

**Tables and Figures Regarding Bay Clam Stock Assessments, Proposed Landing Limits, and Commercial Harvest and Closure Areas**

*Table 1. Summary of commercial bay clam resource issues, current rules, proposed management changes, and expected outcomes and benefits*

<b>No.</b>	<b>Bay Clam Resource Issue:</b>	<b>Current Rule:</b>	<b>Proposed Management Change:</b>	<b>Expected Outcomes &amp; Benefits:</b>
<b>1</b>	<p><b>Tillamook Bay</b> New stock assessment data and monitoring information is available for Tillamook Bay</p> <p>Increased level of commercial harvest of sub-tidal bay clams in Tillamook Bay</p>	<p>Cockles: 90,000 lb annual landing limit in sub-tidal zone</p> <p>No annual landing limits for gaper clams or butter clams</p>	<p>Increase annual landing limit for cockles and establish annual limits for gapers and butter clams harvested by the dive fishery:</p> <ul style="list-style-type: none"> <li>• Cockles: 185,000 lbs</li> <li>• Gapers: 235,000 lbs</li> <li>• Butters: 225,000 lbs</li> </ul>	<p>Increased opportunity for commercial clambers</p> <p>Allow cockle harvest to continue longer during each year</p> <p>Reduce harvest pressure for gaper clams</p>
<b>2</b>	<p><b>Tillamook Bay / Netarts Bay</b> Harvest of small cockles coupled with low meat yield</p> <p>Substantial by-catch mortality of undersized gaper clams</p>	<p>Cockles harvested by dive fishery must be at least 2 ¼"</p> <p>No size limit for intertidal cockles</p> <p>4" size limit on gaper clams for divers</p>	<p>Increase minimum size limit for cockles to 2 ¾"</p> <p>Apply size limit to intertidal and subtidal harvest</p> <p>Eliminate size limit for gaper clams</p>	<p>Increased protection of spawning stock for cockles</p> <p>Increased opportunity for sport clambers</p> <p>Decrease by-catch mortality for undersized gaper clams</p>
<b>3</b>	<p><b>Tillamook Bay</b> Clarify definition and boundaries of commercial closure area in Tillamook Bay</p>	<p>Area east of a line from Coast Guard tower to buoy 13</p>	<p>Extend line to Hobsonville Point to clearly designate and slightly expand commercial closure area</p>	<p>Eliminate confusion about location where commercial clamming is prohibited</p> <p>Protect spawning stock</p>
<b>4</b>	<p><b>Netarts Bay</b> Increased commercial harvest of cockles</p> <p>Conflict between user-groups in Netarts Bay</p>	<p>Cockles are the only clam allowed for commercial harvest in Netarts Bay</p> <p>Existing annual landing limit of 8,000 lbs in sub-tidal zone</p> <p>No annual landing limit in intertidal zone</p>	<p>Prohibit commercial clamming in 76% of Netarts Bay</p> <p>Allow commercial harvest of cockles from intertidal zone only in 548 ac designated area west of primary tidal channel</p> <p>Establish annual landing limits for cockles:</p> <ul style="list-style-type: none"> <li>• Intertidal: 22,000 lbs</li> </ul> <p>Prohibit commercial harvest of cockles from sub-tidal zone of Netarts Bay</p>	<p>Conservation of cockle populations</p> <p>Spatial focus area for commercial harvesters</p> <p>Decrease commercial opportunity</p> <p>Decreased conflict among stakeholders</p>
<b>5</b>	<p><b>State-wide</b> Regional decline in populations of native littleneck clams</p>	<p>Commercial harvest of native littleneck clams is allowed</p>	<p>State-wide prohibition on commercial harvest of native littleneck clams</p>	<p>Precautionary measure to ensure conservation of native littleneck clams</p>

*Table 2. SEACOR stock assessment estimates of the biomass of bay clams that inhabit the intertidal and sub-tidal zones of Netarts Bay and Tillamook Bay (2012-2014)*

BAY	BAY CLAM SPECIES	INTERTIDAL BIOMASS (lbs)	SUB-TIDAL BIOMASS (lbs)
<b>Netarts Bay</b>			
	<b>Cockle</b>	<b>mean</b>	<b>218,000</b>
		lower 95% CI	149,713
		upper 95% CI	286,309
	<b>Gaper</b>	<b>mean</b>	<b>1,200,000</b>
		lower 95% CI	37,980
		upper 95% CI	2,351,969
	<b>Butter</b>	<b>mean</b>	<b>2,200,000</b>
		lower 95% CI	1,529,440
		upper 95% CI	2,904,865
<b>Tillamook Bay</b>			
	<b>Cockle</b>	<b>mean</b>	<b>718,000</b>
		lower 95% CI	470,590
		upper 95% CI	871,110
	<b>Gaper</b>	<b>mean</b>	<b>1,414,000</b>
		lower 95% CI	919,500
		upper 95% CI	1,910,200
	<b>Butter</b>	<b>mean</b>	<b>560,000</b>
		lower 95% CI	195,000
		upper 95% CI	925,700

*Table 3. Estimates of age at maturity, instantaneous natural mortality (M) and annual mortality rates (A) for cockle and gaper clam populations in the subtidal zone of Tillamook Bay*

Species of Clam	Age at Maturity	Instantaneous Natural Mortality Rate	Annual Mortality Rate
<b>Cockles</b>	2 yrs	$M = 0.504$	$A = 39.6\%$ per year
<b>Gaper Clams</b>	2-3 yrs	$M = 0.283$	$A = 24.6\%$ per year
<b>Butter Clams</b>	3-4 yrs	<i>unknown</i>	<i>unknown</i>

*Table 4. Comparison of exploitation rates and annual landing caps for different commercial harvest approaches for cockles, gaper clams, and butter clams in the sub-tidal zone of Tillamook Bay. Exp indicates Exploitation Rate (% of population harvested by commercial clammers)*

Species of Clam	Population Biomass (lbs) Lower 95% Confidence Interval	Status Quo	Conservative Harvest (recommended)	Moderate Harvest (not recommended)	Substantial Harvest (not recommended)	Maximum Harvest (not recommended)
<b>Cockles</b>	1,859,764 lbs	Exp = 4.8%	Exp = 10%	Exp = 15%	Exp = 20%	Exp = 25%
	Landing Cap	90,000 lbs	185,000 lbs	280,000 lbs	370,000 lbs	465,000 lbs
<b>Gaper Clams</b>	2,350,385 lbs	Exp = 5.3%	Exp = 10%	Exp = 15%	Exp = 20%	Exp = 25%
	Annual Harvest	125,000 lbs	235,000 lbs	350,000 lbs	470,000 lbs	585,000 lbs
<b>Butter Clams</b>	4,569,340 lbs	Exp = 0.4%	Exp = 5%	Exp = 10%	Exp = 15%	Exp = 20%
	Annual Harvest	16,000 lbs	225,000 lbs	450,000 lbs	685,000 lbs	910,000 lbs

*Table 5. Comparison of exploitation rates and annual landing caps for different commercial harvest approaches for cockles within a 548 ac designated commercial harvest area that encompasses the intertidal and sub-tidal zones of Netarts Bay. Exp indicates Exploitation Rate (% of population harvested by commercial clammers)*

Species of Clam	Harvest Zone	Population Biomass (lbs) lower 95% CI	Conservative Harvest (not recommended)	Moderate Harvest (recommended)	Substantial Harvest (not recommended)	Maximum Harvest (not recommended)
<b>Cockles</b>	Intertidal:	149,700 lbs	Exp = 10%	Exp = 15%	Exp = 20%	Exp = 25%
		Landing Cap	15,000 lbs	22,000 lbs	30,000 lbs	37,000 lbs

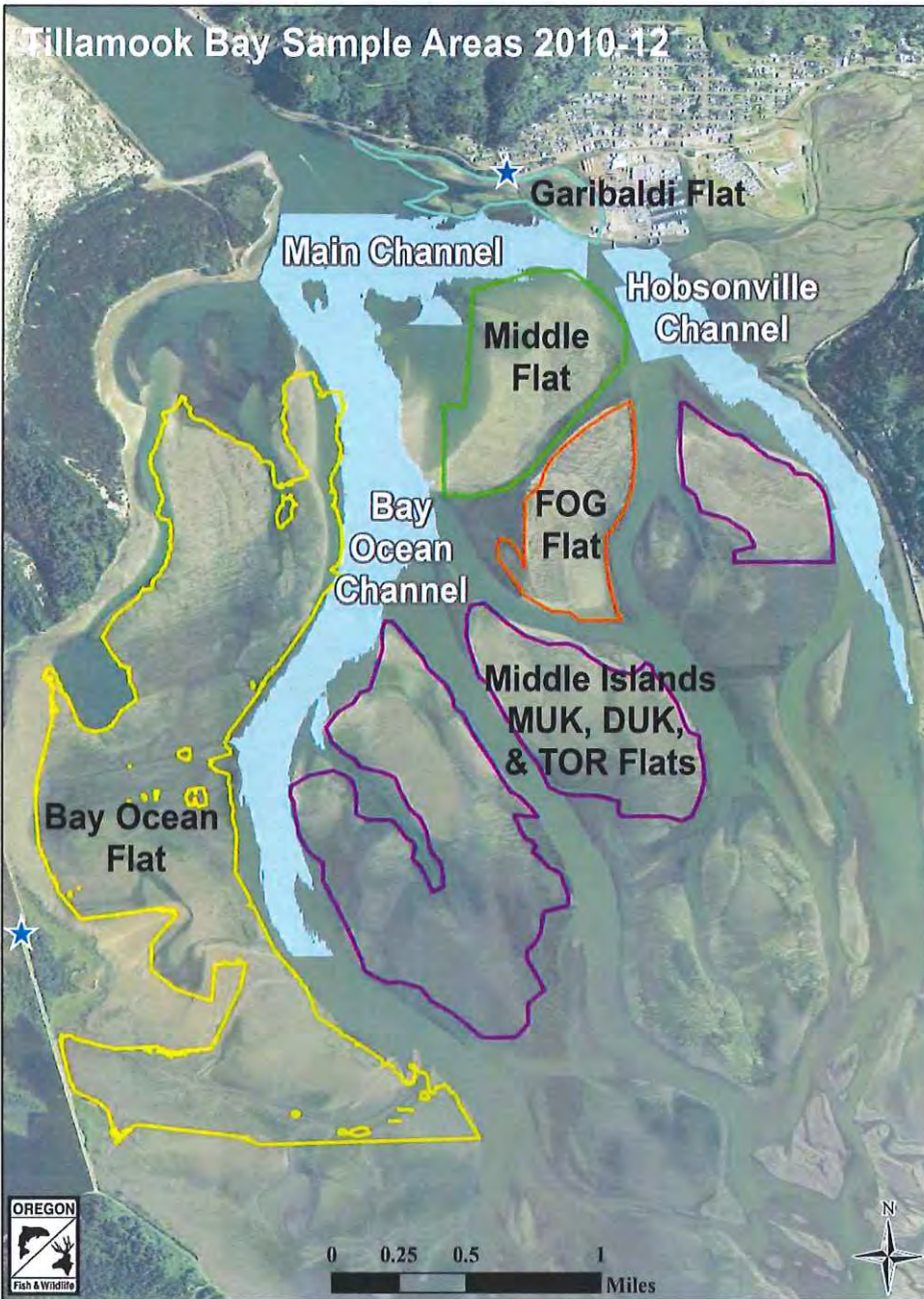
*Table 6. Summary of recent public meetings to discuss bay clam issues, stock assessment surveys, and gain input about specific proposals to make adjustments to the management of bay clam fisheries in Tillamook Bay and Netarts Bay. Complete notes on public attendees and their input and questions are available separately*

<b>Date</b>	<b>Location</b>	<b>Meeting</b>	<b>Goals</b>	<b>Attendance</b>
Oct 26 2011	Tillamook	North Coast Bay Clam Fishery	Increase public awareness; Address concerns about bay clam management; Gather public input about management approaches	25-30
21 Oct 2013	Netarts	SEACOR Stock Assessment Status Update	Provide update about status of SEACOR surveys; provide report on levels of sport and commercial harvests; gain input about resource management issues	43
18 Nov 2014	Netarts	Netarts Bay Clam Stock Assessment and Management Options	Present results of stock assessment surveys for Netarts Bay; Discuss sport and commercial fisheries; Explore possible changes to management approaches and rules; Provide open forum for public input	24-30
19 Nov 2014	Tillamook	Tillamook Bay Clam Stock Assessment and Management Options	Present results of stock assessment surveys for Tillamook Bay; Discuss sport and commercial fisheries; Explore possible changes to management approaches and rules; Provide open forum for public input	15-18
11 May 2015	Tillamook	Proposed Adjustments to Commercial Clamming Regulations	Present five specific proposals for adjustments to the commercial clamming rules; Explore alternatives and options for the proposed rule adjustments; Provide open forum for public input	21

**Figure 1.** Identification of ODFW SEACOR bay clam stock assessment survey areas in Netarts Bay (2013-2014).



**Figure 2.** Identification of ODFW SEACOR bay clam stock assessment survey areas in Tillamook Bay (2010-2012).



**Figure 3.** Time-series records of the total landings of bay clams landed by commercial harvesters in Tillamook Bay, Netarts Bay, and Coos Bay (1994-2014).

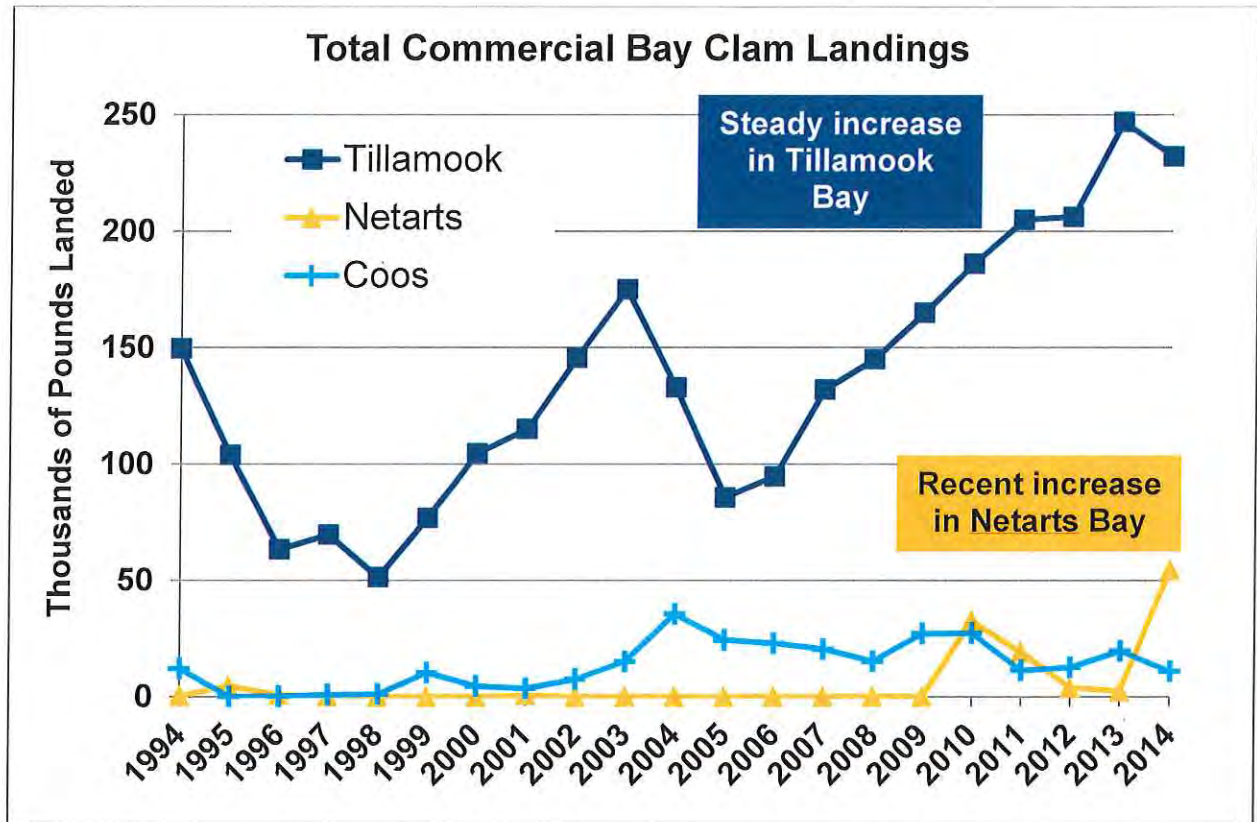
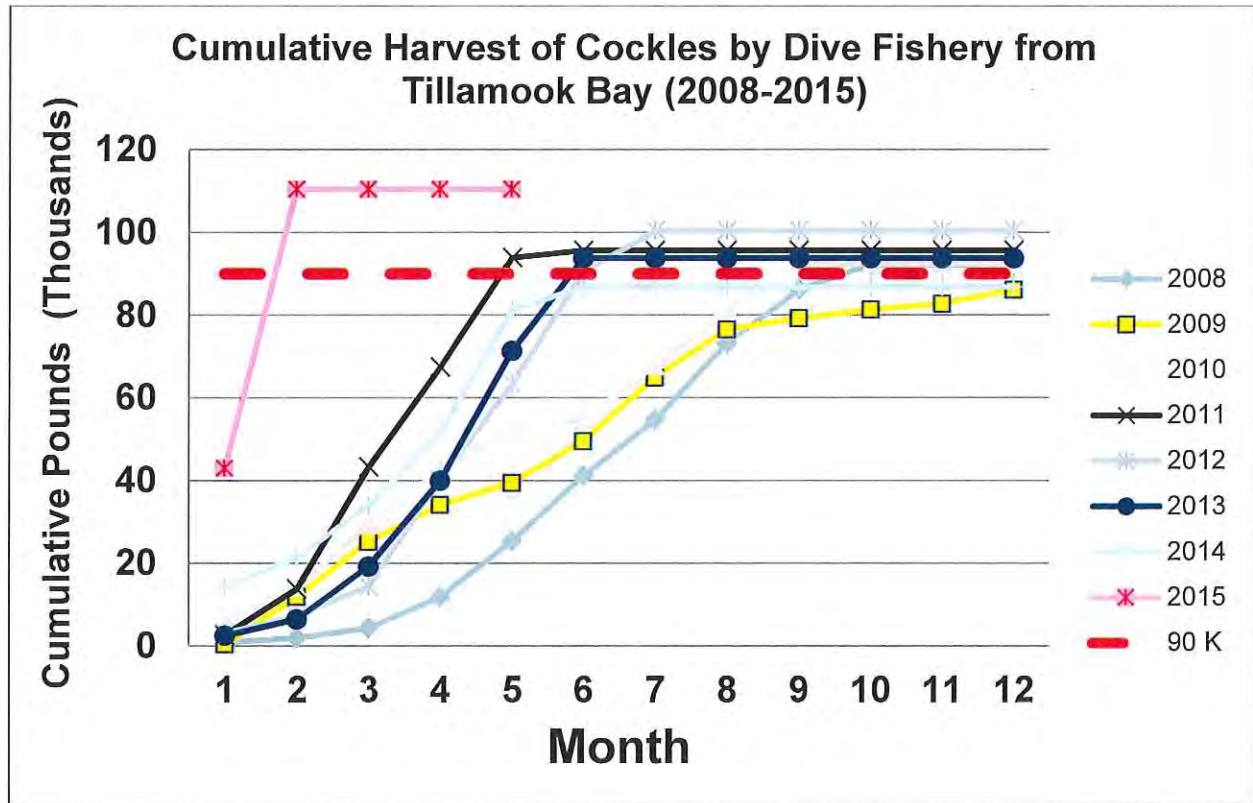
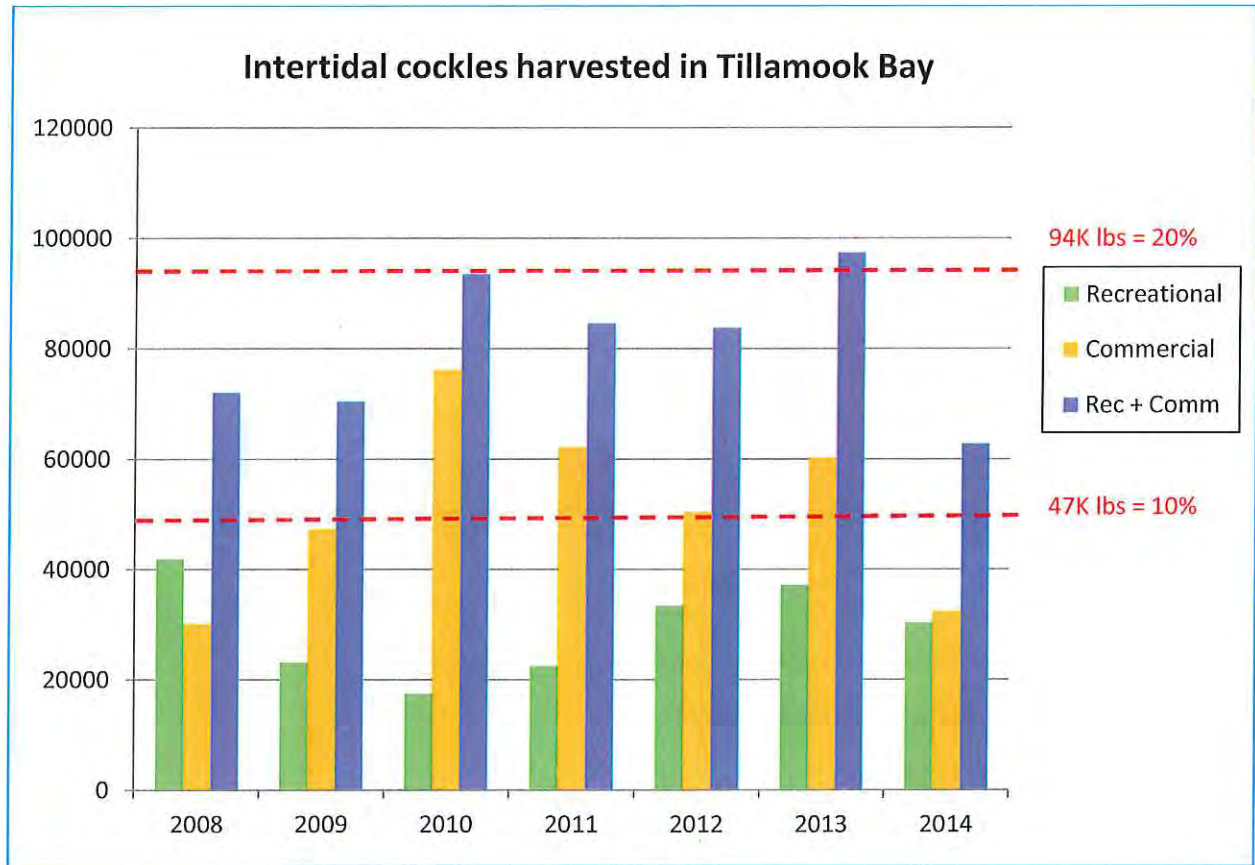


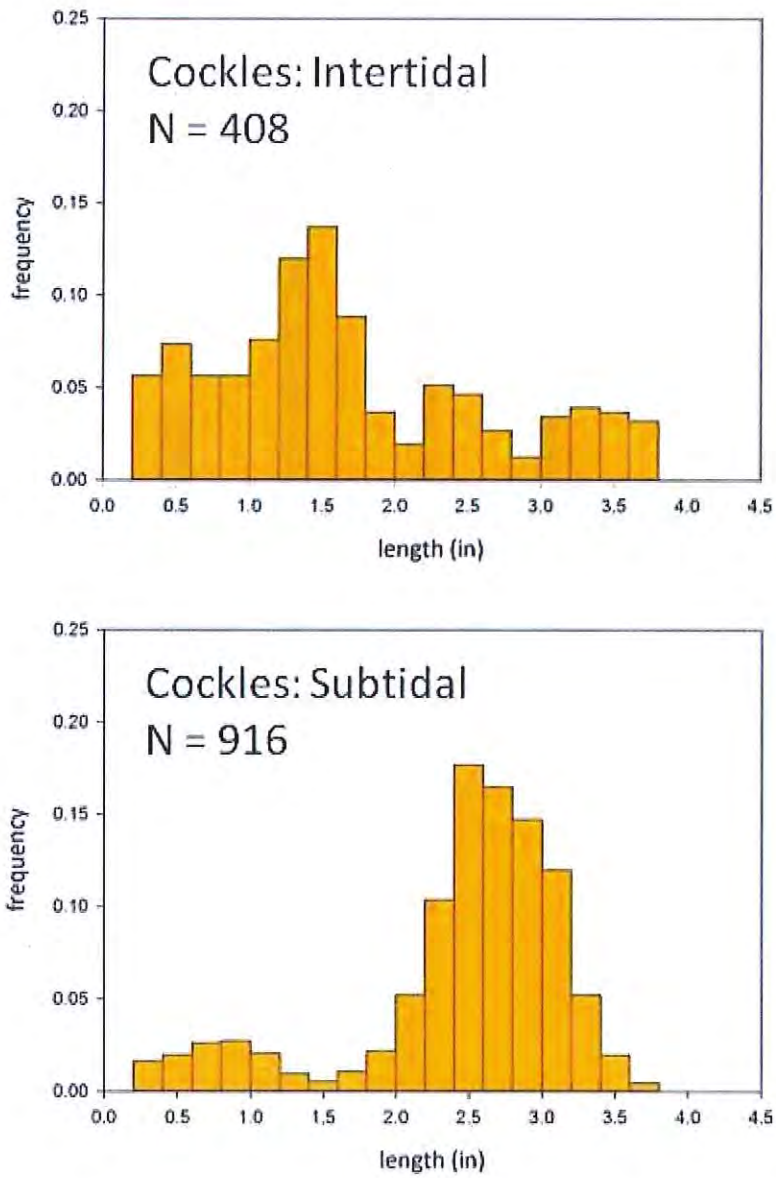
Figure 4. Cumulative pattern for the annual harvest of cockles from Tillamook Bay by the commercial bay clam dive fishery (2008-2015).



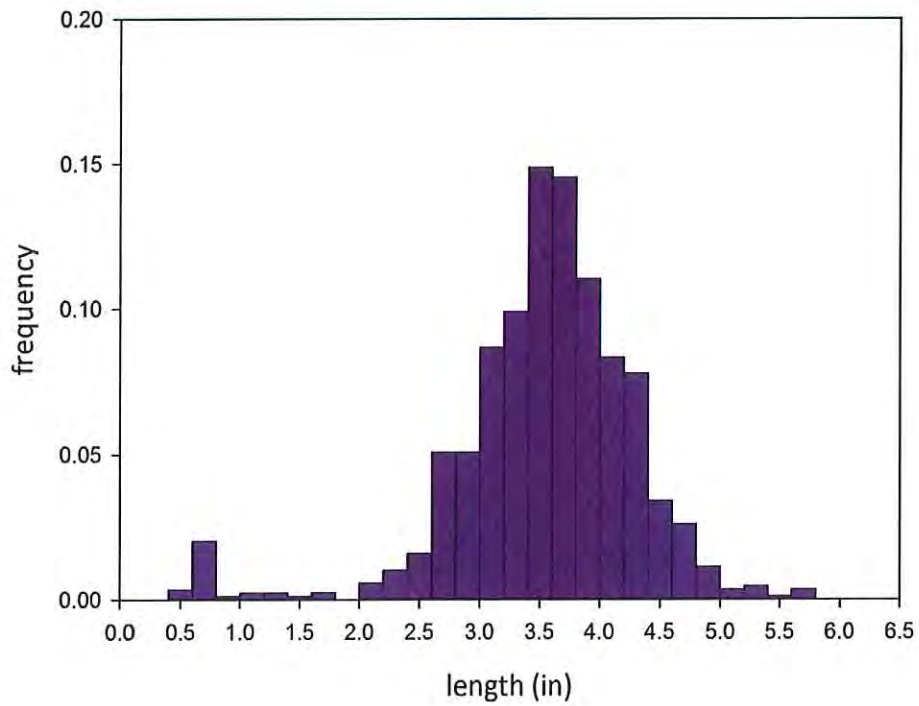
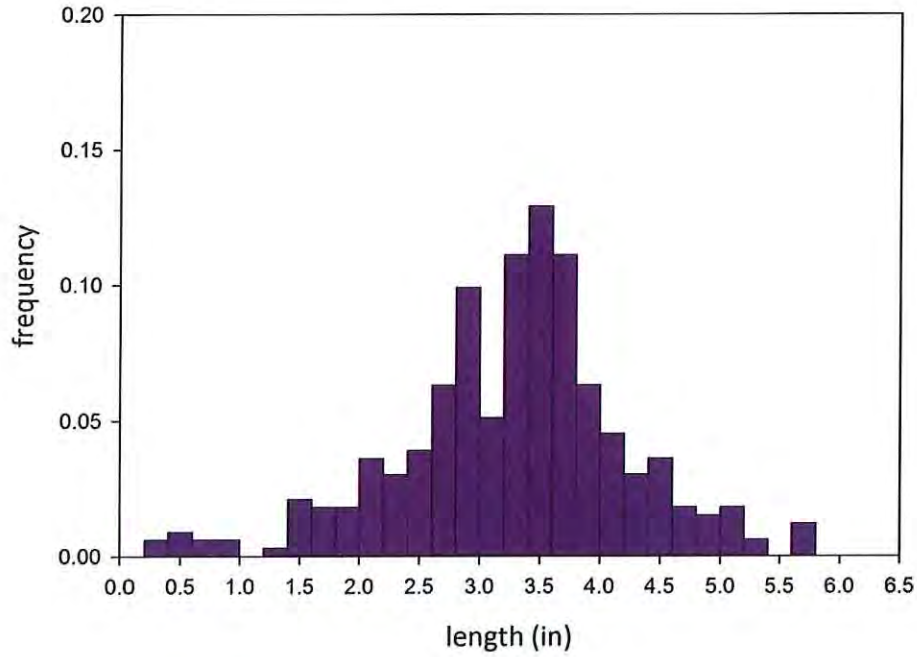
**Figure 5.** Time-series for the annual recreational, commercial, and total harvest of cockles over 2008 to 2014 from the intertidal zone of Tillamook Bay. Red-dashed horizontal lines indicate fishing mortality (total catch) levels of 10% and 20% of the bay-wide intertidal cockle population.



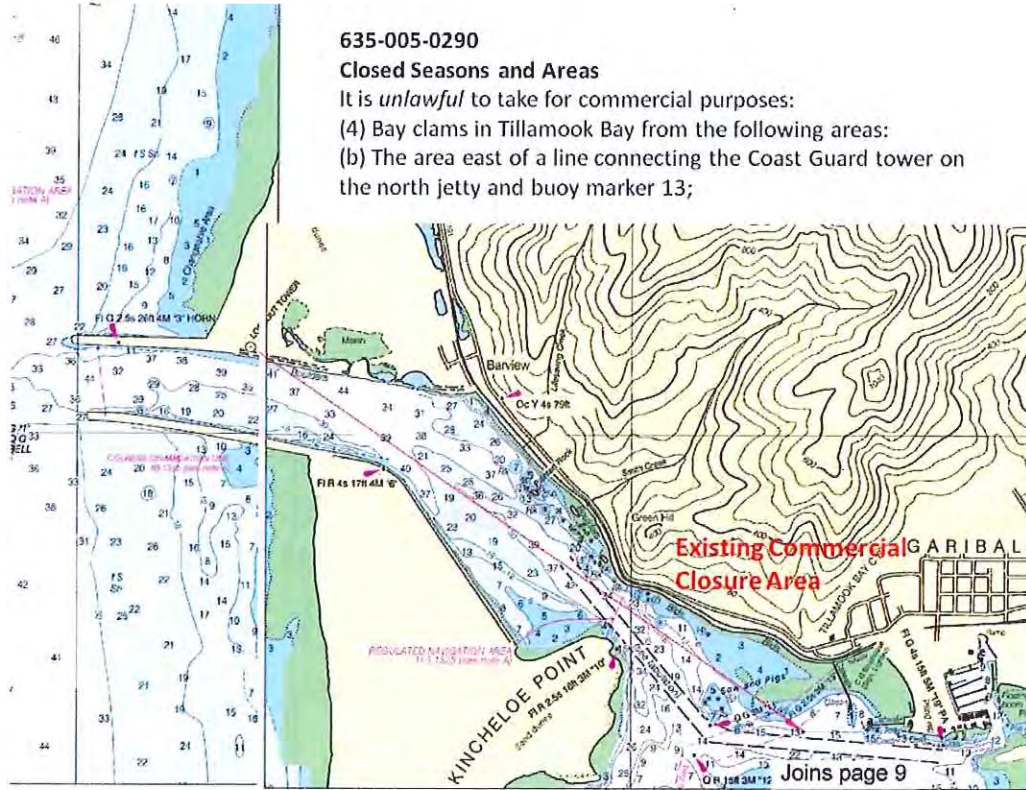
**Figure 6.** Size frequency distributions for cockles in the intertidal (top) and sub-tidal (bottom) zones of Tillamook Bay (intertidal median = 1.50 inches (38.0 mm); sub-tidal median = 2.62 inches (66.6 mm)).



**Figure 7.** Size frequency distribution for gaper clams within the intertidal (top) and sub-tidal (bottom) zones of Tillamook Bay (intertidal median = 3.35 inches (85.2 mm); sub-tidal median = 3.60 inches (91.4 mm)).



**Figure 8.** Existing commercial bay clam closure area in Tillamook Bay. Red line indicates boundary line connecting Coast Guard tower on north jetty to Buoy 13.

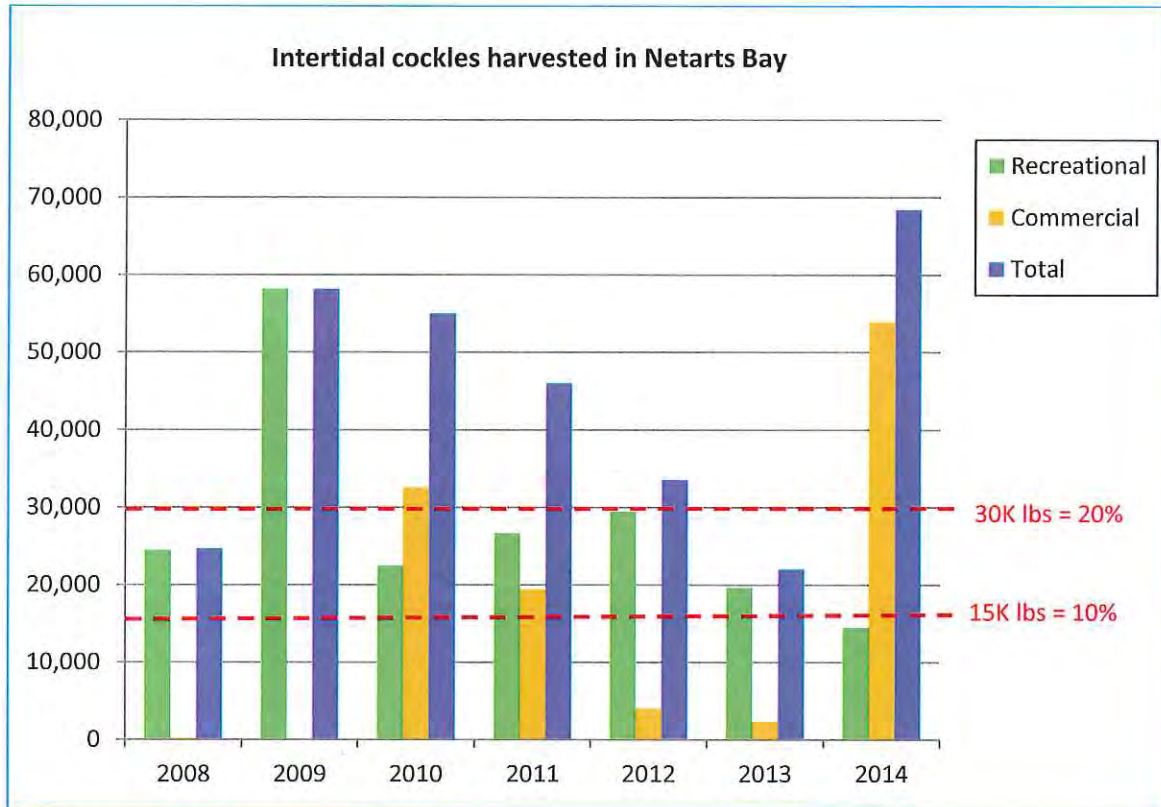


**Figure 9.** Proposed clarification and extension of commercial bay clam closure area from Buoy 13 to Hobsonville Point in Tillamook Bay. Proposed expansion of commercial closure area (180 acres) includes about 73 acres of subtidal habitat and about 107 acres of intertidal habitat.

### Tillamook Bay



**Figure 10.** Time-series for the annual recreational, commercial, and total harvest of cockles over 2008 to 2014 from the intertidal zone of Netarts Bay. Red-dashed horizontal lines indicate fishing mortality (total catch) levels of 10% and 20% of the bay-wide intertidal cockle population.



**Figure 11.** Proposed designated commercial clam harvest area in Netarts Bay. Commercial harvest of cockles will be restricted to area surrounded by black line (548 ac). Pink area indicates intertidal zone and blue area indicates sub-tidal zone. Orange squares indicate biomass of cockles (gms per m<sup>2</sup>) measured during ODFW SEACOR stock assessment surveys (2014). Area surrounded by red line is the Netarts Bay Shellfish Preserve where both commercial and recreational harvest of bay clams is prohibited. Recreational harvest of bay clams is allowed in all areas located north and south of the Shellfish Preserve.

