MARINE RECREATIONAL INFORMATION PROGRAM

Addressing Recommendations from the MRIP Sponsored Review of Monitoring of Washington's Ocean Sampling Program: Evaluation of recreational catch and effort during off peak months on Washington's coast

Washington Department of Fish and Wildlife

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INTRODUCTION

Comprehensive and sound management of recreational finfish fisheries in Washington State requires information on catch, effort, and stock-specific fishery impacts necessary to meet established conservation and allocation mandates. These data are federally required to open and manage recreational fisheries, especially considering the need to limit and monitor impacts to threatened species. For the Washington ocean Marine Catch Areas (Areas 1-4), these critical fishery information needs are met through the Washington Department of Fish and Wildlife (WDFW) Ocean Sampling Program (OSP).

To generate estimates of marine fish catch and effort in ocean Marine Catch Areas (for the "private boat" and "charter boat" modes), WDFW employs a procedure based on data collected by an access point intercept survey. The OSP survey is designed to provide both total effort and catch per unit effort (CPUE). These data are used to generate estimates of total catch and effort by Marine Catch Area, month, and fishing mode which are provided to the Recreational Fishery Information Network (RecFIN, www.recfin.org).

Currently, ocean fishery sampling occurs in all major ocean access ports during "peak" effort months, May through September. Some access sites are also sampled at a lower rate during March, April, and/or October. Effort and catch are assumed to be insignificant during all non-sampled temporal/spatial combinations. This assumption had been tested only once, in a limited study in 2002, with inconclusive results. This is the second year of a two-year proposal to test this assumption.

The objective of this project was to test the assumption that ocean fishing effort and catch are indeed insignificant during the months between September and May. This was a recommendation resulting from the Marine Recreational Information Program's (MRIP) recent review of the WDFW OSP. Work on this project began October 1, 2012, and ceased on April 30, 2013, with prior related work (Stage 1) performed between October, 2011 and April, 2012.

METHODS

Methods were identical to those used in the first year of this project. One field sampler was stationed in each major Washington coastal access site: Ilwaco, Westport, La Push, and Neah Bay; the small ports of Chinook (near Ilwaco) and Snow Creek (near Neah Bay; access to this site is closed during winter months) were not sampled. One Scientific Technician and one Biologist worked to coordinate sampling, collect data, and generate monthly estimates of catch and effort. One Biometrician analyzed the resulting catch data, comparing "winter" months to normally sampled months.

In each port, most weekend days were sampled, and sampled weekdays were assigned using a random number generator to total 40 hours per week. Each port was sampled a minimum of 3 to 5 days per week and days were stratified by weekend and weekday.

The OSP mainly uses a two-stage design for each port, with days constituting the primary sampling units (PSU) and boats within each sampled day as the secondary sampling units (SSU). Selection of days follows simple random procedures. Although sampling of boats is approximately systematic (e.g., every k*th* boat), the selection procedure is not exact and this stage is treated as simple random for estimation purposes. Daily estimates are expanded over days within strata to produce weekly, monthly and annual estimates.

Effort is measured in units of boat-trips and angler-trips, and on sampled days, is measured throughout the entire period of boat activity, i.e., from the time when the first boat leaves a port until the last boat returns. On a given sampling day, the total number of boats that left a port is counted. Boat effort was measured during this project through an <u>entrance count:</u> a count of all boats entering that marina.

The catch per boat is sampled through intercept surveys. Returning boats are systematically sampled at a minimum target rate of 20% within each boat type (charter and private). Every *k*th boat to enter the harbor is included in the sample regardless of size, mooring location, trip type, etc. The size of the sample (leading to the calculation of *m*) depends on the projected effort and the number of available samplers. Overall, the sampling rate during normally sampled timeframes in each port in a year averages over 50% for charter boats and over 40% for private boats. For this project, the sampling goal was 100% of the vessels entering the port on each sampled day, which should result in an overall sampling rate of approximately 60% in each port for the season.

Data collected from each sampled boat trip include target species, area fished, number of anglers, landed catch by species, released salmon by species, releases of all marine fish by species, depth at which the majority of rockfish in the catch were hooked, and other biological data.

Catch and Effort Estimation

The OSP generates preliminary estimates of catch and effort in-season to meet the demands of ocean fishery management. Catch estimates for quota fisheries (currently salmon and halibut) are generated weekly; catch estimates for all other species are generated monthly and provided to the RecFin database by the end of the following month. Final post-season catch and effort estimates for all species are generated by February 1 each year; these post-season estimates replace any existing in-season estimates. For this project, final estimates of effort and catch were generated monthly and provided to the RecFin database by the end of the following month

OSP Estimated Stratum Totals (Primary Stage)

Combined (total) catch estimates are typically stratified by weekend/holiday and weekday. In some strata, every day is sampled. In those strata the combined estimates are simply sums of the daily catches. In other strata, where some days are not sampled, the average catch per day over all sampled days is multiplied by the number of days in the stratum to estimate the total catch.

Let:

a = the marine catch area,

i = trip type,

t = Weekend/holiday or Weekday stratum,

N_t = the number of days in stratum t,

T_t = collection of all days in stratum t,

n_t = the number of days sampled in stratum t, (rather than the number of boats sampled as above),

S_t = collection of sampled days in stratum t (when S=T, n=N),

Y_{taik} = estimated catch (or effort) on day k for stratum t in area a from trip type i,

C_{tai} = catch for stratum t in area a from trip type i,

Then

$$\hat{C}_{tai} = N_t \frac{\sum_{k \in S_t} \hat{Y}_{taik}}{n_t}$$

with estimated variance (Thompson 1992, p. 129):

$$\hat{V}\left(\hat{C}_{tai}\right) = \frac{N_t (N_t - n_t)}{n_t} \frac{\sum_{k \in S_t} \left(\hat{Y}_{taik} - \hat{\bar{Y}}_{tai}\right)^2}{n_t - 1} + \frac{N_t}{n_t} \sum_{k \in S_t} \hat{V}\left(\hat{Y}_{taik}\right)$$

where

$$\hat{\bar{Y}}_{tai} = \frac{\sum_{k \in S_t} \hat{Y}_{taik}}{n_t}.$$

For strata with all days sampled, $n_t = N_t$, and the catch and variance estimators reduce to:

$$\hat{C}_{tai} = \sum_{k \in T_t} \hat{Y}_{taik}$$

and

$$\hat{V}\left(\hat{C}_{tai}\right) = \sum_{k \in T_t} \hat{V}\left(\hat{Y}_{taik}\right).$$

OSP Daily Catch and Effort Estimation (Secondary Stage)

Both catch and effort are post-stratified by trip-type and area fished. Effort in terms of boat-trips is simply the sample number of boats for each trip-type and area expanded by the appropriate boat-type (charter or private) exit/entrance count. Effort in terms of angler-trips is calculated as the mean number of anglers per boat (indexed by trip-type and area) expanded by the counted total population of boats.

The total catch for a given species on a sampled day is the product of the population of boats and the estimated catch per boat, again post-stratified by trip-type and area fished. Key assumptions in the current estimation procedures are that:

1) All boats exiting/entering a port are included in the exit/entrance count
2) Exit/entrance counts are made without error
3) The approximate systematic sample of boats can be treated as a simple random sample
4) Anglers answer questions accurately and do not conceal fish

In the following discussion, subscripts referring to port and boat-type are suppressed. Let:

M_t = total exit or entrance count for a given port on day t (assumed known without error),

m_t = total boats sampled on day t,

m_{tai} = number of boats sampled of trip type i fishing in area a on day t,

a_{taij} = number of anglers on the jth boat from trip type i fishing in area a on day t,

y_{taij} = number of species specific fish caught on the jth boat from trip type i in area a on day t, and

Y_{tai} = total catch of specific species caught from trip type i in area a on day t.

The estimate of the number of boat-trips of trip-type i and area a follows the procedure outlined in Lai et. al. (1991) where the proportion of boats in each category is estimated by:

$$\hat{p}_{tai} = \frac{m_{tai}}{m_t}$$

with estimated variance (Cochran 1977, p. 52):

$$V(\hat{p}_{tai}) = \frac{\hat{p}_{tai} \cdot (1 - \hat{p}_{tai})}{(m_t - 1)} \cdot (\frac{M_t - m_t}{M_t})$$

The estimated total boat-trips is then obtained by:

$$\hat{M}_{tai} = M_t \cdot \hat{p}_{tai}$$

with estimated variance:

$$\hat{V}(\hat{M}_{tai}) = M^2{}_t \cdot \hat{V}(\hat{p}_{tai})$$

Effort expressed in terms of angler-trips is the product of the average anglers per boat-trip times the total number of boat-trips. The mean number of anglers per boat-trip (for trip-type *i* and fishing area *a*) is estimated as:

$$\hat{\bar{a}}_{tai} = \frac{\sum_j a_{taij}}{m_t}$$

with variance:

$$\hat{V}(\hat{\bar{a}}_{tai}) = \frac{\sum_j (a_{taij} - \hat{\bar{a}}_{tai})^2}{m_t(m_t - 1)} \cdot (\frac{M_t - m_t}{M_t})$$

Thus the estimated total number of angler-trips is:

$$\hat{a}_{tai} = M_t \cdot \hat{\bar{a}}_{tai}$$

with variance:

$$\hat{V}(\hat{a}_{tai}) = M^2{}_t \cdot \hat{V}(\hat{\bar{a}}_{tai})$$

The catch (or number released) for a specific species on sampled day *t* in area *a* from trip type *i* is similarly estimated by:

$$\hat{Y}_{tai} = \frac{\sum_j y_{taij}}{m_t} M_t$$

with estimated variance:

$$\hat{V}\left(\hat{Y}_{tai}\right)=\frac{\sum_{j}\left(y_{taij}-\hat{\bar{y}}_{tai}\right)^{2}}{m_{t}\left(m_{t}-1\right)}M_{t}\left(M_{t}-m_{t}\right)$$

This estimate and its variance differs somewhat from that described in Lai et al. (1991) since the total count, M_t (assumed to be a known quantity), is used to expand the estimated CPUE (calculated over all sampled boats) rather than the estimated boat-trips by trip-type and area fished.

RESULTS

In the previous report (Stage 1) on this project, March and April in some areas were included as "normally sampled months" in our calculations since some areas have been sampled at a reduced rate during these time periods. After discussion, we felt it more appropriate not to include these as "normally sampled months", but rather as winter months since (1) sample rates and the number of days sampled during these months has been at rates well below normal, and (2) funding for sampling these months is not dedicated or secure. Consequently, the analysis for the 2011-12 season has been modified.

"Winter" months in this analysis are defined as the months of October through April. "Normally sampled" months are defined as the months of May through September.

Bias correction for unsampled months

Creel sampling of months not currently fully covered by the ocean sampling program (October – April) demonstrated that there is a small harvest of marine finfish during this time period in Ilwaco and La Push, and a more significant harvest in Westport and Neah Bay. During the 2012-13 season, the "winter" catch ranged from 6.0% of total yearly catch in the south coast of Washington state (Ilwaco) to 17.4% of the total in the central coast (Westport) (Table 1), while 2011-12 "winter" catches ranged from 2.1% in Ilwaco to 14.2% in Westport (Table 2).

Table 3 shows the catch contribution by month for each port for the two seasons sampled. In all ports, April was the biggest contributor of the "winter" months, followed by March in most ports.

The marine fish catch by species during "normally sampled" and "winter" months is shown for each port in Appendix 1. Highlighted port/species combinations indicate that "winter" months catch exceeded 10% of the total harvest.

The result is that catch estimates derived from sampling only the May – September time period are underestimated in all ports. The following section examines the effect of the bias on the total uncertainty of catch estimates and considers a correction based on the results of the sampling effort.

Table 1. 2012-2013 Groundfish catch estimates and associated standard errors from each major port for the months normally sampled by WDFW's Ocean Sampling Program, for the additional winter months funded by this project, total harvest for the year, and the percentage of the catch from the winter months.

PORT	Normally-Sampled Months		"Winter" Months		TOTAL CATCH		Percent Catch from "Winter" months
	Catch $\hat{C}_{OSP}$	Standard Error $S\hat{E}(\hat{C}_{OSP})$	Catch $\hat{C}_W$	Standard Error $S\hat{E}(\hat{C}_W)$	Catch	Standard Error	
Ilwaco	16,762	8741	1,074	149	17,836	8743	6.0%
Westport	168,423	4316	35,599	1845	204,022	4694	17.4%
La Push	38,839	1709	3,096	346	41,935	1744	7.4%
Neah Bay	60,556	1568	9,326	630	69,882	1690	13.3%
Catch regardless of target trip type							

Table 2. 2011-2012 Groundfish catch estimates and associated standard errors from each major port for the months normally sampled by WDFW's Ocean Sampling Program, for the additional winter months funded by the previous MRIP sampling project, total harvest for the year, and the percentage of the catch from the winter months.

PORT	Normally-Sampled Months		"Winter" Months		TOTAL CATCH		Percent Catch from "Winter" months
	Catch $\hat{C}_{OSP}$	Standard Error $S\hat{E}(\hat{C}_{OSP})$	Catch $\hat{C}_W$	Standard Error $S\hat{E}(\hat{C}_W)$	Catch	Standard Error	
Ilwaco	35,473	2232	770	73	36,243	2233	2.1%
Westport	195,322	4318	32,226	1779	227,548	4670	14.2%
La Push	41,132	1714	2,427	111	43,559	1717	5.6%
Neah Bay	63,454	1576	8,172	837	71,627	1785	11.4%
Catch regardless of target trip type							

Table 3. Catch contribution by month for each WA coastal port during the 2011-12 and 2012-13 sampling seasons.

MONTH	ILWACO		WESTPORT		LA PUSH		NEAH BAY	
	2012-13	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13	2011-12
January	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
February	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
March	2.2%	0.1%	7.3%	1.8%	2.6%	1.1%	0.2%	0.2%
April	3.3%	1.0%	9.1%	10.9%	4.7%	4.2%	13.2%	10.8%
May	9.9%	4.5%	19.5%	17.5%	34.7%	31.1%	35.7%	34.8%
June	14.7%	7.4%	15.6%	14.6%	16.9%	18.6%	14.2%	14.1%
July	29.0%	25.9%	20.4%	18.6%	22.0%	21.2%	18.8%	19.5%
August	25.3%	36.0%	19.3%	24.4%	16.1%	19.9%	14.3%	15.8%
September	15.1%	24.1%	7.8%	10.8%	2.9%	3.6%	3.7%	4.4%
October	0.5%	0.9%	1.1%	1.4%	0.0%	0.3%	0.0%	0.4%
November	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
December	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

One metric used to evaluate estimators is through comparing the mean squared error (MSE) which takes into account both bias and variance, expressed mathematically as

$$MSE\left(\hat{C}\right) = Bias^2\left(\hat{C}\right) + Variance\left(\hat{C}\right)$$

Often the most desirable estimator is one with the smallest MSE. However, a zero bias does not always equate to a smaller MSE. At times, additional sampling to reduce or eliminate bias can increase the variance of an estimator, particularly if additional parameters are required to obtain an unbiased estimate of the target quantity. Alternatively, the cost of additional sampling may not decrease an MSE sufficiently to justify the use of additional resources.

If the total, unbiased catch in a year is the sum of the current OSP estimate plus the catch from winter months, then

$$Bias\left(\hat{C}\right) = \hat{C}_{OSP} - \left(\hat{C}_W + \hat{C}_{OSP}\right),$$
$$Bias\left(\hat{C}\right) = -\hat{C}_W$$

where $\hat{C}_{OSP}$ = catch as estimated by the current OSP program,
$\hat{C}_W$ = catch from the winter months, or months currently not sampled,
$\hat{C}$ = the total catch for the year.
Total catch is underestimated by the amount of harvest in winter months.

Under the assumption that winter harvest is small or non-existent and $\hat{C}_{OSP}$ is used for total harvest, the MSE is

$$MSE(\hat{C}) = (\hat{C}_w)^2 + Variance(\hat{C}_{OSP}). \qquad \text{Eq. 1}$$

The MSE of total harvest calculated by sampling all months is

$$MSE(\hat{C}) = Variance(\hat{C}_{OSP} + \hat{C}_w),$$
$$MSE(\hat{C}) = Variance(\hat{C}_{OSP}) + Variance(\hat{C}_w) \qquad \text{Eq. 2}$$

because the bias is zero and all months are sampled independently. The MSE of $\hat{C}_{OSP}$ is larger than total harvest, $\hat{C}$, across all ports based on 2011-2012 sampling (Table 2), although the difference decreases with $\hat{C}_W$.

Current OSP catch estimates can be corrected for negative bias using a the following bias correction,

$$\hat{C}_{corr} = \frac{\hat{C}_{OSP}}{BiasCorr}$$

where $BiasCorr = \frac{\hat{C}_{OSP}}{\hat{C}_{OSP} + \hat{C}_W}$. The corrected catch estimate $\hat{C}_{corr}$ is unbiased to the first term of a Taylor series expansion,

$$E(\hat{C}_{corr}) \doteq \frac{E(\hat{C}_{OSP})}{\frac{E(\hat{C}_{OSP})}{E(\hat{C}_{OSP} + \hat{C}_W)}},$$
$$E(\hat{C}_{corr}) \doteq E(C_{OSP} + C_W)$$
$$E(\hat{C}_{corr}) \doteq C$$

The variance of the bias corrected estimate, $\hat{C}_{corr}$, is as follows,

$$Var(\hat{C}_{corr}) \doteq \hat{C}_{corr}^2 \left(\frac{Var(\hat{C}_{OSP})}{\hat{C}_{OSP}^2} + \frac{Var(BiasCorr)}{BiasCorr^2} \right) \qquad \text{Eq. 3}$$

where $Var(BiasCorr)$ is a function of the $\hat{C}_{OSP}$, $\hat{C}_W$, and their associated variances,

$$Var(BiasCorr) \doteq \left(\frac{\hat{C}_W}{\hat{C}_{OSP} + \hat{C}_W} \right)^2 \left(\frac{Var(\hat{C}_{OSP})}{\hat{C}_{OSP}^2} + \frac{Var(\hat{C}_W)}{(\hat{C}_{OSP} + \hat{C}_W)^2} \right).$$

Note that Eq. 3 is derived under the assumption that a bias correction would be independently estimated. Table 2 provides a comparison of the MSE's for current OSP estimates (Eq. 1), total catch, $\hat{C}$ (Eq. 2), and corrected catch, $\hat{C}_{corr}$ (Eq. 3). Because $\hat{C}_{corr}$ is unbiased, the MSE is equal to the variance.

Table 4. 2012-2013 mean squared error among different estimates of groundfish catch.

Port	Mean Square Error		
	Current OSP catch estimate	Total Catch "Winter" Included	Corrected catch estimate
Ilwaco	77,563,118	76,432,067	86,853,065
Westport	1,285,886,757	22,034,750	33,166,183
La Push	12,507,257	3,042,252	3,565,161
Neah Bay	89,426,498	2,855,156	3,860,571

Table 5. 2011-2012 mean squared error among different estimates of groundfish catch.

Port	Mean Square Error		
	Current OSP catch estimate	Total Catch "Winter" Included	Corrected catch estimate
Ilwaco	1,156,573	642,346	703,071
Westport	23,752,177	19,368,689	19,854,154
La Push	3,714,371	3,288,801	3,403,412
Neah Bay	15,801,230	15,720,879	15,832,764

Estimates of total groundfish catch based on sampling in all months have the lowest MSE, followed by the corrected catch estimates (with the exception of Ilwaco) and differences among MSEs decrease as the bias decreases. The MSE for estimates from Neah Bay in the 2011-2012 sample year are almost the same, as would be expected when the winter months only account for 0.4% of the total catch. The MSE of the corrected estimates is between that of $MSE\left(\hat{C}_{OSP}\right)$ and $MSE\left(\hat{C}\right)$, but closer to $MSE\left(\hat{C}\right)$, although the estimates are only based on one year's worth of data. If the percentage of winter catch is consistent across years, then the use of a bias corrected estimate could be recommended when resources are scarce. We looked at consistency across the two years of data for which winter months were sampled. Unfortunately, for about 30% of the species-port combinations, the percentage of catch attributable to winter months was not similar across years (Appendix 2).

DISCUSSION

One of the objectives of this study was to determine whether a catch bias correction would be feasible to apply to months that are typically not sampled or are sampled at a low rate in the Washington ocean recreational fisheries. Based on the two years of data collected, a bias correction does not appear feasible. If funding becomes available in the future, a multi-year study to look at covariates (i.e., weather) may provide further insight into the possibility of applying bias correction factors in some areas.

The two seasons of sampling year-round in Washington coastal ports demonstrated that both Westport and Neah Bay experience significant early spring marine fish harvest. March and April in Westport and April in Neah Bay proved important contributors to total groundfish catch. La Push showed significant catch in April as well, while Ilwaco did not demonstrate significant harvest during any winter months.

From this analysis, we recommend that sampling resources be prioritized as follows:

1. Maintain resources to sample core months (May – September).
2. Sample in March and April in Westport and April in Neah Bay.
3. Sample April in La Push
4. Sample March in La Push and Neah Bay.
5. Sample October in all ports.
6. Sample other “winter” months as funding allows.

Appendix 1

Ocean marine fish recreational catch by species during normally sampled months and winter months in the 2012-2013 season.

Port Sampled	Species Name	TOTAL CATCHES (NUMBERS OF FISH) Normally-Sampled Months	"Winter" Months	Percent landed in Normally-Sampled Mos	Percent landed in in"Winter" Mos
Ilwaco	BLACKROCK	9,209	766	92%	8%
Westport	BLACKROCK	132,994	28,227	82%	18%
La Push	BLACKROCK	28,471	2,109	93%	7%
Neah Bay	BLACKROCK	36,184	5,772	86%	14%
Ilwaco	BLUEROCK	47	-	100%	0%
Westport	BLUEROCK	80	26	75%	25%
La Push	BLUEROCK	138	8	94%	6%
Neah Bay	BLUEROCK	1,349	18	99%	1%
Ilwaco	BOCACCIO	8	-	100%	0%
Westport	BOCACCIO	2	-	100%	0%
La Push	BOCACCIO	211	2	99%	1%
Neah Bay	BOCACCIO	229	-	100%	0%
Ilwaco	CABEZON	218	33	87%	13%
Westport	CABEZON	360	45	89%	11%
La Push	CABEZON	384	22	95%	5%
Neah Bay	CABEZON	1,620	256	86%	14%
Westport	CANARY	4	2	68%	32%
La Push	CANARY	16	-	100%	0%
Neah Bay	CANARY	86	-	100%	0%
Ilwaco	CHINA	25	1	94%	6%
Westport	CHINA	52	2	96%	4%
La Push	CHINA	438	7	98%	2%
Neah Bay	CHINA	2,319	42	98%	2%
Ilwaco	COPPER	8	-	100%	0%
Westport	COPPER	38	3	93%	7%
La Push	COPPER	24	2	92%	8%
Neah Bay	COPPER	845	31	96%	4%
Ilwaco	FLATFISH	8	-	100%	0%
Westport	FLATFISH	1,086	139	89%	11%
La Push	FLATFISH	19	-	100%	0%
Neah Bay	FLATFISH	727	2	100%	0%
Ilwaco	GENERALCOD	9	-	100%	0%
Westport	GENERALCOD	5	-	100%	0%
Neah Bay	GENERALCOD	13	-	100%	0%

Ilwaco	GENERALRF	17	-	100%	0%
Westport	GENERALRF	374	-	100%	0%
Neah Bay	GENERALRF	11	-	100%	0%
Ilwaco	HALIBUT	358	-	100%	0%
Westport	HALIBUT	2,514	-	100%	0%
La Push	HALIBUT	2,323	-	100%	0%
Neah Bay	HALIBUT	2,826	-	100%	0%
Ilwaco	KELPGREENLING	658	56	92%	8%
Westport	KELPGREENLING	458	206	69%	31%
La Push	KELPGREENLING	397	23	94%	6%
Neah Bay	KELPGREENLING	2,534	219	92%	8%
Ilwaco	LINGCOD	1,148	218	84%	16%
Westport	LINGCOD	18,058	5,849	76%	24%
La Push	LINGCOD	5,831	766	88%	12%
Neah Bay	LINGCOD	7,990	2,515	76%	24%
Ilwaco	MISCELLANEOUS	2,000	-	100%	0%
Westport	MISCELLANEOUS	1,493	49	97%	3%
La Push	MISCELLANEOUS	118	20	85%	15%
Neah Bay	MISCELLANEOUS	317	98	76%	24%
Ilwaco	PACIFICCOD	12	-	100%	0%
Westport	PACIFICCOD	4	-	100%	0%
La Push	PACIFICCOD	7	-	100%	0%
Neah Bay	PACIFICCOD	136	-	100%	0%
Ilwaco	PERCH	8	-	100%	0%
Westport	PERCH	39	3	93%	7%
Neah Bay	PERCH	2	-	100%	0%
Ilwaco	QUILLBACK	15	-	100%	0%
Westport	QUILLBACK	834	77	92%	8%
La Push	QUILLBACK	117	6	95%	5%
Neah Bay	QUILLBACK	670	19	97%	3%
Ilwaco	SHARKSANDSKATES	55	-	100%	0%
Westport	SHARKSANDSKATES	87	-	100%	0%
La Push	SHARKSANDSKATES	8	-	100%	0%
Neah Bay	SHARKSANDSKATES	5	-	100%	0%
Ilwaco	TIGER	15	-	100%	0%
Westport	TIGER	7	2	77%	23%
La Push	TIGER	10	1	91%	9%
Neah Bay	TIGER	76	2	98%	2%
Ilwaco	VERMILLION	7	-	100%	0%
Westport	VERMILLION	3	-	100%	0%
La Push	VERMILLION	7	1	87%	13%

Neah Bay	VERMILLION	393	3	99%	1%
Ilwaco	YELLOWEYE	3	-	100%	0%
Neah Bay	YELLOWEYE	44	-	100%	0%
Ilwaco	YELLOWTAIL	2,935	-	100%	0%
Westport	YELLOWTAIL	9,934	969	91%	9%
La Push	YELLOWTAIL	319	128	71%	29%
Neah Bay	YELLOWTAIL	2,181	347	86%	14%

Ocean marine fish recreational catch by species during normally sampled months and winter months in the 2011-2012 season.

Port Sampled	Species Name	TOTAL CATCHES (NUMBERS OF FISH)			
		Normally-Sampled Months	"Winter" Months	Percent landed in Normally-Sampled Mos	Percent landed in in"Winter" Mos
Ilwaco	BLACKROCK	8,401	592	93%	7%
Westport	BLACKROCK	132,931	25,370	84%	16%
La Push	BLACKROCK	28,437	1,220	96%	4%
Neah Bay	BLACKROCK	36,641	5,889	86%	14%
Ilwaco	BLUEROCK	47	10	82%	18%
Westport	BLUEROCK	80	74	52%	48%
La Push	BLUEROCK	139	34	80%	20%
Neah Bay	BLUEROCK	1,362	86	94%	6%
Ilwaco	BOCACCIO	8	-	100%	0%
Westport	BOCACCIO	2	-	100%	0%
La Push	BOCACCIO	211	14	94%	6%
Neah Bay	BOCACCIO	229	53	81%	19%
Ilwaco	CABEZON	193	6	97%	3%
Westport	CABEZON	359	32	92%	8%
La Push	CABEZON	384	20	95%	5%
Neah Bay	CABEZON	1,655	186	90%	10%
Westport	CANARY	4	-	100%	0%
La Push	CANARY	16	1	93%	7%
Neah Bay	CANARY	87	15	85%	15%
Ilwaco	CHINA	25	-	100%	0%
Westport	CHINA	51	1	98%	2%
La Push	CHINA	438	5	99%	1%
Neah Bay	CHINA	2,321	34	99%	1%
Ilwaco	COPPER	8	1	88%	12%
Westport	COPPER	38	6	87%	13%
La Push	COPPER	24	7	78%	22%

Neah Bay	COPPER	889	28	97%	3%
Ilwaco	FLATFISH	8	-	100%	0%
Westport	FLATFISH	1,087	182	86%	14%
La Push	FLATFISH	19	-	100%	0%
Neah Bay	FLATFISH	702	-	100%	0%
Ilwaco	GENERALCOD	9	-	100%	0%
Westport	GENERALCOD	5	-	100%	0%
Neah Bay	GENERALCOD	15	-	100%	0%
Ilwaco	GENERALRF	17	-	100%	0%
Westport	GENERALRF	74	4	95%	5%
Neah Bay	GENERALRF	47	-	100%	0%
Ilwaco	HALIBUT	332	-	100%	0%
Westport	HALIBUT	2,514	-	100%	0%
La Push	HALIBUT	2,323	-	100%	0%
Neah Bay	HALIBUT	3,481	-	100%	0%
Ilwaco	KELPGREENLING	544	16	97%	3%
Westport	KELPGREENLING	459	119	79%	21%
La Push	KELPGREENLING	396	51	89%	11%
Neah Bay	KELPGREENLING	2,575	190	93%	7%
Ilwaco	LINGCOD	1,011	87	92%	8%
Westport	LINGCOD	18,028	4,085	82%	18%
La Push	LINGCOD	5,830	790	88%	12%
Neah Bay	LINGCOD	8,780	1,572	85%	15%
Ilwaco	MISCELLANEOUS	1,881	7	100%	0%
Westport	MISCELLANEOUS	1,793	36	98%	2%
La Push	MISCELLANEOUS	118	4	97%	3%
Neah Bay	MISCELLANEOUS	346	4	99%	1%
Ilwaco	PACIFICCOD	4	-	100%	0%
Westport	PACIFICCOD	4	-	100%	0%
La Push	PACIFICCOD	7	-	100%	0%
Neah Bay	PACIFICCOD	140	-	100%	0%
Ilwaco	PERCH	8	-	100%	0%
Westport	PERCH	39	26	60%	40%
Neah Bay	PERCH	2	-	100%	0%
Ilwaco	QUILLBACK	15	1	94%	6%
Westport	QUILLBACK	834	51	94%	6%
La Push	QUILLBACK	117	21	85%	15%
Neah Bay	QUILLBACK	719	27	96%	4%
Ilwaco	SHARKSANDSKATES	55	-	100%	0%
Westport	SHARKSANDSKATES	80	-	100%	0%
La Push	SHARKSANDSKATES	8	-	100%	0%

Neah Bay	SHARKSANDSKATES	5	-	100%	0%
Ilwaco	TIGER	15	-	100%	0%
Westport	TIGER	7	1	84%	16%
La Push	TIGER	10	6	65%	35%
Neah Bay	TIGER	83	-	100%	0%
Ilwaco	TUNA	19,891	50	100%	0%
Westport	TUNA	26,995	1,236	96%	4%
La Push	TUNA	2,329	-	100%	0%
Neah Bay	TUNA	379	-	100%	0%
Ilwaco	VERMILLION	7	-	100%	0%
Westport	VERMILLION	3	-	100%	0%
La Push	VERMILLION	7	-	100%	0%
Neah Bay	VERMILLION	415	5	99%	1%
Ilwaco	YELLOWEYE	3	-	100%	0%
Neah Bay	YELLOWEYE	50	-	100%	0%
Ilwaco	YELLOWTAIL	2,990	1	100%	0%
Westport	YELLOWTAIL	9,935	1,003	91%	9%
La Push	YELLOWTAIL	319	254	56%	44%
Neah Bay	YELLOWTAIL	2,530	84	97%	3%

Appendix 2

Analysis of consistency in percentage of marine catch attributable to winter months between 2011-2012 and 2012-2013 sample years.

		2012-2013		2011-2012		
Port	Species	Winter Percent Catch	SE (Winter Percent Catch)	Winter Percent Catch	SE (Winter Percent Catch)	P(equality of percentage catch in winter months)
Ilwaco	BLACKROCK	7.68%	1.31%	6.58%	0.83%	0.48
Ilwaco	BLUEROCK	0.00%	0.00%	17.64%	6.03%	0.00
Ilwaco	BOCACCIO	0.00%	0.00%	0.00%	71.15%	1.00
Ilwaco	CABEZON	13.20%	3.28%	3.15%	1.62%	0.01
Ilwaco	CHINA	5.60%	3.14%	0.00%	9.56%	0.58
Ilwaco	COPPER	0.00%	0.00%	12.00%	106.36%	0.91
Ilwaco	FLATFISH	0.00%	0.00%	0.00%	0.00%	1.00
Ilwaco	GENERALCOD	0.00%	0.00%	0.00%	0.00%	1.00
Ilwaco	GENERALRF	0.00%	0.00%	0.00%	0.00%	1.00
Ilwaco	HALIBUT	0.00%	0.00%	0.00%	0.00%	1.00
Ilwaco	KELPGREENLING	7.79%	2.08%	2.90%	0.31%	0.02
Ilwaco	LINGCOD	15.95%	3.77%	7.88%	0.62%	0.04
Ilwaco	MISCELLANEOUS	0.00%	0.00%	0.35%	0.03%	0.00
Ilwaco	PACIFICCOD	0.00%	0.00%	0.00%	0.00%	1.00
Ilwaco	PERCH	0.00%	0.00%	0.00%	0.00%	1.00
Ilwaco	QUILLBACK	0.00%	0.00%	6.36%	1.09%	0.00
Ilwaco	SHARKSANDSKATES	0.00%	0.00%	0.00%	0.00%	1.00
Ilwaco	TIGER	0.00%	0.00%	0.00%	0.00%	1.00
Ilwaco	VERMILLION	0.00%	0.00%	0.00%	0.00%	1.00
Ilwaco	YELLOWEYE	0.00%	0.00%	0.00%	0.00%	1.00
Ilwaco	YELLOWTAIL	0.00%	0.00%	0.03%	0.00%	0.00
La Push	BLACKROCK	6.90%	1.07%	4.11%	0.36%	0.01
La Push	BLUEROCK	5.72%	1.58%	19.72%	4.41%	0.00
La Push	BOCACCIO	0.94%	0.12%	6.38%	2.68%	0.04
La Push	CABEZON	5.41%	1.04%	4.96%	3.08%	0.89
La Push	CANARY	0.00%	0.00%	7.44%	40.08%	0.85
La Push	CHINA	1.64%	0.49%	1.19%	0.31%	0.44
La Push	COPPER	7.67%	1.48%	21.74%	18.46%	0.45
La Push	FLATFISH	0.00%	0.00%	0.00%	0.00%	1.00
La Push	HALIBUT	0.00%	0.00%	0.00%	0.00%	1.00
La Push	KELPGREENLING	5.53%	1.05%	11.35%	1.30%	0.00
La Push	LINGCOD	11.61%	1.44%	11.93%	0.98%	0.86

La Push	MISCELLANEOUS	14.55%	9.77%	3.17%	1.50%	0.25
La Push	PACIFICCOD	0.00%	0.00%	0.00%	0.00%	1.00
La Push	QUILLBACK	5.02%	1.43%	15.42%	2.87%	0.00
La Push	SHARKSANDSKATES	0.00%	0.00%	0.00%	0.00%	1.00
La Push	TIGER	8.80%	2.77%	34.94%	9.28%	0.01
La Push	VERMILLION	12.87%	5.50%	0.00%	0.00%	0.02
La Push	YELLOWTAIL	28.61%	6.09%	44.36%	4.28%	0.03
Neah Bay	BLACKROCK	13.76%	1.23%	13.85%	1.69%	0.97
Neah Bay	BLUEROCK	1.35%	0.25%	5.91%	0.81%	0.00
Neah Bay	BOCACCIO	0.00%	0.00%	18.79%	8.18%	0.02
Neah Bay	CABEZON	13.65%	1.81%	10.08%	1.28%	0.11
Neah Bay	CANARY	0.00%	0.00%	14.77%	10.71%	0.17
Neah Bay	CHINA	1.80%	0.53%	1.46%	0.28%	0.57
Neah Bay	COPPER	3.54%	1.43%	3.07%	0.90%	0.78
Neah Bay	FLATFISH	0.26%	0.18%	0.00%	0.44%	0.59
Neah Bay	GENERALCOD	0.00%	0.00%	0.00%	0.00%	1.00
Neah Bay	GENERALRF	0.00%	0.00%	0.00%	0.00%	1.00
Neah Bay	HALIBUT	0.00%	0.00%	0.00%	0.00%	1.00
Neah Bay	KELPGREENLING	7.96%	1.39%	6.87%	1.14%	0.54
Neah Bay	LINGCOD	23.94%	2.21%	15.19%	2.01%	0.00
Neah Bay	MISCELLANEOUS	23.59%	4.84%	1.10%	0.32%	0.00
Neah Bay	PACIFICCOD	0.00%	0.00%	0.00%	0.00%	1.00
Neah Bay	PERCH	0.00%	0.00%	0.00%	0.00%	1.00
Neah Bay	QUILLBACK	2.79%	0.60%	3.61%	1.59%	0.63
Neah Bay	SHARKSANDSKATES	0.00%	0.00%	0.00%	0.00%	1.00
Neah Bay	TIGER	2.35%	1.57%	0.00%	0.00%	0.13
Neah Bay	VERMILLION	0.71%	0.27%	1.11%	0.17%	0.22
Neah Bay	YELLOWEYE	0.00%	0.00%	0.00%	0.00%	1.00
Neah Bay	YELLOWTAIL	13.74%	1.15%	3.22%	1.13%	0.00
Westport	BLACKROCK	17.51%	1.00%	16.03%	1.00%	0.29
Westport	BLUEROCK	24.76%	5.20%	47.93%	5.57%	0.00
Westport	BOCACCIO	0.00%	0.00%	0.00%	393.46%	1.00
Westport	CABEZON	11.07%	1.98%	8.10%	5.47%	0.61
Westport	CANARY	32.22%	18.25%	0.00%	27.22%	0.33
Westport	CHINA	3.70%	0.36%	2.15%	37.31%	0.97
Westport	COPPER	6.88%	3.03%	12.82%	6.74%	0.42
Westport	FLATFISH	11.35%	4.05%	14.35%	3.97%	0.60
Westport	GENERALCOD	0.00%	0.00%	0.00%	3708.32%	1.00
Westport	GENERALRF	0.00%	0.00%	4.81%	111.94%	0.97
Westport	HALIBUT	0.00%	0.00%	0.00%	0.00%	1.00
Westport	KELPGREENLING	31.05%	3.98%	20.65%	3.06%	0.04

Westport	LINGCOD	24.47%	1.26%	18.47%	1.03%	0.00
Westport	MISCELLANEOUS	3.17%	0.62%	1.96%	0.55%	0.15
Westport	PACIFICCOD	0.00%	0.00%	0.00%	0.00%	1.00
Westport	PERCH	6.82%	4.54%	39.64%	14.85%	0.03
Westport	QUILLBACK	8.48%	2.53%	5.79%	1.60%	0.37
Westport	SHARKSANDSKATES	0.00%	0.00%	0.00%	0.00%	1.00
Westport	TIGER	22.79%	5.74%	16.41%	4.47%	0.38
Westport	VERMILLION	0.00%	0.00%	0.00%	0.00%	1.00
Westport	YELLOWTAIL	8.88%	1.18%	9.17%	1.24%	0.87