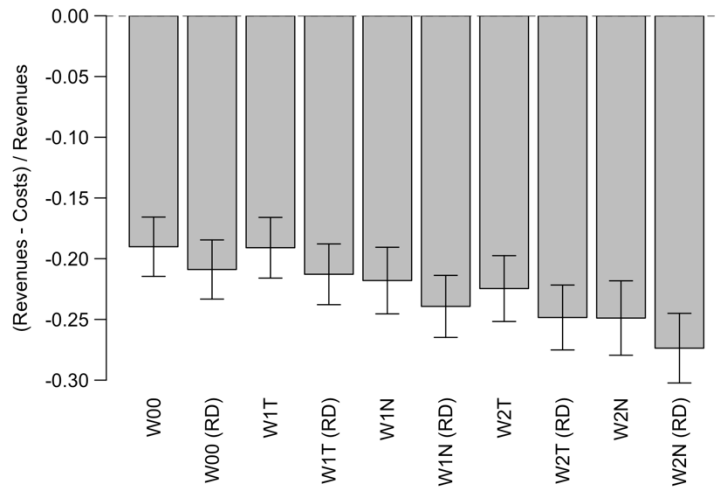


**Figure S1:** Simulated Atlantic surfclam catch displacement, indicated by the change in the average number of bushels caught per model grid cell per year, for scenarios that allow (a) transit but no fishing in existing lease areas (W1T), (b) neither transit nor fishing in existing lease areas (W1N), (c) transit but not fishing in existing and proposed lease areas (W2T), (d) neither transit nor fishing in existing and proposed lease areas (W2N). Catch displacement in each model grid cell was calculated for each simulation scenario relative to the average annual catch in that grid cell with no transit or fishing restrictions (W00). A decrease (increase) in average catch for a model grid cell under a particular scenario indicates behavioral restrictions led to less (more) catch in that area.



**Figure S2:** Profit margins for the fishing fleet across simulation scenarios (Table 4), including simulations using a relaxed fishing decision rule (indicated as “RD”). Values shown are means taken across 10,000 observations from the last 50 years of simulations for a particular scenario. Error bars indicate one standard deviation.

**Table S1:** Comparison of annual vessel cost estimates from a 2011 NEFSC cost survey (n = 7 respondents) with estimates from the economic parameterization for vessels in the *SEFES* model and annual fishing activity calculated from vessel trip reports (number of trips, steam time, fishing time, catch; n=6,830 trip observations 2015-2019 for 33 vessels). The 2011 NEFSC cost survey was distributed to all commercial vessels targeting federally managed species in the northeast U.S. Estimates provided here are for those vessels that indicated surfclam or ocean quahog were their highest grossing species. Calculation of insurance costs in the *SEFES* parameterization relied on crew sizes provided by industry advisors in addition to vessel trip report data.

		2011 NEFSC cost survey estimates <sup>a</sup>	SEFES parameterization	
		Median	Median	
<b>Maintenance &amp; repair costs</b>	<b>Total</b>	<b>\$47,500</b>	Maintenance costs	\$214,000
	(major haul out maintenance)		(major + regular)	
<b>Fishing business related costs</b>	<b>Total <sup>b</sup></b>	<b>\$334,143</b>		
	Leasing quota or DAS <sup>c</sup>	\$48,000	Quota cost	\$142,536 <sup>c</sup>
	Vessel or P&I insurance	\$40,000	Total insurance	\$45,000
	Payment to crew and captain	\$200,000	Share cost	\$204,397
<b>Operating costs</b>	<b>Total</b>	<b>\$479,046</b>		
	Fuel <sup>d</sup>	\$450,000	Fuel cost	\$247,027
	Fishing supplies <sup>e</sup>	\$5,713		
	Crew supplies <sup>e</sup>	\$3,333		
	Food + water <sup>e</sup>	\$20,000		
<b>Other <sup>f</sup></b>		<b>\$209,785</b>		
<b>Total (not including Other)</b>		<b>\$860,689</b>		<b>\$852,960</b>
<b>Total (including Other)</b>		<b>\$1,070,474</b>		

<sup>a</sup>Note that 2011 NEFSC cost survey estimates have not been adjusted for inflation. Using the GDP implicit price deflator to adjust to 2019 USD would increase 2011 cost estimates by ~14%.

<sup>b</sup> 2011 NEFSC cost survey estimates for “Fishing business related costs” also included office expenses, storage expenses, business travel, professional services, principal payments on business loans, and crew benefits. Given the industry’s increasing level of vertical integration, we assume these costs are associated with processing companies and exclude them from our vessel cost categories.

<sup>c</sup> NEFSC cost survey estimates include payments for quota and DAS leasing during the 2011 season. The quota cost estimate from the *SEFES* parameterization applied a fixed quota lease price to all landings, representing both leasing costs and opportunity costs associated with quota use.

<sup>d</sup>No. 2 diesel prices in 2011 were ~50% higher when compared to prices for 2015-2019 (<https://www.eia.gov/>)

<sup>e</sup> Conversations with captains held as part of this research project indicated minimal supplies were needed for fishing trips and most boats reported crew supplying their own food, water, and other provisions.

<sup>f</sup> Three vessels owners indicated other trip/operating cost not covered in the survey category

**Table S2:** Average annual profit margins (%) under alternative economic parameterizations by vessel size class (small  $\leq 24$ m, medium 24 – 29m, large  $>29 - 33$ m, and jumbo  $>33$ m). Parameterizations include the base parameterization (“Base”), a high-cost parameterization where fuel and insurance costs were increased by 25% (“High Cost”), a low-cost parameterization where quota costs were removed and maintenance costs reduced by 25% (“Low Cost”), and a high-price parameterization where ex-vessel bushel prices were increased by 25% (“High Price”). Profit margins were calculated as: (total revenues - total costs) / total revenues x 100. Standard deviations are presented beneath means in italics. The number of fishing vessels in each size class is shown.

Vessel Size Class	Economic Parameterization			
	Base	High Cost	Low Cost	High Price
Small (n=11)	-56.404	-68.961	-21.670	-31.123
	<i>36.207</i>	<i>40.211</i>	<i>31.187</i>	<i>28.965</i>
Medium (n=10)	-33.464	-46.090	-4.534	-12.771
	<i>48.328</i>	<i>55.784</i>	<i>43.707</i>	<i>38.663</i>
Large (n=8)	-77.080	-96.836	-44.376	-47.664
	<i>99.271</i>	<i>112.101</i>	<i>87.287</i>	<i>79.417</i>
Jumbo (n=4)	-2.153	-11.393	22.336	12.277
	<i>9.381</i>	<i>11.221</i>	<i>8.877</i>	<i>7.504</i>

**Table S3:** Fishing activity metrics across simulation scenarios (Table 4). Each value displayed is the mean across 10,000 observations representing 50 years from each of 200 model simulations. Average time at sea and average time fishing are shown as hours per trip. Average LPUE is shown as cages per hour fished. Standard deviations are presented beneath means in italics.

	W00	W1T	W1N	W2T	W2N
Total Trips	1870.207	1796.129	1731.482	1653.101	1597.804
	<i>88.942</i>	<i>92.724</i>	<i>96.705</i>	<i>105.000</i>	<i>103.603</i>
Average Time at Sea	41.631	42.152	45.211	43.791	46.908
	<i>1.314</i>	<i>1.376</i>	<i>1.244</i>	<i>1.421</i>	<i>1.360</i>
Average Time Fishing	25.124	25.005	24.504	25.504	25.100
	<i>0.859</i>	<i>0.869</i>	<i>0.892</i>	<i>1.023</i>	<i>0.983</i>
Average LPUE	1.512	1.537	1.565	1.484	1.508
	<i>0.057</i>	<i>0.058</i>	<i>0.059</i>	<i>0.056</i>	<i>0.060</i>

**Table S4:** Percent (%) change in fishing activity metrics by season, averaged across simulation scenarios. To calculate the displayed values, average percent changes were first constructed for each scenario (W1T, W1N, W2T, and W2N) as compared to the reference simulation W00 using mean values derived from 10,000 observations representing 50 years from each of 200 model simulations. Seasons were considered as follows – Winter: January-March; Spring: April-June; Summer: July-September; Fall: October-December.

	Winter	Spring	Summer	Fall
Total Trips	-11.023	-8.562	-7.831	-10.358
Average Time at Sea	7.422	6.573	6.638	7.308
Average Time Fishing	-0.476	-0.674	0.084	-0.271
Average LPUE	1.052	0.433	0.587	0.985

**Table S5:** Fishing activity metrics across simulation scenarios (Table 4) using a relaxed fishing decision rule. Each value displayed is the mean across 10,000 observations representing 50 years from each of 200 model simulations. Average time at sea and average time fishing are shown as hours per trip. Average LPUE is shown as cages per hour fished. Standard deviations are presented beneath means in italics.

	W00	W1T	W1N	W2T	W2N
Total Trips	2184.498	2146.605	2129.572	2086.434	2051.247
	<i>73.802</i>	<i>73.033</i>	<i>73.265</i>	<i>77.820</i>	<i>81.440</i>
Average Time at Sea	43.193	43.851	47.029	45.603	48.377
	<i>1.724</i>	<i>1.775</i>	<i>1.662</i>	<i>1.741</i>	<i>1.570</i>
Average Time Fishing	25.854	26.061	25.758	26.961	26.604
	<i>0.848</i>	<i>0.861</i>	<i>0.798</i>	<i>0.884</i>	<i>0.841</i>
Average LPUE	1.423	1.420	1.430	1.339	1.350
	<i>0.049</i>	<i>0.053</i>	<i>0.052</i>	<i>0.050</i>	<i>0.051</i>

**Table S6:** Economic metrics across simulation scenarios (Table 4). Each value displayed is the mean across 10,000 observations representing 50 years from each of 200 model simulations. Total revenues and costs are in millions of 2019 USD. Average costs are 2019 USD per landed cage. Standard deviations are presented beneath means in italics.

	W00	W1T	W1N	W2T	W2N
Total Revenues (fleet)	32.595	31.670	30.465	28.711	27.755
	<i>2.092</i>	<i>2.219</i>	<i>2.376</i>	<i>2.407</i>	<i>2.428</i>
Total Costs (fleet)	38.752	37.674	37.055	35.119	34.604
	<i>1.920</i>	<i>2.070</i>	<i>2.299</i>	<i>2.415</i>	<i>2.438</i>
Total Revenues (processors)	113.406	110.140	105.900	99.460	96.045
	<i>7.568</i>	<i>8.042</i>	<i>8.618</i>	<i>8.642</i>	<i>8.651</i>
Average Total Costs (fleet)	546.137	546.522	558.918	562.102	573.077
	<i>11.199</i>	<i>11.463</i>	<i>12.579</i>	<i>12.299</i>	<i>14.055</i>
Average Fuel Costs (fleet)	182.617	182.503	192.755	191.622	200.727
	<i>6.898</i>	<i>6.948</i>	<i>7.590</i>	<i>7.361</i>	<i>8.568</i>
Average Transportation Costs (processors)	19.440	19.587	19.683	20.075	20.236
	<i>0.513</i>	<i>0.550</i>	<i>0.621</i>	<i>0.726</i>	<i>0.809</i>



**Table S7:** Fishing activity metrics across simulation scenarios (Table 4) for vessels landing in Atlantic City, NJ. Each value displayed is the mean across 10,000 observations representing 50 years from each of 200 model simulations. Average time at sea and average time fishing are shown as hours per trip. Average LPUE is shown as cages per hour fished. Standard deviations are presented beneath means in italics.

	W00	W1T	W1N	W2T	W2N
Total Trips	1235.772	1168.335	1109.335	1030.911	981.899
	<i>67.934</i>	<i>68.269</i>	<i>68.786</i>	<i>78.026</i>	<i>78.585</i>
Average Time at Sea	34.264	34.528	37.598	36.235	39.300
	<i>1.488</i>	<i>1.596</i>	<i>1.617</i>	<i>1.785</i>	<i>1.808</i>
Average Time Fishing	24.889	24.634	24.093	25.225	24.845
	<i>1.046</i>	<i>1.076</i>	<i>1.115</i>	<i>1.395</i>	<i>1.340</i>
Average LPUE	1.210	1.221	1.239	1.120	1.132
	<i>0.051</i>	<i>0.052</i>	<i>0.053</i>	<i>0.049</i>	<i>0.050</i>

**Table S8:** Fishing activity metrics across simulation scenarios (Table 4) for vessels landing in New Bedford, MA. Each value displayed is the mean across 10,000 observations representing 50 years from each of 200 model simulations. Average time at sea and average time fishing are shown as hours per trip. Average LPUE is shown as cages per hour fished. Standard deviations are presented beneath means in italics.

	W00	W1T	W1N	W2T	W2N
Total Trips	482.374	476.796	471.790	476.832	471.038
	<i>34.233</i>	<i>34.426</i>	<i>33.806</i>	<i>34.002</i>	<i>33.803</i>
Average Time at Sea	62.914	63.521	66.337	63.468	66.567
	<i>3.998</i>	<i>4.195</i>	<i>4.122</i>	<i>4.124</i>	<i>4.228</i>
Average Time Fishing	26.410	26.507	26.145	26.542	26.122
	<i>1.392</i>	<i>1.417</i>	<i>1.423</i>	<i>1.400</i>	<i>1.418</i>
Average LPUE	2.318	2.342	2.354	2.337	2.359
	<i>0.165</i>	<i>0.171</i>	<i>0.167</i>	<i>0.163</i>	<i>0.171</i>

**Table S9:** Fraction of total annual landings processed as fresh, frozen, and canned products across simulation scenarios (Table 4). Each value displayed is the mean across 10,000 observations representing 50 years from each of 200 model simulations. Standard deviations are presented beneath means in italics.

	W00	W1T	W1N	W2T	W2N
Fresh	0.216 <i>0.007</i>	0.216 <i>0.007</i>	0.216 <i>0.007</i>	0.217 <i>0.008</i>	0.215 <i>0.010</i>
Frozen	0.426 <i>0.016</i>	0.426 <i>0.016</i>	0.426 <i>0.015</i>	0.425 <i>0.013</i>	0.426 <i>0.012</i>
Canned	0.358 <i>0.016</i>	0.358 <i>0.017</i>	0.357 <i>0.017</i>	0.358 <i>0.017</i>	0.359 <i>0.018</i>

**Table S10:** Economic metrics across simulation scenarios (Table 4) for vessels landing in Atlantic City, NJ. Each value displayed is the mean across 10,000 observations representing 50 years from each of 200 model simulations. Total revenues and costs are in millions of 2019 USD. Average costs are 2019 USD per landed cage. Standard deviations are presented beneath means in italics.

	W00	W1T	W1N	W2T	W2N
Total Revenues (fleet)	17.088	16.146	15.221	13.406	12.720
	<i>1.487</i>	<i>1.548</i>	<i>1.597</i>	<i>1.715</i>	<i>1.724</i>
Total Costs (fleet)	21.217	20.171	19.617	17.812	17.345
	<i>1.488</i>	<i>1.592</i>	<i>1.784</i>	<i>1.990</i>	<i>2.017</i>
Total Revenues (processors)	61.799	58.461	55.182	48.596	46.104
	<i>5.421</i>	<i>5.640</i>	<i>5.853</i>	<i>6.217</i>	<i>6.201</i>
Average Total Costs (fleet)	570.710	574.368	592.480	611.177	627.542
	<i>14.965</i>	<i>15.806</i>	<i>15.805</i>	<i>16.608</i>	<i>18.974</i>
Average Fuel Costs (fleet)	186.458	187.182	201.275	206.594	218.962
	<i>9.433</i>	<i>9.994</i>	<i>10.575</i>	<i>10.284</i>	<i>11.180</i>
Average Transportation Costs (processors)	13.506	13.440	13.398	13.181	13.291
	<i>0.515</i>	<i>0.581</i>	<i>0.633</i>	<i>0.761</i>	<i>0.951</i>

**Table S11:** Economic metrics across simulation scenarios (Table 4) for vessels landing in New Bedford, MA. Each value displayed is the mean across 10,000 observations representing 50 years from each of 200 model simulations. Total revenues and costs are in millions of 2019 USD. Average costs are 2019 USD per landed cage. Standard deviations are presented beneath means in italics.

	W00	W1T	W1N	W2T	W2N
Total Revenues (fleet)	13.504	13.530	13.277	13.522	13.275
	<i>1.009</i>	<i>1.005</i>	<i>1.032</i>	<i>0.999</i>	<i>1.057</i>
Total Costs (fleet)	15.132	15.119	15.053	15.115	15.055
	<i>0.631</i>	<i>0.630</i>	<i>0.638</i>	<i>0.627</i>	<i>0.650</i>
Total Revenues (processors)	44.302	44.408	43.545	44.365	43.525
	<i>3.480</i>	<i>3.486</i>	<i>3.566</i>	<i>3.451</i>	<i>3.648</i>
Average Total Costs (fleet)	515.500	514.068	521.733	514.229	522.019
	<i>18.806</i>	<i>18.682</i>	<i>20.429</i>	<i>18.558</i>	<i>21.203</i>
Average Fuel Costs (fleet)	181.790	181.110	187.616	181.226	187.936
	<i>14.569</i>	<i>14.569</i>	<i>15.827</i>	<i>14.481</i>	<i>16.462</i>
Average Transportation Costs (processors)	26.866	26.852	26.835	26.845	26.852
	<i>0.542</i>	<i>0.543</i>	<i>0.537</i>	<i>0.531</i>	<i>0.540</i>

**Table S12:** Economic metrics across simulation scenarios (Table 4) using a relaxed fishing decision rule. Each value displayed is the mean across 10,000 observations representing 50 years from each of 200 model simulations. Total revenues and costs are in millions of 2019 USD. Average costs are 2019 USD per landed cage. Standard deviations are presented beneath means in italics.

	W00	W1T	W1N	W2T	W2N
Total Revenues (fleet)	36.854	36.415	35.965	34.538	33.795
	<i>1.620</i>	<i>1.644</i>	<i>1.599</i>	<i>1.685</i>	<i>1.745</i>
Total Costs (fleet)	44.521	44.132	44.537	43.081	43.001
	<i>1.334</i>	<i>1.341</i>	<i>1.322</i>	<i>1.447</i>	<i>1.518</i>
Total Revenues (processors)	128.759	127.168	125.567	120.308	117.619
	<i>5.721</i>	<i>5.813</i>	<i>5.653</i>	<i>5.954</i>	<i>6.189</i>
Average Total Costs (fleet)	554.742	556.548	568.678	572.871	584.459
	<i>11.171</i>	<i>11.481</i>	<i>11.722</i>	<i>12.267</i>	<i>13.153</i>
Average Fuel Costs (fleet)	194.114	195.811	207.134	207.673	217.944
	<i>7.811</i>	<i>7.997</i>	<i>8.172</i>	<i>8.391</i>	<i>8.905</i>
Average Transportation Costs (processors)	18.445	18.508	18.476	18.790	18.848
	<i>0.350</i>	<i>0.359</i>	<i>0.364</i>	<i>0.401</i>	<i>0.418</i>