

# Demand for recreational shellfish harvest under environmental closures



Leif Anderson and Mark Plummer  
Northwest Fisheries Science Center

Recreational clam and oyster harvesting is a popular activity in Puget Sound

133,688 estimated harvester days on *managed* beaches in Puget Sound (WDFW, 2013)

Beaches are often subject to health-related environmental closures based on ongoing water quality assessments

Puget Sound Partnership has set a priority to reduce the risks of shellfish growing area closures and adverse effects on human health



# Harvest closures

Abundance closures set by Washington Dept of Fish and Wildlife (WDFW)

Health-related closures set by Washington Dept of Health (WDOH)

Health-related closures may be due to:

Biotoxins – diarrhetic shellfish toxins, paralytic shellfish toxins, domoic acid

Pollution (bacteria, viruses, or other)

Closures are posted online, in other media, and (often) at public beaches

Current analysis focuses on *annual* health-related closures

Only the **HEALTH STATUS** of beaches are shown on these maps.  
For **SEASONS & LIMITS** visit [Washington State Department of Fish and Wildlife](#).

## Marine Biotoxin Closure Zones

 Closed for clams, geoduck, scallops, mussels, oysters, snails and other invertebrates.

Marine Biotoxin status updated, 6/18/2014  
12:43:43 PM

Public Beaches  
 Closed

 Area closed due to pollution.

## Beach Information

**Name: BIRCH BAY SP**

**Marine Biotoxin Closure**  
Closed for clams, geoduck, scallops, mussels, oysters, snails and other invertebrates.

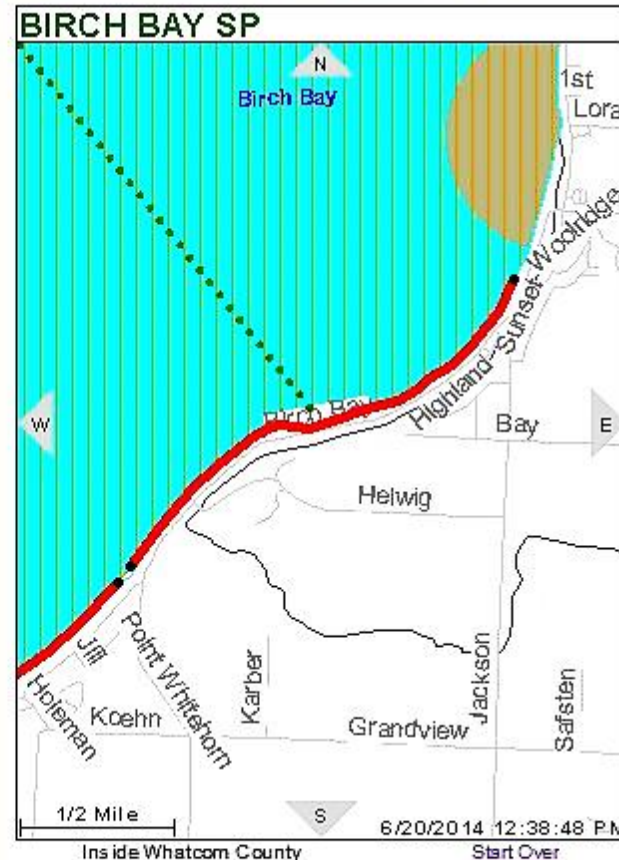
Owner: State Parks and Recreation

**ADVISORY:**  
Water quality and shoreline conditions meet public health standards for recreational shellfish harvesting.

[WDFW Regulations/Restrictions](#)

[DOE Shoreline Photo](#)

[Tide Predictions](#)



Inside Whatcom County

Start Over



[Emergency Closures Due to Marine Biotoxins and Vibrio - Text Version](#)

[County Beach List](#)

[Recreational Program](#)

[Fact Sheets](#)

What is the effect of biotoxin or pollution closures on ...

effort?

recreational use value?

# Values

Three basic categories of “values” affected by recreational harvesting, we focus on #3

1. Regional economic impacts (employment, income)
2. Net values to businesses (profits)
3. Net values to recreational harvesters (consumer surplus)

Value received from the activity minus the cost

Cost is observable, but does *not* measure the value received

Value is not observable and may not even be framed as a dollar value by most people

This sort of value is the underlying motivation for choosing to buy or do anything – expected value must exceed the cost

Value is measured by what economists call willingness to pay

Current data collected by WDFW do not allow us to estimate these values, so we conduct a survey

# Data

Puget Sound Recreational Shellfishing Survey

3 focus groups and 3 sets of one-on-one interviews : Seattle, Bellingham, Silverdale

Up to 6 contacts: phone, prenotice, 1st mailing, postcard, 2nd mailing, 3rd mailing

Fielded in 2013

Estimated response rate ~50%

Data include location of most often used beach, contingent behavior questions

# Experimental design

2 contingent behavior questions on each of 25 survey versions

## Attributes

type of closure (biotoxin, pollution),

species affected (all clams and oysters, butter clams only),

additional distance to a nearby beach that is fully open (5, 10, 20, 30 miles)

“How many trips would you take if the beach you most often use for harvesting clams and oysters was closed ... ?”



C3

Suppose that the Department of Health has closed an area for the entire season (January through December) that includes the Puget Sound beach you most often use for harvesting clams or oysters and there is a nearby beach that is not affected by this closure that is an additional 20 miles away.

Please review the following table and answer the questions below.

Information on the Closure and Your Alternatives	
Type of Closure	Biotoxin
Period of Closure	January through December
Species Closed to Harvest	Butter Clams Only
Additional Distance to a Nearby Beach that is Fully Open	20 miles

C3.1

**During this 12 month closure**, how many trips would you take to the beach you most often use, and to the nearby beach that is fully open?

Trips during the closure (January through December) to the beach you most often use:

Harvesting trips:

Non-harvesting trips:

Trips during the closure (January through December) to the nearby beach that is fully open (20 additional miles):

Harvesting trips:

# Model

Estimate demand for 3 trip types together in order to capture substitution between types of trips

3 trip types: harvest, alternate beach, non-harvest

Demand for trips = f (travel cost, demographics, closures)

$$x_{li} = \alpha_{li}(z) \exp(\sum_k \beta_{lik} P_k + \gamma_{li} y), \text{ negative binomial functional form}$$

Standard restrictions for integrability ( $\gamma_{li} = \gamma_{lk}, \beta_{lik} = 0, \forall i \neq k, \beta_{lii} < 0, \alpha_{li}(z) > 0$ )

$$x_{li} = \exp(\alpha_{li} + \mu U_{sealt} + \varphi F_{em} + \sum_n \delta_{lni} \text{Closed}_{ln} + \beta_{li} P_{li} + \nu y) \text{ heterogeneous baseline demand for trip types}$$

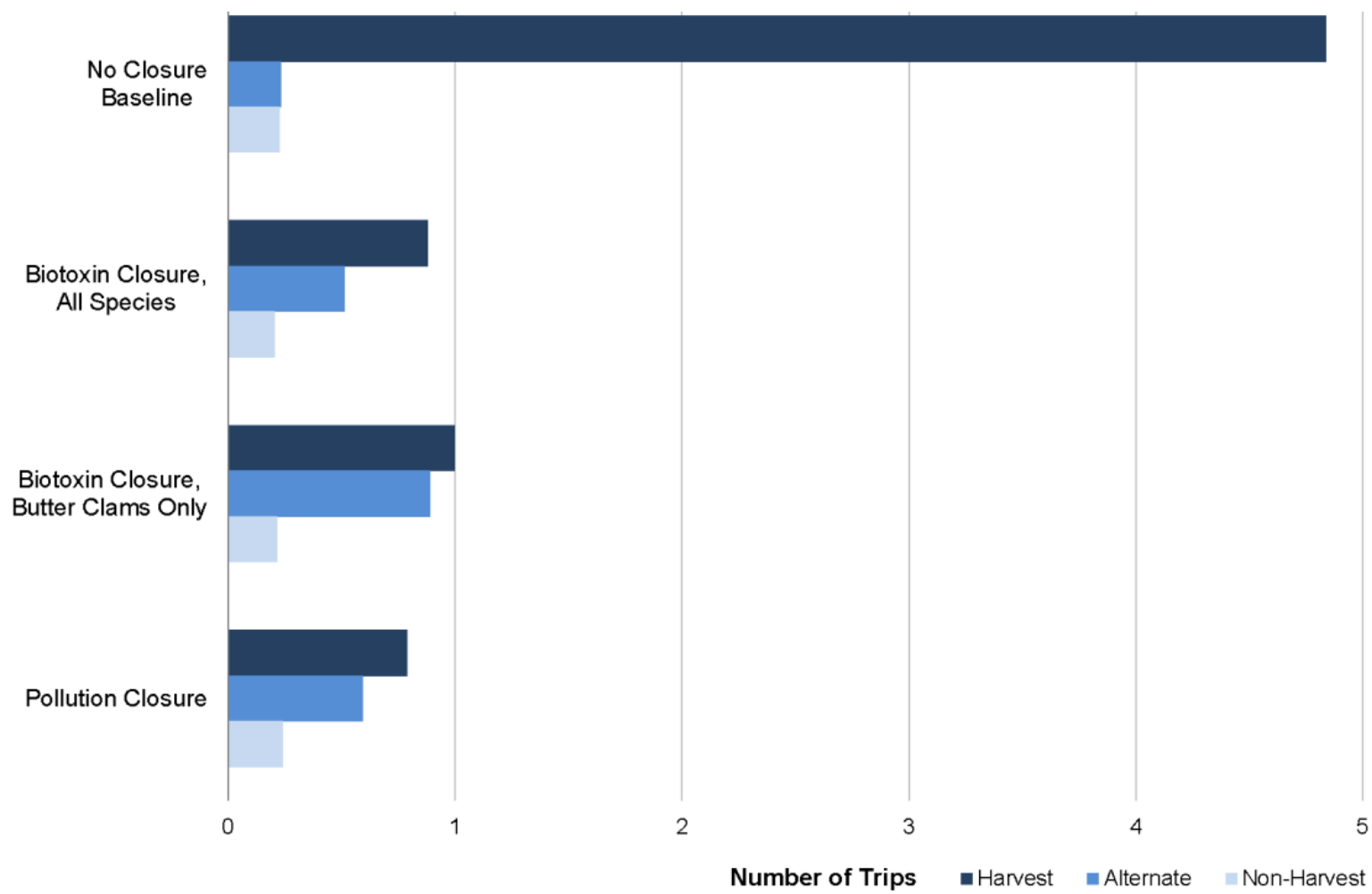
Variable		Coefficient Mean	Coefficient SD
Trip types ( $\alpha_{li}$ )	Harvest	1.55598***	.83007***
	Alternate	-1.03610***	1.74006***
	Nonharvest	-1.39674***	2.96784***
Price ( $\beta_{li}$ )	Harvest	-.01233***	
	Alternate	-.02025***	
	Nonharvest	-.01824***	
Closed ( $\delta_{lni}$ )	Harvest	Biotoxin, All Species	-1.70425***
		Biotoxin, Butter Only	-1.57950***
		Pollution	-1.81607***
	Alternate	Biotoxin, All Species	.78200***
		Biotoxin, Butter Only	1.33626***
		Pollution	.92814***
	Nonharvest	Biotoxin, All Species	-0.09085
		Biotoxin, Butter Only	-0.04823
		Pollution	0.06239
Income ( $\gamma$ )		.15993D-05**	
Fem ( $\varphi$ )		0.07031	
Usealt ( $\mu$ )		.92229***	
Scale		2.82817***	
Respondents	86		
Sample size	860		
Log-likelihood at zero	6538.384		

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# Annual trips



# Willingness to pay

Willingness to pay for a ...

harvest trip = \$81.13

harvest trip to an alternate beach = \$49.38

non-harvest trip = \$54.83



# Annual willingness to pay

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Closure Type	Additional Miles to Open Beach			
	5	10	20	30
No Closure	\$419.24	\$418.26	\$416.50	\$414.98
Biotoxin, All Species	\$113.86	\$111.73	\$107.89	\$104.56
Biotoxin, Butter Clams Only	\$146.95	\$143.24	\$136.55	\$130.75
Pollution	\$113.08	\$110.61	\$106.17	\$102.32

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Willingness to pay to avoid closures consists of two components, a fixed effect and a portion that varies with distance to the nearest beach open for harvest

Most of the loss in value from a closure comes from having to use an alternate beach, rather than the additional travel cost

# Current and future work

Modeling the effect of 1, 2, and 3 month closures

Characteristics of respondents who state they continue to harvest on closed beaches





The **GEODUCK** (Panope Generoso)  
Native of Puget Sound, often reaches great  
size. Geoduck hunting is a very popular  
sport in the neighborhood of  
**HOOD CANAL—WASHINGTON**

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Arlington, WA

# Questions?

*leif.anderson@noaa.gov*