FINAL REPORT

To:

Wildlife Health Center
SeaDoc Society

PI and Affiliation:

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Project Title:

IMPACTS OF HUNTING ON SCOTER NUMBERS IN NORTHERN PUGET SOUND

31 December 2007

PROJECT OBJECTIVES

The primary objectives of this project included:

1. Refine our understanding of scoter use in and around the Penn Cove/Oak Harbor areas by use of both boat-based and aerial surveys to count scoter numbers and record flock locations.
2. Increase our aerial surveillance during the 2006-07 hunting season in order to increase our sample size of observations recorded for transmitting birds.
    - More data on movement of marked scoters is needed to evaluate their movement/site fidelity during winter.
    - These data will augment data collected since 2003 and increase the power and validity of the statistical analyses of scoter movements and site fidelity.
3. Develop a better understanding of how hunting might or might not be contributing to the overall scoter declines:
    - Data collected will be combined with hunter harvest data, U.S. Fish and Wildlife Service band return data, and other data on scoter movement and site fidelity as well as scoter population viability analysis.
    - Estimate impacts of hunting on scoter numbers in North Puget Sound and statewide.

Methods

VHF and Satellite PTT Telemetry

A total of 14 telemetry flights were conducted between 20 October 2006 and 24 January 2007 to obtain locations on VHF-marked birds. These data were used to complement the satellite PTT data from 42 PTT-marked Surf and White-winged Scoters (that survived to the following winter after capture) to assess home-range and local movements during the hunting season. The PTT-transmitted scoters were captured over a four-year period, 2003 - 2006. The PTT data was also used to evaluate migration timing into the Greater Puget Sound and Strait of Georgia region (PS-SOG), as well as timing of movement into the wintering areas.

Boat Surveys in the Vicinity of Penn Cove

Vessel surveys were conducted in the vicinity of Penn Cove to assess fluctuations in numbers of scoters during the hunting season. These data were compared to data gathered by Anderson (unpublilshed, University of Wyoming) who conducted counts in Penn Cove during 2003-04 and 2004-05 as part of his graduate work.

Band Recovery Evaluation

Banding data were evaluated from four years of scoter captures to get an initial estimate on recovery rates (statewide and by county). The number of scoters banded was relatively small for statistical analyses; however, this data set does provide some limited insight into annual recovery rates. Recovery rates can provide a rough indication of harvest rates, but refined estimation of harvest rates should also consider band reporting rates, which were not included in this analysis due to small sample sizes. Band recoveries and banding sites were plotted to evaluate harvest locations relative to capture locations.

Estimation of Harvest Rates from Harvest Reports and Survey Data

We estimated harvest rates by comparing harvest data with population estimates (statewide and by county). Aerial surveys followed procedures described in Nysewander et al (2003). Harvest data used in the analysis were from WDFW mandatory sea duck harvest reports from 2004-06 (WDFW 2007), adjusted for non-retrieved harvest (20%). Mandatory sea duck harvest reporting was initiated in 2004, and requires hunters to immediately record harvest on a report card that they are required to carry while hunting (similar to a salmon punchcard) and return following the season. Aerial survey data from three years (2004-06) were pooled to calculate populations.

Age and Sex Ratios

Age and sex ratios were calculated for both Surf and White-winged Scoters from four years of capture effort. Surf Scoter and White-winged Scoter sex and age ratios were calculated from a sample of 387 and 162 birds, respectively. This sample is probably too small to provide a high level of confidence in the ratios; however, it does point to a research need.

Results

Migration Timing

A high portion of PTT-transmitted scoters had returned to Puget Sound by mid-October (73.8%) (see Figures 1-2). However, only 38.9% of transmitted scoters had returned by this same time to the locations where they would spend the winter, most often near the areas of capture the

prior year. By the first week of November, increasing returns found 95% of transmitted scoters back to Puget Sound, while 75% had returned to their chosen wintering areas (see Figures 3-4).

Home-range analyses shows that before many birds eventually settle into the wintering areas found throughout Puget Sound, they spend time during late October through early November in various areas of the northern Puget Sound and Strait of Georgia, including Penn Cove. During late October there are also scoters from wintering populations south of Washington still remaining in the northern Puget Sound. During VHF flights two VHF-transmitted birds from San Francisco were heard and located during this period.

Counts of Scoters at Penn Cove

Count data during the 2006-07 hunting season in Penn Cove showed scoter numbers were highest during the latter half of October (20-Oct, 6355 scoters), and sharply dropped off after that, with a low count on 09-Nov of 1441 scoters, fluctuating between 1441 and 2075 through the end of January. Adjacent bays to Penn Cove (Oak Harbor, Crescent Bay, and Utsalady Bay) were also counted and showed similar rates of decline, indicating that scoters in Penn Cove did not move to these locations (Figure 5). Data from Anderson (unpublilshed, University of Wyoming) collected during previous winters in Penn Cove followed a similar trend, with high numbers early in the season that dropped significantly into November (Figure 6). Migration timing data suggests that the seasonal decline in scoter numbers in Penn Cove is likely influenced by migrating scoters that are staging in the area before settling in to wintering areas elsewhere in Washington, and by scoters moving to wintering areas south of Washington.

Scoter numbers from the 2006-07 counts were lower that those counted by Anderson (unpublished, University of Wyoming) during previous winters. During early December 2006, our counts ranged around 1500 – 1700, while Anderson reported counts of over 3700 scoters during both December 2003 and December 2004.

Band Recovery Evaluation

Annual recovery rates from limited band return data were estimated to be relatively low statewide, but should be interpreted with caution due to low sample sizes (see Table 1). The mean annual recovery rate of Surf Scoters and White-winged Scoters was calculated as 0.028 and 0.011, respectively, with a combined recovery rate of 0.024. As expected, mean annual recovery rates did vary by county. Surf Scoter recovery rates ranged from 0 to 0.069 with the highest number of recoveries occurring in Island County. White-winged Scoter recovery rates ranged from 0 to 0.042, with the highest rate occurring in Jefferson County. Combining both species of scoters, rates varied from 0.005 to 0.066, with the highest recovery rate in Island County. Band recoveries generally occurred close to capture areas (Figure 7).

Estimation of Harvest Rates from Harvest Reports and Survey Data

Population trends for Puget Sound are shown in Figure 8, and summarized by county and region in Table 2. Statewide, the estimated mean annual harvest rate for all scoters was 0.030, and ranged from 0 to 0.085 (Island County) (see Table 3). If Mason and Thurston counties estimated harvest rates are pooled, the estimated mean annual harvest rate is 0.040 for the two counties. These counties should probably be pooled, as home-range analyses shows that the same birds are using both counties, especially in the southern Puget Sound.

Age and Sex Ratios

The mean age ratios for Surf Scoters were HY (hatch year) = 0.29 and AHY (after hatch year) = 0.71 (SY (second year) = 0.17, TY (third year) = 0.10, and ATY (after third year) = 0.45) (see Figure 9). The mean age ratios of White-winged Scoters were similar, HY = 0.29 and AHY =

0.71 (SY = 0.09, TY = 0.08, and ATY = 0.55) (see Figure 10). The Surf Scoters had a higher proportion of HY surviving to SY, than the White-winged Scoters; however, the proportions of TY were similar for both species.

The sex ratios for both species were similarly male biased, with Surf Scoter male proportions being 0.57 (0.75 females for every male), and White-winged Scoter male proportions being 0.559 (0.79 females for every male) (See Table 4). The Surf Scoter sex ratios are similar, but not as strongly male-biased, as reported by Iverson et al. (2004) in the Strait of Georgia, B.C, where he calculated male proportions of 0.66, during 2000 – 2002.

Discussion

Thanks to financial support from the SeaDoc Society, we were able to evaluate harvest related issues utilizing currently available data (PSAMP population data, banding data from telemetry survey, issues related to site fidelity during the hunting season, and harvest levels based on mandatory hunter reporting). The project has pointed out some data gaps that need to be addressed to come up with sound and defensible management decisions for scoters in Puget Sound.

Estimation of harvest and survival rates of waterfowl populations is typically accomplished using intensive banding efforts and subsequent analysis using standard band recovery software. Several limitations should be considered in using our banding data to estimate scoter band recovery rates (and harvest rates). The data are from scoters banded during the telemetry study, and the study design was not intended to calculate harvest or survival rates. The sample size was small, not representative of the population, and not in enough locations throughout the Puget Sound. This evaluation points to the need for additional banding to estimate harvest and survival rates more accurately. We are currently investigating the most efficient techniques for banding large numbers of scoters through a coordinated flyway approach.

We calculated harvest rates from hunter harvest reports and calculated population levels from operational winter surveys. There are also some potential problems related to these two data sources:

- In the past, we have used density estimates for population trend analysis, and have not calculated population estimates. The application used to calculate population estimates is still being finalized under another contract. The population analyses do not factor in corrections related to detectability, influenced by dive rates, weather, and survey methodology; thus the population estimates reported should be considered as minimums.
- Harvest estimates for each county include the wintering period as well as the migration period, when hunters take scoters from other areas of Puget Sound and the flyway.
- The harvest rate for the entire Sound was estimated at 3%, assuming unretrieved kill is 20%. Goudie et al. (1994) theorized that sustainable harvest rates of some sea duck species should not exceed 3% of the adult population, but also estimated sustainable harvest of harlequin ducks at 3-5% of the adult population based on modeling simulations. Our population and harvest estimates include adults, subadults, and juveniles. Additional information is needed on age ratios in the population and harvest to provide accurate estimates of adult harvest rates.
- Using more contemporary population modeling techniques would improve our estimates of maximum allowable harvest. Calculating more accurate allowable harvest rates would

require additional information on vital rates to develop discrete logistic models, which should be used to guide future harvest management.

It should be noted that currently Washington State has some of the more conservative scoter hunting restrictions in the Pacific Coast States where hunting occurs. Due to concerns over declines documented through PSAMP/WDFW efforts, as well as increased interest in sea duck hunting, scoter hunting seasons in Washington have been reduced since 1998 to be more restrictive than allowed by U.S. Fish and Wildlife Service. The daily bag limit for scoters in other Pacific Flyway states is 7, in British Columbia is 8, versus 4 in Washington. Harvest surveys for scoters in Washington were also upgraded to require a mandatory harvest report for sea duck hunters beginning in 2004, which is a more accurate harvest estimation technique than used in other parts of the flyway.

This evaluation also raises some questions regarding the issue of management scale. It is obvious that scoters are being taken by hunters at different rates in different counties throughout the Sound, not always related to scoter abundance. Like other sea ducks, scoters are relatively long-lived and have a lower reproductive rate compared to other waterfowl (i.e. according to Eadie et al [1988] they are "K-strategists"). Based on telemetry data, 75% of adults returned to the same limited wintering area after capture. However, we also know that the Washington population is contiguous with a much larger population in British Columbia and is highly migratory during part of the year, offering opportunities for population mixing and pioneering of first year and other subadult birds into new wintering areas (see Figure 11). Because of these factors, it is unknown how higher harvest rates in one part of the Sound may affect population trends locally and throughout the entire Sound. Limiting harvest in localized areas may serve to move hunting pressure elsewhere. It would seem that the most effective regulation changes would be targeted at the flyway level, or at the least throughout the entire Puget Sound region. At current levels, it does not appear that harvest is affecting population trends considering the entire Puget Sound scoter population, but additional work needs to be completed.

These data were presented to the Washington Fish & Wildlife Commission on 04 August 2007, where WDFW outlined additional information needs that will be addressed over the next three years. These include:

- Initiating a three-year scoter banding study that is specifically designed to answer issues related to:
    - Statistically defensible harvest levels, statewide and by county.
    - Age/sex ratios, and recruitment rates of juveniles into the population.
    - Recruitment of breeding age birds into the population.
    - Adult survival, as this is likely the main factor influencing sea duck population stability.
- Finish development of survey analyses software to obtain better population estimates.
- Continue to monitor scoter harvest through mandatory reports.
- Continue annual population surveys for all marine birds throughout Puget Sound.
- Investigate the use of discrete logistic models to estimate allowable harvest rates.

As we work to address these information needs over the next three years, we feel it is imperative that ongoing population and harvest monitoring efforts not be limited or scaled back. Without these trend data we will not be able to monitor the effectiveness of future management efforts put forth to ensure the conservation of scoters, as well as the other marine avian species in the Puget Sound.

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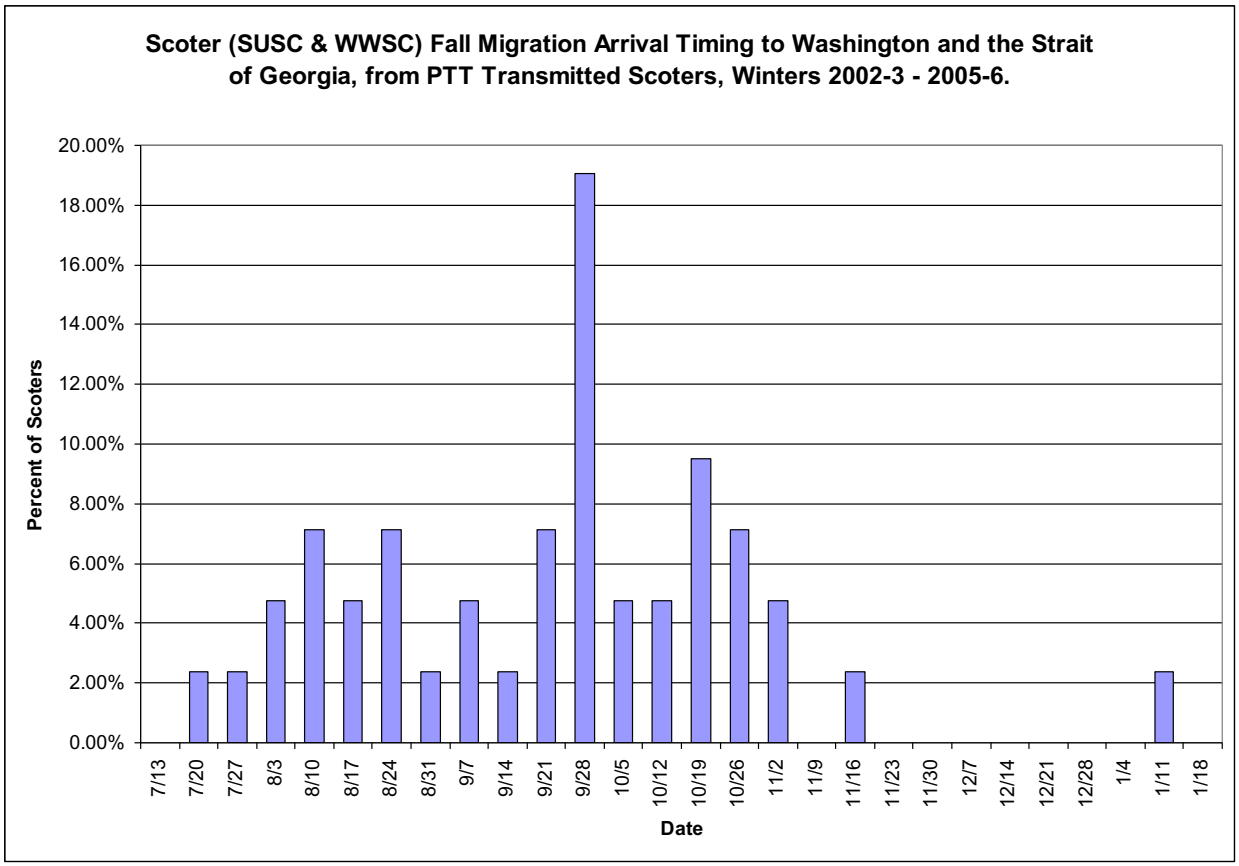

Figure 1. Timing of scoter (surf and white-winged) arrival to Washington and Strait of Georgia after fall migration, from PTT transmitted scoters captured during winters 2002-03 – 2005-06.

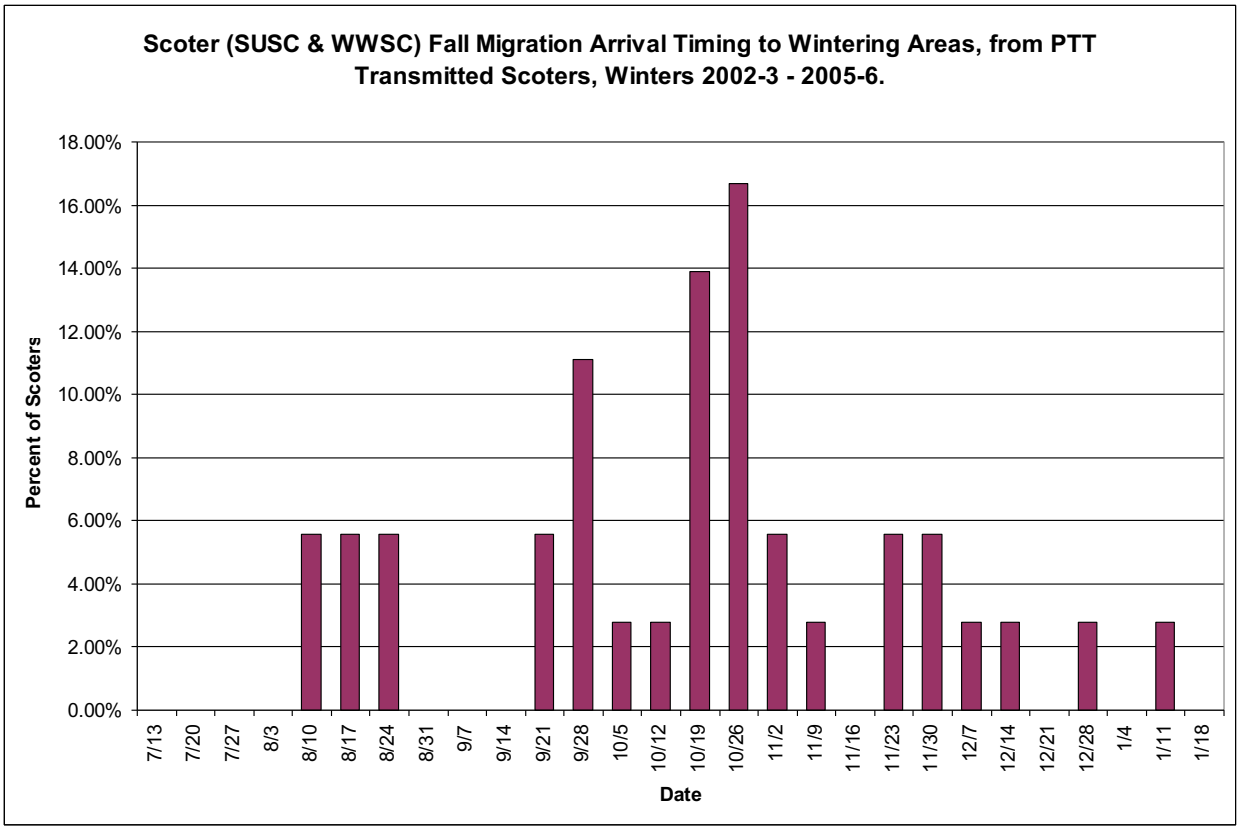

Figure 2. Return timing of scoter (surf and white-winged) arrival to wintering areas in Washington after fall migration and visits to fall/early winter staging areas, from PTT transmitted scoters captured during winters 2002-03 – 2005-06.

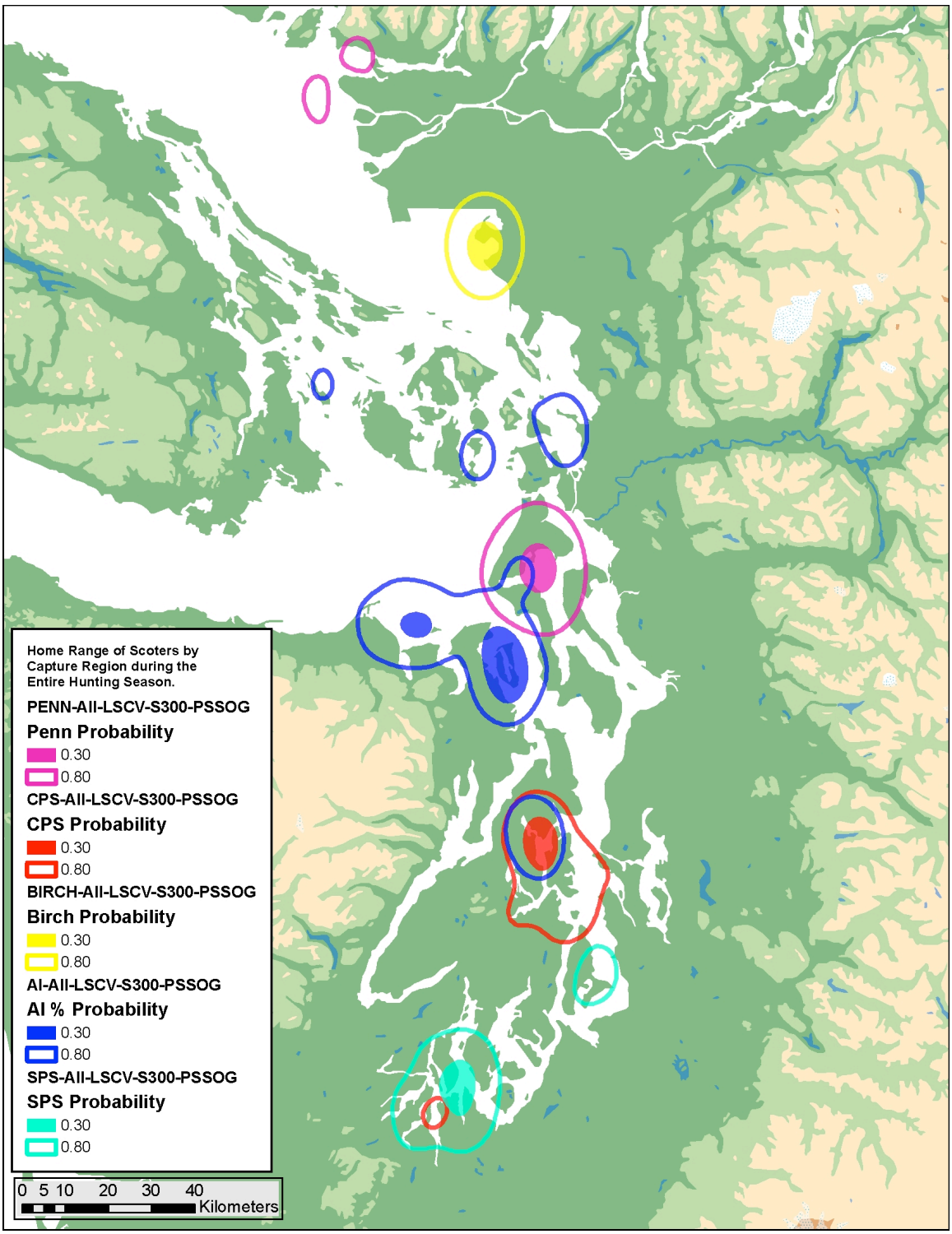

Figure 3. Home range (30% and 80% probability displayed) of white-winged and surf scoters during complete hunting seasons, 14 October – 1 February, by capture region. Data are from PTT transmitted scoters from captured winters 2002-03 – 2005-06, and only include data from scoters returning from fall migration (2003-04 – 2006-07). Returning VHF transmitted scoters, during the 2006-07 hunting season are also included.

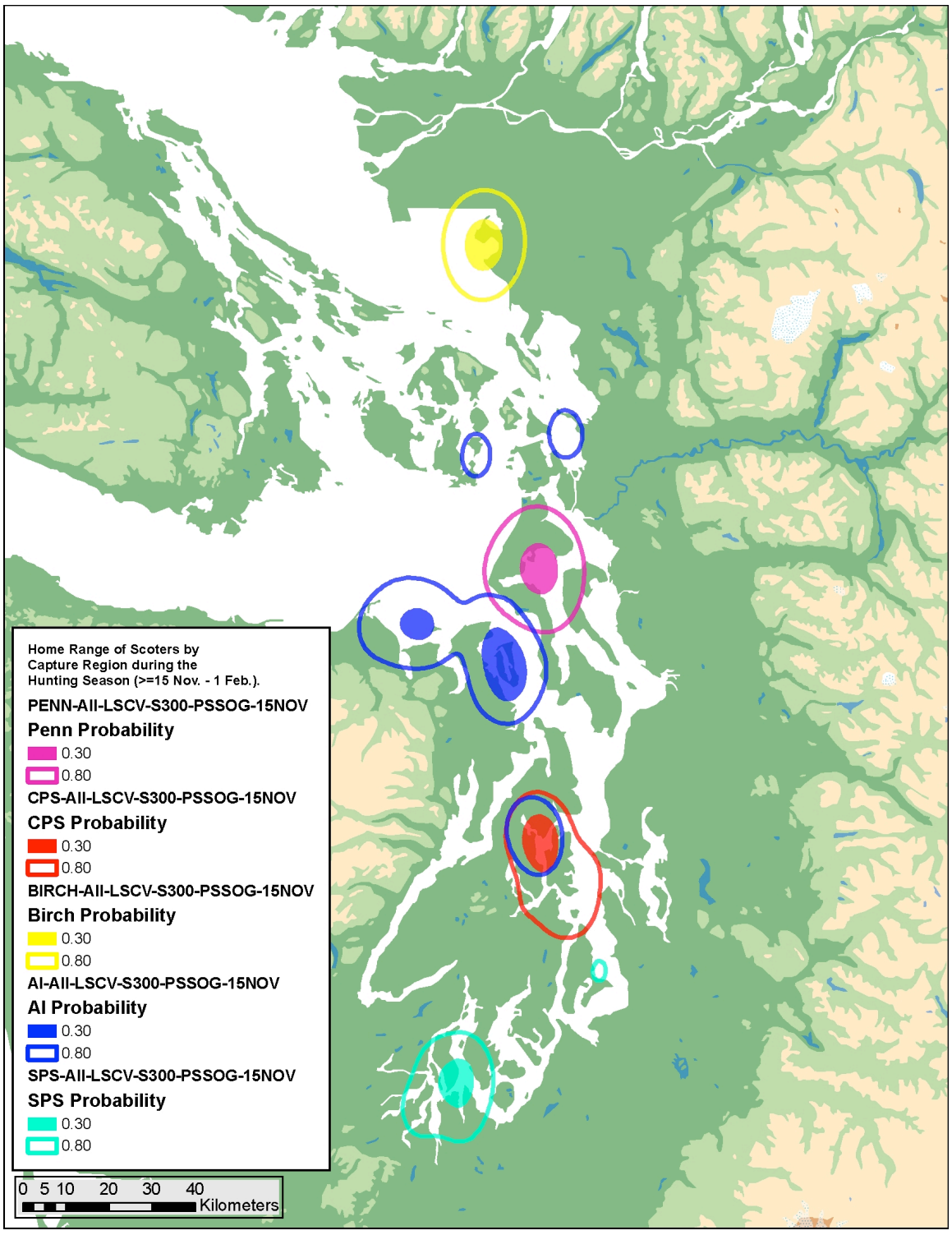

Figure 4. Home range (30% and 80% probability displayed) of white-winged and surf scoters during 2nd 5/7th portion of hunting seasons, 15 November – 1 February, by capture region. Data are from PTT transmitted scoters from captured winters 2002-03 – 2005-06, and only include data from scoters returning from fall migration (2003-04 – 2006-07). Returning VHF transmitted scoters, during the 2006-07 hunting season are also included.

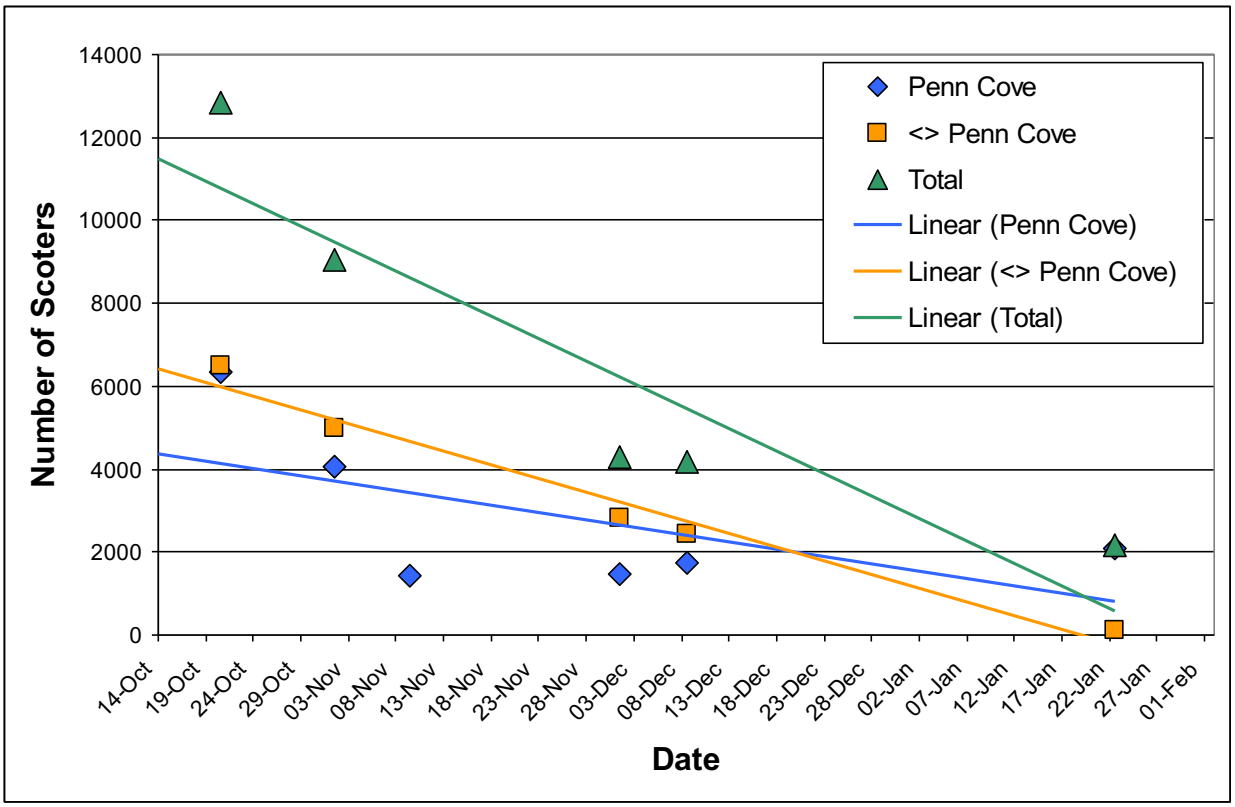

Figure 5. Trends in scoter numbers in the Penn Cove / Crescent Bay area (Penn Cove, Oak Harbor, Crescent Bay, and Utsalady Bay) during the 2006-2007 hunting season.

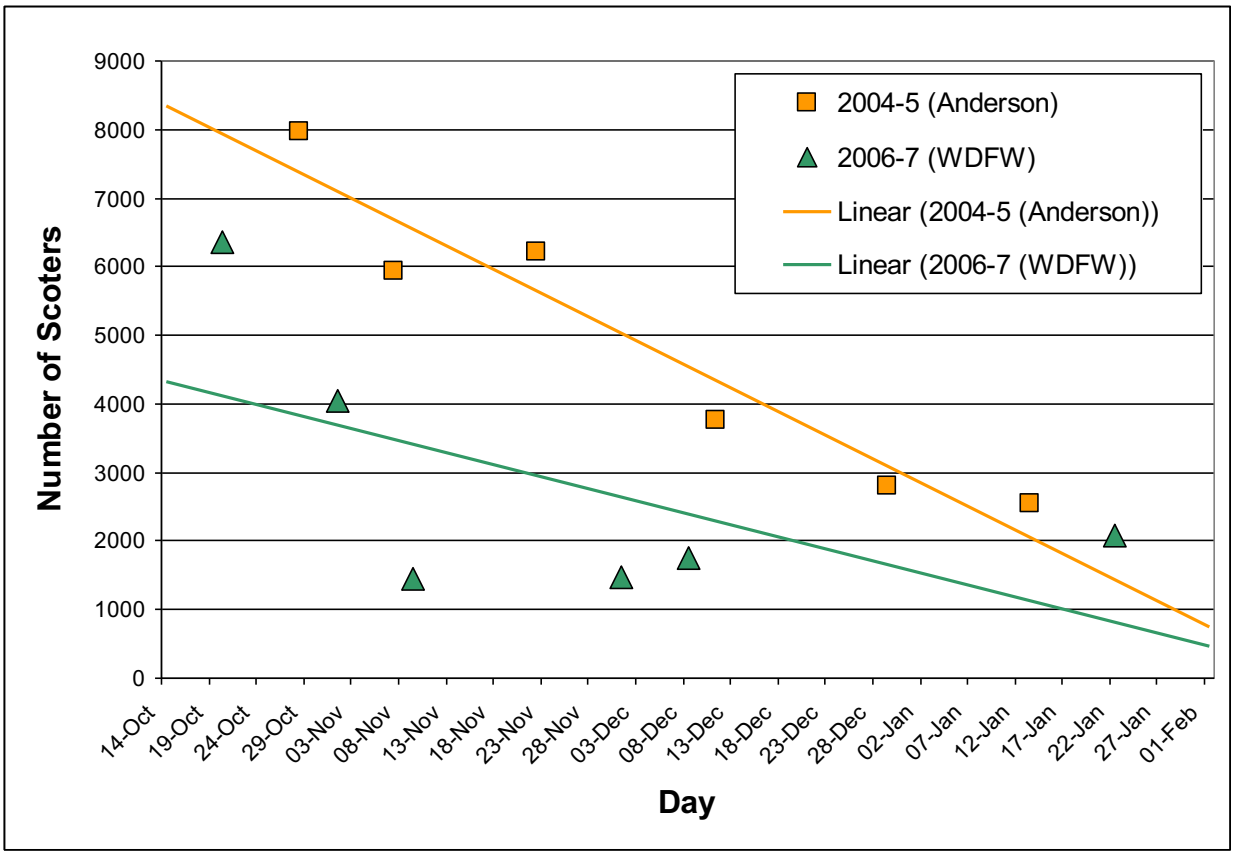

Figure 6. Comparison of scoter trends in Penn Cove during the 2004-5 (Anderson XX) and 2006-7 (WDFW) hunting seasons.

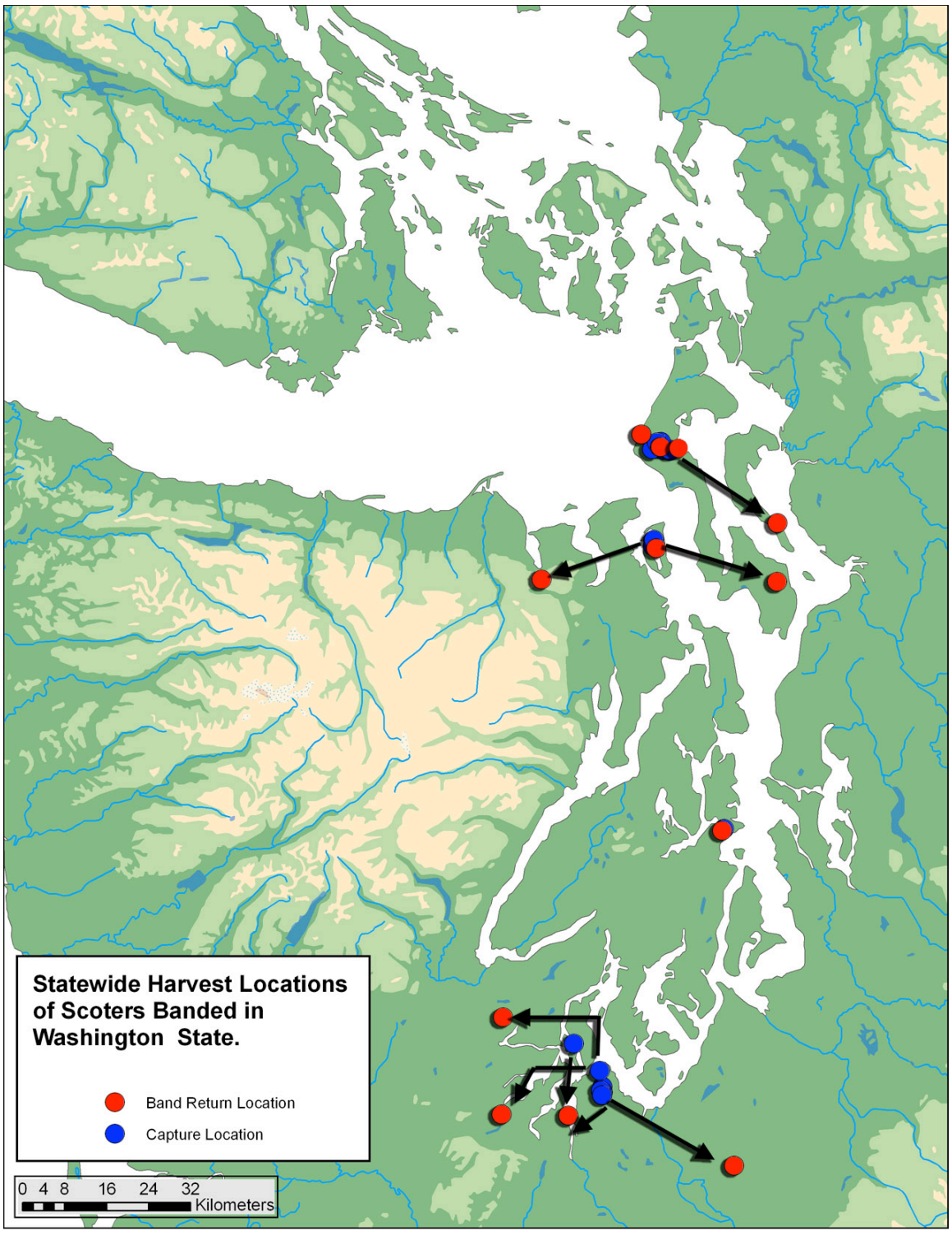

Figure 7. Locations in Washington State of band and transmitter harvest returns from surf and white-winged scoters captured in Washington during winters 2002-03 – 2005-06. Harvest location data is from best-known location (BBL or hunter information).

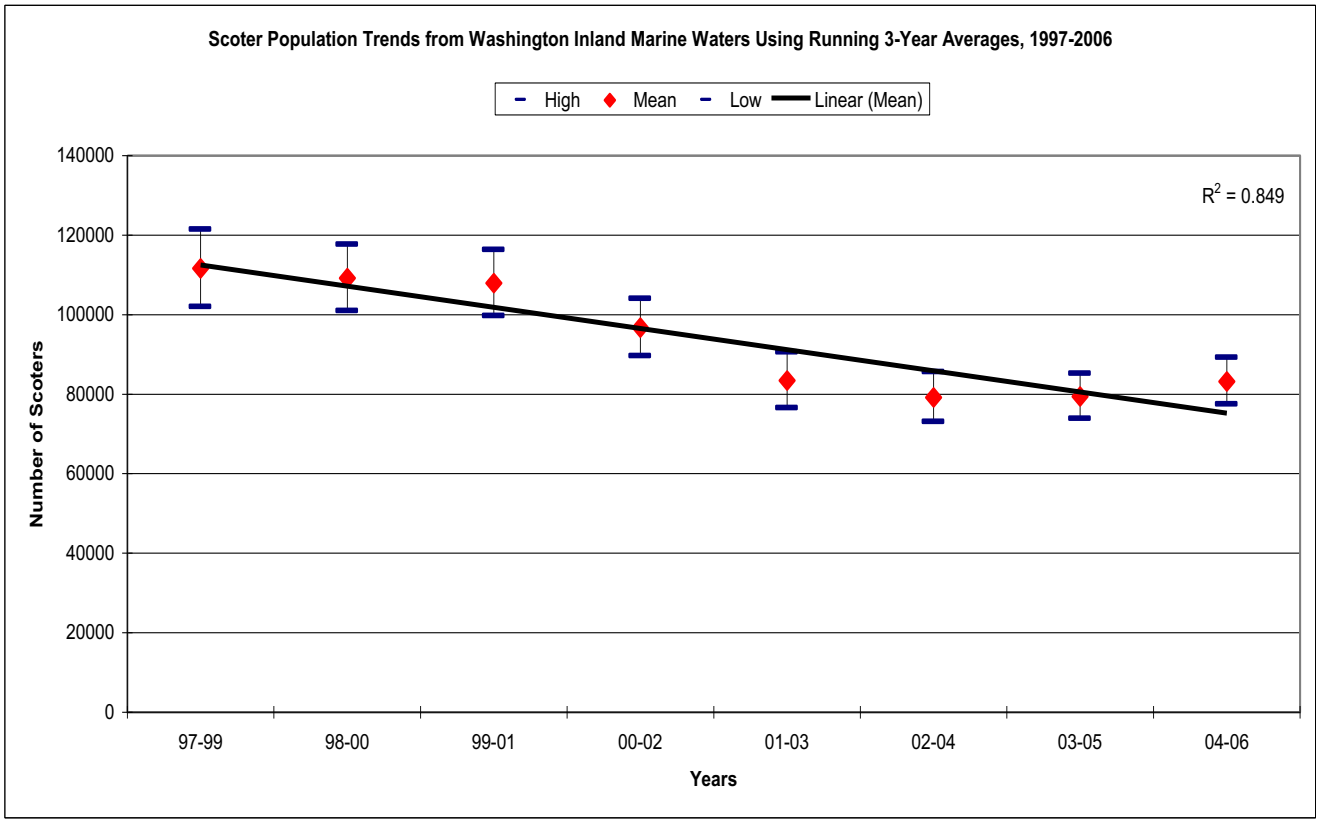

Figure 8. Scoter population trends from Washington inland marine waters using 3-year running averages, 1997-2006.

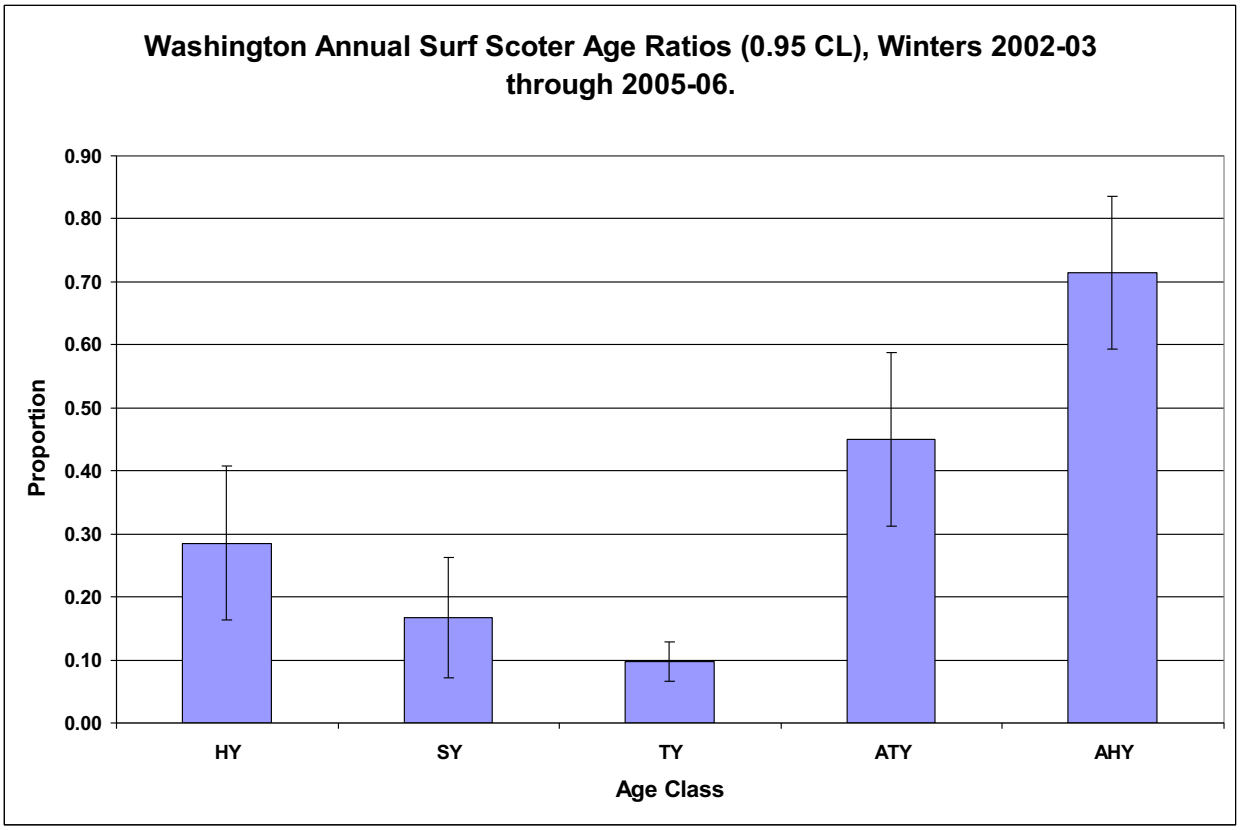

Figure 9. Mean annual surf scoter age class ratios (0.95 CL) from Washington State captures efforts, winters 2002-03 through 2005-06.

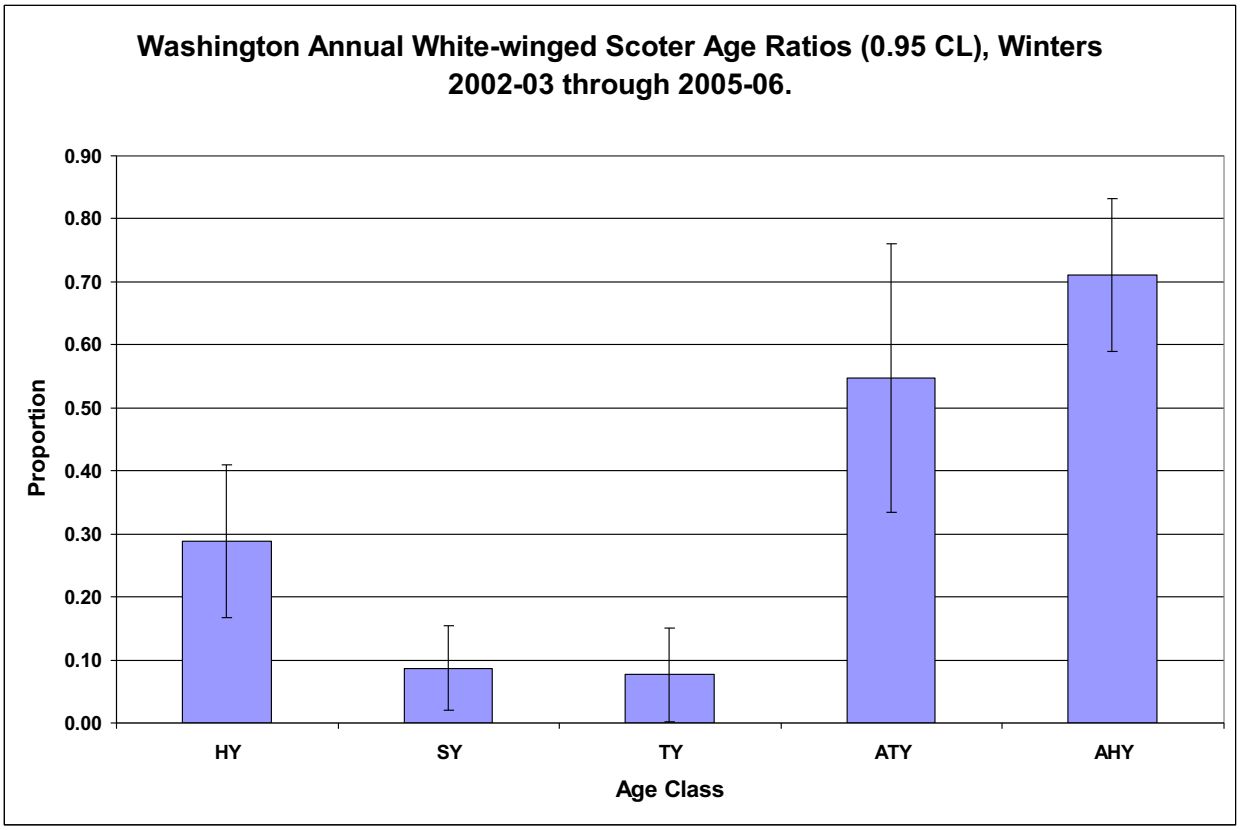

Figure 10. Mean annual white-winged scoter age class ratios (0.95 CL) from Washington State capture efforts, winters 2002-03 through 2005-06.

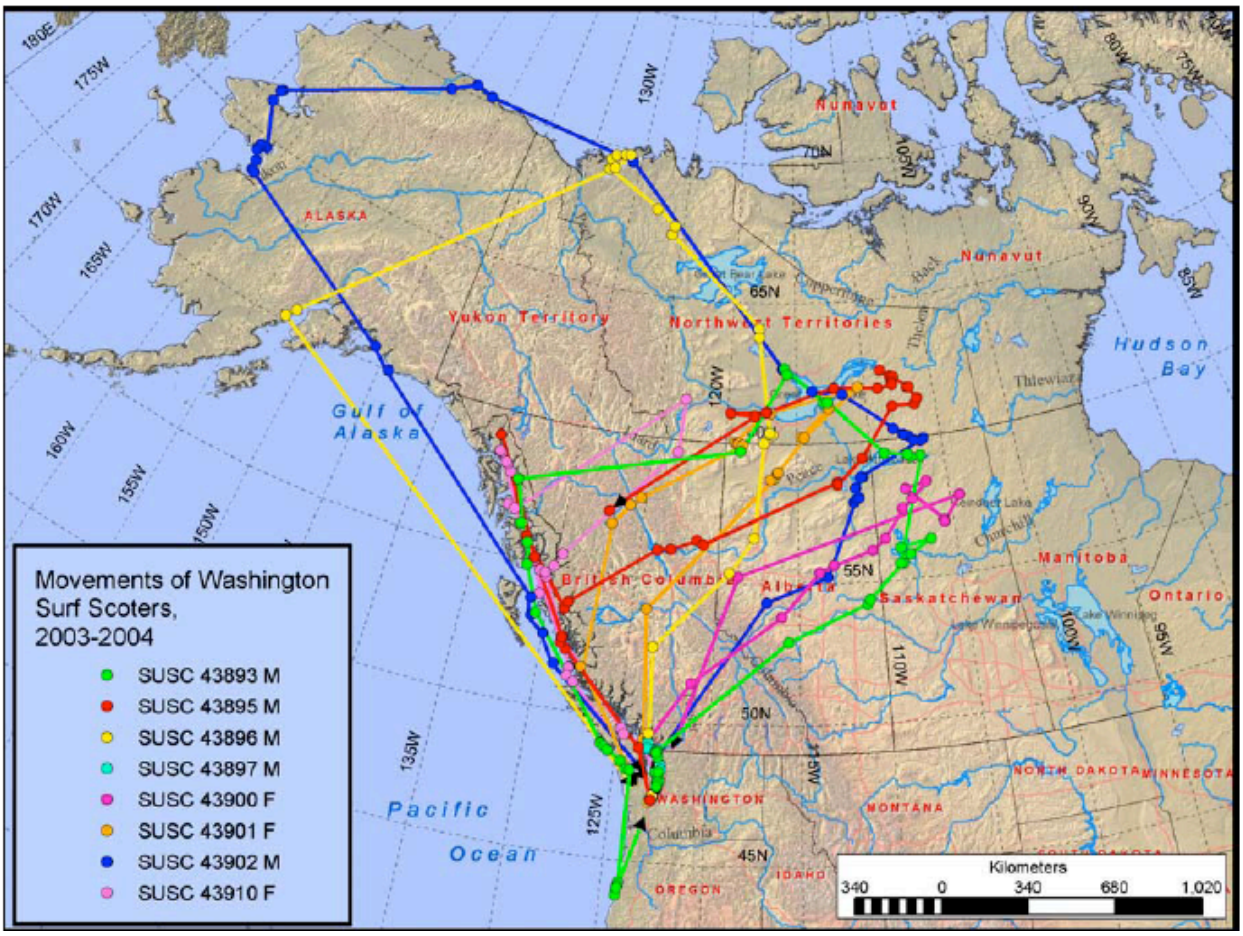

Figure 11. Movements of surf scoters with satellite transmitters in 2003-04.

Table 1. Annual recovery rates of Washington scoters (BLSC, SUSC, WWSC) from band returns of all scoters banded with no VHF or PTT transmitters.

		Winter 2002-2003			Winter 2003-2004									Winter 2004-2005								
		Total Banded 2002-3			Banded + Survival			Band Returns			Recovery Rate			Banded + Survival			Band Returns			Recovery Rate		
Species	County	F	M	M+F	F	M	M+F	F	M	M+F	F	M	M+F	F	M	M+F	F	M	M+F	F	M	M+F
BLSC	Kitsap	0	0	0	0.00	0.00	0.00							0	0	0						
Total		0	0	0	0.00	0.00	0.00							0.00	0.00	0.00						
SUSC	Island	0	0	0	8.00	5.00	13.00	0	0	0	0.00	0.00	0.00	9.17	13.91	23.08	0.00	1.33	1.33	0.00	0.10	0.06
SUSC	Jefferson	0	0	0	0.00	0.00	0.00							0.00	0.00	0.00						
SUSC	Kitsap	0	0	0	0.00	0.00	0.00							11.24	25.68	36.92	0.00	0.00	0.00	0.00	0.00	0.00
SUSC	Mason	3	14	17	2.98	10.77	13.76	0	0	0	0.00	0.00	0.00	3.33	9.42	12.76	0.00	1.33	1.33	0.00	0.14	0.10
SUSC	Thurston	1	5	6	5.78	10.55	16.33	0	0	0	0.00	0.00	0.00	16.05	16.14	32.20	0.00	0.00	0.00	0.00	0.00	0.00
Total		4	19	23	16.77	26.32	43.08	0	0	0	0.00	0.00	0.00	39.79	65.16	104.95	0.00	2.67	2.67	0.00	0.04	0.03
WWSC	Island	0	0	0	0.00	0.00	0.00							2.00	0.00	2.00	0.00		0.00	0.00		0.00
WWSC	Jefferson	0	0	0	0.00	0.00	0.00							0.00	0.00	0.00						
WWSC	Kitsap	0	0	0	7.00	10.00	17.00	0	0	0	0.00	0.00	0.00	5.17	8.73	13.90	0.00	0.00	0.00	0.00	0.00	0.00
WWSC	Mason	3	1	4	1.62	3.00	4.62	0	0	0	0.00	0.00	0.00	1.27	5.47	6.74	0.00	0.00	0.00	0.00	0.00	0.00
WWSC	Thurston	2	7	9	4.20	9.47	13.68	0	0	0	0.00	0.00	0.00	10.74	23.16	33.90	0.00	0.00	0.00	0.00	0.00	0.00
Total		5	8	13	12.82	22.47	35.30	0	0	0	0.00	0.00	0.00	19.18	37.36	56.54	0.00	0.00	0.00	0.00	0.00	0.00
Scoters	Island	0	0	0	8.00	5.00	13.00	0	0	0	0.00	0.00	0.00	11.17	13.91	25.08	0.00	1.33	1.33	0.00	0.10	0.05
Scoters	Jefferson	0	0	0	0.00	0.00	0.00							0.00	0.00	0.00						
Scoters	Kitsap	0	0	0	7.00	10.00	17.00	0	0	0	0.00	0.00	0.00	16.41	34.41	50.82	0.00	0.00	0.00	0.00	0.00	0.00
Scoters	Mason	6	15	21	4.60	13.77	18.38	0	0	0	0.00	0.00	0.00	4.60	14.90	19.50	0.00	1.33	1.33	0.00	0.09	0.07
Scoters	Thurston	3	12	15	9.98	20.02	30.00	0	0	0	0.00	0.00	0.00	26.80	39.30	66.10	0.00	0.00	0.00	0.00	0.00	0.00
Total		9	27	36	29.59	48.79	78.38	0	0	0	0.00	0.00	0.00	58.98	102.52	161.49	0.00	2.67	2.67	0.00	0.03	0.02

		Winter 2005-2006									Winter 2006-2007									Mean Annual Recovery Rate		
		Banded + Survival			Band Returns			Recovery Rate			Banded + Survival			Band Returns			Recovery Rate					
Species	County	F	M	M+F	F	M	M+F	F	M	M+F	F	M	M+F	F	M	M+F	F	M	M+F	F	M	M+F
BLSC	Kitsap	0.00	0.00	0.00							2.77	6.26	9.02	0.00	1.33	1.33	0.00	0.21	0.15	0.000	0.213	0.148
Total		0.00	0.00	0.00							2.77	6.26	9.02	0.00	1.33	1.33	0.00	0.21	0.15	0.000	0.213	0.148
SUSC	Island	9.57	13.13	22.71	1.33	0.00	1.33	0.14	0.00	0.06	6.44	10.27	16.71	0.00	2.67	2.67	0.00	0.26	0.16	0.035	0.089	0.069
SUSC	Jefferson	8.00	15.00	23.00	0.00	0.00	0.00	0.00	0.00	0.00	10.87	16.74	27.61	0.00	1.33	1.33	0.00	0.08	0.05	0.000	0.040	0.024
SUSC	Kitsap	9.21	33.30	42.51	0.00	0.00	0.00	0.00	0.00	0.00	8.40	41.07	49.47	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000
SUSC	Mason	3.81	8.67	12.48	0.00	0.00	0.00	0.00	0.00	0.00	2.98	6.78	9.76	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.035	0.026
SUSC	Thurston	15.22	30.98	46.20	1.33	5.33	6.67	0.09	0.17	0.14	9.77	15.46	25.23	0.00	0.00	0.00	0.00	0.00	0.00	0.022	0.043	0.036
Total		45.81	101.09	146.89	2.67	5.33	8.00	0.06	0.05	0.05	38.46	90.32	128.79	0.00	4.00	4.00	0.00	0.04	0.03	0.015	0.034	0.028
WWSC	Island	0.84	0.00	0.84	0.00		0.00	0.00		0.00	0.66	0.00	0.66	0.00		0.00	0.00		0.00	0.000		0.000
WWSC	Jefferson	5.00	5.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00	7.63	8.24	15.87	0.00	1.33	1.33	0.00	0.16	0.08	0.000	0.081	0.042
WWSC	Kitsap	4.46	9.03	13.49	0.00	0.00	0.00	0.00	0.00	0.00	3.49	7.06	10.55	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000
WWSC	Mason	2.56	5.84	8.40	0.00	0.00	0.00	0.00	0.00	0.00	2.00	4.57	6.57	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000
WWSC	Thurston	12.52	17.72	30.23	0.00	1.33	1.33	0.00	0.08	0.04	8.34	12.45	20.78	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.019	0.011
Total		25.37	37.59	62.96	0.00	1.33	1.33	0.00	0.04	0.02	22.11	32.32	54.43	0.00	1.33	1.33	0.00	0.04	0.02	0.000	0.019	0.011
Scoters	Island	10.41	13.13	23.54	1.33	0.00	1.33	0.13	0.00	0.06	7.10	10.27	17.37	0.00	2.67	2.67	0.00	0.26	0.15	0.032	0.089	0.066
Scoters	Jefferson	13.00	20.00	33.00	0.00	0.00	0.00	0.00	0.00	0.00	18.50	24.98	43.48	0.00	2.67	2.67	0.00	0.11	0.06	0.000	0.053	0.031
Scoters	Kitsap	13.67	42.33	56.00	0.00	0.00	0.00	0.00	0.00	0.00	14.66	54.39	69.04	0.00	1.33	1.33	0.00	0.02	0.02	0.000	0.006	0.005
Scoters	Mason	6.36	14.52	20.88	0.00	0.00	0.00	0.00	0.00	0.00	4.98	11.35	16.33	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.022	0.017
Scoters	Thurston	27.73	48.69	76.43	1.33	6.67	8.00	0.05	0.14	0.10	18.11	27.91	46.02	0.00	0.00	0.00	0.00	0.00	0.00	0.012	0.034	0.026
Total		71.18	138.68	209.85	2.67	6.67	9.33	0.04	0.05	0.04	63.33	128.90	192.23	0.00	6.67	6.67	0.00	0.05	0.03	0.009	0.031	0.024

Table 2. 3 - year average population estimates from WDFW PSAMP surveys, 1997-06.

	Mean								SE							
County	97-99	98-00	99-01	00-02	01-03	02-04	03-05	04-06	97-99	98-00	99-01	00-02	01-03	02-04	03-05	04-06
Clallam	10067	9598	11016	10387	8387	8002	7078	6373	731	852	914	906	657	515	537	474
Island	20469	17239	17238	15291	13130	12478	12574	12390	2276	1714	1689	1701	1595	1639	1443	1399
Jefferson	6634	6118	5316	4072	2973	3050	3730	4145	542	540	455	422	276	343	430	458
King	6162	6680	5743	5844	4495	4505	3583	4235	873	774	636	662	558	524	400	499
Kitsap	11739	14523	13034	11838	10355	10512	9278	10082	1022	963	801	688	677	740	725	834
Mason	6969	5968	5645	4442	3962	4063	4704	5535	535	415	429	345	330	358	334	464
Pierce	5964	5722	4811	4532	3858	4196	5228	6077	434	473	482	456	407	380	474	464
San Juan	6273	4880	4646	4059	2767	2192	2456	3651	1168	878	767	751	366	297	502	1123
Skagit	7509	6588	5736	5539	5463	7020	5972	6702	2318	2288	1949	1099	1032	1289	1004	1018
Snohomish	2103	2428	2456	2074	1598	1359	1439	1537	437	487	527	489	421	326	307	288
Thurston	3891	5530	5255	4985	4491	4914	5591	5217	399	395	385	390	318	290	353	362
Whatcom	23842	23926	27004	23649	21963	16914	17750	17289	3035	2422	2783	2516	2707	2014	1818	1647
Greater Puget Sound	111621	109200	107900	96711	83442	79205	79382	83233	4959	4260	4233	3691	3592	3188	2892	2998
SouthCounties	16824	17219	15711	13960	12310	13173	15522	16828								
NorthernCounties	94798	91980	92189	82751	71132	66032	63860	66405								
Skagit/Island/Whatcom	51821	47753	49978	44478	40557	36412	36296	36381								

Table 3. Estimated mean harvest rates using 3-yr. ave. population (2004-06) and harvest (2005-07)

			Population				Harvest		Estimated Harvest Rate (Adjusted Harvest / Population)		
County	%Pop	%Har	Pop	SE	Low (0.95 CL)	High (0.95 CL)	Reported Harvest	Adjusted Harvest*	Mean	Min	Max
Island	0.151	0.435	12,371	1,399	9,629	15,112	879	1055	0.085	0.070	0.110
Clallam	0.072	0.078	5,936	454	5,047	6,825	158	135	0.023	0.020	0.027
Jefferson	0.054	0.047	4,444	511	3,443	5,445	95	81	0.018	0.015	0.024
Kitsap	0.125	0.009	10,250	916	8,455	12,045	18	15	0.001	0.001	0.002
Mason	0.068	0.138	5,609	454	4,720	6,499	279	238	0.042	0.037	0.050
Pierce	0.075	0.014	6,132	471	5,209	7,055	28	24	0.004	0.003	0.005
Skagit	0.077	0.162	6,336	952	4,471	8,201	327	279	0.044	0.034	0.062
Snohomish	0.021	0.016	1,703	349	1,019	2,387	33	28	0.017	0.012	0.028
Thurston	0.068	0.048	5,554	403	4,765	6,344	97	83	0.015	0.013	0.017
King	0.046	0.000	3,773	449	2,894	4,652	0	0	0.000	0.000	0.000
Whatcom	0.213	0.053	17,491	1,642	14,273	20,708	107	91	0.005	0.004	0.006
San Juan	0.029	0.000	2,393	480	1,451	3,334	0	0	0.000	0.000	0.000
Total	1.00	1.00	81,993	2,836	76,433	87,552	2021	2425	0.030	0.028	0.032

**Adjusted using 20% non-retrieved harvest

Combined Counties			Population				Harvest		Estimated Harvest Rate (Adjusted Harvest / Population)		
County	%Pop	%Har	Pop	SE	Low (0.95 CL)	High (0.95 CI)	Reported Harvest	Adjusted Harvest*	Mean	Min	Max
CLAL/JEFF	0.127	0.125	10,380	964	8,490	12,271	253	304	0.029	0.025	0.036
THUR/MASO	0.136	0.186	11,164	857	9,485	12,843	376	451	0.040	0.035	0.048

Table 4. Annual age class ratios of Surf and White-winged Scoters banded in Washington, Winters 2002-03 through 2005-06.

		Winter 2002-03		Winter 2003-04		Winter 2004-05		Winter 2005-06					
Species	**Age Class**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**Mean**	**SE**	**.95CL**	**.90CL**
SUSC	HY	8	0.35	14	0.16	28	0.20	60	0.43	0.29	0.06	0.12	0.10
SUSC	SY	7	0.30	14	0.16	16	0.12	12	0.09	0.17	0.05	0.09	0.08
SUSC	TY	2	0.09	11	0.13	16	0.12	8	0.06	0.10	0.02	0.03	0.03
SUSC	ATY	6	0.26	47	0.55	78	0.57	60	0.43	0.45	0.07	0.14	0.12
SUSC	AHY	15	0.65	72	0.84	110	0.80	80	0.57	0.71	0.06	0.12	0.10
Total		23		86		138		140					

		Winter 2002-03		Winter 2003-04		Winter 2004-05		Winter 2005-06					
Species	**Age Class**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**Mean**	**SE**	**.95CL**	**.90CL**
WWSC	HY	4	0.17	12	0.19	16	0.36	14	0.42	0.29	0.06	0.12	0.10
WWSC	SY	0	0.00	8	0.13	3	0.07	5	0.15	0.09	0.03	0.07	0.06
WWSC	TY	0	0.00	4	0.06	8	0.18	2	0.06	0.08	0.04	0.07	0.06
WWSC	ATY	19	0.83	38	0.61	17	0.39	12	0.36	0.55	0.11	0.21	0.18
WWSC	AHY	19	0.83	50	0.81	28	0.64	19	0.58	0.71	0.06	0.12	0.10
Total		23		62		44		33					