

Study Results Presentation

Economic Impacts Proposed Regulations for Whale Entanglement Avoidance

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- Tasks:
1. Describe Dungeness crab fishery participation to determine bio-ec model validity to assess current trend economic impacts.
 2. Use existing bio-economic model to assess management alternatives:
 - a. Early season closure.
 - b. Decreased effort (less allowed pots).
 3. Discuss management alternatives impacts.
 4. Provide risk assessment discussion.

Model's Effort Prediction Equation

The model's weekly effort predictor equation explanatory variables are:

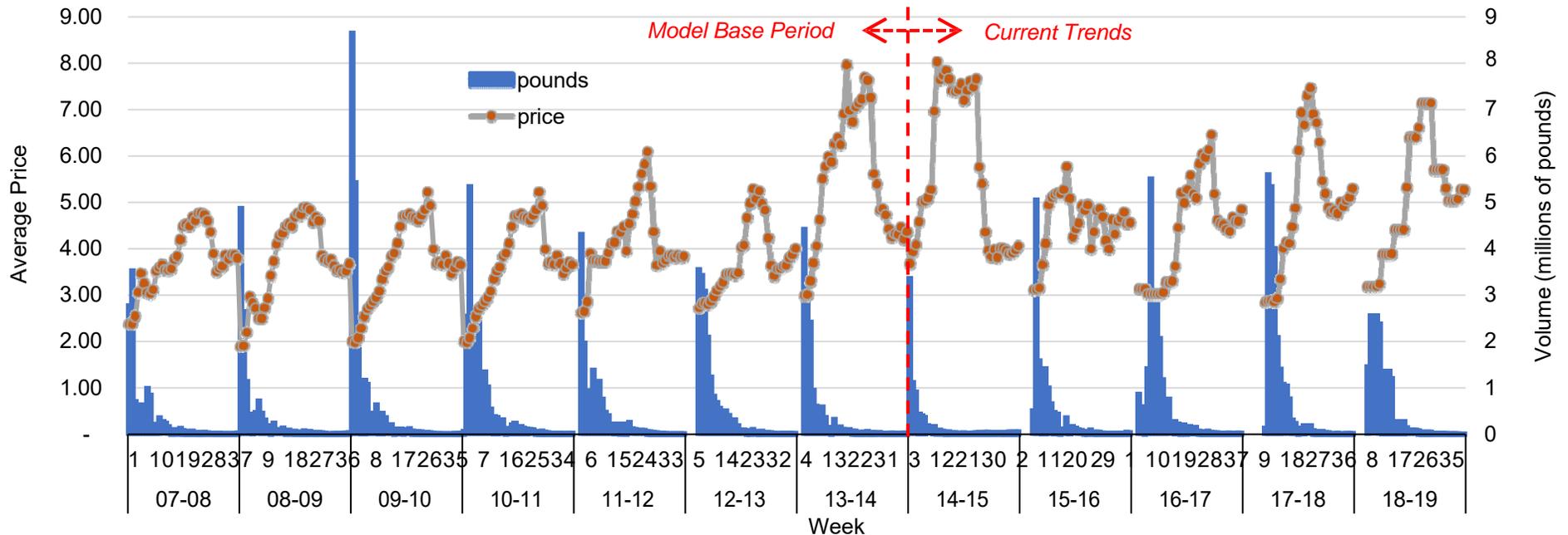
- 1) Fishing power (vessel counts),
- 2) Knowledge about success (revenue per pot pull lagged by one week),
- 3) Opportunity cost, i.e. attractiveness for other fisheries (ratio of D. crab fishery to a vessels total revenue) ,
- 4) Riskiness measure (variance of landings), and
- 5) Explanatory uncertainty (continuous time absorption variable)

Then catch is a function of catchability times effort times biomass.

Note: Effort is measured by pot-pulls.

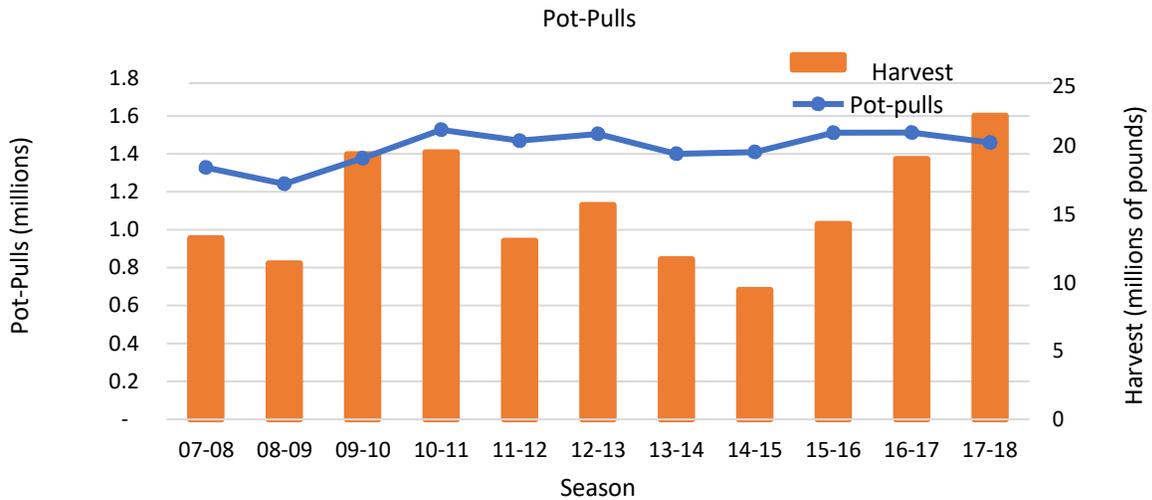
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Oregon Ocean Dungeness Crab Fishery Harvest Volume and Price by Week for Seasons in 2007-08 Through 2018-19

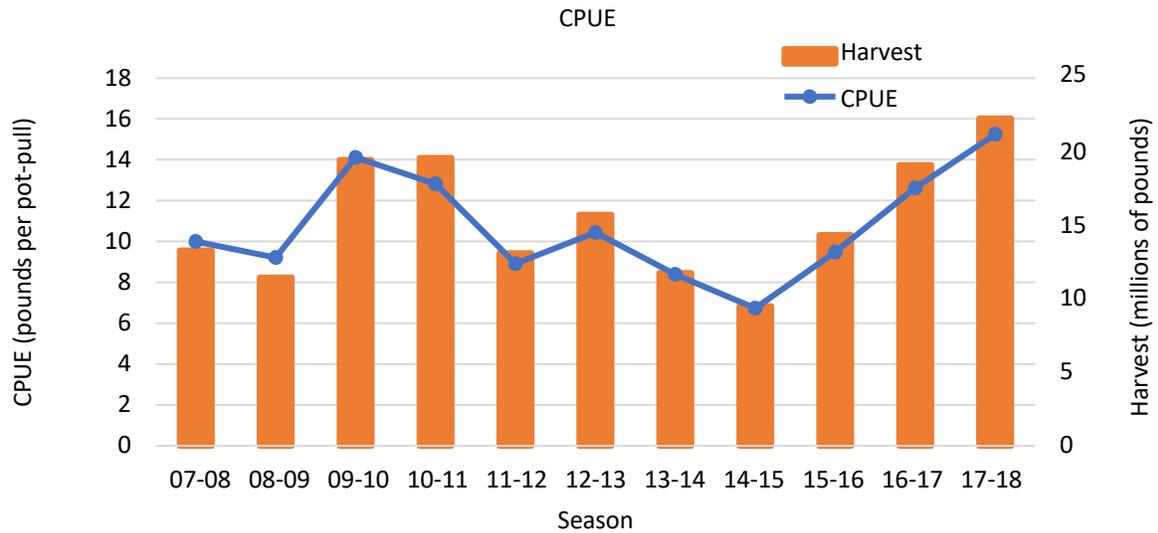


- Notes:
1. Model base period averages are for seven seasons, 2007-08 through 2013-14. The comparison current trends averages are for five seasons, 2014-15 through 2018-19.
 2. Price is in 2019 dollars adjusted using the GDP implicit price deflator developed by U.S. Bureau of Economic Analysis.
 3. Seasons are shown from December 1 whether or not there was a season delayed opening. Any landings after week 37 (which would be after season ending date August 14) are not shown.
 4. Fish tickets include Oregon onshore landings from ocean catch areas. They exclude research and discard disposition.
 5. Year 2019 estimates used monthly landings available from PacFIN APEX reports. Weekly compilations used an average monthly landings per day. Landings may include some bay Dungeness crab fishery harvests.
- Sources: PacFIN fish ticket data, April 2009, March 2010, July 2011, April 2013, March 2014, April 2015, November 2016, March 2017, June 2018, and July 2019 extractions; and PacFIN APEX report CRAB001 downloaded October 15, 2019.

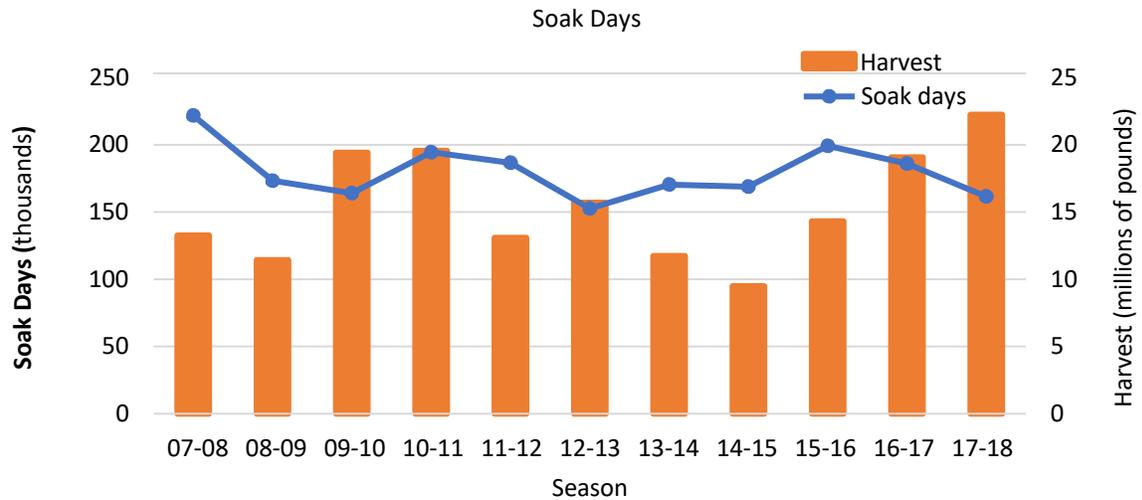
Annual Effort and Harvest for 2007-08 to 2017-18



Note: Logbook data expanded to represent 100% fleet.



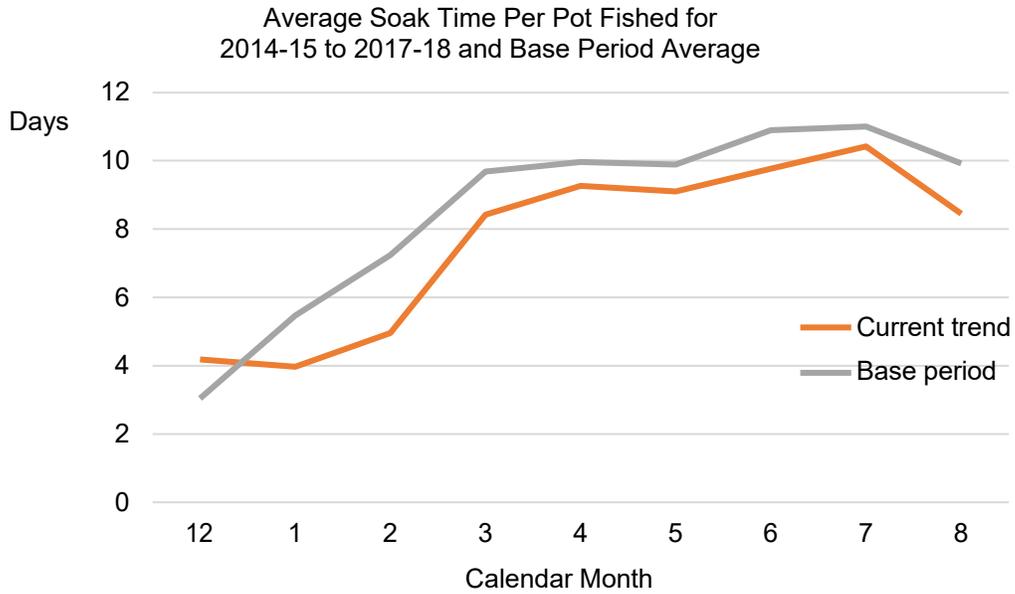
Note: Catch per unit effort (CPUE) is catch (pounds) divided by pot-pulls.



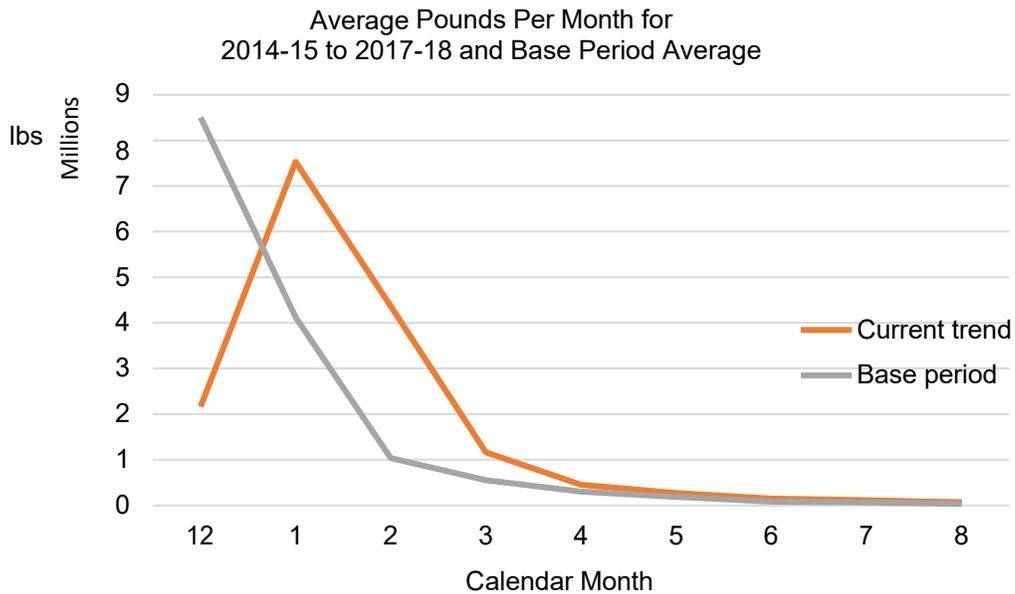
Note: Soak days are days between set and retrieve.

Source: ODFW crab logbook data.

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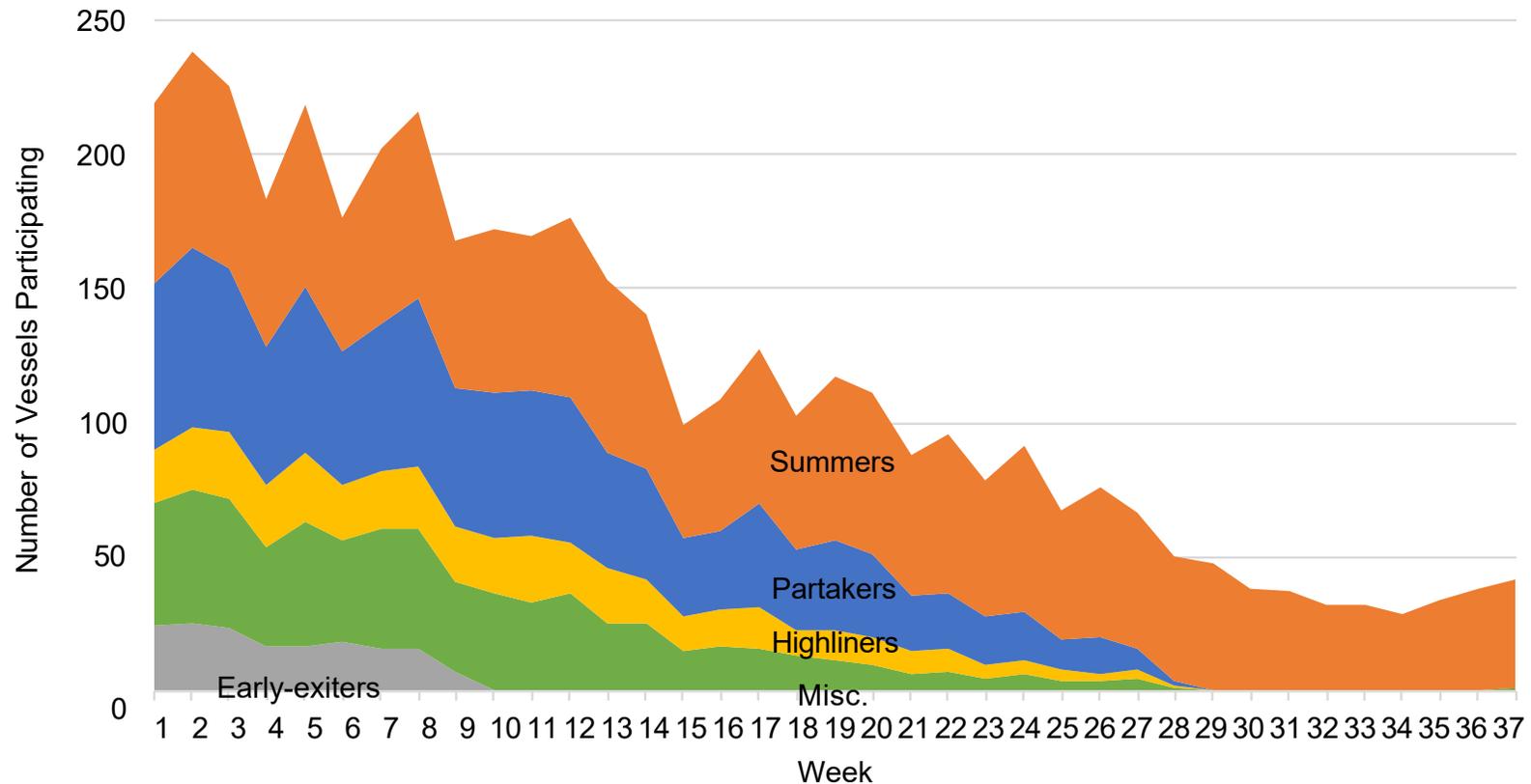


- Notes: 1. Soak days are days between set and retrieve.
2. Adjusted for sample size and compliance by season.
Source: ODFW crab logbook data.



- Note: Adjusted for sample size and compliance by season.
Source: ODFW crab logbook data.

Vessel Participation by Vessel Classifications for Base Period



Notes: Classification descriptions by hierarchy order are:

- 1) Summers: Vessels harvest Oregon ocean D. crab on or after June 10 and on or before August 14.
- 2) Early-exiters: leave fishery on or before January 31.
- 3) Highliners: D. crab is majority of revenue and total revenue greater than \$250,000.
- 4) Partakers: D. crab is majority of revenue and total revenue less than or equal \$250,000.
- 5) Miscellanies: D. crab less than a majority of revenue.

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Frequency Distribution of D. Crab Revenue for Vessel Average of Base Period Seasons

<u>Revenue Bin</u>	<u>Shares of Vessel Counts by Vessel Classification</u>					<u>Total</u>
	<u>Summers</u>	<u>Early-exiters</u>	<u>Highliners</u>	<u>Partakers</u>	<u>Misc.</u>	
<1,000	7.2%	22.7%	6.3%	9.9%	9.5%	10.7%
>=1,000 and <10,000	17.0%	31.2%	7.9%	16.9%	23.7%	19.4%
>=10,000 and <100,000	61.7%	40.3%	64.6%	69.1%	51.7%	58.7%
>=100,000 and <200,000	10.6%	4.5%	11.0%	4.0%	10.0%	7.8%
>=200,000	3.4%	1.3%	10.2%	0.0%	5.2%	3.4%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

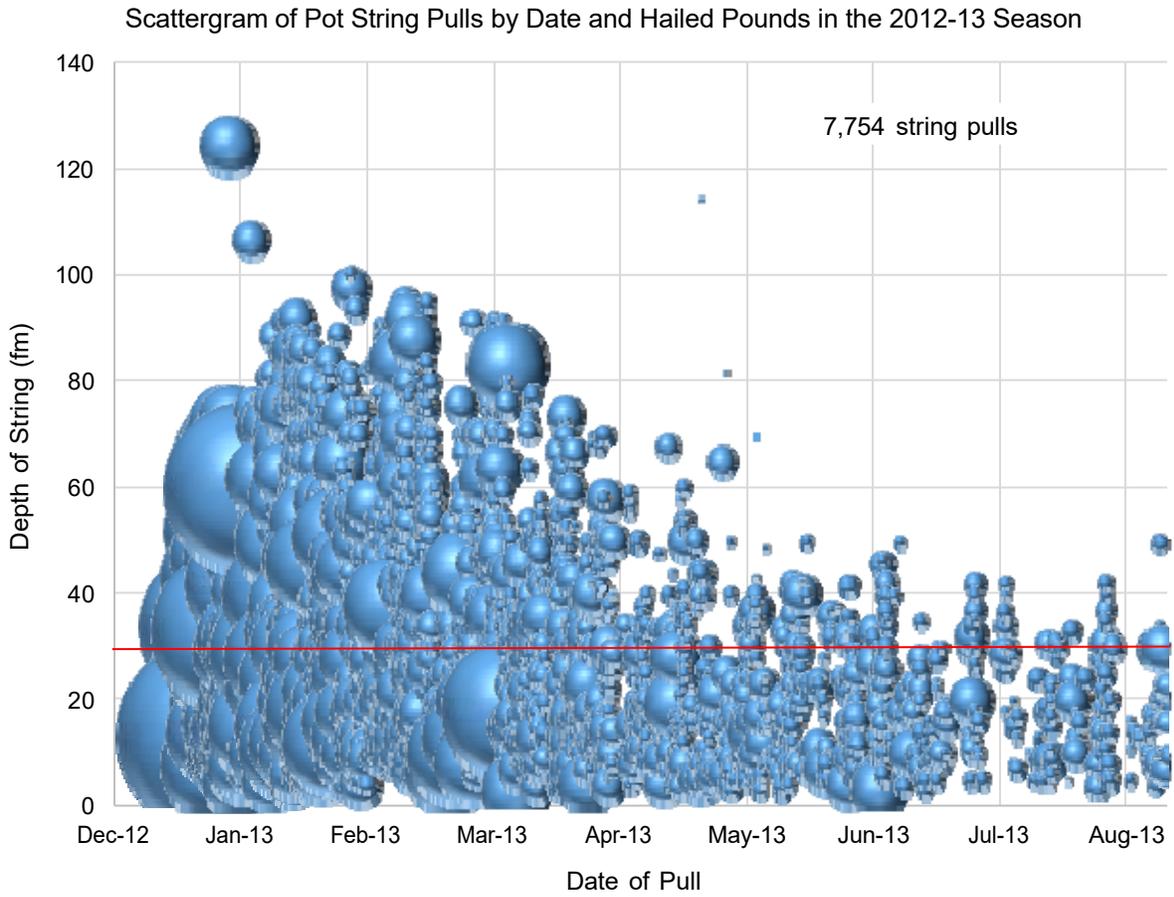
- Notes:
1. Average revenue by vessel is in 2015 dollars for counting bin assignment, which is the base period dollar year for revenue shown as average revenue by vessel.
 2. A vessel may be assigned a different classification in different seasons.
 3. Revenue is D. crab ex-vessel value, excluding disposition for research or discards, and gear codes other than pot, and landings from vessels with id of "NONE" or starting with "ZZ", using PacFIN data.

Monthly 7-Year Average Base Period by Vessel Classifications

<u>Month</u>	<u>Revenue</u>					<u>Total</u>
	<u>Summers</u>	<u>Early-exiters</u>	<u>Highliners</u>	<u>Partakers</u>	<u>Misc.</u>	
Dec	5,268,175	3,418,896	3,608,448	5,444,955	6,332,621	24,073,095
Jan	2,360,038	771,788	1,558,888	2,257,622	2,457,059	9,405,396
Feb	1,297,075	42,770	869,283	1,083,909	916,358	4,209,395
Mar	1,077,084	0	538,938	646,802	408,011	2,670,835
Apr	1,042,124	0	204,444	485,843	179,772	1,912,184
May	562,049	0	63,157	122,679	39,608	787,493
Jun	413,354	0	1,621	12,748	4,218	431,941
Jul	249,757	0	0	0	0	249,757
Aug	164,798	0	0	0	0	164,798
Total	12,434,454	4,233,455	6,844,780	10,054,558	10,337,647	43,904,894

Note: Months are approximated by groups of weeks. December is Weeks 1 to 4, January is Weeks 5 to 8, February is Weeks 9 to 12, March is Weeks 13 to 17, April is Weeks 18 to 22, May is Weeks 23 to 26, June is Weeks 27 to 31, July is Weeks 32 to 35, and August is Weeks 36 to 37.

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Notes: 1. Each bubble represents a crab pot string pull. Bubble radius is hailed pounds.
Source: ODFW crab logbook data, Feb. 26, 2016.

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Management Alternative Summary Total Harvester Impacts, With Model Price Increased to Current Trend

<u>Week</u>	<u>Early</u>	<u>Effort Reduction Starting at Indicated Week</u>		
	<u>Closure</u>	<u>10%</u>	<u>20%</u>	<u>30%</u>
Catch (pounds)				
Week 26	-64,682	1,830	7,401	18,392
Week 22	-217,788	-10,853	-15,982	-12,720
Week 18	-444,482	-31,922	-56,279	-69,353
Revenue (dollars)				
Week 26	-392,663	-16,943	-13,008	21,036
Week 22	-1,232,595	-94,298	-156,779	-172,931
Week 18	-2,484,187	-219,945	-397,521	-512,521
Profitability (dollars)				
Week 26	-152,729	2,804	14,646	39,607
Week 22	-508,791	-28,317	-42,797	-36,967
Week 18	-1,041,270	-79,584	-140,886	-174,881
Income (dollars)				
Week 26	-573,233	-21,507	-12,323	41,137
Week 22	-1,809,720	-134,393	-222,000	-241,443
Week 18	-3,651,208	-318,080	-573,897	-737,682

- Notes: 1. Weeks indicate when closure or effort reduction starts. Week 18 is about April 1; Week 22 is about May 1; and Week 26 is about June 1.
2. Results are with model dashboard price (Menu Item 3.b.ii. Harvest economic terms - Season pattern) current and following sliders set to 33% to get \$3.50 season price, which is the average of current trend seasons 2014-15 to 2017-18 in 2019 dollars, excluding disposition for research or discards, and gear codes other than pot, and landings from vessels with id of "NONE" or starting with "ZZ", using PacFIN data.

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Harvester Impact Per Vessel and Per Vessel Season Shares by Vessel Classifications for Early Season Closure, With Model Price Increased to Current Trend

	<u>Summers</u>	<u>Early-exiters</u>	<u>Highliners</u>	<u>Partakers</u>	<u>Misc.</u>	<u>Total</u>
<u>Week 26 Early Closure Impacts</u>						
Revenue						
Season per vessel	-7,010	1,063	1,651	882	1,337	-1,225
Season share	-5.41%	+0.95%	+0.86%	+0.73%	+0.87%	-0.89%
Profitability						
Season per vessel	-3,164	463	739	590	589	-476
Season share	-4.08%	+0.95%	+0.93%	+0.82%	+0.96%	-0.69%
<u>Week 22 Early Closure Impacts</u>						
Revenue						
Season per vessel	-13,616	1,478	24	-975	991	-3,845
Season share	-10.51%	+1.33%	+0.01%	-0.81%	+0.65%	-2.81%
Profitability						
Season per vessel	-6,486	643	608	-192	714	-1,587
Season share	-8.37%	+1.33%	+0.77%	-0.27%	+1.16%	-2.29%
<u>Week 18 Early Closure Impacts</u>						
Revenue						
Season per vessel	-21,231	2,030	-3,802	-4,929	-377	-7,749
Season share	-16.39%	+1.82%	-1.98%	-4.10%	-0.25%	-5.66%
Profitability						
Season per vessel	-10,486	884	-97	-2,005	672	-3,248
Season share	-13.53%	+1.82%	-0.12%	-2.79%	+1.09%	-4.68%

Note: Twelve-week early closure is at Week 26 (about June 1); sixteen-week early closure is at Week 22 (about May 1); and twenty-week early closure is at Week 18 (about April 1).

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Harvester Impact Per Vessel and Per Vessel Season Shares by Vessel Classifications for Effort Reduction, With Model Price Increased to Current Trend

	<u>Summers</u>	<u>Early-exiters</u>	<u>Highliners</u>	<u>Partakers</u>	<u>Misc.</u>	<u>Total</u>
<u>-10% Effort, starting at Week 26</u>						
Revenue						
Season per vessel	-548	142	216	109	176	-53
Season share	-0.42%	+0.13%	+0.11%	+0.09%	+0.11%	-0.04%
Profitability						
Season per vessel	-173	64	103	77	82	9
Season share	-0.22%	+0.13%	+0.13%	+0.11%	+0.13%	+0.01%
<u>-10% Effort, starting at Week 22</u>						
Revenue						
Season per vessel	-1,197	204	88	-55	167	-294
Season share	-0.92%	+0.18%	+0.05%	-0.05%	+0.11%	-0.21%
Profitability						
Season per vessel	-492	92	109	14	108	-88
Season share	-0.63%	+0.19%	+0.14%	+0.02%	+0.18%	-0.13%
<u>-10% Effort, starting at Week 18</u>						
Revenue						
Season per vessel	-1,988	284	-286	-455	52	-686
Season share	-1.54%	+0.25%	-0.15%	-0.38%	+0.03%	-0.50%
Profitability						
Season per vessel	-900	128	55	-162	121	-248
Season share	-1.16%	+0.26%	+0.07%	-0.23%	+0.20%	-0.36%
<u>-20% Effort, starting at Week 26</u>						
Revenue						
Season per vessel	-717	230	343	166	280	-41
Season share	-0.55%	+0.21%	+0.18%	+0.14%	+0.18%	-0.03%
Profitability						
Season per vessel	-165	103	165	121	133	46
Season share	-0.21%	+0.21%	+0.21%	+0.17%	+0.22%	+0.07%
<u>-20% Effort, starting at Week 22</u>						
Revenue						
Season per vessel	-1,927	349	106	-139	265	-489
Season share	-1.49%	+0.31%	+0.06%	-0.12%	+0.17%	-0.36%
Profitability						
Season per vessel	-758	157	179	5	184	-134
Season share	-0.98%	+0.32%	+0.23%	+0.01%	+0.30%	-0.19%
<u>-20% Effort, starting at Week 18</u>						
Revenue						
Season per vessel	-3,446	502	-609	-906	47	-1,240
Season share	-2.66%	+0.45%	-0.32%	-0.75%	+0.03%	-0.91%
Profitability						
Season per vessel	-1,540	226	78	-332	208	-439
Season share	-1.99%	+0.47%	+0.10%	-0.46%	+0.34%	-0.63%

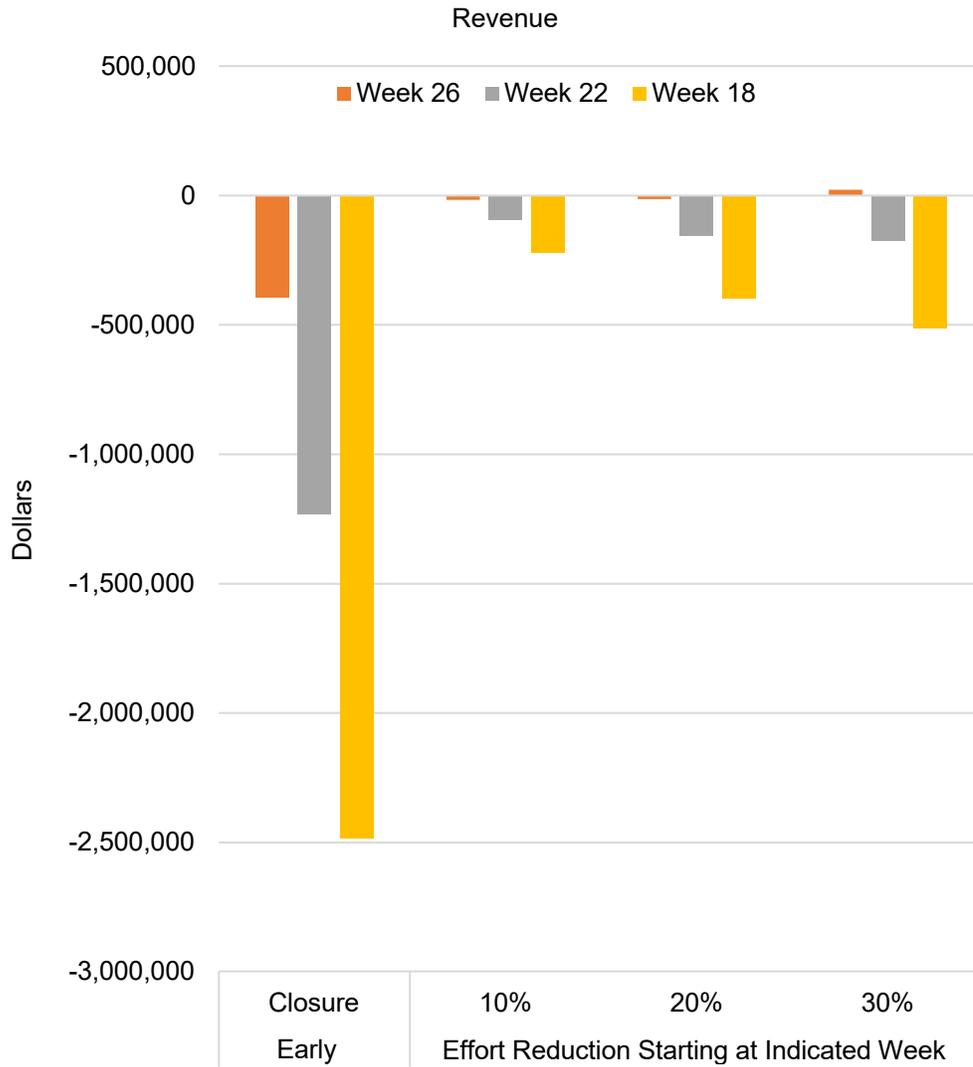
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	<u>Summers</u>	<u>Early-exiters</u>	<u>Highliners</u>	<u>Partakers</u>	<u>Misc.</u>	<u>Total</u>
<u>-30% Effort, starting at Week 26</u>						
Revenue						
Season per vessel	-342	239	340	149	281	66
Season share	-0.26%	+0.21%	+0.18%	+0.12%	+0.18%	+0.05%
Profitability						
Season per vessel	102	107	171	117	140	124
Season share	+0.13%	+0.22%	+0.22%	+0.16%	+0.23%	+0.18%
<u>-30% Effort, starting at Week 22</u>						
Revenue						
Season per vessel	-1,984	407	27	-263	266	-539
Season share	-1.53%	+0.37%	+0.01%	-0.22%	+0.17%	-0.39%
Profitability						
Season per vessel	-698	183	196	-37	212	-115
Season share	-0.90%	+0.38%	+0.25%	-0.05%	+0.34%	-0.17%
<u>-30% Effort, starting at Week 18</u>						
Revenue						
Season per vessel	-4,130	627	-981	-1,346	-39	-1,599
Season share	-3.19%	+0.56%	-0.51%	-1.12%	-0.03%	-1.17%
Profitability						
Season per vessel	-1,800	282	56	-511	248	-546
Season share	-2.32%	+0.58%	+0.07%	-0.71%	+0.40%	-0.79%

Note: Week 18 is about April 1; Week 22 is about May 1; and Week 26 is about June 1.

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Total Harvester Impacts for Management Alternatives Starting at Selected Weeks
With Model Price Increased to Current Trend



Notes: 1. See notes for management alternative table.

Study Takeaways

1. The study used an existing bio-ec model to show economic impacts (measured by fishery revenue and community effects) from proposed management alternatives having to do with gear constraints. The input value for fishing power in the effort prediction equations gets adjusted for the restrictions being suggested. However, there is an issue for assuming each vessel fishing in a particular week is using all of their allowed pots. Does 20% less allowed pots for each tier equate to 20% less effort measured by soak days? (One soak day is the exposure to whales from one line in the water for one day.)
2. From using logbook data, we found that not all allowed pots were being pulled per weekly trips. This implies whale exposure to lines in the water may not be entirely related to management levers for tier pot allowance. More comprehensive research will be required for capacity utilization in order to show how gear constraints affect actual spatial and temporal vessel-effort behavior.
3. Prior to undertaking the HCP/ITP scoping process for identifying reasonable alternatives and potential impacts, a decision support tool should first be developed in collaboration between industry, NGO, ODFW, and NMFS. The decision support tool would determine entanglement/mortality standards and impact calculation methods to test potential management alternatives.
4. When developing the decision support tool, there will be an issue with trying to use very large numbers (such as soak days) to determine small numbers (whale entanglements). Expert opinion will be necessary to deal with the uncertainty envelopes hence the necessity for the collaborative decision making.