Annual Progress Report

Project Title: Population Status of Black Rockfish in Oregon Coastal Waters

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Project Period: October 1 to September 30, 2013

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Foreword:

The Marine Resources Program of the Oregon Department of Fish and Wildlife conducted this project designed to provide information useful for management of fisheries for Black Rockfish. Results from this work were utilized in two federal stock assessments for Black Rockfish (Sampson 2007, Cope et al. 2016). This project received federal funding support from Sport Fish Restoration Grant F-186-R-10 from 2002 through 2013. The 2013 Annual Progress Report presents information for all of the years that the project received federal funding, with a focus on the twelfth and final year of tagging operations and results from eleven years of tag recoveries. Despite the lack of federal funding, ODFW continued to collect data necessary to make estimates for the following recovery year, which ended June 30, 2014. Those data were utilized in the assessment of the Oregon stock of Black Rockfish in 2015 (Cope et al. 2016).

This document provides an update to the 2013 Annual Progress Report. It includes a table of the results for an additional recovery year. The table that provides information from this study in the Assessments of California, Oregon and Washington stocks of Black Rockfish (*Sebastes melanops*) in 2015 by Cope et al. (2016) was added to this document as part of Appendix A, in the hope that it will allow the reader to more easily understand the importance of this work to fishery management. The following text, with minor modifications for clarification and a note about the use of results by Cope et al. 2016, is from the Annual Progress Report submitted in 2013.

This Annual Progress Report for Sport Fish Restoration grant F-186-R-10 summarizes 12 years of tagging and 11 years of tag recovery completed for this project. The study provides estimates of annual recovery and survival rates of tagged fish as well as annual exploitation rates and population abundance estimates of Black Rockfish for the study area. The project study design requires tagging a cohort of Black Rockfish each year before June 30, and then examining fish caught in the sport fishery to recover tagged fish during a recovery year from July 1- June 30. The report's totals, analyses, and summaries are based on the study design. The grant-funding year, October 1 to September 30, differs from the project study year. The Annual Project Performance Report submitted along with this progress report provides an account of work accomplished with the grant funds during the grant period.

Introduction:

Successful sport bottomfishing seasons in Oregon's nearshore waters depend on the abundance and availability of Black Rockfish (*Sebastes melanops*). Although catches include species such as Blue Rockfish (*Sebastes mystinus*), China Rockfish (*Sebastes nebulosus*), Cabezon (*Scorpaenichthys marmoratus*), Kelp Greenling (*Hexagrammos decagrammus*), Lingcod (*Ophiodon elongatus*) and other groundfish, Black Rockfish are the primary target. Localized population numbers of Black Rockfish are a major concern for recreational fishers and fisheries managers alike. Regulations such as bag limits are set to maintain harvest of these and other species within prescribed annual harvest levels. This fishery is open year round, unless annual harvest limits are met or exceeded.

The Oregon Department of Fish and Wildlife (ODFW) started the Status of Black Rockfish in Oregon Coastal Waters study in 2002. The goal is to provide stock assessment authors with an independent source of annual exploitation rates, survival rates, and population abundance for use in assessing this species. That goal was realized when three years of results were incorporated into the 2007 Black Rockfish stock assessment (Sampson, 2007). (It is worth noting that twelve years of results from this study were incorporated in the 2015 Black Rockfish stock assessment (Cope et al. 2016) see Appendix A).

Methods:

Passive Integrated Transponder tags or PIT tags were used to mark Black Rockfish in a multi-year mark recapture study designed to provide information on annual exploitation rates and population size in the waters of the Pacific Ocean off Newport, Oregon. This study was designed to utilize the multi-stage mark recovery models described by Brownie et al. (1985a) which generate a time series of annual estimates of recovery ($\hat{f}_i$) and survival ($\hat{S}_i$) rates where i = year. Program ESTIMATE (Brownie et al. 1985b) was used to estimate recovery and survival rates and to assess which of four different model scenarios best fit the tag return data. Based on the equation given by Jagielo (1991) the exploitation rate ($\hat{u}_i$) was calculated by multiplying the recovery rate parameter ($\hat{f}_i$) by an independent estimate of Black Rockfish catch ($\hat{C}_i$) and dividing by a census of the number of fish sampled for marks (cs_i) during the same time period. The independent estimate for Black Rockfish catch comes

from the Recreational Fisheries Information Network (RecFIN) database maintained by the Pacific States Marine Fisheries Commission. The annual population abundance ($\hat{N}$) is estimated by dividing the annual estimated catch by the estimated exploitation rate ($\hat{u}$) (Buell et al, 2007). For the current analysis, the coefficient of variation (CV) for ($\hat{u}$) and ($\hat{N}$) are underestimated because only the variance of the recovery rate can be calculated and there is no measure of the variance for the estimate of catch.

ODFW conducted tagging operations off the central Oregon coast from north of Yaquina Head, southward to Alsea Bay (Figure 1.) Distribution of marked fish was divided into four areas to reflect the estimated population distribution based on fishing effort, determined by numerous interviews with charter vessel operators and recreational fishers, and available Black Rockfish habitat. Targets for marking fish in each area were 5% in Area 1, 23% in Area 2, 50% in Area 3, and 22% in Area 4 (Figure 1). Fish tagging operations occurred between mid-February and the end of June each year (Table 1), prior to the peak recreational fishing season during the summer.

Black Rockfish were captured with barbless hooks on traditional bottom fishing gear from a chartered vessel whose captain had local knowledge of rocky reef structures. Volunteers, paid anglers, ODFW staff, and vessel crew members were responsible for catching and handling fish for tagging. Fish were scanned for the presence of an existing tag, assessed for barotrauma (pressure-related) symptoms, examined for fishing or handling related injuries, and measured to the nearest centimeter. A PIT tag was scanned to record its number and injected into the fish. The injection site for the PIT tag is anterior of the origin of the pelvic fin into the hypaxial musculature. This site was chosen because it is outside the area typically taken as a fillet and tags are reliably retained in this location (Parker et al. 2003). To reduce the severity of barotraumatic stress, the entire tagging process was accomplished in 2 minutes or less per fish.

Once ODFW staff tagged the fish and recorded data, the fish was released into the ocean. In the early years of the study fish were either released at the surface or released at depth with the aid of a descending device depending on barotrauma symptoms. In later years, all fish were initially released headfirst into an open-bottomed holding pool lashed to the lee side of the boat at the surface, allowed to re-submerge and swim away. Fish that had trouble descending on their own due to expanded gases in the body were assisted by gently pushing them entirely under the surface of the water. If a fish still did not submerge and swim off on its own, it was removed from the pool and released at depth with the aid of a descending device.

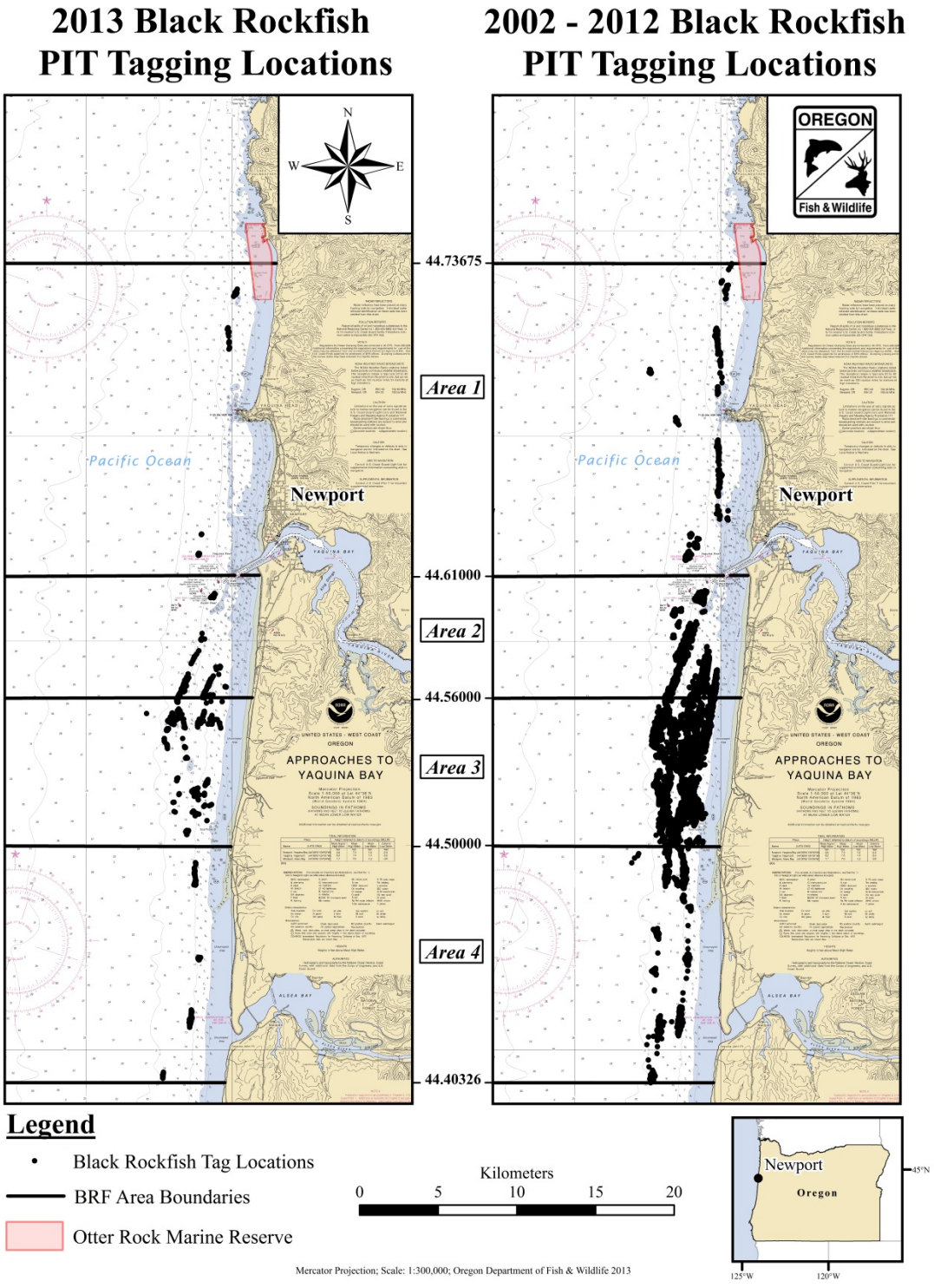
To recover tagged fish, sampling staff visited docks in Newport and Depoe Bay where fish are landed to scan Black Rockfish for the presence of PIT tags with portable scanners. Both Allflex® and Y-Tex® scanners were used during the study. All scanning was done with Y-Tex scanners in 2013. Tag detection rate experiments conducted by project staff with known tagged Black Rockfish carcasses showed rates of detection to be an average of 98.0%. Each vessel's catch was scanned and tallied. The number of fish missed (not scanned) was estimated through discussions with boat captains, crew, filleters, and ODFW port samplers. Each day charter vessel skippers and crewmembers were asked the primary area that they fished to determine where the tagged fish recovered were caught. Depoe Bay

is a nearby port 19 kilometers (km) north of Newport. Interviews with fishermen landing in Depoe Bay indicated that they rarely fish in the study area. The next port to the south of Newport is Florence (73 km), where Black Rockfish landings are very low. Florence catches were not scanned. Newport charter vessels do however occasionally fish off Cape Perpetua, 36 km south of Newport. Black Rockfish caught during these trips were consistently scanned. Scanning fish in Depoe Bay and from trips to Cape Perpetua was done to assess model assumptions regarding tagged fish being available for recapture.

Recapture efforts focused on charter vessel fishing operations, because they account for the vast majority of Black Rockfish catch within the study area. From 2001 to 2010, charter vessels were responsible for an average 81% and 89% of the annual Black Rockfish landings in Newport and Depoe Bay, respectively. Typically, ODFW samplers met the vessels as they return to port, and scanned fish for PIT tags. ODFW Ocean Recreational Boat Survey (ORBS) samplers who assist with scanning efforts typically met private boats. Sampling activities and priorities were coordinated with ORBS samplers, and Pacific States Marine Fisheries Commission (PSMFC) samplers to maximize efficiency of coverage based on daily charter office visits and bar crossing counts to assess effort. Although some carcasses were retained by fishermen, most marked carcasses were recovered to collect data on length, sex, maturity, internal and external condition, tag site migration, and extraction of the PIT tag.

For analysis purposes, two adjustments to the number of tagged fish successfully released alive were made. First, simultaneous release of all marked fish is impossible to accomplish in practice. Fish tagging occurred between mid-February and the end of June each year, prior to the peak recreational fishing season during the summer (Table 1). The recovery period is from July 1- June 30. Any newly marked fish in that cohort recovered during scanning operations before the beginning of the recovery period were not included in the analysis. Second, during the early years of the project the minimum tagging length was 29 centimeters (cm). Starting in 2007, the minimum tagging length was increased to 32 cm because smaller fish were not showing up in the recovery statistics to the degree expected. Smaller fish are suspected of being discarded in the fishery, a process known as “high-grading”. Bag limits were reduced beginning in 2005 due to early attainment of allowable harvest limits for Black Rockfish. With the reduction of the bag limit, anglers may have chosen to discard the smaller fish in hopes of catching larger fish. Examination of length data for discarded fish recorded by ride-along observers aboard charter vessels confirmed that smaller fish were more likely to be discarded. There may be additional unknown factors that contribute to the apparent fishery selectivity for larger fish, but smaller fish were clearly not being landed. Thus, the project decided to discontinue tagging fish less than 32 cm, removing the smaller fish that were not reliably recovered in the fishery. Fish that were tagged at less than 32 cm were not used in the analysis.

Figure 1. Tag distribution by area for 2013 (left panel). Tag distribution by area for 2002 through 2013 (right panel). Latitude measurements are in decimal degrees. Otter Rock Marine Reserve was implemented in 2012.



Results and Discussion:

During 2013, the charter vessel *Gracie K* was contracted for 160 hours to carry out tagging activities. This is the first year this vessel has conducted tagging operations for this project. The *Gracie K* is a 43-foot vessel owned by Larry Craven. The vessel was operated by Shannon Hunter of Newport, Oregon. Mr. Hunter has been a fishing captain for five years and has worked as crew on fishing boats for an additional 23 years. ODFW tagged and released live Black Rockfish during twenty-one outings at-sea from March 26 through June 28, 2013 (Table 1).

ODFW tagged 2,758 Black Rockfish in 2013 (Table 2); 134 in Area 1, 558 in Area 2, 1412 in Area 3, and 654 in Area 4 (Figure 1 left panel). The distribution of fish tagged during 2013 was similar to the overall distribution for all years (Figure 1 right panel). During the twelve years of this study ODFW tagged 39,864 Black Rockfish, but not all of those tagged fish are included in the analysis (Table 2). A small number of fish tagged (293, <1%) did not survive tagging operations. Some of the tagged fish successfully released live (235) were caught by recreational anglers before the recovery period for that year's cohort began on July 1. Finally, fish <32 cm at the time of tagging in the early years of this study (1,351) have been removed from the analysis. The analysis includes 37,985 marked fish (Table 2). It is interesting to note that although small (<32 cm) tagged Black Rockfish were not included in the analysis due to lower than expected recovery rates in the years immediately following tagging, those fish have grown and have subsequently been recovered during scanning operations on a regular basis (n = 195 recoveries).

The survival of Black Rockfish captured and released is essential to the study design of this project. We attribute the low observed mortality rate from tagging operations in this study (0.73% of 39,864 fish, Table 2) to the short handling time during tagging, careful handling of all fish, and the use of a releasing pool and descending devices. Published studies (Parker et. al 2006, Hannah and Matteson 2007) indicate that returning Black Rockfish to depth quickly may be an effective method for minimizing barotrauma related mortality. Controlled laboratory experiments estimate mortality rates for captured and released Black Rockfish to be 3.3% (Parker et al. 2006). That study recreated environmental conditions to simulate fish at a depth equal to four atmospheres being caught and decompressed at the surface, held for two minutes, and recompressed to a depth equal to four atmospheres. The estimate of low mortality rates resulting from barotrauma-induced injuries is supported by the high recapture rates of fish that showed severe external signs of barotrauma during tagging operations in this study. To test the sensitivity of our abundance estimations, we applied 3.3% mortality to our total tags released each year. The abundance estimates ranged from 1.81% to 2.9% lower when the mortality is applied.

During the project's recovery year from July 1, 2012 to June 30, 2013, ODFW samplers scanned 40,042 Black Rockfish for PIT tags in Newport (Table 3). During the same period, 17,843 Black Rockfish were scanned in Depoe Bay. During the 11 recovery periods ODFW scanned 505,606 Black Rockfish in Newport and 152,822 in Depoe Bay (Table 3). Four hundred and two tags were recovered in Newport during the last recovery

period. One additional tag was recovered in Depoe Bay. The one tag found in Depoe Bay was released in area 1, south of Depoe Bay, in 2010. The vast majority of the tags (367, 91%) were recovered from charter vessels. Recoveries from private boats totaled 36. This large difference in tag recoveries likely results from the bulk of the Newport landings of Black Rockfish coming from the charter fleet and to more intense sampling of those vessels than private vessels. Charter vessels caught 71.1% (36,913) of the total Black Rockfish landed by recreational anglers in Newport during the recovery period. Private vessels landed 28.9% (15,008) of the total Black Rockfish catch in Newport.

There are several reasons that PIT tags were utilized in this study. PIT tags are undetectable by recreational fishers, removing the possibility of non-reporting by the anglers. PIT tags are not physically lost with 100% retention demonstrated in Black Rockfish after 49 weeks (Parker and Rankin, 2003). PIT tags are uniquely identifiable with a quick scan making it easy to identify marked fish. Having dedicated samplers checking for marked fish allows for a high percentage of the catch to be sampled. Newport scanners successfully scanned fish from 2,135 charter vessel trips and 1,105 private vessels landing Black Rockfish during the recovery year. The sampling rate of 77.1% (Table 3) refers to the number of fish scanned compared to the estimated number of fish landed. Landing estimates indicate that total Black Rockfish landings in Newport during the recovery year increased by 21.1% from the previous recovery year's landings.

The Otter Rock Marine Reserve was implemented January 1, 2012 (Figure 1). This area is now closed to all fishing. Although it overlaps with the study area, the project has never tagged in the area enclosed by the reserve. Tagging has occurred in close proximity to the western edge of the reserve. The marine reserve is not anticipated to significantly affect the study because of its small size relative to the study area and the fact that relatively little fishing effort occurred there in the past.

Table 1. Summary of tagging operations from 2002 to 2013.

Cohort Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Vessel	Umatilla II	Surfrider	Elahka & Misty	Blitz	Miss Raven	Miss Raven	Misty	Misty	Enterprise	Misty	Umatilla II	Gracie K
Begin tagging	3/27	3/24	3/22	3/17	2/16	3/14	2/25	2/18	3/4	3/7	4/9	3/26
End tagging	5/24	5/13	6/9	6/20	4/18	6/14	5/14	6/4	6/28	6/14	6/25	6/28
At sea outings	20	18	20	25	10	22	17	21	20	21	15	21

Table 2. Results of tagging operations from 2002 to 2013. Tagged Black Rockfish included in the analyses were those fish successfully released live that were greater than 32 cm that were not recovered before the recovery period for the tagging year started on July 1.

Tagging year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Totals
Fish tagged	2,566	2,997	3,027	2,907	3,029	2,982	4,099	4,059	4,171	4,202	3,051	2,774	39,864
Mortalities	19	38	22	26	38	22	35	18	32	17	16	10	293
Cohort recoveries	24	21	16	25	26	19	26	14	32	13	13	6	235
<32 cm	137	391	377	141	303	0	2	0	0	0	0	0	1,351
Analysis marked fish	2,386	2,547	2,612	2,715	2,662	2,941	4,036	4,027	4,107	4,172	3,022	2,758	37,985

Table 3. Estimates of sampling rates for each recovery year of the project. Estimated landings from RecFIN database for the project's recovery year period.

Recovery Year (July1 – June 30)

		Newport			Depoe Bay		
Project Year	Sampling Period	Landings	Scanned	Sampling Rate	Landings	Scanned	Sampling Rate
2002-2003	1	60,977	48,384	79.35%	34,964	11,578	33.11%
2003-2004	2	74,620	51,165	68.57%	64,199	17,593	27.40%
2004-2005	3	60,951	45,607	74.83%	49,946	10,026	20.07%
2005-2006	4	63,948	53,476	83.62%	46,412	16,915	36.45%
2006-2007	5	64,101	56,187	87.65%	41,941	15,681	37.39%
2007-2008	6	62,113	51,552	83.00%	39,095	12,563	32.13%
2008-2009	7	55,829	41,203	73.80%	35,206	14,788	42.00%
2009-2010	8	59,147	47,168	79.75%	43,768	13,091	29.91%
2010-2011	9	51,903	40,475	77.98%	38,924	11,000	28.26%
2011-2012	10	39,843	30,347	76.17%	29,289	11,744	40.10%
2012-2013	11	51,921	40,042	77.12%	35,478	17,843	50.29%

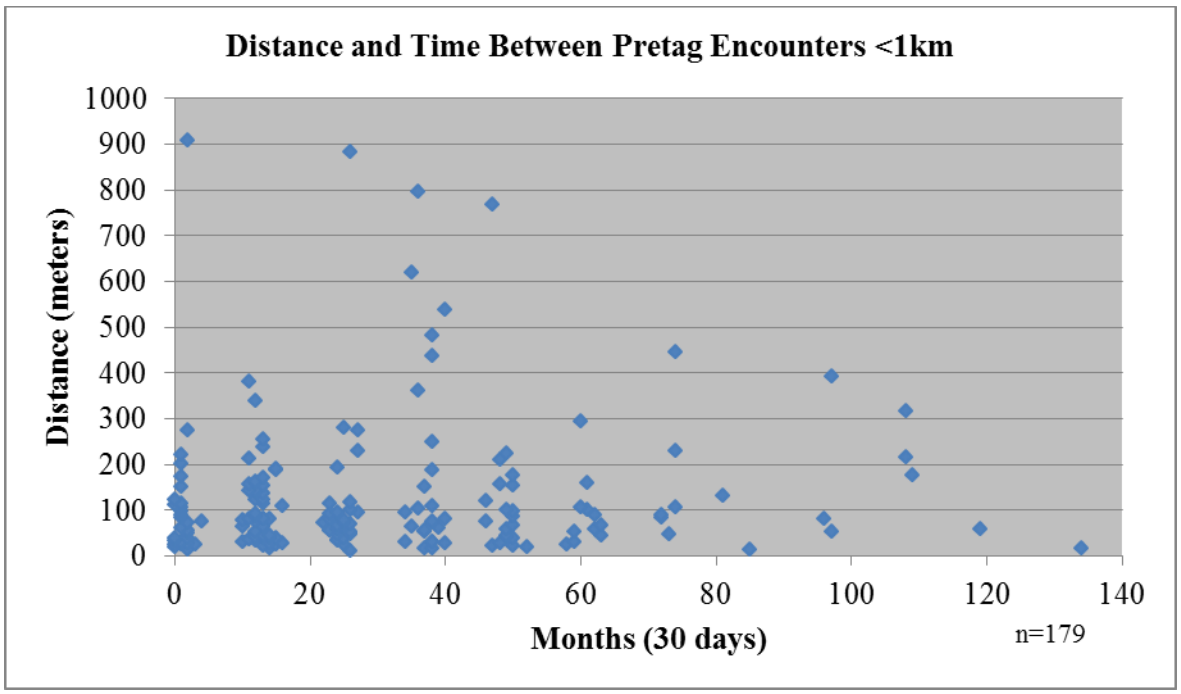
Interviews with vessel skippers and crewmembers to determine locations fished suggest that most of the tagged fish recovered came from the same area in which they were tagged and released. This information indicates that during single area fishing trips, 68.3% of the tagged fish recovered were caught in the area that they were released. Fishing trips were not usually confined to a single area or sometimes even to the northern and southern limits of where fish were tagged and released, so it was not always possible to determine where recovered fish were caught. Additional information about recovery areas comes from previously tagged Black Rockfish (n= 229) recaptured during tagging operations from 2002-2013. These fish were generally caught near the point of initial release (Figure 2). During this 12-year period 78.2% (n=179) of the previously PIT-tagged fish encountered were within 1 kilometer of where they were initially tagged and released; 6.1% from 1-2 km; 7.0% from 2-4 km; 5.2% from 4-8 km; 2.6 % from 8-12 km; and 0.9% were found at >12 km from their original tagging site. The distance between initial release of these tagged fish and the recapture location does not appear to be related to the time that the fish were at large. An acoustic telemetry study conducted by ODFW has shown mixing between tagged and non-

tagged Black Rockfish and also suggests that most Black Rockfish generally stay in a relatively small area (Parker et al., 2007). The home range of 41 Black Rockfish in that study varied from 2 to 271 hectares (mean = 55 ± 9 ha), but several of these fish made excursions out of the area before returning to their home range. Our results also indicate that most Black Rockfish seem to stay close to the area in which they were tagged, but some move greater distances. Over the years, six fish tagged in this study have been recovered from Depoe Bay. Additionally, six tagged fish were caught near Cape Perpetua. During scanning operations we have also recovered five Black Rockfish PIT tagged in Washington waters by Washington Department of Fish and Wildlife and a single fish with an external tag from Moss Landing, California suggesting that some Black Rockfish can and do travel much greater distances.

The model that fits the tag recovery data (Table 4) best is one in which recovery and survival rates are year specific with the first-year recovery rates allowed to differ from other years. This model provides year specific recovery rates for marked fish except for the first and last recovery periods for which only the first-year recovery rates are estimated (Table 5). Year specific estimates of annual survival rates for marked fish are provided for all but the last two recovery periods with this model and range from roughly 62 to 94% (Table 5). Calculations of exploitation rate and abundance require the recovery rate parameter and thus cannot be calculated for the first or last recovery period with this model (Table 5). Abundance estimates ranged from 1.17 to 1.89 million Black Rockfish within the study area over the 10 years that estimates are available. Exploitation rate estimates ranged from 3.15% to 4.93% per year.

The 2007 stock assessment for Black Rockfish off Oregon and California (Sampson, 2007) included fish that reside between Cape Falcon, OR and Point Piedras Blancas, CA. To use the data from this PIT tag study in the waters off Newport, OR for that assessment, several issues had to be resolved. First, the PIT tag study area is relatively small, so it was necessary to provide the assessment with the estimated percentage (q) that the Black Rockfish population off Newport represents with respect to the whole Oregon population (Sampson, 2007). Using onboard observer data from charter vessels and commercial vessels targeting nearshore rockfish, the project was able to estimate the proportion of Black Rockfish habitat that was within the PIT tag study area in respect to the larger area. Based on the assumption that abundance is a function of available habitat, this habitat estimate allows the estimation of q for the Newport population survey (Buell et al, 2007). Estimates of q ranged from 9% to 21% with the best estimate being 16%. Although the CV for population estimates ($\hat{N}_i$) in the Newport area were thought to be underestimated, this did not pose a major problem in the assessment because the assessment model inflated the CV ($\hat{N}_i$) during the tuning process. Next the proportion of Black Rockfish off Oregon vs. off California had to be addressed. The assessment used the Council apportioned optimum yield of 58% to Oregon and 42% to California. Finally, based on the estimate of q for the Newport area of Oregon and the Council apportioned ratio of optimum yield for Oregon and California it was thought that roughly 10% of the exploitable stock would be found off Newport. This proved to be an important consideration in selection of the final assessment model.

Figure 2. Distance and time between encounters of Black Rockfish caught more than once during tagging operations.



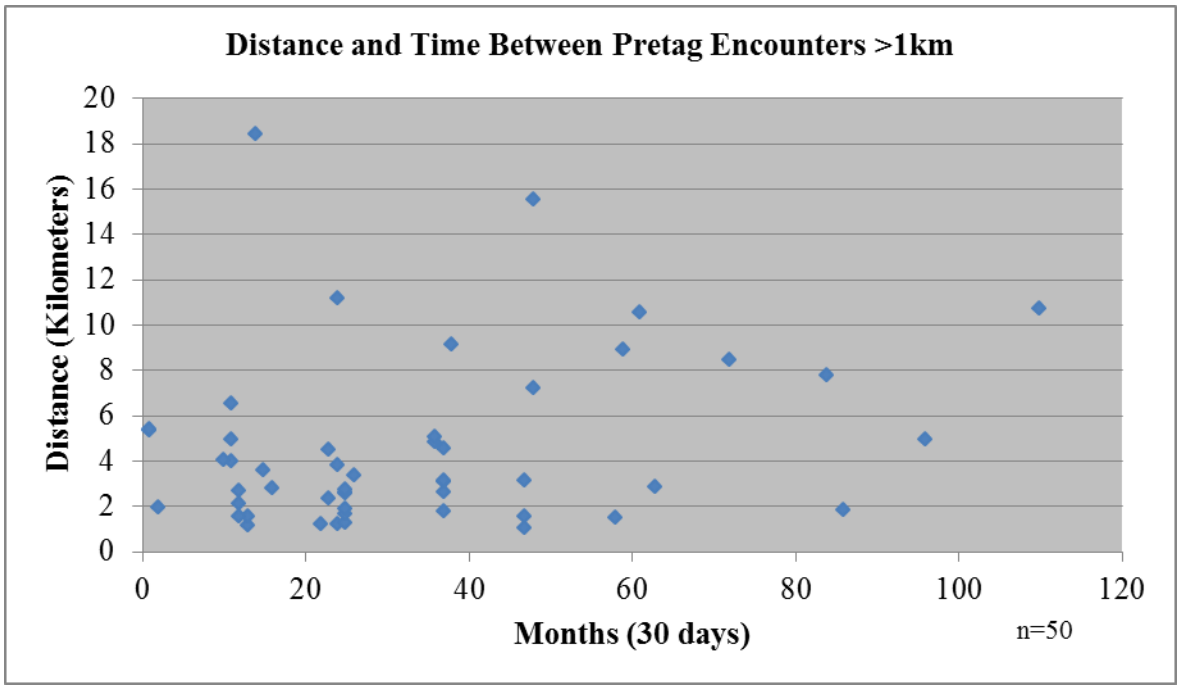


Table 4. Number of tagged fish recaptured in Newport each recovery year of the study. Includes released fish ≥ 32 cm when tagged. Individuals recovered prior to July 1st in the same year they were tagged were removed from analysis.

	Recovery Year (July 1-June 30)											
Marked Cohort	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	Totals
2002	44	50	43	25	17	19	12	8	14	7	5	244
2003		41	56	48	53	35	21	19	12	8	8	301
2004			60	74	54	61	32	21	18	10	11	341
2005				56	60	53	42	36	20	10	12	289
2006					90	76	54	59	31	26	15	351
2007						55	50	55	58	18	24	260
2008							96	95	79	38	41	349
2009								114	104	55	53	326
2010									76	73	72	221
2011										78	99	177
2012											62	62
Yearly Totals	44	91	159	203	274	299	307	407	412	323	402	2921

Table 5. Estimates of Black Rockfish population parameters within the study area. The recovery period begins on July 1, after completion of the tagging.

Year	2002-3	2003-4	2004-5	2005-6	2006-7	2007-8	2008-9	2009-10	2010-11	2011-12	2012-13
Recovery period	1	2	3	4	5	6	7	8	9	10	11
Recovery Rate (*f*i)	--------	3.38%	3.41%	2.83%	3.64%	3.32%	2.61%	3.31%	3.47%	2.40%	--------
CV (*f*i)	--------	3.20%	2.37%	1.92%	1.99%	1.88%	1.65%	1.82%	2.09%	1.94%	--------
1st Year Recovery rate (*f**i)	1.84%	1.61%	2.30%	2.06%	3.38%	1.87%	2.38%	2.83%	1.85%	1.87%	2.05%
CV (*f**i)	14.94%	15.49%	12.76%	13.36%	9.86%	11.40%	10.10%	9.14%	11.28%	11.22%	12.57%
Survival Rate (*S*i)	61.37%	71.75%	93.86%	63.56%	94.77%	78.14%	72.72%	74.61%	73.06%	--------	--------
CV (*S*i)	9.85%	8.61%	8.75%	8.92%	9.36%	9.44%	9.49%	11.22%	11.71%	--------	--------
Exploitation rate (*u*i)	--------	4.93%	4.56%	3.38%	4.16%	4.00%	3.54%	4.15%	4.45%	3.15%	--------
CV (*u*i)	--------	17.36%	12.84%	11.39%	10.45%	10.21%	10.21%	10.02%	11.21%	12.54%	--------
Estimate of Abundance (*N*i) millions of fish	--------	1.5137	1.336	1.8906	1.5417	1.5519	1.5763	1.425	1.1669	1.2632	--------

Future Work:

The author of the Black Rockfish stock assessment recommended that ODFW's PIT tagging program be expanded to other ports, and possibly California, along with further work on estimating the extent of Black Rockfish habitat and densities of the inhabited areas. One area that needs to be addressed is the lack of CV's for landing estimates so that more realistic CVs for annual abundance estimates can be developed. Due to this concern, we have not included CVs for the annual abundance estimates in this report.

Sport Fish Restoration grant funds available to ODFW for the next fiscal year declined by 25%. ODFW was forced to make difficult decisions on which projects to continue to fund. This project has successfully provided a fishery independent index of abundance to the most recent stock assessment. The results of that assessment provided a more optimistic view of the status of this Black Rockfish stock than previous assessments. Results from this study indicate that local exploitation rates and population estimates are meeting management goals. ODFW has chosen to utilize the limited funding to work on other species rather than continuing to tag Black Rockfish. The recoveries of Black Rockfish tagged more than a decade ago suggests that valuable data from this study could continue to be gathered for a number of years. If sufficient funds can be found, there may be continued efforts to scan Black Rockfish landed in Newport in order to take advantage of the work that has been done to date.

Acknowledgements

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References:

Brownie, C., D.R. Anderson, K.P. Burnham, and D.S. Robson. 1985a. Statistical inference from band recovery data—a handbook, 2nd edition. U.S. Fish and Wildlife Service Resource Publication 156.

Brownie, C., D.R. Anderson, K.P. Burnham, and D.S. Robson. 1985b. ESTIMATE Software to compute recovery and survival rates for marked individuals using multi-stage single recapture data. USGS-PWRC. http://mbr-pwrc.usgs.gov/software/estimate.html

Buell, T.V., R.W. Hannah, and S.J. Parker. 2007. Estimation of Black Rockfish (*Sebastes melanops*) population parameters from recreational fisheries mark-recovery data off Newport, Oregon. In: The Status of Black Rockfish off Oregon and California in 2007. Pacific fisheries Management Council, Appendix A. Pacific Fishery Management Council 2130 SW fifth Ave. Suite 224, Portland, OR 97210

Hannah, R.W., and K.M. Matteson. 2007. Behavior of nine species of Pacific rockfish after hook-and-line capture, recompression, and release. Transactions of the American Fisheries Society 136: 24-33.

Jagielo, T. 1991. Synthesis of mark-recapture and fishery data to estimate open-population parameters. *In*: Creel and Angler Surveys in Fishery Management, American Fisheries Society Symposium 12: 492-506.

Parker, S.J., and P.S. Rankin. 2003. Tag location and retention in Black Rockfish: Feasibility of using PIT tags in a wild marine species. North American Journal of Fisheries Management 23: 993-996.

Parker, S.J., H.I. McElderry, P.S. Rankin, and R.W. Hannah. 2006. Buoyancy regulation and barotrauma in two species of nearshore rockfish. Transactions of the American Fisheries Society 135: 1213-1223.

Parker, S.J., P.S. Rankin, J.M. Olson, and R.W. Hannah. 2007. Movement patterns of Black Rockfish (*Sebastes melanops*) in Oregon coastal waters. pp 39-57 IN: J. Heifietz, J. Dilusino, A.J. Gharett, M.S. Love, V.M. O'Connell and R.D. Stanley (eds.) Biology, Assessment, and Management of North Pacific Rockfishes, Alaska Sea Grant University of Alaska, Fairbanks.

Sampson, D. B. 2007. The Status of Black Rockfish off Oregon and California in 2007. Pacific fisheries Management Council, Appendix A. Pacific Fishery Management Council 2130 SW fifth Ave. Suite 224, Portland, OR 97210

Appendix A

A brief update on the end of the Population Status of Black Rockfish in Oregon Coastal Waters project

The above Annual Progress report was written in 2013 which was when federal funding for this project ended and was the last year of Black Rockfish PIT tagging operations carried out by ODFW. Although the report covered the last tagging year there was no federal funding for completion of scanning activity for the 2013-2014 recovery year or for any subsequent years. Nevertheless, ODFW continued scanning for PIT tagged Black Rockfish in Newport through the end of the 2017-2018 recovery year on June 30, 2018, although scanning activity was greatly reduced. Tagged Black Rockfish were recovered every year that scanning operations continued and the last tagged black rockfish scanned was recovered on June 29, 2018. It is worth noting that a black rockfish tagged on April 4, 2003 was recovered almost 15 years later on March 16, 2018, demonstrating the longevity of these tags in wild Black Rockfish.

The value of this long tern tagging study was recognized by stock assessors and the data were utilized in the assessment of Black Rockfish stocks by Cope et al. 2016. The authors used the data from the tagging study and recoveries through the 2013-2014 recovery year in the assessment of the Oregon stock of black rockfish in 2015 and we did add a note to that effect in the above report. This recovery year is not included in the Annual Progress Report above. We are including Table 38 from of the stock assessment by Cope et al. (2016) below to provide the reader with updated information and results from the PIT tag study as they were used in assessment of Black Rockfish in Oregon waters. The reader should see the assessment document for details on how the information was utilized in the assessment. However, the reader is advised that Appendices referred to in that assessment document are not actually included in that document (Jason Cope pers. com).

The following table comes from "Assessments of California, Oregon and Washington Stocks of Black Rockfish (Sebastes melanops) in 2015" by Jason M. Cope, David Sampson, Andi Stephens, Meisha Key, Patrick P. Mirick, Megan Stachura, Tien-Shui Tsou, Phillip Weyland, Aaron Berger, Troy Buell, Elizabeth Councill, E.J. Dick, Kari H. Fenske, Melissa Monk and Brett T. Rodomsky. The document is available at the Pacific Fishery Management Council website: https://www.pcouncil.org/

Table 38. Summary of ODFW tagging study off Newport, Oregon.

			Recapture year (j)											
Tag		Number tagged	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14
year (i)	i	j =	1	2	3	4	5	6	7	8	9	10	11	12
2002	1	2304	44	50	43	25	17	19	12	8	14	7	5	9
2003	2	2459		41	55	48	53	35	21	19	12	8	8	7
2004	3	2523			60	74	54	61	32	21	18	10	11	5
2005	4	2621				56	60	53	42	36	20	10	12	10
2006	5	2572					90	76	54	59	31	26	15	9
2007	6	2935						58	52	58	59	18	24	13
2008	7	3902							96	95	79	38	41	26
2009	8	3891								114	104	55	53	28
2010	9	3967									76	73	72	49
2011	10	4033										78	99	73
2012	11	2920											62	61
2013	12	2663												44
Estimated no. fish landed =			60977	74620	60951	63948	64101	62113	55829	59147	51903	39843	51921	85978
No. fish scanned (cs_j)=			50029	51940	44499	54892	54315	51373	43683	46778	39861	30444	40032	47050
Sampling rate =			82.0%	69.6%	73.0%	85.8%	84.7%	82.7%	78.2%	79.1%	76.8%	76.4%	77.1%	54.7%
Brownie model results:														
Estimated recovery rate, f_i =			0.01910	0.02510	0.02889	0.02904	0.03304	0.02965	0.02966	0.03125	0.02964	0.02892	0.03033	0.02995
Estimated survival rate, S_i =				0.6506	0.7457	0.8812	0.7185	0.9427	0.6933	0.8179	0.7789	0.5812	0.8729	0.6670
Derived abundance:														
Est. abundance (1000s), N_i =			2619.7	2069.59	1540.43	1889.9	1644.15	1732.61	1472.65	1496.70	1344.71	1052.76	1319.81	1570.71
Est. coeff. variation [N_i] =			5.92%	5.69%	4.17%	4.03%	3.62%	3.88%	3.76%	3.41%	3.53%	3.48%	3.34%	3.48%