Sampling Design of the Oregon Department of Fish and Wildlife's Ocean Recreational Boat Survey (ORBS)

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Introduction

The Oregon Department of Fish and Wildlife (ODFW) annually surveys the marine recreational fishery. The ocean boat fishery is sampled by the Ocean Recreational Boat Survey (ORBS) and estimates of catch and effort are made for this fishery. In addition, ORBS also samples estuary boats in the lower estuary areas where ocean sampling is occurring; however, no estimates are made for estuary effort or catch. Shore based anglers and estuary boat anglers are typically sampled by a separate project known as the Shore and Estuary Boat (SEB) survey in years when that survey is in operation.

This report summarizes the basic elements of the ORBS project as current in 2021. This includes data collection, formulas used in calculations, and adjustments to the data, as they relate to the estimation of effort and catch. Other components of ORBS including length-weight data collection, at-sea observations, and other side projects are not detailed.

Background

Sampling and catch estimation of the ocean salmon recreational fishery on the Oregon Coast began its development with some loosely coordinated efforts by the Oregon Department of Fish and Wildlife in 1976. It was soon apparent that there was a need for a more accurate and reliable program, and the salmon sampling project underwent a series of reviews and developed into a program that could generate accurate estimates of catch in a timely manner beginning with the 1979 ocean salmon season. Largely as a result of the development of the Pacific Fishery Management Council and the need for more accurate catch and effort information on the ocean harvest of coho and Chinook salmon, the Ocean Recreational Boat Survey (ORBS) (formerly known as the Ocean Salmon Sampling Project) formalized sampling activities and began to make weekly catch and effort estimates for all major ports along the Oregon Coast throughout the salmon season. The improved project also included estimates for effort and catch of non-salmon marine species occurring during the traditional ocean salmon season time period.

At the same time that ORBS was being developed in 1979, the Marine Recreational Finfish Statistical Survey (MRFSS) was also being implemented by the National Marine Fisheries Service (NMFS). The MRFSS was developed to be an all-encompassing survey of all marine recreational fisheries (excluding shellfish) and included both the ocean and the estuaries, as well as beach, bank, jetty, pier, and boat anglers. This survey had at its core the goal of being able to provide a large-scale view of the marine recreational fisheries of the U.S., and was viewed as the best means of estimating non-

salmon marine species effort and harvest. Unfortunately, the design of MRFSS did not allow for the fine scale of resolution by time or area needed for active fisheries management.

In 1982, an extremely strong El Niño developed in the Eastern Pacific and did not dissipate until late in 1983. In its wake were decimated populations of salmon. As a result, salmon fishing in 1984 and 1985 was sharply curtailed due to poor forecasts for salmon that occurred due to the effects of the El Niño. Because of the poor condition of salmon stocks and the restricted seasons, more and more charter operators and recreational anglers began to look to non-salmon species like rockfish, lingcod, and Pacific halibut as alternatives to salmon fishing. However, since recreational fishery sampling was scheduled to largely match the salmon seasons, this resulted in inadequate sampling of the non-salmon species that were increasingly being targeted by anglers.

By the 1986 season, coho salmon, which had always been the mainstay of the Oregon recreational ocean salmon fishery, looked to be on the rebound, with increased quotas and fishing opportunity. Once again, the non-salmon sampling from the salmon management program appeared to be adequate to address the needs of fishery management. However, the resurgence of the coho was short lived and by the early 1990's things had gone from bad to worse, with coho fishing all but eliminated by 1993. Also, by the mid-1990's, the increase in fishing activity for Pacific halibut was resulting in early attainment of the halibut quota, in-season closures to the fishery, and more restrictive seasons. Halibut quota management at this time was using a catch estimate that was not based on a statistically valid survey method. These issues underscored the need for more consistent sampling of the recreational non-salmon fisheries.

Minor changes to ORBS had been occurring in almost all years to generate better estimates for both salmon and non-salmon species, but a comparison of catch estimates of lingcod from the ORBS and the Marine Recreational Finfish Statistical Survey (MRFSS) raised concerns when the two estimates were generating substantially different estimates of catch. This resulted in a series of meetings beginning in late 1997 between staff from ODFW, NMFS, and the Pacific States Marine Fisheries Commission (PSFMC) to look into the causes for the differences between the two estimates. The results of these meetings included a three-year sampling add-on to ORBS to look at over-winter fishery activity in several major ports, the eventual dissolution of the MRFSS program in Oregon and its reconstitution as the Shore and Estuary Boat Survey (SEBS) with a more limited but focused role, and several other significant changes to ORBS to better address non-salmon fishing activity.

Presently the ORBS project samples at the top ten to eleven ocean access points (Figure 1). There are an additional eleven access points which are estimated to account for less than 2% of the ocean boat activity in total based on evaluations from salmon catch records. For Nehalem and Port Orford, recent MRIP-funded surveys confirmed the low level of ocean recreational activity and catch of bottomfish species. Note that many of these minor access points are considered unsuitable for ocean access by the Oregon State Marine Board. At the five most significant ports with recognized good non-salmon

fishing activity, ORBS begins sampling in early March and continues through October. This period accounts for approximately 96% of the non-salmon fishing effort in those ports. In three of those ports (Depoe Bay, Newport, and Brookings) sampling continues for the full year. The remaining sampled ports typically have start up dates for sampling in the first week of May or the third week of June, with an end to sampling in late September. This sampling period in these ports accounts for an estimated 60%-90% of the activity occurring in those locations. Catch and effort estimates are made for unsampled time periods based on either the temporal patterns observed in the previously noted over-winter study, or on current over-winter sampling in Depoe Bay, Newport, and Brookings by PSMFC samplers working with ODFW. Various add-ons to extend sampling in various seasons. Most recently, ORBS was able to continue full-year sampling at Charleston, and extend sampling in Pacific City to the period of May through October for a two-year period.

During the 2011-12 winter period, special additional sampling was funded through the Marine Recreational Information Program (MRIP) to conduct full year sampling in all currently sampled ports. An additional MRIP study during 2012-13, included over winter sampling in specific ports and extended sampling in several others. The data collected from these two studies is currently being evaluated for improving the ORBS full year estimates for non-salmonid catches and fishing effort.

Effort is estimated by counting the number of boat trips through one of several methods. The adopted method varies by port and boat type (charter boat or private boat), and is selected based on available staffing, the port and fishery layout, and other logistical considerations. For charter vessels operating out of a fixed station or office, the trip effort is collected from the office for all days of the week; and for private boats (as well as charter vessels operating without a fixed station or office) estimates were traditionally made using either "live vessel bar crossing counts" in real time by an on-site employee from dawn to a predetermined ending time; a trailer and moorage slip count with tracking of additional launches; or review of digital video recordings made of the bar and cross channel, or the harbor entrances. As of the 2021 season, trailer and moorage slip counts are conducted at Pacific City and Florence; video harbor entrance counts are conducted at Astoria, Warrenton, Hammond, and Garibaldi; and video bar crossing counts are conducted at Depoe Bay, Newport, Winchester Bay, Charleston, Bandon, Gold Beach, and Brookings.

Sampling and estimates of catch are stratified by port, week, season type, boat type, and trip type for charters (target species group as defined in table 1); domains include private boat trip types and area of catch (Figure 1). Location of catch for non-salmon bottomfish species is narrowed down further to whether or not the activity took place inside or outside of 30 fathoms of depth, and within which major reef/bottom complex area did the catch primarily occur. Interviews are conducted on a boat-level of stratification to match with the effort counting methodology. Total catch, effort, and released fish data are gathered from each interviewed boat. In 2018, a target species category list selection was added to provide more details on trip targets and to autofill the trip type.

The ORBS also gathers length and weight statistics for use in converting numbers of fish into total weight of catch landed by species and strata. This information is also utilized in assessing stock health. ORBS also collects the average bottom depth where bottomfish were caught during each trip (this is not a mandatory field).

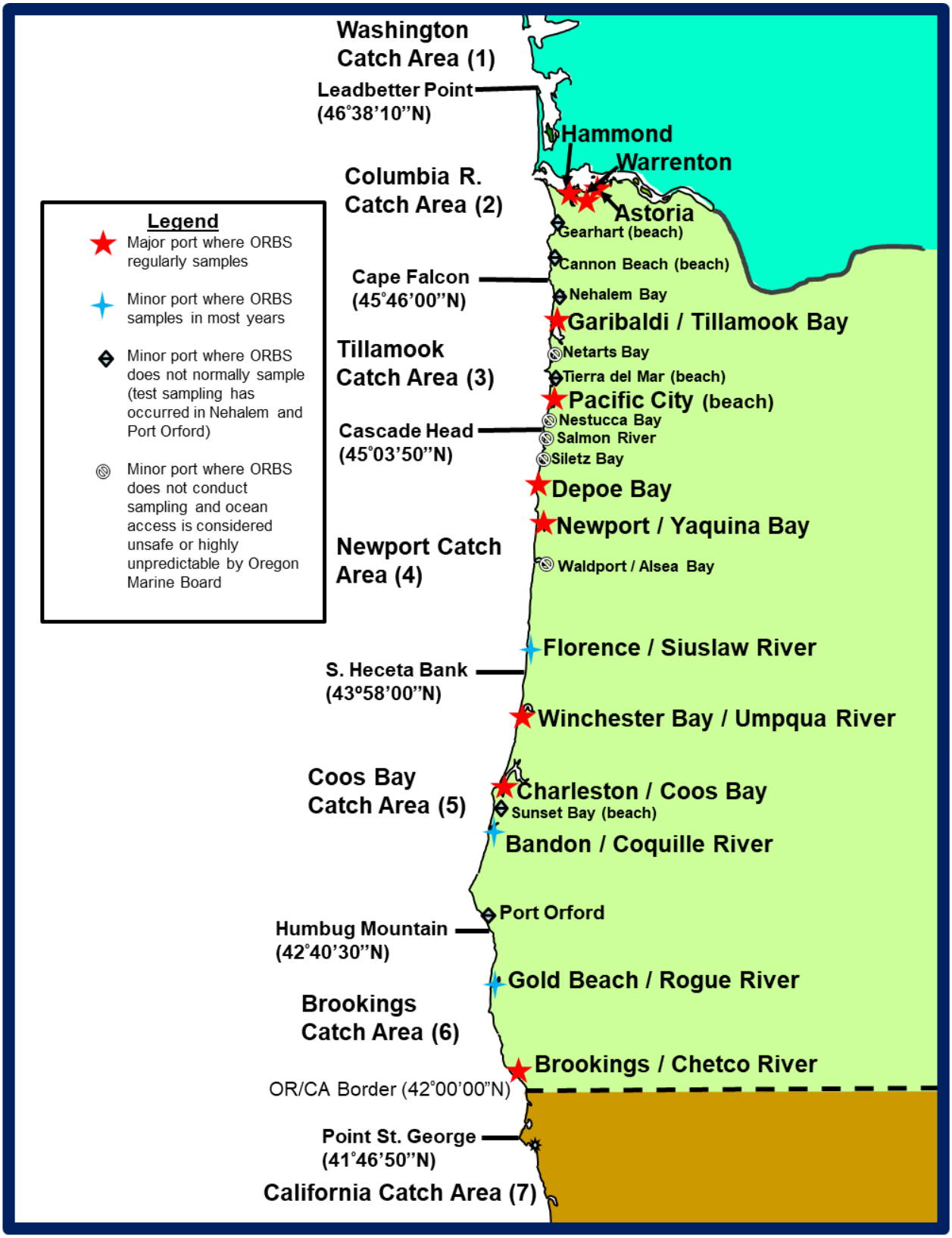

Figure 1. Oregon ocean catch areas, ocean access points, and ORBS sampling locations for the ocean boat fishery. Those sites with a "beach" designation are sites where launching is only via beach access through the surf.

A separate project, consisting of three PSMFC employees working with ODFW, conducts at-sea observations of charter fishing activity to gather information on retained and discarded fish (species, number per angler, average size, location of catch, depth of water, etc.) as well as shoreside sampling to collect age structures from select non-salmon species during the spring through fall. In the winter, these three samplers conduct ORBS sampling in Depoe Bay, Newport, and Brookings.

The ORBS project typically utilizes 24 seasonal port samplers and two crew leaders (one on the North Coast and one on the South Coast to collect the data needed to estimate the effort and catch in the ocean recreational boat-based fishery, and collect other fishery related information. At the start of seasonal employment, each seasonal employee is typically given a three to four day training and orientation session at the Newport office, and new hires are given an in-port orientation to familiarize them with the port where they will be stationed. During the peak months of the season (May through September), all data is delivered to the Marine Resources Program headquarters in Newport on Monday or Tuesday following the end of the prior statistical week. The data is error checked by Newport ORBS data staff, any errors are corrected, the data is then processed, and preliminary effort and catch estimates available by Thursday following the end of the sampling week.

The ORBS project has never been a static program. The project continues to evolve and make changes to sampling structure and methodology. These changes are related to either changes in the fishery, new management needs, recognition of short falls in the project, or improvements in efficiency. The project has gone from using paper forms with a staff of data entry personnel, to an optically scanned form, to handheld computers, and now ruggedized tablets for data collection. The project has changed effort counting methods to add to overall project efficiency and to account for late trips, and has transitioned all but two ports over to video recording equipment for improved effort counts. Undoubtedly, the future will hold many more changes to the project, and the project will continue to strive to provide the most accurate estimates of catch and effort possible to support the fishery management process.

Methodology: Effort Estimation

Effort estimation for the ocean fishery falls to one of several different methods that are dependent largely on the logistics of the port, and the boat type (charter, guide, or private). Effort estimates are made individually for each port, and then summed to estimate effort by area or for the statewide total.

Charter Vessel Effort Estimation

For charter vessels, ORBS relies on contacting each charter office to find out the number of trips by trip type (target species group) for each day of the week. For those few charters who are more transient in nature (they do not have a permanent charter office within the port), charter trips are accounted for using the same effort methods listed below for private boats, but they are recorded as “guides” to be able to identify the level of activity by category as needed. These trip counts are transferred to the “Recreational

Ocean Fishery Effort Form" (Figure 2). This form is a weekly summary of all recreational ocean effort in a port.

Private Vessel Effort Estimation

For private fishing vessels and guides/charters that are not associated with a local storefront or booking office, effort counts are made using one of four general methods: real-time live bar crossing counts, digital video bar crossing counts, digital video harbor exit counts, or trailer/slip counts. In making the counts, the ORBS employees must determine which boats would be on recreational trips or are on commercial fishing trips. If any potential exists that a commercial boat is on a recreational trip then the boat is included in the effort count and is included in the sampling frame. Some of the smallest commercial boats that are easily confused with recreational boats are added to a list for boat count reference use in each port, and local ORBS sampling staff are familiarized with those vessels. In situations where these small commercial fishing boats cannot be separated by the counter, they are included in the sampling frame and sampled as a private non-fishing trip with a notation to indicate they are a commercial boat that looked like a recreational.

Private Vessel Live Bar Crossing Count Method: Until 2010, this had been the primary method for counting private ocean recreational boats. This method involves making real time "bar crossing" counts for a set period of time. This standard method is currently only used when there is a breakdown in the video boat counting equipment. The count period is typically from dawn through 10:15. Both out and in counts are made using the "Ocean Fishery Boat Count" form. For each day that a count is made, the ORBS employee will fill out one form for the "OUT" count and a second form for the "IN" count of returning boats (Figure 3). The form includes fields for the port, boat counter's name, day type, IN/OUT count, date, statistical week, ocean conditions, weather conditions, and other comments. The boat counter makes their count within the specified time frame as scheduled, and records on the form both the starting and ending time of the count. The primary use of the "IN" count is as a correction of the "OUT" count for boats that turned around early and returned due to weather, sea, or other unforeseen circumstances prior to when ORBS samplers would have a chance to interview them. These early returning boats (usually prior to 7:45 AM) on the "IN" count are deducted from the total on the "OUT" count by the project leader the following week when the data arrives at the Newport field office.

Private boat "OUT" counts are transferred to the "Recreational Ocean Fishery Effort Form" (Figure 2), under the header of "PRIV OCEAN BOAT TRIPS". If adjustments are made to the "OUT" count for early returning trips, the adjusted "OUT" count is what is recorded in this column. The next column (labeled "FOR OFFICE USE ONLY") is the final estimate of the ocean private boat effort for the day, and is entered by project staff after making corrections and adjustments (as described below) to the count.

Private Digital Video Boat Count Methods: Beginning in 2009, cameras and digital video recorders (DVRs) began to supplant the real time count methodology. As of the end of the 2021 season, ORBS had implemented video boat counts (VBC) as the primary

methodology in Astoria, Warrenton, Hammond, Garibaldi, Depoe Bay, Newport, Winchester Bay, Charleston, Bandon, Gold Beach, and Brookings.

VBCs are conducted at some point after the actual period for the count has elapsed. Videos are reviewed in a fast forward scan until a vessel crosses the field of view of the camera, and then the video is slowed and/or replayed as needed to correctly identify the vessel type. Both the "out" and "in" counts for each VBC are recorded on a single form for each day (Figure 4). On average, VBC review takes approximately 12 minutes for each hour of count, with a full 16 hour count typically taking less than 2 ½ hours. Video advantages have proven to include an increase to the number of counts conducted, increasing the length of the counting window, and allowing for double checking if a specific count has issues. ORBS originally adopted a standard count period of 04:15-16:15, but has since expanded the end of the counting period to 20:14. By extending the count period to 20:14 the accuracy of the "out count" can be evaluated when compared to the "in count". This has proven invaluable in correcting for days when heavy fog obscures the video in the early part of the count. Additionally, the "in count" is similarly used to correct for early returning trips as described for the live counting methodology above. VBCs also allow for the counting period to be revised at any time to count later or earlier as the DVRs are recording 24 hours a day.

There are two versions of the VBC used currently. At Newport, Winchester Bay, Charleston, Bandon, Gold Beach, and Brookings; the VBC is an ocean entrance count. In this method of the VBC, the count is of boats entering and exiting the ocean across the bar. A second camera view in these locations that shoots directly across the channel allows for a better view of individual vessels, with the bar camera providing verification of ocean entrance. In the Columbia River ports of Astoria, Warrenton, and Hammond; and at Garibaldi; ORBS is using VBC that records at harbor exit points. In these locations, all private recreational boats are counted as they leave and as they return from and to the harbor areas. Total ocean trips are calculated from the harbor VBC based on the proportions of ocean and estuary trips encountered in the interviews.

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RECREATIONAL OCEAN FISHERY EFFORT FORM

PORT:	WEEK:	YEAR:	SAMPLER NAME: Jack Salmon
Newport(24)	35	2014	SAMPLER NUMBER: 22

CHARTER EFFORT **PRIVATE EFFORT**

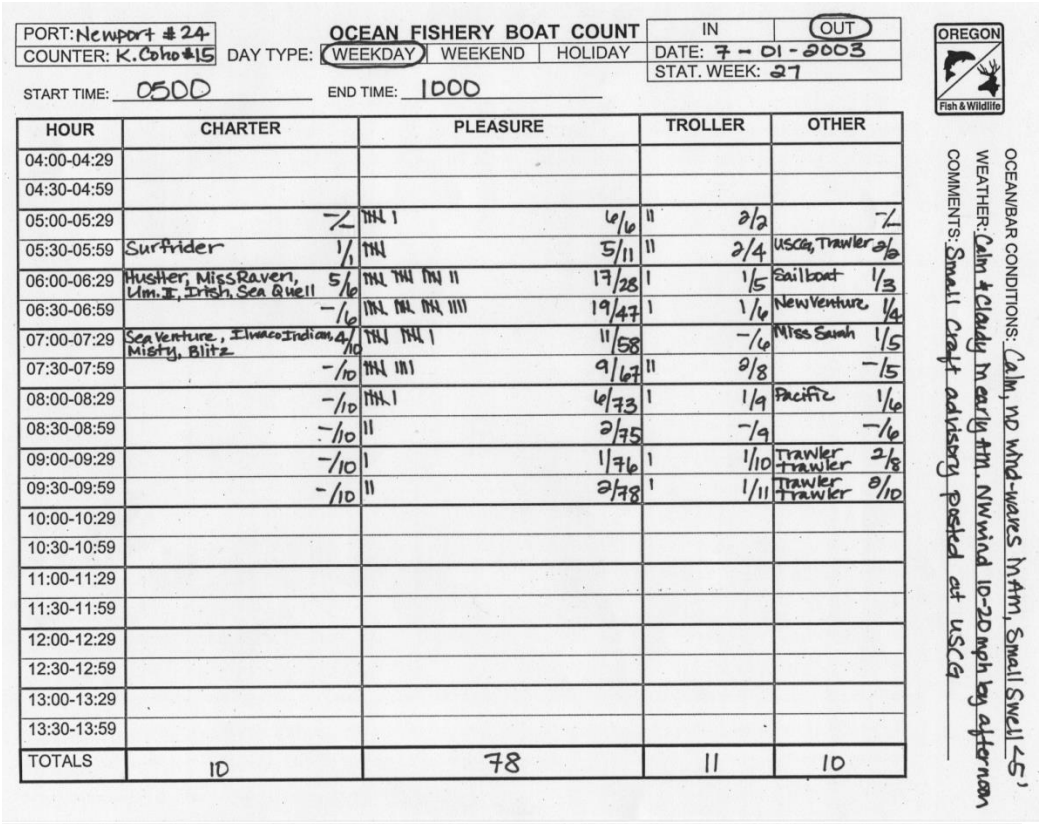
	MONTH	DAY	SALMON TRIPS	B-FISH TRIPS	COMBO TRIPS	TUNA TRIPS	HALIBUT TRIPS	DIVE TRIPS	BOAT COUNT START TIME	BOAT COUNT END TIME	PRIVATE OCEAN BOAT TRIPS	FOR OFFICE USE ONLY	EXPAN SION METHOD
Mon.	8	25		4									
Tues.	8	26	1	5									
Wed. off	8	27							0415	2015	21		
Thurs. off	8	28							0415	2015	17		
Fri.	8	29											
Sat.	8	30	11	4	2	1			0415	2015	408		
Sun.	8	31	8	6	1	2							
	TOTALS		20	19	3	3					446		

SOURCE OF EFFORT COUNTS: VBC and charter office interviews

RECORD PROBLEMS, COMMENTS OR DATA ADJUSTMENTS NEEDED HERE:

Check here if more notes on back of form ☐

Figure 2. ORBS Ocean Recreational Fishery Effort summary form.



PORT: Newport #24
COUNTER: K. Coho #15
DAY TYPE: (WEEKDAY) WEEKEND HOLIDAY
START TIME: 0500 END TIME: 1000

OCEAN FISHERY BOAT COUNT

IN (OUT)
DATE: 7-01-2003
STAT. WEEK: 27

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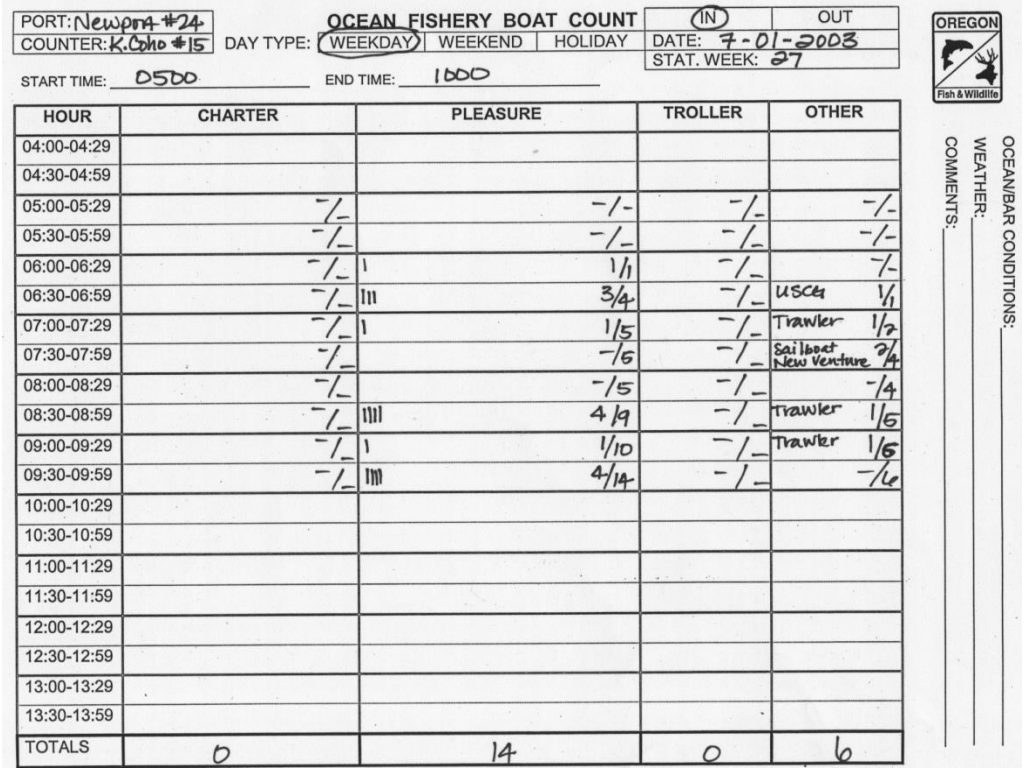
HOUR	CHARTER	PLEASURE	TROLLER	OTHER
04:00-04:29				
04:30-04:59				
05:00-05:29	-/-	6/6	2/2	-/-
05:30-05:59	Surfrider 1/1	5/11	2/4	USCG, Trawler 2/6
06:00-06:29	Hustler, Miss Raven, Um. I., Irish, Sea Que!! 5/6	17/28	1/5	Sailboat 1/3
06:30-06:59	-/6	19/47	1/6	New Venture 1/4
07:00-07:29	Sea Venture, Ilwaco Indian, Misty, Blitz 4/10	11/58	-/6	Miss Sarah 1/5
07:30-07:59	-/10	9/67	2/8	-/5
08:00-08:29	-/10	6/73	1/9	Pacific 1/6
08:30-08:59	-/10	2/75	-/9	-/6
09:00-09:29	-/10	1/76	1/10	Trawler Trawler 2/8
09:30-09:59	-/10	2/78	1/11	Trawler Trawler 8/10
10:00-10:29				
10:30-10:59				
11:00-11:29				
11:30-11:59				
12:00-12:29				
12:30-12:59				
13:00-13:29				
13:30-13:59				
TOTALS	10	78	11	10

OCEAN/BAR CONDITIONS: Calm, ND wind-waves 1ft, Small Swell <5'
WEATHER: Calm & Cloudy early AM. NW wind 10-20 mph by afternoon
COMMENTS: Small craft advisory posted at USCG



PORT: Newport #24
COUNTER: K. Coho #15
DAY TYPE: (WEEKDAY) WEEKEND HOLIDAY
START TIME: 0500 END TIME: 1000

OCEAN FISHERY BOAT COUNT

(IN) OUT
DATE: 7-01-2003
STAT. WEEK: 27

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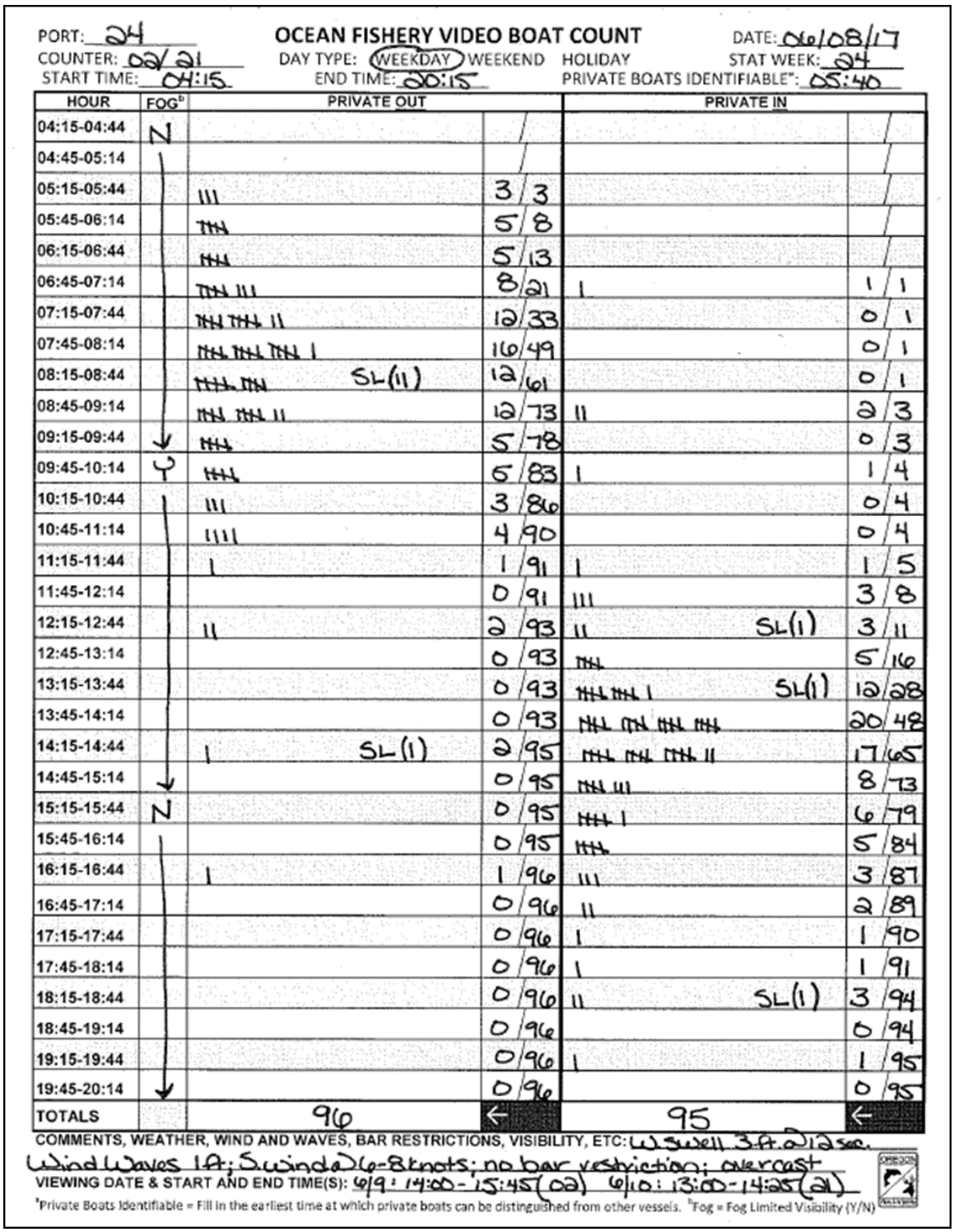
HOUR	CHARTER	PLEASURE	TROLLER	OTHER
04:00-04:29				
04:30-04:59				
05:00-05:29	-/-	-/-	-/-	-/-
05:30-05:59	-/-	-/-	-/-	-/-
06:00-06:29	-/-	1/1	-/-	-/-
06:30-06:59	-/-	3/4	-/-	USCG 1/1
07:00-07:29	-/-	1/5	-/-	Trawler 1/7
07:30-07:59	-/-	-/6	-/-	Sailboat, New Venture 2/4
08:00-08:29	-/-	-/5	-/-	-/4
08:30-08:59	-/-	4/9	-/-	Trawler 1/6
09:00-09:29	-/-	1/10	-/-	Trawler 1/6
09:30-09:59	-/-	4/14	-/-	-/6
10:00-10:29				
10:30-10:59				
11:00-11:29				
11:30-11:59				
12:00-12:29				
12:30-12:59				
13:00-13:29				
13:30-13:59				
TOTALS	0	14	0	6

OCEAN/BAR CONDITIONS:
WEATHER:
COMMENTS:

Figure 3. Samples of the ORBS standard live bar crossing count form.



PORT: 24 **OCEAN FISHERY VIDEO BOAT COUNT** DATE: 06/08/17
COUNTER: 02/21 DAY TYPE: (WEEKDAY) WEEKEND HOLIDAY STAT WEEK: 24
START TIME: 04:15 END TIME: 20:15 PRIVATE BOATS IDENTIFIABLE*: 05:40

HOUR	FOG[b]	PRIVATE OUT		PRIVATE IN	
04:15-04:44	N		/		/
04:45-05:14			/		/
05:15-05:44		III	3 / 3		/
05:45-06:14		++++	5 / 8		/
06:15-06:44		++++	5 / 13		/
06:45-07:14		++++ III	8 / 21	I	1 / 1
07:15-07:44		++++ ++++ II	12 / 33		0 / 1
07:45-08:14		++++ ++++ ++++ I	16 / 49		0 / 1
08:15-08:44		++++ ++++ SL(11)	12 / 61		0 / 1
08:45-09:14		++++ ++++ II	12 / 73	II	2 / 3
09:15-09:44		++++	5 / 78		0 / 3
09:45-10:14	Y	++++	5 / 83	I	1 / 4
10:15-10:44		III	3 / 86		0 / 4
10:45-11:14		IIII	4 / 90		0 / 4
11:15-11:44		I	1 / 91	I	1 / 5
11:45-12:14			0 / 91	III	3 / 8
12:15-12:44		II	2 / 93	II SL(1)	3 / 11
12:45-13:14			0 / 93	++++	5 / 16
13:15-13:44			0 / 93	++++ ++++ I SL(1)	12 / 28
13:45-14:14			0 / 93	++++ ++++ ++++ ++++	20 / 48
14:15-14:44		I SL(1)	2 / 95	++++ ++++ ++++ II	17 / 65
14:45-15:14			0 / 95	++++ III	8 / 73
15:15-15:44	N		0 / 95	++++ I	6 / 79
15:45-16:14			0 / 95	++++	5 / 84
16:15-16:44		I	1 / 96	III	3 / 87
16:45-17:14			0 / 96	II	2 / 89
17:15-17:44			0 / 96	I	1 / 90
17:45-18:14			0 / 96	I	1 / 91
18:15-18:44			0 / 96	II SL(1)	3 / 94
18:45-19:14			0 / 96		0 / 94
19:15-19:44			0 / 96	I	1 / 95
19:45-20:14			0 / 96		0 / 95
TOTALS		96	←	95	←

COMMENTS, WEATHER, WIND AND WAVES, BAR RESTRICTIONS, VISIBILITY, ETC: W swell 3ft. 12sec. Wind waves 1ft; S wind 6-8 knots; no bar restriction; overcast

VIEWING DATE & START AND END TIME(S): 6/9: 14:00 - 15:45 (02) 6/10: 13:00 - 14:25 (21)

*Private Boats Identifiable = Fill in the earliest time at which private boats can be distinguished from other vessels. [b]Fog = Fog Limited Visibility (Y/N)

Figure 4. Sample of the ORBS video boat count form.

Bar Crossing Count Expansions: For effort counts utilizing either the standard "live bar crossing count" or the ocean entrance VBC method, the sample data for the week is examined to determine the proportion of interviewed boats that crossed the bar either before or after the "bar crossing" count was conducted. This information is used to generate expansion factors which are applied back to the "OUT" counts (or "IN" count if the "IN" count is selected for the day) to estimate the total number of private boats that entered the ocean during the day. Most typically, a single expansion factor for all days of the week is calculated, but in weeks with significantly different season types (e.g., deep-water halibut season open for two days of the week, coho salmon season opens or closes mid-week, etc.) then separate expansion factors may be calculated for each season type. Generally, the expansion equates to 10% or less of the total effort for the week for the "live bar crossing count" method, and less than 1% for the VBC method. The formula used for the expansion of effort for trips crossing the bar/harbor outside the count period is:

$$\boldsymbol{E = C \times \left(\frac{(S_c + S_o)}{S_c} \right)}$$

Where:

E = Total ocean effort of private boats
S_c = Number of all ocean private boats interviewed
S_o = Number of ocean private boats interviewed that started trip outside the counting time frame
C = Bar crossing count of all ocean private boats during the counting time frame

Private Vessel VBC Method –Columbia River and Garibaldi: As noted earlier, in the Columbia River ports of Astoria, Warrenton, and Hammond, as well as at Garibaldi, a modified VBC method is utilized that counts boats as they leave/return to the harbor areas. Due to the facts that two state's (Oregon and Washington) boats cross at the mouth of the Columbia and the long distance across the Columbia River, there is no way to effectively conduct a count of vessels leaving Oregon ports and crossing the bar. In Garibaldi, our prior VBC counting site at the US Coast Guard tower was lost due to remodeling of the tower that started in 2017. We worked with the Port of Garibaldi to install a camera at the harbor entrance, and shifted to a harbor exit VBC method.

The count utilizes the same forms as in the standard VBC, and the count is entered on the "Recreational Ocean Fishery Effort Form" under the header of "private ocean boat trips". The count is later adjusted by the ORBS staff based on the proportion of boats interviewed that were only active in the estuary and did not enter the ocean, the proportion of boats that were active in both the estuary and the ocean, and the proportion of boats interviewed that departed outside of the effort count period (as described above). This is a three-stage process that involves (1) adjusting for effort outside the exit count period, (2) adjusting for boats that were active in both inside the estuary and outside in the ocean, and (3) making the final adjustment to estimate the total number of boats that were active in the ocean.

The adjustment for the effort outside of the exit count period uses the same formula as noted in the previous section with the addition of two more parameters to account for boats sampled from the estuary. The formula is as follows:

$$E_t = C \times \left(\frac{S_c + S_o}{S_c}\right)$$

Where:

E_t = Total estimated number of ocean and estuary private boats
S_c = Total of private boats interviewed that departed the harbor (ocean and estuary trips combined)
S_o = Number of private boats interviewed that entered the ocean or estuary but passed the count location outside of the exit count time period
C = Exit count of private boats

The second adjustment is made to account for boats that fished (or spent time) in both the estuary and the ocean, and results in a total number of boat trips to match the interviews. This is a correction factor to account for the dual interviews that occur for boats that spent time in both areas, but is only needed to adjust the effort at those locations where a harbor exit count is used. The formula to calculate the total boat trips is as follows:

$$E_{Di} = \frac{(S_c + S_e)}{(S_c + S_e - D_i)} \times E_t$$

Where:

E_{Di} = Total effort of ocean and estuary private boat trips accounting for dual interviews
E_t = Total effort of ocean and estuary private boats (downstream of the count site)
S_c = Total of private boats interviewed that entered the ocean
S_e = Total of private boats interviewed that fished or spent time in the estuary (downstream of the count site)
D_i = Number of private boat interviews of trips that spent time in both the estuary and ocean and for which dual interviews were conducted

One final calculation is needed in the Columbia ports and Garibaldi to correct for the proportion of estuary trips in the sampling. This formula results in an estimate of the number of private boat trips actually in the ocean, and is as follows:

$$E_o = \frac{S_c}{(S_c + S_e)} \times E_{Di}$$

Where:

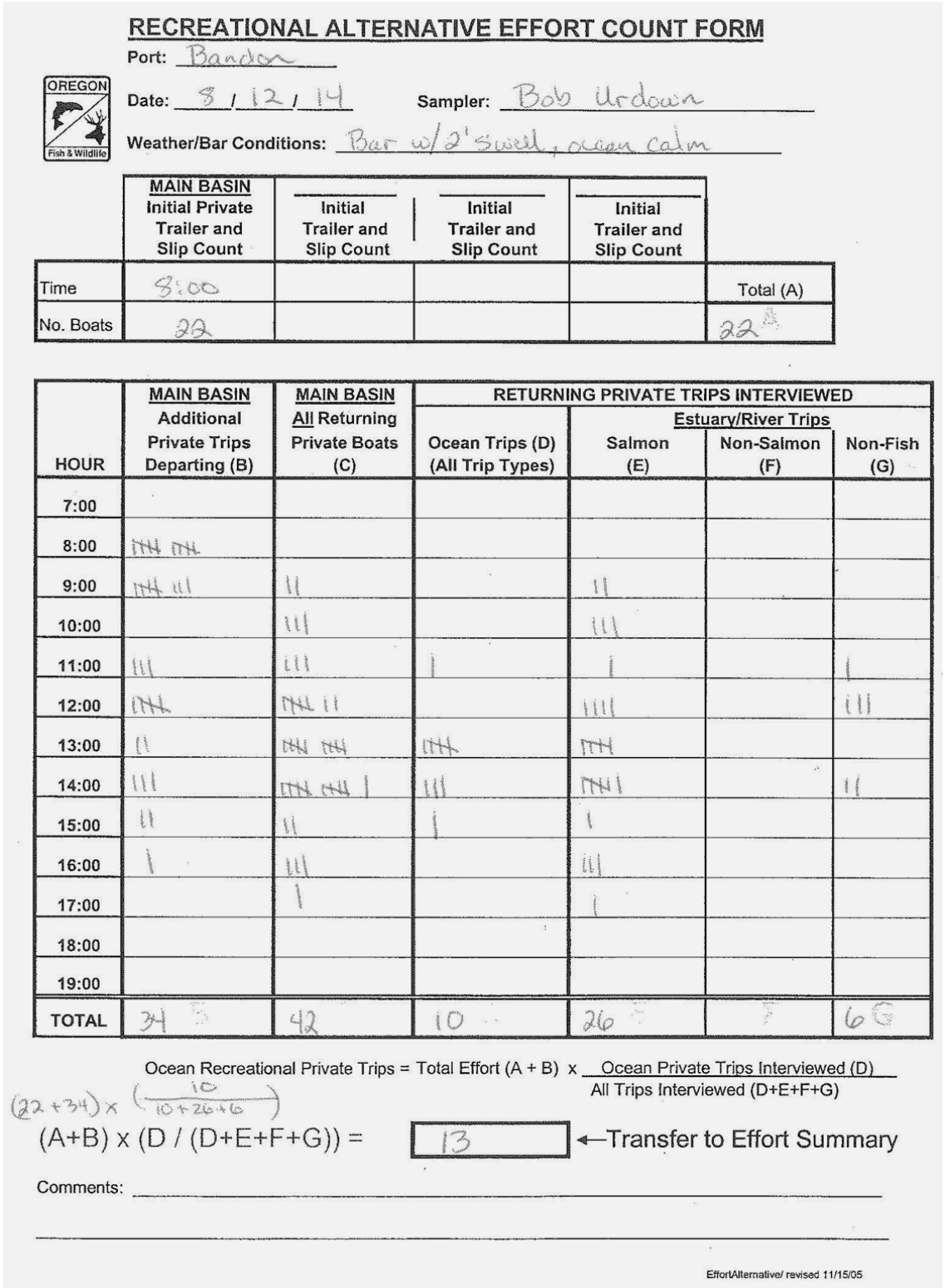
E_O = Estimated total number of ocean private boat trips
E_{Di} = Total effort of ocean and estuary private boat trips accounting for dual interviews
S_c = Total of private boats interviewed that entered the ocean
S_e = Total of private boats interviewed that fished or spent time in the estuary

For the VBCs, there is no means by which to change the location of the camera to adjust to fog. Instead, samplers reviewing video note the time periods when fog precludes getting an accurate vessel count, and an interpolation of the surrounding count periods may be used to fill in for periods when counts were not possible. Alternately, the "In" count is used if fog is only a counting issue early in the morning and not an issue affecting the count of trips returning after approximately 8:00 AM.

Private Vessel Alternative Effort Count: The port of Florence currently utilizes what is known as the "Alternative Effort Count". This method can only be utilized in smaller ports with a view of the exit channel and a single boat basin area that handles the vast majority of the ocean effort and that can be viewed completely by the ORBS sampler at all times.

The alternative effort count form involves four components to estimate the effort (Figure 5). First, the ORBS sampler makes a count of all empty boat trailers near the launch site and moorage slips that are currently in use but vacant at the time of the count. This count needs to include all locations that ocean boats are using as moorage or access points. This count is typically made only once at the start of the sampling day, usually between 8:00 AM and 9:00 AM, and before the fishing boats start returning to port. The start time and initial count may need to occur earlier based on weather conditions and angler success rates. It is important that the ORBS sampler be familiar with which moorage slips are currently occupied by private boats, and which boat trailers are simply being stored in parking areas.

The second component of the alternative effort count is to count any additional departing private boats throughout the day. This includes boats launching at the ramp, boats leaving moorage slips, and boats heading downstream from other moorage areas upstream. The third component involves keeping a count of all private boats that are returning to their moorage slips, the boat ramp, and upstream moorage sites.



RECREATIONAL ALTERNATIVE EFFORT COUNT FORM

Port: Bandon

OREGON Fish & Wildlife

Date: 8 / 12 / 14 Sampler: Bob Urdown

Weather/Bar Conditions: Bar w/2' swell, ocean calm

	MAIN BASIN Initial Private Trailer and Slip Count	Initial Trailer and Slip Count	Initial Trailer and Slip Count	Initial Trailer and Slip Count	
Time	8:00				Total (A)
No. Boats	22				22 A

HOUR	MAIN BASIN Additional Private Trips Departing (B)	MAIN BASIN All Returning Private Boats (C)	RETURNING PRIVATE TRIPS INTERVIEWED			
			Ocean Trips (D) (All Trip Types)	Estuary/River Trips Salmon (E)	Non-Salmon (F)	Non-Fish (G)
7:00						
8:00	𝍸 𝍸					
9:00	𝍸 |||	||		||		
10:00		|||		|||		
11:00	|||	|||	|	|		|
12:00	𝍸	𝍸 ||		||||		|||
13:00	||	𝍸 𝍸	𝍸	𝍸		
14:00	|||	𝍸 𝍸 |	|||	𝍸 |		||
15:00	||	||	|	|		
16:00	|	|||		|||		
17:00		|		|		
18:00						
19:00						
TOTAL	34 B	42 C	10 D	26 E	F	6 G

Ocean Recreational Private Trips = Total Effort (A + B) x (Ocean Private Trips Interviewed (D) / All Trips Interviewed (D+E+F+G))

(22 + 34) x (10 / (10+26+6))

(A+B) x (D / (D+E+F+G)) = 13 ←Transfer to Effort Summary

Comments: _____

EffortAlternative/ revised 11/15/05

Figure 5. Private boat effort count form currently in use at ORBS at the port of Florence.

The fourth and final component is to tally the boats that are interviewed by category on the form. The categories are ocean trips (all trip types), and estuary trips which are split out for salmon, non-salmon, and non-fishing trip types.

These components are plugged into the following formula to estimate the ocean private boat effort for the day:

$$\boldsymbol{E_t = (T + L)\frac{O_i}{(O_i + B_i)}}$$

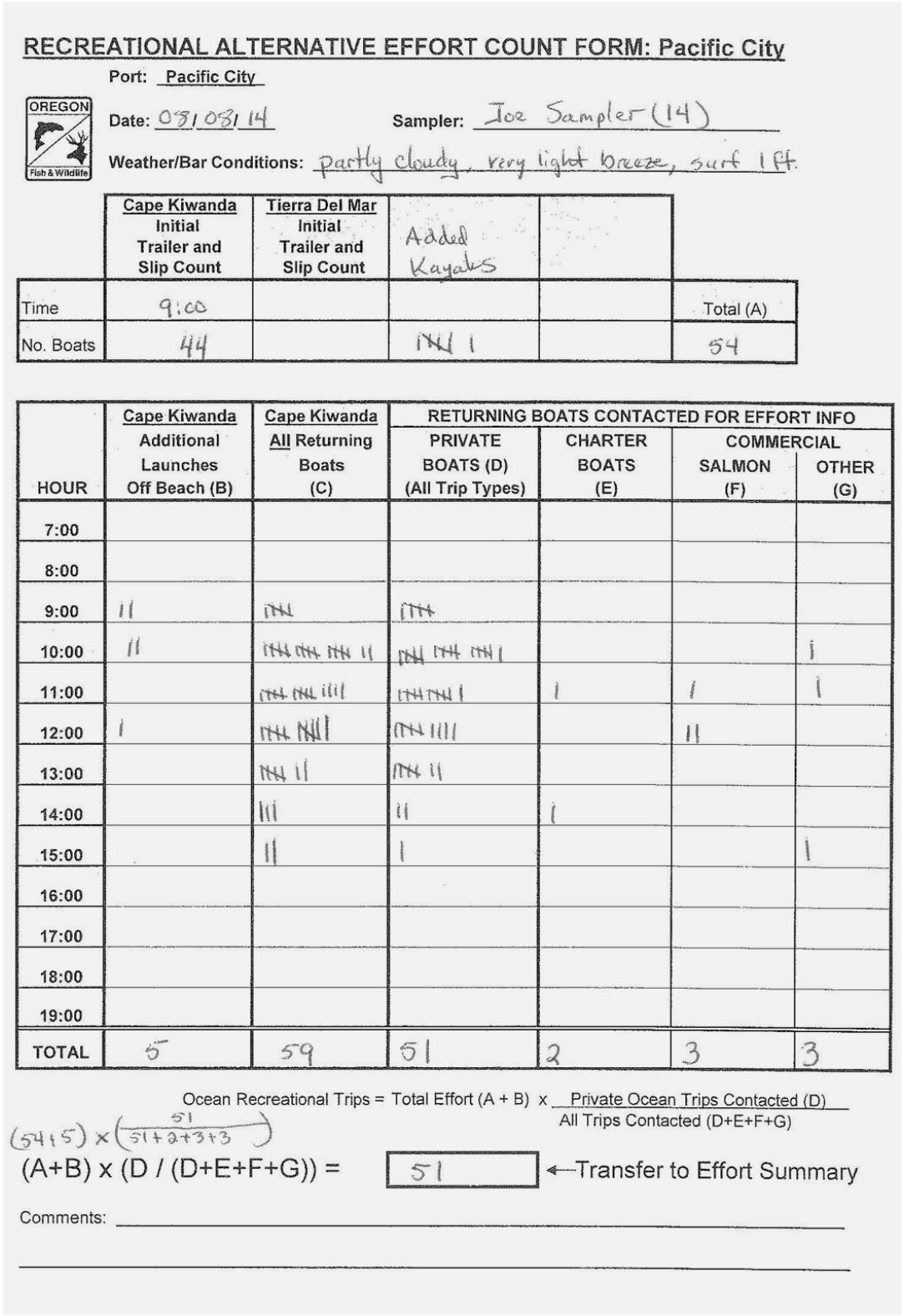
Where:

E_t = Total ocean effort of private boats
T = Initial count of trailers and slips at launch and moorage locations
L = Total of all additional private boat departures during the day
O_i = Total of ocean private boat interviews
B_i = Total of estuary private boat interviews

The total effort is entered onto the "Recreational Ocean Fishery Effort Form", under the header of "PRIV OCEAN BOAT TRIPS". No further adjustments to the effort are made.

Private Vessel Alternative Effort Count – Pacific City: The fishery and fleet at the "port" of Pacific City requires a slightly modified alternative count method for accounting for private boat effort. Pacific City is a beach access point just South of Cape Kiwanda where flat bottomed dories are launched through the surf. In addition, other vessel types such as kayaks and jet skis will also launch at this location. A fair number of the boats in the dory fleet have commercial fishing licenses and on any given day may be either sport fishing or commercial fishing. In order to accurately estimate the component of the fleet that is sport fishing, a separate count form is used at Pacific City (Figure 6). This method accounts for the commercial traffic in much the same way that the "alternative effort count form" deals with estuary fishing activity in other ports.

The ORBS sampler starts the form by making a count of all trailers on the beach and the adjacent parking lot just south of Cape Kiwanda at the start of the sampling day. This initial count usually needs to occur between 7:00 AM and 9:00 AM. Next, any additional boat launches are recorded during the hour in which they occurred.



RECREATIONAL ALTERNATIVE EFFORT COUNT FORM: Pacific City

Port: Pacific City

Date: 05/03/14 Sampler: Joe Sampler (14)

Weather/Bar Conditions: partly cloudy, very light breeze, surf 1 ft.

	Cape Kiwanda Initial Trailer and Slip Count	Tierra Del Mar Initial Trailer and Slip Count	Added Kayaks		
Time	9:00				Total (A)
No. Boats	44		IIII 1		54

HOUR	Cape Kiwanda Additional Launches Off Beach (B)	Cape Kiwanda All Returning Boats (C)	RETURNING BOATS CONTACTED FOR EFFORT INFO: PRIVATE BOATS (D) (All Trip Types)	CHARTER BOATS (E)	COMMERCIAL SALMON (F)	COMMERCIAL OTHER (G)
7:00						
8:00						
9:00	II	IIII	IIII			
10:00	II	IIII IIII IIII II	IIII IIII IIII I			I
11:00		IIII IIII IIII	IIII IIII I	I	I	I
12:00	I	IIII IIII I	IIII IIII		II	
13:00		IIII II	IIII II			
14:00		III	II	I		
15:00		II	I			I
16:00						
17:00						
18:00						
19:00						
TOTAL	5	59	51	2	3	3

Ocean Recreational Trips = Total Effort (A + B) x Private Ocean Trips Contacted (D) / All Trips Contacted (D+E+F+G)

(54+5) x (51 / (51+2+3+3))

(A+B) x (D / (D+E+F+G)) = 51 ← Transfer to Effort Summary

Comments: _____

Figure 6. Effort count form currently in use by ORBS at Pacific City to estimate recreational fishing effort (identifies proportion of commercial fishing boats in trailer count).

Throughout the day, the ORBS sampler tallies all returning boats on the form in column C as they land back on the beach. Then the sampler tallies each boat as to the category the boat falls within: "private boat", "charter boat", "commercial salmon", or "commercial/other" based on contacts with vessels. These components are then entered into the following formula to calculate total private boat effort:

$$E_t = (T + L)\frac{P_i}{(P_i + G_i + C_i)}$$

Where:

E_t = Total effort of private boats
T = Initial count of trailers
L = Total of all additional boat departures during the day (includes commercial boats)
P_i = Interviewed ocean private boats returning to beach
G_i = Interviewed charter boats returning to beach
C_i = Interviewed commercial and other boats returning to beach (sum of all types)

This total is entered onto the "Recreational Ocean Fishery Effort Form", under the header of "PRIV OCEAN BOAT TRIPS". Recently, more kayaks and personal watercraft (PWC) have been using Pacific City to access the ocean. An additional "trailer" is added to the count for each extra kayak or PWC beyond one per vehicle. No further adjustments to the effort are made.

Private Vessel Effort Counts – Expansions for non-count days: Typically ORBS conducts private boat effort counts using the VBC method for all days. For the alternate effort count methods, counts are made at a minimum of four days each week (both weekend days and two or three weekdays). For those days when there were no effort counts made, expansions are made by ORBS staff in Newport to account for the non-counted days. These expansions are simple averages of the counted days that are of similar day and season types. In other words, if it is an all-depth halibut season weekday, then only other deep water halibut season weekdays will be used to average the effort.

If a storm or other extreme weather or ocean conditions occurred on a non-counted day, and information is available to indicate that there were no ocean trips on a non-counted day (US Coast Guard kept the bar closed, adjacent port with a zero count, etc.), then effort would be assigned a zero count for the day.

Methodology: Interviews

The primary goals of the ORBS dockside interviews are to generate accurate and unbiased estimates of anglers per boat and catch by species per boat for the ocean recreational boat fishery, and to sample and recover salmon coded wire tags (CWTs) from Chinook Salmon, Coho Salmon, and steelhead (sea run Rainbow Trout). Further, the estimates are expected to be accurate at the level of statistical week, port, boat type, trip type, season type, and area of effort/catch. To sample salmon adequately for CWTs, a minimum sampling rate standard of 20% of landed salmon by port and week has been established to better ensure that CWT recoveries will represent the actual fishery interceptions occurring for any given strata. The ORBS has adopted this as the minimum standard for all fisheries and time periods sampled.

A variety of other data are also collected, including information on the number of fish released, lengths and weights of fish, departure time, interview time, and information on estuary trips. The data is stratified by port and summed over ports to generate estimates for catch areas and the entire state.

Interview Selection and Bias Avoidance

Due to substantial differences between charters and private boats (i.e., charters often use moorage areas that are separated from the private boat use areas, have a wider range in number of anglers, and the fact that charter trip types and return times are available in advance), charter boat effort is stratified to trip type prior to the interview, and interviews are selected by samplers to be representative of the fleet activity for the various target species over the course of the week or season type. Private boats cannot be stratified to trip type prior to the interview, and therefore interviews are selected in a random fashion within the boat basin and launch ramp area to reduce potential sampling bias towards trip type.

ORBS samplers are instructed to interview private boats without prejudice to size, number of anglers, presence or absence of fish or fishing tackle, etc. Samplers are instructed to always interview the "next boat" that they see returning to their area of operation, and once that interview is completed, to look for the next returning boat. Private boat interviews are recorded for any boat that has completed their trip; regardless of whether they entered the ocean or even fished (a correct proportion of non-fishing trips is needed to determine actual fishing effort).

Sampling schedules are set in advance by ORBS permanent staff to provide representative sampling coverage for all day types, season types, and to cover the hours of the day when charter and private fishing vessels can be expected to return from the ocean. Interviews are always initiated at the boat at the time that it arrives back at the dock or ramp to ensure that all anglers and catch are present from the trip.

ORBS Interview

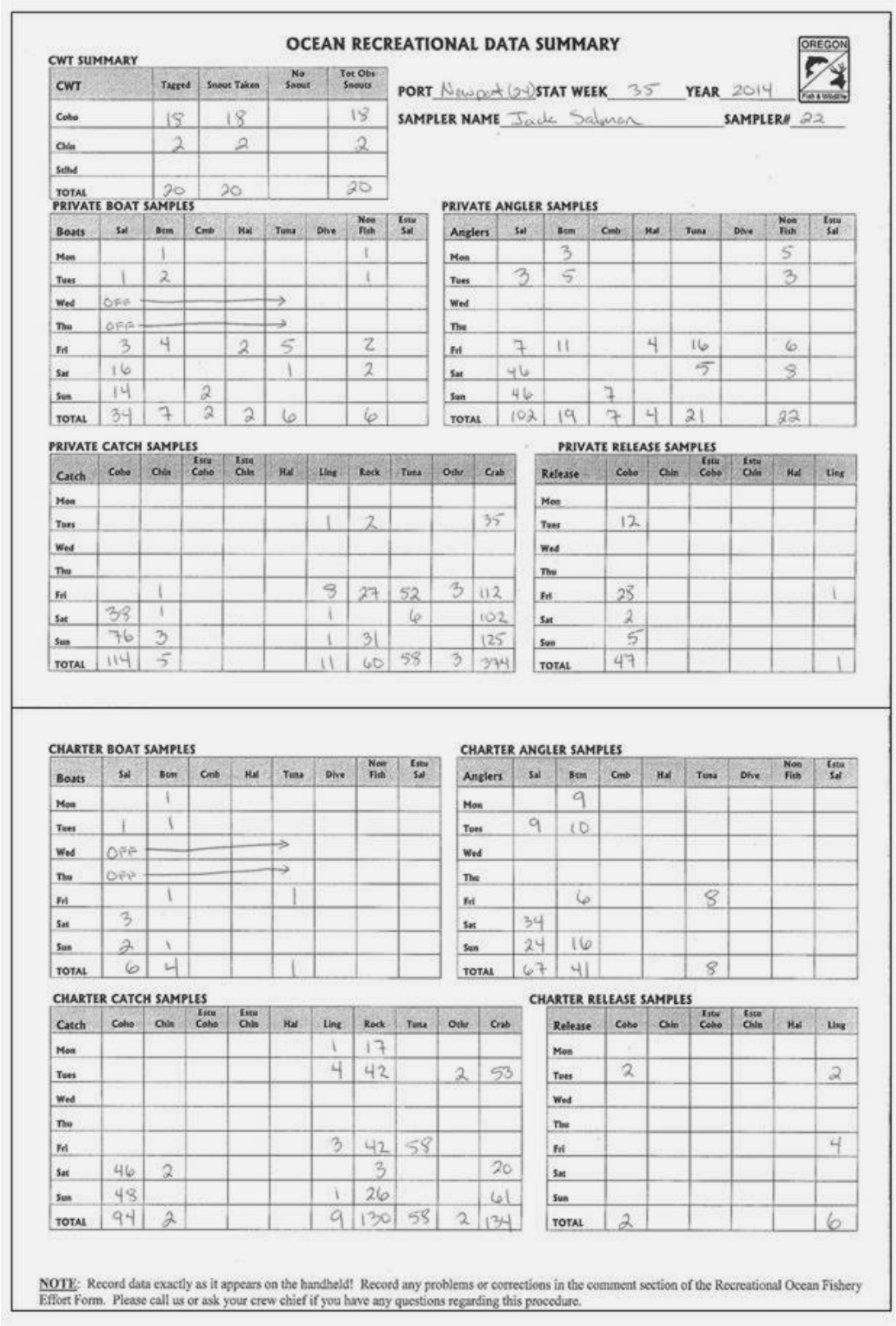
Dockside interviews are currently recorded on a ruggedized tablet (computer) which utilizes a program developed by ORBS staff specific for the tasks of sampling the recreational fishery. This program assists in making sure that all pertinent interview data is gathered and that errors are minimized by using a series of prompts for such things as data that falls outside of expected ranges, and missing data elements. The ORBS interview is not static; it has continued to evolve throughout the history of the project, and the future is certain to hold more refinements or new elements to the interview. The current content and source of the interview data is summarized in Table 1. Additional specialized data elements such as profiles of fishing gear, PIT tag scanning, etc., are occasionally collected, but are not part of the standard ORBS interview.

Table 1. Detailed summary of the Oregon Ocean Recreational Boat Survey (ORBS) dockside interview data elements, frequency of collection, and associated information.

Data Element Collected	Frequency of Collection	Source of Data/Method of Collection	Notes
Sampler ID (Number)	All interviews	Entered once, then automated	Each sampler assigned a 2 digit ID number.
Port (Number)	All interviews	Entered once, then automated	Sampler only needs to change port ID number if they sample at a different port.
Time and Date of Interview	All interviews	Auto generated	Time and date in the computer need only be checked periodically to insure that it is accurate.
Interview Number	All interviews	Auto generated	Starts at 1 each day
Boat Number/Name	All interviews	Entered by sampler on inspection of vessel	Generally state marine board number used for private boats and name used for charters. Drop down list of local charter vessels. If vessel is missing number (new boat) "NONUMBER" is entered from drop down list.
Fishery (Ocean/Estuary)	All interviews	Entered by sampler based on angler response	Anglers are queried to determine if they fished or spent part of trip within estuary or if trip activities were in the ocean.
Boat Type (Charter/Guide/Private)	All interviews	Entered by sampler	Anglers are only queried if there is a question as to the boat type. Guide defined as a charter operating without a fixed station/office.
Trip Targets	All interviews	Entered by sampler based on angler response	Anglers are queried as to activities that occurred during their trip within specific categories. Check off list currently includes: "Salmon"; "Pacific Halibut"; "Rockfish, Lingcod, Cabezon, Greenling, and other Bottomfish"; "Rockfish - Longleader gear >40 fm"; "Flatfish"; "Baitfish"; "Surfperch"; "Sturgeon"; "Tuna, Billfish, and other Offshore Pelagic Species"; "Shark"; "Dive Spearfishing"; "Dive Other"; "Crabbing"; "Clamming"; "Trout Estuary"; "Hunting"; "Non fishing boat trouble"; Non fishing weather/seasick"; "Non fishing wildlife viewing"; "Non fishing other"; "Commercial - appeared as possible recreational"; and "Incomplete"
Trip Type – (Salmon (salmon only) / Combo (salmon + other finfish) / Halibut (Pacific halibut + other finfish other than salmon) / Bottomfish (bottomfish species + tuna and pelagics, but no salmon or Pacific halibut) / Tuna (tuna and other pelagic species, but no salmon, Pacific halibut, or bottomfish) / Spearfishing (no angling on trip, only spearfishing) / Non fishing (no angling or spearfishing on trip, but other non-angling harvest activities such as crabbing, clamming, or waterfowl hunting may occur))	All interviews	Auto generated based on angler response to "trip targets"	Anglers are queried as to the target fish species of the trip.
Catch Area (Number)	All interviews	Entered by sampler based on angler response	Anglers are queried as to the general area of activity.
Sub-area Major Reef Location (Number)	Interviews for trip types other than salmon, tuna, or non fishing.	Entered by sampler based on angler response	Anglers are queried to a more specific reef area activity for groundfish species.
Number of Anglers	All interviews	Entered by sampler based on angler response	Total of all anglers on fishing vessels (includes crew that fished on charters), or all passengers on non fishing trips.
Bottom Depth of Fishing	All bottomfish, halibut, and combo trips interviewed	Entered by sampler based on angler response	Average bottom depth where majority of bottomfish encountered
Departure Time (Start of Trip)	All interviews	Entered by sampler based on angler response	
Trip Hours within Fishery	All interviews	Entered by sampler based on angler response	Calculated based on time spent within each fishery (ocean/estuary)

Table 1 (continued). Detailed summary of the Oregon Ocean Recreational Boat Survey (ORBS) dockside interview data elements, frequency of collection, and associated information.

Data Element Collected	Frequency of Collection	Source of Data/Method of Collection	Notes
Both Ocean and Estuary on Same Trip (Y/N)	All interviews	Entered by sampler based on angler response	This is assigned a yes value if two interviews need to be conducted for the two separate fisheries for the same trip.
Encounter Data: Species ID Code	All interviews with Landed or Released Catch	Entered by sampler	
Encounter Data: Species Retained (Number)	All interviews with Landed Catch	Entered by sampler based on actual count of fish	Samplers count all landed catch with exceptions for crab and albacore tuna where angler estimate of catch is accepted and "baitfish" (herring, anchovies, etc.) where an estimate of the number of fish caught is used.
Encounter Data: Species Released (Number)	All interviews with Reported Released Catch	Entered by sampler based on angler response	Anglers are queried as to whether they released any fish during the trip. If yes, they are queried for number by species. Additional "pop up" question when specific rockfish species are reported as released to identify whether a "release at depth" device was used.
Encounter Data: Number of Coded Wire Tagged Salmon Retained	All interviews with Landed Chinook or Coho Salmon or steelhead	Entered by sampler based on examination of catch	Samplers electronically inspect all Chinook, Coho, and steelhead for tags
Encounter Data: Number Adipose Fin Clipped Salmon Retained	All interviews with Landed Chinook or Coho Salmon or steelhead	Entered by sampler based on examination of catch	Visual inspection of retained salmon and steelhead for adipose fin clips
Biological Data Length/Weight: Species ID Code	As needed to meet sampling goals for various species from the ocean fishery: 15 per non-salmon species per week, and all Coho from 2 boats per day.	Entered by sampler	Length/Weight data is not collected for Pacific Halibut, Albacore Tuna, salmon other than Coho, or other species in excess of 900mm. For Coho Salmon, weights are taken from fish that are commercially dressed i.e. gutted and gilled. For all other species, weights are for fish in the round.
Biological Data Length/Weight: Fork Length (mm)		Entered by sampler to at least the nearest 5 mm based on measurement from measuring board	
Biological Data Length/Weight: Weight (kg)		Entered by sampler to at least the nearest 0.1 kg based on measurement from hand scale	
Biological Data Lengths: Species ID Code	All landed Chinook salmon (ocean caught only) and all Pacific Halibut from every other boat	Entered by sampler	
Biological Data Lengths: Fork Length (mm)		Entered by sampler to the nearest 5 mm	
Biological Data - CWT: Species ID Code	All landed Chinook Salmon, Coho Salmon, and steelhead that test positive for the presence of a CWT will have an entry even if tag is not able to be recovered.	Entered by sampler	
Biological Data - CWT: Fork Length (mm)		Entered by sampler to the nearest 5 mm	
Biological Data - CWT: CWT ID Number		Entered by sampler based on the unique ID number that is assigned the fish.	
Biological Data - CWT: CWT Collected (Y/N)		Entered by sampler, "Y" if CWT was collected "N" if CWT was not collected.	
Biological Data - CWT: Snout		Snout recovered for all CWTs whenever possible, unique ID number is included with snout in plastic bag.	



OCEAN RECREATIONAL DATA SUMMARY

OREGON Fish & Wildlife

CWT SUMMARY

CWT	Tagged	Snout Taken	No Snout	Tot Obs Snouts
Coho	18	18		18
Chin	2	2		2
Stlhd				
TOTAL	20	20		20

PORT Newport (24) STAT WEEK 35 YEAR 2014

SAMPLER NAME Jade Salmon SAMPLER# 22

PRIVATE BOAT SAMPLES

Boats	Sal	Bcm	Cmb	Hal	Tuna	Dive	Non Fish	Estu Sal
Mon		1					1	
Tues	1	2					1	
Wed	OFF	→						
Thu	OFF	→						
Fri	3	4		2	5		2	
Sat	16				1		2	
Sun	14		2					
TOTAL	34	7	2	2	6		6	

PRIVATE ANGLER SAMPLES

Anglers	Sal	Bcm	Cmb	Hal	Tuna	Dive	Non Fish	Estu Sal
Mon		3					5	
Tues	3	5					3	
Wed								
Thu								
Fri	7	11		4	16		6	
Sat	46				5		3	
Sun	46		7					
TOTAL	102	19	7	4	21		22	

PRIVATE CATCH SAMPLES

Catch	Coho	Chin	Estu Coho	Estu Chin	Hal	Ling	Rock	Tuna	Othr	Crab
Mon										
Tues						1	2			35
Wed										
Thu										
Fri		1				9	27	52	3	112
Sat	38	1				1		6		102
Sun	76	3				1	31			125
TOTAL	114	5				11	60	58	3	374

PRIVATE RELEASE SAMPLES

Release	Coho	Chin	Estu Coho	Estu Chin	Hal	Ling
Mon						
Tues	12					
Wed						
Thu						
Fri	23					1
Sat	2					
Sun	5					
TOTAL	47					1

CHARTER BOAT SAMPLES

Boats	Sal	Bcm	Cmb	Hal	Tuna	Dive	Non Fish	Estu Sal
Mon		1						
Tues	1	1						
Wed	OFF	→						
Thu	OFF	→						
Fri		1			1			
Sat	3							
Sun	2	1						
TOTAL	6	4			1			

CHARTER ANGLER SAMPLES

Anglers	Sal	Bcm	Cmb	Hal	Tuna	Dive	Non Fish	Estu Sal
Mon		9						
Tues	9	10						
Wed								
Thu								
Fri		6			8			
Sat	34							
Sun	24	16						
TOTAL	67	41			8			

CHARTER CATCH SAMPLES

Catch	Coho	Chin	Estu Coho	Estu Chin	Hal	Ling	Rock	Tuna	Othr	Crab
Mon						1	17			
Tues						4	42		2	53
Wed										
Thu										
Fri						3	42	58		
Sat	46	2					3			20
Sun	48					1	26			61
TOTAL	94	2				9	130	58	2	134

CHARTER RELEASE SAMPLES

Release	Coho	Chin	Estu Coho	Estu Chin	Hal	Ling
Mon						
Tues	2					2
Wed						
Thu						
Fri						4
Sat						
Sun						
TOTAL	2					6

NOTE: Record data exactly as it appears on the handheld! Record any problems or corrections in the comment section of the Recreational Ocean Fishery Effort Form. Please call us or ask your crew chief if you have any questions regarding this procedure.

Figure 7. The weekly ORBS interview summary form (front and back).

Interview Summary Form
At the end of each workday, each ORBS sampler is required to run a data summary program on their handheld data computer. The results of this summary are then transferred to a two-sided summary form (Figure 7). The summary form has two primary uses. First, it provides minimal information from the interviews that could be used to recreate the majority of the data in the event of failure of the handheld computer. The second use is for mid-week updates on the fishery. This is primarily used for near real-time monitoring of quota managed salmon fisheries and making sure that the overall landings do not exceed the quota.

Final Catch and Effort Expansion
The remaining process is to make the final expansion of the interview data to the fishing population within each stratification. Due to the nature of the effort estimates, separate estimates and expansions are made for charter boats and private/guide boats.

Methodology: Estimation

With the two components of effort and interviews in hand, estimates can now be generated for each of the parameters from the interviews. There are two stages to this process. The first is to calculate design-based estimates of total catch and associated variances according to the assumed sampling design (i.e., stratified, simple random sampling). This stage is described briefly below but more detailed documentation, including computer code and variance estimation formulae, is available upon request. The second stage in the process involves model-based steps to account for potential under-coverage errors in the sampling frame and is done prior to upload of the estimates into RecFIN.

Design-based estimation of all sampling parameters (i.e., anglers, catch by species, released catch by species) is calculated by assuming that sampled boats are a simple random sample of all boats in each stratum. The standard, unbiased estimator for a total is used for estimation:

$$P_t = E_t\left(\frac{P_s}{S_c}\right)$$

Where:

P_t = Total estimated parameter (i.e. anglers, catch by species, released catch by species)
P_s = Sum of sampled units by parameter
S_c = Number of sampled boats
E_t = Total effort in number of boats

Catch and effort are summed across pertinent strata to generate the final estimate. For example, total of salmon angler trips is the sum of anglers on salmon trips and anglers on combination trips for all season types during the week; while the total of Coho Salmon

catch for a port and week is the sum of coho caught on each of the trip types (salmon, combination, bottomfish, halibut, tuna, and spearfishing).

The variance of the total is calculated using the standard formula for simple random sampling (shown here without indices for strata):

$$Var(P_t) = {E_t}^2 \left(1 - \frac{S_c}{E_t}\right)\left(\frac{s^2}{S_c}\right),$$

$$where\ s^2 = \frac{1}{S_c - 1}\sum_{i \epsilon S_c}(p_i - \bar{p})^2$$

Where:

- $\mathbf{P_t}$ = Total estimated parameter (i.e. anglers, catch by species, released catch by species)
- $\mathbf{P_s}$ = Sum of sampled units by parameter
- $\mathbf{S_c}$ = Number of sampled boats
- $\mathbf{E_t}$ = Total effort in number of boats
- $\mathbf{p_i}$ = Measurement (i.e. anglers, catch by species, released catch by species) on sample boat *i*

RecFIN Expansion for Unsampled Ports and Time Periods

The Pacific States Marine Fisheries Commission (PSMFC) maintains a recreational fisheries database known as the Recreational Fishery Information Network (RecFIN). Much of the data in the RecFIN system was originally provided by MRFSS, but now the ocean boat portion of the data is supplied by ORBS. Due to the extreme seasonal nature of fisheries for salmon, Pacific halibut, and albacore tuna the following expansions are not made for those species. The weekly estimates with expansions are summed to the monthly level and provided to PSMFC for inclusion in the RecFIN database. The ORBS does not use or maintain these estimates after they have been transferred to and uploaded by PSMFC to RecFIN. Variances noted above are currently not extended to include the RecFIN expansions.

We now generate estimates for unsampled ports. They are dynamically generated using data from previously sampled time periods at these ports. These previously sampled time periods are partitioned into two seasons, summer and winter. The summer season extends throughout the period when full port sampling effort is occurring, June – September (weeks 25-38). The winter season is November through February. Currently, winter season data used for unsampled port expansions are those collected during the November 2011 – February 2014 MRIP-supported pilot project intended to collect updated winter effort and catch information.

The time of year for which unsampled port estimates are being generated determines whether summer or winter data from previously sampled time periods are used.

Estimates generated for the March through October timeframe use summer data, whereas estimates for the November through February timeframe use winter data.

The estimates for boat effort and catches/releases in numbers of fish for unsampled ports use the following three data components:

- Unsampled Port Boat Effort: Unsampled port fishing effort (number of boat-trips) is estimated using the weekly average of effort at the currently unsampled port's last previous sampling seasons compared to the total effort for all ports during the same time period. Estimates outside the November – February winter season are generated using data from the three previous summer seasons, while estimates made for weeks during the November – February season use the 2011-2014 winter sampling data.

- Unsampled Port Catch per Boat: Unsampled port catch per boat is estimated using the average of the single year sampled catch per boat data determined by the season for which the estimates are generated.

- Unsampled Port Species Composition: Unsampled port species compositions are estimated using the average of the single year sampled species composition data determined by the season for which the estimates are generated.

Effort estimate calculations use data differently depending on when the estimate is being created for. Estimates for weeks during March through October use the average of the three most recent summer sampling seasons. Using three years increases the amount of data available for average effort calculations. Limiting the period to three years minimizes impacts of longer term effort shifts seen within the fishery. When generating unsampled port estimates for weeks in November through February, data from the 2011-2014 winter sampling seasons are used.. When generating catch-per-boat and species composition estimates during non-winter months data from the previous year is used, to minimize management-induced differences in species catches and releases across a longer time frame. When generating catch-per-boat and species composition estimates for the winter months single year data from 2011-2014 winter months is used.

Expansions include both charter and private boats, and are stratified by port and statistical week for each statistical month and then provided to RecFIN. Ports that historically have little or no bottomfishing activity (i.e., Astoria, Florence, and Winchester Bay) are excluded from effort expansions.

Unsampled Port Effort Estimation: Current unsampled port effort estimates are created by generating an all-ports effort estimate for the sampled week, calculating a ratio of the currently unsampled port's previous season effort to the all-ports previous season effort, and applying that ratio to the current week's all-ports effort:

$$E_U = \frac{\overline{E}_{U3}}{\overline{E}_{S3}} \times E_S$$

Where:

E_U = Total groundfish estimated effort for currently unsampled ports
$\overline{E}_{U3}$ = 3-year previous season groundfish estimated average effort for currently unsampled ports
$\overline{E}_{S3}$ = 3-year previous season groundfish estimated average effort for sampled ports
E_S = Total groundfish estimated effort for currently sampled ports

Unsampled Catch per Boat (CPUE) Estimate: To generate catch estimates for unsampled ports, a catch per unit effort (CPUE; in ORBS, the unit of effort is the boat-trip) estimate is created based on the catch per boat data from the one previously sampled season:

$$CPUE_U = \frac{\overline{C}_{U1}}{\overline{E}_{U1}}$$

Where**:**

$CPUE_U$ = Estimated catch per boat for currently unsampled ports
$\overline{C}_{U1}$ = 1-year previous season groundfish estimated average catch in numbers of fish for current unsampled ports
$\overline{E}_{U1}$ = 1-year previous season groundfish estimated average effort for current unsampled ports

Unsampled Catch Estimate: The current unsampled port catch by species is estimated by multiplying each unsampled port's estimated groundfish boat effort by the previous

year's catch per boat estimate, and then by the previous year's estimated groundfish species composition.

$$C_U = E_U \times CPUE_U \times S_{U1}$$

Where:

C_U = Estimated catch by species for currently unsampled ports in numbers of fish
E_U = Total groundfish estimated effort for currently unsampled ports
$CPUE_U$ = Estimated catch per boat for currently unsampled ports
S_{U1} = 1-year previous season groundfish species composition for currently unsampled ports

In general, this expansion accounts for less than 6% of the statewide annual bottomfish effort and catch.

***Depth-based Release Mortality*:** In March 2014, the Pacific Fishery Management Council approved a set of depth-based release mortality rates for most species of recreationally caught fish. They also adopted a set of mortality rates with confidence intervals for Yelloweye Rockfish and Canary Rockfish releases that were dependent on whether fish were released with or without a descending device. Depth-based release mortality estimates are generated after the effort and catch estimation process. With unsampled port mortality estimates the previous years' sampling data used for the unsampled catch estimates are also separated into depth bins and expanded to generate unsampled depth-based release mortalities.

Standard Release Mortality Estimates – Sampling release data used for the estimates is divided into the various six depth bins adopted by the Council dependent on the reported depth of release. The data is then grouped into the different strata (port, week, boat type, etc.) that were used in the estimation process and the samples get combined to create total releases by depth per stratum. Using the discard mortality rates, the releases are further separated as Released Live and Released Dead. Finally, the sample data and the new live and dead releases are added back into the estimates.

Yelloweye and Canary Rockfish Release Mortality Estimates – As in the Standard method for generating release mortality estimates sampling data for Yelloweye Rockfish and Canary Rockfish is divided into depth bins. But they also have a flag that shows whether a descending device was used in the releases. Fish released with a device have an approved depth-based mortality rate with a 90% confidence interval. Fish released without a device have surface released depth-based mortality rates applied. The strata are then combined, re-expanded, and added back into the estimates as released live and released dead fish.

Summary

The ORBS program provides a number of different management entities with accurate and timely effort, catch, and CWT data from the ocean recreational boat fishery off Oregon. This data is stratified to levels usable for adaptive management strategies, and has been the only source of data that can be accessed in a real time manner to address quota fishery management needs. The program continues to evaluate its effectiveness in meeting the needs of fishery management, and has adjusted to changing needs and to improve efficiencies in the light of reduced funding.