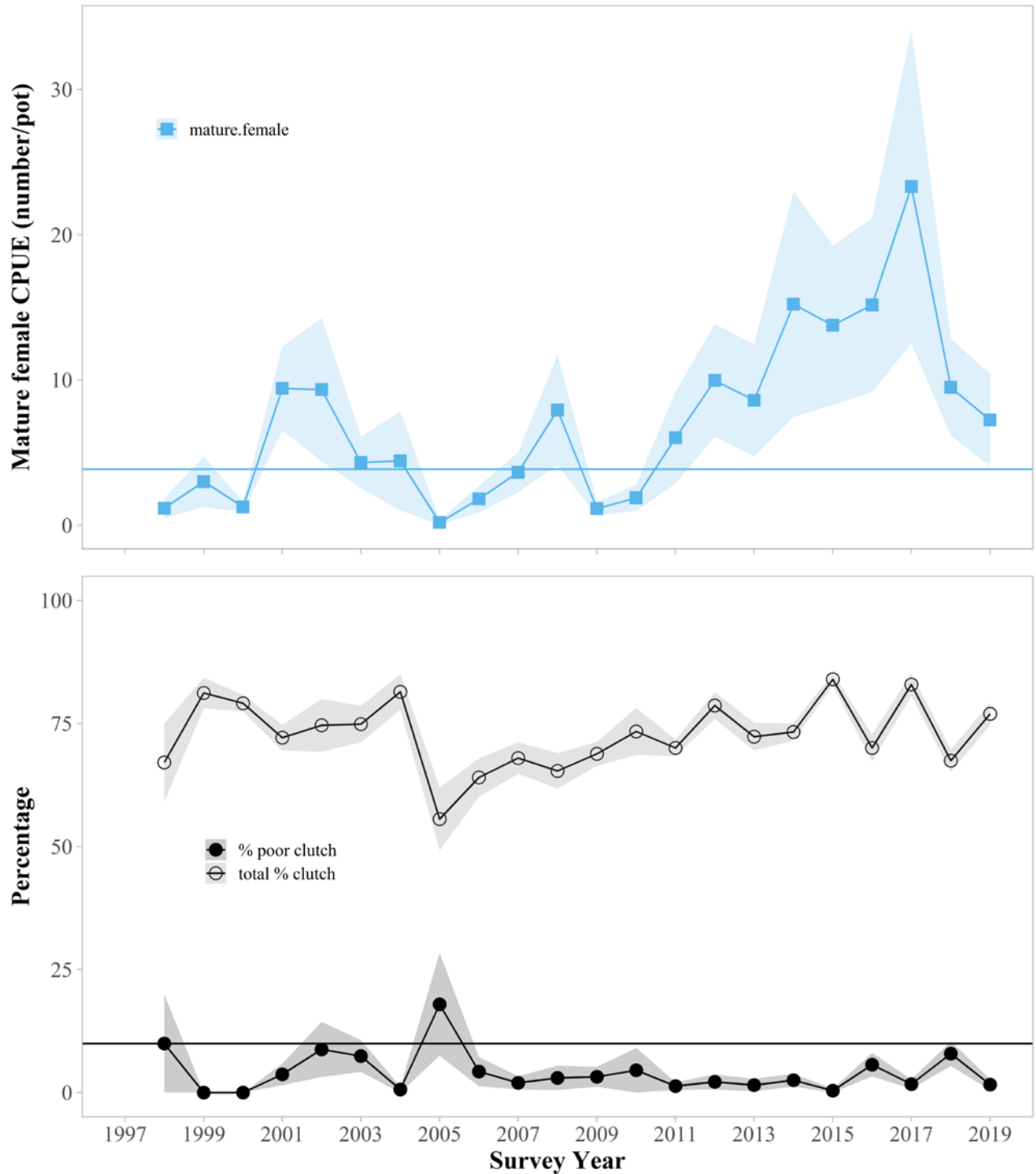


Figure 6b. Female information for Holkham Bay Tanner crab survey area. Reference lines represent long-term benchmark (1997-2006) values. There are NO significant short-term trends in either CPUE or the proportion of poor clutches ($p < 0.05$).

Stephens Passage

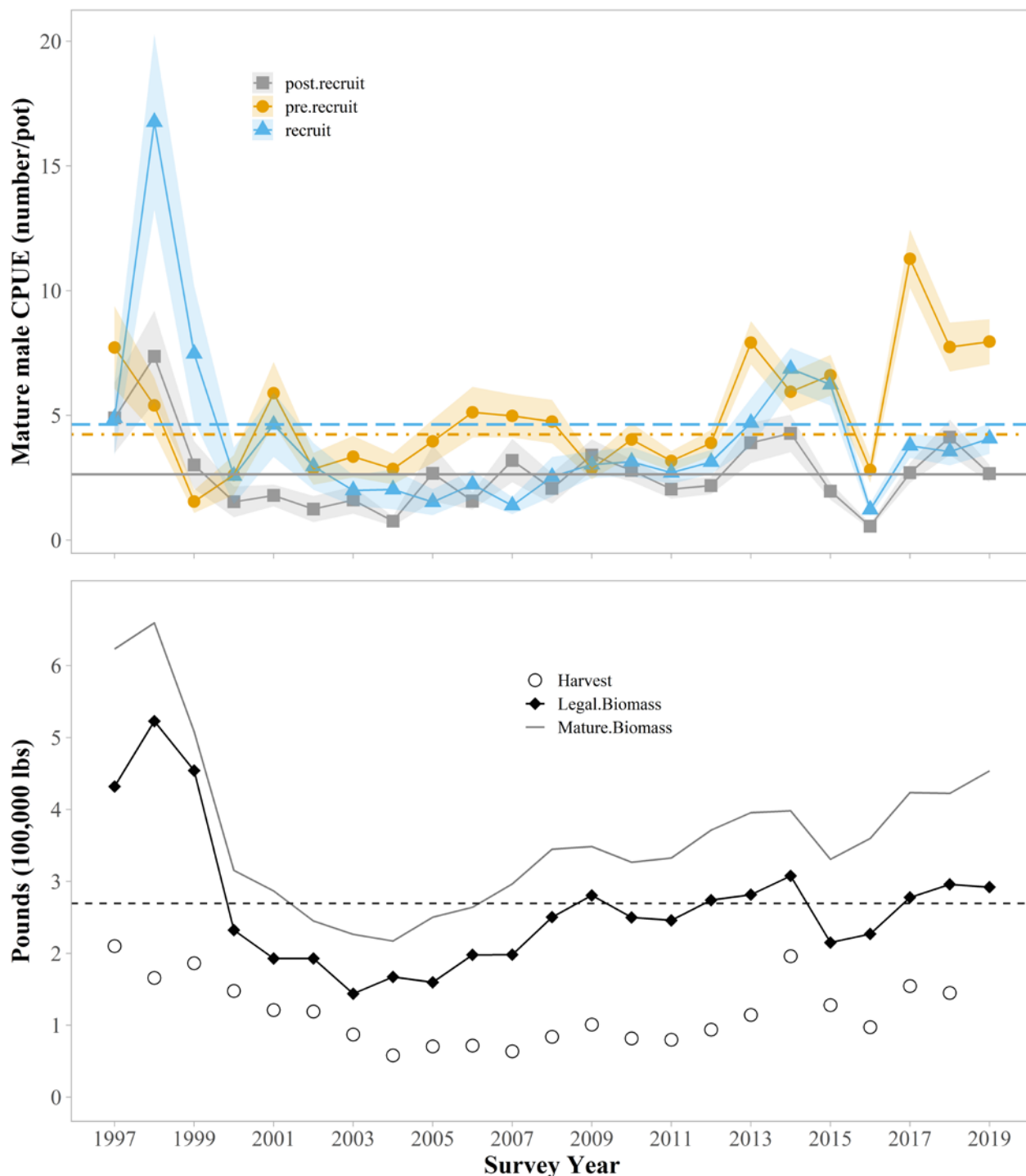


Figure 7a. Stephens Passage red king crab survey area. Biomass estimates of legal and mature Tanner crab are based on catch-survey analysis methodologies. Commercial harvest is the total pounds harvested in associated and adjacent statistical areas. Reference lines represent long-term benchmark (1997-2006) for pre-recruit male (orange), recruit (blue), and post-recruit (grey) crabs. Reference line for biomass (dashed line) represents the long-term average (1997-2006) for legal biomass (lb). There is a significant short-term *increasing* trend for both recruit and post-recruit male CPUE ($p < 0.05$).

Stephens Passage - Females

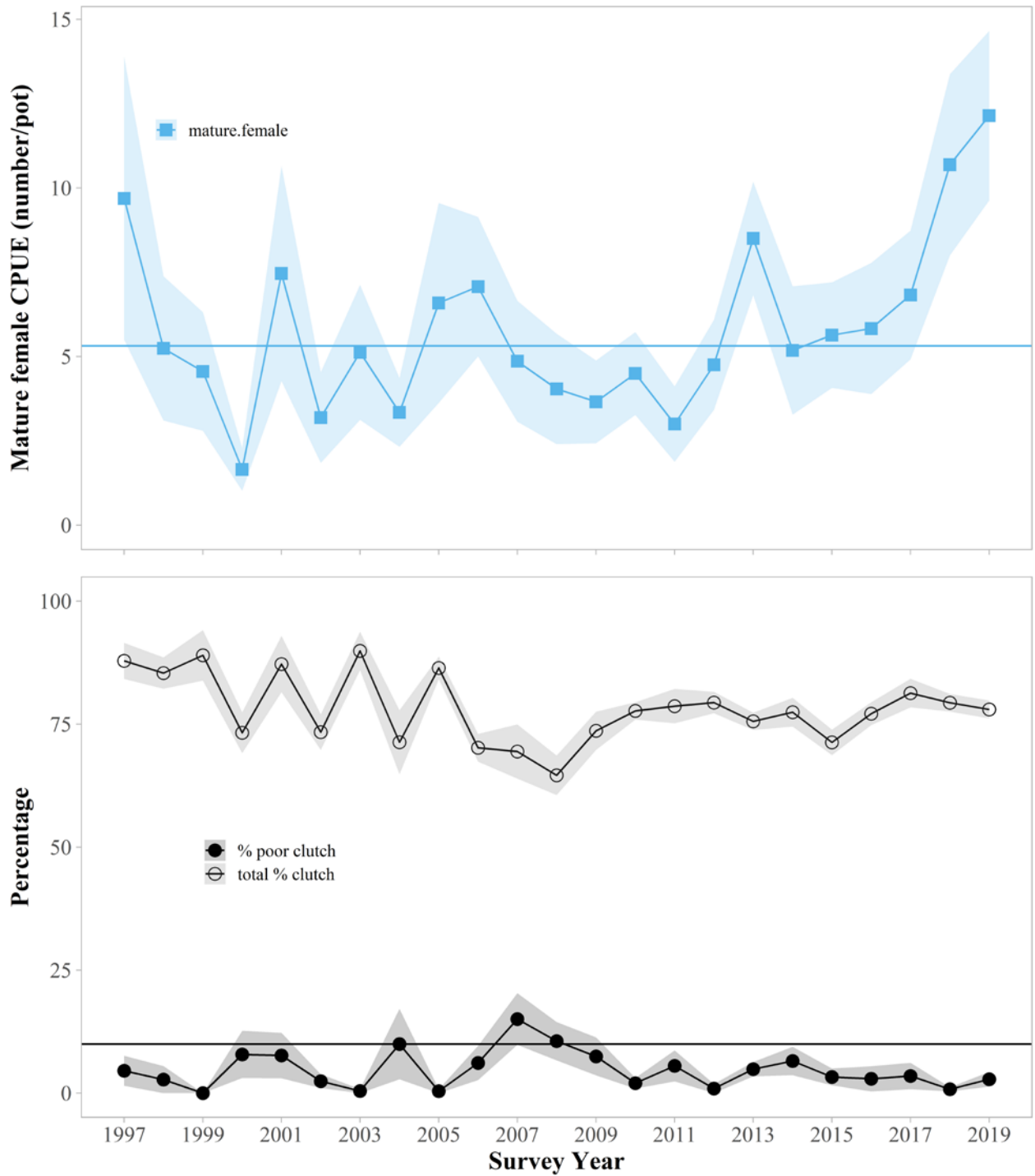


Figure 7b. Female information for Tanner crab in the Stephens Passage red king crab survey area. Reference lines represent long-term benchmark (1997-2006) values. There are NO significant short-term trends in either CPUE or the proportion of poor clutches ($p < 0.05$).

Seymour Canal

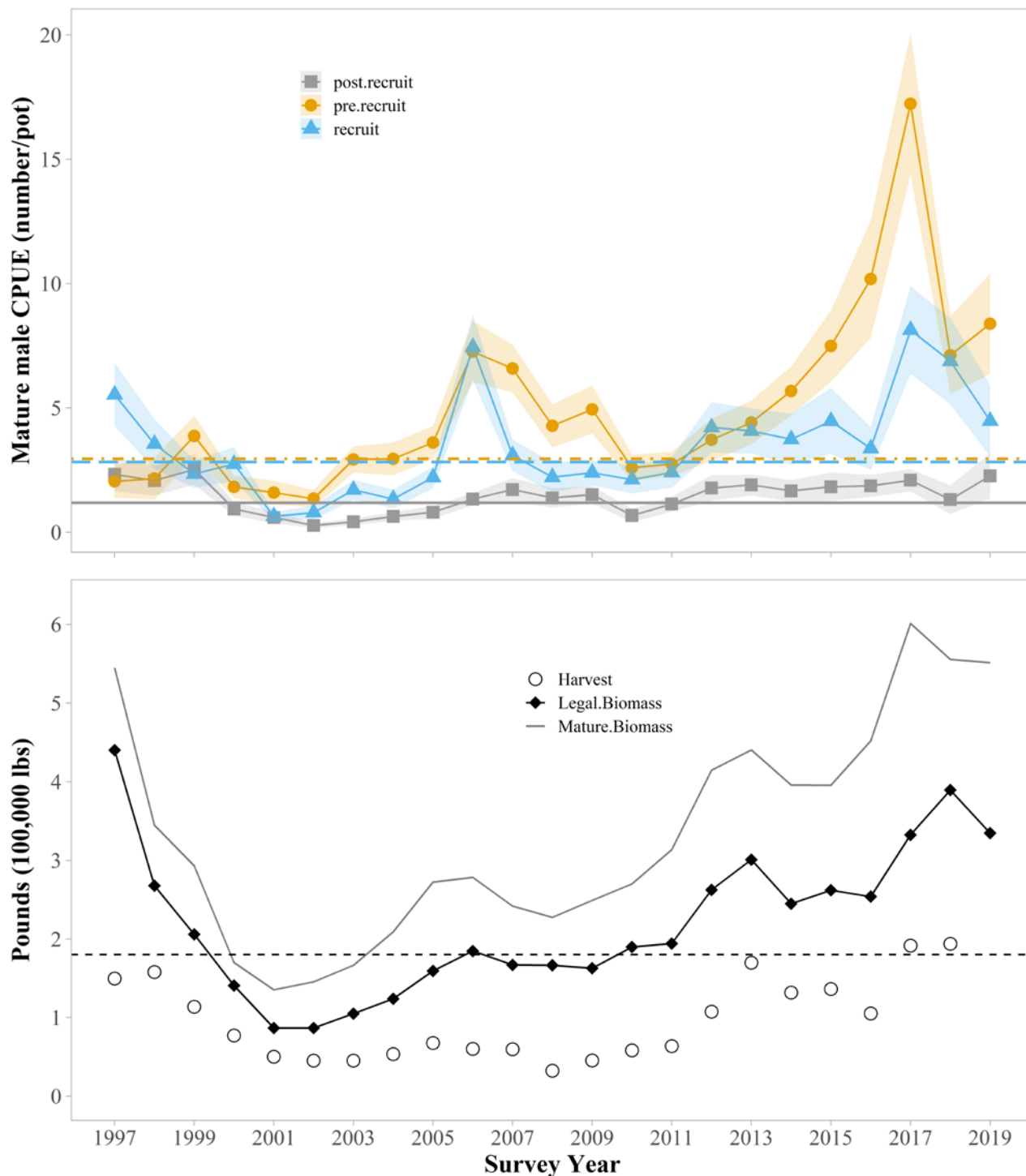


Figure 8a. Seymour Canal red king crab survey area. Biomass estimates of legal and mature Tanner crab are based on catch-survey analysis methodologies. Commercial harvest is the total pounds harvested in associated and adjacent statistical areas. Reference lines represent long-term benchmark (1997-2006) for pre-recruit male (orange), recruit (blue), and post-recruit (grey) crabs. Reference line for biomass (dashed line) represents the long-term average for legal biomass (lb). There are NO significant short-term trends ($p < 0.05$).

Seymour Canal - Females

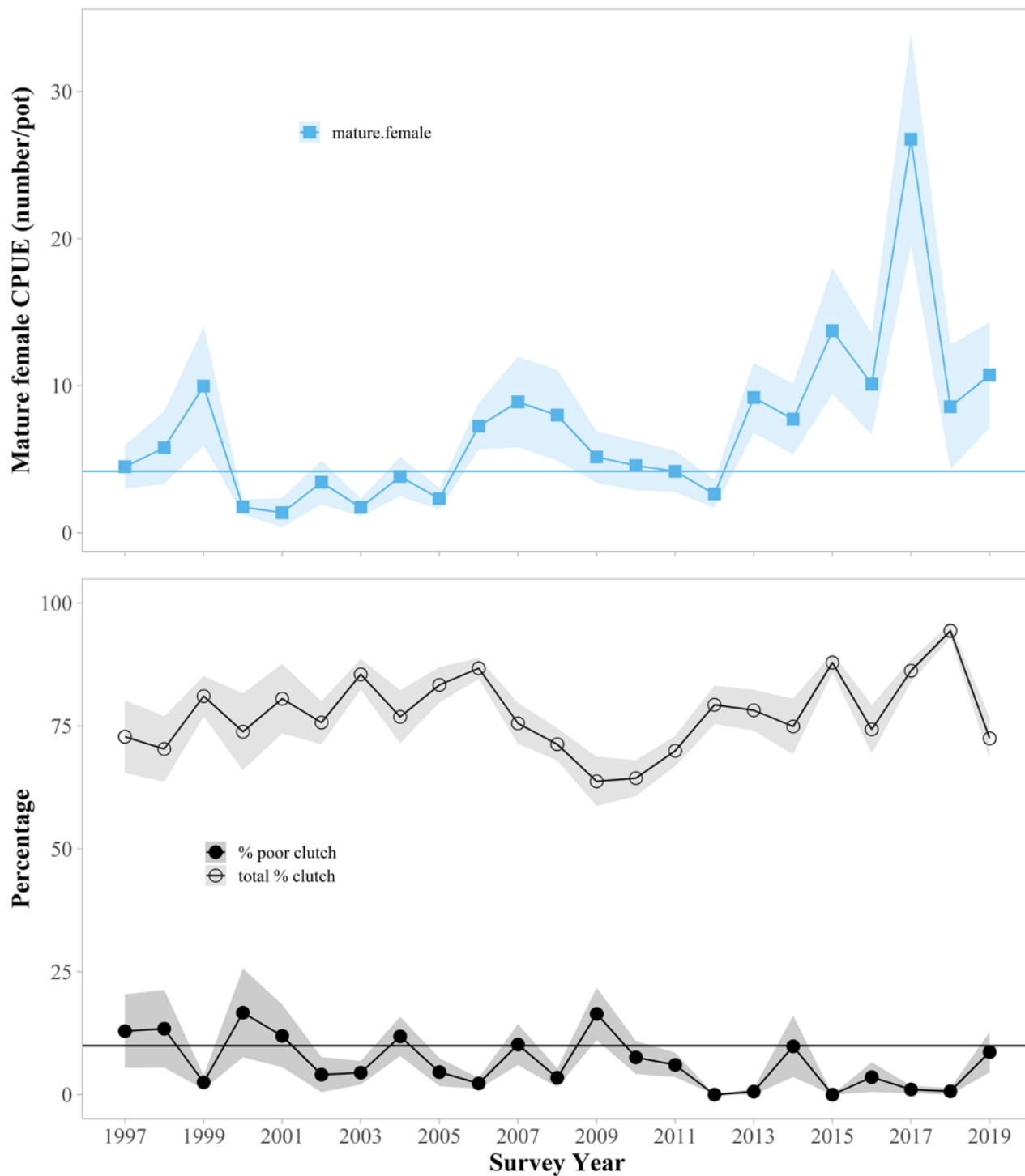


Figure 8b. Female information for Tanner crab in the Seymour Canal red king crab survey area. Reference lines represent long-term benchmark (1997-2006) values. There are NO significant short-term trends in either CPUE or the proportion of poor clutches ($p < 0.05$).

North Juneau

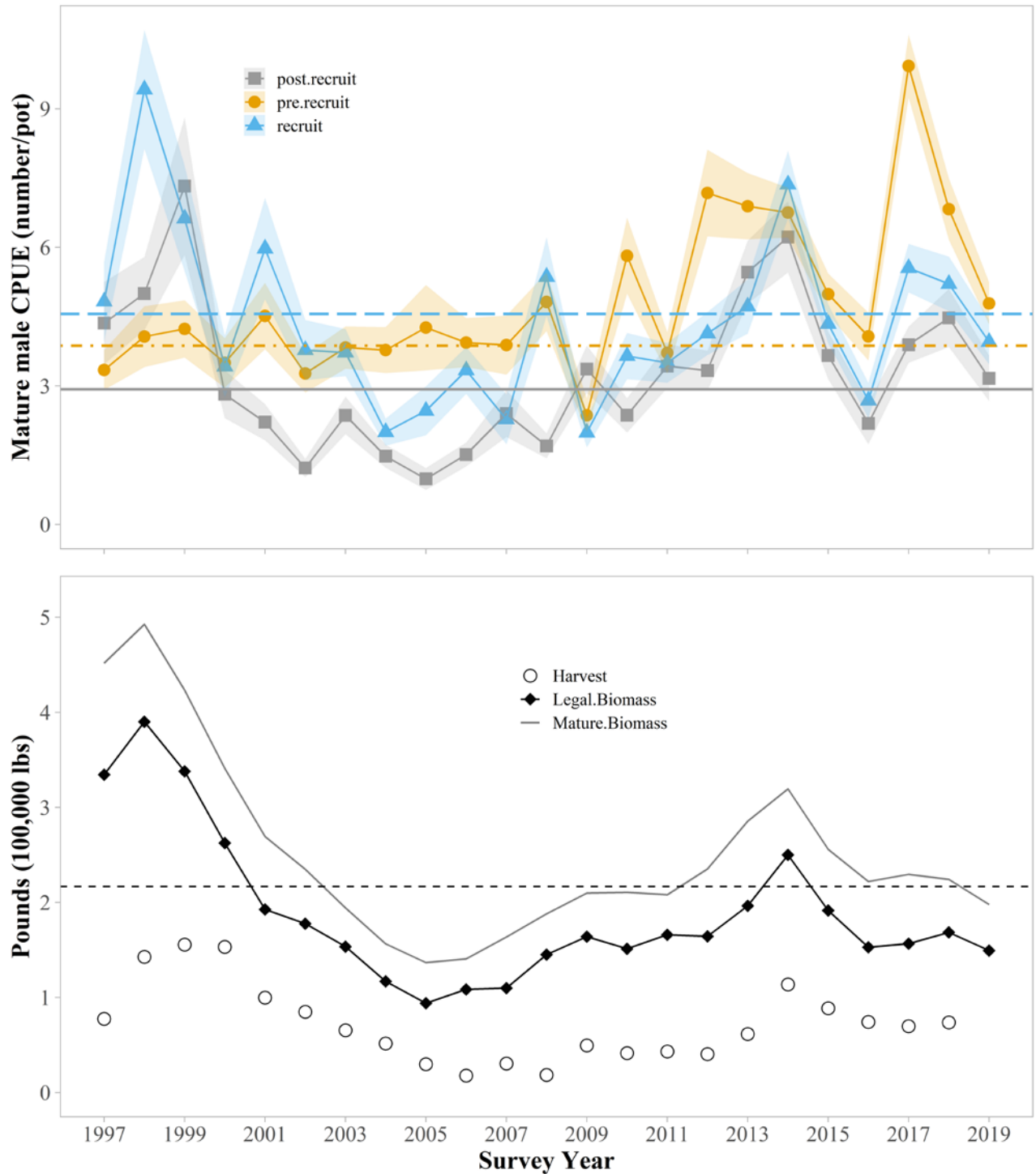


Figure 9a. North Juneau red king crab survey area. Biomass estimates of legal and mature Tanner crab based on catch-survey analysis methodologies. Commercial harvest is the total pounds harvested in associated and adjacent statistical areas. Reference lines represent long-term benchmark (1997-2006) for pre-recruit male (orange), recruit (blue), and post-recruit (grey) crabs. Reference line for biomass (dashed line) represents the long-term average (1997-2006) for legal biomass (lb). There are NO significant short-term trends for mature male CPUE ($p < 0.05$).

North Juneau - Females

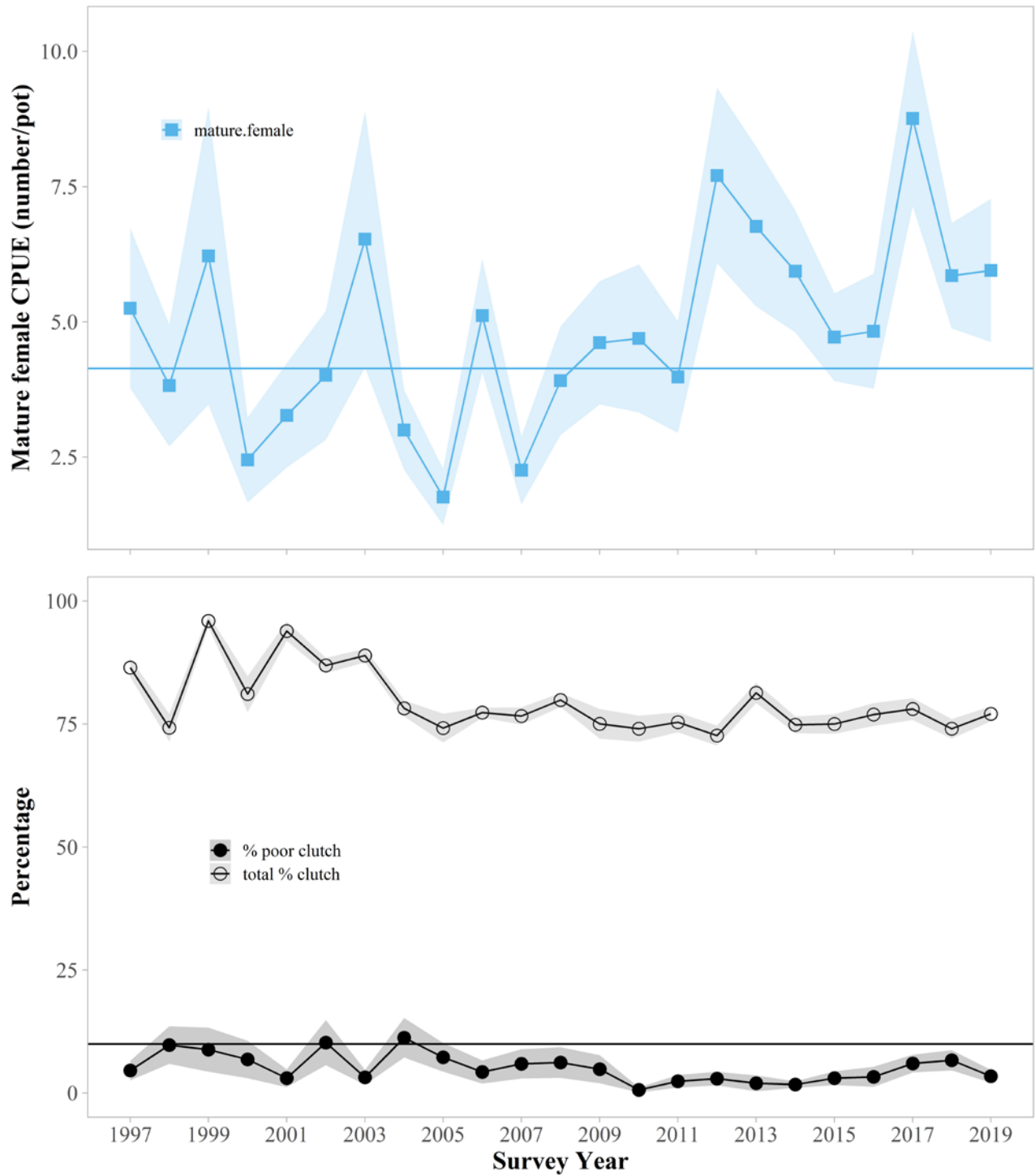


Figure 9b. Female information for Tanner crab in the North Juneau red king crab survey area. Reference lines represent long-term benchmark (1997-2006) values. There are NO significant short-term trends in either CPUE or the proportion of poor clutches ($p < 0.05$).

Excursion Inlet

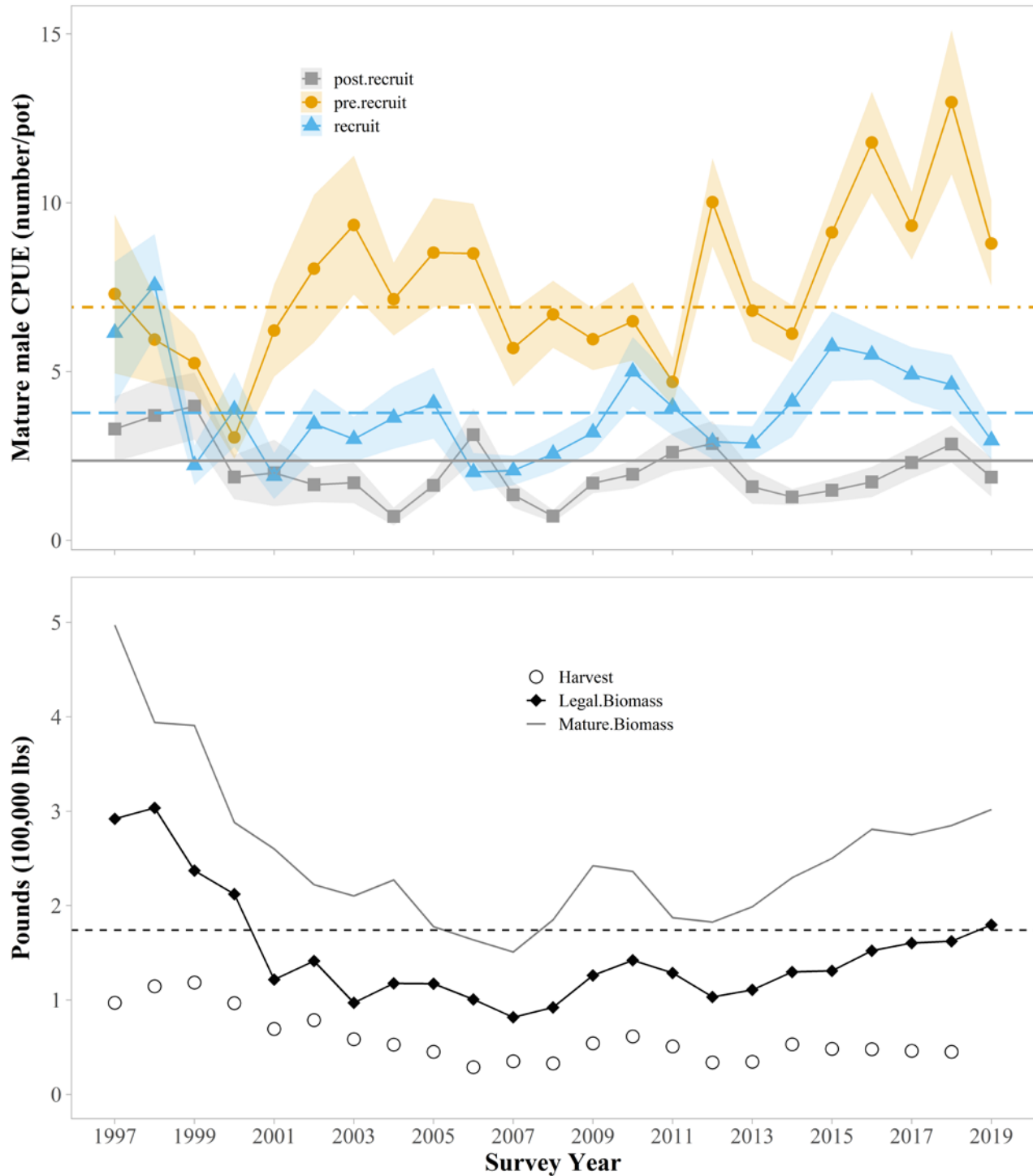


Figure 10a. Excursion Inlet red king crab survey area. Biomass estimates of legal and mature Tanner crab based on catch-survey analysis methodologies. Commercial harvest is the total pounds harvested in associated and adjacent statistical areas. Reference lines represent long-term benchmark (1997-2006) for pre-recruit male (orange), recruit (blue), and post-recruit (grey) crabs. Reference line for biomass (dashed line) represents the long-term average for legal biomass (lb). There is a significant short-term decreasing trend ($p < 0.05$) for recruit male CPUE.

Excursion Inlet - Females

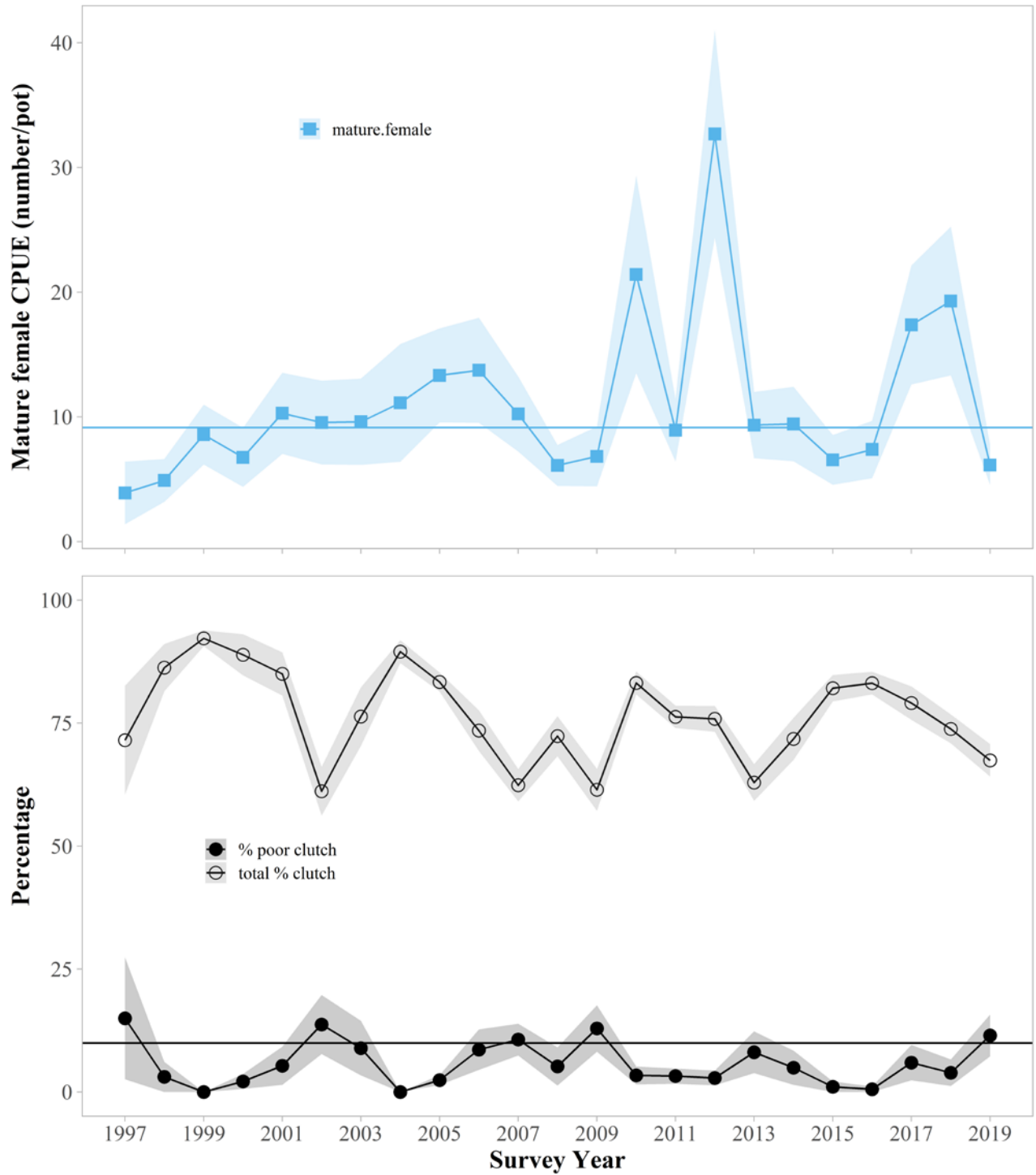


Figure 10b. Female information for Tanner crab in the Excursion Inlet red king crab survey area. Reference lines represent long-term benchmark (1997-2006) values. There are NO significant short-term trends in either CPUE or the proportion of poor clutches ($p < 0.05$).

Pybus Bay

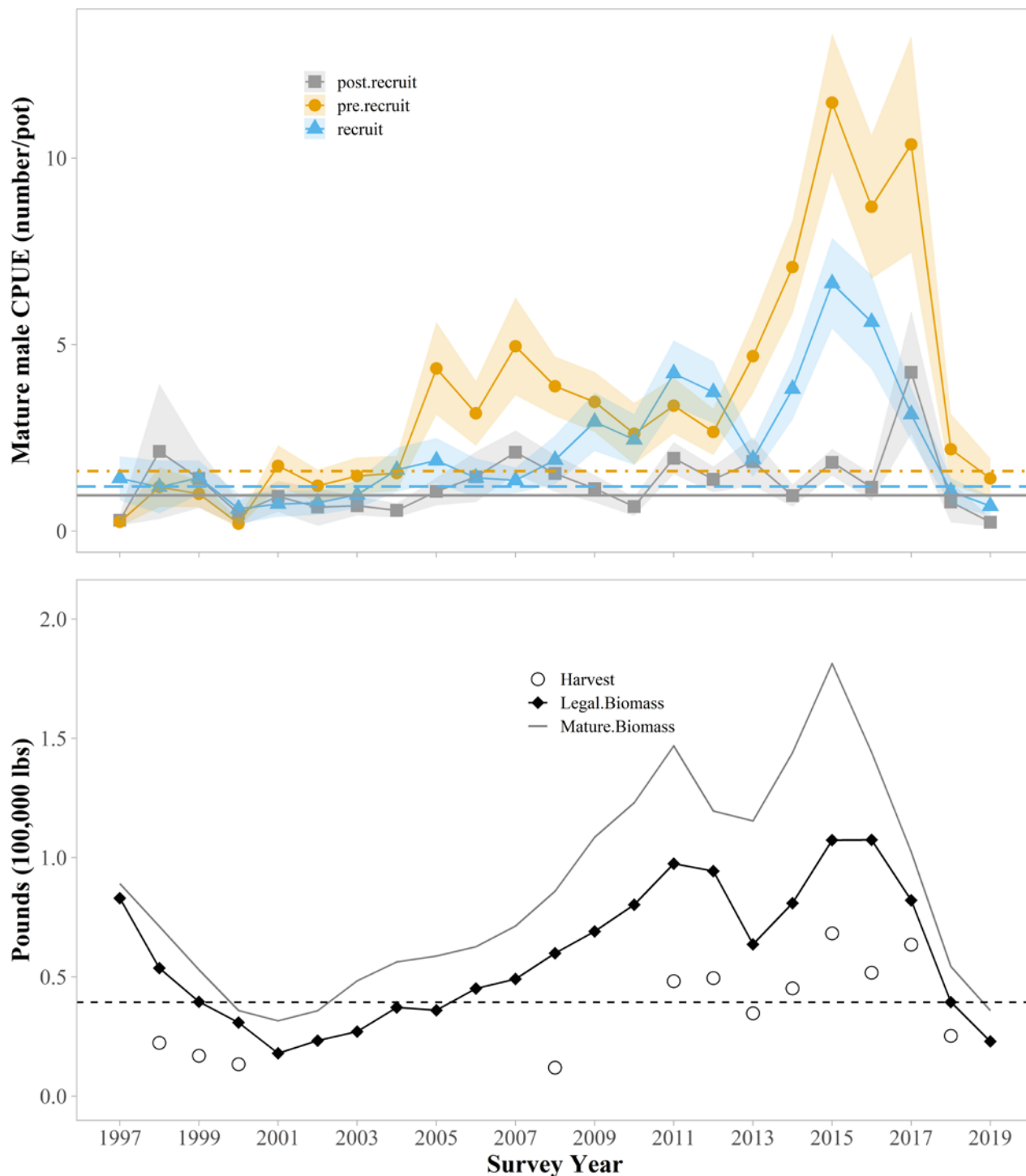


Figure 11a. Pybus Bay red king crab survey area. Biomass estimates of legal and mature Tanner crab are based on catch-survey analysis methodologies. Commercial harvest is the total pounds harvested in associated and adjacent statistical areas. Reference lines represent long-term benchmark (1997-2006) for pre-recruit male (orange), recruit (blue), and post-recruit (grey) crabs. Reference line for biomass (dashed line) represents the long-term average for legal biomass (lb). There is a significant short-term decreasing trend ($p < 0.05$) for pre-recruit and recruit male CPUE.

Pybus Bay - Females

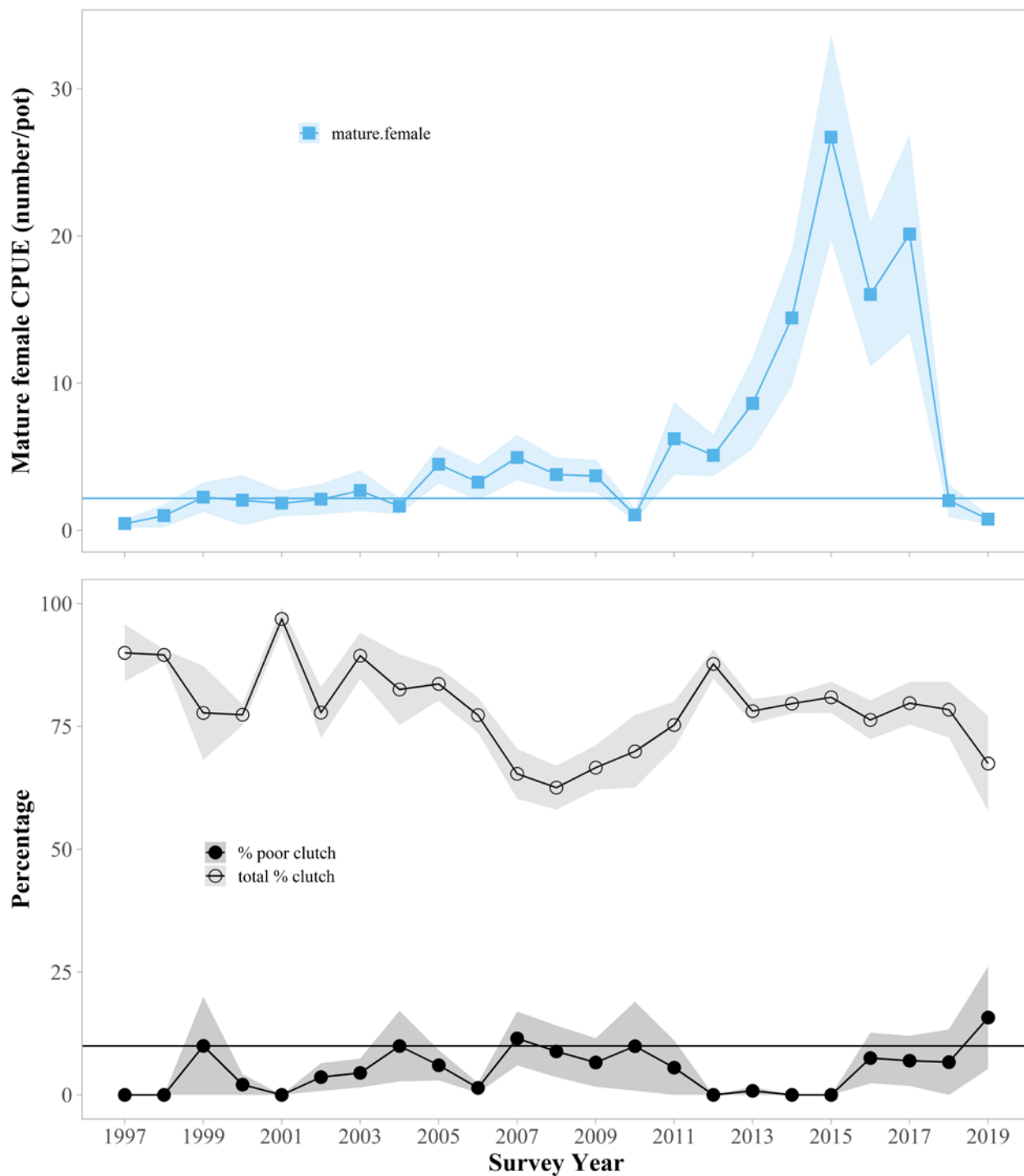


Figure 11b. Female information for Tanner crab in the Pybus Bay red king crab survey area. Reference lines represent long-term benchmark (1997-2006) values. There is a significant short-term decreasing trend ($p < 0.05$) for mature female CPUE.

Gambier Bay

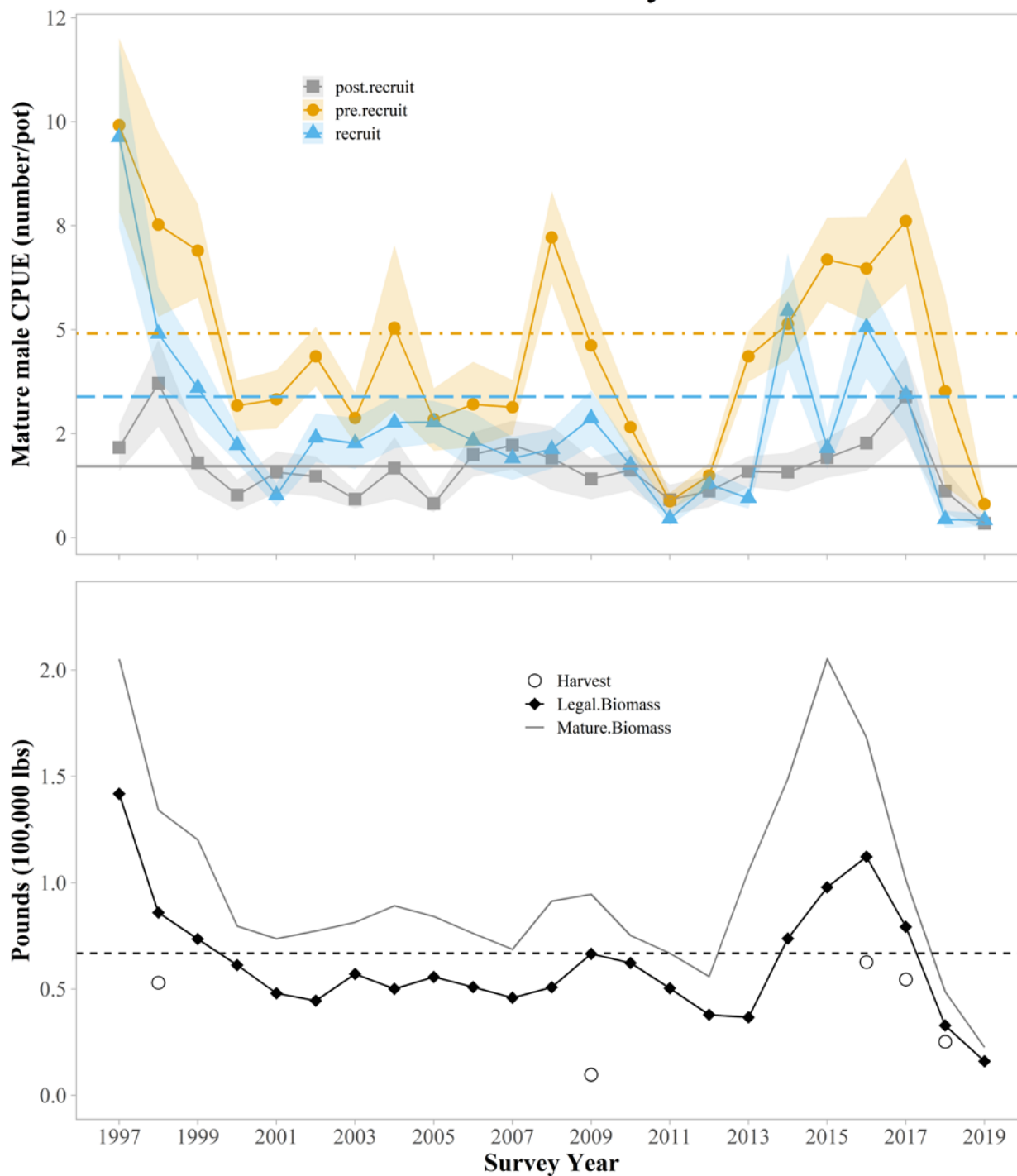


Figure 12a. Gambier Bay red king crab survey area. Biomass estimates of legal and mature Tanner crab are based on catch-survey analysis methodologies. Commercial harvest is the total pounds harvested in associated and adjacent statistical areas. Reference lines represent long-term benchmark (1997-2006) for pre-recruit male (orange), recruit (blue), and post-recruit (grey) crabs. Reference line for biomass (dashed line) represents the long-term average for legal biomass (lb). There are significant short-term *decreasing* trends ($p < 0.05$) for pre-recruit, recruit, and post-recruit male CPUE.

Gambier Bay - Females

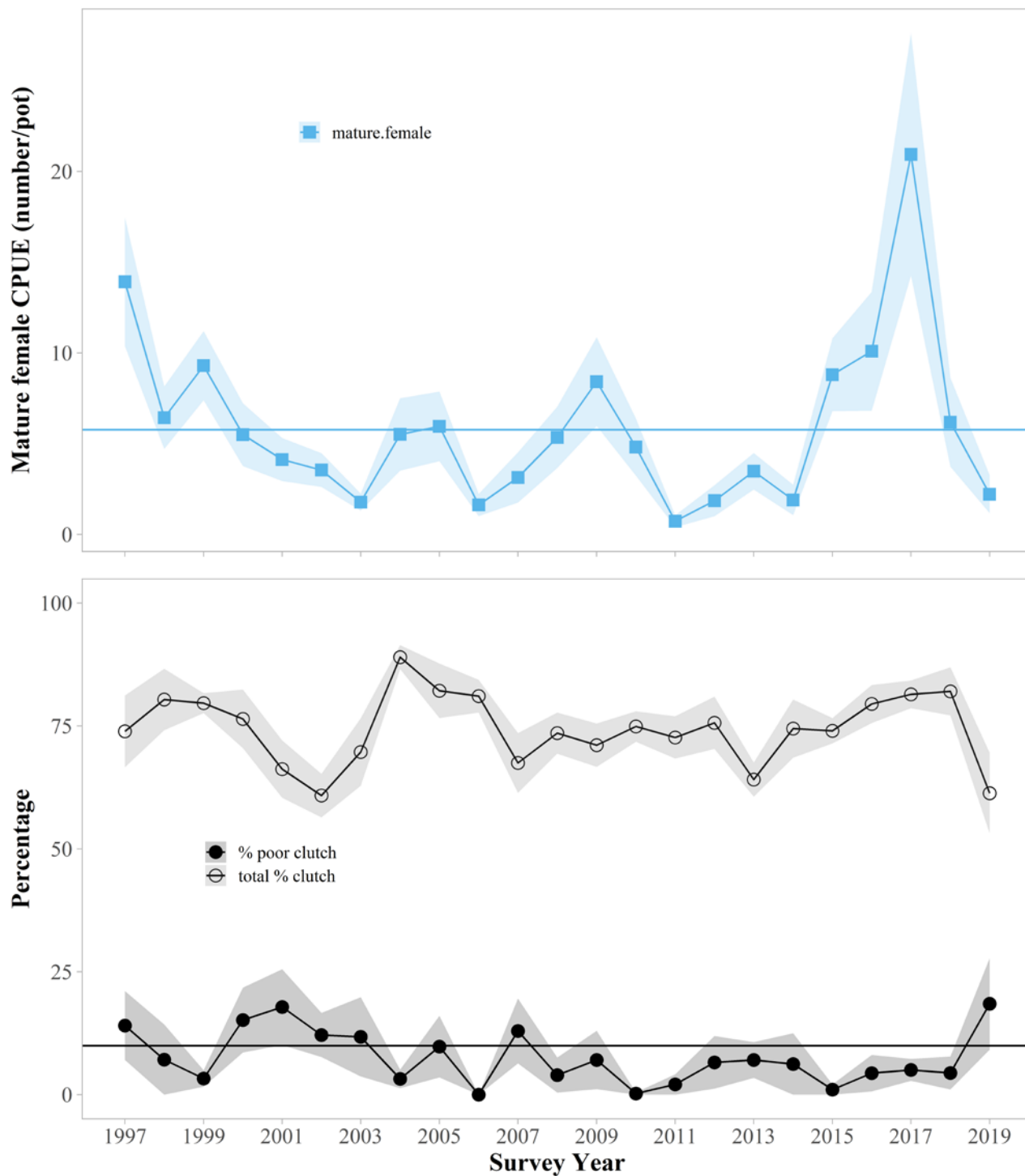


Figure 12b. Female information for Tanner crab in the Gambier Bay red king crab survey area. Reference lines represent long-term benchmark (1997-2006) values. There is a significant short-term decreasing trend in mature female CPUE ($p < 0.05$).

Peril Strait

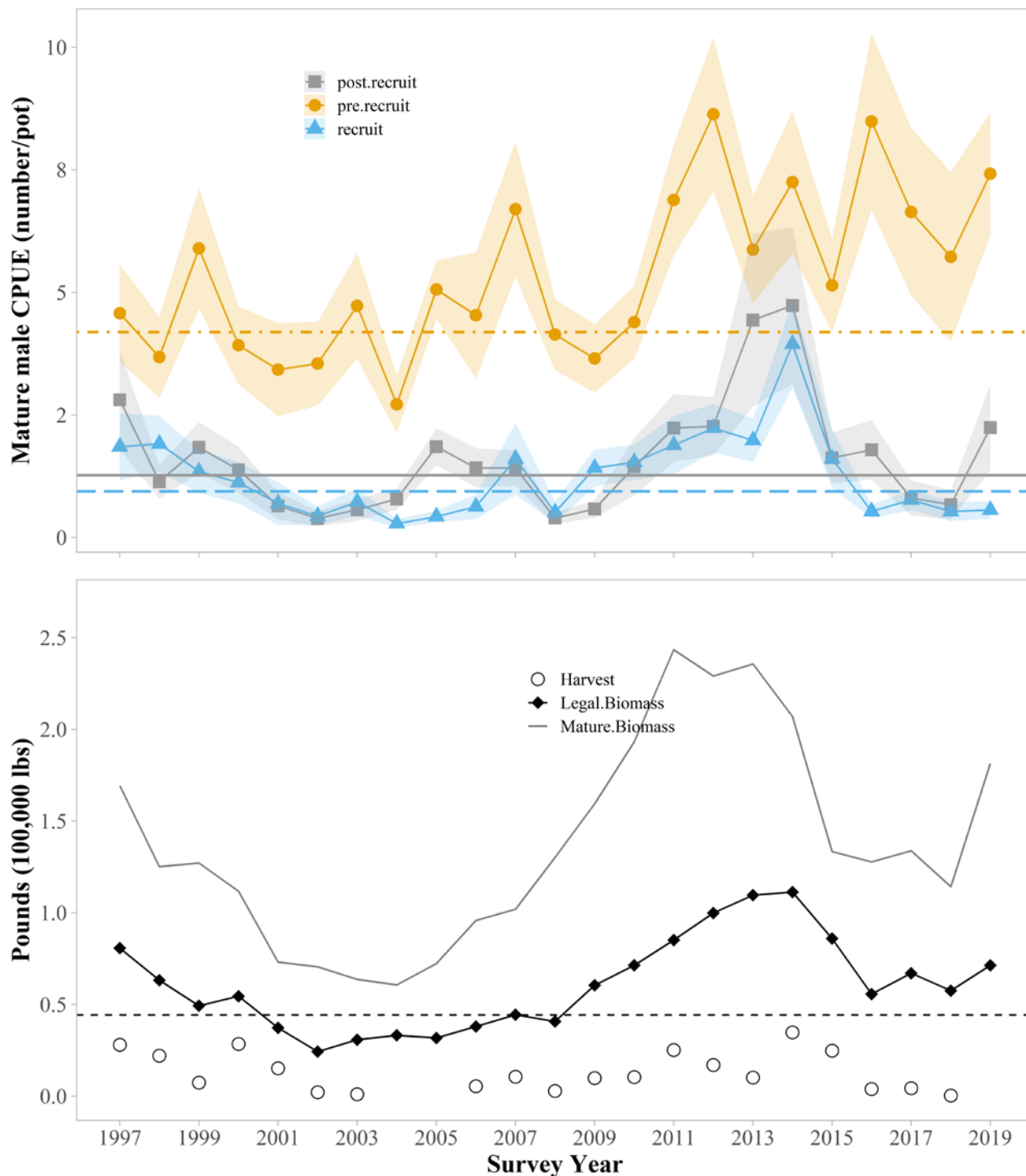


Figure 13a. Peril Strait red king crab survey area. Biomass estimates of legal and mature Tanner crab based on catch-survey analysis methodologies. Commercial harvest is the total pounds harvested in associated and adjacent statistical areas. Reference lines represent long-term benchmark (1997-2006) for pre-recruit male (orange), recruit (blue), and post-recruit (grey) crabs. Reference line for biomass (dashed line) represents the long-term average for legal biomass (lb). There are NO significant short-term trends ($p < 0.05$) for male CPUE.

Peril Strait - Females

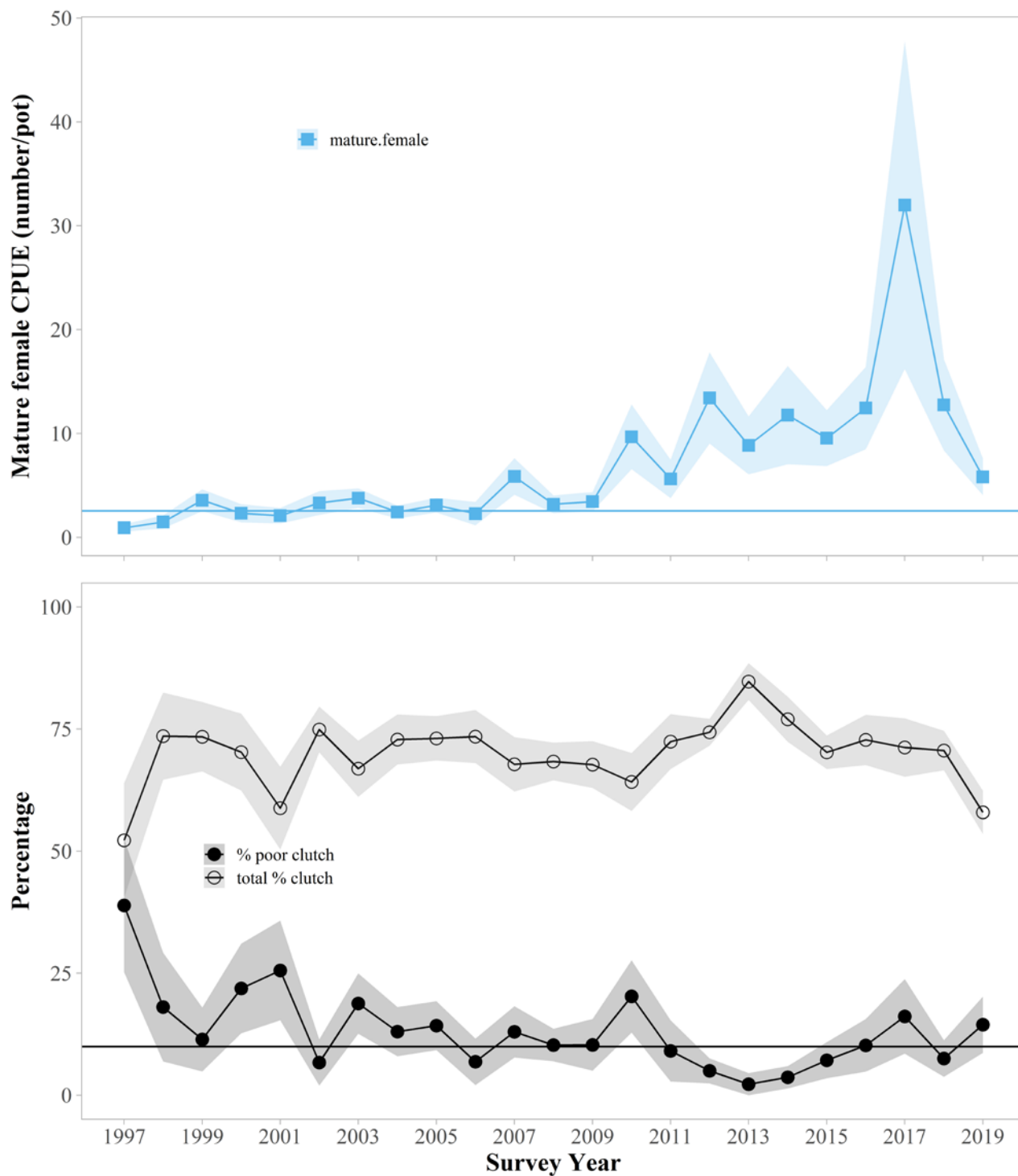


Figure 13b. Female information for Tanner crab in the Peril Strait red king crab survey area. Reference lines represent long-term benchmark (1997-2006) values. There are NO significant short-term trends in either CPUE or the proportion of poor clutches ($p < 0.05$).

Lynn Sisters

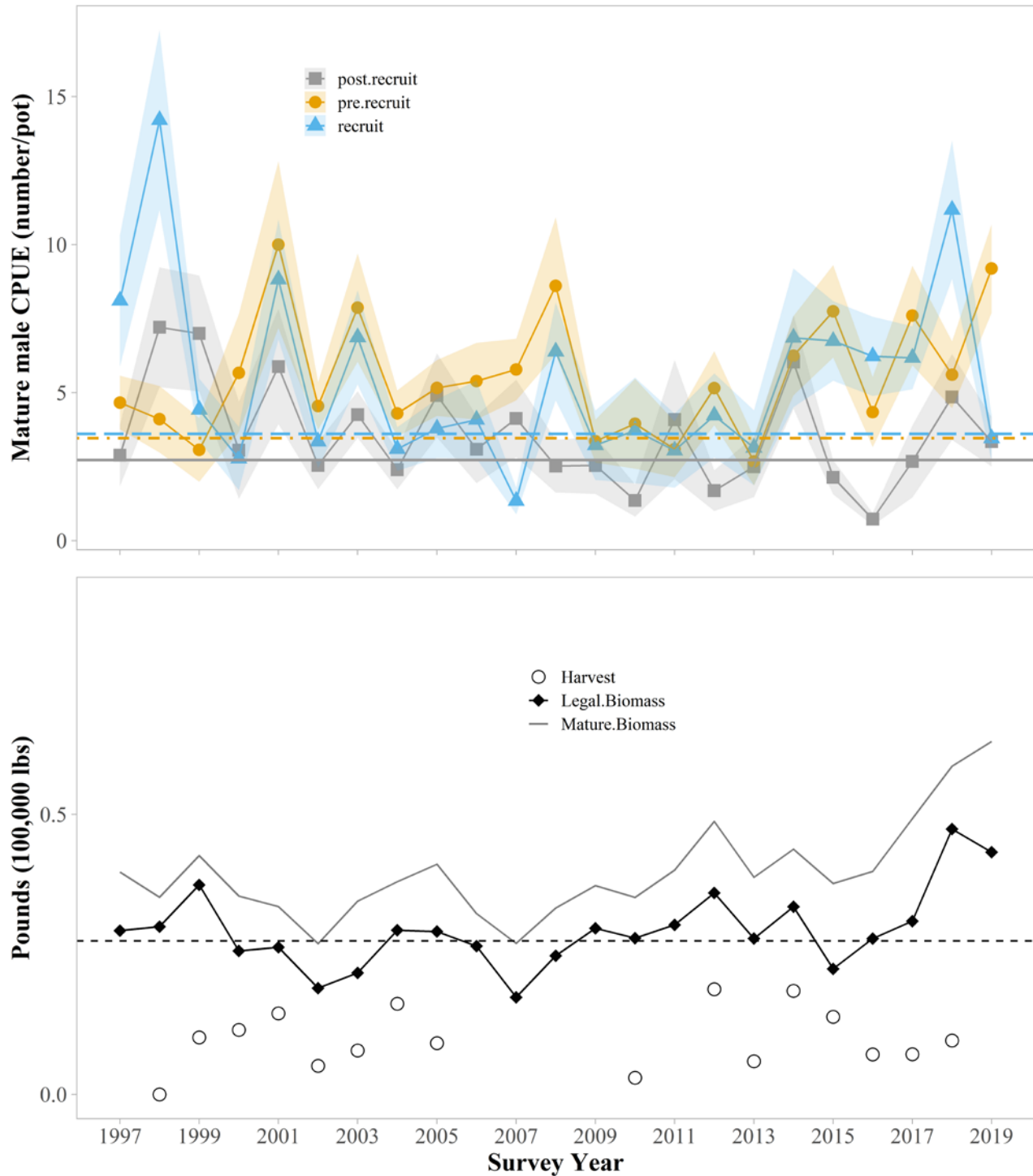


Figure 14a. Lynn Sisters red king crab survey area. Biomass estimates of legal and mature Tanner crab based on catch-survey analysis methodologies. Commercial harvest is the total pounds harvested in associated and adjacent statistical areas. Reference lines represent long-term benchmark (1997-2006) for pre-recruit male (orange), recruit (blue), and post-recruit (grey) crabs. Reference line for biomass (dashed line) represents the long-term average for legal biomass (lb). There is a significant short-term increasing trend ($p < 0.05$) for post-recruit male CPUE.

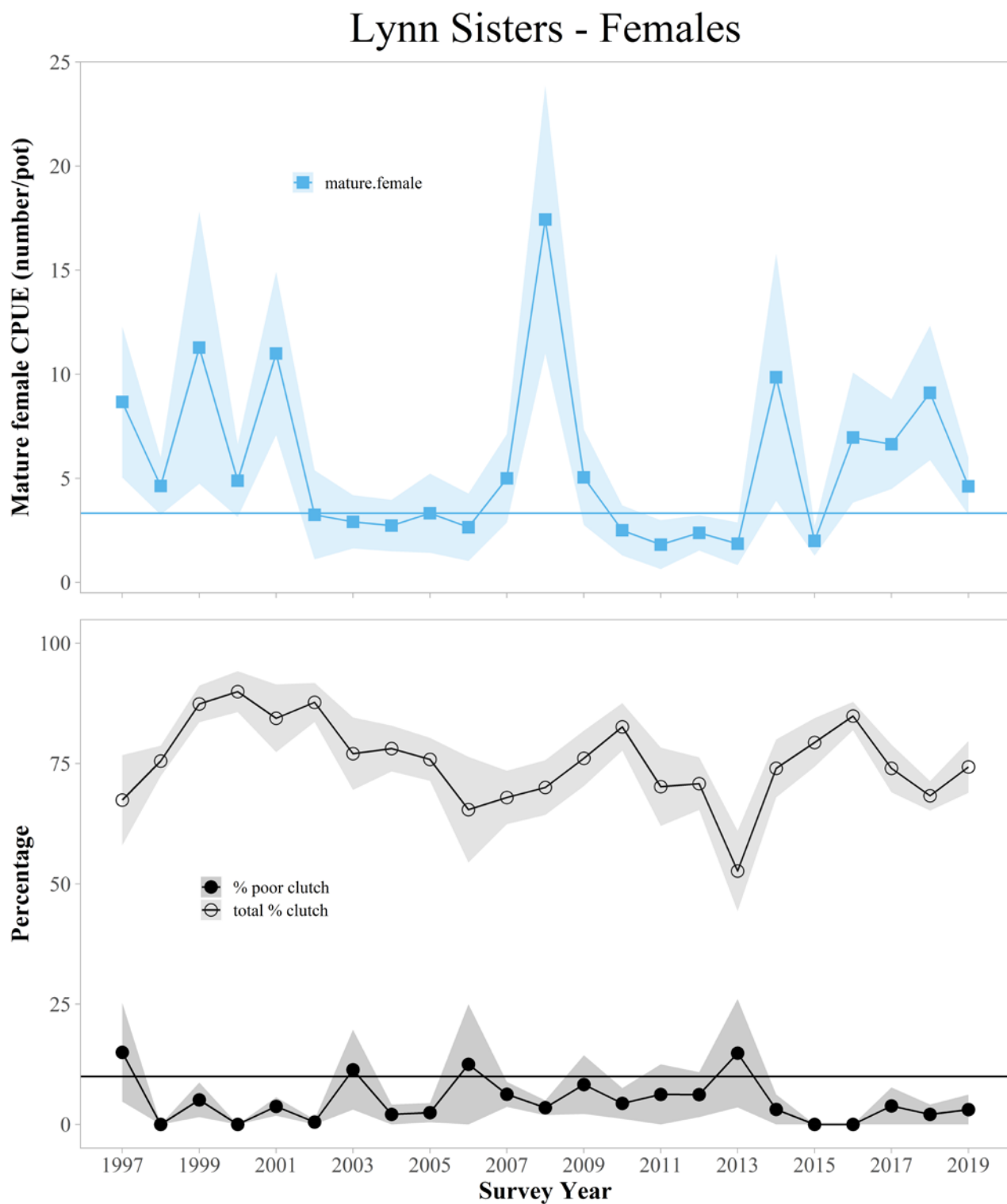


Figure 14b. Female information for Tanner crab in the Lynn Sisters red king crab survey area. Reference lines represent long-term benchmark (1997-2006) values. There are NO significant short-term trends in either CPUE or the proportion of poor clutches ($p < 0.05$).

Appendix A.

Table A1: Regional biomass estimates from surveyed areas ONLY. The “2019 model” reflects biomass estimates from the 2019 CSA models (displayed in Figure 1) and the “Annual Point Estimates” reflects the survey area biomass as a point estimate from each modeling year.

Year	2019 Model		Year	Annual Point Estimates	
	Legal	Mature		Legal	Mature
1997	3,034,354	4,703,731	1997	2,493,821	4,220,952
1998	2,983,310	4,163,417	1998	2,720,334	3,795,396
1999	2,307,946	3,226,590	1999	2,151,751	3,389,834
2000	1,544,115	2,358,595	2000	1,437,612	2,629,980
2001	1,228,075	2,145,529	2001	1,362,224	2,829,680
2002	1,198,081	2,087,969	2002	1,320,312	2,930,950
2003	1,214,769	2,255,966	2003	1,413,118	2,687,625
2004	1,389,310	2,549,526	2004	1,510,615	2,939,302
2005	1,543,724	2,712,004	2005	1,679,678	3,223,890
2006	1,543,596	2,347,890	2006	1,627,099	2,753,115
2007	1,261,547	2,211,765	2007	1,350,935	2,393,922
2008	1,407,896	2,379,753	2008	1,385,647	2,508,436
2009	1,556,515	2,540,816	2009	1,416,062	2,432,032
2010	1,583,723	2,804,456	2010	1,217,049	1,951,796
2011	1,816,249	2,876,253	2011	1,360,387	2,135,861
2012	1,846,843	3,063,883	2012	1,621,839	2,970,708
2013	1,859,711	3,091,489	2013	1,756,533	2,801,311
2014	1,882,505	3,119,017	2014	2,024,637	3,814,305
2015	1,724,459	2,915,194	2015	2,142,529	3,757,413
2016	1,599,344	3,082,953	2016	1,740,116	3,239,586
2017	1,883,753	3,551,852	2017	2,163,773	4,384,734
2018	2,111,831	3,867,381	2018	2,717,958	4,367,920
2019	2,237,506	3,587,481	2019	2,237,506	3,587,481

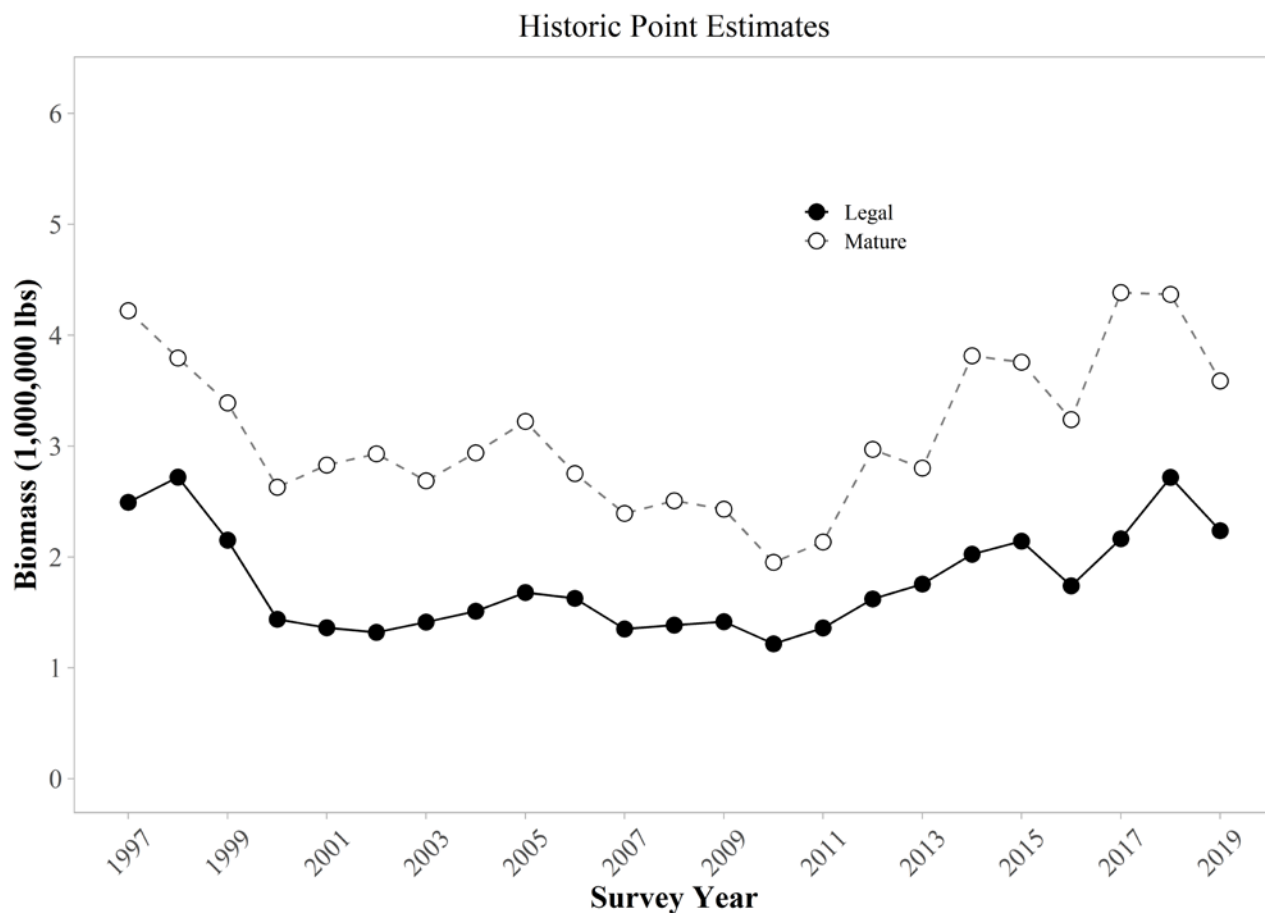


Figure A3. Trends in Tanner crab mature and legal biomass for the surveyed areas estimated from each year’s projection or point estimate using the pot survey data for Southeast Alaska. The points above reflect the survey area biomass as a point estimate from each modeling year, i.e. 2007 values are taken from the 2007 CSA model. Biomass estimates do NOT include non-surveyed areas (starting in 2015 Port Camden and Port Frederick were removed from the survey areas, they are not included in any biomass estimates here). Prior to 2001 the biomass of areas initially not surveyed (Thomas Bay, Glacier Bay), but added in subsequent years, is as estimated as their average percent contribution to the total surveyed biomass in all subsequent years (first year surveyed until 2019 survey).