Pacific States Field Study (Workshop Objective 3) (1.5 hours) Colpo/DeVore

Detection of Rare Events Analysis

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For some rare species, such as NW rockfish species in rebuilding status, the catch (retained or discarded) must be known with minimal error for effective management and quota tracking. To know catch without error, sampling is not an option; however, note that census based approaches are not error-free. This analysis addresses the detection of sensitive rare species in the Northwest Pacific Trawl Rationalization Program under a monitoring system similar to the electronic (video) monitoring (EM) system currently in place in the BC halibut fishery. West Coast Observer Program (WCGOP) data from 2011 are used in this analysis to address the issue.

In this potential monitoring scenario, logbook data are used as the record of at-sea discards. In addition, we are assuming that for those vessels that choose to not carry an at-sea compliance monitor, a requirement for all fishing trips to be monitored using a video monitoring (EM) system would have been implemented as an auditing system. The logbook data would be audited using data from a review of a portion (random sample) of the video record (hauls) for each trip in the fishery. The numbers of each species observed to be discarded on the video record for the selected trip would be compared with numbers of discard reported in the vessel's logbook.

Some discards may not be reported in the logbook as a result of unintentional data recording errors (wrong species code, wrong number of fish), intentional misreporting (underreporting of species catches), or discard events that are unknown to the person filling out the logbook record (unidentified crew discards).

There is a concern that EM review rates may not provide a sufficient audit of the logbook record; only a few (or no) EM records of rebuilding (rare) rockfish species discard will be in the sample. A simulation exercise was conducted to assess the probability that a sample of EM records will contain rebuilding rockfish species discard events (hauls with discards of a rebuilding rockfish species).

Data from the WCGOP (2011) were used in this analysis. Observer data from 93 fishing vessels were included in this analysis. These data do not include the shoreside hake fishery (mid-water trawl). For each observed haul in the shoreside non-hake fishery, an indicator of rockfish discard for each of 6 rebuilding

rockfish species was generated (Table 1). A total of 1,471 trips were included in the simulation population; these are the assumed true values. The average number of hauls per trip ranged from 3 to 20 (Table 1). Within each trip, a sample of hauls was selected as 'sampled' according to a nominal sampling rate (described below). If discards of any rebuilding rockfish species occurred in one of the sampled hauls, that species of rockfish was considered detected and at least one discard event would be available for logbook auditing.

The input data are summarized in Table 1. Catch share (including limited entry CA halibut) fishery trips are included in the analysis. There were no rebuilding rockfish species discard events in the excluded non-hake mid-water trawl trips. On one trip, two gear types were recorded; 14 bottom trawl hauls and 8 mid-water hauls. For this trip only, the mid-water trawl hauls were reassigned to bottom trawl (no rebuilding rockfish were discarded on this trip).

The nominal sample rates tested were 10%, 25%, and 50%; the number of hauls randomly selected was determined by multiplying the sample rate by the number of hauls on the trip, and rounding up to the next whole number. For example, under the nominal 10% sample rate, a trip with 1 to 10 hauls would have one haul sampled while a trip with 11 to 20 hauls would have 2 hauls sampled. Under each nominal sample rate, 1,000 simulation trials were conducted and the results summarized (Table 2 and Figure 1). Since the number of trips to be sampled is always rounded up, the actual sample rates are higher than the nominal rates due to the sampling procedure.

This is a simplified scenario where it is assumed that for each fishing haul, all discard that occurs during the haul is recorded. In other words, if the at-sea compliance monitor did not observe a discard event, we are assuming one did not occur. In addition, note that some hauls were excluded on some trips due to incomplete species composition sampling of the haul by the at-sea compliance monitor. In the simulation trials, the number of hauls fished on those trips was set to include only those hauls that were sampled (where we have records of rockfish discards). We are assuming that the simulated (true) population is representative of a fishing year, although the actual data may not exactly match the data used in fishery management.

The total magnitude of rebuilding rockfish species discards was generally small (Table 2). Darkblotched rockfish were discarded the most in terms of both number of discard events (172 trips had discard) and magnitude of total discards (3,567 lbs). Yelloweye rockfish were discarded the least with only two fish discarded on two different trips (12 lbs).

For each simulated sampling of the observer data, the number of trips where rebuilding rockfish species were detected was summarized (Figure 1). For yelloweye rockfish, discards occurred on two trips. Of the 1,000 samples (simulation trials) taken at a nominal 10% sample rate, close to 80% (close to 800 of the samples) detected no yelloweye discards. In other words, for approximately 800 of the 1,000 times we sampled, the hauls from 2 trips with yelloweye rockfish discards were not included in the sample and those discards were not detected. In the case of Boccacio, there were 5 trips with discards, all five hauls with discard were never detected within a single simulation trial under the nominal 10% sample rate.

While Figure 1 addresses the probability of detecting discards at a fleet-wide level, this does not assess the potential for discards to be detected on any individual trip. In other words, what are the chances that a sample of a specific trip will detect discards of a specific rebuilding or rare species that occurred on that trip? Figure 2 presents the proportion of the 1000 simulation trials where the discards were detected from trips that were known to have had an occurrence of a discard of the specific species. The box contains the center 50% of the trips with the vertical line representing the median value.

As a result of the sampling routine (e.g., at least one haul per trip), the median probability of a sample including at least one of the hauls where discards occurred was above the nominal sample rate (Figure 2). The range of detection is wide with some trips having a 100% probability of discard detection even at a 10% sample rate (e.g. darkblotched rockfish in Figure 2). The probability of sampling a trip and having one or more hauls with detected discard events in the sample is a function of the trip length as well as the rarity of discarding. In the extreme, a trip with only two hauls will always have one haul sampled, and hence will always have a 50% probability of detecting the discard event. There are a few trips where the probability of detecting the discard event is less than the nominal sample rate.

Table 1: Total number of hauls and discarded rockfish in catch share fisheries. This includes the Limited Entry Halibut fishery (CA) but does not include mid-water trawl trips.

	Number of Trips	Number of Hauls	Mean Hauls per Trip (range)	Actual Sample Rates for Nominal		
Northern Area				10% sample	25% sample	50% sample
Bottom Trawl	856	7,225	8.4 (1 to 28)	19.1	31.8	54.6
Hook and Line	21	402	19.1 (1 to 38)	24.5	36.5	55.3
Pot	79	774	10.0 (1 to 23)	18.25	31.5	54.0
Southern Area						
Bottom Trawl	296	1,555	5.2 (1 to 15)	26.7	35.7	56.3
Hook and Line	71	211	3.0 (1 to 20)	47.3	48.0	57.4
Pot	148	736	5.0 (1 to 30)	50	55.3	67.2

Table 2: Summary of frequency and magnitude of rebuilding rockfish species discards in the 2011 NW observer data for catch share trips. This includes the Limited Entry Halibut fishery (CA) but does not include mid-water trawl trips.

		Northern Area			Southern Area			Total
		Bottom Trawl	Hook and Line	Pot	Bottom Trawl	Hook and Line	Pot	
Trips (hauls)	Bocaccio	0	0	0	5 (6)	0	0	5 (6)
Number Fish (lbs)		0	0	0	16 (19)	0	0	16 (19)
Trips (hauls)	Canary Rockfish	15 (31)	0	0	0	0	0	15 (31)
Number Fish (lbs)		189 (303.5)	0	0	0	0	0	189 (303.5)
Trips (hauls)	Cowcod	0	0	0	4 (5)	0	0	4 (5)
Number Fish (lbs)		0	0	0	17 (7)	0	0	17 (7)
Trips (hauls)	Darkblotched Rockfish	133 (346)	5 (31)	1 (1)	32 (46)	0	1 (1)	172 (425)
Number Fish (lbs)		4,481 (3,181)	96 (266)	1 (1)	517 (118)	0	1 (1)	5096 (3567)
Trips (hauls)	Pacific Ocean Perch	53 (78)	4 (15)	0	0	0	0	57 (93)
Number Fish (lbs)		253 (723)	31 (56)	0	0	0	0	284 (779)
Trips (hauls)	Yelloweye Rockfish	2 (2)	0	0	0	0	0	2 (2)
Number Fish (lbs)		2 (12)	0	0	0	0	0	2 (12)

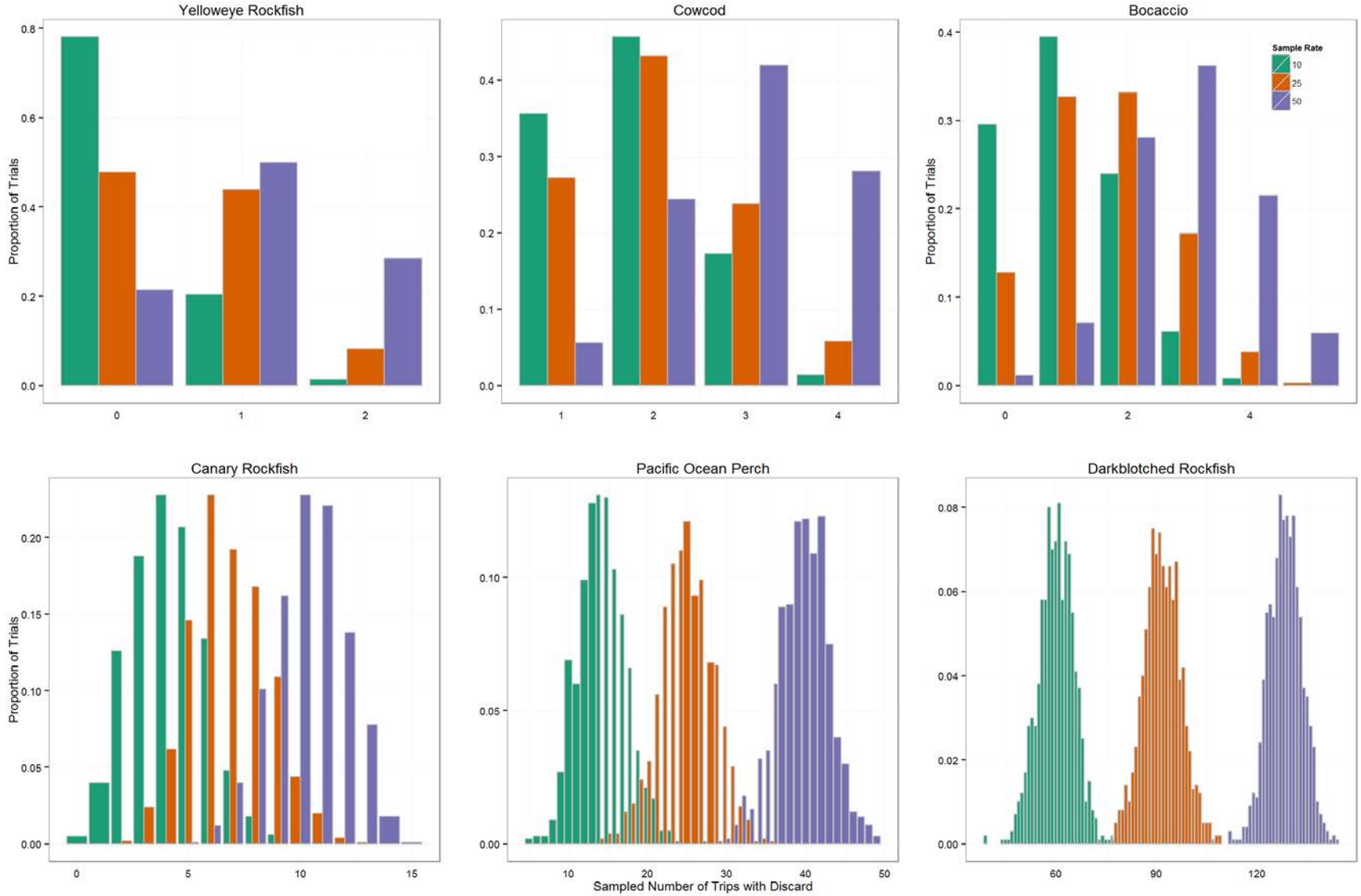

Figure 1: Probability of detecting discard events for 6 species of rockfish. Probability of detection is computed as the proportion of simulation trials where discard of the species was detected on a trip where rockfish were discarded. Inset table depicts the actual number of trips where each species was discarded. Note changes in y-axis scaling.

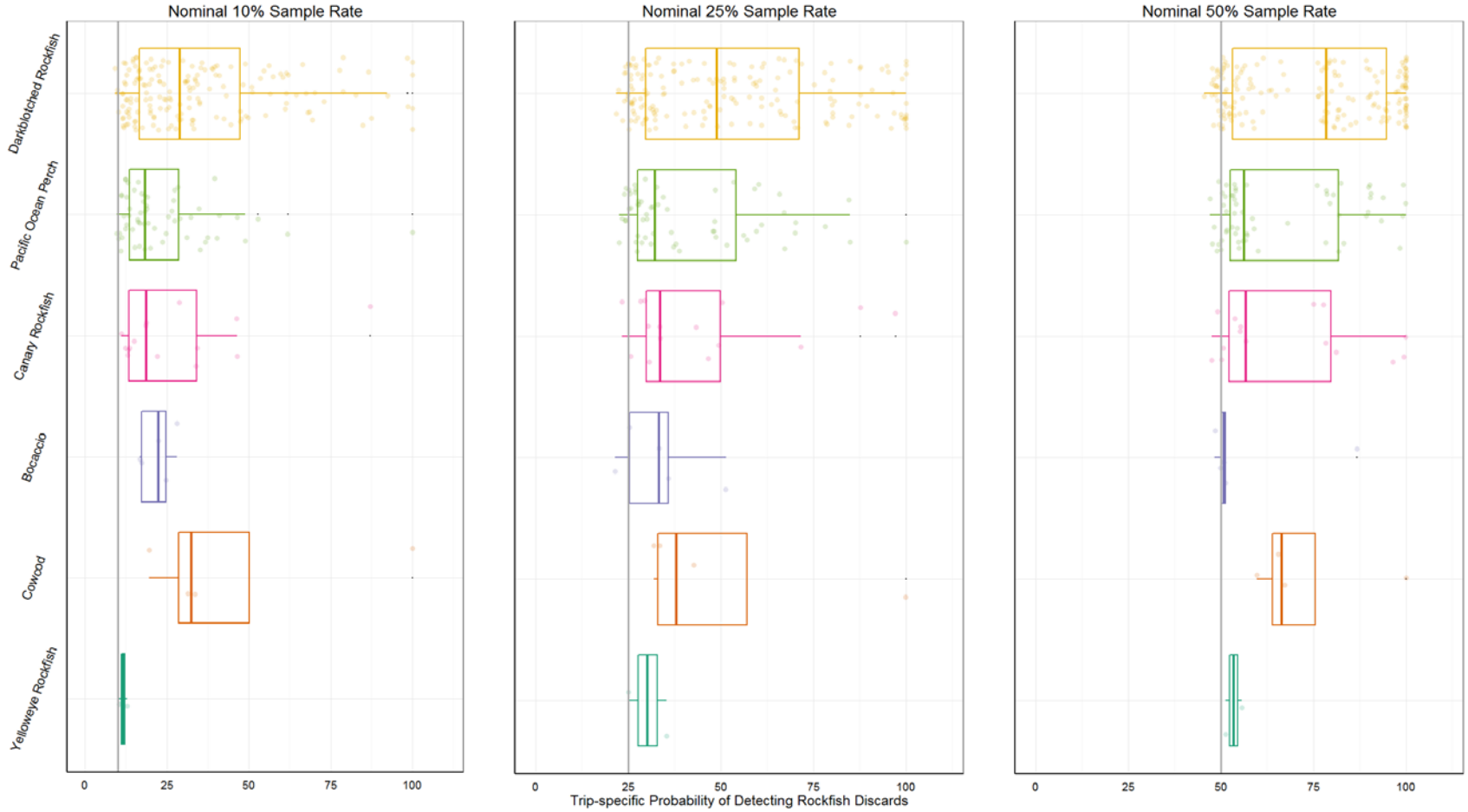

Figure 2: The trip-specific proportion of simulation trial (samples) that included hauls with rockfish discard. Each data point represents the probability of detecting rockfish discards for a single trip where rockfish were discarded. The box outlines the center 50% of the data points while the vertical line inside the box represents the median proportion over all trips.