OREGON DEPARTMENT OF FISH AND WILDLIFE REPORT ON THE OREGON COMMERCIAL SAMPLING PROGRAM AND POTENTIAL CHANGES TO SPECIES COMPLEXES

The Pacific Fisheries Management Council (Council) is considering a range of alternatives to restructure one or more major species groups to more closely align with Magnuson-Stevens Act and National Standard 1 guidelines. These major species groups include several rockfish complexes, other flatfish, and other fish, which would consist of various roundfishes and elasmobranchs. The proposed Council action restructures these complexes to comprise species groups more closely related in terms of: ecological and biological considerations; vulnerability to fishing; and association within fisheries. Restructuring of species complexes within the federal Groundfish Fishery Management Plan will force states to restructure current market categories, as recorded on the official landing receipt ("fish ticket"), to comply with these new federal regulations. Market categories consist of either single species (e.g. black rockfish) or multiple species complexes (e.g. shelf rockfish). Since 2008, there are 159 different market categories in use in Oregon, although many of these categories are rarely landed. These market categories form the basis of commercial port sampling efforts conducted by the Oregon Department of Fish and Wildlife (ODFW), to provide accurate estimates of commercial catch.

Currently, ODFW employees sample commercial landings in Oregon ports to obtain information on species composition of market categories, in addition to the collection of biological samples. Market categories are sampled to assess the species present in the landing and the proportion of those species present (species composition). The purity of a market category (the amount of contamination of species not in the market category) can be assessed for both single-species market categories and multi-species categories. Market categories evolve over time due to a number of factors, including market forces, data quality concerns, the ability to discern similar species, and regulatory requirements.

For Oregon's commercial groundfish fisheries, the number of rockfish market categories has dramatically increased over the last 30 years (Figure 1). Compared with the early 1980s, when there were only two multi-species market categories, ODFW now separates rockfish species into 24 single-species market categories and two multi-species categories. The number of single-species market categories constitutes a high percentage of the number of rockfish species known to occur off the Oregon coast (approximately 32 species), though many are relatively minor components of commercial groundfish landings.

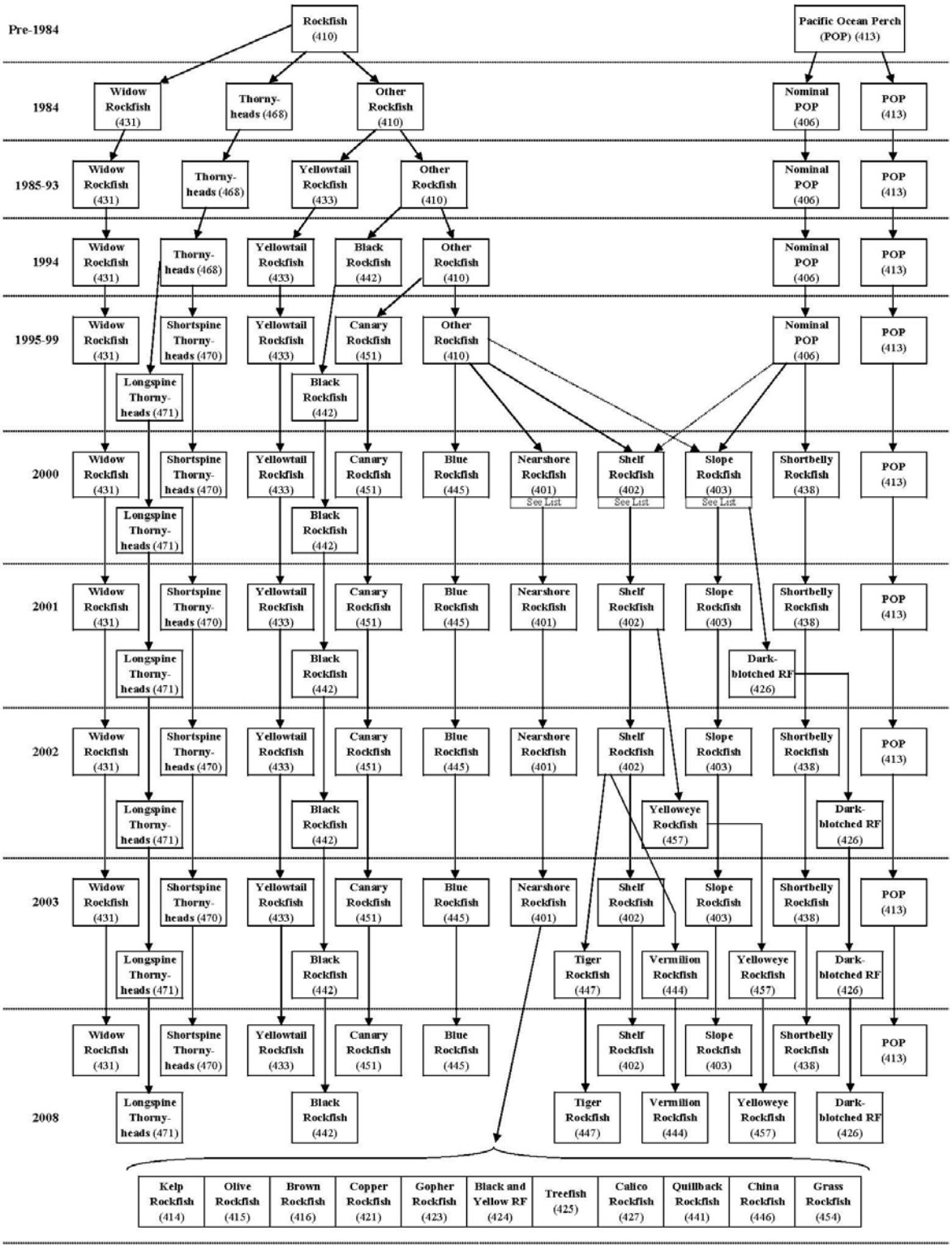

Figure 1. Oregon's rockfish "family tree" demonstrates how rockfish market categories have increased over the last 30 years. Note the two multi-species categories in 2008: shelf rockfish (402) and slope rockfish (403).

Status Quo: Current port sampling efforts and potential impacts of changes in species complexes

Commercial port samplers are unable to sample all landings or all market categories within a landing for a number of reasons that are explained in further detail in the following section. Instead, port samplers attempt to obtain at least one species composition sample per combination of market category, gear type, port, and area fished in each quarter of the year. Samplers aim to take a certain number of lengths, age structures (otoliths, fin rays or vertebrate) and species compositions for each market category. Samplers also take clusters (replicates) of species compositions when possible. Samplers must balance a large number of factors in order to fulfill their species composition sampling goals, including the time of day of the landing, seasonal variation in fishery execution, and prioritization of certain market categories over others.

Port samplers meet the vessel soon after offloading begins and may sample catches for species compositions as the catch is offloaded from large crates or from the conveyor belt within the processing facility. Each vessel and processing facility presents unique situations that the port sampler must be able to quickly adapt to in order to effectively sample the catch.

Uncertainty in rockfish species composition samples generated from the Oregon commercial groundfish monitoring program was assessed in the mid-90s (Crone 1995). Data for evaluating variability in species compositions included the last quarter of 1991 and the first quarter of 1992. At this time, there were only six market categories for rockfish (widow, yellowtail, Pacific Ocean perch, thornyhead, small rockfish complex, and large rockfish complex). This analysis suggested that the majority of the variability of species compositions in the landing estimates resulted from among-trip variation. The magnitude of this variance depended on the strata sampled (combination of port and quarter) but approximately two-thirds of the total rockfish landed had small coefficients of variation (<10 percent). Additionally, single-species market categories were also shown to have extremely precise landing estimates due to their high level of purity (>99 percent). As the number of single-species market categories has increased since this study, it can be reasonably assumed that our current level of sampling produces very precise estimates of rockfish landings for species in those single-species categories.

Over the last 20 years, the purity of the rockfish market categories increased as the number of market categories increased within the last 20 years. Each of the four time periods in Figures 2 and 3 are characterized by increases in the number of rockfish market categories. In 1990-1992 (Figure 1), there were six rockfish market categories. During 1997-1999 (Figure 1), there were nine categories, and in 2000-2002 (Figure 1), there were 12 to 14 categories. Finally, in 2009-2012 (Figure 1), though partially confounded by the advent of the IFQ trawl catch share program, there were 26 rockfish market categories. All of these periods are marked by increases in the purity of the market categories over time. The proportion of contaminated species composition samples (i.e. species present in sample that were not in the market category) at all ports has dropped from over 50 percent to approximately 15 percent over the last 20 years.

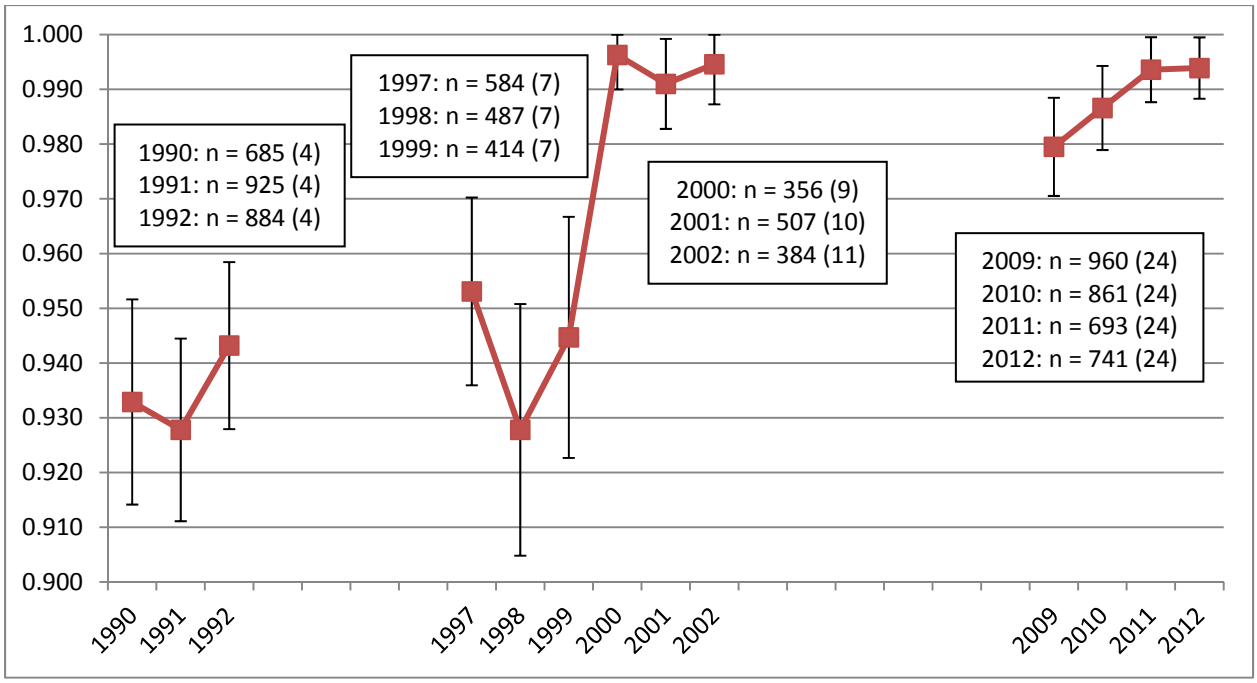

Figure 2. Average proportion of rockfish species compositions comprised of the species identified by the market category during four key time periods (1990-1992, 1997-1999, 2000-2002, and 2009-2012) for trawl landings in all Oregon ports. Sample sizes are provided for each year with the number of single-species market categories in parentheses. The confidence interval approximations are based on a normal distribution due to large sample sizes.

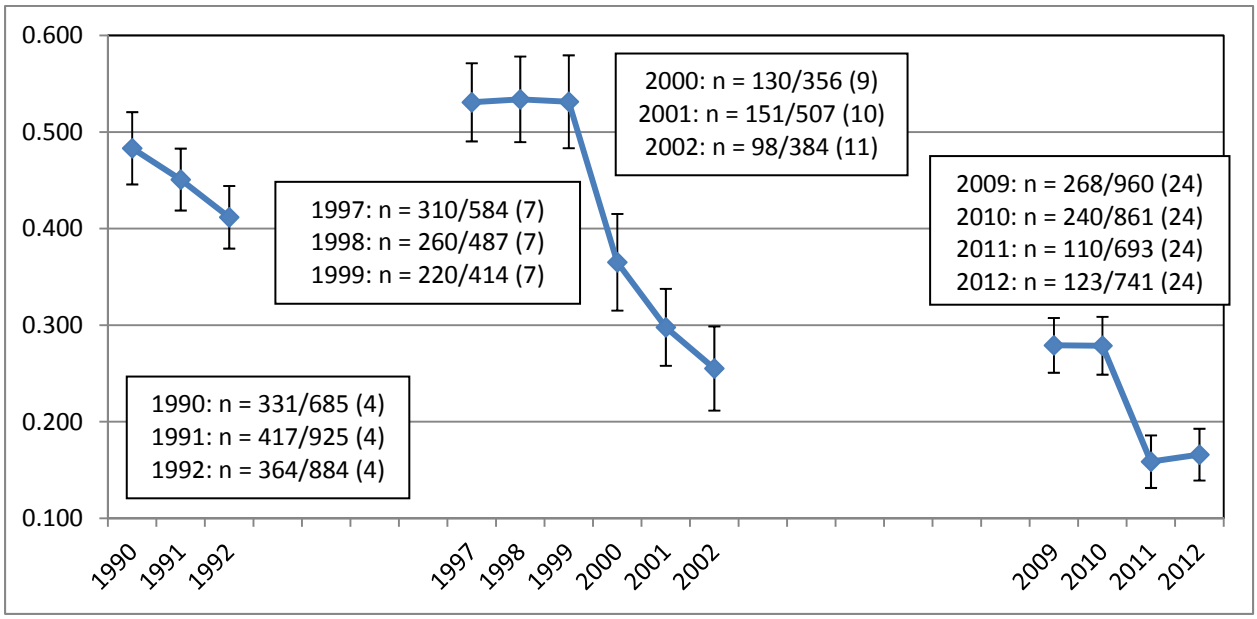

Figure 3. Proportion of rockfish species compositions with contamination of species not in market category for four key time periods (1990-1992, 1997-1999, 2000-2002, and 2009-2012) for trawl landings in all Oregon ports. Sample sizes are provided for each year with the number of single-species market categories in parentheses. The confidence interval approximations are based on a normal distribution due to large sample sizes.

Status Quo: "Borrowing" Species Compositions from Missing Strata

Samplers are unable to conduct sampling at all times, and landings occurring at night, on weekends or on holidays are much less frequently sampled than landings made during daytime hours on weekdays. Staff are not always available to sample multiple boats that are making landings at the same time or to sample each of the market categories from a single landing. Finally, it is not cost effective for ODFW to maintain sampling personnel at certain ports where fishing effort varies dramatically by season. Most often, port samplers are present during summer months at smaller ports and year-round at the larger ports. Processing operations may be moving catch so quickly that samplers are unable to sample. In addition, certain species may be landed relatively rarely, resulting in an increased chance of the sampler missing the species. These challenges result in a number of strata (combination of year, port, quarter, gear, PFMC area, and market category) where there is limited or no information on species compositions for some market categories. In these instances, ODFW "borrows" species compositions from other locations or times to fill in the gaps in the estimated landings. The original set of borrowing rules relied on both temporal and spatial factors in order to estimate species composition for unsampled strata. Documentation on the original protocol ("borrowing rules") is no longer available, but the rules were based on borrowing species composition data from neighboring ports during the same quarter or year.

Currently, there are some market categories for which borrowing is more common than others. Table 1 shows the number of species compositions taken for various strata from 2008 to 2012 for all rockfish market categories. The column labeled "0" indicates the number of strata for which species composition data were borrowed. Note that for some market categories, such as black-and-yellow rockfish or china rockfish, no borrowing was needed in 2008-2012. For other species, such as the longspine thornyhead market category where species composition samples are relatively abundant, borrowing occurred in roughly 30 percent of strata (67 / 226) and roughly 25 percent of strata (57 / 226) had only a single species composition sample to support estimates of landings.

Table 1. Number of species compositions per strata (combination of year, port, quarter, gear, PFMC area, and condition [live/dead]) taken for each rockfish market category from 2008 to 2012.

	Number of samples per strata											Proportion of Strata with Borrowing
Market Category	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9+**	**Total**	
Black rockfish	60	64	25	15	14	20	3	7	15	54	**277**	**0.22**
Blue rockfish	29	44	18	11	5	3	3	1	1	6	**121**	**0.24**
Black and Yellow rockfish	0	3	0	0	0	0	0	0	0	0	**3**	**0**
China rockfish	0	24	13	9	8	5	4	2	5	8	**78**	**0**
Canary rockfish	23	52	21	6	6	3	0	0	2	8	**121**	**0.19**
Copper rockfish	0	32	8	8	3	0	0	1	0	1	**53**	**0**
Darkblotched rockfish	77	133	54	27	26	12	8	6	10	13	**366**	**0.21**
Gopher rockfish	0	13	3	1	0	0	0	0	0	0	**17**	**0**
Grass rockfish	0	9	5	0	0	0	0	0	0	0	**14**	**0**
Longspine thornyhead	67	57	25	20	21	10	11	9	3	3	**226**	**0.30**
Shelf rockfish	49	89	33	22	8	2	2	2	1	0	**208**	**0.24**
Slope rockfish	108	121	55	43	26	21	15	14	12	35	**450**	**0.24**
Olive rockfish	0	2	0	0	0	0	0	0	0	0	**2**	**0**
Pacific ocean perch	79	85	58	23	19	7	9	2	3	12	**297**	**0.27**
Quillback rockfish	0	41	15	8	3	2	3	1	1	3	**77**	**0**
Shortbelly rockfish	2	2	0	0	0	0	0	0	0	0	**4**	**0.50**
Shortspine thornyhead	109	95	45	27	23	7	7	8	2	16	**339**	**0.32**
Tiger rockfish	0	17	6	0	0	0	0	0	0	0	**23**	**0**
Vermillion rockfish	13	31	7	7	4	2	2		3	5	**74**	**0.18**
Widow rockfish	45	62	22	10	6	5	1	3	3	2	**159**	**0.28**
Yelloweye rockfish	1	20	3	0	0	0	0	0	0	0	**24**	**0.04**
Yellowtail rockfish	39	80	27	23	7	1	4	4	1	5	**191**	**0.20**

Another way to gauge the impact of borrowing is to evaluate the percentage of the landings that are based on borrowed species compositions. For example, Table 2 and Table 3 below show the total pounds landed for the slope and shelf rockfish market categories, respectively, and the percentage of landings where borrowed species compositions were applied. In most cases, this is a relatively small percentage of overall landings, except some years of shelf rockfish, where there were a large number of small landings (<1000 lbs.).

Table 2. Total landings and total landings without species compositions available for the slope rockfish market category (2008-2012).

Year	Total Landings (lbs)	Total Landings without Species Compositions (lbs)	Percent landings without Species Compositions
2008	206,759	9,436	4.56%
2009	268,979	18,697	6.95%
2010	363,461	32,175	8.85%
2011	261,228	7,124	2.73%
2012	385,623	19,725	5.12%
Total	**1,486,050**	**87,157**	**5.87%**

Table 3. Total landings and total landings without species compositions available for the shelf rockfish market category (2008-2012).

Year	Total Landings (lbs)	Total Landings without Species Compositions (lbs)	Percent landings without Species Compositions
2008	9,214	2,706	29.37%
2009	15,433	2,652	17.18%
2010	10,826	2,306	21.30%
2011	29,582	7,351	24.85%
2012	68,330	2,737	4.01%
Total	**133,385**	**17,752**	**13.31%**

While there is uncertainty associated with borrowing, this system potentially allows for more accurate estimates of landings information for market categories that rarely occur or those that are not sampled at a high or consistent level. However, in some instances, bias may be introduced and expanded upon, possibly leading to severely inaccurate landings data that may have dramatic impacts on estimated landings of species that are typically minor components of a large fishery. This is of particular concern given the lack of assessment information on some of these species, where continued management relies heavily on landings information.

In 2012, using feedback from both port samplers and local stock assessment authors, the current framework of borrowing rules was revised to exclude borrowing from neighboring ports. Feedback from port biologists and samplers suggested that there are dramatic differences between neighboring ports, especially given the seasonality of many of the species complexes for which borrowing is more common. Staff also evaluated several different options for within-port borrowing. These options included: (1) borrowing from the same quarter in previous years; (2) borrowing from other quarters in the same year; and (3) a combination of both scenario one and two. Using simulations with hypothetically missing data, these scenarios were not found to be dramatically different from each other and all were found to provide reasonable estimates of species compositions after borrowing rules had been applied. Given this information, staff felt that scenario one would be the best option for the new expansion model unless a minimum sample size could not be obtained in the recent past. In that case, borrowing would be allowed across different quarters and between years. These improved borrowing rules are currently being implemented and are expected to improve estimates of species landings in the future.

Costs of Increasing the Number and/or Configuration of Species Complexes

As discussed above, if the number of market categories increases, samplers might not be able to continue to sample at the current rates and compensation measures would need to be taken, such as downward adjustments to sampling goals. This results in less clustering which reduces our ability to accurately gauge variability within samples. There will also likely be more borrowing, as borrowing has increased over time as the number of market categories has expanded. Both of these result in the possibility of increased uncertainty in species composition estimates and estimates of landings of species complexes.

There is the possibility of changes in species proportions within market categories if there are changes in the complexes or market categories. Fishermen could also revise their targeting strategies if species complexes or market categories are modified. At this time, we are unable to predict the behavior of the fishermen in response to this management action. This management action could also result in a reconfiguration of our sampling goals and protocols. Impacts are likely to be similar to those seen in conjunction with increases in the number of market categories in previous years; however, estimating the magnitude of the changes that would be necessary to maintain appropriate sampling rates is extremely uncertain.

Qualitative costs to the state commercial sampling program

The commercial sampling program currently needs to balance the need for high quality data with personnel and budget constraints. If the number of market categories increases, an increase in effort would be required to maintain status quo sampling rates. Over time, ODFW has gradually added more positions dedicated to sampling as market categories have increased (Figure 4). However, this progressed relatively slowly, over the last 20 years. Potentially, even if the number of market categories remains constant but are reconfigured, this will also force a reordering of positions and staff priorities to modify sampling protocols and goals. Borrowing already occurs because it is not effective to have port biologists or samplers at every port throughout the year. Sampling every trip or every complex within each trip is often not possible or cost effective. Without additional resources, increased complexity in market categories and status quo staffing levels in ODFW's commercial sampling program would result in lower sampling rates per category, and higher uncertainty in landing estimates for some species.

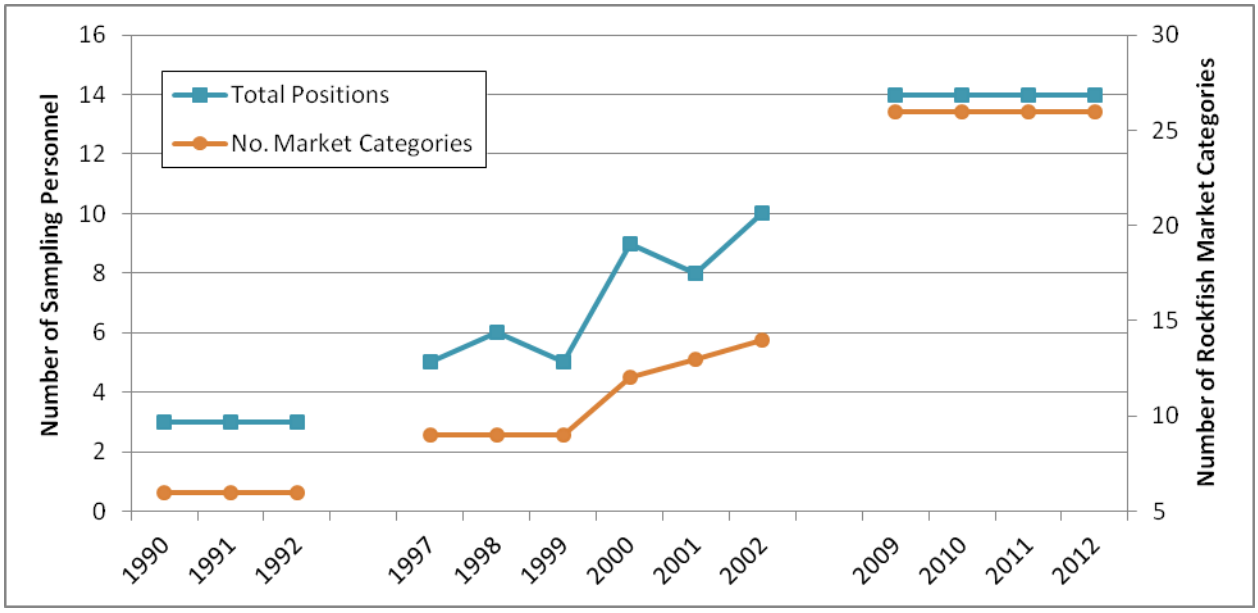

Figure 4. Changes in the number of dedicated sampling personnel with the MRP and the number of rockfish market categories (see Figure 1) for 1990-1992, 1997-2002 and 2009-2012. These are all full-time positions but do include seasonal personnel. Information on the number of positions is missing for some ports prior to 1999.

In Oregon, the Oregon State Police's Fish and Wildlife Division enforces fisheries regulations, including sorting requirements. Changes in species complexes may impact the effectiveness of enforcement and additional enforcement staffing is not expected to be available. Enforcement of sorting requirements is often collaboration between ODFW samplers and OSP troopers. With more market categories, a lower proportion is expected to be sampled by ODFW personnel, who will therefore have less opportunity to observe violations and notify enforcement personnel.

Concluding Points

The impact of changes in the configuration, or number, of species complexes is species- and complex-specific. Some species may be relatively easy to differentiate and some may be more difficult. Those species that are easy to differentiate are likely already in a single-species market category, thus we have high confidence in our landing estimates for these species. Each alternative would need to be evaluated with this in mind. Adding market categories through restructuring stock complexes may lead to lower sampling rates, resulting in higher uncertainty in species composition estimates and ultimately, estimates of catch per species. It is difficult to gauge the impact of one or more of the alternatives presented in this management action because of uncertainties regarding personnel, budgetary constraints, inability to predict changes to fisherman behavior or targeting, and the wide range of alternatives presented in this proposed Council action.

Reference List

Crone, P. R. 1995. Sampling design and statistical considerations for the commercial groundfish fishery of Oregon. Canadian Journal of Fishery and Aquatic Sciences 52: 716-732.