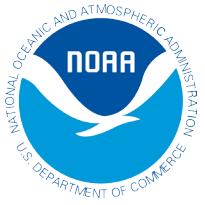
NOAA Technical Memorandum NMFS-NWFSC-132



Puget Sound Recreational Shellfishing Survey:
Methodology and Results

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September 2016

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
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Dedication

Dr. Mark Plummer
1954–2014

Mark Plummer passed away during the completion of this project. He was instrumental in designing the study and a strong proponent of incorporating human behavior into the management of natural resources, particularly in Puget Sound. Mark was a highly respected colleague and a caring mentor. He will be greatly missed.

Executive Summary

The Puget Sound Recreational Shellfishing Survey was administered in 2013 by the Northwest Fisheries Science Center to enable the estimation of changes in economic value associated with biotoxin- and pollution-related clam and oyster harvest closures in Puget Sound, Washington. In particular, data were collected in order to estimate econometric models of recreational demand.

This Technical Memorandum describes the methodology used to administer the survey and some of the basic findings, including characteristics of harvest trips and harvester preferences, expenditures, and demographics.

The survey was administered by mail, but included a telephone screener to identify license holders who had actively harvested clams or oysters in Puget Sound within the previous 12 months. Answers from this short telephone screener were also compared to answers from the mail survey to identify potential nonresponse bias. We found very little evidence of differences between respondents to the telephone screener and those who completed the mail survey.

Clam and oyster harvesting in Puget Sound appears to be a regular, important recreational activity for many respondents. Respondents reported an average of 3.7 and 2.4 days harvesting clams and oysters, respectively. These harvesting days translated into a significant number of meals, as more than half of the respondents consumed at least four meals per year containing their harvest, with 18% consuming more than ten meals per year. Only 30% of Puget Sound clam and oyster harvesters also harvested razor clams on ocean beaches. Respondents also indicated that they would continue to take harvesting trips in the future, with more than half stating they would definitely harvest within the next 12 months and only 1% indicating that they would definitely not harvest. Most harvesters (64%) tended to use a single beach exclusively. Even harvesters who used more than one beach tended to use beaches that were in close proximity to one another. This suggests a unique importance at the individual harvester level for individual beaches, and clusters of beaches, across Puget Sound.

These data provide shellfish managers with useful information about current harvesters. Future work will use these data to estimate models of recreational demand, in order to estimate the changes in economic value that result from changes in harvest closures.

Acknowledgments

The survey described in this document was developed through collaboration and consultation with numerous individuals. The Washington Department of Fish and Wildlife was extremely helpful in providing data from license databases in order to draw the sample of licensed harvesters. The Northwest Fisheries Science Center also thanks all of the recreational shellfish harvesters who volunteered their time for the surveys.

Introduction

The Puget Sound Recreational Shellfishing Survey was administered in 2013 in order to help understand the effects of pollution and biotoxin closures on recreational clam and oyster harvesters. The primary purpose was to collect data that can be used to estimate the change in economic value associated with biotoxin- and pollution-related harvest closures. In addition, the survey was designed to collect baselines for effort, preferences, expenditures, and demographics.

The Puget Sound Partnership is a Washington State agency with responsibility to create an Action Agenda that will lead to the recovery, by 2020, of the Puget Sound Ecosystem. The Northwest Fisheries Science Center participates in the Partnership by loaning staff and completing projects that help to inform management decisions, and by providing input to the Partnership's advisory Science Panel. The Partnership has set a priority to reduce the risks of shellfish-growing area closures and to minimize the potential for adverse effects on human health. The Partnership's Action Agenda has set a goal for a net increase of 10,800 harvestable shellfish acres by 2020, an increase of nearly 6% of the current potentially harvestable area, and a 30% reduction in the amount of shellfish areas currently closed (Puget Sound Partnership 2011).

In support of the Partnership's pursuit of this goal, as well as of its own research priorities, the NWFSC conducted this economic survey to assess the behavior of individual shellfish harvesters in response to the State's management of shellfish harvesting.

The State of Washington manages the resource, administering spatial harvest advisories or closures as needed, to ensure biological conservation of the harvested species as well as to protect the health of harvesters. Shellfish are regularly tested for biotoxins (e.g., paralytic shellfish toxins, domoic acid, and diarrhetic shellfish toxins), pollution (e.g., *Vibrio* spp. or other bacteria), and viruses (norovirus) that can cause illness or even death if ingested.

Aside from this survey, very little information exists to estimate the effect of Puget Sound harvest closures on the level of effort, the economic impact, or the recreational use value of harvesting trips. The Washington Department of Fish and Wildlife conducts harvest (i.e., creel) and effort (i.e., airplane flyover) surveys for all public beaches designated as actively managed, as well as effort surveys on many public beaches designated as passively managed.[1] However, the sampling program is not designed to estimate the effect of environmental closures on harvest effort, nor is it designed to estimate economic values.

We are not aware of any studies that have measured recreational use values of shellfish harvested in the Pacific Northwest. In fact, there are surprisingly few applications we are aware of worldwide.[2] Studies of regional economic impacts are more common. For example, Dyson and Huppert (2010) surveyed razor clam (*Siliqua patula*) harvesters on public ocean beaches of Washington in order to estimate the economic impacts of a razor clam closure.

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[1] For example, see Strom and Bradbury (2007). A passively managed beach is defined by the Washington Department of Fish and Wildlife as "one where the available information on state recreational and tribal ceremonial and subsistence harvest does not indicate the need for clam or oyster population surveys or a total allowable catch."

[2] One application was conducted in France: Beaumais and Appéré (2010) asked recreational harvesters for the maximum additional distance they would travel in order to continue harvesting in the event of a hypothetical sanitary quality downgrade.

Survey Instrument Design and Administration

As the intended purpose of the project was to measure behavioral changes under pollution and biotoxin closures, the first step in the survey design was to decide how to capture the most important factors influencing harvester behavior. We turned to pretesting with harvesters—to assess how the survey could be designed to capture these factors and to check for consistent understanding of survey questions—before administering the survey.

Pretesting

The survey instrument was developed, refined, and eventually finalized with feedback from recreational shellfish harvesters, including focus groups and one-on-one interviews. First, three focus groups were conducted in locations across Puget Sound: Seattle, Bellingham, and Silverdale. These focus groups were used to develop the first version of the survey instrument. Most of the discussion focused on typical harvesting trip behavior, including prior experience with biotoxin or pollution closures. In general, we found that shellfish harvesters were very knowledgeable about species and different types of closures. Multiple modes of information were found to be used by harvesters to determine whether a particular beach was closed prior to making a trip: both the Washington Department of Health website and its telephone hotline were cited as the two most commonly used.

Next, 21 one-on-one interviews were conducted, split across the same locations as the focus groups. The interviews were used to further refine the survey instrument, and in particular to test the understanding of the contingent behavior (CB) questions. CB questions are a type of stated preference question that elicit respondent behavior contingent on a set of attribute levels. This type of question is commonly used to estimate recreational demand under varying environmental conditions. In this survey, the elicited behavior corresponded to the number of harvest trips that would be taken, and the attribute levels corresponded to different types and lengths of harvest closures. Attribute levels for each CB question were generated using an experimental design (see Appendix A).

The final step in pretesting was a mail survey sent to 400 individuals to check for any remaining issues. Since there were no issues detected at this stage, we combined the pretest sample data with the full sample for purposes of analysis. Survey Administration describes the steps used to administer the survey.

During this process of survey pretesting, it became apparent that it would be necessary to quantify how respondents might consider harvesting trips at a nearby beach or non-harvesting trips at the same beach as substitutes when faced with a local harvesting closure. Accounting for this substitution provides a more accurate depiction of the net economic value of changes in pollution and biotoxin closures.

Survey Administration

The target population was all adult Washington State residents who had recreationally harvested clams or oysters in Puget Sound within the previous 12 months. To sample from this population, we used the licensing database maintained by the Washington Department of Fish and Wildlife.

There are three basic license types that allow holders to recreationally harvest clams or oysters: the annual shellfish/seaweed license, the annual combination fishing/shellfish license, and the one- to three-day fishing/shellfish licenses.

After the sample was randomly drawn, phone numbers and addresses were sent to a national database service to be verified. Sampled records containing missing or incorrect telephone numbers or addresses were filled in using this database.

The survey was designed and administered following the general procedures outlined in Dillman (2000). Each respondent received up to six total contacts: a telephone screener, a prenotice letter, the first full mailing of the questionnaire, a reminder postcard, the second full mailing of the questionnaire, and the third full mailing of the questionnaire (see Appendix B).

As noted above, all of the license types that allow the recreational harvest of clams or oysters in Puget Sound also allow additional uses. We used the telephone screener to identify individuals who had made a trip to harvest clams or oysters in Puget Sound within the previous 12 months. All of the subsequent mail contacts were limited to respondents who were either confirmed clam or oyster harvesters or license holders who could not be reached by telephone. The prenotice letter was the first contact administered by mail. For respondents who could not be reached by telephone (69%), the prenotice was the first contact received. The letter alerted respondents to the upcoming study, described its general purpose, and encouraged a future response. Seven days after the prenotice letter was sent, the first survey packet was mailed out. The packet included a personalized cover letter, the 16-page questionnaire, and a business reply envelope. A postcard was sent seven days after the initial survey packet, serving as a reminder to respondents who had not yet returned the questionnaire and as a thank you to those who had already responded. One week after the postcard, the second survey packet was sent out. This packet contained a different cover letter than the initial mailing. Two weeks later, the third and final survey packet was mailed out, including a new cover letter with a final appeal to fill out and return the survey.

It proved challenging to sample clam and oyster harvesters using the licensing database from the Washington Department of Fish and Wildlife, for two reasons. First, there are a large number of people who hold licenses that allow the recreational harvesting of clams and oysters, but who are not active shellfish harvesters. Combination licenses are purchased on an annual basis by people who may want to fish in both saltwater and freshwater, but have no intention of harvesting shellfish. Short-term licenses are even more difficult to sample from, as they are only sold as combination licenses.

Second, many respondents could not be reached by phone. A study conducted in 2007 that used a similar telephone/mail methodology and sampled the same database found that 30% of the sampled population could not be reached by phone. In the current study, more than twice as many sampled license holders (69%) could not be reached by phone.

Response Rate

Response rates are a standard measure that can be used to assess the likelihood that survey respondents differ from those who did not respond. In order to calculate the effective response rate in our context, we first estimated the number of Puget Sound clam or oyster harvesters who received a survey. This was done by adding the number of surveys sent to known harvesters,

$Sent_{harvested}$, to the estimated number of surveys sent to license holders who had not been reached by phone, but still harvested clams or oysters, ($\alpha_{harvested}(Sent_{total} - Sent_{harvested})$). We used the portion of the sample who had harvested clams or oysters in the previous 12 months from the telephone screener to estimate the percentage of harvesters in the license holder population, ($\alpha_{harvested}$). This sum represents the denominator in the standard response rate calculation. The numerator is simply the number of completed surveys received from clam or oyster harvesters. This calculation estimates the response rate among Puget Sound recreational clam and oyster harvesters, rather than among all license holders in general.

$$\text{Effective Response Rate} = \frac{\text{Completed}_{\text{harvested}}}{\text{Sent}_{\text{harvested}} + \alpha_{\text{harvested}}\,(\text{Sent}_{\text{total}} - \text{Sent}_{\text{harvested}})}, \quad (1)$$

where *total* refers to the total sample, and *harvested* refers to the portion of the sample who had harvested clams or oysters in Puget Sound in the previous 12 months. Note that $Sent_{total} - Sent_{harvested}$ represents the number of mail surveys sent to license holders who could not be reached by the telephone screener. The percentage of clam or oyster harvesters ($\alpha_{harvested}$), among the two license types sampled, was estimated to be 15.4%. Using this approach, our effective response rate was estimated to be 50.2%.

Survey Responses

One goal of this project was to describe the characteristics of harvesters and harvesting trips, to help place this recreational activity in an appropriate context. In this section, we provide detail on the trips made by respondents with a focus on the most recent trip, as well as providing some information on the demographics of the harvesting population.

Characteristics of Trips

The survey instrument asked respondents if they had harvested razor clams within the last 12 months, in order to draw attention to the fact that the remainder of the questions did not include razor clams. Razor clam harvesting is quite popular on the Washington coast during the (somewhat infrequent) openings, though these clams are not found in Puget Sound. This question was chosen, in part, to ensure that the definition of "clams and oysters in Puget Sound" used throughout the remainder of the questionnaire was understood to exclude razor clams. Somewhat surprisingly, we found that the majority of respondents (70%) had not harvested razor clams (Table 1) in the previous year.

Next, respondents were asked for the number of days they had spent harvesting Puget Sound shellfish, by type, in the previous 12 months (Table 2). The average number of days was highest for clams and crab (3.7), followed by oysters (2.4), shrimp (0.7), and other species (0.2). Respondents therefore spent a majority of their time harvesting clams and oysters, as this represents 57% of the total number of days. All remaining questions were dedicated to these species, and any respondents who had not targeted or harvested them that year were directed to skip to the demographic questions at the end of the survey instrument.

A number of questions were used to gather characteristics of the beach each respondent used most often to harvest clams or oysters in Puget Sound. There are a number of private tidelands, so respondents were asked to classify their most-used beach as either public or private. Most indicated that they typically harvested clams or oysters at a public beach (61%, Table 3). It would

Table 1. Number of respondents who harvested razor clams in the previous 12 months (n = 548).

Harvested	Number
Yes	163
No	378
Did not answer	7

Table 2. Average number of days spent harvesting during the previous 12 months in Puget Sound.

Type of shellfish	Average days
Clams[a]	3.7
Oysters	2.4
Crab	3.7
Shrimp	0.7
Other shellfish	0.2

[a] Other than razor clams.

be useful to compare this to a preexisting estimate. However, creel surveys and flyover counts by the Washington Department of Fish and Wildlife are only conducted for managed public beaches; there are no existing use estimates for unmanaged public or private beaches.

Because a major goal of this research project was to understand how respondents switch to nearby beaches in the event of an environmental closure, a first step toward this understanding was made by asking respondents whether they use alternate beaches (Table 4). More than half of the respondents (63%) stated that they did not use any nearby alternate beaches. Those who did use alternate beaches tended to only use very close beaches; 29% used an alternate beach within 20 miles (32 km), whereas only 7% used a beach beyond 20 miles.

Travel cost is an important component of the total cost of a harvest trip; knowing it is necessary to estimate models of recreational demand. In order to estimate the travel cost of a harvest trip, we took the product of the number of miles traveled and a commonly used variable cost-per-mile from AAA. The survey instrument directly asked respondents for the number of miles traveled to reach the site by car and by boat, and whether they traveled at all by foot. The average respondent traveled 43.1 miles (69 km) by car and 0.6 miles (1 km) by boat (not including ferries) each way (Table 5). Many respondents also walked to the beach (18%), and, for 12% of respondents, the entire trip was made on foot. Some respondents provided the name of the beach without providing the number of miles traveled to reach the site. For these cases, we used Google Maps to fill in the mileage and determine whether or not a ferry would be needed. We also used Google to provide an estimate of travel time for all respondents.

Table 3. Respondents' most often used beach type (n = 548).

Beach type	Number
Public beach	314
Private beach	200
Did not answer	34

Table 4. Distance from most used beach to nearby beaches (n = 560[a]).

Distance from most used beach	Number
Within 10 miles (16 km)	115
Between 11 and 20 miles (17–32 km)	38
Between 21 and 30 miles (33–48 km)	19
More than 30 miles (48 km)	20
No nearby beaches	330
Did not answer	38

[a] Respondents were able to choose multiple answers.

Table 5. Average distance respondents traveled to their most often used beach (n = 513[a]).

Mode of travel	Miles	(Km)
By car	43.1	(69.36)
By boat	0.6	(0.97)

[a] Sample size affected by item nonresponse.

Table 6. Respondents' preference for day vs. overnight trips (n = 548).

Trip type	Number
Day trip	255
Overnight	262
Did not answer	31

Many recreational demand models separate day trips from overnight trips. In order to allow for this, the survey instrument asked whether harvest trips to the beach used most often were usually a day trip or an overnight trip. Responses to this question were evenly split: 49% usually took day trips, and 51% usually spent the night (Table 6).

The relative importance of the motivations behind harvesting clams or oysters in Puget Sound can help managers more fully understand the behavior of harvesters, and the potential impact of management actions such as closures. Respondents were asked whether they strongly agreed, agreed, felt neutral, disagreed, or strongly disagreed with a series of statements describing their personal motivations for harvesting. While most of the answers were concentrated in the "strongly agree" and "agree" categories, there was some variation across statements (Table 7). For example, more than 90% of respondents agreed or strongly agreed with the statement that they harvest in order to eat something they caught themselves, whereas 62% of respondents agreed or strongly agreed with the statement that they harvest in order to get some exercise. Spending time outdoors, spending time with the family, and spending time with friends were also cited as reasons to harvest by more than 80% of the respondents.

It is likely that the effect of a pollution or biotoxin closure is related to the frequency with which a recreational harvester consumes meals containing their Puget Sound catch. The survey classified the frequency of clam or oyster meals as almost never, about once per year, two to three times per year, four to ten times per year, or more than ten times per year. More than half of the respondents consumed at least four meals per year (53%, Table 8), and 18% consumed more than ten meals per year. Only 3% of respondents had not consumed a meal containing personally harvested Puget Sound clams or oysters during the previous year.

The likelihood of taking a trip to harvest shellfish in the next year can be used to verify answers to the CB questions. For example, respondents who indicated that they were very unlikely to take a trip over the next 12 months should not have indicated in a later section of the same survey

Table 7. Reasons for harvesting clams or oysters in Puget Sound (n = 548).

Reasons to harvest	Strongly agree	Agree	Feel neutral	Disagree	Strongly disagree	Did not answer
Spend time outdoors	249	185	42	6	4	62
Spend time with family	230	175	52	12	10	69
Spend time with friends	208	180	67	10	9	74
Relax	195	156	102	16	6	73
Get some exercise	136	152	122	45	13	80
Eat something I caught	296	149	37	7	3	56
Provide food for family	206	136	100	22	14	70

Table 8. Frequency of meals containing clams or oysters personally harvested in Puget Sound (n = 548).

Frequency	Number
Almost never	16
About once per year	66
Two to three times per year	159
Four to ten times per year	179
More than ten times per year	91
Did not answer	37

Table 9. Likelihood that respondents would harvest shellfish in Puget Sound again in the next 12 months (n = 548).

Likelihood	Number
Definitely will harvest	290
Very likely	126
Somewhat likely	64
Very unlikely	25
Definitely will not harvest	3
Did not answer	40

instrument that they would take many trips. More than half of the respondents said they would definitely harvest (57%), 25% were very likely, 13% were somewhat likely, 5% were very unlikely, and less than 1% would definitely not harvest (Table 9).

The survey used a related question to verify the seasonality of stated trips in the CB section. Respondents were asked whether they take trips to harvest clams or oysters in Puget Sound during each calendar month. In addition to identifying potential issues with the CB data (e.g., stated trips during months in which they do not typically harvest), responses to this question can be used to show the general seasonality of participation. Note that this does not show the seasonality of effort made by harvesters, as the number of trips within each month was not provided. Defined as the percentage of Puget Sound harvesters active in each month, participation was estimated to be quite low in January and February (13% and 14%), increasing steadily to reach its maximum in July (56%), before dropping steadily back down to the winter low in December (14%; Table 10, Figure 1). Not surprisingly, periods of high participation corresponded to less inclement weather. This also lines up with times of the year during which low tides occur during daylight hours, as low tides during the fall and winter occur at night.

Table 10. Percentages of active harvesters, by month.

Month	Percent active
January	13%
February	14%
March	20%
April	30%
May	42%
June	49%
July	56%
August	50%
September	34%
October	21%
November	17%
December	14%

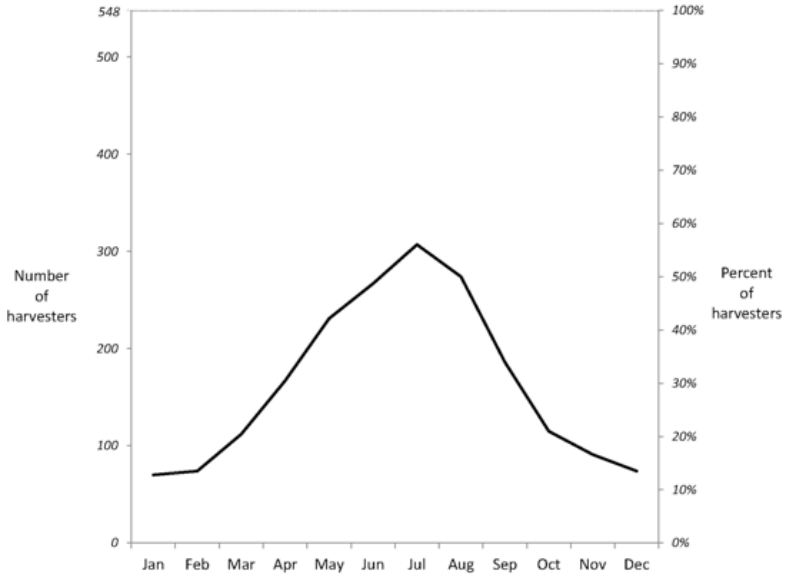

Figure 1. Number and percentage of respondents who reported harvesting shellfish, by month (n = 548).

Table 11. Number of days spent on most recent harvesting trip.

	Average days
Total	2.1 (n = 500[a])
Harvesting	1.6 (n = 491[a])

[a] Sample sizes differ due to item nonresponse.

Table 12. Number of respondents for whom the primary purpose of the most recent trip was harvesting clams or oysters (n = 548).

Primary purpose	Number
Yes	293
No	208
Did not answer	47

Most Recent Trip Information

A more detailed set of questions was asked about each respondent's most recent Puget Sound shellfish harvesting trip. This level of information would be useful to collect for a longer time series from each respondent, but it was decided that this would impose too great a burden while introducing recall errors.

The length of time respondents spent on the most recent harvesting trip was queried in three different ways: the total number of days spent on the trip, the number of days spent harvesting, and the number of hours spent harvesting. The average trip was 2.1 days long, of which 1.6 days were spent harvesting clams or oysters (Table 11). However, there was a significant amount of variation in responses to these questions, ranging from a day trip (59% of total trips) to almost three weeks. The average harvester had spent just over three hours harvesting on the beach on their most recent trip.

The primary purpose of the most recent trip was shellfish harvesting for roughly 59% of respondents (Table 12). Answers to this question are sometimes used to identify trips and trip-related values (e.g., expenditures) that may continue to occur without the possibility of harvest.

The number of shellfish harvested per person per day provides a measure of success (Table 13), though it should be noted that these numbers are often constrained by daily limits set by the Washington Department of Fish and Wildlife for publicly managed beaches.[3] Daily harvest rates of clams defined as "steamer clams" by the survey instrument (from focus group input), including manila (*Venerupis philippinarum*), littleneck (*Leukoma staminea*), butter (*Saxidomus gigantea*), cockle (*Clinocardium nuttallii*), softshell (*Mya arenaria*), and macoma (*Macoma nasuta* and *Macoma brota*) were quite high (23.1/person/day), considering not all trips targeted these species. Harvest rates for geoduck clams (*Panopea generosa*), horse clams (*Tresus nuttallii* and *Tresus capax*), and oysters (*Crassostrea gigas* and *Ostrea conchaphila*) were much lower (0.7, 0.9, and 0.4, respectively).

Trip expenditures per person can be used to estimate the economic impact of recreational clam and oyster harvesting in Puget Sound. Respondents were asked to provide their personal expenditures and the number of people covered by each expense for a set of categories grouped into transportation and lodging or food (Table 14). From these results, it is clear that fuel and food

[3] Private tideland owners and lessees and members of their immediate family are exempt from personal use daily limits when taking clams, oysters, and mussels harvested for their own personal use from their own tidelands (WDFW 2015).

Table 13. Number of shellfish harvested on most recent trip (n = 495[a]).

Type	Average harvest
Steamers	23.1
Geoduck	0.7
Horse	0.9
Oysters	0.4

[a] Sample size affected by item nonresponse.

Table 14. Expenditures, per person, on most recent trip (n = 469[a]).

Category	Expenditures per person
Auto, truck, or RV fuel	$16.41
Boat fuel	$1.46
Parking or boat launch	$2.22
Ferry	$2.16
Other transportation	$0.08
Campgrounds and trailer parks	$3.61
Hotels, motels, and B&B	$0.46
Vacation rental	$2.11
Grocery and convenience stores	$12.98
Restaurants and bars	$5.37
Other lodging or food	$3.46

[a] Sample size affected by item nonresponse.

make up the majority of trip costs. The total trip cost per person is estimated to be $50.32. These numbers can be divided by the average number of days per trip to convert this to an estimate of the total cost per harvesting day.

Demographics

The average age of respondents was 54 years, and the majority of respondents were male (63%). The average household size consisted of 2.0 adults and 0.59 children. Overall, respondents were highly educated (Table 15); the majority were college graduates (54%), followed by those who had completed some college (26%) and high school graduates (14%).

There was a large amount of variation in annual household income across respondents (Table 16). Responses were spread out somewhat uniformly throughout the provided categories, with the highest number of respondents falling into two bins: $60,000–$79,999, and $150,000 or more. As is common in survey research, this question was subject to a high degree of item nonresponse. Hourly wages (Table 17) can be used as an alternative means to estimate household income. Though hourly wage may be a more direct measure of the personal opportunity cost of time than

Table 15. Highest level of education completed (n = 548).

Highest completed level	Number
Some high school	8
High school graduate	74
Technical School	27
Some college	135
College graduate or more	283
Did not answer	21

Table 16. Household income (n = 548).

Income ($)	Number
Less than $20,000	25
$20,000–$39,999	59
$40,000–$59,999	74
$60,000–$79,999	82
$80,000–$99,999	68
$100,000–$124,999	59
$125,000–$149,999	41
$150,000 or more	83
Did not answer	57

Table 17. Hourly wages (n = 315[a]).

Wage rate	Number
$5.00–$9.99	10
$10.00–$14.99	26
$15.00–$19.99	32
$20.00–$29.99	70
$30.00–$39.99	53
$40.00–$49.99	34
$50.00–$59.99	24
$60.00–$74.99	12
$75.00 or more	12
Did not answer	42

[a] Answers were conditional on answering yes to working full- or part-time, and were affected by item nonresponse.

Table 18. Employment outside the home (n = 548).

Status	Number
Not employed outside home	191
Worked part-time	57
Worked full-time	269
Did not answer	31

Table 19. Number of respondents who took time off work to harvest shellfish (n = 333[a]).

Time off	Number
Did not take time off	182
Took paid time off only	94
Took unpaid time off only	45
Take both paid and unpaid time off	7
Did not answer	5

[a] Sample size differs from Table 17 because respondents were allowed multiple answers.

household income, its use involves a tradeoff; hourly wage was subject to an even higher degree of item nonresponse than household income (13.3% vs. 10.4%). A majority of respondents worked outside the home (Table 18), whether full- (52%) or part-time (11%). However, a large percentage of respondents classified themselves as homemakers, retired, or currently unemployed (37%).

In order to understand the full trade-off respondents are making when they decide to take a shellfish harvesting trip, we asked those who worked outside the home whether they had taken time off work to harvest (Table 19). While the majority of respondents had not taken any time off work for the purpose of harvesting shellfish (54%), those who did tended to use paid time off (28%) more than unpaid time off (13%).

Comparison with Telephone Screener

While the primary purpose of the telephone screener was to identify license holders who had harvested clams or oysters in Puget Sound, the data can also be used in comparison to the mail survey data in order to examine potential nonresponse bias. While nonresponse is still possible with a telephone screener, refusals on a short telephone survey may be a subset of the potential refusals on a longer mail survey. If the telephone screener is a better measure of the underlying population, differences between the two data sources may be evidence of nonresponse bias.

Here we examine five of the seven questions on the telephone screener that were repeated on the mail survey. Differences between the answers to the two different surveys may be a sign of differences in metrics important to our intended analyses, such as preferences or expenditures.

Overall, we found no meaningful differences, meaning that the mail survey was not subject to differential nonresponse bias relative to the telephone screener. Approximately 60% of respondents from the telephone screener typically used a public beach for harvest, compared to 61% from the mail survey. The average distance traveled to the beach was 48.3 miles (78 km)

estimated from the telephone screener, compared to 43.7 miles (70 km) from the mail survey. Both data sets show that respondents were very likely to take at least one trip to harvest clams or oysters in Puget Sound within the next 12 months. The telephone screener is very consistent with the mail survey results: from the telephone screener (mail survey), 59% (57%) of respondents stated they will definitely harvest, 24% (25%) were very likely to harvest, 13% (13%) were uncertain, 4% (5%) were very unlikely to harvest, and 0% (1%) stated they will definitely not harvest. The mean age from the telephone screener was 55.9, very similar to the mean age of 53.7 from the mail survey. The greatest difference between the two samples was observed in household income levels. Relative to the survey, the screener had a smaller share of responses under $40,000, a larger share between $40,000 and $100,000, and a smaller share above $100,000. While this difference is sufficient to be statistically significant at standard confidence levels ($\chi^2 = 18.39$; $P = 0.01$), it may be less of a concern than if one income distribution had been consistently higher.

Conclusion

The Puget Sound Recreational Shellfishing Survey collected data on recreational clam and oyster harvesters in Puget Sound. The methodology used to create, test, and administer the survey provided results that should generalize to the population. We explored this, to the extent possible, by comparing answers from the telephone screener to the answers from the mail survey, and found a remarkably high level of similarity between the two sets of answers.

Although we provide a set of general survey results here, further analysis is planned. In particular, the CB data will help us estimate economic models of harvesting trips, focusing on the impact of pollution and biotoxin closures on harvesting effort, trip expenditures, and net economic values.

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Appendix A

The experimental design for the contingent behavior (CB) included scenarios comprising biotoxin and pollution closures of varying spatiotemporal extent. Each of the four CB questions presented a single closure that was described by type (biotoxin or pollution), length in months (1, 2, 3, or 12), and additional distance to the nearest fully open beach (5, 10, 20, or 30 miles [8, 16, 32, or 48 km]). In addition, the biotoxin closures were further broken down by the species affected: either all clams and oysters, or butter clams only.

We used two separate experimental designs for the full-year and partial-year CB scenarios. In order to allow separate models to be estimated for full-year and partial-year closures, we designed the survey so that each respondent received two full-year scenarios and two partial-year scenarios. The candidate set for both experimental designs is essentially the full factorial. However, we eliminated cases where there was a pollution closure that affected only butter clams from the candidate set, based on the absence of such closures in practice.

The design for the full-year closure scenarios was constructed from the remaining 3 × 4 factorial. We used four full replications (five for two profiles[4]), blocked across the 25 survey versions. The design for the partial-year closure scenarios was constructed with a computerized search algorithm that uses D-efficiency[5] as the criterion (Kuhfeld et al. 1994). We used this algorithm to select a very efficient design with 54 closure profiles. Next, we generated all possible combinations of 50 profiles from these 54, retaining the five combinations with highest D-efficiency as candidate designs.

There was some concern that reliance on design techniques that use the D-efficiency of a linear model as the sole criterion for selection might not be well suited to generate an experimental design for a (nonlinear) count model. Therefore, we turned to simulation to examine the competing experimental designs more closely.

We generated count data assuming a Poisson distribution and homogeneous preferences for closures (across both individuals and closure-types). For each of the competing experimental designs, we generated 500 draws of trips, estimated model parameters, and saved model output. Using these draws, we examined the fifth and tenth percentiles of the t-statistics for parameter estimates. The results from this simulation were consistent with the (linear model) D-efficiency measures, so the candidate design with the highest D-efficiency was selected as the final design for the partial-year closure CB questions.

The final design for the partial-year closures was blocked into 25 sets of two by holding all design variables orthogonal to the blocking variable, thus ensuring that closure types were evenly spread across survey versions.

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[4] Due to a combination of constraints imposed by the project budget and a desire to keep the survey booklet to 16 pages, 25 versions of the survey were used, each with four CB questions: two full-year closure scenarios and two partial-year closure scenarios. Since the number of pages allocated to the full-year closures (50) was not equally divided by the size of the full factorial (12), it was necessary to repeat two profiles an additional time.

[5] D-efficiency is calculated as $(|\Omega^{1/K}|)^{-1}$, where K is the number of model parameters. The covariance matrix, Ω, is equal to $\sigma^2(X'X)^{-1}$, where X is the design matrix.

Appendix B

The following pages include the full set of contacts that were included in the survey.

Contact 1: Telephone Screener

Initial Telephone Contact Survey, Draft

This study is subject to strict research protocols. Please follow the script as closely as possible.

INTRO:
Hello, my name is _____. I work for Pacific Market Research and I'm calling on behalf of NOAA Fisheries. We are calling people about recreational shellfish harvesting in Puget Sound. This survey is being conducted to gather information about your shellfishing activities. Your answers will provide fishery managers with information that can be used to help make important decisions.

Hello, may I speak with [Respondent]?

01 (SKIP TO Intro 2:) YES, RESPONDENT AVAILABLE
02 (SKIP TO EXIT1) NO, RESPONDENT UNAVAILABLE
03 DON'T KNOW/REFUSED [Schedule callback]

EXIT1: Thank you, I will call back later. When would be a good time to reach [Respondent]?

[Q: What is NOAA Fisheries? A: NOAA Fisheries is the federal agency responsible for the stewardship of the nation's living marine resources and their habitat.]

[Q: How did you get my name/phone number? A: Your name/telephone number was drawn in a random sample of people who purchased a license in Washington]

[Q: Is this interview confidential? A: This interview is completely confidential. Your name will never be linked to your responses in any way.]

[Q: Why is NOAA doing a survey on Puget Sound shellfish? / Doesn't WDFW manage shellfish in Puget Sound? A: WDFW and NOAA are partners in the management of the Puget Sound.]

Intro 2:
Before we begin, I want to assure you that your answers will be kept completely confidential and this call may be monitored for quality assurance. This is a voluntary state-wide study, and we appreciate your assistance.

Intro 3:

I'm going to read you a few short questions about your recreational shellfish activities in Washington.

1. Have you taken any trips where you harvested *razor clams* in Washington in the last 12 months?

01 Yes
02 No
03 DON'T KNOW/NOT SURE
04 REFUSED

2. Have you taken any trips where you harvested *oysters or clams* in *Puget Sound* in the last 12 months?

01 Yes
02 No
03 DON'T KNOW/NOT SURE
04 REFUSED
/IF Q2 in {02, 03, 04} THEN SKIP TO ENDING1/

3. On your harvesting trips in Puget Sound, do you typically harvest oysters or clams from a *public beach* or a *private beach*?

01 Public
02 Private
03 DON'T KNOW/NOT SURE
04 REFUSED

4. Approximately how many one-way miles do you travel to get to the beach you most often use to harvest oysters or clams in Puget Sound?

01 [Record mileage]
02 DON'T KNOW/NOT SURE
03 REFUSED

5. During the next 12 months, how likely is it that you will take a trip where you harvest shellfish in Puget Sound?

01 Definitely will harvest shellfish
02 Very likely
03 Somewhat likely
04 Very unlikely
05 Definitely will not harvest shellfish

Intro 4:
So we can see how your shellfishing activities compare with those of other people, I'd like a few demographic questions. Again, please remember that all your answers are kept *completely* confidential. .

6. In what year were you born?

01 [Record year]
02 DON'T KNOW/NOT SURE
03 REFUSED

7. I'm going to read you some income categories. For classification purposes only, please tell me which income category best describes your household's total annual income before taxes in 2012. When I read your household income category, please stop me.

01 Less than $20,000
02 More than $20,000 but less than $40,000
03 More than $40,000 but less than $60,000
04 More than $60,000 but less than $80,000
05 More than $80,000 but less than $100,000
06 More than $100,000 but less than $125,000
07 More than $125,000 but less than $150,000
08 More than $150,000
09 Refused

[If R Refuses: Your answers are completely confidential and will only be used for classification purposes. You will never be identified with your response.]

▶GO TO ENDING 2

ENDING1:
Thank you very much for your help today.

ENDING2: Thank you very much for your help today. This call is part of a larger research project to help managers learn more about the likes and dislikes of shellfish harvesters like you. I'd like to send you a short survey in the mail if I could just verify the address I have from your license. I have

Name_____

Street Address_____

City_____State_____Zip_____

Phone_____

[If R Refuses: Very few people were selected for this survey, so your help is critical to its success. Your participation will help provide important information to managers to improve your shellfish harvesting opportunities. The survey should not take more than 20 minutes to complete. We really appreciate your help.]

Thank you, you will be receiving a short survey in the mail in the next few weeks.

Contact 2: Prenotice Letter

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
National Marine Fisheries Service
NORTHWEST FISHERIES SCIENCE CENTER

Puget Sound Recreational Shellfishing Survey

<Month Day, Year>

<First Last>
<Street Address>
<City, State Zip>

Dear <First Last>:

A few days from now you will receive a short questionnaire for an important study being conducted by NOAA Fisheries *(National Marine Fisheries Service).*

The **Puget Sound Recreational Shellfishing Study** will help us learn more about your interest and success in harvesting clams or oysters from Puget Sound beaches. This study will be used to improve the management of Washington's recreational shellfishing through a better understanding of the activities and preferences of harvesters like you. Even if you have not harvested clams or oysters from Puget Sound beaches, it is important that we hear from you.

We need your help. Your response will provide important information to shellfish managers. This information can be used to:

- Improve your shellfishing experience and opportunities, and
- Enhance sound management practices.

Your name was selected at random from people who purchased a Washington fishing or shellfishing license. Very few people were chosen for the study, so your help is critical to its success. We will send you a questionnaire through Pacific Market Research, a nationally recognized survey research firm who is our partner in conducting the survey. Simply complete the questionnaire, and return it in the postage paid envelope provided.

If you would like to learn more about this important survey, or have any questions, please call me at 1-877-321-5874.

Thank you very much for your help!

Sincerely,

Mark Plummer
Project Director
NOAA Fisheries | Northwest Fisheries Science Center

Contact 3a: First Mailing

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
National Marine Fisheries Service
NORTHWEST FISHERIES SCIENCE CENTER

Puget Sound Recreational Shellfishing Survey

<Month Day, Year>

<First, Last>
<Street Address>
<City, State Zip>

Dear <First Last>:

Enclosed is the survey we mentioned in our previous letter to you. The **Puget Sound Recreational Shellfishing Survey** is being conducted by NOAA Fisheries *(National Marine Fisheries Service)*. This is your chance to help improve recreational shellfishing in Puget Sound.

Your answers can be used to:

- Help shellfish managers understand what harvesters like and dislike
- Enhance your shellfish harvesting experience, and
- Improve the management of recreational shellfishing in the region.

Your answers are completely confidential and will be released only as summaries in which no individual's answers can be identified. There are no right or wrong answers and even if you've never harvested shellfish from Puget Sound beaches, it is important that we hear your opinions.

If you have any questions please call me at 1-877-321-5874.

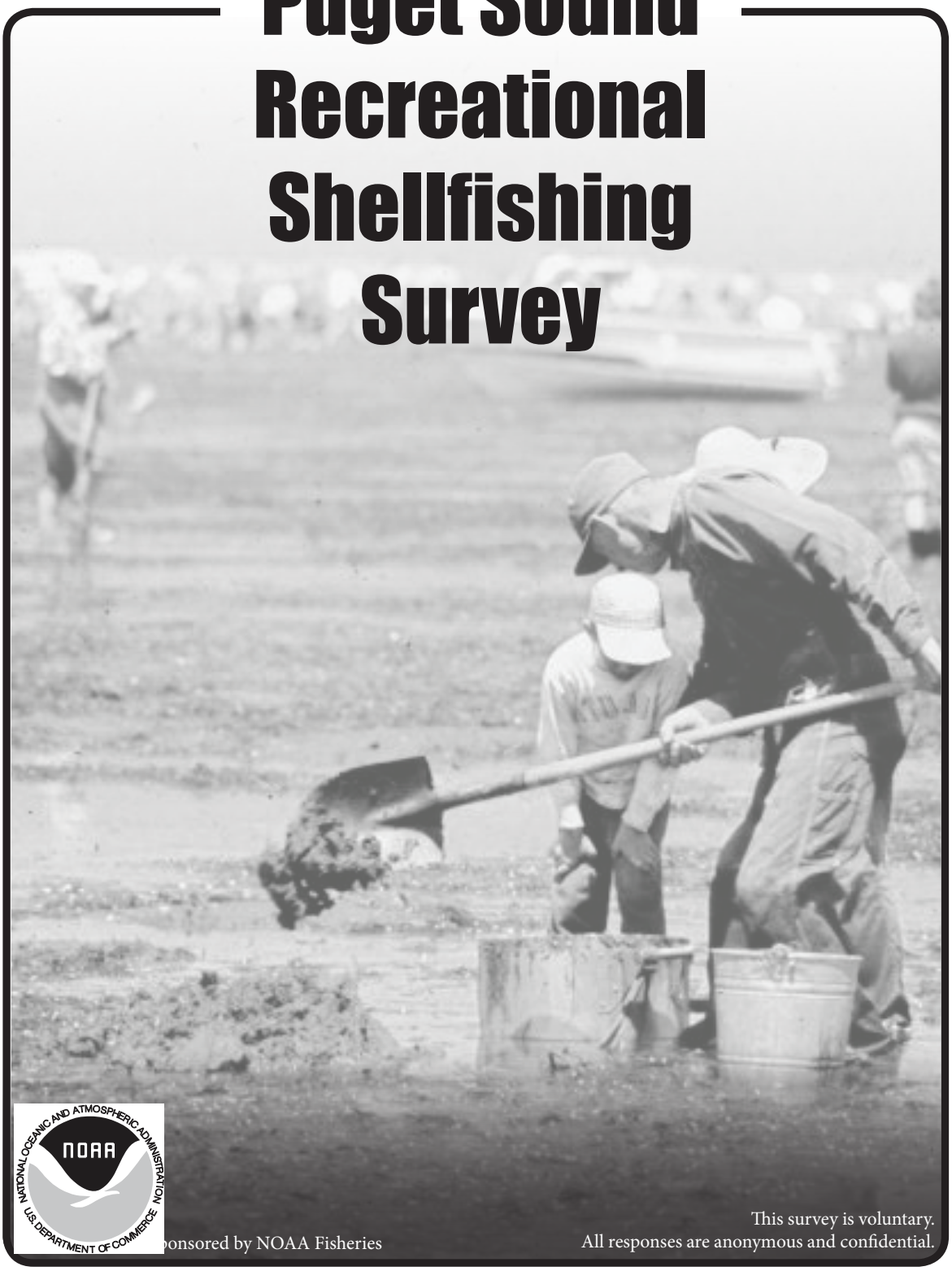
Thank you very much for your help!

Sincerely,

Mark Plummer
Project Director
NOAA Fisheries | Northwest Fisheries Science Center

Contact 3b: The Survey

Puget Sound Recreational Shellfishing Survey



onsored by NOAA Fisheries

This survey is voluntary.
All responses are anonymous and confidential.

Information about Washington Shellfish

Razor clams

- In Washington, five Pacific coast beaches are periodically open to razor clam digging, depending on tides and marine-toxin levels.
- These clams can be dug with a clam shovel or a clam tube.
- The daily limit is the first 15 razor clams, regardless of size or condition.

Crab

- Several species of crab are found in Washington's marine waters and along its shores, but the two most popular are Dungeness and red rock crab.
- The Dungeness crab is frequently associated with eelgrass beds and prefers sandy or muddy areas. The red rock crab prefers rocky areas, as its name implies.
- Crab pots are the most commonly used gear to catch Dungeness and red rock crab in Puget Sound.
- For Puget Sound, the crab season is usually open July through September.

Shrimp

- Many varieties of shrimp are found in the waters of Puget Sound, with spot shrimp being the most popular. Shrimp are found primarily on or near the bottom, and are most frequently caught at depths of 30 to 300 feet.
- Shrimpers use pots of various sizes and designs.
- Shrimp seasons in Puget Sound run from late spring through early fall, although the season for spot shrimp can be much shorter.

Clams (other than razor clams) and Oysters

- The beaches that surround Puget Sound are populated by a variety of clams (Manila, native littlenecks, butter, cockles, macomas, eastern softshell, varnish, geoduck, and horse clams), plus oysters. All are available for harvest at Puget Sound beaches at various times of the year.
- Except for the larger butter clams, rakes are usually most effective for gathering clams, and are less damaging to the clams and the beach. To unearth a geoduck, you'll generally need to excavate a hole up to three feet deep. The only equipment needed to collect oysters are sturdy gloves to protect your hands and a bucket.
- For "steamer" clams (which include all varieties except geoduck and horse clams), the daily limit is 40 clams or 10 pounds in the shell, whichever comes first. There are also separate daily limits for geoducks (three), horse clams (seven) and oysters (18).

This survey focuses mostly on clams (other than razor clams) and oysters.

Section A: Your Washington Shellfishing Activities

The questions in this survey are about YOU and YOUR shellfishing activities and preferences. Except when asked, please do not include any information from other household members or other shellfishing party members.

Please print clearly.

Write numbers as two digits: 1 trip = 0 1 *Fill in boxes with a* ☑ *or* ☒

Have you harvested RAZOR CLAMS in Washington in the last 12 months?

☐	Yes
☐	No

Please tell us the number of days in the last 12 months you spent recreationally harvesting each of the following types of shellfish in PUGET SOUND, including the San Juan Islands, Strait of Juan de Fuca, and Hood Canal. **(If you harvested more than one type of shellfish on the same day, please count that day toward the type of shellfish you spent the most time harvesting)**

TYPE of SHELLFISH	# DAYS in Last 12 Months
Clams (other than razor clams)	
Oysters	
Crab	
Shrimp	
Other (specify):_____	

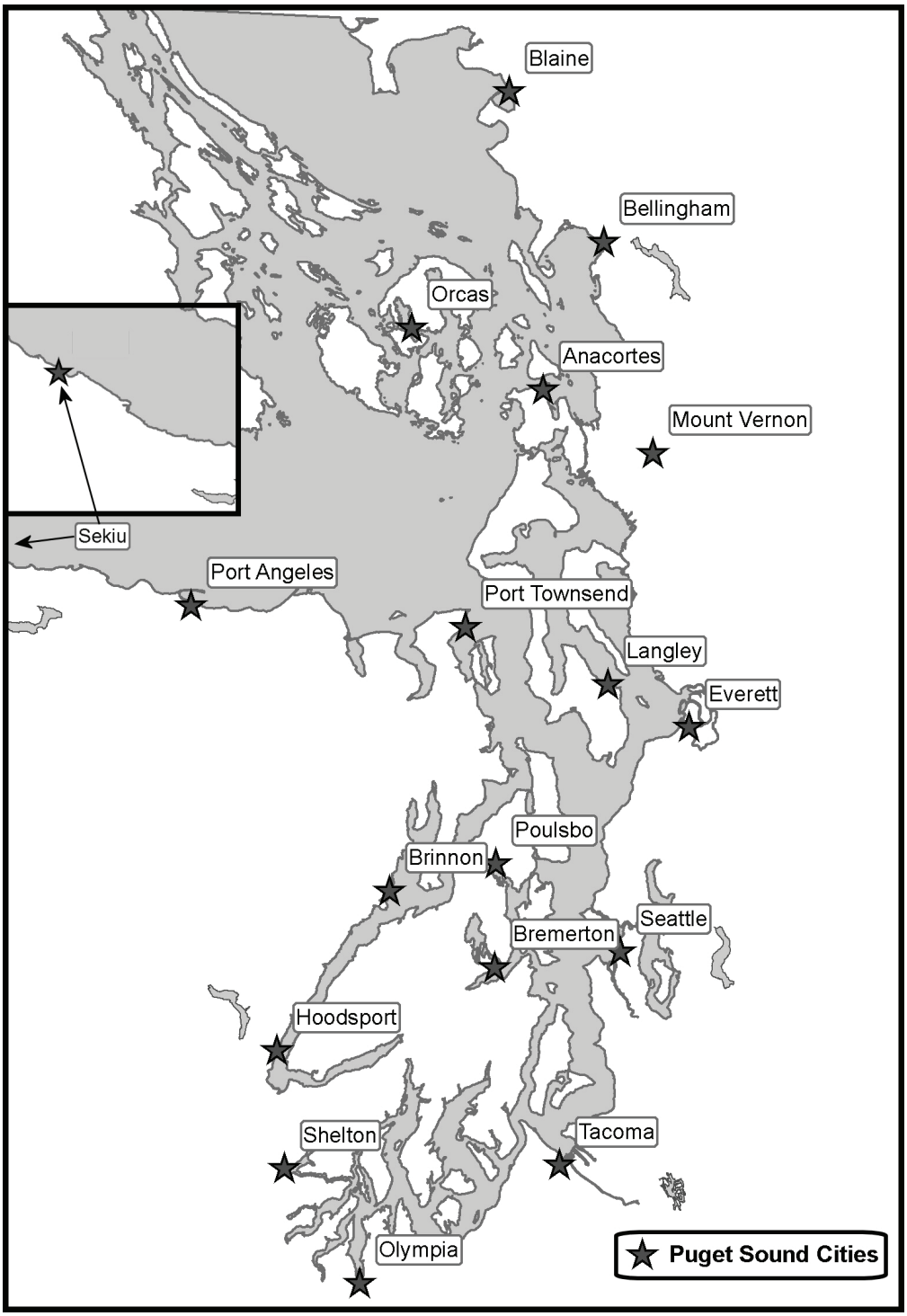
Based on your answer to question A2:

If you harvested CLAMS (other than razor clams) or OYSTERS in PUGET SOUND in the last 12 months, please continue ⬇ to the next page.

If you did not harvest CLAMS (other than razor clams) and did not harvest OYSTERS in PUGET SOUND in the last 12 months, please skip ➲ to question D1 on page 15.

Questions? Call us at 1-877-321-5874

Please use this map of Puget Sound when answering the questions on the next page.
The locations of some cities are given to help you locate your beach.



Questions? Email us at Mark.Plummer@noaa.gov

A3 Please think about all of the trips you took to harvest clams or oysters in Puget Sound within the last 12 months. On the map, please use an 'X' to mark the location of the one beach you most often used in the last 12 months to harvest clams or oysters.

A4 Is this beach a public beach (state park, county park, or other public beach) or private beach?

☐	Public beach
☐	Private beach

A5 What is the name of this beach? **(if this is an unnamed private beach, leave blank)**

A6 For the beach you most often used, how many one-way miles do you travel to get there by car, by boat (not including ferry), by foot, or a combination? **(mark all that apply, round to nearest mile)**

By car: ☐ I travel ☐☐☐ miles by car.

By boat: ☐ I travel ☐☐☐ miles by boat (not including ferry).

By foot: ☐

A7 Do you take a ferry as part of your trip to get to the beach you most often used?

☐	Yes
☐	No

A8 On the trip(s) you took to the beach you most often used, did you usually stay one or more nights in a house you own, a vacation rental, a hotel / motel, or a campground?

☐	No. This is usually a day trip.
☐	House I own
☐	Vacation rental
☐	Hotel, motel, or B&B
☐	Campground or trailer park
☐	Other lodging:_____

Questions? Call us at 1-877-321-5874

A9 Near the beach you most often use, are there other beaches that you also use to harvest clams or oysters? **(mark all that apply)**

☐	No
☐	Yes, within 10 or fewer miles of the beach I most often use
☐	Yes, between 11 and 20 miles of the beach I most often use
☐	Yes, between 21 and 30 miles of the beach I most often use
☐	Yes, more than 30 miles from the beach I most often use

A10 Below are some reasons why you might harvest clams or oysters in Puget Sound. Mark how much you agree or disagree with each statement.

"I harvest CLAMS or OYSTERS in PUGET SOUND to ... "	Strongly Agree	Agree	Feel Neutral	Disagree	Strongly Disagree
... Spend time outdoors	☐	☐	☐	☐	☐
... Spend time with family	☐	☐	☐	☐	☐
... Spend time with friends or others	☐	☐	☐	☐	☐
... Relax	☐	☐	☐	☐	☐
... Get some exercise	☐	☐	☐	☐	☐
... Eat something I caught myself	☐	☐	☐	☐	☐
... Provide food for me or my family	☐	☐	☐	☐	☐

A11 Approximately how often do you consume meals that contain the clams or oysters you've harvested from Puget Sound?

☐	Almost never
☐	About once per year
☐	Two to three times per year
☐	Four to ten times per year
☐	More than ten times per year

Questions? Email us at Mark.Plummer@noaa.gov

Section B: Your Most Recent Puget Sound Clam or Oyster Trip

DO NOT include a trip to the ocean beaches to harvest razor clams.

B1 When was the last trip where you harvested clams or oysters in Puget Sound?

Month: ☐☐

B2 How many DAYS did you spend on this trip? **(count partial days as full days and include travel)**

\# Days: ☐☐

B3 How many DAYS did you spend harvesting clams or oysters on this trip? **(count partial days as full days)**

\# Days Harvesting Clams / Oysters: ☐☐

B4 How many total HOURS did you spend harvesting clams or oysters on this trip? **(round to nearest hour)**

\# Hours Harvesting: ☐☐

B5 On this trip, did you use a public beach (state park, county park, or other public beach) or private beach?

☐	Public beach
☐	Private beach

B6 What is the name of the beach you used on this trip to harvest clams or oysters in Puget Sound?
(if this is an unnamed private beach, leave blank)

☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

B7 How many one-way miles did you travel to get to this beach by car, by boat (not including ferry), by foot, or a combination? **(mark all that apply, round to nearest mile)**

By car: ☐ I traveled ☐☐☐ miles by car.

By boat: ☐ I traveled ☐☐☐ miles by boat (not including ferry).

By foot: ☐

Questions? Call us at 1-877-321-5874

B8 Was harvesting clams or oysters the primary purpose of this trip?

☐	No ⬇ **Continue**	☐	Yes ➲ **Skip to question B11 on page 9**

B9 As part of this trip, did you stay one or more nights in a house you own, a vacation rental, a hotel / motel, or a campground?

☐	No. This was a day trip. ➲ **Skip to question B11 on page 9**
☐	House I own
☐	Vacation rental
☐	Hotel, motel, or B&B
☐	Campground or trailer park
☐	Other lodging:_____

B10 (If overnight trip) How many one-way miles was the beach you used to harvest clams or oysters from the place you stayed the night? **(mark all that apply, round to nearest mile)**

By car: ☐ I traveled ☐☐ miles to the beach by car from the place I stayed.

By boat: ☐ I traveled ☐☐ miles to the beach by boat (not including ferry) from the place I stayed.

By foot: ☐

Questions? Email us at Mark.Plummer@noaa.gov

B11 On this trip, what type(s) of shellfish did you personally target or harvest, and how many did you personally keep?

TYPE of SHELLFISH	Targeted or Harvested? (check if yes)	Number You Kept
Steamer clams (manila, littleneck, butter, cockle, softshell, macoma)	☐	☐☐
Geoduck clams	☐	☐☐
Horse clams	☐	☐☐
Oysters	☐	☐☐
Other (specify):_____	☐	☐☐

B12 On this trip, about how much money did you or your household spend in each of the following expenditure categories? For each type, indicate the number of people covered by the expenditure.

	TYPE of EXPENDITURE	Expenditures by you or your household (round to nearest dollar)	# of people covered by this expense (including you)
Transportation	Auto, truck, or RV fuel	$ ☐☐☐☐.00	☐☐
	Boat fuel	$ ☐☐☐☐.00	☐☐
	Parking or boat launch	$ ☐☐☐☐.00	☐☐
	Ferry	$ ☐☐☐☐.00	☐☐
	Other transportation:_____	$ ☐☐☐☐.00	☐☐
Lodging / Food	Campgrounds and trailer parks	$ ☐☐☐☐.00	☐☐
	Hotels, motels, and B&B	$ ☐☐☐☐.00	☐☐
	Vacation rental	$ ☐☐☐☐.00	☐☐
	Grocery and convenience stores	$ ☐☐☐☐.00	☐☐
	Restaurants and bars	$ ☐☐☐☐.00	☐☐
	Other lodging / food:_____	$ ☐☐☐☐.00	☐☐

B13 During the next 12 months, how likely is it that you will take a trip where you harvest shellfish in Puget Sound?

☐	Definitely will harvest shellfish
☐	Very likely
☐	Somewhat likely
☐	Very unlikely
☐	Definitely will not harvest shellfish

Questions? Call us at 1-877-321-5874

Section C: Trips You Might Take During a Typical Harvest Season

In this section, we'd like you to think about the NUMBER OF TRIPS you might take during a typical season (January through December) to harvest clams or oysters in Puget Sound. We'd also like to know how different types of beach closures might affect your plans.

There are three types of closures:

A **Seasonal Closure** occurs when the Washington Department of Fish and Wildlife closes a beach for the harvest of shellfish species in order to protect and conserve shellfish populations.

A **Biotoxin Closure** occurs when the Washington Department of Health closes a beach for the harvest of some or all shellfish species due to the presence of toxic substances such as paralytic shellfish poison (also known as red tide) and domoic acid.

A **Pollution Closure** occurs when the Washington Department of Health closes a beach to the harvest of shellfish species due to pollution such as bacteria or harmful chemicals.

All of these closures can be for an entire season or for a shorter period of time, and can be for all species or just some species, such as butter clams.

During which month(s) do you take trips to harvest clams or oysters in Puget Sound? **(mark all that apply)**

☐ January	☐ April	☐ July	☐ October
☐ February	☐ May	☐ August	☐ November
☐ March	☐ June	☐ September	☐ December

Please think about the <u>beach you most often use</u> to harvest clams or oysters in Puget Sound and assume there will be <u>no</u> biotoxin or pollution closures on this beach during the harvest season.

During the harvest season, how many trips might you take to this beach where you

Harvest clams or oysters on the trip? I would take ☐☐ harvesting trips.

Do not harvest any clams or oysters on the trip? I would take ☐☐ non-harvesting trips.

Questions? Email us at Mark.Plummer@noaa.gov

Now, we will ask you about a few specific situations when a beach closure might affect the number of trips you typically make during a harvest season (January through December), depending on the

- **Type of Closure**,
- **Period of Closure**,
- **Species Closed to Harvest**, and the
- **Additional Distance to a Nearby Beach that is Fully Open**

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

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: ☐☐

For comparison, suppose instead that this closure would not occur. How many harvesting trips to the nearby beach (20 additional miles) would you now take during January through December?

Harvesting trips in January through December to nearby beach if no closure: ☐☐

C4 Now, 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 10 miles away.

Please review the following table and answer the questions below.

Information on the Closure and Your Alternatives	
Type of Closure	Pollution
Period of Closure	January through December
Species Closed to Harvest	All Clams and Oysters
Additional Distance to a Nearby Beach that is Fully Open	10 miles

C4.1 **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 (10 additional miles):

Harvesting trips: ☐☐

C4.2 For comparison, suppose instead that this closure would not occur. How many harvesting trips to the nearby beach (10 additional miles) would you now take during January through December?

Harvesting trips in January through December to nearby beach if no closure: ☐☐

Questions? Email us at Mark.Plummer@noaa.gov

C5 Now, suppose that the Department of Health has closed an area for **three months** (June through August) 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 30 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	June through August
Species Closed to Harvest	All Clams and Oysters
Additional Distance to a Nearby Beach that is Fully Open	30 miles

C5.1 **During this three month closure** (June through August), 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 (June through August) to the beach you most often use:

Harvesting trips: ☐☐

Non-harvesting trips: ☐☐

Trips during the closure (June through August) to the nearby beach that is fully open (30 additional miles):

Harvesting trips: ☐☐

C5.2 How many trips would you take **the other nine months** (before and after the closure) to the beach you most often use, and to the nearby beach that is fully open?

Trips the other nine months to the beach you most often use:

Harvesting trips: ☐☐

Non-harvesting trips: ☐☐

Trips the other nine months to the nearby beach that is fully open (30 additional miles):

Harvesting trips: ☐☐

C5.3 For comparison, suppose instead that this closure would not occur. How many harvesting trips to the nearby beach (30 additional miles) would you now take during June through August?

Harvesting trips in June through August to nearby beach if no closure: ☐☐

C6 Now, suppose that the Department of Health has closed an area for **one month** (September) 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 5 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	September
Species Closed to Harvest	Butter Clams Only
Additional Distance to a Nearby Beach that is Fully Open	5 miles

C6.1 **During this one month closure** (September), 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 (September) to the beach you most often use:

Harvesting trips: ☐☐

Non-harvesting trips: ☐☐

Trips during the closure (September) to the nearby beach that is fully open (5 additional miles):

Harvesting trips: ☐☐

C6.2 How many trips would you take **the other 11 months** (before and after the closure) to the beach you most often use, and to the nearby beach that is fully open?

Trips the other 11 months to the beach you most often use:

Harvesting trips: ☐☐

Non-harvesting trips: ☐☐

Trips the other 11 months to the nearby beach that is fully open (5 additional miles):

Harvesting trips: ☐☐

C6.3 For comparison, suppose instead that this closure would not occur. How many harvesting trips to the nearby beach (5 additional miles) would you now take during September?

Harvesting trips in September to nearby beach if no closure: ☐☐

Questions? Email us at Mark.Plummer@noaa.gov

Section D: About You and Your Household

The following questions will help us know more about shellfish harvesters. The information you provide will remain STRICTLY CONFIDENTIAL, and you will not be identified with your answers.

D1 In what year were you born?

Year: 1 9 ☐ ☐

D2 Are you . . . ?

☐ Male	☐ Female

D3 What is the highest level of education you have completed? **(mark one response)**

☐ Some high school
☐ High school graduate
☐ Technical school
☐ Some college
☐ College graduate or more

D4 How many adults and children (under 18) are there in your household including yourself?

Adults: ☐ # Children: ☐☐

D5 Which of the following best describes your household's TOTAL annual income before taxes in 2012?

☐ Less than $20,000	☐ $80,000 - $99,999
☐ $20,000 - $39,999	☐ $100,000 - $124,999
☐ $40,000 - $59,999	☐ $125,000 - $149,999
☐ $60,000 - $79,999	☐ $150,000 or more

D6 Are you employed part time or full time outside the home?

☐ No, I am a homemaker, retired, or currently unemployed ➲ **Skip to the next page**
☐ I work part time (less than 35 hours per week)
☐ I work full time (more than 35 hours per week)

D7 Approximately what is your personal hourly wage rate?

☐ $5.00 - $9.99	☐ $20.00 - $29.99	☐ $50.00 - $59.99
☐ $10.00 - $14.99	☐ $30.00 - $39.99	☐ $60.00 - $74.99
☐ $15.00 - $19.99	☐ $40.00 - $49.99	☐ $75.00 or more

D8 Do you take time off work to harvest shellfish? **(mark all that apply)**

☐ No
☐ Yes, I take paid time off (vacation, sick leave)
☐ Yes, I take unpaid time off

Questions? Call us at 1-877-321-5874

Thank You for Participating!

Please use the space below to make any additional comments you may have. If you have any questions regarding the survey, please call 1-877-321-5874 or email Mark.Plummer@noaa.gov.

Contact 4: Reminder Postcard

Sponsored by
NOAA Fisheries

Puget Sound Recreational Shellfishing Survey

REMINDER

Last week a questionnaire about your recreational shellfish harvesting in Puget Sound was mailed to you. Your name was selected at random from everyone who purchased a Washington license.

If you have already completed and returned it to us please accept our sincere thanks. If not, please do so today. The questionnaire has been sent to only a small, but representative, sample of residents who harvest shellfish. It is extremely important that yours also be included in the study if the results are to be representative.

If by some chance you did not receive the questionnaire,
or it got misplaced, please call

1-877-321-5874

Contact 5: Second Mailing

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
National Marine Fisheries Service
NORTHWEST FISHERIES SCIENCE CENTER

Puget Sound Recreational Shellfishing Survey

<Month Day, Year>

<First, Last>
<Street Address>
<City, State Zip>

Dear <First Last>:

About three weeks ago we sent you a questionnaire that asked you about recreational shellfish harvesting in Puget Sound. To the best of our knowledge, it has not yet been returned.

The comments of other people who have already responded include a wide variety of harvesting experiences and preferences. Many have told us about the shellfish they like to harvest and about trips they have taken. We think the results are going to be very useful to managers.

We are writing you again because of the importance that your questionnaire has for helping to get accurate results. Your name was drawn through a scientific sampling process in which every individual who purchased a 2012 or 2013 Washington license had an equal chance of being selected. Because only a small number of people were chosen for the study, your participation is essential if the results are to be truly representative of the opinions, preferences, and activities of all shellfish harvesters.

- **It doesn't matter how often you harvest shellfish, your answers are valuable.**
- **Even if you've never harvested shellfish from Puget Sound beaches, please return the survey so we can more accurately measure participation.**

We hope you will fill out and return the questionnaire soon, but if for any reason you prefer not to answer it, please let us know by returning a note or blank questionnaire in the enclosed stamped envelope.

Thank you very much for your help.

Mark Plummer
Project Director
NOAA Fisheries - Northwest Fisheries Science Center
P.S. If you have any questions, please call me toll free at 1-877-321-5874.

Contact 6: Third Mailing

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
National Marine Fisheries Service
NORTHWEST FISHERIES SCIENCE CENTER

Puget Sound Recreational Shellfishing Survey

<Month Day, Year>

<First, Last>
<Street Address>
<City, State Zip>

Dear <First Last>:

During the last two months we have sent you several mailings about an important research study we are conducting on recreational harvesting of shellfish in Puget Sound. As of today, we have not received your questionnaire. If you have already mailed it to us, we thank you for your assistance.

The purpose of this study is to improve management by providing a more complete picture of participation rates and preferences.

The study is drawing to a close, and this is the last contact that will be made with the random sample of people who purchased a license in 2012 or 2013. We are sending this final contact because of our concern that people who have not responded may have different experiences and preferences than those who have responded. In order for our results to be accurate, we need to hear from you, regardless of whether you harvested shellfish from Puget Sound beaches or the number of trips you made.

We also want to assure you that your response to this study is voluntary and any responses you give us are confidential.

Finally, we appreciate your willingness to consider our request as we conclude this effort to better understand the recreational harvesting of shellfish in Puget Sound. Thank you very much.

Sincerely,

Mark Plummer
Project Director
NOAA Fisheries - Northwest Fisheries Science Center
P.S. If you have any questions, please call me at 1-877-321-5874.

Recent NOAA Technical Memorandums

published by the
Northwest Fisheries Science Center

NOAA Technical Memorandum NMFS-NWFSC-

131 Waples, R. S. 2016. Small investments with big payoffs: A decade of the Internal Grants Program at the Northwest Fisheries Science Center. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-131, 80 p. doi:10.7289/V5/TM-NWFSC-131.

130 Puget Sound Recovery Implementation Technical Team. 2015. Puget Sound Chinook salmon recovery: A framework for the development of monitoring and adaptive management plans. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-130, 146 p. NTIS number PB2016-100691. doi:10.7289/V5/TM-NWFSC-130.

129 Hard, J. J., J. M. Myers, E. J. Connor, R. A. Hayman, R. G. Kope, G. Lucchetti, A. R. Marshall, G. R. Pess, and B. E. Thompson. 2015. Viability criteria for steelhead within the Puget Sound distinct population segment. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-129, 332 p. NTIS number PB2015-105188. doi:10.7289/V5/TM-NWFSC-129.

128 Myers, J. M., J. J. Hard, E. J. Connor, R. A. Hayman, R. G. Kope, G. Lucchetti, A. R. Marshall, G. R. Pess, and B. E. Thompson. 2015. Identifying historical populations of steelhead within the Puget Sound distinct population segment. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-128, 155 p. NTIS number PB2015-103741. doi:10.7289/V5/TM-NWFSC-128.

127 Roni, P., G. R. Pess, T. J. Beechie, and K. M. Hanson. 2014. Fish–habitat relationships and the effectiveness of habitat restoration. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-127, 154 p. NTIS number PB2014-108836.

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123 Ward, E. J., M. J. Ford, R. G. Kope, J. K. B. Ford, L. A. Velez-Espino, C. K. Parken, L. W. LaVoy, M. B. Hanson, and K. C. Balcomb. 2013. Estimating the impacts of Chinook salmon abundance and prey removal by ocean fishing on Southern Resident killer whale population dynamics. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-123, 71 p. NTIS number PB2013-110079.

NOAA Technical Memorandums NMFS-NWFSC are available at the Northwest Fisheries Science Center website, https://www.nwfsc.noaa.gov/index.cfm.